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Environmental Impact Statement – Appendix N1: Soils and Contamination Assessment Report

Warragamba Dam Raising

Reference No. 30012078
Prepared for WaterNSW
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SMEC INTERNAL REF. 30012078

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Executive Summary

This report aims to address relevant components of Section 15 (Soils) of the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Industry and Environment (DPIE) for the Project under application number SSI 8441, which are listed below:

1. Verify the risks of acid sulfate soils (Class 1 2, 3 or 4 on the Acid Sulfate Soil Risk Map) in areas likely to be impacted by the Project.
2. Assess the impact of the Project on acid sulfate soils (including impacts of acidic run-off off-site) in accordance with the current guidelines.
3. Assess whether the land is likely to be contaminated and identify if remediation of the land is required having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, document how the assessment and/or remediation would be undertaken in accordance with current guidelines.
4. Assess whether salinity is likely to be an issue, and if so, determine the presence, extent and severity of soil salinity within the Project area.
5. Assess the impacts of the Project on soil salinity and how this may affect groundwater resources and hydrology.

This report is intended to address potential impacts associated with changes to the probable maximum flood (PMF) extent after dam raising. The scope of work carried out comprised a review of publicly available information relating to acid sulfate soils, contamination and salinity and review of relevant reports made available by WaterNSW. The following conclusions were made.

Acid sulfate soils

Acid sulfate soils are mapped in areas commencing some 40 kilometres downstream. Acid sulfate soils are not known to occur in proximity to Project construction areas or within the upstream PMF extent. This assessment concludes that acid sulfate soils are unlikely to be affected as a result of the Project construction works or longer term as a result of the dam raising.

Salinity

Given the projected limited period of inundation of the flood mitigation zone and the predominantly low permeability of the rock formations in the upstream study area, impacts on the upstream groundwater regime and quality are considered insignificant.

The decreasing footprint (area) and increasing duration of flooding events in the downstream areas are unlikely to impact on groundwater recharge/discharge across most of the flooded areas, where groundwater is within two metres of the surface. However, it may have a minor impact on groundwater recharge/discharge in areas where the groundwater table is more than two metres below the surface due to flushing of slightly more salt from the historically pre-leached soil profile due to slightly longer flood duration, or slightly elevated salt loads due to water logging and evaporative processes. This is likely to be the case for areas mapped as high and moderate salinity risk potential.

Flood mitigation discharges of water volumes from Warragamba Dam may impact electrical conductivity (EC) concentration in the Nepean and Hawkesbury Rivers. However, EC in rivers is governed more by land use, catchment geology, and in-stream processes such as tidal influence, barriers and interferences. As such, any impacts would be considered negligible to minor only.

Land contamination

Areas of potential contamination that could be influenced by the Project have not been identified within the upstream study area.

The downstream study area incorporates extensive urbanisation and development along the Hawkesbury-Nepean River system, which includes numerous sites with potential for contamination, such as service stations, industrial facilities, commercial premises, etc. Flood modelling shows that the Project would result in reduced peak flood discharges, reduced flood area and increased flood duration, and impacts to contaminated land would be less due to the dam raising.

Some sites within the proposed construction zone have been identified as having past contamination issues. The likelihood of encountering widespread contamination within the construction zone is low; however, some areas (as identified in this report) would require management measures to avoid disturbance of known encapsulated contaminated materials. Any contamination would be managed through implementation of an unexpected finds protocol, otherwise initial intrusive assessments could be carried out to gain a better understanding of the potential for contamination to exist in areas that would be specifically disturbed. If identified, soil contamination is likely to be managed through either offsite disposal or on-site capping and management.

Areas of the dam that would be disturbed as part of the works should be checked for hazardous building materials prior to works commencing (such as old pipework, gaskets etc.).

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1 Introduction

This report provides an assessment of soils and soil landscapes within the study areas of the Warragamba Dam Raising (the Project), and potential impacts to these aspects that may arise through construction and operation of the Project.

Project approval is sought under Division 5.2 (s5.13) (State Significant Infrastructure) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A preliminary environmental assessment report was provided to the Secretary of the Department of Planning, Industry and Environment (DPIE; formerly Department of Planning and Environment), with DPIE subsequently issuing Secretary's Environmental Assessment Requirements (SEARs) on 30 June 2017. The SEARs were superseded by an updated version issued on 13 March 2018.

This report addresses the SEARs 15, items 1 to 5, and informs the environmental impact statement (EIS) for the Project.

1.1 Project background

The potential for significant flooding of the Hawkesbury-Nepean Valley was known by the local Aboriginal community before the first European settlement of the area in the 1790s. In the early years of European settlement, the risk of flooding was recognised, and a series of proclamations were issued that warned of the risk of flooding.

During the 1980s and 1990s updated flood investigation techniques and new geological evidence predicted that floods significantly larger than any historically recorded could occur in the Hawkesbury-Nepean Valley. The dam was raised by five metres in the late 1980s to meet modern dam safety requirements. Further investigations into flooding and flood mitigation were undertaken and culminated in 1995 in a proposal to raise Warragamba Dam by 23 metres primarily for dam safety but also to provide flood mitigation. The 1995 proposal did not proceed. In the late 1990s, major upgrades of Warragamba Dam were undertaken to prevent dam failure during extreme flooding events, to protect Sydney's water supply, and to prevent catastrophic downstream floods from dam failure. This resulted in the construction of the auxiliary spillway. However, these works only dealt with dam safety issues and did not address the major flood risks to the people and businesses in the Hawkesbury-Nepean Valley, and to the NSW economy.

In 2011, an approximately 1%AEP (annual exceedance probability) flood occurred in Brisbane, resulting in significant damage, economic costs, and social disruption. The substantial impacts of the 2011 Brisbane flood led the NSW Government to recommence investigations into flood mitigation options for the Hawkesbury-Nepean Valley.

In 2013, the NSW Government, in response to the State Infrastructure Strategy and community concerns, initiated the Hawkesbury-Nepean Valley Flood Management Review to consider flood planning, flood mitigation and flood response in the Hawkesbury-Nepean Valley. The review found that current flood management and planning arrangements were insufficient to mitigate the risk, and no single mitigation option could address all the flood risks present in the Hawkesbury-Nepean Valley (DPI 2014). The review concluded that raising Warragamba Dam to capture inflows is the most effective infrastructure measure that could have a major influence on flood levels during those events, where most of the damages occur. Other complementary and non-infrastructure options were also identified to mitigate flood risks (DPI 2014).

Under the direction of Infrastructure NSW (INSW), the Hawkesbury-Nepean Valley Flood Management Taskforce was established to investigate feasible flood options to reduce overall risk to the Hawkesbury-Nepean Valley. In June 2016, the former Premier and Minister for Western Sydney, Mike Baird MP, announced a NSW Government plan to raise Warragamba Dam to significantly reduce the risk of flooding in the Hawkesbury-Nepean Valley. A flood damage assessment demonstrated that this would provide a 75 percent, on average, reduction in flood damages, and reduce current levels of flood damages from $5 billion to $2 billion (2016 dollars) (INSW 2019).

1.2 The Project

Warragamba Dam Raising is a project to provide flood mitigation to reduce the significant existing risk to life and property in the Hawkesbury-Nepean Valley downstream of the dam. This would be achieved through raising the level of the central spillway crest by around 12 metres and the auxiliary spillway crest by around 14 metres above the existing full supply level for temporary storage of inflows (a flood mitigation zone or FMZ). The spillway crest levels and outlets control the extent and duration of the temporary upstream inundation. There would be no change to the existing maximum volume of water stored for water supply. The current design includes raising the dam side walls and roadway by 17 metres now to enable adaptation to projected climate change. Any consideration of raising spillway heights is unlikely before the mid to late 21st century and would be subject to a separate planning approval process.

The Project would comprise the following main activities and elements:

- demolition or removal of parts of the existing Warragamba Dam, including the existing drum and radial gates
- thickening and raising of the dam abutments
- thickening and raising of the central spillway
- new gates or slots to control discharge of water from the FMZ
- modifications to the auxiliary spillway
- operation of the dam for flood mitigation
- environmental flow infrastructure.

1.2.1 Demolition

Elements of the existing Warragamba Dam require demolition or removal to enable dam raising construction to proceed. These would comprise:

- the existing road and main spillway bridge across the top of the dam
- the drum and radial gates, and associated mechanical and electrical infrastructure, and portions of the piers within the central spillway
- minor concrete structures to allow the tie-in of the new dam and spillway
- the valve house control room building located at the rear of the valve house
- areas of roads, operational laydown areas, drainage systems and other infrastructure external to, but associated with the dam
- the existing gantry crane and associated equipment
- the existing hydroelectric power station equipment to allow for new environmental flow infrastructure
- miscellaneous dam crest services and equipment.

1.2.2 Thickening and raising of the dam abutments

The dam abutments, located either side of the central spillway, would be modified as follows:

- the dam abutments would be thickened on the downstream side with additional concrete; the face of the abutments would be smooth as with the existing dam
- the abutment height would be increased by around 17 metres
- the left abutment would extend into the surrounding rock to suit the thickening and raising.

1.2.3 Thickening and raising of the central spillway

The existing central spillway would be modified as follows:

- the spillway would be thickened on the downstream face with concrete and it would have a smooth surface
- the spillway crest would be raised to create a flood mitigation zone, including the use of post tensioned anchors within the wall for stability
- gated conduits or slots would be constructed within the central spillway to allow for the controlled discharge of floodwaters; these openings would be located so the flood mitigation zone could be drawn back down to the full supply level.

1.2.4 Modifications to the auxiliary spillway

The following modifications would be undertaken on the auxiliary spillway:

- removal of the existing fuse plugs (earth/rock embankments designed to wash away in a major flood) and replacement with a concrete spillway crest
- the spillway floor slabs and walls would be modified and reinforced to suit discharging of flood water from the raised dam
- erosion protection would be provided downstream from the auxiliary spillway.

The existing bridge across the auxiliary spillway would be retained for access to the valve house and the base of the dam and spillway.

1.2.5 Other infrastructure and elements

Other infrastructure and elements would comprise:

- a new bridge would be built above the auxiliary spillway crest to provide access to the raised dam
- the raised abutments and central spillway bridge would allow for vehicle and pedestrian access across the top of the dam, connecting to the approaches and road network on either side of the dam
- new control and instrumentation equipment including mechanical, electrical and communications elements
- new landscaping and urban design features would be provided for areas disturbed by construction and for other areas which require improved integration to the new dam structure
- ancillary works to tie existing services into the raised dam
- the existing two lift towers would be modified to suit the raised dam
- the eel passageway on the left bank would be modified to continue to allow the migration of eels from the river to Lake Burragorang.

1.2.6 Environmental flows infrastructure

In 2017, the NSW Government released the 2017 Metropolitan Water Plan (Metropolitan Water 2017) which included the introduction of new variable environmental flows from Warragamba Dam to improve the health of the Hawkesbury-Nepean River. The Project would provide the infrastructure to enable environmental flows to be released from the Dam. Procedures would be developed as part of the implementation of the metropolitan water plan. Environmental flow releases would be designed to mimic the natural flow of the river if the dam did not exist.

The environmental flows infrastructure would comprise:

- a multi-level offtake tower on the upstream face of the dam wall to draw water from Lake Burragorang
- the use of an existing pipeline, formerly for the hydro-electric power station, to transfer the water to a valve house
- a new valve house, downstream of the existing hydro-electric power station, to discharge the water into the river.

Operation of the environmental flows infrastructure does not form part of the Project and would be assessed separately.

1.2.7 Operation of the dam for flood mitigation

Operational objectives in order of priority are to:

- maintain the structural integrity of the dam
- minimise risk to life
- maintain Sydney's water supply
- minimise downstream impact of flooding to properties
- minimise environmental impact
- minimise social impact.

There would be two different modes of operation for the Project: normal and flood operations. In both modes Warragamba Dam would continue to store and supply up to 80 percent of Sydney's drinking water. The storage capacity, which is the dam's full supply level, would not change.

1.2.7.1 Normal operation

Normal operations would occur when the dam storage level is at or lower than the full supply level.

Normal operations mode for the modified dam would be essentially the same as current operations – apart from environmental flows releases. Inflows would be captured up until the full supply level, after which environmental flows releases would cease and flood operation procedures would be implemented.

1.2.7.2 Flood operation

During large rainfall events when the storage level rises above full supply level, flood operations mode would commence. In this mode, inflows to Lake Burragorang would be captured and temporarily stored (increasing water

levels in Lake Burragorang and upstream tributaries). The raised dam would provide capacity (called a flood mitigation zone) to capture temporarily around 1,000 gigalitres of water during a flood event.

Water would be discharged in a controlled manner via the gated conduits until the dam level returns to full supply level. Flood mitigation zone operating protocols would guide this process and be developed for approval by the relevant regulatory authorities.

The raised dam would not be able to fully capture inflows from all floods. For floods that exceed the capacity of the flood mitigation zone, water would spill firstly over the central spillway and then, depending on the size of the flood, the auxiliary spillway.

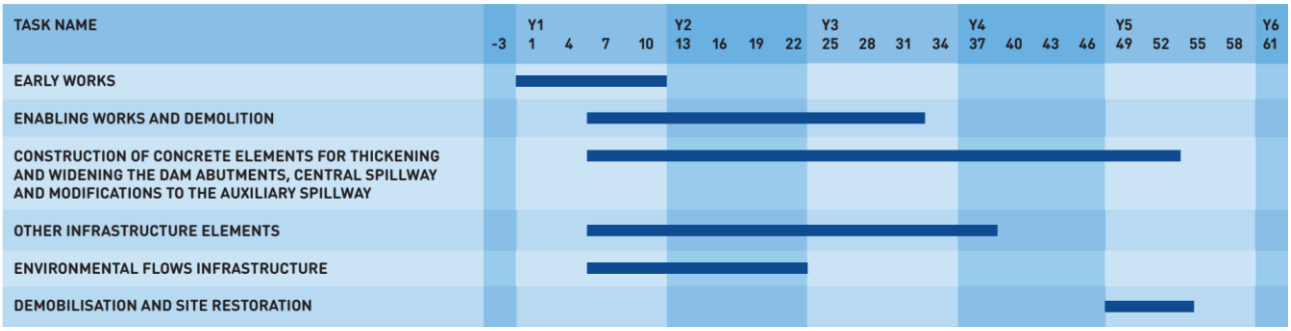
1.2.8 Project construction

This section describes the proposed approach to construction. If the Project is approved, further detailed construction planning would take place prior to commencement to inform a construction environmental management plan (CEMP). This plan would consider methods and the scheduling of activities to minimise impacts on the community and the environment such as noise, access and amenity, and would detail mitigation and management measures.

1.2.8.1 Construction program

A preliminary construction program is presented in Figure 1-1 with the Project anticipated to be completed between four to five years from commencement.

Figure 1-1. Preliminary construction program



1.2.8.2 Construction workforce

The number of workers would vary over the program. Up to 300 workers would undertake establishment activities including setting up offices and compounds, assembling the concrete batch plants and beginning early and enabling works. The number of workers on site would increase during construction to around 500 during peak construction periods.

1.2.8.3 Construction hours

The majority of works would take place during standard construction hours for NSW which are:

- 7 a.m. to 6 p.m. – Monday to Friday
- 8 a.m. to 1 p.m. – Saturday
- no work on Sundays and Public Holidays.

This includes the majority of high noise generating activities such as:

- deliveries of materials including concrete, sand and aggregates for concrete production
- demolition work including hydro-blasting (a concrete removal technique that uses high pressure water)
- earthworks, excavations, drilling and blasting.

Some activities would need to take place outside of recommended standard construction hours**.** These activities may include:

- operation of chilled water plants for cooling and curing of concrete; continuous cooling of the concrete is required to ensure that heat does not become excessive, and cause cracking and loss of strength of the concrete, during curing.

- operation of the batching plants for the delivery and pouring of concrete. In warmer periods, concrete pours may not be able to take place in normal working hours. High temperatures may cause thermal issues and cracking during the curing process. Concrete pours may be required at night-time when temperatures are lower
- preparatory or emergency works for a flood during the construction period including removing equipment and materials from the construction area, minor earthworks and other activities.
- work outside the nominated working hours may need to occur in the case of emergencies, delivery of over-sized items or unexpected issues.

The local community would be notified of construction activities including any activities taking place outside of standard construction hours in accordance with the community consultation plan developed by the construction contractor.

1.2.8.4 Access to Warragamba Dam during construction

The operation of the visitor and education centre may be impacted by construction activities. Options to continue operating the visitor and education centre within the existing site during construction or at alternative locations are being considered. Factors to be considered include safety, impacts to construction, and the visitor and educational experience.

There would be no public access to Haviland Park during construction.

Access to the WaterNSW offices at Warragamba Dam would be maintained for WaterNSW staff and other authorised personnel.

1.2.8.5 Construction methodology

Early works

Early works are activities that may be able to commence before main construction works and would comprise:

- further investigations including surveying, geotechnical studies, building and utility condition and location surveys and other studies as required to assist in the design and construction of the Project
- installation of security fencing and site environmental controls including heritage item protection/relocation, water management, soil management and noise management measures
- establishment of temporary site offices and worker facilities
- procuring of concrete batching facilities, cranes, conveyors and other infrastructure
- clearing of vegetation
- adjustment and provision of utilities for construction facilities
- minor road works and establishment of site access roads including a temporary access bridge downstream of the dam
- establishment of areas for stockpiling of materials such as aggregate and fly ash.

Enabling works and demolition

Enabling and demolition works are required to be undertaken before commencement of concrete placement to raise and thicken the dam wall. These would comprise:

- upgrading the existing boat ramp, pontoon and access road upstream of the dam to allow for water access to the dam wall
- establishment of batching plants on site so concrete can be poured almost immediately after batching to maintain adequate concrete placement temperatures. Potential on-site locations are Havilland Park or the terraced gardens. The facilities would consist of:
  - hardstand area with drainage to environmental control ponds
  - concrete testing and geotechnical laboratory
  - weighbridge and office
  - materials storage bins and sheds (for aggregates, sand, fly ash and other materials)
  - silos, mixers, conveyors, above ground tanks, control facilities and dust control facilities
  - water and material chilling plant

  - connections to communication, power and water supply services
  - other environmental controls if required (for example, noise walls)
- releasing water from the dam until the water is five metres below full supply level; this is required to provide a buffer for floods during construction and allow construction of the new crest in the auxiliary spillway
- emptying (dewatering) the dissipator pool at the base of the dam to enable works to be undertaken
- construction of coffer dams at multiple locations around the dam wall to manage the impact of works on the Warragamba River and protect the site from river backflows. Indicative locations include at the end of the existing central spillway dissipator, immediately upstream of the auxiliary spillway and downstream of the auxiliary spillway. The number and size of the coffer dams would be confirmed by the detailed design
- construction of the raised dam would require demolition of a number of existing structures and removal of machinery, pipes and operational equipment.

Construction of concrete elements for thickening and widening the dam abutments, central spillway and modifications to the auxiliary spillway

Warragamba Dam is a concrete gravity dam which uses the weight of the concrete to resist the horizontal pressure of water. The same design and construction approach would be used for raising the dam wall. Mass concrete would provide the strength to enable the dam height to be increased. Reinforced concrete would be used to construct elements such as bridges, walls, piers, conduits, chambers, etc.

Work would comprise:

- installing formwork to create concrete blocks. The blocks have been sized to match the existing dam block dimensions and for structural performance. Generally, the formwork would be lifted into place by a crane
- where cooling of the concrete is required after the pour, small pipes may be cast into the concrete to allow chilled water to be pumped through the concrete during curing
- pouring concrete into the formwork and allowing the concrete to set and start to cure. The concrete would be delivered from the on-site batch plants by a crane or cableway with a concrete bucket and/or a conveyor
- chilled water may be pumped through the installed pipe systems to assist in curing if required
- removing the formwork and repeating the process for the next concrete block.

Although the majority of the concrete works for the Project would involve mass concrete, certain parts would require reinforced concrete. Work would comprise:

- installing formwork to allow concrete placement as determined by the design; generally, the formwork would be lifted into place by a crane
- placing reinforcing steel in the formwork in the required locations and patterns; reinforcement would be either lifted into place by a crane or would be placed by hand
- pouring concrete into the formwork and allowing the concrete to set; the concrete would be delivered from the on-site batch plants by a truck, a crane, a cableway and/or a conveyor
- Removing the formwork and repeating the process for the next concrete element.

Thickening and raising dam abutments

Works would comprise:

- excavation and earthworks at the base of the dam wall to provide a key for the concrete buttress used to increase the thickness of the dam wall
- excavation and removal of material for about 30 metres east of the left abutment at the raised dam crest location
- grouting of foundations for the raised dam crest on the left abutment
- controlled blasting may also be used to excavate material
- hydro blasting the existing concrete wall. Between 20 and 50 mm of the existing concrete surface of the dam wall would be removed to facilitate the bond between the existing concrete and the new concrete
- thickening the abutments on the downstream face using the placement methodology
- raising the abutments about 17 metres higher than the existing dam crest level
- raising of the two lift towers including installation of two new lifts

The profile of the new abutment would be constructed to mirror the existing profile.

Thickening and raising of the central spillway

Works would comprise:

- excavating the foundations to allow the tie in of the new works
- hydro blasting the existing concrete wall; between 20 and 50 millimetres of the existing concrete surface of the dam wall would be removed to facilitate the bond between the existing concrete and the new concrete
- installing stress bars in the base of the thickened dam; holes for the stress bars would be drilled and the stress bars inserted and then grouted
- thickening the central spillway wall on the downstream face using the placement methodology
- raising the central spillway crest about 12 metres higher than the existing full supply level
- extending the existing training walls downstream on either side of the spillway which would tie in with the existing dissipater walls
- constructing two new reinforced concrete bridge piers within the central spillway crest
- gated conduits or slot would be constructed within the central spillway to allow for the controlled discharge of inflows; these openings would be located so the flood mitigation zone could be drawn back down to the full supply level
- installing hydraulically controlled gates in each the conduits and their control systems
- installing a new maintenance gate including guides for each conduit
- commissioning and testing electrical and mechanical elements for operating the gates.

Auxiliary spillway modifications

Works would comprise:

- removal of the existing earth/rock embankments (fuse plugs) in the crest of the auxiliary spillway
- preparation of the existing bedrock for the foundations of the new auxiliary spillway crest including grouting
- constructing a new uncontrolled concrete spillway crest across the width of the auxiliary spillway; most of the spillway would consist of mass concrete however reinforced concrete sections would be required on the top of the crest of the spillway
- constructing of four new reinforced concrete bridge piers within the spillway crest
- installation of additional anchor bars from the spillway floor into the underlying rock; holes for the anchor bars would be drilled, the anchor bars inserted and then grouted in place
- constructing a 30 to 50 metres long reinforced concrete drop-over slab across the width of the spillway about 130 metres downstream of the new spillway crest to allow for changed spillway flows
- increasing the height and/or strength of the existing spillway chute walls in various locations; construction would be either mass or reinforced concrete depending on the degree of heightening or strengthening required and the location of the wall
- raising and/or replacing of shotcrete wall lining with reinforced concrete or new shotcrete in various locations
- additional scour protection would be required downstream of the auxiliary spillway; activities would include removing soil, excavation of rock to the required level (including blasting if needed) and installation of rock scour protection, concrete and anchor bars.

Other Infrastructure and elements

Works would comprise:

- a new road and pedestrian access would be built along the top of the abutments, the auxiliary, and central spillway. These would connect with the approaches and road network on either side of the dam to provide access and provision of services across the dam crest. Timing of construction of the new access will be linked to raising of the auxiliary, central, and abutment crests
- areas for spoil emplacement may be used for disposal of some excavated materials on-site. Material from the earth/rock embankments removal, the temporary coffer dams and other excess spoil from other excavations may be emplaced into these areas. Activities would include site preparation, emplacing material, site stabilisation and landscaping.

Environmental flows infrastructure

Works would comprise:

- underwater construction of a concrete base for multi-level water intake tower on the upstream face of the dam
- underwater and above water construction of the new tower using precast concrete units connected to the upstream face of the dam
- underwater excavation of a section of the existing hydro-electric power station intake tower to allow water to pass between the new tower and the existing tower
- installation of hydraulically operated gates into the intake tower
- installation of concrete panels to block off the existing hydro-electric power station intake tower openings
- relining of the existing 4.2 metres diameter hydro-electric power station pipe with epoxy or a new pipe grouted in place
- removal of existing generating equipment within the existing downstream hydro-electric power station including hazardous materials
- construction of a new valve house building, downstream of the existing downstream hydro-electric power station, using reinforced concrete
- installation of new steel pipes within the existing hydro-electric power station and new valve house including new valves.

Demobilisation and site restoration

Demobilising and restoration of the construction site would be undertaken progressively, as work in an area is completed, and include activities such as:

- removing temporary construction infrastructure, plant and equipment
- earthworks
- site stabilisation and landscaping
- reinstatement of public areas and facilities.

1.2.9 Consumption of natural resources

1.2.9.1 Energy use during construction

The main energy sources would be electricity to power the concrete batch plants and chilled water units, and fuel (mainly diesel) to power plant and equipment. Electricity would be sourced from the local power network or from generators. Estimates of energy use during construction is presented in Table 1-1.

Table 1-1. Energy use during construction

Energy source	Estimated energy use
Electricity	701,664 kWh
Fuel	79,401 GJ

1.2.9.2 Construction water use

Construction of the Project would require the use of water. Table 1-2 shows the construction activities with the highest water demand and an estimate of volumes required. Water would generally be sourced directly from the dam where possible. Potable water would be used as required.

Table 1-2. Construction water use

Activity	Estimated total water volume (ML)
Hydro blasting the existing concrete wall	50
Concrete curing	20
Concrete production	93
Other general uses – for example, workers' facilities	20
Total	**183**

1.2.9.3 Earthworks volumes

Earthworks would be required during construction. The volume of earthworks for relevant activities is presented in Table 1-3.

Table 1-3. Earthworks volumes

Activity	Estimated earthworks volume (m^3)	Waste classification
Removal of the fuse plugs in the auxiliary spillway.	83,000	General solid waste (non-putrescible) Excavated natural material – consisting of basalt rocks and engineered clay core
Excavation for the foundations and tie ins of the modified dam wall including the left abutment works	60,000	General solid waste (non-putrescible) Mostly virgin excavated natural material with some excavated natural material
Coffer dams	21,000	General solid waste (non-putrescible) Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste
Access road works	40,000	General solid waste (non-putrescible) Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste
Excavation for the auxiliary spillway modifications	25,000	General solid waste (non-putrescible) Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste
Erosion protection works downstream of auxiliary spillway	30,000	General solid waste (non-putrescible) Mostly virgin excavated natural material with some excavated natural material Note: If plunge pool is required this volume would increase to about 670,000 m^3
Excavations for temporary works such as temporary site access roads and for site facilities such as batch plants	10,000	General solid waste (non-putrescible) Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste
TOTAL	**269,000**	

1.2.9.4 Spoil and waste management

Spoil and waste management would be required during construction. The Project would generate spoil due to the earthworks detailed in Table 1-3. Some material may be able to be reused on the Project for temporary or permanent works, or other off-site projects. Spoil may be temporarily stockpiled before being permanently placed. Once spoil has been placed permanently placed, the area would be covered in topsoil and replanted with suitable native vegetation.

Waste materials would be generated from the demolition of existing dam elements such as the hydro blasting, dam road, radial and drum gates, other electrical and mechanical infrastructure and concrete demolition. These materials would be disposed of off-site.

The estimated volume or weight of waste materials generated during construction and potential management options are presented in Table 1-4 and are discussed further in the Chapter 26 (Waste).

Table 1-4. Waste materials generated and potential management options

Material	Volume or weight generated during construction	Potential management options
Concrete from hydroblasting	4,300 t	Suitable material would be reused with remainder emplaced on site or taken off-site for reuse or disposal
Other concrete waste	60,000 t	Taken off-site for reuse or disposal
Steel such as drum and radial gates, crest bridge and gantry crane	2,500 t	Taken off-site for reuse or disposal
Timber formwork	11,000 m^2	Taken off-site for recycling
Vegetation from clearing	50 ha (about 4,000 t)	Mulched and reused on site for landscaping
General construction waste	10,000 t	Reused on-site or taken off-site for disposal

2 Scope of work

2.1 Secretary's Environmental Assessment Requirements

This report addresses the requirements of the Secretary's Environmental Assessment Requirements (SEARs) 15.1 15.2 15.3 15.4, and 15.5, as outlined in Table 2-1.

Table 2-1. SEARs – Soils

Desired performance outcomes	Secretary's Environmental Assessment Requirements	Where addressed
15. Soils The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance of acid sulfate soils and site contamination	1. The Proponent must verify the risk of acid sulfate soils (Class 1 2, 3 or 4 on the Acid Sulfate Soil Risk Map) within, and in the area likely to be impacted by the project.	Section 4.1
	2. The Proponent must assess the impact of the project on acid sulfate soils (including impacts of acid runoff onsite) in accordance with the current guidelines.	Section 4.2
	3. The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risk posed by contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Section 6
	4. The proponent must assess whether salinity is likely to be an issue and if so, determine the presence, extent and severity of soil salinity within the project area.	Section 5.2 Section 5.3
	5. The Proponent must assess the impacts of the project on soil salinity and how it may affect groundwater resources and hydrology.	Section 5.4
	6. The Proponent must assess the impacts on soils and land resources (including erosion risk or hazard). Particular attention must be given to soil erosion and sediment transport consistent with the practices and principles in current guidelines.	Appendix N2 Geomorphology assessment report
	7. Attention must also be given to direct and indirect increase in erosion, siltation, impact on riparian vegetation of increased sediment loads and reduction in stability of river banks or water courses both upstream and downstream in the event of flood. Consideration must be given to the amount of time areas are inundated and the impact of soil during and after these events.	Appendix N2 Geomorphology assessment report

Desired performance outcomes	Secretary's Environmental Assessment Requirements	Where addressed
	8. Consideration should also be given to areas inundated by probable maximum flood levels and the potential for the project to impact how siltation remains deposited in these areas, as well as the potential impact on existing vegetation and changes in soil characteristics. The Proponent should detail, in the event that a probable maximum flood level event occurs, how soil and areas affected by changed hydrological regimes as a result of the project will be managed and/or remediated.	Appendix N2 Geomorphology assessment report
	9. The proponent must detail the capacity of the site to support the increased size of the structure.	EIS Chapter 5

SEARs 15.6 15.7 15.8, and 15.9 are addressed separately in the Geomorphology assessment report (Appendix N2 to the EIS) and the Flooding and Hydrology assessment report (Appendix H1 to the EIS).

The scope for the assessment of potential impacts to soils and soil landscapes included a review of:

- publicly available maps, including geology, topographic and acid sulfate soil risk maps for the area
- flood modelling data provided by WMAwater (2018)
- NSW Environmental Protection Authority (EPA) online databases including:
  - List of contaminated sites notified to EPA
  - Contaminated Land Record of Notices
  - *Protection of the Environment Operations Act 1997* Register
  - National Pollutant Inventory
  - Unlicensed premises regulated by the EPA
  - NSW Planning and Environment MinView Interactive Mining Data (2019)
  - Record of Waste Management Facilities (Geoscience Australia).
- relevant sections of reports provided by WaterNSW.

2.2 Guidelines

The assessment has been undertaken with reference to relevant sections of guidelines listed as 'current guidelines' in Section 15 of the SEARS comprising the following:

- Acid Sulfate Soils Assessment Guidelines (DoP 2008)
- Acid Sulfate Soils Manual (Acid Sulfate Soils Management Advisory Committee 1998)
- Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land (DUAP and EPA 1998)
- Guidelines for Consultants Reporting on Contaminated Sites (OEH, reprinted 2011)
- Guidelines for the NSW Site Auditor Scheme (DEC 2006)
- Guidelines on the Duty to Report Contamination under the *Contaminated Land Management Act 1997* (CLM Act, EPA 2015)
- Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets, which includes *Site Investigations for Urban Salinity* (DLWC 2002)
- Landslide risk management guidelines presented in Australian Geomechanics Society (2007)
- Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)
- Managing Urban Stormwater: Soils and Construction Volume 1 (LandCom 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E .Mines and Quarries) (DECC 2008)
- Other guidelines made or approved under section 105 of the CLM Act (as at the time of writing this report).

3 Site information

3.1 Study area

The study area for this assessment covered the construction footprint (Figure 3-1), as well as the area of the predicted probable maximum flood (PMF) post-construction of the raised dam.

3.1.1 Upstream study area

The upstream study area (Figure 3-2) represents the land area predicted to become inundated during a PMF event post-construction of the raised dam, as modelled by WMAwater (2018). The upstream study area extends about 52 kilometres to the southwest of the dam, encompassing a total area of about 5,280 hectares.

3.1.2 Downstream study area

The downstream study area is immediately downstream to the east of the existing dam, extending approximately 45 kilometres to the northeast to the point at which the Hawkesbury River meets the Tasman Sea. The downstream study area (Figure 3-3) represents the extent of flood water inundation during a PMF event post construction of the raised dam, as modelled by WMAwater (2018). The area in purple on Figure 3-3 represents the change in flood inundation extent pre- and post-construction of the raised dam, which for the downstream study area represents a reduction in inundation area under a PMF event. Raising the dam would reduce the total area of land in the downstream study area exposed to flood waters during a PMF.

Figure 3-1. Construction study area

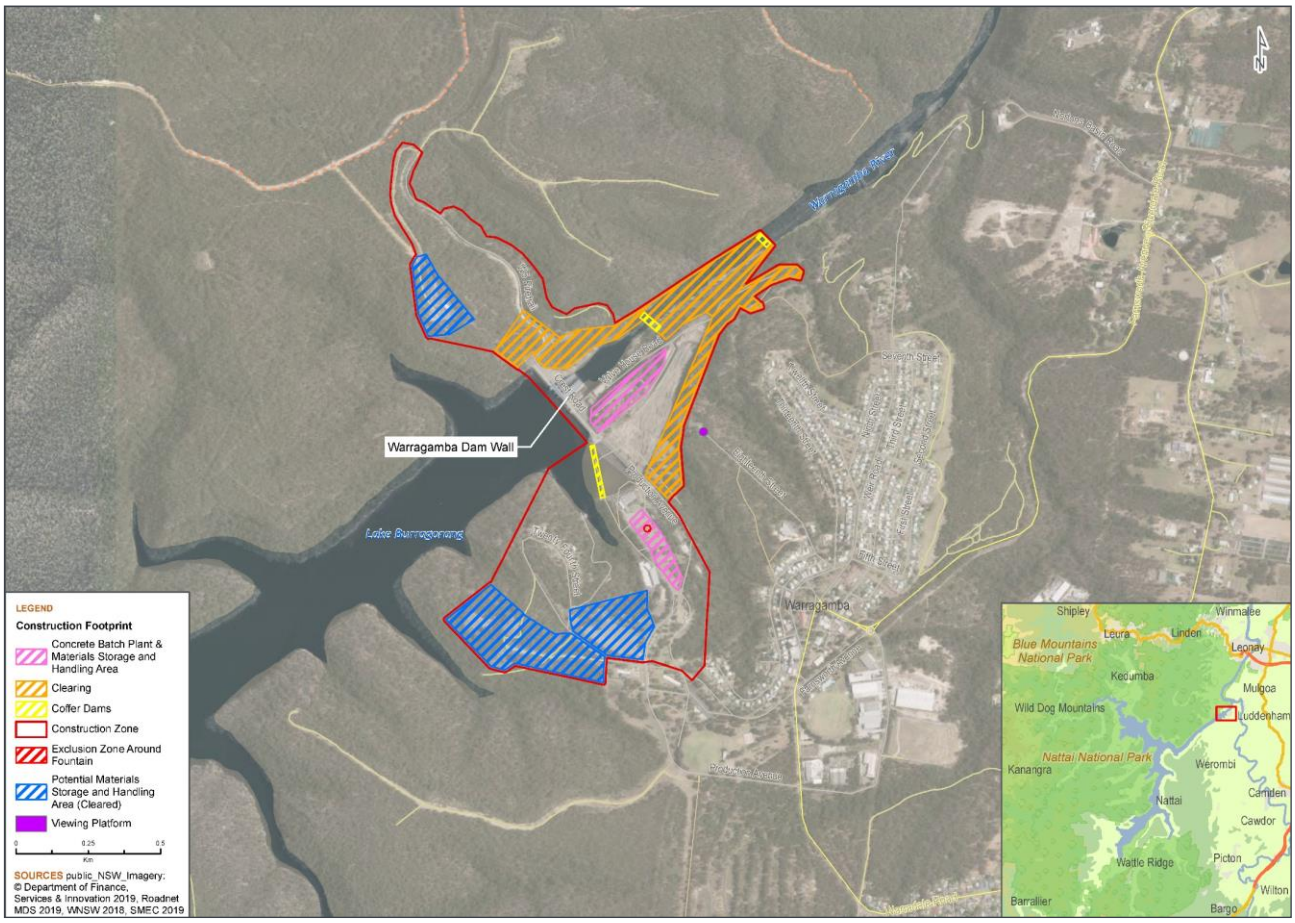


Figure 3-2. Upstream study area

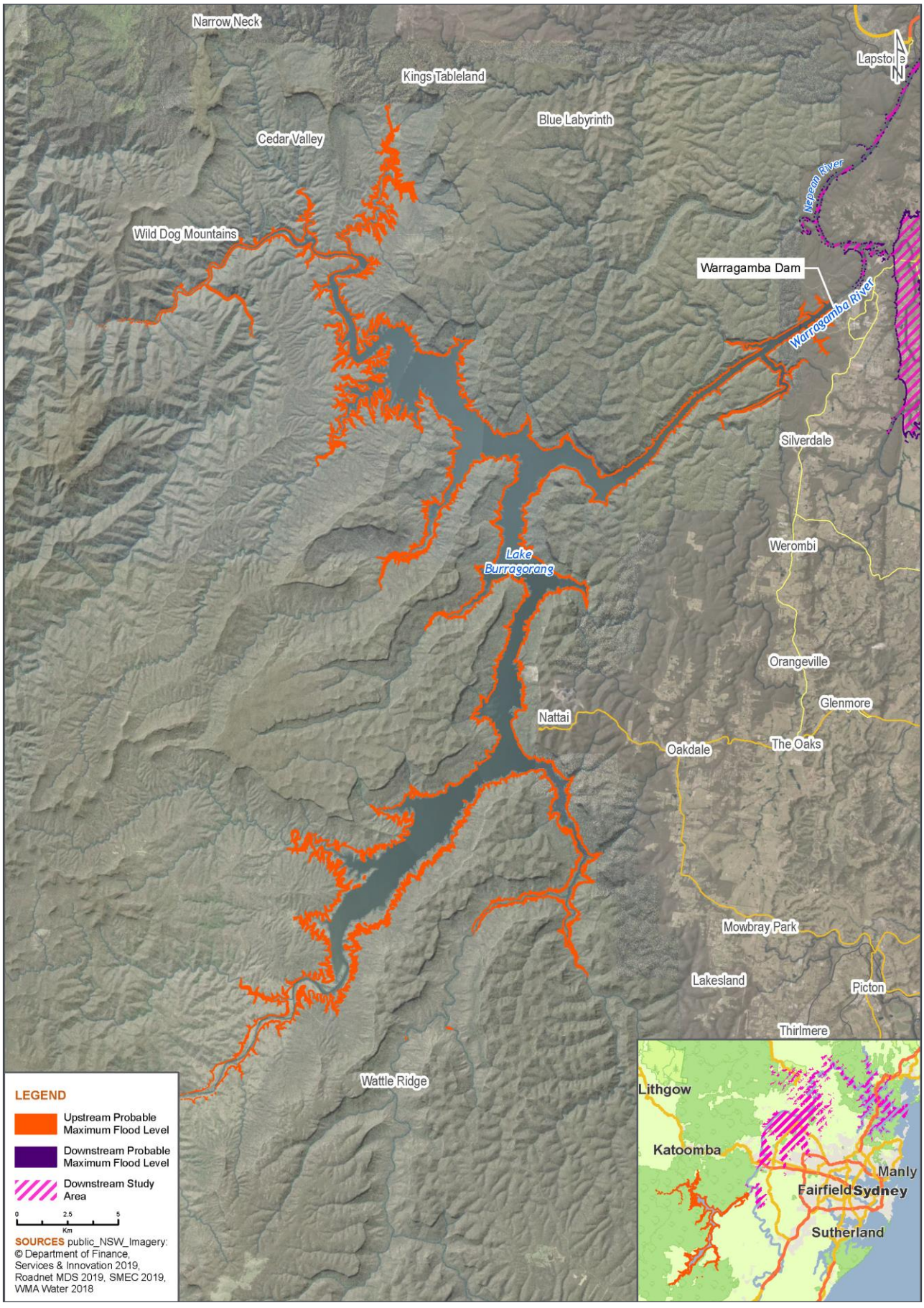
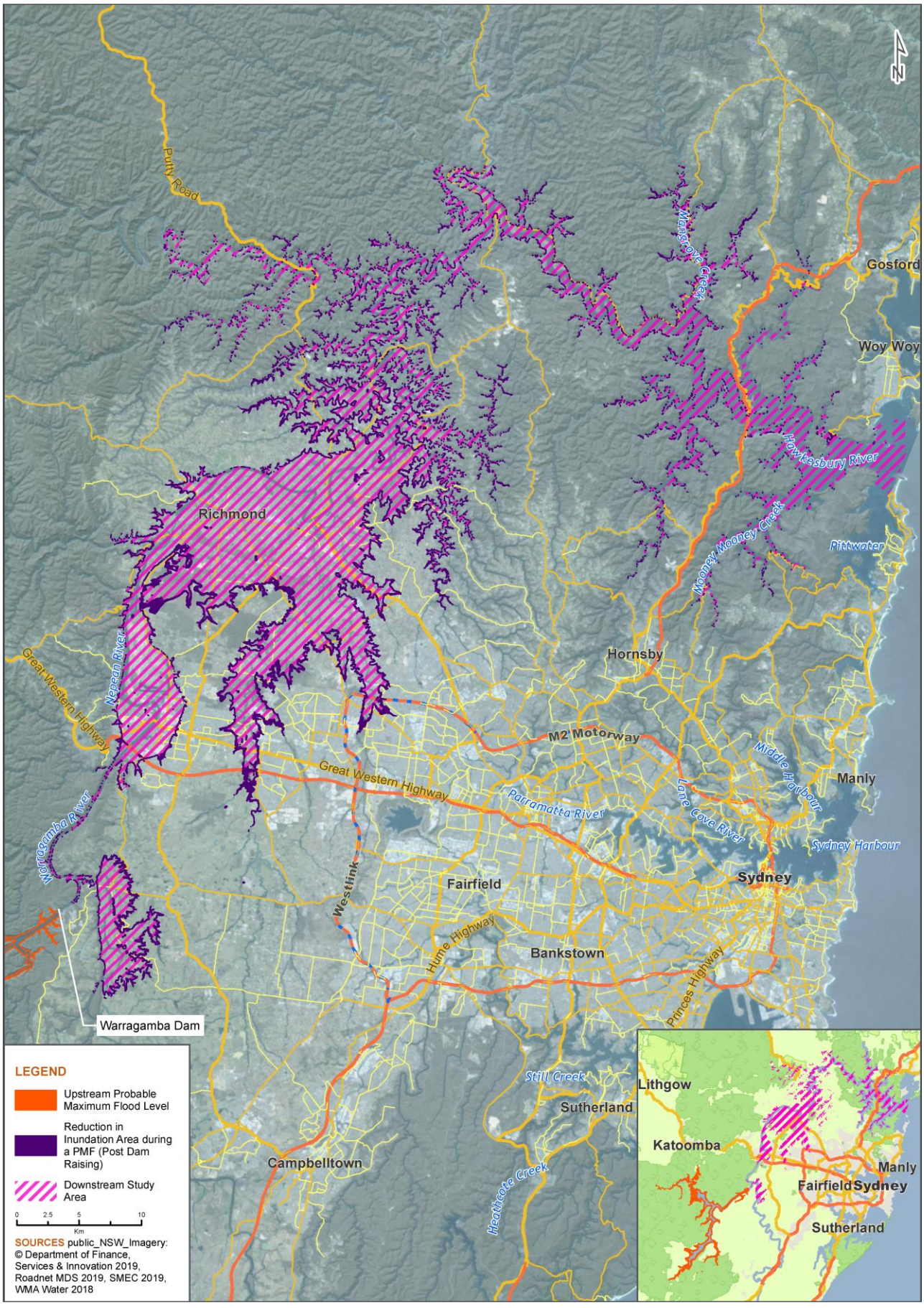


Figure 3-3. Downstream study area



3.2 General land use

3.2.1 Upstream study area

The upstream study area follows the edge of Lake Burragorang. Lake Burragorang is confined by the steeply sloping sides of the Burragorang Valley situated within the Blue Mountains National Park. The land immediately surrounding the incised Burragorang Valley comprises densely forested National Park and Conservation Areas, including the Nattai State Conservation Area and Burragorang State Conservation Area (to the south and east of Lake Burragorang respectively), and the Yerranderie State Conservation Area and Blue Mountains National Park (to the west and north of Lake Burragorang respectively).

Local government area (LGA) land use zones in the upstream study area is shown in Figure 3-4.

3.2.2 Downstream study area

The downstream study area overlaps 13 land use types. Note that these land use types differ to the Local Government Area land zoning. Urban, grazing, river and drainage systems, and tree and shrub cover make up the majority of these. A summary of the total land area occupied by each land use type within the downstream study area is provided in Table 3-1.

Table 3-1. Land use by area cover (approximate) in the downstream study area

Land use in downstream study area	Area (ha)	Percentage (%)
Grazing	15,479	30.42
Urban	10,185	20.00
River and Drainage System	6,301	12.38
Tree and Shrub Cover	4,741	9.32
Horticulture	2,691	5.29
Conservation Area	2,606	5.12
Mining and Quarrying	1,891	3.72
Special Category (e.g., beaches, cliff, rock outcrop, defence facilities and farm infrastructure – house, machinery and storage sheds and garden areas)	1,877	3.69
Intensive Animal Production	1,717	3.37
Transport and Other Corridors	1,669	3.28
Wetland	1,667	3.28
Cropping	35	0.07
Power Generation	29.	0.06
Total	**50,889**	**100**

The percentage of different land zones in the downstream study area is provided in Table 3-2 and shown in Figure 3-5. Note that the total area in Table 3-2 differs to that in Table 3-1 because of the different datasets used, and different degrees of consistency of land area overlapping the study area. However, these provide a useful indication of the main land zones, and land uses, and offer an insight into potential contamination sources.

Figure 3-4. Local Government Area land use zones in the upstream study area

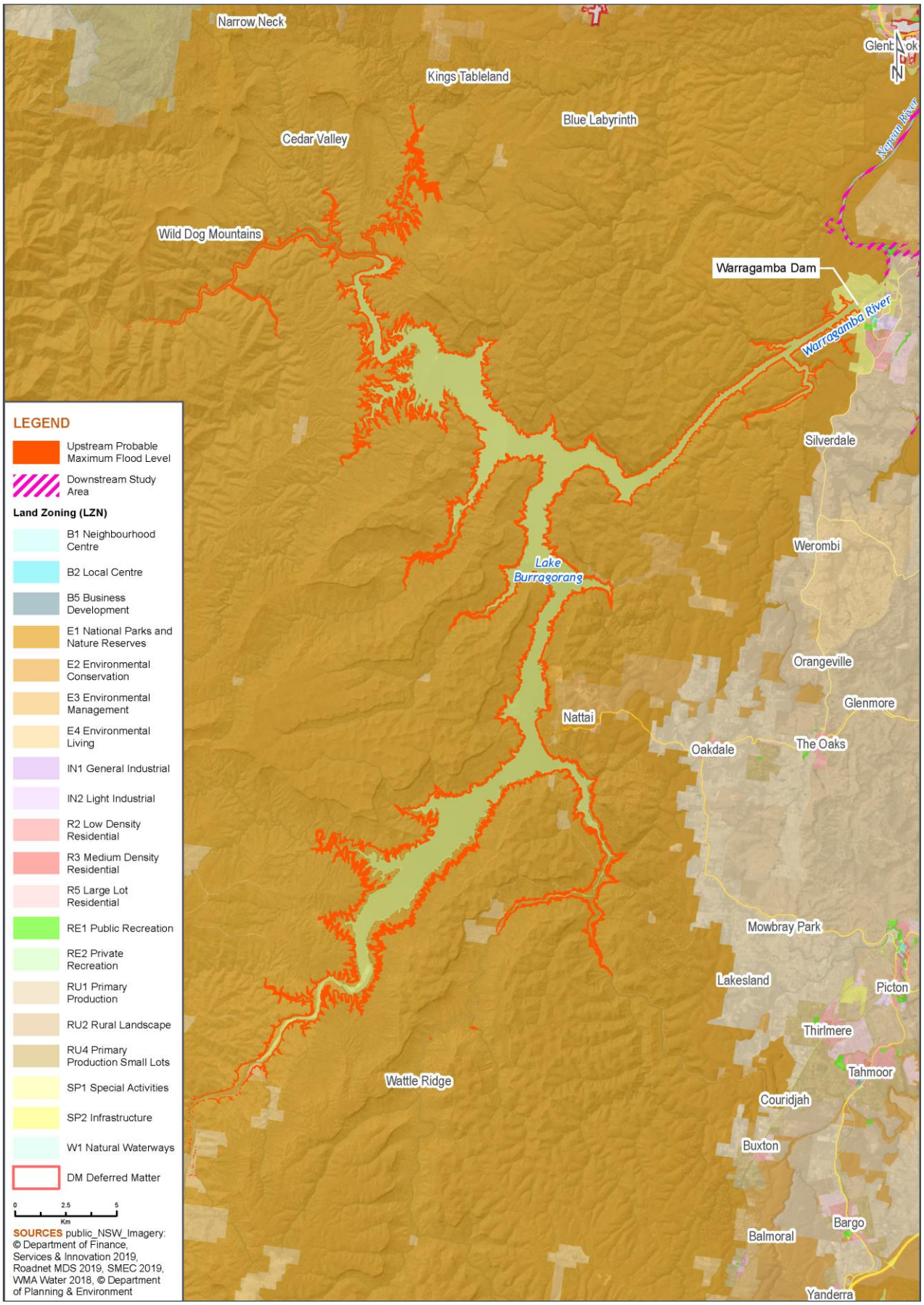
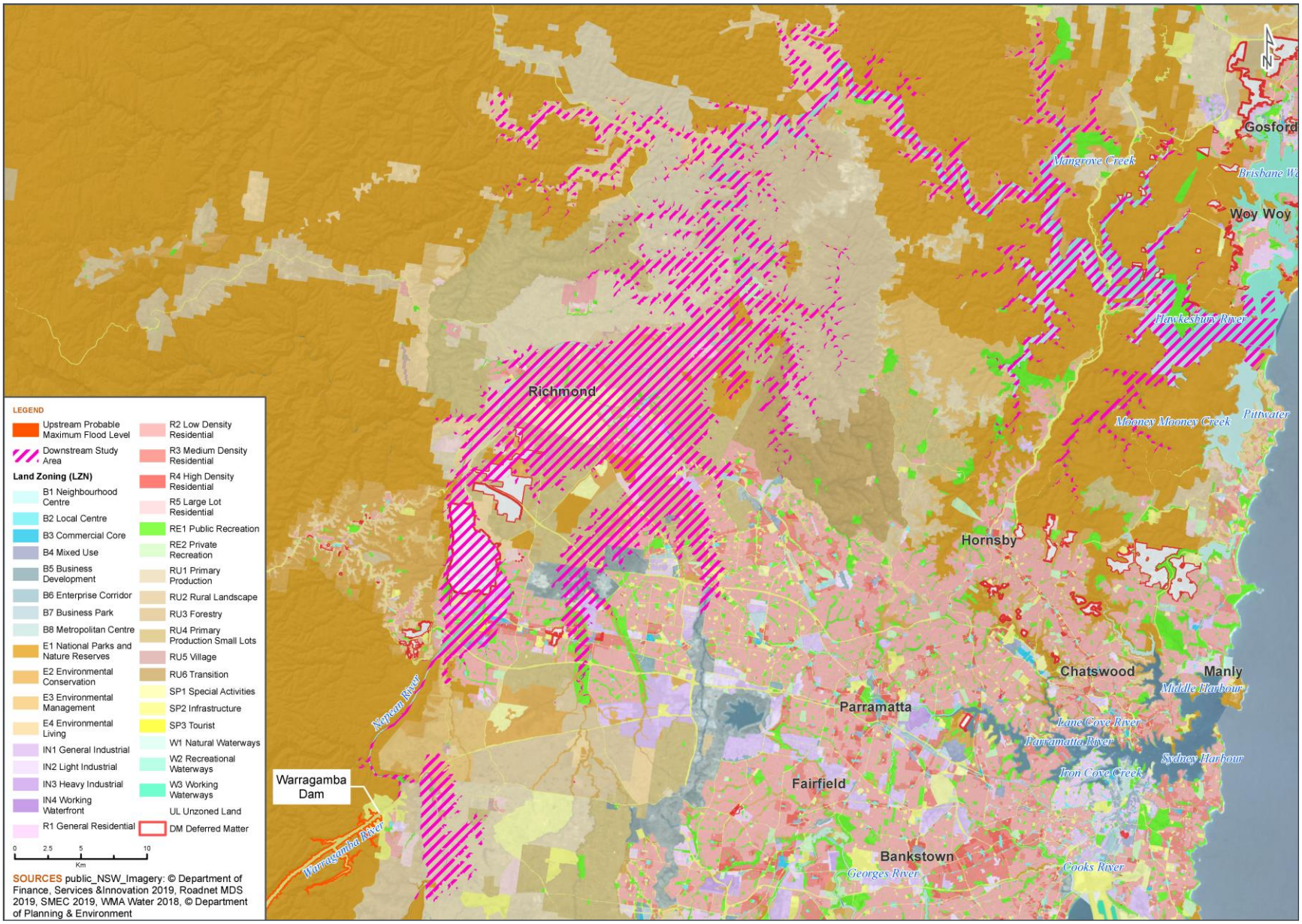


Table 3-2. Local Government Area land use zones for the downstream study area

Land use zone	Land use zone type	Approx. area covered (ha)	Approx. percentage of area covered (%)
B1	Neighbourhood Centre	26.83	0.05
B2	Local Centre	75.58	0.13
B3	Commercial Core	24.56	0.04
B4	Mixed Use	34.89	0.06
B5	Business Development	112.69	0.19
B6	Enterprise Corridor	14.05	0.02
B7	Business Park	49.51	0.08
DM	Deferred Matter	2356.81	4.04
E1	National Park and Nature Reserve	3690.30	6.33
E2	Environmental Conservation	4056.24	6.96
E3	Environmental Management	1100.66	1.89
E4	Environmental Living	3377.52	5.79
IN1	General Industrial	836.41	1.43
IN2	Light Industrial	99.65	0.17
IN4	Working Waterfront	1.67	0.00
R1	General Residential	99.35	0.17
R2	Low Density Residential	1764.60	3.03
R3	Medium Density Residential	442.35	0.76
R4	High Density Residential	75.69	0.13
R5	Large Lot Residential	589.84	1.01
RE1	Public Recreation	1152.98	1.98
RE2	Private Recreation	598.40	1.02
RU1	Primary Production	6001.70	10.30
RU2	Rural Landscape	8871.75	15.22
RU4	Primary Production Small Lots	7332.07	12.58
RU5	Village	203.62	0.35
RU6	Transition	560.46	0.96
SP1	Special Activities	1992.37	3.42
SP2	Infrastructure	1166.85	2.00
SP3	Tourist	108.20	0.19
W1	Natural Waterways	4066.63	6.98
W2	Recreational Waterways	6422.68	11.02
-	Miscellaneous	987.05	1.69
Total		**58,290.92**	**100.00**

Figure 3-5. Local Government Area land use zones in the downstream study area



3.3 Topography and landforms

3.3.1 Upstream study area

Most of the upstream study area is within the steep slopes of the Burragorang Valley. The landscape surrounding the upstream study area is dominated by rugged topography where, over geological timescales, the highlands of a vast plateau have been incised by rivers to form steep valleys, rocky outcrops, sheer cliffs and escarpments. The ridges and peaks surrounding the western extent of the upstream study area, above the Burragorang Valley reach elevations of up to 640 metres Australian Height Datum (mAHD), rapidly decreasing to around 117 mAHD at Lake Burragorang. Elevation of the upstream study area generally decreases moving to the east, coinciding with a change in topography from steeply dipping rugged ridgelines and escarpments, to undulating hills. The rolling hills to the north and south of the dam wall are about 200 mAHD.

Warragamba Dam was built across the Warragamba Gorge, approximately 3.5 kilometres upstream of the confluence of the Warragamba River and Nepean River. The gorge is 160 metres deep, 30 metres wide at the base, and about 450 metres wide at the edge of the plateau. Topography and landform of the upstream study area is presented in Figure 3-6.

3.3.2 Downstream study area

The topography of the downstream study area, near the confluence of the Warragamba River and Nepean River comprises densely forested undulating hills with a maximum elevation of 200 mAHD. At Leonay/ Regentville, the landscape flattens into a floodplain environment with a typical elevation of 20 to 40 mAHD. Between Emu Plains and Castlereagh, the Nepean River is flanked to the west by the steep slopes of the eastern extent of the Blue Mountains National Park.

At Ebenezer/Cattai, the topography starts to gently undulate as the Hawkesbury River flows north toward the Parr Conservation Park. From the confluences of the Colo and Macdonald Rivers with the Hawkesbury River, at Lower Portland/Webbs Creek, to the Tasman Sea, the topography comprises narrow flat floodplain immediately adjacent to the river with undulating hills of the Dharug National Park, Marramarra National Park and Brisbane Water National Parks adjacent. Topography and landform of the downstream study area is presented in Figure 3-7.

Figure 3-6. Topography and landforms – upstream study area

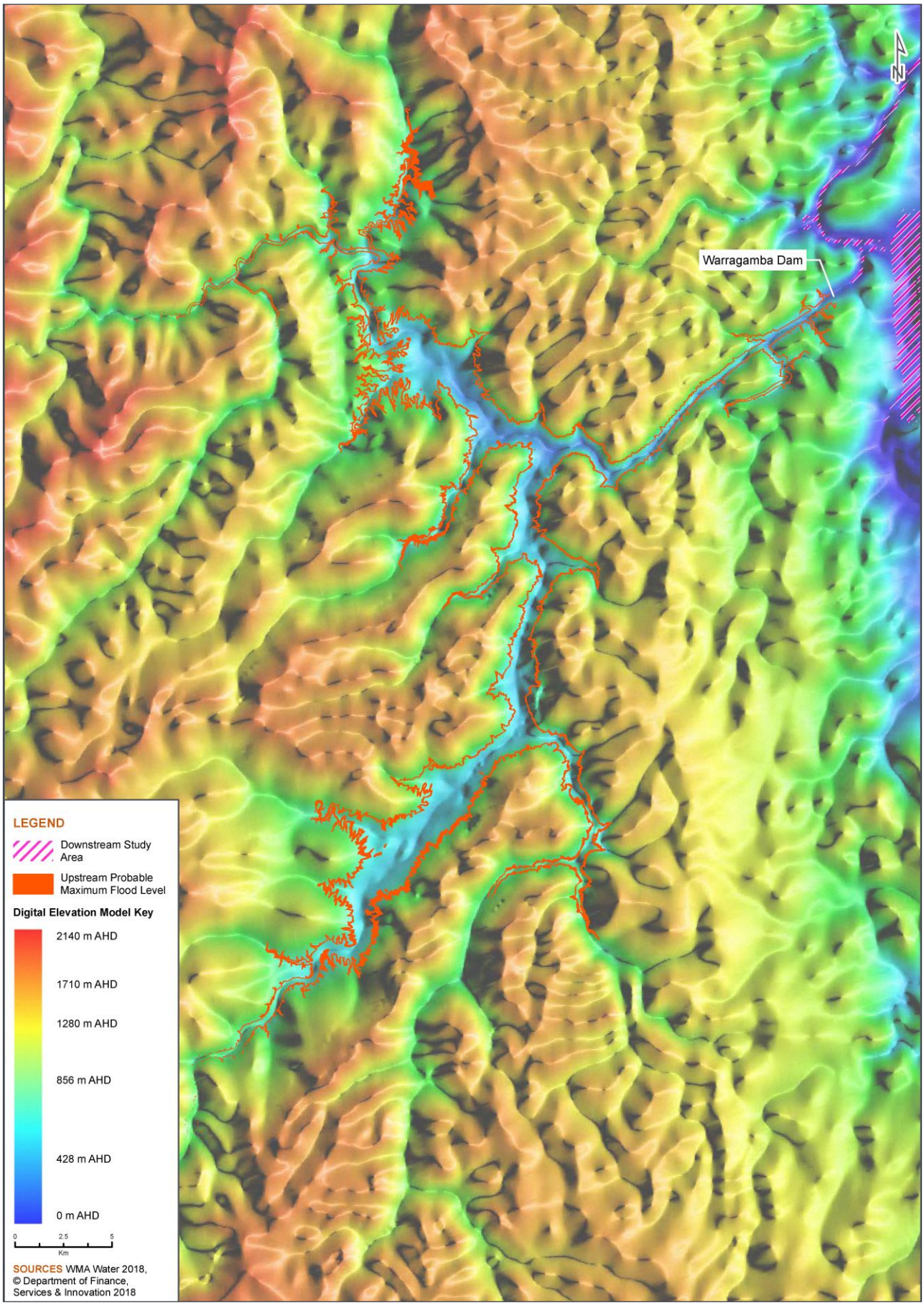
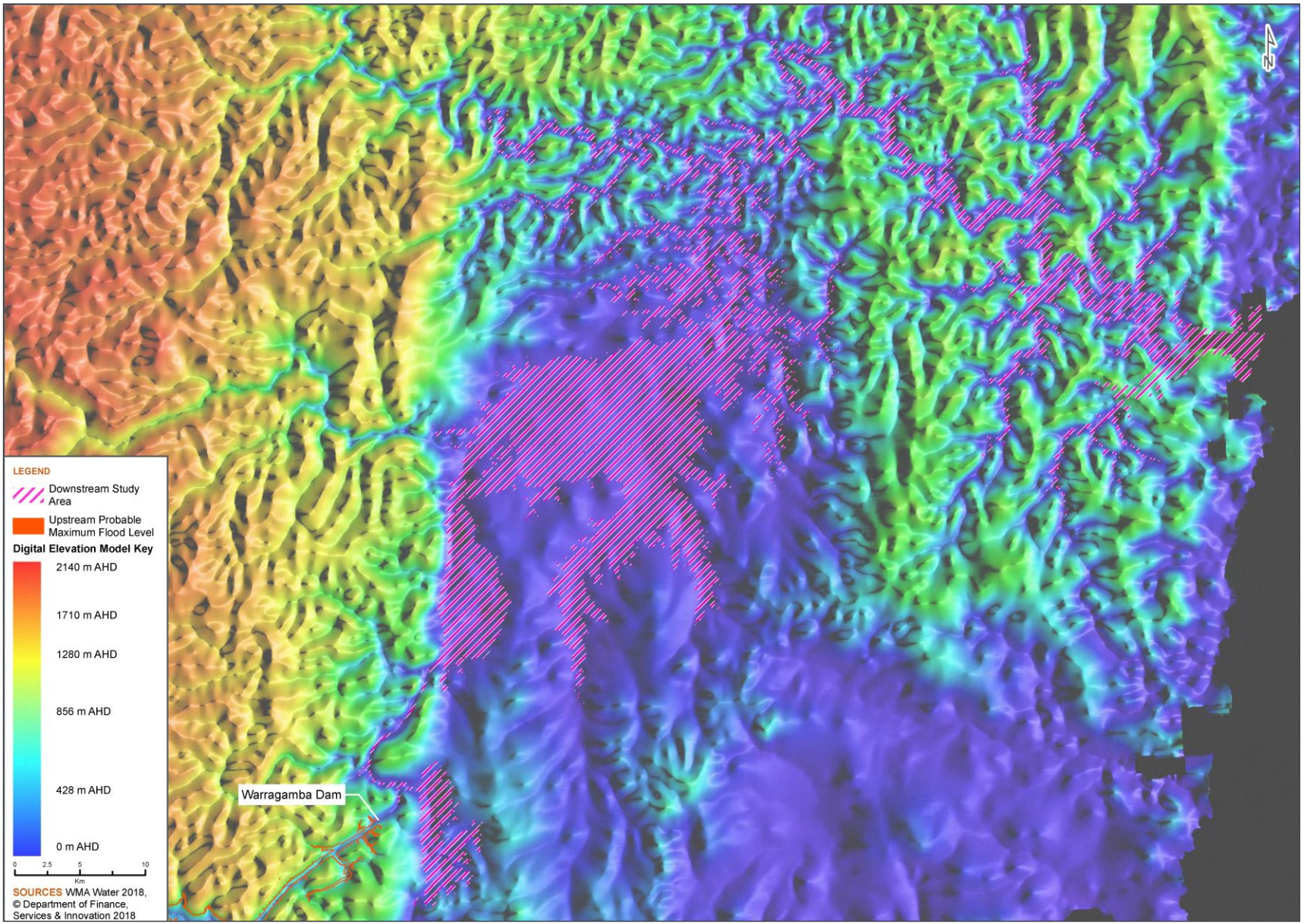


Figure 3-7. Topography and landforms – downstream study area



3.4 Regional geology

3.4.1 Upstream study area

The flooded base and sides of the Burragorang Valley are made up of the Berry Siltstone (Shoalhaven Group) comprising mid to dark grey siltstone to very-fine grained sandstone (NSW Seamless Geology Map Zone 56 2015). The Illawarra Coal Measures comprising shale, quartz-lithic sandstone, conglomerate, chert, sporadically carbonaceous mudstone, coal and torbanite seams are present within the western extent of the Burragorang Valley. In general, the topographically elevated escarpments and ridges above the Burragorang Valley are made up of Triassic Sedimentary rocks comprising quartz-lithic to quartz-rich sandstone (including the Hawkesbury Sandstone) with conglomerate, mudstone and siltstone.

Wentworth Clay Member, Burralow Formation and Banks Wall Sandstone (all components of the Narrabeen Group) make up the base and sides of the Burragorang Valley as it narrows proximal to Warragamba Dam. The Narrabeen Group tapers approximately two kilometres upstream of the dam from which point the Hawkesbury Sandstone dominates the landscape. The Hawkesbury Sandstone comprises horizontally bedded medium to coarse grained quartz sandstone with minor shale and laminate lenses. The northwest and southwest extents of the study area are underlain by quartz rich sandstones and pebbly conglomerate units as well as sandstone, siltstone and mudstone. Geological mapping for the upstream study area is presented in Figure 3-8.

3.4.2 Downstream study area

Between Warragamba Dam and Lapstone Local Government Area (LGA), the Hawkesbury Sandstone (Tuth) dominates the local geology. Between Lapstone (LGA) and Tuth/Maraylya the dominant geological formation is the Wianamatta Group comprising the Ashfield and Bringelly Shales, the remainder of the downstream study area between Tuth/Maraylya and the eastern coastline is underlain by the Hawkesbury Sandstone and the Burralow Formation.

Quaternary sediments including channel and floodplain alluvium comprising gravel, sand, silt and clay are present within the downstream study area predominantly underlying the suburbs of Emu Plains, Penrith, Castlereagh, Agnes Banks, Richmond, Lowlands and Cornwallis. These sediments tend to occupy low lying areas adjacent major rivers and creeks, forming contemporary flood plains. The suburbs of Londonderry, Richmond, Clarendon, Bligh Park, Windsor Downs and Pitt Town are underlain by undifferentiated consolidated Cainozoic sedimentary rocks comprising sandstone, limestone, conglomerate, siltstone, duricrust; commonly ferruginised or silicified. These may be poorly consolidated, highly weathered and dissected by present day drainage.

Geological mapping for the downstream study area is presented on Figure 3-9. Figure 3-10 shows the interrelationship of the rock units in the general area.

Figure 3-8. Geology – upstream study area

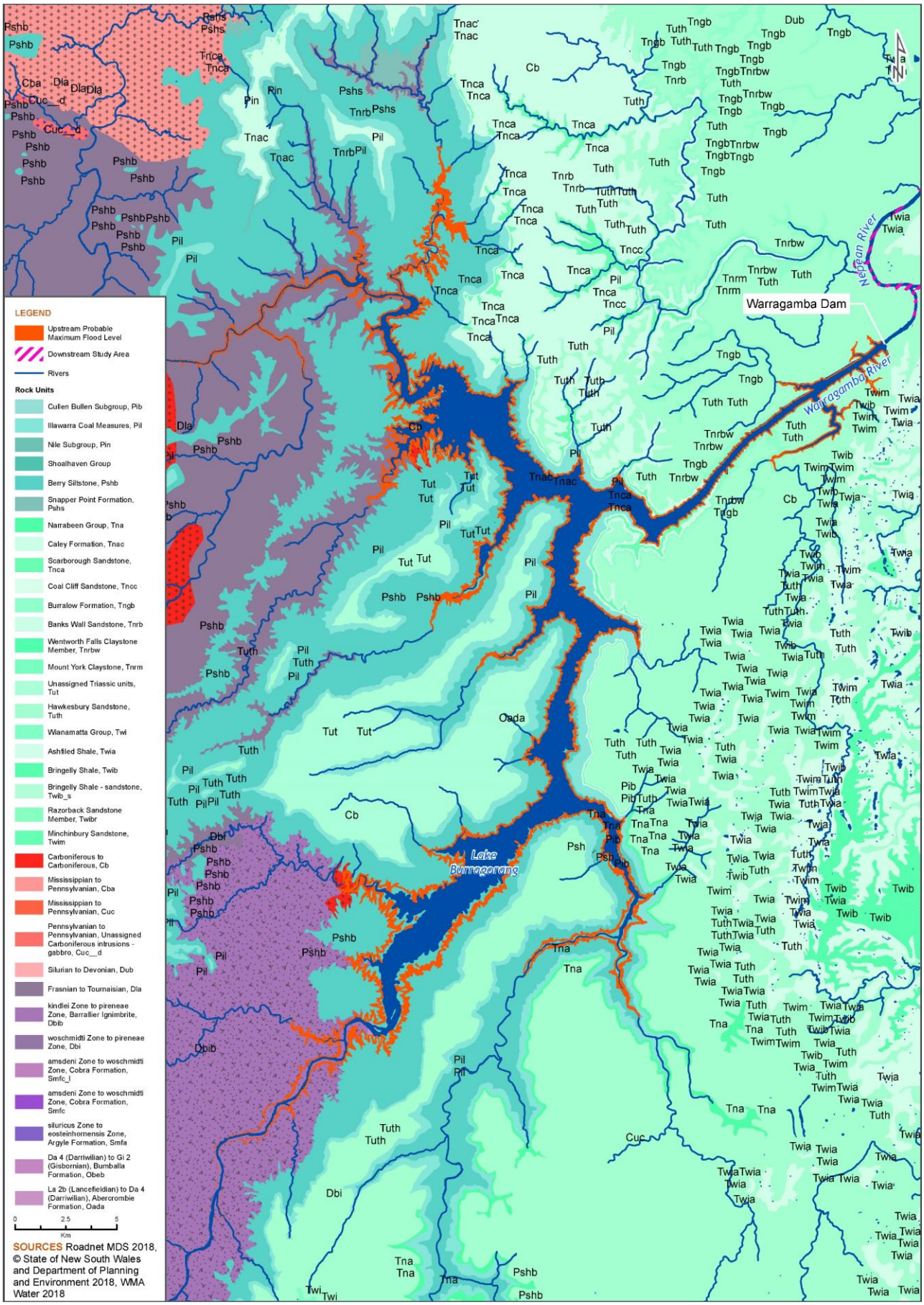


Figure 3-9. Geology – downstream study area

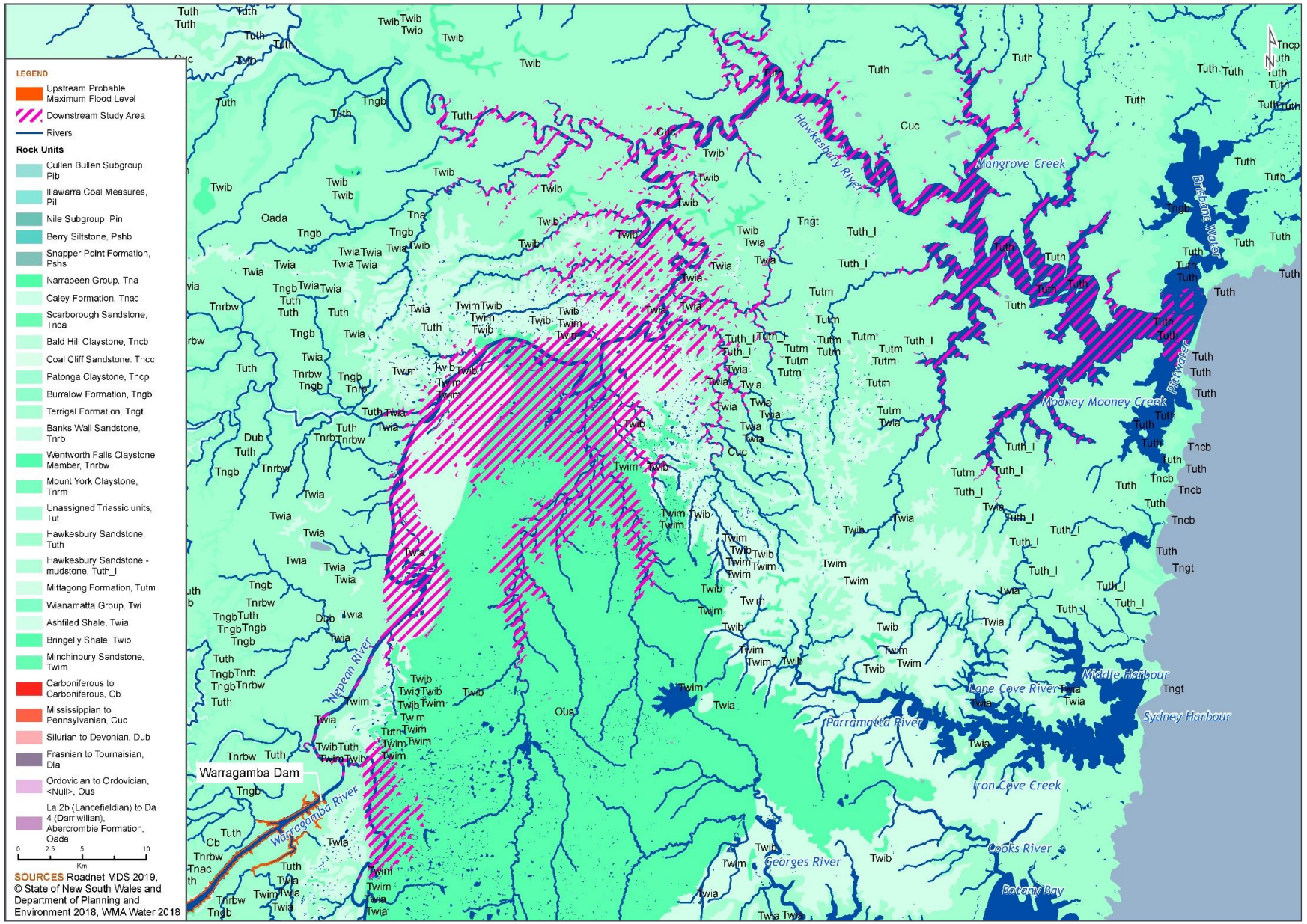
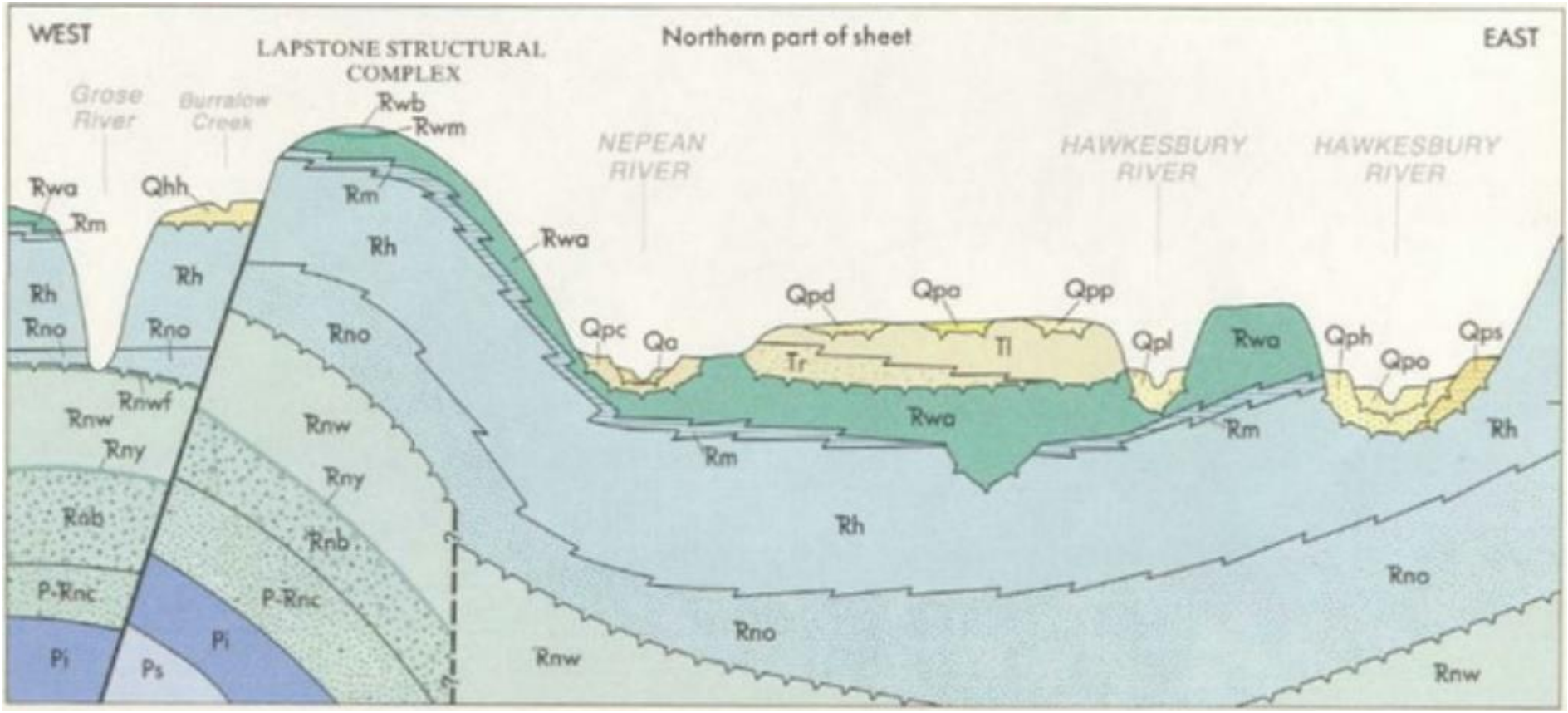


Figure 3-10. Rock relationship diagram (Clark et al. 1991)



3.5 Hydrology and hydrogeology

3.5.1 Hydrology

An assessment of hydrology and hydrogeology is provided within Appendix H1 of the EIS (Flooding and hydrology assessment report). Contents of this assessment relevant to this technical report is provided below.

Flood modelling post-construction of the raised dam for the upstream study area has shown that during a PMF event backwater effects will inundate additional land around Lake Burragorang and its tributaries. This includes several rivers and creeks which originate in the highlands of the surrounding National Parks and Conservation Areas.

The downstream study area immediately to the east of the dam comprises a flat floodplain landscape. Within this area, the Warragamba River flows northeast from the dam for three kilometres to the confluence of the Nepean River. From this point, the Nepean River flows north and then northeast within a narrow valley. The valley is fringed by densely forested slopes and agricultural land for about 10 kilometres, then urban/agricultural areas near Emu Plains. The Nepean River converges with the Grose River near the Navua Reserve, Grose Wold, and becomes the Hawkesbury River which discharges into the Tasman Sea approximately 80 kilometres downstream of Warragamba Dam.

3.5.2 Hydrogeology

The geological units and their soil types within the study area can be classified under the following aquifer types:

- unconsolidated sediment aquifers, for example, surficial sediment aquifers underlying the suburbs of Richmond and Penrith and adjacent to the Hawkesbury River in the downstream study area.
- porous rock aquifers, for example, in Hawkesbury Sandstone Formation and Narrabeen Group Sandstones.
- fractured rock aquifers, for example, the Palaeozoic and Pre-Cambrian Fractured Rock that underlies most of the upstream study area (Milne-Home 2009).

3.5.2.1 Upstream study area

The upstream study area is surrounded by the Palaeozoic and Pre-Cambrian fractured Rock aquifer along its western extent and by Late Permian/Triassic sediments described as ‘porous media along the eastern extent. Hydrogeological mapping for the upstream study area is shown in Figure 3-11.

3.5.2.2 Downstream study area

The hydrogeological landscape of the downstream study area is dominated by Late Permian/Triassic Sediments, with intermittent areas of Cainozoic Alluvium which begin proximal to Penrith and extend northwest to Richmond. Isolated zones of Cainozoic sediments occur adjacent to the Hawkesbury River between Richmond and where the Hawkesbury enters the Tasman Sea. Hydrogeological mapping for the downstream study area is presented in Figure 3-12.

Figure 3-11. Hydrogeology – upstream study area

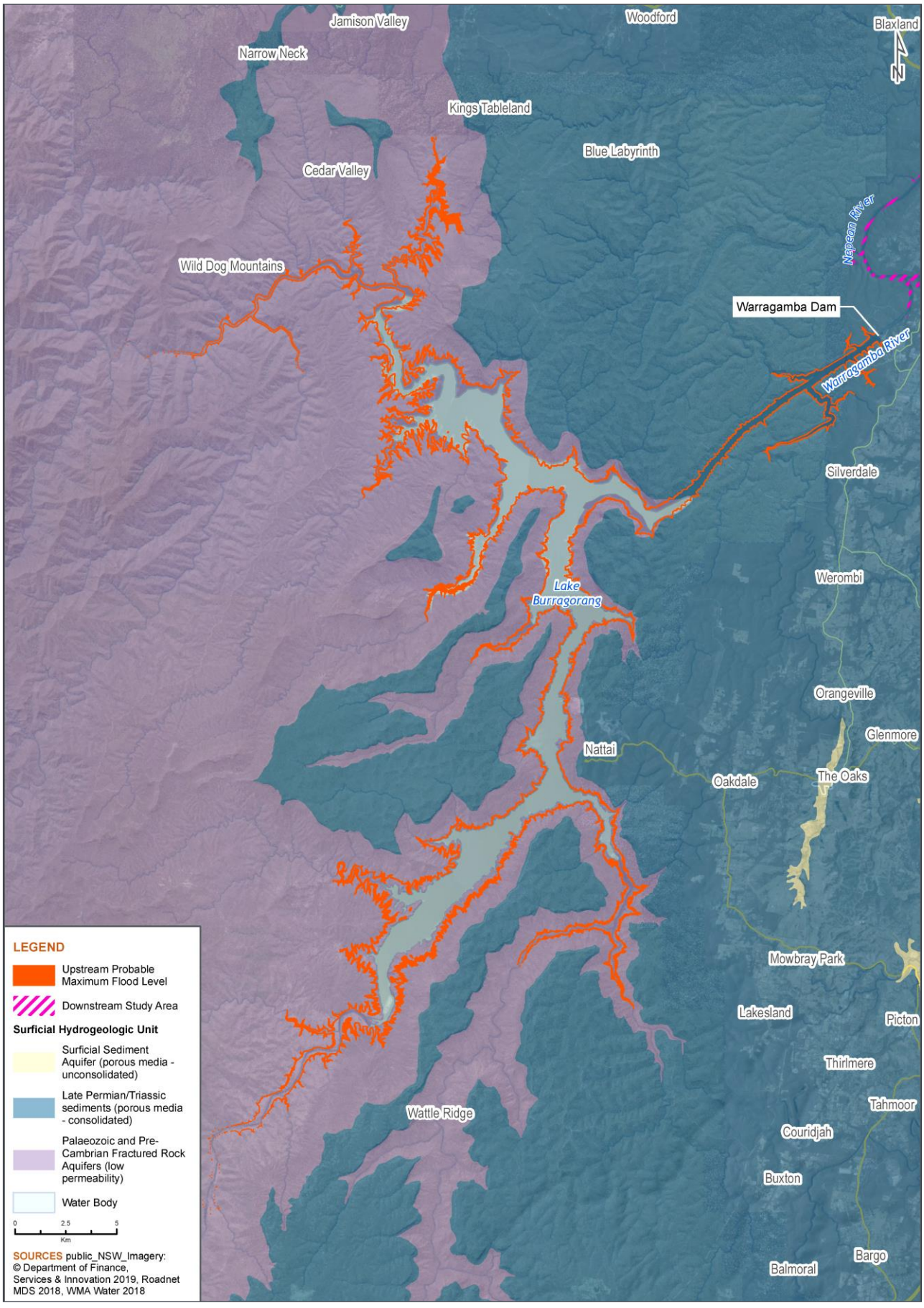
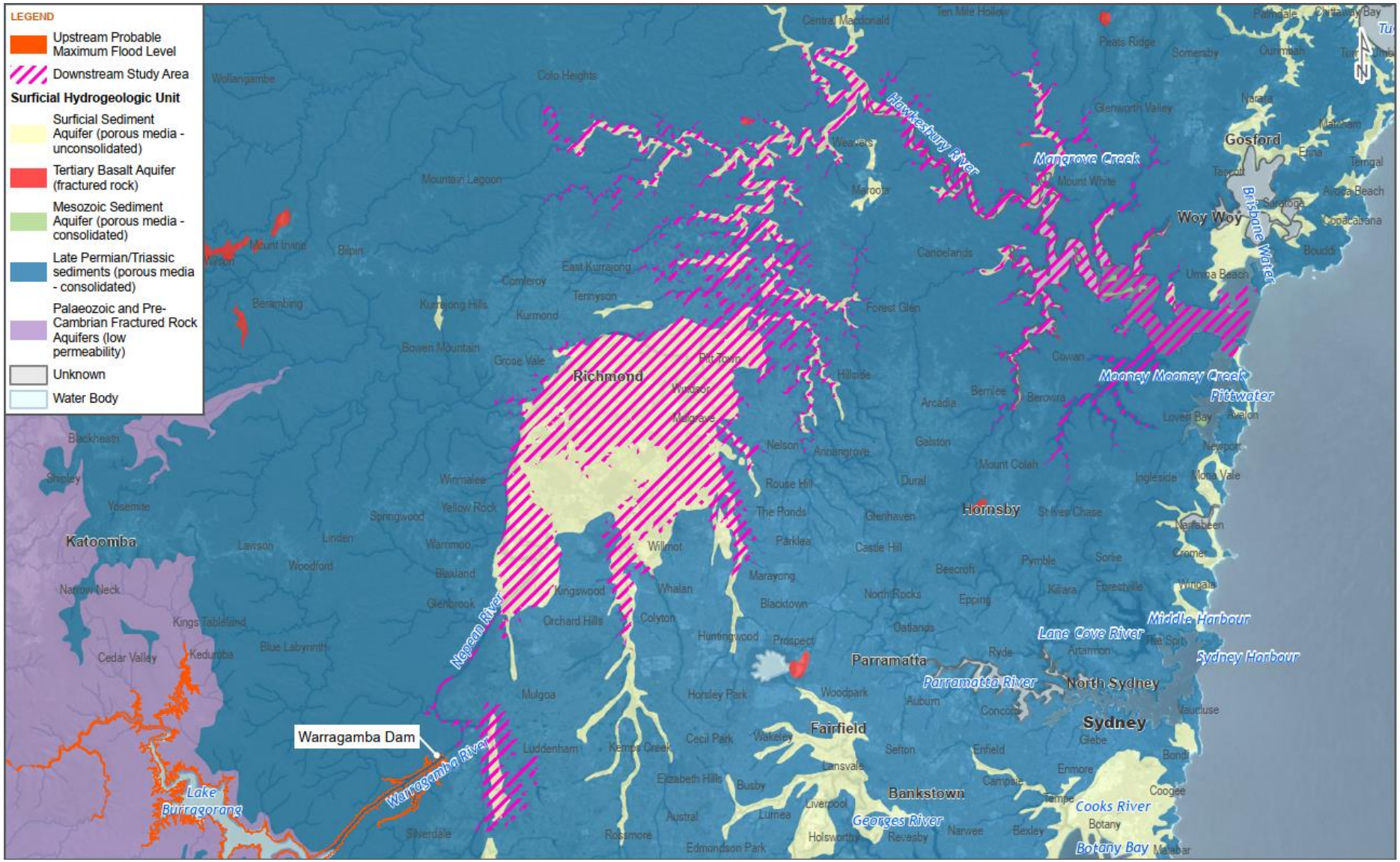


Figure 3-12. Hydrogeology – downstream study area



4 Acid sulfate soils

4.1 Acid sulfate soil potential

Acid sulfate soils is the common term given to naturally occurring soil and sediment that contains iron sulfides. When this material is disturbed and exposed to air, oxidation occurs releasing sulfuric acid and soluble iron. These substances have the potential cause acute and chronic environmental and socio-economic impacts. Environmental impacts that sulfuric acid and soluble iron can cause include fish kills, fish disease, oyster damage and mortality, adverse effects to aquatic ecosystems, release of heavy metals from contaminated sediments, human and animal health impacts from polluted water, adverse impacts on soil structure and arability, damage to build structures such as bridges (Ahern et al. 1998).

Acid sulfate soils are predominantly found in coastal areas at elevations less than 5 metres AHD, which are referred to as coastal acid sulfate soils. Inland acid sulfate soils are less common but can exist associated with inland waterways, wetlands and drainage channels where conditions conducive to the formation of iron sulphides, such as waterlogged saline areas with anaerobic conditions, exist or existed.

The potential presence of acid sulfate soil within the study area was assessed by review of relevant literature and mapping comprising:

- Acid sulfate soil risk maps from NSW DPIE (eSPADE).
- Acid sulfate soil classes – NSW DPIE (Environmental Planning Instrument - Acid Sulfate Soils).
- Atlas of Australian Acid Sulfate Soils (CSIRO).
- Geological maps.

Acid sulfate soil class mapping has been produced by NSW DPIE and is presented in Figure 4-1 and Figure 4-2. The class map is split into five risk classes which are summarised in Table 4-1. Note that the risk and class maps are for coastal acid sulfate soils.

Table 4-1. Summary of Acid Sulfate Soil classes

Class	Description
Class 1	Acid sulfate soils in a class 1 area are likely to be found on and below the natural ground surface
Class 2	Acid sulfate soils in a class 2 area are likely to be found below the natural ground surface
Class 3	Acid sulfate soils in a class 3 area are likely to be found beyond 1 metre below the natural ground surface
Class 4	Acid sulfate soils in a class 4 area are likely to be found beyond 2 metres below the natural ground surface
Class 5	Acid sulfate soils are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres on adjacent class 1,2,3 or 4 land

Note that due to the scale of the maps, Class 5 is a thin wedge around Classes 1-4 and is not shown.

The CSIRO Atlas of Australian Acid Sulfate Soils and the coastal acid sulfate soils mapping were referenced to provide information on inland acid sulfate soils. The CSIRO Atlas of Australian Acid Sulfate Soils uses a provisional acid sulfate soils classification inferred from national and state soils, hydrography and landscape coverages. It should be noted that the maps provided a low data confidence for this area. Regardless, maps have been reproduced from this data source as Figure 4-3 and Figure 4-4; however, these should be treated with low data confidence. A discussion of the information drawn from the mapping for upstream and downstream study areas is provided in the following subsections.

The upstream study area is outside the extent of coastal acid sulfate soil mapped area and are considered areas of no known occurrence of coastal acid sulfate soils due to the elevation greater than 5 metres AHD. No areas within or near the upstream area fall within acid sulfate soil Class 1-5.

Figure 4-1. Acid sulfate soil classes – upstream study area

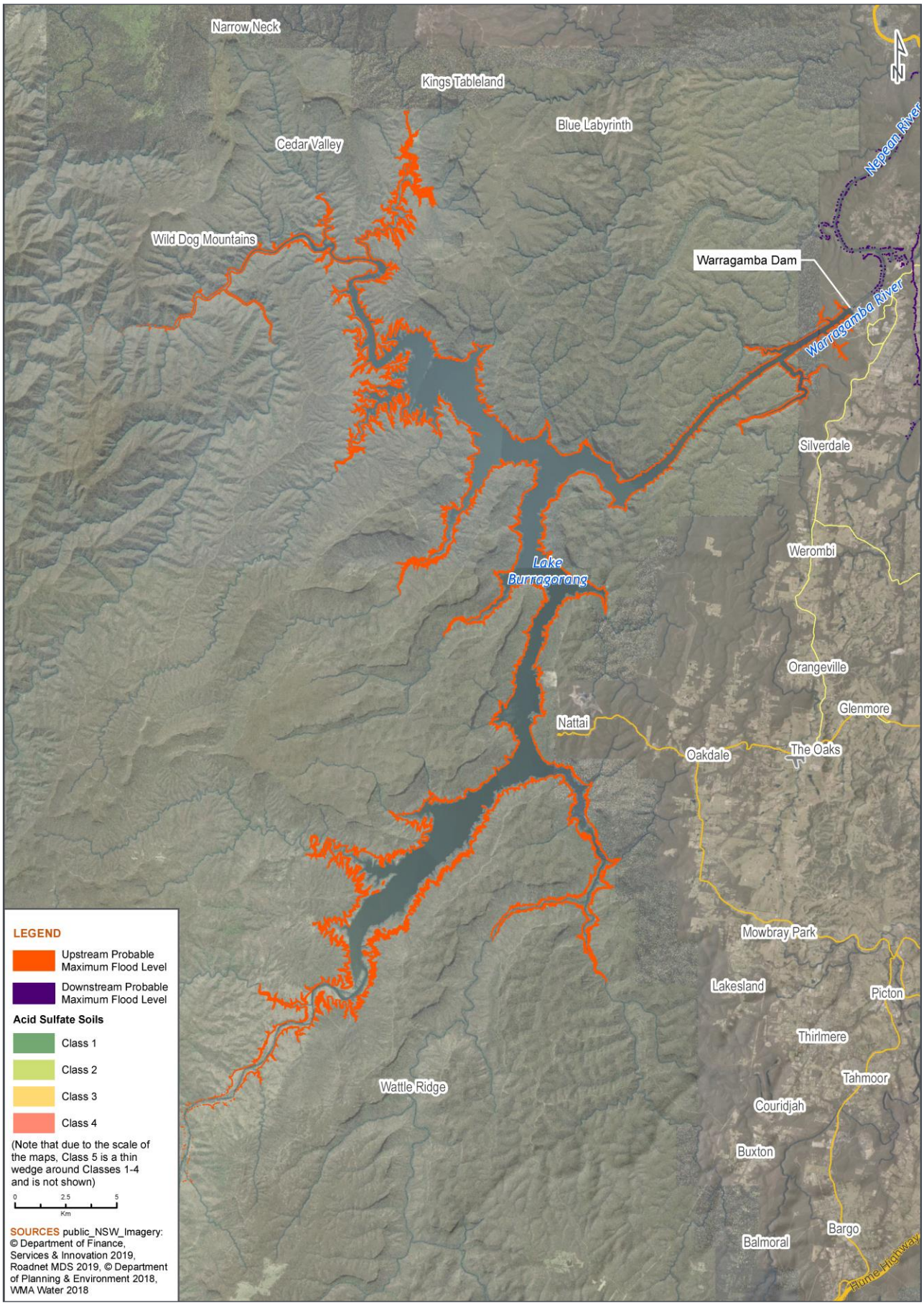


Figure 4-2. Acid sulfate soil classes – downstream study area

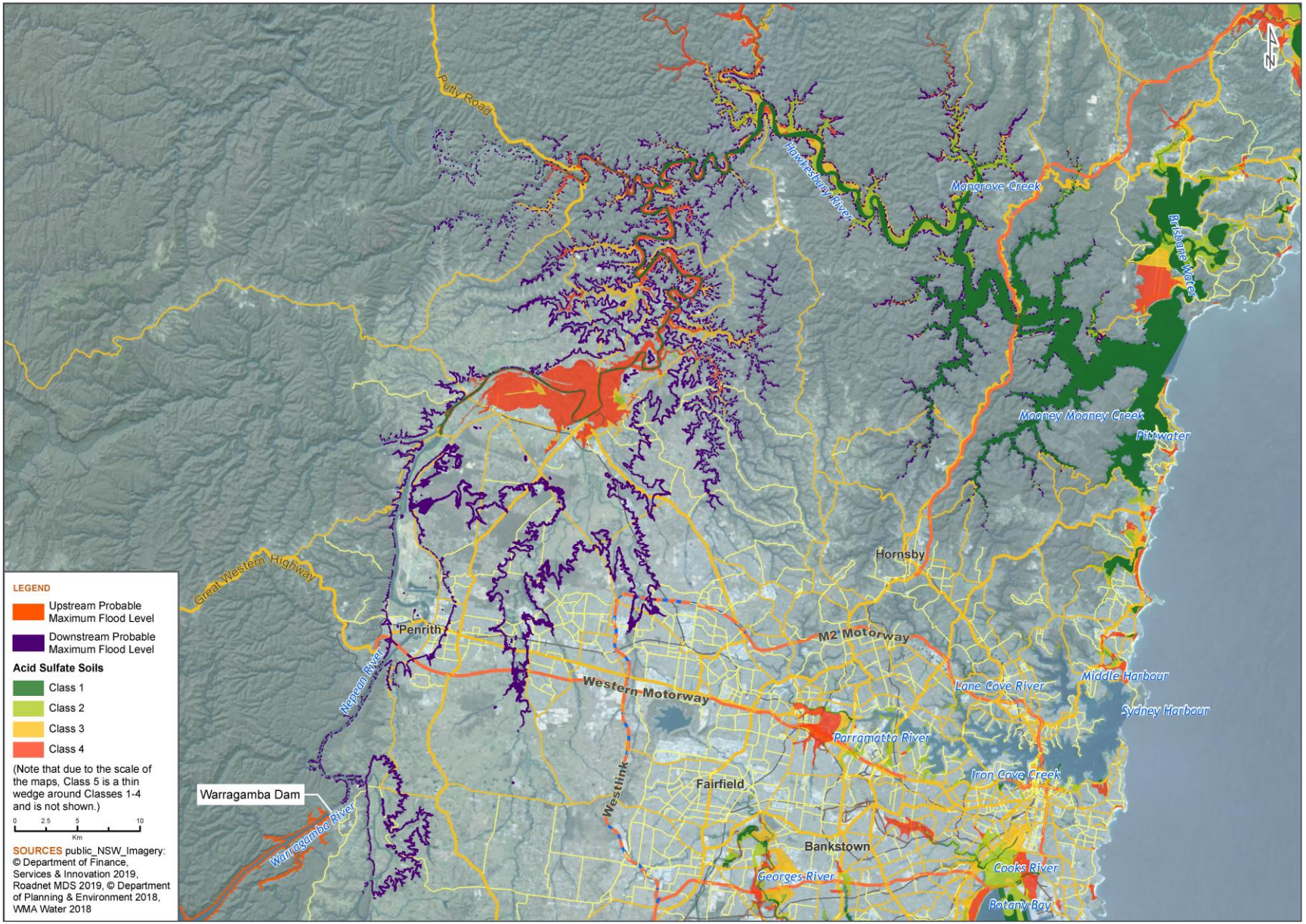


Figure 4-3. Atlas of Australian Acid Sulfate Soils mapping – upstream study area

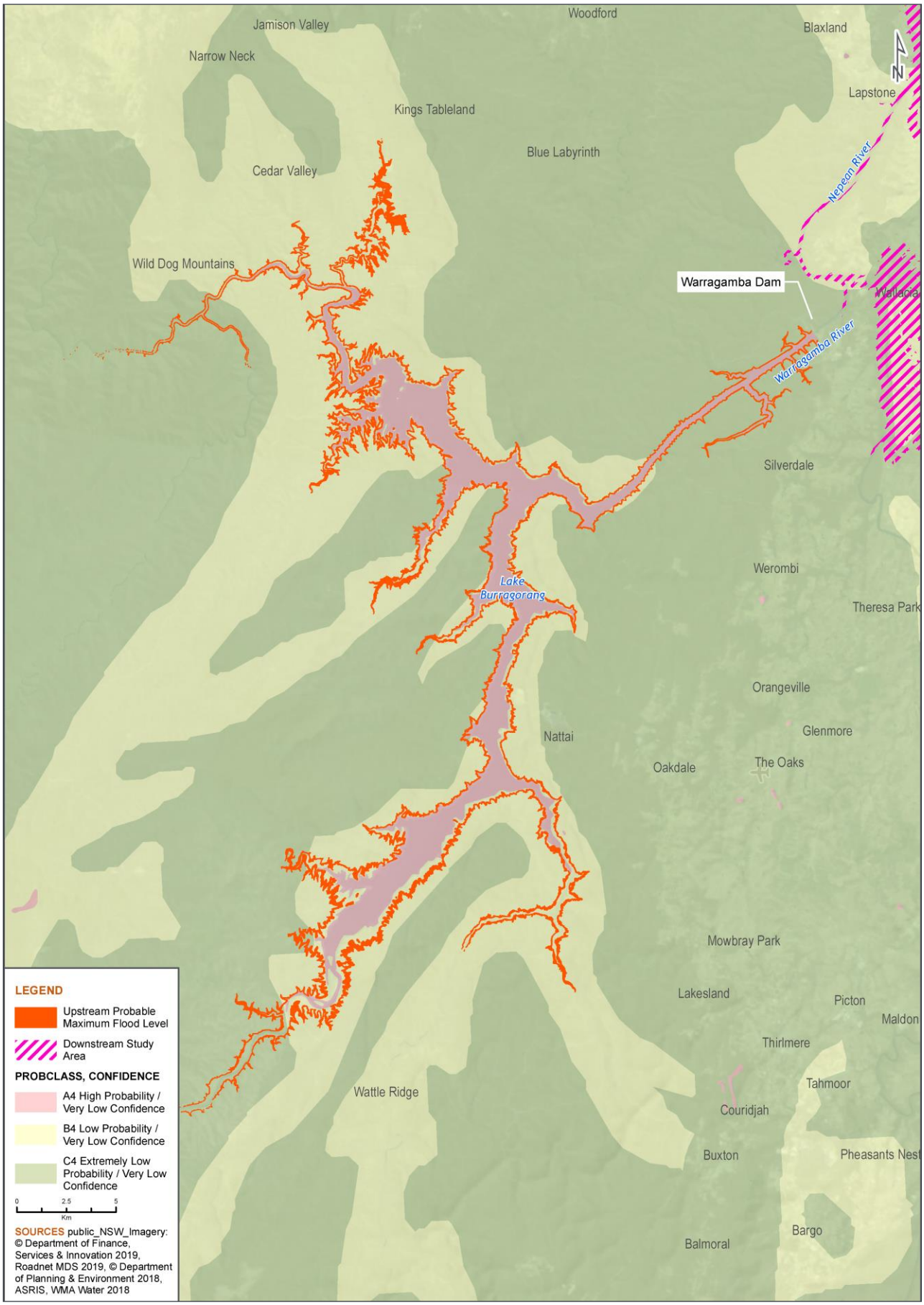
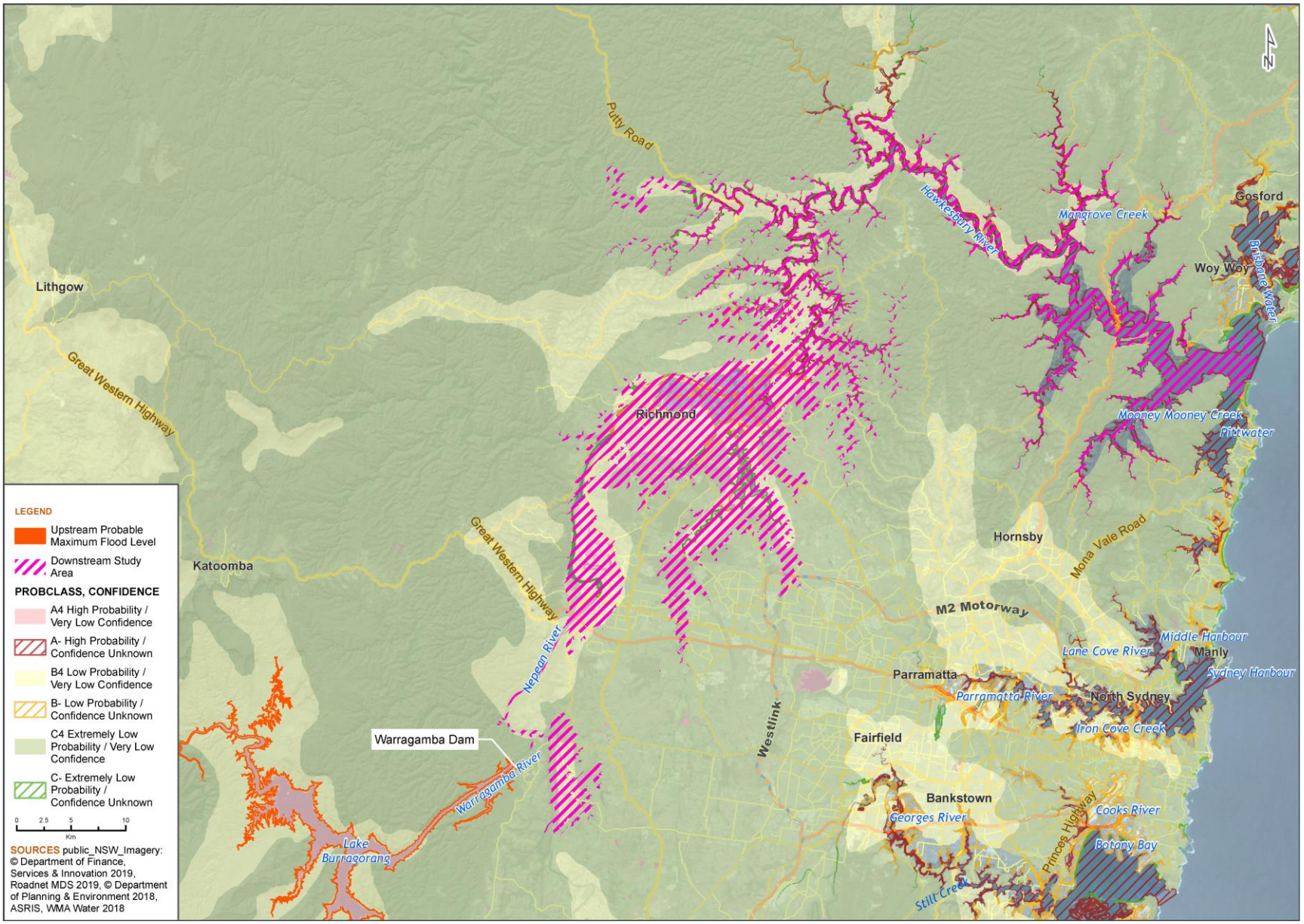


Figure 4-4. Atlas of Australian Acid Sulfate Soils mapping – downstream study area



The CSIRO Atlas of Australian Acid Sulfate Soils maps, has areas of Lake Burragorang mapped as 'high probability of occurrence'. This is likely to be for bottom sediments in low velocity flow environments. Areas outside the water bodies are mapped as 'low probability' or 'extremely low probability' of occurrence.

In the downstream areas, coastal acid sulfate soils are mapped as being present from the start of the Hawkesbury River (that is, the confluence of the Nepean and Gross Rivers) and downstream. This is about 40 kilometres downstream of Warragamba Dam. These are mapped as various classes, within bottom sediments of the river, tributaries and in lower lying alluvial areas.

The CSIRO Atlas of Australian Acid Sulfate Soils mapping was used for sections of the downstream study areas that are outside the extent of coastal acid sulfate soil mapping. The Nepean River and ponds within the Penrith Lakes are classed according to the atlas as 'high probability of occurrence', this is likely to be for bottom sediments in low velocity flow environments. Areas outside the water bodies are mapped as 'low probability' or 'extremely low probability' of occurrence.

4.2 Assessment of Project acid sulfate soil impacts

Acid sulfate soil risk mapping indicates that the proposed construction area for the dam and associated laydown areas that surround it are not located in or in proximity to areas mapped with acid sulfate soils risk classes (1-4). Due to the relatively high elevation of the area it is considered that acid sulfate soils will not be disturbed as part of the works and therefore not impacted.

Upstream areas are well outside areas of known coastal acid sulfate soils. CSIRO mapping (low confidence level) suggests there are potential 'high probability' areas within Lake Burragorang. The potential for inland acid sulfate soils has not been verified. However, even if present, the temporary increase in water levels during a flood event is unlikely to constitute a material change from existing conditions.

Acid sulfate soils classes 1-4 with a range of probability of occurrence are mapped only in downstream areas commencing about 40 kilometres downstream of Warragamba Dam. Flood modelling indicates that the dam raising generally results in a decrease in the inundation of downstream areas (at various annual exceedance probabilities (AEP), including PMF). Modelling of flood velocities indicates that Project flood waters at a given location and flow rate will comprise of similar velocity distributions to the existing conditions. However, due to the increased attenuation and management of flood waters associated with the Project, the exposure to peak flood velocities would be reduced, which would result in an associated reduction of flood hazard. When the flood mitigation zone is emptied, the Project will result in an increase in the duration of sustained bank-full velocities associated with the steady release rate of 100 GL/day, see Chapter 15 (Flooding and hydrology). Given there will be no increase in overall or peak flood velocities, impacts to acid sulfate soils (that is, disturbance) are not considered likely.

5 Salinity

5.1 Background

Salinity is the accumulation of salt in land and water to a level that damages the natural and built environment (NSW Office of Environment and Heritage 2017). Salinisation is the process where salts stored in the soil profile and/or groundwater are mobilised by the movement of water. Subsequent evaporation and accumulation can cause an increase in salt levels in groundwater, surface water and soils to the extent that land and aquatic flora and fauna, soil structure, and building materials such as concrete and steel may be affected.

The mobilisation of salinity can be caused by changes in the existing water cycle through water use or climate changes. In urban areas, the processes which cause salinity can be intensified by increased volumes of water being added to the natural system, through changes to the groundwater flow regimes and exposure of freshly cut saline soils to the weathering process. More specifically, salinity is associated with several issues including:

- degradation of water quality resulting in decreasing plant growth, in lower crop yields and degraded stock water supplies
- reducing overall soil health, resulting in reduced productivity
- changes in soil chemistry reducing soil stability resulting in increased erosion, soil loss, and effects on slope stability
- increased volume (load) and/or concentration (EC) of salinity in creeks and streams can degrade water supplies, affect irrigated agriculture and horticulture and adversely impact river ecosystems.
- salinity has the potential to damage infrastructure, for example, buildings, roads and pipes.

5.2 Existing salinity

The hydrogeological landscapes across the Project area are presented in Figure 5-1 and Figure 5-2. These maps show the relatively consistent formations in the upper catchment and the diverse and complex formations in the lower catchment. Hydrogeological landscape influences salinisation potential as discussed below.

5.2.1 Upstream study area

The Upstream geology consists mainly of porous or fractured rock aquifers, all of low salinity. There is no available mapping of the salinity potential for the upstream study area.

5.2.2 Downstream study area

A map of salinity potential for the downstream study area is provided in Figure 5-3. The map indicates that the majority of the western suburbs located downstream of the dam, for example, Penrith, Richmond Parramatta etc. are underlain by soils categorised as having a ‘moderate salinity potential’. Areas of high and known salinity potential typically occur proximal to the alluvial areas of Nepean and Hawkesbury Rivers. This association is due to the predominant geology, shallow groundwater tables and dissolved salts in these areas. A summary of salinity categories is presented in Table 5-1.

Figure 5-1. Hydrogeological landscape – upstream study area

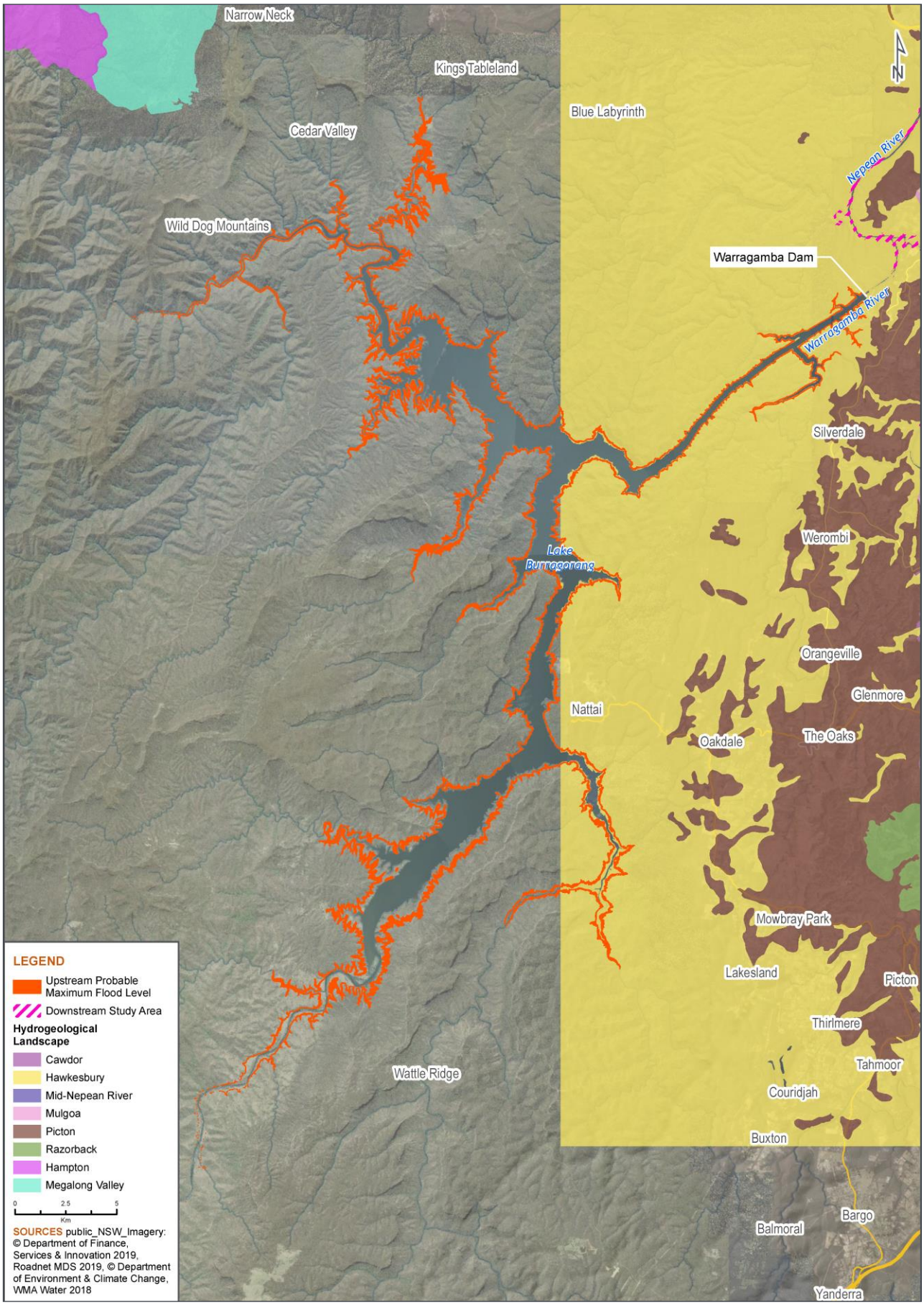


Figure 5-2. Hydrogeological landscape – downstream study area

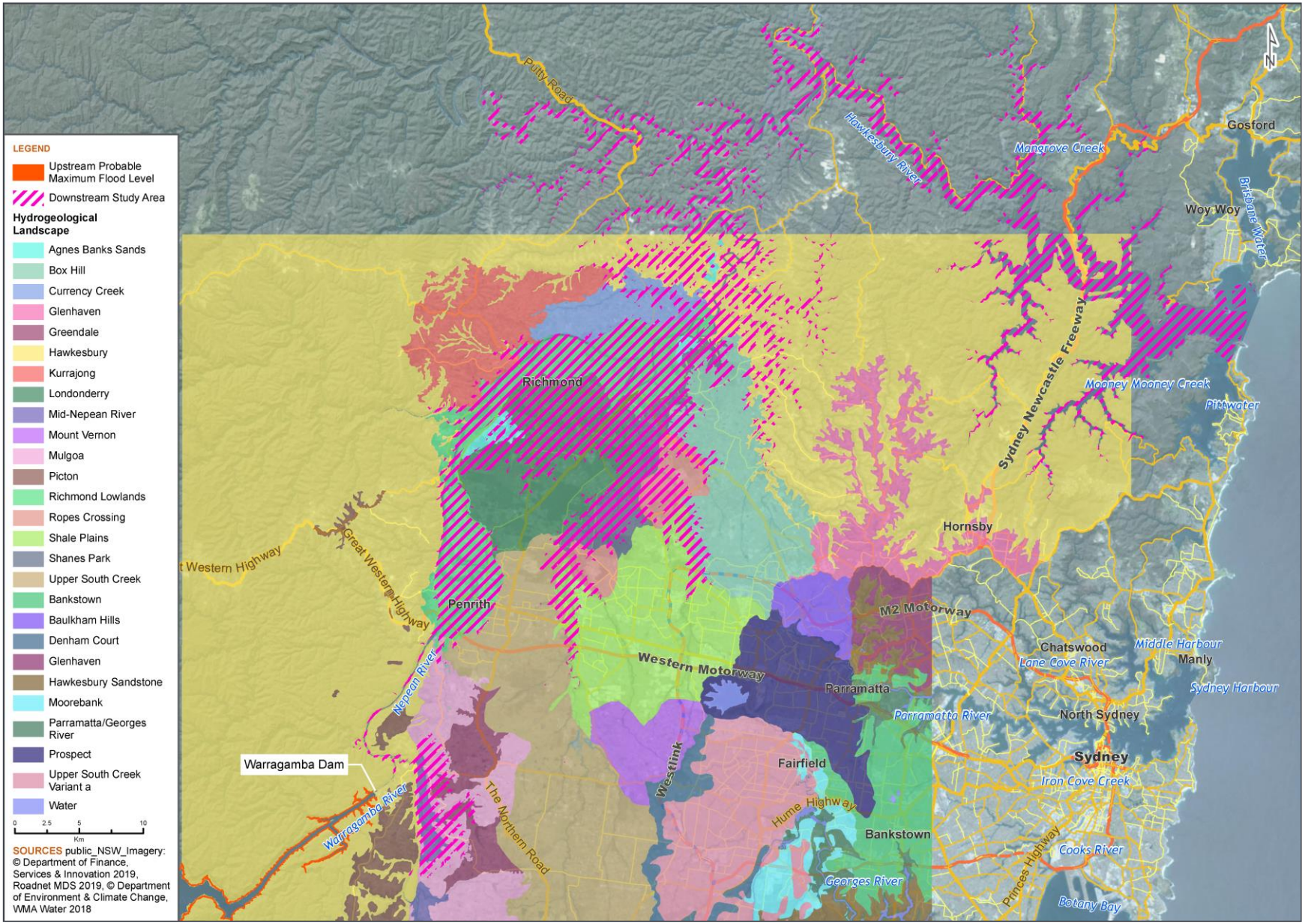


Figure 5-3. Salinity potential – downstream study area

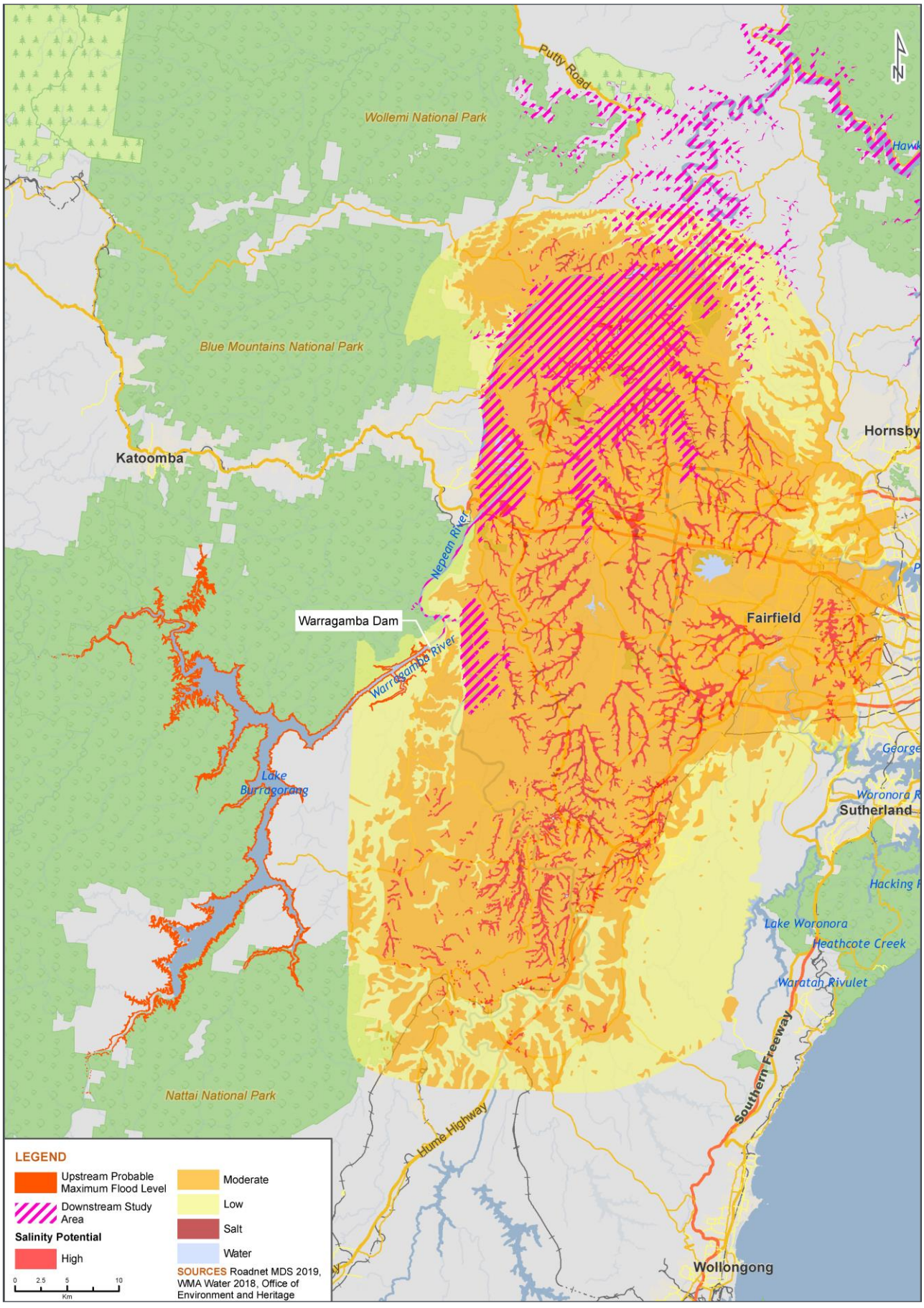


Table 5-1. Summary of salinity potential risk categories (DIPNR 2002)

Mapping category	Description
Known salinity	Areas where there are known occurrence of saline soil or where air photo interpretation and field observations have confirmed more than one of the following: ▪ scalding ▪ salt efflorescence ▪ vegetation dieback ▪ salt tolerant plant species ▪ waterlogging. A high relative wetness index occurs in these areas.
High salinity potential	Areas where soil, geology, topography and groundwater condition predispose a site to salinity. These conditions are similar to areas of known salinity (see above). These areas are most common in lower slopes and drainage systems where water accumulation is high (i.e. high relative wetness index).
Moderate salinity potential	Areas on Wianamatta Group Shales and Tertiary Alluvial Terraces. Scattered areas of scalding and indicator vegetation have been noted but no concentrations have been mapped. Saline areas may occur in this zone, which have not yet been identified or may change if risk factors change adversely.
Low salinity potential	Areas where salinity processes do not operate or are of minor significance. Soils are rapidly drained and underlying strata (Hawkesbury/Narrabeen Sandstone) are highly permeable, resulting in continual flushing and removal of salts in the landscape. No salinity has been observed in these areas and is not expected to occur.

Table 5-2 provides a summary of the various hydrological landscapes (HGLs) intercepted by the downstream study area. The HGL framework includes a risk analysis component which allows the landscape impacts and hazards of each area to be qualitatively categorised with an overall salinity hazard. The process of HGL determination relies on the integration of several factors such as geology, soils, slope, regolith depth, and climate; an understanding of the differences in salinity development and the impacts (land salinity/ salt load/EC) in landscapes. Information sources such as soils maps, site characterisation, salinity site maps, hydrogeological data and surface and groundwater data are incorporated into standard templates. The hazard rating should be considered when assessing potential impacts of developments that have the potential to change any of the factors affecting the salinity regime.

Table 5-2. Summary of hydrogeological landscape hazard ratings for the downstream study area

HGL name	Land salinity impacts	Water electrical conductivity impacts	Salt store	Salt availability	Impact	Likelihood	Overall hazard
Agnes banks Sands	Low	Low	Low	Low	Limited	Low	Low
Kurrajong	Moderate	Low	Moderate	Low	Limited	Moderate	Low
Currency Creek	Moderate	Moderate	Moderate	Low	Significant	Low	Low
Richmond Lowlands	Moderate	Moderate	Moderate	Moderate	Significant	Moderate	Moderate
Londonderry	Low	Moderate	Moderate	Moderate	Significant	Moderate	Moderate
Ropes Crossing	High	High	High	High	Severe	High	Very High
Box Hill	High	Moderate	Moderate	Moderate	Significant	High	High
Shale Plains	High	High	High	High	Severe	High	Very High
Upper South Creek	High	High	High	Moderate	Severe	High	Very High
Mulgoa	Moderate	Moderate	High	Moderate	Significant	Moderate	Moderate
Hawkesbury	Low	Low	Low	High	Limited	Low	Very Low
Greendale	Moderate	Moderate	Moderate	Moderate	Significant	High	High
Shanes Park	Moderate	Moderate	Moderate	Moderate	Significant	Moderate	Moderate

Figure 5-4 and Figure 5-5 show the overall salinity risks as per hydrogeological mapping.

Based on the mapping of overall salinity risk:

- the very high salinity risk area extends east across the downstream Project area, from Glenmore Park to Glendenning, and south from Vineyard to St Clair
- the high risk area is around Oakville and Riverstone
- moderate salinity risk area is mapped across Penrith, Goulburn, Richmond and Pitt Town.

Figure 5-4. Salinity risk – upstream study area

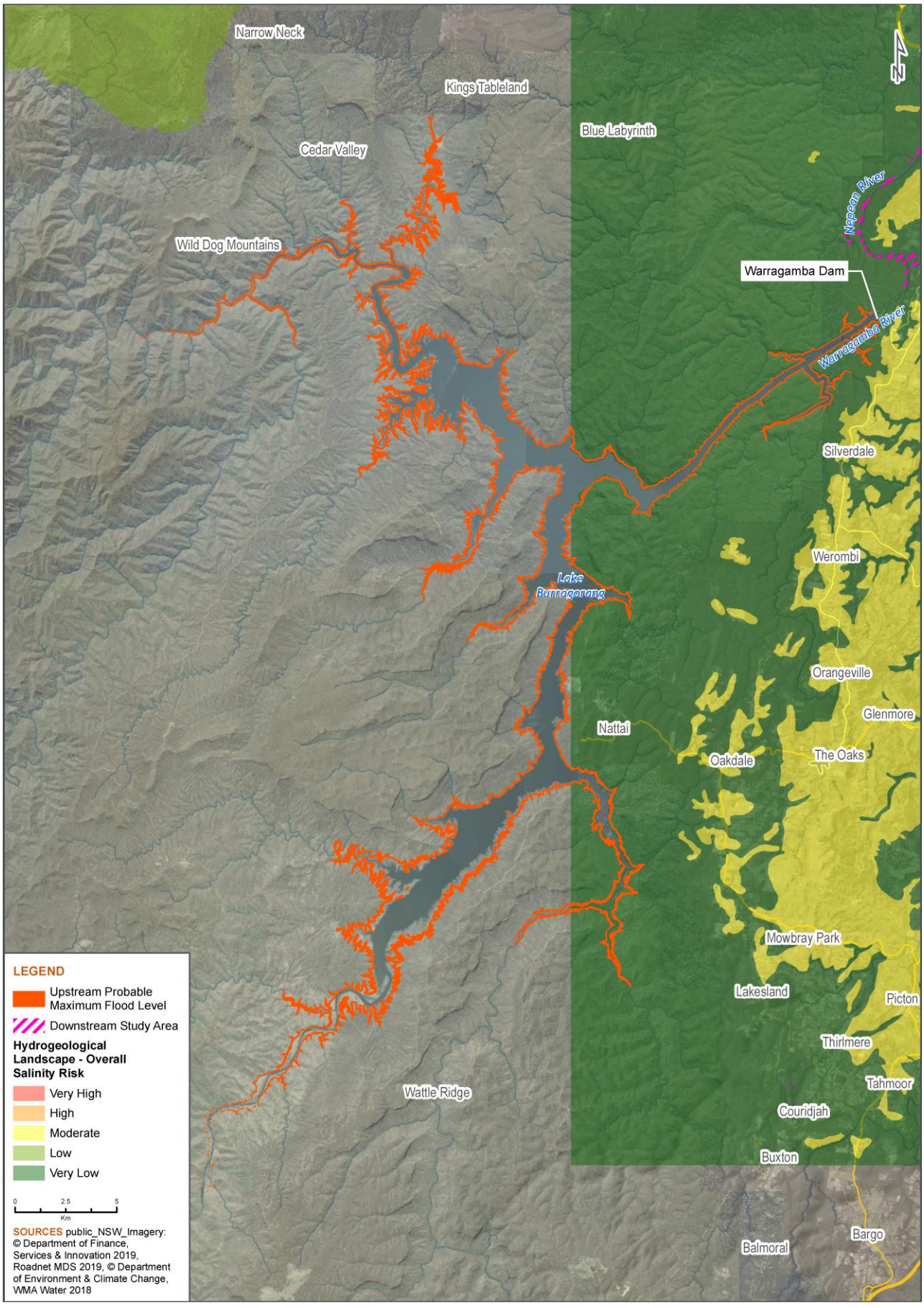
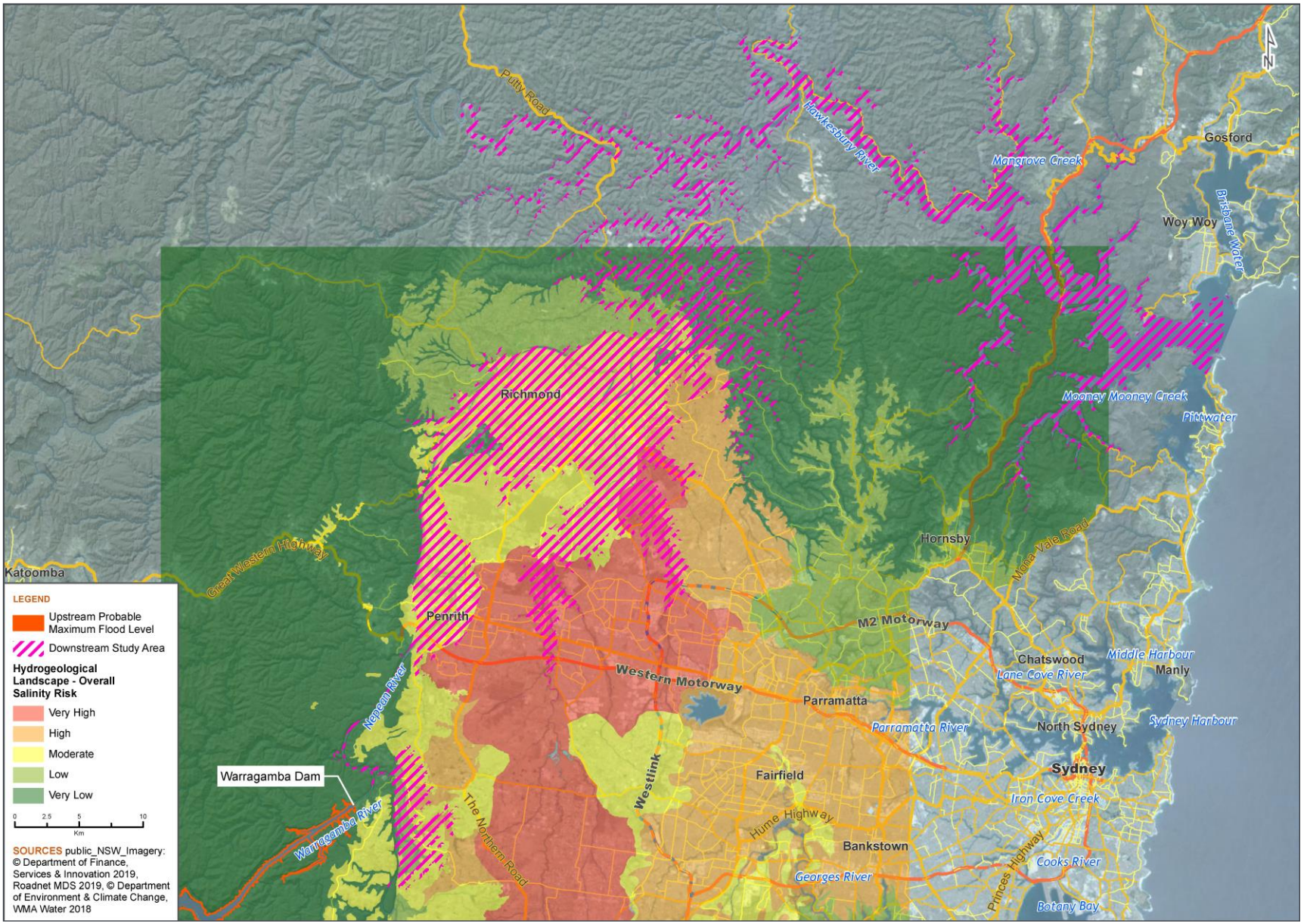


Figure 5-5. Salinity risk – downstream study area



5.3 Hydrogeology and flooding

Flood modelling for the downstream study area indicates that the operation of the flood mitigation zone would reduce downstream flood extents. While the inundation area decreases, the residence time (duration) of flood waters in flood prone areas would increase, primarily due to the increased volume of water that could be held by the dam.

5.3.1 Hydrogeology

Salinity is mainly caused by rising groundwater bringing salts to the land surface. The rise in groundwater is caused by altered natural drainage paths. Lake Burragorang and Warragamba Dam are located where six groundwater sources converge. There are five porous rock aquifers directly downstream of the Project and one alluvial aquifer. The sandstone resources of the Sydney Basin store the greatest volumes of groundwater. Water quality is fresh around the fringes but in the Sydney metropolitan area (towards the centre of the basin) the salinity approaches seawater quality. Groundwater quality in the Hawkesbury Alluvium aquifer, associated with pore spaces in the unconsolidated floodplain material is particularly saline due to influence from the Ashfield shale belt. Therefore, it is likely to be an environment of more salt input than salt output (less salt export from the soil), inducing more saline groundwater infiltration (flooded and or rainfall fraction) to the water table. This could result in a rise in groundwater level eventually degrading land and water resources. Processes such as soil salinisation and aquifer degradation can be non-reversible.

Surface root zone can also be a major source of salts that lead to aquifer salinisation , it is critical that both the interactions within and between these zones (that is, root zone and aquifers) are understood if salinisation of valuable groundwater supplies is to be prevented. It is important to understand the biophysical processes in the root zone (saline soil) and aquifers and their interactions that are likely to cause groundwater salinisation at catchment scale. Management strategies to reduce salinity both in the root zone and/or in aquifers are required.

5.4 Potential impacts

5.4.1 Upstream study area

The upstream study area would be subject to increased inundation over limited periods, resulting in increasing recharge of the submerged geology and subsequent discharges as the level in the dam reduces. This process has the potential to increase the mobilisation of saline components that may be contained within soils and geological formations. However, the predominant soil and subsoil formations underlying the upstream study have low saline levels. Some minor spikes in electrical conductivity (EC) may occur in lake edge waters (close to the areas of inundated) may be expected after initial inundation; however, the potential for inundation to significantly increase salinity is considered negligible to low and the overall water quality of the lake is unlikely to be affected.

Given the short inundation periods and the predominantly low permeability of the rock formations in the upstream study area, impacts on the upstream groundwater regime and quality are not considered to be significant.

5.4.2 Downstream study area

As outlined in Appendix H1 of the EIS Flooding and hydrology assessment report), the decreasing footprint (area) and increasing duration of flooding events in the downstream areas may have:

- very little impact on groundwater recharge/discharge across most of the flooded areas, where groundwater is within two metres of the surface.
- minor impact on groundwater recharge/discharge in the small areas where the groundwater table is more than tow metres below the surface.

The impact in such areas would be either flushing of slightly more salt from the historically pre-leached soil profile due to slightly longer flood duration, or slightly elevated salt loads due to water logging and evaporative processes. This is likely to be the case for known, high, and moderate salinity risk potential areas as the proposed changes from the current flow regime are only minor and other factors contributing to land salinisation remain principally unchanged. However, potential land use changes as part of adaptation to the new flooding regime may impact on the salinity regime through changes in anthropogenic responses, such as increased irrigation, use of fertilizers or general urban and agricultural development of land previously at higher risk of flooding.

As there is limited information on the salinity regimes and changes to the regimes since settlement and since the operation of the reservoir in its current form, it would be difficult to distinguish changes to the soil, surface water and/or groundwater salinisation as a direct result of raising the dam versus the initial dam construction, as well as

changes due to changing land use practices as a result of the raising vs potential changes due to the altered inundation regime directly.

5.4.3 Hydrology and water quality

As salty water from areas affected by salinity flows into creeks and rivers, the EC concentration and volume (load) of salt increases. Over time, as salinity within catchments worsens, the quality of river water declines. Many factors influence EC, but salt load is driven by the volume of water flow. Therefore, flood mitigation discharges of water volumes from Warragamba Dam may impact electrical conductivity (EC) concentration in the Nepean and Hawkesbury Rivers. Water quality in rivers is largely a function of land use and catchment geology, as well as in-stream processes such as tidal influence, barriers and interferences.

6 Contaminated land assessment

6.1 General site history

6.1.1 Upstream

Historical records (circa. 1826) suggest that the Burragorang Valley contained 80,000 to 90,000 acres of fine, well-watered grazing land, as well as cedar and coal reserves. By the late 1800s and into the early 1900s cedar and coal reserves had been exploited for commercial gain, such that by 1916 most of the accessible cedar had been removed. Full scale, commercial coal mining near Mount Burragorang began in 1902, with the industry peaking in the 1950s and 1960s. Simultaneously, a rich deposit of silver ore discovered near Yerranderie was mined from the late 1800s to 1927 when the ore deposit had been exhausted (ERM 1995).

Historical photography from the 1950s, prior to the construction of Warragamba Dam and subsequent flooding of the Burragorang valley, shows the steeply dipping sides of the Burragorang Valley were comprised of dense woodland and the flat floodplain at the base of the valley was comprised of open fields, which were most likely used for grazing.

6.1.2 Downstream

The downstream study area is partially covered by the western and northern-western extents of greater Sydney. Figure 6-1 shows that urban growth within the downstream study area occurred predominantly between 1975 and 2005, although there are some isolated pockets within which urban growth occurred from as early as 1917. Historically, the predominant land use in this area was agriculture including grazing and cropping; although, Penrith did support aggregate mining, and St Marys supported a defence base and munitions store.

6.2 Previous reports assessing contamination risk near proposed construction areas

Construction laydown areas are proposed and would be used for concrete batching and transport, storage of construction materials, and to house offices and other administrative buildings during the construction period . The proposed construction laydown areas are shown in Figure 6-2. WaterNSW provided SMEC with a number of reports relating to area within and adjacent the proposed construction footprint of Warragamba Dam, including:

- Warragamba Dam – Explosives Store and Vehicle Refuelling Area – Left Bank: Remediation Action Plan (Sinclair Knight Merz 1998)
- Warragamba Dam Auxiliary Spillway Environmental Management Plan: Remediation of Proposed Truck Maintenance and Explosive Storage Area (Carey Constructions Ltd 1998)
- Remedial Action Plan: Former Workshop Yard, Farnsworth Avenue, Warragamba, NSW 2752. Prepared for Sydney Catchment Authority (IT Environmental 2004)
- Hazardous Materials Survey Report: Warragamba Dam, Warragamba, NSW. Prepared for Sydney Catchment Authority (ADE Consulting Group 2014)
- Additional Site Investigation: Megarittys Creek, Weir Road, Warragamba, NSW (JBS&G 2017)
- Assessment of Remedial Options - Megarittys Creek, Weir Road, Warragamba, NSW (JBS&G 2017).

A summary of the key details from each of these reports, relevant to potential contamination of the construction area and surrounds, is provided below. The sites associated with these reports have been labelled A to E and their proximity to proposed construction areas are shown in Figure 6-2.

Figure 6-1. Sydney's urban growth history (NYU Stern Urbanisation project 2014)

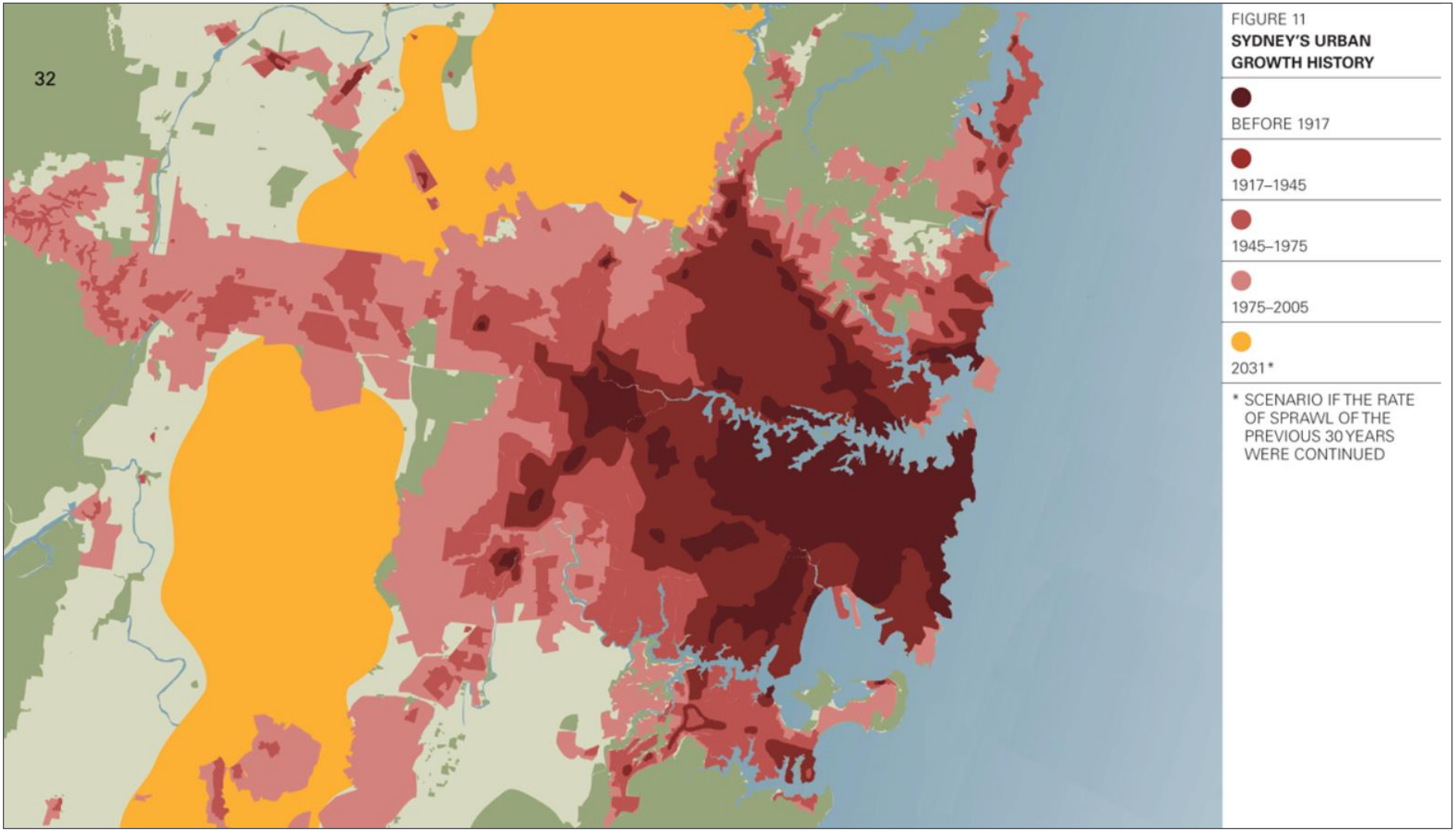
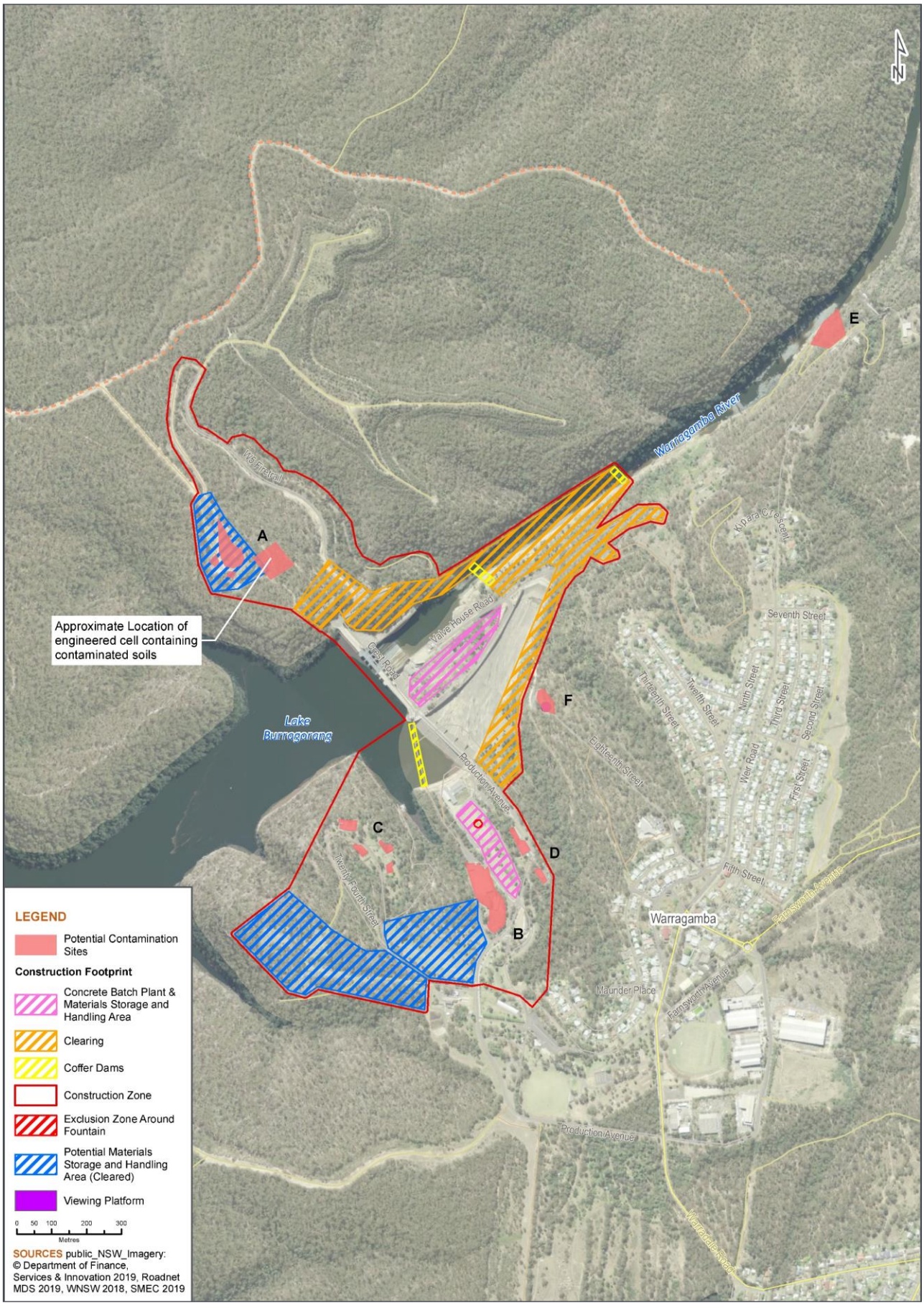


Figure 6-2. Potentially contaminated sites within and near the construction study area



Warragamba Dam – Explosives Store and Vehicle Refuelling Area – Left Bank: Remediation Action Plan (Sinclair Knight Merz 1998) (SITE A)

This report included a remediation action plan to address soil contamination of an area formerly known as 'the painter's area', which had been used for 20 years for grit blasting activities. A previous site investigation identified the following contaminants in soils on the site:

- 'significant' soil contamination of copper, lead and zinc related to grit blasting activities and the use of zinc and aluminium based paints
- areas of oil staining were tested for petroleum hydrocarbons and polychlorinated biphenyl's (PCBs). Hydrocarbons were detected >1,000 milligrams per kilogram but were only isolated to the surface in a relatively small area. No PCBs detected
- the remediation action plan outlined the preferred remediation method which was to bury and contain the heavy metal contamination on site in a purpose-built disposal cell. The hydrocarbon impacted material was to be treated using on site bioremediation techniques.

A supplementary letter (dated 2002) was provided with the document retrieval of this report comprising a statement by Ken Holmes who was the Environmental Management Representative at the time confirming the works were completed as per the approved remediation action plan.

Remedial Action Plan: Former Workshop Yard, Farnsworth Avenue, Warragamba, NSW 2752. Prepared for Sydney Catchment Authority (IT Environmental 2004) – (SITE B)

A remedial action plan was prepared for the former workshop yard located at Farnsworth Avenue, Warragamba, NSW (IT Environmental 2004). The yard formerly comprised two separate fuel storage facilities (one above ground fuel storage area and one below ground fuel storage area). All tanks were removed in 1996 but residual contamination remained. Contaminated material was used as backfill within the empty tank pit and covered with high density polyethylene (HDPE), imported shale and then re-surfaced with bitumen.

- previously evidence of backfill material in the walls of the former tank pit contained contaminants at the following concentrations:
  - TPH at 13,051 milligrams per kilogram
  - xylene at 38.4 milligrams per kilogram
  - the recorded TPH and Xylene concentrations exceeded the NSW EPA Guidelines for Assessing Service Stations Sites which were applicable at the time of the investigation.
- Discarded waste material (for example 205 litre steel drums, paint tins, broken glass and other litter) was detected in on-site drainage lines and surrounding bushland. Five soil samples were collected from the western slope of the site, the results showed that contamination was present at the following concentrations:
  - lead concentrations between 6 milligrams per kilogram and 790 milligrams per kilogram, recorded lead concentrations did not exceed any of the assessment criteria adopted at the time of the investigation
  - zinc concentrations between 24 milligrams per kilogram and 11,000 milligrams per kilogram, all surface soil samples obtained from the western slope of the site exceeded the NSW EPA (1998) phytotoxicity investigation levels adopted at the time
  - synthetic precipitate leachate potential (SPLP) testing generally indicated that lead and zinc present in soils was not highly mobile under normal conditions and was therefore unlikely to have adverse impacts on down gradient water quality if left undisturbed
  - based on surface water sampling within the creek at the base of the western slope, the creek was not being contaminated by lead and zinc.
- the remedial action plan outlined the preferred remediation method which was to comprise excavation of the impacted material followed by offsite disposal and validation. The area of the western slope with discarded waste material was considered to be too difficult to access for remediation and could create a risk of mobilising contaminants. The strategy for this area was to remove surface waste and restrict stormwater flow over this area
- the site history section of the remedial action plan indicates that in December 2001 a bushfire caused considerable damage to buildings at Warragamba Dam. Buildings destroyed by the fire included the main workshop shed, ancillary carport structures and sanitary and kitchen facilities. Issues associated with

contamination as a result of the fire (for example, asbestos debris from old buildings) is not specifically discussed

- Documentation confirming that the remedial activities were not cited during the preparation of this report.

Hazardous Materials Survey Report: Warragamba Dam, Warragamba, NSW. Prepared for Sydney Catchment Authority (ADE Consulting Group 2014) (SITES C and D)

A Hazardous Materials Survey and Risk Assessment was undertaken for the commercial properties at Warragamba Dam (ADE Consulting Group 2014), the findings of each inspection are summarised below:

- Conference Centre interior/exterior – asbestos and synthetic mineral fibre (SMF) observed
- White Cottage interior/exterior – asbestos observed
- Eastern Laundry to White Cottage interior/exterior – asbestos and SMF observed
- Blue Cottage interior/exterior – asbestos and SMF observed
- Yellow Cottage interior/exterior – asbestos and SMF observed
- old production office interior/exterior – asbestos and SMF observed and lead concentration in paints at 46,000 milligrams per kilogram
- SWC dam – remedial building interior/exterior – no asbestos observed
- capacitors were located at multiple locations (presumed to contain PCBs).

Additional Site Investigation: Megarittys Creek, Weir Road, Warragamba, NSW (JBS&G 2017) (SITE E)

An additional site investigation associated with tipped waste and asbestos containing materials within an area of land at Megarritys Creek, Weir Road, Warragamba was undertaken in 2017 (JBS&G 2017a). An asbestos and hazardous materials assessment of the site had previously been completed by Noel Arnold and Associates (February 2003), this assessment identified contamination issues associated with the dumping of waste materials including bonded asbestos containing material (ACM) sheeting and fragments.

The assessment confirmed:

- two areas of tipped waste materials and ACM sheeting and ACM fragments on the surface and within sub-surface soils
- zinc and benzo(a)pyrene concentrations were shown to exceed open space land use ecological investigation levels in a single soil sample
- waste materials including scrap metal, bonded ACM fragments, plastics and construction wastes were identified downgradient of both tipping areas.

This site is not within proposed construction or laydown areas.

Non-Aboriginal Heritage Impact Assessment (Artefact 2019)

A non-aboriginal heritage impact assessment was carried out as part of the EIS for the dam wall raising. The report refers to former construction camps for the original Warragamba Dam construction and for an initial emergency scheme as shown in Figure 6-3. Although not confirmed, these areas may contain contaminated materials.

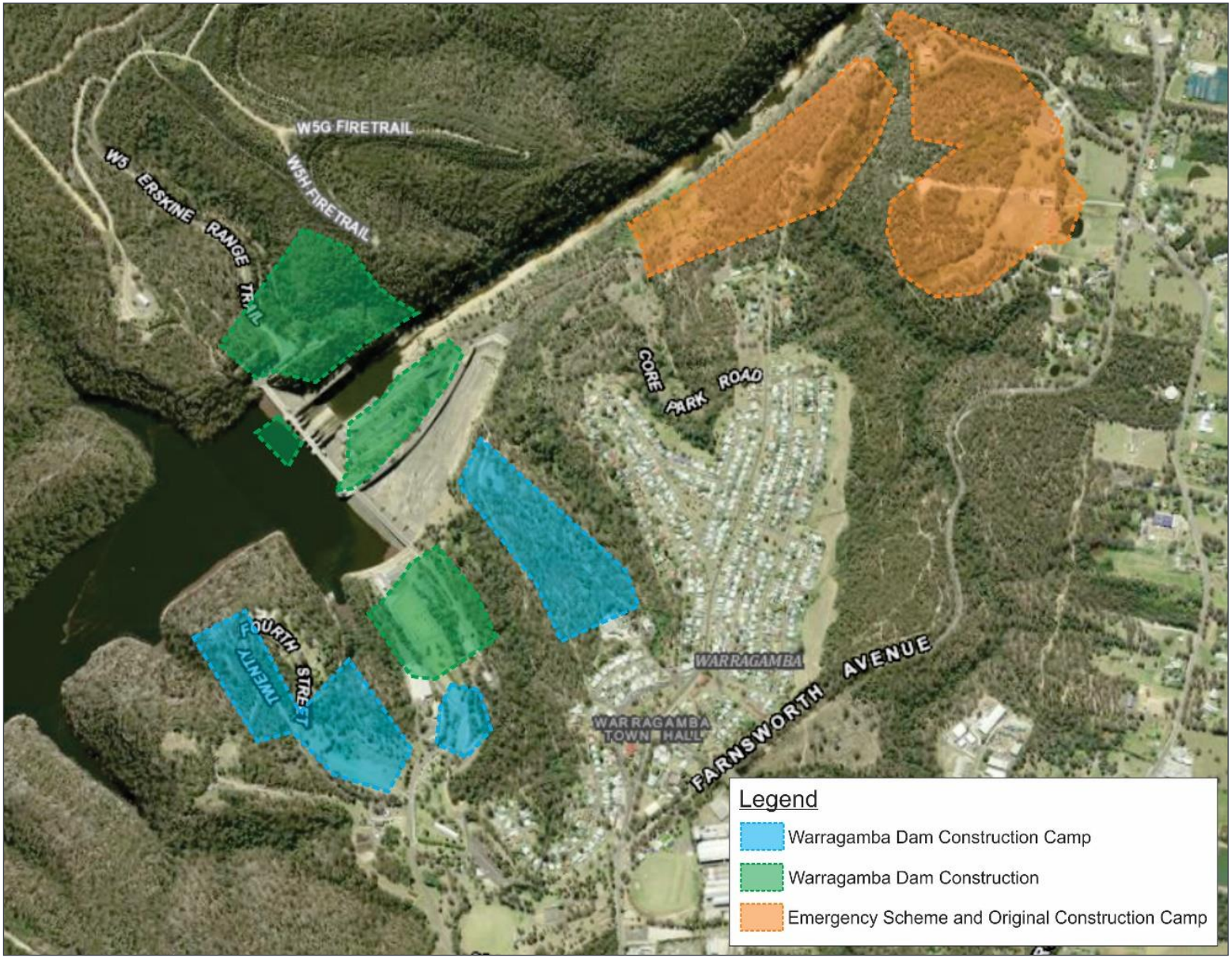
6.3 Public database searches

A search of the following records was conducted to assess broad, potential sources of contamination or land uses with potentially contaminating activities within the Project study area:

- List of contaminated sites notified to EPA
- EPA Contaminated Land Record of Notices
- Protection of the Environment Operations Act 1997 Register
- National Pollutant Inventory
- Unlicensed premises regulated by the EPA
- A review of the Record of Waste Management Facilities (Geoscience Australia)
- A review of the NSW Government Mine View Mining Data.

The results of each search are presented within the following sub sections.

Figure 6-3. Former construction camps



6.3.1 List of contaminated sites notified to EPA

A search of the List of Contaminated Sites Notified to EPA was conducted on 1 February 2019 for all land contained within the study area. The database was filtered by suburb; results of the search are provided in Appendix A.

The List of Contaminated Sites notified to EPA provides notifications under section 60 of the CLM Act . Sites on this list indicate that the notifier considers that the sites are contaminated and warranted reporting to the EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review and, if necessary, obtain more information before it decides on whether the site warrants regulation (EPA 2019).

Search results for the upstream study area identified two sites which were both noted in the records as not requiring regulation by EPA.

There were 30 sites recorded in the downstream study area, many of which were listed as service stations. Of these, three sites were noted to be under regulation by the EPA, these being a service station a metal industry and a former drum re-conditioner. None of these three sites are within the construction footprint.

The Warragamba Dam viewing platform at Eighteenth Street is listed on the List of Contaminated Sites Notified to EPA; however, it is listed under the EPA site management class as 'Regulation under CLM Act not required'. 'Regulation under the CLM Act not required' identifies that the EPA has completed an assessment of the contamination at this site and decided that regulation under the CLM Act is not required. Contamination may still exist at the Warragamba Dam viewing platform, but EPA have determined that it does not need to be managed under the CLM Act.

6.3.2 EPA Contaminated land record of notices

A search of the Contaminated Land Record of Notices was conducted on 1 February 2019 for all land contained within the upstream and downstream components of the study area. A site is recorded on the Contaminated Land Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the CLM Act.

The EPA triggers assessment and remediation of significantly contaminated land by sending written notices to those responsible for cleaning up the contamination. The EPA makes these notices, which include preliminary investigation orders, available to the public through the record of notices.

The contaminated land public record is a searchable database of:

- orders made under Part 3 of the CLM Act
- notices available to the public under section 58 of the CLM Act
- approved voluntary management proposals under the CLM Act that have not been fully carried out and where EPA approval has not been revoked
- site audit statements provided to the EPA under section 53B of the CLM Act that relate to significantly contaminated land
- where practicable, copies of anything formerly required to be part of the public record
- actions taken by EPA (or the previous State Pollution Control Commission) under sections 35 or 36 of the *Environmentally Hazardous Chemicals Act 1985*.

A search of the Contaminated Land Record of Notices was undertaken on 1 February 2019. The search was performed by entering the name of each suburb within the study area and compiling the results.

A search of all suburbs contained within the upstream and downstream study area showed that at the time of the search, no relevant sites were registered on the contaminated land record of notices.

6.3.3 Protection of the Environment Operation Act 1997 Register

The public register under section 308 of the *Protection of the Environment Operations Act 1997* (POEO Act) contains the following:

- environment protection licenses (EPLs)
- applications for new licenses and to transfer or vary existing licenses
- environment protection and noise control notices
- penalty notices issued by the EPA
- convictions in prosecutions under the POEO Act

- the results of civil proceedings
- exemptions from the provisions of the POEO Act or regulations
- approvals granted under clause 9 of the POEO (Control of Burning) Regulation
- approvals granted under clause 7A of the POEO (Clean Air) Regulation.

A search of the public register under section 308 of the POEO Act was conducted on 1 February 2019. Results of the search are included in Appendix C. Two sites were recorded within Silverdale, but in areas not noted to be within the designated study area. Over two hundred sites were recorded for suburbs within or partly within the downstream study area with a range of activities/industries.

6.3.4 National Pollutant Inventory

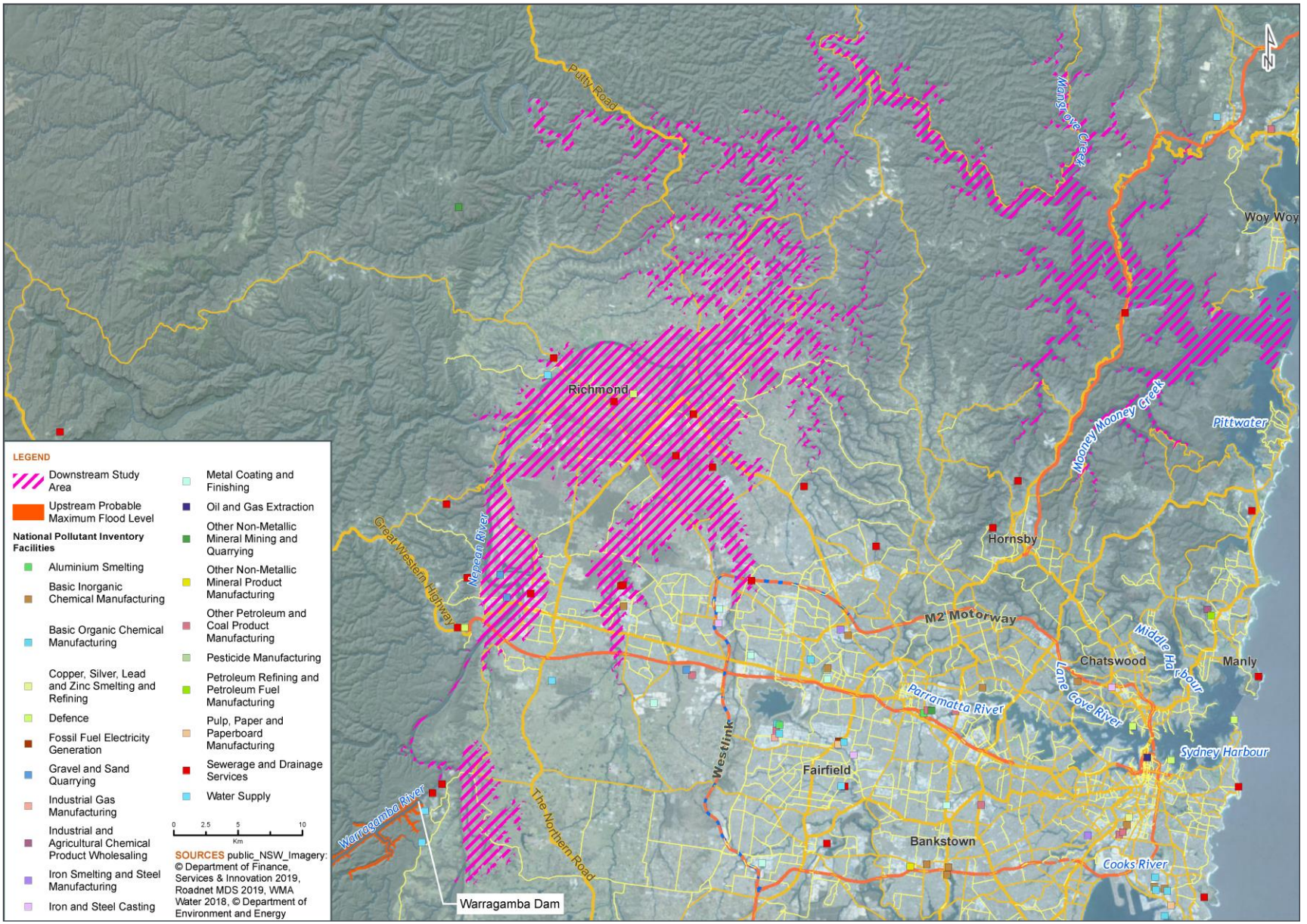
All Australian industrial facilities which meet the reporting criteria are required to submit annual reports of their emissions and transfers of *National Pollutant Inventory* (NPI) substances in waste. These reports are published on or before 31 March each year for the preceding financial year. A search of the National Pollutant Inventory was conducted on 01 February 2019.

The data was subsequently filtered by relevant suburb and is detailed within Appendix B. These sites are also plotted in Figure 6-4.

Over sixty sites were recorded for suburbs within or partly within the downstream study area for a range of industries.

There are no recorded NPI sites contained within the upstream study area, however, a number of NPI sites categorised as, ‘sewerage and drainage services’ and ‘water supply’ are located proximal to the wall, due to their proximity to the wall, these sites have been included within Figure 6-4 (and detailed within Table 5-A of Appendix A).

Figure 6-4. NPI sites – downstream study area



6.3.5 Unlicensed premises regulated by the EPA

The EPA is the Appropriate Regulatory Authority (ARA) for a number of premises that are no longer required to be licensed under the POEO Act. A list of unlicensed premised regulated by the EPA is available through the EPA website (EPA, n.d.). A search of the database was conducted on 01 February 2019 by filtering the data based on suburb. There are no recorded unlicensed premises regulated by the EPA currently located within the upstream study area. The results of the database search for the downstream study area are summarised within Table 6-1.

Table 6-1. Unlicensed premises regulated by the EPA – downstream study area

Suburb	Licence no.	Site name	Site address / location	Fee based activity
Woy Woy	10509	Brisbane Waters Private Hospital	21 Vidler Street	Hazardous, Industrial or Group A Waste Generation or Storage
Windsor	3140	Pioneer Road Services	40-42 Burrows Road	Bitumen mixing
South Windsor	3215	Huhtamaki Australia	120 Mileham Street	Hazardous, Industrial or Group A Waste Generation or Storage
North Richmond	6328	Hanna Group	Bells Line of Road	Hazardous, Industrial or Group A Waste Generation or Storage
Windsor	2292	Pioneer Road Services Pty Ltd	Lot 23 Gardiners Road	Bitumen mixing
St Mary's	3027	CNH Australia Pty Ltd.	31-53 Kurrajong Avenue	Hazardous, Industrial or Group A Waste Generation or Storage
Emu Plains	3498		Kite Street	Concrete works
Penrith	11461	Total Concrete Solutions Pty. Ltd.	261 Coombes Road	Concrete works
Windsor	534	Pioneer Road Services Pty Ltd	132 Bago Road	Bitumen mixing
Windsor	683	Pioneer Road Services Pty Ltd	30 Rivulet Crescent	Bitumen mixing
Windsor	705	Pioneer Road Services Pty Ltd	26 Roach Road	Bitumen mixing
Windsor	12948	Pioneer Road Services Pty Ltd	Lot 4 Bomen Road	Bitumen mixing
Windsor	5002	Pioneer Road Services Pty Ltd	2-4 David Street	Bitumen mixing

6.3.6 Record of waste management facilities

The *National Waste Management Dataset* presents the spatial locations of Australia's known landfills, waste transfer stations and a large number of waste reprocessing facilities. The data is a compilation of Australian, jurisdictional government, council, and industry databases. Waste facilities are split into four main categories: Landfill, multi-purpose, re-processing and transfer station. The results of the search are presented in Figure 6-5 and detailed within Table 6-2 and Table 6-3.

Figure 6-5. Waste management facilities

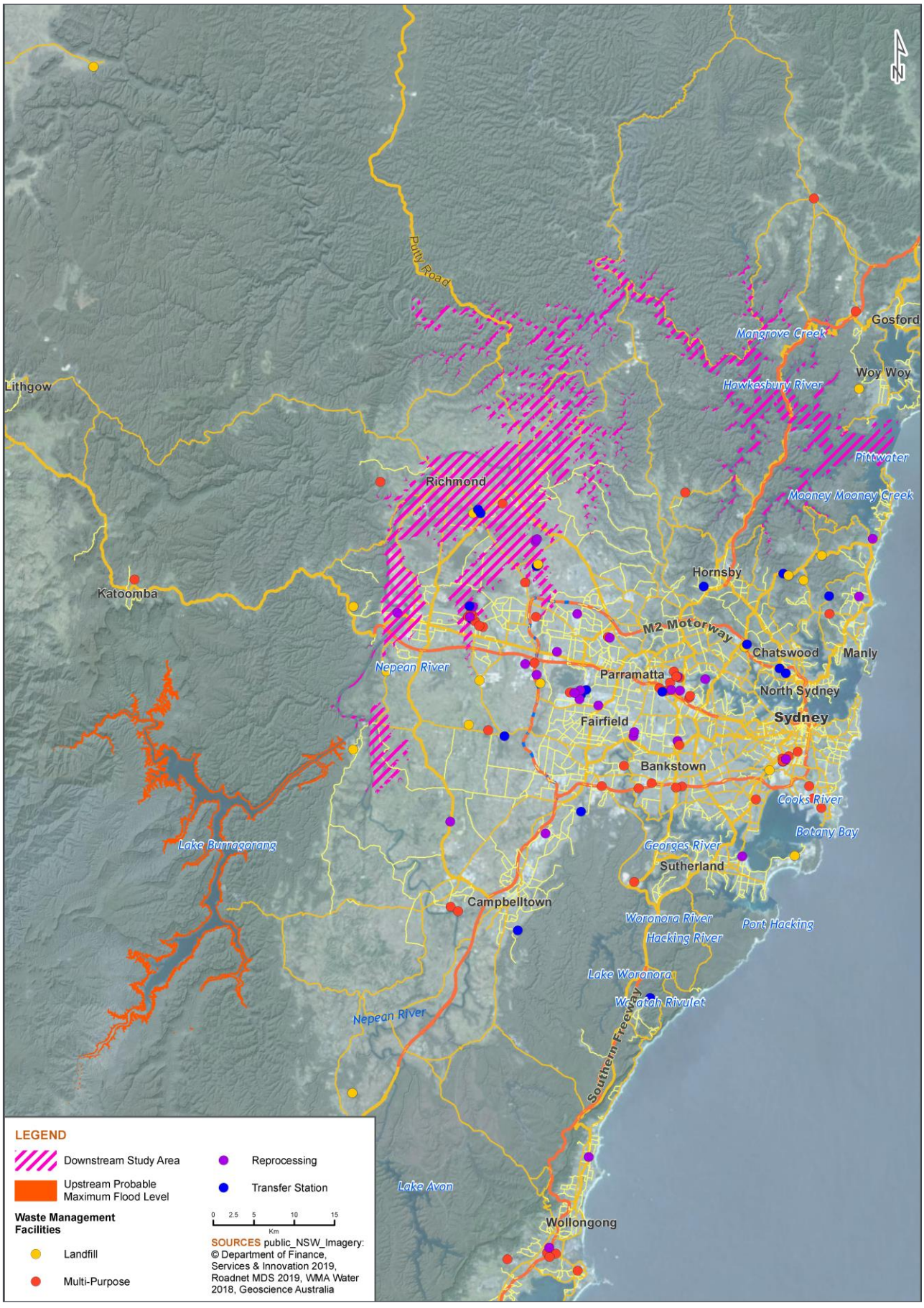


Table 6-2. Record of waste management facilities – downstream study area

Suburb	Class	Name
Emu Plains	Reprocessing	No Fuss Liquid Waste Pty Ltd
Riverstone	Landfill	Riverstone Landfill
	Reprocessing	Back To Earth Mulch Makers
Schofields	Transfer Station	Hlebar, Vinko and Draga
South Windsor	Landfill	Hawkesbury City Waste Management Facility
	Transfer Station	South Windsor Resource Recovery Centre
	Transfer Station	Rock and Dirt Recycling
South Windsor	Multi-Purpose (re-processing and transfer station)	Worth Recycling Pty Ltd
St Marys	Multi-Purpose (re-processing and transfer station)	Sims Group Limited
	Transfer Station	Hallinan's Recycling Services
	Reprocessing	Brandster Services
	Reprocessing	Solveco
	Transfer Station	Toxfree St Mary

Table 6-3. Record of waste management facilities – construction study area

Suburb	Class	Name
Warragamba	Landfill	Warragamba Waste Management Facility (non-operational)

Mining sites

A number of economically important coal seams are contained within the Illawarra coal measures which occur over a substantial part of the catchment. The first significant quantities of coal were mined in the Burragorang Valley in 1878 when the Nattai Mining company was established; the Burragorang coal industry peaked in the 1950s and 1960s and the last mine (Brimstone 1) closed in 2000 (Robinson 2001).

In addition to coal, silver and lead ore were also mined within the Burragorang Valley. A rich deposit of silver ore was discovered at Yerranderie in 1871 and mined in the late 1890s. By 1927 most of the silver ore deposit had been mined (ERM 1995).

Because of the historical use of portions of the Burragorang Valley for mining and a predicted increase in the extent of inundation for a PMF event during operation of the Project, a review of publicly available mining data has been undertaken. Six mining sites were identified based on their proximity to the modelled PMF level (post dam wall raising) as depicted on Figure 6-6 and summarised within Table 6-4.

Figure 6-6. Historic mining inundation risk – upstream study area

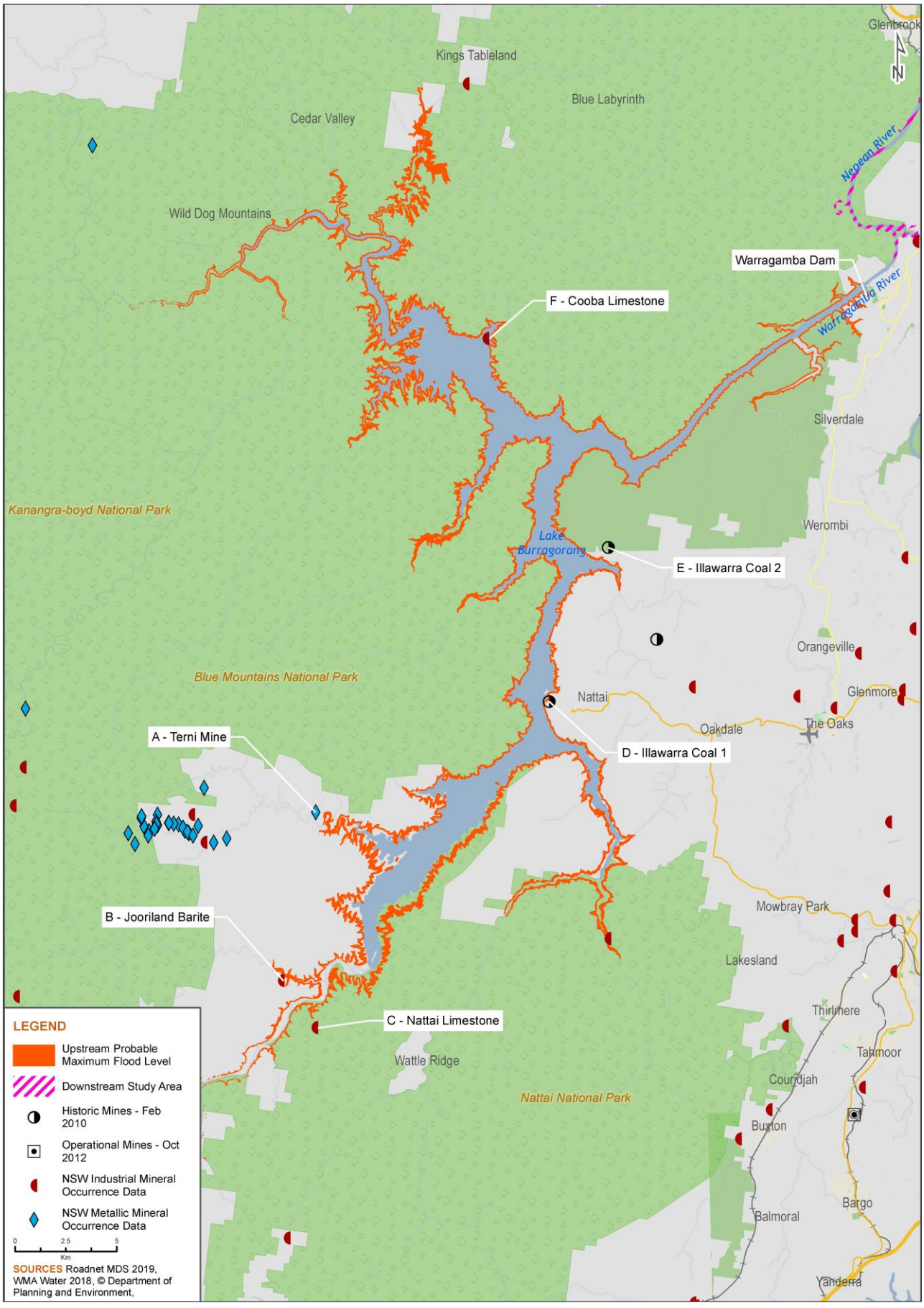


Table 6-4. Summary of Likelihood of inundation of upstream mine sites during Project PMF event

Mine ID	Mine name	Summary	Likelihood of inundation during PMF (post wall raising)
A	Terni Mine/Silver Star Mine	Below ground gold and lead mine	**Low**: The mine is elevated by + 25 m above the PMF line
B	Jooriland Barite Mine	open cut mine	**Low:** The mine is elevated by >40 m above the PMF line
C	Nattai Limestone Deposit	limestone, marble, caliche, travertine, calcrete reserves - never worked	**Low:** The deposit is elevated 10-20 m above the PMF line.
D	Illawarra Coal (1)	Below ground coal mine	**Low:** all mines appear to be elevated above PMF by >20 m
E	Illawarra Coal (2)	Below ground coal mine	**Low:** all mines appear to be elevated above PMF by >20 m
F	Cooba Limestone	limestone, marble, caliche, travertine, calcrete reserves – never worked	**Low:** the reserves have never been mined and are currently located beneath Burragorang Lake

Based on a review of mining data (provided by the Department of Planning and Environment Resources and Energy) and modelling PMF post-construction of the raised dam, it is unlikely that there would be material change to the contamination status of these area from existing / historic conditions as a result of dam raising.

Based on a review of the MinView there are no known historical or currently operational mines within the downstream study area. There are numerous sites described as 'NSW Industrial Occurrence', some of which are operational. A graphical representation of all operational and non-operational sites is presented on Figure 6-7. A summary of all currently operational sites is presented in Table 6-5.

Figure 6-7. Historic mining inundation risk – downstream study area

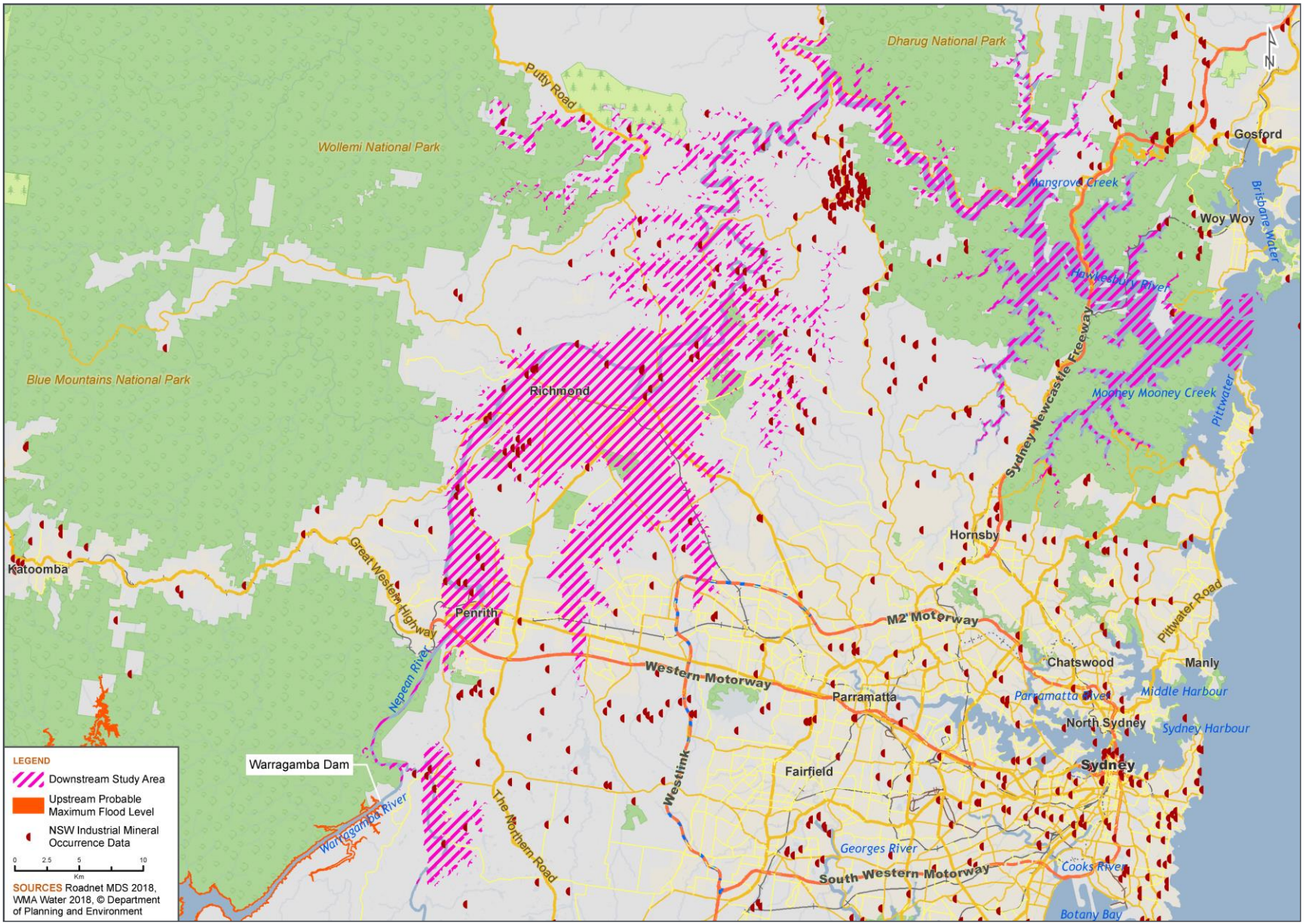


Table 6-5. Mining sites – downstream study area (MinView)

Site ID	Deposit name	Company name	Type	Operating	Current status
200947	Agnes Banks, CSR Readymix	CSR Limited	Sand - construction, clay/shale - structural	Operating	Continuous
201566	Agnes Banks, PB White	PB White Minerals Pty Limited	Sand - construction, silica sand - industrial, clay/shale - structural	Operating	Continuous
202313	Bents Basin Road Quarry	Vicary Corporation P/L	Soil, loam	Operating	Intermittent
200898	Burfitt Road, Riverstone	Collex Waste Management	Coarse aggregate - shale, coarse aggregate - sandstone, clay/shale - structural, coarse aggregate - armour stone, unprocessed construction materials	Operating	Continuous
218414	Camenzuli - Penrith Lakes	Boral Resources (NSW) Pty Limited	Sand - construction, coarse aggregate - river gravel	Operating	Continuous
202320	Glenorie, Hidden Valley	HV Sand & Soil	Soil, loam, unprocessed construction materials	Operating	Intermittent
202319	Kenthurst, 309 Pitt Town Road	Hills District Quarries	Soil, loam, sandstone slabs, flagging stone	Operating	Intermittent
201015	Londonderry, PGH	PGH Pty Limited	Clay/shale - structural	Operating	Continuous
201743	Penrith Lakes Scheme - Boral	Boral Resources (NSW) Pty Limited	Coarse aggregate - river gravel, sand - construction	Operating	Continuous
201415	Penrith Lakes Scheme - Readymix	Readymix Holdings	Coarse aggregate - river gravel, sand - construction	Operating	Continuous
201758	Ravenswood, Bents Basin Rd Wallacia	ME & JA Maxwell T/A	Soil, loam, sand - construction, silica sand - industrial	Operating	Intermittent
200887	Schofields	PGH Pty Limited	Clay/shale - structural	Operating	Continuous
202315	Wallacia, Silverdale Road	Wallacia Sands	Sand - construction	Unknown	N/a
201734	Windsor, Putty Road	Rocla Quarry Products	Sand - construction	Operating	Continuous

6.4 Assessment of contamination impacts

A number of publicly available data sources were used to gain an appreciation of the setting of the study area and also sites that may be associated with past or present contaminating activities. Due to the large size of the study area, searches were targeted to those areas where data could be obtained to gain a broad appreciation of issues. In the context of the proposed Project, the general conceptual site model with respect to land contamination for upstream, downstream and in proposed construction/laydown areas is discussed.

6.4.1 Upstream area

In relation to the upstream study area, raising Warragamba Dam would create an additional 12 metres of air space for flood mitigation purposes. The full supply level would not change. Upstream areas would experience a temporary increase in inundation during periods of rainfall that require temporary storage of flood waters above the full supply level.

This assessment has not identified any sites in the upstream study area with contamination or evidence of contaminating activities that would be influenced by construction or operation of the Project. It is noted that not all sites with contamination issues can be identified through the searches that were carried out for this assessment, but the land uses in the upstream study area suggest the likelihood of this is low.

6.4.2 Downstream area

In relation to the downstream study area, flood modelling (WMAwater 2018) indicates that operation of the raised dam would reduce the extent of flood waters, however some areas will experience an increased duration of flooding.

The downstream study area is large, comprising several suburbs along the Nepean and Hawkesbury River systems. A review of publicly available information suggests there are many sites within the downstream study area that could have site contamination issues, such as service stations, industrial facilities, commercial premises etc. Due to the size of the study area it is not practical to identify all sites that have or could have had exposure to contaminating activities and assess individual specific situations.

The presence of existing contamination is not the focus of this assessment but, rather, whether existing contamination could be exacerbated during construction or operation of the Project. Relevant to typical contaminated site scenarios it is considered that the likelihood of a changes in the contamination status of a property due to increased inundation of flood waters would be low. Impacts to a property that could lead to new, or change in, the contamination status would have occurred in these areas irrespective of the duration of inundation. If anything, the risk is likely to be improved as peak flows are modelled (WMAwater 2018) to be lower. Given that the total area of the downstream study area affected by flooding is predicted to decrease, the impacts would be reduced during operation of the Project.

6.4.3 Construction/laydown areas

This assessment has noted that there is potential for contamination issues within or near the proposed construction sites and laydown areas. These are shown in Figure 6-2.

Site A – Former explosives store and vehicle re-fuelling area/painters workshop/workshop shed

Available reports suggest that contamination identified in soil at this site was remediated through excavation and on-site burial in a clay lined pit. A formal validation report has not been sighted by SMEC, but a supplementary letter was provided by Ken Holmes (the Environmental Management Representative at the time) confirming the works were completed as per the approved remediation action plan.

This site is situated in the boundary of one of the proposed laydown areas; however, the likelihood of contamination remaining at the surface at concentrations that would cause adverse impacts is considered to be low. Assuming no physical ground disturbance is required at the laydown area, the potential for disturbing residual contamination is considered to be low.

Site works should be managed to avoid disturbance of buried contamination through implementation of adequate protocols to ensure restrictions on ground disturbance in the vicinity of the area. If ground disturbances are required anywhere in this site, further investigations are recommended to assess and manage potential contamination risk.

Site B – Former Workshop Yard, Farnsworth Avenue, Warragamba, NSW

Available reports suggest soil contamination at the Former Workshop Yard was remediated. This site is in the proposed construction zone but outside areas designated for disturbance. Residual impacts, if any, are likely to be low and can be managed as part of the construction works, or as a precursor to works if ground disturbance is required.

Site works should be managed to avoid disturbance of potentially contaminated area through implementation of adequate protocols to ensure restrictions on ground disturbance in the vicinity of the area. If ground disturbances are required anywhere in this site, further investigations are recommended to assess and manage potential contamination risk. Areas of contamination, if they were to be uncovered during site works could be managed through implementation of an unexpected finds protocol, otherwise initial intrusive assessments could be carried out to gain a better understanding of the potential for contamination to exist in areas that will be disturbed.

Sites C and D – Selected existing structures

Previous hazardous materials surveys of selected buildings within he construction area have noted hazardous materials such as asbestos. Disturbance or demolition of the buildings or structures referenced in *Hazardous Materials Survey Report: Warragamba Dam, Warragamba, NSW* (ADE Consulting Group 2014) are not proposed as part of the Project.

Should demolition of these structures be required then management of hazardous materials would need to be managed through appropriate controls in accordance with state and national guidelines and codes of practice.

Due to the age of the dam and ancillary services, not all hazardous materials may have been assessed during previous surveys. Areas of the dam that are to be disturbed as part of the construction works should be assessed for hazardous building materials prior to commencing works. A protocol for managing unexpected finds of hazardous materials should be included in the CEMP.

Site F – Warragamba Dam viewing platform (Eighteenth Street)

The Warragamba Dam viewing platform at Eighteenth Street is recorded on the EPA list of contaminated sites. The platform is listed as ‘not requiring regulation’ by the EPA, but contamination may still be present. Details of the contamination are not known. This site is outside the construction zone and not likely to be influenced or disturbed by the Project.

Should construction work impact on this structure then management of hazardous materials would need to be managed through appropriate controls in accordance with state and national guidelines and codes of practice.

Other areas

Documentation of the contamination status of other areas of the Warragamba Dam construction area were not available at the time of preparation of this report, and therefore the assessment could not determine the presence or absence of contamination. Sydney Catchment Authority (now WaterNSW) have undertaken a program of managing legacy contamination. The extent of the program was not able to be judged for this assessment. Areas within the proposed construction zone/laydown area also fall within or close to former construction zones and former construction camps. Potential contamination sources could exist in these areas, including hazardous building materials (such as lead paint and asbestos) from former demolished structures or older pipework/conduits or associated infrastructure.

The majority of construction works for raising the dam will occur on the existing wall, with some disturbance of adjacent areas required for ancillary works. The likelihood of widespread contamination is low based on the reviewed documents. Areas of contamination, if they were to be uncovered during site works could be managed through implementation of an unexpected finds protocol, otherwise initial intrusive assessments could be carried out to gain a better understanding of the potential for contamination to exist in areas that will be disturbed. Soil contamination if identified is likely to be able to be managed through either offsite disposal or on-site capping and management. The Unexpected Finds Protocol would be detailed in the CEMP.

6.4.4 Conceptual site model

This assessment of potential contamination impact as a result of the Project considered the conceptual site model comprising source(s), pathway(s) and ecological/human receptor(s) linkages.

This assessment has not identified any sites (sources) in the upstream study area with contamination or evidence of contaminating activities that would be influenced by construction or operation of the Project. Note, however, that not all sites with contamination issues can be identified through the searches that were carried out for this assessment.

A review of publicly available information suggests there are many sites within the downstream study area that could have site contamination issues and could be exposure sources, such as service stations, industrial facilities, commercial premises etc. The presence of existing contamination is not the primary focus of this assessment but, rather, whether additional interference of existing contamination during construction or operation of the Project could create additional pathways and exposure. Relevant to typical contaminated site scenarios it is considered that the likelihood of changes in the contamination status of downstream properties due to the slightly increased period of inundation by flood waters, and any subsequent additional exposure risk would be low. If anything, the risk of exposure to contamination is likely to be improved, as the downstream inundation footprint is considerably smaller compared to the pre-Project conditions.

Therefore, based on this assessment, the conceptual site model for the upstream and downstream catchments indicate no major changes to existing source-pathway-receptor linkages that would be exacerbated by the Project.

7 Conclusions and recommendations

7.1 Acid sulfate soils

Acid sulfate soils are not known to be in close proximity of areas to be disturbed for construction or within the upstream study area. Acid sulfate soils are mapped in areas commencing some 40 kilometres downstream. This assessment concludes that acid sulfate soils are unlikely to be affected as a result of the Project construction works or longer term as a result of the dam raising.

7.2 Salinity

Given the short inundation periods and the predominantly low permeability of the rock formations in the upstream study area, impacts on the upstream groundwater regime and quality from salinity are considered to be insignificant.

The decreasing footprint (area) and increasing duration of flooding events in the downstream areas may have very little impact on groundwater recharge/discharge across most of the flooded areas, where groundwater is within two metres of the surface. However, it may have minor impact on groundwater recharge/discharge in the small areas where the groundwater table is more than two metres below the surface.

The impact in such areas would be either flushing of slightly more salt from the historically pre-leached soil profile due to slightly longer flood duration, or slightly elevated salt loads due to water logging and evaporative processes. This is likely to be the case for known, high, and moderate salinity risk potential areas as the proposed changes from the current flow regime are only minor and other factors contributing to land salinisation remain principally unchanged.

Flood mitigation discharges of water from Warragamba Dam may impact EC levels in the Nepean and Hawkesbury Rivers. However, EC in rivers is largely a function of land use and catchment geology, as well as in-stream processes such as tidal influence, barriers and interferences.

7.3 Land contamination

Based on the results of this assessment, areas of potential contamination have not been identified within the upstream study area that are likely to be materially influenced as a result in the dam wall rising.

The downstream study area is very large and incorporates many suburbs of Sydney along the Nepean and Hawkesbury River systems which include many sites that could have site contamination issues, (such as service stations, industrial facilities, commercial premises etc). Based on the flood modelling which reduces peak flood discharges, reduces flood area and increases flood duration impacts to contaminated land downstream would be overall less due to the dam raising.

Some sites within the proposed construction zone have been identified as having past contamination issues or incomplete documentation following remediation. Overall, the likelihood of encountering widespread contamination within the proposed construction zone has been assessed as low, but some areas (as identified in this report) will require protocols to avoid disturbance of known encapsulated contaminated materials. Areas of contamination, if they were to be uncovered during site works could be managed through implementation of an unexpected finds protocol, otherwise initial intrusive assessments could be carried out to gain a better understanding of the potential for contamination to exist in areas that will be specifically disturbed. Soil contamination if identified is likely to be able to be managed through either offsite disposal or on-site capping and management.

Areas of the dam that will be disturbed as part of the works should be checked for hazardous building materials prior to works commencing (such as old pipework, gaskets etc).

7.4 Environmental management measures

Safeguards and management measures have been developed to avoid, minimise or manage potential risks identified in Section 6. Relevant management and mitigation measures have been detailed in Table 7-1.

Table 7-1. Safeguards and management measures

Impact	Environmental management measure	Responsibility	Timing
Impacts on site workers and/or local community through disturbance of known or potential contaminated land(s) or material.	Prior to ground disturbance, further investigations are recommended to assess and manage potential contamination risk. Any contamination would be managed through implementation of an unexpected finds protocol, as discussed below. Investigations will be undertaken in accordance with: Site works should be managed to avoid disturbance of known buried contamination (identified as Site A', which is within the boundary of one of the proposed laydown areas) through implementation of adequate protocols to ensure restrictions on ground disturbance in potentially affected areas. The location of this area will be identified on the design drawings. Further investigations and management of potential contamination will be undertaken in accordance with NSW regulatory provisions, the EPA and relevant guidelines such as: ▪ Guidelines for Consultants Reporting on Contaminated Sites (OEH, reprinted 2011) ▪ Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land (DUAP and EPA 1998)	Construction contractor	Construction
	Should demolition of existing structures within the construction footprint be required then management of hazardous materials would need to be managed through appropriate controls in accordance NSW regulatory provisions, the NSW Environment Protection Authority and guidelines such as: ▪ Construction and demolition waste: A management toolkit (EPA 2020) These controls should be detailed in the appropriate construction management plan. A hazardous materials assessment will be carried out prior to and during the demolition of buildings. Demolition works will be undertaken in accordance with the Work Health and Safety Regulation 2011 (NSW), relevant Australian Standards, and relevant NSW WorkCover Codes of Practice. Due to the age of the dam and ancillary services, not all hazardous materials may have been assessed during previous surveys. Areas of the dam that are to be disturbed as part of the construction works should be assessed for hazardous building materials prior to commencing works. A protocol for managing unexpected finds	Construction contractor	Pre-construction

Impact	Environmental management measure	Responsibility	Timing
	of hazardous materials should be included in the CEMP.		
	If areas of contamination were to be uncovered during site works, they would be managed through implementation of an unexpected finds protocol, otherwise initial intrusive assessments could be carried out to gain a better understanding of the potential for contamination to exist in areas that will be disturbed. Soil contamination if identified is likely to be able to be managed through either offsite disposal or on-site capping and management. The protocol would provide for: ▪ ceasing work in the vicinity ▪ initial assessment by an appropriately qualified professional ▪ further assessment and management of contamination, if confirmed, in accordance with section 105 of the CLM Act.	Construction contractor	Pre-construction Construction
	Potentially contaminated areas directly affected by the project would be investigated and managed in accordance with section 105 of the CLM Act.	Construction contractor	Pre-construction Construction
	Asbestos handling and management would be undertaken in accordance with an Asbestos Management Plan (as part of the construction Environmental Management Plan).	Construction contractor	Pre-construction Construction
Accidental spills during construction	Procedures to address spills, leaks would be developed as part of the CEMP and implemented during construction of the project.	Construction contractor	Pre-construction Construction
Impacts to soil and water quality	Measures would be implemented to appropriately store dangerous goods and reduce the potential for environmental contamination due to spills and leaks.	Construction contractor	Pre-construction Construction
	A Construction Soil and Water Management Plan would be prepared for the project including procedures to manage potentially contaminated stormwater runoff.	Construction contractor	Pre-construction Construction

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Appendix A: Contaminated sites notified to EPA

List of contaminated sites notified to EPA (Upstream study area)

Suburb	Site name	Site address/ location	Contamination activity type	EPA site management class
Warragamba	Warragamba Dam Viewing Platform	Eighteenth Street	Unclassified	Regulation under CLM Act not required
	Megarrity's Creek Site	Weir Road	Unclassified	Regulation under CLM Act not required

List of contaminated sites notified to EPA (Downstream study area)

Suburb	Site name	Site address/ location	Contamination activity type	EPA site management class
Brooklyn	Former Oyster Farm	139 Brooklyn (Off Government) Road	Unclassified	Regulation under CLM Act not required
CLARENDON	Coles Express Clarendon Service Station	244 Hawkesbury Valley Way	Service Station	Regulation under CLM Act not required
EMU HEIGHTS	7-Eleven Service Station	126 Old Bathurst Road	Service Station	Regulation under CLM Act not required
EMU HEIGHTS	Woolworths Service Station	132 Old Bathurst Road	Service Station	Regulation under CLM Act not required
EMU PLAINS	Woolworths Service Station	283 Great Western Highway	Service Station	Regulation under CLM Act not required
JAMISONTOWN	7-Eleven Service Station	92 Mulgoa Road	Service Station	Contamination currently regulated under CLM Act
JAMISONTOWN	BP Service Station Jamisontown	124 - 128 Mulgoa Road	Service Station	Regulation under CLM Act not required
JAMISONTOWN	Former Caltex Jamisontown	229-231 Mulgoa Road	Service Station	Regulation under CLM Act not required
MULGRAVE	7-Eleven (former Mobil) Service Station	Corner Windsor Road and Mulgrave Road	Service Station	Regulation under CLM Act not required
NORTH RICHMOND	Caltex Service Station	50 Bells Line of Road	Service Station	Regulation under CLM Act not required
PENRITH	Crane Enfield Metals	Castlereagh Road	Metal Industry	Contamination currently regulated under CLM Act

Suburb	Site name	Site address/ location	Contamination activity type	EPA site management class
PENRITH	Mirvac Industrial Site	2101 Castlereagh Road	Other Industry	Regulation under CLM Act not required
PENRITH	7-Eleven (former Mobil) Service Station	212-222 Andrews Road	Service Station	Regulation under CLM Act not required
PENRITH	Lowes Petroleum (Former Mobil) Depot Penrith	174 Coreen Avenue	Other Petroleum	Regulation under CLM Act not required
PENRITH	Caltex Service Station	Castlereagh Rd Cnr Lugard Street	Service Station	Regulation under CLM Act not required
PENRITH	BP Express Service Station	Corner Coreen Avenue and Castlereagh Road	Service Station	Regulation under CLM Act not required
PENRITH	Caltex Penrith Service Station	153 Coreen Avenue	Service Station	Regulation under CLM Act not required
PENRITH	Jet 60 Dry Cleaners	Shop 3 134-138 Henry Street	Unclassified	Regulation under CLM Act not required
RICHMOND	Caltex Richmond Service Station	98 March (Cnr East Market St) Street	Service Station	Regulation under CLM Act not required
RIVERSTONE	Axalta Coating Systems	15-23 Melbourne Road	Other Industry	Regulation under CLM Act not required
RIVERSTONE	7-Eleven Riverstone	55 Garfield Road	Service Station	Regulation under CLM Act not required
RIVERSTONE	Woolworths Vineyard Service Station, Riverstone	1 Woodland Street, corner of Windsor Road	Service Station	Regulation under CLM Act not required
RIVERSTONE	Vacant Commercial Land	88-94 Junction Road	Unclassified	Regulation under CLM Act not required
ST MARYS	Solveco	38 Links Road	Unclassified	Under assessment
VINEYARD	Shell Coles Express Service Station	731 Windsor Road	Service Station	Regulation under CLM Act not required
WILBERFORCE	Former Drum Reconditioners	12-14 Box Avenue	Other Industry	Contamination formerly regulated under the CLM Act
WILBERFORCE	Former Solvent Recycling Site	13 Box Avenue	Chemical Industry	Regulation under CLM Act not required

Suburb	Site name	Site address/ location	Contamination activity type	EPA site management class
WINDSOR	Former Caltex Service Station	46-52 Macquarie Street	Service Station	Regulation under CLM Act not required
WINDSOR	Former Caltex Windsor Depot and Service Station	48-50 Mileham Street	Service Station	Regulation under CLM Act not required
WINDSOR	Woolworths (former Caltex) Service Station	Cnr Macquarie Street & Baker Street	Service Station	Regulation under CLM Act not required

Appendix B: National Pollutant Inventory

National Pollutant Inventory summary (Upstream study area)

Suburb	Facility ID	Site name	Site address/location	Primary ANZIC class
Warragamba	564844	Sydney Water Corporation - WT16 Warragamba Chlorination Plant	Silverdale Road	Raw water chlorine disinfection
	492520	Sydney Water Corporation - Warragamba Sewage Treatment Plant	End of Weir Road	Tertiary biological sewage treatment plant with tertiary filter and UV disinfection (236 ML/year)
	492568	Sydney Water Corporation - Warragamba Water Filtration Plant	23rd Street	Coagulation and flocculation, filtration (dual media), chlorination, fluoridation.

National Pollutant Inventory summary (Downstream study area)

Suburb	Facility ID	Site name	Site address/location	Primary ANZSIC class
Badgerys Creek	483602	Badgerys Creek Farm 1	465 Badgerys Creek Road	Produce fertile meat chicken eggs for off-site incubation/hatching. (1 of 6 operations on 182.6 ha property)
Badgerys Creek	495436	Inghams Badgerys Creek Farm 2	475 Badgerys Creek Road	Produce fertile meat chicken eggs for offsite incubation/hatching. (1 of 6 operations ha property)
Badgerys Creek	492274	Inghams Badgerys Creek Farm 3	465 Badgerys Creek Road	produce fertile meat chicken eggs for offsite incubation / hatching
Badgerys Creek	492288	Inghams Badgerys Creek Farm 4	465 Badgerys Creek Road	Produce fertile eggs for hatching
Badgerys Creek	492302	Inghams Badgerys Creek Farm 5	465 Badgerys Creek Road	Produce fertile meat chicken for offsite incubation/ hatching
Badgerys Creek	492316	Inghams Badgerys Creek Farm 7	465 Badgerys Creek Road	Produce fertile meat chicken eggs for incubation/hatching
Badgerys Creek	496000	Inghams Badgerys Creek Farm 3/4	3 Badgerys Creek Road	Poultry raising
Badgerys Creek	595522	Elizabeth Drive Landfill Facility	1725 Elizabeth Drive	Mining of clay and shale with rehabilitation by landfill
Badgery'S Creek	484668	Boral Bricks Badgerys Creek	235 Martin Road	Clay brick manufacturing
Badgery'S Creek	487542	Inghams Badgerys Creek Protein Recovery Unit	Badgerys Creek Road	Protein recovery
Brooklyn	564852	Brooklyn Sewage Treatment Plant	Lot 4 Brooklyn Road	Sewage treatment
Emu Plains	489226	Boral Emu Plains Quarry	Railway Street	Crushing, grinding and separating works.
Emu Plains	595954	Rocla Emu Plains	OLD BATHURST ROAD	Concrete products manufacture
Freemans Reach	483976	Terrace Farm	485 Terrace Road	Egg production

Suburb	Facility ID	Site name	Site address/location	Primary ANZSIC class
Glendenning	587234	Pacmetal Services	194 Power St	Cutting coils of tinplate and aluminium to sheets, coating and decorating sheets of tinplate and aluminium for use in can making industry
Glendenning	491572	Valspar Glendenning Plant	203 Power Street	Paint and Resin Manufacture
Glossodia	564600	Baiada Poultry - Jacaranda Farm	103 James Street	Broiler production facility
Hornsby Heights	494334	Hornsby Heights Sewage Treatment Plant	Pike Road	Tertiary biological treatment with phosphorus removal and disinfection.
Maroota	487180	Camilleri Stockfeeds	4777 Old Northern Road	Rendering of waste, chicken, fish and meat products for the production of meals and tallow for the local and export markets. 7MW and 6MW boiler burn natural gas to produce steam for heating rendering cookers.
Marsden Park	490102	Bartter Enterprises Marsden Park	1 South Street	Distribution and poultry deboning
Marsden Park	484050	EDL Grange Avenue Electricity Generation	Grange Avenue	Electricity generation n.e.c.
Marsden Park	493164	Grange Avenue Waste and Recycling Centre (closed Landfill)	Grange Avenue (West)	Solid waste landfill - closed in February 2001
North Richmond	483940	Aanalee Rearing Farm	780A Richmond Road	Egg production
North Richmond	487376	St John of God Health Services North Richmond	177 Grose Vale Road	Mental Health Hospital
North Richmond	492486	North Richmond Sewage Treatment Plant	Cnr Bells Line of Road and Crooked Lane	Tertiary biological sewage treatment plant with disinfection.
North Richmond	492546	North Richmond Water Filtration Plant	Lot 112 Grose Vale Road	Coagulation and flocculation, sedimentation/dissolved air flotation, filtration (dual media), granular activated carbon contactors, chlorination, fluoridation.
Oakville	487438	Oakville Depot	225 Saunders Road	Petroleum Product Wholesaling
Orchard Hills	492560	Orchard Hills Water Filtration Plant	The Chase (off Wentworthville Road)	Coagulation and flocculation, filtration (dual media), chlorination, fluoridation.
Penrith	486950	O-I Sydney Plant (Owens Illinois)	5 Andrews Road	Manufacture and supply of glass containers for beverages and food. Containers are produced in various colours including clear, amber and tints of green in capacities from 200 mL to 1.5 L. Technologies include furnaces, forming, annealing, surface treatment, automatic product inspection and packaging.

Suburb	Facility ID	Site name	Site address/location	Primary ANZSIC class
Penrith	485670	Caltex Energy NSW Penrith Depot	153 Coreen Avenue	Petroleum product wholesaling
Penrith	483654	Capral Limited	2115 Castlereagh Road	Aluminium logs are sheared into set billet lengths, heated in natural gas fired heater & extruded through dies into required shapes. Cut lengths are soaked in natural gas fired furnace. Then sections are packed, weighted & despatched.
Penrith	486610	Clay & Michel Penrith Depot	Lot 8 Coreen Avenue	Petroleum Product Wholesaling
Penrith	490172	Readymix Penrith Quarry	Castlereagh Road	Extractive industries - quarrying
Penrith	489838	National Foods Milk Penrith	2257-2265 Castlereagh Road	Receival, processing, packaging and distribution of liquid whole and modified milk products.
Penrith	494572	Penrith Sewage Treatment Plant	Castlereagh Road	Tertiary biological treatment with disinfection.
Penrith	484300	Fort Dodge Australia Pty Ltd - Penrith	2152 Castlereagh Road	Medicinal & pharmaceutical product manufacturing
Quakers Hill	494708	Quakers Hill Sewage Treatment Plant	Cnr Quakers Road and Riley Place	Tertiary biological treatment with disinfection
Richmond	490226	Richmond Sewage Treatment Plant	Off Bourke Street	Tertiary biological treatment with disinfection.
Riverstone	494660	A J Bush and Sons Riverstone	1106 Windsor Road	Rendering/recycling of meat/poultry co-products to produce protein meals and tallow
Riverstone	487690	Axalalta Coating Systems-Riverstone Site	15-23 Melbourne Road	Processing of coatings and related products.
Riverstone	607268	Riverstone Landfill	167 Burfitt Road	Closed Landfill Site
Schofields	484870	PGH Bricks and Pavers Schofields	75 Townson Road	Manufacture of clay bricks and pavers
Somersby	632270	Somersby Water Treatment Plant	64 Myoora Road	Drinking Water Treatment
Somersby	493802	CSR Hebel Somersby	112 Wisemans Ferry Road	Manufacture of autoclaved aerated concrete
Somersby	488044	Mitavite (a division of Inghams Enterprises Pty Ltd)	3 Pile Road	Animal feed manufacture
Somersby	560774	Spotless Facility Services Somersby	Gindurra Rd	Linen Service - laundry
Somersby	579056	Weir Minerals Somersby	15 Gindurra Road	Non-ferrous metal casting, rubber products manufacturing, maintenance and repair of machinery.
South Windsor	487216	South Windsor Sewage Treatment Plant	Fairey Road	Conventional activated sludge sewage treatment plant with tertiary sand filters and UV disinfection.

Suburb	Facility ID	Site name	Site address/location	Primary ANZSIC class
St Marys	487810	Chemcolour Industries Australia Pty Ltd	19-25 Anne Street	Chemical manufacturing
St Marys	582748	St Marys Advanced Water Treatment Plant	Lot 1 Links Road	Treatment processes include ultrafiltration and reverse osmosis
St Marys	494824	St Marys Sewage Treatment Plant	Off Links Road	Tertiary biological sewage treatment with disinfection.
Sydney	489586	CUB Kent Brewery	26 Broadway	Manufacture, packaging and distribution of beer and other beverages.
Vineyard	483980	Sunnyside Farm	31 Boundary Road	Egg production
Vineyard	491188	Riverstone Sewage Treatment Plant	Bandon Road	Tertiary biological treatment with disinfection.
Wallacia	564854	Wallacia Sewage Treatment Plant	Norton Basins Road	Tertiary Biological treatment plat with phosphorous removal and UV disinfection
Werrington	491680	Werrington Depot	Werrington Road	Petroleum Product Wholesaling
Wilberforce	495180	Baiada Glossodia 1 Poultry Facility	298 Sackville Road	Meat breeder and egg production facility
Wilberforce	495192	Baiada Glossodia 2 Poultry Facility	298 Sackville Road	Meat breeder and egg production facility
Wilberforce	483944	Moutainview Farm	273A Singleton Road	Egg production
Windsor	485810	Caltex Windsor Depot	41 Walker Street	Petroleum product wholesaling.
Woy Woy	570300	AGL Woy Woy Landfill	Nagari Road	Combustion of landfill gas

Appendix C: POEO Register

Protection of the Environment Operations Act 1997 Register (Upstream study area)

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Silverdale	Shannongrove Pty Limited	10723	1810 Silverdale Road	Transport of category 1 trackable waste
	Shannongrove Pty Limited	10723	1810 Silverdale Road	Transport of category 2 trackable waste
	Silverdale Sand & Soil Pty Ltd	10723	2 Econo Place	Transport of category 1 trackable waste

Protection of the Environment Operations Act 1997 Register (Downstream study area)

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Agnes Banks	Jeffsann Excavations Pty Ltd	12267		Transport of category 1 trackable waste
Agnes Banks	Jeffsann Excavations Pty Ltd	12267		Transport of category 2 trackable waste
Box Hill	Sheridan & Sons Pty Ltd	20370		Transport of category 1 trackable waste
Brooklyn	Hawkesbury River Holdings Pty Ltd	10894	31 Brooklyn Road	Boat construction/maintenance (general)
Cattai	Teamcay Pty. Limited	6238		Transport of category 1 trackable waste
Cattai	Teamcay Pty. Limited	6238		Transport of category 2 trackable waste
Cattai	HSP Contracting Pty Ltd	21201		Transport of category 1 trackable waste
Cattai	HSP Contracting Pty Ltd	21201		Transport of category 2 trackable waste
Claremont Meadows		20865		Transport of category 1 trackable waste
Claremont Meadows		20865		Transport of category 2 trackable waste
Cranebrook	Calvani Crushing Pty Ltd	21206	Bogan Road	Crushing, grinding or separating
Cranebrook	Calvani Crushing Pty Ltd	21206	Bogan Road	Land-based extractive activity
Cranebrook	Penrith Lakes Development Corporation Ltd	2956	89-151 Old Castlereagh Road	Land-based extractive activity
Doonside	Cleanaway Operations Pty Ltd	6091	6-8 Rayben Street	Non-thermal treatment of hazardous and other waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Doonside	Cleanaway Operations Pty Ltd	6091	6-8 Rayben Street	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
Doonside	Cleanaway Operations Pty Ltd	11901		Transport of category 1 trackable waste
Doonside	Cleanaway Operations Pty Ltd	11901		Transport of category 2 trackable waste
Doonside	Outboard World Pty Limited	12625		Transport of category 1 trackable waste
Doonside	Outboard World Pty Limited	12625		Transport of category 2 trackable waste
Emu Heights	Fluid Recycling Systems Pty Ltd	21012		Mobile waste processing
Emu Plains	Rocla Pty Limited	1161	Old Bathurst Road	Concrete works
Emu Plains	Josa Equipment Hire and Rental Pty Ltd	20600		Transport of category 1 trackable waste
Emu Plains	Josa Equipment Hire And Rental Pty Ltd	20600		Transport of category 2 trackable waste
Galston	Summertime Chicken Pty Limited	3844	26-28 Crosslands Road	Slaughtering or processing animals
Glendenning	NCI Holdings Pty Ltd	12384	194 Power Street	Metal coating
Glendenning	NCI Holdings Pty Ltd	12384	194 Power Street	Metal waste generation
Glenmore Park	Itreat Pty Ltd	20884	5 Nirvana Street	Non-thermal treatment of hazardous and other waste
Glenmore Park	Itreat Pty Ltd	20569		Transport of category 1 trackable waste
Glenorie	Glenorie Holdings Pty Ltd	20284	11-15 Moores Road	Pharmaceutical and veterinary products production
Greenhills	Donaldson Coal Pty Ltd	12856	1132 John Renshaw Drive	Coal works
Greenhills	Donaldson Coal Pty Ltd	12856	1132 John Renshaw Drive	Mining for coal
Greenhills	Donaldson Coal Pty Ltd	11080	John Renshaw Drive	Coal works
Greenhills	Donaldson Coal Pty Ltd	11080	John Renshaw Drive	Mining for coal
Kellyville	Greenwaste Only Pty Ltd	11620	132 Burfitt Road	Composting
Kellyville	Abterra Australia Pty Limited	12804	"Broulaside" Mid Western Highway	Crushing, grinding or separating
Kellyville	Abterra Australia Pty Limited	12804	"Broulaside" Mid Western Highway	Mining for minerals

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Kenthurst	Peter Vella Pty Ltd	13193		Transport of category 1 trackable waste
Kenthurst	Peter Vella Pty Ltd	13193		Transport of category 2 trackable waste
Kenthurst	Outback Timber Supplies Pty Ltd	20663		Transport of category 1 trackable waste
Kenthurst	Outback Timber Supplies Pty Ltd	20663		Transport of category 2 trackable waste
Londonderry	Kim Haulage Pty. Limited	7632		Transport of category 1 trackable waste
Londonderry	Kim Haulage Pty. Limited	7632		Transport of category 2 trackable waste
Londonderry	Eather Group Pty Ltd	20733		Transport of category 1 trackable waste
Londonderry	Masters Cargo Services Pty Ltd	21184		Transport of category 1 trackable waste
Londonderry	Masters Cargo Services Pty Ltd	21184		Transport of category 2 trackable waste
Luddenham		6294		Transport of category 1 trackable waste
Luddenham		6294		Transport of category 2 trackable waste
Luddenham		6294		Transport of category 1 trackable waste
Luddenham		6294		Transport of category 2 trackable waste
Luddenham		13315		Transport of category 1 trackable waste
Luddenham		13315		Transport of category 2 trackable waste
Mangrove Mountain	Supreme Poultry & Chickens Pty Ltd	1556	2598 Wisemans Ferry Road	General animal products production
Mangrove Mountain	Supreme Poultry & Chickens Pty Ltd	1556	2598 Wisemans Ferry Road	Slaughtering or processing animals
Mangrove Mountain	SFI UT Pty Limited	21126	58 Kirks Road	Bird accommodation
Maroota	Ridley Agriproducts Pty Ltd.	2421	4777 Old Northern Road	Rendering or fat extraction
Maroota	PF Formation Pty Ltd	3829	Old Northern Road	Land-based extractive activity
Maroota	PF Formation Pty Ltd	10357	Lot 2 Old Telegraph Road	Crushing, grinding or separating
Maroota	PF Formation Pty Ltd	10357	Lot 2 Old Telegraph Road	Land-based extractive activity
Maroota	PF Formation Pty Ltd	21046	97 and 113 Old Telegraph Road	Land-based extractive activity

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Maroota	PF Formation Pty Ltd	3407	Wisemans Ferry Road	Land-based extractive activity
Maroota		20813	176 Baradine Road,	Pig accommodation
Maroota		20813	176 Baradine Road,	Pig accommodation
Marsden Park	Aymsheen Pty. Limited	13043		Transport of category 1 trackable waste
Marsden Park	Aymsheen Pty. Limited	13043		Transport of category 2 trackable waste
Mcgraths Hill	Premier Stock Feeds Pty Ltd	2619	21 Curtis Rd	General agricultural processing
Mcgraths Hill	Premier Stock Feeds Pty Ltd	2619	21 Curtis Rd	General animal products production
Mount Kuring-Gai	Steggles Foods Mt Kuring-Gai Pty Limited	13244	4 - 6 Mundowi Road	General animal products production
Mulgrave	Ray's Machinery Painting Pty. Ltd.	11687		Transport of category 1 trackable waste
Mulgrave	Ray's Machinery Painting Pty. Ltd.	11687		Transport of category 2 trackable waste
North Richmond	Taylor Excavations Pty Ltd	20538		Transport of category 1 trackable waste
North Richmond	Taylor Excavations Pty Ltd	20538		Transport of category 2 trackable waste
North Turramurra	Empire Marina Bobbin Head Pty Ltd	1940	Bobbin Head Road	Boat construction/maintenance (general)
Oakville	Sydney Excavation Group Pty Ltd	20758		Transport of category 1 trackable waste
Oakville	Sydney Excavation Group Pty Ltd	20758		Transport of category 2 trackable waste
Orchard Hills	Mulgoa Excavations Pty Ltd	12757		Transport of category 1 trackable waste
Orchard Hills	Mulgoa Excavations Pty Ltd	12757		Transport of category 2 trackable waste
Penrith	Crane Enfield Metals Pty. Limited	1098	2115 Castlereagh Road	Metal processing
Penrith	Crane Enfield Metals Pty. Limited	1098	2115 Castlereagh Road	Metal waste generation
Penrith	Ld&D Milk Pty Ltd	2869	2257 - 2265 Castlereagh Road	Dairy processing
Penrith	Virbac (Australia) Pty Ltd	5269	2152 Castlereagh Road	Chemical production waste generation
Penrith	Virbac (Australia) Pty Ltd	5269	2152 Castlereagh Road	Pharmaceutical and veterinary products production
Penrith	O-I Operations (Australia) Pty Ltd	6357	130-172 Andrew Road	Ceramic waste generation

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Penrith	O-I Operations (Australia) Pty Ltd	6357	130-172 Andrew Road	Glass production (container)
Penrith	O-I Operations (Australia) Pty Ltd	6357	130-172 Andrew Road	Recovery of general waste
Penrith	Capral Limited	12405	2115 Castlereagh Road	Metal processing
Penrith	Capral Limited	12405	2115 Castlereagh Road	Metal waste generation
Penrith	J K Williams Contracting Pty Limited	6154		Transport of category 1 trackable waste
Penrith	J K Williams Contracting Pty Limited	6154		Transport of category 2 trackable waste
Penrith		7503		Transport of category 1 trackable waste
Penrith		7503		Transport of category 2 trackable waste
Penrith		7503		Transport of category 1 trackable waste
Penrith		7503		Transport of category 2 trackable waste
Penrith	South East Qld. Hauliers Pty Ltd	10499		Transport of category 1 trackable waste
Penrith	South East Qld. Hauliers Pty Ltd	10499		Transport of category 2 trackable waste
Penrith	Bakers Transport Pty Ltd	12348		Transport of category 1 trackable waste
Penrith	Bakers Transport Pty Ltd	12348		Transport of category 2 trackable waste
Pitt Town	Dixon Sand Pty Ltd	4939	481 Castlereagh Road	Crushing, grinding or separating
Pitt Town	Dixon Sand Pty Ltd	4939	481 Castlereagh Road	Land-based extractive activity
Pitt Town	Dixon Sand Pty Ltd	3916	4610 Old Northern Road	Land-based extractive activity
Pitt Town	Dixon Sand Pty Ltd	12513	Haerses Road and Intersection of Wisemans Ferry Road	Land-based extractive activity
Pitt Town	White's Water Service Pty Ltd	20326		Transport of category 1 trackable waste
Richmond	Specialised Sand & Soil Pty Ltd	13140	312 Pitnacree Road	Crushing, grinding or separating
Richmond	Specialised Sand & Soil Pty Ltd	13140	312 Pitnacree Road	Land-based extractive activity
Richmond	RKC Group Pty Ltd	21043		Transport of category 1 trackable waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Richmond	RKC Group Pty Ltd	21043		Transport of category 2 trackable waste
Richmond	Extreme Earthmoving & Recycling Pty Ltd	21067		Transport of category 1 trackable waste
Richmond	Extreme Earthmoving & Recycling Pty Ltd	21067		Transport of category 2 trackable waste
Riverstone	Auscol Pty Ltd	2550	148 Riverstone Pde	Non-thermal treatment of hazardous and other waste
Riverstone	Omega Industries Pty Ltd	6070	13 Melbourne Road	Chemical production waste generation
Riverstone	Blacktown Waste Services Pty Limited	11497	Richmond Road	Land-based extractive activity
Riverstone	Blacktown Waste Services Pty Limited	11497	Richmond Road	Non-thermal treatment of general waste
Riverstone	Blacktown Waste Services Pty Limited	11497	Richmond Road	Waste disposal by application to land
Riverstone	Blacktown Waste Services Pty Limited	11497	Richmond Road	Waste storage - other types of waste
Riverstone	Blacktown Waste Services Pty Limited	11497	Richmond Road	Waste storage - waste tyres
Riverstone	Sydneywide Pipecleaning Pty Ltd	11949	40 Edward Street	Non-thermal treatment of hazardous and other waste
Riverstone	Australian Eco Oils Pty Limited	13102	55 Princes Street	Non-thermal treatment of hazardous and other waste
Riverstone	Australian Eco Oils Pty Limited	13102	55 Princes Street	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
Riverstone	Dump It Recycling Centre Pty Ltd	12661	13 Long Street	Non-thermal treatment of general waste
Riverstone	Dump It Recycling Centre Pty Ltd	12661	13 Long Street	Waste storage - other types of waste
Riverstone	Hanson Precast Pty Ltd	542	63 Railway Road North	Concrete works
Riverstone	Penrith Waste Services Pty. Limited	3438	842 Mulgoa Road	Waste disposal by application to land
Riverstone	Penrith Waste Services Pty. Limited	3438	842 Mulgoa Road	Waste storage - other types of waste
Riverstone	Auscol Pty Ltd	6926		Transport of category 1 trackable waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Riverstone	Auscol Pty Ltd	6926		Transport of category 2 trackable waste
Riverstone	Sydneywide Pipecleaning Pty Ltd	11458		Transport of category 1 trackable waste
Riverstone	Sydneywide Pipecleaning Pty Ltd	11458		Transport of category 2 trackable waste
Riverstone	Tony Collector Pty Ltd	12706		Transport of category 1 trackable waste
Riverstone	Tony Collector Pty Ltd	12706		Transport of category 2 trackable waste
Riverstone	Walan Construction Services Pty Limited	20693		Transport of category 1 trackable waste
Riverstone	Walan Construction Services Pty Limited	20693		Transport of category 2 trackable waste
Ropes Crossing	Cook Logistics Pty Limited	20858		Transport of category 1 trackable waste
Ropes Crossing	Cook Logistics Pty Limited	20858		Transport of category 2 trackable waste
Silverdale	Shannongrove Pty Limited	10723		Transport of category 1 trackable waste
Silverdale	Shannongrove Pty Limited	10723		Transport of category 2 trackable waste
Silverdale	Silverdale Sand & Soil Pty Ltd	13380		Transport of category 1 trackable waste
Somersby		11240	270 Grants Road	Land-based extractive activity
Somersby		11240	270 Grants Road	Land-based extractive activity
Somersby	Recycled Concrete Products Pty. Limited	20617	18a Tathra Street	Recovery of general waste
Somersby	Recycled Concrete Products Pty. Limited	20617	18a Tathra Street	Waste storage - other types of waste
Somersby	GG Products Pty Limited	2892	Bullridge Road	Land-based extractive activity
Somersby	Borg Panels Pty Limited	3035	124 Lowes Mount Road	Paints/polishes/adhesives production
Somersby	Borg Panels Pty Limited	3035	124 Lowes Mount Road	Wood or timber milling or processing
Somersby	Woodchem Australia Pty. Limited	11308	Gate 5 Endeavour Street	Chemical production waste generation
Somersby	Woodchem Australia Pty. Limited	11308	Gate 5 Endeavour Street	Chemical storage waste generation
Somersby	Woodchem Australia Pty. Limited	11308	Gate 5 Endeavour Street	Dangerous goods production
Somersby	Woodchem Australia Pty. Limited	11308	Gate 5 Endeavour Street	General chemicals storage

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Somersby	Woodchem Australia Pty. Limited	11308	Gate 5 Endeavour Street	Plastic resins production
Somersby	Borg Manufacturing Pty Limited	11566	Lowes Mount Road	Wood or timber milling or processing
Somersby	GG Products Pty Limited	12023	Wisemans Ferry Road	Land-based extractive activity
South Maroota	ACN. 162 884 040 Pty. Ltd.	20414		Transport of category 1 trackable waste
South Maroota	B & G Transport Pty Ltd	20978		Transport of category 1 trackable waste
South Maroota	B & G Transport Pty Ltd	20978		Transport of category 2 trackable waste
South Windsor	Evoqua Water Technologies Membrane Systems Pty Ltd	5961	1 Memtec Parkway	Chemical production waste generation
St Marys	Southern Oil Collection Pty Ltd	6099	1 Daintree Place	Non-thermal treatment of hazardous and other waste
St Marys	Southern Oil Collection Pty Ltd	6099	1 Daintree Place	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Chemical production waste generation
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Chemical storage waste generation
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Non-thermal treatment of hazardous and other waste
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Pesticides and related products production
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Pharmaceutical and veterinary products production
St Marys	Autopak-Vetlab Group Pty. Limited	1035	39 Harris Street	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
St Marys	Chemcolour Industries Australia Pty Limited	2131	19-25 Anne Street	Chemical production waste generation
St Marys	Chemcolour Industries Australia Pty Limited	2131	19-25 Anne Street	Chemical storage waste generation
St Marys	Chemcolour Industries Australia Pty Limited	2131	19-25 Anne Street	Dangerous goods production

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
St Marys	Chemcolour Industries Australia Pty Limited	2131	19-25 Anne Street	General chemicals storage
St Marys	Chemcolour Industries Australia Pty Limited	2131	19-25 Anne Street	Petroleum products storage
St Marys	Enviroguard Pty Limited	4865	50 Quarry Road	Waste disposal by application to land
St Marys	Brandster Services Pty Limited	5973	Unit 4, 5, 6 & 7; 15 Lee Holm Road	Non-thermal treatment of hazardous and other waste
St Marys	Brandster Services Pty Limited	5973	Unit 4, 5, 6 & 7; 15 Lee Holm Road	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
St Marys	Cooper's Environmental Waste Recycling Pty Ltd	12473	11 Kurrajong Rd	Non-thermal treatment of hazardous and other waste
St Marys	Tox Free Australia Pty Ltd	12943	66 Links Road	Chemical storage waste generation
St Marys	Tox Free Australia Pty Ltd	12943	66 Links Road	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
St Marys	Southern Oil Collection Pty Ltd	20268	27 Forthorn Place	Non-thermal treatment of hazardous and other waste
St Marys	Clean Earth Recycling Pty Ltd	20767	98-102 Links Road	Non-thermal treatment of waste tyres
St Marys	Clean Earth Recycling Pty Ltd	20767	98-102 Links Road	Waste storage - waste tyres
St Marys	Meyer Timber N.S.W. Pty Ltd	21087	2101-2113 Castlereagh Road	Wood preservation
St Marys	Cooper's Environmental Waste Recycling Pty Ltd	5938		Transport of category 1 trackable waste
St Marys	Cooper's Environmental Waste Recycling Pty Ltd	5938		Transport of category 2 trackable waste
St Marys	Cleanaway Pty Ltd	6134		Transport of category 1 trackable waste
St Marys	Cleanaway Pty Ltd	6134		Transport of category 2 trackable waste
St Marys	Brandster Services Pty Limited	6414		Transport of category 1 trackable waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
St Marys	Brandster Services Pty Limited	6414		Transport of category 2 trackable waste
St Marys	Southern Oil Collection Pty Ltd	6650		Transport of category 1 trackable waste
St Marys	Southern Oil Collection Pty Ltd	6650		Transport of category 2 trackable waste
St Marys	Camsons Pty Limited	7537		Transport of category 1 trackable waste
St Marys	Camsons Pty Limited	7537		Transport of category 2 trackable waste
St Marys	Reach Crane Trucks Pty Ltd	13383		Transport of category 1 trackable waste
St Marys	Cooper's Environmental Waste Recycling Pty Ltd	20238		Mobile waste processing
St Marys	Environmental Protection Equipment Pty Ltd	21013		Transport of category 2 trackable waste
Vineyard	Oberon Quarries Pty. Limited	4442	Hargraves Quarry Road	Crushing, grinding or separating
Vineyard	Oberon Quarries Pty. Limited	4442	Hargraves Quarry Road	Land-based extractive activity
Wallacia	Wallacia Soils Pty Limited	20737	205 Bents Basin Road	Recovery of general waste
Wallacia	Wallacia Soils Pty Limited	20737	205 Bents Basin Road	Waste storage - other types of waste
Whalan		12860		Transport of category 1 trackable waste
Whalan		12860		Transport of category 2 trackable waste
Windsor	Bettergrow Liquid Recycling Pty Ltd	12529	11 Whyalla Circuit	Non-thermal treatment of hazardous and other waste
Windsor	Bettergrow Liquid Recycling Pty Ltd	12529	11 Whyalla Circuit	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
Windsor	Bettergrow Pty. Limited	21092	24 Davis Road	Non-thermal treatment of general waste
Windsor	Bettergrow Pty. Limited	21092	24 Davis Road	Non-thermal treatment of liquid waste
Windsor	Bettergrow Pty. Limited	21092	24 Davis Road	Recovery of general waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Windsor	Bettergrow Pty. Limited	21092	24 Davis Road	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
Windsor	Bettergrow Pty. Limited	21092	24 Davis Road	Waste storage - other types of waste
Windsor	Hawkesbury City Council	1684	10-38 Mulgrave Road	Sewage treatment processing by small plants
Windsor	Hawkesbury City Council	3306	Fairey Road	Sewage treatment processing by small plants
Windsor	Hawkesbury City Council	5293	The Driftway	Composting
Windsor	Hawkesbury City Council	5293	The Driftway	Land-based extractive activity
Windsor	Hawkesbury City Council	5293	The Driftway	Non-thermal treatment of general waste
Windsor	Hawkesbury City Council	5293	The Driftway	Waste disposal by application to land
Windsor	Bettergrow Pty. Limited	5487	48 Industry Road	Non-thermal treatment of general waste
Windsor	Bettergrow Pty. Limited	5487	48 Industry Road	Non-thermal treatment of hazardous and other waste
Windsor	Bettergrow Pty. Limited	5487	48 Industry Road	Waste storage - hazardous, restricted solid, liquid, clinical and related waste and asbestos waste
Windsor	Bettergrow Pty. Limited	5487	48 Industry Road	Waste storage - other types of waste
Windsor	Elf Farm Supplies Pty Ltd	6229	108 Mulgrave Road	Composting
Windsor	Elf Farm Supplies Pty Ltd	6229	108 Mulgrave Road	Waste storage - other types of waste
Windsor	MMP Industrial Pty Ltd	12677	3-5 Hannabus Place	Chemical storage waste generation
Windsor	MMP Industrial Pty Ltd	12677	3-5 Hannabus Place	General chemicals storage
Windsor	Bio-Recycle Australia Proprietary Limited	7654	74 Lemington Road	Composting
Windsor	Bio-Recycle Australia Proprietary Limited	11601		Transport of category 1 trackable waste

Suburb	Site name	Environmental protection licence no.	Site address/location	Fee based activity
Windsor	Bio-Recycle Australia Proprietary Limited	11601		Transport of category 2 trackable waste
Windsor	Bettergrow Pty. Limited	11778		Transport of category 1 trackable waste
Windsor	Bettergrow Pty. Limited	11778		Transport of category 2 trackable waste
Windsor	Chemwaste Pty Ltd	13021		Transport of category 1 trackable waste
Windsor	Chemwaste Pty Ltd	13021		Transport of category 2 trackable waste
Woy Woy	Norgrath Pty Ltd	12379		Transport of category 1 trackable waste
Woy Woy	Norgrath Pty Ltd	12379		Transport of category 2 trackable waste

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