Newcastle Coal
INFRASTRUCTURE GROUP

Operation Water

Management Plan

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KEY ELEMENTS

The Key Elements provide a brief overview of this Management Plan. If you are required to complete work in relation to this management plan, it is essential that you familiarise yourself with the contents of the whole management plan

- A Dewatering and Sediment/Erosion Control Permit must be completed in accordance with the NCIG Excavations and Penetrations Procedure (HSEC.PRO.10.12) prior to any excavation works.

- In the event that NCIG experiences >20mm of rain within a 24hour period, an inspection of the site is to be conducted and an Environmental Risk Event (ERE) Checklist and corresponding Rainfall Inspection Sheet are to be completed.

- Shiploader washdown activities that have a risk of spillage into the harbour are to only be conducted when the Shiploader is parked over the Maintenance Bay.

- If ballast water discharging from ships at NCIG's Wharf appears to be polluted, it must be reported to the Process Leader or HSEC Department.

- If the event of overflow from WT30 (Clearwater Pond), samples must be taken daily from WT30 and SW5 (Hunter River) as outlined in the Safe Work Procedure for Adverse Weather (OPS.05.05).

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1. CONTEXT

Newcastle Coal Infrastructure Group (NCIG) is the operator of a Coal Export Terminal (CET) located in the industrial area of Kooragang Island in the Port of Newcastle. NCIG has approval to construct and operate a 79 Million Tonnes per Annum (Mtpa) CET, including associated rail and coal handling infrastructure and wharf/ship loading facilities.

NCIG's activities have the potential to impact water, including local waterways and water quality. This can be from a number of activities, including coal handling activities, use and storage of chemicals, water usage, ground disturbance and erosion.

This management plan outlines the ways in which NCIG plans, implements and monitors its activities to mitigate impacts on water and sustainably control water usage. The plan is specifically developed to meet the needs and expectations of NCIG's stakeholders, as provided for in the overarching NCIG *Operation Environmental Management Plan* (HSEC.MP.12.01).

1.1 Purpose

The Operation Water Management Plan (OWMP) has been developed in order to document the way in which NCIG manages activities that have the potential to impact on receiving waters, reduce water usage and reuse water resources. It outlines the system that identifies and assesses water management risks including statutory and approval requirements, the controls and procedures that manage these risks, and measures to review the system including, its effectiveness. Critical to this approach is business leadership and involvement, particularly at the planning and review stage to ensure that clear objectives and targets are established, and adequate resources are provided in order to achieve these.

The system outlined in this document is consistent with the framework established by the business, and contained within the NCIG *Sustainable Development Management Plan* (*HSEC.MP.01*). This framework (Plan-Do-Check-Act) is shown in more detail in the overarching NCIG *Operation Environmental Management Plan* (HSEC.MP.12.01).

1.2 Scope

This OWMP applies to the operation of the NCIG CET up to the maximum 79 Mtpa capacity (in accordance with Condition 1.1 of the CET Project Approval (06_0009)). It applies specifically to activities undertaken to operate the CET, including general operations, maintenance and administration activities. It does not apply to construction activities, as they are outlined within the NCIG Environmental Assessment and Project Approval (06_0009) and subsequent modification, or construction and maintenance activities undertaken within the NCIG Compensatory Habitat areas. These activities fall within a different set of management plans, which cover specific environmental risks. Despite this, management measures and controls are consistent between all areas under NCIG's operational control wherever practicable.

The NCIG CET operation is located on the south arm of the Hunter River. The following three major activities are undertaken during operations:

- Train Unloading – trains enter the NCIG site from the Kooragang mainline, travel along the rail spur and empty their coal wagons into one of two dump stations. Empty trains travel around the rail loop then rejoin the mainline.
- Coal Handling and Stockpiling – coal is transferred from the dump station, via a series of conveyors, to the stockyard for stockpiling. One of four stacker/reclaimers is used to stack coal onto the stockpile and reclaim coal via a bucket-wheel. Coal is reclaimed from the stockpile and sent to the wharf via an outbound series of conveyors.

- Ship Loading – Two shiploaders are available to transfer coal onto ships at berth, drawing from the buffer bins. There are three berths at the NCIG wharf, taking three ships at any one time.

The CET Operational site is shown on Figure 1 based on the maximum allowable coal throughput of 7 Mtpa.

Other key features of the NCIG CET include the water management system (including containment and reuse of water onsite), Administration, Store and Workshop Buildings, access roads and internal roads, utilities including electricity, water and sewer infrastructure, and site security features.

1.3 Structure

This OWMP is structured as follows:

Section 2 – **Leadership and Commitment.**

Section 3 – **Planning and System Support**, including existing environment and environmental assessment, risk management, legislative requirements and compliance obligations, and water quality standards.

Section 4 – **Operation and Implementation**, including key operational controls and impact management.

Section 5 – **Performance Evaluation and Improvement**, including water monitoring and reporting.

NCIG was granted Project Approval (06_0009) on 13 April 2007. This OWMP has been prepared in accordance with all conditions relating to water management in the Project Approval (06_0009).

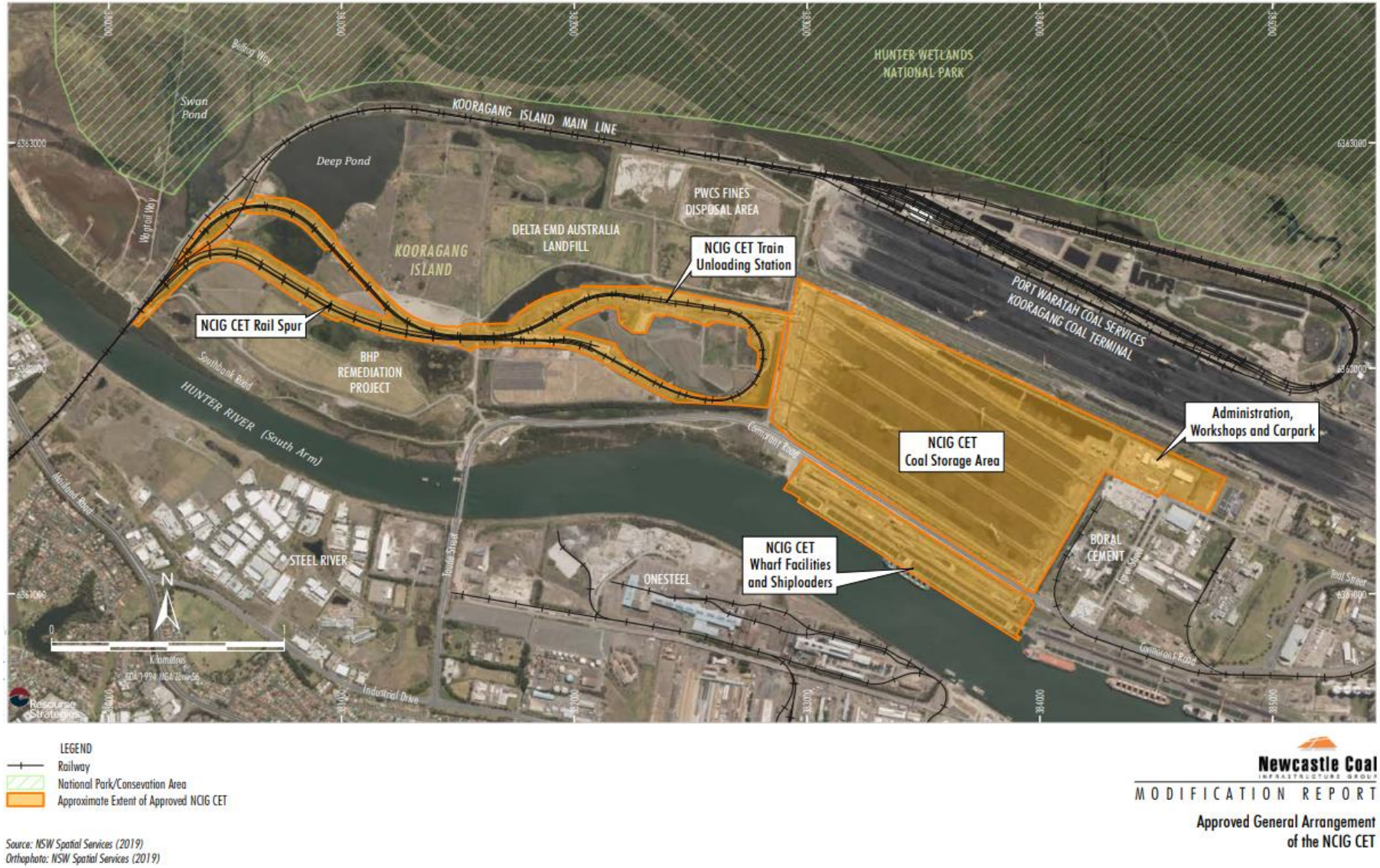

Figure 1. NCIG Project General Arrangement

2. LEADERSHIP AND COMMITMENT

2.1 NCIG Sustainable Development Management Approach

NCIG's leadership commitment is provided in more detail in the NCIG *Operation Environmental Management Plan* (HSEC.MP.12.01). Beyond this, NCIG management provides support for the effective management of environmental issues by:

- providing adequate resources for the management of water quality and usage aspects;
- ensuring integration of water management requirements throughout business processes, eg. risk assessment, procurement and acquisition;
- communication of water management performance and conformance with environmental requirements, eg. Quarterly HSEC Board Reports, CEO presentations at Business-wide Communication Days; and
- ensuring that water management is reflected across business and departmental objectives, through the development of objectives and targets during the annual business planning process – see Section 3.3.

NCIG strives to achieve best practice for environmental management, including water management. For this reason, the NCIG SDMP, which includes this OWMP, aims to comply with the provisions of ISO 14001:2015, which is supported and actively assisted by the Executive Leadership Team.

2.2 Roles, Responsibilities and Functions

Management of water quality and usage is regarded as the responsibility of all NCIG employees and contractors. As well as this, key environmental accountabilities fall with senior and environmental-specific roles within the organisation. Key accountabilities are outlined in the following sections.

2.2.1 Chief Executive Officer (CEO)

- Actively promote and support the effective implementation of this plan
- Ensure adequate resources are provided to manage water quality aspects and impacts of the business

2.2.2 Manager – HSEC

- Ensure the adequacy of this plan to meet relevant approval and licence conditions, legislative requirements and other compliance obligations
- Ensure that the Sustainable Development Management Plan, which includes this management plan, complies with ISO 14001:2015
- Ensure the plan is aligned with relevant NCIG policy and kept up to date with industry best practice
- Ensure water management risks are covered in Broad Brush Risk Assessments (BBRAs)
- Develop the plan in consultation with other NCIG Departments and, where relevant, other stakeholders, eg. government regulators
- Monitor the effective implementation of this plan
- Ensure adequate levels of water management training for all levels of personnel

- Accountable for the timely and effective response of community enquiries, including complaints related to water quality, in accordance with Condition 6.2 and 6.3, Schedule 2 of the Project Approval (06_0009)
- Principal point of contact for environmental regulators
- Ensure environmental performance is reported regularly to the ELT and Board of Directors through appropriate means, eg. Quarterly HSEC Report.
- Fulfil the role of Department of Planning and Environment (now Department of Planning, Industry and Environment)-approved Environmental Representative for the NCIG Project, including taking reasonable steps to avoid or minimise unintended or adverse water quality impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on water quality be likely to occur.

2.2.3 Executive Leadership Team (ELT)

- Ensure this management plan is implemented in their area of accountability
- All direct reports adhere to the requirements of this plan
- All direct reports have sufficient resources to adequately comply with and continuously improve this plan
- All water management matters are brought to the attention of the Manager – HSEC

2.2.4 HSEC Department

- Ensure that this plan is developed to meet or exceed the requirements of relevant approval and licence conditions, legislative requirements and other compliance obligations
- Ensure that this plan is developed to address potentially significant water quality impacts and water usage resulting from NCIG's operational activities
- Assist other departments in the implementation of controls outlined in this management plan, including provision of water management training
- Organise surface water and groundwater monitoring as identified in this plan and maintain surface water and groundwater monitoring data, water-related complaints and water quality incident reports
- Prepare relevant statutory water quality reports, eg. National Pollutant Inventory
- Monitor and review compliance of this plan, including auditing and compliance tracking required in Project Approval (06_0009)
- Any non-conformance of the plan is appropriately addressed through corrective actions, eg. incident or hazard reporting, review of action.

2.2.5 Superintendents/Team Leaders

- Ensure all direct reports are trained and adhere to the applicable requirements of this management plan

2.2.6 Environmental Monitoring Contractors

- Undertake environmental monitoring when required
- Analyse and compiled monitoring data, comparing to any relevant criteria

2.2.7 All Workers

- Actively apply and participate in the application of this procedure.

It is noted that, where relevant, these accountabilities have been formalised by NCIG management in the various Position Descriptions for NCIG personnel.

3. PLANNING AND SYSTEM SUPPORT

3.1 Water Management Strategy

The water management strategy for the NCIG site is based on:

- The separation of surface water runoff generated within the operational areas from that generated by surrounding areas;
- Containment and reuse of water on site; and
- Implementation of water management and erosion and sediment controls to minimise the potential for impacts to offsite water resources.

The primary design goal of this OWMP is to ensure that NCIG does not impact on local waterways, including no discharge to the Hunter River during normal operations. Normal operations refers to any rainfall within the site capacity e.g. a 1 in 100 ARI rainfall event of 2 hours duration (<110mm continuous rain).

3.2 Local Hydrology

For the purposes of identifying off site water resources, a description of the existing local hydrology for the three main site areas is provided below.

Rail Infrastructure

Existing surface water features in the vicinity of the rail infrastructure corridor include water bodies created by the Kooragang Island Main Rail Line embankment and emplacement cells associated with the existing landform that intermittently fill with water in response to rainfall runoff, eg. Delta Pond, BHP Pond, Blue-billed Duck Pond, "The Cell". Deep Pond is a large water body in this area, dissected by the NCIG Rail Arrival Road (Rail Flyover) embankment, and is connected via a culvert that runs through the embankment, and to a series of ponds to its south-east and south-west via drainage lines (Figure 5). Stormwater from the drainage system along the rail infrastructure corridor will drain into the existing drainage system across the site. An existing drain on the eastern side of the rail site, adjacent to Windmill Road, also conveys water to Black Swan Pond aligning Cormorant Road, which ultimately leads to the Hunter River.

Stockyard

The coal storage area is relatively flat with designed and engineered fall from east to west. The stockyard area is drained by a centrally located subsurface drainage network that conveys excess stockpile water to the western end and site drainage system. There are three primary stormwater channels including: a south-north concrete dish drain on the west end of the stockyards, an east-west channel on the southern boundary of the coal storage area and a north-south concrete lined stormwater channel along the eastern boundary of the Project site. The east-west channel drains into the south-north channel which delivers drainage water to the west-east aligned primary and secondary ponds (WT10, WT20 and WT30). Overflow from the final pond, i.e. the Clearwater Pond (WT30), is directed via an Overflow Pond to the north-south channel which in turn drains to the south

arm of the Hunter River. Overflow events from the Clearwater Pond (WT30) into the Hunter River only occur during high intensity rainfall events exceeding a 1 in 100 2 hour ARI event (i.e. >110mm).

Wharf Facility

The site wharf facilities and shiploader area is located on the south arm of the Hunter River. This area is relatively flat and drains to two detention ponds (WF01 and WF02) before being pumped into the stockyard water management network (Figure 4). The south arm of the Hunter River is the dominant natural surface water feature in this area and no water from the wharf facilities and shiploader area will be directed to the south arm of the Hunter River.

3.3 Water Requirements and Supply

Water supply requirements during operation of the terminal will be met from stormwater contained on site and water purchased from the Hunter Water Corporation. Water will be used for the following applications:

- Dust suppression on road surfaces, coal stockpiles and at conveyor transfer points;
- Wash-down of site vehicles, conveyors, wharf areas, shiploaders and other coal handling equipment;
- Belt washing;
- Landscape irrigation;
- Fire protection systems; and
- Employee amenities and other minor potable water uses.

Water will be reused on site to reduce the quantity of water purchased from the Hunter Water Corporation. If required, alternative water supply sources will be investigated during the life of the Project, including the beneficial use of treated sewage effluent or local bore water. Any such alternative sources of site water supply would be subject to a separate approval process.

It should be noted that Hunter Water Corporation have been consulted regarding supply of treated water for industrial use onsite. As a result of discussions in the past, it was previously determined that treated wastewater could not be supplied in a manner that was in line with the water demand cycle of the site. However, due to recent changes in regard to the management of this resource, NCIG has recently commenced detailed investigations into the feasibility of utilising treated wastewater on site.

3.4 Site Water Balance

A site water balance was developed by NCIG as part of the Environmental Assessment (Resource Strategies, 2006) to determine the water demand requirements for the site during operation at 66 Mtpa. The model quantified the water budget for three weather scenarios based on 20 years (1985 to 2005) of historical rainfall records for the Newcastle area from the Bureau of Meteorology.

The amount of stormwater runoff that will be captured for onsite use was expected to vary from 174 to 922 megalitres per annum (ML/annum) based on different rainfall scenarios. Based on the results of the site water balance, the average make-up water demand (i.e. water purchased from Hunter Water Corporation) was estimated to be approximately 406 ML/annum based on an average rainfall scenario. The governing philosophy of the water balance for the NCIG site is that stormwater and rainwater captured will be utilised preferentially to external potable water sources.

Since the commencement of operations, NCIG has recorded extensive data on water usage and collection rates, which can be compared to the 2006 site water balance. Figure 2 shows potable and captured (reuse) water data against annual rainfall totals for the FY15-21 period.

On behalf of NCIG, AK Environmental undertook a Site Surface Water Management Review in 2017, including an updated site water balance. Figure 3 shows the site surface water balance over a 5-year period.

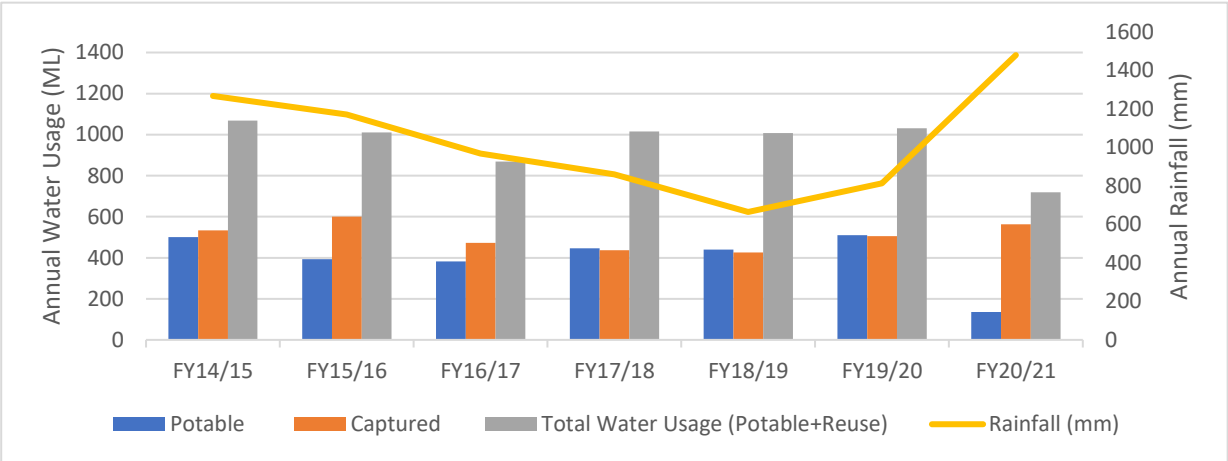

Figure 2. Annual totals of water use and rainfall (BoM Nobbys AWS) for the period 19/5/12 to 6/5/17, AK Environmental, 2017.

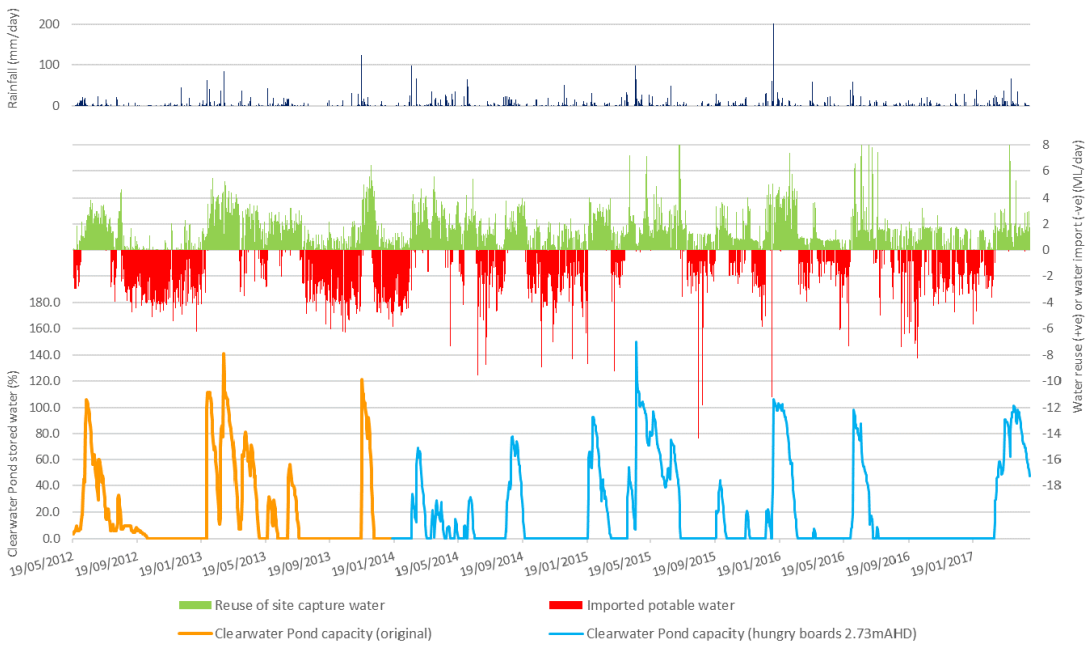

Figure 3. Site surface water balance for the period 19 May 2012 to 6 May 2017, AK Environmental, 2017.

The capacity of the NCIG surface water drainage system was modelled by Aurecon Hatch (2014) using the widely accepted DRAINS hydrologic/hydraulic model in ILSAX mode. Single event design storm modelling was employed by the study to simulate stormwater capture capability, with exceedance of system capacity defined by stormwater discharge from the Clearwater Pond.

At the commencement of each independent design storm, Secondary Settling Pond (WT20) and Clearwater Pond (WT30) were both assumed empty. Each model run commenced with a storm event of known duration, and to accommodate the complex drainage characteristics of the coal stockpiles, runoff routing to the storages proceeded for a total of 50 hours.

The modelling determined a storm event with a 1 in 100 year average recurrence interval (ARI) and 3 hour duration could be captured onsite if freeboard was exhausted in Clearwater Pond. Conversely, offsite discharge resulted where the storm duration was increased above 3 hours. Due to uncertainty regarding the actual drainage characteristics of coal stockpiles, a sensitivity analysis employing a shorter 24 hour stockpile drainage period was undertaken. The modelling determined the 2 hour storm duration as the largest contained onsite. Note that this modelling did not account for stockyard drainage system modifications which have since raised the top water level and increased total capacity by 16% (88.3 ML). It is noted that additional modifications have since been made to the Clearwater Pond which has further increased storage capacity.

3.5 Potential Water Quality Impacts

Surface water runoff from disturbance areas during site operations could potentially contain sediments, soluble salts, fuels, oils, lubricants and other contaminants. The potential surface water quality impacts, contaminants and associated control measures are summarised in Table 1.

There are two major risk groups that relate to potential water quality impacts:

- Risk groups (solid): Coal, toxic contaminants, general sediments, general solid wastes; and
- Risk groups (liquid): Oils, fuels, lubricants, hydrocarbons, groundwater preloading and settlement, surface/site water sprays, rainfall and water pH levels.

Table 1. Potential water quality impacts for the NCIG site

Site area	Potential impact scenario	Potential contaminant	Mitigation and control measures
Rail infrastructure corridor (rail spurs, loops and train unloading station)	Uncontrolled drainage of sediment laden runoff to downstream waterbodies within the KIWEF during rail operations and construction improvements of rail embankments.	Sediments containing soluble salts, heavy metals, organic contaminants, fuels, oils and lubricants.	Appropriate training, regular monitoring, and drainage controls. Localised sediment control structures.
	Uncontrolled drainage of runoff from access roads, operations and construction improvement areas to downstream waterbodies within the KIWEF.		
	Uncontrolled drainage of runoff from exposed soils within the existing KIWEF to downstream waterbodies.		
	Potential erosion and sedimentation resulting from runoff from the rail corridor and associated drainage system.		

	Release/spill into downstream waterbodies.	Sediments containing soluble salts, heavy metals, organic contaminants, fuels, oils and lubricants.	Appropriate training, regular monitoring, drainage controls, bunding, sumps and oil separators.
Stockyard and administration area	Uncontrolled drainage to downstream waterbodies during operation or construction improvements of the Stockyard or administration areas.	Contaminated sediments containing soluble salts, heavy metals, organic contaminants, fuels, oils, lubricants and low pH water. Coal or sediment laden water.	Appropriate training, regular monitoring, drainage controls and oil separators. Sumps, bunding and sediment control structures. Site designed for zero discharge, monitoring of licensed discharges.
	Spillage/overflow of site water to downstream waterbodies due to unplanned discharge from water management system or failure of water management component.		
	Release/spill into downstream waterbodies due to rupture of fuel tank (diesel/petrol) or stored goods.	Lubricants, grease and hydrocarbons.	Appropriate training, spill response kits, regular monitoring, drainage controls, bunding, and oil separators. Site designed for zero discharge, monitoring of licensed discharges. Storage in accordance with Australian Standards and NSW legislation.
Wharf facilities and shiploader area	Uncontrolled drainage of sediment laden runoff to the south arm of the Hunter River during operation and construction improvements of the berths and wharf structure.	Sediments, coal, soluble salts, fuels, oils and grease.	Appropriate training, spill response kits (including marine spill kits), regular monitoring, and drainage controls. Sumps, bunding and sediment control structures. Site designed for zero discharge, monitoring of licensed discharges.
	Uncontrolled drainage of runoff to the south arm of the Hunter River from access roads.		
	Release/spill into the south arm of the Hunter River.	Sediments, coal, diesel, lubricants and hydrocarbons.	

3.6 Legislation, Approvals and Licensing Requirements

There are a number of legislative and regulatory documents which apply to the way in which NCIG manages water impacts from and water usage at its facility. These are primarily broken down into legislation and policies, and approvals and licences. The majority of these are administered by state government departments, including the Department of Planning, Industry and Environment (DPIE) and the NSW Environment Protection Authority (EPA).

3.6.1 Legislation and Policies

Environmental Planning and Assessment Act 1979

The major development approval for the NCIG Coal Export Terminal is the Project Approval provided by DPE (PA 06_0009), including subsequent modifications (MOD1 and MOD2). This approval was provided under the now repealed Part 3A (Major Projects) of the *Environmental Planning and Assessment Act 1979*. The approval contains a number of conditions related to water management which are explained in more detail in Section 3.6.2.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations (POEO) Act 1997* is the primary piece of state legislation regulating pollution, including water pollution. Part 5.3 of the Act specifically regulates water pollution, including prohibition of pollution of waters, defence of authorities and maximum penalty for water pollution offences. The Act also provides for the issuing of Environment Protection Licences (EPLs), which is covered in more detail in Section 3.6.2. The NSW EPA is the applicable regulatory authority, which regulates NCIG under this Act.

Protection of the Environment Operations (General) Regulation 2009

The Protection of the Environment Regulation covers details of environmental pollution controls in the NSW, for example administration of EPLs, prescribes certain matters for the purposes of defining water pollution, gives effect to and requires compliance with the National Environmental Protection (NPI) Measure and prescribes requirements in respect of pollution incident response management plans.

National Environment Protection Council Act 1994 (National Pollutant Inventory NEPM)

The Commonwealth Government, in the form of National Environment Protection Council, has legislated for the mandatory reporting of pollution across Australia, so that the community has access to the information about the emission and transfer of toxic substances which may affect them locally, including to water. The primary objectives are to maintain and improve air and water quality, minimise environmental impacts and improve sustainable use of resources. NCIG is required to report under the National Pollutant Inventory NEPM annually, including emissions to water.

Managing Urban Stormwater: Soils and Construction 2004 (Volume 1: Blue Book, Landcom)

The *Managing urban stormwater: soils and construction* publications provide guidance on erosion and sediment control during construction and other land disturbance activities. These documents provide guidance for practitioners on the design, construction and implementation of measures to improve stormwater management, primarily erosion and sediment control, during the construction-phase of urban development. Principles from these guidelines are adopted for ground disturbance activities.

3.6.2 Approvals and Licences

Project Approval 06_0009, including subsequent Modifications

There are a number of conditions within the Project Approval pertaining to the management of water from the terminal site. Specifically, these are:

- Condition 2.41 – compliance with Section 120 (water pollution) of the Protection of the Environment Operations Act 1997.
- Condition 2.42 – Design, construct, maintain and operate surface water and stormwater management infrastructure to accommodate a 1 in 100 ARI rainfall event and not permit discharge of water to the Hunter River, unless stated in EPL.
- Condition 2.43 – reasonable measures to prevent soil erosion and the discharge of sediments and pollutants during construction.
- Condition 2.44 – installation of stormwater drains, stormwater ponds, settlement ponds and/or storage ponds and other controls to manage stormwater.
- Condition 2.45 – Stabilisation and/or covering of stockpiled construction materials where practicable.

- Condition 2.49 – lining of stormwater and surface water infrastructure intended to manage actual or potentially contaminated water, and collection of stormwater for reuse in dust suppression.
- Condition 2.50 – Use of treated wastewater, if available from relevant authority, in preference to potable water for dust suppression.
- Condition 2.51 – All machinery washdown waters and amenities wastewater to be directed to sewer or an appropriately licenced liquid waste disposal facility.
- Condition 2.52 – Collection of rainwater for domestic and potable uses onsite.
- Condition 7.6 c) – Preparation and implementation of an Operation Water Management Plan, to outline the water management system for the Site. The plan is to include:
    - Predicted site water balance including the water supply system;
    - Details regarding water management structures such as settling ponds, water tanks and the water management system for dredge sea water;
    - Locations and design specifications for all water diversions from undisturbed runoff areas including channel design and stabilisation, sediment retention storages and other structures;
    - Details on the internal drainage system including bunding, drainage channels, dewatering sumps and any pipelines;
    - Procedures for the management of groundwater encountered on site and any temporary dewatering facilities; and
    - procedures to be implemented to minimise potential surface water impacts.

Environment Protection Licence 12693

An Environmental Protection Licence (EPL) 12693 was obtained prior to construction of the Project pursuant to the Protection of the Environment Operations Act 1997. Subsequent amendments to this licence have been made to reflect changes in site boundaries and activities. The key water conditions in the EPL are:

- Condition P1.3 – Groundwater and Discharge Monitoring in accordance with locations shown in the Construction Environmental Management Plan, June 2007.
- Condition L1 – Except as may be expressly provided in any other condition of the licence, the licensee must comply with section 120 (pollution of waters) of the Protection of the Environment Operations Act 1997.
- Condition M1 – refers to the recording and retention of monitoring data, including details of the time, date, location and person who samples.
- Condition M2.3 – Groundwater monitoring requirements for EPL Monitoring Points 1, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 including numerous organic, inorganic and physical pollutants.
- Condition M3.2 – Monitoring of concentration of pollutants discharged to waters to be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any test are conducted.
- Condition E1 – Special Conditions for Groundwater Monitoring Trigger Values for Further Investigations.

Environment Protection and Biodiversity Conservation (EPBC) Act Particular Manner Decision 2006/2987

The NCIG Project, referred to in the EPBC Particular Manner Decision as a proposed action, was found not to be a Controlled Action under the EPBC Act, providing it is undertaken in the manner provided in the Schedule of the decision. Point 11 of the Schedule outlines that a site water management plan, including surface water monitoring program (both a part of this Operation Water Management Plan), is to be developed in accordance with the measures outlined in the NCIG CET Environmental Assessment (July 2006), and Sections 8 and 9 of the Land Contamination and Groundwater Assessment, Newcastle Coal Infrastructure Group Coal Export Terminal, Kooragang Island, Appendix D (RCA Australia, June 2006).

3.7 Water Quality Standards

3.7.1 Surface Water Quality Criteria

Surface water quality trigger levels have been adopted from standard guidelines, as well as developed from site-specific data for NCIG water quality purposes.

The *Australian and New Zealand Environment and Conservation Council Guidelines for Fresh Water and Marine Water Quality (ANZECC 2000)/ the revised Australian and New Zealand Fresh and Marine Water Quality Guidelines (ANZG 2018)*, contain trigger levels for the protection of the marine and freshwater ecosystems of varying levels of disturbance. A selection of these trigger levels are used for NCIG water quality management, based on background water quality data and contaminants of concern. The Guidelines aim to support the ecologically sustainable management of water resources, including a holistic approach to management of aquatic systems focussing on assessment and monitoring of ecosystem health.

In addition to this, environmental consultants Ramboll have developed low reliability Site Specific Trigger Values (SSTVs), which are routinely reviewed and updated for certain analytes where background water quality data is sufficient. SSTVs have been developed for relevant parameters which either do not have ANZECC (2000)/ANZG (2018) default guideline values or where the default guideline vales are deemed to be inappropriate based on the local background environmental conditions. SSTVs are updated periodically to include the latest surface water results from reference locations around the NCIG site.

Table 2 provides details of the adopted trigger levels for selected surface water quality analytes.

Table 2. NCIG Surface Water Quality Trigger Levels

Parameter	***Units***	***Required LOR***	***Trigger Values - Freshwater***	***Trigger Values - Marine***
pH		0.1	6.5 – 8.0* 9.0 ◇	7.0 – 8.5*
Dissolved oxygen	%	10	90 - 110	80 - 110 *
Conductivity	µS/cm	5	2,750 ◇	54,760◇
Turbidity	NTU	1	55◇	59◇
METALS				
Aluminium	mg/L	0.05	0.35 ◇	552 **
Arsenic (III)	mg/L	0.05	0.024 **	ID **
Boron	mg/L	0.05	0.37**	ID **
Cadmium	mg/L	0.0001	0.0002 **	0.0007 **
Chromium (III)	mg/L	0.01	ID **	0.0274 **
Cobalt	mg/L	0.001	ID **	0.001 **
Copper	mg/L	0.001	0.05◇	0.01◇
Iron	mg/L	0.05	4.22 ***	0.574 ◇
Lead	mg/L	0.001	0.0034 **	0.0044 **

Manganese	mg/L	0.5	1.9 **	ID **
Mercury	mg/L	0.0001	0.0006 **	0.0004 **
Molybdenum	mg/L	2	10.4 ***	ID **
Nickel	mg/L	0.01	0.011 **	0.07 **
Selenium	mg/L	0.001	0.005 **	ID **
Zinc	mg/L	0.005	0.07 ◇	0.052◇
PETROLEUM HYDROCARBONS				
C6-C9	mg/L	0.02	ID ***	ID ***
C10-C14	mg/L	0.05	ID ***	ID ***
C15-C28	mg/L	0.1	0.18 ***	ID ***
C29-C36	mg/L	0.1	0.25 ***	ID ***
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)				
Anthracene	mg/L	0.01	0.4 ****	0.4 ****
Benzo(a)pyrene	mg/L	0.01	0.2 ****	0.2 ****
Fluoranthene	mg/L	0.01	1 ****	1 ****
Naphthalene	mg/L	0.01	0.016 **	0.050 **
Phenanthrene	mg/L	0.01	0.6 ****	ID **
NUTRIENTS				
Ammonia	mg/L	0.5	0.9 **	0.91 **
Nitrate	mg/L	0.1	0.7 **	0.4 **
Total Kjeldahl nitrogen	mg/L	0.5	2.8 ***	0.4 ◇
Total phosphorus	mg/L	0.01	0.41 ◇	0.4 ◇
OTHER				
Chloride	mg/L	ns	ns	ID ***

** ANZECC Default Trigger values for physical and chemical stressors in South-east Australia (refer to Table 3.3.2 and Table 3.3.3 in ANZECC 2000)*

*** ANZG (2018) Trigger for Protection of 95% Aquatic Species (Freshwater) / (Marine)*

**** low reliability Site Specific Trigger Value (SSTV) as developed by ENVIRON (2013)*

***** ANZG (2018) low – moderate reliability trigger values from additional data (refer to Section 8.3, Vol.2, ANZECC 2000)*

◇ low reliability Site Specific Trigger Value (SSTV) as developed by Ramboll (2021)

ID insufficient data available to develop a trigger value

ns not specified

3.7.2 Discharge Water Quality Criteria

Surface water discharges to the Hunter River must be monitored to determine whether the potential exists for impacts to occur in receiving waters. This management approach is required to satisfy Section 120 of the *Protection of the Environment Operations Act 1997*, Section L1 of the NCIG EPL 12693, and Project Approval (06_0009) Condition 8.1, Schedule 2, which states *"the Director-General will be notified of any incident with actual or potential significant off site impacts on people or the biophysical environment as soon as practicable after the occurrence of the incident. The Director-General will be provided with written details of the incident within seven days of the date on which the incident occurred."*

Discharge water trigger values are concentrations that, if exceeded, would indicate a potential environmental problem, and so 'trigger' a management response, such as further investigation and/or subsequent refinement of the guidelines according to local conditions. Trigger values are currently not developed for the NCIG site. However, a judgement of actual or potential significant impacts would be made based on monitoring of pH, Turbidity, Total Suspended Solids (TSS) and Oil & Grease from both discharge water and background water quality in the receiving environment, i.e. the Hunter River. It is a requirement of the EPL that discharge water is sampled and analysed for these contaminants.

3.7.3 Groundwater Quality Criteria

Specific groundwater quality trigger criteria have been developed for contaminants of concern, in particular organic and inorganic contaminants associated with the former Kooragang Island Waste Emplacement Facility (KIWEF), upon which parts of the NCIG Rail alignment is constructed. The criteria are:

Trigger Condition 1 – Where monitoring of the parameters required under the licence for Points 20, 21 ,22, 23, 36, 37, 40 or 41 demonstrates a sudden increase in concentration compared to historical data, or sudden increase in pH is observed. A sudden increase or decrease is defined as a value that is greater than the mean plus twice the standard deviation for the historical data.

Trigger Condition 2 – Where the trend analysis of the concentration of the parameters required under the licence for Points 20, 21 ,22, 23, 36, 37, 40 or 41 against time shows an increasing concentration over the most recent four events. Trend analysis tools such as Mann-Kendall may be adopted.

A Contingency Response Program is included in the EPL if one or both of the above criteria is exceeded.

4. OPERATION AND IMPLEMENTATION

4.1 Water Management

The primary design goal of the site water management system is that of no discharge to the Hunter River during normal operation of the Project.

4.1.1 Water Management System

The site water management system is shown in schematic form in Figure 4. This will be progressively developed as water management requirements change over time.

4.1.2 Water Management Infrastructure

A network of stormwater drains and stormwater settlement ponds (primary and secondary) are used to manage runoff on and around the site. All site water management structures are lined with low permeability materials (e.g. compacted clay or geo-membrane) to minimise the potential for leakage. Stormwater captured on site is designated as 'clean' or 'dirty' stormwater. The 'clean' stormwater collection area is considered to be the rail network site (excluding those areas in the vicinity of the unloading station and coal transfer system), which lead to surrounding water bodies such as Deep Pond as shown in Figure 5. All other areas of stormwater capture on site are designated 'dirty' stormwater which is captured and reused by the water management system.

Stormwater runoff from areas external to the NCIG site is directed around infrastructure areas by table drains and culverts to the existing stormwater drainage system on Kooragang Island. Stormwater runoff collected on the infrastructure areas is diverted through sediment control structures and/or to stormwater settlement ponds.

The coal storage area is sloped with dedicated drains located along the pads and berms. A sub-grade drainage system is incorporated into the coal stockpile pads to capture water infiltrating through the coal stockpiles. The subsurface drainage system comprises of a series of underground drains, pits and transfer pumps for controlling drainage from the coal storage area. Lined sumps are used at the end of the open drains to act as sediment traps.

The primary (WT10 and WT20) and secondary (WT30 or Clearwater Pond) settling ponds, consisting of settlement, storage and overflow ponds, are constructed to the north of the coal storage area (Figure 6). The settling ponds capture sediments not trapped in concrete sumps or open drains. Water in the site water pond is pumped to one of two raw water tanks with a capacity of up to 4 mega litres (ML). The raw water tank stores water for reuse on site for purposes such as dust suppression, fire protection and plant wash down. A 2ML potable water tank has been installed adjacent to the raw water tank for firefighting purposes. This tank remains at 100% capacity in the event of a fire. Pumping stations are located adjacent to the water tanks for water reticulation on site.

Stormwater runoff from the Dump Station, inbound conveyors and inbound sample station is diverted via table drains to localised sediment control structures and settlement ponds. Once runoff has passed through these structures is pumped to the primary and secondary ponds. Sediment control structures and settlement ponds are also installed at the wharf facilities and shiploaders. Water collected in these ponds is transferred via pump and pipeline to the primary and secondary ponds.

Runoff from the Administration, Workshop and Stores area is directed to a stormwater detention basin, including oil skimmer pump, which discharges to Hunter Water's sewer infrastructure. The employee/visitor car park, which is considered clean runoff, is discharged to an open drain directly to the north of the Administration Building. Some rainwater from the Administration Building roof is harvested for the private vehicle wash facilities and to a rainwater tank for irrigation purposes.

Consistent with the design goal of avoiding discharge to the Hunter River during operations, the primary and secondary settlement ponds are designed and constructed with sufficient capacity to contain a 1 in 100 year average recurrence interval (ARI) rainfall event (2 hr) (Aurecon, 2014). All water management structures are operated in accordance with the requirements of the Project EPL 12693.

During operations of the NCIG CET, dredging reclamation activities will not be undertaken on the site, and related infrastructure is therefore not included in the site water management network.

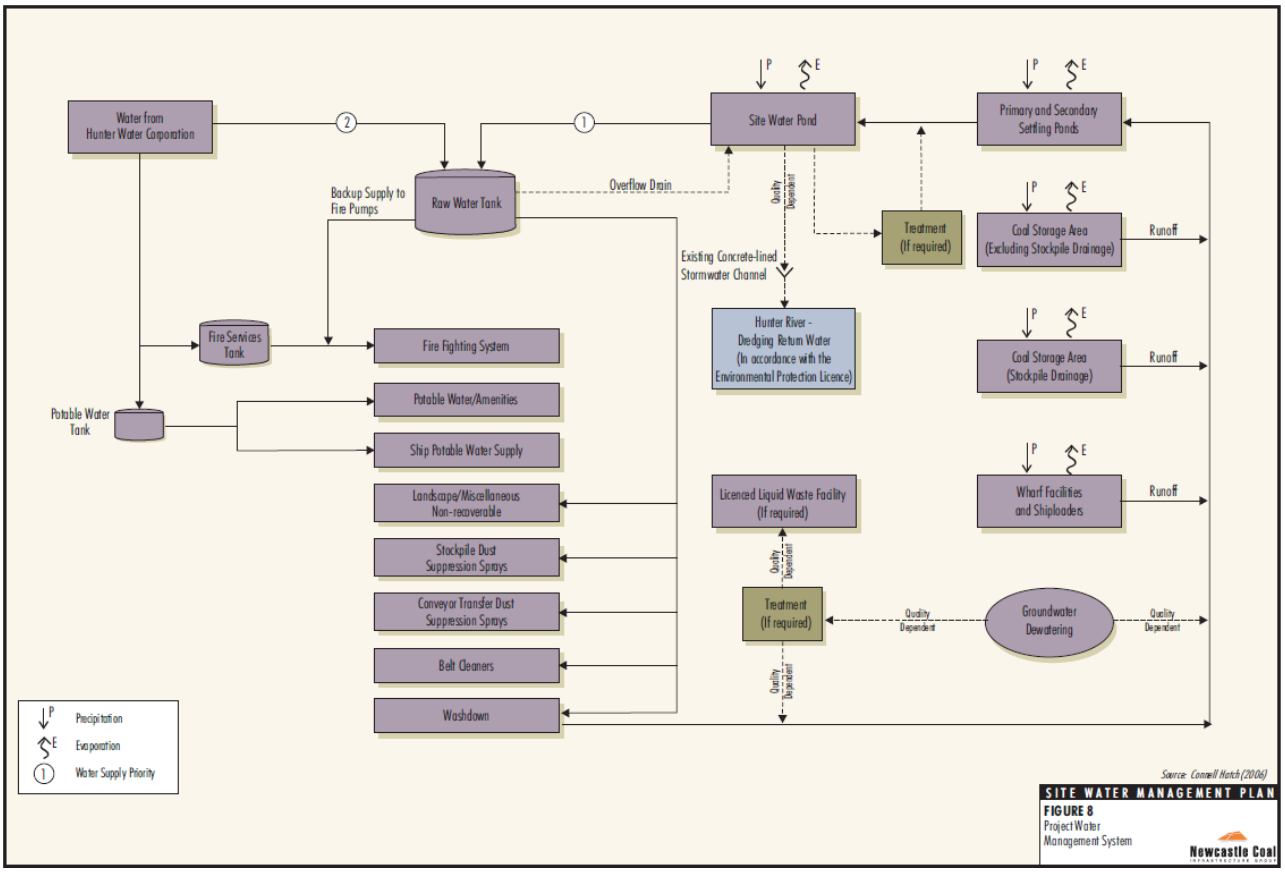

Figure 4: Schematic of the NCIG Water Management System

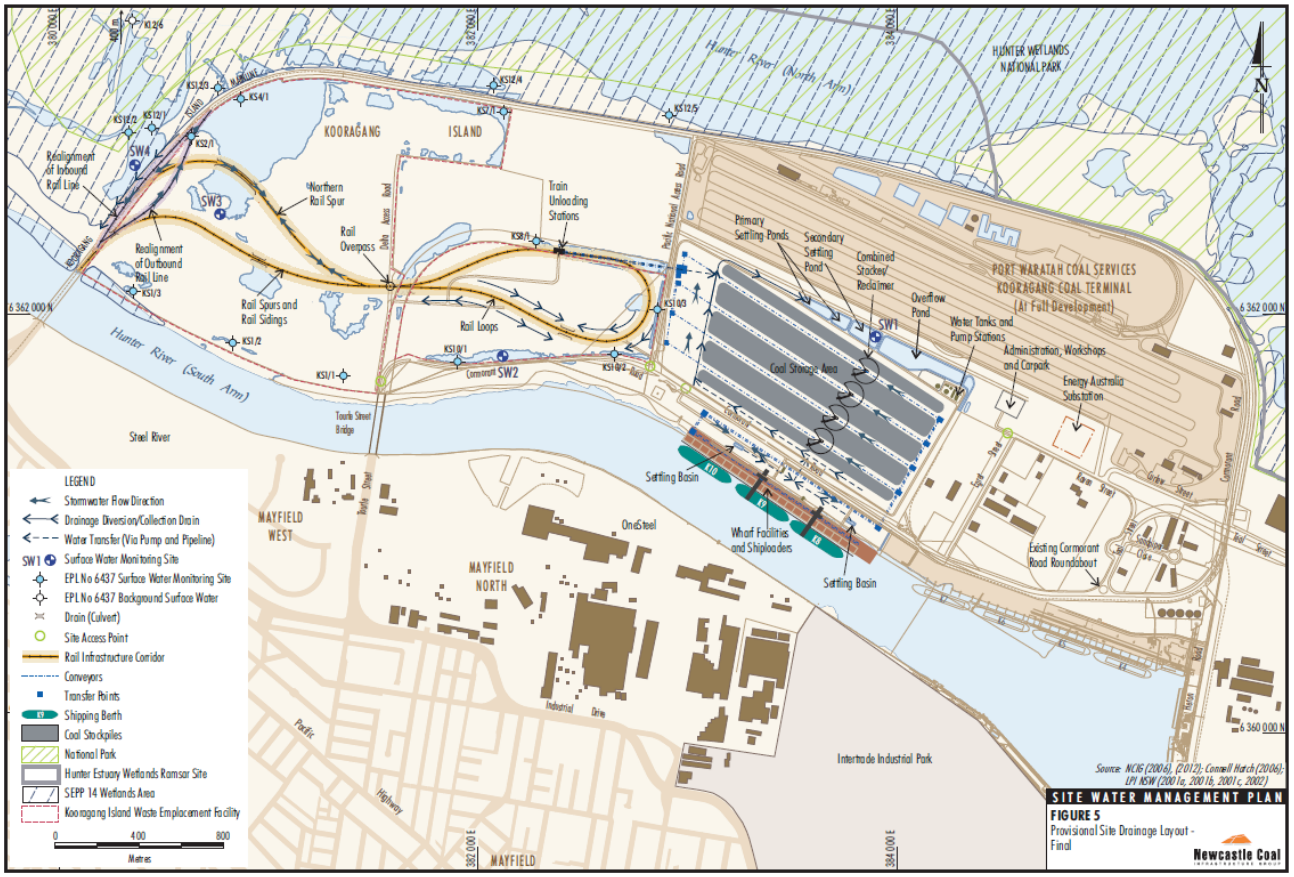

Figure 5: The drainage layout and surface water features for the NCIG site

4.1.3 Groundwater Management

The NCIG site includes a relatively shallow groundwater table in areas of fill from previous land use activities. Consequently, any interception of the groundwater table during operations will need to be managed. NCIG has incorporated into the design of the terminal a comprehensive suite of methods and design systems, including contingency measures. Groundwater management measures include:

- Any groundwater that is dewatered from future excavations and is not considered suitable for reuse will be temporarily stored in dedicated cells with low permeability liners before being treated for reuse and/or removed from site by an appropriately licensed contractor. These facilities will be constructed or procured on the basis of the water quality and quantity encountered during the excavation process. This process is captured as part of the NCIG Excavations and Penetrations Procedure (HSEC.PRO.10.12);
- The use of piled foundations together with a jet-grouted base and secant pile and/or diaphragm subsurface perimeter walls was used in the construction of the train unloading stations and adjacent conveyors to minimise groundwater inflow or connection;
- Incorporation of a low permeability capping layer into the rail embankment formation to minimise infiltration;
- Establishment of groundwater bores to monitor groundwater levels and groundwater quality along the western perimeter of the coal storage area and along the rail infrastructure corridor, which are monitored in accordance with this OWMP and EPL 12693; and
- If the groundwater monitoring program indicates the need, the implementation of groundwater management contingency measures such as:
  - localised temporary pumping of groundwater for subsequent detention, dilution, evaporation, treatment and/or disposal by an appropriately licensed contractor (depending on water quality and quantity); and/or
  - The construction of localised subsurface groundwater barriers (e.g. bentonite filled trench or geo-membrane) to control groundwater migration.

4.1.4 Internal Drainage and Stormwater Controls

A network of stormwater structures are used to manage runoff on and around the site, as detailed in Section 4.1.2. A major component of the OWMP is the capture and management of site water for reuse in dust suppression of coal stockpiles as per the Operation Dust and Air Quality Management Plan (HSEC.MP.12.02).

In accordance with Condition 2.41, Schedule 2 of the Project Approval (06_0009), water management structures are designed to operate to comply with Section 120 of the Protection of the Environment Operations Act 1997 (pollution of waters).

4.2 Erosion and Sediment Controls

The following principles underpin the approach to erosion and sediment controls for the NCIG site to protect adjacent wetland areas, Deep Pond and the Hunter River:

- Minimise surface disturbance, and restrict access to undisturbed areas;
- Minimise or limit construction/contractor compounds where possible;
- Limit soil/material stockpiles and prevent their location within 10 metres (m) of watercourses or stormwater drains;

- Separate runoff from disturbed and undisturbed areas where practicable;
- Implementation of surface drains to facilitate the efficient transport of surface runoff and utilisation of existing stormwater systems;
- Implementation of the site drainage network including perimeter bunds, internal bunds, primary settling ponds and hydraulically controlled discharge structures;
- Implementation of silt drains and diversions in areas where sediment basins are not appropriate;
- Implementation of secondary settling ponds, site water ponds and sediment dams to contain runoff from a 1 in 100 year ARI event; and
- Refuel plant and machinery within bunded areas wherever possible, or at least 50m away from waterways.

The above principles take into account the general recommendations for site drainage works presented in Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom 2004).

While the majority of the site has been stabilised post-construction of the terminal, erosion, sediment and pollution controls will be utilised where major ground disturbance occurs, in accordance with Condition 2.44, Schedule 2 of the Project Approval (06_0009).

4.2.1 Sources of Erosion

Activities that have the potential to cause or increase soil erosion at the site are primarily due to exposure of soils and other materials during operational activities. Effective erosion control requires the successful management of the following components during operation: water management infrastructure including site drainage works, stormwater settlement ponds, primary and secondary settling ponds, water tanks and stockpile spray system. This includes regular cleaning of water management infrastructure, including ponds, to prevent mobilisation of pollutants during flood or high rainfall events.

Further to the above, additional details of sub-activities to be undertaken during operations that have the potential to cause or increase soil erosion at the site include activities such as bulk earthworks, reclamation works, concreting, and structural/mechanical installation.

4.2.2 Erosion and Sediment Control Strategies

The erosion and sediment control principles and design criteria for the terminal operation are described in the following sub sections. Specific erosion and sediment control measures for individual activities are required as part of the Dewatering/Sediment and Erosion Control Permit, detailed in the NCIG Excavations and Penetrations Procedure (HSEC.PRO.10.12).

4.2.2.1 Specifications for Sediment Control Structures

In accordance with Condition 7.3 (b), Schedule 2, of the Project Approval (06_0009), all elements of the site drainage network will include appropriately sized stormwater controls, following the principles of Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom 2004). The general design criteria for sediment control structures are summarised in Table 3.

Table 3: General capacity requirements of NCIG sediment control structures

Sediment Control Structure	Function	Design Capacity
Upslope diversion drains	Reduce runoff from undisturbed areas onto disturbed or operations areas.	Peak flow calculated for 1 in 100 year critical duration rainfall event (equivalent to >110mm rainfall)
Downslope diversion drains	Intercept and convey disturbed area runoff water to sediment dams.	Peak flow calculated for 1 in 100 year critical duration rainfall event (equivalent to >110mm rainfall)
Sediment dams	Containment of sediment-laden runoff	Capacity to store the runoff produced from the 1 in 100 year critical duration rainfall event and suitable sediment storage capacity in accordance with Landcom (2004).

4.2.2.2 Erosion and Sediment Control Plans

As mentioned in Section 4.2.2, Erosion and Sediment Control Plans (ESCPs) are to be prepared for any major ground disturbance works at the direction of the Environmental Representative prior to land disturbance activities. These form part of the Dewatering/Sediment and Erosion Control Permit, included in the NCIG Excavations and Penetrations Procedure (HSEC.PRO.10.12). These ESCPs will follow the principles outlined in Section 4.2.

4.2.2.3 Inspections and Maintenance of Water Management Infrastructure

To ensure successful management of water infrastructure, regular inspections and cleaning of drainage sumps, detention basins and settling ponds is undertaken. The primary purpose of this is to remove sediment from structures that may cause a pollution event, particularly during high rainfall or flooding. Infrastructure is also checked for effective operation, with defects raised for faulty equipment, eg. pumps. Inspections and cleaning tasks are scheduled as part of the maintenance scheduling system.

Indirect engineering activities that influence water quality include modifications to the plant to reduce coal spillage and improvements in capture of spent hydrocarbons from Stacker/Reclaimers and Shiploaders.

4.2.2.4 Flood Management Controls

The NCIG site experiences an increased risk of discharge, including sediment-laden water, during periods of high rainfall. The site drainage system is designed to contain a 1 in 100 year ARI event of 2 hours duration, which is equivalent to 110mm of rainfall. Continuous rainfall which is greater than 110mm will result in discharge from the site at the Clearwater Pond (WT30).

To mitigate the risk of discharge and limit the amount of water discharged from site, a “Flood Mode” is programmed into the NCIG site drainage pump network. When Clearwater Pond levels are greater than 95%, pumps from the wharf and rail settling basins, and coal stockpile subsurface drainage pumps are interlocked to prevent excess flood waters reaching the stockyard settling pond system, effectively utilising these areas as extra flood storage. If the wharf or rail areas are at risk of discharging water directly, these pumps are re-activated automatically.

In addition, flood prediction logic is programmed to mitigate discharge risk from the Clearwater Pond. Coal stockpile subsurface drainage pumps are interlocked during Flood Mode.

4.2.2.5 Rainfall Inspections

In the event that the NCIG site experiences greater than 20mm of rain within a 24 hour period, an alert email is sent to the HSEC Department and Operations Department. This then requires that an NCIG representative undertakes an inspection of the terminal site for any impacts or pollution caused by the rainfall. Sediment levels in the primary and secondary settling ponds are checked for cleaning purposes and the structural integrity and effectiveness of sediment control structures.

4.3 Other Water Management

4.3.1 Fire System

A comprehensive fire system has been installed on the NCIG site which includes spray and deluge components. This system provides protection for all areas of the terminal infrastructure and is supplied by captured stormwater (raw water) and the Hunter Water Corporation supply network.

4.3.2 Potable Water

Potable water is primarily sourced from the Hunter Water Corporation system and is stored in the Raw Water Tank (dependent on settling pond levels) and the Fire Water Tank. In accordance with Condition 2.52 of the Project Approval (06_0009), rain water tanks have been installed and maintained on the NCIG site for the collection of water for domestic uses. Collected rainwater is used preferentially to external potable water supplies for targeted usage in landscaped areas around the Administration Building.

4.3.3 Dust Suppression

In the event that collected site water levels fall below critical levels for water supply to the dust suppression system, potable water will be used for the purpose of dust suppression.

4.3.4 Shiploader and Wharf Washdown

It is recognised that washdown of equipment and infrastructure close to the harbour has the potential to cause pollution in the Hunter River. This includes washing of coal fines into the river. As a result, only some areas of the shiploader are able to be washed down while in operation, eg. the landward side of the shiploader. Other areas that have a risk of discharging washdown water into the harbour are to be conducted only when the shiploader is parked over the maintenance bay.

In addition, washdown activities are conducted so that launder pipes and drainage lines are inspected before and during washdown activities. This ensures that blockages do not occur which might lead to discharge of dirty water from the shiploader. This process is included in the Job Safety and Environmental Analysis (JSEA) for the shiploader washdown tasks.

All water that falls on the maintenance bays is redirected to the site water drainage system, which ultimately pumps to the stockyard settling ponds.

4.3.5 Potential Water Pollution from Ships at Berth

Ships at berth are required to discharge ballast water for operational purposes. Environmental shipping legislation requires that ballast water collected from other ports and locations is initially discharged outside the harbour in international waters, with clean marine water used to refill prior to entering the harbour.

If discharged ballast water at the NCIG wharf is observed to be polluted, then this is to be reported to the NCIG Process Leader or Environmental Department. Based on the appearance and potential for oil, grease or fuel to be in discharged water, this event may then be reported to the Port Authority of NSW for first-response, and Australian Maritime Safety Authority (AMSA) using a Suspected Non-Compliance Form. It is noted that the activity of ships at NCIG berths does not fall under the direct operations control of NCIG.

4.3.6 Environmental Risk Events

The NCIG Control System alerts operators of the plant when a particular environmental risk event is occurring (Environmental System Alert). This may be initiated by high levels in sumps which may lead to overflow, high rainfall (>20mm) or when the Clearwater Pond exceeds capacity, i.e. discharge event. If an alert is activated, an Environmental Risk Event Checklist is required to be completed, including actions taken to control or mitigate the situation. This may also include taking discharge water samples, which is detailed in Section 5.1.2.

4.3.7 Sewer System

The NCIG terminal site is connected to the Hunter Water Corporation sewerage network. Sewerage collection tanks are located at the administration building and wharf areas, which accumulate wastewater from the administration and workshop areas, and wharf facilities respectively before discharging to the Hunter Water Corporation system. Sewerage at the rail infrastructure is serviced via pump-out facilities and disposed of using a licenced contractor.

4.3.8 Workshops and Vehicle Washdown Bays

The workshop and truck washdown areas have purpose-built oil/water separator systems installed which are inspected and maintained on a regular basis. All machinery washdown water and amenities wastewater are directed to sewer (subject to Hunter Water Corporation approval), or to an appropriately licensed liquid waste disposal facility. Waste hydrocarbons collected from site activities and oil/water separation are collected and stored in a 4,000 litre (L) waste oil tank, before being removed by licensed waste transporters on a periodic basis.

4.3.9 Trade and Operation Waste

In accordance with Conditions 2.54 and 2.56, Schedule 2 of the Project Approval (06_0009), all waste materials removed from the site are directed to a waste management facility lawfully permitted to accept the materials.

Trade waste from site will be disposed using either suitably qualified or licensed waste management providers or via a licenced trade waste discharge point.

4.3.10 Bore Water

Bore water will not be utilised on the NCIG site unless an appropriate environmental assessment has been undertaken and approval received.

4.3.11 Treated Wastewater

As mentioned in preceding sections of the plan, treated wastewater is currently supplied to Kooragang Island for industrial use by a neighbouring business. It should be noted that Hunter Water Corporation have been consulted regarding supply of treated water for industrial use onsite. As a result of discussions in the past, it was previously determined that treated wastewater could not be supplied in a manner that was in line with the water demand cycle of the site. However, due to recent changes in regard to the management of this resource, NCIG has recently commenced detailed investigations into the feasibility of utilising treated wastewater on site.

4.3.12 Collected Rainwater

Rainwater is collected from the roof of the NCIG Administration Building and is directed to a rainwater tank. This water is reused around the Administration Building for gardening and irrigation purposes.

4.4 Water Usage

NCIG recognises that water is a valuable natural resource that is to be used sustainability. In this respect, stormwater captured onsite is used preferentially to potable water for dust suppression, washdown and belt cleaning purposes.

In addition, a continuous improvement approach is used to review water usage onsite to ensure that water used is meeting business needs, while not excessive. Examples of this include projects to reduce water added to the coal stream through the handling process, in particular for dust suppression and belt cleaning. Outcomes have included reducing the flow rate of water addition sprays for dust suppression and reducing the number of sprays activated for dust suppression and belt cleaning where possible. Reviewing the dust risk of various coal types also ensures that water addition is reduced where coals pose a lower dust risk. NCIG have developed a Water Efficiency Management Plan in combination with Hunter Water Corporation which further outlines water savings measures.

4.4.1 Stormwater Capacity

The original primary and secondary settling pond (WT10, WT20 and WT30) capacity has been increased to provide more stormwater, or captured water, for dust suppression and cleaning purposes. This has been achieved through the increase of weir height in WT30. This also has the benefit of reducing the risk of overflow during high rainfall or flood events.

4.4.2 Other Water Usage Controls

Control system logic has been developed in the Citect Scada System to reduce potable water taken from the Hunter Water potable water network. If potable water is being used for dust suppression and cleaning purposes, then the Raw Water Tank will only be filled to a maximum of 50%. This ensures that the remaining capacity will be filled with captured water in the event of heavy rainfall.

5. PERFORMANCE EVALUATION AND IMPROVEMENT

5.1 Monitoring

5.1.1 Surface Water Monitoring Program

Surface water monitoring is undertaken on a monthly basis for basic physical-chemical parameters and 6-monthly for pollutants including organic compounds and metals. Table 4 details the locations and frequency of monitoring undertaken. Monitoring locations are shown on Figure 6.

Table 4: NCIG Surface Water Monitoring Program

Monitoring Locations	Frequency	Parameter	Units	Required Limit of Reporting (LOR)
SW1-a, SW1-b, SW1-c, SW1-d (operations sites) SW2, SW3 (reference sites)	Monthly	pH	-	0.1
		Electrical Conductivity (EC)	µS/cm	10
		Total Dissolved Solids (TDS)	mg/L	Not specified
		Turbidity	NTU	10
		Dissolved Oxygen (DO)	% and mg/L	1
		Temperature	°C	Not specified
		Reduction/Oxidation Potential (Redox)	mV	Not specified
		Total Suspended Solids (TSS)	mg/L	Not specified
SW1-d, SW6, SW7, SW8, SW9 (operations sites) SW2, SW3, SW5, SW10, SW11 (background sites)	6-monthly	pH	-	0.1
		Electrical Conductivity (EC)	µS/cm	10
		Turbidity	NTU	10
		Dissolved Oxygen (DO)	%	1
		Aluminium	mg/L	0.05
		Arsenic (III)	mg/L	0.05
		Boron	mg/L	0.05
		Cadmium	mg/L	0.0001
		Chromium (III)	mg/L	0.01
		Cobalt	mg/L	0.001
		Copper	mg/L	0.001
		Iron	mg/L	0.05
		Lead	mg/L	0.001
		Manganese	mg/L	0.5
		Mercury	mg/L	0.0001
		Molybdenum	mg/L	2
		Nickel	mg/L	0.01
		Selenium	mg/L	0.001
		Zinc	mg/L	0.005
		Total Recoverable Hydrocarbons C6-C9	mg/L	0.02
		Total Recoverable Hydrocarbons C10-C14	mg/L	0.05
		Total Recoverable Hydrocarbons C15-C28	mg/L	0.1
		Total Recoverable Hydrocarbons C29-C36	mg/L	0.1
		Anthracene	µg/L	0.01
		Benzo (a) pyrene	µg/L	0.01
		Fluoranthene	µg/L	0.01
		Naphthalene	µg/L	0.01
		Phenanthrene	µg/L	0.01
		Ammonia	mg/L	0.5
		Nitrate	mg/L	0.1
		Total Kjeldahl nitrogen	mg/L	0.5
		Total phosphorus	mg/L	0.01
		Chloride	mg/L	Not specified
				0.05
				Not specified

Figure 6: NCIG Surface Water and Groundwater Monitoring Locations

5.1.2 Discharge Monitoring Program

Water will discharge from the Clearwater Pond during periods of heavy rainfall or flood events, i.e. >110mm of continuous rain. This water ultimately discharges to the Hunter River via a concrete-lined drain along the eastern boundary of the NCIG site. This drain receives runoff from other industrial sources. Table 5 below describes the monitoring that is to be undertaken during discharge.

Table 5. NCIG Discharge Monitoring Program

Monitoring Locations	Frequency	Parameter	Units	Required Limit of Reporting (LOR)
SW1-d (discharge) EPL34, SW5 (background) EPL35	Daily during discharge	pH Turbidity Total Suspended Solids (TSS) Oil and Grease	- NTU mg/L mg/L	0.1 10 Not specified Not specified

Sampling during discharge events is to be undertaken in accordance with the Discharge Monitoring Program – Sampling Procedure as outlined in the Safe Work Procedure for Adverse Weather (OPS.05.05).

As a part of EPL 12693monitoring requirements, the results of one discharge and one background sample are to be reported per discharge event.

5.1.3 Groundwater Monitoring Program

Groundwater monitoring is undertaken on a 6-monthly basis for pollutants including organic compounds and metals. Table 6 details the type and frequency of monitoring undertaken. Monitoring locations are shown on Figure 5. Monitoring detailed below is in accordance with monitoring requirements in EPL 12693.

Table 6. NCIG Groundwater Monitoring Program

Monitoring Locations	Frequency	Parameter	Units	Required Limit of Reporting (LOR)
GW1 (EPL 1), BH21S (EPL 38), BH21D (EPL 39)	6-monthly	pH Electrical Conductivity (EC) Aluminium Arsenic Bromide Copper Cadmium Iron Manganese Nickel Zinc Total Recoverable Hydrocarbons C6-C9 Total Recoverable Hydrocarbons C10-C14 Total Recoverable Hydrocarbons C15-C28 Total Recoverable Hydrocarbons C29-C36 Total Polycyclic Aromatic Hydrocarbons (PAHs) Cyanide (free) Cyanide (total)	- µS/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L µg/L µg/L µg/L µg/L µg/L µg/L µg/L	various
K9/3N (EPL 20), K9/3S (EPL 21), K11/1 (EPL 22), K11/1S (EPL 23), BH20S (EPL 36), BH20D (EPL 37), BH23S (EPL 40), BH23D (EPL 41)	6-monthly	pH Electrical Conductivity (EC) Aluminium Arsenic Bromide Copper Cadmium Iron Manganese Nickel	- µS/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	various

Monitoring Locations	Frequency	Parameter	Units	Required Limit of Reporting (LOR)
		Zinc Total Recoverable Hydrocarbons C6-C9 Total Recoverable Hydrocarbons C10-C14 Total Recoverable Hydrocarbons C15-C28 Total Recoverable Hydrocarbons C29-C36 Total Polycyclic Aromatic Hydrocarbons (PAHs) Cyanide (free) Cyanide (total)	mg/L µg/L µg/L µg/L µg/L µg/L µg/L µg/L	
K11/3E (EPL 24), K11/3W (EPL 25), K11/2W (EPL 26), K11/2E (EPL 27), K9/4W (EPL 28), K9/4E (EPL 29), K9/2W (EPL 30), K9/2E (EPL 31), K10/4W (EPL 32), DM10 (EPL 33)	6-monthly if trigger levels are exceeded at EPL 20, 21, 22, 23, 36, 37, 40 or 41	pH Electrical Conductivity (EC) Aluminium Arsenic Bromide Copper Iron Manganese Nickel Zinc Total Recoverable Hydrocarbons C6-C9 Total Recoverable Hydrocarbons C10-C14 Total Recoverable Hydrocarbons C15-C28 Total Recoverable Hydrocarbons C29-C36 Total Polycyclic Aromatic Hydrocarbons (PAHs) Cyanide (free) Cyanide (total)	- µS/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L µg/L µg/L µg/L µg/L µg/L µg/L µg/L	various

Assessment of groundwater monitoring results is detailed in Section 5.1.5.3 below

5.1.4 Environmental Monitoring Database

Data obtained from the surface water, discharge and groundwater monitoring programs is handled as follows:

- Data is analysed and compiled by NCIG's Environmental Contractor where relevant;
- Data is compared with relevant criteria; and
- Data is reviewed by the NCIG HSEC Department. In the event of a recorded exceedance, NCIG will undertake an investigation to determine any potential contribution and appropriate actons.

The OWMP is designed to facilitate review of relevant monitoring and operational activity data, identification and implementation of appropriate management measures and subsequent review.

5.1.5 Environmental Monitoring Assessment

The assessment of monitoring results varies depending on the type of monitoring conducted and action required. In the event of an exceedance of the relevant environmental monitoring criteria, an assessment will be conducted by the HSEC Department to determine if the exceedance is due to NCIG operation activities (i.e. conduct a review of other non-NCIG activities in the area and if relevant, historical monitoring data).

5.1.5.1 Surface Water Monitoring Assessment

Surface water quality monitoring data will be screened against the ANZECC (2000)/ANZG (2018) trigger values for the protection of 95% of freshwater species and against the site-specific trigger values (SSTVs) calculated from data associated with NCIG's surface water quality reference locations, as detailed in Section 3.7.1.

Monitoring of some of these analytes may not be required once more reliable SSTVs have been established. In the meantime, it is recommended that monitoring of the listed analytes be continued in order to facilitate the calculation of higher reliability SSTVs.

Following common practice and ANZECC (2000)/ANZG (2018) recommendations, the median of each data set is used for comparison with the parameter-specific trigger values. A review of surface water quality, including long-term trends and comparison of reference location data is undertaken on an annual basis. In the event that action trigger levels are reached, the following contingencies may be undertaken:

Step 1: Re-sample the monitoring location at which the trigger level was reached. If the concentration has decreased below the trigger level continue with the monitoring program. If concentrations remain at or above trigger level concentrations instigate Step 2.

Step 2: Evaluate the significance of the monitoring results via statistical analysis and trending graphs undertaken by an appropriately qualified professional. The statistical analysis should also trend data at reference locations to assess whether the trend is only apparent at NCIG operations sites. If the trending analysis indicates a stable or decreasing trend, or is consistent with trends at reference locations, continue with the normal monitoring program. If the trending analysis indicates it is possibly associated with NCIG operations, instigate Step 3.

Step 3: Initiate a monthly monitoring program for three months at selected locations, including selected reference locations. Possible inclusion of additional diagnostic testing, such as silica gel clean-up (for hydrocarbons) or hardness measurements (for bioavailability of metals) to focus on the exact nature of the contamination issue.

If additional monitoring indicates a stable or decreasing trend, or if trending is consistent with trends at reference locations, revert to the initial monitoring program. If trending analysis continues to indicate an upward trend that is independent of reference data, initiate a risk assessment, Step 4.

Step 4: Undertake a risk assessment to identify the risk to the Hunter River and surrounding environment posed by the migration of the contaminants from the site. The risk assessment should include surface water fate and transport modelling.

If risks are identified to be acceptable continue with the normal monitoring program. If risks are unacceptable instigate a remedial options study, Step 5.

Step 5: Undertake a remedial options study for the identified cause of the surface water risk.

5.1.5.2 Discharge Monitoring Assessment

Samples taken from the NCIG discharge point (SW1-d) and background water samples from the Hunter River (SW5) will be assessed for Turbidity, Total Suspended Solids (TSS), pH and Oil and Grease. Based on a comparison of the background and discharge values, an assessment will be made as to whether water pollution has occurred in the receiving water body. The appropriate regulatory authorities will be notified in the event a pollution incident has occurred. For pollution incidents of material environmental harm, the NCIG *Spill and Pollution Incident Response Management Plan* (HSEC.MP.13.04) will be followed.

5.1.5.3 Groundwater Monitoring Assessment

EPL Trigger levels

For groundwater quality EPL Trigger Criteria, the following actions will be taken as part of the monitoring assessment and in accordance with EPL 12693:

Step 1: In the event of either of the two Trigger Conditions being met, the licensee must notify the EPA in writing within two (2) working days of initial results becoming available to the licensee. The notification must included details of the Point(s) and the concentration recorded.

Step 2: In the event of Step 1, the licensee must resample the Point(s) at which the Trigger Condition was met to confirm the elevated level.

Step 3: The licensee must notify the EPA in writing within two (2) working days of the results collected in Step 2 becoming available to the licensee. The notification must included details of the Point(s) and concentration recorded. The EPA must be notified regardless of whether the results are elevated or not.

Step 4: If the results collected in Step 2 confirms the elevated levels, the licensee must commence six monthly groundwater monitoring at Points 24 to 33 inclusive for the parameters as detailed in licence condition M2.2.

Step 5: A suitably qualified and experienced person must undertake an assessment of the cause of the elevated concentration(s) identified in Steps 1 and 2, as well as trends in the groundwater contaminant concentrations. The analysis must consider data collected at Point 1, and any other relevant groundwater data, both historical and current. A report detailing the assessment and its findings must be prepared. The assessment report must provide advice of, and justification for, the trend identified and any actions to be taken by the licensee in response to the elevated concentration. The assessment and report must be completed within eight (8) months of the results collected in Step 2 becoming available to the licensee; and, submitted to the EPA.

Step 6: If the assessment undertaken in Step 5 identifies an increasing or upward trend in contaminant levels, the licensee must undertake an assessment and prepare a report on the risks posed by the migration of the contaminated groundwater on the Hunter River. The risk assessment report must include groundwater fate; transport modelling; and include justification for the conclusions reached as to whether the risk identified is acceptable or unacceptable and what actions are to be taken by the licensee. Where the above risk assessment is required, the risk assessment and report must be completed within two (2) months of the submission of the report required under Step 5.

Step 7: If the risk identified in Step 6 is deemed 'unacceptable', the licensee must undertake a Remedial Options Study to identify and report on remediation options to be implemented to remediate the identified groundwater risk. The Remedial Options Study must be undertaken by a suitably qualified and experienced person. The Remedial Options Study must identify and provide justification for the remedial actions to be undertaken; criteria to validate/monitor the effectiveness of the remedial works; and, timeframes for the implementation of the proposed remedial works. Where the above Remedial Options Study is required, the licensee must provide a report detailing the Remedial Options Study to the EPA within two (2) months of the submission of the report required under Step 6.

5.2 Internal Auditing

The HSEC Department will undertake regular auditing of water management within the SDMP, including this Operation Water Management Plan. This auditing is conducted annually, in accordance with the NCIG *Audit and Inspection Procedure* (HSEC.PRO.15.01) and the annual HSEC Audit and Inspection Schedule. Non-conformances will be recorded and appropriate actions taken to remedy.

5.3 Incident Review

Environmental incidents relating to water management at NCIG are to be managed in accordance with NCIG *Hazard and Incident Management Procedure* (HSEC.PRO.13.01)

5.4 Corrective Action

If corrective actions are identified as a result of water quality monitoring assessment, OWMP audit and inspection results, compliance tracking or regulatory issues regarding water, the HSEC Department or Manager – HSEC will determine appropriate management strategies and implementation of contingency measures in consultation with other departments. This same process is applied as an outcome of management review of environmental management measures, as discussed in Section 5.6. These will be in addition to those implemented as part of normal operational activities.

Corrective actions are also identified for environmental incidents. This process will be implemented in accordance with the NCIG *Hazard and Incident Management Procedure* (HSEC.PRO.13.01).

5.5 Reporting

Operator notifications for water events, as detailed in Section 4.3.6, require management action. These actions are required to be recorded in an NCIG Environmental Risk Event Checklist. This assists NCIG Operators in understanding all necessary considerations during water related events, while also providing a detailed record of the event.

For all other reporting commitments, refer to Section 5.9 of the NCIG *Operation Environmental Management Plan* (HSEC.MP.12.01).

5.6 General Review

Ongoing review and attainment of feedback in regard to environmental measures is undertaken periodically in accordance with Condition 7.7 of the Project Approval (06_0009) and to ensure that the SDMP is meeting its targets and objectives. Any improvements deemed necessary will be identified and SDMP documentation will be updated to reflect this.

5.6.1 Management Review

The ELT reviews progress and health of environmental management measures on a quarterly basis in line with the Quarterly HSEC Report prepared for the NCIG Board. In addition, Key Result Areas (KRAs) and objectives are set during the business planning process (see Section 3.3), to ensure that statements within the Sustainable Development Policy are being achieved. Information used to develop KRAs and objectives include:

- Legislative requirements;
- Performance against environmental objectives and targets in the HSEC Plan;
- Compliance assessment;
- Environmental monitoring results;
- Results of environmental auditing and trends of non-conformance;
- Monitoring of environmental statistics;
- Environmental incidents
- Corrective actions;
- Community complaints;
- Other current environmental issues and concerns;

The above is consistent with the NCIG *Management Planning, Monitoring and Review Procedure* (HSEC.15.02). As with general review of environmental management measures, improvements deemed necessary by management will be identified and SDMP documentation will updated to reflect this.

6. REVISION HISTORY

DATE	REVISION NO.	DESCRIPTION OF CHANGE	PERSONS INVOLVED
1/04/10	1st Draft	Review of draft document	Brendan Logan Nathan Juchau
1/06/10	Final Draft	Final document for approval	Brendan Logan
1/05/12	Review 1	General revision	Phil Reid
1/05/13	Review 2	General revision	Phil Reid
8/02/16	Review 3	Update OWMP to be consistent with revised SDMP framework, including environmental management component. Include the findings of the Site Surface Water Management Review	Phil Reid
15/12/17	Review 4	Site Water Balance and Groundwater Monitoring details updated	Phil Reid
20/11/18	Review 5	General revision, update Discharge Sampling Procedure and Flood Mode Logic	Hayley Ardagh Phil Reid
20/05/20	Review 6	Merged OWMP to new NCIG document template, including the addition of the Key Elements section. General revision with minor updates and formatting changes throughout document. Update Surface Water Monitoring in line with ANZG 2018 Guidelines and recent Ramboll Surface Water review. Update to	Hayley Ardagh

		Groundwater Monitoring section to be consistent with the EPL.	
05/01/22	Review 7	General revision. Update surface water usage. Update surface water monitoring with 2021 review.	Hayley Ardagh Wade Covey

7. REFERENCES

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

- ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.

- Department of Infrastructure, Planning and Natural Resources 2004, Guideline for the preparation of environmental management plans, Department of Infrastructure, Planning and Natural Resources, Sydney.

- Landcom 2004, Managing urban stormwater: soils and construction (4th edn.), vol. 1.

- RCA Australia (2006) Land Contamination and Groundwater Assessment, Newcastle Coal Infrastructure Group, Coal Export Terminal, Kooragang Island.

- Resource Strategies 2006, Newcastle Coal Infrastructure Group Coal Export Terminal – Environmental Assessment.