7 Surface water

7.1 Project changes and assessment

The water management system has been amended to address the changes to the Project, particularly the amended tailings management strategy. Changes to waterway crossings have also been considered. As for the groundwater assessment, the surface water assessment has been updated to address comments from a number of agencies and councils. The updated surface water assessment and associated groundwater modelling (Appendix F) is based on the Project described in the EA and the changes described in this report (Chapter 3).

7.2 Response to submissions

7.2.1 Modelling method

Submissions

NA-13, G-10, G-11, G-21, I-46

Issues

The following comments are made regarding the modelling in the surface water assessment:

- that modelling for the new drought of record was not completed and was not used when assessing the impacts of the transfer on other water users;
- that the models did not consider the Woolandra dams, both during mining and post-closure;
- that the model did not provide pump and pipe specifications to accommodate appropriate transfer rates to ensure that the capacity of the 'settling zone' of sedimentation dams will be recovered within the 5 day regulatory period following a storm event; and
- that the basic water balance modelling may be incorrect.

Responses

The updated 'Water balance and surface water management system' (Appendix E of Appendix F) includes a sensitivity analysis (Section 6.1.1) examining the reliability of the water supply from the Cudgegong River. This analysis examines what would happen if the Project's peak water demand (in Year 20) coincided with the lowest recorded flow in the Cudgegong River (in 2009) and is based on the extraction strategy currently subject to formal agreement with the State Water Corporation. There is a low probability of a water deficit occurring under these worst-case conditions. If this did occur, it would be managed in the first instance by supplementing supply with licensed groundwater extraction, then by reducing water demand, which may include reducing the CHPP throughput.

The baseline water balance model includes the Woolandra dams on Blackheath Creek in their current condition. Woolandra East Dam is in a separate catchment, will not be impacted and is not considered. The operations water balance model assumes that the dams have been decommissioned and flow is no longer captured but allowed to progress downstream (see Section 3.4.1).

Pumping rates and water system operating rules are provided in Sections 5.3.3 and 5.3.4 of the updated 'Water balance and surface water management system' (Appendix E of Appendix F). Pumps and pipes will be specified based on these.

Sedimentation dams capturing runoff from overburden areas have been sized based on criteria recommended in the guidelines 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004) and 'Managing Urban Stormwater: Soils and Construction — Mines and Quarries' (DECCW 2008). The guidelines recommend that for a sensitive receiving environment, the 'settling zone' be sized to capture runoff from a 95th percentile 5-day duration storm event. This means that water with most suspended solids removed would on average overflow from sedimentation dams once or twice a year when the 95th percentile 5-day design storm event is exceeded. Further information on the operation of sedimentation dams is provided in Section 2.3.1 of 'Water balance and surface water management system' (Appendix E of Appendix F).

The water balance model has been independently reviewed and will be further reviewed by the regulatory authorities as part of the Project assessment process.

7.2.2 Flow assessment

Submission:

NA-13

Issues

The DP&I makes the following comments regarding the in stream flow impact assessment:

- more information on flow duration curves comparing pre-mining baseline flows to flows during the operational period for low rainfall and median years is required to demonstrate more clearly how the flow will change in the creek systems;
- further evaluation of the flow changes in the creek system post-mining is required;
- flow duration curves showing the lowest, low (10^{th} percentile) and median rainfall years for lumped catchment and also separately for outlet of individual catchments are required to demonstrate how base flows for contingent releases provides water to pools;
- Table 6-7 of Appendix E requires modification to include percentage changes to in-flow compared to pre-mining and a breakdown of how this changes for the separate modelled catchments;
- further explanation is required as to why total flows will increase;
- the assessment and discussion of impacts to downstream users of surface water is required; and
- a scenario is required which shows the implications if Woolandra Dam licence is used for agriculture and water not returned to system and an option to surrender the water access licence post-mining.

Responses

The updated 'Downstream flow impact assessment' (Appendix C of Appendix F) includes an expanded assessment (sections 5.1 and 5.2) that provides:

- an expanded table of annual flow changes at the outlet of Sandy Creek (ML/a and percentage change) for operations and post-mining; and
- flow duration curves for Laheys Creek, Sandy Creek and Talbragar River for pre-mining, Year 1 and Year 20 (Figures 5.1 to 5.4).

Four semi-permanent pools could be affected by groundwater drawdown (Section 5.4 of Appendix C of Appendix F). Of these, two are in the reach of Sandy Creek that will experience increased surface water flows, one is in the upper reach of Sandy Creek that will not experience increased surface water flow and one is located in the upper reach of Laheys Creek that will not experience increased surface water flow. Therefore, of 14 pools assessed, only two are predicted to experience loss of groundwater inflow and no compensatory increase in surface water flows. An aquatic monitoring strategy to measure impacts to these pools is described in Section 9.5.3.

The updated downstream flow assessment found that flows in Sandy Creek will increase during operations and post-mining in median and wet years. In dry years, the flow in Sandy Creek is predicted to increase in Year 1, decrease in Years 2 to 20 (by up to 6%) and increase post-mining. The impacts to the Talbragar River downstream of the Project will be smaller with a maximum flow decrease of 0.6% occurring in dry years. Therefore, the Project will not measurably impact downstream water users.

Surface water modelling predicts an increase in post-mining flows because:

- the removal of Woolandra West Dam will allow more flow from this catchment to pass downstream;
- topographic changes to the catchments within the final landform will provide more runoff than the undisturbed catchments, ie removal of localised depressions or increased sub-catchment slopes in the upper catchments; and
- changed runoff characteristics of the rehabilitated land areas will contribute more runoff to the creeks, due to changed vegetation and soil conditions.

Increased flows due to the above factors outweighs the factors that reduce flows, which are loss of catchment to the final void and increased recharge to groundwater through rehabilitated spoil areas.

It is not proposed to use water from the Woolandra West Dam for agriculture or to surrender the licence after the completion of mining.

7.2.3 Downstream impacts including on semi-permanent pools

Submissions

NA-2, NA-8, NA-13, G-5, G-11, I-45

Issue

These submissions comment on the impact on semi-permanent pools and the resulting reduced connectivity of aquatic habitats. OEH seeks further detail on the level of treatment and alteration of flows into aquatic and riparian habitat along the creeks and downstream in the Talbragar River. The Central West CMA comment on the cumulative impact of the Project on the interaction of groundwater and surface waters, and the potential impacts to the base flow to the streams and semi-permanent pools.

DP&I comment that the assessment must demonstrate that the key pools predicted to be affected by groundwater drawdown in the catchment are located such that contingent releases from sediment dams will provide additional flow compared to baseline including more specific detail on flow changes in these pools.

Submissions also comment that the Lowland Darling River aquatic endangered ecological community will be impacted by increased fragmentation through loss of low flow connectivity and groundwater drawdown, particularly in periods of prolonged drought. The threatened freshwater catfish was noted as a species particularly vulnerable to this impact.

Response

The primary interaction between groundwater and surface waters occurs within the semi-permanent pools. The Project will result in an increase in annual average downstream flow volumes during median and wet years, with minor decreases during dry years (see 'Downstream flow impact assessment' (Appendix C of Appendix F). However, releases from the mine water management system will modify the flow duration curves of Laheys Creek, Sandy Creek and the Talbragar River such that the magnitude of flows in the low flow categories will be increased, and there will be more regular flow downstream of the Project (see Section 7.2.2).

As described in Section 9.5.3, an aquatic monitoring strategy will be developed to detect changes to the quality and quantity of water in the semi-permanent pools. A river monitoring committee will be formed to review the results from this strategy and to assist formulate adaptive management measures. These measures may include releasing water from the mine site to fill the pools. Three of the four pools that could be affected by groundwater drawdown are downstream of the mining areas and will be fed by gravity. It may be necessary to transport the water by pipe or water truck if water losses along the creeks result in high transmission losses. One pool is upstream of the mining area, requiring pipes or water trucks to be used.

7.2.4 Macquarie Marshes

Submission

G-6

Issue

One submission comments on the long-term impact of the Project on water sources in the Upper Macquarie catchment area of the Murray Darling Basin and on availability of an environmental water allocation to the Macquarie Marshes.

Response

The Macquarie Marshes are a wetland system of international importance, with the lower part listed as a Ramsar wetland. The Macquarie Marshes are approximately 210 km north-west of the PAA as the crow flies. However, they are approximately 466 km downstream of the Project (via Laheys Creek, Sandy Creek, the Talbragar River and the Macquarie River).

The Macquarie River and its largest tributary the Cudgegong River are regulated rivers. The volume and pattern of flows are largely controlled by a series of man-made structures including Windamere Reservoir on the upper Cudgegong River and Burrendong Reservoir on the Macquarie River. These structures have changed the frequency, extent and duration of inundation in the Macquarie Marshes.

The regulation of these rivers is governed by the Water Sharing Plan (WSP) for the Macquarie and Cudgegong Regulated River Water Source 2003. The WSP provides water for environmental needs and directs how much water is available for extraction and how it is to be shared. While the Macquarie Marshes are not part of the WSP area, the WSP includes rules about the release of flows to improve environmental outcomes for the marshes.

The WSP limits the long term annual average extraction from the Macquarie-Cudgegong system to 391 GL/year. All flows above this are reserved for the environment. In the long-term, approximately 73% of the average annual flow is protected for environmental health. Water extraction is managed to ensure that these long-term environmental flows occur.

The Project will extract water from the Cudgegong River 5 km south of Mebul. High security water access licences have been purchased on the open market to allow a maximum of 3,311 ML of water to be extracted for the Project annually. These licenses were purchased from within the area covered by the WSP and therefore will not change the total amount of water in the system or the amount of water reaching the Macquarie Marshes.

Sandy Creek carries all of the flow from the creeks draining the mine area and contributes approximately 0.6% of the mean annual flow of the Macquarie River based on the flow at Dubbo. However, only 26% of the mean annual flow of the Macquarie River passing Dubbo reaches Oxley Station and hence the Macquarie Marshes. Sandy Creek therefore contributes less than 0.2% of the mean annual flow to the marshes. Any changes to the flow of Sandy Creek will be a fraction of this minor contribution.

Water quality in the creeks in the PAA will be protected through implementation of environmental controls (eg erosion controls) and the quality of any discharged water will be regulated by the Environment Protection Licence. Water quality and flows in the Talbragar River will be protected as part of the Project.

The Project is remote from the marshes and will not result in any physical impacts. It will not measurably impact the hydrological regime of the marshes or the quality of water entering the marshes. No mechanisms can be identified that could cause the Project to affect the habitat or lifecycle of native species associated with the marshes or that could introduce or spread an invasive species.

This will ensure that the Project will have no measurable impact on the Macquarie Marshes, 466 km downstream.

The Project was referred to the Department of Sustainability, Environment, Water, Population and Community (SEWPaC) on 21 October 2011 under the *Environment Protection and Biodiversity Conservation Act* 1999 (Commonwealth). On 29 November 2011, the SEWPaC determined that the Project was a 'controlled action' with the relevant controlling provisions being 'listed threatened species and communities' and 'listed migratory species'. The controlling provisions did not include 'wetlands of international importance', as they would have if the SEWPaC considered that the Project could significantly impact the Macquarie Marshes.

7.2.5 Water supply

Submissions

NA-2, C-2, G-2, G-3, G-5, G-10, G-11, G-13, G-15, G-20, G-21, I-4, I-7, I-8, I-12, I-13, I-15, I-21, I-22, I-23, I-27, I-28, I-32, I-34, I-35, I-37, I-38, I-39, I-47, I-46, I-55, I-61, I-62, I-64, I-65, I-66, I-67, I-68, I-73, I-74, I-75, I-76, I-79, I-80, I-84, I-85, I-86, I-89, I-95, I-96, I-98, I-100, I-101, I-109, I-110, I-111, I-113, I-114, I-116, I-118, I-119, I-121, I-122 I-125, I-128, I-133, I-134, I-135, I-136, I-139, I-140, I-142, I-148, I-150, I-152, I-153, I-155, I-157, I-158, I-163, I-164, I-170, I-172, I-178, I-179, I-181, I-183, I-185

Issues

These submissions comment on the impact of the Project on the water supply, including from the Cudgegong River, and the subsequent effect this may have on the environment, agriculture, tourism and the communities in the area. Some commented that the 3.3 GL/a to be extracted from the Cudgegong River is unsustainable and cannot be supported by the river system. Concerns were also raised as to the effect of the water removal on the Macquarie River system downstream of the Cudgegong River.

One submission comments on the allocation of water and usage rights to the Project and that the NSW Government has demonstrated a conflict of interest with this proposal when approving the transfer of high security water licences from below Burrendong Dam into the smaller Cudgegong catchment. Further information is sought on the extraction strategy agreement being negotiated with State Water Corporation and the set of extraction rules which have been developed with the NOW.

OEH requests the opportunity to discuss operational surpluses with the Proponent and State Water Corporation to ensure access to water from the Cudgegong does not compromise the environmental values of the lower Cudgegong River.

Response

As described in the EA (Section 8.5.4), CHC has entitlements (purchased from existing water licences) authorising the extraction of water from the Macquarie and Cudgegong Regulated Rivers Water Source. These entitlements allow 3,311 ML/a to be extracted from the Cudgegong River. Of these entitlements 1,000 ML/a was originally from the Cudgegong River and 2,311 ML/a from the zone downstream of the upper limit of Burrendong Dam (ie on the Macquarie River). The transfer of the entitlement from the Macquarie River to the Cudgegong River was subject to an assessment of the environmental and third party impacts, including changes to the hydrology, by the NOW between 2010 and 2011. The NOW determined that the impacts of the transfer would not be significant and the change in extraction zone for the water access licences was approved in June 2011 under section 71S of the *Water Management Act 2000*.

CHC is the last major water user on the Cudgegong River. CHC is in the process of finalising an extraction strategy agreement with the State Water Corporation. This will ensure as much of CHC's licence entitlement as possible will be extracted during periods of excess flows in the Cudgegong River. This will complement the current operation of the river to help State Water in minimising river transmission losses and, in turn, will leave more water in Windamere Dam for later use.

Further comments on the impact of water use by the Project are provided in Sections 6.2.3 and 8.2.3.

CHC will consult with OEH regarding implementing the extraction strategy to minimise any impacts on the lower Cudgegong River.

7.2.6 Construction water

Submission

NA-7, NA-13

Issue

The DPI requests additional information regarding the proposal to source construction water from one or more dams on CHC land. Further information is requested on the volume required, water sources and relevant licences under water legislation. The DP&I requests clarification on the water supply during construction for dust suppression and road construction.

Response

The construction water demand will be determined during detailed design. However, a survey of licensed water storages in December 2012 determined current stored water reserve is 630 ML. As described in Section 7.6 of Appendix E, access licences for more than 2,500 ML/a are held by CHC (1,780 ML/a from the Lower Talbragar River Water Source and 1,024 ML/from the Gunnedah-Oxley Basin Murray Darling Basin Groundwater Source). Together, these will provide sufficient water for construction.

7.2.7 Threats of drought and global warming

Submissions

I-11, I-37, I-51, I-70, I-88, I-115, I-124, I-125, I-146, I-159, I-165

Issue

These submissions commented that water in the Central West region is a scarce resource which should be retained for agricultural and community use, particularly during droughts. Project water use was considered to divert large amounts of water from the Windermere Dam and the Cudgegong River and create the possibility of water shortages during the Project or in times of drought.

Response

Up to 3,311 ML/a of water will be extracted from the Cudgegong River under high security water access licences purchased on the open market from existing licence holders. The Water Sharing Plan (WSP) for the Macquarie and Cudgegong Regulated River Water Source 2003, Part 9, Division 3, Clause 46 states:

Where extraction components of access licences do not specify the rate as a share of supply capability or a volume per unit of time, the following priority of extractions shall apply whenever supply capability is insufficient to satisfy all orders for water in any section of this water source:

a) water shall be supplied to domestic and stock access licences, local water utility access licences and regulated river (high security) access licences that have placed an order for water, then to regulated river (general security) access licences; and

b) then any remaining supply capability shall be shared between regulated river (general security) access licences that have placed an order for water, in proportion to the share components specified on the access licences.

Under the WSP and the Water Management Act, the delivery of town water supply always takes priority over other consumptive water uses. The Project will not receive any allocation until the entire allocation for town water supply is assured.

The NOW undertakes resource assessments to determine what water allocations can be announced for consumptive users. The resource assessment ensures that water for the environment, river transmission losses and town water supply is assured prior to making other allocations available. Water will be supplied to domestic and stock access licences and local water utility access licences before it is supplied to the Project's high security water extraction licences. Therefore, the Project will not impact the availability of water for rural or urban domestic supply, ie for critical human water needs, including during drought.

As discussed in Section 7.2.5, the State Office for Water transferred of water entitlements from below Burrendong Dam to the Cudgegong River downstream of Windermere Dam after completing resource and environmental assessments.

7.2.8 Climate change

Submission

NA-13

Issue

The DP&I comment that the potential impacts of climate change on the final voids have not been adequately assessed.

Response

The Bureau of Meteorology and CSIRO (Climate Change in Australia – Technical Report, CSIRO and Bureau of Meteorology, 2007 and subsequent results of temperature and climate modelling in 2009 and 2010) predict that climate change will not significantly increase or decrease rainfall in the region over the next 25 years. Therefore, the last 111 years of climate records were used as being the best representative record (including droughts and extended wet years) for the operational phase mine water balance model. However, modelling of the water level in the final void considers impacts over a 1,000 year timescale and therefore includes the use of synthetic climate sequences that take into account climate variability and climate change.

7.2.9 Water balance

Submission

NA-13

Issue

The DP&I requests further information on the Project's water balance and water monitoring system including:

- additional clarification/discussion to demonstrate that the selected 10^{th} percentile; 50^{th} percentile and 90^{th} percentile year were representative of sequence of wet or dry years;
- discussion of the implications from managing additional water on site considering that the peak seepage rate year (Year 17, 1,775 ML/year) has not been modelled;
- the volume of uncontrolled runoff discharge from sediment basins when design capacity of the 5 day 95^{th} percentile storm is exceeded.
- details on water management from the tailings dam; and
- the implications if rehabilitation objectives for runoff from mine rehabilitated areas is not met.

Response

The 10^{th} percentile; 50^{th} percentile and 90^{th} percentile year results were selected based on rainfall depth statistics. Ranking by other indicators, such as total discharge from site or water pumped from Cudgegong River, would result in different 10^{th} percentile; 50^{th} percentile and 90^{th} percentile years. However, the sensitivity analysis described in Section 6.1.1 of the updated 'Water balance and surface water management system' (Appendix E of Appendix F) shows how the site water supply would be affected by low flow conditions in the Cudgegong River for the peak demand in Year 20. The updated 'Downstream flow impact assessment' (Appendix C of Appendix F) presents impacts on the flow duration curves for Laheys Creek, Sandy Creek and the Talbragar River. These show impacts under a range of combined factors including rainfall, evaporation and discharge from the site.

The updated groundwater modelling found the peak seepage rate from groundwater to the pits to be 2,802 ML/yr in Year 14. The water balance model has assessed operations for years 12 and 16 when seepage rates are estimated to be 2,447 ML/yr and 2,403 ML/yr, which are almost 90% of the peak seepage rate. It is believed that the impact of high levels of groundwater seepage have been adequately accounted for within the accuracy of the model. In-pit flooding would not unduly constrain operations in Year 16 when in-pit storage volumes are highest in mining areas B and C and in Year 20 when in-pit storage volume is highest in mining area A (Section 6.1.3 of Appendix E of Appendix F).

Section 6.1.2 of Appendix E of Appendix F provides additional information on the typical overflow regime of the sedimentation basins.

Tailings emplacement water management is described in Section 3.3 and Appendix B. These measures were included in the updated surface water modelling.

Monitoring of progressive rehabilitation is described in Section 6.2 of the 'Mine rehabilitation strategy' (Appendix G). This will measure rehabilitation success and whether the post-mining rehabilitation strategy needs revision to ensure that rehabilitation success criteria are met.

7.2.10 Raw water dam and harvestable rights

Submissions

NA-7, NA-13

Issues

The DP&I requests additional information about the size and volume of the Project's raw water dam and clarification that harvestable water rights will not be used for the 246 ha upstream catchment inflow into the dam.

The DPI also requests further evidence of consideration of Maximum Harvestable Rights Dam Capacity (MHRDC) for the raw water dam due to its location along a second order watercourse. DPI requested that MHRDC is considered for all proposed clean water dams.

Responses

The location of the raw water dam has been amended (see Section 3.4.1). The capacity of the raw water dam now will be about 1 GL and the water surface area when full will be about 17 ha. The catchment upstream of the dam is now 50 ha. The dam will require a licence in accordance with the Water Management Act.

Harvestable rights are discussed in Section 3.6 'Water balance and surface water management system' Appendix E of Appendix E. They will not be applied to the raw water dam.

Harvestable rights dams are generally permitted on first and second order streams anywhere in NSW consistent with the harvestable rights order by which the area is constituted. First and second order streams are defined as:

- starting at the top of a catchment, any watercourse that has no other watercourses flowing into it is classed as a first order watercourse;

- where two first order watercourses join, the watercourse becomes a second order watercourse; and

- if a second order watercourse is joined by a first order watercourse, it remains a second order watercourse.

The MHRDC is determined via a runoff coefficient provided by NOW based on the property's area. For the Project site the MHRDC is 0.065 ML/ha (DWE 2008). Therefore based on a property area of 32,538 ha (as of January 2013), there is the potential to construct dams of capacity up to 2,115 ML.

A desktop mapping assessment by CHC identified 811 unlicensed farm dams on CHC property. The total capacity of the existing unlicensed farm dams is estimated at 1,545 ML. Therefore, the harvestable right capacity currently not accounted for by unlicensed dam capacity is estimated to be 570 ML. Additional storage capacity would require licensing. It is proposed that the clean water dams upstream of the out-of-pit tailings emplacements and other clean water dams will use this unlicensed dam capacity.

7.2.11 Woolandra Dam

Submissions

NA-7, NA-13

Issue

The NOW comments that it is aware of a proposal to modify the Woolandra Dams to enable the continued passage of runoff down Blackheath Creek and into Laheys Creek but requests clarification on this proposal and further detail be provided on the objectives and expected environmental outcomes if it is to be implemented. If this proposal is to mitigate impacts to the downstream aquatic environment and/or to water users, these impacts and the ability to mitigate them need to be clearly defined.

Response

As described in Section 3.4.1, it is proposed to retain the Woolandra West Dam as a construction water supply, although constructing a spillway will decrease the water level. Any water remaining in the dam when construction is complete will be fully drained; a bypass structure will be installed to allow all water flowing from Blackheath Creek upstream of the dam to discharge to Laheys Creek.

The surface water balance modelling ('Water Balance and Surface Water Management System' Appendix E of Appendix F) is based on the installation of this bypass structure.

The ecological impacts of removing this dam on were assessed in Appendix B 'Significance assessments' in Appendix H of the EA. This considered the impacts on:

- Sloane's Froglet (*Crinia sloanei*) (Table B.9);

- Blue-billed Duck (*Oxyura australis*) (Table B.11); and

- Australasian Bittern (*Botaurus poiciloptilus*) (Table B.11 and Table B.26).

In each case, it was found that construction of the raw water storage dam will compensate for lost habitat for these species.

The Woolandra East Dam is in a catchment that will not be impacted by the Project.

7.2.12 Geomorphology

Submission

NA-13

Issue

The DP&I comment that the geomorphology assessment did not contain evidence of extensive fieldwork undertaken for the Lahey Creek and Sandy Creek drainage lines. The DP&I requests a detailed geomorphological assessment to establish baseline conditions, particularly identify areas where there are existing erosion issues and to allow assessment and monitoring of impacts during operational and post mining stages.

Response

The updated 'Baseline Hydrological Environment' (Appendix A of Appendix F) and the updated 'Downstream flow impact assessment' (Appendix C of Appendix F) provide expanded evaluation of the baseline geomorphological characteristics of the creeks and potential impacts and mitigation measures for geomorphological changes to Laheys Creek and Sandy Creek.

7.2.13 Water contamination

Submissions

I-28, I-30, I-37, I-160, I-187

Issues

These submissions comment that the mine will impact on water supplies and resulting in impact on health.

Response

The only surface water leaving the mine site will be clean water diverted around disturbed areas and water displaced from sedimentation dams. Water from the sedimentation dams will be monitored to confirm that it meets the water quality objectives that will protect the existing downstream water quality. As described in the EA (Section 7.5.4), water permeating to groundwater is not expected to impact groundwater quality although localised elevated concentrations of zinc were measured from the shale samples from core DDH51 (35.44 – 35.99 m and 62.92 – 63.095 m). The Australian Drinking Water Quality Guidelines (NRMMC 2011) do not provide a health-based guideline for zinc noting that it usually occurs from corrosion of galvanised pipes/fittings and brasses. Notwithstanding, the groundwater monitoring program will include the analysis of zinc. Therefore, no health impacts are predicted as a result in the change of surface water or groundwater quality.

7.2.14 Water quality objectives

Submission

NA-1

Issue

The EPA questions the appropriateness of the proposed water quality objectives (WQOs) and notes that they will only be accepted as interim limits. The EPA comment that it is unclear whether the reference sites used to derive site specific WQOs are appropriate. The sites may reflect current land use impacts (eg stock access to waters, agricultural runoff and dryland salinity) but not reasonable land management practices that would justify their use as a reference site. The EPA comment that it is also unclear if the baseline surface water quality is affected by groundwater base flow at some sites. It is therefore uncertain whether these WQOs have been appropriately derived in accordance with ANZECC/ARMCANZ (2000) and DEC (2006) procedures for customising WQOs.

The EPA requests that they be able to review the interim WQOs in the in the light of further monitoring data and refined after one year.

Response

The reference sites were selected based on their location within the watercourses that may be impacted by the Project. They are representative of a range of stream orders. There was no apparent variation in land management practices within each reach containing a reference site. Therefore, the reference sites are considered to represent the general catchment conditions and were not biased towards any particular type of land management practice.

EPA's approach is generally agreed to. However, the suggested review after one year of monitoring may not be appropriate because the data gathered may not be representative of longer term conditions. Rather, it is proposed that the Project's first annual environmental management report following the start of operations comments on the representativeness of the monitoring results and their utility as a benchmark for determining WQOs. Revised limits would be agreed with EPA in this context and possibly not finally resolved till later years.

7.2.15 Total dissolved solids

Submissions

NA-1, NA-7, NA-13

Issue

The DPI requests clarification of the salt load contributions pre-, during and post-mining, and the related aquatic impacts to assess the potential for increased water volumes of higher total dissolved solids (TDS). The DP&I comments that the surface water report has not considered the increase in salt loads to the river system compared to baseline conditions and offsetting salt loads. The EPA suggests a TDS discharge limit of 600 mg/L.

Response

A maximum increase in TDS concentration in the Talbragar River is predicted to be 5% above baseline conditions. This is within the historic TDS concentration range in the river and well below the customised water quality objective (WQO). In Sandy Creek, the maximum TDS concentration is predicted to be 52% above median baseline conditions. However, the given the range of TDS concentrations in the creek, the maximum TDS concentration is predicted to exceed the most stringent customised WQO by 6 to 8%.

Post-mining there will be an increase in downstream flows of up to 12% in dry years (with lesser increases in average and wet years) due to changes in catchment characteristics and topography of the final landform (see Section 7.2.2).

There is a reduced likelihood of dryland salinity during and post-mining due to induced drawdown in groundwater levels and increased recharge through backfilled areas. This together with the increased creek flows, will ensure higher dilution of salt in the watercourses and ensure that there are no long term increased salinity downstream. The final void lake in mining area B will act as a groundwater sink and will not overflow to the surface water system under a broad range of climatic scenarios, taking into account uncertainty in the key factors that govern the water balance of the final void lake (Appendix E of Appendix F).

The EPA's recommended sedimentation dam TDS discharge limit of 600 mg/L has been adopted in the updated 'Water quality impact assessment' (Appendix B of Appendix F).

7.2.16 Total suspended solids

Submission

NA-1

Issue

The EPA comments that lower total suspended solids (TSS) discharge levels are possible with the use of flocculants and recommends a discharge limit of 50 mg/L.

Response

The EPA's recommended sedimentation dam TSS discharge limit of 50mg/L has been adopted in the updated 'Water quality impact assessment' (Appendix B of Appendix F).

7.2.17 Metals and acidity

Submission

NA-1

Issue

The EPA suggests that specific management measures will be needed to control metal and acidity concentrations in sediment ponds.

Response

As described in Section 4.2 of the updated 'Downstream water quality impact assessment' (Appendix B of Appendix F), management responses to elevated metals or acidity in sedimentation basins may include diversion of overburden runoff to a dirty water dam, dilution of the water with higher quality water prior to discharge or increased pumping of any contaminated water in sedimentation dams to the dirty water dams.

7.2.18 Flocculants

Submission

NA-1

Issue

The EPA requests that ecotoxicology testing be conducted on any flocculants prior to their use and that this should include potential impacts on local aquatic flora and fauna.

Response

As described in the EA (Section 10.3.6), eight fish species were recorded during the aquatic ecology field assessment. These were the introduced carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), redfin perch (*Perca fluviatilis*), mosquitofish (*Gambusia holbrooki*), and the indigenous native carp gudgeon (Hypseleotris spp.), golden perch (*Macquaria ambigua ambigua*), Australian smelt (*Retropinna semoni*) and freshwater catfish (*Tandanus tandanus*). Invasive fish species had the highest abundance, diversity and distribution.

CHC will use flocculants that are demonstrated to have low ecotoxicity.

Ecotoxicity tests need to be conducted on species from at least five trophic levels (positions in the food chain) to allow a safe concentration for a chemical or mixture of chemicals to be determined. There must be established ecotoxicological tests for each of these species. Given that flocculants are widely used throughout NSW and Australia for the same purposes that they will be used for the Project, ie to assist settle solids from suspensions or slurries in the CHPP and sedimentation dams, it is not believed that the considerable expense and time required for ecotoxicology testing using local aquatic flora and fauna is justified.

7.2.19 Void water quality

Submission

NA-7

Issue

The DPI comments that the final void lake has the potential to degrade groundwater and surface water quality and requests further assessment of the impacts and development of mitigating options be provided including detailed groundwater elevation contours in the vicinity of the void lake post-mining.

Response

Updated modelling under a broad range of climatic scenarios and taking into account uncertainty in the key factors that govern the water balance of the final void lake confirms that a hyper-saline void lake will form and that the highest equilibrium water level in the lake will remain 2 m below the adjacent creek level. The median lake level is modelled to be 6 m below the creek level (Section 8.2.5 of Appendix E of Appendix F). The updated groundwater assessment (Appendix E) confirms that the lake will be a groundwater sink (see sections 6.2.2 and 6.2.5 above). Therefore, saline water is not predicted to flow from the lake to the creek system.

Appendix H 'Groundwater model technical report' of Appendix E provided residual groundwater drawdown contour maps for 20 years (Figure 5.7A and B) and 100 years (Figure 5.8A and B) after the end of mining.

7.2.20 Final landform

Submissions

NA-7, NA-13

Issue

The DPI request further information on the final landform capping layer, surface water runoff and infiltration to assist in understanding the long-term surface water impacts. The DP&I request further justification and assessment of the option of backfilling to avoid pit lake development and issues associated with these including rehandling overburden and seepage from emplaced material. DP&I also request further information on how mining depressions or voids in Pit areas C and A are free draining and specific information on what engineering solutions are proposed to make these free draining, final open cut pit depth, final backfill depth and volumes and how backfilling will be undertaken post-mining.

Response

The final landform and capping soils are described in Appendix G 'Mine rehabilitation strategy'.

The estimated closure cost in the EA was $69 m but detailed engineering estimates that include the additional works to back-fill mine voids as described in the EA have increased this estimate to $340 m (see Section 19.1). It is estimated that an additional 33 Mbcm of material would be required to completely backfill final void B so that the base was a free draining depression with a base at least 3 m above the water table. This would cost about $91 m.

Conceptual details of the drainage outlets from the final landforms in mining areas A and C are provided in Section 8.1 of the updated 'Water balance and surface water management system' (Appendix E of Appendix E). The final landform in mining area A drops about 40 m over about 3.4 km to where the runoff enters the floodplain of lower Sandy Creek. This provides a gradient of around 1 in 100, which will allow for controlled non-erosive runoff velocities. The final landform in mining area C drops about 16 m over about 1 km to where the runoff enters the floodplain of Blackheath Creek. This provides a gradient of around 1 in 50, which while relatively steep is similar to the natural gradient of the nearby upper reaches of Blackheath Creek. Measures to reduce surface water flow speeds to prevent erosion, such as rock armouring, vegetation tolerant of high flow speeds, and/or a shallower gradient meandering outlet channel, will be incorporated in the final landform.

7.2.21 Void geometry

Submission

NA-7

Issue

The DPI request further information on the details of void geometry in mining area B, as well as an assessment of evaporation from the void lake both during filling and at equilibrium and a quantification of water inputs and outputs to the lake.

Response

Figure 8.2 and Section 8.2.2.3 of the updated 'Water balance and surface water management system' (Appendix E of Appendix F) provide a typical section through the mining area B final void and the stage-volume-area relationship for the void. Section 8.2 of this appendix provides details of all inputs and outputs to the final void water balance model, including evaporation.

7.2.22 Flood impact assessment

Submission

NA-13

Issues

The DP&I made the following comments regarding the flood impact assessment:

- spoil protection and proposed levees are not identified on the map;
- the main surface water volume needs to include more details of the rail spur line flood impact assessment particularly in regards to the significant structures and embankments being constructed;
- that a more detailed assessment of the significant rail crossing of Tallawang Creek needs to be completed; and
- that further conceptual design details provided for the flood impacts predicted along Laheys Creek between the Mining Area B overburden and proposed management to manage sediment impacts along Laheys Creek needs to be completed.

Responses

Proposed spoil protection and flood levees are shown on figures 6.6 and 6.6B of the updated 'Flood impact assessment' (Appendix D of Appendix F).

Impacts of all rail spur watercourse crossings on flooding are addressed in Sections 7.1.3 and 7.2.3 of Appendix D of Appendix F. This includes conceptual design and flood modelling results of afflux for the bridge over Tallawang Creek and general mitigation measures in the riparian corridor.

Conceptual details of the waste rock emplacement protection along Laheys Creek are provided in Section 7.3.3 of Appendix D of Appendix F. The toe of the emplacement will be engineered in a similar manner to a flood protection levee. A suitable hard rock material will be sourced from within the disturbance area to construct the bottom section of the emplacement up to the 100-year ARI flood level with a freeboard of 600 mm.

7.2.23 Infrastructure crossings

Submission

NA-13

Issue

The DP&I comments that the level of detail in the report is insufficient to understand the impacts of infrastructure crossings of Laheys and Spring Creek. The DP&I requests more detailed mapping of environmentally sensitive areas such as Aboriginal heritage, permanent ponds and biodiversity.

Response

Two haul road crossings over the existing alignment of Spring Ridge Road will connect the mining area B to the CHPP and to BOOP-E out-of-pit waste rock emplacements. The design of these crossings has now been simplified as the relevant section of Spring Ridge Road, north of the intersection with the Laheys Creek Road (Brooklyn Road) route will not be a public road once the Spring Ridge Road diversion is opened.

The haul road will use pre-cast Super T girder bridge sections of sufficient width to allow two haul trucks to pass. Bridge piles will be bored to minimise disturbance in the riparian zone of Laheys Creek.

7.2.24 Activities on waterfront land

Submission

NA-7

Issue

The NOW recommends that structures proposed within 40 m of watercourses be designed in accordance with the Guidelines for Controlled Activities on Waterfront Land (July 2012). Adequate mitigating options to ensure channel and floodplain stability is also required.

Response

As described in Section 7 of the updated 'Flood impact assessment' (Appendix D of Appendix F), detailed design of the crossings will consider NOW guidelines in the design and construction of watercourse crossings including consideration of:

- minimisation of riparian corridor disturbance;
- preservation of native vegetation;
- preservation of natural hydrological and geomorphological regimes; and

- rehabilitation and stabilisation of disturbed areas and ongoing scour and erosion protection.

7.2.25 Erosion and sediment controls

Submission

NA-1

Issue

The EPA requests that additional references be considered in the preparation of the Project's erosion and sediment control plan and that this plan address all phases of activity from site preparation to mine closure. The EPA also requests that the plan be prepared and approved prior to the commencement of construction activities.

Response

The references cited by EPA will be considered in the preparation of the surface water management plans which will also address erosion and sediment control. It is proposed to prepare separate construction and operations environmental management plans. The operational surface water management plan will include measures that will continue to be implemented after mining ceases, however further management measures will be provided in the detailed mine closure plan.

7.2.26 Adequacy of monitoring

Submission

NA-7

Issue

The NOW requests the following to assess the adequacy of the monitoring measures:

- a clearer and more detailed map showing the existing flood extent for a 100 yr ARI event;
- a map of the impacts to the flood extent or the area impacted by afflux;
- clarification of the spatial extent of flow velocity and afflux impacts to understand potential impacts on land not owned by the proponent; and
- details of the key watercourse crossings for haul roads, road diversions and rail crossings.

Response

The updated 'Flood Impact Assessment' (Appendix D of Appendix F) provides:

- a more detailed map of existing and future flood extents for Blackheath, Laheys and Sandy Creek in the reaches most affected by watercourse crossings and flood protection levees (Figure 6-6B);
- afflux caused by each significant access road, haul road and rail watercourse crossing (sections 7.2.1 and 7.2.3);

- a confirmation that there will be no changes to flood levels or velocities on land not owned by CHC; and
- details of all watercourse crossings (Section 6.3.2).

7.2.27 Water Industry Competition Act

Submission

C-1

Issue

Dubbo City Council comments that the construction village may require nomination of a 'water supplier of last resort' under the *Water Industry Competition Act 2006*. The need for a licence under the Act and, if required, the organisation that is nominated as the last resort water supplier should be nominated.

Response

The proposed construction village will be a temporary facility. The EA assumes that it will be supplied with water delivered by truck purchased from an appropriate water retailer (particularly for the road transport assessment). Alternative sources available to CHC would be either its already licensed allocations from the Cudgegong River or, possibly, a new bore near the village. None of these require approval under the Water Industry Competition Act, nor nomination of 'a retailer of last resort'. However, if a new bore is required, a licence would be sought under the Part 5 of the *Water Act 1912*.

7.3 Conclusion

The updated surface water assessment considers the changes to the Project and addresses a range of comments from agencies and councils.

The changes to the Project and refinements to the groundwater assessment do not materially change the surface water impacts described in the EA, with decreased generally downstream impacts. As stated in the EA, a detailed surface water management plan will prepared.