Lamberts North Water Conditioned Fly Ash Placement Water Quality Monitoring

Annual Update Report for 2014/15

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Summary

Aurecon has been engaged to assist EnergyAustralia NSW in their statutory reporting on the surface and groundwater monitoring at the Lamberts North ash placement site. Specifically, Aurecon's brief is to:

- Review the water quality, trace metal and groundwater level data for potential effects of the dry ash placement at Lamberts North on receiving surface water and groundwater. The aim of the review is to try to determine the effects, if any, of the Lamberts North site above that indicated in the first annual report as originating from the Mt Piper ash placement and local coal mine groundwater. The review covers both the post-placement period from September, 2014 to August, 2015 and the long-term data base from the pre-placement baseline period of October, 2012 to August, 2013 and the initial post-placement period of September, 2013 to August, 2014.
- Comment on the effects of water quality changes at the Mt Piper bores D10 and D11 on the assessment of effects of the Lamberts North dry ash placement on water quality and review the Mt Piper surface and groundwater data as background to the Lamberts North placement
- Determine if groundwater level changes at the seepage detection bore MPGM4/D1, down-gradient of Huon Gully, can indicate water level changes inside the ash placement area
- Review a consultant report by Cardno (2015) on the aquatic life condition in Neubecks Creek.

The key findings of the water quality data review are:

- The review indicated no significant effects of the Lamberts North dry ash placement on the surface or groundwater. The findings were:
    - All the water quality and trace metal concentrations met the local and ANZECC (2000) guidelines for surface water in the Neubecks Creek at the receiving water site WX22.
    - Other than the salinity and sulphate concentrations, most of which is considered likely to have originated from Mt Piper, as well as coal mine related iron and manganese concentrations, the ANZECC groundwater guideline trigger values and local goals were met at the receiving groundwater bore D9, while all the concentrations at bore D8 were all lower than the trigger values.
- The use of an unlined rainfall runoff collection pond in the ash area (see LN Pond 1 coloured dark blue in Figure 1) has the potential to add to the local groundwater concentrations coming from the Mt Piper area via Huon Gully. However, no significant effects are expected if a lined pond was used (as required by the Operational Environmental Management Plan, OEMP, by CDM Smith, 2013). Accordingly, it is recommended that 12 months of groundwater data be collected at the two bores to be installed in the northern embankment wall, to be used to assess the potential effects of the use of an unlined pond.
- As no adverse water quality effects of the Lamberts North site could be identified, no ameliorative measures are indicated in the report.
- The reports by GHD (2014) and Cardno (2015) on the aquatic life in Neubecks Creek found that the macroinvertebrates were already in a poor condition due to the mineralised water quality characteristics of the local surface and groundwater. The AUSRIVAS biotic indices showed no significant differences from the upstream background site in Neubecks Creek with

that near the downstream receiving water site at WX22. The lack of effects on the biotic indices indicated that the aquatic life had adapted to the local mineralised conditions in the creek. Due to the complex interactions between the various sources of water quality inputs to the creek and the effect of variations in stream flow on the concentrations, as well as the abundance of aquatic life, Cardno (2015) considered it was unlikely that effects of the Lamberts North dry ash placement on aquatic life, if any, could be resolved from those due to the other inputs. In addition, the existing poor condition of the creek and its macroinvertebrate community meant that detection of a significant change near WX22 would be difficult, with no certainty of attributing the effects to the ash placement.

The review recommends EnergyAustralia NSW should review the use of temporary unlined runoff collection ponds, as this practice may adversely affect groundwater quality. In addition, the OEMP should be updated to reflect the installation of the two groundwater bores in the northern embankment, once they become part of the routine monitoring program.

1. Introduction

Placement of water conditioned flyash in the Lamberts North site (coloured orange in Figure 1) has been undertaken in the re-contoured Huon Gully since September, 2013. Surface and groundwater monitoring for the Lamberts North placement began in October, 2012 and essentially follows the plan set out in the now modified Operational Environmental Management Plan[1] (OEMP, CDM Smith, 2013).

The water quality sampling sites, including the receiving waters for groundwater at bores MPGM4/D8 and D9, as well as surface water in Neubecks Creek at WX22, are shown on an aerial photograph of the Mt Piper and Lamberts North areas in Figure 2. The ash placement contours for the Mt Piper and Lamberts North sites in January, 2015 are shown in Figure 1.

Other than use of the existing Mt Piper groundwater bores in the area surrounding the Lamberts North ash placement, one of the approval conditions for the OEMP was that groundwater bores are not to be installed in the ash itself. Accordingly, the first annual water quality report for 2013/14 found that the effects of the dry ash placement, if any, could not be distinguished from the dominant effects of coal mine groundwater flows, from under the Mt Piper brine conditioned ash area, which is currently exhibiting higher than predicted chloride levels, which is subject to ongoing third party investigations. It should be noted that the groundwater flows from under the Mt Piper ash area flow down Huon Gully and it was previously shown to be affecting the water quality at bore D9 (Aurecon, 2015).

As no groundwater bores were installed within the ash placement site, the effects of rainfall runoff on the local groundwater quality or levels are unknown. Subsequently, EnergyAustralia NSW has advised that two groundwater bores will be installed in the northern embankment of the Lamberts North site in late 2015 to monitor the groundwater quality and levels. This is discussed further in Section 4.

Due to the current inability to monitor rainfall infiltration into the dry ash placement, this second annual report assesses the effect of the Lamberts North ash placement area on surface and groundwater by estimating the rainfall infiltration through the dry ash and the effects, if any, of the resulting seepage on the local groundwater and Neubecks Creek (see Section 3).

The aerial photograph in Figure 2 shows the relationship between the surface and groundwater quality monitoring sites, the two Mt Piper brine conditioned co-placement areas, the Mt Piper water conditioned ash placement area and the Lamberts North water conditioned placement in Huon Gully. To assess the effects of ash leachates that may enter Neubecks Creek on aquatic life, monitoring for macroinvertebrates was undertaken in Neubecks Creek at the OEMP nominated sites upstream and downstream of the intersection with Huon Gully[2] during the ash pre-placement, construction phase

[1] EnergyAustralia NSW advised Aurecon that in setting up the monitoring program, they took into consideration the practicalities of applying a consistent approach to each sampling site.

[2] The OEMP is required to monitor and quantify the impacts on the ecology of Neubecks Creek and the associated riparian environment. The main focus of the GHD (2014) report was to analyse and investigate if any changes in macroinvertebrate

and post-placement to early 2014 by GHD (2014). The spring (November) 2014 sampling was undertaken by Cardno (2015) for the current reporting period.

This report is the second annual surface and groundwater quality monitoring report and covers a pre-ash placement period from October, 2012 to August, 2013 and post-initial ash placement period from September, 2013 to August, 2015. The pre-ash placement monitoring has been used to establish the 2012/13 baseline conditions for the site. The post-placement water quality data has been examined for indications of leachates from the Lamberts North water conditioned ash[3] into the local groundwater. However, as the ash is placed in Huon Gully, the point at which up-gradient groundwater flows previously accumulated in the Groundwater Collection Basin (GCB), the assessment of effects has been undertaken by the rainfall infiltration approach mentioned above and described in Section 3.

The locally derived and ANZECC (2000) guideline trigger values for the groundwater and surface water receiving waters, set out in the Mt Piper Brine Conditioned Ash Water Management Plan (Connell Wagner, 2008), have been adopted as the Lamberts North ash placement environmental goals in the OEMP. Some of these goals have been adjusted using the Lamberts North pre-ash placement baseline data to ensure that any Mt Piper water and brine conditioned ash effects are not assigned to the Lamberts North placement. The effects, if any, of the Lamberts North placement on the receiving waters of Neubecks Creek, and the surrounding groundwater, have been assessed by comparison with these goals.

1.1 Outline of Report Structure

The report is structured to cover the issues in the EnergyAustralia NSW brief and includes:

- Describe the surface and groundwater quality monitoring program
- Describe the surface water rainfall runoff management and its importance to minimising infiltration into the local groundwater
- Assessment of effects, if any, of the dry ash placement on surface and groundwater quality, during the 2014/15 post-placement period, by estimating the rainfall infiltration through the dry ash and the resulting seepage of ash leachates into Neubecks Creek and the groundwater at the receiving water bore D9. The assessment takes into account the Mt Piper and local coal mine groundwater inflows to Huon Gully, as well as the effects of conditioning the ash with cooling tower blowdown water
- Review the aquatic life monitoring in Neubecks Creek undertaken by Cardno (2015)
- Discuss the findings including potential exceedances of the environmental goals and the potential necessity for mitigation measures
- Present conclusions and recommendations.

community condition were evident in Neubecks Creek. Visual estimates of riparian vegetation cover are shown in an appendix to the report.

[3] The Lamberts North ash is conditioned with Mt Piper cooling tower blowdown water with a chloride concentration of about 250 mg/L. The blowdown water is also sprayed onto the ash to minimise dusting.

The sequence of surface and groundwater quality findings, assessment and inferences drawn has been followed throughout the report.

1.2 Aims and Objectives of Monitoring

The Lamberts North OEMP for the water conditioned dry ash placement sets out the surface and groundwater quality monitoring to be undertaken to provide feed-back for ash placement and surface rainfall runoff management. The aim of the monitoring is to ascertain whether or not leachates[4] from the water conditioned fly ash cause a significant increase in concentrations above the local/ANZECC (2000) guideline trigger values (environmental goals) in surface and/or groundwater receiving waters. The overall environmental aim is to have a neutral or beneficial effect of the ash placement, after consideration of the naturally mineralised conditions in the area, on water quality in receiving waters. In the event that the monitoring shows increases above the environmental goals at the groundwater bores MPGM4/D8 and D9 or in Neubecks Creek at WX22, the effects of the ash placement are expected to be reduced through implementation of mitigation measures.

A most important consideration in the OEMP is that ameliorative measures are only to be implemented if exceedances of the local/ANZECC (2000) trigger values are observed and are considered likely to be attributable to the operation of the Lamberts North ash placement. Such attribution is to be based upon a targeted investigation of the likely sources of the salts or trace metals that caused the environmental goals to be exceeded, as well as the process by which the Lamberts North placement could have introduced leachates into the local groundwater.

If the monitoring shows a significant pollution event down-gradient of the ash area, the OEMP suggests the submission of a report to the relevant Authorities that provides a description of the proposed ameliorative measures, including a timeframe for the management actions to be implemented. This could allow informed consideration of the findings of the targeted investigation of the likely sources and causes.

To be consistent with the Mt Piper Brine Conditioned Ash Water Management Plan, the Lamberts North OEMP has adopted the approach of having early warning of potential effects on groundwater and surface water. This is achieved by comparison of the measured post-placement median concentrations of parameters of interest with the relevant local (90th percentile) and ANZECC (2000) trigger values at the groundwater bores D8 and D9 and in Neubecks Creek at WX22. The intent of this approach is to allow the ash placement managers time to investigate the cause of any early warning trigger being exceeded and to implement mitigation measures if the cause is the water conditioned ash placement. It should be noted that the comparisons made in this report take any changes in water quality at the upstream sites in Neubecks Creek into account. This practice is also followed for the Mt Piper Brine placement surface and groundwater monitoring.

[4] Leachates could be due to surface runoff from the ash placement into the local groundwater, by direct rainfall infiltration through the ash into the underlying groundwater or by a rise in the groundwater table under the ash causing salts and trace metals to be leached from the ash.

For the purposes of the OEMP, the final receiving waters are taken as being Neubecks Creek, just downstream of the ash placement area at WX22 (Figure 2) and the ANZECC (2000) guidelines and local guidelines for surface water apply to WX22. The ANZECC (2000) guidelines and local guidelines for the groundwater and surface water receiving waters are shown in Table 1 in Section 2.7, which also shows the 2012/2013 pre-placement baseline 90th percentile concentrations for Lamberts North.

1.3 Issues and Challenges

The groundwater monitoring plan (Section 6.4 of the OEMP) for Lamberts North does not include a background bore to enable the local coal mine or coal washery area groundwater inflows to Huon Gully to be taken into account. This means that any observed water quality changes at bores D8 and D9, relative to the local/ANZECC goals, cannot be fully understood. To address this matter, EnergyAustralia NSW has advised that additional groundwater bores are to be installed in late 2015 at the sites described in Section 5.1.

The internal ash placement bores MPGM4/D10 and D11 are included in the Lamberts North monitoring program to provide data on the groundwater quality flowing into Huon Gully from the Mt Piper placement. These bores provide early warning of potential effects of Mt Piper on the seepage detection bore D1 and the receiving groundwater bore D9, which are located between the ash area property boundary and Neubecks Creek. The challenge in reviewing the Lamberts North placement in Huon Gully is to assess potential effects on receiving waters, recognising that the ash placement is in the path of the coal mine groundwater flows from under the Mt Piper placement (possibly enriched with brine leachate[5]).

Prior to 2015, the groundwater flows down Huon Gully also included rainfall runoff from the Mt Piper water conditioned ash area. EnergyAustralia NSW has advised that surface runoff from the Mt Piper Ash Repository has been redirected from Huon Gully to a Retention Pond near bore D11 through a subsurface drain to the Lamberts North Ash Repository LN1 Pond, and then through another subsurface drain to the lined LN2 pond, at the southern end of the repository.

1.4 Scope

Aurecon has been engaged by EnergyAustralia NSW to prepare the second annual review report on surface and groundwater quality for the Lamberts North dry ash placement. The scope includes the following:

- Collate and set up a new database for the water quality characteristics at Lamberts North surface and groundwater monitoring sites[6]

[5] Cause of the elevated chloride is to be confirmed by examination of data from the new bores installed in the Mt Piper ash area in December, 2015

[6] The water quality characteristics and monitoring sites described in the Development Consent Conditions referred to under condition A1b (from SKM 2010) - see Attachment 4 below. Aurecon has been requested to report on the water quality characteristics monitored by EnergyAustralia NSW at the OEMP nominated sites.

- Review surface and groundwater water quality, trace metal and groundwater level data for the pre-placement baseline period of October, 2012 to August, 2013 and the post-placement period of September, 2013 to August, 2015 and report on potential effects on receiving surface water and groundwater[7].
- Review the EnergyAustralia NSW groundwater data for the four bores installed in the Lamberts North area[8], as well as bore MPGM4/D19, which samples groundwater in washery waste or mine spoil outside the Lamberts North ash placement area, for possible interaction with Huon Gully and Neubecks Creek water quality
- Comment on the effects of water quality changes at the Mt Piper bores D10 and D11 on the assessment of effects of the Lamberts North placement on water quality in receiving surface water in Neubecks Creek[9]
- Examine the need for mitigation measures in relation to potential for Lamberts North to exceed the ANZECC (2000) guidelines and local guidelines for surface and groundwater.
- Ecological Monitoring Program (Aquatic ecology - macroinvertebrates aquatic habitat). Review the 2015 report by Cardno on the aquatic life data sampling in Neubecks Creek during the 2014/15 post-placement period, including any detected adverse ecological impacts due to the Lamberts North ash placement.

1.5 Information provided by EnergyAustralia NSW

In connection with the assignment, EnergyAustralia NSW has provided copies of the following data and information (the sampling sites referred to are shown in Figure 2):

- Ash Placement Area Contours in January, 2015 (Figure 1) showing the areas and elevation of the placed ash and surface water runoff ponds used for management[10], including:
  - an unlined pond to collect rainfall runoff (Temporary pond over furnace ash),
  - subsurface drain for directing runoff water to a lined pond (LN Pond 2)
- Lamberts North groundwater bore water quality data for bores MPGM4/D1, D10, D11, D8, D9 and D19
- Water level data for the groundwater bores
- Mt Piper surface water quality monitoring data at the power station Licence Discharge Point LDP1 (v-notch below the Holding Pond), used as up-stream background, the aquatic life background site NC01 and at the Neubecks Creek receiving water site at WX22.
- Discharge flow data for the LDP01 v-notch is shown in Attachment 5.

[7] The assessment includes the two receiving water bores MPGM4/D8 and D9 nominated in the OEMP, which are located north and south of Neubecks Creek (the bores replace the Groundwater Collection Basin as the groundwater receiving waters for Lamberts North since July, 2013) and is intended to provide warning of potential effects of local groundwater seepage on Neubecks Creek.

[8] Examination of the bore logs for bores (MPGM4/D15 to D18) indicates that they were drilled into rock and are not sampling the groundwater in the washery waste or mine spoil in the area. The scope requires this matter to be addressed in the report.

[9] The Lamberts North Site does not have a background bore as the water quality at bores D10 and D11 are used to indicate inflows to the site from Mt Piper. The scope requires this matter to be commented on in the report.

[10] No water quality data was available for the temporary pond or the LN Pond 2

- Stream flow data for WX22 gauge 212055 in Neubecks Creek is available from Department of Primary Industries Office of Water (http://realtimedata.water.nsw.gov.au/water.stm).

EnergyAustralia NSW has advised Aurecon that placement of water conditioned ash began in Lamberts North on 2nd September, 2013.

1.6 Lamberts North Water Conditioned Ash Placement and Rainfall Runoff Management

The current January, 2015 contours of the dry ash placement areas are shown in Figure 1 and the water conditioned ash already placed in Lamberts North is shown in orange. Prior to commencement of ash placement, the groundwater level in Huon Gully was reduced to approximately RL901m by pumping, at which level the sediment bottom of the Groundwater Collection Basin (Huon Void) was exposed. The Huon Void was then filled with compacted mine spoil to RL917m, 4m above the highest estimated groundwater level as recommended by the CDM Smith (2012) model. The model indicated that groundwater levels across Lamberts North were at their maximum during wet weather patterns and suggested that groundwater levels were expected to remain at least 4m below the base of the dry ash placement. Therefore, effects of groundwater flows, or level rises, in Lamberts North on leaching salts and trace metals from the ash placement was not predicted to occur. This prediction will be examined with installation of the two bores in the northern embankment in late 2015 (see Section 5.1).

An embankment made of compacted mine spoil was constructed at the northern end of Huon Gully to retain the ash placement as it is progressively placed up to the design height of RL980m and joined with the ash placement at Mt Piper (see CDM Smith, 2013).

1.6.1 Rainfall Runoff Management

Rainfall runoff management is important in preventing runoff from entering the groundwater under the ash placement. The previous report showed, in Figure 1 of Aurecon (2015) an unlined pond (LN Pond 1) to collect rainfall runoff from the Lamberts North site and a pipeline for sending the runoff water to a lined pond (LN Pond 2) at the southern end of Huon Gully. EnergyAustralia NSW has advised that ash was placed over the original LN Pond 1 between 9th July and 14th January 2015 and it was replaced by a temporary, unlined, containment pond located on furnace ash. The collected runoff water that seeps through the bottom of LN Pond 1 is understood to be drained to the southern, lined, LN Pond 2 through the subsurface pipes, shown as blue lines, in Figure 1. Furnace ash is a coarse material that is free draining, so the potential effects of seepage through the bottom of LN Pond 1 on the local groundwater and Neubecks Creek is examined in Section 3.

The use of an unlined pond on furnace ash to collect the rainfall runoff is not in agreement with the Conditions of Approval (CoA)[11] requirement that rainfall runoff, including spray irrigation for dust

[11] CoA, C13 - Surface water drainage must be appropriately engineered and stabilised to convey run off without collapse or erosion. Surface water run off collection ponds are to be lined.

suppression, be retained in lined ponds, designed to hold a 50 year ARI rainfall event, to minimise infiltration into the ash.

Mitigation measures - Design of pond sizes on the basis of catchment areas and where possible sized to a target of minimum 50 year ARI event

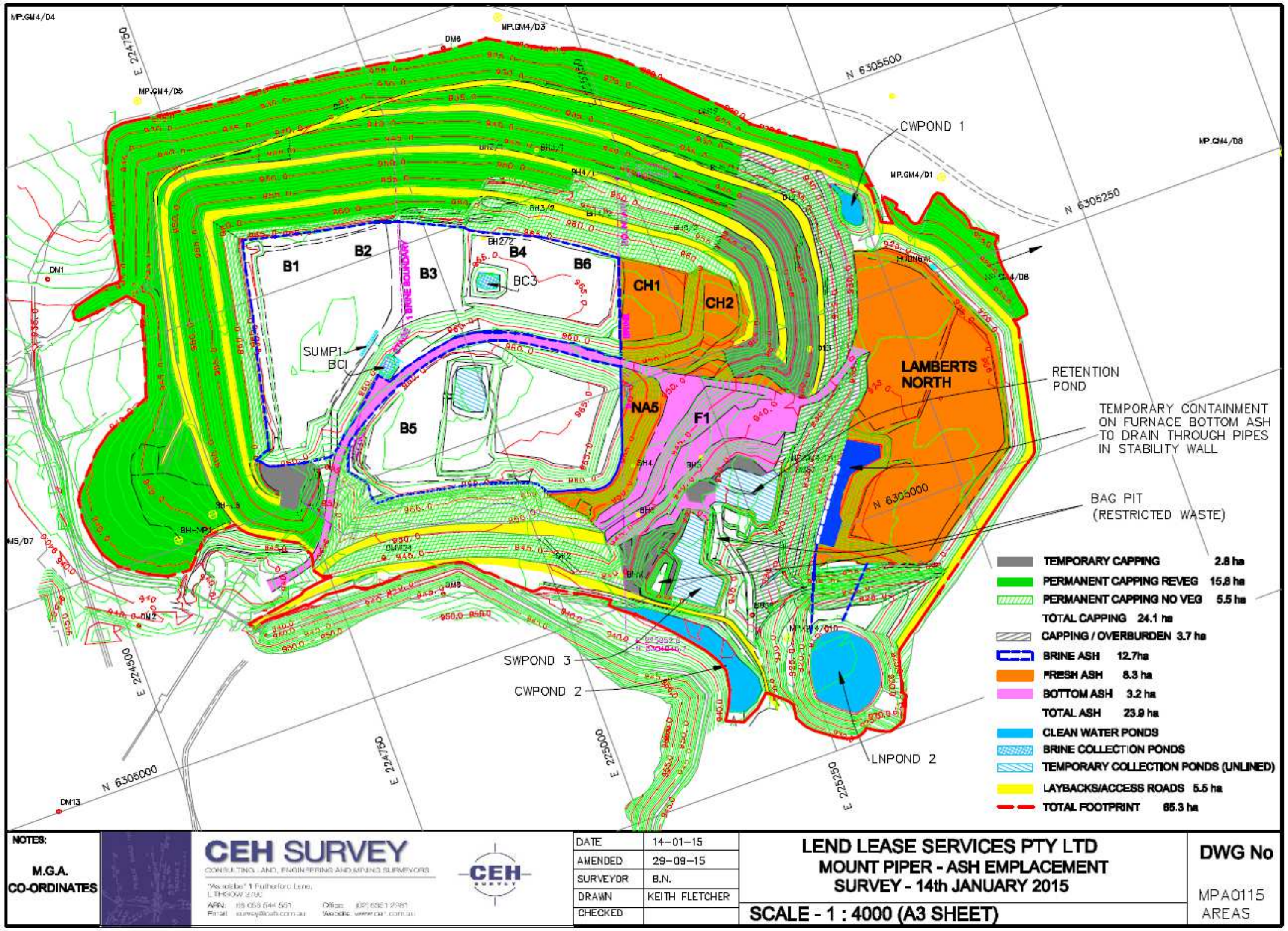

Figure 1: Mt Piper Power Station Brine Conditioned Ash and Lamberts North Placement (Orange) Area contours in January, 2015. Mt Piper Water Conditioned Ash Rainfall Runoff Pond (SW3) replaced by Retention Pond and Lamberts North Ash Runoff Pond (LN Pond 1, dark blue) replaced by Temporary Containment Pond, piped to lined Runoff Pond (LN Pond 2)

2. Surface and Groundwater Monitoring

This Section provides an overview of the groundwater and surface water quality monitoring at the Lamberts North dry ash placement during the period 2012 to August, 2015. The monitoring design, management of the water conditioned ash placement and receiving water quality guidelines are set out in the Lamberts North Operational Environmental Management Plan (CDM Smith, 2013).

The groundwater monitoring program was established in October 2012 and involves monthly sampling at the bores shown in Figure 2, which includes both long-term Mt Piper monitoring bores and bore D19 to the east of the Lambert North site. Bores D15 to D18, in the southern area of the Lamberts North site, are located around the previous Centennial Coal Mine open-cut area, which is now part of the Centennial coal washery, located in the south-east of the site. Those bores are not used in this, or the previous report, because they sample groundwater in the basement rock rather than coal washery waste or mine spoil. Although D19 is east of Huon Gully, it is outside the ash placement area, but it samples washery waste/mine spoil in that area and provides information on groundwater flowing towards Neubecks Creek.

The Mt Piper ash placement area bores (MPGM4/D10 and D11) are on the western side of the Lamberts North ash placement area and are used to monitor groundwater inflows from Mt Piper to the ash placement in Huon Gully. Bore D1 is north of Huon Gully and is used for detection of seepage from the north-eastern Mt Piper brine placement. However, it should be noted that bore D1 has been assumed by the OEMP to be the seepage detection bore for the Lamberts North placement. Similarly, although the groundwater bores D8, north of Neubecks Creek, and D9[12] south of the creek, are used as the Mt Piper receiving water bores, they are also assumed by the OEMP to be the receiving water bores for the Lamberts North placement.

Hence, bores D1, and D8 and D9, are used to provide a warning of leachates that may enter Neubecks Creek to enable management actions to be undertaken to minimise effects of both the Mt Piper brine and the Lamberts North water conditioned ash placements. The dual uses of these monitoring bores caused the previous report to conclude that the Lamberts North placement could not be distinguished from the dominant effects of the Mt Piper/coal mine groundwater flows down Huon Gully toward Neubecks Creek (Aurecon, 2015). In an attempt to overcome this problem, the amount of rainfall infiltration into the Lamberts North ash, and its potential effects on surface and groundwater has been investigated and is discussed in Section 3.

[12] Bore D9 has been monitored by EnergyAustralia NSW because it was listed Table 6-13 “Monitoring Schedule” but inclusion of the bore was not discussed in the OEMP or shown in shown in Figure 5-1 “Monitoring locations” or in Figure 6-2 “Groundwater Monitoring Locations (MPGM4 Series)”

Figure 2: Lamberts North Ash Placement Area and Neubecks Creek Groundwater and Surface Water Quality Monitoring Sites

2.1 Surface Water

As well as routine monitoring of water quality in Neubecks Creek at WX22, the ash placement contractor, Lend Lease Infrastructure (LLI), monitored the water quality of rainfall runoff from the ash placement area during the first year of operation of the ash placement. However, EnergyAustralia NSW has advised that the runoff water quality data has not been collected during 2014/15[13] because the runoff pond LN1, has been covered with ash and replaced by a temporary pond over the furnace ash.

To provide a background benchmark to the WX22 receiving water site, the sampling sites LDP01, and the new NCO1, upstream on Neubecks Creek have been monitored monthly prior to ash placement and have continued to be monitored for comparison with results from WX22, downstream of Huon Gully (Figure 2).

2.2 Groundwater

Prior to construction and ash placement, groundwater monitoring started in October, 2012. It was conducted at monthly intervals to establish baseline results for the bores located inside and outside the Lamberts North area. Monthly monitoring has continued since ash placement began in September 2013. Additionally, groundwater down-gradient of Lamberts North is monitored at bores MPGM4/D1, D8 and D9 to detect groundwater seepage moving from the ash placement area toward Neubecks Creek.

The groundwater bore characteristics of water table depth, collar level and height of the PVC pipe were checked previously in 2011 and again in March, 2014 (see Attachment 3) in relation to the recent chloride increase at bore D10 and the associated groundwater level changes. These characteristics have been used to convert the groundwater level measurements, which are taken from the top of the pipe, to relative levels below the ground surface in AHDm.

2.2.1 Groundwater Levels

The OEMP places emphasis on the need to understand water level changes taking place in the ash placement in Huon Gully and uses bore D1 as a surrogate. Each groundwater bore is monitored to allow identification of the direction of water movement and, in the case of the bores installed for Mt Piper, to measure the predicted groundwater level rise due to mounding under the large water conditioned ash placement area. Note that the layer of compacted mine spoil placed in Huon Gully was designed such that the expected increase in height of the water table in Huon Gully would not come into contact with the bottom of the Lamberts North ash placement. The water level monitoring data for the groundwater bores monitored for Lamberts North since October, 2012, including bore D1, are shown in spread-sheet format in Attachment 1.

2.3 Groundwater Modelling Verification

Verification of the groundwater model prediction of a groundwater level rise lower than the base of the ash placement was suggested to be undertaken in the OEMP if there was a significant increase in the groundwater level at D1. The OEMP suggested that, if there is any significant increase, flow calculations should be undertaken and consideration given to re-running the CDM Smith (2012)

[13] The OEMP has no requirement for rainfall runoff water quality monitoring in the ash placement area, only use of a lined pond to minimise rainfall infiltration into the groundwater.

groundwater model. This suggestion is further discussed in Section 3.1.1 in relation to the review of water level changes during 2014/15.

2.4 Methods

The surface and groundwater water quality characteristics monitored at each site are shown in Attachment 1. Sampling and analyses are undertaken as required on behalf of EnergyAustralia NSW by NALCO Analytical Resources[14], who measure conductivity, pH and dissolved oxygen in the field with a calibrated instrument and all other parameters in their NATA Accredited Laboratory. EnergyAustralia NSW has provided a copy of the NALCO laboratory data to Aurecon for the 2014/15 assessment, as well as the longer database from October, 2012 for examination of long-term changes.

EnergyAustralia NSW monitors the discharge flow at the Mt Piper Power Station to Neubecks Creek at a v-notch (see Attachment 5) and the NALCO samplers note if the creek is flowing at the stream flow gauge 212055 near WX22 gauge in Neubecks Creek. The stream flow data is available from Department of Primary Industries Office of Water (NOW) at http://realtimedata.water.nsw.gov.au/water.stm.

The OEMP requires the water quality and trace metal concentrations to be measured by the methods specified in DEC (2004). This method requires that all trace metal concentrations, except for iron and manganese, are measured on unfiltered samples. At collection, unfiltered trace metal samples are preserved with nitric acid and concentrations are measured on samples using the “acid extractable” method. This involves addition of hydrochloric acid and heating for 15 minutes on a steam bath, as set out in Standard Methods.

Since July, 2012, EnergyAustralia NSW has been determining the concentrations of aluminium, copper and zinc in filtered water collected at both the Mt Piper Licence Discharge Point LDP01 and at the Neubecks receiving water site, WX22. Similar filtered trace metal tests have been undertaken at the new upstream site NC01 since October, 2012. The trace metal tests were undertaken on filtered samples to give dissolved, rather than total “acid extractable” concentrations, because the ANZECC (2000) guideline trigger levels are based on ionic metals (eg Cu^{2+}), which are difficult to measure, and the dissolved concentrations would be closer to that of the ionic trigger values.

However, the Local/ANZECC (2000) trigger value environmental goals for surface water (see Table 1, Section 2.6) are based on unfiltered samples measured by the “acid extractable” method. As the dissolved concentration data is obtained by filtering the samples, it is not consistent with the environmental goals shown in Table 1, which are based on unfiltered samples, the filtered data has not been used in this report.

To allow comparison with the ANZECC (2000) guideline trigger levels, for those trace metals that do not have a locally derived trigger (such as arsenic), EnergyAustralia NSW began low detection limit (DL) testing for trace metals in April/July, 2006, so that all the metals, except silver, were measured at DLs lower than the ANZECC trigger levels. In this report, trace metal data shown as less than the DL are treated in the following way to be consistent with the previous reporting of trace metals at Mt Piper. When the concentration is less than the DL, and the DL is less than the trigger level shown in Table 1, the concentration has been assumed to be the same as the DL. In the event that the laboratory

[14] Nalco has NATA accreditation Number 1099 and is accredited for ISO/IEC 17025

reports the DL as higher than the ANZECC trigger level, the concentration of the metal is assumed to be half of the DL.

EnergyAustralia NSW has advised that silver has continued to be analysed at a higher DL than the guideline trigger value of 0.00005 mg/L because the matrix of elements present in the water samples prevents NALCO from measuring concentrations at the ANZECC (2000) guideline trigger value level (see Attachment 1). The silver data has continued to be tested at <0.001 mg/L, which is 20 times the ANZECC (2000) guidelines, so it has not been assessed in this report. As recommended in previous reports for the ash placement at Mt Piper, it is suggested that silver cease to be monitored as it provides no useful information.

Groundwater level measurements are undertaken at each bore using a dip meter, from the top of the bore pipe, before being bailed or pumped out. NALCO remove three bore volumes as suggested by the groundwater standard - 1998d, AS/NZS 5667.11:1998: Water quality – Sampling. Part 11: Guidance on Sampling of Ground Waters. After pumping, the water in the bore is allowed to recharge to a level suitable for sampling.

The OEMP requires level measurements to be undertaken as the "Total Bore Depth"[15] and "Recharge During Sampling". To be consistent with the OEMP, and to be consistent with the previous reporting for the Mt Piper ash placement, the groundwater level before bailing/pumping is shown as Water Level 1 (WL1) in Attachment 1 and is called "Total Bore Depth".

It is noted that the OEMP does not define the meaning of "Recharge During Sampling", which is shown in relation to "Groundwater connectivity" in Table 7-1 of the OEMP. Nor does the OEMP define the meaning of "Groundwater connectivity". Due to this situation, EnergyAustralia NSW has advised Aurecon that they have taken "Recharge During Sampling" to mean the groundwater level when it has refilled, to a level suitable for sampling, after the bore was bailed or pumped out. They have called this level the "Recharge Bore Level". As the refill level that is suitable for sampling is arbitrarily decided by the samplers, the usefulness of the "Recharge Bore Level" data is questionable and undefined, so it has not been used in this report.

To be consistent with the OEMP and previous reporting for the Mt Piper ash placement, the groundwater level during sampling, after bailing/pumping, is shown as Water Level 2 (WL2) in Attachment 1 and is called "Recharge During Sampling".

2.5 Guidelines

The Protection of the Environment Operations Act requires consideration of the ANZECC (2000) guidelines when assessing potential effects on water quality in receiving waters. To achieve this, the OEMP uses the locally derived and ANZECC (2000) guideline trigger values developed for the Mt Piper Brine Conditioned ash as the local environmental goals for the Lamberts North ash placement. The guideline trigger values apply to the receiving waters of the ash placement seepage, which are taken as being the two groundwater bores MPGM4/D8 and D9 and Neubecks Creek at WX22 (Figure 2). Hence, the Local/ANZECC (2000) trigger values shown in Table 1 for groundwater apply to bores D8 and D9[16] and the surface water guidelines apply to WX22, which is the final receiving water site for the Lamberts North ash placement.

[15] EnergyAustralia NSW calls "total bore depth" either "Initial Bore Level" or "Bore Water Level".

[16] These bores replace the now de-watered and filled Groundwater Collection Basin (Huon Gully Void). The Mt Piper pre-placement background concentrations shown in Table 1 are based on pre-2000 data at the Mt Piper background bores and the Groundwater Collection Basin. They have been applied to these bores for assessing long-term effects of the Mt Piper brine

The Local/ANZECC (2000) trigger values for trace metals used in Table 1 were developed for unfiltered samples, in both surface and groundwater, to establish the pre-placement baseline for Mt Piper ash placement. The baseline data were collected prior to November, 2000 and are consistent with the DEC (2004) requirement for measurements on unfiltered samples.

The ANZECC Guidelines for Groundwater Protection in Australia (ANZECC,1995) and the NEPC (1999) require the background water quality in groundwater bores to be taken into account. As the NEPC (1999) did not define the meaning of “background” concentrations, the baseline concentrations were defined in previous reports for the Mt Piper ash placement as the 90th percentile of the pre-placement concentrations for naturally mineralised, highly disturbed groundwater (condition 3 waterbodies), or the ANZECC guideline default trigger values, whichever is higher.

The pre-placement 90th percentiles that are higher than the default trigger values, are the local guidelines, which are shown in bold in Table 1. The local guidelines for salinity, chloride and sulphate take into account the protection of freshwater aquatic life (via groundwater seepage into Neubecks Creek), livestock, irrigation water or drinking water guidelines. Table 1 shows that the guidelines for groundwater may be different from those used in Neubecks Creek, where the effects on aquatic life are considered.

conditioned ash placement on receiving waters since 2013 and have now been approved, in the OEMP, for use to assess the effects of the Lamberts North placement.

Table 1. Pre-2000 90th Percentile Baseline concentrations and Local/ANZECC (2000) Trigger Value Environmental Goals for the Groundwater Receiving Waters and Neubecks Creek with Lamberts North adjusted pre-placement 90th Percentile Goals applying to bores MPGM4/D8 and D9 and WX22 (bold and parentheses)

Element (mg/L)	Groundwater Collection Basin Pre-placement 90th Percentile	Groundwater ANZECC or Local Guidelines#	Neubecks Creek at WX22 Pre-placement 90th Percentile	Surface Water ANZECC or Local Guidelines#
General Water Quality				
pH		6.5 – 8.0	6.7-7.8	6.5 – 8.0
Cond/ (uS/cm)	1576	2600^	894	2200
TDS	1306	2000	580	1500^
Cl	31.5	350	22	350+
SO4	824	1000 **(1170)!**	332	1000++
Trace Metals				
As	0.001	0.024	<0.001	0.024
Ag	<0.001	0.00005	-	0.00005
Ba	0.037	0.7	0.029	0.7+++
Be	0.001	0.1	<0.001	0.1
B	0.244	0.37 **(0.55)!**	0.09	0.37
Cd	0.002	0.002	<0.001	0.00085
Cr	0.001	0.005	<0.001	0.002
Cu	0.001	0.005 **(0.0075)!**	<0.001	0.0035 **(0.005)!**
F	0.435	1.5	0.338	1.5+++
Fe	0.664	**0.664 (15.9)!**	0.281	0.3+++
Hg	<0.0001	0.00006	-	0.00006
Mn	5.704	**5.704 (8.57)!**	0.72	1.9
Mo	0.001	0.01	<0.001	0.01+
Ni	0.5509	**0.5509**	0.005	0.017 **(0.051)!**
Pb	0.001	0.005	<0.001	0.005
Se	0.002	0.005	<0.001	0.005
Zn	0.908	**0.908**	0.116	**0.116**

* high detection limits used when determining the baseline concentrations – see text

^ 2000 mg/L TDS/0.77 for groundwater; 0.68 x 2200 uS/cm low land river conductivity protection of aquatic life

\# ANZECC (2000) guidelines for protection of freshwaters, livestock, irrigation water or drinking water. Local guideline based upon 90th percentile pre-brine placement are shown in **bold** without parentheses – see text.

Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Current Ca, Mg in GCB 147, 113 mg/L: in Neubecks Creek 19.7, 11.8 mg/L, respectively.

\+ irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L ++ Livestock +++ drinking water

! Lamberts North from pre-placement 90th Percentile baseline for October 2012 to August, 2013 at MPGM4/D9 and Neubecks Creek at WX22 in **parenthesis**

As the local/ANZECC trigger values shown in Table 1 are based on data pre-2000, any increases to the background water quality since then due to inputs from the catchment, including from the Mt Piper ash placement, prior to September, 2013, need to be taken into account so they are not assigned to the Lamberts North placement. This was achieved by calculating the 90th percentile of the pre-placement data at bores D8 and D9 and at WX22[17] from October, 2012 to August, 2013. The resulting increases in the 90th percentile baselines, that are applicable to Lamberts North only, are shown in bold and parenthesis in Table 1[18].

2.5.1 Early Warning of Water Quality Changes

As described in the OEMP, it is necessary to provide an early warning of water quality changes to allow time to undertake targeted investigations of the cause and to implement control measures before the environmental goals are exceeded at the receiving water sites. An early warning is triggered when the post- 50th percentiles for the various elements at the receiving water sites exceed their pre-placement 90th percentiles. This is supported by sampling at bore MPGM4/D1, one of the Mt Piper groundwater seepage detection bores, which has been used to provide an early warning of potential future changes at the surface and groundwater receiving waters. The OEMP has nominated that bore to provide early warning of water quality and water level changes possibly taking place due to the Lamberts North ash placement.

The aim of any targeted investigations that arise is to determine if the changes are due to the water conditioned ash placement or some other cause. If the increases are due to the placement, mitigation measures could be implemented to avoid parameter concentrations approaching or consistently exceeding the relevant ANZECC and local guideline goals in the groundwater at either bore D8 or D9 or at the Neubecks Creek receiving water site, WX22.

2.6 Control Charts

Long-term changes at the receiving water sites are tracked by control charts. The long-term changes were taken from January/February, 2009 to August, 2013[19] to provide 24 measurements (as recommended by the ANZECC (2000) guidelines) prior to ash placement in September, 2013.

At the groundwater receiving water site, the MPMG4/D8 and D9, long-term changes are indicated by comparison with the pre-90th baseline, post- 50th percentile and/or the groundwater trigger value environmental goals. The Lamberts North site does not have a background bore to sample the local mine water inflows to Huon Gully for comparison with the water quality conditions at the Mt Piper seepage detection bore, D1, or bores D8 and D9. This means that changes at bore D1 and the receiving water sites may be difficult to interpret due to effects of mine water inflows, enriched with brine and water conditioned ash leachates, from under the Mt Piper ash placement.

At WX22, long-term changes are indicated by comparison with background conditions at the Mt Piper Power Station Licence Discharge Point, LDP01, on the upper Neubecks Creek, and the environmental goals. The new upstream site, NC01, in Neubecks Creek, just downstream of the Mt Piper Stage I

[17] Bores D8, D9 and WX22 are all in the path of groundwater seepage from the Mt Piper ash placement into Huon Gully, so the background measurements from October, 2012 to August, 2013 have been taken into account. Catchment inflows include the Mt Piper placement groundwater seepage to Huon Gully and local, up-stream, coal mine discharges to Neubecks Creek.

[18] The local, pre-placement Lamberts North 90th percentile baselines are not as reliable as those for Mt Piper because they are only based on eleven measurements at WX22 and four at D8 & D9, whereas the ANZECC (2000) guidelines require a minimum of 24 measurements to set local guidelines.

[19] The January/February, 2009 to July, 2012 Mt Piper groundwater data is from Aurecon (2010, 2011 and 2012)

brine conditioned ash placement and the Neubecks Creek north arm (Figure 2) are also compared with the changes at WX22.

The long-term changes are further put into context by use of the pre-Lamberts North placement 50th and 90th percentiles and the post-placement 50th and 90th percentiles. These are shown for each groundwater and surface water sampling site in the various water quality tables in the report as well as in Attachment 1. This allows pre- and post-placement "like for like" comparisons to be made, together with the pre- and post-placement averages, maxima and minima, as well as the summary data in tables for the current reporting.

2.7 Data Quality

The data contained in this report was provided by EnergyAustralia NSW and was checked for outliers using the ANZECC (2000) protocol. In accordance with the protocol, outliers of three times the standard deviation are removed from the dataset, provided no environmental changes have occurred that could account for such a significant change. No values were deleted from the 2014 to 2015 dataset.

Silver concentrations have not been used in this report because the high detection limits used mean they cannot be compared to the ANZECC (2000) guideline of 0.00005 mg/L. The same applies to the high detection limits used for measurements of nitrite and oxidised nitrogen (nitrite plus nitrate) at the Neubecks Creek sites, which has a guideline of 0.015 mg/L, but uses a detection limit of 0.5mg/L. Hence, these measurements have not been used in this report and it is suggested that EnergyAustralia NSW have the tests undertaken at the appropriate detection limits.

2.8 Climatic Conditions

The average annual rainfall over the pre- to post-water conditioned ash placement period from October, 2012 to August, 2015 was low at 710 mm/year (Attachment 2), which is 82.3% of the long-term annual rainfall of 863 mm/year. During this period, the monthly average rainfall of 59 mm/month, was below the long-term average of 72 mm/month, even though the rainfall in March, 2014 was 144 mm, 124 mm in January, 2015 and 184 mm in April, 2015 (Figure 3).

Figure 3 shows that there was a trend from above average rainfall in 2012 to below average in 2014/15. This trend has been highlighted by calculation of the corresponding change in the cumulative monthly rainfall deficit, which is also shown in Figure 3.

The monthly rainfall deficit was calculated by subtracting the monthly rainfall each month from the long-term average rainfall of 72 mm/month. When the rainfall is lower than 72 mm/month, the difference is called the deficit. A positive deficit means a dominance of below average rainfall and a negative one indicates above average rainfall. The deficit (positive and negative) was accumulated each month until August 2015.

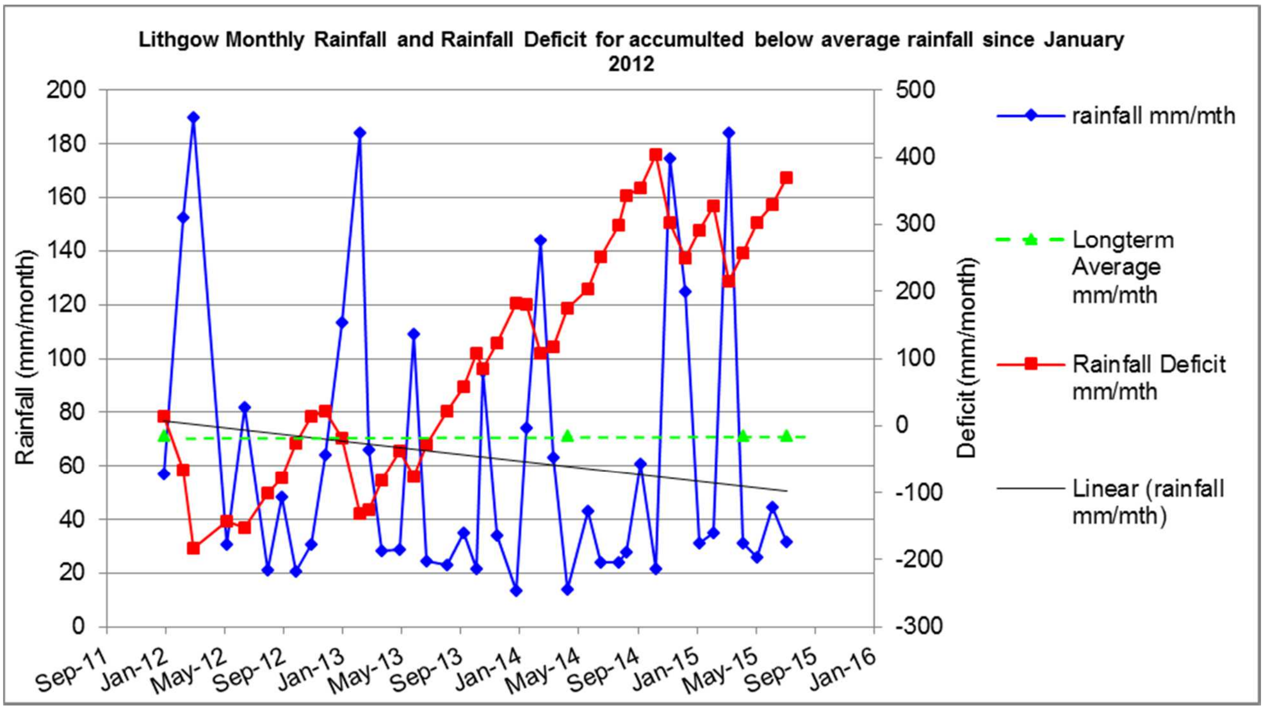

Figure 3. Lithgow Rainfall from January 2012 to August 2015 showing trend for decrease to below average rainfall and corresponding cumulative Rainfall Deficit

3. Water Conditioned Ash Placement Effects on Surface and Groundwater Quality

This Section reviews the Lamberts North surface and groundwater quality and trace metal data for the second year of monitoring from pre-ash placement (October, 2012 to August, 2013) to the post-ash placement (September, 2013 to August, 2015) period. However, the previous report in 2013/14 (Aurecon, 2015) showed that the effects, if any, of the Lamberts North water conditioned ash site on local surface and groundwater could not be distinguished from the overriding effects of Mt Piper groundwater flows down Huon Gully. Accordingly, a direct assessment of the potential effects of the Lamberts North placement on surface and groundwater has been undertaken by estimating the rainfall infiltration. This means that the OEMP requirement to review the water quality at the Mt Piper groundwater bores and the Neubecks Creek water quality (see CDM Smith, 2013) is essentially for background information rather than to facilitate assessment of effects of the Lamberts North placement.

As rainfall infiltration is known to occur into the water conditioned dry ash placement at the Wallerawang Power Station's Kerosene Vale Ash Repository (Aurecon, 2015b), a similar situation could be expected at Lamberts North. Accordingly, a direct assessment of the potential effects of the Lamberts North placement on surface and groundwater has been undertaken by estimating the rainfall infiltration. The approach taken to do the assessment is documented in the next Section.

The Neubecks Creek aquatic life sampling by GHD (2014) and Cardno (2015) is reviewed in Section 3.5.

3.1 Direct Assessment of Rainfall Infiltration and effects on Surface and Groundwater

The previous report showed that assessment of effects of the Lamberts North placement on surface and groundwater was essentially prevented due to the effects of coal mine groundwater flowing from under the Mt Piper ash placement into Huon Gully (potentially enriched with chloride from brine leachates and to be determined by examination of data from the new bores installed in the Mt Piper area in December, 2015). Hence, the rationale for doing the assessment of effects of Lamberts North leachates on surface and groundwater has been to estimate rainfall infiltration into the dry ash and to test whether the infiltration effects are likely to be significant. Accordingly, the Lamberts North assessment has been undertaken by estimating the rainfall infiltration flows and using ash leachate water quality data obtained for the Mt Piper water conditioned ash placement by PPI (1999). The effects on water quality at the receiving sites WX22 and bore D9 were then assessed by comparison with the stream flows in the creek, as well as with the modelled groundwater flows down Huon Gully (Merrick, 2007) toward bore D9, and the monitored WX22 and bore D9 water quality.

As noted in the first annual report, rainfall onto the Lamberts North ash area is retained on the ash by a perimeter bund wall to minimise inflows to the creek or the local groundwater[20]. The accumulated rainfall is expected to result in some infiltration through the dry ash, but from previous studies for the Mt Piper dry ash placement, the amount of rainfall infiltration was estimated to be low at only 5% of the annual rainfall due to compaction of the dry ash by heavy machinery as it is placed (Forster, 1999). Most of the runoff is either lost by evaporation or collected in the ash area runoff LN Pond 2.

[20] Surface water runoff from the Lamberts North ash area is directed firstly into unlined pond LN Pond 1 formed by furnace ash, as shown in Figure 1.

Although the water quality of Mt Piper water conditioned ash leachates are known, the Lamberts North ash has been conditioned with cooling tower blowdown water, rather than fresh water, so the effects of this have been added to the water conditioned results of PPI (1999). This approach is considered reasonable and the procedure for doing this is set out below.

The estimation of rainfall infiltration through the Lamberts North dry ash placement is based on the two year average infiltration of 5% of the average annual rainfall, measured for the Mt Piper brine conditioned ash placement pilot study by Forster (1999). Application of this average to the ash area gave an estimated infiltration rate of about 0.03 ML/day[21] by using a similar approach to that for the groundwater modelling at the Mt Piper ash area by Merrick (2007). If it is assumed that the rainfall infiltration could flow through the northern embankment (the closest to Neubecks Creek), it is unlikely to directly enter the creek because it is about 170m away (Figure 2). Rather, the seepage is more likely to enter the groundwater at the base of the northern embankment and flow towards the creek via the previous[22] groundwater seepage path in the coal seam under the Main Road (Figure 6). Once the seepage water enters the creek it would be diluted by the nearly 180-fold higher average natural flow of about 5.6 ML/day[23], which is measured at the WX22 stream gauge 212055. Note that the average stream flow is used to estimate the concentration increases in Table 2 because Figure 7, Section 3.4, shows the groundwater is expected to flow under the creek via the coal seams during dry weather, and during wet weather to be diluted by the corresponding increase in catchment inflows to the creek.

The increase in salinity and trace metals of the ash leachates due to conditioning with blowdown water has been estimated in the following way: The PPI (1999) leachate concentrations were based on a ratio of 2:1 water: ash[24], that is, 200 g of water and 100 g of ash. The ash is understood to be conditioned with 15% cooling tower blowdown water, so the salinity (TDS) of the water conditioned ash leachates (627mg/L, Table 2) has been enriched with salt from the blowdown water (CT, 2200 mg/L, Table 3) by the following equation:

$$\text{Enriched leachate TDS} = (\text{water conditioned TDS} \times 200\text{g} + \text{CT TDS} \times 15\text{g}) / 215\text{g}.$$

$$\text{Enriched leachate TDS} = (\text{water conditioned } 627\text{mg/L} \times 200\text{g} + 2200\text{mg/L} \times 15\text{g}) / 215\text{g}.$$

The above equation gives a cooling tower blowdown enriched leachate TDS of 737 mg/L. From this, the concentration of the other water quality characteristics, including trace metals, in the blowdown enriched leachates were calculated in a similar way and the results are shown in Table 2.

The PPI (1999) enriched ash leachates results were applied to the Lamberts North ash area and the estimated increases in salinity and trace metals[25] in Neubecks Creek are compared with the surface water quality Guidelines or Goals in Table 2. Column three of Table 2 shows that the estimated increase in water quality concentrations in Neubecks Creek, due to the ash leachates, are lower than the ANZECC (2000) Guidelines or local goals at WX7.

It should be noted that the Lamberts North ash area is sprayed with cooling tower blowdown water for dust suppression. The additional infiltration was estimated to be 72mm/year above that of the rainfall infiltration. This amount of sprinkler water infiltration is considered to be reasonable because

[21] Lamberts North area about 0.250 Km^2 of capped ash x annual average rainfall 860 mm plus sprinkler irrigation of 72 mm/year on the ash area (taken from KVAD that does not evaporate in one day) and 5% infiltration
[22] Previous flow path from the GCB, when it was present, to Neubecks Creek. The groundwater bore data from the Lamberts North ash area embankment will be examined to determine if this is still a viable pathway towards the creek.
[23] Average Neubecks Creek stream gauge 212055 from 1991 to April, 2015.
[24] Leachate test ratio of 2:1 water: ash used to simulate infiltration effects to groundwater PPI (1999).
[25] Increase = CT enriched PPI (1999) leachate x 0.03 ML/day divided by 5.6 ML/day Neubecks Creek flow at WX22.

EnergyAustralia NSW has advised that the rate of evaporation exceeds the volume of sprinkler water used, when averaged over each month of application. The evaporated salts are ultimately dispersed by rainfall runoff (PPI, 1999), which means, in this case, they would be washed into the low-lying ash area runoff collection pond LN Pond 1 (see contours in Figure 1). The accumulation of salts in the runoff pond is most likely the reason for the moderately elevated concentration of dissolved salts in LN Pond 1 shown in Table 3, Section 4.

3.2 Groundwater Effects of the Infiltration

The increase in the groundwater perimeter concentrations at bore D9, due to the infiltration flows, was estimated in a similar way but using the groundwater flow down Huon Gully toward Neubecks Creek of 2 ML/day[26] from Merrick (2007). Most of the 2 ML/day flow comes from the underground coal mine groundwater flows in the rubble drain, under the ash, into the void at the end of Huon Gully[27]. Bore D9 is directly in the path of this mine water as it flows toward the creek (Figure 6), so the Lamberts North rainfall infiltration flow of 0.03 ML/day is expected to enter the mine water flow and be diluted by the 65-fold higher groundwater flow. The estimated increase in salinity and trace metals at bore D9 are compared with the groundwater quality Guidelines or Goals in Table 2. All the estimated increases in water quality concentrations were lower than the relevant trigger values.

It should be noted that the above surface and groundwater results of no likely significant effects are based on use of a lined pond (as required by the OEMP). However, the LN Pond 1 is unlined and is located on furnace ash, so the assessment of effects takes this into account in the next Section.

3.2.1 Rainfall Infiltration due to Unlined Pond used for Surface Runoff

A significant unknown in the assessment of rainfall infiltration and its effects on surface and groundwater quality is the use of an unlined pond, at LN Pond 1, to collect rainfall runoff from the ash area. As mentioned above, the OEMP requires that rainfall runoff be retained in lined ponds to minimise infiltration into the ash. Creation of the LN Pond 1 on furnace ash, which is more porous than the surrounding compacted flyash, is likely to increase the amount of rainfall infiltration[28], as well as the salinity and trace metal concentrations of the infiltration water entering the local surface and groundwater. Hence, the above estimated effects of the Lamberts North ash placement are likely to be underestimated and cannot be relied on as a definitive assessment of effects on the surface and groundwater.

As some of the LN Pond 1, seepage not collected and diverted to LN Pond 2, could infiltrate into the local groundwater, the potential effect on Neubecks Creek was examined by estimation of the water quality concentration increases due to cooing tower blowdown enriched leachates passing through the ash beneath the pond. Use of the data from Table 2 shows that, in the case of selenium for instance, the total rainfall infiltration would have to be increased by 8-fold (0.03 to 0.24 ML/day) to cause a selenium increase in Neubecks Creek equivalent to its trigger value of 0.005 mg/L[29]. In terms of potential groundwater effects, as the groundwater flow is lower than in Neubecks Creek at 2ML/day, only a 3-fold increase in rainfall infiltration to 0.09 ML/day may cause an increase of the selenium

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[26] Increase = CT enriched PPI (1999) leachate x 0.03 ML/day divided by 2.0 ML/day mine groundwater flow down Huon Gully to Bore D9

[27] Now replaced by compacted mine spoil and water conditioned ash in the Lamberts North ash placement area. Since September, 2013, the Huon Gully Void has been filled with compacted mine spoil and water conditioned ash as part of the expansion of the existing ash placement area into the Contingency Ash Storage Area (PPI, 1999). This placement area is now referred to as Lamberts North.

[28] It is understood that most of the collected runoff water that seepage through the bottom of LN Pond 1 is drained through subsurface pipes to the lined LN Pond 2 (see Figure 1).

[29] Infiltration required to give selenium concentration at WX22 of 0.005 mg/L: 0.116 mg/L (see Table 2) x 0.24 ML/day/5.6 ML/day = 0.005 mg/L; Infiltration required to give selenium concentration at D9 of 0.005 mg/L: 0.116 mg/L x 0.09 ML/day/2.0 ML/day = 0.005 mg/L.

concentration in the groundwater to its trigger value, which is also 0.005 mg/L. These increased infiltration rates can be shown to be equivalent to 10 to 35% of the average annual rainfall seeping into the local groundwater[30].

Selenium has been used as an indicator of effects on water quality because Table 4 (groundwater at bore D9) and Table 5 (surface water at WX22) indicate that if the selenium concentration was to increase from its current 0.002 mg/L to 0.005 mg/L, the concentrations of boron, chromium, nickel, lead and zinc may increase in proportion and, if so, could exceed their respective Local/ANZECC trigger values. These effects could occur in both surface and groundwater, although the potential increase in lead only applies to groundwater and zinc to surface water.

Although it is considered unlikely that the LN Pond 1 seepage could increase the total rainfall infiltration sufficiently to affect the water quality in Neubecks Creek, the same cannot be assumed in relation to potential effects on the local groundwater. However, if the pond seepage was assumed to increase the infiltration to 35% of the annual rainfall (0.24 ML/day), the effect of zinc in the pond water of 0.285 mg/L (the highest trace metal concentration in LN Pond 1 in 2013/14) on the concentration in Neubecks Creek can be estimated to be lower than the local surface water trigger value of 0.051 mg/L[31]. During periods of dry weather low flows, groundwater inflows to the creek are expected to be minor. The occurrence of elevated concentrations at these times (up to or temporarily above the pre-placement 90th percentiles) are largely due to effects of evaporation, particularly in the pond formed by the weir at the stream gauging site at WX22.

Nevertheless, due to the various unknowns in relation to the actual LN Pond 1 seepage and its entry into the local groundwater, assessment of effects, if any, of the total rainfall infiltration, including that from LN Pond 1 seepage, will need to wait until sufficient groundwater data has been collected at the two planned Lamberts North embankment bores. It is suggested that this assessment be undertaken as part of the third annual report for Lamberts North in 2016.

[30] Percentage of LN Pond 1 water infiltration through furnace ash and not diverted to LN Pond 2: Estimated lower range: 3-fold increase in average annual rainfall infiltration x 5% = 15%, less the 5% infiltration into the compacted flyash outside the pond = 10%. The upper range is 8-fold x 5% = 40% - 5% = 35%.

[31] Total infiltration of 35% of annual rainfall with LN Pond 1 zinc concentration in seepage gives: 0.285 mg/L (see Table 3) x 0.24 ML/day/5.6 ML/day average flow = 0.012 mg/L at WX22 which is < local guideline of 0.051 mg/L.

Table 2. Mt Piper Power Station flyash leachates and estimated leachates for ash conditioned with Cooling Tower (CT) blowdown water and estimated potential increase in Neubecks Creek and local groundwater compared to WX22 and Bore MPGM4/D9 concentrations and surface and groundwater quality ANZECC (2000) Guidelines or Local Goals (Lamberts North Local Goals in brackets)

Element (mg/L)	**Freshwater conditioned ash Leachates (PPI, 1999)**	**Mt Piper Leachates with CT water**	**Neubecks Creek Increase from LN Leachate**	**WX22 Water Quality post-Aug15**	**Surface Water Guidelines or Goals***	**Local Ground-water Increase from LN Leachates**	**Bore D9 post-ash placement to Aug15**	**Ground-water Guidelines or Goals***
pH	4.9	5.1	*-0.1*	7.1	6.5-8.0	*-0.1*	6.6	6.5-8.0
Cond (µS/cm)	745	902	*5.0*	849	2200	*14*	3909	2600
TDS	627	736	*4.0*	612	1500	*11*	3343	2000
SO4	351	424	*2.2*	352	1000	*6.4*	2045	1000
Cl	<1	3.8	*<0.1*	42	350	*<0.1*	298	350
As	0.009	0.013	*<0.001*	<0.001	0.024	*<0.001*	0.001	0.024
B	4.02*	3.8	*0.02*	0.14	1.25	*0.057*	1.415	0.37**(0.55)**
Cd	0.024	0.022	*<0.0001*	<0.0002	0.0015	*0.0003*	0.0004	0.002
Cr	0.003	0.003	*<0.0002*	0.002	0.005	*<0.0002*	0.0068	0.005
Cu	0.179^	0.167	*<0.001*	0.001	0.005	*0.0025*	0.0023	0.005**(0.0075)**
F	8.2	7.77	*0.040*	0.2	1.5	*0.117*	0.079	1.5
Fe	<0.10	<0.1	*<0.001*	0.070	0.3	*0.0015*	0.44	**0.664(15.9)**
Mn	0.154*	0.15	*<0.001*	0.59	1.9	*0.002*	0.001	**5.704(8.57)**
Mo	2.2	-	-	<0.001	0.01	-	0.10	0.01
Ni	0.020* ^	0.035	*<0.0002*	0.037	0.05	*0.0005*	0.252	**0.5509**
Pb	0.003	0.003	*<0.0002*	0.001	0.005	*<0.0005*	0.002	0.005
Se	0.179	0.116	*<0.001*	<0.002	0.005	*0.002*	0.001	0.005
Zn	0.120*	0.117	*<0.001*	0.044	0.153	*0.0018*	0.361	**0.908**

3.3 Groundwater Level Changes

To put the groundwater level changes since October, 2012 into context, and as bores D10 and D11 have been used to provide water quality and groundwater level data for flows from the Mt Piper site into Huon Gully, the long-term changes at these bores, as well as at D1, D8, D9 and D19 are shown in Figure 4.

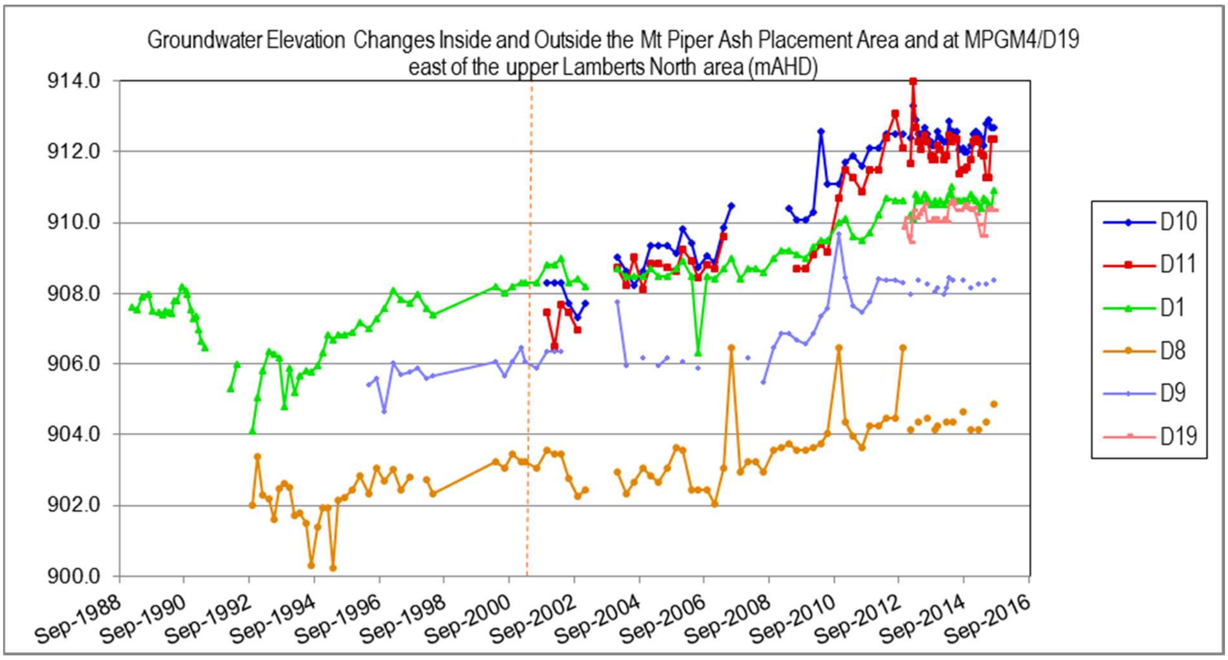

Figure 4. Groundwater Elevation changes at bores inside the Mt Piper ash placement area (MPGM4/D10 and D11 since 2001), at the Seepage Detection bore (D1 since 1989), at Groundwater Receiving Water Bores (D8 and D9 since 1992 and 1996) and just outside Lamberts North ash placement area at D19 since October, 2012

It should be noted that bore D9 has been about 2m higher than it was prior to beginning of ash placement at Mt Piper in 2001. The groundwater level in the Mt Piper ash placement area was predicted to rise by about 2m by groundwater modelling (PPI, 1999). The increase, from the levels present in 1999 (vertical line on Figure 4), was expected due to mounding as the water conditioned ash was placed over an increasing area (and possibly height). The groundwater level at Bore D19 is now about 1m higher than in 2001, even though it is located to the east of the Lamberts North site. This indicates either some mounding caused by the Lamberts North placement or diversion of the groundwater flowing down Huon Gully around the compacted mine spoil under the ash toward bore D19.

Figure 4 shows an overall long-term trend for increase in the height of the water table as the water conditioned ash placement at Mt Piper has approached the eastern boundary of the brine and water conditioned ash placement area, which is 50m from Huon Gully. The increases have been about the 2m predicted by the model other than at bores D10 and D11, where the increases have been about 4m to 5m. The additional 2 to 3m increase at these bores began in 2010 and may be due to rainfall runoff from the Mt Piper water conditioned ash placement entering the groundwater flowing under the ash placement in the rubble drain (Aurecon, 2011). As mentioned in previous reports, these water level increases are unrelated to the brine placement, which is on top of the much larger water conditioned placement.

The groundwater elevations at D10 and D11 are higher than at bores D1, D9, D8 and at bore D19 in Lamberts North. This indicates that the groundwater inflows from the Mt Piper area (see Figure 6) could affect these bores and potentially the water quality in Neubecks Creek. The first annual report (Aurecon, 2015) showed that those groundwater flows prevented a separate assessment of effects of the Lamberts North site on the down-gradient bores and the receiving waters in Neubecks Creek.

3.3.1 Groundwater Level Changes at Bore D1 compared to D10

The OEMP places emphasis on the potential for water level increases in the ash placement area to leach salts and trace metals from the ash and suggests that bore D1 could be used to indicate if there has been a groundwater level increase inside the Lamberts North ash placement area in Huon Gully. Accordingly, the pre- to post-placement changes at bore MPGM4/D1 are reviewed.

Although there is no background bore in the underground mine working, up-gradient of the influence of any inflows from Mt Piper, for comparison of water level changes at bore D1, the relative groundwater level changes at D1 from pre- to the initial post-placement period are compared to those at D10 in Figure 5. Bore D10 was used because it is up-gradient of Lamberts North and groundwater level increases at both D10 and D1 have previously been shown to be related to the mounding effect of the Mt Piper ash placement. Bore D10 normally has a higher groundwater level than D1, so relative changes are compared in Figure 5. Groundwater level changes were taken from January/February, 2009 when the water levels were similar and the two bores were not influenced by any site preparation effects prior to ash placement in September, 2013.

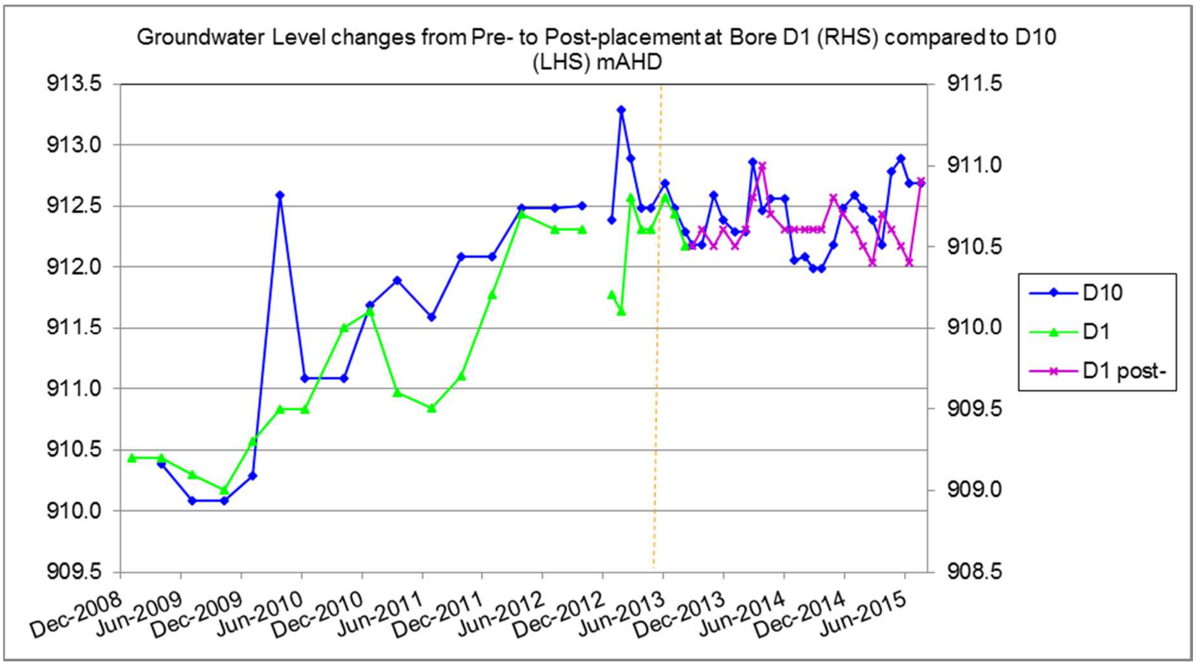

Figure 5. Groundwater Elevation changes at bores D1 and D10 from January, 2011 to August, 2014 with the Pre- (green) and Post-placement (violet) periods for D1 shown (Vertical line shows when Pre-placement water quality monitoring began in October, 2012)

Figure 5 shows that other than the relatively lower groundwater levels at D1 in 2011, which appears to be due to an extended period of low rainfall (see Attachment 2), both bores D10 and D1 had similar relative levels, except during January and February, 2013 when groundwater was being rapidly pumped out of the GCB void. There was a trend for increase in levels at both bores from 2009 to early 2012 and since then the levels have remained steady. In addition, since early 2013 the relative groundwater levels have been similar, indicating that there has been no groundwater level rise at D1 since ash placement began at Lamberts North.

It is expected that the two monitoring bores to be installed in the northern embankment in late 2015 may determine whether the groundwater level in the Lamberts North ash placement has risen into the ash, or the groundwater flows under or around the compacted mine spoil and ash in Huon Gully. This data and information may also show the effects, if any, on the groundwater quality and levels at bore D1.

3.3.2 Groundwater Flow Directions

The indicative groundwater flow directions into and under the Mt Piper brine/ash placement area and leaving the site toward Huon Gully and the Lamberts North ash area are discussed below to obtain an understanding of the sources of groundwater that could affect the local water quality.

As most of the groundwater bores inside the Mt Piper brine/ash placement area have been covered with ash, the groundwater flow directions have been conceptualised from an understanding of the local coal seam structure and hydrogeology. A rubble drain was installed under the Mt Piper ash to enable the background groundwater to flow under the ash placement without coming in contact with the ash. This suggests that groundwater flows follow the dip in the mined coal seam strata, under the ash area, in a north-easterly direction from the ash placement up-gradient groundwater table areas to the now filled Groundwater Collection Basin (GCB) area and to bore D9 (Figure 6).

The groundwater sampled by the internal bores, D10 and D11, is believed to flow to the nearby Huon Gully where it is expected to join that from upstream and flow down Huon Gully on the way to bores D1 and D9, and then to Neubecks Creek. Recent increases in chloride and water levels at bore D19 indicate that these flows may be affecting the eastern side of Huon Gully (Figure 6).

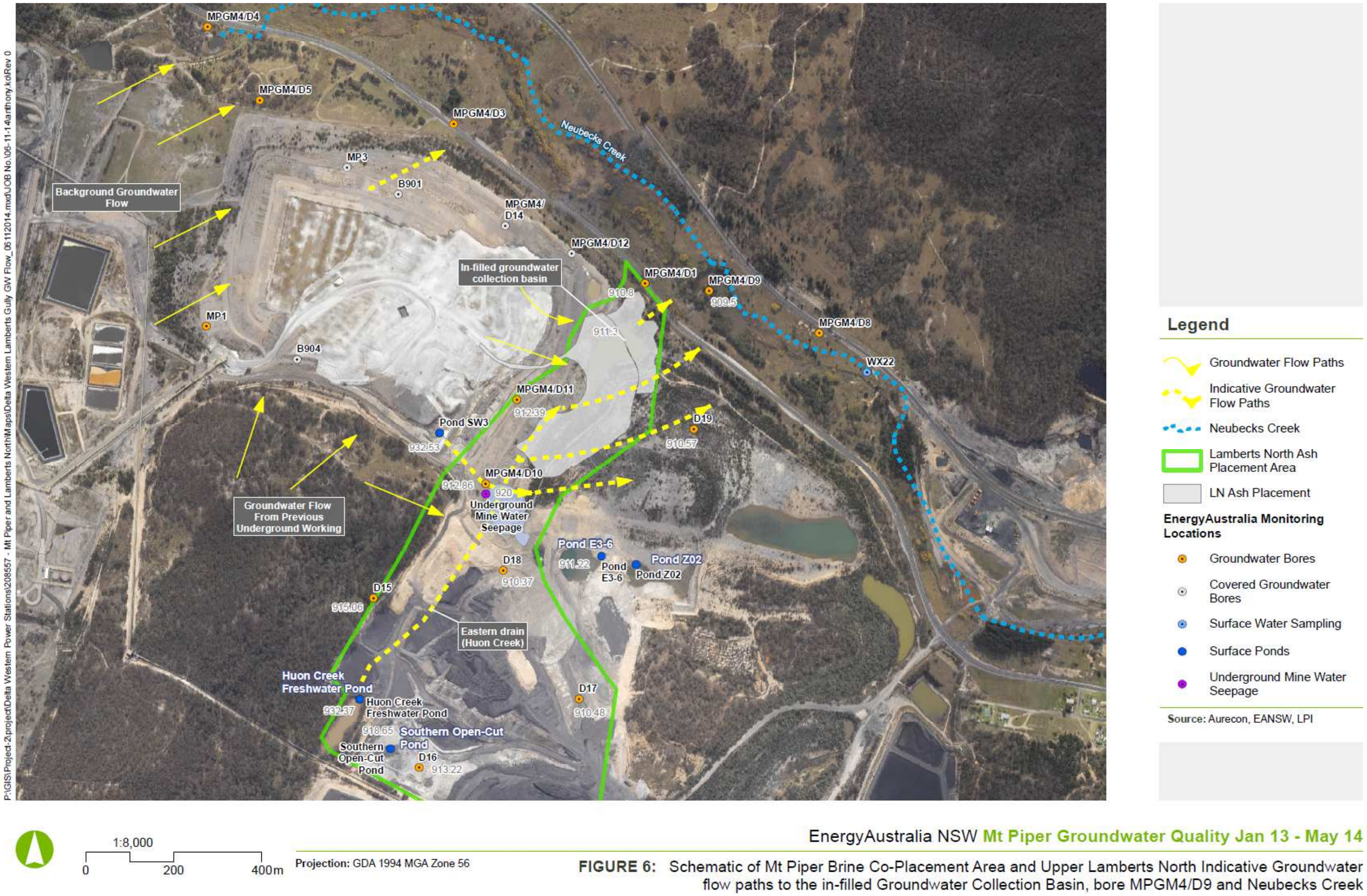

Figure 6. Schematic of Indicative Groundwater flow paths at the Mt Piper Brine Placement Area and Upper Lamberts North to the in-filled Groundwater Collection Basin (now Lamberts North ash placement), bores MPGM4/D1 and D9 and Neubecks Creek

3.4 Groundwater seepage from the Mt Piper ash placement to Neubecks Creek

As discussed in previous reports, the Mt Piper groundwater flow directions were conceptualised from an understanding of the local coal seam structure and hydrogeology. This suggests that groundwater flows follow the dip in the mined coal seam strata, under the ash area, in a north-easterly direction from the high levels, indicated by the background bores[32] toward the low point at the northern end of Huon Gully (bore D1 in Figure 5 gives an indication of the low groundwater level).

The 2007 UTS groundwater model (Merrick, 2007) found that the Mt Piper ash placement area aquifer system is driven by underground coal mine groundwater flows. The mine groundwater flows naturally from the rubble drain, under the ash, to the void at the end of Huon Gully[33] at a rate of about 2 ML/day toward Neubecks Creek, with smaller flow to Huon Gully itself at about 0.5 ML/day.

Figure 7 shows that the groundwater flow from underground coal mines, south of the Mt Piper ash placement area, is expected to follow the coal seams. As the coal seams had been removed from the Western Main open-cut void, an “interburden” layer (also called a rubble drain) was placed in the open-cut void to allow the mine water to flow under the ash without coming into contact with it.

Any groundwater flowing towards Neubecks Creek from the Huon Gully Void, or more recently, under or around the Lamberts North placement in Huon Gully, is expected to flow under the creek via the coal seams, as shown in Figure 7.

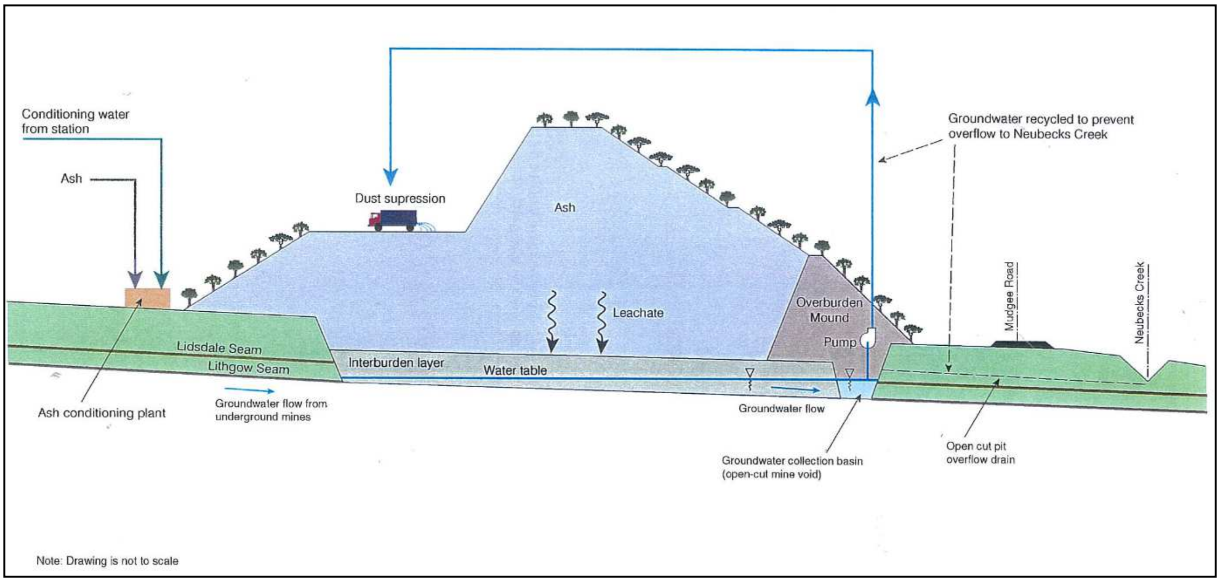

Figure 7. Schematic of Mt Piper ash placement management of surface and groundwater - from PPI (1999). (Note the Groundwater Collection Basin is now filled with compacted mine spoil and dry ash)

[32] The actual height of the background groundwater is currently unknown, but a new bore to be drilled into the underground coal mine workings in late 2015 is expected to show the actual level. The high groundwater levels at the north-western background bore D5, in Figure 4, give some idea of the height of the background levels expected to be found in the south of the ash placement area.
[33] Now replaced by compacted mine spoil and water conditioned ash in the Lamberts North ash placement area. Since September, 2013, the Huon Gully Void has been filled with compacted mine spoil and water conditioned ash as part of the expansion of the existing ash placement area into the Contingency Ash Storage Area (PPI, 1999). This placement area is now referred to as Lamberts North.

Some of the groundwater flowing down Huon Gully could potentially enter Neubecks Creek, upstream of the WX22 creek gauge 212055 (see Figure 6), after rainfall events that cause the water table to rise such that it is above the base of the creek. The UTS model predicted the salt load on the creek, from which the groundwater flow has been estimated at <0.1 ML/day, indicating that most of the 2 ML/day of mine groundwater flowing from under the Mt Piper ash placement, and down Huon Gully, actually flows under the creek.

The background review of the Mt Piper groundwater and surface water effects are undertaken in Section 4.

4. Mt Piper effects on Surface and Groundwater

The previous report (Aurecon, 2015) showed that the salinity and trace metals from the bore D10 groundwater dominated conditions such that the effects, if any, of the Lamberts North placement on the local groundwater could not be seen by using only the Mt Piper monitoring sites. In addition, the minor effects on salinity and trace metals in Neubecks Creek, relative to the local trigger values, were due to coal mine groundwater, enriched with chloride, possibly from the southern Mt Piper brine conditioned ash area, but this is to be confirmed by the new bores installed in December, 2015. Accordingly, the Lamberts North effects have been initially assessed by estimation of rainfall infiltration and use of ash leachate water quality. Hence, this Section reviews the Mt Piper surface and groundwater quality, as a separate input to Huon Gully and the down-gradient groundwater flows toward Neubecks Creek, to provide background conditions to the Lamberts North placement.

As required by the OEMP by CDM Smith (2013), the review undertaken here is for groundwater bores inside the Mt Piper brine conditioned ash placement area (bores D10 and D11), its seepage detection bore, MPGM4/D1 and the Mt Piper receiving water bores D8 and D9, as well as in Neubecks Creek at the final receiving water site, WX22, and its upstream background sites. The data base for these sites has been updated to August, 2015 and changes over time from the pre- to post-placement periods of ash placement at Lamberts North are commented on.

Table 3 provides a summary of the water quality and trace metals of the various potential sources entering the Lamberts North site via Mt Piper inflows to Huon Gully. These include:

- Underground coal mine seepage from a local abandoned mine
- Groundwater from under the Mt Piper brine B5 Bench sampled by bore MPGM4/D10, and now D11
- Leachate test results for:
    - Mt Piper brine conditioned ash
    - Local mine spoil
    - Freshwater conditioned ash (the leachates tests are from PPI, 1999). The use of cooling tower blowdown water to condition the ash on the estimated leachate concentrations is shown in Table 2.

Table 3 compares the water quality and trace metals in these local sources with those present in bore D1, just below the Lamberts North placement, with the background Mt Piper inflows, from bore D10, and the underground coal mine seepage to Huon Gully and their effects on the local groundwater at D1. The concentrations in Table 3 highlighted in blue are for those above the local/ANZECC groundwater trigger values shown in Table 2.

The initial assessment in Section 3 indicates that no significant effects of the dry ash placement on Neubecks Creek are expected, provided there is no significant seepage through the bottom of the temporary LN Pond 1, which is located on furnace ash. Note that although the salinity and some trace metals were elevated in the ash area runoff pond LN Pond 1 during 2013/14 (Table 3 - the only data available), the salinity was lower than in the mine groundwater flow of about 2 ML/day, and the trace metals, such as nickel and zinc, were lower than some of the other sources, particularly from the groundwater sampled by bore D10. This indicates that although seepage through the bottom of the pond may contribute to the groundwater concentrations at bores D1 and D9, effects of the seepage on Neubecks Creek may not be noticeable above that from the other sources.

The reason for the initial finding of no significant effects on Neubecks Creek is that the OEMP requires compaction of the ash to minimise rainfall infiltration into the local groundwater. Hence, the findings in Section 3 are expected to be confirmed by the two new groundwater bores, which may show the effects, if any, of factors such as:

- Seepage through the bottom of the rainfall runoff collection Pond 1 at the Lamberts North ash placement
- Cooling tower blowdown water used in conditioning the Lamberts North ash and for dust suppression.

The local mineralised coal geology of the Mt Piper and Lamberts North area is mainly due to the placement of mine spoil and chitter/tailings (washery reject) in the catchment. Chitter contains pyrites, which release sulphate and trace metals (such as boron, nickel and zinc). As these elements are also present in the local mine water and mine spoil leachate (Table 3), they are not a sole characteristic of the water conditioned ash leachates (see Tables 2 and 3) expected at the Lamberts North ash placement site.

Table 3: Average Water Quality of Lamberts North Runoff Ponds LN1 and LN2^ and various sources of Salinity and Trace Metals (including groundwater sampled by bore MPGM4/D10) to the Lamberts North Site and to the Seepage Detection Bore MPGM4/D1, as well as down-gradient Surface and Groundwater receiving waters

Element (mg/L)	Water Conditioned Ash Rainfall Runoff		Sources of Salinity & Trace Metals to Lamberts North Ash Placement, Bore D1 and Receiving Waters						Bore D1 during 2014/15*
	Unlined Pond LN1 Sept13 to Aug14	Lined Pond LN2 Sept13 to Aug14	Underground Mine Seepage to Huon Gully	Cooling Tower Blowdown	Brine Leachates (PPI, 1999)	Mine Spoil Leachates (PPI, 1999)	Freshwater conditioned ash Leachates (PPI, 1999)	Bore D10 during 2014/15*	
pH	7.7	7.9	6.3 to 7.3	7.4	7.6	7.6	4.9	5.9	6.2
Cond (µS/cm)	1592	1943	2262	3000	10900	1212	745	6827	3910
TDS	1247	1525	1742	2200	8400	800	627	6305	3586
SO4	678	875	1172	1400	3750	349	351	3513	2012
Cl	62	120	133	250	1410	103	<1	645	380
As	0.001	0.001	0.004	0.070	0.05	0.001	0.009	0.001	0.012
B	0.040	1.0	3	1.0	6.1	1.475	4.02*	3.29	2.08
Cd	0.002	0.002	<0.0002	<0.002	0.003	0.002	0.024	0.0056	<0.0002
Cr	<0.001	<0.001	0.003	<0.01	0.037	0.001	0.003	0.001	<0.001
Cu	<0.01	<0.01	<0.01 - 0.016	1.50	0.078	0.002	0.179^	0.0013	0.0013
F	1.0	0.6	-	2.0	6	0.49	8.2	0.93	0.10
Fe Filt	0.14	0.32	<0.01	0.03	0.007	0.097	<0.10	13.8	41.7
Mn Filt	0.275	0.08	0.94	0.094	0.44	1.64	0.154*	8.66	13.08
Mo	-	-	<0.10	-	0.84	0.003	2.2	<0.001	<0.001
Ni	0.165	0.04	0.160	0.230	0.200	0.050	0.020^^	0.92	1.00
Pb	<0.010	<0.010	0.005	0.002	<0.0002	0.0002	0.003	0.0049	<0.001
Se	0.008	0.040	0.014	<0.002	0.18	0.0115	0.179	0.0048	<0.002
Zn	0.285	0.160	0.180	0.080	0.039	0.366	0.120*	1.30	0.0975

^no rainfall runoff data available for 2014/15

^^ Expected to be increased due to conditioning with cooling tower blowdown water

*September, 2014 to August, 2015

Highlights: Blue: > ANZECC/local groundwater guidelines (see Table 1) for indication of source condition. Note: the guidelines apply to bore D9 receiving waters

Table 3 shows that all the salts at bore D10 are above the ANZECC/local guideline trigger values and although they have lower concentrations at bore D1, these are also higher than the trigger values. The chloride concentrations at D1 indicate that the salts are potentially from brine leachates but this is to be substantiated by the data from the new groundwater bores at Mt Piper.

Of the elevated metal concentrations at D10 for boron, cadmium, iron, manganese, nickel and zinc, only cadmium had a lower concentration at the down-gradient bore D1 than the local trigger value of 0.002 mg/L.

The higher concentrations for cadmium, nickel and zinc at bore D10 than in brine conditioned ash leachates, shown in Table 3, indicates that the sources may be from residual coal waste/chitter in the bottom of the Western Main mine void. This source may be occurring due to the prolonged dry weather reducing groundwater mine flows into the rubble drain under the Mt Piper ash. Pyrite oxidation with lower flows may be releasing the metals into solution prior to flowing into Huon Gully. The reduction in pH at bore D10 to only 5.9 suggests this process is occurring. This is discussed further in the next Section.

The role and sources of the increased concentrations of cadmium, boron, iron and manganese may be revealed by installation of the additional groundwater bores in the local coal mine groundwater, residual coal mine waste/chitter south of Huon Gully, the B5 bench and at Lamberts North.

4.1 Lamberts North Ash Placement Area Groundwater Quality

To prevent the effects of the Mt Piper inflows to Huon Gully from being assigned to the Lamberts North ash placement operations, the water quality at the groundwater bores D10 and D11, inside the Mt Piper placement area, are used to provide the concentrations of salts and trace metals entering Huon Gully from Mt Piper. Accordingly, the post-ash placement water quality data for the period September, 2013 to August, 2015 for bores D10 and D11 are summarised in Table 4, together with that for the seepage detection bore, D1, and the receiving water bores D8 and D9[34]. The water quality is also compared with the Groundwater Guidelines or Goals, which apply to the receiving waters for bores D8 and D9. The concentrations are also compared to the background concentrations at D19[35] as an indication of potential effects of the local Mine Spoil/Coal Washery waste leachates from south of Huon Gully. The summary data in Table 4 for parameters with higher concentrations than the ANZECC or local guidelines, during and before the ash placement began in September, 2013, are highlighted in blue.

As noted in Table 1, Section 2.6, the local goals for boron, copper, iron and manganese have been increased (shown in parenthesis and bold), but they only apply to the Lamberts North placement (these higher goals do not apply to D10 or D11, which uses the existing Mt Piper goals). These Lamberts North only goals were developed using the pre-placement groundwater baseline data from October 2012 to August, 2013 at bore MPGM4/D9. This was necessary to ensure that any increases at the down-gradient bores due to groundwater inflows to Huon Gully from under the Mt Piper area (measured at bores D10 and D11) were not assigned to the Lamberts North site.

Parameters triggering investigations of the causes (post-median greater than baseline) are highlighted in yellow. Elements with spikes in concentrations above the background are highlighted by

[34] The pre-and post-placement median and 90th percentile concentrations, at each sampling site and for each characteristic measured, are shown in Attachment 1.

[35] Bores D15 to D18 are not used as they considered to be unrepresentative of the local Mine Spoil/Coal Waste leachate concentrations south of Huon Gully.

comparison of the post-placement 90^{th} percentiles with the pre-placement 90^{th} percentiles and are shown as green.

Table 4: Water Quality for Mt Piper and Lamberts North Monitoring Bores during Pre-placement (October, 2012 to August, 2013) and Post-placement (September, 2013 to August, 2015) Periods Compared to ANZECC Groundwater Guidelines or Local Goals (including Lamberts North Pre-placement 90^{th} Percentile Goals) and Background Mine Spoil/Coal Waste conditions at Bore MPGM4/D19

	Mt Piper and Lamberts North (LN) Ash Placement Area Groundwater Monitoring Bores^											
Element (mg/L)	Mt Piper Ash Placement Background* ^				Mt Piper & LN Seepage Detection^^		Mt Piper & LN Groundwater Receiving Waters				Mine Spoil/ Coal Waste at D19^^^	ANZECC Guideline Goals for Ground-water#
	Pre-D10	Post-D10	Pre-D11	Post-D11	Pre-D1	Post-D1	Pre-D9	Post-D9	Pre-D8	Post-D8		
pH***	5.6	5.8	7.2	6.3	6.1	6.1	6.2	6.1	5.9	5.9	6.4	6.5-8.0
Cond (µS/cm)	4600	6197	2100	4985	2400	3422	2050	2610	305	384	3567	2600
TDS	4500	5773	1400	4874	2200	3189	1700	2408	215	281	3209	2000^
SO4	2600	3265	110	2596	1300	1814	1025	1410	120	150	1923	1000++
Cl	390	579	220	497	101	190	110	187	6	15.5	270	350+
As	0.001	0.001	0.001	0.009	0.012	0.012	0.002	0.002	0.001	0.0013	0.002	0.024
B	3.5	3.33	0.78	2.53	1.820	2.06	0.485	0.54	0.03	0.029	1.40	0.37 **(0.55)!**
Cd	0.0052	0.0057	0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.0002	0.0002	0.0002	0.0004	0.002
Cr	0.001	0.001	0.0025	0.002	0.001	0.001	0.001	0.004	0.001	0.0022	0.007	0.005
Cu	0.005	0.004	0.004	0.002	0.025	0.002	0.004	0.001	0.003	0.0031	0.004	0.005 **(0.0075)!**
Fe**	2.5	11.68	0.03	51.14	18.0	27.7	7.5	14.55	0.02	0.26	0.176	**0.664 (15.9)!**
Mn**	7.7	8.57	0.35	14.38	10.0	14.83	7.7	10.0	0.195	0.76	0.449	**5.704 (8.57)!**
Mo	0.01	<0.001	0.01	<0.001	<0.001	<0.001	0.01	0.001	0.01	0.007	<0.001	0.01+
F	1.6	1.18	0.5	0.22	0.1	0.11	0.1	0.16	0.1	0.09	0.11	1.5+++
Ni	0.69	0.845	0.039	0.383	0.52	0.87	0.27	0.350	0.041	0.070	0.238	**0.5509**
Pb	0.005	0.007	0.002	0.002	0.001	<0.001	0.003	0.003	0.002	0.004	0.004	0.005
Se	0.007	0.006	0.002	0.002	0.002	<0.002	0.002	0.002	0.002	0.002	<0.002	0.005
Zn	1.2	1.367	0.04	0.058	0.048	0.086	0.120	0.110	0.06	0.082	0.403	**0.908**

*Pre-placement October, 2012 to August, 2013; post-placement September, 2013 to August, 2014

^Bore D10 samples groundwater flowing from underground coal mine goaf areas and D11 samples open-cut mine area under Mt Piper ash placement.

^^ Bore D1 samples groundwater seepage from the northern Mt Piper brine/ash placement, groundwater flows from Huon Gully, including any seepage from the Lamberts North placement in Huon Gully

^^^D19 groundwater mine spoil/coal waste current average for September, 2014 to August, 2015

Notes:

**filtered samples for iron and manganese

*** Acidic pH is due to mineralised coal geology of the area and mine spoil and chitter or washery waste containing pyrites

ANZECC (2000) guidelines for protection of freshwaters, livestock or irrigation water apply to groundwater receiving water bores D8 & D9.

Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Ca, Mg in GCB 147, 113 mg/L:

Local guidelines using 90^{th} percentile of pre-placement data in **bold**

! Lamberts North from pre-placement baseline data October 2012 to August, 2013 at MPGM4/D9 in **parenthesis**, which do not apply to bores D10 or D11

+ irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L ++ Livestock +++ drinking water

Highlights: Blue: > ANZECC/local guidelines, Yellow: post-median > 90^{th} pre-placement baseline; Green: post-placement 90^{th} > pre-placement 90^{th} percentile,

Table 4 shows the following changes and water quality characteristics during the pre- to post-placement periods (Note that the post-placement period is from September, 2013 to August, 2014, so the summary data in Table 3 may be different for bores D10 and D1 because they are for a shorter period from September, 2014 to August, 2015).

The changes due to the Mt Piper brine and water conditioned ash placement, as well as any changes potentially related to the Lamberts North placement are indicated by the following:

- Bore D10 as the source of salinity and chloride is supported by the increase from the pre- to post-placement periods. Following from these D10 increases, there were consistent increases at each down-gradient bore from pre- to post-placement. These increases are in agreement with the flows down Huon Gully, shown in Figure 6, from D10 to D9 and the increasing concentrations are due to the source being in the area of the D10 bore. The chloride concentration at bore D10 averaged 579 mg/L from September, 2013 to August, 2015 (up from 390 mg/L during the Lamberts North pre-placement period from October, 2012 to August, 2013).

- The salinity of the D10 groundwater flows down Huon Gully toward Neubecks Creek steadily decreased by dilution by low salinity mine water inflows as the plume moved from D10 to D11, then to D1. The lowest salinity was at D9. The post-placement data in Table 4 for each bore shows this effect.

- There was a sharp increase in iron concentration at bore D11 (since September, 2014), associated with a decrease in pH from 7.2 to 6.3, which suggests that pyrite oxidation/reduction conditions may have changed in the coal mine groundwater flowing through the Western Main void, under the ash, during the period since the D10 plume began to interact with the D11 groundwater. A large increase in iron was also observed at bore D1 at about the same time and a large increase was noted at bore D9 from November, 2014. It is not known to what extent the iron increases may be affecting the groundwater conditions under the compacted ash and mine spoil in Huon Gully but the bores to be installed in the embankment may show what is happening.

- At bores D1 and D9 there was no notable change in trace metals that could be assigned to the Lamberts North placement. The increases for boron, nickel and zinc at bore D1, like the iron increase, may be due to the changed conditions in the mine groundwater flowing under the Mt Piper ash placement, with the lower rainfall recharge. This is also expected to become clearer with the additional groundwater bores to be installed in late 2015.

- The groundwater at the mine spoil/coal waste bore D19 has shown increased concentrations of salinity and chloride, indicating that the bore D10 plume may be flowing around the compacted mine spoil in Huon Gully, as indicated in Figure 6. Associated with this increase are increases in boron, chromium and nickel, which may be adding to the smaller increases observed at bore D9.

- Other than the salinity, sulphate, iron and manganese concentrations at bore D9, all of the ANZECC groundwater guideline trigger values and local goals were met at the receiving water bore D9, while all the concentrations at bore D8 were lower than the trigger values. The small chloride increase at bore D8 indicates that some of the chloride reaching bore D9 has flowed under Neubecks Creek, via the coal seam (see Figure 7), to reach the groundwater sampled by D8.

4.2 Neubecks Creek Surface Water Quality

Although the dry ash placement at Lamberts North is not expected to be a significant source of salinity or trace metals to Neubecks Creek, the water quality characteristics at the three sampling sites in the creek (see Figure 2) are summarised in Table 5. Note that the local goals at WX22 were increased for copper and nickel (shown in parenthesis and bold) for the Lamberts North placement using the pre-placement 90th percentile baseline data from October 2012 to August, 2013 at WX22. This was necessary to avoid inappropriate assignment of the water quality conditions in the creek to the Lamberts North placement.

Table 5 shows the parameters with higher concentrations than the ANZECC or local guidelines, during and before the ash placement began in September, 2013, highlighted in blue. Parameters triggering investigations of the causes (post-median greater than baseline) and are highlighted in yellow. Elements with spikes in concentrations above the background are highlighted by comparison of the post-placement 90th percentiles with the pre-placement 90th percentiles and are shown as green[36].

Any changes in the water quality and trace metals at the Neubecks Creek receiving water site (WX22), from pre- to post-placement are highlighted in Table 5, and have been examined for possible causes. These include inputs from:

- Coal mine groundwater from Huon Gully, possibly (but to be confirmed) enriched with chloride from brine leachates reaching bores D1 and D9 and the groundwater seeping into Neubecks Creek
- Coal washery waste areas at Lamberts North (bore D19)
- Local coal mine seepage, upstream of site WX22, after rainfall events and upstream coal mine discharges and surface emplacements.

[36] The pre-and post-placement median and 90th percentile concentrations, at each sampling site and for each characteristic measured, are shown in Attachment 1. The concentrations for filtered aluminium, copper and zinc are also shown in Attachment 1.

Table 5: Surface Water Quality for Neubecks Creek at Mt Piper Holding Pond Background Licence Discharge LDP01, Lamberts North NC01 Background and the Receiving Water Site WX22 Compared to ANZECC Surface Water Guidelines or Local Goals (including Lamberts North Pre-placement 90th Percentiles)

Element (mg/L)	Neubecks Creek Surface Water Monitoring						Surface Water Guidelines or Goals#
	Mt Piper Holding Pond Background		Lamberts North Ash Placement Background		Surface Water Receiving Water Site		
	Pre-LDP01 Background Oct, 2012 – Aug 2013**	Post-LDP01 Background Sept, 2013 – Aug 2015**	Pre-NC01 Background Oct, 2012 – Aug 2013**	Post-NC01 Background Sept, 2013 – Aug 2015**	Pre-WX22 Oct, 2012 –Aug 2013**	Post-WX22 Sept, 2013 – Aug 2015**	
pH	7.5	7.8	7.1	7.2	7.3	7.2	6.5 – 8.0
Cond/ (uS/cm)	440	424	310	387	620	709	2200
TDS	290	260	170	238	390	486	1500^
SO4	120	124	73	92	210	270	1000 ++
Cl	12	10	10	11	26	27	350 +
As	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.024
B	0.05	0.042	0.05	0.045	0.16	0.11	0.37
Cd	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	0.00085
Cr	<0.001	0.001	<0.001	0.001	<0.001	<0.001	0.002
Cu**	0.008	0.009	0.002	0.002	0.002	0.001	0.0035 **(0.005)!**
Fe*	0.02	0.025	0.06	0.32	0.04	0.090	0.3+++
Mn*	0.034	0.033	0.19	0.33	0.55	0.59	1.9
Mo	<0.01	0.003	0.01	0.001	<0.01	<0.001	0.01+
F	0.2	0.169	0.16	0.13	0.1	<0.2	1.5+++
Ni	<0.01	0.006	0.004	0.005	0.0155	0.027	0.017 **(0.051)!**
Pb	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.005
Se	<0.002	<0.002	<0.002	<0.001	<0.002	<0.001	0.005
Zn**	0.04	0.036	0.026	0.021	0.026	0.030	**0.116**
Turbidity	28	48	17	13.8	3.6	3.8	10 **(19.0)!**
DO	-	9.9	7.5	8.0	10.1	10.2	-
TN	-	0.58	0.45	0.49	0.35	0.36	0.250 **(0.55)!**

* filtered samples for iron and manganese
** See Attachment 1 for aluminium, copper and zinc tested on filtered samples
^ River salinity from 0.68 x 2200 uS/cm low land river conductivity protection of aquatic life
# ANZECC (2000) guidelines for protection of freshwaters, livestock or irrigation water. Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Ca, Mg in Neubecks Creek 19.7, 11.8 mg/L, respectively. Local guidelines using 90th percentile of pre-placement data in **bold**
! Lamberts North pre-placement 90th percentile from October 2012 to August 2013 data at WX22 and NC01 in **parenthesis** (does not apply to LDP01)
+ irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L ++ Livestock +++ drinking water
Highlights: Blue: > ANZECC/local guidelines, Yellow: post-median > 90th pre-placement baseline; Green: post-placement 90th > pre-placement 90th percentile,

Table 5 shows the following changes and water quality characteristics from the pre- to post-placement period:

- Other than copper, turbidity and total nitrogen at the upper Neubecks Creek background site, LDP01, all the ANZECC groundwater guideline values or local goals were met at all the sampling sites. As copper was not elevated at the site further down-stream at NC01, the higher copper at LDP01 appears to be from a local, upper Neubecks Creek source.

- At NC01, spikes in salinity and chloride (at low levels) as well as recent, low level, spikes for boron, manganese, nickel and zinc were highlighted. As the sampling site, NC01, is located adjacent to the northern area of the Mt Piper ash placement, these increases may indicate rainfall runoff from the large area of mine spoil used to cap the northern Mt Piper ash area. Mine spoil leachates (see Table 3) have elevated concentrations of salinity and chloride, as well as some trace metals, but the spikes in concentrations in the creek for all the parameters highlighted were well below the local/ANZECC trigger values for surface water.

- The recent, moderate spikes observed for chloride, nickel and zinc at WX22 were all higher than the spikes at NC01, indicating that they may be due to brine leachate enriched coal mine groundwater inflows from Mt Piper via Huon Gully. However, the concentrations of the spikes were well below the local/ANZECC trigger values (see Attachment 1).

  Bore D9, which is located adjacent to Neubecks Creek, has elevated concentrations of chloride, as well as salts, and for nickel, while bore D19, in the coal washery waste area, has elevated concentrations of zinc (see Table 4). Hence, it is possible that these sources are the cause of the spikes observed. However, there had been no significant rainfall for two months before the sampling and it is likely that the low stream flows during dry weather caused the concentrations in the pond behind the weir at WX22 to be increased by evaporation. The concentrations at WX22 have been well below the local/ANZECC surface water trigger values for about 90% of the time since monitoring began in October, 2012 and, during the 2014/15 reporting period, all the water quality and trace metal concentrations at WX22 were lower than the trigger values.

From the above water quality observations, the monitoring of aquatic life in Neubecks Creek, for potential effects of the dry ash placement is summarised in the next Section and discussed in the context of the above water quality monitoring results. The likely effects of the Lamberts North ash placement on aquatic life are then discussed in Section 5.

4.3 Aquatic Life Monitoring in Neubecks Creek

The review of the first year of aquatic life monitoring by GHD (2014) showed that the changes in aquatic life were variable due to the highly variable stream flow conditions in the creek (Aurecon, 2015). Under those conditions, it was considered unlikely that the changes in aquatic life from near the upstream (NC01) to near downstream water quality site (WX22), if any, could be related to changes in water quality between the two sites. Aurecon (2015) recommended that the aquatic life monitoring be undertaken during the second year of ash placement and the need for the monitoring be reviewed following the results obtained.

The Conditions of Approval and the OEMP requires monitoring for macroinvertebrates in the creek at sites near the OEMP nominated water quality sites:

- Upstream at NCR1 (about 400m upstream of the water quality site NC01 and upstream of the northern arm of the creek)

- Downstream of Huon Gully at NCR2 (near WX22), by GHD (2014) from spring, 2012 to autumn 2014.
- GHD (2014) also introduced a site in the Coxs River, downstream of the junction with Neubecks Creek[37], for comparison with the two sites in the creek.

Further monitoring, at the above three sites, was undertaken for the second annual water quality report in 2014/15 by Cardno (2015). The aim was to assess the potential effects, if any, of leachates from the Lamberts North ash placement on the aquatic life in Neubecks Creek. The Cardno report reviewed the monitoring undertaken by GHD (2014) since spring, 2012 and concluded: "It is unlikely that any potential impact to water quality due to Lamberts North could be isolated from background impacts associated with historic and current coal mining, power generation [the Mt Piper ash area] and historic land clearing activities, among other impacts. A complex interaction between the specific characteristics of each impact (in terms of type and magnitude of impact to water quality), local rainfall, flow and hydrology and water quality in Neubecks Creek would make it almost impossible to definitely attribute any change to water quality, and thus any effect on macroinvertebrates, to the Lamberts North ash placement".

These findings are consistent with the ephemeral nature of the stream flows in Neubecks Creek noted by GHD (2014) and the poor condition of the macroinvertebrates due to the local mineralised conditions in the creek.

The aquatic life monitoring is discussed further in Section 5.

[37] The Coxs River site is also downstream of the junction with Sawyers Swamp Creek, so it is located in the Springvale coal mine groundwater discharge flow of about 18 ML/day. In addition, the Angus Place coal mine discharges into the Coxs River upstream of the junction with Neubecks Creek.

5. Discussion

As effects on local surface and groundwater from the Lamberts North dry ash site could not be distinguished from the Mt Piper effects (Aurecon, 2015), an assessment of rainfall infiltration into the dry ash was undertaken. This indicated no significant effects on surface or groundwater provided a lined pond was used to collect the rainfall runoff. Although the Conditions of Approval and the OEMP requires that runoff, including spray irrigation for dust suppression, be retained in lined ponds, EnergyAustralia NSW has advised Aurecon that the use of an unlined pond is a temporary measure.

Although rainfall infiltration into the dry ash indicated no significant effects, an estimate of the increase in infiltration, by seepage through the bottom of the unlined pond, was also made to determine the amount likely to cause water quality effects on surface and groundwater. A pond seepage of 10 to 35% of the average annual rainfall, in addition to the 5% infiltration into the surrounding ash, was estimated to be required to cause the selenium trigger value to be reached in groundwater and surface water, respectively. Although the actual seepage rate is unknown, the high 35% of annual rainfall was estimated to cause potential effects on groundwater, but no significant effects on Neubecks Creek, with the use of an unlined pond. Hence, an assessment of the effects of the pond seepage on the local groundwater is suggested to be undertaken using data to be collected by the bores to be established in December, 2015 at the northern embankment.

Accordingly, as no adverse effects of the Lamberts North site have been identified, no ameliorative measures are indicated at this time.

5.1 Installation of additional Groundwater Bores at Lamberts North

As mentioned above, to improve the ability to assess the Lamberts North site separately from the Mt Piper ash placement, two new bores are to be installed in the northern embankment of the Lamberts North ash placement in late 2015. One of the bores is to sample the groundwater at the level of the interface of the ash base and mine spoil underneath (approximately RL919m) and the other to sample the groundwater at the level of the base of the compacted mine spoil placed above RL901m in Huon Gully.

These bores are expected to enable a comparison of the water levels in the ash placement area with that at bore D1, and also to show if the ash placement is subject to leaching by groundwater flowing from Mt Piper down Huon Gully. The shallow bore may show effects, if any, of rainfall runoff not retained in the unlined Pond 1 and directed by the subsurface drain away from the ash area to the southern lined LN Pond 2.

5.2 Aquatic Life Monitoring

Cardno (2015) undertook the spring 2014 aquatic life monitoring at the same two sites in Neubecks Creek, as well as at the Coxs River site used by GHD (2014). The Coxs River site was selected by GHD (2014) for comparison with the Neubecks Creek sites because they found that both the upstream and downstream sites in Neubecks Creek had limited amounts of aquatic habitat to support macroinvertebrates. However, use of the Coxs River site appears to be inappropriate as a monitoring site and it is suggested that its use be reviewed for the following reasons: The Coxs River site is affected by the relatively constant Springvale coal mine water discharge of about 18 ML/day since 2009 (compared with the ephemeral flows in Neubecks Creek with an average of 5 to 6 ML/day). In addition, the comparison of the three sampling sites for river environmental conditions by Cardno

(2015), such as the riparian zones, stream bank and channel form, showed no corresponding conditions in the Coxs River with the two sites in Neubecks Creek. Hence, the Coxs River site consistently showed differences in macroinvertebrates compared to the sites in Neubecks Creek.

Accordingly, comparisons between the Lamberts North downstream site (NCR2) with the upstream background site (NCR1) could be considered in future monitoring as the most appropriate sampling for assessment of differences in aquatic life at the Lamberts North ash placement area.

The condition of macroinvertebrates at the three sites was determined by the New South Wales Australian River Assessment System (AUSRIVAS). The AUSRIVAS model indicates the type of macroinvertebrate community expected for the water quality conditions in the sampled stream and compares the results with that at reference streams. Differences from the expected community are rated from severely, moderately or mildly impaired, or indicating a healthy habitat, on the basis of comparison with unpolluted reference streams.

The biotic community results for spring 2014 were similar to those found by GHD (2014) from spring 2012 to autumn 2014. The biotic indices from the AUSRIVAS assessment, including SIGNAL2 scores, showed no significant differences, above that likely due to dry weather stream flow effects, between the upstream and downstream sites in Neubecks Creek during the November, 2014 sampling. It should be noted that there had been no significant rainfall for the whole of 2014 prior to the spring sampling. As a consequence, the SIGNAL2 scores showed that the level of impairment of the macroinvertebrate community due to the poor water quality in the creek, relative to unpolluted reference conditions, was severely impaired at the upstream site, NCR1, severely to moderately impaired at NCR2 and severely to mildly impaired at the Coxs River site.

The findings of both the GHD (2014) and Cardno (2015) studies, of no significant differences in macroinvertebrates between the upstream and downstream sites, is consistent with the water quality and trace metal concentrations meeting the local and ANZECC trigger values at the receiving water site, WX22. Alternatively, the inability to detect differences between the sites appears to be due to the naturally poor habitat and mineralised water quality conditions for aquatic life to populate the creek, as well as the effects of the highly variable stream flow conditions on the macroinvertebrates.

It appears that the aquatic life monitoring, even with increased replication of the sampling at the sites in the creek, is not adding additional value to that of the water quality monitoring and its comparison with the Local/ANZECC (2000) guideline trigger values established for the mineralised conditions in Neubecks Creek.

The first annual water quality report suggested that the need for aquatic life monitoring was to be reviewed after the groundwater levels inside the ash placement area are known and the potential effects on receiving waters are better understood. This is expected to be undertaken during the third annual surface and groundwater report in 2016.

6. Conclusions

The review of the 2012 to 2015 surface and groundwater monitoring undertaken for the Lamberts North ash placement has confirmed the findings of the first annual report that the monitoring could not distinguish the potential effects, if any, of the Lamberts North water conditioned ash placement from those from other sources. However, based on an estimation of the rainfall infiltration, no significant effect of the Lamberts North ash placement is expected to be seen at the surface receiving waters. Due to the relatively low groundwater flow rates, the effects of rainfall runoff seepage through the bottom of the temporary unlined LN Pond 1 in the ash area on groundwater is unknown. Installation of two bores in the northern embankment is expected to allow a more definitive assessment of surface and groundwater effects. This would be documented in the third annual report.

The new bores are also expected to show if the groundwater level changes at the seepage detection bore MPGM4/D1, down-gradient of Huon Gully, is being affected with groundwater level changes inside the ash placement area.

This second annual report of the water quality and trace metal data has confirmed that the local and ANZECC (2000) guidelines in the receiving waters of the MPGM4/D8 and D9 groundwater and Neubecks Creek at WX22 have been met, other than salinity, sulphate, iron and manganese at bore D9. IIt was concluded that the salinity and sulphate increases at bore D9 are likely the result of downstream migration of the plume associated with bore D10; while the increases of iron and manganese appears to be related to changed conditions, due to the prolonged dry weather, in the mine groundwater flowing from under the Mt Piper ash area.

The acceptable levels of water quality and trace metals at WX22 are consistent with the aquatic life study, which found no significant differences in macroinvertebrates at the upstream and downstream sampling sites in Neubecks Creek.

7. Recommendations

From the review of water quality data collected from 2012 to 2015, the following recommendations are made for the water conditioned ash placement at the Lamberts North ash storage area:

- Collect 12 months of groundwater data at the two Lamberts North bores once they are installed at the northern embankment wall.
- Measure groundwater height and water quality
- Assess the data for effects, if any, of rainfall infiltration through the ash placement, dust suppression sprinkler water infiltration and rainfall runoff seepage through the bottom of the unlined pond in the ash area
- Determine the effects, if any, of the total infiltration on the surface and groundwater quality at the receiving water sites.
- If the above assessment finds no effects on surface and groundwater quality with the use of temporary unlined ponds, update the OEMP to align with the use of unlined runoff collection ponds in the ash placement area. This would need to consider the differing effects of use of unlined ponds on compacted flyash and on furnace ash. Otherwise use lined ponds as required by the OEMP.
- Update the OEMP to:
    - Include the new groundwater bores
    - Have nitrate concentrations in Neubecks Creek monitored with detection limits that are lower than the ANZECC (2000) guidelines for protection of aquatic life
- Investigate the necessity for the University of Technology Sydney (UTS, Merrick, 2007) Mt Piper groundwater model to be re-formulated and re-run, if required, including the Lamberts North area.

8. References

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Attachment 1

Surface and Groundwater Data for October, 2012 to August, 2015

1. a) Water Quality Data and Summary for Neubecks Creek WX22 and

   b) Mt Piper Power station Licence Discharge Point LDP01 with

   c) Neubecks Creek background site for Lamberts North NC01

2. Water Quality Data and Summary for Mt Piper Groundwater Receiving Water Bores and MPGM4/D8 and MPGM 4/D9

3. Water Quality Data and Summary for Mt Piper Groundwater Seepage Detection Bore MPGM4/D1

4. Water Quality Data and Summary for Mt Piper Ash Placement Area Groundwater Bores MPGM4/D10 and MPGM4/D11

5. Water Quality Data and Summary for Lamberts North Groundwater Bores MPGM4/D15, MPGM4/D16, MPGM4/D17, MPGM4/D18 and MPGM4/D19

6. Lamberts North Water Conditioned Ash Runoff Pond Water Quality October, 2012 to July, 2014 for Ponds LN1 and LN2 and mine water seepage

1. Water Quality Data and Summary for Neubecks Creek WX22 and Lamberts North Power station Licence Discharge Point

1a. Water Quality Data and Summary for Neubecks Creek WX22

Pre-Water conditioned ash Placement - Background Summary Data in Neubecks Creek at WX22 October, 2012 - August, 2013 (mg/L)

	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Average	<0.001	0.11	0.01	68.0	0.001	0.18	0.034		50	0.0002	32		703	0.001		0.003	0.001	0.18	0.07	<0.00005	7	
Maximum	<0.001	0.61	0.01	86.0	0.001	0.47	0.062		83	0.0002	67		1300	0.002		0.009	0.003	0.70	0.32	<0.00005	11	
Minimum	<0.001	0.02	<0.01	51.0	<0.001	0.06	0.016		26	<0.00002	9		330	<0.001		<0.001	<0.001	<0.01	0.02	<0.00005	4	
90th Percentile	<0.001	0.21	0.01	85.0	0.001	0.28	0.058		81	0.0002	54		1100	0.001		0.005	0.002	0.38	0.07	<0.00005	9	
Pre-50th Percentile Trend	<0.001	0.06	0.01	61.0	0.001	0.16	0.032		48	0.0002	26		620	0.001		0.002	0.001	0.10	0.04	<0.00005	6	
ANZECC 2000	0.00005	0.055	0.055		0.024	0.370	0.700			0.00085	350		2200	0.002		0.0035 **(0.005)**		1.5	0.3	0.00006		

Continued…Pre-Water conditioned ash Placement - Background Summary Data in Neubecks Creek at WX22 October, 2012 - August, 2013 (mg/L)

	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	TDS	TFR	Turbidity	V	Zn	Zn-f	DO	Temp
Average	35	0.83	0.007	48		0.023	<1	<0.5	0.41	0.001	7.2	0.01	0.002	253	455		6.22		0.040	0.012	10.8	
Maximum	63	3.30	0.010	110		0.060	<1	<0.5	0.70	0.003	7.6	0.02	0.002	570	880		31.00		0.190	0.040	15.3	
Minimum	15	0.14	<0.001	22		0.006	<1	<0.5	0.35	<0.001	6.8	<0.001	<0.002	86	210		1.50		0.005	0.005	8.2	
90th Percentile	62	1.50	0.010	76		0.051	<1	<0.5	0.50	0.002	7.5	0.01	0.002	450	800		9.10		0.040	0.022	14.2	
Pre-50th Percentile Trend	31	0.55	0.010	40		0.0155	<1	<0.5	0.35	0.001	7.3	0.01	0.002	210	390		3.60		0.026	0.007	10.1	
ANZECC 2000		1.900	0.010		10.0	0.017 **(0.051)**		0.015	0.250 **(0.55)**	0.005	6.5-8.0	0.020 **(0.030)**	0.005	1000	1500	10.0 **(19.0)**	10.0		0.116			

Neubecks Creek WX22 Water conditioned ash Placement Water Quality Data October 2012 to August 2015

Sample Date	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
12/10/2012	<0.001	0.07	0.01	61	<0.001	0.14	0.022		35	<0.0002	23		510	<0.001		0.002	0.001	0.1	0.32	<0.00005	6	
14/11/2012	<0.001	0.04	<0.01	79	0.001	0.21	0.034		49	0.0002	32		710	0.001		0.002	0.002	0.05	0.07	<0.00005	6	
12/12/2012	<0.001	0.06	0.01	86	0.001	0.16	0.032		49	<0.00002	26		620	0.001		0.001	0.001	0.3	0.07	<0.00005	7	
17/01/2013	<0.001	0.61	<0.01	56	0.001	0.16	0.05		76	0.0002	48		1100	0.001		0.009	0.001	0.7	0.03	<0.00005	9	
24/02/2013	<0.001	0.07	0.01	55	0.001	0.07	0.016		26	0.0002	9		330	0.001		0.002	0.001	0.1	0.07	<0.00005	4	
14/03/2013	<0.001	0.02	0.01	80	0.001	0.47	0.058		81	0.0002	67		1300	0.001		0.004	0.003	<0.01	0.02	<0.00005	11	
10/04/2013	<0.001	0.02	0.01	84	0.001	0.22	0.036		48	0.0002	34		710	0.001		0.001	<0.001	0.2	0.02	<0.00005	6.7	
16/05/2013	<0.001	0.03	0.01	85	0.001	0.28	0.062		83	0.0002	54		1100	0.001		<0.001	0.001	0.01	0.04	<0.00005	9	
14/06/2013	<0.001	0.16	0.01	51	0.001	0.06	0.017		27	0.0002	14		370	0.001		0.004	0.001	0.1	0.04	<0.00005	5	
11/07/2013	<0.001	<0.05	0.01	51	0.001	0.07	0.019		27	0.0002	15		390	<0.001		<0.001	0.001	0.1	0.05	<0.00005	4	
23/08/2013	<0.001	0.05	<0.01	60	<0.001	0.11	0.024		45	<0.0002	26		590	0.002		0.001	<0.001	<0.01	0.02	<0.00005	5	
26-Sep-13	<0.001	0.15	0.03	60	<0.001	0.09	0.023		33	<0.0002	19		480	<0.001		0.001	0.001	<0.2	0.36	<0.00005	5	
23-Oct-13	<0.001	0.06	<0.01	75	0.001	0.2	0.048		76	0.0002	47		990	0.002		<0.001	<0.001	<0.2	0.03	<0.00005	8	
6-Nov-13	<0.001	0.3	0.01	73	0.001	0.21	0.056		87	0.0002	54		1000	0.002		<0.001	0.001	<0.2	0.04	<0.00005	8	
6-Dec-13	<0.001	0.09	<0.01	75	0.001	0.19	0.042		72	0.0002	45		950	0.003		0.001	0.001	0.2	0.04	<0.00005	6	
15-Jan-14	<0.001	0.08	0.01	53	0.001	0.25	0.052		110	0.0002	86		1600	0.002		0.001	0.001	<0.2	0.1	<0.00005	9	
5-Feb-14	<0.001	0.03	<0.01	<25	0.001	0.25	0.05		140	0.0002	130		2000	0.002		<0.001	0.001	0.2	0.1	<0.00005	11	
5-Mar-14	<0.001	0.03	0.01	25	0.001	0.11	0.038		54	0.0002	12		620	0.001		0.002	<0.001	0.2	0.01	<0.00005	6	
3-Apr-14	<0.001	0.06	0.01	27	0.001	0.08	0.016		19	0.0002	9		290	0.002		0.002	0.001	0.2	0.02	<0.00005	3	
2-May-14	<0.001	0.02	0.01	29	0.001	0.06	0.017		28	0.0002	15		400	<0.001		<0.001	<0.001	0.2	0.03	<0.00005	4	
13-Jun-14	<0.001	0.01	0.01	25	0.001	0.08	0.032		43	0.0002	25		600	0.001		0.001	0.001	0.2	<0.01	<0.00005	6	
10-Jul-14	<0.001	0.01	0.01	25	0.001	0.1	0.032		47	0.0002	29		660	0.001		0.001	0.001	0.2	0.01	<0.00005	6	
17/08/2014	<0.001	<0.01	<0.01	<25	<0.001	0.07	0.027		38	<0.0002	29		600	<0.001		<0.001	<0.001	<0.2	0.03	<0.00005	5	
11-Sep-14	0.0005	0.45	0.005	36	0.0005	0.06	0.012		21	0.0001	13		330	0.001		0.001	0.0005	0.1	0.02	0.000025	5	
23-Oct-14	0.0005	0.04	0.005	39	0.0005	0.08	0.014		29	0.0001	19		470	0.001		0.001	0.0005	0.1	0.02	0.000025	4	
13-Nov-14	0.0005	0.05	0.005	47	0.0005	0.15	0.031		72	0.0001	53		1000	0.001		0.001	0.0005	0.1	0.11	0.000025	6	
12-Dec-14	0.0005	0.13	0.005	52	0.0005	0.06	0.013		22	0.0001	10		330	0.001		0.002	0.001	0.1	0.02	0.000025	4	

15-Jan-15	0.0005	0.05	0.02	66	0.0005	0.06	0.007		21	0.0001	7		290	0.001		0.001	0.001	0.1	0.09	0.000025	3	
12-Feb-15	0.0005	0.04	0.01	92	0.0005	0.12	0.021		47	0.0001	30		660	0.001		0.001	0.0005	0.1	0.28	0.000025	5	
11-Mar-15	0.0005	0.03	0.01	89	0.0005	0.16	0.044		83	0.0001	68		1100	0.001		0.003	0.0005	0.3	0.32	0.000025	8	
10-Apr-15	0.0005	0.01	0.005	53	0.0005	0.09	0.018		32	0.0001	26		510	0.001		0.001	0.0005	0.1	0.1	0.000025	5	
28-May-15	0.0005	0.01	0.005	50	0.0005	0.025	0.012		26	0.0001	19		400	0.001		0.001	0.0005	0.1	0.1	0.00002	5	
18-Jun-15	0.0005	0.025	0.025	47	0.0005	0.06	0.022		36	0.0001	26		540	0.001		0.001	0.0005	0.1	0.06	0.00002	6	
16-Jul-15	0.0005	0.11	0.005	51	0.0005	0.025	0.018		26.5	0.0001	19.9		491	0.001		0.001	0.0005	0.2	0.056	0.00002	5.31	
20-Aug-15	0.0005	0.02	0.02	47	0.0005	0.14	0.022		44.2	0.0001	35.6		705	0.001		0.001	0.0005	0.025	0.113	0.00002	6.18	

Continued…Neubecks Creek WX22 Water conditioned ash Placement Water Quality Data October 2012 to August 2015

Sample Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	TDS	TFR	Turbidity	V	Zn	Zn-f	DO	Temp	Rainfall
12/10/2012	23	0.23	<0.01	33		<0.01		<0.5	0.7	<0.001	7	<0.01	<0.002	150	290		3.6		0.005	0.005	10.2		20.8
14/11/2012	33	0.55	0.01	47		0.01		<0.5	0.35	<0.001	7	0.01	0.002	230	490		2.6		0.04	0.005	9		30.9
12/12/2012	33	0.66	0.01	40		0.02		<0.5	0.35	0.001	7.6	<0.01	0.002	200	380		3.9		0.04	0.005	9		64.1
17/01/2013	63	0.45	<0.01	64		0.06		<0.5	0.5	0.003	7.3	0.02	0.002	440	720		31		0.19	0.04	8.2		113.2
24/02/2013	15	0.61	0.01	22		0.01		<0.5	0.35	<0.001	7.4	<0.01	0.002	86	210		6.3		0.01	0.005	8.7		184.2
14/03/2013	62	3.3	<0.01	110		0.05		<0.5	0.35	0.001	7.3	0.01	0.002	570	880		2.7		0.04	0.02	9.2		66.2
10/04/2013	31	0.98	0.01	50		0.02		<0.5	0.35	0.001	7.5	0.01	0.002	228	400		2.1		0.022	0.005	10.1		28.1
16/05/2013	61	1.5	0.01	76		0.03		<0.5	0.35	0.001	7.1	0.01	0.002	450	800		1.5		0.013	0.011	12		29
14/06/2013	18	0.14	<0.001	27		0.006		<0.5	0.4	0.001	7.2	0.01	0.002	110	230		9.1		0.026	<0.005	14.2		109
11/07/2013	19	0.33	0.001	26		0.01		<0.5	0.5	0.001	6.8	0.01	0.002	110	220		2		0.026	0.017	15.3		24.4
23/08/2013	31	0.37																					
26-Sep-13	23	0.52	<0.001	33		0.013	<1	<0.5	0.45	<0.001	7.2	<0.01	<0.002	150	330		5.2		0.027	0.025	10.4		35
23-Oct-13	53	0.39	<0.001	61		0.024	<1	<0.5	0.35	0.001	7.4	0.01	0.002	380	720		2.1		0.032	0.009	5.3		21.8
6-Nov-13	60	0.63	0.001	69		0.026	<1	<0.5	0.35	0.001	7.4	0.01	0.002	420	780		6.6		0.03	0.009	4.8		95.2
6-Dec-13	52	0.55	0.001	63		0.027	<1	<0.5	0.35	0.001	7.4	0.01	0.002	360	620		2.5		0.035	0.012	9.9		34.2
15-Jan-14	99	0.98	0.001	110		0.096	<1	<0.5	0.35	0.001	7.3	0.01	0.002	750	1200		13		0.088	0.046	4.4		13.6
5-Feb-14	140	1.9	0.001	140		0.15	<1	<0.9	0.55	0.001	6.9	0.01	0.002	1000	1600		4.4		0.12	0.1	6		74
5-Mar-14	29	0.42	0.001	28		0.029	<1	<0.5	0.35	0.001	6.7	0.01	0.002	280	460		1.6		0.052	0.028	9		143.8
3-Apr-14	11	0.16	0.001	17		0.011	<1	<0.5	0.4	0.001	7	0.01	0.002	86	180		2.9		0.025	0.009	9.2		63
2-May-14	17	0.33	0.001	21		0.011	<1	<0.5	0.35	0.001	7	0.01	0.002	130	260		0.95		0.028	0.011	12.2		14
13-Jun-14	26	0.41	0.001	36		0.016	<1	<0.5	0.45	0.001	6.9	0.01	0.002	210	400		0.9	<0.01	0.031	0.011	14.1		43.2
10-Jul-14	30	0.41	0.001	41		0.018	<1	<0.5	0.35	0.001	6.9	0.01	0.002	230	390		0.85	<0.01	0.024	0.013	14		24.2
17/08/2014	26	0.37	<0.001	39		0.017	<1	<0.5	<0.7	<0.001	6.9	<0.01	<0.002	230	400		1	<0.01	0.035	0.013	13.3		
11-Sep-14	13	0.042	0.001	23		0.006	0.5	0.5	0.4	0.001	7.5		0.001	100	200		11		0.012	0.005	13.1		
23-Oct-14	20	0.32	0.001	30		0.016	0.5	0.5	0.35	0.001	7.5		0.001	150	270		1.8		0.019	0.005	6.1		
13-Nov-14	51	0.85	0.001	66		0.048	0.5	0.5	0.35	0.001	7.4		0.001	420	690		4.8		0.055	0.005	4.2		
12-Dec-14	13	0.029	0.001	21		0.007	0.5	0.5	0.4	0.001	7.5		0.001	83	170		11		0.006	0.005	11.8		
15-Jan-15	13	0.12	0.001	18		0.006	0.5	0.5	0.4	0.001	7.6		0.001	60	180		2.5		0.005	0.005	5.1		
12-Feb-15	33	1.7	0.001	42		0.033	0.5	0.5	0.4	0.001	7.3		0.001	190	440		4.3		0.017	0.005	4.5		
11-Mar-15	60	3.1	0.001	76		0.056	0.5	0.5	0.4	0.001	7.2		0.001	400	780		6.4		0.031	0.005	10.9		
10-Apr-15	22	0.4	0.001	32		0.011	0.5	0.5	0.4	0.001	7.4		0.001	160	320		0.9		0.008	0.005	12.6		
28-May-15	17	0.19	0.001	23		0.008	0.5	0.5	0.3	0.001	7.5		0.001	110	230		0.95		0.006	0.005	11.6		
18-Jun-15	22	0.18	0.001	33		0.007	0.5	0.5	0.35	0.001	7.1		0.001	180	270		1.4		0.006	0.005	13.8		
16-Jul-15	16.9	0.104	0.001	33.9		0.006	0.001	0.02	0.2	0.001	7.49		0.0002	156	329		3		0.005	0.005	26.6		
20-Aug-15	28.7	0.152	0.001	47.2		0.016	0.001	0.01	0.05	0.001	7.46		0.0001	243	445		1.2		0.011	0.005	11.2		

Neubecks Creek WX22 Post- water conditioned ash Placement summary September 2013 - August 2015 (mg/L)																						
	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Average	<0.001	0.08	0.01	51.64	0.0007	0.11	0.028		50.3	0.0001	27		709	0.001		0.001	0.001	0.15	0.09	<0.00005	6	
Maximum	<0.001	0.45	0.03	92.00	0.0010	0.25	0.056		140.0	0.0002	130		2000	0.003		0.003	0.001	0.30	0.36	<0.00005	11	
Minimum	<0.001	<0.01	<0.01	25.0	<0.001	0.0	0.007		19.0	<0.0002	7		290	<0.001		<0.001	<0.001	<0.02	<0.01	<0.00005	3	
90th Percentile	<0.001	0.15	0.02	75.00	0.0010	0.21	0.049		85.8	0.0002	64		1070	0.002		0.002	0.001	0.20	0.25	<0.00005	8	
Pre-50th Percentile Trend	<0.001	0.04	0.01	50.50	0.0005	0.09	0.023		40.5	0.0001	26		600	0.001		0.001	0.001	0.10	0.06	<0.00005	6	
ANZECC 2000	0.00005	0.055	0.055		0.024	0.37	0.7			0.00085	350		2200	0.002		0.0035 **(0.005)**		1.5	0.3	0.00006		

Neubecks Creek WX22 Post- water conditioned ash Placement summary September 2013 - August 2015 (mg/L)																						
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	TDS		Turbidity	V	Zn	Zn-f	DO	Temp
Average	36	0.59	0.001	46		0.027	<1	0.42	0.36	0.001	7.2	0.01	0.001	270	486		3.8	<0.01	0.030	0.014	10.2	10.5
Maximum	140	3.10	0.001	140		0.150	<1	<1	0.55	0.001	7.6	0.01	0.002	1000	1600		13.0	<0.01	0.120	0.100	26.6	10.5
Minimum	11	0.03	0.001	17		0.006	<1	<0.001	0.05	<0.001	6.7	<0.001	<0.002	60	170		0.9	<0.01	0.005	0.005	4.2	10.5
90th Percentile	60	1.48	0.001	74		0.054	<1	0.50	0.440	0.001	7.5	0.010	0.002	420	780		9.7	<0.01	0.054	0.027	13.9	10.5
Pre-50th Percentile Trend	26	0.40	0.001	35		0.016	<1	0.50	0.350	0.001	7.4	0.010	0.001	200	395		2.5	<0.01	0.026	0.007	10.7	10.5
ANZECC 2000		1.9	0.01		10	0.017 **(0.051)**		0.015	0.250 **(0.55)**	0.005	6.5-8.0	0.020 **(0.030)**	0.005	1000	1500	10.0 **(19.0)**	10		0.116			

1b. Water Quality Data and Summary for Mt Piper Power station Licence Discharge Point

Pre-Water conditoned ash Placement - Background summary Data at Mt Piper Power Station Licence Discharge Point LMP01 October, 2012 - August, 2013 (mg/L)																						
Sample Date	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Ave	<0.001	0.43	0.03	80	0.001	0.05	0.030	<0.001	34	0.0002	13		464	0.001		0.016	0.005	0.2	0.06	<0.00005	6	
Max	<0.001	1.10	0.10	91	0.001	0.07	0.041	<0.001	43	0.0003	18		570	0.002		0.07	0.012	0.4	0.34	<0.00005	8	
Min	<0.001	0.13	0.01	52	0.001	0.03	0.022	<0.001	24	<0.00002	8		370	<0.001		0.005	0.001	0.1	<0.01	<0.00005	5	
90th Baseline	<0.001	0.72	0.05	91	0.001	0.06	0.035	<0.001	39	0.0003	16		560	0.001		0.029	0.008	0.3	0.10	<0.00005	7	
Pre-50th Percentile Trend	<0.001	0.4	0.01	81	0.001	0.05	0.029	<0.001	33	0.0002	12		440	0.001		0.008	0.003	0.2	0.02	<0.00005	6.6	
ANZECC 2000	0.00005	0.055	0.055		0.024	0.370	0.700			0.00085	350		2200	0.002		0.0035 **(0.005)**		1.5	0.3	0.00006		

Continued…………………… Background summary data – Mt Piper Power Station Licence Discharge Point LDP01 October, 2012 – August, 2013 (mg/L)																			
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn
Average	21	0.070	0.007	29		0.009				0.002	7.6	0.028	0.002	128		292	35.9		0.045455
Maximum	31	0.190	0.010	35		0.010				0.008	7.9	0.080	0.002	180		400	100.0		0.070
Minimum	12	0.002	0.002	23		0.006				0.001	7.3	0.010	0.002	90		210	7.3		0.030
90th Percentile	30	0.165	0.01	34		0.010				0.0045	7.9	0.050	0.002	172		380	75.0		0.060
Pre-50th Percentile Trend	21	0.034	0.01	30		0.010				0.0015	7.5	0.020	0.002	120		290	28.0		0.040
ANZECC 2000		1.900	0.010		10.0	0.017 **(0.051)**		0.015	0.250 **(0.55)**	0.005	6.5-8.0	0.020 **(0.030)**	0.005	1000	1500	10.0 **(19.0)**	10.0		0.116

Mt Piper Power Station Licence Discharge Point LDP01 Water conditioned ash Placement Water Quality Data October, 2012 to August, 2015 (mg/L)																						
Date	**Ag**	**Al**	**Al-f**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca:**	**Cd**	**Cl:**	**Co**	**COND uS/cm**	**Cr**	**Cr-6**	**Cu**	**Cu-f**	**F**	**Fe**	**Hg**	K:	Li
12/10/2012	<0.001	0.72	0.1	71	<0.001	0.03	0.023		30	<0.0002	12		390	<0.001		0.029	0.012	0.2	0.34	<0.00005	6	
14/11/2012	<0.001	0.13	<0.01	91	0.001	0.06	0.029		39	0.0002	18		530	0.001		0.01	0.008	0.4	0.02	<0.00005	7	
12/12/2012	<0.001	0.55	0.02	78	0.001	0.04	0.028		30	<0.00002	12		400	0.001		0.008	0.005	0.3	<0.01	<0.00005	7	
17/01/2013	<0.001	0.54	<0.01	84	<0.001	0.07	0.033		30	<0.0002	14		420	0.001		0.011	0.005	0.3	0.02	<0.00005	7	
21/02/2013	<0.001	0.49	0.01	77	0.001	0.05	0.035		32	0.0002	8		390	0.001		0.006	0.003	0.3	0.01	<0.00005	5	
14/03/2013	<0.001	0.21	0.01	81	<0.001	0.04	0.029		38	0.0002	13		540	0.001		0.07	0.003	0.1	0.01	<0.00005	7	
10/04/2013	<0.001	0.18	<0.01	90	0.001	0.05	0.031		38	<0.0002	11		560	0.001		0.016	0.001	0.2	<0.01	<0.00005	6.6	
16/05/2013	<0.001	0.22	0.01	91	<0.001	<0.05	0.041		43	0.0003	16		570	<0.001		0.008	0.006	0.3	0.02	<0.00005	8	
14/06/2013	<0.001	1.1	0.01	52	0.001	<0.05	0.022		24	<0.0002	8		370	0.001		0.008	0.003	0.2	0.04	<0.00005	5	
11/07/2013	<0.001	0.23	<0.01	76	0.001	0.06	0.028	<0.001	33	0.0002	12		440	<0.001		0.006	0.002	0.2	0.02	<0.00005	6	
23/08/2013	<0.001	0.4	0.02	90	<0.001	0.05	0.026	<0.001	38	<0.0002	14		490	0.002		0.005	0.003	0.2	0.02	<0.00005	6	
15-Sep-13													500									
23-Oct-13	<0.001	0.37	0.02	87	0.001	<0.05	0.026	<0.001	33	<0.0002	13		460	0.002		0.013	0.006	<0.2	0.02	<0.00005	6	
06-Nov-13	<0.001	0.27	0.03	100	<0.001	0.06	0.025	<0.001	29	0.0002	13		470	0.002		0.009	0.006	0.2	0.02	<0.00005	6	
06-Dec-13	<0.001	0.28	0.02	80	0.001	0.06	0.03	<0.001	31	0.0002	10		400	0.003		0.009	0.004	0.3	0.02	<0.00005	5	
15-Jan-14	<0.001	0.22	0.02	86	<0.001	0.08	0.025	<0.001	28	0.0002	7		350	0.002		0.005	0.003	0.3	0.01	<0.00005	5	
05-Feb-14	<0.001	0.3	0.02	120	0.001	0.07	0.038	<0.001	39	0.0002	11		460	0.002		0.005	0.002	0.3	0.02	<0.00005	6	
05-Mar-14	<0.001	1.2	0.01	41	0.001	<0.05	0.029	<0.001	22	0.0002	6		300	0.002		0.008	0.004	<0.2	<0.01	<0.00005	5	
03-Apr-14	<0.001	0.82	<0.01	58	0.001	0.06	0.034	<0.001	25	0.0002	10		290	0.002		0.007	0.003	0.2	0.01	<0.00005	5	
02-May-14	<0.001	0.14	0.01	89	<0.001	<0.05	0.031	<0.001	40	0.0002	14		560	<0.001		0.002	0.001	<0.2	0.01	<0.00005	6	
13-Jun-14	<0.001	0.2	<0.01	78	0.001	0.05	0.032	<0.001	34	0.0002	15		490	0.001		0.004	0.002	0.2	0.02	<0.00005	6	
10-Jul-14	<0.001	0.36	0.01	69	0.001	0.06	0.032	<0.001	33	0.0002	17		500	<0.001		0.005	0.004	0.2	0.02	<0.00005	7	
17/08/2014	<0.001	0.15	<0.01	75	<0.001	0.05	0.033	<0.001	29	<0.0002	6		460	0.001		0.006	0.004	0.2	0.02	<0.00005	6	
11-Sep-14	<0.001	1.5	0.01	50	0.001	0.05	0.034	0.001	22	0.0001			420	0.002		0.008	0.002	0.1	0.02	0.000025	4	
23-Oct-14	<0.001	0.22	0.01	60	0.001	0.05	0.023	0.001	23	0.0001			350	0.001		0.005	0.003	0.1	0.03	0.000025	5	
13-Nov-14	<0.001	0.14	0.005	91	0.001	0.05	0.025	0.001	31	0.0001	12		440	0.001		0.004	0.003	0.2	0.02	0.000025	6	
12-Dec-14	<0.001	2	0.01	43	0.002	0.05	0.031	0.001	17	0.0001	3		210	0.002		0.011	0.004	0.1	0.01	0.00008	4	
15-Jan-15	<0.001	0.78	0.02	52	0.001	0.05	0.029	0.001	20	0.0001	4		240	0.001		0.008	0.004	0.1	0.06	0.000025	4	
12-Feb-15	<0.001	0.09	0.01	91	0.001	0.05	0.034	0.001	35	0.0001	9		430	0.001		0.004	0.002	0.1	0.06	0.000025	5	
11-Mar-15	<0.001	0.83	0.02	79	0.001	0.05	0.034	0.001	31	0.0001	9		370	0.001		0.013	0.005	0.2	0.03	0.000025	6	
10-Apr-15	<0.001	0.42	0.01	58	0.001	0.05	0.029	0.001	22	0.0001	8		290	0.001		0.013	0.011	0.1	0.04	0.000025	4	
28-May-15	<0.001	0.34	0.005	77	0.001	0.05	0.036	0.001	34	0.0001	15		480	0.001		0.015	0.011	0.1	0.01	0.00002	7	
18-Jun-15	<0.001	0.86	0.02	59	0.001	0.05	0.026	0.001	23	0.0001	10		730	0.001		0.018	0.008	0.1	0.04	0.00002	5	

16-Jul-15	<0.001	1.6	0.005	57	0.001	0.05	0.031	0.001	21.3	0.0001	9.7		320	0.001		0.014	0.006	0.2	0.02	0.00002	5.72	
20-Aug-15	<0.001	0.21	0.005	80	0.001	0.07	0.027	0.001	34.4	0.0001	17.5		665	0.001		0.014	0.008	0.085	0.025	0.00002	8.74	

Continued…………Mt Piper Power Station Licence Discharge Point LDP1 Water Conditioned Ash Placement Water Quality Data October, 2012 to August, 2015 (mg/L)

Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn	Zn-f	DO
12/10/2012	16	0.19	<0.01	23		<0.01			0.7	<0.001	7.3	0.02	0.002	100		220	50		0.06	0.05	
14/11/2012	22	<0.001	0.01	35		0.01			<0.9	0.001	7.3	0.01	<0.002	140		370	9.6		0.03	0.005	
12/12/2012	15	0.002	0.01	30		0.01			<1.0	0.008	7.8	0.03	0.002	100		220	28		0.06	0.005	
17/01/2013	15	<0.001	0.01	32		0.01			<1.0	0.001	7.8	0.02	0.002	96		210	45		0.04	0.005	
21/02/2013	18	0.026	0.01	29		0.01			<0.7	0.002	7.3	0.02	0.002	100		400	75		0.04	0.005	
14/03/2013	31	<0.001	0.01	26		0.01			<0.8	0.003	7.5	0.01	0.002	160		330	15		0.04	0.005	
10/04/2013	29	0.019	0.01	26		0.01			<0.7	0.001	7.8	<0.01	0.002	172		300	7.3		0.033	0.005	
16/05/2013	30	0.14	<0.01	32		<0.01			<0.8	<0.001	7.4	<0.01	0.002	180		380	14		0.049	0.042	
14/06/2013	12	<0.001	0.002	26		0.006			<1.0	0.002	7.9	0.08	0.002	90		220	100		0.07	0.012	
11/07/2013	21	0.042	0.002	31		0.008			<1.0	0.001	7.4	0.0366	0.002	120		270	34		0.047	<0.005	
23/08/2013	24	<0.001	0.002	34		0.006			<1.0	<0.001	7.9	<0.1	<0.002	150		290	17		0.031	<0.005	
15-Sep-13											8.1										
23-Oct-13	20	<0.001	0.002	34		0.006			<1.0	<0.001	7.9	<0.1	<0.002	120		300	14		0.038	<0.005	
6-Nov-13	19	0.001	0.003	44		0.005			<1.0	0.001	7.9	0.01	0.002	120		320	7.9		0.03	0.005	
6-Dec-13	15	0.001	0.007	27		0.006			<1.0	0.001	7.8	0.01	0.002	98		200	3.3		0.053	0.005	
15-Jan-14	13	0.001	0.002	21		0.005			<1.0	0.001	7.8	0.01	0.002	98		200	8.1		0.023	0.005	
5-Feb-14	18	0.001	0.004	31		0.006			<0.5	<0.001	8.2	<0.1	0.002	98		300	12		0.025	<0.005	
5-Mar-14	8	0.001	0.002	19		0.009			<1.0	0.002	7.3	0.015	0.002	100		200	55		0.058	0.012	
3-Apr-14	14	<0.001	0.002	20		0.009			<1.1	0.002	7.7	<0.1	0.002	90		220	60		0.048	0.007	
2-May-14	30	0.031	0.002	23		0.007			<1.0	<0.001	7.8	0.01	0.002	180		340	5.9		0.028	<0.005	
13-Jun-14	21	0.089	0.002	31		0.006			<1.0	0.001	7.8	<0.1	0.002	140		300	9.1	<0.01	0.038	0.009	
10-Jul-14	20	0.066	0.004	39		0.005			<1.0	0.001	7.8	0.015	0.002	140		270	14	<0.01	0.03	0.009	
17-Aug-14	17	0.05	0.004	39		0.006			<1.0	<0.001	7.8	<0.03	<0.002	150		300	14		0.032	0.007	
11-Sep-14	9	0.0005	0.002	18		0.006	0.5	0.5	0.55	0.004	7.8		0.001	130		200	130	0.005	0.06	0.0025	15.6
23-Oct-14	12	0.012	0.003	25		0.005	0.5	0.5	0.5	0.001	7.7		0.001			200	18	0.005	0.026	0.006	6.7
13-Nov-14	17	0.0005	0.004	32		0.004	0.5	0.5	0.5	0.001	7.9		0.001	130		250	7.9	0.005	0.033	0.0025	3.8
12-Dec-14	6	0.0005	0.002	13		0.008	0.5	1	1	0.005	7.4		0.001	71		160	210	0.005	0.049	0.005	10.9
15-Jan-15	9	0.045	0.002	16		0.005	0.5	0.5	0.55	0.002	7.6		0.001	52		190	100	0.005	0.032	0.015	4.3
12-Feb-15	21	0.004	0.005	21		0.004	0.5	0.5	0.5	0.001	7.9		0.001			280	9.9	0.005	0.007	0.0025	3.8
11-Mar-15	16	0.065	0.003	22		0.006	0.5	1	0.55	0.002	7.8		0.001	120		240	65	0.005	0.033	0.0025	10.5
10-Apr-15	10	0.083	0.002	22		0.006	0.5	0.5	0.5	0.001	7.8		0.001	66		200	23	0.005	0.033	0.026	11
28-May-15	23	0.12	0.003	34		0.007	0.5	0.5	0.35	0.001	7.9		0.001	160		360	23	0.005	0.026	0.015	9.4
18-Jun-15	9	0.056	0.002	24		0.006	0.5	0.5	0.5	0.002	7.9		0.002	240		170	140	0.005	0.054	0.021	12.5
16-Jul-15	11.2	0.048	0.002	31.3		0.007	0.005	0.24	0.9	0.003	7.9		0.0019	100		290	151	0.005	0.055	0.017	18.9
20-Aug-15	20.7	0.026	0.006	64.4		0.008	0.005	0.37	0.6	0.001	7.59		0.0012	210		488	14.5	0.005	0.02	0.01	11.3

Mt Piper Power Station Licence Discharge Point LDP01 Post-water conditioned ash Placement Summary October 2012 to August, 2015 (mg/L)

	Ag	Al	Al-f	ALK	As	B	Ba	Ag	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Average	<0.001	0.58	0.01	73	0.001	0.056	0.030	<0.001	29	0.0001	10		424	0.001		0.009	0.005	0.17	0.02	<0.00005	5.5	
Maximum	<0.001	2.00	0.03	120	0.002	0.080	0.038	<0.001	40	0.0002	18		730	0.003		0.018	0.011	0.30	0.06	<0.00005	8.7	
Minimum	<0.001	0.09	0.01	41	0.001	0.050	0.023	<0.001	17	<0.0002	3		210	0.001		0.002	0.001	0.09	0.01	<0.00005	4.0	
50th Percentile	<0.001	0.34	0.01	77	0.001	0.050	0.031	<0.001	29	0.0001	10		435	0.001		0.008	0.004	0.20	0.02	<0.00005	5.7	
Post-90th Percentile Trend	<0.001	1.44	0.02	91	0.001	0.070	0.034	<0.001	35	0.0002	15		542	0.002		0.014	0.008	0.30	0.04	<0.00005	6.8	

Continued……Mt Piper Power Station Licence Discharge Point LDP01 Post-water conditioned ash Placement Summary October 2012 to August, 2015 (mg/L)																					
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn	Zn-f	DO
Average	16	0.03	0.003	28		0.006	0.418	0.55	0.58	0.002	7.8	0.01	0.002	124		260	47.6	<0.01	0.036	0.009	9.9
Maximum	30	0.12	0.007	64		0.009	0.500	1.00	1.00	0.005	8.2	0.02	0.002	240		488	210.0	<0.01	0.060	0.026	18.9
Minimum	6	0.00	0.002	13		0.004	0.005	0.24	0.35	<0.001	7.3	0.01	<0.002	52		160	3.3	<0.01	0.007	0.003	3.8
50th Percentile	16	0.03	0.002	25		0.006	0.500	0.50	0.53	0.001	7.8	0.01	0.002	120		250	14.5	<0.01	0.033	0.007	10.7
Post-90th Percentile Trend	21	0.08	0.005	39		0.008	0.500	0.95	0.87	0.003	7.9	0.02	0.002	180		336	138.0	<0.01	0.055	0.017	15.3

1C. *Water Quality Data and Summary for Neubecks Creek at upstream site NC01*

Neubecks Creek NC01 Pre-water conditioned ash Placement - Background summary Data October, 2012 – August, 2013 (mg/L)																						
	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Average	<0.001	0.33	0.03	71	0.001	0.04	0.032	<0.001	23	0.0002	10		310	0.001		0.002	0.002	0.16	0.18	<0.00005	4.2	
Maximum	<0.001	0.73	0.08	94	0.001	0.05	0.042	<0.001	40	0.0002	15		540	0.002		0.005	0.003	0.30	0.55	<0.00005	6.3	
Minimum	<0.001	0.06	0.01	34	0.001	0.02	0.024	<0.001	4	<0.00002	5		85	0.000		0.001	0.001	0.10	0.02	<0.00005	2.0	
90th Percentile	<0.001	0.49	0.07	87	0.001	0.05	0.042	<0.001	35	0.0002	13		470	0.001		0.004	0.002	0.21	0.38	<0.00005	6.0	
Pre-50th Percentile Trend	<0.001	0.37	0.02	70	0.001	0.05	0.029	<0.001	24	0.0002	10		310	0.001		0.002	0.002	0.15	0.06	<0.00005	4.0	
ANZECC 2000		0.055			0.024	0.37	0.700			0.00085	350		2200	0.002		0.0035 (0.005)		1.50	0.30	0.0006		

Continued……………….Neubecks Creek NC01 Pre- water conditioned ash Placement - Background summary Data October, 2012 – August, 2013 (mg/L)																						
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn	Zn-f	Ammonia Nitrogen	DO
Average	14	0.23	0.007	19		0.004	<1	<0.5	0.46	0.001	7.1	0.02	0.002	72		184	15.7		0.022	0.006	<0.1	8.0
Maximum	27	1.00	0.020	27		0.005	<1	<0.5	0.70	0.002	7.4	0.03	0.002	156		280	40.0		0.039	0.012	<0.1	14.3
Minimum	3	0.01	0.005	8		0.003	<1	<0.5	0.35	<0.001	6.5	0.00	<0.002	4		61	5.7		0.005	0.005	<0.1	1.7
90th Percentile	24	0.31	0.010	26		0.005	<1	<0.5	0.55	0.002	7.4	0.03	0.002	130		280	19.0		0.031	0.007	<0.01	11.7
Pre-50th Percentile Trend	14	0.19	0.005	22		0.005	<1	<0.5	0.45	0.001	7.1	0.02	0.002	73		170	17.0		0.026	0.005	<0.01	7.5
ANZECC 2000		1.9	0.010		10.0	0.017 (0.051)			0.250 (0.55)	0.005	6.5-8.0	0.020 (0.030)	0.005	1000		1500			0.116		0.013	

Neubecks Creek Upstream NC01 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																						
Date	Ag	Al	Al-f	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
12/10/2012	<0.001	0.37	0.07	<20	<0.001	0.02	0.027		17	<0.0002	10		250	<0.001		0.004	0.002	0.1	0.55	<0.00005	4	
14/11/2012	<0.001	0.45	0.08	<20	0.001	<0.01	0.027		4	0.0002	8		85	0.001		0.002	0.002	<0.1	0.38	<0.00005	2	
12/12/2012	<0.001	0.49	0.05	34	0.001	0.05	0.029		8.2	<0.00002	8		130	0.001		0.002	0.002	0.1	0.35	<0.00005	2	
17/01/2013	<0.001	0.35	0.03	69	0.001	0.03	0.042		13	<0.0002	7		160	<0.001		0.003	0.003	0.1	0.27	<0.00005	3	
21/02/2013	<0.001	0.39	<0.01	83	0.001	0.05	0.029		24	0.0002	5		280	0.0002		0.002	0.001	0.3	0.03	<0.00005	4	
14/03/2013	<0.001	0.11	0.01	82	0.001	0.05	0.035		34	0.0002	12		460	0.001		0.005	0.001	0.2	0.06	<0.00005	6	
10/04/2013	<0.001	0.06	0.01	94	0.001	0.05	0.042		40	0.0002	13		540	<0.001		0.001	<0.001	0.2	0.02	<0.00005	6.3	
16/05/2013	<0.001	0.06	0.01	85	0.001	<0.05	0.04		35	0.0002	15		470	0.001		0.001	0.001	0.2	0.15	<0.00005	6	
14/06/2013	<0.001	0.73	0.01	62	0.001	<0.05	0.024		25	0.0002	10		330	0.001		0.004	0.002	0.2	0.06	<0.00005	5	
11/07/2013	<0.001	0.42	<0.01	63	0.001	0.04	0.025	<0.001	24	0.0002	9		310	<0.001		0.002	0.001	0.1	0.04	<0.00005	4	
23/08/2013	<0.001	0.21	<0.01	70	<0.001	<0.05	0.027	<0.001	30	<0.0002	12		390	0.002		0.001	<0.001	0.1	0.03	<0.00005	4	
26/09/2013	<0.001	0.78	0.14	54	<0.001	<0.05	0.031	<0.001	15	<0.0002	11		220	<0.001		0.004	0.003	<0.2	1.1	<0.00005	4	
23/10/2013	<0.001	0.16	<0.01	91	0.001	0.05	0.032	<0.001	32	0.0002	12		450	0.002		0.002	0.002	<0.2	0.02	<0.00005	5	
6/11/2013	<0.001	0.14	0.01	110	0.001	<0.05	0.041	<0.001	32	0.0002	13		460	0.002		0.001	<0.001	<0.2	0.02	<0.00005	5	
6/12/2013	<0.001	0.16	0.01	97	0.001	0.06	0.026	<0.001	30	0.0002	10		420	0.003		0.002	0.001	0.3	0.03	<0.00005	5	
15/01/2014	<0.001	0.06	0.01	130	0.001	0.07	0.051	<0.001	37	0.0002	13		480	0.002		0.001	<0.001	0.2	0.03	<0.00005	6	
5/02/2014	<0.001	0.1	0.01	170	<0.001	0.05	0.051	<0.001	37	0.0002	18		520	0.002		0.001	<0.001	0.2	0.02	<0.00005	6	
5/03/2014	<0.001	0.1	<0.01	<25	0.002	0.06	0.033	<0.001	22	0.0002	6		330	0.002		0.003	0.002	<0.2	0.14	<0.00005	4	
3/04/2014	<0.001	0.13	0.02	49	0.001	0.07	0.028	<0.001	21	0.0002	6		260	0.002		0.002	0.002	<0.2	0.13	<0.00005	4	
2/05/2014	<0.001	0.04	<0.01	63	<0.001	0.05	0.04	<0.001	34	0.0002	12		460	<0.001		0.001	<0.001	<0.2	0.13	<0.00005	5	
13/06/2014	<0.001	0.03	0.01	61	0.001	0.05	0.038	<0.001	32	0.0002	13		460	0.001		0.001	<0.001	<0.2	0.19	<0.00005	5	
10/07/2014	<0.001	0.02	0.01	55	0.001	0.05	0.036	<0.001	31	0.0002	14		460	0.001		0.001	<0.001	<0.2	0.13	<0.00005	5	
17/08/2014	<0.001	0.06	<0.01	59	<0.001	<0.05	0.031	<0.001	24	<0.0002	12		380	<0.001		0.001	<0.001	<0.2	0.07	<0.00005	4	
11-Sep-14	0.0005	1	0.005	51	0.0005	0.025	0.024	0.0005	20	0.0001	9		280	0.001		0.002	0.001	0.1	0.02	0.000025	4	
23-Oct-14	0.0005	0.06	0.005	59	0.0005	0.025	0.031	0.0005	21	0.0001	8		300	0.001		0.0005	0.0005	0.1	0.04	0.000025	4	
13-Nov-14	0.0005	0.06	0.005	81	0.0005	0.025	0.028	0.0005	30	0.0001	9		390	0.001		0.004	0.0005	0.1	0.05	0.000025	4	
12-Dec-14	0.0005	0.81	0.01	55	0.001	0.025	0.022	0.0005	18	0.0001	3		220	0.001		0.004	0.002	0.1	0.04	0.000025	4	

15-Jan-15	0.0005	0.18	0.03	72	0.0005	0.025	0.021	0.0005	21	0.0001	4		240	0.001		0.003	0.002	0.1	0.19	0.000025	3	
12-Feb-15	0.0005	0.05	0.02	150	0.002	0.05	0.079	0.0005	32	0.0001	8		370	0.001		0.0005	0.0005	0.1	3.8	0.000025	6	
11-Mar-15	0.0005	0.14	0.005	73	0.0005	0.025	0.043	0.0005	31	0.0001	11		400	0.001		0.005	0.001	0.1	0.26	0.000025	6	
10-Apr-15	0.0005	0.07	0.005	70	0.0005	0.025	0.03	0.0005	23	0.0001	9		320	0.001		0.002	0.001	0.1	0.46	0.000025	4	
28-May-15	0.0005	0.14	0.005	66	0.0005	0.025	0.032	0.0005	30	0.0001	11		410	0.001		0.001	0.001	0.1	0.3	0.00002	5	
18-Jun-15	0.0005	0.32	0.005	75	0.0005	0.05	0.03	0.0005	33	0.0001	16		502	0.001		0.004	0.002	0.1	0.14	0.00002	6.6	
16-Jul-15	0.0005	0.83	0.005	61	0.002	0.025	0.028	0.0005	19.8	0.0001	11		360	0.001		0.004	0.001	0.2	0.115	0.00002	4.43	
20-Aug-15	0.0005	0.13	0.005	71	0.0005	0.1	0.034	0.0005	32.8	0.0001	17.2		589	0.001		0.003	0.001	0.06	0.34	0.00002	6.9	

Continued………… Neubecks Creek Upstream NC01 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)

Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn	Zn-f	Ammonia Nitrogen	DO
12/10/2012	10	0.24	0.005	15		0.005		0.5	0.7	<0.001	6.9	0.02	<0.002	54		130	19		0.005	0.005		9.3
14/11/2012	3	0.016	0.005	8		0.005		<0.5	0.45	<0.001	6.5	0.03	0.002	8		61	17		0.02	0.005		6.6
12/12/2012	5	0.016	0.02	10		0.005		<0.5	0.45	0.002	6.9	0.03	0.002	16		65	18		0.03	0.005		5.6
17/01/2013	7	1.00	0.005	11		0.005		<0.5	0.55	0.001	7.2	0.03	0.002	4		160	14		0.03	0.005		1.7
21/02/2013	12	0.008	0.005	21		0.005		<0.5	0.4	<0.001	7.1	0.01	0.002	46		170	17		0.005	0.005		4.7
14/03/2013	23	0.16	0.005	25		0.005		<0.5	0.35	0.001	7.2	<0.01	0.002	120		260	9.9		0.03	0.005		5.9
10/04/2013	27	0.31	0.005	27		0.005		<0.5	0.35	0.001	7.4	<0.01	0.002	156		280	5.7		0.026	0.005		7.5
16/05/2013	24	0.27	0.005	25		0.005		<0.5	0.4	<0.001	7	<0.01	0.002	130		280	5.8		0.014	0.012		8.8
14/06/2013	14	0.073	<0.001	22		0.003		<0.5	0.45	0.001	7.2	0.02	0.002	82		210	40		0.039	0.006		11.7
11/07/2013	15	0.24	<0.001	22		0.003		<0.5	0.5	0.001	7	<0.1	0.002	73		170	18		0.031	<0.005	<0.1	14.3
23/08/2013	19	0.19	<0.001	26		0.003	<1	<0.5	0.5	<0.001	7.4	0	<0.002	100		240	8.2		0.017	<0.005	<0.1	11.7
26-Sep-13											8.1							0.036	0.034	<0.1	4.9	0.036
23-Oct-13	20	<0.001	0.002	34		0.006			<1.0	<0.001	7.9	<0.1	<0.002	120		300	14	0.025	<0.005	<0.1	6	0.025
6-Nov-13	19	0.001	0.003	44		0.005			<1.0	0.001	7.9	0.01	0.002	120		320	7.9	0.021	<0.005	<0.1	4.7	0.021
6-Dec-13	15	0.001	0.007	27		0.006			<1.0	0.001	7.8	0.01	0.002	98		200	3.3	0.023	<0.005	<0.1	7.7	0.023
15-Jan-14	13	0.001	0.002	21		0.005			<1.0	0.001	7.8	0.01	0.002	98		200	8.1	0.018	<0.005	<0.1	4.1	0.018
5-Feb-14	18	0.001	0.004	31		0.006			<0.5	<0.001	8.2	<0.1	0.002	98		300	12	0.017	<0.005	<0.1	4.7	0.017
5-Mar-14	8	0.001	0.002	19		0.009			<1.0	0.002	7.3	0.015	0.002	100		200	55	0.068	0.043	<0.1	5.2	0.068
3-Apr-14	14	<0.001	0.002	20		0.009			<1.1	0.002	7.7	<0.1	0.002	90		220	60	0.028	<0.005	<0.1	5	0.028
2-May-14	30	0.031	0.002	23		0.007			<1.0	<0.001	7.8	0.01	0.002	180		340	5.9	0.044	<0.005	<0.1	7.5	0.044
13-Jun-14	21	0.089	0.002	31		0.006			<1.0	0.001	7.8	<0.1	0.002	140		300	9.1	0.032	<0.005	<0.1	10.5	0.032
10-Jul-14	20	0.066	0.004	39		0.005			<1.0	0.001	7.8	0.015	0.002	140		270	14	0.021	<0.005	<0.1	10.7	0.021
17/08/2014	15	0.3	<0.001	28		0.003	<1	<0.5	<1.0	<0.001	7.1	<0.03	<0.002	110		240	7.5	<0.01	0.025	<0.005	<0.1	10.7
11-Sep-14	10	0.006	0.0005	17		0.003	0.5	0.5	0.5	0.001	7.5		0.001	70		170	28	0.005	0.017	0.0025		15.6
23-Oct-14	12	0.018	0.0005	18		0.003	0.5	0.5	0.5	0.001	7.2		0.001	65		130	5.7	0.005	0.011	0.0025		6
13-Nov-14	16	0.007	0.002	28		0.004	0.5	0.5	0.5	0.001	7.3		0.001	100		220	5	0.005	0.03	0.0025		4.9
12-Dec-14	7	0.0005	0.001	13		0.005	0.5	0.5	0.5	0.002	7.4		0.001	33		130	60	0.005	0.015	0.0025		11.1
15-Jan-15	9	0.22	0.001	14		0.003	0.5	0.5	0.5	0.001	7.4		0.001	37		150	17	0.005	0.008	0.0025		4.4
12-Feb-15	17	3	0.0005	20		0.003	0.5	0.5	0.55	0.001	6.9		0.001	15		280	11	0.005	0.0025	0.0025		3.1
11-Mar-15	16	0.44	0.001	24		0.005	0.5	0.5	0.5	0.001	7.1		0.001	100		250	5.8	0.005	0.009	0.006		8.5
10-Apr-15	12	0.42	0.0005	18		0.005	0.5	0.5	0.5	0.001	7.1		0.001	65		190	5.5	0.005	0.012	0.01		7
28-May-15	18	0.24	0.0005	22		0.003	0.5	0.5	0.3	0.001	7.3		0.001	110		240	9.6	0.005	0.007	0.0025		9.3
18-Jun-15	19	0.092	0.001	37		0.003	0.5	0.5	0.4	0.001	7.88		0.001	150		250	19	0.005	0.011	0.006		11.2
16-Jul-15	11.1	0.11	0.0005	25.4		0.003	0.005	0.13	0.4	0.001	7.44		0.0006	98.2		228	39.3	0.005	0.012	0.0025		19.2
20-Aug-15	18.6	0.211	0.001	53.8		0.003	0.005	0.11	0.3	0.001	7.65		0.0003	183		450	8	0.005	0.0025	0.0025		9.6

Neubecks Creek NC01 Post-water conditioned ash Placement Summary Data September, 2013 – August, 2015 (mg/L)																						
	Ag	Al	Al-f	Ca:	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	Cu-f	F	Fe	Hg	K:	Li
Average	<0.001	0.23	0.02	79	0.001	0.045	0.035	<0.001	27	0.0001	11		387	0.001		0.002	0.001	0.13	0.32	<0.00005	4.8	
Maximum	<0.001	1.00	0.14	170	0.002	0.100	0.079	<0.001	37	0.0002	18		589	0.003		0.005	0.003	0.30	3.80	<0.00005	6.9	
Minimum	<0.001	0.02	0.01	49	0.001	0.025	0.021	<0.001	15	<0.0002	3		220	0.001		0.001	0.001	0.06	0.02	<0.00005	3.0	
90th Percentile	<0.001	0.13	0.01	70	0.001	0.050	0.032	<0.001	30	0.0001	11		395	0.001		0.002	0.001	0.10	0.13	<0.00005	5.0	
Pre-50th Percentile Trend	<0.001	0.80	0.02	126	0.002	0.070	0.049	<0.001	34	0.0002	15		495	0.002		0.004	0.002	0.20	0.42	<0.00005	6.0	
ANZECC 2000		0.06			0.024	0.37	0.700	0.1	175	0.0005	350	0.05	2200	0.002		0.0035		1.500	0.300			2.5

Continued……………….. Neubecks Creek NC01 Post-water conditioned ash Placement Summary Data September, 2015 – August, 2015 (mg/L)																						
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Total Nitrogen	Pb	pH	Total Phosphorus	Se	SO4:	Temp	TDS	Turbidity	V	Zn	Zn-f	Ammonia Nitrogen	DO
Average	16	0.41	0.001	26		0.005	0.418	0.44	0.49	0.001	7.2	0.10	0.001	92		238	13.8	<0.01	0.021	0.009	<0.01	8.0
Maximum	24	3.00	0.002	54		0.017	0.500	0.50	0.65	0.002	7.9	0.10	0.002	183		450	60.0	<0.01	0.068	0.043	<0.01	19.2
Minimum	7	0.00	0.001	13		0.003	0.005	0.11	0.30	<0.001	6.3	0.10	<0.002	15		130	2.0	<0.01	0.003	0.003	<0.01	3.1
90th Percentile	17	0.26	0.001	25		0.004	0.500	0.50	0.50	0.001	7.3	0.10	0.001	99		240	8.8	<0.01	0.018	0.003	<0.01	7.3
Pre-50th Percentile Trend	21	0.58	0.002	36		0.006	0.500	0.50	0.54	0.001	7.5	0.10	0.002	137		300	30.1	<0.01	0.035	0.027	<0.01	11.2
ANZECC 2000		1.9	0	230.00	10.000	0			0.35	0.005	6.5-8.0	0.025	0.005	1000.00		1500		0.1	0.015			

MPGM4/D8 Pre-water conditioned ash Placement - Background summary Data October, 2012 – August, 2013 (mg/L)																				
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Average	<0.001	0.46		0.001	0.063	0.048		78	0.0003	18.3		525	0.001		0.005	0.10	0.17	<0.00005	8.0	
Maximum	<0.001	0.72		0.001	0.180	0.080		180	0.0004	56.0		1200	0.001		0.010	0.10	0.47	<0.00005	20.0	
Minimum	<0.001	0.03		<0.001	0.010	0.032		21	<0.0002	5.0		290	<0.001		0.003	<0.10	<0.01	<0.00005	2.0	
90th Percentile	<0.001	0.71		0.001	0.138	0.068		153	0.0004	41.3		933	0.001		0.009	0.10	0.38	<0.00005	16.1	
Pre-50th Percentile Trend	<0.001	0.55		0.001	0.030	0.040		56	0.0002	6.0		305	0.001		0.003	0.10	0.02	<0.00005	5.0	
ANZECC 2000	<0.001	0.39		0.001	0.025	0.03		37	0.0002	16		480	0.002		0.001	0.2	0.01	<0.00005	3	

Continued………. MPGM4/D8 - Background Summary October, 2012 – August, 2013 (mg/L)																		
	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Average	1.34	0.01	23.3		0.098			0.002	5.9	0.002	216		393		2.1		904.3	0.083
Maximum	4.90	0.01	59.0		0.270			0.003	6.3	0.002	514		940		2.3		904.4	0.160
Minimum	0.06	<0.001	6.0		0.040			<0.001	5.6	<0.002	110		200		2.0		904.1	0.050
90th Percentile	3.50	0.01	47.3		0.201			0.003	6.21	0.002	396		727		2.3		904.4	0.130
Pre-50th Percentile Trend	0.20	0.01	14		0.041			0.002	5.85	0.002	120		215		2.1		904.3	0.060
ANZECC 2000	5.704(8.57)	0.010	230	10.0	0.5509	-	-	0.005	6.5-8.0	0.005	1000(1170)	-	2000	-	-	-	-	0.908

MPGM4/D8 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																				
Date:	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
4-Nov-12	<0.001	0.72		<0.001	0.01	0.039		21	<0.0002	5		290	<0.001		<0.001	<0.1	0.02	<0.00005	2	
13-Jan-13	<0.001	0.7		0.001	0.02	0.04		22	0.0002	7		310	0.001		0.003	0.1	0.02	<0.00005	3	
14-Apr-13	<0.001	0.39		0.001	0.18	0.08		89	0.0004	56		1200	0.001		0.01	0.1	0.47	<0.00005	6.9	
28-Jul-13	<0.001	0.025		0.001	0.04	0.032		180	0.0002	5		300	0.001		0.003	0.1	<0.01	<0.00005	20	
3-Nov-13	<0.001	0.57		0.001	0.025	0.043		35	0.0002	14		470	0.002		0.002	<0.2	<0.01	<0.00005	2	
1-Dec-13	<0.001	0.39		0.001	0.025	0.03		37	0.0002	16		480	0.002		0.001	0.2	0.01	<0.00005	3	
23-Feb-14	<0.001	0.91		0.001	0.06	0.026		23	0.0002	15		320	0.002		0.006	0.2	0.07	<0.00005	3	
25-May-14	<0.001	0.09		0.001	0.19	0.072		140	0.0002	100		1800	<0.001		0.001	0.2	3.6	<0.00005	10	
24-Aug-14	<0.001	1.4		<0.001	0.05	0.025		15	<0.0002	3		220	0.001		0.002	<0.2	0.04	<0.00005	2	
18-Sep-14																				
16-Oct-14																				
20-Nov-14	0.001	0.04	25	0.0005	0.07	0.065		86	0.0001	62		1100	0.0005		0.0005	0.1	1.9	0.000025	6	
17-Dec-14																				
22-Jan-15																				
19-Feb-15	0.001	0.08	29	0.0005	0.13	0.088		120	0.0001	87		1500	0.0005		0.002	0.1	3.4	0.000025	8	
18-Mar-15																				
15-Apr-15																				
14-May-15	0.001	0.15	25	0.0005	0.025	0.036		22	0.0001	8		320	0.001		0.002	0.1	0.02	0.000005	2	
11-Jun-15																				
8-Jul-15																				
12-Aug-15	0.0005	1.11	11	0.0005	0.025	0.027		10.9	0.00005	2.11		168	0.0005		0.004	0.005	0.168	0.00002	2	

Continued………. MPGM4/D8 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																		
Date:	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
4-Nov-12	16	0.17	<0.01	6		0.04			<0.001	5.6	Se	110		200					0.06
13-Jan-13	18	0.22	0.01	8		0.04			0.003	5.7	<0.002	120		200		2.3		904.1	0.05
14-Apr-13	67	4.9	0.01	59		0.27			0.002	6.3	0.002	514		940		2.1		904.3	0.16
28-Jul-13	63	0.056	<0.001	20		0.041			0.002	6	0.002	120		230		2		904.4	0.06
3-Nov-13	28	0.54	0.001	16		0.09			0.002	5.7	0.002	200		330		2.3		904.1	0.11
1-Dec-13	30	1	0.001	18		0.085			0.001	5.9	0.002	230		420		2.2		904.2	0.088
23-Feb-14	17	0.87	0.001	11		0.05			0.003	5.8	0.002	120		290		2.1		904.3	0.053
25-May-14	110	7.1	0.001	94		0.19			<0.001	6	0.002	760		1400		2.1		904.3	0.16
24-Aug-14	12	0.1	<0.001	5		0.025			0.002		<0.002	83		150	<0.01	1.8	1.9	904.6	0.054
18-Sep-14																			
16-Oct-14																			
20-Nov-14	65	4	0.001	60		0.16			0.0005	5.7	0.001	490		870		2.3		904.1	0.15
17-Dec-14																			
22-Jan-15																			
19-Feb-15	91	5	0.001	86		0.18			0.003	5.9	0.001	690		1200		2.3		904.1	0.16
18-Mar-15																			
15-Apr-15																			
14-May-15	18	0.32	0.001	10		0.043			0.003	5.8	0.001	130		250		2.1		904.3	0.066
11-Jun-15																			
8-Jul-15																			
12-Aug-15	7.25	0.041	0.0005	2.72		0.018			0.002	6.17	0.0001	53.6		140	0.005	1.6		904.8	0.03

MPGM4/D8 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)																				
	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe-filtered	Hg	K	Li
Ave	<0.001	0.53		0.001	0.067	0.046		54	0.0001	34		709	0.001		0.002	0.20	0.93	<0.00005	4	
Max	<0.001	1.40		0.001	0.190	0.088		140	0.0002	100		1800	0.002		0.006	0.20	3.60	<0.00005	10	
Min	<0.001	0.04		0.001	0.025	0.025		11	0.0001	2		168	0.001		0.001	<0.20	<0.01	<0.00005	2	
50th Investigation Trigger	<0.001	0.39		0.001	0.050	0.036		35	0.0002	15		470	0.001		0.002	0.20	0.06	<0.00005	3	
Post-90th for Trend	<0.001	1.17		0.001	0.142	0.075		124	0.0002	90		1560	0.002		0.004	0.20	2.54	<0.00005	8	

Continued………. MPGM4/D8 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)																		
	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	42	2.11	0.001	34		0.093			0.002	5.9	0.001	306		561	0.005	2.1		904.4	0.097
Max	110	7.10	0.001	94		0.190			0.003	6.2	0.002	760		1400	0.005	2.3		904.8	0.160
Min	7	0.04	0.001	3		0.018			0.001	5.7	0.000	54		140	0.005	1.6		904.1	0.030
50th Investigation Trigger	28	0.87	0.001	16		0.085			0.002	5.9	0.002	200		330	0.005	2.1		904.3	0.088
Post-90th for Trend	95	5.42	0.001	88		0.182			0.003	6.1	0.002	704		1240	0.005	2.3		904.7	0.160

MPGM4/D9 – Pre-water conditioned ash Background Summary October, 2012 – August, 2013 (mg/L)																				
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.06	45	0.002	0.47	0.055		178	0.0002	116		2000	0.001		0.005	0.13	8.26	<0.00005	13.5	
Max	<0.001	0.08	52	0.003	0.56	0.060		210	0.0002	150		2200	0.001		0.009	0.20	18.00	<0.00005	15.0	
Min	<0.001	0.03	40	0.002	0.36	0.044		150	0.0002	94		1700	<0.001		<0.001	<0.10	0.02	<0.00005	13.0	
90th Baseline	<0.001	0.075	50	0.003	0.55	0.059		204	0.0002	141		2170	0.001		0.0075	0.18	15.90	<0.00005	14.4	
Pre-50th for Trend	<0.001	0.055	44	0.002	0.49	0.058		175	0.0002	110		2050	0.001		0.0035	0.10	7.50	<0.00005	13.0	
ANZECC 2000	0.00005	0.055		0.024	0.37	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664(15.9)	0.00006		

Continued… .MPGM4/D9 – Pre-water conditioned ash Background Summary October, 2012 – August, 2013 (mg/L)																			
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	133	7.73	0.01	135		0.273			0.003	6.1	0.002	1048		1675		1.5		908.1	0.120
Max	170	8.90	0.01	180		0.340			0.004	6.3	0.002	1200		1800		1.7		908.3	0.220
Min	110	6.60	<0.001	100		0.210			0.001	5.8	<0.002	940		1500		1.4		908.0	0.070
90th Baseline	158	8.57	0.01	168		0.328			0.004	6.3	0.002	1170		1800		1.6		908.2	0.184
Pre-50th for Trend	125	7.70	0.01	130		0.270			0.003	6.2	0.002	1025		1700		1.5		908.2	0.096
ANZECC 2000		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5-8.0	0.005	1000(1170)		2000					0.908

MPGM4/D9 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2014 (mg/L)																				
Date:	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
4-Nov-12	<0.001	0.08	40	0.003	0.56	0.06		150	<0.0002	100		2000	<0.001		0.004	<0.1	11	<0.00005	13	
13-Jan-13	<0.001	<0.01	46	0.002	0.36	0.058		160	0.0002	94		1700	0.001		0.003	0.1	4	<0.00005	13	
14-Apr-13	<0.001	0.03	52	0.002	0.46	0.058		190	0.0002	120		2100	0.001		0.009	0.2	18	<0.00005	13	
14-Jul-13	<0.001	<0.05	42	0.002	0.51	0.044		210	0.0002	150		2200	0.001		0.003	0.1	0.02	<0.00005	15	
3-Nov-13	<0.001	0.02	54	0.003	0.54	0.058		230	0.0002	180		2400	0.002		0.012	0.2	3.3	<0.00005	14	
1-Dec-13	<0.001	0.05	50	0.002	0.49	0.044		220	0.0002	190		2000	0.002		0.011	0.2	2	<0.00005	16	
26-Jan-14	<0.001	0.06	45	0.002	0.47	0.045		200	0.0002	160		2400	0.002		0.004	0.2	9.7	<0.00005	15	
2-Mar-14	<0.001	0.01	50	<0.001	0.5	0.048		220	0.0002	180		2200	0.002		0.003	0.2	23	<0.00005	17	
23-Mar-14	<0.001	<0.01	58	<0.001	0.47	0.051		230	0.0002	190		3100	0.001		0.004	0.2	6.8	<0.00005	17	
25-May-14	<0.001	0.01	60	<0.001	0.6	0.052		230	0.0002	200		3000	0.001		0.001	0.2	5.8	<0.00005	16	
24-Aug-14	<0.001	<0.01	59	<0.001	0.59	0.039		220	<0.0002	200		2700	<0.001		<0.001	<0.2	3.4	<0.00005	16	
18/09/2014																				
16/10/2014																				
20/11/2014	0.001	0.03	67	0.0005	0.62	0.041		230	0.0002	200		2600	0.001		0.002	0.1	26	0.00005		
17/12/2014																				
22/01/2015																				
19/02/2015	0.001	0.005	81	0.001	0.54	0.035		200	0.0002	170		2700	0.001		0.001	0.1	27	0.00005		
18/03/2015																				
15/04/2015																				
14/05/2015	0.001	0.01	81	0.002	0.5	0.033		200	0.0002	200		2500	0.001		0.001	0.1	27	0.00001		
11/06/2015																				
8/07/2015																				
12/08/2015	0.001	0.02	106	0.002	0.61	0.034		189	0.0001	189		3110	0.001		0.001	0.05	26.1	0.00002		

Continued….MPGM4/D9 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2014 (mg/L)																		
Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
4-Nov-12	120	7.6	<0.01	140		0.34			0.004	5.8	<0.002	950		1600		1.5		908.2	0.22
13-Jan-13	110	6.6	0.01	100		0.21			0.001	6.1	0.002	940		1500		1.7		908.0	0.07
14-Apr-13	130	7.8	0.01	120		0.24			0.002	6.3	0.002	1100		1800		1.5		908.2	0.091
14-Jul-13	170	8.9	<0.001	180		0.3			0.004	6.2	0.002	1200		1800		1.4		908.3	0.1
3-Nov-13	170	9.6	0.001	200		0.37			0.004	6	0.002	1400		2400		1.6		908.1	0.15
1-Dec-13	170	9.5	0.001	210		0.34			0.01	6.1	0.002	1500		2500		1.5		908.2	0.11
26-Jan-14	150	8.8	0.001	200		0.3			0.007	6	0.002	1200		2100		1.7		908.0	0.11
2-Mar-14	170	9.7	0.001	200		0.35			0.001	6.1	0.002	1400		2300		1.5		908.2	0.11
23-Mar-14	170	9.3	0.001	210		0.34			0.002	6.1	0.002	1500		2700	<0.01	1.2		908.5	0.096
25-May-14	180	11	0.001	210		0.32			<0.001	6.1	0.002	1500		2600		1.3		908.4	0.086
24-Aug-14	180	11	<0.001	210		0.34			<0.001	6.1	<0.002	1500		2400	<0.01	1.3	1.3	908.4	0.093
18/09/2014																			
16/10/2014																			
20/11/2014	190	11	0.0005	220		0.37			0.001	6.2	0.001	1400		2400	0.01	1.5		908.2	0.12
17/12/2014																			
22/01/2015																			
19/02/2015	170	9.9	0.0005	200		0.37			0.0005	6.2	0.001	1300		2200	0.01	1.4		908.3	0.12
18/03/2015																			
15/04/2015																			
14/05/2015	160	9.3	0.0005	220		0.4			0.0005	6.2	0.001	1400		2400	0.01	1.4		908.3	0.095
11/06/2015																			
8/07/2015																			
12/08/2015	160	10.9	0.0005	215		0.355			0.0005	6.31	0.0001	1410		2490	0.01	1.3		908.4	0.118

MPGM4/D9 – Post-water conditioned ash Summary September, 2013 – August, 2014 (mg/L																			
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	0.001	0.02	65	0.002	0.54	0.044		215	0.0002	187		2610	0.001		0.004	0.16	14.55	0.00004	15.9	
Max	0.001	0.06	106	0.003	0.62	0.058		230	0.0002	200		3110	0.002		0.012	0.20	27.00	0.00005	17.0	
Min	0.001	0.01	45	0.001	0.47	0.033		189	<0.0001	160		2000	0.001		0.001	0.05	2.00	0.00001	14.0	
Post-90th for Trend	0.001	0.02	59	0.002	0.54	0.044		220	0.0002	190		2600	<0.001		0.002	0.20	9.70	0.00005	16.0	
50th Trigger	0.00005	0.055		0.024	0.37	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664(15.9)	0.00006		

Continued………. MPGM4/D9 – Post-water conditioned ash Summary September, 2013 – August, 2014 (mg/L)																			
Date	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	170	10.0	0.001	209		0.350			0.003	6.1	0.002	1410		2408	0.010	1.4		908.2	0.110
Max	190	11.0	0.001	220		0.400			0.010	6.3	0.002	1500		2700	0.010	1.7		908.5	0.150
Min	150	8.8	0.001	200		0.300			0.001	6.0	0.000	1200		2100	0.010	1.2		908.0	0.086
Post-90th for Trend	180	11.0	0.001	220		0.370			0.008	6.2	0.002	1500		2600	0.010	1.6		908.4	0.120
50th Trigger	170	9.7	0.001	210		0.350			0.001	6.1	0.002	1400		2400	0.010	1.4		908.3	0.110

3. Water Quality Data and Summary for Groundwater Seepage Detection Bore MPGM4/D1

MPGM4/D1 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																				
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.07	108	0.013	1.8	0.038		254	0.0002	101		2300	0.001		0.011	0.10	18.0	<0.00005	18	
Max	<0.001	0.36	130	0.017	2.1	0.045		290	0.0002	130		2400	0.002		0.073	0.1	37	<0.00005	19	
Min	<0.001	0.01	92	0.011	1.6	0.032		220	<0.0002	69		2100	0.001		0.001	0.1	5.3	<0.00005	16	
90th Baseline	<0.001	0.157	130	0.0162	1.94	0.0434		282	0.0002	122		2400	0.0013		0.0254	0.1	33	<0.00005	19	
Pre-50th Trend	<0.001	0.03	100	0.012	1.80	0.038		260	0.0002	110		2400	0.001		0.0025	0.1	17.0	<0.00005	18	
ANZECC 2000	0.00005	0.055		0.024	0.37(0.55)	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664(15.9)	0.00006		

Continued………. MPGM4/D1 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																			
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	177	10	0.007	126		0.53			0.001	6.2	0.002	1289		2189		2.1		910.5	0.047
Max	200	12	0.010	150		0.62			0.004	6.3	0.002	1400		2500		2.5		910.8	0.065
Min	150	8.5	<0.001	100		0.43			0.001	6.1	<0.002	1100		1900		1.8		910.1	0.030
90th Baseline	200	11.2	0.01	142		0.604			0.0022	6.3	0.002	1400		2420		2.4		910.8	0.061
Pre-50th Trend	180	10.0	0.010	130		0.52			0.001	6.1	0.002	1300		2200		2.0		910.6	0.048
ANZECC		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5 -8.0	0.005	1000(1170)		2000					0.908

MPGM4/D1 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																				
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	Co	COND µS/cm	Cr	Cr-6	Cu	F	Fe-filtered	Hg	K	Li
26/10/2012	<0.001	0.04	110	0.016	1.6	0.033		220	<0.0002	69		2200	0.001		<0.001	<0.1	32	<0.00005	16	
9/01/2013	<0.001	<0.01	100	0.017	1.7	0.032		220	0.0002	78		2100	<0.001		0.001	0.1	7.6	<0.00005	18	
27/02/2013	<0.001	0.01	100	0.012	1.8	0.035		260	0.0002	94		2100	0.001		0.001	0.1	17	<0.00005	18	
27/03/2013	<0.001	0.02	100	0.011	1.9	0.033		250	0.0002	86		2400	0.001		0.073	0.1	12	<0.00005	18	
26/04/2013	<0.001	0.02	130	0.012	1.9	0.045		260	0.0002	110		2400	0.001		0.001	0.1	5.3	<0.00005	18	
13/05/2013	<0.001	0.02	130	0.011	1.7	0.043		250	0.0002	110		2400	0.001		0.004	0.1	13	<0.00005	19	
26/06/2013	<0.001	0.36	110	0.013	1.8	0.043		260	0.0002	110		2400	0.001		0.005	0.1	17	<0.00005	17	
25/07/2013	<0.001	0.07	92	0.012	2.1	0.038		290	0.0002	120		2400	0.002		0.001	0.1	21	<0.00005	19	
29/08/2013	<0.001	0.04	100	0.013	1.9	0.038		280	0.0002	130		2300	0.001		0.004	0.1	37	<0.00005	18	
19/09/2013	<0.001	0.24	110	0.012	2	0.032		300	0.0002	140		2600	0.002		0.002	0.1	9.7	<0.00005	18	
17/10/2013	<0.001	0.13	120	0.016	2.2	0.026		280	0.0002	150		2800	0.002		0.002	0.1	11	<0.00005	19	
21/11/2013	<0.001	0.02	100	0.012	1.8	0.024		270	0.0002	150		2200	0.002		0.002	0.1	12	<0.00005	18	
20/12/2013	<0.001	0.01	130	0.011	2	0.035		290	0.0002	160		2800	0.001		0.004	0.1	1.7	<0.00005	18	
24/01/2014	<0.001	0.14	94	0.008	2	0.037		300	0.0002	170		2800	0.001		0.001	0.1	14	<0.00005	22	
26/02/2014	<0.001	0.29	110	0.011	1.9	0.041		300	0.0002	190		2600	0.002		0.003	0.1	9.8	<0.00005	21	
19/03/2014	<0.001	0.48	99	0.013	1.7	0.046		280	0.0002	190		3100	0.001		0.003	0.1	8.7	<0.00005	20	
17/04/2014	<0.001	0.53	98	0.011	2.1	0.042		320	0.0002	230		3000	0.003		0.002	0.1	11	<0.00005	22	
14/05/2014	<0.001	0.46	130	0.011	2.2	0.044		320	0.0002	230		3500	0.001		0.001	0.1	24	<0.00005	24	
26/06/2014	<0.001	0.04	110	0.011	2.1	0.041		350	0.0002	230		3500	0.001		0.003	0.1	19	<0.00005	26	
24/07/2014	<0.001	<0.01	130	0.012	2.2	0.039		340	0.0002	290		3200	0.001		<0.001	0.25	22	<0.00005	25	
24/08/2014	<0.001	0.02	130	0.013	2.2	0.038		340	<0.0002	270		3100	<0.001		0.001	<0.2	21	0.0001	25	
18/09/2014	0.001	0.03	130	0.012	2.1	0.041		360	0.0002	280		3200	0.001		0.0005	0.1	42	0.00005	25	
16/10/2014	0.001	0.24	84	0.012	2.2	0.04		350	0.0002	290		3600	0.001		0.002	0.1	42	0.00005	26	
20/11/2014	0.001	0.4	110	0.012	2.1	0.04		360	0.0002	320		3400	0.001		0.002	0.1	22	0.00005	26	
17/12/2014	0.001	0.04	120	0.011	2.1	0.035		360	0.0002	320		3000	0.001		0.001	0.1	23	0.00005	26	
22/01/2015	0.001	0.03	98	0.011	1.9	0.041		360	0.0002	350		4000	0.001		0.001	0.1	45	0.00005	25	
19/02/2015	0.001	0.04	110	0.012	2.1	0.04		400	0.0002	360		4000	0.001		0.001	0.1	47	0.00005	28	
18/03/2015	0.001	0.1	110	0.013	2.2	0.04		400	0.0002	390		4100	0.001		0.002	0.1	47	0.00005	29	

15/04/2015	0.001	0.03	110	0.011	2	0.041		390	0.0002	410		4200	0.001		0.001	0.1	46	0.00005	30	
14/05/2015	0.001	0.03	110	0.012	1.9	0.036		380	0.0002	420		3700	0.001		0.002	0.1	45	0.00005	32	
11/06/2015	0.001	0.005	75	0.012	1.8	0.037		400	0.0002	450		3800	0.001		0.001	0.1	44	0.00002	33	
8/07/2015	0.001	0.04	96	0.012	2.2	0.037		408	0.0001	493		4920	0.001		0.001	0.1	43.6	0.00002	36.3	
12/08/2015	0.001	0.08	134	0.012	2.34	0.035		407	0.0001	482		5000	0.001		0.001	0.1	54.2	0.00002	34.9	

Continued….MPGM4/D1 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																			
Date	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4	Temp	TFR	V	WL1	WL2	WLAHD	Zn
26/10/2012	150	8.5	0.01	100		0.43			0.001	6.1	<0.002	1100		1900		2.0		910.6	0.03
9/01/2013	150	9.4	<0.01	110		0.48			<0.001	6.1	0.002	1100		1900		2.4		910.2	0.03
27/02/2013	180	9.8	0.01	130		0.52			0.001	6.1	0.002	1300		2100		2.5		910.1	0.05
27/03/2013	170	10	0.01	120		0.54			0.004	6.1	0.002	1300		2200		1.8		910.8	0.06
26/04/2013	180	10	0.01	130		0.54			<0.001	6.3	0.002	1300		2000		2.0		910.6	0.048
13/05/2013	180	11	0.01	130		0.52			0.001	6.1	0.002	1400		2400		2.0		910.6	0.041
26/06/2013	180	11	<0.001	120		0.6			0.001	6.2	0.002	1300		2300		1.8		910.8	0.065
25/07/2013	200	11	0.001	140		0.62			0.001	6.3	0.002	1400		2500		1.9		910.7	0.049
29/08/2013	200	12	0.001	150		0.52			0.001	6.1	0.002	1400		2400		2.1		910.5	0.047
19/09/2013	210	12	0.001	160		0.58			<0.001	5.9	0.002	1500		2500		2.1		910.5	0.047
17/10/2013	200	11	0.001	160		0.65			0.002	6	0.002	1500		2200		2.0		910.6	0.07
21/11/2013	180	12	0.001	150		0.69			0.001	6	0.002	1500		2700		2.1		910.5	0.073
20/12/2013	200	12	0.001	150		0.69			0.002	6.1	0.002	1600		2500		2.0		910.6	0.069
24/01/2014	210	12	0.001	180		0.67			0.001	6	0.002	1600		2600		2.1		910.5	0.067
26/02/2014	200	13	0.001	170		0.73			0.002	6	0.002	1600		2600		2.0		910.6	0.064
19/03/2014	190	12	0.001	160		0.66			0.001	5.9	0.002	1400		2900	<0.01	1.8		910.8	0.063
17/04/2014	220	14	0.001	180		0.73			0.001	6.1	0.002	1800		3000		1.6		911.0	0.065
14/05/2014	220	14	0.001	190		0.8			0.001	6.1	0.002	1600		3000		1.9		910.7	0.08
26/06/2014	240	14	0.001	210		0.8			0.001	6	0.002	1700		3100		2.0	2.6	910.6	0.093
24/07/2014	230	16	0.001	210		0.89			0.001	6.2	0.002	1900		3200		2.0	2.8	910.6	0.09
24/08/2014	240	15	<0.001	220		0.88		6.2	<0.001	6.2	<0.002	1700		3200	<0.01	2.0	2.7	910.6	0.11
18/09/2014	240	15	0.001	230		0.87			0.001	6.1	0.002	1800		3300	0.01	2.0		910.6	0.078
16/10/2014	240	15	0.001	230		0.89			0.001	6.8	0.002	1800		3300	0.01	2.0		910.6	0.084
20/11/2014	240	15	0.001	230		0.91			0.001	5.9	0.002	1900		3300	0.01	1.8		910.8	0.079
17/12/2014	240	16	0.001	230		0.82			0.001	6	0.002	1900		3500	0.01	1.9		910.7	0.076
22/01/2015	240	16	0.001	230		0.97			0.001	5.9	0.002	1900		3500	0.01	2.0		910.6	0.081
19/02/2015	270	16	0.001	260		0.91			0.001	6.1	0.002	1900		3900	0.01	2.1		910.5	0.11
18/03/2015	280	17	0.001	270		1.1			0.001	5.9	0.002	2000		3900	0.01	2.2		910.4	0.11
15/04/2015	260	16	0.001	280		1.1			0.001	6	0.002	2100		4000	0.01	1.9		910.7	0.1
14/05/2015	250	16	0.001	300		1.1			0.001	6	0.002	2100		3900	0.01	2.0		910.6	0.1
11/06/2015	280	17	0.001	290		1.1			0.001	6.7	0.002	2200		4200	0.01	2.1		910.5	0.1
8/07/2015	284	17.9	0.001	312		1.06			0.001	6.42	0.0002	2330		3090	0.01	2.2		910.4	0.122
12/08/2015	285	22	0.001	327		1.22			0.001	6.51	0.0002	2210		3140	0.01	1.7		910.9	0.13

MPGM4/D1 – Post-water conditioned ash Summary September, 2013 – August, 2014 (mg/L)

Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	Co	COND mS/m	Cr	Cr-6	Cu	F	Fe-filtered	Hg	K	Li
Ave	0.001	0.15	110	0.012	2.056	0.038		344	0.0002	290		3422	0.001		0.002	0.11	27.70	0.00005	25	
Max	0.001	0.53	134	0.016	2.340	0.046		408	0.0002	493		5000	0.003		0.004	0.25	54.20	0.00010	36	
Min	0.001	0.01	75	0.008	1.700	0.024		270	0.0001	140		2200	0.001		0.001	0.10	1.70	0.00002	18	
50th Investigation Trigger	0.001	0.04	110	0.012	2.100	0.040		350	0.0002	285		3300	0.001		0.002	0.10	22.50	0.00005	25	
Post-90th for Trend	0.001	0.45	130	0.013	2.200	0.042		400	0.0002	441		4170	0.002		0.003	0.10	46.70	0.00005	33	

Continued………. MPGM4/D1 – Post-water conditioned ash Summary September, 2013 – August, 2014 (mg/L)

Date	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	235	14.83	0.001	222		0.87			0.001	6.1	0.002	1814		3189	0.010	2.0		910.6	0.086
Max	285	22.00	0.001	327		1.22			0.002	6.8	0.002	2330		4200	0.010	2.2		911.0	0.130
Min	180	11.00	0.001	150		0.58			0.001	5.9	0.0002	1400		2200	0.010	1.6		910.4	0.047
50th Investigation Trigger	240	15.00	0.001	225		0.88			0.001	6.0	0.002	1800		3170	0.010	2.0		910.6	0.081
Post-90th for Trend	280	17.00	0.001	297		1.10			0.002	6.5	0.002	2170		3900	0.010	2.1		910.8	0.110

4. Water Quality Data and Summary for Ash Placement Area Groundwater Bores MPGM4/D10 and MPGM4/D11

MPGM4/D10 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)

Date	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	1.06	32	0.001	3.46	0.024		308	0.005	382		4533	0.001		0.012	1.7	3.71	<0.00005	88	
Max	<0.001	1.90	44	0.001	5.10	0.035		380	0.008	480		5500	0.002		0.028	2.5	11.00	<0.00005	110	
Min	<0.001	0.63	13	<0.001	1.90	0.018		230	0.004	220		3100	0.001		0.001	1.4	0.38	<0.00005	54	
90th Baseline	<0.001	1.34	40	0.001	4.86	0.031		348	0.007	472		5180	0.002		0.026	2.0	7.64	<0.00005	102	
Pre-50th for Trend	<0.001	1.00	34	0.001	3.50	0.023		320	0.005	390		4600	0.001		0.005	1.6	2.50	<0.00005	92	
ANZECC 2000	0.00005	0.055		0.024	0.37 (0.55)	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664 (15.9)	0.00006		

Continued.......... MPGM4/D10 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)

Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	208	7.3	0.007	623		0.69			0.007	5.6	0.007	2456		4267		13.5		912.6	1.333
Max	270	8.9	0.01	780		0.82			0.015	5.9	0.010	2900		5100		13.8		913.3	1.700
Min	140	4.5	0.001	390		0.46			0.003	5.4	0.004	1800		2700		12.8		912.3	1.000
90th Baseline	254	8.9	0.01	756		0.80			0.009	5.7	0.010	2820		5100		13.7		913.0	1.700
Pre-50th for Trend	210	7.7	0.01	620		0.69			0.005	5.6	0.007	2600		4500		13.6		912.5	1.200
ANZECC		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5 -8.0	0.005	1000(1170)		2000					0.908

MPGM4/D10 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)

Date:	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
19-Oct-12	<0.001	1.9	21	<0.001	3	0.03		260	0.005	310		4400	0.001		0.005	1.4	2.9	0.00005	81	
15-Jan-13	<0.001	1.2	36	0.001	4.8	0.018		330	0.006	390		4400	<0.001		0.004	2.5	1.6	<0.00005	100	
15-Feb-13	<0.001	0.78	44	0.001	3.5	0.02		320	0.004	350		3800	<0.001		0.005	1.6	2.1	<0.00005	82	
15-Mar-13	<0.001	1	34	0.001	3.8	0.018		320	0.006	400		5100	<0.001		0.015	1.8	4.6	<0.00005	93	
15-Apr-13	<0.001	1.1	39	0.001	3.6	0.023		340	0.0062	480		5500	0.001		0.028	1.9	2.5	<0.00005	100	
15-May-13	<0.001	1.2	31	0.001	2.7	0.024		300	0.0049	430		4800	0.001		0.02	1.7	1.5	<0.00005	92	
26-Jun-13	<0.001	0.63	35	0.001	2.7	0.035		290	0.0052	390		4600	<0.001		0.002	1.4	11	<0.00005	78	
25-Jul-13	<0.001	1	34	0.001	5.1	0.023		380	0.0078	470		5100	0.002		0.001	1.6	6.8	<0.00005	110	
29-Aug-13	<0.001	0.69	12.5	<0.001	1.9	0.026		230	0.0038	220		3100	0.002		0.026	1.4	0.38	<0.00005	54	
19-Sep-13	<0.001	0.48	12.5	<0.001	1.8	0.029		230	0.0037	200		3100	0.002		0.024	1.3	0.03	<0.00005	50	
17-Oct-13	<0.001	0.86	31	0.001	3	0.024		280	0.0027	370		4700	0.002		0.008	1.5	8.5	<0.00005	77	
21-Nov-13	<0.001	0.64	32	0.003	3.4	0.016		300	0.0072	470		4400	0.004		0.008	2.2	8	<0.00005	100	
20-Dec-13	<0.001	0.96	12.5	0.001	2.5	0.023		270	0.0047	340		4400	0.001		0.005	1.7	15	<0.00005	82	
24-Jan-14	<0.001	0.92	26	0.001	4.1	0.026		340	0.0064	470		5500	0.002		0.007	1.4	12	<0.00005	96	
27-Feb-14	<0.001	1	31	0.001	3.6	0.02		350	0.0072	510		4900	0.003		0.007	1.3	0.03	<0.00005	110	
20-Mar-14	<0.001	0.83	29	0.001	2.7	0.02		310	0.0055	460		6000	0.002		0.004	1.1	10	<0.00005	98	
17-Apr-14	<0.001	0.56	39	0.001	3.2	0.021		330	0.005	480		5500	0.001		0.005	0.9		<0.00005	100	
14-May-14	<0.001	0.56	43	0.001	3.9	0.02		360	0.006	570		6800	<0.001		<0.001	1.3	12	<0.00005	130	
26-Jun-14	<0.001	0.47		0.001	3.6	0.018		380	0.0055	610		7300			0.001	1	10	<0.00005	140	
24-Jul-14	<0.001	0.46		0.001	4.3	0.019		400	0.0064	830		7100			0.003	2	13	<0.00005	150	
31-Aug-14	<0.001	0.48	50	<0.001	4.4	0.021		380	0.008	840		7100	<0.001		0.002	1.4	14	0.00007	160	
18-Sep-14	0.001	0.5	49	0.001	4	0.02		370	0.0074	860		7100	0.001		0.002	1.3	17	0.00005	170	
16-Oct-14	0.001	0.48	39	0.001	4.4	0.018		370	0.0077	830		8600	0.001		0.002	1.3	16	0.00005	180	
20-Nov-14	0.001	0.84	41	0.001	3.2	0.018		310	0.0067	700		6600	0.001		0.002	1.2	19	0.00005	150	
17-Dec-14	0.001	0.5	44	0.001	3.8	0.016		330	0.0064	670		5500	0.001		0.001	1.1	17	0.00005	150	
22-Jan-15	0.001	0.44	40	0.001	2.9	0.018		290	0.0058	570		6800	0.001		0.001	1	17	0.00005	120	
19-Feb-15	0.001	0.4	41	0.001	3	0.018		300	0.0064	440		6300	0.001		0.001	0.9	16	0.00005	120	

18-Mar-15	0.001	0.42	43	0.001	3.9	0.02		350	0.0063	620		7000	0.001		0.001	0.9	13	0.00005	140	
15-Apr-15	0.001	0.31	49	0.001	3.7	0.019		350	0.0058	750		7900	0.001		0.001	0.9	13	0.00005	150	
14-May-15	0.001	0.21	57	0.001	2.4	0.017		280	0.003	530		5700	0.001		0.001	0.7	11	0.00001	110	
11-Jun-15	0.001	0.2	42	0.001	2	0.021		280	0.0032	550		5400	0.001		0.001	0.7	10	0.00002	110	
8-Jul-15	0.001	0.2	61	0.001	2.77	0.018		294	0.0039	599		7070	0.001		0.001	0.9	9.11	0.00002	138	
12-Aug-15	0.001	0.25	63	0.001	3.44	0.018		309	0.005	624		7950	0.001		0.001	0.25	7.86	0.00002	150	

Continued….MPGM4/D10 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)

Date:	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
19-Oct-12	170	6.1	0.01	560		0.68			0.015	5.4	0.005	2100		3500		13.6		912.5	1.7
15-Jan-13	200	8.6	0.01	620		0.82			0.005	5.6	0.007	2600		4400		13.7		912.4	1.6
15-Feb-13	200	6.4	0.01	570		0.69			0.004	5.7	0.004	2300		3800		12.8		913.3	1.4
15-Mar-13	220	7.9	0.01	670		0.78			0.005	5.6	0.006	2600		4500		13.2		912.9	1.7
15-Apr-13	250	8.9	0.01	780		0.73			0.008	5.6	0.01	2800		5100		13.6		912.5	1.1
15-May-13	210	7.7	0.01	660		0.65			0.008	5.6	0.007	2600		4800		13.6		912.5	1.1
26-Jun-13	210	7	0.001	610		0.65			0.005	5.7	0.004	2400		4500		13.4		912.7	1.2
25-Jul-13	270	8.9	0.001	750		0.79			0.006	5.9	0.01	2900		5100		13.6		912.5	1.2
29-Aug-13	140	4.5	0.001	390		0.46			0.003	5.5	0.007	1800		2700		13.8		912.3	1
19-Sep-13	140	4.4	0.001	360		0.5			0.002	5.9	0.008	1600		2700		13.9		912.2	1
17-Oct-13	190	6.3	0.001	650		0.68			0.008	5.5	<0.002	2500		3700		13.9		912.2	1.3
21-Nov-13	220	7.7	0.001	760		0.76			0.009	5.5	0.006	3000		5300		13.5		912.6	1.3
20-Dec-13	180	6.3	0.001	690		0.72			0.01	5.4	0.005	2500		4100		13.7		912.4	1.5
24-Jan-14	230	8.6	0.001	760		0.84			0.008	5.5	0.009	3000		5300		13.8		912.3	1.4
27-Feb-14	250	9.4	0.003	780		0.97			0.016	5.6	0.007	3100		5300		13.8		912.3	1.5
20-Mar-14	220	7.7	0.002	730		0.81			0.014	5.4	0.005	2900		5300		13.2		912.9	1.4
17-Apr-14	240	8.5	0.001	760		0.85			0.006	5.6	0.005	2800		3700		13.3		912.8	1.8
14-May-14	280	10	0.001	940		0.9			0.006	5.6	0.006	3200		6000		13.5		912.6	1.3
26-Jun-14	330	10	0.001	1100		0.98			0.006	5.7	0.005	3400		6500		13.5		912.6	1.3
24-Jul-14	360	12	<0.001	1200		1.1			0.005	5.8	0.008	4100		7400		14.0		912.1	1.5
31-Aug-14	360	11	0.001	1300		1.1			0.007	5.8	0.007	4100	<0.01	7600	<0.01	14.0	14.0	912.1	1.9
18-Sep-14	360	11	0.001	1300		1.1			0.006	5.6	0.009	4400		7700	0.01	14.1		912.0	1.5
16-Oct-14	380	11	0.001	1400		1.1			0.006	6.5	0.007	4300		7600	0.01	14.1		912.0	1.5
20-Nov-14	300	9.3	0.001	1100		0.98			0.006	5.8	0.005	3700		6500	0.01	13.9		912.2	1.4
17-Dec-14	300	9.2	0.001	1000		0.88			0.006	5.6	0.005	3700		6700	0.01	13.6		912.5	1.6
22-Jan-15	250	8	0.001	910		0.88			0.006	5.6	0.003	3200		5800	0.01	13.5		912.6	1.2
19-Feb-15	250	7.6	0.001	880		0.74			0.005	5.7	0.004	2600		5400	0.01	13.6		912.5	1.5
18-Mar-15	300	8.8	0.001	1000		1.1			0.006	5.6	0.006	3500		6400	0.01	13.7		912.4	1.4
15-Apr-15	310	9.5	0.001	1100		1.1			0.005	5.7	0.005	4000		7100	0.01	13.9		912.2	1.3
14-May-15	220	6.6	0.001	860		0.76			0.003	5.8	0.003	3000		5300	0.01	13.3		912.8	1
11-Jun-15	240	6.4	0.001	860		0.74			0.003	6.7	0.002	3100		4900	0.01	13.2		912.9	0.94
8-Jul-15	261	6.87	0.001	983		0.74			0.003	6.15	0.0029	3390		6070	0.01	13.4		912.7	1.08
12-Aug-15	289	9.6	0.001	1120		0.911			0.004	6.29	0.0058	3270		6190	0.01	13.4		912.7	1.19

MPGM4/D10 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)

Date	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.54	40	0.001	3.33	0.020		323	0.0057	579		6197	0.001		0.004	1.18	11.68	0.00005	124	
Max	<0.001	1.00	63	0.003	4.40	0.029		400	0.0080	860		8600	0.004		0.024	2.20	19.00	0.00007	180	
Min	<0.001	0.20	13	0.001	1.80	0.016		230	0.0027	200		3100	0.001		0.001	0.25	0.03	0.00001	50	
50th Investigation Trigger	<0.001	0.48	41	0.001	3.42	0.020		320	0.0059	570		6450	0.001		0.002	1.15	12.00	0.00005	125	
Post-90th for Trend	<0.001	0.90	56	0.001	4.24	0.024		377	0.0073	830		7720	0.002		0.008	1.64	17.00	0.00005	157	

Continued………. MPGM4/D10 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)

Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	269	8.57	0.001	939		0.885			0.007	5.8	0.006	3265		5773	0.010	13.7		912.4	1.367
Max	380	12.00	0.003	1400		1.100			0.016	6.7	0.009	4400		7700	0.010	14.1		912.9	1.900
Min	140	4.40	0.001	360		0.500			0.002	5.4	0.002	1600		2700	0.010	13.2		912.0	0.940
50th Investigation Trigger	256	8.70	0.001	925		0.880			0.006	5.7	0.005	3200		5900	0.010	13.7		912.4	1.400
Post-90th for Trend	360	11.00	0.001	1270		1.100			0.010	6.2	0.008	4100		7540	0.010	14.0		912.8	1.570

MPGM4/D11 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																				
Date	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.11	737	0.003	1.02	0.833		207	0.0002	227		2278	0.003		0.005	0.53	0.07	<0.00005	54	
Max	<0.001	0.29	900	0.008	2.30	1.400		340	0.0002	270		3200	0.005		0.015	0.80	0.28	<0.00005	61	
Min	<0.001	0.01	200	0.001	0.66	0.350		170	<0.0002	210		1800	0.001		0.001	0.20	0.01	<0.00005	45	
90th Baseline	<0.001	0.21	892	0.007	1.74	1.080		292	0.0002	238		2880	0.004		0.011	0.73	0.16	<0.00005	59	
Pre-50th for Trend	<0.001	0.07	840	0.001	0.78	0.850		180	0.0002	220		2100	0.003		0.004	0.50	0.03	<0.00005	55	
ANZECC 2000	0.00005	0.055		0.024	0.37 (0.55)	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664 (15.9)	0.00006		

Continued……… MPGM4/D11 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																			
Date	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	94	2.2	0.008	221		0.055			0.005	7.1	0.002	345		1433		25.1		912.4	0.045
Max	170	11.0	0.010	290		0.140			0.024	7.6	0.002	1700		2100		25.8		914.0	0.080
Min	76	0.2	<0.001	200		0.030			0.001	6.4	0.002	10		1200		23.5		911.7	0.014
90th Baseline	138	7.6	0.010	242		0.100			0.011	7.3	0.002	1036		1620		25.64		912.9	0.080
Pre-50th for Trend	77	0.4	0.010	210		0.039			0.002	7.2	0.002	110		1400		25.2		912.3	0.040
ANZECC		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5 -8.0	0.005	1000(1170)		2000					0.908

MPGM4/D11 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)																				
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	Co	COND µS/cm	Cr	Cr-6	Cu	F	Fe-filtered	Hg	K	Li
19-Oct-12	<0.001	0.15	470	0.005	1.6	0.65		280	0.0002	220		2800	0.001		0.004	0.6	0.01	<0.00005	48	
10-Jan-13	<0.001	0.19	200	0.008	2.3	0.35		340	<0.0002	270		3200	<0.001		0.01	0.2		<0.00005	45	
27-Feb-13	<0.001	0.07	860	<0.001	0.68	1.4		180	0.0002	220		1800	<0.001		0.001	0.8		<0.00005	58	
27-Mar-13	<0.001	0.06	840	0.001	0.76	1		200	0.0002	230		2400	<0.001		0.003	0.5		<0.00005	61	
26-Apr-13	<0.001	0.29	800	0.001	0.66	0.87		170	0.0002	210		2100	0.005		0.015	0.5	0.02	<0.00005	53	
13-May-13	<0.001	0.05	820	<0.001	0.69	0.63		170	0.0002	230		2100	0.001		0.004	0.4	0.03	<0.00005	55	
26-Jun-13	<0.001	0.05	900	<0.001	0.81	0.85		170	0.0002	210		2000	0.003		0.001	0.7	0.04	<0.00005	57	
25-Jul-13	<0.001	0.09	890	0.001	0.9	0.9		180	0.0002	220		2000	0.003		0.006	<0.1	0.03	<0.00005	59	
29-Aug-13	<0.001	0.01	850	0.001	0.78	0.85		170	<0.0002	230		2100	0.002		0.001	0.5	0.28	<0.00005	53	
19-Sep-13	<0.001	0.02	840	<0.001	0.83	0.86		170	<0.0002	220		2100	0.003		<0.001	<0.2	0.03	<0.00005	53	
17-Oct-13	<0.001	0.59	760	0.003	1.3	0.77		220	0.0002	270		2600	0.003		0.002	0.6	0.04	<0.00005	51	
21-Nov-13	<0.001	<0.1	140	0.008	2.8	0.077		450	0.0002	460		3700	0.002		<0.001	0.2	18	<0.00005	50	
20-Dec-13	<0.001	0.01	230	0.007	2.7	0.091		430	0.0002	440		4700	0.002		0.001	0.2	1.5	<0.00005	44	
24-Jan-14	<0.001	0.22	770	0.006	0.94	0.6		180	0.0002	260		2300	0.005		0.002	0.5	23	<0.00005	56	
27-Feb-14	<0.001	0.01	120	0.008	3	0.45		480	0.0002	470		4200	0.003		0.006	0.2	24	<0.00005	58	
20-Mar-14	<0.001	0.03	120	0.009	2.7	0.43		480	0.0002	460		5500	0.002		0.002	0.2	25	<0.00005	56	
17-Apr-14	<0.001	0.01	130	0.010	2.7	0.071		460	0.0002	450		4300	0.003		0.001	0.2	12	<0.00005	55	
21-May-14	<0.001	<0.01	180	0.009	2.7	0.067		430	0.0002	390		4800	0.004		0.001	0.2	14	<0.00005	50	
26-Jun-14	<0.001	0.05	170	0.01	2.4	0.092		480	0.0001	370		4900	0.001		0.015	0.2	20	<0.00005	56	
24-Jul-14	<0.001	0.01	150	0.01	2.7	0.04		460	0.0001	480		4400	<0.001		0.001	0.2	34	<0.00005	52	
31-Aug-14	<0.001	<0.1	150	0.009	2.8	0.04		480	<0.0002	510		4500	0.001		<0.001	<0.2	32	0.00007	56	
18-Sep-14	0.001	<0.1	130	0.009	2.7	0.034		520	0.0002	540		4800	0.001		0.001	0.2	100	0.00005	60	
16-Oct-14	0.001	<0.1	58	0.011	2.9	0.027		520	0.0002	570		6100	0.001		0.001	0.2	100	0.00005	62	
20-Nov-14	0.001	0.15	94	0.011	2.9	0.026		520	0.0002	610		5400	0.001		0.001	0.2	45	0.00005	67	
17-Dec-14	0.001	<0.1	130	0.011	3.2	0.022		540	0.0002	620		4700	0.001		0.001	0.2	53	0.00005	72	
22-Jan-15	0.001	0.01	91	0.011	2.7	0.026		500	0.0002	610		6800	0.001		0.001	0.2	33	0.00005	66	
19-Feb-15	0.001	<0.05	120	0.011	2.9	0.027		550	0.0002	590		6700	0.001		0.001	0.2	110	0.00005	69	
18-Mar-15	0.001	0.01	120	0.012	2.9	0.027		510	0.0002	590		6500	0.001		0.001	0.2	100	0.00005	67	

15-Apr-15	0.001	0.01	110	0.011	2.8	0.023		520	0.0002	620		6500	0.001		0.001	0.2	97	0.00006	69	
14-May-15	0.001	<0.1	80	0.011	2.6	0.021		500	0.0002	610		5600	0.001		0.001	0.2	94	<0.00001	68	
11-Jun-15	0.001	0.005	68	0.01	2.2	0.023		480	0.0001	590		5300	0.001		0.001	0.1	92	0.00002	67	
8-Jul-15	0.001	0.005	111	0.011	2.6	0.026		502	0.0001	603		6580	0.001		0.001	0.2	80.9	0.00002	80.5	
12-Aug-15	0.001	0.005	175	0.01	2.83	0.027		493	0.0001	591		6660	0.001		0.001	0.1	119	0.00002	73.6	

Continued….MPGM4/D11 Water conditioned ash Placement Water Quality Data October, 2012 – August, 2015 (mg/L)

Date	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4	Temp	TFR	V	WL1	WL2	WLAHD	Zn
19-Oct-12	130	6.8	<0.01	210		0.09			0.002	6.7	0.002	870		2100		25.4		912.1	0.06
10-Jan-13	170	11	0.01	290		0.14			0.006	6.4	<0.002	1700		1400		25.8		911.7	0.08
27-Feb-13	76	0.38	0.01	200		0.03			0.002	7.2	0.002	10		1200		23.5		914.0	0.04
27-Mar-13	86	0.36	0.01	220		0.04			0.003	7.2	0.002	160		1500		24.8		912.7	0.05
26-Apr-13	76	0.28	0.01	200		0.039			0.024	7.2	0.002	110		1200		25.2		912.3	0.08
13-May-13	76	0.35	<0.01	200		0.038			0.002	7.2	0.002	140		1400		25.4		912.08	0.027
26-Jun-13	77	0.21	<0.001	210		0.037			0.001	7.2	0.002	35		1400		25		912.5	0.014
25-Jul-13	82	0.26	0.001	230		0.044			0.002	7.6	0.002	44		1400		25.2		912.3	0.025
29-Aug-13	77	0.26	<0.001	230		0.034			<0.001	7.1	<0.002	37		1300		25.6		911.9	0.025
19-Sep-13	77	0.26	0.001	230		0.037			<0.001	7.1	<0.002	42		1300		25.7		911.8	0.025
17-Oct-13	100	2.5	0.001	250		0.098			0.001	6.9	0.002	440		1600		25.7		911.8	0.029
21-Nov-13	240	15	0.001	480		0.24			0.001	6.1	0.002	2600		4800		25.3		912.2	0.034
20-Dec-13	230	14	0.001	460		0.26			0.001	6.4	0.002	2500		4400		25.4		912.1	0.036
24-Jan-14	85	1.1	0.001	250		0.23			0.014	7.2	0.002	140		1500		25.7		911.8	0.039
27-Feb-14	260	16	0.001	540		0.33			0.005	6.0	0.002	2800		4800		25.6		911.9	0.048
20-Mar-14	250	15	0.001	550		0.32			0.004	5.9	0.002	2700		5100		25		912.4	0.058
17-Apr-14	240	15	0.001	480		0.31			0.001	6.1	0.002	2600		4500		24.5		912.9	0.054
21-May-14	220	14	0.001	430		0.28			0.001	6.2	0.002	2200		4100		25.1		912.3	0.065
26-Jun-14	250	15	0.001	500		0.3			0.001	6.2	0.002	2100		4300		25		912.4	0.063
24-Jul-14	240	16	0.001	510		0.36			0.001	6.2	0.002	2700		4700		26	25.7	911.4	0.064
31-Aug-14	260	16	<0.001	600		0.38			<0.001	6.3	<0.002	2800		5100	<0.01	25.9	25.9	911.5	0.08
18-Sep-14	270	17	0.001	610		0.39			0.001	6.1	0.002	3000		5400	0.052	25.9		911.5	0.052
16-Oct-14	280	17	0.001	680		0.48			0.001	5.7	0.002	3100		5800	0.074	25.8		911.6	0.074
20-Nov-14	290	17	0.001	720		0.48			0.001	6.1	0.002	3300		5800	0.059	25.6		911.8	0.059
17-Dec-14	300	18	0.001	760		0.49			0.001	6.1	0.002	3400		6200	0.063	25.1		912.3	0.063
22-Jan-15	280	18	0.001	730		0.53			0.001	5.9	0.002	3300		6200	0.064	25		912.4	0.064
19-Feb-15	310	18	0.001	740		0.51			0.001	6.1	0.002	3100		5900	0.08	25.1		912.3	0.08
18-Mar-15	290	17	0.001	740		0.59			0.001	6	0.002	3200		6100	0.073	25.4		912.0	0.073
15-Apr-15	290	16	0.001	700		0.56			0.001	6.1	0.002	3400		6100	0.068	25.5		911.9	0.068
14-May-15	280	16	0.001	740		0.54			0.001	5.8	0.002	3300		6000	0.065	26.1		911.3	0.065
11-Jun-15	270	15	0.001	680		0.5			0.001	6.6	0.001	3200		5900	0.01	26.1		911.3	0.075
8-Jul-15	286	15.1	0.001	709		0.46			0.001	6.64	0.0001	3350		5710	0.005	25		912.4	0.063
12-Aug-15	281	20.7	0.001	711		0.506			0.001	6.59	0.0003	3040		5660	0.005	25		912.4	0.066

MPGM4/D11 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)																				
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe-filtered	Hg	K	Li
Ave	<0.001	0.07	210	0.009	2.53	0.162		453	0.0002	497		4985	0.002		0.002	0.22	51.14	0.00005	61	
Ave	<0.001	0.59	840	0.012	3.20	0.860		550	0.0002	620		6800	0.005		0.015	0.60	119.00	0.00007	81	
Max	<0.001	0.01	58	0.003	0.83	0.021		170	0.0001	220		2100	0.001		0.001	0.10	0.03	0.00002	44	
Min	<0.001	0.01	130	0.010	2.70	0.037		480	0.0002	525		4850	0.001		0.001	0.20	33.50	0.00005	59	
50th Investigation Trigger	<0.001	0.01	130	0.010	2.70	0.037		480	0.0002	525		4850	0.001		0.001	0.20	33.50	0.00005	59	
Post-90th for Trend	<0.001	0.19	601	0.011	2.90	0.555		520	0.0002	610		6636	0.003		0.002	0.20	100.00	0.00006	71	

Continued.......... MPGM4/D11 – Post-water conditioned ash Summary September, 2013 – August, 2015 (mg/L)																			
Date	Mg	Mn-filtered	Mo	Na	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	245	14.36	0.001	575		0.383			0.002	6.3	0.002	2596		4874	0.052	25.4		912.0	0.058
Max	310	20.70	0.001	760		0.590			0.014	7.2	0.002	3400		6200	0.080	26.1		912.9	0.080
Min	77	0.26	0.001	230		0.037			0.001	5.7	0.000	42		1300	0.005	24.5		911.3	0.025
50th Investigation Trigger	265	16.00	0.001	605		0.385			0.001	6.1	0.002	2900		5250	0.064	25.5		911.9	0.063
Post-90th for Trend	290	18.00	0.001	740		0.537			0.004	6.8	0.002	3335		6100	0.074	26.0		912.4	0.075

5. **Lamberts North Groundwater Bores MPGM4/D19**

MPGM4/D19 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																			
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.55	25.0	0.001	1.35	0.021		226	0.0006	186		2836	0.003		0.009	0.06	0.07	<0.00005	31	
Max	<0.001	2.70	25.0	0.002	1.60	0.030		250	0.0009	214		3000	0.004		0.017	0.10	0.63	<0.00005	35	
Min	<0.001	0.06	<25	<0.001	1.20	0.016		210	0.0003	160		2600	0.002		0.002	0.05	0.01	<0.00005	27	
90th Baseline	<0.001	0.74	25.0	0.002	1.50	0.027		250	0.0007	200		2900	0.004		0.015	0.06	0.03	<0.00005	34	
Pre-50th for Trend	<0.001	0.31	25.0	0.001	1.30	0.020		230	0.0006	190		2800	0.002		0.009	0.05	0.01	<0.00005	30	
ANZECC	0.00005	0.055		0.024	0.37 (0.55)	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664 (15.9)	0.00006		

Continued………. MPGM4/D19 – Pre-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																		
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	159	0.54	0.004	306		0.23			0.005	6.1	0.002	1513		2445		7.6		910.0	0.58
Max	170	1.30	0.005	340		0.33			0.012	6.3	0.002	1600		2800		8.2		910.5	0.94
Min	140	0.11	0.0005	260		0.14			0.003	5.7	<0.002	1400		2100		7.1		909.4	0.35
90th Baseline	170	0.9	0.005	320		0.3			0.008	6.3	0.002	1600		2700		8.0		910.3	0.733
Pre-50th for Trend	159	0.54	0.004	306		0.23			0.005	6.1	0.002	1513		2445		7.6		910.0	0.58
ANZECC 2000		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5 -8.0	0.005	1000(1170)		2000					0.908

MPGM4/D19 Water conditioned ash data October, 2012 – August, 2014 (mg/L)

Date:	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
31/10/2012	<0.001	2.7	<20	0.002	1.3	0.03		210	0.0007	160		2800	0.004		0.011	<0.1	0.02	<0.00005	29	
23/11/2012	<0.001	0.32	<25	0.001	1.5	0.016		230	0.00069	170		2900	<0.001		0.0053	0.05	0.005	<0.00005	30	
21/12/2012	<0.001	0.1	25	<0.001	1.5	0.016		230	0.0005	190		3000	<0.001		0.005	0.05	0.005	<0.00005	32	
25/01/2013	<0.001	0.11	25	0.001	1.5	0.02		250	0.0007	214		2900	<0.001		0.01	0.05	0.03	<0.00005	35	
27/02/2013	<0.001	0.74	25	0.001	1.6	0.024		250	0.0009	190		2600	0.002		0.017	0.05	0.005	<0.00005	34	
27/03/2013	<0.001	0.22	25	0.001	1.4	0.02		220	0.0006	180		2900	<0.001		0.015	0.05	0.005	<0.00005	32	
26/04/2013	<0.001	0.06	25	0.001	1.2	0.019		210	0.0005	170		2800	0.002		0.009	0.05	0.005	<0.00005	30	
13/05/2013	<0.001	0.18	25	0.001	1.2	0.02		210	0.0003	190		2800	0.002		0.002	0.05	0.005	<0.00005	32	
26/06/2013	<0.001	0.31	25	0.001	1.2	0.018		220	0.0004	190		2800	0.004		0.002	0.05	0.005	<0.00005	29	
25/07/2013	<0.001	0.69	25	0.002	1.3	0.027		230	0.0006	190		2900	0.004		0.012	0.05	0.005	<0.00005	29	
29/08/2013	<0.001	0.58	25	<0.001	1.2	0.024		230	0.0004	200		2800	0.002		0.007	0.1	0.63	<0.00005	27	
19/09/2013	<0.001	0.76	25	0.002	1.4	0.027		250	0.0004	220		3000	0.003		0.01	0.1	0.005	<0.00005	29	
17/10/2013	<0.001	0.06	25	<0.001	0.93	0.01		160	0.0004	140		2200	0.002		0.004	0.1	0.02	<0.00005	19	
21/11/2013	<0.001	0.34	25	0.001	1.4	0.018		240	0.0004	250		2600	0.003		0.003	0.1	0.005	<0.00005	33	
20/12/2013	<0.001	0.7	25	0.004	1.5	0.036		260	0.0004	260		3300	0.004		0.008	0.1	0.005	<0.00005	37	
24/01/2014	<0.001	0.09	25	0.001	1.5	0.018		260	0.0006	270		3600	0.003		0.003	0.1	0.005	<0.00005	37	
26/02/2014	<0.001	1	25	0.002	1.6	0.027		290	0.0007	290		3100	0.003		0.008	0.1	2.9	<0.00005	43	
20/03/2014	<0.001	1.5	25	0.006	1.3	0.069		260	0.0007	270		4100	0.006		0.014	0.1	0.03	<0.00005	37	
16/04/2014	<0.001	0.66	25	0.002	1.6	0.031		260	0.0005	270		3400	0.06		0.011	0.1	0.02	<0.00005	38	
14/05/2014	<0.001	0.75	25	0.001	1.5	0.021		250	0.0004	240		3800	0.002		0.004	0.1	0.06	<0.00005	38	
25/06/2014	<0.001	0.28	25	0.001	1.2	0.016		240	0.0002	210		3700	0.001		0.003	0.25	0.005	<0.00005	35	
24/07/2014	<0.001	0.53	25	0.001	1.4	0.019		240	0.0002	230		3000	0.002		0.004	0.1	0.005	<0.00005	34	
31/08/2014	<0.001	0.13	<25	<0.001	1.3	0.015		240	0.0003	250		2900	<0.001		0.002	<0.2	<0.01	<0.00005	33	

Continued………. MPGM4/D19 Water conditioned ash data October, 2012 – August, 2014 (mg/L)

Date:	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
31/10/2012	140	0.9	<0.01	260		0.30			0.012	5.7	<0.002	1400		2200		7.8		909.8	
23/11/2012	150	0.46	0.005	310		0.23			0.0037	6.1	0.002	1500		2300		7.5		910.1	0.64
21/12/2012	160	0.48	0.005	300		0.25			0.004	6.3	0.002	1500		2400		8		909.6	0.71
25/01/2013	170	0.62	0.005	320		0.27			0.004	5.8	0.002	1540		2600		8.2		909.4	0.68
27/02/2013	170	1.3	0.005	340		0.33			0.008	5.9	0.002	1500		2600		7.3		910.3	0.94
27/03/2013	150	0.61	0.005	310		0.24			0.004	6.1	0.002	1500		2400		7.5		910.1	0.67
26/04/2013	150	0.38	0.005	300		0.19			0.003	6	0.002	1500		2100		7.4		910.2	0.44
13/05/2013	160	0.12	0.005	310		0.14			0.004	6.3	0.002	1600		2500		7.3		910.3	0.35
26/06/2013	160	0.11	0.0005	290		0.17			0.003	6.3	0.002	1500		2700		7.1		910.5	0.36
25/07/2013	170	0.54	0.0005	310		0.26			0.007	6.3	0.002	1500		2300		7.6		910.0	0.66
29/08/2013	170	0.37	0.0005	320		0.14			0.005	6	<0.002	1600		2800		7.6		910.0	0.37
19/09/2013	180	0.28	0.0005	360		0.16			0.006	6.1	<0.002	1700		2900		7.5		910.1	0.34
17/10/2013	110	0.32	0.0005	220		0.16			0.0005	6.1	0.002	1100		1700		7.5		910.1	0.49
21/11/2013	170	0.28	0.0005	380		0.18			0.002	6.3	0.002	2000		3400		7.6		910.0	0.38
20/12/2013	190	0.4	0.0005	420		0.24			0.012	6.3	0.002	1900		3000		7.6		910.0	0.5
24/01/2014	190	0.7	0.0005	420		0.29			0.003	6.3	0.002	1900		3200		7.5		910.1	0.61
26/02/2014	210	0.89	0.0005	460		0.33			0.01	6	0.002	2000		3400		7.6		910.0	0.52
20/03/2014	180	0.83	0.002	400		0.32			0.018	5.9	0.002	2000		3400		7.1		910.5	0.61
16/04/2014	180	0.51	0.003	410		0.28			0.006	6.1	0.002	2000		3400		7.0		910.6	0.47
14/05/2014	180	0.71	0.0005	400		0.26			0.004	6	0.002	1800		3200		7.1		910.5	0.45
25/06/2014	170	0.15	0.0005	400		0.15			0.002	7.2	0.002	1600		3000		7.3		910.3	0.32
24/07/2014	170	0.25	0.0005	420		0.17			0.003	6.4	0.002	1700		3200		7.3		910.3	0.3
31/08/2014	170	0.16	<0.001	410		0.14			0.002	6.6	<0.002	1900		3100	<0.01	7.2		910.4	0.36

MPGM4/D19 – Post-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																				
	Ag	Al	ALK	As	B	Ba	Be	Ca:	Cd	Cl:	Co	COND uS/cm	Cr	Cr-6	Cu	F	Fe	Hg	K:	Li
Ave	<0.001	0.57	25	0.002	1.39	0.026		246	0.0004	242		3225	0.008		0.006	0.11	0.28	<0.00005	34	
Max	<0.001	1.50	25	0.006	1.60	0.069		290	0.0007	290		4100	0.060		0.014	0.25	2.90	<0.00005	43	
Min	<0.001	0.06	<25	<0.001	0.93	0.010		160	0.0002	140		2200	0.001		0.002	0.10	0.01	<0.00005	19	
90th Baseline	<0.001	0.98	25	0.004	1.59	0.036		260	0.0007	270		3790	0.006		0.011	0.10	0.06	<0.00005	38	
Pre-50th for Trend	<0.001	0.60	25	0.002	1.40	0.020		250	0.0004	250		3200	0.003		0.004	0.10	0.01	<0.00005	36	
ANZECC	0.00005	0.055		0.024	0.37 (0.55)	0.700			0.002	350		2600	0.005		0.005 (0.0075)	1.50	0.664 (15.9)	0.00006		

Continued………. MPGM4/D19 – Post-water conditioned ash Summary October, 2012 – August, 2013 (mg/L)																			
	Mg:	Mn	Mo	Na:	NFR	Ni	NO2	NO3	Pb	pH	Se	SO4:	Temp	TFR	V	WL1	WL2	WLAHD	Zn
Ave	175	0.46	0.001	392		0.223			0.006	6.3	0.002	1800		3075	<0.01	7.4		910.3	0.446
Max	210	0.89	0.003	460		0.330			0.018	7.2	0.002	2000		3400	<0.01	7.6		910.6	0.610
Min	110	0.15	0.001	220		0.140			0.001	5.9	<0.002	1100		1700	<0.01	7.0		910.0	0.300
90th Baseline	190	0.82	0.002	420		0.317			0.012	6.6	0.002	2000		3400	<0.01	7.6		910.5	0.601
Pre-50th for Trend	180	0.36	0.001	405		0.210			0.004	6.2	0.002	1900		3200	<0.01	7.4		910.2	0.460
ANZECC 2000		5.704(8.57)	0.010		10.0	0.5509			0.005	6.5 -8.0	0.005	1000(1170)		2000					0.908

6. Lamberts North Water Conditioned Ash Runoff Pond LN Pond 1 and LN Pond 2 Water Quality 2012 to 2014 (no data for 2015)

Lamberts North Pond 1							
Date	pH	Conductivity (uS/cm)	TDS (mg/L)	Temperature °C	TSS	Chloride	Sulphate
2/09/2013	7.6	330	300		12	9	100
3/11/2013	7.2	600	360		860	15	240
5/02/2014	7.4	1800	1500		800	54	900
10/04/2014	8	1000	680		14	30	140
30/04/2014	7.9	1300	880		4	37	480
18/07/2014	8.2	2000	1600		7	92	920
30/07/2014	7.4	2400	2100		4	82	1000
Average	7.7	1347	1060		243	46	540

Lamberts North Pond 2							
Date	pH	Conductivity (uS/cm)	TDS (mg/L)	Temperature °C	TSS	Chloride	Sulphate
2/09/2013	7	2800	2300		2	130	140
3/11/2013	8.4	2000	1700		16	110	1100
5/02/2014	8.1	2700	2300		2	130	1300
10/04/2014	7.7	810	560		43	29	310
30/04/2014	8.1	1300	900		26	45	460
18/07/2014	8.1	2000	1500		36	88	890
Average	7.9	1935	1543		21	89	700

Customer Analytical Services
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Final - Report Number: 1211489
LLS INDUSTRIAL C/- MT PIPER POWER
BOULDER ROAD
PORTLAND NSW 2847 AUSTRALIA
Sold To: 0150139749 **Ship To**: 0150139749
Representative: Clive Stacey

Sample Number	AW044094
Date Sampled	18-Jul-2014
Date Received	24-Jul-2014
Date Completed	7-Aug-2014
Date Authorised	7-Aug-2014

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN GW Collection 1

Water

Cations - Metals	**Test Method**	**Filtered**	**Total**
Chromium Hexavalent (Cr)	External		<0.01 mg/L
Aluminium (Al)	*CA14106		0.1 mg/L
Antimony (Sb)	External		<0.001 mg/L
Arsenic (As)	External		0.001 mg/L
Barium (Ba)	*CA14106		0.04 mg/L
Boron (B)	*CA14106		1 mg/L
Cadmium (Cd)	*CA14106		<0.01 mg/L
Calcium (Ca)	*CA14106		120 mg/L
Chromium (Cr)	*CA14106		<0.01 mg/L
Cobalt (Co)	*CA14106		0.01 mg/L
Copper (Cu)	*CA14106		<0.01 mg/L
Iron (Fe)	*CA14106	<0.01 mg/L	0.14 mg/L
Lead (Pb)	*CA14106		<0.01 mg/L
Magnesium (Mg)	*CA14106		79 mg/L
Manganese (Mn)	*CA14106		0.25 mg/L
Mercury (Hg)	External		<0.00005 mg/L
Nickel (Ni)	*CA14106		0.07 mg/L
Potassium (K)	*CA14106		35 mg/L
Selenium (Se)	External		0.008 mg/L
Silver (Ag)	External		<0.001 mg/L
Sodium (Na)	*CA14106		240 mg/L
Zinc (Zn)	*CA14106		0.08 mg/L

Anions Test Method: *CA15000	**Filtered**
Fluoride (F)	1 mg/L
Chloride (Cl)	92 mg/L
Bromide (Br)	<1 mg/L
Sulfate (SO4)	920 mg/L
Nitrate (N)	1.9 mg/L
Nitrite (N)	<0.3 mg/L

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN GW Collection 1

Alkalinity **Test Method: *CA12121**	**Total**
Total Alkalinity (CaCO3)	100 mg/L
Phenolphthalein Alkalinity (CaCO3)	<25 mg/L
Bicarbonate (CaCO3)	100 mg/L

Physical	**Test Method**	**Total**
Conductivity at 25°C	*CA12121	2000 µS/cm
pH @ 25°C	*CA12121	8.2 pH Units
Total Suspended Solids @ 105°C	*CA12119	7 mg/L
Total Dissolved Solids @ 180°C	*CA12120	1600 mg/L

External Analysis Performed By: Australian Laboratory Services. NATA Accreditation no. 825. Report Number: ES1417084. Report Date: 7-Aug-2014
Chromium, Hexavalent (Cr)

External Analysis Performed By: National Measurement Institute. NATA Accreditation no. 198. Report Number: RN1031365. Report Date: 4-Aug-2014
Total ICP

Customer Analytical Services

Gate 5 / 3 Anderson Street Botany NSW 2019
Phone: (612) 9392 3708 Fax: (612) 9392 3722 Email: customeranalyticalservices@nalco.com

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Final - Report Number: 1211489
LLS INDUSTRIAL C/- MT PIPER POWER
BOULDER ROAD
PORTLAND NSW 2847 AUSTRALIA
Sold To: 0150139749 **Ship To**: 0150139749
Representative: Clive Stacey

Sample Number	AW044095
Date Sampled	18-Jul-2014
Date Received	24-Jul-2014
Date Completed	7-Aug-2014
Date Authorised	7-Aug-2014

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN Pond 2 Big Pond

Water

Cations - Metals	Test Method	Filtered	Total
Chromium Hexavalent (Cr)	External		<0.01 mg/L
Aluminium (Al)	*CA14106		0.2 mg/L
Antimony (Sb)	External		<0.001 mg/L
Arsenic (As)	External		0.001 mg/L
Barium (Ba)	*CA14106		0.04 mg/L
Boron (B)	*CA14106		1 mg/L
Cadmium (Cd)	*CA14106		<0.01 mg/L
Calcium (Ca)	*CA14106		120 mg/L
Chromium (Cr)	*CA14106		<0.01 mg/L
Cobalt (Co)	*CA14106		<0.01 mg/L
Copper (Cu)	*CA14106		<0.01 mg/L
Iron (Fe)	*CA14106	<0.01 mg/L	0.32 mg/L
Lead (Pb)	*CA14106		<0.01 mg/L
Magnesium (Mg)	*CA14106		74 mg/L
Manganese (Mn)	*CA14106		0.08 mg/L
Mercury (Hg)	External		<0.00005 mg/L
Nickel (Ni)	*CA14106		0.04 mg/L
Potassium (K)	*CA14106		35 mg/L
Selenium (Se)	External		0.006 mg/L
Silver (Ag)	External		<0.001 mg/L
Sodium (Na)	*CA14106		240 mg/L
Zinc (Zn)	*CA14106		0.03 mg/L

Anions Test Method: *CA15000	Filtered
Fluoride (F)	1 mg/L
Chloride (Cl)	88 mg/L
Bromide (Br)	<1 mg/L
Sulfate (SO4)	890 mg/L
Nitrate (N)	2.0 mg/L
Nitrite (N)	<0.3 mg/L

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN Pond 2 Big Pond

Alkalinity	**Test Method: *CA12121**	**Total**
Total Alkalinity (CaCO3)		100 mg/L
Phenolphthalein Alkalinity (CaCO3)		<25 mg/L
Bicarbonate (CaCO3)		100 mg/L

Physical	**Test Method**	**Total**
Conductivity at 25°C	*CA12121	2000 µS/cm
pH @ 25°C	*CA12121	8.1 pH Units
Total Suspended Solids @ 105°C	*CA12119	36 mg/L
Total Dissolved Solids @ 180°C	*CA12120	1500 mg/L

External Analysis Performed By: Australian Laboratory Services. NATA Accreditation no. 825. Report Number: ES1417084. Report Date: 7-Aug-2014
Chromium, Hexavalent (Cr)

External Analysis Performed By: National Measurement Institute. NATA Accreditation no. 198. Report Number: RN1031365. Report Date: 4-Aug-2014
Total ICP

Customer Analytical Services
Gate 5 / 3 Anderson Street Botany NSW 2019
Phone: (612) 9392 3708 Fax: (612) 9392 3722 Email: customeranalyticalservices@nalco.com

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Final - Report Number: 1211489
LLS INDUSTRIAL C/- MT PIPER POWER
BOULDER ROAD
PORTLAND NSW 2847 AUSTRALIA
Sold To: 0150139749 **Ship To**: 0150139749
Representative: Clive Stacey

Sample Number	AW044096
Date Sampled	18-Jul-2014
Date Received	24-Jul-2014
Date Completed	7-Aug-2014
Date Authorised	7-Aug-2014

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN Pond 2 Seepage Inflow

Water

Cations - Metals	Test Method	Filtered	Total
Chromium Hexavalent (Cr)	External		<0.01 mg/L
Aluminium (Al)	*CA14106		<0.1 mg/L
Antimony (Sb)	External		<0.001 mg/L
Arsenic (As)	External		0.002 mg/L
Barium (Ba)	*CA14106		0.01 mg/L
Boron (B)	*CA14106		2 mg/L
Cadmium (Cd)	*CA14106		<0.01 mg/L
Calcium (Ca)	*CA14106		130 mg/L
Chromium (Cr)	*CA14106		<0.01 mg/L
Cobalt (Co)	*CA14106		<0.01 mg/L
Copper (Cu)	*CA14106		<0.01 mg/L
Iron (Fe)	*CA14106	<0.01 mg/L	0.04 mg/L
Lead (Pb)	*CA14106		<0.01 mg/L
Magnesium (Mg)	*CA14106		75 mg/L
Manganese (Mn)	*CA14106		0.57 mg/L
Mercury (Hg)	External		<0.00005 mg/L
Nickel (Ni)	*CA14106		0.13 mg/L
Potassium (K)	*CA14106		47 mg/L
Selenium (Se)	External		0.010 mg/L
Silver (Ag)	External		<0.001 mg/L
Sodium (Na)	*CA14106		310 mg/L
Zinc (Zn)	*CA14106		0.13 mg/L

Anions Test Method: *CA15000	Filtered
Fluoride (F)	2 mg/L
Chloride (Cl)	110 mg/L
Bromide (Br)	<1 mg/L
Sulfate (SO4)	1100 mg/L
Nitrate (N)	2.8 mg/L
Nitrite (N)	<0.3 mg/L

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: LN Pond 2 Seepage Inflow

Alkalinity **Test Method: *CA12121**	**Total**
Total Alkalinity ($CaCO_3$)	120 mg/L
Phenolphthalein Alkalinity ($CaCO_3$)	<25 mg/L
Bicarbonate ($CaCO_3$)	120 mg/L

Physical	**Test Method**	**Total**
Conductivity at 25°C	*CA12121	2400 µS/cm
pH @ 25°C	*CA12121	7.8 pH Units
Total Suspended Solids @ 105°C	*CA12119	5 mg/L
Total Dissolved Solids @ 180°C	*CA12120	1800 mg/L

External Analysis Performed By: Australian Laboratory Services. NATA Accreditation no. 825. Report Number: ES1417084. Report Date: 7-Aug-2014
Chromium, Hexavalent (Cr)

External Analysis Performed By: National Measurement Institute. NATA Accreditation no. 198. Report Number: RN1031365. Report Date: 4-Aug-2014
Total ICP

Customer Analytical Services
Gate 5 / 3 Anderson Street Botany NSW 2019
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Final - Report Number: 1242035
LLS INDUSTRIAL C/- MT PIPER POWER
BOULDER ROAD
PORTLAND NSW 2847 AUSTRALIA
Sold To: 0150139749 **Ship To**: 0150139749
Representative: Clive Stacey

Sample Number	AW045000
Date Sampled	30-Jul-2014
Date Received	22-Aug-2014
Date Completed	15-Sep-2014
Date Authorised	18-Sep-2014

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: MPiper - Ramberts Nth Seepage Collection Drain

Water

Cations - Metals	Test Method	Filtered	Total
Mercury (Hg)	*CA14500		<0.00005 mg/L
Aluminium (Al)	*CA14106		<0.1 mg/L
Barium (Ba)	*CA14106		0.03 mg/L
Beryllium (Be)	*CA14106		<0.01 mg/L
Boron (B)	*CA14106		<1 mg/L
Cadmium (Cd)	*CA14106		<0.01 mg/L
Calcium (Ca)	*CA14106		200 mg/L
Chromium (Cr)	*CA14106		<0.01 mg/L
Cobalt (Co)	*CA14106		<0.01 mg/L
Copper (Cu)	*CA14106		<0.01 mg/L
Iron (Fe)	*CA14106	<0.01 mg/L	0.06 mg/L
Lead (Pb)	*CA14106		<0.1 mg/L
Magnesium (Mg)	*CA14106		230 mg/L
Manganese (Mn)	*CA14106		0.06 mg/L
Molybdenum (Mo)	*CA14106		<0.1 mg/L
Nickel (Ni)	*CA14106		<0.01 mg/L
Potassium (K)	*CA14106		18 mg/L
Sodium (Na)	*CA14106		140 mg/L
Strontium (Sr)	*CA14106		0.65 mg/L
Titanium (Ti)	*CA14106		<0.01 mg/L
Vanadium (V)	*CA14106		<0.01 mg/L
Zinc (Zn)	*CA14106		<0.01 mg/L
Antimony (Sb)	*CA14503		0.001 mg/L
Arsenic (As)	*CA14503		<0.001 mg/L
Cadmium (Cd)	*CA14503		<0.0002 mg/L
Lead (Pb)	*CA14503		<0.001 mg/L
Selenium (Se)	*CA14503		0.009 mg/L
Silver (Ag)	*CA14503		<0.001 mg/L

Analytical Report

This sample was analysed as received, the results being as follows:

Sampling point: MPiper - Ramberts Nth Seepage Collection Drain

Anions **Test Method: *CA15000**	**Filtered**
Chloride (Cl)	82 mg/L
Sulfate (SO4)	1000 mg/L

Alkalinity **Test Method: *CA12121 (CA11113)**	**Total**
Total Alkalinity (CaCO3)	500 mg/L
Phenolphthalein Alkalinity (CaCO3)	<25 mg/L
Bicarbonate (CaCO3)	500 mg/L

Physical	**Test Method**	**Total**
Conductivity at 25°C	*CA12121 (CA11116)	2400 µS/cm
pH @ 25°C	*CA12121 (A-4.4)	7.4 pH Units
Total Suspended Solids @ 105°C	*CA12119	4 mg/L
Total Dissolved Solids @ 180°C	*CA12120	2100 mg/L

Regulatory Comments

CA14106 according to APHA 3030 E, F & 3120 B

Titanium by CA14106 - NATA Accreditation does not cover the performance of this service.

CA12120 according to APHA 2540 C

Attachment 2

Lithgow Rainfall Data from January, 2000 to August, 2015 (mm/month) from Bureau of Meteorology

Year(s)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2000	57	22.2	271.4	50.6	53	32.2	37.4	51.2	43	75	119.2	59	871.6
2001	105.4	90.6	89.6	84.4	29	9	63.2	30.8	46.4	58.8	80	26.6	713.6
2002	87.8	187	69.4	40.2	68	22.6	16.8	17	21.2	3	22	47.2	601.8
2003	3.6	135	41.8	38.4	54	43.2	20.6	0	18.6	82.4	121	68.8	627.4
2004	35	98.2	22.4	10.4	35	16.2	30.2	50.8	34.8	118	113.8	88.6	654
2005	102.8	105	55.8	28.6	14	117	59.2	24.6	87.6	117	159.4	48.4	918.9
2006	146.6	32.6	6.4	6.8	6.8	6.8	54.2	5.8	59.2	3.2	32.2	72.7	433.3
2007	92.6	141	72.1	44.6	57	223	24.9	65.4	9	37.8	134.7	67	969.1
2008	102	84.6	47.6	59.8	11	60.9	37.1	43.6	88.2	66.2	83.3	113.2	797.5
2009	25.2	166	28	74.5	81	44.5	35.9	48.8	63	69	23.6	81.5	740.7
2010	76.4	119	85.1	35.8	54	40.9	73.5	73.5	52.4	70.9	122.8	164.6	969.5
2011	114	57.2	77.2	41.2	51.2	72.4	24.6	58.7	78.4	46.2	168	96	885.1
2012	57.1	152.6	189.8	44.4	30.6	81.8	49.8	21.2	48.6	20.8	30.9	64.1	791.7
2013	64.1	113.2	184.2	66.2	28.1	29	24.4	23.2	36.8	21.8	95.2	34.2	720.4
2014	13.6	74	143.8	63	14	43.2	24.2	24.2	27.9	60.7	21.8	174.3	684.7
2015	124.8	31	35	184	31	26	44.6	31.6					508.0
												Average	758.6

Attachment 3

Mt Piper Power Station and Lamberts North Groundwater Bore Collar and Pipe Height Survey results for:

a) December, 2011 with Bores MPGM4/D9 and D19 Levels in 2012

b) Groundwater Level Survey 20th March, 2014 including water level of SW3 Pond and underground coal mine water seepage point into Huon Gully

a) Groundwater Bore Survey results December, 2011					
Bore Name	**Easting**	**Northing**	**Ground level RLm**	**Top of pipe RLm**	**Pipe Height m**
MPGM4/D1	225603.983	6305355.123	911.973	912.603	0.63
MPGM4/D3	225168.952	6305718.268	919.834	920.014	0.18
MPGM4/D4	224609.58	6305939.21	919.38	919.64	0.26
MPGM4/D5	224727.822	6305772.088	925.347	925.787	0.44
MPGM4/D8	226000.54	6305241.889	905.899	906.449	0.55
MPGM4/D9*	225686.68	6305313.55	909.566	909.664	0.098
MPGM4/D11	225312.635	6305090.199	937.344	937.48	0.15
MPGM4/D10	225241.559	6304897.926	925.932	926.087	0.14
MPGM4/D19**			916.947	917.607	0.66

January 2012

**from CDM Smith (2012) and Delta Electricity May 2013.

b) **Groundwater Level Survey 20th March, 2014**

MT PIPER POWER STATION WATER MONITORING			
Survey Date 20/03/14			
Notes Vertical Datum is 'Australian Hieght Datum' (AHD) Horizontal Datum is Map Grid Australia (MGA)			
Origin for Survey PM 69965	MGA East 224266.86	MGA North 6306197.29	AHD Height 934.946

D 10	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225241.71	6304897.87	925.95
TOP OF CONDUIT	225241.69	6304897.87	926.06

	MGA EAST	MGA NORTH	AHD HEIGHT	Comments
MINE WATER SEEPAGE POINT INTO HUON GULLY	225242.29	6304874.82	923.16	Ground wet but little seepage
	225248.59	6304873.18	920.02	Seepage flowing
POND WATER LEVEL	225279.48	6304894.09	915.34	

D 11	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225312.69	6305090.30	937.30
TOP OF CONDUIT	225312.67	6305090.30	937.37

D 15	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225027.57	6304669.51	940.18
TOP OF CONDUIT	225027.46	6304669.58	940.83

D 16	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225090.33	6304252.03	921.11
TOP OF CONDUIT	225090.35	6304251.90	921.82

D 17	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225454.95	6304437.14	935.69

TOP OF CONDUIT	225454.86	6304437.13	936.50

D 18	MGA EAST	MGA NORTH	AHD HEIGHT
GROUND	225278.06	6304710.02	932.18
TOP OF CONDUIT	225278.00	6304709.93	932.79

POND SW3	MGA EAST	MGA NORTH	AHD HEIGHT
WATER LEVEL	225142.93	6304987.14	932.53

Attachment 4

Department of Planning and Infrastructure Approval on 16th February, 2012 for the Mt Piper Power Station Ash Placement Project with ash placement at Lamberts North

Attachment 5

Discharge flow data for the LDP01 v-notch from October, 2012 to August, 2014

DATE	Flow kl/day
01/09/2014	0.00
02/09/2014	0.00
03/09/2014	0.00
04/09/2014	0.00
05/09/2014	0.00
06/09/2014	0.00
07/09/2014	0.00
08/09/2014	0.00
09/09/2014	0.00
10/09/2014	0.00
11/09/2014	0.00
12/09/2014	0.00
13/09/2014	0.00
14/09/2014	0.00
15/09/2014	0.15
16/09/2014	0.00
17/09/2014	0.14
18/09/2014	0.18
19/09/2014	0.87
20/09/2014	0.70
21/09/2014	0.00
22/09/2014	0.57
23/09/2014	0.57
24/09/2014	0.00
25/09/2014	1.55

26/09/2014	0.00
27/09/2014	0.00
28/09/2014	0.53
29/09/2014	0.55
30/09/2014	0.60
01/10/2014	0.13
02/10/2014	0.00
03/10/2014	0.00
04/10/2014	0.41
05/10/2014	0.44
06/10/2014	0.00
07/10/2014	0.75
08/10/2014	0.00
09/10/2014	0.49
10/10/2014	0.46
11/10/2014	0.43
12/10/2014	0.00
13/10/2014	2.33
14/10/2014	0.00
15/10/2014	1.84
16/10/2014	0.00
17/10/2014	0.00
18/10/2014	0.52
19/10/2014	0.00
20/10/2014	0.52
21/10/2014	0.09
22/10/2014	0.09
23/10/2014	0.01
24/10/2014	0.00
25/10/2014	0.08
26/10/2014	0.00
27/10/2014	0.00
28/10/2014	0.38
29/10/2014	0.00
30/10/2014	0.33
31/10/2014	0.36
01/11/2014	0.97
02/11/2014	0.65
03/11/2014	0.65
04/11/2014	0.62
05/11/2014	0.65
06/11/2014	0.65
07/11/2014	0.65
08/11/2014	0.65
09/11/2014	0.65
10/11/2014	0.65
11/11/2014	0.00
12/11/2014	0.62
13/11/2014	0.34
14/11/2014	0.32

15/11/2014	0.00
16/11/2014	0.00
17/11/2014	1.74
18/11/2014	0.00
19/11/2014	0.27
20/11/2014	0.00
21/11/2014	0.27
22/11/2014	0.00
23/11/2014	0.00
24/11/2014	2.75
25/11/2014	2.34
26/11/2014	0.00
27/11/2014	0.00
28/11/2014	0.00
29/11/2014	0.34
30/11/2014	0.00
01/12/2014	4.23
02/12/2014	4.01
03/12/2014	0.00
04/12/2014	0.00
05/12/2014	3.44
06/12/2014	14.77
07/12/2014	0.00
08/12/2014	0.00
09/12/2014	1.97
10/12/2014	7.56
11/12/2014	0.00
12/12/2014	2.70
13/12/2014	0.94
14/12/2014	0.57
15/12/2014	0.70
16/12/2014	0.60
17/12/2014	0.44
18/12/2014	0.00
19/12/2014	0.36
20/12/2014	0.33
21/12/2014	0.33
22/12/2014	2.90
23/12/2014	7.69
24/12/2014	2.64
25/12/2014	7.28
26/12/2014	4.68
27/12/2014	1.37
28/12/2014	0.00
29/12/2014	0.68
30/12/2014	0.00
31/12/2014	0.43
01/01/2015	0.43
02/01/2015	0.76
03/01/2015	0.51

04/01/2015	0.83
05/01/2015	3.89
06/01/2015	1.01
07/01/2015	0.42
08/01/2015	0.00
09/01/2015	0.00
10/01/2015	3.16
11/01/2015	0.00
12/01/2015	2.67
13/01/2015	1.66
14/01/2015	0.00
15/01/2015	1.36
16/01/2015	0.00
17/01/2015	0.00
18/01/2015	0.13
19/01/2015	0.18
20/01/2015	0.08
21/01/2015	0.00
22/01/2015	0.00
23/01/2015	0.00
24/01/2015	0.00
25/01/2015	0.00
26/01/2015	0.00
27/01/2015	3.07
28/01/2015	1.11
29/01/2015	0.18
30/01/2015	0.00
31/01/2015	0.00
01/02/2015	0.00
02/02/2015	0.00
03/02/2015	0.00
04/02/2015	0.00
05/02/2015	0.00
06/02/2015	0.00
07/02/2015	0.00
08/02/2015	0.00
09/02/2015	0.00
10/02/2015	0.00
11/02/2015	0.00
12/02/2015	0.00
13/02/2015	0.00
14/02/2015	0.00
15/02/2015	0.00
16/02/2015	0.00
17/02/2015	0.57
18/02/2015	0.50
19/02/2015	0.40
20/02/2015	0.33
21/02/2015	0.52
22/02/2015	0.00

23/02/2015	0.30
24/02/2015	0.00
25/02/2015	0.30
26/02/2015	0.00
27/02/2015	0.30
28/02/2015	0.00
01/03/2015	0.00
02/03/2015	0.74
03/03/2015	0.30
04/03/2015	0.74
05/03/2015	0.74
06/03/2015	0.74
07/03/2015	0.07
08/03/2015	0.07
09/03/2015	0.74
10/03/2015	0.74
11/03/2015	0.30
12/03/2015	2.19
13/03/2015	0.00
14/03/2015	0.30
15/03/2015	0.74
16/03/2015	0.74
17/03/2015	0.30
18/03/2015	0.74
19/03/2015	0.74
20/03/2015	0.74
21/03/2015	0.74
22/03/2015	0.74
23/03/2015	0.30
24/03/2015	0.74
25/03/2015	0.74
26/03/2015	0.74
27/03/2015	0.74
28/03/2015	0.74
29/03/2015	0.74
30/03/2015	0.74
31/03/2015	0.00
01/04/2015	0.00
02/04/2015	0.00
03/04/2015	0.00
04/04/2015	0.00
05/04/2015	0.00
06/04/2015	0.00
07/04/2015	0.00
08/04/2015	0.00
09/04/2015	0.00
10/04/2015	0.00
11/04/2015	0.00
12/04/2015	0.00
13/04/2015	0.18

14/04/2015	0.23
15/04/2015	0.00
16/04/2015	0.96
17/04/2015	0.00
18/04/2015	1.78
19/04/2015	2.90
20/04/2015	12.90
21/04/2015	19.71
22/04/2015	11.40
23/04/2015	10.32
24/04/2015	2.32
25/04/2015	1.35
26/04/2015	1.27
27/04/2015	0.00
28/04/2015	0.07
29/04/2015	0.07
30/04/2015	0.09
01/05/2015	0.09
02/05/2015	0.13
03/05/2015	0.10
04/05/2015	0.07
05/05/2015	0.09
06/05/2015	0.14
07/05/2015	4.35
08/05/2015	0.00
09/05/2015	0.00
10/05/2015	0.09
11/05/2015	0.10
12/05/2015	0.07
13/05/2015	0.04
14/05/2015	0.01
15/05/2015	0.00
16/05/2015	0.00
17/05/2015	0.00
18/05/2015	0.05
19/05/2015	3.07
20/05/2015	0.00
21/05/2015	1.39
22/05/2015	0.00
23/05/2015	0.60
24/05/2015	0.74
25/05/2015	0.71
26/05/2015	0.71
27/05/2015	0.00
28/05/2015	0.59
29/05/2015	0.59
30/05/2015	0.00
31/05/2015	0.59
01/06/2015	0.00
02/06/2015	0.26

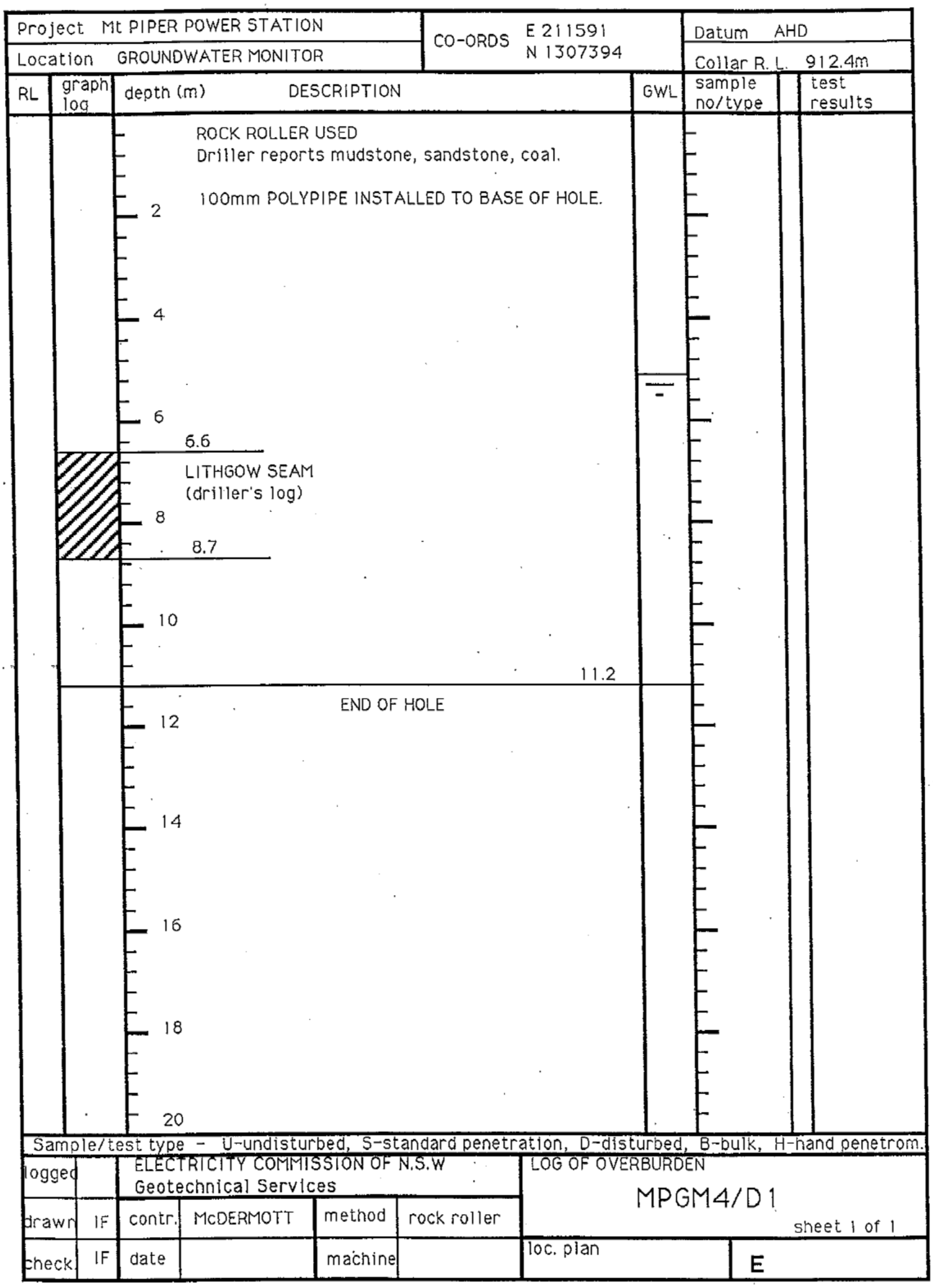
03/06/2015	0.00
04/06/2015	0.32
05/06/2015	0.65
06/06/2015	0.23
07/06/2015	0.36
08/06/2015	0.49
09/06/2015	0.54
10/06/2015	0.00
11/06/2015	0.00
12/06/2015	0.46
13/06/2015	0.39
14/06/2015	0.36
15/06/2015	0.46
16/06/2015	3.68
17/06/2015	4.79
18/06/2015	0.00
19/06/2015	2.66
20/06/2015	0.00
21/06/2015	0.00
22/06/2015	2.66
23/06/2015	2.66
24/06/2015	2.66
25/06/2015	2.66
26/06/2015	2.66
27/06/2015	2.66
28/06/2015	0.00
29/06/2015	2.66
30/06/2015	2.66
01/07/2015	2.66
02/07/2015	2.66
03/07/2015	0.00
04/07/2015	0.00
05/07/2015	0.00
06/07/2015	0.00
07/07/2015	2.66
08/07/2015	0.00
09/07/2015	2.66
10/07/2015	2.66
11/07/2015	0.00
12/07/2015	2.66
13/07/2015	0.00
14/07/2015	2.66
15/07/2015	0.00
16/07/2015	2.66
17/07/2015	2.66
18/07/2015	0.00
19/07/2015	2.66
20/07/2015	2.66
21/07/2015	2.66
22/07/2015	2.66

23/07/2015	0.00
24/07/2015	2.66
25/07/2015	2.66
26/07/2015	0.00
27/07/2015	0.00
28/07/2015	2.66
29/07/2015	2.66
30/07/2015	0.00
31/07/2015	2.66
01/08/2015	0.00
02/08/2015	2.66
03/08/2015	0.00
04/08/2015	2.66
05/08/2015	2.66
06/08/2015	2.66
07/08/2015	2.66
08/08/2015	2.66
09/08/2015	0.00
10/08/2015	0.00
11/08/2015	2.66
12/08/2015	0.00
13/08/2015	2.66
14/08/2015	0.00
15/08/2015	0.00
16/08/2015	0.00
17/08/2015	0.34
18/08/2015	0.42
19/08/2015	0.56
20/08/2015	0.00
21/08/2015	0.98
22/08/2015	0.09
23/08/2015	0.00
24/08/2015	5.87
25/08/2015	5.21
26/08/2015	2.60
27/08/2015	1.26
28/08/2015	1.20
29/08/2015	0.63
30/08/2015	0.51
31/08/2015	0.63

Attachment 6

a) Groundwater installation bore Log for MPGM4/D1

a) Groundwater installation bore Log for MPGM4/D1



b) Bore Logs for MPGM4/D15, D16, D17 and D18

See “Appendix A - Borehole Logs” in Lamberts North Ash Placement Project Groundwater Modelling Report by CDM Smith. Report to Delta Electricity dated 22 November 2012

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Philippines, Singapore, South Africa,
Swaziland, Tanzania, Thailand, Uganda,
United Arab Emirates, Vietnam.