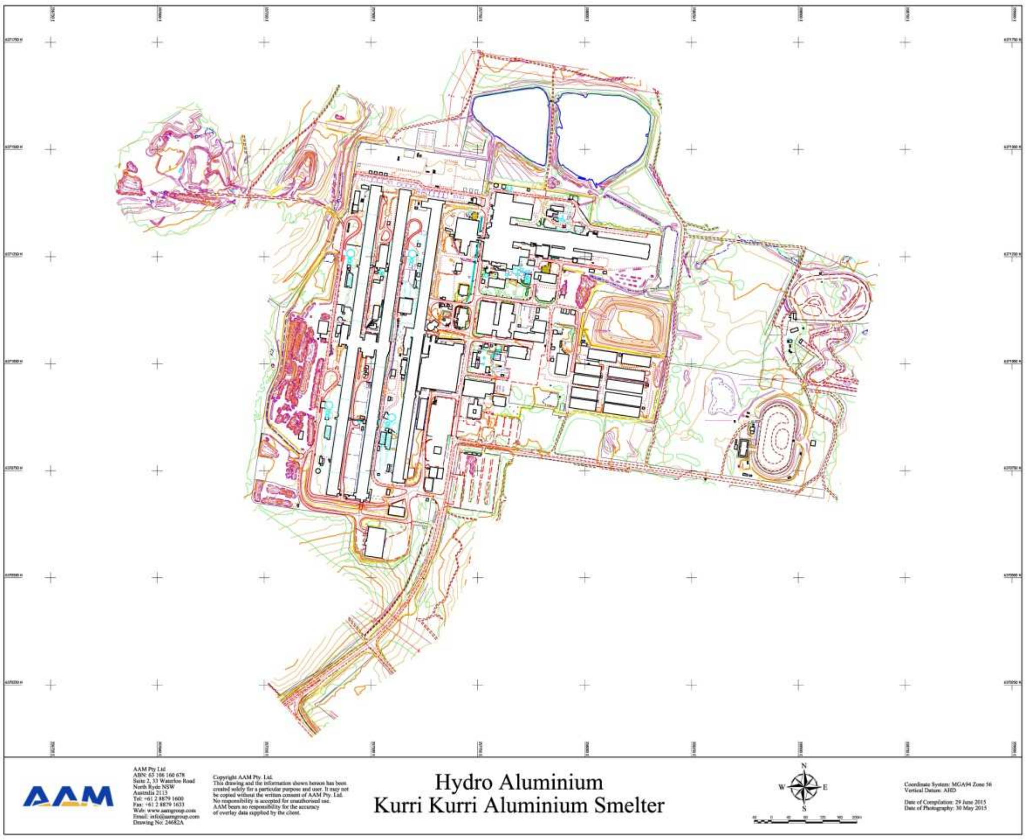
Hydro Aluminium Kurri Kurri Stormwater Management Report - Flood Modelling and Hydrology Review



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Document Register

Issue	Details of Change	Prepared	Reviewed	Date
A	Initial Issue	BC	DE	27/07/2016
B	Revised Issue – Following Discussion	BC	DE	12/09/2016
C	Water Balance Included	BC		17/05/2017
D	Flood Modelling Review and Hydrology	LP	DE	20/06/2017
E	Revised Issue - Flood Modelling Review and Hydrology	LP	-	08/08/2017
F	Revised Issue - Modelling Review, Hydrology & Leachate	LP	DE	19/07/2018
G	Revised Issue – Following Discussion	LP	-	25/07/2018

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Executive Summary

Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) owns approximately 2,080 hectares of land on Hart Road, Kurri Kurri containing a decommissioned aluminium smelter and associated buffer lands. The decommissioned smelter will be demolished and remediated in the near future. An issue identified relating to the demolition works is that of stormwater runoff and containment within the smelter site. The smelter site has a number of onsite detention ponds that collect all surface runoff from rain events. These detention ponds discharge by pumped flows to two large ponds on the north side of the site which in turn are controlled through an irrigation system which irrigates to a licensed discharge area.

A whole of site water balance has also been prepared considering five years of rainfall for the years 2012 to 2016. Results from the water balance indicate that three major storm events, equivalent of 1 in 50 year events which occurred between 2012 and 2016, would not have been able to be contained within the current stormwater system on the site.

The demolition of the decommissioned aluminium smelter will require adequate stored site water for dust control and suppression during site works. For the purposes of the water balance an estimated depletion of 200,000 litres per day for site dust control was assumed with results from the water balance indicating the Western Surge Pond has adequate capacity for rainfall storage as well as on site dust control use.

Glossary of Key Terms

LIDAR – Light detection and range

AEP – Annual exceedance probability

PMF – Probable maximum flood

DEM – Digital elevation model

1 Introduction

Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) owns approximately 2,080 hectares of land on Hart Road, Kurri Kurri containing a decommissioned aluminium smelter and associated buffer lands. The decommissioned smelter will be demolished in the near future. The purpose of this report is to review the existing stormwater management system of the former Aluminium Smelter, provide a contingency plan against stormwater breaches during high rainfall events and supply sustainable sources of water for dust suppression strategies during the demolition process. A number of on-site stormwater ponds are used to control stormwater runoff from the smelter site. Stormwater levels in the ponds are controlled by pumps that transfer the stored storm water to two large stilling basins located on the northern perimeter of the site. The two northern basins are ultimately pumped to a licensed discharge area to the north east of the site.

This report details two separate analyses of the stormwater system:

1. 1% AEP (annual exceedance probability) and PMF (probable maximum flood)
2. Analysis of a water balance of the pond and pump system over a five year simulation period to determine cumulative site flows from each of the ponds together with reuse for site dust control.

It is expected that this report will be read in conjunction with any subsequent reports or discussions relating to water quality.

2 Background

During recent high rainfall events a number of uncontrolled breaches occurred from the onsite stormwater storage ponds with some water releasing into the immediate surrounds of the smelter site. Hydro are proposing that no further uncontrolled breaches of stormwater runoff occur and would like to implement additional preventative measures to ensure all stormwater is contained and managed onsite.

2.1 Scope:

Pulver Cooper & Blackley (PCB) have been engaged by Hydro to consider the following scope of works:

- Conduct a visual site inspection;
- Desktop review of stormwater information available;
- Utilisation of most recent LIDAR Survey data;
- Modelling of water flows across site;
- Preparation of a water balance model

2.2 Detailed Site Survey and Aerial Mapping

Detailed topographic analysis of the site was provided by Hydro. The analysis had been prepared by AAM Pty Ltd from LIDAR information used in previous work on the site.

2.3 Visual Inspection and Site Walkover

A site walk-over was conducted between PCB and representatives of Hydro to gain an understanding of the existing runoff characteristics for the site and the stormwater storage facilities. A number of areas known to be susceptible to overflow during heavy rainfall were identified and will be investigated further as part of the review. Site discussions also focussed on the operation of the pump systems for each detention pond that are used to lower water elevations after rainfall to 5% of holding capacity.

Digital plans provided for the drainage facilities were provided shortly after the site walkover. These plans were used to supplement information provided by AAM. Pump information was supplied in the form of maximum pump flows for each pond control.

2.4 Catchment Delineation

CatchmentSIM, which is a software package for hydrologic analysis of catchments, flow paths and integration with hydrologic models, was used to prepare the Digital Elevation Model for analysis. CatchmentSIM was used to delineate the catchments to each of the identified ponds on-site.

A Triangulated Irregular Network (TIN) was created in 12d software from the LIDAR information for the site in preparation for stormwater and flood analysis.

The TIN was utilised for each pond to determine the current maximum storage capacities and to identify any potential low points that would highlight places where overflows have occurred in the past. For the purposes of this report, storage calculations ignore the 5% minimum holding capacity.

Plan Sheet 1 shows the delineated catchment boundaries to each of the ponds. A summary of the catchment areas, average slope and modelled impervious fraction for each pond is provided in Table 2.1.

Table 2.1 - Pond Summary

Pond/Node	Catchment Area (ha)	Impervious Percentage (%)	Existing pond storage capacity (m^3)	Minimum rainfall to overflow pond (mm)
Western Surge Pond	15.59	91	4,070	26
Southern Surge Pond	7.47	76	1,500	20
Southern Bypass (channel)	-	-	922	32
Eastern Surge Pond	10.66	59	5,900	55
Northern (Stilling Pond)	32.31	84	9,700	30
Northern Surge Pond	8.56	24	23,400	273
TOTAL STORAGE	74.58	-	45,492	61

Volume analysis tools in 12d software were used for extracting the storage capacities of the existing ponds up to the level of the Top Water Level (TWL) or Spillway Level (SL). These volumes, recorded in Table 2.1, are extracted from the LIDAR and represent the total current storage allowing for the reductions in volume due to sedimentation. Rainfall depths listed in the last column of the above table are a direct proportion of the pond capacity and contributing catchment area, assuming no losses to evaporation, infiltration and assuming that any inter-connected pumps have failed. The figures suggest that the smaller ponds to the west, south and east have small storage capacities (20-30mm of rainfall) with respect to the size of the contributing catchment. The total site storage capacity of 45,490m^3 is equivalent to a rainfall depth of 61mm across the combined catchment equally spread across the six existing storages. This is approximately equal to the capture of a 1 in 5 year storm of 3 hours duration.

3 Existing Flood Conditions

3.1 Local Flooding

A number of heavy rainfall events have occurred in recent years around the site. The nearest Bureau of Meteorology (BOM) rain gauge to the site is approximately 2.3km to the east at Kurri Kurri Golf Club. Maximum daily total rainfalls at the station are:

- 203mm – 6th June 2007
- 246mm – 21st – 22nd April 2015
- 143mm – 6th January 2016

Hydro has confirmed that each of these events caused overflows from some or all of the ponds.

Intensity Frequency Duration (IFD) Design Rainfall depths for Kurri Kurri (2016)[1] show the June 2007 storm was approximately equivalent to a 2% AEP (or 1 in 50 year) rainfall event, the April 2015 storm was approximately equivalent to the 2% AEP (or 1 in 50 year) rainfall event and the January 2016 storm approximately equivalent to a 10% AEP (or 1 in 10 year) rainfall event. A 1% AEP (or 1 in 100 year) rainfall event is expected to precipitate approximately 278mm of rainfall in a 24 hour period.

Table 2.1 indicates that the smaller ponds are capable of holding, on average, up to 30mm of rainfall. If the pump system fails, this is representative of the rainfall of a 1EY (One Exceedance per Year) 2 hour duration storm.

3.2 Regional Flooding

The previous Flooding and Stormwater Impact Assessment for the Hydro Landholdings, (PCB 2014) indicated that the level of 1% AEP flooding surrounding the site is to RL9.7m AHD[2], associated with a regional flood event on the Hunter River. Figure 3-1 shows that the Hydro smelter site is elevated above this level and is therefore not affected by 1% AEP flooding of a regional nature.

The Probable Maximum Flood[2] (PMF) level for the site is at RL12.2m AHD. This flood is associated with extreme conditions and is generally considered for flood evacuation and emergency response planning.

Both the 1% AEP flood level and the PMF are shown on Figure 3-1 as shaded dark blue shading and thick light blue outline respectively.

[1] http://www.bom.gov.au/water/designRainfalls/revised-ifd/
[2] Maitland City Council, Hunter River: Branxton to Green Rocks Flood Study, WMAWater, September 2010

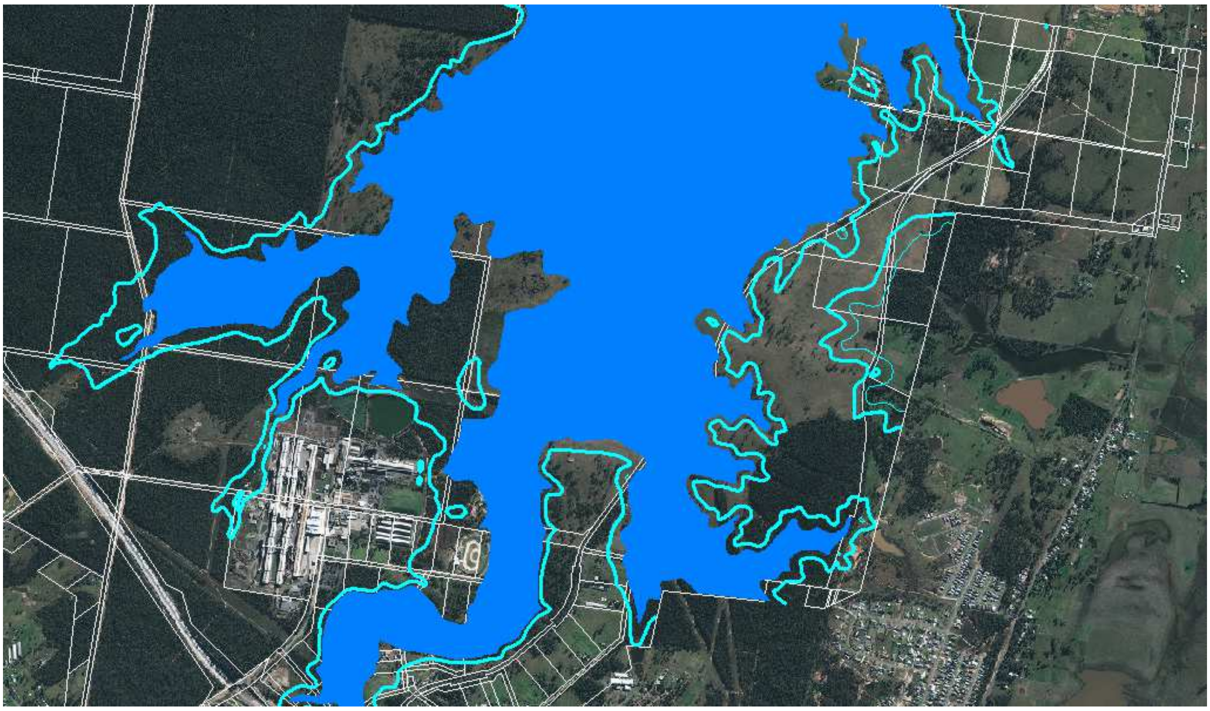


Figure 3-1: Flood Extents in areas considered for Industrial and Residential Development

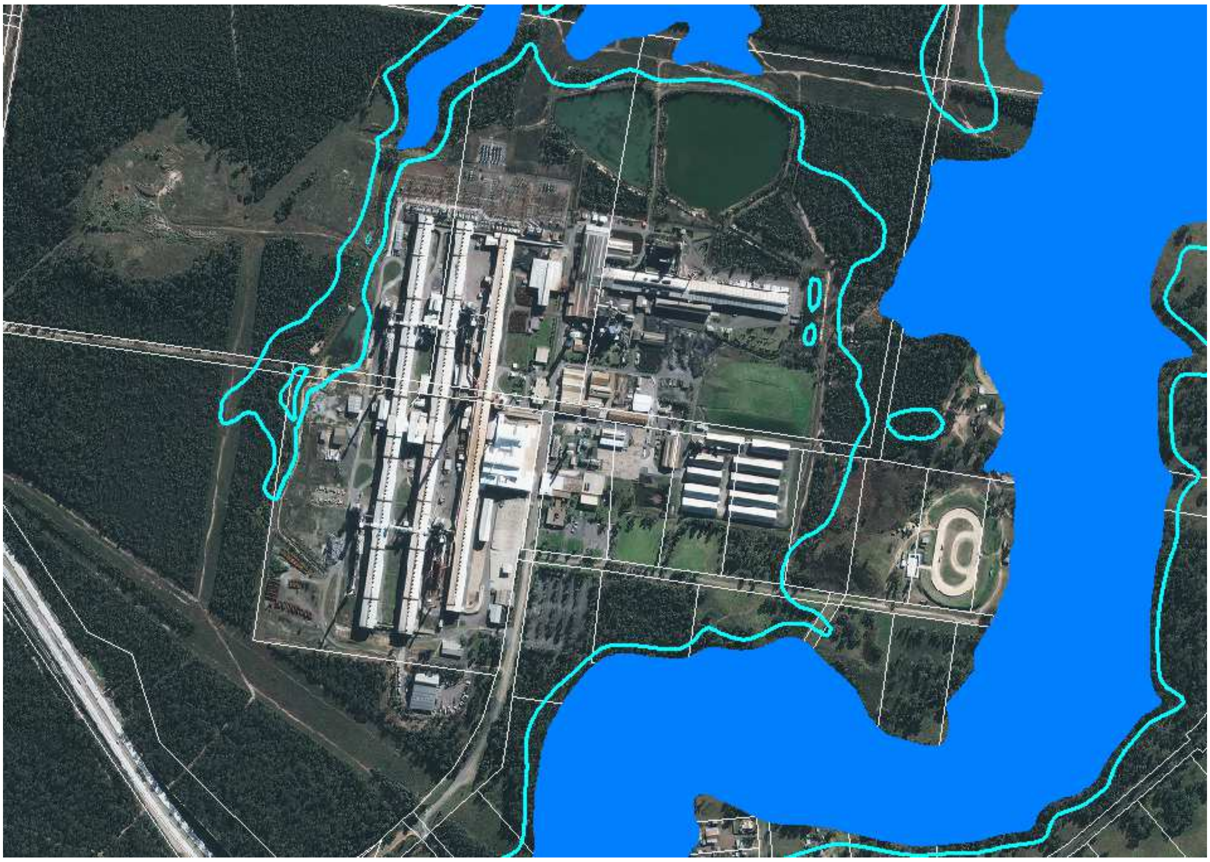


Figure 3-2: Flood Extents for Smelter Site PMF & 1% AEP

4 Hydraulic Modelling

A hydraulic model was prepared for the creek beside the western edge of the site in an effort to ascertain the extent of flooding that has occurred along the creek during recent high rainfall events. It is noted previously that the April 2015 storm produced rainfall depths approximately similar to a 1 in 50 year storm. The April 2015 storm produced flow in the creek to depths exceeding the level of the existing spillway of the western surge pond. This particular event was firstly used to calibrate a model, and then once calibrated, the model was analysed for a 1 in 100 year flood event to determine the predicted flow depth.

4.1 Catchment Extent

LIDAR provided by Hydro extended to the south and west only as far as the Hunter Expressway. A DEM was 'sampled' in CatchmentSIM, extending further to the west and south to include the completed Hunter Expressway. The LIDAR indicates that the crests, or high points, of the Expressway surface are generally located in line with the corresponding ridges. Runoff intercepted by the Expressway is captured by roadside channels and directed under the Expressway to the creek adjacent to the Hydro site.

The catchment draining to the creek adjacent to the western surge pond is sketched in Figure 4-1. The 338ha catchment extent consists of rural land with very little impervious cover.

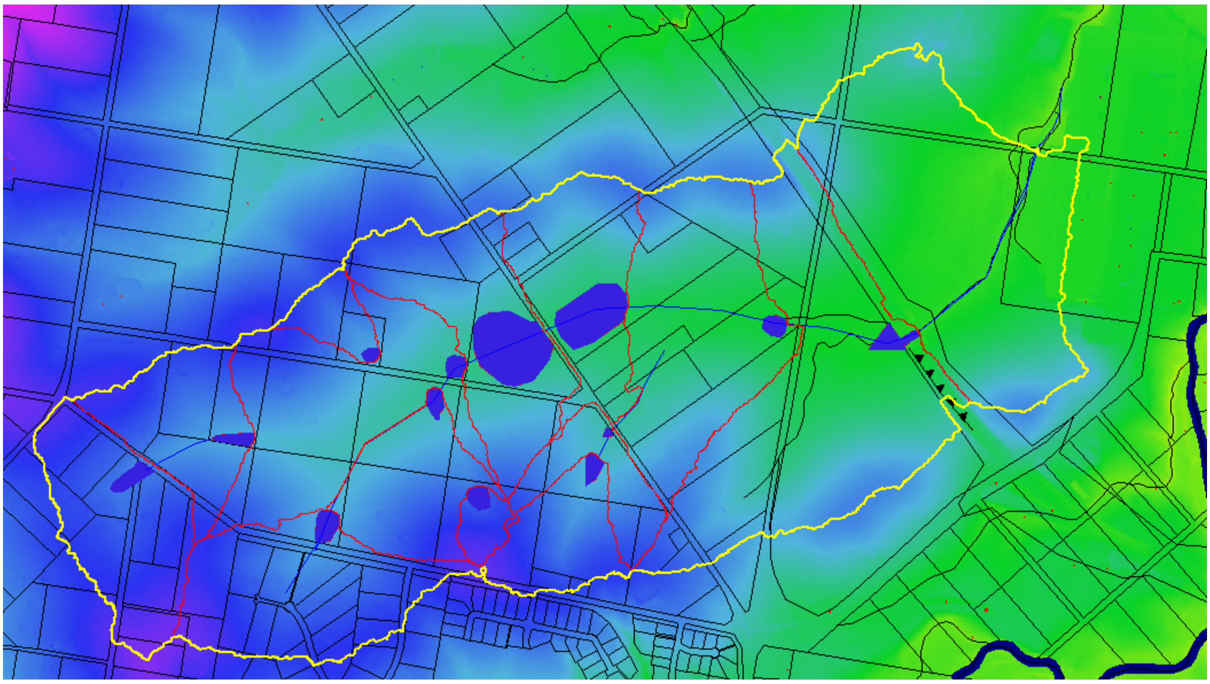


Figure 4-1 – CatchmentSIM derived sub-catchments

4.2 Hydrological Model

A hydrological model was prepared to quantify the peak flow rate in the adjacent creek for a 1 in 50 year rainfall event for calibration purposes and then a 1 in 100 year rainfall event for analysis purposes. A previous flood study[3] has been prepared for Cessnock Council over Black Creek which is located approximately 5km west. Parameters adopted from this calibrated flood study were utilised in the hydrological model for the site.

The hydrological model was prepared in XP-RAFTS, adopting 0% impervious cover, and an initial/continuing loss infiltration model. The pervious infiltration loss model utilised 10mm initial loss and 2.5mm/hr continuing loss as utilised in the Black Creek Flood Study. 14 nodes coinciding with the 'outlets' from the CatchmentSIM model were set-up in the XP-RAFTS model. Each node utilised roughness 'n' values of 0.07 and slope values as calculated from CatchmentSIM. Node 12 is representative of the location of the culvert under the Hunter Expressway. Node 1 is representative of the catchment immediately adjacent to the western surge pond. Figure 4-2 and Table 4.1 shows the XP-RAFTS schematic and XP Tables respectively.

Both rainfall events were simulated for a range of storm durations, utilising temporal rainfall patterns as outlined in Australian Rainfall and Runoff[4], extending from 20 minutes through to 72 hours. The 3 hour duration storm produced the largest flow peak of 24.72m^3/s for the 1 in 50 year event, while the 2 hour duration storm produced the largest flow peak of 28.94m^3/s for the 1 in 100 year event.

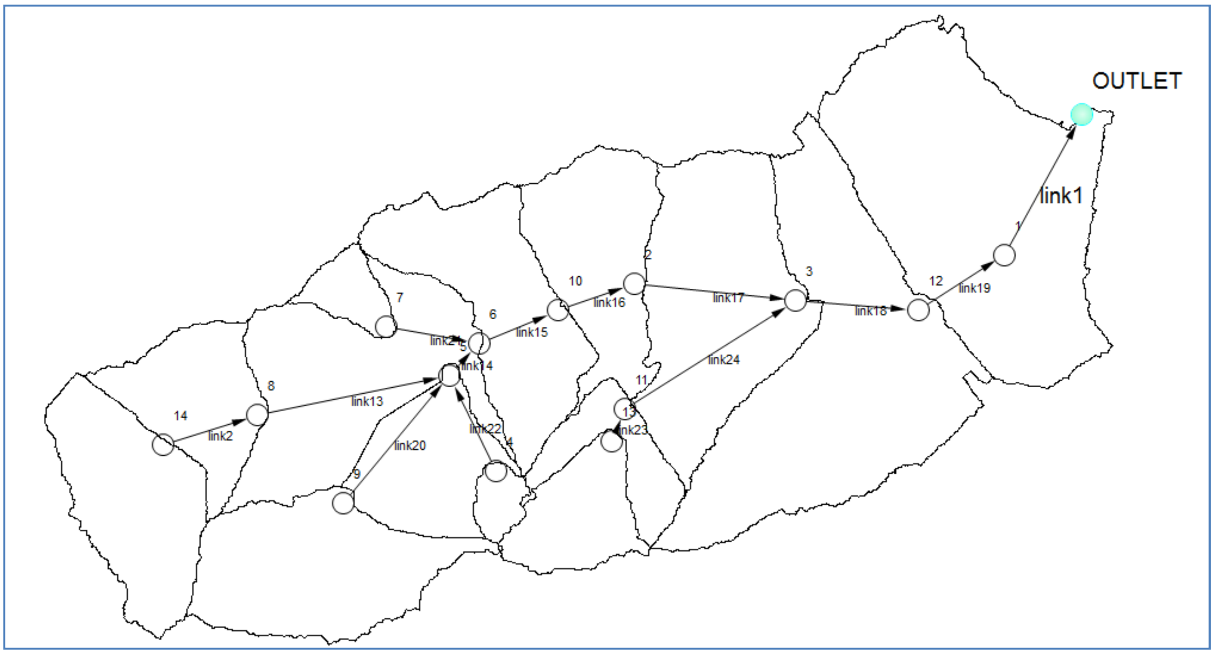


Figure 4-2 - XP-RAFTS Schematic

[3] DHI Water and Environment – June 2010, Black Creek Flood Study, Final Report, Cessnock City Council
[4] Engineer's Australia – 1987, Australian Rainfall and Runoff, A guide to Flood Estimation

Table 4.1 - XP-RAFTS Sub-catchment Details

2	1	Critical Storm	2.53	PERVIO	0	0.07	Initial/Co	21.33
3	1	Critical Storm	1.3	PERVIO	0	0.07	Initial/Co	35.54
4	1	Critical Storm	4.07	PERVIO	0	0.07	Initial/Co	2.92
5	1	Critical Storm	1.56	PERVIO	0	0.07	Initial/Co	15.56
6	1	Critical Storm	1.34	PERVIO	0	0.07	Initial/Co	31.84
7	1	Critical Storm	3.08	PERVIO	0	0.07	Initial/Co	4.63
8	1	Critical Storm	2.41	PERVIO	0	0.07	Initial/Co	16
9	1	Critical Storm	2.65	PERVIO	0	0.07	Initial/Co	27.15
10	1	Critical Storm	2.75	PERVIO	0	0.07	Initial/Co	25.93
11	1	Critical Storm	2.65	PERVIO	0	0.07	Initial/Co	8.71
12	1	Critical Storm	1.34	PERVIO	0	0.07	Initial/Co	54.79
13	1	Critical Storm	2.84	PERVIO	0	0.07	Initial/Co	11.55
1	1	Critical Storm	1.01	PERVIO	0	0.07	Initial/Co	59.77
OUTLET	1	Critical Storm	1	PERVIO	0	0.07	Initial/Co	0.001
14	1	Critical Storm	2.39	PERVIO	0	0.07	Initial/Co	22.69

4.3 Hydraulic Model

The peak rate of flow from the XP-RAFTS model was adopted for a steady-state 1D flow model implemented in HEC-RAS.

Cross sections adjacent to the western surge pond were generated at 40m spacing across the LIDAR surface. Normal flow was used with a normal depth bed slope of 1% as a boundary condition in the analysis. Manning's roughness for the channel and overbank was n=0.05, representative of a well overgrown small natural stream. Figure 4-3 shows a schematic of the HEC-RAS data input.

The calibration analysis, utilising a steady-state inflow of 24.72m^3/s, produced a water surface profile of 10.71m AHD at the location of the pond spillway which resulted in some discharge into the western surge pond. The calibrated model results are consistent with the inflows observed by Hydro staff during the April 2015 storm. The calibrated model was used to analyse the 1 in 100 year design storm.

The simulated results from the 1 in 100 year design storm were used to prepare water surface profiles throughout the system. The water surface profile generated from the 1 in 100 year design storm was exported into 12d software for generating water surface slope lines and water depths for plotting over the LIDAR surface.

At the location of the spillway outlet from the western surge pond the simulated water surface elevation was RL10.83m AHD which is higher than the level of the spillway at RL10.7m AHD. Water surface contours and water depths from the 1 in 100 year storm are shown on Plan Sheet 2.

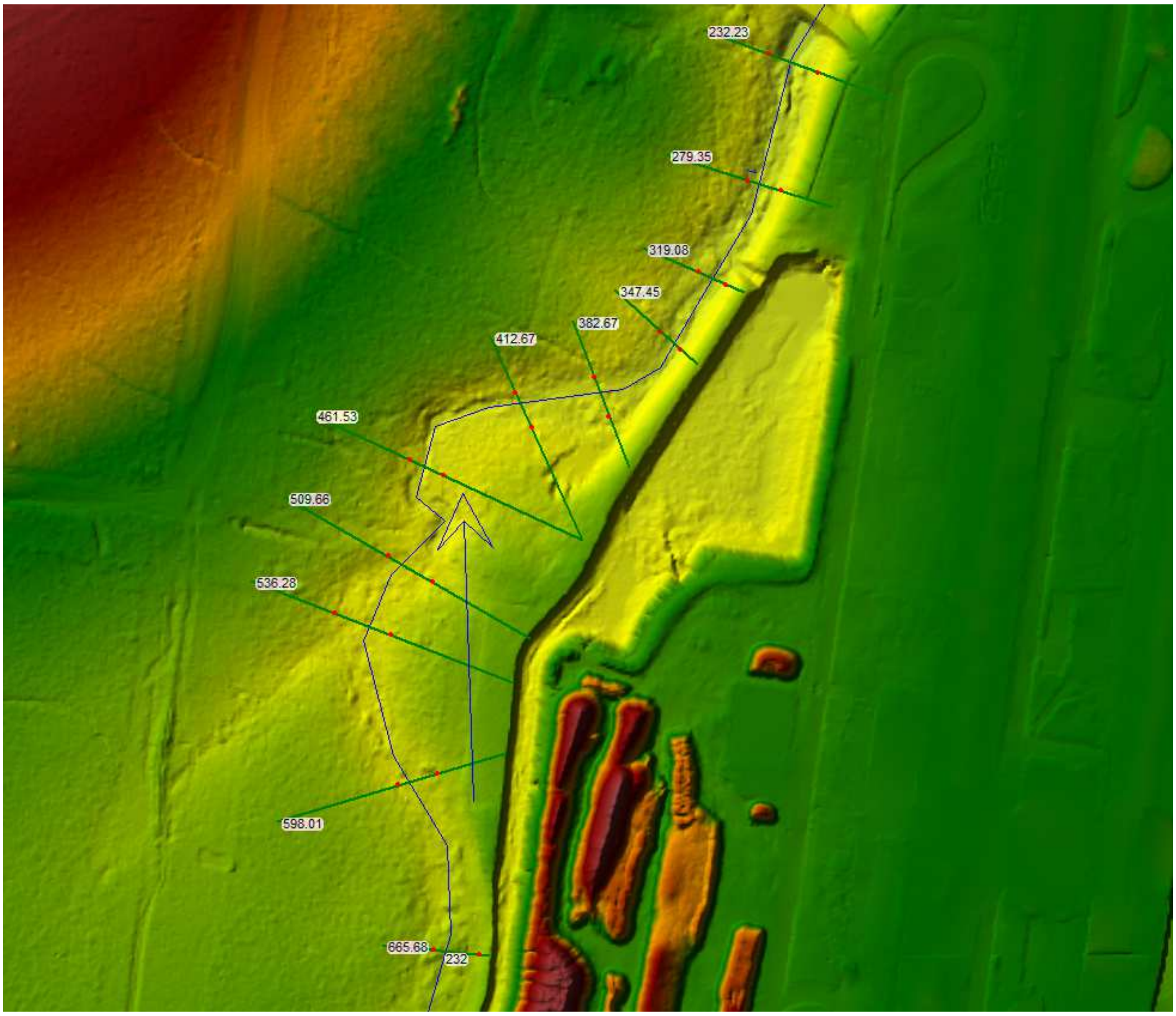


Figure 4-3 – HEC-RAS GIS interface and cross section locations

4.4 Commentary

The observed increase in creek flows through the unnamed watercourse since the completion of the Hunter Expressway may be due to a number of reasons which are explored below.

1. The LIDAR dataset utilised for this study included the completed Hunter Expressway. The grid spacing used to develop the DEM for this study was consistent across the entire catchment whereas refined grid spacing over the area of the Expressway may result in clearer delineation and different times of concentration of the flood flows.
2. The Bureau of Meteorology has provided data supporting the view that rainfall totals and rainfall bursts are increasing due to climate change.
   The timing of peak flows from the catchment, with respect to flows from the impervious surfaces of the Expressway, may arrive coincidentally in some circumstances, resulting in an increase in flow peak.

5 Water Balance Model

A water balance simulation was prepared for the site based on existing ponds and pump systems operating for the duration of the decommissioning period. It was identified that significant capacity upgrades could be obtained by undertaking minor earthworks. Stormwater storage features within the site were incorporated (*see Table 5.1*) in the simulation to quantify the volume and frequency of uncontrolled breaches of the system. Water Quality was not part of the scope of this study.

Table 5.1 Summary of Pond Features

	Features
Western Surge Pond	
Spill RL (m AHD)	11.7
Embankment RL (m AHD)	11.9
Storage Capacity (m^3)	11,300
Southern Surge Pond	
Spill RL (m AHD)	13.5
Embankment RL (m AHD)	14.2
Storage Capacity (m^3)	1,500
Southern Bypass Channel	
Embankment RL (m AHD)	14.3
Storage Capacity (m^3)	2,280
Eastern Surge Pond	
Spill RL (m AHD)	13.1
Embankment RL (m AHD)	13.1
Storage Capacity (m^3)	5,900
Northern Stilling Pond	
Spill RL (m AHD)	13.5
Embankment RL (m AHD)	13.5
Storage Capacity (m^3)	9,700
Northern Surge Pond	
Spill RL (m AHD)	13.1
Embankment RL (m AHD)	13.3
Storage Capacity (m^3)	23,400

5.1 Catchment Data

The total catchment area of each pond has been calculated using aerial photographs and LIDAR contours:

- Northern Stilling Pond + Northern Surge Pond (Catchment Node 1+2) = 8.56+32.31 (ha) = 40.87 ha (Catchment Node 1+2)
- Southern Surge Pond – 7.47 ha (Catchment Node 3)
- Western Surge Pond – 15.59 ha (Catchment Node 4)
- Eastern Surge Pond – 10.66 ha (Catchment Node 5)
- Western Containment Cell – 5.685 ha

In addition, the hardstand carpark (Corner of Hart & Dickson Road) is not considered for the water balance as the stormwater runoff is considered clean and does not need to be captured and treated (see attached plan).

Throughout the decommissioning period there is a requirement to cater for 100% of all leachate generated at the new western containment cell. The proposal nominates two possible options for water management stemming from the earthworks at the western containment cell:

Option 1

Requires pumping or trucking of water from the western cell area to the main site where a temporary treatment basin is required with a capacity of 3500m^3. The temporary basin is sized to cater for 1 in 5 year ARI 3 hour storm (65mm depth)[5] or equivalent. When the retained leachate has been treated the water will be released into the site stormwater network (Northern Ponds) and subsequently discharged per the existing water management strategy.

Option 2

Requires pumping or trucking of water from the western containment cell area to an offsite treatment facility. This option will not affect the water balance in any way.

Note: A conservative approach was adopted regarding the discharge from the western containment cell area and the impact to the site water balance. Current practice nominates the three clean water basins will discharge to the unnamed watercourse in close proximity to the site removing a portion of water from the total site water balance. However, the clean water sediment basins and leachate buffer storage capacity (Figure 5-1) were not considered in water balance calculations for the purpose of this report. Secondly, if the decision arises that 50% of the leachate water is to be treated on site with the remaining 50% trucked offsite the temporary basin proposed in Option 1 can be reduced in size accordingly.

[5] http://www.bom.gov.au/water/designRainfalls/revised-ifd/?coordinate_type=dd&latitude=-32.792&longitude=151.482&sdmin=true&sdhr=true&sdday=true&user_label=&year=2016

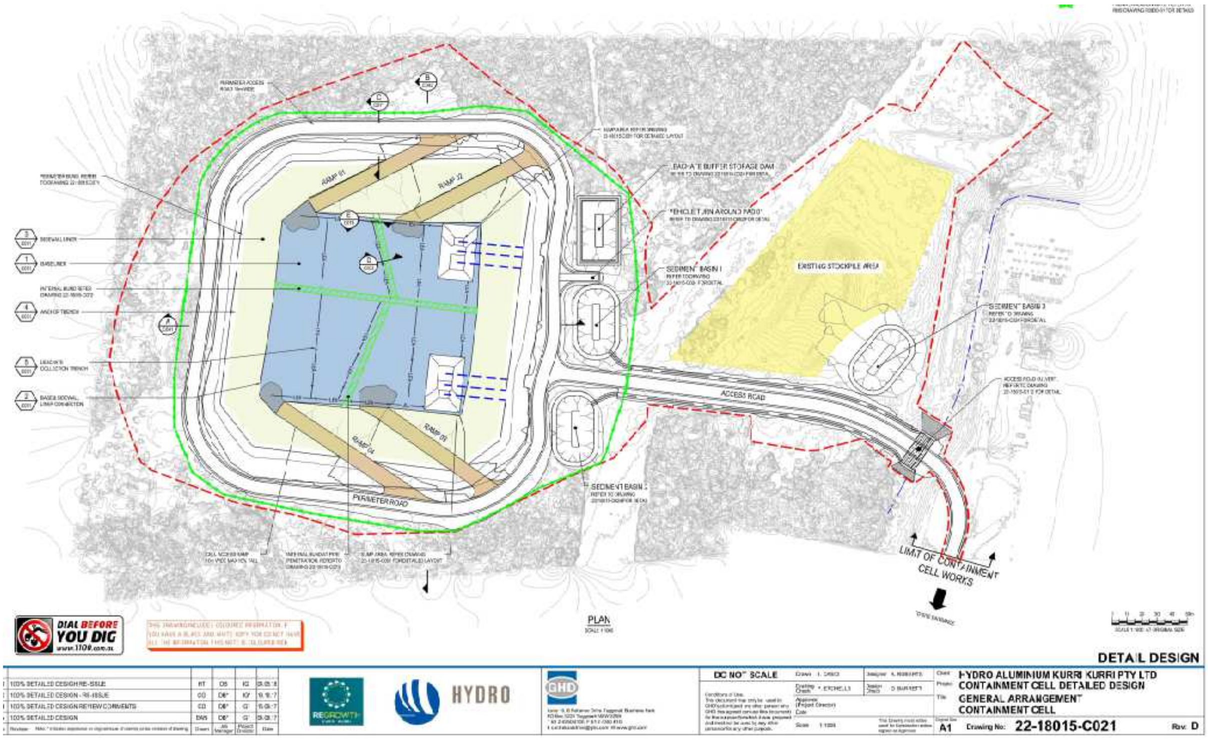


Figure 5-1 - GHD Containment Cell

5.2 Rainfall input

Historic rainfall records from the Kurri Hydro meteorological station located on Roller Park were obtained in hourly time intervals for a five year period from 2012 to 2016. The rainfall records were compiled into a spreadsheet providing a continuous record of approximately 44,000 time steps. An above ground depression storage of 1mm was applied to the commencement of each rainfall event.

5.3 Evaporation and Infiltration

Evaporation was assumed to apply to water stored in each of the ponds only. Evaporation rates were obtained from the Paterson gauge (approximately 25 km to the North East of the smelter) as no other nearby rain gauge had sufficient records to provide a statistical average. Adopted mean monthly evaporation detailed in Table 5.22 were applied to each of the storages.

Table 5.2 Mean Daily Evaporation

Mean Daily Evaporation (mm)					
January	6.2	**February**	5.3	**March**	4.2
April	3.2	**May**	2.4	**June**	2.1
July	2.4	**August**	3.3	**September**	4.4
October	5.2	**November**	5.8	**December**	6.6

Evaporation was applied to each of the storages:

- Northern Stilling Pond + Northern Surge Pond – 6.13 ha
- Eastern Surge Pond – 0.42 ha
- Western Surge Pond – 0.35 ha
- Southern Surge Pond – 0.19 ha

Infiltration was ignored for the purposes of this analyses as the underlying soils are densely compacted and generally most surfaces are impervious. Groundwater flows into and out of the ponds were also ignored for this reason.

5.4 Pump Data

Pumps were assumed to be either operating at maximum capacity or switched off in any given time step. The pumps were assumed to each be electronically (float) switch controlled to water levels, the pumps were also assumed to automatically switch off when water levels dropped to a set percentage of storage as outlined in Table 5.3

Table 5.3 Supplied Pump Information

Pond/Pump Location	Pumping To:	Overflow to:	Pump Max. Capacity (m^3/hr)	Pump On Trigger	Pump Off Trigger
Southern Pond	Eastern Pond	Eastern Pond	180	10%	5%
Eastern Pond	Northern Pond	Northern Pond	86	10%	5%
Western Pond	Northern Pond	Creek	85.2	40%	30%
Northern Ponds	Licensed Discharge Area	Swamp	80	10%	5%

5.5 Dust Suppression Water Usage

As part of the demolition and remediation process, the construction of a containment cell is to occur to the North-West of the smelter site. Throughout the haulage process dust management measures are required for water-cart vehicles to dampen haul roads and to reduce dust from on-site concrete crushing. An assumption of 200m^3 of water is required for daily dust suppression strategies. It is advised that the daily dust management water will be withdrawn from the Western Surge Pond only, as was modelled.

5.6 Results

The water balance simulations were prepared considering the adoption of all recommendations for raising the embankment heights as discussed.

For the purpose of the water balance, Option 1 was adopted. The western containment cell area, temporary treatment basin and equivalent flows were added to the Northern Ponds (Nodes 1 & 2) water balance. It should be noted that additional flows occurring from the containment cell area do not increase peak discharge or overflow rates. The inclusion of the containment cell area into the water balance does increase the total flow in the simulation by up to 3%.

Table 5.4 shows the summary of cumulative and average flows in the simulation period. Cumulative overflows can be isolated to the following number of discrete storm events spanning one or more days:

- 23rd February 2013 - 4th March 2013 continued pumping from the western, eastern and southern ponds to the northern pond at maximum rates and resulting in overflow of 44ML
- 21st April 2015 – 27th April 2015 continued pumping from the western, eastern and southern ponds to the northern pond at maximum rates resulting in overflow of 168.8ML
- 6th January 2016 – 18th January 2016 continued pumping from the western, eastern and southern ponds to the northern pond at maximum rates and resulting in overflow of 38.2ML

The cumulative overflows from the three events equals a total of 251ML, accounting for 73% of the total overflows from the north basin in the five year period. It is also noted that for each of the three events described above, a repeating pattern found that the southern, eastern and western pumps were flowing full, for the equivalent periods and that the total pumped inflows from the three basins exceeded the pump capacity of the northern basin.

Table 5.4 Statistical Results for 5yr Simulation Period

Calculations for The Simulation period (2012 -2016)	
Southern Surge Pond	
Cumulative water pumped out	182 ML
Cumulative water overflow	20 ML
Percentage of water pumped out	**90%**
Percentage of water overflow	**10%**
Average Annual water pumped out	35.9 ML/yr
Western Surge Pond	
Cumulative water pumped out	429.9 ML
Cumulative water overflow	73.3 ML
Percentage of water pumped out	**85%**
Percentage of water overflow	**15%**
Average Annual water pumped out	84.6 ML/yr
Eastern Surge Pond	
Cumulative water pumped out	356 ML
Cumulative water overflow	48 ML
Percentage of water pumped out	**88%**
Percentage of water overflow	**12%**
Average Annual water pumped out	70.0 ML/yr
Northern Stilling Pond + Northern Surge Pond	
Cumulative water pumped out	1342.2 ML
Cumulative water overflow	385.4 ML
Percentage of water pumped out	**78%**
Percentage of water overflow	**22%**
Average Annual water pumped out	264.2 ML/yr
Cumulative Water Overflow off-site from Western and Northern Ponds	458.7 ML

The 5 year period of records contained 2 days with significant rainfalls causing regional flooding in the area (21/04/2015 – 22/04/2015). This particular event is considered to be approximately equivalent to a 1 in 50 year storm. A detailed assessment of these two days & the following week was further considered as a discrete storm 'event' and presented in Table 5.5.

Table 5.5: April 2015 Storm Event – Statistical Summary

Calculations for The Simulation period 21/04/2015 – 27/04/2015	
Southern Surge Pond	
Cumulative water pumped out	9.7 ML
Cumulative water overflow	13.8 ML
Maximum of hourly water overflow	5.9 ML
Western Surge Pond	
Cumulative water pumped out	12.6 ML
Cumulative water overflow	44.6 ML
Maximum of hourly water overflow	13.9 ML
Eastern Surge Pond	
Cumulative water pumped out	13.4 ML
Cumulative water overflow	39.2 ML
Maximum of hourly water overflow	12.8 ML
Northern Stilling Pond + Northern Surge Pond	
Cumulative water pumped out	13.4 ML
Cumulative water overflow	168.8 ML
Maximum of hourly water overflow	48.4 ML

Along with overflow reduction, there also remains the need to supply 200m^3 for daily dust management throughout the simulation, as the Western Surge Pond is used as the solitary source for dust suppression. Table 5.6 shows the minimum volume of water in the Western Pond throughout the simulation, along with how many days of dust suppression storage remains if a dry period was to occur.

Table 5.6 Minimum storage for Western Pond for Dust Management

Minimum Storage (5yr Simulation)	3.8ML
Days storage (200m^3/day)	19

It is possible to raise the pump storage trigger values in order to gain greater dust management capacity. However, by increasing the triggers we also raise the volume of overflow from the Western Pond during a substantial rain event.

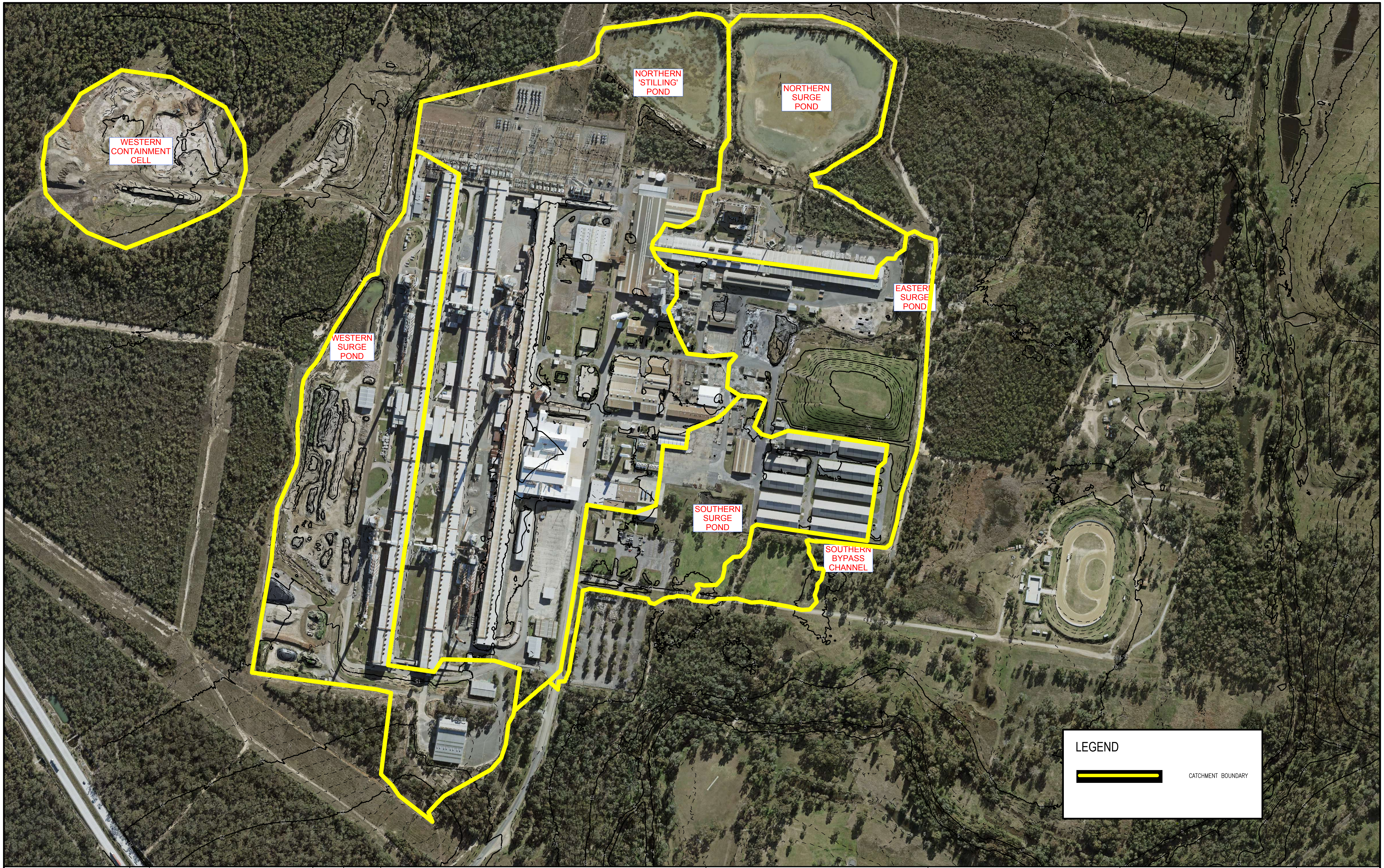
6 Summary

The decommissioned Hydro Aluminium Smelter will be demolished and remediated in the near future. The issue of containing stormwater runoff during the demolition process was identified to prevent runoff into local streams and neighbouring properties. The smelter site has a number of onsite detention ponds to collect surface runoff from rain events. These detention ponds discharge by pumped flows to two large ponds on the north side of the site which in turn are controlled through a licensed discharge system which irrigates to cleared pasture lands further north east.

The results from the water balance suggest that major storm events with prolonged periods of intense rainfall will continue to cause an overflow from the network. Outside of these events the ponds are capable of storing the equivalent of 61mm of rain or approximately a 1 in 5 year 3 hour storm event. The proposed upgrading of the Western Surge Pond and Southern Bypass Channel will provide increased flood proofing and allow for provisional dust management strategies. The decommissioning process requires the development of the western containment cell. 100% of the rainfall from the containment cell must be captured, transported and treated by utilising a $3500m^3$ temporary treatment basin positioned within the main site or trucked to an offsite treatment facility. Either the storage of water onsite or trucking offsite has no dramatic impact on the water discharge from the site for a 5 year rainfall simulation.

All stored stormwater and treated leachate will be used for on-site dust suppression or discharged to the licensed zone for irrigation to the north east of the site per the existing water management strategy.

-- End of Report --



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FILE ID: 115432
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DESIGNED: –
DRAWN: BC
CHECKED:
DATUM: AHD
CONTOUR INTERVAL: 1m

NO.	DESCRIPTION	DRAWN	DATE
B	FOR DISCUSSION	BC	12/09/2016
A	INITIAL ISSUE FOR DISCUSSION	BC	20/07/2016

pcb
PULVER COOPER & BLACKLEY
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TOWN PLANNERS
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PROJECT MANAGERS
P.O. Box 729
NEWCASTLE 2300
Ph (02) 4929 3882
98 LAWES STREET
EAST MAITLAND 2323
Ph (02) 4934 3026

PLAN:
CATCHMENTS DERIVED FROM LIDAR

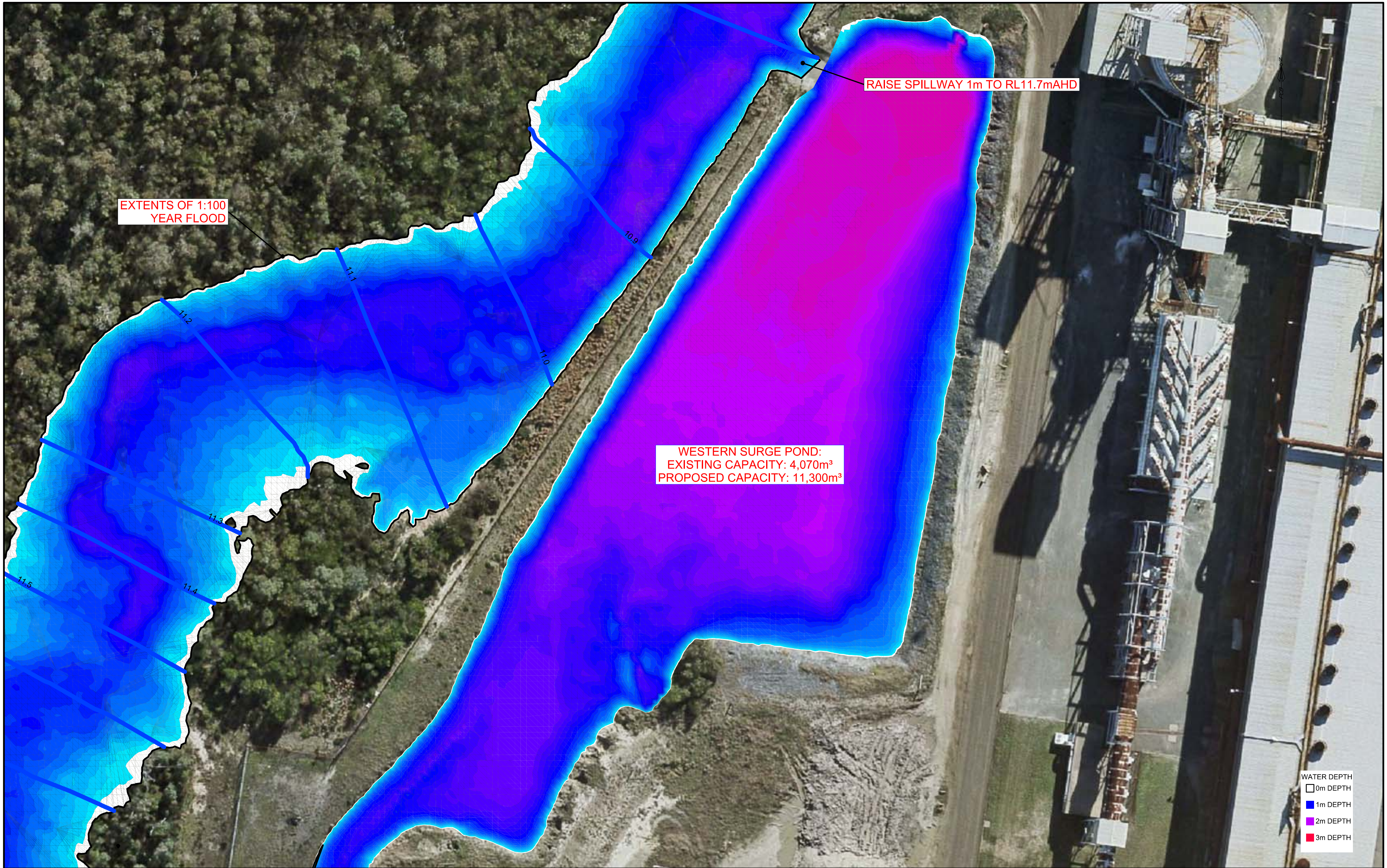
CLIENT:
HYDRO ALUMINIUM KURRI KURRI PTY LTD

50 25 0 50 100 150
Horizontal Scale 1:2500 (A1)
1:5000 (A3)

TOTAL SHEETS
6

SHEET No.
1

Plot Date: Thu Jul 19 14:20:44 2018 Project X:\13_119 Kurri Hydro Stormwater_12d_Planning\FLOOD STUDY



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FILE ID: 115432
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DESIGNED: BC
DRAWN: BC
CHECKED:
DATUM: AHD
CONTOUR INTERVAL: 1m

NO.	DESCRIPTION	DRAWN	DATE
A	INITIAL ISSUE FOR DISCUSSION	BC	20/07/2016

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PLAN:
DETAIL OF WORKS TO WESTERN SURGE POND

CLIENT:
HYDRO ALUMINIUM KURRI KURRI PTY LTD

10 5 0 5 10 15
Horizontal Scale 1:300 (A1)

TOTAL SHEETS
6

SHEET No.
2

Plot Date: Wed Jul 20 10:59:07 2016 Project X:\13_119 Kurri Hydro Stormwater_12d_Planning\FLOOD STUDY