SOILWATER CONSULTANTS

# LYNAS STORAGE FACILITY SURFACE HYDROLOGY ASSESSMENT

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| Prepared for: | LYNAS CORPORATION LTD |
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Revision Code*

A - Report issued for internal review

B - Draft report issued for client review

C - Final report issued to client

## LIMITATIONS

The sole purpose of this report and the associated services performed by Soil Water Consultants (SWC) was to undertake a surface water hydrological study for the Lynas Storage Facility. This work was conducted in accordance with the Scope of Work presented to Lynas Corporation ('the Client'). SWC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the earth sciences profession. Subject to the Scope of Work, the hydrological study was confined to the Project Area (geographical extent). No extrapolation of the results and recommendations reported in this study should be made to areas external to this Project Area. In preparing this study, SWC has relied on relevant published reports and guidelines, and information provided by the Client. All information is presumed accurate and SWC has not attempted to verify the accuracy or completeness of such information. While normal assessments of data reliability have been made, SWC assumes no responsibility or liability for errors in this information. All conclusions and recommendations are the professional opinions of SWC personnel. SWC is not engaged in reporting for the purpose of advertising, sales, promoting or endorsement of any client interests. No warranties, expressed or implied, are made with respect to the data reported or to the findings, observations and conclusions expressed in this report. All data, findings, observations and conclusions are based solely upon site conditions at the time of the investigation and information provided by the Client. This report has been prepared on behalf of and for the exclusive use of the Client, its representatives and advisors. SWC accepts no liability or responsibility for the use of this report by any third party.

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# 1 INTRODUCTION

Lynas Corporation Ltd (Lynas) engaged Soilwater Consultants (SWC) to undertake a hydrological assessment for the proposed Storage Facility Project Area to inform the Mining Proposal (MP) and Mine Closure Plan (MCP). The Project Area is proposed to be sited on the general purpose lease tenement G26/173, with the hydrological surface water study area centred on this tenement and the upstream contributing catchment areas.

This report presents the findings from desktop hydrological (surface water) work and comprises the results of an assessment of regional and local hydro-meteorological data. This information will be used in the future design of the required surface water management measures.

The study consisted of floodplain modelling conducted within the WMS modelling package, incorporating peak flow estimations made using the Rational and Index Flood Methods, and using a HEC-RAS model to predict flood levels. The estimation of flow accumulation was conducted on a regional scale, using satellite data from the Shuttle Radar Topography Mission (SRTM) to derive a Digital Elevation Model (DEM) (Geosciences Australia, 2013), whilst surface water flow routing and depth modelling was conducted using data collected via ground surveys covering the immediate area of the Site which was provided by Lynas.

In order to gain a comprehensive understanding of the local hydrology and related flooding dynamics, a one dimensional flood study to model up a range of different storm events was conducted. This study will be used to assist planning for the required storage facility infrastructure.

## 1.1 LOCATION

The proposed Storage Facility is located approximately 7 km north west of the City of Kalgoorlie-Boulder along Yarri Road in the Goldfields region of Western Australia.

## 1.2 FLOOD MANAGEMENT

The proposed site infrastructure will require protection for rare, low-frequency rainfall events to ensure long-term stability of the Site. Flood assessment was conducted to assist future infrastructure planning and the development of risk management strategies for events such as the 2% and 1% annual exceedance probability (AEP) storms (equivalent to 50 and 100 year average recurrence interval [ARI] events respectively).

In addition to these rare events, flood waters from more frequent events will require management and consideration.

## 1.3 OBJECTIVES

The key objective of this study is to assess the flood extent, depth and flows for rare flood events which approach the higher potential maximum flood depths for the area. For the purposes of this study the 2% and 1% AEP storm events were modelled to assist in planning the required site infrastructure and planning for eventual closure.

# 2 HYDROLOGICAL CHARACTERISATION

The Project Area is bisected by the boundary between the Raeside-Ponton Salt Lake basin catchment and the Lake Lefroy Salt Lake basin catchment (Figure 2.3). Both of these catchments are internally draining salt lake basins which together can an area of approximately 140,000 km$^2$ centred on City of Kalgoorlie-Boulder in the Goldfields region of Western Australia. As the Project Area is located on the boundary of these catchments, the potential for significant flow accumulation is intrinsically low as the upstream catchment area which can contribute surface water run-off during storm events is restricted by the Project locations relatively raised position compared with the surrounding topography.

## 2.1 CLIMATE

The climate for the Kalgoorlie Region (Kalgoorlie Airport – Station No. 012038; 15 km southwest of the Project Area) is classified as semi-arid with hot dry summers and moderately cool winters. Annual rainfall varies from around 150 mm up to 450 mm, with an average of approximately 270 mm/year (Table 2.1). Rainfall is distributed fairly evenly throughout the year with an average monthly rainfall of approximately 23 mm; however the rainfall that occurs during the autumn and early winter months of May to July tends to be more reliable though generally of a lesser total amount than the less dependable, but more intense summer cyclonic rainfall from December to March.

Pan evaporation greatly exceeds rainfall with an average annual pan evaporation of around 2,600 mm (Figure 2.2). Although the average pan evaporation exceeds rainfall for the majority of the year intense rainfall events associated with cyclonic activity results in monthly rainfalls often exceeding pan evaporation. Pan evaporation data was unavailable for this climate station post 2006.

Table 2.1: Climate data

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Daily Temp (max) | 33.7 | 32.1 | 29.5 | 25.3 | 20.7 | 17.6 | 16.8 | 18.7 | 22.4 | 26.0 | 29.1 | 32.1 |
| Mean Daily Temp (min) | 18.3 | 17.9 | 16.1 | 12.7 | 8.7 | 6.3 | 5.1 | 5.7 | 8.1 | 11.2 | 14.2 | 16.7 |
| Mean Monthly Rainfall (mm) | 27.4 | 31.6 | 25.0 | 20.5 | 24.9 | 27.3 | 24.2 | 21.3 | 13.7 | 15.8 | 18.7 | 16.5 |

BOM, (2020)

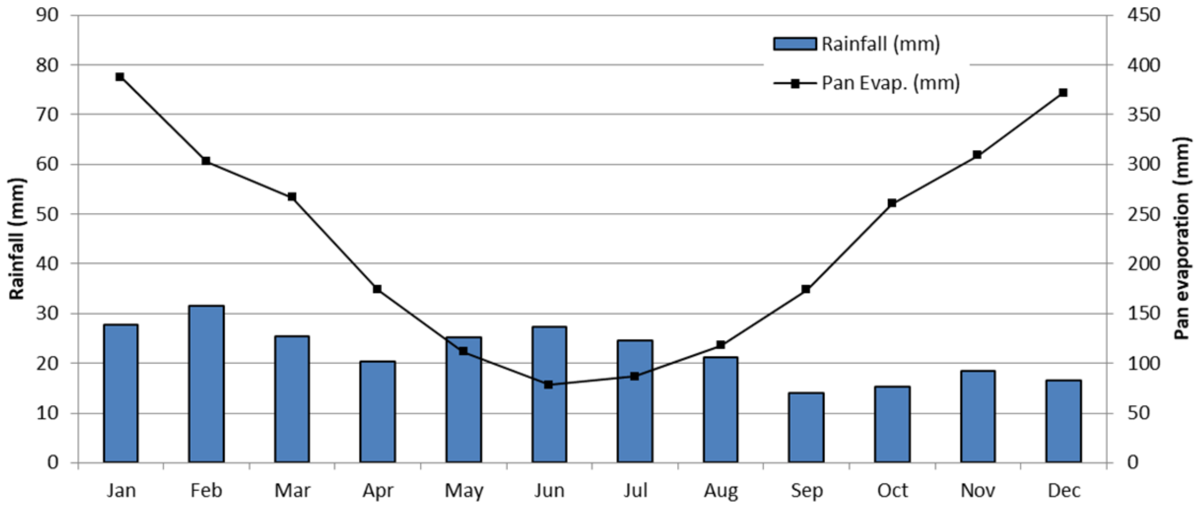



Figure 2.1: Rainfall and evaporation data (Kalgoorlie Airport)

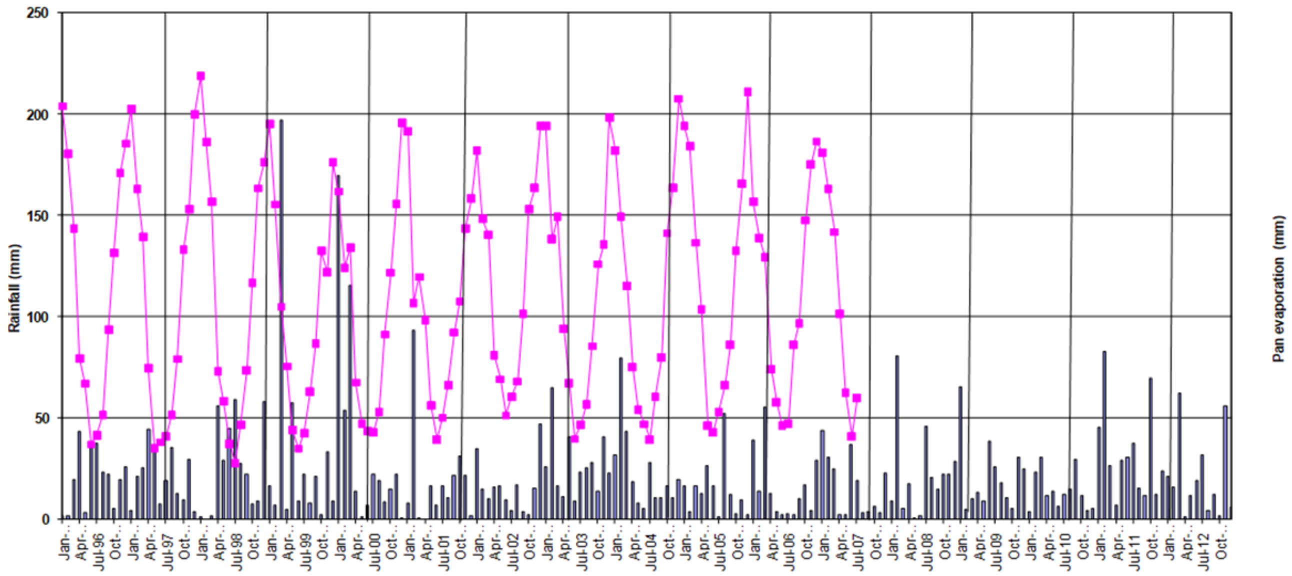



Figure 2.2: Long term pan-evaporation and rainfall data comparison (Kalgoorlie Airport)

## 2.2 LOCAL HYDROLOGY

The drainage morphology and associated hydrological responses across the Project Area are characterised by ephemeral stream, creek and drainage networks consisting of a gently undulating plains with scattered break-away features and ill-defined streamlines. Two linear features cut through the area which impacts the surface drainage morphology; Yarri Road and a raised earth bund approximately 1m in height. These features run approximately parallel to each other and are slightly angled from the natural fall of the land, which makes surface water flows generally run adjacent to them in a south westerly direction with little build-up or ponding expected. Both Yarri Road and the raised bund have locations where surface water can cut across these linear features. In the case of Yarri Road these are in the form of rectangular box culverts with dimensions 1200mmx450mm (Plate 2-1 and Plate 2-2). The ‘cuts’ in the raised bund are approximately 2m in width and appear to link up the two flow paths which run parallel to the bund in a south westerly direction (Plate 2-3).

The local surface water drainage paths and catchments are presented in Figure 2.4. As discussed the proposed site area is located immediately on a regional catchment divide and as such the upstream catchment area is small in scale.

Plate 2-1: Culverts across Yarri Road located upstream of Project area

Plate 2-2: Culvert across Yarri Road located adjacent to Project Area

Plate 2-3: Small break in earth bund allowing combination of flow

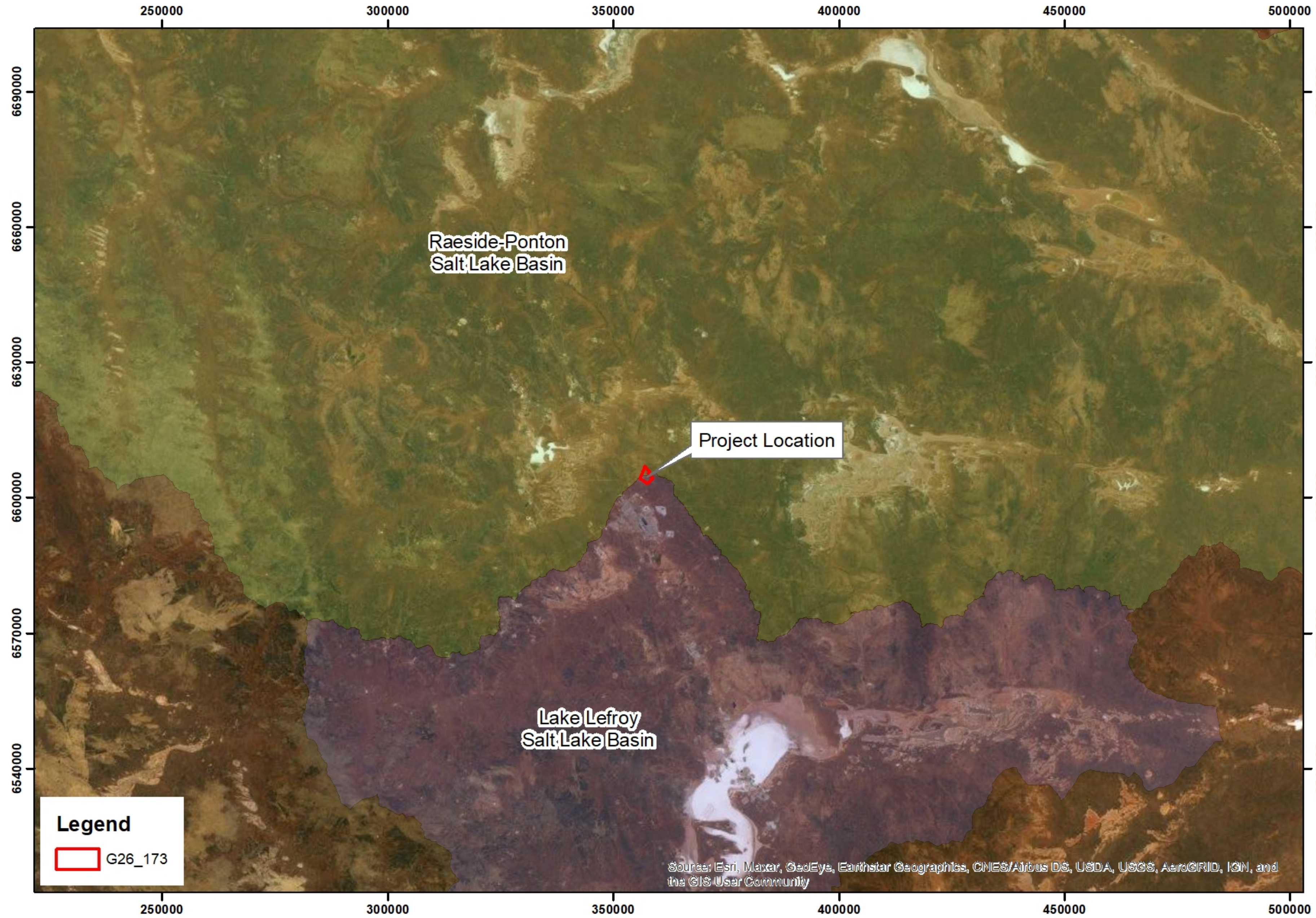
## 2.3 SURFACE WATER FLOWS & QUALITY

There are no gauging stations and therefore no long-term water flow or quality data available within the vicinity of the Project Area (DOW, 2020) and publically available water quality information is sparse with only three (5) Department of Water (DOW) monitoring sites being located on the periphery of both salt lake systems. These five sites are each associated with a mine site dewatering discharge. The data from these monitoring sites is therefore not expected to be representative of “baseline” lake water quality, and are instead indicative of current minor inputs to the lake system.

Coleman (2003) indicates that salinity in playa lakes is typically variable, and highly dependent on the wetting and drying cycle. At times, the lowest points of the Raeside-Ponton Salt Lake basin has been observed to be covered by brine, with salinity values an order of magnitude lower than the average salinity level. Because it is typically covered by small pools of water, salinity pockets can develop; a phenomenon thought to have allowed for the occurrence of freshwater biota in what is often thought of as a saline wetland. Due to this high degree of temporal and spatial variability, and the impacted nature of all monitoring locations, it is difficult to assess trends in constituent concentrations over long time periods.

## 2.4 ADJACENT LAND & WATER USES

The local catchment is largely covered with native vegetation of varying composition. The wider catchment area contains a mixture of light industrial use land, native vegetation and a bitumen transportation route (Yarri Road) adjacent to the Project Area on the south eastern boundary. There is no irrigated agriculture or use of surface water in the immediate vicinity of the site and the City of Kalgoorlie-Boulder drinking water supplies are piped in from Perth.

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| LYNAS CORPORATION LTD | Figure 2.3: Regional Catchment | soilwater GROUP |
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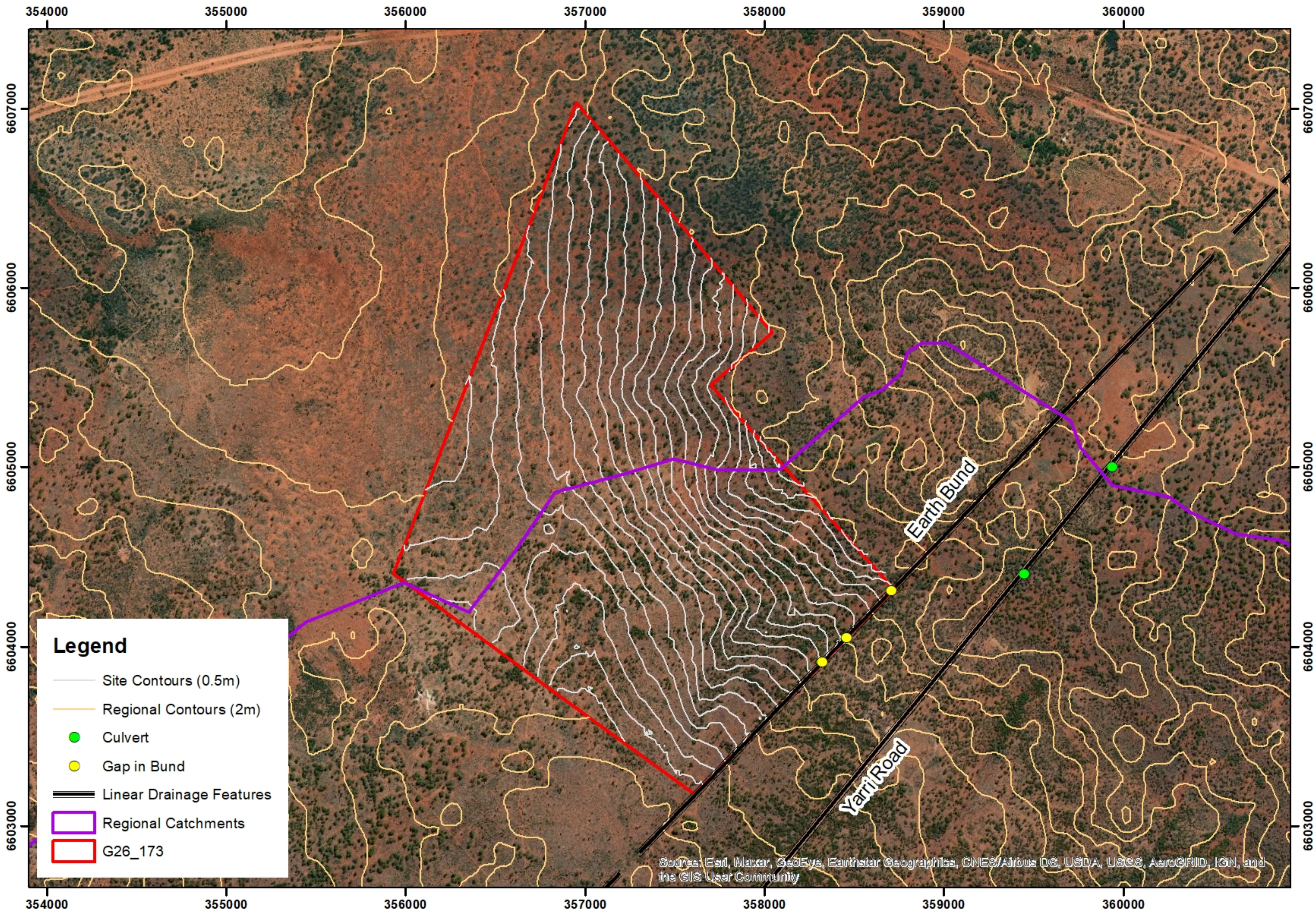


| LYNAS CORPORATION LTD | Figure 2.4: Site topography and data sets | soilwater GROUP |
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# 3 SURFACE WATER FLOW MODELLING

## 3.1 BASELINE CATCHMENT DELINEATION

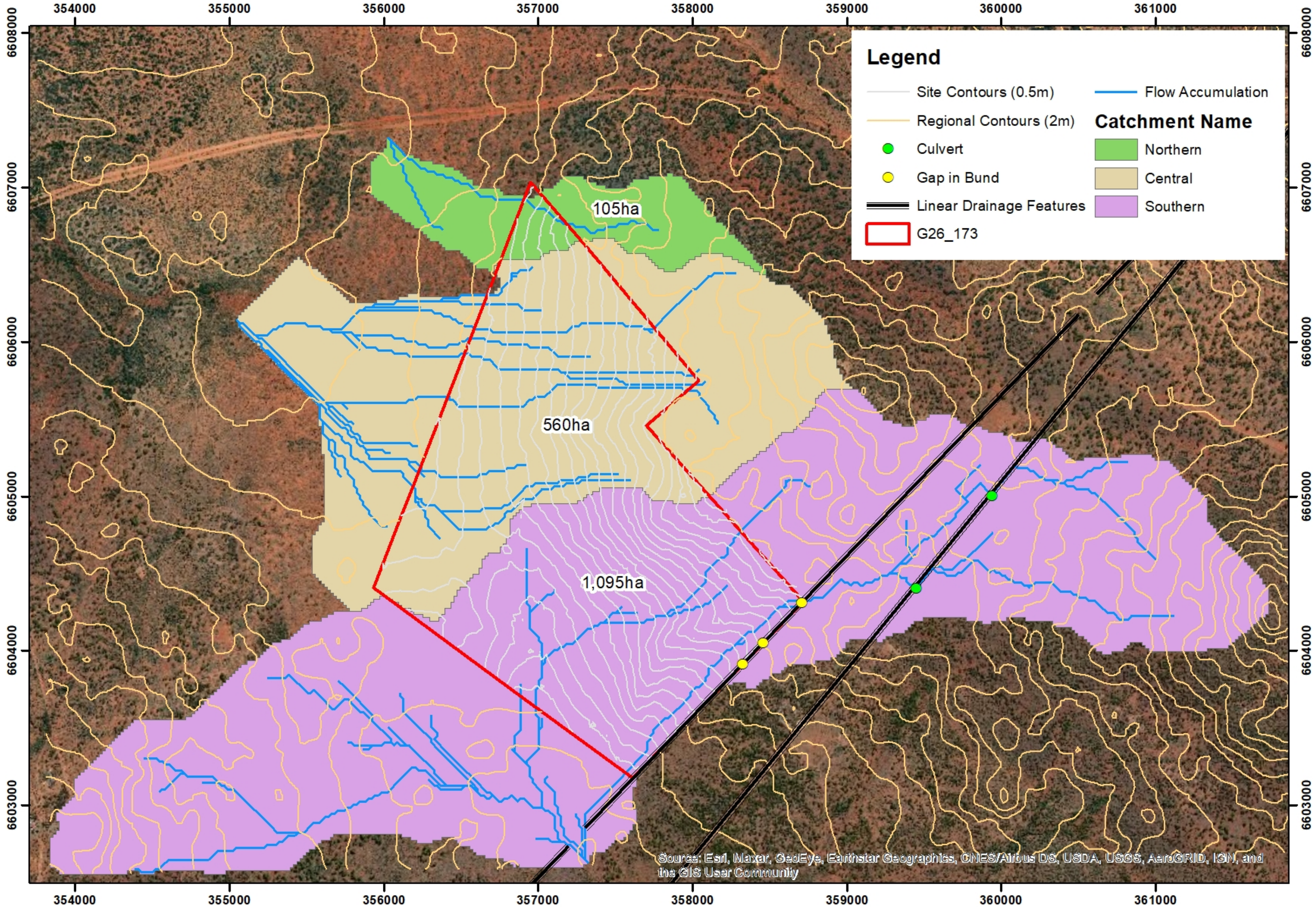
Surface water drainage systems and associated sub-catchments surrounding and upstream of the broader study area have been delineated to determine which catchments are likely to impact on the proposed developments. For this purpose 1 m contour data for the immediate Site area supplied by Lynas was utilised, along with regional scale SRTM data from Geoscience Australia. Surface water catchments were further delineated using a Topographic Paramaterization (TOPAZ) modelling program, embedded in the Watershed Modelling Software (WMS) software. TOPAZ uses a steepest descent, D8, flow direction routing algorithm, combined with pit filling and depression outlet breaching to assign flow directions and surface water contributing areas (Gabrecht and Martz, 1999).

The local surface water flow pathways were assessed from a combination of the satellite data and local survey information. Local survey information was provided as a set of 1 m contours covering the general purpose lease G 26/173 outline. The 1-second satellite data was used for areas outside of the local survey for assessing areas of the local catchments falling outside of the local dataset.

Figure 3.1 shows the surface water drainage catchments derived from the two topography datasets. Where the datasets overlapped, the higher resolution data provided by Lynas was used for catchment delineation. The catchments are limited in scale, with the northern and central catchments draining northwards into the Raeside-Ponton basin, whilst the southern catchment drains southwards into the Lake Lefroy basin. The linear drainage features impact the southern catchment in the upper eastern reaches, diverting flow southwards until the culverts are intersected. These culverts are able to convey a predicted 1% AEP flow for the upstream catchments and therefore will have minimal impact on downstream flow volumes and timings.

Table 3.1: Delineated catchment information summary

| Catchment ID | Catchment Area (ha) | Stream Length (km) | Equal Area Slope (m/km) | Estimated % Cleared | Area upstream of G27/173 |
|---|---|---|---|---|---|
| Northern | 105 | 2.64 | 0.007 | 10 | 48 |
| Central | 560 | 4.05 | 0.006 | 10 | 133 |
| Southern | 1,095 | 6.43 | 0.006 | 10 | 407 |




| | | |
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| LYNAS CORPORATION LTD | Figure 3.1: Delineated catchments over the Project area | soilwater GROUP |
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## 3.2 LOCAL RAINFALL DATA

In order to analyse local rainfall conditions daily rainfall data were obtained for five BoM rainfall stations, all of which remain open and are situated within a 50 km radius of the site. Table 3.2 gives the minimum, maximum, mean and median annual rainfalls for each of the stations, while

Table 3.3 gives the minimum, maximum and mean number of rain days per year and maximum duration without rain.

Table 3.2: Rainfall data summary of surrounding weather stations

| Station Name | Minimum Annual Rainfall (mm) | Maximum Annual Rainfall (mm) | Mean Annual Rainfall (mm) | Median Annual Rainfall (mm) | No. of Years |
|---|---|---|---|---|---|
| Bulong | 94.2 (1969) | 587.7 (1992) | 258.5 | 240.4 | 106 |
| Kalgoorlie-Boulder Airport | 108.7 (1940) | 530.8 (1992) | 266.9 | 254.9 | 70 |
| Kalgoorlie Post Office | 129.3 (1950) | 458.7 (1942) | 240.7 | 222.5 | 46 |
| Woolibar | 79.0 (2002) | 483.8 (1992) | 251.4 | 238.4 | 39 |
| Cowarna Downs | 43.8 (1976) | 500.8 (2000) | 264.8 | 254.8 | 42 |

Table 3.3: Local rainfall data summary

| Station Name | No. of Rain Days per Year | | | Periods Without Rain | | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Mean | Maximum Duration | From | To |
| Bulong | 25 (1944) | 85 (1992) | 47.7 | 149 | 6 Dec 1949 | 4 May 1950 |
| Kalgoorlie-Boulder Airport | 31 (1940) | 132 (1963) | 69.7 | 149 | 6 Dec 1949 | 4 May 1950 |
| Kalgoorlie Post Office | 32 (1944) | 69 (1942) | 50.9 | 110 | 17 Nov 1916 | 7 Mar 1917 |
| Woolibar | 14 (2002) | 62 (1992) | 37.2 | 129 | 8 Dec 2001 | 16 Apr 2002 |
| Cowarna Downs | 13 (1976) | 94 (1992) | 43.3 | 147 | 1 Jun 1976 | 26 Oct 1976 |

The data shows that rainfall patterns across the region are highly impacted by the passage of remnant tropical cyclone systems moving down from the Kimberley/Pilbara region. Even a single extreme cyclonic rainfall event can have a disproportionate effect on the mean of average rainfall for these stations, but has much less effect on the calculated median.

As an example, the annual maximum of 587.7 mm recorded at Bulong in 1992 was due largely to heavy rainfalls associated with remnant Tropical Cyclone Ian which crossed the Goldfields in early March, along with an unusually wet winter that year. It should be noted that 1992 was also the wettest year on record at Kalgoorlie Airport and Woolibar with annual totals of 530.8 mm and 483.8 mm respectively due to the same events.

Frequency analyses of this rainfall event in relation to the long term data available from the Bulong Station indicates that the 1992 maximum annual rainfall had an annual exceedance probability (AEP) of less than 0.4%.

## 3.3 EXTREME RAINFALL INTENSITIES

Rainfall intensity-frequency-duration (IFD) estimates for the study area near were derived using BOM's CDIRS (Computerised Design IFD Rainfall System), which allows automatic determination of a full set of IFD curves and associated data for any location in Australia. This approach is compatible with the manual procedures described in Australian Rainfall & Runoff (ARR): A Guide to Flood Estimation (IEAust, 2016), recommended as appropriate in regions where reliable stream gauging information is unavailable. A selection of rainfall depths for various storm durations from 5 minutes to 72 hours for up to a 1% average exceedance probability (AEP) are presented in Table 3.4.

Table 3.4: Intensity Duration Frequency Rainfall Intensities

| Duration | Average Exceedance Probability (AEP), Rainfall depth (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 63.2% | 50% | 20% | 10% | 5% | 2% | 1% |
| 5 minute | 3.90 | 4.65 | 7.23 | 9.18 | 11.3 | 14.3 | 16.9 |
| 10 minute | 5.71 | 6.82 | 10.7 | 13.6 | 16.7 | 21.3 | 25.3 |
| 30 minute | 9.15 | 10.9 | 17.0 | 21.6 | 26.6 | 33.8 | 40.0 |
| 1 hour | 11.6 | 13.9 | 21.5 | 27.2 | 33.4 | 42.5 | 50.1 |
| 2 hour | 14.5 | 17.2 | 26.6 | 33.8 | 41.4 | 52.6 | 62.1 |
| 3 hour | 16.3 | 19.5 | 30.1 | 38.3 | 47.0 | 59.9 | 70.8 |
| 6 hour | 20.0 | 23.8 | 37.3 | 47.7 | 59.0 | 75.6 | 89.8 |
| 12 hour | 24.3 | 29.0 | 46.0 | 59.6 | 74.7 | 96.4 | 115 |
| 24 hour | 29.0 | 34.9 | 56.3 | 73.8 | 93.7 | 122 | 146 |
| 48 hour | 33.9 | 40.8 | 66.8 | 88.5 | 114 | 148 | 179 |
| 72 hour | 6.5 | 44.1 | 72.4 | 96.1 | 124 | 162 | 195 |

## 3.4 FLOOD ESTIMATION – PEAK DISCHARGE

As there are no hydrometric stations operating in the Project Area, historical records were not available to derive estimates of peak runoff rates. The Regional Rational Method (Rational Method) was therefore applied to estimate peak flow rates in accordance with the procedures set out in the Australian Rainfall and Runoff (ARR) (IEAust, 2016) national guideline document. The parameters for the Goldfields region with lateritic soils were used as the basis for peak flow estimation. The catchment characteristics used in estimating the peak flow using the Rational Method are presented in Table 3.5. To allow for comparison with other modelling methods, peak flow estimates were also performed using the Index Flood Method (IFM).

It should be noted that within the Study Area the regional IFM data tends to have an underlying calculation rate which is too shallow, resulting in over-estimation of low flow scenarios and under estimation of higher flow scenarios. The IFM is therefore supplied for information only and should not be used for design purposes. The rational method is considered a more conservative estimate for use in the current study.

For the rational method in the Goldfields region for areas with loamy and lateritic soil catchments, discharge ($Q$) is based on the relationship:

$Q_y = 0.278 \times C_{10} \times (C_y/C_{10}) \times I \times A$

Where:

- $Q_y$ = peak discharge ($m^3 s^{-1}$) for defined ARI;
- $C_y / C_{10}$ = frequency factor for defined ARI;
- $I$ = rainfall intensity ($mm\ hr^{-1}$) for catchment's time of concentration ($t_c$)
- $A$ = catchment area ($km^2$); and
- $t_c$ = $0.76\ A^{0.38}$

The frequency factors for the 1, 2, 5, 10, 20, 50 and 100 year ARI's are 0.0016, 0.43, 0.67, 1, 1.45, 1.98 and 2.37.

## 3.5 HYDROLOGIC MODELLING

To assess the potential scale and extent of flooding impacts on key infrastructure areas across the entire Study Area a one dimensional steady flow model was developed using the hydraulic software package HEC-RAS. This software is used to simulate rainfall runoff processes and surface water hydraulics via the diffusive wave equation. HEC-RAS requires the creation of stream channel cross-sections derived from available topographic data. Therefore a series of these were constructed from overlays of channel cross sections mapped over the created digital elevation model (DEM) at intervals of between 500 – 100 m along the main stream network. The floodplain extent and flood depth of the pre-mine landscape was derived by interpolation of flood elevations estimated by HEC-RAS over the surface of the DEM.

Flood extent modelling under different rainfall event intensities requires an estimate of catchment surface roughness to accurately derive peak discharges. This roughness factor is primarily determined by the vegetation and degree of rock cover and is termed Manning's 'n', a dimensionless coefficient within Manning's uniform flow equation. Aerial images of the study area were assessed to estimate the roughness of the various channels and adjacent hillslopes. A Manning's roughness assessment of all modelled channels found the majority of ground cover to be well vegetated with a mixture of native shrubs and grasses. Based on this assessment a Manning roughness of 0.04 was adopted for all channels in the catchments modelled, with the surrounding areas contributing to run-off modelled with a Manning roughness of 0.08.

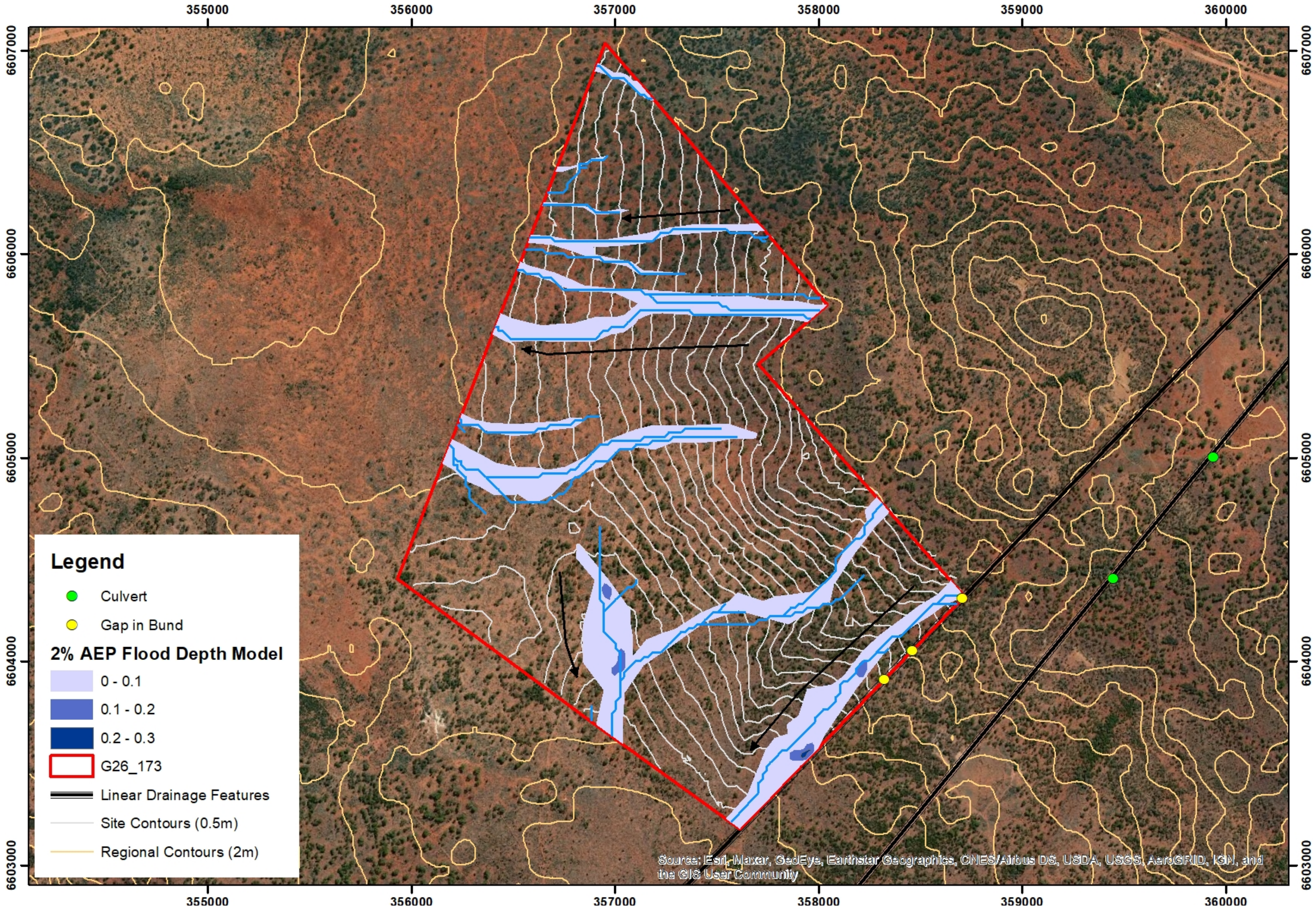
The 1 second SRTM derived digital surface model (DSM) is equivalent to an approximate 30m gridded DEM. The data has some known issues around noise and incomplete removal of vegetation offsets however it is widely regarded as being generally accurate within the inherent limitations imposed by the capture resolution. Because of this resolution the data was only utilised in this study to determine upstream catchment accumulation areas which would contribute to surface water flow entering the Project area. The data was not considered suitable to carry out stream flow routing and flood depth modelling and therefore this aspect of the study was restricted to the Project area where more accurate topography data was available.

## 3.6 PEAK FLOOD ESTIMATION

Estimated peak discharges for all contributing upslope catchments which will impact on the Project area and their respective catchment characteristics are provided within Appendix A. The modelled flood depth and extents under both the 2 and 1% AEP (equivalent to the 1:50 and 1:100 yr ARI event) of those catchments which interact with the Project area are shown in Figure 3.3 and Figure 3.2.

The modelling indicates that shallow, temporary flooding of less than 0.25m depth can be expected to occur along the course of the main drainage line, extending on average 30m from the centre of the drainage line. Maximum flooding is predicted to occur at the confluence of the two northern most drainage lines directly west of the planned ROM pad position. Maximum flood depths of 1.3m occur in a small area, with flooding in this region covering an area approximately 200m in width centred on the confluence point.

The peak flood time of concentration for the small upstream catchment area is just 1.6 hours, indicating that short, heavy rainfall events of less than 2 hours duration in the 1% AEP range are the type of rainfall events which will cause maximum flooding at the Site.

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| LYNAS CORPORATION LTD | Figure 3.2: 2% AEP flood extent over the proposed Project area | soilwater GROUP |
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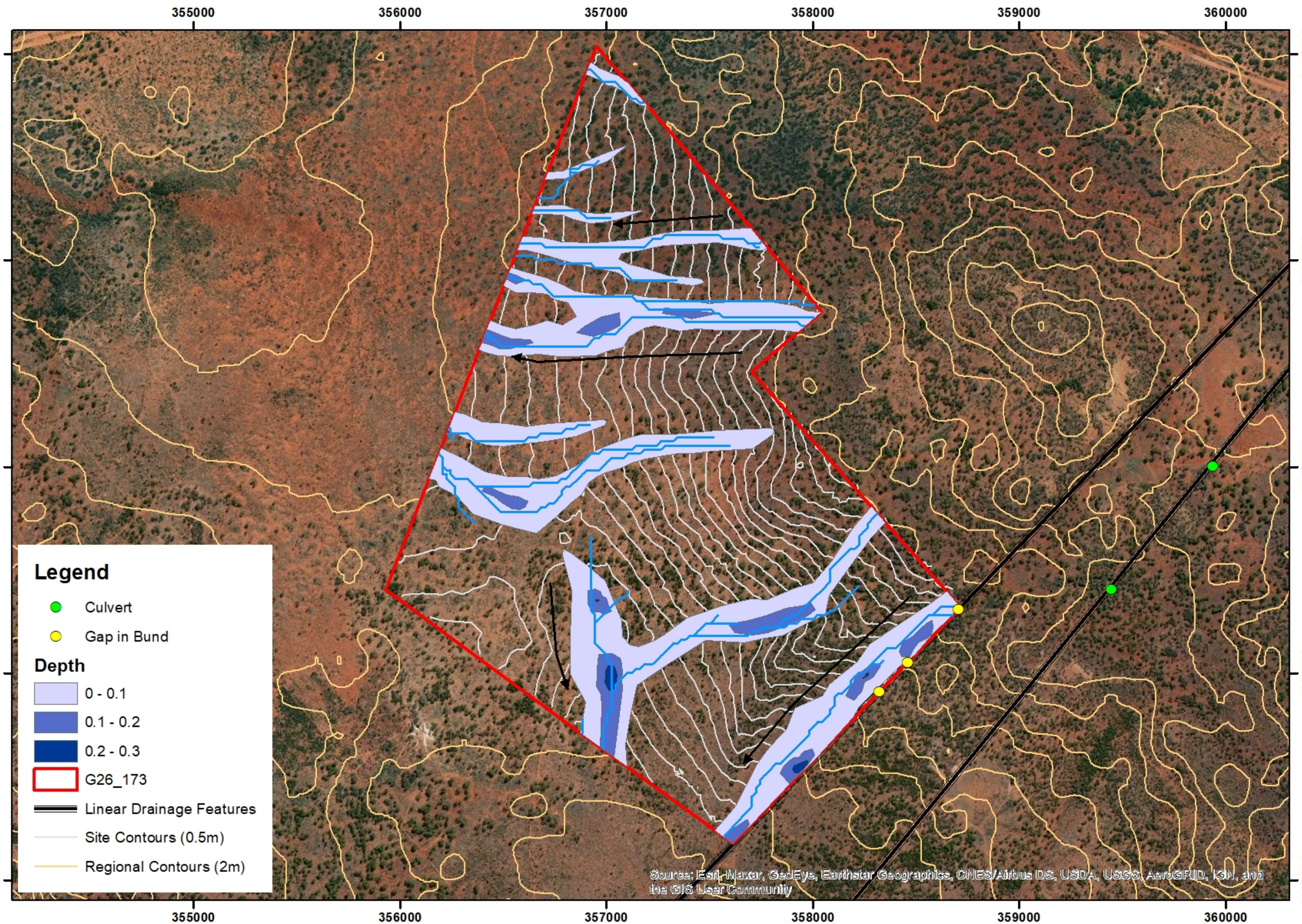


| LYNAS CORPORATION LTD | Figure 3.3: 1% AEP flood extent over the proposed Project area | soilwater GROUP |
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### 3.7 PEAK FLOW ESTIMATION

Catchment outlets were chosen based on the planned Site infrastructure to allow for determination of likely peak flow volumes at key locations across the Site. These locations were chosen as the proposed sites for surface water control infrastructure such as road crossing culverts, diversion drains and flood protection bunding. The derived drainage paths have been validated against aerial photography and site walk over to ensure they closely match with visible drainage morphology. A number of catchment outlets were placed across the Site (Figure 3.4) to allow for determination of key characteristics. At each of the proposed locations, estimation of peak flows for AEPs ranging from 50 to 1% are provided in Appendix A to assist with detailed design requirements.

For all catchments the critical peak discharges for the 100-year storm event were associated with various storm durations. The critical storm duration, $t_c$, is a function of the catchment area in this region. The critical duration of rainfall for peak flow estimation depends upon the catchment characteristics defining the time of concentration of surface water flows to the catchment's outlet. The key catchment characteristics for the chosen peak flow estimation sites are provided in Table 3.5, whilst the calculated peak flow for each catchment areas critical storm duration for 1, 2, 5 and 20% AEPs (roughly corresponding to 100, 50 20 and 5 year ARIs) are shown in Table 3.6.

Table 3.5: Modelled Catchment characteristics

| Peak flow estimation location | Catchment Area (ha) | Stream Length (km) | Equal Area Slope (m/km) | % Cleared |
|---|---|---|---|---|
| 01 | 67 | 1.12 | 0.007 | 10 |
| 02 | 94 | 1.91 | 0.007 | 10 |
| 03 | 392 | 5.03 | 0.006 | 10 |

Table 3.6: Calculated peak flow using the rational flood method

| Peak flow location | Critical storm duration (hours) | 20% AEP ($m^3/s$) | 5% AEP ($m^3/s$) | 2% AEP ($m^3/s$) | 1% AEP ($m^3/s$) |
|---|---|---|---|---|---|
| 01 | 0.65 | 0.02 | 0.07 | 0.14 | 0.19 |
| 02 | 0.74 | 0.04 | 0.10 | 0.17 | 0.25 |
| 03 | 1.28 | 0.13 | 0.43 | 0.75 | 1.06 |

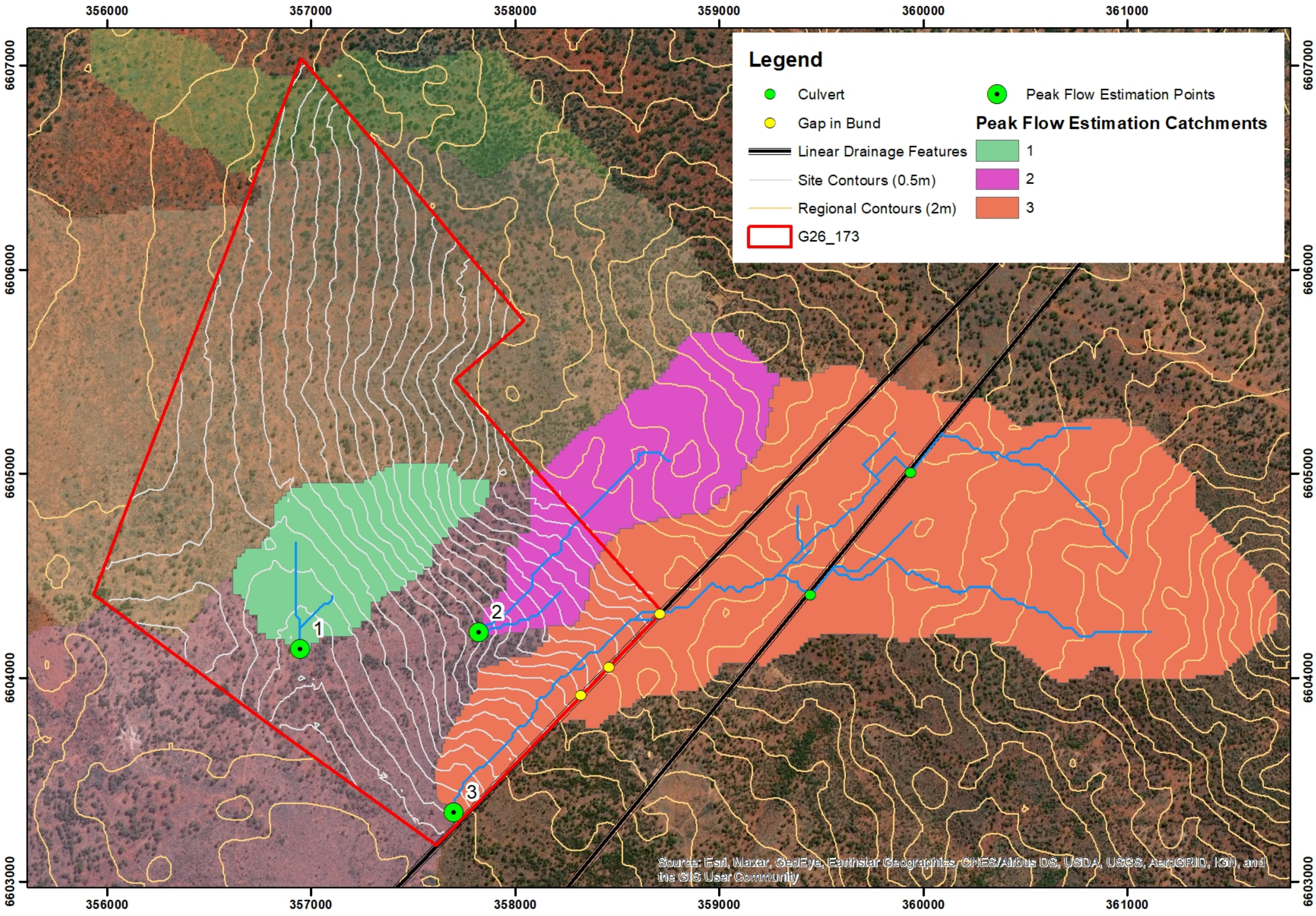


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Figure 3.4: Selected points and catchments for calculation of peak flows

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# 4 CONCLUSIONS & RECOMMENDATIONS

This hydrological assessment studied the area surrounding the proposed Lynas Storage Facility Project area. Peak flows were estimated for each sub-catchment area based on both the rational and index flood methods described in the Australian Rainfall and Runoff Guidelines. In light of the findings from this assessment the following recommendations are made:

- Consideration should be given to further updates to the flood modelling presented here once the required infrastructure designs and footprints have been finalised.
- Surface water control infrastructure designs should be developed once flood modelling has been reviewed and refined prior to commencing the development to ensure they align with guideline requirements, and
- Consideration should be given to access road design and locations to prevent modelled flooding from negatively impacting on this infrastructure.

The development is likely to have the following impacts to hydrological processes after appropriate surface water management:

- Minimal impact to annual flow volumes and the hydrological regime in most of the sub-catchments which cross the development areas following the installation of culverts and drain diversion structures,
- Minor reduction in surface water flow volumes and altered hydrologic variability downstream of the development.

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# APPENDIX A

# FLOOD MODELLING DATA

Table A: Flood modelling data obtained for pre-mine catchments

| Peak Flow Estimation Location | Catchment Area ($km^2$) | Stream Length (km) | Equal Area Slope (m/km) | % Cleared | Time of Concentration $t_c$ (hours) | Discharge Q ($m^3 s^{-1}$) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50% AEP | | 20% AEP | | 5% AEP | | 2% AEP | | 1% AEP | |
| | | | | | | RM | IFM | RM | IFM | RM | IFM | RM | IFM | RM | IFM |
| 01 | 67 | 1.12 | 0.007 | 10 | 0.65 | 0.01 | 0.02 | 0.02 | 0.04 | 0.07 | 0.11 | 0.14 | 0.14 | 0.19 | 0.16 |
| 02 | 94 | 1.91 | 0.007 | 10 | 0.74 | 0.01 | 0.02 | 0.03 | 0.05 | 0.10 | 0.14 | 0.17 | 0.16 | 0.25 | 0.22 |
| 03 | 392 | 5.03 | 0.006 | 10 | 1.28 | 0.05 | 0.08 | 0.13 | 0.20 | 0.43 | 0.48 | 0.75 | 0.73 | 1.06 | 0.95 |