Riverview Projects (ACT) Pty Ltd

Kowen Forest Emergency Landfill

High Level Feasibility Assessment

June 2014

Executive summary

Following a number of years of discussions and negotiations, Corkhill Bros Pty Ltd (Corkhill Group), Reid & Stevens Pty Ltd (Reid & Stevens – part of the Corkhill Group) and the ACT Government signed a Heads of Agreement during May 2013. This Heads of Agreement relates to the proposed re-zoning and subsequent development of substantial areas of land for urban uses in the ACT and NSW. Specifically, the agreement is understood to outline (amongst other things) that Riverview Projects (ACT) Pty Ltd (Riverview) will act as Development / Project Managers on behalf of the ACT Government through their Land Development Agency (LDA) to develop ACT land for residential uses (specifically Blocks 1605 & 1606).

The parcels of land that are currently under consideration for re-zoning and future development are known as the West Belconnen Study Area (Study Area). The central portion of the Study Area is occupied by the West Belconnen Landfill Site (WBLS).

GHD notes that the WBLS is currently designated (by ACT NOWaste) as the emergency landfill site for the ACT. Furthermore, ACT NOWaste is unlikely to support removal of this designation unless an alternative location for an emergency landfill site can be identified and approved (by the ACT government) within the ACT. Riverview have engaged with ACT NOWaste in relation to this issue on several occasions.

During recent communications between Riverview, LDA and ACT NOWaste personnel (Mr. David Roberts) several potential locations for a new emergency landfill site were identified within the Kowen Forest area in the ACT. Riverview subsequently engaged GHD to undertake a high level assessment of the suitability of these sites for development as an emergency landfill.

Site identification criteria were developed by GHD in consultation with Riverview and ACT NOWaste and was used to identify six sites within the Kowen Forest assessment area for potential emergency landfill locations. A site visit was conducted by GHD with Riverview/LDA personnel to ground truth their potential suitability (or otherwise) to house a future emergency landfill.

The identified sites were assessed and ranked using the site assessment criteria which were developed in consultation with Riverview, LDA and ACT NOWaste. Site 6 (located in the south-east portion of Kowen Forest) was identified as the preferred location for the emergency landfill. In particular, it is noted that Site 6 has significant potential future expansion potential, a key assessment criteria item as the site may need to be expanded in the future to become the primary landfill site for the ACT. A sensitivity analysis of the criteria weighting was conducted and yielded the same result.

Based on preferred site, a preliminary cost estimate of $35.3 million was determined for establishing a landfill at the site (including gaining the necessary approvals). Exclusions, assumptions and limitations in developing this preliminary cost estimate are detailed throughout this report.

Based on the assessment, GHD recommend Riverview/LDA should discuss the findings of this report with the relevant stakeholders in relation to whether one of the identified sites should be pursued for future use as an emergency landfill site to replace the current WBLS. If it is agreed that one (or more) of the identified sites is suitable for future use as an emergency landfill site and possibly provide the ACT Government with solutions for other waste operations in future (and that this would remove the emergency landfill status currently at the WBLS and the associated implications for the proposed adjacent development), the project should be pursued further. This may include undertaking preliminary site investigations and commencement of associated environmental studies required to obtain approval for an emergency landfill site in the ACT.

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1. Introduction

1.1 Background

Following a number of years of discussions and negotiations, Corkhill Bros Pty Ltd (Corkhill Group), Reid & Stevens Pty Ltd (Reid & Stevens – part of the Corkhill Group) and the ACT Government signed a Heads of Agreement during May 2013. This Heads of Agreement relates to the proposed re-zoning and subsequent development of substantial areas of land for urban uses in the ACT and NSW. This agreement is understood to outline (amongst other things) that:

- The three parties have agreed to develop land in accordance with agreed project objectives;
- Reid & Stevens can develop NSW into residential and / or commercial lots at a prescribed time; and
- Riverview Projects (ACT) Pty Ltd (Riverview) will act as Development / Project Managers on behalf of the ACT Government through their Land Development Agency (LDA) to develop ACT land for residential uses (specifically Blocks 1605 & 1606).

The parcels of land that are currently under consideration for re-zoning and future development are known as the West Belconnen Study Area (Study Area). The central portion of the Study Area is occupied by the West Belconnen Landfill Site (WBLS).

GHD notes that the WBLS is currently designated (by ACT NOWaste) as the emergency landfill site for the ACT. Furthermore, ACT NOWaste is unlikely to support removal of this designation unless an alternative location for an emergency landfill site can be identified and approved (by the ACT government) within the ACT. Riverview have engaged with ACT NOWaste in relation to this issue on several occasions.

Previously, GHD completed a high level assessment of developing an emergency landfill site at Fairbairn Pines in the ACT. However, due to its close proximity to the Canberra Airport, alternative sites are now being considered.

During recent communications between Riverview, LDA and ACT NOWaste personnel (Mr. David Roberts) several potential locations for a new emergency landfill site were identified within the Kowen Forest area in the ACT. Riverview subsequently engaged GHD to undertake a high level assessment of the suitability of these sites for development as an emergency landfill.

1.2 Purpose of this report

The purpose of this report is to assess the physical suitability of six potential emergency landfill sites within the Kowen Forest area, to identify a preferred site based on this assessment and to provide a preliminary cost estimate for establishing an emergency landfill at the preferred site.

1.3 Scope of works

Based on discussions with Riverview and LDA, GHD has undertaken the following scope of works:

- Review of background information;
- Identification of potential emergency landfill sites within the Kowen Forest area;
- Site visit to the Kowen Forest area to ground truth the potential suitability of the identified sites;
- Development and weighting of assessment criteria;

- High level assessment and ranking of the identified sites, including a sensitivity analysis;
- Identification of a preferred site; and
- Preparation of an order of cost capital estimates for the preferred site.

1.4 Reliance

The following documents were relied upon in the preparation of this report:

- Australian Bureau of Statistics, *Regional Population Growth, Australia, 2012-13*, accessed 30 April 2014, http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2012-13~Main+Features~Australian+Capital+Territory?OpenDocument#PARALINK2
- Dial Before You Dig documents for Kowen Forest site, received 14 February 2014;
- EPA Victoria (2010), *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills (788.1)*.
- GHD (2011), *Fairbairn Pines Emergency Landfill – Cost Estimate Report*;
- NSW Department of Land and Water Conservation (2000), *Soil Landscapes of the Canberra 1:100,000 sheet*;
- NSW Department of Land and Water Conservation (2000), *Canberra – Soil Landscape Series Sheet 8727*; and
- NSW Government, *NSW Natural Resource Atlas*, accessed 24 April 2014, http://www.nratlas.nsw.gov.au/wmc/custom/homepage/home.html

1.5 Limitations

This report: has been prepared by GHD for Riverview Projects (ACT) Pty Ltd and *may only be used and relied on by Riverview Projects (ACT) Pty Ltd for the purpose agreed between GHD and the Riverview Projects (ACT) Pty Ltd as set out in Section 1.2 of this report.*

GHD otherwise disclaims responsibility to any person other than Riverview Projects (ACT) Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically described in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Riverview Projects (ACT) Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimate set out in Section 6 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD described within this report.

The Cost Estimate has been prepared for the purpose of conducting a high level assessment of establishing a new emergency landfill and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

2. Site description

2.1 General

The following section provides a description of the overall site considered for this report, i.e. the Kowen Forest area.

2.2 Site location

The site is located on land owned by the ACT government, and forms part of the Kowen Pine Plantation in Canberra, ACT. It is currently a pine forest plantation; however it is noted that since the 2003 bushfires destroyed a large portion of the ACT pine forest stock, the industry is no longer locally viable. Figure 1 illustrates the approximate site location.

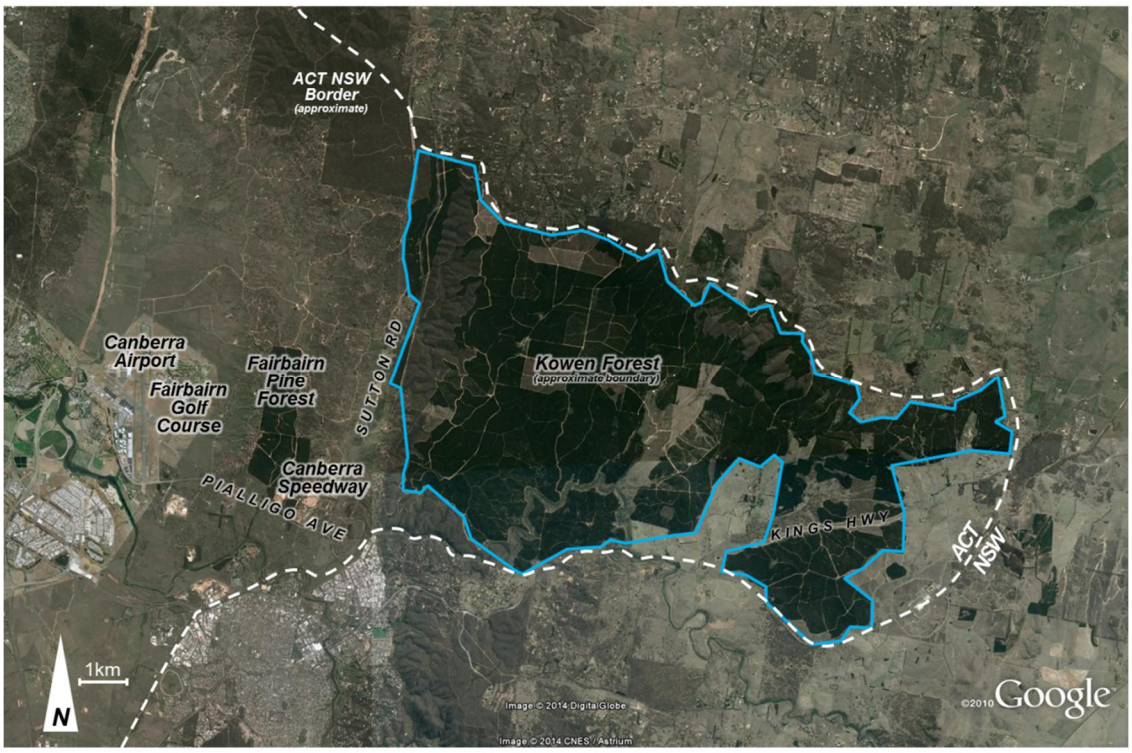


Figure 1 Approximate site location

The ACT and New South Wales border surrounds the Kowen Forest as indicated in Figure 1.

2.3 Access and existing land use

The Kings Highway runs adjacent to the southern boundary of Kowen Forest. Sutton Road runs adjacent to the western boundary. A number of access tracks are formed throughout the forest area. The Kings Highway divides Kowen Forest from Kowen Forest East.

The site is currently used for forestry and recreation purposes.

2.4 Surrounding land use

Kowen Forest is approximately 12 km west of Canberra city centre and approximately 5.5 km west of Kowen Forest. An additional pine forest, Fairbairn Pine Plantation, is located approximately 2.5 km west of Kowen Forest.

Local residences are situated to the south and east of Kowen Forest, with the closest approximately 0.5 km from the southern boundary.

2.5 Local infrastructure

A Dial Before You Dig (DBYD) search was undertaken to identify the underground infrastructure present at the site that may affect the positioning of the site's infrastructure.

Figure 2 identifies the approximate location of the underground services present on or adjacent to the site based on the information supplied by the DBYD service

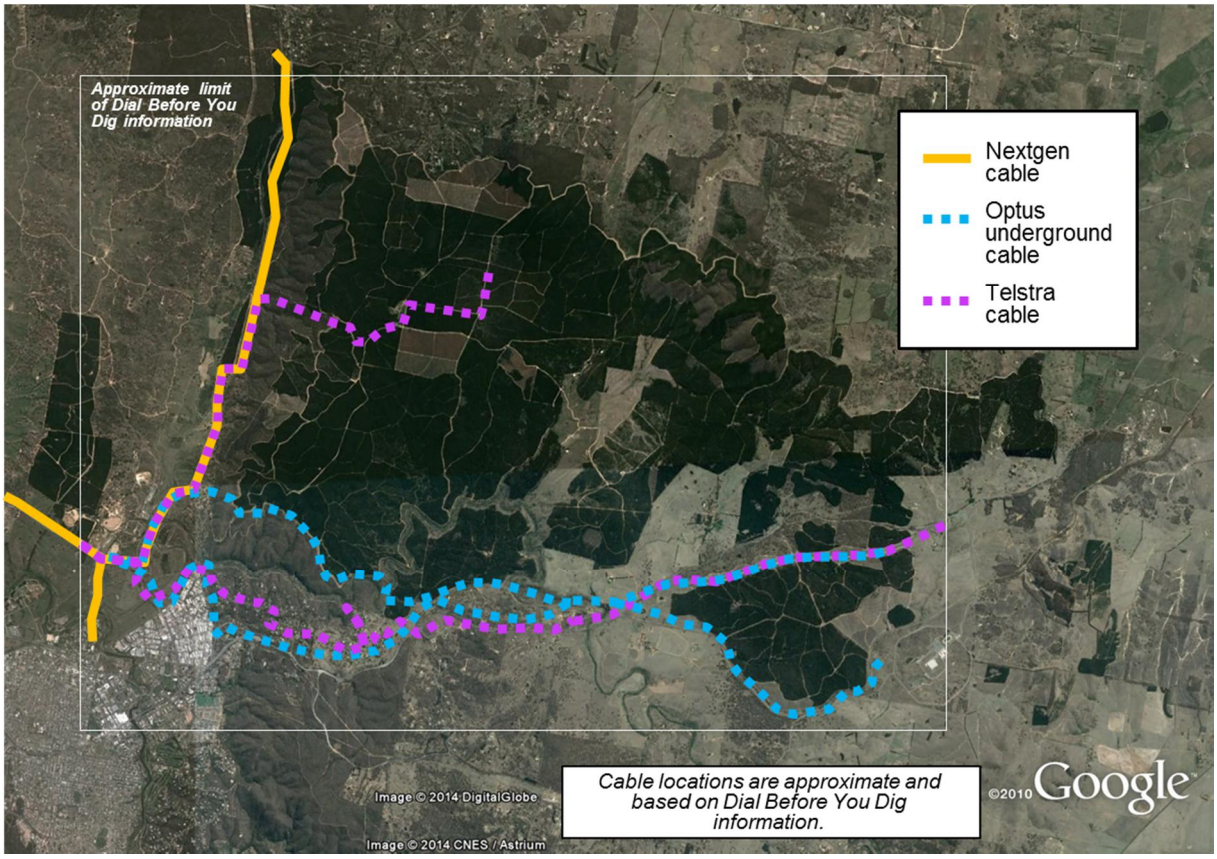


Figure 2 Dial Before You Dig underground infrastructure

2.6 Topography and surface water hydrology

The local topography is undulating, ranging from approximately RL 900 in the north and north-east to RL 570 at the very south-west of the site. The site consists of localised valleys and ridges that direct water to the Molonglo River to the south. This river runs adjacent to parts of the southern boundary of Kowen Forest, as well as crossing into the forest further to the east.

2.7 Geology and soils

The Kowen Forest site's geological profile consists of the following soil types:

- Macanally mountain (erosional);
- Foxlow (colluvial);
- Bywong (vestigial);
- Celeys creek (erosional); and
- Paddy's river (alluvial).

Table 1 describes the characteristics of these soil types.

Table 1 Description of soil types[1]

Soil Type	Description
Macanally mountain (erosional)	**Landscape:** Rolling to steep hills and low hills on metasediments. Local relief < 200 m; elevation 600 – 1000 m; mostly cobble-strewn hillslopes (10 – 30%). Open-forest to woodland, partially cleared from lower slopes. **Soils:** Shallow (< 40 cm) well-drained Rudosols (Lithosols) on crests and some sideslopes. Moderately deep (< 100 cm), moderately well-drained Red and Brown Kurosols (Red and Yellow Podzolic Soils) on sideslopes. Moderately deep (< 130 cm), slowly drained Bleached-Mottled Kurosols (Yellow Podzolic Soils and Soloths) and Sodosols (Solodic Soils) in drainage lines. **Limitations:** Shallow, stony, acidic, hardsetting soils of low fertility with possible aluminium toxicity. Surface rock; locally steep slopes; high to very high erosion hazard.
Foxlow (colluvial)	**Landscape:** Rolling to rugged steep hills and mountains on metasediments. Local relief < 300 m; elevation 750 – 1350 m; cobble-strewn hillslopes (> 20%) and occasional scree slopes. The original open-forest to woodland in frost hollows has undergone only limited clearing. **Soils:** Shallow (5 - 15 cm) well-drained Rudosols (Lithosols) and shallow (< 50 cm) moderately to imperfectly drained Yellow Kandosols (Yellow Earths) and Brown Kurosols (Yellow Podzolic Soils) on crests and upper slopes. Shallow (< 20 cm) well-drained Rudosols (Lithosols) and shallow (< 50 cm), moderately well-drained Magnesic-Natric Red Kurosols (Red Podzolic Soils) on midslopes. Moderately deep (> 100 cm) moderately well-drained Yellow Kandosol / Brown Kurosol intergrades (Yellow Earth/Yellow Podzolic Soil intergrades) on colluvial lower slopes and minor depressions. **Limitations:** Soils are shallow, acid and infertile. Steep stony slopes; sheet erosion hazard; localised rock outcrop; waterlogging.
Bywong (vestigial)	**Landscape:** Rolling to undulating low hills, rises and minor flats on metasediments. Local relief 30-90 m; elevation 600-920 m; slopes 3-20%. Extensively cleared open-forest and woodland. **Soils:** Shallow (< 30 cm), well to rapidly drained Rudosols (Lithosols) on crests and upper slopes, and near rock outcrop. Moderately deep (< 75 cm), moderately well-drained Red Chromosols (Red Podzolic Soils) and Brown Chromosols (Yellow Podzolic Soils and Non-calcic Brown Soils) on midslopes. Deep (> 100 cm), imperfectly drained Bleached-Soda Chromosols (Yellow Podzolic Soils) and poorly drained Sodosols (Solodic Soils) on lower slopes.

[1] Soil types and descriptions are from the *Canberra – Soil Landscape Series Sheet 8727*, NSW Department of Land and Water Conservation, April, 2000

Soil Type	Description
	Limitations: Soils are infertile, erodible and shallow. Subsoils are often dispersible and hardsetting. Run-on; water erosion and salinity hazards.
Celeys creek (erosional)	**Landscape:** Rolling low hills on granitic rock. Local relief 30-120 m; elevation 600-1020 m; slopes 10-32%. Rock outcrop as large tors is common (20-50%) on slopes and crests. Extensively cleared open-forest. **Soils:** Shallow (< 40 cm), well to rapidly drained Tenosols (Earthy Sands) and Rudosols (Lithosols) on crests. Shallow to moderately deep (< 70 cm), well-drained Tenosols (Earthy Sands) on upper slopes. Shallow to moderately deep (< 80 cm), moderately well-drained Red Chromosols (Red Podzolic Soils) and moderately well to slowly drained Yellow Chromosols (Yellow Podzolic Soils) on lower slopes. **Limitations:** Soils are infertile, locally shallow and non-cohesive. Topsoils are acid and highly permeable. Subsoils are hardsetting with low available waterholding capacity. Seasonal waterlogging; localised rock outcrop.
Paddy's river (alluvial)	**Landscape:** Stream channels and adjacent riparian features of moderate to high energy watercourses on Quarternary alluvium. Local relief is dependent on adjacent landscapes as anything outside of the low lying riparian zone is excluded from this landscape unit; streams occur at 500-700 m elevation. Extensively cleared riparian woodland, scrubland, grassland and sedgeland. Contains small and relatively stable floodplain elements. **Soils:** Deep (> 100 cm); well-drained Stratic Rudosols (Alluvial Soils) on floodplain elements. Deep (> 100 cm) imperfectly to poorly drained Stratic Rudosols (Alluvial Soils) in streambeds. **Limitations:** Non-cohesive soils of high permeability, high erodability, low fertility and low available waterholding capacity. Excessive drainage (localised); high run-on; gully erosion risk; wind erosion hazard (localised).

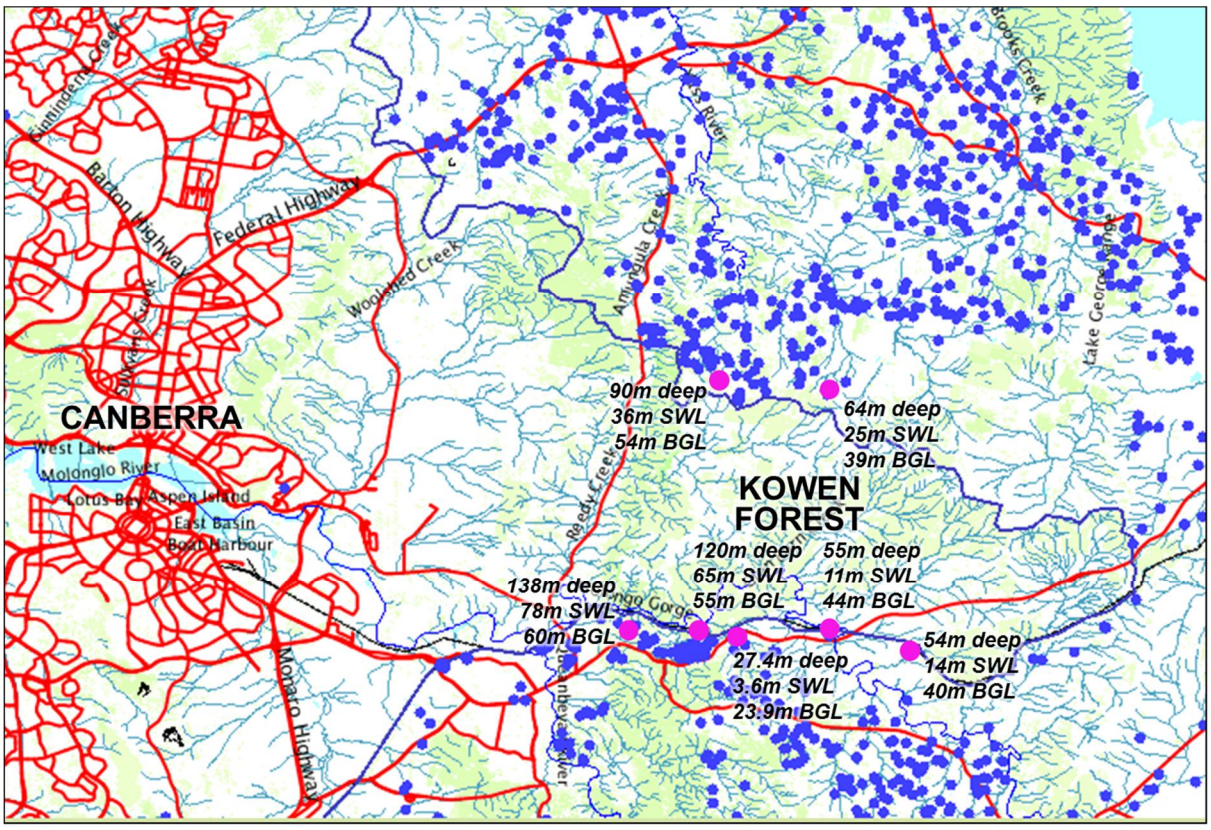
2.8 Groundwater hydrology

Data for local groundwater bores adjacent to the site indicate that the approximate local groundwater level ranges from 20 to 60 m below prevailing ground levels.

Figure 3 identifies the groundwater bore locations that were used in assessing the local groundwater levels[(2)].

Figure 3 indicates the depth of each bore, its standing water level (SWL) relative to the base of the bore, and the depth of the standing water level below ground level (BGL).

[2] Data for these groundwater bores were accessed from the NSW Natural Resource Atlas (2014)



NSW Natural Resource Atlas

Figure 3 Groundwater bore locations and data

2.9 Climate

Climate data collected from Bureau of Meteorology weather monitoring stations within the vicinity of Kowen Forest is summarised in Table 2.

Table 2 Average monthly climate data

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly rainfall (mm)[3]	55.3	51.6	51.6	43.6	43.5	44.3	39.5	43.9	48.1	59.3	59.0	55.5	595.4
Median monthly rainfall (mm)[4]	48.7	43.2	34.0	35.1	30.0	35.0	33.8	40.9	43.8	52.7	54.1	46.5	570.2
2013 monthly rainfall[4]	103.8	40.6	30.0	11.6	6.2	76.6	47.6	29.6	91.8	11.4	57.2	31.2	537.6
Mean evaporation (mm)[4]	145.7	106.4	93	63	40.3	27	31	52.7	78	105.4	117	139.5	985.5

[3] Bureau of Meteorology (2014) – Queanbeyan Bowling Club weather station (Station No. 070072), approximately 4 km south-west of Kowen Forest

[4] Bureau of Meteorology (2014) – Braidwood (Wallace Street) weather station (Station No. 069010), approximately 40 km south-east of Kowen Forest

3. Assessment approach

3.1 General

Figure 4 identifies the approach undertaken in completing this high level assessment.

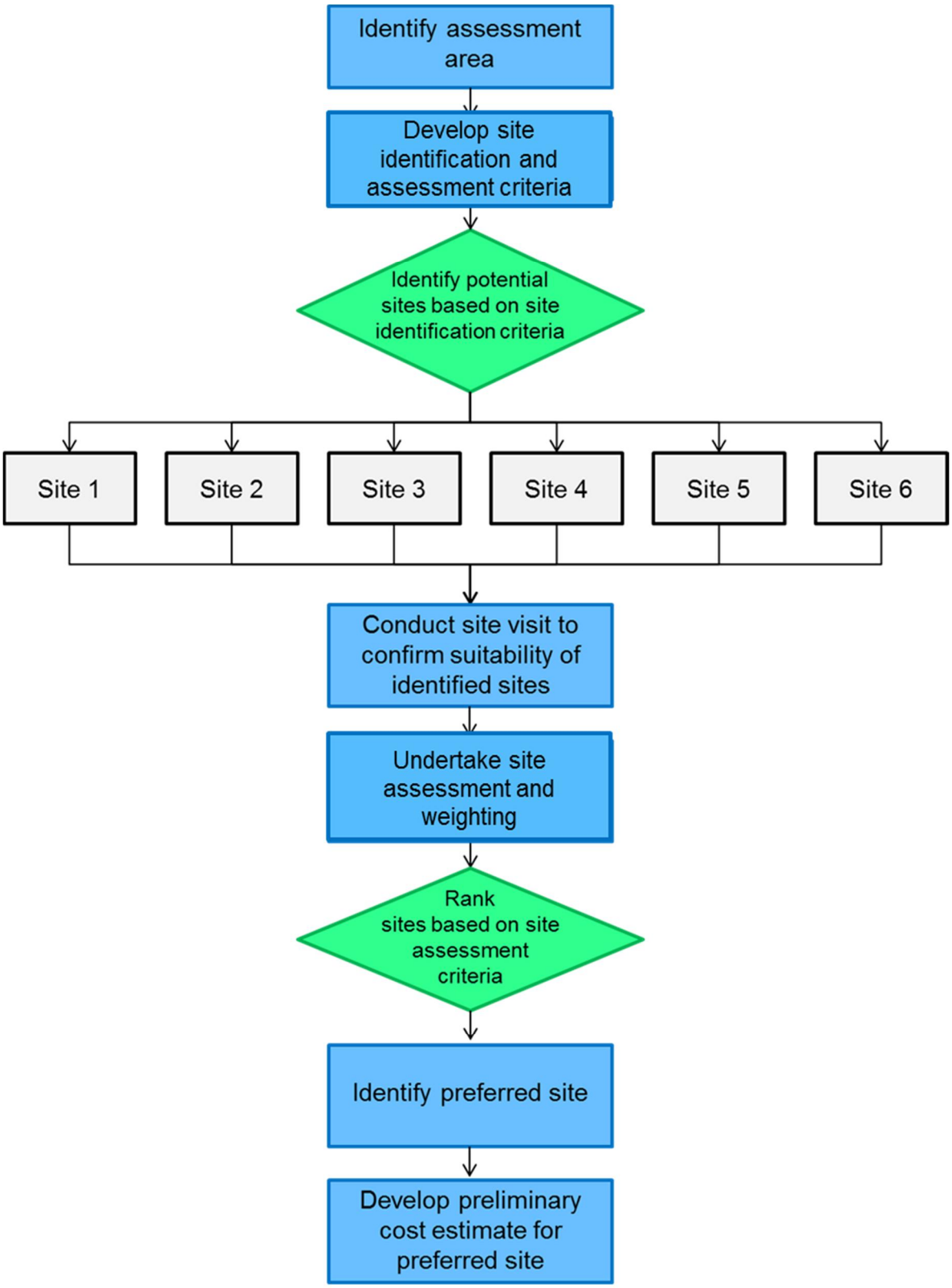


Figure 4 Assessment approach

3.2 Description of approach

Each step of the high level assessment is outlined below. A number of items (including assessment criteria and site ranking) are discussed in more detail in subsequent sections of this report.

3.2.1 Identification of assessment area

The first step of the assessment was to identify the overall assessment area which would be considered for siting a potential emergency landfill location. This step was completed at the onset of the project, with the Kowen Forest area chosen as the assessment area.

3.2.2 Development of site identification criteria

Site identification criteria were developed by GHD in consultation with Riverview and ACT NOWaste. Specific items within these criteria are described in more detail in Section 4.

3.2.3 Identification of potential sites

Using the site identification criteria, GHD identified a number of sites within the assessment area that meets the criteria and could be used as a potential emergency landfill location.

3.2.4 Site visit

With the potential sites identified, a site visit was conducted by GHD with Riverview personnel to ground truth their potential suitability (or otherwise) to house a future emergency landfill. Further details on the site visit can be found in Appendix B.

3.2.5 Development of site assessment criteria and weighting

Site assessment criteria were developed by GHD in consultation with Riverview and ACT NOWaste. Specific items within these criteria are described in more detail in Section 4, as well as weighting considerations.

3.2.6 Site assessment and ranking

The identified sites were assessed and ranked using the site assessment criteria. A sensitivity analysis was also conducted as part of the assessment. This assessment is described in more detail in Section 5.

3.2.7 Identification of preferred site

Based on the site assessment and ranking, a preferred site was identified for the emergency landfill location.

3.2.8 Preliminary cost estimate

Based on the preferred site, a preliminary cost estimate was developed for establishing a landfill at the site (including gaining the necessary approvals). This cost estimate is described in more detail in Section 6.

4. Criteria development

4.1 General

The following section describes the assessment criteria developed for the high level assessment in consultation with Riverview, LDA and ACT NOWaste. Prior to conducting the assessment, the criteria were developed by GHD and subsequently discussed with by Riverview, LDA and ACT NOWaste. GHD then updated the criteria, incorporating the comments provided by these two parties as relevant / possible. These updated criteria were then used to conduct the assessment.

4.2 Development

In developing the assessment criteria for the project, GHD primarily relied on siting criteria/considerations outlined in EPA Victoria's *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills (788.1)*[(5)]. In addition to this, GHD also considered the following:

- Previous GHD siting study experience;
- Previous emergency landfill report completed by GHD (Fairbairn Pines Emergency Landfill – Cost Estimate Report (2011);
- Discussions with ACT NOWaste (David Roberts);
- Discussions with LDA (Peter Griffith and Tom Gordon);
- Discussions with Riverview representatives / sub-consultants (David Maxwell and Tony Adams); and
- Over-arching project approach and vision.

4.3 High level assessment criteria

GHD developed two sets of (subtly different) assessment criteria as follows:

- **The site identification criteria.** These consist of specific constraints (e.g. required buffer zones, prohibited development areas etc.) which were used to produce constraint maps from which potentially appropriate locations were subsequently identified; and
- **The site assessment criteria.** These consist of non-specific criteria which have been weighted based on their perceived level of importance in relation to a future emergency landfill site to enable assessment and ranking of the identified locations.

4.3.1 Site identification criteria

The preliminary site identification criteria are listed in Table 3. Where relevant, the buffer zones for these items have been provided on the attached figures (Appendix A).

[5] ACT EPA currently prescribe this document for landfill design in the ACT and it is likely that a future landfill would need o be designed in accordance with it.

Table 3 Site identification criteria[6]

Item	Criteria
Hydrology	Not located within 100 m of surface waters Not located in a 1% annual exceedance probability (1% AEP) floodplain[7]
Nearby residences	Not located within 500 m of building or structures
Airport	Not located within 3000 m of an aerodrome for jet aircraft
Geology	Not located within 100 metres of a fault line displaced in the Holocene period (the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch — about 10,000 to 12,000 years ago — to the present)[8]

From these site identification criteria, GHD identified areas of Kowen Forest where an emergency landfill site could not be located and subsequently identified 6 potential sites for further consideration (see figures in Appendix A). These 6 sites were inspected by GHD with LDA and Riverview personnel to ground truth their potential suitability (or otherwise) to house a future emergency landfill. Following the site inspections, GHD developed and subsequently weighted preliminary site assessment criteria.

Details of the site inspections conducted by GHD, LDA and Riverview can be found in Appendix B.

4.3.2 Site assessment criteria

The site assessment criteria and associated weighting are listed in Table 4. Two weighting/ranking methodologies were considered for this assessment. For Method 1, each of the seven assessment criteria items are ranked from 1-7, with the item considered most important weighted first and the item considered least important weighted seventh. For Method 2, each of the assessment criteria items are given a percentage weighting out of 100% based on their relative importance, with more important items given a higher percentage weighting. The chosen weighting for each of the assessment criteria items is discussed in Section 4.3.3.

Table 4 Site assessment criteria and weighting

Item	Criteria	Weighting	
		Method 1	Method 2
Location accessibility (to location gate)	Road routes and capacity of local road network to safely accommodate the increased traffic load, and with a minimum of disturbance to the local community	1	25%
Location accessibility (from gate to emergency landfill location)	On site topography and road conditions	2	25%
Future expansion potential	Potential for the location to be expanded further beyond the required emergency landfill capacity	3	20%
Haulage distance	Distance from Canberra centre of population[9]	4	10%
Airport	Distance from Canberra Airport	5	10%
Local infrastructure	Availability/proximity of services to support landfill operations (reticulated water, sewerage, power, etc.)	6	5%

[6] Consideration of these criteria was based on ACT-wide GIS data provided by the ACT Government.

[7] Based on ACT-wide GIS data provided by the ACT Government, does not consider any flooding plans that may have been produced by/for local government (which is not in GIS format).

[8] Fault lines in general were considered for the assessment as a conservative measure.

[9] Based on data provided by the Australian Bureau of Statistics (2013). Understood to be located near the Royal Canberra Golf Course, in the suburb of Yarralumla.

Alternative waste transport options	Potential use of rail to transport waste to the emergency landfill	7	5%

4.3.3 Weighting and ranking considerations

The following issues were considered in developing the site assessment weighting and rankings:

Location accessibility (to location gate)

Location accessibility (to location gate) was defined by the road routes and capacity of the local road network to safely accommodate the increased traffic load to the site with a minimum of disturbance to the local community.

Physical accessibility to the site was considered the most critical criteria (and has been weighted to reflect this), as it would specifically affect the ability for waste to be disposed at the site. If large scale auxiliary access roads need to be constructed, this would result in significant costs as well as adding complexity with respect to the approvals required for the project.

The site ranking for this item was not based on any specific quantitative measurement, but rather on the capacity of the existing roads to be travelled to reach the site (e.g. sites using road routes along existing highways scored higher than those travelling along less developed roads).

Location accessibility (from gate to emergency landfill location)

Location accessibility (from gate to emergency landfill location) was defined by the local conditions (e.g. local topography) from the proposed landfill gate to the actual location of the landfill at the site.

This item was considered critical, as it would specifically affect the ability for waste to be disposed at the site. It has been weighted to reflect this. Safety issues would likely arise if the local topography is not amenable to the expected haul vehicles.

The site ranking for this item was not based on any specific quantitative measurement, but rather on the local topography and existing roads at the site (e.g. gentler sloped road routes scored higher than steeper sloped road routes).

Future expansion potential

Potential future expansion relates to the ability of the site to deal with future expansion or higher emergency requirements then currently specified.

This item was considered of high importance, given the potential need for the site to be expanded in future to the primary landfill for the ACT, thus the importance to secure a site which can be utilised for an extended period of time.

The site ranking for this item was not based on any specific quantitative measurement, but rather on the local topography and its amenability to expansion beyond the current footprint.

Haulage distance

Haulage distance is defined by the distance from the Canberra centre of population to the site via existing roads.

This item was considered of moderate importance, as it relates primarily to potential haulage costs and traffic impacts, but would not necessarily prevent site operations.

The site ranking for this item was based on specific quantitative measurements of the distance from the Canberra centre of population to the site via existing roads. Shorter haulage distances scored higher than greater distances. The sites were ranked as per Table 5.

Table 5 Haulage distance ranking

Distance	Method 1 score	Method 2 score
0 – 20 km	1	5
20 – 25 km	2	4
25 – 30 km	3	3
30 km – 35 km	4	2
35 km and onwards	5	1

Airport

This item was defined by the direct distance from Canberra Airport to the site.

Distance from Canberra Airport is considered of moderate to high importance due to the sensitivity of the airport authority concerning their required buffer distance. It is understood that different requirements will be imposed upon the chosen site based on the distance of the site from the airport.

The site ranking for this item was based on specific quantitative measurements of the distance from Canberra Airport to the site. Sites further outside the airport buffer zone are considered more preferable. The sites were ranked as per Table 6, in general accordance with the understood buffer distances.

Table 6 Airport distance ranking

Distance	Method 1 score	Method 2 score
3 – 5 km	5	1
5 – 10 km	4	2
10 km – 15 km	3	3
15 km – 20 km	2	4
20 km and onwards	1	5

Local infrastructure

This item is defined by the proximity of local infrastructure to the site, including power, water, sewer and telecommunications infrastructure.

Availability/proximity of support services was consider of low importance as it is predominately a cost issue, and existing services could be extended as required to service the landfill. However, it is noted that the location of existing sewer lines may impact on the available leachate disposal options for the site.

The site ranking for this item was based with consideration to the approximate distance from the site to local power, water and sewer infrastructure (based on available information). Where information was not available, ranking was based on proximity of the sites to local communities where this infrastructure would be likely to be present. Power and water were considered the most important infrastructure, followed by sewer and telecommunications. Sites with closer proximity to the required infrastructure scored higher.

Alternative waste transport options

Alternative waste transport options were defined by the distance to local transport options other than road transport.

Alternative waste transport options primarily relates to sustainability and future commercial considerations. It is considered of relatively low importance as it does not directly impact operations of the site.

For the purposes of this assessment, the ranking was based on their approximate distance away from the existing train line (located south of Kowen Forest and generally running parallel to the southern boundary of the forest).

4.4 Limitations

GHD notes the following limitations with the site identification and assessment criteria:

- The assessment has been conducted at a high level; and
- That the Kowen Forest area is similar in nature in relation to a number of potential site identification/assessment criteria, including:
  - Local geology and soils;
  - Local hydrogeology;
  - Local vegetation and bushfire risk;
  - Ecological and heritage considerations;
  - Land ownership, and
  - Alternative potential uses.

These potential site identification/assessment criteria are not considered to be critical criteria in their own right. This is because preliminary investigations suggest that they are unlikely to be significant constraints to the development of a future emergency landfill site in the Kowen Forest area (i.e. are likely to allow an emergency landfill to be constructed in the area). Furthermore, the variability of these items is expected to be low between the sites and thus would unlikely differentiate a preferred site, and therefore have not been used. Site inspections undertaken across Kowen Forest conducted by GHD, LDA and Riverview generally support this position. As such, these potential identification/assessment criteria are not considered further within this report. GHD recommend that these issues be further considered should an emergency landfill site ultimately be developed in the Kowen Forest area.

5. Preliminary assessment

5.1 Identified sites

The six nominated potential emergency landfill sites are identified in Figures 1-8 in Appendix A. The site visit conducted by GHD, Riverview and LDA confirmed these locations were suitable for potential emergency landfill locations.

5.2 High level assessment

5.2.1 Item ranking

The following section describes the observations made and justification for the rank of each site for each of the assessment criteria.

Location accessibility (to location gate)

- Site 6 was considered to have the best accessibility to the landfill gate based on the likely roads travelled to reach the site (from the Canberra centre of population) as the majority of the haulage could be covered via the Kings Highway; and
- The rest of the sites were accessed in similar ways, and were ranked predominately on the distance which needed to be travelled;
- Site 3 ranked lowest given its location in the centre of Kowen Forest (i.e. furthest away from main road).

Location accessibility (from gate to emergency landfill location)

- Site 6 ranked highest due to the relatively flat topography leading towards the site, with Site 1 and Site 2 close behind; and
- Site 3 ranked next highest, whilst Sites 4 and 5 ranked lowest given the steep topography leading towards these sites.

Future expansion potential

- Site 6 was considered to have the highest expansion potential based on the local topography, however Site 3 also scored highly; and
- The rest of the sites scored similarly based on the local conditions.

Haulage distance

- Generally, the sites ranked similarly for this category with the exception of Site 3 given its location in the centre of Kowen Forest (resulting in the longest haulage distance and therefore the lowest score).

Airport

- Site 6 was ranked highest as it is the furthest from the airport of all the sites, followed by Sites 1, 2 and 3; and
- Site 4 and 5 ranked lowest given their relatively close proximity to the airport.

Local infrastructure

- Sites 1 and 2 ranked highest based on their close proximity to local infrastructure (particularly infrastructure servicing Queenbeyan East); and

- Sites 4, 5 and 6 all ranked similarly whilst Site 3 ranked lowest given its location in the centre of Kowen Forest (furthest from existing local infrastructure).

Alternative waste transport options

- Site 6 ranked highest given its close proximity to the local rail line, followed by Sites 1 and 2, then Site 3; and
- Sites 4 and 5 ranked lowest as they were located to the north, furthest from the local rail line.

5.2.2 Overall ranking

Using the site assessment criteria and the associated weightings previously outlined, the sites were ranked using Methods 1 and 2.

Method 1 ranking

For Method 1, the sites were ranked from 1 = most favourable to 5 = least favourable, based on the assessment criteria and available information for each site. Where options were similar, similarly favourable options were given a ranking of 1, and less favourable options were given rankings starting from 2 and decreasing. The score was derived from multiplying the priority by the ranking for each option. The lowest number was the most preferable. Thus, the site with the lowest score was the preferred location.

The results of this ranking exercise are contained in Table 7 below.

Table 7 Site ranking – Method 1

Assessment Criteria	Priority	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	1	2	2	4	3	3	1
Location accessibility (from gate to emergency landfill location)	2	2	2	3	4	4	1
Future expansion potential	3	3	3	2	4	4	1
Haulage distance	4	2	2	4	3	3	3
Airport	5	4	4	4	4	4	3
Local infrastructure	6	1	1	3	2	2	2
Alternative waste transport options	7	2	2	3	4	4	1
Score		**63**	**63**	**91**	**95**	**95**	**52**
Ranking		**2**	**2**	**4**	**5**	**5**	**1**

Method 2 ranking

For Method 2, each site was given a score from 1-5, with a higher score indicating that the site performed better in for that assessment item/category. The scores were then multiplied by the item weighting to get a weighted score for the item, and the sum of the weighted scores for each site was used to rank the sites. The highest weighted score indicates the preferred site.

The results of this ranking exercise are contained in Table 8 below.

Table 8 Site ranking – Method 2

Assessment Criteria	Weighting	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	25%	3	3	1	2	2	4
Location accessibility (from gate to emergency landfill location)	25%	3	3	2	1	1	4
Future expansion potential	20%	3	3	4	2	2	5
Haulage distance	10%	4	4	2	3	3	3
Airport	10%	2	2	2	2	2	3
Local infrastructure	5%	4	4	2	3	3	3
Alternative waste transport options	5%	3	3	2	1	1	4
Score		**3.1**	**3.1**	**2.2**	**1.9**	**1.9**	**4.0**
Ranking		**3**	**3**	**4**	**6**	**6**	**1**

5.2.3 Outcome of assessment

For both methods, Site 6 is the preferred location for the emergency landfill, with 1 and 2 tying for second place under both scenarios.

5.3 Sensitivity analysis

5.3.1 General

A sensitivity analysis was performed by altering the priority/weighting for each of the site assessment criteria. In the majority of cases, Site 6 was still ranked as the preferred location for the emergency landfill. This is due to its high ranking for each of the site assessment criteria, where it ranked highest in 5 of the 7 categories and still ranked relatively highly for the only other criteria (haulage distance and local infrastructure).

Further information on the sensitivity analysis undertaken and the associated results are contained in Appendix C.

6. Preliminary cost estimate

6.1 General

GHD has developed a preliminary cost estimate for the preferred emergency landfill site location (Site 6). The cost estimate includes costs associated with:

- Gaining the necessary regulatory approvals; and
- Developing and establishing the site.

6.2 Assumptions

The assumptions for the cost estimate are discussed throughout this section as well as outlined in the cost sheet (Appendix D). Key assumptions include:

- The extent of the works are as indicated on the conceptual site sketches;
- The quantities are high level estimates only based on limited topographical data. No 3D modelling has been undertaken;
- Unit Rates include materials, labour and equipment;
- Depth to rippable rock assumed to be 3 m;
- No groundwater ingress as excavation proceeds;
- No provision for changes in legislation, third-party litigation or corrective actions resulting in remediation has been allowed for;
- No allowance for bulking, wastage, overexcavation and tolerances has been made as the earthworks quantities are high level estimates only;
- No allowance for geosynthetic overlaps or seams as the geosynthetic quantities are high level estimates only;
- Leachate will be treated and disposed of on-site (no sewer connection / rising main would be required);
- No groundwater collection system would be required;
- An inherent risk allowance of 5-15% (dependent on the line item) has been applied for this estimate based on the level of accuracy; and
- A contingency allowance of 30% has been applied for this estimate based on the level of assumptions made and the accuracy.

6.3 Exclusions

The following items have been excluded from the cost estimate:

- Project financing costs and insurance;
- Client procurement and tender service costs;
- Owner's contingency (funding set aside to cover for unexpected adjustments, fundamental scope changes, etc);
- Escalation;
- Discounting;
- Staging of landfill cells and infrastructure;

- Indirect costs including Contractor overheads such as mobilisation, supervision, site management and administration, light vehicles, survey set out and as-builts, HSE, rain delays, site offices and associated facilities, insurances, fees, site inductions etc.;
- Client project management during construction;
- Ongoing operation and maintenance costs for the site; and
- Construction of on-site resource recovery facilities and associated infrastructure.

6.4 Regulatory approvals

6.4.1 Overview

The following sections describe the scope of work associated with the development and regulatory approvals process for the site, as well as listing the assumptions made in developing costs for this scope. This scope of work was developed between GHD and Tony Adams of A T Adams Consulting (formerly of CBRE). The costs associated with this scope were developed by GHD in collaboration with Tony Adams.

As a part of the development and regulatory approvals process, it has been assumed that no land acquisition is required to develop the site.

6.4.2 Compatibility with National Capital Authority (NCA)

This step would involve a review of the relevant policies in the National Capital Plan (NCP) and determining how they apply to the site. Upon initial review, it appears that the existing Mugga Lane Landfill Site (MLLS) and West Belconnen Landfill Site (WBLS) are not specifically identified within the NCP (and are located within different zones). Landfill is not defined as a use in the NCP; hence it is neither specifically allowed nor prevented. As such, the proponent would need to develop a proposition for the emergency landfill, and seek confirmation that the NCA concurs that it is reasonable / acceptable.

6.4.3 Seek support from ACT Government for further investigation

This step would involve obtaining in-principle support from the ACT Government for more detailed site investigation. This might involve land access agreements, and liaison with ACT NOWaste and ACT Parks and Conservation (the current custodian of the land). It is also likely to involve management of the current licensee / user.

6.4.4 Undertaking a more detailed site investigation and assessment to confirm the suitability of the site

This step would involve obtaining in-principle support from the ACT Government to use the site as a landfill, subject to planning assessment. This would involve liaison with Land and Property Services (LAPS) and the ACT Planning and Land Authority (ACTPLA), with support from ACT NOWaste. The outcome needs to be an agreed scope for investigations to support a Territory Plan Variation.

6.4.5 Detailed site investigation for design and preparation of Strategic Environmental Assessment (SEA)

This step would involve the preparation of an SEA. This would include concept design of the proposal, and other associated detailed assessments (i.e. flora, fauna, heritage, hydrology, traffic, noise, dust, odour, greenhouse gas etc.).

It is noted that there is an ACTPLA template for this document. Completing a high quality SEA may ensure exemption from having to complete a future Environmental Impact Assessment (EIA).

6.4.6 Public consultation stage on SEA

This step would involve public consultation on the SEA, including preparation and endorsement of a consultation program, the consultation period and preparation of consultation report.

It is noted that the cost of this stage is highly dependent on the quantum of public interest in the project, and thus the associated cost could be highly variable.

6.4.7 Rezoning the land for use as an emergency landfill site

This step would require an alteration to the Territory Plan (undertaken by ACTPLA). It has been assumed the proponent would engage a consultant to liaise with ACTPLA (and keep the momentum of the project going).

6.4.8 Preliminary design of the emergency landfill site

This step would involve the preliminary design of the site; including associated infrastructure (e.g. site entrance / access road). It is noted that this step may not be required if an EIA is not required (as a concept design would be competed as part of the SEA).

For the purposes of this cost estimate, it has been assumed that no EIA is required for this project, and thus this step will not be required.

6.4.9 Preparation of an EIA

This step would involve preparation of an EIA for the proposed development. It is noted that it may be possible to obtain an exemption from this step if a suitably high quality SEA is completed and accepted by the ACT Government. However, the proponent will still need to go through the process of confirming exemption to be granted by the ACT Government.

For the purposes of this cost estimate, it has been assumed that no EIA is required for this project (and therefore only the exemption process would need to be undertaken for this step).

6.4.10 Obtaining development consent from the ACT Government

This step would involve the preparation of a Statement against Criteria, packaging of material and lodgement for development approval (DA). It may also require responding to requests for information and liaison with ACTPLA during the assessment period.

6.4.11 Obtaining environmental authorisation from the ACT EPA for the site

This step would involve applications for the necessary post DA approvals to obtain environmental authorisation (landfill licence / permit) from the ACT EPA for the site.

6.4.12 Detailed engineering design and documentation of the site

This step would involve detailed engineering design and documentation of the site (for Tender / Construction); including the associated infrastructure (see Section 6.5).

6.4.13 Design & asset acceptance by ACT Government

Detailed design for any public assets must be accepted prior to construction. Design acceptance normally occurs in parallel with tendering for construction. Upon construction they must be inspected and accepted for handover to Territory and Municipal Services (TAMS). Asset acceptance occurs after construction (Section 6.5), but prior to operation commencing.

6.5 Developing / establishing the site

6.5.1 Overview

A conceptual layout of the site was developed by GHD to provide the basis for estimating the costs associated with establishing the site. The following describes each of the major items required to develop an appropriate landfill site, the costs associated for each of these items to establish the site, and the assumptions made in developing these costs.

In developing a conceptual layout for the site, it was assumed that the capacity of the site would be 1,000,000 m^3 (the maximum likely disposal capacity at the WBLS if it was re-activated). It was also assumed that the site will receive a waste stream equivalent to that currently landfilled at the MLLS. Appendix D provides sketches of the conceptual site layout.

6.5.2 Site entrance and access roads

To access the site, it is proposed that an access road be upgraded from the Kings Highway to the site, as well as an upgrade of the road intersection from the Kings Highway to this road. The sketches in the Appendix D show the basic layout of these roads. The required intersection upgrade was determined by assessing the estimated truck movements at the site (based on the assumed waste stream inputs). The cost of upgrading this intersection assumes that:

- No utilities are required;
- No reconstruction of the existing pavement is required;
- Only a small amount of widening is required; and
- No signals are required.

6.5.3 Site facilities

For this item, it was assumed that only standard facilities would be required at the site including:

- Standard weighbridge;
- Standard wheelwash;
- Standard site office;
- Standard amenities building; and
- Standard maintenance facility/workshop.

For the infrastructure associated with these facilities (and the rest of the site), the following assumptions were made:

- Telecommunications – assumed it can be supplied to the site by connecting to existing telecommunications infrastructure located adjacent to the Kings Highway;
- Electricity – assumed it can be supplied to the site by connecting into existing electrical infrastructure running across the Kings Highway to the north; and
- Water supply – assumed it can be supplied to the site by connecting to existing water pipes understood to be located to the west.

6.5.4 Cell development

The landfill cells at the site would be developed as per the *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* (EPA Victoria, 2010) (BPEM) as per current ACT EPA advice.

It has been assumed that through the construction staging process the existing pine forest plantation will need to be cut down and removed progressively as part of the works.

It was assumed that geosynthetics would be used to line the landfill, as (based on a preliminary assessment of the geology at the site) there is insufficient usable clay to construct a clay liner from on-site materials. As the site will receive putrescible waste, a composite geomembrane / GCL liner is proposed (in accordance with the BPEM).

It is proposed that that the “bowl” shape of the local topography is retained (as it is sympathetic to landfilling activities), with minimal excavation to provide grades suitable for placement of waste. Typical sections showing the conceptual design of the site (with proposed excavated levels and final landform) are provided in Appendix D.

In assessing excavation costs at the site, it was assumed (based on a preliminary assessment of the geology at the site) that the top 3 m of material at the site (below the existing surface) is soil, whilst anything below this is rippable rock. Excavation and filling volumes were aimed at producing an excess of excavated material, which could be used as cover material during the site’s operational phase.

6.5.5 Water management

Water management at the site includes management of stormwater and leachate at the site:

- It was assumed that stormwater will be managed via a series of diversion and collection drains. One sediment dam will be constructed to treat on-site stormwater; and
- It has been assumed that leachate will be managed via on-site treatment and irrigation. On-site treatment and irrigation infrastructure would include a leachate storage pond (for storage prior to treatment), a treatment plant, a second storage pond (for storage of treated leachate prior to irrigation), and irrigation infrastructure.

6.5.6 Monitoring infrastructure

Monitoring infrastructure includes groundwater and landfill gas monitoring bores situated around the perimeter of the site. The amount of groundwater bores proposed was based on GHD’s previous experience. The amount of landfill gas bores proposed has been based on BPEM requirements.

6.6 Project cost estimate

6.6.1 Summary

Table 9 summarises the preliminary cost estimate for establishing an emergency landfill at the site (as per the scope of work identified in Section 1.3). The full breakdown of the preliminary cost estimate can be found in Appendix D and provides an estimated cost for each identified cost item and lists the source of the estimate (GHD, Tony Adams, or other).

Table 9 Summary of preliminary cost estimate

Item	Cost
Regulatory approvals process	
Base estimate (including inherent risk adjustment)	$1,050,000
Contingency	$320,000
GST	$140,000
Total	$1,510,000
Site development / establishment	
Base estimate (including inherent risk adjustment)	$23,600,000
Contingency	$7,100,000
GST	$3,100,000
Total	$33,800,000
Grand total	$35,310,000

6.6.2 Inherent and contingent risk

Risk workshops dedicated to the formation of a risk register for the purpose of conducting a probabilistic risk assessment were not carried out by GHD.

Subsequently, contingencies were calculated in the following manner (derived by reference to industry standards):

- An assessment of inherent risk has been made by GHD based on assumptions applied during the estimation process and the likely accuracy of measured and rated items included to form the base estimate; and
- Project contingency has been calculated at a % mark-up on the base estimate. Contingency is an allowance for unforeseen items not covered in the base estimate. Contingency is a function of the level of assumptions made for the estimate and the level of accuracy of the estimate. A contingency allowance of 30% has been applied for this estimate to consider overall project risk.

6.6.3 Estimate reliance

This estimate has been prepared on pre-concept design and project information and is reliant and fundamental assumptions which have yet to be proven by further project development. As such all aspects of the project are considered highly variable and subject to change. The level of confidence to be expected is in the order of +/-40%. We note that the level of estimate reliance is generally a function of design definition and will increase as the project matures toward contract formation.

7. Conclusions and recommendations

7.1 Conclusions

Based on the outcomes of the assessment, GHD makes the following conclusions:

- Six potential sites were identified within the Kowen Forest area which could potentially be developed as an emergency landfillfor the ACT
- Based on our high level assessment, a preferred site (Site 6) was established; and
- A preliminary cost estimate was developed for this site, considering costs associated with gaining the necessary regulatory approvals and developing/establishing the site. The estimated costs are outlined in Table 9.

7.2 Recommendations

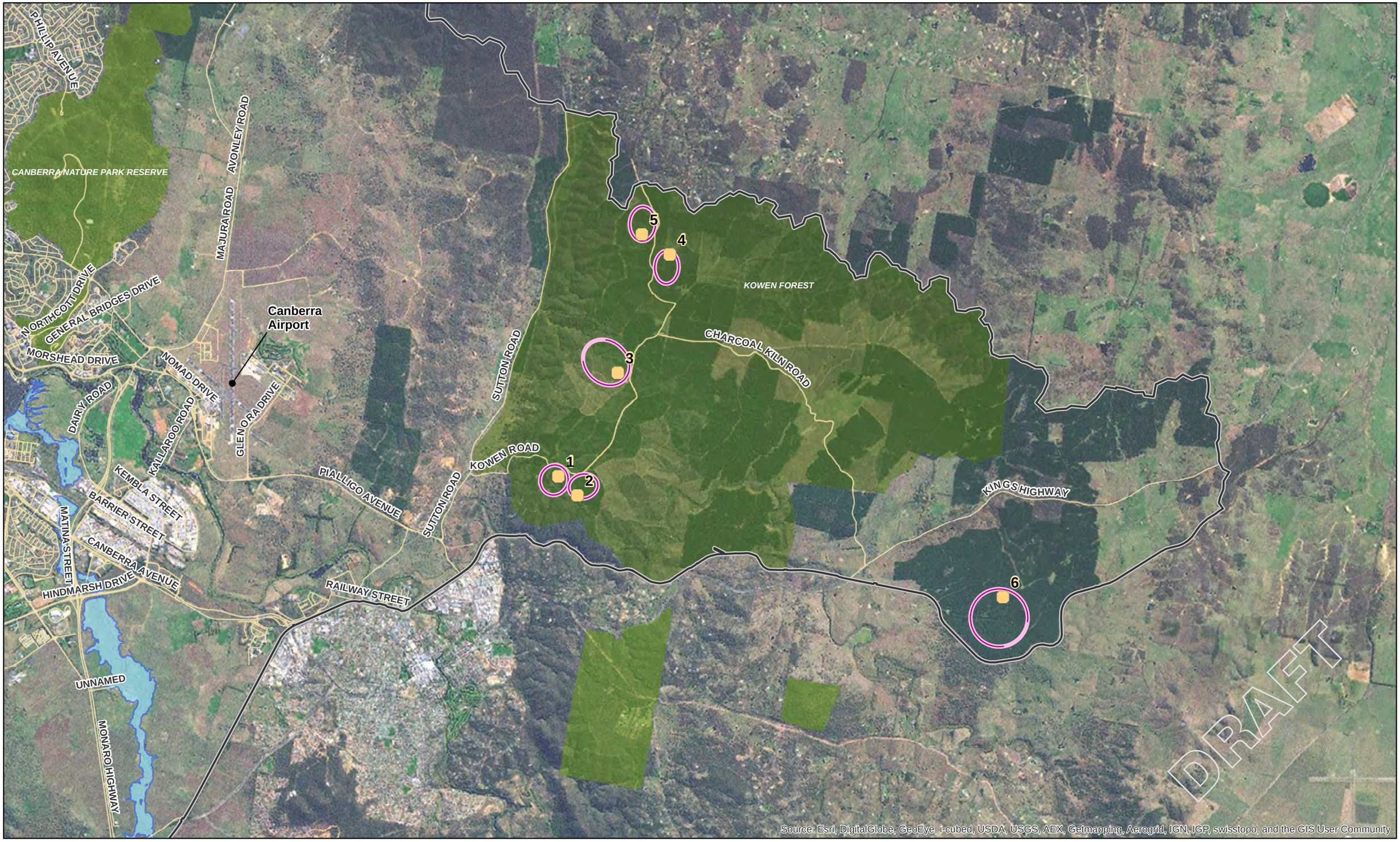
Based on the outcomes of the assessment, GHD makes the following recommendations:

- LDA and Riverview should discuss the findings of this report with the relevant stakeholders in relation to whether one of the identified sites should be pursued for future use as an emergency landfill site to replace the current WBLS; and
- If it is agreed that one (or more) of the identified sites is suitable for future use as an emergency landfill site and possibly provide the ACT Government with solutions for other waste operations in future (and that this would remove the emergency landfill status currently at the WBLS and the associated implications for the proposed adjacent development), the project should be pursued further. This may include undertaking preliminary site investigations and commencement of associated environmental studies required to obtain approval for an emergency landfill site in the ACT.

Appendices

Appendix A – Figures and sketches

Figure 1:	Potential site locations
Figures 2-8:	Constraints mapping



Paper Size A3

0 0.5 1 2 3

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Potential site location
- Proposed approximate site boundary
- ACT border
- 1 in 100yr event
- Forestry Reserve
- Nature Conservation Reserve

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

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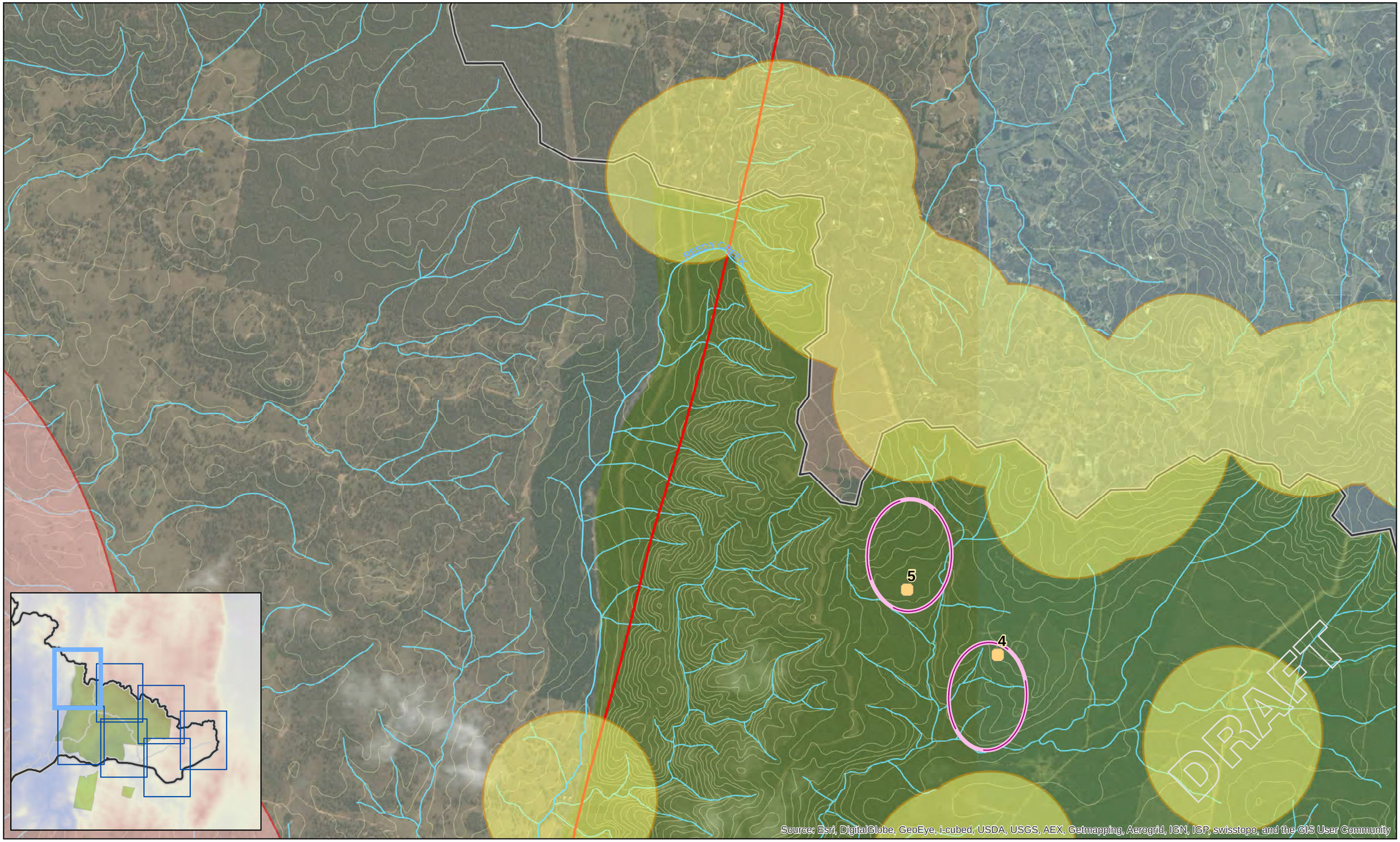
Potential Site Locations

Figure 1

N:\AU\Sydney\Projects\21\23237\GIS\Maps\MXD\2123237_Z003_SiteOptions.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Potential site location
- Proposed approximate site boundary
- ACT border
- Forestry Reserve
- Building/Structures buffer (500m)
- Airport buffer (3km)
- Inland waters buffer (100m)
- Canberra geology - 100K Fault lines
- Inland waters

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Constraints Mapping

Figure 2

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

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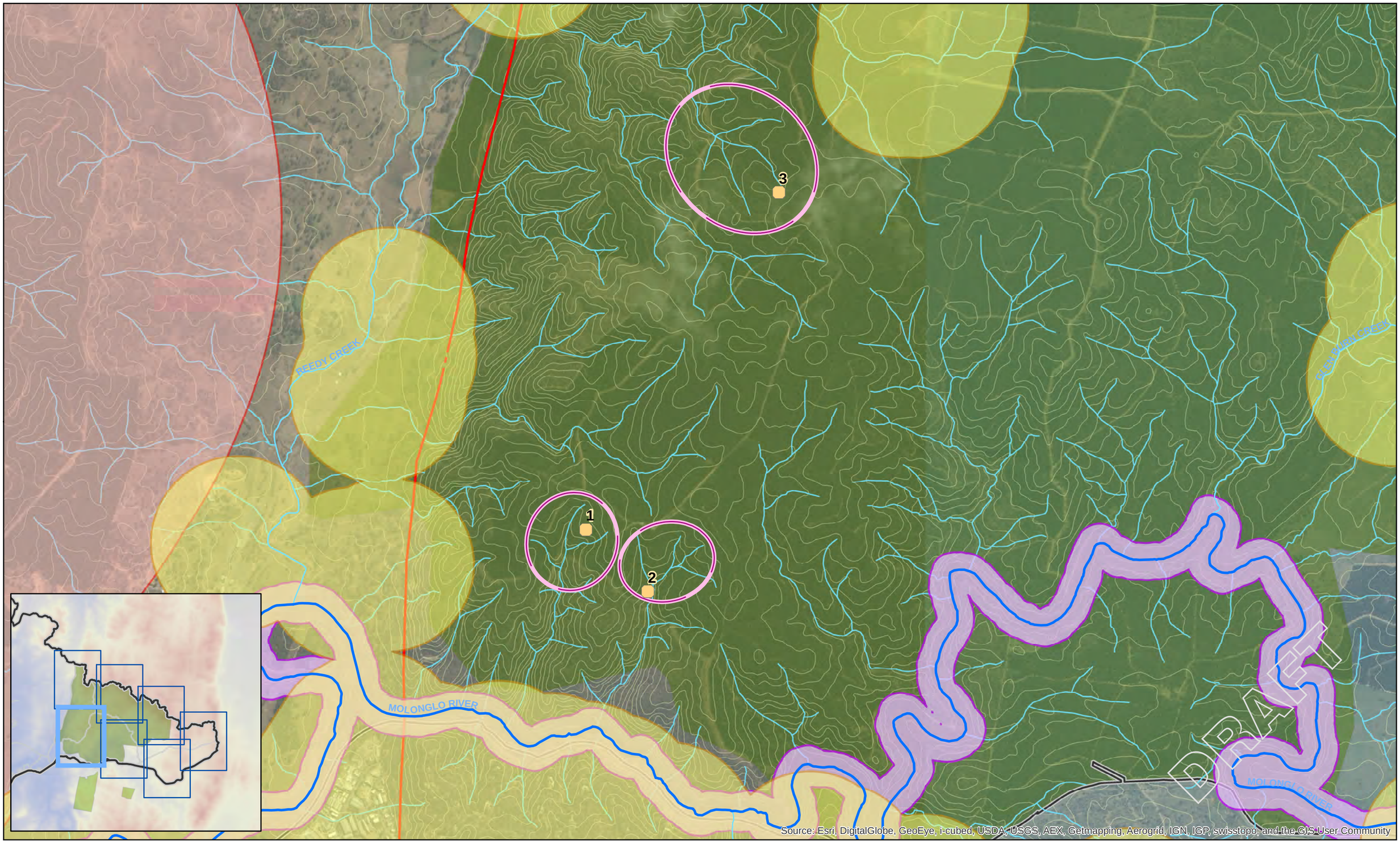

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Kilometres

Map Projection: Transverse Mercator
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Constraints Mapping

Figure 3

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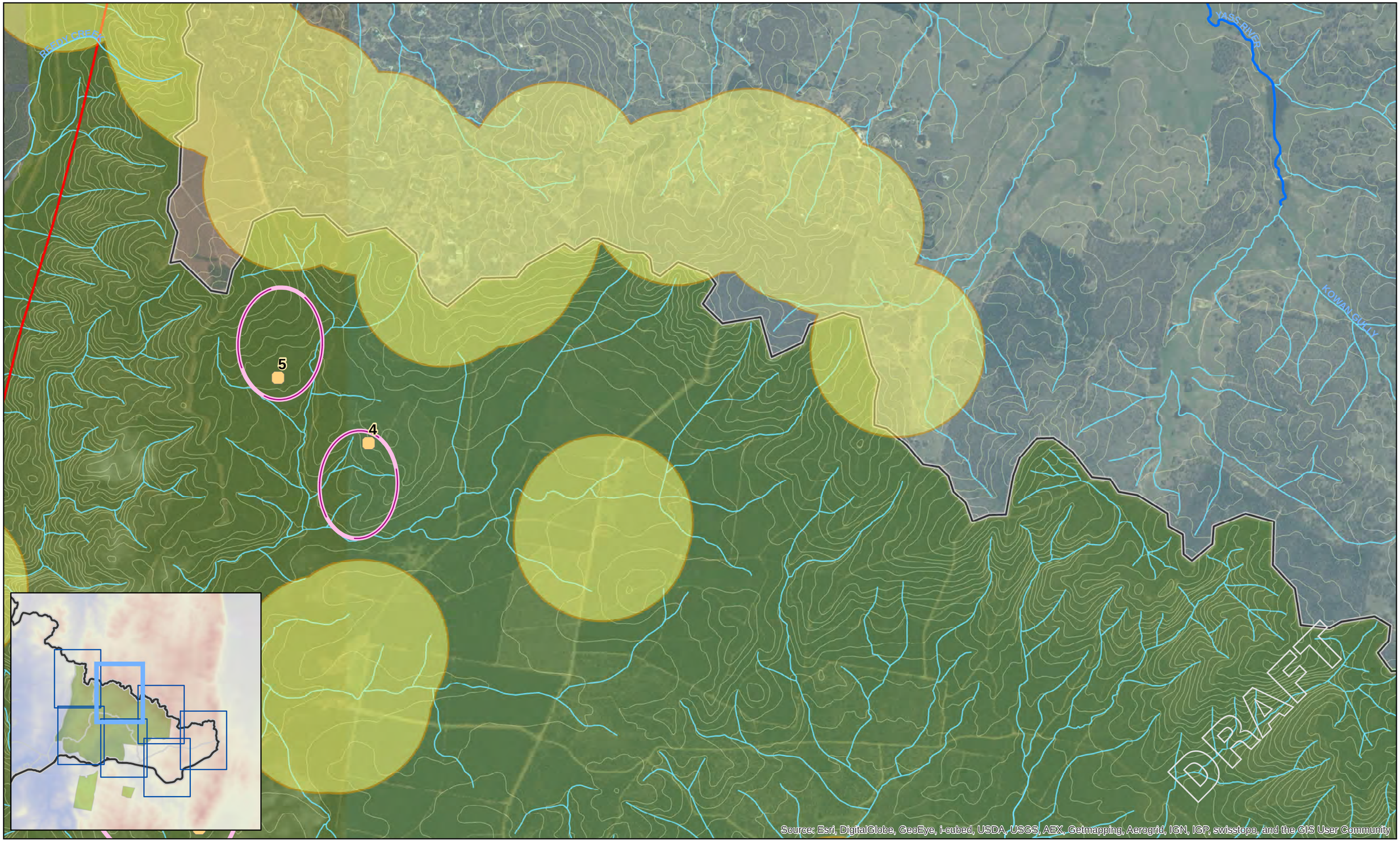

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Potential site location
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- Building/Structures buffer (500m)
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- Inland waters buffer (100m)
- Canberra geology - 100K Fault lines
- Inland waters

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Constraints Mapping

Figure 4

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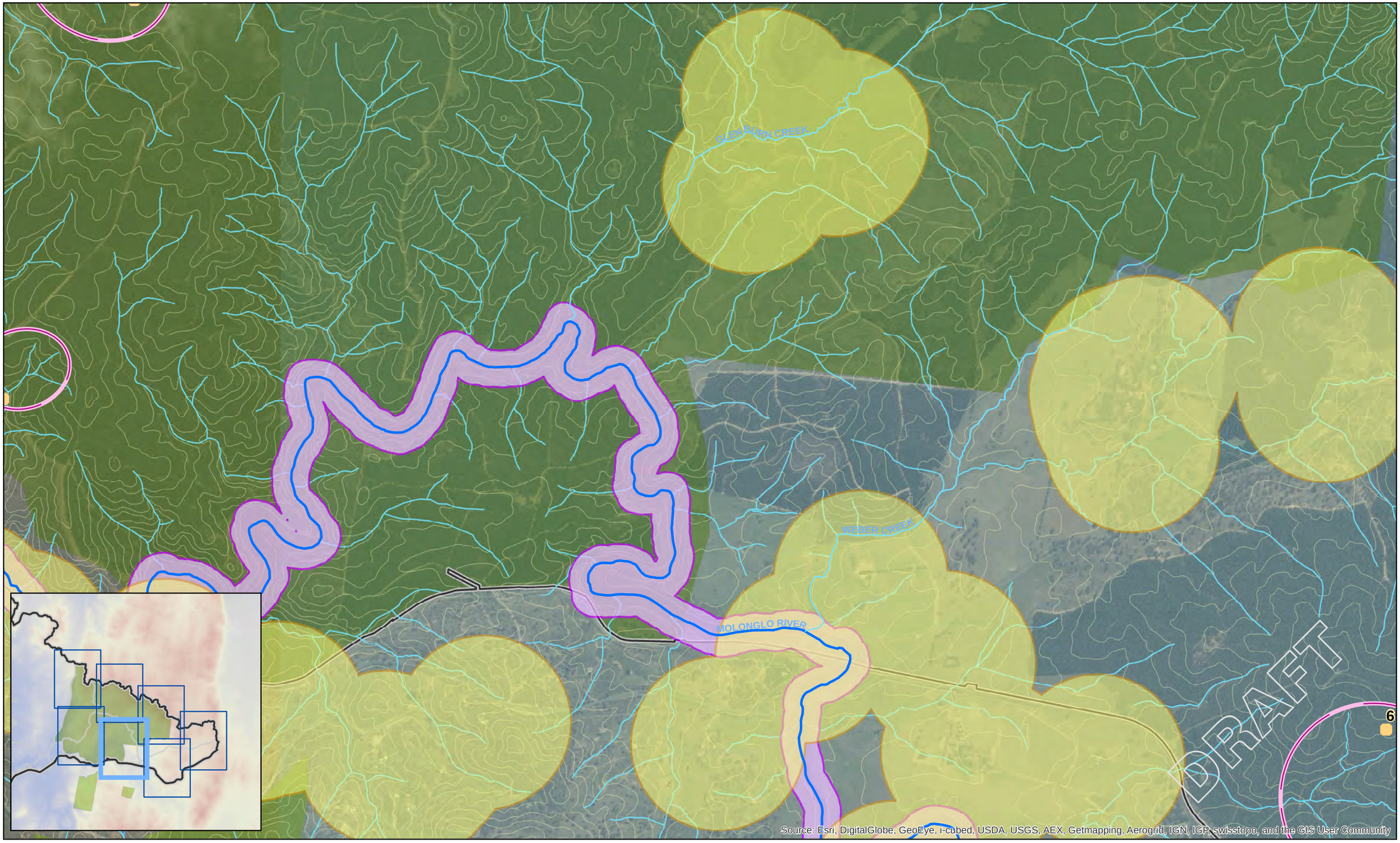

Paper Size A3

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

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Legend

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- Building/Structures buffer (500m)
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- Canberra geology - 100K Fault lines
- Inland waters

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Constraints Mapping

Figure 5

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Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Paper Size A3

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Kilometres

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- Inland waters

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Constraints Mapping

Figure 6

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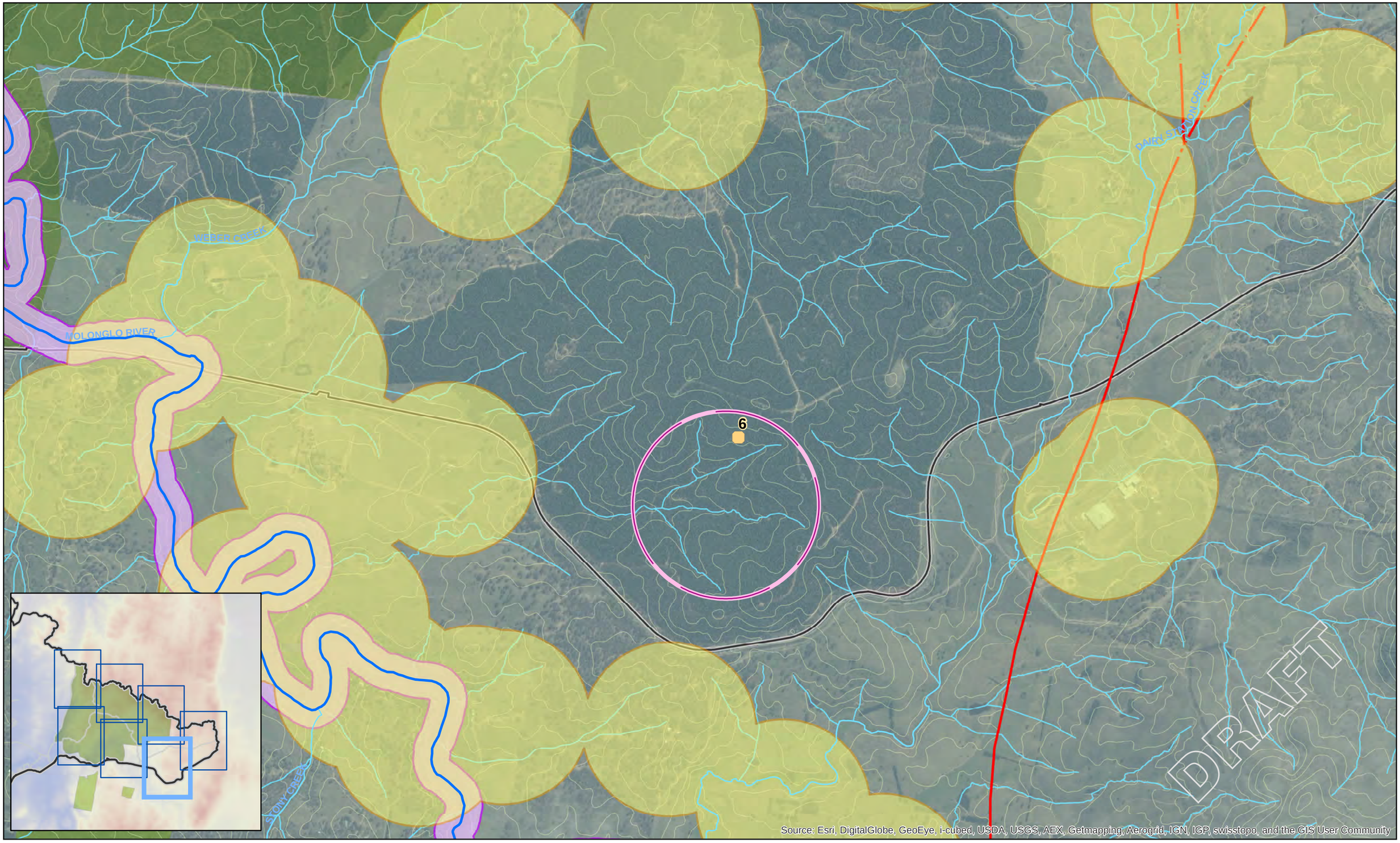

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Constraints Mapping

Figure 7

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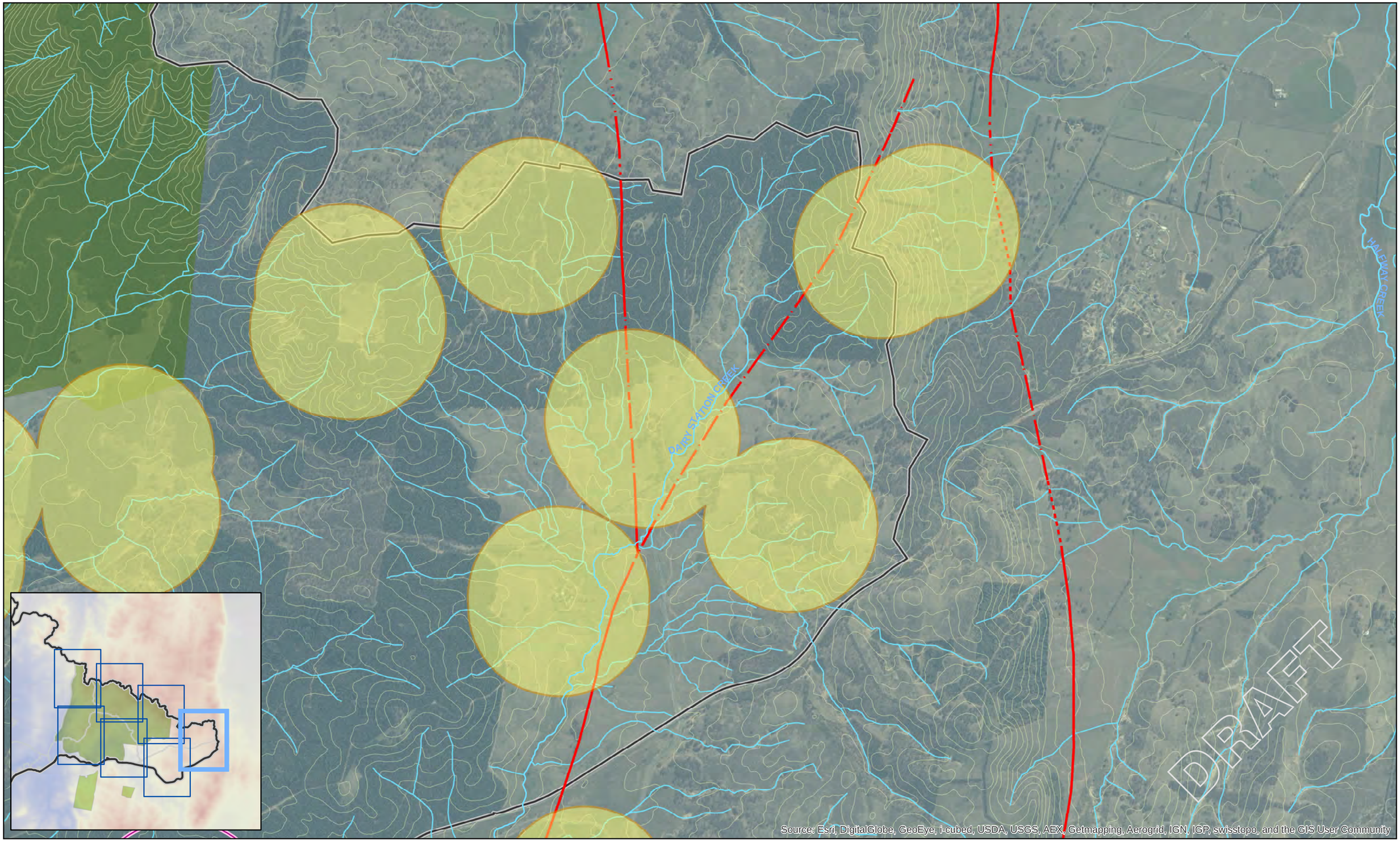
Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung



Paper Size A3

0 0.25 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Potential site location
- Proposed approximate site boundary
- ACT border
- Forestry Reserve
- Building/Structures buffer (500m)
- Airport buffer (3km)
- Inland waters buffer (100m)
- Canberra geology - 100K Fault lines
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Constraints Mapping

Figure 8

N:\AU\Sydney\Projects\21\23237\GIS\Maps\MXD\2123237_Z004_SiteOptions_MapBook.mxd

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Appendix B – Site visit technical notes

Memorandum

14 May 2014

To	Matt Welsh		
Copy to	As appropriate		
From	Matt Welsh	Tel	02 9239 7359
Subject	Kowen Forest - Site Inspections for Emergency Landfill Site - GHD Field Notes	Job no.	21/23237

These notes detail Mr. Matt Welsh's field notes from the field inspection of six (6) potential locations for an emergency landfill site in the Kowen Forest area of the ACT. These notes should be read in conjunction with Figures 9 to 15 (Attachment 1). Figure 9 shows the location of each potential emergency landfill site.

The inspections were undertaken between approximately 8 a.m. and 1 p.m. on 06 March 2014. Matt Welsh was accompanied by Mr. Tony Adams (A T Adams Consulting), Mr. Tom Gordon (ACT Government) and the site ranger.

Notes:

- Kowen Forest area (large area of total area circa 25 km^2 to the north of the Kings Highway).
- Kowen Forest East / Sparrow Hill area (smaller area of total area circa 4 km^2 to the south of the Kings Highway).
- Six potential emergency landfill sites inspected. Locations 1 to 5 were in Kowen Forest area. Location 6 was in Kowen Forest East area (Attachment 1, Figure 9). Soils, geology, topography and ecological value similar at all six sites. Surface soils across sites consist of approximately ~300 mm to 1000 mm of soil then rippable shales. No free flowing rivers or streams observed at any of the inspected sites.

Kowen Forest Area:

- No permanent habitations. Few old homesteads used for events (including Kowen farmstead).
- No water flow observed in gullies by ranger during periods of heavy rain.
- Soils type looks like shallow (< 1 metre thick) silty / clay soil underlain by weathered shale.
- No information on groundwater levels across Kowen Forest area by ranger
- Roads are mostly 50:50 road base / gravel in Kowen Forest, with some short stretches tarmac / asphalt
- Events / recreational activities occur in Kowen Forest every weekend and during the week. These include:

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  - Horse riding, camping, motor cycles
  - Car rally / time trials – 1000's of people
  - The "MONT" = 24 hour mountain bike ride
  - Capital punishment = annual mountain bike race
- Most events are held along "Fernside" which is a major gravel road running through this area.
- Most recreational activities in Kowen Forest, but some in Kowen Forest East.
- "These events / recreational activities are not a constraint for an emergency landfill site" (ACT Government comment).
- The Molonglo River is deeply incised near the Kowen Forest and Kowen Forest East areas. Significant flooding has not historically been a problem near the river at these areas.
- Comments on Sites 1 to 5:
  - Site 2 (Attachment 1, Figure 11) - Some standing water / erosion in main drainage channel (Attachment 2, Plate 6)
  - Site 3 (Attachment 1, Figure 12) - Some standing water / erosion in main drainage channel (Attachment 2, Plate 9).
  - Site 4 and Site 5 (Attachment 1, Figures 13 and 14) – situated in northern portion of Kowen Forest
  - Roads into potential sites 1 to 5 are generally very steep and mixture of gravel and tarred sections (eg. Attachment 2, Plate 10, Plate 21, Plate 22)
  - There is a one way system in operation at sites 1 to 5 due to the logging trucks in the Kowen Forest area. Not much logging actually occurs. Logging trucks seem to have few access problems whether laden or unladen but only work at certain times of the year.
  - Parrots, termites and kangaroos spotted in general Kowen Forest area.

- **Kowen Forest East Area:**
- No permanent habitations.
- No water flow observed in gullies by ranger during periods of heavy rain.
- Soils type looks like shallow (< 1 metre thick) silty / clay soil underlain by weathered shale.
- No information on groundwater levels across Kowen Forest East area by ranger.
- Roads are a mixture of gravel with some short stretches tarmac / asphalt.
- Limited events / recreational activities occur in Kowen Forest East (e.g. mountain biking).
- "These events / recreational activities are not a constraint for an emergency landfill site" (ACT Government comment).
- The Molonglo River is deeply incised near the Kowen Forest and Kowen Forest East areas. Significant flooding has not historically been a problem near the river at these areas.
- Comments on potential site 6 (Attachment 1, Figure 15):

- No standing water observed but some erosion in main drainage channels (Appendix B, Plate 23).
- ACT NOWaste supply waste services to Palerang and Queanbeyan over the border in NSW.
- Site has to be accessed through NSW.
- Main Canberra to Sydney train line runs immediately to the site's south. Waste could potentially be brought in by train, possibly via a siding at Fyshwick.
- This site looks to have the greatest potential capacity and ability to expand in the future if additional capacity is required.
- Access roads are less steep than those in Kowen Forest.
- Majority of current logging occurs at Kowen Forest East.
- Logging trucks seem to have few access problems whether laden or unladen but only work at certain times of the year.
- Parrots, termites and kangaroos spotted in Kowen Forest East area.

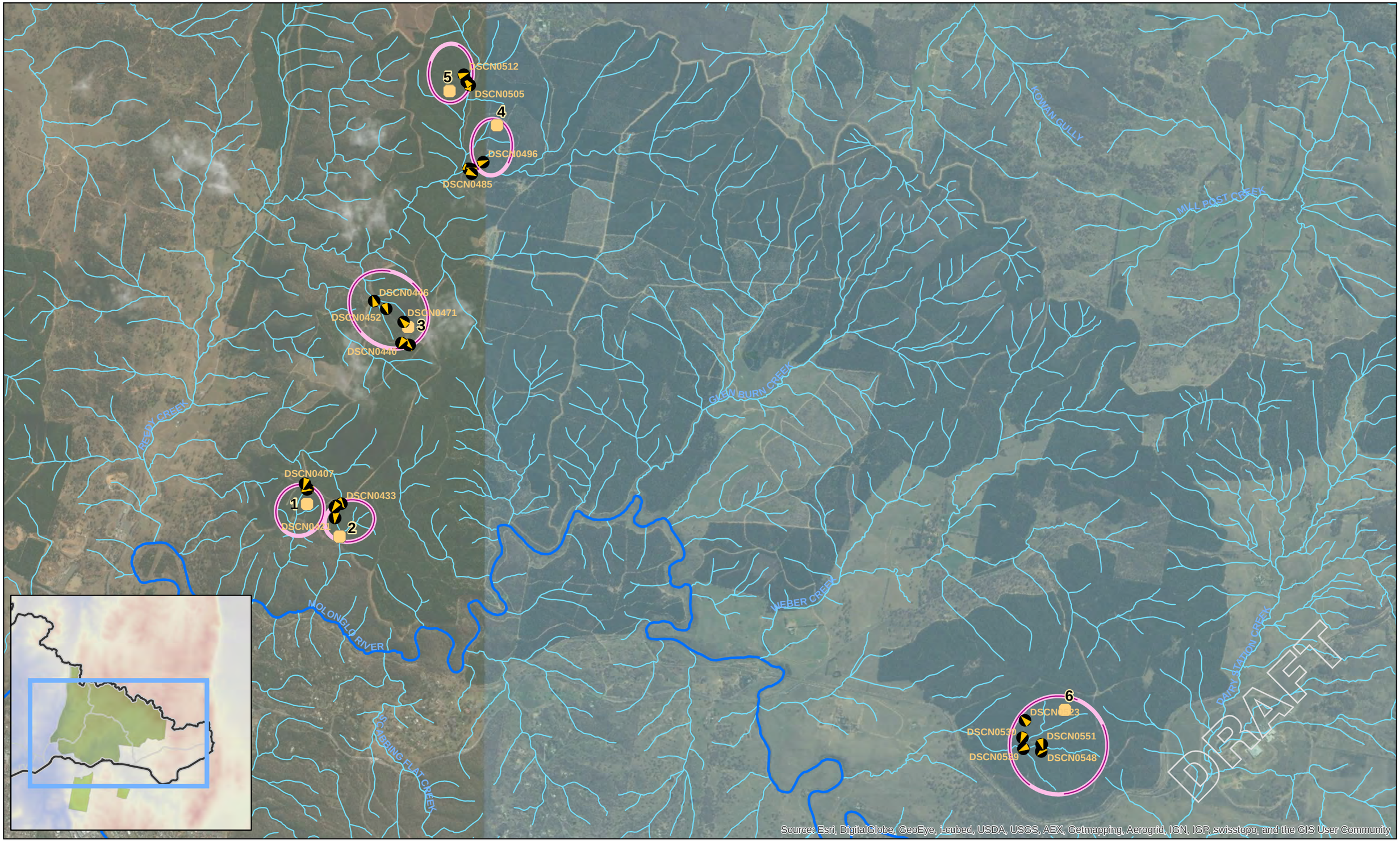
Regards

Matt Welsh
Senior Landfill Gas Specialist

Attachment 1: Figures
Attachment 2: Selected site photos

Attachment 1

Figures



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs - Overview of all sites

Figure 9

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

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Paper Size A3

0 40 80 160

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

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Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs - Site 1

Figure 10

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

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Paper Size A3

0 25 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

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Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs - Site 2

Figure 11

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs
- Site 3

Figure 12

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs - Site 4

Figure 13

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

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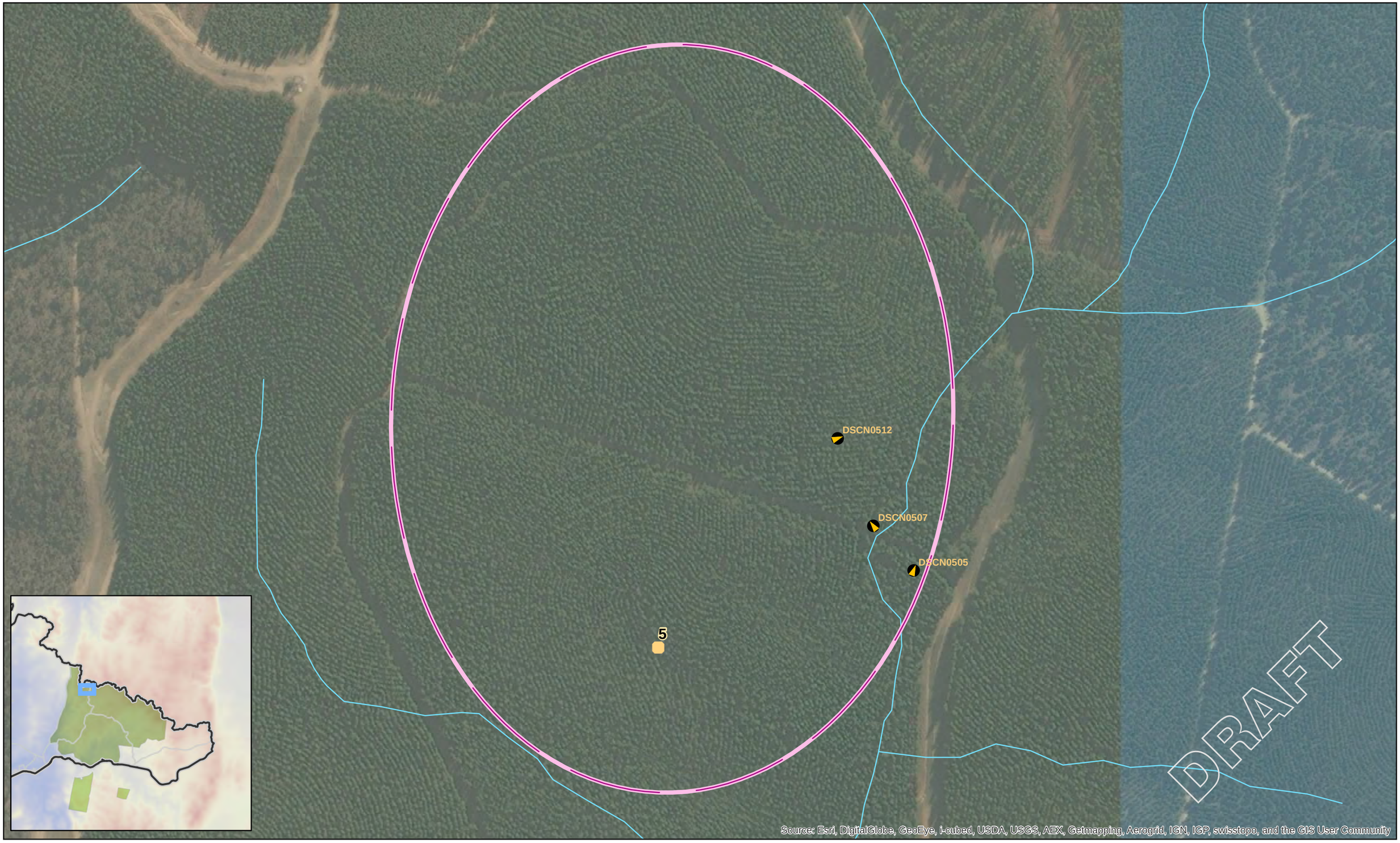

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs
- Site 5

Figure 14

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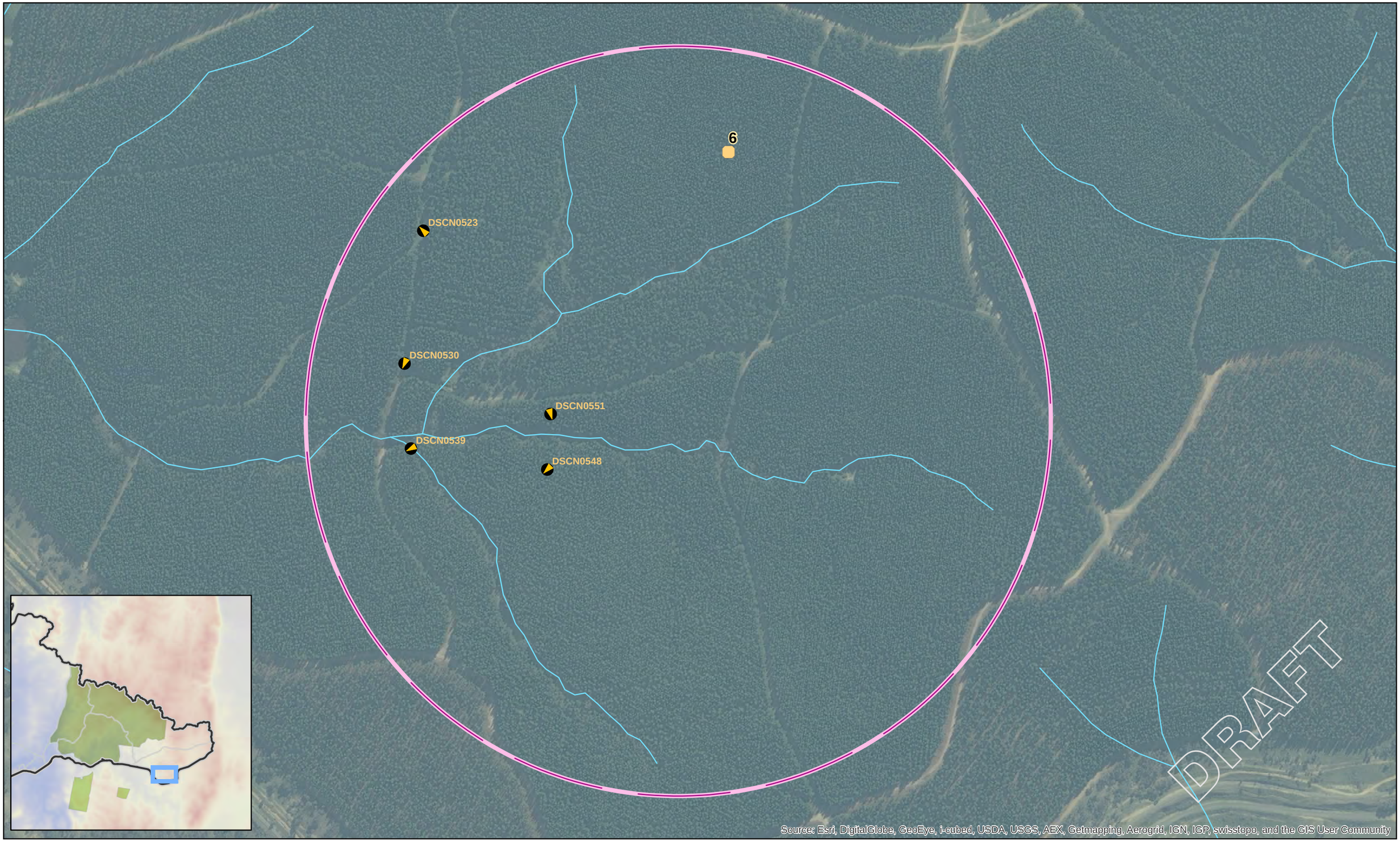
Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com



Paper Size A3

0 65 130 260

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
Grid: AGD 1966 ACT Grid AGC Zone

N

Legend

- Location photos were taken and their associated angle
- Potential site location
- Proposed approximate site boundary
- Inland waters

Kowen Forest Emergency Landfill
Riverview Projects (ACT) Pty Ltd

Job Number	21-23237
Revision	A
Date	02 May 2014

Site Photographs
- Site 6

Figure 15

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Data Source: ACT Government: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

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Attachment 2

Selected site visit photos.

Tables 1-5 should be read in conjunction with Figures 9 to 14.

Table 1 Photographs from Site 1

Photo location	Plate
DSCN0401 Facing north	 **Plate 1**

DSCN0407 Facing east, northern access road	 **Plate 2**
DSCN0399 Facing south	 **Plate 3**

Table 2 Photographs from Site 2

Photo location	Plate
DSCN0411 Facing south-east	 **Plate 4**
DSCN0413 Facing south-east	 **Plate 5**

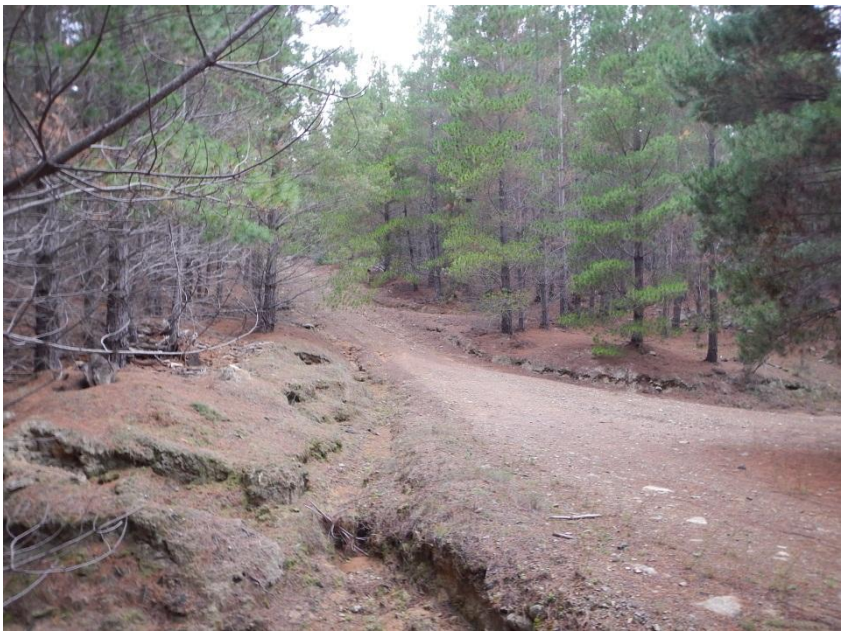
DSCN0421 Southern end, facing south-west Surface water run off beside the road causing erosion	 **Plate 6**
DSCN0433 Northern end, facing north-east	 **Plate 7**

Table 3 Photographs from Site 3

Photo location	Plate
DSCN0436 Southern point, facing north-west	 **Plate 8**
DSCN0438 Southern point, surface water runoff causing erosion	 **Plate 9**

DSCN0440 Facing south east, gravel access road	 **Plate 10**
DSCN0446 Facing south west, northern portion of proposed area showing 50/50 dirt and gravel access roads	 **Plate 11**

DSCN0471 Facing up hill (south-west), mid region	 **Plate 12**
DSCN0452 Facing north east, mid region looking across the hill	 **Plate 13**

Table 4 Photographs from Site 4

Photo location	Plate
DSCN0485 Facing north-east, showing surface water	 **Plate 14**
DSCN0476 Gravel access road, facing north	 **Plate 15**

DSCN0480 Over grown access road, facing south	 **Plate 16**
DSCN0496 Facing north, slight gully	 **Plate 17**

Table 5 Photographs from Site 5

Photo location	Plate
DSCN0505 Facing north, southern access road	 **Plate 18**
DSCN0507 Facing south-west, mid section, showing dirt access roads	 **Plate 19**

DSCN0512 Facing north	 **Plate 20**

Table 6 Photographs from Site 6

Photo location	Plate
DSCN0523 Facing south-west, showing a steep access road.	 **Plate 21**
DSCN0530 Facing west	 **Plate 22**

DSCN0539 Facing south-west, showing a gully	 **Plate 23**
DSCN0548 Facing south-east	 **Plate 24**

DSCN0551 Facing east	 **Plate 25**

Appendix C – Sensitivity analysis results

C1.1 General

A sensitivity analysis was performed by altering the priority/weighting for each of the assessment criteria items. In the majority of cases, Site 6 was still ranked as the preferred location for the emergency landfill. This is due to its high ranking for each of the assessment items, where it ranked highest in 5 of the 7 categories, still ranked relatively high for the only other items (haulage distance and local infrastructure).

Two of the sensitivity analysis cases considered during the assessment are described below.

C1.2 Scenario 1: equal rankings

A sensitivity analysis was run with equal weightings across all of the criteria items. The results are provided in C1 and C2. Both show Site 6 as the preferred site.

Table C1 Site ranking – Method 1 (Scenario 1)

Assessment Criteria	Priority	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	1	2	2	4	3	3	1
Location accessibility (from gate to emergency landfill location)	1	2	2	3	4	4	1
Future expansion potential	1	3	3	2	4	4	1
Haulage distance	1	2	2	4	3	3	3
Airport	1	4	4	4	4	4	3
Local infrastructure	1	1	1	3	2	2	2
Alternative waste transport options	1	2	2	3	4	4	1
Score		**16**	**16**	**23**	**24**	**24**	**12**
Ranking		**2**	**2**	**4**	**5**	**5**	**1**

Table C2 Site ranking – Method 2 (Scenario 1)

Assessment Criteria	Weighting	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	14%	3	3	1	2	2	4
Location accessibility (from gate to emergency landfill location)	14%	3	3	2	1	1	4
Future expansion potential	14%	3	3	4	2	2	5
Haulage distance	14%	4	4	2	3	3	3
Airport	14%	2	2	2	2	2	3
Local infrastructure	14%	4	4	2	3	3	3
Alternative waste transport options	14%	3	3	2	1	1	4
Score		**3.1**	**3.1**	**2.1**	**2.0**	**2.0**	**3.7**
Ranking		**3**	**3**	**4**	**6**	**6**	**1**

C1.3 Scenario 2: reversed rankings

A sensitivity analysis was run with the weightings reversed across the criteria items (i.e. the highest weighted items became the lowest weighted items). The results are provided in Table D3 and Table D4. Both show Site 6 as the preferred site.

Table C3 Site ranking – Method 1 (Scenario 2)

Assessment Criteria	Priority	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	7	2	2	4	3	3	1
Location accessibility (from gate to emergency landfill location)	6	2	2	3	4	4	1
Future expansion potential	5	3	3	2	4	4	1
Haulage distance	4	2	2	4	3	3	3
Airport	3	4	4	4	4	4	3
Local infrastructure	2	1	1	3	2	2	2
Alternative waste transport options	1	2	2	3	4	4	1
Score		**65**	**65**	**93**	**97**	**97**	**44**
Ranking		**2**	**2**	**4**	**5**	**5**	**1**

Table C4 Site ranking – Method 2 (Scenario 2)

Assessment Criteria	Weighting	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Location accessibility (to location gate)	5%	3	3	1	2	2	4
Location accessibility (from gate to emergency landfill location)	5%	3	3	2	1	1	4
Future expansion potential	10%	3	3	4	2	2	5
Haulage distance	10%	4	4	2	3	3	3
Airport	20%	2	2	2	2	2	3
Local infrastructure	25%	4	4	2	3	3	3
Alternative waste transport options	25%	3	3	2	1	1	4
Score		**3.2**	**3.2**	**2.2**	**2.1**	**2.1**	**3.6**
Ranking		**3**	**3**	**4**	**6**	**6**	**1**

Appendix D – Preliminary cost estimate and associated sketches

Sketch 1:	Emergency landfill site location
Sketch 2:	Emergency landfill site layout
Sketch 3:	Emergency landfill typical sections (conceptual)

Bill of Quantities and Preliminary Cost Estimate
Cover Sheet

Client:	Riverview	**Job Number:**	21-23237	**Revision:**	B
Project:	Kowen Forest Emergency Landfill	**Prepared by:**	C Nivison-Smith	**Date of issue:**	19-Jun-14
Subject:	High Level Assessment	**Checked by:**	A Roberts / M Welsh	**Date of review:**	19-Jun-14
Accuracy ±	40%	**Type:**	Budget		

Purpose:

This Quantity Estimate and Preliminary Cost Estimate has been prepared for the purpose of conducting a high level assessment of establishing a new emergency landfill and must not be used for any other purpose.
It is suitable for:
- preliminary comparison of alternatives
- indication of whether there is a case for further study such a detailed engineering study
- rejection of a site

It is NOT suitable for:
- meaningful economic evaluation (such as financing or tender evaluation)
- positive acceptance of a site without a detailed engineering study

Assumptions:

- The extent of the works are as indicated on the conceptual site sketches
- The quantities are high level estimates only based on limited topographical data. No 3D modelling has been undertaken
- Unit Rates include materials, labour and equipment
- Depth to rippable rock assumed to be 3m
- No groundwater ingress as excavation proceeds
- No provision for changes in legislation, third-party litigation or corrective actions resulting in remediation has been allowed for
- No allowance for bulking, wastage, overexcavation and tolerances has been made as the earthworks quantities are high level estimates only
- No allowance for geosynthetic overlaps or seams as the geosynthetic quantities are high level estimates only
- Leachate will be treated and disposed of on-site (no sewer connection / rising main would be required)
- No groundwater collection system would be required
- An inherent risk allowance of 5-15% (dependent on the line item) has been applied for this estimate based on the level of accuracy
- A contingency allowance of 30% has been applied for this estimate based on the level of assumptions made and the accuracy

Exclusions:

- Project financing costs and insurance
- Client procurement and tender service costs
- Owner's contingency (funding set aside to cover for unexpected adjustments, fundamental scope changes, etc)
- Escalation
- Discounting
- Staging of landfill cells and infrastructure
- Indirect costs including Contractor overheads such as mobilisation, supervision, site management and administration, light vehicles, survey set out and as-builts, HSE, rain delays, site offices and associated facilities, insurances, fees, site inductions etc.
- Client project management during construction
- Ongoing operation and maintenance costs for the site
- Construction of on-site resource recovery facilities and associated infrastructure

References:

1. High Level Feasibility Assessment Report (GHD, 2014)
2. Conceptual site layout and cross-section sketches
3. Rawlinsons Australian Construction Handbook (2013)
4. Engineering experience & recent similar projects
5. Tony Adams of A T Adams Consulting (formerly of CBRE)

Disclaimer:

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.
Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

Bill of Quantities and Preliminary Cost Estimate

Client: Riverview
Project: Kowen Forest Emergency Landfill
Subject: High Level Assessment
Accuracy ± 40%

Job Number: 21-23237
Prepared by: C Nivison-Smith
Checked by: M Welsh
Type: Budget

Revision: A
Date of issue: 19-Jun-14
Date of review: 19-Jun-14

Item #	Description	Units	Estimated Quantity	Unit Rate	Inherent Risk Adjustment	Base Estimated Amount	Adjusted Estimated Amount	Reference ID	Notes
Compatibility with NCA									
A1.01	Confirm use of site is not inconsistent with NCA	1	Item	$7,500	15%	$7,500	$9,000	5	Review NCP, prepare proposition paper & liaison with NCA
5									
A2.01	Obtain ACT government support for further investigation of opportunity	1	Item	$7,500	15%	$7,500	$9,000	5	To obtain in-principle support, may require land access arrangements and liaison with ACT NOWaste, PCS and the current licensee. Difficult to acertain quantum of work.
More detailed site investigation and assessment									
A3.01	Co-ordination of LAPS, ACT NOWaste and ACTPLA to discuss proposal	1	Item	$25,000	15%	$25,000	$29,000	5	Co-ordination of meetings with LAPS, ACT NOWaste and ACTPLA. Includes additional contingency if ACT government is to seek initial feedback from key stakeholders
A3.02	Development of SEA scoping document	1	Item	$15,000	15%	$15,000	$17,000	5	May be completed by ACTPLA
A3.03	Undertake a more detailed site investigation and assessment (fieldwork)	1	Item	$100,000	15%	$100,000	$115,000	4	Budget estimate based on similar previous works
Detailed site investigation & preparation of SEA									
A4.01	Concept design of proposal	1	Item	$50,000	15%	$50,000	$58,000	4	Budget estimate based on similar previous works
A4.02	Prepare / collate sea	1	Item	$120,000	15%	$120,000	$138,000	5	Budget estimate based on similar previous works.
A4.03	Flora assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.04	Fauna assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.05	Heritage assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.06	Hydrology assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.07	Traffic assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.08	Noise assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.09	Dust assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.10	Odour assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.11	Greenhouse gas assessment	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
A4.12	Other studies	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
Public consultation stage on SEA									
A5.01	Public consultation	1	Item	$60,000	15%	$60,000	$69,000	5	Estimate is highly dependent upon the quantum of public interest - could be substantially more or less
A5.02	Engineering support	1	Item	$25,000	15%	$25,000	$29,000	4	Budget estimate based on similar previous works
Rezoning land / alteration to territory plan									
A6.01	Liaison with relevant ACT government stakeholders	1	Item	$15,000	15%	$15,000	$17,000	5	Budget estimate to liaise with ACTPLA and keep momentum of project going
Preliminary design of landfill									
A7.01	May not be required if no EIA required	1	Item	$0	15%	$0	$0	5	May not be required if no EIA required. Concept design would have been completed as part of SEA
Environmental impact assessment									
A8.01	Preparation of EIA	1	Item	$0	15%	$0	$0	5	Assumes that project can be exempt from needing an EIA on the basis that SEA will have been completed
A8.02	Preparation of application for EIA exemption and liaison with ACTPLA	1	Item	$7,500	15%	$7,500	$9,000	5	Assumes that project can be exempt from EIA on the basis that SEA will have been completed. Need to go through the process of confirming exemption to be granted by the minister
Obtain development consent from ACT government									

Bill of Quantities and Preliminary Cost Estimate

Client: Riverview
Project: Kowen Forest Emergency Landfill
Subject: High Level Assessment
Accuracy ± 40%

Job Number: 21-23237
Prepared by: C Nivison-Smith
Checked by: M Welsh
Type: Budget

Revision: A
Date of issue: 19-Jun-14
Date of review: 19-Jun-14

Item #	Description	Units	Estimated Quantity	Unit Rate	Inherent Risk Adjustment	Base Estimated Amount	Adjusted Estimated Amount	Reference ID	Notes
A9.01	Preparation of application and liaison with ACTPLA	1	Item	$25,000	15%	$25,000	$29,000	5	Budget estimate based on similar previous works
A9.02	Engineering support	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
Obtain environmental authorisation from ACT EPA									
A10.01	Liaison with ACT EPA and other agencies	1	Item	$15,000	15%	$15,000	$17,000	5	Quantum of work dependent upon design and details to be resolved
A10.02	Engineering support	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
Detailed engineering design & documentation									
A11.01	Detailed design & documentation	1	Item	$250,000	15%	$250,000	$288,000	4	Budget estimate based on similar previous works
Establishment (construction) of site									
A12.01	See site development sheet for costs	1	Item	$0	15%	$0	$0	4	Budget estimate based on assumptions within site development sheet
Design & asset acceptance by ACT government									
13.01	Engineering support	1	Item	$15,000	15%	$15,000	$17,000	4	Budget estimate based on similar previous works
	Subtotal					**$920,000**	**$1,050,000**		
	Contingency						$320,000		30%
	GST						$140,000		
	Grand total						**$1,510,000**		

Bill of Quantities and Preliminary Cost Estimate

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Accuracy ± 40%

Job Number: 21-23237
Prepared by: C Nivison-Smith
Checked by: A Roberts / M Welsh
Type: Budget

Revision: B
Date of issue: 19-Jun-14
Date of review: 19-Jun-14

Item #	Description	Units	Estimated Quantity	Unit Rate	Inherent Risk Adjustment	Base Estimated Amount	Adjusted Estimated Amount	Reference ID	Notes
Site entrance									
B1.01	Weighbridge	1	Each	$100,000	5%	$100,000	$105,000	4	Standard weighbridge
B1.02	Wheelwash	1	Each	$50,000	5%	$50,000	$53,000	4	Standard wheelwash
Roads									
B2.01	Upgrade intersection	1	Item	$600,000	15%	$600,000	$690,000	4	No utilities required , no reconstruction of existing pavement required, small amount of widening, no signals required
B2.02	Construct/upgrade access roads	2,000	m	$70	15%	$140,000	$161,000	2 & 3	
Site facilities									
B3.01	Site office	1	Each	$100,000	5%	$100,000	$105,000	4	Standard site office
B3.02	Amenities building	1	Each	$100,000	5%	$100,000	$105,000	4	Standard amenities building
B3.03	Maintenance facility/workshop	1	Each	$400,000	5%	$400,000	$420,000	4	Standard maintenance facility
B3.04	Telecommunications	1	Item	$50,000	15%	$50,000	$58,000	4	Allowance
B3.05	Electricity	1	Item	$200,000	15%	$200,000	$230,000	4	Allowance
B3.06	Water supply	1	Item	$150,000	15%	$150,000	$173,000	4	Allowance
B3.07	Miscellaneous civil works	1	Item	$50,000	15%	$50,000	$58,000	4	Allowance
Cell development									
B4.01	Clearing and grubbing (cut down trees)	180,000	m^3	$16	15%	$2,940,000	$3,381,000	2 & 3	Trees are 500 mm (or less) in girth. 1 tree per 9 m2
B4.02	Strip topsoil (100 mm) and stockpile on-site	180,000	m^2	$3	15%	$450,000	$518,000	2 & 4	
B4.03	Bulk excavation (soil)	250,000	m^3	$18	15%	$4,500,000	$5,175,000	2 & 4	
B4.04	Bulk excavation (rock)	50,000	m^3	$50	15%	$2,500,000	$2,875,000	2 & 4	
B4.05	Subgrade preparation	160,000	m^2	$3	15%	$400,000	$460,000	2 & 4	
B4.06	Perimeter bunds	7,250	m^3	$15	15%	$109,000	$125,000	2 & 4	
B4.07	Lining system	160,000	m^2	$27	10%	$4,320,000	$4,752,000	2 & 4	Supply and install. Composite GCL/HDPE liner overlain by protection geotextile
B4.08	Drainage aggregate	21,000	m^3	$70	10%	$1,470,000	$1,617,000	3	Supply and placement of recycled aggregate
B4.09	Pipework	2,100	m	$60	10%	$126,000	$139,000	2 & 4	Supply and install
B4.10	Separation geotextile	70,000	m^2	$5	10%	$350,000	$385,000	2 & 4	Supply and install
B4.11	Pumps	3	Each	$25,000	5%	$75,000	$79,000	4	Supply and install
Surface water management									
B5.01	Stormwater diversion drains	900	m^3	$45	15%	$41,000	$47,000	2 & 4	Including lining
B5.02	Stormwater collection drains	725	m^3	$45	15%	$33,000	$38,000	2 & 4	Including lining
B5.03	Sedimentation pond excavation	4,800	m^3	$18	15%	$86,000	$99,000	2 & 3	
B5.04	Sedimentation pond lining	3,100	m^2	$5	10%	$16,000	$18,000	2 & 4	Separation geotextile
B5.05	Sedimentation pond spillways	100	m^3	$350	10%	$35,000	$39,000	2 & 4	
Leachate management									
B6.01	Storage pond excavation	12,000	m^3	$18	15%	$216,000	$248,000	2 & 4	
B6.02	Storage pond lining	6,600	m^2	$24	10%	$158,000	$174,000	2 & 4	For leachate awaiting treatment, no excavation needed (pond in fill area). Composite liner (GCL/HDPE)
B6.03	Treatment pond excavation	12,000	m^3	$18	15%	$216,000	$248,000	2 & 4	

Bill of Quantities and Preliminary Cost Estimate

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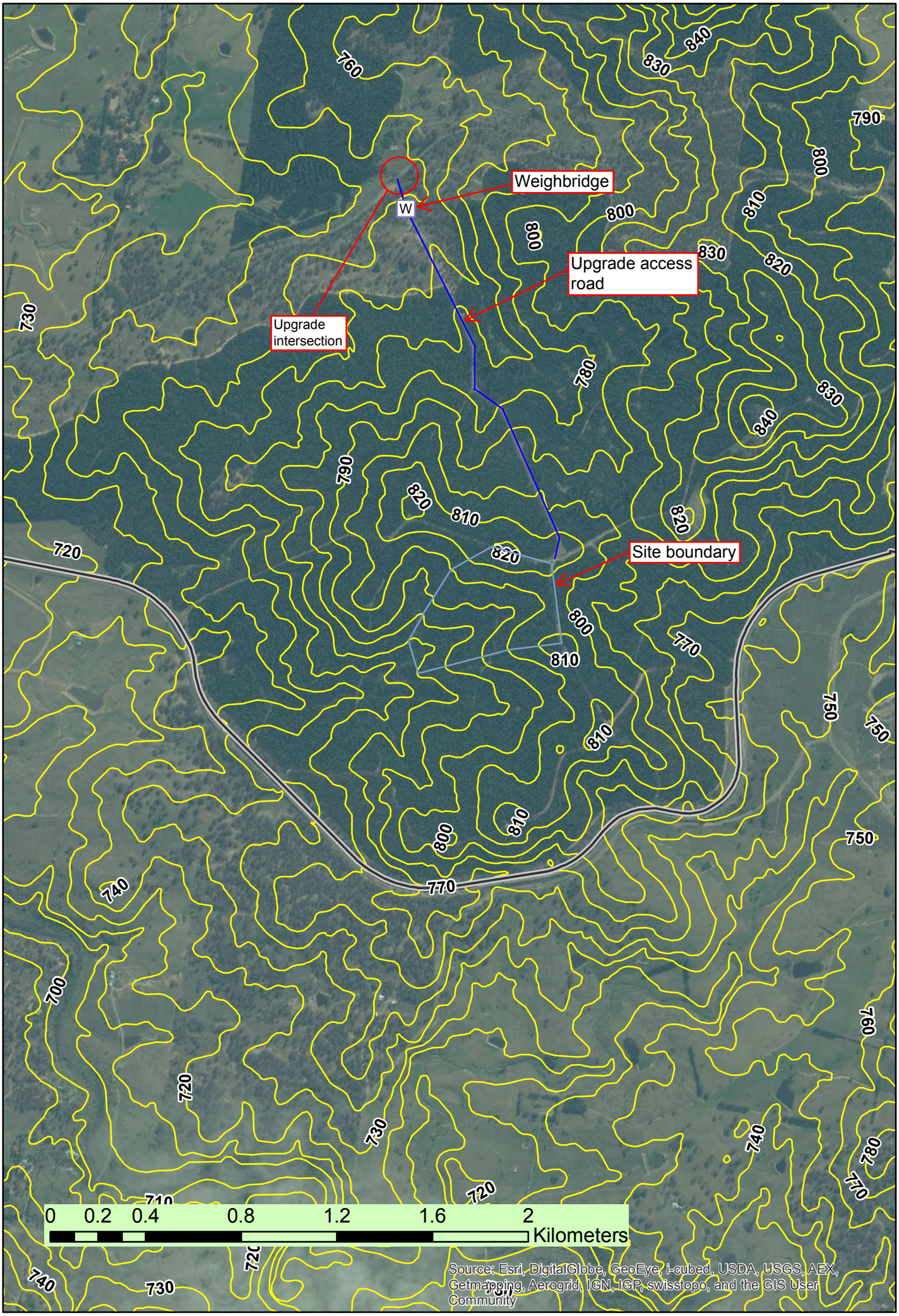
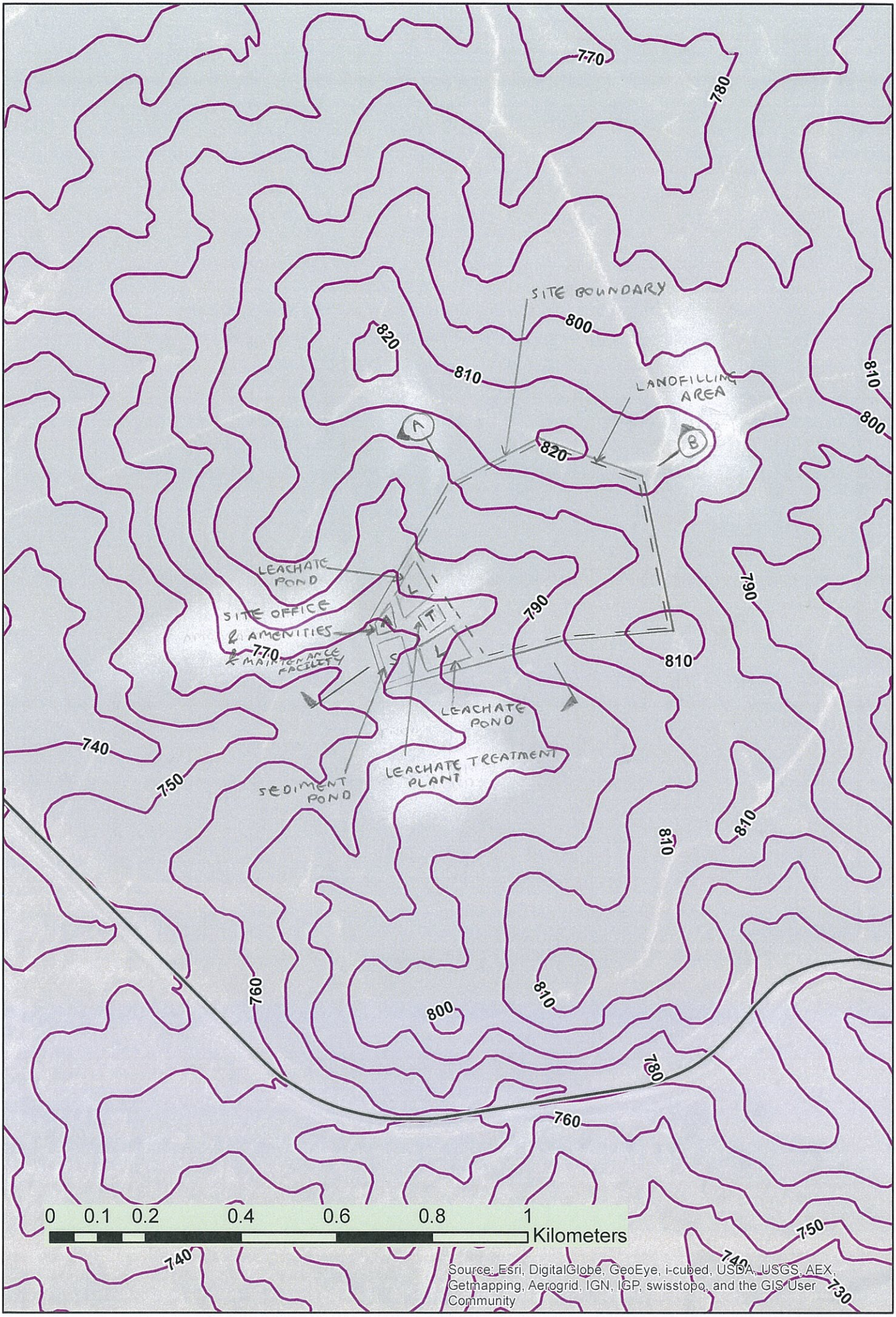
Item #	Description	Units	Estimated Quantity	Unit Rate	Inherent Risk Adjustment	Base Estimated Amount	Adjusted Estimated Amount	Reference ID	Notes
B6.04	Treatment pond lining	6,600	m^2	$5	10%	$33,000	$36,000	2 & 4	For treated leachate awaiting to be irrigated, no excavation needed (pond in fill area). Separation geotextile
B6.05	Treatment plant and irrigation system	1	Each	$500,000	15%	$500,000	$575,000	1 & 4	
Monitoring infrastructure									
B7.01	Gas bores	29	Each	$10,000	15%	$290,000	$334,000	2 & 4	No. of bores required based on BPEM
B7.02	Groundwater bores	5	Each	$10,000	15%	$50,000	$58,000	2 & 4	No. of bores required based on previous work
	Subtotal					**$20,900,000**	**$23,600,000**		Direct costs only
	Contingency						$7,100,000		30% of direct costs
	GST						$3,100,000		
	Grand total						**$33,800,000**		



Kowen Forest Emergency Landfill - Sketch 1 - Site Location



Kowen Forest Emergency Landfill - Sketch 2 - Site Layout

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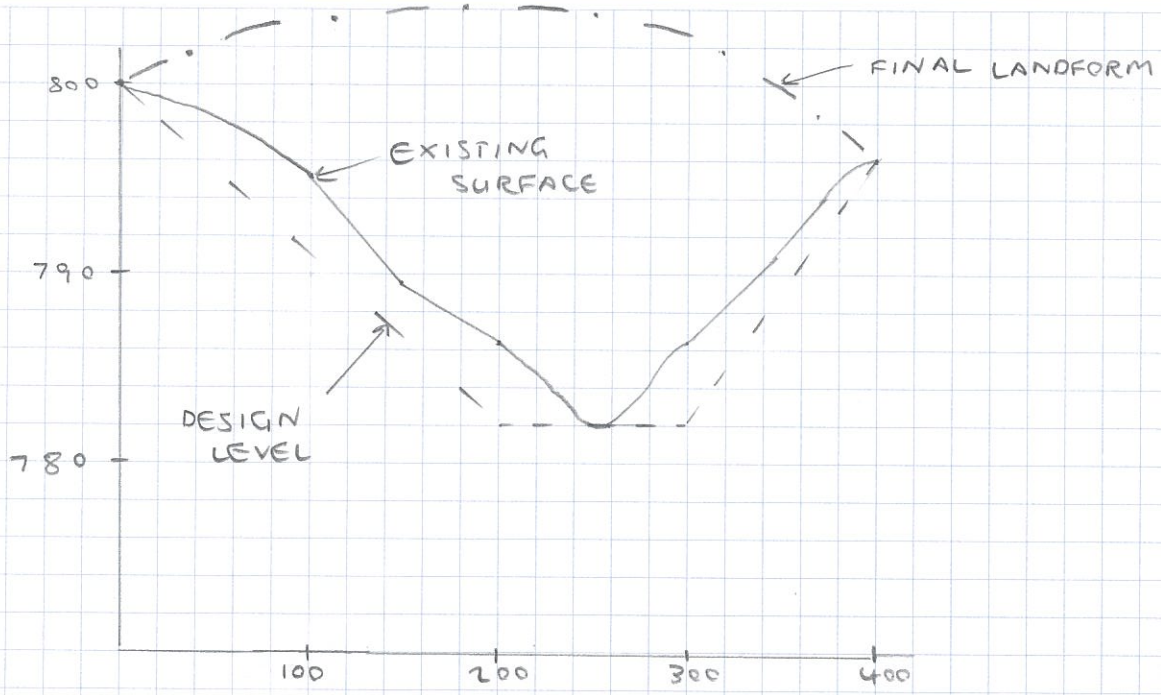
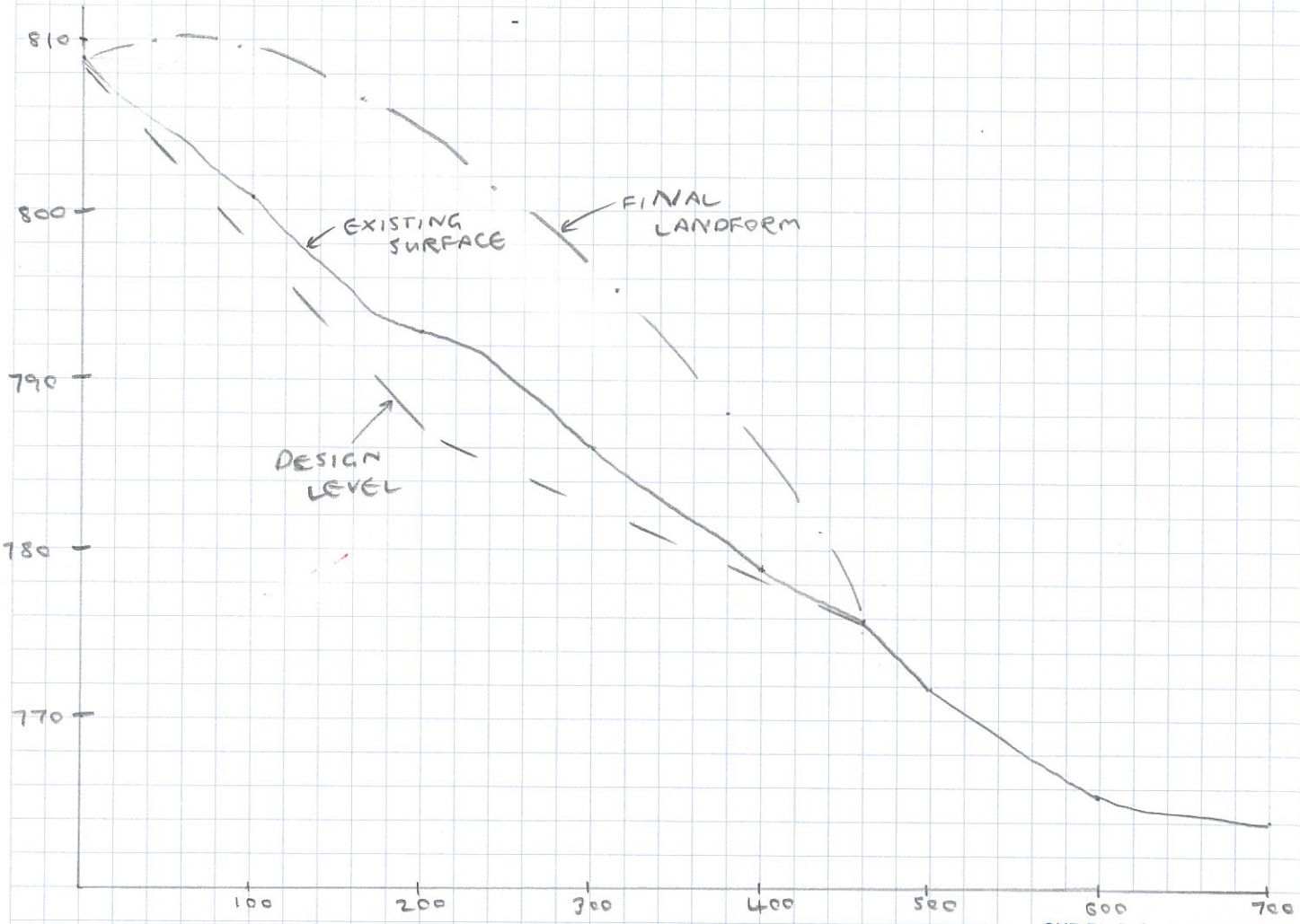
CALCULATIONS

Client	RIVERVIEW	Job no.	21/23237	Sheet	1 of 1
Project	KOWEN FOREST EMERGENCY LANDFILL	Calcs by	CNS	Date	5/5/14
Subject	TYPICAL SECTION (CONCEPTUAL)	Checked by		Date	



(A) SECTION



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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	C. Nivison-Smith	M. Welsh		D. Gamble		23.06.14

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