From:	Santosuosso, Daniel
To:	McGrath, Michael; Oxborrow, Stuart
Cc:	Richardson, Dave
Subject:	FW: Molongolo Priority Sewerage Works: UXO Report for Audit
Date:	Wednesday, 2 October 2013 11:57:44 AM
Attachments:	image001.jpg ACT 33613 Molonglo Priority Works PAR Version 2 DRAFT 4.pdf image003.jpg
Importance:	High

Hi Michael and Stuart,

Have read through the report,

Areas of interest for you and your construction contract are

Section 4 3.5 & 4.3.6 - Page 19.

Section 6 0 & 7.0 – Page 23

Cheers

Daniel Santosuosso Project Manager
Land Development Agency
Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
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From: [redacted]
Sent: Friday, 27 September 2013 4:41 PM
To: Santosuosso, Daniel; Richardson, Dave
Cc: Brian Davis
Subject: Molongolo Priority Sewerage Works: UXO Report for Audit
Importance: High

Dave and Daniel,

Attached is draft Final Report for submission to Site Auditor as discussed Wednesday.

[redacted]

Managing Director Milsearch Pty Ltd
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POST ACTIVITY REPORT

UXO REMEDIATION AND CONTAMINATION ASSESSMENT SURVEY
MOLONGLO DEVELOPMENT
STAGE 3 PRIORITY WORKS

By

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Level 1, Unit 5, 30 Mawson Place,
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Prepared For:	**Land Development Agency, ACT Government**
Reference:	**MilS ACT 33613**
Date:	**27 September 2013**
Copy No:	**1 of 3**

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Milsearch Client

The entity that commissioned this report, and who is Milsearch Australia Pty Limited's (Milsearch) client is New South Wales Land Com

Purpose of This Report

This report was commissioned for the purpose of detailing the activities undertaken by Milsearch on the Client's Site and the results of those activities (The Purpose).

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Revision	Date	Issue	Approved By	Signature
Initial Draft	23 September 2013	Version 2 Draft 1	B. Davis	[redacted]
Head Office Review	27 September 2013	Version 2 Draft 4	D. Halmarick	[redacted]

LIST OF ACRONYMS AND DEFINITIONS

Acronyms and Definitions that may be utilised in this report:

Explosive Ordnance (EO): All munitions containing explosives or chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes, depth charges and demolition charges; pyrotechnics, clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.

Explosive Ordnance Disposal: The detection, identification, field evaluation, rendering safe and final disposal of unexploded ordnance. It may also include the rendering safe and/or disposal of explosive ordnance, which may have become hazardous by damage or deterioration.

Explosive Ordnance Waste (EOW): Inert material remnant from the initiation or functioning of explosive ordnance.

Small Arms Ammunition (SAA): Ammunition for small arms, i.e. all ammunition of less than 20mm in calibre and all gauges of shotgun cartridges.

Unexploded Ordnance (UXO): Explosive ordnance that has been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installation, personnel, or materiel but remains unexploded either by malfunction, design, or any other cause. UXO includes items of EO that have been removed from their original resting place for any reason, including souvenering by members of the public.

UXO Assessment Survey: An operation designed to determine, assess and report on all or some of the following:

1. whether an area is affected by UXO;
2. the boundaries of the affected area;
3. the densities of UXO, including the locations and characteristics of impact areas, within the affected area; and
4. the residual depths, types and natures of UXO and inert ordnance-related items within the affected area.

UXO Remediation: An operation to reduce the hazards associated with UXO, to a level that is acceptable to the appropriate approving authority with regard to the planned use of the land.

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POST ACTIVITY REPORT

UXO REMEDIATION AND CONTAMINATION ASSESSMENT, MOLONGLO STAGE 3 PRIORITY WORKS

1.0 INTRODUCTION

1.1 GENERAL

Land Development Agency (LDA) of the ACT Government is facilitating a three phase urban development project in the Molonglo region of ACT. Areas designated for development are depicted in the LDA supplied image below.

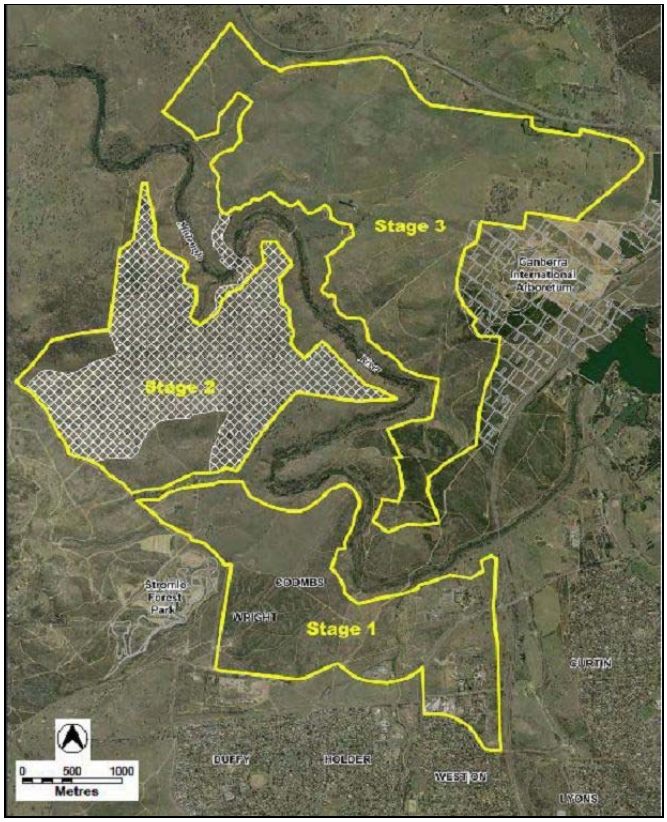

Figure 1: Depiction of Molonglo Development Stages 1, 2 & 3

Recent Milsearch historical research of Military Live Fire Training conducted by the Royal Military College has revealed military training has occurred on land within the footprint of the proposed development. The archival research conducted in association with the ACT Government's West Majura studies, revealed that artillery live firing practices were conducted in 1914 utilizing 15 pdr guns with target areas identified as high ground adjacent

to, and either side of, Coppins Crossing. Further live firing practices occurred in 1920 and 1921 utilizing 18 pdr guns with target areas nominated as being one mile north of Coppins Crossing and near Deep Creek. From information gained through the historical study, Milsearch created an image depicting the postulated artillery templates utilized for the range practices (Figure 2).

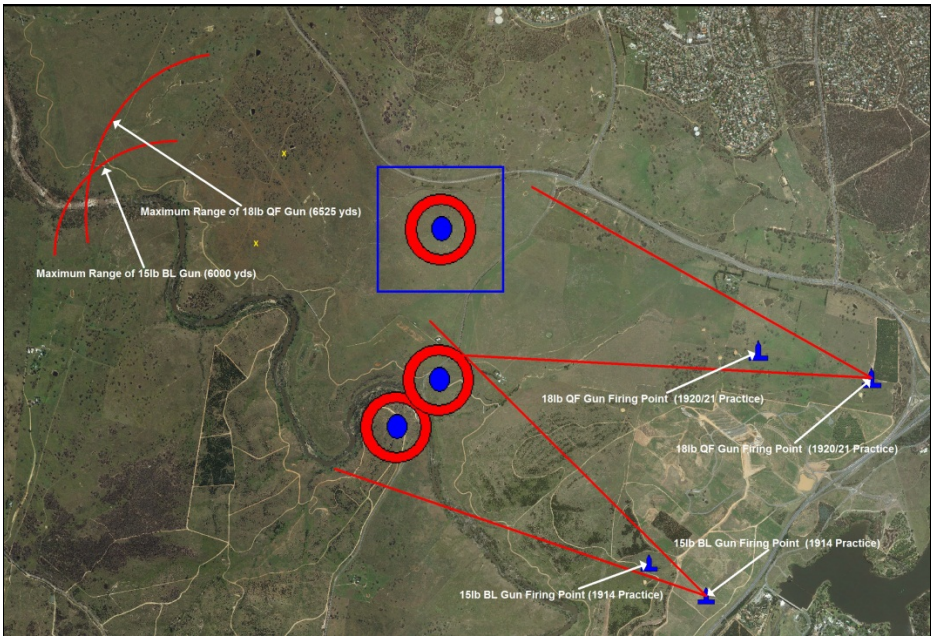

Figure 2: Milsearch Postulated Historical Range Template and Targets (Preliminary only)

The two southern targets depicted are high features adjacent to Coppins Crossing with the Molonglo River between them. They are both either immediately beside, or actually have an overlapping footprint on land identified for Priority Works for the Molonglo development. Those priority works include construction of sewer facilities and a bridge over the Molonglo River.

In total the Priority Works area comprises 101 ha encompassing land either side of Coppins Crossing Road and following the contours of the land parallel to the river. A blue polygon of that area identified by LDA is provided below (Figure 3). Within that diagram is a red polygon of 10.4ha surrounding a yellow schematic of proposed ground invasive works.

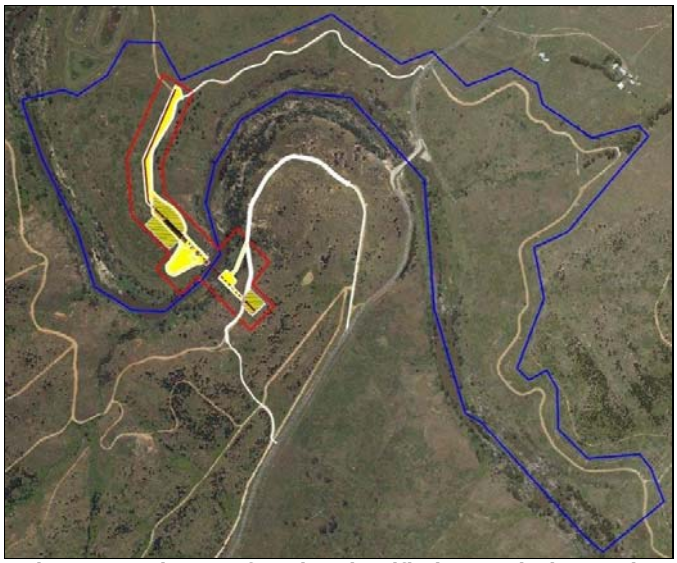

Figure 3: Polygon of 101ha Identified For Priority Works

Having identified the priority works area was within a known historical artillery area, the Land Development Agency (LDA) ACT Government contracted Milsearch to conduct an Unexploded Ordnance (UXO) Contamination Remediation and Assessment of the identified Priority Works land. The task was to conduct a 10% UXO sampling assessment of the 101 ha area, including a 100% geophysical remedial survey of those areas where ground intrusive construction activities are planned.

1.2 SITE DESCRIPTION

The section of the Molonglo Development identified for the subject assessment is predominantly undulating grasslands. Those grasslands contain significant volumes of dense non-native bramble patches and numerous outcrops of low lying rock. Areas of the land that lead down to the Molonglo River are quite steep and rocky in places.

Figure 4: Sample image of onsite vegetation

Much of the vegetation on site was quite dense and posed an obstacle to the use of UXO survey and investigation equipment. Reduction of that vegetation to a height of approximately 100mm was necessary prior to conduct of survey operations. Site clearing planned for construction activities was brought forward and LDA appointed Eden Brae Services to conduct vegetation reduction operations. Full mechanical slashing was conducted in areas to be subjected to 100% geophysical survey. In other areas where only assessment transects were required, nominally parallel lanes were slashed 10 metres apart. Slashing was also required through dense blackberry growth in some locations.

1.3 SAFEGUARDING

Recognising the area had been used for artillery practices meant vegetation reduction operations prior to UXO works could be potentially hazardous. In order for those activities to be carried out safely, the Client requested Milsearch provision of an EOD Technician on-site during slashing for safeguarding duties. That technician provided UXO safety briefings to Eden Brae staff plus maintained on on-site presence for the safe and timely inspection of any suspect items encountered during vegetation reduction. Vegetation reduction commenced on Wednesday, 7 August 2013.

2.0 PROJECT OBJECTIVES

Agreed objectives of the originally proposed works at the site were to conduct a UXO Assessment of an identified 101 ha parcel of land (displayed as a blue polygon in Figure 3) identified by the LDA. That assessment was to be conducted as:

- 100% geophysical survey of 10.44ha containing those areas planned for ground disruptive construction works. Objectives of that survey were to:
    - conduct of a 100% geophysical survey of the 10.44ha within the identified boundaries to locate all potential discrete ferrous items that could be UXO or EOW, equivalent or greater than, the ferrous mass of a 15 pounder artillery projectile buried to a maximum depth of 0.5m. This projectile was of relatively light weight (ferrous mass of 6.4kg), with low calibre radius head, low velocity, used in an indirect fire role and designed to function in flight. It is unlikely to have penetrated beyond 0.5m depth on this Site;
    - conduct geophysical survey data processing and interpretation of anomalies;
    - follow-up physical investigation of interpreted anomalies to identify and or remove UXO items and munitions related items encountered; and
    - Report on findings with recommendations as appropriate.
- 10% UXO Technical Assessment of the remainder of the 101 ha site. The assessment was intended to identify and delineate the presence of any UXO impact areas within the specified area. This was to be achieved by detecting along nominally parallel 1m wide lanes separated at 10m intervals.

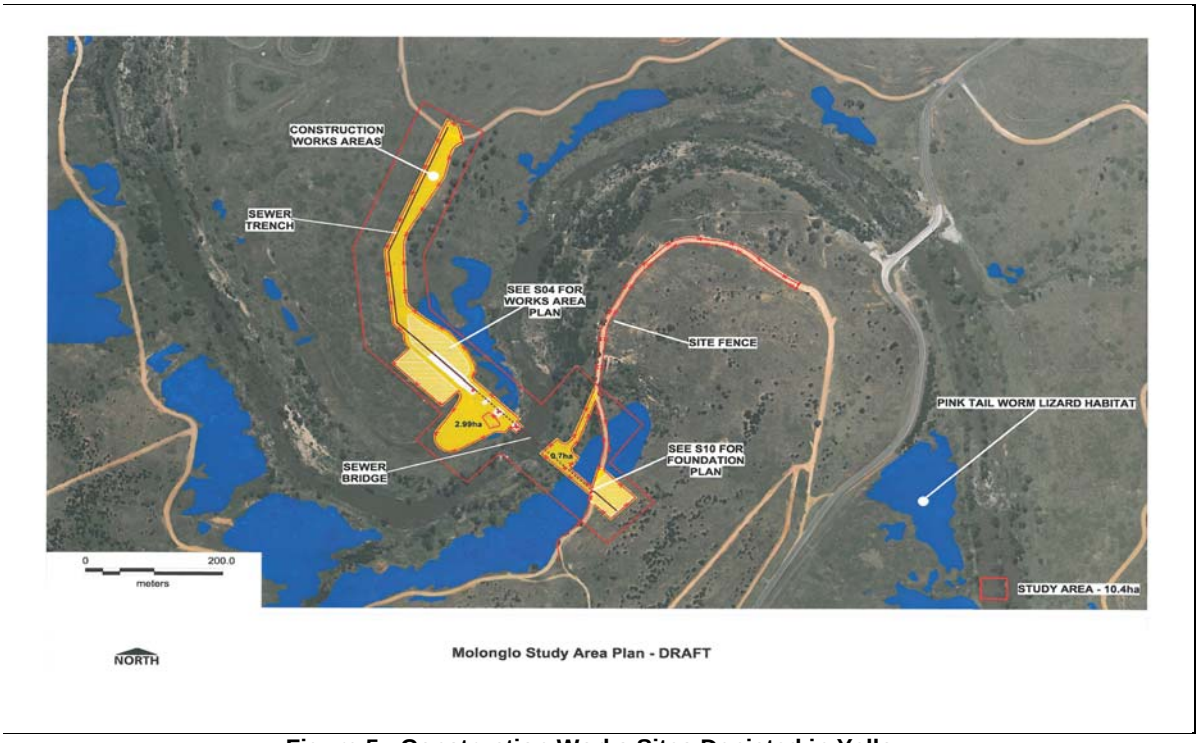

Figure 5: Construction Works Sites Depicted in Yellow

LDA staff site visits led to clarification that the 10.44 ha survey site was a nominal polygon drawn around the intended construction sites. There were concerns that vegetation reduction and UXO survey activities may be detrimental to the habitat of the endangered Pink Tailed Worm Lizard. LDA provided the following diagram (Figure 6) of the 10.44 ha area identifying an amended requirement for the 100% remediation requirement. That amendment entailed 100% survey of the specific construction sites shown as the red cross-hatched zone in Figure 6, and a 10% assessment of the balance of the area. The detailed requirements were also clarified on-site with Mr Daniel Santosuosso (LDA) identifying lizard habitat and specific boundaries for operations.

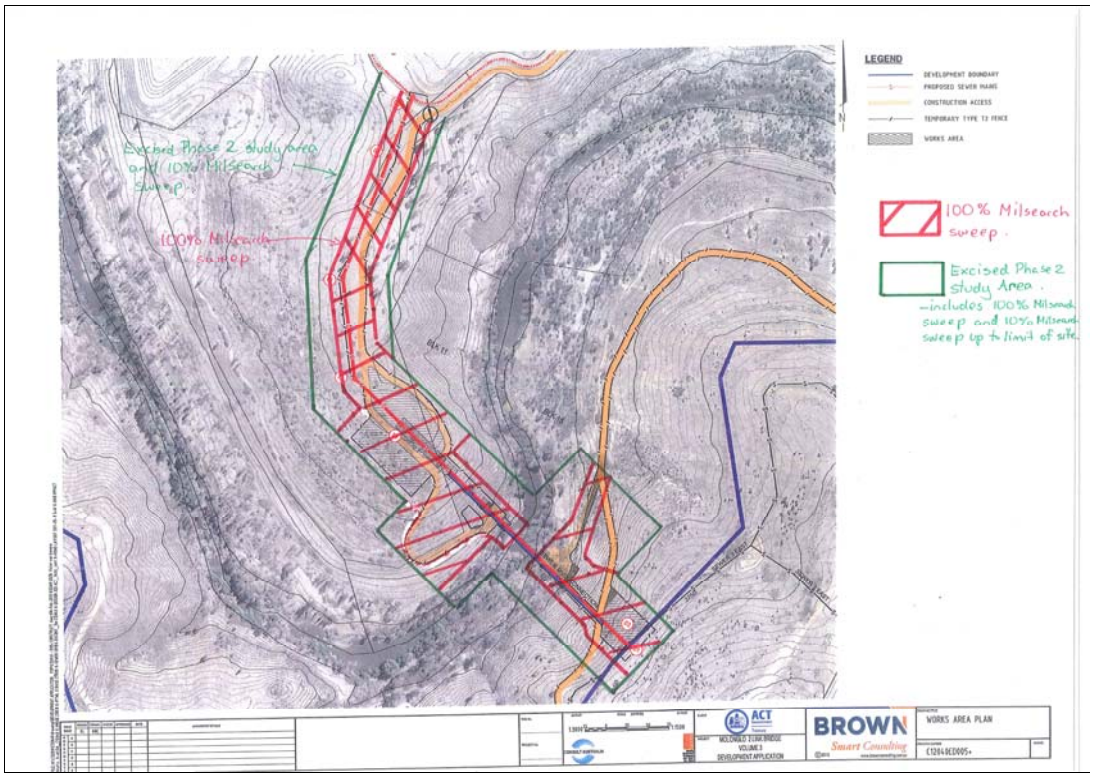

Figure 6: LDA Image Clarification of Assessment Requirements in the Construction Sites Vicinity

3.0 CONTRACTOR DETAILS

The contracting firm is Milsearch Australia Pty Ltd (Milsearch), ABN 44 007 106 881. Milsearch is a Contracted member of the Defence Unexploded Ordnance Panel (DUXOP) and, as part of that membership, is considered competent by, and has a contract with the Commonwealth of Australia, for the conduct of UXO assessment and remediation works.

Milsearch is fully accredited to ISO 9001:2008 Quality Management Systems and OHSAS 18001:2007 Occupational Health and Safety Management System.

3.1 MILSEARCH TECHNICAL STAFF

The following key Milsearch personnel were directly involved in the UXO remediation and safeguarding operations:

- Project Director — David Halmarick
- Project Manager / EOD Technician — Brian Davis
- Geophysical Data Capture & EOD Technician — Paul Wheeler
- EOD Technician — Laith Stevens
- Chief Geophysicist — Torbjorn von Strokirch

4.0 UXO Operations

In order to provide a documented and auditable record of all aspects of the UXO services, the following geophysical remedial survey methodology was adopted:

- Systematically acquire digital geophysical data with high confidence to identify and locate the existence of each discrete ferrous object with a magnetic signature equal to or greater than that produced by a 15lb projectile to a depth of 0.5m[1], which was assessed as the maximum likely kinetic penetration depth for this type of projectile as near maximum range in the site soils. All geophysical surveys were to be positioned by the use of an integrated sub-metre accurate Differential Global Positioning System (DGPS);
- Interpret all data captured during the digital geophysical survey by a Geophysicist experienced in discrete UXO item interpretation utilising special purpose software;
- Present acquired data as colour images showing the position of each anomaly in plan form;
- Produce Interpretation and Excavation Reports (also known as "Dig-Sheets"), listing the position of each anomaly detected. These "Dig Sheets" shall then provide documented and auditable evidence of anomaly follow up, recording the identity and disposal action of each anomaly excavated; and
- Relocate, investigate and identify all discrete anomalies during the investigation phase with any UXO located to be position reported for later custody transfer to Defence authorities for render safe action and or disposal.

The UXO task was planned as a three phase operation:

- Phase One - conduct of 100% geophysical survey of the construction site locations conducted (shaded red in Figure 5) with a Geometrics G858 magnetometer
- Phase Two - 10% analogue search of the balance of the 10.44ha polygon (shown green in Figure 5) using Minelab F3 metal detectors,
- Phase Three – 10% analogue search of the remaining land as depicted in the 101 ha polygon provided at Figure 3, also using Minelab F3 detectors

4.1 DATES OF CONDUCT

Dates of conduct for each of the three phases/activities of Milsearch operations are detailed in the following table:

	Activity	Dates
a.	Safeguarding (exclusive to UXO assessment)	Wednesday 7th to Thursday 8th August

[1] The 15 pdr gun was introduced around the 1880's and employed by the British Army as the principal field artillery during the Boer War. It was progressively replaced during WW1 and ceased service in 1918. Its muzzle velocity is slow by contemporary standards, with a blunt ogive meaning it isn't particularly streamlined. With the sewerage Site located towards this guns's maximum effective range from the Greenhill firing point, the projectiles would have slowed to about 50% of their original mussel velocity. Relatively hard and rocky site ground combined with these factors indicate kinetic penetration depth would be about 0.5m or less.

b.	Phase One – 100% Geophysical Survey	Friday 9th to Thursday 15th August
c.	Phase Two – 10% Assessment of Construction Surrounds	Thursday 15th
d.	Phase Three – 10% Assessment of approximately 90 ha	Friday 16th to Wednesday 21nd August
e.	Phase One – Investigation of geophysical anomalies	Thursday 22nd August

Details of each activity are given in the Project Daily Work Diaries (F-198) accompanying this report at Appendix A.

4.2 EQUIPMENT

The primary geophysical survey instrument employed at the Site was the Geometrics G858 caesium vapour magnetometer, with a dual sensor configuration and with sensors set at 1m separation. The geophysical survey equipment was positioned by integrated streams of DGPS data.

Post geophysical survey, follow-up target investigation was conducted utilizing the Foerster 4.032 analogue magnetometer.

All site boundary and search gridding, as well as the geophysical survey and subsequent follow-up target acquisition, was conducted utilizing sub-metre accurate Differential Global Positioning systems (DGPS).

Technical specifications for the search equipment are presented at Attachment B.

4.3 PHASE ONE SITE WORKS

4.3.1 Site Preparation

The site was divided into survey 'blocks' identified on site by the Milsearch Project Manager. To facilitate continuity and ease of interpretation of survey results the blocks were alphanumerically identified as Block A1, A2 etc. with the nominal start point being the northern end of the 10.44ha block (track junction end). This was achieved through use of DGPS identifying boundary points provided as co-ordinates by the LDA.

Blocks for survey were marked out with stakes and surveyors tape at 50 metre interval baselines. Measuring tapes were then progressively deployed at the northern and southern baseline of each block to facilitate accurate measurement of survey lanes.

4.3.2 Data Collection

On commencement of each day the G858 equipment was set up, configured with a Dual Sensor Array mounted at 1 metre separation and calibrated using the G858 console installed software. Correct functioning was identified on site using the G858 console, then later validated by the Project Geophysicist's confirmation the collected data confirmed correct functioning.

Once the G858 data collection integrity had been validated, data was then collected by an operator traversing the land with the G858 in sequential blocks. Each block was prepared by placing measuring tapes at each end of the block and then laying parallel string lines every 2 metres to ensure full coverage of the land. Once each lane had been subjected to survey, string lines were progressively moved to the corresponding next 2 metre point.

Where possible the geophysical survey area was extended beyond the footprint of the proposed construction works. The area surveyed is presented at Figure 7 below.

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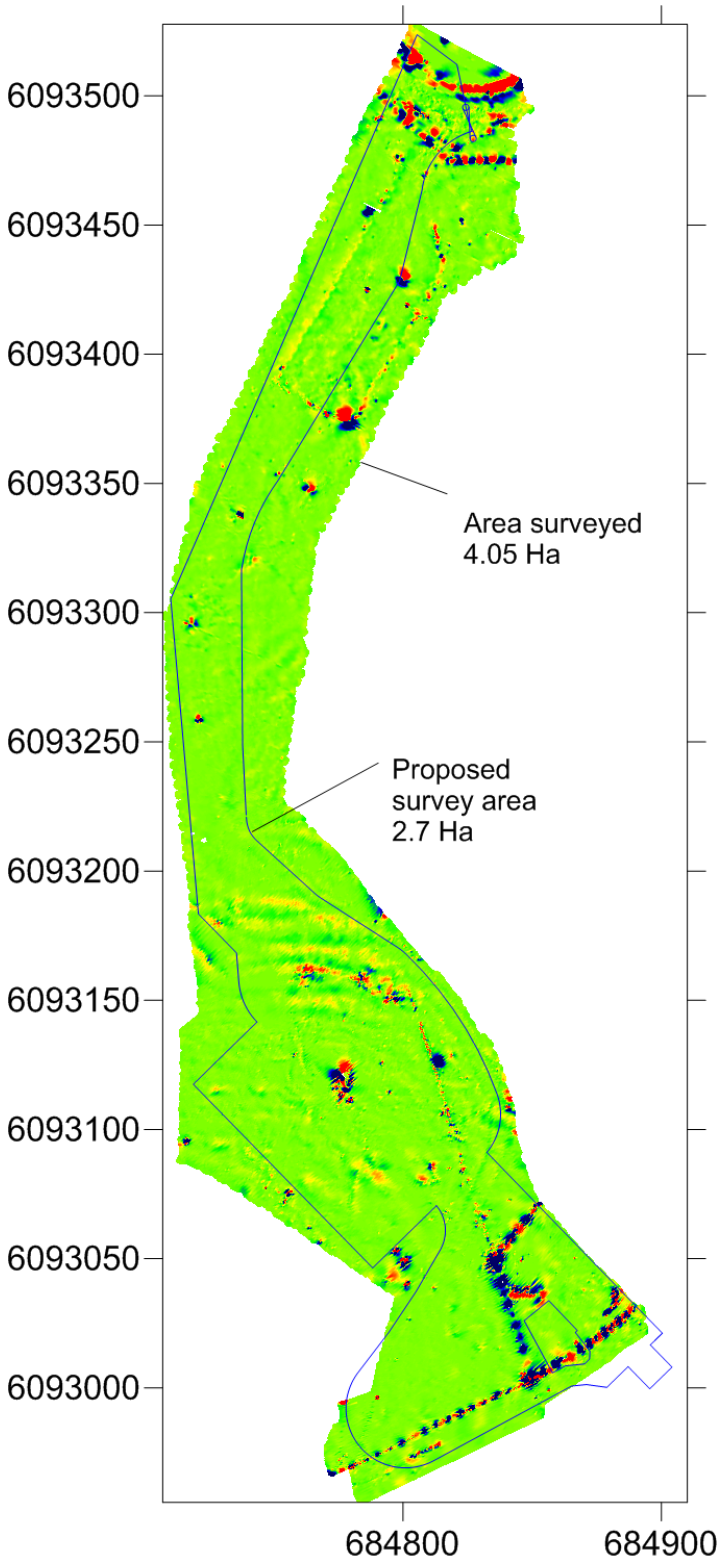

Figure 7: Plotted Geophysical Survey With Priority Works Area Overlay

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Search equipment was tested at the start and end of work each day with results recorded on the Search Equipment Functional Test Log (F-166). A copy of the Log is at Appendix D.

Figure 8: Data Collection Using G858 with integrated DGPS

Commencing at the northern end (track junction end) of the 10.44 ha area, data was collected over 50 metre blocks. Progress was recorded in the Project Daily Work Diary (F-198) at Attachment A.

4.3.3 Data Processing

Data for each survey block was processed independently. It was scanned for anomalies exceeding a predefined amplitude threshold of 80nT as pre-determined by geophysical modelling from the ferrous content of the target 15pdr projectile. The position of each ferrous metallic object within each search block was determined.

Prior to the relocation phase, electronic files of all the interpreted discrete anomalies matching the targeted specification was provided by the Project Geophysicist. These files were transferred directly to the DGPS Recon handset ensuring no 'human errors' were introduced by a manual coordinate input process.

All data was also consolidated into an Ordnance Detection Survey Interpretation and Investigation Report (F-155) for each block surveyed. That data was also converted into a coloured plan view image of each block indicating the location of each anomaly.

Site geology was found to be generally benign and conducive to the task, allowing confident discrimination of targets.

4.3.4 Anomaly Relocation and Investigation

Data analysis by the geophysicist resulted in the survey team being provided an Ordnance Detection Survey - Interpretation and Investigation Report (F-155) 'Dig Sheet' serial number. The F-155 is attached at Appendix C. The 100% survey area image of anomalies was presented in two parts provided below at Figures 9 and 10.

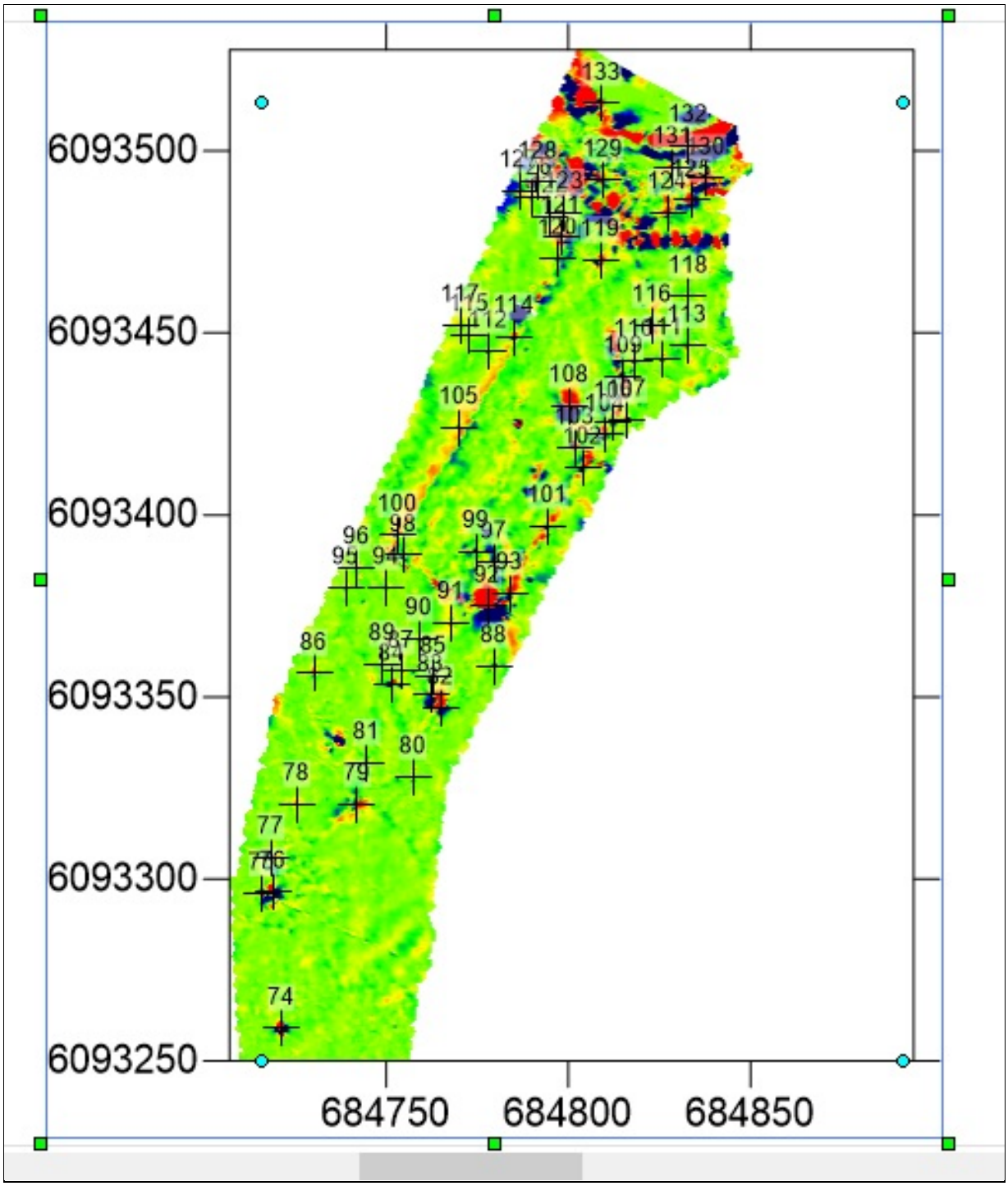

Figure 9: Depiction of Anomalies within the G-858 Survey Site (Part 1)

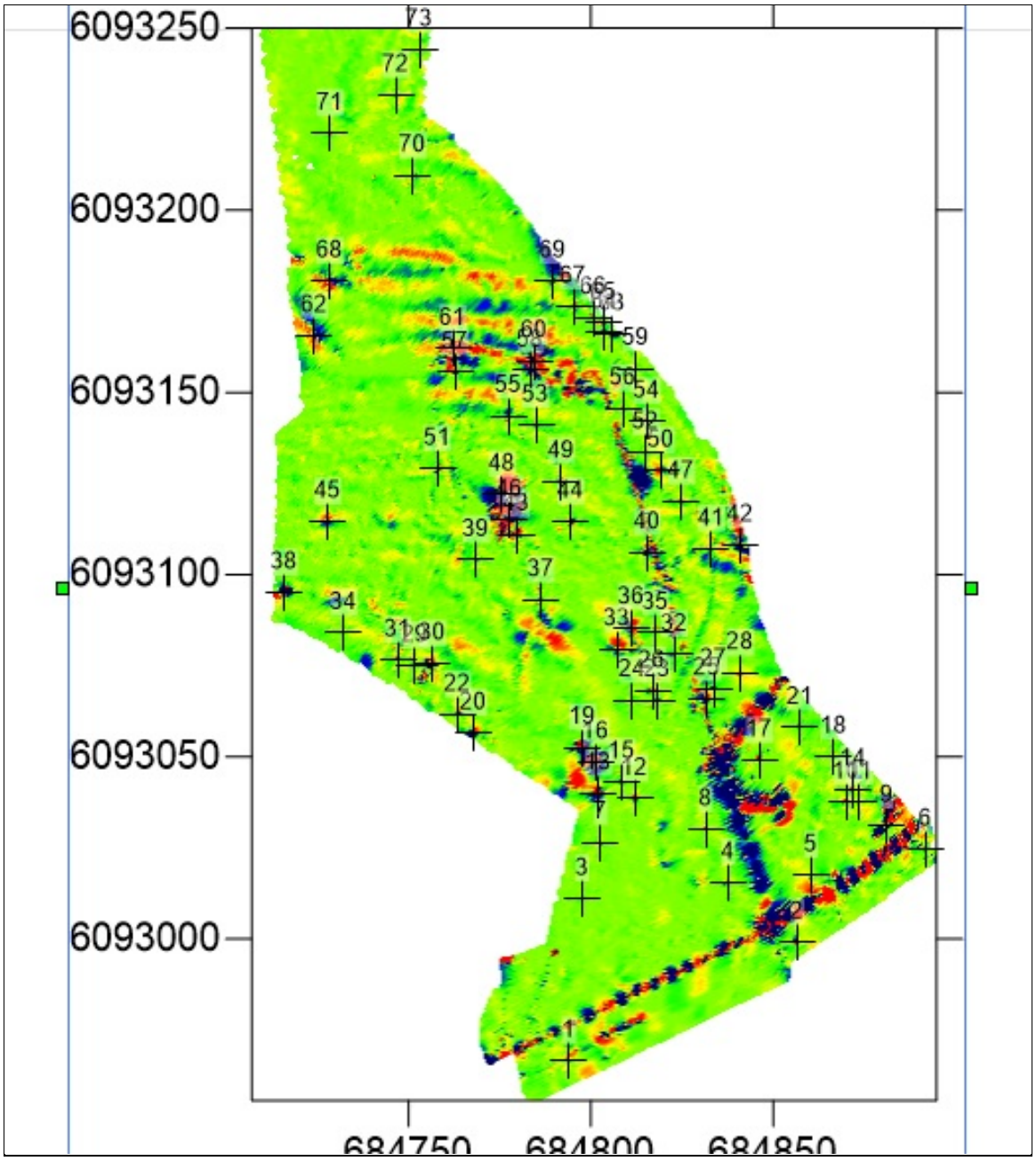

Figure 10: Depiction of Anomalies within the G-858 Survey Site (Part 2)

Each individual anomaly/target was relocated with DGPS utilising the coordinates provided by the geophysicist. Anomaly locations were flagged out on the ground with numbered pin markers that corresponded to the relevant 'Dig Sheet" serial number.

All plotted targets were investigated by manual excavation utilising a Forster 4.032 magnetometer and then excavated for identification. The initial shallow search was conducted from the centre of the plotted target extending outwards to a 2 metre radius until a target matching the identified anomaly properties was located.

Once an item that matched the target specifications had been located and if not UXO, removed, a compulsory second search beneath the identified item was conducted to ensure that an underlying deeper anomaly was not 'masked'. If no further targets were detected, results were recorded against the specific serial number of the 'Dig Sheet'. In the case of further targets being detected the process of excavation and identification was repeated.

This process continued within a Search Block until all targets identified on the 'Dig Sheet' were physically investigated. On completion of investigations within a search block, the relocation process was repeated for the next block.

4.3.5 Variations to Survey Method

The proposed construction site included two areas on the southern side of the Molonglo River. Those areas had been identified as future locations of footings for the planned bridge/sewage works. The area was also identified as high density habitat for the Pink Tailed Worm Lizard and as such could not be devegetated. Vegetation and the rocky terrain made for difficult conditions for G-858 survey. Discussions with LDA management led to the decision to conduct an analogue survey of those areas using Minelab F3 Metal Detectors.

Those locations also included floodplains immediately adjacent to the river. They contained a high volume of washed up trees and fencing materials. In discussions with LDA the Project Manager explained survey of that area could not be achieved without clearing the area with mechanical plant. Eden Brae Services organised a bobcat, however permission for use of plant was not forthcoming. Further discussions with LDA management led to the decision to exempt that area from the survey and to list that site for future survey or possible safeguarding during construction activities.

4.3.6 Finds

As a result of the 100% geophysical G-858 Survey, a total of 133 ferrous anomalies were recorded and investigated. None of these originated from Explosive Ordnance. Identifications, anomaly serial numbers and DGPS co-ordinates of all finds are recorded in the 'dig sheets'.

As a result of the F3 Metal Detector survey of the excised southern footings site, two items of EOW were detected. Those items were Shrapnel projectile sub-munitions, being lead/antimony balls each approximately 1cm in diameter. Their find provides strong evidence that the spur rising from the river's southern bank in an east-south-easterly direction towards Development Stage 2, had most probably been an artillery impact area for shrapnel projectiles from the 15 pdr firing practice of 1914. That they were found on the northern side of the feature lends credence to the possibility a target area exists on the east facing (artillery firing point) side of that feature.

4.4 PHASE TWO – 10% ASSESSMENT OF CONSTRUCTION SURROUNDS

Having surveyed the construction works areas with G-858, the balance of the 10.44ha area was subjected to 10% assessment using Minelab F3 Metal Detector in the hands of two EOD qualified and experienced technicians. Conduct of vegetation reduction measures created search lanes through the coarse scrub. Each lane was traversed by an operator with an F3 detector and the progress recorded as a track using Garmin Foretrex 401 GPS. All anomalies detected were manually excavated/investigated at the time of discovery. No items of EO were detected during this phase. All anomalies investigated were revealed to be metallic scrap of a farm or fencing origin.

4.5 PHASE THREE – 10% ASSESSMENT OF APPROX 90 HA

The Phase Three assessment over the remaining 90 ha was conducted using the same methodology and two-man team as Phase Two. Conduct of vegetation reduction measures created search lanes through the coarse scrub. Land incline, fence lines, rocky outcrops and Pink Tailed Lizard habitat dictated where vegetation cutting machinery could cut the search lanes. Areas that could not be cut were compensated for by increasing the number of lanes in areas that could be cut. Each lane was traversed by an operator with an F3 and the progress recorded as a track using Garmin Foretrex 401 GPS. All anomalies detected were manually excavated/investigated at the time of discovery. No items of EO were detected during this phase. All anomalies investigated were revealed to be metallic scrap of an agricultural or fencing origin. No evidence was found that artillery impact areas existed within, or close to the 90 ha site.

Assessment paths tracked by hand carried Utrex GPS are shown in Figures 11 and 12 below. They show paths for the Phase 2 assessments combined with paths for the Phase 3 assessments.

Figure 12 also shows the location of the two shrapnel balls which were actually located during the Phase 1 remediations, not during the 10% assessment process.

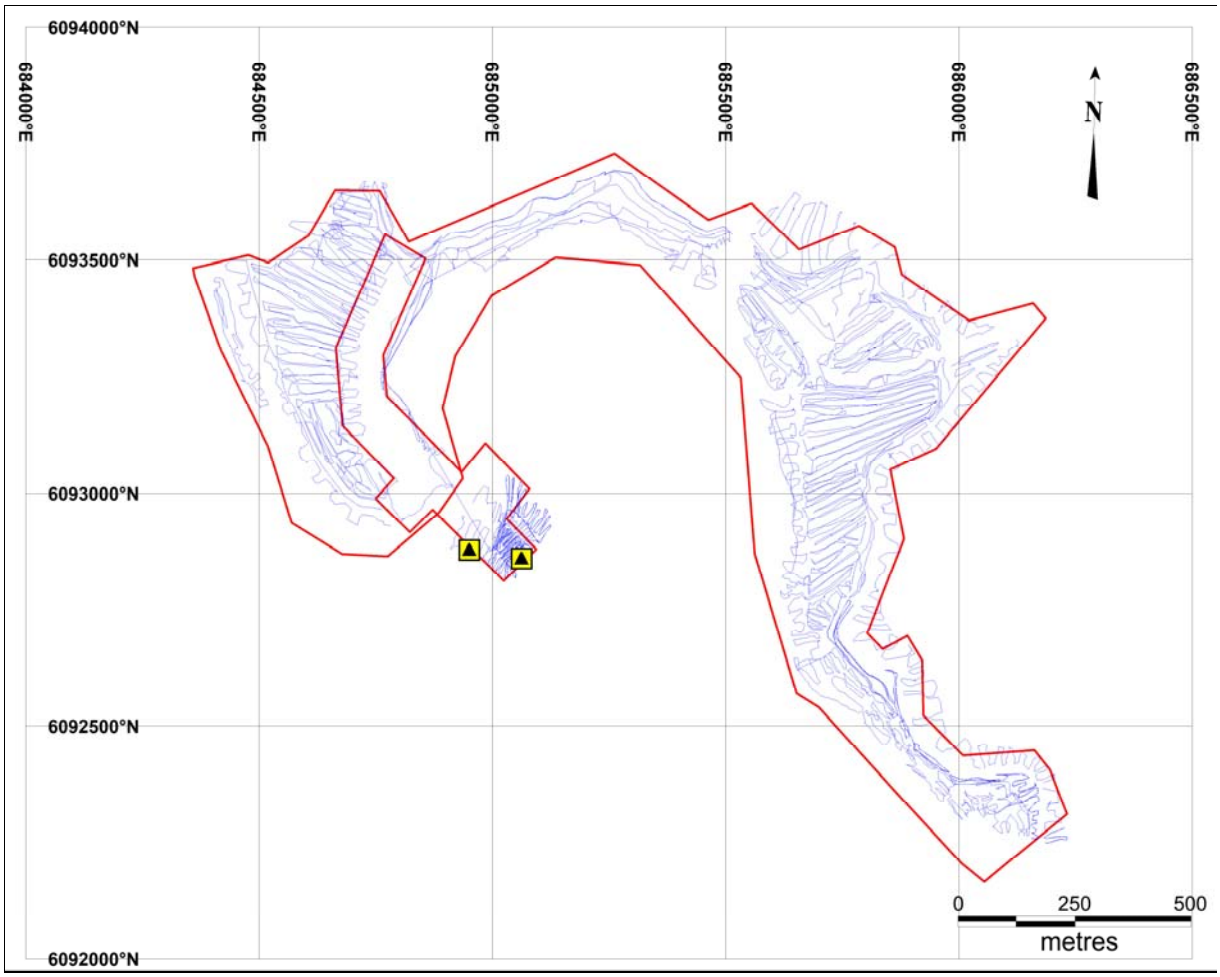

Figure 11: 10% Assessment GPS Tracked Paths.(position of shrapnel ball finds shown by symbol)

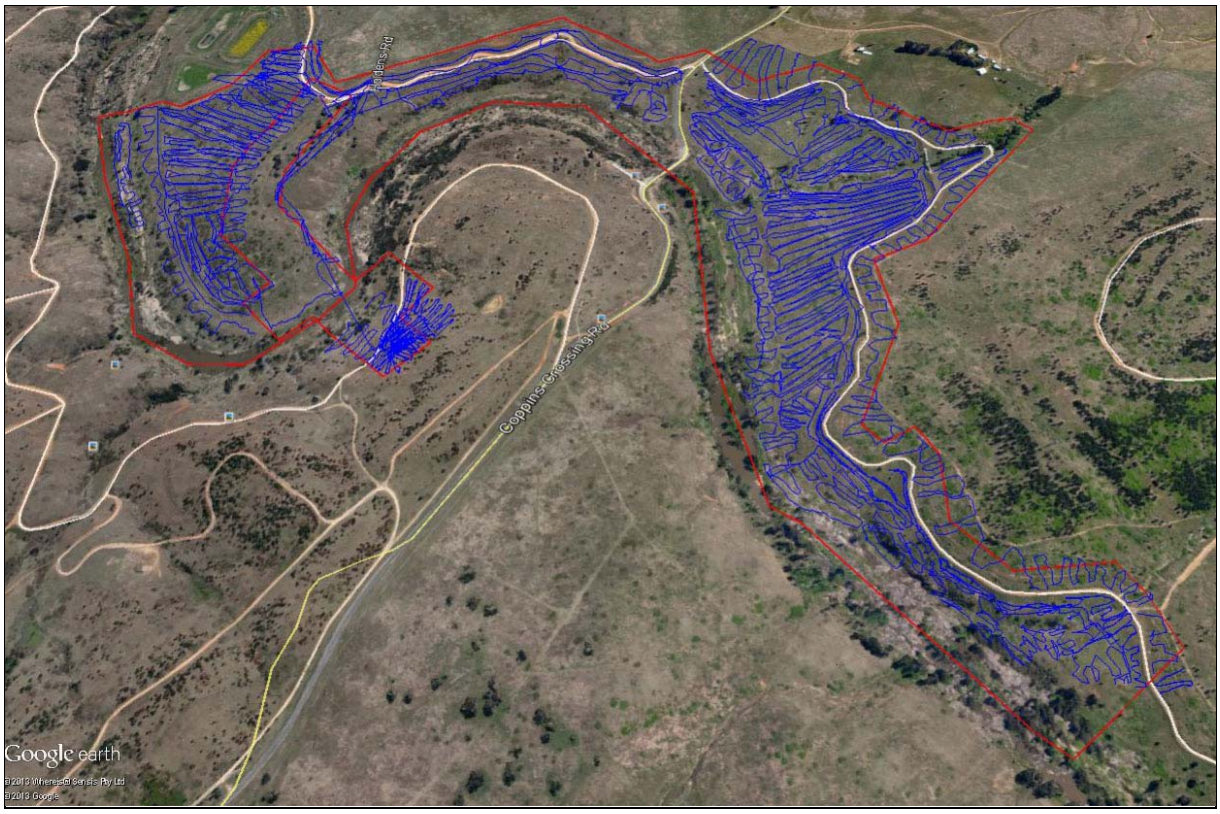

Figure 12: Tracked GPS Assessment Paths overlaid on Google Earth Image

5.0 QUALITY MANAGEMENT

Milsearch is certified by Lloyd's Register Quality Assurance (LRQA) under AS/NZS ISO 9001:2008 Quality management systems – Requirements. Our Quality Management System (QMS) describes the processes and procedures used to satisfy the requirements and expectations of the Client and also, the objectives of the Project. To ensure the required quality control and assurance was achieved on this Project, as a minimum the following actions were undertaken:

- All geophysical survey equipment was tested prior to and after each day's operations on an on-site test range developed specifically for the purpose and in accordance with the Milsearch QMS Work Instruction applicable to that equipment.
- All analogue search equipment was functionally tested prior to the commencement (start) and the completion (end) of the days UXO assessment operations using the on-site test and calibration range. This ensured that at all times the equipment was performing within the manufacturer specifications. Should a magnetometer or detector have failed an end of day functional test, all target investigations undertaken by that instrument would have been re-investigated using detector replacement instrument. For this Project, no instrument failed a daily start or finish functional test.
- Downloaded raw digital data was reviewed by the Project Geophysicist to assess it for suitability and accuracy. The results of this review are recorded on the internal Milsearch Quality Manual document – Project Geophysical Data Review Log (F-197).

- Additionally as part of the geophysicist's review of the raw digital data, the quality of the positioning data was examined. Any surveyed areas with unacceptable positioning data were re-surveyed and that action recorded in the Project Daily Work Diary at Attachment A.
- Quality Control investigations were completed at the end of the anomaly investigation phase. The Project Geophysicist completed a review of the interpreted data and reviewed the completed dig sheets.

6.0 RESULTS AND CONCLUSIONS

The 101ha Molonglo Priority Works area has been subjected to a disciplined UXO remediation in proposed construction areas and elsewhere a disciplined 10% contamination assessment.

Two small bridge-footing construction areas could not be fully searched due to vegetation, and protected fauna constraints. Those areas were floodplain locations with heavy density of washed up trees preventing traversing of that land. LDA representatives identified that land as the proposed sites of future bridge pylons. That immediate vicinity has not been adequately searched for UXO. Should ground invasion/excavation operations be required at those specific sites then attendance of an EOD Technician for safeguarding duties would be considered prudent.

With the exception of two shrapnel balls discovered on the opposite river bank on the feature to the south of the Molonglo River, no other evidence of EO or EOW was detected in any other part of the land subjected to either remediation or assessment.

7.0 RECOMMENDATION and CERTIFICATION

In view of the competence of the Technical personnel appointed to the field operations of this Project, the proven capabilities of the both the digital and analogue equipment, the results of regular equipment testing and the outcomes of QC checks, it is certified the methodology applied to conduct the UXO remediation operations within the project site was sufficient to remove UXO equal to or greater than the size of a 15 pounder artillery projectile at 0.5m depth or shallower. Further, the 10% sampling methods employed to assess the surrounding zones within the Site confirm that no artillery impact areas exist within the assessed zones.

With the exception of the floodplain bridge pylon locations and entry track on the southern river bank, no further UXO interventions are required for the Molonglo Priority Works area and works can now proceed without constraints due to UXO contamination, other than those recommended below. Should excavations be intended in the floodplain location, then EOD Technician UXO safeguarding is recommended.

All organisations and personnel being granted access permission for the Molonglo Priority Works construction site should be advised the area has a history of being exposed to military activities and explosive ordnance. Such advice should include a UXO safety warning incorporating the possibility of finding ordnance items, the associated prospective hazards, and a "Do Not Touch" policy.

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It is recommended UXO safety protocols/policies/procedures be developed for application by all entities with access to the construction site. Such information should be incorporated into site induction training.

The area of contamination surveyed was exclusively within the Priority Works corridor. Development of adjacent land outside the corridor should entail further examination for UXO contamination, particularly if development works are planned for the spur line running south of Coppins Crossing onto the Molonglo Stage 2 Development land. That examination should first comprise a 10% transect sampling assessment to delineate the impact areas, followed by 100 % UXO geophysical remediation of those areas to be developed.

Report prepared by:

[redacted]

[redacted]

Project Manager

27 September 2013

Report reviewed and released by:

[redacted]

Project Director

27 September 2013

Attachments:

A. Project Daily Work Diaries
B. Equipment Technical Specifications
C. Ordnance Detection Survey - Interpretation and Investigation Reports (F-155) with individual block interpretation images
D. Search Equipment Functional Test Logs (F-166)

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Attachment A

Project Daily Work Diaries

(F-198)

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine	Outstanding Issues
Wed 7 Aug 13 Start: 0800 End: 1600	Activity: Mobilisation Resources: Pers: B. Davis Eqpt: Minelab F3 Task: Safeguarding mechanical devegetation operations being conducted by Eden Brae Services (Marco Dede – 0417 959 478 or 02 6253 9368)	Number of employees on site: 1 PPE level (P-116): D Too box talk conducted (F-161): ☒ Equipment test conducted (F-166): ☒ QC check conducted: ☐	
Thu 8 Aug 13 Start: 0800 End: 1600	Activity: Safeguarding Resources: Pers: B. Davis Eqpt: Minelab F3 Task: Safeguarding mechanical devegetation operations. Other: P. Wheeler mobilising from Sydney by road, eta 1200 hr.	Number of employees on site: 1 PPE level (P-116): D Too box talk conducted (F-161): ☒ Equipment test conducted (F-166): ☒ QC check conducted: ☐	

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Fri 9 Aug 13 Start: 0800 End: 1600	Activity: Safeguarding & boundary acquisition Resources: Pers: B. Davis P. Wheeler Eqpt: Minelab F3 DGPS Task: 1. Safeguarding mechanical devegetation operations. 2. Prepare site, identify boundaries	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	1 D ☒ ☒ ☐	Client rep, Daniel visited site. Advised deveg and survey activities to be discontinued in PTWL habitat areas. Daniel toured site and identified "NO GO" areas for deveg workers and survey team.
Sat 10 Aug 13 Start: 0800 End: 1615	Activity: Survey/Remediation Resources: Pers: PM - B. Davis EOD Tech – P Wheeler Eqpt: G858 with DGPS 1. Safeguarding mechanical devegetation operations. 2. Commence survey ops Data collected from Blocks A1 – A4 inclusive Battery change required Block A2	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine	Outstanding Issues
Sun 11 Aug 13 Start: 0730 End: 1540	Activity: Survey/Remediation Resources: Pers: PM - B. Davis EOD Tech – P. Wheeler Eqpt: G858 with DGPS Task: Survey Blocks A5 to A8 inclusive Data submitted to T. von Strokirch	Number of employees on site: 2 PPE level (P-116): D Too box talk conducted (F-161): ☐ Equipment test conducted (F-166): ☒ QC check conducted: ☐	

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Mon 12 Aug 13 Start: 0800 End: 1230	Activity: Survey/Remediation Resources: Pers: PM - B. Davis EOD Tech – P. Wheeler Eqpt: G858 with DGPS Task: *1.* Continue survey. TVS advised data submitted to date is distorted/distorted. DGPS co-axial cable replaced due to split observed in cable casing. Resurveyed Block A8 with regular checks to ensure GPS has not 'dropped' into autonomous mode. New data submitted to TVS. Operations curtailed due to inclement weather. BD & PW return to office for admin duties. TVS advised new Block A8 data also corrupted. Complete DGPS to be replaced prior to continuation. *2.* Eden Brae Deveg Ops continue. 100% survey area deveg now completed for north side of river. Mowers commencing cutting lanes for 10% assessment phase. Cutters stood down due to rain. Deveg mgr in discussions with LDA regarding deveg south side of river. PTWL habitat is factor limiting what ops can be conducted. No action permitted until LDA permission obtained. Other: Ceased work at 1035 hr due to inclement weather. No 'let-up' in weather - Left site 1145 hr.	Number of employees on site:	2	Edenbrae organised bobcat for clearing floodplain at south of river. Bobcat access permission requested from client. Permission not yet received. Discussion with client led to advice to exclude area unless bobcat clearance permission is forthcoming.
		PPE level (P-116):	D	
		Too box talk conducted (F-161):	☒	
		Equipment test conducted (F-166):	☒	
		QC check conducted:	☐	

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Tue 13 Aug 13 Start 0800 End 1610	Activity: Survey/Remediation Resources: Pers: PM - B. Davis EOD Tech – P. Wheeler Eqpt: G858 with DGPS Task: DGPS & all components replaced. Resurvey Block A8 & submit data to TVS to validate eqpt functioning correctly. TVS advised eqpt (DGPS) now functioning normally. Surveyed Blocks A8, A91, A92, A101	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	DGPS now fully functional. Block A8 has now been surveyed 3 times. TVS advised Blocks A1 to A7 will all need to be resurveyed due to DGPS malfunction on Sat & Sun.
Wed 14 Aug 13 Start: 0800 End: 1400	Activity: Remediation Resources: Pers: PM - B. Davis EOD Tech – P. Wheeler Eqpt: G858 with DGPS Task: G858 Survey Blocks A102, A11, A12, A13-1, A13-2	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine	Outstanding Issues
Thu 15 Aug 13 Start: 0800 End: 1600	Activity: Resources: Pers: PM - B. Davis EOD Tech – P. Wheeler Eqpt: G858 with DGPS F3 Garmin 401 Task: G858 Survey Blocks A14, A15, infill on A12 plus resurvey A1 to A7. 10% assessment using F3 on polygon areas not marked as 'yellow' construction areas.	Number of employees on site: 1 PPE level (P-116): D Too box talk conducted (F-161): ☐ Equipment test conducted (F-166): ☐ QC check conducted: ☐	Floodplain area at rivers edge heavily contaminated with washed up trees. Not searchable. LDA's Daniel Santusuossa advised.

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Fri 16 Aug 13 Start: 0800 End: 1600	Activity: Resources: Pers: PM – B. Davis EOD Tech – P. Wheeler Eqpt: F3 Garmin 401 Task: Minelab F3 Survey priority construction area on south side of river. Minelab F3 10% assessment of polygon areas outside of construction areas. Finds: Qty 2 x shrapnel balls discovered @ 1. 685,063E and 6,092,858N 2. 684,951E and 6,092,877N	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	1 D x x ☐	Floodplain area on rivers edge excluded due to impassability caused by washed up deadfall trees and fencing materials. Client permission to deploy Bobcat (required to make area surveyable) still not received.

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Sat 17 Aug 13 Start 0730 End 1600	Activity: 10% F3 Minelab FVS of Priority Works Area Resources: Pers: PM; P. Wheeler Eqpt: F3 Minelab & Garmin 401 Task: Conduct 10% FVS on area to the West of Coppins Crossing Rd IAW client diagram. Intermittent rain throughout the day affected progress. Approx 10 line km completed. All of the area West from Coppins Crossing Rd to the Priority Works Area has been subject to approx 10% FVS with NSTR. Approx 40% of the area to the West of the Priority Works Area has been subjected to approx 10% FVS with NSTR.	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	1 D ☒ ☒ ☐	
Sun 18 Aug 13 Start 0730 End 1530	Activity: 10% F3 Minelab FVS of Priority Works Area Resources: Pers: PM; P. Wheeler Eqpt: F3 Minelab & Garmin 401 Task: Conduct 10% FVS on area to the West of Coppins Crossing Rd IAW client diagram. Approx 11.5 line km completed. All of the area to the West of the Priority Works Area has been subjected to approx 10% FVS with NSTR.	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	1 D ☒ ☒ ☐	Awaiting data return from T regarding 100% remediation area. If it doesn't arrive tonite intend on commencing 10% FVS of Eastern side of Coppins Crossing Rd. Deveg will commence there in morning. If dig sheets arrive intend to complete those first.

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Mon 19 Aug 13 Start 0730 End 1500	Activity: 10% F3 Minelab FVS of Priority Works Area Resources: Pers: PM; P. Wheeler EOD Tech; Laith Stevens Eqpt: F3 Minelab x 2 & Garmin 401 x 2 Task: Conduct 10% FVS on area to the East of Coppins Crossing Rd IAW client diagram. Approx 6.5 line km completed. NSTR Intermittent rain, heavy at times, interrupted works throughout the day hence the reduced line rate. Heavy rain with sleet arrived at approx 1500 calling a halt to slashing and further survey.	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	Still awaiting data return from T regarding 100% remediation area. Will continue with current FVS until dig sheets arrive. If dig sheets arrive intend to complete those first.
Tue 20 Aug 13 Start 0730 End 1600	Activity: 10% F3 Minelab FVS of Priority Works Area Resources: Pers: PM; P. Wheeler EOD Tech; Laith Stevens Eqpt: F3 Minelab x 2 & Garmin 401 x 2 Task: Conduct 10% FVS on area to the East of Coppins Crossing Rd IAW client diagram. Approx 17 line km completed. NSTR	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	Still awaiting data return from T regarding 100% remediation area. Will continue with current FVS until dig sheets arrive. If dig sheets arrive intend to complete those first.

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Project Daily Work Diary

Molonglo Priority Works UXO Assessment and Survey

Date	Daily Work	Routine		Outstanding Issues
Wed 21 Aug 13 Start 0730 End 1530	Activity: 10% F3 Minelab FVS of Priority Works Area Resources: Pers: PM; P. Wheeler EOD Tech; Laith Steven Eqpt: F3 Minelab x 2 & Garmin 401 x 2 Task: Conduct 10% FVS on area to the East of Coppins Crossing Rd IAW client diagram. Approx 19 line km completed. NSTR. 100% of FVS complete. Devegetation contractor completed all works and left site. No further devegetation required.	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	Still awaiting data return from T regarding 100% remediation area. Intent tomorrow is to DGPS mark all survey pegs, remove all non-essential pegs, and reconstitute stores. If data arrives tonite intend to process that first.
Thu 22 Aug 13 Start 0730 End 1815	Activity: Investigation of 100% Surveyed Area Resources: Pers: PM; P. Wheeler EOD Tech; Laith Stevens Eqpt: F3 Minelab x 2 & Foerster 4032 Locator Task: Conducted investigation of anomalies identified in 100% remediation area. All anomalies located, NSTR. Completed site mark out and DGPS marked Cleared Polygon.	Number of employees on site: PPE level (P-116): Too box talk conducted (F-161): Equipment test conducted (F-166): QC check conducted:	2 D ☒ ☒ ☐	Intent tomorrow is to reconstitute stores and demobilise.

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Attachment B

Equipment Technical Specifications

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GEOMETRICS G858 PORTABLE CESIUM MAGNETOMETER TECHNICAL SPECIFICATIONS

The Geometrics G858 Magnetometer is a dual sensor cesium vapour total-field magnetometer designed to measure and record the magnetic field strength of the earth to a high level of accuracy. Ferrous metal objects cause the earth's magnetic field to change in flux direction. These magnetic perturbations are located by sensitive magnetometer sensors and the variations in field strength are used to model the position, depth and theoretical mass of the buried ferrous item. It can be readily integrated with standard GPS positioning systems.

Operating Principle	Self-oscillating split-beam Cesium Vapor (non-radioactive Cs133) with automatic hemisphere switching
Operating Range:	17,000nT to 100,000 nT
Operating Zones	For highest signal-to-noise ratio, the sensor long axis should be oriented at 45^o, +/- 30^o to the earth's field angle, but operation will continue through 45^o, +/- 35^o.
Sensitivity	90% of all readings will fall within the following Peak-to-Peak envelopes: • 0.05nT at 0.1 sec cycle rate • 0.03nT at 0.2 sec cycle rate • 0.02nT at 0.5 sec cycle rate • 0.01nT at 1.0 sec cycle rate
Data Output	Three wire RS232 standard serial port, optional continuous real time transmittal of data via RS232 to PC. Total memory output transfer time less than 5 minutes at 115,200 baud.
Heading Error	+/- 1 nT
Gradient Tolerance	500 nT / inch; >20,000nT / meter
Data Storage	Nonvolatile RAM with capacity for 8 hrs of magnetometer time, event marks, field notes, location, or 3 hrs. of Gradiometer time and GPS at maximum sample rates.
Temperature (Operating)	25^o C to $+50^o$ C (-13^o F to $+122^o$ F
Visual Display	A 320x200 graphic LCD, daylight visible with selectable outputs for: • Data display • System setup functions • Survey setup functions • Survey monitoring • System Diagnostics
Shock	Drop 3 ft. on a hard surface without damage.
Console Magnetic Effect	Less than 1nT at 4 ft. from sensor
Battery Life	• 24 VDC rechargeable gel cell, 6 hrs. Magnetometer (single sensor) or 3 hrs Gradiometer usage (dual sensors). • Internal backup battery for clock and nonvolatile RAM
Water Tight	To 3 ft. (0.9 m) depth

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FOERSTER FEREX 4.032 MAGNETOMETER TECHNICAL SPECIFICATIONS

Detection Sensitivity	8 linear ranges from 0 to 3nT to 0 to 10000 nT or logarithmic range; resolution 0.3nT
Signal Display	Analogue pointer instrument & LEDs
Threshold for Power Cables	1 µT
Power Supply	4 mono cells, IEC LR 14 or 4 rechargeable batteries (optional)
Operating Time (1 probe)	• Intermittent operation >80 h • Continuous operation >70 h
Temperature Range	• Storage: -57°C to +70°C • Operational: -37°C to +70°C
Weight	Approx 4 kg
Dimensions (Approx)	• Control unit: Lx W x H – 500x180x180mm • Carrying tube: 660mm long, 35mm ⦸ • Battery pack: L=395mm, ⦸=44mm

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MINELAB F3 METAL DETECTOR TECHNICAL SPECIFICATIONS

The Minelab Electronics F3 metal detector incorporates patented Bi-polar technology that enhances Minelab's renowned and highly successful Multi-Period Sensing (MPS technology). Through MPS, the sensitivity of a detector remains constant regardless of the mineralized content of soil. Combined with "static coupling" the F3 does not require motion to detect a target thereby making pin-pointing techniques fast and accurate.

Operating Length	1510mm/59.5ins to 750mm/29.5ins
Operating weight with batteries (complete)	3.2kg / 7lbs
Operating weight without Battery Pack	2.3kg / 5lbs
Battery Pack with batteries	0.9kg / 2lbs
Shipping weight (in hard case with batteries)	11.7kg / 26lbs
Transmission (Pulse Induction)	Bi-polar Multi-Period-Sensing
Audio Output	Internal Loudspeaker / Earset (various configurations available)
Data Output	RS-232 (bi-directional)
Temperature (Operating)	-30 deg C to 60 deg C / -22 deg F to 140 deg F
Design Standard	MIL STD 810F
Batteries (Alkaline)	Alkaline D cell (1.5V – LR20)
Batteries (Alkaline)	NiCad or NiMh D cell minimum 4000mAh capacity

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Appendix C

Ordnance Detection Survey - Interpretation and Investigation Reports (F-155)

Milsearch Pty Ltd

Ordnance Detection Survey - Interpretation and Investigation Report - F-155

Block ID:	100% Area	**Project Reference:** MilS	ACT 33613
Project Manager:	Brian Davis	**Project Name:**	Molonglo Priority Works
Interpreter:	T von Strokirch	**Month Surveyed:**	Aug-2013
		Date Data Interpreted:	Aug-2013

Serial	Geophysical				Investigation			
	E(m) Coordinates	N(m) Coordinates	Est. Mass (kg)	Est Depth (m)	Description	Depth (m)	Disposal Action (See Legend)	EOD Tech ID
1	684794.13	6092966.5	13.3	0.8	Scrap	SFC	Removed	PW
2	684856.63	6092999	10.2	0.29	Scrap	SFC	Removed	PW
3	684797.69	6093011	0.2	0	Scrap	SFC	Removed	PW
4	684837.69	6093015.5	1.1	0.32	Scrap	SFC	Removed	PW
5	684860.44	6093017.5	0.8	0.21	Scrap	SFC	Removed	PW
6	684891.81	6093024.5	2.5	0.24	Scrap	SFC	Removed	PW
7	684802.75	6093026.5	2.5	0.28	Scrap	SFC	Removed	PW
8	684831.56	6093030	0.7	0.24	Scrap	SFC	Removed	PW
9	684881.25	6093031	34.4	0	Picket	SFC	In Situ	PW
10	684870.06	6093037.5	6.7	0.65	Scrap	SFC	Removed	PW
11	684873.75	6093037.5	0.9	0.28	Scrap	SFC	Removed	PW
12	684812.06	6093038.5	2.4	0.24	Scrap	SFC	Removed	PW
13	684802.13	6093040	25.4	0.17	Picket	SFC	In Situ	PW
14	684872.06	6093041	1.3	0.21	Scrap	SFC	Removed	PW
15	684808.56	6093043	0.7	0.1	Scrap	SFC	Removed	PW
16	684801.38	6093048.5	266.9	0.56	Picket	SFC	In Situ	PW
17	684846.25	6093049	4.5	0.15	Scrap	SFC	Removed	PW
18	684866.69	6093050	1	0.05	Scrap	SFC	Removed	PW
19	684797.81	6093052.5	109.9	0.55	Picket	SFC	In Situ	PW
20	684767.88	6093056.5	19.3	0.6	Scrap	SFC	Removed	PW
21	684857.5	6093058	0.7	0.23	Scrap	SFC	Removed	PW
22	684763.56	6093061.5	6.2	0.26	Scrap	SFC	Removed	PW
23	684818.25	6093065.5	0.3	0	Scrap	SFC	Removed	PW
24	684811.44	6093065.5	2.1	0.35	Scrap	SFC	Removed	PW
25	684832	6093066	16.8	0.6	Scrap	SFC	Removed	PW
26	684816.94	6093068	1.1	0.06	Scrap	SFC	Removed	PW
27	684833.81	6093068.5	1	0.03	Scrap	SFC	Removed	PW
28	684841.06	6093073	25.3	0.77	Scrap	SFC	Removed	PW
29	684751.88	6093075	4.4	0.51	Scrap	SFC	Removed	PW
30	684756.63	6093075.5	24.6	0.4	Scrap	SFC	Removed	PW
31	684747.13	6093076.5	2.2	0	Scrap	SFC	Removed	PW
32	684822.94	6093078	4.5	0.37	Scrap	SFC	Removed	PW
33	684807.31	6093079.5	32.2	1.06	Geo	0.5	In Situ	PW
34	684732.31	6093084	0.4	0.09	Scrap	SFC	Removed	PW
35	684817.81	6093084	547.9	1.98	Scrap	SFC	Removed	PW
36	684811.19	6093085.5	168.7	1.42	Scrap	SFC	Removed	PW
37	684786.38	6093093	1.7	0.25	Scrap	SFC	Removed	PW
38	684716	6093095	72.9	0.26	Concrete Post	SFC	In Situ	PW
39	684768.56	6093104	0.8	0.12	Scrap	SFC	Removed	PW
40	684815.5	6093106	7	0.18	Scrap	SFC	Removed	PW
41	684833.13	6093107	1.4	0.26	Scrap	SFC	Removed	PW
42	684841.06	6093108	47.4	0.57	Picket	SFC	In Situ	PW
43	684779.63	6093111	102.9	0.46	Scrap	SFC	Removed	PW
44	684794.56	6093114.5	5.5	0.28	Scrap	SFC	Removed	PW

L = Left in situ, D = Destroyed in situ, R = Removed - See F-160

Milsearch Pty Ltd

Ordnance Detection Survey - Interpretation and Investigation Report - F-155

Block ID:	100% Area	**Project Reference:** MilS	ACT 33613
Project Manager:	Brian Davis	**Project Name:**	Molonglo Priority Works
Interpreter:	T von Strokirch	**Month Surveyed:**	Aug-2013
		Date Data Interpreted:	Aug-2013

Serial	Geophysical				Investigation			
	E(m) Coordinates	N(m) Coordinates	Est. Mass (kg)	Est Depth (m)	Description	Depth (m)	Disposal Action (See Legend)	EOD Tech ID
45	684727.88	6093114.5	63.5	1.57	Geo	0.5	In Situ	PW
46	684777.81	6093115	204.9	0.6	Scrap	SFC	Removed	PW
47	684824.81	6093120	1.5	0.18	Scrap	SFC	Removed	PW
48	684775.69	6093122	28300.9	2.83	Scrap	SFC	Removed	PW
49	684791.94	6093125.5	3.8	0.1	Scrap	SFC	Removed	PW
50	684819.31	6093128.5	2.8	0.24	Scrap	SFC	Removed	PW
51	684758.06	6093129	1.8	0.08	Scrap	SFC	Removed	PW
52	684815.19	6093133.5	1.9	0.45	Scrap	SFC	Removed	PW
53	684784.94	6093141	1.5	0.2	Scrap	SFC	Removed	PW
54	684815.44	6093142	1.4	0.31	Scrap	SFC	Removed	PW
55	684777.44	6093143.5	1.5	0.31	Geo	0.5	In Situ	PW
56	684808.94	6093145.5	0.8	0.13	Scrap	SFC	Removed	PW
57	684762.88	6093155.5	69.5	1.31	Geo	0.5	In Situ	PW
58	684783.5	6093156	45.2	1	Geo	0.5	In Situ	PW
59	684812.44	6093156.5	1	0.15	Scrap	0.5	Removed	PW
60	684784.56	6093158.5	49.4	0.75	Geo	0.5	In Situ	PW
61	684762.19	6093162	330.1	1.16	Scrap	SFC	Removed	PW
62	684724.25	6093165.5	25.4	0.84	Geo	0.5	In Situ	PW
63	684805.94	6093166	8.7	0.54	Scrap	SFC	Removed	PW
64	684803.81	6093166.5	2.1	0.26	Scrap	0.5	Removed	PW
65	684803.44	6093169	1.3	0.17	Geo	0.5	In Situ	PW
66	684800.81	6093170.5	5.7	0.55	Scrap	SFC	Removed	PW
67	684795.25	6093173.5	5.7	0.53	Scrap	SFC	Removed	PW
68	684728.44	6093180.5	220.6	1.38	Geo	0.5	In Situ	PW
69	684789.69	6093180.5	4.6	0.16	Scrap	SFC	Removed	PW
70	684751.25	6093209.5	540	2.86	Scrap	SFC	Removed	PW
71	684728.56	6093221	0.7	0.27	Scrap	SFC	Removed	PW
72	684746.63	6093231.5	1.6	0.45	Scrap	SFC	Removed	PW
73	684753.06	6093244	2	0.42	Geo	0.5	In Situ	PW
74	684721.25	6093259	154.5	0.62	Concrete Post	SFC	In Situ	PW
75	684716.06	6093296	15.9	0.53	Geo	0.5	In Situ	PW
76	684719	6093296.5	166.8	1.51	Geo	0.5	In Situ	PW
77	684718.5	6093306	12	0.88	Geo	0.5	In Situ	PW
78	684725.5	6093320.5	7	1.1	Geo	0.5	In Situ	PW
79	684742.13	6093320.5	23.5	1.05	Geo	0.5	In Situ	PW
80	684757.44	6093328	114.1	1.77	Scrap	SFC	Removed	PW
81	684744.75	6093332	0.7	0.1	Scrap	SFC	Removed	PW
82	684765	6093347	241	1.37	Scrap	SFC	Removed	PW
83	684762.38	6093350.5	79.2	1.63	Scrap	SFC	Removed	PW
84	684751.63	6093353.5	23.4	0.66	Scrap	SFC	Removed	PW
85	684763.19	6093355.5	0.9	0.2	Scrap	SFC	Removed	PW
86	684730.25	6093356.5	6.3	0.63	Geo	0.5	In Situ	PW
87	684754.25	6093357	1	0.23	Scrap	SFC	Removed	PW
88	684779.69	6093358.5	6.2	0.58	Scrap	SFC	Removed	PW

L = Left in situ, D = Destroyed in situ, R = Removed - See F-160

Milsearch Pty Ltd

Ordnance Detection Survey - Interpretation and Investigation Report - F-155

Block ID:	100% Area	**Project Reference:** MilS	ACT 33613
Project Manager:	Brian Davis	**Project Name:**	Molonglo Priority Works
Interpreter:	T von Strokirch	**Month Surveyed:**	Aug-2013
		Date Data Interpreted:	Aug-2013

Serial	Geophysical				Investigation			
	E(m) Coordinates	N(m) Coordinates	Est. Mass (kg)	Est Depth (m)	Description	Depth (m)	Disposal Action (See Legend)	EOD Tech ID
89	684749.13	6093359	2.1	0.45	Scrap	SFC	Removed	PW
90	684759.13	6093366	0.9	0.28	Scrap	SFC	Removed	PW
91	684767.88	6093370.5	7.9	0.71	Scrap	SFC	Removed	PW
92	684777.94	6093375	3127.5	1.81	Geo	0.5	In Situ	PW
93	684784	6093378.5	819.7	2.16	Scrap	SFC	Removed	PW
94	684750.13	6093380	1.4	0.42	Scrap	SFC	Removed	PW
95	684739	6093380	3	0.63	Scrap	SFC	Removed	PW
96	684742	6093385.5	11.8	1.1	Scrap	SFC	Removed	PW
97	684779.69	6093387	12.9	0.73	Geo	0.5	In Situ	PW
98	684754.81	6093389	3.8	0.43	Scrap	SFC	Removed	PW
99	684774.75	6093390	1.6	0.19	Scrap	SFC	Removed	PW
100	684753.19	6093394.5	24.3	0.64	Scrap	SFC	Removed	PW
101	684794.38	6093397	10	0.76	Scrap	SFC	Removed	PW
102	684804.06	6093413	11.6	0.56	Scrap	SFC	Removed	PW
103	684801.88	6093418.5	45.8	0.16	Geo	0.5	In Situ	PW
104	684810.13	6093422	20.5	0.63	Scrap	SFC	Removed	PW
105	684770.13	6093424	1.8	0.31	Scrap	SFC	Removed	PW
106	684812.5	6093425.5	22.4	0.84	Scrap	SFC	Removed	PW
107	684816.13	6093426	4.1	0.18	Scrap	SFC	Removed	PW
108	684800.25	6093430	2017.8	2.16	Scrap	SFC	Removed	PW
109	684815.19	6093438	28.1	0.47	Picket	SFC	In Situ	PW
110	684818.13	6093442.5	2.8	0.28	Picket	SFC	In Situ	PW
111	684826.06	6093443	8.2	0.55	Scrap	SFC	Removed	PW
112	684778.13	6093445	4	0.59	Scrap	SFC	Removed	PW
113	684832.63	6093446.5	1.9	0.22	Scrap	SFC	Removed	PW
114	684785.19	6093449	11.7	0.6	Scrap	SFC	Removed	PW
115	684772.88	6093449.5	0.8	0.3	Scrap	SFC	Removed	PW
116	684823.06	6093452	21.5	0.41	Scrap	SFC	Removed	PW
117	684770.5	6093452	1.2	0.26	Scrap	SFC	Removed	PW
118	684833.06	6093460	2.3	0.5	Scrap	SFC	Removed	PW
119	684808.88	6093470	39.5	0.88	Scrap	SFC	Removed	PW
120	684797.19	6093470.5	5.5	0.63	Scrap	SFC	Removed	PW
121	684797.94	6093476.5	37.1	0.48	Picket	SFC	In Situ	PW
122	684794.75	6093482	2.7	0.32	Scrap	SFC	Removed	PW
123	684798.88	6093483	1.6	0.4	Scrap	SFC	Removed	PW
124	684827.25	6093483	12.1	0.68	Scrap	SFC	Removed	PW
125	684833.94	6093486.5	53.6	0.68	Scrap	SFC	Removed	PW
126	684790.25	6093487	4.3	0.6	Scrap	SFC	Removed	PW
127	684786.69	6093489	4.2	0.53	Scrap	SFC	Removed	PW
128	684791.75	6093491.5	14.3	0.45	Scrap	SFC	Removed	PW
129	684809.69	6093492	7.9	0.09	Scrap	SFC	Removed	PW
130	684837.75	6093492.5	159.7	0.7	Scrap	SFC	Removed	PW
131	684828.75	6093495.5	33.9	1.05	Scrap	SFC	Removed	PW
132	684833.06	6093501.5	74.6	0.37	Scrap	SFC	Removed	PW

L = Left in situ, D = Destroyed in situ, R = Removed - See F-160

Milsearch Pty Ltd

Ordnance Detection Survey - Interpretation and Investigation Report - F-155

Block ID:	100% Area	**Project Reference:** MilS	ACT 33613
Project Manager:	Brian Davis	**Project Name:**	Molonglo Priority Works
Interpreter:	T von Strokirch	**Month Surveyed:**	Aug-2013
		Date Data Interpreted:	Aug-2013

Serial	Geophysical				Investigation			
	E(m) Coordinates	N(m) Coordinates	Est. Mass (kg)	Est Depth (m)	Description	Depth (m)	Disposal Action (See Legend)	EOD Tech ID
133	684809.13	6093513	22.4	0.43	Scrap	SFC	Removed	PW

I certify that these interpretations listed above have been investigated, confirmed as described and disposed of as detailed in Disposal Action.

Project Manager's Signature:	Paul Wheeler	**Date:**	**22/08/13**

L = Left in situ, D = Destroyed in situ, R = Removed - See F-160

Appendix D

Search Equipment Functional Test Logs (F-166)

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Milsearch Pty Ltd
Search Equipment Functional Test Log - F-166

Project Name:	Molonglo Priority Works
Project Reference:	MilS ACT33613

See Control of Nonconforming Product Procedure (P-103) and Control, Calibration and Inspection of Equipment Procedure (P-132) The search equipment daily functional test shal be conducted before work starts (Start), on completion of search operations (End), or at any othertime directed by the Project Manager (Other). Refer to Test and Calibration in the Project Management Plan or Standing orders for Minor Projects.

Test Date	Equipment Type	Equipment Serial No	Start Test (Y/N)	End Test (Y/N)	Other Test (Time)	F-104 NCR Report No (if applicable)	Operator's Name	Signature
7 Aug 13	F3 Minelab	N10693	Y	Y			[redacted]	
8 Aug 13	F3 Minelab	N10693	Y	Y				
9 Aug 13	F3 Minelab	N10693	Y	Y				
10 Aug 13	G858	S1369	Y	Y				
11 Aug 13	G858	S1369	Y	Y				
12 Aug 13	G858	S1369	Y	Y				
13 Aug 13	G858	S1369	Y	Y				
14 Aug 13	G858	S1369	Y	Y				
15 Aug 13	G858	S1369	Y	Y				
15 Aug 13	F3	N10693	Y	Y				
16 Aug 13	G858	S1369	Y	Y				
16 Aug 13	F3	N10693	Y	Y				

Printed on 25 September 2013 Version 3 Page 1 of 1

Commercial in Confidence

DRAFT
Commercial in Confidence

See Control of Nonconforming Product Procedure (P-103) and Control, Calibration and Inspection of Equipment Procedure (P-132).The search equipment daily functional test shall be conducted before work starts (Start), on completion of search operations (End), or at any other time directed by the Project Manager (Other). Refer to Test and Calibration in the Project Management Plan or Standing orders for Minor Projects.

Test Date	Equipment Type	Equipment Serial No	Start Test (Y/N)	End Test (Y/N)	Other Test (Time)	F-104 NCR Report No (if applicable)	Operator's Name	Signature
19 Aug 13	F3 Minelab	N13472	Y	Y			[redacted]	
19 Aug 13	F3 Minelab	N10693	Y	Y			[redacted]	
20 Aug 13	F3 Minelab	N13472	Y	Y			[redacted]	
20 Aug 13	F3 Minelab	N10693	Y	Y			[redacted]	
21 Aug 13	F3 Minelab	N13472	Y	Y			[redacted]	
21 Aug 13	F3 Minelab	N10693	Y	Y			[redacted]	
22 Aug 13	F3 Minelab	N10693	Y	Y			[redacted]	
22 Aug 13	4032 Locator	447	Y	Y			[redacted]	

Commercial in Confidence

From: Richardson, Dave
To: Mannion, Mark
Subject: FW: LDA Submission re Provisional Listing of Kama Woodland/Grassland and Lower Molonglo Geological Site
Date: Thursday, 3 October 2013 1:03:00 PM
Attachments: Letter to Mr Gerhard Zatschler -ACT Heritage Council 28Jul10.doc.pdf

Mark,

Here is the LDA comments (with a signed letter) that went to Heritage at the time.

FYI.

Regards

Dave

From: Ijtsma, Michelle
Sent: Wednesday, 28 July 2010 4:53 PM
To: Foxlee, Jasmine
Cc: OConnell, Jennifer; Richardson, Dave; Dawes, David
Subject: LDA Submission re Provisional Listing of Kama Woodland/Grassland and Lower Molonglo Geological Site

Dear Jasmine

I am writing in regard to my conversation with Jenny O'Connell yesterday. Jenny advised that ACT Heritage Council would consider the attached comments if they were received by close of business today.

Attached are the LDA comments regarding the provisional listing of the following sites:

- Kama Woodland/Grassland; and
- Lower Molonglo Geological Site.

The original letter is in the mail. Please contact me if you have any queries regarding the attached documents.

Kind Regards

Michelle

Michelle Ijtsma | Executive Assistant to CEO

Land Development Agency

Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602

Phone: 02 6207 3005 | Fax: 02 6207 0386 | Web: www.lda.act.gov.au

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Email lda@act.gov.au
Web www.lda.act.gov.au

Mr Gerhard Zatschler
Secretary
ACT Heritage Council
GPO Box 158
CANBERRA ACT 2601

Dear Mr Zatschler, Gerhard

Thank you for your invitation to comment on the provisional listing of areas contained in your letter of 1 July 2010. The LDA offers the following comments for your urgent consideration on the Kama Woodland/Grassland and the Geological Areas listings.

Kama Woodland/Grassland

It is noted that the listing for this area extends inside the Future Urban Area (FUA) as identified in Variation 281 to the Territory Plan dated 18 August 2008. The listing you provided outlines buffer areas that the Heritage Council's document identifies as being of lower ecological value. Notwithstanding this, these areas have also been included in the coverage either side of Block 1419.

I am concerned that the eastern buffer area extending inside the FUA has the impact of reducing the area of developable land in the Eastern Precinct of Molonglo. A preliminary estimate of the loss of developable area is in excess of 52ha which may result in the decrease of revenue to government in the order of $270m.

I have drawn this matter to the attention of the Acting Chief Executive of Land and Property Services regarding the potential loss of land.

It should also be noted that the western edge of the listing extends into an area being investigated by ACTPLA and other agencies for use as an environmental offset under the Commonwealth's Environment Protection & Biodiversity Conservation Act 1999 (EPBC).

If the listing proceeds in its current form, it is likely to have a significant adverse financial impact on the ACT community over many years and also reduce the Territory's ability to respond effectively to the offsets provision of the EPBC legislation.

Lower Molonglo Geological Site

I note the location of the listed area and its relationship to Kama, the FUAs and the Molonglo River Corridor. I understand that ACTPLA is investigating stormwater management options for protecting downstream water quality and minimising environmental impacts in the Eastern Precinct of Molonglo and suggest the listing may impact on their current studies. You may wish to discuss this matter with ACTPLA directly if you have not already done so.

If you have any queries with regard to these comments, please contact Dave Richardson on 6207 5616 or dave.richardson@act.gov.au in the first instance.

Yours sincerely

John Robertson
Chief Executive Officer

28 July 2010

cc David Dawes
Acting Chief Executive
Land & Property Services

From: [redacted]
To: Santosuosso, Daniel; Richardson, Dave
Cc: Mike Ransom; Brian Davis
Subject: FW: Proposed 10% UXO Assessment Boundary
Date: Thursday, 3 October 2013 2:02 53 PM
Attachments: image001.jpg
image002.jpg
image003.jpg
image004.jpg
Proposed FVS Boundary.PNG
Proposed FVS Boundary Rev 1.DAT
Proposed FVS Boundary Rev 1.ID
Proposed FVS Boundary Rev 1.MAP
Proposed FVS Boundary Rev 1.TAB
Proposed FVS Boundary.DAT

Dave and Daniel,
Attached is a first cast image and mapinfo files for a suggested 10% UXO assessment of the spur line that we named Town Centre North at our meeting the other day. The area is 81.1Ha and is based on 24 July Nearmap imagery. Civil works associated with the main access road may have advanced further north since that image was flown.
The idea here is to use this 10% assessment to first identify and delineate the target areas for subsequent 100% geophysical remediation.
With minor adjustment, the area indicated should adequately cover the possible targets for the 1914 RMC practice shoot. If we find that we are still getting fragmentation, we can continue the area beyond the indicated boundary until fadeout is reached and cover that with a variation.
I have developed this now in order to get the wheels turning on this area concurrently with Majura West. With good management and your assistance, it ought to be possible to swing the Majura West team over onto this job immediately they finish at Majura, thus avoiding another mobilization.

[redacted]
[redacted]
Managing Director Milsearch Pty Ltd
Ph: 61-2-62868299, Fax: 61-2-62868266, Mob: [redacted]
Web: www.milsearch.com.au
Street Address: Unit 4-5, 30 Mawson Place, Mawson, ACT, Australia, 2607
Mailing Address: PO Box 687, Mawson, ACT, 2607
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From: Mike Ransom
Sent: Thursday, 3 October 2013 1:38 PM
To: [redacted]
Subject: Proposed FVS Boundary
FYA

[redacted]
Principal Operations Manager, Milsearch Pty Ltd
Ph: +61-2-6286 8299, Fax: +61-2-6286 8266, Mob: [redacted]
Web: www.milsearch.com.au
Street Address: Level 1, Unit 5, 30 Mawson Place
Mawson, ACT 2607, Australia
Mailing Address: PO Box 687, Mawson, ACT 2607, Australia
9001_JASANZ
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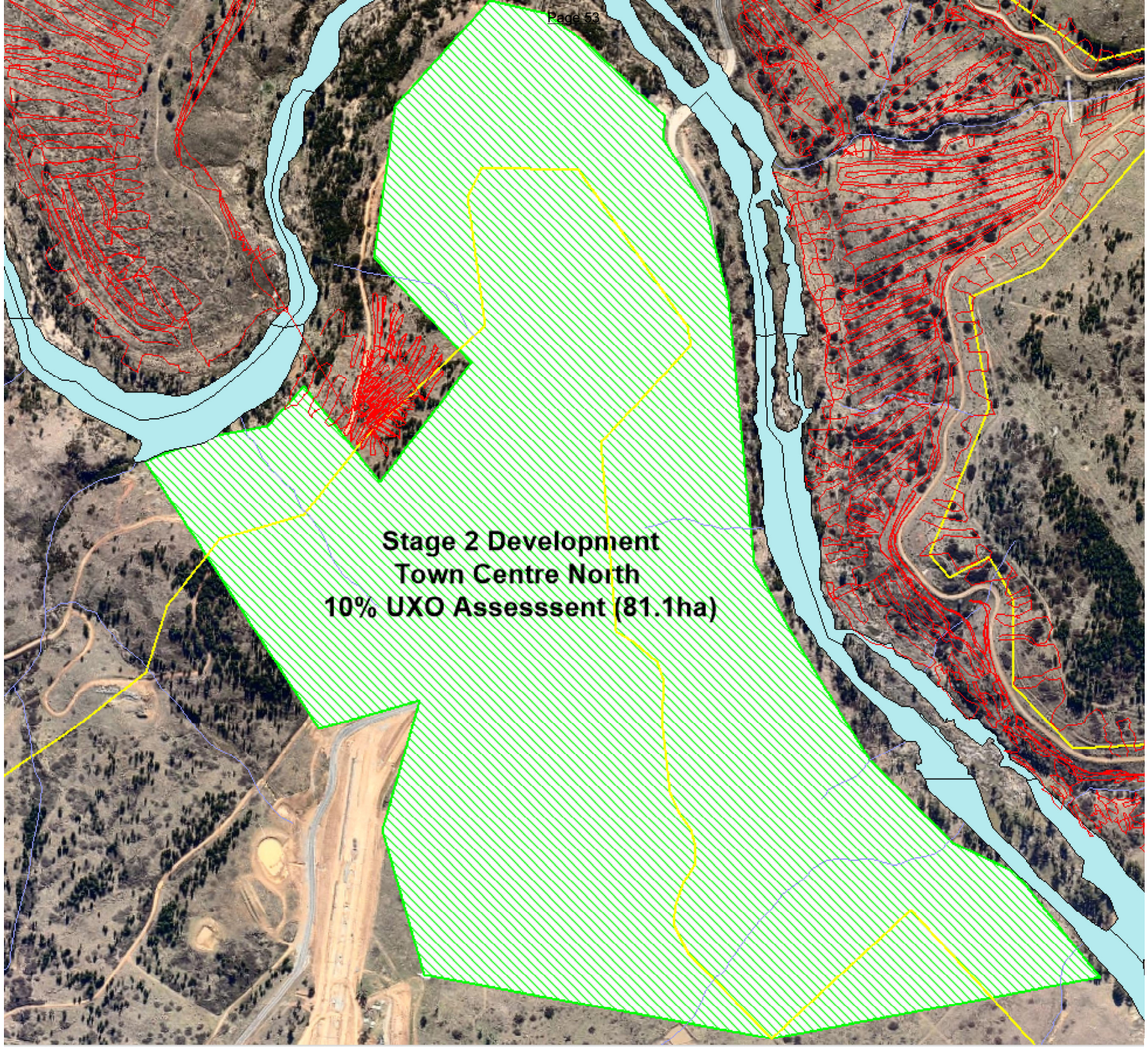
Stage 2 Development
Town Centre North
10% UXO Assesssent (81.1ha)

From: Santosuosso, Daniel
Sent: Thursday, 3 October 2013 11:58 AM
To: Heckenberg, Mark; Power, David; Walters, Daniel
Cc: Richardson, Dave; Oxborrow, Stuart
Subject: Molonglo UXO

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Mark / David / Dan,

The LDA have received the first draft of the Molonglo UXO assessment, please see below figure 3 for study area. I Have sent the report to the site auditor Rowena Salmon from Environ for review.

I will try and keep you all up to date with the progress of this report.

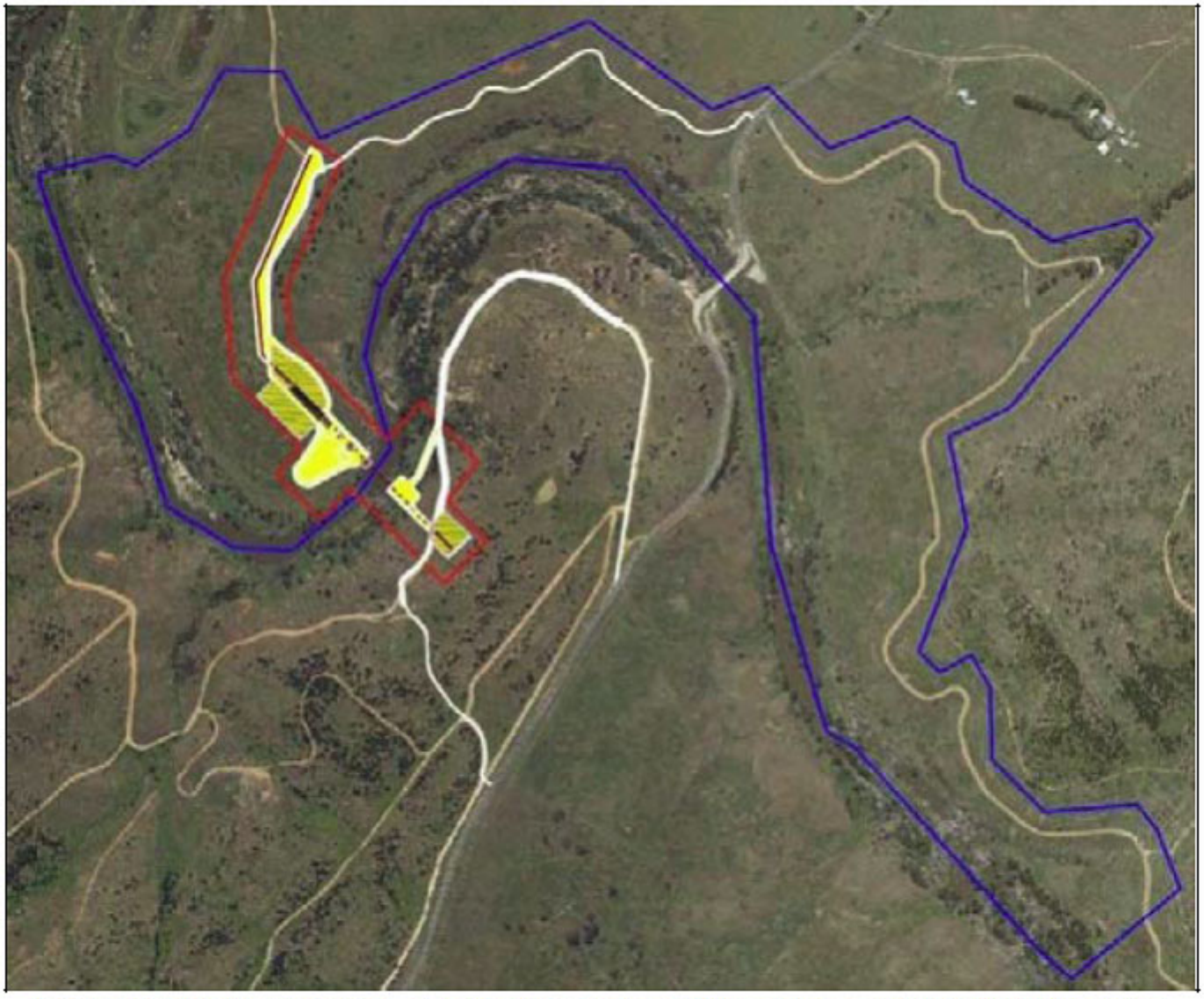

Figure 3: Polygon of 101ha Identified For Priority Works

regards

Daniel Santosuosso | Project Manager
Land Development Agency

Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
Phone: 02 6207 7212 | Fax: 02 62076110 | Web: www.lda.act.gov.au

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From: Santosuosso, Daniel
Sent: Thursday, 3 October 2013 12:00 PM
To: Santosuosso, Daniel; Heckenberg, Mark; Power, David; Walters, Daniel
Cc: Richardson, Dave; Oxborrow, Stuart
Subject: RE: Molonglo UXO

Follow Up Flag: Follow up
Flag Status: Flagged

Sorry I wasn't clear on the study areas. We had both the Blue line and the red area studied for potential UXO. The majority of the red area was surveyed at 100% and the blue area at 10% assessment. It will be supplied as one report.

cheers

Daniel Santosuosso | Project Manager
Land Development Agency

Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
Phone: 02 6207 7212 | Fax: 02 62076110 | Web: www.lda.act.gov.au

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From: Santosuosso, Daniel
Sent: Thursday, 3 October 2013 11:58 AM
To: Heckenberg, Mark; Power, David; Walters, Daniel
Cc: Richardson, Dave; Oxborrow, Stuart
Subject: Molonglo UXO

Hi Mark / David / Dan,

The LDA have received the first draft of the Molonglo UXO assessment, please see below figure 3 for study area. I Have sent the report to the site auditor Rowena Salmon from Environ for review.

I will try and keep you all up to date with the progress of this report.

From: Richardson, Dave
To: Noack, Bronwyn
Cc: Santosuosso, Daniel; Matesic, Ivo; Holt, Nicholas; Gianakis, Steven
Subject: RE: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies
Date: Monday, 14 October 2013 1:34:00 PM

Thanks Bronwyn. If you like we can scope out a preliminary assessment brief for discussion when Steve is back. ABPP has recently done such an exercise for us on Majura West.
Regards
Dave

From: Noack, Bronwyn
Sent: Monday, 14 October 2013 11:28 AM
To: Richardson, Dave
Cc: Santosuosso, Daniel; Matesic, Ivo; Holt, Nicholas; Gianakis, Steven
Subject: RE: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies
Thanks Dave, I'll raise this with Steven when he returns.

From: Richardson, Dave
Sent: Monday, 14 October 2013 11:05 AM
To: Noack, Bronwyn
Cc: Santosuosso, Daniel; Matesic, Ivo; Holt, Nicholas
Subject: RE: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies
Hi Bronwyn,
I don't think one has been done specifically for M3 up till now. There was of course one done for the Molonglo Valley Variation when the Structure Plan was originally put in place. However a number of assumptions have since changed – no dam, river corridor fire wick etc.
I think we need to do a preliminary one covering M3 to identify inherent risks/dangers/length of fire run and the interim management required by LDA/TaMS/lessee (Tully). It should also cover the river corridor although I do know that TaMS are doing something in there. The danger is that they may use the Strategic Bushfire Plan rather than using on ground data which may produce a different result when we get into the urban areas.
Then as we propose development, each EDP will need a specific update with a full BRA and management issues sorted out and confirmed.
Happy to discuss.
Regards
Dave

From: Noack, Bronwyn
Sent: Monday, 14 October 2013 10:02 AM
To: Richardson, Dave
Subject: FW: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies
Hi Dave
The attached list doesn't mention a bushfire study for Molonglo Stage 3 and I can't find a reference to one in our files. Do you know whether one has been undertaken or is proposed?
Cheers
Bronwyn

From: Richardson, Dave
Sent: Thursday, 10 October 2013 1:46 PM
To: Cousins, Meagan; Noack, Bronwyn
Cc: Paynter, Patrick; Santosuosso, Daniel
Subject: RE: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies
Meagan, The main outfall sewer odour study (scrubbers and stacks) is one of Patrick's studies.

No doubt Patrick will forward the info to Bronwyn?
Can you also please ask Patrick to send Bronwyn the latest on the John Gorton Drive/and Bindubi Street roads study crossing the river and in M3. There is nothing at this very early stage on lesser roads nor on cycle networks in Molonglo Stage 3.
Bronwyn, I've attached the latest list of due diligence studies for M3 for you. Steve has the list for adding/correcting/editing at the moment. We will also add through Patrick's area the Capital Works projects relating to land release to "complete" the picture.
We are still looking at options for the location of the playing fields (perhaps above William Hovell as one option). Patrick has another option which is adjacent to the Parkway in the south east of M3.
Let me know if there is anything else you need.
Regards
Dave

From: Cousins, Meagan
Sent: Thursday, 10 October 2013 1:20 PM
To: Richardson, Dave; Paynter, Patrick
Cc: Noack, Bronwyn
Subject: FW: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies

Hi DR and PP
Can you assist Bronwyn?
M

From: Noack, Bronwyn
Sent: Thursday, 10 October 2013 12:10 PM
To: Cousins, Meagan
Subject: Latest thinking Molonglo Stage 3 - road network, on/off road cycle networks and concurrent studies

Hi Meagan
Not sure if this is something you can assist with, if not please feel free to forward me on if you know who can.
We're holding an inception meeting with GHD next Tuesday morning to kick off a study to gain a greater understanding of community, sport and recreation needs in the future suburb. The study will also look at impacts of Molonglo Stage 3 and West Belconnen on the wider Belconnen district. I'm putting together a presentation to provide an overview of background and context for the area, as well as any concurrent studies that are underway and was wondering if you're aware of anything in relation to roads and cycle networks that I might be able to incorporate?
Also, Steven mentioned (some time ago) that work was being undertaken by the LDA in relation to sewerage infrastructure (stacks and scrubbers?). I don't suppose you know where this is at or if there are any other relevant studies that should be mentioned?
Thanks
Bronwyn

Bronwyn Noack | Project Officer
Phone 02 6205 9657
Land Investigation and Planning | Environment and Sustainable Development Directorate | **ACT Government**
Dame Pattie Menzies House, Challis Street, Dickson | GPO Box 1908 Canberra ACT 2601 | www.environment.act.gov.au

From: [redacted]
To: Santosuosso, Daniel
Cc: Peter Cowper
Subject: Molonglo Stage 3 briefing notes
Date: Thursday, 17 October 2013 4:39:02 PM
Attachments: 8039_R05_V1_Comparison_Umwelt_ELA_Molonglo3 studies_bn.pdf
8039_R04_V1_OuterAssetMolonglo3bn.pdf
8039_R03_V1_KamaVeg_bn.pdf
8039_R02_V1_GMSbn.pdf
8039_R03_V1_Belconnen1550veg_bn.pdf

Hi Daniel,

Please find attached five briefing notes prepared as part of variations to our Molonglo Stage 3 study:

- R01 – Belconnen 1550 vegetation
- R02 – Golden Sun Moth release
- R03 – Kama Nature Reserve vegetation
- R04 – Molonglo Stage 3 outer asset protection zone assessment
- R05 – Comparison between Umwelt and Eco Logical studies at Molonglo stage 3

Please call Peter or myself if you have any additional thoughts, or comments which you would like us to address.

Now that the final data has been collected for the EOC review, Pete is reviewing this prior to finalising – this should be forthcoming soon.

Cheers

[redacted]
Senior Ecologist

Umwelt (Australia) Pty Limited
PO Box 6135
56 Bluebell Street
O'Connor, ACT 2602

Phone: (02) 6262 9484
Mobile: [redacted]

www.umwelt.com.au

Inspired People | Dedicated Team | Quality Outcomes

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Briefing Note

To: Daniel Santosuosso, ACT Land Development Agency
cc: Dave Richardson, ACT Land Development Agency
From: [redacted] Umwelt (Australia) Pty. Limited
Author: [redacted], Umwelt (Australia) Pty. Limited
Date: 19 July 2013
Subject: Ecological values of Block 1550, Belconnen

Purpose

The purpose of this briefing note is to inform the ACT Land Development Agency of the following on Block 1550, Belconnen (located at the intersection of William Hovell Drive and Caswell Drive, Belconnen:

- the presence and condition of ecological communities;
- the potential presence of threatened species;
- identify threats to conservation values on site; and
- recommended options for future site management.

Contents

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1.0 Methods

The flora and habitat survey was undertaken by an Umwelt ecologist [redacted]) on July 12 2013, using both systematic quadrat sampling and meandering transect techniques.

Systematic quadrat sampling: Plot survey to record cover and abundance of each plant within a defined area. In ecological community A, a 20x50 metre (0.1 hectare) plot was chosen to determine whether areas dominated by yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*) satisfies criteria for 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community under the EPBC Act.

One 20x50 metre plot was completed in ecological community A, with two 20x20 metre plots in ecological community B.

Meandering transect: Haphazard meander across the entire block to supplement floristic information from plot assessment, gain an understanding of species distribution, characterise vegetation communities and determine habitat values.

Vegetation mapping was undertaken using a combination of aerial photograph interpretation and field reconnaissance. This timing of this survey, while appropriate for the identification of box gum woodland did not allow for a full assessment of floristic diversity which would become more apparent in the warmer months.

2.0 Ecological Communities

There are two ecological communities present on Block 1550, being '*Eucalyptus melliodora – E. blakelyi* tableland grassy woodland (ACT16)' and '*E. macrorhyncha* tableland grass/shrub forest (ACT25)', as defined by Sharp *et al*. (2007)[1]. '*Eucalyptus melliodora – E. blakelyi* tableland grassy woodland' has four subtypes, whereas '*E. macrorhyncha* tableland grass/shrub forest' has two subtypes. Ecological communities are described below, with their distribution shown in **Figure 1**.

A: *Eucalyptus melliodora – E. blakelyi* tableland grassy woodland (ACT16) – 19.72 hectares	
Subtypes	• A1: Yellow box – Blakely's red gum grassy woodland (12.83 hectares); • A2: Blakely's red gum – *Carex appressa* sedge woodland (1.39 hectares); • A3: Teatree shrubland (disturbed; 1.11 hectares); and • A4: cleared yellow box – Blakely's red gum grassy woodland (4.39 hectares).
Description	Community A occupies approximately 19.72 hectares within southern parts of Block 1550, and in the more fertile lower parts of the landscape where resources such as water and nutrients are more available (**Figure 1**). Remnant vegetation within this community is moderately disturbed, with persistent grazing leading to moderate gully erosion in drainage lines and partial loss of A-horizon soils. Four subtypes are present, with dominance of vegetation species changing based on localised disturbances and moisture availability. The majority of the woodland area is subtype A1 dominated by yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*Eucalyptus blakelyi*) with a herbaceous understorey, which would have naturally occurred across the majority of this vegetation type. Subtype A2 is also in a natural state, with natural seepage areas dominated Blakely's red gum, *Carex appressa* and river tussock (*Poa labillardierei* var. *labillardierei*). Subtype A3 is dominated by *Leptospermum* spp. beneath yellow box, occurring in dense localised stands as a result of regular dam seepage. Subtype A4 is a cleared/derived state of subtype A1, and within this zone there is significant gully erosion. Rehabilitation is required within this zone. Within subtype A1, a 20 x 50 metre plot and random meander was completed to quantify floristic diversity and abundance, and determine whether the community meets condition

[1] Sharp S, Macdonald T, Kitchin M and Dunford M (2007) Setting conservation targets for vegetation communities in the ACT. Final report to the Natural Resource Management Council, ACT Parks Conservation and Lands.

A: *Eucalyptus melliodora* – *E. blakelyi* tableland grassy woodland (ACT16) – 19.72 hectares	
	criteria for be considered part of the 'white box – yellow box – Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community (CEEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under this criteria, within the entire remnant a total of 12 non-grass understorey and at least one "important" species as defined by Australian Government (2006)[2] need to be present for the remnant to be considered part of the CEEC. Within community A, a total of 24 non-grass understorey and five "important" species were recorded, resulting in the conclusion that the entirety of community A is part of the Commonwealth listing. The community is also part of the 'yellow box – red gum grassy woodland' under the ACT *Nature Conservation Act 1980*.
Upper stratum	To 15 metres, 45% canopy cover within subtype A1. Yellow box, Blakely's Red Gum, occasional box mistletoe (*Amyema miquellii*) in eucalypts. At the ecotone with vegetation community B, scattered red box (*Eucalyptus polyanthemos*), red stringybark (*Eucalyptus macrorhyncha*) and scribbly gum (*eucalyptus rossii*) may occur as subdominant species.
Mid stratum	Sparse/scattered Hickory wattle (*Acacia implexa*), early wattle (*Acacia genistifolia*), silver wattle (*Acacia dealbata*), black wattle (*Acacia decurrens*), native cherry ballart (*Exocarpos cupressiformis*) and blackthorn (*Bursaria spinosa* subsp. *lasiophylla*). Tea-tree (*Leptospermum ?juniperinum*) occurring in dense stands in subtype A3.
Lowest stratum	Herbaceous understorey dominated by a suite of grasses including Threeawn speargrass (*Aristida vagans*), foxtail speargrass (A*ustrostipa densiflora*), rough speagrass (*Austrostipa scabra* subsp. *falcata*), tall speargrass (*Austrostipa bigeniculata*), wallaby grass (*Rytidosperma* spp.), native wheatgrass (*Elymus scaber*), red-leg grass (*Bothrichloa macra*), snow grass (*Poa sieberiana*), kangaroo grass (*Themeda triandra*) and river tussock (dominant in subtype A2); sedges including wattle mat-rush (*Lomandra filiformis* subsp. *filiformis*), common bog sedge (*Schoenus apogon*) and *Carex appressa* (dominant in subtype A2); rushes including woodrush (*Luzula densiflora*) and *Juncus filicaulis*; forbs including stinking pennywort (*Hydrocotyle laxiflora*), sheep's burr (*Acaena ovina*), grassland woodsorrel (*Oxalis perennans*), common raspwort (*Gonocarpus tetragynus*), fuzzweed (*Vittadinia cuneata* subsp. *cuneata*), blue flax-lily (*Dianella revoluta* var. *revoluta*) and smooth solenogyne (*Solenogyne dominii*); and subshrubs including urn heath (*Melichrus urceolatus*) and bitter cryptandra (*Cryptandra amara*). Heavy stock and macropod grazing has reduced floristic diversity and tussock structure.
Weeds	Infrequent shrubs including sweet briar (*Rosa rubiginosa*), blackberry (*Rubus fruticosus* agg.) and firethorn (*Pyracantha* spp.). Exotic forbs including flatweed (*Hypocharis radicata*), fleabane (*Conyza* spp.), common broomrape (*Orobanche minor*), St Johns wort (*Hypericum perforatum*), sheep's sorrell (*Acetocella vulgaris*), ribwort plantain (*Plantago lanceolata*), common centuary (*Centaurium erythrea*); grasses including brome (*Bromus* spp.), quaking grass (*Briza maxima*), phalaris (*Phalaris aquatica*) and pigeon grass (*Setaria* spp.).
Habitat value	Moderate. Subtype A1 contains a range of tree and hollow sizes, rough bark, fallen timber, patchy shrub cover and a moderately diverse groundlayer. While the block was not surveyed for fauna, flame robin were abundant and the site may support a range of woodland birds. However, high grazing levels have reduced foraging resources and the site would benefit from reduced grazing pressure. It provides important lowland habitat adjacent to larger remnants of open forests of lower fertility such as those found across most of Black Mountain and Aranda bushland reserves. Subtype A2 is likely to support a range of amphibians, and subtype A3 is likely to provide shelter nesting opportunities for smaller woodland bird species. Subtype A4 does contain some large scattered trees, however the condition of these are poor, with roots exposed in deep gully erosion.

[2] Australian Government (2006) *White box – yellow box – Blakely's red gum grassy woodlands and derived native grasslands. EPBC Act Policy Statement.* Department of Environment and Heritage, 2006. Accessed online (04/07/2013): http://www.environment.gov.au/epbc/publications/box-gum.html.

Plate 1: subtype A1: Yellow box – Blakely's red gum grassy woodland

Plate 2: subtype A2: Blakely's red gum – *Carex appressa* sedge woodland

Plate 3: subtype A3: Teatree shrubland (disturbed)

Plate 4: subtype A4: cleared yellow box – Blakely's red gum grassy woodland

B: *Eucalyptus macrorhyncha* tableland grass / shrub forest (ACT25) – 12.37 hectares	
Subtypes	• B1: Red stringybark – red box grass/shrub woodland (9.05 hectares); • B2: Red stringybark – red box grass/shrub woodland (ridge; 3.29 hectares).
Description	Community B occupies approximately 12.37 hectares within the northern midslopes and crests on soils that appeared to be less fertile and shallow to skeletal (**Figure 1**). Remnant vegetation within this community is relatively natural, although persistent grazing has affected vegetation structure, particularly on friable ridgetop soils. Two subtypes of this community are present, with dominance of vegetation species changing based on soil depth and landscape position. The majority of the woodland area is subtype B1, dominated by red stringybark and red box and a herbaceous understorey while occurring in areas where soil is likely to be of moderate depth on midslopes. Subtype B2 is very similar, although red stringybark and scribbly gum are dominant in more skeletal soils, with infrequent red box and a very sparse ground layer of similar species.
Upper stratum	To 12 – 14 metres, 40 – 60% cover of red stringybark, red box, scribbly gum and yellow box.
Mid stratum	Scattered red box, native cherry ballart, early wattle, silver wattle, shiny cassinia (*Cassinia longifolia*), Cassinia *quinquefaria*, sticky hopbush (*Dodonaea viscosa*), common fringe myrtle (*Calytrix tertagona*), box-leaf wattle, daphne heath (*Brachyloma daphnoides*) and blackthorn. Shrubbier in patches of subtype A1.
Lowest stratum	Herbaceous understory characterised by a suite of forbs including wattle mat-rush, ivy goodenia (*Goodenia hederacea* subsp. *hederacea*), common raspwort, climbing saltbush (*Einadia nutans* subsp. *nutans*), stinking pennywort, stiff woodruff (*Asperula ambleia*), sticky everlasting (*Xerochrysum viscosum*), spiny-head mat-rush (*Lomandra longifolia*) and blue flax-lily; infrequent grasses including snowgrass (Poa spp.), red-anther wallaby grass (*Rytidosperma pallidum*), threeawn speargrass; rushes including woodrush and Juncus filicaulis; and subshrubs including hoary guinea flower (*Hibbertia obtusifolia*), common hovea (*Hovea heterophylla*) and urn heath. Most species are common across both subtypes, however subtype B2 on the ridge has significantly lower cover due to shallower soils and a likely loss of soil structure characteristic of friable soils in grazing systems.
Habitat value	Moderate. While this community does not contain the range of hollows found in community A due to a lack of larger hollow-forming yellow box and Blakely's red gum, medium size red stringybark contain large bark fissures. Subtype B2 is likely to contain greater habitat value for woodland birds due to a higher shrub cover and diversity. Relatively high grazing levels have reduced foraging resources and the site would benefit from reduced grazing pressure.

Plate 5: subtype B1: Red stringybark – red box grass/shrub woodland.

Plate 6: subtype B2: Red stringybark – red box grass/shrub woodland (ridge).

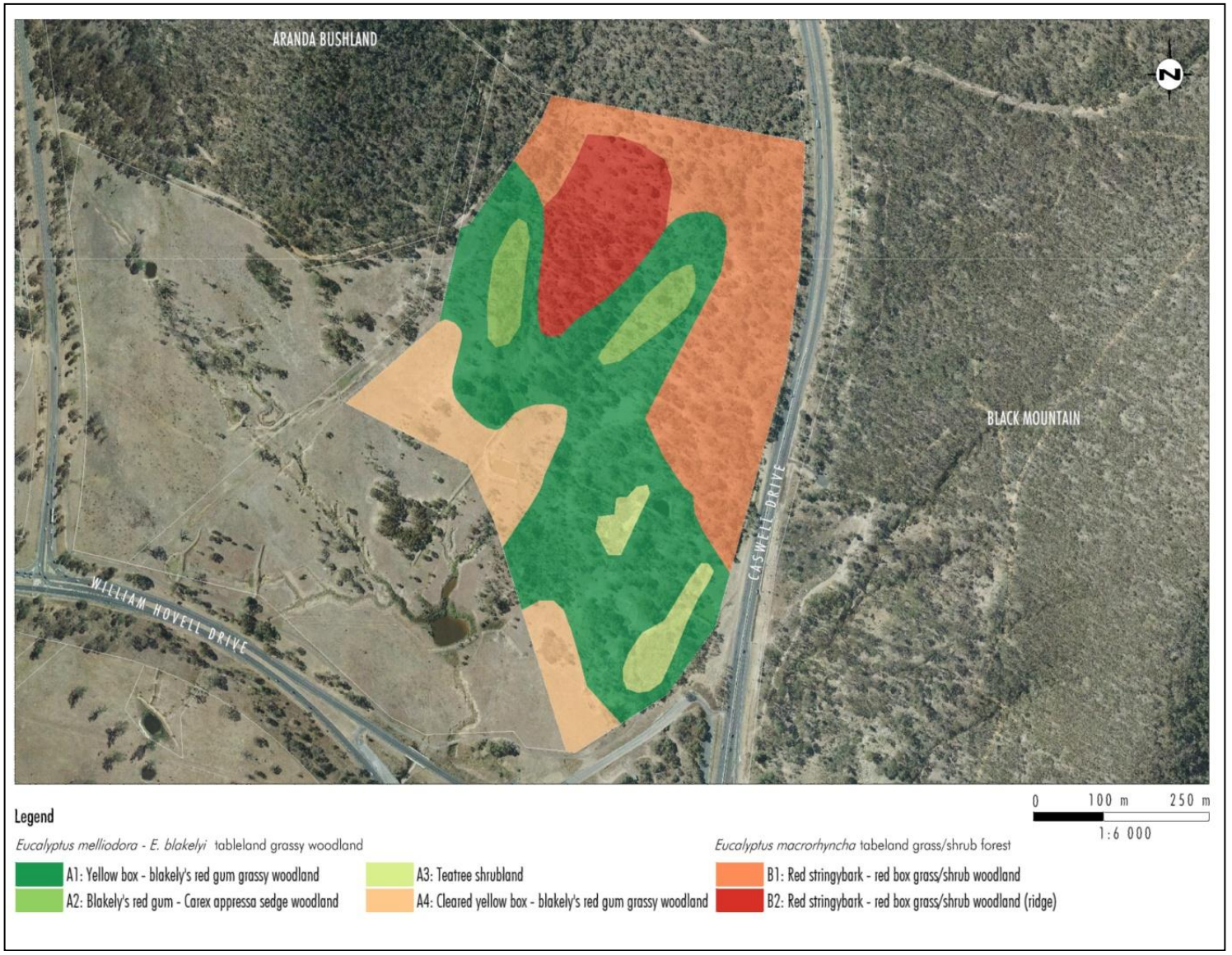

Figure 1: Ecological communities on Block 1550, Belconnen.

3.0 Threatened species

Habitat assessment within both vegetation communities and across the site has revealed a number of important habitat features including tree hollows, bark fissures, patches of dense shrubs, a diverse grassy ground layer and drainage lines in high condition. All of these features provide habitat and foraging opportunities for native fauna including threatened species, however the habitat value is considered moderate primarily due to high grazing pressure reducing seed foraging resources and the historic removal of some larger eucalypts. However, the importance of enhancing values in community A in particular will provide an excellent local habitat resource as much of this community has been cleared, reducing existing nectar and seed resources for lowland woodland birds.

A systematic threatened species survey was not undertaken as part of this study, however based on habitat values present in each community, the site may potentially support the threatened species in **Table 1** (subject to detailed survey). Flora species are not included in this table due to persistent grazing pressure, and these are discussed below.

Table 1: Threatened species which may occur on Block 1550, Belconnen.

Common name	Scientific name	Group	Community	
			A	B
Eastern long-eared bat	*Nyctophilus corbeni*	Microchiroptera	✓	?
Grey-headed flying fox (foraging)	*Pteropus poliocephalus*	Megachiroptera	✓	✓
Brown treecreeper	*Climacteris picumnus*	Aves	✓	✓
Hooded Robin	*Melanodryas cucullata*	Aves	✓	?
Painted honeyeater	*Grantiella picta*	Aves	✓	?
Regent honeyeater	*Xanthomyza phrygia*	Aves	✓	✓
Superb parrot	*Polytelis swainsonii*	Aves	✓	?
Swift parrot	*Lathamus discolor*	Aves	✓	?
White-winged triller	*Lalage sueurii*	Aves	✓	?
Varied sittella	*Dapheonositta chrysoptera*	Aves	✓	✓
Golden sun moth	*Synemon plana*	Invertebrate	✓	×
Perunga grasshopper	*Perunga ochracea*	Invertebrate	✓	×
Rosenberg's monitor	*Varanus rosenbergi*	Reptilia	✓	✓

While threatened flora such as Canberra spider orchid (*Arachnorchis actensis*), Tarengo leek orchid (*Prasophyllum petilum*), Austral toadflax (*Thesium australe*), hoary sunray (*Leucochrysum albicans* var. *tricolor*), silky swainson-pea (*Swainsona sericea*) and small purple-pea (*Swainsona recta*) may occur in these ecosystems, they are considered less likely to occur due to current and historical high grazing intensity.

4.0 Threats to conservation values

Active threats to conservation values on Block 1550, Belconnen include:

Soil erosion: creek lines throughout the site contain gully erosion, with the most significant areas of gully erosion occur within vegetation subzone A4 (cleared yellow box – Blakely's red gum grassy woodland, where large gullies over 10 metres across have eroded), and down slope from artificial dam systems. This erosion has resulted in large areas of soil collapse, with the root zone of large yellow box in particular exposed. Additionally, sediment runoff from the site is likely to be high, affecting water quality lower in the catchment.

High grazing pressure: current high grazing levels by stock and macropod has reduced the habitat structure and foraging value of the site for ground-dwelling and seed-foraging fauna. Historic high grazing is likely to have reduced the floristic integrity of the site. Interim analysis suggests that approximately 1.6 kangaroos per hectare will maintain higher levels of floristic condition in yellow box – Blakely's red gum grassy woodland, not withstanding grazing pressure from other herbivores (Armstrong 2013). Many red stringybarks contained rub marks consistent with fallow deer (*Dama dama*), and these may potentially contribute to grazing pressure within the area.

Weeds: While the majority of the site contains natural vegetation, there are small outbreaks of blackberry (*Rubus fruticosus* agg.) which is a weed of national significance (Australian Government 2012), and noxious weeds under the ACT *Pest Plants and Animal Act 2005* including St Johns wort (*Hypericum perforatum* – category 3: a pest plant that must be contained) and sweet briar (*Rosa rubiginosa* – category 2/4: a pest plant that must be suppressed, and whose propagation and supply is prohibited) (Australian Government 2013).

Rubbish dumping: an old car remains within an eroded gully in the north of Block 1550, and evidence of dumping is also present in the south-east of the block adjacent to Black Mountain car park.

5.0 Recommendations

- Develop a rehabilitation plan to ensure that values are enhanced, particularly if Block 1550 is to be used as an advanced offset.
- Quantify and control grazing pressure to enhance conservation values across the site.
- Suppress blackberry and sweet briar, and contain any outbreaks of St Johns wort.
- If the value of the site is to be determined using ecosystem and species credit offset calculations as part of the Environmental Offsets Assessment Methodology (ACT Government 2013), undertake survey in line with plot allocation decision rules and at the appropriate time of year to determine true values. That is, 3 plots in community A and 3 plots in community B in the spring-summer survey season.
- fauna surveys should be considered to verify the suitability or presence of threatened species. Principally this should target woodland birds however other species as indicated in **Table 1** could also be considered.

6.0 Conclusions

An area of approximately 19.72 hectares conforming to the definition of box gum woodland under the EPBC Act was found to be present within Block 1550. This patch is comprised of areas of varying quality owing to the extent of ongoing and historical disturbance. Despite this, its overall relative quality was considered to be moderate. The upper slope red stringybark and red box community also supports habitat suitable for a range of threatened fauna and could be considered as potential habitat should an offset be required for certain woodland species.

The extent of disturbance, variability in quality and range of environmental degradation across this area will likely require various approaches to monitoring in the future, particularly if this area is targeted for use as an offset.

For both flora and fauna, baseline surveys should be conducted in the warmer months in order to provide a more complete understanding of the property's ecological values. Such surveys will also need to be designed with future monitoring requirements in mind.

7.0 References

ACT Government (2013) *Environmental Offsets Assessment Methodology*. ACT Environment and Sustainable Development Directorate. Version 20130301.

Armstrong R (2013) *Interim analysis of relationships between vegetation condition and kangaroo density in grassy ecosystems of the northern ACT: Data collected in Spring – Summer 2009/2012*. A report for ACT Government, Environment & Sustainable Development Directorate, Canberra, February 2013.

Australian Government (2013) *Weeds Australia: an Australian weeds committee national initiative*. Accessed online (05/07/2013): http://www.weeds.org.au/

Australian Government (2012) *Weeds of National Significance*. Department of Sustainability, Environment, Water, Population and Communities. Accessed online (04/07/13): http://www.environment.gov.au/biodiversity/invasive/weeds/ weeds/lists/wons.html

Australian Government (2006) *White box – yellow box – Blakely's red gum grassy woodlands and derived native grasslands. EPBC Act Policy Statement.* Department of Environment and Heritage, 2006. Accessed online (04/07/2013): http://www.environment.gov.au/epbc/publications/box-gum.html.

Sharp S, Macdonald T, Kitchin M and Dunford M (2007) *Setting conservation targets for vegetation communities in the ACT*. Final report to the Natural Resource Management Council, ACT Parks Conservation and Lands.

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Briefing Note

To: Daniel Santosuosso, ACT Land Development Agency
cc: Dave Richardson, ACT Land Development Agency
From: [redacted], Umwelt (Australia) Pty. Limited
Author: [redacted], Umwelt (Australia) Pty. Limited
Date: 11 October 2013
Subject: Habitat quality of potential golden sun moth release sites

Purpose

The purpose of this briefing note is to inform the ACT land development agency of the potential habitat value for the release of golden sun moth (*Synemon plana*) on the following areas:

- 'north Kama' (Part Block 1616 Belconnen; approx. 9.4 hectares); and
- 'Arboretum'; 'block N1' as defined by the 'Draft Strategic Assessment Report of the Molonglo Valley Plan for the Protection of Matters of National Environmental Significance' (Ecological 2010)[1] (part Block 7 Molonglo; approx 13.4 hectares).

The location of these areas is shown in **Figure 1.1**.

Contents

[1] Ecological (2010) Draft strategic assessment report of the Molonglo valley plan for the protection of Matters of National Environmental Significance. Ecological Australia Pty Ltd. March 2010.

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1.0 Site locations

The 'north Kama' site is located directly north of Kama Nature Reserve on William Hovell Drive, Belconnen. The 'Arboretum' site is located directly adjacent (north-east) of the National Arboretum, and south-west of the cork oak (*Quercus suber*) plantation. The location of these areas is shown in **Figure 1.1**.

Figure 1.1 – Locations for potential GSM release

2.0 Methods

The vegetation and golden sun moth (GSM) habitat survey was undertaken by Umwelt ecologists on July 8 2013 ('block N1') and July 22 2013 (Arboretum), using both systematic quadrat sampling and random-meander techniques. Additional survey of block N was also undertaken on September 25 2013 as part of another study, with further observations made at this time.

Vegetation survey

Vegetation survey was undertaken using a combination of complementary methods including systematic and unsystematic techniques to provide results on floristic diversity, cover and abundance.

Systematic quadrat and line-intersect sampling

Plot-based survey to record cover and abundance of each plant was undertaken for both areas. To ensure assessment was in line with methods described by ACT Government (2013)[2], species richness data was collected within 20x20 metre (0.04 hectare) plots. Habitat variables were assessed within a within a 20x50 metre plot and cover variables assessed along a 50 metre line-intersect transect.

[2] ACT Government (2013) Environmental Offsets Assessment Methodology. ACT Environment and Sustainable Development Directorate. Version 20130301.

Meandering searches

Unsystematic wandering across the entire block was undertaken to supplement floristic information from plot-based surveys to gain an understanding of species distribution, characterise vegetation communities and determine habitat values.

For both the plot survey and meander searches, the presence of GSM habitat (refer to 'habitat assessment' below) was quantified to determine suitability for GSM release.

Vegetation mapping was undertaken using a combination of aerial photograph interpretation and field reconnaissance.

Habitat assessment

Review of existing literature and survey reports regarding GSM population and habitat assessment revealed that previous documented survey efforts were related to assessment of GSM population counts in combination with qualitative habitat assessment to determine habitat quality. Based on this review and liaison with local invertebrate experts, it is understood there are no standard quantifiable methods to assess GSM habitat quality in sites where GSM are not known to occur, and in periods when GSM are not active. Accordingly, the assessment criteria in **Table 2.1** were developed and used to assess habitat suitability.

Table 2.1 – Criteria for golden sun moth habitat quality

Habitat quality	Criteria
High	Area of ≥ 0.25 hectare estimated to contain at least 40% wallaby grass (*Rytidosperma* spp. [syn. *Austrodanthonia* spp.]) cover.
Moderate (A)	(A) Area of ≥ 0.25 hectare of native grassland estimated to contain at least 40% speargrass (*Austrostipa* spp.), or at least 20% wallaby grass.
Moderate (B) *Disturbed*	(B) Area of ≥ 0.25 hectare estimated to contain at least 40% of a combination of wallaby grass, speargrass and Chilean needlegrass (**Nassella neesiana*) of at least 5% cover.
Low	(A) Area of ≥ 0.25 hectare of exotic pasture estimated to contain at least 25% speargrass; or at least 10% wallaby grass or Chilean needlegrass.
Not suitable	Area of ≥ 0.25 hectare of exotic pasture dominated by at least 60% phalaris (*Phalaris aquatica*), ryegrass (*Lolium* spp.), fescue (*Festuca* spp.), other perennial exotic or annual exotic grasses, and not fitting any of the above criteria.

* exotic

Note that the assessment is based on condition at the time of survey, and does not factor in recoverability of a site. For instance, partially cleared box-gum woodland may provide quality habitat if it contains an adequate amount of C3 grasses, however the value may be diminished if overstorey regeneration shades the site. The assessment also excludes sites that are less than 0.25 hectares, however it is not likely that such a small site would be considered as part of a GSM release program.

Based on literature review and discussion with local invertebrate experts, the presence of red-leg grass (*Bothriochloa macra*) was not considered. While GSM pupal cases have been observed as associated with this species, the study site for the quoted literature was heavily mown and it is believed that the abundance of this species was potentially exaggerated. Additionally, through isotope analysis Richter *et al.* (2010)[3] found that GSM feed on a range of C3 grasses including wallaby grasses, speargrasses and Chilean needlegrass, apparently avoiding C4 grasses such as red-leg grass. The paper notes that isotope analysis does not provide a very high taxonomic resolution of the food source and is therefore restricted in its application for dietary studies, however this study still represents the best information on this topic available at present.

While host plant floristics are the focus on potential habitat assessment as this is a primary driver for future GSM release programs, there are a number of other habitat indices which are considered in areas where GSM

[3] Richter A, Osbourne W & Tragoutt M (2010) Dietary specialisation in the Golden Sun Moth Synemon plana – the key to understanding habitat requirements and site rehabilitation for this critically endangered species. Final report to Biodiversity and Programs Branch, Department of Sustainability and Environment (Victoria).

are known to occur. The following criteria developed by the Australian Government (2009)[4] were also considered, and are mentioned where relevant:

- presence of pupal casings
- other vegetation (native and exotic)
- exposure (amount of shading from trees, buildings etc.)
- aspect (sloping sites with an aspect of 3° or less, particularly with a northerly aspect, may be favoured (but not necessarily)[5]
- amount of bare ground (inter-tussock space)
- presence of rocky areas
- soil characteristics
- site history (for example grazing, cropping, biomass management, fertiliser/ pesticide/herbicide use), including current management regime
- proximity to other known populations, including on adjacent sites, and
- presence of similar habitat connecting the site to occupied areas or other areas of grassland or grassy woodland.

3.0 Results

Site 1: 'north Kama'

Assessment summary

The north Kama site was assessed on July 22 2013, including one plot and a random meander across the site. The site is considered a high quality example of 'Box Gum' woodland, characterised by an overstorey of yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*). The understorey is dominated by tall speargrass (Austrostipa bigeniculata) to a cover of approximately 30%, kangaroo grass (Themeda triandra) to 20%, red-leg grass to 15% and wallaby grasses to 10%. Due to macropod and sheep grazing, as well as survey timing, the wallaby grasses were not able to be identified to species level. The remainder of the understorey was dominated by infrequent native grasses and forbs, as well as annual and short-lived perennial grasses and forbs. A total of 27 non-grass understorey species were recorded, and 10 'important' species as defined under the EPBC policy statement for site suitability as box-gum woodland (Australian Government 2006)[6].

A rocky knoll in the south-eastern portion of the site contains red Stringybark (*Eucalyptus macrorhyncha*) and brittle gum (*E. mannifera* subsp. *mannifera*) as the dominant species, with scribbly gum (*E. rossii*) also present, as well as blackthorn (*Bursaria spinosa* subsp. *lasiophylla*). This area is not considered part of the box-gum critically endangered ecological community. **Table 3.1** describes the additional assessment of criteria listed by the Australian Government (2009) for the 'north Kama' site.

[4] Australian Government (2009) Significant impact guidelines for the critically endangered golden sun moth (Synemon plana). Department of Environment, Water, Heritage and the Arts.

[5] NSW Government (2007) Draft NSW recovery plan for the golden sun moth (Synemon plana). NSW Department of Environment and Conservation, Queanbeyan.

[6] Australian Government (2006) White box – yellow box – Blakely's red gum grassy woodlands and derived native grasslands EPBC Act policy statement: species list. [URL accessed 8/10/2013: http://www.environment.gov.au/epbc/publications/box-gum.html].

Table 3.1 – Additional assessment of 'north Kama'

Criteria / Considerations	Findings
Presence of pupal casings	None found
Exposure	Moderate to patchy shading, open areas
Aspect	2-3° south to south-west
Amount of bare ground	Approximately 20% bare
Presence of rocky areas	Some small rocky areas, including potential pink-tailed worm lizard (*Aprasia parapulchella*) habitat
Soil characteristics	Tableland clay, moderate to low fertility
Site history, including current management regime	Long history of grazing, although likely to have been well managed due to floristic diversity and the presence of a range of eucalypt age classes.
Proximity to other known populations	Nearest known population is approximately 5 kilometres east, at Yarramundi Reach.
Presence of similar habitat connecting the site to occupied areas or other areas of grassland or grassy woodland	Further assessment required. Potential for areas in northern and southern Kama Nature Reserve to support low densities of GSM.

Suitability

Considering the composite cover of C4 grasses including tall speargrass and wallaby grasses, in its current condition state the majority of the area is considered to contain 'moderate (A)' habitat for GSM. This may be reduced if significant overstorey regeneration occurs. **Figure 3.1** shows the north Kama site, including GSM habitat quality.

Figure 3.1 – GSM habitat quality for the 'north Kama' site

Site 2: 'Arboretum'

Assessment summary

The Arboretum (block N1) site was assessed on July 22 2013 with a subsequent visit on September 25 2013, including two plots and a random meander across the site. The site is dominated by tall speargrass, especially in the central third of the site where it represents approximately 50-70% of plant cover. Two species of wallaby grass (*Rytidosperma racemosum* and *Rytidosperma* spp.) were present in low abundance, and for the most part were heavily browsed with grass butts remaining. Red-leg grass was present with approximately 10% cover in parts of the area.

Where tall speargrass is not dominant on the upper slope in the west of the site, and the lower slope in the east, perennial exotic grasses such as wild oats (**Avena* spp.), ryegrass (**Lolium* spp.), prairie grass (**Bromus catharticus*) are dominant. Annual grasses such as hairgrass (**Aira* spp.) and rat's-tail fescue (**Vulpia myuros*) are seasonally prominent, along with exotic forbs such as Patterson's curse (**Echium plantagineum*), St John's wort (**Hypericum perforatum*), flatweed (**Hypochaeris radicata*), saffron thistle (**Carthamus lanatus*) and shepherds purse (**Capsella bursa-pastoralis*). **Table 3.2** describes the additional assessment of criteria listed by the Australian Government (2009) for the 'Arboretum' site.

Table 3.2 – Additional assessment of 'Arboretum'

Criteria / Considerations	Findings
Presence of pupal casings	None found
Exposure	Isolated paddock trees and dense stands of exotic sweet briar provide a low level of shading
Aspect	2-3° east
Amount of bare ground	Approximately 5% bare, inter-tussock spaces generally occupied by exotic forbs and annual exotic grasses
Presence of rocky areas	None observed
Soil characteristics	Tableland clay, moderate to low fertility
Site history, including current management regime	Long history of grazing, leading to low floristic diversity. No apparent improved pasture.
Proximity to other known populations	Nearest known population is approximately 600 metres south-east, at Yarramundi Reach. The status of this population is unknown.
Presence of similar habitat connecting the site to occupied areas or other areas of grassland or grassy woodland	Further assessment required. Surrounded by low quality pastoral land, the arboretum, a box-gum remnant with few examples of C4 grasses, and land designated for development.

Suitability

In its current condition state , approximately half of the Arboretum site is considered to contain 'moderate (A)' habitat for GSM. This may be reduced if significant overstorey regeneration occurs (note that the majority of woody vegetation in **figure 3.2** below is exotic sweet briar (**Rosa rubiginosa*) which may be controlled as part of conservation management actions). The remaining areas in the west and east of the block are a mosaic of not suitable or low habitat quality. **Figure 3.2** shows the Arboretum site, including GSM habitat quality.

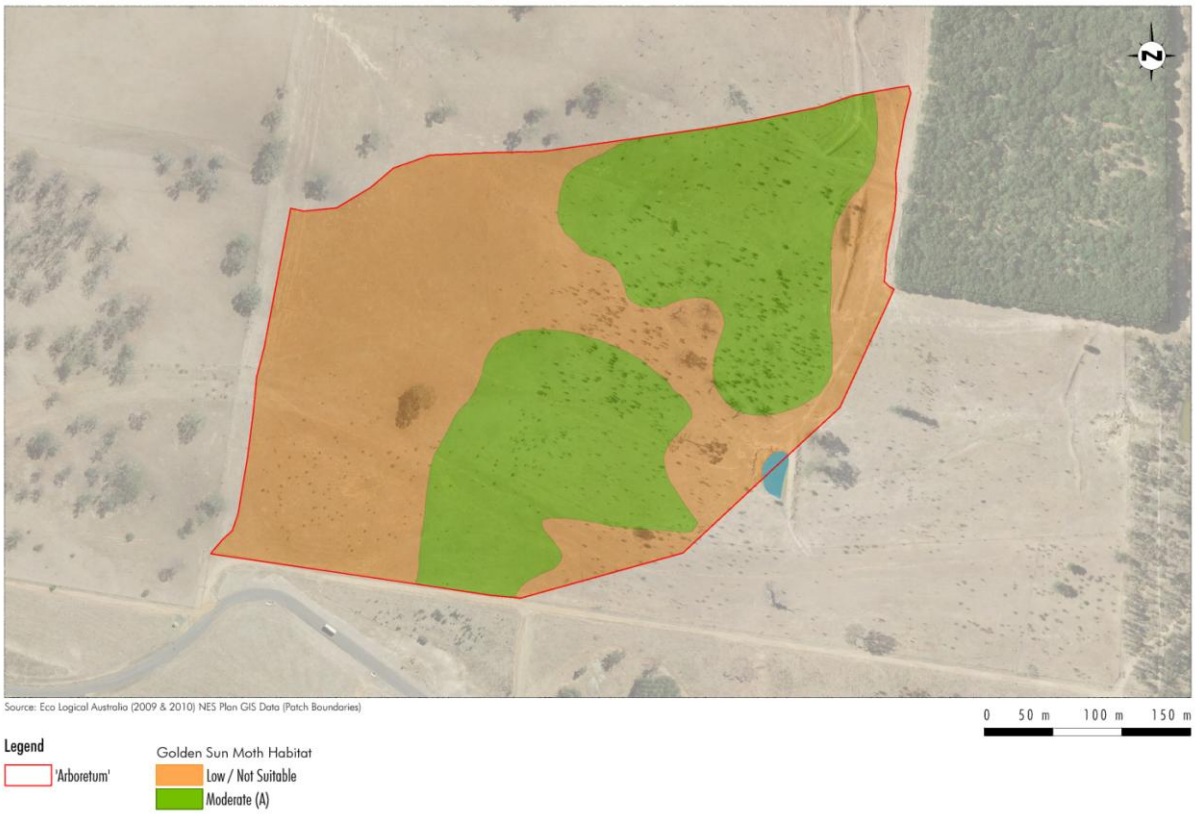

Figure 3.2 – GSM habitat quality for the 'Arboretum' site

4.0 Conclusions & Recommendations

At the time of writing, it is understood that research is underway at the Arboretum site to determine whether the direct addition of laboratory-bred GSM larvae to C4 grass root systems in the field is a viable translocation method. If this research proves successful, both the Arboretum site and the north Kama site provide moderate habitat value for future release. However, from results gained through the surveys described in this report, the north Kama site is considered to be in better condition with a higher cover and richness of native flora, and is likely to be easier to manage for broader conservation values into the future.

Further study

Given the likely high profile and importance of any future GSM release program, it is recommended that the ACT Government consider a broader assessment of potential release sites across grassy ecosystems of the ACT lowlands to find high quality potential translocation sites. This may be done through desktop review and analysis of floristic data, with subsequent site validation.

5.0 References

ACT Government (2013) Environmental Offsets Assessment Methodology. ACT Environment and Sustainable Development Directorate. Version 20130301.

Australian Government (2006) White box – yellow box – Blakely's red gum grassy woodlands and derived native grasslands EPBC Act policy statement: species list. [URL accessed 8/10/2013: http://www.environment.gov.au/epbc/publications/box-gum.html].

Australian Government (2009) Significant impact guidelines for the critically endangered golden sun moth (*Synemon plana*). Department of Environment, Water, Heritage and the Arts.

Ecological (2010) Draft strategic assessment report of the Molonglo valley plan for the protection of Matters of National Environmental Significance. Ecological Australia Pty Ltd. March 2010.

NSW Government (2007) Draft NSW recovery plan for the golden sun moth (*Synemon plana*). NSW Department of Environment and Conservation, Queanbeyan.

Richter A, Osbourne W & Tragoutt M (2010) Dietary specialisation in the Golden Sun Moth *Synemon plana* – the key to understanding habitat requirements and site rehabilitation for this critically endangered species. Final report to Biodiversity and Programs Branch, Department of Sustainability and Environment (Victoria).

Attachment 1: Site Photographs

Photo 1: 'north Kama' vegetation plot, with an understorey dominated by kangaroo grass, tall speargrass, wallaby grasses and red-leg grass.

Photo 2: 'north Kama' box-gum grassy woodland. An array of small to medium rocks suggest that the site may support pink-tailed worm lizard (*Aprasia parapulchella*) also, although surveys are required to confirm this.

Photo 3: 'Arboretum' block N, with tall speargrass tussocks and exotic sweet briar (**Rosa rubiginosa*).

Photo 4: 'Arboretum' block N, with sparse tall speargrass tussocks and exotic sweet briar (**Rosa rubiginosa*), and perennial exotic pasture grasses including wild oats (*Avena* spp.), ryegrass (*Lolium* spp.) and brome (*Bromus* spp.).

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Briefing Note

To: Daniel Santosuosso, ACT Land Development Agency
cc: Dave Richardson, ACT Land Development Agency
From: [redacted], Umwelt (Australia) Pty. Limited
Author: [redacted], Umwelt (Australia) Pty. Limited
Date: 11 October 2013
Subject: Vegetation Mapping for Kama Nature Reserve, Molonglo

Purpose

Accurate vegetation mapping is required to determine values within Kama Nature Reserve for use as an advanced offset for the Molonglo stage 3 development. The purpose of this briefing note is to update the ACT Land Development Agency on the extent and spatial distribution of vegetation communities within Kama Nature Reserve.

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1.0 Existing vegetation maps

There are at least four existing vegetation maps for Kama Nature Reserve, being:

- Vegetation mapping as part of the Molonglo Valley NES plan (ACT Government 2011);
- Box-gum and natural temperate grassland mapping on ACTMAPi (ACT Government 2012a);
- Lowland woodland extent in the ACT Lowland Woodland Conservation Strategy (Action Plan No. 27) and Natural temperate grassland extent in the ACT Lowland Native Grassland Conservation strategy (Action Plan No. 28) (ACT Government 2004, 2005; considered as one product); and
- Vegetation mapping as part of the Kama 'Heritage (Decision about Registration of Kama Woodland/Grassland, Belconnen) Notice 2012' (ACT Government 2012b).

All four map products were assessed in the field through rapid map validation. This involved meandering searches through each map polygon to determine the spatial of mapped boundaries, and the thematic (vegetation type) accuracy within each polygon. Comments of the review of each map are in Table 1.

Table 1 – Review of Existing Vegetation Map Products

Map product	Comments
Molonglo NES Plan	Large areas dominated by scribbly gum (*Eucalyptus rossii*) are mapped as Box-Gum woodland in high and low condition. These areas are not consistent with the 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community definition as per the community's listing advice. Perhaps due to scale issues, this product does not appear to be a suitable base for determining reserve offset values.
ACTMAPi (Box-Gum and NTG)	Similar to the Molonglo NES plan, however the Box-Gum woodland polygon extends into the natural temperate grassland in the south-west of the reserve. This product is not considered a suitable base for determining reserve offset values.
ACT Lowland Woodland / Native Grassland Conservation Strategies	Mapping within the hard copy reports are of a coarse scale, and it is difficult to determine accuracy. GIS layers linked to the report revealed that much of the Box-Gum woodland area is mapped as partially modified lowland woodland and moderately modified lowland woodland. The typology of the mapping is not consistent with Commonwealth and ACT legislation, as 'lowland woodland' includes vegetation types dominated by other lowland species including those not characteristic of 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community. The natural temperate grassland area is not mapped in Action Plan No. 28. These products are not considered a suitable base for determining reserve offset values.
Kama Heritage Notice 2012	The mapping is available as hard copy, and includes areas of mapped scribbly gum woodland. There are areas mapped as dominated by Blakely's red gum (*Eucalyptus blakelyi*) which are either co-dominated or exclusively dominated by scribbly gum in the north-east of the reserve. This product is not considered a suitable base for determining reserve offset values. However, given that the majority of the mapping in the Kama Heritage Notice 2012 is, for the most part, spatially and thematically accurate, it is considered the best starting point for refinement. As it is not available digitally, it is desirable to map the area with consideration of this product as well as up to date reconnaissance information.

The 'vegetation mapping as part of the Kama 'Heritage (Decision about Registration of Kama Woodland/Grassland, Belconnen) Notice 2012' was considered the best existing product, however it required refinement to accurately reflect vegetation distribution in some areas.

2.0 Updated vegetation information

Table 2 summarises the vegetation of Kama Nature Reserve. This information has been adapted from the 'Kama Heritage Notice 2012', with new polygons created and floristic information updated as required. An updated vegetation map, based on the 'Kama Heritage Notice 2012' and field surveys undertaken by Umwelt as part of this investigation is shown in **Figure 1**.

Table 2 – Updated vegetation descriptions for Kama Nature Reserve

Polygon	Area description	Vegetation Community	Area (ha)	Correspondence with legislation	Vegetation Condition (ACT Government 2013)
VT1	Woodland dominated by Blakely's red gum (*Eucalyptus blakelyi*) and yellow box (*E. melliodora*), with infrequent red stringybark (*E. macrorhyncha*), broad-leaved peppermint (*E. dives*) and scribbly gum (*E. rossii*) on a south-easterly to south-westerly hillslope. The mid-layer is comprised of sparsely distributed patches of Blakely's red gum saplings and seedlings, and sweet bursaria (*Bursaria lasiophylla*). The ground layer is dominated by kangaroo grass (*Themeda triandra*), wallaby grasses (*Rytidosperma* spp.) and tall speargrass (*Austrostipa bigeniculata*). There is a high diversity of native forbs present, including uncommon species. Pest plants of concern include a serious infestation of St. John's wort (*Hypericum perforatum*).	Blakely's red gum - yellow box grassy woodland	58.68	*Environment Protection and Biodiversity Conservation Act 1999* Consistent with high quality 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community. *Nature Conservation Act 1980* Consistent with partially modified lowland woodland as part of the 'yellow box – red gum grassy woodland' endangered ecological community (Action Plan No. 27).	Moderate/good. If vegetation is not in low condition (paddock trees or native pasture) then it is in moderate to good condition.
VT1a	Partially cleared version of VT1. The understorey is a mosaic native grasses including tall speargrass and wallaby grasses, along with large areas dominated by exotic pasture including wild oats (*Avena* spp.), barley grass (*Hordeum* spp.) and rat's-tail fescue (*Vulpia myuros*). Weeds of concern include St. John's wort and sweet briar (*Rosa rubiginosa*). It is estimated that approximately 30-40% of patches are dominated by exotic pastures.	Derived mixed exotic and native grassland	28.33	*Environment Protection and Biodiversity Conservation Act 1999* Not considered part of the 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community due to large areas of the understorey being dominated by perennial exotic pasture grasses. *Nature Conservation Act 1980* Consistent with moderately modified lowland woodland as part of the 'yellow box – red gum grassy woodland' endangered ecological community (Action Plan No. 27).	Paddock trees. Native over-storey percent foliage cover is less than 25% of the lower value of the overstorey percent foliage cover benchmark for the relevant vegetation type and less than 50% of ground cover perennial vegetation is indigenous species.

Polygon	Area description	Vegetation Community	Area (ha)	Correspondence with legislation	Vegetation Condition (ACT Government 2013)
VT2	Forest dominated by scribbly gum with some Blakely's red gum and broad-leaved peppermint on a hill slope with a westerly aspect. The patchy mid layer is comprised of Blakely's red gum, scribbly gum and broad-leaved peppermint saplings and small amounts of sweet bursaria. Exotic sweet briar and blackberry (*Rubus fruticosus* agg.) are present. The ground layer is dominated by speargrasses, wallaby grasses, redleg grass (*Bothriochloa macra*) and introduced annual pasture and weed species. Pest plants of concern include Paterson's curse (*Echium plantagineum*), St. John's wort and blackberry.	Scribbly gum grassy open forest	15.48	*Environment Protection and Biodiversity Conservation Act 1999* Nil. *Nature Conservation Act 1980* Nil.	Moderate/good. If vegetation is not in low condition (paddock trees or native pasture) then it is in moderate to good condition
VT2a	Partially cleared version of VT2. Open woodland dominated by scribbly gum, with occasional patches of Blakely's red gum, and broad-leaved peppermint on a north-easterly aspect. The ground layer is a mosaic of native grasses including tall speargrass, wallaby grasses and red-leg grass, and exotic grasses including wild oats, brome (*Bromus* spp.) and ryegrasses (*Lolium* spp.). Pest plants of concern include Paterson's curse, St. John's wort and blackberry.	Scribbly gum grassy open forest (partially cleared)	7.71	*Environment Protection and Biodiversity Conservation Act 1999* Nil. *Nature Conservation Act 1980* Nil.	Paddock trees Native over-storey percent foliage cover is less than 25% of the lower value of the overstorey percent foliage cover benchmark for the relevant vegetation type and less than 50% of ground cover perennial vegetation is indigenous species.
VT3	Southerly foot-slope containing natural temperate grassland, with isolated red stringybark and broad-leaved peppermint (as per ACT Government 2005, <10% projected foliage cover). The ground layer is dominated by kangaroo grass, wallaby grasses, speargrasses and common everlasting (*Chrysocephalum apiculatum*). Several uncommon forbs are present including blue devil (*Eryngium ovinum*). Common exotic species include rat's tail fescue, St. John's wort and wild oats. Other pest plants in lower abundance include saffron thistle (*Carthamus lanatus*) and spear thistles (*Cirsium vulgare*), Paterson's curse and sweet briar.	Natural temperate grassland	44.58	*Environment Protection and Biodiversity Conservation Act 1999* Natural temperate grassland of the Southern Tablelands of NSW and the Australian Capital Territory, a mosaic of high (Botanical Significance Rating 2) to low (BSR 4) significance (Action Plan No. 28). *Nature Conservation Act 1980* Natural temperate grassland endangered ecological community, a mosaic of high (BSR 2) to low (BSR 4) significance (Action Plan No. 28).	Moderate/good If vegetation is not in low condition (paddock trees or native pasture) then it is in moderate to good condition. Note that for natural temperate grassland communities this is relevant while it is technically native pasture, it is in a structurally natural condition.

Cattle grazing appears to be part of the management strategy for Kama Nature Reserve as at the time of survey (10 September 2013), with moderate grazing observed in paddocks in the north-west and south-east of the reserve. This disturbance is not likely to affect the outcomes of the vegetation condition component of this study.

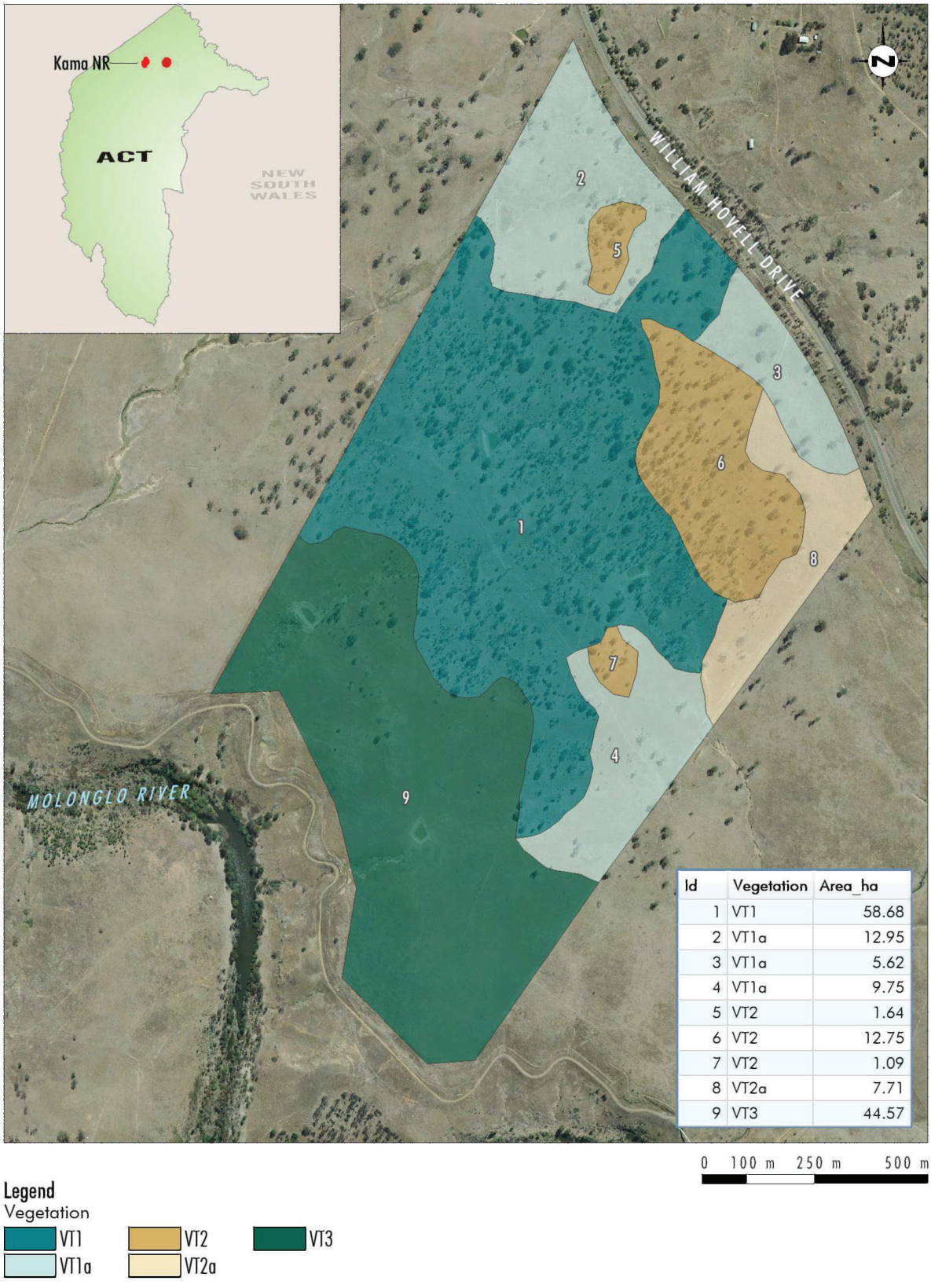

Figure 1 – Updated vegetation mapping for Kama Nature Reserve.

3.0 Conclusions and Recommendations

Through conduct of the study as described in this briefing note, it was apparent that varying degrees of inconsistency and inaccuracy occurs within the existing vegetation map products that relate to Kama Nature Reserve. In part, this could be attributable to temporal variation where ground layer vegetation is influenced by season and prevailing weather and others may be attributable to mapping scale wherein smaller patches are not separated. This investigation has sought to apply current identification guidelines and associated mapping scales to delineate structurally and floristically distinct areas and correlate those to vegetation communities defined under existing Territory and Commonwealth legislation. Given the outcomes of this process, the following recommendations are provided:

- The updated vegetation map should be adopted as the current description of vegetation communities within Kama Nature Reserve.

- The updated information should be considered when determining advanced offsets for the Molonglo Stage 3 development as the previous mapping products are not a sufficiently accurate representation of vegetation condition or distribution within Kama Nature Reserve.

- Umwelt was required to map the vegetation of Kama Nature Reserve as part of a broader project which included additional floristic sampling to finalise the review of the draft Environmental Offsets Calculator (Umwelt 2013; ACT Government 2013). As the mapping of Kama Nature Reserve has delineated the reserve into vegetation types and condition classes, this study has revealed that an additional five plots are required to complete the assessment if the draft Environmental Offsets Calculator (in its current form) is to be used as the basis for offset calculation.

References

ACT Government (2004) Woodlands for Wildlife: ACT Lowlands Woodland Conservation strategy. Action Plan No. 27. Environment ACT, Canberra.

ACT Government (2005) A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy. Action Plan No. 28. Arts, Heritage and Environment, Canberra.

ACT Government (2011) Molonglo Valley Plan for the Protection of Matters of National Environmental Significance. NES Plan, September 2011.

ACT Government (2012a) *ACTMAPi Online interactive maps,* Environment and Sustainable Development Directorate, Canberra. Accessed online (11/09/13): www.actmapi.act.gov.au.

ACT Government (2012b) Heritage (Decision about Registration of Kama Woodland/Grassland, Belconnen) Notice 2012. Notifiable Instrument NI2012-541.

ACT Government (2013) Environmental Offsets Calculator Operational Manual. ACT Environment and Sustainable Development Directorate. Version 20130301.

Umwelt (2013) Review of ACT Environmental Offsets Calculator. Stage 2. Draft July 2013. Prepared by Umwelt (Australia) Pty Limited on behalf of ACT Land Development Agency.

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Briefing Note

To: Daniel Santosuosso, ACT Land Development Agency
cc: Dave Richardson, ACT Land Development Agency
From: [redacted], Umwelt (Australia) Pty. Limited
Author: [redacted], Umwelt (Australia) Pty. Limited
Date: 15th October 2013
Subject: Ecological values of the Kama Nature Reserve – Molonglo Stage 3 outer asset protection zone

Purpose

The purpose of this briefing note is to inform the ACT land development agency of the ecological values of the outer asset protection zone for the interface between Kama Nature Reserve and the Molonglo Stage 3 development.

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1.0 Site location

Based on advice from the ACT Land development Agency, the areas which may be managed as part of the outer asset protection zone may include an area of 200 metres either side of the eastern boundary of Kama Nature Reserve. The location of this area is shown in **Figure 3.1**.

2.0 Methods

While undertaking a broader ecological assessment of Kama Nature Reserve and the Molonglo stage 3 development area on 24 September 2013 as part of the review of the draft Environmental Offsets Calculator (Umwelt 2013)[1], Umwelt ecologists undertook a meandering search to verify the ecological assessment undertaken as part of the Molonglo NES plan. Meandering searches considered general condition, the presence of a native understorey, the potential presence and condition of threatened ecological communities and potential habitat for threatened species.

Additionally, one 20x20 full-floristic quadrat which was assessed as part of subsequent condition assessment undertaken by Eco Logical Australia (2013)[2] was surveyed in order to validate findings of this report.

Vegetation survey

Meandering search: Unsystematic wandering across the entire block to supplement floristic information from plot assessment, gain an understanding of species distribution, characterise vegetation communities and determine habitat values.

Full-floristic quadrat sampling: Plot survey to recording cover and abundance of each plant within a defined area. To ensure assessment is in line with ACT Government (2013)[3], a 20x20 metre (0.04 hectare) plot size was chosen to collect species richness data, with habitat variables and cover variables assessed within a 20x50 metre plot and along a 50 metre line-intersect transect respectively.

3.0 Findings

3.1 Area within Kama Nature Reserve

The ecological condition of the 200 metre area inside the eastern boundary of Kama Nature Reserve is variable, comprised of a mosaic of high condition box-gum woodland, low condition natural temperate grassland and low condition scribbly gum woodland. The ecological condition of each vegetation type is outlined in **Table 3.1** and shown in **Figure 3.1**.

Table 3.1 – Ecological condition of vegetation within the eastern 200 metre strip of Kama Nature Reserve

Vegetation zone	Ecological condition
Natural temperate grassland (VT3)	The natural temperate grassland area is characterised by a high cover of kangaroo grass (*Themeda triandra*) and tall speargrass (*Austrostipa bigeniculata*), with few inter-tussock spaces and a low diversity of native forbs. There are few uncommon native species and some disturbance tolerant species in addition to a high cover of the invasive St John's wort (**Hypericum perforatum*). The area has been subjected to moderate alteration through historic grazing management. The area was assessed in line with the Botanical Significance Rating (BSR) for natural temperate grassland as defined by the ACT lowland native grassland conservation strategy (ACT Government 2005)[4]. At present, the area is considered to be a mosaic of moderate (BSR 3) and low (BSR 4) condition. With an appropriate level of active

[1] Umwelt (2013a) Review of ACT Environmental Offsets Calculator. Stage 2. Draft July 2013. Prepared by Umwelt (Australia) Pty Limited on behalf of ACT Land Development Agency.

[2] Eco Logical Australia (2013) Molonglo valley vegetation survey: baseline condition assessment. Prepared for Design & Development, Territory & Municipal Services Directorate (ACT Government), 1 July 2013.

[3] ACT Government (2013) Environmental Offsets Calculator Operational Manual. ACT Environment and Sustainable Development Directorate. Version 20130301.

[4] ACT Government (2005) A vision splendid of the grassy plains extended: ACT lowland native grassland conservation strategy. Action Plan No. 28 (Arts, Heritage and Environment, Canberra).

	management to reduce biomass and maintain inter-tussock spaces, the area is likely to be of moderate (BSR 3) value. The area is considered to be part of the 'natural temperate grassland of the Southern Tablelands of NSW and the Australian Capital Territory' endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and 'natural temperate grassland' endangered ecological community under the ACT *Nature Conservation Act 1980*. Using condition criteria of ACT Government (2013), this area is in 'moderate/good' condition on the basis that if vegetation is not typified by the presence of paddock trees or native pasture (low condition) then it is in moderate to good condition.
Blakely's red gum - yellow box grassy woodland (box-gum) (partially cleared) (VT1a)	The partially cleared box-gum woodland area is characterised by an open woodland overstorey of Blakely's red gum (*Eucalyptus blakelyi*) which is likely to be have been historically thinned for grazing or other agricultural and land management purposes. The understorey is a mosaic of a moderate to high cover of tussock grasses as per the natural temperate grassland, with approximately 30-40% of the area dominated by exotic pasture patches including wild oats (**Avena* spp.), barley grass (**Hordeum* spp.) and rat's-tail fescue (**Vulpia myuros*), as well as St John's wort and sweet briar (**Rosa rubiginosa*). In native areas there are species which indicate high condition such as blue devil (*Eryngium ovinum*) and early nancy (*Wurmbea dioica* subsp. *dioica*). However, the understorey is not as diverse as box-gum remnants in the central and western portions of Kama Nature Reserve. The area was assessed in line with condition categories in the ACT lowland woodland conservation strategy (ACT Government 2004)[5]. The area is considered to be 'moderately modified lowland woodland'. The area is considered to be part of the 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and 'yellow box – red gum grassy woodland' endangered ecological community under the ACT *Nature Conservation Act 1980*. Using condition criteria of ACT Government (2013), this area is in 'paddock trees' condition. Native over-storey percent foliage cover is less than 25% of the lower value of the overstorey percent foliage cover benchmark for the relevant vegetation type and less than 50% of ground cover perennial vegetation is indigenous species.
Blakely's red gum - yellow box grassy woodland (box-gum) (VT1)	The box-gum woodland area is characterised by a woodland overstorey of Blakely's red gum and yellow box (*E. melliodora*). The understorey is considered to be in high condition, with a suite of native grasses such as kangaroo grass (*Themeda triandra*), wallaby grasses (*Rytidosperma* spp.) weeping grass (*Microlaena stipoides* var. *stipoides*) and *Aristida vagans*, and forbs including blue devil, early nancy, common sunray (*Triptilodiscus pygmaeus*), scaly buttons (*Leptorhynchos squamatus*), and the native small St John's wort (*Hypericum gramineum*). The area was assessed in line with condition categories in the ACT lowland woodland conservation strategy (ACT Government 2004). The area is considered to be 'partially modified lowland woodland'. As a result of the ground layer vegetation diversity and floristic composition, the area is considered to be relatively good quality example of the 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland' critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and 'yellow box – red gum grassy woodland' endangered ecological community under the ACT *Nature Conservation Act 1980*. Using condition criteria of ACT Government (2013), this area is in 'moderate/good'

[5] ACT Government (2004) Woodlands for wildlife: ACT lowland woodland conservation strategy. Action Plan No. 27 (Environment ACT, Canberra).

	condition. If vegetation is not in low condition on the basis that if vegetation is not typified by the presence of paddock trees or native pasture (low condition) then it is in moderate to good condition.
Scribbly gum grassy open forest (partially cleared) (VT2a)	The scribbly gum grassy open forest area is characterised by isolated scribbly gum (*Eucalyptus rossii*) and less frequently, red stringybark (*E. macrorhyncha*), broad-leaved peppermint (*E. dives*) and Blakely's red gum. Like VT2 below, the dominance of scribbly gum is possibly due to reduced fertility and soil depth associated with areas at higher elevations within the reserve. The understorey is highly degraded, and dominated by wild oats (*Avena* spp.), brome (*Bromus* spp.) and ryegrass (*Lolium* spp.). Some patches are dominated by native grasses including tall speargrass, wallaby grasses (*Rytidosperma* spp.) and red-leg grass (*Bothriochloa macra*). Exotic forbs such as Paterson's curse (*Echium plantagineum*) and St John's wort are common. The area was assessed in line with condition categories in the ACT lowland woodland conservation strategy (ACT Government 2004). The area is considered to be 'substantially modified lowland woodland'. Using condition criteria of ACT Government (2013), this area is in 'paddock trees' condition. Native over-storey percent foliage cover is less than 25% of the lower value of the overstorey percent foliage cover benchmark for the relevant vegetation type and less than 50% of ground cover perennial vegetation is indigenous species
Scribbly gum grassy open forest (VT2)	The scribbly gum grassy open forest area is characterised by scribbly gum (*Eucalyptus rossii*) and occasional Blakely's red gum. The dominance of scribbly gum is possibly due to reduced fertility and soil depth associated with areas at higher elevations within the reserve. The understorey is in reasonable condition and is floristically similar to VT1. Dominant species include rough speargrass (*Austrostipa scabra* subsp. *falcata*), short wallaby grass (*Rytidosperma carphoides*), ringed wallaby grass (*R. caespitosum*), kangaroo grass and a range of forbs including scaly buttons, stinking pennywort (*Hydrocotyle laxiflora*), spoon cudweed (*Stuartina muelleri*), wood sorrel (*Oxalis perennans*) and Austral stonecrop (*Crassula sieberiana*). The area was assessed in line with condition categories in the ACT lowland woodland conservation strategy (ACT Government 2004). The area is considered to be 'partially modified lowland woodland'. Using condition criteria of ACT Government (2013), this area is in 'moderate/good' condition. If vegetation is not in low condition (paddock trees or native pasture) then it is in moderate to good condition.

3.2 Area within the Molonglo stage 3 development

The ecological condition of the 300 metre area of the western boundary of Molonglo stage 3 development (adjoining Kama Nature Reserve) is generally low, consisting of degraded exotic pastures, and an area containing scattered Blakely's red gum with an exotic understorey. Vegetation type and condition mapping undertaken by ELA (2013) provides a fair representation of ecological values. As requested in project brief, a full-floristic plot surveyed by ELA (2013) (plot O3-01) was surveyed, confirming that the area is dominated by exotic pasture grasses.

The only feature of ecological significance is the presence of five potential pink-tailed worm lizard (*Aprasia parapulchella*) habitat areas. One of these (location PTWL1) is within a patch of diverse native grasses, whereas the others are of moderate to low value due to a higher abundance of Phalaris (*Phalaris aquatica*) and wild oats (*Avena* spp.) These areas are mapped as moderate habitat quality by Osborne & Wong (2010)[6].

[6] Osborne W & Wong D (2010) Extent of potential pink-tailed worm-lizard (Aprasia parapulchella) habitat in the Stage 2 Investigation Area – East Molonglo downstream of Coppins Crossing. Report commissioned by ACTPLA.

The location of these potential areas is shown in **Figure 3.1**.

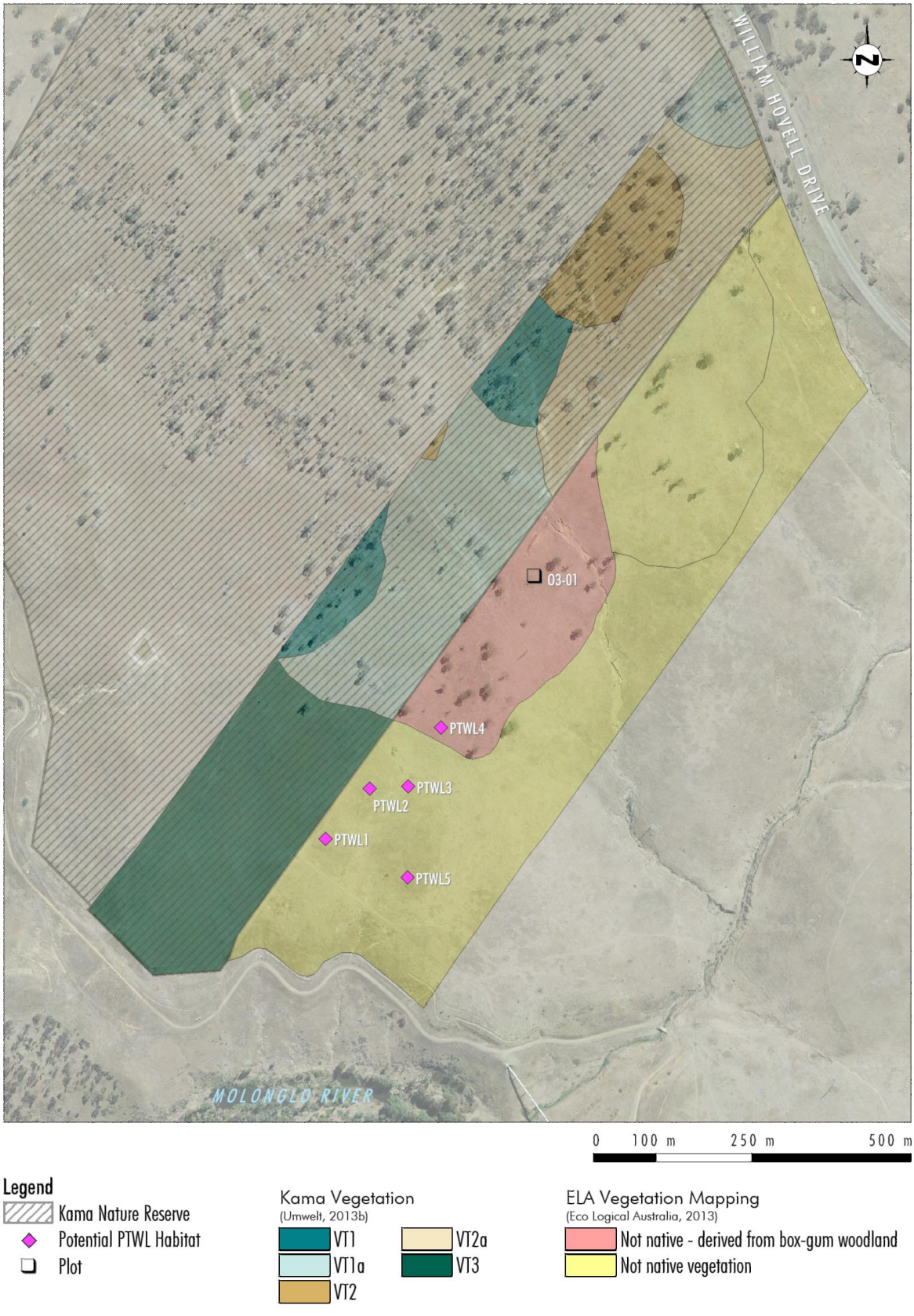

Figure 3.1 - Ecological assets of the outer asset protection zone including potential pink-tailed worm lizard habitat.

Vegetation types within Kama Nature Reserve are as follows (Umwelt 2013b)[7]:

VT1:	Blakely's red gum - yellow box grassy woodland
VT1a:	Derived mixed exotic and native grassland (derived from VT1)
VT2:	Scribbly gum grassy open forest
VT2a:	Scribbly gum grassy open forest (partially cleared)
VT3:	Natural temperate grassland

4.0 Conclusions & Recommendations

- The ecological condition of the eastern 200 metres of Kama Nature Reserve are generally moderate to high within areas of 'box-gum' woodland and natural temperate grassland. While there are patches dominated by exotic flora which are likely to be improved with some active management. Specifically, the natural temperate grassland and box-gum areas could benefit from active St John's wort control both in areas adjacent to the Molonglo stage 3 development, and broadly across the reserve.

- The ecological condition of the scribbly gum woodland is generally low due to a dominance of exotic perennial grasses. It may be difficult to restore these areas to their former value, although supplementary tree planting may assist in a move towards this by reducing the available sunlight to the exotic grasses.

- There are at least five potential pink-tailed worm lizard habitat areas within areas identified as the Molonglo stage 3 outer asset protection zone; there may be additional based on findings by Osborne & Wong (2010). It is recommended that these be considered in the context of the Molonglo Valley NES Plan and associated implications for development in meeting obligations under the approved strategic assessment.

[7] Umwelt (2013b) Briefing note: vegetation mapping for Kama Nature Reserve, Molonglo. Prepared by Umwelt Pty Limited for Daniel Santosuosso, ACT Land Development Agency. 11 October 2013.

5.0 Site Photographs

Photo 1: Natural temperate grassland in the south-eastern corner of Kama Nature Reserve, with considerable cover of exotic St John's Wort.

Photo 2: Blakely's red gum - yellow box grassy woodland (box-gum) (partially cleared) (VT1a), inside Kama Nature Reserve.

Photo 3: Scribbly gum grassy open forest (partially cleared), with a mosaic of native and perennial exotic grass understorey, inside Kama Nature Reserve.

Photo 4: Exotic Phalaris and wild oats dominated pastures, inside the Molonglo stage 3 development area.

6.0 References

ACT Government (2004) Woodlands for wildlife: ACT lowland woodland conservation strategy. Action Plan No. 27 (Environment ACT, Canberra).

ACT Government (2005) A vision splendid of the grassy plains extended: ACT lowland native grassland conservation strategy. Action Plan No. 28 (Arts, Heritage and Environment, Canberra).

ACT Government (2013) Environmental Offsets Calculator Operational Manual. ACT Environment and Sustainable Development Directorate. Version 20130301.

Ecological (2013) Molonglo valley vegetation survey: baseline condition assessment. Prepared for Design & Development, Territory & Municipal Services Dorectorate (ACT Government), 1 July 2013.

Osborne W & Wong D (2010) Extent of potential pink-tailed worm-lizard (Aprasia parapulchella) habitat in the Stage 2 Investigation Area – East Molonglo downstream of Coppins Crossing. Report commissioned by ACTPLA.

Umwelt (2013a) Review of ACT Environmental Offsets Calculator. Stage 2. Draft July 2013. Prepared by Umwelt (Australia) Pty Limited on behalf of ACT Land Development Agency.

Umwelt (2013b) Briefing note: vegetation mapping for Kama Nature Reserve, Molonglo. Prepared by Umwelt Pty Limited for Daniel Santosuosso, ACT Land Development Agency. 11 October 2013.

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Briefing Note

To: Daniel Santosuosso, ACT Land Development Agency
cc: Dave Richardson, ACT Land Development Agency
From: [redacted] Umwelt (Australia) Pty. Limited
Author: [redacted] Umwelt (Australia) Pty. Limited
Date: 17th October 2013
Subject: Ecological values of the Kama Nature Reserve – Molonglo Stage 3 outer asset protection zone

Purpose

The purpose of this briefing note is to provide the ACT Land Development Agency with a comparison of methods and results of studies undertaken by Umwelt (Australia) Pty Limited (Umwelt) and Eco Logical Australia Pty Limited (ELA) as part of the Molonglo Stage 3 development.

Specifically, the briefing note provides comparison of key objectives and results of the Umwelt (2013)[1] study into the utility of the draft Environmental Offsets Calculator (EOC) and the ELA (2013)[2] Molonglo valley vegetation survey within the Molonglo stage 3 development area.

Contents

[1] Umwelt (2013a) Review of the ACT Environmental Offsets Calculator, Stage 2. Draft October 2013. A report prepared by Umwelt (Australia) Pty Limited for the ACT Land Development Agency, Canberra.
[2] Eco Logical Australia (2013) Molonglo valley vegetation survey – baseline condition assessment. Prepared for Design and Development, TAMS.

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1.0 Site location

The Umwelt (2013a) technical report covers native vegetation portions of the Molonglo Stage 3 development, as identified by ACT Government (2011)[3]. The ELA (2013) vegetation survey report covers a broader area, including West Molonglo, Spring Valley Farm and River Park. For the purposes of comparison, this briefing note only compares assessment undertaken on the portions also assessed by Umwelt (2013a). These areas are shown in **Figure 1.1**. Within this figure, patches are identified by the alphabetic codes A, B, O, H, C, J, GG and N.

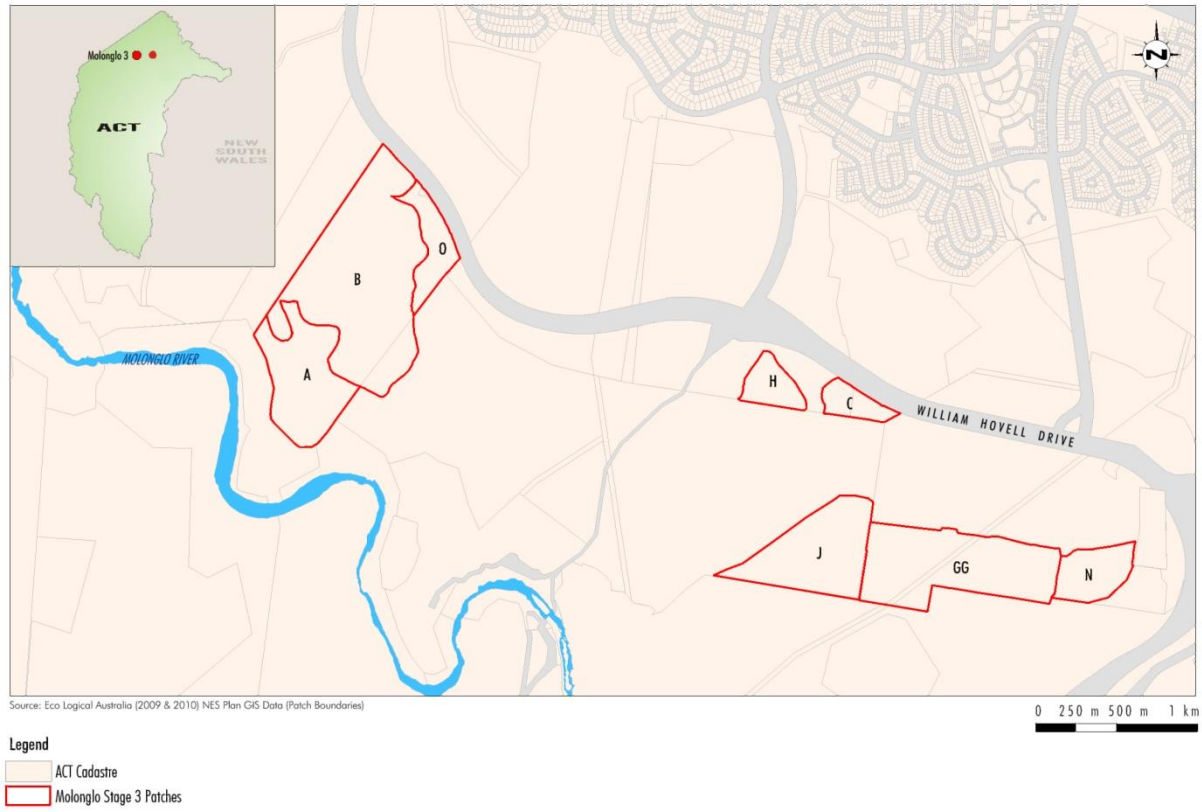

Figure 1.1 – Location of areas for comparison within the Molonglo Stage 3 development.

2.0 Objectives of individual reports

The studies undertaken by Umwelt (2013a) and ELA (2013) were undertaken with a different purpose in mind, but have some common objectives. **Table 2.1.** provides a comparison between objectives of each report.

Table 2.1. Comparison of objectives between Umwelt (2013a) and Eco Logical (2013).

Objective	Correlation between Umwelt (2013a) and Eco Logical (2013)
Umwelt Objective 1: Review EOC function in relation to Environmental Offsets Calculator Operational Manual (EOCOM) (ACT Government 2013a)[4]	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 2: Undertake case studies to trial the applicability of the EOC to determine its consistency, or otherwise, with contemporary offset outcomes	**Partial correlation** with **ELA Objective 1**, **ELA Objective 2**, **ELA Objective 3** and **ELA Objective 4**. Correlation only occurs in areas where Umwelt undertook ecological condition assessment of the Molonglo Stage 3 development offset areas to trial 'real' data in the EOC.

[3] ACT Government (2011) Molonglo Valley plan for the protection of matters of national environmental significance. NES plan, September 2011. ACT Planning and Land Authority

[4] ACT Government (2013a) Environmental Offsets Calculator Operational Manual. ACT Environment and Sustainable Development Directorate. Version 20130301.

Umwelt Objective 3: Undertake a parallel trial of the new EPBC Offsets calculator to relevant significant species and ecological communities to determine the similarity or dissimilarity in outcomes	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 4: Undertake a review of the equations in the Environmental Offsets Assessment Methodology (EOAM) (ACT Government 2013b)[5]	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 5: Review supporting databases	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 6: Undertake a review of the appropriateness and applicability of the survey methodology/effort documented in the EOCOM	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 7: Review the definitions of red flags to ensure they are appropriate	Nil correlation. Specific to Umwelt (2013a).
Umwelt Objective 8: Review the special offset requirements applied to certain threatened species	Nil correlation. Specific to Umwelt (2013a).
ELA Objective 1: Identify the vegetation community that occurs in each patch	**Correlation** with **Umwelt Objective 2**. Umwelt (2013a) identified the vegetation community as per the EOAM vegetation types database (ACT Government 2013c)[6]. Additional information was provided on whether a patch is part of a threatened ecological community. ELA (2013) makes reference to ACT vegetation types, however the plant community nomenclature differs from that of ACT Government (2013c); It is plausible there are different datasets circulating and for the most part correlations can be made. Additional information was provided on whether a patch is part of a threatened ecological community.
ELA Objective 2: Identify the diversity of plant species and vegetation structure present in each patch and conservation area	**Partial correlation** with **Umwelt Objective 2**. Umwelt (2013a) undertook 20x20 metre biometric plot-based full-floristic survey within each patch with complimentary meandering survey in intact and derived box-gum woodland remnants in order to determine whether 12 native non-grass species were present. ELA (2013) undertook 20x50 metre plot-based (woodland) and 20x20 metre (grassland) plot-based survey within each patch with complimentary meandering survey within 100 metres of each plot in potential box-gum areas with a tree cover of ≥ 10%, or where yellow box or Blakely's red gum was considered o at one time be the dominant tree species.
ELA Objective 3: Identify habitat features that may be supporting particular groups of fauna species	**Partial correlation** with **Umwelt Objective 2**. Umwelt (2013a) undertook 20x50 metre plot-based and 50 metre linear transect biometric condition assessment in areas associated with each 20x20 metre plot. In the linear transect, data was collected at 1 metre intervals for groundcover, and 5 metre intervals for the canopy and midstorey in line with ACT Government (2013b). ELA (2013) described habitat features the may support particular groups of fauna as described by Sharp (2012); while this method differs from ACT Government (2013b) it has some advantages in that it subjectively captures variation within woodland stands.

[5] ACT Government (2013b) Environmental Offsets Assessment Methodology. ACT Environment and Sustainable Development Directorate. Version 20130301.
[6] ACT Government (2013c) Vegetation types database. Unknown version associated with ACT Government (2013a, 2013b).

ELA Objective 4: Identify the condition of each conservation area	**Partial correlation** with **Umwelt Objective 2**, which identified vegetation communities occurring in each patch. Umwelt (2013a) provides detail on condition classes as per the EOAM, which was outside of scope for ELA (2013). Umwelt undertook meandering surveys in intact and derived box-gum remnants in order to determine whether 12 native non-grass species were present. ELA (2013) provides a condition rating based on native non-grass understorey species richness, with information collected from within plots and meandering survey within 100 metres of plots.
ELA Objective 5: Identify issues present that require management intervention in each remnant patch to guide the development and implementation of operational plans	Nil correlation. Specific to ELA (2013).
ELA Objective 6: Identify a strategic conservation goal and desired outcomes for each conservation area	Nil correlation. Specific to ELA (2013).
ELA Objective 7: Assist in the identification of actions required to manage the conservation areas for conservation	Nil correlation. Specific to ELA (2013).
ELA Objective 8: Identify what should be monitored to determine if the management being applied realises the desired outcomes	Nil correlation. Specific to ELA (2013).

As indicated in Table 2.1, common objectives of the reports by Umwelt (2013a) and ELA (2013) can be summarised as follows:

1. Identify the vegetation community that occurs in each patch
2. Identify the diversity of plant species and vegetation structure present in each patch
3. Identify habitat features that may be supporting particular groups of fauna species
4. Identify the condition of each conservation area

While the methods to undertake this are not always comparable, both Umwelt (2013a) and ELA (2013) have applied published methods to deliver on these objectives (refer to **Table 2.1**). **Section 3.0** outlines similarities, dissimilarities and implications for interpretation relative to these objectives. **Section 4.0** outlines assessment of matters of national environmental significance (MNES) for each patch.

3.0 Comparable objectives

3.1 Vegetation communities

Both Umwelt (2013a) and ELA (2013) identify vegetation communities occurring in patches A, B, O, H, C, GG and N as defined by ACT Government (2011). Additionally, Umwelt (2013a) looks at patch 'J' (refer to **Section 5**). However, the Umwelt (2013a) findings differ in that:

- Based on advice from the Land Development Agency, the area of interest is extended to the western boundary of Kama Nature Reserve. This area was not included in ACT Government (2011) or subsequently, ELA (2013).

- The extent and type of vegetation communities within Kama Nature Reserve was reviewed by Umwelt (2013b)[7]. This review revealed that an area of 15.5 hectares of scribbly gum grassy open forest is present in north-eastern portions of the reserve, along with an additional 7.7 hectares which is believed to be derived from this scribbly gum community. The mapping of this polygon by Umwelt (2013b) is consistent with vegetation mapping included in ACT Government (2012)[8]. As such, it is

[7] Umwelt (2013b) Briefing note: vegetation mapping for Kama Nature Reserve, Molonglo. Prepared by Umwelt Pty Limited for Daniel Santosuosso, ACT Land Development Agency. 11 October 2013.
[8] ACT Government (2012) Heritage (Decision about Registration of Kama Woodland/Grassland, Belconnen) Notice 2012. Notifiable Instrument NI2012-541.

considered that ELA (2013) has over-estimated the extent of box-gum woodland within Kama nature Reserve. To avoid confusion, patches A, B and O have been renamed Zones 1, 2/3 and 4/5 in Umwelt (2013a), based in three vegetation types, with two condition classes within two of those. Zone 1 is generally similar to patch A, Zones 2/3 are generally similar to patch B (with some refinements in vegetation type and condition) and Zones 4/5 are generally similar to patch O (with major refinements in vegetation type and condition) (refer to **Figure 3.1**).

The findings within patches C, GG, H and N are consistent across both Umwelt (2013a) and ELA (2013), however Umwelt (2013) split some areas based on condition classes defined in the EOAM (ACT Government 2013b). **Section 3.4** expands on this further.

3.2 Diversity of plant species and vegetation structure

Both Umwelt (2013a) and ELA (2013) undertook plot-based and meandering survey to identify the diversity of plant species within each patch.

Umwelt (2013a) undertook 20x20 metre plot-based full-floristic assessment across each patch, with the number of plots assessed determined by plot allocation rules in the EOCOM (ACT Government 2013a). In areas which contained intact or derived box-gum woodland, additional random meander survey was undertaken in native understorey areas to determine if 12 non-grass native understorey were present in a particular patch.

ELA (2013) undertook 20x50 metre plot-based full-floristic assessment in intact box-gum remnants across each patch, and 20x20 metre plot-based full-floristic assessment in derived box-gum woodland areas. Additional meandering surveys in each patch were completed by ELA (2009)[9], the ELA (2013) report does not confirm if this was repeated in 2013.

While there are some differences in findings from Umwelt (2013a) and ELA (2013) based on seasonal, temporal and observer variation, the findings confirm that the diversity of plant species within each patch is sufficiently similar with both assessments and has not affected subsequent condition assessment information. As the Umwelt (2013a) survey took place over two survey events in July and September 2013, some summer grasses and late spring forbs were either not confirmed as present or not identifiable to species level due to an absence of diagnostic features. Similarly, there are some exotic winter forbs and native spring annuals which were not recorded by ELA (2013) as their survey was undertaken in the middle of summer between 14 December 2012 and 7 January 2013. ELA (2013) states that one of the main limitations of their study is that multiple observers were required due to tight timeframes, and that this may provide variation in plant identification based on local experience and biases of individual ecologists.

With respect to vegetation structure, Umwelt (2013) assessed this in line with ACT Government (2013b, 2013c). Native overstorey cover, midstorey cover and groundcover (grasses, shrubs, other, exotic) were assessed along a 50 metre transect, number of large trees and length of fallen logs were assessed within a 50x20 metre plot area and regeneration was assessed across the entire vegetation zone. ELA (2013) followed monitoring guidelines developed by Sharp (2012)[10], which assesses condition variables at the vegetation unit level. While this method is not as objective as plot/transect based methods, it increases observation opportunities for habitat variables in woodland environments with a patchy distribution of habitat features. As such, it is considered that a combination of both methods provides a good assessment of vegetation structure. However, the implications for this are minimal as methods used in both reports reach comparable conclusions on vegetation structure.

Surveys undertaken by Umwelt (2013a) confirm that the majority of patch B (refined and referred to as Zones 2/3 in Umwelt 2013a), as well as patches ‘C’, ‘GG’ and ‘N’ contain intact and derived box-gum woodland. Both reports note that patch C contains a mosaic of box-gum woodland and areas with an exotic understorey which is not representative of the critically endangered ecological community. Patch A (referred to as Zone 1 in Umwelt 2013a) is confirmed as natural temperate grassland.

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[9] Eco Logical (2009) EPBC Listed Flora Community and Species Mapping in the Molonglo Valley. A report prepared for ACT Planning and Land Authority.

[10] Sharp S (2012) Procedures manual – baseline condition assessment in the Lower Molonglo River Valley Conservation Areas 2012.

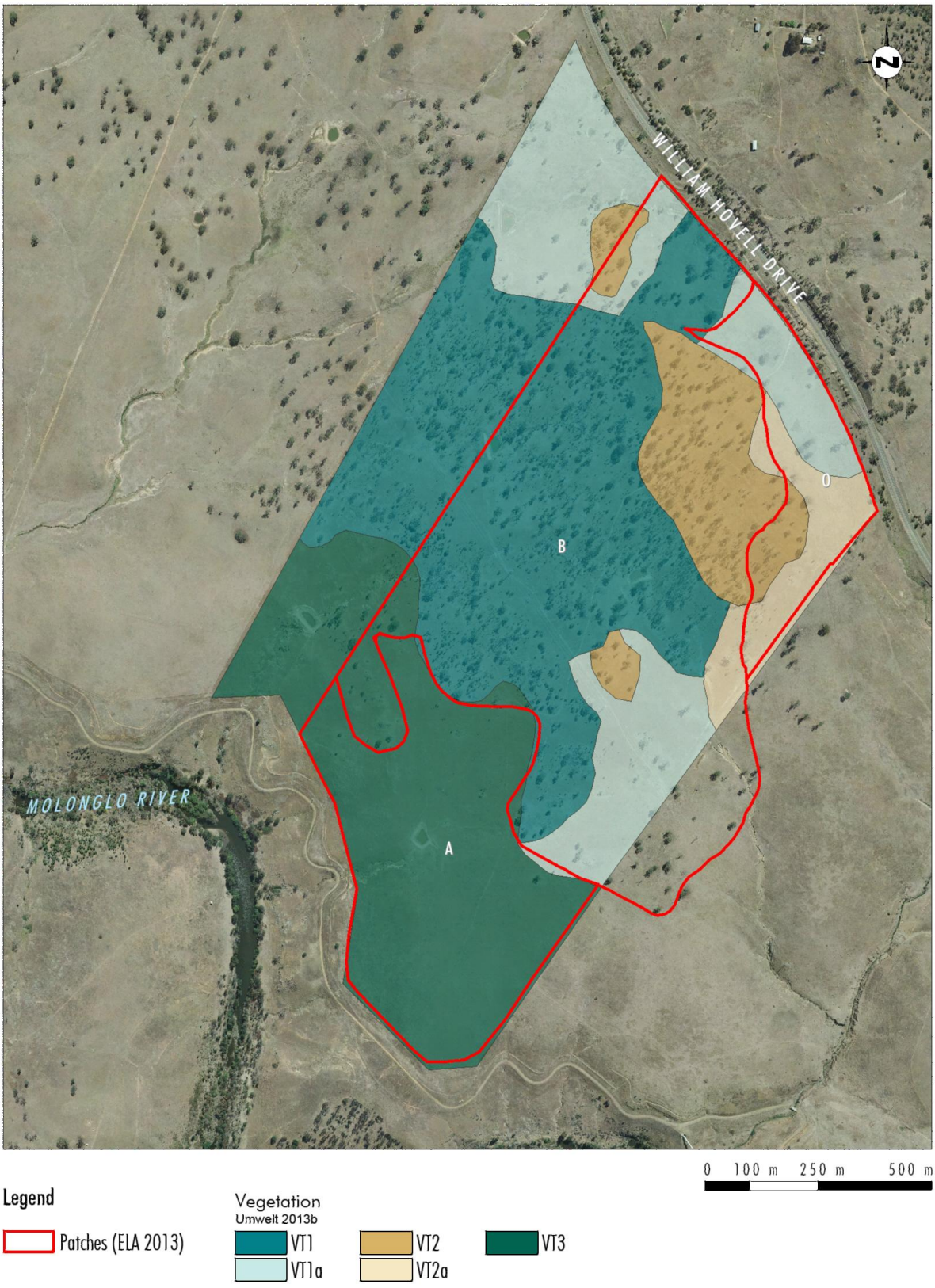

Figure 3.1 – Comparison of vegetation mapping between Umwelt (2013b) vegetation types and ELA (2013) patches.

Umwelt (2013a) considers that much of Patch H is low condition box-gum woodland. ELA (2013) found a total of 11 non-native understorey species, whereas Umwelt (2013a) recorded 18 non-grass native understorey, including four 'important' species (the EPBC Act guidelines consider that box-gum woodland requires at least 12 non-grass native understorey and one 'important' species). However, Umwelt (2013a) surveyed five plots across two condition classes in order to satisfy plot allocation rules of the EOAM (ACT Government 2013b), thus surveying the area in greater detail. It is agreed that patch H contains areas dominated by an exotic understorey; if it is considered important to quantify this further a grid survey should be undertaken to accurately determine the extent of box-gum woodland in this patch.

3.3 Habitat features

Umwelt (2013a) identifies habitat features in line with ACT Government (2013b, 2013c), focusing on general questions related to geographic location and habitat features. Along with identification of significant species subzones (a combination of vegetation type and condition), these questions were used to predict potential threatened species for targeted survey or further consideration. With the exception of a known population of brown treecreeper (*Climacteris picumnus victoriae*) within Kama Nature Reserve, all species were assumed absent for the purpose of operating the EOC. The requirement for targeted threatened flora and fauna survey was outside the scope of the project, with the assumption of absence being based on review of available datasets and subjective appraisal of likelihood of occurrence of threatened species with regard to habitat structure, condition and connectivity.

ELA (2013) identified potential habitat areas for threatened fauna based on habitat features within each patch, developing a list of potential fauna which may occur in particular vegetation units. The study notes that no listed flora species were recorded during the field surveys as they were conducted outside of the optimal flowering time for some threatened flora species. As with Umwelt (2013a), further targeted survey was outside the scope for the project.

3.4 Condition of conservation areas

Studies undertaken by Umwelt (2013a) and ELA (2013) used different condition assessment criteria due to different project scopes. Umwelt (2013a) used condition criteria described in ACT Government (2013b, 2013c), along with determining whether potential extant and derived box-gum woodland patches contained 12 or more non-grass native understorey species and at least one 'important' species. ELA (2013) focused on determining whether potential extant and derived box-gum woodland patches contained 12 or more non-grass native understorey species and at least one 'important' species, categorising relevant patches into quality ranges of 12-15, 15-20 and 21+ non-grass native understorey species.

Both studies provided textual information as to the condition of natural temperate grassland in Kama Nature Reserve. Umwelt (2013a) provided information on the botanical significance rating as per ACT Government (2005)[11]. An important part of the ELA (2013) study was to identify management considerations, and this should be referred to for the most comprehensive information regarding this particular aspect.

4.0 Summary of MNES (vegetation) status

A main reason for LDA requesting this comparison was to determine whether ACT Government (2011), Umwelt (2013a) and ELA (2013) provided different findings with respect to the condition of individual patches. Consistency is important to determine the appropriate values for MNES, in addition to developing a confidence level for development and offset areas that have not been subject to peer review.

Table 4.1 provides a comparison of findings from the two reports, with particular reference to MNES status of individual patches (excluding patch 'J', refer to **Section 5**). As a reference point, patches as described by ACT Government (2011) are used, and where there are discrepancies between findings by Umwelt (2013a) and ELA (2013), these are outlined. MNES as it relates to threatened species is not discussed as this was outside of scope for both projects; however a range of threatened species may be present, including but not limited to striped legless lizard (*Delma impar*) and pink-tailed worm lizard (*Aprasia parapulchella*).

[11] ACT Government (2005) A vision splendid of the grassy plains extended: ACT lowland native grassland conservation strategy. Action Plan No. 28 (Arts, Heritage and Environment, Canberra).

Table 4.1. Comparison of findings from Umwelt (2013a) and ELA (2013) regarding MNES status for individual patches.

Patch	Findings			Comments
	ACT Government (2011)	ELA (2013)	Umwelt (2013a)	
Kama Nature Reserve (including outer asset protection zone within Molonglo Stage 3)				
A	Natural temperate grassland (36.56 ha)	Natural temperate grassland (36.6 ha)	Zone 1: Natural temperate grassland (44.58 ha)*	Generally consistent findings between all three studies. Umwelt (2013a) identify additional area due to the inclusion of western areas of Kama Nature Reserve, which were not considered by ACT Government (2011) or ELA (2013).
B	EPBC box-gum woodland (high) (113.09 ha)	EPBC box-gum woodland (106 ha)	Zone 2: EPBC box-gum woodland (58.68 ha)* Zone 3 (derived): Not EPBC box-gum woodland – some native patches (probably smaller than 0.1 hectare in size) but largely dominated by perennial exotic pasture grasses*	Areas identified in this patch outside of Kama Nature Reserve by ACT Government (2011) were described as part of Patch O by ELA (2013). Umwelt (2013a, 2013b) considers that the majority of cleared (derived) areas are dominated by exotic pasture grasses, and as such do not meet EPBC box-gum woodland criteria.
O	EPBC box-gum woodland (low) (12.03 ha)	EPBC box-gum woodland (12 ha); Exotic pasture (50.2 ha)	Zone 4: Scribbly gum grassy open forest (15.48 ha). Not EPBC box-gum woodland. Zone 5: Scribbly gum grassy open forest, partially cleared (7.71 ha). Not EPBC box-gum woodland.	As part of vegetation mapping undertaken by Umwelt (2013b), Umwelt (2013a) considers much of the original patch O to be dominated by scribbly gum and as such, not EPBC box-gum woodland based on the requirement for yellow box, Blakely's red gum or white box to be one of the *most* dominant species. Umwelt (2013a, 2013b) notes that Blakely's red gum is a subdominant canopy species in Zones 4/5. Areas previously identified as part of patch B outside of Kama Nature Reserve by ACT Government (2011) were described as part of Patch O by ELA (2013). Areas east of Kama Nature Reserve are considered exotic pasture by both Umwelt (2013a) and ELA (2013), and as such, not EPBC box-gum woodland as determined by ACT Government (2011).
Molonglo Stage 3				
C	EPBC box-gum woodland (high) (6.91 ha)	EPBC box-gum woodland (6.9 ha)	EPBC box-gum woodland (6.9 ha)	Both Umwelt (2013a) and ELA (2013) indicate that this patch also contains areas dominated by exotic grasses and forbs. It is estimated that approximately 30% of this patch is dominated by exotic pastures with native *Austrostipa bigeniculata* being the predominant native perennial grass.

Patch	Findings			Comments
	ACT Government (2011)	ELA (2013)	Umwelt (2013a)	
GG	EPBC box-gum woodland (low) (43.86 ha)	EPBC box-gum woodland (43.9 ha) Derived EPBC box-gum woodland (3.7 ha)	EPBC box-gum woodland (43.9 ha). Approximately 2 ha on edge dominated by exotic pasture. Derived EPBC box-gum woodland (3.7 ha)	ACT Government (2011) did not include patch GG2 (3.7 ha), which was incorporated by Umwelt (2013a) and ELA (2013) into Patch GG.
H	EPBC box-gum woodland (medium) (8.60 ha)	Not EPBC box-gum woodland (but satisfies ACT *Nature Conservation Act 1980* criteria) (8.6 ha)	EPBC box-gum woodland (8.6 ha)	ELA (2013) suggests the area could be resurveyed to confirm whether the remnant meets EPBC criteria. While it is estimated that approximately 30% of the patch is dominated by exotic pastures, Umwelt (2013a) considers that the patch meets EPBC criteria as 24 non-grass native understorey species were recorded, including 6 'important' species.
N (N1+N3)	EPBC box-gum woodland (low) (13.36 ha)	Depauperate native pasture/exotic pasture (13.3 ha)	Derived EPBC box-gum woodland (13.3 ha)	Area originally mapped by ELA (2009) as low condition box-gum woodland, which was incorporated into ACT Government (2011). ELA (2013) considers this area not part of the box-gum community based on a lack of species diversity and some areas of exotic pasture. Umwelt (2013a) considers that the majority of this area represents derived box-gum woodland in low condition as while only ten non-grass native understorey were recorded, it is part of a contiguous patch with GG. It is estimated that approximately 20% of this patch is dominated by exotic pastures with native *Austrostipa bigeniculata* being the predominant native perennial grass.

* The Land Development Agency has advised that the entire area of Kama Nature Reserve is part of an advanced offset for the Molonglo Stage 3 development.

5.0 Vegetation within Molonglo Stage 3 (Patch J)

Umwelt (2013a) was required to assess vegetation in patches identified as offset areas in the Molonglo Valley Matters of National Environmental Significance Plan (ACT Government, 2011). Within this plan, patch 'J' was identified as containing 32.97 hectares of EPBC box-gum woodland. This area was not assessed by ELA (2013) however Umwelt (2013a) undertook a meandering search through the area and determined that it is predominantly characterised by exotic pasture grasses.

Umwelt (2013a) concluded that the area contained 2.4 hectares of native grassland in southern portions. Within one plot, 12 non-grass native understorey species were recorded, including three 'important' species. As such, 2.4 hectares of patch 'J' is considered to represent the derived state of EPBC box-gum woodland. This will require consideration in the context of obligations under the NES Plan as part of any proposed development within this area.

6.0 Interpretation of box-gum woodland condition criteria

The Commonwealth listing advice on EPBC box-gum woodland and derived native grassland (TSSC 2006)[12] identifies key criteria in determining the presence of EPBC box gum woodland:

- White box, yellow box or Blakely's red gum (or a combination of all three) as the dominant canopy species. In the Nandewar bioregion western grey box and coastal grey box may also be considered.
- The patch must have a predominantly native understorey.
- The patch must be greater than or equal to 0.1 hectare in size.
- The understorey must contain at least 12 native, non-grass understorey species (such as forbs, shrubs, ferns and sedges), as well as one 'important' species (e.g. grazing sensitive, regionally significant or uncommon species).

Additionally, if an area of greater than two hectares has a predominantly native understorey, and has natural regeneration or 20 or more mature trees per hectare but does not satisfy the criteria for 12 or more native species and at least one 'important' species, it may also be considered EPBC box-gum woodland.

This interpretation has been inconsistently applied by ecologists across different organisations. For example, in areas directly east of Kama Nature Reserve, ELA (2009) and subsequently, ACT Government (2011) identified vegetation meeting the alternate condition state that applies to areas greater than two hectares. Despite this, it was apparent from surveys undertaken by Umwelt (2013a) that these areas do not have the predominantly native understorey and as such could not be considered to be part of the listed community despite being contiguous with a patch that did meet the community's definition in Kama Nature Reserve.

It is Umwelt's understanding that if a wooded but degraded area with a perennial exotic understorey is adjacent to a higher quality remnant, the degraded area should not have EPBC box-gum status on the basis of ground layer vegetation condition. At times, this is difficult to separate in contiguous patches of the same land use where there are patches of week plumes (for example in patches 'C', 'H' and 'N')[13]. However, where there is a differing land use such as having a conservation area adjacent to a treed agricultural paddock with an exotic pasture or cropped understorey, the separation is generally simpler and should be made where possible. This is not to say that the trees in a degraded landscape do not have value, however their status should be assessed where relevant on their value to other entities such as threatened woodland birds as opposed to being attached to the endangered community when the lack of a predominantly native understorey precludes the identification of the community in the first instance.

7.0 Conclusions & Recommendations

It is concluded from the review and verification surveys undertaken as a part of this project that while methods and results of Umwelt (2013a) and ELA (2013) are generally comparable, certain differences do exist and these may be of significance in consideration of offset values within the project area and in the context of the NES Plan. Given this, it is recommended that comments in **Table 4.1** should be noted when determining the true value of offset areas in Kama Nature Reserve and within the Molonglo Stage 3 area.

[12] TSSC (2006) Commonwealth listing advice on white box – yellow box – Blakely's red gum grassy woodland and derived native grassland. Accessed on line 16/10/2013 [URL: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/box-gum.pdf].

[13] It is also noted that the minimum size that a 'patch' of box gum woodland should be mapped is 0.1 ha, it also stands that an area of exotic understorey greater than this size but surrounded by or adjacent to the community should be excluded from being part of that 'patch'. However, this is more difficult to quantify in larger remnants where areas of exotic understorey are not discrete but occur as a mosaic with areas of native understorey.

8.0 References

ACT Government (2005) A vision splendid of the grassy plains extended: ACT lowland native grassland conservation strategy. Action Plan No. 28 (Arts, Heritage and Environment, Canberra).

ACT Government (2011) Molonglo Valley plan for the protection of matters of national environmental significance. NES plan, September 2011. ACT Planning and Land Authority

ACT Government (2012) Heritage (Decision about Registration of Kama Woodland/Grassland, Belconnen) Notice 2012. Notifiable Instrument NI2012-541.

ACT Government (2013a) Environmental Offsets Calculator Operational Manual. ACT Environment and Sustainable Development Directorate. Version 20130301.

ACT Government (2013b) Environmental Offsets Assessment Methodology. ACT Environment and Sustainable Development Directorate. Version 20130301.

ACT Government (2013c) Vegetation types database. Unknown version associated with ACT Government (2013a, 2013b).

ELA (2009) EPBC Listed Flora Community and Species Mapping in the Molonglo Valley. A report prepared for ACT Planning and Land Authority.

ELA (2013) Molonglo valley vegetation survey – baseline condition assessment. Prepared for Design and Development, TAMS.

Sharp S (2012) Procedures manual – baseline condition assessment in the Lower Molonglo River Valley Conservation Areas 2012.

TSSC (2006) Commonwealth listing advice on white box – yellow box – Blakely's red gum grassy woodland and derived native grassland. Accessed on line 16/10/2013 [URL: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/box-gum.pdf].

Umwelt (2013a) Review of the ACT Environmental Offsets Calculator, Stage 2. Draft October 2013. A report prepared by Umwelt (Australia) Pty Limited for the ACT Land Development Agency, Canberra.

Umwelt (2013b) Briefing note: vegetation mapping for Kama Nature Reserve, Molonglo. Prepared by Umwelt Pty Limited for Daniel Santosuosso, ACT Land Development Agency. 11 October 2013.

From: Santosuosso, Daniel
To: [redacted]
Cc: Richardson, Dave
Subject: RE: Molonglo Stage 3 briefing notes
Date: Thursday, 17 October 2013 5:03:48 PM

Thanks [redacted]

Received

Will review and get back to you

Daniel Santosuosso | Project Manager
Land Development Agency
Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
Phone: 02 6207 7212 | Fax: 02 62076110 | Web: www.lda.act.gov.au
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message.

From: [redacted]
Sent: Thursday, 17 October 2013 4:38 PM
To: Santosuosso, Daniel
Cc: Peter Cowper
Subject: Molonglo Stage 3 briefing notes

Hi Daniel,

Please find attached five briefing notes prepared as part of variations to our Molonglo Stage 3 study:

- R01 – Belconnen 1550 vegetation
- R02 – Golden Sun Moth release
- R03 – Kama Nature Reserve vegetation
- R04 – Molonglo Stage 3 outer asset protection zone assessment
- R05 – Comparison between Umwelt and Eco Logical studies at Molonglo stage 3

Please call Peter or myself if you have any additional thoughts, or comments which you would like us to address.

Now that the final data has been collected for the EOC review, Pete is reviewing this prior to finalising – this should be forthcoming soon.

Cheers

[redacted]
Senior Ecologist

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56 Bluebell Street
O'Connor, ACT 2602

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Mobile: [redacted]

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Please consider the environment before printing this email

From: Chandler, Aaron
To: Richardson, Dave
Subject: FW: DRAFT Brief - Molonglo Valley Stage 3 Contamination Assessor
Date: Monday, 28 October 2013 8:45:52 AM
Attachments: DRAFT Brief - Molonglo Valley Stage 3 Contamination Assessor.docx

---

Morning Dave

Draft Contamination Brief from SG.

Should I touch base with MC as suggested regarding any progress she made before taking up the temp position downstairs?

According to SG we have copies of all ESDD's reports undertaken to date – would you like me to review these so we can commence with preparing for any further investigations??

Aaron Chandler | Senior Project Manager (Consultant)
Land Development Agency
Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
Phone: 02 6207 9070 | Mobile: 0434 317 010 | Fax: 02 6207 6110 | Web: www.lda.act.gov.au

Please respect the environment and think about the impact of printing this email.

From: Gianakis, Steven
Sent: Monday, 28 October 2013 8:39 AM
To: Chandler, Aaron
Subject: DRAFT Brief - Molonglo Valley Stage 3 Contamination Assessor

Hi Aaron

Please find attached the draft brief that I prepared a few months ago.

You will need to check with Meagan because she has had the brief for a couple months and may have been working on it.

The LDA has all the report that we prepared.

Cheers,

Steven

Environmental Consultant Services for
Molonglo Valley Stage 3 Contamination Assessment
(Phase 2 and Phase 1 over a number of smaller areas)
PROJECT BRIEF
ACT Environment and Sustainable Development Directorate
~~February~~ April 2013

1. BACKGROUND

The Molonglo Valley is located west of the Canberra city centre, following the lower reaches of the Molonglo River. It is situated between Belconnen and Weston with Mount Stromlo to the south-west and the National Arboretum Canberra to the north-east. When fully developed it is projected that the Molonglo Valley will support about 55,000 people via a three staged approach.

Urban development in Molonglo is guided by the *Molonglo and North Weston Structure Plan* that form~~s~~ part of the Territory Plan. The Molonglo River Park Concept Plan provides the planning framework for improvement and protection of environmental values, bushfire management and recreation provision in the Molonglo River corridor~~ at Molonglo~~.

The Stage 3 area is located generally north of the Molonglo River towards William Hovell Drive and is a current investigation area for the ACT Government, to facilitate future land release and urban development (Attachment A and B). The Molonglo Stage 3 Future Urban Area as defined by the Territory Plan (~~the~~ Site 1) occupies an area of approximately 1028 hectares and has predominantly been used for rural ~~residential~~ purposes and grazing (northern portion) and forestry (southern portion).

Based on the results of Environmental Site Assessment (ESA) Phase 1 ~~Reports~~ undertaken for the site ~~prepared~~ in 2012, ~~it is apparent that~~ further assessment of areas of potential environmental concern is required prior to urban ~~any re~~ development occurring. ~~These investigations would include Phase 2 of the ESA process to be undertaken by a suitably qualified and experienced environmental consultant (the Assessor).~~ This brief seeks ~~is proposed to facilitate the~~to appointment of a suitably qualified and experienced environmental consultant (the Assessor) to undertake the Phase 2 requirements.~~this consultant.~~ The detailed investigation by the Assessor will ~~must also~~ be audited by an accredited contaminated land auditor, who has been engaged separately by the Environment and Sustainable Development Directorate~~ACT Government~~ (see Section 7).

In addition to the Phase 2 assessment of ~~the above~~ Site 1, five further ~~sites~~areas require a ~~preliminary (Phase 1)~~ environmental site assessment (Phase 1) to be undertaken, as they have not previously been assessed. These sites are listed below (section??). With the exception of one site (Site A), all the sites are proposed to be used for non-residential ~~uses~~purposes ~~and will be~~ limited to open space (check river park), recreation, bushfire management and conservation or to be bisected by a future arterial road. Depending on the outcomes of the Phase 1 assessment for these areas more detailed Phase 2 ~~or Phase 3~~ may be required. This is discussed below.

Note – for the purposes of this component of the consultancy the consultant is ONLY to tender to undertake a Phase 1 assessment and to prepare a Sampling and Analysis Quality Plan for the five identified sites. If further detailed work is identified this may lead to a variation in this contract.

2. OBJECTIVE

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The objective of this procurement is to obtain sufficient and relevant information on existing site contamination conditions for the Molonglo Valley Stage 3 future urban area (and the additional identified further areas) in the ACT, to support ~~proposals for~~ future urban and residential estate developments~~ including the design and construction of associated~~and infrastructure.

The detailed investigations by the environmental consultant will be ~~summarised~~ described in a Phase 2 Environmental (Contamination) Site Assessment (ESA) report~~for the site to be completed by an environmental consultant~~. The outcome of the works is to conclude the site suitability for the proposed urban development for Site 1 ~~(concept) land use~~ with regard ~~for~~ to contamination status and/or whether remediation works are required to render the land suitable for the proposed development as per the Territory Plan.

The five additional sites require a preliminary (Phase 1) environmental site assessment to be undertaken to identify any existing site contamination concerns.

3. STUDY AREA

The study area for this consultancy is Molonglo Stage 3 and five additional sites (see Att). Site 1 is the vast majority of the future urban area as identified by the Territory Plan map and is the subject of~~to~~ the Phase 2 assessment as described by this consultancy.

The following five sites require a preliminary (Phase 1) environmental site assessment to be undertaken:

- Site A – (Block??) – This site lies to the east of Site 1 and south of William Hovell Drive. This area was not assessed as part of the earlier Molonglo Stage 3 Phase 1 assessment because it was under rural tenure. The site historically has been used for rural purposes. The ACT Government has recently purchased this area. The site is to be developed for urban residential purposes, consistent with the Territory Plan. It is understood to be at least one sheep dip site lies within this area. A major arterial road is proposed to run through the site and form a new major interchange with William Hovell Drive and ~~Bindubi~~Bindubi Street.

- Site B – (Block??) - This site lies to the east of Site 1 and to the south of Site A. This area was not assessed as part of the earlier Molonglo Stage 3 Phase 1 assessment because it was under rural tenure. The site historically has been used for rural purposes but to a far lesser extent as Site A. As the result of this land management practice, the area's woodland has been ~~retained and~~ preserved. As a consequence, this area now has significant environmental values that need to be protected. The area will be rezoned under the Territory Plan from the current urban purposes ~~under the Territory Plan~~ to conservation ~~purposes~~. This area in the future may form part of the Canberra International Arboretum.

- Site C – (Blocks) – This site lies to the south west of Site 1 and includes Misery Point and Misery Hill. The site is outside the Territory Plan's urban area and lies ~~is~~ within the Molonglo River Corridor. The area closest to the urban area is intended to become a special purpose reserve (i.e. for recreation). The area to the west will become a nature reserve to protect environmental values. ~~Reserve??.~~ The intentions for this site are described in the Molonglo River Park Concept Plan Report. Previous use

- Site D – (blocks) – This site lies to the south east of Site 1 and to the west of the Tuggeranong Parkway and ~~,~~includes Ryans Hill and Bold Hill. The site is outside the Territory Plan's urban area and lies within the Molonglo River Corridor. The land is actually classified as Designated Land, administered by the National Capital Plan. A small part of

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this area is tentatively proposed for district sporting facilities. The remaining area will be used for open space and parkland. The intentions for this site are described in the Molonglo River Park Concept Plan Report ~~Concept plan. The majority of this area will be retained.>>>>>~~previous use

- Site E – (blocks) - This site is located north of William Hovelll Drive and Bindubi Street. The site is zoned as Designated land. This area has been included into this consultancy has there is a potential for the area to be used as a district playing field complex that will be used for recreational purposes for the future residents of Molonglo stage 3 and elsewhere. Current or Previous use.

~~3~~4. DESCRIPTION OF WORK

4.1 Site 1

This brief outlines the scope of work required to complete a Phase 2 Environmental Site Assessment, including the following elements:

- Carry out investigations of contaminated land in compliance with applicable guidelines endorsed by the ACT Environment Protection Authority.
- Create a suitable conceptual contamination model of the site and identify risks associated with particular types of contamination.
- Plan and conduct comprehensive investigations producing a sufficient amount of reliable data to allow the evaluation of possible remediation strategies for the site.
- Identify and assess environmental constraints and opportunities posed by land contamination present at the site.
- Make recommendations for contamination remediation strategies that would be elaborated in a Phase 3 Remedial Acton Plan (RAP) to ensure that remediation will render land as suitable for the proposed land use and will not pose an unacceptable risk to human health and the environment. At this stage, the proposed land use comprises residential and other urban uses with recreational and nature reserve within the Molonglo River corridor.

The investigation will be conducted in accordance with a Sampling Analysis and Quality Plan (SAQP) as agreed by the project manager and endorsed by Environment Protection Unit and the Auditor following successful appointment. A draft SAQP (WSP 2012) has been prepared for the site to provide an indication of required investigation, included at Attachment C.

It is recommended that each Tenderer outlines their proposed methodology for test pit excavation, borehole drilling, soil sampling, groundwater well installation and sampling. The methods should be consistent with procedures detailed in NEPM (1999), ANZECC (2000), Australian Standards (eg. AS4482.1 and 4482.2), ASTM, USEPA and/or other ACT EPA recognised guidance documents.

4.2 Sites A to E

This brief outlines the scope of work required to complete a preliminary (Phase 1) environmental site assessment for the five additional sites (Sites A to E).

~~4~~5. SCOPE OF SERVICES ~~–~~

5.1 SITE 1

The Assessor is to work collaboratively with the Auditor in conducting the Phase 2 ESA investigation. The following scope of work is proposed:

~~4~~5.1 Investigation

The detailed Phase 2 ESA investigation will include, but not necessarily be limited to the following:

a) Review of existing reports referred to at Section 6 below, as well as other available information for the area.

b) Confirm all investigation locations following completion of a detailed site walkover and consultation with other investigations underway (as advised by ESDD), with locations presented in the draft SAQP.

c) Finalise the SAQP in consultation with the Site Auditor and after the site inspection.

d) Prepare appropriate Health & Safety plan, and an Environmental Management Plan to be implemented during fieldworks.

e) Undertake a Phase 2 site investigation using the excavation of test pits or trenching on a grid basis across the site where considered necessary but also "judgmental" test pits and boreholes as required. The number of samples to be submitted to the laboratory for analysis (including detail on QA/QC) and analytical suite proposed should be outlined by the Tenderer.

f) Undertake drilling where test pit excavation is not practicable (i.e. encounter of a concrete structure in the ground).

g) Install and sample ground water monitoring wells where required.

h) Consider any soil/fill material that may be required to be excavated as part of the construction works.

Note: It may not be necessary to investigate on a grid basis certain portions of the site, if the associated soil/fill material is ultimately to be excavated and transported off site. However, conversely, if the soil is to be transported off site for disposal at an appropriately licensed landfill, it may be necessary to obtain samples in order to classify any such soil/fill material in accordance with the relevant waste classification guidelines. Furthermore, for construction purposes, it may be necessary to remove remnants of any concrete floor slabs remaining in the subsurface in certain parts of the site. If so, and if possible, test pits should be excavated following the removal of any such concrete, rather than drilling through the concrete.

i) Record relevant information during sampling including descriptions of material type (test pit and borehole logs) encountered to define subsurface conditions. The Unified Soil Classification System should be used to log samples.

j) Decontamination of sampling equipment in accordance with industry standard practice, cleaning and backfilling and/or sealing excavations.

k) Select samples for analysis and forward samples to a NATA registered analytical laboratory for analysis for parameters specified in the SAQP. Laboratory analysis will be in accordance with those specified in the SAQP. The consultant should allow for the analysis of two samples per testpit/borehole and one sample in groundwater for the contaminants of concern presented in the SAQP.

l) Provide an allowance for the analysis of 10 per cent of the samples for Toxicity Characteristic Leaching Procedure (TCLP) (for preliminary waste classification) or Australian Standard Leaching Procedure (ASLP) testing as appropriate.

Note: Where the proposed use of the site is for stormwater retention, TCLP and ASLP analysis is of particular importance. Although it may be acceptable to leave contaminated fill material in-situ from a human-health perspective, it may not be acceptable to leave the same contaminated fill material in-situ from an environmental perspective due to possible leaching of any contaminants present. In other words, in the event that elevated

concentrations of potential contaminants are identified, in addition to satisfying the appropriate human- health criteria, it must also be demonstrated that the contaminants do not pose an unacceptable risk to the environment – based on the results of TCLP and ASLP analyses.

m) Provide an allowance for the collection of QA/QC samples at the rate of 5 per cent for intralaboratory samples and 5 per cent for interlaboratory samples in accordance with NEPM.

n) Interpret Phase 2 outcomes to provide detailed analysis of the extent and degree of contamination and migration sufficient for developing a Phase 3 Remedial Action Plan (RAP) if required.

Note: Ultimately remedial works will most likely be required in order to suitably address the known contamination. A specific objective of the Phase 2 site investigation will thus be to delineate the extent of contaminated areas for a subsequent Remedial Action Plan (RAP). Additionally, depending on the findings of the Phase 2 investigation, other remedial works may be required.

o) Prepare the Phase 2 ESA report as a stand-alone document. This report should be prepared in accordance with guidelines stated in Contaminated Sites Environment Protection Policy and to a standard suitable for review by a Site Auditor.

Note: a draft copy of the report should be submitted to the auditor for review and, depending on comments, amended accordingly and subsequently issued as a final.

p) Undertake day-to-day fieldwork by suitably experienced environmental scientists, that the work is managed by an experienced and actively involved Project Manager and that the project is directed by an involved Project Director. Additionally, both the project manager and the project director should maintain communications with the Site Auditor and review all documents submitted to the Site Auditor, as appropriate.

q) Provide details of any prospective subcontractors and their experience to the Client and the Auditor for comment and approval.

Note: The prospective environmental consultant should be a member of the Australian Contaminated Land Consultants Association (ACLCA) proficient in: (a) undertaking site investigations in the ACT and (b) the production of the associated reports. The consultant should also be aware that the Phase 2 investigation would be subject to an (ACT) Site Audit, and of any additional (or specific) requirements that this may impose. The primary contractor may be advised and it should then provide details of an alternative sub-consultant, for approval if required.

The Phase 2 ESA investigations are required to be reported to ESDD City Planning and the ACT Environment Protection Authority in accordance with the Contaminated Sites Environmental Protection Policy (2009), National Environment Protection (Assessment of Site Contamination) Measure (1999) and NSW OEH Guidelines for Consultants Reporting on Contaminated Sites (2011).

It is a requirement that in response to this brief, the tenderer will describe the intended contents list for the final Phase 2 ESA Report. In addition to this, the tenderer must provide the minimum and maximum timeframe for implementing Auditor's comments in producing milestone reports.

~~6~~5.2. ~~SCOPE OF SERVICES – SITES A to E~~

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A preliminary (Phase 1) environmental site assessment ~~Phase 1 (Preliminary investigation) study for contamination at the site~~ is to be undertaken of the five sites ~~to identify areas of environmental~~ concern (AEC) possible planning constraints for the use of the land and to scope the requirements for a more detailed Phase 2 and 3 investigation ~~if required~~.

Phase 1 assessment report has to be prepared in accordance with the requirements of the guidelines endorsed by the ACT Environment Protection Authority (EPA) as contained in the *Contaminated Sites Environment Protection Policy (EPP) 2009*.

~~There are a number of significant existing sources of contamination identified in earlier studies as outlined above.~~ The historical land use for much of the area indicates an absence of activities which could result in major contaminated sites in the area.

Preliminary sampling of the soils over the sites and possibly beyond is required to determine the nature of the contamination and to provide a basis for further detailed sampling over the site. A tender proposal should identify any proposed sampling.

The study will provide input for the pending planning and design framework (concept plan) and further planning in the river corridor. ~~to Concept Planning for these suburbs and a broader Environmental Impact Assessment process for development within the Molonglo Valley and assist in the development of an Environmental Management Plan for the area.~~

~~Contamination investigations are required for the proposed Molonglo Valley Stage 3 area and the river corridor prior to any land use changes, detailed planning, engineering design or development.~~ The consultant is required to be familiar with aspects of the completed planning studies ~~concurrent planning and engineering studies, which may impact on the Phase 1 Environmental Site Assessment.~~

ESA Phase 1 – Preliminary Investigation will include but not necessarily be limited to the following:

- Review of existing reports and information including:
  - the EPA Contaminated Land Searches
  - historical aerial photography over 40-50 years,
  - Worksafe ACT records on the site relating to the storage of dangerous goods (if applicable)
  - interviews with people familiar with the site;
- Identification of any past or present potentially contaminating activities;
- Conduct site reconnaissance assess and report on the type and extent of any contamination on the site;
- Gather field data involving limited sampling conducted at target locations observed during the review of existing reports and site walk over ('judgmental' test pit excavation and sampling to meet the requirements of the preliminary contamination assessments);
- Determine the actual or potential migration of contaminants;
- Provide a Preliminary Investigation Report based on future indicative land use over the site (ie recreation or urban);
- Detail a scope of work for further investigation (~~Stage~~Phase 2 ~~Stage~~Phase 3-RAP) and provide indicative budget estimates for ~~Stage~~Phase 2 and ~~Stage~~Phase 3-RAP investigations plus independent auditor costs.

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- Prepare a draft Sampling Analysis and Quality Plan (SAQP) for Phase 2, if required.

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~~4.~~6 Public Consultation

Any stakeholders affected by the proposed activity must be identified and consulted prior to commencement of any on site investigations. The ESDD Project Manager is to be informed on the need to consult with ACT Government agencies and lessees prior to them taking place.

The consultant shall take all reasonable steps to ensure the lessees/land managers of the site are aware of the intended onsite activities, particularly dates and areas of activity. Where practicable, the consultant shall take all reasonable steps to comply with reasonable requests of the lessees/land managers with regard to on-site activity (such as closing gates, minimising disturbance of livestock).

7. Report Requirements

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~~4.3~~7.1 Preliminary Draft Report

Phase 1 Requirements

No preliminary Draft report is required.

Phase 2 Requirements

The Consultant is to prepare and submit a Preliminary Draft Report detailing the results of field and laboratory investigation. The ESDD Project Manager will review the report and provide comments to address in a subsequent revision. The following are the numbers of copies required:

- Three (3) printed copies of the report and plans for ESDD;
- One (1) CD copy of all documentation in PDF format for ESDD.

~~Phase 1 Requirements~~

~~No preliminary Draft report is required.~~

~~4.4~~7.2 Draft Report

Phase 1 Requirements

The Consultant is to prepare and submit a Draft Report comprising a report and plans sufficient to demonstrate the findings. The following are the numbers of copies required:

- Four (4) printed copies of the report and plans;
- One (1) CD copy of all documentation in PDF format for ESDD.

Phase 2 Requirements

The Consultant is to prepare and submit a Draft Report detailing the results of field and laboratory investigation and responding appropriately to comments on the Preliminary Draft Report. The following are the numbers of copies required:

- Three (3) printed copies of the report and plans for ESDD;
- One (1) CD copy of all documentation in PDF format for ESDD;
- One (1) copy in a format as requested by the Auditor.

This report is to be reviewed by the ESDD Project Manager and the appointed site auditor and comments provided for consideration prior to finalising the report.

~~Phase 1 Requirements~~

~~The Consultant is to prepare and submit a Draft Report comprising a report and plans sufficient to demonstrate the findings. The following are the numbers of copies required:~~

- ~~Four (4) printed copies of the report and plans;~~
- ~~One (1) CD copy of all documentation in PDF format for ESDD.~~

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~~4.5~~7.3 **Final Report**

Phase 1 requirements

The ESDD Project Manager will return comment on the draft report, identifying any issues for clarification or review in the report, prior to finalisation.

The following are the numbers of copies required:

- Five (5) printed copies of the report and plans;
- Two (2) electronic copies of all documentation on CD for ESDD including:
  - Reports in PDF format with relevant plans incorporated at A4 size;
  - Plans in PDF format at higher resolution at A1 size;
  - Drawings in DWG/DXF format.

All ESA reports are to be issued in hard and email copy. Both the project manager and the project director should review the reports. A survey plan (produced and signed by a registered surveyor) showing the site, its legal description, and the investigation locations should be included with the Phase 2 site investigation reports. With regard to the investigation locations, these should be recorded in the field with the use of a GPS, and the locations accurately annotated on the survey plan.

Phase 2 requirements

The Consultant is to prepare and submit a Final Report as the final deliverable on the project. The following are the numbers of copies required:

- Five (5) printed copies of the report and plans for ESDD;
- Two (2) electronic copies of all documentation on CD for ESDD including:
  - Reports in PDF format with relevant plans incorporated at A4 size;
  - Plans in PDF format at higher resolution at A1 size;
  - Drawings in DWG/DXF format.
- One (1) copy in a format as requested by the Auditor.

Prior to submission to ESDD, both the project manager and the project director should review the reports for the consultant.

A survey plan (produced and signed by a registered surveyor) showing the site, its legal description, and the investigation locations should be included with the Phase 2 site investigation reports. With regard to the investigation locations, these should be recorded in the field with the use of a GPS, and the locations accurately annotated on the survey plan.

~~Phase 1 requirements~~

~~The ESDD Project Manager will return comment on the draft report, identifying any issues for clarification or review in the report prior to finalisation.~~

~~The following are the numbers of copies required:~~

- ~~Five (5) printed copies of the report and plans;~~
- ~~Two (2) electronic copies of all documentation on CD for ESDD including:~~
  - ~~Reports in PDF format with relevant plans incorporated at A4 size;~~
  - ~~Plans in PDF format at higher resolution at A1 size;~~
  - ~~Drawings in DWG/DXF format.~~

~~All ESA reports are to be issued in hard and email copy. Both the project manager and the project director should review the reports. A survey plan (produced and signed by a registered surveyor) showing the site, its legal description, and the investigation locations should be included with the Phase 2 site investigation reports. With regard to the investigation locations, these should be recorded in the field with the use of a GPS, and the locations accurately annotated on the survey plan.~~

~~5~~8. MEETINGS AND PRESENTATIONS

The consultant should allow for up to five meetings in Canberra with officers of ESDD and the Site Auditor, inclusive of a project inception meeting and a site visit.

As a provisional item, the consultant should allow for a half day workshop involving ACT Government agency representatives to present findings of the site assessment to stakeholders before the reports are finalised. NOTE: This workshop should be priced in the tender response as a provisional item inclusive of travel and disbursements.

The consultant should allow for consultations with ACT Environment Protection Authority, as required.

The project is to be conducted progressively and the consultant project manager is to provide a progress update to the project manager via email on a weekly basis.

There may be a number of studies and investigations in progress concurrently with this project. A high level of cooperation and contact between the project managers must be maintained to achieve a timely and a high quality outcome for the studies. This may include arrangements for a combined workshop and regular progress meetings.

9. PROJECT TIMEFRAMES

The duration of the consultancy will be approximately 6 months from the date of engagement.

As part of the tender submission the Consultant is required to provide a program outlining study methodology, a breakdown of costs and allocation of project fees (including time allocation and hourly rate applicable to each team member for each task) a detailed project timeline indicating milestones and critical dates for discussion with the Project Manager.

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Once finalised any deviation from the prescribed timeframe must be approved by the Project Manager. The draft milestones for reporting and the associated payments schedule against these milestones are outlined below.

Milestone	*Indicative date*	*Payment (% of total fee)*
Inception	1 May 2012	20%
Completion of field work	June 2012	40%
Draft report	July 2012	30%
Final report	September 2012	10%

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10. PROJECT MANAGGEMENT

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The project manager for this consultancy is ~~Mr Tom Percival~~Steven Gianakis, Land ~~Policy~~ Planning Section, Environment and Sustainable Development Directorate, phone (02) 6207 1~~829~~741, email ~~tom.percival@act.gov.au~~steven.gianakis@act.gov.au

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~~6~~11. REFERENCES

The following documents will be made available to the successful consultant:

1. Molonglo Valley, Preliminary Geotechnical and Contamination Constraints Study, Coffey Geosciences, 2005.
2. Gungahlin Drive Extension – Preliminary Assessment of Spoil Construction over sludge ponds at Coppins Crossing, Coffey Geosciences, 2006.
3. Phase 1 Environmental Site Assessment, Molonglo Stage 3, AECOM (for Land Development Agency), June 2012.
4. Phase 1 Environmental Site Assessment, Molonglo Valley Stage 3 ACT, WSP Environmental (for ACT Environment and Sustainable Development Directorate), September 2012.
5. Sampling and Analysis Quality Plan (SAQP) for Phase 2 Environmental Site Assessment, Molonglo Valley Stage 3 ACT, WSP Environmental (for ACT Environment and Sustainable Development Directorate), September 2012 (refer Attachment C).

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If required to provide contextual information, the following documents may also be made available on request:

6. Phase 1 Environmental Site Assessment, Former Weston Creek Sewage Treatment Plant, Adjacent Landfill and night spoil area, Weston District, ACT, Coffey Geosciences, 2006.
7. Final Phase 1 Environmental Site Assessment Report for the precinct of North Weston in Weston Creek, SMEC, 2009.
8. Final Phase 1 Environmental Site Assessment Report for Coombs and Wright, Molonglo, SMEC, 2009.

9. Phase 1 Environmental Site Assessment, Stage 2 Molonglo (West) ACT, AECOM, 2010.

In addition, the consultant should be familiar with, and appropriately consider, the following policies and public documents:

10. ACT Planning Strategy, 2012, ACT Government.
11. National Capital Plan, as amended, National Capital Authority.
12. The Territory Plan, as amended, including the Molonglo and North Weston Structure Plan.
13. Molonglo River Park Concept Plan Report, Hassell for ACT Environment and Sustainable Development Directorate, August 2012
14. Design Standards for Urban Infrastructure, ACT Department of Territory and Municipal Services.
15. Austroads – Guide to Traffic Engineering practice, relevant parts.
16. Contaminated Sites Environmental Protection Policy, Environment Protection and Heritage (Nov 2000).
17. National Environment Protection (Assessment of Site Contamination) Measure 1999; and
18. NSW EPA 1997, Guidelines for Consultants Reporting on Contaminated Sites.

~~7~~12. AUDITOR ADVICE

The Territory has engaged Rebeka Hall (Zoic Environmental) as the accredited site auditor for this project.

The auditor has provided the following initial advice for consideration. This is provided for the information of tenderers to assist in determining the methodology. Any additional advice of the auditor must also be considered during the project.

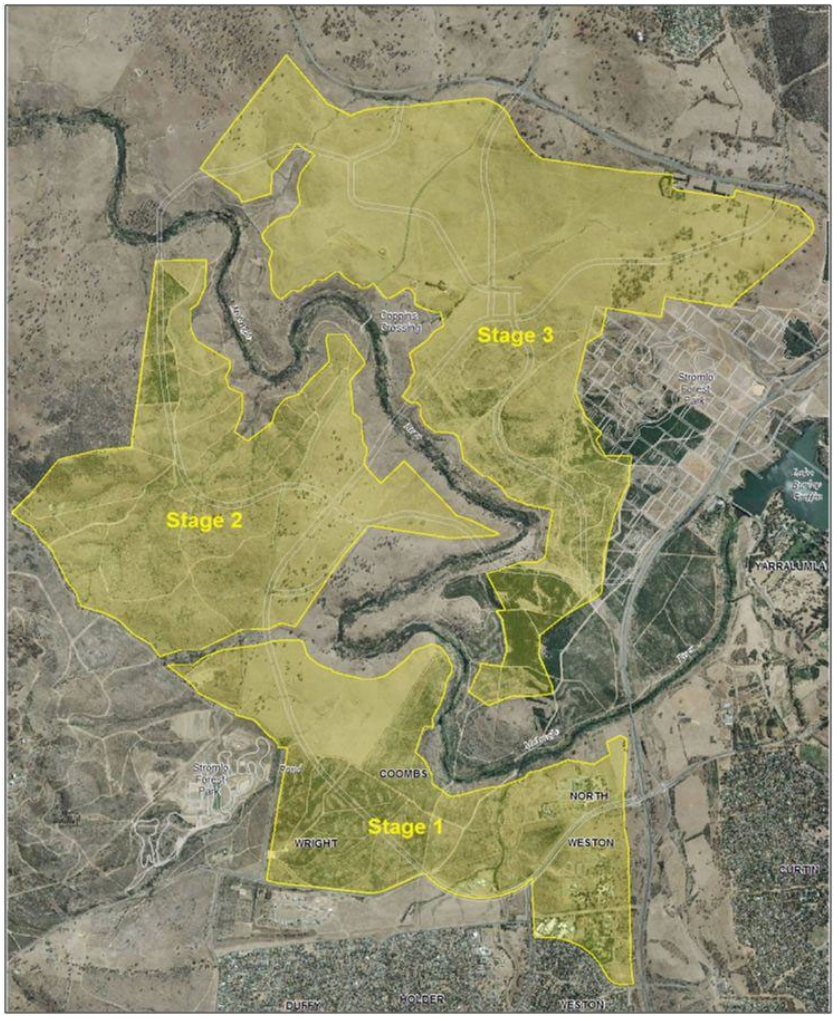
> The key objective of the detailed Phase 2 (ESA) is to determine the nature and extent of any potential contamination that may exist in twenty nine (29) Areas of Environmental Concern (AECs) (as identified by WSP 21012). However, there is the poten ial for other AECs to exist which include a former artillery range, agricultural spraying, multiple animal carcass burial sites, and various stockpiles.
>
> The scope of work for the Phase 2 must be sufficiently robust so that an appropriate Remedial Action Plan (RAP) and/or Environmental Management Plan (EMP) can be prepared to render to site suitable for the proposed use. It is anticipated that following the completion of the Phase 2 ESA estimates of volumes of material requiring remediation/management will be calculated and presented in the report.
>
> In preparing the tender submission, the environmental consultant is to consider the following preliminary Auditor comments following the review of the Draft SAQP (WSP 2012):
>
> - Prior to intrusive works commencing the Assessor needs to ensure that they have considered any Heritage items and/or ecologically sensitivities that may be present in investigation areas;
> - The consultant needs to outline their rationale for the geophysical survey method selected to be used across AECs potentially comprising an artillery range or fallout zones (AECs 20 and 30), as well as AFP training ground (AEC 10) with reported detonation training;

- Sampling densities must be sufficient to delineate the extent of burial grounds and sludge ponds identified;
- It is necessary that all media is sampled including surface waters and groundwater, as appropriate, in target AECs where contaminants may be mobile or transported across the study area or beyond site boundaries;
- An allowance should be made for the analysis of biological contaminants (or indicators) in AECs 10, 12, 32 in various media;
- Consideration for waste classifica ion for materials/spoil requiring removal from the study area, to assist RAP development;
- Review of proposed methodology to ensure compliance with sampling procedures outlined in ACT EPA endorsed guidelines including NEPM (1999) and WA (2009) asbestos assessment guidelines.

>>

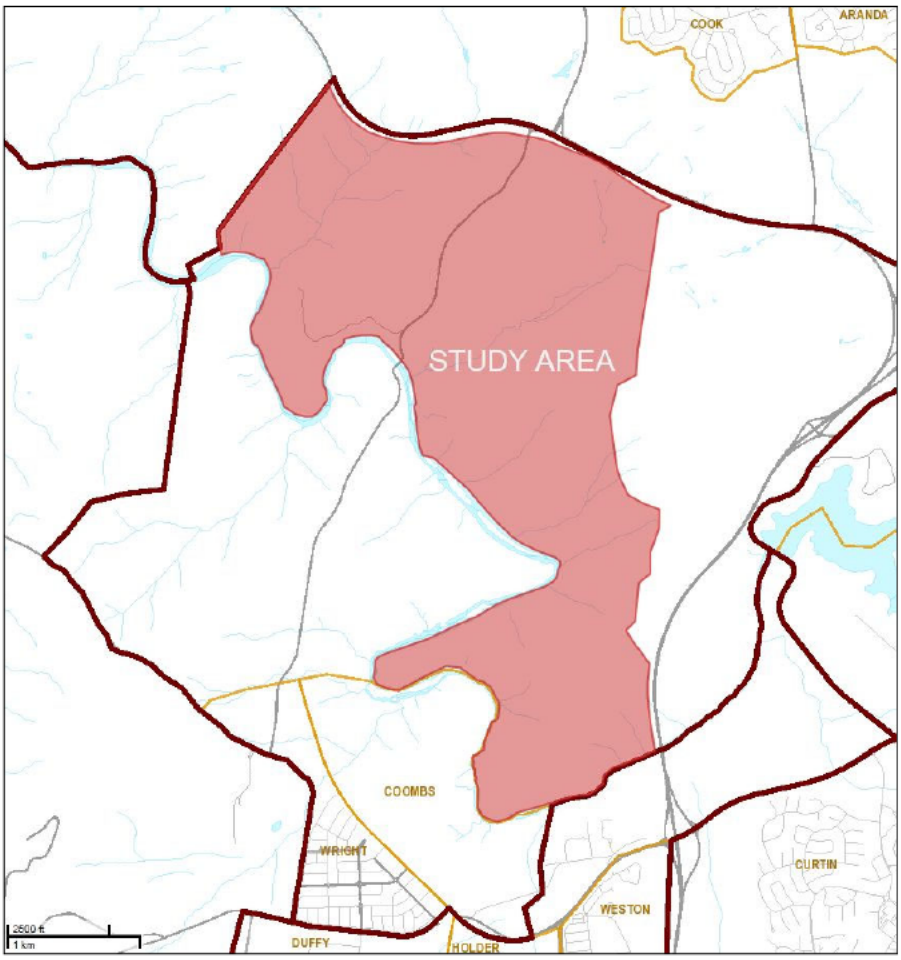
ATTACHMENT 1

Location of Molonglo Valley planning and development stages (approximate)
Based on Territory Plan Map



ATTACHMENT 2

Study Area (approximate)



3 ADDITIONAL AREAS?????
UPDATE MAP

ATTACHMENT 3

Sampling and Analysis Quality Plan (SAQP) for
Phase 2 Environmental Site Assessment, Molonglo Valley Stage 3 ACT,
WSP Environmental (for ACT Environment and Sustainable Development Directorate),
September 2012

From: Santosuosso, Daniel
To: [redacted]
Cc: Mike Ransom; Brian Davis
Subject: RE: Proposed 10% UXO Assessment Boundary
Date: Thursday, 3 October 2013 2:28 03 PM
Attachments: image003.jpg
image005.jpg
image006.jpg
image007.jpg

Thanks [redacted],
This looks great. If you can get a quotation for the 81.1Ha Molonglo Town Centre area to us to review as soon as practical that will be great so that we can gain the necessary approvals during the Majura work.
regards

Daniel Santosuosso Project Manager
Land Development Agency
Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602
Phone: 02 6207 7212 | Fax: 02 62076110 | Web: www.lda.act.gov.au
This message is intended for the recipient's use only. It may contain confidential and legally privileged information. If you receive this document in error, you must not use or disclose it or its contents. If you are not the intended recipient please contact the sender and dispose of the message.

From: [redacted]
Sent: Thursday, 3 October 2013 2:02 PM
To: Santosuosso, Daniel; Richardson, Dave
Cc: Mike Ransom; Brian Davis
Subject: FW: Proposed 10% UXO Assessment Boundary

[redacted] and Daniel,
Attached is a first cast image and mapinfo files for a suggested 10% UXO assessment of the spur line that we named Town Centre North at our meeting the other day. The area is 81.1Ha and is based on 24 July Nearmap imagery. Civil works associated with the main access road may have advanced further north since that image was flown.
The idea here is to use this 10% assessment to first identify and delineate the target areas for subsequent 100% geophysical remediation.
With minor adjustment, the area indicated should adequately cover the possible targets for the 1914 RMC practice shoot. If we find that we are still getting fragmentation, we can continue the area beyond the indicated boundary until fadeout is reached and cover that with a variation.
I have developed this now in order to get the wheels turning on this area concurrently with Majura West. With good management and your assistance, it ought to be possible to swing the Majura West team over onto this job immediately they finish at Majura, thus avoiding another mobilization.

[redacted]
Managing Director Milsearch Pty Ltd
Ph: 61-2-62868299, Fax: 61-2-62868266, Mob: [redacted]
Web: www.milsearch.com.au
Street Address: Unit 4-5, 30 Mawson Place, Mawson, ACT, Australia, 2607
Mailing Address: PO Box 687, Mawson, ACT, 2607
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From: [redacted]
Sent: Thursday, 3 October 2013 1:38 PM
To: [redacted]
Subject: Proposed FVS Boundary
FYA

[redacted]
Principal Operations Manager, Milsearch Pty Ltd
Ph: +61-2-6286 8299, Fax: +61-2-6286 8266, Mob: [redacted]
Web: www.milsearch.com.au
Street Address: Level 1, Unit 5, 30 Mawson Place
Mawson, ACT 2607, Australia
Mailing Address: PO Box 687, Mawson, ACT 2607, Australia
9001_JASANZ
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