

35. A BETTER UNDERSTANDING OF THE WATER RESOURCES IN A 100KM RADIUS OF WILUNA

Please refer to 16. SECURING LAND AND GROUNDWATER, 16.2 Water Supplies, above, where these findings and recommendations have been discussed in some detail.

Key Conclusions

A. Water Resources²⁹

- 1.** The best current estimate of the sustainable, annual average yield of the groundwater resources below the Wiluna Desert Gold Farm and Emu Farm is as calculated in 1972 by the WA Geological Survey Office.
- 2.** Based on limited datasets collected during 2009, the current water table and salinity levels of the groundwater below the farms is similar to those observed over the 1960's prior to extraction for irrigation. This means that the water extracted from the borefield has been replaced by recharge following major rainfall periods and extraction down gradient for the Wiluna town water supply and Wiluna Mine is not at this time, impacting on the water levels or volumes in storage below the Farms. The current extraction for use on the Monty Alison farm is negligible.
- 3.** Additional groundwater resources may be available east and west of the two farms. The previous interpretation of saline water to the east is based on very limited data. Additional groundwater investigations including exploratory drilling would be

²⁹ Preliminary hydro-geological and soils assessment from surveys conducted in September 2009 available from CAHL archives

required to assess the groundwater resources potentially available outside the farm boundaries.

4. Additional groundwater investigations are desirable across the property in locations not previously explored for groundwater.
5. Additional groundwater resources are likely to be available if the resource is managed on a variable extraction basis with greater extraction over years following major recharge periods and reduced extraction over drought years i.e. managing the resource similarly to managing town water supply dams.
6. The existing production & monitoring bores are beyond their working life and need to be replaced. The production bores should be constructed as high standard irrigation bores. Similarly more attention is required to the design and construction of monitoring bores.

B. Soils

1. A limited basic soil sampling survey undertaken during 2010 indicated that the soils are generally acid red soils.
2. There is some evidence that the soils have been affected over localised areas from flood irrigation. There may also be impacts from use of pesticides and other chemicals but until a structured soil survey and testing is undertaken any significant impacts if present and what rehabilitation measures are required if necessary at what cost is not able to be identified.
3. A soil survey can assist in determining the most suitable areas for horticulture, pasture cropping, orchards, sandalwood and tree farms (including areas for biofuel crops).

Key Recommendations:

1. An entity with legal ownership or access to the land needs to be established to enable a water allocation and other statutory approvals to be sought. See recommendations 12 and 13.
2. Funds need to be sought to enable a land and water consultant to be engaged to:
 - a. Prepare applications seeking a water allocation. See recommendation 2.
 - b. Seek direction on the assessments and field investigations to support water allocation options. See recommendations 3 and 4.
 - c. To work with the agricultural and agro forestry consultant to determine a ramp up monthly and seasonal irrigation water demand. See recommendations 3 and 4.
 - d. To provide the developers of the farms with a costed scope of works cover the land and water assessments including exploratory drilling, pump testing, geophysical surveys, down hole camera, water quality testing (standard cations and anions, heavy metal, pesticides and other pollutants), water level monitoring, soils surveys (shallow auger and interpretation of airborne radio-metrics, production bores, monitoring bores, power supplies to the bores, telemetry and other control systems for the bores, water mains,

water storages, development of operational plan including monitoring plans and regulatory compliance. For production bores, monitoring bores. The options should be set out in plain English with an explanation / justification of the costs, timetables and risk management. See Recommendation 22 and Attachment 6, Consultants ToR for Comprehensive Business Plan

3. There is a backlog in processing water applications resulting in project delays of many months. The establishment of a corporate entity or legal association with ownership or licence (or preliminary consent) from the government to use the land is necessary as a key issue. See Recommendations 12 and 13.

Discussion: Activities and findings

A review of the groundwater assessments undertaken following the 1960 & 70's³⁰ drilling and pump testing programs has been undertaken. It is concluded that these pre farming development assessments were sound but that additional sustainable groundwater resources may be available within and outside the defined farming area boundaries.

A reconnaissance survey of the land and water resources of Desert Gold and Duuwa-wati was undertaken September 2009. The data collected in the field has been consolidated with Department of Water records on water bores drilled in the area and information extracted from 1960 & 1970 reports on groundwater investigations undertaken by the Geological Survey Office and an agribusiness developer Mr J Parr.

Most of the production, monitoring and investigation bores drilled during the 1960s & 70's were located but we were unable to obtain current standing water levels and water quality samples except from a few bores as most of the monitoring bores had fallen in and the production bores were blocked. The few new datasets indicate that the standing water levels and salinity of the groundwater is similar to that when originally drilled i.e. they reflect to natural values prior to extraction and also indicate that extraction for mining and town water supplies down gradient are not impacting on these groundwater resources at this time.

There is the potential to obtain a larger sustainable resource by varying the annual extraction to match recharge phases but this would entail using less irrigation water over drought years and more following recharge after major rainfall recharge phases. This approach is similar to management of large irrigation and town water supply dams. Groundwater modelling would

³⁰ The best current estimate of the recharge, groundwater through flow and groundwater in storage below the Desert Gold block are those estimated by Chapman, T, *Hydrology survey at Lorna Glen and Wiluna WA*, CSIRO Land Research and Regional Survey Technical Paper No 18, following the groundwater investigations undertaken during the 1960's & 70's.

need to be carried out to develop a groundwater management program and to identify extraction volumes from the borefields, which do not adversely impact on down gradient users. There is potentially additional sustainable farm and off farm groundwater resources to that identified in the old assessment reports, which could be used for irrigation of various permanent and short-term crops. Additional groundwater investigations involving drilling and pump testing would be required to assess the potential yield and water quality of these resources.

It is unfortunate that we have not been able to locate any records on the effect of extraction when the two farms were in operation. The actual sustainability of the groundwater resources and other management issues such as controlling movement of saline water into the borefield drawdown cone can only be determined by assessing the actual effects of extraction on the water table, monitoring recharge and natural discharge and monitoring natural and induced changes in water quality groundwater. This means that like the original assessments of sustainability of these groundwater resources a conservative approach is required in the first instance, which can be modified following substantial extraction of groundwater from the system over a period of years and carefully recording extraction and monitoring:

- Rainfall over the groundwater/surface water catchments,
- Water levels in monitoring and production bores
- Chemical water quality changes and
- Bacterial quality (domestic water supplies).

All the existing production and monitoring bores are no longer functional or are at the end of their useful life and require rehabilitation or replacement. There are several future borefield development options. These include:

1 On farm (i.e. within the current boundaries of the Desert Gold and Duuwa-wati)

A. Replacing the existing production & monitoring bores. This would be the cheapest option but would not provide any additional information on the sustainability of the resource, maximising utilisation of the resource, allow spreading out the location of production bores to minimise development of borefield drawdown cone over drought periods or provision of flexibility in managing saline water intrusion. The existing production bore sites are not distributed over all the proposed family farms.

B. Rehabilitating and replacing the existing production & monitoring bores. In addition to the costs included in A, above this would involve pulling the pumping equipment out of all the existing production bores, down hole camera survey, cleaning out existing bores with a small drilling rig and field survey of bore standing water levels, and a water sampling program. There is anecdotal information that groundwater in at least one production bore (the bore which provided the domestic water supply) was polluted by chemicals.

Presumably this was pesticides and or fertilisers stored in the adjacent central facilities. It is possible that other aquifers have been polluted by pesticides, fertilisers, and other chemicals or from rubbish dumps. In addition to standard chemical and heavy metal water sampling and analysis additional sampling and water analysis for pesticides and other possible pollutants is necessary for water samples from selected bores.

This program would be more expensive than just replacing the existing production and monitoring bores but would provide useful additional information in developing a water supply management plan and justifying the volume of water being sought for irrigation from the regulators. The additional water-sampling program is needed to identify domestic water supply management issues and the source of groundwater for domestic use.

- C. Drilling investigation bores, new production & monitoring bores** (some of the existing bores may be reconstructed as monitoring bores).

The production bores should be constructed in locations on the basis of maximising sustainability, spreading the borefield(s) to minimise drawdown, sourcing the best quality water, reducing the risk of saline groundwater intrusion, provision of water to each farm, minimising capital and operating costs.

They should be designed and constructed to ensure long life, facilitate monitoring water levels and water quality fluctuations and properly sealed to avoid pollution of the aquifer.

They should be designed to suit the most efficient installation of pumping equipment. Similarly the monitoring bores should be designed and constructed for their purpose, longevity and importantly, sited to obtain the information required for managing extraction and future recalculation of the sustainability of the groundwater resources.

Additional investigation bores are required in areas where there has not been any previous drilling.

2 Off farm (east and west of Desert Gold).

- A.** Drilling limited number of investigation bores, then new production & monitoring bores west of Desert Gold
- B.** Drilling limited number investigation bores, then new production & monitoring bores east of Desert Gold
- C.** Comprehensive groundwater investigation of both areas followed by construction of production and monitoring bores after in principle water allocation.

Borefield management and monitoring plans will need to be prepared and implemented. Periodic assessment of the data by specialist consultants will be required to meet both regulatory requirements and farm management needs.

Soil survey

During the September 2009 reconnaissance survey surface soil grab samples were taken to provide an indication of the soil type, its salinity, acidity/ alkalinity and possible impacts from

previous flood irrigation. Unfortunately the results of the previous soil surveys carried out in the 1960's and later have not been located. The grab samples show that the soils are acid, that there is significant variability across the farms and that use of flood irrigation of alkaline groundwater from the production bores has had some noticeable impact on the soils characteristics over the areas irrigated. There is anecdotal information that indicates that the high acidity resulted in the death of a few citrus trees from time to time though these deaths may be caused by other factors.

A more sophisticated, standard soil survey needs to be undertaken across the whole of the two farms to map the soil types, salinity, acidity / alkalinity with greater detail in the proposed intensive horticulture development areas and previously flood irrigated areas. These surveys will guide the location of proposed horticulture/orchard / cropping/ agro forestry and service areas.

36. NOTES

1. The Farmer family is proposing 2 separate family enterprises by Mr. Ken Farmer and Mr. Darren Farmer
2. As recommended in *ACIL Tasman, Jan 2007, New Desert Gold: A hub for economic development in Shire of Wiluna*
3. See attachment 4
4. \$7,354,000 is for WDC only – not the family farms
5. (Source : www.wiluna.gov.au).
6. (Source : www.wiluna.gov.au).
7. (Source : www.wiluna.gov.au).
8. (Source : www.wiluna.gov.au).
9. (Source: *Wiluna Shire Council Strategic Plan, 2009 – 2014*)
10. (Source: *Wiluna Shire Council Strategic Plan, 2009 – 2014*)
11. (Source: *Wiluna Regional Partnership Agreement – Review of Status as at 30 October 2009 and Outline of Project Plan 2009-2010*)
12. Source: *ACIL Tasman, Jan 2007, New Desert Gold: A hub for economic development in Shire of Wiluna*
13. WDPAC had negotiated lease in early 90's on the strength of fixing all infrastructure problems, re-plant and generally return it to a successful operation (Pers. Comm. Steve Burgess – Mgr State lands, Midwest)
14. After 5 years of letters explaining that WDPAC were not delivering with no response until WDPAC were served with notice of forfeiture of the lease at which point WDPAC responded with, we will satisfy the terms of the lease. In good faith WA government deferred the forfeiture for another 2 years. Still no action so lease was revoked in June 2009 (Pers. Comm. Steve Burgess – Mgr. State lands, Midwest)
15. Pers. Comm. Monty Alison 9 September 2009
16. Pers. Comm. Steve Burgess – Mgr State lands, Midwest
17. Bilateral Agreement on Indigenous Affairs 2006-2010 between the Commonwealth of Australia and The State of Western Australia
18. Source: *Burgess, Steve [Steve.Burgess@lands.rdl.wa.gov.au], Thu 10/12/2009 12:01 PM*
19. Source: Page 32, 12.2 ACIL Tasman report, "New Desert Gold": A hub for economic development in Shire of Wiluna
20. See page 22. Mr. Burgess explained the history of tenure of Lot 17, 12. BACKGROUND INFORMATION ON LOT 17 AND THE EMU FARM (LOTS 134/135)
21. Source: Alan Diver, Australian Produce Brokers, Canningvale Markets, Canningvale, WA (0402 521 053), 30 years experience marketing fruit and vegetables in Perth
22. Source: Page 58, Appendix A, East Wiluna Aquifer 'Safe Yield' requirements, Record No 1971/16 by CC Sanders ACIL Tasman report, "New Desert Gold": A hub for economic development in Shire of Wiluna
23. Bilateral Agreement on Indigenous Affairs 2006-2010 between the Commonwealth of Australia and The State of Western Australia
24. Source: Page 56, 22. Risk Management, ACIL Tasman report, "New Desert Gold": A hub for economic development in Shire of Wiluna
25. Source: Page 56, 22. Risk Management, ACIL Tasman report, "New Desert Gold": A hub for economic development in Shire of Wiluna
26. Cape York Indigenous Employment Strategy, November 2005
27. ACIL Tasman report January 2007, "New Desert Gold" A hub for economic development in Shire of Wiluna
28. The Centrefarm 5-Step training program, based on experience and information from the Anmatjere region of Central Australia has many similarities to the Wiluna region.
29. Preliminary hydro-geological and soils assessment from surveys conducted in September 2009 available from CAHL archives
30. The best current estimate of the recharge, groundwater through flow and groundwater in storage below the Desert Gold block are those estimated by Chapman, T, *Hydrology survey at Lorna Glen and Wiluna WA*, CSIRO Land Research and Regional Survey Technical Paper No 18, following the groundwater investigations undertaken during the 1960's & 70's.

Attachment 1,

Terms of Reference from DEEWR / CENTREFARM contract

Services

5. Indigenous Economic Development Services

5.1 The provider will undertake an umbrella scoping study, including consultations with stakeholders, to develop and operate areas within (Wiluna Lot 17 – about 10 km East of Wiluna) for a range of horticultural crops;

5.2 The provider will conduct and provide assessment of indigenous family group capacity study.

6. Business Development and Support Services

6.1 The provider will complete 4 desktop feasibility studies for 4 local Aboriginal family groups to develop and manage land for horticultural crops.

9. Reporting of Services

9.1 The provider must provide completed reports and forms to DEEWR as and when specified in any Guidelines issued by DEEWR from time to time, as well as the following completed Reports and forms to DEEWR in hard copy format:

(a) An umbrella scoping study containing an overarching appraisal of the project and to include consultations with relevant government agencies, commercial legal practitioners, WA Land Rights legal practitioners, anthropologists, agronomists for relevant main-stream horticultural pursuits and viability, bush tucker experts for both growing crops, viability and understanding the cultural aspects, mining industry representatives to understand the needs and wishes, bio-sequestration experts and local logistical experts. This scoping study will provide Terms of reference for a business plan;

(b) A local indigenous family groups capacity study and to include consultations on current family situations, an assessment of work experience, skills audits, ages, genders and health within the family groups, family enthusiasm for the project(s), traditional links to country, and an overall assessment of familial commitment to the project;

(c) A desktop feasibility study for each of the 4 local indigenous family groups, and to include a review of resources, recommendations for sustainable horticultural enterprises and best options to develop and manage land for horticultural crops.

11. Key Performance Indicators

(a) KPI1 – Number of Indigenous economic development services conducted
Benchmark = 2 (being scoping and capacity studies)

(b) KPI2 – Number of business development and support services conducted
Benchmark = 4 desktop feasibility studies

(c) KPI3 – Contract manager rating of quality of Indigenous economic development services

Benchmark: Rating of 5 on a scale of 0-5, where 5 = strongly agree with contract compliance and service delivery specifications of the contract and 0 = strongly disagree

(d) KPI4 – Contract manager rating of the completion of the business development and support services

Benchmark: Rating of 5 on a scale of 0-5, where 5 = strongly agree with contract compliance and service delivery specifications of the contract and 0 = strongly disagree

Attachment 2, Land tenure, 120Km radius of Wiluna

Wiluna is predominantly surrounded by land designated as pastoral lease; this report classifies these pastoral leases as follows:

- Pastoral lease. See Map 1, below: numbers 2, 3, 4, 5, 6, 8, 10 and 14. Total 8
Where predominant activity is pastoralism
- Pastoral lease (mining company)
Where predominant activity is or intended to be mining – some pastoralism occurs. See Map 1, below: numbers 1, 7, 9, 11, 12, and 13. Total 6
- Crown Land stock routes and water supply and stock camping. See Map 1, below: numbers 15, 16 and 17. Total 3
- Wiluna Shire common area. See Map 1, below: number 18
- Reserve Crown Land. Including Wanjarri Nature Reserve. See Map 2, below: numbers 19, 20
- Unallocated Crown land. See Map 1, below: number 21

This scoping study has identified potential development on lands within the pastoral lease boundaries shown in Map 1 below, as STAGE 2 of the Wiluna Horticultural Industry Development Project. Stage 2 is the full commercial development of the industry.

The mining industry has major requirement of ground water for potable water supplies and mine processing. It would be preferable, where possible if the water allocated to mine processing was poor quality ground water and unsuitable for human consumption and agricultural use.

The West Australian government advocates the use of water to *“support high-value use by industry and agriculture”*³¹.

Critical to development of Stage 2 will be access to land and good to fair quality ground water for developing a sustainable horticultural and agro-forestry industry in this region. It is well understood that there are significant volumes of good to fair quality ground water in storage within the extensive network of paleo-channels across the region. High yielding aquifers suitable

³¹ Source: MWH, *Building a better world. Pre-feasibility study, Pilbara Integrated Water Supply, May 2009*

for horticultural development occur within limestone solution cavities within the fore-mentioned paleo-channels.

This scoping study recommends that 3 to 4 horticultural development areas be established in the region, where sustainable ground water is available.

Securing land

Land: Arrangements required for development of horticulture of agro-forestry will vary within the region according to existing land tenure, agreements with owners and in conformance with regulatory approvals and directions.

Recent correspondence from Steve Burgess, Manager, State Lands – Midwest

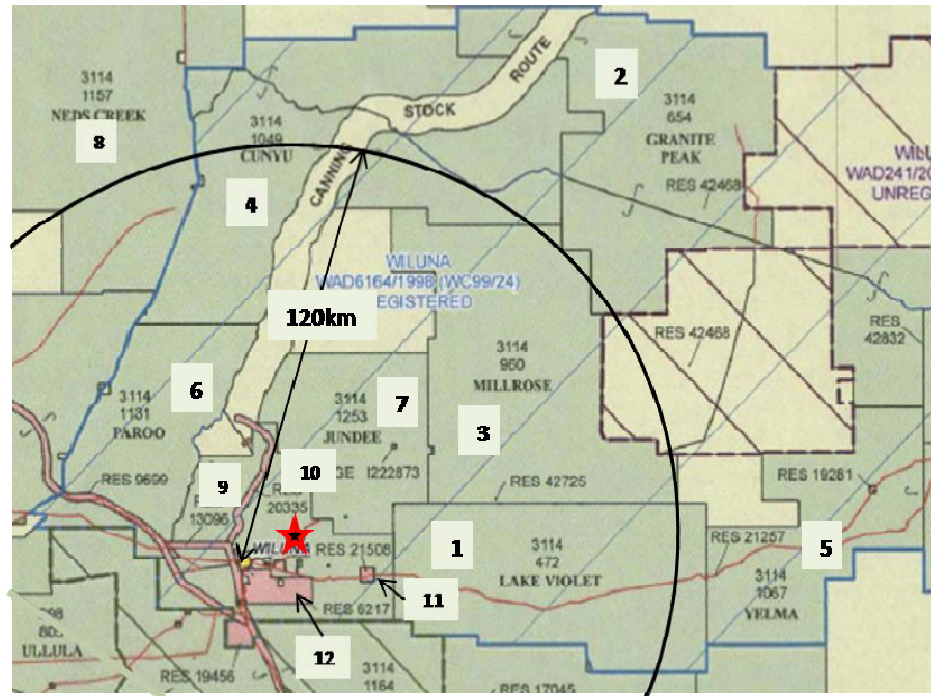
“The current Land Administration Act 1997 does allow for the excision of Land from pastoral leases for separate land tenure. It is therefore possible for a pastoralist to instigate such action at present. However, such tenure would be subject to a number of approvals and legislative procedures being completed, including clearances under the Mining Act, future act provisions of the Federal Native Title Act, planning approvals under the State Planning Act and clearing/environmental approvals under the Environmental Protection Act. There is also the requirement to satisfy the Government’s public competition policy where the proponent is not the pastoral lessee.

While I have no objection in principles to the Stage 2 proposals you advised of at our meeting, provision of land for those proposals would currently be subject to the above constraints³².

The impact on the environment will be critical to accessing land and ground water. Clearance and approvals will be required from the Environmental Protection Authority. Other WA Legislative Acts may also be applicable including, *Soil and land Conservation Act, 1945, Soil and Land Conservation Regulations, 1992, Wildlife Conservation Act, 1950, Aboriginal Heritage Act, 1972, Agricultural and Related Resources Act, 1976, Bushfires Act, 1954, Land Administration Act, 1997* and compliance with the Commonwealth’s *Environmental Protection and Bio-diversity Conservation Act, 1999* and *Native Title Act, 1993*

³² Source: Burgess, Steve [Steve.Burgess@lands.rdl.wa.gov.au], Thu 10/12/2009 12:01 PM

Map1, showing tenure type 120Km radius of Wiluna



★ = Lot 17

— = Native Title Claim area

Tenure type: Pastoral lease

1. Lake Violet Pastoral lease owned by Newmont Yandal Operations P/L - Miner
2. Granite Peak Pastoral lease owned by J.P. Quadrio – Pastoralist
3. Millrose Pastoral lease owned by R. P. Ward – Pastoralist
4. Cunyu Pastoral lease owned by K. A. Shaw & D. M. Martin – Pastoralist
5. Yelma Pastoral lease owned by Wiluna Stations Pty Ltd – Pastoralist
6. Paroo Pastoral lease owned by J. P & T. J. Ford – Pastoralist
7. Jundee Pastoral lease owned by Normandy Yandal Operations Ltd – Miner
8. Ned's Creek Pastoral lease owned by Hall family - Pastoralist

Tenure type: Crown reserve

9. Stock route addition to Peakhill Leonora owned by Crown
10. Stock route owned by Crown
11. Water supply and stock camping owned by Crown
12. Common area owned by Wiluna Shire

Attachment 3,
Wiluna Soil Sample Textures, January 2010

Texture determination methodology

Numerous soil samples were taken from selected sites in the proposed Wiluna horticultural farm area in the central region of Western Australia. Specific sample sites were not geographically located but site descriptions were noted based on knowledge of the survey area.

At this stage of the survey, a brief soil description was conducted in accordance with guidelines outlined in "Australian Soil and Land Survey" Field Book, Second Edition, R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker and M.S. Hopkins, 1990.

The bagged soil samples were sieved to a -2.0mm fraction, which was then worked, by hand and with the addition of some water, to form a malleable bolus from which a textural determination could be made.

Soil samples were taken from the top few centimetres of the soil profile from one survey area and the sample numbers and descriptions are presented in Table 1.

In another survey area a pit was excavated to 2.0 meters and composite samples taken from two intervals as outlined in Table 2.

Table 1. Surface Soil Sample Description.

Sample No.	Site Sample Description	Soil Texture Description
1		Sandy Loam (SL). Coherent but sand to touch. Medium size sand grains. 10% - 20% clay. Minor blocky appearance prior to sieving suggests minor chemical alteration of soil.
2		Clay Sand (CS). Slightly coherent. Medium size sand grains. 5%-10% clay. Slightly sticky.
3	Citrus further west	Clayey Sand (CS). Slightly coherent. Medium size sand grains. 5%-10% clay. Slightly sticky.
4	Citrus near house	Loamy Sand (LS). Slightly coherent. Medium size sand grains. 2%-5% clay.
5	Annuals	Sand (S). Nil to very slight coherence.
6	Citrus from flood irrigated path.	Sandy Loam (SL). Coherent but sand to touch. Fine to medium sand grains. 10% - 20% clay. Initial blocky appearance prior to sieving

		suggests slight chemical alteration in soil.
7	Citrus flood path. Some organic matter from drift.	Loamy Sand (LS). Sand grains of medium size to occ. Coarse grains (1-2mm). <0.5% clay. A blocky fragment before sieving suggests a slight alteration in soil chemical structure.
8	Undisturbed soil in farm area.	Loamy Sand (LS). Slight coherence. Medium size sand grains. About 5% clay.
Kyanga.	East. 100m from eastern fence.	Sandy Clay loam (SCL). Strong coherence. Fine grained. Sandy to touch. 20% - 30% clay.
Kyanga.	200m from eastern fence.	Sandy Loam (SL). Coherent but sandy to touch. Fine to med sand grains. 10% - 20% clay. Blocky fragments prior to sieving suggest slight chemical alteration.

Table 2. Soil Sample Descriptions From Pit.

Sample No.	Site Sample Description	Soil Description
1	0 – 1.0m	Sandy Loam (SL). Coherent but sandy to touch. Med size sand grains. 10% - 20% clay. Blocky fragments prior to sieving suggest slight chemical alteration.
2	1.0m – 2.0m	Clayey sand (CS). Slight coherence. Slight coherence. 5% - 10% clay. Mild clay staining. Medium size sand grains.

Selected site photos of soil survey sites were taken to represent the regional environment and are presented in the following photos.



Photo 1. Johnny Kyanga's block

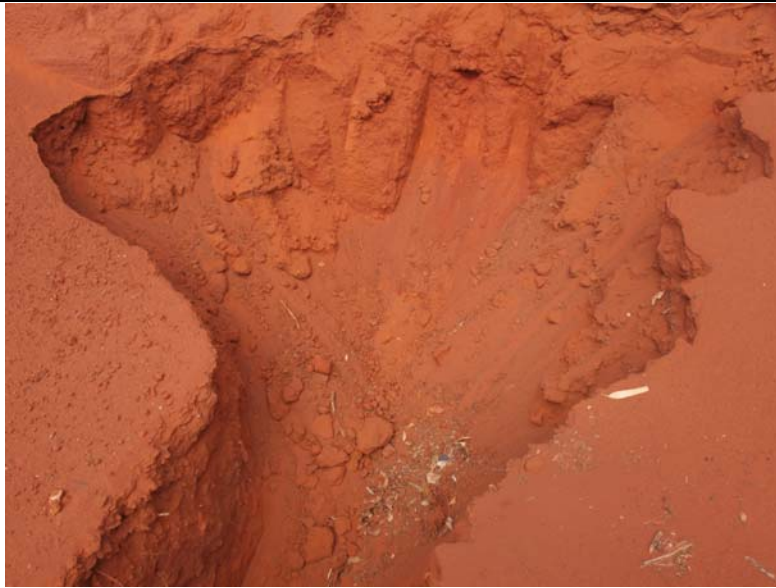


Photo 2. 2.0m Pit on Monty's block.



Photo3. Taking soil samples on Monty's patch

Attachment 4,
WDC scoping budget
Attached as separate document in digital version of this document