Fortescue
The New Force in Iron Ore

SOLOMON PROJECT
RESPONSE TO PUBLIC SUBMISSIONS
EPA ASSESSMENT NO. 1841

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1. INTRODUCTION

Fortescue Metals Group Limited (Fortescue) proposes to develop new mines within the Solomon Project, greenfield sites approximately 60 kilometres (km) north of Tom Price. The Solomon Project involves the development of a new mining province in addition to the Chichester mines already operated by Fortescue at Cloudbreak and Christmas Creek. The deposits will produce a combined total of up to 80 million tonnes (Mt) of iron ore per annum. In accordance with the *Environmental Protection Act 1986 (WA),* a Public Environmental Review (PER) has been prepared which describes the Project and its likely effects on the environment. The PER was available for public review for a period of six weeks between 10 November 2010 and 22 December 2010 (EPA Assessment No. 1841). This report presents Fortescue's response to the public submissions received and requests for additional information by the EPA.

2. PUBLIC SUBMISSIONS

A total of eight public submissions were received from the Office of EPA on the 24 December 2010 in response to the Solomon Project PER. From these submissions, 87 individual comments and/or recommendations were identified and collated in Section 3.

On February 14 2011, the Office of the EPA requested additional information following review of the responses to submission provided on January 11 and further to the EPA Solomon site visit on February 10 2011. The requested additional information and Fortescues responses are provided in Section 3.9 of this response to submissions report.

3. RESPONSE TO SUBMISSIONS

3.1 DEPARTMENT OF ENVIRONMENT AND CONSERVATION – LICENCING (PART V)

- ***Ref 1: Dewatering Discharge***

  DEC IR requests the following additional information be provided by the proponent:

  1) Groundwater and surface water modelling has not been included in the PER and should be provided to adequately assess the impact of dewatering activities. This will be required by Part V licence monitoring and reporting conditions.

  2) The proponent has committed to long term modelling and monitoring of surface and groundwater; however, information is needed on the monitoring of potential impacts and how these will be monitored/managed.

  3) There is the potential for groundwater quality to deteriorate at the Solomon project over time. Fortescue will need to provide details of proposed contingency plans if water cannot be reused onsite and requires alternate disposal. Contingency plans for reinjection have not been provided and should be produced in preparation of the event that reinjection programs are not successful.

  4) The actual proposed borefield location for reinjection should be made available.

  Fortescue Response:

  1) More detailed groundwater and surface water modelling was undertaken following release of the PER. Fortescue will provide this information as supporting documentation for Works Approval and Licence applications as identified through the DEC scoping process.

  2) Fortescue is committed to the development of a surface water and groundwater monitoring program that will include the monitoring for potential impacts as a result of changes to surface water and groundwater as a result of the project. The monitoring program will be developed for the mine and submitted to the relevant regulatory authorities for approval.

  3) Contingency plans related to groundwater management and reinjection will be developed and integrated into a groundwater management plan prior to commissioning of water management infrastructure. It is considered that there is no potential for a significant deterioration in water quality at the

Solomon Project to the point where the water cannot be used in onsite processes.

4) The proposed reinjection borefield will be located in the Kangeenarina Valley between The Castle camp and the main Solomon CID channel. Fortescue will provide location of reinjection borefield with DoW and DEC licence applications.

- ***Ref 2: Stormwater/Flood management***

  The proponent will need to show that the positioning of site infrastructure can be managed so that any water draining from the area is contained and treated to remove sediment and contamination prior to entering the environment. The proponent will also need to ensure that there will be no impact offsite from activities which are occurring onsite.

  Fortescue Response:

  Fortescue will ensure that infrastructure including Ore Processing Facilities, that are managed under EP Act Part V licences, are sited and managed so as to ensure no significant impacts to the downstream environment, including the use of sediment traps, sediment basins or similar.

- ***Ref 3: Air Emissions***

  An option analysis should be provided detailing each alternative power supply option, any associated environmental impacts and management measures to address these.

  Fortescue Response:

  Fortescue is continuing to investigate appropriate, viable energy generation sources for the project, including gas, geothermal and solar. Details of the analysis of these options will be provided to the relevant regulatory authorities as part of the approval applications for the power supply.

3.2 DEPARTMENT OF WATER

- ***Ref 4: Hydrogeological interaction with Weelumurra Creek***

  Fortescue has identified that an impermeable barrier is needed to minimise the interaction between Weelumurra Creek system and the Queens CID during mining, however no geotechnical trials have been conducted to date. The effectiveness of this barrier is imperative to protect the environmental values of Weelumurra Creek, and should be subject to detailed assessment. Post closure management of the barrier will also be required as it will need to be maintained until the system

reaches equilibrium to prevent drainage away from the Weelumurra Creek after mining ceases.

Fortescue Response:

On the basis of initial review work already undertaken, it is considered that the ground conditions are suitable to the installation of grout barrier to restrict groundwater flow in the CID. Fortescue has initiated a prefeasibility study to determine the most effective method for lowering aquifer permeability in the Queens CID upstream of the junction with Weelumurra Creek. The objectives of the study are to review available geotechnical, geological and hydrogeological information to assess the following:

- What types of barrier may be feasible (full grout cut-off wall or injected grout barrier or other);
- Types of grout that are compatible with the CID material (both for during mining and post mining rehabilitation);
- Approximate order of cost and timeframe for constructing a barrier; and
- Scope for trial application.

The grouting option is currently in a conceptual phase and it is proposed that detailed geotechnical and hydrogeological site investigations and testing will be undertaken to confirm the most effective method. It is proposed that personnel from the DMP and DoW be involved in a technical review group to provide stakeholder information.

- ***Ref 5: Drawdown in the Kings and Queens CID Aquifer***

  The DOW would expect a more relevant model to be produced once mine planning is completed, and a revised model and descriptive report included in the submission for a 5C abstraction license. The peer review also identifies that further work is needed to refine the model.

  Fortescue Response:

  A detailed revised hydrological model will be prepared to support a 5c abstraction licence application once mine planning has been completed.

- ***Ref 6: Groundwater Dependant Ecosystems, pools on semi-permanent drainage systems***

  A full understanding of the two significant pools' hydrology and environmental function can only be gained after careful monitoring followed by significant rainfall. The DOW believes that additional work is needed to investigate and acquire an understanding of pool hydrology after a wet season.

Fortescue Response:

The water level monitoring records for the Kangeenarina and Zalamea Pools provides evidence that the open water bodies are not a permanent feature of these drainage lines. Water levels in the pool gradually declined throughout 2010 to a point where they had completely dried out by December. It is acknowledged that monitoring data collected during a "normal" wet season would provide useful additional information.

However, it is considered that maintenance of the water flows to the areas in which the pools can develop is readily achievable by reinjecting water into the alluvial material up gradient of the pool locations. Fortescue will conduct further hydrogeological investigations to determine the optimal location for injection to minimise recirculation to active mine pits and efficiently maintain the downstream water flow within observed levels. Input from the Department of Environment and Conservation's Licensing Branch will be sought on the objectives and coverage of proposed works to ensure appropriate information is gathered to support a Part V licence application.

- ***Ref 7: Groundwater Dependant Ecosystems, groundwater dependant vegetation***

  Additional detail is required to support the approach of managing impacts on phreatophytic vegetation through supplementation. There are two potential methods of delivery discussed, however these are unclear and do not include details on timing, methodology, monitoring or trigger levels. The conceptualisation of the hydrological regime supporting phreatophytic vegetation needs to be supported with sufficient data. In order to assess ecosystem sensitivity to alter water availability, Fortescue need to demonstrate how phreatophytic vegetation is being sustained in the absence of groundwater feed. DOW suggests Fortescue undertake to characterize the hydrologic regime of the three pools systems prior to the commencement of dewatering. Fortescue should also include a map of depth to groundwater across the King Valley CID. Fortescue should include a clear commitment to develop an adequate monitoring program incorporating the above information.

  Fortescue Response:

  A depth to groundwater map for the Solomon Project mine area is provided in the attached (Figure 1). Sufficient information, via detailed vegetation mapping, has been provided for the groundwater dependent ecosystems within the project area to determine impacts. There is no requirement to demonstrate how phreatophytic vegetation is being sustained in the absence of groundwater feed as groundwater feed supporting phreatophytic vegetation

will be maintained throughout the life of mine and post-closure. Fortescue is committed to the development of an adequate monitoring program. This will be developed for the mine operating strategy and submitted to the Dow and DEC for approval.

- ***Ref 8: Groundwater Dependant Ecosystems, Stygofauna***

  Studies conducted identified a high species richness at the Kings mining area. Dewatering and subsequent mining of the CID aquifer will destroy the stygofauna habitat and any communities present. From a habitat protection perspective the DOW can confirm that the entire King and Queens CID is predicted to be dewatered within approximately 8 years.

  Fortescue Response:

  The results of a regional stygofauna sampling program has confirmed that almost 80% of the stygofauna species recorded from the Kings CID system from outside of the impact area in similar geology to the CID system. This supports the hypothesis presented in the PER that the subterranean fauna species collected in the Kings CID paleochannel will also be found outside the mine impact area.

- ***Ref 9: Water Supply***

  DOW has not reviewed any information on the hydrological or environmental impacts of this remote borefield, and considered current work completed is conceptual. The borefield is not part of the Solomon PER footprint or impact assessment and will require a detailed impact assessment prior to commissioning. The DOW also seeks clarification on timeframes that an additional water source will be required. There is discrepancy between the Water Management Plan (year 8) and the Public Environmental Review document (year 13).

  Fortescue Response:

  The potential Serenity Valley borefield is not part of the Solomon PER footprint and will require a separate approval. Detailed hydrological modelling completed following the public release of the PER document refined the timeframe when an additional water source for mine operations and processing would be required, hence the five year discrepancy when an additional water source would be required between the Water Management Plan and PER documents.

- ***Ref 10: Flooding***

  Justification of the doubling of loss rates for the valley areas within the hydrologic modelling is not supported by gauged information or

calibration to observed flood levels. Consequently, it is recommended that the regional loss rate parameters presented in the Australian Rainfall and Runoff are adopted.

Fortescue Response:

Fortescue does not consider that any additional gauging is required as rainfall runoff readily infiltrated the sediments on the valley flank rather than develops overland flow. Fortescue has installed rainfall and level gauges and hopes to record a flood event before the design stage to confirm loss parameters. If there is no calibration event before the design stage Fortescue proposes to revert to 1x ARR losses.

- ***Ref 11: Flooding***

  There are significant reductions in the peak flood-flows from the area under Stage 2 to 5 scenarios. There is no discussion of the significance of the reduced flood-flows on the downstream environment.

  Fortescue Response:

  Under mining, water from high rainfall or flood events will enter the mine pit rather than flow directly down the drainage line. Therefore, the drainage line will not experience "natural" flood flows during mining. Water from such events would be disposed of down the drainage line immediately after the event. A proposed water detention embankment will be designed to control the peak flow.

- ***Ref 12: Solomon Water Management Plan***

  The Water Management Plan provided is based on the Pilbara Water in Mining Guidelines. The document does not adequately address the components specified in the guidelines or provide clear set of viable strategies to manage the key water issues identified in the PER. The DOW can provide guidance directly to the proponent on this issue.

  Fortescue Response:

  As described in the Pilbara Water in Mining Guidelines, only a Draft Water Management Plan is required and this will be refined and finalised in consultation with DoW. As referred to in section 3.3 (Stage C) of the Guidelines, only a draft water management plan is required to describe and justify the strategy for managing water over the life of the project and is typically required by the EPA to assist in the environmental impact assessment process and the DoW to support a licence application.

- ***Ref 13: Cultural Heritage***

  The information provided for the Solomon project, suggesting that Kangeenarina and Zalamea pools have no cultural significance, seems inconsistent with previous DOW findings. The DOW recommends additional surveys be undertaken with traditional owners who have comprehensive knowledge of values and history associated with these sites.

  Fortescue Response:

  Fortescue maintains that there are no documented culturally significant sites associated with the pool areas in Kangeenarina Creek and Zalamea Gorge. However, the cultural values of these pools will be maintained via the proposed water reinjection plan. Fortescue is committed to undertaking archaeological and ethnographic assessments of these pools with representatives of traditional owners prior to commencement of mining.

- ***Ref 14: Closure Impacts, Mine pit voids***

  Based on the presented information it is not clear whether there will be sufficient material to backfill all voids to above the pre-mining water table. Void water levels and water chemistry have not been assessed as part of the PER assessment, and there is no discussion on how FMG will demonstrate that backfilling will reinstate groundwater flows.

  Fortescue Response:

  In mining the CID, the aquifer will effectively be removed. The backfilling of the mine void with waste will result in the establishment of a new groundwater level in response to the more permeable nature of the waste material.

  Due to the benign nature of the surrounding bedrock and backfill waste material coupled with the location at the catchment headwaters, the potential for deterioration of water quality is considered to be negligible.

  Modelling of groundwater level and water quality in response to backfilling will be undertaken in the course of the development of the Mine Closure Plan.

- ***Ref 15: Closure Impacts, Public water source option***

  FMG has recently been involved in discussions with government on the possibility that Solomon could provide additional water to the West Pilbara Water Supply Scheme. The water balance shows that the area covered under the Solomon PER could not provide a water supply until mining has finished and void management complete - at least 20 years from start-up date. In addition as the CID will have been mined out there will be no structural aquifers to source from, which will require

extraction from pit voids post mining. The Serenity CID could be an additional source; however this has not been assessed for impacts of extraction on the local environment or the Millstream aquifer. If the Serenity CID were to become a public water source, full environmental impact assessment would be expected, including extending the Millstream flow model to include the Serenity CID.

Fortescue Response:

The potential Serenity Valley borefield is not part of the Solomon PER footprint and will require a separate approval. Detailed hydrological modelling completed following the public release of the PER document refined the timeframe when an additional water source for mine operations and processing would be required, hence the five year discrepancy when an additional water source would be required between the Water Management Plan and PER documents.

- ***Ref 16:***

  FMG needs to clarify the definition of Solomon as being the only CID which is subject to current assessment. Discussion of potential water sources should be very specific about which location is under consideration and over what time periods.

  Fortescue Response:

  The Solomon Project includes two new iron ore mines at deposits known as Firetail and Kings. The Firetail deposit is comprised of a blend of Bedded Iron Deposits (BID) and Detrital Iron Deposits (DID). The Kings deposit is comprised of mostly Channel Iron Deposits (CID) with some Brockman and Detrital ore.

  Appropriate investigations will be undertaken to determine impacts and satisfy licensing requirements.

- ***Ref 17:***

  This submission provides only a broad approach to water management and does not commit to defined water management tools, but proposes to develop their management approach during project development. This is not consistent with previously assessed projects or the Pilbara Water in Mining Guidelines.

  Fortescue Response:

  The specifics of water management requirements for Solomon will be developed through the final Water Management Plan and Operating Strategy in consultation with the DoW and in accordance with the Pilbara Water in

Mining Guidelines. As per section 3.3 (Stage C) of the Guidelines, only a draft water management plan is required to describe and justify the strategy for managing water over the life of the project and is typically required by the EPA to assist in the environmental impact assessment process and the DoW to support a licence application.

- ***Ref 18:***

  To determine if the project would be manageable under the Rights in Water and Irrigation Act 1914, additional information is required on how the hydrology of the pools would be maintained, and how the connection between the CID and Weelumurra Creek would be managed.

  Fortescue Response:

  The supplementation of the Kangeenarina and Zalamea Pools will involve the injection of water into the drainage line approximately 500m upstream of the area in which the pools develop. The water will be injected directly into the creek alluvial materials. Based on modelling results, sufficient water will be released to allow mounding to occur to ensure downstream flow simulates natural conditions. The release rate will be varied between summer and winter to simulate observed water level changes and seasonal evapotranspiration variations. Excess water that will recirculate towards the pit will be intercepted by the pit dewatering bores. The proposed locations of injection zones for each pool area are shown in Figures 2 and 3.

  As discussed previously, Fortescue is undertaking a prefeasibility study to determine the most effective method for lowering aquifer permeability in the Queens CID upstream of the junction with Weelumurra Creek.

3.3 DEPARTMENT OF INDIGENOUS AFFAIRS

- ***Ref 19:***

  The Executive Summary stats that the majority of Aboriginal heritage sites within the footprint will be impacted. This would have an extremely large effect if 700 Aboriginal heritage sites were to be destroyed as a result of the construction of the project. The Aboriginal Materials Cultural Committee needs to give permission for Aboriginal sites to be impacted under s18 of the Aboriginal Heritage Act 1972.

  Fortescue Response:

  The majority of heritage sites within the construction footprint will be impacted, however prior to finalising the construction footprint, numerous re-alignments were made to avoid all significant heritage sites. A total of 57 Aboriginal heritage sites have been submitted to the Department of Indigenous Affairs for permission to impact under section 18 of the Aboriginal Heritage Act 1972.

To date, Fortescue have avoided every engraving site along the Solomon Rail alignment.

- ***Ref 20: Yandeyarra***

  The rail corridor will go through an Aboriginal Lands Trust reserve, Yandeyarra. The effects of the development on the reserve have not been separately dealt with in the PER. DIA understands however that an agreement has been concluded with the residents of Yandeyarra which includes a benefits package.

  Fortescue Response:

  On 24th December 2010 the Mugarinya Community signed a Consent Agreement enabling Fortescue to construct a railway across Yandeyarra Aboriginal Reserve.

- ***Ref 21: Water Impacts***

  The section concerning environmental aspects relevant to surface water, impacts to heritage sites have not been included (pg 125). It does however state in the section about the Cultural Heritage Management Plan that loss or damage of heritage sites as a result of changes to surface water flows is a potential impact of the project.

  Fortescue Response:

  Noted

- ***Ref 22: Consultation***

  The proponent has signed agreements with four of the Native Title claimant groups and is continuing negotiations with the remaining Native Title group to access the land (pg 2). It would assist if the claimant groups were named in that section of the PER.

  Fortescue Response:

  Fortescue has concluded Land Access Agreements with four Native Title Claimant Groups whose land areas are directly impacted by the Project. These are Palyku, Kariyarra, Martu Idja Bunjima and Eastern Guruma.

- ***Ref 23: Consultation (cont)***

  The Kariyarra Working Group, Eastern Guruma, Yindjibarndi and Martu Idja Banyjima are listed as stakeholders in another section of the PER (pg 31), however the Yindjibarndi are not listed in the summary of consultation undertaken to date (pg 32-33). It is noted that the Pilbara

Development Commission also seems to have suggested that the extent of heritage consultation carried out is a key issue (pg 35).

Fortescue Response:

Fortescue commenced consultation with relevant Traditional Owner groups when the initial project plans became apparent. The initial consultation and negotiations with Yindjibarndi Traditional Owner Group commenced in 2007 however after months of negotiations, the parties failed to reach an agreement and subsequently the relationship between Fortescue and Yindjibarndi representatives has been problematic. Since 2010 Fortescue have managed to engage representatives of a newly formed group known as the Wirlu-Murra Yindjibarndi Aboriginal Corporation whilst the legal proceedings between Fortescue and the Yindjibarndi Aboriginal Corporation continue. The DIA have been informed and regularly updated on all new developments associated with this relationship.

- ***Ref 24: Consultation (cont)***

  Given the number of Aboriginal groups involved and the number of heritage sites in the area, it is concerning that DIA is not listed as a stakeholder (pg 31).

  Fortescue Response:

  Fortescue apologies for this oversight, and does consider that the DIA is a key stakeholder for this project. The DIA were invited to participate in Fortescue presentations of the Solomon Project on August 2 2010, but Fortescue received no reply.

- ***Ref 25: Cultural Heritage Management Plan***

  A CHMP has apparently been prepared for the project (pg 191). However a copy was not included for comment. The proponent also states that study findings have not been included in the PER "to protect the cultural and heritage values of Traditional Owners". It is not clear from the PER whether the Traditional Owner groups have yet agreed to the CHMP. It is hoped that the plan will be flexible and incorporate negotiation with and input from the Traditional Owner groups.

  Fortescue Response:

  The Cultural Heritage Management (CHMP) is in development in consultation with the relevant Traditional Owner Groups and will be submitted to the DIA on completion.

- ***Ref 26: Mine Closure***

  The EPA has an objective in mine closure to "protect historical and cultural associations" (pg 223). If this is to include protection of heritage sites then this could be clarified in the PER. It is hoped that the CHMP will include having Aboriginal monitors present on closure of the mine to advice on heritage matters. The PER states that consultation to discuss specific closure requirements had not commenced at the time of production of the PER (pg 229).

  Fortescue Response:

  The Cultural Heritage Management (CHMP) is in development in consultation with the relevant Traditional Owner Groups and will be submitted to the DIA on completion. Consultation to discuss specific closure objectives will be undertaken during the preparation of the Mine Closure Plan and will be submitted to the DMP as supporting documentation to the Mining Proposal for the project.

3.4 DEPARTMENT OF MINES AND PETROLEUM

- ***Ref 27: Water***

  It is unclear why the flood assessment for the Firetail and Kings deposits has been calculated at a 50 year flood event level (pg 98). Mining Proposal guidelines require flood modelling to be calculated at a 1 to 100, 72 hour rain event levels. It is indicated that Appendix 32 is a flood study (pg 124) but this report is mainly focused on groundwater. A flood study showing the flood level from 1 to 100, 72 hour rain event, in relation to mine infrastructure and landforms must be provided. If the waste landforms are located within this flood zone then long-term management of flood impacts on these landforms should be addressed.

  Fortescue Response:

  The Solomon Flood Management report (MWH, December 2010) was finalised and submitted to the DoW subsequent to the release of the PER. This report provides modelling and an assessment of the Solomon Project for a 100 year ARI flood event. Details of flood modelling for mine infrastructure is based on a 100 year ARI flood event and will be provided in the Mining Proposal to be submitted to the DMP.

- ***Ref 28: Water***

  The PER indicates that impacts to surface water within the Firetail deposit will be low and that clearing will be limited (pg 98/99, section 11.5-6). It appears that the main Firetail drainage channel is also the access into this mine area, and the PER does not address how this

access road will impact on surface water quality or minesite access during rain events.

Fortescue Response:

Detailed road design will be provided in the Mining Proposal to be submitted for the project. This will include flood mapping for the road and proposed surface water management measures to ensure impacts to surface water quality is minimised.

- ***Ref 29: Water***

  The PER does not adequately detail the construction or rehabilitation of surface water control features. If these features are to be retained after mine closure they may have to be designed for more than a 1 in 100 year event. Surface water control features are not clearly displayed in Figure 2.

  Fortescue Response:

  A detailed description of the surface water management features will be proposed in the Mining Proposal for the project. Some roads may be retained following mine closure for access for monitoring or remedial activities. Where necessary, roads will be designed for more than a 1 in 100 year event.

- ***Ref 30: Waste Characterisation***

  The assessment of acid producing potential of the waste will need to be revised if mine plans change and the McRae shale is to be disturbed.

  Fortescue Response:

  There is no proposal to disturbed McRae Shale in the wall of the proposed mine pits. However, Fortescue commits to undertaking a re-assessment of the acid producing potential of mine waste should the mine plans change and the McRae Shale is disturbed by mining.

- ***Ref 31: Waste Characterisation***

  Monitoring must be conducted during the mine life to ensure that any drainage from the waste dumps or mine areas will not result in surface or ground water contamination.

  Fortescue Response:

  The benign nature of the surrounding bedrock and backfill waste material and the location of the mining area at the headwaters of the Millstream catchment indicate that the potential for deterioration in the quality of groundwater and contamination is considered to be negligible.

Monitoring programs will address drainage from waste dumps or mine areas where there is the potential for risk of surface or groundwater contamination.

- ***Ref 32: Waste Characterisation***

  The testing of the physical properties of waste rock appears to only have been based on 5 samples from Firetail and 4 samples from Kings. Given the size of the deposit, it does not appear that this testing has been comprehensive. The waste characterisation summary indicates that the majority of waste rock will be competent, chunky and durable, but it is unclear how this conclusion has been reached, as the summary of test results indicated the material was variously sodic.

  Fortescue Response:

  The blocky nature of generic mine wastes produced at iron ore mines in the Pilbara is considered typical. Identifying friable, earthy varieties of mine wastes for rehabilitation purposes is generally a challenge for iron ore mines due to the dominance of hard rock that requires blasting. Where earthy, friable materials do occur they are invariably comprised of a mixture of fine earth (< 2mm) and rock/lithic fragments ranging up to 0.1mm in size. Such materials do not resemble the oxide wastes derived from the Pallid Zone and Upper Saprolite Zone of geologic profiles characteristic of gold mines on the Yilgarn Block. The later are highly erodible, irrespective of clay-mineralogy and sodicity.

  Fortescue collected and analysed a modest number of samples to determining clay-mineralogy and sodicity as this is typically the level of information that is required for a PER. The fact that the tested-samples were variously sodic is of little consequence, given the clast-rich state.

  Fortescue will undertake further work to ensure that sufficient volumes of materials will be available for rehabilitating the waste-landforms when these are decommissioned. This information will be provided in the Mine Closure Plan and Mining Proposal.

- ***Ref 33: Fibrous Materials***

  The PER does not show where investigative testing for fibrous minerals has been conducted. DMP comments on the draft PER raised concerns that testing has only been conducted in infrastructure, not mine areas, and this issue does not appear to have been addressed.

  Fortescue Response:

  An air sampling assessment for asbestos fibres at various occupational health receptors associated with the Solomon project was undertaken by Fortescue including:

- The Castle Camp (existing Fortescue exploration camp);
- Proposed CID OPF facility;
- Proposed Accommodation Village;
- Proposed Rail Loop;
- Proposed Rail Corridor (location in closest proximity to Wittenoom Gorge); and
- Proposed Rail Camps 1 and 2.

These sites revealed an asbestos fibre concentration below laboratory detection limits (0.01 fibres/L).

Fortescue has committed in the Table 61 (pg. 264) of the PER to the development and implementation of an Asbestos Management Plan. This plan will include a requirement that all deposit areas that may potentially disturb asbesiform material will be sampled and tested. It will also address the assessment and management of fibrous materials in tailings. The plan will be submitted to the DMP for approval prior to intercepting fibrous material.

- ***Ref 34: Fibrous Materials***

  The PER indicates that the management of fibrous minerals will be in accordance with an Asbestos Management Plan. The plan has not yet been developed, and will need to be assessed and approved by the Resources Safety Branch, DMP, prior to intercepting this material.

  Fortescue Response:

  Fortescue has committed in the Table 61 (pg. 264) of the PER to the development and implementation of an Asbestos Management Plan. This plan will include the requirement that all deposit areas that may potentially disturbed asbesiform material will be sampled and tested. It will also address the assessment and management of fibrous materials in tailings. The plan will be submitted to the DMP for approval prior to intercepting fibrous material.

- ***Ref 35: Fibrous Materials***

  The PER does not detail if fibrous materials may be processed and therefore present in tailings. If there is a risk that fibrous materials may be present in tailings, the management of this material, especially in relation to dust, must be addressed in the management plan.

  Fortescue Response:

  Fortescue has committed in the Table 61 (pg. 264) of the PER to the development and implementation of an Asbestos Management Plan. This

plan and the Mine Closure Plan that will be prepared as supporting documentation to the Mining Proposal for the project will include the requirement that all deposit areas that may potentially disturbed asbesiform material will be sampled and tested. It will also address the assessment and management of fibrous materials in tailings. The plan will be submitted to the DMP for approval prior to intercepting fibrous material.

- ***Ref 36: Borrow Pits/Tenure***

  The PER indicated (pg 26) that rail borrow may be obtained from the Investigator Exploration Licence. The appropriate tenure for the extraction of borrow material is a Mining Lease.

  Fortescue Response:

  Fortescue will ensure that the appropriate tenure is obtained prior to sourcing borrow material.

- ***Ref 37: Borrow Pits/Tenure***

  Exploration Licences can also not be used to supply water to a mining operation. The appropriate tenure for the extraction of water to supply a mining operation is a Miscellaneous Licence (if indicated as a purpose), Mining Lease, or General Purpose Licence.

  Fortescue Response:

  Fortescue will ensure that the appropriate tenure is obtained for water supply areas.

- ***Ref 38: Borrow Pits/Tenure***

  The management of unsuitable borrow must ensure that the material cannot disperse, or have impact on the surrounding environment and must be progressively rehabilitated. DMP have no concern with this material being backfilled into an exhausted borrow pit, so long as it is covered with suitable material to prevent erosion and rehabilitated. All borrow pits must be constructed so that they are free draining.

  Fortescue Response:

  Fortescue has committed in the PER (Table 61, pg. 263) to the development and implementation of a Borrow Pit Management Plan that will ensure that borrow pits are appropriately managed and rehabilitated. Wherever possible, borrow pits will be constructed so that they are free draining.

- ***Ref 39: Site Plans***

  Site plans do not show any proposed access roads to the Kings deposits. Access roads and haul roads are likely to have an impact on surface water if constructed along drainage lines, and therefore the access to these mine areas must be included on site plans and the impacts of these roads addressed in the PER.

  Fortescue Response:

  Detailed road design will be provided in the Mining Proposal to be submitted for the project.

- ***Ref 40: Tailing Storage Facility***

  A TSF embankment 100-115m high is likely to pose significant rehabilitation challenges. Further information on how these structures will be designed and rehabilitated must be provided in the Mining Proposal for this project.

  Fortescue Response:

  The proposed Mining Proposal will include this information.

- ***Ref 41: Tailing Storage Facility***

  A material balance sheet must be provided with the Mining Proposal for this project, to demonstrate that sufficient quantities of material with the correct structural properties is available to construct the TSFs and rock armour waste landforms and pits shells.

  Fortescue Response:

  The proposed Mining Proposal will include this information.

- ***Ref 42: Tailing Storage Facility***

  The tailing design must take into account the results of the metalliferous drainage study (when complete).

  Fortescue Response:

  The proposed Mining Proposal will include this information.

- ***Ref 43: Closure***

  Key areas that have not been addressed in sufficient detail in the Solomon Closure Plan: 1) Assessment of whether below watertable pit voids will have an adverse impact on surface or groundwater. 2) a risk assessment (detailing the potential impacts from the project,

consequence, likelihood and proposed mitigation measures to limit these impacts). 3) Preliminary closure costing to ensure the proposed closure options is feasible (confirmation that FMG has completed preliminary costing to determine the likely closure cost should be required).

Fortescue Response:

A detailed Mine Closure Plan addressing these aspects will be submitted to the DMP in support of a Mining Proposal for the project.

- ***Ref 44: Closure***

  Comments are provided on a number of other aspects of the Mine Closure Strategy. These comments are considered unlikely to significantly impact on the EPA assessment and it may therefore be appropriate for these issues to be addressed in the revised Closure Plan that will be submitted to the DMP with the Mining Proposal for Solomon.

  Fortescue Response:

  The proposed Mining Proposal will include this information.

- ***Ref 45: Other***

  It is noted that the PER indicates DMP did not raise any issues during the stakeholder consultation (pg 34). DMP notes indicate that several issues were discussed including: waste characterisation, waste dump design, tenure and assessment timeframes for the PER and Mining Proposal.

  Fortescue Response:

  The discussion with the DMP of issues including waste characterisation, waste dump design, tenure and assessment timeframes for the PER and Mining Proposal were considered by Fortescue to be management issues rather than significant objections or problems associated with the project.

3.5 DEPARTMENT OF ENVIRONMENT AND CONSERVATION (EMB)

- ***Ref 46: General***

  Recommendation 1: That the proponent consolidates the biological survey data and provides an assessment of the impacts of the Solomon Project, as a whole, on species and ecological communities of conservation significance prior to any approval. This applies across all biological values detailed in the PER.

Discussion: The PER separates the environmental impact assessment for the proposed Firetail mining area, proposed Kings mining area and the proposed rail. The total impact of the proposal on species and ecological communities of conservation significance, which in some cases occur within multiple development areas, needs to be considered in this assessment to be able to understand the full impact. In addition, some areas within the impact zone for one mine area appear to be used as undisturbed reference sites for biota occurring in another. It is also difficult to cross-reference the relevant technical appendices for the mines and rail because the surveys have been conducted by different consultants using different nomenclature. As stated in DEC's advice on the draft PER, the biological survey data for the proposal as a whole should have been consolidated and brought forward into the PER to enable assessment of the impacts of the proposal as a whole. The lack of consolidated presentation of the 'whole of proposal' impacts in the PER may result in potentially significant impacts from the Solomon Project being overlooked.

Fortescue Response:

Biological survey data collected from 18 different surveys undertaken for the Solomon project has been consolidated as well as possible. The PER is summation of the results of the 18 surveys and provides a comprehensive assessment of the impacts of the Solomon project on flora and fauna species and communities of conservation significance. Table iii of the Executive Summary of the PER provides a consolidated summary of the cumulative impacts for all key environmental factors associated with the three components (Rail, Firetail and Kings) of the Solomon project.

Fortescue does not believe there are any potentially significant impacts resulting from the Solomon Project that have been overlooked in the assessment.

- ***Ref 47: Airstrip Location***

  Recommendation 2: That the proponent relocates the proposed airstrip to an appropriate location outside of the proposed 2015 pastoral lease (Hamersley Station) exclusion area.

  Discussion: The proposed airstrip is within the proposed 2015 pastoral lease (Hamersley Station) exclusion area and the PER indicates the intention that the airstrip for the Solomon operation is intended to remain at this site well into the long term and beyond the life of the project. The proponent has been advised previously by DEC that the location of the proposed airstrip within a proposed conservation reserve is of potential concern to DEC in the absence of sound justification based on an evaluation of alternatives. The document states that two options for the airport were considered: one to the south of the

project area and one to the north, close to the rail alignment. The PER indicated that Fortescue Metals Group (FMG) selected the location to the south, within the proposed 2015 pastoral exclusion area, but does not provide a strong environmental rationale for this decision given that this area will be managed by DEC for conservation from 2015 and would ideally be avoided as a long-term location for mine-related infrastructure. In the absence of a sound environmental rationale for use of the proposed site, it is DEC's current preference that the airstrip be located in an appropriate area outside of the 2015 pastoral exclusion area.

Fortescue Response:

The proposed Solomon airstrip is located within an area identified by the DEC as the Hamersley Station Proposed Management Area (PMA), not the proposed 2015 Pastoral Lease Exclusion Zone (PLEZ) (Hamersley Station) area. The proposed location of the airstrip is adjacent to the northern boundary of the proposed PMA (see Figure 2 in the PER), while the proposed Hamersley Station PLEZ is indicated as occurring to the east of Wittenoom-Nanutarra Rd. Fortescue has previously discussed the issue of locating the Solomon airstrip within the Hamersley Station lease with DEC (EMB) on August 11, 2010 (as described in the Stakeholder Consultation Issues section on pg. 34 and in Table 12 of the PER) where DEC have indicated that while it was their preference that the airstrip be located elsewhere, it was willing to accept the location provided Fortescue gave some justification for its location and as long as there was no impact on the adjacent Threatened Ecological Community (TEC). The location of the airstrip and associated infrastructure was specifically selected and designed to avoid adverse impacts to the TEC. As described in section 4.4.1, a number of alternative airstrip options were investigated, including one adjacent to the rail corridor on Mt Florance Station within the Fortescue River Valley, but were considered unsuitable for a number of environmental (including interruption of surface water flows) and economic (including disruption to pastoral activities) reasons. Additionally, the selection of the location of the airstrip within the Hamersley Station Proposed Management Area was selected based on its proximity to the proposed permanent village and meeting Civil Aviation Safety Authority (CASA) Obstacle Limitation Surface (OLS) requirements.

- ***Ref 48: Rail corridor alignment***

  Recommendation 3: That the proponent continues to examine options for realigning the portion of the proposed rail that bisects the unallocated Crown land (UCL) area that was formerly part of the Mount Florance pastoral lease (currently managed by DEC for conservation as a proposed addition to the national park) to avoid fragmentation of this parcel of land.

Discussion: The proposed rail intersects a portion of land which is proposed to be added to the national park when the necessary State processes for reserve establishment have been completed. In the absence of a clear environmental rationale in the PER for the proposed alignment, it is DEC's view that the rail be aligned such that it does not bisect and fragment this parcel of land. However, if there is a valid rationale for the proposed alignment which is supported by Government, the realignment of the Wittenoom –Nanutarra Road to the south of the rail may need to be considered. This would provide safer traffic management and a more rational management boundary for the proposed park addition. There should also be a commitment that borrow pits will not be established in the proposed conservation reserve.

Fortescue Response:

As discussed in section 2.2.2 of the PER, Fortescue has undertaken a detailed rail alignment selection analysis. Fortescue will continue to examine alignment options and, where necessary, make minor amendments and refinements to the alignment during the detailed design phase to minimise impacts on the former Mt Florance pastoral parcel that has been acquired by the DEC for addition to the Karijini National Park. Fortescue commits to realigning the east-west portion of Wittenoon-Nanutarra Rd to the southern side of the rail alignment through the former Mt Florance parcel, which the DEC has supported during consultation as the best possible option. Fortescue has also committed to not establishing any borrow pits within the proposed conservation area, as described on pg. 26 of the PER.

- ***Ref 49: Workforce management within Karijini National Park***

  Recommendation 4: That the proponent, in collaboration with DEC, develops management actions for workforce management with respect to potential impacts on Karijini National Park. Actions to include the reporting of any complaints or incidents involving FMG employees and contractors in the park to DEC as soon as possible, in order to determine corrective actions and measures to avoid recurrence.

  Recommendation 5: That the proponent considers the provision of resources to support DEC's visitor management in Karijini National Park to offset potential impacts of the FMG Solomon Project workforce recreating within the park.

  Discussion: Camp 3 (2,000 person capacity, semi-permanent camp) and the permanent village (1,500 personnel) are located in close proximity to Karijini National Park. The proposal has the potential to result in an increase in visitation to the park. It is recommended that the proponent develops management actions for workforce management with respect to visitation and associated impacts on the park in consultation with DEC. The actions should

include workforce education programs, signing in/out procedures and disciplinary action where appropriate. The proponent should liaise with DEC in regard to its commitments to manage workforce recreational activities and behaviour in the park. DEC may require additional resources to manage increased visitation and associated impacts resulting from FMG's workforce, and on this basis FMG is requested to consider the provision of resources to DEC to assist in managing the impacts of its workforce on Karijini National Park.

Fortescue Response:

Fortescue commits to the development of a construction workforce action and management strategy to ensure that potential impacts from Fortescue construction employees or contractors entering Karijini National Park are avoided or minimised. Fortescue proposes to implement a Karijini National Park "No Go" policy for all Fortescue construction employee and contractors to minimise potential impacts to the Park.

- ***Ref 50: Noise and vibration within Karijini National Park***

  Recommendation 6: That the proponent provides support for the installation of vibration monitoring equipment at Hamersley Gorge and the Weano Day Use area in order to determine and manage the potential risk to visitor safety and potential impacts on the natural and cultural values of the gorges from blasting at the Solomon mine site.

  Discussion: DEC has become aware of the potential impacts of blasting from nearby mining activities on the safety and stability of gorge structures in recreational sites within Karijini National Park. Park staff have regularly reported feeling vibrations at both the ranger's headquarters and visitor centre, which may be attributable to blasting at nearby mine sites, the closest of which is approximately 30 kilometres away. This has highlighted the potential for cumulative impacts of regular and ongoing blasting in the area on the stability of gorge structures, and the resultant potential for a risk to visitor safety. Potential impacts on natural and cultural park values associated with rock ledges and caves within the gorges also require consideration. This is an issue that DEC's Pilbara Region is currently investigating with mining companies in the area. The Solomon mine at its closest point (Zion deposit) is about eight kilometres from the DEC recreation site at Hamersley Gorge, and 40 kilometres from the gorges around the Weano Day Use area (Hancock, Weano, Knox, Wittenoom and Joffre Gorges). The impacts of the blasting regime at Solomon on the safety of recreational sites at Hamersley Gorge and the Weano Day Use area are currently unknown. Given the potential for risk to visitor safety, as well as to the natural and cultural values of the gorges, DEC requests that the proponent provides support for the early installation of monitoring equipment at Hamersley Gorge and the Weano Day Use area in

order to determine whether the impacts of blasting at the Solomon site are posing any risk to visitor safety and natural and heritage values of the gorges. A monitoring regime can be developed collaboratively between DEC and FMG, and if required appropriate management strategies put in place to manage visitor risk.

Fortescue Response:

An assessment of the potential ground-borne vibration and airblast emissions associated with overburden blasting has been undertaken for Hamersley Gorge as part of the impact assessment of the Solomon Project. The assessment determined that blast emission levels at Hamersley Gorge will comply with the Environmental Protection (Noise) Regulations recommended for airblast limits and the ANZEC guidelines for ground vibrations. The DEC's Weano Day Use Area is more than 40 km from the nearest Solomon mine area (see Figure 4) and is highly unlikely to be impacted by blasting at Solomon. Fortescue will, however, commit to the installation of vibration monitoring equipment at Hamersley Gorge and Weano Day Use Area and undertake monitoring as appropriate during initial blasting to confirm the impact assessment.

- ***Ref 51: Adequacy of flora and vegetation surveys***

  Recommendation 7: That the proponent undertakes further vegetation and flora surveys in appropriate seasonal conditions.

  Recommendation 8: That the proponent adequately surveys all areas within the proposed mine footprint.

  Discussion: In general, appropriate methods were used to describe the vegetation in the Solomon Project area. That is, quadrats were established, and floristic composition was appropriately analysed through statistical comparison with a regional Pilbara dataset held by Griffin and Associates. However, many of the surveys were completed in poor seasons (being 2008 and 2010) or immediately following fire, thereby skewing the floristic data to varying extents. The PER states that "the Phase 1 survey [25 April -31 May 2008] was completed following a period of above average rainfall for the area and seasonal conditions were considered to be very good" (p. 59). This statement is not consistent with the information in the Coffey Environments' vegetation and flora reports or the advice provided by DEC at that time. Coffey Environments (2010) states that "due to the atypical rainfall preceding the April/May 2008 surveys, and the late timing of the August / September 2008 surveys, annual/ephemeral species may not have [been] present at the time of the surveys" (Table 4, p. 18, Appendix 1). In the case of fire or drought affected quadrat data, in general, few species were recorded, so data are extremely poor. In their analysis of additional sites, Griffin and Trudgen (2010) noted that there was insufficient information to make any reasonable

conclusion as to the best way to treat the sites. In the case of fire or drought affected quadrat data, in general, few species were recorded, so data are extremely poor. In their analysis of additional sites, Griffin and Trudgen (2010) noted that there was insufficient information to make any reasonable conclusion as to the best way to treat the sites. The PER states that the south-eastern edge of Firetail South was not surveyed due to steep terrain (p. 60). This effectively indicates that there are no data available about the vegetation in this area and this is a significant deficiency in the available information, as no data are then available for impact assessment purposes and the area could potentially contain unusual vegetation.

Fortescue Response:

Fortescue commits to undertaking further flora and vegetation surveys of all proposed disturbance areas within the proposed Solomon mine and infrastructure footprint that have not previously been surveyed, prior to construction. While seasonal conditions at the time of the 2010 flora and vegetation surveys were not optimal for the identification of all ephemeral species and flowering grasses, rainfall records at four nearby BOM sites and two pastoral stations show above average or marginally below average rainfall in the months immediately preceding the April/May 2008 flora and vegetation surveys. Average rainfall for the March/April period for Wittenoom is 95mm (80mm fell in this period in 2008), Tom Price 90mm (190mm in 2008), Millstream 100mm (120mm in 2008) and Pannawonica 100mm (250mm in 2008). Furthermore, rainfall records from adjacent Mt Florance and Coolawanyah Stations show that rainfall during the March/April 2008 period was above to well above average. Mt Florence's long-term average for the March/April period is 91mm (109mm in 2008) and Collawanyah is 82mm (157mm in 2008). Based on this 2008 rainfall data, Fortescue does not agree with Coffey Environments assertion that rainfall was atypical preceding the April/May 2008 surveys. Subsequently, beyond the surveys of the additional impact areas already committed to, Fortescue does not believe that it is necessary for any other additional flora and vegetation surveys to be undertaken in appropriate seasonal conditions. Fortescue is aware that the south-eastern edge of Firetail South (i.e. the Boolgeeda Land System portion) has not been surveyed. As there is no proposed disturbance to this area through mining or construction, surveying of this area is not considered necessary.

- ***Ref 52: Flora of conservation significance***

  Recommendation 9: That the proponent clarifies the impacts of the Solomon Project on priority-listed flora prior to approval of the project.

  Recommendation 10: That the proponent minimises impacts from the Solomon Project on priority-listed flora, in particular Aristida

jerichoensis var. subspinulifera (Priority 1) and Paspalidium retiglume (Priority 2), where practicable.

Discussion: The Solomon Project will potentially impact on several priority-listed flora species. The PER does not provide an assessment of the total impacts of the Solomon Project on the local (and where appropriate regional) populations of priority-listed species. It is expected that proponents will provide quantitative impact tables with respect to impacts on priority-listed flora in environmental review documentation and while this information was requested in DEC's comments on the draft PER, it has not been provided. Impacts on priority-listed flora should be avoided, where practicable. In particular, impacts on Aristida jerichoensis var. subspinulifera (Priority 1) and Paspalidium retiglume (Priority 2) within the proposed rail corridor should be avoided, given the higher status of these species and the potential flexibility of the rail alignment within the proposed rail corridor which could enable avoidance of these species.

Fortescue Response:

The Priority-listed flora impacted by the proposal are listed in Table iii (page xxxiii), and pages 103-104, 134-135 and 164 of the Solomon PER.

One individual of the Priority 1 listed *Aristida jerichoensis* var. *subspinulifera* and three individuals of the Priority 2 listed *Paspalidium retiglume* have been recorded from the rail corridor. Fortescue is committed to minimising impacts on all priority listed flora species identified from the Solomon project area wherever practical, in particular the Priority 1 *Aristida jerichoensis* var. *subspinulifera* and the Priority 2 listed *Paspalidium retiglume*.

Fortescue has committed in the Solomon PER to undertaking additional survey work to determine the regional significance and distribution of *Gompholobium karijini* which has recently (24/9/10) been listed by the DEC as a Priority 2 species. A census of the species within the Solomon Project area to determine the total impacts on the known population will also be undertaken.

- ***Ref 53: Other significant flora - G. karijini***

  Recommendation 11: That the proponent clarifies the impacts of the Solomon Project on Gompholobium karijini prior to approval of the project.

  Recommendation 12: That, based on information on the population size and extent of occurrence of this species and the impacts of the project, a suitable proportion of the known population size and area of habitat is identified for protection from disturbance, as determined in consultation with DEC.

Discussion: Gompholobium karijini has been recorded from 60 sites, all within the Solomon Project study areas – 27 sites within the Firetail study area and 33 sites within the Kings study area. No proportional impact table has been provided, however it appears from Figure 16 that G. karijini is largely known from areas within or in close proximity to the proposed disturbance footprint, including mines and infrastructure. Although Table (iii) on p. xxxiii states that no other significant flora was found in the rail alignment, it is clear from the comparison of Figure 16 with Figure 9 that G. karijini also occurs within the rail spur corridor, close to the proposed rail spur alignment. It is therefore recommended that the proponent clarifies the total impacts of the Solomon Project on the known population size and extent of G. karijini prior to approval of the project. The vegetation units that contain G. karijini as a significant species (i.e. >2 per cent cover) have significant overlap with the vegetation associated with the Robe Pisolite geological unit, which is considered by Coffey Environments as being of significant conservation value (p. vii and p. 75, Appendix 7). The PER contains no reference to strategies to be applied for avoiding or ameliorating impacts on G. karijini or the vegetation units/habitat types in which it occurs. As a guide, a minimum of 30 per cent of the known extent of the habitat for G. karijini (based initially on the vegetation units in which it is a significant species) should be conserved, but this proportion would need to be increased if the species population size is found to be low and habitat is found to be highly restricted.

Depending on the known extent of the species and project impacts, a staged mining approval process may be appropriate to manage impacts on G. karijini from the Solomon Project. The PER acknowledges that further studies are required to determine the regional significance of G. karijini and include commitments to undertaking these surveys (pp. 104 and 135, PER). In the event that additional flora surveys identify populations of G. karijini that are not at threat from development, it may be possible to approve further mining without significantly impacting on the long-term conservation of this species.

Fortescue Response:

It is important to note that following the inclusion of the floristic data from the 2010 surveys into the 2009 numerical analysis of the 2008 floristic data, the conservation significance of the Robe Pisolite unit has been revised. The statement by Coffey Environments based on floristic data collected during the 2008 surveys only, that the Robe Pisolite geological unit has vegetation with significant (and possibly high) conservation value is no longer considered accurate. The results of the revised Trudgen and Griffin floristic analysis report (August 2010) (Appendix G in Appendix 12 of the PER), which doesn't identify the Robe Pisolite unit as being of conservation significance, should be considered the current version of floristic analysis results.

As *Gompholobium karijini* had not been identified as a species of potential conservation significance prior to either the 2008 or 2010 flora and vegetation field surveys been undertaken, no census for the species was undertaken, hence it was not possible to clarify impacts on the species. Fortescue notes that subsequent to Fortescue undertaking the 2010 surveys and following the release of the draft PER for comment by the DEC, *Gompholobium karijini* has been listed by the DEC as a Priority 2 species. In addition to the 60 sites that *Gompholobium karijini* was recorded from and in the vicinity of the Solomon project, regional surveys undertaken by Coffey Environments (Appendix 1 of PER) recorded *Gompholobium karijini* from an additional nine sites ranging from 85km west of and to the immediate north of the Solomon Project. Fortescue has committed in the Solomon PER (pgs. 108, 135 and 140) to undertaking additional survey work to determine the regional significance and distribution of *Gompholobium karijini* and will also undertake a census of the species within the Solomon Project area to determine the total impacts on the known population.

- ***Ref 54: Other significant flora - Triodia aff. melvillei***

  Recommendation 13: That the proponent clarifies impacts of the Solomon Project on Triodia aff. melvillei prior to approval of the project.

  Recommendation 14: That the proponent minimises impacts from the Solomon Project on Triodia aff. melvillei, where practicable

  Discussion: The PER states that the "undescribed species Triodia aff. melvillei, is considered to potentially be a 'species of interest', (p. 62). There is no further discussion of this species in the document with respect to impacts or avoidance measures. Triodia aff. melvillei (MET 10, 114) is an undescribed taxon known to have a restricted distribution, which was identified as a species of interest during the numerical (PATN) analysis (p. 76, Appendix 7). Coffey Environments (2010) recommends that the proponent avoids clearing of priority and other potentially significant flora, including Gompholobium karijini and Triodia aff. melvillei, wherever possible. The potential for impacts on Triodia aff. melvillei from the Solomon Project should be clarified and impacts be avoided where practicable.

  Fortescue Response:

  Triodia aff. *melvillei* was not identified as a species of conservation significance prior to any of the baseline surveys being undertaken and consequently no census of the species has been undertaken to clarify impact on the species. DEC advised (6/9/10) that *Triodia melvillei* is more likely to be of scientific interest rather than of conservation value and is not considered rare in the Hamersley Range (see Appendix B). Regardless, Fortescue commits to avoiding impacts on populations *Triodia* aff. *melvillei* wherever possible.

- ***Ref 55: Vegetation of conservation significance***

  Recommendation 15: That the proponent identifies impacts of the Solomon Project on the 'four plant assemblages of the Wona Land System' priority ecological community (PEC) using maps and explaining the specific impacts on the different floristic units within the PEC.

  Recommendation 16: That the proponent minimises impacts from the Solomon Project on the 'four plant assemblages of the Wona Land System' PEC.

  Discussion: The 'four plant assemblages of the Wona Land System' PEC has been identified by the proponent as occurring in the survey area. The PER states that 185 hectares of this PEC are proposed for clearing (p. 164), although the actual location of this area is not easily identifiable from the PER. This PEC consists of a series of four units with different priority ranks, but no information has been provided about which of these are proposed for clearing. Additionally, no information has been provided in the PER about the regional distribution of the Wona Land System units proposed for impact, nor about how the proponent will seek to avoid, manage or minimise impacts on this priority vegetation. The Wona Land System units have different priority rankings and are described as follows: Annual sorghum grasslands on self-mulching clays (Priority 1) - this community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range; Grassless plains of stony gibber covered by a very rich herbfield (mostly peas and Convolvulaceae) after rain (Priority 1); Mitchell grass plains (Astrebela spp.) on gilgai (Priority 3); and Mitchell grass and Roebourne Plain Grass (Eragrostis xerophila) plain on gilgai (Priority 3).

  Fortescue Response:

  The Wona Land System, formerly referred to as the "Plant Assemblages of the Wona Land System" was recently (3/05/10) divided into 4 sub-units, two of which are classified as Priority 1 PECs and 2 as Priority 3 PECs. Based on vegetation mapping and floristic data collected from the flora and vegetation survey of the Solomon rail corridor, the Solomon Rail corridor contains two of the 'Four Plant Assemblages of the Wona Land System' PEC. The two sub-units are:

  - Mitchell grass plains (*Astrebela* spp.) on gilgai; and
  - Mitchell grass and Roebourne Plain grass (*Eragrostis xerophila*) plain on gilgai (typical type, heavily grazed).

  Based on the floristic data collected it has not been possible to delineate the boundaries of the 2 sub-units accurately as they have been mapped as one vegetation type, and are also likely to overlap. However, both of the above

sub-units occurring within the study area are Priority 3 PECs. The attached mapping shows the precise location of the 'Four Plant Assemblages of the Wona Land System' PEC containing these 2 sub-units. Both sub-units have been mapped based on the vegetation mapping, specifically vegetation type FGT1 (Tussock Grassland to Open Tussock Grassland of *Eriachne obtusa*, *Eriachne benthamii*, *Eriachne mucronata* (typical form), *Eragrostis xerophila*, *Astrebla pectinata* and *Aristida latifolia* to 0.5m), which they directly relate to. The total mapped area of vegetation containing FGT1 (Wona Priority 3 PEC) within the entire rail corridor is 2146.5ha (see Figure 5). The total mapped area of FGT1 (Wona Priority 3 PEC) proposed to be impacted as a result of the rail construction is 60.41ha. The 185ha area calculated in the PER was based on the Wona Land System as defined by the Department of Agriculture and Food Land System mapping dataset only. The updated area is more specific as it was calculated based on the sub-unit descriptions in conjunction with the vegetation mapping undertaken by Coffey Environments. Therefore, based on vegetation mapping and the descriptions provided by DEC, it is considered that the balance of the area previously provided is not associated with the Wona Land System PEC.

- ***Ref 56: Other locally and regionally significant vegetation***

  Recommendation 17: That the impacts of the Solomon Project on vegetation are assessed with respect to floristic units, rather than the broad structural vegetation units presented in Figures 15, 21 and 25 in the PER.

  Discussion: As indicated in Appendix 1 (p. iv,) of the PER, DEC has previously advised the proponent of its view that the flora and vegetation within the Solomon Project is likely to be unusual and not well represented outside of the proposed mining area. This is supported by the proponent's flora and vegetation reports. Coffey Environments noted that "the PATN analysis indicated that the areas in which the Solomon Project and Investigator are located have a significant diversity of vegetation, with much of it poorly known and potentially not widely distributed.. [and] have a significant diversity at the 600-group level implying significant conservation value" (p. vii, Appendix 7). More specifically, the conservation assessment within Griffin and Trudgen's 2009 report on their statistical analysis for the Solomon Project (pp. 77-81, Appendix C in PER Appendix 7) notes that the Robe pisolite in the Solomon – Investigator project area has "varied vegetation that is largely restricted to this geological unit" (p. 79) and has "vegetation types with very restricted distribution" (p. 80). These authors suggest that similar values are likely to occur on this geological unit in other areas, and that the vegetation on pisolite is poorly known. They also note that there is significant localisation and diversity of vegetation types and suggest significant geological restriction of many of the vegetation types in the Solomon Project. Griffin and Trudgen

(2009) (p. 36, Appendix C in PER Appendix 7) also identify strong geographic patterning of the floristic composition of the vegetation of the Robe Pisolite.

A series of the vegetation units in the Solomon Project area that are identified as restricted may potentially meet the criteria for inclusion on the list of PECs. Of particular note are the vegetation units that contain Gompholobium karijini as a significant species (i.e. >2 per cent cover) as this is identified as being highly restricted and unusual by Griffin and Trudgen and in Coffey Environments' flora and vegetation reports. Coffey Environments (2009) (Appendix 7, p. 77) notes that disturbance of a significant portion of the Robe Pisolite geological unit in the Solomon Project could have a significant impact on the conservation status of this vegetation unit. The PER contains no reference to means of avoiding or ameliorating impacts on this unit or any other vegetation units identified as being restricted to the Solomon Project area.

Given the potential conservation significance of vegetation units in the Solomon Project area, it is critical that the vegetation assessment is adequate to determine the significance of impacts on locally and regionally significant floristic units. Statements such as "Vegetation type AsppS has a weak to moderate correlation with four floristic units (Units 171, 254, 297, 321)" (p. 105, PER), indicate that vegetation mapping undertaken for this assessment is structurally-based. Structural-based vegetation mapping is not considered adequate for biodiversity impact assessment as it does not reliably reflect the floristic (i.e. species) diversity or distribution of species and communities in these types of landscapes. The vegetation mapping provided in Figure 15 - Firetail, Figure 21 – Kings and Figure 25 - Rail in the PER is at such a broad scale that vegetation units across a range of habitats are mapped as the same units, whereas it is considered likely that a greater number of vegetation units linked to particular habitat types would have been identified and classified as significant, had floristic-based vegetation mapping been completed. Therefore in this case, the impact of the project on floristic units is likely to be higher than is stated for the broadscale structurally based units described in the PER.

Fortescue Response:

As discussed previously, the PATN analysis results from the 2009 Griffin and Trudgen report, including the significance of the Robe Pisolite geological unit, has been amended following the inclusion of the floristic data from the 2010 surveys. The statement by Coffey Environments, which was based on only floristic data collected during the 2008 surveys, that the Robe Pisolite geological unit has vegetation with significant (and possibly high) conservation value is no longer considered accurate. The results of the revised Trudgen and Griffin floristic analysis report (August 2010)(Appendix G in Appendix 12), which doesn't identify the Robe Pisolite unit as being of

conservation significance, should be considered the current version of floristic analysis results.

A combination of floristic data, landforms and soil types were used to assist in the description of vegetation types and structure and aerial photography was used to delineate the boundary of each vegetation unit. Structural-based vegetation units were adopted as an accurate surrogate for floristic units, particularly for structural units that corresponded with only one floristic unit. As the area of each structural unit could be calculated, the impact on the area of the corresponding floristic unit could be determined. This is an appropriate and acceptable approach to undertaking an impact assessment on vegetation and floristic units

- ***Ref 57: Vegetation of conservation significance***

  Recommendation 18: That the proponent adopts the management recommendations of Coffey Environments (p. ix, Appendix 7) with respect to identifying and managing impacts on flora and vegetation of conservation significance).

  Recommendation 19: That suitable areas of vegetation representative of the range of restricted floristic units are protected within the project area until further survey work in appropriate seasonal conditions confirms the extent of these floristic units beyond the proposal footprint in areas not proposed for development, and that strategies to avoid or minimise impacts on restricted floristic units that are deemed significant are developed and agreed.

  Discussion: Although the background vegetation reports identified a series of vegetation units that are likely to be highly restricted in distribution, there is no discussion on means of seeking to reduce or ameliorate the apparently high level of impact proposed to those units and their supporting habitats and landscapes. Some of the vegetation units are proposed for complete removal (i.e. 100 per cent loss of the currently known distribution). Coffey Environments (p. ix, Appendix 7) provides vegetation and flora management recommendations. These management recommendations are supported by DEC and include recommendations that the proponent undertakes additional sampling after a typical wet season, to ensure that the method is suitable for the Environmental Protection Authority (EPA) assessment, and that the proponent minimises clearing and indirect impacts on the flora and vegetation of the Robe Pisolite geological unit.

  The Pilbara pisolitic geological units are ancient environments that are being identified in successive iron ore mining projects as containing very high conservation values, including a suite of subterranean fauna and vegetation units that are highly restricted (e.g. API's West Pilbara Iron Ore Project Stage 1 Mine and Rail Proposal PER (2010) and Robe River Mining's Mesa

A/Warramboo Iron Ore Project PER (2006)). Pisolitic hills and mesas areas are currently subject to an increase in proposals for large-scale mining projects and this may result in total loss of a series of landforms and associated biota, including some highly restricted subterranean fauna and vegetation.

There has not yet been any strategic planning for conservation of significant species and ecological communities associated with pisolite environments of the Pilbara and currently insufficient data that would identify which areas of the Pilbara pisolite areas within the project area and wider region contain restricted vegetation or species. Strategic surveys and planning beyond the project scale are therefore needed to ensure that these habitats and associated restricted vegetation and subterranean fauna continue to exist in the resource-rich pisolite environments and landscapes of the Pilbara.

As there is no Pilbara regional dataset to determine conservation status/significance of the pisolite environments and associated restricted vegetation and subterranean fauna, it is recommended that the proponent identifies and supports reservation of such an area based on the identified vegetation and flora values of the proposal area. This should encompass, in particular, the range of habitats and vegetation units identified in the area, and include at least 30 per cent of the known area of vegetation units, but particularly focus on conservation of species and communities that appear highly restricted.

Fortescue Response:

Fortescue commits to adopting all of Coffey Environment's management recommendations as described on p. ix of Appendix 7 other than the recommendation to undertake additional sampling of quadrats after a typical wet season to ensure the methodology is satisfactory for the EPA to assess the flora and vegetation assessment results. The Coffey management recommendations that Fortescue commits to include:

- Minimise clearing and any indirect impacts on the Robe Pisolite geological unit;
- Install floodways and culverts, where necessary, to minimise or rectify changes to the natural surface drainage adjacent to Mulga dominated vegetation to maintain sheet flow patterns;
- Consider undertaking targeted searches for the potential Priority species, *Gompholobium karijini* to determine its regional distribution and population sizes to assist in the conservation classification;
- Avoid clearing of Priority and other potentially significant flora, including *Gompholobium karijini* and *Triodia* aff. *melvillei*, wherever possible;

- Minimise spread of weed species during and post-construction, particularly *Aerva javanica*, *Cenchrus ciliaris*, *Cenchrus setiger* and *Vachellia farnesiana*, which have a high impact on biodiversity; and

- Take necessary precautions to prevent ignition of fires within native vegetation as a result of activities associated with the project, particularly during construction. Should a fire start, minimise spread, where possible.

Fortescue considers the flora and vegetation surveys undertaken in 2008 were undertaken during optimal conditions for identification of the majority of ephemeral species and flowering grasses likely to occur in the survey area. Aside from committing to conducting additional surveys in impacts areas that were not surveyed during 2008 or 2010 surveys, Fortescue does not consider any additional surveys are necessary.

As discussed previously, the PATN analysis results from the 2009 Griffin and Trudgen report, which was the basis on which the Robe Pisolite geological unit was considered significant by Coffey Environments to be significant, has been amended following the inclusion of the floristic data from the 2010 surveys. The statement by Coffey Environments, which was based on only floristic data collected during the 2008 surveys, that the Robe Pisolite geological unit has vegetation with significant (and possibly high) conservation value is no longer considered accurate or relevant.

- ***Ref 58: Mulga and Sheetflow***

  Recommendation 20: That the proponent clarifies which sections of the rail culverts cannot be installed on and how this relates to vegetation of conservation significance, in particular mulga, that may be dependent on the maintenance of surface water flows, prior to approval.

  Recommendation 21: That the proponent's commitment to install environmental culverts at 50 metre intervals within and adjacent to areas of mulga to maintain sheet flow, is formalised in the Ministerial Conditions, should the Solomon Project be approved.

  Discussion: The PER states that "in various locations along the proposed alignment, natural water paths have been cut off" and that "culverts cannot be installed in these locations" (p. 157). It is unclear in the PER which sections of the rail culverts cannot be installed and what impact this might have on sheet flow dependent vegetation. Maintenance of surface water flows is likely to be relevant for the conservation of grove-intergrove mulga communities (ecosystems at risk, as described in A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002) and broad flood-out valleys on the middle Fortescue (wetlands of subregional significance, as described in A Biodiversity Audit of Western Australia's 53 Biogeographical

Subregions in 2002). The proponent needs to show the locations where culverts cannot be installed relative to any vegetation of conservation significance that may be impacted by changes to surface water flows caused by the rail.

Fortescue Response:

Subsequent to the public release of the Solomon PER, the rail has been designed to accommodate a 1 in 100 year flood event and consequently all rail embankments will be raised over the section of the rail crossing the Fortescue River Valley. This has resulted in majority of the rail alignment being appropriately culverted, ensuring natural water flow paths will not be cut off by the rail alignment. Culverts 900-1200mm in diameter will be installed at evenly spaced intervals (no less than 50m intervals) along the rail alignment within and adjacent to all areas of Mulga vegetation to ensure existing sheet flow regimes to Mulga communities will be maintained. Further design work also identified the requirement for an additional bridge across the Fortescue River South. The Mulga Management Plan (Appendix C) includes maps that indicate the extent of Mulga dominated vegetation along the rail corridor.

- ***Ref 59: Weeds***

  Recommendation 22: That the proponent develops and implements a weed hygiene and management plan to the requirements of the Office of the Environmental Protection Authority (OEPA) on the advice of DEC. This plan should identify and describe specific weed management procedures planned for implementation in areas being managed by DEC for conservation and proposed for future incorporation into the conservation reserve system. The weed hygiene and management plan needs to identify and map the occurrence of weeds within the project area, outline quarantine/hygiene measures that will be implemented within and between sites, and identify ongoing monitoring and control requirements.

  Recommendation 23: That the proponent develops and implements weed management zones, based on weed species and burden, over the length of the rail.

  Discussion: The PER provides limited information on weed management. The proposed Weed Hygiene and Management Plan should be prepared to the satisfaction of the EPA, on the advice of DEC, with respect to any lands currently managed, or proposed to be managed, by DEC for conservation. DEC has a particular interest in weed management at the proposed airstrip within the 2015 pastoral lease exclusion area and along the proposed rail corridor, in particular where it bisects the excised portion of the Mount Florance pastoral lease.

This rail project has the potential to be a pathway for spread of environmental weeds into Karijini National Park. It is not appropriate to define the rail corridor as one continuous site for the purposes of weed management. The rail corridor will need to be divided into a number of management sections based on weed species and burden. Weed hygiene measures are required to be adequate to prevent the spread of significant environmental weeds that currently occur along the rail corridor.

Fortescue Response:

As described in the Environmental Commitments table (Table 61) in the PER (pg. 256), Fortescue is committed to the development and implementation of a Weed Hygiene and Management Plan to the requirements of the OEPA and on advice of the DEC and the Department of Food and Agriculture to achieve weed control during the construction, operation, decommissioning and rehabilitation phases of the Solomon Project. This Plan will include the development and implementation of weed management zones over the length of the rail alignment. In particular for the section of rail that intersects the former portion of Mt Florance station proposed for addition to the conservation estate and the proposed airport within the Hamersley Station Proposed Management Area, Fortescue will identify, map weeds and implement quarantine and hygiene measures and establish an ongoing monitoring program to ensure the spread of weeds is minimised.

- ***Ref 60: Fire management***

  Recommendation 24: That the proponent commits to developing a Fire Management Plan to the requirements of DEC.

  Discussion: Given the close proximity of the Solomon Project to Karijini National Park, there is need for the proponent and DEC to have suitable fire management resources and arrangements in place and an ongoing consultative arrangement with DEC in regard to fire management. FMG's Fire Management Plan should be developed in collaboration with DEC, to ensure that adequate communicative and cooperative arrangements are in place between FMG and DEC for fire events in the area (both bushfires and prescribed burns).

  Fortescue Response:

  Fortescue has committed to the preparation of a Fire Management Plan as indicated in the Environmental Commitments table (Table 61) of the PER. This plan will cover all aspects of fire management where the potential for significant environmental impacts, including impacts to Karijini National Park, may occur. The key objective of the Fire Management Plan will be to manage risks of unplanned fire to the public and the environment.

- ***Ref 61: Groundwater and groundwater dependent ecosystems***

  Recommendation 25: That the proponent assesses the potential impacts on groundwater dependent ecosystems prior to approval. This will require the groundwater modelling to be completed and the expected dewatering drawdown cone relative to any groundwater dependent ecosystems to be presented.

  Recommendation 26: That the proponent assesses the environmental impacts of any proposed stream diversion prior to any approval.

  Recommendation 27: That, once the hydrological studies have been completed, the proponent develops methodologies for management of groundwater dependent ecosystems in consultation with DEC.

  Discussion: On the basis of the limited information on this aspect provided in the PER, it is unclear whether the proposed management strategies are feasible or appropriate. The PER indicates the presence of numerous permanent pool systems potentially impacted by dewatering at Valley of the Kings, Trinity and Valley of the Queens (pp. 128-130). The document states that some of these pools are thought to be groundwater fed. In order to adequately consider impacts on and appropriate management for these pools, a map showing the location of the pools relative to the project footprint and groundwater drawdown cone that will result from dewatering in the Kings mine area is required. Also, a description of the conservation values of the pools should have been provided, in particular a description of the significance of the vegetation community and aquatic fauna species occurring in the permanent pools and how these may be affected by changes to water quality or groundwater levels. This information should be provided prior to any project approval. The document refers to stream flow diversion of Kangeenarina Creek at Trinity to stop recharge to the underlying channel iron deposit (CID) (p. 130). The environmental impacts of this aspect of the proposal do not appear to have been fully considered. Details of any planned stream diversions and potential environmental impacts need to be provided by the proponent and assessed prior to approval.

  The document refers to stream flow diversion of Kangeenarina Creek at Trinity to stop recharge to the underlying channel iron deposit (CID) (p. 130). The environmental impacts of this aspect of the proposal do not appear to have been fully considered. Details of any planned stream diversions and potential environmental impacts need to be provided by the proponent and assessed prior to approval.

  The document states that the pools will be maintained through a combination of surface water supplementation through discharge water, stream flow diversions and groundwater reinjection up-gradient of the pools (p. 130). Stream flow diversion and surface water supplementation may not be

appropriate management for groundwater dependent ecosystems. Reinjection is likely to be the preferred option for maintaining the groundwater dependent communities, but the proponent does not appear to have investigated the feasibility of this option at the relevant permanent pools. It is recommended that the proponent discusses appropriate management of groundwater dependent ecosystems with the OEPA, DEC and the Department of Water.

Fortescue Response:

The water level monitoring records for the Kangeenarina and Zalamea Pools indicate that the pools are not permanent features of the drainage lines, but are surface expressions of a high watertable and are considered episodic. Monitoring of these pools by Fortescue has been during a "drying" phase and by December 2010 both the Kangeenarina and Zalamea pools had completely dried out. Hydrological studies completed subsequent to the public release of the PER have shown that maintenance of the water flows to the areas in which the pools can develop is readily achievable by re-injecting water into the alluvial materials up gradient of where the pools developed. Modelling has shown that re-injection at a rate of 10 litres per second will be sufficient to ensure groundwater levels (and associated groundwater dependent ecosystems) will be maintained throughout the life of mining operations. It is proposed to conduct further hydrogeological investigations to determine the optimal location for injection to minimise recirculation to active mine pits and efficiently maintain the downstream water flow within observed levels. Indicative injection areas are provided in Figures 2 and 3.

Fortescue acknowledges that the environmental impacts associated with the stream flow diversion of Kangeenarina Creek at Trinity to prevent recharge to the underlying CID has not been addressed in the PER. Fortescue agrees assess the environmental impacts of any stream diversion prior to any approval.

- ***Ref 62: Subterranean invertebrates of conservation significance***

  Recommendation 28: That the proponent considers the impacts of the Solomon Project on the Priority 1 ecological community 'subterranean invertebrate community of pisolitic hills in the Pilbara'.

  Recommendation 29: That the proponent minimises impacts from the Solomon Project on the 'subterranean invertebrate community of pisolitic hills in the Pilbara' PEC, as far as practicable.

  Discussion: DEC has previously identified and recorded a number of occurrences of the Priority 1 ecological community 'subterranean invertebrate communities of mesas and hills in the Robe Valley'. At a meeting of the Western Australian Threatened Ecological Communities Scientific Committee

(TECSC) on 12 November 2010, the committee recommended that the description of the PEC be amended to 'subterranean invertebrate community of pisolitic hills in the Pilbara' in recognition of the broader distribution and range of forms of the community and the landscape-scale threats to it. This new community name and description will be amended and updated on the DEC website and where the community occurs in the Solomon Project area, it should now be recognised as comprising a PEC.

Fortescue Response:

The Priority 1 Priority Ecological Community (PEC) described occurs in "pisolitic hills in the Pilbara" (DEC response to Draft Solomon PER), while the subterranean fauna habitat in the Kings area comprises Channel Iron Deposits (CID) in the valleys of the Hamersley Ranges, which is a different geological formation. As a result of this:

- The cited PEC definition should not be applicable to the Kings Project area; and
- The valley CID formation may provide a less restricted subterranean habitat than the pisolite hilltops/ mesas originally designated as a PEC.

It should be recognised that there are many different subterranean fauna communities in numerous geological habitats throughout the Pilbara. The current PEC listing of "pisolitic hills in the Pilbara" does not adequately cover many of these potential habitats.

The Solomon Project includes several potential subterranean fauna habitats in different geologies including CID at Kings, Banded Iron Formation (BIF) and Detrital Iron Formations (DIF) at Firetail, neither of which are relevant to this PEC classification.

- ***Ref 63: Troglofauna***

Recommendation 30: That the proponent demonstrates that the Solomon Project will not unacceptably impact on the conservation of newly described/undescribed troglobitic invertebrate species (including some potentially restricted troglobitic species) only known from the Solomon Project area).

Recommendation 31: That a habitat assessment and the data from the regional troglofauna sampling currently being undertaken by the proponent (p. 150, PER) be provided and considered by the EPA prior to approval of the Solomon Project.

Recommendation 32: That the proponent demonstrates, through further sampling and habitat assessment, that the rich troglofauna communities

associated with the geology of the valley floors extend beyond the Solomon Project footprint.

Recommendation 33: That, if the regional sampling does not provide data to support the hypothesis that the troglofauna communities are unlikely to be restricted, the OEPA considers a staged approval process for the Solomon Project. The proponent needs to commit to the conservation of a proportion (e.g. 30 per cent) of the current known extent of troglofauna habitat (based on the habitat assessment). Further mining could be approved if the proponent's additional survey work determines that troglofauna communities have a wider distribution outside of the Solomon Project area, within areas not currently proposed for development.

Discussion: The PER (p. xxxvi) indicates that there are rich troglofaunal communities associated with the valley floor pisolite geology. Ten species of troglofauna recorded from the Firetail impact zone are currently only known from the Solomon Project impact areas. Seventeen troglobitic morpho-species collected at Kings Mine may represent locally restricted troglofauna species; since their distribution beyond the Solomon area cannot be confirmed or discounted at this time (p. 4, Appendix 13). The rich troglofaunal communities of the project area appear to be closely associated with the geology of the valley floors. Based on the information provided in the PER, it appears that there will be a significant impact on these troglofauna communities, and potential for loss of species, as a result of mining operations.

The PER states that "Fortescue is currently [undertaking] additional regional troglofauna sampling to further define the distribution and abundance of troglofauna species…" (p. 118, PER). This information is required to assess the impacts of the current project on troglofauna and would ordinarily have been expected to be included for review within the PER. The proponent needs to provide the data from the regional survey prior to environmental approval to support its assertion that the troglofaunal community is not restricted and won't be significantly impacted by the Solomon Project. Any further surveys should include sampling of reference sites within the valley floor geology extending beyond the proposal footprint and outside of any areas proposed for future development. A habitat assessment utilising both biological and geological data should also be provided to support the survey data and confirm that the project is unlikely to lead to a level of habitat loss that places species at risk of extinction.

In the event that the regional survey data do not support the wider distribution of the troglofauna community beyond the mine footprint, a staged mining approval process involving further sampling in areas outside the footprint should be considered. In the interim, it is recommended that the proponent

commits to the conservation of a proportion (e.g. at least 30 per cent) of the habitat for restricted troglofauna communities. The location and design of subterranean fauna conservation area(s) should be determined in consultation with the OEPA and DEC and be based on the troglofauna survey data and the habitat assessment. Further mining could then be approved if additional survey work determines that troglofauna communities have a wider distribution outside of the Solomon Project area, within areas not currently proposed for development.

Fortescue Response:

Regional surveys have been undertaken to identify occurrence of troglofauna species outside of the proposed Solomon project impact areas (Appendix A). The results found that 36% of the troglofauna species recorded from the Kings area also occur outside of the Solomon project impact area. Additionally, 91% of the troglofauna species that were recorded only from the proposed Firetail mine area were also recorded outside of the impact area. These findings suggest that there is a high potential for some troglofauna species to be locally widespread, and/or potential for habitat connectivity between Solomon impact areas and regional reference areas. The number of troglofauna species recorded is expected to increase significantly to increase with further taxonomic study and field survey.

Fortescue is committed to undertaking additional regional survey work to determine whether the Solomon troglofauna communities have a wider regional distribution. In the interim, Fortescue will stage mining of the Solomon Project and commits to the conservation of the Zion deposit, from where 56% (15 of a total of 27 species) of species known from Solomon were recorded. Additionally 5 of the 17 species currently known only from inside the Solomon impact area were recorded from Zion.

Additionally, the indicative SRE status of troglofauna taxa collected from the Solomon project area was provisional at the time of the release of the PER, and based primarily on available information at the time. Confirmation of 10 species in reference areas that were previously only known from Solomon impact areas indicates that a proportion of the community is not range-restricted. Further information from the regional survey is likely result in additional species being recorded outside of impact areas.

It is not uncommon to find collected species that are rare or difficult to detect (e.g. singletons), which may result in species being detected only inside the impact area. This is considered a common practical limitation of survey methodologies for subterranean fauna, and is generally not considered to indicate the presence of true range-restricted fauna.

- ***Ref 64: Stygofauna***

  Recommendation 34: That the proponent demonstrates that the distribution and habitat for the diverse stygofaunal community of the Kings mining area (including the eight short range endemic (SRE) stygofauna species currently only known from this mining area) extend beyond the mining impact areas, taking into consideration the extent of the dewatering drawdown cone. This will require the proponent to provide the predicted dewatering drawdown cone at the Kings mining area and to provide the data from the regional survey work beyond the mining/drawdown cone footprint.

  Recommendation 35: Where stygofaunal species have been recorded elsewhere in the region and this information has been used to discount the significance of the impact of the Kings mining proposal on a species, it is recommended that confirmation be provided that the samples referred to were taken from reference sites not proposed for impact and that the species is not restricted to ore bodies for other approved mining projects or mining proposals.

  Recommendation 36: That, if the planned regional sampling does not provide data to support the hypothesis that the stygofaunal community extends beyond the proposal footprint, a staged approval process is considered for the Solomon Project. The proponent should commit to the conservation of a proportion (e.g. at least 30 per cent) of the current known extent of stygofaunal habitat in the interim and further mining could be approved if the proponent's additional survey work determines that the stygofaunal community has a wider distribution outside of the Solomon Project impact area, within areas not currently proposed for development.

  Recommendation 37: That the proponent and the EPA note that PER Figure 19a does not adequately represent the diversity of stygofauna to species (morpho species) level to allow adequate comparisons of species diversity across the project site.

  Discussion: The stygofauna community in the CID aquifer is considered to be diverse (p. 148, PER). "Based on the existing data, 42% (8 morpho species) of species may represent locally restricted SRE species; since their distribution beyond the Solomon area cannot be confirmed or discounted at this point in time" (p. 4, Appendix 13). Based on the information provided in the PER, the proposal may therefore significantly impact on and potentially result in the loss of stygofaunal species.

  Sampling was only undertaken within the mine footprint in the Kings mining area. Sampling at reference sites is required to demonstrate the extent of the stygofaunal community beyond the proposal footprint at Kings Mine, noting

that the footprint includes the dewatering drawdown cone, which has not been provided by the proponent in the PER, as well as the mined ore body. The rich stygofaunal community of the project area appears to be associated with valley floor geology and similar geology outside the direct impact area should be sampled to determine distribution beyond the project impact area. Both the draft and the final PER state that work is underway to accurately model the extent of aquifer drawdown and to further define the regional extent stygofauna species recorded from the impact areas (p. 150), however these data are not yet available. The potential impacts of the Solomon Project on stygofauna cannot be adequately considered without this information.

Fortescue Response:

The results found that approximately 80% of stygofauna species recorded in the Solomon impact area have also been recorded in reference areas, outside of proposed impact areas. The number of stygofauna species recorded is expected to increase significantly to increase with further taxonomic study and field survey.

Of the eight SRE stygofauna species that are referred to, five have subsequently been confirmed from the regional sampling as occurring outside of impact areas to date. Results from the second round of sampling may result in this number increasing.

Reference areas have been designated on the basis that dewatering impacts will not extend beyond the proposed mining impact areas.

Data from the regional stygofauna survey is provided in the form of a Regional Subterranean Fauna Assessment Report (see Appendix A).

Seven regional reference areas were sampled to provide regional context for the stygofauna assessment of the Solomon Project. These areas include Castle Camp, Kangeenarina Creek, Mt Florance Pastoral Station, Serenity, Sheila Valley East, Sheila Valley West and Weelamurra Creek. Reference areas have been designated on the basis that dewatering impacts will not extend beyond the proposed mining impact areas.

At present the seven regional reference areas are not proposed to be mined or impacted either as part of the Solomon Project or as part of other mining projects/proposals.

To date of the 22 stygofauna species recorded in the Solomon mining area, 17 have also been found outside of proposed impact areas (77%). These results strongly support the hypothesis proposed in the PER that the stygofauna community recorded from Solomon extends beyond the proposal footprint. Additionally the identification of regional specimens is ongoing and

the regional distribution of stygofauna species recorded only from Solomon is likely to increase.

Following completion of the regional stygofauna taxonomic analysis, if the data is found not to support the hypothesis that the stygofauna communities are unlikely to be restricted, Fortescue is committed to undertaking additional regional survey work to determine whether the Solomon stygofauna communities have a wider regional distribution. In the interim, Fortescue will stage mining of Solomon Project area and commits to the conservation of the Zion deposit, from where 56% (15 of a total of 27 species) of species known from Solomon were recorded. Additionally 5 of the 17 species currently known only from inside the Solomon impact area were recorded from Zion.

Figure 19a of the PER provides an annotated version of the diversity of stygofauna. Detailed data that adequately represents the diversity of stygofauna (to species or morpho species level) is provided in tables 27 and 38 of the PER and Figures 3.7 to 3.24 in Appendix 13. Further detailed species identification data is provided in the Interim Regional Assessment Report (Appendix A).

In addition to sampling within the mine footprint of the Kings mining area, regional sampling has been undertaken at 72 sites in seven reference areas has been undertaken and the available data is provided in the Interim regional assessment report (Appendix A). This report includes a map of regional sites surveyed relative to the Solomon deposits.

There are often some species which are rare or difficult to detect (e.g. singletons), which may result in species being recorded only inside the impact area. If the majority of the subterranean assemblage is found to range outside of the impact areas, it is likely that there is connectivity of habitat and/or potential for refuge areas outside of impact zones. In this case it is unlikely that the remaining species in the assemblage have restricted distribution unless the habitat information suggests discontinuity or heterogeneity of habitat, or the ecology of a particular taxon indicates potential for range-restricted distribution.

- ***Ref 65: Short range endemic invertebrates***

  Recommendation 38: That the proponent considers a commitment to progressive full or partial backfilling of the valley floor, to ensure the operation does not create a permanent barrier between SRE invertebrate populations that may exist on the ridgelines on either side of the valley.

  Recommendation 39: That the proponent develops an appropriate closure and rehabilitation plan to restore habitat connectivity post-mining.

Discussion: The valley floors may be an important dispersal corridor for SREs (and other animals) between upland habitats. The removal of the valley floor during mining may therefore inhibit the dispersal of SRE species across and along the valley. Given the project is removing a large area of the valley floor, consideration should be given to undertaking mining and rehabilitation in a way that ensures that a permanent barrier is not created to inhibit the dispersal of SREs across the mining area.

Fortescue Response:

Fortescue will commit to the progressive partial backfilling of the valley floor to ensure the mining operations do not create a permanent barrier between SRE invertebrate populations that may exist on the ridgelines on either side of the valley. It will not be possible to completely backfill mine voids, however sufficient connectivity between upland habitats will be maintained or established through appropriate rehabilitation and staging of mining.

- ***Ref 66: Vertebrate Fauna - Pilbara Leaf-nosed Bat***

Discussion: The fauna survey reports in Appendices 9 and 10 identify the potential for Pilbara leaf-nosed bats to occur in the area, given the presence of suitable habitat for this species. The Pilbara leaf-nosed bat was not recorded during either survey phases, which may be due to limitations in the survey methodology. The Coffey (2008) report states that "Caves within the gorges in the Valley of the Kings, Valley of the Queens and Firetail could provide suitable maternal roosts for the Pilbara leaf-nose bat. Restrictions imposed by areas not being searched by heritage assessment teams have meant there has not been a thorough search of the area for the Pilbara leaf-nosed bat" (p. 65, Appendix 9). In the subsequent survey report by Ecoscape (2010) there is very little detail regarding the bat survey methodology and survey sites, however, it is recognised that "Although no individuals were recorded during the surveys, the presence of suitable habitat such as caves means it should be considered to potentially occur in the Firetail study area" (p. 42, Appendix 10).

The report for the Kings mining area by Ecologia (2010) also indicates that a limitation of the bat survey undertaken at Valley of the Kings was that numerous caves were observed along the slopes of the ranges which may provide suitable roosting sites for bats, but that these sites could not be surveyed as they were inaccessible (p. 45, Appendix 2).

The PER does not include any discussion about the Pilbara leaf-nosed bat, its potential to occur in the project area, and possible limitations in bat survey methodology. It is therefore recommended that as a minimum, the proponent provides information on the bat survey methodology undertaken for both the Firetail and Kings project areas, particularly in reference to detecting the

presence of the Pilbara leaf-nosed bat. Given that the report by Coffey (2008) and Ecoscape (2010) identifies that the Pilbara leaf-nosed bat could occur in the project area, and that limitations have been identified in terms of the scope and methodology of the surveys, the proponent should also commit to undertake further bat surveys, in consultation with DEC, to determine the presence/absence of the species and particularly whether any maternal roosts exist in the project area.

Fortescue Response:

Fortescue believes that an appropriate level of investigation (three surveys over two seasons) to determine the presence of the Pilbara Leaf-nosed Bat has been conducted for the Solomon Mine area and that additional bat surveys are not necessary. However, Fortescue is committed to undertaking searches of potential maternal roost areas and caves that may be impacted by the construction of the rail.

A combination of searching of caves in and adjacent to the Solomon Project area as well as extensive Anabat recordings undertaken during baseline surveys of proposed mine or rail areas did not identify any evidence of the Pilbara Leaf-nosed Bat from the Project area.

The initial 2008 vertebrate fauna survey of the Solomon Project area conducted by Coffey Environments (Appendix 9) recorded bat echolocation calls using the Anabat II system. Recordings were taken for 10-12 hours per night on 14 occasions at 21 sites near permanent water, gorges, flyways and accessible forested areas. Call data sequences were examined using AnalookW 3.3f software and representative call sequences were imported into the software package Analyze where three call variables were measured; pulse duration, maximum frequency and end frequency. Dr Kyle Armstrong (from Specialised Zoological), a recognised expert in analysing bat echolocation recordings, particularly the Pilbara leaf-nosed bat, interpreted the bat recording and undertook bat identifications. The locations of Anabat recording sites are provided in the PER (Appendix D and Figures 12 and 13 of Appendix 9). No echolocation calls of the Pilbara leaf-nosed bat were recorded during the 2008 Coffey Environment surveys of the Solomon Project Area. However the report associated with the initial survey recommended additional survey investigation for the Pilbara Leaf-nosed Bat in gorges in the valley of the Kings, the Valley of the Queens and Firetail. These additional investigations were undertaken by Ecologia (Appendix 2) and Ecoscape/Bamford Consulting (Appendix 10) in 2010.

In total more than 295 hours of calls at 16 sites were recorded to Anabat recorders by Ecologia and analysed to determine the presence and identity of bats for the Kings area. Recordings were taken from sites near permanent water, cave entrances, gorges and along cliff faces with caves and rock

overhangs (Figure 3.2, Appendix 2). Kyle Armstrong (Specialist Zoological) and Bob Bullen (Bat Call WA) identified bat acoustic calls to species level. The analysis of the call recordings did not identify any evidence of the Pilbara Leaf-nosed Bat during the 2010 Ecologia surveys of the Kings area.

Similarly, Ecoscape/Bamford Consulting (Appendix 10 of PER) recorded bat echolocation calls using the Anabat II recorder at seven sites totalling 60 hours within the Firetail area (Map 3, Appendix 10). Recordings were analysed by Kyle Armstrong and Mike Bamford against the bat call data library held by Bamford Consulting. While the bat assemblage from Firetail was considered typical for the Hamersley Range and the bat species that were recorded were expected (pg. 34, Appendix 10), there was no evidence of the Pilbara Leaf-nosed bat from the Firetail area.

- ***Ref 67: Vertebrate Fauna – Northern Quoll***

  Recommendation 43: That, given the potential regional significance of northern quoll habitat in the Solomon Project area, the proponent provides information on what actions will be implemented to protect the habitat of this species.

  Recommendation 44: Any plans to relocate and/or translocate northern quolls be discussed with DEC, and if deemed necessary, implemented according to DEC requirements.

  Discussion: Evidence of the northern quoll in both the Kings and Firetail study areas was recorded in the surveys by Coffey (2008), Ecoscape (2010) and Ecologia (2010). It is recognised in all three fauna reports that suitable habitat for the northern quoll is present in most of the Solomon Project area, particularly in the valley floor habitat. Given the large area of valley floor habitat to be disturbed within the Solomon site, Ecologia (2010) recognises that the area "may represent a significant area of habitat within the Hamersley subregion, potentially resulting in a higher level of regional impact" (p. 43-44, Appendix 2). Ecologia's risk assessment allocates the northern quoll to the highest level of risk, with the project having a 'Major' impact, as mining processes may result in the loss of the local population. (p. 56, Appendix 2).

  The PER proposes to implement a trapping and relocation program immediately prior to habitat clearing for all areas identified as high risk for northern quoll. It also states that translocation programs will be implemented. Relocating and translocating fauna require an implementation plan and an ongoing monitoring program. Any plans to relocate and/or translocate fauna would require consultation with DEC, and would need to be implemented in accordance with DEC requirements. The proponent has not consulted DEC on fauna relocation and translocation to date. DEC's preferred approach to managing impacts on northern quoll involves avoiding impacts on significant areas of known habitat for the species wherever possible. The PER does not

include any information on how habitat for the northern quoll may be able to be protected to ensure impacts on habitat and populations utilising the area are minimised.

Fortescue Response:

Fortescue agrees to discuss with the DEC any proposal to relocate and/or translocate Northern Quoll. If required, any proposed Northern Quoll relocation and/or translocation plan will be implemented according to DEC requirements.

Multiple surveys during 2008 and 2010 have resulted in the capture and recording from secondary evidence (i.e. scats and diggings) of only six Northern Quoll records from the Solomon project area, indicating that the likely population size with the Solomon project area is relatively small. Approximately 5400ha of habitat suitable for the Northern Quoll has been identified within Solomon project. The total area of suitable habitat proposed to be impacted is approximately 1000ha.

Fortescue commits to the development and implementation of an offsets package that aims to protect and conserve suitable habitat for conservation significant fauna species including the Northern Quoll.

- ***Ref 68: Vertebrate Fauna – Varanus sp.***

  Recommendation 45: That the proponent undertakes further investigations with the WA Museum to identify the varanid specimen captured during the Coffey (2008) survey.

  Discussion: An unidentified varanid was recorded in the project area in the survey by Coffey (2008). This may be a juvenile specimen of a known species, or may be a new species. Coffey (2008) recommends further investigation to more conclusively identifies this specimen (p. 66, Appendix 9).

  Fortescue Response:

  Photographs of the unidentified varanid specimen collected during the 2008 Coffey Environments survey were shown to number of herpetofauna experts including WA Museum staff, but there has been no verification of the identity of the specimen to date. Scott Thompson (Terrestrial Ecosystems), who coordinated the 2008 Coffey vertebrate survey of the Solomon project area, has advised that the specimen is believed to be a juvenile of a recognised species and its external colour pattern may change as it grows to adult size and its species can be confirmed.

- ***Ref 69: Vertebrate Fauna – Habitats***

  Recommendation 46: That the Fauna Management Plan include measures for the protection of a range of habitat types from mining activities in order to ensure the conservation of fauna populations within the project area. Particular reference should be made to protecting creek bed and rocky cliff habitats, which are known to contain a range of significant species.

  Discussion: The results of the fauna survey (Appendices 2, 9 and 10) indicate that the Solomon Project area is of high value for fauna conservation at the regional level. It has higher species richness in small vertebrate fauna than other sites surveyed in the region, an unusual trappable fauna assemblage structure, and a particularly high number of top order reptile predators (Coffey, 2008). This is a reflection of the range of habitats represented within the Solomon Project area. The spinifex habitat types are generally widespread across the region, however the creek bed habitat common on the valley floors is much less common throughout the region, and impacts on this habitat have the potential to have regional scale significance. Seven of the 16 species of conservation significance recorded in the Ecologia (2010) survey prefer this habitat. The rocky cliffs also provide habitat for a range of significant species, including the ghost bat, Pilbara leaf-nosed bat and northern quoll, and while this habitat is widespread across the Hamersley Ranges, it is particularly susceptible to mining activities such as blasting. The ephemeral pools within the project area also provide habitat for a number of fish and amphibian species, which could be impacted by changes in hydrology.

  The PER does not fully recognise the value and potential regional significance of the Solomon Project area in terms of the diversity of fauna and fauna habitat. While standard management measures are proposed to minimise general impacts on fauna, it is recommended that the Fauna Management Plan contains measures for the protection of a range of habitat types from mining activities and other threats in order to ensure the conservation of fauna within the project area.

  Fortescue Response:

  Fortescue commits to developing and implementing a Fauna Management Plan that includes, wherever possible, measures for the protection of a range of habitat types from mining activities to ensure the conservation of fauna populations within the Solomon project area.

  Additionally Fortescue commits to the development and implementation of an offsets package that aims to protect and conserve suitable habitat for conservation significant fauna species, the Northern Quoll and Mulgara in particular, outside of the Solomon Project area.

It has been found that during extended periods between recharge events the pools associated with Zalamea Gorge and Kangeenarina Creek dry up. This provides evidence that the pools are episodic rather than ephemeral or permanent features and therefore unable to sustainably provide habitat for any fish or amphibian species. However, as previously discussed, Fortescue is committed to ensuring that the groundwater levels associated with the pools are maintained during and after mine operations through re-injection into the sediment upstream of the pools.

- ***Ref 70: Vertebrate Fauna – Fauna Habitat***

  Recommendation 47: That further information is provided by the proponent on the amount and significance of predicted disturbance of the Wona Land System tussock grasslands and the associated potential risk to fauna of conservation significance, in order to demonstrate whether the scale of disturbance warrants a targeted on-ground fauna survey for this habitat type.

  Discussion: The fauna report for the Solomon Rail Project by Coffey (2010) identifies that little is known about the fauna assemblage or species of conservation significance that are present in the tussock grasslands associated with the Wona Land System. Coffey (2010) recommends that undertaking fauna surveys in this habitat type will provide the information necessary to determine the potential impact of constructing a railway line and associated infrastructure.

  Figures 8a and 8b in the PER show that a significant portion of the rail corridor in the eastern section traverses the Wona Land System. However, there is no discussion in the PER on the lack of data on the fauna assemblages in this habitat type. Further information should be provided by the proponent on the predicted level of disturbance to the Wona Land System tussock grasslands, the significance of this in terms of the regional extent and distribution of affected communities, and the potential risk to fauna of conservation significance, in order to demonstrate whether the scale of disturbance warrants a targeted on-ground fauna survey in this habitat type.

  Fortescue Response:

  As discussed previously, based on vegetation mapping and floristic data collected from the flora and vegetation survey of the Solomon rail corridor, the Solomon Rail corridor contains two of the 'Four Plant Assemblages of the Wona Land System' PEC. The two sub-units are:

  - Mitchell grass plains (*Astrebela* spp.) on gilgai; and
  - Mitchell grass and Roebourne Plain Grass (*Eragrostis xerophila*) plain on gilgai (typical type, heavily grazed).

Approximately 60ha of the 2146ha mapped tussock grassland associated with these two subunits within the rail corridor is proposed to be disturbed by the construction of the rail.

Within the rail corridor, the two Wona LS subunits correspond to an area identified by Coffey Environments (Appendix 19) as having a moderate to high risk of supporting habitat for the Northern Quoll. As discussed by Coffey Environments in Appendix 19 f the PER, little is known about the fauna assemblage or conservation significant species that may be present in the tussock grasslands associated with the Wona Land System.

Fortescue commits to undertaking additional fauna surveys within the two subunits of the Wona Land System prior to the commencement of construction will provide the information necessary to determine the potential impact of constructing a railway line and associated infrastructure to determine the potential risk to fauna species of conservation significance.

- ***Ref 71: Closure Management***

  Recommendation 48: That the proponent commits to fully rehabilitate any areas planned for management by DEC for conservation purposes impacted by this proposal in a manner consistent with conservation as the final land use.

  Recommendation 49: That the proponent commits to backfill mine voids to at least two metres above the pre-mining water table level and, if this is not possible, the proponent provides further information with respect to the predicted water quality within potential pit lakes prior to approval.

  Discussion: If approved as part of this project, the airstrip within the Hamersley Station pastoral lease exclusion area, which is proposed to become a conservation reserve, and the portion of Mount Florance pastoral lease purchased by DEC and managed for conservation, need to be rehabilitated to a standard consistent with their intended conservation reservation status.

  Plan 2 (p. 240, PER) for Kings mine rehabilitation shows water in the mine void. DEC recommends backfilling of mine voids to at least two metres above the pre-mining water table level. The PER states that "both surface and groundwater drainage will be specifically designed to maintain current surface and subsurface hydrological flow regimes" (p. 242). However, no information has been provided on the hydrology or the predicted water quality in the pit void. Commitments regarding backfilling of the pit and the water quality of any pit lake formed should be clarified prior to approval.

  Fortescue Response:

Fortescue commits to fully rehabilitate any areas planned for management by DEC for conservation purposes impacted by this proposal in consultation with DEC.

Mining will be staged to ensure either side of the CID valley will remain connected with upland habitat. Overburden and mine waste will be backfilled into depleted mine voids to ensure that connectivity is maintained.

The airport is likely to be retained for subsequent, other users provided the responsibility for management can be transferred. If not, Fortescue will remove all associated infrastructure and rehabilitate the airstrip and infrastructure footprints using consistent rehabilitation techniques.

Mine waste will be backfilled into depleted mine voids, where possible and post closure landforms will be engineered to ensure evaporation of mine pits does not result in negative impacts on water quality/quantity.

- ***Ref 72: Rehabilitation monitoring***

  Recommendation 50: That the proposed rehabilitation monitoring program is based on data obtained from quadrats established in the pre-mining flora and vegetation surveys to provide for comparison of vegetation structure and composition as the basis for assessing rehabilitation performance.

  Discussion: Given that there are floristic community types restricted to the mining areas, some of which are both locally and regionally significant, it may not be possible to establish comparable monitoring sites outside of the mining area for determination of the performance of rehabilitation. The monitoring program should make use of data from quadrats established in the original flora and vegetation surveys for comparison of vegetation community structure and composition and to determine rehabilitation performance. Ecosystem function analysis alone is not regarded as suitable for monitoring rehabilitation success for this proposal.

  Fortescue Response:

  Fortescue will use the information provided by the baseline studies to assist in creating self-sustaining ecosystems comprising of flora, vegetation associations and fauna species, appropriate to the final post-mining land use.

  Ecosystem function analysis will be used in combination with the information provided by the baseline studies to establish the most appropriate rehabilitation criteria.

- ***Ref 73: Environmental Management System***

  Recommendation 51: That the proponent develops an environmental management plan for the Solomon Project to clarify its management commitments prior to approval.

  Discussion: The PER does not include a draft environmental management plan. Management is a significant consideration with respect to the determination of residual risk of this proposal. The proponent's commitment to manage impacts effectively could be demonstrated by the development of this plan and review by relevant government agencies.

  Fortescue Response:

  Fortescue commits to the development of environmental management plans clarifying management commitments for the Solomon Project in accordance with ministerial approval conditions. A key component of the Project will be an Environmental Management Plan (EMP) that considers site specific issues for both construction and operation.

  Fortescue has developed design considerations, mitigation measures (including existing and project specific Environmental Management Plans (EMPs), and environmental management commitments, as detailed throughout this PER. These commitments will be complied into an Environmental Management Plan to ensure that the Project will be constructed and operated in an environmentally and sustainably responsible manner, to the satisfaction of the EPA and other relevant authorities.

3.6 MT FLORANCE STATION

- ***Ref 74: Water Flow Issue***

  Non-restriction of the water flow through the landscape to the north. This is critical so that there is no impact on the vegetation north of the rail corridor. Construction of the rail line must meet the requirements of the sheetflow for the portion of the line crossing Mount Florance lease because it is at this stage that the rail line is parallel to the Hamersley Ranges running along the foothills increasing the potential for disturbance to the vegetation down the slope. Proposed management 23.4.3 dot points 3, 5 and 6 are of concern if they do not reflect the requirements of the Mulga communities which may be slightly outside the 200m downstream classification. A monitoring system will have to be implemented to measure long term effects.

  During a site visit of the rail corridor area, information was provided of the potential for high velocity flows down the Southern Fortescue and therefore the need for a suitable bridge design was critical to cope with

that flow. The potential for vegetation loss due to erosion should the bridge give way is very significant. According to the PER Part 1: 2.2.2, dot point 2 the current alignment has only one bridge which we have been assured is not the case and at this point there are two 100m open span bridges planned although the final decision has not been made. This is a better proposal to allow the potential flow through. We are still concerned about the 'sacrificial' section east of the bridge and the impact this may have downstream if it does give way. Depending on the height of the rail line a considerable amount of water could come down into the Florance proper and create havoc downstream through our lease and into Collawanyah Station. Again the implementation of a monitoring system will be critical to measure long term impacts.

Range Gorge is a significant creek requiring appropriate management. The Mulga communities downstream of the rail line are very easily eroded in the event of high velocity water flow should the rail give way. It is also a flood out area downstream into the mulga so that has to be maintained. As with the above points a monitoring system will have to be implemented.

Fortescue Response:

Following the release of the Solomon PER for public comment on 10 November 2010, more detailed rail design identified the requirement for an additional bridge across the Fortescue River South. The rail will be designed to accommodate a 1 in 100 year flood events and culverts 900-1200mm culverts will be evenly spaced along the rail alignment and aligned and constructed to ensure flows existing culverts are re-established to maintain sheet flow regimes to Mulga communities and minimise erosion. The majority of the Mulga-dominated communities bisected by the proposed rail alignment or within the rail corridor are associated with the Fortescue River Basin, particularly within the section of the rail corridor between Hooley Road and Mulga Downs Road. Fortescue is committed to implementation an appropriate monitoring programme to ensure surface water sheet flow regimes are maintained.

Fortescue acknowledges that Range Gorge, to the east of Wittenoom (Figure 4), support a significant creek system that will require appropriate management to ensure that Mulga communities downstream of the rail are not eroded should the rail embankment be breached during a flood event.

- ***Ref 75: Land Tenure and Vegetation Condition Assessments***

The project area is situated within active pastoral leases which have been in existence for up to 140 years, grazed according to the regulations under the various Land Acts over that time and are not conservation estates. As pastoral leases they may have altered

vegetation communities and there will be signs of grazing however this does not mean that the vegetation is degraded. From a purist environmental perspective this may be considered to be that case and appropriate to a conservation area but not on a pastoral lease. The repeated reference to degraded sections of the rail corridor by the presence of weeds and signs of grazing needs to be revised to present a balance description acknowledging legislated land use not just tenure. While the 'weed' is not identified in each of these particular instances we believe it is generally a reference to Buffel and/or Birdwood grass.

Fortescue Response:

Fortescue acknowledges that the rail component of the Solomon project is located on land that has a pastoral land use, not for biodiversity or conservation purposes. A standardised vegetation condition rating scale, recommended by the DEC for assessing native vegetation condition, was adopted by Fortescue botanical consultants for determining native vegetation condition for all baseline flora and vegetation surveys undertaken for the Solomon project. The Trudgen condition rating scale classifies degraded condition vegetation as an area that is completely or almost completely without native species in the structure of the vegetation. While presence of weed species and grazing may be considered appropriate for pastoral land uses, the environmental impact assessment process only allows for weeds and grazing to be considered in terms of their impact on the environment.

- ***Ref 76: Land Tenure and Vegetation Condition Assessments***

  Buffel and Birdwood grasses may well be high in the list of environmental weeds but in a pastoral land use situation they are considered to be of high carrying capacity and a naturalised species. Again balance needs to be given when describing vegetation assessments in the proposed project area which are pastoral leases.

  Fortescue Response:

  Fortescue acknowledges that neither Buffel Grass (*Cenchrus ciliaris*) nor Birdwood Grass (*Cenchrus setiger*) are listed as declared plants under the *Agriculture and Related Resources Protection Act 1976*. However, both species are identified in the Environmental Weed Strategy (CALM, 1999) as having a high rating due to their impact on biodiversity. Buffel Grass is also identified in the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) on-line search tool as posing a high threat to biodiversity. Although both species may be considered suitable for livestock forage, revegetation and erosion control, both species can only be considered in terms of their impact on the environment.

- ***Ref 77: Land Tenure and Vegetation Condition Assessments***

There is an absence of reference to seasonal conditions for the 2010 assessments. After the very much below average rains for the summer of 2009/2010 the flora and fauna are likely to be affected. Any assessments done in 2010 will be affected by seasonal conditions. Any future assessments by consultants or FMGL personnel would benefit by speaking to the local people to gain a better understanding of the area.

Fortescue Response:

Page 59 of the PER (Section 8.2, paragraph 3) states the seasonal conditions at the time of the 2010 Solomon flora and fauna surveys were poor for the collection of ephemeral species and flowering grasses due to the low summer rainfall preceding the surveys. Fortunately seasonal conditions preceding the previous surveys undertaken in 2008 were considered good with average to above average rainfall recorded at Bureau of Meteorology stations at Wittenoom, Tom Price, Millstream and Pannawonica which enabled the collection and accurate identification of the majority of known and likely ephemeral species and flowering grasses from the region.

3.7 COOLAWANYA STATION

- ***Ref 78: Section 6 - Community and Stakeholder Consultation (Pg 32 and 35)***

  There seems to be little comment on the possible environmental impact to the pastoral landscape attributed to the mining and/or rail infrastructure. A suggested inclusion to the PER would be a section dedicated to pastoral stakeholders, possibly under the heading Part 3 - Environmental Impact Assessment covering the same points/headings as highlighted throughout the document.

  Fortescue Response:

  Environmental impacts on the pastoral landscape were not intended nor were they expected to be a focus of the Solomon environmental review document. However Fortescue agrees that environmental impacts on the pastoral landscape should be considered in future assessments.

- ***Ref 79: Section 23 - Surface Water (Pg 156, dot point 3)***

  "The horizontal alignment was selected to minimise river crossings". Interpretation of this point has varying meanings: 1) that 'the horizontal alignment was selected to minimise the number of river crossings along the corridor' OR - bring it into line with dot point 4, 2) that 'the horizontal alignment was selected to minimise water flow angles and resistance'. A suggested change may be that of rewording to clearly explain the statement.

Fortescue Response:

This should be interpreted as meaning "horizontal alignment was selected to minimise the number of river crossings along the corridor"

- ***Ref 80: Section 23 - Surface Water (Pg 156, dot point 4)***

  "River crossings were designed to have minimal skew to minimise bridge length and associated protection works". It would have been refreshing to see that minimal skew design also included 'minimising damming and maximising water flow' rather than just economic reasons.

  Fortescue Response:

  Noted

- ***Ref 81: Section 23.4.3 Proposed Management (Page 157 and 158, dot point 3)***

  "Where there is no mulga, environmental culverts will be placed at 400m intervals". The decrease of culvert intervals outside mulga belts in concerning, particularly in areas of railway embankments. In the event of a major (1 in a 100 year) flood system along the Fortescue River valley, as occurred in December 1975 from Cyclone Joan, the potential of water damming upstream of the railway corridor is of concern. As there is significant catchment and run off from the Hamersley Ranges, we suggest a review be done on all culvert sizes, intervals, locations and water flow angles along all areas of raised rail corridor, particularly those of high water flow where culverts are the preferred option.

  Fortescue Response:

  Fortescue acknowledges this is a significant issue and commits to addressing through detailed design. The detailed rail design will include an assessment of culvert sizes, intervals, locations and water flow angles.

- ***Ref 82: Section 23.4.3 Proposed Management (Page 157 and 158, dot point 6)***

  "Diversion drains and cut off drains will be constructed to provide a contained flow channel between catchments or around cuttings to ensure that the rail embankment is protected from high velocity flows". Concerns are raised in the fact that there is no mention of 'overflow or pressure relief culverts' adjacent to contained flow channels in the event of a severe flood event. It would be favourable to see further assessment done looking at the proposed management with these relief culverts factored in.

  Fortescue Response:

Culvert sizes, intervals, locations and water flow angles will be assessed and addressed during the detailed phases of the rail design.

3.8 KINGS PARK AND BOTANIC GARDENS

- ***Ref 83:***

  The PER covers most environmental issues with varying comment but seems to limit detail on the effect of water damming upstream of rail corridor and the potential impacts to fragile rangelands downstream of rail corridor in the event of a 'water pressure blow out'. More assessment of these potential threats needs to be done with proposed management strategies put in place and monitoring programs established with pastoral stakeholders as a 'life of rail' strategy.

  Fortescue Response:

  Culvert sizes, intervals, locations and water flow angles will be assessed and addressed during the detailed phases of the rail design.

- ***Ref 84:***

  A significant concern in the document is the use of generic, catch-all phrases that undersell the complexities and impediments to achieving successful and sustainable mine site restoration and rehabilitation in the Pilbara. Failure to explain in the document the actual restoration approach may result in the site failing to achieve a level of restoration acceptable to regulators.

  Fortescue Response:

  More specific details relating to the restoration approach proposed for the project area will be addressed in the Mine Closure Plan that will be prepared as part of the Mining Proposal for the project.

- ***Ref 85:***

  The following represent key areas that are deficient in the document and for which the proponent needs to demonstrate capacity to deliver effective restoration outcomes by specifically addressing these concerns (these should be address specifically rather than deferring to the creation of the MMP and MCP): Seed use effectiveness; Seed farming; Provenance; Seed banking; Topsoil; and Growing medium.

  Fortescue Response:

  Fortescue will commit to ensure effective closure outcomes are addressed in the Mine Closure Plan.

- ***Ref 86:***

  Research into rehabilitation and trialling is mentioned (pg 224). Research is clearly a major and needed area for ensuring the mine is able to deliver an effective approach to restoring the plant diversity in the degraded landscapes and ecosystems.

  Fortescue Response:

  Fortescue will commit to ensure effective closure outcomes are addressed in the Mine Closure Plan.

- ***Ref 87:***

  No details provided of what the Rehabilitation and Revegetation Management Plan will contain e.g. Research questions to answer, approaches to be taken that require investigation. Also how is this plan different to the Rehabilitation Management Plan and Mine Closure Plan mentioned variously throughout the document.

  Fortescue Response:

  The Rehabilitation and Revegetation Management Plan will include, but will not be limited to, the following procedures soil handling, rehabilitation works, revegetation, fauna habitat re-establishment, maintenance, success criteria and monitoring and research and development. A Rehabilitation and Revegetation Management Plan differs from a Mine Closure Plan which establishes planning objectives and procedures for all aspect of mine closure, not just those relating to ecological restoration.

3.9 EPA REQUEST FOR ADDITIONAL INFORMATION

1. ***Details regarding installation of a barrier between Weelumurra Creek and the Queen's Channel Iron Deposit. Further information required includes:***

   a. ***Technical feasibility***

   b. ***Potential maintenance requirements post closure***

   c. ***Assessment of risk to the environment associated with failure of the barrier post closure; and]***

   d. ***Example of similar carriers which have been successfully in the past***

Fortescue Response

a) Fortescue Metals Group is working with BAUER Resources Australia to design a proposed hydraulic barrier (cut-off or diaphragm wall) to be installed at the intersection of the Solomon Queens Valley with the Weelumurra Creek valley. The following information provides a brief overview of the construction method and the sequence of activities required for the construction of a diaphragm wall.

Diaphragm walls are underground structural elements commonly used for retention systems and permanent foundation walls. They can also be used as deep groundwater barriers.

Diaphragm walls are constructed using the slurry trench technique. The technique involves excavating a narrow trench (~1m wide) that is kept full with an engineered fluid or slurry. The slurry exerts hydraulic pressure against the trench walls and acts as shoring to prevent collapse. Slurry trench excavations can be constructed in all types of soil, even below the ground water table.

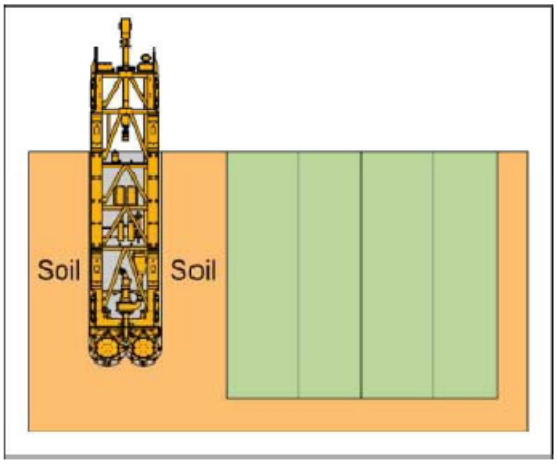
Specific applications and ground conditions demand the use of hydraulically operated reverse circulation trench cutters where the excavation technique is by 'cutting' as opposed to 'digging'. This technique is appropriate for deeper diaphragm walls and walls located in granular materials and soft rock. The trench is filled with cement from the base up to complete the impermeable barrier.

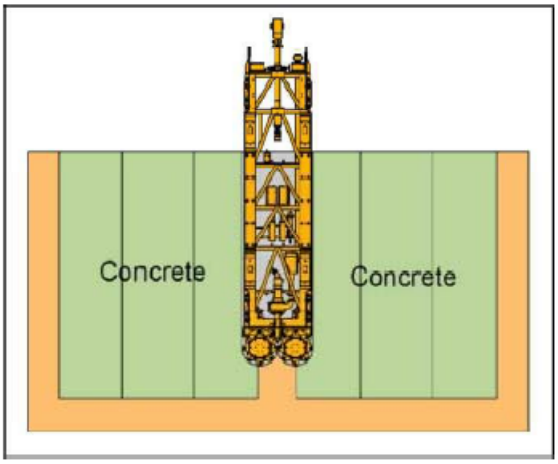
Working Sequence

The working sequence for the construction of a diaphragm wall comprises of the following key steps:

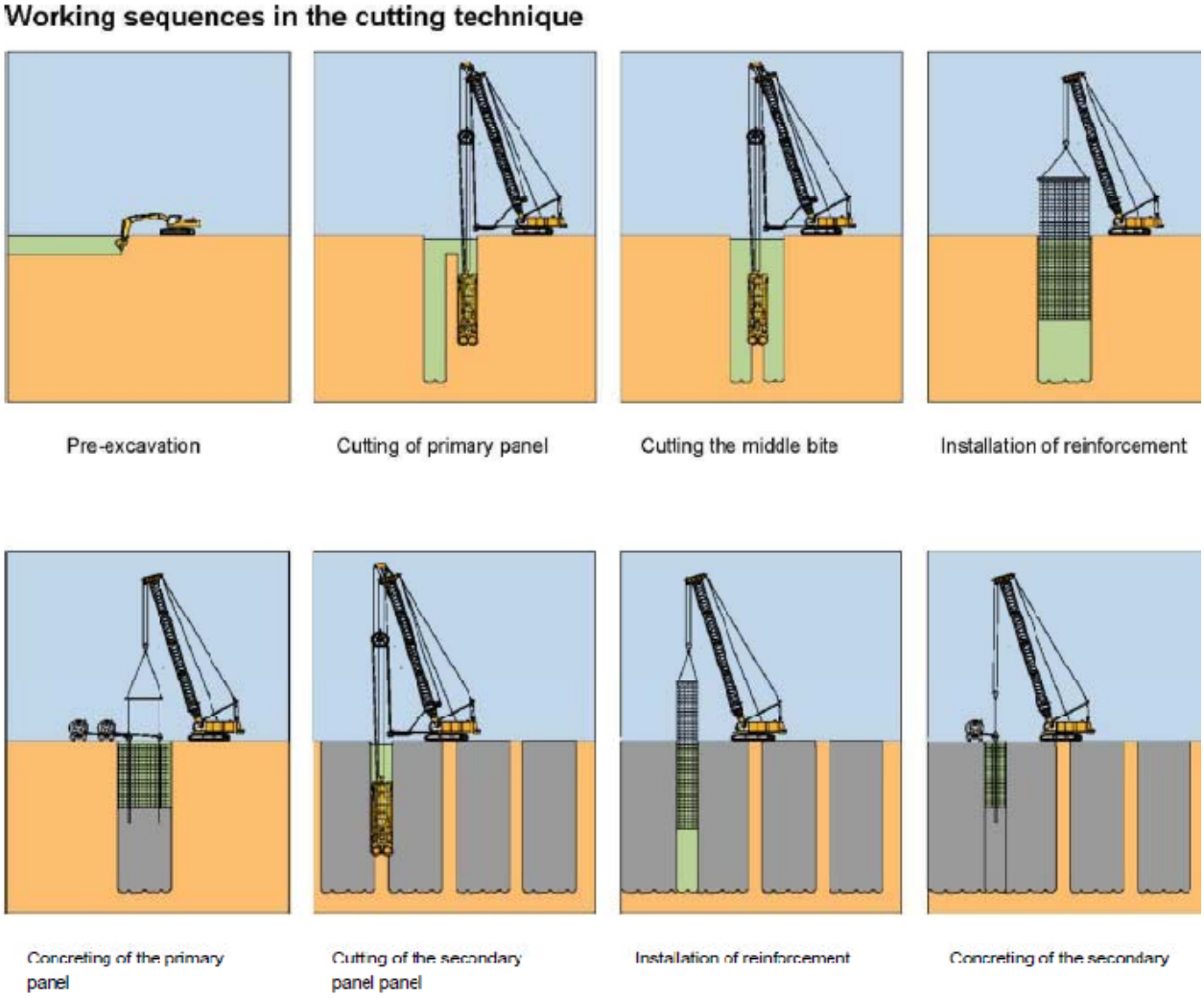
- Site preparation, guide wall construction and trench pre- excavation
- Panel excavation
- Panel cleaning (de-sanding)
- Reinforcement installation
- Concreting

Following preparation of the site and construction of the guide walls, excavation of the diaphragm wall can begin using the BC trench cutter. In order to ensure trouble-free excavation and to achieve the required trench alignment, the cutter should always work within similar boundaries. The following sketches illustrate typical applications.





Diaphragm wall construction begins with the trench being excavated in discontinuous sections or "panels" using a BAUER trench cutter. Typically primary single or multiple bite panels are constructed first, followed by the construction of intermediate secondary or closing panels Panel excavation is carried out in a predefined sequence to enable the construction of clear joints. This is achieved by constructing alternate "primary" panels first, followed by the excavation of the intermediate "secondary" or "closing" panels.



b) no post-closure maintenance is required as the proposed Bauer curtain will be an in situ concrete barrier with no maintenance issues.
c) the risk to the environment associated with the failure of the barrier is considered minimal as complete failure of the barrier is highly unlikely. Leakage in the order of < 3 L/second is considered the worst –case scenario with an associated drawdown in Weelumurra Creek of less than a few centimetres.
d) examples of similar barriers successfully used are listed in Table 1.

Table 1: Australian and International Examples of Constructed Bauer Barriers

Project Name	Location	Client / Main Contractor / Contact Person	Description	Executed by
Hinze Dam	Australia	Hinze Dam Alliance	270 m Diaphragm Wall 0,6 to 1,0 m thick, depth up to 50 m.	BAUER
Tugun Bypass Motorway Project	Australia	Client: MainroodMC: Pacifik Link	-16,500 m^2 Diaphragm Wall; 27 m deep - Barrette installation - 60 nos 3,200m^2	BAUER
Capital Plaza	UAE	Client: REISCO (Real Estate Investment & Services Co.)	400 Lm Diaphragm Wall, 2.1 m thick, 28.0 m exc. depth	BAUER
Peribonka Dam	Canada	Client:Hydro-Quebec	3 Cut-off Wall, depth to max. 126m, thickness varies between 800 to 1500 mm; Injection works, earth works for dam	BAUER
Lehrter Bahnhof Berlin Los 1.4, Deutschland	Germany	Client:DeutscheBahn	- 36.000m^2 Diaphragm Wall - 50 m deep - 23.000m^2 Sheet Piles - 44.000m Anchors - 67.000m^2 UW-Beton-Sohle 140.000m Uplift Piles	BAUER)
Subway U2/3 Praterstern, Vienna	Austria	Client: Wiener Linien GmbH & CoKG	- 7450 m^2 sheet pile - 12,150m^2 diaphragm wall 80 m deep - 10000 m^3 DSV - 1400 m^2MIP	BAUER
New Naga Hamadi	Egypt	Client: Ministry of Water Resources & Irrigation	Cut-Off Wall for barrage at river Nile 1800m long max depth: 60 m wall surface: 92,000 m^2 thickness: 800 mm	BAUER

Project Name	Location	Client / Main Contractor / Contact Person	Description	Executed by
Borcka & Muratli Dams	Turkey	Client: General Directorate of StateMC: Strabag	2 phase Cutoff Walls, 80 m depth, wall surface 19,500 m2, thickness 1000mm	BAUER
Dhaulighanga Dam	India	Client: Kashima Limited and Daewoo	Cutoff Wall, max. depth 72m, wall surface 8,000 m2, thickness 800 mm	BAUER
Puclaro Dam	Chile	Client: Ministry of Public Works,	2 phase Cutoff Wall, max. depth 60m, surface 16,850 m2, thickness 800 mm, Dam capacity 200 Million m3	BAUER
Meeks Cabin Dam	USA	Client: USA Depart. of Interior,	Sealing of the Dam Core by means of a Cut-off Wall max depth: 52 m wall surface: 11,900 m² thickness: 910 mm	BAUER
Power Station Dam, Sichuan	China	Client: China Szechuan Province	Two phase Cut-off Wall in a 300 m long tunnel max depth: 70 m wall surface: 20,000 m² thickness: 1,000 mm	BAUER
Shiokawa Dam	Japan	Client:Tokyo Electric Power Co.	Cut-off Wall max depth: 64 m wall surface: 7500 m² thickness: 640 mm	BAUER

Below is an article ("*Bauer works double time on dam"*) describing a dam barrier, similar to that proposed for Solomon that was recently constructed in Queensland.

Gateway leads to piling alliance

LEIGHTON Abigroup Joint Venture's Gateway Bridge upgrade project is the largest piling and ground improvement project currently being undertaken in Australia.

The project comprises a duplication of the current bridge, a 12km upgrade of the Gateway Motorway, and 7km of road along a new alignment north of the river. Apart from the main bridge, there are 31 other bridges to be built as part of the project.

The piling works are critical to the project. Of the five sections of road north of the river, four of them required some form of ground treatment. A combination of preloading and wick drains, continuous flight auger, displacement piles, dynamic replacement and driven precast square piles were used to treat these areas.

Rigs working in these sections operated from prepared and certified working platforms of rock fill over geotextile fabric.

The mix of piling and ground improvement techniques comprises 50,000 linear metres of prestressed piles, 2100 precast piles, 1 million linear metres (lm) of wick drains, 113,000lm of displacement piles, 87,000lm of continuous flight auger piles and 9000lm of dynamic replacement.

The scope of the project and its tight schedule meant that a joint venture of piling companies, the Gateway Piling Alliance, was formed to work in an alliance with the LAJV and provide the people, machines and expertise required for the job. The work is now drawing to a close but resources on the project for piling and ground improvement works peaked at 21 rigs and 130 people.

The GPA brought together Piling Contractors, Frankipile Australia, Vibro-pile and Keller Ground Engineering. Although these companies are all part of the Keller Group, they compete individually and this was the first project to bring them together in Australia. The alliance was headed up by Piling Contractors, which had previously been involved in two alliance contracts and had expertise in the area.

GPA construction manager Danny Treen said the arrangement worked well and allowed decisions to be made on a "best for project" basis.

Management of the piling project brought together 13 staff drawn from all four joint venture participants, as well as staff seconded from the LAJV. Formal coordination was through monthly meetings of site foremen.

The alliance partners used the size and duration of the project to implement programs to upskill the workforce. People were rotated in and out of the project, not only to allow them to take leave as scheduled, but also to broaden the benefits of the training program.

The project brought together a mix of Bauer, Soilmec, Casagrande, Liebherr, Enteco, Junttan and MAIT piling rigs of various types. One of the first considerations was to ensure consistency of instrumentation and calibration of the rigs so that their output would be comparable.

The most demanding piling activity was boring the piles for the main river piers, which was done from a temporary island accessed by a causeway constructed from the northern bank and from a platform constructed out into the river from the southern bank.

A Bauer BG 28 rig from Piling Contractors and a Soilmec R-622 rig from Frankipile Australia were used for boring the river piles, which comprised 24 holes, 1800mm in diameter, for each of piers 6 and 7, with the maximum depth being 50m. Work took place around the clock, with the piles for each pier completed in nine weeks. A camera was passed down each hole to inspect it for cleanliness, as part of the quality control.

Dynamic replacement is still not a common technique in Australia. A 20t weight is dropped initially, to form a depression in the ground. This is filled with coarse rock and driven into the ground to form a column. A grid is formed with the stone columns. This technique was employed extensively in soft ground conditions near Kedron Brook.

Driving piles for the approach pier.

New foundations at Liebherr

LIEBHERR Australia has created a Crawler Crane and Foundation Division to handle sales and service for Australasia for machines produced in the Nenzing factory in Austria. This was previously handled by Baden Cranes, and Rob McInnes and Tom Grady have transferred to Liebherr to manage sales and service respectively and maintain continuity for customers.

There are currently more than 40 Nenzing-**built machines in Australia, encompassing the HS series duty cycle cranes, LR series lift** cranes and LRB series foundation piling and drilling rigs.

The new division operates from separate premises in the western Sydney suburb of Arndell Park but support is available through the Liebherr Australia network and the regional Hong Kong facility.

The Liebherr units are undertaking a diverse range of work around the country. Keller Ground Engineering is using a **number of 120t HS cranes for dynamic compaction at the NCIG coal terminal project** in Newcastle, and will undertake dynamic compaction and soil mixing at the Ballian Bypass project. Liebherr machines are well represented with many of the contractors working on the Gateway Bridge upgrade project in Brisbane.

Sydney-based contractor Civil Foundations, which has become a major user of **Liebherr** piling rigs, obtained special permission **from the** Liebherr Nenzing factory to configure **an LRB** 255 with a **33m leader** to drive 30m sheet **piles. This was the first** time a sheet of this length **was driven using a lea**der-based machine.

Bauer works double time on dam

THE Hinze Dam was initially completed in 1976 and upgraded in 1989 to a storage capacity of 161,000 million litres. Now the dam's storage capacity is being increased to more than 309,700 million litres to ensure an adequate water supply to the Gold Coast for the next 50 years.

The increased storage capacity will be achieved by raising the height of the Hinze Dam embankment by 15m to 108.5m. To ensure the stability and water tightness of the structure, a two-phase cut-off wall 840mm thick and up to 50m deep is being installed in the dam structure. This contract is being carried out by Bauer Foundations Australia.

The construction of the cut-off wall is a huge technical challenge.

"To create the space for the cut-off wall, a large amount of material has to be excavated, primarily rock," Bauer Foundations Australia managing director Gerhard Zylowski said. "Half of this material consists of extremely hard rock."

Bauer said the importance attached to the project was shown by the time schedule for the site establishment and the bonus payment offered by the client for complying with it. "We did meet this deadline," Zylowski said.

Construction works for the cut-off wall have been underway since the end of May 2008.

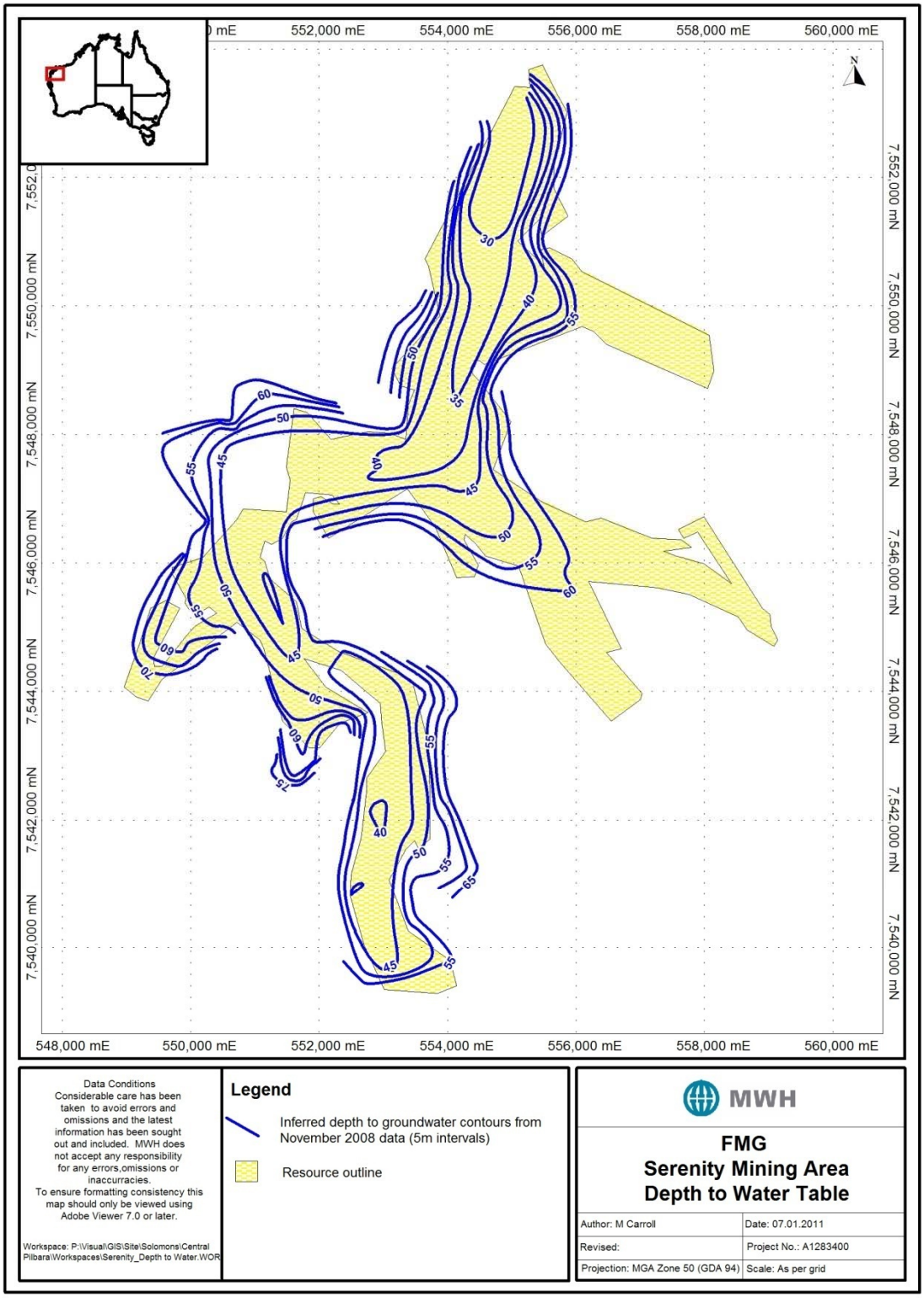
Bauer is installing the cut-off wall at the Hinze Dam expansion.

Plant onsite include a Bauer BC 40 diaphragm wall cutter, a rope-operated grab, a BE 500 desanding plant couple with a BS 50 desilter unit, a decanter and a bentonite mixing unit with a capacity of 1000 cubic metres. Bauer's contract is due for completion by the end of March 2009, which the company says requires working double shifts six days a week.

2. A brief analysis of potential impacts associated with the Serenity Borefield

Fortescue Response

The depth to groundwater associated with the proposed Serenity Valley borefield is greater than 30m (see depth to groundwater plan below). Only a small area of the vegetation type Se81, which occurs in the northern portion of the Serenity Valley area over groundwater at a depth of 35-40m, supports the weakly vadophytoic species *Eucalyptus victrix* (see Figure 7). Therefore the potential impacts of groundwater abstraction on the susceptible ecosystems within the proposed borefield at Serenity are anticipated to be minimal.



Plan A – Serenity Valley – Depth to Water Table

3. ***A description of the mine hydrology post-closure, including a cross section and demonstrating how the hydrology of Kangeenarina Creek would be re-established, and the potential for pit lakes and degradation of groundwater***

Fortescue Response

Longitudinal cross–sections profile indicating the proposed pre and post closure hydrology associated with Kangeenarina Creek and the surrounding CID is provided in Figures 6a-6c.

The mine pit voids outside of the Kangeenarina section will be backfilled to a level that precludes the formation of pit lakes. On the basis of the sloping gradient of the bed rock and pit back, all inflow water will flow in a westerly direction towards Queens and the K2 barriers.

The primary element of mine closure will be the reinstatement of the land surface for the Kangeenarina Creek flow. This will require the installation of two cut off barriers and the infilling of the total pit void back to original levels. Surface flows in Kangeenarina Creek and northwest catchment will infiltrate into the backfilled material. This will result in the development of a localised aquifer that will mimic the existing pre-mining hydrological regime where high water levels provide flows to the pool system. Pool levels will decline between flow events as per existing conditions.

4. ***Any additional results available from regional troglofauna surveys, and advice from your consultant regarding the likelihood of species currently considered to be potentially restricted to outside the area of impact following further surveys.***

Fortescue Response

The latest results from regional troglofauna survey have identified 36% of the troglofauna species that were identified from the Solomon have also been recorded from outside of the proposed mine impact area as per Table 2 below.

Table 2: Regional Troglofauna Results

TROGLOFAUNA	Total of Species Recorded	Species recorded from Regional Surveys (non-impact areas)	Percentage of total recorded from Regional Surveys
Total Kings Deposits	**26**	**9**	**36%**
Trinity	5	1	20%
Valley of the Kings	5	2	40%
Valley of the Queens	11	4	36%
Zion	13	6	46%

The regional subterranean fauna results support Subterranean Ecology's conclusions in the Solomon Baseline Subterranean Fauna Survey and the Solomon PER:

"that the sampling evidence suggests it is probable that species of subterranean fauna collected in the Kings CID palaeochannel deposits will also be found to occur outside the proposed mine impact zones, in suitable porous geological strata and connected hydrologic catchments".

Full details of the Subterranean Ecology Regional Survey report are provided in Appendix A while Appendix D is a file note providing Subterranean Ecology's advice on the likelihood of potentially restricted troglofauna species being restricted to Solomon impact area.

5. ***Map detailing the proposed sequence of mining in relation to the locations of potentially restricted troglofauna species***

Fortescue response

The locations of potentially restricted troglofauna species in relation to the proposed mining sequence for the Solomon project are shown in Figure 8. This figure reinforces the hypothesis these species are likely to be found outside of the impact areas due to both similar geology and geological connectivity.

6. ***Additional details regarding the supplementation of pools in the project area, including discussion regarding how maintenance water levels would be determined, and potential for variation in water levels following cyclone events.***

Fortescue Response

The establishment of the level of water re-injection requirements relating to supplementation of the pools in the project area has been determined through 3 years of monitoring and modelling. The modelling shows that re-injection of water into the alluvials upstream of the pools at a rate of 10L/s will be required to maintain groundwater levels beneath the pools. During a cyclone event water will still be discharged, while the peak flow will be controlled via an onsite flood control feature.

7. ***Details of hydrocarbon management actions to be implemented***

Fortescue Response

Management strategies and action outlined in Fortescue's Chemical and Hydrocarbon Management Plan (Appendix E) addresses the risks posed by chemicals and hydrocarbons. This represents the minimum level of management to be applied at all Fortescue owned and operated facilities, including the Solomon Project. These actions will be adopted as part of the environmental management at Solomon and will include:

- Reporting;
- Spill Response;
- Chemical and Hydrocarbon Procurement;
- Chemical and Hydrocarbon Storage;
- Chemical and Hydrocarbon Transport and Handling;
- Chemical and Hydrocarbon Use and Disposal;

- Oily Water Management;
- Training.
- Fire protection and emergency response

8. Proposed sewage treatment methods and management of impacts.

Fortescue Response

Sewage treatment at the Solomon Mine will occur at several locations around the site. The primary wastewater treatment plants (WWTPs) will be located at the accommodation camps, with package plants treating up to 600kL/day. These package plants will treat the wastewater to at least a Low Exposure Risk Level (previously referred to as Class C) for irrigation to a suitable area (suitable in both size and location), in accordance with the Department of Water's *Water Quality Protection Note 22 – Irrigation with Nutrient Rich Wastewater*. This will ensure that nutrient loading is sustainable within the designated irrigation area.

The wastewater will also be further treated to a High Exposure Risk Level (previously referred to as Class A), which would allow the treated wastewater to be used for dust suppression or reticulation within the camp gardens. This will result in the wastewater being disposed of over a larger area than is required under WQPN 22, therefore the environmental impacts will be minimised.

Up to ten distinct locations (outlying offices or workshop areas around the mine site) will contain toilets and hand basins, and as such will require wastewater to be stored or treated and disposed of. Final details are still to be determined with each contractor responsible for each site however it is expected that each location will either be fitted with appropriate wastewater storage tanks or a small WWTP (<20kL/day). Wastewater storage tanks will be pumped out as required and the wastewater will be disposed of to a nearby WWTP. The small WWTPs that may be installed will treat the wastewater to a Low Exposure Risk Level and will predominantly dispose of the wastewater to a dedicated irrigation area, which will be native vegetation initially, but previously mined areas may be used at a later stage. Some of the smaller WWTPs (<10kL/day) may dispose the waste to leach drains or evaporation ponds, depending on the location and land available.

All wastewater treatment or storage areas will be subject to DEC and/or Department of Health (DOH) approval requirements, and environmental and health issues will be managed in accordance with these licences.

9. Options analysis for power supply and discussion of best practice in management of air emissions.

Fortescue response

An options analysis for the Solomon Project was conducted by Energetics, a specialist energy management consultancy. Energetics were requested to undertake a desktop study into various energy options available to Fortescue for both current and future mining, port and rail operations.

The options analysis was developed on a cost basis, with consideration given to construction costs, operational costs (including fuel usage), transmission costs and fuel type (gas or diesel). Clearing for infrastructure and fuel usage were considered surrogates for environmental considerations in the analysis Future carbon trading costs were also considered in the analysis.

Eight scenarios to supply power to Fortescue's operations were explored in detail, containing variations of the following options:

0. Stand alone power station at each mine site
1. Central power station servicing all mine sites
2. Integration of wind power
3. Use of heat recovery generators
4. Fuel type (LNG, diesel, dual fuel)
5. Connection to grid (North West Integrated System (NWIS))
6. Transmission from Port Hedland
7. Development of own transmission network

Table 3 below shows the eight scenarios and the options related to each scenario.

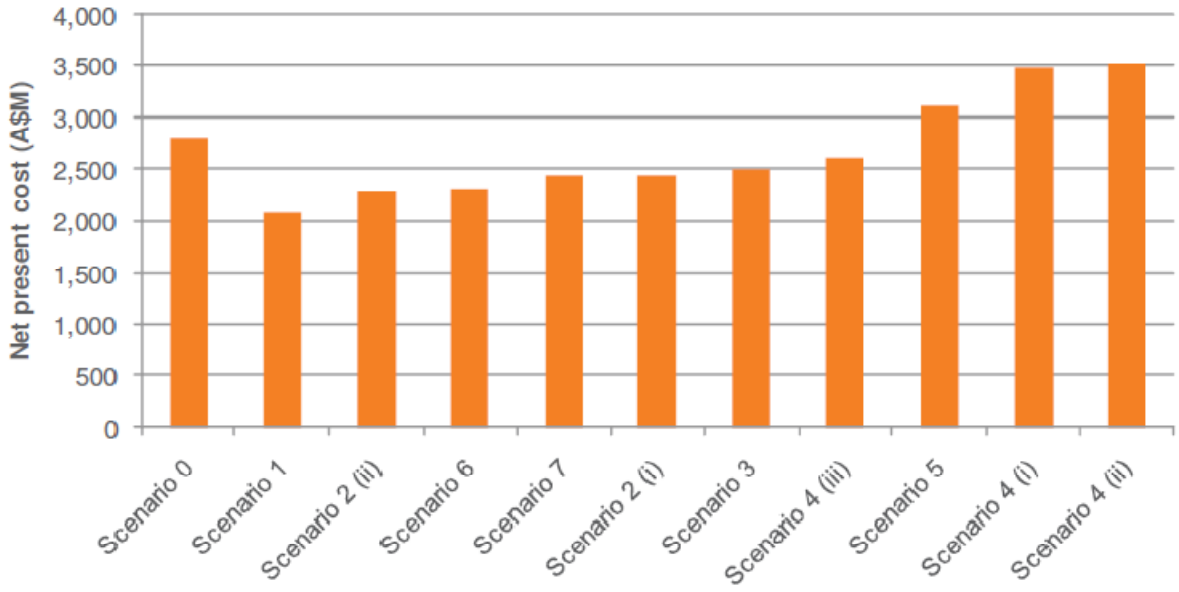
Table 3: Power supply options considered

	Power station type				Fuel			Transmission		
	Stand alone generation at hubs	Central power station	Wind	Heat recovery	Diesel	Diesel/LNG	Natural gas	Connected to NWIS	330 kV line from Port Hedland	Own network
Scenario 0	✓				✓					
Scenario 1	✓					✓				
Scenario 2 (i)		✓		✓			✓			✓
Scenario 2 (ii)		✓					✓			✓
Scenario 3		✓					✓	✓	✓	
Scenario 4 (i)		✓					✓	✓	✓	
Scenario 4 (ii)		✓	✓				✓	✓	✓	
Scenario 5		✓		✓			✓	✓	✓	
Scenario 6		✓					✓	✓		
Scenario 7	✓			✓		✓	✓			

A financial model was developed to evaluate the Net Present Cost (NPC) of each of the scenarios. The capital and operating costs for each of the Scenarios was calculated from a combination of indicative pricing from suppliers and factored costs where appropriate.

The results of this analysis showed that dual fuel (LNG/diesel) reciprocating generators installed at the Solomon Mine is the best NPC option (Scenario 1). Scenario 1 was preferred largely because high voltage transmission lines are not required. This is shown in Graph 1 below:

Graph 1: Net present costs for each scenario option



Environmental Assessment of Scenario 1

Although the options analysis was primarily cost-based, there are some key environmental factors that were considered when assessing Scenario 1.

1. Scenario 1 does not include transmission line connections with the NWIS or Port Hedland. While this has an economic advantage, it also reduces the environmental footprint of the Solomon Project. The installation of adequate transmission lines from the NWIS or Port Hedland to the Solomon Project would have a significant environmental impact with regards to native vegetation clearing, fauna and associated habitat, visual impact, and impacts to landholders.

2. The proposed implementation of dual fuel turbines allows Fortescue to keep the option of potentially using gas as a fuel source in the future, which will result in lower emissions. This decision has both economic and environmental benefits.

Best Practice Power Station Design

The emissions from the Power Station were considered when developing the proposed Power Station design, to ensure it meets all emissions and ambient air criteria. Best practice design will be implemented to minimise these air emissions. These include turbine efficiency requirements, pollution reduction and suitable stack design to promote mixing. These are discussed further below:

1 Engine efficiency – Around 50% efficiency can be achieved which can only be bettered by using combined cycle gas turbine technology suited to much larger power stations.

2 Pollution reduction – Possibility to use Natural Gas; high efficiency reduces the amount of fuel required to generate electricity.

3 Stack design – Will ensure optimal dispersion of the fumes

The predicted impact of the resultant air emissions is detailed in the report by Heggies (2010), which was included as Appendix 29 of the PER. As the location is remote, there is no existing air shed or sensitive receptors of concern, the NEPM standard for air emissions from the power station will not be exceeded.

Additional Approval Requirements

The Power Station is classified as a prescribed premise under Part V of the EP Act, and will require a works approval and licence. Power Station design details, pollution controls, air emissions assessments and proposed monitoring will all be identified and assessed throughout the works approval process. When the works approval application is due to be submitted in mid-2011, the design will be advanced to a point where Fortescue can provide detailed information to DEC for their assessment.

4 Alternative airstrip locations considered and confirmation from the Department of Environment and Conservation that the chosen location is acceptable

Fortescue Response

See amended response to Ref 47 and letter to the DEC detailing Fortescue's proposed management commitments for the Solomon airport (Appendix F).

5 Additional hydrological documents provided to Department of Water following the release of the PER, including peer review by Hydroconcept, should be appended to the Responses to Submissions.

Fortescue Response

Five additional hydrological and hydrogeological reports have been included in Appendices G-K:

6 Appendix G. Solomon Hydrogeological Assessment_FINAL REPORT

7 Appendix H. Solomon Flood Management - Report (Final Rev 1) 101210

8 Appendix I. Solomon Groundwater Modelling_V2_Report&Figures

9 Appendix J. Solomon Water Management Plan v1

10 Appendix K. Fortescue - Solomon - Dec 2010 Peer Review (Hydroconcept)

11 Reference 11 – Further details are required regarding the potential for impacts to the environment as a result of decreased flows downstream of the mine areas.

Fortescue Response

Although peak flows during mining will be moderated via surface water control structures, typical flows will be maintained and there will be no resulting impact on the downstream environment.

12 Reference 29 – Please clarify whether long-term surface water control features are required, and if so, how will they be rehabilitated

On mine closure, any long-term surface water control barrier or flood management structure will removed to enable full natural flow patterns to be re-established and the disturbed area appropriately rehabilitated and revegetated with locally endemic plant species.

13 Reference 42 – Please provide details of tailings characteristics analysis (include fibrous materials) if available, and further information regarding the design of tailings storage facilities, seepage controls and monitoring proposed in relation to these facilities.

Fortescue Response

The design for the Solomon Tailing Storage Facility (TSF) was prepared based on consideration of the geologic setting, the site topography, the mine development plan, and the expected tailings characteristics.

Valley-type tailings storage will be constructed, with an embankment wall constructed of waste rock and clayey materials from the mine. Approximately 4.7Mtpa of tailings will be generated by the BID/DID OPF. The TSF has also been designed to accept approximately 4Mtpa of tailings from the CID OPF following the commencement of Stage 1 mining.

The total amount of tailings to be stored in this TSF for the 18 year life of the mine is 148 Mt.

A summary of the characteristics of the TSF is provided in Table 4.

Table 4: Summary of Tailings Storage Facility Characteristics

Factor	Description
Tailings Storage Capacity, Mm^3	99
Tailings Storage Capacity, Mt	148
Tailings Storage Capacity, Years	18
Embankment Crest Elevation, mRL	630
Embankment Volume, Mm^3	14
Maximum Embankment Height, m	100
Tailings Surface Area (full), ha	264
Expected Settled Dry Density t/m^3	1.5
Beach Slope	1%

Tailings will be pumped into a decant pond at the top of the TSF via the tailings slurry pipelines from the BID/DID and CID OPFs (Figure 8a). At this point, the tailings will be approximately 55% solids. To optimise tailings storage capacity and reduce the risks associated with embankment stability and seepage, tailings will be deposited from the embankment and along the perimeter of the storage. A monitoring program for the TSF will be developed which will include ongoing assessment of the embankment stability, the tailings operations management, and the potential impact to groundwater flow and quality.

The tailings are expected to be non-acid producing (according to waste characterisation studies provided in Appendices 23, 24, 26 and 27 of the Solomon PER), with a diameter of less than 1 mm.

Embankment Design

The zoned embankments will be constructed in stages using mine waste. The embankments will consist of a low permeability upstream zone constructed with clayey mine waste and a downstream structural zone. The upstream zone will be constructed with select mine waste and moisture conditioned and compacted in order to mitigate seepage and lower the phreatic surface through the embankment. The final embankment crest width

will depend on the equipment used in construction and operational requirements. The crest will be sufficiently wide to accommodate vehicle traffic, the tailings slurry pipeline, and a safety windrow. An indicative drawing of the embankment is provided in Figure 8b.

The embankment design incorporates concave batter slopes to mimic the natural long term erosive process on the slope. To achieve the concave batter slope, it is proposed to construct the final downstream slope with a 25 degree (2.15H:1V) batter slope on the upper third of the slope and a 15 degree batter slope (3.7H:1V) on the lower two thirds of the slope. The resulting overall batter angle from the dump crest to the dump toe is very slightly shallower than the 18 degrees (3H:1V) commonly adopted.

Stability analyses were undertaken for the proposed TSF embankment design concept at the highest section of the embankment by using the computer modelling programme, Slide. The aim of the analysis was to ensure that the TSF will meet the Factors of Safety (FOS) specified in ANCOLD (1999), Guidelines on Tailings Dam Design, Construction and Operation, as required by the Department of Minerals and Petroleum (DMP). The results of the stability analyses for the cases examined are summarised in Table 5.

Table 5: Results of Stability Analyses

Location	Case	Crest (m, RL)	Factor of Safety (FoS)	Recommended Minimum FoS*	Comment
TSF (LOM) Embankment	1a	630.0	2.26	1.5	FoS Adequate
	1b	630.0	1.92	1.5	FoS Adequate
	1c	630.0	1.38	1.1	FoS Adequate

Note: *Recommended factor of safety in accordance with ANCOLD (1999)

The stability analyses indicate that all the cases examined have adequate factors of safety when compared with the recommended minimum factors of safety in ANCOLD (1999). The analyses confirm that the preliminary TSF embankment design geometry is adequate for the volumes of tailings expected over the life of the mine.

Embankment stability is typically monitored by a combination of routine visual inspections and periodic measurements of selected instrumentation including: slope inclinometers, survey markers, and standpipe and/or vibrating wire piezometers.

Water Balance

A preliminary water balance for the TSF was undertaken to assess the expected water flows within the system (Appendix D). The water balance for

the tailings storage facility was undertaken to assess the expected water flows within the system. Water inflows to the OPF and TSF will include slurry water, rainfall, and surface water run-on. Outflows from the system include evaporation, seepage, and water retained in the tailings.

Assuming average weather conditions, it has been assessed that there will be a net negative annual water balance at the TSF. Greater amounts of water can be lost to evaporation and retained in the tailings than are expected as input flows. Accordingly, it is anticipated that for average conditions there will be limited to no water return available from the process water delivered with the tailings slurry.

The water balance model was also run with lower seepage (5 x 10-8 m/s), a lower assumed moisture content of tailings, 10% higher rainfall and 10% lower evaporation to assess the sensitivity of the model to these parameters. In this case, approximately 350,000 m^3 (4% of slurry water inflow) was available for return over 5 months of the year.

Seepage Management

Preliminary embankment seepage and stability analyses were undertaken for the proposed TSF. Under normal operating conditions, seepage from the TSF is expected to be minimal as the tailings are thickened and a relatively small decant pond is expected on the TSF. The seepage flow determinations from the cases analysed are summarised in Table 6. A total of 500 m^3/day of seepage is expected over the approximately 1 km length of the embankment.

Table 6: Results of Seepage Analyses

Location	Case	Crest (m, RL)	Seepage Flow (m^3/s/m)	Southern Embankment Approximate Length (m)	Estimated Seepage Flow (m^3/day)
Embankment	1	630.0	6.0 x 10-6	1,000	500

The actual seepage flows will depend on the size of the supernatant pond, its proximity to the embankment and the permeability of the tailings and foundation. Under normal operating conditions, seepage from the OPF and TSF is expected to be minimal as the tailings are thickened and a relatively small decant pond is expected on the TSF.

An underdrainage system is proposed to reduce the hydraulic head on the embankment and increase the settled density of the tailings and prevent uncontrolled seepage out of the TSF (Figure 8c). The underdrain will be a continuous slotted pipe surrounded in filter sand and wrapped in a geotextile filter fabric. The underdrain will be installed along the upstream toe of the

embankment to collect water draining from the tailings. The collected water will be removed from a central sump via a submersible pump in a riser pipe installed against the upstream embankment slope. The underdrainage system will reduce the hydraulic head on the embankment and increase the settled density of the tailings. Further work is being undertaken assess the potential benefits of extending the underdrainage away from the wall and into the main body of the TSF.

Shallow seepage below the embankment will be mitigated by construction of a compacted clayey mine waste cutoff wall. The cutoff wall is expected to be 1.5m deep.

Tailings Storage Facility - Environmental Management

Fortescue will manage the impacts of the TSF on surface water quality and quantity. The Pilbara landscape is subject to extreme climatic events such as high rainfall intensities and storms associated with cyclonic activity. Design has incorporated site-specific surface water controls. Stormwater overflow and run off from the TSF during high rainfall events is expected to be uncontaminated and will not impact the environment.

Stormwater

During operations, the TSF will include a permanent pond or sump into which the tailings slurry is pumped. Runoff from the approximately 150 ha catchment on the eastern face of the hills above the TSF and normal drainage from within the 243 ha TSF will be collected in a sump and recycled to the processing plant. The sump area at the western end of the TSF has sufficient volume to accommodate the design storm event, a 1 in 100 year ARI 72-hour duration rainfall event, plus provision of a minimum of 1m freeboard as required by the Department of Mines and Petroleum (DMP). Stormwater collected in the sump will be reused in the OPF.

The TSF design also incorporates an emergency ‘over wall’ spillway in order to provide for the controlled release of water from the facility during an extreme storm event. The emergency spillway will be located at the junction between the western and southern embankments on the southern side of the facility. The spillway is anticipated will be 20m wide and comprise an invert 0.3 m lower than the adjacent crest.

A programme to monitor freeboard on a fortnightly basis will be implemented to ensure that available freeboard on the storage complies with the DMP minimum requirement.

Seepage

The TSF is designed to minimise seepage through the underdrain system and clay cutoff wall. While it is not expected that significant seepage will cross through the embankment, visual inspections will be undertaken to ensure this is the case (Figure 8).

Groundwater

Groundwater movement out of the TSF is considered unlikely because of the measures put in place to limit water movement, in terms of the underdrain system and clay cutoff wall. The base of the TSF will be placed on relatively low permeability material to prevent groundwater movement out of the TSF.

Tailings will be pumped into the TSF via pipelines. In the event of pipeline failure, to prevent groundwater from contamination, pipelines to and from the TSF will be bunded as necessary to prevent spillage of tailings or return water into the surrounding area.

Geochemical analysis of tailings demonstrated that the tailings samples are acid consuming and have little capacity to leach metals at concentrations of potential environmental concern.

To monitor potential seepage and groundwater contamination from the TSF, the design will incorporate a low permeability cut-off key and piezometric array to monitor any rise in the phreatic surface within the tailings storage embankment and at the toe.

A minimum of six monitoring bores will be installed and sampled downstream of the TSF in advance of the TSF commissioning. Water levels will also be recorded from the monitoring bores on a monthly basis (Table 7). Recorded groundwater data will be reviewed regularly and described within annual environmental reports.

Table 7: Groundwater Monitoring Program

Parameters	Purpose	Frequency	Location	Corrective Action
Groundwater levels, inclination of slope	To ensure that the TSF embankment remains stable.	Monthly	Inclinometers and monitoring well network within and adjacent to TSF embankment	Determine if additional stabilizing work or infrastructure is needed

Parameters	Purpose	Frequency	Location	Corrective Action
Groundwater quality	To ensure that seepage from the TSF does not result in changes in groundwater quality	Three monthly chemical analyses. Monthly field measurement of EC and pH.	Monitoring well network in all potentially affected areas and control sites. Specific monitoring sites to be determined	Determine if remedial actions required, and implement

14 Reference 53 – The assertion that the Robe Pisolite unit is no longer considered to be significant should be confirmed by obtaining specific advice from the primary biological consultants that made recommendations in their reports regarding those units. If the Robe Pisolite unit cannot be confirmed as having low conservation status, please provide a map detailing the expected extent of the unit within the mine area in relation to the proposed sequence of mining.

Fortescue Response

As per Fortescue's response to the DEC's comments and recommendations in Ref 53 (pg 26-28 of responses to submissions), which is based on Fortescue's botanical consultants results and analysis of floristic data collected during the second phase of botanical surveys in the Kings area, the analysis by ENV does not support the initial advice from Coffey Environments that vegetation associated with the Robe Pisolite geological unit is of significant conservation value.

Figure 9 has been provided indicating the extent of the vegetation associated with the Robe Pisolite unit as delineated by Coffey Environments from floristic data collected during the initial surveys of the Kings area in relation to the proposed sequence of mining in Solomon. The majority of the Robe Pisolite unit is associated with the Zion deposit. As indicated in Figure 9, the mine schedule for the Solomon Project does not include any proposal to mine the Zion area. However, Fortescue is committed to undertaking additional floristic analysis to confirm the conservation status of vegetation associated with the unit prior to any potential mining. Should the additional analysis determine the unit to be of conservation significance, Fortescue will exclude the area from any potential future mining consideration without approval from the Minister for the Environment

15 Reference 61 – In keeping with Fortescues's commitment to assess the impacts of any stream diversion prior to approval, please provide the details of that assessment in the revised Response to Submissions.

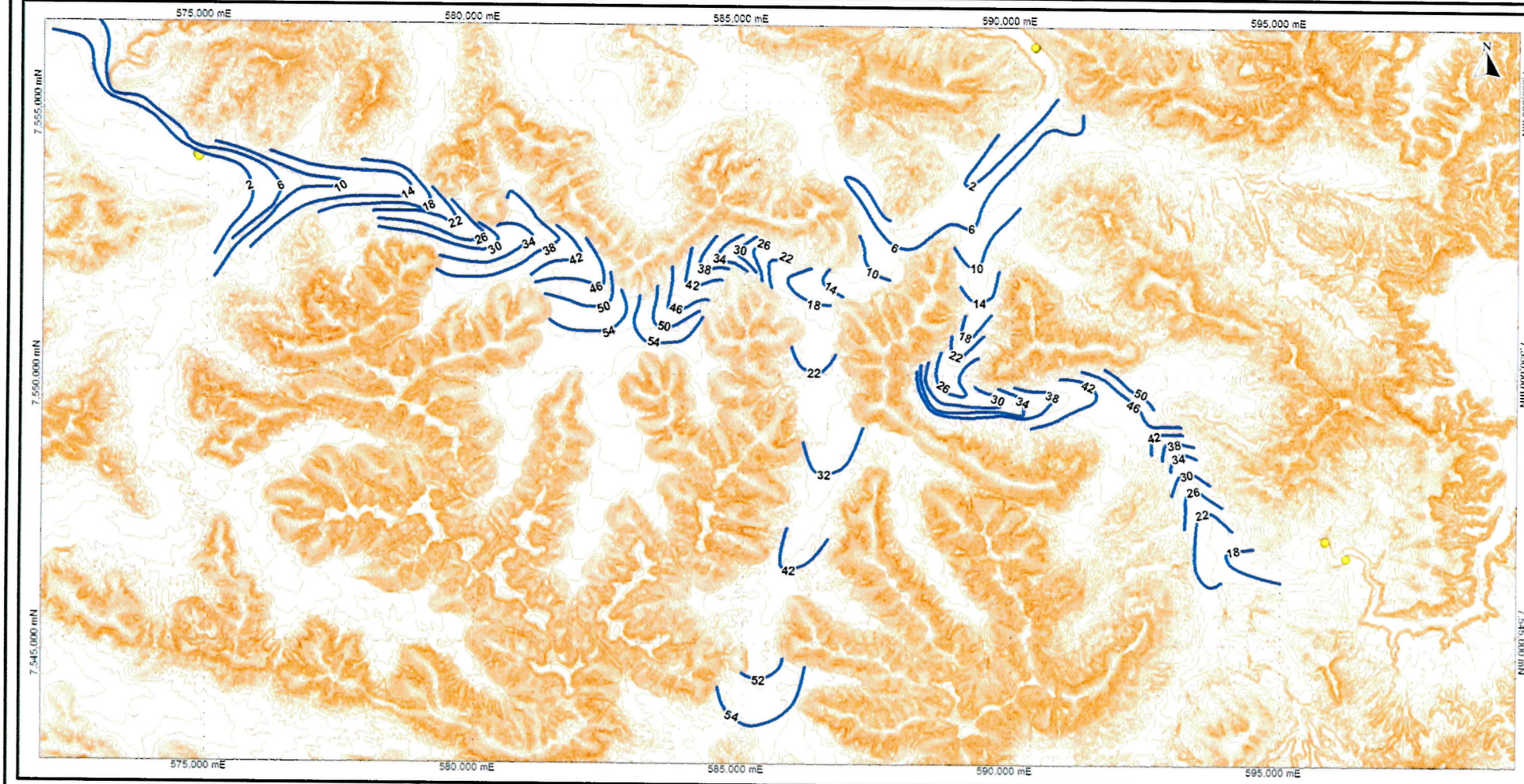
Fortescue Response

Subsequent to the public release of the PER and following further refinement of groundwater modelling for the Solomon Project, the proposal for possible stream flow diversion as a mechanism for maintaining the pools system in Kangeenarina Creek and preventing recharge to the underlying CID is no longer required. Therefore there is no longer any requirement to assess the impacts of stream diversion prior to approval.

Figures

Figure 1.

October 2010 Groundwater Depth Contours



Data Conditions

Considerable care has been taken to avoid errors and omissions and the latest information has been sought out and included. MWH does not accept any responsibility for any errors, omissions or inaccurracies.

To ensure formatting consistency this map should only be viewed using Adobe Viewer 7.0 or later.

Legend

- Surface Water Sampling Sites
- Groundwater Depth Contours (4 m intervals)
- Topographic Contours (5 m interval)

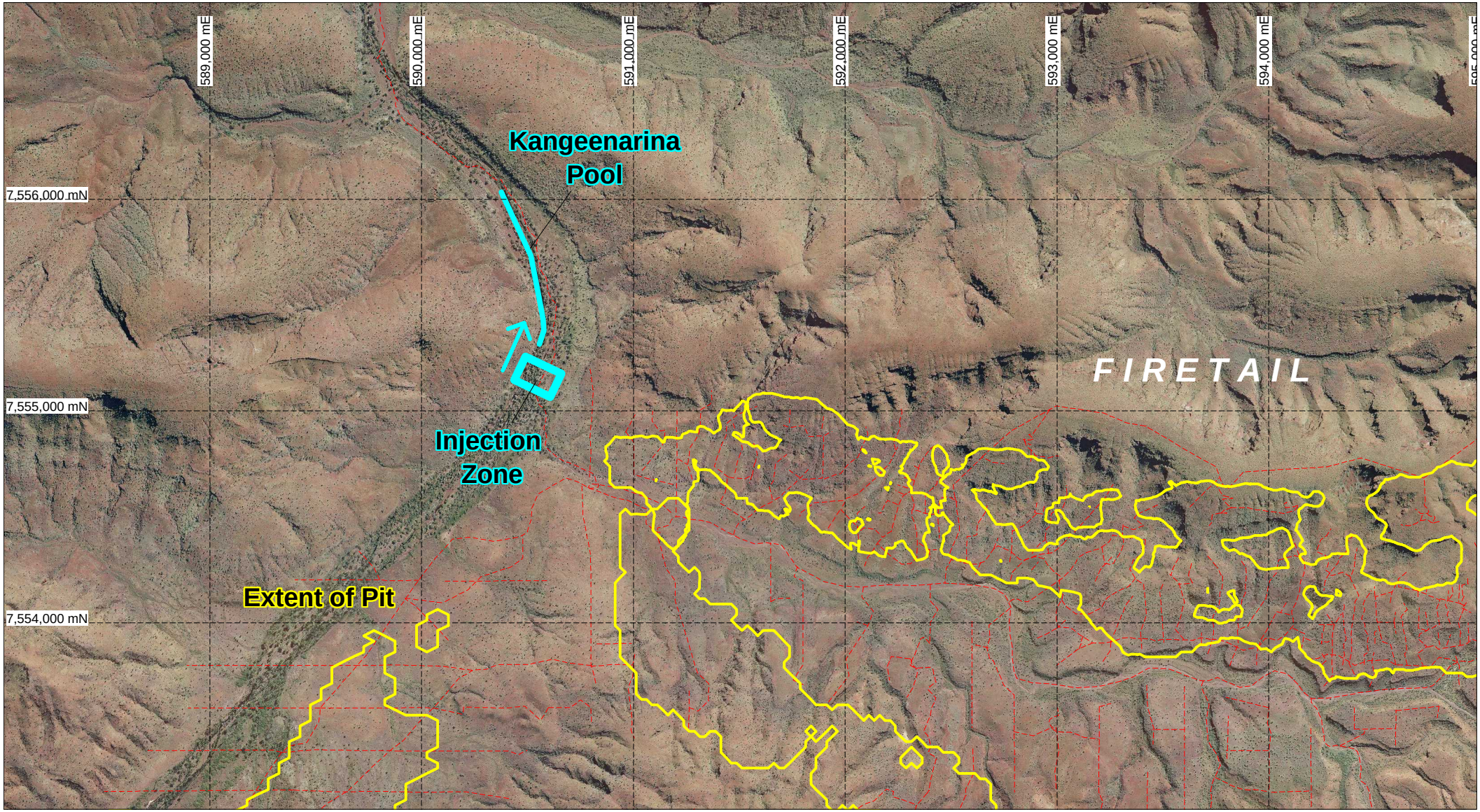
MWH

FMG Solomon
October 2010 Groundwater Depth Contours

Author: M Carroll	Date: 29.10.10
Revised: 29.12.2010	Project No.: A1256700
Projection: MGA Zone 50 (GDA 94)	Scale: As shown

Figure 2.

Kangeenarina Groundwater Injection Plan



Location Map

Pit Outlines

Injection Zones

%

0 250 500 1,000

metres

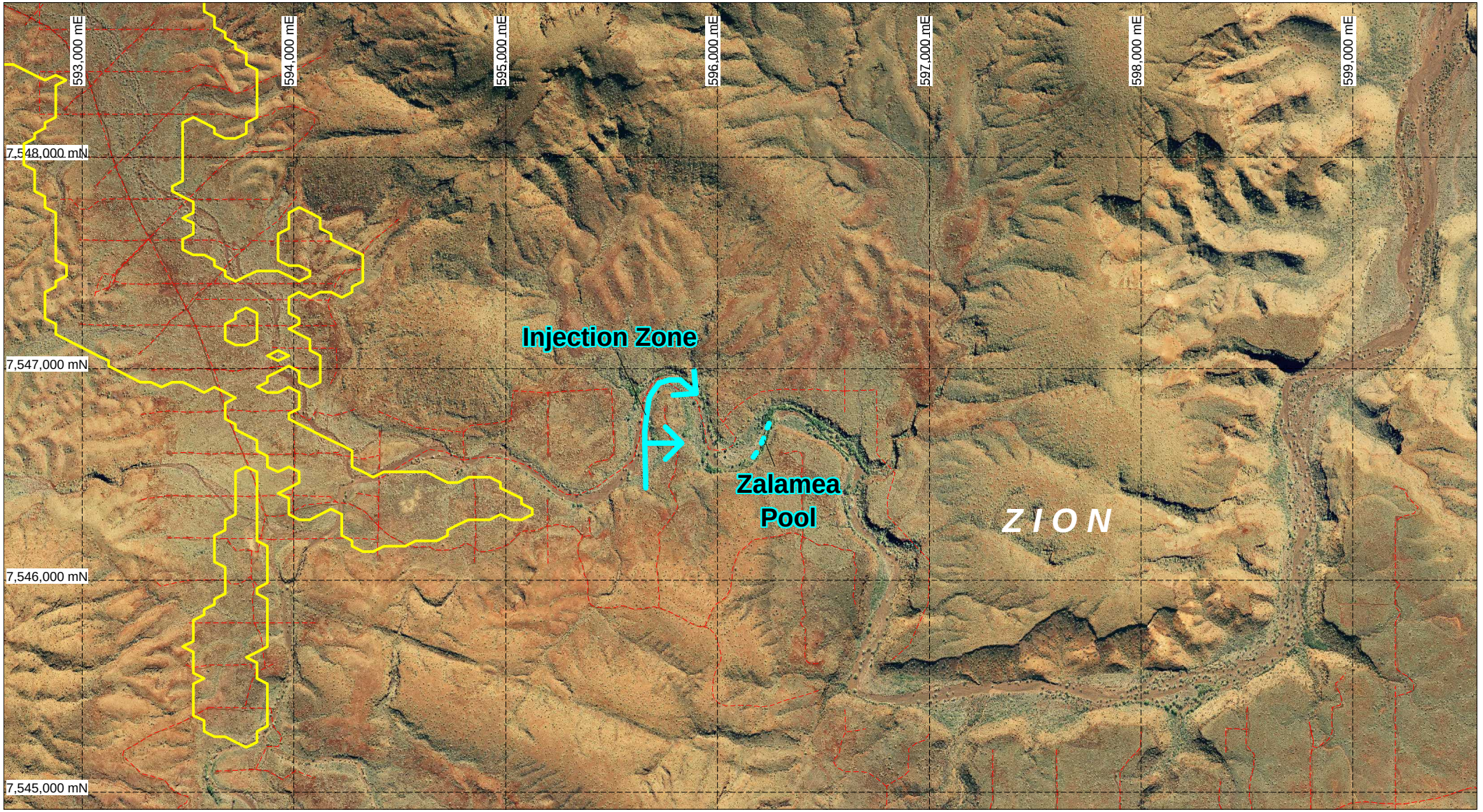
Fortescue Metals Group Ltd

Kangeenarina Groundwater Injection Plan

Author: R. C / S. G	Date:7/1/2011
Drawn By: A. Weston	Revision:
Doc No: SO_MP_HY_0002	Confidentiality:
Projection: MGA Zone 50 (GDA 94)	Scale: 1:25000

Figure 3.

Zalamea Groundwater Injection Plan



Location Map

Pit Outlines

Injection Zones

%

0 250 500 1,000

metres

Fortescue Metals Group Ltd

Zalamea Groundwater Injection Plan

Author: R. C / S. G	Date:7/1/2011
Drawn By: A. Weston	Revision:
Doc No: SO_MP_HY_0002	Confidentiality:
Projection: MGA Zone 50 (GDA 94)	Scale: 1:25000

Figure 4.

Weano Gorge and Range Gorge

580,000 mE
590,000 mE
600,000 mE
610,000 mE
620,000 mE
630,000 mE
640,000 mE
650,000 mE

7,560,000 mN
7,550,000 mN
7,540,000 mN
7,530,000 mN
7,520,000 mN

Briney Camp
The Castle
Dally Camp
Range Gorge
Wittenoom
Weano Gorge

Location Map
Port Hedland
Project
Kalgoorlie
PERTH

FMG Solomon Rail
Pit Outlines
Karijini National Park

N

0 2 4 8
kilometres

Fortescue Metals Group Ltd

Solomon Mine Site

Author: SV/SG	Date: 06/01/2011
Drawn By: FH	Revision: 0
Doc No: SO_MP_EN_0046	Confidentiality: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:200000

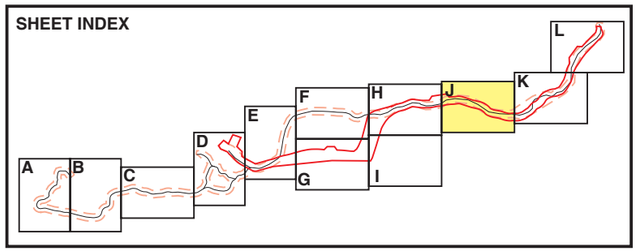
Figure 5.

Wona Land System Sub-units

PRINTED: Wed 05 Jan 11
CHECKED: CG 05-01-11
DRAWN: CR 05-01-11
DATUM: MGA zn50
ENV/PERT/00550AD/Flora and Vegetation Assessment/EP2009-051F08j.dgn

660000E
665000E
670000E
675000E
7565000N
7560000N

SHEET INDEX



metres
0 500 1000 1500 2000
SCALE 1 : 50 000 @ A3

LEGEND
- Revised Stage 1 Rail Alignment
- Original Stage 1 Rail Corridor
- Revised Stage 1 Rail Corridor
- Stage 2 Rail Corridor
- Vegetation Types Boundary
- SeE45 Vegetation Type
- Vegetation Condition Boundary
- VG Vegetation Condition
- Burnt Area
- Mulga Dominated Vegetation
- Wona Land System Priority 3 PEC

HWE11/HSA1
FSM3
FSA7
SUP37
SUP38
SUP39
SUP40
SUP41
SUP42
SUP43
SUP44
FGT1/ FGT2
FSA8
MDSA4
FGT1
VG to G
HSA2
MDWE5
HSA1
DSA2
FSA1
MDWE3/DWE4
HSA5/HWE5/DWE7
CH 56000
CH 54000
CH 52000
CH 50000
CH 48000
CH 46000
CH 44000
CH 42000
CH 40000
CH 38000
CH 36000

coffey environments
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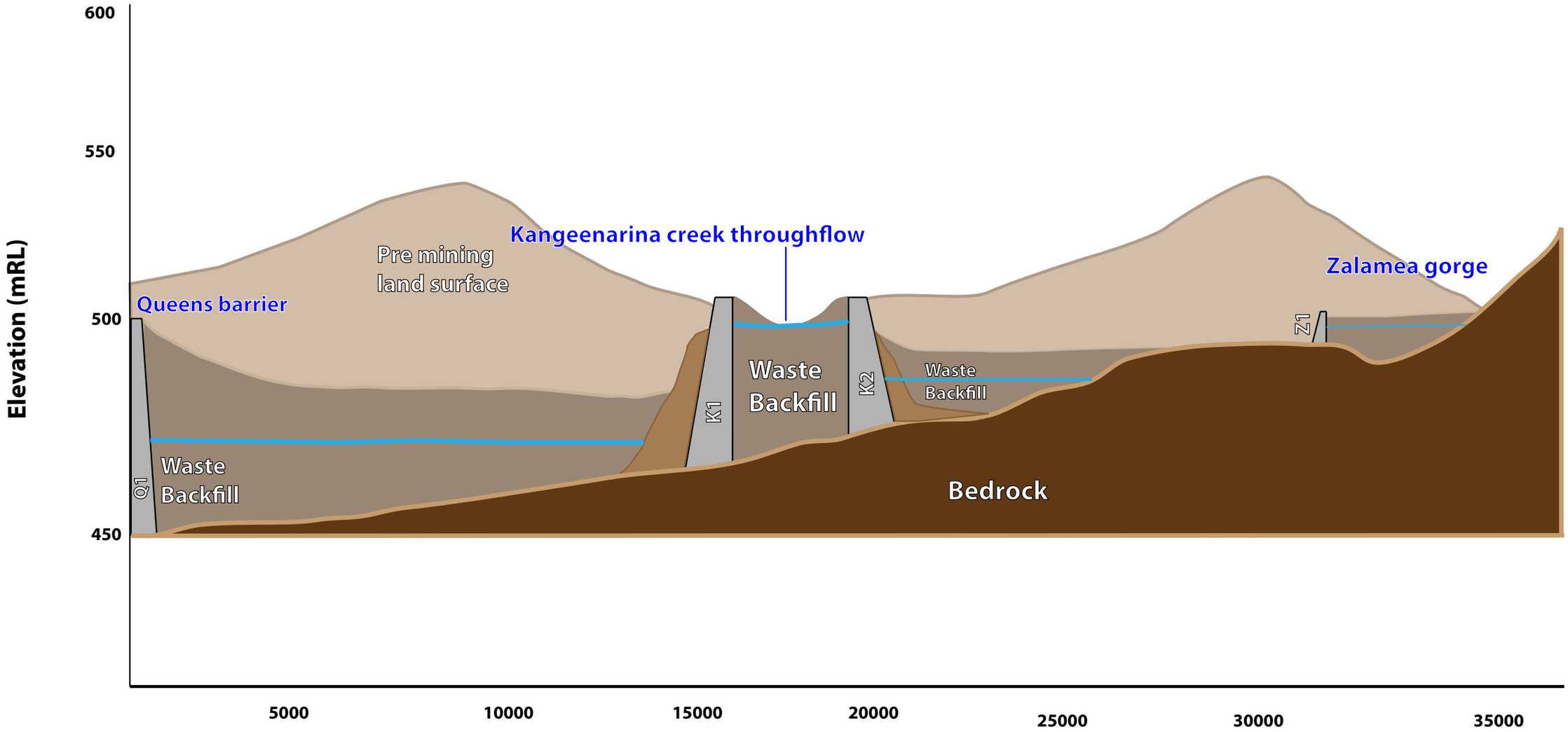
FLORA AND VEGETATION ASSESSMENT
SOLOMON RAIL PROJECT
VEGETATION TYPES AND CONDITION
FIGURE 8j

Figure 6.

Kangeenarina Hydrology Longitudinal Cross Section

W

E



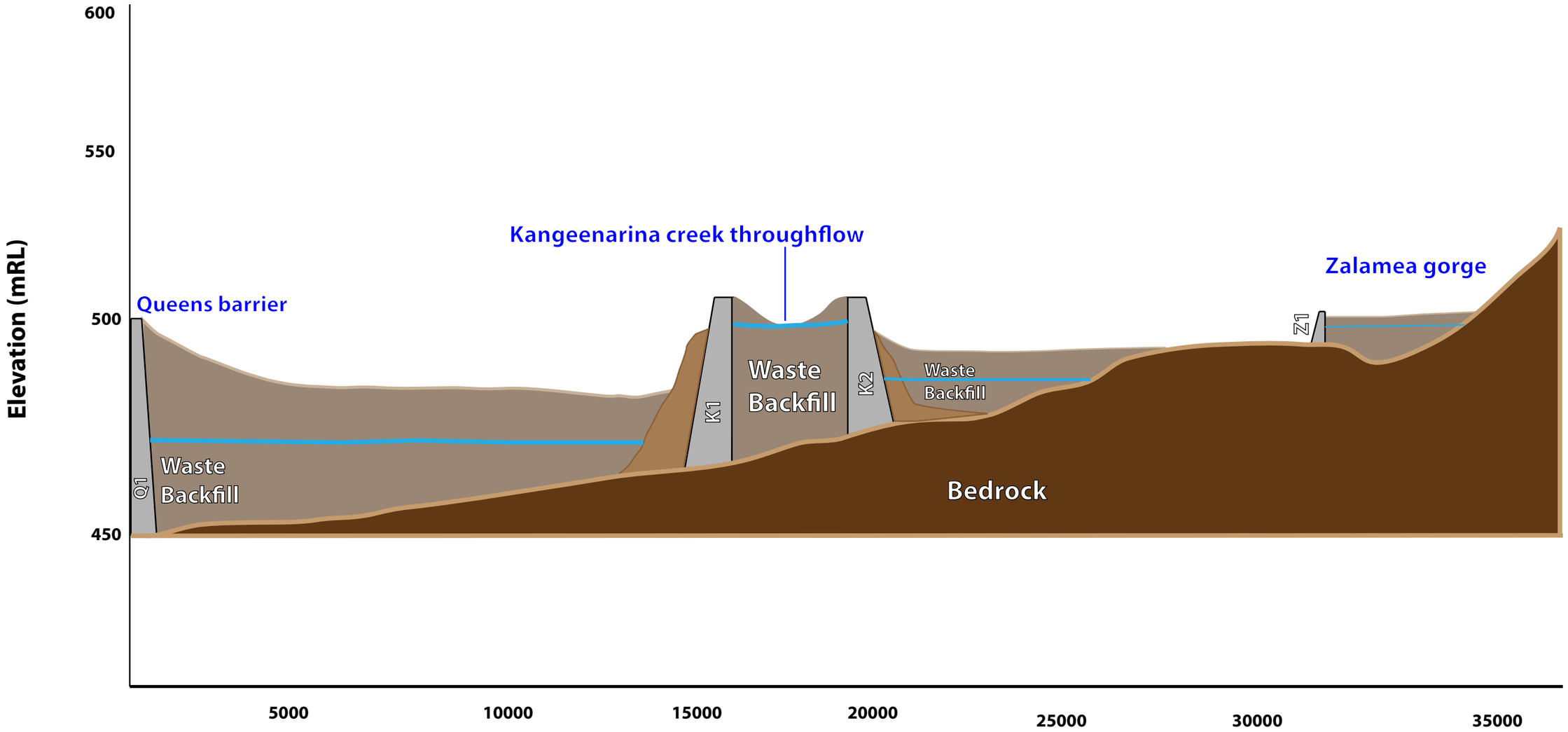
Legend

- Bedrock Surface
- Bedrock
- Pit Wall
- Groundwater Surface

Fortescue
The New Force in Iron Ore

FMG Solomon
Longitudinal Profile
Pre Mining Schematic

W **E**



Legend

- Bedrock Surface
- Bedrock
- Pit Wall
- Groundwater Surface

Fortescue
The New Force in Iron Ore

FMG Solomon
Longitudinal Profile
Post Mining Schematic

575,000 mE
580,000 mE
585,000 mE
590,000 mE
595,000 mE
7,555,000 mN
7,550,000 mN
7,545,000 mN

Queens Barrier
Kings Barrier 1
Kings Barrier 2
Zalamea Barrier
Reinstated Land Surface
Kangeenarina Creek
Flow Line

Location Map
Port Hedland
Project
Kalgoorlie
PERTH

Backfilled Pit Area
Barriers

N
0 0.5 1 2
kilometres

Fortescue Metals Group Ltd

Mine Closure Schematic Configuration

Author: R Colman	Date:22/2/2011
Drawn By: C Whyte	Revision:
Dwg No: SO_MP_HY_0003	Report No:
Projection: MGA Zone 50 (GDA 94)	Scale: 1:65000

Figure 7.

Serenity Valley Vegetation Mapping

coffey environments
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FLORA AND VEGETATION ASSESSMENT
SOLOMON PROJECT AND INVESTIGATOR

VEGETATION TYPES AND CONDITION SERENITY

FIGURE 15a

metres
0 200 400 600 800 1000
SCALE 1 : 30 000 @ A3

LEGEND

- Study Area Boundary
- Tenement Boundary
- Vegetation Types Boundary
- SeE45 Vegetation Type
- Vegetation Condition Boundary
- VG Vegetation Condition
- Burnt Areas

552000E 554000E 556000E

7552000N 7550000N 7548000N

SeE1 SeE72 G to P SeE37/SeE41 SeE67 SeE77 SeE1 SeE104 SeE11 G to P SeE38/SeE55 SeE39 SeE42 SeE54 SeE2 SeE34 VG SeE53 SeE45 SeE38/SeE55 SeE81 SeE14 G to P P to VP SeE36 SeE74 M47/1408 SeE43 SeE40 SeE43 SeE34 SeE51/SeE65 SeE67 VG SeE63 G to P SeE67 M 4701407 SERENITY 2 SeE71 SeE70 SeE44/SeE58/SeE59 SeE24/SeE44/SeE75 SeE60/SeE62 SeE61 SeE15 SeE44/SeE58/SeE59

550000E 552000E 554000E 556000E 558000E

PRINTED: Mon 21 Dec 09
CHECKED: CG 20-12-09
DRAWN: CR 20-12-09
DATUM: MGA zn50
ENVI/PERT/00550AA/Flora and Vegetation Assessment/EP2009-040F15a.dgn

PRINTED: Mon 21 Dec 09
CHECKED: CG 20-12-09
DRAWN: CR 20-12-09
DATUM: MGA zn50
ENV\PERT/00550AA/Flora and Vegetation Assessment/EP2009-040F15b.dgn

7546000N
7544000N
7542000N
7540000N
552000E
554000E
556000E
558000E

M47/1407
M47/1408

SeE76
SeE3
SeE12
SeE16
SeE32
VG
SeE24/SeE44/SeE75
SeE33
SeE1
SeE46
SeE66
SeE29
SeE1
SeE10
SeE70
SeE31
SeE23
SeE30
SeE4
VG
SeE73
SeE6
SeAc2
SeAc1
SeE5
SeE66
SeE20/SeE21/SeE22
SeE19
SeE27
G to P
SeE28
SeE82
SeE47
SeE56
SeE48
SeAc2
P to VP
SeE27
SeE62
SeE18
VG
SeE4
SeE13
SeE7
SeE13
SeE79
SeE80
SeE52
SeE25/SeE17
SeE26/SeE35
SeE68
SeE66

SeE61
VG
SeE64
SeE44/SeE58/SeE59
SeE1
VG
SeE78
SeE78
SeE69
SeE57
SeE9

metres
0 200 400 600 800 1000
SCALE 1 : 30 000 @ A3

LEGEND

- Study Area Boundary
- Tenement Boundary
- Vegetation Types Boundary
- SeE45 Vegetation Type
- Vegetation Condition Boundary
- VG Vegetation Condition
- Burnt Areas

coffey environments
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FLORA AND VEGETATION ASSESSMENT
SOLOMON PROJECT AND INVESTIGATOR

VEGETATION TYPES AND CONDITION SERENITY

FIGURE 15b

SERENITY VEGETATION TYPES LEGEND

HILLS/LOW RISES/SLOPES

Eucalyptus Woodlands

SeE1
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 10m over Scattered Tall Shrubs of *Hakea lorea* subsp. *lorea* and *Acacia ancistrocarpa* to 4.5m over Closed to Mid-dense Hummock Grassland of *Triodia wiseana* to 1.2m over Low Open Shrubland of *Indigofera monophylla* and *Acacia tenuissima* to 0.25m

SeE2
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* to 7m over Tall Open Shrubland of *Acacia monticola* and *Grevillea wickhamii* subsp. *hispidula* to 2.5m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.2m over Very Open Tussock Grassland of *Eriachne mucronata* (typical form) and *Eriachne ciliata* to 0.25m

SeE3
Low Woodland of *Eucalyptus gamophylla* to 3m over Scattered Shrubs of *Acacia atkinsiana* to 1.3m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 3) to 1.3m

SeE4
Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 6m over Scattered Tall Shrubs of *Grevillea pyramidalis* subsp. *leucadendron*, *Hakea chordophylla* and *Senna glutinosa* subsp. *glutinosa* to 3.5m over Shrubland of *Acacia maitlandii* to 1.5m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.2m over Scattered Low Shrubs of *Acacia hilliana*, *Acacia adoxa* var. *adoxa* and *Keraudrenia nephrosperma* to 0.8m

SeE5
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 6m over Tall Shrubland of *Acacia monticola*, *Acacia dictyophleba*, *Hakea chordophylla* and *Acacia tumida* var. *pilbarensis* to 3m over Shrubland of *Senna glutinosa* subsp. *glutinosa* to 1.8m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.2m over Low Shrubland of *Gompholobium karijini* and *Goodenia stobbsiana* to 1m over Very Open Tussock Grassland of *Paraneurachne muelleri* to 0.8m

SeE6
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* to 7m over Tall Open Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Tephrosia spechtii* and *Senna glutinosa* subsp. *glutinosa* to 2.9m over Scattered Shrubs of *Sida hackettiana* to 1.2m over Mid-dense Hummock Grassland of Triodia wiseana to 1.2m over Scattered Low Shrubs of *Corchorus incanus* subsp. *incanus* to 0.8m

SeE7
Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 8m over tall Open Shrubland of *Acacia inaequilatera* and *Acacia cowleana* to 3.5m over Hummock Grassland of *Triodia epactia* (Form 4) to 1.3m over Low Open Shrubland of *Senna artemisioides* subsp. *oligophylla* x *helmsii* and *Gossypium australe* (Burrup Peninsula form) to 0.5m

SeE8
Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 10m over Scattered Shrubs of *Gossypium robinsonii* and *Acacia monticola* to 2m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.3m

SeE9
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 9m over Tall Open Shrubland of *Acacia pruinocarpa*, *Tephrosia spechtii*, *Acacia monticola*, *Gossypium robinsonii* and *Grevillea pyramidalis* subsp. *leucadendron* to 4m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.1m over Low Open Shrubland of *Eremophila macmillaniana*, *Corchorus* sp. (HD260) and *Sida* sp. Barlee Range to 1m

SeE10
Scattered to Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 12m over Shrubland of *Acacia maitlandii* and *Acacia elachantha* (golden hairy variant) to 2m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia epactia* (Form 4) to 1.2m

SeE11
Low Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* to 6m over Tall Shrubland of *Acacia tumida* var. *pilbarensis* to 3m over Shrubland of *Acacia tenuissima*, *Acacia maitlandii* and *Mirbelia viminalis* to 2m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.3m over Very Open Grassland of *Themeda triandra* to 1m over Scattered Low Shrubs of *Abutilon dioicum* to 0.6m

SeE12
Scattered Low Trees of *Eucalyptus gamophylla* to 2.2m over Tall Shrubland of *Acacia monticola* to 2.5m over Hummock Grassland of *Triodia* sp. to 1.2m

Acacia Shrubland

SeAc1
Tall Open Shrubland of *Acacia tumida* var. *pilbarensis* to 2.2m over Low Open Shrubland of *Acacia inaequilatera* and *Senna glutinosa* subsp. *glutinosa* to 2m over Closed Hummock Grassland of Triodia wiseana to 1.1m

VALLEY FLOOR

SeE13
Open Woodland of *Corymbia hamersleyana* to 7m over Tall Open Shrubland of *Acacia inaequilatera*, *Acacia dictyophleba*, *Hakea lorea* subsp. *lorea* and *Acacia tumida* var. *pilbarensis* to 3.5m over Hummock Grassland of *Triodia epactia* (Form 3) to 1.3m over Very Open Tussock Grassland of *Themeda triandra* and *Chrysopogon fallax* to 1.1m over Low Open Shrubland of *Senna artemisioides*. aff. subsp. *oligophylla* (thinly sericeous) and *Ptilotus obovatus* to 1m

SeE14
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 5m over Scattered Low Trees of *Sida* sp. spiciform panicles to 1m over Open Hummock Grassland of *Triodia epactia* (Form 4) to 1m

SeE15
Low Open Woodland of *Eucalyptus gamophylla*, *Corymbia deserticola* subsp. *deserticola* and *Corymbia hamersleyana* to 6m over Tall Shrubland of *Acacia tumida* var. *pilbarensis* to 3m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 3) to 1.6m

SeE16
Low Open Woodland of *Eucalyptus gamophylla*, *Corymbia zygophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* to 6m over Mid-dense Hummock grassland of *Triodia* aff. *epactia* to 1.25m

SeE17
Open Woodland of *Corymbia deserticola* subsp. *deserticola*, *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 8m over Tall Open Shrubland of *Acacia dictyophleba*, *Acacia cowleana*, *Acacia inaequilatera* and *Acacia ancistrocarpa* to 2.5m over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* to 1m

SeE18
Low Open Woodland of *Eucalyptus gamophylla* and *Eucalyptus xerothermica* to 3.5m over Tall Open Shrubland of *Senna glutinosa* subsp. *glutinosa* and *Acacia inaequilatera* to 3m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 4) to 1.4m over Low Open Shrubland of *Ptilotus rotundifolius*, *Ptilotus astrolasius* var. *astrolasius* and *Senna artemisioides* subsp. *oligophylla* x *helmsii* to 1.1m

SeE19
Woodland of *Eucalyptus xerothermica* and *Corymbia hamersleyana* to 6m over Open Heath of *Acacia pyrifolia* var. *pyrifolia* and *Eremophila longifolia*, *Santalum lanceolata*, *Hakea lorea* subsp. *lorea* and *Acacia inaequilatera* to 2m over Mid Dense Hummock Grassland of *Triodia epactia* (Form 3) to 1.4m over Open Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax*, *Digitaria brownii* and *Eulalia aurea* to 1m

SeE20
Low Open Woodland of *Eucalyptus gamophylla* and *Corymbia deserticola* subsp. *deserticola* to 5.5m over Tall Open Shrubland of *Acacia tumida* var. *pilbarensis* to 2.2m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia epactia* (Form 4) to 1.6m

SeE21
Low Woodland of *Corymbia deserticola* subsp. *deserticola*, *Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* to 4m over Open Heath of *Acacia ancistrocarpa*, *Acacia elachantha* (golden hairy variant) and *Acacia tenuissima* to 2m over Closed Hummock Grassland of *Triodia* aff. *epactia* and *Triodia wiseana* to 1.4m over *Mirbelia viminalis*, *Keraudrenia nephrosperma*, *Ptilotus astrolasius* var. *astrolasius* and *Acacia adoxa* var. *adoxa* to 1m

SeE22
Low Open Woodland of *Corymbia hamersleyana*, *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus gamophylla* to 8m over Tall Open Shrubland *Gastrolobium grandiflorum* and *Acacia elachantha* (golden hairy variant) to 2.8m over Mid-dense Hummock Grassland *Triodia epactia* (Form 3) and *Triodia wiseana* to 1.2m over Scattered Tussock Grassland *Eulalia aurea* and *Themeda triandra* to 0.9m

SeE23
Low Woodland of *Corymbia hamersleyana* and *Eucalyptus xerothermica* to 3.1m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.5m over Very Open Tussock Grassland of *Aristida holathera* var. *latifolia* and *Themeda triandra* to 1.1m over Shrubland of *Acacia pruinocarpa* and *Hakea lorea* subsp. *lorea*, *Senna glutinosa* subsp. *glutinosa* and *Acacia pyrifolia* var. *pyrifolia* to 2m over *Acacia dictyophleba*, *Bonamia rosea* and *Scaevola acacioides* to 1m

SeE24
Low Open Forest of *Eucalyptus gamophylla*, *Corymbia hamersleyana* and *Eucalyptus xerothermica* to 7m over Tall Open Scrub to Tall Shrubland of *Acacia inaequilatera* and *Acacia tumida* var. *pilbarensis* to 3m to 2m over Closed Hummock to Mid-dense Hummock Grassland of *Triodia* aff. *epactia* and *Triodia wiseana* to 1.5m over Tussock to Very Open Tussock Grassland of *Cymbopogon obtectus*, *Eulalia aurea* and *Themeda triandra* to 1.3m over Low Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* to 1m over Low Shrubland of *Senna artemisioides* subsp. *oligophylla*, *Senna artemisioides* subsp. *oligophylla* x *glutinosa* and *Senna glutinosa* subsp. *luerssenii Ptilotus rotundifolius*, *Acacia adoxa* var. *adoxa* and *Gompholobium karijini* to 1m

SeE25
Low Open Woodland of *Corymbia hamersleyana* and *Corymbia deserticola* subsp. *deserticola* to 6m over Tall Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Acacia dictyophleba* to 3m over Open Shrubland of *Acacia ancistrocarpa*, *Acacia elachantha* (golden hairy variant) and *Acacia tenuissima* to 2m over Hummock Grassland of *Triodia* sp. to 1.3m

SeE26
Low Open Woodland of *Corymbia hamersleyana* to 5m over Shrubland of *Acacia ancistrocarpa* and *Acacia tenuissima* to 1.6m over Closed Hummock Grassland of *Triodia wiseana* to 1.4m

SeE27
Scattered Low Trees of *Corymbia hamersleyana* and *Eucalyptus xerothermica* to 4.5m over Tall Open Shrubland of *Gossypium robinsonii*, *Hakea lorea* subsp. *lorea*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia inaequilatera* to 4m over Scattered Shrubs of *Gossypium australe* (Burrup Peninsula Form) to 1.4m over Closed Hummock Grassland of *Triodia wiseana* to 1.1m

SeE28
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus xerothermica* to 7m over Tall Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Acacia inaequilatera* to 3.6m over Open Shrubland of *Eremophila longifolia* and *Rhagodia eremaea* to 1.6m over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* to 1.2m over Open Tussock Grassland of *Chrysopogon fallax*, *Eulalia aurea* and *Themeda triandra* to 1.2m

SeE29
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 6m over Tall Open Shrubland of *Hakea chordophylla*, *Acacia cowleana* and *Grevillea wickhamii* subsp. *aprica* to 3m over *Acacia maitlandii* and *Acacia tenuissima* to 1.5m over Closed Hummock Grassland of *Triodia wiseana* to 1.5m over Low Shrubland of *Ptilotus rotundifolius*, *Acacia adoxa* var. *adoxa* and *Ptilotus calostachyus* var. *calostachyus* to 1m

SeE30
Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 6m over Tall Open Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia dictyophleba* and *Senna glutinosa* subsp. *glutinosa* to 3.2m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 3) and *Triodia wiseana* to 1.4m

SeE31
Low Open Forest of *Eucalyptus gamophylla* and *Corymbia hamersleyana* to 5m over Scattered Tall Shrubs of *Hakea lorea* subsp. *lorea* over Open Heath of *Acacia ancistrocarpa*, *Acacia tumida* and *Acacia dictyophleba* to 2m over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* to 1.5m over Low Shrubland of *Bonamia rosea*, *Senna artemisioides* subsp. *oligophylla*, *Senna symonii* and *Keraudrenia velutina* subsp. *elliptica* to 1m

SeE32
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* to 8m over Tall Shrubland of *Acacia monticola* and *Acacia elachantha* (golden hairy variant) to 2.5m over Open Shrubland of *Acacia tenuissima* to 1.6m over Hummock Grassland of *Triodia wiseana* to 1.4m over Low Open Shrubland of *Acacia adoxa* var. *adoxa* to 0.6m

SeE33
Low Open Woodland of *Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* to 7m over Tall Shrubland of *Acacia dictyophleba* to 3m over Open Shrubland of *Acacia monticola*, *Hakea lorea* subsp. *lorea*, *Senna glutinosa* subsp. *glutinosa* and *Acacia elachantha* (golden hairy variant) to 2m over Closed Hummock Grassland of *Triodia* aff. *epactia* to 1.2m

SeE34
Scattered Low Trees of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 5m over Tall Open Shrubland of *Acacia elachantha* (golden hairy variant) and *Hakea lorea* subsp. *lorea* to 3m over Scattered Shrubs of *Senna artemisioides* subsp. *oligophylla* x *helmsii* to 1.4m over Mid-Dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.4m over Very Open Tussock Grassland of *Paraneurachne muelleri*, *Digitaria brownii* and *Themeda triandra* to 1m

SeE35
Low Open Woodland of *Corymbia hamersleyana* to 6m over Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Hakea lorea* subsp. *lorea* to 2m over Hummock Grassland of *Triodia epactia* (Form 4) to 1.2m

SeE36
Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* to 12m over Open Shrubland of *Senna glutinosa* subsp. *glutinosa*, *Mirbelia viminalis*, *Acacia tenuissima* and *Acacia maitlandii* to 2m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.3m over Scattered Low Shrubs of *Ptilotus rotundifolius* and *Acacia adoxa* var. *adoxa* to 0.6m

SeE37
Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* to 6m over Open Shrubland of *Acacia tenuissima, Acacia tumida* var. *pilbarensis* and *Mirbelia viminalis* to 1.7m over Hummock Grassland of *Triodia wiseana* to 1.4m

SeE38
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* to 8m over Tall Open Woodland of *Acacia elachantha* (golden hairy variant), *Acacia pyrifolia* var. *pyrifolia* and *Acacia dictyophleba* to 3m over Hummock Grassland of *Triodia* aff. *epactia* to 1m

SeE39
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 8m over Tall Open Shrubland of *Acacia dictyophleba* and *Acacia elachantha* (golden hairy variant) to 4m over Hummock Grassland of *Triodia* aff. *epactia* to 1m over Scattered Low Shrubs of *Indigofera monophylla* to 0.3m

SeE40
Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* to 8.5m over Tall Open Shrubland of *Acacia monticola* to 2.5m over Hummock Grassland of *Triodia wiseana* to 0.2m

SeE41
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* to 8m over Tall Open Shrubland of *Acacia dictyophleba*, *Acacia tenuissima*, *Acacia trachycarpa* x *tumida, Grevillea wickhamii* subsp. ? and *Acacia elachantha* (golden hairy variant) to 2.5m over Mid-dense Hummock to Hummock Grassland of *Triodia wiseana* to 1.4m

SeE42
Low Open Forest of Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* and *Eucalyptus gamophylla* to 5m over Tall Open Shrubland of *Hakea lorea* subsp. *lorea* to 2.1m over Scattered Shrubs of *Gossypium australe* (Burrup Peninsula Form) to 1.2m over *Crotalaria medicaginea* var. *neglecta*, *Sida* sp verrucose glands and *Bonamia rosea* to 0.5m over Closed Tussock Grassland of *Eulalia aurea*, *Chrysopogon fallax*, *Cymbopogon obtectus*, *Aristida holathera* var. *holathera* and *Digitaria brownii* to 1.1m over Very Open Herbland of *Swainsona formosa*, *Indigofera linnaei* and *Indigofera colutea* to 0.3m

SeE43
Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* to 2m over Tall Shrubland of *Acacia monticola* and *Acacia ancistrocarpa* to 3m over Open Shrubland of *Acacia tenuissima*, *Acacia tumida*, *Acacia dictyophleba* and *Senna glutinosa* subsp. *glutinosa* to 2m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1.1m over Scattered Herbs of *Ptilotus calostachyus* var. *calostachyus* to 1m over Scattered Sedges of *Fimbristylis simulans* to 0.1m

SeE44
Open Woodland of *Corymbia hamersleyana* to 6m over Hummock Grassland of *Triodia epactia* (Form 3) to 1m

SeE45
Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* to 10m over Open Shrubland of *Acacia ancistrocarpa* to 2m over a Mid-dense Hummock Grassland of *Triodia* aff. *epactia* and *Triodia wiseana* to 1m

SeE46
Scattered Low Trees of *Eucalyptus gamophylla*, *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 9m over Tall Open Shrubland of *Acacia dictyophleba* and *Acacia elachantha* (golden hairy variant) to 2.4m over Mid-dense Hummock Grassland of *Triodia* spp. to 1.2m

SeE47
Scattered Low Trees of *Corymbia hamersleyana* to 6m over Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* to 2m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 3) to 1.5m over Open Tussock Grassland of *Digitaria brownii*, *Eriachne mucronata* (Typical Form), *Themeda triandra*, *Cenchrus ciliaris* and *Paraneurachne muelleri* to 1m over Low Open Shrubland of *Indigofera monophylla* and *Tephrosia rosea* var. *glabrior* to 0.8m

SeE48
Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* to 10m over Open Shrubland of *Gastrolobium grandiflorum* and *Acacia elachantha* (golden hairy variant) to 2m over Hummock Grassland of *Triodia wiseana* and *Triodia epactia* (Form 5) to 1.2m over Low Open Shrubland of *Indigofera monophylla* and *Senna artemisioides* subsp. *oligophylla* to 0.8m over Very Open Tussock Grassland of *Paraneurachne muelleri*, *Themeda triandra* and *Eulalia aurea* to 0.6m

SeE49
Tall Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 7m over Tall Open Shrubland of *Acacia inaequilatera, Acacia elachantha* (golden hairy variant) and *Acacia dictyophleba* to 4m over Scattered Shrubland of *Senna artemisioides* subsp. *oligophylla* x *glutinosa* over Mid-dense Hummock Grassland of *Triodia epactia* (Form 4) and *Triodia wiseana*

SeE50
Scattered Trees of *Corymbia hamersleyana* and *Eucalyptus camaldulensis* to 15m over Scattered Shrubs of *Acacia pyrifolia* var. *pyrifolia* to 1.1m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 4) to 1.2m over Scattered Herbs of *Cleome viscosa* to 0.45m

SeE51
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Eucalyptus gamophylla* to 8m over Tall Open Shrubland of *Acacia monticola*, *Acacia elachantha* (golden hairy variant) and *Hakea chordophylla* to 3m over Hummock Grassland of *Triodia epactia* (Form 3) to 1.2m over Low Open Shrubland of *Gompholobium karijini*, *Ptilotus rotundifolius* and *Acacia adoxa* var. *adoxa* to 0.8m

SeE52
Low Woodland of *Corymbia hamersleyana* and *Eucalyptus xerothermica* to 5m over Scattered Tall Shrubs of *Hakea lorea* subsp. *lorea* to 2.2m over Shrubland of *Acacia elachantha* (golden hairy variant), *Acacia dictyophleba* and *Acacia ancistrocarpa* to 2m over Closed Hummock Grassland of *Triodia wiseana* to 0.8m

SeE53
Scattered Low Trees of *Corymbia hamersleyana* to 6m over Open Shrubland of *Grevillea wickhamii* subsp. *hispidula* and *Acacia pyrifolia* subsp. *pyrifolia* to 2m over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* to 1.2m

SeE54
Scattered Low Trees of *Corymbia hamersleyana* to 4m over Scattered Tall Shrubs of *Grevillea wickhamii* subsp. *hispidula*, *Hakea lorea* subsp. *lorea* and *Senna glutinosa* subsp. *glutinosa* to 2.8m over Mid-dense Hummock grassland of *Triodia wiseana* to 1.2m

SeE55
Low Open Woodland of *Corymbia hamersleyana*, *Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* to 10m over Scattered Shrubs of *Acacia tumida* var. *pilbarensis, Acacia pyrifolia* var. *pyrifolia*, *Corchorus* aff. *parviflorus* and *Hakea lorea* subsp. *lorea* to 1.5m over Hummock Grassland of *Triodia wiseana*, *Triodia epactia* (Form 3), *Triodia epactia* (Form 4) to 1.1m over Low Open Shrubland of *Corchorus* aff. *parviflorus* and *Corchorus lasiocarpus* subsp. *parvus* to 0.3m

SeE56
Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia deserticola* subsp. *deserticola* to 10m over Low Open Shrubland of *Ptilotus rotundifolius*, *Acacia tenuissima*, *Acacia maitlandii* and *Acacia elachantha* (golden hairy variant) to 2m over Hummock Grassland of *Triodia wiseana* to 1.2m

SeE57
Scattered Low Trees of *Corymbia hamersleyana* over Tall Shrubland of *Acacia inaequilatera* and *Acacia dictyophleba* over Mid-dense Hummock Grassland *Triodia wiseana* to 1.2m

SeE58
Low Woodland of *Eucalyptus gamophylla* and *Eucalyptus xerothermica* to 3.5m over Tall Open Shrubland to Scattered Tall Shrubs of *Acacia pyrifolia* var. *pyrifolia*, *Acacia dictyophleba*, *Grevillea wickhamii* subsp. *hispidula*, *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* to 3m over Mid-dense Hummock Grassland to Hummock Grassland of *Triodia* aff. *epactia* to 1.2m over Tussock Grassland of *Digitaria brownii*, *Chrysopogon fallax* and *Paraneurachne muelleri, Aristida holathera* var. *holathera*, *Eragrostis* aff. *eriopoda* (WAS site 963) and *Eriachne mucronata* (Typical Form) to 0.7m

SeE59
Low Open Woodland of *Corymbia deserticola* subsp. *deserticola*, *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 10m over Tall Open Shrubland to Scattered Tall Shrubs of *Hakea chordophylla*, *Acacia maitlandii*, *Acacia dictyophleba*, *Acacia ancistrocarpa*, *Acacia tumida* var. *pilbarensis*, *Acacia monticola* and *Acacia elachantha* (silvery hairy variant) over Low Open Shrubland of *Acacia adoxa* var. *adoxa* and *Gompholobium karijini* to 1m over Mid-dense Hummock Grassland of *Triodia wiseana* to 1m

SeE60
Open Low Woodland of *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus gamophylla* to 7m over Open Shrubland of *Acacia atkinsiana* to 1.7m over Mid-dense Hummock Grassland of *Triodia epactia* (Form 4) to 1.5m over Tussock Grassland of *Eulalia aurea*, *Paraneurachne muelleri* and *Themeda triandra* to 1.3m

SeE61
Low Woodland of *Eucalyptus gamophylla*, *Corymbia deserticola* subsp. *deserticola* and *Corymbia opaca* to 7m over Tall Shrubland of *Acacia elachantha* (golden hairy variant) and *Acacia tumida* var. *pilbarensis* to 3.2m over Tussock Grassland of *Eulalia aurea* and *Themeda triandra* to 1.1m

SeE62
Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 6m over Tall Open Shrubland of *Acacia inaequilatera* to 5m over Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Acacia elachantha* (golden hairy variant) to 1.5m over Hummock Grassland of *Triodia epactia* (Form 3) and *Triodia* aff. *epactia* to 1.3m over Very Open Tussock Grassland of *Chrysopogon fallax* and *Themeda triandra* to 1.1m

SeE63
Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Eucalyptus gamophylla*, *Corymbia hamersleyana* to 6m over Scattered Tall Shrubs of *Grevillea wickhamii* subsp. *hispidula*, *Santalum lanceolatum*, *Acacia inaequilatera* and *Acacia atkinsiana* to 3m over Tussock Grassland of *Eulalia aurea*, *Themeda triandra* and *Chrysopogon fallax* to 1.6m

SeE64
Low Open Woodland of *Corymbia hamersleyana* to 6m over Tall Shrubland of *Acacia tumida* var. *pilbarensis* over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* over Open Tussock Grassland of *Digitaria brownii*, *Themeda triandra* and *Aristida holathera* var. *holathera* to 0.5m

SeE65
Open Woodland of *Corymbia hamersleyana* to 6m over Tall Open Shrubland of *Grevillea wickhamii* subsp. *aprica* to 2.2m over Low Open Shrubland of *Indigofera monophylla* and *Acacia pyrifolia* var. *pyrifolia* to 1.2m over Hummock Grassland of *Triodia* aff. *epactia* to 1m

MAJOR DRAINAGE

SeE66
Open Woodland to Scattered Low Trees of *Corymbia hamersleyana* to 7m over Tall Open Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Gossypium robinsonii* and *Acacia tumida* var. *pilbarensis* to 3m over Very Open Tussock Grassland of *Cymbopogon procerus*, *Eriachne tenuiculmis* and *Digitaria brownii* to 1.4m over Hummock Grassland to Open Hummock Grassland of *Triodia epactia* (Form 4) to 1.2m over Low Shrubland of *Tephrosia rosea* var. *glabrior*, *Corchorus crozophorifolius* and *Corchorus incanus* to 0.8m

SeE67
Scattered Low Trees of *Corymbia hamersleyana* to 3.5m over Tall Shrubland of *Grevillea wickhamii* subsp. *macrodonta* to 3m over Hummock Grassland of *Triodia* aff. *epactia* to 1.6m over Open Shrubland of *Acacia pyrifolia* subsp. *pyrifolia* to 1.5m over Open Tussock Grassland of *Aristida latifolia* to 0.6m over Low Shrubland of *Indigofera monophylla* and *Tephrosia rosea* var. *glabrior* to 0.5m over Grassland of *Triodia epactia* and *Aristida latifolia* to 1.6m

SeE68
Woodland of *Corymbia hamersleyana* to 8m over Tall Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Grevillea wickhamii* subsp. *hispidula* to 2.5m over Scattered Shrubs of *Acacia inaequilatera* and *Gastrolobium grandiflorum* to 1.6m over Scattered Low Shrubs of *Tephrosia rosea* var. *glabrior* and *Dodonaea lanceolata* var. *lanceolata* to 1m over Open Tussock Grassland of *Themeda triandra*, *Cymbopogon ambiguus* and *Eulalia aurea* to 1.2m over Open Hummock Grassland of *Triodia epactia* (Form 4) to 0.8m

SeE69
Open Woodland of *Corymbia hamersleyana* to 11m over Tall Open Shrubland of *Gossypium robinsonii* and *Acacia inaequilatera* over Open Shrubland of *Tephrosia rosea* var. *glabrior* over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* over Open Tussock Grassland of *Cymbopogon procerus* to 1.1m

SeE70
Scattered Low Trees of *Corymbia hamersleyana* to 8m over Scattered Tall Shrubs of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Grevillea pyramidalis* subsp. *leucadendron* to 3.8m over Hummock Grassland to Open Hummock Grassland of *Triodia* aff. *epactia* to 1.2m over Very Open Tussock Grassland of *Themeda triandra* and *Eulalia aurea* to 1m over Scattered Low Shrubs of *Tephrosia rosea* var. *glabrior* to 0.8m

SeE71
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus xerothermica* over Tall Open Shrubland of *Gossypium robinsonii*, *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia pyrifolia* var. *pyrifolia* over Low Open Shrubland of *Tephrosia rosea* var. *glabrior* over Hummock Grassland of *Triodia* aff. *epactia* over Open Tussock Grassland of *Themeda triandra*, *Cymbopogon* sp. and *Digitaria brownii*

SeE72
Low Open Woodland of *Corymbia hamersleyana* to 6m over Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia pyrifolia* subsp. *pyrifolia* to 1.8m over Scattered Tussock Grasses of *Themeda triandra* to 1m over Low Open Shrubland of *Tephrosia rosea* var. *glabrior* to 0.6m

SeE73
Low Open Woodland of *Eucalyptus gamophylla* and *Corymbia deserticola* subsp. *deserticola* to 5m over Tall Open Shrubland of *Acacia ancistrocarpa* to 2.1m over Open Shrubland of *Senna symomii*, *Ptilotus rotundifolius* and *Acacia tenuissima* to 1.5m over Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.4m

SeE74
Scattered Low Trees of *Corymbia hamersleyana* to 5.0m over Low Shrubland of *Sida* sp. spiciform panicles, *Ptilotus astrolasius* var. *astrolasius*, *Corchorus lasiocarpus* var. *parvus*, *Hibiscus leptocladus* to 0.8m over Open Hummock Grassland of *Triodia* aff. *epactia* over Very Open Grassland of *Aristida contorta*, *Eriachne tenuiculmis* to 0.4m over Herbland of *Cleome viscosa* to 0.45m

Acacia Shrubland

SeAc2
Tall Shrubland of *Acacia tumida* var. *pilbarensis* to 2.2m over Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Corchorus* sp. (HD260) and *Eremophila longifolia* to 1.6m over Open Hummock Grassland of *Triodia epactia* (Form 3) to 1.6m over Very Open Tussock Grassland of *Cymbopogon procerus* and *Aristida contorta* to 1.4m over Low Open Heath of *Tephrosia rosea* var. *glabrior* to 0.6m

MINOR DRAINAGE/GULLIES

SeE75
Low Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* to 6m over Tall Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia inaequilatera* to 4.5m over Closed Hummock Grassland of *Triodia wiseana* and *Triodia* aff. *epactia* to 1.3m over Very Open Tussock Grassland of *Eulalia aurea* and *Themeda triandra* to 1.2m

SeE76
Scattered Low Trees of *Corymbia hamersleyana* to 8m over Scattered Tall Shrubs of *Acacia monticola*, *Acacia elachantha* (golden hairy variant) and *Gossypium robinsonii* to 2.3m over Low Open Shrubland of *Tephrosia rosea* var. *glabrior*, *Scaevola acacioides*, *Acacia pyrifolia* subsp. *pyrifolia* and *Indigofera monophylla* to 1.4m over Hummock Grassland of *Triodia epactia* (Form 4) to 1.2m over Scattered Tussock Grasses of *Eulalia aurea* and *Themeda triandra* to 0.8m

SeE77
Low Woodland of *Corymbia hamersleyana* to 6m over Tall Shrubland of *Acacia monticola, Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* to 3m over Scattered Shrubs of *Santalum lanceolatum* to 2m over Low Shrubland of *Indigofera monophylla* to 1m over Herbland of *Bidens bipinnata* and *Cleome viscosa* Tussock Grassland of *Themeda triandra Cymbopogon ambiguus* and *Paraneurachne muelleri* to 1m

SeE78
Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* to 5m over Tall Open Scrub of *Acacia tumida* var. *pilbarensis*, *Acacia bivenosa* and *Senna glutinosa* subsp. *glutinosa* over Mid-dense Hummock Grassland of *Triodia wiseana* to 0.4m

SeE79
Scattered Low Trees of *Corymbia hamersleyana* to 10m over Tall Open Shrubland of *Acacia tumida* var. *pilbarensis* to 2.5m over Scattered Hummock Grasses of *Triodia epactia* (Form 4) to 1m over Scattered Tussock Grasses of *Digitaria brownii Themeda triandra* and *Cymbopogon procerus* to 1m over Low Open Shrubland of *Tephrosia rosea* var. *glabrior* to 0.6m

SeE80
Low Open Woodland of *Corymbia hamersleyana* to 10m over Open Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia* var. *pyrifolia* and *Rulingia luteiflora* to 2m over Open Hummock Grassland of *Triodia epactia* (Form 4) to 1.3m over Scattered Hummock Gasses of *Themeda triandra* to 0.8m

SeE81
Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* to 14 m over Tall Open Shrubland of *Grevillea wickhamii* subsp. *hispidula* to 2.5m over Scattered Shrubs of *Acacia pyrifolia* subsp. *pyrifolia* to 1.3m over Low Open Shrubland *Tephrosia rosea* var. *glabrior*, *Indigofera monophylla* and *Corchorus lasiocarpus* var. *parvus* to 0.4m over Hummock Grassland of *Triodia* aff. *epactia* to 1.2m over Very Open Grassland of *Aristida holathera* var. *holathera* and *Cymbopogon procerus* to 1.2m

SeE82
Open Woodland of *Corymbia hamersleyana* to 10m over Scattered Shrubs of *Gossypium robinsonii*, *Acacia elachantha* (golden hairy variant), *Acacia pyrifolia* var. *pyrifolia* and *Santalum lanceolatum* to 2m over Open Tussock Grassland of *Themeda triandra*, *Cymbopogon procerus* and *Eulalia aurea* to 1.4m over Open Hummock Grassland of *Triodia wiseana* to 1.2m over Low Open Shrubland of *Tephrosia rosea* var. *glabrior* and *Cleome viscosa* to 0.5m

VEGETATION CONDITION LEGEND

E - Excellent
Pristine or nearly so; no obvious signs of damage caused by activities of European man.

VG - Very Good
Some relatively slight signs of damage caused by activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as **Ursinia anthemoides* or **Briza* spp., or occasional vehicle tracks

G - Good
More obvious signs of damage caused by activities of European man, including some obvious signs of impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as **Erharta* spp.

P - Poor
Still retains basic vegetation structure or ability to regenerate to it after very obvious activities of European man, such as grazing, partial clearing (chaining) or frequent fires.Weeds as above, probably plus some aggressive ones such as **Erharta* spp.

VP - Very Poor
Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.

D - Degraded
Areas that completely or almost completely without native species in the structure of their vegetation ; i.e. areas that are cleared or 'parkland cleared'with their flora comprising weed or crop species with isolated native trees or shrubs

* denotes weed species
(Devised by Malcolm E. Trudgen)

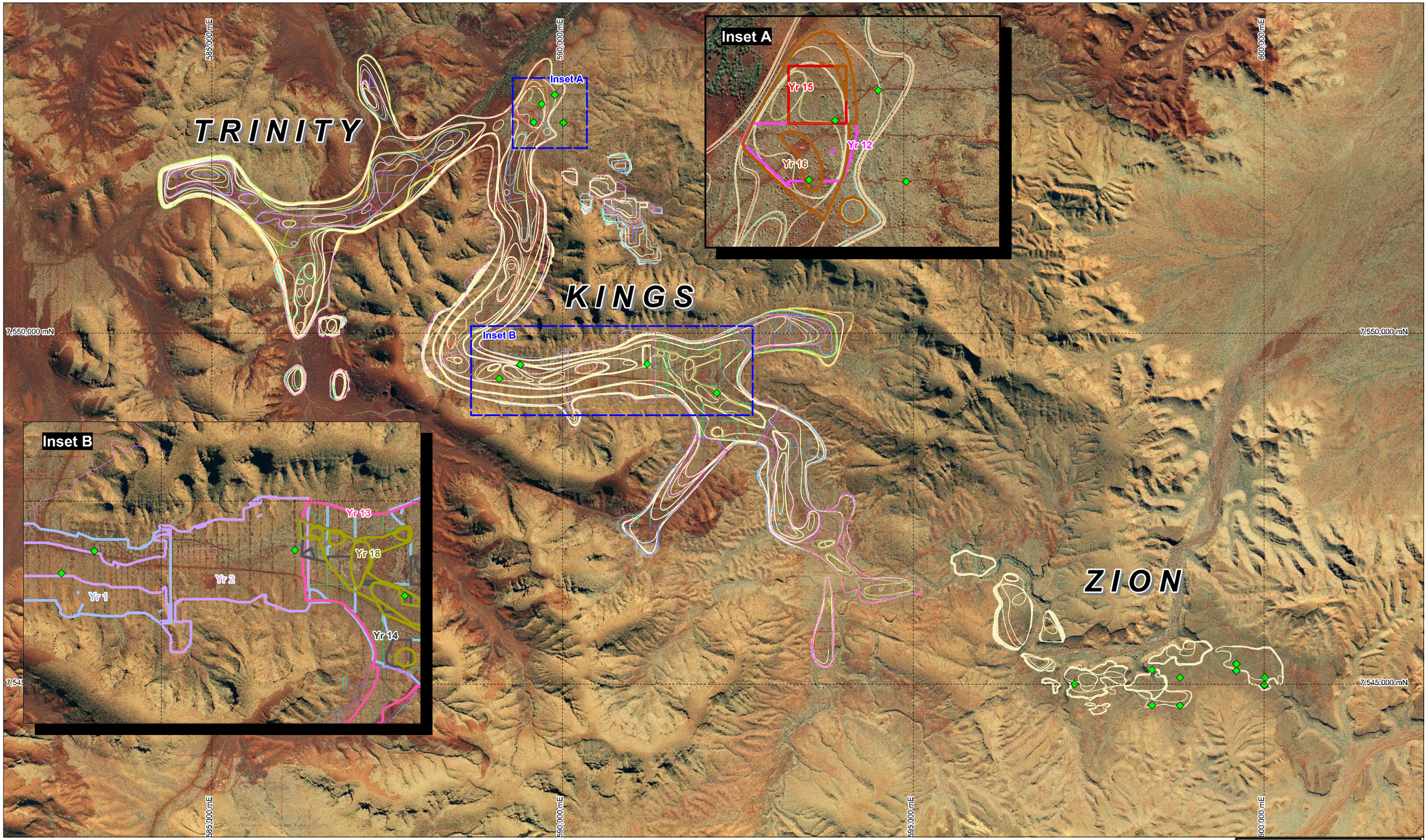
coffey environments
SPECIALISTS IN LIVING AND WORKING PLACES

FLORA AND VEGETATION ASSESSMENT
SOLOMON PROJECT AND INVESTIGATOR
VEGETATION LEGEND - SERENITY
FIGURE 15c

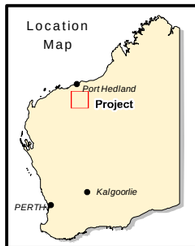
ENVI/PERT/00550AA/Flora and Vegetation Assessment/EP2009-040F15c.dgn DATUM: N/A DRAWN: CR 20-01-10 CHECKED: CG 20-01-10 PRINTED: Thu 21 Jan 10

Figure 8.

Mine Plan Schedule and Troglofauna Distribution



Location Map



Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12
Year 13
Year 14
Year 15
Year 16
Year 18

Pit Design Topography

Impacted Troglofauna

N

0 0.5 1 2

kilometres

Fortescue Metals Group Ltd

Kings and Zion Yearly Face Positions Troglofuana Present

Author: S. Grein	Date:22/2/2011
Drawn By: SH	Revision: 0
Dwg No: SO_MP_EN_0055	Confidentiality: 1
Projection: MGA Zone 50 (GDA 94	Scale: 1:50000

7,555,000 mN
7,554,000 mN
7,553,000 mN
7,552,000 mN
7,551,000 mN
7,550,000 mN
576,000 mE
577,000 mE
578,000 mE
579,000 mE
580,000 mE
581,000 mE
582,000 mE
583,000 mE
584,000 mE
585,000 mE

See Inset A

See Inset B

Inset B

Year 17

Year 18

Inset A

Year 10

Year 14

Year 11

QUEENS

Location Map

Port Hedland

Project

Kalgoorlie

PERTH

Year 8
Year 9
Year 10
Year 11
Year 12
Year 13
Year 14
Year 15
Year 16
Year 17
Year 18

Pit Design Topography

Impacted Troglofauna

N

0 250 500 1,000

metres

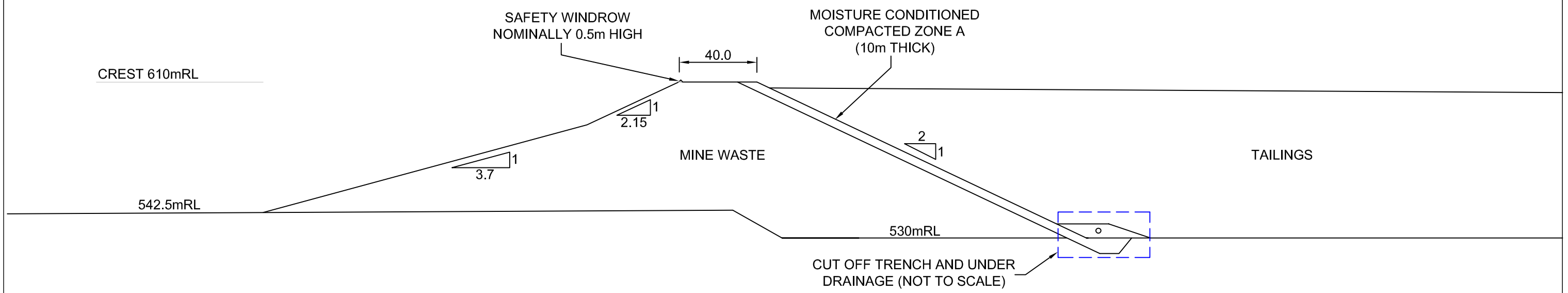
Fortescue Metals Group Ltd

Queens Yearly Face Positions Troglofauna Present

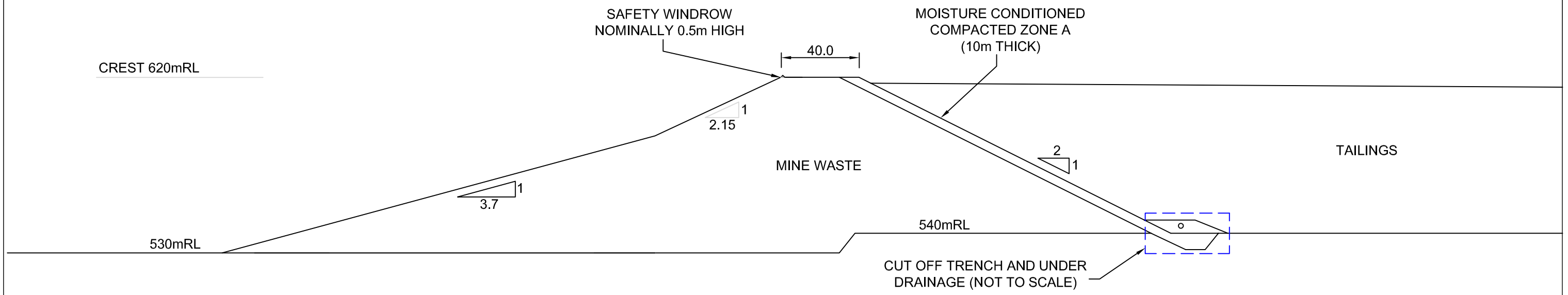
Author: S. Grien	Date:22/2/2011
Drawn By: SH	Revision: 0
Dwg No: SO_MP_EN_0055	Confidentiality: 1
Projection: MGA Zone 50 (GDA 94	Scale: 1:25000

Figure 9.

Tailing Storage Facility Design Figures



TSF1 TYPICAL SECTION



TSF2 TYPICAL SECTION

Drawn:	MW
Approved:	CJ
Date:	06/09/2010
Scale:	1:2000
Original size:	A3

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Client:	FORTESCUE METALS GROUP
Project:	TAILINGS MANAGEMENT CONCEPT STUDY SOLOMON IRON ORE PROJECT
Title:	TYPICAL EMBANKMENT SECTIONS
Project no:	MWP00779AA
Dwg no:	MWP00779AA_04
Rev:	A

REF:
DWG: M:\MINE\Projects\Fortescue Metals Group\MINEWPER00779AA_FMG_Solomon Combined PFS\Tailings\Drawings\MWP00779AA_04_RevA.dwg

590000mE
591000mE
592000mE
593000mE
752000mN
751000mN
300 MEGAFLO UNDERDRAINAGE
SM3175
SM3174
SM3173
SM3619
SM4011
SM3605
SM3600
RISER PIPE ANCHORED AT EMBANKMENT CREST
EMBANKMENT CREST RL 630m
300 MEGAFLO
UNDERDRAINAGE SUMP
UNDERDRAINAGE LINE
PROPOSED SUPERNATANT WATER POND LOCATION
TSF1 CATCHMENT AREA
TSF1 CATCHMENT AREA
PIPE BENCH AND ACCESS TRACK AT CONTOUR RL 630m
TAILINGS SURFACE (ASSUMED 1% BEACH SLOPE
630
628
626
624
622
650
700
720
740
775
835

TSF1

STORAGE VOLUME:	99 Mm³
STORAGE CAPACITY:	148 Mt*
STORAGE YEARS:	17.0 yrs
CREST ELEVATION:	630 m (RL)
ESTIMATED VOLUME OF COMPACTED FILL:	0.71Mm³
TOTAL EMBANKMENTVOLUME:	14 Mm³

*For 8.7 Mtpa at an assumed settled dry density of 1.5 t/m³ = 5.8 Mm³/yr

LEGEND:
- GEOLOGICAL CROSS SECTION
- BOREHOLES
- APPROXIMATE DISCHARGE POINTS (ASSUMED 250m SPACING)
- TAILINGS BEACH CONTOURS
- UNDERDRAINAGE LINES

REF:
DWG: M:\MINE\Projects\Fortescue Metals Group\MINEWP\ER00779AA_FMG_Solomon Combined PFS\Tailings\Drawings\MWP00779AA_03_RevA.dwg

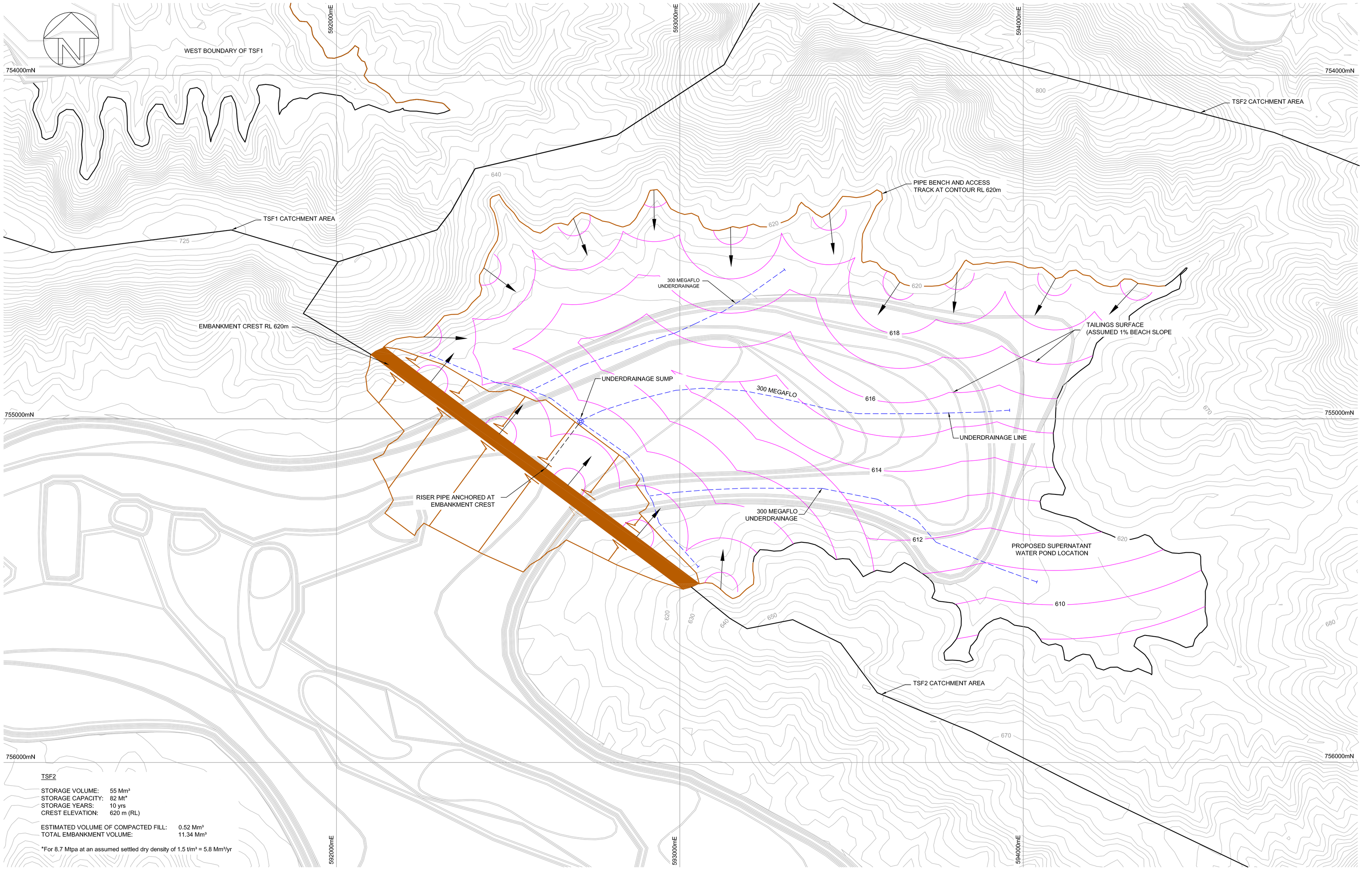
notes: Geological Cross Section A - A' shown on Drawing MWO00779AA_07

rev no	revision note	date	approved

Drawn:	MW
Approved:	CJ
Date:	24/08/10
Scale:	1:5000
Original size:	A1

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Client: FORTESCUE METALS GROUP LIMITED
Project: TAILINGS MANAGEMENT CONCEPT STUDY SOLOMON IRON ORE PROJECT
Title: TSF1 PLAN - LIFE OF MINE OPTION
Project no: MWP00779AA
Dwg no: MWP00779AA_03
Rev: A



TSF2

STORAGE VOLUME:	55 Mm³
STORAGE CAPACITY:	82 Mt*
STORAGE YEARS:	10 yrs
CREST ELEVATION:	620 m (RL)
ESTIMATED VOLUME OF COMPACTED FILL:	0.52 Mm³
TOTAL EMBANKMENT VOLUME:	11.34 Mm³

*For 8.7 Mtpa at an assumed settled dry density of 1.5 t/m³ = 5.8 Mm³/yr

LEGEND:

- BOREHOLES
- APPROXIMATE DISCHARGE POINTS (ASSUMED 250m SPACING)
- TAILINGS BEACH CONTOURS
- UNDERDRAINAGE LINES

notes:

rev no	revision note	date	approved

Drawn:	MW
Approved:	
Date:	01/09/10
Scale:	1:5000
Original size:	A1

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Client: FORTESCUE METALS GROUP LIMITED

Project: TAILINGS MANAGEMENT CONCEPT STUDY
SOLOMON IRON ORE PROJECT

Title: TSF2 PLAN - 10 YEAR OPTION

Project no: MWP00779AA | Dwg no: MWP00779AA_02 | Rev: A

REF:
DWG: M:\MINE\Projects\Fortescue Metals Group\MINEWPER00779AA_FMG_Solomon Combined PFS\Tailings\Drawings\MWP00779AA_02_RevA.dwg

590000mE
591000mE
592000mE
593000mE
752000mN
751000mN
300 MEGAFLO UNDERDRAINAGE
SM3175
SM3174
SM3173
SM3619
SM4011
SM3605
SM3600
RISER PIPE WITH ACHORED AT EMBANKMENT CREST
EMBANKMENT CREST RL 630m
UNDERDRAINAGE SUMP
300 MEGAFLO
UNDERDRAINAGE LINE
TSF1 CATCHMENT AREA
PIPE BENCH AND ACCESS TRACK AT CONTOUR RL 630m
TAILINGS SURFACE (ASSUMED 1% BEACH SLOPE)
PROPOSED SUPERNATANT WATER POND LOCATION
610
608
606
604
602
775
835
650
700
720
740
630
680

TSF1

STORAGE VOLUME: 57 Mm³
STORAGE CAPACITY: 86 Mt*
STORAGE YEARS: 10 yrs
CREST ELEVATION: 610 m (RL)

ESTIMATED VOLUME OF COMPACTED FILL: 0.5 Mm³
TOTAL EMBANKMENTVOLUME: 8 Mm³

*For 8.7 Mtpa at an assumed settled dry density of 1.5 t/m³ = 5.8 Mm³/yr

LEGEND:
- GEOLOGICAL CROSS SECTION
- BOREHOLES
- APPROXIMATE DISCHARGE POINTS (ASSUMED 250m SPACING)
- TAILINGS BEACH CONTOURS
- UNDERDRAINAGE LINES

REF:
DWG: M:\MINE\Projects\Fortescue Metals Group\MINEWPER00779AA_FMG_Solomon Combined PFS\Tailings\Drawings\MWP00779AA_01_RevA.dwg

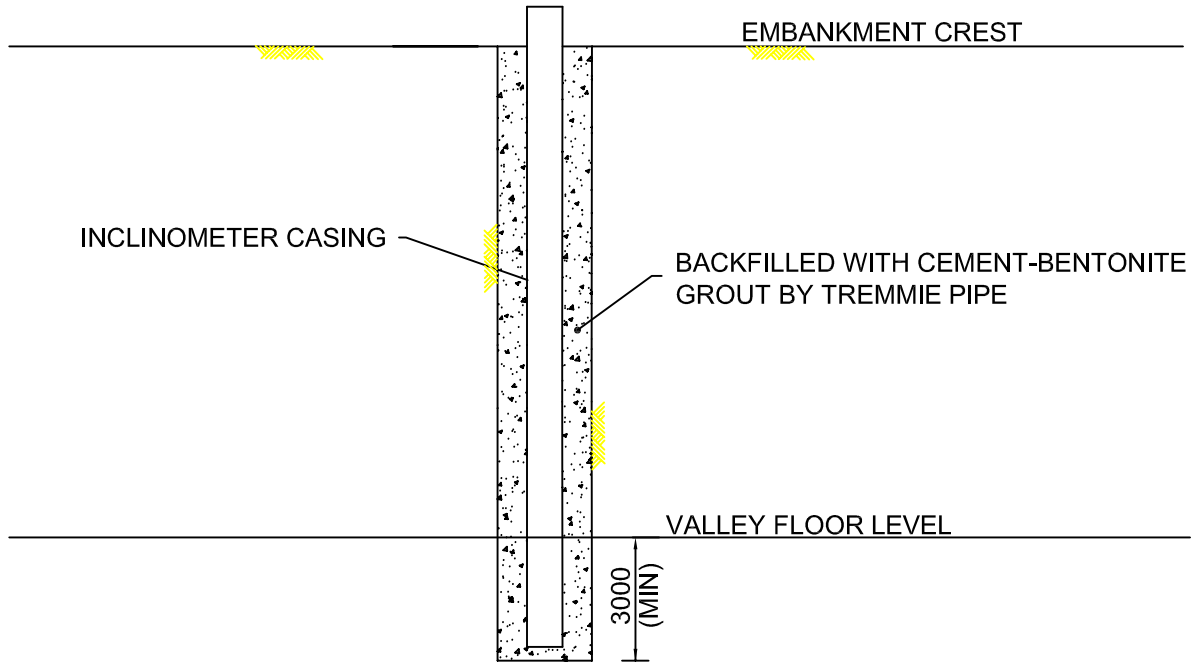
notes Geological Cross Section A - A¹ shown on Drawing MWO00779AA_07

rev no	revision note	date	approved

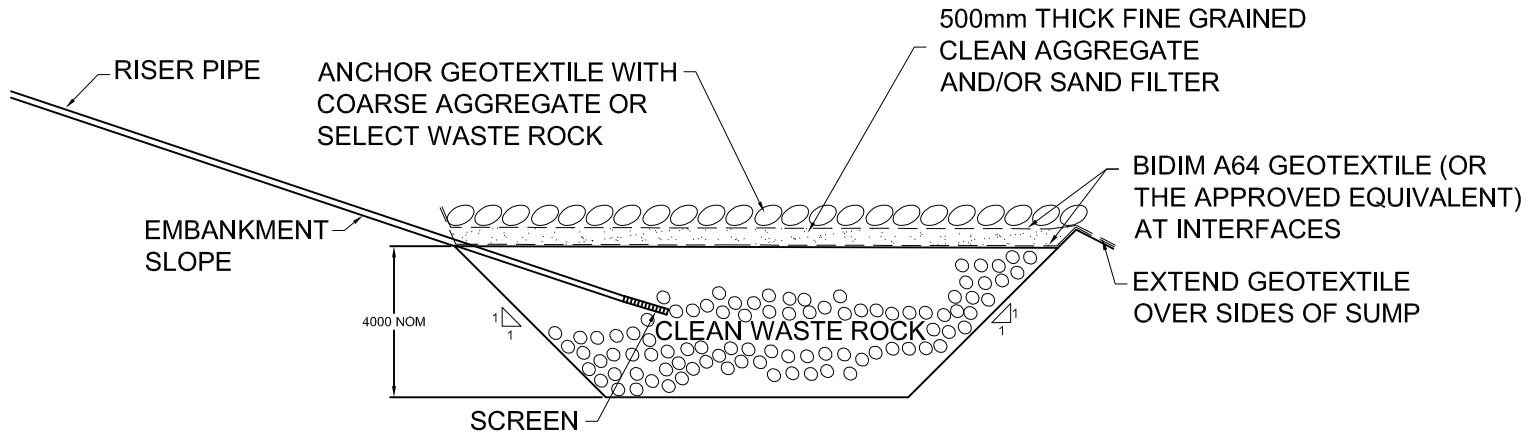
Drawn:	MW
Approved:	
Date:	01/09/10
Scale:	1:5000
Original size:	A1

coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

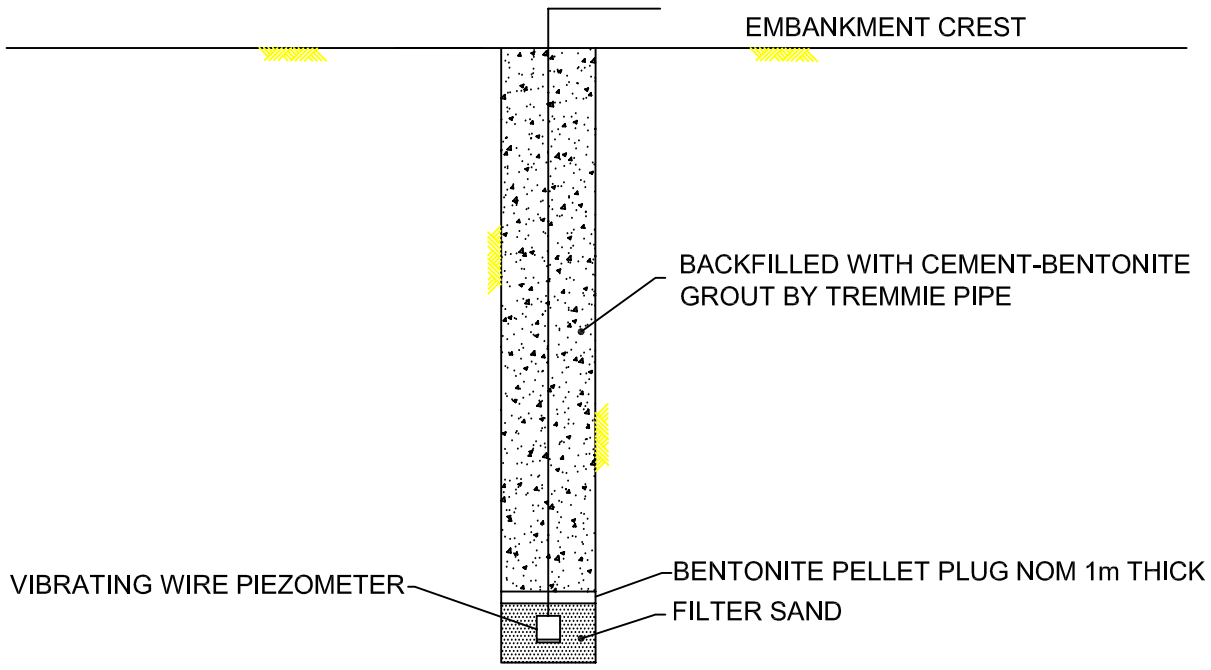
Client: FORTESCUE METALS GROUP LIMITED
Project: TAILINGS MANAGEMENT CONCEPT STUDY SOLOMON IRON ORE PROJECT
Title: TSF1 PLAN - 10 YEAR OPTION
Project no: MWP00779AA
Dwg no: MWP00799AA_01
Rev: A



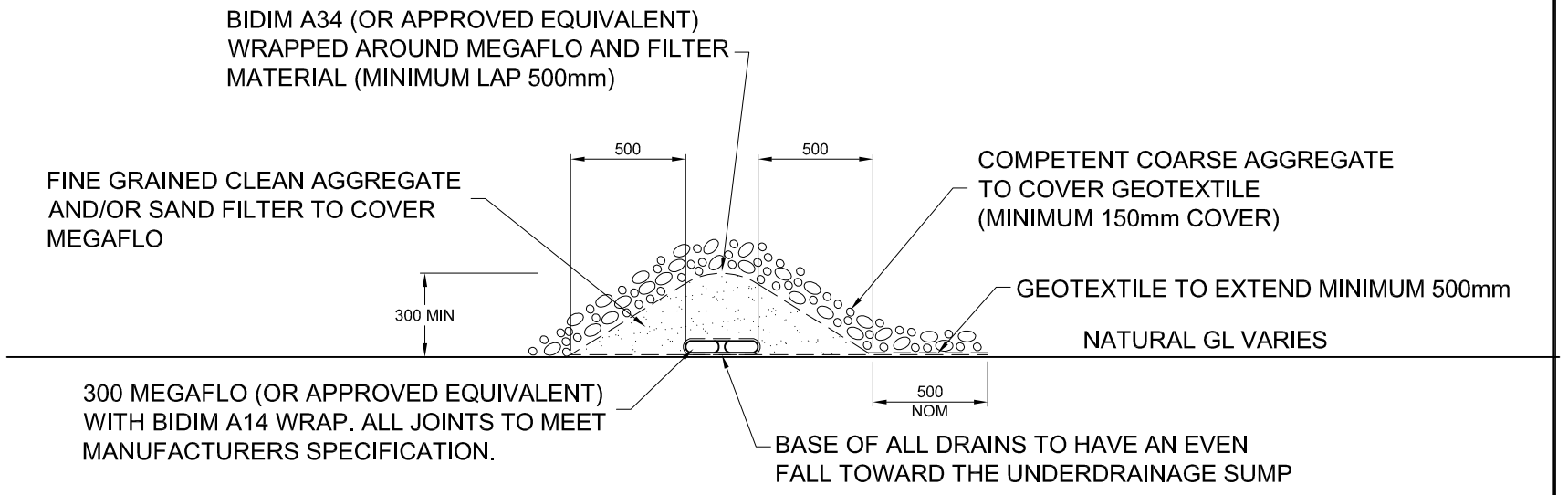
A 01 INCLINOMETER TYPICAL DETAIL
SCALE: N.T.S



C 01 UNDERDRAINAGE SUMP TYPICAL DETAIL
SCALE: 1:2000



B 01 VIBRATING WIRE PIEZOMETER TYPICAL DETAIL
SCALE: N.T.S



D 01 MEGAFLO UNDERDRAINAGE TYPICAL DETAIL
SCALE: 1:1500

Drawn:	MW
Approved:	CJ
Date:	19/08/2010
Scale:	AS SHOWN
Original size:	A3

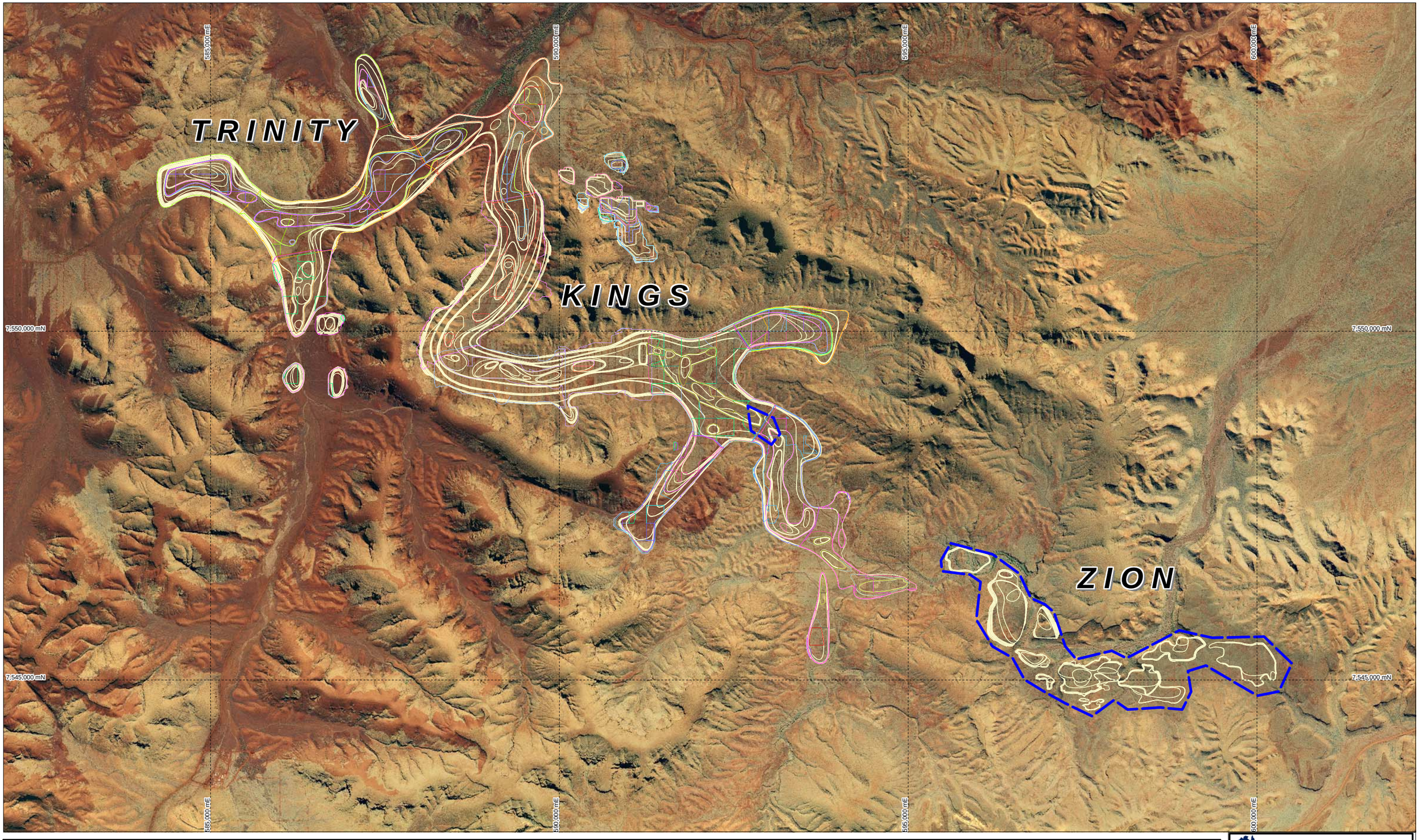
coffey mining
SPECIALISTS FROM BOARDROOM TO MINE FACE

Client:	FORTESCUE METALS GROUP LTD
Project:	TAILINGS MANAGEMENT CONCEPT STUDY SOLOMON IRON ORE PROJECT
Title:	TYPICAL INSTRUMENTATION AND UNDERDRAINAGE
Project no:	MWP00779AA
Dwg no:	MWP00779AA_05
Rev:	A

REF:
DWG: M:\MINE\Projects\Fortescue Metals Group\MINEWPER00779AA_FMG_Solomon Combined PFS\Tailings\Drawings\MWP00779AA_05_RevA.dwg

Figure 10.

Extent of Robe Pisolite Unit



Location Map

Port Hedland
Project
Kalgoorlie
PERTH

Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12
Year 13
Year 14
Year 15
Year 16
Year 18

Pit Design Topography

Robe Pisolite

N

0 0.5 1 2
kilometres

Fortescue Metals Group Ltd

Kings and Zion Yearly Face Positions
Robe Pisolite

Author: S. Grein	Date:22/2/2011
Drawn By: SH	Revision: 0
Dwg No: SO_MP_EN_0055	Confidentiality: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:50000