Peabody Energy Australia Coal Pty Ltd

Construction of the Return Water Dam Decant Structure and Pipeline

April 2014

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1. Introduction

1.1 Project Background

Coppabella Mine currently operates a reject co-disposal area (CDA) and a series of water dams as part of their on-going coal mining operations.

As a result of recent dam inspections, certain deficiencies were highlighted that require upgrades to be undertaken to meet the requirements of the Mine's Environmental Authority.

GHD were contracted to provide a suitable design for the construction of a decant structure and associated pipelines to transfer mine affected water in the Return Water dam (RWD) to the adjacent and larger Worked Water Dam (WWD).

A design incorporating a fabricated steel inlet structure supplying twin 800 mm diameter HDPE pipes constructed through the existing earth embankment of the RWD and discharging into the WWD approximately 150 m east of the RWD was provided to Peabody Energy Australia Coal(PEAC) in September 2013. The capacity of the decant structure and pipeline was designed to pass a 1:100 AEP rainfall event reporting into the RWD though to the WWD without creating an uncontrolled discharge into the adjacent diversion channel of the south 30 Mile Creek.

The project was tendered for construction in October and the successful Contractor was required to provide to the stakeholders practical complete the works before the onset of the 2013-2014 rains .The date for construction completion was required no later than 31st December 2013 in order to have the works safe from the forthcoming rain season. This required a fast track programme of works to be undertaken to achieve a tight construction schedule.

Some of the major constraints the Contractor had contended with are highlighted below:-

- The RWD water level could not be significantly lowered as the pumps supplying the wash water to the Coal Handling and Preparation Plant (CHPP) operated from this dam.
- A structurally sound and watertight coffer dam had to be constructed in front of the proposed position of the decant structure to enable the installation of the inlet structure and pipeline through the earth embankment wall to be undertaken in the dry.
- 11kV overhead head power lines crossing the construction area had to be de-energised for certain construction operations to be undertaken. This required close liaison and strict adherence to outage times with the mine stakeholders as this outage would shut down the CHPP as well.
- Strict OH&S site requirements for working close to or under water levels.
- Short lead times available to procure the necessary materials and equipment.
- Limited supply of suitable clay material to backfill the necessary excavations through the earth embankment for the passage of the decant pipelines.

Peabody Energy Australia Corporation (PEAC) contracted GHD to:

- Provide as required, to the Site Superintendent during the construction of the works to provide timeous and professional technical assistance, and
- Provide Construction Certification that the completed works, documented by virtue of "as constructed" drawings supported by performance tested and reporting by the Contractor that the works, achieved the design intent and satisfied the quality requirements as laid down technical performance specification.

1.2 Reference Documents

1.2.1 Construction drawings

Table 1 below is a list of the construction drawings issued to PEAC.

Table 1 List of Issued Construction Drawings

Drawing Number	Revision Number	Title of Drawing
41-26752-G001	Rev.0	LOCALITY PLAN AND DRAWING LIST
41-26752-G002	Rev.0	GENERAL NOTES
41-26752-C001	Rev.0	GENERAL ARRANGEMENT
41-26752-C010	Rev.0	EMERGENCY SPILLWAY PLAN
41-26752-C011	Rev.0	EMERGENCY SPILLWAY SECTIONS
41-26752-C012	Rev.0	DECANT PIPELINE - PLAN AND SECTION
41-26752-C013	Rev.0	DECANT PIPELINE - DETAILS
41-26752-C014	Rev.0	DECANT OUTLET TANK PLAN
41-26752-C015	Rev.0	DECANT OUTLET TANK DETAILS - SHEET 1
41-26752-C016	Rev.0	DECANT OUTLET TANK DETAILS - SHEET 2
41-26752-S001	Rev.0	STRUCTURAL NOTES
41-26752-S002	Rev.0	GENERAL ARRANGEMENTS
41-26752-S003	Rev.0	STEEL FRAMING ARRANGEMENTS SHEET 1
41-26752-S004	Rev.0	STEEL FRAMING ARRANGEMENTS SHEET 2
41-26752-S005	Rev.0	STEEL FRAMING DETAILS

1.2.2 Technical Performance Specification

This was issued to PEAC to accompany the Construction drawings. A copy of this is provided in provided in Appendix K

1.3 Purpose of this report

The purpose of this report is to

- Summarise the Technical Assistance provided in the Refer for Information (RFI’s) provided during the construction of the works
- Provide a summary of the Quality Assurance programmes and the performance testing results undertaken by the Contractor during the course of construction of the works
- Provide a compiled set of the Surveillance Reports (with the associated photographic records) for the visits to the construction works undertaken by GHD
- Provide all the “As Constructed” drawings issued by the Contractor in support of their certification of the completed works in pursuance of their construction of the Decant Works and Pipeline from the Return Water Dam

1.4 Scope, Assumptions and Limitations

1.4.1 Scope

The Scope of Work is limited to providing technical assistance on an as and when required basis to the PEAC appointed Site Superintendent during the construction of the decant intake tank, pipelines and associated structures.

Provide to the Owner of this Asset a Certification (provided by a suitably qualified and Registered Professional Engineer of Queensland) that the works as constructed by the Contractor meets the:-

- design intent as set out in the “For Construction” drawings;
- technical specification for the undertaken work by reviewing the performance testing results provided by the contractor; and
- performance specification has been met after all non-conformance reports issued by the contractor have been addressed.

1.4.2 Assumptions

- The Construction work undertaken by the Contractor has not been supervised in any way by GHD and only technical assistance in an advisory capacity has been provided to the Site Superintendent.
- Certification of the Construction is based on the Quality Assurance (QA) testing results as provided to the Site Superintendent and it is assumed that these are representative of the whole test lot.
- The certification is further supported by the photographic recordings taken by GHD during their site surveillance visits and supplemented by the construction photographs submitted in the Contractor’s Construction Records.

1.4.3 Disclaimer

This report: has been prepared by GHD for Peabody Energy Australia Coal Pty Ltd and may only be used and relied on by Peabody Energy Australia Coal Pty Ltd for the purpose agreed between GHD and the Peabody Energy Australia Coal Pty Ltd as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Peabody Energy Australia Coal Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.4.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

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

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Technical Assistance Provided to PEAC

In terms of GHD's contract to provide Technical Assistance and RPEQ Construction Certification to the Client Peabody Energy Australia Pty Ltd, GHD's Lead Design Engineer responsible for the project visited site on the days detailed in the table below to witness key operation. Table 2 is a summary of the days visited site with the key operations viewed. The completed Surveillance Reports with a photographic record for the days on site are attached in Appendix A.

Table 2 Summary of Day Visits to Site

Date visited	Key operation viewed
28/11/2013	Fabrication of decant tank
03/12/2013	Requested by the Site Superintendent to assess the suitability of the material being used for the construction of the coffer dam.
10/12/2013	Approve foundation for decant tank and DCP test for bearing capacity estimation of base of decant tank plinth
12/12/2013	Instillation of Decant tank onto plinth
13/12/2013	Inspect decant tank and excavation after rainfall
17/12/2013	Excavation of pipe trench and discharge point of 800 mm pipelines
23/12/2013	View concrete being placed to the surround of the steel pipes through the Return Water Dam Embankment
30/12/2013	Inspect Pipe trench invert ready for DCP bearing capacity testing
07/01/2014	View concrete placed to the encasement of the 400 mm steel pipe line and view Gabion and Reno mattress protection to the 800 mm HDPE pipes through the Diversion Channel
08/01/2014	View placing of rock protection to the discharge sump
09/01/2014	View backfill to the levee wall
22/01/2014	View completed slush grouting to the rock fill protection in the sump at the discharge end of the 800 mm HDPE pipes.
27/01/2014	Repair of flanged joints between Steel and HDPE piping Sikaflex being placed on all flanged pipe joints.

3. Construction Overview

3.1 Coffer Dam Installation

As a result of not being able to lower the dam sufficiently to install the pre-constructed steel inlet tank into the dam basin, provision had to be made for the construction of a fit for purpose coffer dam. The Contractor elected to construct an earth embankment wall as opposed to the use of sheet piles to form the coffer dam walls. The Contractor selected suitable earth fill (from a stock pile of mine pit overburden) that had a matrix of clay, rock fragments and boulders up to 500 mm in diameter The clay to was to provide a water tight barrier and rock to add strength to the earth-fill and improve the stability of the embankment walls.

The contractor used a 40T excavator in the borrow area to load the material into 40T Moxie articulated dump trucks and a D6 Dozer was used to push the dumped earth fill into the dam in front of the area required for the installation of the tank and pipeline. The RWD contained a large portion of deposited fine coal tailings and it was imperative that a good seal be made between the contact of the floor of the dam and the coffer dam earth fill. By dumping and pushing the earth fill in an advancing front this effectively squeezed out the tailings ahead and allowed a good contact to be made This process continued with approximately 8,000 m^3 of fill being placed covering an area about 40 m long and 20 m wide in front of the tank position. The continual passage of construction plant over the earth fill imparted a reasonable degree of compaction to the earth fill.

A sump was then excavated out of the placed fill to enable the rock fill foundation of the tank to be constructed. Initially after excavation of the sump, there was a small amount of seepage through the coffer dam walls but this gradually decreased as the clay took up moisture and swelled. This enabled the final excavation down to the base of the rock fill plinth to be inspected prior to placement of the rockfill.

3.2 Installation of the Steel Intake Tank

The intake tank structure was fabricated in Brisbane and transported by road to Coppabella mine in Central West Queensland. The earth foundation for the rock fill achieved the specified 200kPa allowable bearing capacity at the proposed design foundation level of 210.0 m without having a change of design. The test results are presented in Appendix E. The required D_{50} =300 mm selected rock fill was placed and compacted into position as per the construction drawings. The installation of the tank onto the prepared rock fill foundation plinth was set for 12 December 2013 and all the safety permits and de-energising of the 11kV overhead power line was put in place. The 8T steel tank was lifted safely into place on the plinth using a mobile crane positioned on the southern wall of the coffer dam.

The position and verticality of the tank was verified and immediately afterwards the 10 mPa ballast concrete was placed into the allotted areas of the tank to prevent uplift.

3.3 Excavation of Pipe Trench and Outlet Works

A Geotechnical Investigation along the length of the pipe trench was undertaken as part of the Contractors requirements. This was to provide a check on the quality of the foundations and provide soil parameters through the existing embankment walls to confirm the stability of the excavation slopes. Four augured holes to between 12 m and 14 m below surface level were drilled, logged and samples taken for soil parameter testing. These tests enabled the excavation sloped to be confirmed at a minimum of 1.0 V to 1.5 H. The Geotechnical Investigation Factual Report is included in Appendix J.

The material in the base of the trench was a clayey sand to sandy clay residual soil with a stiff to hard consistency presenting a competent base for the pipelines. However this was not the case for the area at the end of the pipeline where the concrete guide walls, floor and rock fill discharge channel were to be constructed. As a result of the dredging operation taking place in the Return Water Dam and the construction for the raising of the Co-Disposal Area (CDA), dredging slimes were discharged directly into the Worked Water Dam in the vicinity of the proposed decant outlet works. The associated build-up of slimes against the levee embankment and the consequential saturation of the levee bank toe area of the batter and natural ground where the outlet works were proposed made access nearly impossible to enable the construction of an effective coffer dam for the outlet works to proceed according to the original design. Even the construction of finger walls out into the Return Water Dam to provide access to construct the 80 m long graded return channel was not possible in the short time available as Cultural Heritage clearance had not been undertaken in this area. Consequently the Contractor had to make the most of what was presented to him.

The contractor managed to gain access for tracked equipment by pushing out the sandy clay material from the trench excavation at the end of the pipeline. This enabled him to form a plinth from which he excavated out a sump to at least establish the set out point DS03 for the outlet works. However the material, being of a sandy clay and not having any proper compaction applied to it, allowed high seepage rates.

A design change was needed and the length of pipeline reduced by 3.0 m to bring the outlet works onto firmer ground. DCP tests at this new end point showed that there was still inadequate bearing capacity to the ground to construct the designed outlet works. To compound the situation, seepage water had considerably reduced the stability of the earth fill walls to the point where two localised collapses were noted.

The Contractor was instructed by the Superintendent to use the D_{50}=500 mm selected rock fill, available from a stockpile on the site, to line the base and sides of the walls to stabilise them from total collapse. The contractor used the 30T excavator to select load the Moxie ADT with rock and tip the load as close as was safely possible to the sump. The 40T excavator then strategically placed the rock into the base and sides squeezing them into the softened fill with the back of the excavator bucket. This was repeated with further rock until refusal was reached. This successfully stabilised the slopes and prevented any further slips taking place. The base and a section of the sides were slush grouted to lock the rock in place and assist in preventing wash out of the rock fill during the periods the pipeline is to be under full flow and potentially lead to and undermining the levee embankment.

3.4 Installation of Steel and HDPE Pipes

This installation of the steel pipes proceeded in accordance with the design and the only changes or modifications required are detailed below:

- The construction drawings showed the 750 mm steel pipe stubs from the decant tank to be coupled to the steel decant pipes using a Viking Johnson (VJ) dismantling joint. However the Australian suppliers for the VJ joints had to import these as no stock of this size were available in the country. These did not arrive in time to meet the installation program and had to be replaced with Stainless Steel FERNCO wide band couplers. The coupling was wrapped with DENSO tape after installation.
- The 750 mm flanged pipes exiting the encasement concrete on the tank side were inadvertently shipped from the factory with the incorrect protective coating. The error was only discovered after the surround concrete was in place and could not easily be removed to apply the correct protective coating. The steel connecting pipe from the encased section

to the tank also had the incorrect coating. These connection pipes were uncoupled and returned to the factory to have the specified coating applied.

To rectify the coating issue on the concrete encased steel pipe, and once the connection pipe returned with the correct external coating, the Contractor extended the encasement concrete by 1.0 m. Anchor “j” bars were drilled and chemical grouted into the existing vertical concrete face and the extended 12R steel reinforcing cage anchored onto them. Leaving the uncoated steel pipe protruding the concrete without adequate protection would have allowed corrosion to take place.

The steel pipe and concrete interface now is conforming to the design drawings. The extra 1.0 m of concrete has not materially changed any critical aspect of the design intent.

- After the decant and pipeline IFC drawings were issued, a design for a proposed 1.5 m raising to the Return Water Dam was amended to incorporate the existing access road, at the base of the present dam embankment, in with the raised dam embankment. This change resulted in the two 1.2 m diameter precast concrete pits, for access to the 400 mm butterfly valve and water meter, to be in the centre of the proposed access road. To accommodate this possible eventuality, the position of the pits was moved closer to the decant tank.

3.5 Backfilling of the Pipeline Trench and Reinstatement of the RWD and Levee Embankments.

3.5.1 Pipeline

A sand bedding layer of 150 mm (see Appendix J for results of grading analysis) was placed dry to the invert of the prepared trench. The 800 mm pipelines were then placed into the trench to the required line and levels as shown on the relevant Construction Drawings

The backfilling of the pipeline through the diversion levee was undertaken according to the technical specification and with the appropriate performance testing undertaken by Queensland Wide Testing, a NATA approved testing facility. Material from the excavation of the trench was conditioned and compacted around the pipes up to the underside of the Reno rock mattress. Plate compactors were used to provide the compactive effort. All density ratio and moisture ratio test results were within specification.

3.5.2 Levee Embankment to the Diversion Channel

The excavated material from the levee embankment, that had been temporarily stockpiled adjacent to the embankment, was moisture conditioned and compacted back into place to reinstate the levee embankment. Special care was taken to adequately prepare and moisture condition the interface of the sides of the excavation with the replaced material to provide a good bond. This would reduce the possibility of a zone of weakness on the interface that could result in embankment failure as a result of piping failure.

3.5.3 Return Water Dam Embankment

To reinstate the Return Water Dam embankment, around and above the concrete surround to the decant pipes, the contractor elected to import clay material from the Moorvale Mine area. The clay sources in the Coppabella Mine area are typically sandy clay with a low Plasticity Index (PI) and do not meet the Zone 1 clay fill specification. Sample tests from the Moorvale clay material indicated the PI to be just inside the specification.

As the amount of Zone 1 material required was small, road trains were used to import approximately 100 m^3 to use against the concrete and to reconstruct the central core of the dam.

Unfortunately the single PI test done for this lot yielded a PI of 17, just under the Zone 1 specification of 20. However the compaction and moisture tests taken on this material were all within the specification.

The photographic records of the backfilling show the clay compacting down well with the plate compactor and Sheep's Foot roller. The section of access road down from the embankment was reinstated with Zone 2 type material left over from the pipe trench excavation and the coffer dam material.

4. Requests for Information (RFI)

During the course of the construction, a total of 8 RFI's were presented by the Contractor to the Client. Of this total, seven were referred to GHD for attendance and instruction. This information, provided timeously to the Contractor, is summarised in Table 3.

Appendix B provides the detailed responses.

Table 3 Summary of RFI Responses

RFI	Date of Request	Synopsis of Request	Response provided	Date of Reply
1	07/11/13	Webforge are unable manufacture C203, and QCE propose to use C205	PEAC accepted change.	07/11/13
2	11/11/13	Cardno queried which samples required hydrometer to be done	GHD confirmed they were required on clayey samples	11/11/13
3	15/11/13	Provide dxf file for drawing C015	GHD sent file to PEAC	15/11/13
4	15/11/13	Provide details for valve pits	Information already on Drawing 1-26752-C012_R0 reissued by PEAC to WEC	10/12/13
5	20/11/13	Clarification sought on geofabric to be placed under rock fill	Confirmed geofabric required, omitted in error from drawing.	21/11/13
6	06/12/13	Jindex valves request to change actuator mechanism to meet the delivery schedule	GHD confirmed provided it was still "fit for purpose"	09/12/13
7	18/12/13	Replace VJ dismantling joints throughout with FERNCO joints wrapped with Denso tape	Accepted provided the Stainless steel is 316 marine grade	18/12/13
8	10/01/14	Propose to lift invert of 400 mm pipe above the top of the water meter to ensure the pipe flows full for correct flow measurement	Accepted and sketch provided with construction details to follow	13/01/14

5. Quality Assurance and Performance Testing Results

5.1 Concrete 7 and 28 day Cube Crush Strengths

Sets of three sample cubes were taken for each structural concrete pour. For the larger volume pours two sets were taken. Crushing was done at 7 and 28 days by a NATA approved laboratory to establish the compressive strength of the concrete. All concrete sampled and tested met the required target strengths

Figure 1 below summarises the results of these tests, full test results are included in Appendix C.

Placing	Location of	Target	Target	Measured	Crushing Strength		Pass/
Date	Concrete Placed	Strength	Slump	Slump	7 Day	28 Day	Fail
5/01/14	P2 RWD 750mm pipe	40mPa	80mm		24.5mPa	-	Pass
5/01/14	P2 RWD 750mm pipe	40mPa	80mm			40.5mPa	Pass
5/01/14	P2 RWD 750mm pipe	40mPa	80mm			40.5mPa	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	95mm	35.0mPa	-	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	95mm		47.5mPa	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	95mm		47.5mPa	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	90mm	37.5mPa	-	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	90mm		51.5mPa	Pass
20/12/13	P1 RWD 750mm pipe	40mPa	80mm	90mm		50.0mPa	Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	70mm	32.5mPa		Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	70mm		46.5mPa	Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	70mm		47.5mPa	Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	85mm	32.5mPa		Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	85mm		45.0mPa	Pass
7/01/14	RWD 400mm pipe	40mPa	80mm	85mm		47.0mPa	Pass
5/01/14	Levee 750mm pipe	25mPa	80mm	80mm	17.0mPa		Pass
5/01/14	Levee 750mm pipe	25mPa	80mm	80mm		28.0mPa	Pass
5/01/14	Levee 750mm pipe	25mPa	80mm	80mm		27.5mPa	Pass
15/01/14	Anchor block	25mPa	80mm	85mm	21.0mPa		Pass
15/01/14	Anchor block	25mPa	80mm			30.5mPa	Pass
15/01/14	Anchor block	25mPa	80mm			30.0mPa	Pass

Figure 1 Summary of Concrete Test Results

5.2 Results of Zone 1 and Zone 2 Compaction and Moisture Tests

Figure 2 below is the summary matrix of the Lot test results extracted from the field test data sheets. The complete set of field test data sheets is included in Appendix D.

Four tests (Lots 1, 3, 5 and 6) failed on moisture variation from OMC being higher than specification. These lots were accepted on the basis of:

- the moisture variation being only 0.3% over the specification, and the backfill material, being disbursive, would benefit from being slightly wet of specification
- The compaction tests on these four lots were all well over the required 98% of MDD

Place	Lot	RL	Easting	Northing	Date	Report Number	Compaction Hilf Density Ratio %	Pass or Fail	Moisture Content From OMC	Pass or Fail	Accept or Reject Lot
Gabions	1	212.0	646372.9	7581775.2	3.1.14	QWT160-1	102.0	Pass	2.3% wet	Fail	Accept
Gabions	2	211.9	646372.9	7581775.1	3.1.14	QWT160-1	103.0	Pass	2.0% wet	Pass	Accept
Gabions	3	211.8	646372.7	7581774.9	3.1.14	QWT160-1	102.5	Pass	2.3% wet	Fail	Accept
Decant	4	212.0	646391.5	7581774.9	3.1.14	QWT160-1	101.0	Pass	1.2% wet	Pass	Accept
Decant	5	212.2	646391.5	7581765.1	3.1.14	QWT160-1	102.0	Pass	2.3% wet	Fail	Accept
Decant	6	212.4	646391.4	7581765.3	6.1.14	QWT160-1	102.5	Pass	2.3% wet	Fail	Accept
Decant	7	212.6	646372.7	7581773.9	6.1.14	QWT160-2	98.0	Pass	0.3% wet	Pass	Accept
Decant	8	212.8	646369.2	7581777.0	6.1.14	QWT160-2	98.5	Pass	0.2% wet	Pass	Accept
Wall	9	211.2	646461.7	7581725.9	6.1.14	QWT160-2	98.5	Pass	0.1% wet	Pass	Accept
Wall	10	211.4	646454.5	7581727.4	6.1.14	QWT160-2	98.5	Pass	0.0% wet	Pass	Accept
Wall	11	211.6	646455.7	7581727.8	6.1.14	QWT160-2	98.0	Pass	0.1% wet	Pass	Accept
Wall	12	211.8	646437.4	7581739.7	6.1.14	QWT160-2	98.5	Pass	0.0% wet	Pass	Accept
Wall	13	212.0	646436.4	7581739.9	6.1.14	QWT160-2	98.5	Pass	0.1% wet	Pass	Accept
Wall	14	212.2	646435.8	7581739.8	6.1.14	QWT160-2	98.0	Pass	0.0% wet	Pass	Accept
Wall	15	212.4	646435.3	7581740.4	6.1.14	QWT160-2	98.5	Pass	0.1% wet	Pass	Accept
Wall	16	212.6	646428.8	7581743.7	6.1.14	QWT160-2	102.0	Pass	0.1% wet	Pass	Accept
Wall	17	212.8	646423.2	7581745.3	6.1.14	QWT160-3	99.7	Pass	0.1% wet	Pass	Accept
Wall	18	213.0	646454.5	7581727.4	7.1.14	QWT160-3	101.9	Pass	0.0% wet	Pass	Accept
Wall	19	213.0	646455.7	7581727.8	7.1.14	QWT160-3	100.6	Pass	0.0% wet	Pass	Accept
Wall	20	213.2	646437.4	7581739.7	7.1.14	QWT160-3	*99.6*	Pass	0.0% wet	Pass	Accept
Wall	21	213.2	646436.4	7581739.9	7.1.14	QWT160-3	99.7	Pass	0.0% wet	Pass	Accept
Wall	22	213.4	646435.8	7581739.8	7.1.14	QWT160-3	100.5	Pass	0.0% wet	Pass	Accept
Wall	23	213.4	646435.3	7581740.4	7.1.14	QWT160-3	100.4	Pass	0.3% wet	Pass	Accept
Wall	24	213.6	646428.8	7581743.7	7.1.14	QWT160-3	99.1	Pass	0.0% wet	Pass	Accept
Wall	25	213.6	646423.2	7581745.3	7.1.14	QWT160-3	98.7	Pass	0.0% wet	Pass	Accept
Wall	26	213.8	646454.5	7581727.4	7.1.14	QWT160-3	99.1	Pass	0.0% wet	Pass	Accept
Wall	27	214.0	646455.7	7581727.8	7.1.14	QWT160-3	98.7	Pass	0.0% wet	Pass	Accept
Wall	28	214.2	646437.4	7581739.7	7.1.14	QWT160-3	98.0	Pass	0.0% wet	Pass	Accept
Wall	29	214.4	646436.4	7581739.9	7.1.14	QWT160-3	99.2	Pass	0.0% wet	Pass	Accept
Wall	30	214.6	646435.8	7581739.8	8.1.14	QWT160-6	98.0	Pass	0.0% wet	Pass	Accept
Wall	31	214.8	646435.3	7581740.4	8.1.14	QWT160-6	99.5	Pass	0.0% wet	Pass	Accept
Wall	32	215.0	646428.8	7581743.7	8.1.14	QWT160-6	100.5	Pass	0.0% wet	Pass	Accept
Wall	33	215.2	646423.2	7581745.3	8.1.14	QWT160-6	99.5	Pass	0.0% wet	Pass	Accept
Wall	34	215.4	646454.5	7581727.4	8.1.14	QWT160-6	100.5	Pass	0.0% wet	Pass	Accept
Wall	35	215.6	646455.7	7581727.8	8.1.14	QWT160-6	99.5	Pass	0.0% wet	Pass	Accept
wall	36	215.8	646438.8	7581732.7	10.1.14	QWT160-8	104.0	Pass	2% dry	Pass	Accept
Wall	37	216.0	646436.9	7581731.3	10.1.14	QWT160-8	105.5	Pass	2% dry	Pass	Accept
Wall	38	216.2	646436.4	7581732.2	10.1.14	QWT160-8	103.0	Pass	0.5% dry	Pass	Accept
Wall	39	216.4	646445.6	7581734.9	12.1.14	QWT160-8	105.5	Pass	2% dry	Pass	Accept
Wall	40	216.6	646449.1	7581735.4	12.1.14	QWT160-8	103.5	Pass	0.5% wet	Pass	Accept
Wall	41	216.8	646447.7	7581732.5	14.1.14	QWT160-8	105.0	Pass	2% dry	Pass	Accept
Wall	42	217.0	646447.1	7581727.6	14.1.14	QWT160-8	104.5	Pass	1.5% dry	Pass	Accept
Wall	43	217.2	646442.3	7581730.3	17.1.14	QWT160-8	104.5	Pass	1% dry	Pass	Accept
Wall	44	217.4	646442.3	7581733.6	17.1.14	QWT160-8	104.0	Pass	1.5% dry	Pass	Accept
Wall	45	217.6	646444.8	7581735.2	19.1.14	QWT160-8	103.0	Pass	1% dry	Pass	Accept
Wall	46	217.8	646445.2	7581745.2	19.1.14	QWT160-8	104.0	Pass	1% dry	Pass	Accept
Wall	47	218.0	646443.1	7581739.6	19.1.14	QWT160-8	104.5	Pass	1.5% dry	Pass	Accept
Decant	48	213.0	646367.2	7581773.6	14.1.14	QWT160-7	103.5	Pass	2% dry	Pass	Accept
Decant	49	213.2	646361.1	7581775.9	14.1.14	QWT160-7	104.0	Pass	1.5% dry	Pass	Accept
Decant	50	213.4	646356.5	7581777.8	17.1.14	QWT160-7	102.5	Pass	1% dry	Pass	Accept
Decant	51	213.6	646354.8	7581780.0	17.1.14	QWT160-7	102.5	Pass	1.5% dry	Pass	Accept
Decant	52	213.8	646344.2	7581782.1	20.1.14	QWT160-7	102.5	Pass	1% dry	Pass	Accept
Decant	53	214.0	646342.1	7581781.2	20.1.14	QWT160-7	102.0	Pass	1.5% dry	Pass	Accept
Decant	54	214.2	646342.0	7581777.9	20.1.14	QWT160-7	103.0	Pass	1.5% dry	Pass	Accept
key	55	213.2	646345.1	7581776.0	14.1.14	QWT160-10	100.0	Pass	0.0% dry	Pass	Accept
key	56	213.4	646346.8	7581777.2	14.1.14	QWT160-10	99.5	Pass	0.5% wet	Pass	Accept
key	57	213.6	646347.1	7581781.0	17.1.14	QWT160-10	101.0	Pass	1% dry	Pass	Accept
key	58	213.8	646346.2	7581779.1	17.1.14	QWT160-10	100.0	Pass	0.5% wet	Pass	Accept
key	59	214.0	646345.4	7581777.8	20.1.14	QWT160-10	100.5	Pass	0.5% dry	Pass	Accept
key	60	214.2	646346.1	7581771.8	20.1.14	QWT160-10	100.0	Pass	0.5% wet	Pass	Accept
key	61	214.4	646343.2	7581765.0	22.1.14	QWT160-9	101.0	Pass	1.0% wet	Pass	Accept
key	62	214.6	646344.9	7581768.8	22.1.14	QWT160-9	102.5	Pass	0.5% wet	Pass	Accept
key	63	214.8	646344.5	7581773.8	22.1.14	QWT160-9	102.0	Pass	0.0% wet	Pass	Accept
key	64	215.0	646346.1	7581781.0	22.1.14	QWT160-9	102.5	Pass	0.5% wet	Pass	Accept
key	65	215.2	646346.3	7581788.8	22.1.14	QWT160-9	101.5	Pass	1.0% wet	Pass	Accept
Key	66	215.4	646346.2	7581782.3	23.1.14	QWT160-13	99.0	Pass	0.5% dry	Pass	Accept
Key	67	215.6	646344.6	7581778.8	23.1.14	QWT160-13	99.0	Pass	0.0% dry	Pass	Accept
Key	68	215.8	646345.5	7581774.4	23.1.14	QWT160-13	99.5	Pass	0.5% dry	Pass	Accept
Key	69	216.0	646344.5	7581769.3	23.1.14	QWT160-13	98.5	Pass	0.5% wet	Pass	Accept

Figure 2 Summary of the Compaction and Moisture Test Results by Lot

5.3 DCP Test results

5.3.1 Invert of the Pipeline Trench

DCP tests were undertaken every 10 m along the invert of the pipe trench. This was to identify any soft portions of the trench that would require required further treatment to a uniform and firm base. The results shown in Figure 2 are a summary from the field test results as recorded in Appendix E

DYNAMIC CONE PENETROMETER

TEST LOCATION - Base of plinth for decant t

SHEET 1 of 2

CLIENT: PEABODY ENERGY AUSTRALIA - COPPABELLA MINE

PROJECT: HAZARDOUS DAMS UPGRADE- RETURN WATER DAM DECANT INTAKE AND PIPELINE

SITE LOCATION: INVERT OF 800mm PIPLEINE TRENCH from Ch 12.00m to 102.00m

JOB No.:

DATE OF TEST: 10/12/2013

SUPERVISED BY: Jeff Orr

WITNESSED BY: -Nigel Forbes

WEIGHT (kg): 9.0

DROP (mm): 510

R.L. SURFACE (m): Invert of excavated pipeline trench.

TIP (cone or blunt): Cone

DATUM:

TEST RESULTS

TEST No.	No 1		No 2		No 3		No 4		No 6		No 6		No 7		No 8		No 9		No 10	
POSITION	Ch 12.00m		Ch 22.00m		Ch 32.00m		Ch 42.00m		Ch 52.00m		Ch 62.00m		Ch 72.00m		Ch 82.00m		Ch 92.00m		Ch 102.00m	
DEPTH (mm)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)
0 - 100	>25	430	24	410	16	315	16	315	16	315	Ref @ 21	>380	Ref @18	>350	7	205	14	300	9	240
100 - 200															9	240				
200 - 300															11	260				
300 - 400																				

NOTES: Test started at top of excavated foundation

Method of Testing to AS 1289.6.3.2-1997

> 150kPa Spec. requirement

<150kPa Spec. requirement

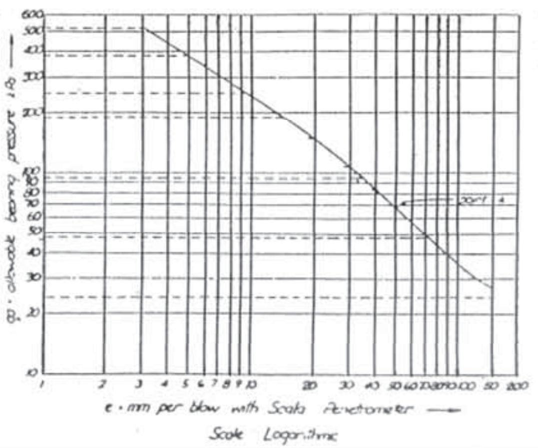

Figure 3 Summary of the DCP and Allowable Bearing Capacity Ch 12.0 to Ch102

DYNAMIC CONE PENETROMETER

TEST LOCATION - Base of plinth for decant t

SHEET 2 of 2

CLIENT: PEABODY ENERGY AUSTRALIA - COPPABELLA MINE

PROJECT: HAZARDOUS DAMS UPGRADE- RETURN WATER DAM DECANT INTAKE AND PIPELINE

SITE LOCATION: INVERT OF 800mm PIPLEINE TRENCH from Ch 112.00m to 142.00m

JOB No.:

DATE OF TEST: 10/12/2013

SUPERVISED BY: Jeff Orr

WITNESSED BY: -Nigel Forbes

WEIGHT (kg): 9.0

DROP (mm): 510

TIP (cone or blunt): Cone

R.L. SURFACE (m): Invert of excavated pipeline trench.

DATUM:

TEST RESULTS

TEST No.	No 11		No 12		No 13		No 14													
POSITION	Ch 112.00m		Ch 122.00m		Ch 132.00m		Ch 142.00m													
DEPTH (mm)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)
0 - 100	17	330	>25	430	23	315	9	240												
100 - 200					6	180	5	140												
200 - 300					5	140	3	100												
300 - 400					10	250														
400 - 500																				

NOTES: Test started at top of excavated foundation

Method of Testing to AS 1289.6.3.2-1997

> 150kPa Spec. requirement (green)

<150kPa Spec. requirement (red)

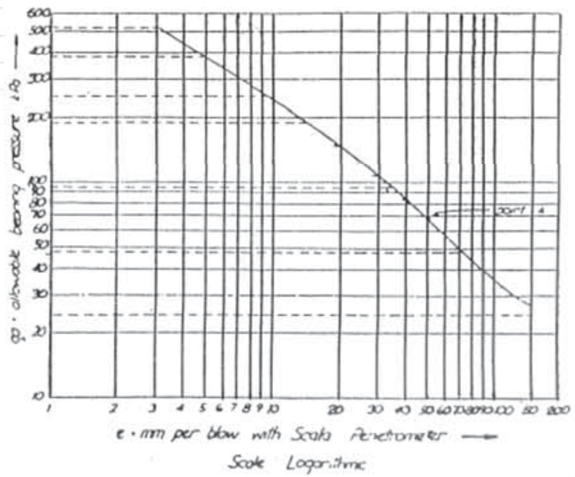

Figure 4 Summary of the DCP and Allowable Bearing Capacity Ch 112.0 to Ch142.0

The results indicated a firm uniform base along the length of the trench up until Ch 142.0 approximately 6 m where the outlet works was to be situated. The top 100 mm presented an acceptable bearing capacity of 240 kPa however this gave way to a soft underlying layer below the required 150 kPa bearing capacity.

Chainage 148.5 (end of the pipeline) was inaccessible because of the ponded seepage water and the very soft conditions underfoot. The ramifications of this inaccessibility and the corrective actions taken are discussed in more detail in section 3.3.

5.3.2 Decant Tank Foundation.

The specification required a minimum bearing capacity of 200 kPa to safely support the weight of the decant tank. The initial excavation for the tank foundation was taken down to sandy clay residual soil at level 211.0 m, approximately 1.0 m above the estimated level for the foundation The DCP test results showed satisfactory bearing capacity at RL 210 m. On this basis the foundation was lowered by 1.0 m The rock fill plinth was placed and compacted into the foundation with the back of the 40T excavator bucket. The sand capping was then placed and levelled off to the design level of 211.275 m.

DYNAMIC CONE PENETROMETER

TEST LOCATION - Base of plinth for decant tank

SHEET 1 of 1

CLIENT:	PEABODY ENERGY AUSTRALIA - COPPABELLA MINE	DATE OF TEST: 10/12/2013	
PROJECT:	HAZARDOUS DAMS UPGRADE- RETURN WATER DAM DECANT INTAKE AND PIPELINE	SUPERVISED BY: Jeff Orr	
SITE LOCATION:	BASE OF ROCK PLINTH FOR DECANT INLET TANK (1.0m ABOVE FOUNDATION LEVEL)	WITNESSED BY: -Nigel Forbes	
JOB No.:			
WEIGHT (kg):	9.0	DROP (mm): 510	R.L. SURFACE (m): 211.0 - 1.0m above finish foundation level (base of rock plinth)
TIP (cone or blunt):	Cone		DATUM:

TEST RESULTS

TEST No.	No 20869		No 20873		No 20874		No 20870		No 20871		No 20872		No 20875							
POSITION	Toe (back) of tank		Toe (back) of tank		Toe (back) of tank		Front (outside) of tank		Front (outside) of tank		C/L (Middle) of tank		C/L (Middle) of tank							
DEPTH (mm)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)	BLOWS (Ns) per 100mm	Allow. Bearing Press. (kPa)
0 - 100	10	250	3	100	6	180	6	180	4	125	1	36	3	100						
100 - 200	18	360	7	205	5	148	5	148	2	70	4	125	6	180						
200 - 300	25	430	25	430	10	250	5	148	4	125	4	125	7	205						
300 - 400	Refusal		Refusal		9	240	4	125	4	125	6	180	7	205						
400 - 500					12	280	4	125	4	125	6	180	9	240						
500 - 600					10	250	7	205	4	125	4	125	9	240						
600 - 700					9	240	10	250	5	148	5	148	11	260						
700 - 800					12	280	8	220	4	125	5	148	7	205						
800 - 900					14	300	9	240	5	148	6	180	7	205						
900 - 1000																				

NOTES:

Test started at top of excavated foundation

Method of Testing to AS 1289.6.3.2-1997

(green) > 200kPa Spec. requirement

(red) <200kPa Spec. requirement

Initial testing undertake when Cardno Bowler was on site, excavation levels were discovered to be still 1.0m above finished level. Testing done to give indicative bearing capacity but ground near front and middle of the plinth toe position had softened up by seepage water standing overnight. Excavation taken down to finish excavation level, seepage water was contained in sump and removed. The foundation at FFL went to hard clay sand (allowable bearing capacity > 400kPa) and and on the strength of the initial testing, and hardening up with increased depth, was accepted as over the required 200kPa.

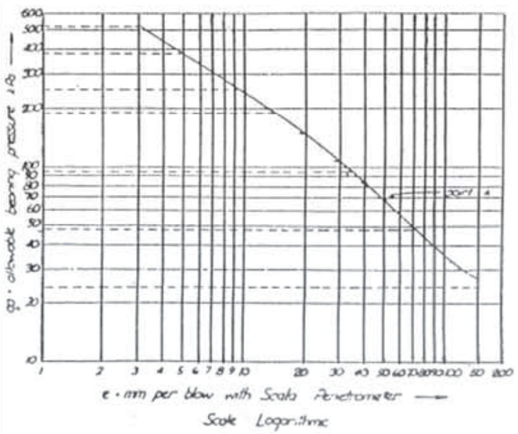

Figure 5 Summary of the DCP Test and Allowable Bearing Capacity under the Rock-fill Plinth to the Inlet Tank

5.4 Inspection Test Plan and Hold Points

The signed sheets of the Contractor's Inspection Test Plan and the Hold Points is show in Appendix F.

5.5 Non Compliance Reports (NCR).

Only one NCR was logged by the contractor and this was the result of the failure of both the 800 mm HDPE pipelines to achieve the performance pressure test under normal operating head. It was identified that there was a significant loss of water through both the flanged joints of the steel to HDPE pipe closest to the outlet works. On further investigation it was admitted by the Contractor’s Sub-Contractor for the pipeline installation that the rubber insertion gasket on this joint had inadvertently been omitted from both pipes. The pipes were not performance tested prior to placing of the concrete as the plugs to seal the pipes for hydraulic testing were not available at the time to wait for these were going to delay the concreting and backfilling of the embankment.

The contractor proposed to apply Sikaflex, a marine grade epoxy sealer, to the inside of the flange joints. This had been successfully used in similar instances by the Contractor. The necessary confined space entry permits, PPE and air blowers were arranged and the sealer applied to all the six flanged steel/HDPE joints along the full pipe length.

Retesting of the pipelines resulted in both 800 mm pipes achieving the minimum allowable leakage under the working head condition 0.077 litres/hr. A copy of the NCR is attached in Appendix G.

6. As Constructed Drawings.

The Contractor has submitted to Peabody Energy Australia their certified set of As Constructed Drawings. Table 4 is a summary these drawing which are provided in Appendix H.

GHD have not fully reviewed these drawings but have checked in so far that they include sufficient detail to confirm the design changes that were made on site:

- by way of RFI's
- instructions by the Site Superintendent

Table 4 Summary of As Constructed Drawings

Drawing Owner	Drawing Number	Rev.	Title of drawing
TMM/WEC[1]	41-26752-G001	1	LOCALITY PLAN AND DRAWING LIST
TMM/WEC[1]	41-26752-G002	1	GENERAL NOTES
TMM/WEC[1]	41-26752-C001	1	GENERAL ARRANGEMENT
TMM/WEC[1]	41-26752-C010	1	EMERGENCY SPILLWAY PLAN - (DELETED)
TMM/WEC[1]	41-26752-C011	1	EMERGENCY SPILLWAY SECTIONS -(DELETED)
TMM/WEC[1]	41-26752-C012	2	DECANT PIPELINE - PLAN AND SECTION
TMM/WEC[1]	41-26752-C013	1	DECANT PIPELINE - DETAILS
TMM/WEC[1]	41-26752-C014	1	DECANT OUTLET TANK PLAN
TMM/WEC[1]	41-26752-C015	3	DECANT OUTLET TANK DETAILS - SHEET 1
TMM/WEC[1]	41-26752-C016	2	DECANT OUTLET TANK DETAILS - SHEET 2
QCE[2]	ST1	K	GENERAL ARRANGEMENT
QCE[2]	ST2	G	TANK ARRANGEMENT
QCE[2]	ST3	D	STEEL DETAILS
QCE[2]	ST4	B	STEEL DETAILS
QCE[2]	ST5	A	PLATFORM STEEL DETAILS
QCE[2]	ST6	F	PLATFORM STEEL DETAILS
QCE[2]	ST7	D	STEEL DETAILS
QCE[2]	ST8	D	STEEL DETAILS
QCE[2]	ST9	D	STEEL DETAILS
QCE[2]	ST10	E	HANDRAIL & KICKER PLATE MARKING PLAN
QCE[2]	ST11	E	HANDRAIL & KICKER PLATE PLAN
QCE[2]	ST12	B	STEEL DETAILS

1 Windsor Earthmoving Contractors Pty Ltd- Main Contractor
2 Queensland Coatings and Engineers Pty. Ltd- Sub-Contractor to WEC for steelwork fabrication

7. Construction Certification

The Return Water Dam is a referable dam and as such any changes made to the structure require the design and the construction of the work to be approved by a suitable experienced and qualified Registered Professional Engineer of Queensland (RPEQ). The certified design for these works was submitted to the Department of Environment and Heritage Protection and approval was granted to the Owner to proceed with the construction.

By way of this report, that has been compiled, at the completion of the construction of the decant inlet structure, pipeline, and outlet works, from information supplied by the contractor, (Windsor Earthmoving Contractors Pty Ltd) and from the technical assistance records by GHD's, the Construction Certification by the RPEQ has been provided on the following basis:-

- The works as constructed, and duly certified by way of the Contractors "As Built" drawings, follows and satisfies the original design intent presented in the "For Construction" drawings provided to the Contractor.
- The works as constructed and quality tested in accordance with the Contractor's signed Inspection Test Plan together with the test records provided in their Construction Record Report to Peabody Energy Australia, show that the work tested has met the quality standards required in the Technical Specification document. This is qualified with the proviso that the section of work selected for quality testing and reporting by the suitably qualified and NATA approved test facility, is a true representative of the whole work lot.

The signed Construction Certification document is attached in Appendix I.

Appendices