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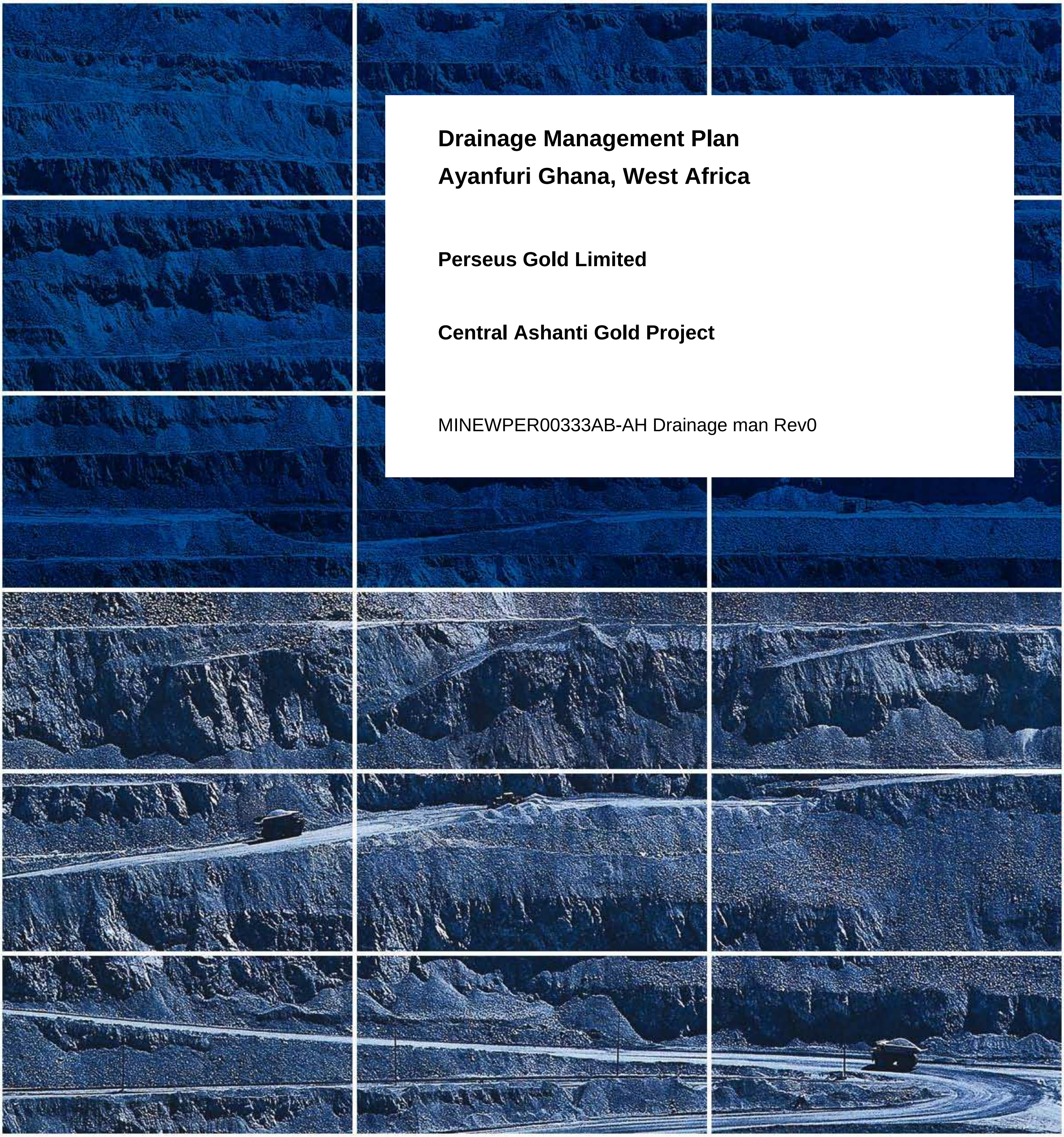

Drainage Management Plan
Ayanfuri Ghana, West Africa

Perseus Gold Limited

Central Ashanti Gold Project

MINEWPER00333AB-AH Drainage man Rev0

3 June 2009

Perseus Gold Limited
30 Ledgar Road
BALCATTA WA 6021

Attention: Mr Brad Marwood

Dear Sir

RE: Drainage Management Plan - Ayanfuri Ghana, West Africa

Please find attached one copy of our report which documents the Drainage Management Plan for the Central Ashanti Gold Project, at Ayanfuri in Ghana.

Should you require clarification of any details or if we can be of further assistance, please do not hesitate to contact the undersigned.

For and on behalf of Coffey Mining Pty Ltd

Christopher Hogg
Principal

Distribution: 1 Copy – Coffey Mining
1 Copy – Perseus Mining

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Document Review

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Christopher Lane

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1 INTRODUCTION

This document presents the drainage management plan required as part of project approvals for the proposed Central Ashanti Gold Project (the Project), located near the town of Ayanfuri in Ghana, West Africa. This document also presents the results of a review of preliminary hydrology studies carried out as part of the design of the main drainage diversion around the project site. Erosion and sediment control measures are also detailed in the plan. The main focus of the plan is the project area adjacent to the plant area, Abnabna Pit and Fobinso Pits.

Perseus Mining Limited propose to re-open a decommissioned gold mine. The Project will comprise mining of the Fobinso north and south pits and the Abnabna pit, near the processing plant and several satellite pits. The processing plant will use GFIL methods to process predominantly granitic ore at a nominal production rate of 5.5 Mtpa. The project will also comprise haul roads, a ROM Pad, workshops, offices, a contractor's yard and a tailings storage.

The objectives of the study were:

(i) Review the project data including miscellaneous calculations, general arrangement plans, design sketches and provide recommendations on any design changes.

(ii) Mark up general arrangement drawings with proposed drainage, and erosion and sediment control measures.

(iii) Compile a drainage management plan detailing the above, for submission to government authorities.

The site wide drainage plan was an integral part of the design and incorporated at inception of the DFS, reflected in the Coffey scope of work and covered under the Environmental Project design Criteria. Site wide drainage was identified at inception and could not be addressed until the major surface infrastructure had been designed.

Our advice is based on the information stated and on the assumptions expressed herein. Should that information or the assumptions be incorrect then Coffey Mining Pty Ltd shall accept no liability in respect of the advice whether under law of contract, tort or otherwise.

2 INFORMATION SUPPLIED

The following information was supplied by the client:

(i) Project area Plan (ref: 00-CIVIL14apr09), showing site infrastructure, pits and process plant and proposed main diversion.

(ii) Proposed plant site layout from Mintrex showing plant lay out and drainage concept.

(iii) Calculations, design sketches, a long section and catchment plan for the main drainage diversion by GJL Engineers. An email providing a brief description of the design from GJL Engineers dated 9 April 2009 was also provided.

(iv) A spreadsheet summarising the environmental design parameters for the project, dated March 2009

3 SITE CONDITIONS

3.1 General

The site for the Project comprises subsistence and commercial agriculture, and remanent rainforest. The landforms in the project vary from flat, gently inclined to steep terrain. The geology at the site generally comprises clayey gravels, overly weathered rock. The major rock types include phyllite and granites. For a detailed description of the site conditions, sub-surface conditions and geology of the project, please refer to the Coffey Geotechnics (2009)[2] hydrogeology report.

3.2 Topography and drainage

The Project is located in comparatively rugged terrain with catchments well defined and stream systems that vary from well defined channels to broader, low gradient 'wet land' areas.

The Abnabna Pit and the plant area are located adjacent to small tributaries in the upper reaches of the Asuafa Stream. The tributaries join the main Asuafa Stream immediately to the east of the mine. It was noted that a section of the main branch of the stream has been straightened and 'trained' by the main stream channel. The Fobinso North Pit will be located to the north east of the main channel.

The satellite pits (Fetish Pits and Esuajah North) are located in the subin-Asuaa stream, which is a separate stream system to the Asuafa Stream.

Both the Asuafa and Subin-Asuaa Stream systems drain north meeting the Ofin River, 5 to 7kms downstream, respectively.

4 DESIGN CONCEPT

4.1 General

The drainage management for the Project has been designed such that clean runoff water from areas upslope of the project infrastructure is diverted, where possible, around the site via diversion drains. Where drainage diversion is not possible (ie some areas upstream of the pits), runoff will be collected in pump sumps and either used in dust suppression, as process water or disposed of downstream if water quality guidelines are met. A general arrangement plan provided in Appendix A, presents location details of various project infrastructure, and proposed drainage lines and sumps.

4.2 Main Diversion

A main diversion channel will be constructed to the south west of the plant site in order to divert runoff from the upper reaches of the Asuafa Stream catchment around the project area. The diversion channel required will be approximately 2.3kms long and will traverse in a north westerly direction around the south western end of the Abnabna Pit and discharge into the main Asuafa Stream channel approximately 1.5kms upstream from natural confluence of the tributary and the main channel. The channel will require major cut earthworks with a proposed maximum cut depth of approximately 18m.

The diversion channel will have a minimum width of 8m and an entrance invert level of RL187. The diversion channel as presented in the GIL calculations provided for a narrower channel base, the channel geometry was revised in order to lower the risk of blockage and reduce channel velocities. The batter geometry adopted is similar to the pit slopes proposed for the nearby pits. The channel design is based on a retention of 1.4 days and hence the water at flood peak will back up to an estimated RL189.5. The channel slope is a gradual 1:750 and at its design flow will have a velocity of 1.2m/s. It should be noted at low flow, some siltation may be possible.

A sketch detailing the proposed channel geometry is provided in Appendix A.

The following miscellaneous items are included as part of the design concept:

- Erosion protection (mortared stone pitching or equivalent) should be provided in soils exposed along the channel and in non competent rock, as directed by an Engineer.
- Energy dissipator rock should be provided at the channel outlet in order to slow flow velocities and reduce erosion immediately upstream of the main Asuafa Steam (refer to sketch in Appendix A).
- A silt trap (nominal size 8m x 15m x 1m deep) is required at the out let of the main diversion channel (refer to sketch in Appendix A)
- A road is located immediately upstream of the channel. A low floodway (less than 1m in height) will be provided across this road and will likely comprise low fines ‘free draining’ rock and ‘low’ flow culverts.
- Consideration will be made with regard to providing access across the main diversion channel for villagers. A possible solution may be to backfill a section of the channel and provide ‘sea container’ culverts to take the flow under the fill.

4.3 Plant Area

A plant site general arrangement plan is provided in Appendix A. Areas such as the GFIL, reagent mixing tanks within the plant area have been designed as ‘closed’ systems. Runoff from the general plant area will drain to a collection sump. Runoff collected in this sump will be piped under gravity to a plant runoff collection to the north west of the ROM. The plant runoff collection area will be bound by access roads on 2 sides and the adjacent plant and ROM. A section of road will comprise select filter rock in order to allow collected runoff water to filter through to a pump sump located immediately downstream.

Runoff from areas to the east of the plant site will be diverted to the process water dam located immediately to the north east of the pit via trapezoidal drains. Overflow from the process water dam will be diverted via a spillway to the north west away from the plant area to the Fobinso North Area.

The process water dam will be unlined and therefore in order to minimise the potential for seepage from this dam, 'softening' foundation materials and causing settlement of plant footings, the water level within the dam will need to be controlled (ie be less than RL195m). Low permeability cufoffs will need to be installed at the location of major structures (ie tanks and mill) in order to divert groundwater away from these areas. These cutoffs will comprise Elcoseal geo-membrane installed in vertical trenches excavated through the gravel soil strata into weathered phyllite. The geo-membrane will need to be adequately lapped at the base and between membrane panels.

Runoff from area to the north and north west of the plant area will be diverted by trapezoidal drains to the pump sump west of the plant or north towards the Fobinso North area.

4.4 Pits

The pits will require earth bunds in upstream areas in order that runoff from extended catchments upstream, does not flow over the pit rim. The earth bunds should be compacted and have adequate foundation preparation including a seepage cutoff. Pump sumps may be established upstream of these bunds. Water collected in the sumps will either be used in dust suppression, as process water or disposed of downstream if water quality guidelines are met. Where sumps are required, allowance for a design capacity to store a 1 in 100 year average recurrence interval storm event of 24 hours duration, and adopting a volumetric runoff coefficient of 0.8 (see Section 5.2) should be made.

Diversion bunds and haul roads etc will be used to divert runoff to the sumps and where possible runoff will diverted around the ends of the pits. It is proposed to infill low areas with mine waste and provide lined drains to divert runoff around the pits in lieu of drainage collection and pumping.

4.5 Erosion and Sediment Control

The following miscellaneous erosion and sediment control measures are included as part of the plan:

- Provision of silt traps downstream of main drainage lines and waste dump drop structures in order to reduce sediment load to the downstream environment. It is recommended that silt traps for small catchment areas (ie not main diversion) are initially sized on the basis of nominally of 1.3m^3 of silt/ha of catchment. This sizing criteria should be checked during the first year of project development.

- Rock lining of channels when design channel velocities are greater than 1m/s:
- Provision of drop structures for disposal of runoff from waste dumps. The drop structures should be rock lined and a silt trap provide at the base of the drop structure prior to discharge downstream.
- Land disturbance should be keep to a minimum at the Asuafu Stream channel and floodplain. This includes excavation of silt traps near the channel and on the flood plain, as construction of the traps may lead to an increase in sediment transport downstream (ie from disturbed ground and earthworks).
- Periodic maintenance of drainage structures and cleaning out of silt traps will be required. Silt collected in the silt traps should be disposed of appropriately (eg within the tailings storage).
- Progressive rehabilitation of waste dumps and other disturbed areas should be undertaken where possible.

5 DESIGN ISSUES AND METHODOLOGY

5.1 Main Diversion Drain

Calculations GIL Engineers were provided by the client for review by Coffey Mining. Hydrology analyses were conducted utilising procedures outlined in Australian Rainfall and Runoff (ARR), A Guide to Flood Estimation[1]. The peak flows for individual catchments reporting to the diversion were estimated using the Rational method. Flood Routing methods were then used to route the flood through the main diversion assuming partial retention of the flood volume upstream of the catchment. The 'Quick' approximate method as outlined in ARR[1] was utilised.

The catchment areas were determined by CAD (refer to the Catchment Plan in Appendix A). The runoff coefficient utilised in the analyses was estimated using the Queensland MRD Bridge Branch Method (refer ARR (2001)[1]). The rainfall intensity frequency duration curve for Kumasi, reference Ghana Metrological Services Department, Departmental Note No.23 (1974) [3] was used in the analyses.

The diversion drain has been designed to accommodate, a design flow from a 1 in 100 year Average Recurrence Interval (ARI) rainfall event, with a retention of 33 hours. Manning's Formula was used to size the diversion drains required to pass the flows determined by the hydrology analysis. The basic drain geometry adopted in the design is presented on the drawings and sketches (refer to Appendix A). The results of these are summarised in Table 1:

Table 1 Summary of Drain Design				
Drain Chainage	**Area (km^2)**	**Peak Flow Q (m^3/s)**	**Drain Width**	**Design Flow Depth (m)**
0-1600	7.4	25.0	8.0	2.0
1600-2270	9.4	29.3	8.0	2.2

5.2 Plant Area Sump(s)

The sump(s) will need to be sized, based on a 1 in 100 year average recurrence interval storm event of 24 hours duration, and adopting a volumetric runoff coefficient of 0.8. Table 2 below summarises the assessment of the sump capacity. If no allowance for pumping of the sump is made during the event, the capacity in the table should be provided. If pumps are provided to dispose of the water downstream, and water within the sump meets environmental guidelines, the sump capacity in the table can be reduced.

Table 2 Sumps Capacity

Table 2 Sumps Capacity			
Sump	**Rainfall Intensity (mm/hr)[1]**	**Equivalent Catchment Area (ha)[2, 3]**	**Total Runoff Volume, 1:100 year ARI 24 hour event**
General Plant Area (Excluding bunded Tanks and Contractors Area)	9.6	8.8	20,400 m^3
Contractors Area	9.6	3.6	8,300 m^3

Notes:

1. Rainfall intensity of based on values from the rainfall intensity curve for Ghana Metrological Services Department, Departmental Note No.23 (1974) [3]
2. Equivalent catchment area = contributing catchment area multiplied by the runoff coefficient of 0.8.
3. Catchment excludes areas upslope of the plant area
4. Consideration should be given to constructing two plant site sumps, one for the general plant area and one for the contractors area (ie at a separate location)

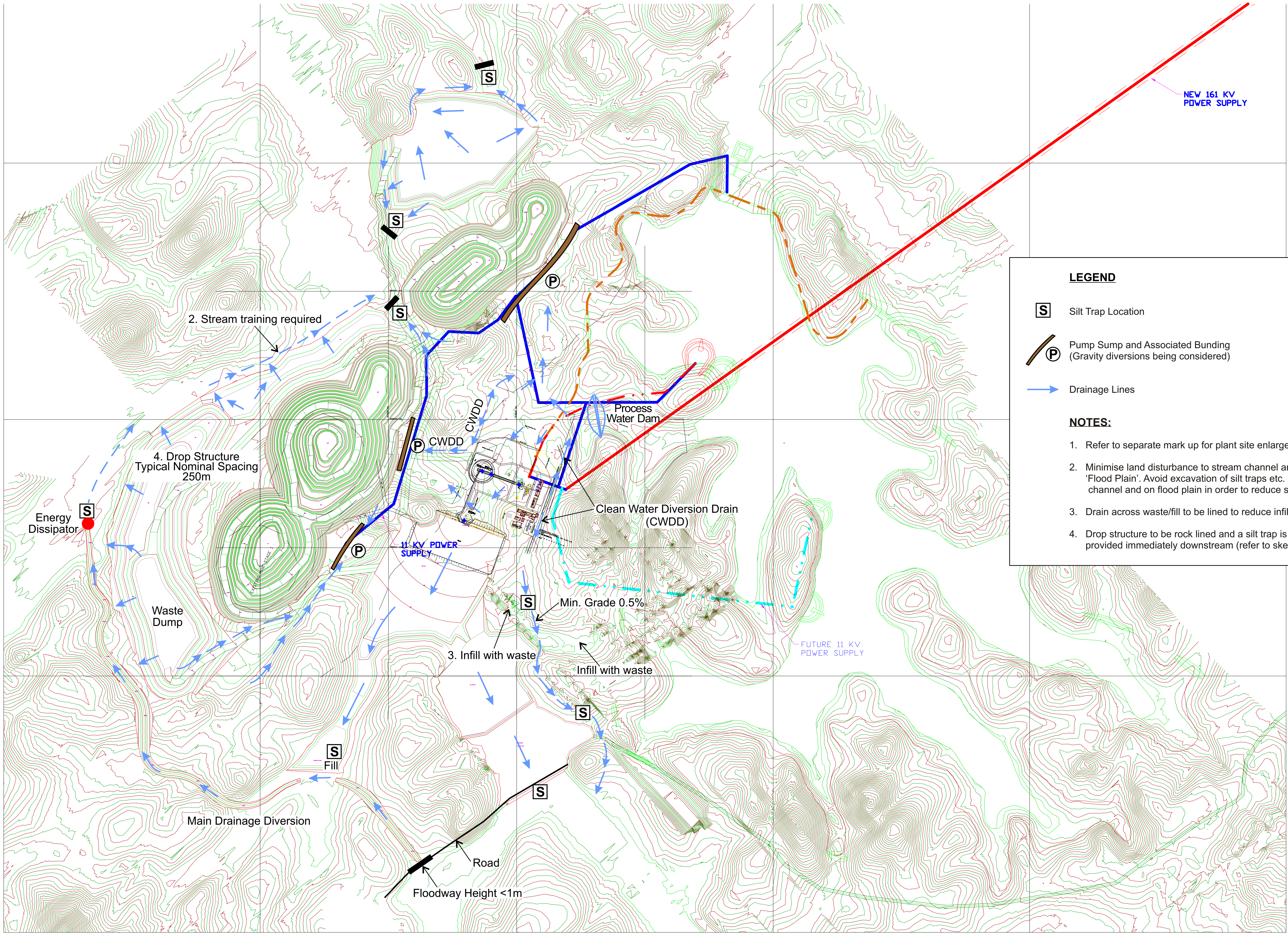
6 REFERENCES

The following references were used in the preparation of this report.

1. The Institution of Engineers, Australia, (reprinted 2001), '*Australian Rainfall and Runoff, A Guide to Flood to Flood Estimation'*, Volumes 1 and 2.
2. Coffey Geotechnics Pty Ltd draft report (2009), '*Ayanfuri Gold Project: Hydro-geological Review (Draft Report)'*
3. Ghana Metrological Services Department, Departmental Note No.23 (1974) *'Maximum Rainfall Intensity-Duration Frequencies in Ghana',* author JB Dankwa

Appendix A

Drawings and Sketches



LEGEND

S Silt Trap Location

Ⓟ Pump Sump and Associated Bunding (Gravity diversions being considered)

Drainage Lines

NOTES:

1. Refer to separate mark up for plant site enlargement.
2. Minimise land disturbance to stream channel and on 'Flood Plain'. Avoid excavation of silt traps etc. near channel and on flood plain in order to reduce sediment transport.
3. Drain across waste/fill to be lined to reduce infiltration into fill.
4. Drop structure to be rock lined and a silt trap is to be provided immediately downstream (refer to sketch for schematic).

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Drawn	FAC	PERSEUS MINING LIMITED DEFINITIVE FEASIBILITY STUDY CENTRAL ASHANTI GOLD PROJECT DRAINAGE MANAGEMENT PLAN GENERAL ARRANGEMENT	Original Size	A3
Approved	CH		Project no:	MWP00333AB
Date	28/05/2009		Figure	1
Scale	NTS			

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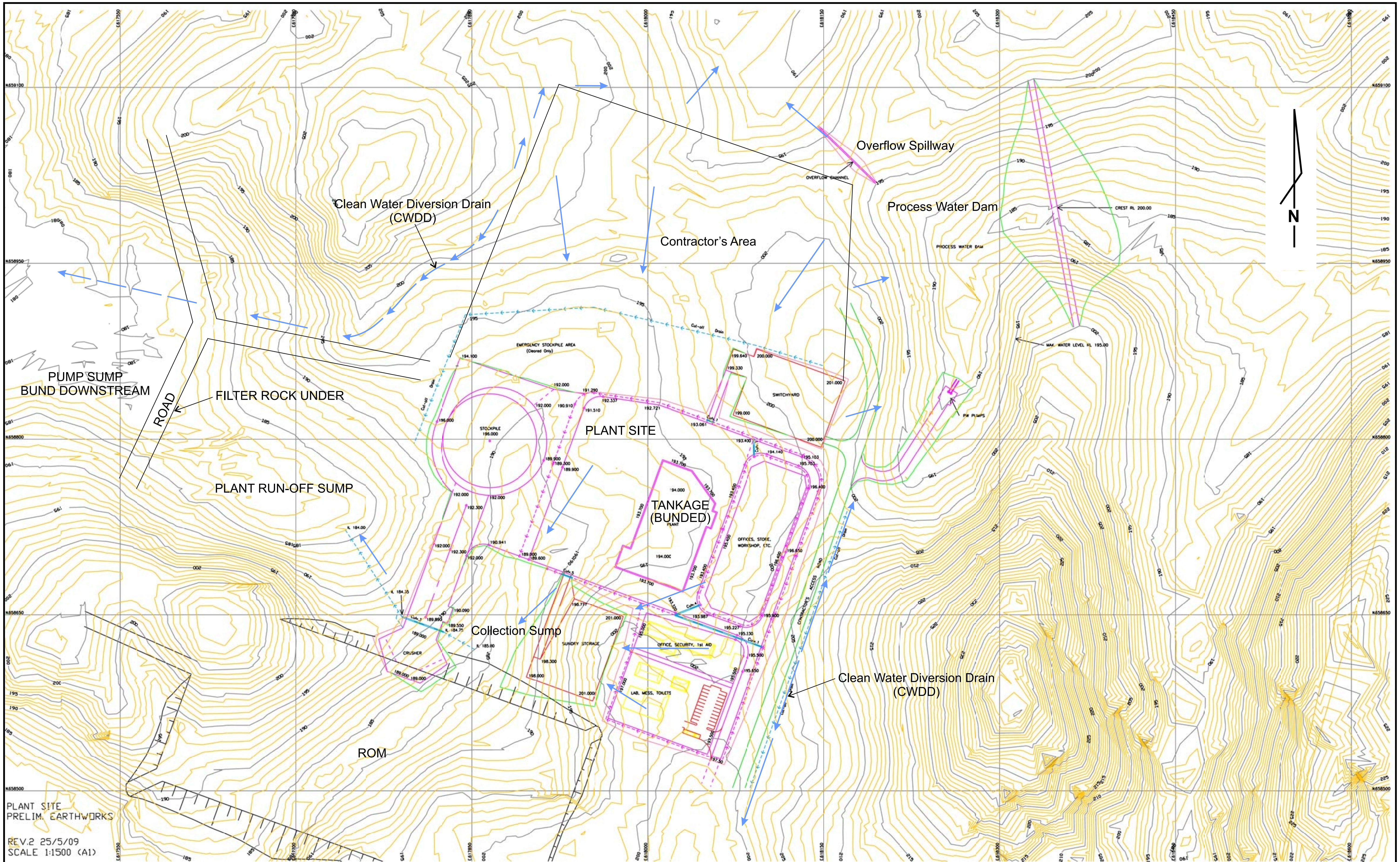
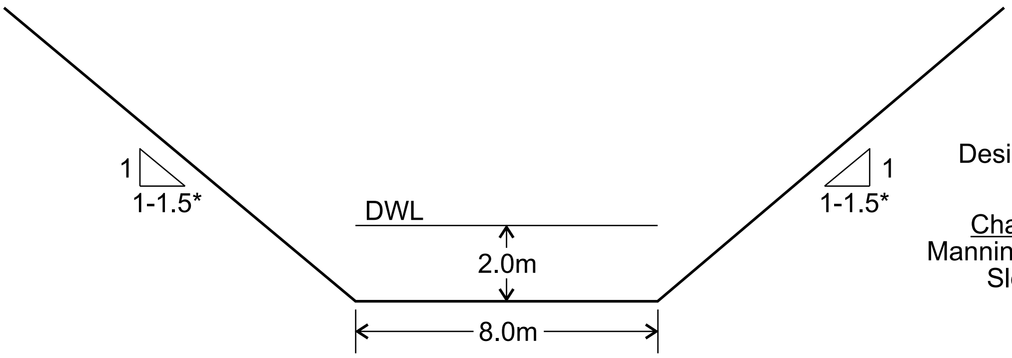


coffey mining SPECIALISTS FROM BOARDROOM TO MINE FACE	Drawn	FAC	PERSEUS MINING LIMITED DEFINITIVE FEASIBILITY STUDY CENTRAL ASHANTI GOLD PROJECT DRAINAGE MANAGEMENT PLAN	Original Size	A3
	Approved	CH		Project no:	MWP00333AB
	Date	28/05/2009			
	Scale	NTS	GENERAL ARRANGEMENT - PLANT SITE	Figure	2

MAIN DIVERSION CHANNEL

CH 0 - 1600



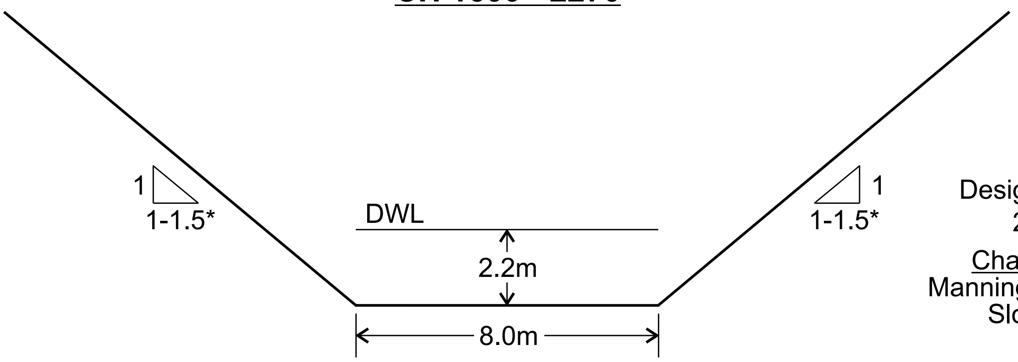
Design Flow Rate
$25m^3/s$

Channel Design
Mannings Number 0.04
Slope 0.0013

* CHANNEL BATTERS TO SUIT GEOTECHNICAL GROUND CONDITIONS.
1:1 (V:H) OVERALL SLOPE, MAXIMUM. SLOPE 1:1.5 (V:H) IN OVERBURDEN SOIL.

MAIN DIVERSION CHANNEL

CH 1600 - 2270



Design Flow Rate
$29.3m^3/s$

Channel Design
Mannings Number 0.04
Slope 0.0013

NOTE: STONE PITCHING (MORTARED) OR THE APPROVED EQUIVALENT SHOULD BE PROVIDED IN AREAS OF EXPOSED "OVERBURDEN" SOIL AND NON-COMPETENT ROCK, AS DIRECTED.

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Drawn	FAC	PERSEUS MINING LIMITED DEFINITIVE FEASIBILITY STUDY CENTRAL ASHANTI GOLD PROJECT DRAINAGE MANAGEMENT PLAN	Original Size	A4
Approved	CH		Project no:	MWP00333AB
Date	29/05/2009			
Scale	AS SHOWN	MAIN DIVERSION CHANNEL DESIGN	Figure	3

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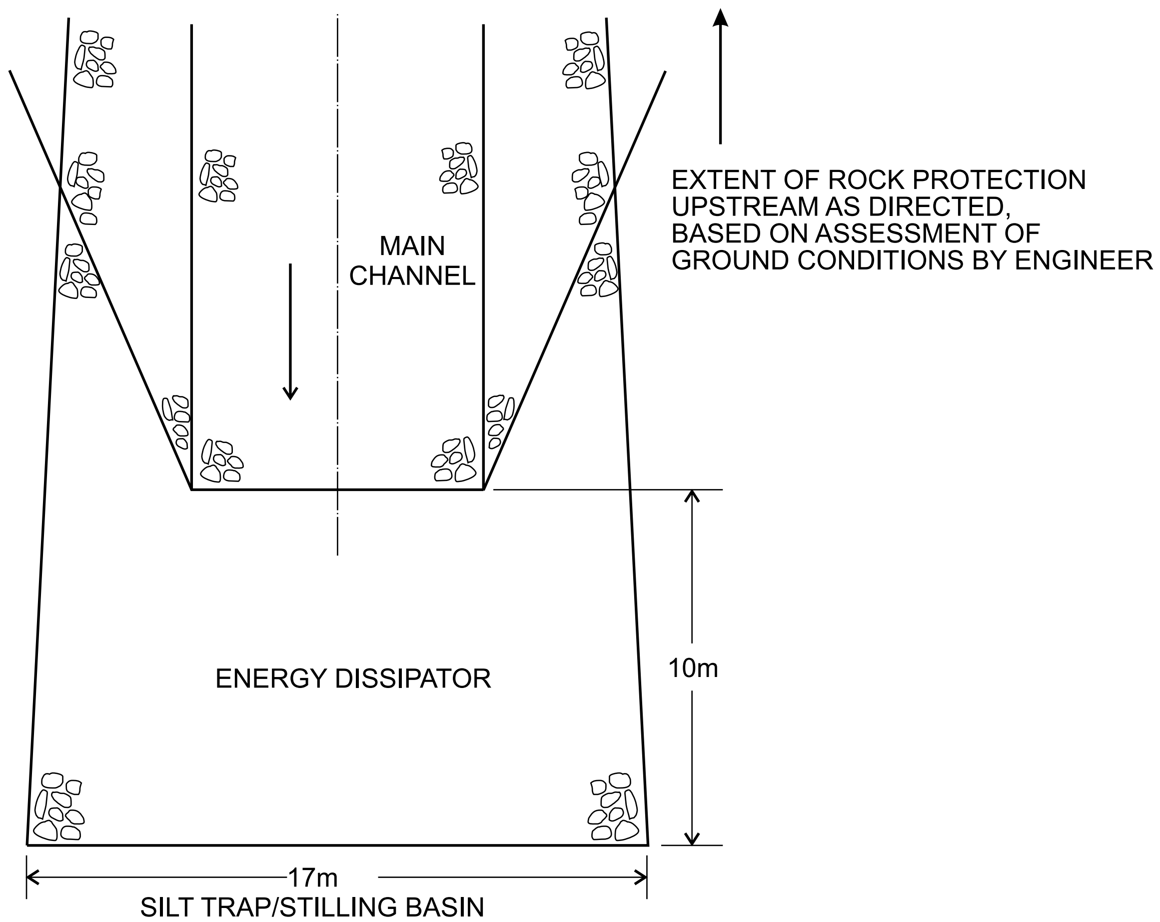
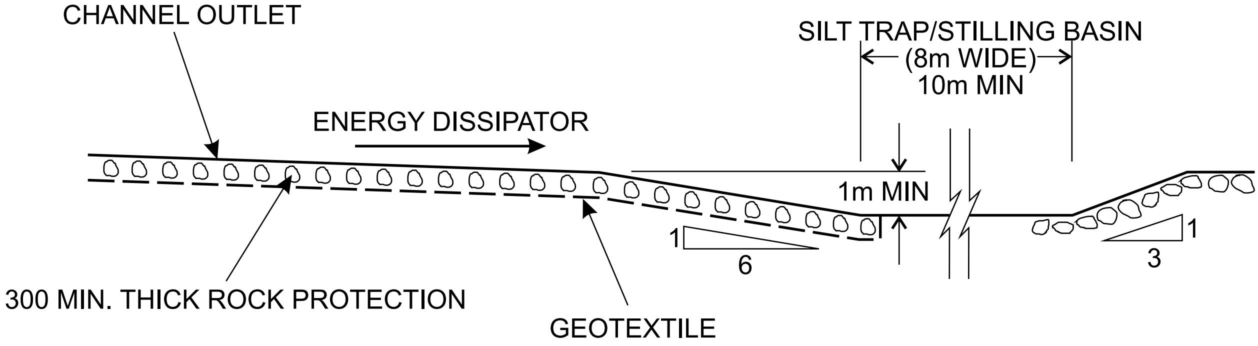


PLAN



SECTION

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Drawn	FAC	PERSEUS MINING LIMITED DEFINITIVE FEASIBILITY STUDY CENTRAL ASHANTI GOLD PROJECT DRAINAGE MANAGEMENT PLAN MAIN DIVERSION OUTLET	Original Size	A4
Approved	CH		Project no:	MWP00333AB
Date	29/05/2009		Figure	4
Scale	AS SHOWN			

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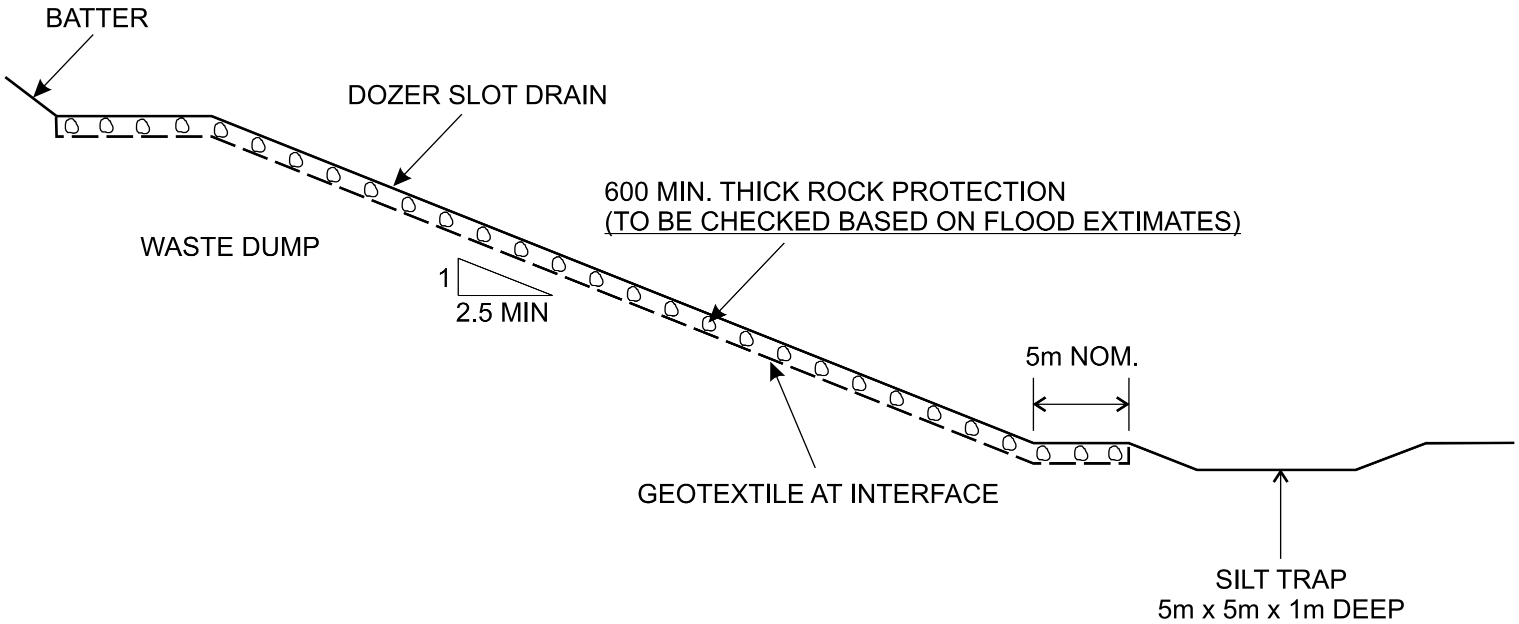

coffey mining SPECIALISTS FROM BOARDROOM TO MINE FACE	Drawn	FAC	PERSEUS MINING LIMITED DEFINITIVE FEASIBILITY STUDY CENTRAL ASHANTI GOLD PROJECT DRAINAGE MANAGEMENT PLAN	Original Size	A4
	Approved	CH		Project no:	MWP00333AB
	Date	29/05/2009			
	Scale	AS SHOWN	DROP STRUCTURE SCHEMATIC SECTION	Figure	5

F:\MINE\MH300-499\MWP00333AB Ayanfuri DFS Infrastructure and TSF\Drainage Layout\Figures\MWP00333AB Fig 5 A4.pdf