Memorandum

Date	6 September 2022	Pages	6
Attention	Damien Plucknett		
Company	METServe		
Job No.	1571-22-C		
Subject	Final landform drainage summary		

Dear Damien,

Overview

This memo has been prepared to outline the drainage concepts underlying the final landform designs for the Vulcan Coal Mine (VCM). WRM has provided details regarding the final landforms in the *Vulcan Coal Mine EA Amendment Surface water assessment* (WRM, 2022). This report summarises the design concepts provided in WRM (2022) and provides conceptual cross sections of the final landform profiles, which expand on the design details.

A plan view of the final landform profiles showing the locations of the conceptual cross sections is shown in Figure A. The cross sections showcase the key features of the landforms and are displayed as follows:

- Figure B shows cross section XS-1, which is taken north-south from the undisturbed slope through the backfilled pit to the north of the Jupiter Pit final landform, through the in-pit waste rock dump, to the undisturbed ridgeline on the southern side of the Jupiter Pit landform.
- Figure C shows XS-2 and XS-3, which are west-east cross sections taken from the undisturbed ridgeline to the west of the Jupiter Pit landform, through the backfilled pit/the in-pit waste rock dump, to Saraji Road and the Norwich Park Branch Railway on the eastern side of the Jupiter Pit landform.
- Figure D shows cross-section XS-4, which is an east-west cross section taken from the undisturbed ridge to the west of the Jupiter Pit landform, through the ex-pit and in-pit waste rock dumps, to Saraji Road and the Norwich Park Branch Railway to the east.
- Figure E shows cross section XS-5 and XS-6. XS-5 is taken north-south from the rehabilitated rail loop area through the western backfilled Matilda Pit/in-pit waste rock dump and out to the undisturbed slope to the south. XS-6 is a west-east cross section taken from the rehabilitated rail loop area out through the backfilled Matilda Pit/in-pit waste rock dump.

This report and the accompanying final landform conceptual cross sections are intended to be used to support a Progressive Rehabilitation and Closure Plan currently being prepared by METServe for the VCM.

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Note that the cross sections are conceptual drawings which are not to scale. The cross sections are intended to showcase the key features of the final landforms and design principles which will be used in its detailed design. Specific design elements of the final landform (including final grades, material selection, and final geometries etc.) will be prepared as part of detailed design phase to support relevant rehabilitation reports.

Final landform design features

Figure A shows the conceptual final landform drainage plan, which shows the drainage principles intended to be used for the final landforms. The drainage plan was developed using end of life mine plans with an aim to retain water infrastructure constructed during operations. The landforms are intended to be free draining and to discharge water to the receiving environment which is consistent with water quality from surrounding background sites.

Key features of the final landforms shown in Figure A, as well as in the cross sections (Figure B, Figure C, Figure D and Figure E), are described in the sections below.

Waste rock dump drainage

An in-pit waste rock dump (Jupiter Pit) on the eastern side of the Project area, as well as an ex-pit waste rock dump and in-pit waste rock dump (Matilda Pit) on the western side of the Project area will be retained in the final landform (Figure A). No final voids are proposed as part of the final landform. The open cut pits will be backfilled with overburden material.

Key drainage features for the waste rock dumps include:

- The final surfaces of the eastern and western dumps will be designed to shed water and avoid concentrated flows. The design of the final landform surface is described in the 'Final landform geometry' section below. Drainage structures will be constructed on the top of the dump, on the batter slopes and at the toe of the dumps, in order to minimise erosion and avoid ponding.
- Plateau drains will collect runoff from the plateau and generally drain them to drop structures and sediment dams. Contour banks on the batter slopes will collect residual runoff not collected in the plateau drains.
- Drop structures will collect runoff from the plateau drains and control the flow down the batter slopes, discharging the flow at the toe of the landform.
- Contour banks will control runoff from the batters.
- Surface water drains will collect runoff at the toe of the dumps and direct it towards sediment dams. These surface water drains will be retained from the operational phase of the Project.
- Erosion control measures will be used in the construction of the plateau drains, surface water drains, contour banks and drop structures as appropriate. These control measures (shown in Figure B, Figure C, Figure D and Figure E) may include topsoiling and vegetating the drainage structures, incorporating erosion resistant liners (e.g., geotextile liners) and/or rock lining the structures.

Dams

A number of dams will be retained, or introduced as part of the final landform design:

- Sediment dams SD1 – SD10 will be retained from the operational phase and will collect surface water runoff generated from the dumps and release it to the receiving waters.
- Sediment dams SD11 and SD12 will be constructed as part of the final landform design to collect runoff from the northern side of the eastern in-pit waste rock dump.
- Sediment dams SD13 – SD15 will be retained from the operational phase and will collect surface water runoff generated from the western in-pit waste rock dump and release it to the receiving waters.
- Sediment dam SD16 will be constructed as part of the final landform design of the western in-pit waste rock dump to collect runoff from the east of the dump.
- A catchment runoff dam DD1 will be retained from the operational phase and will collect undisturbed runoff from the northwest of the final landform. It will spill to the proposed drainage corridor. DD1 will be retained until the drainage corridor has been fully established.
- Operational details regarding the dams (including catchment areas and full supply volumes) are outlined in WRM (2022).

When a sediment dam catchment is completely rehabilitated, and water quality monitoring of the runoff has established that it is consistent with natural background conditions, the sediment dam and associated drainage infrastructure will be decommissioned. Surface runoff and seepage from the rehabilitated catchment will be allowed to shed directly to the receiving environment.

Existing flood levee and drainage diversion

An existing flood levee and drainage diversion, which drains southward through the Project area between the in-pit and out-of-pit dumps (Figure A), was constructed in the Project area prior to its commencement. The flood levee may or may not be retained for the final landform. Flooding results presented in WRM (2022) show Post-closure Conditions assessed against both retaining and removing the existing flood levee.

Proposed drainage corridors

A drainage corridor will divert flows from the western side of the Jupiter Pit eastern in-pit waste rock dump, out to the east (Figure A). The drainage corridor is designed as free-flowing gravity drains.

The drainage corridor is a narrow channel on the southwestern side of the Jupiter Pit eastern in-pit waste rock dump, commencing at the western edge of the in-pit waste rock dump, draining from SD6 and through SD11. The drainage channel will collect runoff from the drop structures along the western side of the in-pit waste rock dump, as well as undisturbed residual runoff draining from the eastern side of the existing levee. The corridor wraps eastward through the backfilled section of the eastern in-pit dump, joining with a discharge channel from the outlet of DD1. The corridor flows around the northern edge of the backfilled pit, discharging through the existing culverts under the Norwich Park Branch Railway to the east. The corridor is proposed to be approximately 2.2 km in length.

The drainage diversion diverting the western upstream clean water catchment around the Matilda Pit final landform will be formed by the Matilda Pit drainage diversion constructed during operations. The drainage diversion will collect undisturbed upstream runoff and discharges to the existing drainage diversion. The drainage diversion is proposed to be approximately 900 m in length.

Cross sections of the proposed Jupiter Pit drainage corridor are shown in XS-1 (Figure B), XS-2 and XS-3 (Figure C).

Flooding maps within Appendix C of the SWA (WRM, 2022) indicate the areas of the landform which are inundated during flood events and the impacts when compared against Pre-mining Conditions. Figures C.1, C.2, C.7 and C.8 of the SWA indicate:

- Under both 1% and 10% AEP conditions, floodwaters will be confined to the proposed drainage corridor draining around the final landform toe. Retaining the flood levee, flood results indicate peak inundation for the 10% AEP and 1% AEP events will be approximately 1.4 m and 2.6 m respectively within the drainage corridor upstream of the proposed Saraji Road. Without the flood levee, flood results indicate peak inundation for the 10% AEP and 1% AEP events will be approximately 2.8 m and 4.0 m respectively within the drainage corridor upstream of the proposed Saraji Road.
- The results shown in Figures C.3 and C.9 of the SWA (WRM, 2022) that the proposed drainage corridor has sufficient capacity under both levee scenarios to convey flood events up to the 0.1% AEP.
- In addition, the flood assessment presented in WRM (2022) indicate that under 1% AEP conditions, peak velocities within the drainage corridor are up to 1.5 m/s (with levee) and 2.2 m/s (without levee). Under 0.1% AEP conditions, maximum velocities in the drainage corridor are up to 2.5 m/s (with levee) and 2.8 m/s (without levee).
- Under the 10% and 1% AEP conditions, floodwaters will be confined to the proposed drainage diversion around the Matilda Pit final landform. Under 0.1% AEP conditions, the floodplain is inundated within the vicinity of the drainage diversion. The flood results indicate peak inundation for the 10% AEP, 1% AEP and 0.1% AEP events will be approximately 1.2 m, 1.6 m and 2.2 m respectively within the drainage diversion.
- Under the 10% AEP, 1% AEP and 0.1% AEP events, maximum velocities in the drainage diversion upstream of the Matilda Pit final landform will be 1.2 m/s, 1.3 m/s and 1.7 m/s respectively. Rock-lining the drainage diversion and/or rock-chute drop structures will be required where the proposed drainage diversion connects with the existing drainage line up to where the drainage diversion discharges to the existing drainage diversion to reduce high velocities and prevent scour and erosion.
- Flooding results from the SWA (WRM, 2022) for the 1% and 10% AEP events retaining the levee have been conceptually represented in Figure B, Figure C, Figure D and Figure E.

Considering the peak velocities referenced above, erosion and scour protection will be required along the proposed corridor structure around Jupiter Pit, the proposed diversion around Matilda Pit and for the toe of the final landforms, particularly if the existing flood levee is removed post closure. Erosion control measures will need to be carefully considered at the inlet and outlet of the drainage corridor, as well as the downstream culvert crossings. Suitable erosion and sediment control measures will be determined during detailed design. Possible erosion controls include:

- topsoiling and revegetating the drainage corridor;
- rock lining the corridor and landform toe;
- operating DD1 until all erosion controls have been implemented in the channel and/or revegetation is established;
- implementing seepage minimisation measures (such as the addition of a liner along the base of the diversions) to minimise seepage from the corridor to the underlying backfilled material (as shown in Figure B and Figure C); and

- routine monitoring of erosion and sedimentation along the drainage corridor to ensure the diversion is stable during natural flow events.

When the drainage corridor is rehabilitated, DD1 will be decommissioned. DD1 will remain until this time to allow in-stream vegetation to establish before receiving upstream catchment flows.

The size and configuration of the proposed drainage corridor and the proposed drainage diversion around Matilda Pit will be confirmed during detailed design; however, it is expected that they will be designed to convey at least 0.1% AEP flow event (assuming the existing drainage levee is removed) as they will form part of the permanent landform structure.

Final landform profile

The conceptual cross sections in Figure B, Figure C, Figure D and Figure E show the intended profile of the two final landforms, including across the in-pit and out-of-pit waste rock dumps. The conceptual landform surfaces have been developed using the finished level of the dumps supplied from Vitrinite Pty Ltd and have been shaped in order to evenly shed water down the landform and minimise erosion.

The key features of the final landform profiles are described below:

- Cross section XS-1 shows a north-south profile across the backfilled pit and eastern in-pit dump (Figure B). As shown, the final landform is intended to be shaped to direct runoff inwards towards the plateau drains situated along the surface. This sloping will ensure that runoff generated along the surface will be collected and controlled through the drainage structures along the surface and minimise uncontrolled flows down the landform batters.
- The surface of the final landforms will be topsoiled and will be vegetated consistent with final rehabilitation plans.
- Batter slopes (shown in Figure B, Figure C, Figure D and Figure E) will be graded at a maximum of 15% and therefore, will be well below the angle of repose.
- Cross section XS-2, XS-3, and XS-4 (shown in Figure C and Figure D) show a west-east profile across the out-of-pit and eastern in-pit waste rock dump. The dumps are intended to be shaped to grade to the west in order to direct runoff along the western side of the final landform to the planned drainage structures.
- Contour banks and plateau drains along the final landform surfaces are intended to be lightly vegetated and lined with a suitable erosion control material (as shown on Figure B, Figure C, Figure D and Figure E).

The materials used in the construction of levees and final landforms will be considered at the time of detailed design.

Memorandum

For and on behalf of

WRM Water & Environment Pty Ltd

Laurence Ziukelis

Lead Project Engineer

References

WRM, 2022 — *Vulcan Coal Mine EA Amendment Surface water assessment*. Prepared for Vitrinite Pty Ltd, Report number 1571-22-B, July 2022.

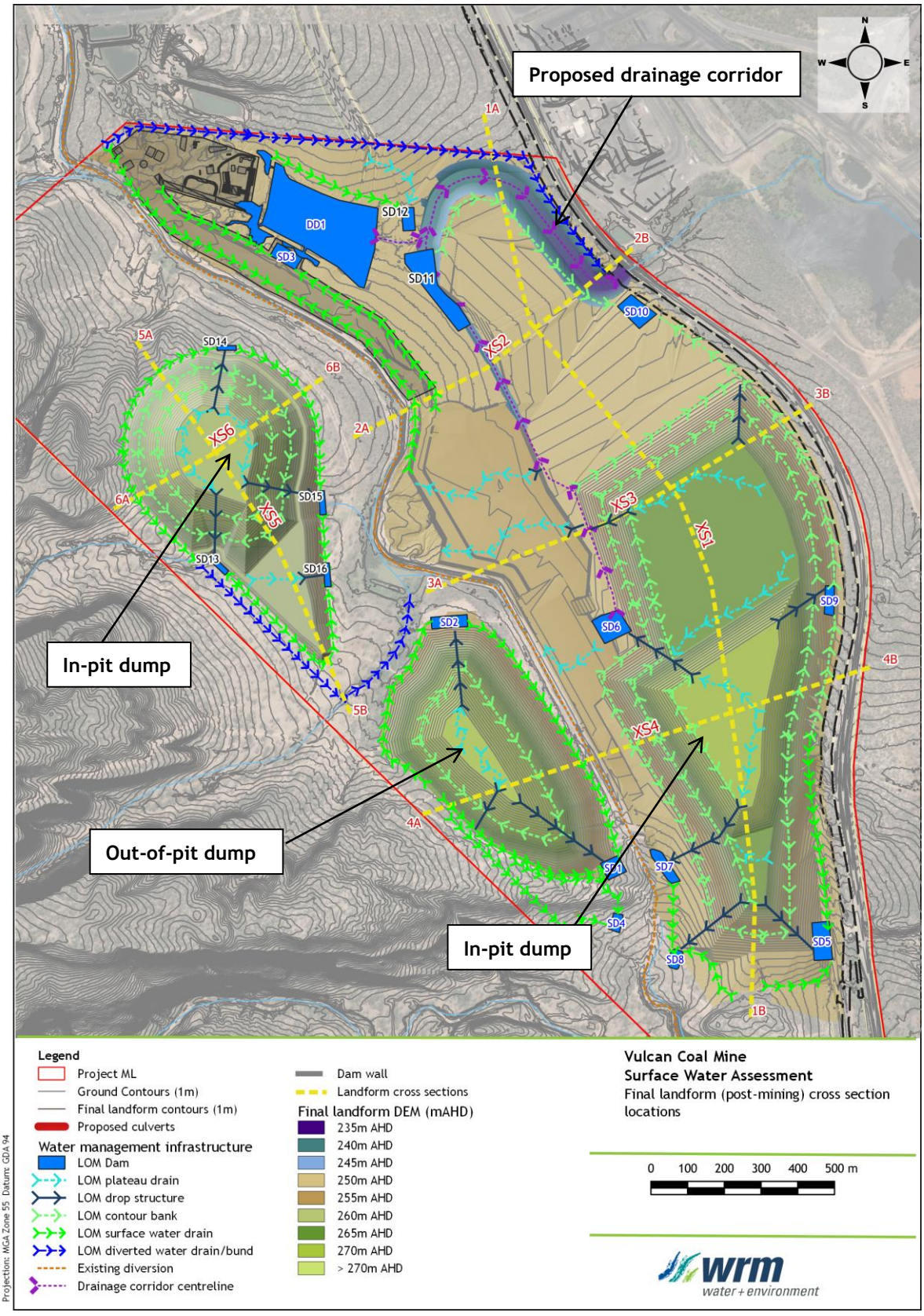
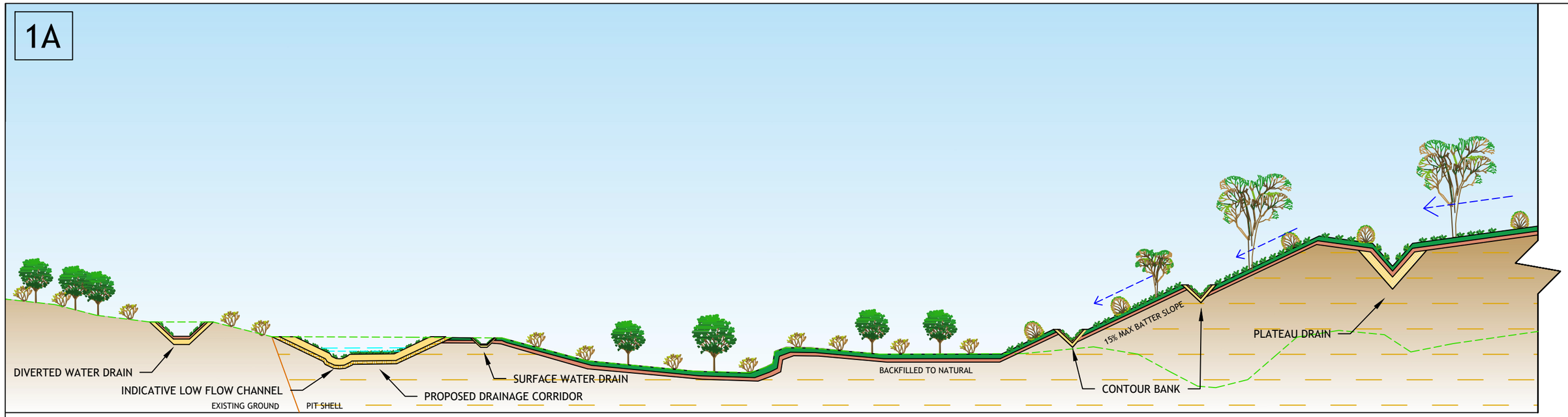
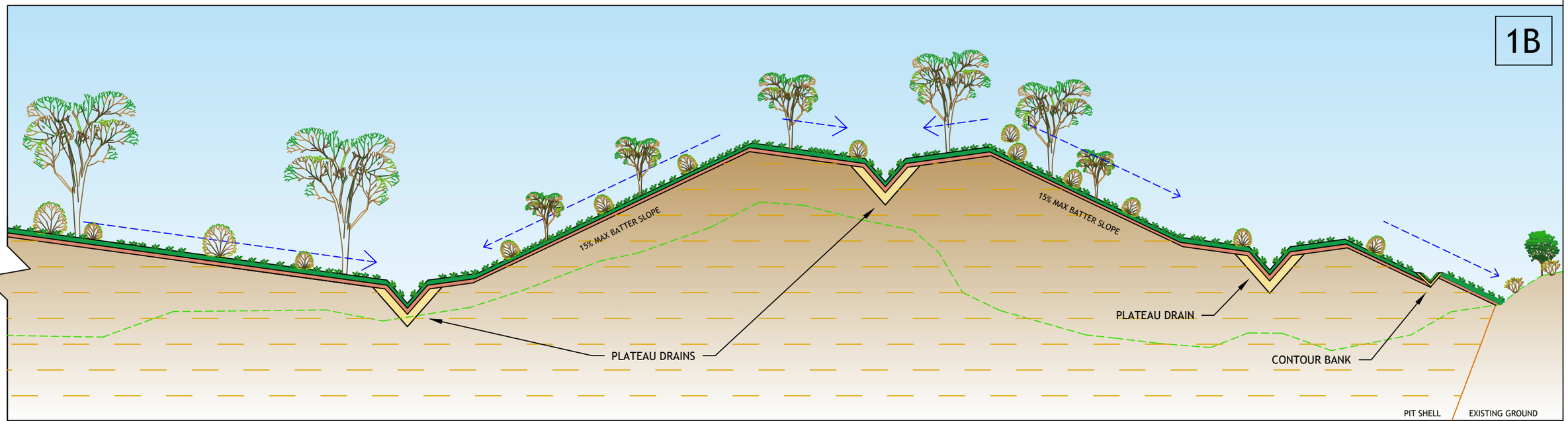


Figure A – Final landform (post-mining) cross section locations

1A



1B



LEGEND

- INDICATIVE RUNOFF PATH
- GROWTH MEDIUM
- 1% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- 10% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- BACKFILLED SPOIL
- SEEPAGE CONTROL MATERIAL
- EROSION CONTROL MATERIAL
- INDICATIVE EXISTING GROUND LEVEL

Dwg. No.	Reference Dwg.	Rev.	Revision Details	By	Chk'd	Date

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Client: METSERVE

Project: VULCAN COAL MINE

	Initial	Signat.	Date
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Drawn			
Checked			
Approved			
Scale	NTS		

FINAL LANDFORM
CONCEPTUAL DRAINAGE
(XS-1)

Job No. 1571-22

Drawing No. FIGURE B

Rev. C

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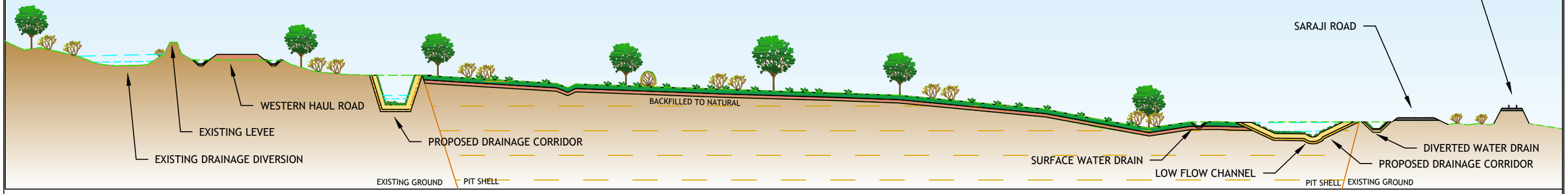
2A

2B



3A

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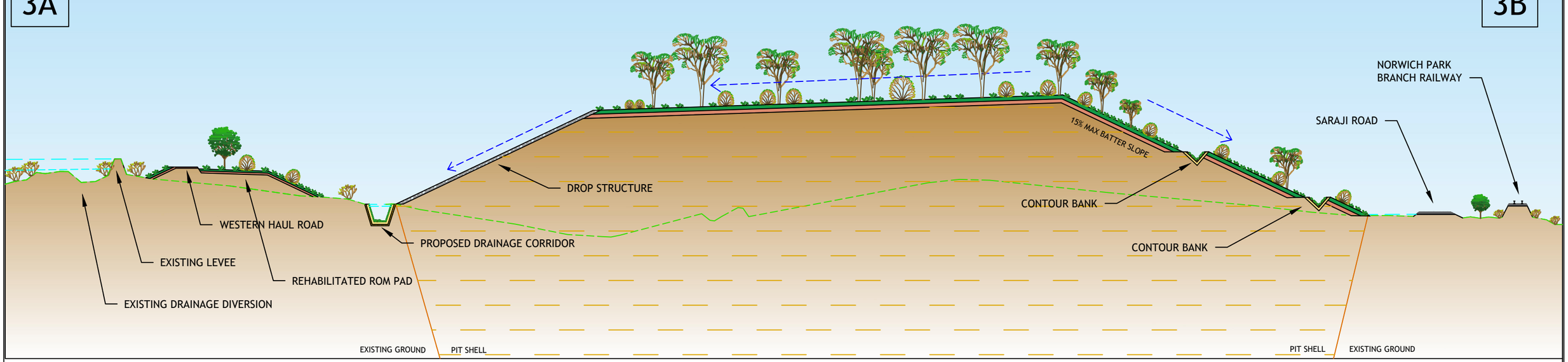

LEGEND

- INDICATIVE RUNOFF PATH
- GROWTH MEDIUM
- 10% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- 1% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- ROCK LINING
- SEEPAGE CONTROL MATERIAL
- EROSION CONTROL MATERIAL
- INDICATIVE EXISTING GROUND LEVEL
- BACKFILLED SPOIL

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Checked			
Approved			
Scale	NTS		

FINAL LANDFORM
CONCEPTUAL DRAINAGE
(XS-2 & XS-3)

Job No. 1571-22

Drawing No. FIGURE C

Rev. B

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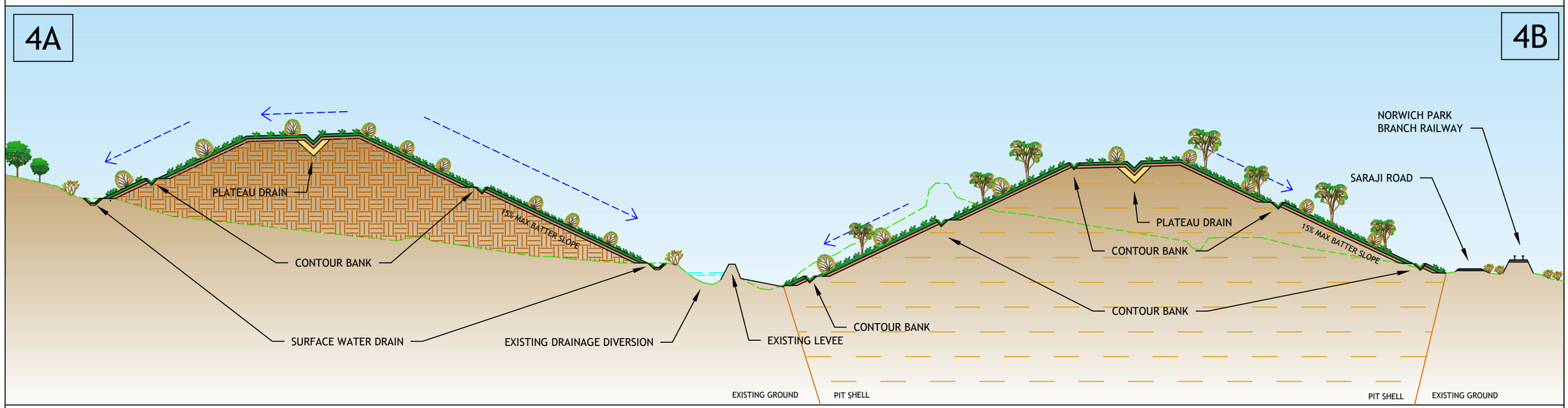
4A

4B



LEGEND

- INDICATIVE RUNOFF PATH
- GROWTH MEDIUM
- 10% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- 1% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- EROSION CONTROL MATERIAL
- SEEPAGE CONTROL MATERIAL
- SUITABLE OVERBURDEN MATERIAL
- INDICATIVE EXISTING GROUND LEVEL
- BACKFILLED SPOIL

Dwg. No.	Reference Dwg.	Rev.	Revision Details	By	Chk'd	Date

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FINAL LANDFORM
CONCEPTUAL DRAINAGE
(XS-4)

Job No. 1571-22

Drawing No. FIGURE D

Rev. B

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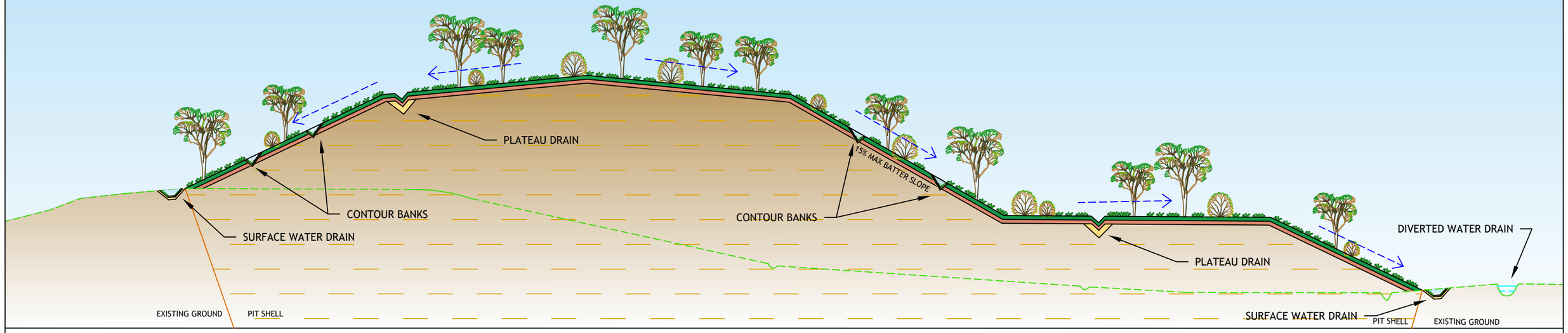

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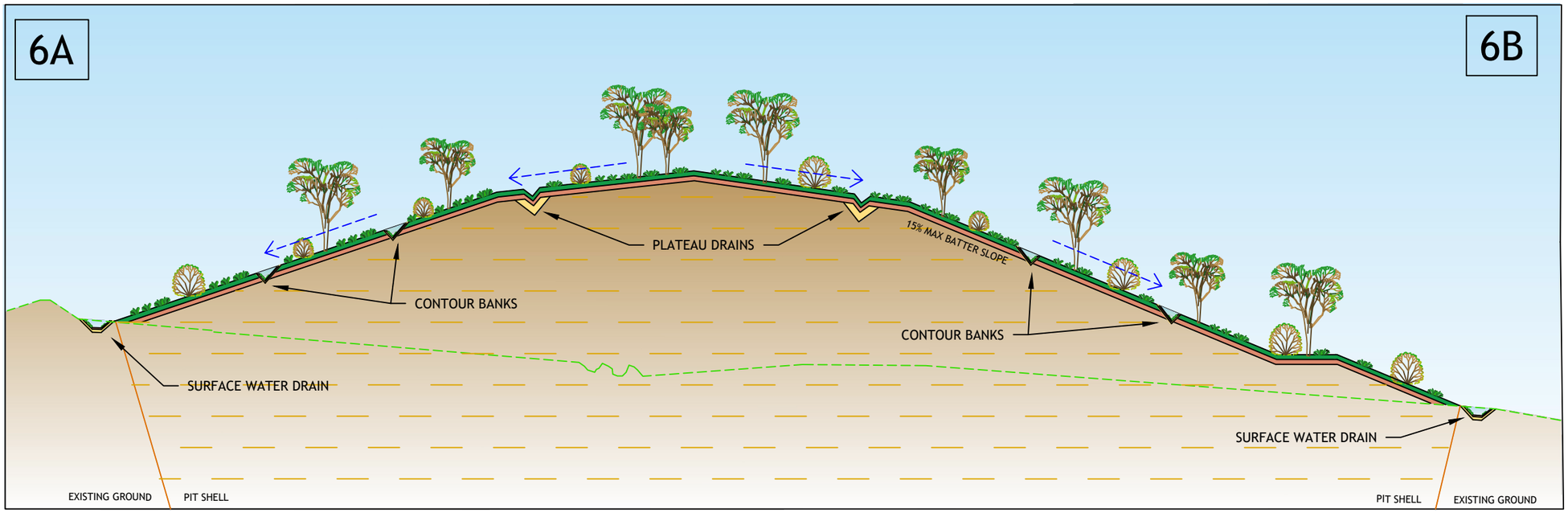
6B



LEGEND

- INDICATIVE RUNOFF PATH
- GROWTH MEDIUM
- 10% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- 1% AEP PEAK FLOOD LEVEL (WITH LEVEE)
- SUITABLE OVERBURDEN MATERIAL
- SEEPAGE CONTROL MATERIAL
- EROSION CONTROL MATERIAL
- INDICATIVE EXISTING GROUND LEVEL
- BACKFILLED SPOIL

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Scale	NTS		

FINAL LANDFORM
CONCEPTUAL DRAINAGE
(XS-5 & XS-6)

Job No. 1571-22

Drawing No. FIGURE E

Rev. B

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