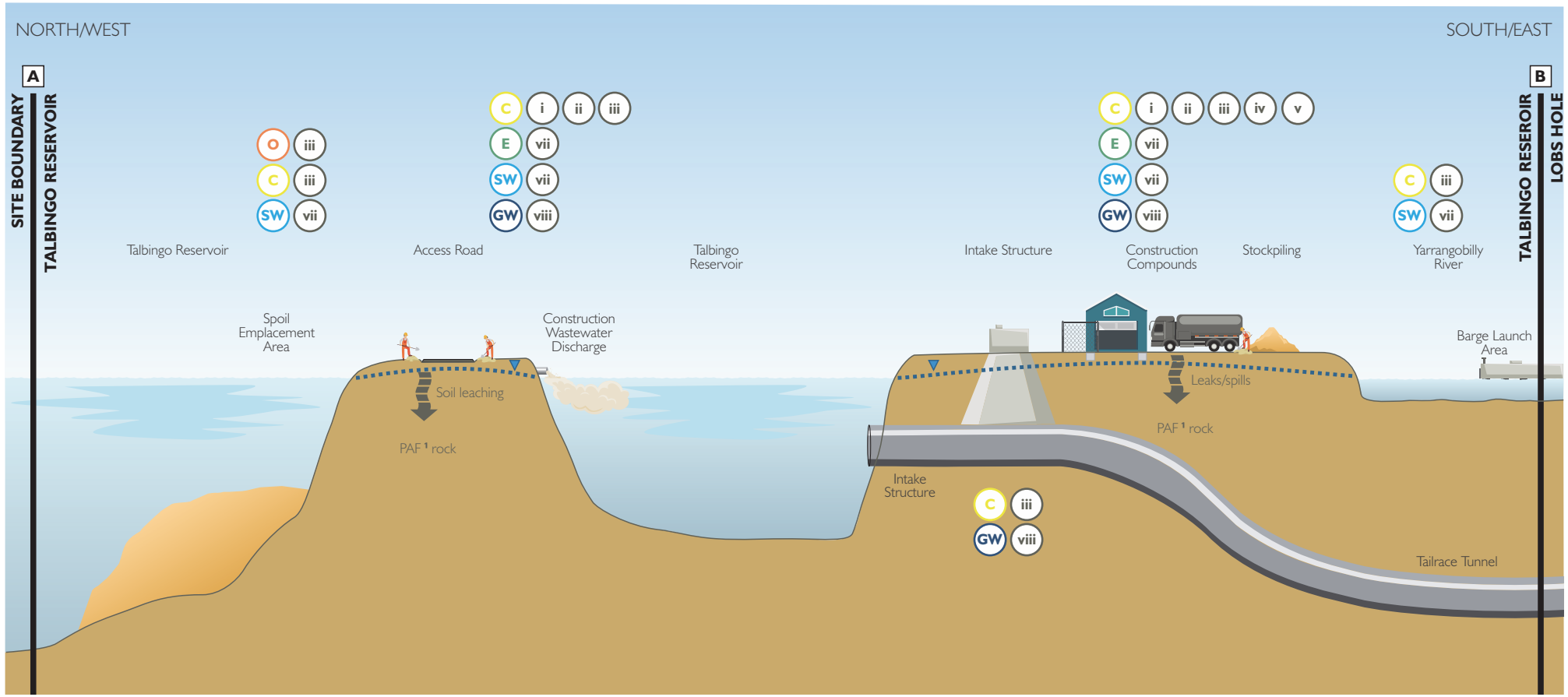
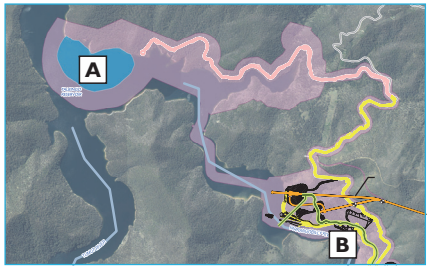
Annexure A

Conceptual site model and risk assessment





Key

Groundwater level

Receptors

- C Construction workers
- E Terrestrial ecosystem
- SW Surface water and sediment ecology
- GW Groundwater ecosystem
- O Open space/recreational users

Pathways

- i Dermal contact and incidental ingestion of soil
- ii Inhalation of dust from soil
- iii Dermal contact and incidental ingestion of surface water/groundwater/leachate
- iv Inhalation of soil/groundwater vapours in indoor air
- v Inhalation of soil/groundwater vapours in outdoor air
- vi Inhalation of soil/groundwater vapours within a trench
- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

[1] PAF – Potentially Acid Forming

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EMM creating opportunities

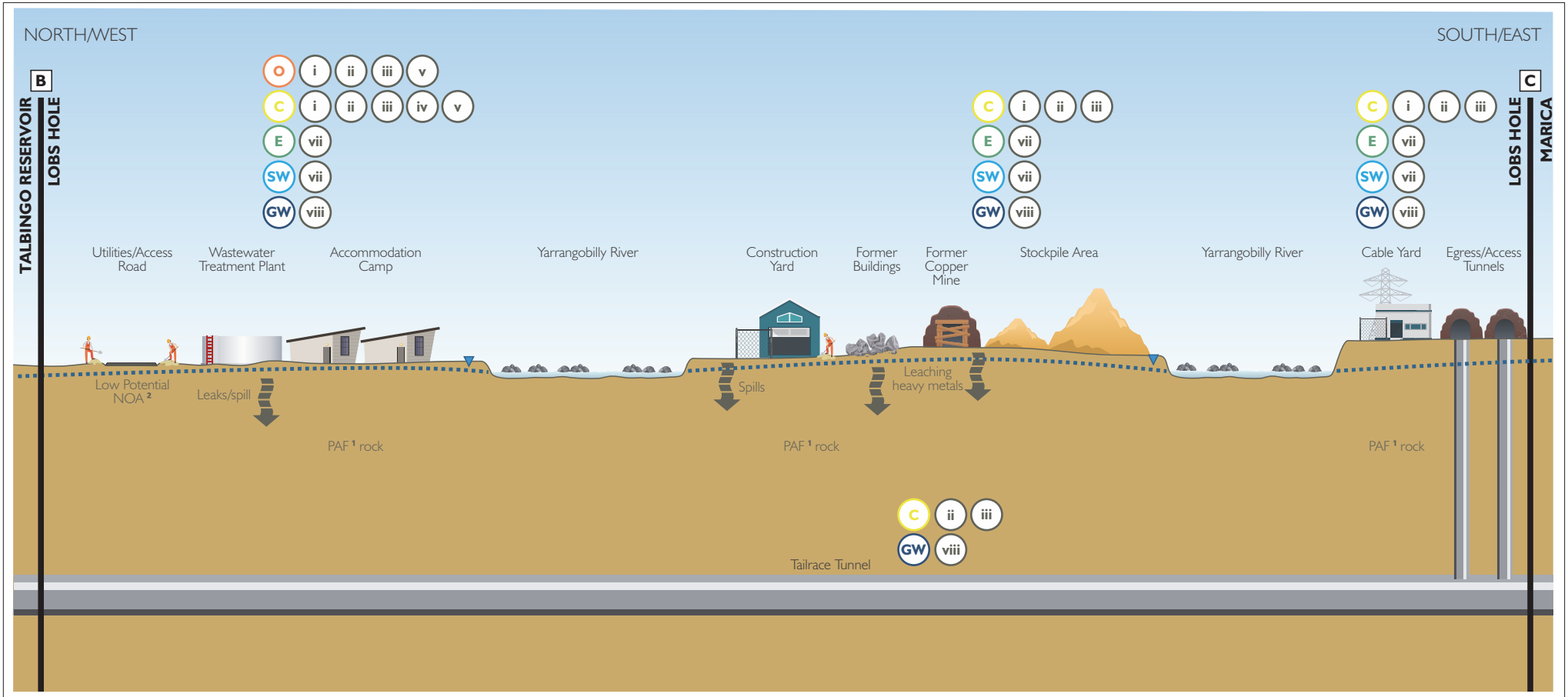
snowy2.0

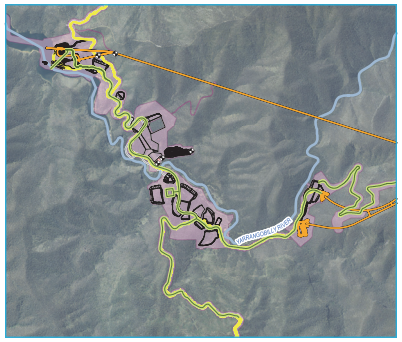
Conceptual Site Model – Talbingo Reservoir

Snowy 2.0

Contamination Assessment

Figure A.1





Key

Groundwater level

Receptors

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Pathways

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- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

[1] PAF – Potentially Acid Forming

[2] NOA – Naturally Occurring Asbestos

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EMM creating opportunities

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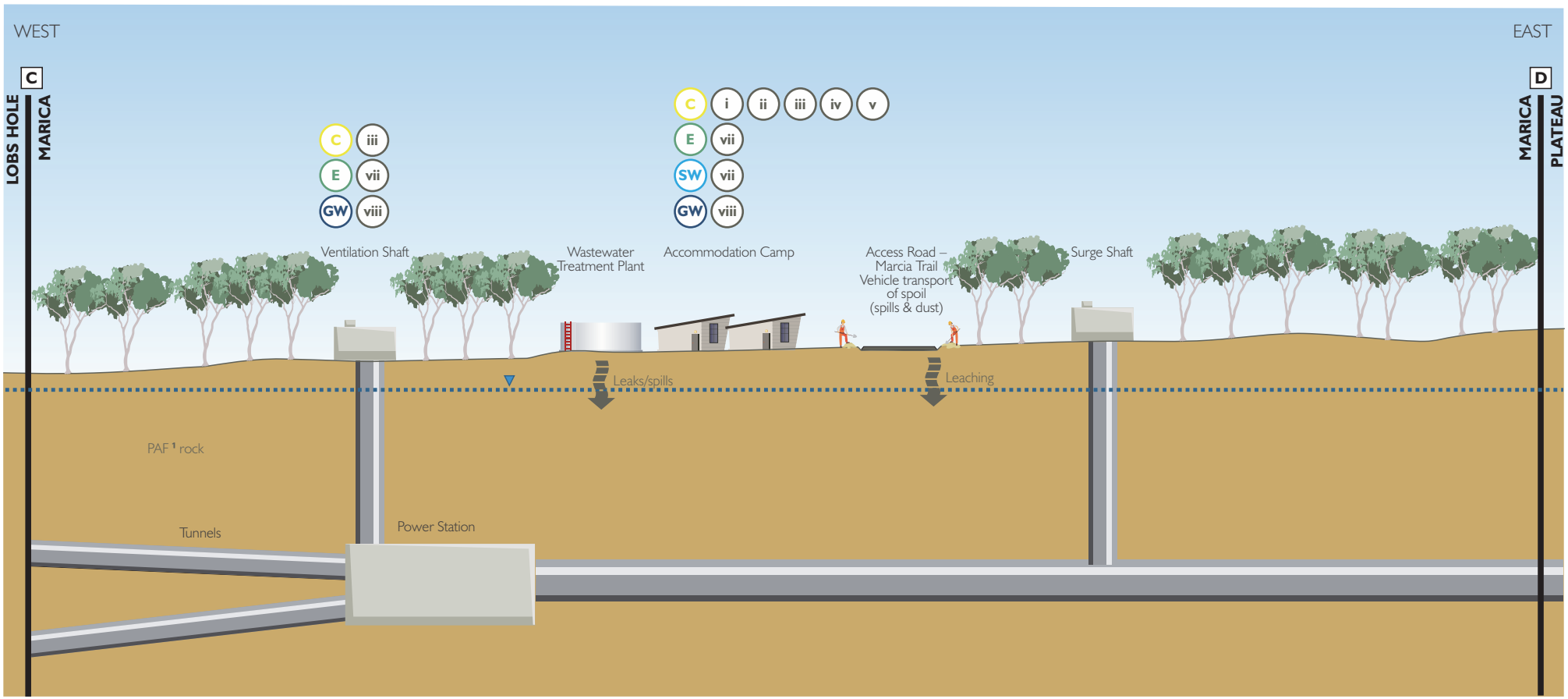
Conceptual Site Model – Lobs Hole

Snowy 2.0
Contamination Assessment
Figure A.2



Key

Groundwater level

Receptors

- C Construction workers
- E Terrestrial ecosystem
- SW Surface water and sediment ecology
- GW Groundwater ecosystem
- O Open space/recreational users

Pathways

- i Dermal contact and incidental ingestion of soil
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- v Inhalation of soil/groundwater vapours in outdoor air
- vi Inhalation of soil/groundwater vapours within a trench
- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

[1] PAF – Potentially Acid Forming

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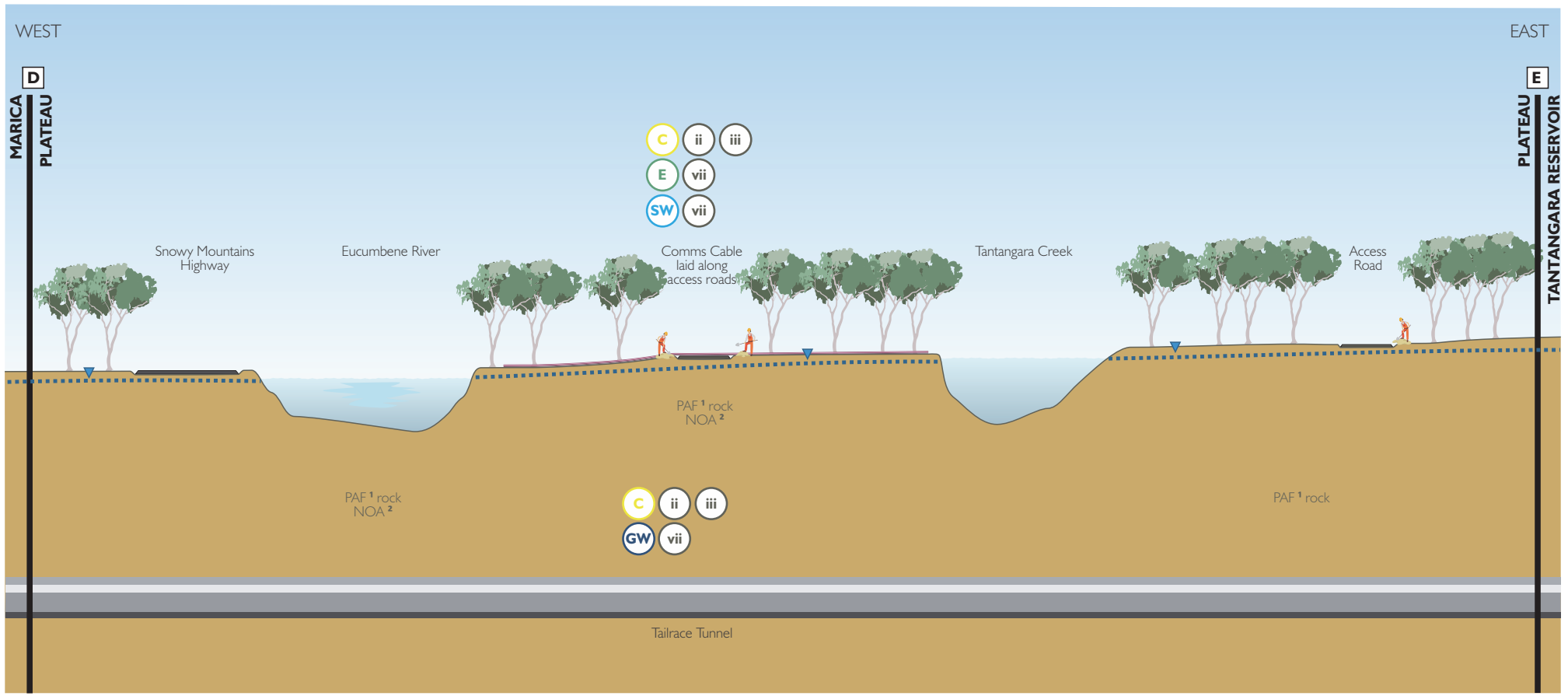
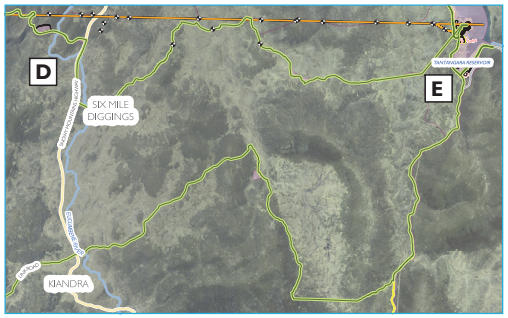
Conceptual Site Mode – Marica

Snowy 2.0
Contamination Assessment
Figure A.3





Key

Groundwater level

Receptors

- C Construction workers
- E Terrestrial ecosystem
- SW Surface water and sediment ecology
- GW Groundwater ecosystem
- O Open space/recreational users

Pathways

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- iii Dermal contact and incidental ingestion of surface water/groundwater/leachate
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- v Inhalation of soil/groundwater vapours in outdoor air
- vi Inhalation of soil/groundwater vapours within a trench
- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

[1] PAF – Potentially Acid Forming

[2] NOA – Naturally Occurring Asbestos

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EMM creating opportunities

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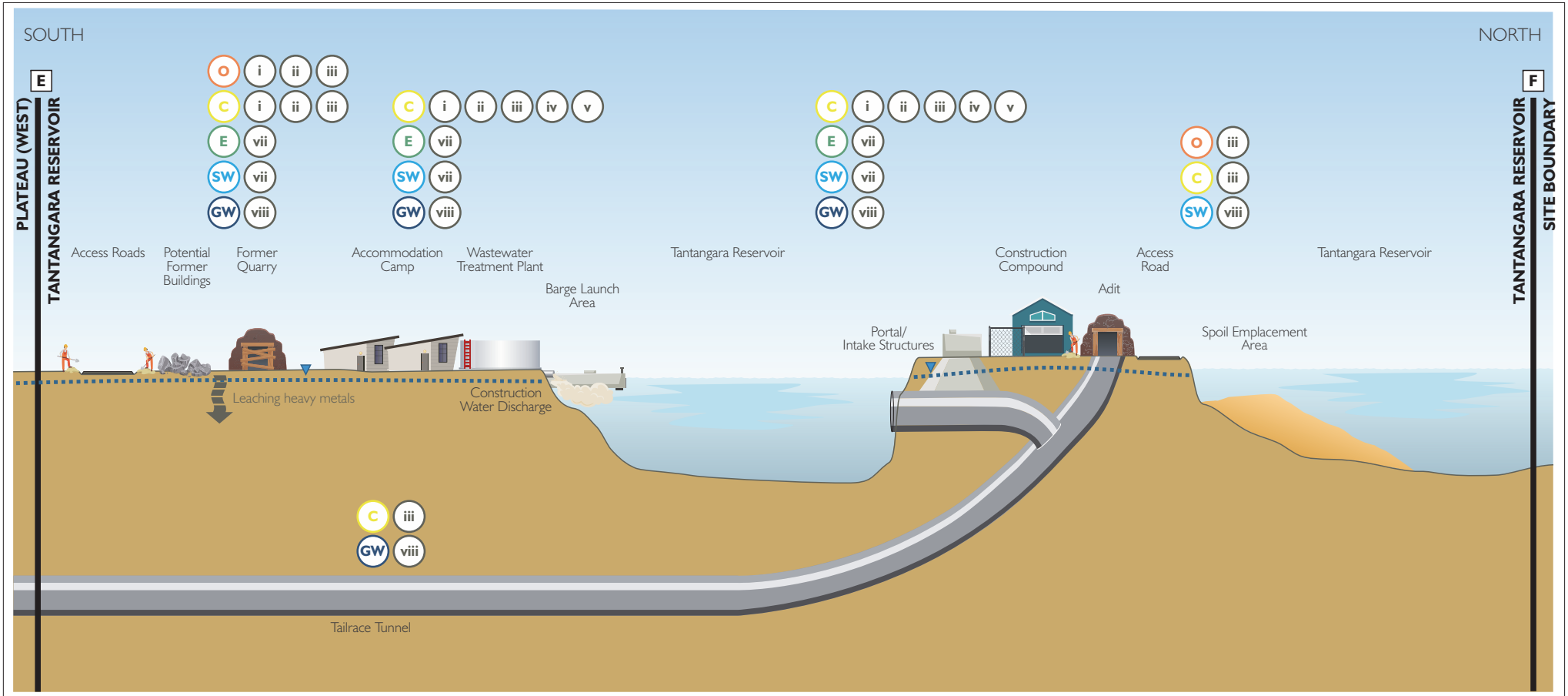
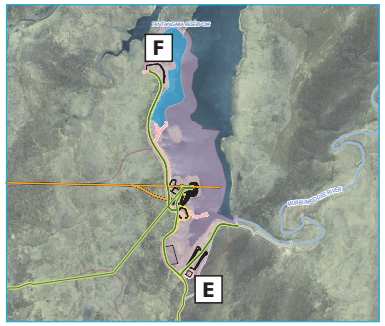
Conceptual Site Model – Plateau

Snowy 2.0
Contamination Assessment
Figure A.4





Key

Groundwater level

Receptors

- C Construction workers
- E Terrestrial ecosystem
- SW Surface water and sediment ecology
- GW Groundwater ecosystem
- O Open space/recreational users

Pathways

- i Dermal contact and incidental ingestion of soil
- ii Inhalation of dust from soil
- iii Dermal contact and incidental ingestion of surface water/groundwater/leachate
- iv Inhalation of soil/groundwater vapours in indoor air
- v Inhalation of soil/groundwater vapours in outdoor air
- vi Inhalation of soil/groundwater vapours within a trench
- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

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creating opportunities

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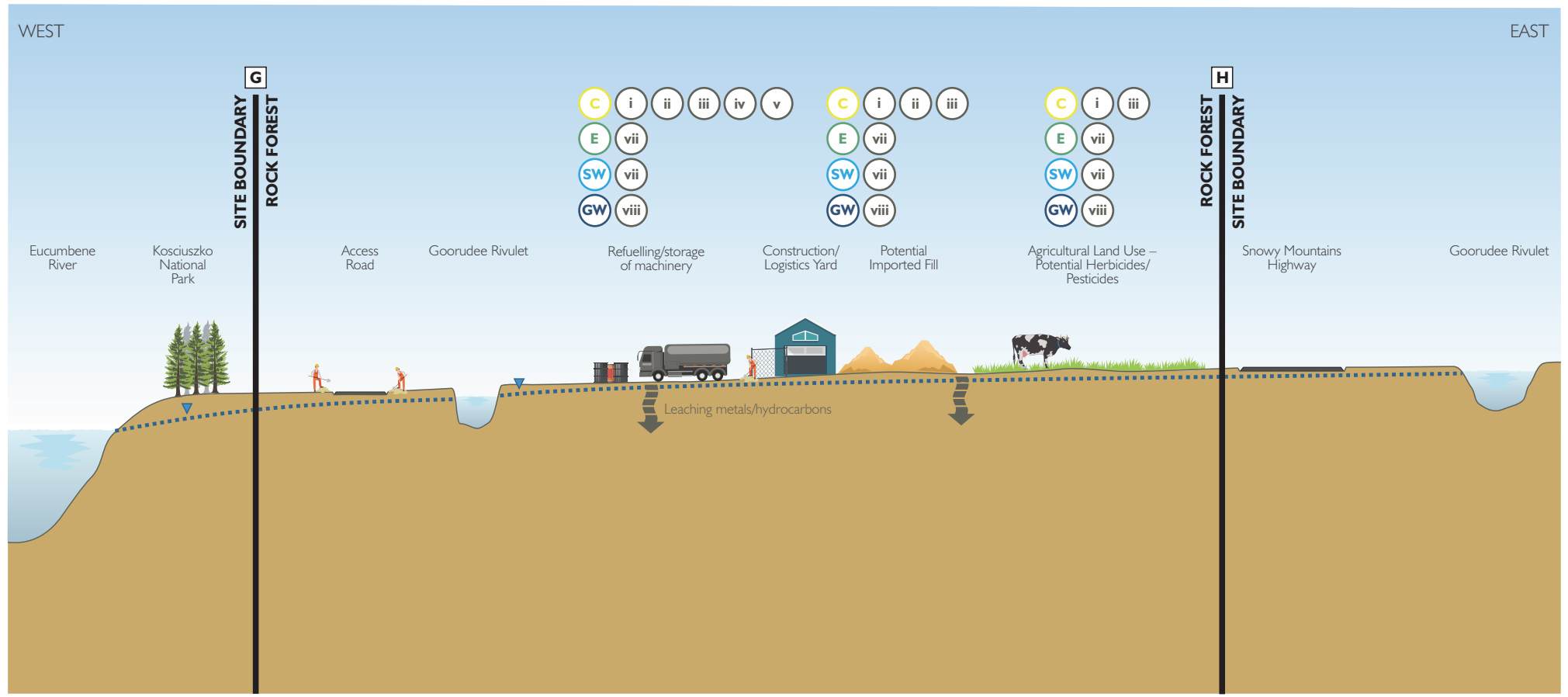
Conceptual Site Model – Tantangara Reservoir

Snowy 2.0
Contamination Assessment

Figure A.5



Key

Groundwater level

Receptors

- C Construction workers
- E Terrestrial ecosystem
- SW Surface water and sediment ecology
- GW Groundwater ecosystem
- O Open space/recreational users

Pathways

- i Dermal contact and incidental ingestion of soil
- ii Inhalation of dust from soil
- iii Dermal contact and incidental ingestion of surface water/groundwater/leachate
- iv Inhalation of soil/groundwater vapours in indoor air
- v Inhalation of soil/groundwater vapours in outdoor air
- vi Inhalation of soil/groundwater vapours within a trench
- vii Plant uptake and/or ingestion by animals
- viii Uptake of CoPC from groundwater (stygofauna and microorganisms)

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EMM creating opportunities

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Conceptual Site Model – Rock Forest

Snowy 2.0
Contamination Assessment

Figure A.6

A.1 Conceptual site model and risk assessment

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Talbingo Reservoir						
General construction and ancillary facilities	Confirmed presence of Potential Acid Forming (PAF) rock in geological formation (primary source – receptor pathways do not exist) producing potential heavy metal impacted leachate due to acidic water neutralisation (secondary source – receptor pathways exist).	1. PAF rock disturbance during excavation/construction. 2. Refuelling and storage of machinery, equipment and materials to be used during construction – leaks/spills – petroleum hydrocarbons. 3. Backfilling construction areas for rehabilitation with contaminated or fill (ie not or incorrectly classified as VENM) – heavy metals, asbestos. 4. Discharge of excess wastewater (following treatment) to Tantangara Reservoir – heavy metals, hydrocarbons.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4] • inhalation in indoor and outdoor air[2,3,4] **Migration pathways:** • aeolian transport as dust[3] • surface water runoff/sedimentation[1,2,3,4] • leaching into ground surface[1,2,3,4] • plant uptake and/or ingestion by animals[1,2,3,4] • groundwater transport[1,2,3,4] • vapours[3,4]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology • Kosciuszko National Park (KNP) ecosystem	Yes	Low
Access roads	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction. 2. Transport of potentially contaminated by vehicles along roads – spills and dust generation – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2] • Inhalation in outdoor air[1,2] **Migration pathways:** • aeolian transport as dust2 • surface water runoff/sedimentation[1,2] • leaching into ground surface[1,2] • groundwater transport[1,2] • plant uptake and/or ingestion by animals[1,2]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology • KNP ecosystem	Yes	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Tunnelling, adit and shaft excavation	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction. 2. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure**: • dermal contact and incidental ingestion[1,2] • inhalation in indoor and outdoor air[2] **Migration pathways:** • aeolian transport as dust[2] • leaching into ground surface[1,2] • groundwater transport[1,2]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology • KNP ecosystem	Yes	Low
Intake structure excavation	Confirmed presence of PAF rock in geological formation – potential heavy metals. Low potential for naturally Occurring Asbestos (NOA) on the eastern shore opposite the proposed intake area. Disturbance during construction is unlikely in this specific area.	1. PAF rock disturbance during excavation/construction. 2. NOA disturbance during excavation/construction. 3. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,3] • inhalation in indoor and outdoor air[1,2,3] **Migration pathways:** • aeolian transport as dust[1,2,3] • surface water runoff/sedimentation[1,3] • leaching into ground surface[1,3] • plant uptake and/or ingestion by animals[1,3] • groundwater transport[1,3]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology • KNP ecosystem	Yes – future pathways, with the exception of NOA, as no disturbance is proposed near the source area.	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Construction compounds - stockpiling of excess material	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction. 2. Stockpiling of potentially contaminated material – heavy metals, asbestos. 3. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3] • inhalation in indoor/outdoor air[2,3] **Migration pathways:** • aeolian transport as dust[2,3] • surface water runoff/sedimentation[1,2,3] • leaching into ground surface[1,2,3] • plant uptake and/or ingestion by animals[1,2,3] • groundwater transport[1,2,3]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology • KNP ecosystem	Yes	Low
Barge launch areas	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] **Migration pathways:** • plant uptake and/or ingestion by animals[1] • surface water transport/sedimentation[1]	• Construction workers • Talbingo Reservoir – recreational users and aquatic ecology	Yes, but none pre-construction, as no disturbance is proposed near the source area.	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Lobs Hole						
Accommodation camps	Confirmed presence of PAF rock in geological formation – heavy metals. Former structures associated with the historic township of Ravine – demolition fill – potential heavy metals (eg lead based paint) within the vicinity of accommodation camp.	1. PAF rock disturbance during excavation/construction. 2. Fill disturbance during excavation/construction. 3. Wastewater treatment plants (WTP) are proposed to be located near accommodation camps – spills, leaks and odours – heavy metals, hydrocarbons. 4. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4] • inhalation in indoor and/or outdoor air[2,3,4] **Migration pathways:** • aeolian transport as dust[2,4] • surface water[1,2,3,4] runoff/sedimentation • leaching into ground surface[1,2,3,4] • groundwater transport[1,2,3,4] • plant uptake and/or ingestion by animals[1,2,3,4] • vapours[3]	• Construction workers • Recreational users (eg campers) post construction. • KNP ecosystem. • Yarrangobilly River – aquatic ecology	Yes	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Access roads	Low NOA potential within a small section of Lobs Hole Ravine Road – near Prospector Creek. Note no NOA was encountered along Ravine Road, Mine Trail or Lobs Hole Road (SMEC 2018). Low-medium potential NOA within a section of Link Road near Three Mile Dam, Mt Selwyn and Kiandra. Confirmed presence of PAF rock in geological formation – heavy metals. Former copper mine – potential heavy metals, within the vicinity of Lobs Hole Construction Compound. Former buildings – demolition fill – potential heavy metals (lead based paint) within the vicinity of Lobs Hole Accommodation Camp and Construction Compound.	1. PAF rock disturbance during excavation/construction. 2. NOA disturbance during excavation/construction. 3. Mine contamination disturbance during excavation/construction. 4. Fill disturbance during excavation/construction. 5. Transport of potentially contaminated by vehicles along roads – spills and dust generation.	**Exposure:** • dermal contact and incidental ingestion[3,4,5] • inhalation in outdoor air[2,3,4,5] **Migration pathways:** • aeolian transport as dust[2,3,4,5] • surface water runoff/sedimentation[1,3,4,5] • leaching into ground surface[1,3,4,5] • plant uptake and/or ingestion by animals[1,3,4,5] • groundwater transport[1,3,4,5]	• Construction workers • Recreational users post construction – Lobs Hole Road and Ravine Road (Mines Trail Road – workers only) • KNP ecosystem • Yarrangobilly River – aquatic ecology	Yes	Medium

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
stockpiles	Confirmed presence of PAF rock in geological formation – heavy metals. Former copper mine – confirmed heavy metals in soil, sediment and surface water within proposed stockpile area at concentrations exceeding relevant land use criteria (URS, 2015). Former buildings – demolition fill – potential heavy metals (lead based paint) within the vicinity of stockpile area.	1. PAF rock disturbance during excavation/construction. 2. Fill disturbance during excavation/construction. 3. Mine contamination disturbance during excavation/construction. 4. Stockpiling of potentially contaminated material – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4] • inhalation in outdoor air[2,3,4] **Migration pathways:** • aeolian transport as dust[2,3,4] • surface water runoff/sedimentation[1,2,3,4] • leaching into ground surface[1,2,3,4] • plant uptake and/or ingestion by animals[1,2,3,4] • groundwater transport[1,2,3,4]	• Construction workers • KNP ecosystem • Yarrangobilly River – aquatic ecology	Yes	High
Construction yard	Confirmed presence of PAF rock in geological formation – heavy metals. Former copper mine – potential heavy metals, within the vicinity of Lobs Hole Construction Compound. Former buildings – demolition fill – potential heavy metals (lead based paint) within the vicinity of Lobs Hole Construction Compound.	1. PAF rock disturbance during excavation/construction. 2. Fill disturbance during excavation/construction. 3. Mine contamination disturbance during excavation/construction. 4. Refuelling and storage of machinery, equipment and materials to be used during construction – petroleum hydrocarbons, metals. 5. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4,5] • inhalation in outdoor and indoor air[2,3,4,5] **Migration pathways:** • aeolian transport as dust[2,3,4,5] • surface water runoff/sedimentation[1,2,3,4,5] • leaching into ground surface[1,2,3,4,5] • groundwater transport[1,2,3,4,5] • plant uptake and/or ingestion by animals[1,2,3,4,5] • vapours[4]	• Construction workers • KNP ecosystem • Yarrangobilly River – aquatic ecology	Yes	Medium

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Cableyard, emergency/ cable/ventilation tunnel, access tunnel and portal (already constructed) and ancillary buildings.	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction. 2. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2] • inhalation in outdoor and indoor air[2] **Migration pathways:** • aeolian transport as dust[2] • surface water runoff/sedimentation[1,2] • leaching into ground surface[1,2] • plant uptake and/or ingestion by animals[1,2] • groundwater transport[1,2]	• Construction workers • KNP ecosystem • Yarrangobilly River – aquatic ecology	Yes	Low
Utilities – electricity and water pipeline construction via trenching and underboring.	Confirmed presence of PAF rock in geological formation – heavy metals. Former copper mine – potential heavy metals, within the vicinity of Lobs Hole Construction Compound. Former buildings – demolition fill – potential heavy metals (lead based paint) within the vicinity of Lobs Hole Accommodation Camp and Construction Compound.	1. PAF rock disturbance during excavation/construction. 2. Fill disturbance during excavation/construction. 3. Mine contamination disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,] • inhalation in outdoor air[2,3] **Migration pathways:** • aeolian transport as dust[1,2,3,4] • surface water runoff/sedimentation[1,2,3] • leaching into ground surface[1,2,3] • plant uptake and/or ingestion by animals[1,2,3] • groundwater transport[1,2,3]	• Construction workers • KNP ecosystem • Yarrangobilly River – aquatic ecology	Yes	Medium

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Marica						
Excavation for tunnels and shafts	Confirmed presence of PAF rock in geological formation – potential heavy metals. There is an unlikely PAF rock presence between the power station and headrace isolating valve chamber.	1. PAF rock disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] **Migration pathways:** • leaching into ground surface[1] • groundwater transport[1]	• Construction workers	Yes	Low
Power station complex – underground construction via drill and blast	Confirmed presence of PAF rock in geological formation – potential heavy metals.	1. PAF rock disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] **Migration pathways:** • leaching into ground surface[1] • groundwater transport[1]	• Construction workers	Yes	Low
Utilities – electricity and water pipeline construction via trenching and underboring.	Potential to confirmed presence of PAF rock at ground surface in geological formation – heavy metals.	1. PAF rock disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] **Migration pathways:** • surface water runoff/sedimentation[1] • leaching into ground surface[1] • plant uptake and/or ingestion by animals[1] • groundwater transport[1]	• Construction workers • KNP ecosystem	Yes	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Accommodation camp	No existing contamination sources identified.	1. WTPs are proposed to be located near accommodation camps – spills, leaks and odours – heavy metals, hydrocarbons. 2. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2] • inhalation in outdoor air[1,2] **Migration pathways:** • surface water runoff/sedimentation[1,2] • leaching into ground surface[1,2] • groundwater transport[1,2] • plant uptake and/or ingestion by animals[1,2] • vapours[2]	• Construction workers • KNP ecosystem	Yes, but none pre-construction.	Low
Access roads – Marica Trail	No existing contamination sources identified.	1. Transport of potentially contaminated by vehicles along roads – spills and dust generation – heavy metals and asbestos.	**Exposure:** • dermal contact and incidental ingestion[1] • inhalation in outdoor air[1] **Migration pathways:** • aeolian transport as dust[1] • surface water runoff/sedimentation[1] • leaching into ground surface[1] • plant uptake and/or ingestion by animals[1] • groundwater transport[1]	• Construction workers • KNP ecosystem and recreational users post construction	Yes, but none pre-construction.	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Plateau						
Tunnelling	Medium potential for NOA to be encountered within the tunnel alignment within the Tantangara Block geological domain, west of Tantangara Creek. Confirmed presence of PAF rock in geological formation – heavy metals.	1. PAF rock disturbance during excavation/construction. 2. NOA disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] • inhalation in indoor air[2] **Migration pathways:** • aeolian transport as dust[2] • leaching into ground surface[1] • groundwater transport[1]	• Construction workers	Yes	Medium
Communications cable lines – open trenches with some areas of under boring, mostly along existing roadways (eg Snowy Mountains Highway, Tantangara Road) and access tracks	Medium potential for NOA - Gooandra Trail, west of Tantangara Creek. Confirmed presence of PAF rock in geological formation – heavy metals.	1. PAF rock disturbance during excavation/construction. 2. NOA disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1] • inhalation in outdoor air[2] **Migration pathways:** • aeolian transport as dust[2] • surface water runoff/sedimentation[1] • leaching into ground surface[1] • plant uptake and/or ingestion by animals[1] • groundwater transport[1]	• Construction workers • KNP ecosystem	Yes	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Tantangara Reservoir						
General construction and ancillary facilities	Potential former buildings – demolition fill within vicinity of Tantangara – heavy metals, asbestos.	1. Disturbance of fill material during construction.	**Exposure:** • dermal contact and incidental ingestion[1] • inhalation in outdoor air[1] **Migration pathways:** • aeolian transport as dust[1] • surface water runoff/sedimentation[1] • leaching into ground surface[1] • plant uptake and/or ingestion by animals[1] • groundwater transport[1]	• Construction workers • Recreational users (campers) post construction • KNP ecosystem • Tantangara Reservoir aquatic ecology and recreational users	Yes	Low
Accommodation camp	Former quarry – heavy metals. Potential former buildings – demolition fill within vicinity of Tantangara – heavy metals, asbestos.	1. Potential quarry contamination disturbance during construction works. 2. Fill disturbance during excavation/construction. 3. WTPs are proposed to be located near accommodation camps – spills, leaks and odours – heavy metals, hydrocarbons. 4. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4] • inhalation in outdoor/indoor air[1,2,3,4] **Migration pathways:** • aeolian transport as dust[1,2,4] • surface water runoff/sedimentation[1,2,3,4] • leaching into ground surface[1,2,3,4] • plant uptake and/or ingestion by animals[1,2,3,4] • vapours[3]	• Construction workers • KNP ecosystem • Tantangara Reservoir aquatic ecology and recreational users	Yes	Medium

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Access roads	Former quarry – heavy metals. Potential former buildings – demolition fill within vicinity of Tantangara – heavy metals, asbestos.	1. Transport of potentially contaminated by vehicles along roads – spills and dust generation – heavy metals and asbestos. 2. Mine contamination disturbance during excavation/construction. 3. Fill disturbance during excavation/construction.	**Exposure:** • dermal contact and incidental ingestion[1,2,3] • inhalation in outdoor air[1,2,3] **Migration pathways:** • aeolian transport as dust[1,2,3] • surface water runoff/sedimentation[1,2,3] • plant uptake and/or ingestion by animals[1,2,3] • leaching into ground surface[1,2,3] • groundwater transport[1,2,3]	• Construction workers • KNP ecosystem and recreational users post construction • Tantangara Reservoir aquatic ecology and recreational users	Yes	Medium
Tunnelling, adit, shaft and intake structure excavation	No existing contamination sources identified.	1. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1] • inhalation in indoor/outdoor air[1] **Migration pathways:** • aeolian transport as dust[1] • leaching into ground surface[1] • plant uptake and/or ingestion by animals[1] • groundwater transport[1]	• Construction workers	Yes, but none pre-construction	Low

Table A.1 Conceptual site model and risk assessment

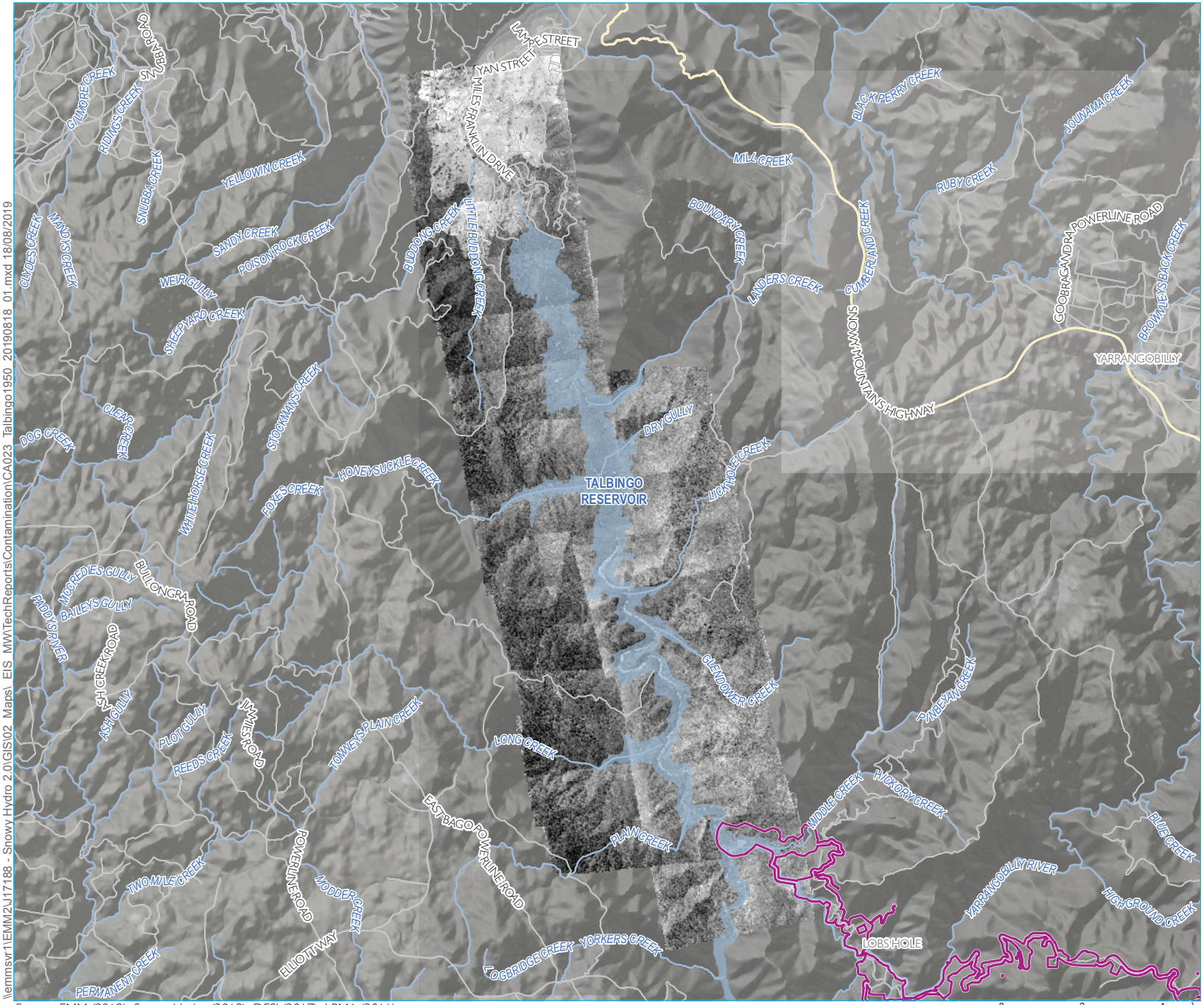
Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Construction compounds / laydown areas - stockpiling of excess material	Potential former buildings – demolition fill within vicinity of Tantangara – heavy metals, asbestos.	1. Fill disturbance during excavation/construction. 2. Stockpiling of potentially contaminated material / importing or backfilling during rehabilitation – heavy metals, asbestos. 3. Refuelling and storage of machinery, equipment and materials to be used during construction – petroleum hydrocarbons. 4. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4] • inhalation in outdoor/indoor air[1,2,3,4] **Migration pathways:** • aeolian transport as dust[1,2,4] • surface water runoff/sedimentation[1,2,3,4] • leaching into ground surface[1,2,3,4] • groundwater transport[1,2,3,4] • plant uptake and/or ingestion by animals[1,2,3,4] • vapours[3]	• Construction workers • KNP ecosystem • Tantangara Reservoir aquatic ecology and recreational users	Yes	Low
Barge launch areas	No existing contamination sources identified.	1. Importing or backfilling during rehabilitation with contaminated or fill – heavy metals, asbestos.	**Exposure:** • dermal contact and incidental ingestion[1] **Migration pathways:** • surface water runoff/sedimentation[1] • plant uptake and/or ingestion by animals[1]	• Construction workers • Tantangara Reservoir aquatic ecology and recreational users	Yes, but none pre-construction	Low

Table A.1 Conceptual site model and risk assessment

Construction activity/area	Existing CoPC and sources – likelihood of presence within construction footprint	Potentially contaminating activities and associated CoPC	Potential exposure pathway between contamination and receptor	Receptors	Potentially complete source > pathway > receptor	Qualitative tier one risk assessment
Utilities – electricity and water pipeline construction via trenching and underboring.	Former quarry – heavy metals. Potential former structures – demolition fill within vicinity of Tantangara – heavy metals, asbestos.	1. Fill disturbance during excavation/construction. 2. Mine contamination disturbance during excavation/construction. 3. Discharge of excess wastewater (following treatment) to Tantangara Reservoir – heavy metals, hydrocarbons.	**Exposure:** • dermal contact and incidental ingestion[1,2,3] • inhalation in outdoor/indoor air[1,2,3] **Migration pathways:** • aeolian transport as dust[1,2] • surface water runoff/sedimentation[1,2,3] • leaching into ground surface[1,2,3] • plant uptake and/or ingestion by animals[1,2,3] • vapours[3]	• Construction workers • KNP ecosystem and recreational users post construction • Tantangara Reservoir aquatic ecology and recreational users	Yes	Medium
Rock Forest						
Construction/logistics yard and access road – land levelling and heavy vehicle storage on private land	Agricultural land – use of pesticides/herbicides, potential former uncontrolled fill – asbestos, hydrocarbons, metals.	1. Fill disturbance during excavation/construction. 2. Pesticide/herbicide impacted material disturbance during construction/excavation. 3. Transport of potentially contaminated by vehicles along roads – spills and dust generation – heavy metals and asbestos. 4. Importing or backfilling with potentially contaminated fill – heavy metals, asbestos. 5. Refuelling and storage of machinery, equipment and materials to be used during construction – petroleum hydrocarbons.	**Exposure:** • dermal contact and incidental ingestion[1,2,3,4,5] • inhalation in outdoor/indoor air[1,2,3,4,5] **Migration pathways:** • aeolian transport as dust[1,2,3,4] • surface water runoff/sedimentation[1,2,3,4,5] • leaching into ground surface[1,2,3,4,5] • groundwater transport[1,2,3,4,5] • plant uptake and/or ingestion by animals[1,2,3,4,5] • vapours[5]	• Construction workers • Agricultural workers at private land post construction • Goorudee Rivulet and Eucumbene River aquatic ecology and recreational users	Yes	Low

Annexure B

Historical aerial photographs



\\emmsvr1\EMM2\J\17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA023 Talbingo1950 20190818 01.mxd 18/08/2019

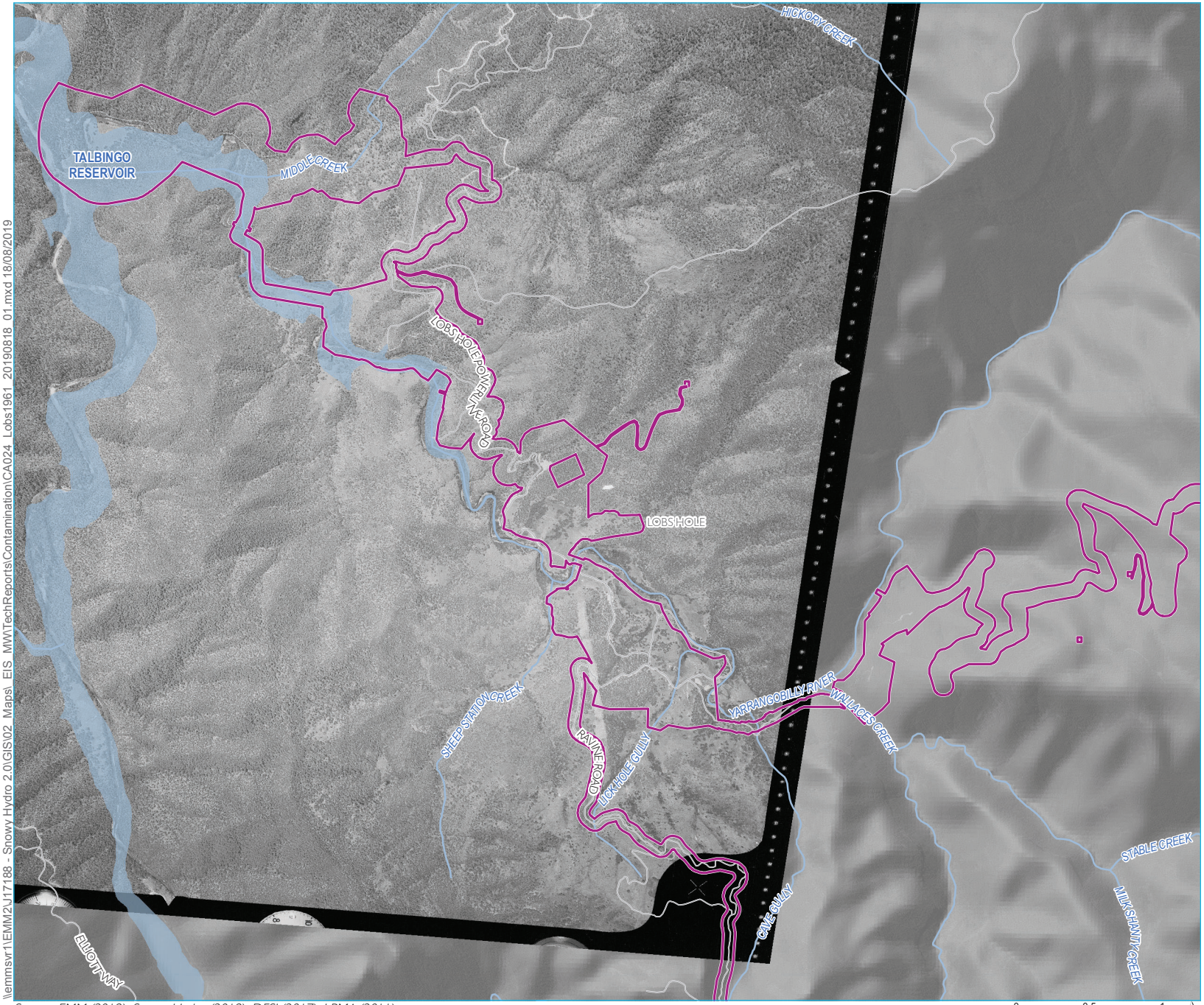
Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

Talbingo, 1950's

Snowy 2.0
Contamination Assessment
Main Works
Figure B.1

snowy 2.0

EMM
creating opportunities



KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

Lobs Hole, 1961

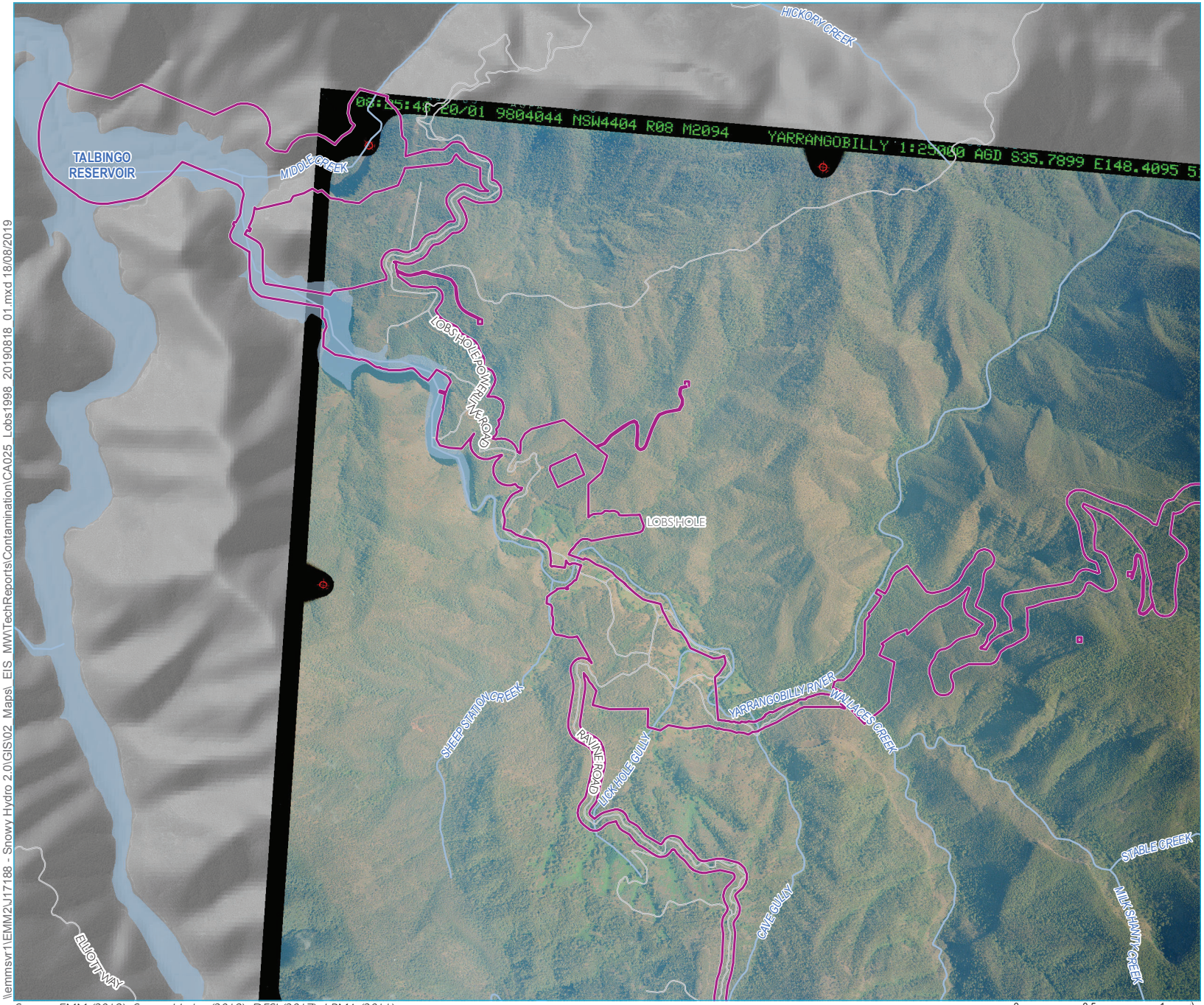
Snowy 2.0
Contamination Assessment
Main Works
Figure B.2

0 0.5 1 km
GDA 1994 MGA Zone 55

N

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA024 Lobs1961 20190818 01.mxd 18/08/2019



KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

Lobs Hole, 1998

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

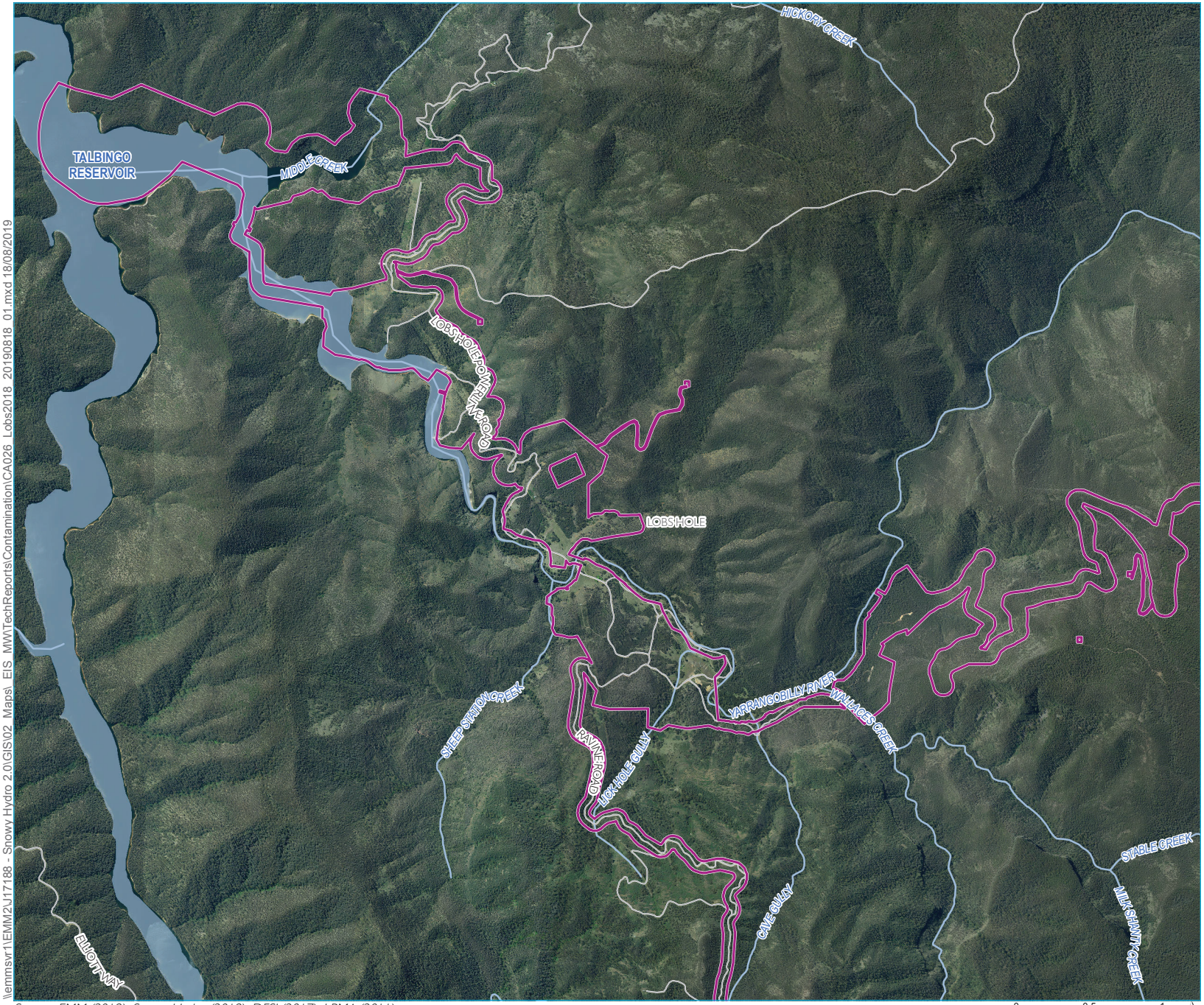
N

Snowy 2.0
Contamination Assessment
Main Works
Figure B.3

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MWTechReports\Contamination\CA025_Lobs1998_20190818_01.mxd 18/08/2019



KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

Lobs Hole, 2018

Snowy 2.0
Contamination Assessment
Main Works
Figure B.4

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

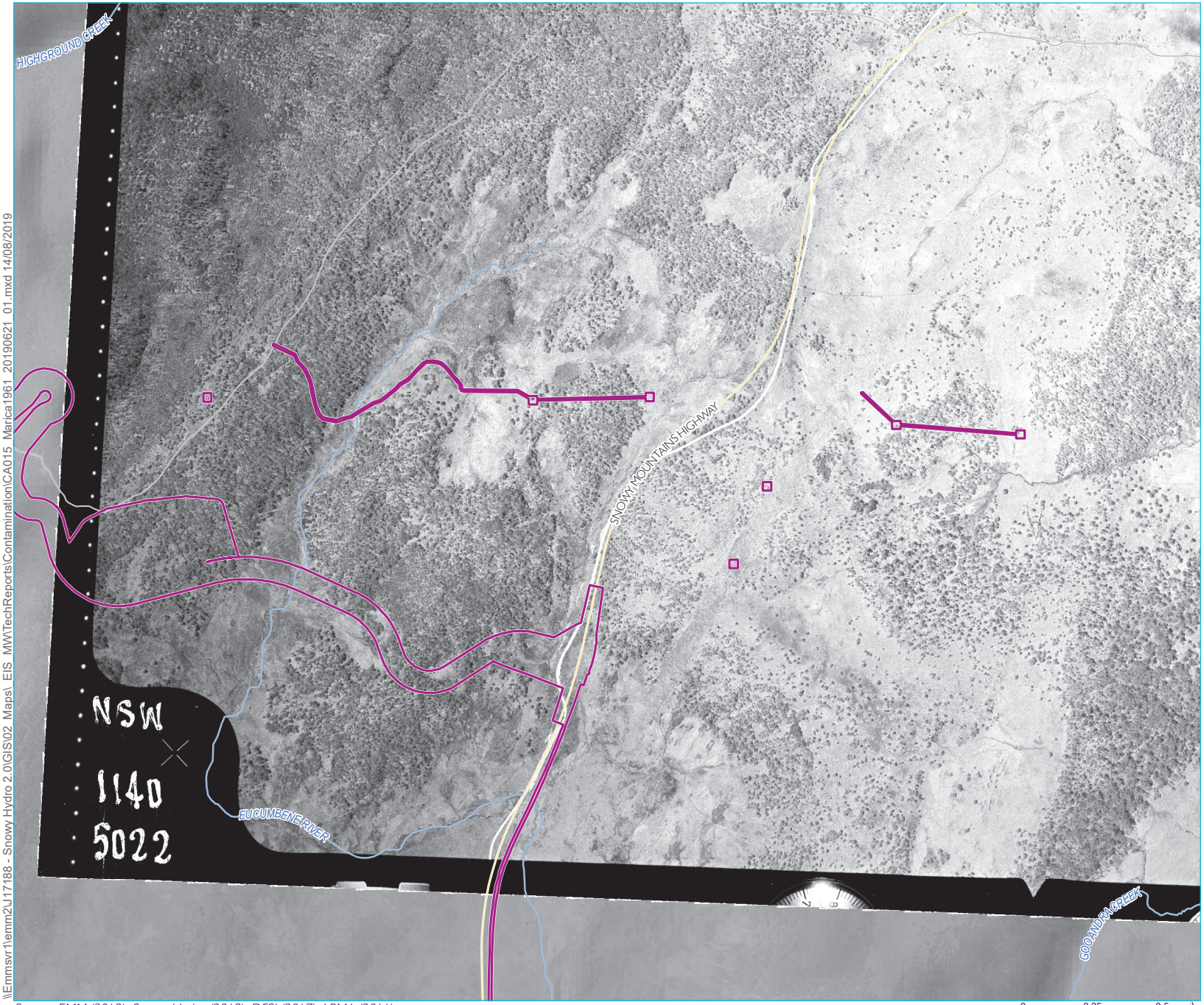
GDA 1994 MGA Zone 55

N

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA026 Lobs2018 20190818 01.mxd 18/08/2019



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\Emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA015 Marica1961 20190621 01.mxd 14/08/2019

Marica, 1961

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.25 0.5 km

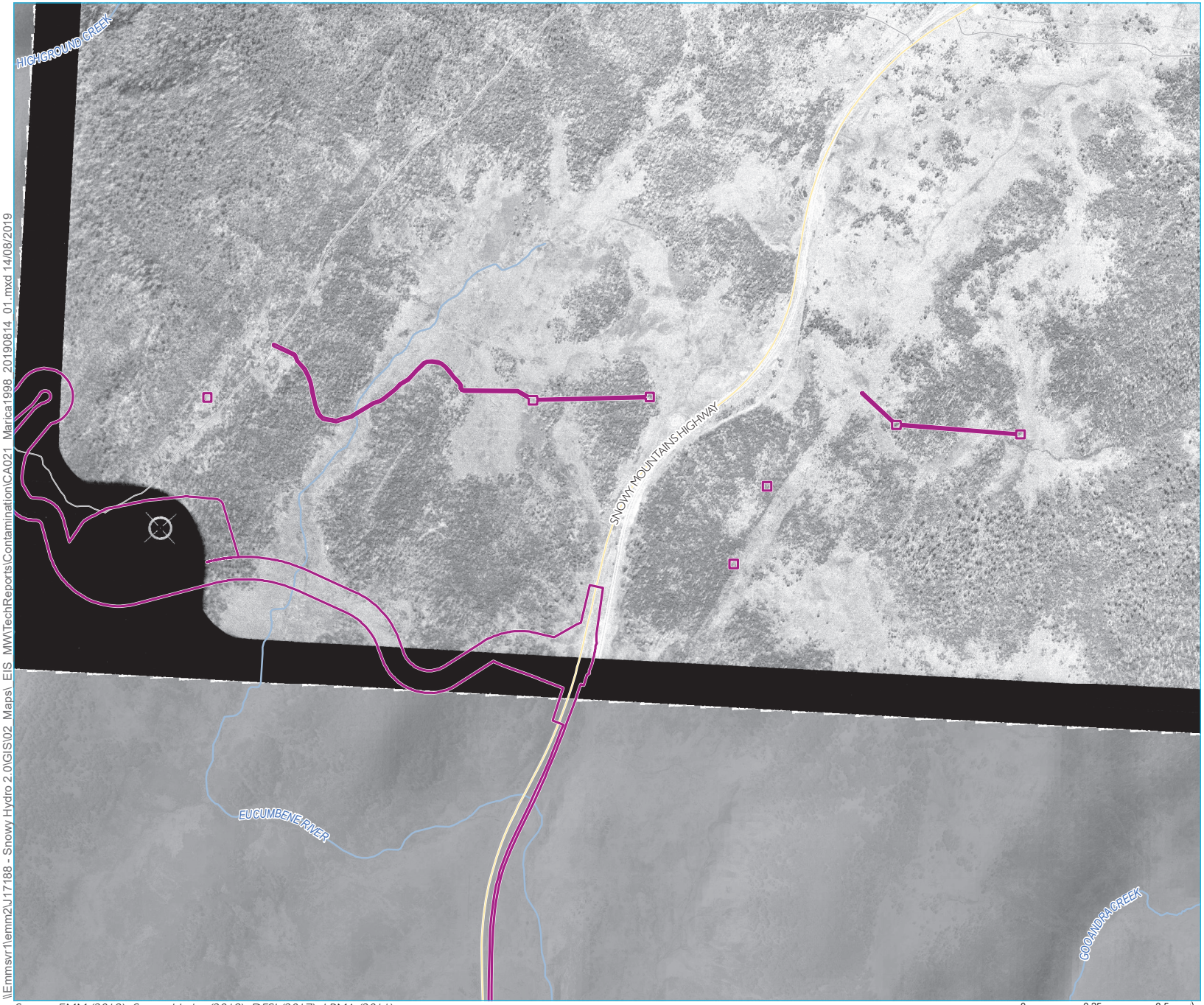
GDA 1994 MGA Zone 55

N

Snowy 2.0
Contamination Assessment
Main Works
Figure B.5

snowy 2.0

EMM creating opportunities



KEY

Disturbance boundary

Existing environment

Main road

Local road

Watercourse

\\Emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA021 Marica1998 20190814 01.mxd 14/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.25 0.5 km

GDA 1994 MGA Zone 55

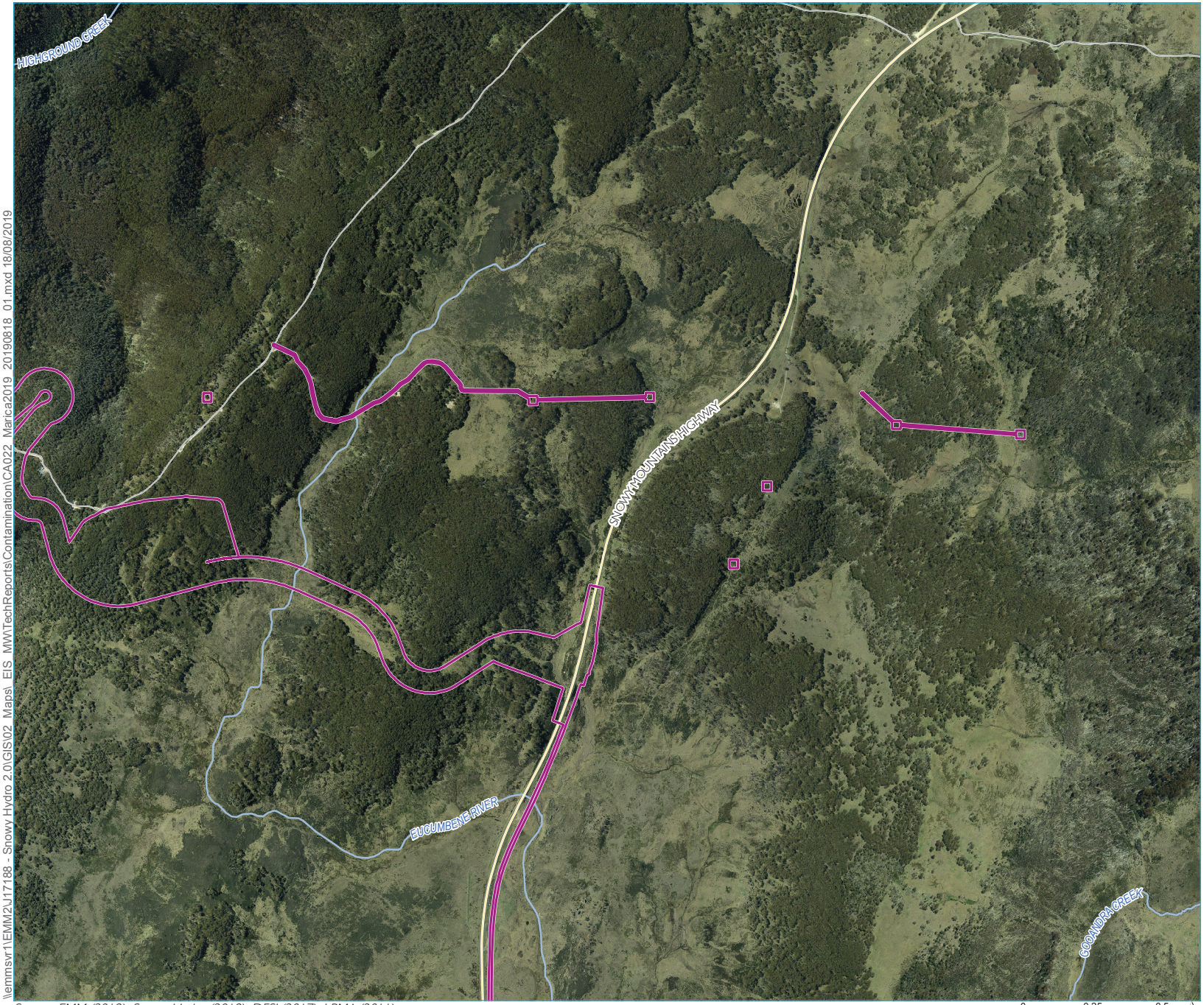
N

Marica, 1998

Snowy 2.0
Contamination Assessment
Main Works
Figure B.6

snowy 2.0

EMM creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA022 Marica2019 20190818 01.mxd 18/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.25 0.5 km

GDA 1994 MGA Zone 55

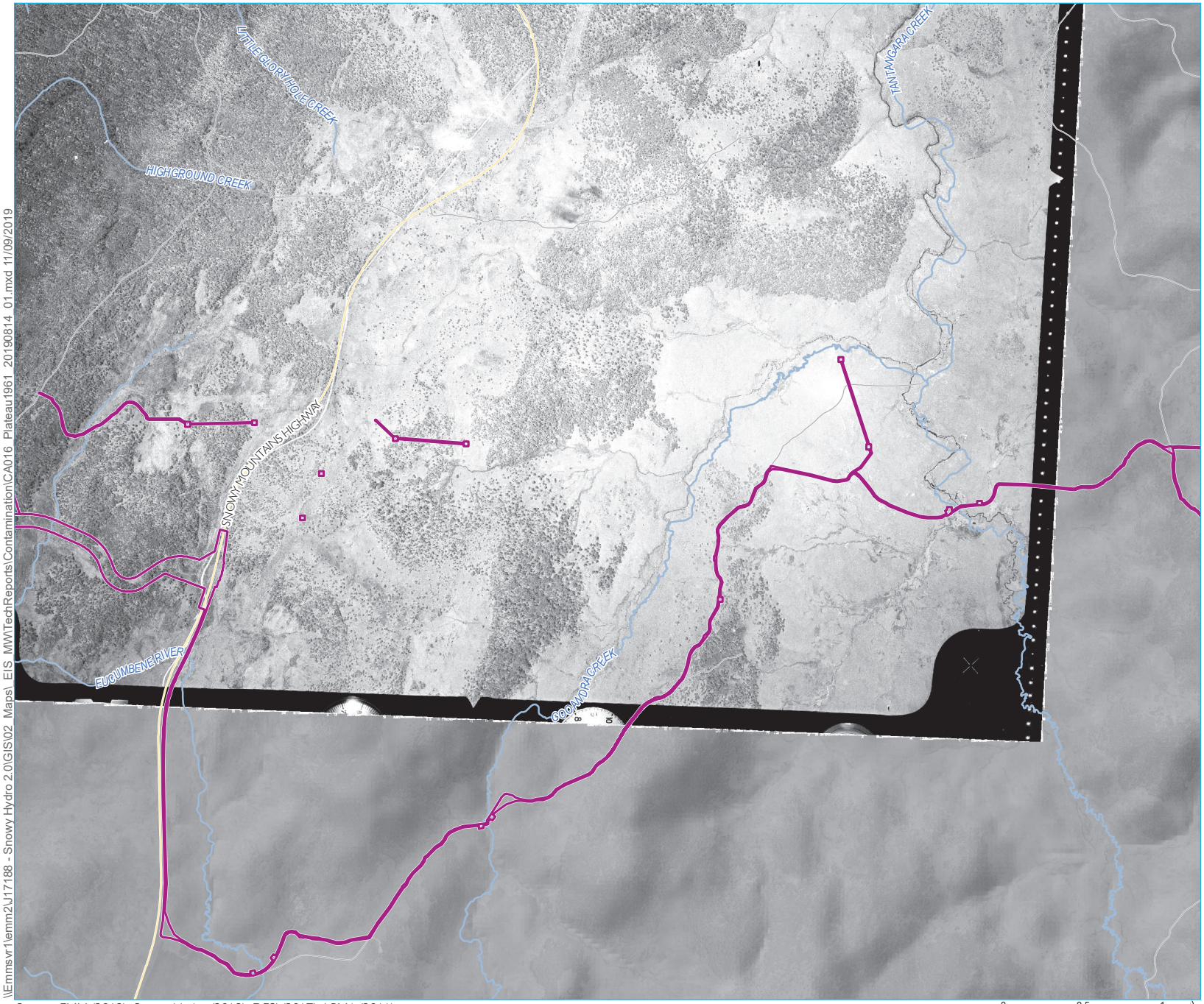
N

Marica, 2018

Snowy 2.0
Contamination Assessment
Main Works
Figure B.7

snowy 2.0

EMM creating opportunities



\\Emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA016 Plateau1961 20190814 01.mxd 11/09/2019

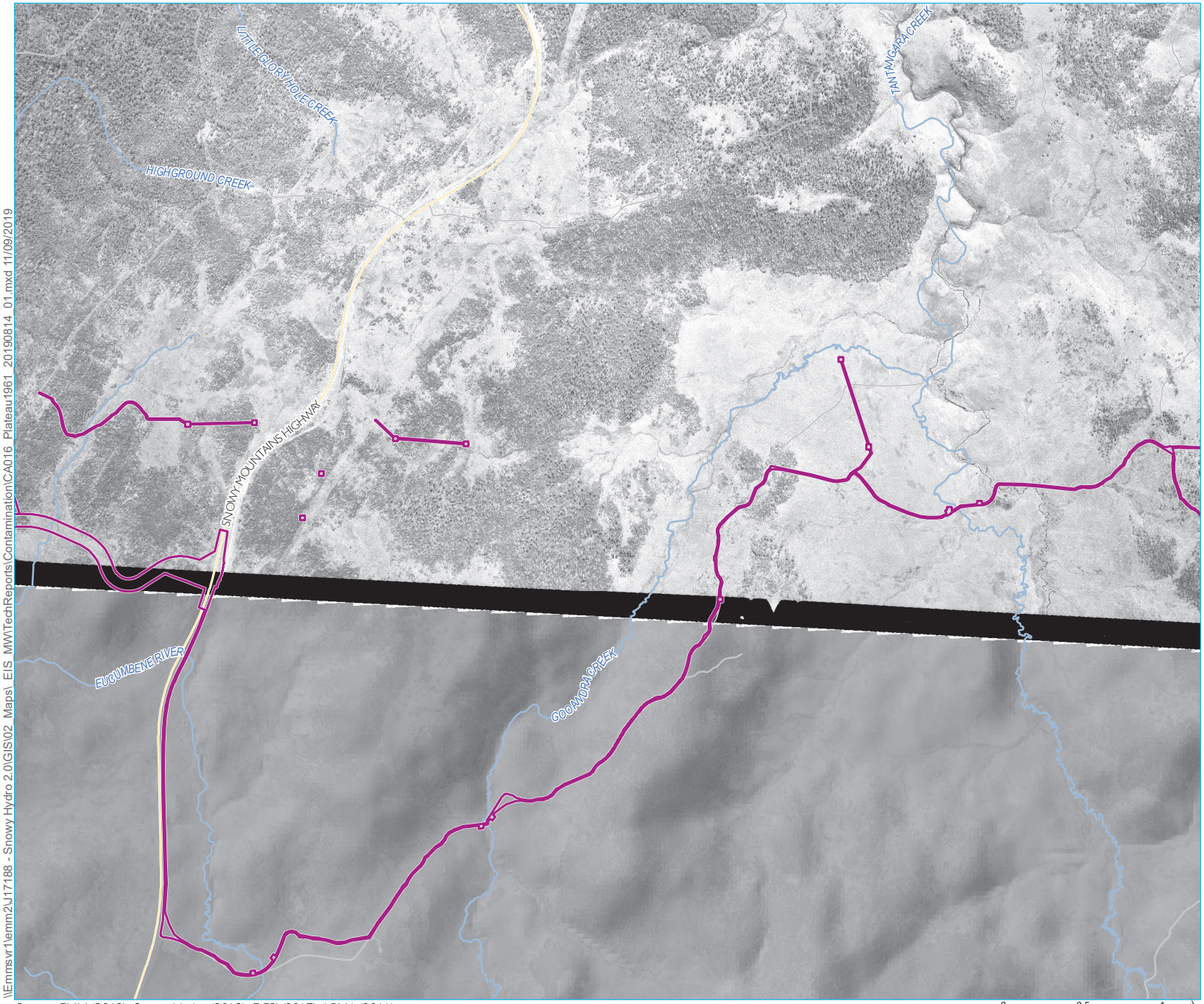
Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

Plateau, 1961

Snowy 2.0
Contamination Assessment
Main Works
Figure B.8

snowy 2.0

EMM
creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\Emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA016 Plateau1961 20190814 01.mxd 11/09/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

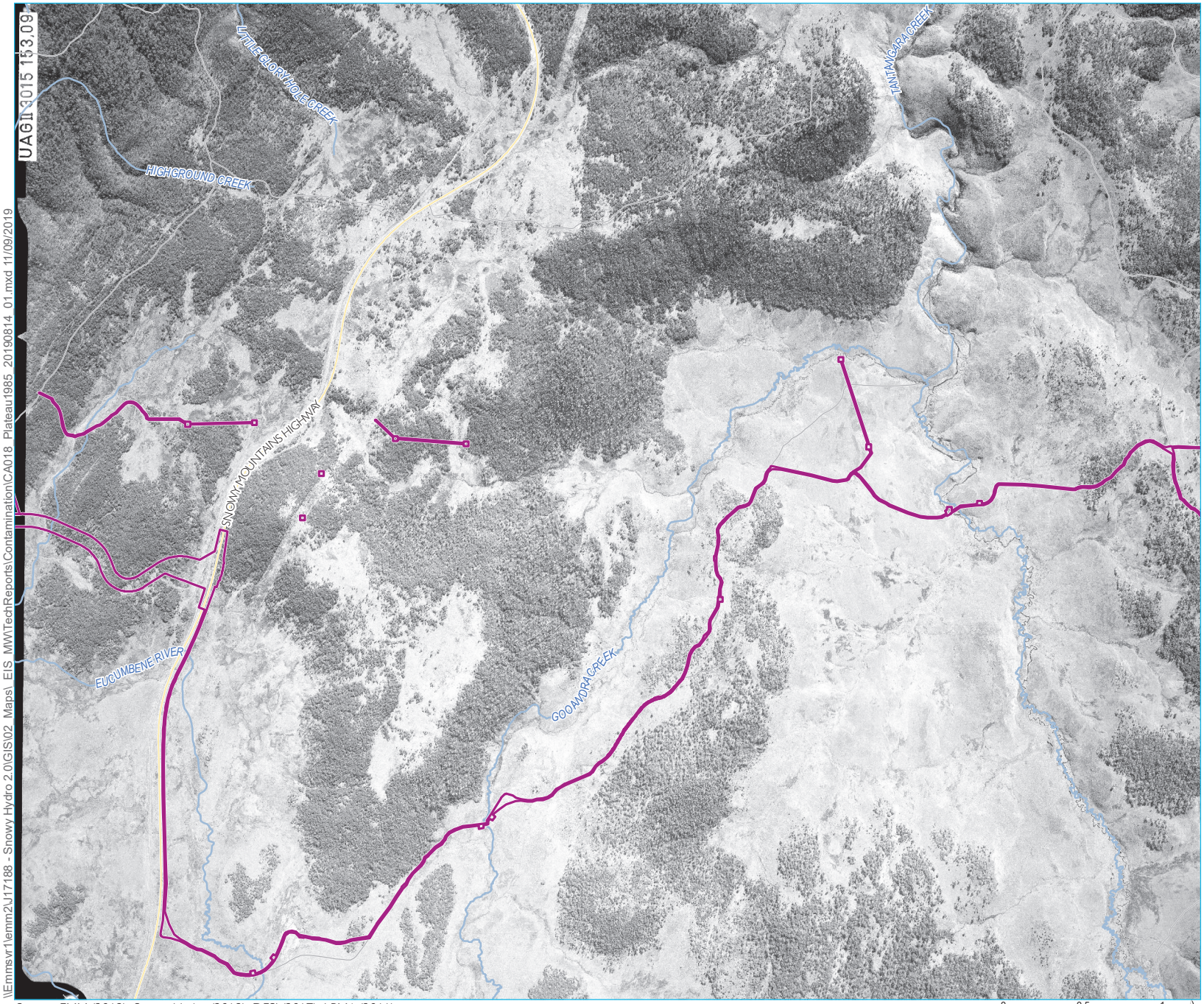
N

Plateau, 1976

Snowy 2.0
Contamination Assessment
Main Works
Figure B.9

snowy 2.0

EMM creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\Emmsvr1\emm2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA018 Plateau1985 20190814 01.mxd 11/09/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

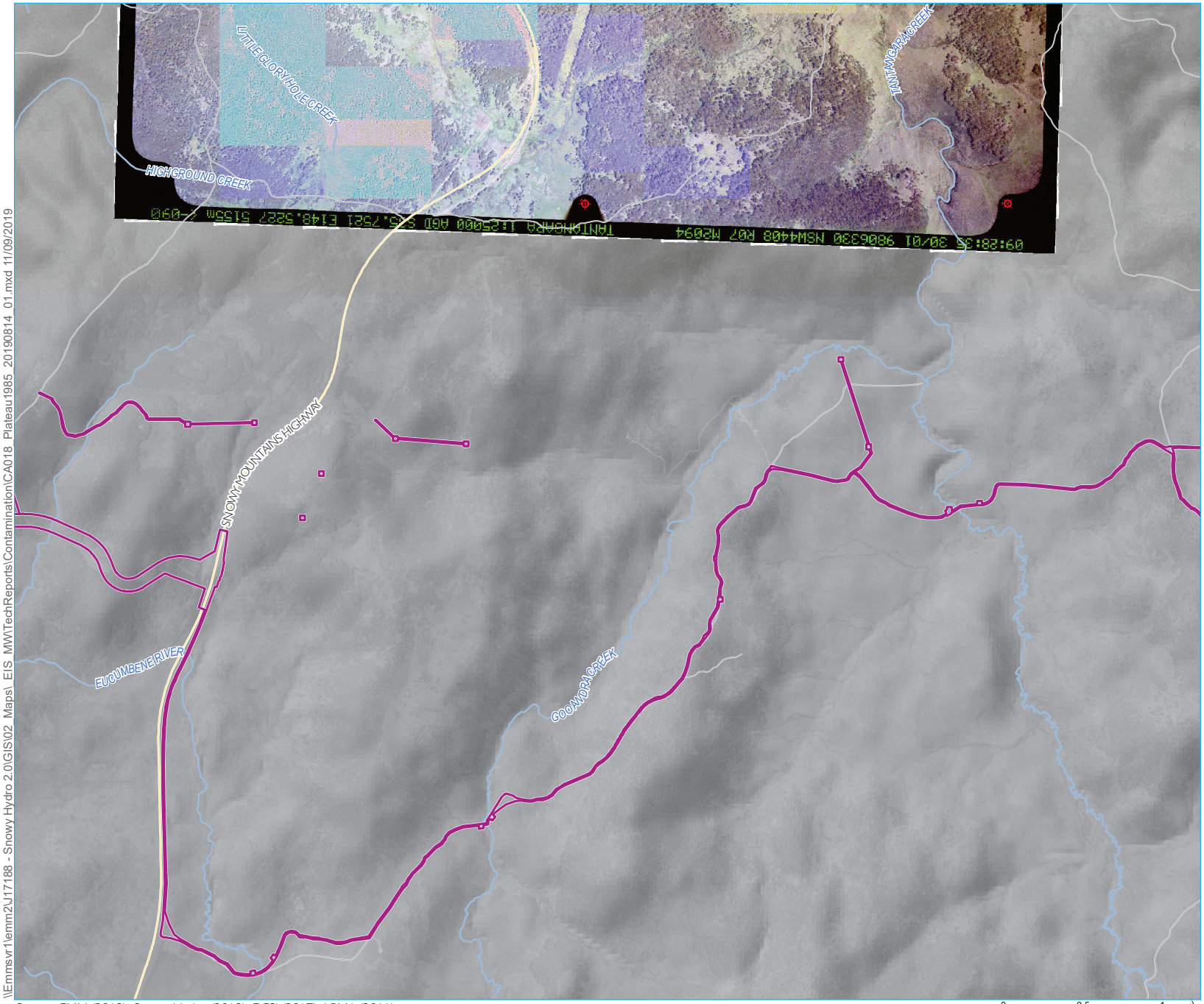
N

Plateau, 1985

Snowy 2.0
Contamination Assessment
Main Works
Figure B.10

snowy 2.0

EMM creating opportunities



KEY

Disturbance boundary

Existing environment

Main road

Local road

Watercourse

Plateau, 1998

Snowy 2.0
Contamination Assessment
Main Works
Figure B.11

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

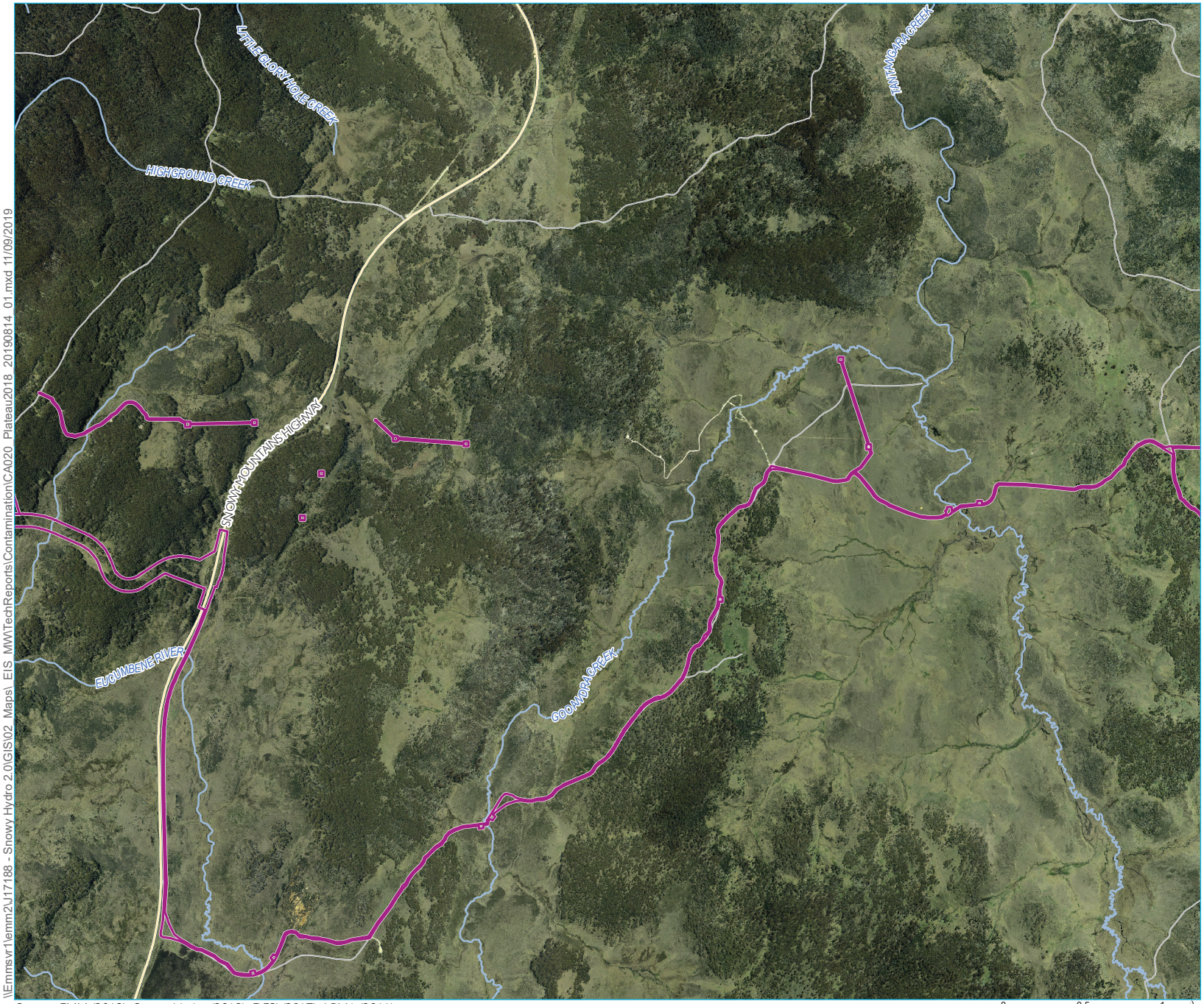
GDA 1994 MGA Zone 55

N

snowy 2.0

EMM creating opportunities

\\Emmsvr1\emm2\U17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\TechReports\Contamination\CA018_Plateau1985_20190814_01.mxd 11/09/2019



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

Plateau, 2018

Snowy 2.0
Contamination Assessment
Main Works
Figure B.12

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

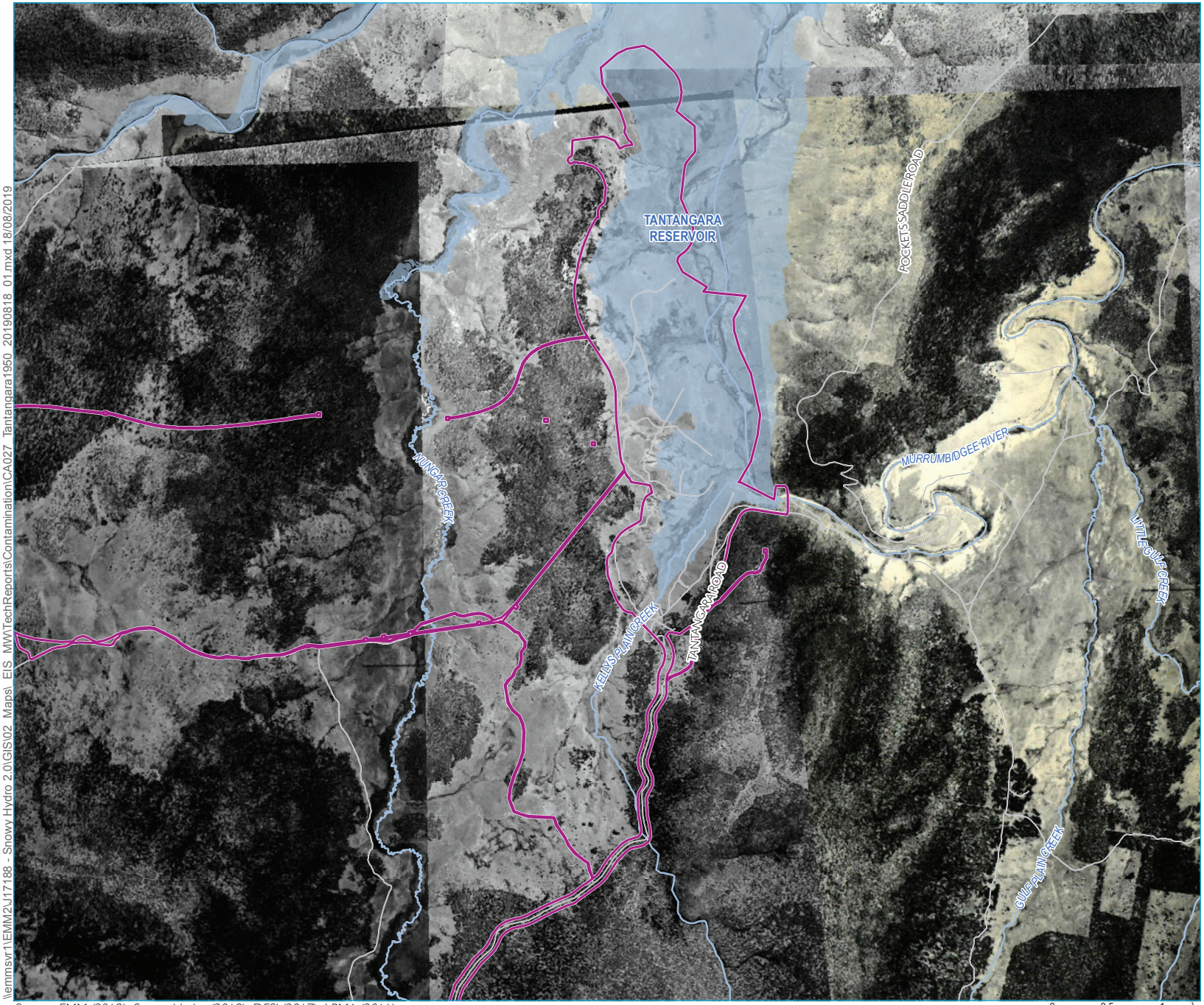
GDA 1994 MGA Zone 55

N

snowy 2.0

EMM creating opportunities

\\Emmsvr1\emm2\U17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA020 Plateau2018 20190814 01.mxd 11/09/2019



KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA027 Tantangara1950 20190818 01.mxd 18/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

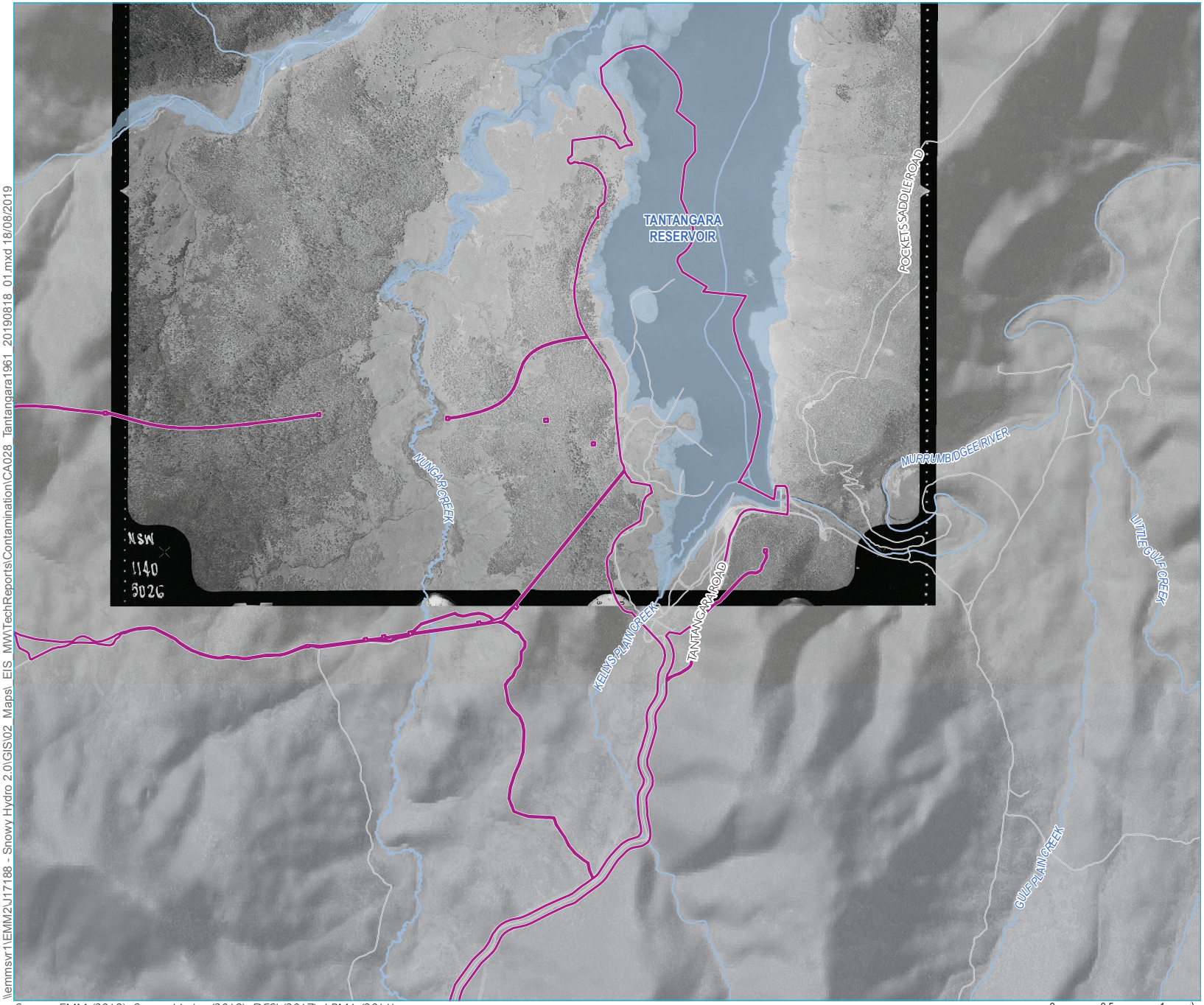
N

Tantangara, 1950s

Snowy 2.0
Contamination Assessment
Main Works
Figure B.13

snowy 2.0

EMM
creating opportunities



\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MWTechReports\Contamination\CA028_Tantangara1961_20190818_01.mxd 18/08/2019

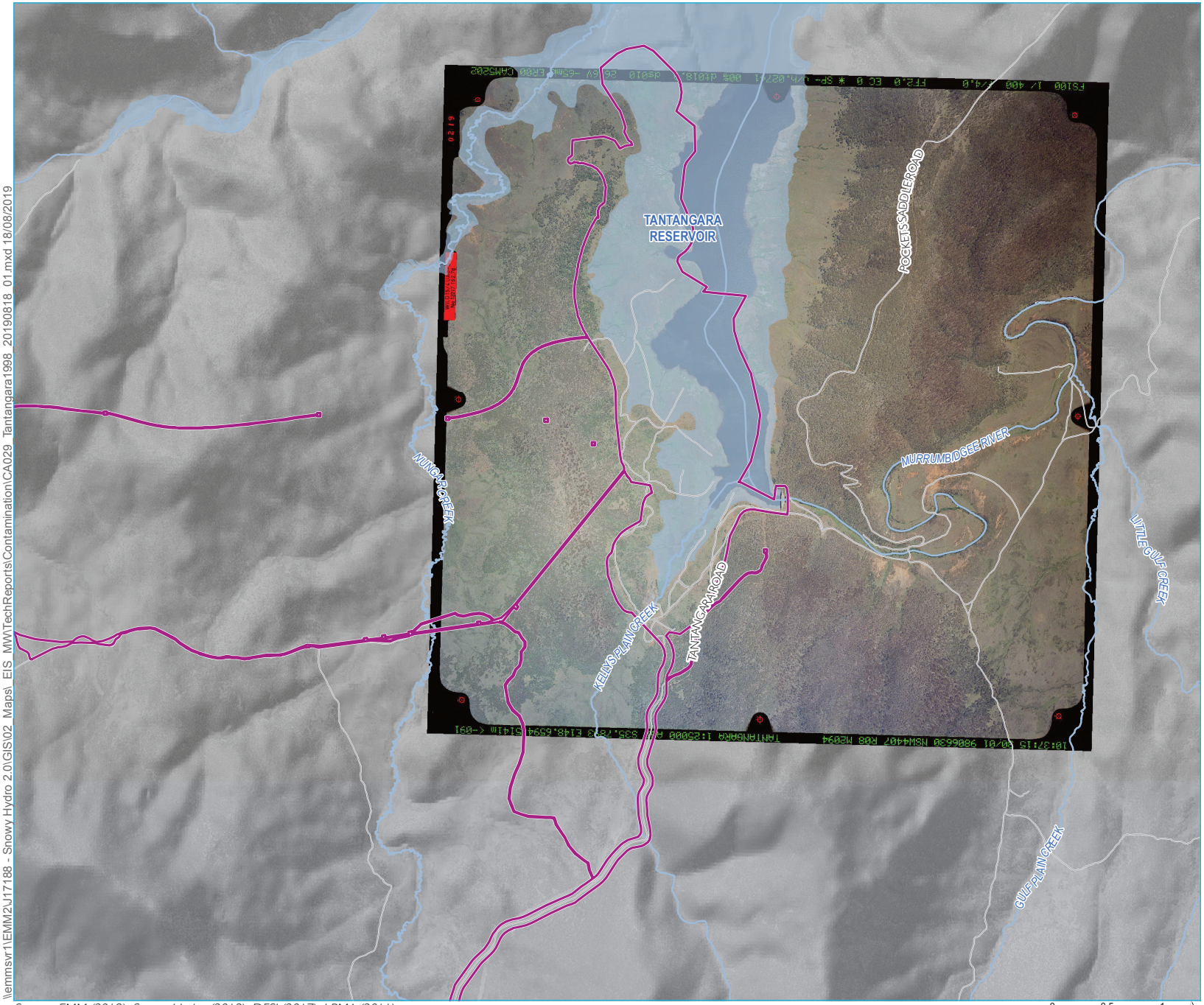
Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

Tantangara, 1961

Snowy 2.0
Contamination Assessment
Main Works
Figure B.14

snowy 2.0

EMM
creating opportunities



KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

Tantangara, 1998

Snowy 2.0
Contamination Assessment
Main Works
Figure B.15

0 0.5 1 km

GDA 1994 MGA Zone 55

N

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

\\emmsvr1\EMM2\U17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MWTechReports\Contamination\CA029_Tantangara1998_20190818_01.mxd 18/08/2019

snowy 2.0

EMM creating opportunities

KEY

- Disturbance boundary

Existing environment

- Local road
- Watercourse
- Waterbody

Tantangara, 2018

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

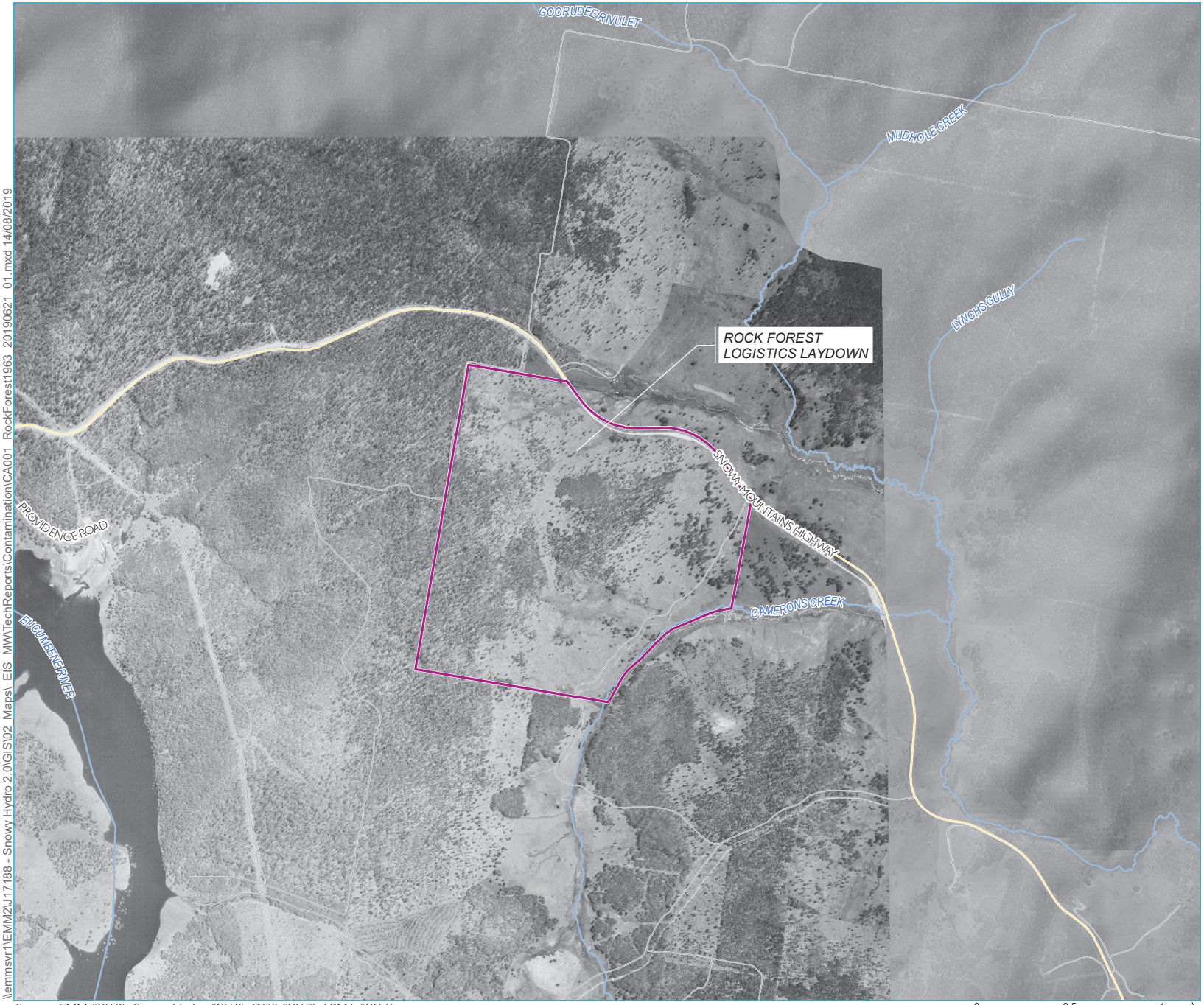
N

Snowy 2.0
Contamination Assessment
Main Works
Figure B.16

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA030 Tantangara2018 20190818 01.mxd 18/08/2019



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

Rock Forest, 1963

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

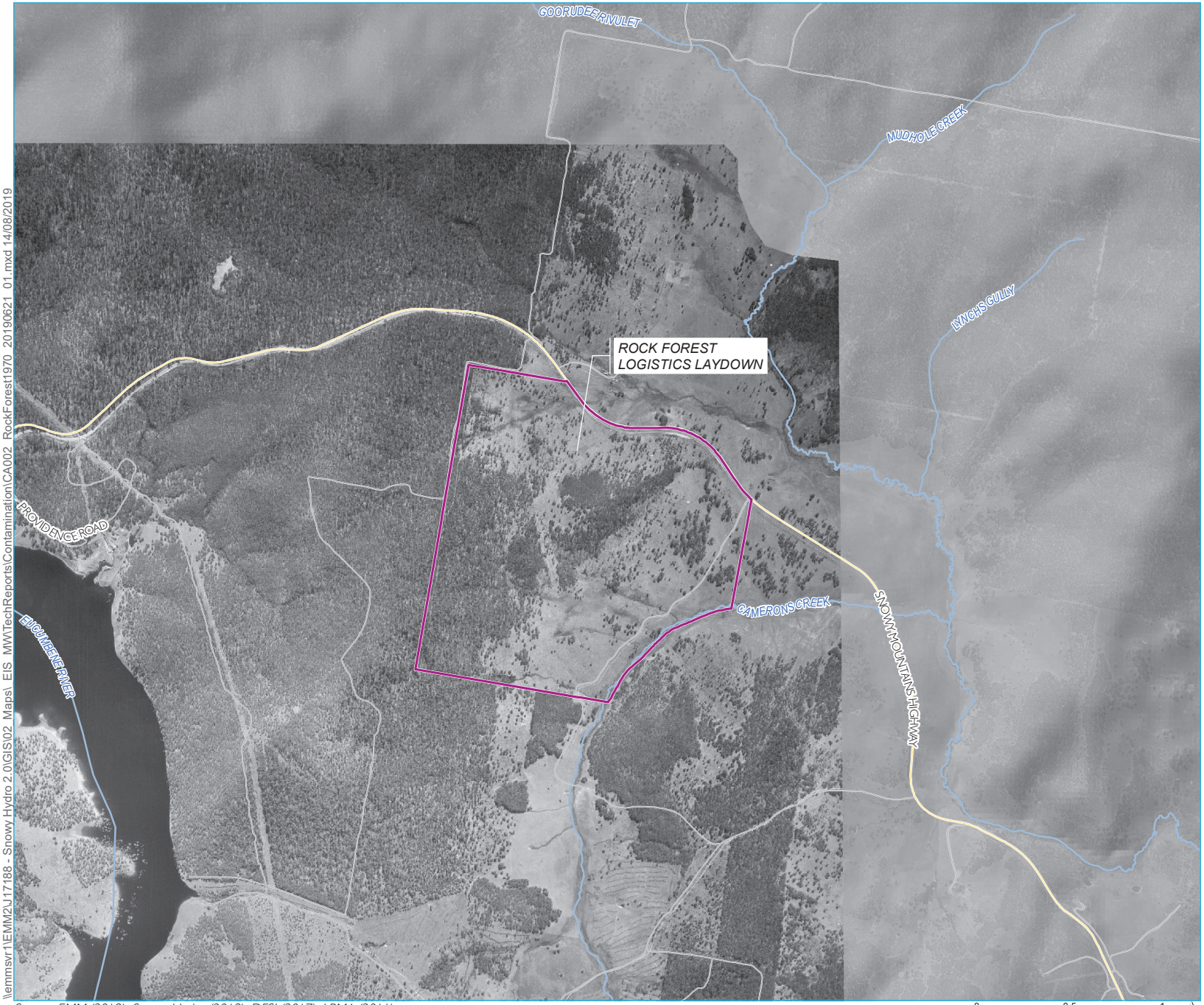
N

Snowy 2.0
Contamination Assessment
Main Works
Figure B.17

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA001 RockForest1963 20190621 01.mxd 14/08/2019



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

Rock Forest, 1970

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

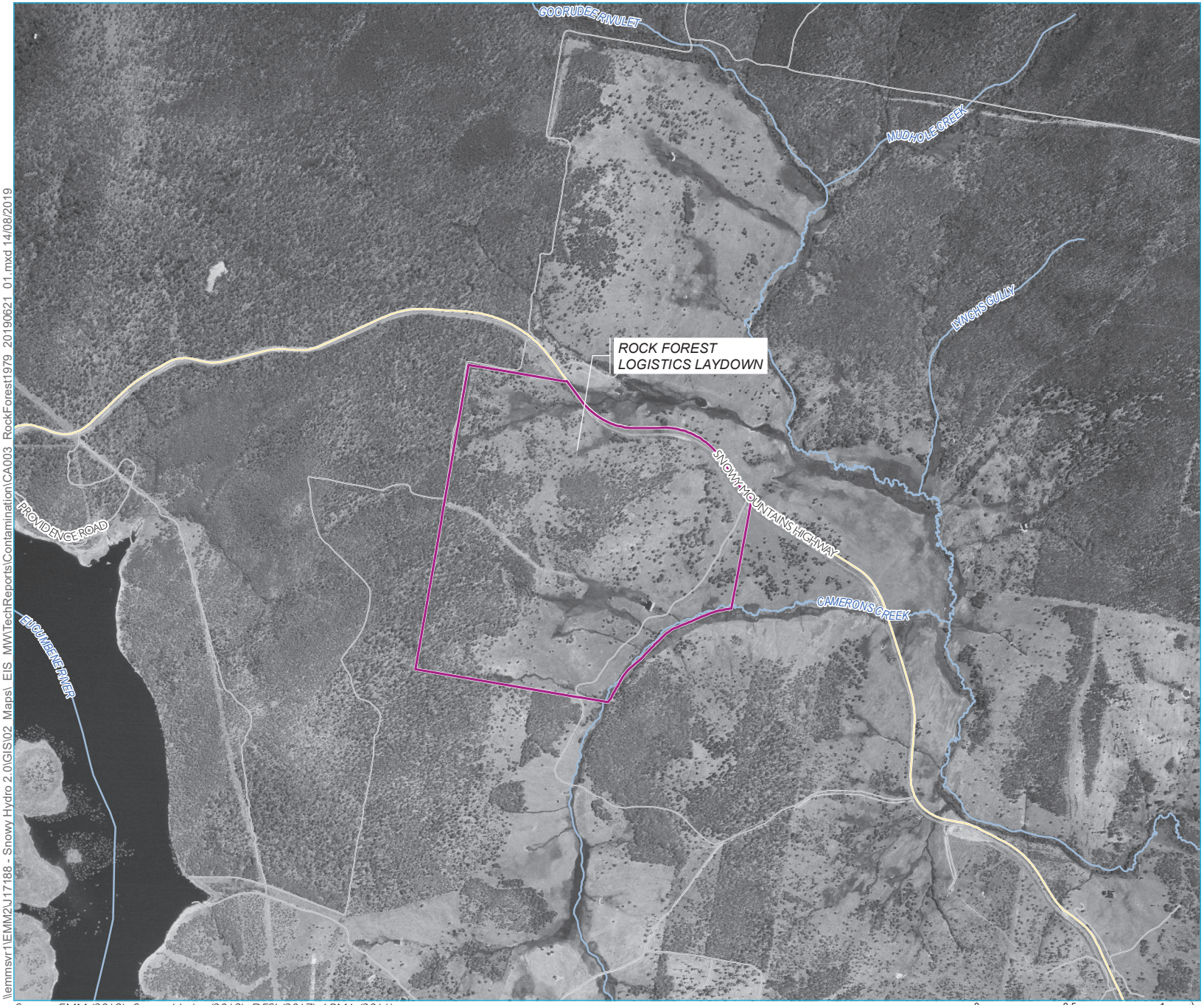
N

Snowy 2.0
Contamination Assessment
Main Works
Figure B.18

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA002 RockForest1970 20190621 01.mxd 14/08/2019



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA003 RockForest1979 20190621 01.mxd 14/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

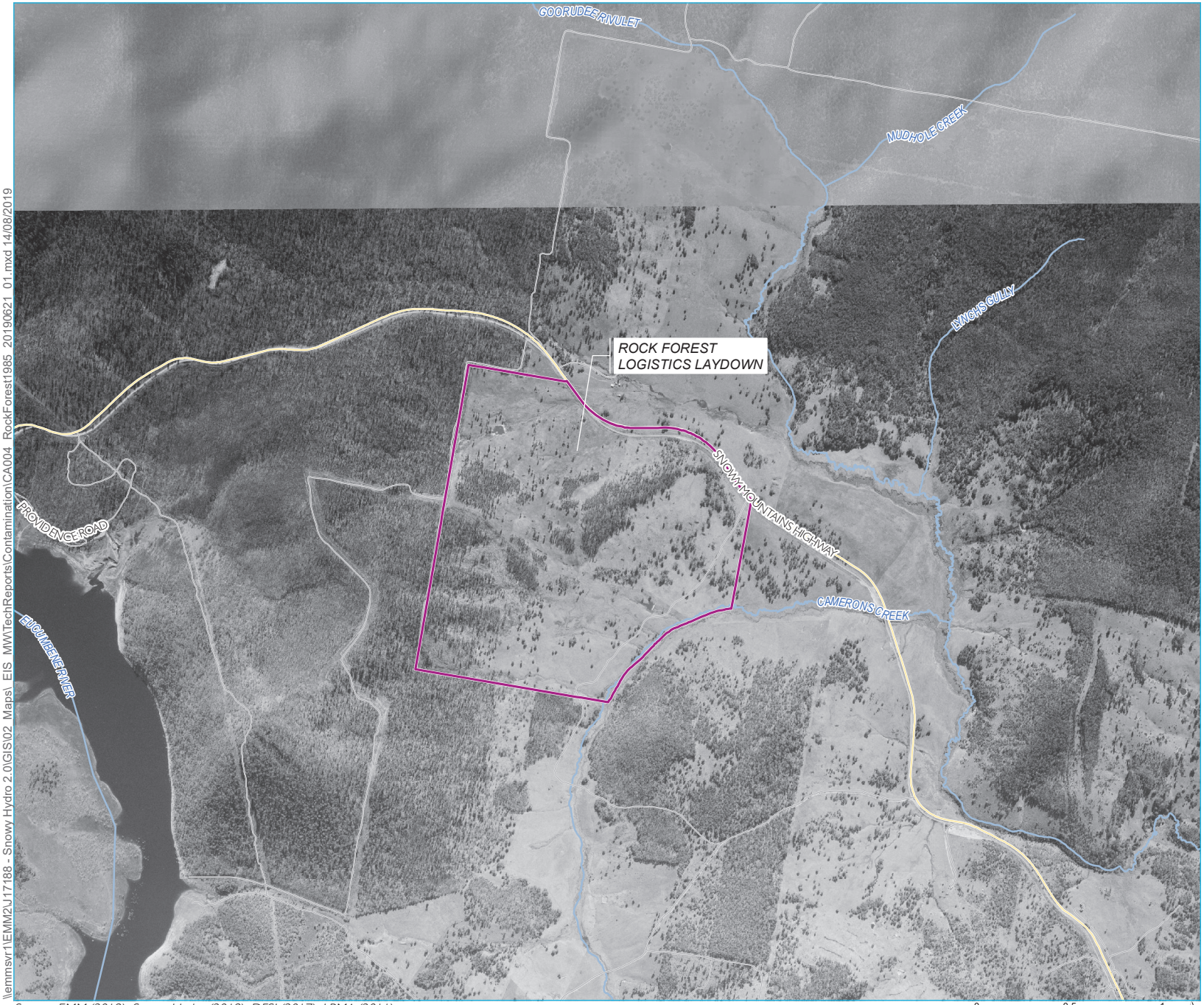
N

Rock Forest, 1979

Snowy 2.0
Contamination Assessment
Main Works
Figure B.19

snowy 2.0

EMM creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA004 RockForest1985 20190621 01.mxd 14/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

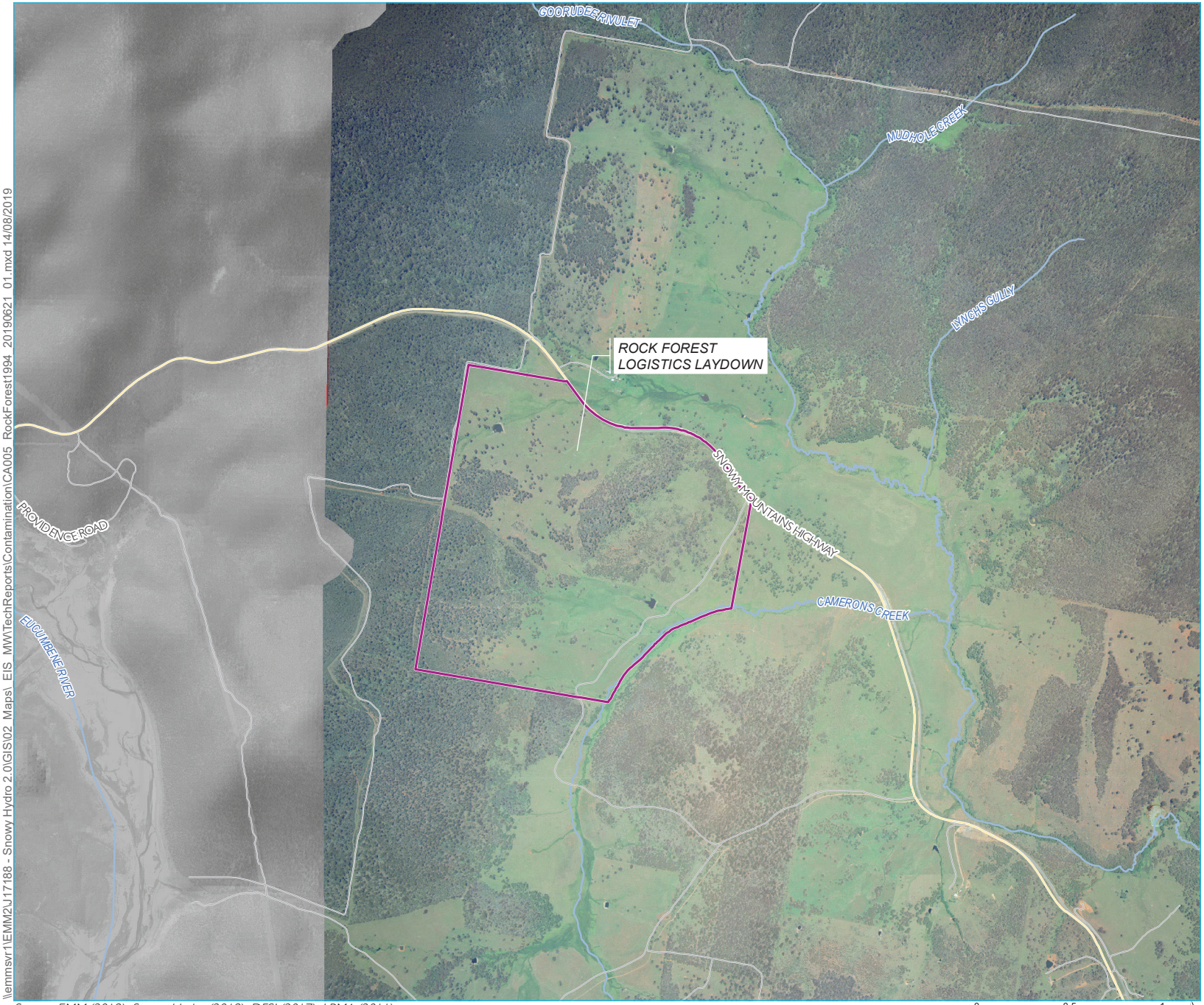
N

Rock Forest, 1985

Snowy 2.0
Contamination Assessment
Main Works
Figure B.20

snowy 2.0

EMM creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MWTechReports\Contamination\CA005 RockForest1994 20190621 01.mxd 14/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

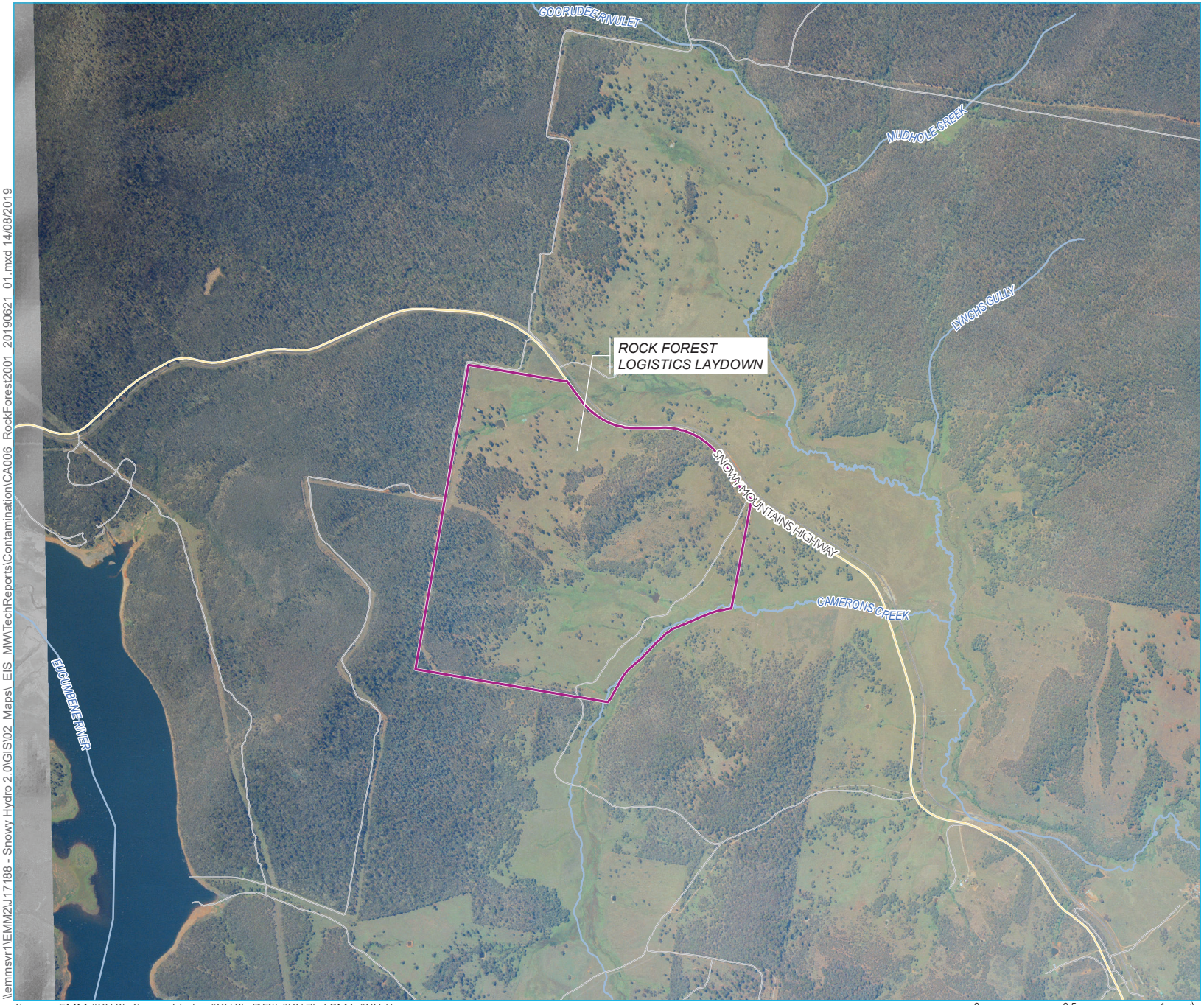
N

Rock Forest, 1994

Snowy 2.0
Contamination Assessment
Main Works
Figure B.21

snowy 2.0

EMM
creating opportunities



KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA006 RockForest2001 20190621 01.mxd 14/08/2019

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

Rock Forest, 2001

Snowy 2.0
Contamination Assessment
Main Works
Figure B.22

snowy 2.0

EMM creating opportunities

KEY

- Disturbance boundary

Existing environment

- Main road
- Local road
- Watercourse

Source: EMM (2019); Snowy Hydro (2019); DFSI (2017); LPMA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\Contamination\CA014 RockForest2018 20190814 01.mxd 14/08/2019

Rock Forest, 2018

Snowy 2.0
Contamination Assessment
Main Works
Figure B.23

snowy 2.0

EMM creating opportunities

Annexure C

Rock Forest historical land ownership

C.1 Historical land ownership at Rock Forest site

Table C.1 Historical land ownership – Rock Forest

Year	Owner
Lot 13, DP 756720	
1996 – to date	Timothy Gregory Russell
1989 – 1985	Gregory Russell, grazier
Prior – 1985	Crown Land
(1977 – 1985)	Conditional Purchase 1977-27 Cooma to Commercial Banking Co. of Sydney Ltd.
(1903 – 1977)	Crown Lease 1903/36 Cooma to George Brown
(1866 – 1903)	Within Kiandra Gold Field Proclaimed vide Government Gazette 6 July 1866
Lot 2 & 11, DP 756720	
1996 – to date	Timothy Gregory Russell
1964 – 1996	Gregory Russell, grazier
1962 – 1964	Delia Jane Russell, widow & Gregory Russell, grazier
Portion 11	
1938 – 1947	The Bank of New South Wales
Prior – 1938	Crown Land
(1903 – 1938)	Crown Purchase 1903/35 Cooma to George Brown
Portion 2	
1911 – 1911	George Brown, grazier
1911 – 1911	The Commercial Banking Company of Sydney Limited
Prior – 1911	Crown Land
Lot 110, DP 756728	
1996 – to date	Timothy Gregory Russell
1989 – 1985	Gregory Russell, grazier
Prior – 1985	Crown Land
(1977 – 1985)	Conditional Purchase 1977-24 Cooma to Gregory Russell
(1890 – 1977)	Crown Lease 1890/307 Cooma to W.J.J. Kearns
(1866 – 1890)	Within Kiandra Gold Field Proclaimed vide Government Gazette 6 July 1866

Annexure D

Site photos

Table D.1 Site photos of potential contamination sources

Description	Photo
Talbingo Reservoir	
Recreation area at Talbingo Spillway (facing north), showing small fire pit	
Lobs Hole	
Adit south, Lobs Hole, facing north-west	

Table D.1 Site photos of potential contamination sources

Description	Photo
Historical mining located in the vicinity of the former processing area adjacent to Yarrangobilly River	
Historical mined waste at Lobs Hole	
Historical shaft and processing area (facing east) at Lobs Hole	

Table D.1 Site photos of potential contamination sources

Description	Photo
Historical shaft and processing area at Lobs Hole	
Rock emplacement at Lobs Hole	

Rock Forest

A single empty drum. No evidence of contamination to the underlying or surrounding ground surface was noted.

Abandoned ute.

Used tyre storage area. Note covered fertiliser phosphate stockpile.

Dead cow

Rock Forest stockyard.

Annexure E

Tim Russell interview

E.1 Interview with Tim Russell

Table E.1 Interview questions – Tim Russell 8 July 2019

Question	Answer (include location where possible)
Ownership	
1.1 How long have you owned the property?	Since the 1940s, spanning three generations
1.2 Do you know the previous owners / what they used the land for?	Crown lands
1.3 What is the purpose or current activities on the neighbouring properties? Now and historically?	Farming – sheep mainly, cattle recently
Land use	
2.1 What do you currently use the property for?	Farming
2.2 Do you know what the land was historically used for?	Sheep and cattle grazing or bushland
2.3 Does the site flood, water storage, boggy?	No
Potentially contaminating activities	
3.1 Do you know of any of the following potentially contaminating activities on site, including:	
• Underground storage tanks or above ground fuel storages?	No, everything (fuels, chemicals) are stored offsite at a different property
• Chemical storages / sheds (housing pesticides, fertilisers, agricultural chemicals)?	Phosphate fertiliser stockpiled every two or three years
• Tips / rubbish collections, including in dams or infilled pits?	Used tyres are used to hold down a tarpaulin to cover stockpiled fertiliser
• Cattle / sheep dips at the stockyard?	No
• When was the stockyard built?	Late 1980's – these are the main stockyards
• Septic tanks?	No
• Properties (standing or demolished) build prior to the 1980's that may contain asbestos?	No
• Application of fertilisers / pesticides?	Every 2 or 3 years phosphate
• Fuel spills or leaks from machinery?	No
• Cattle / sheep graveyards?	No
• Burning of waste materials?	Occasionally timber
• Wash down areas?	No
• Areas of fill (source?)	No