49 Brittany Drive

Oxenford

4210

29th July 2020

For the attention:
**Hoagy Moscrop-Allison**
Senior Planner – Major Assessment
City Development Branch
Council of City of Gold Coast

Dear **Hoagy Moscrop-Allison,**

Objection submission COM/2019/81 - Groundwater impact

Please find below further information that I think should be considered re this development Application and its Environmental Submission re the effect on the groundwater and the Coomera River

I have serious concerns as to the effect on the surrounding environment of quarrying 95 metres below the Coomera River Level.

I do not believe the submitted documents, as part of the Groundwater Impact assessments clarify the situation appropriately and hence does not show the full impact this development could have on the surrounding area.

How close is the quarry pit to the Coomera River and how will it affect the Groundwater

Figure 6.1 from the Groundwater Impact Assessment document shows where the cross sections are taken from (Reproduced in Attachment A1). The Conceptual Cross section B-B Is reproduced in Attachment A2. This clearly shows how the existing groundwater that currently flows into the Coomera River will be reversed and the Groundwater will instead be leaching into the quarry pit.

Unfortunately the effect on the water table is not shown in this pictorial. However, it can safely be assumed it would have a major effect.

Conceptual Cross Section B-B (Attachment A3) does not, I believe show appropriately how close the proposed quarry pit will be to the Coomera River. As such I have endeavoured to produce an accurate cross section at the intersection of the John Muntz Bridge (Attachment A4). The cross-section position is shown on Attachment A5.

The scale of the proposed excavation, compared to the size of the Coomera River can be clearly seen from Attachment A4. It can clearly and worryingly be seen how the existing groundwater that flows towards the Coomera River will be reversed and will leach water from this freshwater source of the Coomera River (pre weir). The existing water table is going to be severely effected as it is very close to the surface and is currently above the Coomera River.

I suggest that the effective lowering of the Water table could have a disastrous effect on the surrounding water table.

Neranleigh-Fernvale Beds is it an aquifer?

Section 6.1.2, of the Groundwater assessment (Reproduced in Attachment B2) discusses whether the Neranleigh-Fernvale Beds is an aquifer or a 'water-bearing unit'. It incorrectly, in my opinion, choses to treat the area as a 'water-bearing unit' as it claims: "there are very few bores completed in the Nerang-Fernvale Beds that provide useable volumes of water that meet either the fresh water or drinking water guidelines".

However, a cursory glance at the "DNRME GWDB bore locations map (Submitted as Figure 5.1, and reproduced as attachment C3) shows there are 18 bores just within 1.4km radius of the Nucrush quarry (Yellow outline). The Neranleigh-Fernvale Beds is a large expansive area stretching from Brisbane down beyond the NSW border. Therefore, I believe to dismiss this as an aquifer is incorrect.

Also, the definition of an aquifer is: "A body of permeable rock which can contain or transmit groundwater" or "An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials. Groundwater can be extracted using a water well". Clearly to dismiss the Neranleigh-Fernvale Beds as a 'water-bearing unit' is a severe injustice.

This is further emphasised by the 'Bore Report' for Bore RN124033, approximately 1.1km from the quarry, identified geographically in (Attachment C3). The Bore Report (Attachment C4) clearly identifies three aquifers at this location at 15m at 20m and at 21m.

**Therefore, the Neranleigh-Fernvale Beds (identified in Attachment B3) is clearly an 'aquifer', however impact assessment considers it, incorrectly, as a 'water-bearing unit' for its impact assessment. It is abundantly clear the Neranleigh-Fernvale Beds are far more than that.**

What effect will the excavation of the quarry have on the water table in the area?

The Radius of Influence submission (Section 7.4, reproduced in C1) demonstrates how the proposed excavations will have either a 700m (low permeability bedrock) or 1418m radius of influence (high permeability bedrock).

Firstly, with the test bores that have been carried out I would expect the quarry to be able to tell if the bedrock was low or high permeability? However, we must assume worst case.

The radius of influence will be an area of over 6km$^2$ around the quarry. Therefore, all of this area will see a drop in the water table. How will this affect the area?

The bore location map (Attachment C2) shows there are eighteen legal bores within this area. The artificial lowering of the water table could have severe effects on these bores.

**Bore RN124033**

For instance the perfectly legal Bore 'RN124033', approximately 1080 metre from the proposed quarry subterranean excavations (identified in Attachment C3).

It can be seen from the bore report that the bore traverses three aquifers at 15.85m, 19.80m and 21.35m (Bore Report, Attachment C4). This bore is 8m AHD. Therefore the aquifers are approximately between 8m and 13m below the Coomera River Level (0m AHD).

This is within the Radius of Influence as shown in Attachment C2.

It would seem the lowering of the water table in this area could well see this bore being adversely effected.

I have attempted to show the expected effects of lowering the water table, with respect to Bore RN124033 in Attachment C5. This clearly shows that the lowering of the water table within the 'Radius of Influence' would, I believe, catastrophically effect the lawful Bore RN124033.

This will also affect all Bores within the Radius of Influence (Attachment C2).

How much water would be leached into the quarry?

From the development application the total water inflow will be between 128.7 ML/yr (best case) and 431.6 ML/yr (Worst case) as reproduced in Attachment B1. This is equivalent to between 51 and 172 Olympic swimming pools of ground water, leached from the surrounding area into the quarry excavation.

This will lower the water table from currently just below the surface (as shown in Attachment A2) to the bottom of the quarry excavations (Attachment C5).

This will obviously affect all the bores within the radius of influence. But how will it affect the Coomera River approximately 80 metres of the subterranean excavation? Attachment A4 shows how the existing scenario allows ground water to flow into the Coomera River and thus showing the bottom of the water table to be 0m AHD in line with the Coomera River level. However, excavating below the Coomera River level will drastically change this current equilibrium and see the Coomera River instead leach into the quarry excavation pit (Attachment A4). There could well be serious problems in attempting to lower the water table so far below the Coomera River Level.

What will happen to the between 128.7 ML/yr (best case) and 431.6 ML/yr (Worst case) that is leached into the excavation pit?

Will all this additional water caused by artificially lowering the water table so drastically be merely pumped back into the Coomera River?

The only reference to this in the Groundwater Impact Assessment is Section 7.2, Conceptual model during and after extraction extract: "The Quarry will require dewatering to remain dry. Any water that flows to the quarry would be available for use on site and any excess likely discharged" (Attachment F1).

So, of the between 51 and 172 Olympic swimming pools worth of ground water, leached from the surrounding area into the quarry excavation, severely effecting the water table for the surrounding area, the only mention of disposing of this is: **"excess likely discharged"**. No details of this, no method for doing so, no assessment of the discharging of so much 'now contaminated' water.

This, I believe is a major omission. The effect of removing so much water from the surrounding area, artificially lowering the water table, the effect on the Coomera River, the effect on the riparian wetland and on the Gold Coast Wake Park and on the Aqua centre. And then seemingly dumping this water into the Coomera River will potentially have a massive effect. Has any analysis being performed as to the effect of adding a further 128.7 ML/yr (best case) and 431.6 ML/yr (Worst case) of water into the Coomera River annually? What controls will there be on water quality>

The contamination of the water will be a major factor e.g. One example is the disturbing of pyrite in the excavations will release toxic metals such as Arsenic (Attachment E1). This will contaminate the ground water leaching into the quarry pit. This could needlessly pollute the Coomera River.

Is the risk worth it?

It has already been proved the quarry product is not needed, having ample supplies from existing quarries in the Northern Darlington Hills (all quarrying above ground with vast supplies without having to go subterranean). Is it really worth risking the ground water effects of lowering the water table so drastically, in a suburban environment, then pumping this maybe contaminated water into the Coomera River?

I would consider the risks to be too great and for no benefit for the Gold Coast.

However, it is abundantly clear to see that: **"excess likely discharged"** is not a right and proper analysis of the effect this subterranean quarrying will have on the surrounding environment.

## Conclusion

With so many quarries in the North Darlington range that are in rural (not urban) locations and are not subterranean (e.g. Cedar Creek currently at 170m AHD, Luscombe 142m AHD, Ormeau and Yatala 60m AHD and Kingsholme 60m AHD) it would seem ridiculous to risk unknown consequences of altering the water table in a residential area and so close to the Coomera River whilst there are clear viable and more cost effective alternatives without the risks associated with a subterranean venture such as this that is fully enclosed within an urban environment and may well have a disastrous effect on the water table in the area.

The potential contamination of the Coomera River by "discharging" large amounts of excess water, that has been artificially leached from the surrounding area, and will have been contaminated by quarrying activity, that has artificially dropping the water table to 95 metres below the current natural water table level, into the Coomera River could have a disastrous effect on our local ecosystem.

The lawful bores within the radius of effect will likely run dry. Is this fair?

I believe, the risks of subterranean quarrying in this location are potentially devastating for our fragile ecosystem, they are also unnecessary and of no actual benefit to the Gold Coast.

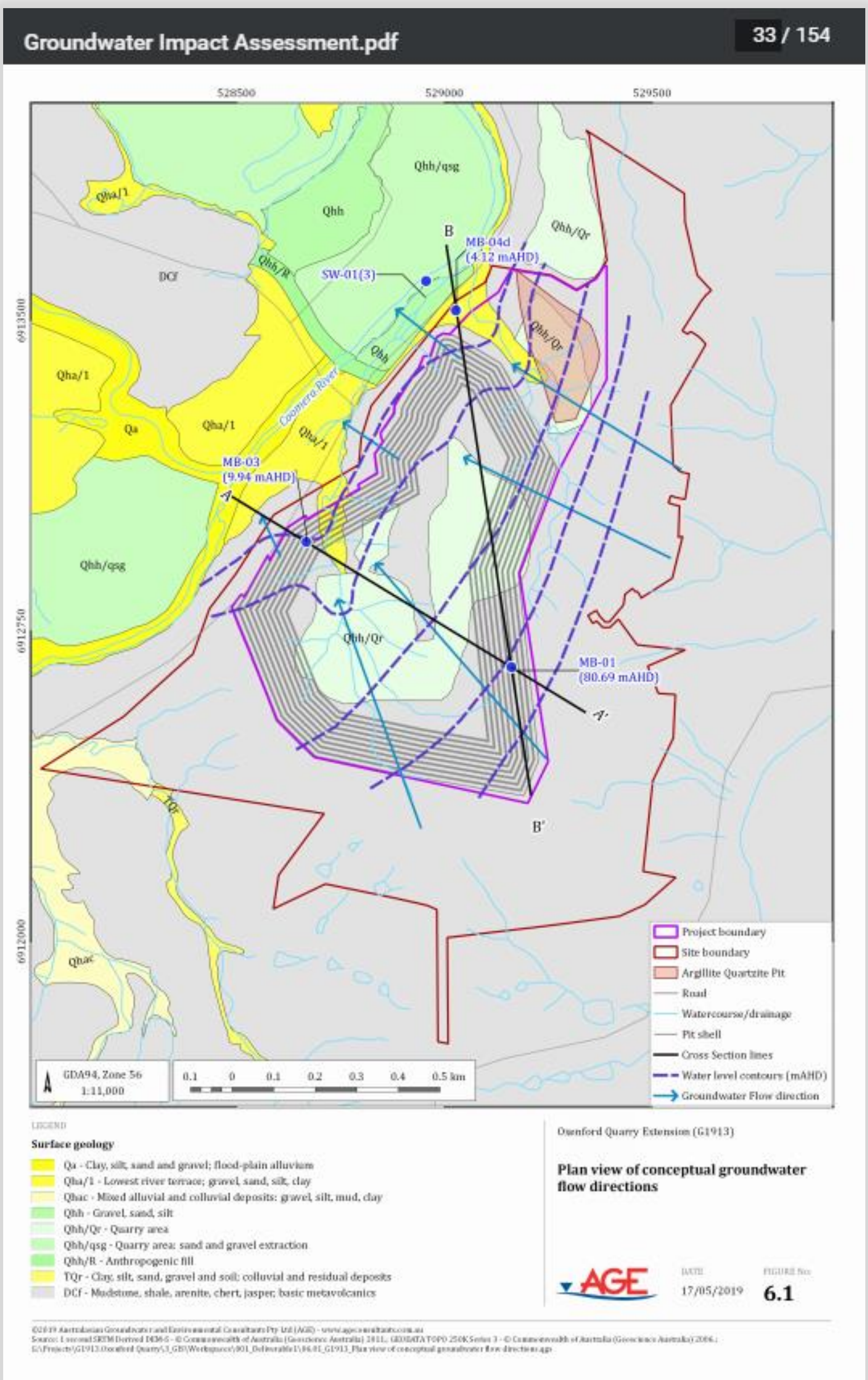
Thank you for considering my objection,

Kind regards

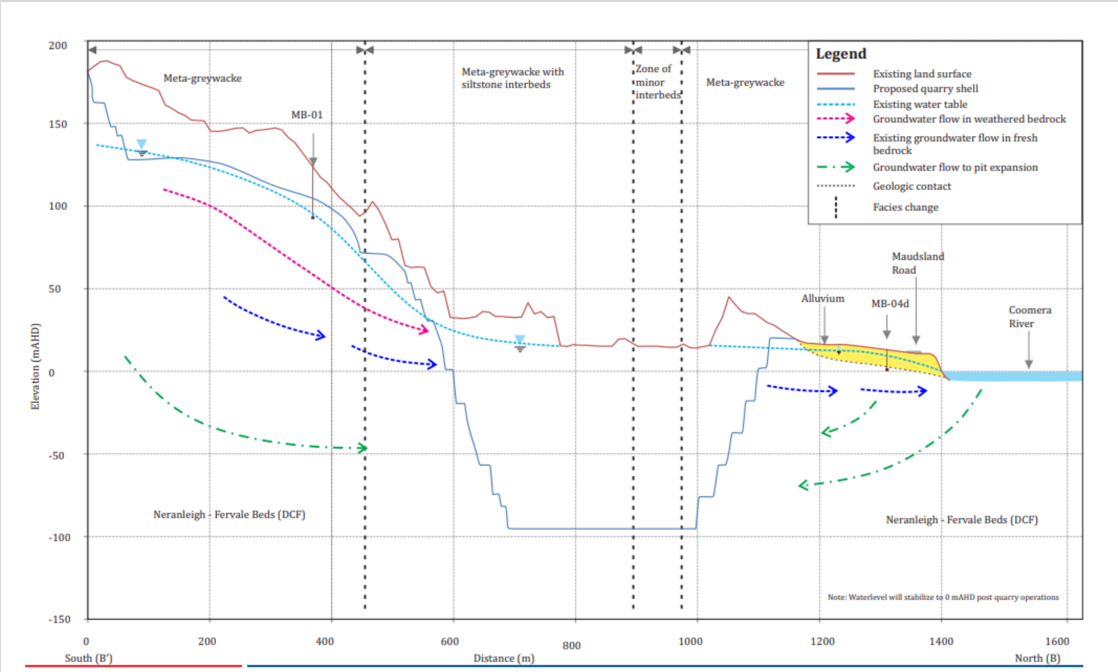
Tony Potter

* Disclaimer. Please note my findings are believed correct and are to the best of my ability. However, there may be errors and assumptions I have made that are incorrect. I do not believe this to be the case, but, realise with the vast amounted of submitted data from the applicant, errors and assumptions on my part may occur. Hopefully this is not the case, but please accept my apologises if this is so. Thank you.

Attachment A1 - Cross section identifier

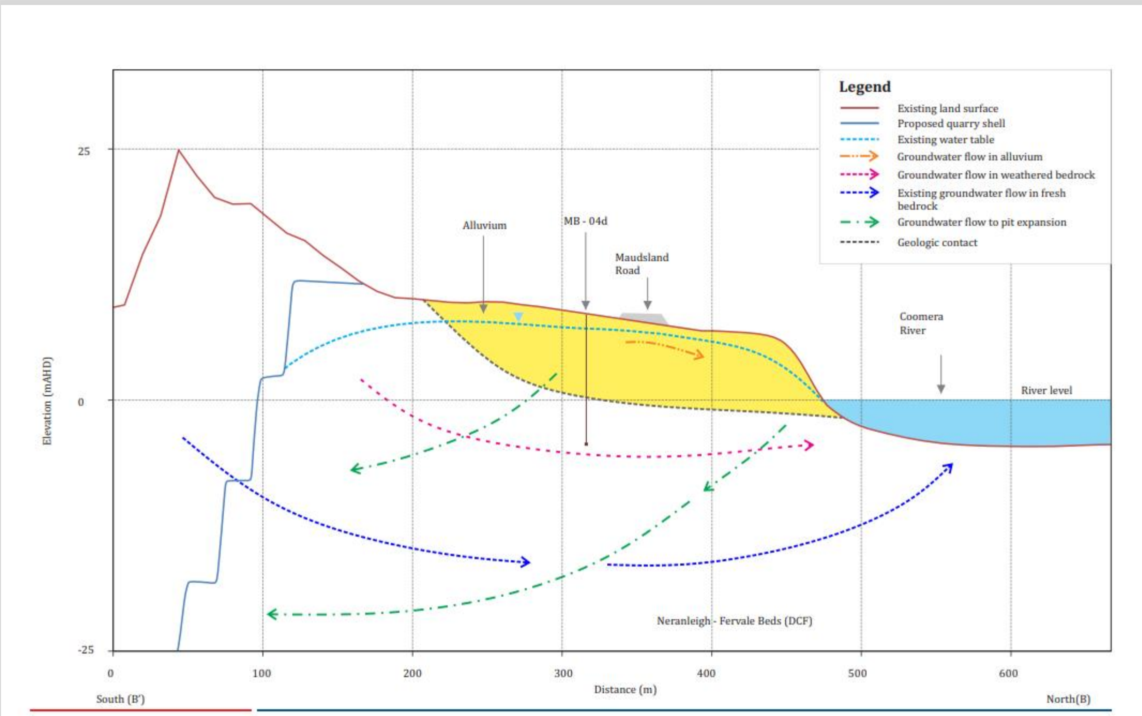


## Attachment A2 - Cross section at B-B



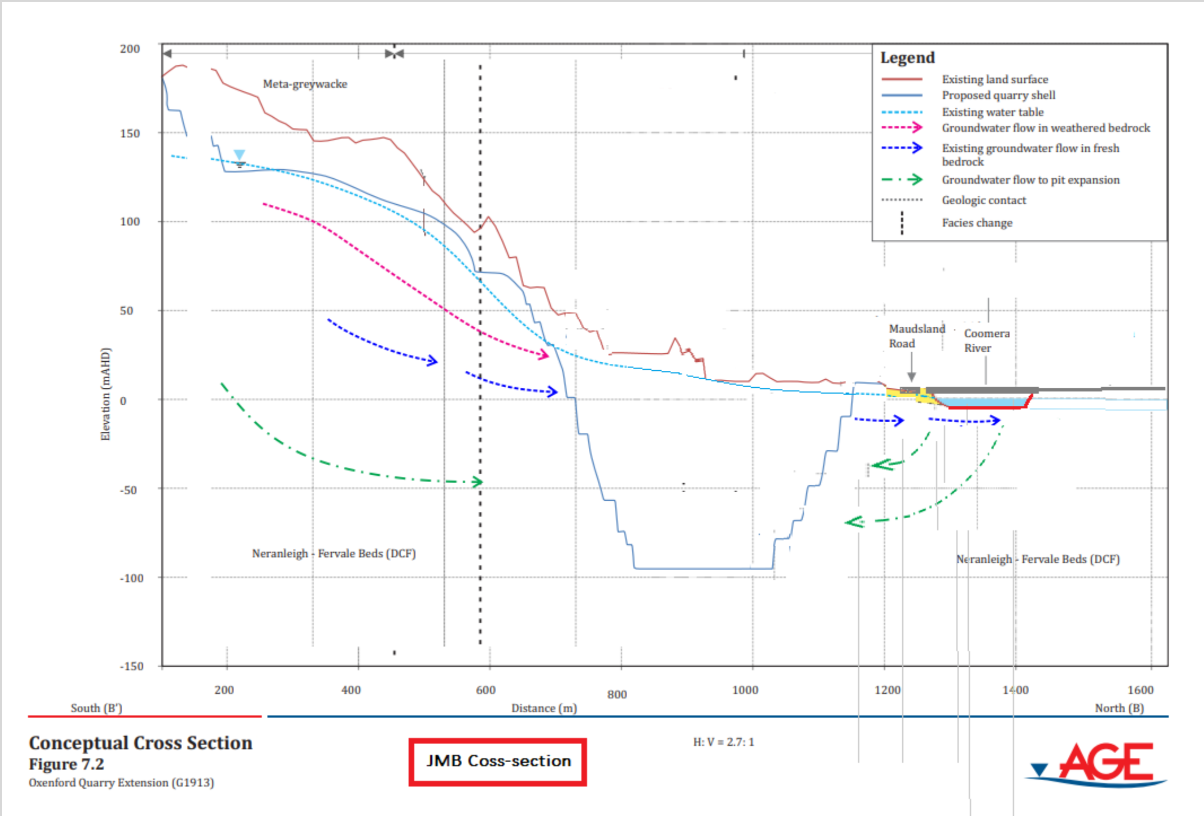

**Conceptual Cross Section B' - B, MB-04 to MB-01**
**Figure 7.2**
Oxenford Quarry Extension (G1913)
H: V = 2.7: 1
AGE

## Attachment A3 - Cross section at B-B

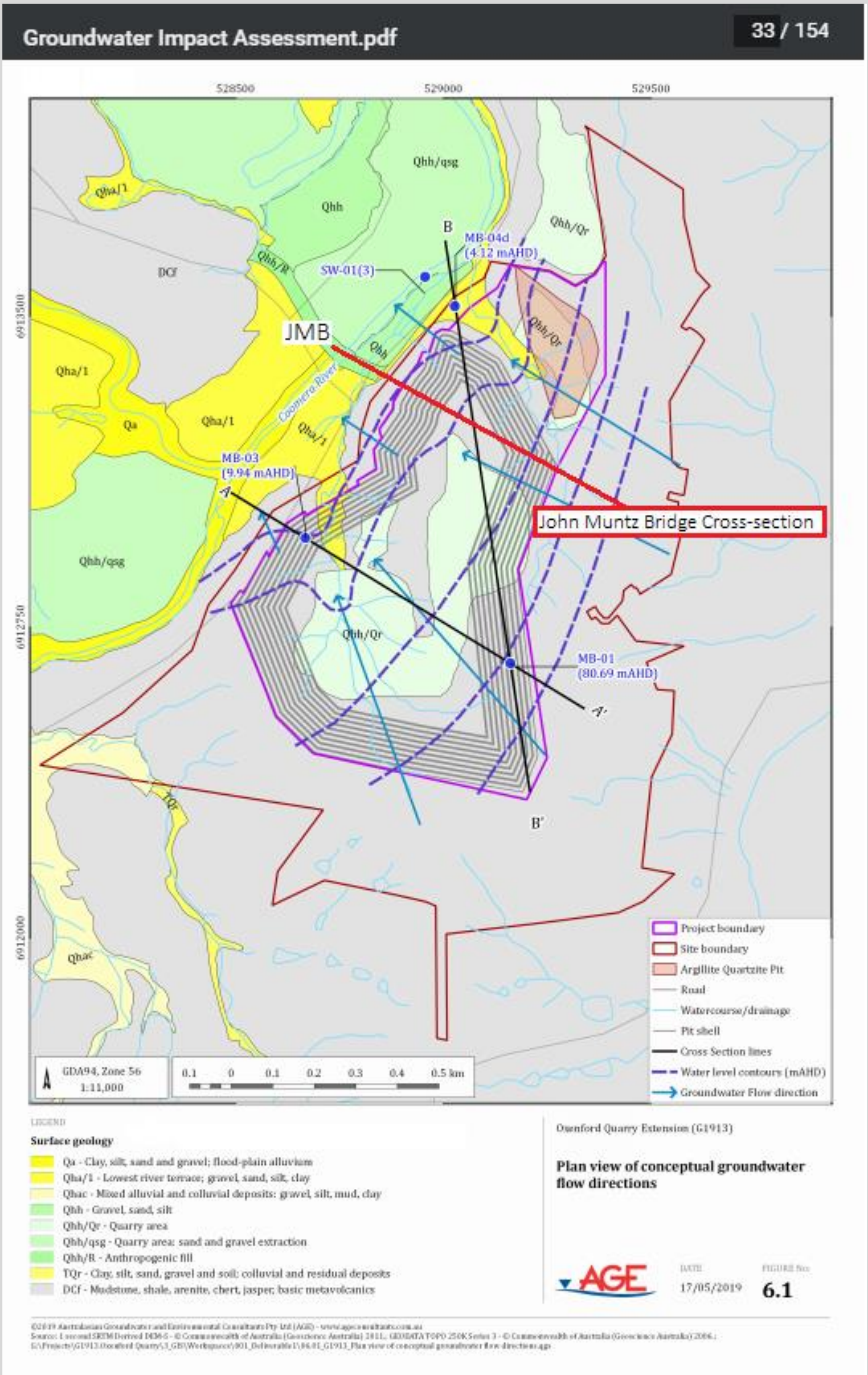



**Conceptual Cross Section B' - B, during operations**
**Figure 7.3**
Oxenford Quarry Extension (G1913)
H: V = 6.7:1
AGE

# Attachment A4 - Cross section at John Muntz Bridge



Attachment A5 - Cross section position identification at John Muntz Bridge



Attachment B1 - Groundwater Inflows

**Groundwater Impact Assessment.pdf**

## 7.3 Groundwater inflows

Groundwater inflow to the quarry was calculated using analytical equations developed by Marinelli and Niccoli (2000). The analytical method requires a simplification of the hydrogeological environment and is used to provide a 'broad' range of potential drawdowns and inflows. The Marinelli and Niccoli (2000) approach considers not only inflows to the quarry walls but includes inflow from the quarry floor (Figure 7.6). The equations separately calculate groundwater inflow from the quarry walls (Zone 1) and from the base of the quarry (Zone 2), based on the conceptual model presented in Figure 7.6.

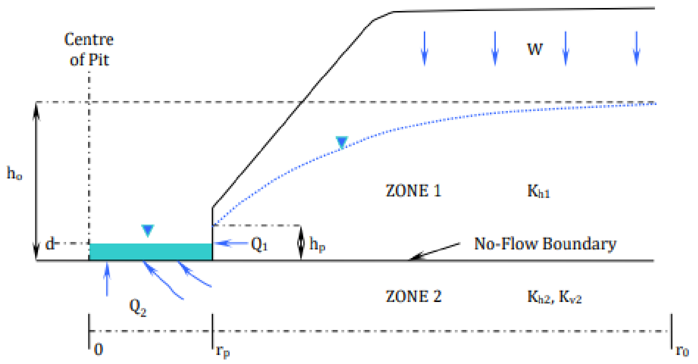



**Figure 7.6 Analytical model - inflow into quarry and drawdown (after Marinelli and Niccoli, 2000)**

The inflows from Zone 1, the pit walls, varies from 15.1 ML/yr to 72.4 ML/yr when the permeability of the bedrock is varied from 0.001 m/d to 0.01 m/d. The 0.001 m/d value represents the anticipated permeability of the rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.01 m/d value represents the permeability of the bedrock as measured in the monitoring bores completed for this project.

**Table 7.2 Analytical results**

| Scenario | Zone | $K_{h1}$ (m/day) / $K_{h2}$ (m/day) | Radius of influence (m) | Q (L/s) | Q (ML/yr) |
|---|---|---|---|---|---|
| Low bedrock conductivity | 1 | 0.001 | 700 | 0.5 | 15.1 |
| | 2 | 0.0001 | 700 | 3.6 | 113.6 |
| High bedrock conductivity | 1 | 0.01 | 1,418 | 2.3 | 72.4 |
| | 2 | 0.0001 | 1,418 | 3.6 | 113.6 |
| High bedrock wall and floor conductivity | 1 | 0.01 | 1,418 | 2.3 | 72.4 |
| | 2 | 0.001 | 1,418 | 11.4 | 359.2 |

The inflows from Zone 2, the pit floor, varies from 113.6 ML/yr to 359.2 ML/yr when the permeability of the bedrock is varied from 0.0001 m/d to 0.001 m/d. The 0.0001 m/d value represents low permeability rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.001 m/d value represents the highest probable floor permeability.

**Total water inflow between 128.7 ML/yr (best case) and 431.6 ML/yr (Worst case)**

**This is equivalent to between 51 and 172 Olympic swimming pools**

Attachment B2 - Neranleigh-Fernvale Beds is an aquifer

Groundwater Impact Assessment.pdf 31 / 154

### *6.1.2 Neranleigh-Fernvale Beds*

Groundwater in the Neranleigh-Fernvale Beds is typically limited to secondary porosity (i.e. fractures, joints or other structural voids). The hydraulic conductivity of the Neranleigh-Fernvale Beds is very low with hydraulic conductivities ranging from a low of $<10^{-9}$ m/s up to $10^{-6}$ m/s in areas of significant weathering or fracturing. Groundwater typically can be found at relatively shallow depths; however, the actual depth to groundwater in the Neranleigh-Fernvale Beds is highly variable and is strongly influenced by fracture location and density and by seasonal and longer-term variations in rainfall, (SKM, 2008). There are no long-term groundwater level hydrographs for bores completed in the Neranleigh-Fernvale Beds to assess the how rainfall influences water levels within the bedrock.

Groundwater recharge to the bedrock is likely to be influenced by the fractures with connectivity to the surface. Inter-fracture connectivity in general, would be assessed as slow and tortuous in most instances. Hydraulic testing in association with geotechnical investigations of the Neranleigh-Fernvale Beds indicate an approximate permeability range from negligible (i.e. $<10^{-9}$ m/s) to $1.15 \times 10^{-6}$ m/s with an average of $4.65 \times 10^{-7}$ m/s (AGE 2004, 2006).

The hydrogeology of the Neranleigh-Fernvale Beds always poses the question of whether this unit is an aquifer or a water-bearing unit. An aquifer is defined as being able to yield usable volumes of water to a bore. A water-bearing unit is defined as strata that contain "groundwater" but does not yield usable volumes. Strictly speaking, the Neranleigh-Fernvale Beds can locally meet the aquifer definition however, there are very few bores completed in the Neranleigh-Fernvale Beds that provide usable volumes of water that meet either the fresh water or drinking water guidelines. on this basis, the Neranleigh-Fernvale Beds are considered a water-bearing unit for purposes of this groundwater impact assessment

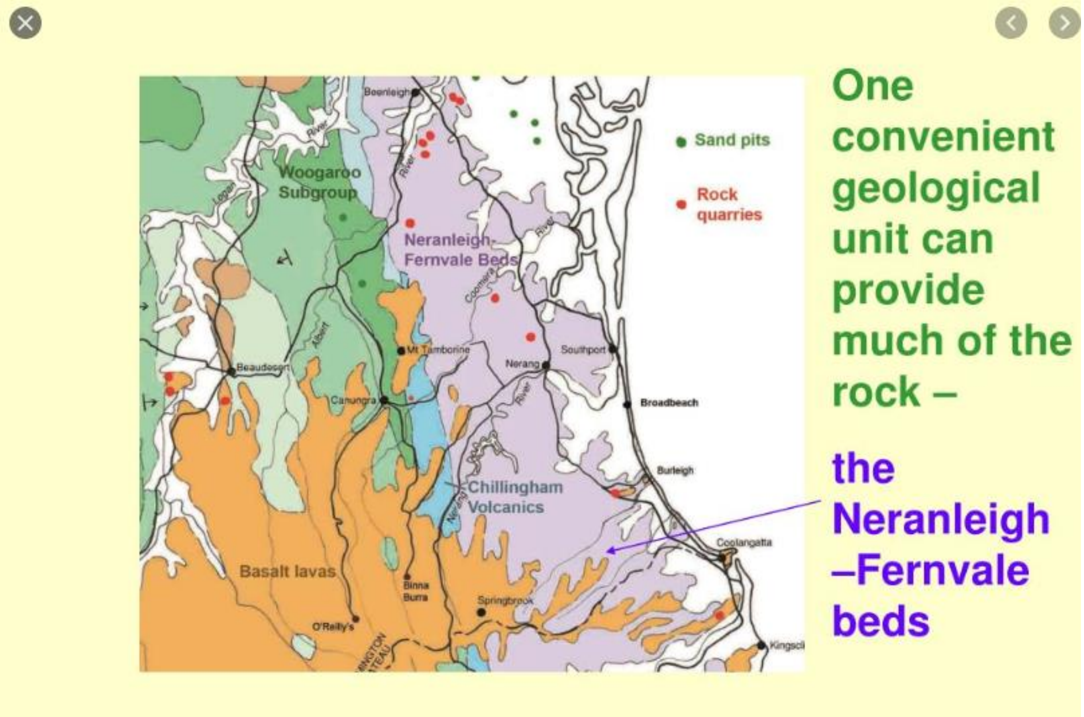
## Aquifer

*noun* a body of permeable rock which can contain or transmit groundwater.

An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials. Groundwater can be extracted using a water well.

**The Neranleigh-Fernvale Beds are clearly an 'aquifer', however impact assessment considers it, incorrectly, as a 'water-bearing unit' for its impact assessment**

Attachment B3 - The Neranleigh-Fernvale Beds




Attachment C1 - The Radius of Influence

Groundwater Impact Assessment.pdf

### 7.4 Radius of influence

The actual radius of influence of the pit will be dependent upon the hydraulic parameters of the groundwater system (hydraulic conductivity and storage parameters) of which only hydraulic conductivity is considered in this equation, as it is a steady-state approximation only. Furthermore, the Marinelli and Niccoli (2000) analysis does not include any no flow boundaries, such as catchment boundaries, rivers, or geological structures, which can limit the radius of influence. The greatest magnitude of drawdown will occur closest to the quarry and will diminish with distance from the quarry walls.

The radius of influence based on low permeability bedrock in the pit wall is estimated to be 700 m (Table 7.2). The Coomera River and the Water Polishing Pond off Oxenford-Tamborine Rd are both located within this radius of influence and may therefore provide a source of water for quarry inflows. If there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary that will limit the western extent of the radius of influence.

The radius of influence assuming high permeability bedrock and high permeability pit floor is estimated to be 1,418 m (Table 7.2). This scenario extends the radius of influence to include private water bore (RN 124033), a more extensive portion of the Coomera River and approximately 400 m of riparian wetland located upstream of the Gold Coast wave park. Providing there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary limiting the western extent of the radius of influence. The riparian wetland located upstream of the Gold Coast wave park is fed by surface water from the Coomera River originating upstream of the Oxenford Quarry. The low permeability scenario indicates quarrying operations will not impact surface water flow supplying these riparian wetlands, so they are highly unlikely to be impacted by the proposed development. Whilst groundwater level decline at the one private active water-supply bore (RN 124033) is located within the potential radius of influence, this is likely to be negligible.

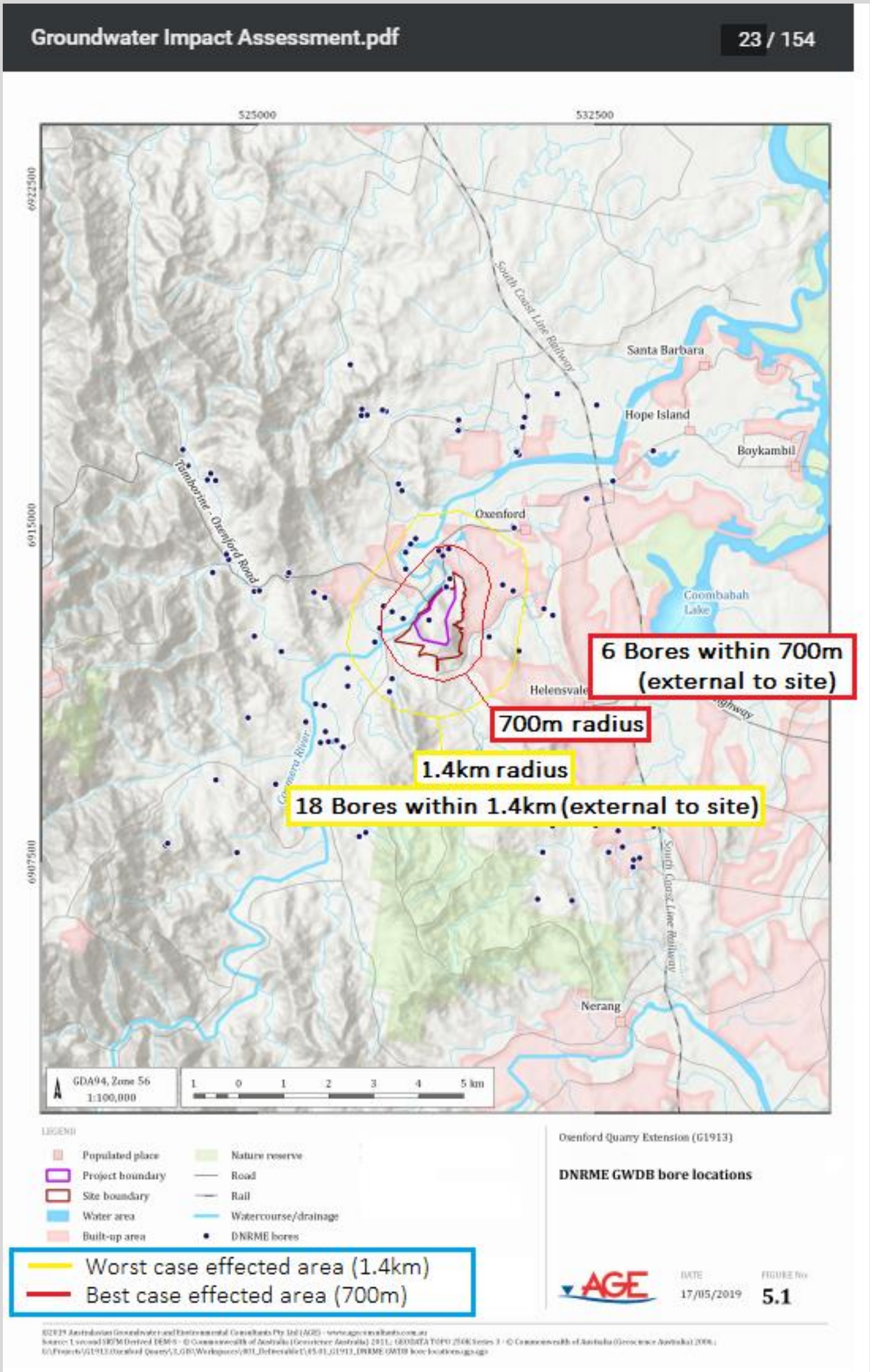
Regardless of the radius of influence and the inflows reporting to the quarry during operations, the groundwater levels in the vicinity of the quarry void are assessed to recover once quarry development ceases and the quarry void is allowed to fill. The elevation at which the quarry void water level stabilises will be governed by the surface water balance of the post-closure landscape and the elevation of a spill point within the final pit void.

Radius of influence is between 700m and 1418m

Groundwater affected

Translated as: "Whatever happens to the groundwater levels it will be ok in 100+ years"

<u>Attachment C2 - Bore Locations</u>



<u>Attachment C3 - Bore RN124033 Location</u>

<u>Attachment C4 - Bore RN124033 Statistics</u>

resources.information.qld.gov.au/groundwater/reports/borereport?gw_pub_borecard&p_rn=124033

**Report Date:** 19/07/2020 09:40

**Queensland Government**
**Groundwater Information**
**Bore Report**

**Page:** 1 **of** 5
**GWDB8250**

**From Year:**

| Registered Number | Facility Type | Facility Status | Drilled Date | Office | Shire |
|---|---|---|---|---|---|
| 124033 | Sub-Artesian Facility | Existing | 30/07/2004 | Brisbane | 3430 - GOLD COAST CITY |

**Details**

| | | | |
|---|---|---|---|
| **Description** | | | |
| **Parish** | 328 - BARROW | | |
| **Original Name** | | | |
| **Driller Name** | K.A.DIPPEL | | |
| **Drill Company** | KA & LC DIPPEL | | |
| **Const Method** | ROTARY AIR | | |
| **Bore Line** | | | |
| **D/O File No** | | **Polygon** | |
| **R/O File No** | | **Equipment** | |
| **H/O File No** | | **RN of Bore Replaced** | |
| **Log Received Date** | | **Data Owner** | |
| **Roles** | Water Supply | | |

**Location**

| | | | |
|---|---|---|---|
| **Latitude** | 27-54-43 | **Basin** | 1460 |
| **Longitude** | 153-18-23 | **Sub-area** | |
| **GIS Latitude** | -27.91198489 | **Lot** | 6 |
| **GIS Longitude** | 153.3062772 | **Plan** | SP118653 |
| **Easting** | 530149 | | |
| **Northing** | 6912514 | **Map Scale** | |
| **Zone** | 56 | **Map Series** | |
| **Accuracy** | GPS | **Map No** | |
| **GPS Accuracy** | 10 | **Map Name** | |
| **Checked** | Yes | **Prog Section** | |

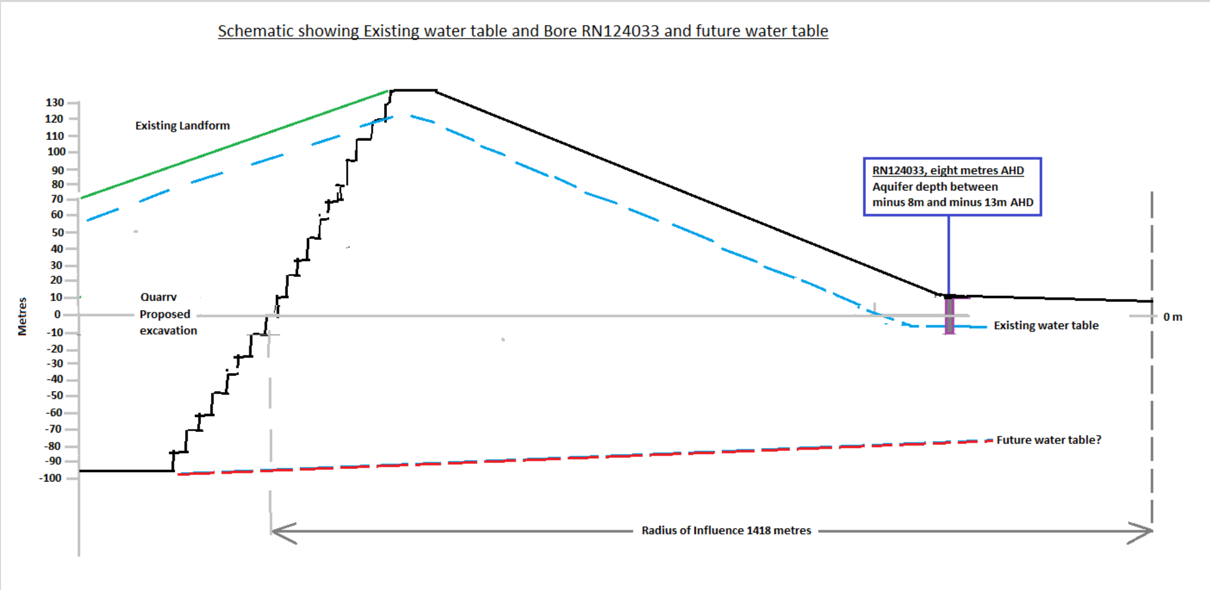
**Strata Logs** — **14** *records for RN* 124033

| Rec | Top (m) | Bottom (m) | Strata Description |
|---|---|---|---|
| 1 | 0.00 | 0.30 | YELLOW SUBSOIL |
| 2 | 0.30 | 0.60 | CLAY |
| 3 | 0.60 | 1.05 | ROCKS & SOME CLAY |
| 4 | 1.05 | 8.70 | SOLID GREYWACKE |
| 5 | 8.70 | 8.85 | GREYWACKE FRACTURED |
| 6 | 8.85 | 15.85 | GREYWACKE |
| 7 | 15.85 | 17.35 | SOFTER GREYWACKE * |
| 8 | 17.35 | 19.80 | GREYWACKE |
| 9 | 19.80 | 20.75 | GREYWACKE FRACTURED * |
| 10 | 20.75 | 21.35 | GREYWACKE |
| 11 | 21.35 | 25.90 | DARK GREY GREYWACKE * |
| 12 | 25.90 | 29.90 | LIGHT GREY GREYWACKE * |
| 13 | 29.90 | 32.00 | DARK GREY GREYWACKE |
| 14 | 32.00 | 33.05 | LIGHT GREY GREYWACKE |

**Aquifers** — **3** *records for RN* 124033

| Rec | Top (m) | Bottom (m) | Lithology | Date | SWL (m) | Flow | Quality | Yield (L/s) | Contr | Cond | Formation Name |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15.85 | | META - Metamorphics | | | N | BRACKISH | 0.30 | Y | FR | NERANLEIGH-FERNVALE BEDS |
| 2 | 19.80 | | META - Metamorphics | | | N | BRACKISH | 0.30 | Y | FR | NERANLEIGH-FERNVALE BEDS |
| 3 | 21.35 | | META - Metamorphics | | | N | BRACKISH | 1.30 | Y | FR | NERANLEIGH-FERNVALE BEDS |

## Attachment C5 - Bore RN124033 Cross-section diagram




## Attachment E1 - Pyrite

mining-technology.com/features/featurethe-11-most-dangerous-minerals-4256873/

# Pyrite

Pyrite, which is a sulphide mineral composed of iron and sulphur, is a major contaminator of ground water and streams due to acid mine drainage from sulphide mine tailings. Oxidation of pyrite releases toxic metals and metalloids such as Arsenic (As), which is poisonous for humans. Arsenic-containing pyrite in coals still poses a severe health problem for millions of people in the Guizhou province in China.

Sulphur and sulphuric acid used to be produced from Pyrite ore but are currently obtained as by-products of natural gas and crude oil processing leaving very limited economic value to Pyrite so the mineral is currently mined only for specimen purposes.

## Attachment F1 - Dewatering - excess likely discharged

### 7.2 Conceptual model during and after extraction

The quarry will require dewatering to remain dry. Any water that flows to the quarry would be available for use on site and any excess likely discharged. The conceptual flow diagrams depicted in Figure 7.3 and Figure 7.4 show that the pit will capture groundwater flow from the eastern and southern portion of the project site. The future excavation will capture groundwater all the way to the current divide running along the topographic high.