BarkerRyanStewart

PLANNING
PROJECT MANAGEMENT
ENGINEERING
CERTIFICATION


# Road Condition Assessment and Road Contributions Study

## 270 Grants Road, Somersby

June 2015
Our Ref: SY140135

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|---|---|
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SYDNEY
Suite 603, Level 6, 12 Century Circuit
Norwest Business Park NSW 2153
P (02) 9659 0005 F (02) 9659 0006
E sydney@barkerryanstewart.com.au

CENTRAL COAST
Suite F, 78 York Street
East Gosford NSW 2250
P (02) 4325 5255 F (02) 4322 0798
E coast@barkerryanstewart.com.au

HUNTER
Unit 1, 17 Babilla Close
Beresfield NSW 2322
P (02) 4966 8388 F (02) 4966 1399
E hunter@barkerryanstewart.com.au

barkerryanstewart.com.au

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Suite 603, Level 6, 12 Century Circuit
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P (02) 9659 0005 F (02) 9659 0006
E sydney@barkerryanstewart.com.au

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E hunter@barkerryanstewart.com.au

barkerryanstewart.com.au

# 1 Introduction

Barker Ryan Stewart have been engaged to prepare a road condition assessment and road maintenance contributions study for Grants Road, Somersby, on behalf of the Hanson Central Coast Sands Quarry and Grants Road Sand Quarry. This report shall document the existing condition of Grants Road and recommend a maintenance contribution rate per an annum for both the Hanson Central Coast Sands Quarry and Grants Road Sand Quarry in accordance with their Major Projects Approvals; (08_0173 for Hanson Central Coast Sands Quarry; and 08_0099 for Grants Road Sand Quarry).

The following points are to be addressed as part of this report in order to satisfy; Schedule 3 Condition 16 of the Grants Road Sand Quarry approval and Schedule 3 Condition 19 of the Hanson Central Coast Sands Quarry approval.

- *Be co-funded by the Hanson Central Coast Sands Quarry and the operator of the Grants Road Sand Quarry on a basis which is proportionate to the maximum number of tonnes of quarry product expected to be dispatched from each quarry over the life of their major project approvals, and the length of Grants Road affected by laden vehicles from each quarry.*
- *Assess current road condition of the length of Grants Road affected by laden vehicles from each quarry and future road maintenance requirements for this length of road over the life of the major project approvals for both quarries;*
- *Give consideration to the usage of Grants Road by laden vehicles from each quarry over the past five years and the predicted usage of Grants Road by each quarry over the life of their major project approval including any importation of Virgin Excavated Natural Material.*
- *Recommend per tonne/per kilometre road maintenance contributions for the project for the haulage of quarry products on Grants Road.*

The report has been prepared from notes and photographic evidence from visual inspections conducted on the 27th October 2014 and the 15th January 2015. It should be noted that the area was not surveyed as part of this investigation and the chainages provided in the report are indicative only.

# 2 Scope of Works

The purpose of this report is to note and record the current condition of the existing road, roadside drainage (i.e. table drains) and any other Gosford City Council assets that have effect on the amenity/use of Grants Road. This report will provide a basis for determining a maintenance contribution from Hanson Central Coast Sands Quarry and Grants Road Sand Quarry for the ongoing maintenance of Grants Road over the life of their major project approvals.

This report is based on a visual inspection and therefore does not take into consideration:

- Faults outside the road reserve for Grants Road, Somersby;
- Any testing;
- Current geotechnical or subsurface conditions or investigations;
- Faults not apparent on visual inspection;
- Faults apparent only in different environmental or weather conditions;
- Latent faults not apparent at the time of inspection.

# 3 Description of Road

Grants Road extends from the east at the intersection of Wisemans Ferry Road, and heads generally in a western/south-western alignment terminating at Lot 2 DP 358717. Grants Road is sealed from Wisemans Ferry Road to the entrance of the Grants Road Sand Quarry (approximately 2.6km), after this it continues as an unsealed track. Grants Road is a two (2) lane rural road functioning mostly as an access road for residential, agricultural and extractive industry uses; however it does have a lesser collector function, collecting traffic from Keighley Avenue and Viitasolo Road.

The carriageway way in the vicinity of Grants Road from Wisemans Ferry Road to the Grants Road Sand Quarry consists of a sealed carriageway with gravelled shoulders, and table drain for certain extents. The sealed carriageway is approximately 6 metres wide. The longitudinal grade of Grants Road can be described as undulating, generally consisting of small gradual hills/slopes between stretches of generally flat to slightly sloping land.

Other notes regarding Grants Road include;

- There is no formal footpath in the road reserve. The road reserve generally consists of grassed or gravelled shoulders and verges.
- There is a formal and informal table drain along the road edge for varying extents. Some of the table drain is insufficiently protected with visible evidence of scouring next to pavement seal.
- There are numerous pavement patches along Grants Road.
- There is seal edge fraying in areas up to the intersection of Reservoir Road.
- Trucks from the Hanson Central Coast Sands Quarry enter Grants Road at the intersection of Reservoir Road (approximate chainage CH 1,900m).
- Trucks from Grants Road Sand Quarry enter Grants Road at the end of the sealed section of Grants Road (approximate CH 2,600m).

The location of the subject site is shown in Figure 1.

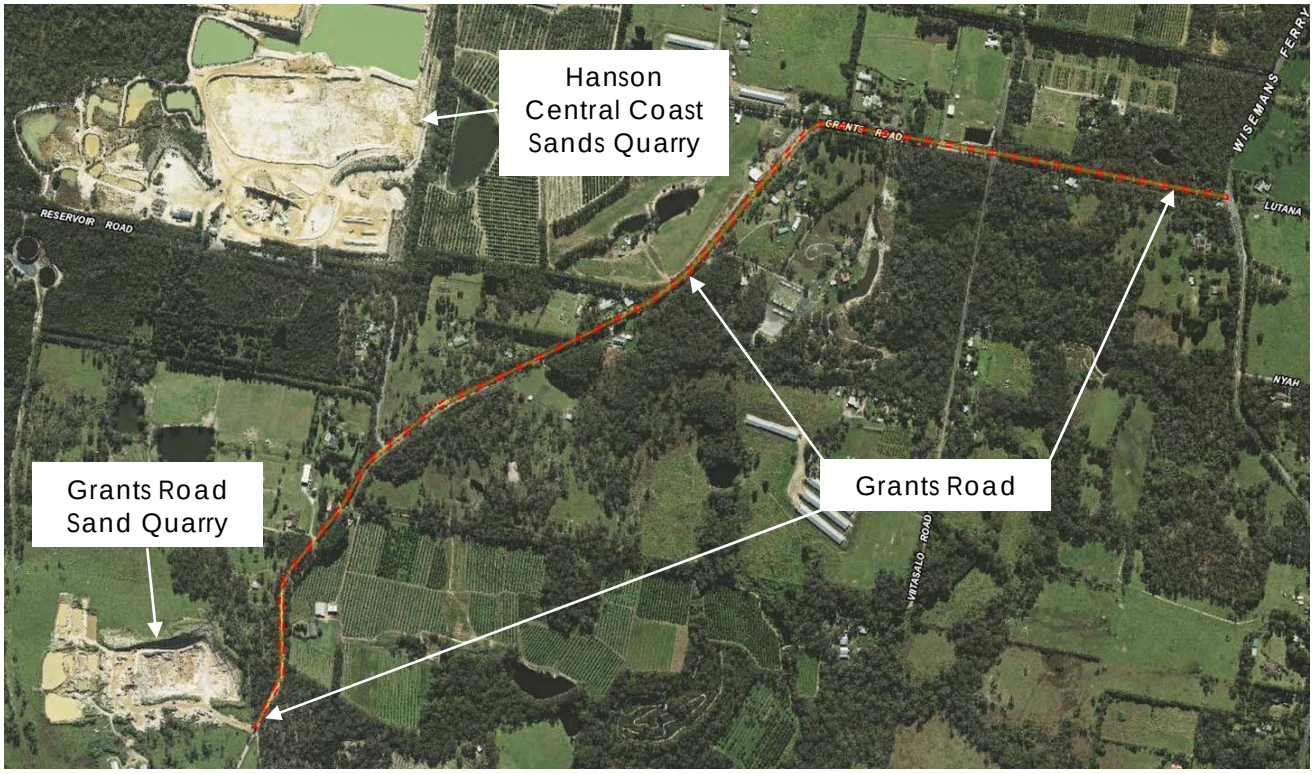


**Figure 1 Site Location**

# 4 Inspection Results

## 4.1 General

A joint visual inspection was undertaken at the site with a Gosford City Council (GCC) Officer. The inspection of Grants Road commenced from Wisemans Ferry Road and terminated at the entrance to the Grants Road Sand Quarry. A cumulative chainage was measured along the length of the road, with zero chainage (CH-0m) set at the intersection of Wisemans Ferry Road; the end chainage is CH-2600m which corresponds to the site entrance of the Grants Road Sand Quarry.

Photos were taken of Grants Road and any defects identified within the road reserve were recorded in Table 1. Each photo was recorded with a corresponding approximate chainage, the side of the road the defect was located, being north/south/east/west, a description of the defect, orientation of the photo north/south/east/west and photo reference number. Photos are shown in Appendix A.

## 4.2 Road Condition Assessment

The condition of the road carriageway was found to consist of a number of defects including surface edge defects and failing of previous repair works (e.g. pothole repair) throughout the sealed carriageway. There are some areas where the sealed edge is fraying due to either reduced table drain functionality (e.g. scour erosion) or vehicle trafficking in locations of reduced sealed carriageway width. Defects are noted in the following table.

**Table 1 Record of Observed Defects**

| Photo Ref. | Road Chainage (approximate) | Side of Road | Description | Direction / orientation of photo |
|---|---|---|---|---|
| 1 | 2600 | East | General view (end of sealed section of Grants Rd) | North |
| 2 | 2600 | East | End of sealed section of Grants Rd – Edge patch | North |
| 3 | 2570 | East | General | North |
| 4 | 2570 | East | Minor longitudinal cracking | North |
| 5 | 2560 | East | General | North |
| 6 | 2600 | West | General – Grants Road Sand Quarry entrance | North |
| 7 | 2595 | West | General – Grants Road Sand Quarry entrance | North |
| 8 | 2600 | West | Longitudinal cracking | – |
| 9 | 2600 | West | Pothole patch | – |
| 10 | 2600 | West | Cracking/minor pothole | – |
| 11 | 2600 | West | Longitudinal cracking | – |
| 12 | 2500 | West | General – minor wheel rutting | North |
| 13 | 2500 | West | General | North |
| 14 | 2500 | West | Pothole patch | – |
| 15 | 2450 | West | General – edge patch | South |
| 16 | 2450 | West | Crocodile cracking | – |
| 17 | 2450 | West | Crocodile cracking | North |
| 18 | 2450 | West | Crocodile cracking | – |
| 19 | 2450 | West | Crocodile cracking | North |

| Photo Ref. | Road Chainage (approximate) | Side of Road | Description | Direction / orientation of photo |
|---|---|---|---|---|
| 20 | 2450 | West | Crocodile cracking (close-up) | – |
| 21 | 2450 | West | Crocodile cracking (close-up) | – |
| 22 | 2450 | East | General | South |
| 23 | 2450 | East | General | North |
| 24 | 2350 | West | General | North |
| 25 | 2350 | West | General | – |
| 26 | 2300 | West | General | North |
| 27 | 2300 | West | General | South |
| 28 | 2300 | West | Pothole patch | – |
| 29 | 2300 | West | General (bend) | North |
| 30 | 2250 | West | General (bend) | North |
| 31 | 2250 | West | General (bend) | South |
| 32 | 1900 | South-west | General | South |
| 33 | 1900 | South-west | Edge fraying | South |
| 34 | 1900 | South-west | General | North |
| 35 | 1900 | North-west | Sediment build up on road edge | East |
| 36 | 1900 | North-west | Edge loss off aggregate in seal – drainage sediment | – |
| 37 | 1900 | North-west | Edge loss off aggregate in seal – drainage sediment | – |
| 38 | 1900 | North-west | Edge loss off aggregate in seal – drainage sediment | North |
| 39 | 1900 | North-west | Edge patch | North |
| 40 | 1880 | North-west | General | South |
| 41 | 1880 | North-west | General | North |
| 42 | 1890 | North-east | General intersection and table drain | South |
| 43 | 1870 | North-east | Edge fray and table drain | South |
| 44 | 1860 | North-east | General | South |
| 45 | 1860 | North-east | General | South |
| 46 | 1840 | North-east | General edge patch | South |
| 47 | 1830 | North-east | General edge patch | South |
| 48 | 1830 | North-east | Table drain profile looking towards Reservoir Rd intersection | South |
| 49 | 1810 | North-east | General | South |
| 50 | 1650 | East | Edge fraying | South |
| 51 | 1620 | West | Edge fraying | North |

| Photo Ref. | Road Chainage (approximate) | Side of Road | Description | Direction / orientation of photo |
|---|---|---|---|---|
| 52 | 1620 | West | Edge fraying (close up) | – |
| 53 | 1620 | West | Edge fraying | South |
| 54 | 1600 | East | Patch remediation cracking | – |
| 55 | 1600 | East | Cracking at pavement repair interface | South |
| 56 | 1600 | East | Cracking at pavement repair interface (close up) | – |
| 57 | 1600 | East | Patch / remediation | South |
| 58 | 1600 | East | Patch / remediation | South |
| 59 | 1600 | East | Patch / remediation | – |
| 60 | 1600 | East | Patch / remediation | – |
| 61 | 1600 | East | Patch / remediation | – |
| 62 | 1570 | East | Patch and pothole patch | – |
| 63 | 1570 | East | Patch and pothole patch | North |
| 64 | 1570 | East | Pothole patch and crocodile cracking | – |
| 65 | 1570 | East | Pothole patch and crocodile cracking | – |
| 66 | 1570 | East | Patch edge | – |
| 67 | 1570 | East | Patch edge cracking | – |
| 68 | 1570 | East | General patch | – |
| 69 | 1550 | West | Edge patch | South |
| 70 | 1400 | West | General pavement and edge | North |
| 71 | 1350 | East | Edge fraying | North |
| 72 | 1350 | East | Edge fraying | North |
| 73 | 1335 | West | Edge fraying | North |
| 74 | 1320 | East | Edge fraying | North |
| 75 | 1220 | East | General and pothole | South |
| 76 | 1220 | East | Pothole | – |
| 77 | 1180 | West | Edge fraying | South |
| 78 | 1180 | West | Edge fraying | South |
| 79 | 1180 | East | Edge patch | South |
| 80 | 1180 | East | General | North |
| 81 | 1140 | East | General pavement interface | North |
| 82 | 1140 | East | Close-up of pavement interface | North |
| 83 | 1120 | East | General pavement interface | North |
| 84 | 1120 | East | Close-up of pavement interface | – |
| 85 | 1120 | East | General | North |
| 86 | 1000 | East | Pothole patch | South |
| 87 | 1000 | East | Pothole and edge patch | South |
| 88 | 950 | East | General | South |
| 89 | 950 | East | Close-up of edge interface | – |
| 90 | 950 | East | Close-up edge cracking | – |
| 91 | 950 | East | General | North |
| 92 | 1000 | West | Driveway | South |
| 93 | 900 | West | Pavement edge and shoulder | South |
| 94 | 900 | West | Pavement edge and shoulder (looking towards bend) | North |
| 95 | 900 | East | Pavement edge and shoulder | South |

| Photo Ref. | Road Chainage (approximate) | Side of Road | Description | Direction / orientation of photo |
|---|---|---|---|---|
| 96 | 900 | East | Pavement edge and shoulder (looking towards bend) | North |
| 97 | 880 | East | Pavement edge and shoulder | South |
| 98 | 880 | East | Pavement edge and shoulder (looking towards bend) | North |
| 99 | 870 | South | Fraying edge and shoulder | West |
| 100 | 860 | South | Shoulder widening/patch | East |
| 101 | 860 | South | Shoulder widening/patch close-up | East |
| 102 | 830 | North | General bend – pothole patch at edge | West |
| 103 | 800 | North | General pavement patch | East |
| 104 | 800 | North | General pavement patch | East |
| 105 | 800 | North | General pavement patch with crocodile cracking | East |
| 106 | 800 | North | Close up crocodile cracking in patch | East |
| 107 | 800 | North | Pavement patch interface | – |
| 108 | 800 | North | Crocodile cracking throughout patch | East |
| 109 | 800 | North | Close-up crocodile cracking in patch | – |
| 110 | 800 | North | Close-up crocodile cracking in patch | – |
| 111 | 750 | North | Pavement edge, shoulder and table drain | West |
| 112 | 750 | North | Pavement edge, shoulder and table drain | East |
| 113 | 790 | South | Pavement edge and cracking at wheel path | West |
| 114 | 660 | South | Pavement edge and shoulder, edge patch | West |
| 115 | 660 | South | Pavement edge and shoulder, edge patch | East |
| 116 | 580 | South | Pavement edge fray and shoulder | West |
| 117 | 580 | South | Pavement edge fray and shoulder | East |
| 118 | 560 | North | Surface aggregate loss | West |
| 119 | 560 | North | Surface aggregate loss (close-up) | – |
| 120 | 480 | North | Keighley Ave intersection | South |
| 121 | 480 | North | Keighley Ave intersection | South |
| 122 | 480 | North | Keighley Ave intersection | South |
| 123 | 480 | North | Keighley Ave intersection | South |
| 124 | 460 | South | Frayed pavement edge and shoulder, edge patch | East |
| 125 | 130 | North | Pavement patch interface | – |
| 126 | 130 | North | Pavement patch interface | – |
| 127 | 130 | North | Pavement patch crocodile cracking | East |
| 128 | 130 | North | Pavement patch crocodile cracking at interface | West |
| 129 | 130 | North | Pavement patch and edge patch | East |
| 130 | 130 | North | Edge fray/pothole | East |
| 131 | 50 | South | Shoulder and edge fray (looking west) | West |
| 132 | 5 | North | Shoulder of intersection with Wisemans Ferry Rd | East |

| Photo Ref. | Road Chainage (approximate) | Side of Road | Description | Direction / orientation of photo |
|---|---|---|---|---|
| 133 | 5 | North | Shoulder of intersection with Wisemans Ferry Rd – edge patch/failure | East |
| 134 | 15 | South | Shoulder of intersection with Wisemans Ferry Rd | East |
| 135 | 5 | South | Shoulder of intersection with Wisemans Ferry Rd | East |

# 5 Road Maintenance Contributions

Each of the operating quarries has a major project approval which speculates a maximum permissible tonnage of material that can be extracted per a year. Hanson Central Coast Sands Quarry is permitted to extract 310,000 tonne of material per year. Grants Road Sand Quarry is permitted to extract 250,000 tonne of material per year.

It is noted that Hanson Central Coast Sand Quarry is functioning at its peak extraction rate of 310,000 tonne per year. However the Grants Road Sand Quarry functions at well below its approved 250,000 tonne per year extraction rate (previously 50,000 tonne per year).

In order to satisfy *Schedule 3 Condition 16* of the Grants Road Sand Quarry approval and *Schedule 3 Condition 19* of the Hanson Central Coast Sands Quarry approval, the road maintenance contributions will;

- *Be co-funded by the Hanson Central Coast Sands Quarry and the operator of the Grants Road Sand Quarry on a basis which is proportionate to the maximum number of tonnes of quarry product expected to be dispatched from each quarry over the life of their major project approvals, and the length of Grants Road affected by laden vehicles from each quarry.*
- *Be based on the assessment of current road condition of the length of Grants Road affected by laden vehicles from each quarry and future road maintenance requirements for this length of road over the life of the major project approvals for both quarries;*
- *Based on consideration to the usage of Grants Road by laden vehicles from each quarry over the past five years and the predicted usage of Grants Road by each quarry over the life of their major project approval including any importation of Virgin Excavated Natural Material.*
- *Recommend per tonne/per kilometre road maintenance contributions for the project for the haulage of quarry products on Grants Road.*

## 5.1 Heavy Vehicle Movements

For the purposes of estimating the equivalent standard axles (ESA's) of the heavy vehicles that use Grants Road, the following assumptions are made;

- Truck utilised for quarries is Truck and Dog.
  - Fully loaded Truck and Dog is equivalent to 7.1 ESA.
  - Average loaded Hanson Quarry Truck and Dog is equivalent to 5.6 ESA (based on historical data).
  - Unloaded Truck and Dog is equivalent to 1.1 ESA.
- All other heavy vehicles not associated with quarries are equivalent to 2.1 ESA.

### 5.1.1 Current Heavy Vehicle ESA

Operations for both quarries over the last 5 years are summarised below.

Grants Road Sand Quarry

- Previously operating at 50,000 tonne per year. This was approximately 1,800 trucks per year (4.93 trucks/day) or equivalent to 14,755.5 ESA per year.

Hanson Central Coast Sands Quarry

- Previously approved operational output of quarry was 310,000 tonnes per year. The 2006 total trucks in a year measured at the Hanson weighbridge was 12,083 trucks (average of 33.10 trucks/day). This is equivalent to 80,946.1 ESA per year.

Other Heavy Vehicles

- Based on the amount of heavy vehicles measured in Councils traffic count minus the quarry traffic, this equates to 103.94 trucks per day or equivalent to 79,670 ESA per year.

Total Average Current ESA

- The current yearly amount of heavy vehicle ESA is 175,371.6.

### 5.1.2 Future Heavy Vehicle ESA

Grants Road Sand Quarry

- Currently approved to output 250,000 tonne a year. However due to the size of the Grants Road Sand Quarry operations, it will not reach this output for a sizable period of time. Thus it is assumed for the purposes of this assessment that over the approval period, the Grants Road Sand Quarry will average an output of 125,000 tonne a year.
- Trucks are topped up on weighbridge to 32 tonnes – this equates to approximately 3,906.25 trucks per year (average of 10.70 trucks/day). This is an increase in average trucks per day of approximately 5.77 trucks. The total ESA expected to be generated on average per year is 32,025.1 ESA per a year.

Hanson Central Coast Sands Quarry

- Currently the approved output is 310,000 tonnes per year which is unchanged from 2006. Therefore, 2006 levels are utilised as current truck amounts (average of 33.10 trucks/day). This is equivalent to 80,946 ESA per year.

Other Heavy Vehicles

- This is not expected to change thus the current level of 79,670 ESA per year is used.

Total Average Future ESA

- It is expected that the average future yearly amount of heavy vehicle ESA is 192,641.2.

## 5.2 Road Maintenance Contribution Rate

A maintenance contribution rate has been calculated based on the following;

- What the current road would cost to build and what its design life is under current loading.
- How much the future loading will reduce the current life of the pavement.
- What the future road would cost to build under future loading with a 20yr design life.
- Grants Road Sand Quarry to have a 30 year life with average of 125,000 tonne a year output for this period (including VENM in).
- Hanson Sands Quarry to have a 20 year life with 310,000 tonnes a year output (including VENM in).

- Maintenance contribution fee to be paid as an annual invoice indexed at consumer price index (CPI).

The contribution to be paid by quarries consists of two parts (with contribution being proportional to the loading and length of road each quarry uses);

1. A compensation for the reduced life of existing pavement by future loading – converted to a monetary sum.
2. A contribution proportional to the increase in costs/loading for the future constructed pavement.

For the purposes of the assessment, Grants Road has been separated into two distinct sections;

- Section-A, this section is loaded by both Hansons Central Coast Sands Quarry and the Grants Road Sand Quarry. This is the section from Wisemans Ferry Road to the intersection of Reservoir Road, from which Hanson trucks exit. This section is 1,940m long.
- Section-B, this section is loaded by Grants Road Sand Quarry but not the Hanson Central Coast Sands Quarry. This is the section between Reservoir Road and Grants Road Sand Quarry. This section is 660m long.

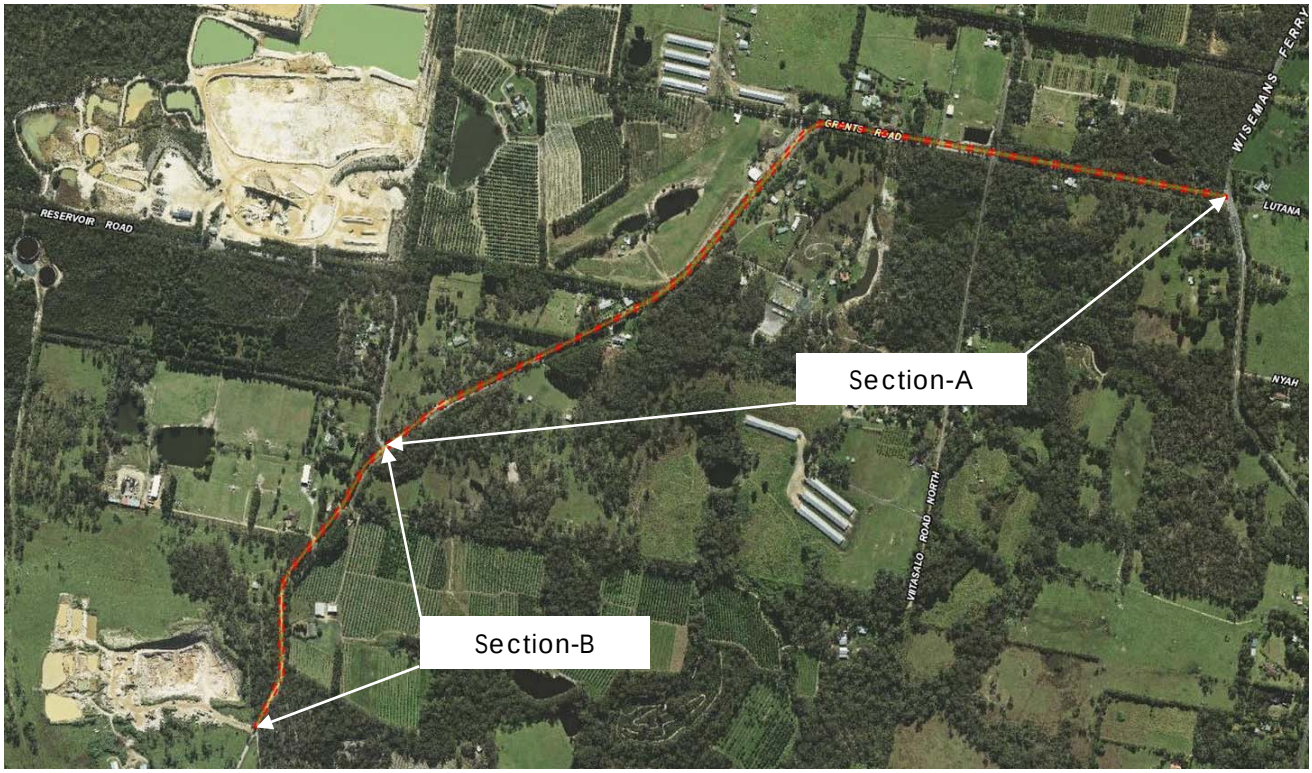


**Figure 2 Site Location showing Section-A and Section-B**

### 5.2.3 Section-A Road Maintenance Contribution Rate

The road maintenance contribution rate for Section-A is calculated as follows (greater detail is provided in Appendix B);

#### 5.2.3.1 Section-A Compensation for Reduction in Current Pavement Life

- Assumed current pavement design life is $2.2 \times 10^6$ ESA.
- Current pavement life under current loading is 12.54 years.

    - Current reconstruction cost for road to current design is $931,200.
- Current pavement life under future loading is 11.42 years.

Therefore under the future loading, Council is shortfalled 1.12 years of pavement life or an 8.96% reduction in pavement life. Hence due to the increased loading leading to a reduced pavement life, the Quarries are to compensate 8.96% of initial cost for the current pavement, which equates to $83,478.84.

- Hanson Sands Quarry will repay $59,490.67 which is proportional to its average yearly output, as compensation for the reduced life of the current pavement.
    - Hanson Sands Quarry is estimated to have a life of 20 years - thus will repay $59,490.67 over 20 years, which equates to $2,974.53 per year.
- Grants Road Sand Quarry will repay $23,988.17 which is proportional to its average yearly output, as compensation for the reduced life of the current pavement.
    - Grants Road Sand Quarry will operate for the life of the major project approval of 30 years - thus will repay $23,988.17 over 30 years, which equates to $799.61 per year.

#### 5.2.3.2 Section-A Contribution for Future Pavement Life

Due to the future loading of pavement in Section-A of Grants Road, at the end of the current pavements life, a better pavement will need to be constructed to give a 20 year design life. The future pavement reconstruction for Section-A to a 20yr design life under increased loading will cost approximately $1,338,600 (note having a better pavement design that is more costlier but lasts 20yrs [i.e. approx 66,930.00 per a year], is cheaper per a year than the current pavement design which has a design life of 12.54 years [i.e. approx $74,229.99 per year cost to Council]).

The quarries will increase the amount of ESAs above the existing conditions by approximately 9.85%, thus shall contribute 9.85% of the future pavement costs to Council;

- Hanson Sands Quarry shall pay $4,696.96 per year as contribution for the future pavement cost which is proportional to its loading of Section-A.
- Grants Road Sand Quarry shall pay $1,893.93 per year as contribution for the future pavement cost which is proportional to its loading of Section-A.

#### 5.2.3.3 Section-A Total Maintenance Contribution;

- Hanson Sands Quarry shall pay $7,671.49 per year for Section-A.
- Grants Road Sand Quarry shall pay $2,693.54 per year for Section-A.

### 5.2.4 Section-B Road Maintenance Contribution Rate

The road maintenance contribution rate for Section-B is calculated as follows (greater detail is provided in Appendix B);

#### 5.2.4.1 Section-B Compensation for Reduction in Current Pavement Life

- Assumed current pavement design life is $2.2 \times 10^6$ ESA.
- Current pavement life under current loading is 23.3 years.
    - Current reconstruction cost for road to current design is $376,200.
- Current pavement life under future loading is 19.7 years.

Therefore under the future loading, Council is shortfalled 3.6 years of pavement life or a 15.46% reduction in pavement life. Hence due to the increased loading leading to a reduced pavement

life, Grants Road Sand Quarry is required to compensate 15.46% of initial cost for the current pavement, which equates to $58,160.52.

- Grants Road Sand Quarry will operate for the life of the major project approval of 30 years - thus will repay $58,160.52 over 30 years, which equates to $1,938.68 per year.

#### 5.2.4.2 Section-B Contribution for Future Pavement Life

Under the future loading of Section-B a pavement life of 19.7 years is expected. Given this is approximately 20 years, it is expected that the same/similar pavement design will be built with same/similar cost. The future pavement will have a similar cost overall to build but last approximately 19.7 years as opposed to 23.3 years. Currently the pavement reconstruction averaged per year is $18,685.22; whilst the future cost averaged out per year will be $21,638.33.

Thus the maintenance contribution for Section-B future pavement construction to be paid by the Grants Road Sand Quarry will be the increase in cost per year for pavement which is $2,953.11.

#### 5.2.4.3 Section-B Total Maintenance Contribution;

- Grants Road Sand Quarry shall pay $4,891.79 per year for Section-B.

### 5.2.5 Total Road Maintenance Contribution Rate

Hanson Sands Quarry will only load Section-A of Grants Road. Hence proportionally to its loading on Grants Road it shall pay Council $7,671.49 per year as an annual invoice, indexed to CPI.

Grants Road Sand Quarry will load Section-A and Section-B of Grants Road. Hence proportionally to its loading on Grants Road it shall pay Council $7,585.33 per year as an annual invoice, indexed to CPI.

# 6 Conclusion

A record of the existing condition of Grants Road, Somersby has been presented in this report. The condition of the road carriageway was found to consist of a number of defects including surface edge defects and failing of previous repair works (e.g. pothole repair) throughout the sealed carriageway. There are some areas where the sealed edge is fraying due to either reduced table drain functionality (e.g. scour erosion) or vehicle trafficking in locations of reduced sealed carriageway width.

The future maintenance contributions for Grants Road are based on two parts, a compensation for the reduction in current life of the pavement due to increased loading, and a proportional funding by the quarries of the cost of the future pavement construction. Based on this rationale; the Hanson Sands Quarry will contribute $7,671.49 per year to maintenance and the Grants Road Sand Quarry will contribute $7,585.33 per year to maintenance. All contributions will be as an annual invoice indexed at CPI.

The proposed maintenance contributions provide an equitable means for Council to recuperate maintenance costs from the quarries for the loading over Grants Road.

# Appendix A: Photographic Record of Defects

# Appendix B: Calculation of Maintenance Contribution Rate