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SITE BASED STORMWATER MANAGEMENT PLAN

FOR

PROPOSED RESIDENTIAL DEVELOPMENT AT 31 MANN AVE & 14 ELSON RD, NORTHGATE

May 2007

Prepared by: Swaan Consulting Pty Ltd

SITE BASED STORMWATER MANAGEMENT PLAN
TABLE OF CONTENTS

1 INTRODUCTION

Swaan Consulting Pty Ltd has prepared this Site Based Stormwater Management Plan (SBSMP) for a proposed residential development located at 31 Mann Ave & 14 Elson Rd, Northgate. The site is properly described as Lot 3 RP 76215 and Lot 39 RP34599.

The SBSMP has been prepared to accompany a Development Application for the site which has been lodged with Brisbane City Council.

It is proposed to develop the site as a unit development. The site is bounded by Mann Ave and Elson Road to the west, and existing residential on the other boundaries. The site has access via Mann Ave & Elson Road.

The site has a total area of 0.3950 Ha. The proposed development will comprise of 10 residential units.

This document provides the conceptual stormwater design for the proposed development. This design incorporates a Water Sensitive Urban Design (WSUD) to ensure that Water Quality Objectives (WQO's) for receiving waters are achieved. The proposal complies with the requirements of the requirements of the Brisbane City Council (BCC) Stormwater Drainage Design Standards and Queensland Urban Drainage Manual (QUDM) unless specifically noted, A detailed engineering design will subsequently be undertaken prior to the Operational Works Application.

2 SITE CHARACTERISTICS

2.1 Location

The site location is 31 Mann Ave and 14 Elson Road, Northgate

2.2 Topography and Site Drainage

The site generally falls from the Western boundary to the Eastern boundary at an average slope of approximately 2.5%. Site levels range from approximately RL 3.9m AHD to RL 1.5m AHD.

The site drainage will be to the north-east corner of the site.

2.3 Soils

No soil testing has been undertaken for the site. Soil testing to determine the dispersive characteristics of the soil will be undertaken prior to finalisation and sizing of water quality management devices for the site.

An Erosion and Sediment Control Plan (ES&CP) will be required to manage the erosion risks associated with this development.

2.4 Acid Sulphate Soils

The site will be filled from a source which will not contain Acid Sulphate soils, and there will be minimal excavation to the site. The only excavation will be for trenching for services, which will be backfilled as soon as the services are installed.

Hence, Acid Sulphate Soils (if existing) will not be a problem to the site.

2.5 Vegetation

A vegetation plan has been prepared by others, hence site vegetation has not been considered in this report.

3 STORMWATER QUANTITY

3.1 GENERAL

The proposed development is shown in Figure 1 in Appendix B. The site detailed drainage design will be undertaken in accordance with Brisbane City Council and Queensland Urban Drainage Manual (QUDM). The following level of serviceability will be provided for the stormwater drainage system:

- Minor System: 2 year ARI.
- Major System: 50 year ARI.

The proposed stormwater system is shown in Figure 2 in Appendix B.

Internally it is intended to adopt Water Sensitive Road Design (WSRD) road layouts incorporating vegetated swales and bio-retention filters, where possible.

The WSRD road cross sections, details and calculations will be undertaken in accordance with Brisbane City Council Design Guidelines.

3.2 LEGAL POINT OF DISCHARGE

The intended legal point of discharge for the site drainage system is the north-eastern corner of the site boundary as sheet flow.

3.3 QUANTITY

The development will increase the amount of impervious area which will reduce time of concentration and decrease infiltration, thus increasing the amount of stormwater runoff created by the site. The pre-development and post-development flows, for a range of A.R.I's, are detailed below;

PRE-DEVELOPMENT FLOWS

As the site is existing residential, time of concentration, tc, for pre-development flows is taken from QUDM, Table 5.05.1, as urban residential with average slope is up to 2.03 %

If standard inlet time is 15 mins (Table 5.05.1 – Urban Res. Slopes up to 3%) plus overland flow of 120m, with 2.4 m of fall (i.e. 2 %).

Overland flow = 20.6 mins

Total tc = 35.6 mins

Rainfall intensities are taken from Brisbane City Council charts, and run off coefficients are taken from QUDM.

The pre development peak flows, for a time of concentration of 35.6 minutes and catchment area of 0.3950 Ha are provided in Table 1 below.

Table 1 Existing Site Peak Flows

Recurrence Interval (yrs)	Rainfall Intensity (mm/hr)	Runoff Coefficient	Peak Flow (m^3/s)
1	49	0.592	0.032
2	63	0.629	0.044
5	82	0.703	0.063
10	94	0.740	0.076
20	109	0.777	0.093
50	130	0.851	0.121
100	147	0.888	0.143

POST-DEVELOPMENT FLOWS

Time of concentration, tc, for post-development flows is taken from QUDM, Table 5.05.1, as urban residential with average slope is up to 2.03%.

If standard inlet time is 15 mins (Table 5.05.1 – Urban Res. Slopes up to 3%) and pipe flow is approximately 1 min (Figure 5.05.6 – Fall 1.2m, Length 60m), plus overland flow, length of 60m with 2.0m of fall giving 15min. Use t_c = 31 mins. This will give the peak development flows in Table 2 below.

Table 2 Proposed Site (Unmitigated) Peak Flows

Recurrence Interval (yrs)	Rainfall Intensity (mm/hr)	Runoff Coefficient	Peak Flow (m^3/s)
1	53	0.632	0.037
2	68	0.715	0.053
5	89	0.751	0.073
10	101	0.790	0.088
20	118	0.829	0.107
50	140	0.909	0.140
100	157	0.948	0.163

The worst increase is for the 1 in 100 year storm which equates to 0.020m^3/s, which is very small.

Volume of Flow to be Retarded for Q_{100}

Flow to be Retarded $= 0.020m^3/s$

From QUDM Section 6.06.1

$$r = (Q_i - Q_o) / Q_i$$

$$= (0.020) / 0.163$$

$$= 0.123$$

Inflow Volume $V_i = (4t_cQ_i) / 3$

$$= (4 \times 31 \times 60 \times 0.163) / 3$$

$$= 404.24m^3$$

Using the formulas listed in QUDM, we have:

$$\text{Culp} - V_s = (V_i \times r(1 + 2r)) / 3$$

$$= (404.24 \times 0.123(1 + 0.246)) / 3$$

$$= 20.65m^3$$

$$\text{Boyd} - V_s = V_i \times r$$

$$= 404.24 \times 0.123$$

$$= 49.72m^3$$

Carroll – V_s $= (V_i \times r\,(3 + 5r)) / 8$

$= (404.24x\ 0.123 \times (3.615)) / 8$

$= 22.47m^3$

Basha – V_s $= (V_i x\ r\,(2 + r)) / 3$

$= (404.24 \times 0.123 \times 2.123) / 3$

$= 35.19m^3$

Hence Average Vol $= 32.0075m^3$

$\approx 32m^3$

Use a 10 x 3.2 x 1.0 meter deep underground tank, as shown on figure 2 in Appendix B.

4 STORMWATER QUALITY

It is proposed to use the methods set out in Brisbane City Council (B.C.C.) guidelines for determining and treating stormwater, if required. These guidelines are listed in section 6- "References"

4.1 Environmental Values and Water Quality Objectives

Section 4.3 of Council's Stormwater Management Code states that a multi – unit development is considered low risk if the impermeable surface area (not including roof area) is less than 2500m^2, the approximate impermeable surface area of this development is only 460m^2, which is less than the allowable.

Consequently it is only required to minimise water quality impacts using best practice techniques.

The proposed development is shown in Figure 1, Appendix B.

4.2 Pollutants Generated By Development

As the development is considered low risk, the pollutants to be treated will mostly be generated during the Construction Phase. As the development is a multi-unit development, with all units to be constructed simultaneously, all turfing and landscaping etc. will be installed during the construction phase, thereby reducing the effects of pollutants generated during the Operational Phase.

During the construction phase of a development the pollutants listed below have been identified in BCC's "Water Quality Management Guidelines" as being typically generated. In accordance with these guidelines, measures are to be incorporated into the construction methodology to manage the above mentioned pollutants

Table 3 Pollutants likely to be generated during construction

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic Materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (eg from tile works)
pH Altering Substances	Acid sulphate soils, cement slurry and washwaters

4.3 WATER QUALITY TREATMENT

4.3.1 Construction Phase

An Erosion and Sediment Control Plan will be implemented during the construction phase as previously discussed. Details of the proposal are shown on Figure 3 in Appendix 2.

4.3.2 Operational Phase

A number of management measures have been considered with a focus on reducing runoff volumes from the site. As has been stated previously it is intended to incorporate WSRD principles where appropriate into the development. The following SQBMP's are therefore:

- Buffer Strips
- Water Tank per lot
- Swales

Details of the proposed treatment are shown in Figure 4 in Appendix B.

4.4 Pollutant Export Modelling

Pollutant export rates are currently only available for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorous (TP). Therefore only quantitative modelling for TSS, TN & TP is necessary.

The site parameters and Stormwater Quality Improvement Devices (SQID) have been input and calibrated in the MUSIC (Model for Urban Stormwater Improvement Conceptualisation) program to determine potential pollutant export rates from the development site. Detailed pollutant export calculations are included in MUSIC Results in Appendix A.

In order to satisfy BCC's guidelines, it is desirable that the pollutant export rates meet Water Quality Objectives (WQO) set by BCC which equate to a mean annual TSS load of 15mg/L, a mean annual TP load of 0.07 and a mean annual TN load of 0.65mg/L.

The mean annual loads generated by the developed site and the WQO's based on the reduction required are shown in table 5 below.

Table 4 Post Development Unmitigated Annual Load(mg/L)

Indicator	Post Development Unmitigated Annual Load (mg/L)	Reduction Required (%)	Required Post Development Mitigated Annual Load (mg/L)
TSS	64.144	76.6	15
TP	0.158	55.7	0.07
TN	1.264	48.6	0.65

Treatment of stormwater is required in order to achieve the desired WQO's.

4.5 WATER QUALITY TREATMENT

The following treatment train is proposed for the site to treat the above mentioned pollutants.

Buffer Strips

Buffer Strips are vegetative strips of turf proposed on areas where sheet flow can be buffered to treat stormwater. This treatment consists of sheet flow dissipating over the grassed section, seeping into the ground and infiltrating as base flow. These will be placed around the total site in landscaped areas. Details are shown on figure 4 in Appendix B

Swales

Vegetated Swales are used to convey Stormwater in lieu of, or with, underground pipe drainage system, and to provide the removal of coarse and medium sediments. These will be placed below the flood regulation line to treat the water that come from the developed area. Details are shown on figure 4 in Appendix B.

Water Tanks

Water tanks are to be installed by persons constructing their homes, with each tank to be 3000L, as a treatment device for Post-Developed Scenario.

The mean annual loads generated by the developed site after installing treatment devices is shown in the table below as well as the required levels to be achieved, and it is shown that the WQO's have been achieved.

Table 5 Post Development Mitigated Annual Load (mg/L)

Indicator	Post Development mitigated Annual Load (mg/L)	Reduction Required (%)	Reduction Achieved (%)
TSS	20.72	76.6	67.7
TP	0.073	55.7	53.8
TN	0.73	48.6	42

The treatment train efficiency achieved is shown in table 4.2 below.

Table 6 Treatment Train Efficiencies

Pollutant	Efficiency of Treatment Train (%)	Reduction Required (%)
Total Suspended Solids	67.7	76.6
Total Phosphorus	53.8	55.7
Total Nitrogen	42	48.6

From the results presented in Table 6, it can be seen that the treatment train devices proposed significantly reduce the impacts of the development. Additionally, sediment fencing will be installed and maintained for the entire duration of the construction period which has a huge impact on removing TSS, TN and TP nutrients. Unfortunately the current version of MUSIC does not have a treatment node allocated for sediment fencing, but it will be included in future versions.

However, as the development is a low-risk development it is not required to totally achieve the WQO's.

Detailed treatment efficiency calculations are included in Appendix A. Details of the proposed treatment are shown on Figure 4 in Appendix B.

5 MAINTENANCE OF WATER QUALITY TREATMENT DEVICES

5.1 Buffer Strips

- Inspect at 3 month intervals, other than regular mowing or after large storm events.
- Mow grass at regular intervals.
- Remove rubbish from grass.
- Ensure grass is not covered with fill material etc., and that grass is free of any material that may prevent uniform flow across surface, or flow from penetrating surface.
- Repair any areas that have been subject to erosion. Ensure vehicles do not access area other than at designated driveways.
-

5.2 Swales

Typical maintenance of swale elements will involve

- Routine inspections of the swales profile to identify any areas of increased sediment deposition or scouring of the swales from the storm flows.
- Routine inspections of inlet points, to identify any areas of scour, litter build up or blockages.
- The removal of sediment where it is impeding the conveyance of the swale and also the smothering of vegetation.
- Moving or slashing of the turf to preserve the optimal design height of the vegetation.
- Litter and debris removal
- Clearing of blockages to ensure flow over the swale.

6 CONCLUSION

As the development is considered to be low risk, the methods proposed to treat pollutants generated during the construction and operational phases, will achieve the treatment objectives.

7 REFERENCES

- Brisbane City Council, Queensland Department of Natural Resources & Institute of Municipal Engineering Association of Queensland, 1994. *Queensland Urban Drainage Manual.* Queensland Department of Natural Resources, Brisbane.

- Brisbane City Council, 2000. *Brisbane City Plan (including Waterway Code and Stormwater Management Code).* Brisbane City Council, Brisbane.

- Brisbane City Council, 2000. *Guidelines for Pollutant Export Modelling in Brisbane (Version 6, 2000).* Brisbane City Council, Brisbane.

- Brisbane City Council, 2000. *Water Quality Management Guidelines (Version 1, 2000).* Brisbane City Council, Brisbane.

- Brisbane City Council & WBM Oceanics Australia, 2000. *Site Based Stormwater Management Plan Case Studies.* Brisbane City Council, Brisbane.

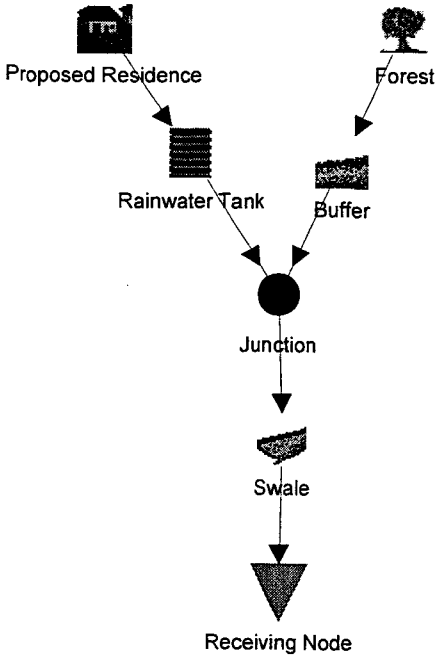
- Brisbane City Council, 2000. *Guideline on Identifying and Applying Water Quality Objectives in Brisbane City (Version 1, 2000).* Brisbane City Council, Brisbane.

- Brisbane City Council, October 2003. *Guidelines for Pollutant Export Modelling in Brisbane Version 7.*

8 APPENDICES

APPENDIX A

MUSIC MODELLING RESULTS FOR POLLUTANT DISCHARGES


Proposed Residence
Forest
Rainwater Tank
Buffer
Junction
Swale
Receiving Node

Receiving Node

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Treatment Train Effectiveness

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Sources	3.34	478	0.823	4.64	63.4
Residual Load	1.82	158	0.379	2.62	21.8
% Reduction	45.4	66.8	53.9	43.5	65.6

MUSICM~1 - Receiving Node

All Data Statistics

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Inflow

	mean	stddev	median	maximum	minimum	10 %ile	90 %ile
Flow (cubic metres/sec)	57.8E-6	490E-6	5.33E-6	19.7E-3	0.00	0.00	31.5E-6
TSS Concentration (mg/L)	11.9	54.0	2.93	2.83E3	0.00	0.00	8.99
Log [TSS] (mg/L)	0.598	0.473	0.528	3.45	-0.601	0.105	1.00
TP Concentration (mg/L)	33.4E-3	90.8E-3	14.9E-3	3.41	0.00	0.00	45.1E-3
Log [TP] (mg/L)	-1.71	0.394	-1.77	0.532	-2.84	-2.11	-1.30
TN Concentration (mg/L)	0.327	0.420	0.238	8.27	0.00	0.00	0.571
Log [TN] (mg/L)	-0.546	0.291	-0.574	0.917	-1.46	-0.895	-0.209
TSS Load (kg/6 Minutes)	1.81E-3	13.6E-3	4.96E-6	0.515	0.00	0.00	53.9E-6
TP Load (kg/6 Minutes)	4.33E-6	33.3E-6	24.6E-9	1.02E-3	0.00	0.00	265E-9
TN Load (kg/6 Minutes)	29.9E-6	280E-6	418E-9	12.2E-3	0.00	0.00	3.75E-6
Gross Pollutant Load (kg/6 Minutes)	249E-6	1.53E-3	0.00	23.0E-3	0.00	0.00	0.00

Receiving Node

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Mean Annual Loads

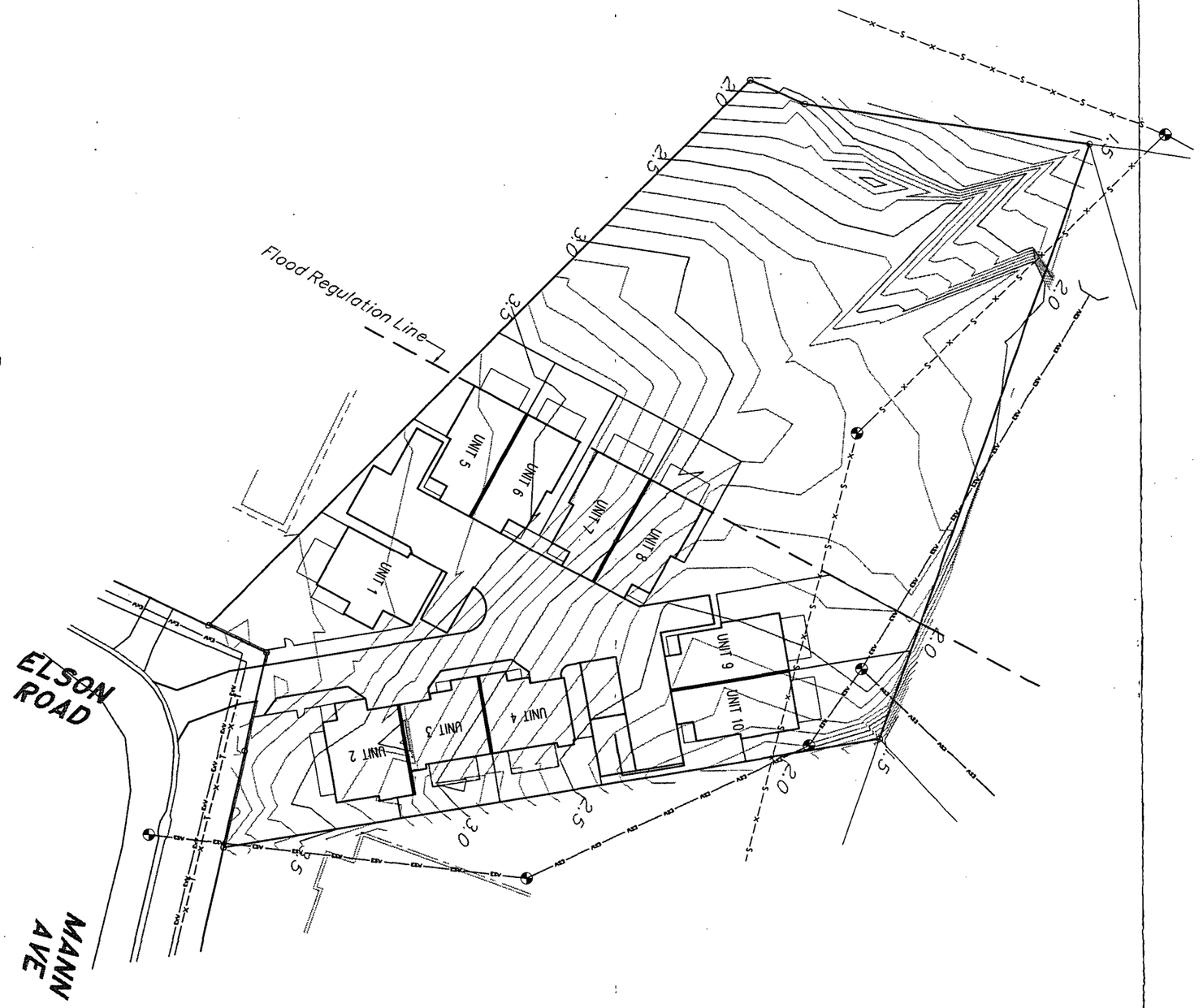
	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Inflow	1.82	158	0.379	2.62	21.8

APPENDIX B

NORTH

LEGEND

—x—T—EXISTING TELSTRA CABLE
—ew—ew—EXISTING WATER MAIN
—stv—stv—EXISTING STORMWATER MAIN
—s—x—EXISTING SEWER MAIN



R.P.D.	
LOT No.	3 & 39
ON RP No.	76215 & 34599
LOCAL AUTHORITY	BRISBANE C.C.
SITE AREA TOTAL	3950 SQ.M.
SITE COVER	785 SQ.M. (19.9%)
PROPOSED RESIDENCE	1309 SQ.M.
PROPOSED PORCH/OPEN PERGOLA/PATIO ETC.	212 SQ.M.
PROPOSED BALCONY/ VERANDAH	78 SQ.M.
TOTAL AREA	1518 SQ.M.
TOTAL G.F.A	1007 SQ.M.
TOTAL COURTYARD AREA	650 SQ.M.

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SCALE 1:500 (A3) 0 5 10

CODE	DATE	REVISION	AUTHORISED
A	21/05/07	ISSUED FOR COUNCIL APPROVAL	T.S.

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CLIENT: Mr. PETER TORNABENE

COUNCIL: BRISBANE CITY COUNCIL

PROJECT: 31 MANN AVENUE & 14 ELSON ROAD, NORTHGATE

Scales: AS SHOWN
Designed: CS | Checked: T.S.
Drawn: CS | Date: 21/05/07
Authorised: T.SAVARIMUTHU B.P.E.Q. No.3881

Drawing title: GENERAL LAYOUT PLAN

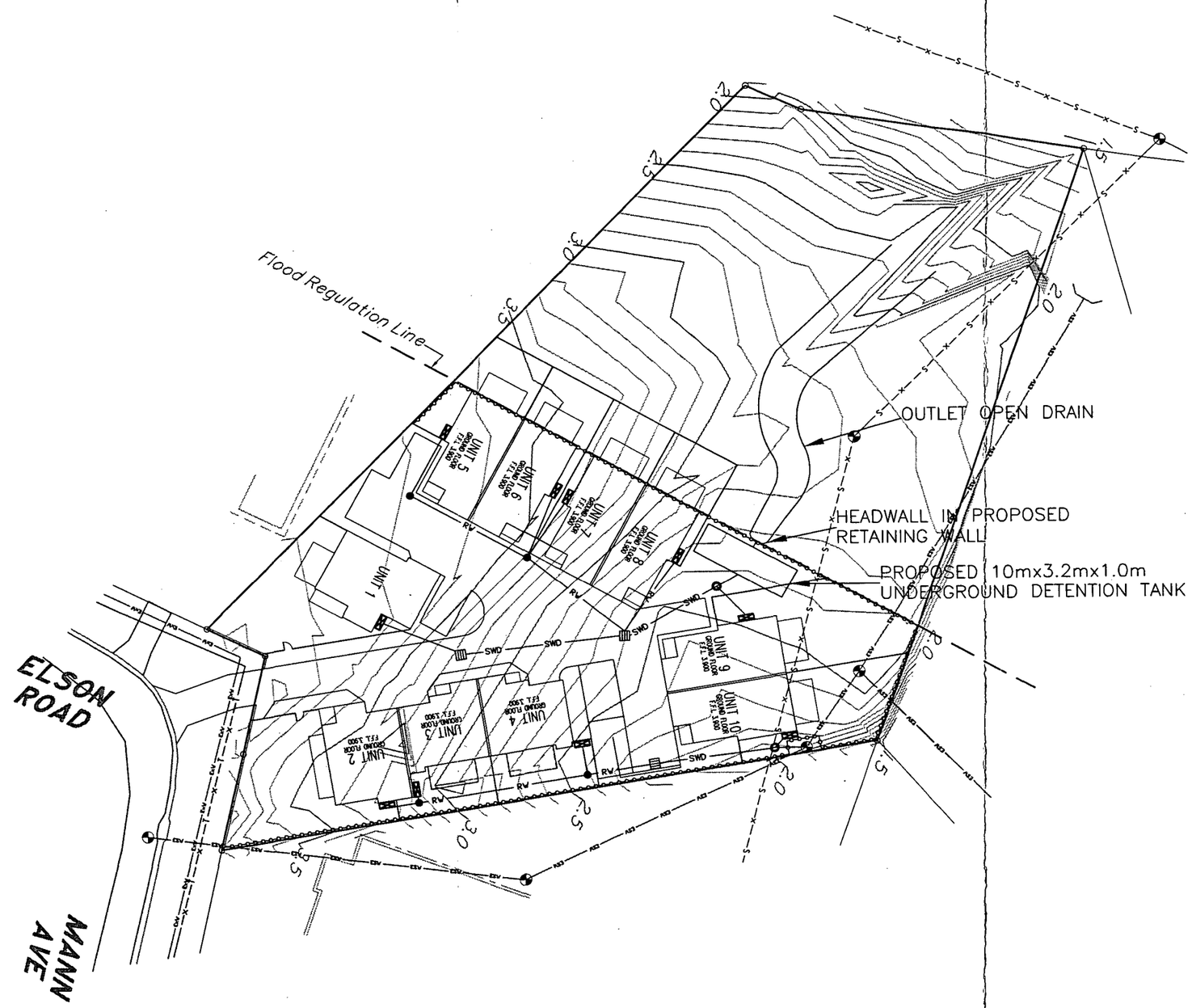
Council File No. —

No in set | Drawing No: J174-00-FIGURE 1 | Revision Code

NORTH

LEGEND

- SWD ——— PROPOSED STORMWATER AND GRATED PIT
- SWD ——— PROPOSED STORMWATER AND I.O.S.
- SWD ——— PROPOSED STORMWATER AND HEADWALL
- ——— PROPOSED ROOFWATER AND I.O.S.
- PROPOSED RAINWATER TANK
- ——— CSV ——— EXISTING STORMWATER MAIN
- ——— PROPOSED RETAINING WALL



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Scales: AS SHOWN
Designed: CS | Checked: T.S.
Drawn: CS | Date: 21/05/07
Authorised: T.SAURMANN R.P.E.Q. No.3681

Drawing title: STORMWATER LAYOUT PLAN

Council File No. ---

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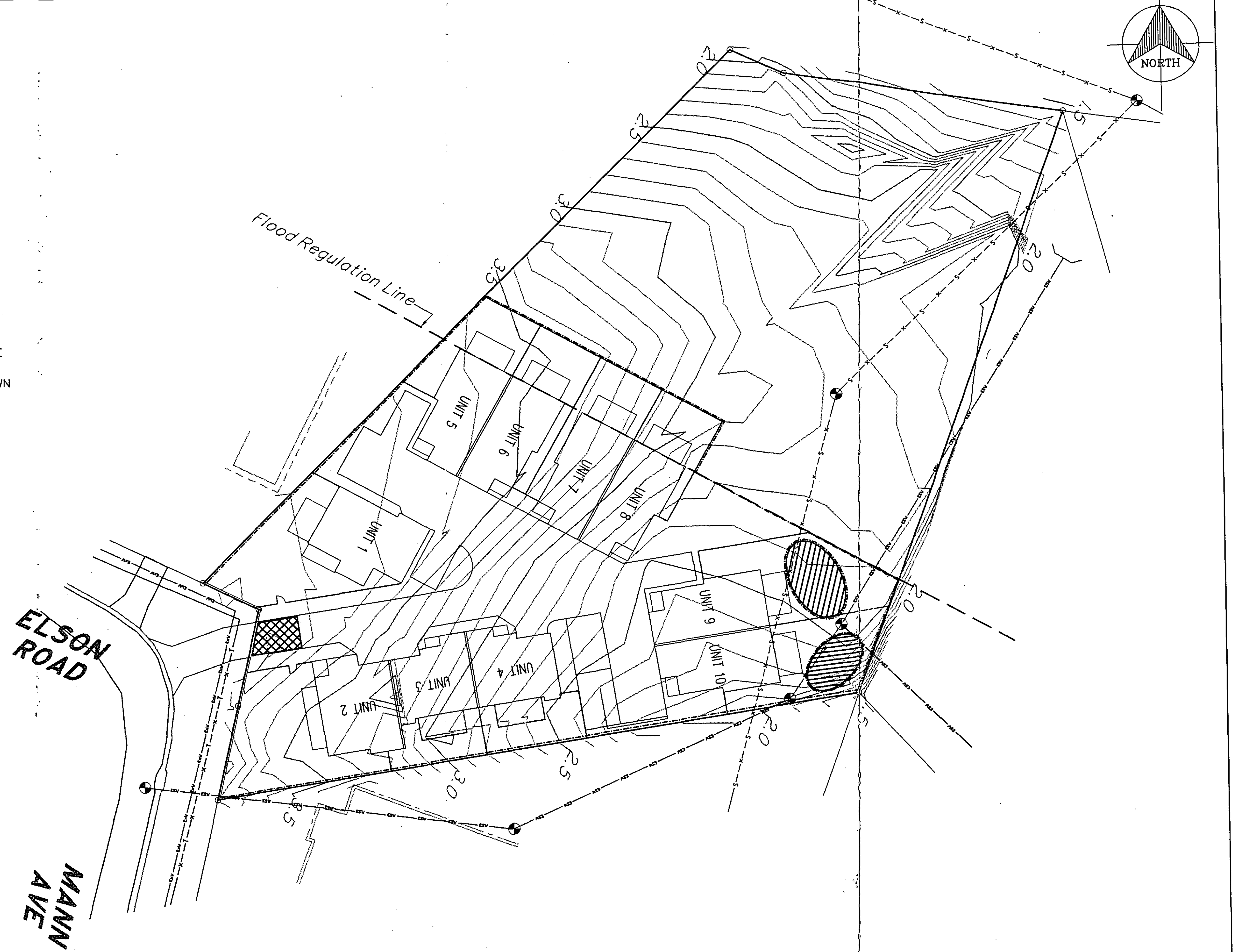
LEGEND

- PROPOSED TOPSOIL STOCKPILE
- PROPOSED SILT FENCE
- PROPOSED VEHICLE SHAKEDOWN



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Drawn: CS
Date: 21/05/07
Authorised: T.SHUERMANN R.P.E.Q. No.3881

Drawing title: CONSTRUCTION PHASE - EROSION AND SEDIMENT CONTROL PLAN

Council File No. --

No in set:

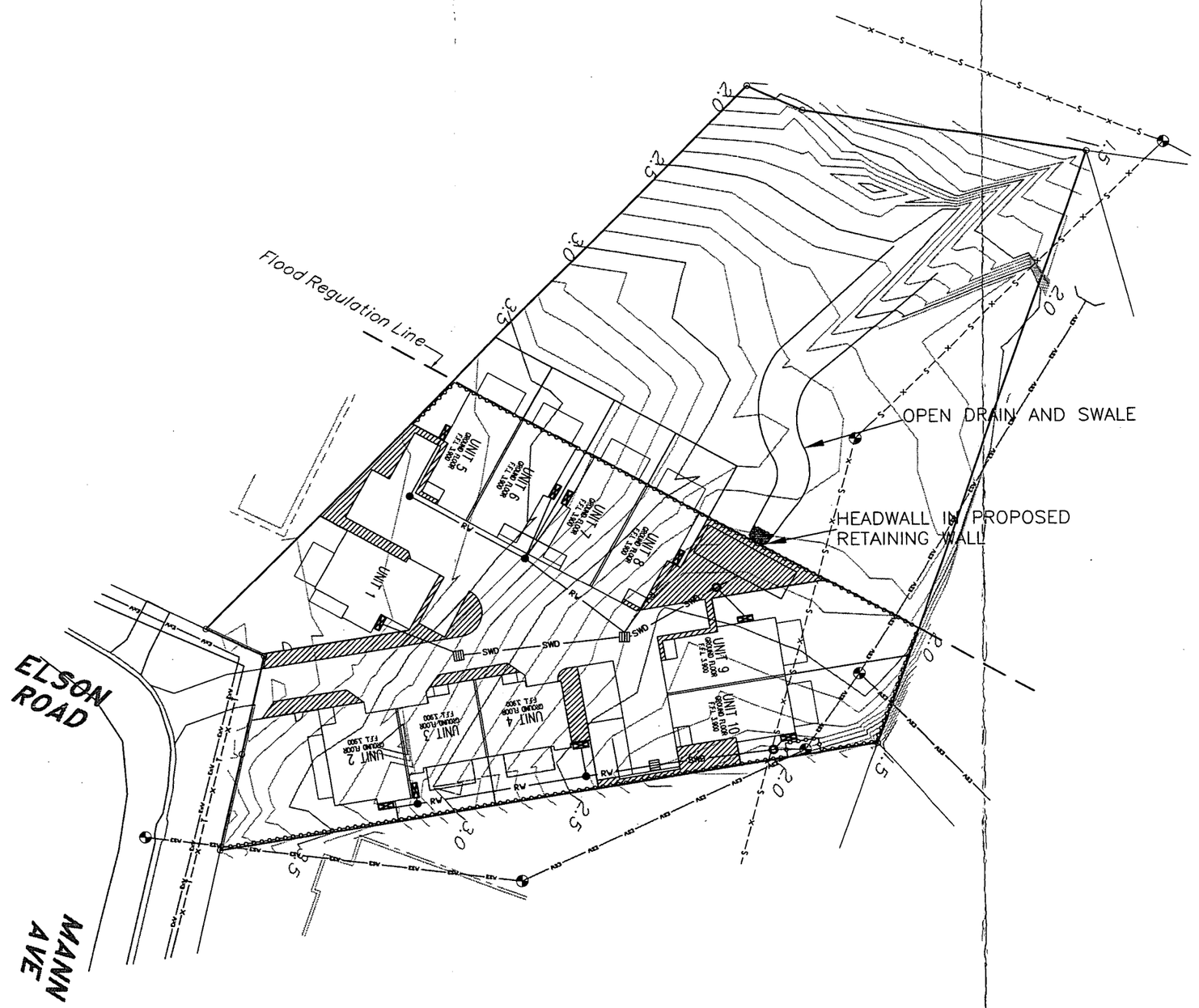
Drawing No: J174-00-FIGURE 3

Revision Code:

NORTH

LEGEND

- SWD —— PROPOSED STORMWATER AND GRATED PIT
- SWD —— PROPOSED STORMWATER AND I.O.S.
- SWD —— PROPOSED STORMWATER AND HEADWALL
- PROPOSED ROOFWATER AND I.O.S.
- PROPOSED RAINWATER TANK
- CEV —— EXISTING STORMWATER MAIN
- PROPOSED RETAINING WALL
- PROPOSED BUFFER STRIPS
- PROPOSED STONE PITCHING



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SCALE 1:500 (A3) 0 5 10

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CLIENT: Mr. PETER TORNABENE

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PROJECT: 31 MANN AVENUE & 14 ELSON ROAD, NORTHGATE

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Designed: CS | Checked: T.S.
Drawn: CS | Date: 21/05/07
Authorised: T.SAUERMANN R.P.E.Q. No.3681

Drawing title: OPERATIONAL PHASE - STORMWATER TREATMENT PLAN

Council File No. —

No in set | Drawing No: J174-00-FIGURE 4 | Revision Code

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Environmental Industrial Noise Assessment for Proposed Residential Development, 31 Mann Avenue and 14 Elson Road, Northgate

conducted for

Urban & Rural

Report No: R07081/D1838/Rev.0/30.05.07

Report prepared for:	Mr Peter Tornabene 85 Charlie Street ZILLMERE QLD 4034 Telephone: 0412 879 136 Fax: 07 3216 2714
Town Planners:	Urban & Rural Unit 3, 32 Billabong Street STAFFORD QLD 4053 Telephone: 07 3354 9720 Fax: 07 3354 9797
Contact:	Mr Paul Hanly Town Planner
Dates of assessment:	Wednesday 16 to Thursday 17 May 2007
Consultants:	David Moore & Associates Pty Ltd 80 Beverley Hill Street (PO Box 120) MOOROOKA QLD 4105 Telephone: 07 3848 7924 Fax: 07 3892 3551

David Moore

David Moore, B App Sc, MAAS

Our reference:	R07081/D1838/Rev.0/30.05.07

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INTRODUCTION

It is proposed to remove the existing structures from the subject site at 31 Mann Avenue and 14 Elson Road (Lot 3 on RP 76215 and Lot 39 on RP 34599) and develop multi unit dwellings on the subject site.

For the proposed multi unit dwellings the only potential noise impact upon the subject site is from the industry to the north-east on the opposite side of Cannery Creek. Vehicle activities on the subject site have the potential to noise impact the adjoining residential uses.

To determine current ambient noise levels a noise assessment was conducted from monitoring location A on the Mann Avenue boundary of the subject site with clear line of sight to the industry on the opposite side of Cannery Creek. This noise assessment included noise from the industry.

This report details the results of these noise level measurements, noise limits, comparison between the measured noise levels and the noise limits and noise control options.

In preparing this report the site plan prepared by Dow Royle, project number C7019, was referenced.

Refer Figure 1 for locality plan and Figure 2 for the proposed site plan and monitoring location.

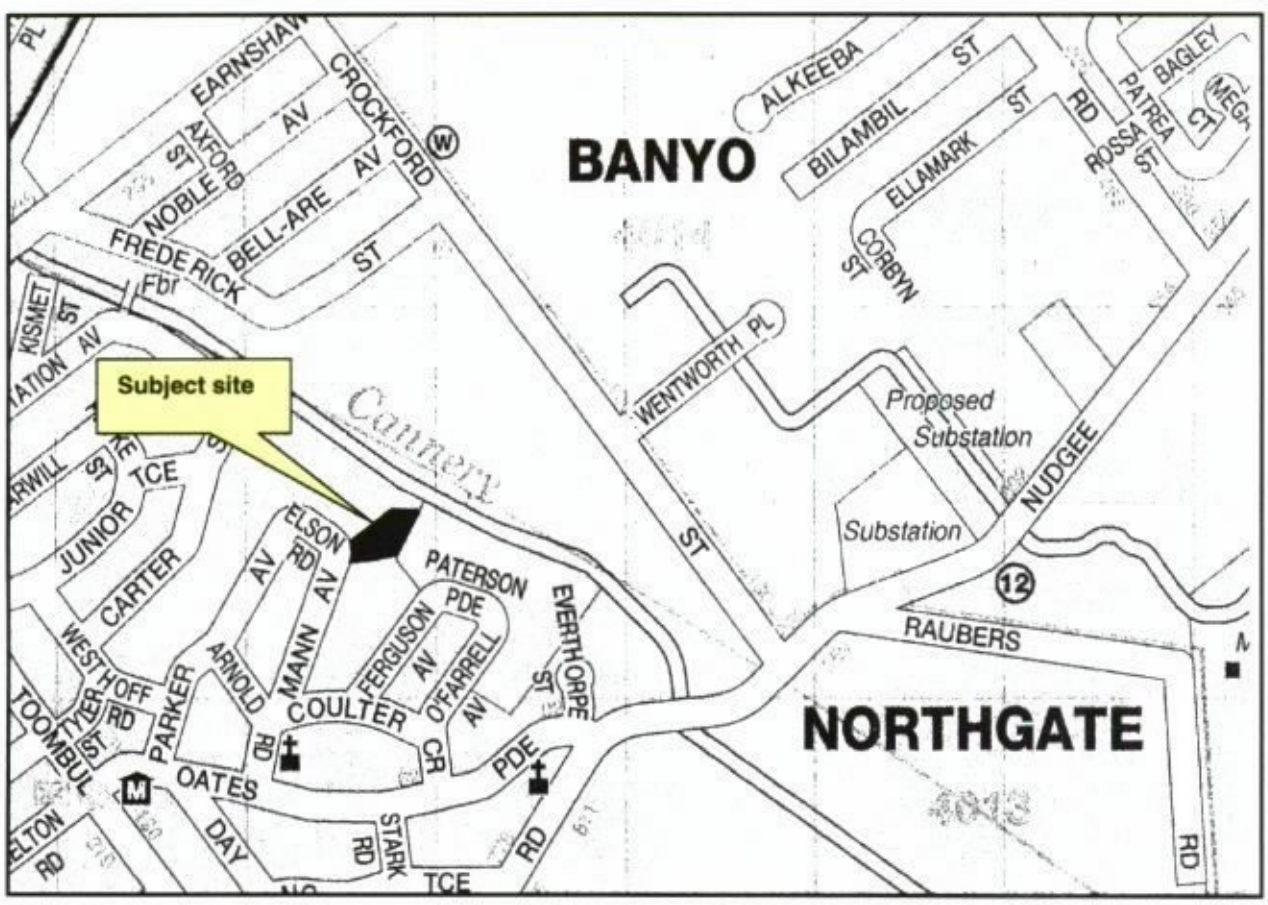

Figure 1
Locality Plan

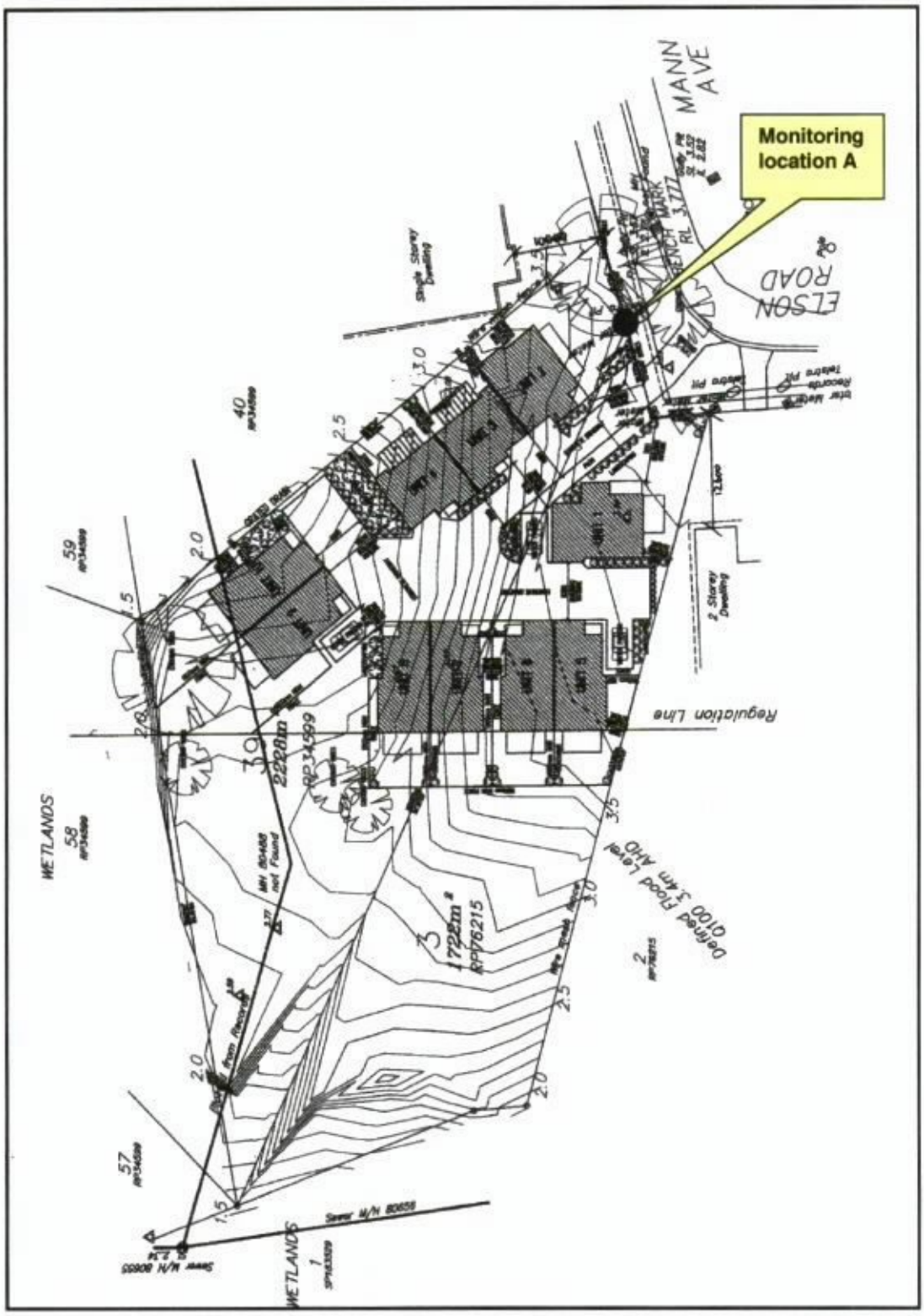

Figure 2
Proposed Site Plan and Monitoring Location A

CITY PLAN 2000

In accordance with City Plan 2000, the following should be noted:

- Subject site: Lot 3 on RP 76215 and Lot 39 on RP 34599
  31 Mann Avenue and 14 Elson Road, Northgate
- City Plan Area: Low Density Residential
- City Plan Use: Multi-unit Dwelling
- Codes: Residential Design – low density, character and low-medium density code.
- Performance Criteria: P20 – Noise from the development must not affect existing or likely future dwellings on adjacent land unreasonably.

  P21 – Exposure of new dwellings to noise must be minimised.
- Acceptable Solutions: A20.1 – Vehicle movement areas are located a minimum of 3 m from any adjoining dwellings, or are provided with acoustic screening to the boundary.

  A20.2 Any airconditioning plant is located toward the centre of the site.

  A20.3 – Communal open space is located a minimum of 3 m from adjoining dwellings or provided with acoustic screening.

  A20.4 – The development complies with the "Noise Impact Assessment Planning Scheme Policy".

  A21.1 – Noise impacts on dwellings located within 150 m of a ... road corridor (suburban routes, motorways and arterial routes) ... are mitigated to comply with the requirements of the "Noise Impact Assessment Planning Scheme Policy".

CRITERIA

Measurements and Calculations

All noise level measurements were conducted in accordance with the following:

- general requirements of the Queensland environmental protection legislation;
- Environmental Protection (Noise) Policy 1997;
- Brisbane City Council City Plan 2000;
- *Noise Measurement Manual*, Queensland Government – Environmental Protection Agency, 3rd Edition, March 2000; and
- Australian Standard AS 1055.1-1997, *Acoustics – Description and measurement of environmental noise, Part 1 – General procedures.*

Noise Limits

Noise from the industry on the opposite side of Cannery Creek is time varying – noise of industrial activities which sound like banging, items being dropped, scrapping noises, horns and reversing beepers. There were no steady state noise sources audible with respect to this industry.

For time varying noise sources, the following extract from the Noise Impact Assessment Planning Scheme Policy should be noted:

> *"... Comparison of like parameters will mostly be applicable to assessment of noise emissions, in which case, an acceptable environmental outcome using this methodology is achieved when the chosen parameter assessing the impact of the development does not exceed the same parameter describing the ambient noise by more than 3 dB(A). ...".*

This criteria applies to time-varying noise, with the following qualifications:

- applies during the daytime and evening;
- requires the source noise to be adjusted for tonality and impulsiveness, as appropriate;
- applies as a measured level, not a component level;
- applies at a distance of at least 3.5 metres from sensitive receptors.

For time varying noise during the night-time (10 pm to 7 am), a different noise limit is applicable. In accordance with the *Noise Impact Assessment Planning Scheme Policy*:

> *"... Research adopted by the World Health Organisation (WHO), concludes that for short duration variable noise sources the onset of sleep disturbance commences at internal L_{max} noise levels of between 45 dB(A) and 50 dB(A)."*

Accordingly, for these noise sources measured internal average maximum noise levels in area categories:

- R1-R3 must not regularly exceed 45 dB(A); and
- R4-R6 must not regularly exceed 50 dB(A).

Due to the location of the subject site adjacent an industrial area, the adopted noise limit is 50 dB(A) L_{Amax}.

AMBIENT NOISE LEVEL RESULTS

Monitoring location A was on the Mann Avenue boundary of the subject site with clear line of sight between the existing residences to the industry. Table 1 details the results of the ambient noise levels at monitoring location A. For details of measurement equipment, equipment settings, calibration and atmospheric conditions for monitoring location A, refer Appendix B. Table 2 details the industrial noises audible during this 24-hour assessment, from 0600 to 1800 hours.

Refer Figure 2 for monitoring location.

Table 1
Results of Ambient Noise Level Measurements, Monitoring Location A, Mann Avenue, Northgate, Wednesday 16 and Thursday 17 May 2007

Day	Date	Time Period	Ambient Noise Level, dB(A)					
			L_{Aeq}		L_{A1}		L_{A10}	
			Range	Average	Range	Average	Range	Average
Wednesday	16.05.07	Evening	45.2-51.4	47.9	50.4-61.8	56.6	46.5-54.9	49.3
Wednesday/ Thursday	16/ 17.05.07	Night-time	43.0-54.9	49.0	47.5-64.3	56.7	44.9-57.2	50.5
Thursday	17.05.07	Daytime	45.5-62.1	52.8	49.7-76.2	65.1	46.9-61.5	53.7

From Table 1, the following average ambient noise levels should be noted:

- average L_{Aeq}
  - daytime: 53 dB(A)
  - evening: 48 dB(A)
  - night-time: 49 dB(A)
- average L_{A1}
  - daytime: 65 dB(A)
  - evening: 57 dB(A)
  - night-time: 57 dB(A)
- average L_{A10}
  - daytime: 54 dB(A)
  - evening: 49 dB(A)
  - night-time: 51 dB(A)

INDUSTRIAL NOISE LEVEL IMPACT

During the above sampling maximum noise levels from the industry on the opposite side of Cannery Creek were noted for a 12-hour period. These noises' comprise clangs, bangs, engine revving, reversing beeper, scraping noise, etc and for each one-hour daytime period the maximum noise levels are detailed in Table 2.

Table 2
Maximum Industry Noise, Monitoring Location A, Wednesday 16 and Thursday 17 May 2007

Time Period	Maximum Industry Noise Levels, dB(A)
1600-1700	47.9, 47.6, 47.7, 51.1, 49.5, 48.7, 54.1, 55.6, 46.1, 49.2, 51.2, 51.1, 50.4
1700-1800	52.2, 48.7
0600-0700	48.4, 47.6, 45.6, 48.7, 47.1, 46.2, 50.4, 52.2
0700-0800	54.3, 48.9, 48.1, 51.1, 49.8, 48.5, 53.2
0800-0900	52.1, 49.7, 53.2, 48.9, 51.3, 54.8, 47.6, 48.8, 54.1, 51.6, 53.2, 51.5
0900-1000	53.1, 52.6, 52.8, 54.5, 47.1, 53.3, 51.1, 46.2, 48.9, 50.7, 50.1, 55.0, 52.3, 50.0, 49.3, 47.1
1000-1100	53.4, 49.1, 48.6, 52.8, 48.7, 50.1, 52.1, 49.0, 53.4, 49.6, 51.5, 56.2, 51.4, 55.9,

Table 2 Maximum Industry Noise, Monitoring Location A, Wednesday 16 and Thursday 17 May 2007	
Time Period	Maximum Industry Noise Levels, dB(A)
	49.2, 51.3, 54.7, 48.2, 49.3, 48.1
1100-1200	52.6, 54.6, 57.6, 58.8, 56.7, 57.2, 52.2, 52.4, 49.0, 48.8, 49.7, 53.2
1200-1300	50.1, 52.2, 53.4, 48.9, 51.6, 52.2, 52.4, 47.1, 50.1, 49.0, 48.8, 57.2, 52.1, 54.6, 56.1
1300-1400	51.8, 54.9, 55.2, 58.2, 62.1, 54.6, 54.3, 53.3, 52.6, 54.8, 62.7, 55.3, 55.0, 54.6, 64.8, 55.4, 57.6, 58.8, 50.6, 56.7, 57.2
1400-1500	51.3, 58.4, 55.2, 51.9, 61.2, 55.8, 50.7, 62.3, 54.6, 55.5, 56.9, 49.1, 52.2, 46.2, 57.1, 48.8, 50.1, 58.1, 63.2, 55.7, 55.1
1500-1600	56.2, 47.4, 51.0, 51.6, 51.8, 57.2, 52.3, 52.4, 48.1, 56.0, 51.3, 48.1, 55.7, 56.2

From Table 2 the overall average of the maximum noise levels from industry is 52.4 dB(A) $L_{Amax,T}$. During the same time the total ambient, including industry, average of the maximum noise level (assumed to be the L_{A1}) noise level, was 65.1 dB(A). Therefore, for the daytime period the ambient average of the maximum noise level was 65.1 – 52.4 = 64.9 dB(A) $L_{Amax,T}$.

The industrial noise must be adjusted for tonality and/or impulsiveness. Due to the nature of the industrial noise the most appropriate adjustment would be + 5 dB(A), resulting in an industrial noise level of 52.4 + 5 = 57.4 dB(A) $L_{Amax,adj,T}$.

After 1800 hours there was no noise from the industry audible.

At monitoring location A the noise levels were:

- industrial noise: 57.4 dB(A) $L_{Amax,adj,T}$; and
- ambient noise: 64.9 dB(A) $L_{Amax,T}$.

From the closest proposed part of the multi unit dwelling to the closest part of the industrial area on the opposite side of Cannery Creek is a separation distance of approximately 110 metres, whilst from monitoring location A this closest part of the industrial area is approximately 155 metres distant. This difference in separation distance will result in an increase in industrial noise of 3 dB(A). Therefore, at the closest part of the proposed multi unit dwelling to the industry industrial noise levels will be 57.4 + 3 = 60.4 dB(A) $L_{Amax,adj,T}$ compared to an ambient noise level alone of 64.9 dB(A) $L_{Amax,T}$.

In accordance with City Plan 2000 the noise limit for this type of noise is that the adjusted source noise level and ambient noise level combined should not exceed the ambient noise level by more than 3 dB(A) for the same parameter. This is equivalent to the adjusted source noise level not to exceed the ambient noise level, for the same parameter.

From the measured ambient noise levels at Location A, the noise limit for time varying noise sources would be:

- daytime: 65 dB(A) $L_{A1,T}$.

The daytime noise limit is complied with by the industry on the opposite side of Cannery Creek, with no noise control measures in place. Therefore, for industrial noise for the daytime period, no noise control measures are required.

ON-SITE VEHICLE NOISE LEVEL IMPACT

The only on-site noise with a potential to noise impact the adjoining residences is vehicle activities on the subject site and doors closing and engines starting in the visitor carparking space. Based on previous noise level measurements conducted by the consultant, vehicle activity noise levels are:

- car driving on site: 50 dB(A) $L_{A10,adj,T}$ @ 8 m;
- car door closing: 52 dB(A) $L_{A10,adj,T}$ @ 30 m;
- car engine starting: 52 dB(A) $L_{A10,adj,T}$ @ 30 m.

All of the above noise sources are time-varying. In accordance with City Plan 2000 the noise limit for this type of noise is that the adjusted source noise level and ambient noise level combined should not exceed the ambient noise level by more than 3 dB(A) for the same parameter. This is equivalent to the adjusted source noise level not to exceed the ambient noise level, for the same parameter.

From the measured ambient noise levels at Location A, the noise limits for on-site vehicle activities would be:

- daytime: 54 dB(A) $L_{A10,T}$;
- evening: 49 dB(A) $L_{A10,T}$.

At the closest adjoining residences – residence on each side of the subject site – on-site vehicle activity noise levels would be:

Closest Residence to West

- car driving in driveway: 50 dB(A) $L_{A10,adj,T}$ @ 8 m – 6 (increased separation distance) = 44 dB(A) $L_{A10,adj,T}$;
- car engine starting: 52 dB(A) $L_{A10,adj,T}$ @ 30 m + 9 (reduced separation distance) – 11 (acoustic barrier) = 50 dB(A) $L_{A10,adj,T}$;
- car door closing: same as car engine starting.

Closest Residence to South

- car driving in driveway: 50 dB(A) $L_{A10,adj,T}$ @ 8 m – 6 (increased separation distance) = 44 dB(A) $L_{A10,adj,T}$.

All of the above on-site vehicle activities comply with the daytime noise limits at the closest residences – residences on each side of the subject site, provided an acoustic barrier is located as per Figure 3, 2.1 metres high. The evening noise limit is exceeded by 1 dB(A) at the closest residence to the west by the noise of car engines starting and car doors closing. Subjectively a change in noise level of 1 dB(A) is not discernible to the human ear and, therefore, the evening noise limit at this residence is effectively complied with.

This acoustic barrier must be 2.1 metres high relative to existing ground levels, be continuous and gap free for its complete length and have a minimum surface area density of 10 kg/m^2.

Examples of suitable materials of construction include:

- reinforced concrete;
- concrete block;
- minimum 7.5 mm thick fibrous cement sheet;
- hebel panelling;
- brick;
- sheet metal minimum 2 mm thick;

- earth mound;
- lapped timber palings, for example, kiln dried softwood palings at least 15 mm thick and overlapped a minimum 25 mm or at least 19 mm thick and overlapped a minimum 15 mm;
- any combination of the above.

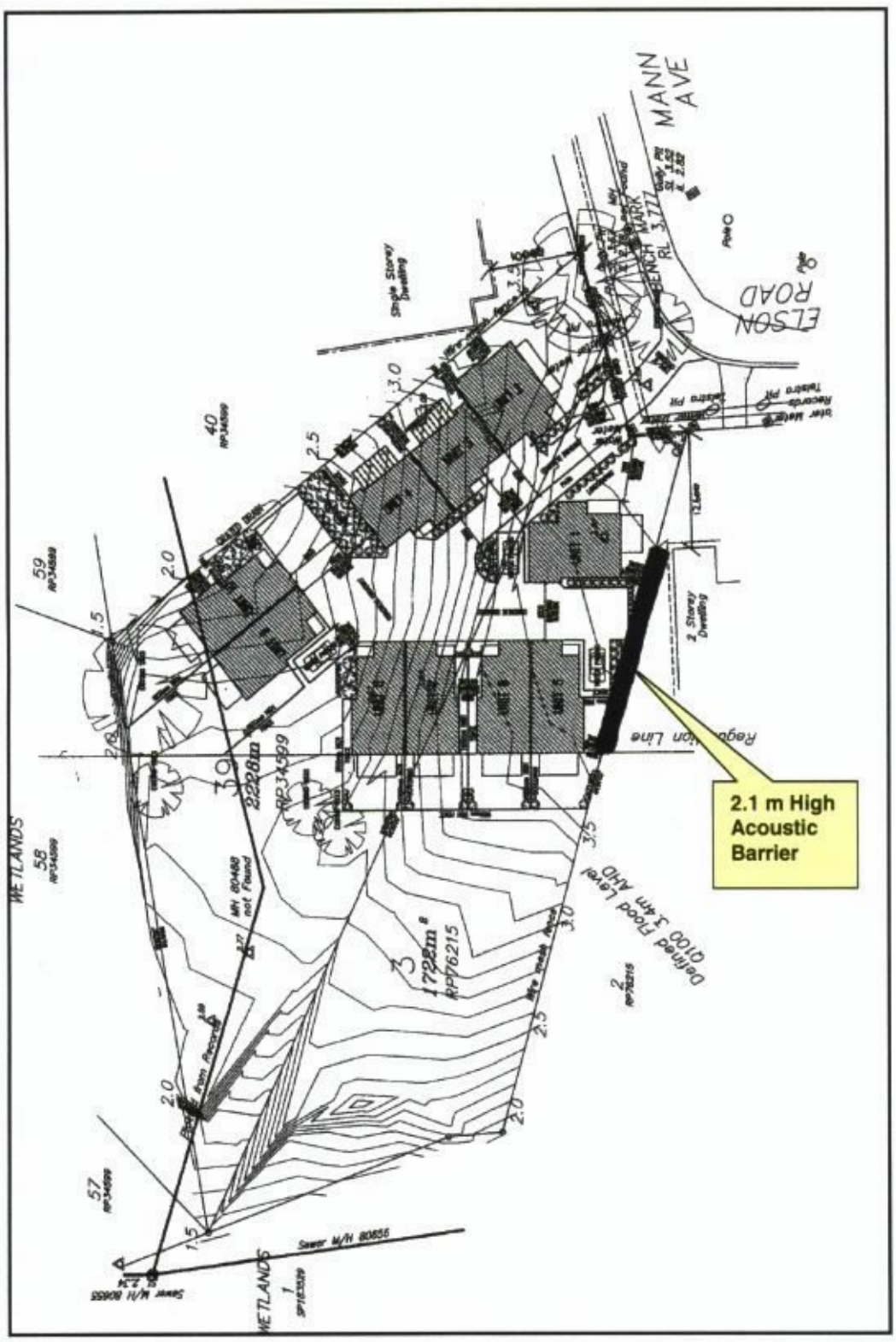

Figure 3
Location of 2.1 m High Acoustic Barrier (Bold Line)

CONCLUSIONS

It is proposed to remove the existing structures from the subject site at 31 Mann Avenue and 14 Elson Road (Lot 3 on RP 76215 and Lot 39 on RP 34599) and develop multi unit dwellings on the subject site.

For the proposed multi unit dwellings the only potential noise impact upon the subject site is from the industry to the north-east on the opposite side of Cannery Creek. Vehicle activities on the subject site have the potential to noise impact the adjoining residential uses.

To determine current ambient noise levels a noise assessment was conducted from monitoring location A on the Mann Avenue boundary of the subject site with clear line of sight to the industry on the opposite side of Cannery Creek. This noise assessment included noise from the industry. From the results of the 24-hour ambient noise assessment and daytime specific industrial noise levels at monitoring location A, daytime ambient noise levels excluding industrial noise were calculated and the adjusted (tonality and/or impulsiveness) industrial noise sources compares to the daytime ambient noise level relative to the closest facade of the proposed residential units to this industry. At the closest future residential facade industrial noise complies with the daytime noise limit. As this industry did not continue into the evening time period, no noise control measures are required for industrial noise, for the daytime operation of this industry.

For on-site vehicle activities, these comply with the noise limits at the closest adjoining residence to the south, but require a 2.1 metre high acoustic barrier located as per Figure 3 to comply/effectively comply with the noise limits at the closest residence to the west.

RECOMMENDATION

It is recommended that, from an environmental noise perspective, the proposed residential development be approved, provided the noise control measures detailed in this report are incorporated into the development.

APPENDIX A: NOISE LEVEL MEASUREMENT EQUIPMENT

Measurement Equipment

The following equipment was used to conduct the ambient noise level studies at Monitoring Locations A and B:

- Bruel and Kjaer Type 2260I Modular Precision Sound Analyzer – Observer – Serial No. 2409371, with Type BZ 7220 Software and Prepolarised free-field ½" microphone, Type 4189, Serial No. 2395445;
- Bruel and Kjaer Type 3592 outdoor microphone kit, including Type UA1404 outdoor microphone;
- Bruel and Kjaer Type AO 0442 ten metre microphone extension cable; and
- Bruel and Kjaer Type 4231 Sound Level Calibrator, Serial No. 2292746.

All of the above equipment is Type 1 in accordance with the requirements of Australian Standard AS 1259-1990, *Acoustics – Sound Level Meters*, as required by Australian Standard AS 1055.1-1997.

Measurement Equipment Settings

The above equipment was used with the following settings:

- Detector: RMS
- Time Weighting: FAST
- Frequency Weighting: A
- Sound Incidence: FRONTAL
- Microphone sensitivity: -26.6 dB
- Range: 20-100 dB.

Calibration

The sound level meter was calibrated to the required value of 93.8 dB at 1000 Hz immediately before and after the noise level measurements were conducted. At no time was an adjustment of more than ±0.5 dB required. This complies with the requirements of the Australian Standard.

Monitoring Location

Monitoring Location A was on the Mann Avenue boundary of the subject site with the microphone elevated 4.5 metres, with clear line of sight to the industry on the opposite side of Cannery Creek between the existing residences. Refer Figure 2 for further details of Monitoring Location A.

Atmospheric Conditions

Throughout the ambient noise level studies atmospheric conditions complied with the requirements of the Australian Standard.

APPENDIX B: RESULTS OF TRAFFIC NOISE LEVELS, LOCATION A

Instrument:		2260
Application:		BZ7219 version 1.1
Start Time:		16/05/2007 04:29:08 PM
End Time:		17/05/2007 04:30:07 PM
Elapsed Time:		24:00:59
Bandwidth:		1/1 Octave
Peaks Over:		140.0 dB
Range:		20.6-100.6 dB
	Time	Frequency
Broad-band measurements:	S F I	A C
Broad-band statistics:	F	A
Octave measurements:	F	L
	Logging	
Log Rate:	0:15:00	
Broadband Parameters:	All	
Spectrum Parameters:	Nothing	
Instrument Serial Number:		2409371
Microphone Serial Number:		2395445
Input:		Microphone
Windscreen Correction:		None
S. I. Correction:		Frontal
Calibration Time:		31/03/2007 09:48:43 AM
Calibration Level:		94.0 dB
Sensitivity:		-26.6 dB
ZF0023:		Not used

Start date	Start time	LAeq	LAFmax	LAFmin	LAF1	LAF10	LAF50	LAF90	LAF99
16/05/2007	04:45:00 PM	48.9	61.7	41.6	57.2	51.9	46.8	44.4	43.0
16/05/2007	05:00:00 PM	51.5	64.8	40.1	59.9	55.6	48.1	44.1	41.9
16/05/2007	05:15:00 PM	46.5	63.3	40.7	56.7	47.7	44.3	42.7	41.8
16/05/2007	05:30:00 PM	46.4	67.4	41.7	53.1	48.0	45.3	43.8	42.9
16/05/2007	05:45:00 PM	53.7	79.3	42.2	65.0	52.5	47.5	45.5	44.1
16/05/2007	06:00:00 PM	49.0	66.7	43.2	57.4	49.9	47.2	45.6	44.5
16/05/2007	06:15:00 PM	46.4	63.8	41.2	52.1	47.4	45.1	43.6	42.6
16/05/2007	06:30:00 PM	50.3	78.0	41.6	55.4	48.5	45.4	43.9	42.8
16/05/2007	06:45:00 PM	45.3	60.3	39.8	54.2	46.5	43.7	42.0	40.7
16/05/2007	07:00:00 PM	46.3	66.5	38.7	56.4	46.8	43.4	41.3	39.9
16/05/2007	07:15:00 PM	45.9	61.7	39.2	54.9	47.5	43.8	41.6	40.4
16/05/2007	07:30:00 PM	45.7	54.6	39.6	51.4	48.2	44.6	42.3	41.1
16/05/2007	07:45:00 PM	49.1	72.2	38.4	60.1	50.4	45.8	42.8	40.2
16/05/2007	08:00:00 PM	45.8	55.1	38.5	52.1	48.5	44.7	42.0	39.9
16/05/2007	08:15:00 PM	49.4	72.8	40.6	58.7	54.9	45.2	43.0	41.9
16/05/2007	08:30:00 PM	46.0	55.4	41.5	51.7	48.0	45.0	43.3	42.4
16/05/2007	08:45:00 PM	51.4	76.8	41.4	60.2	48.8	45.9	43.8	42.6
16/05/2007	09:00:00 PM	46.1	57.9	39.6	51.1	47.9	45.5	43.3	40.7
16/05/2007	09:15:00 PM	45.2	56.1	40.4	50.4	47.2	44.4	42.6	41.6
16/05/2007	09:30:00 PM	46.8	56.6	41.9	52.4	49.1	45.8	43.8	42.8
16/05/2007	09:45:00 PM	49.9	69.4	41.8	61.8	50.0	46.5	43.8	42.6
16/05/2007	10:00:00 PM	46.7	56.8	42.3	52.0	48.7	45.9	44.3	43.3
16/05/2007	10:15:00 PM	49.4	73.3	42.2	58.9	49.6	46.5	44.0	43.0
16/05/2007	10:30:00 PM	44.6	60.5	40.6	50.6	45.8	43.7	42.2	41.4
16/05/2007	10:45:00 PM	44.3	57.2	40.1	49.3	46.2	43.5	41.8	40.9
16/05/2007	11:00:00 PM	44.1	54.1	40.0	50.2	45.5	43.4	41.9	40.9
16/05/2007	11:15:00 PM	44.1	55.6	39.6	49.8	45.9	43.1	41.7	40.7
16/05/2007	11:30:00 PM	44.0	56.1	40.0	48.1	45.4	43.5	42.2	41.3
16/05/2007	11:45:00 PM	47.9	64.0	39.4	59.8	48.8	43.8	41.6	40.3
17/05/2007	12:00:00 AM	46.1	64.2	39.6	55.6	47.6	43.7	41.8	40.7
17/05/2007	12:15:00 AM	44.4	57.6	40.0	50.5	46.3	43.4	41.9	40.9
17/05/2007	12:30:00 AM	44.3	61.0	38.2	51.5	46.3	42.6	40.9	40.0
17/05/2007	12:45:00 AM	43.0	64.2	36.7	48.4	44.9	42.4	39.5	37.5
17/05/2007	01:00:00 AM	46.1	62.1	39.4	57.1	47.1	43.8	41.8	40.7
17/05/2007	01:15:00 AM	43.9	68.6	39.5	47.5	45.3	42.4	40.7	40.0
17/05/2007	01:30:00 AM	44.8	61.3	39.2	52.1	46.7	43.4	41.1	40.1
17/05/2007	01:45:00 AM	44.4	60.2	40.3	49.0	46.3	43.8	42.2	41.2
17/05/2007	02:00:00 AM	45.5	59.2	41.8	49.9	47.1	44.9	43.5	42.8
17/05/2007	02:15:00 AM	46.7	54.9	41.3	50.6	48.8	46.3	43.7	42.2
17/05/2007	02:30:00 AM	45.5	56.1	40.6	50.5	47.3	44.9	42.7	41.5
17/05/2007	02:45:00 AM	50.2	64.8	40.0	60.3	55.3	44.1	42.3	41.3
17/05/2007	03:00:00 AM	44.7	54.5	40.4	49.2	46.7	44.0	42.3	41.4
17/05/2007	03:15:00 AM	43.5	51.5	38.5	48.5	45.3	42.9	41.4	40.2
17/05/2007	03:30:00 AM	45.0	54.0	40.5	49.5	46.6	44.5	43.0	41.4
17/05/2007	03:45:00 AM	43.7	49.8	39.9	47.8	45.5	43.2	41.6	40.7

Start date	Start time	LAeq	LAFmax	LAFmin	LAF1	LAF10	LAF50	LAF90	LAF99
17/05/2007	04:00:00 AM	46.6	60.8	41.1	51.7	48.7	46.0	43.8	42.1
17/05/2007	04:15:00 AM	52.6	73.5	43.4	64.3	49.9	47.4	45.8	44.7
17/05/2007	04:30:00 AM	48.7	57.5	44.8	52.0	50.1	48.4	46.5	45.6
17/05/2007	04:45:00 AM	50.1	61.3	45.9	58.2	51.1	49.0	47.8	46.9
17/05/2007	05:00:00 AM	51.4	66.3	47.0	60.5	52.4	50.1	48.8	47.9
17/05/2007	05:15:00 AM	51.7	58.4	48.5	55.5	53.1	51.3	50.2	49.5
17/05/2007	05:30:00 AM	52.4	68.5	48.4	57.6	53.8	51.7	50.1	49.3
17/05/2007	05:45:00 AM	52.3	62.0	49.1	57.1	53.4	51.9	50.7	49.9
17/05/2007	06:00:00 AM	53.4	71.6	48.5	62.9	54.4	51.9	50.4	49.4
17/05/2007	06:15:00 AM	54.9	70.0	49.6	62.0	57.2	53.5	51.8	50.8
17/05/2007	06:30:00 AM	53.6	65.0	50.0	60.4	54.8	52.9	51.7	50.8
17/05/2007	06:45:00 AM	52.0	72.8	48.8	56.4	53.0	51.3	50.2	49.5
17/05/2007	07:00:00 AM	52.9	75.1	47.8	60.9	54.7	51.0	49.5	48.7
17/05/2007	07:15:00 AM	55.6	71.9	46.5	67.8	57.7	50.2	48.5	47.4
17/05/2007	07:30:00 AM	53.5	74.2	44.1	66.9	52.1	47.6	46.0	45.1
17/05/2007	07:45:00 AM	49.9	71.9	42.2	59.0	52.6	46.7	44.7	43.5
17/05/2007	08:00:00 AM	49.1	68.6	41.2	59.0	50.6	46.0	43.6	42.3
17/05/2007	08:15:00 AM	49.8	66.4	39.9	60.9	52.1	44.4	42.2	41.1
17/05/2007	08:30:00 AM	45.9	61.1	39.9	54.6	48.8	43.5	41.5	40.6
17/05/2007	08:45:00 AM	47.5	68.6	40.6	57.6	49.3	44.3	42.6	41.6
17/05/2007	09:00:00 AM	48.3	68.5	40.3	58.9	50.5	44.6	42.3	41.2
17/05/2007	09:15:00 AM	48.5	67.9	40.4	59.7	50.8	43.7	42.1	41.2
17/05/2007	09:30:00 AM	48.4	69.1	39.8	58.6	51.0	44.5	42.1	41.0
17/05/2007	09:45:00 AM	52.0	77.6	39.3	62.0	50.0	45.2	42.3	40.5
17/05/2007	10:00:00 AM	47.1	67.1	38.1	57.3	48.6	43.5	40.4	39.0
17/05/2007	10:15:00 AM	50.9	68.4	40.5	63.5	52.4	45.4	43.1	41.7
17/05/2007	10:30:00 AM	50.2	73.1	42.0	61.7	51.2	46.2	44.2	42.9
17/05/2007	10:45:00 AM	48.7	75.3	41.7	57.4	49.0	45.5	43.9	42.7
17/05/2007	11:00:00 AM	53.4	74.7	41.5	63.1	56.9	48.5	44.4	42.9
17/05/2007	11:15:00 AM	49.9	65.4	41.8	59.5	53.3	46.3	44.0	43.0
17/05/2007	11:30:00 AM	57.6	77.6	41.4	71.1	57.4	46.5	43.8	42.8
17/05/2007	11:45:00 AM	50.9	68.6	42.0	60.7	53.9	47.5	44.7	43.3
17/05/2007	12:00:00 PM	62.1	85.0	43.3	76.2	61.5	47.3	45.3	44.3
17/05/2007	12:15:00 PM	49.3	69.8	42.3	57.3	52.1	46.7	44.3	43.1
17/05/2007	12:30:00 PM	54.1	74.5	42.2	67.8	53.7	46.0	44.2	43.1
17/05/2007	12:45:00 PM	45.5	61.2	41.3	49.7	46.9	45.0	43.6	42.6
17/05/2007	01:00:00 PM	47.0	63.2	41.3	54.7	48.6	45.5	43.6	42.2
17/05/2007	01:15:00 PM	52.8	82.3	42.9	59.0	52.4	47.0	45.0	44.0
17/05/2007	01:30:00 PM	50.0	68.1	43.1	60.0	51.8	47.6	45.1	44.0
17/05/2007	01:45:00 PM	50.3	63.1	43.2	59.7	53.1	47.7	45.5	44.4
17/05/2007	02:00:00 PM	49.3	67.7	42.5	59.3	50.9	46.5	44.6	43.6
17/05/2007	02:15:00 PM	50.3	72.3	41.0	61.6	51.3	46.8	44.6	42.6
17/05/2007	02:30:00 PM	51.9	72.2	42.2	64.4	52.7	46.0	44.1	43.1
17/05/2007	02:45:00 PM	50.8	72.9	41.6	60.6	54.3	46.0	43.7	42.7
17/05/2007	03:00:00 PM	48.2	64.9	42.1	56.6	51.0	46.0	43.9	42.9
17/05/2007	03:15:00 PM	58.2	77.1	41.8	71.5	58.2	47.5	44.5	43.2

Start date	Start time	LAeq	LAFmax	LAFmin	LAF1	LAF10	LAF50	LAF90	LAF99
17/05/2007	03:30:00 PM	54.5	77.3	41.7	67.7	54.4	46.2	43.8	42.9
17/05/2007	03:45:00 PM	53.7	75.1	41.0	65.8	54.5	45.9	43.8	42.3
17/05/2007	04:00:00 PM	53.5	77.6	42.3	66.0	52.6	46.2	44.5	43.6
17/05/2007	04:15:00 PM	54.9	78.5	42.4	67.7	54.6	46.2	44.3	43.3
17/05/2007	04:30:00 PM	52.8	69.6	41.8	63.2	56.4	47.8	44.2	43.0