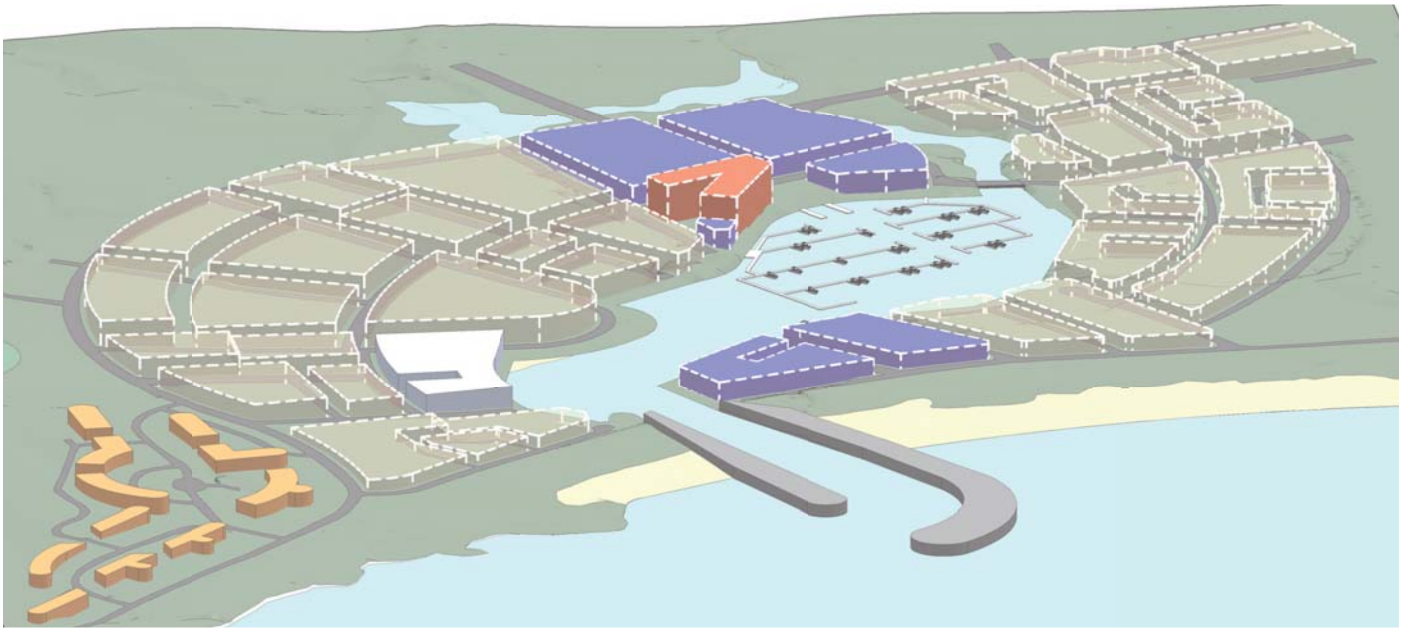

Shell Cove
Boat Harbour Precinct

Concept Plan Application
and Environmental Assessment
Appendix K - Odour Control

prepared by LFA (Pacific) Pty Ltd

date February 2010

CLIENTS | PEOPLE | PERFORMANCE

20 May 2009

Glenn Colquhoun
Australand Corporation Pty Ltd
PO Box A148
SHELLHARBOUR NSW 2529

Our ref: 21/17414/149723
Your ref:

Dear Glenn

Shell Cove Boatharbour Precinct Sewerage System
Odour Control

As requested, we outline the typical odour control measures that are applied to sewerage infrastructure in accordance with Sydney Water's requirements. These odour control measures will be provided as part of the sewerage infrastructure constructed to serve the Boatharbour Precinct in Australand's Shell Cove development.

1 Shell Cove Development

Shell Cove is a residential development located immediately south of the township of Shellharbour and approximately 17 km south of Wollongong (ref. UBD (Wollongong) Map 54 D11). The development is primarily residential of varying densities, but also includes commercial and retail areas, a primary school, a golf course and the Boatharbour Precinct.

Development is planned to proceed over a number of years having commenced in 1996.

2 Shell Cove's Sewerage System

2.1 Existing System

The Shell Cove development is serviced by a network of reticulation mains, trunk gravity mains, and a number of sewage pumping stations (SPS's) and their associated pressure (rising) mains. All sewage collected in the Shell Cove development site is pumped to the existing Shellharbour sewerage network that drains to the Shellharbour Sewerage Treatment Plant (STP) for treatment.

There are two (2) existing SPS's in Shell Cove, SP1101 and SP1145. SP1101 collects sewage from its natural gravity catchment and also receives flows from SP1145. SP1101 pumps the sewage to the existing Shellharbour sewerage network eventually draining to the Shellharbour STP.

2.2 The Boatharbour Precinct

The Boatharbour Precinct will be serviced by a reticulation system that collects sewage and conveys it to a number of proposed SPS's. These SPS's will transfer the sewage to the existing SPS SP1101 (refer Section 2.1).

3 Sewerage Infrastructure Components

3.1 Sewer Reticulation and Trunk Mains

Individual properties are connected to the sewer reticulation mains operating under gravity and comprise of varying sized pipelines laid at determined grades. The reticulation mains are connected to trunk carriers. The sewage flow rates travelling through the pipes determine the size and grading.

Maintenance hole (MH) structures located along the gravity mains provide access to the pipelines for maintenance purposes. These are generally located at a maximum spacing of 120m and at changes of direction. The MH's have sealed airtight covers.

3.2 Sewage Pumping Stations

Shell Cove is not located within the Shellharbour STP's natural gravity catchment. Therefore SPS's are required to pump sewage from the development to the STP. An SPS is required within each natural gravity catchment within the development site to collect and transfer sewage from that catchment.

Sewer from gravity mains eventually drain to a single MH structure located within the SPS, known as the Inlet Maintenance Hole (IMH). The major hydraulic structures that comprise the SPS are connected to the IMH; including the wet well, separate emergency storage structure (if applicable) and emergency relief (overflow) system.

Under normal operation, sewage is collected within the SPS's wet well. The wet well contains submersible pumps that pump the sewage through the outgoing pressure main. The SPS commences pumping when the sewage reaches a pre-determined level within the wet well.

Emergency storage is provided to cater for instances where normal operation of the SPS is compromised (e.g. power failure). It is designed such that sufficient time is provided for Sydney Water to attend to the SPS and apply contingency plans to address the SPS's failure.

Both the wet well and the emergency storage structures are underground concrete tanks with sealed airtight covers.

3.3 Pressure Mains

The submersible pumps within the SPS pump the sewage through the pressure main via the discharge pipework and a system of valves contained within a valve chamber located at the SPS site. The pressure main itself is laid at a typical depth and discharges at an appropriate receiving MH.

4 Odour Control Measures

Odour in sewerage systems is generally related to the levels of septicity experienced within the system. Odour control measures are therefore designed to reduce septicity and the associated generation of hydrogen sulphide (H_2S) gas, which is the typical cause of odour problem in sewerage systems.

Septic conditions are a result of anaerobic bacterial activity within the sewage in the absence of oxygen and/or nitrate. H_2S gas has a very low odour threshold level and small concentrations can be smelt in a wide radius from sewerage systems.

Sydney Water requires the following parameters to be met in the design of SPS's and associated pressure mains:

- H_2S gas concentration to be equal or less than 10 ppm;
- Total dissolved sulphide in sewage to be less than 0.5 mg/L; and
- pH of sewage to be above 6.8.

Although the "Technical framework for Assessment and management of odour form stationary sources in NSW" (DEC, Nov 2006) is acknowledged, discussions with Sydney Water have confirmed that they operate under an existing licence and any additions to their system need to comply with these licence conditions. The following sections outline the typical odour control measures that are incorporated into the design of their sewerage infrastructure in order to comply with the EPA licence.

4.1 Sewer Gravity Mains

The vertical alignment and therefore grade of the sewer gravity mains are determined by minimum and maximum grades for slime control and septicity. The maximum grade is implemented to minimise the amount of turbulence, which exacerbates H_2S generation. Sydney Water's standards dictates that the maximum grade of the branch and trunk sewer gravity mains shall be that for which the velocity of flow does not exceed 3.0 m/s for the sewer flowing full. This maximum velocity applies during half full flow for the reticulation sewers.

To reduce anaerobic conditions, the sewer gravity system is well ventilated by releasing sewer gases to the atmosphere in a controlled manner and introducing fresh air into the system. Gravity reticulation sewers are ventilated through property connection sewers and domestic waste pipe stacks. Ventilation via a series of alternately sited induct and educt vents is applied to the branch and trunk sewers.

Educt vents are provided via installation of vent shafts, with the following guidelines provided by Sydney Water:

- One vent shaft to be provided for every 400 lineal metres of sewer;
- To be provided on steep grades;
- To be located on high ground above the level of adjacent inhabited areas;
- To be located as the most exposed sites or in places where full advantage can be taken of high wind velocities;
- To be located as far as practicable from houses and or habitable areas;
- To be located outside the zone of influence of sewer inlets.

Vent shafts are also to be provided immediately upstream of siphon arrangements, at SPS's and at receiving MHs where turbulent sewage is likely.

Provision of vent shafts as an educt venting system discharges any potential odours such that the odour is diluted by the time it has reached areas where it might be detected by people.

4.2 Sewage Pumping Stations and Pressure mains

Ventilation is provided at the SPS's via an induct and educt system. Introduction of fresh air into the system is via the upstream sewer gravity system and provision of an induct vent(s). A vent shaft is provided at the SPS and is connected to the IMH, wet well and emergency storage structure (if applicable).

The design of the SPS's and the pressure mains is such that turbulence is minimised and detention time is sufficiently short. Detention time is a function of inflow into the SPS, pumping frequency and volume capacity. Sydney Water requires that detention time is limited to a maximum of 2 hours, otherwise additional mitigation measures are to be employed.

4.2.1 Chemical Dosing Units

Additional mitigation measures normally include the provision of a chemical dosing unit (CDU) at the SPS site, which injects chemical into the sewage in order to reduce H_2S generation. Two (2) common forms of chemical are used:

- Nitrate: The injection of nitrate causes a change in the microbial population within the sewage. Sulphide producing bacteria are competed by more other bacteria which transform the nitrate and organic compounds into nitrogen and carbon dioxide. Any H_2S already present is oxidized back into sulphate and sulphur; and
- Magnesium Hydroxide: The injection of magnesium hydroxide reduces the acidity levels within the sewage and raises the pH to above 8, which is outside the ideal pH range for H_2S generation. At this pH level, the solubility of H_2S is also increased and H_2S gases are therefore reduced.

This form of odour and H_2S mitigation within the SPS's and pressure mains is also aimed at reducing odour in the receiving systems.

Yours sincerely

Terence Capuyan
Civil Engineer
02 8898 8871