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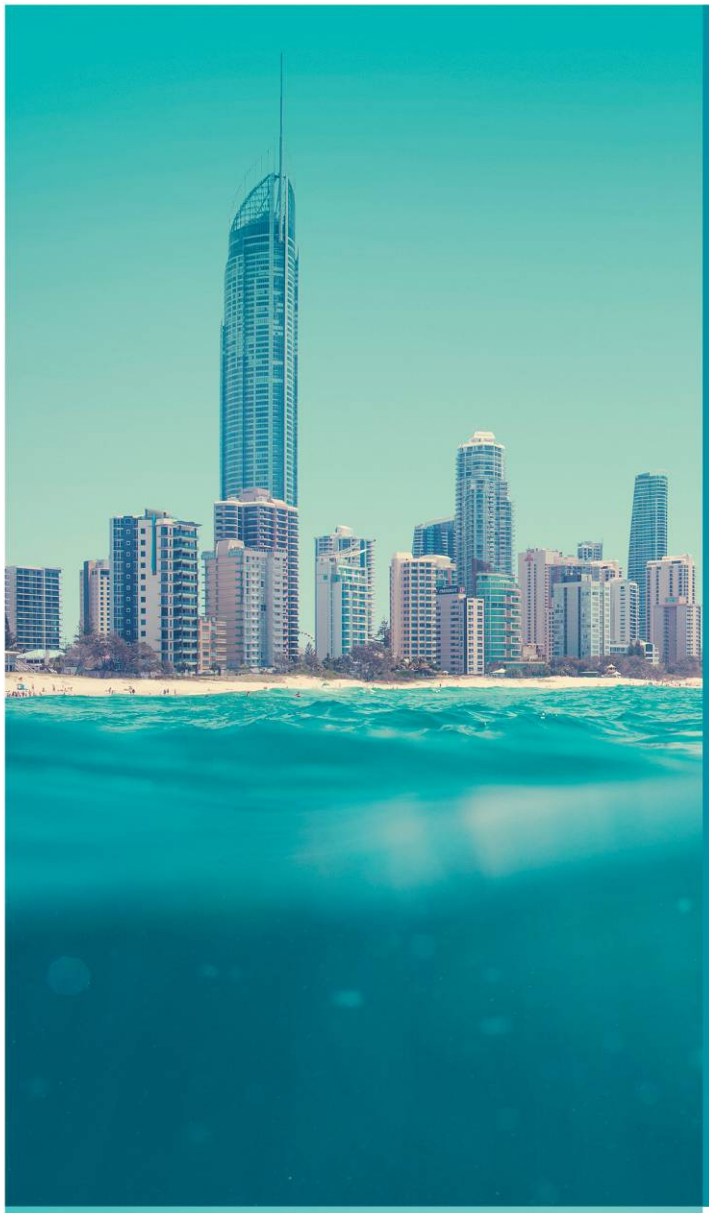
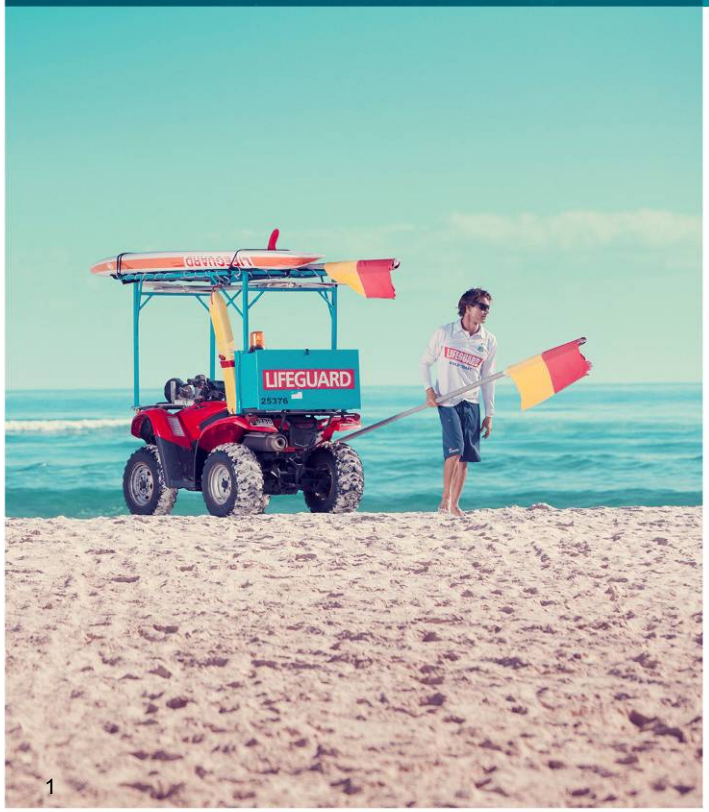


Guidelines for Dewatering Management Plan



City Development

Economy Planning and Environment Directorate

March 2018

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1. INTRODUCTION

Dewatering is defined by the process of removal of water from a site that accumulates in earthwork excavations or underneath structures at or below the existing watertable. Dewatering activities are either permanent or temporary. Permanent discharges occur from sites that have structures at or below the existing watertable, (for example, underground car parks below buildings), although this practice is being phased out. Temporary discharges occur from construction sites that have water entering the earthwork excavation. A temporary discharge usually occurs for the duration of the construction phase. This document relates specifically to temporary dewatering activities.

Construction of basements or excavation below the existing groundwater level in coastal areas has the potential to create significant sedimentation, amenity issues and other water quality impacts on sensitive estuarine and fresh water receiving environments. The problem arises from the dewatering operations associated with the basement construction. The majority of high-rise developments that incorporate basements are also located in coastal areas where the natural surface levels are below five metres Australian height datum (AHD). These areas are likely to contain actual or potential acid sulphate soils. The dewatering required for the construction of these basements therefore often results in the extraction, through the use of groundwater spears, of low pH (acidic) groundwater.

The solubility of many metals is pH sensitive and in particular the solubility of iron and aluminium increases significantly at lower pH. Because of this property, acidic groundwater often contains high concentrations of soluble metals, which are virtually colourless while in a dissolved, soluble state. While present in a soluble form at low pH, these metals are also extremely toxic to many forms of aquatic life.

Dewatering that may lower the watertable near a coastal or estuarine environment should be assessed for potential saltwater intrusion of the aquifer. The operator should control dewatering to ensure there is no significant change in water quality or change in the natural watertable or flow regime of surface water.

If the extracted acidic groundwater is discharged untreated to estuarine or marine receiving waters a range of possible impacts is likely to occur, including direct mortality or injury to aquatic life, reduction in the pH buffering capacity of estuaries, damage to infrastructure, and loss of visual amenity from visual plumes and staining.

An assessment of the impact on local vegetation, springs, wetlands and groundwater bores used by others in the vicinity of the project should be made prior to dewatering. Where assessment indicates potential reduction in watertable or quality of groundwater, the operator should either design the dewatering system to overcome this threat or provide an acceptable alternative water supply to affected parties.

The monetary costs incurred to local authorities investigating or cleaning up when responding to the one of the abovementioned incidents can also be substantial.

Odour problems that emanate from dewatering activities can negatively impact on residents surrounding the site. If the groundwater is contaminated, gases such as hydrogen sulphide and hydrocarbon can be released during the dewatering process. These gases when released can cause severe odours that can be offensive to nearby residents.

Noise emanating from the plant such as pumps and diesel generators that is used in the dewatering process, can cause a noise nuisance to nearby noise sensitive places. During temporary dewatering activities in most cases the plant is required to be operated twenty four (24) hours per day, which can increase the intrusiveness of the noise particularly during later or early morning periods when the background noise levels are minimal.

2. PURPOSE OF DEWATERING

The proponents/operators need to understand the environment they are working in and to evaluate potential impacts of dewatering discharge. The proponent or operator is required to ensure that appropriate measures are taken to prevent pollution or degradation of the receiving water body. As such, discharge water should not be allowed to:

- enter poorly defined channels as water may leave the channel and inundate vegetation
- enter any surface water, (for example, ephemeral stream, creek or river) or groundwater where the physical, chemical or biological nature of the discharge will affect the beneficial use of the receiving water body
- cause or contribute to soil erosion
- have visual impact in high profile tourist or residential areas
- have a detrimental impact on flora and fauna downstream of the discharge point

This guideline applies to dewatering operations that draw water from groundwater seepage, excavations that intersect aquifers or run-off from storm events. The main purpose is to guide the environmental management of dewatering associated from construction sites.

1. Prevent contaminated groundwater resulting from the dewatering process, being discharged into the City of Gold Coast's waterways.
2. Provide for possible treatment options of groundwater prior to discharge into waterways when the quality of the groundwater requires this.
3. Protect the environmental values of the City of Gold Coast's waterways from potential/possible impacts from poor dewatering activities.
4. Eliminate odour and noise nuisances associated with improper treatment.

3. LEGISLATIVE REQUIREMENTS

Person/s conducting dewatering activities shall do so in accordance with the requirements of the *Environmental Protection Act 1994* and *Environmental Protection Regulation 2008*. *Parts of State Planning Policy*, *Planning and Managing Development Involving Acid Sulphate Soils*, is also applicable.

Person/s conducting dewatering activities shall take all reasonable and practicable measures to:

- ensure all groundwater that is discharged from a site into receiving waters is adequately treated and disposed of so as not to create environmental nuisance or harm
- ensure all contaminated groundwater that is to be treated off-site is done so in accordance with all relevant legislation
- prevent the emission of nuisance odours associated with the dewatering process
- ensure there is no scouring or erosion at the point of discharge into the receiving waters
- manage and resolve any complaints generated by the activity
- ensure all plant and equipment associated with the dewatering process is to be adequately acoustically attenuated to comply with the *Environmental Protection Act 1994*

The *Act* provides that all persons have a general environmental duty to take all practical and reasonable measures to prevent or minimise harm when carrying out activities. Person/s carrying out dewatering activities shall take all reasonable and practical measures to ensure:

- dewatering wastewater is treated to meet requirements and is discharged or disposed in a way that does not cause environmental harm or environmental nuisance
- all groundwater treated off-site or unable to be treated is done so in accordance with relevant legislation
- no scouring or erosion at the point of discharge into the receiving waters
- no offensive odours or nuisance noise are released as a result of dewatering

4. PREPARATION OF DEWATERING MANAGEMENT PLAN (DMP)

The DMP will be submitted with the development application and must include details of who is carrying out the dewatering activities, who the developer is, and who the owner is. It will also state clearly where to address complaints or issues that may arise during dewatering activities.

For Council of the City of Gold Coast's assessment and approval, the applicant must provide the following information in the DMP.

1. Purpose of dewatering (that is, an explanation of why dewatering is necessary).
2. Dewatering technique (that is, wellpoint, deep well, open hole, etc.).
3. Anticipated dewatering flow rate and total dewatering duration.
4. Controls (that is, settling tank, turbidity curtain, etc.) and method of effluent discharge.
5. Measures and techniques to manage noise, vibration and odour issues.
6. Measures and techniques to manage geotechnical stability issues.
7. Contingency plan in case of any emergency situation.
8. If dewatering conducted in a contaminated area, engineering specifications for dewatering effluent treatment (that is, air-stripper, carbon filtration, etc.) and details for an analytical monitoring program to ensure that effluent will meet *water quality release standards* described in *Tables 1 and 2.*
9. A monitoring program to ensure that effluent will comply with applicable *water quality release standards* described in *Tables 1 and 2*.
10. Baseline assessment of the existing environment (for example, fauna and water quality) that will receive the discharge.
11. A strategy for monitoring and managing any impacts during the life and after the closure of the project.
12. The point of discharge to the stormwater system and to any waterway or water body.

Further, the proponent/operator may also be required to provide the following additional information in the DMP for any complicated site:

- a hydro geological and hydrological assessment of the project area to estimate quantity and quality of water to be discharged
- verification that the quality of discharge water will comply with the receiving water duration and frequency of the discharge
- seasonal variability of the receiving water quality
- assessment of the viability of treating or recycling the wastewater

4.1 Dewatering release criteria

Direct discharge of untreated groundwater may potently cause unlawful environmental harm which is prohibited under the *Environmental Protection Act 1994*. Prior to releasing any water from a construction site, discharges must comply with on-site discharge release criteria in accordance with *Council of the City of Gold Coast Land Development Guidelines (City Plan Policy)* . At the receiving water, 15 metres upstream and downstream of the point of discharge, discharges must comply with *receiving water release criteria* specified in *Tables 2 and 3*. However, when the receiving water discharge point is directly to Coomera River, Nerang River, Albert River, Pimpama River, Currumbin Creek or Tallebudgera Creek discharges must not exceed environmental values to protect aquatic ecosystem as outlined in *Environmental Protection (Water) Policy 1997 for Gold Coast Waterways*. For further information, refer to Department of Environment and Heritage Protection website.

At receiving water it is common that the impact from a site may be amplified as contaminants may accumulate. It is therefore critical that the receiving environment is fully investigated and understood when deciding how to manage releases from the site.

Table 1 – On-site dewatering water quality release criteria

Indicators	Criteria
Turbidity (NTU)	Less than 20
pH	6.5 – 8.5
Dissolve oxygen (DO)	90th percentile is greater than 80% saturation or 6mg/L
Litter	No visible litter washed from site

Table 2 – Receiving water dewatering water quality (physio-chemical) release criteria

Indicators	*Queensland Water Quality Guideline 2006*			
	Coastal	Estuary	Streams	Fresh water lakes
Ammonia (µg/L)	6-8	10-30	10-60	10
Total nitrogen (TN) (µg/L)	140-200	300-450	250-500	350
Chl-a (µg/L)	1-2	4-8	2-5	5
Total phosphorus (TP) (µg/L)	20	25-30	30-50	10
DO (% sat)	90-105	80-100	85-110	90
Turbidity (NTU)	1-6	8-25	25-50	1-20
pH	8.4-9	7-8.4	6.5-8.2	6.5-8
SS (mg/L)	10-15	20-25	6	-

Table 3 – Receiving water dewatering water quality (toxicants) release criteria

Metals	*ANZECC/ARMCANZ 2000 Guidelines* - Trigger values (µg/L)							
	Fresh water level of protection (% species)				Marine water level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Aluminium pH > 6.5	27	55	80	150	-	-	-	-
Copper	1.0	1.4	1.8	2.5	0.3	1.3	3	8
Lead	1.0	3.4	5.6	9.4	2.2	4.4	6.6	12
Zinc	2.4	8.0	15	31	7	15	23	43

4.2 Issues to be addressed in DMP

Innovative techniques for dewatering structures and handling of wastewater are encouraged and will be approved on a case-by-case basis, provided the DMP details suitable justification.

The discharge of poor quality groundwater into the receiving waters can cause the following:

- severe environmental, water quality, odour, amenity and noise impacts on the receiving environment
- physio-chemical impacts on the quality of receiving waters, (for example, alteration of natural pH, increase of suspended solids)
- impacts on both aquatic and terrestrial organisms, (for example, causation of bird and fish kills)
- potential impacts on human health from swimming, skiing, boating on poor quality waters, (for example, skin irritations and eye/ear infections)

For Council of the City of Gold Coast's assessment purpose the proponent/applicant shall address the following issues in detail in the DMP or in separate reports signed by qualified consultants/engineers.

4.2.1 Treatment of groundwater

The DMP must address methods for the treatment of groundwater that is to be discharged to the stormwater system includes, but are not limited to the following:

- treatment of the groundwater – off-site removal of groundwater from the site to a treatment facility for treatment and disposal
- physical treatment – filtration of the groundwater to remove suspended solids/reduce turbidity on-site before disposal into the stormwater system
- chemical treatment, (for example ,flocculation) – addition of lime to the groundwater in order to form a precipitate of the waste content of the water – this process should be used as last resort because it can cause other solid/sludge disposal implications/costs

Often the dewatering wastewater will require treatment prior to discharge. A qualified company/ professional should be consulted and supervise water treatment procedures. The DMP must detail proposed treatment processes and operating protocols, in addition to justify these decisions. It must indicate where the treatment is being carried out in relation to the pump and other equipment and the point of discharge. Erosion prevention methods should also be detailed including pump protection at inlet and outlet.

4.2.2 Acid sulphate soils (ASS)

The occurrence of ASS in coastal areas is a common phenomenon. ASS contains iron sulphides, mostly pyrites and when they are exposed to the air they can generate large amounts of sulphuric acid. When iron sulphides have been exposed to oxygen, they become very acidic, that is with a pH less than or equal to four and can contaminate groundwater.

In the past, large scale drainage of coastal flood plains for flood mitigation, urban expansion and agriculture has exposed significant areas of ASS. This disturbance has generated acidic water, through the generation of sulphuric acid, together with elevated concentrations of typically aluminium, iron and arsenic. The discharge of acidic ‘slugs’ of water into streams, rivers or estuaries have resulted in major fish kills in rivers along the Queensland coast.

4.2.3 Geotechnical issues

The DMP should also include an assessment of the potential geotechnical and hydrological impacts of groundwater extraction. It should demonstrate that nearby structures and infrastructure will remain stable during and after dewatering. Consideration of groundwater recharge should be given. This may require groundwater modelling. Details of dewatering volume, rate, duration, equipment and procedures must be included in the DMP.

A geotechnical investigation shall be undertaken to determine the groundwater level and the absorption rate for all sites. The lowest value obtained from the geotechnical investigation shall be used in the absorption calculations. The geotechnical investigation shall report the meteorological details of the test day, the general site condition and the level of the watertable applicable at the site.

The report must identify and address the overall potential adverse effects of dewatering on the stability and integrity of any adjacent property or structure. The report shall assess the radius of influence of the draw-down cone on potential settlements and lateral movements of any adjacent structures, properties or services.

A minimum of two boreholes per site is required. One of the boreholes shall be within the proposed absorption area and others in various locations throughout the site. For developments where the gross site area (GSA) is greater than or equal to 1000 square metres, an additional borehole is required for every 400 square metres or part thereof over 1000 square metres. For example, a site with GSA of 1450 square metres, four boreholes are required. Copies of the borehole logs are to be attached to the report. Unless groundwater is encountered, borehole depth shall be a minimum of four metres from the existing ground level.

4.2.4 Noise and vibration issues

The DMP should detail the type and location of equipment to be used and the duration of use. Potential noise/vibration issues and potential sensitive receivers should be identified within the DMP. It must detail any mitigation measures and how they will prevent any noise issues.

Treatment methods for the reduction of noise emitted from the mechanical plant involved in the dewatering process include, but are not limited to methods such as:

- installation of a fully acoustically attenuated enclosure around noise generating equipment, (for example, pumps and generators)
- the use of sound attenuating material such as hay bales to surround the plant
- installation and maintenance of mufflers and suitable exhaust systems for all noise generating plant and equipment
- operation of particularly noisy equipment within restricted time periods 7am – 6pm
- restriction of operating hours of the offending plant

All noise emitted from the dewatering process is to comply with the provisions of the *Environmental Protection Act 1994.*

4.2.5 Odour issues

The presence of potential odour-causing gas hydrogen sulphide (H_2S) should be detailed in the DMP. The DMP should identify potential mitigation measures and demonstrate they will be effective. The proposed treatment methods for the dewatering process are required to be included within the DMP. The proximity of the residents should be considered when undertaking dewatering activities.

The treatment of reducing odours resulting from dewatering activities varies in complexity and effectiveness. Options range from simple methods such as placing the discharge point directly into stormwater gullies or traps, to more complex ones such as installing a surge tank with an activated carbon filter to arrest odours. The intensity of the odour arising from the dewatering process will determine the extent of the treatment method required to reduce the odour. The odour threshold for H_2S is 0.08 – 0.2ppm (parts per million), *IUE Commission Cape Town, 2001*.

4.3 Operational and monitoring requirements

Assessment during the design phase will assist in the determination of the most appropriate operational methodology, tanked or sump and pump, and the corresponding monitoring method. This will assist in compliance with legislative requirements and addressing potential impacts on the completed structure after construction.

To avoid any environmental harm where water contains significant suspended solids and other harmful chemical and toxicants, the proponent should install and operate a settling basin/balance tank with a capacity to contain a minimum of two hours prior to release to the environment, depending on sediment characteristics. This is necessary to remove flocculating matters and also allow aeration and dissolved iron to precipitate and settle. It may be also necessary to apply chemical dosing such as lime to raise pH, metal salt to enhance removal of toxicants.

Where it is not possible due to lack of space, the proponent must explore mobile tanks or other forms of solids reduction such as filtration or chemical coagulation.

To ensure that any potential environmental harm is managed correctly and to enable the proponent to demonstrate compliance, regular monitoring of water quality parameters must continue in a manner advised by professionals. The monitoring regime will depend on the wastewater quality, water treatment methods and point of discharge. The details of monitoring plans should be contained in the DMP, including:

- water quality parameters to be monitored
- frequency of monitoring during dewatering
- monitoring techniques and equipment
- availability of monitoring records

The operator should develop and maintain a program that monitors, records and reports on the effects of dewatering. The program should include:

- a record of the quantity of water discharge rate
- regular visual inspection of the dewatering system to confirm its integrity and note impacts at the point of release
- suitable monitoring facilities, (for example, bores to record the effects of pumping on the water table)
- relevant water quality analysis of the water discharged and the receiving environment
- periodic investigations of the impacts on vegetation and water resources
- photographic records of vegetation and other sensitive parameters should be included as appropriate

It is important that during construction and operational phases of a project, the existing groundwater regime is maintained as close as possible to the pre-development condition. In this regard, consideration should be given to the level and flow attributes of the groundwater regime, through appropriate monitoring. In general a minimum monthly for static water levels via piezometers in the surrounding watertable is required to assess draw-down effects.

4.4 Dewatering contingency plan

A key feature of the DMP is that it will identify risks at the planning stage before construction begins. Where problems are unlikely and are not accounted for in the general dewatering procedures, contingency plans must be prepared. Triggers that activate the contingency plans should also be detailed within the DMP. Contingency plans within the DMP are binding through conditions of approval. The DMP should identify management actions for scenarios including but not limited to the following:

- noise complaints
- odour complaints
- complaints about appearance of wastewater discharge
- unexpected contaminants found during monitoring
- failure of treatment methods
- failure of pumping systems
- groundwater seepage into construction area
- heavy rainfall
- impacts on the stability of adjacent structures
- release of any toxicant materials outside the trigger values in *Tables 1, 2 and 3*

Examples of contingency actions may include:

- consulting a professional
- stopping operations
- changing methods or equipment
- additional monitoring

Contingency plans with a higher level of detail and foresight prove more useful if the situation arises.

4.5 Deemed to comply solution for small scale development

The purpose of deemed to comply solution is mainly to help small scale development not to provide any report to Council of the City of Gold Coast (Council) for approval. Any small scale development which complies with the requirements of *Table 4* and provides necessary certifications can avoid lodgement of the DMP for Council's approval. Note: the DMP must still be prepared for the site.

Table 4 – Self assessable dewatering plan checklist

Has the DMP been prepared by suitably qualified person?				No		Yes
Is the site area less than 800 square metres? If greater than 800 square metres, a detailed DMP is required to be submitted to Council of the City of Gold Coast (Council).				No		Yes
Is the dewatering depth is less than one metre? If greater than one metre, a detailed DMP is required to be submitted to Council.				No		Yes
Has the legal point of discharge been identified, (that is the capacity of the downstream system)?				No		Yes
Does the site contain potential acid sulphate soil? If yes, a detailed DMP is required to be submitted to Council.				No		Yes
Have geotechnical issues been addressed by a Registered Professional Engineer of Queensland (RPEQ) or an equivalent qualified professional? If no, the associated reports are required to be submitted to Council.						
1. Slope stability?	No		N/A		Yes	
2. Integrity of adjacent properties?	No		N/A		Yes	
3. Cone of influence and draw-down effects?	No		N/A		Yes	
Have measures been put in place to ensure *dewatering release criteria* by a suitable qualified person as defined in *Tables 1, 2 and 3*?				No		Yes
Has noise, odour and dust issues been addressed in the *dewatering contingency plan*? If no, further approval by Council is required.				No		Yes

The applicant is advised that if "*Yes"* has been answered to the above checklist, the following two certifications MUST be provided with any development application.

1. Provide certification *Appendix A* from a qualified scientist/engineer, specialising in dewatering that all the above requirements in *Part A* have been fulfilled and achieved. This certification is to be signed by a RPEQ.
2. Provide separate certification *Appendix B* that all geotechnical requirements have been addressed, including but not limited to slope stability, integrity, acid sulphate soils, cone of influence and draw-down effects.

The applicant shall also provide a monthly monitoring report in relation to dewatering discharge and measures in how it has met the release criteria *(Tables 1, 2 and 3).* This report is to be submitted to Council for compliance and record keeping.

5. REFERENCES

Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
Environmental Protection Act 1994, State of Queensland
Environmental Protection (Water) Policy 1997, State of Queensland
Environmental Protection Regulation 2008, State of Queensland
Environmental Protection Regulation 1998, State of Queensland
City Plan Policy Land development Guidelines, of the City of Gold Coast
IUE Recommendations for Odour Control in Tannery 2001, IUE Commission Cape Town, South Africa

Appendix A

Deemed to comply checklist certification pro-forma

Property details	
Lot number	
Registered plan number	
Property address	

Proposed works	
Description	

Proposed development	
Description	

Declaration			
I,		Water quality scientist / registered professional engineer of Queensland (RPEQ) number	
of			(Consulting engineer's firm)

being duly authorised on this behalf, do certify that the proposed development has taken all necessary measures to satisfy *Deemed to comply* requirements as outlined in *Council of the City of Gold Coast's Dewatering Management Plan Guidelines (2009).*

I am aware that Council of the City of Gold Coast will rely upon this certificate and any associated geotechnical reports, maps, graphs, tables, attachments, etc. produced as a consequence of commissioning this development proposal.

Signature		**Designation**			
Certified this		**Day of**		**20**	

Appendix B

Deemed to comply geotechnical certification pro-forma

Property details	
Lot number	
Registered plan number	
Property address	

Proposed works	
Description	

Proposed development	
Description	

Declaration			
I,		Registered professional engineer of Queensland (RPEQ) number	
of			(Consulting engineer's firm)

being duly authorised on this behalf, do certify that all geological issues have been analysed and necessary measures have been ensured to avoid construction phase stability problem/s both on-site and external to the site.

I am aware that Council of the City of Gold Coast will rely upon this certificate and any associated geotechnical reports, maps, graphs, tables, attachments, etc. produced as a consequence of commissioning this development proposal.

Signature		**Designation**			
Certified this		**Day of**		**20**	

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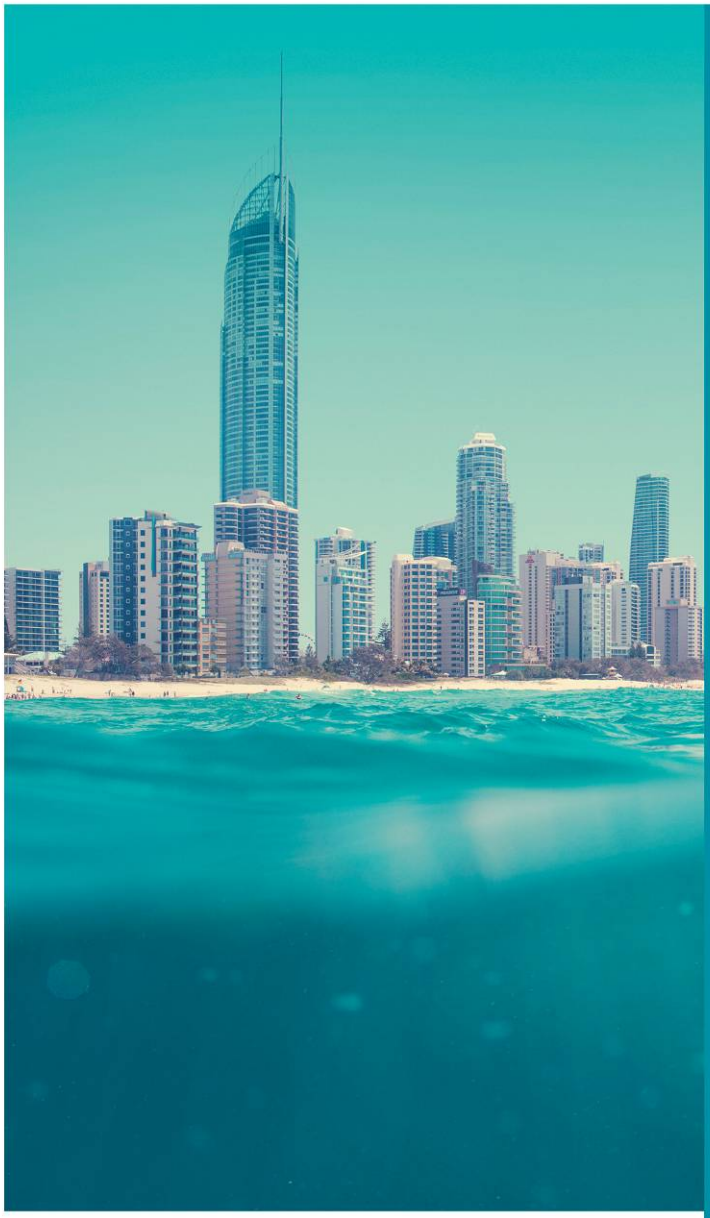

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