

Groundwater

A preliminary investigation into the use of groundwater as a supplementary water source for the pond was initially undertaken in March 2014. The use of groundwater was not advanced at that time given past problems experienced using groundwater for flushing sewerage mains when the Seabreeze Estate was in its early stages. The most viable spear points needed to be located within the coastal sands aquifer located on low lying areas to the north of the pond. The spear points suffered from constant clogging of filters due to water chemistry (ie. high iron precipitate). There were also limitations with exposing acid sulphate soils. It was also advised that spears were not installed towards the ridgeline area due to greater depths to groundwater in that location and possible limitations on volumes.

The NSW Office of Water (NOW) was contacted to discuss the likelihood of receiving a licence to extract groundwater to supplement the pond water. Concerns were expressed regarding constraints with water chemistry and that the proposal was unlikely to be consistent with the principles of the Water Management Act - being to enhance or maintain the water resources of the state.

Given an ongoing commitment to investigate alternative or additional water sources for the pond, the feasibility of using groundwater to supplement other sources of pond water was reinvestigated and is discussed below. NOW was again contacted and correspondence requested in order to understand information requirements associated with seeking a ground water licence under the NSW Water Act 1912.

Groundwater Chemistry and Management

The subject site comprises two main soil landscapes being an Erosional landscape associated with the ridge area (and includes the location of the pond) and an Aeolian landscape (being lands directly north of the pond). The soil landscape associated with the pond area is described as rolling hills on metamorphics of the Neranleigh-Fernvale Group. Limitations of relevance include localised rock outcrops, acidic, erodible soils with high aluminium toxicity potential, low permeability, localised hard setting, stony and shallow soils. The Aeolian landscape is described as sand sheets overlying peat and alluvium. Limitations include non-cohesive, highly erodible and permeable soils of low fertility, localised water logging, high water tables and very localised occurrences of acid sulfate soils.

A review of past groundwater sampling and bore logs from the Aeolian landscapes in the area suggests that the pH of ground water is generally neutral, has low dissolved oxygen, electrical conductivity typical of fresh water, and a significant level of total aluminium and iron is present. As a consequence, management of groundwater would be required to increase dissolved oxygen and most likely reduce turbidity and suspended solids. Similarly, given the high levels of aluminium, pH may require management to prevent dissolution of aluminium. Further, given the high levels of iron, there is likely to be iron staining associated with the oxidation of ferrous iron in groundwater. This would in-turn cause orange staining of surfaces (pond rock, concrete etc) over time. A dewatering management plan would be required to manage water chemistry.

Lands to the north of the pond in the vicinity of the stormwater basins are mapped as Acid Sulphate Soils (ASS). It is likely that drawing down of the water table, particularly in dry periods, may result in oxidation of potential ASS (PASS) and consequently, an ASS Management Plan would be required to ensure impacts to ASS soils are avoided.

Other potential issues, depending on the final location of groundwater spears or bores, could be impacts on structures due to the radius of influence from drawdown of groundwater. This can be in the order of 15m to 40m for unconfined aquifers (although would need to be quantified through further assessment). As a consequence, an inspection of neighbouring structures within any expected radius of influence may be necessary.

NSW Office of Water (NOW) - Groundwater Extraction Licence requirements

NOW was contacted to determine whether an application for a groundwater extraction licence would be considered and what assessment requirements would be necessary. Correspondence from the NOW is reproduced in italics below. In summary, the NOW raised similar concerns in regards to exposing acid sulphate soils, discharging water with high metal concentrations (including potential for iron staining of surfaces), and potential impacts to the ground water aquifer when dewatering in the dry season when the recharge potential of some aquifers is low.

A list of activities that would not be permitted by the NOW is listed in the fact sheet in Attachment 2. In particular, it is noted that extraction of water with high levels of metals (eg. iron or aluminium) may not be permitted in areas mapped as having a probability of occurrence of ASS.

Below are comments in response to your request for information on the possibility of installing groundwater spearpoints in the Seabreeze estate for operation of a water feature at the entrance to the estate.

Attached are 2 bore logs for spears constructed near the pond on the corner of Seabreeze Boulevard & Ballina Street at Pottsville. These spears are into the coastal sands and the soils at this location are at risk of being acid sulfate soils.

The Office of Water can accept an application for spears in the area as currently there are no embargoes on applications in the coastal sands aquifer. However we would have concerns that the proposed extraction may have impacts on the water table during dry periods and may lead to dewatering of potential acidic soils causing them to oxidise and create sulfuric acid which is then mobilised when the water table rises during wet periods.

The Office of Water would require information on the amount of water to be extracted and an acid sulfate soils management plan would need to be provided to detail how the extraction would be managed to prevent environmental damage. The water quality in acid sulfate soil areas is normally high in iron and other metals which usually stains concrete and may cause metals to be distributed into storm water network and into creek systems.

I have attached an information brochure about water extraction and ASS which details the issues that need to be considered and the minimum requirements for an application to be considered.

Groundwater Summary

In summary, the use of groundwater to supplement pond water would be constrained by water chemistry, the presence of ASS, aquifer recharge rates in drier periods, and potential drawdown impacts to adjacent structures. Further detailed assessment including testing and analysis and the development of a detailed dewatering management plan and an Acid Sulfate Soils Management Plan would be required with an application to the NOW. Even if the application is approved (which sounds unlikely), the extraction limit may be such that the cost

of attaining the licence, monitoring long term impacts, and maintenance costs associated with iron staining of surfaces would restrict the feasibility of using groundwater as a supplementary water source for the pond.

Stormwater Retention Basins

Stormwater management within Seabreeze Estate is managed via stormwater retention basins (also known as constructed wetlands). The primary objective of the constructed wetlands at Seabreeze Estate is for the retention of stormwater and removal of various pollutants including nutrients, heavy metals, pathogens, hydrocarbons and colloidal particles. The wetlands are designed to collect a specified rainfall event via a pipe network and gross pollutant trap, then retain and filter any sediments or other pollutants via a series of open water sedimentation zones and reed bed zones (or macrophyte zones). The design of the basins is such that larger events are bypassed.

Pollutants are removed through physical processes (sedimentation via reduced velocities), and filtration by aquatic vegetation. Constructed wetlands are not natural systems and consequently, they require ongoing monitoring and management for continued performance over their design life. The stormwater basins at Seabreeze Estate (wetland 2 was investigated for the purposes of this assessment) have been engineered to include deep and shallow zones with differing floor levels in relation to minimum standing water levels.

Management constraints

Potential constraints associated with the use of water from the basins include:

Water quality - When water levels are high in the basins, drawing water from the top of the water column may have limited water quality issues. In drier periods, drawing water from lower levels has the potential to mobilise sediments, metals, and anaerobic water. Although this water remains in the stormwater system (ie. the entrance pond overflows to the stormwater basins), dirty water would be transferred to the pond resulting in subsequent odour issues.

Basin design - The basins are designed to operate to a minimum design water level. Drawdown of water would need to be contained within a certain range to minimise any impacts to the functioning of the basins. Given supplementary water is often needed during drier periods, there is likely to be only a limited range where water can be drawn from the basins.

Infrastructure development and maintenance - To enable supplementary water from the stormwater retention basins to be delivered to the Seabreeze Estate Entry Pond, approximately 400 metres of pipe network, a pump and concrete sump would be required. The pump would be operated by float switches such that when water reached a certain level in the sump, the pump would turn on and pump the water to the pond. Likewise when the water level in the Pond reached the pond full level, another float switch would need to shut down the pump to ensure the pond was not overfilled.

Around half of the pipeline route (200m) would be located within roadways requiring an open trench and reinstatement of the road surface.

As with all mechanical equipment, regular maintenance would be required to keep it in good working condition.

Stormwater Retention Summary

In summary, although water from the stormwater basins could be used to supplement the pond, there is considered to be only a small operational range of suitable water to draw from. Below this, there are potential issues with mobilising sediments and other pollutants (potentially causing odour and other amenity issues at the pond) and impacts to macrophytes within the basins affecting wetland functioning.

Additionally, the infrastructure and maintenance requirements for the pump, float switches and pipeline would need to be factored into Council's maintenance budget.

Additional water harvesting from the existing stormwater network

The pond currently receives stormwater redirect from a portion of the stormwater network to the southeast of the pond. The redirection of stormwater to the pond was undertaken in 2014. A water balance assessment was undertaken prior to redirection works and it was considered that once full, the pond could be sustained with water from the diverted catchment. However, given the extended dry period during spring/early summer of 2014, the diverted network has not been sufficient to maintain water levels in the pond.

The as-constructed diverted stormwater could accommodate the addition of a larger nearby catchment being connected to it. That is, the larger section of the stormwater network to the east of the entry pond could be connected to the existing stormwater pipes currently directing stormwater to the pond. Given the current dry period, however, it is recommended that the current system be given additional time to generate a sustainable water level in the pond. If the catchment as connected is deemed insufficient following a period of typical rainfall, a relatively simple and inexpensive option could be to add the nearby larger eastern catchment to the diverted stormwater network. This would be a low maintenance alternative as it would be a gravity connection.