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BIODIVERSITY AT THE JUNEE WASTEWATER TREATMENT AND EFFLUENT REUSE FACILITY

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ABSTRACT

In this paper we briefly explore how the introduction of penalties under the Protection of the Environment Operations Act 1997 for discharges to the environment acted as a catalyst for a paradigm shift in Council's attitude towards effluent. A number of projects were undertaken with the intent being to enhance the wastewater treatment process to increase its suitability as a resource and enhance biodiversity at the site and in our local environment. In the years after these project's completion it has been demonstrated that quality wastewater treatment and biodiversity are mutually beneficial at an economic, social and environmental level.

KEY WORDS Biodiversity, wastewater treatment, environment, effluent reuse.

1.0 INTRODUCTION

Junee is a rural town with a population of over 4000 and is located midway between Sydney and Melbourne on the main Southern railway. The surrounding countryside is cropped with wheat and canola and is some of the most productive cropping country in NSW.

The town is serviced by a gravity fed treatment plant comprising an old Trickle Plant built in the late 1930's and a Pasveer Channel built in 1977. The total capacity of the treatment plant is 4700 EP and is currently running close to its limit. The Junee Correctional Centre – population 800 - has its own pumping station feeding to the treatment plant as does the local abattoirs (domestic waste only); these are the only two pump stations on line.

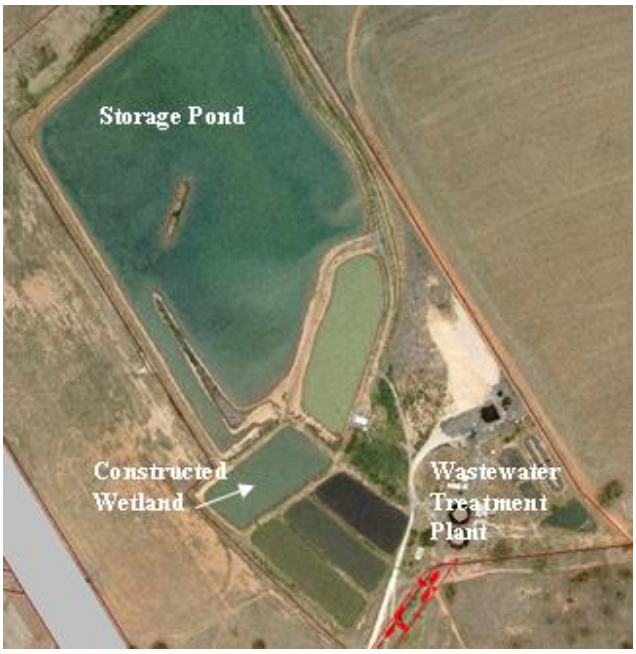

Figure 1: ***Junee Wastewater Treatment Plant***

Prior to 1997, a small amount of effluent was piped to the local golf course, however this accounted for little in terms of volume reused. The effluent was piped directly from the third tertiary pond to a holding dam located on the Golf Course. The remaining effluent was discharged to Houlaghans Creek.

The land surrounding the Wastewater Treatment Plant (WWTP) is predominantly agricultural; cropped and grazed paddocks adjoin three out of four boundaries. This monoculture type of environment is limited in its capacity to support biodiversity with many species relying on remnant vegetation along roadsides and on rural properties, for food and shelter.

2.0 DISCUSSION

The introduction of load based fees on Environment Protection Licences under the Protection of the Environment Operations Act 1997, forced the Council to examine alternative options for disposal of treated effluent. The decision to expand and diversify the reuse of treated effluent to limit fees was made.

The reuse expansion project began in 1997 with the construction of a 140ML storage dam. The dam's capacity represented approximately half of the annual flow into the STP and would, when also taking into account ongoing inflows, store sufficient effluent during the cooler months of Autumn and Winter to be used for irrigation on the High School oval and the Junee Golf Course over the hotter months of Spring and Summer.

Algae (mainly diatoms) quickly colonised the storage pond and provided the foundation for the establishment of a thriving local ecosystem. Micro and macro fauna such as fly larva, molluscs, mud eyes, grubs and worms quickly followed the algae. In an attempt to establish a balanced ecosystem, the storage pond was stocked with 1000 Silver Perch, 1000 Murray Cod and 1000 Golden Perch.

In 2000 the pond was full and was already home to a vast array of wildlife. Council saw this as an opportunity to further enhance biodiversity within the local environment and planned several projects to better accommodate the birds frequenting the area.

In 2002, a group from Conservation Volunteers Australia undertook several projects including construction and erection of 5 nesting boxes, a floating pontoon and a fox proof fence. The aim of the project was to provide safe nesting habitat for some species of ducks and swans and to protect turtle's eggs from being predated on by foxes. Although it took some years, the nest boxes now see a number of species - such as the Grey Teal - using them throughout the year.

The group also planted a mixture of 200 native trees and shrubs around the nest boxes and down a small stretch of land separating the inlet channel from the main storage. The aim of the planting was to create sufficient habitat to support the food chain between the micro and macro fauna and the larger birds of prey. This small area of native scrub continues to play an important role as a refuge for native animals. Annual tree panting projects continue to enhance the habitat creating an environment recognised as favourable habitat by many bird species. Table 1 lists several of the birds species directly linked to habitat provided by the storage pond.

Table 1: ***Bird species directly linked to pond habitat***

SPECIES	PRIMARY FOOD SOURCE
Daublers Black Duck, Grey Teal, White Eye Duck	Insects, seeds
Filter feeders Shoveler, Pinkear Duck	Micro-organisms (algae, Daphnia)
Grazers Wood Duck, Whistling Duck, Mountain Duck	Grasses
Diving ducks Bluebill Duck, Musk Duck	Macro fauna (invertebrates and molluscs)
Whistling Kite	Fish, turtle, Ducks, Carrion
Harrier	Ducks
Buff Banded rail	Insects, Molluscs, seeds
Spotted Crake	Insects, molluscs, Plant matter (from the mud)
Marsh Crake	Insects, molluscs, Plant matter
Dusky Moorhen	Water weed, grasses, insects, frogs
Purple Swamphen	Reeds, insects, frogs
Coot	Dives for weed
Painted Snipe	Insects, worms
Plover	Insects, invertebrates
Red Three Dotterel	Aquatic animal insects
Black Fronted Dotterel	Aquatic animals insects
Pied stilt	Aquatic plant and animals
Red necked Avocet	Aquatic plant and animals
Whiskered Tern	Insects
White-Faced Heron	Crustaceans, fish grasshoppers
White-Necked Heron	Crustaceans, fish grasshoppers
Large Egret	Crustaceans, fish grasshoppers
Glossy Ibis	Aquatic insects, snails spider
White Ibis	Grasshoppers, insects, snails, spiders
Stray Necked Ibis	Grasshoppers, insects, snails, spiders
Royal Spoonbill	Fish, insects
Yellow-billed Spoonbill	Fish, insects, aquatic insects
Darter	Fish, small turtles, aquatic insects
Little Pied Cormorant	Yabbies, insects
Little Black Cormorant	Fish
Little Grebe	Feathers, insects, fish
Hoary-headed Grebe	Feathers, insects, fish

For a full list of bird species that have been observed at the WWTP see Junee Shire Council's website.

In early 2003 Council put forward a proposal to the Environment Protection Authority to expand reuse of treated effluent to include Willow Park, Loftus Oval and Burns Park (our main sporting fields). Once approved, the Council now had the capacity to irrigate all the major sporting facilities with treated effluent providing a safeguard against drought and nearly entirely eliminating discharges to the environment.

2003 also saw the drought take a strangle-hold on the region. However the damage to our sporting facilities and the social impact from this drought, when compared to neighboring towns and council, was minimal. This assurance was provided at minimum cost when compared to irrigating with potable water, the latter being approximately double the cost.

There was also a significant environmental benefit realised during this time of drought. The storage pond and surrounding environment became an important refuge for birds and other animals in the area. Although the water level in the pond varied considerably, it never completely dried up and therefore continued to provide food and shelter for many bird, amphibian and reptile species.

Prior to the drought, a flat island in the middle of the storage pond was regularly inundated as the storage reached top water level. When this occurred, considerable amounts of manure, deposited by roosting birds, would be washed into the storage, leading to heightened suspended solid and nutrient levels. The nests of ground roosting birds (such as the Black Swan) would also be inundated despite the birds' best attempts at elevating their nests. This would often result in eggs and/or juvenile birds being washed into the pond and perishing.

Figure 2: ***Successful breeding of Black Swan and cygnets***

The Council took the opportunity presented by extremely low water levels to raise the island by approximately one metre, provide erosion protection, plant out the island with native vegetation and provide additional habitat in the form of hollow logs. These works not only had the benefit of minimising nutrient and turbidity rises, but helped to protect roosting birds from being flooded and provided a fox and cat free location for turtles to lay their eggs.

The most recent project undertaken at the WWTP was the conversion of the fourth tertiary pond into a constructed wetland. The initial aim of the project was to reduce nutrient levels (nitrogen and phosphorus), reduce pH and reduce suspended solids. The bulk earthworks and pipework for the twin wetlands – operating in parallel – was completed in mid-2010 and the first planting took place in October 2010.

Vegetation establishment took approximately 8 months and during this time there was little impact on effluent quality. However, since establishment, we have observed reductions in all effluent quality indicators, the largest reduction being in the level of suspended solids and BOD (refer to Table 2 and Table 3). An additional achievement has been a reduction in water temperature; an important factor in the prevention of algal blooms.

Figure 3: ***Constructed wetland Oct 2010***

Figure 4: ***Constructed wetland Feb 2012***

Table 2: ***Effluent Quality Indicators - SS and pH***

	Suspended Solids (mg/L)			*pH (pH Units)*		
Date	**Inlet**	**Outlet**	**%**	**Inlet**	**Outlet**	**Difference**
05-Jun-11	21	28	-33	8.6	7.9	0.7
01-Nov-11	48	9	81	8.17	7.79	0.38
24-Nov-11	125	8	94	8.71	8.08	0.63
01-Dec-11	22	9	59	8.07	7.51	0.56
15-Dec-11	23	5	78	8.38	7.65	0.73
05-Jan-12	-	-	-	9.38	8.83	0.555
31-Jan-12	33	6	82	8.42	7.89	0.53
20-Feb-12	-	-	-	8.94	7.89	1.055

Table 3: ***Effluent Quality Indicators - BOD, Phosphorous and Total Nitrogen***

	BOD (mg/L)			*Phosphorous (mg/L)*			*Total Nitrogen (mg/L)*		
Date	**Inlet**	**Outlet**	**%**	**Inlet**	**Outlet**	**%**	**Inlet**	**Outlet**	**%**
05-Jun-11	9	7	22	-	-	-	13.2	9.45	28
16-Nov-11	9	<0.1	99	4.8	4.29	11	11	8	27

The benefit of these wetlands has not been exclusive to effluent quality though. The densely vegetated wetlands have expanded the biodiversity significantly and most importantly have created additional habitat for small mammals, birds, reptiles and amphibians, protecting them from foxes and cats.

The alternative to the constructed wetlands, to address high pH levels, was to install an acid dosing system. Reductions in pH aside, such a system would have had zero benefit on remaining effluent quality indicators or on biodiversity and habitat creation.

On New Years day 2006, the storage pond became an invaluable resource as a major grass fire burnt 20,000Ha in and around Junee. The volume of effluent present and more importantly the depth of the pond, allowed for the quick turn around of aerial fire-fighting units. In this regard the pond played a pivotal role in the protection and ultimately saviour of a number of public and private assets.

3.0 CONCLUSIONS

The ponds provide a diverse habitat for many species of birds and animals; the projects undertaken over the last 15 years have been undertaken to provide better quality effluent, but to also support and strengthen biodiversity. This biodiversity has helped to link disjointed patches of remnant vegetation that are so typical in regional NSW. The environment together with the history and records of its evolution are a valuable resource for research, education and future tourism ventures.

And this is achieved whilst the wastewater treatment plant continues to produce a product that not only meets, but exceeds the standards set by our effluent reuse licence and that ensures a higher quality of amenity and facility for the residents of, and visitors to, Junee.

We have demonstrated how what was once considered a waste by-product of settlement can be utilised as a resource with favorable social, economic and environmental outcomes. Quality effluent and strong biodiversity are not mutually exclusive but are, as we have found, generally complementary of each other. The Council is committed to the protection and enhancement of biodiversity and will continue to strengthen the environment at the wastewater treatment plant.

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