

## Frequently Asked Questions

### What are The Water & Carbon Group (WCG) Constructed Wetlands?

WCG Constructed Wetlands are a new generation of wetland technology based on the lessons learned from the rehabilitation of older systems. These systems are essentially "Static Bed Biofilm Reactors."

Our constructed wetlands are designed to mimic natural ecological processes using complex science to remove or transform virtually all contaminants into environmentally benign forms. The wetlands also provide a buffering function, reinstate natural water quality and hydrology, enhance biodiversity, and improve the health of downstream aquatic ecosystems.

### Why choose WCG Constructed Wetlands?

WCG Constructed Wetlands are high-performing systems that meet and exceed EPA standards. Our systems are effective for treatment of wastewater, agricultural and mining runoff, stormwater, enhancing reuse options and minimising carbon footprint.

Outcomes achieved from WCG Constructed Wetlands are:

- significantly lower capital and operating costs;
- lower embedded carbon footprint and reduced energy related carbon emissions;
- can be implemented incrementally to meet capacity needs of a growing population;
- meet and exceed EPA standards; provide high quality water for water recycling;
- creation of valuable habitat;
- become iconic community assets;
- can augment existing treatment systems.

### How much do constructed wetlands cost?

The establishment and operational costs are  $\frac{1}{4}$  to  $\frac{1}{2}$  the cost of conventional STP systems as is the operational upkeep and maintenance. Our performance results are comparable if not better than conventional modern systems.

### What is the treatment performance of a constructed wetland?

Constructed Wetlands designed and managed by WCG meet and exceed Local Government, EPA and community expectations by producing natural wetland background levels for pollutants that enhance downstream aquatic ecosystems.

However, constructed wetlands are less effective for phosphorus – prior treatment for phosphorus using chemicals or ponds is recommended.

### How do constructed wetlands apply to existing wastewater treatment infrastructure?

WCG Constructed Wetlands are a cost-effective solution for upgrading older wastewater treatment infrastructure (e.g. Trickling Filter Plants and Oxidation Ditches). Constructed Wetlands are added to the existing infrastructure and therefore avoid the higher capital expenditure in replacing existing infrastructure with advanced mechanical wastewater treatment technology.

Constructed wetlands can be retrofitted to existing mechanical wastewater treatment systems (BNR, MBR or SBR) to provide wastewater treatment of the highest standard enhancing downstream aquatic ecosystems and providing high quality water for reuse application.

### **How do constructed wetlands benefit effluent reuse options?**

WCG Constructed Wetlands can be integrated with effluent reuse for the benefit of the whole effluent management system. Reuse of all effluent is rare in most areas of Australia because evapotranspiration is usually low in wet seasons and cool weather, and additionally, effluent flows often increase in wet weather. Effluent dams to store this water can involve large capital outlays such that reuse schemes often don't get off the ground. Constructed wetlands provide water authorities with a rational balance of beneficial reuse of dry season effluent production on one hand, and when reuse is not practical, natural wetland background discharge flows to waterways on the other.

### **What happens to the constructed wetland if effluent reuse is 100% in the future?**

It is extremely rare that 100% effluent reuse is achieved; in particular, peak wet weather flows often bypass existing wastewater treatment systems and are not utilised in reuse operations unless large volumes of storage are available. However, in the worst case scenario, WCG constructed wetlands are designed to be managed on natural rainfall and minimal effluent top-ups during drought conditions. In addition, if future effluent reuse demand exceeds supply the constructed wetland can easily be converted to a biodiversity wetland with minor works to enhance the community asset and provide a sanctuary for migratory, endangered and other wetland birds.

### **What is the life expectancy of a constructed wetland?**

It is considered that an effectively operated and maintained constructed wetland system can be operational indefinitely with minor infrastructure replacement estimated at every 25 years. Constructed wetlands designed by WCG staff in Australia have been in successful operation for over 7 years. Similarly, constructed wetland systems in the United States have been in operation for up to 50 years.

### **What is the maximum wastewater flow constructed wetlands can treat?**

Constructed wetlands are capable of treating any flow rate from a Wastewater Treatment Plant. Flows are simply allocated to specific design areas of wetland. In general the largest individual wetland cells are about 4 hectares. At present, the highest known flow rate for a constructed wetland in Australia is 7ML/day. However, constructed wastewater wetlands are more than capable of providing high treatment performance for flow rates of greater than 100ML/day. Application of constructed wetlands technology is only constrained by land availability. Higher flow rates incur higher land requirements.

### **What is the standard wetland sizing?**

A rule of thumb used without detailed site information is 2ha per 1ML/day for tertiary wastewater treatment and 4ha per 1ML/day for secondary wastewater treatment.

### **How are risks managed within a WCG Constructed Wetland?**

The WCG Constructed Wetlands have been developed and implemented over more than a decade. Knowledge gained during this time is used to design and construct WCG Constructed Wetlands that minimise or eliminate risk. Environmental risk factors such as fire, flood, frost and mosquitoes are effectively managed through specific design features and in some cases utilized

as part of the wetland operations (e.g. frost can be utilized for effective weed management if required). Refer below for more information on specific risks associated with constructed wetlands.

### **What are the effects of climate change on constructed wetlands?**

Constructed wetlands are able to effectively manage predicted impacts associated with climate change if appropriately designed, constructed and managed. The functional design includes appropriate cell lengths and widths and adaptable depth management through the use of innovative hydraulic infrastructure providing adaptability to predicted climate change impacts.

Climate change is not likely to be rapid, but will occur over decades, allowing for adaptation as conditions and impacts become better documented and understood. In our projects we include an assessment of climate change impacts on each individual site.

### **How do wetlands treat pathogens?**

Wetlands reduce pathogen numbers through a number of often synergistic processes including natural die-off during retention in the slow-moving waters, sedimentation and consequent inactivation and predation, by adsorption to plant surfaces in the wetlands, by ultra-violet light and by antagonistic water chemistry.

The environment that favours pathogens in the human body is replaced by a wetland environment that provides time for the complex but hostile conditions to destroy the organisms. Wetlands are effective in reducing pathogen numbers with our systems meeting and exceeding EPA requirements for faecal coliform removal.

### **Do your constructed wetlands accumulate pollutants over time?**

The plants, litter and wetland floor provide the substrate for high microbial populations to break down organic matter into elements such as plant-derived carbon that are a source for other treatment processes. Carbon is utilized to transform nitrogen to gases that are released to the atmosphere via denitrification.

The conservative nutrient phosphorus will accumulate only in low quantities if pre-treated with chemicals and residual quantities are effectively retained in the constructed wetland via simple operational procedures such as drying and wetting phases and low flow velocities. If phosphorus accumulation meets saturation in the wetland (long-term – usually greater than 15 years) then phosphorus stripping and wetland re-establishment may be required.

Trade waste agreements are a management tool to prohibit heavy metals entering sewage reticulation systems. However, heavy metals that do enter the sewage system are effectively treated in constructed wetlands and excessive adsorption sites are present as not to incur any future management requirements

### **How are mosquito populations managed in a constructed wetland?**

WCG Constructed Wetlands are not a source of mosquito nuisance. Our constructed wetlands consist of high numbers and biodiversity of plants and predator populations (macroinvertebrates) that inhibit the mosquito life cycle development. Mosquito larvae provide a food source for several ecological classes of predators and larvae rarely reach their adult stage.

### **What are the operational requirements of constructed wetlands?**

A well designed, constructed and managed wetland requires relatively minor operational requirements. The main activities involve mowing of the containing berms, water level management, regular monitoring, cycling from dry to wet by adjusting outlets and early detection of weeds. This relatively low operational requirement is related to the self-organising capacity of the wetlands and robustness to buffer any ecosystem disturbance.

### **How are wet weather flows managed through constructed wetlands?**

Many wastewater treatment systems in Australia have high peak wet weather flows based on stormwater and groundwater infiltration to the sewage reticulation system. The majority of standard wastewater treatment systems are unable to treat high flows once they reach 2 to 4 times the average flow. WCG Constructed Wetlands are able to provide this with a fill and draw function that effectively retains and treats wet weather flows. Due to innovative hydraulic infrastructure the constructed wetland can fill to the designed extended detention depth for a period then slowly release the wet weather flow.

### **Are constructed wetlands negatively affected by floods?**

There is minimal impact to constructed wetlands during floods as long as inundation does not last for extensive periods. Constructed wetland infrastructure such as low-profile berms, inlets and outlets, are robust and resilient in the face of typical flood flows.

The risk of scouring of effluent materials such as nutrients contained in the wetland detritus is also low. The function of the constructed wetlands is primarily to provide a treatment substrate for microbial populations to break down organic pollutants. Nutrients do not accumulate in high-risk quantities. Conservative materials such as phosphorus will be present only in low quantities, and detritus and sediment layers are usually protected from scour by the layer of aquatic plants above bending in the flow and forming a protective mat over the sediments.