

APPENDIX E

WATER QUALITY SAMPLING FROM 2002

Water Quality Sampling from 2002

After the research reported in 1999, sampling has occurred less frequently from January 2002 with sampling done at least twice a year. This means as few as two data points per year for each site. Below is a table of when sampling occurred and if this was considered to be a 'wet' or 'dry' day. Days are considered to be 'wet' if there was at least 10 mm in the previous two to four days, or after 5 mm on the day of sampling.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	Wet	Dry	Wet	Wet			Wet			Wet	Wet	Wet
2003							Dry	Dry	Wet			Dry
2004								Dry				Dry
2005						Wet	Dry	Wet			Dry	
2006					Wet		Dry					Wet
2007	Dry					Dry			Wet			
	Wet sampling days											
	Dry sampling days											

Not all ten locations were sampled on each date, which was usually due to no flows within the creeks at the sampling sites. Dates where all sites were not sampled are:

- 1 Jul 2002 – GC Huntly not sampled
- 1 Jul 2002 (b) – Only SC Hiney, SC Mitchell, and FVC Little Bridge were sampled (part of training)
- 12 Dec 2002 – BSC Woodward, PC Ploughmans, SC Hiney and GC Huntly not sampled
- 10 June 2005 – BSC Woodward and SC Mitchell not sampled
- 30 Jun 2005 – EOC William and BSC Dalton were not sampled
- 22 Dec 2006 – SC Hiney and SC Mitchell were not sampled
- 24 Jan 2007 – SC Hiney and SC Mitchell were not sampled
- 7 Jul 2007 – SC Hiney not sampled

There is a set of 15 test parameters that have been sampled since 2002. Not all parameters are assessed each time, with the 15 being done on one occasion (January 2007). It must also be noted that parameters listed for each date were done for most of the sites; however some sites may not have had a certain variable sampled. Note the different variables sampled at January, June and September of 2007.

Variables sampled on wet and dry days since January 2002

Wet Days	5th Feb-02	2nd Jul-03	11th Aug-03	22nd Dec-03	30th Aug-04	10th Dec-04	10th Jun-05	29th Nov-05	24th Jul-06	24th Jan-07	7th Jun-07			
Variables sampled	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP, NO ₂ ⁻	Cond, pH, TN, NH ₄ , NO ₃ , OP, TP, SS, NO ₂ ⁻	Cond, pH, TN, NH ₄ , NO ₃ , OP, TP, SS, NO ₂ ⁻ , TON	Cond, pH, TN, NH ₄ , NO ₃ , OP, TP, SS, NO ₂ ⁻ , TON	Cond, pH, TN, NH ₄ , NO ₃ , OP, TP, SS, NO ₂ ⁻	Cond, Turb., pH, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	All	NH ₄ , NO ₃ , OP, TP, SS, NO ₂ ⁻ , TON			
Dry Days	9th Jan-02	12th Mar-02	23rd Apr-02	1st Jul-02	1st Jul-02	10th Oct-02	13th Nov-02	12th Dec-02	29th Sep-03	30th Jun-05	20th Jul-05	19th May-06	22nd Dec-06	10th Sep-07
Variables sampled	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, NH ₄ , NO ₃ , OP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, Turb, pH, TN, NH ₄ , NO ₃ , OP, TP	Cond, pH, TN, NO ₃ , TP, SS	Cond., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.	Cond., Turb., pH, DO, DO%, EC, Temp.

APPENDIX F

STRATEGY FOR IMPLEMENTATION FROM PREVIOUS STORMWATER MANAGEMENT PLANS FOR THE CITY OF ORANGE

Reporting Table for Previous SMP Implementation Strategy

Option Ref No	Short Description of Action	Type of Management Action	Status of Management Action
2005			
1	Establish a target litter education campaign	Educational activities	Complete
2	Review water quality monitoring and continue collecting water quality data	Monitoring, studies, or investigation	Ongoing
3	Include stormwater issues on ENRMA Committee	Riparian zone management	Ongoing
4	Create filter points for piped stormwater outlets entering natural waterways (ie sedges/reed filter)	Riparian zone management	Ongoing
5	Assess and improve internal communication	Educational activities	Ongoing
6	Compile stormwater and ecology in GIS database	Council operations	Ongoing
7	Educate contractors, developers and Council employees on erosion and sedimentation controls	Educational activities	Ongoing
8	Investigate the options of removing gross pollutants from downstream of the Orange urban areas	Council operations	Complete
9	Investigate stormwater infiltration and inflow problems	Council operations	Complete
2006			
10	Ensure stormwater issues are represented in the Environment Learning Facility (ELF)	Educational activities	Ongoing
11	Audit, plan and carry out a process of stream bank remediation	Riparian zone management	Ongoing
12	Assess the viability of wetlands to be used in conjunction with the proposed detention basins	Council operations	Ongoing
13	Assess the viability and install a stormwater holding dam downstream of the WWTP and in general	Council operations	Ongoing
14	Rehabilitate and manage sedimentation: i) Hill Street to Kearneys Drive ii) Downstream of Kearneys Drive	Rehabilitation	Ongoing
15	Rehabilitate Blackmans Swamp Creek between Dalton and McLachlan Streets	Rehabilitation	Ongoing
2007			
16	Build a stormwater retention system or wetland at Ploughmans valley	Structural stormwater measure	Ongoing

17	Rehabilitate and manage sediment at Alan Ridley Oval.	Rehabilitation	Ongoing
18	Provide direction to local community groups working on stormwater related issues	Educational activities	Ongoing

Council has also undertaken the following Stormwater Management strategies which were not listed in the previous SMP (above table):

- Street sweeping – CBD and as required in other urban areas
- Drain stencilling
- Autumn leaf collection program
- Dredging / clearing of aquatic vegetation
- Cleaning of drains and pits (two man crew)
- Sewer manhole inspections
- Table drain maintenance
- Riparian revegetation
- Willow removal
- Litter removal – roadside pickup
- GPT maintenance

Following is Council's SMP implementation progress report.

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
1999 –2000 Implementation					
Establish Council Working Party	\$3,000	\$2,000	Complete	This group is operational with a mix of Councillors and key Council staff	Continuation of group to manage Council's future stormwater management.
Implement existing community awareness	\$1,000	\$2,000	Complete	<p>Council has been proactive in community stormwater education and has undertaken the following activities:</p> <ul style="list-style-type: none"> ▪ Cigarette butt bin formulation and distribution ▪ Education of year 4-5 school children ▪ Talks to multicultural groups and other meetings about stormwater ▪ Talked to the Uni of Sydney about Stormwater ▪ Hosted the SIA stormwater conference ▪ Drain stencilling, production by schools of the nutters for gutters slogan, stormwater video, nutters for gutters pens, magnets and information brochures production ▪ Stormwater displays at the Orange Show ▪ Media releases to raise community awareness about the GP 	<ul style="list-style-type: none"> ▪ Continue the distribution and promotion of stormwater material. ▪ Run a component of the Nutters For Gutters video on cinema advertising. ▪ Redo drain stencilling in a more permanent manner. ▪ Hold stormwater education displays at appropriate events and display the types of litter being trapped in the GPT. ▪ Send stormwater information to all Council indoor and outdoor staff. ▪ Educate the community about how degraded the streams are.
Develop community education program (phase 1)	15,000	1,000	Complete	See above	

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
Monitor and collect data	10,000	3,000	Complete	An ongoing monitoring strategy has been devised. Water quality is monitored at 6 urban sites and 4 sites outside the urban area on a monthly basis.	Ongoing monitoring
Establish catchment care committee	6,000	3,000	Limited activity	Some groups have been formed with assistance from Council. Blackmans Creek has a Landcare group but it does not report to Council. Ploughmans Creek does not have a Landcare group.	There is no real need to sustain this activity in to the future, it is important however to assist the groups where possible.
Restore riparian vegetation (phase 1)	15,000	1,500	Complete and ongoing	<ul style="list-style-type: none"> ▪ Have rehabilitated Pilcher Park and installed the detention basin. ▪ 400m of the creek in the urban area has been rehabilitated. 	The next phase should focus on the downstream end of the CBD and Dalton Street. Ridley Oval and above Woodward Street should also be targeted.
Short Term Options 2000 - 2003					
Continue restoring riparian vegetation (phase 2)	15,000	1,500	Complete and ongoing	See above	See above
Stream bank stabilisation	16,400	1,500	Complete and ongoing	Rock gabion protection on the East Orange Channel. The bank has been stabilised on a tributary of Ploughmans Creek.	
Construct detention basins at 9 locations	460,000	90,000	Ongoing	Three installed. Council resources have not allowed for all 9 detention basins to be installed.	This program will continue as the funds become available but there are unlikely to be any in the short term.
Install sand and aggregate filters at construction sites	10,000	500	Ongoing	Coarse aggregate is being placed On Council sites where there is trucks access. This is not happening for private developments. However for large subdivisions a cattle grid is put	This activity will be addressed more substantially in the future

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
Develop community education program	15,000	1,000	Ongoing	on the exit point of the site A number of education projects have been undertaken (see above)	<ul style="list-style-type: none"> - Service centres - CBD - Fast food outlets Also Council is developing an Environmental Learning Facility (ELF), which will include stormwater topics within its overall program.
Promote Drain Stencilling	4,000	300	Complete	Program has been running and 30 locations in CBD drainage outlets are stencilled with a more permanent technique	
Educate and train builders and developers about stormwater best management practices	18,000	6,000	Not achieved	This priority has not been met at this stage	Still relevant. Council could look at inviting someone to give a seminar on stormwater best practice. Council has a list of preferred contractors and it could be a requirement that all builders undertake the course to stay on the preferred contractor list.
Review Council Policies	17,000	8,200	Not achieved	No reviews of Council Policy at this stage as it has not been a focus of Council. Have reviewed the Council Street Sweeping Policy and have increased the level of sweeping	<ul style="list-style-type: none"> ▪ Review of erosion and sedimentation control policy and how this is implemented. ▪ Changes to the building development process to achieve better stormwater outcomes.
Construct GPT at the corner of Bathurst and Allenby Roads	175,000	4,000	Complete		
Short Term Options 2004 - 2007					
Establish a target litter education campaign			Complete	Enforcement of campaign in known problem areas. Clean up	

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
				Australia Day activities won Tidy Towns award	
Review water quality monitoring parameters and procedures, and collection of water quality data			Ongoing	Report to ENRMA Committee: ongoing quarterly monitoring and targeted monitoring for stormwater harvesting feasibility	Ongoing monitoring of water quality data
Include stormwater issues on ENRMA Committee agenda			Ongoing	Regular reports to ENRMA	Continue open communication and exchange of information
Create filter points for piped stormwater outlets entering natural waterways (ie sedges/reed filter)			Ongoing	Ongoing works by Manager City Presentation	Particular focus on Blackmans Swamp Creek and the unnamed watercourse in Sommerset Park. Investigate opportunity for including waterway stabilisation design parameters in subdivision code.
Assess and improve internal communication			Ongoing	Reports to ENRMA, Council and staff meetings	Assess and improve protocols for stormwater management and environmental issues so they become second nature for councillors and staff (e.g. map/plan of process)
Compile stormwater and the environment in GIS database			Ongoing	Focus has been on quantity data to date	Include quality data. To be updated regularly
Educate contractors, developers and Council employees on best practice erosion and sedimentation controls			Ongoing	Development Services addressing issue with regular reports to ENRMA	Regular workshops and updates. Enforcing the implementation of controls
Investigate the options of removing gross pollutants from downstream of the Orange urban areas			Complete	Internal advice on location sought. Specialist consultant engaged – report completed	GPT to be installed corner of Dalton Street
Investigate stormwater infiltration and inflow problems			Complete	Staff member has been appointed as Sewer Investigations Officer and is supervised by Sewer Manager	

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
Ensure stormwater issues are represented in the Environment Learning Facility (ELF)			Ongoing	Stormwater workshops for schools initiated in conjunction with NetWaste Environmental Learning Advisor. Watermarks banners exhibited	ELF to be utilised in education campaigns
Audit, plan and carry out a process of stream bank remediation			Ongoing	Manager City Presentation will continue to incorporate into Greenways plan	Restoring creek drainage lines to a more natural flow where possible
Assess the viability of wetlands to be used in conjunction with the proposed detention basins			Ongoing	Considerable focus on Ploughmans Creek by Development Services via Plans of management	Document further opportunities in other existing and planned detention basins
Assess the viability and install a stormwater holding dam downstream of the WWTP and in general			Ongoing	Consultants have completed draft study – refer Sewer Manager	
Rehabilitate and manage sedimentation: i) Hill Street to Kearneys Drv ii) Downstream of Kearneys Drv			Ongoing	Grant for revegetation has been awarded for downstream of Kearneys Drive	Upstream works to be held over until detention basin is installed
Rehabilitate Blackmans Swamp Creek between Dalton and McLachlan Streets			Ongoing	Willows have been cleared between McLachlan and Spring Street Child Care Centre. Felling and chipping completed.	Grant for revegetation has been awarded and works are to begin.
Build a stormwater retention system or wetland at Ploughmans valley			Ongoing	See above	
Rehabilitate and manage sediment at Alan Ridley Oval.			Ongoing	Willow control underway	
Provide direction to local community groups working on stormwater related issues			Ongoing		
Long Term Options 2008 – 2033					
Construct Artificial Wetland	700,000	20,000	Not		Not likely to be achieved or

Management Action	Capital Cost	Annual Cost	Status	Progress	Future Direction
Blackmans Swamp Creek			achieved		funded in the foreseeable future
Construct Artificial Wetland – Ploughmans Creek	500,000	20,000	Not achieved	Investigations by Development Services	Not likely to be achieved or funded in the foreseeable future
Install GPT at Dalton Street	120,000	5,000	Not achieved	Specialist consultant engaged – report completed	
Establish salt tolerant vegetation	20,000	10,000	Not achieved		This item needs further clarification. The salt affected areas need to be determined before salt tolerant vegetation can be planted.
Install energy dissipaters	40,000	4,000	Progress towards achievement	Some rock gabions have been installed	Analysis needs to be made and locations for other energy dissipaters need to be targeted.
Construct detention basins at 9 locations	4,600,000	90,000	3 installed	See previous entry	
Install rubbish bins	12,500	3,000	Complete	10 new rubbish bins have been installed	New bins will be installed as necessary to ensure litter cannot access the stormwater system.
Provide public access to waterways	30,000	3,000	Ongoing	Council is trying to open up access to waterways to make them a focus of the community. A grant application to assist this proposal was unsuccessful	This is a strong focus for the short-term future.
Promote low maintenance gardens	5,000	1,000	Ongoing	Council has introduced a user pays water system and has educated the community about low water use gardens	Ongoing, active promotion of low water use gardens.

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