

How to budget for SQID Maintenance

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ABSTRACT

The single most important reason for not achieving the environmental objectives from our Stormwater Quality Improvement Devices is maintenance. There are many areas & reasons how & why maintenance is the biggest problem & these are broken down & discussed in this paper. From the manual cleaning of trashracks & bio-retention systems, to large scale cleaning of proprietary devices & old school GPTs, to media filters & oil & grit separators, there is room for improvement with all of them. You just need to know what to improve & this paper will tell you.

The common things that are done wrong are so common it's almost embarrassing. Lack of monitoring & how to do it correctly, not using the monitoring & cleaning information & untrained operators being expected to guess how to clean it are common, but that's not the root of the problem. It runs deeper, to a lack of quality on the information about each device, a lack of understanding about what constitutes a regular clean & an annual clean & a lack of budget by the owner to clean it adequately.

Of course, there is misleading information from proprietors about how "easy" it is to clean & these myths will be reviewed with a good dose of reality. Also, there are devices that were designed down to a price, not up to a standard & now the owner can't afford the maintenance. The paper is concluded with some very relevant advice for all SQID designers & maintenance managers in regards to device selection, approval, dealing with cleaning companies, specs for cleaning & what's needed to get all your SQIDs working at 100% of their capacity & being cleaned correctly & most importantly.....how to budget for all this.

KEYWORDS

Keywords: Maintenance; Monitoring; Inspections; Cleaning; Waste Management; Reporting; Audit

1 INTRODUCTION

The subject of "maintenance" is just as UNsexy as "asset management". But it is also the single largest reason for Council's not achieving their environmental objectives from the millions of dollars' worth of Stormwater Quality Improvement Device (SQID) assets they own.

"Maintenance" is the all-encompassing keyword that covers: Monitoring, Inspections, Investigations, information recording, use of that information to trigger a cleaning, Cleaning, Waste Management, Reporting & hopefully that cleaning information and updated training is being provided back to decision makers regarding future devices & back to maintenance managers to better manage their cleaning budgets.

There is insufficient room in one paper to cover every aspect of every element within maintenance, but hopefully, the summary & example information provided here, will trigger stormwater managers to think about their own assets & to follow the reasoning presented below, so that the process of SQID maintenance & its budgeting, is much better understood

2 SQID INFORMATION

The first & most obvious thing needed to manage SQID maintenance is to have correct information on each device. This should include:

1. Location & access point
2. Type of device & its size or model
3. Storage volume for pollution
4. Relevant information on depth to invert, depth to base, volume of water in the device
5. Discharge location for water, or how this is otherwise addressed
6. Keys, tools, etc. required to access the device
7. Any traffic management, backwater, overhead power, residents to advise, etc.

If you don't have all of this, or it's not correct, then the ongoing maintenance is very unlikely to be done well. So the first step is to have a proforma or "Data Sheet" for every SQID with all information on one page. This would include how to determine its % full. Note it helps to have a photo of the site & a photo of the lid (if there is one) on the back of the page as well.

It is from this information that Council staff or cleaning contractors will work out how long it should take to empty the device & what equipment they'll need to do it & hence the cost to clean it. In most cases Council doesn't have Works-As-Executed drawings for their devices, so they should get someone to do an audit on all their devices & validate this information.

3 MONITORING SPECIFICATION

The ease of monitoring varies greatly between devices & solutions. Some simpler devices such as pit traps & trashracks are easy to visually inspect. GPTs & other underground devices tend to be a bit harder & then there are the hardest of all, which are the wetlands & bioinfiltration systems.

But regardless of the type of solution, there must be a specification for the monitoring. This does not need to be complicated, but should cover the exact position to monitor at so if someone else monitors it next month, they are measuring at the same place (especially important for wetlands & biofiltration). The monitoring spec should clearly advise:

1. Where to monitor
2. What tools or equipment will be needed to do it
3. What to measure (data)
4. What to compare it to (information)
5. Where to report (this new information)

If you used a staff & measured a GPT & noted it was 4m to the accumulated pollution.... this tells you nothing. The 4m measurement is "Data". It's when you compare this to the Data Sheet, that you should be able to read off a table or graph to note that 4.5m is empty, 3.0m is full, so 4m is half a meter of accumulated pollution when the storage capacity is for 1.5m in height, therefore the device is at 33% full. 33% full is "Information".

This should then be reported back to the Maintenance Manager, who will keep a "record" of this

information, so over the course of the next year/s, the rate at which the device fills & needs cleaning can be more accurately predicted & more accurately budgeted. Monitoring of bioinfiltration systems, is more complex, but needs to follow exactly the same process. Whether you are monitoring depth of accumulated debris, or amount of blockage, or infiltration rate, the location must be specified along with what to monitor & how to do it.

When monitoring trashracks & net solutions, the device may not be “full”, but it could be non-operational because the rack or net is blocked. This would also trigger either an “unblocking” or a cleaning requirement. Booms & floating traps, also need to have a defined trigger for cleaning, because the longer you leave pollution in those devices, the greater the chance of loss.

Finally for some devices IF you are going to go to the trouble to go & monitor it, it’s almost worth cleaning it regardless, such as for booms, nets, trashracks & the surface of bioretention systems.



4 CLEANING – REGULAR & ANNUAL

Just like monitoring, the cleaning operations need a specification. Cleaning contractors will quote for a regular clean. Every one of them does. Unless you clarify the difference in scope between a “regular clean” & an “annual clean”, you will only ever get a regular clean. For some devices or solutions, there IS no difference. But for most there is. In an Annual Clean, you would additionally:

1. Pumpdown the system (if wet) so everything can be seen & accessed
2. Enter the confined spaces
3. Inspect all lids & grease them
4. Inspect for any debris deposition, scouring, corrosion, blockages, screen breaches, etc.
5. Inspect behind all screens & clean out silt/sediment build-up if required
6. Flush any gravity drained water lines clean

It would be common for the owner to be there to see their device completely empty & validate the cleaning was done as per the spec. SQID owners need to understand that if only “regular cleans” are done, devices don’t get pumped down & inspected fully, there is an 80% chance that they will not be working properly (based on the authors experience).

Cleaning for SQIDs such as wetlands would normally involve removal of accumulated sediments from the inlet area or sediment forebay. An annual cleaning would also normally involve removal of macrophytes (macrophyte harvesting), but the system would remain mostly full of water.

Once every 20–30 years the wetland will need to be drained &/or dredged. This is complicated, messy & expensive. It will require decanting, pumps, drying areas & returning the wetland to its original design levels. If this is not done, Council can expect reduced environmental outcomes via reduced water volumes, reduced residence time, nutrient cycling, re-suspension in larger events, ever decreasing performance & a growing chance of algal blooms & weed infestations.

5 SQID AUDITING

Council's change staffs, records gets misplaced, developers don't hand over drawings, devices get changed, things get modified or upgraded, and things get decommissioned. Every 5 or 10 years it is worth getting a SQID audit done. The benefits are:

1. This audit would validate the information held by Council
2. Check up on the performance of the cleaning contractors
3. Check on the status of the device (screen blockages, breaks, problems, debris build-up, structural or hydraulic issues)
4. Identify & ballpark any rectification or repair works required

Based on the audit outcomes Council will likely have reasons why some devices are not performing to expectation through improved quality information. Also, if the devices are working well, Council can look at fine tuning the cleaning frequency, to get better cost benefits from the maintenance \$.

Based on previous audits undertaken by the author, an averaged figure of 90% of GPTs inspected were not working optimally. Be it structural, access, cleaning, damage, blockage, or any one of several other problems, the vast majority of devices all needed to be (or certainly could be) cost effectively improved to get better performance from their asset.

In many cases GPTs had been either poorly designed, poorly selected, poorly installed, or conditions had changed to make them ineffective. They had been selected on capital price only & now Council was paying for ineffective or inefficient devices & getting a very poor return for their maintenance \$. An audit will show this up, identify the problem, cause & provide Council with some options to fix it & improve the design. In most cases, Councils don't realise they have a problem.

6 20 THINGS FOR MAINTENANCE MANAGERS TO KNOW

The following are a list of 20 useful things that maintenance managers should note, which are highly likely to be relevant for most sites, at every Council.

1. Make sure monitoring of SQIDs is done at the same place every time. Different places within a SQID will almost certainly give different results.
2. When monitoring a GPT use a FIXED STAFF (like an extendable 7m survey staff) because tape measures & weights on string don't give reliable results as they can only check vertically down.
3. Monitoring results should include the measurement recorded (data) & ALSO the percentage full (information), on which cleaning decisions will be made.
4. When companies do a cleaning, get a photo taken of the site before & after, plus the inside of the GPT before & after. This will prove the site was left neat & tidy & the device was cleaned properly (you can ensure cleaning contractors remember to do this by including a provision where 10% of the cleaning fee is deducted for a clean without photos).
5. Before a device is cleaned it should be monitored & the percentage full recorded. Whether the device is full of sediment or leaves, it could still be full. But the weight of these is VERY different & without noting the percentage full at the start, Council could draw the wrong conclusion from the weight of pollution.
6. It is difficult to estimate the percentage of litter, organics & sediments when everything is in water & being sucked up a hose. But the best person to estimate this is the guy on the end of the hose.
7. If Councils would like to reduce long term costs, one of the biggest costs is the disposal cost. If Councils set up a recycling area for stormwater pollution, typically 90% of the organics & sediment

can be recycled & reused & does not need to fill up our landfill. Some cleaning contractors offer this & Councils should give credit to this in their decision making process between cleaning contractors.

8. Cleaning contractors all want your business & will cut prices to get it. Council needs to have a Monitoring spec, Regular cleaning spec & Annual cleaning spec. This is so everyone is competing on the same scope & the scope is what Council wants, not what the cleaning contractor wants. They are in business to make money & will do the least they can to get their money. If Council doesn't specifically note the need for an Annual Clean (& have a scope for it), then it will not be costed or done. The losers in this arrangement are Council & the environment.

9. If SQIDs are 'out of the ordinary' they should each have their own O&M Manual. All SQIDs need a Data Sheet & without this a device can't be properly monitored or properly maintained.

10. Councils should require that cleaning contractors do a "site tidy" (i.e., pick up litter within a 25m radius of the site) It's simple to do, they always have someone that can do it, but unless you ask, they won't do it.

11. Council maintenance managers need to have an effective & reliable way of recording the monitoring & cleaning information as it comes in. It's handy to have a spreadsheet for each device. So monitoring & cleaning information can be kept together. This can also be held within a Database, to make extraction of information easier.

12. If you only look at cleaning weights removed, you might not get a correct picture of the SQID. Was it half full, 100% full, or massively overfull. How much pollution had bypassed if the device was overfull. Was the device functioning correctly, or was the inlet blocked, was it scouring, was there material behind the screens or screen blockage? Weights are a good measure of effectiveness, but only when the device is regularly monitored, cleaned when required & the device is working correctly. IF you don't know if it was working correctly you can't draw decisions on device effectiveness or pollution loads from the catchment.

13. Beware proprietary GPT Operation & Maintenance Manuals from some proprietors. Some are nothing more than marketing material, tell you very little, mislead you in regards to storage volumes in their devices & mislead you in regards to how hard it is to clean their device. If the O&M Manual handed over with the device does not have Works-As-Executed levels & a customised Data Sheet for that particular device, just throw it in the bin.

14. Performance levels claimed by most proprietors are the absolute best that the device could get if correctly sized, working under ideal conditions, with no site constraints & plenty of maintenance. The reality of things is that 99% of devices will not meet those levels. But you will get closest if the devices are well understood & well maintained.

15. 100% full is DIFFERENT for all devices. Maintenance managers NEED to understand that as a device fills up, there is a certain point at which it triggers the need for a clean. This point then becomes the "100% full" point. This point is NOT when the device is blocked to the top & bypassing. If pollution is stored within the screening area, this point is commonly when pollution is half way up the screens (blockage of the remaining screens is common & occurs rapidly during a storm, resulting in substandard performance, hence the need for a clean). The Data Sheet for the device should note what height of pollution equates to 100% full & what it is when empty. From there, a table can be drawn up in 10% increments noting Depth of pollution Vs Percentage full.

16. Listen to your cleaning contractors. Most are smarter than you might presume & their experience with different devices can give you insight into how they work, their strengths & limitations & assist Council's with future SQID selection. They also can have very good ideas on ways to improve your SQIDs that they probably learned from another site.

17. Maintenance Managers should talk to DA & Council Stormwater Engineers & advise them what sort of GPTs they like & dislike & their experiences with them. If Council has had poor experiences

with a certain type of SQID, don't select or don't approve them in the future. Council's CAN say "based on our previous experience with this type of device, we have chosen not to install any more of them". Council's should not be forced or blackmailed into installing devices they don't want.

18. Don't select or install devices you can't afford to clean. In many cases Councils are requiring SQIDs to reach the "targets" of 90% gross pollutants, 80% TSS, 45% TN & 45% TP. These are definitely noble targets but if the SQID to reach these targets costs \$500,000 to put in & cleaning is approx. 5% of this per year \$25,000. The question becomes 'can Council afford to clean it?' Avoid installing or inheriting devices that are really expensive to clean, they consume too much of the maintenance budget which means other devices & the environment suffers. Maintenance Managers should advise DA Engineers on what type of devices they want & can cost effectively clean.

19. Scheduled or Reactive cleaning? Reactive cleaning seems to be a logical way to clean SQIDs. However, this commonly doesn't work as intended. When a big storm hits & the SQID is full of pollution, so is every other SQID & every other Council wants their SQID cleaned within a week too! Obviously this can't happen. Also, it's very hard to budget on how many cleans will be required when you can't know how many storms are going to hit your catchment. A better, more reliable solution is to clean all SQIDs on a programmed basis. It's common to start with every 3 months & from there determine if cleaning is needed more or less frequently. When programmed on a time basis, you know exactly how many will be done in the year & it is easy to budget accordingly.

20. Approving cleans? Is it better to have the cleaning contractor automatically approved to clean any devices they feel are in need or a clean, or is it better to have them report it & Council go & check or have to approve every clean. The answer is simple. Council's need to put a little faith & trust in their cleaning contractor to do the right thing. Most are trustworthy & those that do the wrong thing will get caught either by a Council check or an audit. But with an automatic approval to clean devices noted to be above say 80% full, this dramatically reduces red tape & delays, making for a cheaper, faster & environmentally better outcome.

7 BUDGETING – THE 9 KEY STEPS

1. Do an audit or otherwise validate the information on which cleaning contractors are pricing the cleaning works.
2. Provide them with Data Sheets & O&M Manuals as required.
3. Provide a clear scope of works for monitoring, regular cleans & annual cleans
4. Get a price for each activity.
5. Assume (take your best guess) at the cleaning frequency required
6. Work out \$/monitoring x12, plus \$/reg clean x 3, plus \$/annual clean x 1 = total annual cleaning budget for that device.
7. Repeat for all devices to get a total Annual Cleaning Budget for all SQIDs.
8. At the end of year 1, have a meeting with the cleaning contractor & review the cleaning frequency for all SQIDs. This will result in lower cleaning frequency & cost for some & higher cleaning frequency & cost for others but will give a better cost benefit outcome for Council.
9. Then every 10 years, get another audit done.

8 UNDERSTANDING YOUR BUDGET

All SQIDs are different in size, efficiency, storage volume, functionality, ease of cleaning, etc. Council's need to understand that efficient devices fill faster & inefficient ones let the pollution

through or block & bypass. So devices that need cleaning a lot could be good..... Or they could be bad. Cleaning frequency is impacted on by 4 things:

1. Catchments size
2. Pollution type & load
3. Device efficiency (including potential for re-suspension & potential for blockage)
4. Storage size

These 4 parameters determine when a device needs cleaning. This is then multiplied by the \$/clean & this is multiplied by the cleanings/yr. It's likely that when this is calculated for all SQIDs (you include the extras for monitoring & the extra for an Annual Clean on each device), Council can commonly find they have not been allocating sufficient money to the cleaning of SQIDs.

If this was the case (& the author has never found it any other way), then Council needs to make some deliberate decisions in regards to which devices it will not clean as required due to budget limitations. Councils should be aware that some devices when you "let them go", are easy to bring back into operation & don't cost much more to do this. Others if you let them get overfull, (i.e., pollution accumulates behind screens, or gets spread right through a wetland), you can find that the cost to "get it back" is disproportionately large (Ask the author if you have queries on certain devices & which ones you can & can't "let go").

9 SQIDS IN PRIVATE OWNERSHIP

Another element of the "SQID Maintenance Budget" should/could be the wages for a Council staff member to be involved with SQIDs in private ownership. Blacktown City Council has a program that records SQIDs in private ownership & requires the owners to submit monitoring & cleaning information to them on an annual basis. This cleaning information must be supplied by a professional stormwater cleaning company, not the fabricated by the owner.

This process will pay huge dividends for Council in the long term. If all the industrial SQIDs, the GPTs, pit traps, oil & grit separators, media filters, bioretention basins, etc. have to be reported on, they will likely actually get cleaned! As a result, Councils more regional stormwater quality solutions will be less loaded with pollutants coming from private properties. Put simply, if you check on private owners & require them to report on their devices, they are much more likely to be operated & maintained correctly but if no-one checks, its clear to the private owners, that no-one cares & why spend money cleaning something if no-one cares. Blacktown City Council is a leader in this area & other Councils might consider getting a copy of their process & information required & then fund a person to implement it. This is a long overdue step in the right direction & ALL Councils should follow suit.

10 SQIDS IN PRIVATE OWNERSHIP

This is know to many as the Stormwater Levy. Every Council in NSW is legally allowed to charge each property \$25 per year, for the ongoing management of stormwater within their municipality. Most Councils have taken this up, giving them access to hundreds of thousands, if not millions of dollars to spend on stormwater.

When the charge was originally concieved, the author was on the group that put it to the minister & it should be known to all, that the PRIMARY purpose of the Stormwater Levy was for the cleaning of SQIDs. Whilst it can be used for all manner of stormwater issues, its original & primary purpose was

to provide a renewable & secure funding source for the ongoing management of all the grant funded SQIDs & stormwater assets that Councils had. This should be the primary source of income to fund each Council's SQID maintenance program & any leftover money used for new SQIDS, flooding problems, asset renewal, etc, etc.

11 SQIDS IN PRIVATE OWNERSHIP

It is also wise for Councils to assume a certain amount of damage either by massive storms, accidents or vandalism. After massive storms, the removal of trees & cars from regional SQIDs can put pressure on Maintenance Budgets if there is not a little extra in there. Likewise, vandals can leave devices damaged, unsafe or covered in profanity & there is a cost to addressing this. Over time, Councils will get a good idea of how much needs to be allocated for these "unplanned" maintenance activities. Accidents involving cars that fill a raingarden with petrol, poison all the soil & kill everything in it must be assumed to happen from time to time.

It's not a big cost, but an allowance of 1% - 5% should ideally be added to Council's SQID budget for these unpredictable but likely costs. The good part is, if you don't use it, you can roll it forward to next year, or spend it on something else. But if you don't have any budget for this unexpected maintenance, it will have to eat into your regular maintenance & something else has to suffer.

12 SUMMARY

Best plan is to start with an audit & validate what you have. This will also be able to validate if it's working properly or not & advise on ballpark costs to fix things that aren't. From the type of device, its efficiency, storage volume & contributing catchment & load, you should be able to determine a device's cleaning frequency (If you are unsure about this step involve a consultant that has experience in this area, it won't cost much). Write a monitoring, regular cleaning & annual cleaning spec, so your expectations of the cleaner are black & white. Then Councils can get cleaning quotes from the market & know what it will cost \$/clean & cleans/yr.

Many Council SQID cleaning budgets are inadequate at present & this is mainly due to not realising this is the case. But by following the advice above, Council's can determine a realistic maintenance cost & then budget for it accordingly. There are many pitfalls & traps that Council staff will be presented with & these were mentioned, along with some advice on how to plan & program the maintenance. With some food for thought on how to manage SQIDs in private ownership, what to budget for the unexpected & how to fund it all, hopefully the Stormwater Managers reading this will pass a copy to their Maintenance Manager, who will in turn become a little more educated & hopefully in the end produce a better environmental outcome for a cheaper cost.

AUTHOR BIOGRAPHY

Murray Powell has a bachelor of Chemical Engineering & a Masters in Business Administration. Of more relevance, he's been working with stormwater for the past 20 years, which includes time spent with the state government, local government, two proprietors & a consultancy. As such, Murray has a very good grounding in stormwater management from every side of every fence. Currently Murray heads up Optimal Stormwater which is both a consultant & contractor in stormwater treatment & stormwater harvesting. Murray has also been involved with auditing of GPTs & other SQIDs for multiple Councils in the past & is currently doing this for the SSROC Councils. He has been on the Stormwater NSW committee for more than a decade & is a past NSW President.