WSUD Audit, Maintenance and Rectification Insights for Assets 5-15 Years Old Questions & Answers

Thursday, 16th September 2020

1. **Weeding - Have you considered steam weeding, pros and cons?**
   Have considered steam weeding but have not been able to source a machine. Would also require extra space on ute, water source, extra OHS etc.

2. **Have you done analysis of sediment such as PSD?**

   Not on streetscape WSUD. PSD is very expensive.

3. **Do you test sediment for contamination? If so, what do you do if contaminated?**

   No. Not within scope of contracts at present. Would significantly add to maintenance cost. Catchments are small so would assume concentrations are also small. Sediment basins have large catchments where contaminant accumulate and concentrate over time.

4. **What's the council's key driver for its WSUD asset maintenance contract? How do they reconcile the hard money expenditure against the less readily monetisable WQ, visual amenity and other benefits?**

   Council has a strategic goals to improve WQ and improve amenity, reduce urban heat etc. The expense is justified by management and political support.

5. **Ralf in all your sites did you notice a difference in quality of plant growth / lushness, between rock mulched raingardens and non mulched? Any thoughts?**

   Rock mulch did not seem to improve lushness of plants. It seemed to be more related to inflow and success in establishment. There also seemed to be a negative effect of long term exposure to occasional herbicide exposure that slowly reduces diversity in raingardens if weeds get in and less tolerant species such as Ficinia nosodsa are knocked out.

6. **Have you tried iAuditor for data collection?**

   No we have not. I believe there is a monthly fee per person. Across 3 people $19/month for one contract quickly eats into your profit margins. We may consider it in the future, particularly if it integrates well with council systems.

7. **Do you feel the WSUD assets in most cases appropriately sized for the catchment ? the functionality of the assets were mainly compromised due to regular maintenance and not so much by the design ?**

   The systems seem to generally be appropriately sized. Designs are evolving as we learn more and some of these systems are more than 10 years old. From observation, blocked inlets seems to be the main constraint on systems working well. Then clogging surface layer.

8. **The works seems to be superficial rectification. Were the quality of outflow post treatment from the WSUDs considered as an indicator for defect and for intervention repairs?**

   The rectifications removed sediment that was clogging the filter layer and sediment, litter and vegetation that was taking up EDD space. These combined will greatly improve capture and treatment potential of each system. Testing WQ is not a simple matter. WQ will change from rain event to rain event and during an event from the dirty initial flush to being "cleaner" later in the event. You have to sample the same "batch" of water entering and leaving the system to get accurate results. This is best done with autosamplers taking regular samples throughout any rain event and over multiple rain events. Ask a manufacturer going through the SQID protocol how expensive and difficult this is to do. Hence we depend on the data coming out of Uni.'s and the CRC WSC.

9. **What do you do with the sediment? Where do you dispose? Do you test what is in it?**

   Sediment is disposed to landfill or where possible, taken to a recycling facility such as RePurpose It. We do not test the sediment from WSUD streetscapes.

10. **Ralf, your stats on the kgs of litter removed seem to include organic and 'man made' litter. Any feel for how much of that would be man made?**

    Mostly organic leaf litter. I would say 80-90%. However, this organic load is not good for our creeks, if it makes it that far. Or it slowly accumulates in pits and pipes, where it composts and will eventually need cleaning out.

11. **This maintenance is all rightly targetting the accessible surface elements of the devices, do you have any observations on the quality/need for work on the underdrainage? Specifically, how oftern is a 'major' as opposed to minor service required???**

    Under drain seem to work fine. In general, if constructed with the right layers, only the top 50-100m of filter sand cloggs. There's a very obvious change from dirty to clean sand. If the sand is replaced and replanted, the system may never need a total reset. Root intrusion into underdrains may be a problem.

12. **What do you do with all the accumulated sediment?**
    Sediment is disposed to landfill or where possible, taken to a recycling facility such as RePurpose It. We do not test the sediment from WSUD streetscapes.

13. **Did the trees with the tree pits show better growth than trees in the nature strip not linked with stormwater?**
    We don't have many to compare with. In Glenferrie Road they are all heavily pruned so cannot tell.

14. **How toxic is the sediment being captured within the WSUD?**
    Catchments are small so would assume "toxic" concentrations are also small. Sediment basins have large catchments where contaminant accumulate and concentrate over time.

15. **Does this need to be removed to an appropriate facility?**
    Sediment is disposed to landfill or where possible, taken to a recycling facility such as RePurpose It.

16. **Have you guys considered using non destructive digging to protect tree roots ?**

    Not really. This would remove the sediment but the tree roots would still be there. Assume any exposed root would die if not backfilled with "soil"? The issue is that the EDD is no longer airspace to be filled with water ponding each rain event and then clearing again.

17. **Hair? Who would've thought?**
    A quick Google search concurred with the following statement; According to the American Academy of Dermatologists, it's normal to lose anywhere from 50 to 100 strands of hair per day. For people with longer hair strands, losing them may be more noticeable. Since there are 100,000 hair follicles — or more — on each person's scalp, the loss of 100 or so hair strands a day doesn't make a big difference in appearance.

18. **Dog hair?**
    Would be some dog hair as well as human.

19. **Do you record any data on the tree itself that can be tracked over time (height, canopy diameter etc)?**
    No, not at this stage. Council may.

20. **In a greenfield site, would you recommend non-deciduous trees to spread the shedding of leaf matter rather than a seasonal dropping?**

    Yes, but I'm told that over the year indigenous trees drop a similar leaf load, just spread out.

21. **What are key characteristics of tree pits that improve the health of the tree?**
    Soil moisture, good growing medium. However, tree pits need to be large enough to not constrain root growth with the tree pit structure (4 walls of the pit)

22. **What levels of gross pollutants/sediments have you found in the overflow pits for bioretention's?**
    Not that much. Sometimes leaf litter accumulates on the grates if the raingarden has filled. If it makes it through the grate it generally get flushed through the pit into the drain.

23. **Couldn't you vacuum the rougher inlets?**
    Would need a powerful vacuum to suck up the sediment. Could be done, would be matter of expense, access and traffic management.

24. **Do you find there is an OH&S issue with cleaning and rectifying the rock inlets etc (eg tripping, hard to clean)? Would a concrete chute be a better solution?. Maroondah City Council have used a concrete chute/energy disipation structure on some inlets in recent installations.**
    Yes, cleaning the rock inlets is back breaking work and you would not want to do it every year. A sediment trap that's easier to clean with a shovel would be preferred. Interested in the Maroondah design if you have a photo, drawing?

25. **Interesting that rosemary has been chosen. Has this been considered in the modelling parameters to measure the pollutants that will be removed vs Lomandra or more frequently used raingarden plants?**
    Not sure about the modelling. Assume you might have to select "non-nitrogen reducing vegetation".

26. **Are the water quality or hydrologic outcomes being monitored on any of these systems?**
    Not to our knowledge
27. **Hi Ralf, would you recommend not using rock mulch and using sediment pits at inlets rather than large rocks?**
    Would recommend not using rock mulch and instead using higher (8-10/sqm) plant densities and ensuring good establishment. Would recommend sediment pits at inlets that are shallow (100-200mm) with grates that have large openings.

28. **Any idea on typical cost range associated with various types of asset rectification and maintenance i.e. for tree pits , sediment pond and bioretention ? Is any of this systems are easier to maintain compared to others ?**
    I won't be too specific as it does depend on the elements includes, number of assets, travel time between etc. But we have some rough annual costs: Small raingarden (<50m2) $10-$20/m2; Larger raingardens (50-200m2) $6-$15/m2; Tree pits $150-$200/asset, Wetlands (500-10,000m2) $2.5-$5/m2, Sediment basin ($180-$400/m2 depending on contamination, drying area availability etc.)

29. **Do you think , in general, mulch (rock or other) is required in a well planted biorientation system? I find not generally as velocities are pretty low...**
    Rock mulch should not be needed. I think it's mainly used to hold in moisture as a substitute for wood mulch, which is assumed to float. Not sure it does this.

30. **To the inlet sediment pits have some sort of soak through or do they just pond water until it evaporates.?**
    We have drilled holes in the ones we installed and with the holes they generally empty within a week or so.

31. **Are there any OHS considerations with the handling of the sediment? have there been tests done of the pollutants within the sediment removed, especially in relation traffic pollution (heavy metals, brake dust etc.?**
    No tests done. Assume there are heavy metals to some degree. We use gloves when handling sediment, take them off when we enter the cars and wash hands before eating.

32. **what monitoring of water is done in pits to understand their performance as a WSUD measure? Are any monitored?**
    No WQ Monitoring done. Testing WQ is not a simple matter. WQ will change from rain event to rain event and during an event from the dirty initial flush to later in the event. you have to sample the same "batch" of water entering and leaving the system to get accurate results. this is best done with autosamplers taking regular samples throughout any rain event and over multiple rain events. Ask a manufacturer going through the SQID protocol how expensive and difficult this is to do. hence we depend on the data coming out of Uni.'s and the CRC WSC.

33. **Ralf, what are your thoughts around having light, hard, perforated plastic lids for WSUD tree pits. These would be easy to lift and maintain the WSUD element.**
    Good idea. Lightweight is good. Perforated maybe not so good if people see litter (although people obviously create the litter, they seem very keen for council to remove it asap and this can be a hassle).

34. **excellent presentation. Have you done a business case that demonstrates the advantage of assets being maintained properly by a dedicated WSUD maintenance business like Wave maintenance, versus an ordinary contractor maintaining assets and how much money is saved in the long term by assets functioning and lasting longer?**

    We have not done a business case but it is a good idea. I think another years data at Stonnington (assuming we get the contract again) will put us in a good position to quantify this, post rectifications this year. You would assume that rectification could be delayed a lot further into the future or even indefinitely if you keep on top of the sediment load.

35. **Has proportion of anthropogenic (litter, plastic/polystyrene etc) vs organic or sediment material been recorded?**
    Not formally but it's mostly organic leaf litter. I would say 80-90%. However, this organic load is not good for our creeks, if it makes it that far. Or it slowly accumulates in pits and pipes, where it composts and will eventually need cleaning out.

36. **Do we know how much nutrient removal a plant like rosemary provides?**
    Not sure. Assume would mainly depend on the biofilm in the sand to do the nitrogen reduction.

37. **Any correlation with lifecyle costs done by eWater**
    We haven't done this comparison

38. **With the sediment issue being a major one, would it be unsustainable (costly) to manage WSUDs in a rural or semi rural environment with unsealed roads, driveways etc?**
    Could be. I see open drains and swale are a form of WSUD. These slow flows and capture sediment. I've been told there are different ways to shape dirt roads and drain to minimise erosion. Not my area of expertise. But looking at it from another perspective, where is the sediment ending up if it's not caught in a WSUD system?

39. **Agree that rock mulch is problematic, hugely reduces extended detention depth and very difficult to maintain. What would you recommend using as an alternative to rock mulch?**
    High planting densities and ensuring good establishment/100% plant coverage. Could also use double shredded hard wood mulch like Ocean Protect are using in there systems with success.

40. **In your opinion do you agree that regular maintanance is pushing the major rectification by a few years ? so we expect to undertake major clean out of sediment pond every 5 years ? by regular maintanance do you think we are pushing this towards a 10 year mark ?**
    I think regular removal of sediment and capturing the majority at the inlet of raingardens will definitely reduce or eliminate the need for rectification. Also, as your work has shown, it means the systems work year in year out rather than reducing in effectiveness as it gets more clogged. Not sure you can apply the same thinking for sediment basins, as that's their

job, to capture sediment, like a large sediment trap at the inlet of a raingarden. SB's will always need de-silting on a 2 to 5 to 10 year basis, depending on the sediment load from the catchment.

41. **Great to hear your thoughts Ralf and Rob. What are your thoughts on sediment forbay and sump pits at the inlet. My experience is these systems were not used due to potential maintenance issues. Yet in some of your rectification works you have installed them. Would be interested in your commentsmay Councils do not require GPTs or any form of sediment control for bioretention's servicing up to 5 hectares.**
GPT's or smaller sediment traps should be used upstream of a bioretention system

42. **Hair - maybe hair dressers?**
A quick Google search concurred with the following statement; According to the American Academy of Dermatologists, it's normal to lose anywhere from 50 to 100 strands of hair per day. For people with longer hair strands, losing them may be more noticeable. Since there are 100,000 hair follicles — or more — on each person's scalp, the loss of 100 or so hair strands a day doesn't make a big difference in appearance.

43. **Do you feel this is an appropriate value, and what are the consequences in a bioretention when we consider 5Ha of catchment with limited GP and TSS control.**
No sure what the "appropriate valve" referred to is?

44. **Hi guys, I did a mass project desilting 2 large lakes and converting them to a wetland and SWH system. Prior to the works got silts tested, and found 30yrs buildup and of high organic quality and not contaminated. So we avoided landfill transport and disposal costs and took to depot to mix with other topsoil for parks garden bed top dressing. :-)**
Depending on the catchment, that's definitely possible. At a resent sediment basin de-silt the sediment was tested and only just meet Cat. C due to Zinc and TRH (Total Recoverable Hydrocarbons) levels.

45. **Great presentation. Many councils hesitant to install streetscape raingardens due to maintenance cost burden outweighing benefit of infiltration, treatment and sediment capture. Any thoughts on possible arguments/angle to get councils to commit to raingarden installation from your 'hands on the ground' perspective?**

    Larger, end of pipe solutions are more cost effective for construction and maintenance, if they are possible. Streetscape systems can be inserted across the catchment, wherever there is space. It's a question of much the community/councillors/managers, care about what is flowing out into your waterways and the effect of this. In Melbourne we had some research in the mid-90's about the impact of nitrogen on Port Phillip Bay and this has provided some great investment and momentum. Dealing with urban heat through greening and canopy cover is now also a driver. It takes a lot of time, an internal champion(s), management support and some community support to make progress.

46. **Would be interested in sediment and litter loads (kg) coming out of each system to get an idea of typical sediment and litter loads per ha for different land uses.**

    We might be able to do that analysis in the future. Don't think we have the catchment area for the systems, unless you have some of these figure (E2D likely designed/audited a few of them)?