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RE: Feedback on Draft SQIDEP Laboratory Protocol

Dear Stormwater Australia

Thank you for the opportunity to provide feedback in relation to the Stormwater Australia "Draft SQIDEP Laboratory Protocol" (hereafter referred to as "the draft protocol").

Ocean Protect is committed to protecting the health of our oceans and waterways and subsequently fully supports a national protocol for the evaluating stormwater quality improvement devices (SQIDs).

The key objectives of this correspondence are to:

- Provide a summary description of existing SQID lab protocols
- Highlight the key deficiency with the draft protocol
- Identify other deficiencies with the draft protocol
- Identify recommended changes for the draft protocol (and explain the rationale for these recommended changes)

In summary, our key recommendation is for Stormwater Australia to review and endorse the existing standards developed by ASTM International E64 stormwater committee for the laboratory testing of SQIDs under sub-committee E64.01. This is because the ASTM International methods are globally recognised as being suitably established, technically sound, resourced, and independent, have been vetted by various individuals and organisations undertaking this type of testing for over twenty (20) years and allow contributions through a formal governance process.

If improvements/changes are preferred or required, I would recommend Stormwater Australia collaborate with ASTM International Committee E64 on Stormwater Control Measures to support these improvements/changes and enhance collaboration between the two groups (and the associated stormwater industries within Australia and overseas).

I would welcome the opportunity to discuss with you further.

Kind Regards,



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Existing laboratory protocols for evaluating SQIDs

There are two (2) existing groups that have developed laboratory protocols for the evaluation of SQIDs:

- **ASTM International:** is a globally recognised leader in the development and delivery of voluntary consensus standards, including laboratory protocols for the evaluation of SQIDs. Further information is available at <https://www.astm.org/get-involved/technical-committees/committee-e64/subcommittee-e64>
- **NJCAT:** The State of New Jersey (USA) Department of Environmental Protection established the New Jersey Comprehensive Assessment Tool (NJCAT), which includes a laboratory protocol for evaluating and certifying SQIDs, guidance document and a register of certified SQIDs. Further information is available at <https://dep.nj.gov/stormwater/>

Both groups and their associated laboratory protocol for evaluating SQIDs are globally recognised as being suitably established, technically sound, resourced, and independent, however ASTM International associated stormwater testing standards is now more recognised across North America

In 2012, the Water Environment Federation (WEF) invested in developing the Stormwater Testing and Evaluation for Products and Practices (STEPP) program. Later from 2017, WEF staff and STEPP volunteers established a consortium of partners to further develop the national testing and verification program. This included:

- Washington Department of Ecology Technology Assessment Protocol (TAPE)
- New Jersey Corporation for Advanced Technology (NJCAT)
- Interstate Technology Regulatory Council (ITRC)
- American Society of Testing and Materials International (ASTM International)
- Water Research Foundation (WRF)

Engagement with organisations such as USEPA and the Stormwater Equipment Manufacturers Association (SWEMA), and more importantly the dedication of STEPP volunteers and WRF and ASTM International staff led to the formation of a new committee known as ASTM International Committee E64 on Stormwater Control Measures in late 2020. The new standards developed by this committee cover laboratory testing of several different types of devices for hydraulic, sediment and gross pollutant performance measurement.

As such, the body of technically superior work completed by ASTM International E64 Committee can be built upon for the benefit of the Australian stormwater community. The ASTM International process also allows and welcomes individuals and organisations to contribute through a formal governance process, which is critically important and seemingly absent from Stormwater Australia's process. From what I understand, the ASTM International E64 working committee would welcome collaboration with Stormwater Australia to develop standards that satisfy Stormwater Australia's requirements and objectives.

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Key deficiency of the draft protocol

The key deficiency of the draft protocol is that is an attempt to 're-invent the wheel'. As described above, there are already suitably established, technical sound, resourced and independent protocols for the testing of proprietary SQIDs within the laboratory.

The development and management of a suitable laboratory protocol will (and likely already has) require a significant and continued investment in resources, which I believe is likely beyond the capacities of Stormwater Australia. This is because Stormwater Australia is largely reliant on volunteers and based on my personal experience with Stormwater Australia's SQIDEP V1.3. For example, Stormwater Australia is yet to make any revisions to SQIDEP V1.3 (issued in 2018), despite Stormwater NSW¹, Stormwater Victoria² and Stormwater Queensland³ all requesting significant changes to SQIDEP and advising that they do not endorse SQIDEP in its current form.

By creating another laboratory protocol separate to the existing aforementioned laboratory protocols also creates an un-necessary burden on Stormwater Australia and wider stormwater industry, including SQID developers, manufacturers and reviewers that will subsequently need to be involved in assessing and/ or demonstrating compliance with another protocol - all when clearly other, more important issues within our industry remain and seemingly are lacking in any action by Stormwater Australia - such as poorly functioning 'WSUD' assets, lack of maintenance of existing stormwater treatment assets, lack of any stormwater treatment in existing urbanised areas, dubious stormwater quality 'offset' programs, continued decline in waterway, increasing 'urban heat island' problems.

The creation and potential application of another, separate laboratory protocol for testing SQIDs will also limit the application of new, innovative and possibly better solutions to protect our oceans and waterways and enhance liveability. This will also miss a potential opportunity for the stormwater industry within Australia to better collaborate with international bodies such as ASTM International.

I would subsequently highly recommend that Stormwater Australia review (and, if appropriate) endorse the methods outlined by ASTM International - instead of developing another laboratory protocol for testing SQIDs. If improvements/ changes are preferred or required, I would recommend Stormwater Australia collaborate with ASTM International to support these improvements/ changes and enhance collaboration between the two groups (and associated stormwater industries within Australia and overseas).

¹ Stormwater NSW, 2019, <https://stormwater.nsw.asn.au/wp-content/uploads/2019/09/Stormwater-NSW-Comments-and-Advice-on-SQIDEP.pdf>

² Stormwater Victoria, 2022, *2022 Stormwater Victoria SQIDEP Position Paper*, <https://www.stormwater.victoria.com.au/about-us/publications/183-stormwater-victoria-s-sqidep-position-paper>

³ Stormwater Queensland, 2022, *SQIDEP*, <http://stormwaterqueensland.asn.au/advocacy/sqidep/>

Other deficiencies with the protocol

This section identifies other deficiencies within the protocol, provides an explanation of this deficiency and associated recommended changes.

- **Front page: “Prepared by Technical Review Panel”**
 - No information is given within the draft protocol in relation to the individuals on this panel, and/or their associated experience or expertise (and associated ability to appropriately develop such a protocol). The only reference that I can see in relation to potential members of this panel is the Stormwater Australia website⁴ that describes that the panel ‘includes’ the names of three (3) named and eight (8) organisations, although no clarity is given in relation to whether other individuals or organisations are involved or the relevant experience of any of the individuals and groups in relation to testing SQIDs.
 - *Recommendation:* List all individuals involved in the draft protocol, their role, and (if appropriate) describe how they are suitably qualified to develop the draft protocol.
- **Page iii – Exec Summary, 2nd Paragraph and Page 5/6 “Purpose”**
 - The exec summary states: “The Laboratory Protocol was prepared to supplement the field protocol and allow a Claimant to test a treatment measure in a laboratory setting and if accepted by regulatory and industry bodies, potentially provide a faster, more predictable pathway for new innovative devices to enter the stormwater market.”
 - Pages 5 and 6 also state that “devices that are tested against this laboratory protocol will be able to claim the device is demonstrated to achieve (stated) removals under SQIDEP laboratory protocol conditions” ... and “in principal, the laboratory protocol is intended to allow a claimant to generate evidence of removal efficiency for total suspended solids (TSS), Total Nitrogen (TN) and Total Phosphorus (TP) (or other relevant contaminants)”
 - Based on the given text, the value of undertaking laboratory testing under the draft protocol is unclear.
 - There may be value in laboratory testing demonstrating a treatment flow rate together with hydraulic head loss (including over the life of the asset), so perhaps this should be included but is not currently.
 - The laboratory pathway should only be used to supplement (and not replace) field testing. This is largely because laboratory testing is not particularly representative of ‘real world’ conditions. For example, Fairbaugh et al (2022)⁵ demonstrates that hydrocarbons (present in the ‘real world’) blind filters, and the synthetic water described in the draft protocol does not even need to have hydrocarbons in it. Furthermore, during field testing and associated inter storm activity,

⁴ <https://www.stormwater.asn.au/sqidep/sqidep-governance>

⁵ Fairbaugh CM, 2022, *Mass Capacity Analysis of Stormwater Control Measures Using Synthetic Stormwater with Silica, Organic and Hydrocarbon Constituents*, Thesis submitted to Portland State University. Department of Civil & Environmental Engineering, https://pdxscholar.library.pdx.edu/open_access_etds/5926/

organic matter stored within the sump of devices undergoes decomposition and subsequent transformation of both N and P species (see conversion of particulate Organic Nitrogen to NH₄⁺ and NO_x) which cannot be represented within a short time duration test with a laboratory.

- *Recommendation:* Provide clarity as to what the objective/ value of this pathway/ protocol is.
- *Recommendation:* undertake further research on synthetic stormwater and the ability of a laboratory environment to accurately assess the removal of pollutants, particularly in relation to nitrogen species.

- **Page 6:**

- The draft protocol states “It is envisaged that this protocol will be expanded to include gross pollutants, hydrocarbons and heavy metals in future releases.”
 - There is already an ASTM International method⁶ to test for gross pollutants. Refer to “ASTM E3332-23 - Standard Test Method for Determining Trash and/or Debris Capture Performance of Stormwater Control Measures”.
 - *Recommendation:* Refer to aforementioned ASTM International method for testing of gross pollutants.

- **Page 7, Table 2:**

- The draft protocol provides a target average TSS concentration of synthetic stormwater of “100 +/- 50 mg/L”
- This range is excessive. By allowing such a wide range of pollutants, the data quality objectives (given in Section 3.2, that “... are to obtain accurate, and repeatable data”) will be unlikely to be achieved.
- I understand it should be relatively easy to keep TSS within 5% of the target. A similarly much lower range should be appropriate for the other pollutants.
 - *Recommendation:* Default to recommendations given by ASTM International, collaborate with ASTM International to develop appropriate standards for influent concentrations, and/ or apply target of +/- 10% for TSS and other pollutants with multiple replicates.
- Only ‘target’ values are given for nutrient speciations
 - *Recommendation:* Minimum Dissolved Inorganic Nitrogen %’s should be specified, consistent with Blacktown City Council (2020)⁷.

⁶ ASTM E3332-23 - Standard Test Method for Determining Trash and/or Debris Capture Performance of Stormwater Control Measures, <https://www.astm.org/jurisdiction-e6401>

⁷ Blacktown City Council, 2020, *MUSIC modelling and WSUD developer handbook*, <https://www.blacktown.nsw.gov.au/Plan-build/Stage-2-plans-and-guidelines/Developers-toolkit-for-water-sensitive-urban-design-WSUD/MUSIC-modelling-and-WSUD-developer-handbook>

- No minimum hydrocarbon values are given.
- The aforementioned Fairbaugh (2022) study shows that hydrocarbons (present in the 'real world') blind filters.
 - *Recommendation:* Specify minimum hydrocarbon concentration consistent with 'real world' data.
- **Page 8:**
 - No definition of "full scale" is given.
 - *Recommendation:* provide definition of 'full scale'.
 - No definition given for consistent inflow and outflow sampling locations and orientations. Eg: "d) Provides for suitable sampling locations..." is inadequate.
 - *Recommendation:* follow ASTM C1746/C1746M-19, ASTM C1814/C1814M-20 or ASTM E3332-23 as appropriate.
 - Ambiguity of data analysis outputs.
 - *Recommendation:* provide one or two specific metrics to be used to determine comparability.
- **Page 9, Table 2:**
 - No method for testing "Particle size distribution" is given.
 - *Recommendation:* provide recommended testing method.
 - No mention of head loss and/ or scour is provided.
 - *Recommendation:* refer to ASTM International recommendations and/ or provide requirements for testing method.
 - "Number of hydraulically paired Aliquots" is inappropriate, non-sensical and cost prohibitive. Given we recommend tighter controls on the influent variability and the lower effluent variability with restricted filters, it is unclear why is there a need for so many aliquots.
 - *Recommendation:* follow ASTM C1746/C1746M-19, ASTM C1814/C1814M-20 or ASTM E3332-23 as appropriate.
 - No method/ guidance for pre-loading of pollutants in device.
 - *Recommendation:* follow ASTM C1746/ C1746M-19, ASTM C1814/ C1814M-20 or ASTM E3332-23 as appropriate.
 - No method/ guidance for testing duration or bed volumes sampled
 - *Recommendation:* follow ASTM C1746/C1746M-19, ASTM C1814/ C1814M-20 or ASTM E3332-23 as appropriate.
- **Page 10**
 - states that "The QAPP should be developed by an independent person ...", which is seemingly impossible given anyone involved in preparation of QAPP will be paid by the claimant.

- *Recommendation:* Replace “independent person” with “suitably qualified person”.
 - The statement “The Testing organisation shall provide a Statutory Declaration that the testing process has been performed independently without duress from the Claimant” is inadequate. A recent federal court decision (see paragraph 99(4) of SPEL Environmental Pty Ltd v IES Stormwater Pty Ltd [2022] FCA 891, file QUD 179 of 2021)⁸ highlights the potential influence claimants can have on the process of laboratory testing.
 - *Recommendation:* Statutory Declarations must be expanded to include that Testing Organisations have not altered the method to provide more favourable results. This is entirely appropriate given the outcome above and lack of detail in the protocol.
- **Page 12, Section 3.4, “Description of the laboratory testing rig” section**
 - This section provides very little detail of the actual requirements.
 - The ASTM International provides clear and consistent requirements for the lab apparatus.
 - *Recommendation:* Refer to recommendations given by ASTM International.
- **Page 12, Section 3.6, “What is the composition of stormwater?”**
 - This section has no significance in terms of the protocol and test methods.
 - *Recommendation:* Remove section.
- **Page 14**
 - Reference to Holcim UPT (2021) but reference is not in in references section.
 - *Recommendation:* Provide reference.
- **Page 14**
 - The statement “The use of a homogenous graded material is not considered appropriate for this protocol as it is not sufficiently representative of real-world conditions” is correct – but no ‘formula’ (or recipe/ blend) is specified, which means tests are unlikely to be repeatable.
 - *Recommendation:* liaise with Craig Fairbaugh in relation to a suitable formula, noting that a suitable formula was applied in Fairbaugh et al (2022)⁹ and Craig is developing an ASTM International standard for the formula.
- **Page 16, ‘Water Source’ section.**
 - ASTM International includes a whole section on water sources.
 - *Recommendation:* Refer to recommendations given by ASTM International.

⁸ <https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/single/2022/2022fca0891>

⁹ Fairbaugh CM, 2022, *Mass Capacity Analysis of Stormwater Control Measures Using Synthetic Stormwater with Silica, Organic and Hydrocarbon Constituents*, Thesis submitted to Portland State University, Department of Civil & Environmental Engineering, https://pdxscholar.library.pdx.edu/open_access_etds/5926/

- **Page 16, "TSS Mass Balance" section**
 - states "The Claimant will be required to provide a detailed explanation where the weighed masses and calculated masses differ by more than 20%." This is a very large error for a laboratory test.
 - *Recommendation:* Reduce limit of error requiring explanation to <5%. Use total mass in an EMC mass out for filters and total mass captured in HDS units.
- **Page 18:**
 - Reference to "all analysis shall be undertaken at laboratory or analytical facility with current NATA accreditation for each of the requested analysis"
 - *Recommendation:* Should clarify that this 'all analysis' is just for the water samples, as seemingly implies that set-up of SQID etc will need to be in a NATA-lab, which is unlikely to be practical.
- **Page 19, Section 3.14 "Reporting":**
 - States "Reporting is undertaken by an external independent party to the claimant"
 - This is impossible given that any party responsible for the reporting will clearly be paid by the claimant.
 - *Recommendation:* replace "external independent party to the claimant" with "suitably qualified person".

Acknowledgments

This correspondence has been prepared with assistance from Jim Lenhart and Brad Dalrymple.

Jim Lenhart is a globally recognised expert in stormwater management. He is the founder of Stormwater Management Inc and former Chief Technology Officer for Contech Stormwater Solutions. He is currently the owner of Stormwater Northwest and consults with companies that provide products and services in the stormwater related markets. Jim is actively involved in ASTM International E64, and an active member of the ASCE EWRI Urban Drainage Standards Committee and Urban Water Resources Research Council. Jim holds a BS in Plant Sciences, a BS in Agricultural Engineering and MS in Water Resources Engineering.

Brad Dalrymple is Principal Environmental Engineer at Ocean Protect and Adjunct Lecturer at Griffith University, and has over 20 years' experience in Environmental Engineering. He has a Bachelor of Environmental Engineering.