Perth NRM

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

PERTH SOUTH WEST Metropolitan Alliance

‘Sediment Snapshot’ Pilot Trial

Summary Report

An analysis of baseline data and observations from twenty-six construction sites in the Perth South West Region over one week, focusing on sediment loss, presence and effectiveness of erosion and sediment controls and rates of legislative compliance

Winner of the Stormwater WA 2024 Award for Excellence in Research and Innovation

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Cover Images

LHS: *Sediment plume in Swan River from Riviere Apartment Development in Canning Beach Rd, City of Melville. (Photo credit: David Bond)*
Centre: *Building sand evident in constructed wetland in Willagee subdivision, North Lake Rd/ Archibald St, City of Melville. (Photo credit: David Bond)*
RHS: *Building sand from adjacent construction site encroaching on natural wetland, Market Street/Thomas Road, Casuarina, City of Kwinana. (Photo credit: Pia Hackshaw)*

This 'Sediment Snapshot' Pilot Trial was coordinated by the Sediment Task Force in collaboration with the Perth South West Metropolitan Alliance. The Sediment Task Force is funded by the Rivers and Estuaries Branch of the Department of Biodiversity, Conservation and Attractions and supported by Perth NRM.

Executive Summary

When soil erosion and sediment runoff is not effectively controlled on subdivision, building and public works sites (construction sites), it can become a significant source of water pollution.

A pilot trial in the Perth South West region in 2023 brought together stakeholders interested in maintaining drainage assets and water quality to undertake a 'Sediment Snapshot'. This involved developing new tools and undertaking multiple site inspections over one week in early winter to gauge the scale of sediment pollution occurring in the region.

The Sediment Snapshot required identification of participants, in this case the responsible Local Government Officers (LGOs), preparing a briefing to introduce the issues and shared recording tool, undertaking multiple site visits across the region, and compiling and analysing results. A Finalisation Workshop reviewed the findings and identified areas needing further attention and action.

Results demonstrated significant movement of sand and sediment across urban development areas, and little compliance with legislative requirements for sediment control.

The findings point to a need for changed and improved practices, greater awareness, clearer and more consistent regulations, and increased compliance inspections.

Improving three key industry practices, namely, effectively covering soil and sand stockpiles, minimising vehicular tracking of sand from site to road and improving poor sand delivery practices, will provide the most rapid change with the least effort.

Acknowledgements

Collaboration across Perth NRM, Sediment Task Force (STF) representatives from the Department of Biodiversity, Conservation and Attractions and the City of Cockburn, and Officers from the Perth South West Metropolitan Alliance, Cities of Cockburn, Melville and Kwinana and Department of Water and Environmental Regulation brought together the goodwill and capacity to make this Sediment Snapshot successful.

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Agni Bhandari, Department of Water and Environmental Regulation (DWER)
Bronwyn Scallan, Perth NRM (PNRM)

Key findings and outcomes

1. There was a low level of compliance with legislative requirements for sediment control.
2. Voluntary uptake of best practice sediment control by residential building practitioners was limited.
3. Frequent 'minor non-compliance' was resulting in a large cumulative sediment pollution impact.
4. Undertaking the Sediment Snapshot was an effective tool to rapidly highlight where significant changes are required.
5. Land development and building sector sediment management accountability would reduce Local Government (LG) expenditure on 'cleaning up' sand and soil, Water Sensitive Urban Design (WSUD) infrastructure, and remediating drainage and natural assets impacted by sediment.

Context

Sediment laden runoff from urban land developments is a significant source of water pollution, can erode creeks and riverbanks and result in sedimentation (Scallan, 2021).

Sedimentation of waterways, including tributaries, wetlands, estuaries and marine environments is a clear early warning sign that more action and investment is needed to effectively manage pollution and urban run-off, including sediment surface run-off (Healthy Land Water, 2019).

Sedimentation negatively impacts water quality, and habitat availability, by supporting aquatic weed growth, altering flow regimes, indirectly impacts community health by increasing mosquito populations (SERCUL, 2016), pathogens, nutrients and toxic contaminants and decreasing, recreational, cultural, amenity and aesthetic values of waterways (Scallan, 2021).

Soil erosion, sediment laden runoff and 'sand drift' from construction sites can cause sediment pollution when construction site soil erosion and sediment controls and good site management practices are absent or ineffective. On construction sites, sediment laden runoff comprises 'loose' *in-situ* soil (often containing soil nutrients that can cause eutrophication) and imported building sand, and other common building materials such as cement. It can also be contaminated with chemicals present from degrading hydro-mulch, paint, plastics and other rubbish (Scallan, 2024).

Research commissioned by the STF and completed in 2020 by the Cooperative Research Centre for Water Sensitive Cities (CRC-WSC) at the University of Western Australia (UWA) to quantify sediment loss during urban development was undertaken at Heron Park in Harrisdale, Armadale, Perth ((Western Australia (WA)) in 2017 and 2019. This study determined that uncontrolled sediment was being discharged at a rate of approximately 17,000 kilograms (kg) per hectare (ha) of exposed sand annually, making its way into stormwater drains and polluting waterways and wetlands, and that this was particularly prevalent during significant weather events (Oldham C.E., Eynon F. and Ocampo, C.J, 2020).

The sediment discharge rate at Heron Park compared to measured sediment fluxes of 350 kg/ha/year from an agricultural (grazing) catchment in WA (McKergow et al. 2001); after restoration of the stream riparian zone, this agricultural sediment export reduced to 9 kg/ha/year (McKergow et al. 2001). The CRC-WSC/ UWA researchers noted that the differences between the discharge rate measured at Heron Park, and that measured by McKergrow et al. (2001), was broadly in line with the United States of America Environment Protection Agency (2000) estimate that construction activities discharge sediment at rates 10-20 times the rate from agricultural lands, and 1000-2000 times the rate from forested land. For the sites monitored in WA, land under construction was discharging sediment at approximately 50 times the rate from agricultural land (Oldham C.E., Eynon F. and Ocampo, C.J, 2020).

The potential for sediment pollution and sedimentation will increase as land historically used for low intensity purposes (e.g., agriculture) is developed to cater for population growth, particularly due to recent and planned government economic stimulus packages for house building (Scallan, 2021).

Best practice soil erosion and sediment controls that keep soil and sand on construction sites will minimise sediment pollution. Preventative controls are far less expensive than the costs associated with 'cleanup' (Healthy Land Water, 2019).

Governments often incur significant costs to sweep roads, repair and maintain stormwater and WSUD infrastructure and remediate waterways when there is poor industry practice, both during and after land development activities (Scallan, 2021).

Further economic costs are related to the loss of storage capacity and reduced design life for reservoirs, dredging costs to maintain navigable channels, increased water treatment costs, reduced flood capacity (bridges, culverts), bank erosion, reduced lifespan of stormwater infrastructure and increased maintenance costs. Economic costs resulting from declining tourism, fish stocks, recreation and cultural and heritage values are also evident, and further costs are predicted (Healthy Land Water, 2019).

It has been calculated that there is an economic benefit of $1.20 for every $1.00 invested in current best practice erosion and sediment control (Healthy Land Water, 2019) and that the costs of construction and maintenance of WSUD devices can be reimbursed through the benefits of mitigated pollution damage control costs over a period of five to ten years (New Zealand Ministry for Environment, 2019).

Air-borne dust is highly visible to the public, impacts on air quality and amenity, and is subject to significant monitoring and relatively effective regulation. In contrast, water-borne sediment is typically visible during peak storm events when public scrutiny is reduced, and monitoring becomes challenging. Discharged sediment may be evident downstream after a storm event, however attributing this to a specific stakeholder or development activity can be difficult, and thus regulation of sediment discharge remains a challenge. This is despite a number of regulatory instruments already in place for water-borne sediment discharges (Essential Environmental Services, 2010).

As demonstrated by this Snapshot, more effective active management of wind and water-borne dust, sand and soil is essential during all phases of land development, from initial earthworks, through to civil works, house construction and finally during landscaping.

Background to the 'Sediment Snapshot'

STF member Chris Beaton invited PSWMA colleagues to explore the issue of sediment in the region. He found that sediment and sand management and remediation was costing the City of Cockburn significantly. Of the City of Cockburn's 23 suburbs in 2021, 50% had subdivision developments and 50% had infill residential subdivisions taking place, and most developments were causing sand drift.

The $1.66 million cost to the City of Cockburn in the 2019/2020 financial year associated with sediment control of new subdivisions and residential infill building comprised:

- $1,310,400 sweeping program for internal roads and paths.
- $250,000 for the cost of its educting program. (Specialist tankers remove residual sediment and build-up of other materials and flush the system, helping to optimise drain performance).
- $103,000 for the costs of waste disposal for sweeping and educting.

Heavy rainfall events in 2022, including flash flooding, highlighted how soil erosion, poor subdivision and building practices and drain design significantly contribute to the sedimentation of wetlands. It also highlighted the importance of keeping the City of Cockburn's drainage infrastructure free from sediment, so they are clean and functioning.

The proposal

A proposal was developed by PNRM's Sediment Project Manager and PSWMA's Regional NRM Facilitator to coordinate a site inspection ('Sediment Blitz') event in the PSWMA region as a pilot trial.

The proposed trial would collect baseline data regarding sediment issues and rates and effectiveness of erosion and sediment control and legislative compliance.

The PSWMA region 'Sediment Blitz' proposal was inspired by the New South Wales's GET THE SITE RIGHT education and compliance campaign and the Auckland City Council's *Closing the Gap Program*.

Whilst this proposal was endorsed in principle at the Perth South West Environmental Forum Meeting 10

November 2022, it was decided that PSWMA would instead coordinate a 'Sediment Snapshot' pilot trial as a data collection exercise, using current LG resources. The pilot trial would not issue warnings, infringement notices or fines, nor would there be a pre-snapshot communication campaign. This prevented any special effort being made by land developers, site supervisors, builders, bricklayers, sand carriers etc. to change their current practices/behaviours prior to, or on, the day, therefore providing a better indication of current practice.

The 'Sediment Snapshot' pilot trial aimed to establish:

- How big an issue sediment is for PSWMA LG assets, infrastructure and the natural environment;
- How to improve understanding of the extent of the problem in the region; and
- To identify opportunities to increase compliance and protect infrastructure.

Methodology

A 'Sediment Snapshot' Pre-Site Inspection Information Form and Site Inspection Form was developed for in-field use. A sample Site Inspection Form for a lot inspected in Cygnia Cove (Waterford) was provided to Officers as a guide. The forms were later adapted as per Officer feedback at the Briefing Session.
(*Refer to Appendix 1 for a copy of the 'Sediment Snapshot' PSW region Site Inspection Form*).

Officers from the six Perth South West LG, DBCA, DWER and PNRM were invited to participate in the Snapshot. The invitation included Building Services Compliance, Planning Compliance, Environmental Health, Environment and Planning, and Building Services Officers.

Eight Officers from the Cities of Cockburn, Kwinana, and Melville, DBCA and, PNRM attended the "Sediment Snapshot" Briefing Session at the City of Cockburn Operations Centre on 30 May 2023.

The following presentations were delivered at the 'Sediment Snapshot' Briefing session:
Sediment loss during urban development; the environmental values at threat
Alison McGilvray, Healthy Catchments Program, Rivers and Estuaries Branch, DBCA

DWER's Unauthorised Discharge Regulations and roles of Water Sensitive Design for sediment control in urban development
Agni Bhandari, Senior Engineer, Water and Ecosystem Planning, DWER and member of the Stormwater WA Association

Identifying and quantifying soil erosion and sediment loss
Bronwyn Scallan, Project Coordinator-Sediment Action, PNRM

Sediment Snapshot site inspections were undertaken during the week of 19-23 June 2023, by seven Officers from the Cities of Cockburn, Kwinana, and Melville, DBCA, PSWMA, and PNRM.

A Finalisation Workshop was held 7 September 2023 to discuss the results, as analysed and presented by the STF Coordinator. Seven Officers from the City of Cockburn, DBCA, PSWMA, and PNRM attended this workshop.

All Officers involved in the Sediment Snapshot pilot trial for all stages were invited to provide input and feedback to the draft 'Sediment Snapshot' Pilot Trial Summary Report.

In-field site inspections

The 'Sediment Snapshot' site inspections comprised the collection and assessment of group baseline data (poor practices, compliance rates, actual and potential erosion and sediment loss risk, presence/effectiveness of erosion and sediment control (ESC) measures).

Note that there was potential for bias during the selection of Snapshot sites that needs to be considered. Reasons given by Officers for site selection were:

a) Location (uphill of wetland, coastal site, near drain, close proximity to wetland/river).
b) Frequent prior dust/sand drift complaints/clean up orders.
c) Choice of site on arrival by non-PSWMA Officers influenced by current visual poor practice. (e.g. sand left site, vehicular tracking of sand, stockpiled sand, concrete wash, rubbish).

Snapshot Site Inspection Results

Details of site inspections

Twenty-six site visits were made by seven Officers during 'Sediment Snapshot Week', who investigated and recorded both potential sediment loss (water, and wind erosion) and actual sediment loss (sand drift and sediment laden run-off).

Building had commenced at twenty-one sites and five sites were vacant lots and comprised:

- Sixteen residential lots in new subdivisions.
- Four commercial building sites.
- One small scale subdivision.
- Three medium scale subdivision development.
- One mostly complete subdivision and some market gardens.
- One rural lot (post subdivision).

On average, subdivision and commercial sites took from between 30-45 minutes to inspect and residential sites between 10-20 minutes to inspect.

Weather

Weather experienced during 'Sediment Snapshot Week' included wind and rain events that could, and did in some cases, result in sediment movement/transport, including into drains.

There were zero incidences of flooding caused by sediment, even with recent rainfall events and rainfall during some of 'Sediment Snapshot Week' in some jurisdictions.

Poor site sediment control site practices were commonly observed

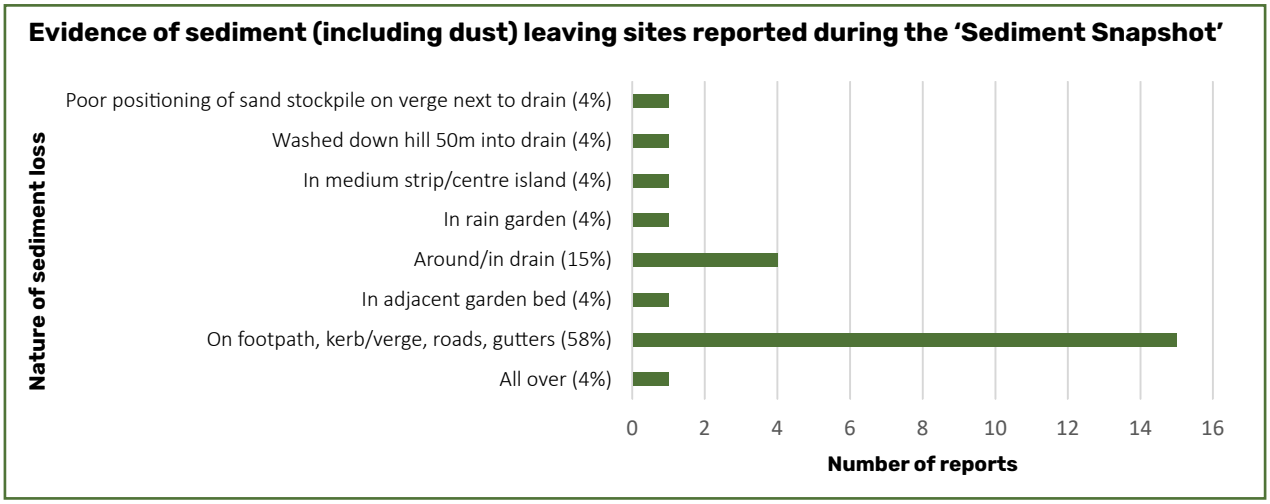
Poor site soil erosion and sediment control was a common observation at building sites in all jurisdictions. At two Snapshot sites there was clear evidence of soil, sand, silt, mud (sediment) being swept or hosed down the drain. (Visual inspection only; water quality/sediment sampling not undertaken).

There was evidence of sediment (including dust) leaving sites reported at 92% of the Snapshot sites, with 58% of this uncontrolled sediment being observed on the footpath, curb, in gutters and on roads.

Approximately eight tonnes/nine cubic metres (equivalent to one large dump truck full of sand) was estimated by Officers to have been transported from all twenty-six sediment snapshot sites (via sand-drift or water-borne sediment-laden surface run-off).

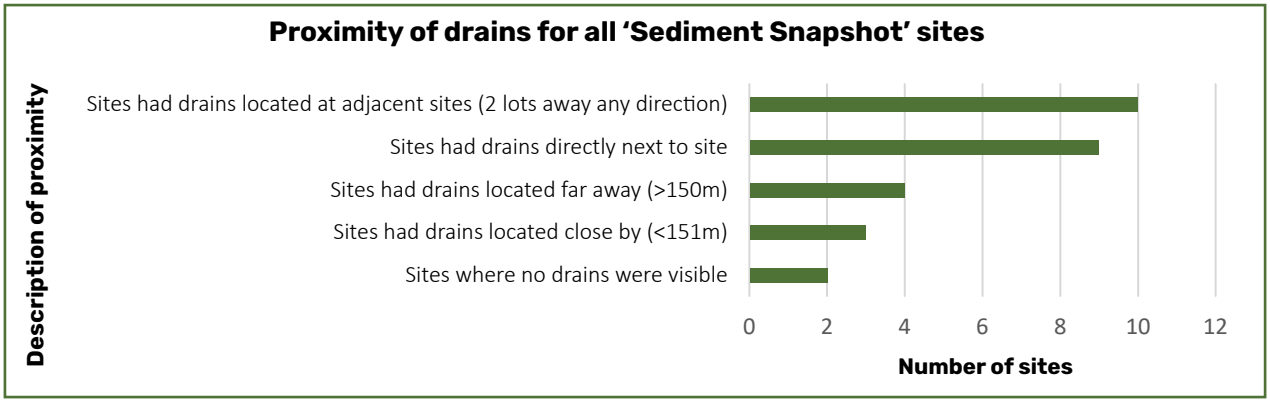
62% of Snapshot sites had no (zero) soil erosion or sediment controls installed. The Snapshot concluded that 73% of sites inspected were non-compliant with legislative requirements.

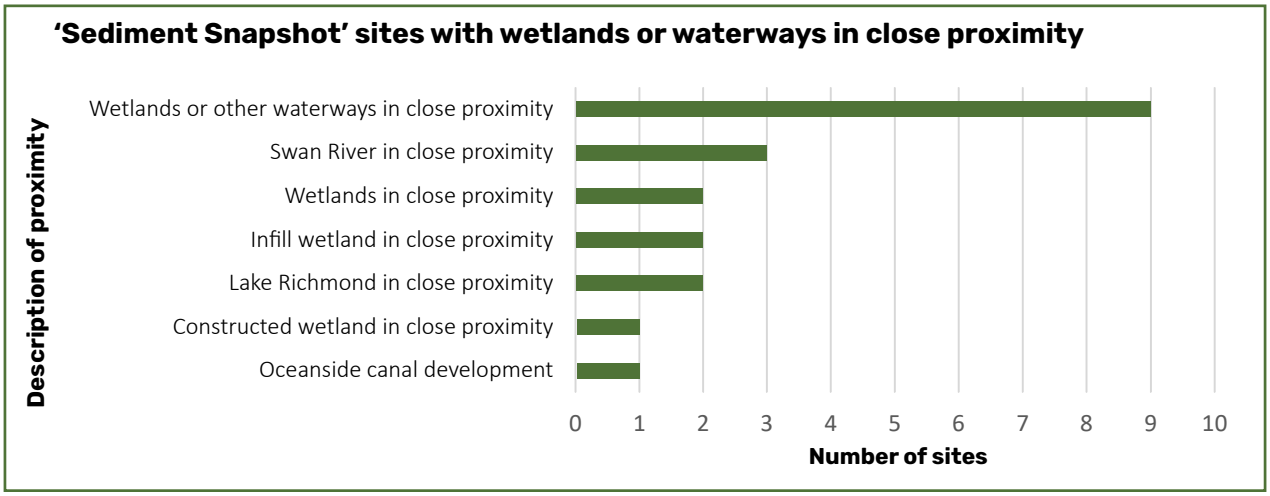
(Further information is expanded on below and related photographs can be viewed in Appendix 2).



The importance of Snapshot site proximity to drains, wetlands and waterways

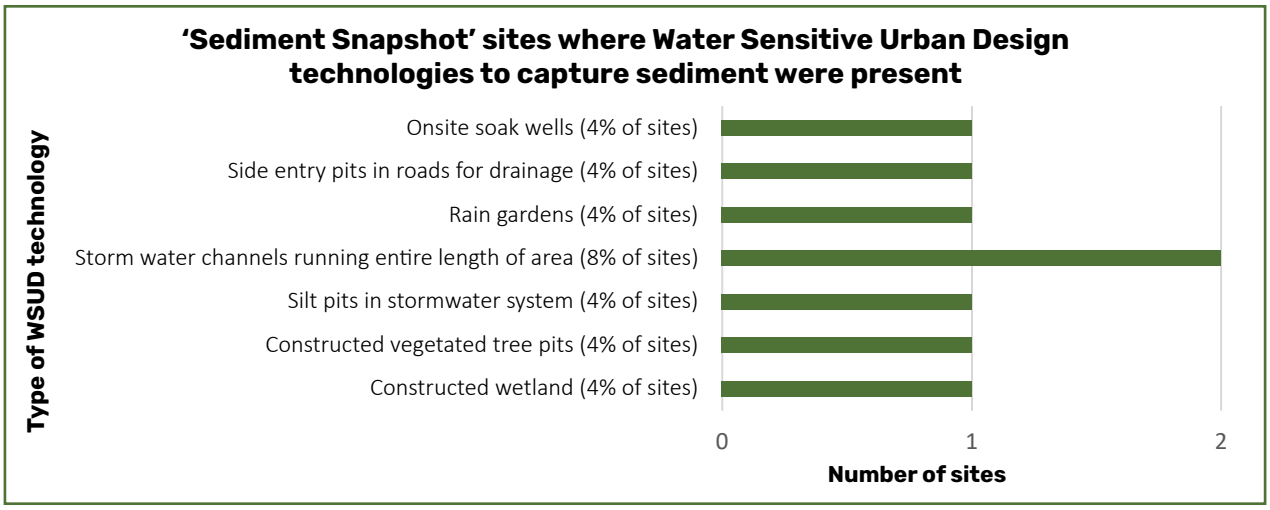
Snapshot sites in close proximity to drains and wetlands, waterways and the ocean have an increased sediment pollution risk when sediment is not adequately controlled on construction sites (Healthy Land Water, 2019). Details of the Snapshot sites' proximity to drains, wetlands and waterways is important therefore, and has been summarised in the two graphs below.



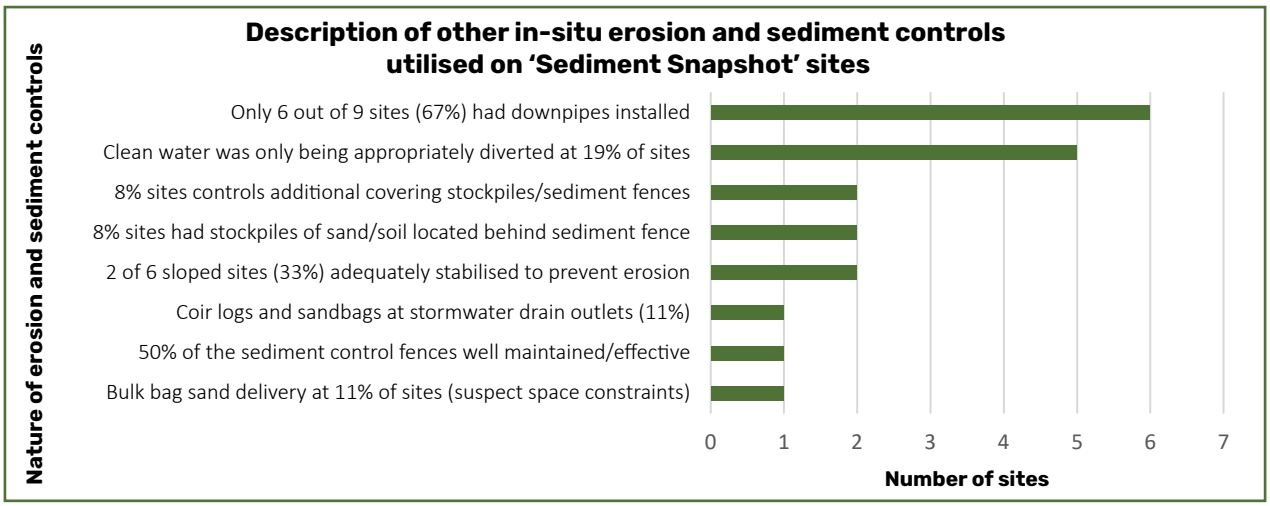


Presense of soil erosion and sediment controls to mitigate sediment pollution risk and assessment of their effectiveness

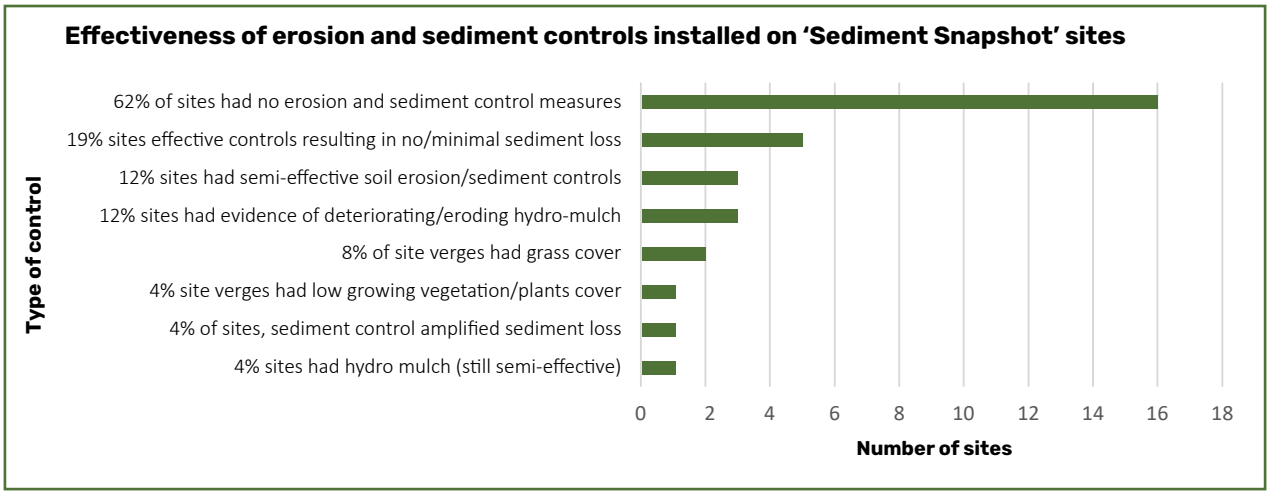
WSUD technologies to capture sediment were observed at only eight Snapshot sites, as per below graph:



Details of the other *in-situ* erosion and sediment controls utilised on Snapshot sites and their effectiveness are summarised in the below graphs. (Related photographs can be viewed in Appendix 2).

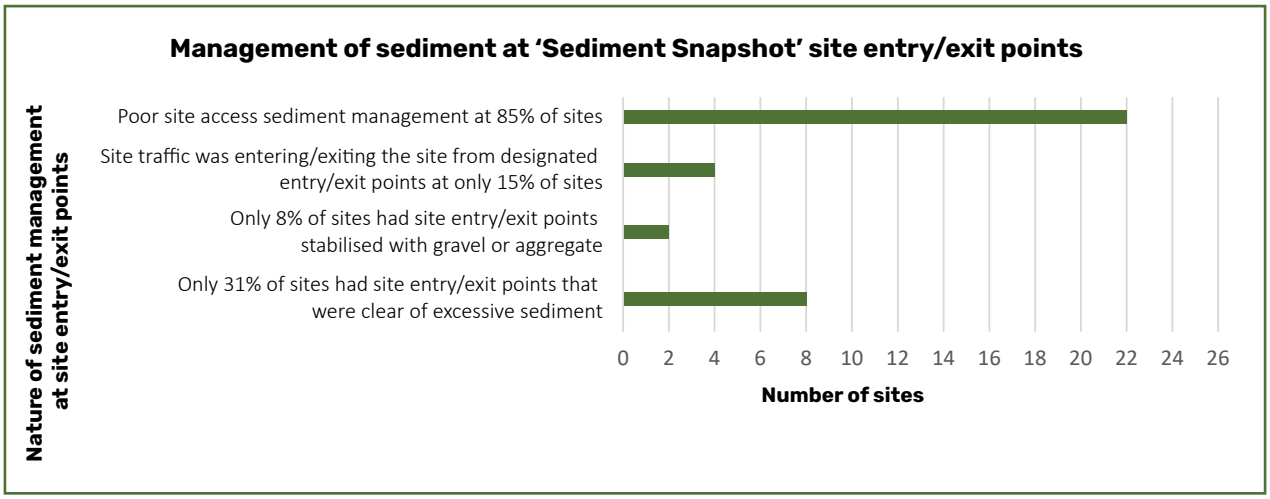


Note: No sites had signage outlining any on-site sediment control rules/regulations installed.



Reports of poor soil erosion and sediment control industry practices

Poor management of sediment at construction site entry/exit points was commonly observed during the Snapshot, as per the below graph:



Evidence of sedimentation of wetlands and waterways

Sedimentation of wetlands and waterways resulting from poor industry practice was reported at seven of the Sediment Snapshot Sites with yellow building sand being clearly observed at three of these sites, even when sediment controls were in place.

Vehicular tracking of sediment from site onto roads

Vehicular tracking of sand onto roads from both subdivision and residential building sites was a major but avoidable source of sediment on roads, and subsequently into drains, for almost all sites inspection during this snapshot.

Twenty-three sites (88%) had evidence of 'vehicular tracking' of sediment from site or adjacent site onto the road. This commonly observed poor industry practice represents a high risk of sediment pollution. (Related photographs can be viewed in Appendix 2).

Potential pedestrian safety hazards resulting from sand drift

There were four instances (15%) of pedestrian safety hazards caused by sediment leaving sites. (Related photographs can be viewed in Appendix 2).

Quantification of sediment leaving all Snapshot sites

To quantify how much sediment had been allowed to migrate from Snapshot sites, Officers were asked to make a visual observation and roughly estimate the volume of sediment present on the road (including in the gutter).

It was estimated that approximately nine cubic metres, or eight tonnes of sediment, equivalent to one large dump truck and constituting primarily imported building sand, left the inspected sites.

At a cost of $12/tonne bulk builders sand, it can be extrapolated it would cost only $72 to replace all the sediment estimated to have left the twenty-one Snapshot sites where controls were absent or ineffective. The cost to industry of replacing this sand would be much greater, however, due to minimum quantities of sand being required for each site and as delivery costs for builders sand are significant. Consideration should also be given to the benefits of preventing building sand from leaving construction sites given the environmental impacts incurred by clearing native vegetation to quarry for building sand.

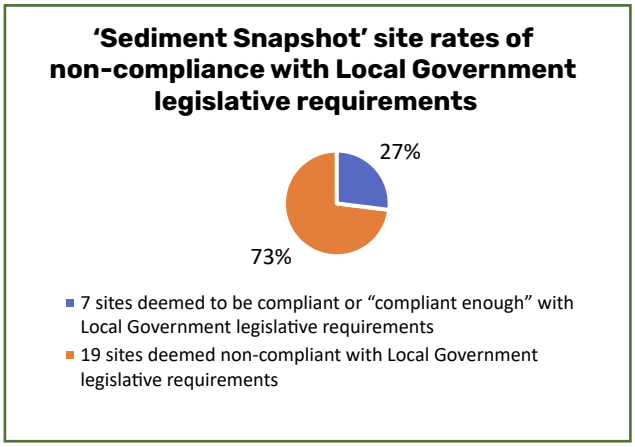
This is important as if the cost of 'cleaning up' and remediating drainage, WSUD and natural assets impacted by unmitigated sediment is greater than the cost to industry of replacing soil and sand that leaves construction sites, a private cost benefit for the land development industry will ensue.

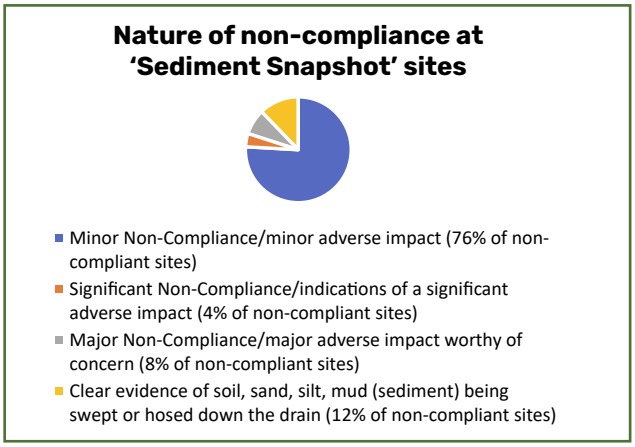
Compliance with legislative requirements

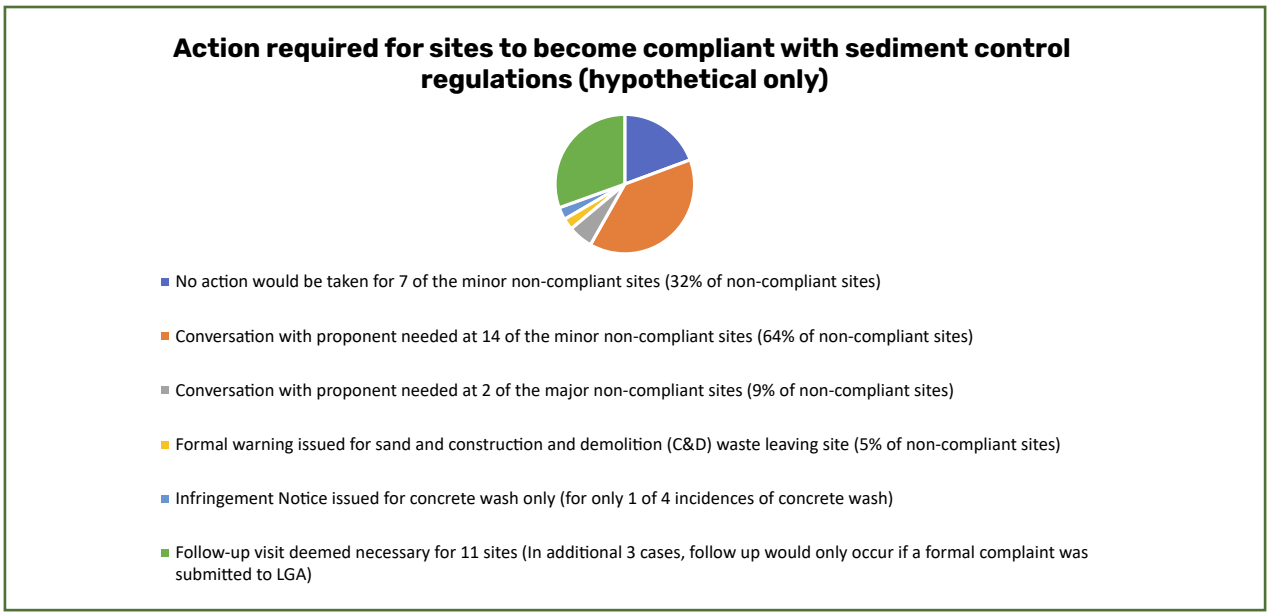
A summary of the data collected on compliance rates is presented in the three graphs below. (Related photographs can be viewed in Appendix 2).

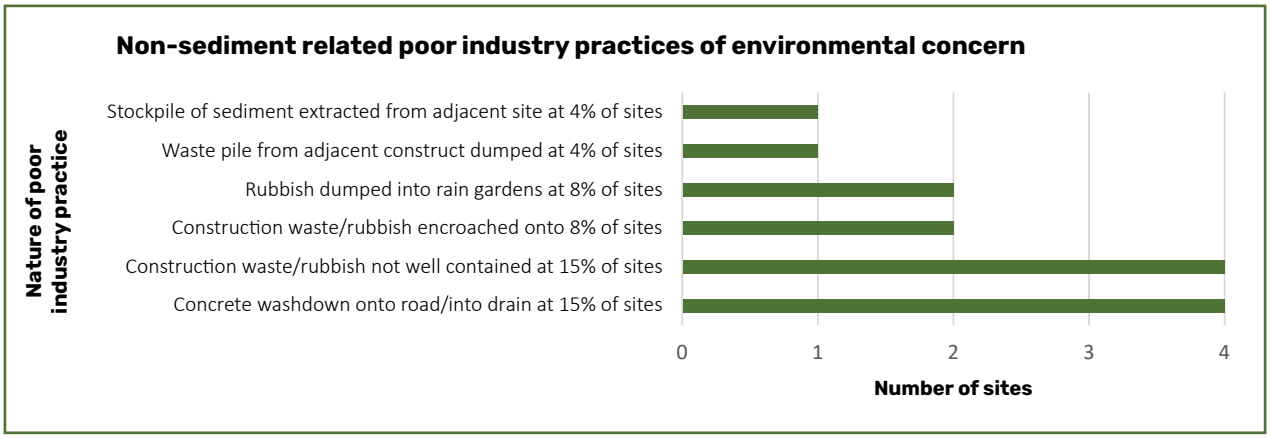
Other poor industry practices of environmental concern

During the Snapshot exercise, sediment control non-compliance was often accompanied by other poor, and non-compliant, site management practices, as per the fourth graph below. Poor industry practice observed included the Illegal dumping of residential building site waste on adjacent vacant lots.
(Related photographs can be viewed in Appendix 2).









A regional perspective
No erosion and sediment controls were in place for all five sites inspected in the City of Cockburn.

For the City of Kwinana, sediment loss was evident at twelve out of the thirteen sites inspected and no erosion and sediment controls were in in place for all residential sites.

In the City of Melville, there was uncontained sediment loss from one site of the four sites inspected but erosion and sediment controls in place for all commercial sites.

In the Rockingham LG, sediment loss was reported from all four sites inspected. There were no erosion and sediment controls in place for the three residential sites and semi-effective controls at one subdivision site. Two of the Snapshot sites were located on the boundary of Lake Richmond, therefore preventative soil erosion and sediment control at these two Snapshot sites will be required as a high priority.

Lake Richmond in the Rockingham LGA is an important ecosystem for thrombolites and waterbirds, and a Bush Forever site.
(Photo credit: Google Maps)

Headline Findings

1. At Snapshot sites, legislative requirements for sediment control were mostly not being complied with.
2. There was limited voluntary industry adoption of best practice measures to prevent erosion and sediment runoff from construction sites.
3. Sediment laden runoff and 'sand drift' from construction sites in the Perth South West region is resulting in pollution of wetlands and waterways.
4. In most cases for the Perth South West region's commercial and subdivision sites inspected during this snapshot:
    - Where WSUD technologies are present, they are mostly effective at capturing sediment.
    - Where preventative on-site soil erosion and sediment controls are in place, such as sediment control fences, stabilised slopes and hydro mulch applications, but are not maintained and/or functioning effectively, they are ineffective at mitigating sediment loss.
5. In most cases for the Perth South West region's residential building sites inspected during this snapshot had substantial non-compliance with local laws for mitigating sand drift, sediment-laden runoff, including near drains, wetlands/waterways, including:
    - Minimal temporary or permanent soil cover/verge to lot groundcover.
    - Few single, stabilised entry and exit points to prevent soil/sand tracking off sites.
    - Little covering of soil and sand stockpiles to prevent wind/water erosion.
    - No preventative on-site soil erosion and sediment controls installed (not even sediment control fences).
    - A number of incidences of illegal sand dumping on the road by sand carriers (which poses a significant sediment pollution risk as this sand is not being moved off the road onto site).
    - No clean water being diverted around the work site, so it runs over soil/sand surface
    - (i.e. no stormwater diversion).
    - A one-in three occurrence of downpipes not being immediately connected from guttering to stormwater drains when roof is installed.
    - An absence of site supervisors, builders, bricklayers and other trades undertaking regular site checks, sweeping (cleaning up).
    - In one reported case, the 'V' shape of kerbing is funnelling water and sand into the drain, compounding the problem. This may be the case for other drainage infrastructure installed by some land development companies for this region.

In the Cockburn, Kwinana and in Rockingham LGAs, these above practices were often observed to be common for the whole street/subdivision.

6. Hydro-mulch used on vacant lots or on sand stockpiles at the Snapshot sites (to prevent sand drift by wind or water erosion) was mostly ineffective due to degradation of the product over time, so could not be considered to be a form of vegetative cover.
7. Frequent incidents of sediment loss deemed as a 'minor non-compliance' with legislative requirements by inspecting Officers demonstrate a larger cumulative sediment pollution impact. Ensuring the land development industry is more accountable for poor practice in the Perth South West region will improve environmental outcomes and reduce the current high level of private financial benefit to the land development industry, benefitting PSWMA region LGs and ratepayers.

Conclusions

1. This Pilot provided evidence of the widespread nature of sediment pollution in Perth South West and also some 'low hanging fruit' that may lead to significant change quickly, including clear and specific guidance for sand delivery and improved sediment and traffic management on construction sites.
2. The priority area for improving industry practice across the region is residential housing building sites, as there was very little evidence of a shared responsibility for water-borne sediment discharge by tradespersons at these sites.
3. The priority locations for improving industry practice are the high growth Cockburn, Kwinana and Rockingham LGAs.
4. The priority for managing sediment pollution in the region is to focus on areas adjacent to and within drainage systems associated with high value wetlands and waterways.
5. Lessons were learned in refining the Snapshot tool and during the briefing and reporting, with excellent feedback from participating Officers.

Recommendations (Participating Officers)

General

1. Undertake a systems mapping exercise to prioritise areas where the risk is higher (for natural values), the practices are widespread and easier to change. This would involve engaging with stakeholder groups with these report results and deciding what change is feasible.
2. Raise awareness – publicise and communicate the outcomes of this Snapshot, with a focus on prevention as a priority solution rather than 'cleaning-up', sediment extraction and/or remediation of natural assets.
3. Dust control should be acknowledged as a form of erosion and sediment control rather than just preventing public nuisance. Conversely, poor dust control practices should be a lever for improving on-site wind-borne soil erosion and sediment control.
4. With pre-event planning and reporting and follow up managed through the STF and Perth South West NRM, this event is low cost and has potential to be more effective in future if it also included participation of the building industry and a dedicated communications campaign.

Local Government

1. Increase Officer understanding of legislative requirements for site sediment control during land development, at subdivision and at lot scale.
2. Increase Officer understanding of site erosion and sediment control best practice.
3. Prevent soil erosion and sediment loss during urban development at the planning, design and approval stages.
4. Clarify and strengthen regulations e.g., all sites must have and implement an Erosion and Sediment Control Plan (ESCP example at https://www.teer.org.au/erosionandsedimentcontrol).
5. Address poor practice through monitoring for compliance systems.
6. Consolidate data on end of pipe impacts, cost of recovering drainage and wetland systems.
7. Focus on sites where environmental impacts are greatest and encourage homeowners (in particular first-home buyers purchasing lots in new subdivisions) and the general public to get involved (can connect this to other programs e.g., Saving Our Snake-Necked Turtle).
8. Offer annual Officer awareness and training.

Regional (Perth South West Metropolitan Alliance LGs)

1. Determine a regional perspective on the scale of the problem, including best management erosion and sediment control practices during infilling of wetlands for urban development.
2. Collate data on wetlands and waterways impacts.
3. Focus on change at a regional scale as these problems are common among LGs (could separate into established/developing areas).
4. Ensure PSW LG's processes (policy, assessment, approval, compliance) for 'LG owned' developments effectively prevent on-site soil erosion and sediment loss (i.e. 'walk the talk').
5. Consider adopting similar models/aligning with other programs such as DWER's Light Industry Program and learnings from the proposed sediment control and prevention program for the Armadale, Canning, Gosnells and Victoria Park region.
6. Seek opportunities to integrate sediment/dust control with other regional initiatives.

Sediment Task Force

1. Amend Snapshot Site Inspection Form to include an assessment category for the scale of non-compliance between minor and major non-compliance, for greater understanding of perceived impact.
2. Promote Snapshot as tool for use by other LGs.
3. Advocate for industry leadership and regulatory change.
4. Share best practice methodologies, case studies, guidelines etc. (E.g., *Healthy Land and Water Soil Erosion & Sediment Control Internal Management Systems Review Report Template and Action Plan; Get the Site Right, The Blue Book; Erosion and Sediment Control; The fundamentals for development in Tasmania; ESC Guide for Land Disturbing Activities in the Auckland Region*).

State Government

1. The Armadale Gosnells Landcare Group (AGLG), the South East Regional Centre Urban Landcare (SERCUL) and the South East Corridor Councils Alliance (SECCA) with support from DBCA's Rivers and Estuaries Branch (REB) are developing a project funded through the Federal Urban Rivers and Catchments Program. This is a four-year project and is likely to focus on upskilling LG and educating the building industry and the community on best practice sediment and erosion controls.
2. Explore opportunity for legislative change.

Priority Actions (Participating Officers)

<u>Completed actions</u>

1. Submission in September 2023 of abstract titled *Perth South West Sediment Snapshot: A Case Study in Collaboration* to the Connected by Water 2024 Conference. Authors: Dr Kathleen Broderick, Bronwyn Scallan and Alison McGilvray. Unfortunately, this abstract was unsuccessful.
2. Presentation by STF Coordinator to PSWMA Environment Forum Meeting, November 2023. Aimed to inform Councillors and Officers that the Sediment Snapshot (briefing, data collection and reporting) was useful and effective in increasing awareness of the problem and understanding of the contributing factors at a local and regional scale.
3. Key findings, results, conclusions, and recommendations of the Snapshot were presented to the STF for discussion in March 2024.
4. Snapshot's key findings were included in a presentation by the STF Coordinator at the inaugural WA Sustainability and Climate Alliance Meeting, hosted by the Water Corporation in March 2024.
5. Pia Hackshaw from the City of Kwinana will give a presentation titled *Sediment Snapshot; An Environmental Health Officer's perspective*, at the STF, New WAter Ways and Stormwater WA's LG Sediment Forum 24 April 2024.
6. Publication of the PSWMA region Sediment 'Sediment Snapshot' Pilot Trial Summary Report.

Actions in progress

1. Continue to communicate the Sediment Snapshot process and results widely. Suggested audiences are the CRC-WSC Water Transition Network, the Australian Water Association, LG networks, the Department of Planning, Lands and Heritage, DWER, New WAter Ways and the Water Corporation.
2. Look for internal and external opportunities for Sediment Snapshot methodology uptake, including allies and potential partners.
3. Target, as a priority: effective covering of soil and imported sand stockpiles; vehicular tracking of sand from site to road by trade vehicles and earthmovers (e.g., bobcats, diggers, construction and demolition waste recovery machinery); and poor practices by sand delivery carriers.
4. Raise awareness and educate builders on other best practice soil erosion and sediment controls options such as sediment control fences, stabilised access ways, immediate connection of drainpipes to gutters and soakwells. Communicate the importance of sweeping and collecting any soil, sand, silt, mud and dust from roads and gutters, and replacing it back on site, pre-, during and post- siteworks.
5. Consider adapting the PNRM/DBCA Keep Soil and Sand On-Site signage as a PSWMA region resource, for use by building companies at lot scale. (For further information visit https://www.perthnrm.com/blog/2023/06/22/stopping-site-sediment-pollution/)
6. Increase awareness through education and encourage public reporting (and support LGO capacity to respond). Options include sediment public reporting signage, using 'snap, send, solve', i-auditor', 'eyes on the street', or similar.
7. Identify interrelated opportunities on the regional scale (e.g., development approvals, LGA networks).

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Healthy Land and Water. 2013. Updated 2019. *The Case for Best Practice Erosion and Sediment Control Compliance - A South East Queensland Perspective*.

New Zealand Ministry for the Environment. 2019. *Literature Review Sediment Attributes and Urban Development*. Prepared for Ministry for the Environment by Morphum Environmental Ltd.

Appendix 1 Sediment Snapshot PSW region Site Inspection Form

PERTH SOUTH WEST Metropolitan Alliance

SEDIMENT SNAPSHOT 19-23 JUNE (Site Inspection Form)

Please submit to: bronwyn.scallan@perthnrm.com by 14 July 2023

Perth NRM

Reporting Officer Name and Organisation:		
Local Government Authority area:		
Date:	Time (start):	Time (finish):
Site Address (lot number and/or physical address):		
Building/land development company name (project proponent):		
Why did you choose to inspect this site?		
Describe relevant current and predicted weather conditions (wind, rain, storms) that are/could cause sediment movement.		
Site type (Circle best fit) residential building site commercial building site industrial building site transport infrastructure site roadworks large scale subdivision medium scale subdivision small-scale subdivision home renovations swimming pool installation landscaping (gardens)		
Proximity to drains - Is the drain? (Circle best fit) A) directly next to this site B) next to adjacent sites (2 lots away any direction) C) close by (<151m) D) far away (>150m)		
Is there evidence of soil, sand, silt, mud (sediment) being swept or hosed down the drain? **Describe:**		Yes / No / NA
Description of Gross Pollutant Traps and Water Sensitive Urban Design technologies present or in close proximity to this site. (E.g. strawbales, raingarden, bioretention system, constructed wetland, other vegetated stormwater assets).		
Description of wetland/waterways in close proximity. Take photos and look for evidence of sedimentation in wetlands or waterways you think is due to poor construction practices. (Look for major sediment deposition e.g. "yellow builders sand").		
Is there evidence of sediment (including dust) leaving this site? (e.g. footpath, road verge and/or road surface, in gutter or around/in drain, storm water entry pit etc). **Describe**:		Yes / No / NA
Estimate quantity of sediment that has left site; length *(m) x width (m) x depth (cm)*		
Is there evidence of flooding and/or other hazards (e.g. visibility, worker/pedestrian safety) caused by sediment leaving this site? **Details:**		Yes / No / NA

EVIDENCE OF THE POTENTIAL FOR SOIL EROSION /SEDIMENT LOSS TO OCCUR (In-situ erosion & sediment control measures)	
Are slopes adequately stabilised to prevent erosion?	Yes / No / NA
Is vegetative cover present? (e.g. existing native vegetation, mulch, turf strips, hydromulch) **Details:**	Yes / No / NA
Is clean water is being appropriately diverted at site?	Yes / No / NA
Are all sand and/or soil stockpiles adequately covered?	Yes / No / NA
Are all stockpiles of sand, soil located behind a sediment control fence?	Yes / No / NA
Are sediment control fences well maintained and build-up of sediment does NOT exceed 1/3 of the height of the sediment fence?	Yes / No / NA
Are other sediment control devices free from excessive sediment deposition? **Details:**	Yes / No/ NA
Is there evidence of "vehicular tracking" of sediment from site or adjacent site onto the road?	Yes / No / NA
Are site entry/exit points clear of excessive sediment?	Yes / No / NA
Are site entry/exit points stabilised with gravel or aggregate?	Yes / No / NA
Is all site traffic entering/exiting the site from the designated entry/exit points?	Yes / No / NA
Is there signage explaining on-site sediment control rules/regulations? (Take photos). **Describe:**	Yes / No / NA
Have downpipes been installed "as soon as the roof is on"?	Yes / No / NA
How effective have the on-site ESC measures COLLECTIVELY been in preventing soil erosion and/or sediment loss? (Circle best fit and take photos of each ESC measure). **Effective** (no/minimal sediment loss) **Semi-effective** (working to some capacity but not well enough to stop sediment runoff) **Not effective** (put up incorrectly, damaged, needs sediment removed) **Amplifying** (increasing erosion or sediment loss)	
Is this site compliant with your Local Government legislative requirements? (e.g. Sand Drift Local Law) **Details:**	Yes / No / NA
Is this site compliant with other legislative requirements/other LGA sediment control requirements? (e.g., EP Act, DWER Unauthorised Discharge Regulations, Planning Development Act WA 2005, Swan Canning Rivers Management Act 2006 (DCA), LGA Sediment Control Site Guidelines; conditions/permits/bonds etc.) **Details:**	Yes / No / NA
Which best describes the non-compliance? (Circle best fit) **Minor Non-Compliance** (minor adverse impact) **Major Non-Compliance** (major adverse impact worthy of concern) **Significant Non-Compliance** (indications of a significant adverse impact) **Critical Non-Compliance** (critical adverse impact)	
What would be your normal course of action to rectify a non-compliance like or similar to this? (Circle best fit) A) No action taken B) Conversation with proponent C) Formal Warning D) Infringement Notice E) Issue fine **Other details:**	**(Hypothetical only)**
Will a follow-up visit to this site by your LGA be necessary?	Yes / No / NA
Did you engage/communicate with anyone on site? **Provide short summary of conversation and** outcome and include information/educational resources taken.	Yes / No / NA
Other site-specific relevant information (e.g. present of construction and demolition waste, rubbish, paint or concrete being poured/hosed down drains, other unexpected influences/outcomes e.g. presence of street sweeper, verge watering truck mobilising sediment on roads to runoff into drains etc).	

Appendix 2 Examples of sediment management practices and issues reported during the Perth South West Region Sediment Snapshot pilot trial

Snapshot sites where soil erosion and sediment controls were absent or ineffective



Above left and centre: The absence of soil erosion and sediment controls at this canal development site in Orisno Boulevard in North Coogee in the City of Cockburn will result in degradation of the marine ecosystem. (Photo credits: Lisa Brideson)
Above right: Hydro-mulch quickly loses its structural integrity, resulting in wind or water transport of 'loose' sediment, as well as the constituents of hydro-mulch. Observed at lot on Chelydra Point North Coogee, City of Cockburn. (Photo credit: Alysha Kempf)



Above left: Unmitigated sediment leaving subdivision site "drops out" when water velocity slows, filling up a new drainage asset in Market Street/Thomas Road, Casuarina, City of Kwinana. (Photo credit: Pia Hackshaw)
Above centre and right: The use of as construction fence instead of a sediment control fence means sand drifts onto the footpath and onto the road, Lake Road, Rockingham LG. (Photo credit: Bronwyn Scallan)



Above left: Use of a construction fence at Riviere Apartment development, Canning Beach Rd in the City of Melville (adjacent to the Swan River) is not preventing sediment being transported from site. (Photo credits: David Bond)
Above centre and right: Sediment runoff not effectively captured by site geotextile mesh fence. Sabina Apartments development, Kintail Rd Canning Highway, City of Melville. (Photo credits: David Bond)

Sand drift from Snapshot sites

Left: Sand drift into nearby drain at residential building site, Chelydra Point, North Coogee, City of Cockburn.

Right: Retaining wall results in sand being blown on to side over path at site on Orsino Boulevard, North Coogee, City of Cockburn, amplifying sediment loss.

(Photo credits: Lisa Brideson)

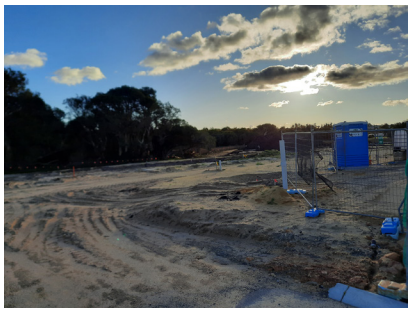
Above left: Windich Rd, Mandogalup, City of Kwinana. (Photo credit: Bronwyn Scallan)
Above centre: Use of a construction safety fence instead of a sediment control fence results in soil erosion and sediment runoff at Market Street and Thomas Road site in Casuarina, City of Kwinana, even when the slope has been recently revegetated. (Photo credit: Pia Hackshaw)
Above right: Torwood Avenue, Lake Treeby, City of Cockburn.(Photo credit: Alysha Kempf)

Above left: Unmitigated sand drift from Orisno Boulevard, North Coogee, in the City of Cockburn becomes a pedestrian safety hazard as well as a form of pollution. (Photo credit: Lisa Brideson)
Above centre: Unsafe sand drift onto footpath at residential building site in Torwood Avenue, Lake Treeby, City of Cockburn. (Photo credit: Alysha Kempf)
Above right: Sand drifting from building site onto road, Boota Way, Hammond Park, City of Cockburn. (Photo credit: Bronwyn Scallan)

Vehicle tracking of sand and soil from Snapshot sites and verges onto roads



Above left: Vehicle tracking of sand onto roads from residential building site in Bolam Lane, Wellard, a new subdivision in the City of Kwinana. (Photo credit: Bronwyn Scallan)
Above centre: Vehicle tracking of sand from verge in Coracina Vista, Wellard, City of Kwinana. (Photo credit: Melissa Mykytiuk)
Above right: Vehicle tracking of sand onto road from building site and adjacent vacant lot on Coracina Vista, Wellard, City of Kwinana. (Photo credit: Bronwyn Scallan)



Above left: Vehicular tracking of sand west accessway Malurus St/Corocina Vista subdivision, City of Kwinana. (Photo credit: Bronwyn Scallan)
Above centre: Vehicular tracking of sand east accessway Malurus St/Corocina Vista subdivision, City of Kwinana. (Photo credit: Bronwyn Scallan)
Above right: Vehicular tracking of sand from lot on Ebrington Road, Wellard, City of Kwinana. (Photo credit: Bronwyn Scallan)


Above left: Sand tracked on road by earthmoving machinery and trucks, Lake St subdivision Rockingham, Rockingham LGA. (Photo credit: Bronwyn Scallan)
Above right: Vehicle tracking of sand form verge, Lake St, Rockingham, Rockingham LG. (Photo credit: Melissa Mykytiuk)

Poor sediment management at Snapshot site entry/exit points

Above left: Lot in Chelydra Point North Coogee, City of Cockburn. (Photo credit: Alysha Kempf)
Centre: Market Street/Thomas Road subdivision, Casuarina, City of Kwinana. (Photo credit: Pia Hackshaw)
Above right: Poor sediment control on curb area in front of residential build on Ebrington Road, Wellard, City of Kwinana. (Photo credit: Melissa Mykytiuk)

Grassy verges effective at trapping some sand at two Snapshot sites, reducing the sediment pollution risk

Left: Thomas Rd/Market St Casuarina subdivision site, City of Kwinana. (Photo credit: Pia Hackshaw)

Right: Residential building site on Chelydra Point North Coogee, City of Cockburn. (Photo credit: Alysha Kempf)

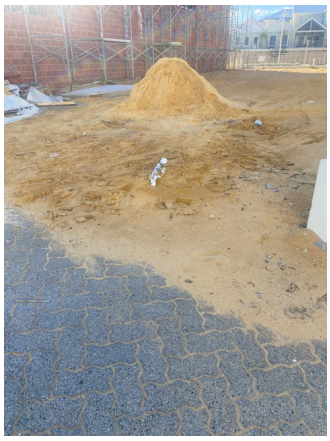
Poor sand delivery practices by sand carriers

Left: Builders sand partially dumped on the road by sand carriers at building site on Windich Rd, Mandogalup; another new subdivision in the City of Kwinana. (Photo credit: Bronwyn Scallan)

Impacts of uncontrolled sediment on Water Sensitive Urban Design infrastructure at or adjacent to Snapshot sites

Left: Raingardens installed in new subdivision to capture sediment at Coracina Vista, Wellard subdivision, City of Kwinana, rendered significantly less effective due to littering. (Photo credits: Bronwyn Scallan)

Uncovered sand stockpiles on Snapshot sites observed to be a significant potential source of sediment pollution



Above left: Uncovered building sand stockpile migrating onto road, Orisno Boulevard, North Coogee, City of Cockburn. (Photo credit: Lisa Brideson)
Above centre: Uncovered stockpile of building sand Lot on Boota Way, Hammond Park, City of Cockburn. (Photo credit: Melissa Mykytiuk)
Above right: Uncovered sand stockpile immediately adjacent to drain. Torwood Avenue, Lake Treeby, City of Cockburn. (Photo credit: Alysha Kempf)

Above left and centre: Lake St subdivision Rockingham, Rockingham LG. (Photo credit: Bronwyn Scallan)
Above right: Uncovered building sand stockpiles Malurus St subdivision North East access point, Wellard, City of Kwinana. (Photo credit: Bronwyn Scallan)

Non-sediment related poor industry practices of environmental concern




Above left: Concrete wash dumped on top of soil and sand in verge at lot on Ebrington Road, Wellard, City of Kwinana. (Photo credit: Bronwyn Scallan)
Above centre: Concrete wash from two different sites into drains at subdivision near North Lake Rd and Archibald St (previously Carawatha Primary School) in Willagee, City of Melville. (Photo credits: David Bond)
Above right: Uncovered sediment and concrete wash on road, corner Kintail Rd/Canning Highway Sabina Apartments development, City of Melville. (Photo credit: David Bond)




Above left (LHS): Sand and concrete wash had been allowed to leave this apartment development on Kintail Rd in the City of Melville. (Photo credit: David Bond)
Above left (RHS): Sand and concrete wash had been allowed to leave this apartment development on Canning Beach Rd in the City of Melville. (Photo credit: David Bond)
Above right (LHS): Poor site management practices resulted in sand, mulch and rubbish being transported into the drain at this building site in Tamblyn Place, Wellard, City of Kwinana. (Photo credit: Bronwyn Scallan)
Above right (RHS): Illegal dumping of residential building site waste on nearby vacant lot on Windich Rd, Mandogalup, in the City of Kwinana. (Photo credit: Bronwyn Scallan)