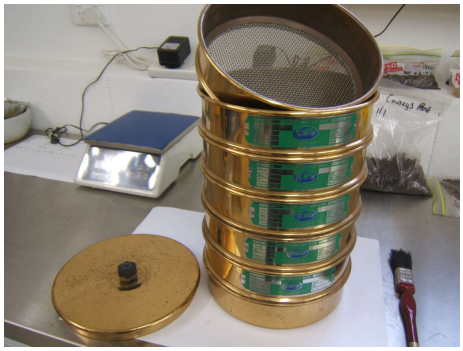
Selection of Media for Mound Systems

Filter Media Properties

- For wastewater treatment, the physical properties of the filter media we are interested in can be determined by conducting a 'sieve analysis' of the media
- From this analysis it will then be possible to determine:
  1. Effective Size (ES) of the filter media
  2. Uniformity Coefficient (UC) of the filter media
  3. Percentage of fines (clay) within the filter media

Sieve Analysis



Filter Media Properties Effective Size (ES)

- Effective Size is defined as the maximum particle size of the smallest 10% of the media sample by weight and is estimated by plotting the results of the sieve analysis on a cumulative frequency curve
- The effective size is typically expressed as $\mathbf{d_{10}}$ and identifies the minimum grain size likely to influence the hydraulic performance of the filter bed

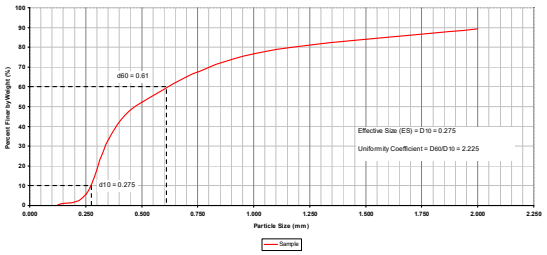
Filter Media Properties Uniformity Coefficient (UC)

- The Uniformity Coefficient is defined as the ratio of the maximum particle size for the smallest 60% ($\mathbf{d_{60}}$) of the media by weight to the maximum particle size of the smallest 10% ($\mathbf{d_{10}}$) of the media by weight

$$\mathbf{UC = d_{60} / d_{10}}$$

- This value is used to determine the homogeneity or heterogeneity of the filter media

Filter Media Properties



Filter Media Properties
Percentage of Fines

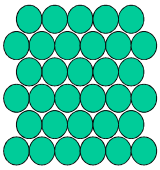
- Fine materials including dust, fine organic particles, fine silt particles and clays are the enemy of an effective sand filter or mound system design
- 'Dirty' sands are one of the most common causes of poor operation and clogging in filter media systems because, over time, fine materials migrate to the bottom of the filter where they can form a restrictive layer and eventually block hydraulic flow through the filter bed

Filter Media Properties
Percentage of Fines

- Fine materials are generally defined as all particles passing a 0.063mm sieve. The percentage of fines can be determined during the sieve analysis or interpolated from the cumulative frequency curve if the sieve data is unavailable

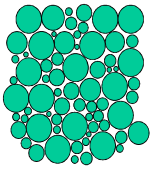
Filter Media Properties

Large Effective Size (d_{10}) ~ 2mm



Highly Uniform – Homogeneous
UC ~ 1 - 2

Small Effective Size (d_{10}) ~ 0.75mm



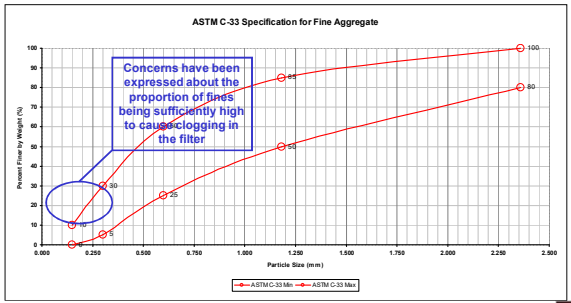
Moderately Uniform – Heterogeneous
UC ~ 3 - 6

Selection of Media for Sand Mound Construction

Filter Media Specifications

- To address these issues many Regulatory Authorities and researchers have developed specifications for filter media used in wastewater treatment systems
- In some cases existing specifications for other uses have been utilised and, in some cases, have proven problematic
- Most specifications relate to the filter media properties outlined in the previous section

The Use of ASTM C-33 as a Filter Media Specification



Australian Guideline Values (SPSF or Mound)

	ES	UC	% fines
AS/NZS 1547:2012	0.3mm – 1.0mm	<4	<3
EPA VIC 2024	0.3mm – 1.0mm	<4	<3
SAHC 1998	0.25mm – 0.6mm	<4	<5

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Filter Media Specifications – Guidelines, Regulations and Standards

Organisation	Media Specifications: Effective Size (mm)	Media Specifications: Uniformity Coefficient	Media Specifications: Percent Fine Material (%)	Bed Design: Depth of Filter Bed (m)	Reference:
Intermittent Sand Filter and / or Mound Systems					
AS/NZS 1547:2012	**0.25 – 1.00**	**< 4**	**< 3**	**0.60 (min)**	AS/NZS 1547:2012. *On-site Domestic Wastewater Management.* Standards Australia and Standards New Zealand.
EPA Victoria	**0.25 – 1.00**	**< 4**	**< 3**	**0.60 (Prim) 0.40 (Sec)**	EPA Victoria 2024. Guideline for onsite wastewater effluent dispersal and recycling systems.
South Australian Health Commission (SAHC)	**0.25 – 0.60**	**< 4**	**≤ 5**	**≥ 0.75**	SAHC 1998. Waste Control Systems – Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia. Supplement A – Aerobic Sand Filters. Environmental Health Branch, South Australian Health Commission.
Ohio State University	**0.15 – 0.30**	**4 - 6**	**≤ 5**	**0.60 (min)**	OSU 1900. *Mound Systems for On-site Wastewater Treatment.* Ohio State University Extension Service Bulletin, 813-90. http://ohioline.osu.edu/b813/b813_1.html
Crites and Tchobanoglous	**0.25 – 0.75**	**< 4**	**Trace**	**0.45 – 0.90**	Crites, R. and Tchobanoglous, G. 1998. *Small and Decentralised Wastewater Management Systems.* McGraw-Hill, Boston.
Wisconsin Mound Design Manual	**~ 0.30**	**< 4**	**≤ 1**	**0.60 (min)**	Converse, J. C. and Tyler, E. J. 2000. *Wisconsin Mound Soil Absorption System: Siting, Design and Construction Manual.* Small Scale Waste Management Project, Soil Science Department, University of Wisconsin – Madison.
US EPA	**0.25 – 1.00**	**< 4**	**≤ 3**	**0.60 – 0.90**	USEPA 2002. *Onsite Wastewater Treatment Systems Manual* – Technical Fact Sheet 10. Office of Water, U.S. Environment Protection Agency. EPA/625/R-00/008.
Washington State DOH	**Coarse sand media 0.30 – 0.50**	**< 4**	**≤ 3**	**0.60 (min)**	WSDOH 2016. *Recommended Standards and Guidance for Performance, Application, Design, Operation and Maintenance of Intermittent Sand Filter Systems.* Washington State Department of Health, Office of Environmental Health and Safety – Wastewater Management Program. Olympia Washington.
Siegrist	**0.25 – 1.00**	**< 4**	**≤ 3**	**0.60**	Siegrist, R.L. 2017. *Decentralized Water Reclamation Engineering - A Curriculum Workbook.* Springer.

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Sourcing of Media

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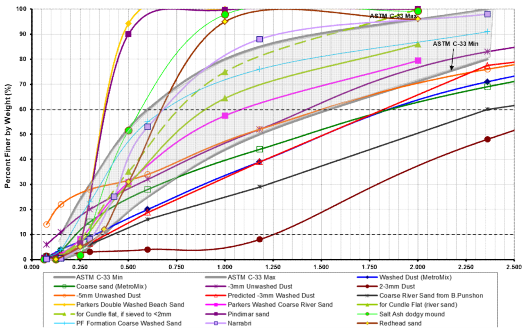
Media Data

Sample Media



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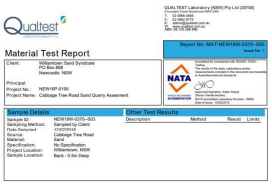
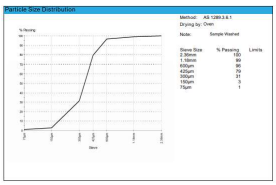
Quality Control

- Test report
- Particle size distribution





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Presby "Spec-Check"

- https://www.infiltratorwater.com/products/combined-treatment-and-dispersal/spec-check-1/
- Enables determination of grain size distribution of media to assess suitability for use in sand filters and mounds
- Available through AES

https://www.infiltratorwater.com/video-library/spec-check-demo/

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