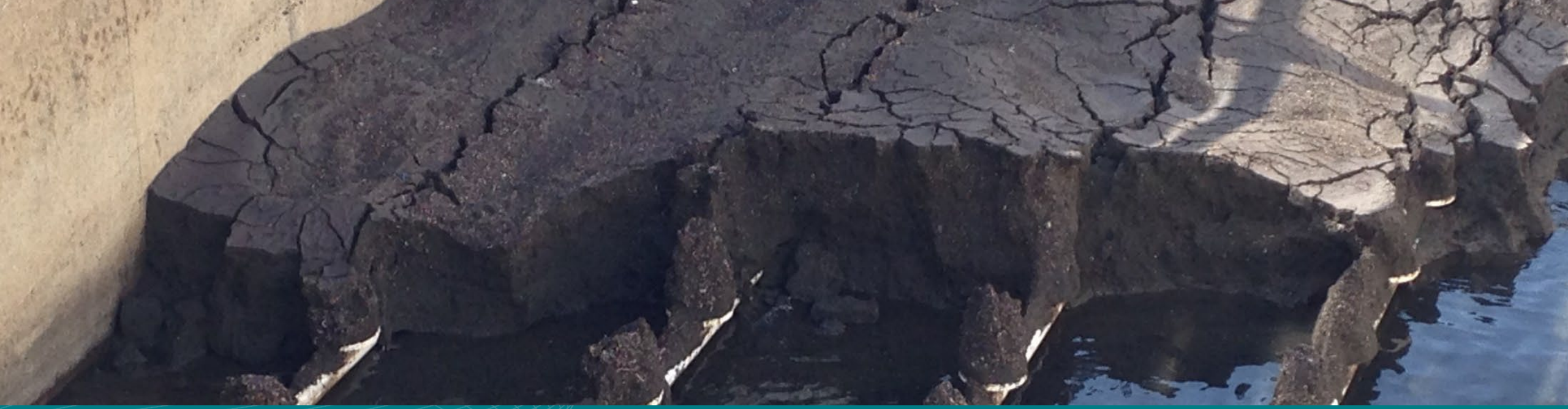


Advanced Grit Management® (AGM)

A Scientific Approach to Grit System Design

Hydro International®

What is Advanced Grit Management®?

Modern performance for today's treatment plants

- **95%+ removal** efficiency while targeting grit particles 75-150 micron
- AGM systems typically **remove 85-95% of the total grit load** entering the plant
- **Conventional grit systems remove only 30-50% of incoming grit**

Who Needs AGM?

A critical first line of defense

- Headworks screening and grit removal protect all treatment processes and equipment in a WWTP
- Biological processes continue to evolve toward better effluent quality in a smaller footprint
- Many expensive advanced processes eliminate the protection of primary clarification, allowing grit that is not captured in the headworks to pass directly to the biological process
- The small footprint used by these **advanced processes** means **increased sensitivity to grit** accumulation
- New processes, in conjunction with reductions in plant personnel, further drives the need for AGM to remove grit where it should be removed, at the headworks

Understanding Grit Behavior

Key Considerations

- Grit is NOT clean sand
- Understand local grit behavior, characteristics, and gradations
- Apply this understanding to achieve desired results

Trust science over assumptions

- Grit particle settling velocities are significantly less than physical size would indicate
- Municipal grit settles much slower than would be expected based on its physical size
- Physical particle size analysis is not sufficient to accurately characterize municipal grit

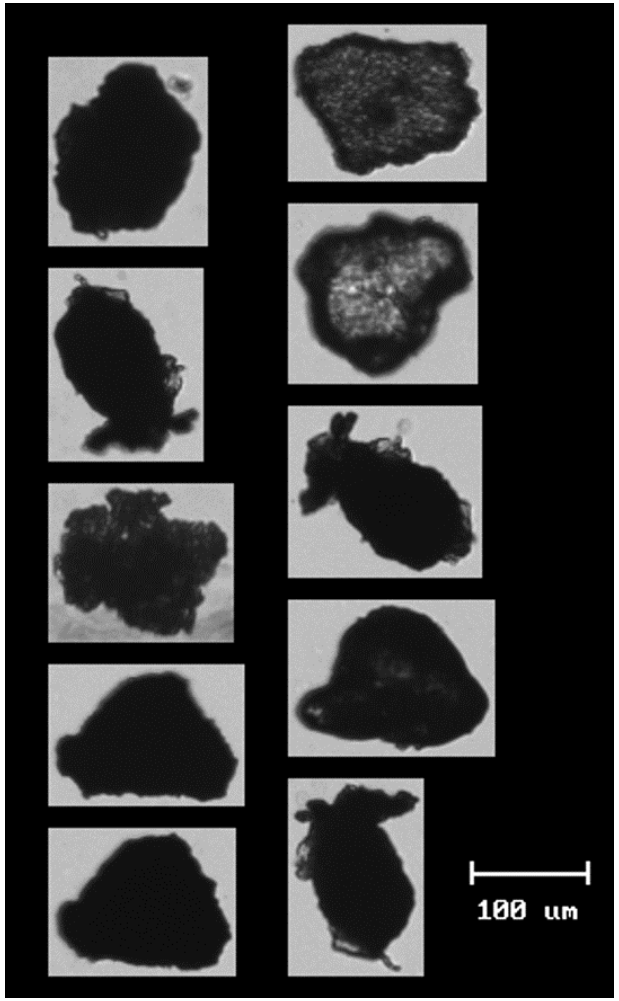
Grit Characteristics

106 micron minimum

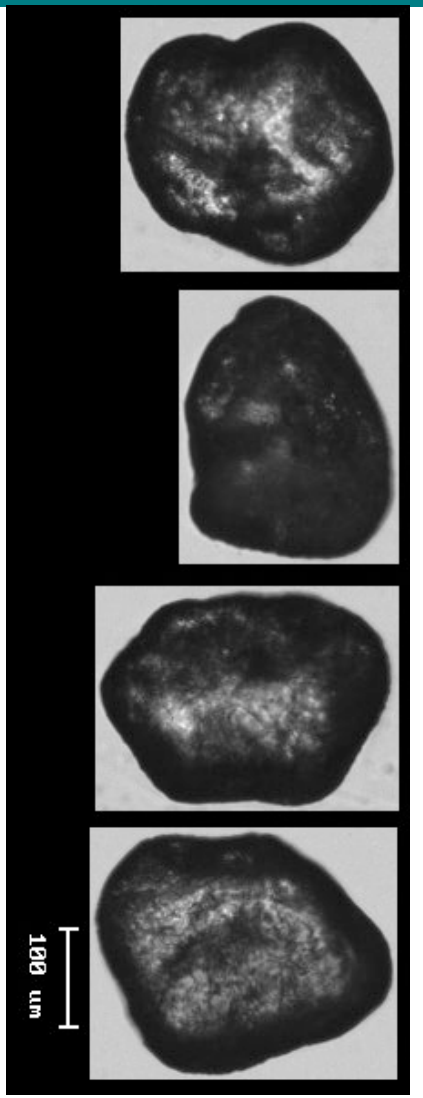
- Grit particle size has long been a criteria used for system design
- Shape and Specific Gravity (SG) significantly affect **grit particle settling velocity**
- Accounting for shape and SG in system design is **critical for achieving desired results**
- Through extensive field, lab, grit characterization, and modeling experience, Hydro has found that 106 micron is the ideal target particle size capture to design for most plants

Protection is paramount

- Dated design criteria used in conventional technology often only removes 30-50% of incoming grit
- These designs fail to **protect the plant** from abrasive wear and deposition from 50-70% of incoming grit



Municipal wastewater grit particles

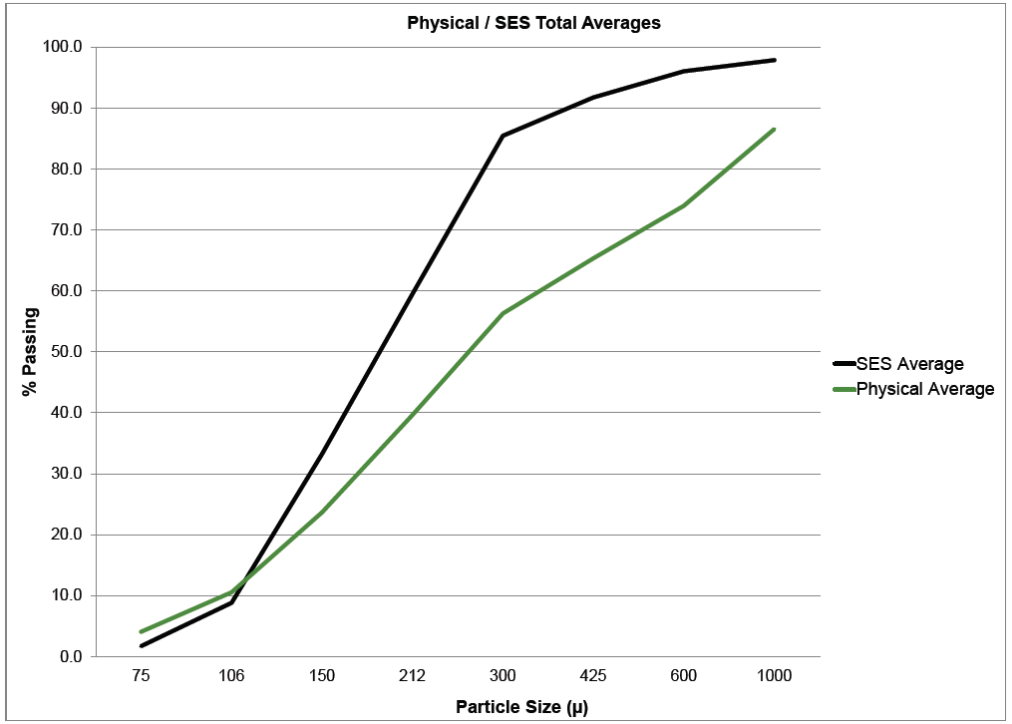


Clean sand particles

Grit Gradations

Know YOUR grit

- Influent wastewater grit size characterization **has changed** dramatically over the past 10 years
- Historically characterization focused solely on material 212 micron and larger
- Numerous failures of systems designed for 212 micron mandated looking at grit as small as 75-micron
- Unfortunately, many grit system designs start with little understanding of native grit and as a result fail
- In an ideal world, all grit system designs would start by accurately characterizing their native grit, however this is not always possible
- Alternatively, plants can use data from a plant in their region. **Hydro international has regional grit characterization data** from a continuously growing base of plants across North America, in most cases both **size distribution** and **settling velocity** are documented.



% Passing								
Micron	**75**	**106**	**150**	**212**	**300**	**425**	**600**	**1000**
National Average Physical Size	4.1	10.5	23.5	39.4	55.9	65.0	73.6	86.3
National Average Settling Velocity	1.7	8.8	33.0	59.1	85.2	91.5	95.9	97.8

Applying Grit Knowledge

Grit problems are preventable with thoughtful design

- Understanding grit characteristics is the foundation for successful AGM system design
- Knowing the sizes and behaviors of grit is key to designing a complete system which effectively **removes 85-95% of all influent grit** while producing a clean, dry output grit
- Eliminating common assumptions aimed at simplifying settling velocity calculations **aligns theory with field measurements**.
- When assumptions of laminar flow, perfect spheres and 2.65 specific gravity are removed, a level of realism is incorporated into the design

Designing an AGM System

Key Design Considerations

- Surface loading rate of bulk grit separation device
- Separating grit from organics in high energy washing process
- Dewatering must be in a quiescent process
- Optimizing utility usage requirements

Bad data leads to design failure

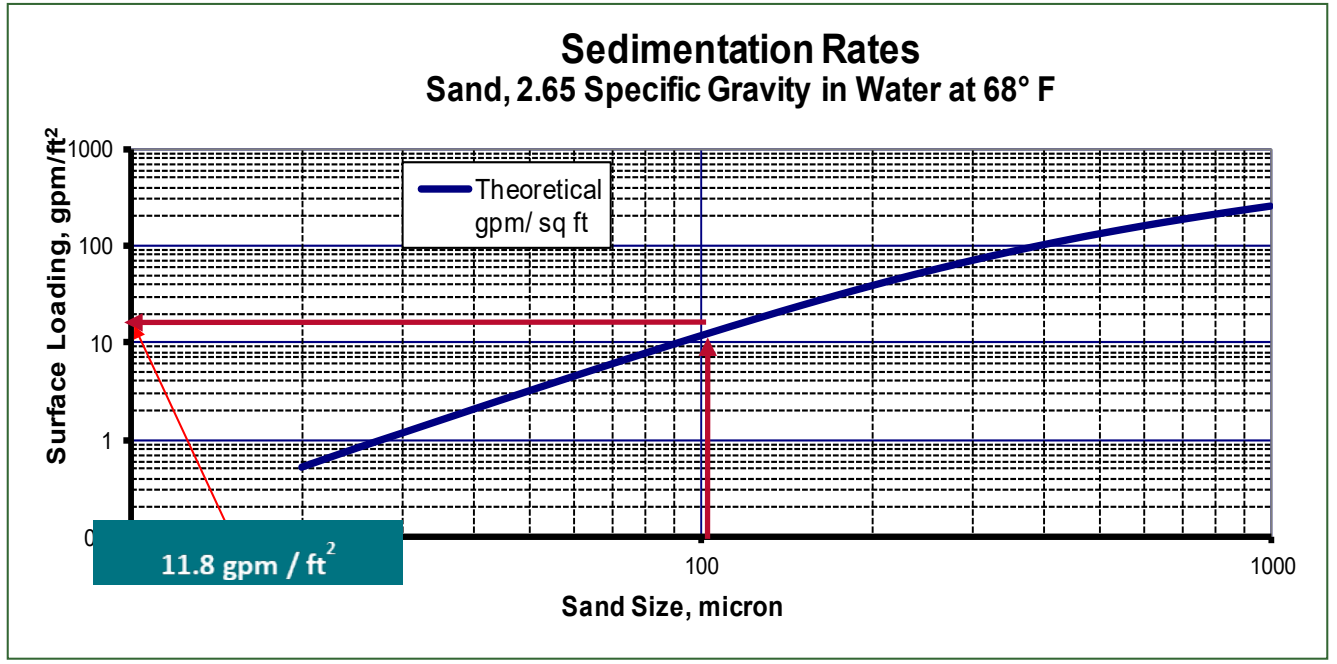
- Historical grit removal systems designed with flawed assumptions about grit behavior failed to protect plants from abrasive wear and deposition
- Advanced Grit Management® Systems designed with an **accurate understanding of grit can succeed** where other systems have failed

Surface Loading Rate

Targeting fine & slowly settling grit is critical

- Most vortex grit removal systems and conventional technologies rely on **gravity settling** as the primary means for removing grit particles
- Grit settles using Type 1 discrete particle settling therefore sedimentation engineering principles apply
- As such **surface loading** rate ultimately dictates system **removal efficiency***

* Water Environment Federation. (2017). Guidelines for grit sampling and characterization: Wef special publication. Alexandria, VA.



Knowledge + Design = Great Results

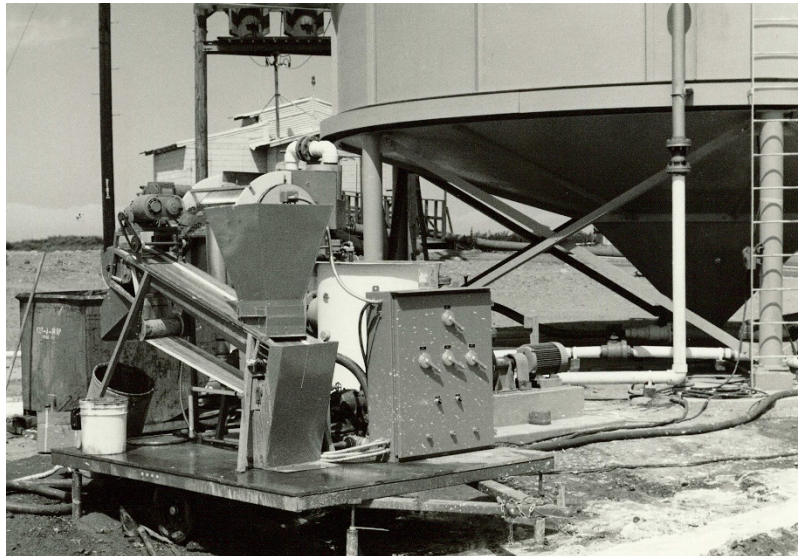
Consider lifetime costs

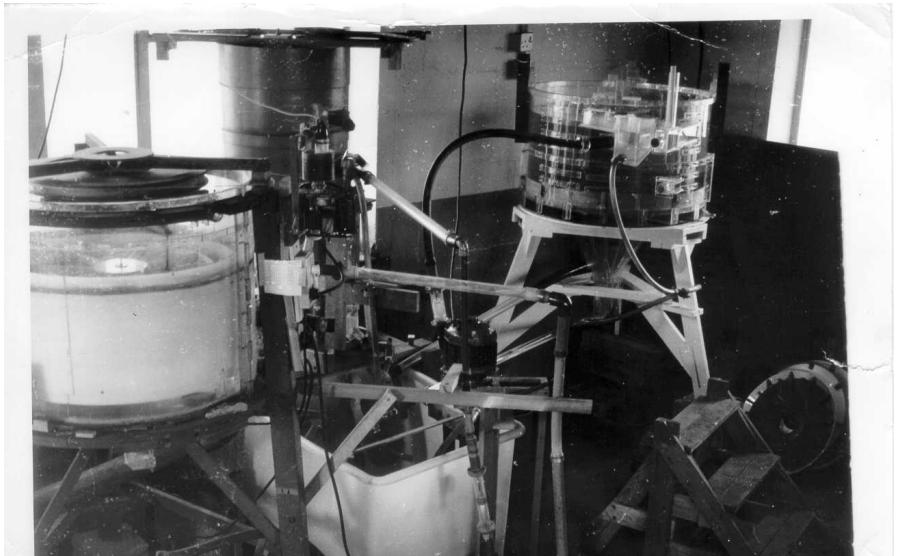
- Ineffective, lower-cost mechanically induced vortex systems might be tempting, but they provide just **1/3rd the surface area and claim to treat 3X the flow** increasing the surface loading rate by a factor of 9.
- The **long-term cost of inefficient grit removal** will more than offset the premium of AGM.
- Grit bypassing the headworks accelerates maintenance requirements for sludge processing equipment and accumulates throughout the plant reducing processing capacity. This leads to **costly cleanups** and **poor performance**.
- AGM Systems pay dividends throughout the life cycle by removing grit at the headworks and **protecting valuable assets** downstream.

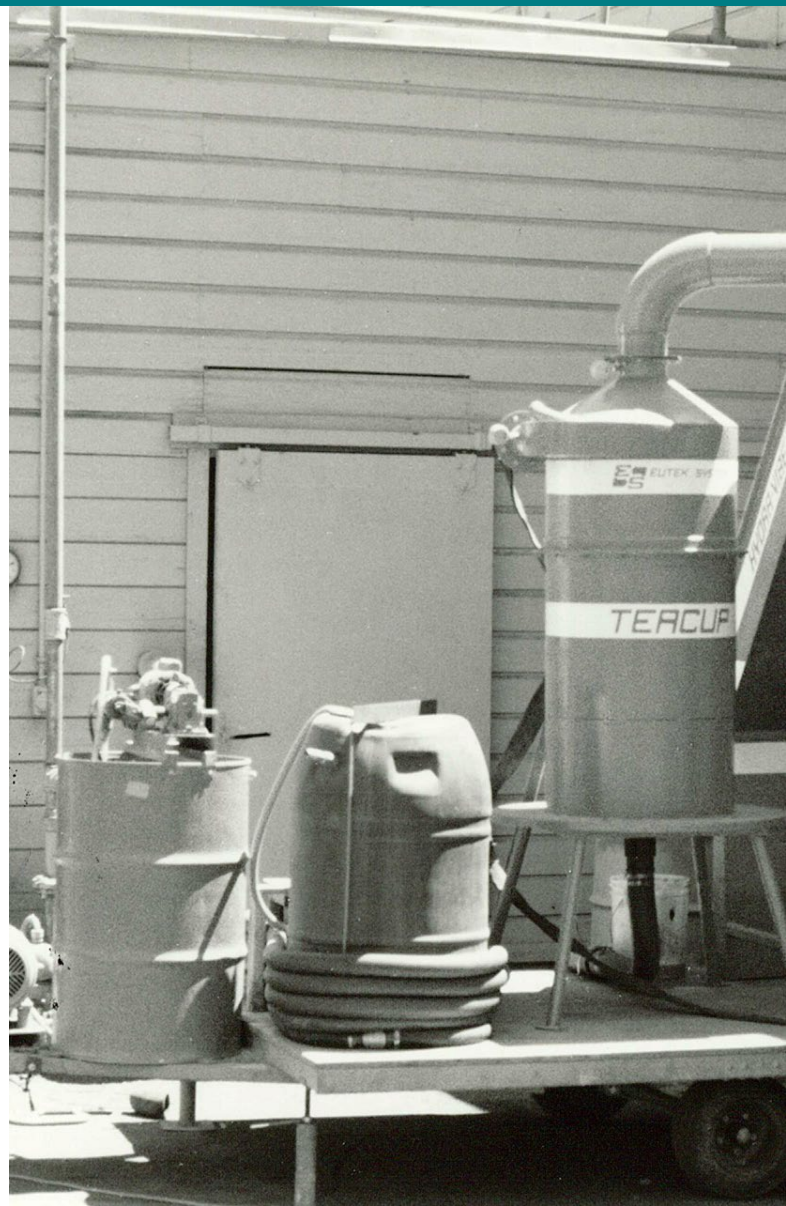
The Hydro Advantage

Best performing grit removal for over 40 years

- Hydro International acquired Eutek Systems in 2008, consolidating **a wealth of grit knowledge** and an acute understating of grit behavior from the two leading grit system providers.
- As the market leader in AGM, we have taken an aggressive agenda to optimize and continually evolve HeadCell® and Grit King® technologies to make them even more cost-effective, better performing, and user friendly.
- With **over 1,000 HeadCell® and Grit King®** units installed in North America alone, the demand for advanced grit separation is evident and rapidly becoming the norm in modern wastewater treatment plant design.







Service That Stands Apart

We custom tailor to fit your plant's needs

- Our **pre-order engineering** team works with you to ensure that the right equipment goes in the ideal location to seamlessly integrate with your existing plant layout and maximize performance.
- Our **post-order project engineers** ensure that our equipment hits the ground running to meet your scheduling, delivery, and start-up timing needs.

Ongoing training, service, and support

- When our equipment arrives on site, that is just the beginning. We have redoubled our effort towards making each of our customers grit experts and ensuring all of them are completely satisfied with their equipment.
- Our experienced service team provides **extensive after-sale support** and training to make certain our customers are satisfied with our equipment's performance.

Applying Grit Knowledge

We get grit

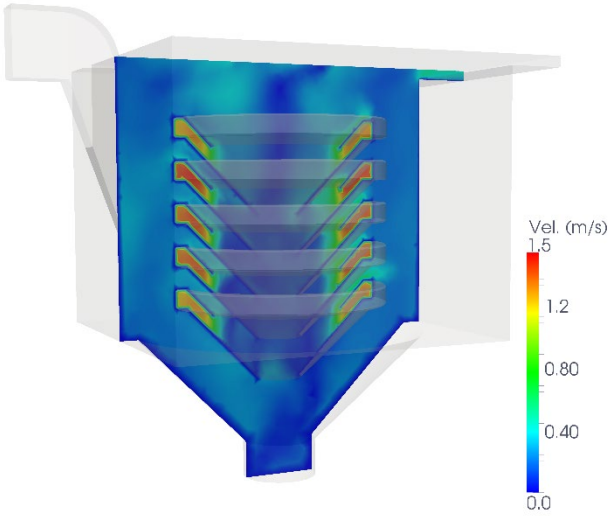
- What is knowledge without application? We design for the site-specific needs of our customers
- Our products are developed and rigorously assessed through a four-stage process: computer modeling, laboratory analysis, third-party field testing, and collaboration with industry experts and academic institutions.
- We develop products with **superior performance**, **maximized design flexibility** and **minimal maintenance** to serve our customers' complex needs.

Our Full Scale Hydraulics & CFD Labs

Science you can trust

Full Scale Laboratories: We conduct laboratory research at our hydraulics lab facilities in Clevedon, England and Portland, Maine. Our Portland facility is the Hydro Wastewater Group's center for water quality analysis. This laboratory has full scale operational models of nearly all our wastewater treatment technologies.

Computational Fluid Dynamics (CFD): We have long been recognized as an early adopter of CFD. CFD plays a critical role in Hydro's customer satisfaction and R&D program in refining our products for performance and maximizing efficiency. We have heavily invested in the application of CFD in the wastewater industry with a dedicated server cluster, training and collaboration with centers of CFD expertise and excellence such as Exeter University Center for Water Systems.



Sharing Our Knowledge

Our commitment to collaboration

Knowledge is of little use unless it is shared. We have a long legacy of collaboration with academic institutions, industry organizations, and municipalities all with the objective of sharing what we learn to help customers.

Our commitment to advancing the area of grit removal technology begins with a **relentless effort to understand grit** behavior. By understanding the behavior of municipal grit, we endeavor to develop technology that **maximizes system performance** in capture efficiency and output grit quality.

Learn More

Contact us

To learn more about how our Advanced Grit Management® solutions can improve your plant, contact us:

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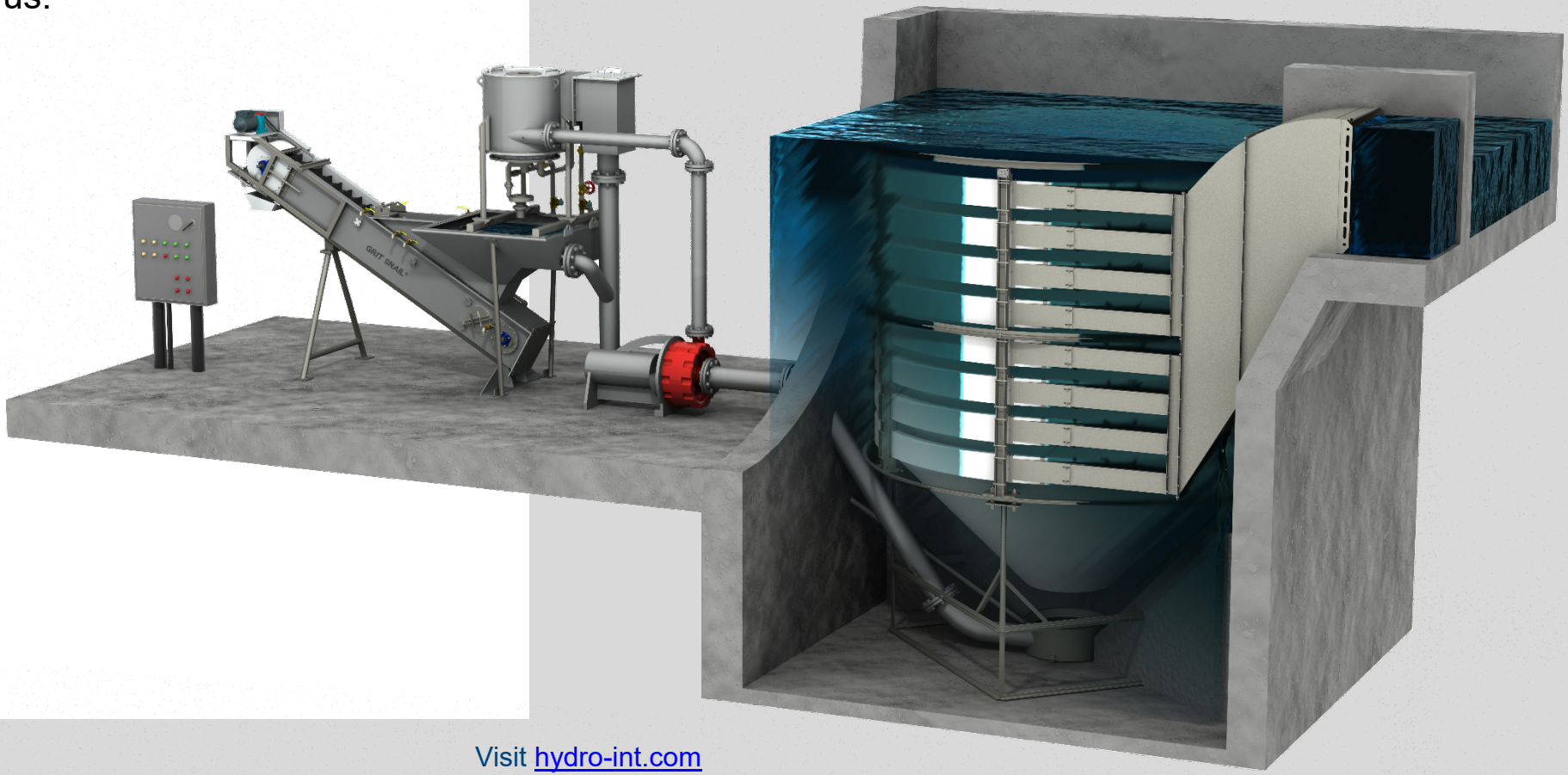
Our Advanced Grit Management® Solutions

HeadCell®
Grit King®
SlurryCup™
TeaCup®
Grit Snail®
Hydro GritCleanse™



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