# HeadCell®
Small footprint, high performance stacked tray grit separation

Hydro International

# Grand Island, NE WWTP

## As Part of a Critical Plant Upgrade, the City Selects HeadCell Advanced Grit Management

## Wastewater Case Study Project Profile

### Objective
Facing a growing population and rising flow volumes a major plant upgrade was required. Designing for built-in redundancy and achieving grit particle removal performance of 90 micron (µm) were important factors in designing the optimum solution.

### Solution
Evaluation of both a HeadCell® system and a Mechanically Induced Vortex showed that equipment and installation costs were very similar. The HeadCell was selected due to its high performance, minimal mechanical components and lower maintenance costs.

### Benefits
- Provides the plant with grit removal capacity to meet their 50 year design requirements
- Protects primary clarifiers from grit loading
- Protected the plant from a challenging first flush of construction debris from a new sewer line
- Small footprint design allowed identical trains to be built providing full redundancy while easing construction and installation
- Fully automated control panel easily integrated with existing SCADA system

As a critical part of an upgrade to its wastewater treatment facilities, the City of Grand Island, Nebraska, invested in an Advanced Grit Management system for **high-performance grit removal** from the wastewater treatment plant (WWTP) headworks ensuring reliable and effective protection to downstream treatment equipment and processes.

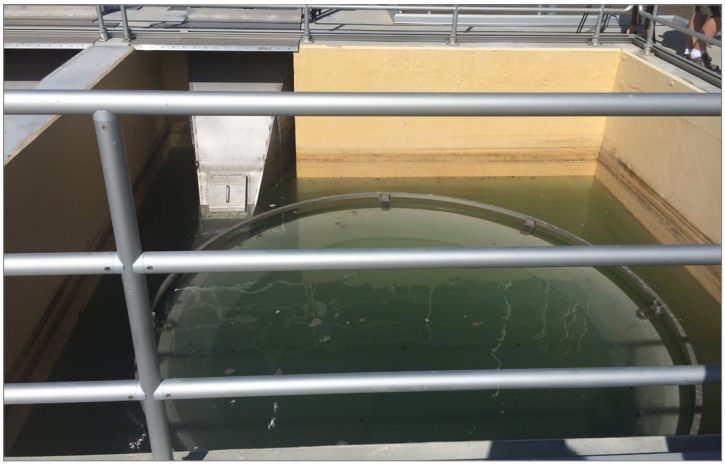
“The existing wastewater infrastructure at Grand Island was around 50 years old,” said Dr. Jue Zhao, PE, WWTP Operations Engineer, City of Grand Island. “The City had many issues with the treatment plant equipment, and we were faced with a growing population and rising flow volumes. As a consequence, the City decided to invest...[into a] WWTP refurbishment project built to meet our future needs. Designing for redundancy and achieving grit particle removal performance of 90 µm were important factors in designing the optimum solution for the plant operators, replacing aging and inefficient equipment,” said Dr. Zhao.

Grand Island, the fourth largest city in Nebraska with over 50,000 inhabitants, sits on the Platte River, which flows east out of Colorado and Wyoming into the Missouri at the Iowa border. The water table is high, and pumping is necessary to maintain flow in pipelines and across the treatment plant.

The plains topography is comprised of low, rolling hills and the soil is wind-blown and silty, which inevitably ends up being washed by surface water drainage into the sewers and the treatment plant. As well as domestic and city sewage, a major meat processing plant discharges to the plant, with all waters treated by the WWTP before discharge to the Platte through the Wood River.

### Grit Removal Technology Comparison
“Grit removal at the **headworks was one of the priority areas**. A major concern in any treatment plant is to provide **continuous treatment through redundancy** and the existing plant with its grit basins was inadequate; indeed much of the equipment such as valves and pumps were corroded and barely functioning, so a complete replacement was required,” commented Nathan White, PE, Black & Veatch Engineering Manager

“We evaluated **two alternative types of grit removal** to meet the new maximum 40 Mgal/d (1753 L/s) flow capacity, a **mechanical vortex** based design and **Hydro’s HeadCell® / SlurryCup™ / Grit Snail®** treatment train. The specification for each of the two treatment technologies was to remove 95% of grit 90 µm and larger at the average design flow of 13 Mgal/d (570 L/s) per treatment train, and 95% or grit 150 µm and larger at max peak hourly flow capacity per treatment train of 30 Mgal/d (1314 L/s).



*One of Grand Island’s HeadCell Systems*

***“Overall capital and installation costs were very similar [comparing a mechanically induced vortex vs. a HeadCell system]”***

**Nathan White, Black & Veatch Engineering**

"Overall capital and installation costs were very similar. In consultation with the City's Public Works engineers we made a visit to a nearby plant at Lincoln, Nebraska already using HeadCell® treatment technology. The City engineers were **impressed with the collected grit quality**, and we went with the Hydro design because of its high grit removal performance combined with low mechanical equipment needs which offer **much lower maintenance** costs in the future."

The existing plant was sized for 35 Mgal/d (1533 L/s) hydraulic capacity, but its age meant that its capacity was restricted to around 27 Mgal/d (102.2 ML/d). Although the original 1965 grit treatment building structure was in good condition, the **equipment and facilities** such as the Parshall flume for flow measurement were in **poor condition and undersized**, the bar screens required replacement and the wet well concrete at the base of the building was in need of repair. Additionally, the existing facilities had no provisions for odor control. Hydrogen sulfide gas accumulates in the long, level pipe runs characteristic of the topography and must be handled.

*Grand Island's SlurryCup / Grit Snail Washing & Dewatering Systems*

## HeadCell® Provides Required Redundancy

"There was sufficient building space to achieve the ideal configuration for a plant with parallel treatment trains, providing the redundancy capacity we desired. This made the planning, construction and installation of the equipment very straightforward," commented White.

Black & Veatch worked with the Hydro team on the design, to optimize the layout with each treatment train as a mirror image of the other. After mechanical bar screening, the set up on each side is a 12 ft. (3.7 m) HeadCell® unit with 10 separation trays and a dedicated pump.

The treatment is completed by SlurryCup™ grit washing and classification and Grit Snail® dewatering units, which dewater the grit for disposal at not less than 60% total solids and a maximum organics content of 15%. A dedicated control panel serves each and allows full automation and integration with the existing SCADA system for remote monitoring and control, including automatic start-up based on incoming flows.

*Clean Dewatered Grit travelling up Grit Snail Belt*

"After grit treatment, the wastewater exits via the primary clarifiers and flow distribution structure to downstream processes including an activated sludge process and digestion," added Nathan White.

## Coping With Extreme Grit Loads

The built-in redundancy is designed to **maximize the City's return on the investment** in the pre-treatment and grit removal facilities, which has an anticipated design life of 50 years. Predicted peak day flows of 25 Mgal/d (1095 L/s) per treatment train are well within the plant design capacity with 20% of additional capacity. It is anticipated that only hourly peak flows would reach the equivalent of the 60 Mgal/d (2629 L/s) capacity when both treatment trains would be engaged; 99% of the time only one treatment train would be required to be operational.

Construction started in July 2013, the new plant was put into commission in early March 2015, running with groundwater to test the equipment, then with an initial loading from the sewers to fully test the new pumping station in parallel with the old equipment. After just two days, the grit removal system was put under an **extreme test** due to the very tight construction schedule, and came through with **excellent results**.

Nathan White explained: "The replacement North Intercept sewer had been completed a year before and the old pipeline was due to be taken out of service. We made the decision to divert the sewer through the new grit removal plant as the **commissioning had proved problem-free**.

"A year's worth of construction trash, sediment, grease and grit was washed through with the raw sewage and the Hydro equipment coped with the influx without any problems. It was possibly the **worst conditions the plant will face** and we ran both treatment trains for a considerable time to catch the accumulated material.

Dr. Jue Zhao confirmed the progress with the HeadCell® "I worked in consultancy before I joined the City project team, in 2012, and have prior experience with the HeadCell®. The **grit removal is already performing much better than previously**."

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