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**2009 Project Summary**  
**UPGRADING AN EXPERIMENTAL FLUME FOR ENGINEERING RESEARCH AND EDUCATION**  
**Proposal Number 55455EV**  
**Guohong (Jennifer) Duan**  
Department of Civil Engineering  
The University of Arizona

### **Objectives**

This grant supports the upgrading of an open channel flume at the University of Arizona. The flume was built in 1980s and has been used by senior faculty conducting intensive experiments on fluvial hydraulics and sediment transport. After a faculty retired in the 1990s, the flume has not been used in the past 10 years. To re-activate the flume, it requires remove the old channel, design/build a new one, install a digital automatic flow controller, add rails and instrument carts, install a sand feeder, acquire several micro-ADV's and two acoustic velocity profilers, and a laser surface profiler. The upgraded flume will be capable of simulating unsteady flows, sediment transport, and losing streams. The flume has a sufficient length to capture several flood waves. This feature is essential to researches, such as the attenuation and amplification of flood waves, non-equilibrium sediment transport in flood events, evolution of alluvial channel cross sections, processes of bank erosion, sorting of bi-modal sediment under unsteady flow, fluvial impacts of in-stream hydraulic structures (e.g. dikes, bridge piers, abutments), migration of channel platforms, and nutrient dynamics in losing streams.

### **Approach**

The proposed project consists of three parts: 1) repair/design/construct the main flume; 2) install measurement equipments, such as sand feeder, laser profiler, ADVs, and high speed cameras; 3) test the flume for simulating unsteady flow, sediment transport, and experimental losing streams. This flume is a major facility and basic research instruments for junior and senior faculty teaching hydraulics, hydrology, and sediment transport courses to undergraduate and graduate students. It's also a critical facility for conducting research on the dynamics of unsteady flow, quantifying the effect of unsteadiness on river morphodynamic processes, and investigating nutrient dynamics in losing streams.

### **Significance and Army Value**

The proposed flume upgrading is valuable for the PI to establish the basic research facility, sustain collaborative projects with the Army Corps of Engineers, build up an interdisciplinary research team, acquire basic research instruments, and link educations with PI's research. On a broader scale, this facility is an important infrastructure for hydraulic, hydrologic, geologic engineering research at the Univ. of Arizona. The proposed experimental and modeling research will provide useful insights into the management of flow and sediment in the Mississippi River, which is vital to preserve the integrity of ecosystem. Those projects will also apply a two-dimensional computational model from an ARO funded project as a cost-effective tool for analyzing engineering alternatives for river management. In addition, the facility will provide valuable continuity with research previously funded by the Corps of Engineers to enhance sediment transport modeling in order to predict morphodynamic processes.

# Accomplishments

1. Complete the design of the new flume shown in Fig.1.

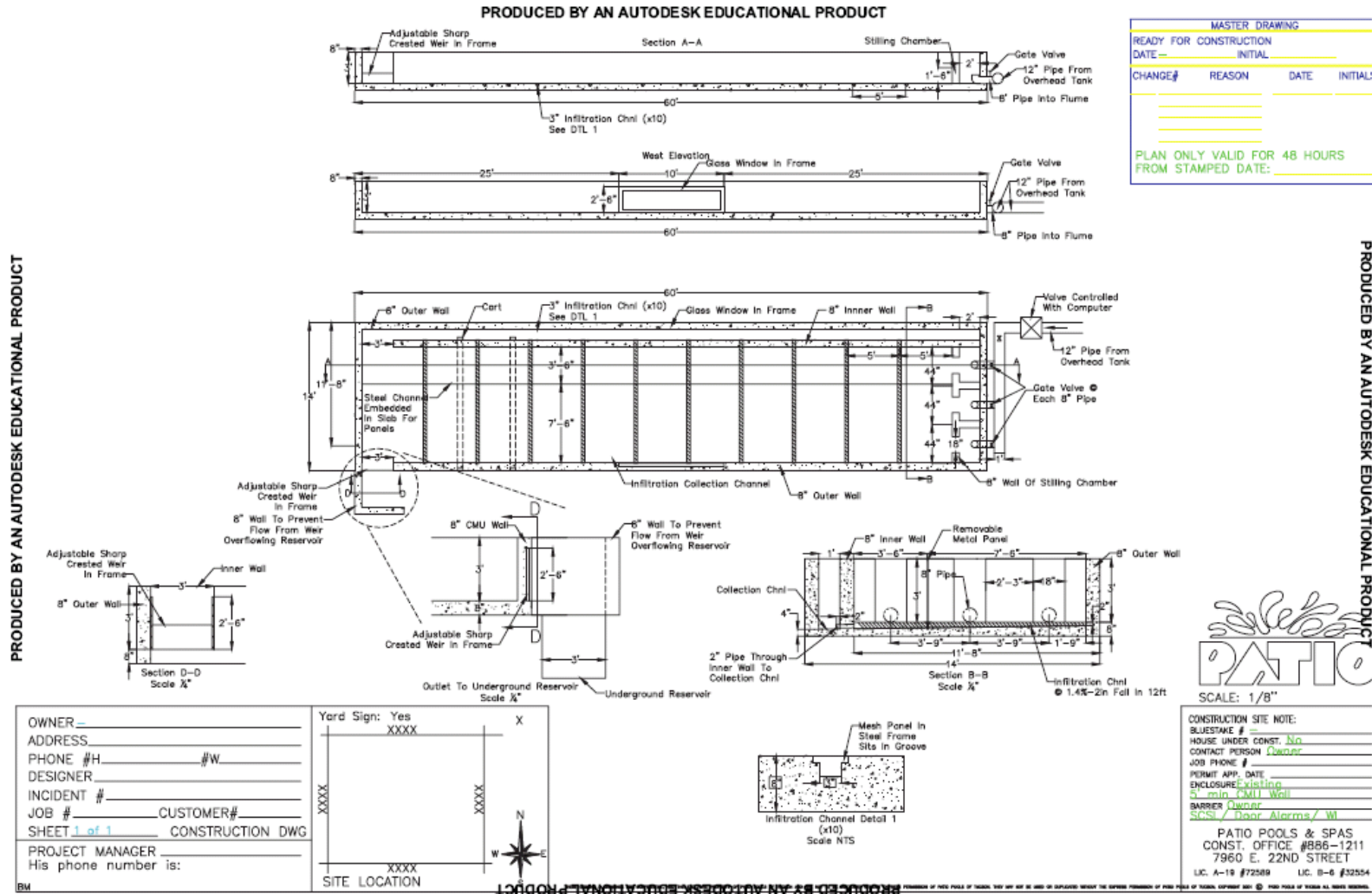


Fig.1 Upgraded new flume design - planform