Proposal title: “Multi-Purpose River Hydraulics Research Facility”

Final report submitted to

OREGON STATE UNIVERSITY RESEARCH OFFICE
RESEARCH EQUIPMENT RESERVE FUND (RERF)

By

Principal Investigator:
Dr. Arturo Leon, Assistant Professor, Civil and Construction Engineering, College of Engineering

Co-PIs:
Dr. Desiree Tullos, Associate Professor, Biological & Ecological Engineering, College of Engineering
Dr. Guillermo Giannico, Associate Professor, Fisheries and Wildlife, College of Science
Dr. David Hill, Associate Professor, Civil and Construction Engineering, College of Engineering

Award Information:
Type: Fabricated capitalized equipment/New construct
Location: OSU Hinsdale Wave laboratory
Date of award: January 30, 2012
Amount of award: $59,950
1. **Proposal Title/Instrument:** “Multi-Purpose River Hydraulics Research Facility”

**PI:** Dr. Arturo Leon, Assistant Professor, Civil and Construction Engineering, College of Engineering

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**Equipment housed at:** Hinsdale Wave Research Laboratory (see Figure 1)

2. **Brief description of facility:** The new river hydraulics research facility is located at the OSU Hinsdale wave laboratory. This facility consists of a re-circulating system with a 20 m x 8 m concrete slab, two independent head tanks, a sediment catchment, a clean water sump, three 25 horsepower (HP) pumps, a 12” diameter impulsion steel pipe (from pump to head tank) and a 36” diameter PVC pipe (see Figures 1-7). This hydraulic facility has been designed to accommodate two simultaneous and independent experiments and will be built in two stages. RERF funding was used towards the first stage of the facility. The first stage was recently completed and allows to accommodate a small-scale single experiment with a maximum flow of 20 L/s. At the completion of the second stage, the facility will be able to accommodate two separate experiments simultaneously. One of these experiments could be large scale with a flow up to 1000 L/s.

3. **Final budget statement:** describing how the RERF funds were expended.

3.1 **Amount requested from RERF**
The amount requested from RERF was as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount Requested</th>
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<tbody>
<tr>
<td>Matching Funds</td>
<td>$15,000</td>
</tr>
<tr>
<td>TOTAL RERF FUNDS REQUESTED</td>
<td>$59,950</td>
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3.2 **Expenditure of RERF funds**

RERF funds were used to pay part of the construction of the sediment and water sumps of the Multi-Purpose River Hydraulics Research Facility, which 3D view and photo of actual construction are shown in Figs. 2 and 3, respectively. The as-built engineering drawings of
these sumps are shown in Figures 4-6. The rest of the Multi-Purpose River Hydraulics Research Facility (Fig. 7) was built using EPA funds. The total cost of the construction of the facility will be about 400,000 dollars, and so far about $225,000 was spent on its construction. RERF contributed $74,950 (including CCE match) and EPA provided $150,000. In order to complete the facility for operating at its design capacity, about $175,000 is still needed. However, with what is available now (incomplete facility), a small scale single-experiment can be accommodated with a maximum flow of 20 L/s. At the completion of the second stage, the facility will be able to accommodate two separate experiments simultaneously. One of these experiments could be large scale with a flow up to 1000 L/s.

Fig. 1. Location of Multi-Purpose River Hydraulics Research Facility (OSU Hinsdale Wave Laboratory)
RERF: Multi-Purpose River Hydraulics Research Facility

Fig. 2. 3D view of sediment and water sumps of the Multi-Purpose River Hydraulics Research Facility. RERF funds were used to pay part of the construction of these sumps. The rest of the facility was built using EPA funds.

Fig. 3. Photo of constructed sumps (left: sediment sump, right: water sump).
Fig. 4. As-built plan view of sumps
Fig. 5. As-built side views of sumps
Fig. 6. As-built side views of sumps
Fig. 7. 3D aerial view of complete river hydraulics research facility. A) Concrete slab, B) Head tanks, C) Sediment catchment, D) Sump, E) Hydraulic pumps, F) 12” diameter impulsion steel pipe, G) 36” diameter PVC pipe and H) Floor slab. The 36” PVC pipe that returns the flow from the tanks to the sump is not shown in this figure as it is buried in the ground below the floor slab.

4. Scholarly work/activities as a result of RERF funding

4.1 Enabled research projects:
The river facility adds value to a number of existing research projects and will contribute to the development of proposals for new research. A list of proposals funded, submitted or in preparation made possible as a result of the RERF funding is shown in section 6.

The river facility is a multi-purpose testing system that will be used for a large set of research projects such as flood control, reservoir sedimentation, density currents, erosion and scour, aquatic habitat, stream restoration, fish passage, hydraulic structure testing (e.g., turbines) and dam removal. The river facility will strengthen the ability of a large number of OSU researchers...
to pursue competitive funding from a variety of sources (e.g., NSF, NOAA, USACE, EPA, USGS, BPA, etc.)

4.2 Industrial Collaboration/Outreach
In the last few months, two potential research sponsors contacted PI Leon inquiring about the River hydraulics facility for testing a fish screen and for improving the performance of tidal gates in the Columbia River. The contacts were made by Engineers Pete Baki (Oregon Department of Environmental Quality, ODEQ) and Aaron Beavers (NOAA's National Marine Fisheries Service, Portland).

The interest of industry in a river hydraulics facility is not new and will continue because there is a continuous need to test technologies in rivers such as turbines and measurement devices, and to assess the performance of innovative designs and practices in rivers such as those for flood control, dam removal and stream restoration practices.

The river facility will also be involved in the CCE Labs outreach program and will expose students of all ages to the dynamics of rivers and streams.

4.3 Other investigators or user groups to benefit from this facility
Below is an incomplete list of investigators that would benefit from this facility.
1) Harry Yeh, Professor, Civil and Construction Engineering
2) Richard Cuenca, Professor, Biological & Ecological Engineering
3) Gordon Grant, Research Hydrologist and Courtesy Professor of Geosciences at OSU, USDA Forest Service
4) Jonathan Istok, Professor, Civil and Construction Engineering
5) Roy Haggerty, Professor, Geosciences
6) Merrick Haller, Associate Professor of Civil and Construction Engineering
7) John Selker, Professor, Biological & Ecological Engineering
9) Josh Gordon, President Earth By Design Inc.
10) Jim Gordon, Senior VP Hydroelectric Energy and Research & Development Earth By Design Inc.
12) Sonya Reiser, P.E., Senior Mechanical Engineer Knight Piésold and Co.
13) Nathan Gibson, Assistant Professor of Mathematics
14) Sally Duncan, Policy Research Program Manager (OSU)
15) Todd Jarvis, Interim Director, Institute for Water and Watersheds (OSU)
16) Dan Cox, Professor of Civil and Construction Engineering
17) Peter Ruggiero, Associate Professor of Geosciences
18) Carmen Bernedo, Lead/Supervising Engineer, Montgomery Watson and Harza (MWH), Denver.

5 Additional scholarly activities the RERF funding made possible for the investigator(s).
The river facility which first stage was just completed has made possible the development of the following proposals by the investigators.
Overall, this facility will support sponsored research by faculty in various colleges, especially the Colleges of Engineering, Agricultural Sciences and Science.