

NOTE from FISP Chief: In addition to this project, \$10K was provided in 2011 to WA WSC for further testing of LISST-SL per agreement by FISP Technical Committee

FISP PROPOSAL FORM

Proposal Title: **LISST-SL Testing**

Project Chief: Tim Straub, Sediment Specialist

Project Chief Location: USGS, Illinois Water Science Center

Proposed Start Date: February 1, 2011

Proposed End Date: January 31, 2012

1. **Relation to FISP goals** – A Stream Lined (SL) version of the surrogate technology Laser In-Situ Scattering and Transmissometry (LISST) has been developed but not thoroughly tested. Continued testing of the LISST-SL instrument is directly related to the current vision of the FISP of working on emerging sediment surrogate technologies for practical field application.

2. **Technical merit (Scientific merit)** – The purpose of the proposed work is to complete the FISP testing guidelines for the LISST-SL. The current use of physical samplers and subsequent lab analysis is costly and slow. The LISST-SL provides a potential for more timely results and continuous records computation for sediment.

3. **Technical context (Relevance and importance)** – The LISST-SL was loaned to the ILWSC for testing in 2010. Initial testing of the LISST-SL has been completed by the ILWSC (without FISP funding) and the manufacturer has completed upgrades to the instrument during the testing period. With the upgrades, full FISP testing is the next step. Funds to cover the labor and analytical costs will greatly help in obtaining an adequate range of conditions for testing.

4. **Timeline, budget (Feasibility), and partners** – The proposed duration of the project is one year starting in February 2011. *Testing will be completed while performing sediment cross sections (EWI or EDI) at existing or experimental sediment sites. The instrument will not be recalibrated or adjusted through the experimental process, unless absolutely necessary*

Single Vertical Samples:

Each manual single vertical sample collected within the EWI (maximum of 10 single vertical locations for this testing) or EDI (5 single vertical locations) will also be done concurrently with a LISST-SL single vertical if conditions are favorable and extra staff is available. If conditions are not favorable or extra staff is not available, then a LISST-SL single vertical (L) will be completed before and after the manual sample (M) as shown in the following schematic L – M – L.

One manual bottle and one single LISST-SL file will be saved for each single vertical completed (possibly two LISST-SL files will be saved per single vertical location). A LISST-SL background file will be saved before and after the EWI or EDI cross section is completed. If the conditions are rapidly changing in a smaller stream, the number of verticals per EWI may be reduced as would be done in typical sampling scheme.

Point Samples:

The cross section will then be repeated by doing a 0.6 depth point sample and LISST-SL reading at each single vertical location. The point sample and LISST-SL reading will also be done concurrently if conditions are favorable and extra staff is available. If conditions are not favorable or extra staff is not available, then a LISST-SL point sample (L) will be completed before and after the manual sample (M) as shown in the following schematic L – M – L.

One manual bottle and one single LISST-SL file will be saved for each point sample completed (possibly two LISST-SL files will be saved per point sample location). A LISST-SL background file will be saved before and after the full set of point samples are completed.

Sample Summary and Laboratory Analysis:

Approximately 360 total manual samples will be collected (i.e. approximately 180 single vertical and 180 point samples). If all the cross sections were EWIs with 10 single verticals each, then approximately 18 cross section could be completed. From the 360 samples the lab analysis will include concentration-only on 300, sand-fine splits on 30, and full particle size on 30 (assuming enough material is available for full particle size analysis).

Stations:

The cross sections will be completed at approximately 5-7 stations from the existing 14 Illinois Water Science Center sediment stations listed in table 2 and possibly two experimental sites located on the Wabash River in southeastern Illinois and Saline Branch in east central Illinois.

The stations provide a range of possible concentrations between the minimum (10 mg/L) and maximum (3,000 mg/L) that the LISST-SL is capable of measuring. The larger Illinois River sites and the urban Des Plaines transport sediment concentrations are in the 10 to 500 mg/L range at high flows. The smaller Judy's Branch and Kickapoo sites transport sediment concentrations well above the maximum at high flows. These sites will be useful though if there are only mid-ranged flows for the year of testing. For the sand-fine split, the range of percent finer than 0.0625 mm for the combined 14 sites is generally between 80 to 99 percent. The Spoon River, Piasa, and the Illinois River sites trend toward the lower range of percent finer at high flows. Also, experimental project sites on the Wabash River and the Saline Branch might be used and would most likely trend toward the lower range of percent finer at high flows.

The current 14 sediment sites and 2 experimental projects sites provide a range of conditions that will be useful for testing the LISST-SL. A comparison of the LISST-SL readings and physical sampler sample lab results will be summarized in a technical memo to the FISP.

Table 1. Budget

Item	Cost
Salary	\$17,000
Travel	\$1,000
Vehicles	\$1,000
Lab Costs	\$15,000
TOTAL	\$34,000

Table 2. List of Illinois Water Science Center sediment stations.

Station Number	Drainage Area (mi²)	Station Name
05532500	630.0	Des Plaines River at Riverside
05527905	4.69	Hastings Creek at Lindenhurst
05559600	13,717	Illinois River at Chillicothe
05586100	26,743	Illinois River at Valley City
05588720	8.3	Judy's Branch at Rte 157 near Glen Carbon
05579610	7.3	Kickapoo Creek at 2100 at Bloomington
05579630	14.8	Kickapoo Creek at Ireland Grove at Bloomington
05579620	3.8	Kickapoo Creek at Tributary at Bloomington
05527900	20.2	North Mill Creek at Hickory Corners
05527910	28.4	North Mill Creek near Milburn
05587480	102.5	Piasa Creek near Melville
05559700	84.5	Senachawine Creek near Chillicothe
05570000	1,636	Spoon River at Seville
05548105	84.5	Nippersink Creek above Wonder Lake