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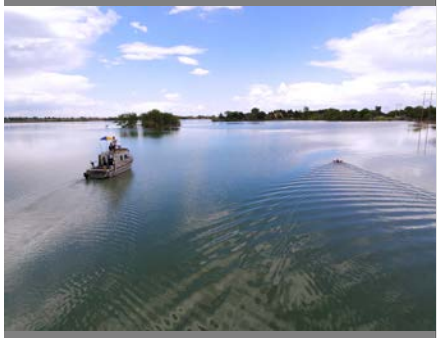
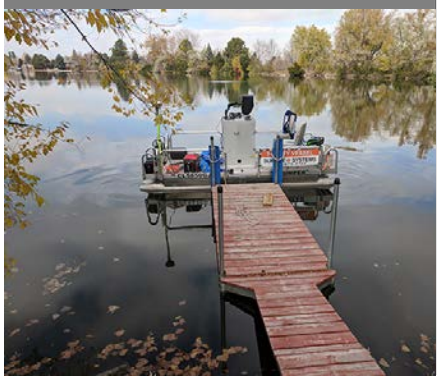
HYDROGRAPHIC SURVEYING

What is it, and How to Contract for It

SURVEY SYSTEMS

Survey Systems (SSI) is a Service-Disabled Veteran-Owned Small Business, certified through the Center for Veterans Enterprise, and an SBE with the City and County of Denver and RTD Fastracks.





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Background

Survey Systems (SSI) has been providing Hydrographic Surveying Services since 2008. One might ask, “How does a land surveyor in Colorado decide to provide these services and in a land locked state?” That is a very good question and this is my attempt to answer that question and hopefully shed some light on the process to help our clients contract for these services.

Before Survey Systems, I was in the United States Coast Guard and retired in 1996 after an unfortunate accident that would not allow me to continue my career. When one path stops, another appears. This is how I found my chosen career path in land surveying and eventually to President and Owner of Survey Systems. Survey Systems started to receive requests for hydrographic deliverables, and it made sense to put the two skills sets together and start down the path of adding hydrographic surveying services to our existing land surveying skill set.

Difference Between Land-Based & Hydrographic Surveying

There is a large learning curve from land-based surveying compared to water-based surveying.

On land, SSI uses GPS, total stations and levels, optical instruments with the exception of GPS, to conduct the majority of our work. We can for the most part see everything we need to survey and it is pretty straight forward. On land, light travels through air with no issues. SSI just needs to know the temperature, barometric pressure and possibly how much water vapor is suspended in the air, then we can compensate for how fast light travels and adjust our observations.

On the water, we rarely see what it is that we are surveying. In its purest form, Hydrographic Surveying is making the un-seen, seen. There are some issues with this and we have to devise ways to verify that what we

are observing is what will be seen if the body of water is ever drained. On the water, we can't use light to conduct the survey. Light dissipates in as little as 10 feet of water. Since light is not an option, we have to rely on Sonar/Sound to inject a physical pulse in the water column. Similar to air, in the water we need to know the temperature, salinity, turbidity and local speed of sound. Then we can also compensate for how fast sound travels through the water to arrive at the depths and start to develop a picture and make the un-seen, seen.

Sensors Used in Hydrographic Surveying

Single Beam. Just like it sounds we send down a vertical / nadir, singular pulse of sound that reflects off the bottom and returns to the source. We time it and then we can determine the depth. No this is not a fish finder. It is a survey grade transducer, and has much more power with a large range of controls to ensure we lock onto the bottom. This is usually a 200 Khz transducer.

Sub-Bottom Profiling. This instrument is a stronger / lower frequency, 24Khz, pulse we send through the water column just like the higher frequency single beam and often at the same time as single beam. This not only gets the first return but the second and third return that is often harder than the first surface return. The purpose in collecting this data is so we can classify the bottom and at times, even develop quantities between the layers. This technology is highly dependent on the sediments and composition of the bottom of the reservoir. This work should be conducted with a drilling project to ensure the that the layers are classified correctly.

Side-Scan. This is a sonar that scans off to the sides and can have a "Nadir" gap directly under the vessel. This technology can collect large areas of shallow depths for object detection. We are looking for shadows with this work and we can cover large areas quickly and mark targets to survey in higher resolution with other technology. No this is not the same as the side scan sonar you find on fish finders. These sensors are much higher power and have a much higher resolution.

Multi-Beam. This is a sonar that is just as it sounds and has 256, 512 or 1024 sound pulses that travel to the bottom in a discrete fan pattern, left and right or rather port and starboard, and return to the survey vessel for processing. These systems are intended to gather full bottom coverage and basically, we survey everything and extract what we need from the data.

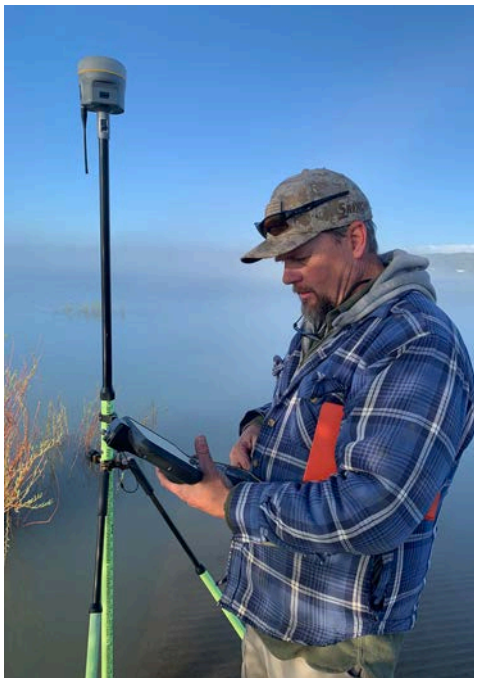
The above list is not all of the services but the primary services that we provide to our clients.

Standardizations

Standards are the most important consideration when contracting for this work. All of the work we do at Survey Systems is in compliance with one of the following standards depending on the project.

- US Army Corps of Engineers, Hydrographic Surveying, EM 1110-2-1003
- National Oceanic and Atmospheric Administration,
  Office of Coast Survey, Field Procedures Manual
- National Oceanic and Atmospheric Administration,
  Hydrographic Surveys Specifications and Deliverables
- International Hydrographic Organization, Standards for Hydrographic Surveys, S44

All of these standards are basically in agreement with each other. They are constantly being updated and re-issued due to changing technology, on a daily basis. The fundamentals however stay the same.



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Sound Velocity

The most important thing that has to be compensated for in Hydrographic Surveying is the sound velocity. The sound velocity probes, that are used on any project, need to be calibrated on a yearly basis. Their certificates should be requested and required when contracting for services. There should be more than one so that they can be compared against each other. How often you should cast to determine the speed of sound of the body of water is more difficult to determine. At a minimum, one should cast twice a day to observe the change in the sound velocity. In Multi-Beam surveying, there is a sensor at the sonar head observing the speed of sound constantly and one should cast a minimum of every 4 hours on the water.

On land we run our instruments through a base-line to evaluate our instruments to known values. On the water, we do the same thing however there is no base line. We have to make our own calibration equipment. We call this a bar check. The bar check ensures that all of your offsets are input into the system appropriately and that the depths that are collected to develop the deliverables are correct. This should be contracted for and delivered with each project.

Conclusion

I want to ensure that you understand that the above is a very simplified explanation of what it is that we surveyors and hydrographers do. This is meant to give you an idea of how the system works. This work should never be conducted with a fish finder and a handheld GPS.

A large part of my work is to educate our existing and potential clients on our services and build a relationship of trust and collaboration. This work is a passion of mine, and I look forward to discussing your project and the best sensor package for your needs.

You can always call me to discuss this document, and we are more than willing to talk with you about our services and your hydrographic needs.

Regards,

Gerald Matt Nichols, PLS, CFeds
President