# Channel Cross-section Standard Operating Procedures

*Suggested citation: US Geological Survey. 2011. Channel cross-section standard operating procedure. Unpublished protocols. USGS, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA.*



**Purpose/Objective:**
Channel cross-sections provide useful information on the 3D development and geomorphological changes to tidal channels over time. A line is stretched from bankfull to bankfull perpendicular to the channel flow, and depths from the line to the channel bottom are measured every 0.5 meters along the line. Measurements can also be made with a laser level (Hood 2010) or with an RTK GPS*. Intertidal channels should be stratified by habitat type and channel type (e.g. distributary, blind channel). Prior to restoration, non-tidal channels within the interior of a dike or levee should be well mapped to document channel formation after dike removal.

***RTK GPS NOTES:*** If measuring cross-sections with an RTK GPS, follow steps 1 & 2 and create a new elevation point of the sediment surface every half meter along the cross-section. For graphical displays, use UTM Easting or Northing coordinates (depending on the orientation of your channel) as the x-axis.

***Equipment:***
2 – 4 to 5 foot lengths of 1.5 inch PVC
Rubber Mallet or Hammer
2 – Wooden stake
Flagging
Long line
Torpedo line leveler
Measuring Tape
Measuring Stick
Laser level
Data Book
GPS
Waders
If needed: boat and life vests

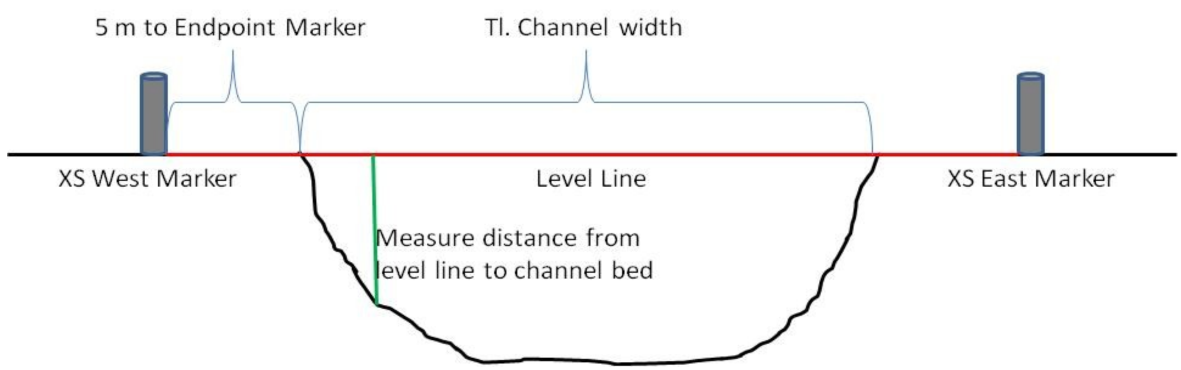


**Figure 1. Diagram of a channel cross-section.**

***Field Methods:***
1. Determine bankfull of channel by using clues such as vegetation type, wrack line, channel shape etc. Envision where the water line would be just before topping the banks of the channel into the floodplain. From bankfull on each side of the channel, measure an additional 5 meters from the bank, these will be your channel endpoints. You can place these endpoints farther from the bank if needed to ensure that they will not be washed out by erosive forces.

2. Install a 6 foot PVC pole 2 to 3 feet into the ground at your endpoints on either side of the channel. Mark with a wooden stake and flagging (Figs. 1 and 2). Coordinates for endpoints should be recorded using a GPS, preferable with differential correction.

3. Tie a strong, long line to one of the PVC endpoint markers. Push the line down so that it is at the surface of the soil on the base of the marker. If you are using a laser level, skip to step 5.

4. Stretch the line taut across the channel and attach to the other PVC endpoint marker at the base. Use the torpedo line level placed on the center of the line to make sure the line is level. You can adjust the line up or down the endpoint markers to ensure a level line. ***Measure and record the distance from the top of the endpoint marker to the level line on both banks.*** These data will be used to determine the elevation of the level line once the endpoint markers have been surveyed.

5. Stretch the tape measure across the channel and attach to the PVC makers with the start of the tape on the east bank.

6. Starting at 0 meters, use the measuring stick to measure the depth of the channel from the channel bottom to the level line at every half meter across the channel. If the channel bottom is soft, try to place the base of the measuring stick just on the surface of the sediment. Make sure you are measuring to the level line as opposed to the tape measure. If you are using a laser level, the laser detector attached to the measuring pole will be moved up and down the pole until it reaches the level of the laser. The readings on the measuring pole will be recorded when the detector is at the same height as the laser level.

7. After making your way across the channel, measure the total width of the channel.

8. The tops of the channel endpoint markers need to be surveyed so that data can be corrected to elevation (see Data Entry and Analysis).

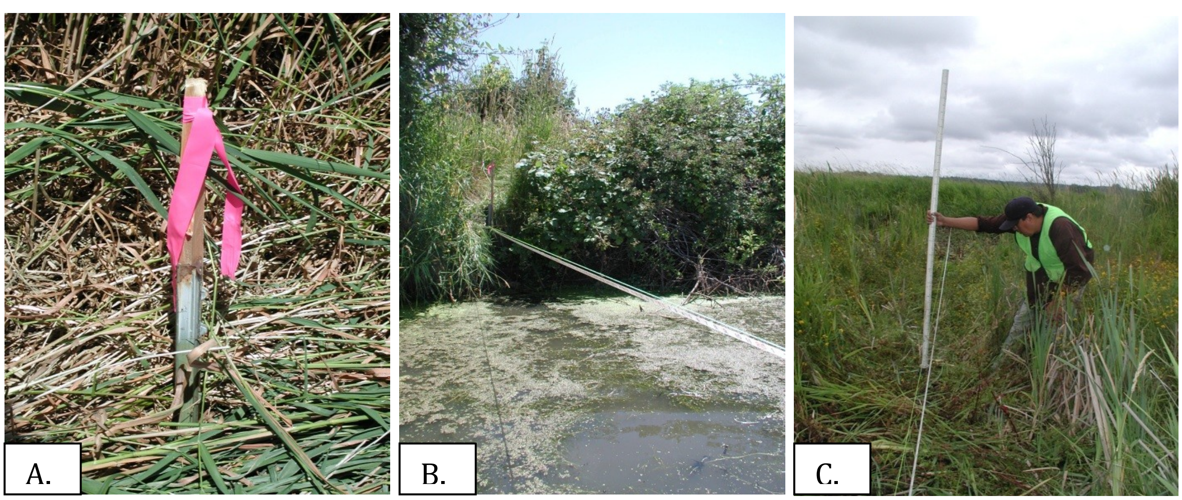


**Figure 2. Channel cross-section techniques, A. Endpoint marker. B . Taut level line and measuring tape stretched across channel. C. Measuring depth from channel bed to taut line.**

## Channel Cross-section Standard Operating Procedures

***Data Entry and Analysis:***

1. Data to record (see Channel Cross Section Datasheet): date, time, observer, site, location, endpoint marker bank location, UTM coordinates and distance to level line, starting bank, measurements along channel and total channel width.

2. Enter data in Excel database (see downloadable Channel Cross Section Database Template)

3. It is also helpful to take note of ideal surveying conditions (i.e. best time/tide to safely walk across channel). You can also use the date and time of the previous survey to determine tide height suitable for taking measurements.

4. **Convert relative depths to elevation.** Subtract the distance from the elevation at the top of each endpoint marker to the level line to determine the elevation of the line. If the line was level during measurements, the calculated elevation from each endpoint marker should be the same or very similar. Then subtract the depth at each channel measurement from the level line elevation to determine the sediment elevation at each point along the channel. This can be done as a script in the Excel database.

5. Channel development (i.e. scour or fill) is determined by comparing measurements at channel cross sections over time (Figure 3).

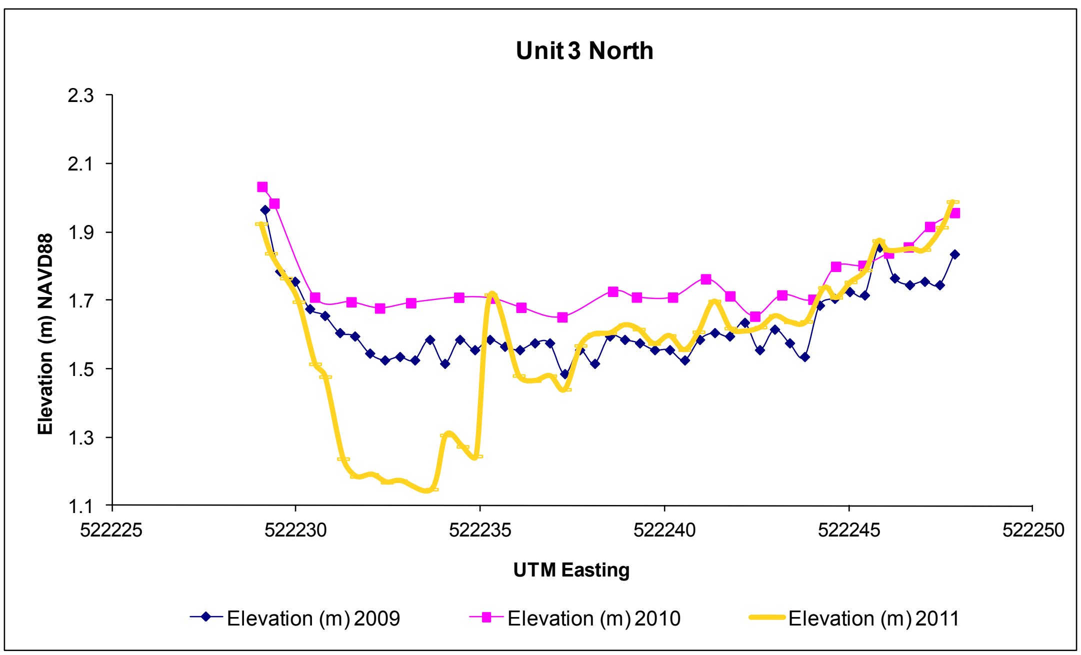


**Figure 3. Example graphical representation of channel cross-section data from Nisqually NWR restoration project, Unit 3 tidal channel. At the northern portion channel, bed elevation increased slightly in the first year, likely due to the initial decay and floatation of large cattail mats that had filled in the channel prior to restoration. In the second year post restoration, these cattail mats had begun to clear out and the channel started to scour. X-axis could also display distance across channel (i.e. 0 – 15 m) instead of UTM coordinates.**

***References:***

Hood W. G. 2010. Tidal channel meander formation by depositional rather than erosional processes: examples from the prograding Skagit River Delta. *Earth Surface Processes and Landforms* **35**: 319 – 330.

Roegner, G.C., H.L. Diefenderfer, A.B. Borde, R.M. Thom, E.M. Dawley, A.H. Whiting, S.A. Zimmerman, and G.E. Johnson. 2008. *Protocols for Monitoring Habitat Restoration Projects in the Lower Columbia River and Estuary.* PNNL-15793. Report by Pacific Northwest National Laboratory, National Marine Fisheries Service, and Columbia River Estuary Study Taskforce submitted to the U.S. Army Corps of Engineers, Portland District, Portland, Oregon.

## Channel Cross Section Datasheet

| | | |
|---|---|---|
| **Date:** | **Time:** | **Observer(s):** |
| **Site (i.e. NNWR):** | | **Location (i.e. U3N):** |
| | | |
| **Endpoint Marker 1:** | | **Endpoint Marker 2:** |
| **Bank Location (i.e. N, S, E, W)** | | **Bank Location (i.e. N, S, E, W)** |
| **UTM Northing:** | | **UTM Northing:** |
| **UTM Easting:** | | **UTM Easting:** |
| **Distance from level line to top of endpoint marker (m):** | | **Distance from level line to top of endpoint marker (m):** |
| | | |
| **Starting Bank (i.e. N, S, E, W):** | | **Total Channel Width (m):** |

| Distance along channel (0.5 m increments) | Height to level line (m) | Notes | Distance along channel (0.5 m increments) | Height to level line (m) | Notes |
|---|---|---|---|---|---|
| 0 | | | 13.5 | | |
| 0.5 | | | 14.0 | | |
| 1.0 | | | 14.5 | | |
| 1.5 | | | 15.0 | | |
| 2.0 | | | 15.5 | | |
| 2.5 | | | 16.0 | | |
| 3.0 | | | 16.5 | | |
| 3.5 | | | 17.0 | | |
| 4.0 | | | 17.5 | | |
| 4.5 | | | 18.0 | | |
| 5.0 | | | 18.5 | | |
| 5.5 | | | 19.0 | | |
| 6.0 | | | 19.5 | | |
| 6.5 | | | 20.0 | | |
| 7.0 | | | 20.5 | | |
| 7.5 | | | 21.0 | | |
| 8.0 | | | 21.5 | | |
| 8.5 | | | 22.0 | | |
| 9.0 | | | 22.5 | | |
| 9.5 | | | 23.0 | | |
| 10.0 | | | 23.5 | | |
| 10.5 | | | 24.0 | | |
| 11.0 | | | 24.5 | | |
| 11.5 | | | 25.0 | | |
| 12.0 | | | 25.5 | | |
| 12.5 | | | 26.0 | | |
| 13.0 | | | 26.5 | | |