



# Site Selection and Installation of Surface Water Level Instruments

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When selecting sites for water level monitoring stations, existing infrastructure, access, and security are the most important parameters to be considered. Make proper arrangement for fencing and lock system to protect instrument and civil structure from theft.

Human interference with hydrometric installations is a problem in our country. This issue has to be given serious consideration during the site selection process. The sensor, solar panel, battery, antenna, cables and connectors should be protected from theft. From the security point of view, choose a site where a permanent caretaker can be provided.

If a choice has to be made between two hydraulically similar sites, the final selection should be made in favour of the site which has fewer problems due to human interference and law and order.

There should be enough land near the site to install various instruments. In some cases land availability is a challenge along the river bank.

For successful operation and maintenance of the surface water level monitoring station, local manpower, financial and logistic support resources have to be available.

- The site should be away from the back water zone caused by any structure on the river.
- The site should be far away from HT lines, frequency converter, variable frequency motor and high power electric equipment.
- Sites with a tendency for formation of vortices, reverse flow or dead water shall be avoided.
- Avoid submerged obstructions such as rocks or bridge piers that disturb the water level.



- Select the site where an instrument shelter can be easily installed. The instrument shelter should be high enough to be above the flood level.
- The electrical grounding for all electronic and electrical equipment should be done by following standard CPWD procedure.
- The gauge site should be far enough upstream from the confluence with another stream and from tidal effect.





- The station should be installed so that sensitive equipment such as the data logger, batteries, and telemetry radios and antennas are located well above expected high water.
- Zones of high turbulence, eddies, and super elevation should be avoided.
- The site should be accessible by motor vehicle during all weather and streamflow conditions.
- Sites where foam is present, should be avoided.
- Avoid sites where there is a heavy traffic on bridge.
- There should be a good GSM signal or a clear line-of-site to the INSAT or VSAT satellite system.



- The water surface must be as smooth as possible in the area of the sensor beam.
- The site should be cleared of bushes, trees and other obstructions that would make access hazardous.
- Sites where high sediment deposition or scouring occurs should be avoided.
- Site should be easily accessible for maintenance / repairing of the instruments.
- The entire unit has to be adequately protected against lightning and build of static charges.
- Sites which are subject to weed growth, should be avoided.

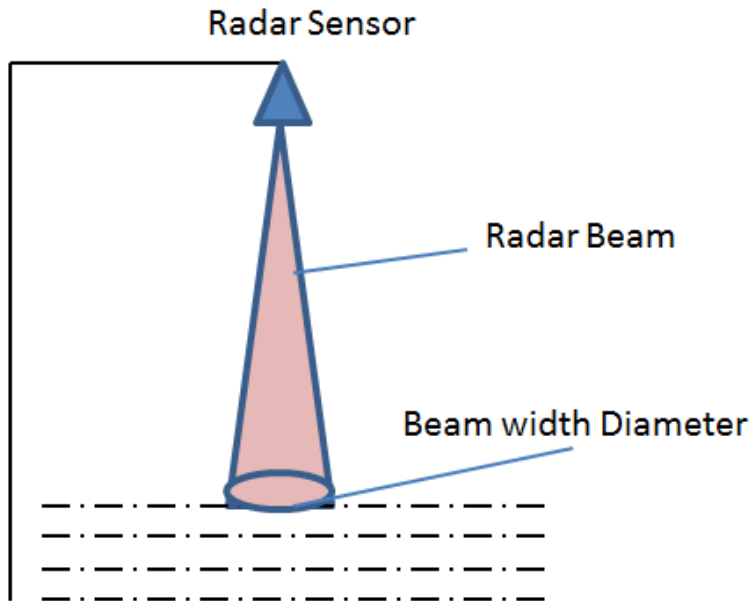


- A reference gauge such as a staff gauge, wire weight gauge, or reference mark should be established at each gauging station.
- Solar panels should be oriented to maximize daily sunlight absorption.
- Locations which are subject to high turbulence or wind effects should be avoided.
- Data logger and transmitter should be secured in a NEMA type 4 enclosures or equivalent to prevent access by water, dust, or insects.



# **Installation requirements for Radar and Ultrasonic Sensor Sites**

- Installation of radar sensor requires some sort of bridge or platform to mount the sensor.
- Radar or ultrasonic sensors should have a direct vertical shot to the water surface with no obstruction of their beams within the cone. Sensor must not have any object within the area of signal projection.
- Many dams, bridges and stilling wells have pillars, pipes, ladders, or other equipment attached to the walls. If a sensor beam hits the obstacle, it will return a false reading.



The radar sensor should be mounted directly above the water surface, such that the radar beam is perpendicular to the water.



There should be a clear path between the sensor and the water to avoid false reflections.

The radar sensor's beam path should be free of excessive turbulence, splashing, waves, pipes, wires, and other obstructions that could disturb the measurement.



Avoid turbulent areas and areas where obstructions in the waterway or bridge piers cause changes in the water level. Zones of high turbulence, eddies should be avoided.



The picture shows a site where there is a bend after bridge; hence it is not a good site for water level monitoring.





Debris accumulation at bridge

This is not a good site for water level monitoring.

The stream bed should be free of aquatic growth.



## Vegetation - Algae

These are not good sites for water level monitoring.



Floating debris accumulation at the front of the bridge pier.  
Avoid such site locations for Radar and Ultrasonic sensor.





The picture below shows a section of braiding river, where a water level station should not be installed.



0 3.5 7 14 21 28 Kilometers

Make certain the radar sensor is mounted high enough to avoid being submerged during high water or flood conditions. The height of the sensor installation should be carefully chosen.



Radar Installed at Khadakwasla Dam

The water surface must be as smooth as possible in the area of the radar sensor beam.

Waves and ripples on water surface may cause problems for radar water level measurement.

Instead of reflecting back upwards towards the antenna, radar signals hitting a turbulent surface may scatter and disperse.

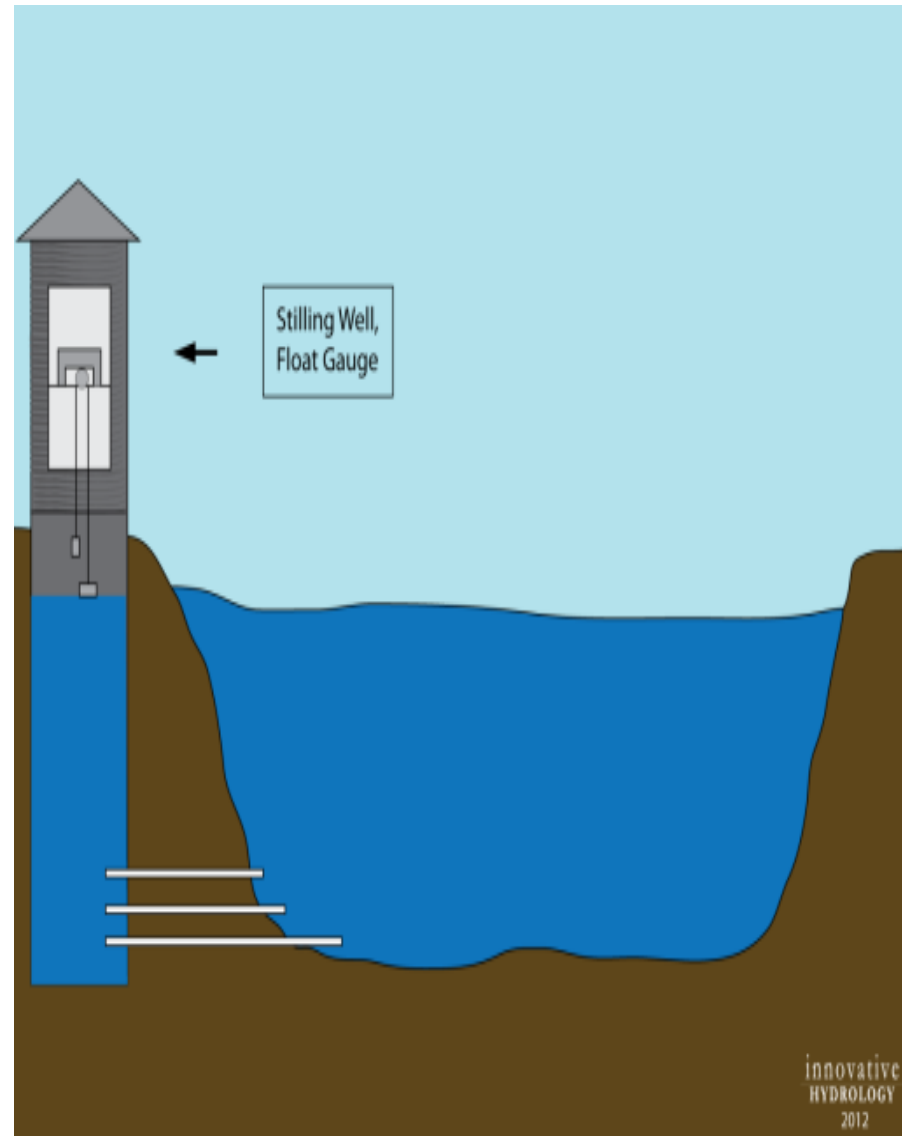
Thus a lot of signal energy strength can be lost (almost 90%).

This gives radar problems with obtaining an accurate and reliable measurement.

# **Installation requirements for Shaft Encoder sites**



- Shaft encoder cannot be installed directly in the river in turbulent flowing water. It has to be installed in a stilling well.
- Ideal site for shaft encoder type water level sensor is the stable river bed where the channel does not change or migrate away from intakes.
- Site with minimal sedimentation are preferred.
- The horizontal pipes connecting to the river get choked with sediment and sometimes it is difficult to keep them clear.



At some places, a steel pipe of diameter about 200mm is attached to the bridge pier, to act as a stilling well. This pipe is open at the bottom end. Since it is installed in the river directly, there are no horizontal pipes to get choked. This drastically reduces the overall cost and also gets rid of the problem of choked connecting pipes.



Shaft encoder type water level sensor

Steel Pipe

## Shaft encoder installation at ISP dam, M.P.

Installation of a shaft encoder from the side of a bridge. A steel structure is erected on the side of the bridge, with a 6-inch diameter pipe hanging from the bridge deck, extending till the river bed.

The shaft encoder with a pulley is installed at the top of the pipe. The float and counterweight are hanging from the pulley.



A shaft encoder installed on the side of a bridge in Gujarat

Graduated Tape should be of high quality to withstand harsh and humid environment, it should not get twisted or wrinkled while operation.



Shaft Encoder Type Water Level Sensor at Bhakhra Nangal Dam

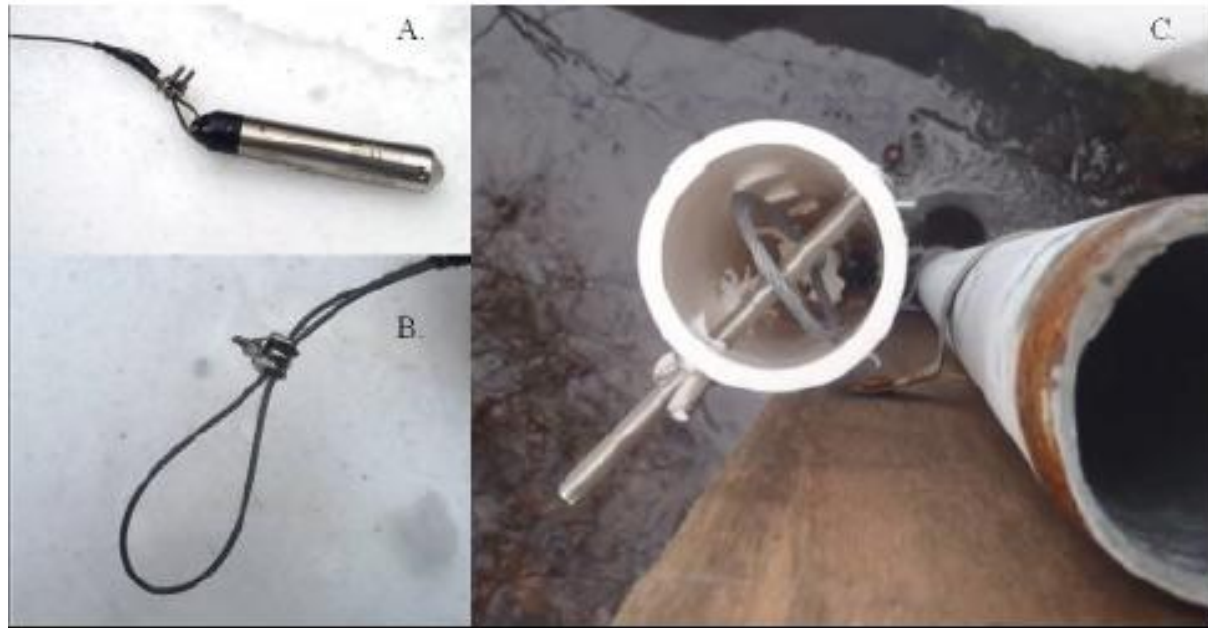


# **Installation requirements for Bubbler Sites**

- Bubbler systems work well in open channels as well as in reservoirs.
- It is installed directly in the river bed. Electronics part is installed away from the water, only bubbler tubing contacts the water. Therefore main part i.e. sensor is not affected by any sediment deposited on it.
- A large Nitrogen tank is used which must be periodically refilled.



# **Installation requirements for Pressure Transducer Sites**



- Pressure sensor is installed directly in the river, therefore it has the risk of being damaged in a high flood or by rolling boulders.
- The reading of pressure sensor is also affected by the weight of any sediment deposited over it.
- Always install transducer in cool and deep pool to reduce turbulence and noisy data.
- Once the costly sensor is damaged, it is difficult to replace it till the high-flow season is over. Till then all the data is lost.
- More susceptible to unintentional damage by animals or people.

# Summary

- Select site with stable river bed where the channel does not change or migrate away from intakes.
- There should be a clear path between the sensor and the water to avoid false reflections.
- Site with minimal sedimentation is preferred.
- The water surface must be as smooth as possible in the area of the radar sensor beam.



Thank you