Action of the vortex removes bed material from around the base of the obstruction. Transport rates of sediment away from the base region are greater than the transport rate into the region, and, consequently, a scour hole develops. As the depth of scour increases, the strength of the horseshoe vortex is reduced, thereby reducing the transport rate from the base region. Eventually, for live-bed local scour, equilibrium is re-established between bed material inflow and outflow and scouring ceases.

Scour depth is a basis for design of the abutment and pier protection. For design of piers and supporting piles, the total of the predicted scour depths is used as the maximum vertical unsupported pier length for reinforcement design. Pier support pile caps will typically be placed at this elevation. Even where piles require less depth for structural loading, the depth of the piling must extend beyond this depth to act as a SF against undermining by the flow.

Scour predictions will also have a large effect on the type of abutment support, whether pile-supported or using spread footings. Use of spread footings require suitable erosion protection, such as heavy riprap with concrete wing walls or flow deflection dikes to protect both the supports and the backfill from flow erosion. It may be more economical to provide a positive scour protection, such as concrete slab on the channel bottom, than construct the additional pier and abutment protection structures that will otherwise be required.

A5.2.2.2. Deck drainage

Design of deck drainage shall meet the minimum spread and inlet spacing requirements as stipulated in Section A3.2.5, for kerbed roadways.

A5.2.2.3. Bridge hydraulic design documentation

Bridge hydraulic designs shall be documented in a Bridge Hydraulic Report. Documentation shall be provided in detail, commensurate with the complexity of the Project.

Documentation shall be sufficient enough so that an independent Engineer with expertise in bridge hydraulics, but not involved with the Project design, can fully interpret, follow, and understand the logic, methods, computations, analysis, and considerations used to develop the final design.

1. Documentation for bridge designs shall include, at a minimum, the following:
   a. Hydrologic analysis, including sources of data and methodology.
   b. Alternative analysis or evaluation of structure sizes, including length and vertical height or clearance. This evaluation shall include the following considerations:
      i. Cost;
      ii. Design standards;
      iii. Structure hydraulic performance, including backwater, velocity, and scour; and
      iv. Impacts of the structure on the adjacent property.
2. Alternative analysis shall include the reasons for selecting the recommended structure and a clear explanation as to why it is the most economical structure for the site in question. At a minimum, the following structure sizes shall be evaluated:
   a. Minimum structure size required to meet hydraulic standards for vertical and horizontal clearance, scour, and backwater.
   b. Existing structure size, if applicable.
   c. Recommended structure size, if different from the above.
3. Design recommendations for bridges shall include the following:
   a. Bridge length and justification for the length, including locations (stations) of abutments;