

3.1 INTRODUCTION

This chapter describes the procedures for hydraulic design and analyses of elements of intakes as they affect the efficient delivery of water to the turbine. The purpose of hydraulic design of all the elements of conveyance or power intakes is to ensure that water is delivered to the turbine economically and efficiently. Hydraulic design includes:

- Consideration of the value of energy and head losses and potential effects on project performance and integrity resulting from factors including: nonuniform flow, swirl, vortices, air entrainment, waterhammer, and waves. This is generally achieved through specification of the geometry of the hydraulic components of the intake. In the broadest sense, geometry is specified to achieve a balance between performance, construction cost, and operational cost. Performance is measured by hydraulic efficiency or head loss and resulting loss of energy. In a more practical sense, judgment is applied to establish acceptable criteria for facility performance based on general experience with similar facilities. Hydraulic design often deals with the specification of acceptable velocity values, provision of uniform velocity distributions, and uniform acceleration. Hydraulic considerations affect the geometric design of large components such as canals and the forebay and small components such as gate slots and trashrack bars.
- Specification of static and dynamic loads for the design of civil and mechanical features of intakes including loadings resulting from vorticity, waves, gate movements, and earthquake induced acceleration of water.
- Provision for handling of items transported with the flow including sediment, debris, ice and fish.

The principles of hydraulic engineering are applied to all of the components of a hydroelectric project between the source of water and the entrance of the tailrace into the receiving waters. The intake includes the components between the source and the pressurized conductor(s) upstream of the turbine and may include: excavations, structures, embankments and operating equipment, including facilities for passage of fish and handling of logs, sediment, ice, or debris.

As described in Chapter 2, two types of intakes may be provided: a conveyance intakeⁱ which delivers water diverted from the source to the forebay, and a power intake which delivers water from the forebay to the pressurized conductor, penstock or turbine, depending on the arrangement of the power facilities.

For the purpose of this chapter it is convenient to divide the discussion of hydraulic design into the following sections:

- **3.2 Hydraulic Components** describes the various hydraulic components of the intake and design considerations.
- **3.3 Siting and Orientation** describes overall planning criteria for siting an intake prior to detailed design.
- **3.4 Intake Geometry** describes the specification of intake geometry and effects on flow.
- **3.5 Hydraulic Losses** describes the evaluation of head losses in the various components of an intake.

ⁱ A conveyance intake, as defined in Chapter 2, is also known as a diversion intake.

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