**Nutrient Project**

Northern Water initiated the Nutrient Project in 2005 to comprehensively assess C-BT Project water quality. The Nutrient Project includes the Three Lakes Nutrient and Horsetooth Water Quality studies.

**The Nutrient Project’s objectives are:**
- Identify nutrient-related water quality issues
- Analyze nutrient-related water quality problems and causes
- Recommend feasible options to improve nutrient-related C-BT Project water quality

**Scoping**

Scoping was completed in 2005, and the Phase 1 Final Report, available at northernwaternow.org, includes these recommendations:
- Assess nutrient loading in Lake Granby, Shadow Mountain Reservoir, and Grand Lake
- Develop mitigation strategies and determine the causes of low dissolved oxygen levels in Horsetooth Reservoir

These recommendations are being addressed in the second phase through the Three Lakes Nutrient Study, the Grand Lake Clarity Project and the Horsetooth Water Quality Study.

Stakeholders would then implement feasible options after completion of the third phase.

**GRAND LAKE CLARITY PROJECT**

In response to the Colorado Water Quality Control Commission’s adoption of a Grand Lake clarity standard in 2008, a stakeholder group was developed to carry out monitoring and assessment efforts for understanding and improving the lake’s water clarity. The stakeholders are collaborating with the Three Lakes Nutrient Study to:
- Determine the factors that influence Grand Lake’s water clarity
- Collect data to support the commission’s adoption of a Grand Lake clarity standard, effective in 2015
- Study the feasibility of strategies to improve water quality in Grand Lake, Shadow Mountain Reservoir, and Lake Granby without adversely affecting C-BT Project operations

Northern Water and stakeholders have been working on understanding the causes of these water quality issues. A water quality model was developed in 2012 and serves as a tool to help understand the causes of low dissolved oxygen concentrations in the reservoir and to investigate impacts of changes in the watershed and in C-BT operations on water quality. More information on the model is available at northernwaternow.org.
Baseline Monitoring Program

The monitoring sites in the Baseline Monitoring Program cover both the Colorado-Big Thompson and Windy Gap projects throughout eight watersheds. Monitoring frequency varies from monthly to weekly depending on site location. The program focuses on nutrients, metals, general chemistry, phytoplankton and zooplankton. The program is used to monitor spatial and temporal trends in C-BT and Windy Gap water quality as well as the potential impacts of releasing C-BT and Windy Gap water into rivers and streams. All release points are monitored for compliance with state water quality standards. Staff members from the U.S. Geological Survey conduct some of the sampling, and members of Northern Water’s field services department conduct the rest, utilizing USGS protocols modified for Northern Water’s needs.

Algae Toxins

Northern Water participates in a collaborative program spearheaded by Grand County to monitor for algae toxins in the Three Lakes system, which includes Grand Lake, Shadow Mountain Reservoir and Lake Granby. The Grand County Water Information Network, a nonprofit organization that manages and coordinates water quality monitoring, information and educational programs, conducts the program’s samples weekly from July 1 to September 15 at nine sites in the C-BT Project’s West Slope Collection System: Grand Lake, Shadow Mountain Reservoir, Lake Granby, Willow Creek Reservoir and Windy Gap Reservoir. The data supports Grand County’s Emergency Response Plan in the event toxins would be released into the water bodies during an algae bloom.

Syntex Hazardous Waste Landfill

The former Syntex Landfill near the St. Vrain Supply Canal was used by pharmaceutical manufacturers during the 1960s and 1970s as a hazardous waste disposal site. It was cleaned up in the 1980s but hazardous materials remain. Northern Water installed monitoring wells to detect any hazardous materials that could reach the canal. The program monitors and samples four monitoring wells along the canal for total dissolved solids, chloride, tetrachloroethylene, ethyl ether (diethyl ether), pH, specific conductivity and temperature. Ongoing monitoring every three to five years since the 1980s has shown no sign the hazardous materials are migrating toward the canal.

Specific Conductivity in the Lower South Platte

The South Platte Specific Conductivity Monitoring Program records continuous specific conductivity concentrations using more than 20 automated stations to provide a baseline of data. The stations are on the Lower South Platte River and its tributaries: the Cache la Poudre, Big Thompson, Little Thompson, and St. Vrain rivers as well as Boulder Creek.

Specific Conductivity and Water Temperature in the Three Lakes

Specific conductivity and water temperature are continuously monitored at 10 inflow sites to the Three Lakes in order to inform existing and future water quality modeling efforts. Specific conductivity is often used to study circulation patterns and hydrodynamics in waterbodies.

Shadow Mountain Aquatic Weeds

The Shadow Mountain Aquatic Weeds Program assesses nuisance aquatic weed growth in Shadow Mountain Reservoir. Weeds are a significant problem because of the reservoir’s shallow depth. Each year an aquatic plant specialist assesses the extent and type of plant coverage and determines whether control strategies are needed. Every three to five years hydro-acoustic surveys measure plant height, using technology that is able to detect, assess, and monitor plants’ underwater physical and biological characteristics; detect water body depth, and measure the presence, abundance, distribution, size and behavior of underwater plants and animals.

Shadow Mountain Dissolved Oxygen

Northern Water initiated dissolved oxygen monitoring in Shadow Mountain Reservoir in 2008 to determine the causes, extent and duration of low dissolved oxygen events in Shadow Mountain Reservoir during late summer. Dissolved oxygen helps protect the aesthetic qualities of water and maintain aquatic life, and dissolved oxygen concentrations are a gauge of existing water quality. Monitoring includes a buoy system near the reservoir’s dam that collects dissolved oxygen data every four hours, as well as collection of hourly dissolved oxygen data in the Grandy Pump Canal, a source of low dissolved oxygen to Shadow Mountain Reservoir. Monitoring will provide a baseline of data to evaluate the effectiveness of future mitigation strategies.

Clarity in Grand Lake and Shadow Mountain

In 2008 the Colorado Water Quality Control Commission adopted a clarity standard for Grand Lake. The Grand County Water Information Network and volunteers collect Secchi data weekly between June and October, and then three times a week during periods of modified C-BT operations in Grand Lake and Shadow Mountain Reservoir. These Secchi data provide a baseline of data to support review of the Grand Lake clarity standard in 2014, which will become effective in 2015. Data collection also helps monitor clarity changes related to C-BT Project operations.

Emerging Contaminants

Emerging contaminants are a growing concern to human health and the environment, and in 2009 Northern Water launched a collaborative monitoring program. University of Colorado research scientists Imma Ferrer and Michael Thurman helped design the program and provide expertise on new research and developments regarding emerging contaminants. The program monitors more than 150 contaminants, including pesticides, herbicides, pharmaceuticals, personal care products and endocrine-disrupting compounds. Monitoring site locations include Windy Gap Reservoir, the Adams Tunnel, Carter Lake, Horsetooth Reservoir, Boulder Reservoir and the Cache la Poudre River.

Macroinvertebrates

Macroinvertebrate assemblages are often sensitive to a wide range of environmental disturbances and pollution. Biological monitoring, or biomonitoring, evaluates aquatic environments, and it has important advantages over physical or chemical water quality monitoring. Sustained biological monitoring studies help explain the effects of long-term influences such as population growth, urban development, and land use changes. The biomonitoring study evaluates the biological and ecological integrity of streams potentially influenced by Northern Water activities.

Water Temperature

The program monitors water temperature for protection of aquatic life and for compliance to state water quality standards downstream of reservoirs, in canals at points of release to the streams, and in streams above and below release points. There are more than 30 monitoring sites in the Colorado River between Lake Granby and Kremmling, and several more sites on each of the South Platte River tributaries on Colorado’s East Slope at points of release of C-BT and Windy Gap water into the streams.

Algae Control Program Monitoring

Northern Water uses approved herbicides or other agents in East Slope canals and to control algae growth that can restrict canal capacity and pose operational and maintenance difficulties. Monitoring ensures that herbicide applications are in accordance with labels and water quality regulations and to monitor the efficiency of treatments.

Water Quality Monitoring Programs

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