Background

While Grand Lake clarity was greater before C-BT construction, it varies significantly by season and by year. A recent long-term trend analysis of Secchi depth data from 1953 to 2011 revealed that clarity has not worsened since 1953 and shows an improvement of 0.58 meters over the 1991 to 2010 period. Nonetheless, clarity in Grand Lake remains less than it was before construction of the C-BT Project and continues to be a concern to local stakeholders and agencies.

A Secchi depth reading of 9.2 meters was recorded in September 1941 at Grand Lake, before most Colorado-Big Thompson facilities, including the Adams Tunnel, were built or operational. From June to October 1953, observers recorded an average Secchi depth reading of 2.63 meters at Grand Lake. By this time C-BT water was moving through Grand Lake from Lake Granby and Shadow Mountain Reservoir to the East Slope.

C-BT Operations and Grand Lake Clarity

During the snowmelt runoff period, the native inflows to Grand Lake and Shadow Mountain Reservoir are sufficient to meet East Slope delivery requirements through the Adams Tunnel. During this time, water that doesn’t flow into the Adams Tunnel flows downstream from Grand Lake into Shadow Mountain Reservoir and then eventually into Lake Granby via the Colorado River. When runoff flows taper off and inflows into Grand Lake and Shadow Mountain Reservoir are no longer sufficient to meet East Slope delivery requirements, water is pumped from Lake Granby into Shadow Mountain Reservoir via the Farr Pump Plant and the Granby Pump Canal. The pumped water flows by gravity from Shadow Mountain Reservoir to Grand Lake via the connecting channel and eventually to the west portal of the Adams Tunnel.

As water flows through Shadow Mountain Reservoir some degradation in water quality can occur due to:
- Shallowness of the reservoir
- Re-suspension of particles
- Susceptibility to aquatic weed growth and algal growth

At certain times, these factors can contribute to an ensuing decline in Grand Lake clarity.

A closer look: Measuring Clarity

Current and historic Grand Lake clarity measurements are largely based on Secchi depth, which is measured by lowering a circular plate known as a Secchi disk into water until it is no longer visible. A Secchi disk is a circular plate divided into quarters painted alternatively black and white. The distance at which the disk disappears in the water is the Secchi depth. A higher Secchi depth equates to greater clarity. Visual water clarity, the distance at which objects can be seen through water, is typically described by Secchi depth measurements.

Monitoring and Reporting

In 2008, Northern Water formed the Three Lakes Technical Committee. The committee’s initial task of studying nutrient loading in the Three Lakes (Grand Lake, Shadow Mountain Reservoir and Lake Granby) rapidly expanded with a more specific focus on Grand Lake clarity and general water quality in the Three Lakes system. Generally, the committee met monthly from 2008 to 2015.

During its tenure, extensive water quality analyses were carried out including water quality monitoring, installation of real time water quality monitoring stations, Secchi monitoring and flow gaging at identified sites of interest. The data supported the development of a water quality model and numerous studies and reports documented factors that affect Grand Lake clarity and water quality in the Three Lakes, and more specifically the relationship between water quality and C-BT Project operations.
Clarity Standard

In 2008, the Colorado Water Quality Control Commission (WQCC) was petitioned to consider the adoption of a clarity standard for Grand Lake, a first in Colorado. In absence of definite answers at the time, it adopted a 4-meter clarity standard with a delayed effective date. The WQCC also directed stakeholders to work collaboratively to develop an appropriate standard, also protective of aquatic life, which would not adversely impact the ability to make C-BT deliveries to the East Slope. Meanwhile a narrative standard was in place aiming at the best achievable clarity, while considering factors previously mentioned.

In 2014, although much more information had been collected and compiled, a definitive numeric clarity standard had not been agreed upon, nor had any permanent and feasible solution to improve clarity been firmly identified. Northern Water along with Grand County and the Northwest Colorado Council of Governments jointly requested an extension in the delayed implementation date. The WQCC granted this delay and directed the parties to also consider impacts to water quality in the Three Lakes in the development of a clarity standard.

By 2015, it had become apparent that a single and rigid numeric standard would not work for all intended purposes. Instead, in April 2016, the WQCC adopted a more workable approach relying on adaptive management (see In depth: clarity memorandum of understanding) as an implementation vehicle for the narrative standard.

By 2015, through concerted efforts between all parties and the Bureau of Reclamation, it had become apparent that a single and rigid numeric standard would not work for all intended purposes. Instead, the parties agreed to pursue an adaptive management approach focused on achieving numeric clarity goals (instead of standards). This approach was memorialized in an agreement signed by Northern Water, the Bureau of Reclamation, Grand County, the Northwest Colorado Council of Government and the Colorado River Water Conservation District in January 2016. This approach was proposed to, and adopted by the WQCC in April 2016.

The clarity goals are a 3.8 meter average and a 2.5 meter minimum for the July through September 11 period. The Clarity MOU lays out the terms of collaboration and consultation between the parties in order to inform C-BT operations although Reclamation retains ultimate decision authority.

Clarity Alternatives

Building on the strong technical foundation developed by the Three Lakes Technical Committee, the U.S. Bureau of Reclamation initiated preliminary investigations of possible alternatives to improve clarity in Grand Lake beginning in 2012. In 2016, Reclamation intends to formally engage in the evaluation of alternatives through the National Environmental Policy Act (NEPA) process. Alternatives considered may include operational changes, structural alternatives (such as a pipeline around Grand Lake and/or Shadow Mountain Reservoir), watershed management and non-structural options.

About Grand Lake

Grand Lake is the largest natural water body in Colorado. The lake’s beauty and proximity to the west entrance of Rocky Mountain National Park draws thousands of visitors annually.

Grand Lake plays a key role in the Colorado-Big Thompson Project as the last West Slope stop for C-BT water headed to the East Slope.

C-BT Project operations minimize fluctuations in Grand Lake’s level to one vertical foot or less. Grand Lake has a capacity of 68,600 acre-feet of water, 4.5 miles of shoreline, 515 surface acres and a maximum depth of 265 feet.