



Water Quality Monitoring

Importance

Most Northern Colorado Plateau Network (NCPN) parks are located in semi-arid to arid environments where water is a major factor in determining the distribution of flora, fauna, and historic human habitation. Additionally, the abundance and quality of water resources reflect human activities and land use in and near parks, and are a primary factor influencing park visitation and recreational activities. Water bodies in national parks are protected by the Clean Water Act and other policies that prevent unacceptable levels of pollution and establish acceptable values for other water quality measures. Park managers need information on status and trends in surface-water quality and quantity to comply with the Clean Water Act and to mitigate historic and future impacts to park water resources that may have ecological and social significance.

Long-term Monitoring

Water quality monitoring sites are selected based on historic impacts, perceived threat, current monitoring by others, or to determine baseline status as a starting point for long-term trend detection. As many as 30 water quality parameters are measured at each site visit. At every site, portable sensors are used to measure core parameters (specific conductivity, flow, temperature, pH, and dissolved oxygen) as basic indicators of water quality. Field and laboratory measurements are then compared to state water quality standards to determine if acceptable concentrations are present and if, over time, conditions are changing beyond acceptable normal ranges. NCPN water quality monitoring is a coordinated effort between the network, individual park units, the U.S. Geological Survey, and the State of Utah.

Status and Trends

Between January 2006 and December 2009, 1,267 site visits were conducted at 76 different locations on NCPN streams and rivers in or near 12 park units. Results indicated that 576



Water quality monitoring, Capitol Reef NP.

(2.3%) of the 25,406 total measurements exceeded state water quality standards. Of the 576 exceedances, the most commonly exceeded water quality standards are displayed in Figure 1. The most frequently exceeded standard was the indication of impairment due to excess nutrients. However, evaluation of other parameters measured concurrently did not show evidence of eutrophication. While some exceedances may have been caused by human activities, many were due to naturally occurring conditions characteristic of the geologic setting.

Management Implications

Recent water quality monitoring on the North Fork Virgin River in Zion NP detected persistently elevated *E. coli* concentrations. The North Fork Virgin River was subsequently included on Utah's 2010 draft 303(d) list of impaired water bodies as a result of its failure to meet the primary-recreation contact standard for *E. coli* concentrations. Currently the NCPN, Zion NP, the State of Utah Division of Water Quality, and the University of Utah are cooperating to more intensively study the potential sources and spatial extent of bacterial contamination (see next page).

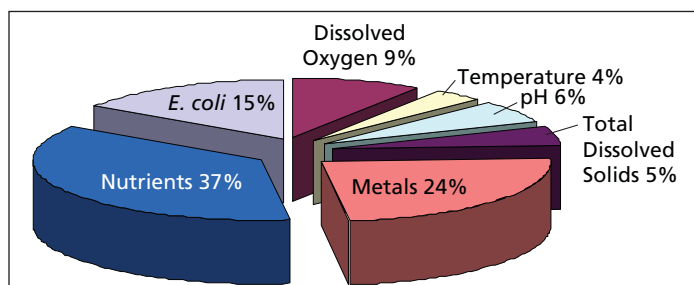


Figure 1. Most commonly exceeded water quality standards in monitored NCPN parks, 2009.

Network park units where the NCPN monitors water quality

Arches NP	Dinosaur NM
Black Canyon of the Gunnison NP	Golden Spike NHS
Bryce Canyon NP	Hovenweep NM
Canyonlands NP	Natural Bridges NM
Capitol Reef NP	Timpanogos Cave NM
Curecanti NRA	Zion NP

NHS = National Historic Site; NP = National Park; NM = National Monument;
NRA = National Recreation Area

Diving Deeper into Water Quality

In 2006, the NCPN began monitoring for *E. coli* on the North Fork Virgin River upstream from Zion NP and the Narrows, where the river flows through pastures that are irrigated and grazed. In summer 2006, 2007, and 2008, the network noted and reported elevated *E. coli* levels to Zion NP staff (see figure). In 2009, hikers entering the Virgin River upstream of the park were issued warnings about these elevated levels, and an intensive study was initiated to isolate the source of contamination and help determine if the problem was persistent or intermittent.

Under the study, monitoring was conducted more frequently at the original pasture site and at two additional sites 1–2 miles upstream, plus a heavily used visitor site at the mouth of the Zion Narrows, 16 miles downstream (these latter three sites are lumped as non-pasture sites in the figure below). Results from 2009 confirmed that the contamination source was located near the pasture and was persistent during the summer season.

Definitively identifying the source of contamination is complicated by several factors. Land ownership in the area is mixed federal and private. Cattle graze pastures near the stream in summer, hundreds of visitors also use the stream, and there are second homes situated higher in the watershed.

A public meeting, hosted by the Utah Division of Water Quality (UDWQ) and attended by staff from the NPS, Bureau of Land Management, and county conservation district, resulted in a course of action that included additional intensive monitoring and a microbial source tracking study to determine

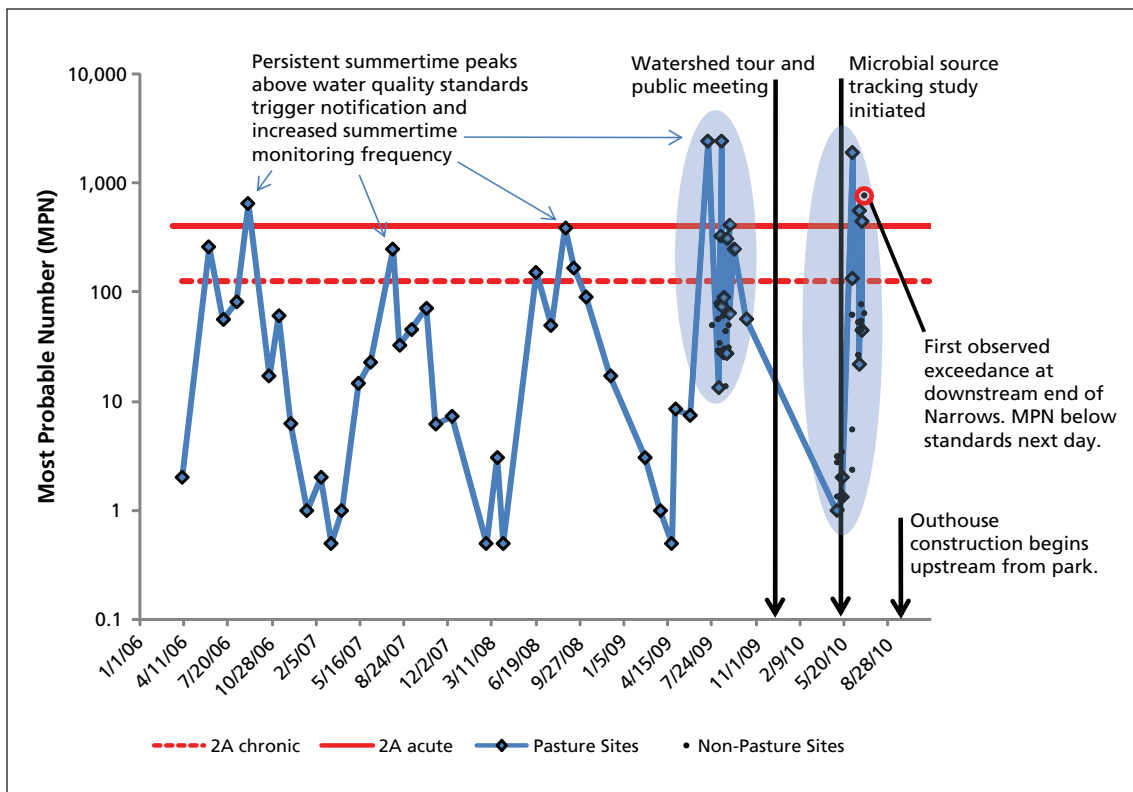


Conducting bacterial monitoring on the North Fork Virgin River, upstream from Zion NP.

if the bacterial source was human or animal in origin. The UDWQ also provided funds for the BLM to build an outhouse at the trailhead upstream from the park, to mitigate potential human sources of bacteria. Continued multiagency cooperation will help us to determine the source of bacteria and arrive at solutions involving federal and state agencies as well as local landowners.

Contact

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The single incidence of an exceedance at a non-pasture site (770 MPN on July 6, 2010) occurred at the mouth of the Zion Narrows, where more than 2,000 people enter the water each summer. On the next day, concentrations were back below the 2A chronic criteria (68 MPN, July 7, 2010).