

A HISTORY OF THE SKAGIT RIVER BASIN SNOW SURVEYS AND HYDROELECTRIC PROJECT

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ABSTRACT

Follow the trials and tribulations of snowpack data collection through a historic timeline within the Skagit River Basin in the North Cascade Mountains of Washington State. From past to present, snow survey data was collected in support of the major hydroelectric project that provides electricity primarily to the City of Seattle. The first recorded snow surveys were conducted by the United States Geological Survey (USGS) in 1944 at 8 manual snow courses. Canadians began collecting data in support of the project in 1946. Throughout the years, numerous snow courses and Aerial markers were started and some later discontinued. The Natural Resources Conservation Service, in cooperation with Seattle City Light, took over data collection responsibility in 1979 and began converting select manual sites to automated SNOTEL stations. The network now consists of 6 SNOTEL sites and 11 manual snow courses with support of 7 aerial markers.

INTRODUCTION

The City of Seattle's hydroelectric development on the Skagit spanned over half a century of activities resulting in construction of the Gorge, Diablo, and Ross dams. This monumental project was the vision of Seattle City Light Superintendent James D. Ross. The following timeline lists the significant milestones of the development.

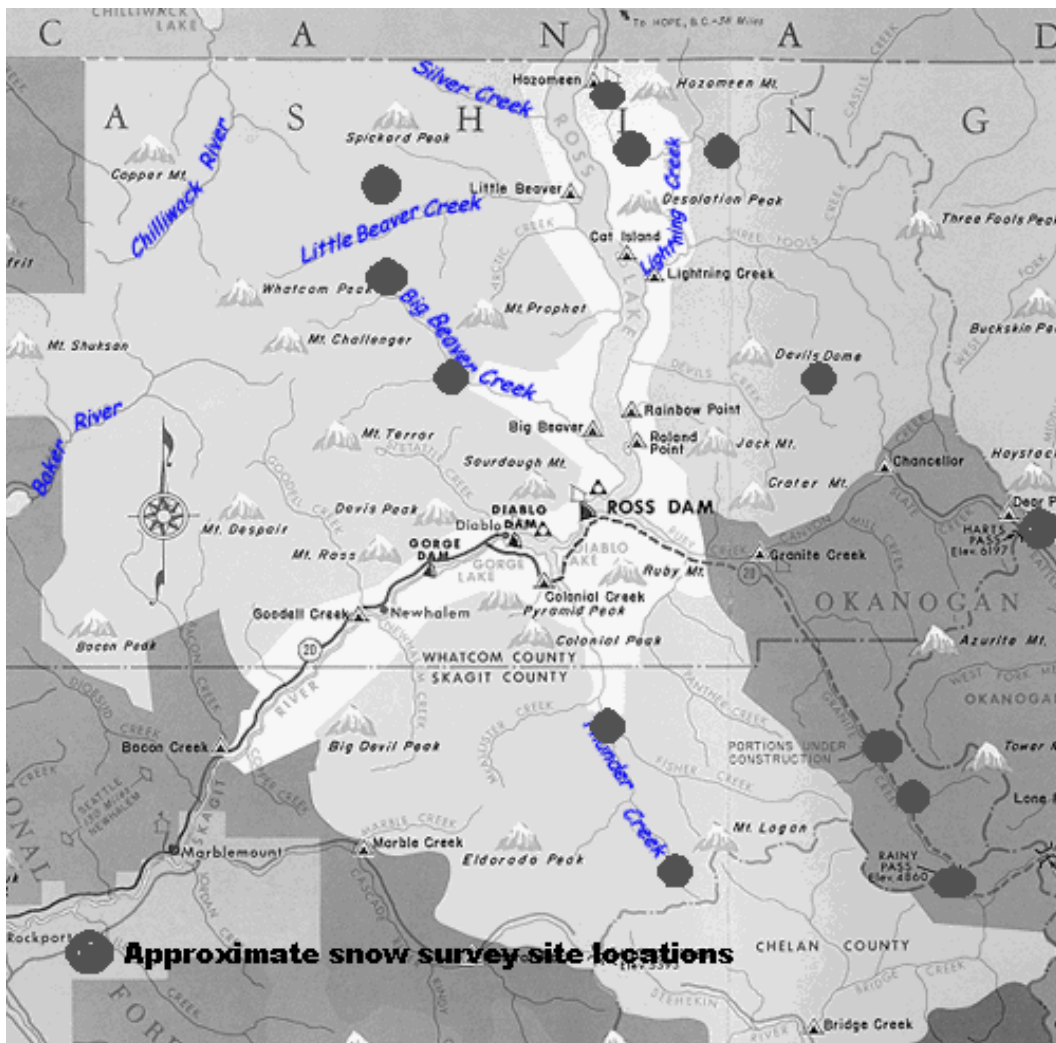


Figure 1. Map of Skagit River Basin with approximate snow survey site locations.

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TIMELINE

- 1917** Seattle applies to U.S. Department of Agriculture for permission to develop the hydroelectric resource of the Skagit River.
- 1918** Federal permit granted to build the Newhalem Creek and Gorge power plants.
- 1919** Thirty-one mile railway constructed to take workers and equipment to Skagit project site.
- 1921** Newhalem Hydroelectric Unit number 20 put into operation.
- 1924** Gorge Dam hydroelectric units 21 and 22 placed in service.
- 1925** Skagit Engineering Commission, appointed by the Seattle City Council, recommends construction of three Dams on the Skagit--Gorge, Diablo, and Ruby (later called Ross). The Ruby Dam reservoir would flood lands into British Columbia.
- 1926** Seattle applies to Federal Power Commission (FPC) of Diablo Dam and Powerhouse was approved, and construction begun.
- 1929** A third unit at Gorge placed in service. The three Gorge units doubled the previous peak kilowatt output by the Department of Lighting.
- Seattle purchases the 640 acre Whitworth ranch in British Columbia, the only privately owned land within the proposed Ruby reservoir.
- 1930** Diablo Dam construction completed. The dam is 389 feet high and 1,180 feet long.



Figure 2. Diablo Dam dedication – 1930.

- 1930** First manual snow surveys conducted at Rainy Pass by Chelan PUD
- 1936-1937** Diablo hydroelectric units 31-32, 35-36 become operation. Generators for unit 31 and 32 are the largest in the world at the time. Output doubles the previous electrical output by the Department.
- 1937** FPC approves amendment to the Project License, allowing for construction of Steps 1 and 2 of Ruby Dam.
- 1939** James D. Ross dies. Ruby Dam is renamed Ross Dam in his memory.
- 1940** First step of Ross Dam construction completed. It was 305 feet high and created a reservoir whose water level reached 1380 feet above sea level. Dam was initially constructed for storage, not generation.
- 1941** Seattle applies to the International Joint Commission to raise the level of Ross Reservoir to 1725 feet, enough to flood into Canada.

- 1942** IJC approves raising level of Ross Lake subject to Seattle making an agreement with British Columbia for compensation for flooding.
- 1943** Step two construction of Ross Dam begun; dam height to be raised to 475 feet. Authorized to elevation 1550 feet above sea level by Amendment number 1.

In cooperation with Seattle City Light, U.S. Department of Interior Geological Survey established 8 new manual snow courses in the Upper Skagit River Basin.
- 1945** Contracts let for removal of 318 million board feet of timber from the Ross Reservoir area.
- 1946** In cooperation with Seattle City Light, the Canadian government began snow survey in the upper basin.
- 1947** FPC approves step three construction of Ross Dam to 1615 feet with reservoir elevation to 1582, the elevation of the Skagit River at the border with British Columbia.
- 1947** Skagit Valley Lands Act passed by British Columbia authorizing the cabinet to sign an agreement with Seattle for flooding the required area in British Columbia, providing the province is compensated for losses incurred.

Snow surveying in the Skagit was not for the light hearted. The following travel itinerary, for just a few snow courses, was followed each month.

Snow surveyors Sterling Osbourne & Stanley Dragnich survived a harrowing experience on day 6 when Stanley lost footing on solid ice and slid off of the Lightning Creek trail, injuring his shoulder and hips. It took 16 hours and the resources of a logging camp to rescue him from the wilderness and get him into the nearest hospital.

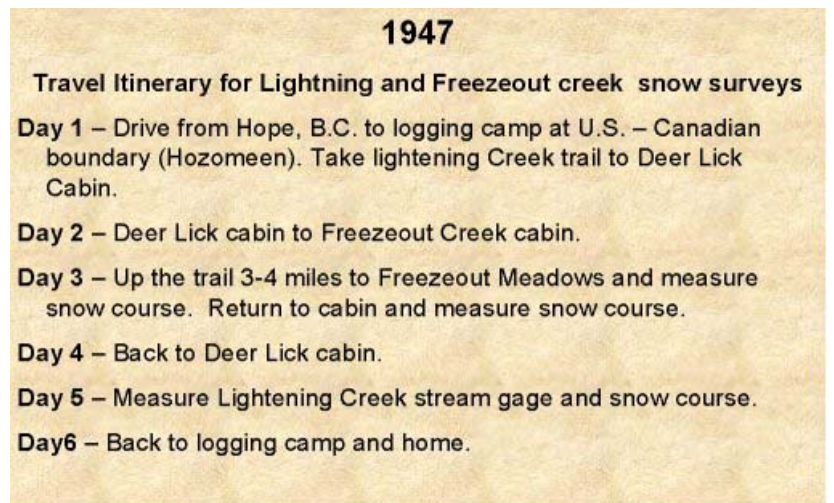


Figure 3. Typical 1947 snow survey travel itinerary.

- 1949** Third step of Ross Dam completed, raising the dam height to 540 feet. Ross Lake reaches Canadian border and elevation 1600 feet during the year.
- 1950** FPC authorizes construction of Ross Powerhouse and three generating units.

Helicopters were used for the first time to conduct snow surveys at the remote wilderness sites of the Skagit.
- 1951** Gorge hydroelectric unit number 24 placed in service.
- 1952-1956** Ross Powerhouse constructed and four generators go on-line, doubling the electrical output by the Department.
- 1952** City Council passes Ordinance approving settlement terms negotiated with British Columbia for flooding to elevation 1725 feet. However, a change in administration of British Columbia government leads to rejection of the agreement.
- 1954-1966** Seattle makes series of annual agreements regarding flooding of Canadian lands to an elevation of 1600 feet, encompassing approximately 500 acres of land.
- 1956** Fourth generating unit installed at Ross Powerhouse.
- 1961** Gorge High Dam construction completed.
- 1967** Agreement between Seattle and British Columbia for 99 years allows flooding of Canadian land to 1725 feet. FPC authorizes amendment to Skagit license to raise Ross Lake reservoir to 1602.50 feet.

- 1967** Remote mountain cabins were still being maintained and used for snow survey parties. There were 10 cabins available for the 10 snow courses being measured.
- 1968** US Congress creates Ross Lake National Recreation Area and the North Cascades National Park. FPC retains jurisdiction of power projects in the recreation area.
- Envisioned as a scenic highway, not an access for logging, mining or development, a rough pioneer road was completed. On September 29, hundreds of four-wheel drive vehicles formed a caravan to make the first crossing and celebrate at the summit of Rainy Pass.
- 1970** Seattle applies to FPC for construction of fourth step of Ross Dam to raise reservoir to 1725 feet.
- 1972** After 76 years of planning, surveying and negotiating, North Cascades Highway is officially opened.
- 1977** FPC authorizes construction of the fourth step of Ross Dam.
- 1983** U.S. Department of Agriculture Soil Conservation Service installed the first SNOTEL sites in the Basin, automating Harts Pass and Rainy Pass snow courses.
- 1984** Agreement for a period of 80 years between Seattle and British Columbia stipulates that the fourth step will not be constructed, that British Columbia will supply power to Seattle in lieu of construction, and that Seattle will pay an amount relative to construction costs.
- The above agreement creates Skagit Environmental Endowment Commission.
- 1989 – 2002** Four additional SNOTEL sites have been installed to help improve water supply forecasting and dam operations. (Thunder Basin, Swamp Creek, Beaver Pass and Hozomeen Camp)
- 1993** Long time snow survey contractor, Larry Eaken, dies of a massive heart attack while doing snow survey at Beaver Creek Trail snow course.



Figure 4. Memorial plaque mounted in rock wall near Beaver Creek Trail.

Today There are 6 SNOTEL sites and 11 manual snow courses still being measured on a regular basis. All snow surveys are done by helicopter. Only one snow survey cabin remains at Freezeout Creek Trail. The rest were all removed according to U.S. Department of Agriculture Forest Service wilderness policy.

SUMMARY

The history described above would be indicative of many river basins in the West where snowpack plays a crucial roll in water supply. Water supply forecasting from mountain snowpack has evolved since the late 1800's when settlers first discovered and began harnessing the abundant water supplies of the west. Whether it is for irrigation, hydroelectric, municipality, fisheries or recreation; snow is the lifeblood of western civilization.

REFERENCES

Photos Courtesy of Seattle City Light, USGS and NRCS Archives.

Historic References include; Seattle City Light, USGS, NRCS, WA-Department of Transportation and Skagit Environmental Endowment Commission