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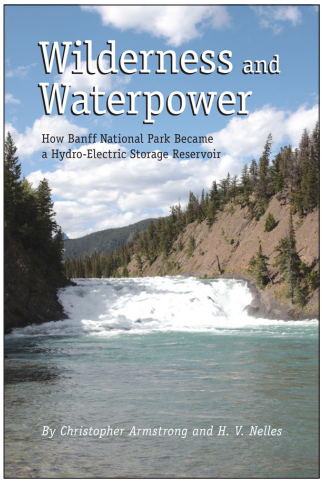

WILDERNESS AND WATERPOWER: HOW BANFF NATIONAL PARK BECAME A HYDROELECTRIC STORAGE RESERVOIR
Christopher Armstrong and H. V. Nelles

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CHAPTER 1

Water Falls

Falling water has always excited the emotions. Thundering waterfalls and roiling rapids have filled hearts with both dread and wonder from time immemorial. Such fearsome places, where a misstep led to certain death, were thought by many peoples around the globe surely to be the abode of the gods. In the Christian era, it was believed that these were sites of revelation where God made manifest his enormous power, casting human pretensions in pitiful perspective. For millennia, human beings approached waterfalls with a sense of fear, awe, and wonder.

In the modern era, the power of falling water has also stirred another human emotion, ambition, inspiring ingenious thoughts on ways of using some or all of that power for human purposes. The aesthetic of the sublime associated with sites of spectacular nature was gradually displaced in the case of falling water by utilitarian thoughts guided by mechanical engineers and, subsequently, hydroelectric technology. How could that energy, now perceived to be going to waste in conspicuous display, be converted to productive human ends? How could the genie bottled up in nature be released to be re-employed in the service of humanity?

Millers led the way, creating millponds and rechannelling flows in ever more efficient ways to turn their water wheels and crank their machinery. At the larger sites of falling water, millers could use only a small portion of the energy available with their mechanical technology, but at places like Lowell, Massachusetts, and Minneapolis, Minnesota, extensive hydraulic engineering works recovered a large proportion of the available energy to power textile mills, flour mills, and other manufacturing enterprises.[1]

Hydroelectric power – a more efficient process that could be developed on a larger scale, producing a much more adaptable form of energy that could be used at a distance – rapidly displaced mechanical technology at the end of the nineteenth century. After the physics of electricity was worked out in the late eighteenth and early nineteenth century, it was left to tinkerers like Edison and Tesla of the late nineteenth century, and then the electrical engineers and capitalist entrepreneurs, to work out, manufacture, and distribute the integrated system to produce, transmit, and then use electrical power. Long-distance transmission proved to be one of the key elements of this integrated technological system, allowing power to be generated in one place but consumed with minimal transmission losses dozens, hundreds, and eventually thousands of kilometres away. Previously, energy users had to locate themselves at sources of power, or power production had to take place close to sites of consumption. Long-distance transmission broke the bond between production and consumption. Henceforth, industry did not have to go to power; power came to industry.[2]

In Europe and the Americas, electrical power generation, either by steam power or by hydraulic means, was well understood and widely exploited commercially by the beginning of the twentieth century. Large corporations produced, sold, and installed the equipment to generate, transmit, distribute, and consume electricity for a variety of purposes: domestic, commercial, electromechanical, industrial, and traction. Following the relentless logic of returns to scale, electrical systems and generation facilities sought ever larger power sources to generate electricity at the lowest cost and maximum efficiency.

Under this new intellectual and commercial regime, the energy of falling water could gradually be rechannelled through machines all over the world. Waterfalls went silent, or were greatly diminished. Dams across rivers drowned rapids in slack-water lakes as vast quantities of hydraulic energy were converted to electricity to light up the night, energize factories and transportation, and perform a host of mundane domestic tasks. The subdued hum of whirling turbines and generators replaced the thunderous roar of waterfalls and rapids. This new hydroelectric doctrine, which

subjugated falling water and transformed hydrology, took root nowhere in the world more firmly than Canada, with its abundant and widely distributed waterpowers. Canada quickly became one of the most aggressive developers of hydroelectricity in absolute quantities, on a per capita basis, and as a proportion of its total energy production mix – an international ranking that it retains to this day.[3] Canada got the hydroelectric religion.

And so, eventually, did southern Alberta. With the rise of a significant urban population at the end of the nineteenth century, hydroelectric thinking descended upon the Bow River with all of the evangelism, restless drive, and impetuosity characteristic of western ambition. Calgary's early experience with electricity mirrored in a microcosm the development of the technology more generally. The first steam-powered electric generators sprang up in the city, close to the hotels and businesses and street lights they served. Then, also in the city, a small dam across the river, primarily for a sawmill raceway, raised water levels to power a low-head hydroelectric-generating facility. With the advent of long-range transmission and under the inspiration of iconic projects at Shawinigan, Niagara, and many other Canadian waterfalls, the entrepreneurial search for electrical energy to empower a burgeoning urban industrial society turned toward the upper reaches of the Bow, where several spectacular cascades advertised its hydroelectric potential.

The first reasonably comprehensive survey of hydroelectric development in Canada in 1910, a heroic example of inventory research conducted for the Commission of Conservation by Leo G. Denis and Arthur V. White, helps us place the Bow River developments in their contemporary context.[4] This snapshot of the Canadian hydroelectric industry in its infancy counted 960 waterpower sites across Canada, not including an unknown number of unsurveyed locations in the far North. Denis and White identified hundreds of hydroelectric installations operating or under construction, with a total output of a little over a million horsepower (hp), or 740 megawatts (mw). Most of these were small, low-head stations producing a few hundred horsepower and serving mines, sawmills, factories, electric companies, and municipal electric utilities. A few, associated with pulp and paper mills, generated in the range of several thousand horsepower.

Two projects at Shawinigan and Niagara Falls were world scale at over 100,000 hp each. Scale mattered more than the sheer number of projects. Only thirty-three large projects (over 5,000 hp) accounted for 79 per cent of total Canadian output. In 1910, electric companies, mainly privately owned, distributed approximately 75 per cent of this hydroelectricity to towns and cities for commercial, industrial, municipal, and domestic uses. A few municipalities close to waterfalls operated their own small plants. Pulp and paper companies and other industries equally divided the remaining 25 per cent of the hydroelectricity. Provincially, Ontario led the way with 53 per cent of total Canadian output, followed by Quebec, British Columbia, and Manitoba. All of the other provinces had less than 10,000 hp under development in 1910. Alberta, with 1 per cent of the national output, was thus just getting into a game already well under way in the East and in British Columbia. Significantly for us, Alberta's total was accounted for by a single project located on the Bow River.

To look ahead just briefly, Canadian hydroelectric fever would continue unabated in the decades to follow. Despite World War I, hydroelectric capacity would almost double in a decade. It would virtually triple during the 1920s, creating, as it turned out, serious oversupply problems for the industry during the Depression, when hydroelectric development had to be severely reduced. During the 1940s, a global war hampered development, notwithstanding the fact that electricity had become a major weapon of war. Postwar economic growth unleashed another hydroelectric building boom during the 1950s, when capacity once again more than doubled. Hydroelectric capacity growth would ease off during the 1960s, as the engineers ran out of easily accessible rivers. Nevertheless, hydroelectric expansion would continue, albeit at a slower pace, to the present day by exploiting more remote sites in the far North.

The engineering of the Bow River for hydroelectric development would, to a large extent, mirror the broader Canadian experience. As the first run-of-the-river projects became fully operational during the second decade of the twentieth century, growth rates spiked above the national figure. During the 1920s, the system on the river doubled its capacity, but during the Great Depression, not one new hydroelectric project on the

Hydroelectric Development in Canada in 1910

Province	Output (hp)	% of Canada	Electric Cos	Pulp & Paper	Other Indust
Ontario	532,266	52%	75%	11%	14%
Quebec	300,153	30%	64%	26%	11%
British Columbia	100,920	10%	87%	8%	4%
Manitoba	48,300	5%	100%	0%	0%
Nova Scotia	15,272	2%	12%	79%	9%
New Brunswick	9,765	1%	35%	31%	34%
Alberta	7,300	1%	100%	0%	0%
Yukon	2,000	0%	100%	0%	0%
P E I	500	0%	10%	0%	90%
Saskatchewan	45	0%	0%	0%	100%
Canadian Total	1,016,521	100%			

Source: Leo G. Denis and Arthur V. White, *Water-Powers of Canada* (Ottawa: Commission of Conservation, 1911), 22a.

Installed Hydroelectric Capacity in Canada, 1910–1960 (in thousands of hp)

	Installed Capacity	Growth Per Decade
1910	1,011.0	
1920	1,754.1	173.5%
1930	5,114.1	291.6%
1940	7,576.1	148.1%
1950	11,029.8	145.6%
1960	25,019.3	226.8%
1970	38,793.6	155.1%

Source: *Historical Statistics of Canada*, 1st ed., Series P1-6; 2nd ed., Series Q81-4.

Bow River Hydroelectric Development, 1910–1970 (in kw)

1910	7,000	
1920	23,900	341.4%
1930	51,900	217.2%
1940	51,900	100.0%
1950	82,800	159.5%
1960	234,200	282.9%
1970	320,000	136.6%

Source: Calgary Power and TransAlta Annual Reports, see Appendix.

Bow came online. The contraction on the Bow was more severe than the national average. Expansion picked up slightly again under the stimulus of World War II, after which the 1950s witnessed a major explosion of developments that slackened off considerably during the 1960s. By then, the Bow, like many other rivers in Canada, had been dammed, plumbed, machined, and wired to its maximum, and Calgarians, along with other southern Albertans, would have to look elsewhere to satisfy their electricity dependence.

But all of this did not just happen passively. These facilities had to be designed, financed, and built, and their output sold. They were thus driven by a capitalist imperative. Similarly, powerful social forces lay behind the rising but variable demand for electricity, which the developers strove to meet. Technological necessities, especially the need to increase the output of expensive capital equipment to the maximum capacity, demanded further action. The energy of the river was also perceived to be the "property" of other actors; this property had to be politically re-appropriated in favour of the power developers. None of this would be easy, nor was any of it inevitable. Electrification of a city had profound environmental, social, and political implications far beyond its borders. In the process, Banff National Park became a hydroelectric storage reservoir. Such was the power of the hydroelectric religion, capitalism, and urban growth, and

the momentum of path-dependent technological development. This story of hydroelectric development on the Bow River, a tale that eventually involved a replumbing of the river to meet the requirements of the technology and the demand for energy, takes us into the fundamental questions of power in a democratic society: Who gets what? Who decides? Who pays?

Blame it on Calgary. Without the mushrooming of a major urban centre in southern Alberta, the Bow, like the other rivers flowing off the eastern face of the Rockies, would not have been extensively engineered. For three decades after its founding in 1875 as a North West Mounted Police post at the confluence of the Elbow and the Bow, Calgary's growth from a handful of residents to 4,152 in 1901 was far from spectacular. The arrival of the Canadian Pacific Railway in 1883 reoriented activity to the more expansive real estate possibilities of the open prairie, but the town remained primarily an unremarkable regional distribution centre for agriculture and commerce. Its energy demands, mainly for street lighting and commercial and industrial power, were slight but not inconsequential and could, for the most part, be handled locally.[5] Typically, major industrial power users – hotels, retail stores, and of course, municipalities for street lighting – provided the main stimulus to the development of the electric industry and often organized the companies themselves. Within just three years of the time that Calgary secured municipal incorporation in 1884, its council approved a proposal to light the streets electrically from the small locally owned Calgary Electric Company. Employing a small steam-powered generator, this undercapitalized and badly managed business made more enemies than friends with its intermittent service. Antipathy to the Calgary Electric Company opened the door to competition.[6]

The Eau Claire Lumber Company, organized by itinerant Wisconsin businessmen who had moved to Calgary, had set up shop on the Bow River just north of the town in the mid-1880s. It conducted logging operations on its timber leases located in the mountains in the upper reaches of the Bow River system, and in classic Canadian fashion, it floated its logs in an annual spring drive to holding booms at its steam-powered sawmill in Calgary. To create the ideal ponding conditions at the mill, the Eau Claire Company acquired the right to build a dam across the Bow just

upstream from Calgary in order to redirect water into a channel between Prince's Island and the company's mills on the south bank of the Bow. This dam created the conditions for a low-head hydroelectric installation at the outlet of this channel.[7] Needing power for their mill, the Eau Claire partners built a small hydroelectric plant with enough capacity to serve other customers as well. With its steam plant and this hydro installation, Eau Claire, under the name Calgary Water Power Company, took over electrical distribution from the moribund Calgary Electric Company.[8] By the beginning of the twentieth century, Calgary had recapitulated the history of the electric industry: first came a centrally located steam-powered direct current system mainly for street lighting; then, a small hydroelectric alternating current system exploited local power resources – the slight drop in the level of the Bow River as it passed through Calgary – to serve industry, commerce, and municipal power users.

After 1901, however, the explosive growth of Calgary and expectations of its future possibilities suddenly outstripped the capacity of the local electric utility. Population growth and commercial ambition unleashed a search for new sources of energy; the situation was sufficiently urgent that the city itself was moved to act. Railway construction, ranching, settlement, meat packing, brewing, financial institutions, and wholesale and retail trades combined to create a classic western boom. Population soared more than tenfold in the first decade of the century, reaching 43,704 by 1911 and over 50,000 by 1914. At the best of times – periods of high streamflow and low use by the sawmills – the 600 hp Calgary Water Power plant struggled to meet its existing customers' requirements. But with seasonal diminution of streamflow, the ill-named Calgary Water Power Company had to rely upon its thermal generating system, a relic of which – the chimney – still stands like an industrial menhir in the Eau Claire recreation and entertainment area. Urban growth simply overwhelmed the Calgary Water Power Company, a subsidiary of the Eau Claire Lumber Company, whose main priorities remained supplying building materials for all of this construction.

Inevitably, relations between the city, as a main user of electricity and as an agent for frustrated commercial and residential customers, and the

Calgary Water Power Company hydroelectric plant between Prince's Island and the Eau Claire Lumber Company (Glenbow Archives, NA-1044-6).

Calgary Water Power Company broke down. Interest groups urged the city itself to enter the electricity business to provide the needed infrastructure to maintain growth. At first, local ratepayers, in 1903, turned down a proposal to invest in a municipal steam plant. However, when the Calgary Water Power Company, faced with the need to finance a major expansion of its system, insisted that the city sign a ten-year contract in 1904, the aldermen balked at a long-term continuation of an unsatisfactory relationship and recommended a municipal plant instead. This time, the voters agreed, and the new station started production in 1905.[9]

Here, too, Calgary was following a well-established political tradition witnessed in other parts of the country. When private capital failed to meet expectations, government stepped in to meet the need. Market failure leading to public ownership had occurred in many small towns and cities across the country, most particularly in Ontario, where this municipal empowerment gave rise to a unique trans-provincial, publicly owned hydroelectric system. Not only population but also social and

technological change drove the rising demand for electricity. The City of Calgary operated a street lighting system and an electric street railway, both of which needed large quantities of power. Similarly, the taste for brightly illuminated shops, warehouses, and even homes increased the public demand for electricity. The municipal system, operating at a much larger scale and greater efficiencies than before, charged lower rates, which, of course, only increased the demand for more electricity. Rising demand vastly outdistanced readily available supply. Into this gap, the animal spirits of industrial capitalism charged, bearing a new elixir: hydroelectricity, to be extracted from the Bow.

Like a siren, the Bow beckoned entrepreneurial spirits. It was so close, so accessible – seemingly inviting use. There was nothing new in this. The river had always appealed to its human inhabitants in one way or another. Evidence of the first human habitation, following the last ice age, has been found on the upper reaches of the Bow above Banff. Native peoples traditionally valued the lower reaches of the river, where buffalo herds often sought shelter, water, and lush grasses, and where buffalo jumps could be situated on cutbanks. On the lightly treed banks – the only woods to speak of on the prairie – poles for travois and teepees could be cut and firewood gathered. Fords and flats offered venues for meetings and ceremonies. After contact, Native people often raised their horses on the meadows of the river flats. For Native people, the mountain reaches of the river served mainly as seasonal hunting grounds. Mountain passes leading out of the Bow valley also afforded regular communication for commerce, comity, and conflict between the people of the foothills and prairie, and the people of the Columbia River valley. In the treaty-making process, the Native peoples of the plains all sought reserve lands astride portions of the river.[10]

For fur traders, the Bow was something of a disappointment. On account of the forest composition in the upper reaches, beaver were not as abundant as elsewhere. Moreover, numerous rapids, shallows, and waterfalls made the river treacherous for navigation in its upper reaches. Downstream, the Bow meandered aimlessly, from a trader's point of view, into a no man's land of desolate prairie far from the more northerly system of posts. Yet ranchers, when they arrived, valued the abundance of fresh

water for their stock on the open prairie and the meadows on the flats for their ranches. The North West Mounted Police built their fortified post at a river junction. Railroaders used the valley floor as a roadbed through the mountains and the river's water to get up steam. Lumbermen admired the river's forested banks and its log-driving capacity. For them, the rapids and waterfalls were regrettable obstacles to be overcome.[11] But this falling water was precisely what caught the waterpower developers' attention.

While the Bow River is not particularly big as Canadian rivers go, over the 645 kilometres from the glacier where it trickles into existence to its confluence with the Oldman to form the South Saskatchewan River, the Bow River falls twenty-six hundred metres.[12] Much of this descent occurs on the lower streamflow of its upper reaches. But where the Bow forces its way out of the mountains at Banff and where it carves its way through the sandstone shelves in the foothills, it plunges over three quite spectacular waterfalls that drew attention to its hydroelectric possibilities: Bow Falls (19.5 m), Kananaskis Falls (21.3 m), and Horseshoe Falls (21.3 m). The Denis and White 1911 inventory of Canadian waterpowers contained full-page photographs of each of these falls in full spate. In the eighty-eight kilometres between Kananaskis Falls and Calgary, the mainstem of Bow River descends a total of 230 metres through valley terrain, providing several potential dam sites. As the Bow descends, its tributaries add to the volume of its flow. Taking the measure of the river below Calgary as 100 per cent, on average that flow is made up of the following constituents:

At Banff, only 30 per cent of the ultimate Bow tumbled over Bow Falls, but at the Kananaskis and Horseshoe Falls sites, waterpower developers had at their disposal approximately 60 per cent of the downstream flow of the river and a respectable twenty-one-metre head. They were located, however, within the bounds of a reserve set aside for the Nakoda in 1885 subsequent to their signing of Treaty 7 in 1877.[13]

Of course, others besides waterpower developers and hydraulic engineers took delight in falling water. By the turn of the twentieth century, the upper reaches of the Bow River had become an international tourist destination, with the Bow Falls a centrepiece attraction.

Elements of the Flow of the Bow River

Bow River above Banff	31.2%
Spray River	11.1%
Cascade River	5.9%
Kananaskis River	12.1%
Ghost River	5.8%
Elbow River	7.6%
Bow Basin runoff	26.3%

Source: Environment Alberta, South Saskatchewan River Basin Historical Natural Flows, 1912–1995, CD-ROM version 2.02.

During the construction of the Canadian Pacific Railway in 1883, workers discovered hot springs in the region that would come to be known as Banff. William Van Horne, the vice-president of the CPR, inspired by the example of the Northern Pacific Railroad and Yellowstone, urged the Government of Canada to reserve the area around the hot springs as Canada's first national park. The government obliged with commendable speed, the prime minister himself playing a leading role. In 1885, the government declared, and in 1886, created Rocky Mountains National Park, a small twenty-five square kilometre reservation that included the springs and Bow Falls. The initial inspiration emphasized the hot springs as a health spa, but other rationales also crept in. Prime Minister Macdonald, speaking in the House of Commons, expressed the hope that the new park would become "a place of great resort." Government ownership would prevent squatting and tawdry commercial development and would thus attract well-off tourists. In Macdonald's words: "There is beautiful scenery, there are the curative properties of the water, there is a genial climate, there is prairie sport and there is mountain sport; and I have no doubt that that will become a great watering-place."[14]

To accommodate visitors, doctors and businessmen built spas, hotels and sanitoria in the park for the ill, the infirm, and the enervated during the late 1880s and 1890s. The railway quickly built a grand hotel on a

ridge affording spectacular views across Bow Falls down the river valley. A small tourist village developed where the road from the railway station crossed the Bow River leading to the hotels and spas. Drawn by publicity brochures, advertisements, and colourful railway posters, tourists from all over the world, but mainly the eastern United States, began to descend on Rocky Mountains National Park, arriving and departing, of course, as passengers of the CPR. As the number of summer visitors steadily expanded, so too did the boundaries of the park and its identity. Although it was a small postage stamp presence in 1885, two years later, conscious of the attraction of the unspoiled mountain scenery of the region, the government enlarged Rocky Mountains National Park to 674 square kilometres. In 1892, the Lake Louise region was appended to the park. By 1902, with tourists flocking to the region by rail each summer, the park had expanded to an enormous 110,250 square kilometres encompassing a huge triangular area of southern Alberta between the BC boundary and the front range of the Rockies.[15]

The tourists, through their behaviour and the aiding and abetting by the railway and local businessmen, gradually transformed a health resort and spa into something quite different. It turned out that visitors came primarily for the magnificent mountain scenery, and a brave few for the mountaineering opportunities afforded by the surrounding peaks. The mountaineers branded Banff as the "Switzerland of Canada," an idea seized upon by CPR managers, who imported actual Swiss mountain guides to ensure the safety of their wealthy and influential guests. Less adventurous visitors sought more moderate outdoor pursuits – tally ho rides, hikes, trail riding, sightseeing, fishing, and boating, activities assiduously developed and promoted by local entrepreneurs. All of this outdoor leisure could be enjoyed in a sublime, bracing mountain setting and in luxury accommodation. The CPR and local boosters ensured that the word got out.[16]

By the first decade of the twentieth century, Rocky Mountains National Park (it would become the more familiar Banff National Park in 1930) had established itself as one of the world's premier tourist destinations and an object of Canadian national pride. The idea of what a national park should

be continued to evolve in practice under the necessity of attracting more visitors to make the park self-financing. Amusements and distractions – such as wild animal zoos, curio shops, and eventually a Wild West–inspired Indian Days festival – were organized to entertain idle guests and draw new types of visitors. Through it all, the Bow River in its various forms played a starring role in the park production – as lakes, as a mirror to mountains, as a gentle curving stream, as thundering falls, and as a majestic valley. In passing, it should be noted that the hydroelectric engineers excluded Bow Falls from their waterpower calculations after applying the principle of highest and best use. In the words of Leo Denis and J. B. Challies, who surveyed the waterpower of the Bow between 1911 and 1914: "The famous Bow fall, on the Bow River, near the Canadian Pacific Railway Company's hotel at Banff, has been considered to have a far greater potential value from an aesthetic standpoint than from any possible use for power development purposes. For this reason no attempt has been made to consider it from a utilitarian viewpoint."[17] In other words, Bow Falls had the potential to generate more income from tourism than from electricity.

A powerful new cultural phenomenon, tourism, combined with corporate authority of the CPR and the power of the Government of Canada, conspired to drape a world-famous and much beloved national park upon the headwaters of the Bow River. As fate would have it, the falling water and hydroelectric potential of the Bow River thus locked the City of Calgary, the power developers, the Nakoda people, and the national park in an inescapable mutual embrace.