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United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
MULTIPLE PROPERTY DOCUMENTATION FORM

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

Electric Power Plants of Utah

B. Associated Historic Contexts

Development of Hydroelectric Power in Utah, 1881-1939

C. Geographical Data

State of Utah

___ See continuation sheet

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards for Planning and Evaluation.

Max J. Evans — 3-2-89

Signature of certifying official — Date

UTAH STATE HISTORICAL SOCIETY

State or Federal agency and bureau

I, hereby, certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

for Bruce J. Noble, Jr. — 4/20/89

Signature of the Keeper of the National Register — Date

E. Statement of Historic Contexts

Discuss each historic context listed in Section B.

(see continuation sheet)

x See continuation sheet

Introduction and Organization

A multiple property listing is appropriate for Utah's historic hydroelectric power plants for several reasons. First, the plants have either local or state significance in the areas of engineering and industry. Second, as related properties the plants exist in sufficient numbers to warrant such a registration. Third, a multiple property listing relates to federal planning goals. Several plants currently operated by the Utah Power and Light Company (UP&L) will soon be subject to relicensing through the Federal Energy Regulatory Commission. As part of this process UP&L will subject some of its plants to a determination of eligibility for the National Register. UP&L has chosen to complete a multiple property nomination to satisfy this requirement. Finally, Utah's historic hydroelectric plants make up a group of significant properties linked by a common historic context and several property types. The historic context and property types provide the principal organizational basis for the hydroelectric plant multiple property group.

The historic context of hydroelectric power development in Utah between 1883 and 1927 unifies the individual histories of the plants. During the late nineteenth century, a combination of technological developments, capitalist enterprise, and economic demands led to the creation of Utah's hydroelectric power industry. Small utility companies around the state built water power plants to generate electricity, mostly for streetcar systems, mines, and other industries. Cities and small towns also consumed power for municipal, commercial, and domestic use. During the early twentieth century, a merger and consolidation movement among Utah's utilities culminated in the formation of the Utah Power and Light Company (UP&L). Using a modern business organization and drawing on extensive capital, UP&L became the dominant utility in the state. The company constructed new generating facilities of unprecedented size, completed major projects started by predecessor companies, and interconnected different transmission systems. Utah's hydroelectric power plants typified the technology, engineering, and architecture of the eras in which they were built. How the plants represented solutions to problems encountered in providing power to particular customers in particular geographical settings distinguished the plants individually.

Utah's historic hydroelectric power plants have important associations with these principal developments. In particular, the plants have significance in the areas of engineering and industry. The period of significance, 1883-1927, was chosen because it encompasses the major events in the development of hydroelectric power industry in the state. These events include the beginnings of Utah's electrical power industry; technological advances which precipitated the establishment of small hydroelectric companies; the evolution of hydroelectric power technology; economic and industrial developments important to the hydroelectric power industry; mergers, consolidations, and the formation of UP&L; and the construction of UP&L's Bear River hydroelectric power system, which was essentially completed in 1927 with the construction of the Cutler plant. For a few hydroelectric plants, the period of significance extends beyond 1927, largely because of substantial improvements (such as new dwellings and other buildings) made after that date and up to 1939.

The hydroelectric power plant multiple property group is also defined by several related property types: dams, conduit, surge tanks, penstocks, powerhouses, operator's dwellings, transmission equipment, and ancillary structures such as sheds. Dams and conduit (including penstocks) diverted and delivered water to the powerhouse, where the kinetic energy of moving water was converted by machinery into electricity. Dwellings housed plant operators and their families. Ancillary structures such as sheds sheltered equipment and materials needed to maintain the power station. The physical components of Utah hydroelectric stations have significance because they represent engineering methods, technology, and architecture typical of such complexes between the 1880s and the 1920s. The plants also have important historical associations, primarily with the major events in the overall development of Utah's hydroelectric power industry. In some instances hydroelectric plants have significance because of their association with important individuals, usually businessmen who played key roles in the development of Utah industry, including hydroelectric power.

The geographical boundaries for the multiple property group as it relates to the context of hydroelectric development in Utah were chosen for administrative purposes. It is expected that this multiple property documentation form will be used to nominate hydroelectric power plants in Utah. These nominations will be reviewed by the Utah State Historic Preservation Office and the Utah Historic and Cultural Sites Review Committee. Although this multiple property documentation form directly relates to Utah properties, it is expected that the form could also serve as the basis for nominating properties in surrounding states, particularly Idaho. Utah Power and Light Company, for instance, operates several hydroelectric power plants along the Bear River, a waterway which originates and ends in Utah but which also flows through Wyoming and Idaho. UP&L's Bear River plants are located in both Utah and Idaho. Because UP&L's history comprises an important part of the historic context of hydroelectric development in Utah, UP&L's Bear River plants in Idaho could conceivably be evaluated using some of the information contained within this multiple property documentation form.

Context: Development of Hydroelectric Power in Utah, 1883-1927

Hydroelectric development in Utah took place within a setting originally defined by pioneer settlement. During the late 1840s, members of the Church of Jesus Christ of Latter-day Saints, the Mormons, began settling an area near the southern shore of the Great Salt Lake, the largest body of water in the Great Basin region. Soon after their arrival, the Mormons laid out the streets, blocks, and lots for Salt Lake City, later the capital of Utah and one of the largest cities in the intermountain West. Just east of the Great Salt Lake and the new Mormon settlement towered the rugged peaks of the awesome Wasatch mountains, one of the region's most prominent natural features. Mormons quickly came to rely on these mountains for water and other natural resources.

Rising in southeastern Idaho, the Wasatch range extended directly south for about 270 miles into south central Utah before intersecting with a series of smaller ranges and high plateaus. Wasatch slopes were covered primarily with scrub oak and evergreen forest, in contrast to the relatively barren Great Basin deserts lying to the west. Adjacent to the Salt Lake valley, Wasatch peaks attained elevations of more than 11,000 feet. Deep canyons, cut by swift, rapidly-descending rivers and streams, punctuated the entire length of the range.

Wasatch canyons and the water that gushed forth from them provided the Mormons with the means to survive in the harsh desert environment of the Salt Lake valley. Mormons adapted their agricultural practices to the desert by irrigating crops with Wasatch water channeled through a system of dams and canals. As more settlers arrived, new farming towns were founded north and south along the Wasatch front at canyon mouths where rivers and streams emerged from the mountains. Communities such as Provo, Ogden, Bountiful, Logan, American Fork, Centerville, established between the late 1840s and 1850s, were located at such places. In later years, particularly near Salt Lake City, Wasatch canyons provided Mormons with numerous sites for small water-powered mills. During the 1850s and 1860s, in an effort to diversify their economy, Mormons built numerous flour, saw, textile, and other mills along water courses flowing from Wasatch canyons. By the 1880s, Utah boasted seventy-five flour and grist mills and 100 sawmills. These early operations foreshadowed the later use of Wasatch streams for hydroelectric power production.

The central portion of Utah, particularly the western edge of the Wasatch range and around adjacent smaller mountain ranges, remained the focus of settlement in the region, but other areas attracted settlers as well. In an attempt to create a corridor of settlement stretching from Salt Lake to the Pacific ocean, Mormons established towns in the direction of what is now the southwestern corner of Utah. Communities such as Beaver, Cedar City, and St. George, founded between the early 1850s and 1860s, were some of the principle settlements in this effort.

The area around St. George acquired a geographical identification distinct from other parts of Utah. Mormon pioneers established St. George at the bottom of a valley drained by the Santa Clara, Virgin, and other rivers. At an elevation of about 2,800 feet, the St. George vicinity was much lower than the rest of Utah, which was largely made up of high desert basins, mountain ranges, and high plateaus. Given its southerly latitude and relatively low elevation, the St. George area was also considerably warmer than more northerly settlements. Perhaps in part because of the climate, early farmers around St. George grew cotton, a crop which earned St. George and its environs (now the center of Washington County) the name "Utah's Dixie."

Two main regions of Utah remained sparsely settled compared with the central corridor of settlement centered on the Wasatch mountain range. West of the Great Salt Lake and the Wasatch range, comprising about one third of present day Utah, lay a region of desert basins interspersed with forested mountain ranges. East of the Wasatch and south of the Uinta mountains, making up about another third of the state, was a region of high plateaus intersected by two major rivers, the Green and the Colorado.

The Mormon tendency to settle adjacent to mountain ranges where water was available indicated their economic reliance on irrigated agriculture. The pattern of small towns, farmland, and small processing industries proved to be a successful formula for supporting the region's growing population. By 1856, 22,000 settlers lived near the Great Salt Lake or in small towns along the "Mormon corridor" stretching to the southwest.

Prior to the 1890s, the only other settlement and economic development to occur in Utah was related to mining, an industry largely shunned by Mormons. After 1869, important mining districts appeared along the Wasatch mountains, in the Oquirrh range southwest of Salt Lake City, and in the Rush Valley southwest of the Oquirrhs. Utah's mines soon proved their value: during the 1870s, they provided fifteen percent of the nation's silver and twenty percent of its lead. During the 1880s, fifty percent of the nation's lead production came from Utah mines. That same decade, four great mining districts emerged: Mercur, in the Rush Valley; Tintic, southwest of Provo at the southern tip of the Oquirrhs; Bingham on the west slope of the Oquirrhs; and Park City, southeast of Salt Lake in the Wasatch mountains.

Until 1896, when Utah became a state, the Mormon agricultural economy remained separate from economic activity centered on mining. After

1896, the two economies merged as Utah became socially, politically, and economically integrated into the rest of the United States. Meanwhile, various types of economic ventures promoted by scientists, engineers, and outside developers diversified Utah's economy and left the state dependent on a few activities, principally big mining, manufacturing, commercial agriculture, and transportation. Virtually all of this development was concentrated in and around the cities of Logan, Ogden, Salt Lake, and Provo, whose populations grew apace. Most of Utah's hydroelectric developments were built to serve this urban/industrial market.

Of all Utah's industries, mining was perhaps the greatest. By 1899, one company--the Consolidated Mercur Gold Mines Company, led by J.L. De La Mar--dominated the Mercur district. Over the next fifteen years, the firm yielded $18 million in gold. Even more important developments went on at Bingham, where low-grade copper deposits attracted the interest of several large mining companies, some of them financed by outside capital. By the early 1900s, three companies controlled the district: the Boston and Consolidated Copper and Gold Mining Company, backed by British interests; the Utah Consolidated Mining Company, financed by William Rockefeller and H.H. Rogers; and the Utah Copper Company, led by D.C. Jackling and financed by the Guggenheim family. The Bingham district became one of the nation's leading producers of copper and other metals. In addition to Mercur and Bingham, the Park City and Tintic districts--the latter dominated by entrepreneur J.C. Knight--produced sizeable quantities of gold, silver, and lead. By 1919, smelters in the Salt Lake Valley (including plants owned by giant concerns such as the American Smelting and Refining Company) produced more metal than any other smelter complex in North America.

After 1896, a similar degree of commercialization and industrialization characterized Utah agriculture. Farmers produced livestock, sugar beets, wheat, fruit, and dairy products for market. In conjunction with commercial farming, large food processing companies established factories in Utah, particularly in Ogden, which became the state's leading food processing center. Some examples of large food processing companies in Utah included the Sego Milk Company evaporated milk plant built in Richmond in 1904; the Ogden Packing and Provision Company plants, begun in 1906; and the Utah and Idaho Sugar Company, a giant conglomerate formed in 1907 with plants located in Logan, Ogden, Provo, Lehi, and other cities. By 1914, Utah ranked fifth in the nation in canning; by 1916, the state was the third-greatest producer of sugar; and by 1919, Ogden was among the top-ten leading grain-milling centers in the nation.

Other industries (textile mills, iron foundries, machine shops, brick and tile factories, etc.) concentrated in and around Utah's largest cities after the mid-1890s. Just as Ogden became the state's agricultural center, Salt Lake City became the focus of most industry, with one half of all manufacturing establishments located there. In addition, both Ogden and Salt Lake became the focus of railroad transportation. Following the completion of the nation's first "transcontinental" railway in 1869, numerous railways converged at Ogden and Salt Lake. By the early 1900s, these lines included the Union Pacific, the Western Pacific, the Southern Pacific, the Denver, Rio Grande and Western, and others.

Besides steam railroads, the Salt Lake and Ogden area featured numerous streetcar and interurban lines, most of them powered by electricity. By 1904, the Utah Light and Railway Company operated most of the lines in Salt Lake City. Meanwhile, the Ogden Rapid Transit Company, the Logan Rapid Transit Company, and later the Ogden, Logan and Idaho Railway served the city of Ogden and points north. After 1891, the Salt Lake and Ogden Railway (the Bamberger Railway) connected Utah's two largest cities, while the Salt Lake and Utah Railway (the Orem Line), built in 1912, joined the capital with Provo. Street railways and interurbans carried passengers as well as all types of freight, such as agricultural produce.

Given their economic position and their importance as educational, governmental, and cultural centers, Salt Lake, Ogden, Provo, Logan, and adjacent areas rapidly increased in population beginning in the 1890s. In 1900, for instance, slightly over 81,000 people lived in Utah's four major cities. By 1910, this number had risen to a little over 134,000. Salt Lake City's population alone went from about 53,000 in 1900 to about 93,000 in 1910, a seventy-three percent increase.

Rapid population increase, industrialization, and technological developments provided the stimulus for the establishment of Utah's electric power industry, including its water-driven generating stations. Large cities such as Salt Lake, as well as nearby mining districts and numerous small towns along the Wasatch front, offered outstanding markets for power companies eager to furnish electricity for lighting, factory machinery, transportation, and eventually domestic appliances. Once they realized the economic advantages and convenience of electrification, business, industry, and domestic consumers readily adopted all manner of electrical devices. Power companies in turn nurtured their markets and expanded their generating and transmission facilities. In the process, the power companies participated in the same industrialization that characterized other parts of Utah's economy, such as its mining and agriculture.

Beginning in the early 1880s, power companies began delivering electricity for lighting in Utah's largest cities. Early generating stations, in Utah and elsewhere, featured dynamos powered by coal-fired steam engines. In 1881, the Salt Lake Power, Light, and Heating Company began service to downtown Salt Lake, making it only the fifth city in the world to have electric lighting from a central generating station. That same year, the Ogden City Electric Light Company built a steam-power plant to supply electricity for lighting. Aside from Salt Lake and Ogden, by the end of the 1880s few other cities in the region could boast electric service. As early as 1885, the Ontario Silver Mining Company furnished light to mines and mills around Park City. In 1886, the Logan Electric Light and Power Company began supplying electricity for lights from a small hydro plant.

Widespread use of electricity did not happen until the 1890s, when technological advances facilitated economical, practical, hydroelectric power production and transmission. Until the 1890s, direct current generators were used for producing hydroelectric power. Yet d.c. power presented a significant problem to engineers because it could be transmitted for only about one mile. Thus, industrial facilities and cities could receive hydroelectric power only if streams or rivers ran near by. Not surprisingly, before the 1890s few companies in Utah built hydroelectric plants. In 1881, the Ogden City Electric Light Company set up the first such facility in Utah at the mouth of Ogden Canyon. This was followed by the Logan plant, installed in 1886, and by the Ontario Silver Mining Company's station in Park City, also built in 1886 (presumably replacing an earlier steam plant).

In the absence of sufficient water supply for hydroelectric power production, most utility companies used steam engines, fired with coal, to drive generating units. Electrical production from coal, however, was not economical. Coal was an expensive and sometimes scarce resource in the Rocky Mountains. Even if readily available, the difficulty of conveying the fuel over long distances proved costly. For mining companies, power from coal or other combustible fuels such as wood could sometimes account for thirty to fifty percent of total mining and milling expenses. Moreover, heavy coal-fired boilers and steam engines were often difficult and costly to transport to mines and mills at remote, mountainous locations.

Technological developments of the late 1880s and early 1890s allowed mining companies, utility companies, and individual power developers to establish efficient hydroelectric stations on remote stretches of rivers and streams. The most important technological event during that time was the improvement of electrical transmission, this time using alternating current. Engineers in Europe and the United States demonstrated efficient, economical, point-to-point transmission of high-voltage, alternating current over long distances. One project took place in Colorado, where in 1891 L.L. Nunn and Westinghouse engineers installed a three-mile line for the Gold King Mining Company near Telluride. One of the most spectacular demonstrations of large-scale power generation and transmission occurred at Niagara Falls. In 1895, the Cataract Construction Company completed a large generating plant at the bottom of the falls, and in 1896, began to deliver power twenty miles to Buffalo, New York.

The success of the Telluride and Niagara Falls projects drew attention to hydroelectric power and inspired engineers to discover and develop new sources of power elsewhere in the United States, especially in the West. In Utah, the canyon streams of the Wasatch mountains, first exploited by Mormon pioneers, presented engineers with outstanding opportunities to build hydroelectric plants. Beginning in the 1890s and continuing into the 1910s and 1920s, numerous power companies installed generating plants on Utah's principal rivers and streams.

Most of these facilities were "high-head" plants designed to take advantage of Utah's environment, which featured relatively few large rivers but many small mountain streams. High-head plants required little water to generate power, instead relying on the velocity of the water to power the turbines. The water gained velocity as it was conveyed downward hundreds of feet through steeply-inclined pipelines built on the sides of mountains and canyons (see associated property types for more descriptive and historical information on hydroelectric plants). Many of the early high-head plants in Utah were the work of professional engineers who spread through the American West during the late nineteenth and early twentieth centuries. These engineers, often university-trained, arrived in the West to work for large mining, railroad, and electric power corporations.

In Utah, mining companies were among the first to build hydroelectric plants. Besides lighting offices and underground workings, electricity served a number of purposes in the mining industry. Drills, ventilation systems, hoists, pumps, and locomotives all could be run by electric power. Electricity was also used to drive crushers and rollers in mills. In smelting operations, electricity was used for electrolytic refining and to generate compressed air.

By the 1890s and early 1900s, several Utah mining districts, such as Park City, used electricity from small hydro plants. One of the most noteworthy plants that generated power for mining was located in Provo Canyon. Built by L.L. Nunn in 1895-1897, the station furnished electricity to Joseph De La Mar's mining operation at Mercur. When placed in operation in 1898, Nunn's Provo Station (Nunn Plant) generated power over a 32-mile transmission line, the longest in the world at that time and the first 40,000 volt line in the United States. In 1900, Nunn built another line, this time 43 miles long, to mines at Eureka.

Lucien Lucius Nunn was the most important early hydroelectric developer in Utah. Indeed, historian John S. McCormick called him "the father of the electric power industry in the Intermountain West." Through his pioneering transmission projects, Nunn was largely responsible for demonstrating in the Rocky Mountain West the feasibility of long distance, high voltage transmission of alternating current power, especially as applied to mining. Between the early 1890s and the 1910s, Nunn operated twenty hydroelectric plants in Colorado, Utah, Idaho, and Montana. Most of these projects were built and operated by Nunn's Telluride Power Company, although Nunn often set up smaller firms to operate particular plants. In Utah, besides the plant in

Provo Canyon, Nunn financed a merger in 1900 which created the Hercules Power Company of Logan. In 1903-1904, Nunn oversaw the construction of the Olmsted Plant at the mouth of Provo Canyon. His later hydroelectric projects in Utah included Jordan Narrows (1908), Battle Creek (1909), and two facilities on the Beaver River (1908 and 1917) built by the Beaver River Power Company. The Beaver facilites were built to supply mining districts near the town of Milford. Nunn also initiated development of the Bear River in northeastern Utah and southeastern Idaho. Nunn built most of his hydroelectric plants to supply power to the mining industry.

Nunn's importance also extended into the area of engineering eduction. In 1903, he established the Telluride Institute at his new Olmsted Station, located at the mouth of Provo Canyon. Under the direction of Nunn's brother P.N., the Telluride Institute provided young men with practical and classroom education in electrical engineering. Many of Utah's early power plant operators and engineers received training at the Telluride Institute. In 1911, Nunn established the Telluride Association to provide engineering scholarships at Cornell University.

After Nunn, probably the most important hydroelectric developer for mining purposes was J.C. Knight. One of the Utah's leading industrialists, Knight owned important mining properties in the Park City and Tintic districts. Realizing the financial advantages of hydroelectric power, Knight created the Snake Creek Power Company in 1909. The next year, the company completed a generating station near Heber City, which supplied power to mines and mills at Park City. At about the same time, Knight began operating other plants at Santaquin and on the Provo River (Murdock). Within a few years, Knight consolidated a number of other hydroelectric stations with his own to form the Knight Consolidated Power Company. Along with Nunn's Telluride Power Company and Utah Light and Railway, Knight Consolidated was one of the largest utilities in the state.

While Nunn and Knight dominated the mining market for hydroelectric power, other new companies sought to supply power for general urban/industrial uses. During the mid-1890s, these firms constructed plants on canyon streams in the Wasatch Range in the Salt Lake City-Ogden area. Salt Lake City, with its adjacent canyons, provided an outstanding market for electricity as well as ideal locations for power sites. During the early 1890s, engineer Robert L. Jones appropriated water about ten miles from Salt Lake in Big Cottonwood Canyon, previously the site of water-powered saw mills. Jones then organized the Big Cottonwood Power Company and built a plant in 1895 on Big Cottonwood Creek. In 1896, Stairs Station transmitted power to Salt Lake over a fourteen-mile transmission line, then the longest ever built in Utah. The electricity went to a substation owned by the Salt Lake and Ogden Gas and Electric Company, which used the power for municipal lighting.

Jones was not the only developer to utilize Big Cottonwood Canyon, for as he completed work on Stairs Station another company began building a plant about two miles downstream. Owners of the Salt Lake City Railroad Company, one of the leading mass transit systems in the metropolis, formed the Utah Power Company in 1896 for the purpose of supplying their streetcars with electricity from a hydro plant. Built in 1896, the station (Granite) on Big Cottonwood Creek began generating electricity in 1897. By 1898, the plant was also supplying power to a smelter in Sandy, south of Salt Lake City.

While the two plants near Salt Lake were under construction, the Pioneer Electric Power Company of Ogden was installing a facility much larger that either the Stairs or Granite stations. Designed by engineer C.K. Bannister, constructed in 1895-1897, the Pioneer Plant near the mouth of Ogden Canyon was the largest and most technologically advanced hydroelectric plant in Utah until 1904, when the Olmsted Plant was completed. Formed primarily to supply power to Ogden, the Pioneer Electric Power Company also erected a 36-mile, 16,000-volt line from its Pioneer Plant to Salt Lake City. Rubber magnate Joseph Bannigan of Providence, Rhode Island, provided major investment capital that allowed the Pioneer Plant to be completed. Big Cottonwood Power, like the Pioneer Company, also received a major portion of its construction capital from eastern sources.

During the late 1890s and early 1900s, most hydroelectric power concerns focused their attention on large urban and mining centers, but some concerns had less ambitious designs. These companies, some of them municipally-owned, built hydroelectric plants to supply electricity to small towns. Introduction of electricity to small towns, usually for lighting, probably was part of an overall movement toward greater technological organization among small and large communities. Around the turn of the century, towns began to install paved streets and sidewalks, telephone lines, and water and sewer systems, in addition to street and domestic lighting systems. As evidenced by the number of small, municipally-owned companies, many small towns considered electrical service to be an important technological advancement, one which they readily adopted and paid for.

Most hydroelectric plants built to serve small towns dated from the early 1900s, although municipal plants continued to be erected well into the 1930s. Manti, for instance, received a Public Works Administration grant to build a hydroelectric plant during the 1930s. Other towns began planning electrical systems much earlier. In 1899, officials from Lehi, American Fork, and Pleasant Grove each purchased stock in the Utah County Light and Power Company. Within a decade, the company operated three hydroelectric plants (including Upper American Fork, built 1907) and a steam plant. Moreover, the firm supplied electricity not only for local uses but for industrial purspose at the Tintic mining district as well. Other municipal companies were smaller or were started by private investors, not the towns themselves. In the late 1890s, entrepreneurs at Fountain Green in Sanpete County founded the Big Springs Electric Company. The company's small hydroelectric plant, completed in 1903, served the town of Fountain Green. During the same period, mining magnate William A. Clark and other investors established the Ophir Hill Mining and Electric Company which, despite its name, operated a small plant solely for the purpose of generating electricity for street and domestic lighting at Ophir. Some hydroelectric companies, like Utah County Light and Power, were large enough that they supplied power to more than just one community. Another good example of such a firm was the Dixie Power Company. Between 1917 and 1929, Dixie Power built five hydroelectric plants on the Santa Clara and Virgin rivers in southwestern Utah. The electricity generated went to numerous communities in Washington and Iron counties as well as Zion National Park.

For various reasons, many of the hydroelectric plants erected during the late 1890s and early 1900s rendered poor service. Electrical supply from isolated plants could be particularly unreliable. Lightning could damage a plant or its machinery might break down, which meant that it would be out of service indefinitely. Freezing water could deprive a hydroelectric station of its water supply, preventing it from operating. Or, landslides could damage the conduit that conveyed water to the facility. Furthermore, a single plant might be unable to meet peak demands for electricity. The early problems of electrical supply, particularly from hydroelectric stations, caused some potential consumers to think twice about depending on electricity. On 21 March 1899, for instance, the Deseret News reported that various smelter companies in the Salt Lake Valley were reluctant to sign contracts for power from utility companies because they doubted the ability of one particular plant to furnish a constant supply of power.

Recognizing the problems of operating solitary hydroelectric plants, and because fierce competition was wasteful and retrograde, Utah hydroelectric power companies began to consolidate their companies and interconnect their plants with transmission lines. Creating an integrated network of plants and distribution systems allowed power companies to meet varied demands and to make more efficient use of water resources. For instance, plants situated on streams with a high springtime runoff could supply power while other stations collected water in reservoirs for use during drier months. Operating a network of plants also meant that companies would not wastefully duplicate transmission and distribution systems.

Around 1900, the major hydroelectric power companies in Utah started to consolidate their holdings. By 1904, for instance, the Utah Light and Power Company (UL&P), a successor of several firms, operated the Pioneer, Stairs, and Granite plants in conjunction with one another. As part of an integrated system, these plants served Salt Lake, Ogden, and the smelters south of Salt Lake. Apparently, the more reliable supply from Utah Light and Power convinced the smelter companies to electrify their operations. Mergers continued until by 1912, three large corporations--Nunn's Telluride Power Company, the Knight Consolidated Power Company, and the Utah Light and Traction Company (a successor of UL&P)--dominated Utah's electric power industry.

As companies interconnected their hydroelectric plants, they also designed new plants to fulfill particular needs of their overall systems. Previously, hydroelectric plants were designed without forethought as to what their place might be in an integrated system. A good example of the new kind of hydro plant was the Devil's Gate

(Weber) plant on the Weber River. In 1906, E.H. Harriman of the Union Pacific Railway purchased Utah Light and Railway Company (a predecessor of Utah Light and Traction) and set about upgrading the company in an effort to create model street railway systems in Salt Lake City and Ogden. Apparently Harriman also may have considered electrifying a portion of the Union Pacific. In 1908-1910, Utah Light and Railway built a hydroelectric plant on the Weber River near Ogden. Unlike earlier Utah hydro stations, engineers designed the Weber plant to fit into a larger network of generating plants. The engineers intended the Weber facility to operate at its full capacity on a continual basis. Other plants in Utah Light and Railway's system would adjust their production to meet daily and seasonal fluctuations in demand.

The consolidation movement among Utah's hydroelectric power companies resulted in the formation of the Utah Power and Light Company (UP&L) in 1912. UP&L was the creation of a large national holding company, the Electric Bond and Share Company (EBASCO). General Electric established EBASCO in 1905 in order to merge small companies into larger, more financially secure companies. By providing them with capital as well as financial, managerial, and engineering support, EBASCO ensured that its subsidaries were financially secure enough to buy General Electric equipment. By the mid-1920s, EBASCO owned 200 companies in thirty states, including UP&L, and its plants generated fourteen percent of the nation's electricity. EBASCO itself was indicative of a national trend toward consolidation. By 1929, sixteen holding companies generated eighty percent of all electricity in the United States.

Within a few years of its establishment, Utah Power and Light gained control of four large utilities: the Knight Consolidated Power Company, L.L. Nunn's Telluride Power Company, the Utah Light and Traction Company, and the Idaho Power and Transmission Company. UP&L's objective in acquiring the companies was to achieve even greater economies of scale by combining the companies' plants and distribution systems into a huge, fully-integrated, superpower system. The concept of the superpower system gained widespread popularity in the United States during the 1910s and 1920s. The idea represented the ultimate in human attempts to master the natural environment with technology and corporate organization. By the 1920s, engineers presented plans for systems even larger than UP&L's. These became the vast, interconnected regional and national networks of power plants and transmission lines that are in place today.

In order to build its superpower system, UP&L pursued several objectives. First, the company upgraded existing plants, installing new turbines, generators, and transmission equipment, and rebuilding dams, operator's dwellings, and other structures. Second, UP&L interconnected all of its properties with extensive and elaborate systems of transmission lines. Third, the company tapped the power potential of Bear Lake and the Bear River in northeastern Utah and southeastern Idaho. UP&L's system required extensive outlays of capital, acquisition of land for plant sites and transmission line right-of-ways, and a corporate organizational structure that provided professional and technical expertise and new business methods for operating and controlling a widespread, interconnected system. Only a corporation such as UP&L, backed by the resources of an entity like EBASCO, could have put together a superpower system.

During the 1910s and 1920s, UP&L focused its efforts on building hydroelectric power plants on the Bear River. Originating in Utah, the Bear River flowed north, through Wyoming, Utah, and Idaho, before turning south and emptying into the Great Salt Lake. UP&L was not the first company to utilize the waterway. In 1902, the Utah Sugar Company, needing electricity for its factory at Garland, built the first hydroelectric plant--Wheelon--on the Bear. But even before Utah Sugar's project, developer L.L. Nunn was planning to build a series of stations on the river. During the 1890s, Nunn and an engineer for the Telluride Power Company, E.B. Searle, conceived the idea of using Bear Lake as a reservoir for hydroelectric power plants and irrigation systems downstream. Bear Lake, straddling the Utah/Idaho border, emptied into the Bear River. Nunn and Searle prepared a plan in which spring runoff from the Bear River would be diverted into Bear Lake, which would be dammed. During summer when the river was low, the water would be pumped out of the lake and back into the river, feeding the plants downstream. In 1902, Nunn filed appropriations for Bear River water and in 1907 the Department of the Interior granted him permission to develop Bear Lake. In 1906-1908, Nunn's Telluride Power Company built the Grace (Idaho) hydroelectric plant, at 11,000 kilowatts probably the largest facility in the region. Nunn never realized his dreams for the Bear River, as UP&L took over Telluride Power in 1912.

After acquiring Telluride Power, UP&L undertook to fully develop the Bear River, including Nunn's plan for Bear Lake. By the 1910s, virtually all of the profitable power sites along Wasatch and other mountain streams had been developed. Thus UP&L, in order to meet increasing demand, turned to the Bear River as a major source of power. Building plants on the Bear and creating a reservoir out of Bear Lake, furthermore, fit in with UP&L's overall objective of putting together a superpower system of modern, interconnected generating facilities. Backed by the resources of EBASCO, UP&L built several new plants on the Bear River during the 1910s and 1920s. These included three stations in Idaho--Oneida (1915), Cove (1917), and Soda (1924)--and one in Utah: Cutler (1927). In addition, UP&L constructed the Lifton Pumping Station (1916) on Bear Lake and periodically upgraded existing facilities. By 1922, UP&L's Bear River plants (including the facility at Grace) accounted for one-half of the company's 224,000 kilowatt capacity.

UP&L's Bear River plants differed from nearly all of Utah's earlier hydroelectric power projects. First, the Bear River stations were large, low-head facilities which produced substantially greater amounts of power than the high-head facilities situated on Utah's mountain streams. The installed capacity of Cutler, for instance, was 30,000 kilowatts (30 megawatts). Second, all of the Bear River plants (except perhaps Grace) were designed as components of a larger system. Cutler, again, exemplified this. The plant was situated at a place where it could utilize springtime runoff from the lower reaches of the Bear River watershed. Cutler's use of water from the lower Bear allowed upstream plants to store more water in their reservoirs, thereby increasing the efficiency of the entire Bear River hydroelectric power system. Finally, unlike most early hydro plants in Utah, the Bear River plants were the product of a modern corporate organization. EBASCO's Engineering Department probably designed all of the plants and the Phoenix Utility Company, a subsidiary of EBASCO, probably built all of them. The Engineering Department of EBASCO and Phoenix Utility Company brought special expertise to the construction of hydroelectric plants that differed from earlier, smaller, companies. Older facilities were usually designed by one or two engineers and built by general contractors. EBASCO's operations, in contrast, employed a team of engineers as well as a construction company, both of which specialized in power plant construction.

Hydroelectric power development in Utah peaked with the construction of Cutler Station in 1927. Not only was the construction of hydroelectric plants complete, but that same year UP&L finished another major part of its superpower system--the interconnection of its Bear River plants with Idaho Power and Light's plants on the Snake River. An 82-mile, 130,000 volt transmission line was built between American Falls, Idaho and a substation at Wheelon, just downstream from Cutler. This transmission line allowed an interchange of power between plants located in two different watersheds.

After 1927, UP&L continued to expand its productive capacity. But instead of building more hydroelectric plants, the company branched out into steam generation, taking advantage of Utah's coal resources. The first steam-powered facility that the company built was the Jordan plant near Salt Lake City, completed in 1925. UP&L continued to expand its steam power capacity. Today, UP&L's coal-fired plants account for 96 percent of the electricity that the company generates.

Although UP&L built no new hydroelectric plants until well after World War II, the company did periodically renovate its existing stations. Often this entailed the construction of new ancillary structures, such as dwellings and sheds. Small companies not owned by UP&L (such as Dixie Power and Southern Utah Power, which UP&L eventually acquired) also periodically upgraded their hydro plants. Some of these smaller concerns, as already mentioned, also built new plants during the 1920s and 1930s. But in general, large-scale hydroelectric development in Utah culminated with the construction of Cutler.

Condition of Existing Facilities

A complete picture of historic hydroelectric power plants in Utah is not yet available. Appended below is a list of stations known to have operated. Currently, there are at least twenty historic Utah hydro plants operating or still standing. The majority of these are high-head plants owned by the Utah Power and Light Company. A few municipalities, such as Manti, Logan, and Beaver, operate their own plants. Only two Utah hydroelectric stations are listed on the National Register. These are the Olmsted and Nunn plants in Provo Canyon. Further survey based on the appended list might clarify the status of plants other than the twenty whose conditions are known. In addition, further research and survey might reveal the existence of yet even more plants. Currently, Utah has forty non-profit, consumer-owned utilities. It is possible that many of these companies continue to operate old hydroelectric facilities.

Of the twenty known historic hydroelectric power plants in Utah, all generally retain good physical integrity. Inevitably, some alteration has occurred over time. Still, most plants have intact powerhouses as well as at least one other intact major feature, such as the dam, conduit, surge tank, penstock, or operator's dwellings (see associated property types).

F. Associated Property Types

I. Name of Property Type Overview

Numerous types of buildings and structures comprise hydroelectric power plants. Often, the most prominent features of such facilities are dams and powerhouses. But hydroelectric plants include a variety of other buildings and structures as well, such as water delivery systems for conveying water from its source to the turbines, ancillary storage and shop buildings, and operator's dwellings. All of these buildings and structures perform specific functions in the generation of electricity, and all feature specific designs and material compositions. The associated property types significant under the hydroelectric power context will be described in the following order: dams, conduit (including flumes, canals, and pipelines), surge tanks, penstocks, powerhouses, ancillary structures, transmission equipment, and operator's dwellings. The most important feature of a hydroelectric power plant is the powerhouse, because it houses the machinery which actually generates electricity. Therefore, the powerhouse of a hydroelectric plant must be standing and have integrity for the other components of the facility to have significance (see integrity requirements for each property type).

Many hydroelectric plants, made up of several associated property types, will be divided into discontiguous historic districts. This is because of two reasons. First, many sections of conduit and/or penstock have been altered or replaced within the last fifty years. Second, in addition to having been altered, substantial portions of some conduit/penstock lie underground, hidden from view. For these two reasons, such conduit/penstock will be excluded from historic district boundaries, which means that intact dams and powerhouse sites will be separated from each other. Such components, however, will still be nominated as discontiguous components of the same historic district. Discontiguous districts are justified because visual continuity between dam and powerhouse is not a factor in historic significance. Dams are freqently located several miles from powerhouses, especially in rugged, mountainous terrain. Nominations will still describe and assess the integrity of all the features associated with each hydroelectric plant, whether included in a historic district or not. The number of resources within nominated districts and the number of contributing and noncontributing features, however, will reflect only those features included within the boundaries of historic districts.

x See continuation sheet

x See continuation sheet for additional property types

I. Name of Property Type Hydroelectric Power Plant Dams

II. Description

In order to generate hydroelectric power, engineers first needed sufficient quantities of water. To this end, they usually appropriated a portion of the flow of a river or stream. Conveying water from its natural course to the turbines in the powerhouse involved the use of dams. Basically, dams associated with hydroelectric power plants are not significantly different than irrigation or flood control dams. Hydroelectric power plant dams also can serve purposes other than just power generation.

In terms of physically controlling the flow of water, dams are closely related to the conduit (also known as the "headrace") that actually carries the water to the turbines. Both types of structures, dams and conduit, might be considered as components of the same system. Yet dams have important functional and structural characteristics that set them apart from conduit. First, conduit carries water, but dams are the structures that actually block water and divert it from its natural course. Second, dams can also impound water, storing floodwaters for later use during dry spells. Third, dams perform the important function of raising the total head of the hydroelectric station (head being the vertical distance that water can be made to fall; see the section dealing with the powerhouse property type). Fourth, dams control the flow of rivers and streams by means of gates and spillways. Fifth, aside from structural characteristics dams can be materially distinctive. Most dams are made of either earth, rock-filled timber cribs, stone masonry, or reinforced concrete, while conduit is usually made of steel or thin wood staves. Finally, dams make up a distinct property type because occasionally the powerhouse and headrace are integral to them. That is, the headrace and power generating machinery are inside the dam. In such cases, or when the powerhouse is relatively close by, dams are often the dominant features of hydroelectric stations.

Natural features, mainly topography and stream flow, combined with the amount of power engineers desired to produce, determined the design of dams. This means that dams come in a multitude of sizes, shapes, and configurations. Such diversity does not prevent dams from being categorized. Donald C. Jackson, probably the foremost expert on the history of dams in the United States, recognizes two principal kinds, or "traditions," of dams: the massive and the structural.

Massive dams function as their name implies: a mass of material, such as timber, earth, or concrete simply resists the hydrostatic pressure of the water behind it. Because gravity acting on massive dams gives them stability, they are also known as gravity dams. Generally, gravity dams are composed of three principal materials, used either singly or in combination: earth (including dirt and stone), wood, and concrete (sometimes reinforced with steel bars). Timber crib dams are made of timbers bolted together, with rock and other earthen material placed inside the cribs. In some instances all or part (such as the spillway) of timber crib dams are faced with concrete. Some timber crib dams have concrete abutments. Another main structural material of gravity dams is earth. Earth-fill dams are made of boulders, gravel, and finer grades of earthen material. Parts of earth fill dams, mainly the spillway, also can be faced with concrete. Some gravity dams are made of stone masonry. The historic advantage of stone, timber, or earth dams is that often they could be made from locally-available materials, thereby reducing construction costs. Finally, gravity dams are also composed of reinforced concrete.

The shape of gravity dams is determined by their structural materials. Loose-fill earth, for example, cannot be built in a vertical face. Thus, earth-fill dams in section are roughly triangular in shape. Timber crib dams also usually feature a triangular shape in section. Masonry dams, both stone and concrete, feature a somewhat different shape, because they can be built with a vertical upstream face. Still, these gravity dams also exhibit a triangular shape, with a heighth-width ratio of 3:2. Gravity dams in plan are usually straight-crested, running directly across a valley or a canyon. Sometimes they are built with an upstream curve, a shape which does not actually function as an arch. Curved gravity dams merely give the impression of greater strength than straight-crested dams; both types have the same capacity to resist hydrostatic pressure. In general, gravity dams are simple structures that presented no great obstacles to design or construction.

A number of Utah hydroelectric plants include gravity dams. Some, such as at Fountain Green and Sand Cove (Santa Clara Hydros), are made of earth. Several facilities have small, reinforced concrete dams that might be lumped under the gravity dam category. These include, for instance, American Fork and the Lavina Creek Dam at Snake Creek. These latter two structures are very low dams with flashboards used to control the level of water in the reservoir.

Structural dams function quite differently than gravity dams. The shape of structural dams, much more than size, is critical to how they function. There are two sorts of structural dams: arch dams and buttress dams. Both are much thinner than gravity dams, as they require less material. Historically, this meant that they were less expensive to build than gravity dams made of the same material. Structural dams at first featured stone masonry construction, a material later abandoned in favor of reinforced concrete.

Arch dams, unlike the curved gravity structures, function as true arches. Hydrostatic pressure on the upstream face of an arch dam is transferred to both ends, where it is passed on to the rock into which the dam is anchored. More modern arch dams are further stabilized through the use of weep holes, which allow water seeping underneath the dam to be released, thereby preventing the pressure caused by the seep from displacing the dam. Perhaps the best example of an arch dam in Utah is located at the Cutler Plant on the Bear River. This structure is probably the largest dam in Utah. It is about 127 ft. high and over 500 ft. across.

Buttress dams employ a different structural system than arch dams. Buttress dams feature a series of discrete buttresses, which are then joined on the upstream side by either relatively thin concrete arches or flat concrete slabs. In the former, called multiple arch dams, the buttresses support the arches. Historically, multiple arch buttress dams were less expensive than the flat slab type. Arches allowed the buttresses to be spaced further apart, which meant that a muliple arch dam used less material than a flat slab configuration of the same size. Flat slab butress dams are also know as Ambursen dams, after Ambursen Hydraulic Construction Company, an early designer and manufacturer of flat slab dams. Unlike gravity dams with a vertical upstream face, buttress dams feature a sloped upstream face. This sloped face allows water to exert a vertical load on the buttress dam. The downward force of the water makes the dam stable by forcing it to stay in place.

All dams associated with hydroelectric stations feature a variety of mechanisms related to the function of retaining and moving water. Some of these mechanisms--particularly intake structures--also could be categorized with conduit, but usually they are integral to (physically a part of) dams, and so will be included in the hydroelectric power dam property type. Intake structures allow water to pass from behind the dam into the conduit. Intakes usually consist of a concrete foundation (usually part of the dam), a trash-rack (consisting of a metal grate) to prevent floating objects from passing into the conduit, and some type of valve or gate for letting water into the conduit. Dams also have features for passing water over the dam, thereby reducing the amount of water behind the dam (an especially important function during flood stage). Most dams have a spillway, which channels the water as it passes over the dam. Spilling water is met at the bottom of the dam by an apron, usually a slab of concrete sloped at a mild angle away from the dam. The apron prevents undermining of the dam by the spilling water. Sometimes rocks are piled at the end of the apron to dissipate the energy of the spilling water, further preventing erosion. Water passing through the spillway is controlled by various types of gate mechanisms, including flashboards, rolling gates, sliding gates, tilting gates, and tainter gates. Most dams also have sluice gates at the bottom, which allow a reservoir to be drained rapidly in emergencies. In addition to devices for controlling the flow of water, some dams feature fishways (also called fish ladders), that allow fish to pass over the dam, both upstream and downstream (the Weber River Dam, built 1917, has a small fishway).

Generally, dams are not significant architecturally or artistically, unless one acknowledges an aesthetic of machinery and/or pure structural forms. In some cases, dams are outfitted with ornamentation (usually present in balustrades, light poles, etc.) that exhibit a particular architectural style. Usually, though, dams are devoid of such motifs.

Two factors are likely to contribute to or detract from the physical condition of the hydroelectric power dam property type. The most obvious of these is that dams are constantly in contact with, and under pressure from, water. The presence of water (either as stream water, ice, or rain, or a combination of these) leads to various degrees of weathering and physical deterioration of dams; wood rots, concrete crumbles, exposed metal rusts, cracks appear. Sometimes the erosive action of water, especially during floods, can cause dam failure. Trees growing on earth-fill dams can allow water seepage which eventually causes failure. The second factor affecting the condition of hydroelectric dams stems from their functional purpose. Repair and maintenance, improvements in engineering methods, and changing the capacity of dams, have brought about varying degrees of alterations in most dams. For instance, some dams have been raised in height in order to increase their storage capacity.

Numerous environmental factors determine the location of dams and even the design of dams themselves. When siting a hydroelectric power facility, engineers had to assess natural conditions. First, engineers determined the available water supply, taking into account stream flow averages, size and conditions of watershed, rainfall patterns, etc. An adequate supply of water was essential. Prior appropriation of water, a cultural factor, could also conceivably influence where a dam was located. Second, engineers studied the topography of potential dam sites. Topography was important mainly because it helped to determine the head of the hydroelectric power facility. Using measurements of head and stream flow, engineers could then calculate the potential horse power of a future hydroelectric station. Generally, engineers tried to utilize a maximum flow and head while expending the least amount of energy, labor, and materials in construction (thus saving money). Third, engineers tried to situate dams on a solid geological formation, preferably bedrock.

Given these various factors, dams could be located in any manner of geographical settings. Not surprisingly, mountains often provided ideal places for hydroelectric power dams. Fast-flowing, rapidly descending rivers in deep canyons afforded engineers the opportunity to build various types of dams. An entire canyon could be dammed. Or, a small diversion dam could be built near the top of a waterfall or short stretch of rapids with the powerhouse at the bottom, a situation offering optimum use of natural conditions, energy, labor, and materials. In or out of mountain regions, canyons offered prime advantages for dam-building. Sometimes engineers chose a narrow gorge for a dam, because less materials would be needed to span a narrow than a large opening. Engineers also chose damsites behind which a reservoir could be created, such as at the low end of a valley (perhaps at the entrance to a canyon).

Particular dam designs were best suited to particular environmental conditions. For instance, a dam built in a low river bottom where the river was wide and the volume of flow high, would probably be a long, low, gravity or buttress dam. On the other hand, in a narrow, deep gorge, a dam was more likely to be an arch dam, a design particularly suited to narrow canyons with a solid bedrock walls. If a canyon was wide, an arch dam might not be economical, because the larger the arch the more material required to build it. Above a certain size, an arch dam required as much or more material than a gravity dam. At that point, the gravity dam became the optimum type of dam. Where stream volume was low, or where only a certain portion of stream flow was required, a dam might have been relatively small, of simple design (for instance, timber crib or earth-fill), and served only to divert water into an intake. In contrast, larger, more ambitious projects required larger, more sophisticated dams.

Technological, economic, and political factors also determined the location and size of dams. During the late nineteenth century, small companies built hydroelectric stations. With only small amounts of capital and relatively simple technology available to them, these firms usually built simple earth-fill or timber crib dams on small streams, which were in fact probably the most common type of waterway in Utah. During the early twentieth century, as dam technology (and hydroelectric power technology in general) improved, companies began to build larger dams on larger waterways. The perfection of structural dam designs and the widespread use of reinforced concrete were important developments in this regard. Larger companies, with greater access to capital and expertise, also facilitated the construction of more sophisticated dams. Eventually, through merger and consolidation, gigantic power companies emerged which could command the capital, resources, and expertise necessary to utilize the largest rivers for hydroelectric power production. Even more than private capital, the federal government was responsible for building hydroelectric power dams in the twentieth century. The U.S. Army Corps of Engineers and the Bureau of Reclamation planned and constructed some of the greatest installations ever built in the United States.

In general, older, smaller, simpler dams appear on the small streams and rivers (often in the mountains), while the largest, most sophisticated, and most recently-constructed dams appear on the largest rivers. In Utah, hydroelectric power dams were built between 1883 and the 1930s. The temporal and spatial distribution of these structures generally follows the pattern outlined above; the earliest, simplest dams are located on small canyon rivers and streams in Utah's mountain ranges, particularly the Wasatch range. Larger dams are located (or were once located) on low-lying sections of the state's important waterways, such as the Bear River. Many such rivers lie within the Great Basin drainage, with the Great Salt Lake their final destination.

Besides physical characteristics, important associative characteristics help to define hydroelectric power dams as a property type. Generally, hydroelectric power dams in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of dams); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power dams might have associations with important developers or engineers. Some facilities, for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power dam property type will likely be chosen according to two factors. First, a boundary for a hydroelectric power dam will probably encompass the area upon which the dam sits as well as some area related to the functioning of the dam, such as land used for access or for some function related to the operation of the dam (an operator's dwelling, for instance). Furthermore, the boundaries for a hydroelectric power dam will likely exclude structures and sites adjacent or nearby and not related to the operation of the dam. The second factor influencing the boundaries for a hydroelectric power dam is that the dam probably is integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, hydroelectric power dams might be included within a larger, district boundary that includes other structures.

III. Significance

Hydroelectric power dams built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Dams were an integral feature of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, dams were prominent physical features in an industry--electrical generation--important in its own right. Finally, as key structures in the operation of hydroelectric power plants, dams help to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that a dam can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Dams were integral structures in an industrial complex which served to generate electricity. The most important feature of hydroelectric power stations was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for a dam to have significance, it must still show a relationship to the historic powerhouse. Specifically, the powerhouse must still be standing and it must have integrity. If a dam is still standing but the powerhouse is demolished or has lost integrity, then the dam no longer represents the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) A dam considered independent of its relationship to a hydroelectric plant may have significance under a context other than the development of hydroelectric power.

Given its special relationship to the powerhouse, penstocks may have significance under Criteria A, B, and C as follows:

Under criterion A, dams, as parts of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for dams because of their associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under criterion A, dams have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As parts of hydroelectric power plants, dams may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Dams may also have associations with broad patterns of events--for example, a dam may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under criterion B, dams are eligible when associated with significant persons. Usually, dams will have significance in this situation because they were developed by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, dams might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Dams may also have significance because of their association with an influential engineer. In any case, dams significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, dams will have significance because they represent the distinctive characteristics of a type, period, or method of construction, or because they represent the work of a master engineer. Dams play a specific role in the operation of hydroelectric power plants. They are distinguished from other components of such a facility not only by function but also by materials and structural form. They may be built in a variety of materials--timber, rock, earth-fill, stone masonry, reinforced concrete, etc.--and may feature any number of basic forms, e.g., gravity or structural. Dams may appear in any number of geographical settings, but will have some sort of relationship to a natural waterway. Dams help to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. In general, earlier dams tend to feature smaller size, simpler construction, and less sophisticated materials, such as rock and timber. Later dams, built during periods when greater expertise and capital were applied to hydroelectric power projects, are more complex technologically, may be larger, and tend to be made of reinforced concrete.

In order to determine the significance of dams under criteria A, B, and C, evaluation must consider three levels of significance: national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, a dam must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, a dam has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a hydroelectric power dam may require more specific information about a locale than is included in this multiple property documentation form.

Hydroelectric power plants in Utah include dams that represent all of the basic categories. Most notably, historic dams are found at the Cutler, Stairs, Weber, American Fork, Snake Creek, Sand Cove, and Fountain Green facilities. As parts of hydroelectric plant complexes, these and other dams are significant because they have important associations with the development of hydroelectric power in Utah and because they contribute to the distinctive characteristics of hydroelectric power plants.

IV. Registration Requirements

The following requirements must be met for a hydroelectric power dam to be eligible for the National Register under criteria A, B, and C:

For Criterion A:

1. The dam must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The dam must have been built within the period of significance, 1883-1927.

For Criterion B:

1. The dam must have qualities that associate it with the life of a significant person.

2. The dam must have been built within the period of significance, 1883-1927.

For Criterion C:

1. The dam must represent one of the basic dam types outlined in the Description.

2. The dam must be composed of materials outlined in the Description.

3. The dam must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities.

4. The dam must have been built within the period of significance, 1883-1927.

For integrity under Criteria A, B, and C:

Design: The dam must maintain integrity of the design evident during the period of significance. A dam that has been altered so that it no longer stores water for a hydroelectric plant no longer retains its integrity of design; nor does a dam that is now structurally different than it was historically (for instance, a masonry dam that has been covered with loose rock). A dam may still retain integrity of design if it has minor alterations which do not obscure its historic function as a hydroelectric power dam or which do not overwhelm the dam's original historic structure.

Setting: Because the hydroelectric power dam is an integral component of an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facilities--is critically important to its integrity. If a hydroelectric power dam retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as dams to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Materials: The dam must retain integrity of the majority of materials present during the period of significance. Because dams are engineered structures that serve a specific industrial function, it is expected that they may have undergone periodic maintenance and improvement. Most dams will have some type of alteration (for instance, a spillway may have been rebuilt). In order to retain integrity of materials, the dam's historic materials must not be overwhelmed by later additions.

Workmanship: If the dam retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the dam retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that a dam will have been moved. If the dam retains integrity of setting, then it retains integrity of location.

I. Name of Property Type: Hydroelectric Power Plant Conduit

II. Description

After water is impounded and/or diverted by a dam, the water is conveyed through horizontal conduit to a point where it is then passed into a penstock. In the penstock, water gathers velocity before it is directed into the turbines. Conduit, then, performs an intermediary but integral function in the delivery of water for a hydroelectric power plant. Other terms that a have the same general meaning as conduit include flume, canal, pipe, wood stave pipeline, pipeline, flowline, etc. (the latter terms sometimes written as two words). It is recognized that a penstock, a separate property type, is also a form of conduit. However, for the purposes of this documentation form conduit will refer to that type of structure which carries water between the dam and the penstock (or in a few cases, the powerhouse).

In general, engineers determined the location of conduit in relation to the location of the dam and the powerhouse. Those features, as mentioned in the descriptions of the dam and powerhouse property types, were situated according to various environmental factors, mainly availability of water and topography. The amount of power desired also figured in how and where they were located. Conduit, however, because it represented a major expenditure of energy and materials (an expense which would continue in the future because of necessary maintenance) also could help to determine the location of the dam and powerhouse. Ideally, a hydroelectric power plant involved a maximum amount of power production at the least expense. In part, this meant that in an ideal plant, the major components--dam and powerhouse--would be built close together, thus allowing the conduit to be relatively short. However, this was usually not the case as the optimum location for a dam was often relatively far from the optimum site for a powerhouse. In such a situation, the conduit would be a fairly lengthy and thus a more expensive structure. Lengthy conduit most often was used in high-head plants where it was necessary to convey a minimal amount of water to a point where it could be delivered to Pelton wheels at high velocity. Low or medium-head plants handling greater amounts of water and located in more level settings often required shorter lengths of conduit. (See the Hydroelectric Power Plant Powerhouse property type description for more information on low, medium, and high-head plants.)

In Utah, where waterways typically were small and located in the mountains, most hydroelectric plants were of the high-head type, thus necessitating the use of conduit sometimes several miles long. In addition, as part of high-head plants in mountainous settings, these lengths of conduit usually traversed the steep, rocky sides of mountains or canyons. Numerous existing Utah hydroelectric power plants feature conduit of this sort. Outstanding examples include the American Fork, Beaver, Fountain Green, Granite, Santa Clara, and Snake Creek facilities. Conduit for all of these plants generally measures a mile or more. For most of the plants, the conduit is located along the sides of canyons. One exception is the Fountain Green facility, which has a long steel pipeline that runs across a stretch of prairie. The best example of a plant with a short conduit is Stairs Station in Big Cottonwood Canyon near Salt Lake City. R.M. Jones, the engineer who designed the plant, located it in an ideal setting. The dam for Stairs Station is situated at the top of a cascade with a sharp drop in elevation (350 ft. in about 1/4 mile). The powerhouse is located at the bottom of the cascade. The sharp drop in elevation allowed Jones to locate his plant such that it required a relatively short length of conduit--1,200 ft. (not counting penstock). Another short conduit is located at Cutler Plant on the Bear River, a large, low-head facility. Originally, engineers of the Electric Bond and Share Company intended Cutler's powerhouse to be integral to the dam, but geological factors required them to locate the two structures about 1,200 ft. apart. A large flowline carries water from the dam to the penstocks just above the powerhouse.

Conduit for hydroelectric plants could be built in any number of sizes and could feature several designs using various types of materials. Many plants had conduit consisting of steel pipe. In general, older pipe dating from the late nineteenth and early twentieth centuries was riveted, whereas pipe installed later in the twentieth century was welded together. The majority of known hydroelectric power plants in Utah feature conduit of the latter sort. One facility--Weber--features a section of conduit consisting of reinforced concrete pipe constructed on the site. Sometimes conduit consisted of a wood flume, which was box-like, generally rectangular in section, and made of boards held together by nails and/or metal straps and braces. Flumes could also be made of wood staves joined together in a shape that was semi-circular in section. Semi-circular wood stave flume looked like the lower half of a wood stave pipe. The Granite Plant in Big Cottownwood Canyon near Salt Lake City features good example of both types of flume. Conduit could also consist of a wood stave pipeline. This structure was fashioned from wood staves held together by metal bands or hoops. Few examples of wood stave pipeline still exist in Utah. One example is the Ogden Canyon Conduit, which delivers water to the Pioneer Plant at Ogden as well as to nearby irrigation canals. Wood stave pipe generally was used in hydroelectric power plants between the late nineteenth century and the 1930s, and was eventually superceded by the more widely-used welded steel pipe. Finally, some conduit consisted of canal. Canals could be simple ditches dug into the earth. In some cases canals were lined with concrete. One of the few examples of this sort of a canal used for power purposes is located between the Santa Clara Hydros in Washington County. Generally, the amount of water the conduit needed to carry determined its size.

Hydroelectric plant conduit often included some ancillary structures, usually bridges, tunnels, and saddles. As conduit often crossed rugged topography, power companies often found it necessary to build such structures to support the conduit, or in the case of tunnels, allow it to pass through geological obstructions. Bridges, tunnels, and saddles, although perhaps worthy of note in their own right, were ancillary to the conduit itself. The principle function of such structures was to facilitate the delivery of water.

One additional characteristic of hydroelectric power plant conduit is worthy of discussion. In some cases, conduit lies under ground. It is unclear exactly why engineers sometimes chose to bury conduit. Laying conduit (usually wood or steel pipe) in a trench and/or covering it with earth often prevented the pipe from movement caused by pressure changes. Conduit also may have been buried in order to protect it from rock slides and the weather as well as to prevent it from freezing.

The enviromental setting of conduit most often contributed to or detracted from its physical condition. Located in mountainous settings and exposed to the elements, wood rotted and steel corroded. In addition, falling rocks could puncture steel pipeline or crush wood pipes or flumes. Erosion could lead to the undermining of the ground underneath the conduit, causing it to buckle and break. Sometimes, operation of a hydroelectric plant (such as rapidly shutting off water to the turbines) could cause violent pressure changes within pipeline conduit, causing it to rupture. Because of these factors, perhaps more than any other feature of a hydroelectric power plant, the conduit was subject to frequent repair and replacement. Indeed, none of the known hydroelectric power plants in Utah (except for Cutler Plant) have conduit that retains its original integrity over any substantial length. Most plants, in fact, have replaced the original conduit (which usually was wood stave pipeline) with welded steel pipe.

Besides physical characteristics, important associative characteristics help to define hydroelectric power conduit as a property type. Generally, hydroelectric power conduit in Utah is associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of the various property types); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power conduit might have associations with important developers or engineers. Some facilities, for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power plant conduit property type will likely be chosen according to two factors. First, considering conduit as a distinct entity, a boundary for a length of it will probably encompass the area upon which the conduit sits as well as some area on either side of it, generally comprising the legal right-of-way for the structure. Furthermore, the boundaries for conduit will likely exclude structures and sites adjacent or nearby and not related to the operation of the hydroelectric plant of which the conduit is part. The second factor influencing the boundaries for conduit is that conduit is integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, surge tank, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, hydroelectric power plant conduit will probably be included within a larger, district boundary that includes other structures.

At some plants, the conduit lies underground or major portions of it have been replaced within the last fifty years. In such cases, the conduit is excluded from the hydroelectric plant historic district. Conduit that has been substantially altered or that lies underground does not convey the historic associations or historic visual associations of the plant with which it is connected. Conduit lying underground, for instance, is not visible and is not a significant element on the landscape. It would be innapropriate to nominate sections of surface ground which gives little or no indication that the conduit lies underneath. Moreover, it would be difficult to manage conduit that runs underneath public rights-of-way. At the Weber plant, for instance, portions of the pipeline lie deep underground, beneath a multi-lane interstate highway.

III. Significance

Hydroelectric power plant conduit built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Conduit was an integral feature of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, conduit was a prominent physical feature in an industry--electrical generation--important in its own right. Finally, as a key type of structure in the operation of hydroelectric power plants, conduit helps to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that conduit can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Conduit was an integal structure in an industrial complex which served to generate electricity. The most important feature of hydroelectric power stations was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for conduit to have significance, it must still show a relationship to the historic powerhouse. Specifically, the powerhouse must still be standing and it must have integrity. If a length of conduit is still standing but the powerhouse is demolished or has lost integrity, then the conduit can no longer represent the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) It may, however, be eligible under a context other than hydroelectric power development.

Given its special relationship to the powerhouse, conduit may have significance under Criteria A, B, and C as follows:

Under criterion A, conduit, as part of hydroelectric power plants, helps to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for conduit because of its associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, conduit has further significance because it helps to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, conduit may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Conduit may also have associations with broad patterns of events--for example, conduit may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under criterion B, conduit is eligible when associated with significant persons. Usually, conduit will have significance in this situation because it was built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, conduit might have significance because of its association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Conduit may also have significance because of its association with an influential engineer. In any case, conduit significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, conduit will have significance because it represents the distinctive characteristics of a type, period, or method of construction, or because it represents the work of a master engineer. Conduit plays a specific role in the operation of hydroelectric power plants. It is distinguished from other components of such facilities not only by function but also by materials and structural form. Conduit helps to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. Conduit built within the period of significance can be made of various materials, feature one of several basic designs, and can appear in different sizes. In general, conduit dating from the late nineteenth or early twentieth centuries is made of wood or riveted steel. Conduit built later was usually made of welded steel pipe.

In order to determine the significance of conduit under criteria A, B, and C, evaluation must consider three levels of significance: national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, conduit must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, conduit has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of hydroelectric power conduit may require more specific information about a locale than is included in this multiple property documentation form.

Of the known examples of hydroelectric power plants in Utah, few have conduit that retains integrity of location, design, setting, materials, workmanship, feeling, and association. As discussed above, because of damage and deterioration conduit undergoes frequent repair if not outright replacement. Two examples of a hydroelectric plant with intact historic conduit include Cutler and Stairs. The conduit at Cutler and Stairs help to represent the historic associations of the historic districts to which they belong.

Registration Requirements

The following requirements must be met for hydroelectric power plant conduit to be eligible for the National Register under Criteria A, B, and C:

For Criterion A:

1. The conduit must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The conduit must have been built within the period of significance, 1883-1927.

For Criterion B:

1. The conduit must have qualities that associate it with the life of a significant person.

2. The conduit must have been built within the period of significance, 1883-1927.

For Criterion C:

1. The conduit must represent the basic physical characteristics outlined in the Description.

2. The conduit must be composed of materials outlined in the Description.

3. The conduit must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities. Specifically, it must

show a physical connection with a dam and a powerhouse.

4. The conduit must have been built within the period of significance, 1883-1927.

For integrity under Criteria A, B, and C:

Design: The conduit must maintain integrity of the design evident during the period of significance. Conduit that has been altered so that it no longer resembles the type of conduit that it originally was no longer retains integrity of design. For instance, conduit that originally consisted of wood stave pipe but that is now made up of welded steel pipe installed after the period of significance lacks integrity of design. Conduit may still retain integrity of design if it has minor alterations which do not overwhelm the original historic structure.

Setting: Because the hydroelectric power plant conduit is an integral component of an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facility--is critically important to its integrity. If a length of conduit retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as conduit to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Materials: The conduit must retain integrity of the majority of materials present during the period of significance. Due to harsh environmental conditions, most conduit has undergone continual repair and replacement. It can be expected that few hydroelectric plants have conduit that is virtually unchanged. Evaluation of the material (and design) integrity of conduit must take place on an individual basis, but in general, if more than 50 percent of a length of conduit has lost its material integrity then the entire conduit no longer retains its material integrity.

Workmanship: If the conduit retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the conduit retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that conduit will have been moved. If the conduit retains integrity of setting, then it retains integrity of location. In some instances sections of conduit may have been moved from one hydroelectric plant to another. If so, the conduit no longer retains integrity of location.

I. Name of Property Type: Hydroelectric Power Plant Surge Tanks

II. Description

In most hydroelectric plants water is carried in a roughly horizontal conduit before passing into an inclined penstock. Many water delivery systems feature a surge tank (or a closely related structure called a standpipe) located between the horizontal conduit and the penstock.

Basically, the surge tank or standpipe serves to alleviate a condition in the penstock and conduit (if it was a closed structure, such as a wood stave pipeline) called "waterhammer." This condition arose when the column of water is suddenly shut off at the lower end of the penstock--for instance, when powerhouse operators close valves that allow water to the turbines. The pressure rise caused by the column of water backing up in the penstock and pipeline can rupture the pipeline or cause undesirable movement in both penstock and pipeline. A surge tank or standpipe located at the top of the penstock alleviates the dangerous pressure by taking in the excess water from the pipeline and penstock. In some cases surge tanks and standpipes were built with openings at the top so that water could flow out. Surge tanks/standpipes also serve to hold water for increased load. If more water is needed at the powerhouse, water flows from the surge tank faster than the velocity of the water coming down the horizontal pipeline can increase. By the time the water level in the penstock drops, the water in the pipeline is flowing fast enough to supply the demand. In some cases hydroelectric plants were not furnished with surge tanks or standpipes. In these cases water delivery systems were usually outfitted with pressure relief valves at the lower end of the horizontal pipeline or at the upper end of the penstock. These valves either let off pressure from waterhammer or prevent a vacuum from forming in the pipeline. This latter condition can arise because the water in the inclined penstock is moving at a higher velocity than in the horizontal pipeline.

Surge tanks are basically simple structures that consist of vertical tanks made of steel or reinforced concrete. Surge tanks usually look like simple water storage tanks or towers. Sometimes they are hulking, rectangular chambers, called "pressure chambers" or "surge chambers" made of reinforced concrete and built into the sides of mountains or canyon walls (a good example of this type of structure is at the Olmsted plant in Provo). Most surge tanks, however, consists of tanks made of riveted or welded steel plates. A good example of a structure made of riveted steel is the surge tank at the Beaver plant in Beaver County. Surge tanks are usually located on a concrete base, to which the pipeline and the penstock are attached. Standpipes, on the other hand, usually consist of a vertical section of pipe about the size of the horizontal pipeline and are attached directly to the pipeline or to the top of the penstock. One plant with a standpipe rather than a surge tank is Stairs Station. A more complex type of surge tank--the Johnson Differential type--consists of a standpipe located inside of a storage tank. The water in the tank is stored independently of the action of the water in the standpipe, which responds directly to fluctuations in demand. Apparently, storing water and feeding in independently into the system lends the Johnson Differential surge tank greater stability than simpler types. A good example of a Johnson Differential surge tank is located at the Cutler plant on the Bear River. Because surge tanks and standpipes operate according to atmospheric pressure, their maximum height is usually above the maximum level of water at the reservoir or intake. Otherwise, the size of the surge tank or standpipe is determined by the amount of water it is required to hold.

Generally, surge tanks exist at plants dating from the late nineteenth century. Larger, more modern plants (e.g., Cutler) have larger, more sophisticated surge tanks. Many plants, especially earlier, smaller, less sophisticated facilities, have no surge tanks. It is possible that the cost of erecting such structures may have been a consideration in a power company's decision to leave them out. Facilities without surge tanks have small relief valves instead.

Few factors contribute to or detract from the physical condition of surge tanks and standpipes. These structures are exposed to the elements, so some weathering and the thus repair and alteration may have occurred. In general, though, known examples of the property type retain excellent physical integrity.

Besides physical characteristics, important associative characteristics help to define hydroelectric power surge tanks as a property type. Generally, hydroelectric power surge tanks in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of the various property types); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power surge tanks might have associations with important developers or engineers. Some structures, for instance (as part of power plant complexes), were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power plant surge tank property type will likely be chosen according to two factors. First, a boundary for a surge tank as a distinct entity will probably encompass the area upon which the surge tank sits as well as some area around it. Furthermore, the boundaries for a surge tank will likely exclude structures and sites adjacent or nearby and not related to the operation of the hydroelectric plant of which the surge tank is part. The second factor influencing the boundaries for a surge tank is that such a structure is integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, surge tank, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, a surge tank will probably be included within a larger, district boundary that includes other structures.

III. Significance

Hydroelectric power plant surge tanks built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Surge tanks were an integral features of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, surge tanks were prominent physical features in an industry--electrical generation--important in its own right. Finally, as a key type of structure in the operation of hydroelectric power plants, surge tanks help to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that a surge tank can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Surge tanks were integral structures in an industrial complex which served to generate electricity. The most important feature of hydroelectric power stations was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for a surge tank to have significance, it must still show a relationship to the historic powerhouse. Specifically, the powerhouse must still be standing and it must have integrity. If a surge tank is still standing but the powerhouse is demolished or has lost integrity, then the surge tank no longer represents the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) A surge tank considered independent of its relationship to a hydroelectric plant may have significance under a context other than the development of hydroelectric power.

Given its special relationship to the powerhouse, surge tanks may have significance under Criteria A, B, and C as follows:

Under criterion A, surge tanks, as parts of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for a surge tank because of its associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, surge tanks have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, surge tanks may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Surge tanks may also have associations with broad patterns of events--for example, they may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under criterion B, surge tanks are eligible when associated with significant persons. Usually, a surge tank will have significance in this situation because it was built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, surge tanks might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Surge tanks may also have significance because of their association with an influential engineer. In any case, surge tanks are significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, a surge tank will have significance because it represents the distinctive characteristics of a type, period, or method of construction, or because it represents the work of a master engineer. Surge tanks play a specific role in the operation of hydroelectric power plants. They are distinguished from other components of such facilities not only by function but also by materials and structural form. Surge tanks help to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. Surge tanks built within the period of significance can be made of various materials, feature one of several basic designs, and can appear in different sizes. In general, surge tanks dating from the late nineteenth or early twentieth centuries are made of riveted or welded steel, or reinforced concrete.

In order to determine the significance of surge tanks under criteria A, B, and C, evaluation must consider three levels of significance:

national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, a surge tank must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, a surge tank has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a surge tank may require more specific information about a locale than is included in this multiple property documentation form.

Of the known hydroelectric power plants in Utah, relatively few have surge tanks. These facilities include Cutler, Beaver, and Pioneer. Pioneer's surge tank, however, because of its relationship to an irrigation system, has historic associations different than the plant as a whole. At Cutler, the surge tank, as part of a hydroelectric plant, is significant because it has important associations with the development of hydroelectric power in Utah and because it is part of a plant with distinctive characteristics. The same is true for the Beaver surge tank, which has additional significance because it is part of a plant associated with the life of L.L. Nunn. At least three Utah plants--Sand Cove, Gunlock, and Stairs--have standpipes, although the one at Stairs has lost its integrity. The structures at Sand Cove and Gunlock are integral to plants with associations to hydroelectric development and which are distinctive types. Other known surge tanks--in these cases pressure chambers--exist at a plant in Logan and at the Olmsted plant in Provo Canyon. Although Olmsted is listed in the National Register, apparently the boundaries as drawn only encompass the powerhouse grounds, thus excluding other important structures, such as the surge chamber and penstock.

Registration Requirements

The following requirements must be met for a hydroelectric power plant surge tank to be eligible for the National Register under Criteria A, B, and C:

For Criterion A:

1. The surge tank must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The surge tank must have been built within the period of significance, 1883-1927.

For Criterion B:

1. The surge tank must have qualities that associate it with the life of a significant person.

2. The surge tank must have been built within the period of significance, 1883-1927.

For Criterion C:

1. The surge tank must represent the basic physical characteristics outlined in the Description.

2. The surge tank must be composed of materials outlined in the Description.

3. The surge tank must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities.

4. The surge tank must have been built within the period of significance, 1883-1927.

For integrity under Criteria A, B, and C:

Design: The surge tank must maintain integrity of the design evident during the period of significance. Surge tanks that have been altered so that they no longer resemble the type of surge tanks that they originally were no longer retain integrity of design. For instance, a surge tank that originally consisted of riveted steel but that is now made up of welded steel installed after the period of significance lacks integrity of design. A surge tank may still retain integrity of design if it has minor alterations which do not overwhelm the original historic structure.

Setting: Because a hydroelectric power plant surge tank is an integral component of an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facility--is critically important to its integrity. If a surge tank retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as a surge tank to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Materials: The surge tank must retain integrity of the majority of materials present during the period of significance.

Workmanship: If the surge tank retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the surge tank retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that surge tanks will have been moved. If a surge tank retains integrity of setting, then it retains integrity of location. If moved from one hydroelectric plant to another, a surge tank no longer retains integrity of location.

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(see continuation sheet)

I. Name of Property Type: Hydroelectric Power Plant Penstocks

II. Description

Penstocks are nearly ubiquitous features of hydroelectric power stations, especially those that can be classed as high-head plants. The penstock, consisting of an inclined pipe, is located between the powerhouse and the surge tank or horizontal conduit. Usually, the penstock runs down a steep mountainside or canyon wall. The penstock performs two functions. First, through the force of gravity, it lends velocity to the water coming from the horizontal conduit. Second, it directs the water into the turbines located in the powerhouse. The size of a hydroelectric plant's penstock basically depends on the amount of water to be supplied and the head available. In a low-head plant, where the volume of water is more important than its velocity, the penstock is relatively large in diameter and short in length. The penstock for a high-head plant (a plant with a head of roughly 200 ft. or more), on the other hand, generates electricity from a small amount of water moving at high velocity. A high-head penstock, then, is usually of a relatively narrow diameter and is long and steep. The penstock at the low-head Cutler Plant, for instance, is about 110 ft. long, whereas the conduit for the high-head Snake Creek facility runs for 4,000 ft. Another feature of a typical penstock is that it is usually straight. Turns and bends in the penstock tend to create friction, which slows the water and diminishes its effect on the turbines.

Penstocks usually consist of either riveted or welded steel pipe. In rare instances penstocks are made of wood staves or reinforced concrete. Generally, riveted steel penstocks are associated with hydroelectric plants built between about the 1890s and the 1920s. The majority of penstocks associated with the known hydroelectric power plants in Utah consist of riveted steel pipe. Penstocks also have physical characteristics which are not readily apparent under casual observation. Penstocks sometimes increase slightly in diameter as they approach the turbines, which raises the pressure of the water. In addition, the lower lengths of penstocks often consist of progressively thicker steel which allows the structure to withstand the water pressure.

Like other features of hydroelectric power plants, weathering probably most detracts from penstock structures. However, penstocks associated with the known hydroelectric plants in Utah retain a remarkable degree of physical integrity. Replacement of a penstock might have occurred because of wear or because a new structure increased the efficiency of the plant. But on the whole, penstocks seem to have been stable structures that warranted less attention than other parts of water delivery systems, particularly horizontal conduit made of wood. One final feature that relates to the physical condition of the penstock is that sometimes they were partially buried. Apparently this practice helped to stabilize the penstock and helped to prevent freezing.

Besides physical characteristics, important associative characteristics define hydroelectric power plant penstocks as a property type. Generally, hydroelectric power penstocks in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of the various property types); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power plant penstocks might have associations with important developers or engineers. Some structures (as components in larger hydroelectric plants), for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power plant penstock property type will likely be chosen according to two factors. First, a boundary for a penstock as a distinct entity will probably encompass the area upon which it sits as well as some area on either side of it. Furthermore, the boundaries for a penstock will likely exclude structures and sites adjacent or nearby and not related to the operation of the hydroelectric plant of which the penstock is part. The second factor influencing the boundaries for a penstock is that such a structure is integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, surge tank, penstock, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, a penstock will probably be included within a larger, district boundary that includes other structures.

In some cases substantial portions of a penstock will be underground or will have been replaced within the past fifty years. As well, some penstocks lie under public rights-of-way, particularly highways and streets. In such cases, penstocks will be excluded from hydroelectric power plant historic districts. If buried, a penstock is out of sight and is not a prominent feature on the landscape. Lying underground it conveys none of the historic visual associations of the facility with which it is connected. Nominating surface ground which shows little or no physical, visual association with the penstock itself would be a complicated and ultimately innefective way of including the structure within a district. In addition, it would be difficult to manage penstocks lying underneath public rights-of-way such as streets and roads.

III. Significance

Hydroelectric power plant penstocks built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Penstocks were an integral features of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, penstocks were prominent physical features in an industry--electrical generation--important in its own right. Finally, as a key type of structure in the operation of hydroelectric power plants, penstocks helped to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that a penstock can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Penstocks were integral structures in an industrial complex which served to generate electricity. The most important feature of a hydroelectric power station was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for a penstock to have significance, it must still show a relationship to the historic powerhouse. Specifically, the powerhouse must still be standing and it must have integrity. If a penstock is still standing but the powerhouse is demolished or has lost integrity, then the penstock no longer represents the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) A penstock considered independent of its relationship to a hydroelectric plant, however, may have significance under a context other than the development of hydroelectric power.

Given its special relationship to the powerhouse, penstocks may have significance under Criteria A, B, and C as follows:

Under criterion A, penstocks, as parts of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for a penstock (as part of a hydroelectric plant) because of its associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, penstocks have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, penstocks may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Penstocks may also have associations with broad patterns of events--for example, they may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under criterion B, penstocks are eligible when associated with significant persons. Usually, a penstock will have significance in this situation because it was part of a facility built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, penstocks might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Penstocks may also have significance because of their association with an influential engineer. In any case, penstocks (as part of a hydroelectric plant complex) that are significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, a penstock will have significance because it represents the distinctive characteristics of a type, period, or method of construction, or because it represents the work of a master engineer. Penstocks play a specific but subsidiary role in the operation of hydroelectric power plants. They are distinguished from other components of such facilities not only by function but also by materials and structural form. Penstocks help to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. Penstocks built within the period of significance can be made of various materials and can appear in different sizes. In general, penstocks dating from the late nineteenth or early twentieth centuries are made of riveted or welded steel or reinforced concrete.

In order to determine the significance of penstocks under criteria A, B, and C, evaluation must consider three levels of significance: national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, a penstock (as part of a hydroelectric plant) must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, a penstock has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a penstock may require more specific information about a locale than is included in this multiple property documentation form.

Of the known hydroelectric power plants in Utah, virtually all include penstocks with outstanding integrity. Most of the penstocks are associated with high-head plants and consist of rivetted steel pipe. Outstanding examples of penstock, among others, can be found at the Olmsted plant in Provo, at the Beaver station in Beaver County, at American Fork Plant in American Fork Canyon, and at Stairs Station in Big Cottonwood Canyon near Salt Lake. Cutler Plant, one of the few relatively large, low-head hydroelectric stations in Utah, features a large, short conduit, also made of riveted steel. As parts of hydroelectric plant complexes, the penstocks found in Utah are significant because they have important associations with the development of hydroelectric power and because they contribute to the distinctive characteristics of hydroelectric power plants. In addition, as part of hydroelectric plants, some have associations with important individuals.

Registration Requirements

The following requirements must be met for a hydroelectric power plant surge tank to be eligible for the National Register under Criteria A, B, and C:

For Criterion A:

1. The penstock must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The penstock must have been built within the period of significance, 1883-1927.

For Criterion B:

1. The penstock must have qualities that associate it with the life of a significant person.

2. The penstock must have been built within the period of significance, 1883-1927.

For Criterion C:

1. The penstock must represent the basic physical characteristics outlined in the Description.

2. The penstock must be composed of materials outlined in the Description.

3. The penstock must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities.

4. The penstock must have been built within the period of significance, 1883-1927.

For integrity under Criteria A, B, and C:

Design: The penstock must maintain integrity of the design evident during the period of significance. Penstocks that have been altered so that they no longer resemble the type of penstock that they were originally no longer retain integrity of design. For instance, a penstock that originally consisted of riveted steel but that is now made up of welded steel installed after the period of significance lacks integrity of design. A penstock may still retain integrity of design if it has minor alterations which do not overwhelm the original historic structure.

Setting: Because a hydroelectric power plant penstock is an integral component of an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facility--is critically important to its integrity. If a penstock retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as a penstock to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Materials: The penstock must retain integrity of the majority of materials present during the period of significance.

Workmanship: If the penstock retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the penstock retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that a penstock will have been moved. If a penstock retains integrity of setting, then it retains integrity of location. If moved from one hydroelectric plant to another, a penstock no longer retains integrity of location.

I. Name of Property Type Hydroelectric Power Plant Powerhouses

II. Description

Powerhouses are the most important features of hydroelectric plants because they contain the machinery that generates electricity. All of the features of a hydroelectric plant function as a unit, but in general, structures such as dams and pipelines serve the ancillary purpose of conveying water to the powerhouse. In addition, especially in small, high-head facilities, the powerhouse is often the largest and most technologically sophisticated feature.

As with dams, a number of factors determined the location and layout of a powerhouse. After determining the amount of power desired, engineers located a powerhouse in relation to water supply, topography, and the likely location of a dam and water delivery system. In some cases, they also took into account the distance of the contemplated power site from the point of consumption, although this consideration became less important as the efficiency of transmission technology increased. Using measurements for potential head and stream flow, engineers could calculate the horse power of a future hyroelectric station. Generally, power companies tried to design stations that would utilize a maximum flow and head but that would require a relatively small amount of energy and materials to build. The potential cost of future operation and maintenance was also considered.

In Utah during the late nineteenth and early twentieth centuries, developers located most hydroelectric plants (including powerhouses) on streams and small rivers emanating from mountain canyons. Early hydroelectric power companies in general lacked the capital, organizational strength, and technical expertise to develop Utah's large rivers--the Green, the Colorado, and the Bear--which were located relatively far from the state's major market for electricity, concentrated along the western front of the Wasatch Mountains around Salt Lake City. Later developments tapped the larger rivers, but by far the majority of hydroelectric plants in Utah built before about 1910 were located on small canyon streams. These offered much more manageable opportunities for power development, ones that were closer to the Salt Lake City area and other markets. As well, canyon streams of the Wasatch and other ranges were ideally suited to small-scale, high-head technology.

During the mid-nineteenth century, engineers discovered the technology with which to efficiently generate electricity from small amounts of water. Using a special feature of a high-head plant called a penstock (see property type description), engineers conveyed water at high velocity hundreds of feet down steep mountainsides and canyon walls to specially-designed turbines called Pelton wheels (see description below). The action of gravity gave the water its velocity. Rather than using large volumes of river water to generate electricity, power companies using high-head technology could instead rely on a minimal amount of water moving at high speed.

Compared to modern hydroelectric plants, Utah's early powerhouses now seem rather diminutive, and indeed their size reflects their origins in an era not dominated by massive, monopolistic utilities and government agencies. Most are utilitarian structures made of brick or stone, with a few (e.g., Gunlock and Sand Cove) featuring reinforced concrete construction. Those of larger size--Cutler and Pioneer, for example--have structural steel frameworks around which their facades were built. Most powerhouses have stone or reinforced concrete foundations. Roofs, sometimes made of concrete, are often supported by steel trusses.

In terms of architectural style, Utah's powerhouses generally reflect the eras in which they were built. Those structures dating from the 1890s up to about the early 1900s feature modified revival styles that generally mimic the commercial buildings of the era. A few, such as the Nunn Plant, show virtually no refinement at all. This may have been due to a lack of capital or because the owners felt that the plant was so remote from a population center that it was unecessary to build an impressive facade.

Later powerhouses exhibited greater attention to style as well as landscaping. In 1909, engineer Frank Koester advocated that American utility companies erect powerhouses with pleasing appearances. Well-designed powerhouses, he argued, should harmonize with natural surroundings. Ultimately, Koester thought, aesthetically pleasing powerhouses that included sanitary facilities would contribute to higher morale among workers and thus lead to a more efficient plant overall. Some of Utah's powerhouses dating from the early 1900s perhaps reflect Koester's sentiments. At least two, at Snake Creek (c.1910) and Beaver (c.1908), were designed by architects. The Beaver powerhouse, designed by architect W.H. Lepper, is a fine example of the Craftsman style. With its pink tuffa stone walls and heavy wood eave brackets and purlins, the Beaver powerhouse is particularly appropriate to its rustic mountain setting. Lepper also incorporated Craftsman elements into the adjacent operator's camp. All of the buildings at Beaver are situated around a central, rectangular green. Similar attention to landscaping appears at the Olmsted Plant (1902) also home of L.L. Nunn's Telluride Institute. Nunn, head of the Telluride Power Company, showed increasing attention to architecture in his early 1900s powerhouses and station grounds. Nunn was associated with the Beaver River Power Company and it is possible that he was instrumental in obtaining Lepper's services. Nunn's interest in architecture seems to have peaked in 1907 with the construction of the Battle Creek powerhouse near Pleasant Grove. Strongly reminiscent of a Greek temple, this building may have reflected Nunn's classical education in a German university. Powerhouse construction in Utah culminated in the Cutler Plant, which featured an Art-Deco style exterior.

The architecture of powerhouses, although appealing, is actually secondary to the function of sheltering electrical generating equipment. The primary features of a hydroelectric plant powerhouse are the turbine-generator units. Water from the penstocks spin the turbines, which are usually connected by large steel shafts to generators. High-head plants of the type commonly found in Utah are most often outfitted with turbines called Pelton wheels (also known as impulse turbines). The Pelton wheel originated in the California gold fields during the 1860s, '70s, and '80s. Various inventors, including Lester Pelton, perfected several prototypes, all of which came to be known under the universal title of "Pelton wheel." As mention above, velocity of water, not large volume, is the principle behind this type of turbine. Water traveling down the penstock passes through nozzles, which shoot the water at extremely high pressure into buckets mounted around the circumference of the Pelton wheel. The other principle type of turbine is the reaction, or Francis turbine, which is usually installed in low- to medium-head plants (less than 200 ft.) but which also can be used in high-head situations. The flow of water into the Francis turbine is continuous, so that the turbine is actually filled with water. Inside, vanes guide the water into buckets. Francis turbines installed in most Utah powerhouses (e.g., Pioneer, Weber, Olmsted) are horizontal units, meaning that they turn on a horizontal axis. The most striking feature of these turbines is their covering, or scroll case, which looks like a big snail shell. Another type of turbine appearing in Utah plants (most notably Cutler) is the vertical Francis turbine, which is more efficient than the horizontal type and which is usually much larger.

Besides turbine-generator units, other important powerhouse apparatus includes small d.c. motors which provide electricity for the magnetic field in the generators; transformers for converting electricity to higher voltages for transmission; batteries for storage of power for emergencies; bus bars and switches; control boards with instruments for regulating electrical generation; valves for controlling the flow of water to the turbines and governors for controlling the speed of the turbines; telephone booths for operators; and overhead traveling cranes for installing, removing, and repairing heavy machinery.

The interior arrangment of a powerhouse basically depends on the amount of power that the hydroelectric plant produced and to a certain extent the date of construction of the plant. Most powerhouses in Utah usually feature one floor, most of which is taken up by one or two turbine-generator units. Larger plants required more or larger turbine-generator units, which necessitated a relatively large powerhouse. Two of the largest powerhouses in Utah are located at Pioneer and Cutler. The powerhouse at Pioneer (1897) was built for ten turbo-generators, whereas Cutler (1927) was built to house only two. Yet Cutler, as a modern station with large turbines and much sophisticated control equipment, is much more capacious than the Pioneer facility. Earlier powerhouses, dating from the late nineteenth and early twentieth centuries, were usually small, although Pioneer is one exception. Larger, more sophisticated, and/or more modern powerhouses also had more space for ancillary equipment such as transformers and switches. In some cases, powerhouse space is divided into rooms for specific purposes. Besides the main turbine-generator floor, some powerhouses have high-tension rooms for switch equipment. A good example of a facility with such a space is the Weber powerhouse (c.1910). Other, smaller, facilities, such as Upper American Fork (1907) and Snake Creek (1910) have spaces for electrical equipment that adjoin the turbine-generator area, but that are not separated by a wall. The space for electrical equipment in the Upper American Fork and Snake Creek powerhouses gives them a T-shape. Other powerhouses featured more than one floor for its equipment. Stairs Station (1895), for instance, has a second floor that once housed transformers and switchgear. By far the powerhouse with the most complex interior space is at Cutler. The Cutler powerhouse includes several floors and numerous rooms which provide space for all the different powerhouse apparatus.

Other notable physical features of powerhouses include window arrangement and provisions for the movement of water after it leaves the turbines. Generally, the architectural style of the powerhouse determines to a certain extent the size and shape of powerhouse windows. But otherwise, such windows serve a useful purpose by allowing daylight into the powerhouse and by providing much-needed ventilation. Filled with moving machinery and high-voltage electrical apparatus, powerhouses can be extremely hot, especially in summer. Windows help to circulate fresh air through the powerhouse. Interestingly, of the known powerhouses in Utah, only one (Pioneer) features a roof monitor, a typical feature on late nineteenth- and early twentieth- century industrial buildings. Besides windows, another little-known aspect of powerhouses is the area underneath, where spent water from the turbines (called wastewater) is ejected. Wastewater falling from the turbines passes into a channel underneath the powerhouse that leads outside and becomes the tailrace. In plants with reaction turbines, the turbines are often located over draft tubes which essentially create a vacuum that sucks the water through the turbines, thus increasing their efficiency.

Factors contributing to or detracting from the physical condition of powerhouses include enviromental conditions and technological changes. Like other components of a hydroelectric plant, powerhouses are subject to weathering on their exteriors. Sometimes this leads to repair and maintenance that compromises the physical integrity of the building. At Granite, for instance, the parapet on the powerhouse has been replaced. Most changes in powerhouses, however, have come about because of the removal of old equipment and the installation of new. As discussed in the description of transmission equipment, at most plants transformers and switches are now kept outside the powerhouse in a switchyard. Changes in electrical technology also sometimes caused the rearrangement of interior space in some powerhouses. Other alterations to the physical condition of powerhouses are due to worn-out machinery. Turbines and generators, for instance, are sometimes replaced or at least heavily overhauled so that now a unit might only superficially resemble its original condition.

Besides physical characteristics, important associative characteristics help to define hydroelectric power plant powerhouses as a property type. Generally, powerhouses in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the develoment and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of the various property types); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric powerhouses might have associations with important developers or engineers. Some structures (as a component in a larger hydroelectric plant), for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a powerhouse property type will likely be chosen according to two factors. First, a boundary for a powerhouse as a distinct entity will probably encompass the area upon which the it sits as well as some area on either side of it. Furthermore, the boundaries for a powerhouse will likely exclude structures and sites adjacent or nearby and not related to the operation of the hydroelectric plant of which the powerhouse is part. The second factor influencing the boundaries for a powerhouse is that such a structure is integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, surge tank, penstock, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, a powerhouse will probably be included within a larger, district boundary that includes other structures.

III. Significance

Hydroelectric power plant powerhouses built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Powerhouses were the principal features of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, powerhouses were prominent physical features in an industry--electrical generation--important in its own right. Finally, as a key type of structure in the operation of hydroelectric power plants, powerhouses help to illustrate the evolution of hydroelectric power technology during the period of significance. Generally, powerhouses will have significance within the areas of industry and engineering.

Under criterion A, powerhouses help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for powerhouse because of its associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, powerhouses have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, powerhouses may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Powerhouses may also have associations with broad patterns of events--for example, they may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period. Under criterion B, powerhouses are eligible when associated with significant persons. Usually, a powerhouse will have significance in this situation because it was built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, powerhouses might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Powerhouses may also have significance because of their association with an influential engineer. In any case, powerhouses significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, a powerhouse will have significance because it represents the distinctive characteristics of a type, period, or method of construction, or because it represents the work of a master engineer. Powerhouses are the most important structures in the operation of hydroelectric power plants. They are distinguished from other components of such facilities not only by function but also by materials and structural form. Powerhouses help to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. Powerhouses built within the period of significance can be made of various materials and can appear in different sizes. In general, powerhouses dating from the late nineteenth or early twentieth centuries are made of brick (sometimes reinforced concrete). Their size largely depends on the amount of electricity they were built to produce and their date of construction.

In order to determine the significance of powerhouses under criteria A, B, and C, evaluation must consider three levels of significance: national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, a powerhouse must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, a powerhouse has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a powerhouse may require more specific information about a locale than is included in this multiple property documentation form.

Known examples of powerhouses in Utah are significant under Criteria A, B, and C, within the areas of industry and engineering. They have important associations with the development of hydroelectric power (in both local and statewide contexts), they embody distinctive characteristics of their type, and they have associations with important individuals. The powerhouse at Stairs Station, for instance, is significant because it is an outstanding example of a late nineteenth century, high-head hydroelectric facility, because it was the first hydroelectric plant to generate electricity for Salt Lake City, and because it was the first hydroelectric plant in Utah to transmit electricity over a relatively long distance.

Registration Requirements

The following requirements must be met for a hydroelectric power plant powerhouse to be eligible for the National Register under Criteria A, B, and C:

For Criterion A:

1. The powerhouse must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The powerhouse must have been built within the period of significance, 1883-1927.

For criterion B:

1. The powerhouse must have qualities that associate it with the life of a significant person.

2. The powerhouse must have been built within the period of significance, 1883-1927.

For criterion C:

1. The powerhouse must include the basic physical characteristics outlined in the Description.

2. The powerhouse must be composed of materials outlined in the Description.

3. The powerhouse must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities.

4. The powerhouse must have been built within the period of significance, 1883-1927.

For integrity under criteria A, B, and C:

Design: The powerhouse must maintain integrity of the design evident during the period of significance. Assessing the integrity of design for a powerhouse may be somewhat more difficult than for other plant features. For instance, a powerhouse contains important machinery integral to the design of the powerhouse and hydroelectric plant as a whole. Alteration to this equipment must be considered in assessments of the design integrity of the powerhouse. Significant changes in the apparatus can conceivably compromise the overall integrity of a powerhouse design. On the other hand, if a powerhouse is still functioning or if its machinery is still in place, then the building probably still retains integrity of design. In Utah, many powerhouses no longer have their original turbines and generators. Yet many powerhouses still have the same type of equipment, such as Pelton wheels, as they did originally. Thus these powerhouses overall still retain their original high-head design. In some instances a powerhouse may have been abandoned with serious compromises to its design integrity. In such cases, the material integrity of the powerhouse will need to be assessed, but in general if the building is not used for some other function and if it still retains integrity of materials, location, setting, feeling, and association, (particularly if the remains of other plant features are in place), then the powerhouse will retain its integrity of design. Finally, in order for it to retain integrity of design, the major features of the powerhouse exterior must not have been overwhelmed by subsequent alterations or additions. Doubling the powerhouse in size with a modern addition, for instance, or significantly changing the overall shape and massing of the building, destroys its integrity of design.

Setting: The powerhouse must retain integrity of setting. Specifically, the powerhouse must still show a relationship to the natural enviroment that indicates its function as a hydroelectric plant. As the most important feature of a hydroelectric plant, the powerhouse will retain its integrity of setting even if it is the only structure of a plant still standing. If a powerhouse no longer functions, is no longer near water, and is surrounded and visually dominated by modern buildings, then its integrity of setting is lost.

Materials: The powerhouse must retain integrity of the majority of materials present during the period of significance. Major changes to features such as windows, massing, shape, and the exterior fabric of the building will cause it to lose integrity of materials.

Workmanship: If the powerhouse retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the powerhouse retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that a powerhouse will have been moved. If a powerhouse retains integrity of setting, then it retains integrity of location. If moved from its original site, a powerhouse no longer retains integrity of location.

I. Name of Property Types Hydroelectric Power Ancillary Structures

II. Description

Because of the nature of hydroelectric generation, power companies were required to erect ancillary structures for functions needed for the maintenance of or access to the hydroelectric plant. Such buildings and structures are a distinct property type within the hydroelectric plant. Included in the ancillary structures property type are buildings such as shops, storage buildings, barns, oil houses and coal sheds and structures such as major bridges. To be included, the building or structure must have a function associated with operation of the powerhouse or power plant system. (Automobile garages for personal use are included within the Operators' Camp Property Type.) Structures such as retaining walls, roads, fences, fuel tanks, tailrace ditches, and irrigation canals secondary to plant operation are not included in this property type and have not been counted as contributing or noncontributing.

In locating a hydroelectric power plant, engineers sought sites where fast-flowing, rapidly-descending streams could be diverted through turbines within a powerhouse. Most often, mountain streams ideally met the requirements for generation, especially in Utah as steep canyons in the Wasatch Mountains could be dammed and water diverted to powerhouses at lower elevations. (See Dam and Powerhouse Property Types for more information.) As electrical technology advanced, alternating current transmission lines allowed companies to construct their plants further from the site of generation. Therefore, power plants were generally situated in relatively isolated, mountainous areas often miles distant from existing urban centers. This meant that workers living at the plant needed tools and equipment with which to maintain the plant system and build and repair machinery. Employees and their families were also required to be somewhat self-sufficient, producing some food.

To house activities supporting power generation, power companies constructed a variety of buildings. As most power plants needed a place to repair and build machinery, shop buildings were erected. Storage buildings and garages provided space for equipment or repair materials, such as extra wood staves. As oil was used to cool transformers, as well as for lubrication, separate oil shed were sometimes erected near the powerhouse. Coal sheds stored fuel used to heat the powerhouses during cold weather. Because workers were required to inspect conduit often, sometimes covering long distances of difficult terrain, companies provided horses for transportation. Barns were erected to house the horses. At some stations, cows also utilized barns, as employees relied on cows for a fresh source of milk. Some families raised other domestic animals, such as pigs and chickens, which required the construction of pens and sheds.

Another structure which allowed workers greater freedom and access to the power plant were major bridges. By their nature, power plants were located near water. In some cases, surrounding geography limited choices for plant location and builders found it necessary to construct parts of the facility on either side of the stream. A good example is the Upper American Fork Plant. Squeezed into a narrow canyon between the stream and the canyon wall, planners were forced to situate the powerhouse across the American Fork River from the highway providing access to it and the residence. A bridge was then constructed to connect the powerhouse with access from the site.

Ancillary structures in a hydroelectric power plant are usually located near the powerhouse or within the operators' camp. Because their function was directly associated with powerhouse operations, shops, storage buildings, coal sheds, oil houses are most often situated close to the powerhouse. Barns could be erected within the operators' camp, as at Snake Creek, or at the edge of the compound as occurs at the Beaver Power Plant. Bridges also may exist within or on the periphery of the powerhouse site but most often are located near the powerhouse or operators' camp. Structures situated either at the dam or along the conduit are not considered in the Ancillary Structures Property Type. (See Hydroelectric Power Plant Dam and Conduit Property Types.)

Environmental considerations may have influenced the location of ancillary structures to hydroelectric power plants. Geographical features such as stream course and width of the canyon may have affected the positioning of these structures. Cultural factors, such as location of roads and the powerhouse, ownership of land and proximity to the operators' camp may have been considerations as well.

Ancillary structures--shops and storage buildings, for instance--generally have a common industrial design which standard architectural styles do not encompass. As interior space is an important consideration, such buildings are mostly rectangular-shaped without ornamentation. Ancillary structures, including bridges, may have a variety of building materials although brick, wood and metal are the most common. Sometimes the function of the building determines the building material. An example is the oil shed at the Pioneer Power Plant, which was constructed of brick because of the inflammable nature of oil. Most barns are wood-frame with wood siding though they may have other siding such as wood pipeline staves as does the barn at Upper Beaver Station. Storage structures and garages are mostly wood-frame and may have either wood or corrugated metal siding.

Several factors are likely to influence the physical condition of ancillary structures at hydroelectric power plants. The most obvious is the affect of weathering. Constant exposure to weather can cause such problems as wood rot, deteriorated concrete and crumbling brick. Because of their proximity to streams, ancillary structures can be damaged by floods. Throughout the years, the functions of ancillary structures may change and the new use may result in alterations to the structure. An example of this is the coal shed at the Snake Creek Power Plant which was converted into a sauna and then into a personal storage shed. It has a extension made of wire on its west side. Company neglect may also cause deterioration. As improved transportation tied power plants more closely with urban areas, power plant workers began to lose the need for self-sufficiency. Technological advances and automation lessened the need for constant maintenance and ancillary structures sometimes went unused. When structures such as storage buildings and garages no longer had a useful function, some companies, Utah Power and Light for example, "retired" them and stopped maintaining the structures.

Besides physical characteristics, important associative characteristics help to define hydroelectric power plant ancillary structures as a property type. Generally, hydroelectric power plant ancillary structures in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mention in the discussion of dams); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power plant ancillary structures might have associations with important developers, engineers or architects. Some facilities, for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power plant ancillary structures property type will likely be chosen according to two factors. First, a boundary for ancillary structures will probably encompass the area upon which the buildings sit. The boundaries will likely exclude structures and sites adjacent or nearby which are not related to the operation of the power plant. The second factor influencing the boundaries is that ancillary structures are probably integral to a hydroelectric generating facility as a whole. A hydroelectric power plant, consisting of the dam, conduit, powerhouse, operators' camp, and ancillary structures, may comprise a district. Thus, ancillary structures might be included within a larger district boundary that includes other structures.

III. Significance

Hydroelectric power plant ancillary structures built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Ancillary structures were an integral feature of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history.

Moreover, as parts of hydroelectric power plants, these structures were a prominent physical feature in an industry--electrical generation--important in its own right. Finally, as a key type of facility in the operation of hydroelectric power plants, ancillary structures help to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that ancillary structures can only have significance in terms of their relationship to a hydroelectric power plant as a whole. Ancillary structures were integral structures in an industrial complex which served to generate electricity. The most important feature of hydroelectric power stations was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for ancillary structures to have significance, they must still show a relationship to the powerhouse with which they were historically associated. Specifically, the powerhouse must still be standing and it must have integrity. If ancillary structure still exists but the powerhouse has been demolished or has lost integrity, then the camp can no longer represent the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) Ancillary structures may still be be eligible for the National Register under another context.

Given their special relationship to the powerhouse, ancillary structures may have significance under Criteria A, B, and C as follows:

Under criterion A, ancillary structures, as part of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportaion, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for ancillary structures because of their associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, ancillary structures have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, ancillary structures may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method (automation, for instance); the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Ancillary structures may also have associations with broad patterns of events--for example, an ancillary structure may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under Criterion B, hyroelectric power plant ancillary structures are eligible when associated with a significant person. Usually, ancillary structures will have significance in this situation because it was built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, ancillary structures might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Ancillary structures may also have significance because of their association with an influential engineer or architect. In any case, ancillary structures significant under Criterion B must best illustrate the individual's contributions to history.

Under Criterion C, ancillary structures will have significance because they represent the distinctive characteristics of a type, period, or method of construction, or because they represent the work of a master architect or engineer. Ancillary structures play a specific role in the operation of hydroelectric power plants. They can be distinguished from other components of such facilites not only by function but also by materials and structural form. Ancillary structures help illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and 1930s. Ancillary structures built within the period of significance can be made of various materials--such as brick or wood--and may feature one of several basic designs. Although ancillary structures may have various shapes and materials, storage buildings, garages, small shops, etc. constructed after about 1910 are often wood-frame, have a rectangular shape, a shed roof and are sided with corrugated metal.

In order to determine the significance of ancillary structures under Criteria A, B, and C, evaluation must consider three levels of significance: national, state and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, an ancillary structure must have physical characteristics, or have associations with events or persons that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, an ancillary structure has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a hydroelectric power ancillary structures may require more specific information about a locale than is included in this multiple property documentation form.

IV. Registration Requirements

The following requirements must be met for a hydroelectric power plant ancillary structure to be eligible for the National Register under criteria A, B, and C:

For criterion A:

1. The ancillary structure must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The ancillary structure must have been built within the

period of significance, 1883-1927.

For criterion B:

1. The ancillary structure must have qualities that associate it with the life of a significant person.

2. The ancillary structure must have been built within the period of significance, 1883-1927.

For criterion C:

1. The ancillary structure must generally conform to the Description of an ancillary structure provided in this form.

2. The ancillary structure must be generally composed of materials outlined in the Description.

3. The ancillary structure must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities. Specifically, it must be within the general vicinity of the powerhouse.

4. The ancillary structure must have been built within the period of significance, 1883-1927.

For integrity under criteria A, B, and C:

Location: Hydroelectric power plant ancillary structures must maintain their original location from the period of significance. It is possible that an ancillary structure could retain integrity of location if it was moved during the period of significance and reflected a technological improvement to the plant. A relocated ancillary structure may also be eligible if the new site replicates the original site. The new location must reflect the historic spacial relationship of the ancillary structure to the powerhouse.

Setting: Because the hydroelectric power plant ancillary structures are an integral component of an industrial complex, their setting--their relationship to the rest of the hydroelectric plant facilities--is critically important to its integrity. If an ancillary structure retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as ancillary structures to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Design: Ancillary structures must maintain integrity of the design evident during the period of significance. An ancillary structure may retain integrity of design if it has minor alterations which do not obscure its historic design, style, plan or function.

Materials: Ancillary structures must retain integrity of the majority of materials present during the period of significance. Buildings and structures often undergo periodic improvements and maintenance. These alterations do not detract from the integrity of materials if they do not overwhelm the original materials. For instance, asphalt shingles have replaced the wood-shingled roofs of most structures. This does not destroy integrity as the asphalt replicates the pattern of wood shingles.

Workmanship: If an ancillary structure retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If an ancillary structure retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

I. Name of Property Type Hydroelectric Power Plant Transmission Equipment

II. Description

Hydroelectric plants, although primarily for generating power, also include equipment which performs the separate but related function of transmitting electricity. Transmission equipment includes switches, transformers, switchracks, transformer houses (also called substation buildings), and transmission poles, towers, and lines.

After the turbine-generator units of a power plant create electricity, the electricity is passed through step-up transformers. These are heavy, usually cylindrical structures made of metal and sometimes covered with numerous radiator fins that serve to dissipate heat. Step-up transformers increase the voltage of electricity for transmission to substations, where the electricity is then passed through step-down transformers for distribution to consumers. Originally, transformers (and related equipment such as switches and bus bars) were installed inside the powerhouses or set up in adjacent transformer houses or substation buildings. Later advancements in transmission technology allowed the transformers and other equipment to be moved outside. There, power lines, transformers, switches, etc., where erected around a wood or steel structure called a switchrack. The switchrack and its related equipment, including the ground on which they sit, is called a switchyard.

Besides physical characteristics, important associative characteristics help to define hydroelectric power plant transmission equipment as a property type. Generally, transmission equipment at Utah hydroelectric plants is associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mentioned in the discussion of the various property types); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power plant transmission equipment might have associations with important developers or engineers.

Boundaries for a hydroelectric power plant transmission equipment property type will likely be chosen according to two factors. First, a boundary for such equipment as a distinct entity will probably encompass the area upon which it sits as well as some area on either side of it. Furthermore, the boundaries for transmission equipment (such as transformers) will likely exclude structures and sites adjacent or nearby and not related to the operation of the hydroelectric plant of which the equipment is part. The second factor influencing the boundaries for transmission equipment is that it is related to a hydroelectric generating station as a whole. A hydroelectric power plant, consisting of the dam, conduit, surge tank, penstock, powerhouse, operators' dwellings, and related structures, may comprise a district. Thus, transmission equipment will probably be included within a larger, district boundary that includes other structures. However, transmission lines outside of the general vicinity of a hydroelectric power plant complex, because they serve a different function than the generation of power, will not be included within the boundaries of a hydroelectric power plant complex (see registration requirements).

III. Significance

Hydroelectric power plant transmission equipment built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Transmission equipment was a feature of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, transmission equipment was a prominent physical feature related to an industry--electrical generation--important in its own right. Finally, as a technology related to the operation of hydroelectric power plants, transmission equipment helps to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that transmission equipment can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Transmission equipment was related to the operation of hydroelectric power plants, the most important feature of which was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for transmission equipment to have significance, it must still show a relationship to the historic powerhouse. Specifically, the powerhouse must still be standing and it must have integrity. If transmission equipment is still standing but the powerhouse is demolished or has lost integrity, then the transmission equipment no longer represents the historic associations of the hydroelectric plant to which it was related. (See the discussion of integrity in the registration requirements listed below.) Transmission equipment considered independent of its relationship to a hydroelectric plant may have significance under a context other than the development of hydroelectric power.

Given its special relationship to the powerhouse, transmission may have significance under Criteria A, B, and C as follows:

Under criterion A, transmission equipment, as parts of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportation, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for transmission equipment (as part of a hydroelectric plant) because of its associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, transmission equipment has further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As a related part of hydroelectric power plants, transmission equipment may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state. Transmission equipment may also have associations with broad patterns of events--for example, they may be related to a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under criterion B, transmission equipment is significant when associated with significant persons. Usually, transmission equipment will have significance in this situation because it was part of a facility built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, transmission equipment might have significance because of its association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Transmission equipment may also have significance because of its association with an influential engineer. In any case, transmission equipment (as a feature related to a hydroelectric plant complex) that is significant under criterion B must best illustrate the individual's contributions to history.

Under criterion C, transmission equipment will have significance because it represents the distinctive characteristics of a type, period, or method of construction, or because it represents the work of a master engineer. Transmission equipment performs a function related to the operation of hydroelectric power plants. Transmission equipment is distinguished from other components of such facilities not only by function but also by materials and structural form. Transmission equipment helps to illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and the 1930s. Transmission equipment built within the period of significance can be made of various materials and can appear in different sizes.

In order to determine the significance of transmission equipment under criteria A, B, and C, evaluation must consider three levels of significance: national, state, and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, transmission equipment (as part of a hydroelectric plant) must have physical characteristics, or have associations with events or persons, that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, transmission equipment has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of transmission equipment may require more specific information about a locale than is included in this multiple property documentation form.

Of the known hydroelectric power plants in Utah, few have the majority of their transformers and related equipment located inside the powerhouse. Virtually all of the plants now feature modern, outdoor switchracks built after the period of significance. A good example of such a facility is the Upper Beaver Plant in Beaver County. The Beaver powerhouse was designed to house transformers and switches as well as generating machinery. Now, however, the modern transformers and switchrack are located outside. An example of a station that was designed to have the switchrack outside is Cutler. The Cutler switchrack is a large structure made of steel lattice. It is a striking feature which contributes to the overall feeling of the Cutler Plant Historic District. Some plants, such as Snake Creek, Granite, and Fountain Green, have substation buildings that in materials and architectural style resemble the adjacent powerhouses. None of these buildings still serves its original function, but each still represents important associations of the hydro plants to which they contribute.

Most hydroelectric power plants have transmission lines somewhere on the powerhouse grounds. Often made of wood with the wires strung between, transmission poles can often be made of steel, in which case they are called towers. Transmission lines serve an entirely different function than the rest of a hydroelectric power plant, including transformers and switchgear, which in some ways serve an intermediary function between generation and transmission. Because they serve an entirely different function, transmission lines will generally not be counted as features within a hydroelectric power plant complex.

Registration Requirements

The following requirements must be met for a hydroelectric power plant's transmission equipment to be eligible for the National Register under Criteria A, B, and C:

For Criterion A:

1. The transmission equipment must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The transmission equipment must have been built within the period of significance, 1883-1927.

For Criterion B:

1. The transmission equipment must have qualities that associate it with the life of a significant person.

2. The transmission equipment must have been built within the period of significance, 1883-1927.

For Criterion C:

1. The transmission equipment must represent the basic physical characteristics outlined in the Description.

2. The transmission equipment must be composed of materials outlined in the Description.

3. The transmission equipment must have functioned in relation to a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities.

4. The transmission equipment must have been built within the period of significance, 1883-1927.

For integrity under Criteria A, B, and C:

Design: The transmission equipment must maintain integrity of the design evident during the period of significance. Transmission equipment that has been altered so that it no longer resembles the type of transmission equipment that it was originally no longer retains integrity of design. For example, if a switchyard has been altered to serve a different transmission system such that the components of the switchyard no longer resemble their original configuration, then the switchyard lacks integrity of design. On the other hand, a substation building that has its transmission equipment removed from its interior but that still retains integrity as a building, still exhibits integrity of design.

Setting: Because hydroelectric power plant transmission equipment is related to an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facility--is critically important to its integrity. If transmission equipment retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as transmission equipment to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Materials: The transmission equipment must retain integrity of the majority of materials present during the period of significance. Thus, if a switchrack originally made of wood has been replaced with a modern steel structure, then the switchyard in which it sits probably lacks integrity of materials.

Workmanship: If the transmission equipment retains integrity of design and materials, then it will retain integrity of workmanship.

Feeling and Association: If the transmission equipment retains its integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

Location: It is not expected that transmission equipment will have been moved. If transmission equipment retains integrity of setting, then it retains integrity of location. If moved from one hydroelectric plant to another, transmission equipment no longer retains integrity of location.

I. Name of Property Type Hydroelectric Power Plant Operators' Camp

II. Description

Because of the nature of hydroelectric generation, power companies were compelled to provide housing for their workers at the powerhouse site. The small communities which formed became known as operators' camps and are a distinct property type within a hydroelectric plant. Included in the operators' camp property type are one or more workers' residences, sheds and outbuildings used for personal property and landscaping details. For the purposes of a National Register nomination, the sheds and garages of operators will be considered as ancillary structures to the residences.

In locating a hydroelectric power plant, engineers sought a site where fast-flowing, rapidly-descending streams could be diverted through turbines within a powerhouse. Most often, mountain streams ideally met the requirements for generation, especially in Utah as steep canyons could be dammed and water diverted to powerhouses at lower elevations. (See Dam and Powerhouse Property Types for more information.) As electrical technology advanced, alternating current transmission lines allowed companies to construct their plants further from the site of generation. Therefore, power plants were generally situated in relatively isolated, mountainous areas often miles distant from existing urban centers. Once constructed, power stations needed constant attention to insure continuous and controlled power production. Among other tasks, workers measured the amount of water entering the plant, checked conduit for leaks, regulated electricity entering the transmission system and maintained the entire operation. Much of this work required skilled and trained personnel.

To attract qualified workers and insure round-the-clock plant operation, hydroelectric firms built housing for their employees at plant sites. Comfortable living conditions guaranteed a relatively stable, skilled labor force and was thought to promote a greater sense of loyalty among workers to the company. Workers also benefited from company housing. They secured improved living quarters close to their place of employment and were able to bring their families with them.

The camps which hydroelectric firms constructed shared some general characteristics. The company retained ownership of the residences and rented them to workers, usually at a substantially reduced rate. Services and utilities--such as electricity, gas, sewer and water--were the responsibility of the company, as was maintenance of the houses, streets and grounds. Houses were often erected on large lots. Particularily in the twentieth-century, some companies made a concerted effort to make their camps attractive by landscaping the grounds with terraced rockwork, flowers and street lamps. Because of their location near water, most hydroelectric plants had numerous shade trees and green lawns.

Operators' camps are located directly adjacent to or within walking distance of the powerhouse, the main site of worker activity. Occasionally, a dam tender's residence was situated at the dam, as at the Weber Power Plant, but such structures are considered outside of the operators' camp. Because powerhouses usually were located in mountainous regions near a significant water source, hydroelectric power plant camps are generally found near water in or at the mouth of Utah's steep canyons. These geographic features influenced the site and configuration of the camps. In Utah's narrow canyon bottoms, residences are often squeezed between the stream and a steep canyon wall, as is the Upper American Fork Power Plant.

Geographic and cultural factors also may have influenced the configuration of the camps. Most operators' camps have a row of residences, as at Cutler, or are grouped around a central lawn area, as exists at Beaver. Physical limitations of the site often dictate the camp layout. Social values also affected camp configuration. At some plants, the superintendent's residence may be somewhat separated from the workers' cottages or have a larger or more elaborate style. A good example of this is the brick superintendent's house at the Pioneer Plant which is much larger and exhibits the relatively ornate Queen Anne style as opposed to the smaller and simpler wood-frame operators' cottages. To provide a more pleasing view, houses were almost always constructed facing the water--as the Cutler Power Plant cottages do--or a central park area, as do the dwellings at the Beaver Power Plant. Contemporary design and landscaping ideas may have affected camp layout. Again, a good example of this is the Beaver Power Plant which was probably designed by an architect influenced by the idea of a pastoral suburb. Its curving driveway around a central park area and Craftsman-style buildings are elements of a popular design used in suburbs at the time.

Within the operators' camp, residences may exhibit any architectural design contemporary to the time of construction. For instance, the original 1897 superintendent's house at the Pioneer Plant has a Queen Anne style, reflecting its date of construction. Many of the early twentieth-century plants have houses with Craftsman-style elements. However, most power plant residences have a simple design which is typical of company housing in general. In his 1920 book, Housing by Employers in the United States, Leifur Magnusson found that "the typical company house was a single or detached frame house..." and that the most common style was the "small four-room hip-roofed frame cottage or bungalow." Residences such as these are particularily prevalent in Utah's hydroelectric power plant camps after 1915 when control passed to Utah Power and Light. Company villages seldom employed numerous individual architectural styles. Usually houses with a similar design, if not identical, were constructed, thus giving company-owned towns a distinctive uniform appearance. This uniformity, often accentuated by building rows of identical cottages, may be the most prominent characteristic of operators' camps.

Building materials for camp residences may vary depending on time of construction. But because companies wanted to limit the cost, the most common material is wood. Earlier plants did have brick houses--such as the Granite Power Plant--but twentieth-century camps, especially, contained wood-frame dwellings with either drop or shingled siding.

Several factors are likely to influence the physical condition of operators' camps. The most obvious is the affect of weathering. Constant exposure to weather can cause such problems as wood rot, deteriorated concrete and crumbling brick. Because of their proximity to streams, operators' residences can be damaged by floods, as has occurred at both the Granite Station and Weber Plant. Throughout the years, cottages may have been "improved," most commonly with the addition of asbestos siding and extensions or replaced windows. In some cases, these alterations will affect the physical condition of the structure. An example is the camp at the Cutler Power Station, where houses have been sided with asbestos shingles and now suffer from moisture problems. Company neglect may also cause deterioration. As better transportation allows workers to commute to the stations and plant automation requires fewer workers, more camp residences are becoming vacant. When houses are no longer used, companies such as Utah Power and Light "retire" them and stop maintaining the structures.

Besides physical characteristics, important associative characteristics help to define hydroelectric power operators' camps as a property type. Generally, hydroelectric power operators' camps in Utah are associated with the overall development of hydroelectric power in Utah between 1883 and 1927. Important events during the period include the development and evolution of hydroelectric power technology and systems (some of these already mention in the discussion of dams); the establishment and growth of hydroelectric power companies; the development of industries (mining, streetcar systems, etc.) associated with the hydroelectric power industry; and the growth of towns and cities which consumed power generated from hydroelectric plants. In addition, Utah's hydroelectric power camps might have associations with important developers, engineers or architects. Some facilities, for instance, were constructed under the auspices of L.L. Nunn, one of the most important hydroelectric power developers in the Rocky Mountains during the late nineteenth and early twentieth centuries.

Boundaries for a hydroelectric power operators' camp property type will likely be chosen according to two factors. First, a boundary for an operators' camp will probably encompass the area upon which the camp sits, including adjacent landscaping elements. The boundaries will likely exclude structures and sites adjacent or nearby which are not related to the operation of the camp and structures not owned by the power company. The second factor influencing the boundaries is that it is probably integral to a hydroelectric generating faciality as a whole. A hydroelectric power plant, consisting of the dam, conduit, powerhouse, operators' camp, and related structures, may comprise a district. Thus, operators' camps might be included within a larger district boundary that includes other structures.

III. Significance

Hydroelectric power plant operators' camps built during the period of significance may have associations with aspects of the overall historic context of hydroelectric power development in Utah. Camps were an integral feature of hydroelectric power plants, facilities which supplied electricity to various industries and cities important in Utah's history. Moreover, as parts of hydroelectric power plants, camps were a prominent physical feature in an industry--electrial generation--important in its own right. Finally, as a key type of facility in the operation of hydroelectric power plants, camps help to illustrate the evolution of hydroelectric power technology during the period of significance.

It is important to consider, however, that operators' camps can only have significance in terms of its relationship to a hydroelectric power plant as a whole. Operators' camps were integral structures in an industrial complex which served to generate electricity. The most important feature of hydroelectric power stations was the powerhouse, because it was there that actual power generation took place. In this sense, all the other components of a hydroelectric plant were ancillary to the powerhouse. Therefore, in order for an operators' camps to have significance, it must still show a relationship to the powerhouse with which it was historically associated. Specifically, the powerhouse must still be standing and it must have integrity. If an operators' camp still exists but the powerhouse has been demolished or has lost integrity, then the camp can no longer represent the historic associations of the hydroelectric plant of which it was part. (See the discussion of integrity in the registration requirements listed below.) An operators' camp may still be eligible for the National Register under another context, such as the development of company towns.

Given its special relationship to the powerhouse, operators' camps may have significance under Criteria A, B, and C as follows:

Under criterion A, operators' camps, as part of hydroelectric power plants, help to represent the overall development of the hydroelectric power industry in Utah between 1883 and 1927. During that time, events important to the broad patterns of Utah's history, particularly urbanization and industrialization (such as mining), took place. By offering markets for power companies, these events were important in the growth of the hydroelectric power industry. In turn, hydroelectric plants were important to these broad patterns, because they generated relatively cheap electricity for factories, businesses, transportaion, lighting systems, and individual consumer uses. Careful research and evaluation will be necessary to establish significance for operators' camps because of their associations with these broad patterns. More specific contexts for each event or pattern of events, such as mining, may need to be defined.

Under Criterion A, operators' camps have further significance because they help to illustrate important events in the development of just the hydroelectric power industry. As part of hydroelectric power plants, operators' camps may reflect specific events, such as: the introduction of a new, later widely-used type of technology or engineering method; the construction of a plant important to Utah's hydroelectric power industry; or the application of particular types of business methods and organization that represent major changes in the development of the hydroelectric power industry in the state, such as ideas of welfare capitalism or community planning. Operators' camps may also have associations with broad patterns of events--for example, an operators' camp may be part of a hydroelectric power plant which consistently generated the most power of any facility in Utah over a prolonged period.

Under Criterion B, operators' camps are eligible when associated with a significant person. Usually, operators' camps will have significance in this situation because it was built by a major hydroelectric power entrepreneur such as L.L. Nunn. Or, operators' camps might have significance because of their association with an important industrialist in general, such as E.H. Harriman or Jesse Knight. Operators' camps may also have significance because of their association with an influential engineer or architect. In any case, operators' camps significant under Criterion B must best illustrate the individual's contributions to history.

Under Criterion C, operators' camps will have significance because they represent the distinctive characteristics of a type, period, or method of construction, or because they represent the work of a master architect or engineer. Operators' camps play a specific role in the operation of hydroelectric power plants. They are distinguished from other components of such facilites not only by function but also by materials and structural form. Operators' camps help illustrate the history of hydroelectric power engineering and technology in Utah between the 1880s and 1930s. Residences in operators' camps built within the period of significance can be laid out in different configurations, made of various materials--such as brick or wood--and may feature one of several basic designs. Although residences may exhibit elements of a variety of architectural styles, in general, dwellings constructed before 1900 have Victorian stylistic elements while those erected after 1900 tend to reflect the Craftsman or bungalow styles. The most common house is a rectangular, hip roofed, wood-frame cottage.

In order to determine the significance of operators' camps under Criteria A, B, and C, evaluation must consider three levels of significance: national, state and local. At present, this multiple property documentation form is best suited to evaluate properties on the state and local levels. In order to have significance in a statewide context, an operators' camp must have physical characteristics, or have associations with events or persons that illuminate major themes (such as the development of hydroelectric power) in Utah's history. On the local level, an operators' camp has local significance if its physical characteristics or historic associations are important within a local setting. Assessing the local significance of a hydroelectric power operators' camp may require more specific information about a locale than is included in this multiple property documentation form.

IV. Registration Requirements

The following requirements must be met for a hydroelectric power plant operators' camp to be eligible for the National Register under criteria A, B, and C:

For criterion A:

1. The operators' camp must have associative qualities that link it historically to events important to the context of hydroelectric power development in Utah.

2. The operators' camp must have been built within the period of significance, 1883 and 1927.

For criterion B:

1. The operators' camp must have qualities that associate it with the life of a significant person.

2. The operators' camp must have been built within the period of significance, 1883 and 1927.

For criterion C:

1. The operators' camp must generally conform to the Description of an operators' camp provided in this form.

2. The operators' camp must be generally composed of materials outlined in the Description.

3. The operators' camp must have functioned as a component of a hydroelectric power plant. Therefore it must exhibit characteristics that indicate its relationship to other hydroelectric power plant facilities. Specifically, it must be within the general vicinity of the powerhouse.

4. The operators's camp must have been built within the period of significance, 1883 and 1927.

For integrity under criteria A, B, and C:

Location: The operators' camp and its structures must maintain its original location from the period of significance. It is possible that a camp could retain integrity of location if it was moved during the period of significance and reflected a technological improvement to the plant. However, these instances are probably rare in Utah. Within the camp, relocated structures may be eligible if the new site replicates the original site. For instance, the three cottages at the Pioneer Plant, moved in 1968, are still contributing elements because they were placed in a row behind the superintendent's house. Their new location reflects their historic spacial relationship to the powerhouse and other camp residences. Positioning of the structures also retained the characteristics and general configuration of an operators' camp.

Setting: Because the hydroelectric power operators' camp is an integral component of an industrial complex, its setting--its relationship to the rest of the hydroelectric plant facilities--is critically important to its integrity. If an operators' camp retains its integrity of design, materials, and workmanship, but is the only remaining feature of a hydroelectric power complex, then it no longer retains its integrity of setting as a property type that represents the larger historic associations of the hydroelectric power plant of which it was a part. In general, the powerhouse--the place at which actual power production occurred--must still exist in order for property types such as operators' camps to convey historic associations under the hydroelectric power development context (see the Hydroelectric Power Plant Powerhouse property type).

Design: The operators' camp and its structures must maintain integrity of the design evident during the period of significance. The camp, as well as individual buildings within it, may retain integrity of design if it has minor alterations which do not obscure its historic design, style, plan or function. However, the overall historic configuration of the camp, as well as the historic form of the structures, must still be evident.

Materials: The operators' camp and its structures must retain integrity of the majority of materials present during the period of significance. Residences and structures often undergo periodic improvements and maintenance. These alterations do not detract from the integrity of materials if they do not overwhelm the original materials. For instance, asphalt shingles have replaced the wood-shingled roofs of most structures. This does not destroy integrity as the asphalt replicates the pattern of wood shingles. In some cases, the integrity of materials may be seriously compromised yet the building can still be a contributing element to a district. An example is the cottages at the Cutler Plant. Originally wood-sided, the dwellings have been re-sided with asbestos shingles. However, the cottages are all contributing because as a row of identical company-built houses, their most important features are a uniform appearance and an identical plan, massing and style. The integrity of the overall camp, therefore overrides compromised historic materials on individual dwellings.

Workmanship: If the operators' camp and its structures retain integrity of design and materials, then they will retain integrity of workmanship.

Feeling and Association: If the operators' camp and its structures retain their integrity of design, setting, and materials, then in general integrity of feeling and association will remain intact.

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

(see continuation sheet)

x See continuation sheet

H. Major Bibliographical References

(see continuation sheet)

x See continuation sheet

Primary location of additional documentation:

- x State historic preservation office
- ___ Other State agency
- ___ Federal agency
- ___ Local government
- x University
- x Other

Specify repository: University of Utah, Marriot Library
Utah Power and Light Company, Central files

I. Form Prepared By

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This multiple property listing, entitled "Electric Power Plants of Utah," initially includes twelve hydroelectric power plants owned by the Utah Power and Light Company. These twelve plants are virtually all of the hydroelectric power plants pre-dating 1939 that UP&L operates in the State. Utah Power and Light's purpose in preparing the multiple property listing is to provide a basis for future management decisions and to comply with the Section 106 process.

The survey of UP&L's historic hydroelectric power plants involved several steps. First, previous documentation of four of the company's hydroelectric plants was reviewed. Second, the files of the Utah State Historic Preservation Office were gleaned for information about other hydro stations and for other relevant information. Four plants, including two owned by UP&L, have been documented to varying degrees. Two have been listed in the National Register.

Third, the HAER CHECKLIST: 1969-1985 was consulted. Seven hydroelectric plants have been documented in varying levels according to HAER standards. Three of these are UP&L plants. However, the HAER information was not consulted, primarily because copies of the data are not kept by the Utah SHPO. In addition, copies were not ordered from HAER because of time constraints and because the amount of available written information probably would not have contributed significantly to the compilation of the multiple property documentation form.

Fourth, research was conducted in several repositories, including the Utah State Historical Society, Marriott Library at the University of Utah, and various departments of the Utah Power and Light Company. Sources consulted included measured drawings, historic photographs, company records, engineering journals, reports, theses, books, articles, and other secondary materials. Information gathered from research was used to document individual plants and create a background context with which to evaluate the significance of the plants.

Finally, hydroelectric power plants were visited to collect on-site data, including field descriptions, photographs and interviews with plant operators and other individuals. Twelve UP&L hydroelectric plants were documented to the degree (field notes and photographs) necessary to complete National Register documentation forms. Eight additional plants, only one operated by UP&L, were visited in order to provide a broader understanding of historic hydroelectric power plants in Utah.

The historic context used to evaluate the twelve UP&L hydroelectric power plants was prepared to provide as broad a background as possible. Indeed, this was necessary because the twelve plants vary in size and sophistication, were built anywhere between the mid-1890s and the late 1920s, were built by numerous companies for a variety of purposes, and are located throughout the entire state. Because of these factors, and anticipating that the multiple property documentation form might be used again in the future by UP&L or other entities, the geographic scope of the historic context was determined to be the entire state of Utah. This broad scope was also chosen for administrative purposes. The theme of the context, development of hydroelectric power plants, was chosen because hydroelectric power plants are a unique type of electrical generating technology that played an important part in the second industrial revolution of the late nineteenth and early twentieth centuries. The period of significance, 1883-1939, was chosen because that period essentially covers all of the events that explain the rise and maturation of the hydroelectric power industry in Utah, outside of the last fifty years. The most valuable sources used in compiling the historic context were those by McCormick, UP&L, and Dastrup. McCormick's work was a concise statement and analysis of the history of the electrification of Utah. Secondary sources on the economic history of Utah were valuable, particularly the work edited by May. (See bibliography for full citations.)

Property types associated with the context of hydroelectric development in Utah were delineated according to function. Hydroelectric power plants usually include a number of related, integral features, such as dams, water delivery systems (including pipelines, canals, flumes, and penstocks), surge tanks, powerhouses, and operator's dwellings. Each of the prinicipal features in a hydroelectric plant performs a specific function. As well, each feature has a distinctive design and material composition. Dividing the significant property types according to function provided a basis for efficiently and systematically evaluating significance and integrity.

Integrity requirements were based on the National Register standards for evaluating integrity. These standards were elaborated to address the integrity of the property types. Requirements for integrity were also based on knowledge of the condition of existing properties and an understanding of the function and operation of the properties and how these factors affect integrity.

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