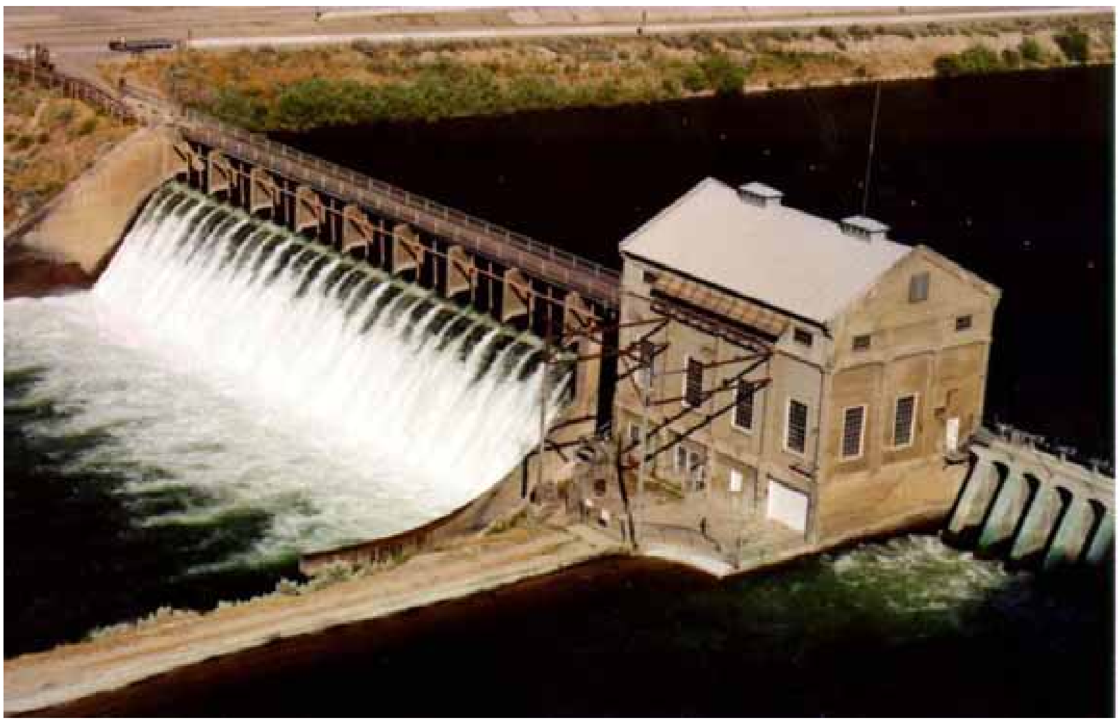
Potential Hydroelectric Development at Existing Federal Facilities

For Section 1834 of the Energy Policy Act of 2005



May 2007

Potential Hydroelectric Development at Existing Federal Facilities

For Section 1834 of the Energy Policy Act of 2005

prepared by

U.S. Department of the Interior
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
National Park Service
Fish and Wildlife Service

U.S. Department of the Army
U.S. Army Corps of Engineers

U.S. Department of Energy
Bonneville Power Administration
Southeastern Power Administration
Southwestern Power Administration
Western Area Power Administration

May 2007

Contents

Tables

Figures

Executive Summary

This report complies with Section 1834 of the Energy Policy Act of 2005[1] (Section 1834) that requires the Secretary of the Interior, the Secretary of the Army, and the Secretary of Energy to "jointly conduct a study assessing the potential for increasing electric power production at federally owned or operated water regulation, storage, and conveyance facilities." The study participants included select staff of the Bureau of Reclamation, the U.S. Army Corps of Engineers, the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service, the U.S. Fish and Wildlife Service, the Western Area Power Administration, the Southeastern Power Administration, the Southwestern Power Administration, and the Bonneville Power Administration.

The study examined 871 existing federal facilities, with and without hydroelectric generating capability, assessing their physical capacity for generation or generation expansion and their economic viability based on comparisons with regional electric power rates. The report does not include any assessments of lands not under federal domain or consider new dam construction. In addition, the study participants developed and included assessment tools for generating capacity and economic viability that may be used and updated for future use.

Based on current economic conditions, the report only found potentially viable sites at facilities owned by the U.S. Army Corps of Engineers and the Bureau of Reclamation. The Bureau of Reclamation found six sites that could demonstrate both physical and economic conditions sufficient to warrant further exploration for additional hydropower development. The U.S. Army Corps of Engineers identified 58 sites based on similar criteria. The total additional capacity at these sites is estimated to be 1,230 MW—enough to serve over 957,000[2] residences. In addition, there are opportunities for refurbishment of some facilities with existing hydropower, which could result in the addition of approximately 1,283 MW of generating capacity.

No recommendations for development are offered from this report. Rather, the report only attempts to give a broad inventory and assessment of future hydropower development at federal facilities under the jurisdiction of the participating agencies. Hydropower development on federal lands is a program with a nearly century-long history. Most of the economically attractive sites have long since been developed and continue to play an integral part of the Nation's electric power grids. This report offers an assessment of new generation opportunities that may remain. The development of any site or project identified

---

[1] PL 109-58, the Energy Policy Act of 2005, enacted August 8, 2005

[2] Based on the Energy Information Agency's reported average residential monthly energy use of 938 kwh.

in this report would require a more comprehensive review of the environmental, economic and social impacts under the National Environmental Policy Act (NEPA) and/or compliance with the requirements of the Federal Power Act.

An electronic copy of this report is available at www.usbr.gov/power.

Introduction

This report complies with Section 1834 of the Energy Policy Act of 2005[3] (Section 1834) that requires the Secretary of the Interior, the Secretary of the Army, and the Secretary of Energy to "jointly conduct a study assessing the potential for increasing electric power production at federally owned or operated water regulation, storage, and conveyance facilities." The study identifies sites that have potential, with or without modification, of producing additional hydroelectric power for public consumption. This excludes power used exclusively for irrigation pumping or similar "project use" loads. The report also includes a discussion of rehabilitating and uprating existing power generating units. Pumped storage facilities were not examined in this report. Such an examination would have been outside the budget and time frame allowed for the report. The text of Section 1834 is given in appendix 1.

This report reflects the *historical and current* use of water in the storage projects. Water storage reallocations for municipal and industrial (M&I) water supply, recreation, and endangered species mitigation/protection continually reduce hydroelectric power production at existing hydropower projects. Furthermore, the future need for M&I water supply, recreation and endangered species mitigation/protection has the potential to reduce any future electric power production as well.

The report contains no recommendations. Rather, it identifies a set of candidate sites based on explicit criteria chosen to be sufficiently general so as to address all sites equally across the geographically broad scope of the report. The report contains only a very limited analysis of environmental and other potential constraints at the sites. The report must not be construed as advocating development of one site over another or any other site-specific support for development. Preliminary site-specific power and economic data have been developed using very broad criteria. Lastly, the report offers two "open source" software tools developed by the Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (USACE) for the study that may be useful for future initial assessments of hydroelectric sites.

[3] PL 109-58, the Energy Policy Act of 2005, enacted August 8, 2005.

Study Participants

Pubic Law 109-58 required that the Secretaries of the Interior, Energy, and the Army complete this effort. In doing so, the Secretary of the Interior served as the lead with individual agencies and bureaus within each Department providing staff to prepare this report. The U.S. Army Corps of Engineers represented the Department of the Army. The Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), National Park Service (NPS), and the Fish and Wildlife Service (FWS) represented the Department of the Interior (DOI). The Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA), and Western Area Power Administration (WAPA) represented the Department of Energy. This report has been reviewed and approved by all three Departments.

Objectives

The following specific objectives were established for the report:

1. Analyze and define the current federal inventory of hydroelectric power-generating facilities and their existing capabilities.

2. Assess the physical potential for increasing hydroelectric power capacity and generation at those federal facilities along with the feasibility of increasing the reliability of the government-owned and -operated power-generating facilities through the rehabilitation and uprating programs.

3. Determine the economic viability of increasing hydroelectric generation capacity by adding generation facilities to existing water resources projects, or by increasing the reliability and efficiency of existing hydroelectric power plants and systems.

4. Report to Congress the current state of the federal hydropower infrastructure and the economically viable opportunities for future hydroelectric power development and major rehabilitations.

Previous Studies

Efforts to identify new or nontraditional sources of hydroelectric power are not new, and the Section 1834 request is only the latest in a series that dates back three decades. Several previous reports provided information and analyses on potential new hydroelectric generation in the West and nationwide. The energy crisis of 1973 led to an increased effort to identify renewable energy sources. The 1976 Public Works Appropriations Act provided funds for the Bureau of Reclamation to complete the Western Energy Expansion Study (Reclamation, 1977a). This study identified and evaluated opportunities for increased electrical power production in Reclamation's 17 Western States. Its focus was on the development of power, including pumped storage, at new sites and existing facilities. Some of its conclusions included the immediate and cost effective advantage of upratings at existing facilities and the role of hydropower in supporting other intermittent renewable energy sources such as wind and solar power.

In 1980 and beyond, the Water and Power Resources Service[4] contracted with Tudor Engineering to produce a series of reports on small and low-head hydroelectric development, which received appropriations through the 1979 Public Works Appropriations Act. Phase I of these reports was titled, *Report on Assessment of Small Hydroelectric Development at Existing Facilities* (WPRS, 1980a). The Water and Power Resources Service examined 159 of its sites and found 37 sites to be economically feasible and compatible with social and environmental concerns with respect to hydropower development. Phase II of this effort produced *Western States: Inventory of Low-Head Hydroelectric Sites* (WPRS, 1980b). Combining an early inventory of hydroelectric sites compiled by the U.S. Army Corps of Engineers with the results in Phase I resulted in 7,201 sites which, when screened for various physical, economic, and environmental characteristics, produced 2,628 low head hydroelectric sites with a combined capacity of slightly over 50,545 megawatts (MW).

Phase III, *Report on Assessment of Low-Head Hydroelectric Sites in the Western States* (Reclamation, 1982), conducted site-specific studies of 86 sites identified in Phase II, including preliminary design, cost estimates, economic analyses, and environmental and social impact assessments. The studies in Phase III are in addition to the 159 sites examined in Phase I. The procedures used in Phase III were generally equivalent to appraisal-level studies but without the associated public involvement processes. Individual site reports are included in State-by-State appendix volumes.

Possibly due to relatively low fuel costs throughout the 1980s and early 1990s combined with increased environmental and community opposition to hydroelectric development, there had been no significant requests to inventory remaining hydropower development until the Energy Policy Act of 2005 (EPAct). Section 1840 of the EPAct required the Bureau of Reclamation to develop a report "identifying and describing the status of potential hydropower facilities included in water surface storage studies . . . for projects that have not been completed or authorized for construction." The report, *Inventory of Reclamation*

[4] The Bureau of Reclamation was called the Water and Power Resources Service between November 6, 1979 and May 20, 1981.

Water Surface Storage Studies with Hydropower Components (Reclamation, 2005) listed approximately 500 projects where hydropower was a component and the projects had not been completed or authorized for construction.

With the exception of the last report, all previous examinations of DOI hydropower potential shared similar methods, albeit to varying degrees of detail. They generally amassed a population of sites, reduced the usable sites through a series of screens—usually physical, environmental, and social—and then assessed the remaining sites on economic or other electricity marketing criteria. Similar methods are used in this report.

Similarly, the U.S. Army Corps of Engineers published the 23-volume *National Hydroelectric Power Resources Study* (1983). This comprehensive study identified all the best candidate sites for potential hydropower development in all 50 States and Puerto Rico. It was a 3-year study that was appropriated $7 million for completion and included both federal and nonfederal sites including completely undeveloped natural ones. The USACE report identified the best candidate sites with existing and undeveloped projects, categorized by North American Electric Reliability Council regions, and locations with existing and undeveloped projects while screening for physical potential, economic feasibility, environmental and marketing constraints, and short-term versus long-term potential. In addition, the USACE updated this 1983 study with the *Directory of Corps Projects with Existing Hydroelectric Power Facilities and/or the Potential for the Addition of Hydroelectric Power* (1988). This 1988 directory was limited to addressing only those sites that were owned by the USACE, and relied mainly on the 1983 study. In that study, the USACE identified 261 facilities with the potential for additional or new capacity of over 6,100 MW.

These two USACE studies, along with a recent update of the 1988 study as well as a recent BPA Hydropower Expansion Evaluation, provided the bulk of the USACE's information sources for this report to Section 1834 of the Energy Policy Act.

Data Collection

Sections 1834(a) and (b) call for the report to study the potential federal facilities that are capable, with or without modification, of generating hydroelectric power. The study group defined "facilities" to include dams with existing hydroelectric generation capability, dams without existing hydroelectric generation capability, and water conveyance facilities with significant head such as canal drops or other pipeline features. "Modifications" include installing additional generation at a facility that currently has generation or installing new generation at existing dams or conveyance structures. In addition, a review of rehabilitation and uprating programs is included for agencies that have an active program to upgrade existing generation.

Data for facilities capable of generating hydroelectric power were obtained from bureaus within the Department of the Interior and the Hydropower Analysis Center of the U.S. Army Corps of Engineers. No facility data were obtained from the Department of Energy's power marketing agencies (PMAs) as they do not own or operate generation facilities—the PMAs are only responsible for marketing federal power. The Department of the Interior asked the BIA, BLM, FWS, NPS, and Reclamation to review all facilities with greater than 10 feet of head.[5] Of those sites with more than 10 feet of head, the BLM lacked a 1-year or longer hydrologic record that was required for future analysis. Many of the BLM's dams are used as stock ponds or for related agricultural and erosion control purposes. These types of dams typically do not have high flow or head that would justify hydroelectric development. Likewise, some of their dams were inherited from previous land management agencies and therefore had inadequate records for hydroelectric evaluation purposes. Consequently, there are no submissions from BLM.

Hydroelectric development is not compatible with the NPS mission. In fact, at this time, the NPS has two dams with hydroelectric generation that are slated for either decommissioning or removal. The mission of the NPS, as provided for in the National Park Service Organic Act of 1916, is to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. Congress further directed that the NPS authorization of activities within units of the National Park System will not be exercised in derogation of the values and purposes for which the various areas have been established, except as specifically provided for by Congress. While hydroelectric dams do occur in park units, they have been specifically authorized by Congress and are owned and operated by other entities. Exceptions to this are the Elwha and Glines Canyon hydroelectric dams in Olympic National Park, whose purchase by the NPS was authorized by Congress with the express intent that the dams be removed. Adding new or increased hydroelectric capacity to dams within units of the National Park System is inconsistent with the NPS mission. Therefore, no NPS facilities are identified in this report for consideration.

Like the NPS, hydropower development is also inconsistent with the FWS's land use mandates. Furthermore, the FWS reported they had no facilities that would have qualified for the minimum hydraulic head of 10 feet. Therefore, no FWS facilities are identified in this report.

---

[5] Hydropower experts within the study group concluded that it was unreasonable to expect a site with less than 10 feet of head to be capable of a capacity of 1 MW (the initial selecting criterion) in any but the most extraordinary hydrologic conditions.

Within the Department of the Interior, the BIA and Reclamation were able to identify sites for potential hydroelectric development. The BIA was able to identify a population of over 120 sites. This initial population can be found in appendix 2a. Likewise, Reclamation was able to identify approximately 530 sites, the majority of which were in Reclamation's Great Plains and Upper Colorado Regions. All of these selected sites were then introduced to three levels of screening to reduce the populations to a set of physically promising sites whose unit production and capital recovery costs could then be compared to regionally estimated wholesale electric power rates. These sites are also listed in appendix 2a.

The USACE mainly relied on previous studies to identify their initial viable sites. The *National Hydroelectric Power Resources Study* (USACE, 1983) , subsequent 1988 *Directory of Corps Projects with Existing Hydroelectric Power Facilities and/or the Potential for the Addition of Hydroelectric Power* and other more current sources were the comprehensive reviews used to identify the initial 215 candidate sites in all 50 States and Puerto Rico. These USACE sites with capacities greater than 1 MW are also listed in appendices 2a and 2b. These sites were then analyzed for costs of production in the same manner as those found by the BIA and Reclamation.

Assumptions and Methods

Section 1834 of the Energy Policy Act of 2005 requires this report to include descriptions of individual facilities that are "capable, with or without modification, of producing additional hydroelectric power" including an "estimation of the existing potential for the facility to generate hydroelectric power." Study participants examined all dams with and without existing hydropower and other water conveyance facilities for their potential hydroelectric capacity based on potential head and hydraulic conditions.

Reclamation only had a minor selection of facilities with existing generation that could potentially support an additional generating unit. Lewiston Dam in California, currently with a capacity of only 350 kW, has been committed for replacement with a 3-MW unit. Canyon Ferry Dam in Montana was examined in 1977 for a 90-MW facility. While an additional powerplant proved to be economically feasible 30 years ago, additional work on this facility has never begun. Black Canyon Dam in Idaho has been studied, but not funded, for an additional 10 MW of generating capability. The remainder of Reclamation's existing generation facilities have been sized to their available hydrology, many over 30 years ago. Combined with drought conditions and environmental restrictions on flow and ramping rates, there is little to no surplus water at Reclamation generating facilities to warrant additional units. Consequently, Reclamation only examined facilities where no generating facilities currently exist. A separate section concerning rehabilitation and uprating of existing generating units is also included.

All Department of the Interior bureaus performed a survey of potentially qualifying sites. Upon identifying federal dams without power generation and other federal water conveyance facilities, the sites were run through a series of three screens to determine which sites would require further examination in the report. The first screen eliminated sites that had less than 10 feet of head that could not demonstrate 1 MW of capacity at even the highest reported hydrologic flows. The second screen eliminated sites prevented by federal legislation from hydropower development. The final screen applied an analysis of exceedence curves using hydrologic records and estimations of hydraulic head to provide a more refined estimation of potential generating capacity. Again, those sites that could not demonstrate a minimum of 1 MW of capacity were eliminated. Similar screening techniques were used in the studies conducted by the Water and Power Resources Service (1980) and Tudor Engineering (1982) as well as the Idaho National Engineering and Environmental Laboratory (INEEL) (Hall et al., 2003).

Rather than initially surveying their district offices to provide the applicable hydroelectric power sites as was done by agencies of the DOI, the USACE completed their qualifying site survey through their Hydropower Analysis Center. The site survey relied primarily on updates to the previously mentioned 1983 and 1988 studies to identify the initial viable sites both with and without existing power generation capability. Similar to Reclamation, the USACE also refined their initial data. The USACE first updated the 1983 and 1988 data with information from their Institute for Water Resources (IWR), the lead agency of both previous studies, as well as other sources, including the BPA Hydropower Expansion Evaluation and current Federal Energy Regulatory Commission data. Next, the USACE eliminated sites with less than 1 MW of capacity as previously determined. At this point, the DOI and USACE facility inventories were at a comparable level in the evaluation process.

Section 1834(c)(4) calls for the costs of installing, upgrading, or modifying equipment and facilities for additional hydroelectric development. The costs of producing the hydropower were estimated using a proxy method based on previous analyses by the Idaho National Engineering and Environmental Laboratory (Hall et al., 2003). These costs included licensing, construction, fish and wildlife mitigation, water quality monitoring, and operations and maintenance (O&M), as well as other categories of costs and divided them by average power generation. All cost factors depended on the size of the generating capacity of a proposed facility. Aggregating these costs provided a unit value in dollars per megawatt-hour, which may then be compared to the regional wholesale power rate at the respective facility. While essentially a survey of costs associated with different existing facilities, the INEEL results provided the best available tool for uniformly estimating costs on a wide physical and geographic range of potential sites given budget and time limitations and the scope of this report.

The benefits of these potential sites, as requested in Section 1834(c)(5), were estimated using regional wholesale electric power values from Platts, a McGraw-Hill company specializing in energy industry-related marketing data. These benefit values were then compared to the cost figures previously described to identify the most economically viable sites for future analysis. As with the INEEL cost report, the study participants felt it would be most appropriate to select a single, outside source for data and tools to retain the objectivity of the analysis. The study group selected the methods of analysis stated above and discussed further below as the best tools to achieve a uniform, inventory-level analysis of hydroelectric potential.

This study is only an inventory-level analysis and should not in any way be interpreted as equivalent to a feasibility analysis. Rather, it was intended only to remove from consideration sites that were very unlikely to have hydroelectric development potential and highlight those that remained. The results reflect preliminary assessments based on available data. Those interested in further development of a site will need to undertake a site-specific feasibility analysis.

Site Screening Analysis (DOI Only)

First Screening

The first screen examined all DOI sites that had either dams or other water conveyance facilities with no hydropower generation. Similarly to previous studies of hydroelectric potential, a minimum capacity criterion was set at 1 MW, based on highest historical flow, given estimated hydraulic head measured as the difference between maximum reservoir surface elevation and estimated tailwater elevation. Capacity (kW) was estimated using the simple formula,

$$\text{Max.}Q*H*E = P$$

where,

Q = maximum recorded streamflow, ft^3/s
H = estimated hydraulic head
E = system efficiency (0.073 used for this study)
P = capacity, kW

0.073 = units conversion constants and efficiency (see below)

The formula assumes 83.5 percent “water to wire” efficiency, which includes factors for turbine efficiency, transformer loss, trashrack and tailrace loss, short transmission line, etc. This is realistic for a new turbine at its most efficient operating level but overly optimistic for a turbine at lower flows, and when the turbine is operating significantly off of its most efficient ranges. No attempt was made to estimate outage rates, which makes the assessment slightly more optimistic. These assumptions are typical for an assessment level study.

The generally agreed upon formula for converting cubic feet per second to kilowatts is developed from the following factors:

1 horsepower = 550 ft-lb/s
Weight of water = 64.4 lb/ft^3
1 horsepower = 0.7457 kW
Assume 83.5% efficiency

0.073 conversion factor = 64.4 / 550 * 0.7457 * 0.835 (from the above values)

The period of record used to determine historical flows varied by site according to available data. Sites were also screened out if their estimated hydraulic head was less than 10 feet. The purpose of this screening was to remove from consideration all facilities without reasonable development potential before considering further analysis. Nevertheless, the use of highest historical flow to estimate generating capacity was intentionally conservative to ensure all possible sites were included in the study.

Second Screening

The second screen was designed to eliminate sites that emerged from the first screening but would likely be prevented from development due to existing federal land or water use laws that are incompatible with hydroelectric development. Select categories included:

1. National Rivers
2. National Historic Areas
3. Wild and Scenic Rivers
4. National Monuments
5. Critical Habitat

Reclamation and BIA staff then reexamined their respective sites that passed the first screening to determine if these land use legislations would impact individual sites. Sites that would have run into conflict with such laws were removed from further consideration.

Third Screening

The third screening was the most technically comprehensive of the three screens. Reclamation's Pacific-Northwest Regional Office developed the analysis tool, *Generic Energy Analysis* (GEA), an Excel-based tool that produces exceedence curves for all sites that passed through the previous two screens and for which hydrologic information could be obtained. The best available sources of data were Reclamation's Hydromet web site, internal databases, and U.S. Geological Survey stream gauging records. Hydromet is an automated network of water supply monitoring stations located throughout the Great Plains, Pacific Northwest, and Upper Colorado regions. The GEA program is designed to accept data downloaded directly from various official Internet sites, resulting in an average user being able to easily produce very accurate results. For those sites where Hydromet data were not available, the best available information was used. In some cases, these data came from U.S. Geologic Survey stream gauging stations, and in other cases, staff hydrologists were consulted.

Exceedence curves reflect the percentage of time a particular generating capacity is possible for a given set of historical hydrologic data and a given head. Examples of two different exceedence curves are shown in figure 1. Note that the curves demonstrate waterways with both short periods of high volume followed by longer periods of lower volumes, in addition to waterways with relatively constant flows throughout their estimation time periods. The curve on the left, South Canal Site #1, is a seasonal canal system, which is manually controlled, does not have high springtime flows, and is shut down for a substantial portion of the year. The curve on the right, A.R. Bowman Dam, is more typical of a natural stream channel that has high flows during a portion of the year and continues to flow at some level throughout the year. A useful feature of the GEA is that it also allows the user to identify the range of net head variation and thereby assist in selection of the best efficiency range for a selected turbine or combination of turbines.

By using GEA's exceedence curve analysis, study participants were able to estimate the generating capacity for each site based on actual hydrologic record rather than maximum flow as was estimated in the initial screening. This provided the capacity figures that were used in the cost analyses below. Similar methods were used in Reclamation's 1983 analyses of low-head hydroelectric sites (Reclamation, 1983).

While GEA was developed as an analysis tool specifically for this report, it has been included in the accompanying CD for public use. As such, it is important to recognize that it is only intended for preliminary assessments. No warranties, express or implied, are included for the use of GEA or any resulting products. The user's manual for GEA is included as appendix 3.

Development Cost Analysis

Section 1834(c)(4) calls for the overall study to measure the "costs to install, upgrade, or modify equipment or take other actions to produce additional hydroelectric power from each identified facility . . . ." Given that this report examines sites with existing power facilities, sites without existing power facilities, and sites that can upgrade existing units, assessing the costs for each individual site would have been prohibitively expensive as well as excessively time consuming beyond the project deadline. In order to capture the costs of so many sites with differing physical, regulatory, and environmental aspects, the report used a method based on previous analyses by INEEL (2003).

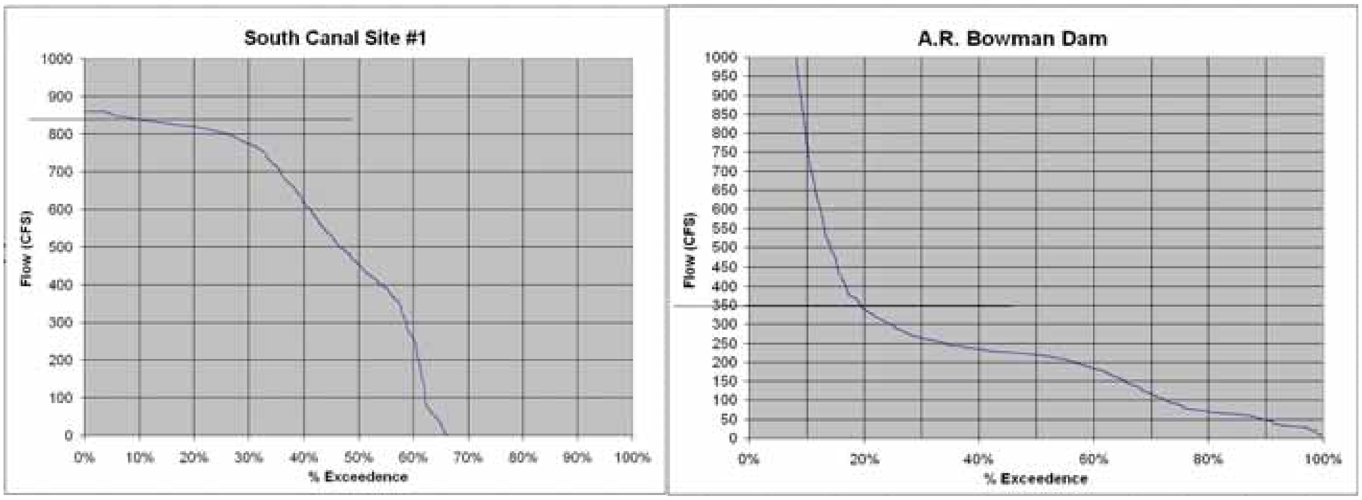


Figure 1.—Sample exceedence curves.

The INEEL process provides these separate cost categories as functions of the size (generating capacity) of a proposed complete facility or facility addition. These functions were derived through straightforward generalized least squares regression techniques where the only statistically significant independent variable for each cost estimator was plant capacity. While using only one independent variable for every estimator of development cost could be viewed as too simplistic, INEEL's model development results showed enough statistical significance for an adequate level of validity. Aggregating these separate categorical costs and dividing them by the expected amount of annual energy generation produced "break-even" values in dollars per megawatt-hour, which can then be compared to forecasted prices of future hydropower production to give benefit/cost ratios for each of the potential hydropower developments. The break-even rate is the minimum power rate that will justify construction of the plant. If a rate can be secured in excess of this value, the plant becomes economically viable. Appropriate to an assessment level study, all sites have been evaluated against a uniform set of development costs and cost of money.

While essentially a historical survey of costs associated with different existing facilities, the INEEL models provided effective tools for estimating costs on a wide physical and geographic range of potential sites given this study's budget and time limitations. "The principal conclusion of the study" remark the authors, "is that historical hydropower data, while exhibiting significant scatter, exhibit sufficient correlation with plant capacity to allow the production of simulating tools that can produce meaningful cost and generation estimates." A cursory comparison of these cost models to one found by Gulliver and Arndt (1990, pp. 2.20-2.22) demonstrated similar results as shown by differences of less than 5 percent in several test cases. This is remarkable because attempting to estimate the costs of building hydroelectric powerplants is highly determined by site specific conditions that do not aid in the generalization of such costs.

To actually estimate the costs according to Section 1834(c)(4), the potential individual plant capacity values, along with their associated estimated energy generation values, were directly processed through the INEEL cost model via a spreadsheet jointly developed by the USACE and Reclamation. The spreadsheet calculations also escalated the base INEEL 2002 cost level to a year 2005 cost level using general deflator values based on the gross domestic product. This was done to compare the cost values to the benefit values, which are given in 2005 dollars. A summary of the INEEL methodology is offered below. Those interested in a comprehensive examination of the methods and procedures are encouraged to go to the INEEL website to access the study directly.

Summary of Cost Estimation Model

INEEL has developed a model for estimating development (construction-related), O&M, and power-generating costs for hydroelectric powerplants at undeveloped sites both at dams without existing hydropower facilities and at dams with existing hydroelectric generation capability (table 1). The latter represented only the costs associated with adding incremental capacity to a facility with pre-existing generation. For plant development or expansion, INEEL acquired historical data on licensing, construction, and environmental mitigation from a number of sources including Federal Energy Regulatory Commission (FERC) environmental assessment and licensing documents, U.S. Energy Information Administration data, Electric Power Research Institute reports, and other reports on hydropower construction and environmental mitigation. In addition to the development and expansion cost categories, other categories addressing annual fixed and variable O&M costs, as well as the FERC annual administration fee, are included. Fixed O&M costs included costs for O&M supervision and engineering; maintenance of structures, reservoirs, dams, and waterways; and electric plants. Variable O&M costs included water expenses, hydraulic expenses, electric expenses, and rents. Moreover, the study added additional cost categories addressing debt service, insurance, taxes, overhead, and other miscellaneous fees.

This report includes additional cost categories addressing debt service, insurance, taxes, overhead, and other fees to approximate an annual “pro forma” budget from which a cost of production could be developed. The study assumes that development would be pursued by a private developer who would be faced with all of the above costs. Development of the model in this regard depends upon study team members’ experience in the field of powerplant operation. Debt service costs are based upon the federal funds rate of 5.125 percent and a 30-year debt service period. While this number is certainly low in regard to a private developer’s ability to finance a typical project, standardization of the discount rate in the analysis around this benchmark results in consistent relative results between sites. Federal development of sites would require appropriate adjustments to this model.

Table 1.—Cost categories (all models from Hall, et al., 2003)

Cost category	Undeveloped sites, $	Dams w/o power, $	Dams w/ power, $
Licensing	$610{,}000(C)^{0.70}$	$310{,}000(C)^{0.70}$	$210{,}000(C)^{0.70}$
Construction	$3{,}300{,}000(C)^{0.90}$	$2{,}200{,}000(C)^{0.81}$	$1{,}400{,}000(C)^{0.81}$
Fish & wildlife mitigation	$310{,}000(C)^{0.96}$	$200{,}000(C)^{0.96}$	$83{,}000(C)^{0.96}$
Recreation mitigation	$240{,}000(C)^{0.97}$	$170{,}000(C)^{0.97}$	$63{,}000(C)^{0.97}$
Historical & archeological mitigation	$100{,}000(C)^{0.72}$	$85{,}000(C)^{0.72}$	$63{,}000(C)^{0.72}$
Water quality monitoring	$400{,}000(C)^{0.44}$	$200{,}000(C)^{0.44}$	$70{,}000(C)^{0.44}$
Fish passage mitigation	$1{,}300{,}000(C)^{0.56}$	$1{,}300{,}000(C)^{0.56}$	$1{,}300{,}000(C)^{0.56}$
Fixed annual O&M	$240{,}000(C)^{0.75}$	$240{,}000(C)^{0.75}$	$240{,}000(C)^{0.75}$
Variable annual O&M	$240{,}000(C)^{0.80}$	$240{,}000(C)^{0.80}$	$240{,}000(C)^{0.80}$
FERC charges	0.17238G + 1.53227C	0.17238G + 1.53227C	0.17238G + 1.53227C

Where C = installed capacity (MW), G = annual generation (MWh)

Included in the CD that accompanies this report is a cost estimating tool using these models. A user may input the year of proposed construction, and the cost tool will calculate the percentage cost escalation factor from 2002 up through 2005 based upon actual consumer price index value. Future users of the software tool will need to calculate and enter their own escalation factors to the intended development year. Otherwise, a user need only enter the year construction is to begin for a chosen facility, as well as the installed capacity, and annual production values from the GEA exceedence model to arrive at an estimated annual cost of power production. All data in the INEEL report were escalated to 2002 dollars. The cost estimating tool then re-escalates the cost figures to 2005 dollars to match the benefit measures, which are also in 2005 dollars.

Benefit Evaluation

Section 1834(c)(5) seeks to identify the "benefits that would be achieved by such installation, upgrade, modification, or other action, including quantified estimates of any additional energy or capacity from each facility identified . . . ." Economic benefits of an additional hydropower facility may be defined as the consumer surplus associated with additional hydropower generation, that is, society's willingness to pay for additional energy that often exceeds the rate paid by consumers. Nevertheless, the economic procedures for assessing these values are costly and time consuming, especially when considering the number, size, and geographic range of the sites included in this report. A more appropriate method of estimating benefits is necessary.

According to the U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*" (1983) (Guidelines), evaluations of benefits pertaining to new hydropower facilities generally consider the contributions to national economic development (NED). This is consistent with planning guidelines used by both the Bureau of Reclamation and the U.S. Army Corps of Engineers. Such extensive evaluations of federal projects include detailed measures of installation expenditures, measures of benefit streams over the life of the project, and expected costs of operation, maintenance, and replacement over the life of the project. While appropriate for examinations of single, large federal projects, this level of detail is outside the scope of this report. Moreover, the Guidelines state that "simplifications of the procedures . . . are encouraged in the case of single-purpose, small scale hydropower projects (25 MW or less)" (U.S. Water Resources Council, 1983, p. 43) (emphasis added). Lastly, the Guidelines also state that benefit examinations of projects less than 80 MW at existing Federal facilities may be modified through a simple marketability approach (U.S. Water Resources Council, 1983, p. 43). Such a simplified approach is most appropriate for the inventory-level analysis contained in this report.

Similar procedures were employed by the Water and Power Resources Service's 1980 evaluation of hydroelectric facilities at existing sites (1980a). In that study, the authors observed that the total viable generation potential identified would represent less than 1 percent of demand, thus demonstrating no significant impact on economic development. Similar conditions exist for the sites examined in this study. Even FERC has used alternative market rates as a measure for the benefits of additional hydroelectric power (FERC, 1979). The report states, "Since willingness to pay is difficult or impossible to measure for electric power, an alternative approach is used. Thus, the cost of power from the most likely alternative source, or avoided cost, provides an appropriate measure of the value of the power creditable to the project" (FERC, 1979, p. 3-2).

Traditionally, hydropower generated at federal facilities and marketed by the PMAs has been sold at cost recovery rates rather than market value. Over the last decade, wholesale markets throughout the country have been moving toward competitively priced exchanges, with real-time and forward markets better reflecting the marginal costs of energy production. The Guidelines support valuing the benefit of new hydroelectric power by the resource cost of the most likely alternative generation source--its avoided cost. A regional power market price is the best proxy for this avoided cost when examining multiple sites in a study so geographically broad. Again, the Water and Power Resources Service report concurs that, "This is consistent with the generally accepted economic concept that the most socially acceptable price is that established at the margin" (1980a, p. 25).

Forecasted regional power market prices are available from a variety of sources and vary based on the methods used to derive them. Regardless of the sophistication of the derivation process, the power values themselves are generally consistent among the various sources. However, this is not to say that the power values are easily predictable since the numerous parameters used to compute them are unpredictable, especially fuel commodity prices. For this study, power market price information was obtained from Platts Power Outlook Research Service, a North American power market forecast firm based in Colorado. Platts data are proprietary and are used under paid contractual subscription by the U.S. Army Corps of Engineers' Hydropower Analysis Center.

Like many other prerequisite models, Platts uses AuroraXMP, a complex electric power market model owned and licensed by EPIS Inc. of Oregon, to forecast market clearing prices for electric power in the U.S./Canada region. Platts estimates both on-peak and off-peak energy-only values along with "all-hours energy and capacity" composite power values on an aggregated monthly and annual basis for a 20-year forecast period from 2006 through 2025. The all-hours energy and capacity power values incorporate the additional costs of having to build new power generating resources to meet increasing electricity demand. Platts differs in this way from just pure energy-only values, which only portray the incremental variable cost of producing electricity.

Essentially, AuroraXMP modeling for any distinct load area determines the hourly market-clearing price based upon a fixed set of resources dispatched in least-cost order to meet demand while subject to emissions limits and other constraints. The hourly price is set equal to the variable cost of the marginal resource needed to meet the last unit of demand. A long-term resource optimization feature within the AuroraXMP model allows generating resources to be added or retired based on economic profitability. This makes the market-clearing price and the resource portfolio interdependent because the market-clearing price affects the revenues any particular resource can earn and consequently will affect which resources are added or retired. AuroraXMP sets the market-clearing price using predictions of demand levels (load) and assumptions of supply costs, ensuring that no load is unmet. The load demand forecast implicitly includes the effect of price elasticity over time. The supply side is defined by the cost and operating characteristics of individual electric generating plants, including resource capacity, heat rate, and fuel price. AuroraXMP also takes into consideration the effect that transmission system capacity and wheeling prices have on the system's ability to move power generation output between different distinct load areas.

Platts develops power price forecasts for all the North American Electric Reliability Council (NERC) regions and subregions. For this study, it was decided to aggregate various subregions into three defined geographic regions that were labeled Western, Central, and Eastern—these are self-explanatory. The study team believed that this would provide the appropriate level of granularity for this type of planning-level effort. Use of a smaller granularity would have caused overstated precision given other assumptions made during the screening process. Use of a larger granularity would have neglected to characterize the real differences that exist in regional power markets today and in the future.

The power values used in this study are based on the Baseline Price Forecast published by the Platts Power Outlook Research Service and represent conditions as of June 2006, the latest data available at the time of the study. The Platts Baseline Price Forecast assumes average hydrologic conditions and average cost for fuel for each year of the modeling simulation. In addition, Platts provides for high (wet) and low (dry) hydrologic conditions and high and low fuel cost scenarios, respectively.

As stated above, Platts aggregates their hourly modeling results and provides forecasts of projected market power values on both a monthly and an annual basis for the period of 2006 through 2025. These forecasted values are provided in both nominal and constant 2005 dollars for monthly and annual values given in units of $/MWh. Although power generation at hydropower plants varies on a monthly basis, it was beyond the defined scope of this study to perform the analysis at the monthly level. Therefore, only the annual power values in units of constant 2005 dollars were used to estimate the benefits through an economic time-value levelization technique that derived a single levelized energy and capacity power value for each region given the annual all-hours energy and capacity power values, a 30-year economic period of analysis, and the federal water resources discount rate of 5.125 percent. These regional levelized power values were then compared to the individual development site unit cost values described above. A simple division of any levelized benefit value by the development cost value for any specific site gives the estimated benefit/cost ratio for developing hydroelectric power at that site.

The benefit measures included in this section serve only as proxies for the actual benefits associated with additional hydropower. Conceptually, the benefits of additional hydropower are equivalent to society’s willingness to pay for that additional increment of hydropower. This value often exceeds the market price, resulting in conservative underestimates of actual benefits. Nevertheless, for purposes of developing an inventory of sites, these marketability estimates offer a cautious lower bound for evaluating site-specific benefits.

Power Facility Rehabilitation

Bureau of Reclamation Power Rehabilitation Program

Following the 1973 oil embargo, Reclamation conducted a review of its powerplants to determine if they could be uprated to a higher capacity and to produce more energy. Uprating existing hydroelectric powerplants to fully use available water power for additional peaking capacity and energy was recognized as one of the better long-range improvements that could help alleviate the energy problem. The 1977 *Western Energy Expansion Study* (Reclamation, 1977a) identified several proposals to uprate hydroelectric units. The study concluded that uprating existing units is the most immediate, cost-effective, and acceptable means to contribute to meeting the Nation's electric capacity and energy needs. In 1978, Reclamation and the Department of the Interior established, as one of their major goals, the investigation and implementation of all viable opportunities to improve existing plants by modernizing and uprating the generating equipment.

A General Accounting Office study (1977), recommended that Reclamation evaluate opportunities to improve hydropower production and act on those that are economically justified. Since 1978, beginning with two Shasta powerplant units, Reclamation initiated a power uprating program to increase the capacity of Reclamation facilities as funding and unit availability allowed. In addition, a number of generators were rewound when no appreciable uprate potential existed but winding condition was poor.

Some confusion has existed over the terms rewind and uprate when applied to the rehabilitation of generators. Definitions for rewinds and uprates are as follows:

- *Rewinds.*—Many of Reclamation's older generators were purchased with a continuous overload capability of 15 percent above rated output. Generally, when Reclamation "rewinds" a generator, the new winding has a base rating equal to the 115-percent machine level and at the appropriate allowable temperature rise consistent with the insulation class of the new winding. Although the new winding may be capable of operating at higher levels, the machine is still limited to operating at the 115-percent level because the mechanical characteristics of the generator have not been confirmed to be capable of higher loads. Ratings of the bus, transformer, etc. are examined, but a detailed study is not performed.

- *Uprates.*—An uprate normally involves increasing the rating more than 15 percent, which, in turn, necessitates reviewing the capability and limits of all of the power equipment from the penstock through the turbine, generator, bus, switchgear, transformer, and transmission system. These systems then can be retained, modified, or replaced to obtain the optimum uprate level.

Uprate Criteria

Uprating a hydropower facility can be accomplished in one of three ways:

- Increasing the turbine runner efficiency to produce more power with the same amount of water.

- Increasing the generator and other component capacity to accept excess capacity available from the turbine.

- Replacing the turbine with one that has a higher flow through capacity.

Modern computational fluid dynamics and machining techniques have resulted in turbine runners that have higher efficiencies and wider operational envelopes than older turbine designs. Even with regular maintenance, turbines tend to become less efficient over time due to cavitation damage and runner wear. Replacing an old, inefficient turbine with a new runner that significantly exceeds the original efficiency and flow capacity often makes economic sense. Additionally, newer stainless steel turbines are less prone to wear and can be repaired without removal, using modern welding techniques.

Another good indicator for considering uprating a generator is when the turbine capability substantially exceeds the generator capability at normal operating heads. Most hydroelectric turbines are designed to provide rated output (nameplate capacity) at rated head. Since the rated head was chosen far enough below the maximum operating head to ensure that the generator overload capacity could be utilized, reservoirs often operate at heads much higher than rated head, and the turbine is usually capable of more mechanical output than the generator can convert to electrical energy. In other situations, increased rating and efficiency can be obtained by runner replacement. For pre-1960 turbines, it is frequently possible to obtain output increases as high as 30 percent and efficiency increases of 1 percent by replacing existing runners with runners of improved design.

The original plant capacity generator power ratings were decided based on several constraints, including historical river flows and allowable variations in reservoir levels. Sometimes, authorizing legislation included allowable limits on generator size. The former requirement that generators deliver rated output with no more than a 60 °C temperature rise and the conservative safety factors provided by early generator manufacturers resulted in the possibility of substantial increases in machine capacity by installing windings using modern insulation technology that can provide increased electrical capacity with the same physical size as earlier manufactured windings. Therefore, it is often possible to increase the capacity of older units by installing new stator windings and improved runners and by upgrading various auxiliary equipment. In any case, the best returns typically occur when older equipment has reached the end of its usable service life and the runner, stator, and other major equipment would need repair or refurbishment.

In the past, many Federal projects were designed with excess capacity in order to allow peaking operations. In recent years, increased awareness of the effect of peaking operations on downstream fisheries and river ecosystems has removed much of the flexibility out of many hydro plants, resulting in plants that have excess capacity that can only be utilized during very high flows. Throughout the hydropower industry, project relicensing stipulates ramping rates that limit load-following and peaking opportunities.

Apart from technical limitations, the economic value of capacity is most important in justifying an uprate. Uprates based upon efficiency improvement generally result in increased power production. Uprates that result in higher turbine flow rates (and higher power) result in a lower overall plant factor. Because many Reclamation projects develop the maximum energy available from the water resource (without spillway operation), little additional energy may be generated after the uprate. Uprate capacity is obtained at the expense of plant factor (more power can be produced when needed but for fewer hours). The practical limit of uprating is reached when the cost of replacing equipment to obtain additional capacity equals the economic worth of that added capacity.

Assessing the worthiness of an uprating involves examining engineering and economic criteria. A plant engineering study analyzes the effect of uprating on all plant components. From the plant engineering study, various levels of uprate potential are determined. Many economic considerations are included, such as lost revenue during outage time and increased power and energy rates to provide for equipment replacement. Other considerations include water operations, power operations, environmental considerations, contractual obligations, and coordination and scheduling.

Status of Reclamation's Power Uprating Program

Under Reclamation's Power Uprating Program, as of July 2006, generator uprates have been completed on 64 units, resulting in an increase in Reclamation generator capacity of 1,902 MW. Reclamation has only 141 MW of capacity improvements scheduled for 2007 and beyond. In addition, significant improvements in generator efficiency are also scheduled for 2007 and beyond. The graphs below depict the increase in Reclamation capacity by region (fig. 2) and the number of generating units that have been rewound or uprated (fig. 3).

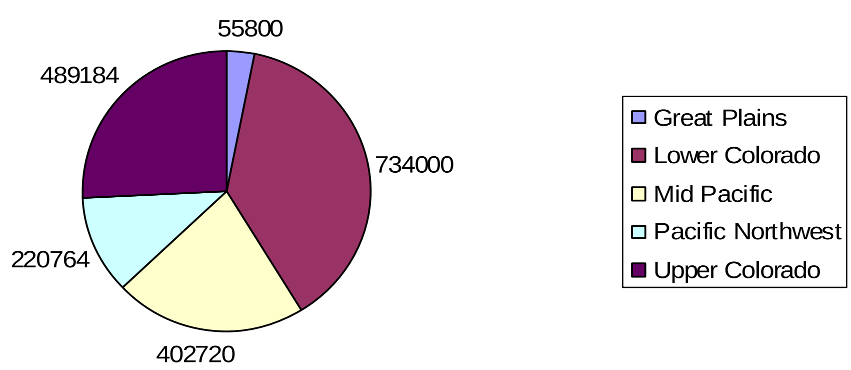


Figure 2.— Increased capacity by Reclamation region (kW).

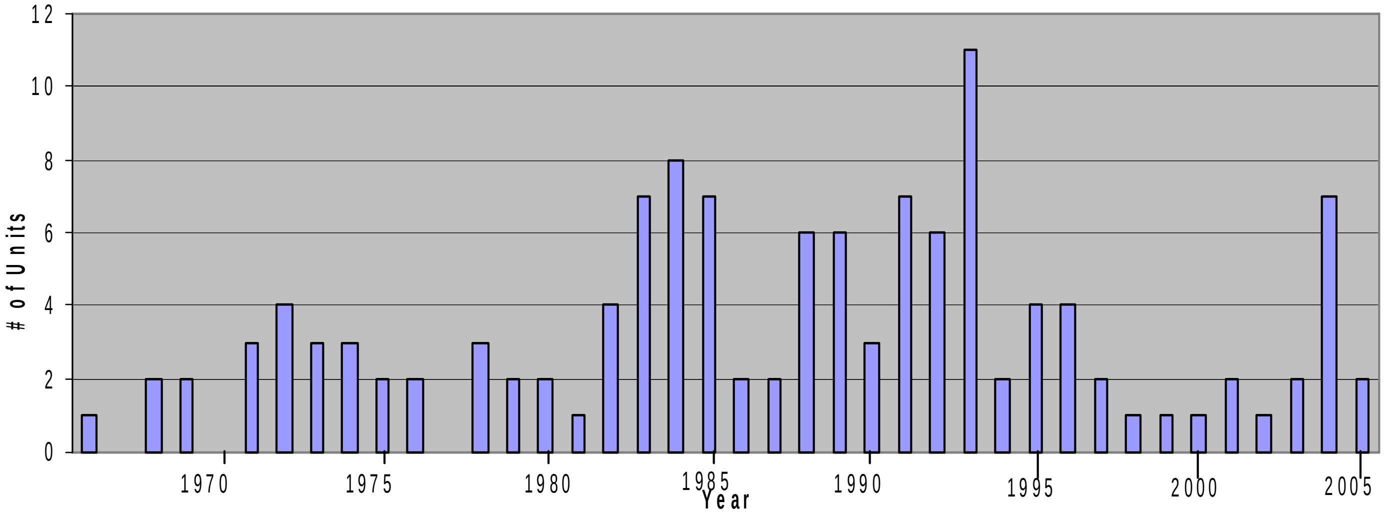


Figure 3.— Number of generators that Reclamation has rewound or uprated.

U.S. Army Corps of Engineers Major Rehabilitation Program

Over the last 15 years, the USACE Major Rehabilitation Program has resulted in 21 completed studies for the major refurbishment and/or replacement of the existing power generating equipment at USACE-owned and -operated hydroelectric power facilities. These studies are comprehensive and examine the economic feasibility of the project alternatives in high detail. While the intent of the Major Rehabilitation Program has not been to exclusively study the potential for uprating existing powerplants, some of the results of the studies have recommended uprating as the most economically feasible alternative. In these cases, the additional capacity would be a bonus beyond the increased equipment reliability that would result from a completed major rehabilitation project. Typically, the amount of increased capacity is not large due to the physical constraints of the civil works configuration of the existing power generating units. Rather, the increased capacity is a result of advancements in the technology of the turbines and generators since the original equipment was installed. Five of the 21 recommended Major Rehabilitation Program projects have been completed, 6 are in various stages of execution, and 10 have not yet been started. USACE recognizes that some of the studies not yet implemented may have become dated and thus require limited re-evaluation.

The USACE anticipates that several more Major Rehabilitation Program studies or similar PMA-sponsored studies will be completed in the near future as the 75 USACE-operated hydroelectric power facilities age and degrade. Recently, there has been renewed momentum in the USACE to programmatically re-evaluate the overall hydropower program with special emphasis on equipment condition monitoring and assessment as part of a framework for a formal asset management strategy. Table 2 gives a summary of the current state of the Major Rehabilitation Program.

Table 2.—Summary of Major Rehabilitation Program (without constructing new units)

Stage of rehabilitation	No. of projects	Capacity beyond existing (MW)
Project completed	5	207
Under way	6	626
Not yet started	10	516
Total	21	1349

Results

The following summarizes the results of the stepwise analyses of hydroelectric power production capability at federally owned facilities. Summary results are included in the text and tables of this section. Site specific results are included in the referenced appendices. As mentioned throughout this report, the results included herein should not be interpreted as recommendations for development in general or for one site as compared to another. Any proposal to develop new or additional hydropower, whether identified in this report or not, will require additional analysis of the environmental, economic, and social impacts as required under the National Environmental Policy Act (NEPA) and the Federal Power Act.

Initial Population of Facilities

The tables below summarize the initial population of sites, with and without existing generation, examined for potential hydropower development. Tables 3a and 3b are sorted by agency and region or division. Table 4 reiterates these sites but lists them by State. The sites for the Department of Interior include all five regions of the Bureau of Reclamation and the Bureau of Indian Affairs. The Bureau of Land Management was not included as they lacked the 1 year of hydrological data necessary for further analysis. The National Park Service and U.S. Fish and Wildlife Service missions were incompatible with hydroelectric development on their lands. Finally, the U.S. Army Corps of Engineers' data are included, although these data were acquired from their 1983 report, *National Hydroelectric Power Resources Study* (USACE, 1983). Individual site listings for all agencies that were examined within this study are listed in appendix 2a and 2b.

Table 3a.—Total number of DOI facilities in study, by agency

Agency	Region/Division	No. of facilities
BIA	Great Plains	22
BIA	Midwest	1
BIA	Navajo	15
BIA	Northwest	22
BIA	Pacific	2
BIA	Rocky Mountain	11
BIA	Southwest	26
BIA	Western	24
Reclamation	Great Plains	146
Reclamation	Lower Colorado	30
Reclamation	Mid-Pacific	44
Reclamation	Pacific Northwest	105
Reclamation	Upper Colorado	205
	Total DOI	653

Table 3b.—Total number of USACE facilities in study

Agency	Region/Division	Number of facilities
USACE	Great Lakes and Ohio River	113
USACE	Mississippi Valley	16
USACE	North Atlantic	25
USACE	Northwestern	11
USACE	South Atlantic	15
USACE	South Pacific	2
USACE	Southwestern	36
	Total USACE	218

Table 4.—Total number of DOI and USACE facilities in study, by State

State	No. of facilities	State	No. of facilities
Alabama	6	Montana	60
Arizona	53	Nebraska	22
Arizona-California	4	Nevada	10
Arkansas	13	New Hampshire	3
California	39	New Mexico	67
Colorado	96	New York	3
Connecticut	3	North Carolina	6
Florida	1	North Dakota	6
Georgia	2	Ohio	20
Idaho	24	Oklahoma	12
Illinois	6	Oregon	57
Indiana	7	Pennsylvania	28
Iowa	10	South Dakota	26
Kansas	13	Texas	17
Kentucky	33	Utah	109
Louisiana	5	Vermont	3
Maryland	1	Virginia	2
Massachusetts	2	Washington	39
Minnesota	2	West Virginia	14
Mississippi	4	Wisconsin	3
Missouri	7	Wyoming	33
		TOTAL	871

First Screening (DOI Only)

The first of three screens selected sites that have both (1) more than 10 feet of head and (2) a capacity of at least 1 MW at the point in their hydrological record with the highest flow. The intent of this screening was to remove sites that could not be expected to meet the 1-MW criterion during the most optimistic circumstances. This screen and the following two were only applied to DOI facilities because the USACE had previously screened their sites using their 1983 and 1988 studies and their updates. A summary of sites that survived this first screen, listed by agency, is included in table 5. Table 6 lists the same sites, organized by State. A detailed listing of those sites that survived this screen is included in appendix 4.

Table 5.—DOI facilites surviving first screen, listed by agency/region

Owner	Region/division	No. of facilities
BIA	Great Plains	4
BIA	Navajo	1
BIA	Rocky Mountain	3
BIA	Western	3
Reclamation	Great Plains	70
Reclamation	Lower Colorado	8
Reclamation	Mid-Pacific	26
Reclamation	Pacific Northwest	24
Reclamation	Upper Colorado	56
	Total	195

Table 6.—DOI facilites surviving first screen , listed by State

State	No. of facilities
Arizona	4
Arizona-California	2
California	23
Colorado	31
Idaho	5
Kansas	6
Montana	26
Nebraska	10
Nevada	6
New Mexico	9
North Dakota	3
Oregon	10
South Dakota	8
Texas	1
Utah	26
Washington	10
Wyoming	15
Total	195

Second Screening (DOI Only)

The second screen selected for DOI sites with specific laws or legislation that would preempt any possible development at those sites. Sites such as designated wilderness, wild and scenic rivers, or national monuments would require special authorization by the President or Congress to enable hydroelectric development. Most environmental or other laws or regulations simply require mitigating action and were not included in this screen. The exception was the National Historic Preservation Act (NHPA), which included sites listed or determined as eligible for listing. While the NHPA does not explicitly prevent development, its prominent role in hydropower licensing and potentially significant mitigation costs justified inclusion in the second screen. Only a relatively small number of sites faced legislation that would unequivocally preempt development. Rather than list all sites that survived the second screen, table 7 summarizes those sites by agency that were eliminated from further consideration. Table 8 summarizes those sites by State. Appendix 5 lists each site eliminated and its associated potential generating capacity.

Table 7.—DOI facilities eliminated due to law or legislation, by region

Owner	Region/division	No. of facilities
BIA	Great Plains	1
BIA	Western	2
Reclamation	Great Plains	16
Reclamation	Mid-Pacific	1
Reclamation	Pacific Northwest	1
	Total	21

Table 8.—DOI facilities eliminated due to law or legislation, by State

State	No. of facilities
Arizona	1
California	1
Nebraska	4
Nevada	1
Oregon	1
South Dakota	3
Texas	1
Wyoming	9
Total	21

Third Screening (DOI Only)

The third screen examined the remaining DOI sites using an analysis of exceedence curves derived through hydrological records specific to each site. Some sites had longer hydrological records than others and, commensurately, more accurate results. Nevertheless, this site-specific analysis allowed study members to critically size potential generating capacity based on a multi-year record of streamflow. Those sites that again demonstrated a capacity of 1 MW or greater survived this screen. Table 9 summarizes the results of the third screen. No BIA facilities survived this screen, only Reclamation facilities.[6] Appendix 6 lists all Reclamation sites individually.

Table 9.—DOI facilities without existing hydropower with potential capacity > 1 MW, listed by agency/region

Owner	Region/division	No. of facilities	Potential capacity (kW)
Reclamation	Great Plains	21	91,829
Reclamation	Mid-Pacific	4	5,432
Reclamation	Pacific Northwest	15	35,700
Reclamation	Upper Colorado	31	146,496
	Total	71	279,457

DOI sites that survived the third round of screening were joined with equivalent data from the U.S. Army Corps of Engineers' qualified sites. All USACE sites

[6] Reclamation's Lower Colorado Region had no facilities that survived the third screen.

with potential capacity greater than 1 MW are listed in appendix 7. A summary of these USACE facilities without existing generation is listed in table 10. A similar summary of USACE facilities with existing generation is listed in table 11. A summary of all DOI and USACE facilities, with and without existing generation, sorted by State, is provided in table 12.

Table 10.—USACE facilities without existing hydropower with potential capacity > 1 MW, listed by agency/region

Owner	Region/division	No. of facilities	Potential capacity (kW)
USACE	Great Lakes & Ohio River	77	1,060,500
USACE	Mississippi Valley	32	514,100
USACE	North Atlantic	16	51,000
USACE	Northwestern	11	82,000
USACE	South Atlantic	12	162,000
USACE	South Pacific	3	48,300
USACE	Southwestern	24	345,800
	Total	175	2,263,700

Table 11.—USACE facilities with existing hydropower with potential capacity > 1 MW, listed by agency/region

Owner	Region/division	No. of facilities	Potential capacity
USACE	Great Lakes & Ohio River	9	247,600
USACE	Mississippi Valley	7	181,200
USACE	Northwestern	9	2,770,800
USACE	Southwestern	5	303,500
	Total	30	3,503,100

Each Reclamation and USACE site's installed capacity (kW) and average annual production (kWh) were entered into the cost estimator tool, which produced an annual cost of production. These results, sorted by agency and region, are provided in appendix 8. The levelized Platts regional power rates for 2006 are provided in table 13. All rates are in 2005 dollars to remain consistent with the power cost estimates, which are also in 2005 dollars. Appendix 9 sorts, in order of greatest difference between production cost and respective regional rate, the same sites found in appendix 8. An accompanying ratio of rates to costs of production is provided in appendices 8 and 9 as well.

Table 12.—All DOI and USACE facilities with potential capacity > 1 MW, listed by State

State	No. of facilities	Potential capacity (kW)	State	No. of facilities	Potential capacity (kW)
Alabama	6	125,500	Montana	15	554,770
Arkansas	14	440,100	Nevada	1	1,549
California	4	27,183	New Mexico	7	45,948
Colorado	20	75,001	New York	3	8,700
Florida	1	2,500	North Carolina	3	23,300
Georgia	2	10,700	North Dakota	2	273,302
Idaho	5	669,420	Ohio	8	44,400
Illinois	8	130,200	Oklahoma	7	173,800
Indiana	7	53,100	Oregon	16	1,385,693
Iowa	12	283,700	Pennsylvania	29	268,600
Kansas	5	42,533	Texas	6	23,400
Kentucky	34	605,600	Utah	12	87,706
Louisiana	5	60,900	Vermont	2	4,800
Maryland	1	13,800	Virginia	2	13,000
Massachusetts	1	1,100	Washington	6	16,878
Minnesota	4	42,000	West Virginia	13	340,900
Mississippi	4	44,400	Wisconsin	2	5,100
Missouri	7	137,700	Wyoming	2	5,465
			Total	276	6,042,748

Table 13.—Levelized regional wholesale electric power rates, 2005 dollars

Regional Zone	Rate ($/MWh)
Eastern	57.61
Central	48.74
Western	52.89

Source: Platts through USACE

Tables 14, 15 and 16 summarize the facilities without generation for DOI and facilities with and without generation for the USACE whose estimated benefit to cost ratios are greater than one, sorted by region or division. These facilities are the most likely candidates for further examination for development given the tools and assumptions used throughout this analysis. Facilities that did not meet these tests of economic viability may, in other circumstances, demonstrate potential for development. Finally, table 17 aggregates the results of tables 14, 15 and 16, sorted by State.

Table 14.—DOI facilities without existing hydropower with potential capacity > 1 MW and b/c ratio > 1, listed by division

Owner	Region/Division	No. of facilities	Potential capacity (kW)
Reclamation	Great Plains	2	12,158
Reclamation	Mid-Pacific	3	3,788
Reclamation	Upper Colorado	1	36,792
	Total	6	52,738

Table 15.—USACE facilities without existing hydropower with potential capacity > 1 MW and b/c ratio > 1, listed by division

Owner	Region/Division	No. of facilities	Potential capacity (kW)
USACE	Great Lakes & Ohio River	21	410,600
USACE	Mississippi Valley	19	347,500
USACE	North Atlantic	1	6,000
USACE	Northwestern	1	5,200
USACE	South Atlantic	2	13,200
USACE	Southwestern	3	36,600
	Total	47	819,100

Reclamation, the only DOI agency with facilities that passed all three screens, had six sites with an estimated benefit-cost ratio greater than one while the USACE had 58 sites with ratios greater than one. Developable site capacity for those facilities that proved viable by meeting each screen criterion and a benefit-cost ratio of greater than one ranged from the largest at 103,800 kW to the smallest at 1,045 kW. The median size facility was 11,650 kW.

Table 16.—USACE facilities with existing hydropower with potential capacity > 1 MW and b/c ratio > 1, listed by division

Owner	Region/Division	No. of facilities	Potential capacity (kW)
USACE	Great Lakes & Ohio River	5	177,200
USACE	Mississippi Valley	5	169,000
USACE	Northwestern	1	11,800
	Total	11	358,000

Table 17.—All facilities with potential capacity > 1 MW and b/c ratio > 1, listed by State

State	No. of facilities	Potential capacity (kW)
Alabama	1	6,000
Arkansas	3	36,600
California	2	2,239
Georgia	1	7,200
Illinois	3	99,100
Iowa	8	216,600
Kentucky	4	136,300
Louisiana	3	17,400
Minnesota	3	29,300
Mississippi	2	29,200
Missouri	5	124,900
Montana	2	12,158
Nevada	1	1,549
Oregon	2	17,000
Pennsylvania	15	182,500
Utah	1	36,792
Virginia	1	6,000
West Virginia	7	269,000
Total	64	1,229,838

Impacts of Increased Hydropower Production

This report has examined improvements at federal facilities both without existing hydroelectric generation as well as with existing hydroelectric generation where new generating units could potentially be introduced. In both cases of new or additional generation, environmental or cultural impacts have the potential to occur.

Adding units to an existing generation facility may have a number of adverse impacts. Downstream water conditions—particularly dissolved oxygen content and temperature—may change. Volume changes can also result in impacts to water quality, and fish populations may be threatened because of water conditions or negatively impacted habitat. Additional turbines may boost problems of entrainment or fish mortality. Lastly, significant changes in water levels can impact human uses such as fishing, boating, and other recreational activities. Similarly, new generation construction can have negative impacts as well. Dissolved oxygen content in tailwater often is reduced as new penstocks draw water from less oxygenated reservoir levels, fish mortality increases with the introduction of generator turbines, and new construction activity frequently diminishes water quality if but for a temporary period.

Installation of new generation at existing dams avoids impacts from new impoundments of a stream associated with building a new dam. Impacts such as changing aquatic habitat from flowing water to slack water, altering the magnitude and timing of downstream flows, water quality changes, blockage of fish migration, and submergence of terrestrial habitat have already occurred. Nevertheless, impacts associated with new generation certainly do occur. Construction can cause fuel spills and increased sediment loads, and other contamination may degrade habitat and threaten downstream fish populations. Furthermore, larger reservoirs, where water is withdrawn from lower elevations than at small reservoirs, tend to have lower dissolved oxygen content and higher concentrations of heavy metals due to natural stratification of quality in impounded water. Multilevel intake and other dissolved oxygen enhancement technologies can serve to partially mitigate tailwater quality concerns. Many of the problems listed above may also impact recreational uses such as fishing, swimming, and boating.

Nevertheless, many positive impacts may also result from additional hydroelectric development such as increased opportunities for flat water recreation, and increased shore lines and beaches. Likewise, hydroelectric power provides energy with virtually no carbon emissions. While coal-fired facilities create an average of 2 pounds of carbon dioxide per kWh of generation, a hydroelectric facility provides next to none—and, any carbon dioxide that is generated from a hydroelectric facility is usually from ancillary activities. Ten MW of new hydroelectric generating capacity at, for example, a 70-percent load factor has the potential to displace over 122 million pounds of carbon dioxide per year from an average coal-fired powerplant.

Section 1834(c)(7) asks the report to comment on the impact of increased hydroelectric production on irrigation, water supply, fish, wildlife, Indian tribes, river health, water quality, navigation, recreation, fishing, and flood control. These issues can be addressed from one of two perspectives. First, all new hydropower development must honor the authorized project purposes that underlie the federal projects in which new development may be located. For example, by law Reclamation gives priority to water deliveries over hydropower generation. Therefore, contracted irrigation and municipal water supply deliveries cannot be impacted by hydropower operations. Instead, Reclamation hydropower operations are effectively a by-product of water deliveries. Similar conditions hold for the USACE where flood control and navigation take priority over hydropower generation. Any subsequent development would be subject to first satisfying congressionally authorized project purposes, which may include, but are not limited to, irrigation, flood control, navigation, recreation, hydroelectric generation, preservation, and propagation of fish and wildlife. Under a FERC license, it is incumbent on the controlling federal agency to include Sections 4(e)[7] terms and conditions and Section 18 prescriptions in the project license that ensure that the project does not affect authorized project purposes.

Second, for hydropower projects developed under a FERC license, hydroelectric licensing requires a collaborative process on which FERC bases its decisions and fulfills its responsibilities under the Federal Power Act, the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, and other related statutes. Throughout the FERC licensing process, the applicant must consult with a number of federal agencies that manage lands within the project boundary including the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (NMFS), the National Park Service, the Bureau of Indian Affairs, the Environmental Protection Agency, the federal agency administering any lands used or occupied by the project, and other State, local, and tribal agencies and members of the public. FERC is required to give equal consideration to both developmental and nondevelopmental values prior to issuing a license. In doing so, FERC considers the values of existing power generation, flood control, and other development objectives with the nondevelopment objectives such as present and future needs for water quality, recreation, fish and wildlife, and other environmental attributes. FERC must include license provisions mandated to protect federal reservations by the federal

[7] Section 4(e) conditions refer to Section 4(e) of the Federal Power Act, which addresses Protection of Federal Reservations. Section 18 prescriptions refer to Section 18 of the Federal Power Act, which addresses fishway prescriptions. Section 4(e) conditions and Section 18 prescriptions are mandatory conditions submitted by the controlling agency that are included in the license. FERC may not amend or delete these conditions by its own authority.

land management agency; to provide fish passage by the FWS and NMFS; and to protect water quality by the Clear Water Act certification agency. The comprehensive nature of the FERC licensing process (or the similar procedure for a lease of power privilege) for any individual site provides the best indicators of impacts associated with hydropower development as discussed in Section 1834(c)(7).

Federal agencies develop hydropower either through general projectwide authorization or authorization for specific-site development. Nonfederal entities may develop hydropower on federal facilities either by acquiring a license from FERC or under a Lease of Power Privilege contract with Reclamation. After obtaining a FERC license, or an exemption from a license,[8] a licensee may construct, operate, and maintain a nonfederal hydroelectric project that occupies U.S. lands or uses surplus water or water power from a U.S. government dam or similar facility. The sites included in this report may be developed by federal or nonfederal entities.

A lease of power privilege is a contractual right, given to a nonfederal entity, to use federal facilities and lands for the purpose of developing the hydroelectric facility for electric power generation and use and/or sale of hydroelectric power consistent with authorized project purposes. Leases of power privilege are used by Reclamation when the facility in question is part of a project's general authorization allowing hydropower development. Environmental and cultural conditions addressed through a FERC license process are also addressed with a lease of power privilege. The lease of power privilege process includes NEPA compliance as well as coordination with the FWS in accordance with Section 2 of the Fish and Wildlife Coordination Act, which can be integrated with the NEPA process. Lessees are generally required to compensate the federal agency on whose dam the lease applies for any costs incurred by that agency.

This report did not attempt to provide this level of information regarding hydropower development impacts on a site-specific basis because examination of these categories is the responsibility of the developing entity. In particular, assessing the impacts of hydropower development is an integral part of the licensing or lease preapplication process. In general, the licensing or leasing process considers impacts to natural and cultural resources. Mitigating measures may be installation of physical structures like fish ladders, fish "friendly" turbines, or temperature control structures. Other measures might include downsizing the turbine capacity to provide for bypass flows and ramping rate restrictions to prevent fish stranding and other operational measures to enhance aquatic habitat, geomorphic processes, and recreational opportunities.

The Federal government, as owner of these facilities, could also undertake the task of increasing power production capability although this report does not advocate development of any specific sites. Generally, an appraisal

[8] Exemption from Part 1 of the Federal Power Act.

(Reclamation) or reconnaissance (USACE) study is conducted to determine if there is a Federal interest in conducting a more detailed feasibility study. The feasibility study and report determines whether an investment is justified and serves as the decision document and vehicle for construction authorization.

An appraisal or reconnaissance study is normally completed within about a year, conducted at full Federal expense, and uses existing information and professional judgment on whether a solution would likely be feasible for producing net benefits and being environmentally compliant. The feasibility study, on the other hand, is detailed, involves data collection, and ordinarily requires 3 years (sometimes longer) to complete. Feasibility studies are cost shared with non-Federal interests if applicable and must be specifically authorized by Congress.

These studies are guided by the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G), which were promulgated in 1983 pursuant to Section 103 of the Water Resources Planning Act of 1965 (P.L. 89-80). The P&G provides a systematic framework for Reclamation and the USACE to use in analyzing the economic, social, and environmental benefits of proposed water development alternatives, including hydropower. The primary emphasis of the P&G is to ascertain what the national economic development benefits and costs will be for proposed project alternatives. Other emphasis areas are regional economic development, environmental quality, and other social effects. The P&G also calls for NEPA compliance activities to be fully integrated into the process at the outset.

A feasibility report and associated NEPA compliance documentation (EA or EIS) would address all of the elements in Section 1834(c), as well as many other considerations. Examples include environmental and social impact assessment, consideration of significant resources and significant effects, regulatory considerations, project implementation timing, cooperation with other agencies, cost sharing with non-Federal interests, and public involvement and coordination.

Additional Considerations for Hydropower Development

Section 1834(c)(8) requests any additional considerations for increasing hydroelectric power, reducing costs, and improving efficiency at federally owned or operated water regulation, storage, and conveyance facilities. While the process of preparing this report considered opportunities for additional hydroelectric generation, this report also emphasizes the dramatic distinction between physically viable hydropower opportunities and economically viable opportunities.

Often, sites appear to have hydropower potential when examined from only their physical or hydrologic characteristics. Numerous national studies of hydropower potential have reported thousands of undeveloped sites but ignore the economic and regulatory barriers that may confront those sites. This report has attempted to provide rudimentary selection tools to refine the search on federal sites by developing exceedence curves to capture the quantity *and* timing of available water as well as simple estimations of development cost to better inform the reader regarding site viability.

The federal hydropower system is very mature. Most of the sites that are both physically and economically viable as well as capable of meeting regulatory standards have been developed. With rare exceptions, sites that already have generation were sized with the available hydrology to take the greatest advantage of the available supply and the intended use of the water. In some cases where there is additional water, studies have found that adding generators is usually not cost effective (Reclamation, 1984) or that the constraints on the water prohibit further development (Reclamation, 1977b). Lastly, few of the existing Federal facilities with power were developed with power as their primary purpose. The primary project purpose is usually water supply (Reclamation) or flood control and navigation (USACE). For example, for Reclamation facilities, power is generated as a secondary benefit when project water releases and deliveries are made. In all of these cases, the project's primary purpose takes precedence over other secondary development such as hydropower generation.

Over the last 30 years, federal sites for *nonfederal* development have become increasingly attractive. This past year, nonfederal hydroelectric projects at Reclamation's Tieton Dam (13 MW) and Mora Drop (2 MW) went on line. Both sites were originally licensed in the early 1980s, and their developers had waited until economic conditions facilitated development. Many other sites identified in this study have had outstanding FERC permits for many years[9]. Power marketing and cost of development are most always the deciding factors for new development.

Possibly the most economically attractive opportunity is to upgrade and modernize existing hydroelectric generation. Upratings require no additional units and licensing of higher output units require only modest administrative procedures. Yet upratings can easily yield over 15 percent increases in peak generating capacity. Other additional benefits include lowering operation and maintenance expense while enhancing system reliability. While Reclamation and the USACE, the two largest federal generators, have had formal uprating programs for many years, more opportunities still exist within both agencies and are being actively pursued. As of September 2005, uprates have been completed on 62 Reclamation units resulting in an increase in generator nameplate capacity of 1,867 MW. The USACE has rehabilitated five projects with a total increase in

[9] Preliminary permits expire after 3 years and would then require re-evaluation.

capacity of approximately 200 MW. The USACE has an additional 1,100 MW of rehabilitation at existing facilities in planning or underway as well.

The single most important constraint for additional hydropower development is available water. Existing facilities have been sized for a historical record of stream flow. Efforts to increase stream flow may provide opportunities to increase energy production or, in the most optimistic scenarios, even support the development of additional generating units. Methods to increase stream flow may be technical, such as increased irrigation efficiency, or institutional, such as leasing back irrigation water for other downstream uses such as municipal and industrial water delivery.

Pump storage opportunities, while beyond the scope and time frame of this report, are also worthy of additional attention. Pump storage facilities are not constrained by water availability to the same extent as a traditional hydropower facility. Instead, a pump storage facility exchanges water from a forebay to an afterbay, pumping uphill during off-peak periods and generating on-peak when energy is valued highest. Water losses can be limited to only evaporation and ground seepage. In addition, pump storage facilities can be integrated with wind facilities thereby firming an otherwise intermittent generation resource to create a reliable, emission-free source of energy. In the past, Reclamation has examined the possibility of adding pump storage facilities. For example, a study on the North Platte in 1979 looked at the possibility of adding pump storage facilities at Alcova and Seminoe Reservoirs while a previous study examined the Cutler Park-Rockwood site west of Dayton, Wyoming and the Sheep Mountain Site also in Wyoming as potential pump-storage sites. However, environmental impacts associated with pump storage facilities may be a concern.

There is also limited potential for increased power generation by using flow releases that may be adopted for environmental purposes but do not conform to the original design of outlet works. An example is the periodic flushing flows released from Glen Canyon Dam that simulate high spring runoff flows. In this case, flows beyond the dam's power generating capacity are passed through the jet flow valves at the base of Glen Canyon for the purpose of moving sediment to build fish habitat downstream. Another example occurs at Crystal Dam in Reclamation's Aspinall Unit. Crystal's primary objective is to protect downstream river resources by evening out the cyclical load-following releases made at Morrow Point Dam immediately upstream. Over the last few decades, the Crystal Dam power generator has been bypassed up to 40 percent of the time. Modification of the operation of any facilities in this regard would result in a new shape of the flow exceedence curve. If such additional flows or peaking flows occur 20 percent of the year or more (20 percent exceedence), then this might be economical to evaluate. Typically, environmental flow releases occur for a shorter portion of the year. However, if it can be shown that the modified operation schedule results in a significantly modified exceedence curve, then this might be a good opportunity. Over the last couple of decades, a lot of these releases have been made in experimental programs, short term agreements, or programs that are mandated by the courts. Translating these agreements into long-term operation plans would require that facility-specific environmental issues be resolved; and, such plans would have to be made firm before they could be used as a basis for constructing additional generation capacity.

Lastly, structural changes to dams and related generating facilities may increase hydroelectric power production. For example, the USACE has examined alternative pool heights at Chief Joseph Dam, the USACE's largest dam in terms of installed generating capacity. In scenarios with sufficient inflow, raising the height of dams can increase operating head and potentially increase generation. Likewise, dredging streambeds below dams can also increase the available head by lowering the surface level of the tailrace.

All other things being equal, hydroelectric facilities become less expensive per unit of generation as they become larger. The most ideal sites have long since been developed, and few sites that can meet the previously mentioned categories still exist on federal facilities. Even studies 25 years ago confirmed the relatively small number of opportunities remaining on federal sites (see, for example, WPRS, 1980a).

Conclusion

Critical to evaluating a hydroelectric site is to not just consider the site in isolation but rather to consider the site comprehensively with respect to its physical, hydrological, sociological, environmental, regulatory, and economic factors. The federal hydropower system is under many of the same pressures as other segments of the hydroelectric industry. The trend in relicensing has been to lose or restrict generation to accommodate changing public values and understanding of the impacts of hydropower operations on factors such as fisheries, recreation, and tribal trust responsibilities. The Elwha and Glines hydroelectric plants—operated by Reclamation but owned by NPS—are scheduled for decommissioning by 2010 to restore the ecosystem of the Elwha River and Olympic National Park. Recent biological opinions have resulted in decreased generation and load following capability at Reclamation's Glen Canyon Dam as well as many of the USACE's dams on the lower Columbia River.

This report offers only an assessment of additional hydroelectric generation potential at federal facilities. The report does not advocate one site over another or additional hydroelectric development in general. Rather, it provides an inventory of federal sites and a relatively simple assessment of the included sites' viability. As mentioned earlier, the report cannot be used as a substitute for detailed feasibility analyses.

Nevertheless, the report does provide an indication of remaining potential for hydroelectric development on federal facilities. While most of the economically attractive sites have been developed over the previous decades, those that remain and were considered viable in this report generally had modest benefit to cost ratios. Fluctuations in power rates or inaccuracies in the assessment models could certainly alter the results for any site from positive to negative or, conversely, from negative to positive. Consequently, the report has also provided the tools used in the assessments so that readers can use and alter certain assumptions to fit current conditions.

Bibliography

Bureau of Reclamation. 1977. *Report on the Western Energy Expansion Study*. U.S. Department of the Interior. Washington, D.C.: Government Printing Office.

Bureau of Reclamation. 1977. *Special Report on Additional Powerplant at Canyon Ferry Dam, Montana*. Upper Missouri Region. U.S. Department of the Interior.

Bureau of Reclamation. 1982. *Report on Assessment of Low-Head Hydroelectric Sites in the Western States.* U.S. Department of the Interior. Washington, D.C.: Government Printing Office.

Bureau of Reclamation. 1984. *Concluding Report—Guernsey Dam Powerplant Enlargement*. U.S. Department of the Interior.

Bureau of Reclamation. 2005. *Inventory of Reclamation Water Surface Storage Studies with Hydropower Components.* U.S. Department of the Interior. Denver: Bureau of Reclamation, Power Resources Office.

Federal Energy Regulatory Commission. 1979. *Hydroelectric Power Evaluation*. DOE/FERC-0031. Washington, D.C.: Government Printing Office.

General Accounting Office. 1977. *Power Production at Federal Dams Could Be Increased by Modernizing Turbines and Generators*. PB 269 2254.

Gulliver, John S. and Roger E.A. Arndt. 1990. *Hydropower Engineering Handbook*. McGraw-Hill**.**

Hall, Douglas G., Richard T. Hunt, Kelly S. Reeves, and Greg R. Carroll. 2003. *Estimation of Economic Parameters of U.S. Hydropower Resource*. Idaho National Engineering and Environmental Laboratory. Prepared for the U.S. Department of Energy, Contract DE-AC07-99ID13727. http://hydropower.inel.gov/resourceassessment/pdfs/project_report-final_with_disclaimer-3jul03.pdf

Walsh, Michael R. and Darrell R. Nolton. 1988. *Directory of Corps Projects with Existing Hydroelectric Power Facilities and/or the Potential for the Addition of Hydroelectric Power*. Internal report for USACE distribution only.

Water and Power Resources Service. 1980a. *Report on Assessment of Small Hydroelectric Development at Existing Facilities.* U.S. Department of the Interior. Washington, D.C.: Government Printing Office.

Water and Power Resources Service. 1980b. *Western States: Inventory of Low-Head Hydroelectric Sites*. U.S. Department of the Interior. Washington, D.C.: Government Printing Office.

U.S. Army Corps of Engineers. 1983. *National Hydroelectric Power Resources Study*. Report No. IWR-82-H-1. Washington, D.C.: Government Printing Office.

U.S. Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington, D.C.: Government Printing Office.

Appendix 1

Section 1834 of the Energy Policy Act of 2005

.

Sec. 1834. Increased Hydroelectric Generation at Existing Federal Facilities

(a) In General—The Secretary of the Interior, the Secretary, and the Secretary of the Army shall jointly conduct a study of the potential for increasing electric power production capability at federally owned or operated water regulation, storage, and conveyance facilities.

(b) Content—The study under this section shall include identification and description in detail of each facility that is capable, with or without modification, of producing additional hydroelectric power, including estimation of the existing potential for the facility to generate hydroelectric power.

(c) Report—The Secretaries shall submit to the Committees on Energy and Commerce, Resources, and Transportation and Infrastructure of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the findings, conclusions, and recommendations of the study under this section by not later than 18 months after the date of the enactment of this Act. The report shall include each of the following:

(1) The identifications, descriptions, and estimations referred to in subsection (b).

(2) A description of activities currently conducted or considered, or that could be considered, to produce additional hydroelectric power from each identified facility.

(3) A summary of prior actions taken by the Secretaries to produce additional hydroelectric power from each identified facility.

(4) The costs to install, upgrade, or modify equipment or take other actions to produce additional hydroelectric power from each identified facility and the level of Federal power customer involvement in the determination of such costs.

(5) The benefits that would be achieved by such installation, upgrade, modification, or other action, including quantified estimates of any additional energy or capacity from each facility identified under subsection (b).

(6) A description of actions that are planned, underway, or might reasonably be considered to increase hydroelectric power production by replacing turbine runners, by performing generator upgrades or rewinds, or construction of pumped storage facilities.

(7) The impact of increased hydroelectric power production on irrigation, water supply, fish, wildlife, Indian tribes, river health, water quality, navigation, recreation, fishing, and flood control.
(8) Any additional recommendations to increase hydroelectric power production from, and reduce costs and improve efficiency at, federally owned or operated water regulation, storage, and conveyance facilities.

Appendix 2a

All Facilities Included in Study without Existing Hydropower

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Great Plains		Allen Dam	South Dakota	26	50	98
BIA	Great Plains		Ambrose Dam	South Dakota	25	50	94
BIA	Great Plains		Antelope Dam	South Dakota	25	100	188
BIA	Great Plains		Belcourt Lake Dam	North Dakota	10	500	375
BIA	Great Plains		Crow Creek Dam	South Dakota	54	500	2,025
BIA	Great Plains		Ghost Hawk Dam	South Dakota	32	100	240
BIA	Great Plains		Gordon Dam	North Dakota	10	100	75
BIA	Great Plains		He Dog Dam	South Dakota	48	500	1,800
BIA	Great Plains		Indian Scout Dam	South Dakota	33	50	124
BIA	Great Plains		Kyle Dam	South Dakota	34	300	765
BIA	Great Plains		Oglala Dam	South Dakota	60	500	2,250
BIA	Great Plains		Parmalee Dam	South Dakota	36	300	810
BIA	Great Plains		Paulsen Dam	South Dakota	14	50	52
BIA	Great Plains		Ponca Dam	South Dakota	35	300	788
BIA	Great Plains		Prairie No. 1 Dam	North Dakota	24	50	90
BIA	Great Plains		Ring Thunder Dam	South Dakota	30	50	112
BIA	Great Plains		Rosebud Dam	South Dakota	33	300	742
BIA	Great Plains		South Okreek Dam	South Dakota	25	50	94
BIA	Great Plains		Standing Rock No. 1 Dam	South Dakota	30	50	112
BIA	Great Plains		Sulley 2 Dam	South Dakota	26	50	98
BIA	Great Plains		White Clay Dam	South Dakota	40	500	1,500
BIA	Great Plains		Wolf Creek Dam	South Dakota	27	50	101
BIA	Midwest		Neopit Dam	Wisconsin	18		0
BIA	Navajo		Asaavi Dam	New Mexico	66	20	99
BIA	Navajo		Blue Canyon Dam	Arizona	142	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Navajo		Canyon Diablo Dam	Arizona	40	0	0
BIA	Navajo		Captain Tom Dam	Arizona	28	10	21
BIA	Navajo		Charley Day Dam	Arizona	15	0	0
BIA	Navajo		Cutter Dam	New Mexico	74	701	3,891
BIA	Navajo		Ganado Dam	Arizona	23	25	43
BIA	Navajo		Many Farms Dam	Arizona	45	30	101
BIA	Navajo		Red Lake Dam	New Mexico	22	30	50
BIA	Navajo		Round Rock Dam	Arizona	35	10	26
BIA	Navajo		Todacheene Dam	New Mexico	20	0	0
BIA	Navajo		Tohajiilee Dam	New Mexico	20	0	0
BIA	Navajo		Tsaile Dam	Arizona	61	11	50
BIA	Navajo		Wheatfields Dam	Arizona	67	20	100
BIA	Navajo		Window Rock Dam	Arizona	30	0	0
BIA	Northwest		Black Lake Dam	Montana	75	0	0
BIA	Northwest		Blackfoot Dam	Idaho	59	0	0
BIA	Northwest		Crow Dam	Montana	99	21	156
BIA	Northwest		Equalizer Dam	Idaho	24	0	0
BIA	Northwest		Fourth Creek Dam	Oregon	34	2	5
BIA	Northwest		Happy Valley Dam	Oregon	45	0	0
BIA	Northwest		Hubbart Dam	Montana	130	0	0
BIA	Northwest		Indian Lake Dam	Oregon	54	0	0
BIA	Northwest		Jocko Dam	Montana	93	0	0
BIA	Northwest		Kicking Horse Dam	Montana	29	0	0
BIA	Northwest		Little Bitterroot Dam	Montana	17	0	0
BIA	Northwest		Lower Dry Fork Dam	Montana	37	0	0
BIA	Northwest		McDonald Dam	Montana	64	19	91
BIA	Northwest		Mission Dam	Montana	83	18	112
BIA	Northwest		Ninepipe Dam	Montana	38	0	0
BIA	Northwest		Owhi Dam	Washington	12	0	0
BIA	Northwest		Pablo Dam	Montana	43	0	0
BIA	Northwest		Tabor Dam	Montana	53	0	0
BIA	Northwest		Tarheel Dam	Oregon	36	2	5
BIA	Northwest		Twin (Turtle) Lake Dam	Montana	39	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Northwest		Twin Lakes Dam (BIA)	Washington	25	0	0
BIA	Northwest		Upper Dry Fork Dam	Montana	40	0	0
BIA	Pacific		Lauer Dam	California	13	4	4
BIA	Pacific		Tahquitz Dam	California	25	0	0
BIA	Rocky Mountain		Agency Dam	Montana	32	30	72
BIA	Rocky Mountain		Bonneau Dam	Montana	100	50	375
BIA	Rocky Mountain		Crow No. 3 Dam	Montana	21	5	8
BIA	Rocky Mountain		East Fork Dam	Montana	80	30	180
BIA	Rocky Mountain		Fort Belknap No. 8 Dam	Montana	13	5	5
BIA	Rocky Mountain		Four Horns Dam	Montana	45	20	68
BIA	Rocky Mountain		Frazer Dam	Montana	12	0	0
BIA	Rocky Mountain		Lower Two Medicine Dam	Montana	50	1,000	3,750
BIA	Rocky Mountain		Ray Lake Dam	Wyoming	29	200	435
BIA	Rocky Mountain		Washakie Dam	Wyoming	62	800	3,720
BIA	Rocky Mountain		Willow Creek Dam	Montana	136	200	2,040
BIA	Southwest		Acomita Dam	New Mexico	40	0	0
BIA	Southwest		Black Rock Dam	New Mexico	110	0	0
BIA	Southwest		Dulce Dam	New Mexico	30	0	0
BIA	Southwest		La Jara Dam	New Mexico	27	0	0
BIA	Southwest		Lake Capote Dam	Colorado	42	0	0
BIA	Southwest		Lake Mescalero Dam	New Mexico	85	1	6
BIA	Southwest		Lower Mundo Dam	New Mexico	64	0	0
BIA	Southwest		Nanaka Dam	New Mexico	25	3	6
BIA	Southwest		Paquate Dam	New Mexico	36	0	0
BIA	Southwest		Pescado Dam	New Mexico	25	0	0
BIA	Southwest		Pin Dee Dam	New Mexico	20	3	4
BIA	Southwest		San Francisco Dam	New Mexico	19	0	0
BIA	Southwest		Sandia Pueblo 82-1 Dam	New Mexico	18	0	0
BIA	Southwest		Sandia Pueblo 82-2 Dam	New Mexico	18	0	0
BIA	Southwest		Sandia Pueblo 82-3 Dam	New Mexico	18	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Southwest		Sandia Pueblo 82-4 Dam	New Mexico	18	0	0
BIA	Southwest		Sandia Pueblo 83-A Dam	New Mexico	18	0	0
BIA	Southwest		Santa Ana Dam	New Mexico	24	0	0
BIA	Southwest		Seama Dam	New Mexico	25	0	0
BIA	Southwest		Silver Lake Dam	New Mexico	50	0	0
BIA	Southwest		Stone Lake Dam	New Mexico	30	0	0
BIA	Southwest		Tesuque School Dam	New Mexico	26	0	0
BIA	Southwest		Trapped Rock Dam	New Mexico	40	0	0
BIA	Southwest		Tschicoma Dam	New Mexico	25	3	6
BIA	Southwest		Water Tank Dam	New Mexico	17	0	0
BIA	Southwest		Weinpovi Dam	New Mexico	25	3	6
BIA	Western		A-1 Dam	Arizona	37	50	139
BIA	Western		Bog Tank Dam	Arizona	20	50	75
BIA	Western		Bootleg Dam	Arizona	47	50	176
BIA	Western		Bottle Hollow Dam	Utah	60	100	450
BIA	Western		Christmas Tree Dam	Arizona	45	50	169
BIA	Western		Cooley Dam	Arizona	39	50	146
BIA	Western		Coolidge Dam	Arizona	252	800	15,120
BIA	Western		Cyclone Dam	Arizona	52	50	195
BIA	Western		Davis (Hawley Lake) Dam	Arizona	50	50	188
BIA	Western		Dry Lake Dam	Arizona	16	50	60
BIA	Western		Elgo Dam	Arizona	133	50	499
BIA	Western		Horseshoe Cienega Dam	Arizona	40	50	150
BIA	Western		Midview Dam	Utah	54	100	405
BIA	Western		Pasture Canyon Dam	Arizona	18	50	68
BIA	Western		Point of Pines Dam	Arizona	47	50	176
BIA	Western		Reservation Dam	Arizona	54	50	202
BIA	Western		Shush Be Tou Dam	Arizona	36	50	135
BIA	Western		Shush Be Zahze Dam	Arizona	37	50	139
BIA	Western		Sunrise Dam	Arizona	50	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Western		Tat Momolikot Dam	Arizona	76	0	0
BIA	Western		Tufa Stone Dam	Arizona	36	0	0
BIA	Western		Upper Point of Pines Dam	Arizona	29	50	109
BIA	Western		Weber Dam	Nevada	50	1,000	3,750
BIA	Western		Wild Horse Dam	Nevada	114	600	5,130
Reclamation	Great Plains	Arbuckle	Arbuckle Dam	Oklahoma	10	1	1
Reclamation	Great Plains	Belle Fourche	Belle Fourche Dam	South Dakota	48	900	3,240
Reclamation	Great Plains	Belle Fourche	Belle Fourche Diversion Dam	South Dakota	20		17
Reclamation	Great Plains	Canadian River	Sanford Dam	Texas	76	196	1,117
Reclamation	Great Plains	Colorado-Big Thompson	Carter Lake Dam No. 1	Colorado	190	1,260	17,955
Reclamation	Great Plains	Colorado-Big Thompson	Dixon Canyon Dam	Colorado	215		0
Reclamation	Great Plains	Colorado-Big Thompson	East Portal Diversion Dam	Colorado	10	550	412
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dam	Colorado	214	435	6,982
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dikes 1-4	Colorado			0
Reclamation	Great Plains	Colorado-Big Thompson	Horsetooth Dam	Colorado		2,500	0
Reclamation	Great Plains	Colorado-Big Thompson	Little Hell Creek Diversion Dam	Colorado	33	550	1,361
Reclamation	Great Plains	Colorado-Big Thompson	North Poudre Diversion Dam	Colorado	6	250	112
Reclamation	Great Plains	Colorado-Big Thompson	Olympus Dam	Colorado	45	550	1,856
Reclamation	Great Plains	Colorado-Big Thompson	Rattlesnake Dam	Colorado	100	960	7,200
Reclamation	Great Plains	Colorado-Big Thompson	Satanka Dike	Colorado			0
Reclamation	Great Plains	Colorado-Big Thompson	Shadow Mountain Dam	Colorado	37	10,050	27,889
Reclamation	Great Plains	Colorado-Big Thompson	Soldier Canyon Dam	Colorado	203	90	1,370
Reclamation	Great Plains	Colorado-Big Thompson	South Platte Supply Canal Diverion Dam	Colorado	5	230	86
Reclamation	Great Plains	Colorado-Big Thompson	Spring Canyon Dam	Colorado	198		0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	Colorado-Big Thompson	St. Vrain Canal	Colorado	105	575	4,528
Reclamation	Great Plains	Colorado-Big Thompson	Willow Creek Dam	Colorado	95	2,050	14,606
Reclamation	Great Plains	Colorado-Big Thompson	Willow Creek Forebay Diversion Dam	Colorado	11	400	330
Reclamation	Great Plains	Fryingpan-Arkansas	Carter Creek Diversion Dam	Colorado	8	100	60
Reclamation	Great Plains	Fryingpan-Arkansas	Chapman Diversion Dam	Colorado	13	300	292
Reclamation	Great Plains	Fryingpan-Arkansas	Fryingpan Diversion Dam	Colorado	14	400	420
Reclamation	Great Plains	Fryingpan-Arkansas	Granite Creek Diversion Dam	Colorado	4	50	15
Reclamation	Great Plains	Fryingpan-Arkansas	Halfmoon Creek Diversion Dam	Colorado	17	150	191
Reclamation	Great Plains	Fryingpan-Arkansas	Hunter Creek Diversion Dam	Colorado	10	140	105
Reclamation	Great Plains	Fryingpan-Arkansas	Ivanhoe Diversion Dam	Colorado	10	150	112
Reclamation	Great Plains	Fryingpan-Arkansas	Lily Pad Diversion Dam	Colorado	9	20	14
Reclamation	Great Plains	Fryingpan-Arkansas	Middle Cunningham Creek Diversion Dam	Colorado	10	50	38
Reclamation	Great Plains	Fryingpan-Arkansas	Midway Creek Diversion Dam	Colorado	12	85	76
Reclamation	Great Plains	Fryingpan-Arkansas	Mormon Creek Diversion Dam	Colorado	10	60	45
Reclamation	Great Plains	Fryingpan-Arkansas	No Name Creek Diversion Dam	Colorado	13	95	93
Reclamation	Great Plains	Fryingpan-Arkansas	North Cunningham Creek Diversion Dam	Colorado	12	30	27
Reclamation	Great Plains	Fryingpan-Arkansas	North Fork Diversion Dam	Colorado	13	30	29
Reclamation	Great Plains	Fryingpan-Arkansas	Pueblo Dam	Colorado	191	5,767	82,612
Reclamation	Great Plains	Fryingpan-Arkansas	Sawyer Creek Diversion Dam	Colorado	6	30	14
Reclamation	Great Plains	Fryingpan-Arkansas	South Cunningham Creek Diversion Dam	Colorado	12	20	18
Reclamation	Great Plains	Fryingpan-Arkansas	South Fork Diversion Dam	Colorado	13	215	210

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	Fryingpan-Arkansas	Twin Lakes Dam (USBR)	Colorado	53	3,465	13,773
Reclamation	Great Plains	Huntley	Anita Dam	Montana	42	30	94
Reclamation	Great Plains	Huntley	Huntley Diversion Dam	Montana	8		0
Reclamation	Great Plains	Lower Yellowstone	Lower Yellowstone Diversion Dam	Montana	4	159,000	47,700
Reclamation	Great Plains	Milk River	Dodson Diversion Dam	Montana	23	200	345
Reclamation	Great Plains	Milk River	Fresno Dam	Montana	55	2,600	10,725
Reclamation	Great Plains	Milk River	Lake Sherburne Dam	Montana	68	2,100	10,710
Reclamation	Great Plains	Milk River	Nelson Dikes	Montana	22	250	405
Reclamation	Great Plains	Milk River	Nelson Dikes	Montana	22	550	891
Reclamation	Great Plains	Milk River	Paradise Diversion Dam	Montana	14	19,000	19,950
Reclamation	Great Plains	Milk River	Saint Mary Diversion Dam	Montana	6	850	382
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 1	Montana	36	850	2,295
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 2	Montana	29	850	1,849
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 3	Montana	27	850	1,721
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 4	Montana	66	850	4,208
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 5	Montana	56	850	3,570
Reclamation	Great Plains	Milk River	Vandalia Diversion Dam	Montana	27	300	608
Reclamation	Great Plains	Mirage Flats	Box Butte Dam	Nebraska	52	420	1,638
Reclamation	Great Plains	Mirage Flats	Dunlap Diversion Dam	Nebraska	6	220	99
Reclamation	Great Plains	Mountain Park	Bretch Diversion Canal	Oklahoma	25		0
Reclamation	Great Plains	Mountain Park	Mountain Park Dam	Oklahoma	45	34	115
Reclamation	Great Plains	Norman	Norman Dam	Oklahoma	70	0	0
Reclamation	Great Plains	North Platte	Dry Spotted Tail Diversion Dam	Nebraska	14	40	44
Reclamation	Great Plains	North Platte	Horse Creek Diversion Dam	Wyoming	6		0
Reclamation	Great Plains	North Platte	Lake Alice Lower 1-1/2 Dam	Nebraska	23	475	819
Reclamation	Great Plains	North Platte	Lake Alice No. 1 Dam	Nebraska	23	0	0
Reclamation	Great Plains	North Platte	Lake Alice No. 2 Dam	Nebraska	8	475	285
Reclamation	Great Plains	North Platte	Minatare Dam	Nebraska	48	420	1,512
Reclamation	Great Plains	North Platte	Pathfinder Dam	Wyoming	192	2,000	28,800

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	North Platte	Pathfinder Dike	Wyoming	20	0	0
Reclamation	Great Plains	North Platte	Tub Springs Creek Diversion Dam	Nebraska	11	93	77
Reclamation	Great Plains	North Platte	Whalen Diversion Dam	Wyoming	11	8,000	6,600
Reclamation	Great Plains	Nueces River	Choke Canyon Dam	Texas	93	33	230
Reclamation	Great Plains	PSMBP - Almena	Almena Diversion Dam	Kansas	19	100	142
Reclamation	Great Plains	PSMBP - Almena	Norton Dam	Kansas	58	300	1,305
Reclamation	Great Plains	PSMBP - Armel	Bonny Dam	Colorado	93	130	907
Reclamation	Great Plains	PSMBP - Bostwick	Lovewell Dam	Kansas	47	635	2,238
Reclamation	Great Plains	PSMBP - Bostwick	Superior-Courtland Diversion Dam	Nebraska	8	751	451
Reclamation	Great Plains	PSMBP - Cedar Bluff	Cedar Bluff Dam	Kansas	102	2,500	19,125
Reclamation	Great Plains	PSMBP - Cheyenne Div.	Keyhole Dam	Wyoming	65	1,250	6,094
Reclamation	Great Plains	PSMBP - Dickinson	Dickinson Dam	North Dakota	26	2,500	4,875
Reclamation	Great Plains	PSMBP - East Bench	Barretts Diversion Dam	Montana	10	2,500	1,875
Reclamation	Great Plains	PSMBP - East Bench	Clark Canyon Dam	Montana	82	2,200	13,480
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Bartley Diversion Dam	Nebraska	3	130	29
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Cambridge Diversion Dam	Nebraska	2	325	49
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Culbertson Diversion Dam	Nebraska	7	400	210
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Enders Dam	Nebraska	70	1,300	6,825
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Medicine Creek Dam	Nebraska	66	390	1,930
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Red Willow Dam	Nebraska	74	700	3,885
Reclamation	Great Plains	PSMBP - Glendo	Gray Reef Dam	Wyoming	18	8,900	12,015

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	PSMBP - Hanover-Bluff	Hanover Diversion Dam	Wyoming	8		0
Reclamation	Great Plains	PSMBP - Heart Butte	Heart Butte Dam	North Dakota	59	4,000	17,700
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Dam	Montana	21	350	551
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Pumping Plant	Montana	150	1,026	11,542
Reclamation	Great Plains	PSMBP - James Diversion	James Diversion Dam	South Dakota	15		225
Reclamation	Great Plains	PSMBP - Jamestown Dam	Jamestown Dam	North Dakota	40	1,250	3,750
Reclamation	Great Plains	PSMBP - Kirwin	Kirwin Dam	Kansas	67	2,100	10,552
Reclamation	Great Plains	PSMBP - North Loup	Davis Creek Dam	Nebraska	91	630	4,300
Reclamation	Great Plains	PSMBP - North Loup	Kent Diversion Dam	Nebraska	9	500	338
Reclamation	Great Plains	PSMBP - North Loup	Virginia Smith Dam	Nebraska	74	2,000	11,100
Reclamation	Great Plains	PSMBP - Owl Creek	Anchor Dam	Wyoming	146	300	3,285
Reclamation	Great Plains	PSMBP - Rapid Valley	Pactola Dam	South Dakota	156	500	5,850
Reclamation	Great Plains	PSMBP - Riverton	Bull Lake Dam	Wyoming	40	4,000	12,000
Reclamation	Great Plains	PSMBP - Riverton	Pilot Butte Dam	Wyoming	100		1,000
Reclamation	Great Plains	PSMBP - Riverton	Wind River Diversion Dam	Wyoming	19	6,600	9,405
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 1016	Wyoming	13		252
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 1490	Wyoming	40		688
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 1520	Wyoming	13		246
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 1626	Wyoming	34		483
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 1972	Wyoming	24		247
Reclamation	Great Plains	PSMBP - Riverton	Wyoming Canal - Sta 997	Wyoming	17		243

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	PSMBP - Shadehill	Shadehill Dam	South Dakota	65	600	2,925
Reclamation	Great Plains	PSMBP - Webster	Webster Dam	Kansas	69	380	1,966
Reclamation	Great Plains	PSMBP - Webster	Woodston Diversion Dam	Kansas	14	160	168
Reclamation	Great Plains	PSMBP - Yellowtail	Yellowtail Afterbay Dam	Montana	36	20,750	56,025
Reclamation	Great Plains	PSMBP Ainsworth Unit	Merritt Dam	Nebraska	71	750	3,994
Reclamation	Great Plains	PSMBP Ainsworth Unit	Merritt Dam	Nebraska	71	580	3,088
Reclamation	Great Plains	PSMBP Cambridge Unit	Trenton Dam	Nebraska	32	312	749
Reclamation	Great Plains	PSMBP Cambridge Unit	Trenton Dam	Nebraska	59	3,500	15,488
Reclamation	Great Plains	PSMBP Cheyenne Diversion	Angostura Dam	South Dakota	122	290	2,654
Reclamation	Great Plains	PSMBP Glen Elder Unit	Glen Elder Dam	Kansas	70	4,000	21,000
Reclamation	Great Plains	Rapid Valley	Deerfield Dam	South Dakota	100	90	675
Reclamation	Great Plains	San Angelo	Twin Buttes Dam	Texas	76	0	0
Reclamation	Great Plains	Shoshone	Corbett Diversion Dam	Wyoming	12		1,400
Reclamation	Great Plains	Shoshone	Deaver Dam	Wyoming	12		0
Reclamation	Great Plains	Shoshone	Ralston Dam	Wyoming			0
Reclamation	Great Plains	Shoshone	Willwood Canal	Wyoming	37	415	1,152
Reclamation	Great Plains	Shoshone	Willwood Diversion Dam	Wyoming	41	5,000	15,375
Reclamation	Great Plains	Sun River	A-Drop Project, Greenfield Main Canal Drop	Montana	34	200	510
Reclamation	Great Plains	Sun River	Fort Shaw Diversion Dam	Montana	9		0
Reclamation	Great Plains	Sun River	Gibson Dam	Montana	168	3,050	38,316
Reclamation	Great Plains	Sun River	Greenfield Project, Greenfield Main Canal Drop	Montana	38	425	1,211
Reclamation	Great Plains	Sun River	Johnson Project, Greenfield Main Canal Drop	Montana	46	425	1,466

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	Sun River	Knights Project, Greenfield Main Canal Drop	Montana	60	425	1,912
Reclamation	Great Plains	Sun River	Lower Turnbull Drop Structure	Montana	146	1,200	13,185
Reclamation	Great Plains	Sun River	Mary Taylor Drop Structure	Montana	44	600	1,980
Reclamation	Great Plains	Sun River	Mill Coulee Canal Drop, Upper and Lower Drops Combined	Montana	186	200	2,796
Reclamation	Great Plains	Sun River	Pishkun Dike - No. 4	Montana	28	1,600	3,360
Reclamation	Great Plains	Sun River	Sun River Diversion Dam	Montana	45	1,400	4,725
Reclamation	Great Plains	Sun River	Upper Turnbull Drop Structure	Montana	102	1,200	9,144
Reclamation	Great Plains	Sun River	Willow Creek Dam	Montana	77	350	2,021
Reclamation	Great Plains	Sun River	Woods Project, Greenfield Main Canal Drop	Montana	53	425	1,689
Reclamation	Great Plains	W.C. Austin	Altus Dam	Oklahoma	70	0	0
Reclamation	Great Plains	Washita Basin	Fort Cobb Dam	Oklahoma	63	30	142
Reclamation	Great Plains	Washita Basin	Foss Dam	Oklahoma	79	25	148
Reclamation	Great Plains	Wichita	Cheney Dam	Kansas	52	93	363
Reclamation	Lower Colorado	Boulder Canyon Project	All American Canal	California	21	15,155	23,869
Reclamation	Lower Colorado	Boulder Canyon Project	All American Canal Headworks	California	23	31,000	53,475
Reclamation	Lower Colorado	Boulder Canyon Project	Coachella Canel	California	11	2,500	2,025
Reclamation	Lower Colorado	Boulder Canyon Project	Granite Reef Diversion Dam	Arizona-California	18	2,000	2,700
Reclamation	Lower Colorado	Boulder Canyon Project	laguna Dam	Arizona-California	10		0
Reclamation	Lower Colorado	Central Arizona Project	Agua fria River Siphon	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Buckskin Mountain Tunnel	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Burnt Mountain Tunnel	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Centennial Wash Siphon	Arizona		3,000	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Lower Colorado	Central Arizona Project	Cunningham Wash Siphon	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Gila River Siphon	Arizona		2,800	0
Reclamation	Lower Colorado	Central Arizona Project	Hassayampa River Siphon	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Interstate Highway Siphon	Arizona		621	0
Reclamation	Lower Colorado	Central Arizona Project	Jackrabbit Wash Siphon	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	New River Siphon	Arizona		3,000	0
Reclamation	Lower Colorado	Central Arizona Project	Reach 11 Dike	Arizona		0	0
Reclamation	Lower Colorado	Central Arizona Project	Salt River Siphon Blowoff	Arizona		3,000	0
Reclamation	Lower Colorado	Gila	Gila Gravity Main Canal Headworks	Arizona	14	2,200	2,392
Reclamation	Lower Colorado	Palo Verde Diversion Project	Imperial Dam	Arizona-California	23	0	0
Reclamation	Lower Colorado	Palo Verde Diversion Project	Palo Verde Diversion Dam	Arizona-California	46	1,800	6,210
Reclamation	Lower Colorado	Salt River Project	Arizona Canal	Arizona	7	2,000	1,020
Reclamation	Lower Colorado	Salt River Project	Bartlette Dam	Arizona	188	4,000	56,400
Reclamation	Lower Colorado	Salt River Project	Consolidated Canal	Arizona	8	1,325	795
Reclamation	Lower Colorado	Salt River Project	Cross Cut Canal	Arizona	6	400	180
Reclamation	Lower Colorado	Salt River Project	Eastern Canal	Arizona	4	325	102
Reclamation	Lower Colorado	Salt River Project	Grand Canal	Arizona	5	900	338
Reclamation	Lower Colorado	Salt River Project	Horseshoe Dam	Arizona	142	2,200	23,430
Reclamation	Lower Colorado	Salt River Project	Tempe Canal	Arizona	4	600	180
Reclamation	Lower Colorado	Salt River Project	Western Canal	Arizona	4	550	165
Reclamation	Lower Colorado	Yuma Project	Agua Fria Tunnel	Arizona		3,000	0
Reclamation	Mid-Pacific	Cachuma	Bradbury Dam	California	190	28,744	409,602
Reclamation	Mid-Pacific	Cachuma	Carpenteria	California	17	1,950	2,048
Reclamation	Mid-Pacific	Cachuma	Glen Anne Dam	California	86	40	258
Reclamation	Mid-Pacific	Cachuma	Lauro Dam	California	99	35	260
Reclamation	Mid-Pacific	Cachuma	Ortega	California	18	26	35

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Mid-Pacific	Central Valley	Buckhorn Dam (Reclamation)	California	72	240	1,296
Reclamation	Mid-Pacific	Central Valley	Camp Creek Dam	California	11	500	413
Reclamation	Mid-Pacific	Central Valley	Contra Loma Dam	California	82	970	5,966
Reclamation	Mid-Pacific	Central Valley	Funks Dam	California	36	15	40
Reclamation	Mid-Pacific	Central Valley	John Franchi Dam	California	15	1,000	1,125
Reclamation	Mid-Pacific	Central Valley	Little Panoche Detention Dam	California	86	1,040	6,708
Reclamation	Mid-Pacific	Central Valley	Los Banos Creek Detention Dam	California	126	1,255	11,860
Reclamation	Mid-Pacific	Central Valley	Martinez Dam	California	42	22	69
Reclamation	Mid-Pacific	Central Valley	Mormon Island Auxiliary Dike	California	105	0	0
Reclamation	Mid-Pacific	Central Valley	Red Bluff Dam	California	22	161,389	266,292
Reclamation	Mid-Pacific	Central Valley	San Justo Dam	California	126	99	936
Reclamation	Mid-Pacific	Central Valley	Sly Park Dam	California	170	250	3,188
Reclamation	Mid-Pacific	Central Valley	Spring Creek Debris Dam	California	184	1,690	23,322
Reclamation	Mid-Pacific	Central Valley	Sugar Pine	California	200	13	195
Reclamation	Mid-Pacific	Humboldt	Rye Patch Dam	Nevada	49	7,840	28,812
Reclamation	Mid-Pacific	Humboldt	Upper Slaven Dam	Nevada	8	7,790	4,674
Reclamation	Mid-Pacific	Klamath	Anderson-Rose Dam	Oregon	12	800	720
Reclamation	Mid-Pacific	Klamath	Clear Lake Dam	California	33	1,000	2,475
Reclamation	Mid-Pacific	Klamath	Gerber Dam	Oregon	63	900	4,252
Reclamation	Mid-Pacific	Klamath	Lost River Diversion Dam	Oregon	24	3,000	5,400
Reclamation	Mid-Pacific	Klamath	Malone Diversion Dam	Oregon	18	220	297
Reclamation	Mid-Pacific	Klamath	Miller Dam	Oregon	5	406	152
Reclamation	Mid-Pacific	Newlands	Carson River Dam	Nevada	14	14	1,950
Reclamation	Mid-Pacific	Newlands	Derby Dam	Nevada	15	16,400	18,450
Reclamation	Mid-Pacific	Newlands	Lake Tahoe Dam	California	10	2,630	1,972
Reclamation	Mid-Pacific	Newlands	Sheckler Dam	Nevada			
Reclamation	Mid-Pacific	Orland	East Park Dam	California	90	6,074	41,000
Reclamation	Mid-Pacific	Orland	Northside	California	3	125	28
Reclamation	Mid-Pacific	Orland	Rainbow Dam	California	29	200	435

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Mid-Pacific	Santa Maria	Twitchell Dam	California	211	1,825	28,881
Reclamation	Mid-Pacific	Solano	Putah Creek Dam	California	11	14,557	12,009
Reclamation	Mid-Pacific	Solano	Putah Diversion Dam	California	11	14,557	12,010
Reclamation	Mid-Pacific	Solano	Terminal Dam	California	19	270	385
Reclamation	Mid-Pacific	Truckee Storage	Boca Dam	California	2530	93	17,647
Reclamation	Mid-Pacific	Ventura River	Casitas Dam	California	261	612	11,980
Reclamation	Mid-Pacific	Ventura River	Robles Dam	California	13	13,320	12,987
Reclamation	Mid-Pacific	Washoe	Dressler Dam	Nevada			
Reclamation	Mid-Pacific	Washoe	Marble Bluff Dam	Nevada	24	19,300	34,740
Reclamation	Mid-Pacific	Washoe	Prosser Creek Dam	California	119	1,790	15,976
Reclamation	Pacific Northwest	Baker	Mason Dam	Oregon	150		3,000
Reclamation	Pacific Northwest	Baker	Thief Valley	Oregon	49	200	718
Reclamation	Pacific Northwest	Bitter Root	Rock Creek	Montana	5		0
Reclamation	Pacific Northwest	Boise	Arrowrock	Idaho	80	200	15,000
Reclamation	Pacific Northwest	Boise	Deadwood Dam	Idaho	137	500	5,000
Reclamation	Pacific Northwest	Boise	Deer Flat East Dike	Idaho	10		0
Reclamation	Pacific Northwest	Boise	Deer Flat Middle	Idaho	11	78	63
Reclamation	Pacific Northwest	Boise	Deer Flat North Lower	Idaho	43	500	1,570
Reclamation	Pacific Northwest	Boise	Deer Flat Upper	Idaho	60	170	745
Reclamation	Pacific Northwest	Boise	Golden Gate Canal	Idaho	43	250	785
Reclamation	Pacific Northwest	Boise	Hubbard	Idaho	9		0
Reclamation	Pacific Northwest	Boise	Main Canal No. 10	Idaho			
Reclamation	Pacific Northwest	Boise	Main Canal No. 6	Idaho			
Reclamation	Pacific Northwest	Boise	Mora Canal Drop	Idaho			
Reclamation	Pacific Northwest	Burnt River	Unity	Oregon	62	120	539

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Chief Joseph Dam	Spectacle Lake Dike	Washington	20	75	110
Reclamation	Pacific Northwest	Columbia Basin	Crab Creek Lateral #4	Washington	120	69	604
Reclamation	Pacific Northwest	Columbia Basin	Dry Falls - Main Canal Headworks	Washington			26,000
Reclamation	Pacific Northwest	Columbia Basin	Eltopia Branch Canal 4.6	Washington			
Reclamation	Pacific Northwest	Columbia Basin	PEC Mile 26.3	Washington	20	1,650	2,409
Reclamation	Pacific Northwest	Columbia Basin	Pinto	Washington	30	10	22
Reclamation	Pacific Northwest	Columbia Basin	Potholes East Canal 66.0	Washington			
Reclamation	Pacific Northwest	Columbia Basin	Quincy Chute Hydroelectric	Washington			
Reclamation	Pacific Northwest	Columbia Basin	Russel D Smith	Washington			
Reclamation	Pacific Northwest	Columbia Basin	Soda Lake Dike	Washington	0		0
Reclamation	Pacific Northwest	Columbia Basin	Summer Falls on Main Canal	Washington			
Reclamation	Pacific Northwest	Coulmbia Basin	Col W.W. No 4	Washington	50	250	912
Reclamation	Pacific Northwest	Coulmbia Basin	Eltopia Branch Canal	Washington			2,200
Reclamation	Pacific Northwest	Coulmbia Basin	Esquatzel Canal	Washington	113	205	1,691
Reclamation	Pacific Northwest	Coulmbia Basin	Potholes Canal Headworks	Washington			6,500
Reclamation	Pacific Northwest	Coulmbia Basin	Potholes East Canal - PEC 66.0	Washington			2,400
Reclamation	Pacific Northwest	Coulmbia Basin	RB4C W. W. Hwy26 Culvert	Washington	224	200	3,270
Reclamation	Pacific Northwest	Coulmbia Basin	Ringold W. W.	Washington	515	110	4,135
Reclamation	Pacific Northwest	Coulmbia Basin	Saddle Mountain W. W.	Washington	114	120	999
Reclamation	Pacific Northwest	Coulmbia Basin	Scootney Wasteway	Washington	188	120	1,647
Reclamation	Pacific Northwest	Crooked River	Arthur R. Bowman Dam	Oregon	180		4,800

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Crooked River	Diversion Canal Headworks	Oregon	15	200	219
Reclamation	Pacific Northwest	Crooked River	Lytle Creek	Oregon	4		0
Reclamation	Pacific Northwest	Crooked River	Ochoco	Oregon			
Reclamation	Pacific Northwest	Deschutes	Arnold	Oregon	4		0
Reclamation	Pacific Northwest	Deschutes	Crane Prairie	Oregon	25	300	562
Reclamation	Pacific Northwest	Deschutes	Haystack	Oregon	63	230	1,053
Reclamation	Pacific Northwest	Deschutes	North Canal Diversion Dam	Oregon	28	400	818
Reclamation	Pacific Northwest	Deschutes	North Unit Main Canal	Oregon	6		0
Reclamation	Pacific Northwest	Deschutes	Pilot Butte Canal	Oregon	5		0
Reclamation	Pacific Northwest	Deschutes	Wickiup Dam	Oregon	58	1,000	4,219
Reclamation	Pacific Northwest	Duck Valley Irrigaion District - BIA	Wild Horse - BIA	Nevada	83	75	454
Reclamation	Pacific Northwest	Frenchtown	Frenchtown	Montana	13	172	163
Reclamation	Pacific Northwest	Lewiston Orchards	Reservoir "A"	Idaho	10		0
Reclamation	Pacific Northwest	Lewiston Orchards	Soldier´s Meadow	Idaho	10	10	7
Reclamation	Pacific Northwest	Lewiston Orchards	Sweetwater	Idaho	8		0
Reclamation	Pacific Northwest	Lewiston Orchards	Webb Creek	Idaho	20	100	146
Reclamation	Pacific Northwest	Little Wood River	Little Wood River Dam	Idaho	119	200	1,739
Reclamation	Pacific Northwest	Mann Creek	Mann Creek	Idaho	118	80	688
Reclamation	Pacific Northwest	Minidoka	Cascade Creek	Idaho	6		0
Reclamation	Pacific Northwest	Minidoka	Cross Cut	Idaho			
Reclamation	Pacific Northwest	Minidoka	Grassy Lake	Wyoming	105	50	383

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Minidoka	Mile 28 - on Milner Gooding Canal	Idaho			
Reclamation	Pacific Northwest	Okanogan	Conconully	Washington	70	40	204
Reclamation	Pacific Northwest	Okanogan	Salmon Creek	Washington	6		0
Reclamation	Pacific Northwest	Okanogan	Salmon Lake	Washington			
Reclamation	Pacific Northwest	Owyhee	Owyhee Tunnel No. 1	Oregon			
Reclamation	Pacific Northwest	Ririe River	Ririe Dam	Idaho	150	100	1,095
Reclamation	Pacific Northwest	Rogue River Basin	Agate	Oregon	65	30	133
Reclamation	Pacific Northwest	Rogue River Basin	Antelope Creek	Oregon	7		0
Reclamation	Pacific Northwest	Rogue River Basin	Ashland Lateral	Oregon	5		0
Reclamation	Pacific Northwest	Rogue River Basin	Beaver Dam Creek	Oregon	4		0
Reclamation	Pacific Northwest	Rogue River Basin	Conde Creek	Oregon	4		0
Reclamation	Pacific Northwest	Rogue River Basin	Daley Creek	Oregon	4		0
Reclamation	Pacific Northwest	Rogue River Basin	Dead Indian	Oregon	4		0
Reclamation	Pacific Northwest	Rogue River Basin	Emigrant	Oregon	193	35	493
Reclamation	Pacific Northwest	Rogue River Basin	Fish Lake	Oregon	42	40	123
Reclamation	Pacific Northwest	Rogue River Basin	Fourmile Lake	Oregon	18	85	112
Reclamation	Pacific Northwest	Rogue River Basin	Howard Prairie	Oregon	10		0
Reclamation	Pacific Northwest	Rogue River Basin	Hyatt	Oregon	38	10	28
Reclamation	Pacific Northwest	Rogue River Basin	Keene Creek	Oregon	10		0
Reclamation	Pacific Northwest	Rogue River Basin	Little Beaver Creek	Oregon	9		0
Reclamation	Pacific Northwest	Rogue River Basin	Oak Street	Oregon	5		0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Rogue River Basin	Phoenix Canal	Oregon	5		0
Reclamation	Pacific Northwest	Rogue River Basin	Soda Creek	Oregon	13	280	266
Reclamation	Pacific Northwest	Rogue River Basin	South Fork Little Butte Creek	Oregon	4		0
Reclamation	Pacific Northwest	Tualatin	Scoggins	Oregon	92	150	1,004
Reclamation	Pacific Northwest	Umatilla	Cold Springs	Oregon	82	250	1,487
Reclamation	Pacific Northwest	Umatilla	Feed Canal	Oregon	8		0
Reclamation	Pacific Northwest	Umatilla	Maxwell	Oregon	4		0
Reclamation	Pacific Northwest	Umatilla	McKay	Oregon	142	150	1,555
Reclamation	Pacific Northwest	Umatilla	Three Mile Falls	Oregon	20	0	0
Reclamation	Pacific Northwest	Vale	Agency Valley	Oregon	79	200	1,200
Reclamation	Pacific Northwest	Vale	Bully Creek	Oregon	6		0
Reclamation	Pacific Northwest	Vale	Harper	Oregon	8		0
Reclamation	Pacific Northwest	Vale	Warm Springs Dam	Oregon			
Reclamation	Pacific Northwest	Wapinitia	Wasco	Oregon	17	10	12
Reclamation	Pacific Northwest	Yakima	Bumping Lake	Washington	35		1,024
Reclamation	Pacific Northwest	Yakima	Cle Elum Dam	Washington	130		3,950
Reclamation	Pacific Northwest	Yakima	Clear Creek	Washington	55	200	803
Reclamation	Pacific Northwest	Yakima	Cowiche	Washington			
Reclamation	Pacific Northwest	Yakima	Easton Diversion Dam	Washington	46	400	1,355
Reclamation	Pacific Northwest	Yakima	French Canyon	Washington	56	120	491
Reclamation	Pacific Northwest	Yakima	Kachess Dam	Washington	63	400	1,848

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Yakima	Keechelus Dam	Washington	93	300	2,035
Reclamation	Pacific Northwest	Yakima	Orchard Avenue	Washington			
Reclamation	Pacific Northwest	Yakima	Prosser	Washington	9		0
Reclamation	Pacific Northwest	Yakima	Roza Diversion Dam	Washington	0		0
Reclamation	Pacific Northwest	Yakima	Sunnyside	Washington	8		0
Reclamation	Pacific Northwest	Yakima	Tieton Diversion	Washington	3		0
Reclamation	Upper Colorado	Balmorhea	Madera Diversion Dam	Texas	10	750	562
Reclamation	Upper Colorado	Bostwick Park	Silver Jack Dam	Colorado	85	280	1,785
Reclamation	Upper Colorado	Brantley	Brantley Dam	New Mexico	44	1,400	4,620
Reclamation	Upper Colorado	Carlsbad	Avalon Dam	New Mexico	33	450	1,114
Reclamation	Upper Colorado	Carlsbad	Sumner Dam	New Mexico	135	1,700	17,212
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Alpine Tunnel	Utah	6	450	202
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Currant Creek Dam	Utah	100	5,540	41,550
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Currant Tunnel	Utah	12	620	558
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Docs Diversion Dam	Utah	5	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Hades Creek Diversion Dam	Utah	3	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Hades Tunnel	Utah	29	30	65
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Jordanelle Dam	Utah	235	3,600	63,450
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Knight Diversion Dam	Utah	11	154	127
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Layout Creek Diversion Dam	Utah	5	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Layout Creek Tunnel	Utah	22	1	2
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Lost Lake Dam	Utah	28	200	420
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Olmstead Diversion Dam	Utah	10	277	208
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Open Channel #1	Utah	6	475	214
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Open Channel #2	Utah	16	620	744
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Rhodes Diversion Dam	Utah	3	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Rhodes Flow Control Structure	Utah	5	20	8
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Rhodes Tunnel	Utah	11	325	268
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Sixth Water Flow Control	Utah	1300	800	78,000
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Soldier Creek Dam	Utah	272	2,830	57,732
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Spanish Fork Flow Control Structure	Utah	900	560	37,800
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Dam	Utah	140	2,310	24,255
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Feeder Conduit Tunnel	Utah	11	300	248
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Stillwater Tunnel	Utah	81	285	1,731
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Strawberry Tunnel Turnout	Utah	300	25	562
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Inlet	Utah	0	660	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Tunnel	Utah	125	1,000	9,375
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Tanner Ridge Tunnel	Utah	12	660	594
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Trial Lake Dam	Utah	41	150	461
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Flow Control Structure	Utah	100	660	4,950
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Tunnel	Utah	11	660	544
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Stillwater Dam	Utah	170	414	5,278
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Vat Diversion Dam	Utah	5	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Vat Tunnel	Utah	7	475	249
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Washington Lake Dam	Utah	39	210	614
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Water Hollow Diversion Dam	Utah	11	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Water Hollow Tunnel	Utah	27	3	5
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Win Diversion Dam	Utah	2	0	0
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Win Flow Control Structure	Utah	10	25	19
Reclamation	Upper Colorado	Central Utah Project - Jensen Unit	Red Fleet Dam	Utah	130	550	5,362
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Fort Thornburgh Diversion Dam	Utah	9	0	0
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Dam	Utah	130	550	5,362

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Feeder Canal	Utah	25	400	750
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Service Canal	Utah	0	300	0
Reclamation	Upper Colorado	Collbran	East Fork Diversion Dam	Colorado	4	0	0
Reclamation	Upper Colorado	Collbran	Leon Creek Diversion Dam	Colorado	4	0	0
Reclamation	Upper Colorado	Collbran	Park Creek Diversion Dam	Colorado	8	0	0
Reclamation	Upper Colorado	Collbran	Southside Canal	Colorado	54	85	344
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 171+ 90 thru 200+ 67 (2 canal drops)	Colorado	273	240	4,914
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 349+ 05 thru 375+ 42 (3 canal drops)	Colorado	170	240	3,060
Reclamation	Upper Colorado	Collbran	Southside Canal, Station 1245 + 56	Colorado	55	130	536
Reclamation	Upper Colorado	Collbran	Southside Canal, Station 902 + 28	Colorado	68	150	765
Reclamation	Upper Colorado	Collbran	Vega Dam	Colorado	140	470	4,935
Reclamation	Upper Colorado	Dallas Creek	Ridgway Dam	Colorado	175	1,440	18,900
Reclamation	Upper Colorado	Delores	Delores Tunnel	Colorado	9	520	351
Reclamation	Upper Colorado	Delores	Towoac Canal	Colorado	8	135	81
Reclamation	Upper Colorado	Dolores	Great Cut Dike	Colorado	64	820	3,936
Reclamation	Upper Colorado	Eden	Big Sandy Dam	Wyoming	50	635	2,381
Reclamation	Upper Colorado	Eden	Eden Canal	Wyoming	0	475	0
Reclamation	Upper Colorado	Eden	Eden Dam	Wyoming	20	120	180
Reclamation	Upper Colorado	Eden	Little Sandy Diversion Dam	Wyoming	5	0	0
Reclamation	Upper Colorado	Eden	Little Sandy Feeder Canal	Wyoming	0	150	0
Reclamation	Upper Colorado	Eden	Means Canal	Wyoming	0	635	0
Reclamation	Upper Colorado	Emery County	Cottonwood Creek/Huntington Canal	Utah	0	165	0
Reclamation	Upper Colorado	Emery County	Huntington North Dam	Utah	50	100	375
Reclamation	Upper Colorado	Emery County	Huntington North Feeder Canal	Utah	0	100	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Emery County	Huntington North Service Canal	Utah	0	35	0
Reclamation	Upper Colorado	Emery County	Joes Valley Dam	Utah	187	385	5,400
Reclamation	Upper Colorado	Emery County	Swasey Diversion Dam	Utah	5	0	0
Reclamation	Upper Colorado	Florida	Florida Farmers Diversion Dam	Colorado	6	0	0
Reclamation	Upper Colorado	Fort Sumner	Fort Sumner Diversion Dam	New Mexico	12	267	240
Reclamation	Upper Colorado	Fruitgrowers Dam	Fruitgrowers Dam	Colorado	40	135	405
Reclamation	Upper Colorado	Grand Valley	Grand Valley Diversion Dam	Colorado	14	3,216	3,377
Reclamation	Upper Colorado	Grand Valley	Tunnel #1	Colorado	5	1,675	628
Reclamation	Upper Colorado	Grand Valley	Tunnel #2	Colorado	1	1,675	126
Reclamation	Upper Colorado	Grand Valley	Tunnel #3	Colorado	5	730	274
Reclamation	Upper Colorado	Hammond	Hammond Diversion Dam	New Mexico	7	0	0
Reclamation	Upper Colorado	Hyrum	Hyrum Dam	Utah	75	300	1,688
Reclamation	Upper Colorado	Hyrum	Hyrum Feeder Canal	Utah	0	9	0
Reclamation	Upper Colorado	Hyrum	Hyrum-Mendon Canal	Utah		89	0
Reclamation	Upper Colorado	Hyrum	Wellsville Canal	Utah	0	15	0
Reclamation	Upper Colorado	Lyman	Meeks Cabin Dam	Wyoming	144	1,070	11,556
Reclamation	Upper Colorado	Lyman	Stateline Dam	Utah	105	400	3,150
Reclamation	Upper Colorado	Mancos	Inlet Canal	Colorado	159	258	3,077
Reclamation	Upper Colorado	Mancos	Jackson Gulch Dam	Colorado	160	280	3,360
Reclamation	Upper Colorado	Mancos	Outlet Canal	Colorado	252	207	3,912
Reclamation	Upper Colorado	Middle Rio Grande	Angostura Diversion	New Mexico	5	0	0
Reclamation	Upper Colorado	Middle Rio Grande	Isleta Diversion Dam	New Mexico	5	0	0
Reclamation	Upper Colorado	Middle Rio Grande	San Acacia Diversion Dam	New Mexico	8	0	0
Reclamation	Upper Colorado	Moon Lake	Duschense Feeder Canal	Utah	0	200	0
Reclamation	Upper Colorado	Moon Lake	Midview Dam	Utah	40	80	240
Reclamation	Upper Colorado	Moon Lake	Moon Lake Dam	Utah	79	610	3,614
Reclamation	Upper Colorado	Moon Lake	Yellowstone Feeder Canal	Utah	0	88	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Navajo Indian Irrigation	Navajo Dam Diversion Works	New Mexico	100	1,800	13,500
Reclamation	Upper Colorado	Newton	East Canal	Utah	0	9	0
Reclamation	Upper Colorado	Newton	Highline Canal	Utah	0	18	0
Reclamation	Upper Colorado	Newton	Main Canal	Utah	0	25	0
Reclamation	Upper Colorado	Newton	Newton Dam	Utah	74	1,260	6,993
Reclamation	Upper Colorado	Ogden River	Ogden Brigham Canal	Utah	0	35	0
Reclamation	Upper Colorado	Ogden River	Ogden-Brigham Canal	Utah	0	120	0
Reclamation	Upper Colorado	Ogden River	Pineview Dam	Utah	95	2,300	16,388
Reclamation	Upper Colorado	Ogden River	S.Ogden Highline Canal Div. Dam	Utah	0	45	0
Reclamation	Upper Colorado	Paonia	Fire Mountain Diversion Dam	Colorado	4	0	0
Reclamation	Upper Colorado	Paonia	Paonia Dam	Colorado	188	1,130	15,933
Reclamation	Upper Colorado	Preston Bench	Mink Creek Canal	Idaho	0	36	0
Reclamation	Upper Colorado	Preston Bench	Station Creek Tunnel	Utah	3	250	56
Reclamation	Upper Colorado	Provo River	Alpine-Draper Tunnel	Utah	12	150	135
Reclamation	Upper Colorado	Provo River	Broadhead Diversion Dam	Utah	5	0	0
Reclamation	Upper Colorado	Provo River	Duchesne Diversion Dam	Utah	17	73	93
Reclamation	Upper Colorado	Provo River	Duchesne Tunnel	Utah	64	600	2,880
Reclamation	Upper Colorado	Provo River	Murdock Diversion Dam	Utah	19	171	244
Reclamation	Upper Colorado	Provo River	Olmsted Tunnel	Utah	5	150	56
Reclamation	Upper Colorado	Provo River	Provo Reservoir Canal	Utah	180	325	4,388
Reclamation	Upper Colorado	Provo River	Weber-Provo Canal	Utah	184	1,000	13,800
Reclamation	Upper Colorado	Provo River	Weber-Provo Diversion Canal	Utah	100	1,000	7,500
Reclamation	Upper Colorado	Provo River	Weber-Provo Diversion Dam	Utah	9	0	0
Reclamation	Upper Colorado	Rio Grande	American Diversion Dam	New Mexico	5	0	0
Reclamation	Upper Colorado	Rio Grande	Caballo Dam	New Mexico	78	5,000	29,250
Reclamation	Upper Colorado	Rio Grande	Leasburg Diversion Dam	New Mexico	7	0	0
Reclamation	Upper Colorado	Rio Grande	Lucero Dike	New Mexico	10	140	105
Reclamation	Upper Colorado	Rio Grande	Mesilla Diversion Dam	New Mexico	10	950	712

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Rio Grande	Percha Arroyo Diversion Dam	New Mexico	19	1,029	1,466
Reclamation	Upper Colorado	Rio Grande	Percha Diversion Dam	New Mexico	8	0	0
Reclamation	Upper Colorado	Rio Grande	Picacho North Dam	New Mexico	38	283	807
Reclamation	Upper Colorado	Rio Grande	Picacho South Dam	New Mexico	26	170	332
Reclamation	Upper Colorado	Rio Grande	Riverside Diversion Dam	Texas	8	0	0
Reclamation	Upper Colorado	San Juan-Chama	Azeotea Creek and Willow Creek Conveyance Channel Station 1565+00	New Mexico	24	215	387
Reclamation	Upper Colorado	San Juan-Chama	Azeotea Creek and Willow Creek Conveyance Channel Station 1702+75	New Mexico	18	215	290
Reclamation	Upper Colorado	San Juan-Chama	Azeotea Creek and Willow Creek Conveyance Channel Station 1831+17	New Mexico	15	215	242
Reclamation	Upper Colorado	San Juan-Chama	Azotea Creek and Willow Creek Conveyance Channel Outlet	New Mexico	22	215	355
Reclamation	Upper Colorado	San Juan-Chama	Azotea Tunnel	New Mexico	143	65	699
Reclamation	Upper Colorado	San Juan-Chama	Blanco diversion Dam	New Mexico	13	2,940	2,866
Reclamation	Upper Colorado	San Juan-Chama	Blanco Tunnel	New Mexico	111	46	380
Reclamation	Upper Colorado	San Juan-Chama	Heron Dam	New Mexico	249	4,160	77,688
Reclamation	Upper Colorado	San Juan-Chama	Little Navajo River Siphon	New Mexico	2	520	78
Reclamation	Upper Colorado	San Juan-Chama	Little Oso Diversion Dam	Colorado	10	550	412
Reclamation	Upper Colorado	San Juan-Chama	Nambe Falls Dam	New Mexico	121	80	726
Reclamation	Upper Colorado	San Juan-Chama	Oso Diversion Dam	Colorado	17	60	76
Reclamation	Upper Colorado	San Juan-Chama	Oso Feeder Conduit	New Mexico	8	650	390
Reclamation	Upper Colorado	San Juan-Chama	Oso Tunnel	New Mexico	73	65	357
Reclamation	Upper Colorado	San Luis Valley	Platoro Dam	Colorado	131	710	6,976
Reclamation	Upper Colorado	Sanpete	Beck's Feeder Canal	Utah	0	94	0
Reclamation	Upper Colorado	Sanpete	Brough's Fork Feeder Canal	Utah	0	32	0
Reclamation	Upper Colorado	Sanpete	Cedar Creek Feeder Canal	Utah	0	66	0
Reclamation	Upper Colorado	Sanpete	Ephraim Tunnel	Utah	21	95	150

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Sanpete	South Feeder Canal	Utah	0	60	0
Reclamation	Upper Colorado	Sanpete	Spring City Tunnel	Utah	15	95	107
Reclamation	Upper Colorado	Scofield	Scofield Dam	Utah	55	500	2,062
Reclamation	Upper Colorado	Silt	Rifle Gap Dam	Colorado	102	344	2,632
Reclamation	Upper Colorado	Smith Fork	Crawford Dam	Colorado	135	125	1,266
Reclamation	Upper Colorado	Smith Fork	Smith Fork Diversion Dam	Colorado	5	0	0
Reclamation	Upper Colorado	Strawberry Valley	Indian Creek Crossing Div. Dam	Utah	5	0	0
Reclamation	Upper Colorado	Strawberry Valley	Indian Creek Dike	Utah	5	0	0
Reclamation	Upper Colorado	Strawberry Valley	Spanish Fork Diversion Dam	Utah	13	115	112
Reclamation	Upper Colorado	Uncompahgre	East Canal	Colorado	0	330	0
Reclamation	Upper Colorado	Uncompahgre	East Canal Diversion Dam	Colorado	8	0	0
Reclamation	Upper Colorado	Uncompahgre	Garnet Diversion Dam	Colorado	4	0	0
Reclamation	Upper Colorado	Uncompahgre	Gunnison Diversion Dam	Colorado	10	105	79
Reclamation	Upper Colorado	Uncompahgre	Gunnison Tunnel	Colorado	17	465	593
Reclamation	Upper Colorado	Uncompahgre	Ironstone Canal	Colorado	0	400	0
Reclamation	Upper Colorado	Uncompahgre	Ironstone Diversion Dam	Colorado	13	105	102
Reclamation	Upper Colorado	Uncompahgre	Loutzenheizer Canal	Colorado	0	120	0
Reclamation	Upper Colorado	Uncompahgre	Loutzenheizer Diversion Dam	Colorado	9	0	0
Reclamation	Upper Colorado	Uncompahgre	M&D Canal-Shavano Falls	Colorado	130	550	5,362
Reclamation	Upper Colorado	Uncompahgre	Montrose and Delta Canal	Colorado	0	550	0
Reclamation	Upper Colorado	Uncompahgre	Montrose and Delta Div. Dam	Colorado	10	105	79
Reclamation	Upper Colorado	Uncompahgre	Selig Canal	Colorado	0	320	0
Reclamation	Upper Colorado	Uncompahgre	Selig Diversion Dam	Colorado	10	105	79
Reclamation	Upper Colorado	Uncompahgre	South Canal Tunnels	Colorado	5	1,030	386
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta 19+ 10 "Site #1"	Colorado	54	826	3,345
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 181+10, "Site #4"	Colorado	63	1,010	2,950

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 472+00, "Site #5"	Colorado	28	1,010	1,335
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 72+50, Site #2"	Colorado	12	1,010	990
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta.106+65, "Site #3"	Colorado	46	1,010	2,200
Reclamation	Upper Colorado	Uncompahgre	Taylor Park Dam	Colorado	168	1,500	18,900
Reclamation	Upper Colorado	Uncompahgre	West Canal	Colorado	0	172	0
Reclamation	Upper Colorado	Uncompahgre	West Canal Tunnel	Colorado	4	100	30
Reclamation	Upper Colorado	Vermejo	Dam No. 13	New Mexico	25		0
Reclamation	Upper Colorado	Vermejo	Dam No. 2	New Mexico	8	0	0
Reclamation	Upper Colorado	Vermejo	Stubblefield Dam	New Mexico	35	300	788
Reclamation	Upper Colorado	Vermejo	Vermejo Diversion Dam	New Mexico	5	0	0
Reclamation	Upper Colorado	Weber Basin	Arthur V. Watkins Dam	Utah	28	10,800	22,680
Reclamation	Upper Colorado	Weber Basin	Davis Aqueduct	Utah	0	335	0
Reclamation	Upper Colorado	Weber Basin	East Canyon Dam	Utah	185	700	9,712
Reclamation	Upper Colorado	Weber Basin	Farmington Creek Stream Inlet	Utah	0	2	0
Reclamation	Upper Colorado	Weber Basin	Gateway Tunnel	Utah	17	435	555
Reclamation	Upper Colorado	Weber Basin	Haights Creek Stream Inlet	Utah	0	35	0
Reclamation	Upper Colorado	Weber Basin	Layton Canal	Utah	0	180	0
Reclamation	Upper Colorado	Weber Basin	Lost Creek Dam	Utah	187	805	11,290
Reclamation	Upper Colorado	Weber Basin	Middle Fork Kays Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Ogden Valley Canal	Utah	0	80	0
Reclamation	Upper Colorado	Weber Basin	Ogden Valley Diversion Dam	Utah	6	0	0
Reclamation	Upper Colorado	Weber Basin	Ricks Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Sheppard Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Slaterville Diversion Dam	Utah	7	0	0
Reclamation	Upper Colorado	Weber Basin	South Fork Kays Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Staight Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Stoddard Diversion Dam	Utah	7	0	0

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Weber Basin	Stone Creek Stream Inlet	Utah	0	5	0
Reclamation	Upper Colorado	Weber Basin	Weber Aqueduct	Utah	0	80	0
Reclamation	Upper Colorado	Weber Basin	Willard Canal	Utah	0	1,050	0
USACE	Great Lakes & Ohio River	Buffalo	MOUNT MORRIS DAM	New York			5,000
USACE	Great Lakes & Ohio River	Detroit	LITTLE KAUKAUNA L&D	Wisconsin	6		
USACE	Great Lakes & Ohio River	Huntington	ALUM CREEK DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	ATWOOD DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	BEACH CITY DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	BEECH FORK DAM	West Virginia			50
USACE	Great Lakes & Ohio River	Huntington	BELLEVILLE L&D	West Virginia	18		42,000
USACE	Great Lakes & Ohio River	Huntington	BLUESTONE DAM	West Virginia			55,000
USACE	Great Lakes & Ohio River	Huntington	BURNSVILLE DAM	West Virginia			50
USACE	Great Lakes & Ohio River	Huntington	CAPTAIN ANTHONY L. MELDAHL L&D	Kentucky	30		70,300
USACE	Great Lakes & Ohio River	Huntington	CLENDENING DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	DEER CREEK DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	DELAWARE DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	DEWEY DAM	Kentucky			3,825
USACE	Great Lakes & Ohio River	Huntington	DILLON DAM	Ohio			6,527
USACE	Great Lakes & Ohio River	Huntington	DOVER DAM	Ohio			121
USACE	Great Lakes & Ohio River	Huntington	EAST LYNN DAM	West Virginia			50
USACE	Great Lakes & Ohio River	Huntington	FISHTRAP DAM	Kentucky			3,500
USACE	Great Lakes & Ohio River	Huntington	GRAYSON DAM	Kentucky			3,947

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Great Lakes & Ohio River	Huntington	JOHN W. FLANNAGAN DAM	Virginia	180		7,000
USACE	Great Lakes & Ohio River	Huntington	PAINT CREEK DAM	Ohio			8,037
USACE	Great Lakes & Ohio River	Huntington	PIEDMONT DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	PLEASANT HILL DAM	Ohio			3,180
USACE	Great Lakes & Ohio River	Huntington	R.D. BAILEY DAM	West Virginia			17,730
USACE	Great Lakes & Ohio River	Huntington	SENECAVILLE DAM	Ohio			50
USACE	Great Lakes & Ohio River	Huntington	SUTTON DAM	West Virginia	89		15,000
USACE	Great Lakes & Ohio River	Huntington	WILLS CREEK DAM	Ohio			50
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER DAM	Kentucky			6,750
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER L&D # 1	Kentucky			3,800
USACE	Great Lakes & Ohio River	Louisville	BROOKVILLE DAM	Indiana			12,147
USACE	Great Lakes & Ohio River	Louisville	BUCKHORN DAM	Kentucky			7,784
USACE	Great Lakes & Ohio River	Louisville	CAESAR CREEK DAM	Ohio			6,142
USACE	Great Lakes & Ohio River	Louisville	CAGLES MILL DAM	Indiana			3,598
USACE	Great Lakes & Ohio River	Louisville	CARR FORK DAM	Kentucky			92
USACE	Great Lakes & Ohio River	Louisville	CAVE RUN DAM	Kentucky			18,267
USACE	Great Lakes & Ohio River	Louisville	CECIL M. HARDEN DAM	Indiana			1,421
USACE	Great Lakes & Ohio River	Louisville	CLARENCE J. BROWN DAM	Ohio			99
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER DAM	Kentucky			20,613
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 1	Kentucky	65		9,500
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 2	Kentucky			5,500

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 3	Kentucky			9,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 5	Kentucky			4,900
USACE	Great Lakes & Ohio River	Louisville	HUNTINGTON DAM	Indiana			7,130
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 2	Kentucky			3,300
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 3	Kentucky			6,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 4	Kentucky			5,400
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 5	Kentucky			16,200
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 6	Kentucky	14		4,504
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 8	Kentucky			7,387
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 9	Kentucky			3,843
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #10	Kentucky			4,800
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #11	Kentucky			6,200
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #12	Kentucky			5,500
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #13	Kentucky			6,100
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #14	Kentucky			6,050
USACE	Great Lakes & Ohio River	Louisville	MISSISSINEWA DAM	Indiana			13,227
USACE	Great Lakes & Ohio River	Louisville	MONROE DAM	Indiana			5,241
USACE	Great Lakes & Ohio River	Louisville	NEWBURG L&D	Kentucky			57,400
USACE	Great Lakes & Ohio River	Louisville	NOLIN DAM	Kentucky	78		10,000
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #52	Kentucky			69,100
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #53	Kentucky			70,000

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Great Lakes & Ohio River	Louisville	ROUGH RIVER DAM	Kentucky	47		14,961
USACE	Great Lakes & Ohio River	Louisville	SALAMONIE DAM	Indiana			10,528
USACE	Great Lakes & Ohio River	Louisville	TAYLORSVILLE DAM	Kentucky			16,884
USACE	Great Lakes & Ohio River	Louisville	UNIONTOWN L&D	Kentucky			65,000
USACE	Great Lakes & Ohio River	Louisville	WEST FORK DAM	Ohio			50
USACE	Great Lakes & Ohio River	Louisville	WILLIAM H. HARSHA DAM	Ohio			15,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 2	Pennsylvania	11		10,683
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 3	Pennsylvania	14		12,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 4	Pennsylvania	11		15,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 7	Pennsylvania	13		16,456
USACE	Great Lakes & Ohio River	Pittsburgh	BERLIN DAM	Ohio			3,000
USACE	Great Lakes & Ohio River	Pittsburgh	CROOKED CREEK DAM	Pennsylvania	143		4,753
USACE	Great Lakes & Ohio River	Pittsburgh	DASHIELDS L&D	Pennsylvania	10		25,000
USACE	Great Lakes & Ohio River	Pittsburgh	EAST BRANCH DAM	Pennsylvania	184		1,599
USACE	Great Lakes & Ohio River	Pittsburgh	HANNIBAL L&D	West Virginia	21		
USACE	Great Lakes & Ohio River	Pittsburgh	HILDEBRAND L&D	West Virginia			9,600
USACE	Great Lakes & Ohio River	Pittsburgh	LOYALHANNA DAM	Pennsylvania	47		1,636
USACE	Great Lakes & Ohio River	Pittsburgh	MAHONING CREEK DAM	Pennsylvania	72		5,000
USACE	Great Lakes & Ohio River	Pittsburgh	MAXWELL L&D	Pennsylvania	20		10,000
USACE	Great Lakes & Ohio River	Pittsburgh	MICHAEL J. KIRWIN DAM	Ohio			1,470
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 2	Pennsylvania			6,747

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 3	Pennsylvania			4,736
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 4	Pennsylvania	17		8,250
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 7	Pennsylvania	15		9,255
USACE	Great Lakes & Ohio River	Pittsburgh	MONTGOMERY L&D	Pennsylvania	15		38,000
USACE	Great Lakes & Ohio River	Pittsburgh	MORGANTOWN L&D	West Virginia	17		2,500
USACE	Great Lakes & Ohio River	Pittsburgh	MOSQUITO CREEK DAM	Ohio			1,100
USACE	Great Lakes & Ohio River	Pittsburgh	OPEKISKA L&D	West Virginia			10,000
USACE	Great Lakes & Ohio River	Pittsburgh	PIKE ISLAND L&D	West Virginia	21		49,500
USACE	Great Lakes & Ohio River	Pittsburgh	POINT MARION L&D	Pennsylvania			5,000
USACE	Great Lakes & Ohio River	Pittsburgh	SHENANGO RIVER DAM	Pennsylvania	22		3,000
USACE	Great Lakes & Ohio River	Pittsburgh	STONEWALL JACKSON DAM	West Virginia			1,058
USACE	Great Lakes & Ohio River	Pittsburgh	TIONESTA DAM	Pennsylvania	60		5,000
USACE	Great Lakes & Ohio River	Pittsburgh	TYGART RIVER DAM	West Virginia			20,000
USACE	Mississippi Valley	Rock Island	BRANDON L&D	Illinois	34		6,100
USACE	Mississippi Valley	Rock Island	CORALVILLE DAM	Iowa	31		11,630
USACE	Mississippi Valley	Rock Island	DRESDEN ISLAND L&D	Illinois	22		10,500
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #11	Iowa	11		11,500
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #12	Iowa	9		11,500
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #13	Iowa	11		11,500
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #14	Iowa	11		22,080
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #16	Iowa	9		13,600

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #17	Iowa	8		8,230
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #18	Iowa	10		11,500
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #20	Missouri	10		15,330
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #21	Missouri	10		15,390
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #22	Missouri	10		19,230
USACE	Mississippi Valley	Rock Island	RED ROCK DAM	Iowa	47		30,000
USACE	Mississippi Valley	Rock Island	SAYLORVILLE DAM	Iowa	40		17,300
USACE	Mississippi Valley	St. Louis	KASKASKIA RIVER L&D	Illinois	19		8,305
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #24	Missouri	8		35,000
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #25	Missouri	10		40,000
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #26	Illinois			78,000
USACE	Mississippi Valley	St. Louis	SHELBYVILLE DAM	Illinois	54		4,514
USACE	Mississippi Valley	St. Louis	WAPPAPELLO DAM	Missouri	49		9,232
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 5	Minnesota			5,800
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 7	Minnesota			12,700
USACE	Mississippi Valley	Vicksburg	ARKABUTLA DAM	Mississippi			7,700
USACE	Mississippi Valley	Vicksburg	COLUMBIA L&D	Louisiana			6,000
USACE	Mississippi Valley	Vicksburg	ENID DAM	Mississippi			7,500
USACE	Mississippi Valley	Vicksburg	GRENADA DAM	Mississippi			13,200
USACE	Mississippi Valley	Vicksburg	JOHN H. OVERTON L&D	Louisiana			25,500
USACE	Mississippi Valley	Vicksburg	JONESVILLE L&D	Louisiana			6,000

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D # 1	Louisiana	90		18,000
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D #3	Louisiana			5,400
USACE	Mississippi Valley	Vicksburg	SARDIS DAM	Mississippi			16,000
USACE	North Atlantic	Baltimore	ALVIN R. BUSH DAM	Pennsylvania	165		1,323
USACE	North Atlantic	Baltimore	BLOOMINGTON DAM	Maryland	280		13,846
USACE	North Atlantic	Baltimore	COWANESQUE DAM	Pennsylvania	112		2,322
USACE	North Atlantic	Baltimore	CURWENSVILLE DAM	Pennsylvania	131		1,375
USACE	North Atlantic	Baltimore	EAST SIDNEY DAM	New York			1,698
USACE	North Atlantic	Baltimore	FOSTER JOSEPH SAYERS DAM	Pennsylvania	100		3,510
USACE	North Atlantic	Baltimore	HAMMOND DAM	Pennsylvania	89		1,155
USACE	North Atlantic	Baltimore	TIOGA DAM	Pennsylvania	104		3,394
USACE	North Atlantic	Baltimore	WHITNEY POINT DAM	New York			1,954
USACE	North Atlantic	New England	BALL MOUNTAIN DAM	Vermont			3,720
USACE	North Atlantic	New England	BLACKWATER DAM	New Hampshire			357
USACE	North Atlantic	New England	HOPKINTON DAM	New Hampshire			249
USACE	North Atlantic	New England	KNIGHTVILLE DAM	Massachusetts			963
USACE	North Atlantic	New England	LITTLEVILLE DAM	Massachusetts	86		1,100
USACE	North Atlantic	New England	MANSFIELD HOLLOW DAM	Connecticut			240
USACE	North Atlantic	New England	NORTH SPRINGFIELD DAM	Vermont			495
USACE	North Atlantic	New England	THOMASTON DAM	Connecticut			415
USACE	North Atlantic	New England	TOWNSHEND DAM	Vermont	24		1,120
USACE	North Atlantic	New England	UNION VILLAGE DAM	New Hampshire	65		615
USACE	North Atlantic	New England	WEST THOMPSON DAM	Connecticut			451
USACE	North Atlantic	Norfolk	GATHRIGHT DAM	Virginia			6,000
USACE	North Atlantic	Philadelphia	BELTZVILLE DAM	Pennsylvania	123		2,150
USACE	North Atlantic	Philadelphia	BLUE MARSH DAM	Pennsylvania	48		1,260
USACE	North Atlantic	Philadelphia	FRANCIS E. WALTER DAM	Pennsylvania	172		5,000

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	North Atlantic	Philadelphia	PROMPTON DAM	Pennsylvania	133		750
USACE	Northwestern	Kansas City	KANOPOLIS DAM	Kansas			2,276
USACE	Northwestern	Kansas City	MILFORD DAM	Kansas			7,891
USACE	Northwestern	Kansas City	POMME DE TERRE DAM	Missouri			3,605
USACE	Northwestern	Kansas City	TUTTLE CREEK DAM	Kansas			21,848
USACE	Northwestern	Omaha	CHATFIELD DAM	Colorado			5,429
USACE	Northwestern	Portland	APPLEGATE DAM	Oregon	180		9,000
USACE	Northwestern	Portland	BLUE RIVER DAM	Oregon	225		14,650
USACE	Northwestern	Portland	DORENA DAM	Oregon			5,200
USACE	Northwestern	Portland	FERN RIDGE DAM	Oregon			4,335
USACE	Northwestern	Seattle	HIRAM A. CHITTENDEN L&D	Washington			2,600
USACE	Northwestern	Seattle	HOWARD HANSON DAM	Washington	65		5,200
USACE	South Atlantic	Charleston	WILLIAM KERR SCOTT DAM	North Carolina			4,850
USACE	South Atlantic	Jacksonville	INGLIS L&D	Florida	24		2,535
USACE	South Atlantic	Mobile	CARTER'S REREG DAM	Georgia			3,500
USACE	South Atlantic	Mobile	CLAIBORNE L&D	Alabama			15,000
USACE	South Atlantic	Mobile	COFFEEVILLE L&D	Alabama			24,000
USACE	South Atlantic	Mobile	DEMOPOLIS L&D	Alabama	35		37,500
USACE	South Atlantic	Mobile	GEORGE W. ANDREWS L&D	Alabama			26,700
USACE	South Atlantic	Mobile	WARRIOR L&D	Alabama			6,000
USACE	South Atlantic	Mobile	WILLIAM BACON OLIVER L&D	Alabama			16,300
USACE	South Atlantic	Savannah	NEW SAVANNAH BLUFF L&D	Georgia			7,200
USACE	South Atlantic	Wilmington	B. EVERETT JORDAN DAM	North Carolina			10,000
USACE	South Atlantic	Wilmington	CAPE FEAR L&D # 1	North Carolina			800
USACE	South Atlantic	Wilmington	CAPE FEAR L&D # 2	North Carolina			450
USACE	South Atlantic	Wilmington	FALLS LAKE DAM	North Carolina			8,389
USACE	South Atlantic	Wilmington	WILLIAM O. HUSKE L&D	North Carolina			640

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	South Pacific	Albuquerque	COCHITI DAM	New Mexico			22,900
USACE	South Pacific	Albuquerque	CONCHAS DAM	New Mexico			2,078
USACE	South Pacific	Albuquerque	JOHN MARTIN DAM	Colorado			802
USACE	South Pacific	Albuquerque	LOS ESTEROS DAM	New Mexico			93
USACE	South Pacific	Albuquerque	TRINIDAD DAM	Colorado			826
USACE	South Pacific	Sacramento	HIDDEN DAM	California			984
USACE	South Pacific	Sacramento	NORTH FORK DAM (California)	California			23,270
USACE	Southwestern	Fort Worth	BELTON DAM	Texas			1,400
USACE	Southwestern	Fort Worth	FERRELL'S BRIDGE DAM	Texas			540
USACE	Southwestern	Fort Worth	GRANGER DAM	Texas			5,000
USACE	Southwestern	Fort Worth	GRAPEVINE DAM	Texas			750
USACE	Southwestern	Fort Worth	LAVON DAM	Texas			1,080
USACE	Southwestern	Fort Worth	LEWISVILLE DAM	Texas	63		
USACE	Southwestern	Fort Worth	NORTH FORK DAM (Texas)	Texas			999
USACE	Southwestern	Fort Worth	SOMERVILLE DAM	Texas			500
USACE	Southwestern	Fort Worth	STILLHOUSE HOLLOW DAM	Texas			999
USACE	Southwestern	Fort Worth	WACO DAM	Texas			6,000
USACE	Southwestern	Fort Worth	WRIGHT PATMAN DAM	Texas			3,310
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 3	Arkansas	18		48,000
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 4	Arkansas			26,840
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 5	Arkansas	16		33,360
USACE	Southwestern	Little Rock	ARTHUR V. ORMOND L&D	Arkansas	19		42,400
USACE	Southwestern	Little Rock	BLUE MOUNTAIN DAM	Arkansas			6,966
USACE	Southwestern	Little Rock	DAVID D. TERRY L&D	Arkansas	17		33,360
USACE	Southwestern	Little Rock	DE QUEEN DAM	Arkansas			1,226
USACE	Southwestern	Little Rock	DIERKS DAM	Arkansas			1,179
USACE	Southwestern	Little Rock	GILLHAM DAM	Arkansas	46		2,901
USACE	Southwestern	Little Rock	NIMROD DAM	Arkansas			5,814

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
USACE	Southwestern	Little Rock	TOAD SUCK FERRY L&D	Arkansas			15,000
USACE	Southwestern	Tulsa	FULTON L&D	Arkansas			17,989
USACE	Southwestern	Tulsa	HUGO DAM	Oklahoma			3,000
USACE	Southwestern	Tulsa	JOHN REDMOND DAM	Kansas			9,004
USACE	Southwestern	Tulsa	MILLWOOD DAM	Arkansas	23		3,600
USACE	Southwestern	Tulsa	OOLOGAH DAM	Oklahoma			17,500
USACE	Southwestern	Tulsa	PINE CREEK DAM	Oklahoma			10,000
USACE	Southwestern	Tulsa	W. D. MAYO L&D	Oklahoma			44,040
USACE	Southwestern	Tulsa	WISTER DAM	Oklahoma			6,800

Appendix 2b

All Facilities Included in Study with Existing Hydropower

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	Great Lakes & Ohio River	Chicago	CEDARS L&D	Wisconsin	1,800	
USACE	Great Lakes & Ohio River	Chicago	MENASHA L&D	Wisconsin	200	GEO. WHITTING PAPER COMPANY
USACE	Great Lakes & Ohio River	Detroit	DE PERE L&D	Wisconsin	1,078	Nicolet Paper Co.
USACE	Great Lakes & Ohio River	Detroit	KAUKAUNA L&D	Wisconsin	5,600	CITY OF KAUKAUNA
USACE	Great Lakes & Ohio River	Detroit	LITTLE CHUTE L&D	Wisconsin	3,300	KAUKAUNA ELEC & WATER DEPARTMT
USACE	Great Lakes & Ohio River	Detroit	LOWER APPLETON L&D	Wisconsin	500	Consolidated Paper Co.
USACE	Great Lakes & Ohio River	Detroit	RAPIDE CROCHE L&D	Wisconsin	2,400	KAUKAUNA ELEC & WATER DEPARTMT
USACE	Great Lakes & Ohio River	Detroit	ST. MARY'S FALLS	Michigan	20,600	USACE
USACE	Great Lakes & Ohio River	Detroit	UPPER APPLETON L&D	Wisconsin	3,400	MICH-WISCONSIN ELECTRIC CO.
USACE	Great Lakes & Ohio River	Huntington	GALLIPOLIS L&D	West Virginia		
USACE	Great Lakes & Ohio River	Huntington	GREENUP L&D	Kentucky	70,560	CITY OF Hamilton, KY
USACE	Great Lakes & Ohio River	Huntington	LONDON L&D	West Virginia	14,400	KANAWHA VALLEY POWER
USACE	Great Lakes & Ohio River	Huntington	MARMET L&D	West Virginia	14,400	KANAWHA VALLEY POWER
USACE	Great Lakes & Ohio River	Huntington	RACINE L&D	West Virginia	47,500	OHIO POWER COMPANY
USACE	Great Lakes & Ohio River	Huntington	SUMMERSVILLE DAM	West Virginia	85,000	
USACE	Great Lakes & Ohio River	Huntington	WILLOW ISLAND L&D #16	West Virginia	15,000	
USACE	Great Lakes & Ohio River	Huntington	WINFIELD L&D	West Virginia	14,760	KANAWHA VALLEY POWER

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 7	Kentucky	2,040	KENTUCKY UTILITIES COMPANY
USACE	Great Lakes & Ohio River	Louisville	MARKLAND L&D	Kentucky	81,000	PUBLIC SERVICE CO. OF IN
USACE	Great Lakes & Ohio River	Louisville	MCALPINE L&D	Kentucky	80,320	LOUISVILLE GAS & ELEC COMPANY
USACE	Great Lakes & Ohio River	Louisville	SMITHLAND L&D	Kentucky	40,000	
USACE	Great Lakes & Ohio River	Nashville	BARKLEY DAM	Kentucky	130,000	USACE
USACE	Great Lakes & Ohio River	Nashville	CENTER HILL DAM	Tennessee	135,000	USACE
USACE	Great Lakes & Ohio River	Nashville	CHEATHAM L&D	Tennessee	36,000	USACE
USACE	Great Lakes & Ohio River	Nashville	CORDELL HULL L&D	Tennessee	100,000	USACE
USACE	Great Lakes & Ohio River	Nashville	DALE HOLLOW DAM	Tennessee	54,000	USACE
USACE	Great Lakes & Ohio River	Nashville	J. PERCY PRIEST DAM	Tennessee	28,000	USACE
USACE	Great Lakes & Ohio River	Nashville	LAUREL DAM	Kentucky	61,000	USACE
USACE	Great Lakes & Ohio River	Nashville	OLD HICKORY L&D	Tennessee	100,000	USACE
USACE	Great Lakes & Ohio River	Nashville	WOLF CREEK DAM	Kentucky	270,000	USACE
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 5	Pennsylvania	9,500	CENTRAL CITY, PA & MITEX
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 6	Pennsylvania	8,560	Allegheny #6 Hydro Part Ltd.
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 8	Pennsylvania	13,000	Allegheny Hydro
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 9	Pennsylvania	17,400	Allegheny Hydro
USACE	Great Lakes & Ohio River	Pittsburgh	CONEMAUGH RIVER DAM	Pennsylvania	15,000	SALTSBURG & PA REN RES
USACE	Great Lakes & Ohio River	Pittsburgh	EMSWORTH L&D	Pennsylvania	18,000	
USACE	Great Lakes & Ohio River	Pittsburgh	KINZUA DAM	Pennsylvania	405,000	PENN ELECTRIC COMPANY
USACE	Great Lakes & Ohio River	Pittsburgh	NEW CUMBERLAND L&D	West Virginia		

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	Great Lakes & Ohio River	Pittsburgh	YOUGHIOGHENY RIVER DAM	Pennsylvania	12,200	Youghiogheny Hydro Authority
USACE	Mississippi Valley	New Orleans	OLD RIVER	Louisiana	192,000	TOWN OF VIDALIA, LA
USACE	Mississippi Valley	Rock Island	LOCKPORT L&D	Illinois	13,600	METRO SANITARY DIS OF CHICAGO
USACE	Mississippi Valley	Rock Island	MARSEILLES DAM	Illinois	2,800	ILLINOIS POWER COMPANY
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #15	Iowa	3,700	IA & IL GAS & ELEC COMPANY
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #19	Iowa	128,000	IA UNION ELECTRIC COMPANY
USACE	Mississippi Valley	Rock Island	STARVED ROCK L&D	Illinois	7,400	
USACE	Mississippi Valley	St. Louis	CARLYLE DAM	Illinois	4,800	
USACE	Mississippi Valley	St. Louis	CLARENCE CANNON DAM	Missouri	58,000	USACE
USACE	Mississippi Valley	St. Paul	LOWER ST ANTHONY FALLS L&D	Minnesota	8,400	NORTHERN STATES POWER COMPANY
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 2	Minnesota	4,000	CITY OF HASTINGS, MN
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D #1	Minnesota	17,920	FORD MOTOR COMPANY
USACE	Mississippi Valley	St. Paul	UPPER ST ANTHONY FALLS L&D	Minnesota	12,400	NORTHERN STATES POWER COMPANY
USACE	Mississippi Valley	Vicksburg	BLAKELY MOUNTAIN DAM	Arkansas	75,000	USACE
USACE	Mississippi Valley	Vicksburg	CANNELTON L&D	Kentucky	0	
USACE	Mississippi Valley	Vicksburg	DE GRAY DAM	Arkansas	68,000	USACE
USACE	Mississippi Valley	Vicksburg	NARROWS DAM	Arkansas	25,500	USACE
USACE	North Atlantic	Baltimore	RAYSTOWN DAM	Pennsylvania	20,300	PA ELEC CO. ET AL
USACE	North Atlantic	New England	COLEBROOK RIVER DAM	Connecticut	3,000	MET DISTRICT OF HARTFORD, CT
USACE	North Atlantic	New England	NORTH HARTLAND DAM	Vermont	4,000	VERMONT ELECTRIC COOPERATIVE

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	North Atlantic	New England	VERNEY MILL DAM	New Hampshire	623	AMERICAN HYDROPOWER COMPANY
USACE	North Atlantic	New York	TROY L&D # 1	New York	6,000	NIAGARA MOHAWK POWER COMPANY
USACE	Northwestern	Kansas City	HARRY S. TRUMAN DAM	Missouri	160,000	USACE
USACE	Northwestern	Kansas City	STOCKTON DAM	Missouri	45,000	USACE
USACE	Northwestern	Omaha	BIG BEND DAM	South Dakota	468,000	USACE
USACE	Northwestern	Omaha	FORT PECK DAM	Montana	185,250	USACE
USACE	Northwestern	Omaha	FORT RANDALL DAM	South Dakota	320,000	USACE
USACE	Northwestern	Omaha	GARRISON DAM	North Dakota	518,000	USACE
USACE	Northwestern	Omaha	GAVIN'S POINT DAM	South Dakota	132,000	USACE
USACE	Northwestern	Omaha	OAHE DAM	South Dakota	786,000	USACE
USACE	Northwestern	Portland	BIG CLIFF REREG DAM	Oregon	18,000	USACE
USACE	Northwestern	Portland	BONNEVILLE L&D	Oregon	1,092,000	USACE
USACE	Northwestern	Portland	COUGAR DAM	Oregon	25,000	USACE
USACE	Northwestern	Portland	DETROIT DAM	Oregon	100,000	USACE
USACE	Northwestern	Portland	DEXTER REREG DAM	Oregon	15,000	USACE
USACE	Northwestern	Portland	FOSTER REREG DAM	Oregon	20,000	USACE
USACE	Northwestern	Portland	GREEN PETER DAM	Oregon	80,000	USACE
USACE	Northwestern	Portland	HILL'S CREEK DAM	Oregon	30,000	USACE
USACE	Northwestern	Portland	JOHN DAY L&D	Oregon	2,160,000	USACE
USACE	Northwestern	Portland	LOOKOUT POINT DAM	Oregon	120,000	USACE
USACE	Northwestern	Portland	LOST CREEK DAM	Oregon	49,000	USACE
USACE	Northwestern	Portland	THE DALLES L&D	Oregon	1,807,000	USACE

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	Northwestern	Seattle	ALBENI FALLS DAM	Idaho	42,600	USACE
USACE	Northwestern	Seattle	CHIEF JOSEPH DAM	Washington	2,614,070	USACE
USACE	Northwestern	Seattle	LIBBY DAM	Montana	525,000	USACE
USACE	Northwestern	Seattle	WYNOOCHEE DAM	Washington		
USACE	Northwestern	Walla Walla	DWORSHAK DAM	Idaho	402,000	USACE
USACE	Northwestern	Walla Walla	ICE HARBOR L&D	Washington	603,000	USACE
USACE	Northwestern	Walla Walla	LITTLE GOOSE L&D	Washington	810,000	USACE
USACE	Northwestern	Walla Walla	LOWER GRANITE L&D	Washington	810,000	USACE
USACE	Northwestern	Walla Walla	LOWER MONUMENTAL L&D	Washington	810,000	USACE
USACE	Northwestern	Walla Walla	LUCKY PEAK DAM	Idaho	101,250	BOISE PROJECT BOARD OF CONTROL
USACE	Northwestern	Walla Walla	MCNARY L&D	Oregon	980,000	USACE
USACE	South Atlantic	Charleston	ST. STEPHENS DAM	South Carolina	84,000	USACE
USACE	South Atlantic	Mobile	ALLATOONA DAM	Georgia	74,000	USACE
USACE	South Atlantic	Mobile	BUFORD DAM	Georgia	86,000	USACE
USACE	South Atlantic	Mobile	CARTER'S DAM	Georgia	500,000	USACE
USACE	South Atlantic	Mobile	HOLT L&D	Alabama	40,000	ALABAMA POWER COMPANY
USACE	South Atlantic	Mobile	JIM WOODRUFF L&D	Florida	30,000	USACE
USACE	South Atlantic	Mobile	JOHN HOLLIS BANKHEAD L&D	Alabama	45,125	ALABAMA POWER COMPANY
USACE	South Atlantic	Mobile	MILLER'S FERRY L&D	Alabama	75,000	USACE
USACE	South Atlantic	Mobile	ROBERT F. HENRY L&D	Alabama	68,000	USACE
USACE	South Atlantic	Mobile	WALTER F. GEORGE L&D	Alabama	130,000	USACE
USACE	South Atlantic	Mobile	WEST POINT DAM	Georgia	73,400	USACE
USACE	South Atlantic	Savannah	HARTWELL DAM	Georgia	344,000	USACE

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	South Atlantic	Savannah	J.STROM THURMOND DAM	South Carolina	280,000	USACE
USACE	South Atlantic	Savannah	RICHARD B. RUSSELL DAM	Georgia	300,000	USACE
USACE	South Atlantic	Wilmington	JOHN H. KERR DAM	Virginia	204,000	USACE
USACE	South Atlantic	Wilmington	PHILPOTT DAM	Virginia	14,100	USACE
USACE	South Pacific	Sacramento	BLACK BUTTE DAM	California	6,800	CITY OF SANTA CLARA, CA
USACE	South Pacific	Sacramento	H.L. ENGLEBRIGHT #2	California	46,800	YUBA COUNTY WATER
USACE	South Pacific	Sacramento	ISABELLA DAM	California	12,000	Southern CA Edison
USACE	South Pacific	Sacramento	NEW HOGAN DAM	California	2,650	CALAVERAS COUNTY WATER DIST
USACE	South Pacific	Sacramento	PINE FLAT DAM	California	165,000	KINGS RIVER CONSERVATION DIST
USACE	South Pacific	Sacramento	SUCCESS DAM	California	1,400	LOWER TULE RIVER IRRIG DIST
USACE	South Pacific	Sacramento	TERMINUS DAM	California	17,000	KAWEAH RIVER POWER AUTHORITY
USACE	South Pacific	San Francisco	COYOTE DAM	California	3,500	CITY OF UKIAH, CA
USACE	South Pacific	San Francisco	WARM SPRINGS DAM	California	2,790	SONOMA COUNTY WATER AGENCY
USACE	Southwestern	Albuquerque	ABIQUIU DAM	New Mexico	11,000	LOS ALAMOS COUNTY, NM
USACE	Southwestern	Fort Worth	CANYON DAM	Texas	6,070	GUADALUPE-BLANCO RIVER AUTH
USACE	Southwestern	Fort Worth	R. D. WILLIS DAM	Texas	7,200	USACE
USACE	Southwestern	Fort Worth	RAY ROBERTS DAM	Texas	6,600	
USACE	Southwestern	Fort Worth	SAM RAYBURN DAM	Texas	52,000	USACE
USACE	Southwestern	Fort Worth	WHITNEY DAM	Texas	30,000	USACE
USACE	Southwestern	Little Rock	BEAVER DAM	Arkansas	112,000	USACE
USACE	Southwestern	Little Rock	BULL SHOALS DAM	Arkansas	340,000	USACE
USACE	Southwestern	Little Rock	DARDANELLE L&D	Arkansas	124,000	USACE

Owner	Region / Division	Project / District	Facility	State	Capacity (kW)	Powerplant Operating Entity, FERC Applicant, and Comments
USACE	Southwestern	Little Rock	GREERS FERRY DAM	Arkansas	96,000	USACE
USACE	Southwestern	Little Rock	JAMES W. TRIMBLE L&D	Arkansas	33,200	ARK ELECTRIC COOP. CORP.
USACE	Southwestern	Little Rock	MURRAY L&D	Arkansas	39,000	CITY OF NORTH LITTLE ROCK, AR
USACE	Southwestern	Little Rock	NORFORK DAM	Arkansas	81,000	USACE
USACE	Southwestern	Little Rock	OZARK L&D #12	Arkansas	100,000	USACE
USACE	Southwestern	Little Rock	TABLE ROCK DAM	Missouri	200,000	USACE
USACE	Southwestern	Little Rock	WILBER D. MILLS DAM	Arkansas		
USACE	Southwestern	Tulsa	BROKEN BOW DAM	Oklahoma	100,000	USACE
USACE	Southwestern	Tulsa	DENISON DAM	Oklahoma	70,000	USACE
USACE	Southwestern	Tulsa	EUFAULA DAM	Oklahoma	90,000	USACE
USACE	Southwestern	Tulsa	FORT GIBSON DAM	Oklahoma	45,000	USACE
USACE	Southwestern	Tulsa	KAW DAM	Oklahoma	31,433	OK Municipal Power Authority
USACE	Southwestern	Tulsa	KEYSTONE DAM	Oklahoma	70,000	USACE
USACE	Southwestern	Tulsa	ROBERT S. KERR DAM	Oklahoma	110,000	USACE
USACE	Southwestern	Tulsa	TENKILLER FERRY DAM	Oklahoma	39,400	USACE
USACE	Southwestern	Tulsa	WEBBER'S FALLS L&D	Oklahoma	60,000	USACE

Appendix 3

Using the Generic Energy Analysis Spreadsheet

Summary
The Generic Energy Analysis (GEA) spreadsheet is an Excel based analysis tool developed by the Pacific-Northwest Region, Bureau of Reclamation to assist federal agencies in performing assessment of potential hydroelectric sites as required by the 2005 Energy Policy Act, Section 1834. The program uses several approximations of energy production, therefore is it is deemed useful only for preliminary assessment. The program is intended only for use by federal agencies and no warranties or representations are made for its use outside of the Section 1834 purposes.

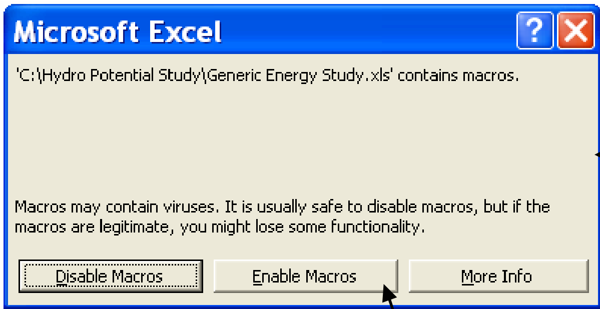
In order to produce accurate results with this spreadsheet you must have a moderate working knowledge of Microsoft Excel.

In order to use this analysis program you will need to obtain the following information:

1) Daily upstream dam or headwater water elevation and flow through the potential site. This information must be on a daily basis and must be for at least one full year (minimum 365 day). The user should enter only even full year increments of data. The recommended data basis is either on a water year or calendar year basis. Missing or bad data points must be corrected or approximate before running the full assessment program.
2) Expected average tailwater elevation. This must be entered in the same datum reference as the headwater elevation. Although the standard datum reference for flow gaging purposes is sea level (MSL), if this is not available use the tailwater elevation as 0 and expected height of the water above the tailwater at the headwater elevation.
3) Expected average energy rate for generated power in dollars per kilowatt-hour.
4) During the program execution the user will need to examine the flow exceedence curve (sometimes referred to as flow duration) and make an assessment of potential plant sizing. Further guidance on sizing will be given on this subject later in these instructions.

Loading the Spreadsheet

The GEA spreadsheet includes substantial Visual Basic (VBA) code to assist the end user. When the program is initially loaded the following message will appear:



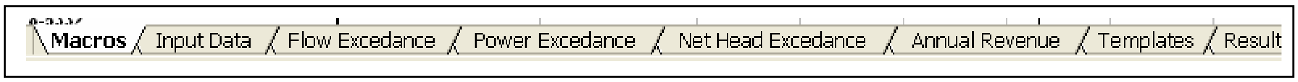
Note – If a message appears indicating Macros are disabled due to high security settings rather than the screen to the left – refer to Frequently Asked Questions – 13 (page 24)

<u>Click on **Enable Macros**</u>

Click Here

<u>Program Features</u>

Available Worksheets



Available worksheets are located on individual tabs at the bottom of the Excel screen.

Macros Tab

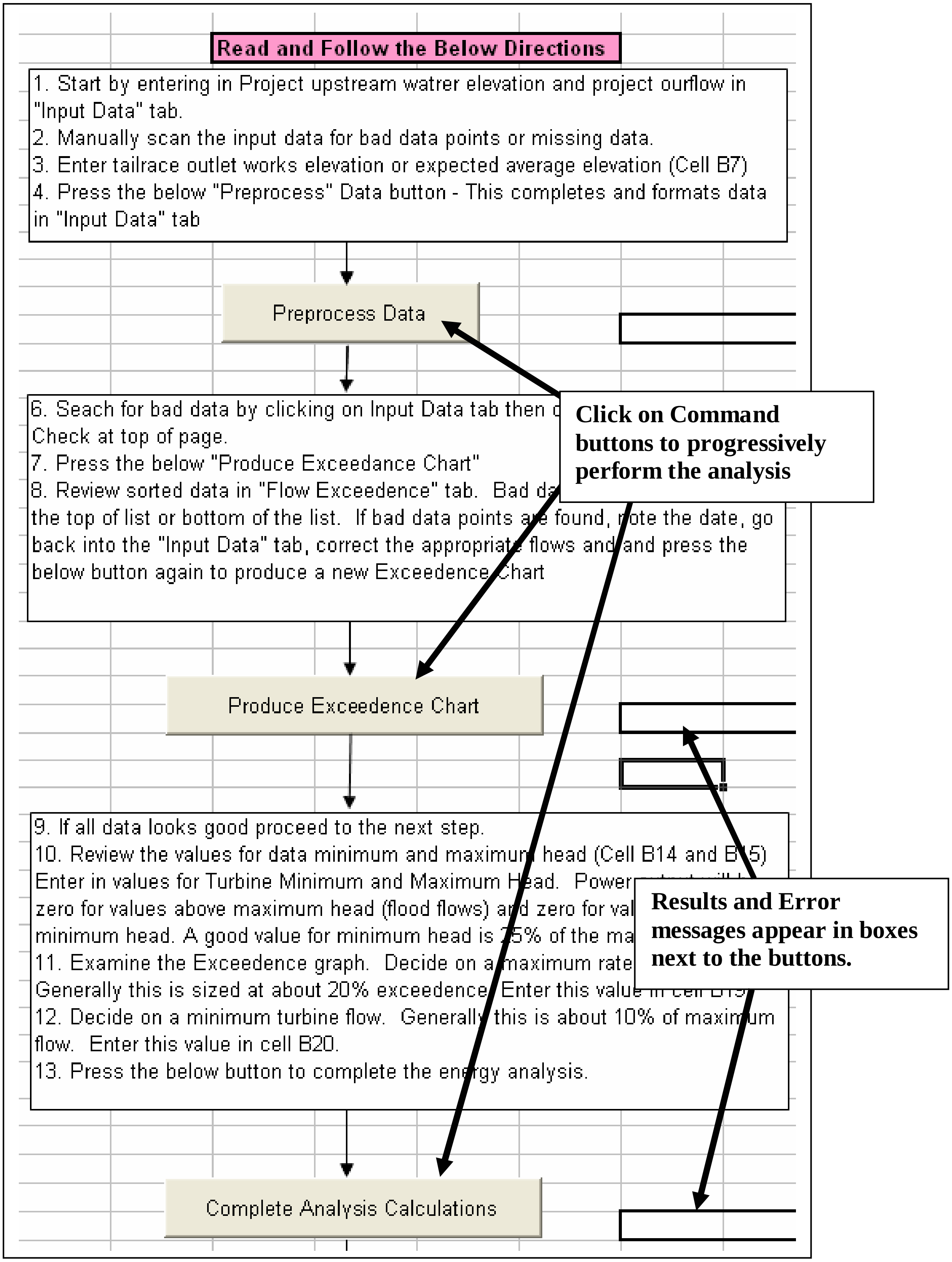
The Macros tab is where program execution is commanded. It divided into three separate areas.

- User Input and Results
- Progressive Executions Commands
- Utilities and Demonstration

User General Input and Results Data Area (Screen view when initially loaded)

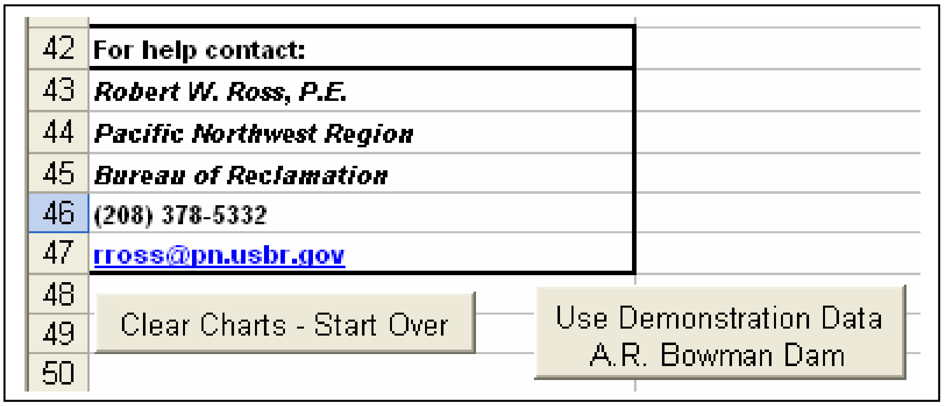
Bureau of Reclamation	
Section 1834 Energy Analysis - Version 1.06	
Facility Name	**Generic Federal Dam**
Agency	
Analysis Performed by	
Tailrace Elevation (MSL) in feet	**1234.56**
Exceedance Chart Maximum (CFS)	**900**
Exceedance Chart Grid Step (CFS)	**50**
Data Minimum - Project Head (ft)	0.0
Data Maximum - Project Head (ft)	0.0
Minimum Turbine Head (ft)	**125**
Maximum Turbine Head (ft)	**250**
Minimum Turbine Flow (CFS)	**100**
Maximum Turbine Flow (CFS)	**500**
Expected Power Rate ($/KWH)	$ 0.052
Note - Yellow boxes are user entries	
Analysis Results	
Data Set (Years)	**0**
Projected Annual Production (KWH)	**#REF!**
Projected Annual Revenue	**#REF!**
Turbine Peak Power (KW)	**#REF!**
Plant Factor	**0.000**

Progressive Execution Command Buttons



Help, Utilities and Demonstration

The Clear Charts and Demonstration Data buttons are located at the lower left side of the Macros spreadsheet. Most users will need to space down on the left side of the sheet to view these options.

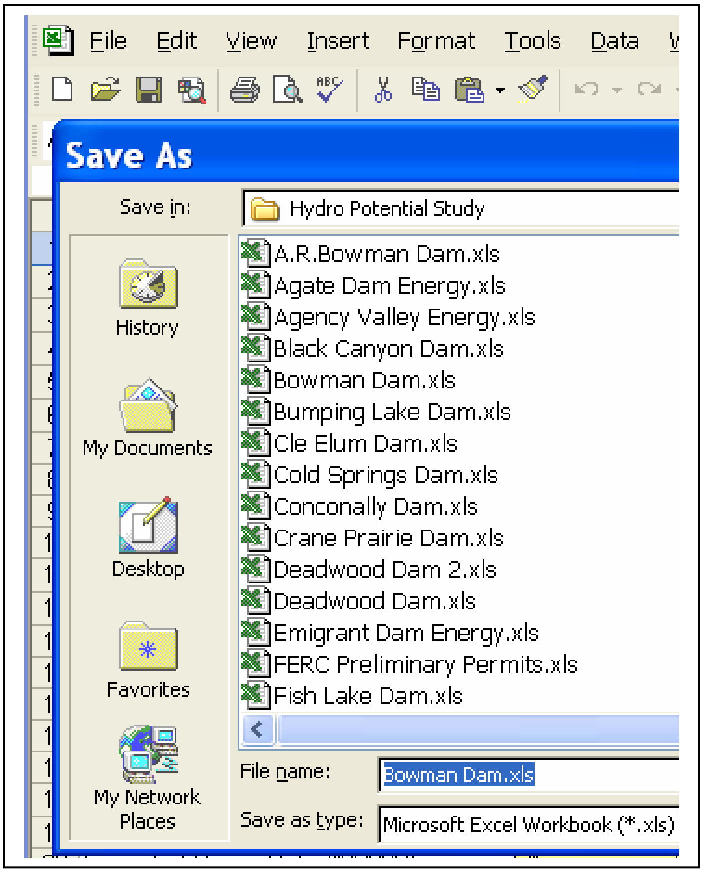


Notice

- **Modifying the cell locations, inserting columns or rows into the spreadsheet may cause inaccurate or unexpected results.**
- **Project data (Date, Head & Flow) must be entered or transferred into the proper input columns for the program to produce accurate results. There must be no blank or empty cells in the data record.**
- **Command buttons must be pressed in sequence from 1 to 3. The analysis is not complete until buttons have in sequence with the same data set.**

Start by Saving the Workbook to a Different Name

Save the "Generic" workbook under a different name. Choose any valid file name that represents the name of the site. Sample data in the spreadsheet is for Arthur R. Bowman Dam in Oregon so the file is named "Bowman Dam.xls" In the following picture the user clicked on **File** > **Save As** and entered Bowman Dam and then clicked the **Save** button.



Entering Data and Running the Analysis

Note – the remainder of this section of this manual uses data transferred using the "Demonstration" button in the Utilities area or the Macros tab. A novice user may wish to click on this button to transfer data to better follow these instructions. See Appendix A for various ways to transfer data from data bases and web sites into this spreadsheet.

1) Click on the Input Data tab before transferring data to view the general form of the Input Data worksheet. Note that the worksheet has columns for Date, Headwater Elevation, Tailwater Elevation and Flow.

2) **Determine an <u>average</u> tailwater elevation**. A source of this information might be project drawings, surveys, GPS data. If available, the elevation of the outlet works is a good starting point. (This will <u>always</u> be higher than the streambed elevation.) If the site is unsurveyed, enter tailwater elevation as zero and all headwater elevations as elevations above the expected tailwater. This assessment program always assumes a fixed tailwater elevation. In reality this is never true and tailwater changes can have a major impact on production, particularly on low head sites. For purposes of this assessment a reasonable approximation is good enough.

Tailwater elevation will be transferred over as the value entered on the Macros tab under "Tailrace Elevation (MSL) " – (Cell B7). Net Head and Max Available Power will be calculated automatically.

3) Click on the Macros tab.

4) Click on the Use Demonstration Data A.R. Bowman Dam button to transfer demonstration data into the input area. The Input Data tab should look like the following screen. Note – Twenty nine years of data, over 10500 data points have been transfer into the input area. This is real data previously download from the USBR web site. (See Appendix A for how this was done.)

A.R. Bowman Dam					
Data Source -					
Date	Head Water Elevation (ft)	Tailwater (Project Data Book)	Net head (feet)	Flow (CFS)	Max Available Power (KW) Hd * Q *.073
9/30/2005	3214.34			171	
9/29/2005	3216.84			183	
9/28/2005	3214.67			183	
9/27/2005	3214.84			183	
9/26/2005	3214.99			183	
9/25/2005	3215.14			184	
9/24/2005	3215.30			185	

Checking the Macros tab, updated values have also been entered in yellow cells for project information.

5) Click on the Preprocess Data button. Go back over to the Input Data tab and review the data. The process has been paused at this point to allow a quality check on input data. (See Appendix B on ways to find bad or missing data.) Note – Bad or missing data records occurs, particularly in such a large data record that spans 29 year of gage operation, because it is difficult to keep any measuring device working continuously for this period of time. Almost all data records, from any source, will need review and possible adjustment. For purposes of this study make the best estimate possible for missing records and enter the value under the Input Data tab.

6) After clicking on the Preprocess Data button the Input data tab, the Tailwater will be filled in and Net Head and Max Power columns should be calculated. The Input Data should look like the following screen.

A.R. Bowman Dam

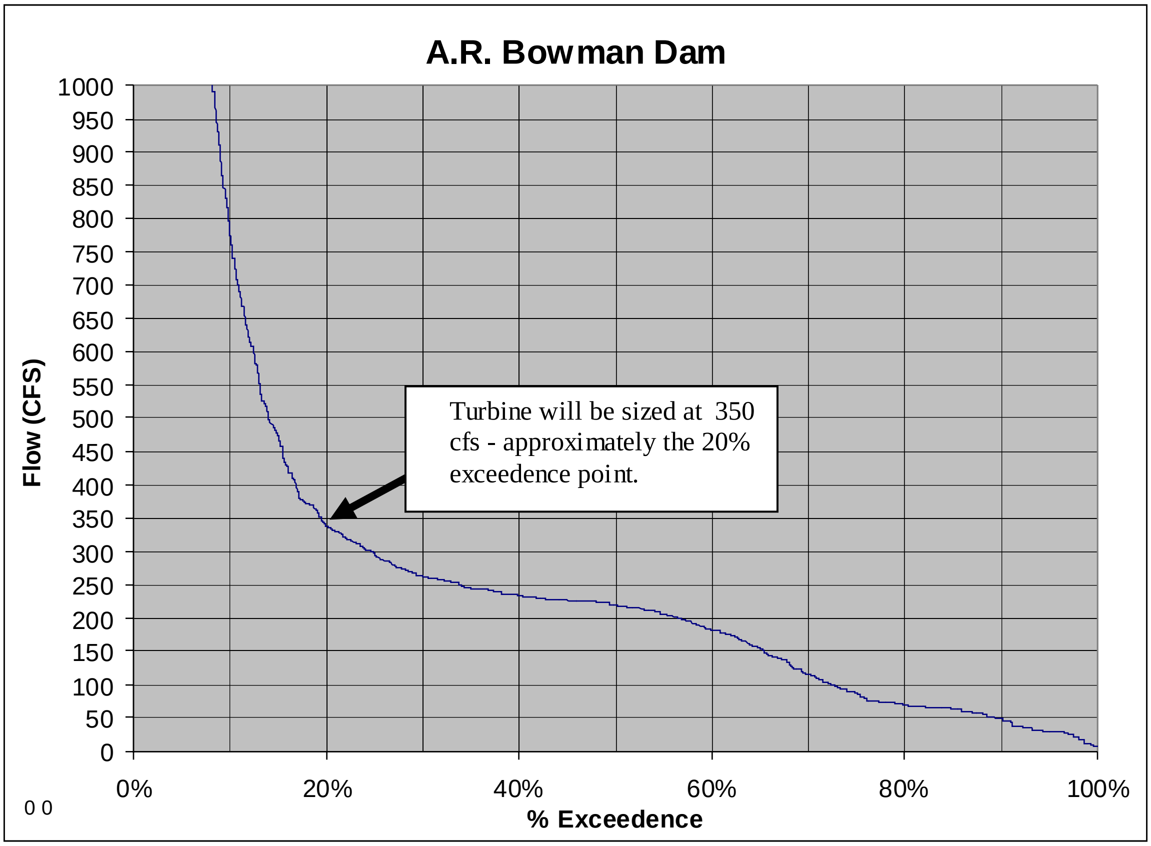
Data Source -					
Date	Head Water Elevation (ft)	Tailwater (Project Data Book)	Net head (feet)	Flow (CFS)	Max Available Power (KW) Hd * Q *.073
9/30/2005	3214.34	3052.60	161.74	171	2022
9/29/2005	3216.84	3052.60	164.24	183	2196
9/28/2005	3214.67	3052.60	162.07	183	2167
9/27/2005	3214.84	3052.60	162.24	183	2169
9/26/2005	3214.99	3052.60	162.39	183	2171
9/25/2005	3215.14	3052.60	162.54	184	2186
9/24/2005	3215.30	3052.60	162.70	185	2198

Note – When running the analysis, click on the command buttons in sequence from step 1 to 3. At least one years data on a daily basis (365 values) must be entered.

Monitor the status message next to the command buttons for error messages after clicking on a button.

7) Go back to the Macros tab and click on Produce Exceedance Chart button

The computer will go through a number of calculations in this stage which may take some time on slower computers. Data will be resorted by flow in the order of highest to lowest flow and an exceedence graph produced.



Note - The maximum left scale of the chart, in this case 1000 CFS, is specified on the Macros tab – Cell B9. The step increment between grid lines, in this case 50 CFS, is specified in Macros cell B10. To change scale values enter new values in cells B9 and B10 and press the "Produce Exceedence Chart button again to replot.

8) **Decide on a turbine maximum flow capacity**. At this point the program user will be required to use a little judgment as the turbine sizing. There is no right or wrong answer. A good guide is to size at an even flow size close to the 20% exceedence value. Another approach to sizing is to choose a size at an exceedence where the slope of the curve turns sharply upward. (Referred to as a point of inflection.) At this point the flow capacity of the turbine and associated civil costs are increasing much more rapidly than the rate of return. Particularly if only one unit is to be located in the plant efficiency is decreasing on the low side of the flow region as overall size increase. Sizing at a 20% exceedence means that the plant will be spilling water about 20% of the year. The above chart (produced from real data) is a typical shape for a run of the river project. In a water conduit, such as a canal system in which flow into the system

is regulated, the sizing will generally be close to maximum expected flow through the canal. For A.R. Bowman dam a flow size of 350 CFS (19% exceedence) was chosen. Enter this value into the Macros worksheet Cell B18.

9) **Decide on a minimum turbine flow** under which the plant will be too inefficient to operate. (i.e. flows below this point will be bypassed) A good guide for this number is between 10% and 15% of rated flow. Using the 10% guidance a value of 35 is entered into Macros Cell B17.

10) **Decide on a minimum and maximum head**. Typically turbines are designed around a particular net head (water pressure available to the turbine expressed in feet). As the net head varies below about 50% of their rated head, efficiencies start dropping dramatically. Typically turbines are selected to operate most efficiently in the net head region that they operate in most of the time. This will be less than maximum head and higher than minimum head. As a guide the Section 1834 assessments, choose an operational head range from about 25% of maximum data value (Minimum Turbine Head) to slightly higher than the maximum data value (Maximum Turbine Head). In the case of Bowman Dam, an operational net head range of 50 ft to 195 ft was chosen. (Note the min / max values of the input data set are shown on the Macros worksheet, Cells B12 and B13.) Bowman is a fairly good site so the chosen operational range encompasses the entire data set. On other sites this may not be true. If there is information that indicates a plant may not be able to operate during flood flow (plant overtopping) the head can be designated with a maximum head limitation. In the program, net head values above or below the turbine operation ranges will result in zero production, i.e. the plant is shut down.

11) Click on the Complete Analysis Calculations button. The program will create the following products:

- Annual Revenue Tab – Daily energy estimate for the period of record bases upon input turbine characteristics. <u>Results are transferred to Macros tab – Analysis results</u>
- Power Exceedence Chart
- Net Head Exceedence Chart

Analysis Results Products

Analysis Results

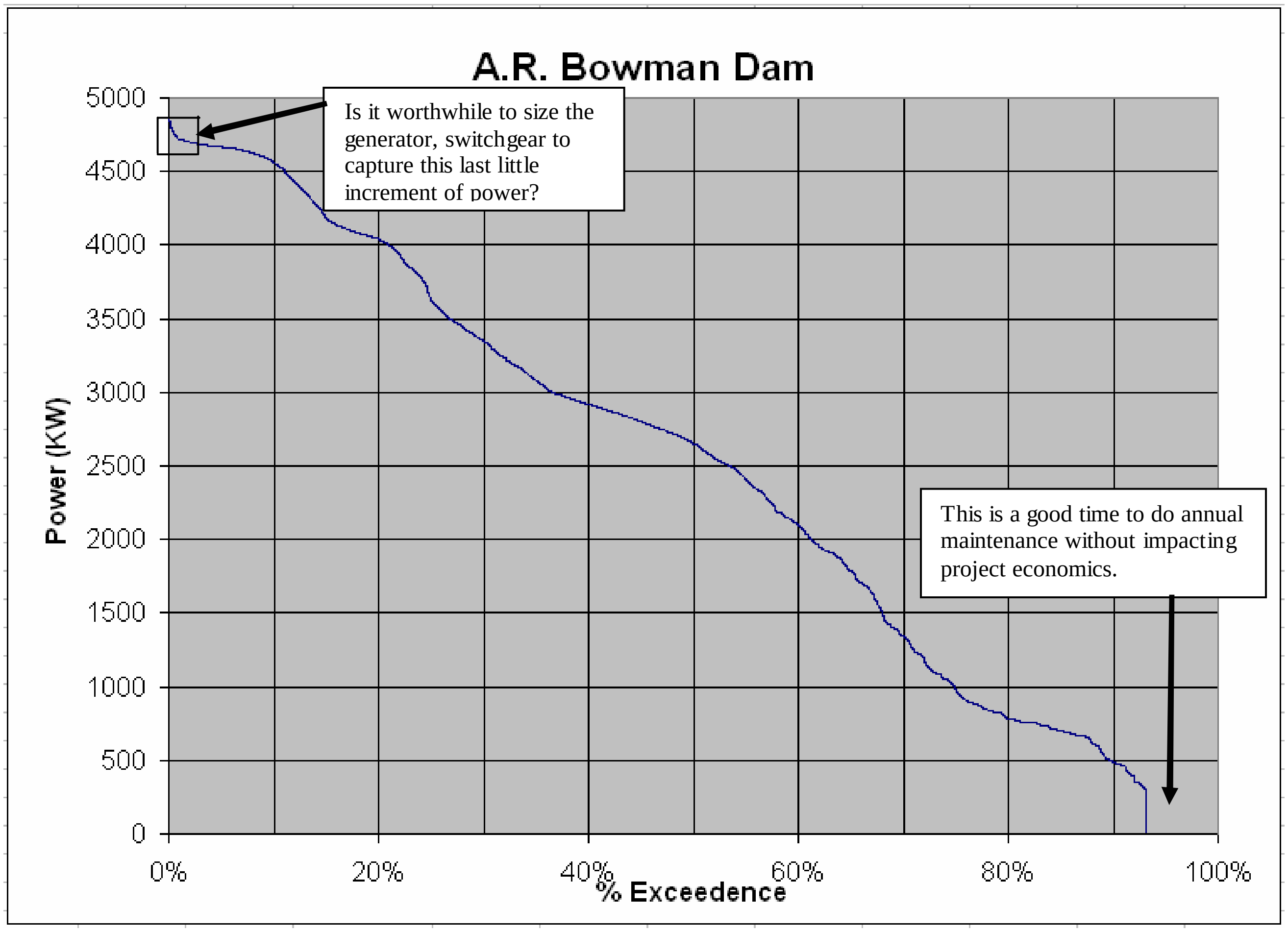
Shown on Macros Tab – Data for A.R. Bowman Dam

Analysis Results	
Data Set (Years)	29
Projected Annual Production (KWH)	21,427,278
Projected Annual Revenue	$ 1,285,637
Turbine Peak Power (KW)	4857
Plant Factor	0.503

The analysis results have several pieces of information necessary to complete the section 1834 assessment. The turbine peak KW will be the installed capacity reported on the study. Annual revenue must be sufficient to cover the amortized debt on the project plus operation and maintenance, reserves, FERC fees and profit. (Economic and construction cost estimates to be performed separately.) The higher the plant factor, the better the plant economics. (Plant factor is defined as actual annual production divided by theoretical production if generator were running continuously at maximum power.)

The value of the Generic Energy Analysis Spreadsheet is that it allows a very quick assessment of a site's potential. Different values for turbine maximum and minimum flow can be evaluated for their effect on plant factor. Generally, a larger turbine flow value will result in a lower plant factor. Another factor for advanced users to consider is if it is worthwhile to invest in two turbines, which cost more, that together may have the capability to capture a broader range of flows. By entering various turbine values one can very quickly understand site characteristics and relative economics.

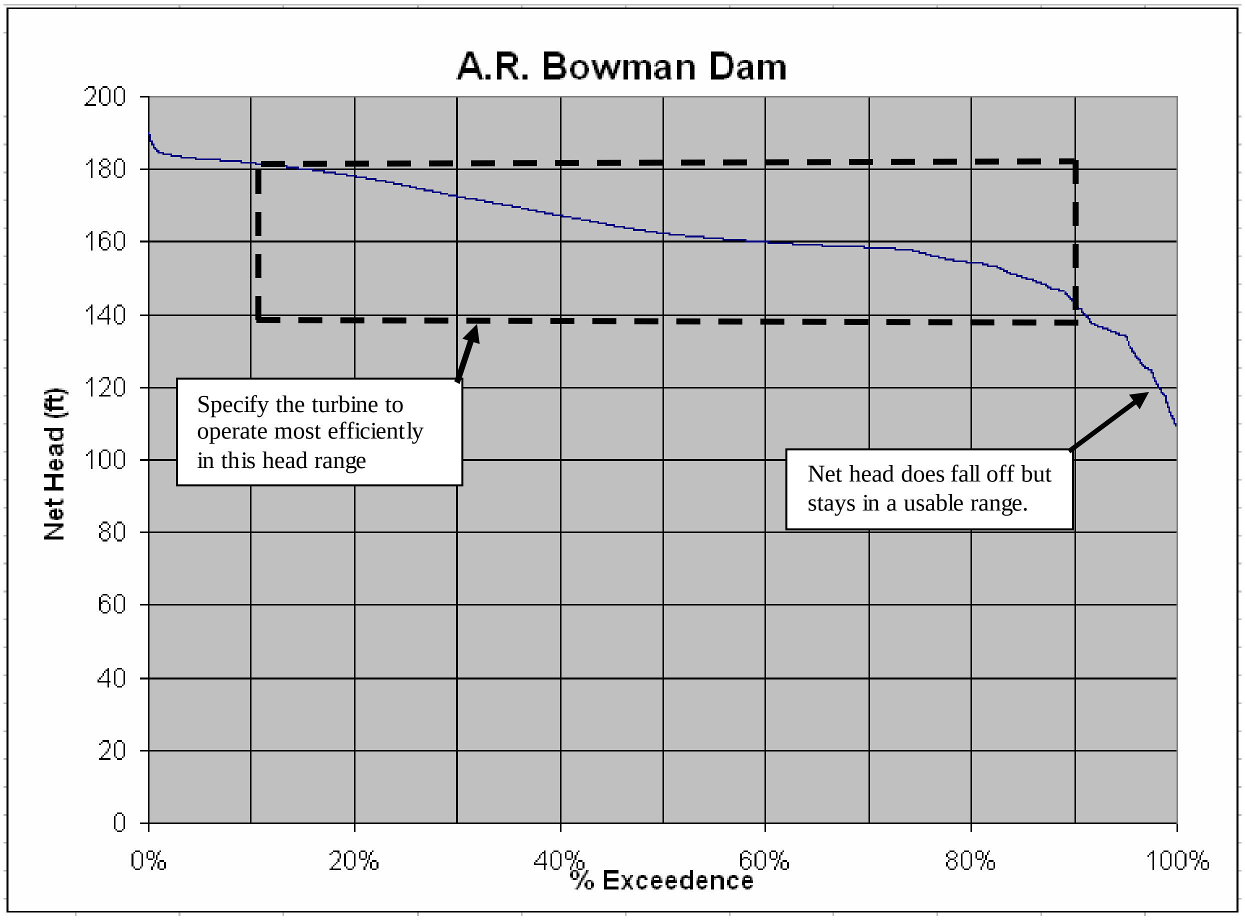
Power Exceedence Chart



The Power Exceedence (or distribution) chart is a feature intended for more advanced users.

The above chart indicates that a more economical generator capacity might be at 4700 KW rather than 4850, saving in the generator, transformer, switchgear and other electrical costs. The above chart also indicates that there is a small portion of the year that the plant will be off line due to low flows, allowing annual maintenance without impacting project economics. The above graph indicates that a plant at this location would be on line at some level of production better than 92% of the time. The distribution is fairly even from high to low power.

The Net Head Chart



The Net Head distribution chart is feature more useful to advanced users.

The idea in this chart is obtain a better understanding of net head variation i.e. what head range to specify for best turbine performance. The formula used to Generic Analysis convert flow and head to power assumes constant efficiency. This is a reasonable assumption over moderate changes in head. At sites where the net head may vary from 0 head (dam drained) to maximum head, the assumption is optimistic.

The Net Head Chart:

- Is a basis for specifying the best efficiency range for the turbine
- Is a basis for understanding overall head variation and accuracy of program assumptions

Appendix A

Transferring and Organizing Data From Web Sites

Reservoir flow and elevation information may be obtained from a multitude of different sources on the Internet.

- Bureau of Reclamation, Pacific Northwest Region – Hydromet (other regions have web site with similar information) see http://www.usbr.gov/pn/hydromet/
- USGS – (Note most USGS gage sites, gage height, critical for calculating net head is not available. This information must be estimated or obtained from other sources

Example Downloading data for A.R. Bowman Dam from Hydromet

1) Select web site www.usbr.gov/pn/hydromet/

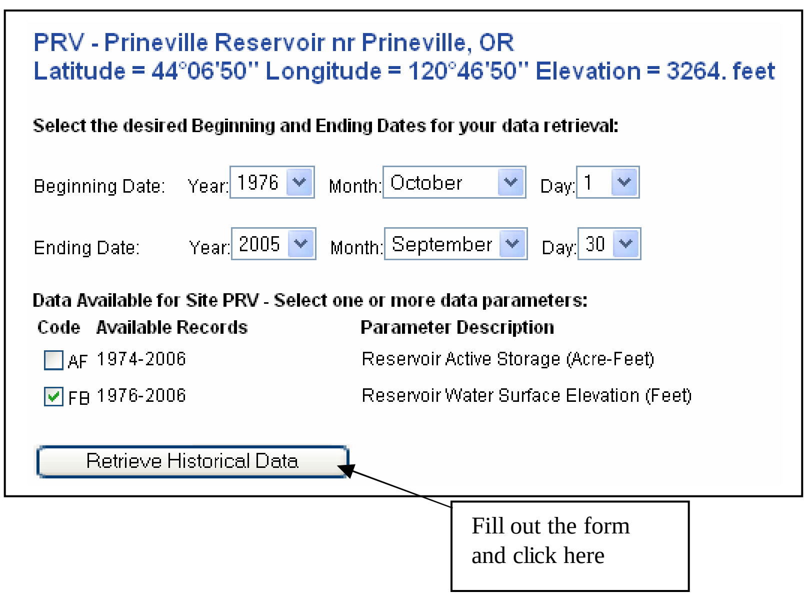
2) Click on Historical Data Access - Under Daily Values (Archived Data)

First download the reservoir surface elevation – this will be the headwater elevation.

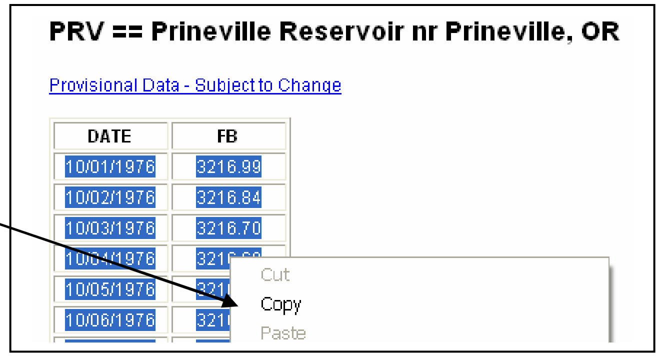
3) Scroll down list of Hydromet Stations and Select station PRV – Prineville Reservoir

4) Click on > Step 1 – Find Data Button

5) Select data record starting October 1, 1976 to Sept 30, 2005. Select FB – Water surface elevation



6) Highlight the data, right click and select Copy



7) Open a blank spreadsheet and insert the copied data into the fourth row. In the following sheet I have copied the headings over also for clarity.

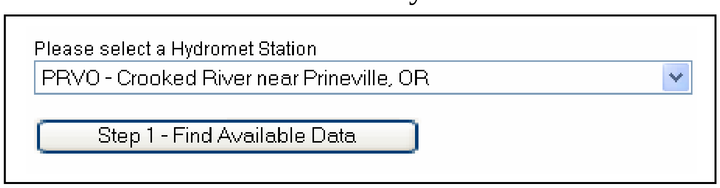
Paste to cell A4

1						
2	Data Source -					
3	Date	Head Water Elevation (ft)	Tailwater (Project Data Book)	Net head (feet)	Flow (CFS)	Max Available Power (KW) Hd * Q *.073
4	10/1/1976	3216.99				
5	10/2/1976	3216.84				
6	10/3/1976	3216.7				
7	10/4/1976	3216.6				
8	10/5/1976	3216.5				
9	10/6/1976	3216.39				

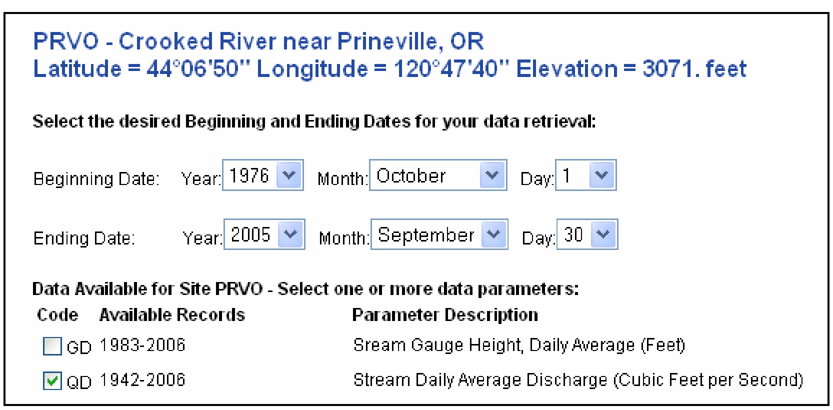
8) Go back to the Hydromet screen. Backup to the gage selection screen .

Next download the reservoir outflow.

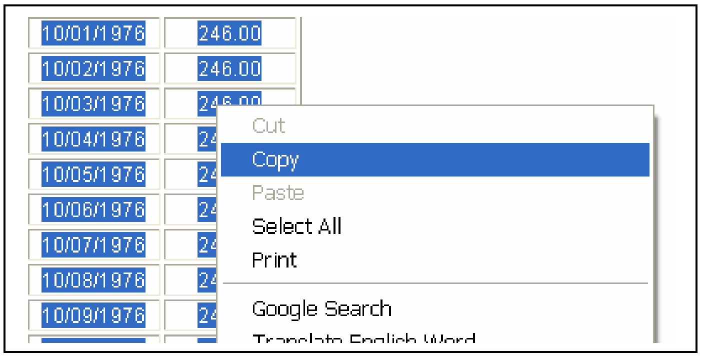
9) Select Station PRVO which is the station directly downstream from the dam.



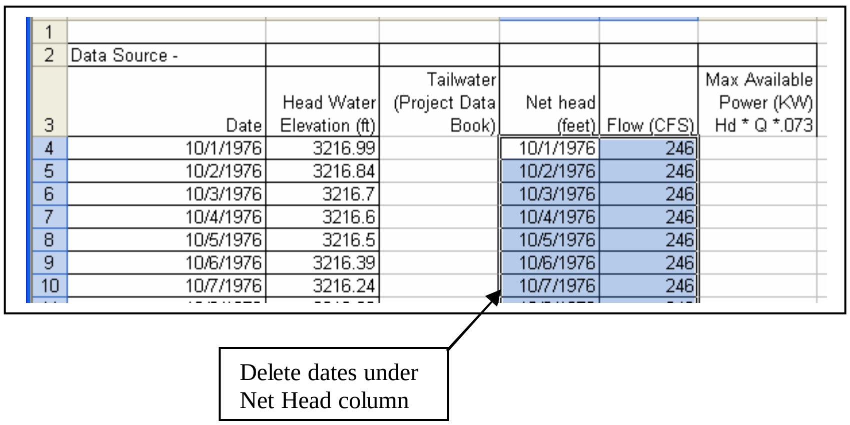
10) Click on Find Available Data. Select the same period of record as the headwater. QD is the discharge in CFS.



11) Click on Retrieve Historical Data button. The dam discharge is now shown. Highlight the data, Right Click and select Copy.



12) Go back over to the previous blank spreadsheet that we copied the data into. Select Cell D4 and Paste the data. Note Cell D4 was chosen as the Paste location because that put the flow numbers in the correct cell location.

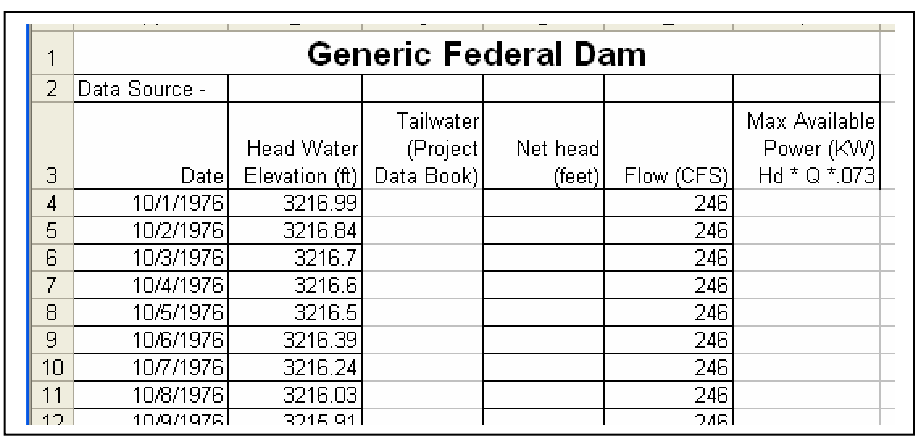


1							
2	Data Source -						
3		Date	Head Water Elevation (ft)	Tailwater (Project Data Book)	Net head (feet)	Flow (CFS)	Max Available Power (KW) Hd * Q *.073
4		10/1/1976	3216.99		10/1/1976	246	
5		10/2/1976	3216.84		10/2/1976	246	
6		10/3/1976	3216.7		10/3/1976	246	
7		10/4/1976	3216.6		10/4/1976	246	
8		10/5/1976	3216.5		10/5/1976	246	
9		10/6/1976	3216.39		10/6/1976	246	
10		10/7/1976	3216.24		10/7/1976	246	

13) After insuring that the elevation and flow correspond to the same date, delete dates shown in the net head field. There should now be over 10500 data point in each column.

14) Highlight the entire data record and click on copy.

15) Open the Generic Energy Analysis Program. Click on the Input Data tab and paste the data into Cell A4. The screen should now look like the one below.



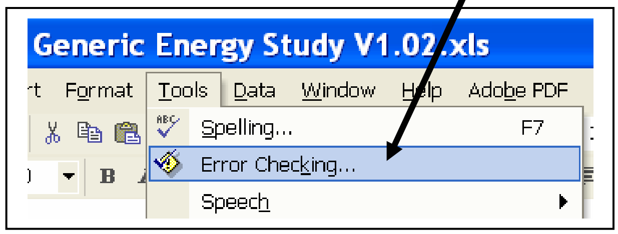
1	**Generic Federal Dam**					
2	Data Source -					
3	Date	Head Water Elevation (ft)	Tailwater (Project Data Book)	Net head (feet)	Flow (CFS)	Max Available Power (KW) Hd * Q *.073
4	10/1/1976	3216.99			246	
5	10/2/1976	3216.84			246	
6	10/3/1976	3216.7			246	
7	10/4/1976	3216.6			246	
8	10/5/1976	3216.5			246	
9	10/6/1976	3216.39			246	
10	10/7/1976	3216.24			246	
11	10/8/1976	3216.03			246	

<u>The next step will be to find any bad or missing data records</u>.

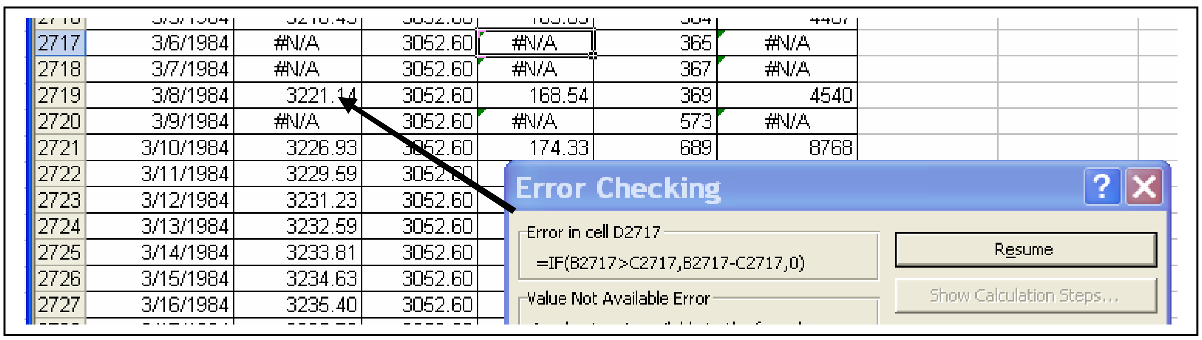
16) Go to the Macros tab and enter as much of the site information. This will include the facility name and tailwater elevation.

17) Click on the Preprocess Data button.

18) Click on the Input Data tab. Search for errors as follows – Select Tools > Error Check



19) An Error Checking screen will pop up. Refer to the message "Error in cell". Because cell D2717 is calculated as the A column minus the B column the number causing the problem is actually in the A column.

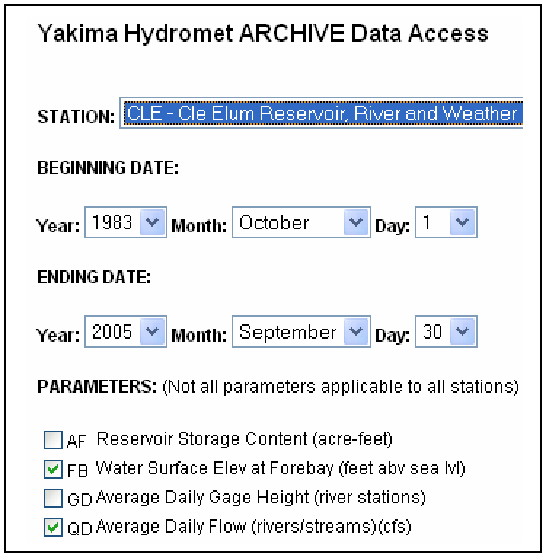


20) Once the bad number is corrected hit the Resume button and continue searching for bad or mission data points. If you don't know what the data is, make an educated guess. In the above screen, a reservoir elevation is missing for 3/9/1984. A value of 3224.04 would be a good value to enter as it is halfway between the previous and next dates. Do not worry about doing a little educated data correction (another way of saying an educated guess). Correcting 20 or 30 values in a data set of 10,000 will not significantly affect the results.

21) There is an old saying about computers – "Garbage In – Garbage Out" . The user has the responsibility to provide the most accurate data possible for accurate result. When the error checking is complete manually scan the data. Does it look right? Once you run the Exceedence analysis view that graph also. Are there data points that appear to be falling way out of expectations? In the exceedence analysis the bad data value will tend to appear at either the top or bottom of the sorted data list. Note the dates on the bad data points, go back into the original data set, make the corrections and start over on Step 1 – Preprocess Data.

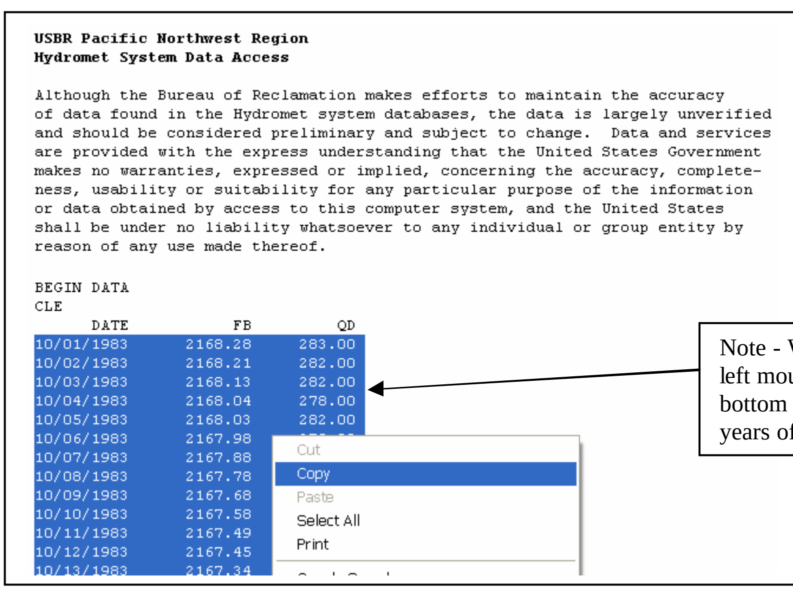
Example - Downloading Space or Tab Delimited Data

Some web sites may download data in a Tab or Space delimited format. This may also be common for data records obtained from document files. In both cases Excel has some very nice features that can be used to enter the data into proper Excel column format usable by the analysis program.



In this example, data will be downloaded for Cle Elum Dam. The Yakima Hydromet data can be accessed through the PN Region Hydromet web site or accessed directly at: http://www.usbr.gov/pn/hydromet/yakima/yakwebarcread.html

1) On the Yakima site, data is presented as a portion of a text document. (This is a very common way for web sites to present information.) Just highlight the portion of the text you want to transfer, right click and select Copy. (See below screen)



USBR Pacific Northwest Region
Hydromet System Data Access

Although the Bureau of Reclamation makes efforts to maintain the accuracy of data found in the Hydromet system databases, the data is largely unverified and should be considered preliminary and subject to change. Data and services are provided with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, usability or suitability for any particular purpose of the information or data obtained by access to this computer system, and the United States shall be under no liability whatsoever to any individual or group entity by reason of any use made thereof.

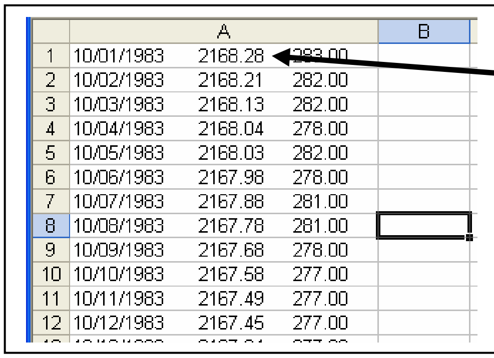
BEGIN DATA
CLE

DATE	FB	QD
10/01/1983	2168.28	283.00
10/02/1983	2168.21	282.00
10/03/1983	2168.13	282.00
10/04/1983	2168.04	278.00
10/05/1983	2168.03	282.00
10/06/1983	2167.98	
10/07/1983	2167.88	
10/08/1983	2167.78	
10/09/1983	2167.68	
10/10/1983	2167.58	
10/11/1983	2167.49	
10/12/1983	2167.45	
10/13/1983	2167.34	

Cut
Copy
Paste
Select All
Print

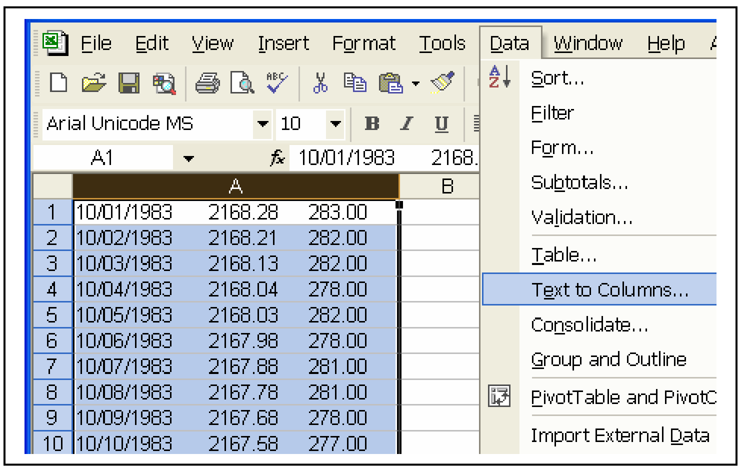
Note - When highlighting data – Hold down the left mouse button and keep the mouse at the bottom of the screen. You will be able to copy 22 years of data in one operation

2) Open up a blank spreadsheet and Paste the data into cell A1. The screen will appear as follows. Note – column A4 has been expanded to show that all data has been pasted into a single column as text.

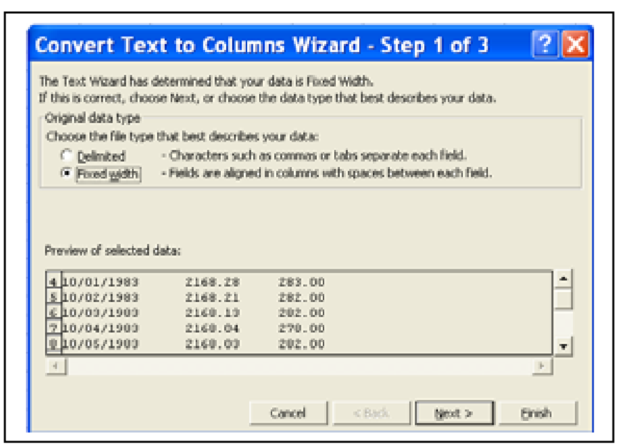


Be sure to Paste Data to Cell A1. This avoids a potential problem later on.

3) In the following step Excel's "Text to Columns" feature will be used to separate the data into individual columns. First click on the "A" above the data to highlight the entire data set. Under the Data selection at the top of the screen Select "Text to Column" as shown.



4) When "Text to Columns is selected the following screen will appear.



<u>A fixed width selection will work for most situations.</u> (Reference an Excel manual for separating special data bases.)

Click on "Next" button

Then click the "Finish" button to compete the separation of data into columns.

OK – You are almost there – just two more steps.

5) The spreadsheet should appear like the following screen. Note that data has now been separated into three columns (A,B & C)

	A	B	C
1	10/1/1983	2168.28	283
2	10/2/1983	2168.21	282
3	10/3/1983	2168.13	282
4	10/4/1983	2168.04	278
5	10/5/1983	2168.03	282
6	10/6/1983	2167.98	278
7	10/7/1983	2167.88	281
8	10/8/1983	2167.78	281
9	10/9/1983	2167.68	278
10	10/10/1983	2167.58	277
11	10/11/1983	2167.49	277

In the next step two blank columns will be inserted between columns B and C

6) Select Column C and insert two blank columns. The screen should appear as follows:

	A	B	C	D	E
1	10/1/1983	2168.28			283
2	10/2/1983	2168.21			282
3	10/3/1983	2168.13			282
4	10/4/1983	2168.04			278
5	10/5/1983	2168.03			282
6	10/6/1983	2167.98			278
7	10/7/1983	2167.88			281
8	10/8/1983	2167.78			281
9	10/9/1983	2167.68			278
10	10/10/1983	2167.58			277
11	10/11/1983	2167.49			277
12	10/12/1983	2167.45			277
13	10/13/1983	2167.34			277

The data is ready to be transferred to the Input Data tab of the Generic Energy Analysis program. Highlight the entire above data set, right click and select Copy. Open the GEA spreadsheet, select the Input Data tab and Paste the data into Cell A4.

Remember to use Excel's Error Checking function to search for bad or missing data as previously shown.

Appendix B

Adjusting Data for Minimum Stream Flows

The program works with net flow available for generation. Minimum stream flow (i.e. flow for fish or other aquatic resource and not available to run through the turbines for generation) must be subtracted out before transferring information to the Input Data Tab. Minimum stream flow may change seasonally so it would be very difficult to predict all user end needs when designing this program.

Solution - Create a separate spreadsheet and subtract out the expected minimum flow. Transfer the date, elevation and net available for generation water into the appropriate columns on the "Input Data" worksheet.

Appendix C – Common Problems / Frequently Asked Questions

1) Problem – I have entered good data but the energy production is zero.

Ensure that you have entered valid operational parameters on the Macros worksheet for the turbine flow size and operational head. Flow and head data **outside** (above and below) of the turbine operational head will give **zero** production. The value entered for the turbine minimum head must be less that the maximum head. The value entered for the minimum turbine flow must be less than the maximum flow.

2) Problem – There is no or just a partial plot on the exceedence chart.

Enter an exceedence chart maximum value that is just above the maximum data value to adjust the chart scale. Specifying a maximum chart value around the 5 percent exceedence point will give a fairly good visualization of the exceedence chart. Specifying a step increment at an even increment about 1/10 to 1/15 of the maximum produces a good looking chart. As an example, if you specify 2400 CFS as the maximum chart value, a step increment of 200 CFS will produce a nice chart.

3) Problem – The charts displayed on the power exceedence and do not display data to produce a nice looking chart.

These charts are more intended for advanced users and adjustment of the scales is a user preference item. Right click on the chart Y scale > Click Format Axis > Click on Scale Tab and enter a chart maximum scale and major unit to display the chart in the preferred scale.

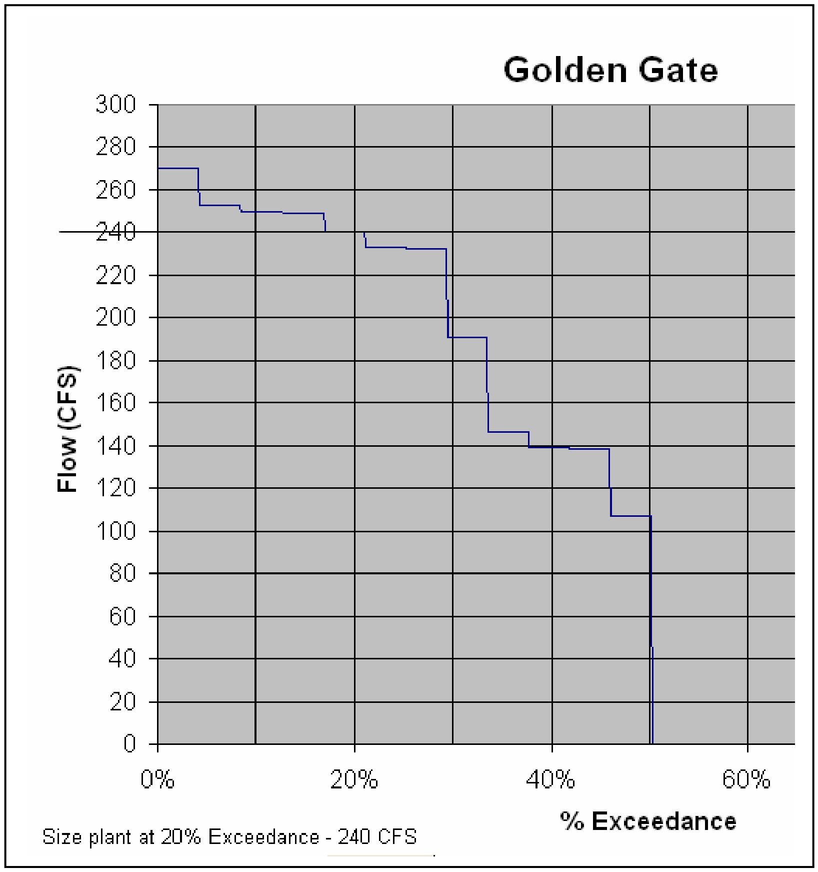
4) Problem – There is an extra line on the exceedence chart and a cell to fill in exceedence sizing point and flow. What do I do with these?

The extra line is just there to help you visualize exceedence sizing. Move the line around on the chart with the mouse pointer. This represents the turbines maximum flow point. The intent of exceedence sizing is to capture as much energy as **economically** possible **below** the horizontal line. Generally the area under the exceedence curve above the horizontal line will be small relative to the area under the curve above the line. The exceedence entry values are just there to help you remember how you sized the turbine. After doing 20 to 50 sites you may come back to a particular site and wonder “How did I do this one?” These entries are there to help you remember – they are not otherwise used by the program. You still have to transfer the value for the turbine size back over to the Macros sheet.

4) Problem – I have been given average monthly data. The program needs daily data. What do I do?

Copy the average monthly values through for every day of the given month. The program still works pretty well with monthly values and will produce exceedence charts. The exceedence analysis will tend to be not as accurate as one performed with daily data, but sometimes that’s all

This is an example of a irrigation canal for which only three years of monthly average data, supplied as acre feet, were available. Even though only monthly data were available, an exceedence curve begins to emerge. The greater the number of data points entered the smoother the graph will be.



5) Problem – I have been given the numbers in acre ft discharge rather than CFS. What do I do?

One acre ft delivered over a one day period is equivalent to .5042 CFS per day. (43560 / 2400 / 3600). Multiply daily acre ft of water delivery by .5042 to arrive at average daily CFS. If given total acre ft delivered during the month, divide by the days in the month and multiply the result by .5042.

6) Problem – I can run peaking operations at the proposed hydro facility. Can the program calculate energy production for peaking operations?

Enter the flow values for average daily flow. Set the turbine low flow cutoff value to zero. As much energy is produced running for one hour at, for example, 240 CFS as is produced in 24 hours at 10 CFS. The program assumes a constant efficiency from the low flow cutoff point to maximum flow. (Good enough for this first level assessment study.)

7) Problem – I don't understand the power conversion formula. (KW=Head * Flow * .073) Where does this come from? What are your assumptions?

The formula assumes 83.5 percent "water to wire" efficiency which includes factors for turbine efficiency, transformer loss, trashrack and tailrace loss, short transmission line, etc. This is realistic for a new turbine at its most efficient operating level but overly optimistic for a turbine at lower flows, but good enough for an assessment level study.

The generally agreed upon formula for converting CFS to KW is developed from the following factors:

1 Horsepower = 550 ft-lb/sec
Weight of water = 64.4 lbs/cu-ft.
1 Horsepower = .7457 KW
Assume 83.5% efficiency

.073 conversion factor = 64.4 / 550 * .7457 * .835 (from the above values)

8) The sample numbers imported into the Macro screen for the A.R. Bowman show an operational head from 50 to 195 ft. Typically a Francis turbine will only operate effectively down to 50 percent of design head. Why is the program so optimistic?

This part of the program was written as a learning tool to provide a demonstration of how the program works. The maximum turbine head is the maximum “flood stage” head and may be well in excess of “design head” This is the point above which the turbine will not be allowed to operate due to a manufactures operation limit, cavitation, etc. It was included in the program to answer the question “What if there is a flood?” Both minimum and maximum head are user settable number. If you are an advanced user, reference the net head exceedence chart, determine a design head, and set the turbine cutoff value at 50 percent of this value or whatever is appropriate for the type of turbine you would propose installing. Rerun the analysis after determining the turbine operational range.

9) I am using a USGS gage which only gives flow information. Can I still perform the energy analysis? What should I do?

Energy and power are as much dependent on the available net head (difference between the headwater and tailwater elevations as flow. Some attempt must be made to determine net head. Canal drops will generally have a relatively fixed head as there is no water storage in canal. If there is no elevation tailwater information enter zero for this number and the height above this point for the canal water. Make the best estimate possible.

Storage reservoirs are a different problem. Many storage reservoirs totally drain down through the irrigation season such that there is no available power generation head. Elevation of the water behind the dam must be found in order to perform a valid analysis. Most turbines do not run well below 50 percent of their design head. If a median head is assumed for a storage dam then a head below the turbine low flow cutoff point must be entered for those times of the years that the reservoir elevation is below it “normal” pool. In all cases where information is incomplete or estimated a more detailed feasibility study including actual data must be performed prior to plant construction. This may cause several years delay in project development while gages are installed at the site and assumptions are validated.

10) Should I include a partial year's data if that's all I have?

The idea behind this analysis is to obtain an assessment of average annual production. Including a partial year's data can skew the result one way or the other. Including a portion of the year that has flows below the average tends to underestimate production. Including spring runoff flows but not the summer low flow period tends to over estimate. If there are small gaps in the data, make the best estimate possible. In all cases it is recommended to start and end the data on a water year or calendar year basis. Ignore data that falls outside of the selected analysis period.

11) After I click on the "Preprocess Data" button the data files for minimum and maximum project head show "#Value!"

12	Data Minimum - Project Head (ft)	#VALUE!
13	Data Maximum - Project Head (ft)	#VALUE!

All of the data entered into the Input Data tab must be recognized by Excel as numeric information. In this case the error was cause by the following invalid value entered for headwater elevation.

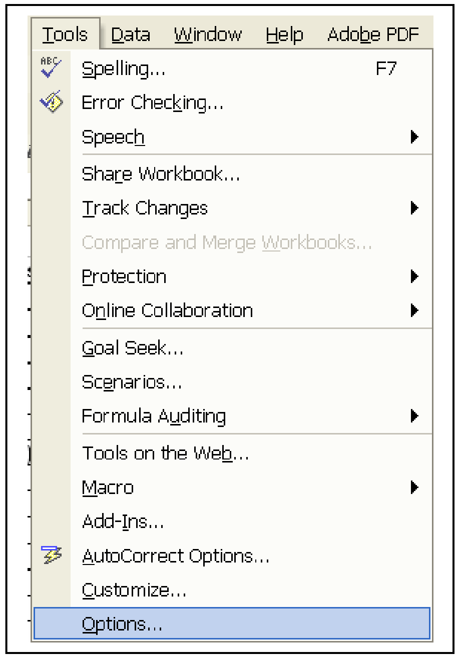
15	9/19/2005	3216.24	3052.60	163.64	200	2387
16	9/18/2005	cdfg	3052.60	#VALUE!	200	#VALUE!
17	9/17/2005	3216.56	3052.60	163.96	200	2391

Note – All data for headwater elevation and flow must be numeric. Refer to page 16 for on how to find bad data records.

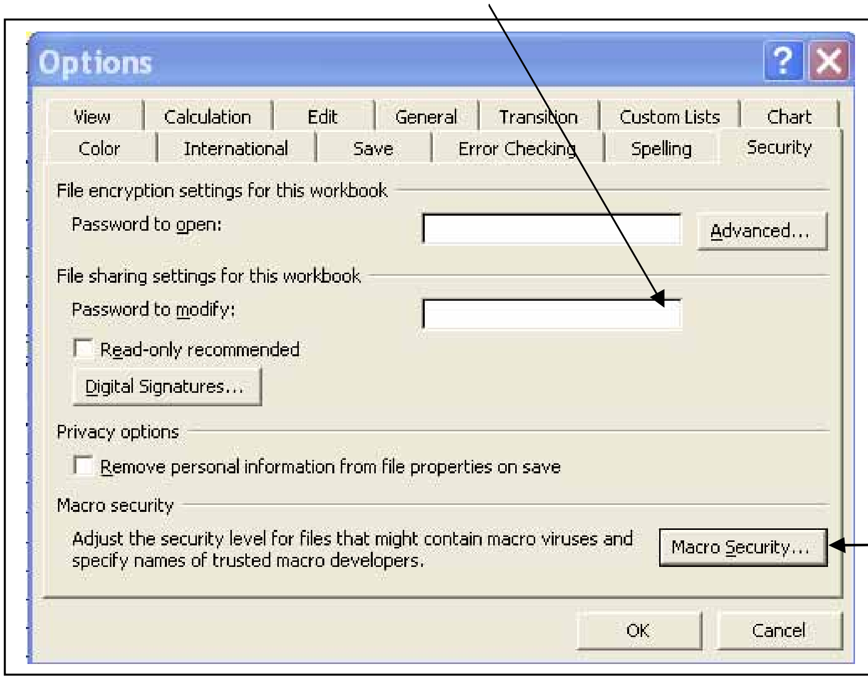
12) Macro Disabled Message – When I load the program the following message appears. What do I do to run the program?

This energy analysis program is highly dependant on Excel Macros (Visual Basic for Applications). If the Excel Macro security is set to "High", macros will not run. You must first open a blank Excel spreadsheet and change the security settings to medium or low. (When Excel is closed it will save the new setting.) To change the default settings:

a) Click on Tools (top of screen)

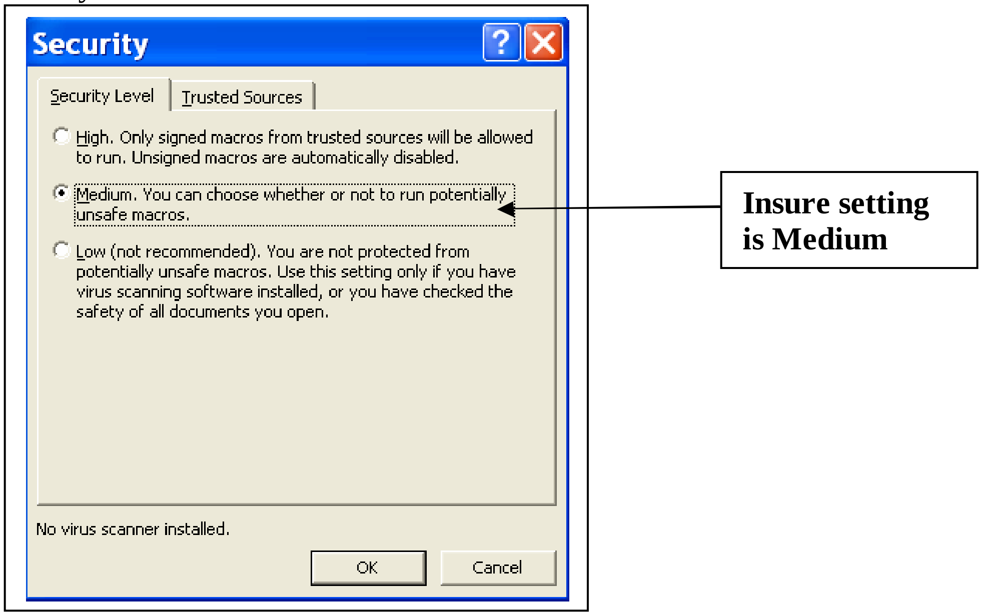


b) Options (Bottom of pull down menu)



Click here

c) Macro Security



13) The site I am evaluating only has flow for 6 months out of the year. Can I perform turbine sizing just based upon six months of data?

<u>In all cases</u> the program must have a continuous period of record from the start of the evaluation period until the end of the period. Start and end on given annual date i.e. fiscal year or water year. For <u>those days that the flow is zero be sure to enter zero for that day</u>. The basis for the program design is that data for complete years are entered. The program is not smart enough to expand or fill in the gaps.

An exceedence chart indicates that flow is greater than a given value for a given percent of time, (all of time not just part) so you have to account for the low or zero flow periods as well as the periods of high flow. All of the calculations of annual energy are based upon a year containing 365 days. <u>Skipping periods with zero flow effectively puts more than one years flow into an annual average energy calculation producing overly inflated results</u>. (Average annual production is calculated by dividing the total number of entered days in the record to arrive at the total number of years. The total energy production over the entire period of record is divided by the number of years to arrive at average annual energy.)

Example of invalid data entry

214	10/28/1969	5770.65	5737.00	33.65	15	37
215	10/29/1969	5770.70	5737.00	33.70	15	37
216	10/30/1969	5770.70	5737.00	33.70	15	37
217	10/31/1969	5770.75	5737.00	33.75	15	37
218	4/1/1970	5770.77	5737.00	33.77	10	25
219	4/2/1970	5770.80	5737.00	33.80	10	25
220	4/3/1970	5770.80	5737.00	33.80	10	25
221	4/4/1970	5770.80	5737.00	33.80	10	25
222	4/5/1970	5770.85	5737.00	33.85	10	25
223	4/6/1970	5770.85	5737.00	33.85	10	25

Note that data for 5 months, November to March is missing for each year. This will result in an invalid analysis.

(Also see Question 4 – above)

The simple answer to this question is that the program is just not smart enough to handle incomplete or missing data.

Appendix D

Known issues

1) Under Excel 2002 – Service pack 3 – Clicking on either the Print Preview or Printing the Macros screen will cause the command buttons to move to the left. This is a bug in Excel not the Energy Analysis Program. The program has been run under Excel 2000 with no problem.

2) The program assumes a constant 83.5 percent water to wire conversion efficiency in the formula for power - Power = Head * Flow * .073. This is formula is optimistic in assessing long term plant performance. Factors such as cavitation, wear on turbine buckets (impulse turbines), and corrosion on the inside of unlined penstocks are major long term factors that cause decreased efficiency. Inclusion of accurate turbine and plant performance conversion factors is applicable to detailed site feasibility study. If a better approximation can be determined, the conversion formulas on Annual Revenue sheet column L can easily be modified to adjust the spreadsheet results. (See item #8 in the FAQ section.)

Appendix 4

DOI Facilities after First Screen

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
BIA	Great Plains		White Clay Dam	South Dakota	40	500	1,500
BIA	Great Plains		Crow Creek Dam	South Dakota	54	500	2,025
BIA	Great Plains		He Dog Dam	South Dakota	48	500	1,800
BIA	Great Plains		Oglala Dam	South Dakota	60	500	2,250
BIA	Navajo		Cutter Dam	New Mexico	74	701	3,891
BIA	Rocky Mountain		Willow Creek Dam	Montana	136	200	2,040
BIA	Rocky Mountain		Lower Two Medicine Dam	Montana	50	1,000	3,750
BIA	Rocky Mountain		Washakie Dam	Wyoming	62	800	3,720
BIA	Western		Weber Dam	Nevada	50	1,000	3,750
BIA	Western		Coolidge Dam	Arizona	252	800	15,120
BIA	Western		Wild Horse Dam	Nevada	114	600	5,130
Reclamation	Great Plains	Belle Fourche	Belle Fourche Dam	South Dakota	48	900	3,240
Reclamation	Great Plains	Canadian River	Sanford Dam	Texas	76	196	1,117
Reclamation	Great Plains	Colorado-Big Thompson	Carter Lake Dam No. 1	Colorado	190	1,260	17,955
Reclamation	Great Plains	Colorado-Big Thompson	Shadow Mountain Dam	Colorado	37	10,050	27,889
Reclamation	Great Plains	Colorado-Big Thompson	Willow Creek Dam	Colorado	95	2,050	14,606
Reclamation	Great Plains	Colorado-Big Thompson	St. Vrain Canal	Colorado	105	575	4,528
Reclamation	Great Plains	Colorado-Big Thompson	Soldier Canyon Dam	Colorado	203	90	1,370

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	Colorado-Big Thompson	Rattlesnake Dam	Colorado	100	960	7,200
Reclamation	Great Plains	Colorado-Big Thompson	Olympus Dam	Colorado	45	550	1,856
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dam	Colorado	214	435	6,982
Reclamation	Great Plains	Colorado-Big Thompson	Little Hell Creek Diversion Dam	Colorado	33	550	1,361
Reclamation	Great Plains	Fryingpan-Arkansas	Pueblo Dam	Colorado	191	5,767	82,612
Reclamation	Great Plains	Fryingpan-Arkansas	Twin Lakes Dam (USBR)	Colorado	53	3,465	13,773
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 4	Montana	66	850	4,208
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 5	Montana	56	850	3,570
Reclamation	Great Plains	Milk River	Fresno Dam	Montana	55	2,600	10,725
Reclamation	Great Plains	Milk River	Lake Sherburne Dam	Montana	68	2,100	10,710
Reclamation	Great Plains	Milk River	Paradise Diversion Dam	Montana	14	19,000	19,950
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 1	Montana	36	850	2,295
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 2	Montana	29	850	1,849
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 3	Montana	27	850	1,721
Reclamation	Great Plains	Mirage Flats	Box Butte Dam	Nebraska	52	420	1,638
Reclamation	Great Plains	North Platte	Minatare Dam	Nebraska	48	420	1,512
Reclamation	Great Plains	North Platte	Pathfinder Dam	Wyoming	192	2,000	28,800
Reclamation	Great Plains	North Platte	Whalen Diversion Dam	Wyoming	11	8,000	6,600
Reclamation	Great Plains	PSMBP - Almena	Norton Dam	Kansas	58	300	1,305
Reclamation	Great Plains	PSMBP - Bostwick	Lovewell Dam	Kansas	47	635	2,238
Reclamation	Great Plains	PSMBP - Cedar Bluff	Cedar Bluff Dam	Kansas	102	2,500	19,125
Reclamation	Great Plains	PSMBP - Cheyenne Div.	Keyhole Dam	Wyoming	65	1,250	6,094
Reclamation	Great Plains	PSMBP - Dickinson	Dickinson Dam	North Dakota	26	2,500	4,875

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	PSMBP - East Bench	Barretts Diversion Dam	Montana	10	2,500	1,875
Reclamation	Great Plains	PSMBP - East Bench	Clark Canyon Dam	Montana	82	2,200	13,480
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Red Willow Dam	Nebraska	74	700	3,885
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Enders Dam	Nebraska	70	1,300	6,825
Reclamation	Great Plains	PSMBP - Frenchman-Cambridge	Medicine Creek Dam	Nebraska	66	390	1,930
Reclamation	Great Plains	PSMBP - Glendo	Gray Reef Dam	Wyoming	18	8,900	12,015
Reclamation	Great Plains	PSMBP - Heart Butte	Heart Butte Dam	North Dakota	59	4,000	17,700
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Pumping Plant	Montana	150	1,026	11,542
Reclamation	Great Plains	PSMBP - Jamestown Dam	Jamestown Dam	North Dakota	40	1,250	3,750
Reclamation	Great Plains	PSMBP - Kirwin	Kirwin Dam	Kansas	67	2,100	10,552
Reclamation	Great Plains	PSMBP - North Loup	Virginia Smith Dam	Nebraska	74	2,000	11,100
Reclamation	Great Plains	PSMBP - North Loup	Davis Creek Dam	Nebraska	91	630	4,300
Reclamation	Great Plains	PSMBP - Owl Creek	Anchor Dam	Wyoming	146	300	3,285
Reclamation	Great Plains	PSMBP - Rapid Valley	Pactola Dam	South Dakota	156	500	5,850
Reclamation	Great Plains	PSMBP - Riverton	Wind River Diversion Dam	Wyoming	19	6,600	9,405
Reclamation	Great Plains	PSMBP - Riverton	Pilot Butte Dam	Wyoming	100		1,000
Reclamation	Great Plains	PSMBP - Riverton	Bull Lake Dam	Wyoming	40	4,000	12,000
Reclamation	Great Plains	PSMBP - Shadehill	Shadehill Dam	South Dakota	65	600	2,925
Reclamation	Great Plains	PSMBP - Webster	Webster Dam	Kansas	69	380	1,966
Reclamation	Great Plains	PSMBP - Yellowtail	Yellowtail Afterbay Dam	Montana	36	20,750	56,025
Reclamation	Great Plains	PSMBP Ainsworth Unit	Merritt Dam	Nebraska	71	750	3,994

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Great Plains	PSMBP Ainsworth Unit	Merritt Dam	Nebraska	71	580	3,088
Reclamation	Great Plains	PSMBP Cambridge Unit	Trenton Dam	Nebraska	59	3,500	15,488
Reclamation	Great Plains	PSMBP Cheyenne Diversion	Angostura Dam	South Dakota	122	290	2,654
Reclamation	Great Plains	PSMBP Glen Elder Unit	Glen Elder Dam	Kansas	70	4,000	21,000
Reclamation	Great Plains	Shoshone	Willwood Diversion Dam	Wyoming	41	5,000	15,375
Reclamation	Great Plains	Shoshone	Willwood Canal	Wyoming	37	415	1,152
Reclamation	Great Plains	Shoshone	Corbett Diversion Dam	Wyoming	12		1,400
Reclamation	Great Plains	Sun River	Mill Coulee Canal Drop, Upper and Lower Drops Combined	Montana	186	200	2,796
Reclamation	Great Plains	Sun River	Mary Taylor Drop Structure	Montana	44	600	1,980
Reclamation	Great Plains	Sun River	Pishkun Dike - No. 4	Montana	28	1,600	3,360
Reclamation	Great Plains	Sun River	Sun River Diversion Dam	Montana	45	1,400	4,725
Reclamation	Great Plains	Sun River	Upper Turnbull Drop Structure	Montana	102	1,200	9,144
Reclamation	Great Plains	Sun River	Willow Creek Dam	Montana	77	350	2,021
Reclamation	Great Plains	Sun River	Woods Project, Greenfield Main Canal Drop	Montana	53	425	1,689
Reclamation	Great Plains	Sun River	Lower Turnbull Drop Structure	Montana	146	1,200	13,185
Reclamation	Great Plains	Sun River	Gibson Dam	Montana	168	3,050	38,316
Reclamation	Great Plains	Sun River	Knights Project, Greenfield Main Canal Drop	Montana	60	425	1,912
Reclamation	Great Plains	Sun River	Johnson Project, Greenfield Main Canal Drop	Montana	46	425	1,466
Reclamation	Great Plains	Sun River	Greenfield Project, Greenfield Main Canal Drop	Montana	38	425	1,211
Reclamation	Lower Colorado	Boulder Canyon Project	All American Canal	California	21	15,155	23,869

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Lower Colorado	Boulder Canyon Project	Coachella Canel	California	11	2,500	2,025
Reclamation	Lower Colorado	Boulder Canyon Project	All American Canal Headworks	California	23	31,000	53,475
Reclamation	Lower Colorado	Boulder Canyon Project	Granite Reef Diversion Dam	Arizona-California	18	2,000	2,700
Reclamation	Lower Colorado	Gila	Gila Gravity Main Canal Headworks	Arizona	14	2,200	2,392
Reclamation	Lower Colorado	Palo Verde Diversion Project	Palo Verde Diversion Dam	Arizona-California	46	1,800	6,210
Reclamation	Lower Colorado	Salt River Project	Horseshoe Dam	Arizona	142	2,200	23,430
Reclamation	Lower Colorado	Salt River Project	Bartlette Dam	Arizona	188	4,000	56,400
Reclamation	Mid-Pacific	Cachuma	Carpenteria	California	17	1,950	2,048
Reclamation	Mid-Pacific	Cachuma	Bradbury Dam	California	190	28,744	409,602
Reclamation	Mid-Pacific	Central Valley	Little Panoche Detention Dam	California	86	1,040	6,708
Reclamation	Mid-Pacific	Central Valley	Red Bluff Dam	California	22	161,389	266,292
Reclamation	Mid-Pacific	Central Valley	Spring Creek Debris Dam	California	184	1,690	23,322
Reclamation	Mid-Pacific	Central Valley	John Franchi Dam	California	15	1,000	1,125
Reclamation	Mid-Pacific	Central Valley	Sly Park Dam	California	170	250	3,188
Reclamation	Mid-Pacific	Central Valley	Contra Loma Dam	California	82	970	5,966
Reclamation	Mid-Pacific	Central Valley	Los Banos Creek Detention Dam	California	126	1,255	11,860
Reclamation	Mid-Pacific	Central Valley	Buckhorn Dam (Reclamation)	California	72	240	1,296
Reclamation	Mid-Pacific	Humboldt	Rye Patch Dam	Nevada	49	7,840	28,812
Reclamation	Mid-Pacific	Klamath	Gerber Dam	Oregon	63	900	4,252
Reclamation	Mid-Pacific	Klamath	Lost River Diversion Dam	Oregon	24	3,000	5,400
Reclamation	Mid-Pacific	Klamath	Clear Lake Dam	California	33	1,000	2,475
Reclamation	Mid-Pacific	Newlands	Carson River Dam	Nevada	14	14	1,950
Reclamation	Mid-Pacific	Newlands	Lake Tahoe Dam	California	10	2,630	1,972

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Mid-Pacific	Newlands	Derby Dam	Nevada	15	16,400	18,450
Reclamation	Mid-Pacific	Orland	East Park Dam	California	90	6,074	41,000
Reclamation	Mid-Pacific	Santa Maria	Twitchell Dam	California	211	1,825	28,881
Reclamation	Mid-Pacific	Solano	Putah Diversion Dam	California	11	14,557	12,010
Reclamation	Mid-Pacific	Solano	Putah Creek Dam	California	11	14,557	12,009
Reclamation	Mid-Pacific	Truckee Storage	Boca Dam	California	2530	93	17,647
Reclamation	Mid-Pacific	Ventura River	Robles Dam	California	13	13,320	12,987
Reclamation	Mid-Pacific	Ventura River	Casitas Dam	California	261	612	11,980
Reclamation	Mid-Pacific	Washoe	Marble Bluff Dam	Nevada	24	19,300	34,740
Reclamation	Mid-Pacific	Washoe	Prosser Creek Dam	California	119	1,790	15,976
Reclamation	Pacific Northwest	Baker	Mason Dam	Oregon	150		3,000
Reclamation	Pacific Northwest	Boise	Arrowrock	Idaho	80	200	15,000
Reclamation	Pacific Northwest	Boise	Deadwood Dam	Idaho	137	500	5,000
Reclamation	Pacific Northwest	Boise	Deer Flat North Lower	Idaho	43	500	1,570
Reclamation	Pacific Northwest	Columbia Basin	PEC Mile 26.3	Washington	20	1,650	2,409
Reclamation	Pacific Northwest	Coulmbia Basin	Ringold W. W.	Washington	515	110	4,135
Reclamation	Pacific Northwest	Coulmbia Basin	RB4C W. W. Hwy26 Culvert	Washington	224	200	3,270
Reclamation	Pacific Northwest	Coulmbia Basin	Esquatzel Canal	Washington	113	205	1,691
Reclamation	Pacific Northwest	Coulmbia Basin	Scootney Wasteway	Washington	188	120	1,647
Reclamation	Pacific Northwest	Crooked River	Arthur R. Bowman Dam	Oregon	180		4,800
Reclamation	Pacific Northwest	Deschutes	Haystack	Oregon	63	230	1,053
Reclamation	Pacific Northwest	Deschutes	Wickiup Dam	Oregon	58	1,000	4,219
Reclamation	Pacific Northwest	Little Wood River	Little Wood River Dam	Idaho	119	200	1,739

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Pacific Northwest	Ririe River	Ririe Dam	Idaho	150	100	1,095
Reclamation	Pacific Northwest	Tualatin	Scoggins	Oregon	92	150	1,004
Reclamation	Pacific Northwest	Umatilla	Cold Springs	Oregon	82	250	1,487
Reclamation	Pacific Northwest	Umatilla	McKay	Oregon	142	150	1,555
Reclamation	Pacific Northwest	Vale	Agency Valley	Oregon	79	200	1,200
Reclamation	Pacific Northwest	Yakima	Cle Elum Dam	Washington	130		3,950
Reclamation	Pacific Northwest	Yakima	Easton Diversion Dam	Washington	46	400	1,355
Reclamation	Pacific Northwest	Yakima	Bumping Lake	Washington	35		1,024
Reclamation	Pacific Northwest	Yakima	Kachess Dam	Washington	63	400	1,848
Reclamation	Pacific Northwest	Yakima	Keechelus Dam	Washington	93	300	2,035
Reclamation	Upper Colorado	Bostwick Park	Silver Jack Dam	Colorado	85	280	1,785
Reclamation	Upper Colorado	Brantley	Brantley Dam	New Mexico	44	1,400	4,620
Reclamation	Upper Colorado	Carlsbad	Sumner Dam	New Mexico	135	1,700	17,212
Reclamation	Upper Colorado	Carlsbad	Avalon Dam	New Mexico	33	450	1,114
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Soldier Creek Dam	Utah	272	2,830	57,732
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Stillwater Tunnel	Utah	81	285	1,731
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Stillwater Dam	Utah	170	414	5,278
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Flow Control Structure	Utah	100	660	4,950
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Sixth Water Flow Control	Utah	1300	800	78,000
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Tunnel	Utah	125	1,000	9,375

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Dam	Utah	140	2,310	24,255
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Spanish Fork Flow Control Structure	Utah	900	560	37,800
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Jordanelle Dam	Utah	235	3,600	63,450
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Currant Creek Dam	Utah	100	5,540	41,550
Reclamation	Upper Colorado	Central Utah Project - Jensen Unit	Red Fleet Dam	Utah	130	550	5,362
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Dam	Utah	130	550	5,362
Reclamation	Upper Colorado	Collbran	Vega Dam	Colorado	140	470	4,935
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 171+ 90 thru 200+ 67 (2 canal drops)	Colorado	273	240	4,914
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 349+ 05 thru 375+ 42 (3 canal drops)	Colorado	170	240	3,060
Reclamation	Upper Colorado	Dallas Creek	Ridgway Dam	Colorado	175	1,440	18,900
Reclamation	Upper Colorado	Dolores	Great Cut Dike	Colorado	64	820	3,936
Reclamation	Upper Colorado	Eden	Big Sandy Dam	Wyoming	50	635	2,381
Reclamation	Upper Colorado	Emery County	Joes Valley Dam	Utah	187	385	5,400
Reclamation	Upper Colorado	Grand Valley	Grand Valley Diversion Dam	Colorado	14	3,216	3,377
Reclamation	Upper Colorado	Hyrum	Hyrum Dam	Utah	75	300	1,688
Reclamation	Upper Colorado	Lyman	Stateline Dam	Utah	105	400	3,150
Reclamation	Upper Colorado	Lyman	Meeks Cabin Dam	Wyoming	144	1,070	11,556
Reclamation	Upper Colorado	Mancos	Outlet Canal	Colorado	252	207	3,912
Reclamation	Upper Colorado	Mancos	Jackson Gulch Dam	Colorado	160	280	3,360
Reclamation	Upper Colorado	Mancos	Inlet Canal	Colorado	159	258	3,077

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Moon Lake	Moon Lake Dam	Utah	79	610	3,614
Reclamation	Upper Colorado	Navajo Indian Irrigation	Navajo Dam Diversion Works	New Mexico	100	1,800	13,500
Reclamation	Upper Colorado	Newton	Newton Dam	Utah	74	1,260	6,993
Reclamation	Upper Colorado	Ogden River	Pineview Dam	Utah	95	2,300	16,388
Reclamation	Upper Colorado	Paonia	Paonia Dam	Colorado	188	1,130	15,933
Reclamation	Upper Colorado	Provo River	Weber-Provo Canal	Utah	184	1,000	13,800
Reclamation	Upper Colorado	Provo River	Weber-Provo Diversion Canal	Utah	100	1,000	7,500
Reclamation	Upper Colorado	Provo River	Provo Reservoir Canal	Utah	180	325	4,388
Reclamation	Upper Colorado	Provo River	Duchesne Tunnel	Utah	64	600	2,880
Reclamation	Upper Colorado	Rio Grande	Caballo Dam	New Mexico	78	5,000	29,250
Reclamation	Upper Colorado	Rio Grande	Percha Arroyo Diversion Dam	New Mexico	19	1,029	1,466
Reclamation	Upper Colorado	San Juan-Chama	Blanco diversion Dam	New Mexico	13	2,940	2,866
Reclamation	Upper Colorado	San Juan-Chama	Heron Dam	New Mexico	249	4,160	77,688
Reclamation	Upper Colorado	San Luis Valley	Platoro Dam	Colorado	131	710	6,976
Reclamation	Upper Colorado	Scofield	Scofield Dam	Utah	55	500	2,062
Reclamation	Upper Colorado	Silt	Rifle Gap Dam	Colorado	102	344	2,632
Reclamation	Upper Colorado	Smith Fork	Crawford Dam	Colorado	135	125	1,266
Reclamation	Upper Colorado	Uncompahgre	M&D Canal-Shavano Falls	Colorado	130	550	5,362
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta.106+65, "Site #3"	Colorado	46	1,010	2,200
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 181+10, "Site #4"	Colorado	63	1,010	2,950
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 472+00, "Site #5"	Colorado	28	1,010	1,335
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta 19+ 10 "Site #1"	Colorado	54	826	3,345
Reclamation	Upper Colorado	Uncompahgre	Taylor Park Dam	Colorado	168	1,500	18,900
Reclamation	Upper Colorado	Weber Basin	Arthur V. Watkins Dam	Utah	28	10,800	22,680

Owner	Region/Division	Project/District	Facility	State	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)
Reclamation	Upper Colorado	Weber Basin	East Canyon Dam	Utah	185	700	9,712
Reclamation	Upper Colorado	Weber Basin	Lost Creek Dam	Utah	187	805	11,290

Appendix 5

DOI Facilities Eliminated by Second Screen

Owner	Facility	State	Region/Division	Project/District	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)	National Monument	Critical habitat	Wild and Scenic Rivers	National Historic Area	National Rivers
BIA	Crow Creek Dam	South Dakota	Great Plains		54	500	2,025				x	
BIA	Coolidge Dam	Arizona	Western		252	800	15,120				x	
BIA	Weber Dam	Nevada	Western		50	1,000	3,750				x	
Reclamation	Belle Fourche Dam	South Dakota	Great Plains	Belle Fourche	48	900	3,240				x	
Reclamation	Sanford Dam	Texas	Great Plains	Canadian River	76	196	1,117	x				
Reclamation	Box Butte Dam	Nebraska	Great Plains	Mirage Flats	52	420	1,638			x		x
Reclamation	Minatare Dam	Nebraska	Great Plains	North Platte	48	420	1,512				x	
Reclamation	Pathfinder Dam	Wyoming	Great Plains	North Platte	192	2,000	28,800				x	
Reclamation	Whalen Diversion Dam	Wyoming	Great Plains	North Platte	11	8,000	6,600				x	

Owner	Facility	State	Region/Division	Project/District	Max Head (ft)	Max Q (ft3/s)	Max Power (kW)	National Monument	Critical habitat	Wild and Scenic Rivers	National Historic Area	National Rivers
Reclamation	Anchor Dam	Wyoming	Great Plains	PSMBP - Owl Creek	146	300	3,285				x	
Reclamation	Bull Lake Dam	Wyoming	Great Plains	PSMBP - Riverton	40	4,000	12,000				x	
Reclamation	Pilot Butte Dam	Wyoming	Great Plains	PSMBP - Riverton	100		1,000				x	
Reclamation	Wind River Diversion Dam	Wyoming	Great Plains	PSMBP - Riverton	19	6,600	9,405				x	
Reclamation	Merritt Dam	Nebraska	Great Plains	PSMBP Ainsworth Unit	71	750	3,994			x		x
Reclamation	Merritt Dam	Nebraska	Great Plains	PSMBP Ainsworth Unit	71	580	3,088			x		x
Reclamation	Angostura Dam	South Dakota	Great Plains	PSMBP Cheyenne Diversion	122	290	2,654				x	
Reclamation	Corbett Diversion Dam	Wyoming	Great Plains	Shoshone	12		1,400				x	
Reclamation	Willwood Canal	Wyoming	Great Plains	Shoshone	37	415	1,152				x	
Reclamation	Willwood Diversion Dam	Wyoming	Great Plains	Shoshone	41	5,000	15,375				x	
Reclamation	Red Bluff Dam	California	Mid-Pacific	Central Valley	22	161,389	266,292		x			
Reclamation	Arthur R. Bowman Dam	Oregon	Pacific Northwest	Crooked River	180		4,800			x		

Appendix 6

DOI Facilities after Third Screen—Final List

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
Reclamation	Great Plains	Colorado-Big Thompson	Carter Lake Dam No. 1	Colorado	2	2,218	5,399,876
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dam	Colorado	2	7,989	35,841,544
Reclamation	Great Plains	Colorado-Big Thompson	St. Vrain Canal	Colorado	2	1,597	3,695,875
Reclamation	Great Plains	Fryingpan-Arkansas	Pueblo Dam	Colorado	2	18,025	51,776,781
Reclamation	Great Plains	Fryingpan-Arkansas	Twin Lakes Dam (USBR)	Colorado	2	1,898	7,130,708
Reclamation	Great Plains	Milk River	Fresno Dam	Montana	2	3,230	8,301,410
Reclamation	Great Plains	Milk River	Lake Sherburne Dam	Montana	2	2,358	4,519,873
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 1	Montana	2	1,555	5,349,302
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 2	Montana	2	1,249	4,297,223
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 3	Montana	2	1,137	3,911,955
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 4	Montana	2	2,851	9,809,524
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 5	Montana	2	2,438	8,386,995
Reclamation	Great Plains	PSMBP - East Bench	Clark Canyon Dam	Montana	2	4,300	15,476,984
Reclamation	Great Plains	PSMBP - Glendo	Gray Reef Dam	Wyoming	2	2,497	10,578,789
Reclamation	Great Plains	PSMBP - Heart Butte	Heart Butte Dam	North Dakota	2	1,302	1,981,720
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Pumping Plant	Montana	2	2,241	22,747,500

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
Reclamation	Great Plains	PSMBP - Yellowtail	Yellowtail Afterbay Dam	Montana	2	9,917	64,359,183
Reclamation	Great Plains	PSMBP Glen Elder Unit	Glen Elder Dam	Kansas	2	1,533	3,217,705
Reclamation	Great Plains	Sun River	Gibson Dam	Montana	2	17,546	47,711,435
Reclamation	Great Plains	Sun River	Pishkun Dike - No. 4	Montana	2	1,431	2,686,018
Reclamation	Great Plains	Sun River	Sun River Diversion Dam	Montana	2	4,517	14,595,130
Reclamation	Mid-Pacific	Cachuma	Bradbury Dam	California	3	1,045	4,947,687
Reclamation	Mid-Pacific	Humboldt	Rye Patch Dam	Nevada	2	1,549	5,805,167
Reclamation	Mid-Pacific	Truckee Storage	Boca Dam	California	2	1,644	4,635,446
Reclamation	Mid-Pacific	Washoe	Prosser Creek Dam	California	2	1,194	4,290,292
Reclamation	Pacific Northwest	Baker	Mason Dam	Oregon	2	3,086	8,057,383
Reclamation	Pacific Northwest	Boise	Deadwood Dam	Idaho	2	5,011	11,470,594
Reclamation	Pacific Northwest	Boise	Deer Flat North Lower	Idaho	2	1,574	4,990,367
Reclamation	Pacific Northwest	Deschutes	Haystack	Oregon	2	1,028	3,915,727
Reclamation	Pacific Northwest	Deschutes	Wickiup Dam	Oregon	2	4,222	16,142,225
Reclamation	Pacific Northwest	Little Wood River	Little Wood River Dam	Idaho	2	1,740	5,567,992
Reclamation	Pacific Northwest	Ririe River	Ririe Dam	Idaho	2	1,095	3,846,207
Reclamation	Pacific Northwest	Tualatin	Scoggins	Oregon	2	1,003	3,899,269
Reclamation	Pacific Northwest	Umatilla	Cold Springs	Oregon	2	1,062	2,455,550
Reclamation	Pacific Northwest	Umatilla	McKay	Oregon	2	1,544	4,093,011
Reclamation	Pacific Northwest	Vale	Agency Valley	Oregon	2	1,748	4,896,859
Reclamation	Pacific Northwest	Yakima	Cle Elum Dam	Washington	2	3,840	13,190,995

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
Reclamation	Pacific Northwest	Yakima	Easton Diversion Dam	Washington	2	1,356	7,584,283
Reclamation	Pacific Northwest	Yakima	Kachess Dam	Washington	2	1,847	4,377,651
Reclamation	Pacific Northwest	Yakima	Keechelus Dam	Washington	2	2,035	6,076,629
Reclamation	Upper Colorado	Bostwick Park	Silver Jack Dam	Colorado	2	1,390	4,710,179
Reclamation	Upper Colorado	Carlsbad	Sumner Dam	New Mexico	2	1,648	7,181,634
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Jordanelle Dam	Utah	2	7,410	35,778,244
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Sixth Water Flow Control	Utah	1	36,792	148,196,336
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Spanish Fork Flow Control Structure	Utah	1	8,870	25,275,364
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Dam	Utah	2	4,154	16,417,462
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Tunnel	Utah	1	1,779	8,594,659
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Flow Control Structure	Utah	1	16,771	67,552,830
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Stillwater Dam	Utah	2	1,357	3,794,599
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Dam	Utah	2	1,248	3,301,177
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 171+ 90 thru 200+ 67 (2 canal drops)	Colorado	1	3,763	10,244,645
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 349+ 05 thru 375+ 42 (3 canal drops)	Colorado	1	3,067	8,349,682
Reclamation	Upper Colorado	Collbran	Vega Dam	Colorado	2	1,273	3,298,909
Reclamation	Upper Colorado	Dallas Creek	Ridgway Dam	Colorado	2	4,919	18,507,106

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
Reclamation	Upper Colorado	Emery County	Joes Valley Dam	Utah	2	2,815	9,716,521
Reclamation	Upper Colorado	Lyman	Meeks Cabin Dam	Wyoming	2	2,968	7,854,746
Reclamation	Upper Colorado	Mancos	Outlet Canal	Colorado	1	1,196	2,700,217
Reclamation	Upper Colorado	Moon Lake	Moon Lake Dam	Utah	2	1,672	3,718,180
Reclamation	Upper Colorado	Navajo Indian Irrigation	Navajo Dam Diversion Works	New Mexico	2	5,110	15,757,206
Reclamation	Upper Colorado	Ogden River	Pineview Dam	Utah	2	2,894	9,540,662
Reclamation	Upper Colorado	Paonia	Paonia Dam	Colorado	2	2,270	7,118,303
Reclamation	Upper Colorado	Rio Grande	Caballo Dam	New Mexico	2	4,466	28,433,137
Reclamation	Upper Colorado	San Juan-Chama	Heron Dam	New Mexico	2	6,724	13,880,344
Reclamation	Upper Colorado	San Luis Valley	Platoro Dam	Colorado	2	2,008	6,521,086
Reclamation	Upper Colorado	Uncompahgre	M&D Canal-Shavano Falls	Colorado	1	2,891	15,913,854
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta 19+ 10 "Site #1"	Colorado	1	3,220	13,508,497
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 181+10, "Site #4"	Colorado	1	3,762	16,507,346
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 472+00, "Site #5"	Colorado	1	1,635	7,263,256
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta.106+65, "Site #3"	Colorado	1	2,844	12,162,559
Reclamation	Upper Colorado	Uncompahgre	Taylor Park Dam	Colorado	2	3,636	14,921,786
Reclamation	Upper Colorado	Weber Basin	East Canyon Dam	Utah	2	1,944	5,697,833

Appendix 7

USACE Facilities after Third Screen—Final List

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Great Lakes & Ohio River	Buffalo	MOUNT MORRIS DAM	New York	2	5,000	19,800,000
USACE	Great Lakes & Ohio River	Huntington	BELLEVILLE L&D	West Virginia	2	42,000	255,000,000
USACE	Great Lakes & Ohio River	Huntington	BLUESTONE DAM	West Virginia	2	55,000	210,000,000
USACE	Great Lakes & Ohio River	Huntington	CAPTAIN ANTHONY L. MELDAHL L&D	Kentucky	2	70,300	394,000,000
USACE	Great Lakes & Ohio River	Huntington	DEWEY DAM	Kentucky	2	3,800	5,900,000
USACE	Great Lakes & Ohio River	Huntington	DILLON DAM	Ohio	2	6,500	12,000,000
USACE	Great Lakes & Ohio River	Huntington	FISHTRAP DAM	Kentucky	2	3,500	12,600,000
USACE	Great Lakes & Ohio River	Huntington	GRAYSON DAM	Kentucky	2	3,900	6,300,000
USACE	Great Lakes & Ohio River	Huntington	JOHN W. FLANNAGAN DAM	Virginia	2	7,000	25,700,000
USACE	Great Lakes & Ohio River	Huntington	PAINT CREEK DAM	Ohio	2	8,000	14,400,000
USACE	Great Lakes & Ohio River	Huntington	PLEASANT HILL DAM	Ohio	2	3,200	6,200,000
USACE	Great Lakes & Ohio River	Huntington	R.D. BAILEY DAM	West Virginia	2	17,700	53,000,000
USACE	Great Lakes & Ohio River	Huntington	SUTTON DAM	West Virginia	2	15,000	58,000,000
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER DAM	Kentucky	2	6,800	48,400,000
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER L&D # 1	Kentucky	2	3,800	12,500,000
USACE	Great Lakes & Ohio River	Louisville	BROOKVILLE DAM	Indiana	2	12,100	24,900,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Great Lakes & Ohio River	Louisville	BUCKHORN DAM	Kentucky	2	7,800	19,200,000
USACE	Great Lakes & Ohio River	Louisville	CAESAR CREEK DAM	Ohio	2	6,100	15,100,000
USACE	Great Lakes & Ohio River	Louisville	CAGLES MILL DAM	Indiana	2	3,600	8,800,000
USACE	Great Lakes & Ohio River	Louisville	CAVE RUN DAM	Kentucky	2	18,300	43,200,000
USACE	Great Lakes & Ohio River	Louisville	CECIL M. HARDEN DAM	Indiana	2	1,400	4,100,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER DAM	Kentucky	2	20,600	47,700,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 1	Kentucky	2	9,500	13,500,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 2	Kentucky	2	5,500	19,800,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 3	Kentucky	2	9,000	27,700,000
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 5	Kentucky	2	4,900	17,100,000
USACE	Great Lakes & Ohio River	Louisville	HUNTINGTON DAM	Indiana	2	7,100	14,000,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 2	Kentucky	2	3,300	10,500,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 3	Kentucky	2	6,000	28,700,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 4	Kentucky	2	5,400	26,400,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 5	Kentucky	2	16,200	18,400,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 6	Kentucky	2	4,500	20,800,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 8	Kentucky	2	7,400	29,800,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 9	Kentucky	2	3,800	16,600,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #10	Kentucky	2	4,800	20,900,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #11	Kentucky	2	6,200	19,600,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #12	Kentucky	2	5,500	16,000,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #13	Kentucky	2	6,100	18,800,000
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #14	Kentucky	2	6,100	21,100,000
USACE	Great Lakes & Ohio River	Louisville	MISSISSINEWA DAM	Indiana	2	13,200	29,800,000
USACE	Great Lakes & Ohio River	Louisville	MONROE DAM	Indiana	2	5,200	10,400,000
USACE	Great Lakes & Ohio River	Louisville	NEWBURG L&D	Kentucky	2	57,400	214,000,000
USACE	Great Lakes & Ohio River	Louisville	NOLIN DAM	Kentucky	2	10,000	30,000,000
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #52	Kentucky	2	69,100	142,600,000
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #53	Kentucky	2	70,000	145,000,000
USACE	Great Lakes & Ohio River	Louisville	ROUGH RIVER DAM	Kentucky	2	15,000	30,400,000
USACE	Great Lakes & Ohio River	Louisville	SALAMONIE DAM	Indiana	2	10,500	20,800,000
USACE	Great Lakes & Ohio River	Louisville	TAYLORSVILLE DAM	Kentucky	2	16,900	23,300,000
USACE	Great Lakes & Ohio River	Louisville	UNIONTOWN L&D	Kentucky	2	65,000	189,000,000
USACE	Great Lakes & Ohio River	Louisville	WILLIAM H. HARSHA DAM	Ohio	2	15,000	25,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 2	Pennsylvania	2	10,700	66,200,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 3	Pennsylvania	2	12,000	93,100,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 4	Pennsylvania	2	15,000	89,200,000
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 7	Pennsylvania	2	16,500	89,500,000
USACE	Great Lakes & Ohio River	Pittsburgh	BERLIN DAM	Ohio	2	3,000	7,400,000
USACE	Great Lakes & Ohio River	Pittsburgh	CROOKED CREEK DAM	Pennsylvania	2	4,800	27,500,000
USACE	Great Lakes & Ohio River	Pittsburgh	DASHIELDS L&D	Pennsylvania	2	25,000	120,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	EAST BRANCH DAM	Pennsylvania	2	1,600	11,900,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Great Lakes & Ohio River	Pittsburgh	HILDEBRAND L&D	West Virginia	2	9,600	40,900,000
USACE	Great Lakes & Ohio River	Pittsburgh	LOYALHANNA DAM	Pennsylvania	2	1,600	12,600,000
USACE	Great Lakes & Ohio River	Pittsburgh	MAHONING CREEK DAM	Pennsylvania	2	5,000	16,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	MAXWELL L&D	Pennsylvania	2	10,000	71,600,000
USACE	Great Lakes & Ohio River	Pittsburgh	MICHAEL J. KIRWIN DAM	Ohio	2	1,500	4,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 2	Pennsylvania	2	6,700	38,800,000
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 3	Pennsylvania	2	4,700	25,700,000
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 4	Pennsylvania	2	8,300	62,900,000
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 7	Pennsylvania	2	9,300	58,900,000
USACE	Great Lakes & Ohio River	Pittsburgh	MONTGOMERY L&D	Pennsylvania	2	38,000	197,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	MORGANTOWN L&D	West Virginia	2	2,500	19,600,000
USACE	Great Lakes & Ohio River	Pittsburgh	MOSQUITO CREEK DAM	Ohio	2	1,100	1,900,000
USACE	Great Lakes & Ohio River	Pittsburgh	OPEKISKA L&D	West Virginia	2	10,000	42,200,000
USACE	Great Lakes & Ohio River	Pittsburgh	PIKE ISLAND L&D	West Virginia	2	49,500	230,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	POINT MARION L&D	Pennsylvania	2	5,000	39,300,000
USACE	Great Lakes & Ohio River	Pittsburgh	SHENANGO RIVER DAM	Pennsylvania	2	3,000	10,100,000
USACE	Great Lakes & Ohio River	Pittsburgh	STONEWALL JACKSON DAM	West Virginia	2	1,100	4,000,000
USACE	Great Lakes & Ohio River	Pittsburgh	TIONESTA DAM	Pennsylvania	2	5,000	20,200,000
USACE	Great Lakes & Ohio River	Pittsburgh	TYGART RIVER DAM	West Virginia	2	20,000	103,100,000
USACE	Mississippi Valley	Rock Island	BRANDON L&D	Illinois	2	6,100	36,100,000
USACE	Mississippi Valley	Rock Island	CORALVILLE DAM	Iowa	2	11,600	25,700,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Mississippi Valley	Rock Island	DRESDEN ISLAND L&D	Illinois	2	10,500	82,700,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #11	Iowa	2	11,500	72,600,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #12	Iowa	2	11,500	71,100,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #13	Iowa	2	11,500	88,200,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #14	Iowa	2	22,100	145,000,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #16	Iowa	2	13,600	91,800,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #17	Iowa	2	8,200	45,300,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #18	Iowa	2	11,500	90,600,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #20	Missouri	2	15,300	105,000,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #21	Missouri	2	15,400	91,700,000
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #22	Missouri	2	19,200	114,700,000
USACE	Mississippi Valley	Rock Island	RED ROCK DAM	Iowa	2	30,000	116,500,000
USACE	Mississippi Valley	Rock Island	SAYLORVILLE DAM	Iowa	2	17,300	44,300,000
USACE	Mississippi Valley	St. Louis	KASKASKIA RIVER L&D	Illinois	2	8,300	27,400,000
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #24	Missouri	2	35,000	226,000,000
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #25	Missouri	2	40,000	315,100,000
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #26	Illinois	2	78,000	522,300,000
USACE	Mississippi Valley	St. Louis	SHELBYVILLE DAM	Illinois	2	4,500	14,700,000
USACE	Mississippi Valley	St. Louis	WAPPAPELLO DAM	Missouri	2	9,200	32,700,000
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 5	Minnesota	2	5,800	45,000,000
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 7	Minnesota	2	12,700	54,700,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Mississippi Valley	Vicksburg	ARKABUTLA DAM	Mississippi	2	7,700	33,600,000
USACE	Mississippi Valley	Vicksburg	COLUMBIA L&D	Louisiana	2	6,000	47,200,000
USACE	Mississippi Valley	Vicksburg	ENID DAM	Mississippi	2	7,500	25,500,000
USACE	Mississippi Valley	Vicksburg	GRENADA DAM	Mississippi	2	13,200	58,000,000
USACE	Mississippi Valley	Vicksburg	JOHN H. OVERTON L&D	Louisiana	2	25,500	73,400,000
USACE	Mississippi Valley	Vicksburg	JONESVILLE L&D	Louisiana	2	6,000	47,200,000
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D # 1	Louisiana	2	18,000	53,800,000
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D #3	Louisiana	2	5,400	42,500,000
USACE	Mississippi Valley	Vicksburg	SARDIS DAM	Mississippi	2	16,000	80,800,000
USACE	North Atlantic	Baltimore	ALVIN R. BUSH DAM	Pennsylvania	2	1,300	5,200,000
USACE	North Atlantic	Baltimore	BLOOMINGTON DAM	Maryland	2	13,800	37,400,000
USACE	North Atlantic	Baltimore	COWANESQUE DAM	Pennsylvania	2	2,300	6,400,000
USACE	North Atlantic	Baltimore	CURWENSVILLE DAM	Pennsylvania	2	1,400	6,500,000
USACE	North Atlantic	Baltimore	EAST SIDNEY DAM	New York	2	1,700	4,500,000
USACE	North Atlantic	Baltimore	FOSTER JOSEPH SAYERS DAM	Pennsylvania	2	3,500	11,600,000
USACE	North Atlantic	Baltimore	HAMMOND DAM	Pennsylvania	2	1,200	3,400,000
USACE	North Atlantic	Baltimore	TIOGA DAM	Pennsylvania	2	3,400	8,500,000
USACE	North Atlantic	Baltimore	WHITNEY POINT DAM	New York	2	2,000	5,300,000
USACE	North Atlantic	New England	BALL MOUNTAIN DAM	Vermont	2	3,700	6,900,000
USACE	North Atlantic	New England	LITTLEVILLE DAM	Massachusetts	2	1,100	3,850,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	North Atlantic	New England	TOWNSHEND DAM	Vermont	2	1,100	4,900,000
USACE	North Atlantic	Norfolk	GATHRIGHT DAM	Virginia	2	6,000	32,200,000
USACE	North Atlantic	Philadelphia	BELTZVILLE DAM	Pennsylvania	2	2,200	10,900,000
USACE	North Atlantic	Philadelphia	BLUE MARSH DAM	Pennsylvania	2	1,300	6,300,000
USACE	North Atlantic	Philadelphia	FRANCIS E. WALTER DAM	Pennsylvania	2	5,000	21,700,000
USACE	Northwestern	Kansas City	KANOPOLIS DAM	Kansas	2	2,300	4,400,000
USACE	Northwestern	Kansas City	MILFORD DAM	Kansas	2	7,900	19,700,000
USACE	Northwestern	Kansas City	POMME DE TERRE DAM	Missouri	2	3,600	9,600,000
USACE	Northwestern	Kansas City	TUTTLE CREEK DAM	Kansas	2	21,800	57,300,000
USACE	Northwestern	Omaha	CHATFIELD DAM	Colorado	2	5,400	16,300,000
USACE	Northwestern	Portland	APPLEGATE DAM	Oregon	2	9,000	41,600,000
USACE	Northwestern	Portland	BLUE RIVER DAM	Oregon	2	14,700	66,000,000
USACE	Northwestern	Portland	DORENA DAM	Oregon	2	5,200	38,000,000
USACE	Northwestern	Portland	FERN RIDGE DAM	Oregon	2	4,300	10,100,000
USACE	Northwestern	Seattle	HIRAM A. CHITTENDEN L&D	Washington	2	2,600	13,000,000
USACE	Northwestern	Seattle	HOWARD HANSON DAM	Washington	2	5,200	24,900,000
USACE	South Atlantic	Charleston	WILLIAM KERR SCOTT DAM	North Carolina	2	4,900	23,300,000
USACE	South Atlantic	Jacksonville	INGLIS L&D	Florida	2	2,500	2,100,000
USACE	South Atlantic	Mobile	CARTER'S REREG DAM	Georgia	2	3,500	10,800,000
USACE	South Atlantic	Mobile	CLAIBORNE L&D	Alabama	2	15,000	50,400,000
USACE	South Atlantic	Mobile	COFFEEVILLE L&D	Alabama	2	24,000	39,000,000
USACE	South Atlantic	Mobile	DEMOPOLIS L&D	Alabama	2	37,500	100,000,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	South Atlantic	Mobile	GEORGE W. ANDREWS L&D	Alabama	2	26,700	60,000,000
USACE	South Atlantic	Mobile	WARRIOR L&D	Alabama	2	6,000	34,300,000
USACE	South Atlantic	Mobile	WILLIAM BACON OLIVER L&D	Alabama	2	16,300	54,000,000
USACE	South Atlantic	Savannah	NEW SAVANNAH BLUFF L&D	Georgia	2	7,200	56,700,000
USACE	South Atlantic	Wilmington	B. EVERETT JORDAN DAM	North Carolina	2	10,000	45,000,000
USACE	South Atlantic	Wilmington	FALLS LAKE DAM	North Carolina	2	8,400	24,700,000
USACE	South Pacific	Albuquerque	COCHITI DAM	New Mexico	2	22,900	69,700,000
USACE	South Pacific	Albuquerque	CONCHAS DAM	New Mexico	2	2,100	4,800,000
USACE	South Pacific	Sacramento	NORTH FORK DAM (California)	California	2	23,300	63,500,000
USACE	Southwestern	Fort Worth	BELTON DAM	Texas	2	1,400	11,000,000
USACE	Southwestern	Fort Worth	GRANGER DAM	Texas	2	5,000	5,400,000
USACE	Southwestern	Fort Worth	LAVON DAM	Texas	2	1,100	2,200,000
USACE	Southwestern	Fort Worth	WACO DAM	Texas	2	6,000	5,400,000
USACE	Southwestern	Fort Worth	WRIGHT PATMAN DAM	Texas	2	3,300	9,400,000
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 3	Arkansas	2	48,000	100,900,000
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 4	Arkansas	2	26,800	72,600,000
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 5	Arkansas	2	33,400	84,000,000
USACE	Southwestern	Little Rock	ARTHUR V. ORMOND L&D	Arkansas	2	42,400	88,100,000
USACE	Southwestern	Little Rock	BLUE MOUNTAIN DAM	Arkansas	2	7,000	12,500,000
USACE	Southwestern	Little Rock	DAVID D. TERRY L&D	Arkansas	2	33,400	88,500,000
USACE	Southwestern	Little Rock	DE QUEEN DAM	Arkansas	2	1,200	3,900,000
USACE	Southwestern	Little Rock	DIERKS DAM	Arkansas	2	1,200	3,700,000

Owner	Region/Division	Project/District	Facility	State	Plant Type 1= Undev. 2=Add Plant w/ Existing D	Installed Capacity (kW)	Annual Production (kWh)
USACE	Southwestern	Little Rock	GILLHAM DAM	Arkansas	2	2,900	9,400,000
USACE	Southwestern	Little Rock	NIMROD DAM	Arkansas	2	5,800	12,500,000
USACE	Southwestern	Little Rock	TOAD SUCK FERRY L&D	Arkansas	2	15,000	69,000,000
USACE	Southwestern	Tulsa	FULTON L&D	Arkansas	2	18,000	98,100,000
USACE	Southwestern	Tulsa	HUGO DAM	Oklahoma	2	3,000	13,500,000
USACE	Southwestern	Tulsa	JOHN REDMOND DAM	Kansas	2	9,000	17,300,000
USACE	Southwestern	Tulsa	MILLWOOD DAM	Arkansas	2	3,600	28,300,000
USACE	Southwestern	Tulsa	OOLOGAH DAM	Oklahoma	2	17,500	47,700,000
USACE	Southwestern	Tulsa	PINE CREEK DAM	Oklahoma	2	10,000	25,500,000
USACE	Southwestern	Tulsa	W. D. MAYO L&D	Oklahoma	2	44,000	92,200,000
USACE	Southwestern	Tulsa	WISTER DAM	Oklahoma	2	6,800	11,500,000

Appendix 8

List of Facilties, with Costs, Sorted by Owner

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Great Plains	PSMBP Cheyenne Diversion	Angostura Dam	South Dakota	1,586	4,540,233	6,813.29	147.98	0.357481
Reclamation	Great Plains	Belle Fourche	Belle Fourche Dam	South Dakota	2,190	4,507,863	8,640.64	188.72	0.2803147
Reclamation	Great Plains	PSMBP - Riverton	Bull Lake Dam	Wyoming	2,409	4,938,451	9,272.36	184.81	0.2862458
Reclamation	Great Plains	Colorado-Big Thompson	Carter Lake Dam No. 1	Colorado	2,218	5,399,876	8,722.20	159.05	0.332595
Reclamation	Great Plains	PSMBP - East Bench	Clark Canyon Dam	Montana	4,300	15,476,984	14,291.72	90.88	0.5820568
Reclamation	Great Plains	Shoshone	Corbett Diversion Dam	Wyoming	1,528	5,816,840	6,629.79	112.46	0.4703953
Reclamation	Great Plains	Milk River	Fresno Dam	Montana	3,230	8,301,410	11,533.31	136.70	0.3869717
Reclamation	Great Plains	Sun River	Gibson Dam	Montana	17,546	47,711,435	41,879.87	86.36	0.6125812
Reclamation	Great Plains	PSMBP Glen Elder Unit	Glen Elder Dam	Kansas	1,533	3,217,705	6,645.68	203.63	0.2597858
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dam	Colorado	7,989	35,841,544	22,851.83	62.78	0.842562
Reclamation	Great Plains	PSMBP - Glendo	Gray Reef Dam	Wyoming	2,497	10,578,789	9,522.39	88.69	0.5964764
Reclamation	Great Plains	PSMBP - Heart Butte	Heart Butte Dam	North Dakota	1,302	1,981,720	5,897.85	292.33	0.1809607
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Pumping Plant	Montana	2,241	22,747,500	8,789.02	38.19	1.385274
Reclamation	Great Plains	Milk River	Lake Sherburne Dam	Montana	2,358	4,519,873	9,126.49	198.74	0.2661737

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Great Plains	North Platte	Pathfinder Dam	Wyoming	30,994	112,688,879	65,318.08	57.08	0.9267727
Reclamation	Great Plains	PSMBP - Riverton	Pilot Butte Dam	Wyoming	2,008	5,644,093	8,104.29	141.46	0.3739594
Reclamation	Great Plains	Sun River	Pishkun Dike - No. 4	Montana	1,431	2,686,018	6,319.10	230.93	0.2290733
Reclamation	Great Plains	Fryingpan-Arkansas	Pueblo Dam	Colorado	18,025	51,776,781	42,765.31	81.27	0.6509279
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 1	Montana	1,555	5,349,302	6,715.42	123.84	0.4271744
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 2	Montana	1,249	4,297,223	5,721.87	130.83	0.4043452
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 3	Montana	1,137	3,911,955	5,343.81	134.32	0.3938427
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 4	Montana	2,851	9,809,524	10,508.43	105.48	0.5015373
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 5	Montana	2,438	8,386,995	9,354.99	109.86	0.4815206
Reclamation	Great Plains	Colorado-Big Thompson	St. Vrain Canal	Colorado	1,597	3,695,875	6,847.91	182.66	0.2896082
Reclamation	Great Plains	Sun River	Sun River Diversion Dam	Montana	4,517	14,595,130	14,831.16	99.99	0.5290561
Reclamation	Great Plains	Fryingpan-Arkansas	Twin Lakes Dam (USBR)	Colorado	1,898	7,130,708	7,774.58	107.48	0.4921809
Reclamation	Great Plains	Shoshone	Willwood Diversion Dam	Wyoming	1,661	8,019,055	7,048.21	86.73	0.609934
Reclamation	Great Plains	PSMBP - Yellowtail	Yellowtail Afterbay Dam	Montana	9,917	64,359,183	26,962.09	41.32	1.280373
Reclamation	Mid-Pacific	Truckee Storage	Boca Dam	California	1,644	4,635,446	560.00	370.20	0.1428957

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Mid-Pacific	Cachuma	Bradbury Dam	California	1,045	4,947,687	19,713.00	46.10	1.147505
Reclamation	Mid-Pacific	Washoe	Prosser Creek Dam	California	1,194	4,290,292	100,111.00	27.10	1.952029
Reclamation	Mid-Pacific	Central Valley	Red Bluff Dam	California	22,484	64,776,383	2,709.00	154.80	0.3417313
Reclamation	Mid-Pacific	Humboldt	Rye Patch Dam	Nevada	1,549	5,805,167	36,060.00	29.70	1.781145
Reclamation	Pacific Northwest	Vale	Agency Valley	Oregon	1,748	4,896,859	7,317.55	147.29	0.3591518
Reclamation	Pacific Northwest	Yakima	Cle Elum Dam	Washington	3,840	13,190,995	13,127.44	97.95	0.5400869
Reclamation	Pacific Northwest	Umatilla	Cold Springs	Oregon	1,062	2,455,550	5,085.53	203.76	0.2596212
Reclamation	Pacific Northwest	Boise	Deadwood Dam	Idaho	5,011	11,470,594	16,038.30	137.50	0.3847354
Reclamation	Pacific Northwest	Boise	Deer Flat North Lower	Idaho	1,574	4,990,367	6,775.46	133.91	0.3950491
Reclamation	Pacific Northwest	Yakima	Easton Diversion Dam	Washington	1,356	7,584,283	6,075.36	78.66	0.6725172
Reclamation	Pacific Northwest	Deschutes	Haystack	Oregon	1,028	3,915,727	4,966.97	124.83	0.4237628
Reclamation	Pacific Northwest	Yakima	Kachess Dam	Washington	1,847	4,377,651	7,620.19	171.50	0.3084475
Reclamation	Pacific Northwest	Yakima	Keechelus Dam	Washington	2,035	6,076,629	8,184.56	132.70	0.3986538
Reclamation	Pacific Northwest	Little Wood River	Little Wood River Dam	Idaho	1,740	5,567,992	7,292.92	129.13	0.409672
Reclamation	Pacific Northwest	Baker	Mason Dam	Oregon	3,086	8,057,383	11,147.34	136.14	0.3885649

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Pacific Northwest	Umatilla	McKay	Oregon	1,544	4,093,011	6,680.58	160.96	0.32866
Reclamation	Pacific Northwest	Ririe River	Ririe Dam	Idaho	1,095	3,846,207	5,199.71	132.97	0.397829
Reclamation	Pacific Northwest	Tualatin	Scoggins	Oregon	1,003	3,899,269	4,879.00	123.20	0.4293831
Reclamation	Pacific Northwest	Deschutes	Wickiup Dam	Oregon	4,222	16,142,225	14,096.35	85.96	0.6154025
Reclamation	Upper Colorado	Rio Grande	Caballo Dam	New Mexico	4,466	28,433,137	7,082.45	187.74	0.2817772
Reclamation	Upper Colorado	Weber Basin	East Canyon Dam	Utah	1,944	5,697,833	16,704.44	188.38	0.2808104
Reclamation	Upper Colorado	San Juan-Chama	Heron Dam	New Mexico	6,724	13,880,344	21,577.71	59.40	0.8905619
Reclamation	Upper Colorado	Emery County	Joes Valley Dam	Utah	2,815	9,716,521	10,066.47	131.23	0.4031192
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Jordanelle Dam	Utah	7,410	35,778,244	10,409.50	105.49	0.5014893
Reclamation	Upper Colorado	Uncompahgre	M&D Canal-Shavano Falls	Colorado	2,891	15,913,854	17,379.34	121.17	0.4365756
Reclamation	Upper Colorado	Lyman	Meeks Cabin Dam	Wyoming	2,968	7,854,746	6,186.25	128.95	0.410247
Reclamation	Upper Colorado	Moon Lake	Moon Lake Dam	Utah	1,672	3,718,180	13,925.36	83.50	0.6335276
Reclamation	Upper Colorado	Navajo Indian Irrigation	Navajo Dam Diversion Works	New Mexico	5,110	15,757,206	15,921.48	94.34	0.5607223
Reclamation	Upper Colorado	Mancos	Outlet Canal	Colorado	1,196	2,700,217	5,801.78	172.78	0.3061775
Reclamation	Upper Colorado	Paonia	Paonia Dam	Colorado	2,270	7,118,303	15,711.14	121.77	0.4344263

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Upper Colorado	Ogden River	Pineview Dam	Utah	2,894	9,540,662	134,287.67	84.17	0.6284877
Reclamation	Upper Colorado	San Luis Valley	Platoro Dam	Colorado	2,008	6,521,086	19,736.15	181.15	0.2920204
Reclamation	Upper Colorado	Dallas Creek	Ridgway Dam	Colorado	4,919	18,507,106	10,827.97	135.66	0.3899316
Reclamation	Upper Colorado	Bostwick Park	Silver Jack Dam	Colorado	1,390	4,710,179	10,767.95	118.55	0.4462087
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Sixth Water Flow Control	Utah	36,792	148,196,336	14,704.91	50.98	1.037621
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta 19+ 10 "Site #1"	Colorado	3,220	13,508,497	8,104.29	122.46	0.4319771
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 181+10, "Site #4"	Colorado	3,762	16,507,346	8,873.05	122.78	0.4308656
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 472+00, "Site #5"	Colorado	1,635	7,263,256	7,007.67	96.27	0.5494962
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta.106+65, "Site #3"	Colorado	2,844	12,162,559	19,731.86	112.47	0.4703397
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 171+ 90 thru 200+ 67 (2 canal drops)	Colorado	3,763	10,244,645	7,856.71	275.22	0.1922127
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 349+ 05 thru 375+ 42 (3 canal drops)	Colorado	3,067	8,349,682	15,815.56	84.11	0.6289323
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Spanish Fork Flow Control Structure	Utah	8,870	25,275,364	20,039.99	141.94	0.3726811
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Dam	Utah	4,154	16,417,462	16,276.97	101.63	0.5205202

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Dam	Utah	1,248	3,301,177	6,078.63	157.30	0.3362973
Reclamation	Upper Colorado	Carlsbad	Sumner Dam	New Mexico	1,648	7,181,634	5,718.53	170.20	0.310802
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Tunnel	Utah	1,779	8,594,659	40,122.02	148.50	0.3562244
Reclamation	Upper Colorado	Uncompahgre	Taylor Park Dam	Colorado	3,636	14,921,786	10,626.21	109.65	0.4824331
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Flow Control Structure	Utah	16,771	67,552,830	7,913.00	136.84	0.386582
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Stillwater Dam	Utah	1,357	3,794,599	12,601.19	83.15	0.6361981
Reclamation	Upper Colorado	Collbran	Vega Dam	Colorado	1,273	3,298,909	68,617.94	94.75	0.5583338
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 2	Pennsylvania	10,700	66,200,000	28,581.66	42.57	1.353418
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 3	Pennsylvania	12,000	93,100,000	31,217.21	33.11	1.740496
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 4	Pennsylvania	15,000	89,200,000	37,086.77	41.00	1.405246
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 7	Pennsylvania	16,500	89,500,000	39,929.04	43.98	1.310031
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER DAM	Kentucky	6,800	48,400,000	20,211.96	41.19	1.183537
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER L&D # 1	Kentucky	3,800	12,500,000	13,024.76	102.55	0.5618947

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Huntington	BELLEVILLE L&D	West Virginia	42,000	255,000,000	82,991.74	32.13	1.793496
USACE	Great Lakes & Ohio River	Pittsburgh	BERLIN DAM	Ohio	3,000	7,400,000	10,914.86	145.14	0.3358808
USACE	Great Lakes & Ohio River	Huntington	BLUESTONE DAM	West Virginia	55,000	210,000,000	102,763.57	48.20	1.195394
USACE	Great Lakes & Ohio River	Louisville	BROOKVILLE DAM	Indiana	12,100	24,900,000	31,417.41	124.05	0.3929724
USACE	Great Lakes & Ohio River	Louisville	BUCKHORN DAM	Kentucky	7,800	19,200,000	22,438.17	114.93	0.4241864
USACE	Great Lakes & Ohio River	Louisville	CAESAR CREEK DAM	Ohio	6,100	15,100,000	18,611.48	121.21	0.4021886
USACE	Great Lakes & Ohio River	Louisville	CAGLES MILL DAM	Indiana	3,600	8,800,000	12,507.64	139.82	0.3486593
USACE	Great Lakes & Ohio River	Huntington	CAPTAIN ANTHONY L. MELDAHL L&D	Kentucky	70,300	394,000,000	124,943.82	31.30	1.557737
USACE	Great Lakes & Ohio River	Louisville	CAVE RUN DAM	Kentucky	18,300	43,200,000	43,271.50	98.52	0.494843
USACE	Great Lakes & Ohio River	Louisville	CECIL M. HARDEN DAM	Indiana	1,400	4,100,000	6,218.74	148.91	0.3273838
USACE	Great Lakes & Ohio River	Chicago	CEDARS L&D	Wisconsin	1,800	6,000,000	83,600.00	91.14	0.5349165
USACE	Great Lakes & Ohio River	Pittsburgh	CROOKED CREEK DAM	Pennsylvania	4,800	27,500,000	15,526.09	55.63	1.035692
USACE	Great Lakes & Ohio River	Pittsburgh	DASHIELDS L&D	Pennsylvania	25,000	120,000,000	55,189.41	45.33	1.271056
USACE	Great Lakes & Ohio River	Huntington	DEWEY DAM	Kentucky	3,800	5,900,000	13,024.76	217.05	0.2246047

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Huntington	DILLON DAM	Ohio	6,500	12,000,000	19,530.64	159.99	0.3047027
USACE	Great Lakes & Ohio River	Pittsburgh	EAST BRANCH DAM	Pennsylvania	1,600	11,900,000	6,857.34	56.94	1.011989
USACE	Great Lakes & Ohio River	Pittsburgh	EMSWORTH L&D	Pennsylvania	18,000	79,500,000	13,000.00	37.24	1.5472954
USACE	Great Lakes & Ohio River	Huntington	FISHTRAP DAM	Kentucky	3,500	12,600,000	12,246.65	95.68	0.5095162
USACE	Great Lakes & Ohio River	Huntington	GRAYSON DAM	Kentucky	3,900	6,300,000	13,281.01	207.27	0.2352036
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER DAM	Kentucky	20,600	47,700,000	47,447.74	97.83	0.4983012
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 1	Kentucky	9,500	13,500,000	26,088.64	189.91	0.2567011
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 2	Kentucky	5,500	19,800,000	17,207.53	85.53	0.5699941
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 3	Kentucky	9,000	27,700,000	25,030.57	88.90	0.5483529
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 5	Kentucky	4,900	17,100,000	15,769.45	90.75	0.5371782
USACE	Great Lakes & Ohio River	Pittsburgh	HILDEBRAND L&D	West Virginia	9,600	40,900,000	26,298.82	63.31	0.9100615
USACE	Great Lakes & Ohio River	Louisville	HUNTINGTON DAM	Indiana	7,100	14,000,000	20,886.80	146.67	0.3323826
USACE	Great Lakes & Ohio River	Huntington	JOHN W. FLANNAGAN DAM	Virginia	7,000	25,700,000	20,662.55	79.13	0.728201
USACE	Great Lakes & Ohio River	Detroit	KAUKAUNA L&D	Wisconsin	3,300	13,000,000	31,200.00	64.93	0.7508230

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 2	Kentucky	3,300	10,500,000	11,719.51	109.86	0.4437627
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 3	Kentucky	6,000	28,700,000	18,379.66	63.07	0.7729507
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 4	Kentucky	5,400	26,400,000	16,970.35	63.31	0.7700084
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 5	Kentucky	16,200	18,400,000	39,364.95	210.21	0.2319138
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 6	Kentucky	4,500	20,800,000	14,789.11	70.02	0.6962366
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 8	Kentucky	7,400	29,800,000	21,555.52	71.21	0.6846295
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 9	Kentucky	3,800	16,600,000	13,024.76	77.26	0.6309479
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #10	Kentucky	4,800	20,900,000	15,526.09	73.14	0.6664962
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #11	Kentucky	6,200	19,600,000	18,842.47	94.58	0.5154252
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #12	Kentucky	5,500	16,000,000	17,207.53	105.80	0.4607955
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #13	Kentucky	6,100	18,800,000	18,611.48	97.39	0.5005478
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #14	Kentucky	6,100	21,100,000	18,611.48	86.80	0.5616521
USACE	Great Lakes & Ohio River	Pittsburgh	KINZUA DAM	Pennsylvania	46,800	0	69,300.00	NA	
USACE	Great Lakes & Ohio River	Pittsburgh	LOYALHANNA DAM	Pennsylvania	1,600	12,600,000	6,857.34	53.78	1.071308

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Pittsburgh	MAHONING CREEK DAM	Pennsylvania	5,000	16,000,000	16,011.71	98.46	0.5851909
USACE	Great Lakes & Ohio River	Huntington	MARMET L&D	West Virginia	18,500	46,000,000	5,900.00	65.56	0.8789126
USACE	Great Lakes & Ohio River	Pittsburgh	MAXWELL L&D	Pennsylvania	10,000	71,600,000	27,135.01	37.39	1.540893
USACE	Great Lakes & Ohio River	Louisville	MCALPINE L&D	Kentucky	19,200	95,200,000	22,200.00	32.67	1.4921124
USACE	Great Lakes & Ohio River	Pittsburgh	MICHAEL J. KIRWIN DAM	Ohio	1,500	4,000,000	6,540.61	160.46	0.3590977
USACE	Great Lakes & Ohio River	Louisville	MISSISSINEWA DAM	Indiana	13,200	29,800,000	33,597.67	110.87	0.4397101
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 2	Pennsylvania	6,700	38,800,000	19,985.59	50.76	1.13509
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 3	Pennsylvania	4,700	25,700,000	15,281.60	58.58	0.9835349
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 4	Pennsylvania	8,300	62,900,000	23,527.98	36.91	1.561023
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 7	Pennsylvania	9,300	58,900,000	25,666.86	42.97	1.340945
USACE	Great Lakes & Ohio River	Louisville	MONROE DAM	Indiana	5,200	10,400,000	16,493.06	155.92	0.3126575
USACE	Great Lakes & Ohio River	Pittsburgh	MONTGOMERY L&D	Pennsylvania	38,000	197,000,000	76,685.47	38.39	1.500857
USACE	Great Lakes & Ohio River	Pittsburgh	MORGANTOWN L&D	West Virginia	2,500	19,600,000	9,530.87	48.00	1.200502
USACE	Great Lakes & Ohio River	Pittsburgh	MOSQUITO CREEK DAM	Ohio	1,100	1,900,000	5,216.93	270.06	0.2133612

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Buffalo	MOUNT MORRIS DAM	New York	5,000	19,800,000	16,011.71	79.60	0.7238457
USACE	Great Lakes & Ohio River	Louisville	NEWBURG L&D	Kentucky	57,400	214,000,000	106,311.80	48.93	0.9963355
USACE	Great Lakes & Ohio River	Louisville	NOLIN DAM	Kentucky	10,000	30,000,000	27,135.01	88.99	0.5478384
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #52	Kentucky	69,100	142,600,000	123,239.07	84.97	0.5737603
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #53	Kentucky	70,000	145,000,000	124,518.14	84.43	0.5774233
USACE	Great Lakes & Ohio River	Pittsburgh	OPEKISKA L&D	West Virginia	10,000	42,200,000	27,135.01	63.31	0.9100587
USACE	Great Lakes & Ohio River	Huntington	PAINT CREEK DAM	Ohio	8,000	14,400,000	22,875.84	156.15	0.368993
USACE	Great Lakes & Ohio River	Pittsburgh	PIKE ISLAND L&D	West Virginia	49,500	230,000,000	94,519.85	40.51	1.422253
USACE	Great Lakes & Ohio River	Huntington	PLEASANT HILL DAM	Ohio	3,200	6,200,000	11,453.23	181.71	0.317105
USACE	Great Lakes & Ohio River	Pittsburgh	POINT MARION L&D	Pennsylvania	5,000	39,300,000	16,011.71	40.20	1.43339
USACE	Great Lakes & Ohio River	Huntington	R.D. BAILEY DAM	West Virginia	17,700	53,000,000	42,165.07	78.29	0.7360211
USACE	Great Lakes & Ohio River	Louisville	ROUGH RIVER DAM	Kentucky	15,000	30,400,000	37,086.77	119.95	0.406421
USACE	Great Lakes & Ohio River	Louisville	SALAMONIE DAM	Indiana	10,500	20,800,000	28,170.42	133.15	0.3661337
USACE	Great Lakes & Ohio River	Pittsburgh	SHENANGO RIVER DAM	Pennsylvania	3,000	10,100,000	10,914.86	106.39	0.5415872

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Great Lakes & Ohio River	Louisville	SMITHLAND L&D	Kentucky	40,000	190,300,000	20,200.00	28.58	1.7056726
USACE	Great Lakes & Ohio River	Pittsburgh	STONEWALL JACKSON DAM	West Virginia	1,100	4,000,000	5,216.93	128.28	0.4491814
USACE	Great Lakes & Ohio River	Huntington	SUMMERSVILLE DAM	West Virginia	85,000	213,800,000	6,200.00	45.39	1.2695815
USACE	Great Lakes & Ohio River	Huntington	SUTTON DAM	West Virginia	15,000	58,000,000	37,086.77	62.96	0.9151915
USACE	Great Lakes & Ohio River	Louisville	TAYLORSVILLE DAM	Kentucky	16,900	23,300,000	40,677.93	171.57	0.2841388
USACE	Great Lakes & Ohio River	Pittsburgh	TIONESTA DAM	Pennsylvania	5,000	20,200,000	16,011.71	78.03	0.738434
USACE	Great Lakes & Ohio River	Pittsburgh	TYGART RIVER DAM	West Virginia	20,000	103,100,000	46,367.74	44.34	1.299624
USACE	Great Lakes & Ohio River	Louisville	UNIONTOWN L&D	Kentucky	65,000	189,000,000	117,372.61	61.11	0.7977222
USACE	Great Lakes & Ohio River	Louisville	WILLIAM H. HARSHA DAM	Ohio	15,000	25,000,000	37,086.77	145.82	0.3343209
USACE	Great Lakes & Ohio River	Huntington	WILLOW ISLAND L&D #16	West Virginia	15,000	76,500,000	8,700.00	33.76	1.7068150
USACE	Mississippi Valley	Vicksburg	ARKABUTLA DAM	Mississippi	7,700	33,600,000	22,218.44	65.11	0.8849544
USACE	Mississippi Valley	Rock Island	BRANDON L&D	Illinois	6,100	36,100,000	18,611.48	50.81	0.9594549
USACE	Mississippi Valley	St. Louis	CARLYLE DAM	Illinois	4,800	9,100,000	27,100.00	121.58	0.4009768
USACE	Mississippi Valley	Vicksburg	COLUMBIA L&D	Louisiana	6,000	47,200,000	18,379.66	38.42	1.499603

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Mississippi Valley	Rock Island	CORALVILLE DAM	Iowa	11,600	25,700,000	30,412.92	116.36	0.4189498
USACE	Mississippi Valley	Rock Island	DRESDEN ISLAND L&D	Illinois	10,500	82,700,000	28,170.42	33.63	1.449642
USACE	Mississippi Valley	Vicksburg	ENID DAM	Mississippi	7,500	25,500,000	21,777.12	84.03	0.6856683
USACE	Mississippi Valley	Vicksburg	GRENADA DAM	Mississippi	13,200	58,000,000	33,597.67	57.05	1.009905
USACE	Mississippi Valley	Vicksburg	JOHN H. OVERTON L&D	Louisiana	25,500	73,400,000	56,051.22	75.15	0.7667771
USACE	Mississippi Valley	Vicksburg	JONESVILLE L&D	Louisiana	6,000	47,200,000	18,379.66	38.42	1.499603
USACE	Mississippi Valley	St. Louis	KASKASKIA RIVER L&D	Illinois	8,300	27,400,000	23,527.98	84.49	0.5769798
USACE	Mississippi Valley	St. Paul	LOWER ST ANTHONY FALLS L&D	Minnesota	13,600	74,500,000	92,200.00	32.22	1.5131002
USACE	Mississippi Valley	Rock Island	MARSEILLES DAM	Illinois	10,600	59,000,000	39,900.00	33.77	1.4437820
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 5	Minnesota	5,800	45,000,000	17,913.48	39.28	1.241207
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 7	Minnesota	12,700	54,700,000	32,611.50	58.72	0.8302677
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #11	Iowa	11,500	72,600,000	30,210.96	41.04	1.187865
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #12	Iowa	11,500	71,100,000	30,210.96	41.90	1.163432
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #13	Iowa	11,500	88,200,000	30,210.96	33.81	1.441689

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #14	Iowa	22,100	145,000,000	50,120.78	34.12	1.428835
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #15	Iowa	31,100	120,100,000	31,200.00	37.31	1.3066933
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #16	Iowa	13,600	91,800,000	34,381.06	36.95	1.319186
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #17	Iowa	8,200	45,300,000	23,311.17	50.71	0.9613507
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #18	Iowa	11,500	90,600,000	30,210.96	32.92	1.480696
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #19	Iowa	103,800	447,800,000	37,100.00	25.40	1.9196315
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #20	Missouri	15,300	105,000,000	37,659.70	35.40	1.377224
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #21	Missouri	15,400	91,700,000	37,850.16	40.71	1.197556
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #22	Missouri	19,200	114,700,000	44,917.56	38.63	1.261966
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #24	Missouri	35,000	226,000,000	71,872.21	31.40	1.552533
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #25	Missouri	40,000	315,100,000	79,853.67	25.06	1.945432
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #26	Illinois	78,000	522,300,000	135,760.23	25.68	1.898172
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D # 1	Louisiana	18,000	53,800,000	42,719.21	78.14	0.7374378
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D #3	Louisiana	5,400	42,500,000	16,970.35	39.40	1.462492

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Mississippi Valley	Rock Island	RED ROCK DAM	Iowa	30,000	116,500,000	63,666.99	53.83	0.9056574
USACE	Mississippi Valley	Vicksburg	SARDIS DAM	Mississippi	16,000	80,800,000	38,987.71	47.56	1.211627
USACE	Mississippi Valley	Rock Island	SAYLORVILLE DAM	Iowa	17,300	44,300,000	41,423.24	91.98	0.5300077
USACE	Mississippi Valley	St. Louis	SHELBYVILLE DAM	Illinois	4,500	14,700,000	14,789.11	99.00	0.4924397
USACE	Mississippi Valley	Rock Island	STARVED ROCK L&D	Illinois	7,400	19,200,000	12,800.00	79.24	0.6152472
USACE	Mississippi Valley	St. Paul	UPPER ST ANTHONY FALLS L&D	Minnesota	9,900	53,000,000	58,300.00	35.71	1.3649987
USACE	Mississippi Valley	St. Louis	WAPPAPELLO DAM	Missouri	9,200	32,700,000	25,455.25	76.61	0.6363208
USACE	North Atlantic	Baltimore	ALVIN R. BUSH DAM	Pennsylvania	1,300	5,200,000	5,891.24	111.28	0.5177799
USACE	North Atlantic	New England	BALL MOUNTAIN DAM	Vermont	3,700	6,900,000	12,766.99	181.96	0.3166696
USACE	North Atlantic	Philadelphia	BELTZVILLE DAM	Pennsylvania	2,200	10,900,000	8,669.80	78.42	0.7347728
USACE	North Atlantic	Baltimore	BLOOMINGTON DAM	Maryland	13,800	37,400,000	34,770.97	91.46	0.6300256
USACE	North Atlantic	Philadelphia	BLUE MARSH DAM	Pennsylvania	1,300	6,300,000	5,891.24	91.85	0.6273101
USACE	North Atlantic	Baltimore	COWANESQUE DAM	Pennsylvania	2,300	6,400,000	8,959.70	137.86	0.4179578
USACE	North Atlantic	Baltimore	CURWENSVILLE DAM	Pennsylvania	1,400	6,500,000	6,218.74	93.93	0.6134591
USACE	North Atlantic	Baltimore	EAST SIDNEY DAM	New York	1,700	4,500,000	7,169.36	157.04	0.3669075

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	North Atlantic	Baltimore	FOSTER JOSEPH SAYERS DAM	Pennsylvania	3,500	11,600,000	12,246.65	103.91	0.554513
USACE	North Atlantic	Philadelphia	FRANCIS E. WALTER DAM	Pennsylvania	5,000	21,700,000	16,011.71	72.65	0.7931264
USACE	North Atlantic	Norfolk	GATHRIGHT DAM	Virginia	6,000	32,200,000	18,379.66	56.24	1.024629
USACE	North Atlantic	Baltimore	HAMMOND DAM	Pennsylvania	1,200	3,400,000	5,557.54	160.65	0.3586597
USACE	North Atlantic	New England	LITTLEVILLE DAM	Massachusetts	1,100	3,850,000	5,216.93	133.28	0.4323372
USACE	North Atlantic	Baltimore	TIOGA DAM	Pennsylvania	3,400	8,500,000	11,983.96	138.71	0.4153993
USACE	North Atlantic	New England	TOWNSHEND DAM	Vermont	1,100	4,900,000	5,216.93	104.72	0.5502471
USACE	North Atlantic	Baltimore	WHITNEY POINT DAM	New York	2,000	5,300,000	8,080.46	150.19	0.3836453
USACE	Northwestern	Portland	APPLEGATE DAM	Oregon	9,000	41,600,000	25,030.57	59.26	0.8926764
USACE	Northwestern	Portland	BLUE RIVER DAM	Oregon	14,700	66,000,000	36,511.50	54.50	0.9707259
USACE	Northwestern	Portland	BONNEVILLE L&D	Oregon	11,800	67,000,000	31,200.00	43.35	1.2202370
USACE	Northwestern	Omaha	CHATFIELD DAM	Colorado	5,400	16,300,000	16,970.35	102.42	0.51648
USACE	Northwestern	Portland	COUGAR DAM	Oregon	35,000	41,700,000	31,200.00	431.34	0.1226420
USACE	Northwestern	Portland	DETROIT DAM	Oregon	26,000	37,400,000	5,900.00	78.82	0.6711078
USACE	Northwestern	Portland	DORENA DAM	Oregon	5,200	38,000,000	16,493.06	42.81	1.235701
USACE	Northwestern	Walla Walla	DWORSHAK DAM	Idaho	660,000	216,000,000	25,000.00	162.28	0.3259719

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Northwestern	Portland	FERN RIDGE DAM	Oregon	4,300	10,100,000	14,291.72	139.17	0.3801128
USACE	Northwestern	Omaha	FORT PECK DAM	Montana	185,000	0	92,200.00	NA	
USACE	Northwestern	Omaha	GARRISON DAM	North Dakota	272,000	0	58,300.00	NA	
USACE	Northwestern	Seattle	HIRAM A. CHITTENDEN L&D	Washington	2,600	13,000,000	9,812.44	74.39	0.7111133
USACE	Northwestern	Seattle	HOWARD HANSON DAM	Washington	5,200	24,900,000	16,493.06	65.23	0.8109367
USACE	Northwestern	Portland	JOHN DAY L&D	Oregon	540,000	35,000,000	69,300.00	716.66	0.0738145
USACE	Northwestern	Kansas City	KANOPOLIS DAM	Kansas	2,300	4,400,000	8,959.70	200.44	0.2432158
USACE	Northwestern	Seattle	LIBBY DAM	Montana	315,000	25,000,000	83,600.00	262.75	0.2013301
USACE	Northwestern	Walla Walla	MCNARY L&D	Oregon	726,000	506,400,000	27,100.00	188.02	0.2813591
USACE	Northwestern	Kansas City	MILFORD DAM	Kansas	7,900	19,700,000	22,657.30	113.11	0.4310139
USACE	Northwestern	Kansas City	POMME DE TERRE DAM	Missouri	3,600	9,600,000	12,507.64	128.19	0.3803091
USACE	Northwestern	Kansas City	TUTTLE CREEK DAM	Kansas	21,800	57,300,000	49,589.14	85.14	0.5725816
USACE	South Atlantic	Wilmington	B. EVERETT JORDAN DAM	North Carolina	10,000	45,000,000	27,135.01	59.39	0.9702509
USACE	South Atlantic	Mobile	CARTER'S REREG DAM	Georgia	3,500	10,800,000	12,246.65	111.59	0.5163351
USACE	South Atlantic	Mobile	CLAIBORNE L&D	Alabama	15,000	50,400,000	37,086.77	72.43	0.7955806
USACE	South Atlantic	Mobile	COFFEEVILLE L&D	Alabama	24,000	39,000,000	53,455.47	134.73	0.4276657

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	South Atlantic	Mobile	DEMOPOLIS L&D	Alabama	37,500	100,000,000	75,888.48	74.67	0.771692
USACE	South Atlantic	Wilmington	FALLS LAKE DAM	North Carolina	8,400	24,700,000	23,744.24	94.57	0.6093073
USACE	South Atlantic	Mobile	GEORGE W. ANDREWS L&D	Alabama	26,700	60,000,000	58,106.17	95.25	0.6049547
USACE	South Atlantic	Jacksonville	INGLIS L&D	Florida	2,500	2,100,000	9,530.87	446.40	0.1290765
USACE	South Atlantic	Savannah	NEW SAVANNAH BLUFF L&D	Georgia	7,200	56,700,000	21,110.37	36.74	1.568194
USACE	South Atlantic	Mobile	WARRIOR L&D	Alabama	6,000	34,300,000	18,379.66	52.80	1.091213
USACE	South Atlantic	Mobile	WILLIAM BACON OLIVER L&D	Alabama	16,300	54,000,000	39,553.21	72.09	0.7992532
USACE	South Atlantic	Charleston	WILLIAM KERR SCOTT DAM	North Carolina	4,900	23,300,000	15,769.45	66.65	0.864472
USACE	South Pacific	Albuquerque	COCHITI DAM	New Mexico	22,900	69,700,000	51,531.53	72.76	0.7270288
USACE	South Pacific	Albuquerque	CONCHAS DAM	New Mexico	2,100	4,800,000	8,376.78	171.86	0.3078088
USACE	South Pacific	Sacramento	NORTH FORK DAM (California)	California	23,300	63,500,000	52,233.22	80.93	0.6536335
USACE	Southwestern	Albuquerque	ABIQUIU DAM	New Mexico	3,000	4,300,000	25,000.00	182.92	0.2891942
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 3	Arkansas	48,000	100,900,000	92,242.30	89.90	0.6409643
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 4	Arkansas	26,800	72,600,000	58,276.58	78.98	0.7295582
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 5	Arkansas	33,400	84,000,000	69,272.88	81.13	0.7102287

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Southwestern	Little Rock	ARTHUR V. ORMOND L&D	Arkansas	42,400	88,100,000	83,615.91	93.33	0.6173865
USACE	Southwestern	Fort Worth	BELTON DAM	Texas	1,400	11,000,000	6,218.74	55.50	0.8783467
USACE	Southwestern	Little Rock	BLUE MOUNTAIN DAM	Arkansas	7,000	12,500,000	20,662.55	162.49	0.3546163
USACE	Southwestern	Little Rock	DARDANELLE L&D	Arkansas	201,400	94,000,000	37,100.00	202.03	0.2852051
USACE	Southwestern	Little Rock	DAVID D. TERRY L&D	Arkansas	33,400	88,500,000	69,272.88	77.01	0.7481844
USACE	Southwestern	Little Rock	DE QUEEN DAM	Arkansas	1,200	3,900,000	5,557.54	140.06	0.3480723
USACE	Southwestern	Tulsa	DENISON DAM	Oklahoma	70,000	15,000,000	39,900.00	554.39	0.0879347
USACE	Southwestern	Little Rock	DIERKS DAM	Arkansas	1,200	3,700,000	5,557.54	147.63	0.3903061
USACE	Southwestern	Tulsa	FORT GIBSON DAM	Oklahoma	22,500	20,000,000	22,200.00	174.50	0.2793635
USACE	Southwestern	Tulsa	FULTON L&D	Arkansas	18,000	98,100,000	42,719.21	42.94	1.135414
USACE	Southwestern	Little Rock	GILLHAM DAM	Arkansas	2,900	9,400,000	10,642.61	111.46	0.4373707
USACE	Southwestern	Fort Worth	GRANGER DAM	Texas	5,000	5,400,000	16,011.71	291.37	0.1673102
USACE	Southwestern	Tulsa	HUGO DAM	Oklahoma	3,000	13,500,000	10,914.86	79.64	0.6121019
USACE	Southwestern	Tulsa	JOHN REDMOND DAM	Kansas	9,000	17,300,000	25,030.57	142.23	0.3427453
USACE	Southwestern	Fort Worth	LAVON DAM	Texas	1,100	2,200,000	5,216.93	233.23	0.2090191
USACE	Southwestern	Tulsa	MILLWOOD DAM	Arkansas	3,600	28,300,000	12,507.64	43.61	1.117927

Owner	Region/Division	Project/District	Facility	State	Potential Capacity (kW)	Potential Additional Energy (kWh)	Plant Construction Cost ($K)	Energy Production Cost ($/MWh)	b/c ratio
USACE	Southwestern	Little Rock	NIMROD DAM	Arkansas	5,800	12,500,000	17,913.48	140.91	0.4089248
USACE	Southwestern	Tulsa	OOLOGAH DAM	Oklahoma	17,500	47,700,000	41,794.58	86.20	0.5655387
USACE	Southwestern	Tulsa	PINE CREEK DAM	Oklahoma	10,000	25,500,000	27,135.01	104.66	0.46581
USACE	Southwestern	Fort Worth	RAY ROBERTS DAM	Texas	6,600	10,600,000	83,000.00	131.79	0.3699008
USACE	Southwestern	Little Rock	TOAD SUCK FERRY L&D	Arkansas	15,000	69,000,000	37,086.77	52.95	1.088145
USACE	Southwestern	Tulsa	W. D. MAYO L&D	Oklahoma	44,000	92,200,000	86,101.49	91.83	0.5308694
USACE	Southwestern	Fort Worth	WACO DAM	Texas	6,000	5,400,000	18,379.66	334.39	0.1457859
USACE	Southwestern	Tulsa	WISTER DAM	Oklahoma	6,800	11,500,000	20,211.96	172.75	0.282194
USACE	Southwestern	Fort Worth	WRIGHT PATMAN DAM	Texas	3,300	9,400,000	11,719.51	122.69	0.3973445

Appendix 9

List of Facilties, with Costs, Sorted by b/c Ratio

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Mid-Pacific	Washoe	Prosser Creek Dam	California	1,194	4,290,292	100,111.00	27.10	1.952029	No
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #25	Missouri	40,000	315,100,000	79,853.67	25.06	1.945432	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #19	Iowa	103,800	447,800,000	37100	25.40	1.919632	Yes
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #26	Illinois	78,000	522,300,000	135,760.23	25.68	1.898172	No
USACE	Great Lakes & Ohio River	Huntington	BELLEVILLE L&D	West Virginia	42,000	255,000,000	82,991.74	32.13	1.793496	No
Reclamation	Mid-Pacific	Humboldt	Rye Patch Dam	Nevada	1,549	5,805,167	36,060.00	29.70	1.781145	No
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 3	Pennsylvania	12,000	93,100,000	31,217.21	33.11	1.740496	No
USACE	Great Lakes & Ohio River	Huntington	WILLOW ISLAND L&D #16	West Virginia	15,000	76,500,000	8700	33.76	1.706815	Yes
USACE	Great Lakes & Ohio River	Louisville	SMITHLAND L&D	Kentucky	40,000	190,300,000	20200	28.58	1.705673	Yes
USACE	South Atlantic	Savannah	NEW SAVANNAH BLUFF L&D	Georgia	7,200	56,700,000	21,110.37	36.74	1.568194	No
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 4	Pennsylvania	8,300	62,900,000	23,527.98	36.91	1.561023	No
USACE	Great Lakes & Ohio River	Huntington	CAPTAIN ANTHONY L. MELDAHL L&D	Kentucky	70,300	394,000,000	124,943.82	31.30	1.557737	No
USACE	Mississippi Valley	St. Louis	MISSISSIPPI RIVER L&D #24	Missouri	35,000	226,000,000	71,872.21	31.40	1.552533	No
USACE	Great Lakes & Ohio River	Pittsburgh	EMSWORTH L&D	Pennsylvania	18,000	79,500,000	13000	37.24	1.547295	Yes
USACE	Great Lakes & Ohio River	Pittsburgh	MAXWELL L&D	Pennsylvania	10,000	71,600,000	27,135.01	37.39	1.540893	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Mississippi Valley	St. Paul	LOWER ST ANTHONY FALLS L&D	Minnesota	13,600	74,500,000	92200	32.22	1.5131	Yes
USACE	Great Lakes & Ohio River	Pittsburgh	MONTGOMERY L&D	Pennsylvania	38,000	197,000,000	76,685.47	38.39	1.500857	No
USACE	Mississippi Valley	Vicksburg	JONESVILLE L&D	Louisiana	6,000	47,200,000	18,379.66	38.42	1.499603	No
USACE	Mississippi Valley	Vicksburg	COLUMBIA L&D	Louisiana	6,000	47,200,000	18,379.66	38.42	1.499603	No
USACE	Great Lakes & Ohio River	Louisville	MCALPINE L&D	Kentucky	19,200	95,200,000	22200	32.67	1.492112	Yes
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #18	Iowa	11,500	90,600,000	30,210.96	32.92	1.480696	No
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D #3	Louisiana	5,400	42,500,000	16,970.35	39.40	1.462492	No
USACE	Mississippi Valley	Rock Island	DRESDEN ISLAND L&D	Illinois	10,500	82,700,000	28,170.42	33.63	1.449642	No
USACE	Mississippi Valley	Rock Island	MARSEILLES DAM	Illinois	10,600	59,000,000	39900	33.77	1.443782	Yes
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #13	Iowa	11,500	88,200,000	30,210.96	33.81	1.441689	No
USACE	Great Lakes & Ohio River	Pittsburgh	POINT MARION L&D	Pennsylvania	5,000	39,300,000	16,011.71	40.20	1.43339	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #14	Iowa	22,100	145,000,000	50,120.78	34.12	1.428835	No
USACE	Great Lakes & Ohio River	Pittsburgh	PIKE ISLAND L&D	West Virginia	49,500	230,000,000	94,519.85	40.51	1.422253	No
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 4	Pennsylvania	15,000	89,200,000	37,086.77	41.00	1.405246	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Great Plains	PSMBP - Helena Valley	Helena Valley Pumping Plant	Montana	2,241	22,747,500	8,789.02	38.19	1.385274	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #20	Missouri	15,300	105,000,000	37,659.70	35.40	1.377224	No
USACE	Mississippi Valley	St. Paul	UPPER ST ANTHONY FALLS L&D	Minnesota	9,900	53,000,000	58300	35.71	1.364999	Yes
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 2	Pennsylvania	10,700	66,200,000	28,581.66	42.57	1.353418	No
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 7	Pennsylvania	9,300	58,900,000	25,666.86	42.97	1.340945	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #16	Iowa	13,600	91,800,000	34,381.06	36.95	1.319186	No
USACE	Great Lakes & Ohio River	Pittsburgh	ALLEGHENY RIVER L&D # 7	Pennsylvania	16,500	89,500,000	39,929.04	43.98	1.310031	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #15	Iowa	31,100	120,100,000	31200	37.31	1.306693	Yes
USACE	Great Lakes & Ohio River	Pittsburgh	TYGART RIVER DAM	West Virginia	20,000	103,100,000	46,367.74	44.34	1.299624	No
Reclamation	Great Plains	PSMBP - Yellowtail	Yellowtail Afterbay Dam	Montana	9,917	64,359,183	26,962.09	41.32	1.280373	No
USACE	Great Lakes & Ohio River	Pittsburgh	DASHIELDS L&D	Pennsylvania	25,000	120,000,000	55,189.41	45.33	1.271056	No
USACE	Great Lakes & Ohio River	Huntington	SUMMERSVILLE DAM	West Virginia	85,000	213,800,000	6200	45.39	1.269582	Yes
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #22	Missouri	19,200	114,700,000	44,917.56	38.63	1.261966	No
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 5	Minnesota	5,800	45,000,000	17,913.48	39.28	1.241207	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Northwestern	Portland	DORENA DAM	Oregon	5,200	38,000,000	16,493.06	42.81	1.235701	No
USACE	Northwestern	Portland	BONNEVILLE L&D	Oregon	11,800	67,000,000	31200	43.35	1.220237	Yes
USACE	Mississippi Valley	Vicksburg	SARDIS DAM	Mississippi	16,000	80,800,000	38,987.71	47.56	1.211627	No
USACE	Great Lakes & Ohio River	Pittsburgh	MORGANTOWN L&D	West Virginia	2,500	19,600,000	9,530.87	48.00	1.200502	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #21	Missouri	15,400	91,700,000	37,850.16	40.71	1.197556	No
USACE	Great Lakes & Ohio River	Huntington	BLUESTONE DAM	West Virginia	55,000	210,000,000	102,763.57	48.20	1.195394	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #11	Iowa	11,500	72,600,000	30,210.96	41.04	1.187865	No
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER DAM	Kentucky	6,800	48,400,000	20,211.96	41.19	1.183537	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #12	Iowa	11,500	71,100,000	30,210.96	41.90	1.163432	No
Reclamation	Mid-Pacific	Cachuma	Bradbury Dam	California	1,045	4,947,687	19,713.00	46.10	1.147505	No
USACE	Southwestern	Tulsa	FULTON L&D	Arkansas	18,000	98,100,000	42,719.21	42.94	1.135414	No
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 2	Pennsylvania	6,700	38,800,000	19,985.59	50.76	1.13509	No
USACE	Southwestern	Tulsa	MILLWOOD DAM	Arkansas	3,600	28,300,000	12,507.64	43.61	1.117927	No
USACE	South Atlantic	Mobile	WARRIOR L&D	Alabama	6,000	34,300,000	18,379.66	52.80	1.091213	No
USACE	Southwestern	Little Rock	TOAD SUCK FERRY L&D	Arkansas	15,000	69,000,000	37,086.77	52.95	1.088145	No
USACE	Great Lakes & Ohio River	Pittsburgh	LOYALHANNA DAM	Pennsylvania	1,600	12,600,000	6,857.34	53.78	1.071308	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Sixth Water Flow Control	Utah	36,792	148,196,336	14,704.91	50.98	1.037621	No
USACE	Great Lakes & Ohio River	Pittsburgh	CROOKED CREEK DAM	Pennsylvania	4,800	27,500,000	15,526.09	55.63	1.035692	No
USACE	North Atlantic	Norfolk	GATHRIGHT DAM	Virginia	6,000	32,200,000	18,379.66	56.24	1.024629	No
USACE	Great Lakes & Ohio River	Pittsburgh	EAST BRANCH DAM	Pennsylvania	1,600	11,900,000	6,857.34	56.94	1.011989	No
USACE	Mississippi Valley	Vicksburg	GRENADA DAM	Mississippi	13,200	58,000,000	33,597.67	57.05	1.009905	No
USACE	Great Lakes & Ohio River	Louisville	NEWBURG L&D	Kentucky	57,400	214,000,000	106,311.80	48.93	0.996336	No
USACE	Great Lakes & Ohio River	Pittsburgh	MONONGAHELA RIVER L&D # 3	Pennsylvania	4,700	25,700,000	15,281.60	58.58	0.983535	No
USACE	Northwestern	Portland	BLUE RIVER DAM	Oregon	14,700	66,000,000	36,511.50	54.50	0.970726	No
USACE	South Atlantic	Wilmington	B. EVERETT JORDAN DAM	North Carolina	10,000	45,000,000	27,135.01	59.39	0.970251	No
USACE	Mississippi Valley	Rock Island	MISSISSIPPI RIVER L&D #17	Iowa	8,200	45,300,000	23,311.17	50.71	0.961351	No
USACE	Mississippi Valley	Rock Island	BRANDON L&D	Illinois	6,100	36,100,000	18,611.48	50.81	0.959455	No
Reclamation	Great Plains	North Platte	Pathfinder Dam	Wyoming	30,994	112,688,879	65,318.08	57.08	0.926773	No
USACE	Great Lakes & Ohio River	Huntington	SUTTON DAM	West Virginia	15,000	58,000,000	37,086.77	62.96	0.915192	No
USACE	Great Lakes & Ohio River	Pittsburgh	HILDEBRAND L&D	West Virginia	9,600	40,900,000	26,298.82	63.31	0.910062	No
USACE	Great Lakes & Ohio River	Pittsburgh	OPEKISKA L&D	West Virginia	10,000	42,200,000	27,135.01	63.31	0.910059	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Mississippi Valley	Rock Island	RED ROCK DAM	Iowa	30,000	116,500,000	63,666.99	53.83	0.905657	No
USACE	Northwestern	Portland	APPLEGATE DAM	Oregon	9,000	41,600,000	25,030.57	59.26	0.892676	No
Reclamation	Upper Colorado	San Juan-Chama	Heron Dam	New Mexico	6,724	13,880,344	21,577.71	59.40	0.890562	No
USACE	Mississippi Valley	Vicksburg	ARKABUTLA DAM	Mississippi	7,700	33,600,000	22,218.44	65.11	0.884954	No
USACE	Great Lakes & Ohio River	Huntington	MARMET L&D	West Virginia	18,500	46,000,000	5900	65.56	0.878913	Yes
USACE	Southwestern	Fort Worth	BELTON DAM	Texas	1,400	11,000,000	6,218.74	55.50	0.878347	No
USACE	South Atlantic	Charleston	WILLIAM KERR SCOTT DAM	North Carolina	4,900	23,300,000	15,769.45	66.65	0.864472	No
Reclamation	Great Plains	Colorado-Big Thompson	Granby Dam	Colorado	7,989	35,841,544	22,851.83	62.78	0.842562	No
USACE	Mississippi Valley	St. Paul	MISSISSIPPI RIVER L&D # 7	Minnesota	12,700	54,700,000	32,611.50	58.72	0.830268	No
USACE	Northwestern	Seattle	HOWARD HANSON DAM	Washington	5,200	24,900,000	16,493.06	65.23	0.810937	No
USACE	South Atlantic	Mobile	WILLIAM BACON OLIVER L&D	Alabama	16,300	54,000,000	39,553.21	72.09	0.799253	No
USACE	Great Lakes & Ohio River	Louisville	UNIONTOWN L&D	Kentucky	65,000	189,000,000	117,372.61	61.11	0.797722	No
USACE	South Atlantic	Mobile	CLAIBORNE L&D	Alabama	15,000	50,400,000	37,086.77	72.43	0.795581	No
USACE	North Atlantic	Philadelphia	FRANCIS E. WALTER DAM	Pennsylvania	5,000	21,700,000	16,011.71	72.65	0.793126	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 3	Kentucky	6,000	28,700,000	18,379.66	63.07	0.772951	No
USACE	South Atlantic	Mobile	DEMOPOLIS L&D	Alabama	37,500	100,000,000	75,888.48	74.67	0.771692	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 4	Kentucky	5,400	26,400,000	16,970.35	63.31	0.770008	No
USACE	Mississippi Valley	Vicksburg	JOHN H. OVERTON L&D	Louisiana	25,500	73,400,000	56,051.22	75.15	0.766777	No
USACE	Great Lakes & Ohio River	Detroit	KAUKAUNA L&D	Wisconsin	3,300	13,000,000	31200	64.93	0.750823	Yes
USACE	Southwestern	Little Rock	DAVID D. TERRY L&D	Arkansas	33,400	88,500,000	69,272.88	77.01	0.748184	No
USACE	Great Lakes & Ohio River	Pittsburgh	TIONESTA DAM	Pennsylvania	5,000	20,200,000	16,011.71	78.03	0.738434	No
USACE	Mississippi Valley	Vicksburg	RED RIVER WATERWAY L&D # 1	Louisiana	18,000	53,800,000	42,719.21	78.14	0.737438	No
USACE	Great Lakes & Ohio River	Huntington	R.D. BAILEY DAM	West Virginia	17,700	53,000,000	42,165.07	78.29	0.736021	No
USACE	North Atlantic	Philadelphia	BELTZVILLE DAM	Pennsylvania	2,200	10,900,000	8,669.80	78.42	0.734773	No
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 4	Arkansas	26,800	72,600,000	58,276.58	78.98	0.729558	No
USACE	Great Lakes & Ohio River	Huntington	JOHN W. FLANNAGAN DAM	Virginia	7,000	25,700,000	20,662.55	79.13	0.728201	No
USACE	South Pacific	Albuquerque	COCHITI DAM	New Mexico	22,900	69,700,000	51,531.53	72.76	0.727029	No
USACE	Great Lakes & Ohio River	Buffalo	MOUNT MORRIS DAM	New York	5,000	19,800,000	16,011.71	79.60	0.723846	No
USACE	Northwestern	Seattle	HIRAM A. CHITTENDEN L&D	Washington	2,600	13,000,000	9,812.44	74.39	0.711113	No
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 5	Arkansas	33,400	84,000,000	69,272.88	81.13	0.710229	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 6	Kentucky	4,500	20,800,000	14,789.11	70.02	0.696237	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Mississippi Valley	Vicksburg	ENID DAM	Mississippi	7,500	25,500,000	21,777.12	84.03	0.685668	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 8	Kentucky	7,400	29,800,000	21,555.52	71.21	0.68463	No
Reclamation	Pacific Northwest	Yakima	Easton Diversion Dam	Washington	1,356	7,584,283	6,075.36	78.66	0.672517	No
USACE	Northwestern	Portland	DETROIT DAM	Oregon	26,000	37,400,000	5900	78.82	0.671108	Yes
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #10	Kentucky	4,800	20,900,000	15,526.09	73.14	0.666496	No
USACE	South Pacific	Sacramento	NORTH FORK DAM (California)	California	23,300	63,500,000	52,233.22	80.93	0.653634	No
Reclamation	Great Plains	Fryingpan-Arkansas	Pueblo Dam	Colorado	18,025	51,776,781	42,765.31	81.27	0.650928	No
USACE	Southwestern	Little Rock	ARKANSAS RIVER L&D # 3	Arkansas	48,000	100,900,000	92,242.30	89.90	0.640964	No
USACE	Mississippi Valley	St. Louis	WAPPAPELLO DAM	Missouri	9,200	32,700,000	25,455.25	76.61	0.636321	No
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Stillwater Dam	Utah	1,357	3,794,599	12,601.19	83.15	0.636198	No
Reclamation	Upper Colorado	Moon Lake	Moon Lake Dam	Utah	1,672	3,718,180	13,925.36	83.50	0.633528	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 9	Kentucky	3,800	16,600,000	13,024.76	77.26	0.630948	No
USACE	North Atlantic	Baltimore	BLOOMINGTON DAM	Maryland	13,800	37,400,000	34,770.97	91.46	0.630026	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 349+ 05 thru 375+ 42 (3 canal drops)	Colorado	3,067	8,349,682	15,815.56	84.11	0.628932	No
Reclamation	Upper Colorado	Ogden River	Pineview Dam	Utah	2,894	9,540,662	134,287.67	84.17	0.628488	No
USACE	North Atlantic	Philadelphia	BLUE MARSH DAM	Pennsylvania	1,300	6,300,000	5,891.24	91.85	0.62731	No
USACE	Southwestern	Little Rock	ARTHUR V. ORMOND L&D	Arkansas	42,400	88,100,000	83,615.91	93.33	0.617387	No
Reclamation	Pacific Northwest	Deschutes	Wickiup Dam	Oregon	4,222	16,142,225	14,096.35	85.96	0.615403	No
USACE	Mississippi Valley	Rock Island	STARVED ROCK L&D	Illinois	7,400	19,200,000	12800	79.24	0.615247	Yes
USACE	North Atlantic	Baltimore	CURWENSVILLE DAM	Pennsylvania	1,400	6,500,000	6,218.74	93.93	0.613459	No
Reclamation	Great Plains	Sun River	Gibson Dam	Montana	17,546	47,711,435	41,879.87	86.36	0.612581	No
USACE	Southwestern	Tulsa	HUGO DAM	Oklahoma	3,000	13,500,000	10,914.86	79.64	0.612102	No
Reclamation	Great Plains	Shoshone	Willwood Diversion Dam	Wyoming	1,661	8,019,055	7,048.21	86.73	0.609934	No
USACE	South Atlantic	Wilmington	FALLS LAKE DAM	North Carolina	8,400	24,700,000	23,744.24	94.57	0.609307	No
USACE	South Atlantic	Mobile	GEORGE W. ANDREWS L&D	Alabama	26,700	60,000,000	58,106.17	95.25	0.604955	No
Reclamation	Great Plains	PSMBP - Glendo	Gray Reef Dam	Wyoming	2,497	10,578,789	9,522.39	88.69	0.596476	No
USACE	Great Lakes & Ohio River	Pittsburgh	MAHONING CREEK DAM	Pennsylvania	5,000	16,000,000	16,011.71	98.46	0.585191	No
Reclamation	Great Plains	PSMBP - East Bench	Clark Canyon Dam	Montana	4,300	15,476,984	14,291.72	90.88	0.582057	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #53	Kentucky	70,000	145,000,000	124,518.14	84.43	0.577423	No
USACE	Mississippi Valley	St. Louis	KASKASKIA RIVER L&D	Illinois	8,300	27,400,000	23,527.98	84.49	0.57698	No
USACE	Great Lakes & Ohio River	Louisville	OHIO RIVER L&D #52	Kentucky	69,100	142,600,000	123,239.07	84.97	0.57376	No
USACE	Northwestern	Kansas City	TUTTLE CREEK DAM	Kansas	21,800	57,300,000	49,589.14	85.14	0.572582	No
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 2	Kentucky	5,500	19,800,000	17,207.53	85.53	0.569994	No
USACE	Southwestern	Tulsa	OOLOGAH DAM	Oklahoma	17,500	47,700,000	41,794.58	86.20	0.565539	No
USACE	Great Lakes & Ohio River	Louisville	BARREN RIVER L&D # 1	Kentucky	3,800	12,500,000	13,024.76	102.55	0.561895	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #14	Kentucky	6,100	21,100,000	18,611.48	86.80	0.561652	No
Reclamation	Upper Colorado	Navajo Indian Irrigation	Navajo Dam Diversion Works	New Mexico	5,110	15,757,206	15,921.48	94.34	0.560722	No
Reclamation	Upper Colorado	Collbran	Vega Dam	Colorado	1,273	3,298,909	68,617.94	94.75	0.558334	No
USACE	North Atlantic	Baltimore	FOSTER JOSEPH SAYERS DAM	Pennsylvania	3,500	11,600,000	12,246.65	103.91	0.554513	No
USACE	North Atlantic	New England	TOWNSHEND DAM	Vermont	1,100	4,900,000	5,216.93	104.72	0.550247	No
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 472+00, "Site #5"	Colorado	1,635	7,263,256	7,007.67	96.27	0.549496	No
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 3	Kentucky	9,000	27,700,000	25,030.57	88.90	0.548353	No
USACE	Great Lakes & Ohio River	Louisville	NOLIN DAM	Kentucky	10,000	30,000,000	27,135.01	88.99	0.547838	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Pittsburgh	SHENANGO RIVER DAM	Pennsylvania	3,000	10,100,000	10,914.86	106.39	0.541587	No
Reclamation	Pacific Northwest	Yakima	Cle Elum Dam	Washington	3,840	13,190,995	13,127.44	97.95	0.540087	No
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 5	Kentucky	4,900	17,100,000	15,769.45	90.75	0.537178	No
USACE	Great Lakes & Ohio River	Chicago	CEDARS L&D	Wisconsin	1,800	6,000,000	83600	91.14	0.534917	Yes
USACE	Southwestern	Tulsa	W. D. MAYO L&D	Oklahoma	44,000	92,200,000	86,101.49	91.83	0.530869	No
USACE	Mississippi Valley	Rock Island	SAYLORVILLE DAM	Iowa	17,300	44,300,000	41,423.24	91.98	0.530008	No
Reclamation	Great Plains	Sun River	Sun River Diversion Dam	Montana	4,517	14,595,130	14,831.16	99.99	0.529056	No
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Starvation Dam	Utah	4,154	16,417,462	16,276.97	101.63	0.52052	No
USACE	North Atlantic	Baltimore	ALVIN R. BUSH DAM	Pennsylvania	1,300	5,200,000	5,891.24	111.28	0.51778	No
USACE	Northwestern	Omaha	CHATFIELD DAM	Colorado	5,400	16,300,000	16,970.35	102.42	0.51648	No
USACE	South Atlantic	Mobile	CARTER'S REREG DAM	Georgia	3,500	10,800,000	12,246.65	111.59	0.516335	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #11	Kentucky	6,200	19,600,000	18,842.47	94.58	0.515425	No
USACE	Great Lakes & Ohio River	Huntington	FISHTRAP DAM	Kentucky	3,500	12,600,000	12,246.65	95.68	0.509516	No
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 4	Montana	2,851	9,809,524	10,508.43	105.48	0.501537	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Jordanelle Dam	Utah	7,410	35,778,244	10,409.50	105.49	0.501489	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #13	Kentucky	6,100	18,800,000	18,611.48	97.39	0.500548	No
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER DAM	Kentucky	20,600	47,700,000	47,447.74	97.83	0.498301	No
USACE	Great Lakes & Ohio River	Louisville	CAVE RUN DAM	Kentucky	18,300	43,200,000	43,271.50	98.52	0.494843	No
USACE	Mississippi Valley	St. Louis	SHELBYVILLE DAM	Illinois	4,500	14,700,000	14,789.11	99.00	0.49244	No
Reclamation	Great Plains	Fryingpan-Arkansas	Twin Lakes Dam (USBR)	Colorado	1,898	7,130,708	7,774.58	107.48	0.492181	No
Reclamation	Upper Colorado	Uncompahgre	Taylor Park Dam	Colorado	3,636	14,921,786	10,626.21	109.65	0.482433	No
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 5	Montana	2,438	8,386,995	9,354.99	109.86	0.481521	No
Reclamation	Great Plains	Shoshone	Corbett Diversion Dam	Wyoming	1,528	5,816,840	6,629.79	112.46	0.470395	No
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta.106+65, "Site #3"	Colorado	2,844	12,162,559	19,731.86	112.47	0.47034	No
USACE	Southwestern	Tulsa	PINE CREEK DAM	Oklahoma	10,000	25,500,000	27,135.01	104.66	0.46581	No
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D #12	Kentucky	5,500	16,000,000	17,207.53	105.80	0.460796	No
USACE	Great Lakes & Ohio River	Pittsburgh	STONEWALL JACKSON DAM	West Virginia	1,100	4,000,000	5,216.93	128.28	0.449181	No
Reclamation	Upper Colorado	Bostwick Park	Silver Jack Dam	Colorado	1,390	4,710,179	10,767.95	118.55	0.446209	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 2	Kentucky	3,300	10,500,000	11,719.51	109.86	0.443763	No
USACE	Great Lakes & Ohio River	Louisville	MISSISSINEWA DAM	Indiana	13,200	29,800,000	33,597.67	110.87	0.43971	No
USACE	Southwestern	Little Rock	GILLHAM DAM	Arkansas	2,900	9,400,000	10,642.61	111.46	0.437371	No
Reclamation	Upper Colorado	Uncompahgre	M&D Canal-Shavano Falls	Colorado	2,891	15,913,854	17,379.34	121.17	0.436576	No
Reclamation	Upper Colorado	Paonia	Paonia Dam	Colorado	2,270	7,118,303	15,711.14	121.77	0.434426	No
USACE	North Atlantic	New England	LITTLEVILLE DAM	Massachusetts	1,100	3,850,000	5,216.93	133.28	0.432337	No
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta 19+ 10 "Site #1"	Colorado	3,220	13,508,497	8,104.29	122.46	0.431977	No
USACE	Northwestern	Kansas City	MILFORD DAM	Kansas	7,900	19,700,000	22,657.30	113.11	0.431014	No
Reclamation	Upper Colorado	Uncompahgre	South Canal, Sta. 181+10, "Site #4"	Colorado	3,762	16,507,346	8,873.05	122.78	0.430866	No
Reclamation	Pacific Northwest	Tualatin	Scoggins	Oregon	1,003	3,899,269	4,879.00	123.20	0.429383	No
USACE	South Atlantic	Mobile	COFFEEVILLE L&D	Alabama	24,000	39,000,000	53,455.47	134.73	0.427666	No
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 1	Montana	1,555	5,349,302	6,715.42	123.84	0.427174	No
USACE	Great Lakes & Ohio River	Louisville	BUCKHORN DAM	Kentucky	7,800	19,200,000	22,438.17	114.93	0.424186	No
Reclamation	Pacific Northwest	Deschutes	Haystack	Oregon	1,028	3,915,727	4,966.97	124.83	0.423763	No
USACE	Mississippi Valley	Rock Island	CORALVILLE DAM	Iowa	11,600	25,700,000	30,412.92	116.36	0.41895	No
USACE	North Atlantic	Baltimore	COWANESQUE DAM	Pennsylvania	2,300	6,400,000	8,959.70	137.86	0.417958	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	North Atlantic	Baltimore	TIOGA DAM	Pennsylvania	3,400	8,500,000	11,983.96	138.71	0.415399	No
Reclamation	Upper Colorado	Lyman	Meeks Cabin Dam	Wyoming	2,968	7,854,746	6,186.25	128.95	0.410247	No
Reclamation	Pacific Northwest	Little Wood River	Little Wood River Dam	Idaho	1,740	5,567,992	7,292.92	129.13	0.409672	No
USACE	Southwestern	Little Rock	NIMROD DAM	Arkansas	5,800	12,500,000	17,913.48	140.91	0.408925	No
USACE	Great Lakes & Ohio River	Louisville	ROUGH RIVER DAM	Kentucky	15,000	30,400,000	37,086.77	119.95	0.406421	No
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 2	Montana	1,249	4,297,223	5,721.87	130.83	0.404345	No
Reclamation	Upper Colorado	Emery County	Joes Valley Dam	Utah	2,815	9,716,521	10,066.47	131.23	0.403119	No
USACE	Great Lakes & Ohio River	Louisville	CAESAR CREEK DAM	Ohio	6,100	15,100,000	18,611.48	121.21	0.402189	No
USACE	Mississippi Valley	St. Louis	CARLYLE DAM	Illinois	4,800	9,100,000	27100	121.58	0.400977	Yes
Reclamation	Pacific Northwest	Yakima	Keechelus Dam	Washington	2,035	6,076,629	8,184.56	132.70	0.398654	No
Reclamation	Pacific Northwest	Ririe River	Ririe Dam	Idaho	1,095	3,846,207	5,199.71	132.97	0.397829	No
USACE	Southwestern	Fort Worth	WRIGHT PATMAN DAM	Texas	3,300	9,400,000	11,719.51	122.69	0.397345	No
Reclamation	Pacific Northwest	Boise	Deer Flat North Lower	Idaho	1,574	4,990,367	6,775.46	133.91	0.395049	No
Reclamation	Great Plains	Milk River	St. Mary Canal - Drop 3	Montana	1,137	3,911,955	5,343.81	134.32	0.393843	No
USACE	Great Lakes & Ohio River	Louisville	BROOKVILLE DAM	Indiana	12,100	24,900,000	31,417.41	124.05	0.392972	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Southwestern	Little Rock	DIERKS DAM	Arkansas	1,200	3,700,000	5,557.54	147.63	0.390306	No
Reclamation	Upper Colorado	Dallas Creek	Ridgway Dam	Colorado	4,919	18,507,106	10,827.97	135.66	0.389932	No
Reclamation	Pacific Northwest	Baker	Mason Dam	Oregon	3,086	8,057,383	11,147.34	136.14	0.388565	No
Reclamation	Great Plains	Milk River	Fresno Dam	Montana	3,230	8,301,410	11,533.31	136.70	0.386972	No
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Upper Diamond Fork Flow Control Structure	Utah	16,771	67,552,830	7,913.00	136.84	0.386582	No
Reclamation	Pacific Northwest	Boise	Deadwood Dam	Idaho	5,011	11,470,594	16,038.30	137.50	0.384735	No
USACE	North Atlantic	Baltimore	WHITNEY POINT DAM	New York	2,000	5,300,000	8,080.46	150.19	0.383645	No
USACE	Northwestern	Kansas City	POMME DE TERRE DAM	Missouri	3,600	9,600,000	12,507.64	128.19	0.380309	No
USACE	Northwestern	Portland	FERN RIDGE DAM	Oregon	4,300	10,100,000	14,291.72	139.17	0.380113	No
Reclamation	Great Plains	PSMBP - Riverton	Pilot Butte Dam	Wyoming	2,008	5,644,093	8,104.29	141.46	0.373959	No
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Spanish Fork Flow Control Structure	Utah	8,870	25,275,364	20,039.99	141.94	0.372681	No
USACE	Southwestern	Fort Worth	RAY ROBERTS DAM	Texas	6,600	10,600,000	83000	131.79	0.369901	Yes
USACE	Great Lakes & Ohio River	Huntington	PAINT CREEK DAM	Ohio	8,000	14,400,000	22,875.84	156.15	0.368993	No
USACE	North Atlantic	Baltimore	EAST SIDNEY DAM	New York	1,700	4,500,000	7,169.36	157.04	0.366908	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Louisville	SALAMONIE DAM	Indiana	10,500	20,800,000	28,170.42	133.15	0.366134	No
Reclamation	Pacific Northwest	Vale	Agency Valley	Oregon	1,748	4,896,859	7,317.55	147.29	0.359152	No
USACE	Great Lakes & Ohio River	Pittsburgh	MICHAEL J. KIRWIN DAM	Ohio	1,500	4,000,000	6,540.61	160.46	0.359098	No
USACE	North Atlantic	Baltimore	HAMMOND DAM	Pennsylvania	1,200	3,400,000	5,557.54	160.65	0.35866	No
Reclamation	Great Plains	PSMBP Cheyenne Diversion	Angostura Dam	South Dakota	1,586	4,540,233	6,813.29	147.98	0.357481	No
Reclamation	Upper Colorado	Central Utah Project - Bonneville Unit	Syar Tunnel	Utah	1,779	8,594,659	40,122.02	148.50	0.356224	No
USACE	Southwestern	Little Rock	BLUE MOUNTAIN DAM	Arkansas	7,000	12,500,000	20,662.55	162.49	0.354616	No
USACE	Great Lakes & Ohio River	Louisville	CAGLES MILL DAM	Indiana	3,600	8,800,000	12,507.64	139.82	0.348659	No
USACE	Southwestern	Little Rock	DE QUEEN DAM	Arkansas	1,200	3,900,000	5,557.54	140.06	0.348072	No
USACE	Southwestern	Tulsa	JOHN REDMOND DAM	Kansas	9,000	17,300,000	25,030.57	142.23	0.342745	No
Reclamation	Mid-Pacific	Central Valley	Red Bluff Dam	California	22,484	64,776,383	2,709.00	154.80	0.341731	No
Reclamation	Upper Colorado	Central Utah Project - Vernal Unit	Steinaker Dam	Utah	1,248	3,301,177	6,078.63	157.30	0.336297	No
USACE	Great Lakes & Ohio River	Pittsburgh	BERLIN DAM	Ohio	3,000	7,400,000	10,914.86	145.14	0.335881	No
USACE	Great Lakes & Ohio River	Louisville	WILLIAM H. HARSHA DAM	Ohio	15,000	25,000,000	37,086.77	145.82	0.334321	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
Reclamation	Great Plains	Colorado-Big Thompson	Carter Lake Dam No. 1	Colorado	2,218	5,399,876	8,722.20	159.05	0.332595	No
USACE	Great Lakes & Ohio River	Louisville	HUNTINGTON DAM	Indiana	7,100	14,000,000	20,886.80	146.67	0.332383	No
Reclamation	Pacific Northwest	Umatilla	McKay	Oregon	1,544	4,093,011	6,680.58	160.96	0.32866	No
USACE	Great Lakes & Ohio River	Louisville	CECIL M. HARDEN DAM	Indiana	1,400	4,100,000	6,218.74	148.91	0.327384	No
USACE	Northwestern	Walla Walla	DWORSHAK DAM	Idaho	660,000	216,000,000	25000	162.28	0.325972	Yes
USACE	Great Lakes & Ohio River	Huntington	PLEASANT HILL DAM	Ohio	3,200	6,200,000	11,453.23	181.71	0.317105	No
USACE	North Atlantic	New England	BALL MOUNTAIN DAM	Vermont	3,700	6,900,000	12,766.99	181.96	0.31667	No
USACE	Great Lakes & Ohio River	Louisville	MONROE DAM	Indiana	5,200	10,400,000	16,493.06	155.92	0.312658	No
Reclamation	Upper Colorado	Carlsbad	Sumner Dam	New Mexico	1,648	7,181,634	5,718.53	170.20	0.310802	No
Reclamation	Pacific Northwest	Yakima	Kachess Dam	Washington	1,847	4,377,651	7,620.19	171.50	0.308448	No
USACE	South Pacific	Albuquerque	CONCHAS DAM	New Mexico	2,100	4,800,000	8,376.78	171.86	0.307809	No
Reclamation	Upper Colorado	Mancos	Outlet Canal	Colorado	1,196	2,700,217	5,801.78	172.78	0.306178	No
USACE	Great Lakes & Ohio River	Huntington	DILLON DAM	Ohio	6,500	12,000,000	19,530.64	159.99	0.304703	No
Reclamation	Upper Colorado	San Luis Valley	Platoro Dam	Colorado	2,008	6,521,086	19,736.15	181.15	0.29202	No
Reclamation	Great Plains	Colorado-Big Thompson	St. Vrain Canal	Colorado	1,597	3,695,875	6,847.91	182.66	0.289608	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Southwestern	Albuquerque	ABIQUIU DAM	New Mexico	3,000	4,300,000	25000	182.92	0.289194	Yes
Reclamation	Great Plains	PSMBP - Riverton	Bull Lake Dam	Wyoming	2,409	4,938,451	9,272.36	184.81	0.286246	No
USACE	Southwestern	Little Rock	DARDANELLE L&D	Arkansas	201,400	94,000,000	37100	202.03	0.285205	Yes
USACE	Great Lakes & Ohio River	Louisville	TAYLORSVILLE DAM	Kentucky	16,900	23,300,000	40,677.93	171.57	0.284139	No
USACE	Southwestern	Tulsa	WISTER DAM	Oklahoma	6,800	11,500,000	20,211.96	172.75	0.282194	No
Reclamation	Upper Colorado	Rio Grande	Caballo Dam	New Mexico	4,466	28,433,137	7,082.45	187.74	0.281777	No
USACE	Northwestern	Walla Walla	MCNARY L&D	Oregon	726,000	506,400,000	27100	188.02	0.281359	Yes
Reclamation	Upper Colorado	Weber Basin	East Canyon Dam	Utah	1,944	5,697,833	16,704.44	188.38	0.28081	No
Reclamation	Great Plains	Belle Fourche	Belle Fourche Dam	South Dakota	2,190	4,507,863	8,640.64	188.72	0.280315	No
USACE	Southwestern	Tulsa	FORT GIBSON DAM	Oklahoma	22,500	20,000,000	22200	174.50	0.279364	Yes
Reclamation	Great Plains	Milk River	Lake Sherburne Dam	Montana	2,358	4,519,873	9,126.49	198.74	0.266174	No
Reclamation	Great Plains	PSMBP Glen Elder Unit	Glen Elder Dam	Kansas	1,533	3,217,705	6,645.68	203.63	0.259786	No
Reclamation	Pacific Northwest	Umatilla	Cold Springs	Oregon	1,062	2,455,550	5,085.53	203.76	0.259621	No
USACE	Great Lakes & Ohio River	Louisville	GREEN RIVER L&D # 1	Kentucky	9,500	13,500,000	26,088.64	189.91	0.256701	No
USACE	Northwestern	Kansas City	KANOPOLIS DAM	Kansas	2,300	4,400,000	8,959.70	200.44	0.243216	No
USACE	Great Lakes & Ohio River	Huntington	GRAYSON DAM	Kentucky	3,900	6,300,000	13,281.01	207.27	0.235204	No

Owner	Region/Division	Project/District	Facility	State	Potential capacity (kW)	Potential annual production (kWh)	Plant construction cost (k$)	Energy production cost ($/MWh)	b/c ratio	Existing hydro
USACE	Great Lakes & Ohio River	Louisville	KENTUCKY RIVER L&D # 5	Kentucky	16,200	18,400,000	39,364.95	210.21	0.231914	No
Reclamation	Great Plains	Sun River	Pishkun Dike - No. 4	Montana	1,431	2,686,018	6,319.10	230.93	0.229073	No
USACE	Great Lakes & Ohio River	Huntington	DEWEY DAM	Kentucky	3,800	5,900,000	13,024.76	217.05	0.224605	No
USACE	Great Lakes & Ohio River	Pittsburgh	MOSQUITO CREEK DAM	Ohio	1,100	1,900,000	5,216.93	270.06	0.213361	No
USACE	Southwestern	Fort Worth	LAVON DAM	Texas	1,100	2,200,000	5,216.93	233.23	0.209019	No
USACE	Northwestern	Seattle	LIBBY DAM	Montana	315,000	25,000,000	83600	262.7524405	0.20133	Yes
Reclamation	Upper Colorado	Collbran	Southside Canal, Sta 171+ 90 thru 200+ 67 (2 canal drops)	Colorado	3,763	10,244,645	7,856.71	275.22	0.192213	No
Reclamation	Great Plains	PSMBP - Heart Butte	Heart Butte Dam	North Dakota	1,302	1,981,720	5,897.85	292.33	0.180961	No
USACE	Southwestern	Fort Worth	GRANGER DAM	Texas	5,000	5,400,000	16,011.71	291.37	0.16731	No
USACE	Southwestern	Fort Worth	WACO DAM	Texas	6,000	5,400,000	18,379.66	334.39	0.145786	No
Reclamation	Mid-Pacific	Truckee Storage	Boca Dam	California	1,644	4,635,446	560.00	370.20	0.142896	No
USACE	South Atlantic	Jacksonville	INGLIS L&D	Florida	2,500	2,100,000	9,530.87	446.40	0.129077	No
USACE	Northwestern	Portland	COUGAR DAM	Oregon	35,000	41,700,000	31200	431.3365424	0.122642	Yes
USACE	Southwestern	Tulsa	DENISON DAM	Oklahoma	70,000	15,000,000	39900	554.3880797	0.087935	Yes
USACE	Northwestern	Portland	JOHN DAY L&D	Oregon	540,000	35,000,000	69300	716.6611796	0.073815	Yes
USACE	Northwestern	Omaha	FORT PECK DAM	Montana	185,000	0	92200	NA		Yes
USACE	Northwestern	Omaha	GARRISON DAM	North Dakota	272,000	0	58300	NA		Yes
USACE	Great Lakes & Ohio River	Pittsburgh	KINZUA DAM	Pennsylvania	46,800	0	69300	NA		Yes