RECLAMATION
Managing Water in the West

Federal Replacements
Units, Service Lives, Factors

US Army Corps of Engineers®

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

Bonneville POWER ADMINISTRATION

Western Area Power Administration

2017 REVISION 1.1

REPLACEMENTS,

UNITS, SERVICE LIVES, FACTORS

2017 Revision

Update

Prepared by

U.S. Department of Energy
Western Area Power Administration (WAPA)

U.S. Department of the Interior
Bureau of Reclamation
(Reclamation)

U.S. Department of Army
Corps of Engineers (USACE)

U.S. Department of Energy
Bonneville Power Administration
(BPA)

REPLACEMENTS,

UNITS, SERVICE LIVES, FACTORS

2017 Revision Errata Sheet

Errata 1.1
October 6, 2017

The 100 year service life assigned to Intake Gates (Table Item #42, p. 4-49) was a typo.

Change: Intake Gates service life was corrected to read 50 years, per Justification Number 29 (p. App-47). The correction is reflected in 2017 REVISION 1.1. Updated agency logos are also reflected in 2017 REVISION 1.1.

PREFACE AND ACKNOWLEDGEMENT

The Update was prepared by a team of WAPA, Reclamation, USACE, and BPA staff members during the period from December 2012 through January 2017.

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Contents

Tables

Figures

Appendices

Appendix : Service Life Justifications

1. INTRODUCTION

A. Purpose and Background

The purpose of this update is to revise the May 2006 report, "Replacements, Units, Service Lives, Factors" published by Western Area Power Administration (WAPA) and the Bureau of Reclamation (Reclamation). There is significant continuity of data in many Units of Property from earlier reports dating as far back as March 1968 for some plant accounts. This version also includes data from the United States Army Corps of Engineers (USACE) Accounting Treatment for Multiple-Purpose Projects (ER-37-1-30, Chapter 14, 31 Dec 03) and Accounting for Property, Plant and Equipment (ER-37-1-30, Chapter 15, 31 Jan 12).

This update was prepared by a team of WAPA, Reclamation, Bonneville Power Administration (BPA), and USACE staff members from December 2012 through December 2016. This version changes the title of the book to *Federal Replacements, Units, Service Lives, Factors* as a testament to the collaboration between these federal agencies. The update also includes adding new units of property as well as combining some of the units of property and expanding others. These changes were made to reflect current operating and accounting practices. The update includes the additions and changes as summarized in Table 1.

Table 1. Summary of 2017 Changes and Additions

Item	Change
New Chapter 3: Accounting Guidelines for Capitalization	A subcommittee of members from the stakeholder agencies developed this chapter to assist in decision making with regard to cost classification: capital or expense.
New Table 5: Units of Property / Plant Item	This table replaces a previous table located in Appendix B of the 2006 edition and is a look up table for Units of Property / Plant Item by the specific the Item Number in Table 7 instead of page numbers.
New Table 6: Comprehensive List of Maintenance Items	This table replaces a previous table located in Appendix B of the 2006 edition and is a look up table for Maintenance Item by the specific Item Number in Table 7 instead of page numbers.
Table 7 Merged USACE ER-37-1-30, Chapter 14	Table 7 (the blue pages) now includes merged units of property (Plant Items) from the USACE Accounting Treatment for Multiple-Purpose Projects ER-37-1-30 (31 Dec 03). This resulted in adding over 300 new units of property.
Modifications to Service Lives and Justifications	Modifications to Service Lives and Justifications are listed in Table 3.
New Units of Property for Life Safety and Security	The Reclamation Safety, Security, and Dam Safety Office added new Accessory Electric Equipment FERC Code 334 to cover Life Safety Equipment: Access Control and Intrusion Detection Systems per Reclamation Manual Directive and Standard (D&S), *Reimbursability of Security Cost* (SLE 05-01), *Appendix A - Service Lives for Security Equipment*.
Reclamation Units of Property formerly set to >50	These Units of Property were evaluated by the SME and a fixed service life applied. Generally they were set to between 50 years or 100 years.
Updated Replacement Percentages and Factors and Associated Tables (Chapter 5)	Reclamation and WAPA updated the financial data in Chapter 5 (formerly Chapters 4 and 5).
Added New Justifications	Justification 31: Transformer Monitor and Annunciation System, Justification 76: Units of Property Adopted in 2017 from the USACE ER-37-1-30 Accounting Treatment for Multipurpose Projects, Justification 77: Plant Life Safety and Security, Justification 78: Flow Meters, and Justification 79: Machine monitoring system (vibration, air gap, partial discharge, etc.).

A team of Subject Matter Experts (SMEs) convened with participants from the four agencies, with facilitation by HDR|CDM Joint Venture as contractor. During Phase I of the study, the Steering Committee and the SME team (a group of experts from Reclamation, WAPA, BPA, and USACE) met seven times. As a result of these meetings, Table 7 was thoroughly reviewed and merged with the USACE ER-37-1-30. Each asset (unit of property) in the FERC accounts was reviewed by the SME and recommended changes made to the Steering Committee. The recommended service lives were then discussed and approved by the Steering Committee on Replacements. In addition, a sub-team of SMEs from the financial communities of each agency convened and was tasked to write a new chapter to provide guidance on capitalization versus expensing replacement of equipment and infrastructure. This new chapter (3) is titled Accounting Guidance for Capitalization.

Phase II of the work was started on July 31, 2015. Phase II requirements were as follows:

- Update and finalize the table of Units of Property/Plant Item Service Lives (Blue Pages).
- Rewrite Chapters 1 – 5 and Justifications (formerly Appendix A).
- Compile federal accounting guidelines related to the treatment of hydropower system replacement costs. Develop new rules for capitalizations (new Chapter 3: Accounting Guidance for Capitalization).
- Prepare a draft revision for a 6 month agencies beta test.
- Collect beta test comments and produce a findings and gap analysis of the comments.
- Revise the book based on the gap analysis and produce the final revision of the Federal Replacements book.

Table 2 contains the list of Steering Committee and SME meetings for Phase I and Phase II. Many of the service lives in previous versions of this report were confirmed and a number of lives were modified. Several new Units of Property were added and some deleted. Lastly, replaceable percentages by service life groups and major accounts were calculated, and new replacement factors and depreciation rates were computed for the publication.

Table 2. Steering Committee/SME Meetings

Date	Location	Attendance		Comments
Phase I Meetings				
1/17/2013	WAPA Office Lakewood, CO	Reclamation	5	Kickoff Meeting
		WAPA	1	
		USACE	5	
		BPA	2	
		HDR/CDM	6	
4/10/2013	Teleconference	Reclamation	4	Agency involvement, data, and project scope
		HDR/CDM	4	

Table 2. Steering Committee/SME Meetings

Date	Location	Attendance		Comments
11/06/2013	Teleconference	Reclamation WAPA USACE BPA HDR/CDM	15 1 5 3 5	Review of Table 7 (Blue Pages)
11/13/2013	Teleconference	Reclamation WAPA USACE BPA HDR/CDM	8 1 3 3 4	Proposed changes to Table 7 (Blue Pages)
12/03/2013	Teleconference	Reclamation WAPA USACE BPA HDR/CDM	7 1 3 1 4	SMEs collaboratively confirmed or rejected/revised HDR-recommended changes to additions/deletions, service life revisions, and cost treatment (capitalize/expense)
01/08/2014	Teleconference	Reclamation USACE BPA HDR/CDM	2 3 3 4	Strategy for merging USACE ER-37-1-30
03/13/2014	Portland HDR Office/ Teleconference	Reclamation WAPA USACE BPA HDR/CDM	8 1 4 3 4	Completion of Phase 1 – Final Review of Table 7 and Accounting Guidelines for Capitalization
03/28/2014	Conference Webinar (Capitalization Guidance Subcommittee)	Reclamation WAPA USACE BPA HDR/CDM	4 1 4 3 4	Subcommittee of respective agencies to help review the Replacements Book - Capitalization Guidance document
Phase II Meetings				
8/25/2015	Phase II Kick Off Meeting Denver Reclamation/Teleconference	Reclamation WAPA USACE BPA HDR/CDM	10 1 3 4 2	Steering Committee and Subject Matter Experts meeting to kick off Phase II
9/15/2015	Denver Reclamation /Teleconference	Reclamation WAPA HDR/CDM	3 10 2	Meeting to discuss data needs for Replacement Percentages, Factors and Depreciation

Table 2. Steering Committee/SME Meetings

Date	Location	Attendance	Comments
10/22/2015	Denver WAPA	WAPA	WAPA Internal meeting to address updating the Factors Tables
11/23/2015	Denver Reclamation / Teleconference	Reclamation 3 WAPA 2 USACE 1 BPA 0 HDR/CDM 1	Steering Committee Meeting to discuss schedule slip
4/12/2016	Factors Table Data Complete		Agency beta test scheduled for 5/11/2016 through 10/25/2016
5/31/2016	Denver Reclamation / Teleconference	Reclamation 2 WAPA 18 USACE 1 HDR/CDM 1	Kick off meeting for the agencies beta test.
11/8/2016	Denver Reclamation / Teleconference	Reclamation 3 WAPA 1 USACE 1 BPA 0 HDR/CDM 2	Steering Committee meeting to discuss the gap analysis from the beta test comments.
12/13/2016	Denver Reclamation, Power Resources Office (PRO) / Teleconference	Reclamation 5 WAPA 7 USACE 1 BPA 0 HDR/CDM 1	Steering Committee meeting to resolve outstanding gap analysis comments

B. Users

This update has three major users: (1) those who prepare financial records, update plant in-service accounts, and calculate depreciation expenses; (2) asset managers that plan maintenance, replacement, and refurbishment activities; and (3) those who prepare power repayment studies, which use replaceable percentages by service life and major cost classifications to estimate year-by-year and periodic replacements for determining revenue requirements.

A note of caution to the user: Each agency may use different depreciation capitalization thresholds and may use its own discretion as to what to treat as an expense in the financial statements. See Chapter 3 for further guidance.

WAPA's Power Repayment Studies (PRS) will use the financial accounts for historic costs to be repaid. However, the PRS will not project repetitive future replacement costs on that item if it is not defined as a unit of property.

As noted above, for rate setting purposes, the decision whether to expense or capitalize the cost of an item is not entirely dependent on its characterization in this report. However, for items of significant cost having an expected life of 50 to 100 years (such as trash racks, head gates, and valves), PRS policy and precedent would call for capitalization at current interest rates. To do otherwise would be a significant departure from the presentations made to the power customers and to Congress. Should it be necessary to make such a policy change, presentation to and approval of the Steering Committee on Replacements for agency-wide use would be required.

C. Organization of Report

A list of Acronyms and Definitions is found in Section D of this chapter. The list contains definitions of terms used throughout the update.

Chapter 2, Methodology, addresses the methodology and procedures followed in completing the update.

Chapter 3, Accounting Guidance for Capitalization, is a new chapter added to this revision to assist users in the determination of cost classification for capitalization versus expense; for equipment replacement, and for additions, betterments, and enhancements of facilities and infrastructure.

Chapter 4, Units of Property and Service Lives is a summary of principal items, units of property, service lives, and minor items. It is used by field personnel in distinguishing between replaceable units of property for which service lives have been assigned and items of property that are part of the maintenance program. The determination of service lives for identified units of property and a detailed summary of individual replaceable units of property and their service lives, with a comparison between the 1995 report, 2006 report, and this update, are presented in this chapter.

- Table 3 summarizes the changes in units of property and service lives established in this report as compared with those in the May 2006 update.
- Table 4 shows the combined or obsolete units of property and service lives. Establishing service lives is a significant part of the analysis.
- Table 5 is the look up table for Units of Property/Plant Items, which is cross-referenced to Table 7 by the Table Item Number.
- Table 6 is the look up table for Maintenance Items, which is cross-referenced to Table 7 by Table Item Number.
- Table 7 presents the relationship of the Federal Energy Regulatory Commission (FERC) cost classification system as

related to the Reclamation and USACE account numbers. Table 7 also provides the service life, maintenance items, and Justification index as appropriate for each unit of property.

- Chapter 5, Replacement Percentages, Factors, and Depreciation, provides the critical factors needed to determine revenue requirements in PRS and includes a discussion on the methodology for calculating depreciation rates for a plant account using a composite life. Table 8 contains the factor calculations used in Table 9 through Table 11. Table 9 is intended primarily to determine revenue requirements in PRS.
- Table 10 is a composite of the annual and periodic replacement percentages, weighted service lives, and depreciation by plant account from Table 8.
- Table 11 is a look up for calculated service life and percent replaced by FERC account.

The appendix includes the narrative justifications that describe many of the units of property, the rationale for establishing the individual service lives, and identifies the items to be accounted for as replaceable units of property. The justifications were added to justify changes made to service lives over the years as technology has changed. Not all units of property have been assigned a written Justification number in the appendix.

The former Appendix B, titled Supplemental Historical Reference, contained historic information. This appendix can be found in the previous version of the Replacements Document (2006) and in the Reclamation Denver Power Resources Office.

D. Acronyms and Definitions

A&B	Additions and Betterments. Improvements and upgrades that increase the size, capacity, or operating efficiency of an existing asset or extend the service life of the asset. Additions and betterments are capitalized if the cost is equal to or greater than the applicable capitalization threshold.
BPA	U.S. Department of Energy, Bonneville Power Administration (sometimes referred to as Bonneville).
Capital Assets	Land, structures, equipment, intellectual property, software, and information technology that are used by the federal government and have an estimated useful life of 2 years or more, and an acquisition cost that meets the capitalization threshold. Represents assets that are capitalized versus expensed.
CARMA	Capital Asset and Resource Management Application. Reclamation's asset management system using the asset management software MAXIMO.

Cavitation	The creation and subsequent collapse of vapor bubbles, which can produce extremely high local pressure causing damage to metal and concrete structures and equipment.
CEFMS	Corps of Engineers Financial Management System
CFR	Code of Federal Regulations
D&S	Reclamation Directive and Standard, support directives and standards for Reclamation official policies.
Depreciation Rates	Depreciation rates used in this report are straight line and are the annual depreciation percentages required to recover the entire account investment over the composite or weighted average service life of the investment. **Note:** Reclamation will not use composite service life effective October 1, 2013.
DoD FMR	Department of Defense Financial Management Regulation
FASAB	Federal Accounting Standards Advisory Board
FBMS	Financial and Business Management System. This system replaced the Reclamation FFS system in FY2013.
FEM	Facility and Equipment Maintenance System, MAXIMO-based (used by USACE).
FERC	Federal Energy Regulatory Commission
FERC Accounts	A set of accounts used in the uniform system of accounts prescribed by FERC for use by electric utilities.
FFS	Federal Financial System. Former financial system used by Reclamation.
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
Identified Property	Each major physical feature, distinct and separate physical feature, or group of closely related physical features. Examples are dam and reservoir; power plant, substation, and transmission line.
Iowa Curves	A series of survivor curves used to mathematically analyze the service lives of equipment for replacement purposes. These curves are used within the utility industry for service life standardization on replaceable equipment.
Maintenance	The work required to preserve and maintain the asset to perform its designated function for its established life.
Maximo	An asset and work management software tool used by Reclamation and also referred to as CARMA (see *CARMA*)
Minor Items of Property	Those items of property not considered replaceable units of property because of low cost or because they are a part of a unit of property.
NiCad	Nickel Cadmium

Percent Net Salvage Value	Gross salvage value less the cost of removal divided by the installed original cost.
Period of Analysis	The period (in years) used in analyzing the economic aspects of a project. This is usually considered to be 100 years.
Plant Account	An account used to record the increases and decreases of cost of similar or related items for accounting purposes.
PMA	Power Marketing Administration (i.e., WAPA, BPA and others).
PP&E	Property, Plant, and Equipment
PRS	Power Repayment Study
Principal Items	Major items or systems included in the various plant accounts.
Property Unit Listing/Catalog	A written list of property units for use in accounting for additions and retirements of electric plant.
Provision for Replacement	An annual sinking fund amount that will accumulate the original cost of the items to be replaced at the end of their service lives. Also historically referred to as replacement factor.
Reclamation	United States Department of the Interior, Bureau of Reclamation (sometimes referred to as USBR, Bureau, or BOR).
Repairs	Activities that allow PP&E to attain its original useful life.
Replacement Cost	In the historic tables of this report, replacement cost is considered the same as annual provision for replacement. It is also used in the narrative to describe the cost of future investment in replaceable units of property.
Replacement Investment	The amount of money invested in replaceable units of property.
Retirement Unit	See *Unit of Property*
Sample Project	A representative sample of projects or equipment that was used to develop the replacement percentages.
SCR	Silicon Controlled Rectifier
Service Life	The useful life of a category of PP&E (as defined by the FERC plant accounting regulations). This is usually based on the average service life of a group of similar items.
SME	Subject Matter Experts
SFFAS	Statement of Federal Financial Accounting Standards
TR	Technical Release
Update	Commonly used to identify this most recent “Replacement” document (2017).

Unit of Property	(a) An item that will be replaced as a complete unit one or more times within the period of analysis and (b) an item that is significant in terms of annual maintenance expense but is not ordinarily replaced as a part of the normal recurring maintenance program. The period of analysis is generally considered to be 100 years. (USACE ER-37-1-30 refers to this as a Plant Item.) (Reclamation refers to this as Asset/Sub-Asset effective October 1, 2013.)
USACE	United States Department of Army, Corps of Engineers
VLA	Vented Led Acid (type of battery)
VRLA	Valve Regulated Lead Acid (type of battery)
WAPA	United States Department of Energy, Western Area Power Administration (sometimes referred to as Western).

2. METHODOLOGY

A. General

In updating the units of property/plant items and service lives, the basic definition used in determining whether an item should be included as a unit of property is:

> Unit of property/plant item – (a) an item that will be replaced as a complete unit one or more times within the period of analysis, and (b) an item that is significant in terms of annual maintenance expense but is not ordinarily replaced as a part of the normal recurring maintenance program. The period of analysis is generally considered to be 100 years.

Within this definition, the Unit of Property (Reclamation)/Plant Item (USACE) falls into four general categories:

- Items that should be designated as replaceable units of property.
- Items whose lives will exceed a period of analysis of 100 years.
- Major items for which significant parts will be replaced on a piecemeal basis within the period of analysis.
- Items whose costs are such that they should be replaced as a part of maintenance expense (maintenance item).

Within the category of items designated as units of property/plant item, service life intervals of 5 years were established for all units of property with 15 years or more. Units of property with 14 years or less can have any interval as is the case with motor vehicles and the newly added security equipment. The recommended service lives extend over a range from 3 years through 100 years.

In this update, the establishment of service lives for new units of property/plant item or changes of lives for previously established units of property/plant item was based on the experience of WAPA, BPA, USACE, and Reclamation SMEs. In general, established service lives were not changed unless new information obtained from agency experience indicated a change should be made. The study methodology used to determine the service lives and replacement percentages is depicted in Figure 1.

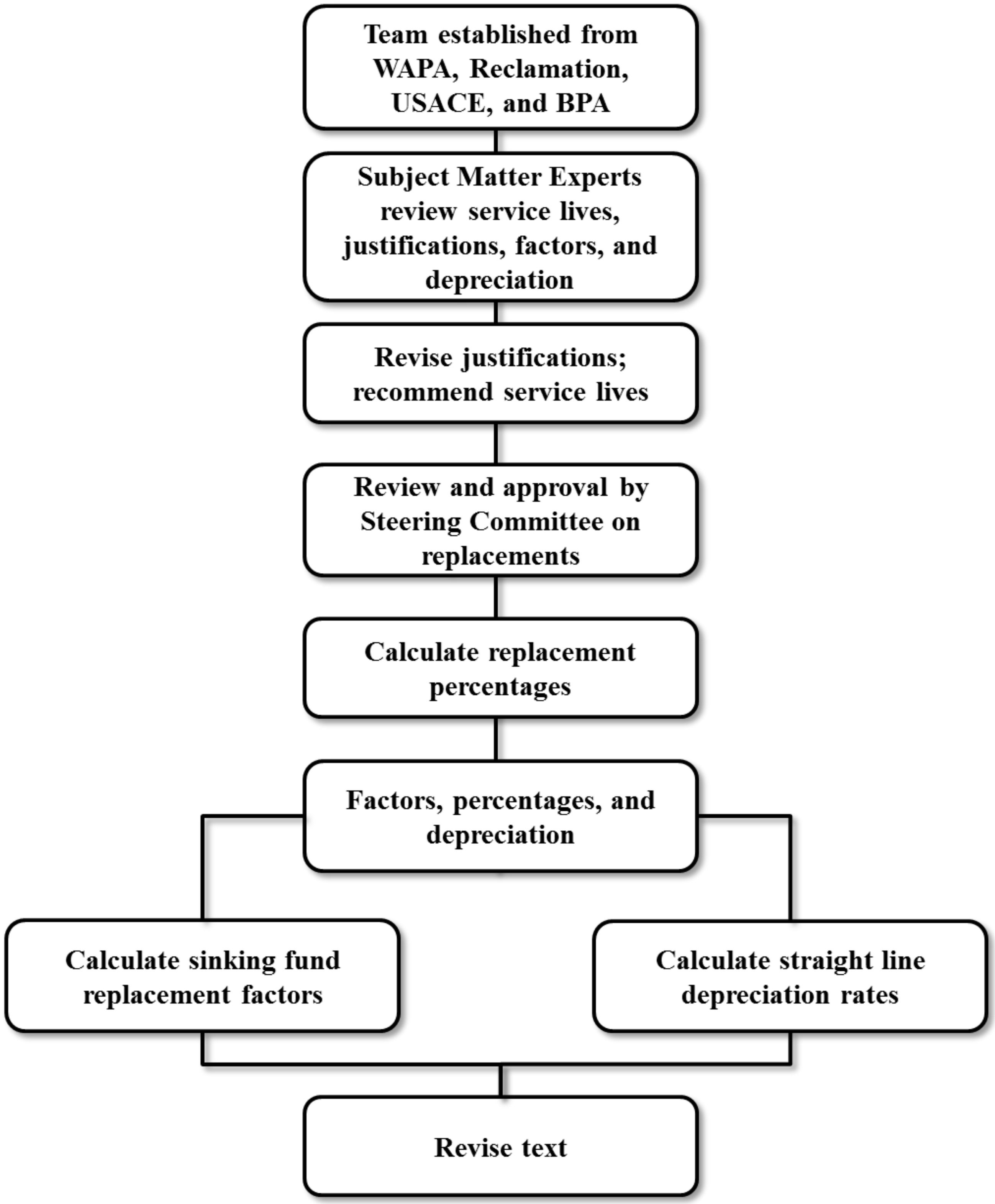

Figure 1. Study Methodology

B. Analysis Procedure

Meetings were conducted with WAPA, Reclamation, BPA, and USACE SMEs (see Table 2), and the team's recommended service lives were then presented to and approved by the Steering Committee. Many of the service lives in previous reports were confirmed and a number of lives were modified. Some units of property were combined into one unit, and some new units of property were added. See Table 5 for a complete listing.

Replaceable percentages by service life groups by FERC accounts were calculated. New weighted periodic replacement factors and annual depreciation rates were also calculated for publication.

1. Statistical Analysis

When calculating replacement factors and depreciation rates, it is necessary to relate the cost of the units of property grouped by service life to the total account cost. For some equipment, equipment count and individual costs were available. In other cases, only the total cost was available from the financial records. Equipment is classified in accordance with FERC guidelines for Uniform System of Accounts Prescribed for Public Utilities and Licensees Subject to the Provisions of the Federal Power Act, 18 CFR Part 101 dated April 1, 2013.

Specific details of the analysis calculations are found in Chapter 5, Replacement Percentages, Factors, and Depreciation. The analysis of depreciation rates for power facilities is also discussed in Chapter 5.

2. Multi-Agency SME Meeting and Interviews

Over the course of the revision of this book, the Steering Committee along with multiagency SMEs met fourteen times as listed in Table 2. The meetings were facilitated to provide a complete review and revision of the 2006 book. In particular, the previous version of Table 7 was merged with the USACE ER-37-1-30, Chapter 14, and each Unit of Property/Plant Item was reviewed and updated if necessary.

In addition, individual interviews were held with SMEs to resolve differences. The interviews yielded opinions on service lives, added details to program documents, gave supplemental information on design problems, cost information, facilities added, replaced, or retired, and suggested changes for the 2017 update.

3. Final Selection of Service Lives

The team presented a recommended service life for Steering Committee consideration. Based on all of the information presented, an appropriate service life for each unit of property was agreed on.

The final selected service lives were then used in updating the periodic replacement factors and the annual depreciation rates for repayment and financial accounting. All of these analyses are described in more detail in the next two chapters of this update.

3. ACCOUNTING GUIDANCE FOR CAPITALIZATION

A. Purpose

The purpose of this section is to provide accounting reference information regarding the rules for capitalizing the costs of assets,[1] guidance for making decisions regarding cost classification, capital improvements and maintenance and repair costs, and guidance to help promote a better understanding of the definitions of additions, betterments, replacements, and enhancements. This guidance provides an overall "umbrella" and does not supersede specific agency guidance.

The capitalization and expense flowchart (Figure 2) is to assist in identifying the steps and follow-on actions necessary in making capitalization and expense decisions. The information in the flowchart is for illustrative purposes only and is not intended to modify, limit, or contradict any of the definitions this document provides.

B. Capitalized Assets

The accounting guidance for capitalizing assets is specifically discussed in:

- Federal Accounting Standards Advisory Board's (FASAB) Statement of Federal Financial Accounting Standards (SFFAS) and Technical Releases (TR);
- Federal Energy Regulatory Commission (FERC), Title 18 Code of Federal Regulations (CFR), Part 101, (aka utility accounting);
- Government Accountability Office's (GAO) Glossary of terms;
- Department of Defense Financial Management Regulation (DoD FMR);
- Bureau of Reclamation, Reclamation Manual D&S, *Assets Under Construction* (FIN 07-24);
- United States Army Corp of Engineers (USACE) guidance ER-37-1-30 (for USACE);
- BPA Accounting Manual, Chapter 3 (for BPA);
- WAPA Accounting Policy Property, Plant and Equipment;
- Department of Energy Financial Management Handbook, Chapter 10.

[1] For the purpose of this document the term asset(s) will be used to refer to assets and sub-assets for Reclamation, structures and components for WAPA, retirement units for USACE, and major and minor units of property for BPA.

For WAPA, the determination of costs as a regulatory asset (FASAB Accounting Standards Codification Topic 980 Regulated Operations) is secondary to the capitalization policy and is addressed by each Power Marketing Administration (PMA). The generating agencies do not use the regulatory asset concept; it is only applied by the PMAs upon consolidation of costs incurred and determination of subsequent rate impact.

GAO's glossary of terms defines capital assets as land, structures, equipment, intellectual property (e.g., software), and information technology that are used by the federal government and have an estimated useful life of 2 years or more.

In SFFAS 6, the FASAB pronounced that federal entities should establish capitalization thresholds. Entities must consider their own financial and operational conditions in establishing an appropriate capitalization threshold or thresholds. Once established, federal entities should consistently apply the threshold(s). (Refer to your agency's capitalization policy for applicable thresholds.)

SFFAS 6, paragraph 17, also states that Property, Plant, and Equipment (PP&E) consist of tangible assets, including land that meets the following criteria:

- Assets that have estimated useful lives of 2 years or more;
- Assets that are not intended for sale in the ordinary course of operations; and
- Assets that have been acquired or constructed with the intention of being used, or being available for use by the entity.

C. Capital Improvements

A capital improvement is an activity that extends the useful life of a PP&E asset, expands the capacity or efficiency of an asset, or otherwise upgrades an asset to serve needs different from, or significantly greater than, an asset's current use.

According to SFFAS 6, costs for work that either extend the useful life of existing general PP&E, or enlarge or improve its capacity shall be capitalized and depreciated/amortized over the extended service life of the associated general PP&E.

SFFAS Handbook, Appendix E: Consolidated Glossary – Page 8, defines betterment as an expenditure having the effect of extending the useful life of an existing asset, increasing its normal rate of output, or increasing rather than merely maintaining its efficiency. Betterment is distinguished from repair or maintenance in that the latter have the effect of merely keeping the asset in its customary state of operating efficiency without the expectation of added future benefits.

Additions and betterments (A&B) are improvements and upgrades that increase the size, capacity, or operating efficiency of an existing asset. An A&B may also extend the service life of an asset. To qualify as a capitalized A&B, the cost must meet the following criteria:

- The cost of the work must be equal to or greater than the capitalization threshold (the individual agency determines its thresholds) and
- The work must increase the size, capacity, or operating efficiency of the asset consistent with its intended purpose. For example, enhanced lighting is a general improvement to work and safety but does not increase the overall efficiency of the asset and is, therefore, not an A&B.

Some examples of capital improvements that increase the size, capacity, or operating efficiency or extend the useful life of PP&E assets are discussed in the following scenarios.

1. **Generator Rewind**

   Generators and associated electrical equipment are essential elements of any hydroelectric powerhouse. Main generator components include the stator and rotor, which operate to convert mechanical energy to electrical energy. A stator and rotor rewind can improve generator efficiency, capacity, and extend the service life. For example, replacing the existing equipment with lower loss windings with increased copper cross-sectional area and improved insulating materials with better heat transfer and higher temperature tolerance will extend the useful life of the asset and may increase capacity. Accordingly, a generator rewind replacement project likely constitutes a capital improvement due to the resulting increase in capacity, efficiency, or service life.

2. **Turbine Runner Replacement**

   The turbine runner (the rotating part of the turbine) functions as the prime mover in the hydroelectric unit. The turbine runner operates to convert the energy of flowing water into mechanical energy. How the runner is designed impacts the operating efficiency of the unit. Advances in design and manufacturing, in conjunction with improved materials, have markedly improved unit efficiency and reliability. As such, replacing an antiquated runner with a modern runner may constitute a capital improvement due to the resulting increase in unit operating efficiency. Increases in operating efficiency allow the unit to conserve water and maximize electrical output. Accordingly, a turbine runner replacement usually constitutes a capital improvement due to the resulting increase in capacity, efficiency, function, or service life.

3. **Replacement of Mechanical Governor with Digital Governor**
The governor monitors turbine speed to ensure the generator spins at a defined speed, thereby maintaining proper voltage and frequency. Governor performance (e.g., accuracy of frequency, sensitivity, and synchronization time) can affect unit efficiency and generation. In comparison to mechanical governors, digital governors are state of the art. Replacing a mechanical governor with a digital governor will reduce maintenance cost and improve unit efficiency and generation. Accordingly, the digital governor replacement project constitutes a capital improvement due to the resulting increase in efficiency or service life.

D. Maintenance and Repairs

SFFAS 42 states that maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Activities include preventive maintenance, replacement of parts, systems, or components, and other activities needed to preserve or maintain the asset. Maintenance and repairs, as distinguished from capital improvements, exclude activities directed toward expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, its current use.

Maintenance and repair costs are not capital improvements and are expensed in the period incurred, regardless of whether the cost equals or exceeds the capitalization threshold. Maintenance is the work required to preserve and maintain the asset to perform its designated function for its established life. Maintenance includes the cost required to maintain certifications needed to perform the function of the asset, such as safety requirements or building codes.

Repairs are activities that allow PP&E to attain its original useful life.

Some examples of repairs and maintenance that allow PP&E assets to perform the function for which it was acquired and attain its original useful life are discussed in the following scenarios:

1. **Penstock Coating/Lining**
Penstocks are pressurized conduits that transport water to a turbine. To prevent corrosion, leakage, and cracks, the penstock may be either coated or lined (e.g., with silicone-based fouling release systems). Whereas coatings and linings provide protection for the shell material and are critical to the performance and longevity of the penstock, the activity merely allows the penstock to perform the function for which it was acquired and attain its original useful life. Therefore, the action is a maintenance activity.

2. Cavitation Repair

The term cavitation is used to describe the creation and subsequent collapse of vapor bubbles, which can produce extremely high local pressures. Cavitation commonly occurs in turbines (generally appearing around guide vanes, wicket gates, the turbine runner, and in the draft tube) and can damage flow surfaces. The repair of cavitation damage on turbines is an essential component of any maintenance program. Cavitation repair allows for restoration of the turbine to its original condition to perform the function for which it was acquired and attain its original useful life. Therefore, the action is a maintenance activity.

E. Replacements

1. Replacement of Assets

Reclamation's FIN 07-24, Appendix C, Paragraph I, defines a replacement as the construction or installation of plant to replace property retired, together with the removal of the retired property.

2. Replacement of Component Parts of an Asset

For the purpose of clarity within this document, a component is not an asset, but is, rather, part of an asset.

Replacement of components of an asset may be either a repair or an A&B. When repairing an asset, the components of the asset may be repaired by replacement. Replacement may involve upgrades to current standards and codes or may provide incidental efficiencies, such as reduced fuel consumption. The determination as to whether a replacement is a repair or an A&B is based on the purpose of the replacement. The replacement component is expensed if the component allows the asset to perform the function for which it was acquired and attain its original useful life. Work performed specifically for the purpose of preventing failure, restoring serviceability, or maintaining the life of the plant is expensed. However, maintenance and repair activities do not include rebuilding entire structures within the same physical footprint. Replacement of a component undertaken to improve or expand the efficiency of an asset or a replacement in kind in the same physical footprint is a capitalized cost.

Replacement undertaken to improve or expand the efficiency of an asset that is in good working order is considered an improvement and is capitalized. Therefore, if replacement or improvement does not extend the useful life or capacity of the asset, the costs will be expensed.

3. Disposal, Retirement, or Removal from Service

In the period of disposal, retirement, or removal from service, assets will be properly disposed of and removed from the accounting records along with associated accumulated depreciation (i.e., when the assets are no longer providing service in the operations of the entity). Any difference between the book value and amounts realized shall be recorded as a gain or a loss in the period the asset is disposed of, retired, or removed from service, except for agencies applying group life depreciation methodology. No additional depreciation shall be taken once an asset is removed in anticipation of disposal, retirement, or removal from service.

F. Enhancements

In accordance with SFFAS 10, paragraphs 25, 26, and 73, enhancements apply predominately to software. The acquisition cost of enhancements to existing internal use software (and modules thereof) should be capitalized when it is more likely they will result in significant additional capabilities. Enhancements normally require new software specifications and may require a change of all or part of the existing software specifications as well. The FASAB believes that an enhancement should be limited to instances where significant new capabilities are being added to the software. Merely making the software more efficient and/or extending its service life does not constitute a capital cost.

G. Expenditures for Items Not in the Replacements Book

The Replacements Book is not all-inclusive. Occasionally, expenditures occur for items not yet in the Replacements Book. These situations call for coordination between stakeholders. When faced with two reasonable options, accountants consider the facts and apply accounting principles to make a capital or expense determination.

The following is an example of stakeholder coordination: Reclamation's Great Plains region faced the choice of expensing or capitalizing the expenditure for fiber optic technology necessary as a replacement for analog technology. The normal process was to expense items not listed in the Replacements Book. The Power Manager and Chief of Engineering prepared documentation to support the treatment of the new technology as an asset (unit of property) appropriate for capitalization. The accountants used the documentation as justification and backup and capitalized the expenditure. Ultimately the capitalization decision must be based on accounting guidance. A typical process would follow these steps:

- Coordinate with the stakeholder to understand the facts regarding the work.
- Assess the issue, circumstances, and transactions in question.

- Review applicable policies and apply the appropriate policy to the extent possible.
- Determine applicable criteria as it applies to the conditions.
- Develop an interpretation based on available information.
- Develop conclusions in conformance with Generally Accepted Accounting Principles (GAAP), FASAB, and FERC guidance to the extent practicable as determined by the agency.

H. Incidental Expense

Work classified as expense based on accounting guidance (i.e., maintenance expense) should not be capitalized based on factors such as dollar amount, contract structure, or ease of tracking. This practice may occasionally be contentious but must be consistently applied for proper accounting. During major capital projects that involve teardown of a major component (i.e., replacing a transformer, stator rewind, turbine runner replacement), used accessories may need replacement while completing the major capital work. In some cases it would either be impossible or impractical to reinstall old seals, large rubber gaskets, etc., so these types of items must be replaced as part of the capital work. In this example, if the seal replacement is necessary to successfully complete the capital project, these costs may be capitalized. However, if maintenance work is completed due to convenience (i.e., "the unit was open") and not as a necessary part of the capital project, the work must be expensed.

I. Summary

The capitalization of expenditure is appropriate only if the cost is equal to or greater than the capitalization threshold amount and meets any of the following conditions:

- It will increase capacity or efficiency or otherwise upgrade the asset to serve needs different from or significantly greater than, its current use.
- It will extend the useful life of the asset.
- It is for a new or replacement asset meeting the capitalization criteria listed in paragraph B., above.

In contrast, the costs necessary to preserve the asset, so the asset will continue to perform its designated function for its established life, will be expensed. Cost, other than meeting the agency threshold, is not a factor in determining capitalization or expense.

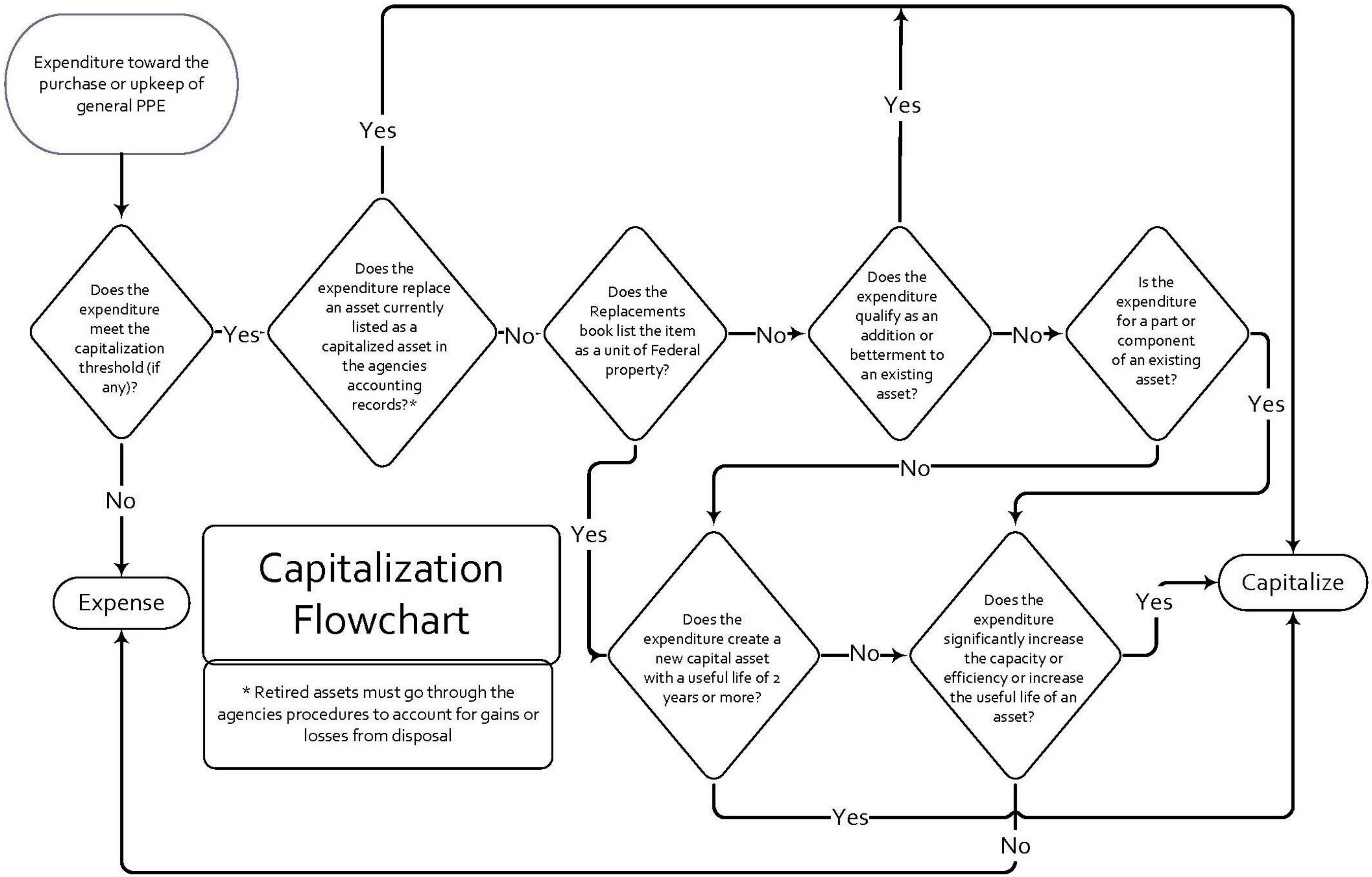

Figure 2. Capitalization Flowchart

4. UNITS OF PROPERTY AND SERVICE LIVES

A. Explanation of Summary Tables

This chapter catalogs the Reclamation and USACE accounting systems Unit of Property (Reclamation)/Plant Item (USACE) by FERC Account. Each Unit of Property/Plant Item (i.e., equipment and infrastructure) expected to be replaced within the period of study is assigned a service life. If a service life changes during an update of the Replacements Book, it will be assigned a justification (see Appendix), which will describe the nature of the change. If a Unit of Property/Plant Item does not have an assigned service life, it generally means that it is not expected to be replaced within the study period of 100 years. If a component of a larger system is not listed or if a smaller, less expensive unit of property is not listed, it generally implies that the component or equipment is considered a maintenance item.

If, in the course of using this book, there are discoveries of equipment and replacements of property not contained in the following tables and are deemed to be capitalized additions or replacements, please send this information to:

Bureau of Reclamation Power Resources Office
ReplacementsBook@usbr.gov

Table 3 is a summary of those Units of Property that have had a change in service life in recent revisions since 1995 Each replaceable unit of property is assigned a justification number. The final three columns of Table 3 compare the service lives between the 1995, 2005, and 2017 updates.

Table 4 is a summary of both the combined and obsolete units of property and service lives from July 1995 through December 2005. Table 5 and Table 6 are comprehensive indexes for Table 7, with a line reference to locate each unit of property and maintenance item. This index also provides cross referencing of the replaceable units of property with minor maintenance items.

Table 7 (the Blue Pages) is designed primarily as a look-up table for the service life of any given unit of property/plant item, the associated maintenance items and retirement units, and justification if relevant. This table also provides a cross reference for FERC accounts to the USACE account number and the Reclamation (FBMS) account number.

B. Clarification between FERC Regulations and Unit of Property Definitions Used in this Update

In accounting for the construction of facilities and the retirement of those facilities at a later date, accountants for WAPA, Reclamation, BPA, and USACE have occasion to refer to the regulations of FERC, codified as Title 18 of the Code of Federal Regulations. Prior to 1998, two parts of Subchapter C – Accounts, Federal Power Act, were involved:

- **Part 101.** Uniform System of Accounts Prescribed for Public Utilities and Licensees Subject to the Provisions of the Federal Power Act, and
- **Part 116.** Units of Property for use in Accounting for Additions and Retirements of Electric Plant

In the 1998 version, 18 CFR, Part 116 was deleted and Part 101 was amended to include the language contained in the old Part 116.

Part 101 now contains, as part of the Uniform System of Accounts, Electric Plant Instructions and a set of electric plant accounts. Each electric plant account description contains a listing of typical items of electric property that should be included in that specific account. However, it should be clearly understood that the items listed are not necessarily "units of property" as previously listed in Part 116 or as described in this update; the listing is merely to provide guidance for proper classification.

The Federal Power Act, for public utilities and licensees, defines units of property required to be used in accounting for additions, retirements, and replacements of electric plant. The accounting is to be in accordance with Electric Plant Instruction 10, Additions and Retirements of Electric Plant, found in Part 101. In general, property is to be considered as consisting of (1) retirement units, and (2) minor items of property.

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 1	Air Compressor and Motor	Adopted USACE service life.	335, 353, 398	35	35	Station Air System, excluding compressors 100 cfm and over 50 Air Compressors and motor, complete, 100 cfm or over 25
Justification No. 2	Arrester, Surge (Lightning)	No change	353, 356, 358	35	35	35
Justification No. 3	Inverter Type Battery Charger	Changed name from Battery Charger, 24 Volts and Above toe Distribution Boards	334, 353	20	20	20
Justification No. 4	Battery Bank, 48-Volts and Above	Added various types of batteries with varying service lives	334, 353	15	15	Multiple
Justification No. 5	Boom	Adopted USACE service life from >50 to 25 years	332	Exceeds 50	Exceeds 50	25
Justification No. 6	Bridge	Adopted AASHTO standards service life. Changed service life N/A to 75	336, 359	N/A	N/A	75
Justification No. 7	Building	Category 1 adopted USACE (General Bldgs.) of 100 years. Category 2 – no change Category 3 title changed from Maintenance to Fiberglass, Framed, and Modular Buildings with a service life now of 25 years.	331, 352	Cat. 1 Exceeds 50 Cat. 2 50 Cat. 3 Maint.	Cat. 1 Exceeds 50 Cat. 2 50 Cat. 3 25	Cat. 1 100 Cat. 2 50 Cat. 3 25
Justification No. 8	Cable–Power, Generator, and Pump Motor	No change from 2005	334	50	40	40
Justification No. 9	Cable System, Communication	No Unit of Property referenced. Justification No. 9 Communication cables are not a separate unit of property.	397	Metallic N/A Fiber Optic N/A	Metallic N/A Fiber Optic N/A	Metallic N/A Fiber Optic N/A

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 10	Cable System, Control	No Unit of Property referenced Justification No. 9. Not a unit of property.	334, 353	Metallic N/A Fiber Optic N/A	Metallic N/A Fiber Optic N/A	Metallic N/A Fiber Optic N/A
Justification No. 11	Capacitor Bank, Shunt and Series	No change	353	25	25	25
Justification No. 12	Carrier Wave Trap (Tunable and Non-Tunable)	Adopted USACE service life of 35 years	397	20	20	35
Justification No. 13	Circuit Breaker, Power	Add breakout of Circuit Breaker Types - Air Magnetic/Air Blast, Oil Tank Type, SF6 Type, Vacuum Type	353	35	35	Air Magnetic/Air Blast 45 Oil Tank Type 50 SF6 Type 50 Vacuum Type 50
Justification No. 14	Closed Circuit Television (TV) and Security Systems (previously titled Television System, Closed-Circuit)	No change from 2005	397	15	10	10
Justification No. 15	Communication Tower with Passive Antenna and Active Antenna (previously titled Antenna Tower, Radio or Microwave, including Billboard Type Reflectors)	No change from 2005	397	40	Comm Tower w/Passive Antenna 40 Active Antenna 20	Comm Tower w/Passive Antenna 40 Active Antenna 20
Justification No. 16	Conductor, Underground Insulated (15 kV and above)	No Change	358	15–35 kV 40 Above 35 kV 25	15–35 kV 40 Above 35 kV 25	15–35 kV 40 Above 35 kV 25
Justification No. 17	Control and System Protection Equipment (previously titled 19" rack-mounted panel w/components)	No change	334, 353	15	15	15
Justification No. 18	Coupling Capacitor Voltage Transformer (CCVT) (69 kV and Above)	No change from 2005	353	25	30	30

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 19	Crane, Hoist, Derrick, and Cableway	Adopted USACE service life changed Exceeds 50 to 50 years.	331, 335, 353, 398	Cat. 2 Buildings 50 Others Exceeds 50	Cat. 2 Buildings 50 Others Exceeds 50	Cat. 2 Buildings 50 50
Justification No. 20	Dam, Storage	Adopted USACE service life of 100 years	332	Exceeds 50	Exceeds 50	100
Justification No. 21	AC and DC Distribution Boards and Breaker Panels (480v or less)	Change from DC Distribution Board	331, 332, 334, 353, 353	N/A	N/A	30
Justification No. 22	Digital Fault Recorder (previously titled Fault Recorder and Master Station)	No change from 2005	334, 353	10	15	15
Justification No. 23	Engine Generator Set, Auxiliary	USACE uses 40 years, SME determined to use 35 years.	334, 353	40	35	35
Justification No. 24	Exciter, Electric Prime Mover (1,500 hp or Larger)	Break out analog and digital exciter for synchronous motors	No Comparable FERC Acct.	45	45	Analog 30 Digital 15
Justification No. 25	Exciter, Generator	Break out Rotating, Static Excitation - Analog, Static Power Section, Digital, and Supply Transformer	333	45	45	Rotating 40 Static Excitation System-Analog 30 Static Power Section 30 Digital 15 Supply Transformer 40
Justification No. 26	Fiber Optic Cable, Optical Ground Wire (OPT-GW), and All Dielectric Self Supporting (ADSS)	No change from 2005	397	—	Wood 50 Steel 50	Wood 50 Steel 50
Justification No. 27	Fiber Optic Multiplexer	No change from 2005	397	—	10	10
Justification No. 28	Flume	Not deleted as recommended by the 2005 report.	332	N/A	N/A	N/A

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 29	Gates and Valves	Adopted USACE service life of 50 years.	Gates–No Comparable FERC Acct., Valves–333	Exceeds 50	Exceeds 50	50
Justification No. 30	Governor	Update Justification to include Mechanical, Oil Pump, Air Compressor, and Digital Governor as separate units. Mechanical 50 (Changed to 50) Oil Pump 40 (added) Air Compressor 20 (Added) Digital Control System 15 (Added) Governor Oil and Lubricating Systems 40 (Added)	333	Exceeds 50	Exceeds 50	Mechanical 50 Oil Pump 40 Air Compressor 20 Digital Control System 15 Governor Oil and Lubricating Systems 40
Justification No. 31	Transformer Monitor and Annunciation System	New addition (Previous No. 31 was merged with No. 63)	331, 332, 334, 352, 353,	N/A	N/A	15
Justification No. 32	Impeller, Pump	Adopted USACE division at 1,499 hp and SME change to service life of 250 to 1499 hp from 30 to 35 years	No Comparable FERC Acct.	250 hp and above 35 Below 250 hp and Deep Well Type Maint.	250 hp and above 35 Below 250 hp and Deep Well Type Maint.	250-1,499 hp 35 1,500 hp or more 40 Below 250-hp and Deep Well Type Maint.
Justification No. 33	Interrupter Switches with Fault Clearing Capability	No change from 2005	353	25	20	20
Justification No. 34	Motor (Engine) Generator Set, Communication	No change	397	15	15	15
Justification No. 35	Penstock, Intake and Discharge Pipe	Adopted USACE service life of 100	332	Exceeds 50	Exceeds 50	100
Justification No. 36	Phase Shifting Transformer (previously titled Phase Angle Regulator)	Adopted USACE service life. Change service life from 40 to 45 years	353	40	40	45

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 37	Pipeline	Adopted USACE service life. Change service life from >50 to 100	332	Exceeds 50	Exceeds 50	100
Justification No. 38	Pressure Regulator and Energy Absorber	Changed to 45 year life to agree with turbine runner replacement (normally replaced about the same time as the turbines)	333	Exceeds 50	Exceeds 50	45
Justification No. 39	Prime Mover, Fuel-Type	No change	No Comparable FERC Acct.	Low Speed, 250 hp and above 40 Low Speed, below 250 hp 25 High Speed 25	Low Speed, 250 hp and above 40 Low Speed, below 250 hp 25 High Speed 25	Low Speed, 250-hp and above 40 Low Speed, below 250 hp 25 High Speed 25
Justification No. 40	Radio Transmitter and/or Receiver Set, Microwave/Multi-Channel (previously titled Transmitter and/or Receiver Set, Microwave/Multi-Channel Radio)	No change	397	10	10	10
Justification No. 41	Reactor (Dry Air Core or Oil Immersed)	No change	353	Dry Air Core (Single or 3-Phase Unit) 25 Oil Immersed (Single or 3-Phase Unit) 35	Dry Air Core (Single or 3-Phase Unit) 25 Oil Immersed (single or 3-Phase Unit) 35	Dry Air Core (Single or 3-Phase Unit) 25 Oil Immersed (single or 3-Phase Unit) 35
Justification No. 42	Roof Covering	No change	331, 352	20	20	20
Justification No. 43	Rotor Winding, Electric Prime Mover (250-hp and Above)	No change	No Comparable FERC Acct.	50	50	50
Justification No. 44	Rotor Winding, Generator	No change	333	50	50	50

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 45	Runner, Hydraulic Turbine Prime Mover	Changed to break out 250-hp (186 kW) to 1,499 hp 30 years Pump Turbine Runner 1,500 hp or more – 40 years Below 250-hp – Maintenance	No Comparable FERC Acct.	Below 250-hp Maint. 250-hp and above 50	Below 250-hp Maint. 250-hp and above 50	250-1,499- hp 30 1,500 -hp or more 40 Below 250-hp Maint.
Justification No. 46	Runner, Turbine	Changed to break out Generator Turbines 45 Pump/Generator Turbine 1,500 -hp or greater 50	333	Runner 50 (See Just. No 79)	Runner 50 (See Just. No 74)	Generator Turbine 45 P/G Turbine 50
Justification No. 47	Sequential Event Recorder System (SER)	No change from 2005	397	10	15	15
Justification No. 48	Solar Collector Systems	No change	331, 352	15	15	15
Justification No. 49	Solar-Photo Voltaic Power Supply	No change	397	15	15	15
Justification No. 50	Speed Increaser	Changed service life from 35 years to 20 years	333	35	35	20
Justification No. 51	Stator Winding, Electric Prime Mover	Adopted USACE division at 1,499 hp and SME change to service life for 250 to 1499 hp from 30 to 35 years	No Comparable FERC Acct.	Above 10,000-hp 25 250-hp–10,000-hp 35 Below 250-hp Maint.	Above 10,000-hp 25 250-hp–10,000-hp 35 Below 250-hp Maint.	250-1,499- hp 35 1,500- hp or more 25 Below 250-hp Maint.
Justification No. 52	Stator Winding, Generator	Add Above 11.5 kV, below 11.5 kV and Stator Core above 11.5 kV.	333	11.5 kV and above 25 11.5 kV and below 50	11.5 kV and above 25 11.5 kV and below 50	11.5-kV and above windings 30 Below 11.5-kV 50 Stator core iron, 11.5-kV and above 50 Stator core iron, below 11.5-kV 100
Justification No. 53	Steel Structure, Steel Pole, or Concrete Pole Transmission Line Section	Changed to break out differing pole materials.	354, 355, 356	50	50	Steel 50 Timber 50 Foundations, Footings, Tunnels, Duct Lines, Manholes 50
Justification No. 54	Structure, Diversion	Adopted USACE service life of 100 years	332	Exceeds 50	Exceeds 50	100

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 55	Supervisory Control and Data Acquisition (SCADA)/Energy Management System (EMS)	USACE added Life Cycle Design service life of 40 years	397	Master 10 RTU 10	Master 10 RTU 10	Master 10 RTU 10 Life Cycle Design 40
Justification No. 56	Surge Tank, Steel Surge Chamber and Storage Tank	Adopted USACE service life of 50 years	332	Exceeds 50	Exceeds 50	50
Justification No. 57	Switch, Disconnecting (69-kV and above)	Adopted USACE service life of 50 years	353, 356	35	35	50
Justification No. 58	Switching Equipment	Circuit Breaker—unit, complete with accessories changed to 45 Motor Control Switchgear – associated with units 3,000-hp (2,240 kW) and above 35 Circuit Breaker—Main Station Service, complete 35 Control Panel 35	334	35	35	Circuit Breaker 45 Motor Controlled 35 Station Service 35 Control Panel 35
Justification No. 59	Switchyard/Substation Supports and Structures (previously titled Supports and Structures)	Adopted USACE service life of 50 years	353	Steel Structures Exceeds 50 Timber Structures Maint.	Steel Structures Exceeds 50 Timber Structures Maint.	Steel Structures 50 Timber Structures Maint.
Justification No. 60	Telephone system	No change	397	10	10	10
Justification No. 61	Thrust Bearing, Electric and Hydraulic Prime Movers	No change	No Comparable FERC Acct.	Maintenance	Maintenance	Maintenance
Justification No. 62	Thrust Bearing, Generator	Adopted USACE service life of 50 years. USACE includes bearing cooling system as a separate component.	333	Exceeds 50	Exceeds 50	50

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 63	Thyristor Valve Banks–HVDC (High Voltage Direct Current) and SVS (Static Var Systems) (previously titled Thyristor Valves–HVDC and SVS)	Merge with Justification No. 31	353	35	30	30
Justification No. 64	Transformer, Grounding	Adopted USACE service life of 45 years.	353	40	40	45
Justification No. 65	Transformer, Instrument–69-kV and Above	Adopted USACE service life	353	25	30	45
Justification No. 66	Transformer, Main Power	Adopted USACE service life	353	40	40	45
Justification No. 67	Transformer, Mobile Power	No change	353	40	40	40
Justification No. 68	Transformer, Station Service	No change from 2005	334, 353	30	35	35
Justification No. 69	Transmitter and/or Receiver Set, Power Line Carrier	No change	397	15	15	15
Justification No. 70	Transmitter and/or Receiver Set, Single Channel Radio	Service life changed from 10 to 25 years	397	10	10	25
Justification No. 71	Trash racks	Adopted USACE service life to 40 years for FERC 331 and 75 for FERC 332	332	Exceeds 50	Exceeds 50	FERC 331 40 FERC 332 75
Justification No. 72	Uninterruptible Power Supply System (UPS)	No change	335, 397	10	10	10
Justification No. 73	Voltage Regulator	No change	353	40	40	40
Justification No. 74	Wearing Rings, Runner	No change	333	20	20	20
Justification No. 75	Wood Pole/Structure Transmission Line Section	No change from 2005	335, 356	40	50	50

Table 3. Summary of Changes To Units of Property and Service Lives (1995 to 2017)

Justification No.	Units of Property	Service Life and Comments	FERC Account(s)	1995 Life (years)	2005 Life (years)	2017 Life (years)
Justification No. 76	Plant Items merged from the USACE ER-37-1-30	USACE service life was adopted	Multiple	N/A	N/A	Multiple
Justification No. 77	Items added for plant Life Safety and Security	Submitted by Reclamation Security, Safety, and Law Enforcement Office	334	N/A	N/A	Multiple
Justification No. 78	Flow Meter System	New Unit of Property	331, 333	N/A	N/A	15
Justification No. 79	Machine monitoring system (vibration, air gap, partial discharge, etc.)	New Unit of Property	333	N/A	N/A	15

Table 4. Obsolete Units of Property and Service Lives (1995 to December 2017)

Old Ref. No.	Combined Units of Property	Service Life and Comments	FERC Account(s)	1995 Life	2005 Life	2017 Life
16	Computer System, Control (see Justification No. 55 - SCADA)	Added life cycle design	397	N/A	N/A	40
17	Conductor, Overhead (see Justification No. 53 and Justification No. 75)	Combined with Transmission Lines, Ref. Nos. 53 & 75, which are redefined to better reflect current O&M practices	356	Wood 40 Steel 50	N/A	50
21	DC Distribution Board	Deleted, Combined with Justification No. 3	334, 353, 397	25	25	25
22	Data-Logging System - Intrasite (for intersite see Justification No. 55)	This item is included with Supervisory Control and Data Acquisition (SCADA) systems, Ref. No. 58	334, 353	N/A	N/A	N/A
31	Ground Wire, Overhead (see Justification No. 53 and Justification No. 75)	Combined with Transmission Lines, Ref. Nos. 53 & 75, which are redefined to better reflect current O&M practices	356	Wood 40 Steel 50	N/A	N/A
31	High Voltage Direct Current (HVDC) and Static Volt Ampere-Reactive Systems (SVS) Combined with Justification No. 63	Merged with No 63		See Ref. No. 35 (Thyristor Valves)	See Justification No. 63	See Justification No. 63
40	Pole or Structure, Steel or Concrete	Combined with Transmission Lines, Ref. No. 53, which is redefined to better reflect current O&M practices	355	Steel or Concrete Pole Structure 50	N/A	50
41	Pole or Structure, Wood	Combined with Transmission Lines, Ref. No. 75, which is redefined to better reflect current O&M practices	355	Wood 40	N/A	50
56	Steel Tower Structure	Combined with Transmission Lines, Ref. No. 53, which is redefined to better reflect current O&M practices	354, 355, 356	50	50	50
	Obsolete Units of Property					
36	Oscillograph	Recommended that oscillographs be deleted as a unit of property	334, 353	15	N/A	N/A

Table 5. Unit of Property/Plant Item

Unit of Property/Plant Item	Table 7 Item Number(s)
A	
AC Distribution Board	445, 514
Accessory Electrical Equipment – Power Plants and Pumping Plants (For plants with multiple units totaling 1,500-Hp and above. Use the following Units Of Property as they apply.)	425
Acquisitions	2
Building, Administration	91
Air Compressor, complete, 100 cfm and over	282
Air Compressor, complete, primarily for draft tube water depression while condensing	416
Air Compressors and motor, complete, 100 cfm or over	510, 599
Air Compressors, complete, 100 cfm and over	74, 189, 253, 307, 335
Air Conditioning System	596
Air Coolers and their piping furnished as part of a generator (main units only)	422
Ambulances (heavy) - Group DI	629
Ambulances (light) - Group D	628
Analog Excitation System for Synchronous Motors	199
Annunciator System, excluding Switchboard mounted equipment	431
Antenna Tower (Passive) – Reflector mounted on a hillside or mountain top to redirect the signal	538
Antenna Tower, Radio, Including Billboard-Type Reflectors	533
Antenna Tower Microwave (Active), including Billboard Type Reflectors	537
Antenna Towers, 80-feet and higher	457, 604
Applications	699
Apron, downstream	243
Arresters, Surge (lighting)—3-phase installation, 69-kV and above	582
Athletic Field Structures and Improvements	134
Auxiliary Equipment	504
Auxiliary Power Supply System	511
Auxiliary Power Supply System, Engine Generator Set 100 kW and over, complete with accessories	442
B	
Back Hoes, excluding Back Hoe attachments for general purposes Tractors or Cranes	673
Balanced Magnetic Switch (BMS)	715
Barges, Mooring	619

Unit of Property/Plant Item	Table 7 Item Number(s)
Barges, or Floating Work Platforms	622
Barrier Actuator/Controls	710
Barrier Structural Components	711
Basic Features	181, 353, 360
Basic Features, excluding other principal items	229, 264, 287, 315
Basic Structure	25
Battery - Hydrogen Fuel Cell	521
Battery - Nickel Cadmium (NiCad)	451, 520
Battery - Valve Regulated Lead Acid	449, 518
Battery - Vented Lead Acid	519
Battery - Vented Lead Acid (flooded)	450
Battery Bank, 48-volts and above	448, 517
Battery Charging System	453, 522
Battery Switchboards, including attached accessories	443
Bearings, Main	391
Board or panel, Control—devoted to a single purpose, with accessory electric equipment	439
Boat, Outboard, excluding Motors	623
Boats (Derrick) or Barges	617
Boats (Drill) or Barges and Jet-probing Barges	616
Boats (Maneuver)	618
Boats (Patrol)	614
Boats (Snag)	615
Boats (Tow)	613
Boats (Tug)	610
Bridge and Trestles steel, concrete, or masonry	221
Bridge and Trestles wood - covered	222
Bridge and Trestles wood - un-covered	223
Bridges, Concrete, Steel or Masonry	215, 220
Building, except roof covering (Category 1 defined in Justification 7)	27
Buildings for General Public Safety Needs	142
Buildings, Community	93
Buildings, concrete, excluding replaceable roof coverings	60, 131, 182, 354
Building, Municipal	92
Building, Operating - Concrete (excluding replaceable roofs)	320
Building, Office	90
Buildings, Operating - other than concrete, not part of lock structure, excluding control houses, excluding replaceable roofs	330

Unit of Property/Plant Item	Table 7 Item Number(s)
Buildings, other than concrete excluding replaceable Roof Coverings	61, 356, 132, 184
Bulkhead or stop logs (Steel)	247
Bulkhead or stop logs (Wood)	248
Bulkheads	231
Bulkheads and retaining walls	338
Bus and Insulations, including mounting hardware	159
Bus and Insulators—Cable or Pipe Type	476
Bus Support or Terminal Structure	153
C	
Camera Thermal	728
Camera Visible Light - Fixed	726
Camera Visible Light - PTZ	727
Capacitor Bank, Series—Assembly includes a single phase series-parallel grouping of capacitor units with capacitor steel racks, supporting insulators, and a set of protective equipment, i.e., relays, controls, bypass gap assembly, shorting and load break switch, damping equipment, fuses, and protective devices.	495
Capacitor Bank, Shunt—Bank includes a 3-phase series-parallel grouping of capacitor units with capacitor steel racks and supporting insulators.	494
Capacitors	493
Card Reader	717
Carrier Current Communication (Power Line Carrier)	544
Carrier Current Line Traps	173
Carrier Wave Trap (tunable and non-tunable)	547
Carryalls (including Station Wagons mounted on Truck Chassis) Group E1	631
Central Processor or Computer with associated main memory, central processing unit, and back-up storage devices, Include intersite data-logging system.	550
Central Processor, electronic control installation	468
Channels, waste way structures, overchutes, runoff water collection systems, culverts for passing flood flows	371
Circuit Breaker Oil System, which includes Storage, Pumps, Piping and Purification Facilities	525
Circuit Breaker—Main Station Service, complete	438
Circuit Breakers and Operating Mechanisms	486
Circuit Breakers, 15-kVA and over	170
Circuit Breaker—unit, complete with accessories	436
Clearing	18
Clearing and Cutting Danger Trees	20

Unit of Property/Plant Item	Table 7 Item Number(s)
Clearing Land and Right-of-Way	19
Clearing Substation and Switching Area	21
Clearing Transmission Line Land Right-of-Way	22
Communication Cable	175, 462
Components (Other) not listed elsewhere	183, 363, 412
Compressed Air System complete with attached accessories	508
Compressed Air System, excluding compressors 100 cfm and over	267, 300, 326, 251
Concrete foundations, piers, settings, and supports for equipment	473
Concrete or steel flumes	348
Concrete Pole Structure with appurtenant fixtures and hardware (including Footings and Foundations)	566
Concrete Structures (Other)	355
Conductor, Underground, 15-kV through 35-kV. Solid dielectric insulated cables in a replaceable section.	579
Conductor, Underground, above 35-kV Oil and Gas insulated cables in a replaceable section.	580
Conductors - on steel towers or steel or concrete poles	573
Conductors - on wood poles or structures	572
Conduit, Steel, Power and Control	161
Construction Cost, including payments for relocation by owner	17
Control and auxiliary switchboards, including attached accessories (excluding applicable items listed below), complete, devoted to a single purpose	460
Control and System Protection Equipment	454
Control and System Protection Equipment, complete, devoted to a single purpose	440
Control Cable	463, 176
Control House, separate from lock structure	319
Controller Panel	703
Coupling Capacitor Voltage Transformer (CCVT) (69-kV and above)	496, 546
Coupling Capacitors, including auxiliary equipment	172
Cranes and Hoists (All Other)	601
Cranes, Hoists, Derricks, and associated cableways.	506
Crane, Hoist, Derrick, Or Cableway when replaced with Building, Category 2.	103
Cranes, complete (excluding mobile and crawler types)	249, 276, 294, 329
Cranes, Crawler type	669
Cranes, Hoists, Derricks and Cableways, and the machinery or operating them excluding mobile crane and crawler types	45
Cranes, Hoists, etc., and the machinery for operating them	505

Unit of Property/Plant Item	Table 7 Item Number(s)
Cranes, Hoists, etc., and the machinery for operating them (Associated with Category 2 Buildings, excluding Mobile and Crawler types cranes)	600
Cranes, Mobile	667
Cranes, Wheel-mounted, excluding those classified as Automotive Equipment	668
D	
Dam Appurtenances	245
Data Logging Equipment mounted separately from Switchboard	466
Data Transport	704
DC Distribution Board	446, 515
Digital Excitation System for Control System	410
Digital Excitation System for Synchronous Motors	200
Digital Fault Recorder	502
Digital Fault Recorder (Previously titled Fault Recorder and Master Station)	441
Digital Governors - Control System	399
Disconnecting Switches	492
Disconnecting Switches, 15-kVA and over	171
Distribution Boards and Breaker Panels	444, 513
Distribution lines used only for carrying power to dam sites or diversion structures	456
Ditchers, Trenchers, Excavators, and Back fillers, excluding attachments for other basic equipment	675
Docks, Piers, and Moving Facilities	233
Domestic water, plumbing, sewage and disposal system	258
Door Hardware	713
Dormitory	88
Draft tube	384
Drainage System	32, 112
Dredges	609
Drift Collectors	612
Dry-Pipe Fixed Spray Water System for fire protection of Transformers	527
Duplicating and Reproducing Machines initial cost, new, $25,000 or more per unit	687
Dwelling	86
E	
Earth-moving Equipment, initial cost, $25,000 or more per unit	670
Easements, Lesser Interest	4, 10
Electric Distribution System	109
Electric Strike/Release	714

Unit of Property/Plant Item	Table 7 Item Number(s)
Electric System, Power and Lighting	138
Electric Type Prime Movers (Motors)	195
Electronic calculators, computer, and related items	686
Electronic Supervisory Control and Data handling equipment	467
Elevator, complete with operating mechanism excluding cab and embedded parts	278, 46, 261, 303, 332
Embankments	244
Embedded turbine parts	385
Embedded turbine parts	392
Encoder / Decoder	729
Engine Generator Set, Auxiliary, 100 kW and over	512
Engine Generator Sets, 100 kW and over	73, 187, 252, 279, 304, 333
Equipment, Miscellaneous	426
Equipment (Miscellaneous) not listed elsewhere, including items initial cost, new, less than $25,000 per unit	684
Equipment (Miscellaneous) not listed elsewhere, including items initial cost, new, less than $25,000 per item (including shelving, storage bins, portable conveyors, dollies, and similar equipment)	689
Equipment (Miscellaneous) Initial cost, new, $25,000 or more per unit	678
Equipment, such as Typewriter, Adding machines, Calculators, Duplicating and Recording Machines, Key Punch Equipment, Electronic Calculators and Computers	683
Excitation Supply Transformer	411
Excitation Systems and Appurtenances	406
F	
Fee Land	3
Fences and fence curbs and other protective works	118
Fiber Driver	707
Fiber Optic Cable, Optical Ground Wire (OPT-GW), and All Dielectric Self Supporting (ADSS)	554
Fiber Optic Multiplexer	555
Filling and emptying valves and operating equipment	324
Fingerling By-pass Channels, Systems applicable and Equipment	79
Fire Protection System	33
Fire Protection System (water and chemical for general station use)	595
Fire Protection System (when forming a part of a structure)	111
Fire Station	95
Fire Trucks - Group N	641

Unit of Property/Plant Item	Table 7 Item Number(s)
Fish Attraction and Guidance Systems; applicable Sonic, Visual, Electrical and Electronic	80
Fish Attraction Water Pumps and Motors under 250 hp	62
Fish Elevator or Fish locks, complete with Operating Mechanism	57
Fish Hatchery Station (Category 2)	51
Fish Ladder Components (Other) not listed elsewhere	56
Fish ladders Structure, including Collection Channel and Training Walls	52
Fish Propagation Facilities not otherwise listed	58
Fish Tapping Station, concrete, complete	77
Fish Tapping Station, timber, complete	78
Fixed-conveyor Systems (Mono-rail, Roller Type) initial cost, new $25,000 or more per system	690
Fixed Shop Equipment (Major) consisting of such items as lathes, sharpers, drying ovens, Forges, pipe, and sheet metal machines, table and band saws, initial cost, new, $25,000 or more, per unit	694
Fixed Shop Equipment (Miscellaneous) not listed elsewhere, including items initial cost, new, less than $25,000 per unit	693
Floating Plant (Miscellaneous), initial cost, new of $25,000 or more per unit	621
Floating Plant (Other Major Non-group)	620
Floating Trash Boom	48
Floating Trash Boom, complete	226
Flow Meter System	208, 421
Flumes, Concrete or Steel	297
Flumes, other than timber	367
Flumes, timber	368
Foundations, Footings, Tunnels, Duct Lines, Manholes	156
Fuel Type Prime Movers	205
Furniture (Decks, Tables, Chairs, Lockers, Files, Map Cases, Bookcases and Safes)	680
G	
Gages and Indicating Equipment	593
Garage	98
Gas System	110
Gate	274
Gate, spillway	239
Gates	292, 317
Gates and Valves	209
Generator, Neutral Grounding Equipment including Neutral Breakers	427
Generator Bus (Main) or Cable System	428

Unit of Property/Plant Item	Table 7 Item Number(s)
Generator Switchgear (Main) and Breakers, including Air Compressors when applicable	435
Governor air compressor, 100 cfm and over	398
Governor oil and lubricating oil systems which includes oil storage, purification, pumps, and piping	400
Governor oil pressure pump, complete for one unit	397
Governors	395
Graders, Self-propelled or Towed	676
Grease and Oil Lubrication Systems for Turbine Operation	418
Ground Wires - on steel towers or steel or concrete poles	576
Ground Wires - on wood poles or structure	575
Grounding System, Including Grounding Mat, if separate from Powerhouse Grounding Mat	165
Grounding System, Including Powerhouse Grounding Mat	432
Grounding Transformers	482
Grounds and Site Improvements	116
Guest house	89
H	
Heating and/or Ventilating System	323
Heating System, Conventional	114
Heating System, Solar	39, 115, 146
Heating, Ventilating and Air-conditioning Systems (HVAC)	31
Heating, Ventilating, Air-conditioning, and Thawing Systems	262
Hospital	96
Housing, Personnel Residence	87
Housing Assembly	389
Hydraulic Type Prime Movers	202
Hydraulic Type Prime Movers, 250-hp (186 kW) to 1,499-hp	203
Hydrogen Fuel Cell	452
I	
Incinerator	113
Instrument Transformer (current, potential, and metering set -69Kv and above)	479
Insulating Oil Storage and Piping System (does not include oil purifiers listed under item 13)	162
Intake Gates	42
Intake Structure (When integral part of Powerhouse)	40
Interrupter Switches	491
Intrusion Detection	718
Inverter - 24 volts and above	447, 516

Unit of Property/Plant Item	Table 7 Item Number(s)
Items (Miscellaneous), initial cost, new less than $25,000 per unit	681
Items (Other) not listed elsewhere	625
Items not listed elsewhere, including Items with initial cost, new, of less than $25,000 per unit	663
L	
Laboratory	85
Land Acquisition Expenses	6, 16
Land Costs (Other)	7
Landscaping, Lawns, Shrubbery	119
Lifecycle Designed System	552
Lifting Beams	41, 250, 277, 296
Lighting and Power Boards for Station Service and Unit Auxiliaries, including Breakers, transformers, and attached Accessories	459
Lighting and Power Boards, complete with attached Accessory Equipment	177
Lighting Arresters, 15-kVA and over per phase	167
Lighting System	34, 68, 108, 160, 257, 271, 298, 325
Lighting, Power and Control Boards complete with attached Accessory Equipment	188
Line Disconnecting Switches, 3-phase, 69-kV or above	569
Load Control Equipment, complete, for entire plant	464
Loaders, excluding attachments for general purpose tractors	674
Locomotives and Railroad Cars	664
M	
Machine Monitoring System (vibration, air gap, partial discharge, etc.)	387, 394
Machinery, Gate Hoist	240
Machinery, Gate Operating	43, 275, 293, 318
Major Structure (Category 1)	26
Major Structures (Miscellaneous), appurtenant to identified properties such as Personnel Housing, Tool Houses, Warehouses, Garages, Shops, Service Centers Laboratories (See Operators Camp Or Village)	143
Major Structures (Other)	140
Material-handling Equipment, initial cost, new, $25,000 or more per unit	677
Matrix Switcher	730
Mechanical Governor	396
Media Converter	706, 731
Microwave Communication	535
Microwave System (main and standby radio-frequency and multiplex equipment)	536

Unit of Property/Plant Item	Table 7 Item Number(s)
Monitor	702
Moorage and Lock Approach Structures Guide Walls, Dolphins and Other Guide Structures, Timber	336
Mooring Dolphins and other facilities for temporary moorage for water-borne traffic	337
Motion Sensors (PIR)	719
Motor (Engine) Generator Set, Communication	534, 539
Motor Control Switchgear – associated with units 3,000-hp (2,240 kW) and above	437
Motorcycles, and Scooters, All Types Group DD	657
Motors, Outboard	624
N	
Needle-valve assembly	390
O	
Office Machines, such as Accounting Machines, Dictating Machines, typewriters, Adding Machines, Key Punch and Electronic Mechanical Data Processors, Electro-Mechanical Calculators, initial cost, new $25,000 or more per unit	685
Oil Purifiers, Fixed or Portable, Centrifugal, vacuum or Clay Treatment, type, 600 GPH or over used for lubricating oil, hydraulic oil or lubricating and insulating oil	592
Oil Purifiers, Portable or Fixed, Centrifugal, Vacuum, or Clay Treatment, with or without Filter Press 600 GPM or over	174
Oil Storage, Handling and Reclaiming System	591
Open waterway structures such as tunnels, check, inlet and outlet transitions for siphons and pumping plants, drops, chutes, etc.	365
Oscillographs (Automatic Recording)	470
Outlet Gate Operating Machinery	242
Outlet Works (Exclusive of Power)	263
P	
Parking Areas	121, 136
Patent rights, licenses, privileges, and other intangible property items necessary or valuable in the conduct of project operations are not subject to replacement.	586
Penstock	291
Penstock Valves Or Gates (Butterfly or slide gate at entrance to scroll case)	414
Permanent Structures adjacent to the Powerhouse or Pumping Plant Building (Category 2) Buildings for General Public Needs, Vista Houses	141
Piers Mooring Facilities, Bulkheads Training Walls, Trash Booms, Timber	357

Unit of Property/Plant Item	Table 7 Item Number(s)
Piers, Docks, and Mooring Facilities: Concrete	120
Piers, Docks, Booms, and Bridges: Timber	139
Pipeline	344
Pipeline and penstock structures including surge tanks, surge chambers, associated storage tanks, and reservoirs	366
Piping Systems (Miscellaneous) and their Auxiliary Equipment	417, 523
Plant communications equipment, including telephone, code call, and voice recording systems	606
Plumbing System	36
Police Station	94
Power (Main), Lighting and Control Boards, complete with attached accessories	334
Power and Lighting Boards, complete with attached accessories	260, 281
Power Breaker Panel (Main) , Lighting and Control Boards, complete with attached accessories	71
Power Cable (Main), 15-kVA and over	164
Power Cables	430
Power Circuit Breaker - Air Magnetic / Air Blast	487
Power Circuit Breaker - Oil Tank Type	488
Power Circuit Breaker - SF6 Type	489
Power Circuit Breaker - Vacuum Type	490
Power Lighting Boards (Main), complete unit with attached accessories	306
Power Line Carrier System (for Telephone Communications)	543
Power Lines, Telephone, Telegraph, Gas, Oil, Water Lines, Buildings, Cemeteries, and Historical Monuments	15
Power Plant Communications Equipment	603
Power Regulating Transformers	481
Power Supply	723
Power Supply and Related	733
Power System, excluding power boards and engine generator sets 100 kW and over	259, 270, 301, 327
Power System (Main), excluding Power Boards, Engine Generator Sets 100-kW and over and Transformers 1,000-kw and over	69
Power Transformers (Main)	478
Power Transformers, 1,000 kVA and over including Auto Transformers	163
Power Transformers (Mobile)	483
Powerhouse and Pumping Plant Structural and General Service Facilities Systems	28
Pressure Maintaining Equipment for insulating media	581

Unit of Property/Plant Item	Table 7 Item Number(s)
Pressure Regulator and Energy Absorber (when included as part of the turbine or scroll case assembly)	413
Prime Mover, Fuel Type, Low Speed below 250-hp (186 kW)	45
Prime Mover, Fuel-Type, Low Speed 250-hp (186 Kw) and above	207
Pump Impeller, 1,500 hp and over	63, 194
Pump Impeller, 250-1,499 hp	64, 193
Pump Motor, Stator Winding (less stator iron), 1,500 hp and over	65
Pump Motor, Stator Winding (less stator iron), 250-1,499 hp	66
Pump Motor, Thrust Bearing, 1,500 hp and over	67
Pump Turbine Runner with 1,500-hp (1,120 kW) prime mover or larger	377
Pump Turbine Runner, 1,500 hp or more	204
Pump, less than 250-hp (186 kW) prime mover	192
Pumps and Prime Movers	191
Pumps and Prime Movers purchased from manufacturer's stock or of standard design and shipped as units with only installation and minor assembly required at the site and those with total plant capacity less than 1,500-hp	589
R	
Radar	720
Radar carriage	721
Radio Communication Fixed Station	530
Radio communications equipment including transmitter, receiver system but excluding land and improvements, buildings, and tower 80 feet and over	340
Radio or Microwave Buildings	458
Radio or Microwave Equipment Buildings	605
Radio Towers, 80 feet and over	331
Radio, Microwave, or Carrier Equipment, complete system at one location including transmitter receiver power supplies, auxiliary generators batteries, cables, and antennas, but excluding land and improvements, buildings, and towers 80 ft. and over	469, 607
Railroad Siding (Powerhouse Spur) Or Railroad, Intrasite	147
Railroads and Appurtenant Structures	13
Railroads and Railroad Sidings	216
Rails	217
Raw Water System for plant equipment cooling	594
Raw Water System including Pumps and Piping for Generator, Air Compressor, and Air Conditioning Equipment, Cooling and Filter Plant	419
Raw Water System which includes Pumps and Piping for Transformer Cooling	526

Unit of Property/Plant Item	Table 7 Item Number(s)
Reactor, Dry Air Core	498
Reactor, Oil Immersed	499
Reactors, Shunt or Series	497
Reactors, Shunt or Series, 15-kVA and over	166
Recording Annunciation mounted separately from Switchboard	465
Recreational Facilities	130
Relocation	8
Relocation of Fee Land Property of Others	9
Relocation of Highways and Roads	12
Relocation of Utilities	14
Remote Terminal Unit, (RTU), Input/Output Device	551
Request to Exit (REX) Device	716
Reservoir Area (Other Items), such as Evaporation Measurement Station and Equipment, Fish and Wildlife Facilities, Docks, Piers, Patrolman's Towers	228
Resettlements and Damages	5, 11
Retaining Walls	122, 232
Riprap and other protective works to the reservoir area	227
Road Beds, Railroad, including Culverts	219
Roads and Trails	212
Roads Including Roadbase, Culverts, Surfacing, Bridges Including Concrete, Concrete, or Masonry	135
Roadway Base Culverts	213
Roadway Surfacing	214
Roadways	361
Rollers, Self-propelled or Towed	672
Roof Covering complete for one building, when made of impervious, bituminous or other types of nonpermanent materials (excluding supports, and insulation)	104
Roof Covering complete for one building, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	144
Roof Covering for one building, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	82
Roof covering, complete for one building	284, 308
Roof Covering, for one building when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	49

Unit of Property/Plant Item	Table 7 Item Number(s)
Roof Covering, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation	152
Roof coverings	75, 339
Roof Coverings complete for one building	190, 358, 133
Rotating Excitation System	201, 407
Rotor 250-hp (186 kW) and above	196
Rotor and shaft	386, 393
Runners - Reaction and Impulse Type and Pump/Turbines	375
S	
Safes, Special Equipment, etc., initial cost, new, $25,000 or more, per unit	682
School	97
Scraper-carriers, Self-propelled or Towed	671
Scroll case assembly	380
Sequential Event Recorder System (SER)	556
Server	700
Service Facilities and Systems in the Dam	256
Sewer System	30, 107, 322
Sewer System, excluding piping	269
Sewer System, packaged unit, excluding piping	302
Sewers, Drainage Facilities, and Other Recreation Developments excluding components listed elsewhere	137
Sewers, drainage facilities, and outfalls	362
Shop	102
Shop Equipment (Portable) and Tools (Miscellaneous) not listed elsewhere, initial cost, new, less than $25,000 per unit	695
Sidewalks and Walkways, Culverts, Curbs, Gutters, etc.	123
Signaling System	35
Sluiceways, including gates, gatehouses, and operating mechanisms	241
Snow Plows, Rotary- Group Q	644
Software /Firmware / Hardware	698
Solar Voltaic Power Supply System, 100 Watts and above	553
Speed Increaser	415
Sprinkling Systems	124
Static Excitation - Power Section Only	409
Static Excitation System	408
Station Air System	597
Station Air System, excluding compressors 100 cfm and over	509, 598
Station Service Main Bus	429

Unit of Property/Plant Item	Table 7 Item Number(s)
Station Wagons (passenger car chassis) Group C	627
Station, Signal, Or Call Communication Equipment (Intrasite)	541
Station-Service Transformer	484
Stator Components	401
Stator core iron, 11.5-kV and above	404
Stator core iron, below 11.5-kV	405
Stator Winding, 1,500 hp or more	198
Stator Winding, 250-1,499 hp	197
Stator, 11.5-kV and above - Stator windings	402
Stator, Below 11.5-kV	403
Steel	154
Steel Access Bridge	265, 288
Steel Structure—fences, platforms, railings, steps, gratings, appurtenant to station equipment	474
Steel Structures, complete (excluding foundations)	158
Steel Structures, Steel Pole, Or Concrete Pole Transmission Line Section	565
Steel Tower Structures with appurtenant fixtures and hardware	560
Stilling Basin	272, 346
Stoplogs	54
Stoplogs and Bulkheads	44, 273, 295, 328, 351
Storage Building	99
Storage Racks (Special) , Bins, Ramps, Platforms, and similar equipment, independent of other Structures, initial cost, new, $25,000 or more per unit	691
Streets and Alleys	125
Streets, Roads and Roadways, Curbs, and Sidewalks intrasite, intended primarily for connecting employee's houses with the power plant, pumping plant, and other structures.	117
Structural and General Service Facility Systems, Grounds and Utilities	105
Structure, Dam (all types including power plant foundation or substructure when constructed integrally with the dam)	236
Structure, Diversion	237
Structure, except roof covering of the types defined below. (Category 2)	151
Structure, excluding Timber Structures	316
Structure, Spillway	238
Structures and Equipment (Miscellaneous)	157
Structures (Category 2 Defined On A-7): Operational Buildings and Structures, other than Concrete, excluding replaceable Roof Coverings	84
Structures and Equipment for Gaging and Water-Level Recording Purposes. (Category 3)	148

Unit of Property/Plant Item	Table 7 Item Number(s)
Supervisory Control and Data Acquisition (SCADA) / Energy Management System (EMS) Proprietary Designed System	549
Surge Protection, 3-phase, 69-kV or above	570
Surge Protection, complete 3-phase set	500
Switchboards, Cubicles, Control Cables, and Appurtenances	501
Switches / Routers	705
Systems, Miscellaneous (Except Solar Heating)	145
T	
Tailrace	350
Tanks (Surge)	290
Telephone Communication	540
Telephone Intercommunication System	542
Tenders	611
Testing facilities installed	455
Thyristor Valve Banks - component of High Voltage Direct Current (HVDC) and Static Var System (SVS)	503
Ties and Ballast	218
Timber	155
Timber Access Bridge	283
Timber Flumes	347
Timber Structure	475, 230
Tool House	101
Tower and fixture foundations and footings	561
Tractors, Crawler, including Bulldozers initial cost $25,000 or more	666
Tractors, Wheel-mounted, initial cost $25,000 or more	665
Trailers and semi-Trailers, 16-30 Ton All Types Group GG	660
Trailers and semi-Trailers, 30 Ton and over, all types - Group HH	661
Trailers and semi-Trailers, 3-15-Ton All Types Group FF	659
Trailers, 1/4-Ton-2 1/2-Ton All Types Group EE	658
Transformer Monitoring and Annunciation System	70, 178, 186, 434, 485
Transformer Oil System which includes Storage Pumps, Piping, ad Purification Facilities	524
Transformer, Regulating	169
Transformer, Station Service, Liquid filled or Air or Gas insulated 1,000-kVA or more in one or more phases (excluding those installed as part of Station Service Power Boards)	433
Transformers	477
Transformers, Instrument, 15-kVA and over, PT and CT	168
Transformers, liquid-filled or air or gas insulated, 1,000 kVA total or more in one or more phases not part of power board	72

Unit of Property/Plant Item	Table 7 Item Number(s)
Transformers, Liquid-Filled or Air or Gas insulated, 1,000-kVA or more in one or more phases	185
Transmitter and/or Receiver Set, Carrier (exclusive of sets used for telephone communications)	545
Transmitter and/or Receiver Set, Multi-Channel Radio	531
Transmitter and/or Receiver Set, Single Channel Radio	532
Trash Racks	47, 254, 280, 305
Trash Rakes and Removal Equipment	255
Trash Removal Equipment	285, 309
Trucks and Fish Transportation Tanks, including refrigeration and aeration equipment, if applicable	76
Trucks and Truck Tractors, 1-1/2-Ton - Group H	635
Trucks and Truck Tractors, 2-1/2-Ton - Group I	636
Trucks and Truck Tractors, Military Design, 1 1/2- Ton-Group X	651
Trucks and Truck Tractors, Military Design, 11- Ton and over -Group BB	655
Trucks and Truck Tractors, Military Design, 2 1/2- Ton-Group Y	652
Trucks and Truck Tractors, Military Design, 3-4- Ton-Group Z	653
Trucks and Truck Tractors, Military Design, 5-10- Ton-Group AA	654
Trucks and Trucks Tractors, 11-Ton and over Group L	639
Trucks and Trucks Tractors, 3-4-Ton-Group J	637
Trucks and Trucks Tractors, 5-10-Ton-Group K	638
Trucks, 1/4-ton, 4x4- Group E	630
Trucks, 3/4 - 1 - Ton - Group G	634
Trucks, Compressor or Welder Mounted - Group T	647
Trucks, Drill Rig - Group R	645
Trucks, Military Design, 1/2-1-Ton- Group W	650
Trucks, Military Design, 1/4-Ton- Group V	649
Trucks, Military Design, Amphibious Group CC	656
Trucks, Mobile Crane - Group S	646
Trucks, Panel and sedan Delivery Group E2	632
Trucks, Pickup - Group F	633
Trucks, Power Line and telephone Construction and Maintenance Group P	643
Trucks, Refrigerator - Group U	648
Trucks, Refuse - Group O	642
Trucks, Wrecker - Group M	640
Tunnels and Water Conduits	266, 289
Turbine Components - Impulse Type	388
Turbine Components - Reaction Type	379
Turbine guide bearings and thrust bearing	383

Unit of Property/Plant Item	Table 7 Item Number(s)
Turbine runner	376
Turbine shaft, including thrust collar and Kaplan control not located in hub	382
TV Closed Circuit	548
U	
Underground Duct Lines, Conduits, and Appurtenances	584
Uninterruptible Power Supply System (UPS)	557, 602
Un-Tanking Tower and Transfer Track	507
Un-Watering and Low-Level Drainage System	590
Use same property items as prescribed for Account 041 - MAIN DAMS, as applicable	311
Use same property items as prescribed for Account 044 - POWER INTAKE WORKS, as applicable	313
V	
Vacuum Cleaning System	37
Valves, Gates and Operating Machinery	55
Vehicle Barrier	709
Vessel Barrier	712
Video Amplifier	724
Video Monitoring System	725
Video Recorder	732
Voltage Regulating Transformers	480
Voltage Regulation and Excitation Equipment including Motor-Generator Set, when required (Main Generation units only)	461
W	
Warehouse	100
Water Conduit (Penstock, Tunnels, Intake, and Discharge Pipe)	343
Water Level	722
Water Level Sensing and Recording Equipment	246
Water Meters and Supply System for a building or for general purposes	106
Water spray sprinkler and carbon dioxide system for fire protection of oil storage and oil purifier rooms	420
Water supply piping, hydrants, and wells	127
Water System	38, 321
Water System, excluding piping	268, 299
Water System, Potable and Raw Water	29
Waterfront Improvements, Docks, Pipers, Wharves, etc.	126
Wearing rings, runner	378
Weirs	53
Wells	345

Unit of Property/Plant Item	Table 7 Item Number(s)
Wicket gate assembly	381
Wildlife Preservation Facilities not otherwise listed	59
Wildlife Refuge Buildings (Category 2)	81
Wireless Transceiver	708
Wood Poles/Structures Transmission Line Section	564
Workstation	701
Y	
Yard Drainage System	128
Yard Lighting System	129

Table 6. Comprehensive List of Maintenance Items

Maintenance	Table 7 Item Number(s)
A	
accessories	73, 147, 164, 187, 216, 252, 279, 304, 333, 428, 429, 430, 442, 512
accumulators	400
adjustment unit	172, 496, 546
air compressors	436
air conditioning	51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
air vent	413
alarm	33
alarm system	595
alarms	111
amortisseur winding	65, 66, 196, 197, 198, 386, 393
analog-to-digital converters	441
anchors	48, 226, 357, 560, 564
anemometers	228
antennas	331, 340, 457, 469, 533, 537, 538, 604, 607
appurtenant -structures	216
armature	201
armature field pole	407
armor rods	575, 576
arms	566
asbestos cement	291, 343, 344
asphalt	123
auxiliary generators	340, 469, 607
B	
backfill	27
baffle	389
ballast	34, 68, 69, 108, 129, 138, 147, 160, 216, 257, 271, 298, 325
bank protection	212
batteries	340, 469, 607
battery	534, 539, 542, 553
battery bank	602
battery cells	449, 450, 451, 518, 519, 520
battery charger	553
beams	247, 475
bearing	67, 45, 207, 383, 589, 589
bearings	45, 193, 194, 199, 200, 201, 203, 204, 240, 242, 274, 275, 292, 293, 318, 377, 381, 407, 415, 461

Maintenance	Table 7 Item Number(s)
bell crank	413
bells	35
blade	376
blade control valve	396
blades	569
bleachers	134
block	45, 207, 600
blocks	45, 103, 118, 249, 276, 294, 329, 505
blow offs	291, 343, 344
bolts	376
bottom ring	380
braces	560, 564
bracket arms	565
brackets	560, 564
brake air pressure gage	396
braking ring	386, 393
breaker	34, 68, 69, 108, 129, 138, 160, 257, 271, 298, 325
breaker draw out unit	438
breakers	445, 446, 514, 515
brick	584
bridge fans	408, 409
bridge traveling	45, 103, 118, 249, 276, 294, 329, 505, 600
bridges	408, 409
brushes	65, 66, 196, 197, 198, 199, 200, 201, 386, 393, 407, 461
buckets	376
bulb	34, 68, 69, 108, 129, 138, 160, 257, 271, 298, 325
bulbs	431
bulkheads	590
burners	113
bus	164, 428, 429, 430
bus equipment	476
buses	494, 495
bushing	498, 499
bushing current transformer	170, 436, 438, 486, 487, 488, 489, 490
bushing potential device	170, 486, 487, 488, 489, 490
bushings	72, 163, 169, 170, 185, 433, 436, 438, 478, 481, 483, 484, 486, 487, 488, 489, 490
bypass valves	414

Maintenance	Table 7 Item Number(s)
C	
cabinets	111, 595
cable racks	156
cable tunnel	156
cable vault	584
cables	48, 109, 164, 226, 240, 242, 247, 274, 275, 292, 293, 318, 340, 357, 428, 429, 430, 469, 476, 506, 541, 542, 601, 606, 607
cableway	148, 365
camera	548
camera main tube	548
capacitor unit	172, 494, 495, 496, 546
capacitors	503, 531, 532, 536, 543, 545
car	148, 365
case	193, 194, 203, 204, 377, 380
casing	127, 345
cathodic protection equipment	291, 343, 344
cement slab	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
chains	48, 226, 247, 357
charger	542
check structures	365
chutes	365
circuit breaker	71, 177, 188, 260, 281, 306, 334, 443, 459
circuit breakers	444, 456, 513
circuit card	410
circuit cards	70, 178, 186, 208, 387, 394, 408, 421, 434, 485, 548, 551, 555, 557
clock	439, 440, 465, 466, 501, 502
CO2 cylinders	33, 111
coaxial cable	172, 496, 531, 532, 536, 543, 546, 548
coil	72, 163, 169, 185, 401, 402, 403, 433, 478, 481, 483, 484, 498, 499
collector rings	386, 393
collectors	39, 146
column section	589
communication cable	175, 462
communications interface equipment	441
commutator	199, 200, 201, 407, 461
compensating mechanism	396
complete set for one unit	392
components	522

Maintenance	Table 7 Item Number(s)
components of set of protective equipment	495
composition	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
compressed air system	170, 486, 487, 488, 489, 490
compressor	74, 189, 253, 282, 300, 307, 326, 335, 398, 416, 500, 510, 599
compressors	31, 262, 323
computer-type printers	441
concrete	27, 42, 122, 123, 126, 156, 227, 238, 239, 241, 273, 584
concrete pad for pumping units	345
condensers	31, 262, 323
conductors	109, 476
conduit	72, 156, 163, 164, 169, 185, 428, 429, 430, 433, 478, 480, 481, 482, 483, 484
conduit envelope	584
cone	376
connecting rod	45, 207, 381, 413
connectors	48, 226, 357, 476, 494, 498, 499, 503, 570, 575, 576, 582
consoles	551
contactor	71, 177, 188, 199, 200, 201, 260, 281, 306, 334, 407, 443, 444, 459, 461, 513
contacts	170, 436, 438, 486, 487, 488, 489, 490, 491
control cable	176, 463
control device	71, 177, 188, 260, 281, 306, 334, 443, 459
control devices	72, 163, 169, 185, 433, 439, 440, 444, 454, 465, 466, 478, 480, 481, 482, 483, 484, 501, 502, 513, 581
control equipment	209, 414, 503
controls	31, 31, 32, 33, 37, 45, 67, 74, 103, 111, 112, 118, 128, 189, 249, 251, 253, 262, 262, 267, 276, 282, 294, 300, 307, 323, 323, 326, 329, 335, 383, 391, 396, 398, 416, 500, 505, 506, 509, 510, 548, 596, 598, 599, 600, 601
cooling equipment	72, 163, 169, 185, 433, 478, 480, 481, 483, 484
cooling system	67, 383, 391
core	72, 163, 169, 185, 433, 478, 481, 483, 484, 498, 499
crankshaft	45, 207
cross arms	155, 456, 560, 564
crystals	531, 532, 536
cubicles	551
culverts	125, 212, 216
current breaker	454
current transformer	199, 200, 201, 407, 461

Maintenance	Table 7 Item Number(s)
D	
dam deck	236
damping devices	575, 576
dashpot	413
deflectors	390
devices wiring	455
digital clock	556
dike	353
diode	199, 200, 201, 407, 461
discharge pit liner	389
disconnect	171, 492
disconnecting switches	164, 428, 429, 430
disk drives	441
disposal facilities	30, 107, 137, 269, 302, 322, 362
distributing frame	541, 606
distribution system	38, 106
distribution transformer	34, 68, 69, 108, 129, 138, 160, 257, 271, 298, 325
distribution transformers	109
doors	27, 51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
draft tube liner	384
drain inlets	365
drainage connections	584
drains	27, 32, 112, 128, 156, 236
drive motors	396
drops	365
drying oven	418, 524, 525, 591
ducts	31, 156, 262, 323, 596
E	
embankment of waterway	353
embedded gantry crane rails	236
embedded metal gates guides	236
embedded parts	42, 238, 239, 241, 273
embedded penstock	236
engine	73, 187, 252, 279, 304, 333, 442, 512, 534, 539
equipment	134, 548
evaporation pans	228
extension arms	564
extinguisher	33

Maintenance	Table 7 Item Number(s)
F	
facing plate	380
fans	31, 37, 262, 323, 386, 393, 596
feeding areas	228
fencing	147, 216
field circuit breaker	199, 200, 201, 407, 461
field pole	65, 66, 196, 197, 198, 199, 200, 201, 386, 393
filter pads	418, 524, 525, 591
filters	38, 106, 400, 531, 532, 536, 543, 545
fittings	164, 414, 415, 418, 419, 420, 428, 429, 430, 476, 524, 525, 526, 527
fixture	34, 68, 69, 108, 129, 138, 160, 257, 271, 298, 325
flashings	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
floats	126, 228, 246
flooring	27, 51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 215, 220, 221, 222, 223, 265, 283, 288, 320, 330, 354, 356, 458, 605
footings	290, 291, 343, 344, 347, 348, 366, 367, 368, 565, 566
foundation grouting	236
foundations	27, 51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 215, 220, 221, 222, 223, 265, 283, 288, 320, 330, 331, 354, 356, 457, 458, 533, 537, 538, 565, 566, 604, 605
frame	170, 407, 436, 438, 461, 486, 487, 488, 489, 490
frames	236, 503
fuel cell	452, 521
fuses	199, 200, 201, 407, 461, 494, 495, 531, 532, 536, 543, 545
G	
gages	67, 383, 391, 396, 581
gate components	239
gate limit	396
gate operating ring	381
gate seals	42, 238, 239, 241, 273
gate section	42, 238, 239, 241, 273
gates	228, 290, 291, 343, 344, 366
gears	415
generator	73, 187, 252, 279, 304, 333, 442, 512, 534, 539
generator braking control	396
generator neutral system	164, 428, 429, 430
girders	215, 220, 221, 222, 223, 265, 283, 288
glands	589
gongs	35

Maintenance	Table 7 Item Number(s)
governor ball head mechanism	396
grass	119
grating	27, 31, 113, 262, 323, 596
gravel	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
gravel pack	345
grease pump	381
grilles	31, 262, 323, 596
grounding connection	154
grounding mat	27
grouting	27
guardrails	215, 220, 221, 222, 223, 265, 283, 288
guards	147, 212, 216, 560
guides	42, 238, 239, 241, 273
guy clamps	564
guy guards	564
guy insulators	564
guys	331, 457, 533, 537, 538, 560, 564, 604
H	
handling equipment	113
handrails	236
hard/floppy disks	550
hardware	155, 331, 457, 533, 537, 538, 604
hatch covers	236
head	396, 564
head cover	193, 194, 203, 204, 377, 380
heads	124
heating ventilating	51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
hoist	240, 242, 274, 275, 292, 293, 318
horns	35
hose	33, 111, 595
housing	67, 148, 164, 383, 415, 428, 429, 430
hub	376
HVAC	51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
hydraulic system	170, 486, 487, 488, 489, 490
hydraulic-operating-mechanism	209, 240, 242, 274, 275, 292, 293, 318, 414
I	
impeller	589
impeller parts	193, 194, 377

Maintenance	Table 7 Item Number(s)
indicating lights	551
indicators	396
inlet	365
instrument	71, 177, 188, 260, 281, 306, 334, 443, 459
instrument transformers	164, 428, 429, 430
instruments	439, 440, 444, 454, 465, 466, 501, 502, 513
insulating materials	579, 580
insulator pins	564
insulators	109, 164, 428, 429, 430, 456, 476, 491, 579, 580
interconnected wiring	557
interior partitions	27
interrupting elements	171, 492
inverter-regulator	602
J	
joint connector	579, 580
joints	156, 236
K	
keyboards	441
keys	376
L	
ladders	236, 290, 291, 343, 344, 366, 560
leaf	42, 209, 238, 239, 241, 273, 414
lighting	156
lighting facilities	109
lighting system	584
lights	35, 134
limit switches	396
line tuning unit	172, 496, 546
linings	290, 291, 343, 344, 366
linkage	381
load ratio control equipment	72, 163, 169, 185, 433, 478, 481, 483, 484
logic circuit boards	431, 556
logs	48, 226, 357
louvers	31, 262, 323, 596
lubricating system	193, 194, 203, 204, 377, 415
M	
manholes	30, 38, 106, 107, 137, 269, 290, 291, 302, 322, 343, 344, 362, 366, 584
measuring structures	365
memory assemblies	441

Maintenance	Table 7 Item Number(s)
memory cell	556
mercury	246
metalwork	156
meters	38, 106, 439, 440, 465, 466, 501, 502
microphone	541, 606
microprocessors	441
motion recorder	413
motor	396
motor generator	444, 513
motor winding	589
motors	30, 31, 31, 32, 37, 38, 45, 67, 74, 103, 106, 107, 112, 118, 128, 137, 189, 209, 240, 242, 249, 253, 262, 262, 269, 274, 275, 276, 282, 292, 293, 294, 300, 302, 307, 318, 322, 323, 323, 326, 329, 335, 362, 381, 383, 391, 398, 414, 416, 418, 419, 420, 436, 436, 500, 505, 506, 510, 524, 525, 526, 527, 591, 596, 599, 600, 601
motors operating mechanism	240, 242, 274, 275, 292, 293, 318
N	
needles	390
nesting	228
nozzles	390, 420, 526, 527, 595
O	
oil pumps	67, 383, 391, 400, 436
operating mechanism	170, 436, 486, 487, 488, 489, 490, 491, 569
operating mechanisms	438
other materials.	371
outlet transitions	365
outlet works	236
outlets	37
P	
packing	589
packing assembly	589
packing gland	193, 194, 377
paint	402, 403
panel board	71, 177, 188, 260, 281, 306, 334, 443, 459
panels	551, 553
parapet walls	236, 238
partitions	51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
permanent magnet generator	396
phone sets	541, 606

Maintenance	Table 7 Item Number(s)
photovoltaic cells	553
picture tube	548
pier nosings	236
piers	215, 220, 221, 222, 223, 265, 283, 288
piles	215, 220, 221, 222, 223, 228, 247, 265, 283, 288, 347, 348, 367, 368
pilot valve	396, 413
pipelines	30, 38, 106, 107, 137, 269, 302, 322, 362
pipes	27, 33, 110, 111, 112, 127, 128
pipes fittings	72, 163, 169, 185, 433, 478, 480, 481, 482, 483, 484
piping	31, 32, 36, 37, 39, 67, 74, 115, 124, 146, 189, 236, 246, 251, 253, 262, 267, 282, 300, 307, 323, 326, 335, 383, 391, 396, 398, 416, 418, 419, 420, 422, 500, 509, 510, 524, 525, 526, 527, 590, 591, 594, 595, 598, 599
piston	45, 207, 413
pit liner	380
platform railings	27
platforms	193, 194, 203, 204, 377, 380
plotter	470
plumbing	51, 60, 61, 81, 84, 131, 132, 141, 142, 143, 151, 182, 184, 320, 330, 354, 356, 458, 605
point cards	431, 556
Pole	34, 68, 69, 108, 129, 138, 160, 257, 271, 298, 325, 564, 565, 566
pole plates	564
pole steps	564
poles	109, 155, 456, 475
position indicator	413
position mechanisms	396
positioning devices	548
posts	126, 228
potential device	172, 496, 546
potheads	579, 580
power modules	503
power supplies	70, 178, 186, 208, 340, 387, 394, 421, 434, 469, 485, 607
power supply	410, 555
pressure	413
pressure switch	396
pressure tank; sump tank	396
pressure tanks	581
printer	556

Maintenance	Table 7 Item Number(s)
protection equipment	542
protective devices	32, 74, 189, 251, 253, 267, 282, 300, 307, 326, 335, 398, 416, 500, 509, 510, 598, 599
protective fencing	560
protective items	112
protective plates	236
pumps	30, 31, 38, 39, 106, 107, 115, 137, 146, 262, 269, 302, 322, 323, 362, 396, 418, 419, 420, 524, 525, 526, 527, 590, 591, 594, 595
purifier	418, 524, 525, 591
pushbuttons	551, 556
Q	
quarried rock	227
R	
racks	33, 111, 579, 580
railings	560
rails	147, 216, 347, 348, 367, 368, 507
rain gages	228
rating sections	365
reactors	503
receivers	548, 551
recorders	246
recording equipment	148
rectifier unit	71, 177, 188, 260, 281, 306, 334, 443, 459
rectifier units	444, 513
rectifier-charger	602
rectifiers	408, 409
reels	33, 111
regulator	595
reinforcing steel	122
relays	199, 200, 201, 407, 439, 440, 461, 465, 466, 470, 501, 502, 551
resistance temperature detectors	401, 402, 403
resistors	503
restoring mechanism	396
resurfacing	121, 125
rheostat	199, 200, 201, 407, 461
ring	402, 403
ring buses	401
riprap	236, 243, 244, 560
rmature field pole	461
road surface	212

Maintenance	Table 7 Item Number(s)
roadway surfacing	236
rock backfill	564
roller train assembly	42, 238, 239, 241, 273
roof patching materials	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
roof repair	51, 60, 61, 81
rotor	589
RTDs	401, 402, 403
runner parts	203, 204
runway collectors	45, 103, 118, 249, 276, 294, 329, 505, 600
S	
screen	345
SCRs	199, 200, 201, 407
seals	27, 156, 236, 247
sections of concrete	291, 343, 344, 371
sections of levee	353
selector grounding switch	171, 492
sensors	70, 178, 186, 208, 387, 394, 421, 434, 485
septic tanks	30, 107, 137, 269, 302, 322, 362
sequential event recorders	441
servo motors	400
servomotors	381
settling basins	30, 107, 137, 269, 302, 322, 362
shaft	65, 66, 193, 194, 196, 197, 198, 376, 377, 393, 589
shaft packing gland	203, 204
sheet metal sections	347, 348, 367, 368
shrubs	119
shutoff valves	110
signal equipment	541, 606
signs	212, 560, 564, 565, 566
silicon controlled rectifier	199, 200, 201, 407
slate	49, 75, 82, 104, 133, 144, 152, 190, 284, 308, 339, 358
software	550
soil cement	227
solid state components	545
solid state devices	557
solid-state components	431, 531, 532, 536, 543, 556
spacers	575, 576
speaker	541, 606
special guard railings	236
speed changer	396

Maintenance	Table 7 Item Number(s)
speed droop adjustment mechanism	396
speed switches	396
spider	65, 66, 196, 197, 198, 386, 393
splices	579, 580
splitter noising	384
sprinkler system	111
sprinklers	33
stairway nosing	236
starting equipment	534, 539
starting sensors	441
station interrupter	602
station service type transformer	602
stator iron	401
stay ring	380
steel	291, 343, 344, 371, 584
steel members	507
steel members for bus support	154
steel poles	554
stem	209, 414
stems	381
step bolts	560, 565, 566
stop joint	579, 580
storage tank	106
storage tanks	38
strainers	594
structural members	215, 220, 221, 222, 223, 265, 283, 288, 331, 347, 348, 367, 368, 457, 533, 537, 538, 604
structural steel frame	27
Structural steel members	247, 560
structure	148, 164, 428, 429, 430
sump pumps	32, 112, 128, 584
support	595
support insulators	494, 495, 498, 499, 569, 570, 582
supports	164, 290, 291, 343, 344, 366, 428, 429, 430, 579, 580
surge arrester units	570, 582
surge protective equipment	164, 428, 429, 430
suspension bolts	564
switch	34, 68, 69, 71, 108, 129, 138, 160, 177, 188, 257, 260, 271, 281, 298, 306, 325, 334, 443, 459
switchboard	542

Maintenance	Table 7 Item Number(s)
switches	35, 147, 444, 513, 548, 550, 551
T	
tachometer generator	396
tank hangers	595
tanks	39, 72, 74, 115, 146, 163, 169, 170, 185, 189, 253, 282, 300, 307, 326, 335, 398, 416, 418, 420, 433, 436, 438, 478, 481, 483, 484, 486, 487, 488, 489, 490, 498, 499, 500, 510, 524, 525, 591, 594, 595, 599
tap changer	72, 163, 169, 185, 433, 478, 481, 483, 484
tape drives	550
telephone instruments	542
telephone switchboard	541, 606
temperature relays	67, 383, 391
terminal blocks	439, 440, 465, 466, 470, 501, 502
terrazzo concrete flooring	236
test panels	455
tie plates	147
ties	147, 216, 507
tile	49, 75, 82, 104, 133, 144, 152, 190, 236, 284, 308, 339, 358, 584
timbers	126, 228, 247
Toilet facilities	36
tone transmitters	551
transducers	70, 178, 186, 208, 387, 394, 421, 434, 485
transfer car	506, 601
transfer valve	396
transformer	71, 177, 188, 260, 281, 306, 334, 443, 459
transformers	444, 456, 513
transmitting equipment	148
traps	36
trays	156, 579, 580
treatment plants	38, 106
treatment tanks	30, 107, 137, 269, 302, 322, 362
trees	119
trim	27
trolley traveling equipment	45, 103, 118, 249, 276, 294, 329, 505, 600
tubes	531, 532, 536
tuning packs	173, 547
tunnel supports	365
tunnels	27
turnouts	365

Table 7. Unit of Property/Plant Item Service Life (Blue Pages)

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
1	**LAND AND LAND RIGHTS**									
2	330 if Hydraulic Production Plant, 350 if Transmission Plant, 389 if General Plant	100	010	LAND AND LAND RIGHTS	1	Acquisitions		N/A	*None	
3						a	Fee Land		Each parcel retired or added!!	
4						b	Easements, Lesser Interest			
5						c	Resettlements and Damages			76
6						d	Land Acquisition Expenses			76
7						e	Other Land Costs			
8		110	020	LAND AND LAND RIGHTS	2	Relocation		N/A	*None	
9						a	Relocation of Fee Land Property of Others			76
10						b	Easements, Lesser Interest			76
11						c	Resettlements and Damages			76
12						e	Relocation of Highways and Roads			
13						f	Railroads and Appurtenant Structures			
14						g	Relocation of Utilities			
15						h	Power Lines, Telephone, Telegraph, Gas, Oil, Water Lines, Buildings, Cemeteries, and Historical Monuments			
16						i	Land Acquisition Expenses			
17					3	Construction Cost, including payments for relocation by owner		N/A	*None	76
18	331 if Hydraulic Production Plant, 352 if Transmission Plant, 390 if General Plant	120	N/A	LAND CLEARING	4	Clearing		N/A	*None. Per FERC, Clearing is not to be charged to the land and land rights accounts, but to the appropriate plant account directly benefitted, assumed to be in 331, 352 or 390.!!	

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
19						a	Clearing Land and Right-of-Way		All clearing operations other than initial clearing should be charged to maintenance.!!	
20						b	Clearing and Cutting Danger Trees			
21						c	Clearing Substation and Switching Area		All clearing operations other than initial clearing should be charged to maintenance!!	
22						d	Clearing Transmission Line Land Right-of-Way		All clearing operations other than initial clearing should be charged to maintenance!!	
23	**STRUCTURES AND IMPROVEMENTS**									
24	331	130	Use 071 Power-house, for Pumping Plants use 013	STRUCTURES AND IMPROVEMENTS	Power House or Pumping Plant					
25					1	Basic Structure				
26						a	Major Structure (Category 1)	100	Basic structure has no maintenance items!!	7
27						b	Building, except roof covering (Category 1 defined in Justification 7)	100	concrete, grounding mat, foundations, grouting, weeps and drains, tunnels, pipes, backfill, structural steel frame, walls, interior partitions, seals, flooring, trim, doors, windows, platform railings and grating	7
28					2	Powerhouse and Pumping Plant Structural and General Service Facilities Systems		100	*Complete structure, including sub items a - k	
29						a	Water System, Potable and Raw Water			
30						b	Sewer System	25	*System, complete, each system septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	
31						c	Heating, Ventilating and Air-conditioning Systems (HVAC)	25	ducts, fans, motors, louvers, controls, grilles, grating, pumps, motors, condensers, compressors, piping, controls, wiring	

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32						d	Drainage System	25	*System, complete, each system sump pumps, motors, controls or protective devices, piping, drains	
33						e	Fire Protection System	25	sprinklers, hose, reels, racks, pipes, valves, controls, alarm, CO_2 cylinders, extinguisher	
34						f	Lighting System	35	*System, complete, each system Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	
35						g	Signaling System	25	horns, gongs, lights, bells, switches, wiring	
36						h	Plumbing System	25	Toilet facilities, piping, traps, vents	
37						i	Vacuum Cleaning System	25	motors, controls, fans, piping, outlets	
38						j	Water System	25	wells, pumps, storage tanks, treatment plants, filters, distribution system, pipelines, meters, motors, valves, manholes	
39						k	Heating System, Solar	15	pumps, tanks, piping, collectors	48
40					3	Intake Structure (When integral part of Powerhouse)			*Complete structure, including sub items a-e	76
41						a	Lifting Beams	100	*Complete Set of all Intake Beams	76
42						b	Intake Gates	50	concrete and embedded parts, gate section, gate seals, roller train assembly, leaf, guides	29
43						c	Machinery, Gate Operating	100	*Complete System for one Gate	76
44						d	Stoplogs and Bulkheads	50	*Complete Set for all gates	76
45						e	Cranes, Hoists, Derricks and Cableways, and the machinery or operating them excluding mobile crane and crawler types	50	*Cranes, complete *For category 2 buildings with cranes, hoists and derricks: bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks, wire ropes, bearings	19
46					4	Elevator, complete with operating mechanism, excluding cab and embedded parts		40		76

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
47					5		Trash Racks	40	*Complete Set for one generating unit	71
48					6		Floating Trash Boom	25	logs, cables, connectors, anchors, chains	5
49					7		Roof Covering, for one building when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
50	331, 332	130, 153	060	STRUCTURES AND IMPROVEMENTS	Fish and Wildlife Facilities					
51					1		Fish Hatchery Station (Category 2)	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC, roof repair	7
52						a	Fish ladders Structure, including Collection Channel and Training Walls	100		76
53						b	Weirs	50	*Complete System for one Fish ladder	76
54						c	Stoplogs	50	*Complete Set for all Fish ladders	76
55						d	Valves, Gates and Operating Machinery	50	*Complete System for one Fish ladder concrete and embedded parts, gate section, gate seals, roller train assembly, leaf, guides	29
56						e	Other Fish ladder components not listed elsewhere	N/A	*None	
57					2		Fish Elevator or Fish locks, complete with Operating Mechanism	50		76
58					3		Fish Propagation Facilities not otherwise listed	50		76
59					4		Wildlife Preservation Facilities not otherwise listed	50		76
60					5		Buildings, concrete, excluding replaceable roof coverings	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC, roof repair	7
61					6		Buildings, other than concrete excluding replaceable Roof Coverings	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC, roof repair	7
62					7		Fish Attraction Water Pumps and Motors under 250 hp	30	*Complete Set of all pumps and motors	76
63					8		Pump Impeller, 1,500 hp and over	40		32
64					9		Pump Impeller, 250-1,499 hp	35		32
65					10		Pump Motor, Stator Winding (less stator iron), 1,500 hp and over	25	field pole, amortisseur winding, brushes, spider, shaft	51

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66					11		Pump Motor, Stator Winding (less stator iron), 250-1,499 hp	35	field pole, amortisseur winding, brushes, spider, shaft	51
67					12		Pump Motor, Thrust Bearing, 1,500 hp and over	50	bearing, housing, oil pumps and motors, piping, controls, cooling system, gages, temperature relays	61
68					13		Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
69					14		Main Power System, excluding Power Boards, Engine Generator Sets 100-kW and over and Transformers 1,000-kw and over	50	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
70					15		Transformer Monitoring and Annunciation System	15	sensors, transducers, circuit cards, power supplies	31
71					16		Main Power Breaker Panel, Lighting and Control Boards, complete with attached accessories	30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
72					17		Transformers, liquid-filled or air or gas insulated, 1,000 kVA total or more in one or more phases not part of power board	15	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66
73					18		Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
74					19		Air Compressors, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
75					20		Roof coverings	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
76					21		Trucks and Fish Transportation Tanks, including refrigeration and aeration equipment, if applicable	10		76
77					22		Fish Tapping Station, concrete, complete	50		76
78					23		Fish Tapping Station, timber, complete	25		76
79					24		Fingerling By-pass Channels, Systems applicable and Equipment	N/A	*As applicable	76
80					25		Fish Attraction and Guidance Systems; applicable Sonic, Visual, Electrical and Electronic	N/A	*As applicable	76
81					26		Wildlife Refuge Buildings (Category 2)	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC, roof repair	7

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82					27		Roof Covering for one building, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
83	331,352,353, 398	130	19	Note: use FERC code 331 for Hydraulic Production Plant, 352 for Transmission Plant, 353 for Station Equipment, 398 for General Plant	Operators Camp, Village, and Station Yard Buildings; Grounds; and Recreation Facilities Appurtenant to Identified Properties					
84					1		Structures (Category 2 Defined On A-7): Operational Buildings and Structures, other than Concrete, excluding replaceable Roof Coverings		foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
85						a	Laboratory	50	See 1 above!!	7
86						b	Dwelling	50	See 1 above!!	7
87						c	Personnel Residence Housing	50	See 1 above!!	7
88						d	Dormitory	50	See 1 above!!	7
89						e	Guest house	50	See 1 above!!	7
90						f	Office Building	50	See 1 above!!	7
91						g	Administration Building	50	See 1 above!!	7
92						h	Municipal Building	50	See 1 above!!	7
93						i	Community Buildings	50	See 1 above!!	7
94						j	Police Station	50	See 1 above!!	7
95						k	Fire Station	50	See 1 above!!	7
96						l	Hospital	50	See 1 above!!	7
97						m	School	50	See 1 above!!	7
98						n	Garage	50	See 1 above!!	7
99						o	Storage Building	50	See 1 above!!	7
100						p	Warehouse	50	See 1 above!!	7
101						q	Tool House	50	See 1 above!!	7
102						r	Shop	50	See 1 above!!	7
103					2		Crane, Hoist, Derrick, Or Cableway when replaced with Building, Category 2.	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19
104					3		Roof Covering complete for one building, when made of impervious, bituminous or other types of nonpermanent materials (excluding supports, and insulation)	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
105	331, 352	130	19	Use FERC code 331 for Hydraulic Production	4		Structural and General Service Facility Systems, Grounds and Utilities			

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106				Plant, 352 for Transmission Plant		a	Water Meters and Supply System for a building or for general purposes	25	wells, pumps, storage tank, treatment plants, filters, distribution system, pipelines, meters, motors, valves, manholes	76
107						b	Sewer System	25	septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
108						c	Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
109						d	Electric Distribution System	25	distribution transformers, poles, conductors, insulators, cables, lighting facilities	
110						e	Gas System	25	pipes, shutoff valves	
111						f	Fire Protection System (when forming a part of a structure)	25	sprinkler system, hose and cabinets, reels and racks, pipes and valves, controls and alarms, CO2 cylinders and valves	
112						g	Drainage System	25	sump pumps, motors, controls, protective items, pipes, drains	76
113						h	Incinerator	25	burners, grating, handling equipment	
114						i	Heating System, Conventional	25	*See air conditioning system	
115						j	Heating System, Solar	15	Pumps, tanks, piping	48
116					5	Grounds and Site Improvements				
117						a	Streets, Roads and Roadways, Curbs, and Sidewalks intrasite, intended primarily for connecting employee's houses with the power plant, pumping plant, and other structures.	100	Total replacement of a complete site improvement at one time is not expected. Maintenance includes the repair and replacement of all items in the grounds and site improvement category. Roads and Parking - if item is replaced and life extended it will be capitalized (50 years) . Refer to Methodology Section/Test for Capitalization Grading, culverts, etc., including permanent paving and surfacing within the property lines.!!	
118						b	Fences and fence curbs and other protective works	N/A	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	
119						c	Landscaping, Lawns, Shrubbery	N/A	shrubs, grass, trees	

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120						d	Piers, Docks, and Mooring Facilities: Concrete	50	*Independent Structure, complete	76
121						e	Parking Areas	50	resurfacing	
122						f	Retaining Walls	N/A	concrete, reinforcing steel	
123						g	Sidewalks and Walkways, Culverts, Curbs, Gutters, etc.	N/A	concrete, asphalt	
124						h	Sprinkling Systems	N/A	piping, heads, valves	
125						i	Streets and Alleys	N/A	resurfacing, culverts	
126						j	Waterfront Improvements, Docks, Pipers, Wharves, etc.	50	*Building or structure, complete timbers, posts, concrete, floats	
127						k	Water supply piping, hydrants, and wells	N/A	pipes, valves, casing	
128						l	Yard Drainage System	N/A	sump pumps, motors, controls, pipes, drains	
129						m	Yard Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	
130	331, 352	130	14	STRUCTURES AND IMPROVEMENTS	6	Recreational Facilities				
131						a	Buildings, concrete, excluding replaceable roof coverings	100	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
132						b	Buildings, other than concrete excluding replaceable Roof Coverings	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
133						c	Roof Coverings, complete for one building,	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
134						d	Athletic Field Structures and Improvements	N/A	bleachers, lights, and equipment	
135						e	Roads Including Roadbase, Culverts, Surfacing, Bridges Including Concrete, Concrete, or Masonry	100	*Complete item, including sub items a-d	76
136						f	Parking Areas	100		76
137						g	Sewers, Drainage Facilities, and Other Recreation Developments excluding components listed elsewhere	100	*Complete item, including sub items a-c septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
138						h	Electric System, Power and Lighting	25	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76

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139						i	Piers, Docks, Booms, and Bridges: Timber	25	*Independent Structure, complete	76
140					7	Other Major Structures				
141						a	Permanent Structures adjacent to the Powerhouse or Pumping Plant Building (Category 2) Buildings for General Public Needs, Vista Houses	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
142						b	Buildings for General Public Safety Needs	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
143						c	Miscellaneous Major Structures appurtenant to identified properties such as Personnel Housing, Tool Houses, Warehouses, Garages, Shops, Service Centers Laboratories (See Operators Camp Or Village)	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
144						d	Roof Covering complete for one building, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation)	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
145						e	Miscellaneous Systems (Except Solar Heating)	N/A		
146						f	Heating System, Solar	15	pumps, tanks, piping, collectors	48
147						g	Railroad Siding (Powerhouse Spur) Or Railroad, Intrasite	N/A	rails and accessories, ties, switches, tie plates, ballast, guards, fencing	
148						h	Structures and Equipment for Gaging and Water-Level Recording Purposes. (Category 3)	25	housing and structure, wells, cableway, car, recording equipment, transmitting equipment	7
149	331, 352	130	076	Use FERC code 331 for Hydraulic Production Plant, 352 for Transmission Plant	Switchyard and Substation					
150					Switchyard and Substation Building					
151					1	Structure, except roof covering of the types defined below. (Category 2)		50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
152					2	Roof Covering, when made of impervious, bituminous or other types of nonpermanent materials (exclusive of permanent deck, structural supports, and insulation		20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42

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153					3	Bus Support or Terminal Structure				
154						a	Steel	50	steel members for bus support, grounding connection	53
155						b	Timber	50	poles, cross arms, hardware	53
156						c	Foundations, Footings, Tunnels, Duct Lines, Manholes	50	cable tunnel, concrete, metalwork, lighting, drains, seals and joints, ducts, trays, conduit, cable racks	53
157					4	Miscellaneous Structures and Equipment				
158						a	Steel Structures, complete (excluding foundations)	50	*Complete Switchyard Structural System	59
159						b	Bus and Insulations, including mounting hardware	50		76
160						c	Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
161						d	Conduit, Steel, Power and Control	50		76
162						e	Insulating Oil Storage and Piping System (does not include oil purifiers listed under item 13)	50		76
163						f	Power Transformers, 1,000 kVA and over including Auto Transformers	45	*Transformer, complete, excluding windings bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66
164						g	Main Power Cable, 15-kVA and over	50	*System, complete for each transformer structure and supports, cables, bus, conduit, housing, instrument transformers, surge protective equipment, generator neutral system, disconnecting switches, insulators, fittings, and accessories	8
165						h	Grounding System, Including Grounding Mat, if separate from Powerhouse Grounding Mat	50		76
166					5	Reactors, Shunt or Series, 15-kVA and over		50		76
167					6	Lighting Arresters, 15-kVA and over per phase		35	*Complete three-phase Set	76
168					7	Transformers, Instrument, 15-kVA and over, PT and CT		45		65
169					8	Transformer, Regulating		45	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66

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170					9		Circuit Breakers, 15-kVA and over	50	bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13
171					10		Disconnecting Switches, 15-kVA and over	50	disconnect, selector grounding switch, and interrupting elements	57
172					11		Coupling Capacitors, including auxiliary equipment	35	capacitor unit, line tuning unit, potential device, adjustment unit, coaxial cable	18
173					12		Carrier Current Line Traps	35	*One unit for all traps tuning packs	12
174					13		Oil Purifiers, Portable or Fixed, Centrifugal, Vacuum, or Clay Treatment, with or without Filter Press 600 GPM or over	35		76
175					14		Communication Cable	N/A	*maintenance item unless with complete system communication cable	9
176					15		Control Cable	N/A	*maintenance item unless with complete system control cable	10
177					16		Lighting and Power Boards, complete with attached Accessory Equipment	35	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
178					17		Transformer Monitoring and Annunciation System	15	sensors, transducers, circuit cards, power supplies	31
179	**PUMPING PLANTS, PUMPS AND PRIME MOVERS**									
180	331	130	13	STRUCTURES AND IMPROVEMENTS	Pumping Plants					
181					1		Basic Features		*Complete item, including sub items a, b	
182						a	Buildings, concrete, excluding replaceable roof coverings	100	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
183						b	Other Components not listed elsewhere	N/A	*None	
184					2		Buildings, other than concrete excluding replaceable Roof Coverings	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7

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185					3		Transformers, Liquid-Filled or Air or Gas insulated, 1,000-kVA or more in one or more phases	45	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66
186					4		Transformer Monitoring and Annunciation System	15	sensors, transducers, circuit cards, power supplies	31
187					5		Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
188					6		Lighting, Power and Control Boards complete with attached Accessory Equipment	35	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
189					7		Air Compressors, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
190					8		Roof Coverings complete for one building	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
191	331	160	13		9		Pumps and Prime Movers			
192						a	Pump, less than 250-hp (186 kW) prime mover	35	*maintenance item	32
193						b	Pump Impeller, 250-1,499 hp	35	impeller parts, case, shaft, packing gland, head cover, wearing rings, platforms, bearings, lubricating system	32
194						c	Pump Impeller, 1,500 hp and over	40	impeller parts, case, shaft, packing gland, head cover, wearing rings, platforms, bearings, lubricating system	32
195	331	160	13		10		Electric Type Prime Movers (Motors)			
196						a	Rotor 250-hp (186 kW) and above	50	field pole, amortisseur winding, brushes, spider, shaft	43
197						b	Stator Winding, 250-1,499 hp	35	field pole, amortisseur winding, brushes, spider, shaft	51
198						c	Stator Winding, 1,500 hp or more	25	field pole, amortisseur winding, brushes, spider, shaft	51
199						d	Analog Excitation System for Synchronous Motors	30	field pole, commutator, brushes, diode, silicon controlled rectifier, SCRs, fuses, current transformer, bearings, rheostat, field circuit breaker, contactor, relays, wiring	24
200						e	Digital Excitation System for Synchronous Motors	15	field pole, commutator, brushes, diode, silicon controlled rectifier, SCRs, fuses, current transformer, bearings, rheostat, field circuit breaker, contactor, relays, wiring	24

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201						f	Rotating Excitation System	40	armature, field pole, commutator, brushes, diode, silicon controlled rectifier, SCRs, fuses, current transformer, bearings, rheostat, field circuit breaker, contactor, relays, wiring	24
202					11	Hydraulic Type Prime Movers				
203						a	Hydraulic Type Prime Movers, 250-hp (186 kW) to 1,499-hp	30	runner parts, case, shaft packing gland, head cover, wearing rings, platforms, bearings, lubricating system	45
204						b	Pump Turbine Runner, 1,500 hp or more	40	runner parts, case, shaft packing gland, head cover, wearing rings, platforms, bearings, lubricating system	45
205					12	Fuel Type Prime Movers				
45						a	Prime Mover, Fuel Type, Low Speed below 250-hp (186 kW)	25	*Engine, complete piston, bearing, crankshaft, connecting rod, block	39
207						b	Prime Mover, Fuel-Type, Low Speed 250-hp (186 Kw) and above	40	*Engine, complete piston, bearing, crankshaft, connecting rod, block	39
208					13	Flow Meter System		15	sensors, transducers, circuit cards, power supplies	78
209					14	Gates and Valves		50	valve body, stem, leaf, hydraulic-operating-mechanism, motors, control equipment	29
210	**ROADS AND STRUCTURES**									
211	336, 359	140	08	336 - Roads, Railroads, and Bridges 359 - Roads and Trails	Roads and Road Structures					
212					1	Roads and Trails			*Roads, complete, including sub items listed in a-c road surface, culverts, guards, signs, bank protection	
213						a	Roadway Base Culverts	100		76
214						b	Roadway Surfacing	100		76
215						c	Bridges, Concrete, Steel or Masonry	75	foundations, piers, piles, structural	6

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									members, girders, flooring, guardrails	
216					2	Railroads and Railroad Sidings			*Complete item, including sub items listed in a-d ballast, ties, rails and accessories, culverts, guards, fencing, and appurtenant -structures	
217						a	Rails	100		76
218						b	Ties and Ballast	100		76
219						c	Road Beds, Railroad, including Culverts	100		76
220						d	Bridges, Concrete, Steel or Masonry	75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
221					3	Bridge and Trestles steel, concrete, or masonry		75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
222					4	Bridge and Trestles wood - covered		75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
223					5	Bridge and Trestles wood - un-covered		75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
224	**RESERVOIRS**									
225	332	150	03	RESERVOIRS, DAMS, AND WATERWAYS	Reservoir, Storage, and Diversion					
226					1	Floating Trash Boom, complete		25	logs, cables, connectors, anchors, chains	5
227					2	Riprap and other protective works to the reservoir area		N/A	*None quarried rock, concrete, soil cement	
228					3	Other items in the reservoir area, such as Evaporation Measurement Station and Equipment, Fish and Wildlife Facilities, Docks, Piers, Patrolman's Towers		N/A	*None See specific item elsewhere in the table. evaporation pans, anemometers, rain gages, nesting and feeding areas, piles, timbers, floats, gates, posts, wire	
229					4	Basic Features, excluding other principal items		100		76
230					5	Timber Structures				76
231						a	Bulkheads	25		76
232						b	Retaining Walls	25		76
233						c	Docks, Piers, and Moving Facilities	25		76

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234	**DAMS**									
235	332	151	041 & 042	RESERVOIRS, DAMS, AND WATERWAYS	Dams and Dikes, Storage, and Diversion					
236					1	Structure, Dam (all types including power plant foundation or substructure when constructed integrally with the dam)		100	*None embedded gantry crane rails, hatch covers and frames, embedded metal gates guides, protective plates, ladders, stairway nosing, handrails, parapet walls and pier nosings, tile, terrazzo concrete flooring and wall surfacing, dam deck or roadway surfacing, seals and joints, special guard railings, riprap, embedded penstock and outlet works, piping and drains, foundation grouting, upstream concrete on rock apron	20
237					2	Structure, Diversion		100	*None	54
238					3	Structure, Spillway		50	parapet walls, concrete and embedded parts, gate section, gate seals, roller train assembly, leaf, guides	
239					-	a	Gate, spillway	50	concrete and embedded parts, gate components or gate section, gate seals, roller train assembly, leaf, guides	29
240						b	Machinery, Gate Hoist	50	*Complete system for one gate motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29
241						c	Sluiceways, including gates, gatehouses, and operating mechanisms	50	concrete and embedded parts, gate section, gate seals, roller train assembly, leaf, guides	29
242						d	Outlet gate operating machinery	50	motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29

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243						e	Apron, downstream	N/A	*None Riprap	
244						f	Embankments	N/A	*None Riprap	
245					6	Dam Appurtenances				
246						a	Water Level Sensing and Recording Equipment	N/A	*None Floats, recorders, mercury, piping	
247						b	Bulkhead or stop logs (Steel)	50	*Complete set for the entire system Structural steel members, piles, timbers, beams, chains, cables, seals	
248						c	Bulkhead or stop logs (Wood)	25	*Complete set for the entire system	
249						d	Cranes, complete (excluding mobile and crawler types)	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19
250						e	Lifting Beams	50	*Complete set of all beams related to main dam	19
251						f	Compressed Air Systems, excluding compressors 100 cfm and over	50	piping, controls, and protective devices	1
252						g	Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
253						h	Air Compressors, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
254						i	Trash Racks	75	*Complete set for one outlet	71
255						j	Trash Rakes and Removal Equipment	40		71
256					7	Service Facilities and Systems in the Dam				
257						a	Lighting system	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	
258						b	Domestic water, plumbing, sewage and disposal system	40		
259						c	Power System, excluding power boards and engine generator sets 100 kW and over	50		76
260						d	Main power and lighting boards complete with attached accessory equipment	30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
261						e	Elevator, complete with operating mechanism, excluding cab and embedded parts	40		76
262						f	Heating, ventilating, air-conditioning, and thawing systems	40	ducts, fans, motors, louvers, controls, grilles, grating, pumps, motors, condensers, compressors, piping, controls, wiring	
263	332	151	043	RESERVOIRS, DAMS, AND WATERWAYS	8	Outlet Works (Exclusive of Power)				
264						a	Basic Features, excluding other principal items	100	*Complete item, including sub items a-n	76
265						b	Steel Access Bridge	75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
266					-	c	Tunnels and Water Conduits	100		76
267						d	Compressed Air System, excluding compressors 100 cfm and over	50	piping, controls, and protective devices	1
268						e	Water System, excluding piping	40		76
269						f	Sewer System, excluding piping	40	septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
270						g	Power System, excluding power boards and engine generator sets 100 kW and over	50		76
271						h	Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
272					-	i	Stilling Basin	N/A	*None	
273						j	Stoplogs and Bulkheads	50	*Complete set for all outlets concrete and embedded parts, gate section, gate seals, roller train assembly, leaf, guides	76
274						k	Gate	50	motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29
275						l	Machinery, Gate Operating	50	*Complete system for one gate motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
276						m	Cranes, complete (excluding mobile and crawler types)	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19
277						n	Lifting Beams	50	*Complete set of all beams related to outlet works	19
278					9		Elevator, complete with operating mechanism excluding cab and embedded parts	40		76
279					10		Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
280					11		Trash Racks	75	*Complete set for one outlet	71
281					12		Power and Lighting Boards, complete with attached accessories	30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
282					13		Air Compressor, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
283					14		Timber Access Bridge	75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
284					15		Roof covering, complete for one building	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
285					16		Trash Removal Equipment	40		76
286	332	151	044	RESERVOIRS, DAMS, AND WATERWAYS	Power Intake Works					
287					1		Basic Features, excluding other principal items		*Complete Item, including sub item a-0	
288						a	Steel Access Bridge	75	foundations, piers, piles, structural members, girders, flooring, guardrails	6
289					-	b	Tunnels and Water Conduits	100		76
290					-	c	Surge Tanks	50	manholes, vents, gates, valves, supports and footings, linings, ladders	56
291					-	d	Penstock	100	sections of concrete, steel, asbestos cement, manholes, vents, blow offs, gates and valves, cathodic protection equipment, supports and footings, linings, ladders	35
292						e	Gates	50	motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29
293						f	Machinery, Gate Operating	50	*Complete system for one gate motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29

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294						g	Cranes, complete (excluding mobile and crawler types)	50	*Crane, complete bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19
295						h	Stoplogs and Bulkheads	50	*Complete Set for all Intakes	76
296						i	Lifting Beams	50	*Complete Set for all beams related to intake works	19
297					-	j	Flumes, Concrete or Steel	100		76
298						k	Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
299						l	Water System, excluding piping	40		76
300						m	Compressed Air System, excluding compressors 100 cfm and over	50	compressor, motors, tanks, piping, controls, and protective devices	1
301						n	Power System, excluding power boards and engine generator sets 100 kW and over	50		76
302						o	Sewer System, packaged unit, excluding piping	40	septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
303					2		Elevator, complete with operating mechanism, excluding cab and embedded parts	40		76
304					3		Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
305					4		Trash Racks	75	*Complete Set for one Penstock	71
306					5		Main Power Lighting Boards, complete unit with attached accessories	30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
307					6		Air Compressors, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
308					7		Roof covering, complete for one building	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
309					8		Trash Removal Equipment	40		76
310	332	151	045	RESERVOIRS, DAMS, AND WATERWAYS	Auxiliary Dams					
311					1		Use same property items as prescribed for Account 041 - MAIN DAMS, as applicable		*Same retirement unit as prescribed for Account 041 - MAIN DAMS as applicable.	

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312	332	151	046	RESERVOIRS, DAMS, AND WATERWAYS	Municipal and Industrial Water Delivery Facilities					
313					1	Use same property items as prescribed for Account 044 - POWER INTAKE WORKS, as applicable			*Same retirement unit as prescribed for Account 044 - POWER INTAKE WORKS as applicable.	
314	332	N/A	05	RESERVOIRS, DAMS, AND WATERWAYS	Locks					
315					1	Basic Features, excluding other principal items			*Complete Item, including sub items a-n	
316						a	Structure, excluding Timber Structures	50		76
317						b	Gates	50	*Miter Gate, consisting of right and left gate leaves, complete; or gate complete for other type.	29
318						c	Machinery, Gate Operating	50	motors, hoist, cables, bearings, hydraulic-operating-mechanism, motors operating mechanism	29
319						d	Control House, separate from lock structure	50		76
320						e	Operating Building, Concrete (excluding replaceable roofs)	100	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
321						f	Water System	40		76
322						g	Sewer System	40	septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
323						h	Heating and/or Ventilating System	25	ducts, fans, motors, louvers, controls, grilles, grating, pumps, motors, condensers, compressors, piping, controls, wiring	76
324						i	Filling and emptying valves and operating equipment	40		76
325						j	Lighting System	35	Pole, wire, switch, distribution transformer, fixture, bulb, ballast, breaker	76
326						k	Compressed Air System, excluding compressors 100 cfm and over	50	compressor, motors, tanks, piping, controls, and protective devices	1
327						l	Power System, excluding power boards and engine generator sets 100 kW and over	50		76
328						m	Stoplogs and Bulkheads	50	*Complete Set, for all Systems	76
329						n	Cranes, complete (excluding mobile and crawler types)	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19

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330					2		Operating Buildings, other than concrete, not part of lock structure, excluding control houses, excluding replaceable roofs	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
331					3		Radio Towers, 80 feet and over	40	foundations, structural members, guys, hardware, antennas	15
332					4		Elevator, complete, with operating mechanism, excluding cab and embedded parts	40		76
333					5		Engine Generator Sets, 100 kW and over	35	generator, engine, and accessories	23
334					6		Main Power, Lighting and Control Boards, complete with attached accessories	30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
335					7		Air Compressors, complete, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	1
336					8		Moorage and Lock Approach Structures Guide Walls, Dolphins and Other Guide Structures, Timber	25		76
337						a	Mooring Dolphins and other facilities for temporary moorage for water-borne traffic	25		76
338						b	Bulkheads and retaining walls	25		76
339					9		Roof Coverings	20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
340					10		Radio communications equipment including transmitter, receiver system but excluding land and improvements, buildings, and tower 80 feet and over	10	power supplies, auxiliary generators, batteries, cables, and antennas	40
341	**WATERWAYS**									
342	332	152	043 for Outlet Works, 044 for Intake Power Works	RESERVOIRS, DAMS, AND WATERWAYS	Basic Waterway Features					
343					1		Water Conduit (Penstock, Tunnels, Intake, and Discharge Pipe)	100	sections of concrete, steel, asbestos cement, manholes, vents, blow offs, gates and valves, cathodic protection equipment, supports and footings, linings, ladders	35
344					2		Pipeline	100	sections of concrete, steel, asbestos cement, manholes, vents, blow offs, gates and valves, cathodic protection equipment, supports and footings, linings, ladders	37

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345					3	Wells		N/A	*None casing, screen, concrete pad for pumping units, gravel pack	
346					4	Stilling Basin		N/A	*None	
347					5	Timber Flumes		25	footings, piles, structural members, sheet metal sections, walks, rails	28
348					6	Concrete or steel flumes		100	footings, piles, structural members, sheet metal sections, walks, rails	28
349	332	152	075		Tailrace					76
350					1	Tailrace		100		76
351					2	Stoplogs and Bulkheads		50		76
352	332	152	09		Channels and Canals, Laterals, Drains					
353					1	Basic Features			*Complete item, excluding sub items a-b sections of levee, dike, embankment of waterway	
354						a	Buildings, concrete, excluding replaceable roof coverings	100	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
355						b	Other Concrete Structures	100		76
356					2	Buildings, other than concrete excluding replaceable Roof Coverings		50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
357					3	Piers Mooring Facilities, Bulkheads Training Walls, Trash Booms, Timber		25	*Independent structure, complete logs, cables, connectors, anchors, chains	5
358					4	Roof Coverings, complete for one building		20	roof patching materials, flashings, cement slab, gravel, tile, slate, composition	42
359	332		11		Levees and Floodwalls					76
360					1	Basic Features			*Complete item, including sub items a-c	76
361						a	Roadways	100		76
362						b	Sewers, drainage facilities, and outfalls	100	septic tanks, treatment tanks, settling basins, pumps, motors, manholes, pipelines, disposal facilities	76
363						c	Other Components not listed elsewhere	N/A	*None	

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364	332	153	11	RESERVOIRS, DAMS, AND WATERWAYS	Open Waterway Structures and Tunnels					
365					1	Open waterway structures such as tunnels, check, inlet and outlet transitions for siphons and pumping plants, drops, chutes, etc.		100	check structures, inlet and outlet transitions, drops, chutes, drain inlets, rating sections, measuring structures, turnouts, weirs, tunnel supports, cableway and car	76
366					2	Pipeline and penstock structures including surge tanks, surge chambers, associated storage tanks, and reservoirs		100	manholes, vents, gates, valves, supports and footings, linings, ladders	35
367					3	Flumes, other than timber		100	footings, piles, structural members, sheet metal sections, walks, rails	28
368					4	Flumes, timber		25	footings, piles, structural members, sheet metal sections, walks, rails	28
369	**WATERWAY PROTECTIVE WORKS**									
370	332	154		RESERVOIRS, DAMS, AND WATERWAYS	Waterway Protective Works					
371					1	Channels, waste way structures, overchutes, runoff water collection systems, culverts for passing flood flows		N/A	*None sections of concrete, steel, or other materials.	
372	**WATERWHEELS, TURBINES, AND GENERATORS**									
373	333	165	072	WATERWHEELS, TURBINES AND GENERATORS	Waterwheels, Turbines, and Generators Turbines and Pump/Generator (from Connection with Penstocks or Flume to Tailrace)					
374					Turbines				See sub-components, listed below.!!	
375					1	Runners - Reaction and Impulse Type and Pump/Turbines				
376						a	Turbine runner	45	cone, blade, hub, bolts, buckets, keys, and shaft	46
377						b	Pump Turbine Runner with 1,500-hp (1,120 kW) prime mover or larger	50	impeller parts, case, shaft, packing gland, head cover, wearing rings, platforms, bearings, lubricating system	46
378						c	Wearing rings, runner	20	*no serviceable parts	74
379					2	Turbine Components - Reaction Type				

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380						a	Scroll case assembly	100	stay ring, case, head cover, bottom ring, facing plate, pit liner, platforms	
381						b	Wicket gate assembly	100	wicket gate, gate operating ring and linkage, servomotors, connecting rod, stems and bearings, grease pump and motors	
382						c	Turbine shaft, including thrust collar and Kaplan control not located in hub	100		
383						d	Turbine guide bearings and thrust bearing	50	bearing, housing, oil pumps and motors, piping, controls, cooling system, gages, temperature relays	62
384						e	Draft tube	100	*None draft tube liner, splitter noising	
385						f	Embedded turbine parts	50		76
386						g	Rotor and shaft	50	*Rotor winding, complete set for one unit and shaft field pole, amortisseur winding, collector rings, brushes, spider, braking ring, fans	44
387						h	Machine monitoring system (vibration, air gap, partial discharge, etc.)	15	sensors, transducers, circuit cards, power supplies	79
388					2	Turbine Components - Impulse Type				
389						a	Housing assembly	N/A	*None discharge pit liner, baffle	
390						b	Needle-valve assembly	N/A	*None needles, nozzles, deflectors, vanes	
391						c	Main bearings	50	oil pumps and motors, piping, controls, cooling system, gages, temperature relays	62
392						d	Embedded turbine parts	50	Complete set for one unit	76

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393						e	Rotor and shaft	50	*Rotor winding, complete set for one unit and shaft field pole, amortisseur winding, collector rings, brushes, spider, braking ring, fans, shaft	44
394						f	Machine monitoring system (vibration, air gap, partial discharge, etc.)	15	sensors, transducers, circuit cards, power supplies	79
395					3	Governors				
396						a	Mechanical governor	50	governor ball head mechanism, head, drive motors, permanent magnet generator, speed switches, tachometer generator, pilot valve, valve servomotor, transfer valve, compensating mechanism, speed changer, speed droop adjustment mechanism, gate limit and position mechanisms and indicators, restoring mechanism, limit switches, blade control valve, pumps, unloaded valve and pressure switch, motor, controls, pressure tank; sump tank, piping, gages, brake air pressure gage, generator braking control	30
397						b	Governor oil pressure pump, complete for one unit	40		30
398						c	Governor air compressor, 100 cfm and over	25	compressor, motors, tanks, piping, controls, and protective devices	30
399						d	Digital Governors - Control System	15	Upgrading the governor from mechanical to digital is a capital improvement on the electronic component.!!	30
400						e	Governor oil and lubricating oil systems which includes oil storage, purification, pumps, and piping	40	oil pumps, servo motors, valves, filters, accumulators	30
401					4	Stator Components			coil, ring buses, stator iron, resistance temperature detectors, RTDs	
402						a	Stator, 11.5-kV and above - Stator windings	30	coil, ring, wedging, paint, resistance temperature detectors, RTDs	52
403						b	Stator, Below 11.5-kV	50	coil, ring, wedging, paint, resistance temperature detectors, RTDs	52
404						c	Stator core iron, 11.5-kV and above	50	*no serviceable parts	52

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405						d	Stator core iron, below 11.5-kV	100	*no serviceable parts	52
406					5	Excitation Systems and Appurtenances				
407						a	Rotating Excitation System	40	armature field pole, commutator, brushes, diode, silicon controlled rectifier, SCRs, fuses, current transformer, bearings, frame, rheostat, field circuit breaker, contactor, relays, wiring	25
408						b	Static Excitation System	30	circuit cards, rectifiers, bridge fans, bridges	25
409						c	Static Excitation - Power Section Only	30	rectifiers, bridge fans, bridges	25
410						d	Digital Excitation System for Control System	15	circuit card, power supply,	25
411						e	Excitation Supply Transformer	40		25
412					6	Other Components not listed elsewhere				
413						a	Pressure Regulator and Energy Absorber (when included as part of the turbine or scroll case assembly)	45	valve body, valve stem, valve disk, pilot valve, dashpot, bell crank, connecting rod, piston, air vent, position indicator, pressure and motion recorder	38
414						b	Penstock Valves Or Gates (Butterfly or slide gate at entrance to scroll case)	50	valve body, stem, leaf, hydraulic-operating-mechanism, motors, control equipment, bypass valves and fittings	29
415						d	Speed Increaser	20	housing, bearings, fittings, lubricating system, gears	50
416						e	Air Compressor, complete, primarily for draft tube water depression while condensing	25	compressor, motors, tanks, piping, controls, and protective devices	1
417					7	Miscellaneous Piping Systems and their Auxiliary Equipment				
418					8	Grease and Oil Lubrication Systems for Turbine Operation		N/A	*None tanks, pumps, motors, piping, purifier, drying oven, filter pads, valves, fittings	
419					9	Raw Water System including Pumps and Piping for Generator, Air Compressor, and Air Conditioning Equipment, Cooling and Filter Plant		40	pumps, motors, piping, valves, fittings	
420					10	Water spray sprinkler and carbon dioxide system for fire protection of oil storage and oil purifier rooms		N/A	*None pumps, motors, piping, valves, fittings, nozzles, tanks	

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
421					11	Flow Meter System		15	sensors, transducers, circuit cards, power supplies	78
422					12	Air Coolers and their piping furnished as part of a generator (main units only)		40	piping, valves	76
423	**ACCESSORY ELECTRIC EQUIPMENT**									
424	334	170	073	ACCESSORY ELECTRIC EQUIPMENT	Accessory Electric Equipment					
425					1	Accessory Electrical Equipment – Power Plants and Pumping Plants (For plants with multiple units totaling 1,500-Hp and above. Use the following Units Of Property as they apply.)		50	For below 1,500-hp, it is expected that replacements as required will be made as a part of maintenance.!!	
426					2	Miscellaneous Equipment			*Complete unit, including sub items a-f	
427						a	Generator, Neutral Grounding Equipment including Neutral Breakers	50	*Complete System for all Generators	76
428						b	Main generator bus or cable system	40	*Complete System for one Generator or Transformer structure and supports, cables, bus, conduit, housing, instrument transformers, surge protective equipment, generator neutral system, disconnecting switches, insulators, fittings, and accessories	8
429						c	Station Service Main Bus	40	*Complete system for one generator or transformer structure and supports, cables, bus, conduit, housing, instrument transformers, surge protective equipment, generator neutral system, disconnecting switches, insulators, fittings, and accessories	8
430						d	Power Cables	40	*Complete system for one generator or transformer structure and supports, cables, bus, conduit, housing, instrument transformers, surge protective equipment, generator neutral system, disconnecting switches, insulators, fittings, and accessories	8

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431						e	Annunciator System, excluding Switchboard mounted equipment	50	solid-state components, logic circuit boards, point cards, bulbs	76
432						f	Grounding System, Including Powerhouse Grounding Mat	50	*no serviceable parts	76
433					3		Transformer, Station Service, Liquid filled or Air or Gas insulated 1,000-kVA or more in one or more phases (excluding those installed as part of Station Service Power Boards)	45	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66
434					4		Transformer Monitoring and Annunciation System	15	sensors, transducers, circuit cards, power supplies	31
435					5		Main Generator Switchgear and Breakers including Air Compressors when applicable		*Breaker or Switchgear, complete with Accessories	58
436						a	Circuit Breaker—unit, complete with accessories	45	bushings, contacts, operating mechanism, tanks and frame, oil pumps and motors, air compressors and motors, bushing current transformer	58
437						b	Motor Control Switchgear – associated with units 3,000-hp (2,240 kW) and above	35	(See circuit breaker typical minor items above) Reduced voltage starting equipment.!!	58
438						c	Circuit Breaker—Main Station Service, complete	35	bushings, contacts, operating mechanisms, breaker draw out unit, tanks and frame, bushing current transformer	58
439						d	Board or panel, Control—devoted to a single purpose, with accessory electric equipment	35	meters, instruments, relays, control devices, clock, wiring, terminal blocks	58
440						e	Control and System Protection Equipment, complete, devoted to a single purpose	15	meters, instruments, relays, control devices, clock, wiring, terminal blocks	17
441					6		Digital Fault Recorder (Previously titled Fault Recorder and Master Station)	15	starting sensors, microprocessors, analog-to-digital converters, memory assemblies, video display units, keyboards, computer-type printers, disk drives, sequential event recorders and communications interface equipment	22
442					7		Auxiliary Power Supply System, Engine Generator Set 100 kW and over, complete with accessories	35	generator, engine, and accessories	23

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443					8	Battery Switchboards, including attached accessories		30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
444					9	Distribution Boards and Breaker Panels		30	motor generator, circuit breakers, contactor, switches, instruments, control devices, rectifier units, transformers	21
445						a	AC Distribution Board	30	breakers, wiring	21
446						b	DC Distribution Board	30	breakers, wiring	21
447					10	Inverter - 24 volts and above		20		3
448					11	Battery Bank, 48-volts and above			*Battery System, complete	
449						a	Battery - Valve Regulated Lead Acid	5	battery cells	4
450						b	Battery - Vented Lead Acid (flooded)	30	battery cells	4
451						c	Battery - Nickel Cadmium (NiCad)	30	battery cells	4
452						d	Hydrogen Fuel Cell	15	fuel cell	4
453						e	Battery Charging System	20		
454					12	Control and System Protection Equipment		15	current breaker, control devices and instruments, wiring	17
455					13	Testing facilities installed		N/A	*None test panels, devices wiring	
456					14	Distribution lines used only for carrying power to dam sites or diversion structures		50	*None poles, wires, cross arms, insulators, transformers, circuit breakers	
457					15	Antenna Towers, 80-feet and higher		40	foundations, structural members, guys, hardware, antennas	15
458					16	Radio or Microwave Buildings		50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
459					17	Lighting and Power Boards for Station Service and Unit Auxiliaries, including Breakers, transformers, and attached Accessories		30	panel board, circuit breaker, contactor, switch, instrument, control device, rectifier unit, transformer	21
460					18	Control and auxiliary switchboards, including attached accessories (excluding applicable items listed below), complete, devoted to a single purpose		50		76

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461					19		Voltage Regulation and Excitation Equipment including Motor-Generator Set, when required (Main Generation units only)	40	rmature field pole, commutator, brushes, diode, fuses, current transformer, bearings, frame, rheostat, field circuit breaker, contactor, relays, wiring	25
462					20		Communication Cable	N/A	*maintenance item unless with complete system communication cable	9
463					21		Control Cable	N/A	*maintenance item unless with complete system control cable	10
464					22		Load Control Equipment, complete, for entire plant	15		76
465					23		Recording Annunciation mounted separately from Switchboard	15	meters, instruments, relays, control devices, clock, wiring, terminal blocks	76
466					24		Data Logging Equipment mounted separately from Switchboard	15	meters, instruments, relays, control devices, clock, wiring, terminal blocks	22,47
467					25		Electronic Supervisory Control and Data handling equipment	10	*maintenance item unless with complete system	55
468		474			26		Central Processor, electronic control installation	10	*maintenance item unless with complete system	55
469					27		Radio, Microwave, or Carrier Equipment, complete system at one location including transmitter receiver power supplies, auxiliary generators batteries, cables, and antennas, but excluding land and improvements, buildings, and towers 80 ft. and over	10	power supplies, auxiliary generators, batteries, cables, and antennas	40
470					28		Automatic Recording Oscillographs	15	plotter, relays, wiring, terminal blocks	76
471	**TRANSMISSION PLANT (SUBSTATION EQUIPMENT)**									
472	352, 353	175	USACE does not have FERC 35X series	STRUCTURES AND IMPROVEMENTS STATION EQUIPMENT	Station Equipment Supports and Structures					
473					1		Concrete foundations, piers, settings, and supports for equipment	50	foundations, footings, and supports for equipment such as transformers, circuit breakers, air compressor, synchronous condensers, oil tanks!!	53, 59,75
474					2		Steel Structure—fences, platforms, railings, steps, gratings, appurtenant to station equipment	50	modified if necessary to accommodate equipment replacement!!	59
475					3		Timber Structure	50	poles, beams	59, 75
476					4		Bus and Insulators—Cable or Pipe Type	50	bus equipment, cables, conductors, connectors, insulators, fittings	

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477					5	Transformers				
478						a	Main Power Transformers	45	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	66
479						b	Instrument Transformer (current, potential, and metering set -69Kv and above)	45		65
480						c	Voltage Regulating Transformers	40	conduit, pipes fittings, cooling equipment, control devices	73
481						d	Power Regulating Transformers	45	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	36
482						e	Grounding Transformers	45	conduit, pipes fittings, control devices	64
483						f	Mobile Power Transformers	40	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	67
484						g	Station-Service Transformer	35	bushings, tanks, core, coil, tap changer, load ratio control equipment, conduit, pipes fittings, cooling equipment, control devices	68
485					6	Transformer Monitoring and Annunciation System		15	sensors, transducers, circuit cards, power supplies	31
486					7	Circuit Breakers and Operating Mechanisms			bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13
487						a	Power Circuit Breaker - Air Magnetic / Air Blast	45	bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13
488						b	Power Circuit Breaker - Oil Tank Type	50	bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13

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489						c	Power Circuit Breaker - SF6 Type	50	bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13
490						d	Power Circuit Breaker - Vacuum Type	50	bushings, contacts, operating mechanism, tanks, frame, bushing current transformer, bushing potential device, compressed air system, and hydraulic system	13
491					8	Interrupter Switches		20	insulators, contacts, operating mechanism	33
492					9	Disconnecting Switches		50	disconnect, selector grounding switch, and interrupting elements	57
493					10	Capacitors				
494						a	Capacitor Bank, Shunt—Bank includes a 3-phase series-parallel grouping of capacitor units with capacitor steel racks and supporting insulators.	25	capacitor unit, support insulators, fuses, buses, connectors	11
495						b	Capacitor Bank, Series—Assembly includes a single phase series-parallel grouping of capacitor units with capacitor steel racks, supporting insulators, and a set of protective equipment, i.e., relays, controls, bypass gap assembly, shorting and load break switch, damping equipment, fuses, and protective devices.	25	capacitor unit, support insulators, fuses, buses, and components of set of protective equipment	11
496						c	Coupling Capacitor Voltage Transformer (CCVT) (69-kV and above)	30	capacitor unit, line tuning unit, potential device, adjustment unit, coaxial cable	18
497					11	Reactors, Shunt or Series				
498						a	Reactor, Dry Air Core	25	coil, core, tanks, bushing, connectors, support insulators	41
499						b	Reactor, Oil Immersed	35	coil, core, tanks, bushing, connectors, support insulators	41
500					12	Surge Protection, complete 3-phase set		35	compressor, motors, tanks, piping, controls, and protective devices	2

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501					13	Switchboards, Cubicles, Control Cables, and Appurtenances		15	meters, instruments, relays, control devices, clock, wiring, terminal blocks	17
502					14	Digital Fault Recorder		15	meters, instruments, relays, control devices, clock, wiring, terminal blocks	22
503					15	Thyristor Valve Banks - component of High Voltage Direct Current (HVDC) and Static Var System (SVS)		30	power modules, reactors, resistors, capacitors, frames, connectors, wiring and control equipment	63
504					16	Auxiliary Equipment				
505						a	Cranes, Hoists, etc., and the machinery for operating them	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, blocks	19
506						b	All other Cranes, Hoists, Derricks, and associated cableways.	50	motors, cables, controls, transfer car	19
507						c	Un-Tanking Tower and Transfer Track	50	steel members, rails, ties	
508					17	Compressed Air System complete with attached accessories				1
509						a	Station Air System, excluding compressors 100 cfm and over	50	piping, controls, and protective devices	1
510						b	Air Compressors and motor, complete, 100 cfm or over	25	compressor, motors, tanks, piping, controls, and protective devices	1
511					18	Auxiliary Power Supply System				
512						a	Engine Generator Set, Auxiliary, 100 kW and over	35	generator, engine, and accessories	23
513					19	Distribution Boards and Breaker Panels		30	motor generator, circuit breakers, contactor, switches, instruments, control devices, rectifier units, transformers	21
514						a	AC Distribution Board	30	breakers, wiring	21
515						b	DC Distribution Board	30	breakers, wiring	21
516					20	Inverter - 24 volts and above		20		3
517					21	Battery Bank 48-volts and above				
518						a	Battery - Valve Regulated Lead Acid	5	battery cells	4
519						b	Battery - Vented Lead Acid	30	battery cells	4

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520						c	Battery - Nickel Cadmium (NiCad)	30	battery cells	4
521						d	Battery - Hydrogen Fuel Cell	15	fuel Cell	4
522						e	Battery Charging System	20	components	4
523					22	Miscellaneous Piping Systems and their Auxiliary Equipment				
524						a	Transformer Oil System which includes Storage Pumps, Piping, ad Purification Facilities	25	tanks, pumps, motors, purifier, drying oven, filter pads, piping, fittings, valves	
525						b	Circuit Breaker Oil System, which includes Storage, Pumps, Piping and Purification Facilities	25	tanks, pumps, motors, purifier, drying oven, filter pads, piping, fittings, valves	
526						c	Raw Water System which includes Pumps and Piping for Transformer Cooling	25	pumps, motors, nozzles, piping, fittings, valves	
527						d	Dry-Pipe Fixed Spray Water System for fire protection of Transformers	25	pumps, motors, nozzles, piping, fittings, valves	
528	**INSTALLED SUPERVISORY CONTROL AND COMMUNICATIONS EQUIPMENT**									
529	397	180		GENERAL PLANT MISCELLANEOUS EQUIPMENT	Installed Supervisory Control and Communications Equipment					
530					1	Radio Communication Fixed Station				
531						a	Transmitter and/or Receiver Set, Multi-Channel Radio	10	tubes, solid-state components, filters, crystals, capacitors, coaxial cable, fuses	40
532						b	Transmitter and/or Receiver Set, Single Channel Radio	10	tubes, solid-state components, filters, crystals, capacitors, coaxial cable, fuses	70
533						c	Antenna Tower, Radio, Including Billboard-Type Reflectors	40	foundations, structural members, guys, hardware, antennas	15
534						d	Motor (Engine) Generator Set, Communication	15	engine, generator, starting equipment, battery, voltage	34
535					2	Microwave Communication				
536						a	Microwave System (main and standby radio-frequency and multiplex equipment)	10	tubes, solid-state components, filters, crystals, capacitors, coaxial cable, fuses	40
537						b	Active Antenna Tower Microwave, including Billboard Type Reflectors	20	foundations, structural members, guys, hardware, antennas	15
538						c	Passive Antenna Tower – Reflector mounted on a hillside or mountain top to redirect the signal	40	foundations, structural members, guys, hardware, antennas	15

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539						d	Motor (Engine) Generator Set, Communication	15	engine, generator, starting equipment, battery, voltage regulator	34
540					3	Telephone Communication				
541						a	Station, Signal, Or Call Communication Equipment (Intrasite)	10	telephone switchboard, phone sets, signal equipment, distributing frame, cables, speaker, microphone	60
542						b	Telephone Intercommunication System	10	telephone instruments, switchboard, cables, battery, charger, protection equipment	60
543						c	Power Line Carrier System (for Telephone Communications)	15	solid-state components, filters, capacitors, coaxial cable, fuses	69
544					4	Carrier Current Communication (Power Line Carrier)				
545						a	Transmitter and/or Receiver Set, Carrier (exclusive of sets used for telephone communications)	25	*One unit for all traps solid state components, fuses, filters, capacitors	70
546						b	Coupling Capacitor Voltage Transformer (CCVT) (69-kV and above)	30	capacitor unit, line tuning unit, potential device, adjustment unit, coaxial cable	18
547						c	Carrier Wave Trap (tunable and non-tunable)	35	*One unit for all traps tuning packs	12
548					5	TV Closed Circuit		10	camera, camera main tube, positioning devices, circuit cards, switches, coaxial cable, wiring, receivers, picture tube and controls and equipment	14
549					6	Supervisory Control and Data Acquisition (SCADA) / Energy Management System (EMS) Proprietary Designed System				
550						a	Central Processor or Computer with associated main memory, central processing unit, and back-up storage devices, Include intersite data-logging system.	10	tape drives, hard/floppy disks, switches, software	55
551						b	Remote Terminal Unit, (RTU), Input/Output Device	10	consoles, panels, cubicles, switches, pushbuttons, indicating lights, relays, circuit cards, tone transmitters, and receivers, wiring	55

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552						c	Lifecycle Designed System	40	Individual component such as servers, RTUSs, etc. replaced in accordance with IT rules. Open system design using commercially available components such as servers, RTUs, PLC devices and COTS software or locally developed software. These system components are replaced periodically to sustain the system to Service Lives exceeding 10 years!!	55
553						d	Solar Voltaic Power Supply System, 100 Watts and above	15	panels, photovoltaic cells, battery, battery charger, and voltage regulator	49
554						e	Fiber Optic Cable, Optical Ground Wire (OPT-GW), and All Dielectric Self Supporting (ADSS)	50	wood or steel poles	26
555						f	Fiber Optic Multiplexer	10	circuit cards, power supply	27
556					7	Sequential Event Recorder System (SER)		15	solid-state components, logic circuit boards, point cards, memory cell, digital clock, printer or typewriter, pushbuttons, wiring	47
557					8	Uninterruptible Power Supply System (UPS)		10	circuit cards, interconnected wiring and solid state devices	72
558	**TOWERS AND FIXTURES**									
559	354	181	USACE does not have FERC 35X series	TOWERS AND FIXTURES	Towers and Fixtures					
560					1	Steel Tower Structures with appurtenant fixtures and hardware		50	*Steel Structure, Steel Pole, or Concrete Pole Transmission Line Section structural steel members, anchors, guys, braces, brackets, cross arms, guards, ladders, step bolts, railings, signs, protective fencing, riprap	53
561					2	Tower and fixture foundations and footings		100	normally, tower foundations and footings are not expected to be replaced when towers are replaced because of storm damage.!!	76

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562	**POLES AND FIXTURES**									
563	355	182	USACE does not have FERC 35X series	POLES AND FIXTURES	Poles and Fixtures				*An identifiable transmission line section replacement, point-to-point or tap-to-tap.	
564					1		Wood Poles/Structures Transmission Line Section	50	*One or more poles not apart of a complete section. pole, guys, anchors, head, guy guards, guy clamps, guy insulators, pole plates, brackets, cross arms and braces, extension arms, insulator pins and suspension bolts, pole steps, signs, rock backfill	75
565					2		Steel Structures, Steel Pole, Or Concrete Pole Transmission Line Section	50	*One or more poles not part of a complete section. pole, bracket arms, step bolts, signs, footings and foundations	53
566					3		Concrete Pole Structure with appurtenant fixtures and hardware (including Footings and Foundations)	50	*One or more poles not part of a complete section. pole, arms, step bolts, signs, footings and foundations	53
567	**OVERHEAD CONDUCTORS AND DEVICES**									
568	356	183	USACE does not have FERC 35X series	OVERHEAD CONDUCTORS AND DEVICES	General Components					
569					1		Line Disconnecting Switches, 3-phase, 69-kV or above	50	blades, operating mechanism, support insulators	57
570					2		Surge protection, 3-phase, 69-kV or above	35	surge arrester units, connectors, support insulators	2
571					Conductors (Buried, Submarine, or In-conduit)					

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572					1		Conductors - on wood poles or structures	50	Conductor, overhead on wood structures. Conductors are assumed to last as long as their supporting structures. Less than the point-to-point identified spans of insulated and bare conductor, damping devices, armor rods, connectors, spacers!!	75
573					2		Conductors - on steel towers or steel or concrete poles	50	Conductor, overhead on wood structures. Conductors are assumed to last as long as their supporting structures. Less than the point-to-point identified spans of insulated and bare conductor, damping devices, armor rods, connectors, spacers!!	53
574					Ground Wires					
575					1		Ground Wires - on wood poles or structure	50	*Ground wire, overhead on wood structures. Ground wires are assumed to last as long as their supporting structures. damping devices, armor rods, connectors, spacers	75
576					2		Ground Wires - on steel towers or steel or concrete poles	50	*Ground wire, overhead on wood or concrete structures. Ground wires are assumed to last as long as their supporting structures. damping devices, armor rods, connectors, spacers	53
577	**UNDERGROUND CONDUCTORS AND DEVICES**									
578	358	184	USACE does not have FERC 35X series	UNDERGROUND CONDUCTORS AND DEVICES	Conductors (Buried, Submarine, or In-conduit)					
579					1		Conductor, Underground, 15-kV through 35-kV. Solid dielectric insulated cables in a replaceable section.	40	joint connector, stop joint, insulating materials, splices, insulators, racks, trays, potheads, supports	16

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580					2		Conductor, Underground, above 35-kV Oil and Gas insulated cables in a replaceable section.	25	joint connector, stop joint, insulating materials, splices, insulators, racks, trays, potheads, supports	16
581					3		Pressure Maintaining Equipment for insulating media	40	pressure tanks, control devices, gages	16
582					4		Arresters, Surge (lighting)—3-phase installation, 69-kV and above	35	surge arrester units, connectors, support insulators	2
583	**UNDERGROUND CONDUIT**									
584	357	185	USACE does not have FERC 35X series	UNDERGROUND CONDUIT	1		Underground Duct Lines, Conduits, and Appurtenances	100	conduit envelope, concrete, tile, brick, steel, manholes, cable vault, ventilating equipment, drainage connections, sump pumps, lighting system	
585	**MISCELLANEOUS INTANGIBLE PLANT**									
586	303	190	N/A	MISCELLANEOUS INTANGIBLE PLANT	1		Patent rights, licenses, privileges, and other intangible property items necessary or valuable in the conduct of project operations are not subject to replacement.	N/A	*None	
587	**MISCELLANEOUS INSTALLED EQUIPMENT**									
588	335, 398	199	074	MISCELLANEOUS POWER PLANT EQUIPMENT	Auxiliary Equipment for General Station Use - Power Plants; and Pumping Plants 1,500-HP and Above					
589					1		Pumps and Prime Movers purchased from manufacturer's stock or of standard design and shipped as units with only installation and minor assembly required at the site and those with total plant capacity less than 1,500-hp	35	*None impeller, bearing, packing, glands, shaft, column section, packing assembly, motor winding, rotor, bearing	32
590					2		Un-Watering and Low-Level Drainage System	50	bulkheads, pumps, piping	76
591					3		Oil Storage, Handling and Reclaiming System	50	tanks, pumps, motors, piping, purifier, drying oven, filter pads	76
592					4		Oil Purifiers, Fixed or Portable, Centrifugal, vacuum or Clay Treatment, type, 600 GPH or over used for lubricating oil, hydraulic oil or lubricating and insulating oil	35		76
593					5		Gages and Indicating Equipment	25		76

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594					6		Raw Water System for plant equipment cooling	40	pumps, piping, valves, tanks, strainers	76
595					7		Fire Protection System (water and chemical for general station use)	25	pumps, piping, tanks, cabinets, hose, nozzles, tank hangers and support, regulator, alarm system	76
596					8		Air Conditioning System	25	ducts, fans, motors, louvers, controls, grilles, grating	
597					9		Station Air System			
598						a	Station Air System, excluding compressors 100 cfm and over	50	piping, controls, and protective devices	1
599						b	Air Compressors and motor, complete, 100 cfm or over	25	compressor, motors, tanks, piping, controls, and protective devices	1
600					10		Cranes, Hoists, etc., and the machinery for operating them (Associated with Category 2 Buildings, excluding Mobile and Crawler types cranes)	50	bridge traveling and trolley traveling equipment, controls, motors, runway collectors, block	19
601					11		All other Cranes and Hoists	50	motors, cables, controls, transfer car	19
602					12		Uninterruptible Power Supply System (UPS)	10	station service type transformer, battery bank, rectifier-charger, inverter-regulator, and station interrupter	72
603					13		Power Plant Communications Equipment			76
604						a	Antenna Towers, 80-feet and higher	40	foundations, structural members, guys, hardware, antennas	15
605						b	Radio or Microwave Equipment Buildings	50	foundations, flooring, walls, windows, doors, partitions, plumbing, wiring, heating ventilating and air conditioning, HVAC	7
606						c	Plant communications equipment, including telephone, code call, and voice recording systems	10	*Each independent system, complete telephone switchboard, phone sets, signal equipment, distributing frame, cables, speaker, microphone	60

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
607						d	Radio, Microwave or Carrier Equipment complete system at one location, including Transmitter, Receiver, Power Supplies, Auxiliary Generators, Batteries Cables and Antennas, but excluding Land and Improvements, Buildings and Towers 80 Ft. and over	10	power supplies, auxiliary generators, batteries, cables, and antennas	40
608	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Permanent Operating Equipment - Floating Plant					76
609					1	Dredges		50		76
610					2	Tug Boats		25		76
611					3	Tenders		25		76
612					4	Drift Collectors		25		76
613					5	Tow Boats		25		76
614					6	Patrol Boats		25		76
615					7	Snag Boats		25		76
616					8	Drill Boats or Barges and Jet-probing Barges		25		76
617					9	Derrick Boats or Barges		25		76
618					10	Maneuver Boats		25		76
619					11	Barges, Mooring		25		76
620					12	Other Major Non-group Floating Plant		25	*Boat, barge, vessel, or plant item complete with all Accessory Equipment	76
621					13	Miscellaneous Floating Plant, initial cost, new of $25,000 or more per unit				
622						a	Barges, or Floating Work Platforms	25		76
623						b	Boat, Outboard, excluding Motors	20		76
624						c	Motors, Outboard	10		76
625					14	Other items not listed elsewhere		25		76
626	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Automotive Land Plant					
627					1	Station Wagons (passenger car chassis) Group C		7		76
628					2	Ambulances (light) - Group D		10		76
629					3	Ambulances (heavy) - Group DI		10		76
630					4	Trucks, 1/4-ton, 4x4- Group E		7		76

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
631					5		Carryalls (including Station Wagons mounted on Truck Chassis) Group E1	10		76
632					6		Trucks, Panel and sedan Delivery Group E2	7		76
633					7		Trucks, Pickup - Group F	7		76
634					8		Trucks, 3/4 - 1 - Ton - Group G	7		76
635					9		Trucks and Truck Tractors, 1-1/2-Ton - Group H	8		76
636					10		Trucks and Truck Tractors, 2-1/2-Ton - Group I	8		76
637					11		Trucks and Trucks Tractors, 3-4-Ton-Group J	10		76
638					12		Trucks and Trucks Tractors, 5-10-Ton-Group K	10		76
639					13		Trucks and Trucks Tractors, 11-Ton and over Group L	12		76
640					14		Trucks, Wrecker - Group M	8		76
641					15		Fire Trucks - Group N	12		76
642					16		Trucks, Refuse - Group O	8		76
643					17		Trucks, Power Line and telephone Construction and Maintenance Group P	8		76
644					18		Snow Plows, Rotary- Group Q	12		76
645					19		Trucks, Drill Rig - Group R	8		76
646					20		Trucks, Mobile Crane - Group S	15		76
647					21		Trucks, Compressor or Welder Mounted - Group T	8		76
648					22		Trucks, Refrigerator - Group U	8		76
649					23		Trucks, Military Design, 1/4-Ton- Group V	7		76
650					24		Trucks, Military Design, 1/2-1-Ton- Group W	7		76
651					25		Trucks and Truck Tractors, Military Design, 1 1/2- Ton-Group X	8		76
652					26		Trucks and Truck Tractors, Military Design, 2 1/2- Ton-Group Y	8		76
653					27		Trucks and Truck Tractors, Military Design, 3-4- Ton-Group Z	10		76
654					28		Trucks and Truck Tractors, Military Design, 5-10- Ton-Group AA	10		76
655					29		Trucks and Truck Tractors, Military Design, 11- Ton and over - Group BB	12		76
656					30		Trucks, Military Design, Amphibious Group CC	10		76
657					31		Motorcycles, and Scooters, All Types Group DD	5		76
658					32		Trailers, 1/4-Ton-2 1/2-Ton All Types Group EE	20		76
659					33		Trailers and semi-Trailers, 3-15-Ton All Types Group FF	20		76
660					34		Trailers and semi-Trailers, 16-30 Ton All Types Group GG	20		76

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
661					35		Trailers and semi-Trailers, 30 Ton and over, all types - Group HH	20		76
662	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Other Mobile Land Plant					
663					1		Items not listed elsewhere, including Items with initial cost, new, of less than $25,000 per unit	10		76
664					2		Locomotives and Railroad Cars	100		76
665					3		Tractors, Wheel-mounted, initial cost $25,000 or more	12		76
666					4		Tractors, Crawler, including Bulldozers initial cost $25,000 or more	15		76
667					5		Cranes, Mobile			76
668						a	Cranes, Wheel-mounted, excluding those classified as Automotive Equipment	15		76
669						b	Cranes, Crawler type	15		76
670					6		Earth-moving Equipment, initial cost, $25,000 or more per unit			76
671						a	Scraper-carriers, Self-propelled or Towed	15		76
672						b	Rollers, Self-propelled or Towed	15		76
673						c	Back Hoes, excluding Back Hoe attachments for general purposes Tractors or Cranes	15		76
674						d	Loaders, excluding attachments for general purpose tractors	15		76
675						e	Ditchers, Trenchers, Excavators, and Back fillers, excluding attachments for other basic equipment	15		76
676						f	Graders, Self-propelled or Towed	15		76
677					7		Material-handling Equipment, initial cost, new, $25,000 or more per unit	20		76
678					8		Miscellaneous Equipment, Initial cost, new, $25,000 or more per unit	15		76
679	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Office Furniture and Equipment					
680					1		Furniture (Decks, Tables, Chairs, Lockers, Files, Map Cases, Bookcases and Safes)			
681						a	Miscellaneous Items, initial cost, new less than $25,000 per unit	10		76
682						b	Safes, Special Equipment, etc., initial cost, new, $25,000 or more, per unit	20		76

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
683					2		Equipment, such as Typewriter, Adding machines, Calculators, Duplicating and Recording Machines, Key Punch Equipment, Electronic Calculators and Computers	10		76
684						a	Miscellaneous Equipment not listed elsewhere, including items initial cost, new, less than $25,000 per unit	10		76
685						b	Office Machines, such as Accounting Machines, Dictating Machines, typewriters, Adding Machines, Key Punch and Electronic Mechanical Data Processors, Electro-Mechanical Calculators, initial cost, new $25,000 or more per unit	15		76
686						c	Electronic calculators, computer, and related items	15		76
687						d	Duplicating and Reproducing Machines initial cost, new, $25,000 or more per unit	15		76
688	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Material Handling Equipment					
689					1		Miscellaneous Equipment not listed elsewhere, including items initial cost, new, less than $25,000 per item (including shelving, storage bins, portable conveyors, dollies, and similar equipment)	50		76
690					2		Fixed-conveyor Systems (Mono-rail, Roller Type) initial cost, new $25,000 or more per system	25		76
691					3		Special Storage Racks, Bins, Ramps, Platforms, and similar equipment, independent of other Structures, initial cost, new, $25,000 or more per unit	25		76
692	335	-	20	MISCELLANEOUS POWER PLANT EQUIPMENT	Shop Tools and Equipment					76
693					1		Miscellaneous Fixed Shop Equipment not listed elsewhere, including items initial cost, new, less than $25,000 per unit	10		76
694					2		Major Fixed Shop Equipment consisting of such items as lathes, sharpers, drying ovens, Forges, pipe, and sheet metal machines, table and band saws, initial cost, new, $25,000 or more, per unit	25		76
695					3		Miscellaneous Portable Shop Equipment and Tools not listed elsewhere, initial cost, new, less than $25,000 per unit	10		76

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
696	**LIFE SAFETY EQUIPMENT**									
697	334	170	073	ACCESSORY ELECTRIC EQUIPMENT	Life Safety equipment: Access Control and Intrusion Detection Systems					
698					1	Software /Firmware / Hardware				
699						a	Applications	5		77
700						b	Server	5		77
701						c	Workstation	5		77
702						d	Monitor	5		77
703						e	Controller Panel	7		77
704						f	Data Transport			
705						g	Switches / Routers	5		77
706						h	Media Converter	7		77
707						i	Fiber Driver	5		77
708						j	Wireless Transceiver	7		77
709						k	Vehicle Barrier			
710						l	Barrier Actuator/Controls	10		77
711						m	Barrier Structural Components	20		77
712						n	Vessel Barrier	10		77
713						o	Door Hardware			
714						p	Electric Strike/Release	7		77
715						q	Balanced Magnetic Switch (BMS)	10		77
716						r	Request to Exit (REX) Device	7		77
717						s	Card Reader	7		77
718						t	Intrusion Detection			
719						u	Motion Sensors (PIR)	7		77
720						v	Radar	10		77
721						w	Radar carriage	20		77
722						x	Water Level	10		77
723						y	Power Supply	5		77
724						z	Video Amplifier	7		77

TABLE ITEM #	FERC ACCOUNT NUMBER	USBR ACCT	USACE ACCT	FERC UNIFORM ACCOUNT NAME	ITEM	SUB-ITEM	UNIT OF PROPERTY/PLANT ITEM	SERVICE LIFE (YR)	RETIREMENT UNITS* & MAINTENANCE ITEMS	JUSTIFI-CATION NUMBER
725					2	Video Monitoring System			The video monitoring systems may be integrated with the Access Control and Intrusion Detection Systems, not as a stand-alone system. In this case, some of the components may be shared (i.e. server, workstation).!!	
726						a	Camera Visible Light - Fixed	7		77
727						b	Camera Visible Light - PTZ	7		77
728						c	Camera Thermal	7		77
729						d	Encoder / Decoder	7		77
730						e	Matrix Switcher	7		77
731						f	Media Converter	7		77
732						g	Video Recorder	5		77
733						h	Power Supply and Related	7		77

5. REPLACEMENT PERCENTAGES, FACTORS, AND DEPRECIATION

A. Introduction

After establishing the replaceable units of property and their respective service lives, as described in preceding chapters, the next step is the determination of the percent distribution of cost by service life categories and by major accounts. By applying these percentages to the financial plant-in-service records, estimates of anticipated future replacement expenses can be made. Example factor calculations are discussed in this chapter.

1. 2017 Update

The 2017 update focused on collecting new data for all plant accounts. New factors were calculated for applicable FERC accounts and for the FBMS accounts (that do not have a corresponding FERC account) with replaceable units of property.

Justification No. 53 and Justification No. 75 continue to support the factors used for wood and steel transmission lines that are in accounts 354, 355, and 356. Composite factors were prepared for Plant Accounts 355 (Poles and Fixtures), 356 (Overhead Conductors and Devices), and 397 (Supervisory Control and Communication Equipment).

2. Organization of Chapter Five

Detailed calculations are included as the Factor Calculations at the end of this chapter (Table 8). The results of these tabulations are summarized in Table 9 and Table 10. Table 9 provides the percentages of replaceable plant by plant accounts by service life groups for repayment purposes. Table 10 summarizes by plant account the annual periodic replacement percentages, together with weighted service lives and depreciation rates. Table 11 is the “Look-Up” Table that is used in the Replacements subsection of the PRS.

B. Approach

1. General

The computations of replacement percentages, replacement factors, and depreciation rates follow the same general approach used in the 1995 and 2005 update except for some procedural changes discussed below. As discussed in Chapter 2, service life categories are in 5-year increments for those units of property with 15 through 100 years. Only those replaceable units of property with lives of 100 years or less are included in the power replacement study subsection of repayment analyses. Also, as of the 2017 revision, service life shorter than 5 years is allowed for units of property with service lives less than 14 years.

2. Price Level Impacts

The cost data for each of the plant accounts are generally consistent with the costs representing price levels at the time the projects were completed or the equipment installed.

3. Impact of Technological Changes

Rapid technological changes can impact the replacement percentages and factors. This especially applies to accounts such as communications, which are affected by technological advances in those units of property involving sophisticated electronic devices. Therefore, all units of property involving new technology should be reviewed every 5 years or sooner if need be.

4. Summary of Annual and Periodic Replacement Percentages and Weighted Service Lives (Factor Calculations)

Table 10, which summarizes, by plant account, the depreciation and periodic replacement percentages, together with weighted service lives, is intended to simplify the calculation of future replacement costs for power repayment studies.

The factors for equipment are recalculated according to the financial information available as of September 30, 2015. The calculations are similar to those in previous updates.

In instances where WAPA does not track the financial information to a level lower than the minor category, costs are consolidated into one line. As an example, data was not available to separate the plant account investment for Circuit Breakers into the different types indicated in Justification No. 13.

FERC 353-WAPA determined that it was no longer necessary to separate AC and DC Terminals. Data has been consolidated into one spreadsheet.

In accordance with the agreed-to changes in service lives, the following items have been updated to reflect changes:

FERC 353

1: Air Compressor and Motor changed from 50 years to 25 years.

3: Distributions Boards (Battery Chargers) service life changed from 20 to 35 years

13: Circuit Breakers service life changed from 35 to 50 years

18: CCVT service life changed from 35 to 30 years

36: Phase Shifting Transformer service life changed from 40 to 45 years

57: Disconnecting Switches service life changed from 35 to 50 years

63: HVDC and SVS service life changed from 35 to 30 years

64: Grounding Transformer service life changed from 40 to 45 years

65: Instrument Transformer service life changed from 30 to 45 years

66: Power Transformer service life changed from 40 to 45 years

FERC 356

57: Disconnecting Switches service life changed from 35 to 50 years

FERC 397

70: Transmitter and/or Receiver Set, Single Channel Radio service life changed from 10 to 25 years

5. Depreciation Rates for Power Facilities

This update develops annual straight-line depreciation rates, which are summarized in Table 10.

Because this update is not a depreciation study, there is no requirement to address other project costs such as cost of removal and interest during construction. Salvage and cost of removal are additional elements of cost that must be addressed in establishing rigorous depreciation requirements. However, this update assumes that the salvage value equals the cost of removal, resulting in no effect on the project costs.

The percent of account investment by service life is the basis for the straight line depreciation rates. The procedure for developing the depreciation rates for each plant account using the composite life method is to combine the depreciation rates for each service life group weighted according to the percentage that each service life group represents of the total account cost.

Table 8. Factor Calculations

FERC Code 331 - Structures and Improvements - Power Plants, Camps, Project Buildings

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
7	Building	Cat 1	N/A	2,011,140,686.37	82.62%			
		Cat 2	50	420,878,106.84	17.29%	0.35%	21,043,905,342	
		Cat 3	25	2,084,688.44	0.09%	0.00%	52,117,211	
48	Solar Collector		15					
	Total Replaceable Plant			**422,962,795**	17.38%	0.35%	**21,096,022,553**	49.88
	Investments life more than 50 years			2,011,140,686	82.62%	0.83%	201,114,068,600	
	Plant Account Total			2,434,103,481	100.00%	1.18%		

Total Investment **2,434,103,481**

FERC Code 331 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment) **49.88 Years**

Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total) **17.38%**

Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years) **1.18% per year**

Note: Assumed Buildings, Improvements and Renovation on Financial schedule represented category 3 buildings.

Note: Divided remaining amounts for buildings according to percentages in the previous study.

For FERC Code Composite 331 & 352

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 8)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
7	Building	Cat 1	N/A	2,011,140,686	70.97%			
		Cat 2	50	759,780,573	26.80%	0.54%	37,989,028,650	
		Cat 3	25	14,125,809	0.50%	0.02%	353,145,225	
42	Roof Covering		20	7,542,915	0.27%	0.01%	150,858,300	
48	Solar Collector		15					
	Total Replaceable Plant			**781,449,297**	27.58%	0.57%	**38,493,032,175**	49.26
	Investments life more than 50 years			2,052,440,184	72.42%	0.71%	205,244,018,400	
	Plant Account Total			2,833,889,481		1.28%		

Total Investment **2,833,889,481**

Composite FERC Codes 331 & 352 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment) **49.26 Years**

Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total) **27.58%**

Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years) **1.28% per year**

Note: Assumed Buildings, Improvements and Renovation on Financial schedule represented category 3 buildings.

Note: Divided remaining amounts for buildings according to percentages in the previous study.

FERC Code 333 - Waterwheels, Turbines, and Generators

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 8) (E/Total Investment)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
74	Wear Rings, Runner		20	19,400,000	0.63%	0.03%	388,000,000	
52	Stator Winding, Generator	levels	25	300,000,000	9.73%	0.39%	7,500,000,000	
50	Speed Increaser		20	106,051	0.00%	0.00%	2,121,020	
25	Exciter, Generator		15/30/40	194,000,000	6.29%	0.16%	7,760,000,000	
44	Rotor Winding, Generator		40/50	97,000,000	3.14%	0.06%	4,850,000,000	
46	Runner, Turbine		50	436,000,000	14.14%	0.28%	21,800,000,000	
	Subtotal For 50 Years		**50**	**533,000,000**	**17.28%**	**0.35%**	**26,650,000,000**	
29	Gates and Valves		50					
30	Governor		Varies	79,000,000				
38	Pressure Regulator and Energy Absorber		45					
62	Thrust Bearing, Generator		50					
	Subtotal More Than 50 Years			**2,037,802,971**	**66.07%**	**0.66%**	**203,780,297,100**	
	Total Replaceable Plant			**1,046,506,051**	33.93%	0.93%	**42,300,121,020**	40.42
	Investments life more than 50 years			2,037,802,971	66.07%	0.66%	0	
	Plant Account Total			3,084,309,022		1.59%		

Total Investment **3,084,309,022**

FERC Code 333 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment) **40.42 Years**

Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total) **33.93%**

Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years) **1.59% per year**

Investment dollars derived from cost estimates provided by Reclamation Technical Service Center.
Speed Increaser Investment dollars derived from 2006 Replacements Book.

FERC Code 334 - Accessory Electrical Equipment

A	B	C	D			E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Equipment Count**	**Cost Per Item**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
4	Batteries 48 volts & above		5/15/30	58	57,127	3,313,366	1.01%	0.07%	49,700,490	
3	Distribution Boards (Formerly Battery Charger)		20	58	15,000	870,000	0.26%	0.01%	17,400,000	
23	Engine Generator Set, Aux		35	11	967,031	10,637,341	3.23%	0.09%	372,306,935	
58	Switching Equipment		35/40	194	410,985	79,731,090	24.23%	0.61%	3,189,243,600	
	Subtotal for 35 years		35			90,368,431	27.46%	0.78%	3,561,550,535	
8	Cable-Power, Generator & Pump		40	194	25,000	4,850,000	1.47%	0.04%	194,000,000	
	Total Replaceable Plant					**99,401,797**	30.20%	0.90%	**3,822,651,025**	38.46
	Investments life more than 50 years					229,693,456	69.80%	0.70%	22,969,345,600	
	Plant Account Total					329,095,253		1.60%		
Total Investment						**329,095,253**				

FERC Code 334 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment)	**38.46**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**30.20%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**1.60%**	**per year**

Note: Investments with life more than 50 years was calculated by subtracting the total replaceable plant from the Total Investments.

Note: The Total Investment (329,095,253) is from the Bureau Financials

FERC Code 335 - Miscellaneous Equipment

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	Equipment Count	Cost Per Item	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 8) (E/Total Investment)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
72	UPS		10	No Available Data						
1	Air Compressor & Motor		25	194	128,524	24,933,656	3.73%	0.15%	623,341,400	
	Subtotal 50 years or less					**24,933,656**	**3.73%**	**0.15%**	**623,341,400**	**25.00**
	Total Replaceable Plant					**24,933,656**	3.73%	0.15%	**623,341,400**	25.00
	Investments life more than 50 years					643,528,971	96.27%	0.96%	64,352,897,100	
	Plant Account Total					668,462,627		1.11%		

Total Investment **668,462,627**

FERC Code 335 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment)	**25.00**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**3.73%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**1.11%**	**per year**

Note: Air Compressor & Motor investments in the previous edition were 3.73 percent of the total miscellaneous equipment investment.

FERC Code 352 - Structures and Improvements

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
42	Roof Covering		20	7,542,915	1.89%	0.095%	150,858,300	
7	Building	Category 3	25	12,041,121	3.01%	0.120%	301,028,025	
7	Building	Category 2	50	338,902,466	84.77%	1.695%	16,945,123,300	
Total	**Replaceable Plant**			**358,486,502**	**89.67%**	**1.910%**	**17,397,009,625**	**48.53**
	Investments life more than 50 years			41,299,498	10.33%	0.103%	4,129,949,800	
	Plant Account Total			399,786,000	100.00%	2.013%		

Total Investment	**399,786,000**

FERC Code 352 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment)	**48.53**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**89.67%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**2.01%**	**per year**

FERC Code 353 - Station Equipment AC and DC Terminals

A	B	C	D		E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Equipment Count**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
17	Control and System Protection Equipment		15						
		Meter, Combination Transducer	15	472					
		Meter, Electromechanical	15	69					
		Meter, Electronic	15	34					
		Meter, Microprocessor	15	1,792					
		Meter, Panel	15	1,826					
	Total Meters		15	4,193	34,680,671	2.88%	0.192%	520,210,065	
		Relay, Communications Processor	15	405					
		Relay, Electromechanical	15	3,755					
		Relay, Electronic	15	1,379					
		Relay, Isolation	15	112					
		Relay, Microprocessor	15	4,369					
		Substation Control, Relay Panel	15	548					
	Total Relays		15	10,568	118,570,685	9.85%	0.657%	1,778,560,275	
4	Battery Bank, 48 Volts and Above	Battery	15	671	13,402,055	1.11%	0.074%	201,030,825	
22	Digital Fault Recorder	Recorder, Digital Fault	15	159	6,696,398	0.56%	0.037%	100,445,970	
	Subtotal 15 year life		**15**		**173,349,809**	**14.39%**	**0.959%**	**2,600,247,135**	

A	B	C	D		E	F	G	H	I
Justification No.	Equipment/Facility	Equipment Class	Life	Equipment Count	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
33	Interrupter Switches with Fault Clearing Capability		20		33,655,466				
		Circuit Recloser	20	35					
		Interrupter	20	314					
		MOG	20	66					
		SwitchGear, Metal-Clad	20	25					
	Subtotal 20 year life		**20**		**33,655,466**	**2.79%**	**0.140%**	**673,109,320**	
11	Capacitor Bank, Shunt and Series				67,854,939				
		Capacitor, Series	25	41					
		Capacitor, Shunt	25	390					
	Subtotal 25 year life		**25**		**67,854,939**	**5.63%**	**0.225%**	**1,696,373,475**	
18	Coupling Capacitor Voltage Transformer (CCVT)	Transformer, CCVT	30	2,660	24,136,713	2.00%	0.067%	724,101,390	
63	Thyristor Valve Banks - HVDC (High Voltage Direct Current) and SVS (Static Var Systems)	High Voltage DC Thyristor Valve	30		12,293,219	1.02%	0.034%	368,796,570	
	Subtotal 30 year life		**30**		**36,429,932**	**3.03%**	**0.101%**	**1,092,897,960**	
2	Arrester, Surge	Arrester	35	1,778	1,407,796	0.12%	0.003%	49,272,860	
3	Distribution Boards (Battery Charger, 24 Volts and Above)	Charger, Battery	20/25/35	944	13,460,140	1.12%	0.032%	471,104,900	
23	Engine Generator Set, Auxiliary	Generator	35	285	1,806,985	0.15%	0.004%	63,244,475	
41	Reactor (Dry Air Core or Oil Immersed)	Reactor, Substation or Line	25/35	480	45,725,561	3.80%	0.109%	1,600,394,635	
68	Transformer, Station Service	Transformer, SS - Station Service	35	559	10,019,716	0.83%	0.024%	350,690,060	
	Subtotal 35 year life		**35**		**72,420,198**	**6.01%**	**0.172%**	**2,534,706,930**	

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	Equipment Count	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 8) (E/Total Investment)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
67	Transformer, Mobile Power	Transformer, Mobile	40	17	5,234,591	0.43%	0.011%	209,383,640	
73	Voltage Regulator	Voltage Regulator	40		12,201,316	1.01%	0.025%	488,052,640	
	Subtotal 40 year life		**40**		**17,435,907**	**1.45%**	**0.036%**	**697,436,280**	
64	Transformer, Grounding	Transformer, Grounding	45	64	20,029,050	1.66%	0.037%	901,307,250	
65	Transformer, Instrument - 69 kV and Above		45		18,354,758	1.52%	0.034%	825,964,110	
		Transformer, CT	45	2,924					
		Transformer, Meter Set	45	102					
		Transformer, PT	45	2,421					
36	Transformer, Phase Shifting	Transformer, Phase Shifting	45	5	36,745,233	3.05%	0.068%	1,653,535,485	
66	Transformer, Main Power	Transformer, Power	45	440	246,590,012	20.48%	0.455%	11,096,550,540	
	Subtotal 45 year life		**45**		**321,719,053**	**26.71%**	**0.594%**	**14,477,357,385**	
13	Circuit Breaker, Power		50		331,764,478	27.55%	0.551%	16,588,223,900	
		Breaker, Air	45	4					
		Breaker, Gas	50	1,712					
		Breaker, Oil	50	376					
		Breaker, Vacuum	50	110					
57	Switch, Disconnecting		50		90,909,964	7.55%	0.151%	4,545,498,200	
		Switch, Disconnect	50	6,538					
		Switch, Fused	50	493					
		Switch, Ground, Manual	50	1,129					
		Switch, Transfer	50	82					
		Switch, Vacuum	50	77					
	Subtotal 50 year life		**50**		**422,674,442**	**35.10%**	**0.702%**	**21,133,722,100**	

For FERC Code 353

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	Equipment Count	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 8) (E/Total Investment)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
Total	**Replaceable Plant**				**1,145,539,746**	**95.12%**	**2.929%**	**44,905,850,585**	**39.20**
	Investments life more than 50 years				58,746,514	4.88%	0.049%	5,874,651,400	
	Plant Account Total				1,204,286,260	100.00%	2.978%		

Total Investment **1,204,286,260**

FERC Code 353 AC (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment)	**39.20**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**95.12%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**2.98%**	**per year**

FERC Code 354 - Towers and Fixtures

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Cross Arms	50	2,538	0.00%	0.000%	126,900	
		Footings	50	24,596	0.01%	0.000%	1,229,800	
		Foundations	50	775,068	0.21%	0.004%	38,753,400	
		Steel Tower	50	10,454,074	2.79%	0.056%	522,703,700	
	Subtotal 50 year life		**50**	**11,256,276**	**3.00%**	**0.060%**	**562,813,800**	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Cross Arms	N/A	82,059	0.02%	0.000%	8,205,900	
		Footings	N/A	795,265	0.21%	0.002%	79,526,500	
		Foundations	N/A	25,060,526	6.68%	0.067%	2,506,052,600	
		Steel Tower	N/A	338,015,066	90.09%	0.901%	33,801,506,600	
	Subtotal more than 50 year life		**N/A**	**363,952,916**	**97.00%**	**0.970%**	**36,395,291,600**	
Total	**Replaceable Plant**			**11,256,276**	**3.00%**	**0.060%**	**562,813,800**	**50.00**
	Investments life more than 50 years			363,952,916	97.00%	0.970%	36,395,291,600	
	Plant Account Total			375,209,192	100.00%	1.030%		

Total Investment **375,209,192**

FERC Code 354 (Table 9)		
Weighted Service Life ((Total Life X $)/ Total Investment)	**50.00**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**3.00%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**1.03%**	**per year**

For FERC Code 355

FERC Code 355 - Poles and Fixtures

A	B	C	D	E	F	G	H	I
Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Concrete Pole	50	3,018,583	0.54%	0.011%	150,929,150	
75	Wood Pole/Structure Transmission	Wood Pole	50	25,054,878	4.51%	0.090%	1,252,743,900	
75	Wood Pole/Structure Transmission	Cross Arms	50	5,259	0.00%	0.000%	262,950	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Cross Arms	50	1,143	0.00%	0.000%	57,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Steel Pole	50	8,198,843	1.48%	0.030%	409,942,150	
	Subtotal 50 year life		**50**	**36,278,706**	**6.53%**	**0.131%**	**1,813,935,300**	
Total	**Replaceable Plant**			**36,278,706**	**6.53%**	**0.131%**	**1,813,935,300**	**50.00**
	Investments life more than 50 years			519,268,800	93.47%	0.935%	51,926,880,000	
	Plant Account Total			555,547,506	100.00%	1.066%		

Total Investment **555,547,506**

FERC Code 355 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment)	**50.00**	**Years**
Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total)	**6.53%**	
Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years)	**1.07%**	**per year**

FERC Code 355 - Poles and Fixtures

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
75	Wood Pole/Structure Transmission	Wood Pole	50	25,054,878	13.80%	0.276%	1,252,743,900	
75	Wood Pole/Structure Transmission	Cross Arms	50	5,259	0.00%	0.000%	262,950	
75	Wood Pole/Structure Transmission	greater than 50 years	100	156,535,059	86.20%	0.862%	15,653,505,900	
	Subtotal Justification No. 75			**181,595,196**	**100.00%**	**1.138%**	**16,906,512,750**	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Concrete Pole	50	3,018,583	0.81%	0.016%	150,929,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Cross Arms	50	1,143	0.00%	0.000%	57,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Steel Pole	50	8,198,843	2.19%	0.044%	409,942,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	greater than 50 years	100	362,733,741	97.00%	0.970%	36,273,374,100	
	Subtotal Justification No. 53			**373,952,310**	**100.00%**	**1.030%**	**560,928,450**	
Total	**Replaceable Plant**			**36,278,706**	**6.53%**	**0.336%**	**1,813,935,300**	**50**
	Investments life more than 50 years			519,268,800	93.47%			
	Plant Account Total			555,547,506	100.00%			
Total Investment				555,547,506				

FERC Code 356 - Overhead Conductors and Devices

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
57	Switch, Disconnecting >69 KV	Disconnect Switch	50	1,936,172	0.35%	0.007%	96,808,600	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Conductor-Steel Strct	50	1,050,023	0.19%	0.004%	52,501,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Ground Wires-Steel	50	160,109	0.03%	0.001%	8,005,450	
		Conductor	50	3,579,320	0.64%	0.013%	178,966,000	
		Insulators	50	249,876	0.04%	0.001%	12,493,800	
		Ground Wires	50	4,048,311	0.72%	0.014%	202,415,550	
							0	
75	Wood Pole/Structure Transmission	Conductor-Wood Strct	50	2,677,686	0.48%	0.010%	133,884,300	
							0	
75	Wood Pole/Structure Transmission	Ground Wires-Wood	50	206,719	0.04%	0.001%	10,335,950	
		Conductor	50	14,677,312	2.62%	0.052%	733,865,600	
		Insulators	50	1,024,637	0.18%	0.004%	51,231,850	
		Ground Wires	50	16,600,448	2.97%	0.059%	830,022,400	
	Subtotal 50 year life		**50**	**46,210,613**	**8.25%**	**0.165%**	**2,310,530,650**	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Conductor-Steel Strct	N/A	33,950,735	6.06%	0.061%	3,395,073,500	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Ground Wires-Steel	N/A	5,176,870	0.92%	0.009%	517,687,000	
		Conductor	N/A	115,731,359	20.67%	0.207%	11,573,135,900	
		Insulators	N/A	8,079,314	1.44%	0.014%	807,931,400	
		Ground Wires	N/A	130,895,385	23.38%	0.234%	13,089,538,500	
75	Wood Pole/Structure Transmission	Conductor-Wood Strct	N/A	16,725,834	2.99%	0.030%	1,672,583,400	

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
75	Wood Pole/Structure Transmission	Ground Wires-Wood	N/A	1,291,242	0.23%	0.002%	129,124,200	
		Conductor	N/A	91,680,022	16.38%	0.164%	9,168,002,200	
		Insulators	N/A	6,400,268	1.14%	0.011%	640,026,800	
		Ground Wires	N/A	103,692,656	18.52%	0.185%	10,369,265,600	
	Subtotal more than 50 year life			**513,623,685**	**91.75%**	**0.918%**	**51,362,368,500**	
Total	**Replaceable Plant**			**46,210,613**	**8.25%**	**0.165%**	**2,310,530,650**	**50.00**
	Investments life more than 50 years			513,623,685	91.75%	0.918%	51,362,368,500	
	Plant Account Total			559,834,298	100.00%	1.083%		

Total Investment **559,834,298**

FERC Code 356 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment) **50.00** **Years**

Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total) **8.25%**

Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years) **1.08%** **per year**

For FERC Code separated 356

FERC Code 356 - Overhead Conductors and Devices

A	B	C	D	E	F	G	H	I
Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
57	Switch, Disconnecting >69 KV	Disconnect Switch	50	1,936,172	100.00%			
	Subtotal Justification No. 57		**50**	**1,936,172**	**100.00%**	**2.000%**	**96,808,600**	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Conductor-Steel Strct	50	1,050,023	0.35%	0.007%	52,501,150	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	Ground Wires-Steel	50	160,109	0.05%	0.001%	8,005,450	
		Conductor	50	3,579,320	1.18%	0.024%	178,966,000	
		Insulators	50	249,876	0.08%	0.002%	12,493,800	
		Ground Wires	50	4,048,311	1.34%	0.027%	202,415,550	
53	Steel Structure, Steel Pole or Concrete Pole Transmission Line	greater than 50 years	100	293,833,663	97.00%	0.970%	29,383,366,300	
	Subtotal Justification No. 53			**302,921,302**	**100.00%**	**1.031%**	**29,837,748,250**	
75	Wood Pole/Structure Transmission	Conductor-Wood Strct	50	2,677,686	1.05%	0.021%	133,884,300	
75	Wood Pole/Structure Transmission	Ground Wires-Wood	50	206,719	0.08%	0.002%	10,335,950	
		Conductor	50	14,677,312	5.76%	0.115%	733,865,600	
		Insulators	50	1,024,637	0.40%	0.008%	51,231,850	
		Ground Wires	50	16,600,448	6.51%	0.130%	830,022,400	
75	Wood Pole/Structure Transmission	greater than 50 years	100	219,790,022	86.20%	0.862%	21,979,002,200	
	Subtotal Justification No. 75			**254,976,824**	**100.00%**	**1.138%**	**23,738,342,300**	

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) x 1/D)	(F Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
Total	**Replaceable Plant**			**46,210,613**	**8.25%**	**2.337%**	**2,310,530,650**	**50.00**
	Investments life more than 50 years			513,623,685	91.75%			
	Plant Account Total			559,834,298	100.00%			

Total Investment	**559,834,298**

FERC Code 397 - Supervisory Communication and Control Equipment

A	B	C	D	E	F	G	H	I
Justification No.	**Equipment/Facility**	**Equipment Class**	**Life**	**Plant Account Investment (Dollars)**	**Percent of Plant Account Investment (Table 8) (E/Total Investment)**	**Annual Depreciation (Percentage) (F x 1/D)**	**Life times Plant Account Investment (Dollar Years)**	**Weighted Service Life (Years)**
27	Fiber Optics Multiplexor	Fiber Optics Equip	10	12,379,918	3.03%	0.303%	123,799,180	
		Add Drop Multiplexer	10	20,503,155	5.02%	0.502%	205,031,550	
		Termination Equip	10	2,944,706	0.72%	0.072%	29,447,060	
	Load & Frequency Control		10	1,858,389	0.45%	0.045%	18,583,890	
55	Supervisory Control and Data Acquisition (SCADA) / Energy Management System (EMS)							
		SCADA	10	63,478,511	15.53%	1.553%	634,785,110	
		RTU	10	16,284,511	3.98%	0.398%	162,845,110	
		Miscellaneous	10	15,462,260	3.78%	0.378%	154,622,600	
60	Telephone System	Com, Telephone Portable	10	7,834,123	1.92%	0.192%	78,341,230	
14	Closed Circuit Television and Security System		10	4,683,173	1.15%	0.115%	46,831,730	
		Camera	10					
		Security System	10					
		Video Equipment	10					
40	Radio Transmitter and/or Receiver Set, Microwave Multi-Channel							
		Radio	10	1,693,661	0.41%	0.041%	16,936,610	
		Channel Bank	10	5,476,597	1.34%	0.134%	54,765,970	
		Microwave system	10	116,273,121	28.45%	2.845%	1,162,731,210	
72	Uninterruptable Power Supply (UPS)	UPS- Uninterruptable Power Supply	10	10,204,931	2.50%	0.250%	102,049,310	
	Subtotal 10 year life		**10**	**279,077,056**	**68.29%**	**6.829%**	**2,790,770,560**	
69	Transmitter and/or Receiver Set, Powerline Carrier	Power Line Carrier	15	3,003,226	0.73%	0.049%	45,048,390	

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
47	Sequential Event Recorder System (SER)	Recorder, SER	15	565,419	0.14%	0.009%	8,481,285	
34	Motor (Engine) Generator Set, Communication	Electric Motor/Generator	15	1,595,336	0.39%	0.026%	23,930,040	
49	Solar-Photo Voltaic Power Supply	Solar Regulator System	15	378,469	0.09%	0.006%	5,677,035	
	Subtotal 15 year life		**15**	**5,542,450**	**1.36%**	**0.091%**	**83,136,750**	
12	Carrier Wave Trap	Wave Trap	35	10,571	0.003%	0.000%	369,985	
15	Communication Tower with Passive Antenna and Active Antenna		20	13,545,161	3.31%	0.166%	270,903,220	
	Subtotal for 20 year life		**20**	**13,555,732**	**3.32%**	**0.166%**	**271,114,640**	
70	Transmitter and/or Receiver Set, Single Channel Radio	Mobile Radio	25	2,519,585	0.62%	0.025%	62,989,625	
	Subtotal 25 year life		**25**	**2,519,585**	**0.62%**	**0.025%**	**62,989,625**	
15	Communication Tower with Passive Antenna and Active Antenna		40	13,545,161	3.31%	0.083%	541,806,440	
	Subtotal 40 year life		**40**	**13,545,161**	**3.31%**	**0.083%**	**541,806,440**	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Wood Structure)		50	5,781,881	1.41%	0.028%	289,094,050	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Steel Structure)		50	1,410,013	0.35%	0.007%	70,500,650	
	Subtotal 50 year life		**50**	**7,191,894**	**1.76%**	**0.035%**	**359,594,700**	

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 8) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
Total	**Replaceable Plant**			**321,431,878**	**78.65%**	**7.229%**	**4,109,412,715**	**12.78**
	Investments life more than 50 years			87,260,950	21.35%	0.214%	8,726,095,000	
	Plant Account Total			408,692,828	100.00%	7.443%	12,835,507,715	

Total Investment **408,692,828**

FERC Code 397 (Table 9)

Weighted Service Life ((Total Life X $)/ Total Investment) **12.78** **Years**

Periodic Replacement Factor (Total Replaceable Plant / Plant Account Total) **78.65%**

Depreciation (Sum of Individual Annual Percentage + Investments Life More than 50 Years) **7.44%** **per year**

FERC Code 397 - Supervisory Communication and Control Equipment

A Justification No.	B Equipment/Facility	C Equipment Class	D Life	E Plant Account Investment (Dollars)	F Percent of Plant Account Investment (Table 9) (E/Total Investment)	G Annual Depreciation (Percentage) (F x 1/D)	H Life times Plant Account Investment (Dollar Years)	I Weighted Service Life (Years)
27	Fiber Optics Multiplexor	Fiber Optics Equip	10	12,379,918	9.93%	0.993%	123,799,180	
		Add Drop Multiplexer	10	20,503,155	16.44%	1.644%	205,031,550	
		Termination Equip	10	2,944,706	2.36%	0.236%	29,447,060	
	Subtotal 10 year life		**10**	**35,827,779**	**28.73%**	**2.873%**	**358,277,790**	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Wood Structure)		50	5,781,881	4.64%	0.093%	289,094,050	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Steel Structure)		50	1,410,013	1.13%	0.023%	70,500,650	
	Subtotal 50 year life		**50**	**7,191,894**	**5.77%**	**0.115%**	**359,594,700**	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Wood Structure)		100	36,115,811	28.96%	0.290%	3,611,581,100	
26	Fiber Optic Cable, Optical Ground Wire (OPT-GW) (Steel Structure)		100	45,590,424	36.55%	0.366%	4,559,042,400	
	Subtotal more than 50 year life		**100**	**81,706,235**	**65.50%**	**0.655%**	**8,170,623,500**	
	Subtotal Fiber Optics			**124,725,908**	**100.00%**	**3.643%**	**8,888,495,990**	**16.69**
							Fiber Optics Periodic Replacement Factor	**34.49%**
55	Supervisory Control and Data Acquisition (SCADA) /	SCADA	10	63,478,511	66.66%	6.666%	634,785,110	
		RTU	10	16,284,511	17.10%	1.710%	162,845,110	
		Miscellaneous	10	15,462,260	16.24%	1.624%	154,622,600	
	Subtotal SCADA		**10**	**95,225,282**	**100.00%**	**10.000%**	**952,252,820**	**10.00**
							SCADA Periodic Replacement Factor	**100.00%**

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 9) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
40	Radio Transmitter and/or Receiver Set, Microwave Multi-Channel	Radio	10	1,693,661	1.24%	0.124%	16,936,610	
		Channel Bank	10	5,476,597	4.00%	0.400%	54,765,970	
		Microwave system	10	116,273,121	84.88%	8.488%	1,162,731,210	
	Subtotal 10 year life		**10**	**123,443,379**	**90.12%**	**9.012%**	**1,234,433,790**	
15	Communication Tower with Active Antenna		20	6,772,581	4.94%	0.247%	135,451,620	
	Subtotal 20 year life		**20**	**6,772,581**	**4.94%**	**0.25%**	**135,451,620**	
15	Communication Tower with Passive Antenna		40	6,772,581	4.94%	0.124%	270,903,240	
	Subtotal 40 year life		40	**6,772,581**	**4.94%**	**0.124%**	**270,903,240**	
	Subtotal Microwave			**136,988,541**	**100.00%**	**9.39%**	**1,640,788,650**	**11.98**
							Microwave Periodic Replacement Factor	**100.00%**
69	Transmitter and/or Receiver Set, Powerline Carrier	Power Line Carrier	15	3,003,226	99.65%	6.64%	45,048,390	
	Subtotal 15 year life		**15**	**3,003,226**	**99.65%**	**6.64%**	**45,048,390**	
12	Carrier Wave Trap	Wave Trap	20	10,571	0.35%	0.02%	211,420	
	Subtotal 20 year life			**10,571**	**0.35%**	**0.020%**	**211,420**	
	Subtotal Carrier			**3,013,797**	**100.00%**	**6.66%**	**45,259,810**	**15.02**
							Carrier Periodic Replacement Factor	**100.00%**
	Subtotal Load & Frequency Control		**10**	**1,858,389**	**100.00%**	**10.00%**	**18,583,890**	**10.00**
70	Transmitter and/or Receiver Set, Single Channel Radio	Mobile Radio	25	2,519,585	15.68%	0.63%	62,989,625	
	Subtotal 25 year life		**25**	**2,519,585**	**15.68%**	**0.63%**	**62,989,625**	
15	Communication Tower with Active Antenna		20	6,772,580	42.16%	2.11%	135,451,600	
	Subtotal 20 year life		**20**	**6,772,580**	**42.16%**	**2.11%**	**135,451,600**	
15	Communication Tower with Passive Antenna		40	6,772,580	42.16%	1.05%	270,903,200	
	Subtotal 40 year life		**40**	**6,772,580**	**42.16%**	**1.05%**	**270,903,200**	

Justification No.	Equipment/Facility	Equipment Class	Life	Plant Account Investment (Dollars)	Percent of Plant Account Investment (Table 9) (E/Total Investment)	Annual Depreciation (Percentage) (F x 1/D)	Life times Plant Account Investment (Dollar Years)	Weighted Service Life (Years)
	Subtotal Radio			**16,064,745**	**100.00%**	**3.79%**	**469,344,425**	**29.22**
							Radio Periodic Replacement Factor	**100.00%**
47	Sequential Event Recorder System (SER)	Recorder, SER	15	565,419	100.00%	6.67%	8,481,285	
	Subtotal Comm & Control		**15**	**565,419**	**100.00%**	**6.67%**	**8,481,285**	**15.00**
							Comm & Control Periodic Replacement Factor	**100.00%**
60	Telephone System	Com, Telephone Portable	10	7,834,123	31.72%	3.17%	78,341,230	
14	Closed Circuit Television and Security System		10	4,683,173	18.96%	1.90%	46,831,730	
		Camera	10					
		Security System	10					
		Video Equipment	10					
72	Uninterruptable Power Supply (UPS)	UPS-Uninterruptable	10	10,204,931	41.32%	4.13%	102,049,310	
	Subtotal 10 year life		**10**	**22,722,227**	**92.01%**	**9.20%**	**227,222,270**	
34	Motor (Engine) Generator Set, Communication	Electric Motor/Generator	15	1,595,336	6.46%	0.43%	23,930,040	
49	Solar-Photo Voltaic Power Supply	Solar Regulator System	15	378,469	1.53%	0.10%	5,677,035	
	Subtotal 15 year life		**15**	**1,973,805**	**7.99%**	**0.53%**	**29,607,075**	
	Subtotal Other			**24,696,032**	**100.00%**	**9.73%**	**256,829,345**	**10.40**
							Other Periodic Replacement Factor	**100.00%**
	Total Replaceable Plant			**321,431,878**	**78.65%**	**59.23%**	**4,109,412,715**	**12.78**
	Investments life more than 50 years			87,260,950				
	Plant Account Total			408,692,828				

Table 9. Replacement Investment in Percent of Plant Account Investment

(This table is used primarily to develop year-by-year estimates of future replacement costs for power repayment studies.)

PLANT ACCOUNTS			DESCRIPTION	FOR SERVICE LIFE GROUP (YEARS)									
FERC		FFS		10	15	20	25	30	35	40	45	50	>50
-			- STRUCTURES AND IMPROVEMENTS										
331	352		COMPOSITE (A)	0.00	0.00	0.27	0.50	0.00	0.00	0.00	0.00	26.80	72.43
331		130	POWERPLANTS AND PUMPING-GENERATING PLANTS, CAMPS, PROJECT BUILDINGS	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	17.29	82.62
352			SWITCHYARDS AND SUBSTATIONS (B)	0.00	0.00	189	3.01	0.00	0.00	0.00	0.00	84.77	10.33
			- PUMPS AND PRIME MOVERS (C)										
			ELECTRIC – UNIT CAPACITY - 250 to 1,500-hp	0.00	0.00	0.00	0.00	0.00	17.34	0.00	0.00	7.07	75.59
			ELECTRIC – UNIT CAPACITY - 1,500 to 10,000-hp	0.00	0.00	0.00	0.00	0.00	15.72	0.00	2.54	7.56	74.18
-		160	ELECTRIC – UNIT CAPACITY - 10,000-hp & ABOVE	0.00	0.00	0.00	12.88	0.00	3.54	0.00	3.22	9.66	70.70
			HYDRAULIC – UNIT CAPACITY - 250-hp & ABOVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	85.00
			FUEL TYPE – UNIT CAPACITY - LOW SPEED, BELOW 250-hp & ALL HIGH SPEED	0.00	0.00	0.00	75.00	0.00	5.00	0.00	0.00	0.00	20.00
			FUEL TYPE – UNIT CAPACITY- LOW SPEED, 250-hp & ABOVE	0.00	0.00	0.00	0.00	0.00	5.00	75.00	0.00	0.00	20.00
333		165	- WATERWHEELS, TURBINES, AND GENERATORS										
			POWERPLANTS AND PUMPING-GENERATING PLANTS	0.00	0.00	0.63	9.73	0.00	0.00	0.00	6.29	17.28	66.07
334		170	- ACCESSORY ELECTRIC EQUIPMENT										
			POWER AND PUMPING GENERATING PLANTS, AND PUMPING - PLANTS 1,500-hp AND ABOVE	0.00	101	0.26	0.00	0.00	27.46	147	0.00	0.00	69.80
335	398	199	- MISCELLANEOUS EQUIPMENT										
			POWER AND PUMPING-GENERATING PLANTS AND PUMPING - PLANTS 1,500-hp AND ABOVE	0.00	0.00	0.00	3.73	0.00	0.00	0.00	0.00	0.00	96.27
353		175	- STATION EQUIPMENT										
			AC and DC terminals	0.00	14.39	2.79	5.63	3.03	6.01	145	26.71	35.11	4.88
354		181	- TOWERS AND FIXTURES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	97.00
			POLES AND FIXTURES:										
355		182	COMPOSITE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.53	93.47
0.1		0.1	WOOD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	86.20
0.2		0.2	STEEL AND CONCRETE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	97.00
			OVERHEAD CONDUCTOR AND DEVICES:										
356		183	COMPOSITE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.25	9175
0.1		0.1	WOOD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.80	86.20
0.2		0.2	STEEL AND CONCRETE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	97.00

PLANT ACCOUNTS			DESCRIPTION	FOR SERVICE LIFE GROUP (YEARS)									
FERC		FFS		10	15	20	25	30	35	40	45	50	>50
397		180	- SUPERVISORY COMMUNICATION AND CONTROL EQUIPMENT										
		0.5	COMPOSITE	68.28	136	3.32	0.62	0.00	0.00	3.31	0.00	176	2135
		0.2	SCADA	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.3	MICROWAVE	90.12	0.00	4.94	0.00	0.00	0.00	4.94	0.00	0.00	0.00
		0.4	CARRIER CURRENT	0.00	99.65	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.5	LOAD & FREQUENCY CONTROL	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.1	RADIO	15.68	0.00	42.16	0.00	0.00	0.00	42.16	0.00	0.00	0.00
			FIBER OPTICS	28.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.77	65.50
		0.5	COMMUNICATION AND CONTROL	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		180.5	OTHER	92.01	7.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(A) Applicable to structures and improvements accounts of identified properties indicated. Composite factor may be used for power investment when a cost breakdown is not available.

(B) Use for those switchyards or substations that have control and equipment buildings.

(C) New data for this FSS code was not available for this update. Data shown is from previous update.

Table 10. Annual and Periodic Replacement Percentages and Weighted Service Lives (Factor Calculations)

(This table is used primarily to develop weighted estimates of future replacement costs for power repayment studies.)

PLANT ACCOUNTS						
FERC		FFS	DESCRIPTION	DEPRECIATION RATES PER YEAR (In Percent)	WEIGHTED SERVICE LIFE (YEARS)	PERIODIC REPLACEMENT PERCENTAGE
			- STRUCTURES AND IMPROVEMENTS			
331		130	COMPOSITE (A)	1.28	49.26	27.58
331			POWERPLANTS AND PUMPING-GENERATING PLANTS	1.18	49.88	17.38
352			SWITCHYARDS AND SUBSTATIONS (B)	2.01	48.53	89.67
			- PUMPS AND PRIME MOVERS (C)			
			ELECTRIC – UNIT CAPACITY - 250 to 1,500-hp	0.64	39.35	25.05
			ELECTRIC – UNIT CAPACITY - 1,500 to 10,000-hp	0.66	40.37	26.52
		160	ELECTRIC – UNIT CAPACITY - 10,000-hp & ABOVE	0.88	36.65	32.28
			HYDRAULIC – UNIT CAPACITY - 250-hp & ABOVE	0.30	50.00	15.00
			FUEL TYPE – UNIT CAPACITY - LOW SPEED, BELOW 250-hp & ALL HIGH SPEED	3.14	25.63	80.54
			FUEL TYPE – UNIT CAPACITY- LOW SPEED, 250-hp & ABOVE	2.02	39.69	80.08
333		165	**- WATERWHEELS, TURBINES, AND GENERATORS**			
			POWERPLANTS AND PUMPING – GENERATING PLANTS	1.59	40.42	33.93
334		170	**- ACCESSORY ELECTRIC EQUIPMENT**			
			POWER AND PUMPING-GENERATING PLANTS AND PUMPING PLANTS 1,500-hp AND ABOVE	1.60	38.46	30.20
335	398	199	**- MISCELLANEOUS EQUIPMENT**			
			POWER AND PUMPING-GENERATING PLANTS AND PUMPING PLANTS 1,500-hp AND ABOVE	1.11	25.00	3.73
353		175	**- STATION EQUIPMENT**			
			AC and DC TERMINALs	2.98	39.20	95.12
354		181	**- TOWERS AND FIXTURES**	1.03	50.00	3.00
			- POLES & FIXTURES			
355		182	COMPOSITE	1.07	50.00	6.53
0.1		0.1	WOOD	0.28	50.00	13.80
0.2		0.2	STEEL AND CONCRETE	0.06	50.00	3.00

PLANT ACCOUNTS						
FERC		FFS	DESCRIPTION	DEPRECIATION RATES PER YEAR (In Percent)	WEIGHTED SERVICE LIFE (YEARS)	PERIODIC REPLACEMENT PERCENTAGE
			- OVERHEAD CONDUCTORS AND DEVICES ON:			
356		183	COMPOSITE	1.08	50.00	8.25
0.1		0.1	WOOD	0.28	50.00	13.80
0.2		0.2	STEEL OR CONCRETE	0.06	50.00	3.00
			- SUPERVISORY CONTROL AND COMMUNICATION EQUIPMENT			
397		180	COMPOSITE	7.44	12.78	78.65
0.1		0.5	SCADA	10.00	10.00	100.00
0.2		0.2	MICROWAVE	9.39	11.98	100.00
0.4		0.4	CARRIER CURRENT	6.66	15.02	100.00
0.5		0.5	LOAD AND FREQUENCY CONTROL	10.00	10.00	100.00
0.6		0.1	RADIO	3.79	29.22	100.00
0.7			FIBER OPTICS	3.64	16.69	34.49
0.9		0.5	COMMUNICATION AND CONTROL	6.67	15.00	100.00
n.a.		180.5	OTHER	9.73	10.40	100.00

(A) Applicable to structures and improvements accounts of identified properties indicated. Composite factor may be used for power investment when a cost breakdown is not available.

(B) Use for those switchyards or substations that have control and equipment buildings.

(C) New data for this FSS code was not available for this update. Data shown is from previous update.

Table 11. Power Repayment Study "Look Up" Table

Plant Acct.	Service Life	% Replaced	Description
331.10	49	27.58%	Structures & Improvements - Composite of 331 and 352
331.20	50	17.38%	S& I - Power & Pumping /Generation
331.30	50	17.38%	S & I - Camps
333.10	40	33.93%	Waterwheels, Turbines & Generators - PPs & Pump/Gen plants below 11.5kV
333.20	40	33.93%	Waterwheels, Turbines & Generators - PPs & Pump/Gen plants 11.5kV & above
334.10	38	30.20%	Accessory Elec Equip - Pwr & Pump-Gen plants
335.00	25	3.73%	Misc Equip
352.10	49	89.67%	S & I - Switchyards & Subs A.C.
352.20	49	89.67%	S & I - Switchyards & Subs D.C. Terminals
353.10	39	95.12%	Station Equip - A.C. Terminal
353.20	39	95.12%	Station Equip - D.C. Terminal
354.00	50	3.00%	Towers & Fixtures
355.10	50	13.80%	Poles & Fixtures - Wood
355.20	50	3.00%	Poles & Fixtures - Steel
356.10	50	13.80%	Overhead Conductors & Devices on wood
356.20	50	3.00%	Overhead Conductors & Devices on Steel/Concrete
397.00	13	78.65%	Supvy Ctrl & Comm Equip
Other	0	100.00%	Other & never replaced

APPENDIX: SERVICE LIFE JUSTIFICATIONS

(See Table of Contents for Index)

APPENDIX: SERVICE LIFE JUSTIFICATIONS

The following contains justifications for any change made to a Unit of Property during the update of revisions to the Replacements Book. Many justifications describe the data and reason for a change in service life, breakout of equipment type, technology changes, or deletions. The page index for each justification may be found in the Table of Contents.

Justification No. 1 Air Compressor and Motor

Account: 335, 353, 398 (175, 199)

Service Life:	Station air system, excluding compressors 100 cfm and over	50 years
	Air compressors and motor, complete, 100 cfm or over	25 years

2017 Summary and Recommendation. As a result of the merger of the USACE ER-37-1-30, the following items were adopted and approved by the Steering Committee. Prior service life designation was 35 years.

Station Air System

- Station air system, excluding compressors 100 cfm and over 50 years
- Air compressors and motor, complete, 100 cfm or over 25 years

2005 Summary and Recommendation. There is no new statistical evidence for air compressors and motors that indicate a change should be made in the status of this category. A small number of retirements were noted, which did not provide sufficient data to propose any changes. The service life for air compressor and motor will remain at 35 years.

Historical Background. Compressed air systems serve many purposes. These include general plant use, draft tube suppression, generator air brakes, governor oil pressure, and ice prevention systems. Because it is not expected that complete systems will be replaced at one time during the period of analysis, the compressor with motor has been established as the unit of property in previous studies with a service life of 35 years.

The retirement rate study made for the 1981 report was based on exposures of 210 air compressors and motors and 22 retirements. The age at time of retirement for these compressors averaged 21 years. The study included an exposure and retirement period of 1909 - 1982, and resulted in an average service life of 51 years. That report concluded that the average life of 25 years established in the previous 1968 report should be increased to 35 years.

Operations personnel point out that the duty cycle is the key factor in the service life of air compressors and motors. Most applications have intermittent operations, which vary from plant to plant. Peaking plants, for example, require more frequent operation of the governor air compressor than base load plants due to continuous turbine adjustments. Ice prevention systems will need continuous operation or rapid cycling of their air compressors in winter, but will be shut down for the remainder of the year. A majority of operations personnel considered a 35-year service life too long and would prefer to see 20 to 30 years. Comments indicate that modern plants are using higher pressure units which wear faster, and foreign manufactured units are not lasting as long. Although older units such as those at Hoover, Parker, Davis, and Shasta were replaced after 35 to 50 years, the new replacement compressors are not expected to last as long.

During the current study period there were no retirements, but during the historical period there were 23 retirements, which had an average service life of 22 years. Most of the air compressors were retired during the 15- to 20-year time period. When combined with those that are still in service, the Iowa curve fit analysis indicates a service life of 50 years.

The statistical analysis indicates that the previously established average service life of 35 years should be increased. However, the retirement rate study is based on a relatively small number of retirements, and there are indications that more recently purchased air compressors may have a shorter life than older air compressors. Also, high pressure units tend to have shorter lives than low pressure units. Because more and more units being acquired are in the high pressure category, further review is suggested in the next update. It appears that duty cycle or actual operating hours could be an important factor, but in the absence of good data and in view of modern trends in design, it is concluded that the average service life for compressors and motors is to remain at 35 years.

Justification No. 2 Arrester, Surge (Lightning)

Account: 353, 356, 358 (175, 183, 184)

Service Life: 35 years

2017 Summary and Recommendations. Assessment of this item by the multiagency SME team determined that no change is required for this item.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 53 arrester retirements with an average life of 39 years. Reclamation data shows four arrester retirements with an average life of 39 years. Opinions of a reasonable life vary from 20 to 35 years. It is recommended that this Update continue to use 35 years for the average life for surge arresters.

Historical Background. Surge arresters provide surge protection for major substation and switchyard equipment, particularly transformers and transmission lines. The degree of protection provided depends on the characteristics of the arrester application. Providing optimum protection usually means accepting the risk of damage to the arrester from the abnormally severe surges that may occur.

Present industry practice is to provide tank-mounted surge arresters as an integral part of power transformers. However, there are installations among WAPA and Reclamation facilities that include stand-alone station-type surge arresters for transformer, bus, or high-voltage cable protection.

Three-phase arrester installations used with circuits 69 kilovolt (kV) and above have been designated as units of property. Replacement of individual arresters, regardless of voltage or sets used on circuits less than 69 kV, has been considered as maintenance. Valve-type arresters are currently being replaced with those using metal oxides, which are expected to have longer lives.

Most of the operating personnel interviewed indicated that the 50-year life expectancy recommended in the 1981 study is too long. It was noted that the duty seen by the insulator had a great effect on its life. A number suggested 30 to 35 years as a more appropriate life and that obsolescence is a significant factor. The view was expressed that the arrester will be retired when the transformer is retired, and that transformers do not have that long a life. An observation was made that arresters above 230 kV seem to last no longer than 20 years, while those from 69 to 230 kV have longer lives of about 30 years.

BPA included surge arresters as a portion of station equipment, and thus assigned a 375_o Iowa curve.

During the latest study period (1980 to 1987), a total of 137 arresters were added. The 21 that were retired had an average life of 23 years, with a statistical range of 14 to 32 years. When the complete historical data base is considered, the average life of those arresters retired has been 21 years, with a range of 10 to 37 years. The Iowa curve fit analysis indicated a $25R_4$ Iowa curve, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-1).

In view of their relative cost, the consensus in the field interviews and the statistical support for a rather sharp reduction in service lives, the average life of surge arresters is reduced from 50 years to 35 years, with no distinction in voltage.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 28 surge arresters were retired with an average life of about 29 years. There is merit to the argument that arresters mounted on transformers should have the same longer life as the transformers. However many arresters are in stand-alone installations for system protection, and are generally more vulnerable to lightning strikes. It is recommended that this Update continue to use 35 years for the average life for surge arresters.

Justification No. 3 Inverter Type Battery Charger (24 volts and above)

Account: 334, 353 (170, 175)

Service Life: Inverter - 24 volts and above 20 years
When replacing inverter, consider aligning the battery charger to the type of battery defined in Justification 4.

2017 Summary and Recommendation. The expected life of battery chargers has not changed; therefore, the 20 years of service life is still applicable. This applies to the charger and associated inverter. Keeping the battery charger on the same replacement interval of the type of battery is convenient and also provides "insurance" for the new battery (i.e., the charger should not fail in such a way that also kills the battery – at least in the first few years of service).

The 20-year life also takes into account differences in how new chargers are designed and built. Charges built in the 1940's, 1950's, and 1960's utilized magnetic amplifiers or controlled ferroresonant technology. These chargers provided exceptional reliability and service life. When Silicon Controlled Rectifier (SCR) and switch-mode technology became the norm, the size and cost of the chargers decreased, but reliability also went down.

One must examine the components that make up the chargers presently being manufactured. Microcontrollers and components, such as capacitors, have a service life of about 15 years; thus, in the future it may be expected that the typical life of a charger will continue to drop to 15 years, but until those values can be substantiated, 20 years is the default.

2005 Updated Summary and Recommendation. The current data from WAPA's financial system and Maximo show 70 battery charger retirements with an average life of 19 years. Opinions of a reasonable life vary from 15 to 30 years. It is recommended this Update continue to use 20 years for an average life for battery chargers. There is some expectation that this life may decrease because of the trend toward using switch mode rectifier technology.

Historical Background. The Reclamation and WAPA systems have hundreds of battery chargers installed in dams, power plants, switchyards, substations, operating centers, and communication sites. Historically, motor-generator, magnetic amplifiers, or ferroresonant chargers were utilized. Modern charging systems are Silicon Controlled Rectifier (SCR), switch mode, or ferroresonant type. Chargers associated with storage batteries 125 volts and above are designated as units of property. They were given a 30-year life in the August 1981 replacement report, which was a reduction of 5 years from the previously established life.

Personnel interviewed in the area offices were divided in their opinions regarding service life. Some felt that the 30-year life is appropriate. Others felt that the assigned life is too long, and should be shortened to reflect the fact that chargers are frequently replaced along with the storage battery banks, or are difficult to maintain after 20 years due to obsolescence and unavailability of spare parts. Contrasts in lives are reflected by the experience at Morrow Point and Blue Mesa, where chargers were replaced after 18 and 23 years, as compared to Hoover and Parker with replacements occurring after 35 to 50 years. Field interviews indicate there is divided opinion between 20 and 30 years. Those recommending the 20-year life suggested that the charger-service life should match the life set for batteries.

The 1985 BPA study is by account and thus offers no guidance for individual units of property; the prior BPA study used a life of 25 years.

Since the 1981 report, 70 new battery chargers have been added, and 34 were retired. The battery chargers retired during this time period had an average service life of 21 years with a standard deviation of 6 years, indicating a high probability that a variation between 15 and 25 years can be expected. Combining the new data with the existing replacements database yields an average service life of 20 years with an overall range of 2 to 36 years. The highest frequency of retirements is in the 15- to 20-year category. This matches the results from the previous study where the retirement age was an average of 20 years. The Iowa curve fit analysis also indicates a shorter service life of 17 years. The final Iowa curve selected is a $20S_3$, as presented in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-2).

Based on the interviews and the shorter-life trend recognized in the last study and supported by the statistics from this study, the service life is reduced from 30 years to 20 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 35 battery chargers were retired with an average life of about 16 years. The distinction between chargers operating at 125 volts and above and those operating below 125 volts does not seem realistic with today’s equipment and use. Opinion is about evenly divided whether life should be 15 or 20 years. It is recommended this Update continue to use 20 years for the average life for battery chargers, and include chargers operating at 24 volts and above as replaceable units of property.

Justification No. 4 Battery Bank (48-volts and Above) (Previously titled Battery, Storage, 24-volts and Above)

Account: 334, 353 (170, 175)

Service Life:

- Valve regulated lead acid (VRLA) – 5 years
- Vented lead acid (VLA, flooded) – 30 years
- Nickel cadmium (NiCad) – 30 years
- Hydrogen fuel cell – 15 years (see Backup Engine Generator)

2017 Summary and Recommendation. From many years of operational experience with different batteries from the Federal Agencies involved (valve regulated lead acid – VRLA, vented lead acid – flooded, nickel cadmium – NiCad, and hydrogen cell), Table 7 was expended in 2017 to provide for the different life expectancy of each type. The life expectancy ranged from 5 years for VRLA and up to 30 years for vented lead acid and nickel cadmium batteries. Reclamation has years of experience with 125-volt vented lead acid cells, because the majority of the facilities use this type of battery. The expected life has a very high variability and it would not be justified to provide just one average service life. Clarification was provided that the unit of property like Engine Generators (See Justification No. 21) includes accessories such as Hydrogen Fuel Cell System.

For example, absorbed glass mat (AGM), gel-cells, and valve-regulated lead-acid cells were a technological development utilized for a few years. These battery types should all be considered VRLA cells and have a shorter service life than flooded cells. There were a wide range of service lives in the historical data. The introduction of the VRLA cells may have contributed to the range of service lives. Recent experience has shown that VRLA cells have a service life of around 5 years. All lead acid cells should be replaced at 80 percent capacity and OEM prescribed maintenance should be performed to prolong system life. When examining all battery types, opinions of a reasonable life vary from 5 to 30 years. It is recommended that this update use the service life based on the type of battery system used as listed below. As in the 1995 Update, 24-volt systems are typically considered maintenance items after their initial installation.

The life expectancy of the different types of batteries is as follows:

- Valve regulated lead acid (VRLA) – 5 years
- Vented lead acid (VLA) – 30 years
- Nickel cadmium (NiCad) – 30 years
- Hydrogen fuel cell – 15 years (see Backup Engine Generator)

Historical Background. Storage batteries in use on Reclamation and WAPA systems are rated from 24-volts up to 250-volts. Although most batteries in power plants and substations are rated 125-volts, some of the large power plants have 250-volt batteries. There are some 480-volt systems, however, that are usually a component part of the UPS and should be considered a maintenance component of the computer UPS system. There are some small substations that have 24-volt or 48-volt batteries, which are considered maintenance items. Battery systems at 125-volts and above are established as units of property. Individual cells and batteries below 125-volts are being replaced as maintenance expense.

Operating personnel were in substantial agreement that 30 years continues to be an appropriate service life for vented lead acid and NiCad. Some commented on isolated instances where longer or shorter lives were experienced. Others mentioned problems with certain types of cells or manufacturers. Many observed that they thought newer battery banks may not last as long as the older ones. The pre-1981 BPA study used a life of 15 years for storage batteries.

During the period 1980 to 1987, 55 batteries were added, while 53 were retired. The retired batteries had an average life of 17 years with a statistical range of 9 to 25 years. The average service life over the entire study period is 18 years; most of the batteries are retired between 15 and 20 years. The Iowa curve fit analysis selected a $25S_2$ Iowa curve, which is a somewhat longer life than that shown by the retirements. This analysis is presented in the Supplemental Historical Reference Section, Exhibit A-3).

Justification No. 5 Boom

Account: 332 (150)

Service Life: 25 years

2017 Summary and Recommendations. The SME team assessed this item and adopted the long-standing USACE service life of 25 years. This item was changed from “Exceeds 50 years” to a service life of 25 years. The SME team recommended and the Steering Committee approved the new service life of 25 years.

2005 Summary and Recommendation. There is no new statistical evidence for booms that indicates a change should be made in the established service life. It is concluded that no change should be made in the service life exceeding 50 years established in the previous reports.

Historical Background. Booms are made up of items such as logs, buoys, wire rope, and anchors and are not normally replaced in their entirety but are replaced by sections or parts.

Operating personnel report varying experience with log booms. The boom at Elephant Butte was replaced after 40 years, Nimbus after 35 years, Lewiston after 30 years. The Monticello boom was replaced twice in 30 years. Complete replacements such as these seem to have been made at very few plants. Most operations personnel treat log booms as maintenance items.

Data were not recorded to permit a statistical analysis.

Although a few booms have been replaced in less than 50 years, no extensive new evidence has been found to indicate that the previous conclusion reflecting agency-wide experience should be changed. Therefore, booms are not to be considered as a replaceable unit of property, but continue to be repaired or replaced as a part of the normal maintenance program. They have a life exceeding 50 years.

Justification No. 6 Bridge

Account: 336, 359 (140)

Service Life: 75 years

2017 Summary and Recommendations. As a result of the merger of the USACE ER-37-1-30, the following items were recommended by the SME team and approved by the Steering Committee: In comments on the Beta report, the TSC has recommended that we use the American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Standards for the Service Life for all bridges. The AASHTO LRFD Standard states the service life for all bridges is 75 years and does not distinguish between the materials used. Prior to the decision to use the AASHTO Standard the following Service Lives were recommended.

- Steel: Changed service life from N/A to 50 years
- Wood covered: Changed from N/A to 40 years
- Wood uncovered: Changed from N/A to 25 years

2005 Summary and Recommendation. There is no new statistical evidence for bridges that indicates a change should be made in the status of this category. Bridges continue to be eliminated as replaceable units of property.

Historical Background. Bridges range in size from small roadway structures or timber bridges over laterals to huge steel and concrete spans such as the Glen Canyon Bridge. Because of the difficulty and expense of obtaining good timbers, the trend has been away from the construction of wooden bridges in recent years.

Most regional and project offices either have no bridges within their jurisdictions or have not experienced any problems. Those interviewed that did have experience agreed with service lives established by previous studies. Wooden bridges have been replaced at Cascade and Arrowrock after 40 years service.

There is no statistical evidence available on service lives of bridges.

Discussions with the Steering Committee indicated that there were few wooden bridges now being operated by the agencies; most of the wooden bridges previously built are the responsibility of irrigation districts. The Steering Committee concludes that since steel and concrete bridges have lives in excess of 50 years, and the few remaining wooden bridges can be covered under the maintenance program, bridges are eliminated as replaceable units of property.

Justification No. 7 Building

Account: 331, 352 (130)

Service Life: Category 1 – 100 years
Category 2 – 50 years (General Building Construction)
Category 3 – 25 years (Fiberglass, Framed, and Modular Buildings)

2017 Summary and Recommendations. Clarification was made that the service life for the Category 1 building was 100 years. Discussions by the SME confirmed the service lives for Category 1 and Category 2 as is, and is supported by the 1981 BPA study sited below. There was some concerns with regards to Category 3 buildings. New materials and technology has made the service life of these types of building longer, although no new study data exists from the agencies. There was a general agreement that often Category 3 Building are temporary in nature as related to construction or maintenance activities and often retired before their full life in accordance with their temporary use. Smaller, less expensive, Category 3 building are often considered maintenance items.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 10 building retirements with an average life of 17 years. This average may include prefabricated buildings with shorter life spans. Opinions of a reasonable life vary from 15 to 25 years for fiberglass modular buildings. It is recommended that this Update continue to use 50 years for the Category 2 buildings and redefine Category 3 as fiberglass modular buildings with a life of 25 years. Pre-cast buildings are starting to be used more frequently and are expected to last as long as the Category 2 buildings.

Historical Background. Reclamation and WAPA have hundreds of buildings of various sizes, types, and uses throughout their systems. These range from small huts to large power and pumping plant structures. Because of this wide difference in types of buildings, they were divided into three categories. These are: Category 1, which includes powerhouse and pumping plant buildings; Category 2, which includes operator's camp or village, switchyard and substation buildings, residences, warehouses, and permanent type buildings for radio and microwave systems, fish and wildlife facilities, and miscellaneous structures which are pertinent to identified properties; and Category 3, which includes minor buildings and structures.

The Category 1 buildings are of many different structure types. Some are of monolithic concrete which combines the substructure and the superstructure. Others are mass concrete, as in some power plant or pumping plant substructures, or where the dam structure also forms the foundation of the building. Others are reinforced concrete column and beam, concrete slab and wall, or heavy structural steel frame. Superstructures may have walls constructed in masonry wall panels, insulated metal panel siding, concrete block, or glass siding.

Although maintenance will be required and portions of walls may be replaced from time to time, the previous reports determined that Category 1 buildings have a life exceeding the period of analysis.

The buildings in Category 2 are of many different types of structures. They include both frame and brick residences, office buildings of all sizes and types, warehouses, garages, shops, substation control and equipment buildings, vista houses, and permanent type buildings for radio and microwave systems.

Category 3 buildings, made up of minor buildings and structures of relatively low cost, were not designated units of property in the previous analysis. The repair or replacement of these buildings has been considered a part of normal maintenance expense.

There was agreement among operations personnel during the field interviews that the service lives previously established should be retained.

BPA, in a 1981 study, used 60 years for steel, concrete, or masonry buildings and 40 years for wood buildings. The latest BPA study indicates a $90R_2$ Iowa curve for steel and a $65L_1$ Iowa curve for wood building structures, as a part of the general accounts for structures and improvements, which could apply to both Category 1 and Category 2 buildings.

The statistical data collected were listed as buildings or roofs. The roofs contained in this category are steel or cement structures. During the current study period, 89 structures were added, while 18 were retired at an average life of 23 years. In the entire study period, 65 structures were retired, with an average service life of 22 years; most of the retirements took place between 15 to 20 years. However, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-4), when the retirement data are combined with the vintage data, a $50S_1$ Iowa curve is the most appropriate fit.

There is no new evidence to warrant revision of the conclusions contained in the 1981 report that Category 1 buildings have a life exceeding 50 years; Category 2 buildings have a 50-year service life; and Category 3 buildings are to be treated as a part of the maintenance program.

Justification No. 8 Cable - Power, Generator, and Pump Motor

Account: 334 (170)

Service Life: 40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current service life assessment is accurate. Special note that one unit of property is equal to the full set of all traps or tuning packs. Observed no significant change to justification. No change was made.

2005 Summary and Recommendation. The current data from Reclamation shows eight retirements of generator cables with an average life of 46 years. As the service life was set at 40 years to recognize possible decreases in service lives of newer equipment, it is recommended that this Update continue to use 40 years for the average life for power, generator, and pump motor cables.

Historical Background. Connection of generators to unit breakers or unit transformers may be by isolated phase bus or by one or more individual insulated cables for each phase. Of the 222 generators on Reclamation's system, half are installations of the latter type with voltages ranging from 2-kV to 16.5-kV. Virtually all of Reclamation's more than 1,000 pumps are also of the latter type with a similar voltage range.

In view of the cost of replacing individual generator cables, the 1981 report recommended that any replaceable run be established as a unit of property with an average service life of 50 years. The isolated phase bus was not designated as a unit of property as its life was determined to exceed 50 years.

The general consensus among operations personnel interviewed was that the service life established in the previous report is satisfactory. A few notable exceptions were cited, such as the Heart Mountain cables replaced after 30 years due to failure, and the cables at Tracy, which were replaced after about 30 years' service due to design problems.

BPA does not have a comparable category.

Several generator cables were added during the 1980 to 1987 time frame (149), but there were no retirements. In the entire historical data base there are only 70 retirements, with an average life of 28 years. Most of the retirements take place between 30 and 45 years, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-5). The Iowa curve fit analysis of all data, including cables not retired, indicates a 50 R_2 Iowa curve.

Since this item covers power cables for both generators and pump motors, the Justification item is retitled "Cable-Power, Generator and Pump Motor." The Steering Committee concludes that the life is shortened to 40 years to recognize possible decreases in service lives of newer equipment.

Justification No. 9 Cable System, Communication

Account:	397 (180.50)	
Service Life:	Metallic Cables	not applicable
	Fiber-Optic Cables	not applicable

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show four cable retirements with an average life of 17 years. Opinions of a reasonable life vary from 40 to 50 years. The comments do not support keeping cables as a separate unit of property for either communications or control use. Cables are relatively inexpensive, and have a long life when undisturbed. Maintenance personnel tend to replace cables as necessary when equipment is replaced, and consider the cable to be a part of the equipment. It is recommended that cables should not be a unit of property, and that communication cable replacement be considered a maintenance item.

Historical Background. Communication cables are used for remote control, telemetering, telephone, radio, microwave, and carrier communications. They are usually composed of multiple pairs of insulated wire encased in a protective jacket. A second, or outer, jacket of protective armor and polyethylene may also be used for added protection to the cable when it is buried in the earth. The 1981 report indicated that only two communication cables had been replaced and there was insufficient evidence to change the life from the 35 years established in the preceding report.

The 1981 report indicated that fiber-optic cables are being used for new installations and to replace older metallic cables. Fiber-optic cables generally consist of a structural core with the fibers located in channels. The cables may be packed with grease, or dry powders for fiber protection. Armor, internal stringers, or power cables or stringers with integral fibers may be used depending on the application.

Replacements of conventional cable systems were cited at Pinnacle Peak, Glen Canyon, and Flagstaff at about 25 years; Nimbus and San Luis at 20 to 25 years; and Hoover lines being replaced by fiber-optics after 25 years. At Grand Coulee, none were replaced after about 50 years. The field interviews indicated that there was little experience and no general consensus as to the life of fiber-optic systems, though it was mentioned several times that the life should at least match that of conventional equipment. A comment was made that fiber-optics should be considered separately from other cables.

The previous BPA study assigned a service life of 16-2/3 years, and in the latest study in 1985, categorized under account 397, cable systems were assigned a life of 20 years.

The statistical data for the current study period recorded no retirements, although 39 communication cables were added. In all of the historical data, there are only three retirements out of 49 cables, with an average service life of 13 years. Thus, there are not enough retirements for an Iowa curve fit analysis to be performed.

Although buried cables may have somewhat longer lives, considering the predominance of aerial cables, the changing composition with increased installation of fiber-optic equipment and the avoidance of further complexity in the reporting process, the unit of property is designated as a multiple conductor cable station to station. Based on available data and field interviews, the Steering Committee concludes that the average life of metallic communication cables is reduced from 35 years to 30 years. A separate accounting should be made of fiber-optic cables in order to establish an experience base; however, in the interim a 30-year life is designated.

1995 Limited Update Summary and Recommendation. There is little MIS data for these items. The comments do not support keeping metallic cables as a separate unit of property for either communications or control use. Metallic cables are relatively inexpensive, and have a long life when undisturbed. Maintenance personnel tend to replace cables as necessary when equipment is replaced, and consider the cable to be just a part of the equipment. It is recommended that metallic cables should not be a unit of property, and that metallic cable replacement be considered a maintenance item.

Fiber-optic cables are becoming very common, particularly for communications use. There is a general uneasiness about the life of fiber-optic cables. Phoenix MIS data records three fiber-optic "cable terminal systems" retired with a life of less than 5 years. Basin Electric has replaced fiber-optic cables installed in 1976. Industry standards have changed; ground connections are different; terminals for the early fiber cables are not available. Furthermore, cables are routinely replaced when shorter lived equipment is replaced, and are not considered a "significant" item in terms of maintenance expense. They no longer fit the definition of a unit of property. It is recommended that fiber-optic cables should not be a unit of property for this Updating, and that fiber-optic cable replacement be considered a maintenance item.

Justification No. 10 Cable System, Control

Account: 334, 353 (170, 175)

Service Life:	Metallic Cable	not applicable
	Fiber-optic Cable	not applicable

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show four cable retirements with an average life of 17 years. Opinions of a reasonable life vary from 40 to 50 years. The comments do not support keeping cables as a separate unit of property for either communications or control use. Cables are relatively inexpensive and have a long life when undisturbed. Maintenance personnel tend to replace cables as necessary when equipment is replaced, and consider the cable to be a part of the equipment. It is recommended that cables continue to be excluded as a unit of property, and that control-cable replacement is considered a maintenance item.

Historical Background. The materials in general use for control-cable insulation prior to 1940 were varnished-cambric tape and natural rubber compounds protected by cotton braid or lead sheathing. In the old power plants, the cables were usually installed in metallic conduit, exposed, imbedded in trenches, or supported on cable hooks or trays inside the building. Since 1940, synthetic rubber and thermoplastic insulation and jacket materials suitable for direct burial have been used for these cables. In recent years, the direct burial of control cables has been practiced in numerous substations.

Because of cost and the many replacements associated with control panels replaced in modernization programs, the 1966 study selected the control-cable system as the unit of property rather than individual cables. The cable system was given an average service life of 35 years, the same as control boards.

The 1981 report indicated that only two records had been found involving replacement of control-cable systems in the review of replacements since 1966. One of these replacements occurred after 14 years and the other after 20 years. The report concluded that there was not sufficient evidence to indicate a change in the service life of 35 years previously established.

In the field interviews, there was considerable support expressed for the 35-year service life assumption. Fiber-optics, also mentioned under communication-cable systems, is being installed. Estimates of service life on fiber-optics offered by the interviewees ranged from 25 to 35 years.

BPA assigned a life of 16 2/3 years in the previous study, and 37 years as a part of FERC accounts 334 and 335 in the later study.

In the current study period, 117 control cables were added while there have been no retirements. Because there are only six control cables in the entire historical data base, no conclusions can be made based on statistics.

In view of the information disclosed in the field discussions, the 35-year service life is retained for metallic cables. For communication cables, a separate accounting is to be made for fiber-optic cables to establish an experience base, with an assumed initial service life of 30 years.

1995 Limited Update Summary and Recommendation. There is little MIS data for these items. The comments do not support keeping metallic cables as a separate unit of property for either communications or control use. Metallic cables are relatively inexpensive, and have a long life when undisturbed. Maintenance personnel tend to replace cables as necessary when equipment is replaced, and consider the cable to be just a part of the equipment. It is recommended that metallic cables should not be a unit of property, and that metallic cable replacement be considered a maintenance item.

Fiber-optic cables are becoming very common, particularly for communications use. There is a general uneasiness about the life of fiber-optic cables. Phoenix MIS data records three fiber-optic “cable terminal systems” retired with a life of less than 5 years. Basin Electric has replaced fiber-optic cables installed in 1976. Industry standards have changed; ground connections are different; terminals for the early fiber cables are not available. Furthermore, cables are routinely replaced when shorter lived equipment is replaced, and are not considered a “significant” item in terms of expense. They no longer fit the definition of a unit of property. It is recommended that fiber-optic cables should not be a unit of property for this Updating, and that fiber-optic cable replacement be considered a maintenance item.

Justification No. 11 Capacitor Bank, Shunt and Series

Account: 353 (175)

Service Life: 25 years (for both Shunt and Series)

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show two capacitor bank retirements with an average life of 13 years. This is not a sufficient sample to determine average life. Opinions of a reasonable life vary from 25 to 30 or more years. It is recommended that this Update continue to use 25 years for the average life for capacitor banks.

Historical Background. Shunt capacitor banks are installed in substations for use in regulating bus voltage and at pumping plants to improve the power factor. The series capacitor banks are used to compensate for a part of a transmission line's inductive reactance and increase the loading capability of the line.

Capacitor banks, both shunt and series, were assigned a life of 25 years in the August 1981 study. Operations personnel generally expressed the view that the life of 25 years seems appropriate. Some personnel expressed an opinion that the life might be closer to 30-35 years. Individual capacitor units are replaced as maintenance. In recent years there have been a larger than usual number of replacements due to environmental concerns over PCB insulating fluid. This was mentioned several times as an extraordinary occurrence, and should not be considered to adversely impact the life of capacitor banks in the future. No difference was noted between the life expectancy of series and shunt capacitors. Although the consensus seemed to favor a somewhat longer life, it was suggested that the PCB experience indicated that the extension of the life beyond the 25-year established life is not warranted.

The latest BPA study uses a $37S_o$ Iowa curve for the account; the previous BPA life for both series and shunt capacitors was 35 years.

Based on the statistical data from 1980 to 1987, the average life for the eight retirements was 19 years, with the range of 9 to 30 years. Only 16 capacitor banks were added during this time period. The statistics for the complete history show that the average life for capacitor banks retired has been 22 years, with a range of 4 to 34 years. Most of the retirements are in the 25 to 30 year interval. The initial Iowa curve fit analysis determined an average service life of 40 years, but this average would be lower if only the most recent experience was considered and not the entire historical data base.

The trend of retiring the capacitor banks over a shorter service life noted in the previous study is apparently continuing. After giving greater weight to the more recent statistical data, a $25R_2$ Iowa curve is selected. These results are shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-6). The designated service life is retained at 25 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 17 retirements with an average life of about 22 years. These retirements are more associated with changing system requirements than with failure of the capacitor banks. Capacitor banks continue to be long lived items, with opinions varying both more and less than 25 years. It is recommended that this Update continue to use 25 years for the average life for capacitor banks.

Justification No. 12 Carrier Wave Trap (Tunable and Non-Tunable)

Account: 397 (180.40)

Service Life: 35 years

2017 Summary and Recommendations As a result of the merger of the USACE ER-37-1-30, changing the service life form 20 years to 35 years was recommended by the SME team and approved by the Steering Committee

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 47 carrier wave trap retirements with an average life of 24 years. Opinions of a reasonable life vary from 20 to 25 years. It is recommended that this Update continue to use 20 years for the average life for carrier wave traps that exceed the capitalization limit.

Historical Background. In the 1981 report this item was called "carrier line inductor" in the justifications and "carrier line trap" in the Table 10 list of units of replaceable property. Line traps are made of a coil of copper or aluminum conductor supported by a frame, with tuning components located inside the coil. Line inductors are not tunable. The use of the term, "Powerline Carrier Wave Trap" is suggested to include the two items covered in this definition, which would include both tunable and non-tunable units.

The 1981 study assigned a life of 25 years to these items. The operating personnel surveyed indicated that 25 years was acceptable, but a number indicated that it could be longer.

The latest BPA study used a $20S_1$ Iowa curve; the previous BPA life was 25 years.

The statistical data available from 1980 to 1987 indicates an average service life of 23 years for the 24 wave traps that were retired. Another 16 were added during this time. Over the entire study period, 91 wave traps have been retired with an average life of 18 years. The highest frequency of retirements occurs in the 20- to 25-year time interval. There have been several retirements between 4 and 20 years, which tend to lower the overall average. As shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-7), the Iowa curve fit for the wave-trap retirements indicates an even shorter service life of 20 years with an L2 dispersion. In the 1981 study the observed average service life of retirements was 16 years, so the assigned life was reduced from 35 years to 25 years.

Although field opinion was almost unanimous that the 25-year service life in the August 1981 report should be continued, the statistics strongly indicate that a shorter service life of about 20 years would be more appropriate. The life is shortened to 20 years based on the statistical evidence.

1995 Limited Update Summary and Recommendation. MIS data for the period 1988-1994 show 24 wave trap retirements with an average life of about 18 years. Technical change has reduced the use of powerline-carrier equipment in most areas. Comments generally supported a 20-year life for wave traps, and some thought it should be longer.

It is recommended that this Update continue to use 20 years for the average life for wave traps with the expectation that the equipment will be obsolete in a few years.

Justification No. 13 Circuit Breaker, Power

Account: 353 (175)

Service Life:	Air magnetic/air blast	45 years
	Oil tank type	50 years
	SF6 type	50 years
	Vacuum type	50 years

2017 Summary and Recommendations. A review of this item by the multiagency SME team determined that power circuit breakers should be grouped to better reflect experience with maintenance, service life, upgrades, and modernization. In previous books, the service life for power circuit breakers was 35 years. The following types of circuit breakers were recommended by the SME team and approved by the Steering Committee:

- Air magnetic/air blast 45 years
- Oil tank type 50 years
- SF6 type 50 years
- Vacuum type 50 years

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 225 breaker retirements. Of these, 205 were oil breakers with an average life of 37 years which was the largest group of breakers being retired. Reclamation data showed 20 oil breaker retirements with an average life of 33 years. Other breaker types (air, gas, and vacuum) had an average life between 13 and 29 years. Opinions of a reasonable life vary from 20 years to more than 35 years. It is recommended that this Update continue to use 35 years for the average life for all breakers.

Historical Background. Included in this justification are circuit breakers that are used in switchyards and substations throughout Reclamation and WAPA systems. The unit of property is defined as the complete unit. Components of the units may include items such as interrupter elements, operating mechanisms, contacts, bushings, bushing current transformers, tanks, frame, compressed air systems, and hydraulic systems all of which generally can be kept in good condition by normal maintenance as long as parts are available. With more and more breakers of foreign manufacture, there has been an increasing problem in obtaining replacement parts. This, coupled with their abnormally high cost, has dictated premature replacement of some breakers.

Each application of switching equipment requires consideration of many factors such as voltage rating, continuous current rating, and interrupting capacity and time. The effect of system growth and service requirements has a significant influence on the service life of this type of equipment in specific locations. When it is necessary to replace breakers for this reason, they generally are reinstalled in other stations where the duty is not as severe.

In the 1981 report, power-circuit breakers were given a service life of 40 years. In interviews with operating personnel, the apparent consensus was that a 40-year life for circuit breakers was too long, with a number specifying 35 years as a preferred choice. It was noted that oil circuit breakers have traditionally had long lives, but the newer gas or air breakers show evidence of shorter lives. As the number of manufacturers of circuit breakers shrinks, it becomes increasingly difficult to obtain replacement parts. This trend is also indicating a shorter life expectancy.

The Iowa curve used by BPA in its latest study for Account 353, Station Equipment, is a $37S_o$. The prior BPA study used a life of 20 years if the voltage was lower than 230-kV and 25 years for 230-kV and higher voltage breakers.

Based on the statistical data collected for circuit breakers, 366 were added during the 1980 to 1987 study period, and about 200 were retired; these had an average service life of 28 years. The statistical range is 22 to 34 years. When the entire statistical data base is considered there have been over 600 retirements at an average life of 20 years, with most of the retirements taking place either between 15 and 20 years or between 25 and 30 years. Based on these statistics, over 90 percent of the circuit breakers are retired before 35 years. However, when the vintage as well as the retirement data are considered in the Iowa curve fit analysis, the average service life is 35 years with an Rl dispersion. These Iowa curve fit results are shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-8).

Based on all the relevant evidence, the Steering Committee concludes that the life of power-circuit breakers is reduced from 40 to 35 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 41 Air breakers have been retired with an average life of about 27 years. Moisture condensation in 230-kV units damages the controls and causes the breakers to fail; parts are hard to get for 230-kV air breakers. Opinions of expected life range from 25 to 35 years.

MIS data for the period 1988-1994 show 235 oil breakers have been retired with an average life of about 34 years. Oil breakers are being phased out due to concern about contamination from leaks and spills; they are no longer being made, and parts are hard to get. Most people feel 35 years is a reasonable life for existing oil units.

Experience with Gas breakers is limited. MIS data for the period 1988-1994 show seven gas breakers have been retired with an average life of about 12 years. The trend is to go to gas breakers, although some people feel gas equipment is not as good quality as they would like. Estimates of service life for gas ranged from 20 or 25 to 35 years. Thirty-five years was frequently mentioned as a reasonable life for the overall class. It is recommended that this Update continue to use 35 years for the average life for power circuit breakers, without distinction for type or voltage.

There was no recorded service life experience with low voltage vacuum breakers, although some are in use on the system.

Justification No. 14 Closed Circuit Television (TV) and Security Systems (Previously titled Television System, Closed-Circuit)

Account: 397 (180)

Service Life: 10 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. Information from interviews suggests that the title of this unit of property be redefined to Closed Circuit TV and Security System. The current data from WAPA's financial system and Maximo show nine television system retirements with an average life of 13 years. Opinions of a reasonable life vary from 10 to 15 years. The service life of this equipment is limited by the time that replacement parts can be obtained. It is recommended that this Update reduce the life from 15 to 10 years for Closed Circuit TV and Security Systems.

Historical Background. The 1981 replacement report indicated that Reclamation has closed-circuit television systems installed at Blue Mesa, Grand Coulee, Parker, Davis, Yellowtail, and Hungry Horse power plants.

These television systems are used for monitoring equipment and facilities of a plant from the centralized control room and for supplementing the supervisory control and telemetering systems of remote plants and stations. The modern closed-circuit television system is essentially composed of solid state devices similar to those used in supervisory control and telemetering systems and is replaceable. Component parts of cameras and monitors which are not solid state devices, such as the control motors and picture tube are also replaceable.

The 1981 report cited one television system replaced at the Davis Power Plant. It was 7 years old at the time of replacement.

Of the eight interviewees with experience, all agreed with the 15-year life. Both Grand Coulee and Boise had one system replaced after 15 years.

Of the five television systems recorded in the data base, there have been no reported retirements since the 1981 report.

Based on the field interviews, and the lack of contrary data, it is concluded that the service life is to remain at 15 years for the equipment at the sending end of the system. The equipment at the receiver end is replaceable through maintenance expense.

1995 Limited Update Summary and Recommendation. The MIS has no retirements of closed-circuit TV systems. Experience with these systems is very limited, although full security systems which include closed-circuit TV are becoming more common. It is recommended that this Update continue to use 15 years for the average life for closed-circuit TV systems.

Justification No. 15 Communication Tower with Passive Antenna and Active Antenna (Previously titled Antenna Tower, Radio or Microwave, including Billboard Type Reflectors)

Account: 397 (180.10, 180.20)

Service Life: 40 years Communication Tower and/or Passive Antenna
20 years Active Antenna

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 112 antenna retirements with an average life of 20 years. It is recommended that this Update continue to use 40 years for towers with passive antenna. One interview suggested 15 years life for active antenna. Based upon WAPA's financial system and Maximo data it is recommended that this Update use 20 years for the average life for active antennas.

Historical Background. Antenna towers are normally constructed of galvanized steel and therefore should have a long life. As microwave equipment is being updated, some of the older, taller towers are being replaced to accommodate the new facilities. The 1981 report showed that only 11 towers had been retired, primarily from a change in requirements. That report recommended a service life of 50 years. In previous reports, an 80-foot height was established as the dividing point; replacement of antennas below that height would be considered maintenance.

Billboard-type passive reflectors are large structures similar to antenna towers. They are passive devices and have life characteristics similar to active antenna towers. They are added to this item of property accordingly.

Field interviews indicated that antenna towers 40 to 50 feet in height are being used to support microwave equipment. A number of the comments suggested that a life of 50 years is excessive. Also, obsolescence affects the life of the tower and associated equipment more than hardware failure. Several towers have been replaced as a result of changing load requirements.

BPA previously had assigned a service life of 50 years, but in the 1985 study the average life was changed to 20 years with an S_1 dispersion.

In the current study period, five additional antenna towers were added to the system, with one retirement, which only lasted 6 years. The entire historical data base shows only 11 retirements, which had an average service life of 14 years. There is not enough data for a statistical Iowa curve fit analysis.

The current average service life of 50 years is revised downward to 40 years for towers in excess of 40 feet. Billboard type reflectors are included in this item. The replacement of towers shorter than 40 feet, and antennas and other appurtenant equipment when replaced separately is considered a part of maintenance.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 17 tower retirements with an average life of about 14 years. It appears these retirements are more associated with changing technical requirements and/or different transmission paths than they are with tower failure. Antenna towers continue to be long lived items, with opinions varying both more and less than 40 years. It is recommended that this Update continue to use 40 years for the average life for antenna towers.

Justification No. 16   Conductor, Underground Insulated (15-kV and above)

Account: 358 (184)

Service Life:	15 to 35 kV	40 years
	Above 35 kV	25 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo, and from Reclamation show two underground insulated conductors operating above 35-kV being retired with a life of 30 years. It is recommended that this Update continue to use 40 years for 15 - 35-kV cables, and 25 years for cables operating above 35-kV.

Historical Background. Insulated cables used on the Reclamation and WAPA systems are of two general types--oil or gas insulated and solid dielectric insulated. Material used in the manufacture of oil or gas insulated conductors generally is oil-impregnated wood pulp paper, covered with electrical shielding. The dielectric strength of the insulation is maintained by subjecting the cable to an insulating oil or gas medium under pressure. This requires the cable to be sheathed in aluminum or lead or to be drawn into a steel pipe. The operating pressure of the medium varies with the voltage class of the cable.

In a solid dielectric cable the individual conductors are insulated with an extruded compound of either cross-linked polyethylene or ethylene propylene rubber. The insulated conductors are either cabled together and jacketed, or jacketed individually.

Both Reclamation and WAPA have a number of installations of oil or gas insulated cables ranging from 25-kV up to 525-kV. The longest individual circuit is the 13-mile (20.9 kilometer) 69-kV gas-filled pipe-type cable installation made in 1951 in the Alva B. Adams water tunnel under the continental divide in Northern Colorado.

Because of environmental considerations, an increasing number of applications are being designed to utilize solid dielectric insulated cables at voltages ranging from 15-kV up to and including 115-kV. This is particularly true on irrigation projects where there are a number of load points for control of gates or for individual pumps along canals.

Reclamation has had extensive experience with 15-kV through 35-kV cables on their irrigation projects. There are very few 69-kV cables on the Reclamation or WAPA systems. Cables at 115-kV and above tend to be used in or around power houses, and are constructed in an inclined shaft. This inclined application is a very severe mechanical loading on these cables, producing premature failures.

Operating personnel surveyed had varying opinions regarding the life of these systems. Most centered on environmental differences between regions which could produce longer or shorter lives. Comments from participants in Boulder City and Phoenix indicated shorter lives of from 20 to 30 years for desert locations. The general consensus was that the 40-year life assigned by the 1981 report was appropriate, except for desert locations. A suggestion was made to separate the cables by voltage, with 115-kV being the dividing voltage.

The latest BPA study is by account; the previous study used 33 1/2 years for the estimated life of insulated transmission cables.

There are no statistical data recorded for this unit of property.

A logical division point in voltages is at 35-kV, since cables 35-kV and below are standard production items. Cables above 35-kV are custom designed and used only in specific applications. A service life of 40 years is established for cables from 15-kV to 35-kV. For cables above 35-kV, the service life is 25 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show two underground insulated conductor retirements in the Phoenix area with an average life of about 24.5 years. At least one of these was a 69-kV cable. The Adams Tunnel cable has been in service for 43 years. Commenters generally felt the 1989 lives were reasonable. It is recommended that this Update continue to use 40 years for 15 - 35-kV cables, and 25 years for cables operating above 35-kV.

Justification No. 17 Control and System Protection Equipment (Previously titled 19" rack mounted panel with components)

Account: 334, 353 (170, 175)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. This Update recommends the title for this unit of property be changed from 19" rack mounted panel with components to Control and System Protection Equipment. The current data from WAPA's financial system and Maximo show 16 control panel retirements with an average life of 12.34 years. Opinions of a reasonable life vary from 10 to 25 years. It is recommended that this Update continue to use 15 years for the average life for the rack mounted panels with control and system protection components.

Historical Background. Control boards, excluding those for supervisory control or communication equipment, consist of a number of individual panels for monitoring, controlling, and protecting major equipment such as transformers, generators, or transmission lines. The 1981 study selected complete panels or complete boards as units of property replaceable during the period of analysis. Individual components on panels that are replaced due to failure or obsolescence are considered a part of normal maintenance.

A rather wide range of comments was noted in the field interviews. There was general agreement on the current 35-year life, though observations were made that the life could be either shorter or longer. The board at Shiprock was mentioned as being replaced after 25 years; on the other hand, boards at Hoover were mentioned as being replaced after 40 to 45 years. The problem of obsolescence was raised as a reason for retirement.

BPA prior to 1985 had assigned a 16 2/3 year life to control boards or panels, but in the latest study this property unit was assigned a $37S_o$ Iowa curve under account 353.

The numbers of instances where boards are replaced are few, as the completion reports for the period 1980 to 1987 indicate only nine replacements. A total of 130 have been added over the entire historical period, and 16 were retired after an average service life of 27 years. Most of the panels or boards were retired between 30 and 35 years. There is not sufficient information for a Iowa curve fit analysis.

While the structure of the board has an almost indefinite life, the components of some boards are being replaced due to obsolescence. Sometimes the entire board is replaced because of overall changed needs. Considering this, the Steering Committee concludes that the present service life of 35 years is retained and that individual components are covered under maintenance.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 78 switchboards were retired with an average life of about 28 years when equipment at Pinnacle Peak substation was recently modernized. Old type switchboards are being replaced with 19" rack mounted units when stations are upgraded. It is expected these new units will have a reasonably long life, although the merit of retaining either new or old as a unit of property is seriously questioned. Given the likelihood of technical change requiring the replacement of entire racks and panels with all the equipment mounted thereon, the Steering Committee suggests that the unit of property be redefined to be the now used 19" rack mounted panel with components. Therefore, the Update will discontinue use of the control board or panel with its 35-year life, and redefine the unit of property as the 19" rack mounted panel with components, with a 15-year life.

Justification No. 18 Coupling Capacitor voltage Transformer (CCVT) (69-kV and above)

Account: 331, 332, 353, 397 (175, 180)

Service Life: 30 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 225 coupling capacitor voltage transformer retirements with an average life of 36 years. Opinions of a reasonable life vary from 25 to 35 years. The large sample of data recorded combined with opinions of a 35-year life span suggest that 35 years be considered as a reasonable life span. The majority of this equipment is in account 353, also known as CCPT and CCVT. This function is changing from mostly communication use to include system protection use. Therefore the investment may be classified in either plant account 353 or 397. It is recommended that this Update increase the average life of coupling capacitor voltage transformers from 25 years to 30 years.

Historical Background. In the 1981 report these were called "Carrier Coupling Capacitors." There are more than 1,000 of these installed on Reclamation and WAPA systems. This equipment, used in conjunction with the powerline carrier systems, consists of an oil-filled capacitor unit enclosed in a porcelain housing with carrier accessories, and with facilities for either base or suspension mounting.

Capacitors are replaced for a number of reasons, such as changed requirements, deterioration, failure, and obsolescence.

A majority of the operating personnel interviewed expressed a view that the 30-year life assigned in the 1981 report is appropriate. Several comments suggested a longer life, with Keswick cited as an example of replacement after 40 years. During the discussions the name change from "Carrier Coupling Capacitor" to "Coupling Capacitor voltage Transformer (CCVT)" was suggested, to be in line with modern terminology.

The 1985 BPA study includes coupling capacitors in FERC account 397, with a 2051 service life; the previous BPA study used 25 years.

During the current study period, 113 CCVTs were added, while 19 were retired. Those retired had an average service life of 27 years, with a range of 17 to 37 years. However, when the current statistical data are combined with the historical data base the average service life decreases to 19 years, with most of the retirements occurring between 15 and 20 years. In the 1981 study the average age of retirements was also 16 years. The final Iowa curve selected is a $20S_4$, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-9). Thus, the statistical data indicates a lower average life than that reflected in the opinions of field personnel.

Based on the much lower statistical result, the Steering Committee concludes that the service life is reduced from 30 to 25 years. The above described name change is implemented.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 82 CCVT retirements with an average life of about 28 years. CCVTs are a relatively trouble-free component of the powerline carrier system. Older units often have PCB. Opinions generally agree that 25 years is reasonable; however, two commenters noted that longer than 25 years would also be reasonable.

The discussion of wave traps, Justification No. 14, points out that several areas have phased out or are in the process of phasing out powerline carrier in favor of leased lines or radio communication. There will be less use of CCVTs as this trend continues; it is likely that carrier systems will be dropped from the list of unit of properties in another few years. Therefore, it is recommended that this Update continue to use 25 years for the average life for coupling capacitor voltage transformers.

Justification No. 19 Crane, Hoist, Derrick, and Cableway

Account: 331, 335, 353, 398 (130, 175, 199)

Service Life: 50 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. Earlier versions of this report made a distinction between Cranes in Category 2 buildings set at 50 years, and larger cranes in Category 1 buildings service life was Exceeds 50 years. As a result of the merger of the USACE ER-37-1-30, changing the service life Exceeds 50 years to 50 years was recommended by the SME team and approved by the Steering Committee

SME comments: Large cranes last 40-50 years and are then rehabilitated, which includes upgrades to the control systems, cables, drums, motors, etc. The service life is therefore set to 50 years. SME team discussion determined that extensive rehabilitation of crane systems to extend life and/or increase capacity should be capitalized, while smaller repairs using in-kind replacement of parts is maintenance.

2005 Summary and Recommendation. There is no new statistical evidence for cranes and hoists that indicate a change should be made in the established service lives. Cranes and hoists associated with Category 2 buildings continue to have a 50-year service life, while all others have lives exceeding 50 years.

Historical Background. The largest of these devices, installed at dams, have long lives. They are made of heavy steel parts and, although exposed to the elements, are operated relatively infrequently. Parts may be replaced, but the replacement of the entire device should not be required except in rare instances.

Some of these devices also are installed at power plants, pumping plants, warehouses, service centers, switchyards, and substations. They include stationary hoists, derricks, monorail hoists, jib cranes, gantry cranes, and overhead traveling cranes. Parts of cranes have been replaced and there have been complete replacements in a few instances where increased duty required the installation of larger cranes.

For the purpose of establishing service life, the 1981 report divided cranes, hoists, derricks, and cableways into two categories: those associated with Category 2 buildings and all others. Since cranes installed in Category 2 buildings are expected to be replaced when the buildings are replaced, they were given a 50-year life. All other cranes, hoists, derricks, and cableways were given lives that exceeded the period of analysis.

Discussions with operations personnel indicated unanimous agreement with these service lives. Replacement of a very few cranes in the “all others” category were reported; gate cranes on Friant dam and the powerhouse crane at Folsom were replaced after 40 years due to wear. The controls for the Hoover powerhouse crane were modernized after 50 years of service. Due to insufficient data, no statistical analyses were made. The replacement problems mentioned in the field interviews appear to be isolated occurrences which do not justify changing the established service life for cranes, with a total number of installations in the hundreds. Consequently, it is concluded that crane and related facilities associated with Category 2 buildings continue to have a 50-year service life, while all others have lives exceeding 50 years.

Justification No. 20 Dam, Storage

Account: 332 (151)

Service Life: 100 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 years" be set to 100 years to align with the USACE data. The SME team recommended and the Steering Committee approved this item be changed from Exceeds 50 years to 100 years.

2005 Summary and Recommendation. Reclamation presently has 457 dams and dikes throughout 17 western states. 358 of these would endanger lives if a failure occurred. Since 1978 Reclamation has employed a program to ensure dam safety through inspections for safety deficiencies, analyses that use current technologies and designs, and corrective actions if needed based on current engineering practices. Dam safety modifications and development of new dam safety technologies have aided in providing Reclamation storage dams with long useful lives. It is concluded that no change should be made in the service life exceeding 50 years established in the previous reports.

Historical Background. With adequate operation, maintenance, and replacement programs, storage dams designed and constructed by Reclamation will, in general, have an indefinitely long, useful life.

Reclamation has constructed or rehabilitated and had in operation on its projects, 325 storage dams or dikes and 243 storage reservoirs. Approximately 80 of the storage dams were constructed prior to 1940. The oldest dams still in operation by Reclamation are the Deer Flat in Idaho and the Avalon in New Mexico, which were completed in 1907.

In areas where earthquakes occur, provisions for increased stresses have been incorporated in the designs. Also, the freeboard at the abutments and appurtenant structures provides protection for wave action due to landslides in the reservoir areas. New methods of risk analysis and computer models for dams are being developed to aid designers in minimizing the effect of earthquakes and landslides.

The American Falls Dam, Minidoka Project, completed in 1927, is the only storage dam that has been replaced as the result of structure deterioration. This replacement was due to continuous cement aggregate reaction. Two other concrete dams have experienced less severe cement aggregate reaction, but it is believed that replacement will not be required. Concrete technology during the last 40 years has so advanced that problems with cement aggregate reaction have virtually been eliminated.

Storage allocation for sediment accumulation for a 100-year period is made for all reservoirs where the estimated volume of sediment deposits exceeds 5 percent of the available storage capacity at normal water surface. This insures an adequate storage space for the first 100 years of operation without encroachment on this space by sediment accumulation.

Spillways and outlet works of storage dams are designed in conjunction with allocated reservoir storage space to safely accommodate the estimated maximum probable flood. Obsolescence of data and technology for estimating floods has made it apparent that some existing dams and reservoirs cannot safely accommodate the updated estimated floods. Consequently, a number of existing spillways are presently being enlarged and modified. Repairs of spillways not related to increased estimated maximum probable floods are usually accomplished as part of the maintenance program.

Reclamation lost one dam in 1976, the Teton Dam, during filling operations.

Under a program of examination of structures, all storage dams and reservoirs and appurtenances are examined periodically by teams of engineers to assure that the facilities are safe and adequately maintained.

Operating personnel that commented during interviews were in agreement with the determination in the 1981 report that the service life exceeds that of the period of analysis.

It is concluded that no change should be made in the service life exceeding 50 years established in the previous report.

Justification No. 21 AC and DC Distribution Boards and Breaker Panels (480v or less)

Account: 331, 332, 334, 353, 353 (130, 151, 153, 170)

Service Life: 30 years

2017 Summary and Recommendations. This is a new item in the 2017 revision. This covers both AC and DC distribution boards and breaker panels for voltages of 480 Volts or less. The determination of capitalization versus expense will require an analysis following the guidance covered in Chapter 3. Distribution boards and breaker panels are common and widely distributed throughout any given facility and most are not consider a capitalized unit of property for replacement under normal maintenance conditions. However in the case of major facility power service entrances or very large facility distribution centers, their replacement can be consider a capitalized investment, especially if the newer equipment will enhance and extend the life of the equipment. In many cases an entire facility will upgrade its distribution boards and breaker panels to be within industry standards such as Safety, Hazardous Energy Control (add lock out mechanisms), Arc Flash (higher protection), etc. In these cases, capitalization is a consideration. In cases where only one satellite breaker panel is replaced, this is usually considered a maintenance activity and expensed.

Agency experience has shown that if the installation is outdoors and exposed to the elements (harsh environment) and without maintenance, then replacement should be 12 years. Indoor installations without maintenance would be 30 years, and with proper maintenance can be extended to 40 years.

The large manufacture for several brands of breakers and panels, Schneider Electric, list the life expectancy for molded case circuit breakers in the industry is generally expected to be about 30 years. Conditions of service including number of operations, number of load operations, overloads, short circuits, environmental conditions, and maintenance may affect the time of useful service. The Consumer Product Safety Commission (CPSC) estimates a circuit breaker's life expectancy at 30 to 40 years, and it is the same for GFCI, AFCI, and standard breakers.

Justification No. 22 Digital Fault Recorder (Previously titled Fault Recorder and Master Station)

(Also see Justification No. 47.)

Account: 334, 353 (170, 175)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 12 fault recorder retirements with an average life of 13 years. Opinions of a reasonable life vary from 10 to 15 years. Technology has changed so that a master station is no longer required and fault recorders being installed now are digital. The title for this unit of property has been changed to reflect this new technology. It is recommended that this Update increase the average life from 10 years to 15 years for digital fault recorders.

Historical Background. Fault recorders are large, self-contained instruments used for recording system faults, transients, and disturbances. They include sensitive electronic components, such as starting sensors, microprocessors, analog-to-digital converters, electronic-memory assemblies, video-display units, keyboards, computer-type printers (typically dot-matrix type), disk drives, sequential-event recorders (SERs), and communications interface equipment. Since they are relatively expensive, they are defined as units of property.

Master stations for fault recorders are microcomputer-based, with customized software and communications interfaces. They are used to retrieve, analyze, and archive the data obtained by the fault recorders.

Improvements in the available technology, the design, hardware, and software, and changes in system requirements tend to make the useful life of these instruments relatively short because of obsolescence. The transient fault recorders and master stations currently in use by WAPA are too new to have any replacement records. The oldest unit was purchased in 1984. As of July 1988, there are currently 16 such fault recorders in service, with 13 more on order. There are three master stations in service, with one on order.

Because of the rapid changes in technology, the expected service life may be as short as 6 years and as long as 10 years. Master station life may be even shorter due to rapid changes in microcomputer equipment and software. Replacement is not a function of physical wear, but of obsolescence and the need for a better, more efficient system. The Steering Committee concludes that the service life is 10 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show eight fault recorder retirements with an average life of about 7 years. Changing technical requirements are a consideration with electronic equipment. Opinions vary both more and less than 10 years. It is recommended that this Update continue to use 10 years for the average life for automatic fault recorders. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 23 Engine Generator Set, Auxiliary (100 kW and over)

Account: 334, 353 (170, 175)

Service Life: 35 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that service life should be maintained at 35 years. The USACE ER-37-1-30 lists this item with a service life of 40 years. Analysis of the data listed in 2005 and the experience of the team resulted in leaving this item at 35 years. Clarification was provided that the unit of property includes accessories such as Hydrogen Fuel Cell System (See Justification No. 4).

2005 Summary and Recommendation. The current data from Reclamation shows two retirements at an average age of 32 years. It is recommended the service life for auxiliary engine generator sets remain at 35 years.

Historical Background. Engine generators are used to supply station service power during emergencies when a normal source of power fails, in such facilities as power plants, pumping plants, dams, large substations, and operating centers. They usually are small, with a generator rated less than 300 kilowatts, and are driven by engines using gasoline, propane, or diesel fuel. Since they are used only in emergencies, the actual operating time for the units is small, except in pumping plants subject to unreliable power supply. With proper maintenance these sets should have long service lives.

Operations personnel at about half of the project and division offices agreed with the previously established service life of 40 years; others had little or no experience. Some personnel were of the opinion that operating time rather than installation time is more relevant to service life, as many units are only operated infrequently over many years to test their readiness for emergency service. A few recommendations were made to reduce the service life from 40 years to 20 or 25 years for units with higher duty cycles. The observation was made that quality control in manufacturing on new sets has declined, and that parts replacement is a growing problem.

The statistics on engine generator sets are limited to 11 observations. Of those 11, eight were retired at an average life of 22 years. While most were retired from 30 to 35 years, some lasted only 5 to 20 years, thus lowering the average. The selected Iowa curve indicated a 20-year life with an S_2 dispersion. These findings are shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-10).

Considering recent operating experience, statistical data, and possible problems with lesser quality units and parts procurement, the service life is reduced to 35 years.

Justification No. 24 Exciter, Electric Prime Mover (1,500 hp or Larger Synchronous Motors)

Account: No comparable FERC Account (160)

Service Life:	Analog	30 years
	Digital	15 years
	Rotating Exciter	40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team. It was recommended by the SME team and approved by the Steering Committee that there was a need to differentiate the service life for analog and digital exciters.

- Analog 30 years
- Digital 15 years
- Rotating Exciter 40 years

Experience over the past 10 years has shown that analog controllers are no longer supported by industry. Vendors now only supply digital controllers which have a vendor user support of about 15 years. Digital controllers usually become obsolete in about 15 years. Also, when rotating exciters are replaced, they are replaced with at digital controller.

2005 Summary and Recommendation. There is no new statistical evidence for electric prime mover exciters that indicates a change should be made in the established service life. It is concluded that no change should be made in the service life of 45 years established in the previous reports.

Historical Background. For motors 1,500 horsepower (1,120-kilowatts) and above, motor exciters, which include the static type as well as the rotating type, are similar to generator exciters and were given an average service life of 45 years in the 1981 report.

The general consensus among operations personnel was that the previously established service life is adequate. A few instances of earlier replacement were cited; a Flatiron exciter failed after 32 years and the exciters at Tracy are to be replaced after about 40 years of service. These apparently are not typical experiences considering that more than 1,000 motor driven pumps are in service. One suggestion was received to change the description to "Excitation Control Systems" because the voltage regulator and other associated items are typically replaced together with the exciter.

There are no statistical data available for exciters.

It is concluded that motor exciters on motors 1,500 horsepower and larger continue to have an average service life of 45 years. Exciters on smaller motors are to be replaced as required, with costs charged to maintenance expense.

Justification No. 25 Exciter, Generator

Account: 333 (165)

Service Life:	Rotating Excitation System	40 years
	Static Excitation System –Analog	30 years
	Static Excitation - Power Section Only	30 years
	Digital Excitation System - Control System	15 years
	Excitation Supply Transformer	40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined there is a need to break out the difference in service life between rotating, static, and digital excitation systems. Previous editions list excitation as a single item with a service life of 45 years. Based on the stakeholder agencies' collective experience with the newer technologies in this area, the SME team recommended and the Steering Committee approved the following new service lives for generator exciters:

- Rotating Excitation System 40 years
- Static Excitation System –Analog 30 years
- Static Excitation - Power Section Only 30 years
- Digital Excitation System - Control System 15 years
- Excitation Supply Transformer 40 years

Experience over the past 10 years has shown that analog static controllers are no longer supported by industry. Vendors now only supply digital controllers which have a vendor user support of about 15 years. Digital controllers usually become obsolete in about 15 years. Also, when rotating exciters are replaced, they are replaced with at digital controller.

2005 Summary and Recommendation. Current data from Reclamation shows 17 retirements at an average age of 38 years. As it has been common practice to replace the exciter during generator rewinds and particularly during an upgrade rewind and experience with static exciters is still insufficient to determine their service lives, it is recommended to retain the 45-year service life for generator exciters.

Historical Background. Main exciters used in conjunction with generators may be either of the static or rotating type. Of the more than 220 generator exciters in service, records indicate that only a small number have been replaced. These include two turbine-driven exciters at the Minidoka power plant replaced by motor-driven exciters in 1927 after 18 years of service. Separate pilot and main exciters were purchased for the Grand Coulee power plant a number of years ago. Rotors from these spares were used to replace the rotors of both the main and pilot exciters of Unit G-6. The original rotors were repaired and held as spares.

According to available data, exciters have been replaced at Shasta and Parker power plants. Unit No. 1 exciter was replaced at Shasta in 1978 after 29 years of service, and the Unit No. 2 exciter was replaced in 1980 after 32 years of service. One exciter was replaced at Parker in 1977 after 35 years. The exciter on the single unit at Crystal installed in 1978 is faulty as of 1988 and will be replaced with a static type after only 10 years of service. Most of the evidence indicates that problems with exciters involving commutators, bearings and windings are resolved by maintenance. This will continue to be the case with static exciters, which also require periodic thyristor replacement.

Operations personnel were in general agreement with the service life of 45 years established in the 1981 report. Some pointed out that it was common practice to replace the exciter during generator rewinds and particularly during an upgrade rewind. Static exciters are usually chosen as replacements because of their lower maintenance requirements.

The statistical data for exciters is limited to 14 additions and only two retirements, which lasted 30 years.

In view of the ages of the exciters which are still in service, (20 percent are at least 45 years old), the limited new evidence of replacements and the relatively little experience with static exciters, the average service life of 45 years is retained.

Justification No. 26 Fiber Optic Cable, Optical Ground Wire (OPT-GW), and All-Dielectric Self-Supporting (ADSS)

Account(s): 397

Service Life/Factor Update: 13.8 percent at 50 years on wood pole structures
3 percent at 50 years on steel structures

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. In a fiber optic system, an optical quality glass or plastic fiber is used as the information channel. Since fiber optics have a low attenuation and high efficiency in light collection, the signals can be transmitted over long path lengths without much distortion. Fiber optic cables generally consist of a structural core of glass fibers protected by a shielded type of jacket. Based on the above, and discussions with WAPA field personnel, it is concluded that fiber optic cables, type OPT-GW should have a life service of at least 35 years with aggressive periodic maintenance at 10-15 year intervals. Due to the unresolved issues on the ADSS cable, a service life for this type of fiber optic cable is variable. It is possible that the cable could last up to 30-35 years. WAPA currently does not have a great deal of ADSS installed, but expects to add more of this type of equipment in the future, so it is suggested that this be re-examined during the next update.

Historical Background. Early fiber optic systems utilized duct and direct buried optical cables. Since then, there has been considerable development and interest in using existing transmission and distribution lines to install fiber optic cables. Common fiber optic cables include OPT-GW and ADSS. OPT-GW is a composite cable made up of a ground wire for aerial transmission power lines which contain optical fibers encased in an aluminum tube. The optical ground wire is designed to match the mechanical and electrical requirements of conventional overhead ground wire. ADSS is designed specifically for installations in short span distribution systems. Placement of ADSS follows the same basic procedure as for aerial cable. However, it has been observed that in high-voltage-line installations, special precautions must be taken to protect against induced voltage and corona effect on the jacket.

The majority of WAPA's fiber optic installations are of the type OPT-GW. According to the 1995 Replacements Book, over-head ground wires (OHGW) of transmission lines installed on wood poles and steel towers have life expectancies of 40 to 50 years, respectively. Since OHGW have service lives of 40 and 50 years and these wires are used for housing fiber optic cables, it is assumed that both OHGW and fiber optic cables should have the same replacement period.

Coaxial cable, which is also used in transmission of information for control and communication purposes, is considered more expensive to install than fiber optic cable. Coaxial cable was not directly listed in the 1995 Replacements Book. It was referenced with radio, microwave, telephone, and carrier current communication systems having life expectancies of 10 to 15 years.

Justification No. 27 Fiber Optic Multiplexer

Account(s): 397

Service Life: 10 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Limited Update and Recommendation. This equipment is considered to be fiber optic accessories. Components of these accessories continue to be upgraded or enhanced. Therefore, it is anticipated that this equipment may be upgraded or replaced as it becomes obsolete due to development of new technologies. Based on the above, and discussions with WAPA field personnel, it is concluded equipment should have a service life of 10 years.

Justification No. 28 Flume

Account: 332 (153)

Service Life:	Flume other than wooded	100 years
	Flume, wooden	25 years.

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no new statistical evidence for flumes that indicates a change should be made in the determination that flumes should not be a replaceable unit of property.

Historical Background. A flume is defined as an open water conveyance channel which is supported by something other than earth. Only one flume has been constructed by Reclamation since 1973--a replacement for an existing flume where insufficient head was available to change to a closed conduit. Considerations such as right-of-way, vulnerability to damage, aesthetics, and water savings generally lead to the choice of closed conduits rather than flumes for water conveyance. Nearly all existing flumes on Reclamation's projects have been constructed of concrete, steel, timber, or a combination of these materials. Flumes of concrete or steel or a combination of these materials should have a long life with adequate maintenance. Usually they are accessible for periodic inspection and maintenance. Locations on rock and on steep slopes can make maintenance quite expensive. Replacement of sections of sheet metal flumes can be expected as part of the normal maintenance program. Existing timber flumes or flumes with wood trestles are a rarity, and it is unlikely that new projects will have timber flumes.

Interviews with operations personnel uncovered no new evidence to indicate a change in service life. Flumes of concrete or steel or a combination of these materials continue to have an average service life that exceeds the period of analysis.

Data are not available for a statistical analysis.

Flumes are eliminated as a replaceable unit of property, whether concrete, steel, or wood. Any expenditures are to be included as part of maintenance.

Justification No. 29 Gates (Head) and Valves

Account: No Comparable FERC Account (160), 333 (165)

Service Life: 50 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 years" be set to 100 years to align with the USACE data, unless current analysis determined otherwise. Based on the stakeholder agencies' collective experience with gates and valves, the SME team recommended and the Steering Committee approved the new service life to be 50 years.

2005 Summary and Recommendation. Reclamation replaced 3 gates (head) at Canyon Ferry with a service life of 48 years. One gate (head)/valve was also replaced at Mary's Lake with a service life of 53 years. It is concluded that no change should be made in the service life of exceeds 50 years established in the previous reports.

Historical Background. Reclamation has installed thousands of gates and valves in dams, power plants, pumping plants, and canal structures. These gates and valves function under a wide range of head conditions depending on the installation. In 1960, a survey was made of valves and gates at 32 of Reclamation's oldest storage dams and at 16 of its oldest diversion dams. Using available sources of data, the condition of this equipment was updated in 1981, and again in 1988. The data are summarized in these Exhibits, which are included in the 1995 and earlier publications. See Appendix B of the 2006 Replacements Book (Supplemental Historical Reference).

Exhibit A-11 - Gates, Spillway, and Canal Headworks

Exhibit A-12 - Outlet, Penstock, and Sluice Gates and Valves (except needle-type valves)

Exhibit A-13 - Needle-Type

These listings, which contain only a small percentage of gates and valves installed over the years, are considered representative for the purpose of determining the service life for gates and valves. As mentioned previously, the equipment reviewed was some of Reclamation's oldest. In fact, all original equipment listed was installed prior to 1926, some as early as 1906. These tables were updated in 1988 based on information received from Reclamation's Denver office. An important finding regarding Exhibit A-13 on needle-type valves is discussed subsequently.

Most of the gates listed in Exhibit A-11 are constructed of steel or cast-iron members and operate under low head conditions. They include radial, drum, roller, and slide gates in a range of sizes. There are 341 gates ranging in age from 35 to 81 years listed in this table and 321 are still in service. Of the 20 gates removed from service, two were no longer needed and the remaining 18 were replaced. Six are scheduled for replacement in 1989 and 1990: Roosevelt, Minadoka, and Belle Fourche. The three gates at Jackson Lake were removed and reinstalled in new concrete structures.

The equipment listed in Exhibit A-12 is, in general, subjected to high head operation and, therefore, is of heavier construction than the gates listed in Exhibit A-11. Of the 159 gates and valves listed, ranging in age from 28 to 81 years, 148 are still in service. Of the 11 gates no longer in service, six were replaced and five were abandoned. No valves were involved. The gates were replaced or abandoned as follows: (1) the 3 gates at Buffalo Bill Dam were abandoned after 50 years of service when new outlet works were constructed at a higher elevation because of rock slides; (2) a gate was replaced at Boise River Diversion Dam after 50 years of service; (3) the two gates at Sherburne Lake Dam were replaced after 39 years of service; (4) the two gates at Keechelus were replaced after 61 years of service; (5) the gates at Strawberry were plugged after 28 years of service; and one gate at Minidoka was replaced after 71 years.

There has been a significant policy change with respect to needle valves, a sampling of which is listed on Exhibit A-13. Since the 1981 report, a program has been initiated to replace all needle valves, due to operation and maintenance problems as exemplified in a serious incident at Bartlett Dam in Arizona. (See report "Bartlett Dam Needle Valve Accident," October 1984.) Although the average ages of the valves shown in Table 41 vary from 54 to 78 years, all of the equipment will be replaced in time. Eight of the listed valves have been either replaced or removed from service since the 1981 report and two more are scheduled for replacement in 1989. Needle valves at dams not included in the listing which have been replaced are at Echo and Taylor Park. Work has begun on replacing valves at Summer, Seminoe, Deadwood, Moon Lake, Agency Valley and McKay dams. Jet flow valves are generally being used in the replacement of the existing needle valves.

The controls to the gates and valves listed in the tables in a number of instances have been changed. The changes, in general, were made to convert to a more advanced method of operation such as manual to engine-powered, engine-powered to electric operation, and in some cases to a remote type of operation.

There was general agreement among operations personnel on the designated service life, and the problems with needle valves were identified. Some projects reported seal replacements carried out as maintenance, but suggested that the cost was sometimes high and that consideration should be given to making seals and seats a unit of property.

In consideration of the previous findings and the fact that a longer life for this type of equipment can be expected in the future through cathodic protection programs, improved maintenance methods, design advancements, and material improvements; gates and valves, excluding needle valves, are established as a unit of property with a service life that exceeds 50 years. Needle valves are removed as a unit of property. Seals and seats continue to be maintenance items.

Justification No. 30 Governor

Account: 333 (165)

Service Life:	Mechanical governors	40 years
	Governor oil pump	40 years
	Air compressor	25 years
	Digital control system (controller only)	15 years
	Governor oil and lubricating systems	40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined there is a need to break out governor components. Previous editions list excitation as a single item with a service life of 50 years. Based on the stakeholder agencies' collective experience with the newer technologies in this area, the following new service lives for the governor and its components was recommended by the SME and approved by the Steering Committee:

- Mechanical governors 40 years
- Governor oil pump 40 years
- Air compressor 20 years
- Digital control system (controller only) 15 years
- Governor oil and lubricating systems 40 years

Experience over the past 10 years has shown that mechanical governors are no longer supported by the Original Equipment Manufacturer (OEM), but rather by third party support vendors. When mechanically controlled governors are replaced they are replace with a digital controller type. While the mechanical portion of the governor still has longer service life (40 years) the digital governor controller is typically supported by the OEM for about 15 years.

2005 Summary and Recommendation. The current data from Reclamation for governors shows 22 replacements at an average service life of 39 years and five retirements due to unit retirement at an average service life of 86 years resulting in an overall average service life of 48 years. Some of the governor replacements occurred when the units they were associated with were being rewound and modernized. It is recommended the service life for governors remain at exceeds 50 years.

Historical Background. A review of Reclamation's operating experience on governors for controlling the speed and output of the hydraulic turbine-generator units indicates that of 230 governors installed, 13 governors have been replaced and another nine were retired as a result of plant abandonment. Of the 13 replaced, 5 were at Shasta and 3 were at Kortes. These governors, which had been in service 25 to 30 years, had been considered as problem governors regarding unit and system control capabilities. They also had high maintenance costs from the time of their original installation. Two governors at Black Canyon had been in service 40 to 45 years when they were replaced in connection with planned plant automation. The governors for the three station service units at Grand Coulee were replaced, two after 41 years, and one after 31 years of service during control systems modernization. These 13 governor replacements are considered as being due to unusual conditions. Of the governors remaining in service, eight have been in service for over 70 years, 12 have been in service 50 to 70 years, 39 for 40 to 50 years, 76 for 30 to 40 years, and 67 for 20 to 30 years.

The governor ball head mechanism, the permanent magnet generators (where used), and the governor oil pressure pump and motors are items that receive considerable wear and require maintenance. The records indicate that about 40 ball-head mechanisms have been replaced under maintenance and modernization programs. The 10 governor replacements at Shasta, Kortes, and Black Canyon discussed above also included replacement of the ball heads, pumps, motors, etc., since they were parts of the replaced governors.

The consensus among operating personnel was that 50 years is still a reasonable service life. A problem that has recently surfaced is that replacement parts for some older governors are unavailable because the manufacturer is no longer in business. This is causing the whole governor to be replaced with new designs to ensure turbine operability. Such replacements have occurred at Big Thompson after 28 years of service and at Parker and Davis after about 35 years. The Yellowtail governors have been budgeted for replacement after 25 years of service.

It can be expected that this trend will continue and that old governors, with the exception of those built by one specific manufacturer, which are the majority, will all eventually be replaced.

The statistical data for the current study period included 25 additions. In the historical period only five retirements were recorded, with an average service life of 27 years. Based on a limited statistical analysis, the Iowa curve fit indicates a 50-year average life.

In view of the long-term experience on governors and their components, it is concluded that the complete governor will continue as the unit of property with an average service life exceeding 50 years. Replacement of individual components is handled under the maintenance program.

Justification No. 31 Transformer Monitor and Annunciation System

Accounts: 331, 332, 334, 352, 353

Service Live: 15 years

2017 Summary and Recommendations. This is a new item added to the 2017 revision. This item was assessed by the multiagency SME team and it was determined that the service life for Transformer Monitor and Annunciation System is 15 years. As technology has improved over the past 20 years, these items are being installed as condition based monitoring system for the large power transformers. The initial installation can be considered a capitalized improvement which may increase the longevity of the transformer at large. Replacement of component parts of these units such as sensors and transducers are considered maintenance items.

Justification No. 32 Impeller, Pump

Account: No Comparable FERC Account (160)

Service Life:	Pump impeller, 250 to 1,499 hp	35 years
	Pump impeller, 1,500 hp or more	40 years
	Below 250 hp and deep well type	Maintenance

2017 Summary and Recommendation. As a result of the merger of the USACE ER-37-1-30, pump impellers have been grouped into three categories. It was recommended by the SME team and approved by the Steering Committee that the USACE service life for large pump impellers 1,500 hp or larger (40 years) be adopted. For pump impellers 250 – 1,499-hp, the service life was adjusted from 30 years to 35 years. Deep well type pump impellers and pumps below 250-hp continue to be maintenance items.

- Pump impeller, 250 to 1,499 hp 35 years
- Pump impeller, 1,500 hp or more 40 years
- Below 250 hp and deep well type Maintenance

2005 Summary and Recommendation. There is no new statistical evidence that indicates a change should be made in the service life recommendation for pump impellers. Therefore, pump impellers rated above 250-hp continue to have an average service life of 35 years and pump impellers rated below 250-hp and deep well type pump impellers continue to be maintenance items.

Historical Background. As of October 1, 1986, Reclamation had 190 pumping plants, 1,000 horsepower (746 kilowatts) or larger, installed on the various projects. In addition, there are thousands of smaller plants. The size of units in these plants range from a few horsepower in some of the relift plants up to 65,000 horsepower (48,500 kilowatts) for some of the units in the Grand Coulee pumping plant. Most of the small plants and some of the larger ones have been transferred to irrigation districts for operation and maintenance. Available records indicate that very few complete pumping units have been replaced. Replacements for pumps and motors for the Shirley, Terry, and Fallon Relift pumping plants were carried out in 1983 to increase capacity and efficiency. Replacement pumps were installed in the Fallon pumping plant also in 1983. These Buffalo Rapids Project plants, with unit capacities between 150 and 300 horsepower, were installed in 1943, 1944, and 1948, respectively.

Although there have been some complete replacements of pumps, as described above, most replacements involve equipment parts. For the purpose of establishing service lives in the 1981 report, pumps were divided into three groups: those requiring prime movers of 1,500 horsepower (1,120 kilowatts) or above; those requiring prime movers of from 250 to 1,499 horsepower (186 to 1,119 kilowatts); and deep well pumps and those requiring a prime mover of below 250 horsepower (186 kilowatts). Current data available on the distribution of pumps by size of prime mover is summarized in the following table. It is noted that there is a distinctive size break above 10,000 horsepower, which is of special interest.

Pumps Larger than 250-hp (excluding pump-turbines):

Capacity Range (hp)	**No. of Units Installed**
250 to 1,500	716
1,500 to 10,000	159
Above 10,000	18

Pumps with prime movers 1,500 horsepower (1,120 kilowatts) or above are comparable to power plant turbines and it is not expected that the complete pump will be replaced during the period of analysis. However, the impellers are subject to damage by erosion and cavitation and require maintenance and repair, usually by welding in place. The ease of access for maintenance in the larger sized pumps is one factor which contributes to the relatively long life. Since replacements are sometimes required, impellers were designated units of property in the 1981 report and given a life of 40 years. The established service life may be conservative since most pump impellers currently being purchased are made of aluminum bronze alloy or stainless steel. This applies both to the intermediate size pump group as well as the large size group.

Operating staffs report that replacement programs are beginning on the six 65,000-hp pump impellers at Grand Coulee after 37 years and on three of the six 40,000-hp pump impellers at Dos Amigos after 20 years. The Grand Coulee impellers are experiencing severe cavitation erosion and cracking; Dos Amigos has experienced excessive cavitation problems. The only other very large pumps (over 10,000-hp) are the six 22,500-hp units at Tracy, which have been in operation for 37 years. The nine pumps scheduled for replacement represent 50 percent of the very large pumps installed (excluding pump-turbines). Perhaps a new category of very large (over 10,000-hp) pump impellers should be added.

Pumps with prime movers ranging from 250 to 1,500 horsepower (186 to 1,119 kilowatts) also should have long lives. Although the quality of maintenance with this group has been high, it may not be quite as high as for the larger units. Access for maintenance is not as good for these units and the preventative maintenance program is not as closely controlled. The average life for impellers of this group was established at 30 years in the 1981 report.

For pumps with prime movers below 250 horsepower (186 kilowatts) a program of periodic reconditioning of pumps and motors has been followed in most instances. This group includes deep-well type units, even though in some cases they exceed the 250 horsepower (186 kilowatts) limit. When replacements of component parts are required, the costs of these are low enough that they can easily be handled through the normal maintenance program. The 1981 report established that pumps with prime movers below 250 horsepower (186 kilowatts) and deep-well type pumping units, given proper maintenance, should have service lives exceeding the period of analysis..

As with some other units of property, it has been suggested by some operating personnel that the service life of pump impellers is affected by factors other than installation period. Type of operation, hours of operation, water quality, and suitability of the design all contribute. Unfortunately, except for actual time of operation, these factors are not being quantified.

It appears that there is insufficient evidence to continue the distinction in impeller service life for sizes of pumps above 250-hp. Recent experience suggests that 40 years on larger units may be excessive. On the other hand, there is inadequate data to corroborate continuance of the 30-year life for the smaller units. The Steering Committee therefore concludes that plant accounting is to be simplified and establishes a single service life of 35 years for all units 250-hp and above.

Justification No. 33 Interrupter Switches with Fault Clearing Capability

Account: 353 (175)

Service life: 20 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 17 interrupter retirements with an average life of 20 years. Reclamation has 3 retirements with an average life of 31 years. Opinions of a reasonable life vary from 20 to 25 years. It is recommended that this Update decrease the average life from 25 to 20 years for interrupter switches.

Historical Background. Included in this justification are interrupter switches with fault clearing capability that are used in switchyards and substations throughout Reclamation and WAPA systems. In each case the unit of property has been defined as the complete unit. Components of the units may include items such as interrupter elements, operating mechanisms, contacts, bushings, bushing current transformers, tanks, frame, and compressed gas systems, all of which generally can be kept in good condition by the normal maintenance program as long as parts are available.

In the 1981 report interrupter switches with fault-clearing capability were given a service life of 35 years. The results of the interviews focusing on the 35-year service life for interrupter switches were not conclusive. The consensus was that 35 years is a maximum, and there were several observations that 25 to 30 years is more appropriate.

The Iowa curve used by BPA in its latest study for Account 353, Station Equipment, is a $37S_o$. The prior BPA study used a life of 20 years if the voltage was lower than 230-kV and 25 years for 230-kV and higher voltage breakers.

Based on the current data for interrupter switches with fault clearing capability, the average service life for the nine units retired was 19 years. Considering the entire historical data base, the average service life is 19 years, with most of the retirements taking place in the 20- to 25-year range. As shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-14), the Iowa curve fit average life is 20 years with an R_4 dispersion. Based on all evidence considered, the Steering Committee is disposed to shorten the service life for interrupter switches from 35 years to 25 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 16 retirements with an average life of about 23 years. Interrupter switches with fault-clearing capability are quite sensitive to the manufacturer's design rating number of duty cycles. The frequent operation at DC converter stations wears those switches out sooner because the operational design limit is reached much earlier than it is reached at other locations. It is recommended that this Update continue use of 25 years for the average life for interrupter switches with fault clearing capability.

Justification No. 34 Motor (Engine) Generator Set, Communication

Account: 397 (180.10, 180.20)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show four generator retirements with an average life of 10 years. With so few items recorded, it is recommended that this Update continue to use 15 years for the average life for communication engine generator sets.

Historical Background. These generators are a part of the auxiliary power supply system for radio and microwave systems. The conditions under which they operate are more severe than the larger auxiliary power supply generators discussed separately. Also, the operating time is normally greater than for the auxiliary generator sets. They generally range in size from 3 kilowatts up to 30 kilowatts. The service life is highly dependent on amount of use and proper maintenance.

The majority of opinion in the field interviews supported the present 15-year service life. Replacement at Montrose after 15 years was cited. There were a few comments that 15 years was maximum, suggesting that any change in the assigned life should be downward.

In the pre-1981 BPA study a life of 16 2/3 years was established.

In the 1981 report the retirement's analysis indicated a trend toward a lower age at time of retirement for those units most recently installed. This trend is apparently continuing, as in the current study period six generators were added while four were retired at an average age of 14 years. Overall, of the 20 generators retired, the average life was 16 years. A $15S_2$ Iowa curve fit was found to be the most appropriate, as presented in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-5).

It is concluded that available data continues to substantiate the current 15-year service life.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 17 communication motor generator set retirements with an average life of about 15 years. Fifteen years seems generally reasonable. It is recommended that this Update continue to use 15 years for the average life for communication motor generator sets.

Justification No. 35 Penstock, Intake and Discharge Pipe

Account: 332 (152)

Service Life: 100 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 years" be set to 100 years to align with the USACE data. The SME team recommended and the Steering Committee approved changing this item from "Exceeds 50 years" to 100 years.

2005 Summary and Recommendation. There is no new statistical evidence that indicates a change should be made in the penstock, intake and discharge pipe service life recommendation. However, it was recommended that flowmeter systems be included in this account. Therefore, penstock, intake and discharge pipe, and flowmeter system will continue to have an average service life that exceeds 50 years.

Historical Background. One of the earliest penstock installations was in the Minidoka Dam on the Snake River in Idaho in 1906. The penstocks consisted of five 10-foot (3 meter) diameter steel penstocks, one steel-lined concrete penstock of variable circular section, and two steel-lined 9.625 by 11.25-foot concrete penstocks located in the powerhouse section.

For many years, penstocks have been constructed using steel pipe lined on the inside with coal tar enamel. Generally, these pipelines are encased in concrete. However, some installations are exposed or buried in earth. When exposed, they are painted, and when buried, they are coated with either cement mortar or coal tar enamel.

Future installations will specify coal tar epoxy coatings in place of coal tar enamel for personnel safety reasons during application.

Straight sections of intake and discharge pipelines at pumping plants are generally steel pipe with a mortar lining, and protected on the outside with either a cement mortar coating or coal tar enamel.

One project office recommended that the penstock lining be added as a unit of property in view of the high cost of recoating, plant downtime, and limited service life. Another indicated that some linings require replacement after 20 to 25 years.

Further investigation of the suggestion to consider lining of steel penstocks as a property unit indicates that over 90 percent of the linings of penstocks, intake, and discharge pipes is coal tar enamel, expected to have a 50-year life before major maintenance is required. Patching is normally accomplished as part of the maintenance program. Current environmental considerations have required shifting to coal tar epoxy for new installations. It is expected that coal tar epoxy will have a life of 30 years before significant patching is required. As with coal tar enamel linings, repairs are expected to be made as a part of maintenance.

As a general rule, all of the different types of pipe purchased and installed under Reclamation's specifications will give satisfactory service for more than 100 years with proper preventative maintenance. Replacements as may become necessary will be minor and handled as maintenance. Therefore, the average service life exceeds 50 years.

Justification No. 36 Phase Shifting Transformer (Previously titled Phase Angle Regulator)

Account: 353 (175)

Service Life: 45 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the service life should be increased from 40 to 45 years. Based on the stakeholder agencies' collective experience with these components, the SME team recommended and the Steering Committee approved the change.

2005 Summary and Recommendation. There is no data from WAPA's financial system and Maximo for retirements of phase angle regulators. It is recommended that the name for this unit of property be changed from phase angle regulator to phase shifting transformer. It is also recommended that this Update continue to use 40 years for the average life for the phase shifting transformers.

Historical Background. The requirement for transformer power regulation generally occurs on a system having parallel transmission paths or one that is interconnected with a number of other systems. Under such conditions this equipment is used to control the power flow over an individual line or interconnection to keep line loading within acceptable, economic, or contract loading limits. There are only a few of these installations in the WAPA power system. The August 1981 report indicated that there was no evidence to support changing the service life from the 45 years established in the previous study.

Interviews with operating personnel suggested a change in name for this device from "Power Regulating Transformer," used in the 1981 report, to "Phase Shifter." Vendors refer to them as "Phase Angle Regulators," which is also an IEEE listed definition. Because of limited experience, there was no real consensus on service life. There was general support for the 45-year life, but some suggested a shorter life. Some felt that the same life should be assigned to power regulating transformers as to main power transformers. The statistics for power regulating transformers were limited to two retirements which had an average life of 18 years.

It is concluded that the term "Phase-Angle Regulator" will be used. Because of the limited number of units in service and physical similarities, the life of 40 years assigned to main transformers is also established for transformers used for power regulation.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show two phase angle regulator retirements with an average life of about 34 years. WAPA has relatively little experience with phase-angle regulators, since there are only eight in service on the system. Phoenix notes that replacement parts are not available for a 25 year old unit, which is a strong argument for a shorter life. Opinions of reasonable life vary from 30 or 35 years to 40 years. However, because of the limited experience, and the similarity to main power transformers, it is recommended that this Update continue to use 40 years for the average life for phase-angle regulators.

Justification No. 37   Pipeline

Account: 332 (152)

Service Life: 100 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 years" be set to 100 years to align with the USACE data. The SME team recommended and the Steering Committee approved the item be changed from "Exceeds 50 years" to 100 years.

2005 Summary and Recommendation. There is no new statistical evidence that indicates a change should be made in the service life recommendation for pipelines. Therefore, pipelines continue to have an average service life that exceeds 50 years.

Historical Background. Reclamation considers 13 different types of pipe when designing pipelines for water conveyance. Each type of pipe usually consists of two or more different types of material, such as cement, rock aggregate, steel, ductile iron, asbestos, plastics, and fiberglass. The thirteen types of pipe used by the Reclamation are as follows:

1. Asbestos Cement Pipe (No longer used/contains hazardous material)
2. Reinforced Concrete (Bar Pipe)
3. Reinforced Concrete Cylinder Pipe
4. Monolithic Prestressed Concrete
5. Noncylinder
6. Embedded Cylinder
7. Lined Cylinder
8. Pretensioned Concrete Cylinder
9. Steel Pipe – Mortar Lined – Various types of exterior coatings
10. Ductile Iron – Mortar Lined – Various types of exterior coatings
11. Reinforced Plastic Mortar (RPM)
12. Reinforced Thermosetting Resin (RTR)
13. Poly Vinyl Chloride (PVC)

The above listed pipe options cannot all be used as substitutes because of the manufacturer's size and head class restrictions.

From 1902 to 1940 only a few pipelines were constructed since most of the distribution systems were open ditches. The few pipelines installed were unlined steel, cast-in-place concrete pipe, or wood-stave pipe. From 1940 to 1955 most of the irrigation water pipe distribution systems were low head (less than 25 feet, 11 pounds per square inch), and the pipe generally used was unreinforced concrete pipe with mortared joints. Most of these systems have been replaced, but some are still providing satisfactory service.

In the mid-1950s the pipe industry was revolutionized by the development of the rubber gasket joint. The rubber gasket created a flexible, water-tight joint and pipe could be laid more rapidly and efficiently. Also, new types of pipe were being designed for higher pressures, and new materials were being used.

Since 1902 over 11,000 miles of pipe, ranging in diameter from 4 inches to 21 feet, have been installed on projects constructed by Reclamation. Approximately 80 percent of the pipe that is 24 inches in diameter or less is asbestos cement pipe. General agreement or no comment was expressed by operations personnel with respect to the previously established service life. Cathodic protection is now provided on steel and ductile iron pipelines where a corrosive environment is present. This will effectively eliminate corrosion associated with lining breakdown in situations difficult to monitor.

Considering the excellent service of concrete pipe indicated in past surveys and reports and the many improvements in recent years in design, manufacture, and installation, it is concluded that pipe of all types will give satisfactory service for a period exceeding 50 years. Such replacements as may become necessary, perhaps because of unusual local conditions, will be minor and can be handled as maintenance. Therefore, pipelines continue to have an average service life that exceeds 50 years.

Justification No. 38 Pressure Regulator and Energy Absorber

Account: 333 (165)

Service Life: 45 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER037-30-1, the SME team determined that the service life for energy absorbers should be 45 years when included as part of the turbine or scroll case assembly, as these units are normally replaced along with the turbine runner. The SME team recommended and the Steering Committee approved the new service life of 45 years for turbine runners (see Justification No. 46).

2005 Summary and Recommendation. Current Reclamation data show no retirements for pressure regulators during the analysis period. Therefore there is no change in the service life of exceeds 50 years.

Historical Background. Pressure regulators are used in a few of Reclamation's installations to reduce excessive pressure rises in the penstocks or scroll cases when rapid closure of the turbine wicket gates or nozzles occurs. Of the total power plants operated by Reclamation, only about a dozen plants have pressure regulators. Most of these are in the Great Plains region.

Most Reclamation power plants recently constructed recently have short penstocks allowing fast wicket gate closing times without incurring excessive pressure rise, eliminating the need for pressure regulators.

In recent years, the governor closing time settings have been increased where possible, as a method of improving power system stability. This action has resulted in holding pressure regulator activation to a minimum, in fact non-existent under most operating conditions. However, considering the short periods of time the pressure regulators are subjected to water flow, damage to the flow surfaces through cavitation, pitting, and vibration are quite extensive.

In general, the pressure regulator bodies are embedded in concrete and would not be replaced. Periodic repair of the flow surfaces of the regulators, such as cones, seats, splitters, vanes and valve bodies, will be accomplished as maintenance, but complete replacement of this type of equipment should not be required during the analysis period.

There are no retirements listed in the data base. Operations personnel concurred with the service life exceeding 50 years determined by the 1981 report. Therefore, there is no change.

Justification No. 39 Prime Mover, Fuel-Type

Account: No Comparable FERC Account (160)

Service Life: 40 years – Low speed, 250 hp and above
25 years – Low speed, below 250 hp
25 years - high speed pumps

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no new statistical evidence for fuel-type prime movers that indicates a change should be made in the established service lives. It is concluded that service lives are unchanged: low speed 250-hp and above at 40 years; low speed below 250-hp and high speed units at 25 years.

Historical Background. Prime movers, as applied for pumping water for irrigation purposes, are segregated into two groups: those of the low-speed type, such as a diesel engine, having a rating of 250 horsepower (186 kilowatts) and above; and those rated below 250 horsepower (186 kilowatts) or of a high-speed type.

It was reported in 1981 that many engines in the first group have been in service in the Lower Rio Grande area of Texas in excess of 50 years and are just now being replaced with electric prime movers under a Rehabilitation and Betterment Program. Modern low-speed engines, when properly operated and maintained, are expected to provide satisfactory service over a long period. No significant additional information has been collected since 1981 to modify the presently established average service life of 40 years.

The second group of fuel-type prime movers includes units below 250 horsepower (186 kilowatts) fueled by gasoline or natural gas. Because of the higher speed of these types of prime movers, their longevity normally is expected to be somewhat less.

For this group also, no additional information has been collected since 1981 that would warrant changing the presently established average service life of 25 years.

Operations personnel have concurred with the present service lives where experience exists with these units. Duty cycle is obviously a factor here also, but no comments have been received indicating that this should be considered. No statistical data on replacements for this unit of property are available. In their absence and in view of the concurrence of operations personnel, it is concluded that service lives are unchanged: low speed 250-hp and above at 40 years; low speed below 250-hp and high speed units at 25 years.

Justification No. 40 Radio Transmitter and/or Receiver Set, Microwave/Multi-Channel (Previously titled Transmitter and/or Receiver Set, Microwave/Multi-Channel Radio)

Account: 397 (180.20)

Service Life: 10 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 366 fixed transmitter/receivers being retired with an average service life of 15 years. Opinions of a reasonable life vary from 10 to 15 years. However, due to the rapid change in technology it is recommended this Update continue to use 10 years for the average life for microwave multi-channel transmitter and/or receiver sets.

Historical Background. Reclamation and WAPA have extensive microwave systems. The transmitter and receiver sets are constructed of many replaceable parts, which are replaced under the normal maintenance program. Because of changes in requirements or obsolescence, complete sets require replacement at intervals.

Comments from the field agreed with the 10-year service life established in the 1981 report with two exceptions, one recommending 7.5 years, and one recommending 15 years.

There were five additional microwave transmitters recorded in the data base and three retirements which had lasted only 6 years. The other retirements recorded had an average service life of 13 years. Overall, statistics are limited for this unit of property.

Based on the interviews and the limited statistics, the service life remains at 10 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 33 microwave transmitter and/or receiver retirements with an average life of about 8 years. Microwave technology is changing. Manufacturer support is poor, both for honoring warranties and for parts. Some replacement has been required to comply with recent FCC rules. Opinions generally agree that 10 years is reasonable; however, some felt that 5 or 6 years would be more appropriate as higher capacity communication systems become more common. It is recommended that this Update continue to use 10 years for the average life for microwave transmitter/receiver sets. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 41 Reactor (Dry Air Core or Oil Immersed)

Account: 353 (175)

Service Life: 25 years – Dry air core (single or 3-phase unit)
35 years – Oil immersed (single or 3-phase unit)

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 36 reactor retirements with an average life of 26 years. Data down to the air core or oil immersed level was not recorded. Field experience indicates the lives previously used are reasonable. It is recommended that this Update continue to use 25 years for the average life for air core reactors and 35 years for oil immersed reactors.

Historical Background. Reactors are used in an electrical power system for either of two purposes: shunt connected as voltage control equipment, or series connected to limit the fault current reaching a circuit or portion of a bus. Reactors used principally for current limiting purposes are generally of the dry air-core type for indoor use. Reclamation and WAPA have only a few series-connected, current-limiting reactors. Most of the reactors are of the outdoor type and are used for voltage control on WAPA transmission systems. As of October 1, 1986, there was a total installed reactor capacity of 1,500,000 kVA in about 60 shunt-connected banks ranging in capacity from 393 kVA to 50,000 kVA and of voltages from 12.5-kV to 345-kV. About three-fourths of the total reactor banks were in air core units, with the remainder in oil immersed units.

Prior to the early 1950s the construction of outdoor-type reactors was similar to power transformers. They were oil immersed, usually with steel cores in steel tanks with entrance bushings. About this time, air core reactors suitable for outdoor use on voltages of up to 25-kV were developed, and in the early 1960s reactors of this type were installed on the system. The early designs included concrete columns for support of the windings. In some of these applications, problems were encountered with loose windings in the concrete, spalling of the concrete, and ultimate failure of the reactor, generally precipitated by excessive vibration induced by the reactor. The next generation of reactors is of a design where all windings are completely encapsulated in fiberglass which was less subject to vibration. However, even these improved designs have not been without problems.

Factors which have been considered in determining the service life of reactors include: deterioration with age, usage, and growth, and changes of the transmission system. These may make the capacity or voltage rating inadequate or eliminate the need for this equipment in specific instances. System growth and changes cause a large proportion of all reactor retirements. Reactor-capacitor combinations serve the same purpose as synchronous condensers and will always be useful on a system for voltage control purposes. Reactors also are used in extra high voltage systems to suppress voltage surges during switching. Generally, air-core shunt connector devices are used at lower voltages, and may be switched frequently. Oil-immersed devices are used in high voltage situations, with fewer occasions for switching.

The 1981 report established a 35-year service life for air-core reactors and 45 years for oil immersed reactors. Interviews of operating personnel indicated agreement that oil-immersed reactors have longer lives than air-core reactors. Several suggested that 25 years was a better approximation for air-core reactors and that there were definite design problems with one major manufacturer. A number agreed with the specified life of 35 years for air-core reactors. With regard to oil-immersed reactors, several indicated that the 45-year life was excessive and suggested lives of 30 and 35 years. While opinions were divided, the 10-year differential between the two types seemed to be generally supported.

Formerly, BPA used 35 years as the life for a reactor without distinguishing between types; BPA now applies a $37S_o$ life to all station equipment.

The statistical data are limited, but when the entire historical period is considered, the 26 retirements had an average service life of only 11 years, with a range of 3 to 22 years. Although there were limited observations, the Iowa curve fit analysis determined that a $20R_1$ is the most appropriate Iowa curve. These results are presented in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-18). This shorter service life could be due to the problems from one of the major manufacturers. In the current study period there were-no oil core reactors retired, and in the historical data base the seven that were retired had an average life of 16 years. The three air-core reactors retired during the study period lasted 21 years.

The two types of reactors are to continue to be handled separately. The lives are shortened to 25 years for air core and 35 years for oil immersed.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 16 reactors retired with an average life of about 28 years; however, the data does not distinguish between air core and oil immersed equipment. Most, but not all, feel 25 years is reasonable for air core. Most, but not all, feel 35 years is reasonable for oil immersed, particularly if they are not switched very often. Phoenix is experiencing core problems with rebuilt Westinghouse oil immersed and feels 25 years is more appropriate for oil than 35 years may be. It is recommended that this Update continue to use 25 years as being representative of the average life for air-core reactors, and 35 years for oil-immersed reactors.

Justification No. 42 Roof Covering

Account: 331, 352 (130)

Service Life: 20 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined the unit of property should have the 3000 square feet criteria removed. User should use the Chapter 3 guidance to determine capitalization versus expense.

2005 Summary and Recommendation. There is little roof data available from WAPA's financial system and Maximo. Interviews with maintenance personnel in Farmington, New Mexico, indicated that problems can occur early on in a building's service life. It is recommended that this Update continue to use 20 years for the average life for roof coverings in areas greater than 3,000 square feet.

Historical Background. A roof covering has been designated a unit of property when it meets all the following criteria:

The roof covering is made of a built-up type of nonpermanent material.

The roof area is equal to or greater than 3,000 square feet. Where a structure has more than one roof level and there are several isolated roofs, each roof must have 3,000 square feet or more of area to be considered a unit of property. In the case of structures to which lateral extensions have been made, even though having one roof level, that part of the roof covering an entire section built at one time must have a roof area of 3,000 square feet or more to be a unit of property.

The roof area is exposed, i.e., the water-tight laminations are not protected from exposure by cover of concrete.

In the March 1968 replacement report, roof coverings, excluding supporting members for all categories of buildings, were given an average service life of 20 years. The 1981 report cited the replacement of 15 roof coverings with ages at time of replacement ranging from 21 to 34 years, an average of 26 years. Although it was recognized that this was a relatively small number of replacements compared to the total number of roof coverings installed, the 1981 report resulted in increasing the average service life from 20 to 25 years.

In the study period 26 roofs were added, with no retirements. Considering the entire historical period, 15 have been retired, with an average life of 26 years. The Iowa curve fit analysis indicates an L_5 dispersion, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-19).

A majority of operations personnel indicated that 25 years is too long and would favor returning to the original 20 years. Several comments that desert climate would have the effect of reducing the life to 25 years.

Roof coverings apparently represent an extremely small portion of total, project costs. Maintaining the requirement that it cover 3,000 square feet or more places roof coverings into a higher cost category. Further study may be warranted to determine whether roof coverings should continue to be a replaceable unit of property. In view of the statistical analysis and current experience, roof coverings are continued as a unit of property, but the service life is reduced to 20 years.

Justification No. 43 Rotor Winding, Electric Prime Mover (250-hp and Above)

Account: No Comparable FERC Account (160)

Service Life: 50 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made. Clarification was provided that this unit of property includes a complete set of rotor windings for one unit and shaft.

2005 Summary and Recommendation. There is no new statistical evidence for pump motors that indicates a change should be made in the established service life for rotor windings for pumps with prime movers. The service life remains at 50 years for all categories, starting above 250 horsepower. Replacement rotor windings for pump motors of less than 250 horsepower continue to be charged to maintenance expense.

Historical Background. Motor rotor windings for pumps with prime movers 1,500 horsepower (1,120 kilowatts) or larger are considered similar to generators and, therefore, in 1981 were given an average service life of 50 years, the same as was recommended for generators.

Operation's personnel generally concur with the established service life, and there is no new statistical evidence for pump motors that indicates a change should be made. The service life remains at 50 years for all categories, starting above 250 horsepower.

Rotor windings for smaller pump motors are expected to be maintained through the period of analysis, with replacements as needed charged to maintenance expense.

Justification No. 44 Rotor Winding, Generator

Account: 333 (165)

Service Life: 50 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no new statistical evidence for rotor windings that indicates a change should be made in the established service life for rotor windings. The service life remains at 50 years

Historical Background. Generator rotor winding insulation deteriorates with age. However, the voltage stresses are much less than in stator windings; consequently, a type of insulation can be used which should increase life compared with stator windings. Records indicate that only four complete rotor windings have been replaced in Reclamation's total operating experience. One winding on the former Prosser generator failed after 3 years of service. The failure was believed due to induced high voltages in the rotor windings after malfunction of generator protective devices. A fire subsequently developed in both the rotor and stator windings, destroying them beyond repair. The second rotor winding failure was in the number one unit at Shoshone Power Plant which also was destroyed by fire in 1955 after 33 years of service. The other rotor winding replacements were on the two units at Trinity which were completely rewound during exciter replacement, after 20 years of service. Although individual coils have been damaged in a number of rotors, there are no other instances of complete rotor winding replacement.

There is currently a program to replace the end turns of the rotor windings at San Luis due to insulation deterioration. Six of the eight units had already been replaced by 1988. These were less than 20 years old. Two units at Shasta have been reinsulated during generator uprating after 40 years of service and it is expected that reinsulation may be adopted as standard practice on large rotors in the future. There is general concurrence among operations personnel with the previously established service life.

Over the historical period there have been five retirements which had an average service life of 24 years, but there is not enough statistical data available for a Iowa curve fit analysis for this unit of property.

In view of this record, the present established average service life of 50 years is retained.

Justification No. 45 Runner, Hydraulic Turbine Prime Mover

Account:	No comparable FERC Account (160)	
Service Life:	Pump impeller, 250 to 1,499 hp	35 years
	Pump impeller, 1,500 hp or more	40 years
	Below 250 hp and deep well type	Maintenance

2017 Summary and Recommendation. As a result of the merger of the USACE ER-37-1-30, hydraulic turbine runners have been grouped into three categories. Previous editions had two categories: 250 hp and above with a service life of 50 years, and below 250 hp was considered a maintenance item. The SME team recommended and the Steering Committee approved the USACE service life for hydraulic turbine runners as follows:

- Pump impeller, 250 to 1,499 hp 35 years
- Pump impeller, 1,500 hp or more 40 years
- Below 250 hp and deep well type Maintenance

2005 Summary and Recommendation. There is no new statistical evidence for pump motors that indicates a change should be made in the established service life for runners for hydraulic turbine prime movers. None were added or replaced during the period of analysis. The service life remains at 50 years for those rated 250-hp and above. Replacements for units less than 250 horsepower remain a part of maintenance.

Historical Background. Turbine driven pumping units are installed in special situations in place of electric motor driven units. In previous reports the turbine runners were established as units of property for all units above 250-hp (186 kilowatts). In the 1981 report, units above 1,500-hp (1,120 kilowatts) were considered similar to generator turbines and were given an average service life of 40 years. Specifications for pump turbines normally require aluminum bronze alloy or stainless steel runners which should also contribute to a long life. Those units from 250 to 1,500-hp (186 to 1,119 kilowatts) were given an average service life of 30 years. This reflects a somewhat lower maintenance standard for the smaller units. For units under 250-hp (186 kilowatts), replacements are a part of maintenance.

Operations personnel interviewed were in general agreement with the 1981 report findings. There are only a very few hydraulic driven pumps among Reclamation operated facilities. Discussions with Reclamation personnel concluded that there should be no differentiation in sizes other than those below 250-hp and that a single 50-year life should be adopted. The Steering Committee affirms those conclusions.

Justification No. 46 Runner, Turbine Generator or Pump/Generator

Account: 333 (165)

Service Life:	Generator turbine	45 years
	Pump/generator turbine	40 years

2017 Summary and Recommendation. As a result of the merger of the USACE ER-37-1-30, turbine runners for generators and pump/generators have been grouped into two categories. Previous editions had a single item with a service life of 50 years. The SMT team adopted the USACE service life for hydraulic turbine runners as follows:

- Generator turbine 45 years
- Pump/generator turbine 50 years

2005 Summary and Recommendation. Reclamation presently has 194 Francis-type turbines, 10 Kaplan-type (variable blade propeller), one propeller-type, and four Pelton-type (impulse) turbines in service. Five propeller-type turbines were retired in 1995 after 86 years of service each. 25 turbines (21 Francis-type and four Pelton-type) were replaced during the scope of this Update with an average lifespan of 48 years for the Francis-type turbines. In view of this record, the present established average service life of 50 years for runners is retained

Historical Background. The two general types of hydraulic turbines (impulse and reaction) used for electric power generation were considered and studied in previous reports in recommending replaceable turbine items. Physically these two types, impulse and reaction turbines, are very different. Both types are used by Reclamation. Impulse turbines are used for high hydraulic head development and produce power through jet action on buckets placed around the rim of a metal disc. Reaction turbines are best adapted to low and medium hydraulic heads and large water flow. They develop power from the combined action of pressure and velocity of the water which completely fills the runner and water passages of the turbine. Principal parts of an impulse turbine consist of one or two runners mounted on a shaft, a bearing support, a housing including baffles, a distributor or manifold connected to the penstock to line up the water jet(s) onto the runner buckets and one or more needle-valve assemblies for controlling the water jet(s) and usually including either deflectors or a relief valve. Principal parts of the reaction turbine are the scroll case connected to the penstock or conduit and forming a water passage around the turbine which allows water to enter the runner from all sides, the speed ring which provides structural support for the machine and usually acts as a preliminary guide for the water in its passage from the scroll case to the runner, the wicket gate assembly which controls the flow of water into the runner, the runner which may be either of Francis-type or propeller, the turbine shaft, guide bearing including lubricating system, and the draft tube for conducting the water from the runner to the tailrace below the plant and developing the draft head.

The principal parts of a turbine are, in general, of rugged metal construction and, except for turbine runners, subjected to negligible wear; consequently, they have very long lives. Some parts, such as the scroll case, speed ring, pit liner, and draft tube liner usually are embedded in concrete; these do not require replacement during the period of analysis and, therefore, have not been designated units of property. On other principal parts, worn areas, such as the journal surfaces on the wicket gate stems and eroded areas of the needle valves, are generally restored through repairs. Other minor turbine parts with limited lives are replaced as a part of maintenance. The 1981 report included such items as the stuffing box sleeve, wearing (seal) rings, lubricating pumps, and bushings for wicket gate stems.

In general, damage to turbine runners by cavitation or erosion is repaired by welding. After repeated repairs, the loss of structural strength or the high cost of maintenance may make replacements necessary. Because of the importance of this item, the turbine runner has been designated as a replaceable unit of property.

Runner replacements in the future are expected primarily to be due to requirements for more efficient runners to increase the output of a unit. It also can be expected that some runners will be replaced with stainless steel runners to decrease maintenance costs. However, this latter type of replacement should decrease because most replacement and new equipment runners have been constructed from a more cavitation-resistant material such as stainless steel or cast steel with stainless steel overlay. These runners should have a longer life than the cast iron and cast steel runners that were originally installed years ago. However, the experience on these new materials is still somewhat limited.

Operations personnel were in general agreement with previously established service lives. One suggestion was to make runner wearing rings, which are replaceable items, a separate unit of property, as the cost to replace these rings will be over $100,000 for the larger turbines.

There is not any relevant B PA data available.

Reclamation has installed over 230 runners between 1909 and 1988. To date, 41 of these runners have been retired. These retirements include three runners at Hoover because of a change in operating frequency from 50 hertz to 60 hertz and nine runners retired because of the abandonment of Lingle, Prosser, Angostura, and Shoshone power plants. There were three runners replaced at Seminoe to increase the turbine output and three replaced at Grand Coulee due to excessive cavitation damage and to increase turbine output. A number of runners also have been replaced at Hoover to change runner material from cast steel to stainless steel and, more recently, all cast steel and stainless steel runners have been replaced by more efficient stainless steel runners to obtain greater output. A retirement rate study carried out in 1981 indicated an average service life of 50 years.

The statistical data for the current study period indicates that 21 turbine runners were added, but none were retired. In the historical period, 41 were retired with an average service life of 28 years. When the retirements are combined with the turbine runners in existence, the Iowa curve fit analysis indicates a 60-year life, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-20).

The previous retirement rate study conclusions are virtually unaffected by the few recent replacements. The age of those runners remaining in service is now greater by 7 years. Therefore, the average service life of turbine runners should remain at 50 years.

Because of the high cost of runner wearing rings and the historical frequency of replacement, the Steering Committee concludes that runner rings are to be considered a separate unit of property with an average service life of 20 years.

Justification No. 47 Sequential Event Recorder System (SER)

(Also see Justification No. 22)

Account: 397 (180)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show one SER retirement with a life of 14 years. Similar digital equipment is discussed in Justification No. 22, Digital Fault Recorders. This Update recommends increasing the service life from 10 to 15 years, based upon retirement data and interviews. Technologies are changing and this may not be a unit of property in future updates.

Historical Background. Practically all major power systems today are connected with neighboring systems. In the contiguous United States such connections form two giant interconnected systems, commonly designated "East" and "West." Interconnections permit the exchange of power between systems to make the most efficient use of resources, and through sharing of reserves or assisting in maintaining system frequency each system contributes in improving continuity of service. Along with the benefits, though, there is an obligation for each individual system to maintain a high level of reliability for its transmission system. This emphasis on reliability dictated the need for equipment to provide information for analyzing system troubles and identification of equipment or devices when false operations are involved. The sequential event recorder provides this information by monitoring high-speed system relaying and equipment performance routinely encountered at major power stations. Such equipment is designed to store sequentially the real time each protective relay, device, and power circuit breaker operates. This stored information is available, after the fact, for analysis as to whether all protective equipment operated as designed. This information is particularly useful and essential for analyzing system disturbances.

Field interviews indicated that the sequential event recorder function should be incorporated in the SCADA or computer systems. There was divided opinion on service life, as some comments indicated that a shorter life of 10 years be used while other comments favored the 1981 report established life of 15 years. An observation was made that they were easier to maintain than oscillographs.

A number of sequential event recorders are in use, so the unit of property is to be retained. Since the industry standard term is "sequential event recorder" (SER), the name of the item of property is revised from the 1981 justification to "Sequential Operation Recorder System." SERs are usually self-contained solid state electronic devices. Consideration should be given in the future to the combining of SERs with fault recorders.

After review of the data and discussions, the Steering Committee agrees that the average service life is similar to fault recorders. Consequently the service life is reduced from 15 years to 10 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show five sequential event recorders retired with an average life of about 10 years. The equipment is no longer used in one area, but is used to varying degrees in the other four. Technical improvements sometimes drive the replacement; 10 years is reasonable in that case. Some commenters point out that longer life may be appropriate, particularly if spare parts are purchased when the equipment is first installed. It is recommended that this Update use 10 years for the average life for sequential event recorders. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 48 Solar Collector System

Account: 331, 352 (130.10)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no new statistical evidence for solar collector systems that indicates a change should be made in the established service life. The service life remains at 15 years.

Historical Background. The basic function of a solar heating system is the collection and conversion of solar radiation into thermal energy. Simply stated, this is accomplished in the following manner: Solar energy is absorbed by a collector, placed in storage as required, and then distributed to where it will be used for space heating and water heating. A control system and an auxiliary energy source complete the installation.

Collectors are of different types and include flat-plate, concentrating, and tracking collectors. The flat-plate is one of the most used types of collectors because of its simplicity. The absorber plate is usually made of metal which is coated black to absorb the sun's energy. It may be made of copper, aluminum, plastic, or steel. The plate is insulated on the underside and covered with a transparent cover, normally glass.

Heat is transferred from the collector by a fluid, usually water or air. The transfer medium in some systems is a liquid such as ethylene or propylene glycol and water mixture. A silicon heat transfer medium is used in some installations. Where water is used as the transfer medium, generally a drain-down system is used to prevent freeze up.

In some systems, heat exchangers are required between the transfer medium being circulated through the collector and the thermal storage medium or between the storage and the distribution medium. Storage, when used, is commonly provided by materials such as rock, water, eutectic salts, concrete, and brick.

Solar systems can also be designed for cooling. The solar collectors provide the heated air or liquid required to perform the energy function in a cooling system. The three basic types of solar cooling systems are:

The heated liquid runs a generator or boiler which activates a refrigeration loop. This loop cools a storage reservoir from which cool air is drawn for distribution into the space to be cooled.

The Rankine steam turbine engine runs a vapor compressor air conditioner or water chiller.

The solar desiccant system produces cooled air by drying, extracting heat from, and rehumidifying room air. It employs a desiccant material such as silica gel or lithium chloride.

To accomplish all these various functions, types of equipment and items needed, depending on the system, are: collectors, fans, pumps, compressors, heat pumps, heat exchangers, tanks or rock bins, controls, valves, and piping.

In keeping with the philosophy in the previous replacement report that systems such as heating systems, plumbing systems, and water systems should not be established as units of property, it is recommended that the collector system be the only item considered as a unit of property in solar heating and cooling systems. The many other items should be considered minor items replaceable through normal maintenance.

In a review of industry resources and in discussions with experts in the solar field, it was found that there is considerable difference of opinion as to the service life of collectors. There is a range from 7 to 30 years depending on who is making the estimate. However, much of the variation is related to the quality of materials and workmanship that is assumed.

Since the consensus appears to be that the service life falls between 10 years and 20 years, a service life of 15 years is chosen by the Steering Committee.

Justification No. 49 Solar Photovoltaic Power Supply

Account: 397 (180)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no current data recorded in WAPA's financial system or MAXIMO for solar photovoltaic power supplies. Fifteen years seems reasonable for the three or four in use. It is recommended that this Update continue use of 15 years for the average life for solar photovoltaic power supplies.

Historical Background. Photovoltaic power supply systems are used to provide power for remote telemetering and communications equipment where electrical power is not available, or would be expensive or difficult to provide. They normally consist of a panel of photo-voltaic cells, battery, battery charger, and voltage regulator.

The consensus of the interviews was that large systems (Phoenix-WAPA suggested 100 watts and above) should be considered a unit of property. Wilson, Newman, and Cunningham were cited as examples of large systems. Boise (50 watts), Grand Coulee (30 watts), and Sacramento (no size mentioned) stated that their systems were small and should be considered as maintenance items. Only Phoenix-WAPA and Phoenix-Reclamation recommended service lives, both at 15 years. Industry experience indicates that regular maintenance is critical to equipment life.

Based on the interviews, the service life for systems 100 watts and above is established at 15 years. Smaller systems continue to be maintenance items.

1995 Limited Update Summary and Recommendation. There is no MIS data for solar photovoltaic power supplies. Fifteen years seems reasonable for the three or four that have been in use. It is recommended that this Update continue use of 15 years for the average life for solar photovoltaic power supplies.

Justification No. 50   Speed Increaser

Account: 333 (165)

Service Life: 20 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the service life should be decreased from 35 to 20 years. Based on the stakeholder agencies' collective experience with these components, the SME team recommended and the Steering Committee approved the change.

2005 Summary and Recommendation. Reclamation still has no speed increasers in service. Information on replacement lives for this equipment may yet prove useful in planning of low-head power plants. The life of 35 years established previously is therefore continued.

Historical Background. Low-head hydro design options generally specify relatively low turbine speeds. Generators to match these speeds are larger and more expensive than higher speed machines. As an alternative to higher generator costs and costs associated with larger buildings, a speed increaser is sometimes installed. In tube-type and pit-type turbine installations, these devices, inserted between the main turbine shaft and the generator shaft, step up the turbine speed to the required higher generator speed. They may contain the downstream guide and thrust bearing and these bearings and the speed increaser gears are lubricated by the same lubricant. They may be of the parallel shaft, right angle or epicyclical gear type. If properly designed and maintained, they have a relatively long life.

At the present time Reclamation does not have any plants using speed increasers. However, in future planning of low-head power plants, information on replacement lives may prove useful. The small low-head Headgate Rock Power Plant presently being constructed using a tube-type turbine will not include a speed increaser.

The complete unit is designated as a unit of property. Contact with speed increaser manufacturers suggests a service life of from 25 to 50 years. The life of 35 years established previously is therefore continued. Due to a lack of data, percentage replacement factors will have to be developed on a case-by-case basis.

Justification No. 51 Stator Winding, Electric Prime Mover

Account: No comparable FERC account (160)

Service Life:	25 years	Unit sizes above 1,500 hp
	35 years	Unit sizes of 250 to 1,499 hp
	Maintenance	Below 250 hp

2017 Summary and Recommendation. As a result of the merger of the USACE ER-37-1-30, the unit size was changed from 1,000 hp to 1,500 hp. The SME team recommended and the Steering Committee approved adopting the USACE service life for large stator windings of 25 years for 1,500 hp or larger and 35 years for stator windings 250 –to 1,499 hp. Below 250 hp remains a maintenance item.

Historical Background. The number and size range of motors indicated in current data as being associated with conventional pumps operated by Reclamation are as follows: 250 to 1,500-hp, 76 units; 1,500-hp to 10,000-hp, 159 units; and above 10,000-hp, 18 units.

Stator windings, like impellers, have been divided into three categories in previous reports for the purpose of establishing service lives. The first group consists of windings for motors 1,500-hp (1,120 kilowatts) and above. These large motors are considered comparable to generators, except their duty is not usually as severe. Therefore, the stator windings are expected to have a somewhat longer life. Motor rewinds were performed on all six of the Tracy Pumping Plant units in the 1977 through 1984 period. These units were originally installed in 1951, so the ages at the time of rewind ranged from 26 to 33 years. Motor rewinds are being considered for the six 65,000-hp pumps at Grand Coulee which are now 35 to 47 years old. Stator windings 1,500-hp and above previously have been given an average service life of 35 years.

The second group is made up of windings for motors 250 to 1,500-hp (186 to 1,119 kilowatts). These windings should have a relatively long life, though they receive less maintenance. As indicated in the 1981 report, maintenance reports for 13 projects involving 36 pumping plants with 183 pumping units and data received from Reclamation's personnel revealed 25 motor rewinds and 12 motor replacements during the period 1966 through 1981. The age of the windings at the time of rewinding or replacement ranged from 2 years to 40 years with an average age of 26 years. Normally, the age obtained by taking an average of the age of units of property retired will be less than that obtained if a retirement rate analysis were made because averaging the retirements does not take into account the age of those units that survive. Nevertheless, the 1981 report established an average service life of 25 years for the 250-hp to 1,500-hp sizes.

The third group includes motors below 250-hp (186 kilowatts) and motors on deep-well-type pumps. Through periodic reconditioning and occasional rewinding as a part of maintenance expense, they are expected to last through the period of analysis. This is borne out by experience at the Salt River Project, which operates nearly 300 deep-well pumps, and at the North Side Pumping Division of the Minidoka Project. The cost of replacing the windings on the smaller pumps and the deep-well type can be handled as a part of maintenance. The 1981 report indicated that there was no new information to support making a change.

Operations personnel were in general agreement with service lives previously established, although one office indicated that the number of pump starts and method of starting should dictate service life, rather than age. This is because starting places much greater stress on the windings than normal running due to higher currents. This can be alleviated by reduced voltage starting or reducing the starting load. Methods such as back-to-back starting or displacing the water in the impeller with pressured air as are used on large pump-turbines by Reclamation.

Apart from pump-turbines, Reclamation has only 18 pumps over 10,000-hp, of which six of 65,000-hp are at Grand Coulee, six of 40,000-hp at Dos Amigos and six of 22,500-hp at Tracy. The winding voltage is 13.6-kV in each case. Therefore, a classification for stator windings on prime movers over 10,000-hp is comparable to the generator stator classification based on voltages above 11.5-kV. (Generator stators above 11.5-kV have a service life of 25 years. See Stator Winding, Generator.)

Other than the winding replacements at Tracy no retirement data is available for analysis for the 1981 to 1988 period. In the historical period seven were retired with an average life of 30 years. The Iowa curve fit also indicates a 30-year life, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-21).

Based on the statistical analyses, the data from interviews and contacts with operations personnel, the following classifications and service lives are established:

Unit of Property (hp)	**Service Life (years)**
Above 10,000	25
250 to 10,000	35
Below 250	Maintenance

The distinction in sizes indicated above is intended to facilitate record keeping and developing service lives and percentage factors in future replacement studies.

Justification No. 52 Stator Winding, Generator

Account: 333(165)

Service Life:	Stator, 11.5 kV and above – stator windings	30 years
	Stator, below 11.5 kV	50 years
	Stator core iron, 11.5 kV and above	50 years
	Stator core iron, below 11.5 kV	100 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that a distinction should be made between the stator windings and the stator iron core, as well as an adjustment to service life. The SME team recommended and the Steering Committee approved changing the service life for stator windings 11.5 kV and above from 25 years to 30 years and the following distinctions for stator cores were added:

- Stator, 11.5 kV and above – Stator windings 30 years
- Stator, below 11.5 kV 50 years
- Stator core iron, 11.5 kV and above 50 years
- Stator core iron, below 11.5 kV 100 years

2005 Summary and Recommendation. The current data for generator stator windings 11.5-kV and above shows 43 replacements with an average life of nearly 33 years. These units represented a mixture of the old-style and newer-style insulation systems with the old-style systems significantly affecting the average. The service life for generator stator winding insulation 11.5-kV and above should remain at 25 years and be reviewed in the next update to assess the effect of the newer insulation system.

The current data for generator stator windings below 11.5-kV shows 17 replacements at an average life of 55 years and five generator retirements at an average life of 86 years. This data supports retaining the average service life of generator stator windings below 11.5-kV at 50 years.

Historical Background. As of 1988 Reclamation had 222 individual generating units in operation. Up to this time no complete generators have been replaced by Reclamation in any of its hydroelectric plants. However, nine small units have been removed from service because of retirements of complete facilities for reasons other than age. The small units removed from service were installed in the Angostura, Lingle, Prosser, and Shoshone power plants. Although other small plants may be removed from service because of the economics of operation, there is no reason to expect that entire generators of appreciable size will be replaced in any of Reclamation's plants during the period of analysis. Of the existing generating units, at 1988, one unit is 79 years old, 13 are 60 years old or older, 61 are 40 years old or older, and half of the units are 34 years old or older.

There are some heavy and expensive parts of a generator which require replacement because of wear, failure, or deterioration. It previously has been concluded that the following items are units of property: stator winding complete (excluding stator iron), rotor winding complete, and exciters (main, pilot, or motor exciter set). Thrust bearings have service lives exceeding the period of analysis.

Stator winding electrical insulation deteriorates with time and use, as a result of aging and breakdown of the organic matter in the older type insulation varnishes, binders, and fillers. Some higher-voltage stator windings have failed because of corona damage to the insulation. Windings also have been destroyed by fire. More recently, a few units are being scheduled for rewinding slightly ahead of the winding's life, primarily to increase capacity because of economic considerations.

Windings 11.5-kV and above generally have a shorter average service life than windings below this voltage. This shorter life is believed to result from the greater effect of corona associated with higher voltage windings. A retirement rate study of stator windings for the period 1909-1982 indicated an average service life of 52 years for windings below 11.5-kV and of 27 years for windings 11.5-kV and above. Because most of Reclamation's generator stator winding investment is in the higher voltage windings and because of scheduled rewindings in the higher voltage group, the 1981 report concluded that the average service life for windings of this voltage class should be lowered to 25 years. Conversely, the average service of the lower voltage windings was raised to 50 years.

Information on replacement activity since the 1981 report discloses that the two generator stators at Green Mountain (6.9-kV) were rewound after 39 years. In the higher voltage class, the two conventional units at Flatiron were rewound after 28 and 29 years of service and Pole Hill after 33 years. All 18 main units in the first and second powerhouses at Grand Coulee have been rewound to increase output, the oldest unit being in service 33 years. Fourteen units at Hoover have been rewound as part of a programmed upgrade in capacity; these units had been in service for up to 50 years. Two units at Shasta have been rewound after 40 years of service as part of a programmed upgrade, and J. F. Carr, Spring Creek, and Trinity have been rewound after over 20 years of service due to design problems. The motor-generator winding at Flatiron has failed three times due to a design problem. One unit in Grand Coulee Third power plant (600 MW) suffered fire damage due to design and installation problems after 4 years of operation and had to be rewound. The general consensus among operating personnel was that the established service lives are satisfactory. However, there was expectation that the newer epoxy insulation may have shorter life.

The statistics since the 1981 report indicates that there has been only one stator-winding retirement, with 40 additions. Including the previous data, 79 have been retired with an average life of 24 years. As shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-22), the Iowa curve fit indicates a 50 L_o Iowa curve as the most appropriate. Approximately two-thirds of the units, representing more than 90 percent of Reclamation generating capacity, are in the 11.5-kV or greater voltage category. Based on interviews, recent experience, and statistical analysis, the previous service lives are retained: 50 years for those below 11.5-kV and 25 years for those 11.5-kV and above. These lives will be reviewed in the next update to assess the effect of the newer insulation being used.

Justification No. 53 Steel Structure/Pole or Concrete Pole Transmission Line Section

Account(s): 354, 355, 356 (181, 182, 183)

Service Life:	Steel	50 Years
	Timber	50 Years
	Foundations, Footings, Tunnels, Duct Lines, Manholes	50 Years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as “Exceeds 50 Years” be set to 100 years to align with the USACE data, unless current analysis determined otherwise. Based on the stakeholder agencies’ collective experience with these items, the SME team recommended and the Steering Committee approved the new service life of 50 years.

2005 Updated Summary and Recommendations. Since an entire line is rarely replaced in kind, it is recommended that the unit of property for steel and concrete transmission lines be redefined to be a line section, complete, between two identifiable points. The points could be angle structures, structure type changes, road crossings, or other identifiable locations or features. A specific storm-damaged section would also be a unit of property. Ice and windstorms are a fact of life, and need to be recognized. There is no WAPA financial system or Maximo data available. Generally, opinions suggest that 50 years is a reasonable life for these lines, considering current utility maintenance practice. It is recommended that the factor of 3% replacement at 50-year intervals continue to be used for steel structures, steel pole, and concrete pole transmission lines.

Justification No. 54 Structure, Diversion

Account: 332 (151)

Service Life: 100 years

2017 Summary and Recommendations. As a result of the merger of USACE ER-37-1-30, the SME team determined that all Reclamation items listed as “Exceeds 50 years” be set to 100 years to align with the USACE data. The SME team recommended and the Steering Committee approved this item be changed from “Exceeds 50 years” to 100 years.

2005 Summary and Recommendation. There is no new statistical evidence for diversion structures that indicates a change should be made in the established service life. The service life remains at exceeds 50 years.

Historical Background. These facilities, similar to storage dams, are constructed to be permanent and will provide satisfactory service for longer than the period of analysis. In September 1986, there were 154 diversion structures constructed or rehabilitated by Reclamation, in operation. As there is generally little or no water impoundment at diversion structures, danger to downstream life and property due to failure is not usually a major consideration. Therefore, selection of the design flood is influenced by economic considerations and diversion facilities are designed to safely pass flood flows of 50- or 100-year frequencies. Freeboard above the design flood water surface elevation is provided to prevent overtopping the structure from wave action, settlement, or operating problems with outlet control works.

Diversion structures are also under the program of periodic examination to insure adequate maintenance. Although some structures have been lost in floods greater than design magnitude such as on the Big Thompson in Colorado, there is no new evidence to change previous recommendations. Therefore, it is concluded that diversion structures have useful lives that exceed 50 years.

Justification No. 55 Supervisory Control and Data Acquisition (SCADA)/Energy Management System (EMS)

Account: 397 (180.50)

Service Life:		
	SCADA Master (Previously titled Central Processor)	10 years
	Remote Terminal Unit	10 years
	Life Cycle Design SCADA	40 years
	Video Display (man-machine interface)	not applicable

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team recommended and the Steering Committee approved that a new item be added for Life Cycle Design SCADA.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 40 SCADA retirements with an average life of 13 years. Opinions of a reasonable life vary from 10 to 15 years. Changing technologies are a consideration with this type of electronic equipment. It is recommended that this Update continue to use 10 years for the average life of SCADA Master and for Remote Terminal Units.

Historical Background. Supervisory control systems have been in use on Reclamation's and WAPA's systems for many years. The first installation was made in 1947 for control of the Heart Mountain power plant from the Shoshone power plant about 5 miles upstream. A number of single facility installations for control of power plants, pumping plants, and substations were added during the 1947-1966 period. In the post-1966 period the technology in the supervisory control field has advanced rapidly and greater attention has been given to control of a number of power plants and/or substations in a large geographical area from centralized operating centers or power-control centers. The modern day systems are designated as SCADA systems--Supervisory Control and Data Acquisition systems. For individual controlled stations under a SCADA system, it is possible not only to perform a substantial number of individual control operations but to also obtain numerous quantities of equipment or system operating information, or transmission of pertinent analog or digital information at a centralized control point or master station.

The 1981 report contained these separate items: Supervisory Control and Associated Telemetering System; Computer System, Control; and Data-Logging System. Due to changes in technology these systems have become similar. Often the same hardware is used for all of these systems. These systems typically consist of three components: (1) a remote input/output device commonly termed a Remote Terminal Unit (RTU); (2) a central processor or computer with associated main memory, central processing unit, and back-up storage devices (tape drives, hard/floppy disks, etc.); and (3) a man-machine interface consisting of keyboards, cathode ray tube (CRT) displays, and printers. Often the man-machine interface will include a small computer for console and graphics control. Because of the similarity of hardware and crossing over of functions, the first two units of property and the intersite portion of the third unit of property cited above are to be included under the industry standard single heading of Supervisory Control and Data Acquisition (SCADA) system.

Remote terminal units have reached some degree of standardization within the industry. They are self-contained, solid-state devices whose function is to take in data from field devices, and output control commands to field devices. Since most manufacturers can make RTUs that utilize other manufacturers' protocol, one make of RTU is often used with a central processor of another manufacturer. While RTUs are subject to the obsolescence just as the man-machine interface and central processor, they have a simpler function that has matured and is not undergoing significant change. Thus, RTUs are considered a separate item of property with an independent.

The man-machine interface and central processor equipment are undergoing constant evolution in design, hardware, and function. Thus, they quickly become obsolete. Also, due to the highly competitive nature of the field, manufacturers go in and out of the market frequently, often right after system delivery. System peripheral devices such as printers, CRTs, keyboards, and memory devices have been replaced as maintenance. There is no new information indicating that this should change.

Field interviews indicated that a 10-year service life was maximum and a life between 5 to 10 years appears more appropriate. Comments also supported consolidation of computer and supervisory control systems in a single justification.

The Justification is revised to "Supervisory, Control and Data Acquisition" system and is expanded to include all or portions of the items discussed above. It is further concluded that the central processor, the man-machine interface, and the remote terminal units are to be considered as sub-items under the SCADA system. Although the field interviews suggest a shorter life primarily due to obsolescence, administrative considerations would seem to make it difficult to justify replacement before 10 years of use. The central processor and man-machine interface are therefore given a 10-year service life. Due to standardization, greater simplicity in design, and less susceptibility to change, the remote terminal units have a 15-year service life.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 55 central processor retirements with an average life of about 11 years. Ten years is generally considered to be a reasonable life; although there is little manufacture support for equipment that old. It is recommended that this Update continue use of 10 years for the average life for central processors.

The MIS data for the period 1988 to 1994 show 23 video display terminal retirements with an average life of about 5 years. This equipment is being phased out in favor of PCs having integral displays. It is recommended that video display terminals should be deleted from the list of unit of properties.

The MIS data for the period 1988 to 1994 show 112 remote terminal units retired with an average life of about 15 years. This equipment is being phased out in favor of improved technology with faster response. Ten years is generally considered reasonable for the state-of-the-art equipment being installed. Rack-mounted equipment is phasing out automatic generation control and supervisory control remotes. It is recommended that the new rack-mounted equipment use a 10-year life to be consistent with the life of the central processor. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 56 Surge Tank, Steel Surge Chamber, and Storage Tank

Account: 332 (153)

Service Life: 50 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 Years" be set to 100 years to align with the USACE data, unless current analysis determined otherwise. Based on the stakeholder agencies' collective experience with these items, the SME team recommended and the Steering Committee approved the new service life of 50 years.

2005 Summary and Recommendation. There is no new statistical evidence for surge tanks that indicates a change should be made in the established service life. The service life remains in excess of 50 years.

Historical Background. Surge tanks and chambers used in conjunction with power plants and storage tanks used primarily in municipal water systems have long lives. In general, they should be treated similar to large steel pipe. The 1981 report concluded that with the maintenance of a proper protective coating on internal and external surfaces, they were expected to last through the period of analysis.

Field personnel made few comments on these items except for one field office where observations were made that underground storage tanks can cause seepage problems and that surface tanks could have shorter lives than the established 50 years. The Steering Committee concludes that there is insufficient evidence to support a change in the current service life in excess of 50 years. Storage tanks, whether surface or underground, will not be separately identified.

Justification No. 57 Switch, Disconnecting (69-kV and above)

Account: 353, 356 (175, 183)

Service Life: 50 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that the service life of 35 years should be increased to 50 years to align with the USACE data. The SME team recommended and the Steering Committee approved the new service life of 50 years.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 527 disconnect, fused, and grounding switch retirements with an average life of 40 years. The current data from Reclamation shows 18 retirements with an average life of 53 years. Switches are frequently repaired but parts availability is sometimes a problem. Opinions of a reasonable life vary from 25 years to 40 years. Even though data shows 40 years, the preference is to continue with 35 years for a more conservative approach. Operating voltage levels appear to have little to do with expected service life. However, lower voltage switches are not as expensive and should continue to be considered a maintenance item. The 69 kV distinctions should be maintained. It is recommended that this Update continue to use 35 years for the average life for disconnecting switches 69 kV and above.

Historical Background. The Reclamation and WAPA systems have several thousand disconnecting switches. They perform various functions when used with other equipment, such as isolating, bypassing, grounding, and sectionalizing. Some are equipped with special interrupting elements which permit their use for load breaking or circuit deenergization.

Disconnecting switches have been divided into two groups, station and line, for purposes of designating units of property and service lives. Those switches below 69-kV are relatively low in cost, so they have not been designated units of property. They are expected to be repaired and replaced when necessary as a part of normal maintenance expense. A set of disconnecting switches 69-kV and above has been designated a unit of property. A service life of 40 years for each type of switch is assigned.

A large majority of operating personnel interviewed agreed that the 40-year life is suitable. Some comments suggested a longer life while others expressed concern about parts problems and that newer switches are not built as well as earlier ones.

The previous BPA service life was 25 years before changing to depreciation by account

The statistical data for the current study period showed that 690 switches were added, while 168 were retired, with an average service life of 30 years. The statistical confidence interval ranged from 24 to 36 years. The historical data base only added nine more disconnecting switches to the retirement data; thus, the average remains at 30 years with most of the retirements taking place between 30 and

35 years. Since this average life does not recognize the thousands of disconnecting switches that have not been replaced, it would be expected that the Iowa curve estimate is more accurate. The Iowa curve analysis supported a 40-year life with an S_2 dispersion. These findings are presented in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-23).

Since there appears to be little difference in the lives of station and line equipment, it is concluded that this distinction is eliminated, that the 69-kV division is to be continued, and that the average life of 40 years applies to both station and line equipment.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 440 disconnect, fused, and grounding switch retirements with an average life of about 32 years. Opinions of average life range from 35 to 45 years, with the frequent comment that switches are routinely replaced when the breakers are replaced. Switches are also replaced when the transmission system is modified. The MIS data included seven fused disconnect switches with an average life of 26 years, supporting the comment that unavailability of fuses contributes to shorter useful life. Based on the MIS data and the documentation, it is recommended that this Update use 35 years for the average life for disconnect switches. Operating voltage level appears to have little to do with expected service life; however, lower voltage switches are not as expensive and should continue to be considered a maintenance item. The 69-kV distinction should be maintained.

Justification No. 58 Switching Equipment

Account: 334 (170)

Service Life:	Power circuit breaker	40 years
	Motor controlled switchgear – 3000 hp (2,240 kW) and above	35 years
	Motor controlled switchgear – 3000 hp (2,240 kW) and above	35 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined a distinction was needed between various types of switching equipment. Previous versions had only one item with a service life of 35 years. Based on the stakeholder agencies' collective experience with these components, the SME team recommended and the Steering Committee approved the following:

- Power circuit breaker 40 years
- Motor controlled switchgear – 3000 hp (2,240 kW) and above 35 years
- Main station service breaker 35 years

2005 Summary and Recommendation. These are typically lower voltage breakers, 16-kV and below, used for generator unit breakers, unit substations, and station service, as well as for large motor control switchgear. In the period 1995 – 2004 there were 53 unit breakers replaced with an average lifespan of 44 years. The replacement ages ranged from 13 years to 68 years. This data indicates that 35 years is a reasonable life for this equipment when it is properly maintained. It is recommended that this Update continue to use 35 years for the average life for main station, unit, and large motor control circuit breakers.

Historical Background. Unit circuit breakers associated with generating units and motor control switchgear for pumping plants have not been affected by load growth to the same extent as power circuit breakers (Justification No. 13). However, with the present trend toward uprating the capacity of existing generating units, no doubt, there will be an increase in the number of retirements of unit breakers due to inadequate capacity. Maintenance and parts availability are significant factors in breaker life.

Field comments on unit circuit breakers were divided, with some agreement with the 40-year service life established in the 1981 report, but with a number suggesting that the life should be shortened to 30 or 35 years. Replacements were cited at Tracy after 36 years; Folsom after 32 years; and Shasta after 37 years. Spare parts problems were mentioned as a factor influencing the service life. One comment suggested that power, unit, and main station service breakers be given the same life of 35 years.

Results of interviews on motor control switch gear generally agreed with the 3,000-hp size distinction and the 35-year service life established in the 1981 report. Comments from Boise and Grand Coulee indicated that the lives could be longer. Problems with replacement parts were cited.

Station service circuit breakers usually are of the air type and a distribution voltage class. There may be more replacements of this type of equipment in the future due to power plant uprating.

Field comments on main station service circuit breakers indicated shorter lives of 20 to 25 years for poor quality equipment, with one specific manufacturer cited as producing inferior equipment. On the other hand, in offices such as Grand Coulee, Boise, and Boulder City, there was general agreement with the established 35-year service life, with the further indication that it could be longer. Problems with replacement parts were also mentioned in the interviews.

The statistical data for unit circuit breakers indicates there were 35 retirements which had an average service life of 24 years, with most retired between 20 and 35 years. The Iowa curve fit analysis indicates a $25R_4$ Iowa curve, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-24, pages 1 and 2). The statistical data for motor switchgear was limited to one retirement at an age of 29 years. There were no data available for main station service circuit breakers.

Station Power Panels or Boards have previously been considered a unit of property. They are similar to Motor Control Centers (MCC) which are not designated as a unit of property. In both cases, replacement usually involves failed components rather than the entire panel or the MCC, and could reasonably be treated as a maintenance item.

In view of the similarity of the equipment for unit circuit breakers, motor control switchgear, and main station circuit breakers, results of the field interviews, and the lack of definitive statistical data, a single average service life of 35 years is established. This is consistent with the service life set for circuit breakers-35 years.

Station power panels or boards are deleted as a replaceable unit of property, with individual component replacements covered under maintenance.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 includes these breakers with power circuit breakers, Justification No. 15. These are typically lower voltage breakers, often 13.8-kV, used for unit substations and station service, as well as for large motor control switchgear. Oil breakers are replaced when possible due to environmental considerations. There is general agreement that 35 years is reasonable when the breakers are properly maintained. It is recommended that this Update continue to use 35 years for the average life for main station, unit, and large motor control circuit breakers.

Justification No. 59 Switchyard/Substation Supports and Structures (Previously titled Supports and Structures)

Account: 353 (175)

Service Life:	Steel Structures	50 years
	Timber Structures	Maintenance

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as “Exceeds 50 Years” be set to 100 years to align with the USACE data, unless current analysis determined otherwise. Based on the stakeholder agencies’ collective experience with these items, the SME team recommended and the Steering Committee approved the new service life of 50 years. Timber structures are considered maintenance items.

2005 Summary and Recommendation. The current data from WAPA’s financial system and Maximo show 209 support and structure retirements with an average life of 37 years. Opinions of a reasonable life were in agreement at longer than 50 years for steel. It is recommended that this Update continue to use a service life in excess of 50 years for steel supports and structures; hence, they are not units of property. It is also recommended that wood supports and structures continue to be treated as a part of the maintenance program.

Historical Background. Supports and structures are used in switchyards and substations for supporting high-voltage buses, high-voltage circuit terminals, certain types of switching equipment such as disconnecting and grounding switches, and for supporting high-voltage connections to transformers, power circuit breakers, and similar equipment. These structures usually consist of structural steel shapes or truss-type construction, but occasionally wooden poles and beams are used. This is particularly true in substations of relatively small size and of a lower voltage class. The galvanized steel structures are normally mounted on concrete footings and none of the steel is in contact with the ground. In general, the areas in which Reclamation and WAPA operate are arid or semi-arid and free from corrosive atmospheres.

Occasionally, it is necessary to modify existing steel supporting structures when changes are made in metering, circuit breakers, or power transformers. However, these changes have been minor and should not unduly influence the service life established.

In the March 1968 replacement report, steel supporting structures were expected to last through the period of analysis. It was expected that minor replacements would be made as a part of the normal maintenance program. Timber structures were given an average service life of 25 years, which was continued in the 1981 report.

The statistical data and interviews with operations personnel have not provided any evidence that would suggest a change in these decisions. The Steering Committee concludes that steel supports and structures continue to have a life that exceeds 50 years. Timber structures, because they represent such a minor overall investment, are to be treated as a part of the maintenance program.

Justification No. 60 Telephone System

Account: 397 (180.30)

Service Life: 10 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 24 telephone retirements with an average life of 11 years. Opinions of a reasonable life vary from 10 to 15 years. Changing technologies are a consideration with this type of electronic equipment. It is recommended that this Update continue to use 10 years for the average life for telephone systems.

Historical Background. Reclamation and WAPA have telephone systems in power plants, operating centers, and some of the larger substations. The telephone system includes all handsets, switching equipment, and processors to make a complete system. It also includes station signal and call systems. These systems, both manual and automatic, are kept in operating condition through the replacement of minor parts as maintenance expense. However, due to new technology and lower cost systems with increased modular parts, a new system quickly can become obsolete.

The field interviews agreed, with one exception, that 25 years established in the 1981 report was too long. The reasons cited were system obsolescence, parts problems, and the reduced durability and life of the solid-state components and assemblies. BPA shows a 20-year service life for all those units of property classified into Account 397.

The statistical data in the current study period is limited to five additions and two retirements with an average service life of 16 years. Over the entire period, an average service life of 21 years was derived. However, there is not sufficient information for a Iowa curve fit analysis.

Based on the field recommendations, and the retirement of two systems after only 16 years, the service life is revised to 15 years from 25 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 11 telephone system retirements with an average life of about 7 years. Communications technology for phones, PBX, and off-premise extensions is changing; there is poor manufacturer support for old systems. Opinions generally agree that 10 years is reasonable. It is recommended that this Update use 10 years for the average life for telephone systems. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 61 Thrust Bearing, Electric and Hydraulic Prime Movers

Account: No Comparable FERC Account (160)

Service Life: Maintenance

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There is no new statistical evidence for thrust bearings for electric and hydraulic prime movers that indicates a change should be made. Thrust bearings for electric and hydraulic prime movers continue not to be units of property and are to be dealt with as a part of the maintenance program.

Historical Background. For electric and hydraulic prime movers 1,500 horsepower (1,120 kilowatts) or larger, thrust bearings prior to the 1981 report were treated similar to generator thrust bearings and were given an average service life of 50 years. There have been some motor thrust bearings replaced and others are programmed for replacement. Unit Nos. 1 and 3 at Tracy Pumping Plant had thrust bearings replaced in 1961 and 1975, respectively. These bearings were originally installed in 1951 resulting in a life of 10 years for the Unit No. 1 bearing and 24 years for the Unit No. 3 bearing. These replacements are not representative of the normal situation because most bearings are repaired and reused, as discussed in conjunction with generator thrust bearings. For this reason, the 1981 report established that thrust bearings are not units of property, but with proper maintenance should have a life that exceeds the period of analysis.

The 1981 report further established that for pump motors smaller than 1,500 horsepower (1,120 kilowatts) thrust bearing replacements are charged to maintenance expense.

Operations personnel interviewed for this study were in complete agreement with previous recommendations. Therefore, thrust bearings continue not to be units of property and are to be dealt with as a part of the maintenance program.

Justification No. 62 Thrust Bearing, Generator

Account: 333 (165)

Service Life: 50 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as "Exceeds 50 Years" be set to 100 years to align with the USACE data, unless current analysis determined otherwise. However, based on the stakeholder agencies' collective experience with these items, the SME team recommended and the Steering Committee approved the new service life to be 50 years.

2005 Summary and Recommendation. Current Reclamation data shows 11 thrust bearing replacements with an average life of 44 years and five retirements with an average life of 86 years for an overall average of 57 years. No revision is made to the service life of exceeds 50 years.

Historical Background. Thrust bearing failures were quite common and expected during the initial operation of units in the period 1930 to 1950. It is a matter of record that Hoover, Shasta, and Hungry Horse had 23 failures on the last 27 units installed. Grand Coulee had at least an average of one failure for each unit installed on the first 18 units. In general, the units were still under warranty and costs involved were assumed by the manufacturers. In contrast, very few thrust bearing failures have resulted during commercial operation. In general, they have been the result of unusual conditions, such as water in the oil, wiped bearings during unit carbon dioxide tests, and low oil.

In recent years, new major units have been supplied with pressure lubricating systems. These systems lubricate the bearing during unit start-up and shut-down. In addition, thrust bearing pressure lubricating systems have been added to Reclamation's existing units at Grand Coulee, Parker, Estes, Kortes, Seminoe, Elephant Butte, Marys Lake, and Flatiron, to name a few.

As reported in 1981, operating experience indicates that the requirement for complete bearing replacement is unlikely except as an expedient measure to get a unit back in service when complete spare bearings are on hand. In general, any damaged bearings would be reconditioned as a maintenance item, when required. Considering this operating experience, thrust bearings have not been designated a unit of property and are considered as having a life that exceeds the period of analysis. Interviews with field personnel provide strong support for the 1981 report conclusions. There were no additions or retirements during the study period to enlarge the data base.

No revision is made to the service life which exceeds 50 years.

Justification No. 63 Thyristor Valve Banks –High voltage Direct Current (HVDC) and Static Var Systems (SVS)

(See Justification No. 31)

Account: 353 (175)

Service Life: 30 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made. Thyristor valve banks are designated as the only replaceable unit of property in HVDC and SVS systems. Other equipment used in HVDC and SVS systems are similar to those used in AC systems and are assumed to have the service lives identified elsewhere in this update A typical HVDC converter station consists of many items of equipment and units of property that are identical to those found in any major alternating current substation. These items include power circuit breakers, disconnect switches, shunt capacitor banks, reactors, power transformers, instrument transformers and lightning arresters, to name a few.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show two banks of thyristor valves retired with an average life of 8 years. By itself, this small sample does not support a change in the service life. However, MIS (Maintenance Information System) data for the 1988 to 1994 period as recorded in the 1995 Update noted that there had been 13 earlier retirements, and they also had 8 years average life. Most of WAPA's experience with thyristor valve banks in AC-DC-AC Converter stations has been in the Upper Great Plains Region. Opinions based on maintenance experience suggest 20 to 25 years is a reasonable life for thyristor valve banks. Replacement of failed individual thyristors in a bank is a maintenance item. Since WAPA's experience trend suggests a shorter life than previously expected, it is recommended that this Update use 30 years instead of 35 years for the average life of thyristor valve banks.

Historical Background. A typical High voltage Direct Current (HVDC) Convertor Station and Static VAR System (SVS) consists of many items of equipment history that are identical to those found in major alternating current bank history. However, the major item that is unique in HVDC and SVS terminals is the thyristor. These valves were included in the 1981 report under the heading "direct current bridge," which has been revised in this report to focus on the critical replaceable unit. (For other related equipment and reasons for identifying the thyristor valve as a separate item, see the discussion under Justification No. 38 "HVDC and SVS Terminals.")

Thyristors consist of a number of modules connected in series. The modules may contain a number of series and parallel connected groups of power thyristors on a common assembly, together with reactors, resistors, and capacitors needed to maintain desired circuit currents and voltages for operation of the thyristors. A number of valve modules, depending on voltage and current requirements, are then assembled into a 3-phase circuit. In a 200-megawatt back-to-back HVDC converter station, for example, twelve thyristor valves typically would be operated together as a single, 12-pulse converter bridge for each AC side of the converter station.

Reports indicate that the electrical components making up the valve modules are quite reliable and should last many years with minimal maintenance expense. However, like all new technology, thyristors or other module components of new design may eventually result in the need for full replacement because of their unavailability or cost.

The August 1981 report established the direct current bridge as a unit of property. Since the first commercial installation had not been in service very long, an average service life of 35 years was designated.

Prior to 1981, BPA used a service life of 30 years for all D.C. equipment. Currently BPA includes similar equipment under FERC Account No. 353, Station Equipment, for which a $37S_o$ survivor Iowa curve was selected.

There are no statistical data available for thyristor valves.

Operating personnel had little comment on this item, because of limited experience. There was discussion on terminology, with the suggestion that the “direct current bridge” be referred to as a “converter, high voltage direct current.”

The unit nomenclature is changed to thyristor valves to allow for reference to both HVDC converter stations and SVS terminals. The 35-year life continues to apply.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 13 thyristor valve retirements with an average life of about 8 years. Replacement of individual thyristors in the valve is normal maintenance. Because WAPA’s experience base is still developing, it is recommended that this Update continue to use 35 years for the average life for thyristor valves in HVDC and static VAR systems.

It is not reasonable to consider the entire HVDC or static VAR system as a unit of property.

Justification No. 64 Transformer, Grounding (Zig-Zag)

Account: 353 (175)

Service Life: 45 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that the service life of 40 years should be increased to 45 years to align with the USACE data. The SME team recommended and the Steering Committee approved the new service life of 45 years.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show only three grounding transformers that have been retired at an average age of 2 years. These transformers were all at the same substation. Opinions of a reasonable life were all in agreement at 40 years. It is recommended that this Update continue to use 40 years for the average life for grounding transformers.

Historical Background. Grounding transformers are used in special applications at substations to provide a neutral point for grounding purposes and a path for ground fault current. As of October 1, 1986, there were 11 three-phase banks of grounding transformers in service at switchyards or substations on Reclamation and WAPA power systems.

Field interviews generally supported the 45-year life established in the 1981 report. A number of replacements have been made due to PCB problems. Grand Coulee experience not only confirms the 45-year life, but indicates that the grounding transformers could last longer.

The previous BPA life for grounding transformers was 35 years.

In the historical data base there are only four retirements, with an average service life of 23 years.

Because of the limited statistical data and the results of the interviews, the 45-year life is retained.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 121 main power and grounding transformer retirements with an average life of about 32 years. Opinions agree that 40 or 45 years is a reasonable life, and generally agree that the life is the same for main power transformer and for grounding transformer use. The transformers at Tracey are 45 years old, and are just starting to gas. It is thought that the new designs run cooler and should continue to have a long life. System changes and load growth are often reasons transformers are retired. The MIS Equipment Class Count dated April 4, 1995, shows WAPA has 700 transformers; the MIS retirement data would indicate that 17 percent of the transformers have been replaced for various reasons at an average life of only 32 years. It is recommended that the life of grounding transformers be reduced from 45 years to 40 years in the Update.

Justification No. 65 Transformer, Instrument (69-kV and above)

Account: 353 (175)

Service Life: 45 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that the service life of 30 years should be increased to 45 years to align with the USACE data. The SME team recommended and the Steering Committee approved the new service life of 45 years.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 502 current, potential, and metering instrument transformer retirements with an average life of 32 years. Opinions of a reasonable life vary from 25 to 30 years. Based on the large data sample, it is recommended that this Update increase the average life from 25 to 30 years for current, potential, and metering instrument transformers.

Historical Background. There are thousands of current (CT) and potential (PT) transformers and some metering sets installed throughout the Reclamation and WAPA systems. Many of them are of the 15-kV class used in metering stations on the systems of others for metering wheeled power. Others are installed at switchyard, substations, and high voltage interconnections.

In the March 1968 replacement report, only those instrument transformers 69-kV and above were made units of property with an estimated average service life of 45 years. Only the higher voltage transformers were made units of property, because it was felt that the cost of transformers below 69-kV would be such that they could be replaced as a part of normal maintenance.

Since 1966, there have been numerous problems with high voltage instrument transformers. In the 1981 report the life was reduced to 25 years. The operating personnel interviewed supported the 25-year life expectancy. Several indicated that the 1981 report overreacted to short-term problems and that the actual life probably exceeds 25 years. Grand Coulee indicated that the mortality rate was higher for larger units, 345-kV and above, which should be given a 20-year life; a 30-year life was suggested for units below 345-kV.

The previous BPA life for current and potential transformers was 25 years.

In the current statistical information there are 533 additions and 193 retirements at an average age of 24 years. The historical data base contains 296 retired instrument transformers with an average life of 21 years. The highest number of retirements occurred in the 10- to 15-year range. The previous study showed an average service life of 22 years. As shown in t Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-25), the Iowa curve fit analysis matched a $25L_2$ Iowa curve to the instrument transformer data.

The service life is kept at 25 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 498 instrument transformer retirements with an average life of about 24 years. Bushing, potential, and wound current instrument transformers have about the same expected life. Instrument transformers are replaced when the power transformer is changed out because of system or load conditions. Opinions agree that 25 to 30 is reasonable. It is recommended that the Update continue to use 25 years for the average life for instrument transformers.

Justification No. 66 Transformer, Main Power

Account: 353 (175)

Service Life: 45 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that the service life of 40 years should be increased to 45 years to align with the USACE data. The SME team recommended and the Steering Committee approved the new service life of 45 years.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 71 power transformer retirements with an average life of 42 years. The current data from Reclamation shows 40 power transformer retirements with an average life of 41 years. Opinions of reasonable life support 40 years. It is recommended that this Update continue to use 40 years for the average life for both three phase and single phase power transformers.

Historical Background. The Reclamation and WAPA systems had over 14 million kVA of transformer capacity as of October 1, 1986. This capacity, ranging in size from 25 kVA to 600,000 kVA, is about equally divided between transformers at hydroelectric power plants and at load substations. They represent a major portion of the total investment in transformers.

Design and manufacturing advances over the years have contributed to the long life of transformers. These include such items as impulse testing to reduce susceptibility to damage from voltage transients, improved insulation system, the use of nitrogen in place of air in the transformer tanks and improved coordination with surge arresters, fuses and relays. The use of forced air and forced oil cooling has reduced the size, weight, and oil requirements of transformers. Partially offsetting these improvements have been the reduction or elimination of safety margins available in older transformer designs, brought about by improved methods of calculating design requirements for individual transformer components. Reclamation and WAPA periodic maintenance and testing programs to detect incipient troubles with insulation and insulating oil also help to extend the life of transformers.

The 1981 study, after a rather detailed analysis, changed the designation which defined windings as the unit of property for transformers 1,000 kVA and above to the current definition, which classifies a complete main power transformer of any size as a replaceable unit of property. This designation continues to be a reasonable approach. An average service life of 45 years was established in the 1981 report, an increase from the 35-year life in the 1968 report.

Results of the field interviews indicated a division in opinion. A number of interviewees indicated that a reduction in service life may be warranted. There have been special problems with a certain manufacturer and at certain projects such as Glen Canyon, Keswick, and Flatiron. The problems limited service lives to about 30 years. On the other hand, the Grand Coulee comments supported the longer life. Several observed that newer units do not seem to be as well built, and that a good preventive maintenance program is necessary to retain service life.

The previous BPA life for power transformers was 40 years.

The current statistical information indicates an average service life of 31 years for the 51 retirements. Over the entire historical period the average age of retirements has been 26 years, with a statistical confidence interval of 15 to 37 years. The highest frequency of retirements occurred between 30 to 35 years. The Iowa curve fit analysis indicates a service life of 40 years with an R_3 dispersion when some of the older data are not considered. These results are shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-26).

Based on the combined results of the interviews and the statistical analysis, the designated service life for main power transformers is reduced from 45 years to 40 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 121 main power and grounding transformer retirements with an average life of about 32 years. Opinions agree that 40 or 45 years is a reasonable life, and generally agree that the life is the same for main power transformer and for grounding transformer use. The transformers at Tracy are 45 years old, and are just starting to gas. It is thought that the new designs run cooler and should continue to have a long life. System changes and load growth are often reasons transformers are retired. The MIS Equipment Class Count dated April 4, 1995, shows WAPA has 700 transformers; the MIS retirement data would indicate that 17 percent of the transformers have been replaced for various reasons at an average life of only 32 years. It is recommended that the Update continue to use 40 years for the average life for main power transformers.

Justification No. 67 Transformer, Mobile Power

Account: 353 (175)

Service Life: 40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. There are no retirements of mobile transformers recorded in WAPA's financial system or Maximo. Opinions on service life vary from 40 to 45 years. These mobile transformers are constructed similar to main power transformers and the service life should be similar. It is recommended that mobile transformers service life be kept at 40 years for this Update.

Historical Background. Mobile power transformers primarily are used as temporary replacements to provide service to customers when failure of a main power transformer results in complete isolation of a power supply. They also are used to facilitate stage additions to substations when construction activity requires de-energizing the normal power supply. These transformers are trailer mounted for mobility, and the units are specially designed to meet size and weight limitations of the highways over which they travel. Because of this, there are limitations as to the amount of capacity that can be furnished by this means. The number of mobile transformers and mobile substations owned by WAPA is relatively small.

As was also established for power transformers, the August 1981 report established the unit of property for mobile transformers as the complete transformer, with an estimated average service life of 45 years. The trailer portion of the mobile unit should, with proper maintenance, have a relatively long life. It is not considered a unit of property.

Operating personnel interviewed indicated that mobile transformers should have the same life as main power transformers.

BPA formerly gave mobile and stationary transformers the same 40-year life.

The statistical data for mobile transformers is limited to three retirements at an average age of 17 years.

Mobile power transformers have the same service life as main power transformers. Accordingly, the service life for mobile power transformers is designated at 40 years.

Justification No. 68   Transformer, Station Service

Account: 334, 353 (170,175)

Service Life: 35 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 36 station service transformer retirements with an average life of 37 years. The current data from Reclamation shows 13 station service retirements with an average life of 35 years. Opinions of a reasonable life vary from 35 to 40 years. It is recommended that this Update increase the average life from 30 to 35 years for station service transformers.

Historical Background. Although generally of a smaller size than main power transformers, station service transformers include banks of up to 1,000 kVA capacity. Station service transformers are not exposed to system faults to the same extent as main power transformers. Furthermore, because of the nature of the load they serve, they usually operate below their nameplate capacity. Because of these considerations they were given an average life of 50 years in the 1981 study, a slightly longer service life than power transformers of comparable size.

The operating personnel interviewed were divided in their opinions on service life. About half thought that 50 years is appropriate, and about half thought that 50 years is too long. There were a number of comments indicating that a single life should be used for the major transformers (other than instrument transformers) as it is difficult to rationalize the small 5-year difference between station service transformers and grounding, main power, mobile power, power regulatory, and voltage regulating transformers. All of the latter have a life of 45 years in contrast with 50 years for a station service transformer.

BPA treats the station service transformer as any other substation transformer; the previous study life was 40 years.

During the current study period 73 additional station service transformers were added, while 12 were retired. Those retired had an average service life of 21 years. The transformers retired over the entire study period had an average life of 18 years, with a range of 1 to 29 years. As presented in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-27), the Iowa curve fit analysis supports a much shorter service life of 20 years, with an R_4 dispersion.

Although the field interviews indicated that the station service transformer should be combined with other transformers, the statistical data support a shorter life. The statistics reflect the tendency for a number of transformers to become undersized due to load growth, requiring earlier replacement. The Steering Committee concludes that station service transformers are to continue to be considered separately and that the life is to be shortened to 30 years from 50.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988 to 1994 show 20 station service transformer retirements with an average life of about 31 years. This equipment sometimes gets overloaded and has to be replaced with higher capacity transformers. One area replaces the transformer when the station service breaker is replaced. The older transformers contain PCB. Opinions generally agree that 30 years is reasonable when located outside on a pole; up to 40 or 45 years is reasonable when protected inside the substation. It is recommended that this Update continue to use 30 years for the average life for station service transformers.

Justification No. 69 Transmitter and/or Receiver Set, Powerline Carrier

Account: 397 (180.40)

Service Life: 15 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 76 powerline carrier retirements with an average life of 20 years. Opinions of a reasonable life were in agreement at 15 years. Changing technologies are a consideration with this electronic equipment. It is recommended that this Update continue to use the more conservative average life of 15 years for powerline carrier transmitter and/or receiver sets.

Historical Background. Reclamation and WAPA have more than 600 carrier transmitter-receiver sets in service throughout their systems. These sets consist of a multiplicity of tubes, transistors, solid state components, transformers, rectifiers, resistors, crystals, filters and miscellaneous devices all mounted on panels and enclosed in cabinets. Individual components of these sets which fail, become defective, or become obsolete are replaced as a part of the normal maintenance program. This equipment is experiencing declining use as Reclamation is gradually replacing carrier systems with fiber-optics. WAPA intends to continue using carrier systems.

Comments from the field generally agreed with the established 15-year service life. Two offices, Loveland and Phoenix, recommended a 20-year life. Montrose recommended 10 years. Boulder City stated that carrier systems are too old after 10 years, but remain in service.

In the current study period 17 powerline carriers were added, and 12 were retired with an average service life of 21 years. Over 170 have been retired over the entire historical period, after attaining an average age of 18 years. The Iowa curve fit analysis indicates a $20S_3$ Iowa curve, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-28).

Based on the statistical data and the consensus of those interviewed, the service life remains at 15 years.

1995 Limited Update Summary and Recommendation. MIS data for the period 1988-1994 for powerline-carrier transmitter/receiver sets show 195 retirements with an average life of about 17 years. Technical change has reduced the use of powerline-carrier equipment in most areas. The equipment will probably be obsolete and deleted as a unit of property in the next few years. Therefore, it is recommended that this Update continue to use 15 years for the average life for powerline-carrier transmitter and/or receiver sets.

Justification No. 70 Transmitter and/or Receiver Set, Single Channel Radio

Account: 397 (180.10)

Service Life: 25 years

2017 Summary and Recommendation. This item was assessed by the multiagency SME team and it was determined a distinction that the service life needed to be increased from 10 years to 25 years. Previous version had service life set to 10 years. Based on the stakeholder agencies' collective experience with this equipment, the SME team recommended and the Steering Committee approved the change.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show 44 mobile transmitter/receiver retirements with an average life of 11 years. Opinions of a reasonable life vary from 10 to 15 years. Technologies are changing in this equipment; therefore, it is recommended that this Update continue to use 10 years for the average life for single channel radio transmitter and/or receiver sets.

Historical Background. Reclamation and WAPA systems had nearly 500 fixed station transmitters and/or receiver sets in service as of October 1987, including both base stations and repeaters. The replacement of component parts such as tubes or transistors, transformers, rectifier, resistors, crystals circuit boards, and filters is accomplished as normal maintenance.

Comments from the field indicated that the service life should be longer than the 10-year service life established in the 1981 report, with 15 years as the most frequently mentioned alternative. No one interviewed recommended a shorter life. Data for the current study period indicates that nine radio transmitters were retired after an average service life of 23 years. Nine transmitters were added. Over 150 have been retired in the historical time period, and these had an average service life of 15 years. The selected Iowa curve, 1554, also indicates a 15-year service life, as depicted in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-29).

Based on the field recommendations and the statistical data, the service life is revised to 15 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show 88 single channel radio base and repeater retirements with an average life of about 14 years. Radio equipment service life in general is very much technology driven. Manufacturer support is poor, both for warranty service and for parts. Some replacement has occurred to comply with changing FCC rules. Opinions are about equally divided whether 10 years or 15 years is the reasonable life. The Steering Committee recommends that the Update use 10 years for the average life for single channel radio base and repeater sets. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 71   Trash Racks

Account: 331, 332 (151)

Service Life:	FERC 331	40 years
	FERC 332	75 years

2017 Summary and Recommendations. As a result of merging service life data from the USACE ER-37-1-30, the SME team determined that all Reclamation items listed as “Exceeds 50 years” should be evaluated and set to a fixed service life. The SME team recommended and the Steering Committee approved that be trash racks falling under 332 Reservoirs, Dams, and Waterways which “Exceeds 50 years” be set to 75 years, and those trash racks falling under 331 Structures and Improvements – Power and Pumping Plants be set to 40 years to align with the USACE ER-37-1-30 data.

2005 Summary and Recommendation. Complete trash rack structure replacement continues to occur very infrequently and is often the result of a change to the inlet structure rather than due to failure of the trash rack. Required section replacements are to continue to be considered as maintenance. The entire trash rack continues to be considered as having a life that exceeds 50 years.

Historical Background. Periodic inspections of trash racks that have been in service for long periods (about 80 years at Minidoka Dam) indicates that trash racks can last for many years in a normal water environment. The greatest deterioration occurs to the trash rack sections that are intermittently exposed to a water and air environment, with less deterioration resulting in sections that are always submerged.

The consensus among operations personnel was in agreement with previous findings, with a few exceptions. Rocky Mountain waters cause accelerated corrosion to trash racks requiring more frequent replacement and attention. The trash racks have been replaced at Tracy and Nimbus after 50 years of service.

The Mt. Elbert trash racks were replaced after only a few years operation due to vibration failure. This type of failure has occurred at many pumped-storage power plants and is generally not associated with hydro plants. Trash racks at Yuma are to be replaced due to algae problems.

Cathodic protection systems and improved protective coatings being used on new installations and added to older installations are expected to further increase the life of trash rack structures.

Removing, sandblasting, and applying protective coatings to trash rack structures is very expensive and, in some instances, hard-hat divers are required. This periodic reconditioning of trash racks is no longer a Reclamation practice, as a study made about 20 years ago led to the conclusion that practice possibly did not add longevity. In addition, the study indicated that the cost per square foot for trash rack reconditioning, when rack removal, sandblasting, repainting, and reinstalling are considered, would far exceed the cost of section replacements, if and when required.

Large trash rack installations consist of many small removable sections. Under extremely corrosive conditions or freezing action, sections may require replacement. Complete structure replacement, as indicated by past experience, occurs very infrequently.

Required section replacements are to continue to be considered as maintenance. The entire trash rack continues to be considered as having a life that exceeds 50 years.

Justification No. 72 Uninterruptible Power Supply System (UPS)

Account: 335, 397 (180, 199)

Service Life: 10 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show no uninterruptible power supply retirements. Opinions of a reasonable life vary from 10 to 15 years. Changing technologies are a consideration with electronic equipment. It is recommended that this Update continue to use 10 years for the average life for uninterruptible power supplies.

Historical Background. The public and all utilities in an interconnected system expect a high degree of reliability from an electric power system. This dictates that operation of control computers and/or SCADA master stations that control or monitor power plants, substations and transmission lines be as nearly continuous as possible. To achieve this objective, most of these installations include an uninterruptible power supply installation. Typical installations include a station service type transformer, a battery bank, redundant UPS units consisting of rectifier-charger, inverter-regulator and static interrupter, along with associated circuitry and interconnected wiring and miscellaneous components. The devices utilize a high number of solid-state devices.

The field interviews indicated that a majority supports a reduction in service life to 10 years from the 15 years set in the 1981 report. Phoenix has two systems that are 8 years old and scheduled to be replaced in the next 2 years. Huron indicated that the UPS at Jamestown is 11 years old and parts are unavailable. Grand Coulee indicated that they had one fail after 5 years, but it may have been a design problem. They have one that is 8 years old and working normally.

No statistical data exists for this unit of property.

This equipment is often associated with a SCADA master, with a 10-year life. When the SCADA system is replaced it is likely that the power requirement will also necessitate replacement of the UPS. Because of this and the field experience, the service life is revised to 10 years.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 is not conclusive, showing only one uninterruptible power supply retirement after a 7-year life. UPS are used where a very reliable power source is required in SCADA centers, HVDC terminals, computer installations, and for dependable radio and telephone communications. Technology is changing, and manufacturer support is often unavailable. Some poor quality equipment has been purchased that never worked satisfactorily. On the other hand, Watertown is now replacing a UPS that has worked for 15 years. Opinions agree that 10 years is reasonable, and that 15 years is more than could normally be expected. It is recommended that the Update continue to use 10 years for the average life for uninterruptible power supplies. It may be necessary to establish a 5-year life for this equipment in the future.

Justification No. 73 Voltage Regulator

Account: 353 (175)

Service Life: 40 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. The current data from WAPA's financial system and Maximo show three voltage regulator retirements with an average life of 14 years. The sample is too small to determine average life. Opinions of a reasonable life were in general agreement at 40 years. It is recommended that this Update continue to use 40 years for the average life for voltage regulators.

Historical Background. Transformers that regulate voltage are used at locations on the transmission system where voltage levels are not within acceptable limits. As of October 1, 1986, there were 38 banks of voltage regulators on WAPA's transmission system with a combined capacity of about 637,000 kVA. It is noted that in WAPA's current power facilities listing, the term "Voltage Regulator" is used rather than the 1981 report justification, "Transformer, voltage Regulating."

The 1981 study assigned a 45-year life to these units. The interviewed operating personnel generally agreed with the 45-year life. In the 1980 to 1987 study period 79 voltage regulators were added, while four were retired with an average life of 24 years. Over the entire study period the 22 retired had an average life of 17 years, with the greatest frequency between 10 and 20 years. The Iowa curve fit analysis indicates that an $10L_5$ Iowa curve is the most appropriate, as shown in Appendix B of the 2006 Replacements Book (Supplemental Historical Reference, Exhibit A-30).

The justification is changed to "Voltage Regulator" to be consistent with WAPA terminology. A service life of 40 years is established, for consistency with other large transformers, such as main power, mobile, and phase angle regulators.

1995 Limited Update Summary and Recommendation. The MIS data for the period 1988-1994 show seven voltage regulator retirements with an average life of about 31 years. voltage regulator life tends to be about 5-10 years less than the transformers' life, but parts seem to be available. One area is phasing out voltage regulators on its system as the existing installations fail. Opinions agree that 40 years is reasonable. It is recommended that the Update continue to use 40 years for the average life for voltage regulators.

Justification No. 74 Wearing Rings, Runner

Account: 333 (165)

Service Life: 20 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Summary and Recommendation. Current data from Reclamation shows four replacements with an average service life of 35 years. This small number of replacements is not sufficient statistical evidence to indicate a change should be made in the service lives of runner wearing rings.

Historical Background. In considering the evidence relating to the unit of property definition and service life for turbine runners, the Steering Committee set out wearing rings as a separate unit of property with a service life of 20 years.

Justification No. 75 Wood Pole/Structure Transmission Line Section

Account(s): 355, 356 (182, 183)

Service Life: 50 years

2017 Summary and Recommendations. This item was assessed by the multiagency SME team and it was determined that the current assessment is accurate. No change was made.

2005 Updated Summary and Recommendations. Since an entire line is rarely replaced in kind, it is recommended that the unit of property for wood pole/structure transmission lines be redefined to be a line section, complete, between two identifiable points. The points could be angle structures, structure type changes, road crossings, or other identifiable locations or features. A specific storm-damaged section would also be a unit of property. Opinions of a reasonable life greater than 50 years and the 13.8% periodic replacement factor seem to be generally accepted. It is therefore recommended that the factor of 13.8% replacement at 50-year intervals (an increase of 10 years) be used for wood pole/structure transmission lines. (The basis for the 13.8% factor is recorded in Reference 41 of the 1995 Update, page A-68.)

Historical Background. Reference No. 41 noted that WAPA was adopting an aggressive inspection and preventive maintenance program for wood pole/structure transmission lines. Under the program, individual transmission line components (poles, cross arms, insulators, conductor, etc.) would be examined for signs of deterioration, and components in weakened condition would then be replaced as maintenance items. Pole butt ground line treatment would be an integral part of the comprehensive program. The program was to be continuous and long term, with every transmission line being covered over a specific period (Upper Great Plains Region uses a 12-year cycle). The cycle would then repeat itself with interim as-needed maintenance keeping the lines in good operating condition at an economical cost.

The program has been successful, as documented by wood pole/structure transmission line statistics contained in WAPA Area Power Administration's Annual Reports. For example: The 1979 Annual Report shows that only 1,900 miles of line were older than 35 years (page 29). The 1982 report shows about 2,100 miles were that old (page 58). In the 1994 report 736 miles of wood line were 50 years old or older (page 13). In 10 years the number increases to 4,068 miles that were 50 years old or older (2004 Annual Report (page 14)). Other examples include the Havre-Rainbow 69-kV line was put in service in 1939 and is 66 years old. Wolf Point-Williston was put in service in 1949 and is 56 years old. Leeds-Rolla was in service in 1952 and is 53 years old. Hesket-DeVaul was in service in 1953 and is 52 years old. Edgeley-Forman was in service in January of 1953, and is also 52 years old.

While useful transmission line service life is being significantly extended, unpredictable ice storms, tornadoes, and other natural events do occur. There is little current WAPA financial system or Maximo data available on these events. However, opinions generally agree that 50 years is now reasonable for wood pole/structure transmission lines. It is recommended that a conservative factor of 13.8% replacement at 50-year intervals be used for wood pole/structure transmission lines, rather than the 40 years used in the 1995 Update.

Justification No. 76 Units of Property Adopted in 2017 from the USACE ER-37-1-30 Accounting Treatment for Multipurpose Projects

Account(s): All Accounts

Service Life: Those Units of Property (USACE Plant Items) adopted by the 2017 Update to use the USACE service life from the USACE ER-37-1-30 December 31, 2003.

2017 Summary and Recommendations. As a result of collaborative efforts between Reclamation, WAPA, BPA, and USACE, the decision was made and approved by these stakeholder agencies to merge the former Appendix B Table 6 Blue Pages (now Table 7) from the May 2006 Replacements Book with a similar document, USACE Accounting Treatment For Multiple-Purpose Projects ER-37-1-30. Both books have similar and overlapping data for determining equipment service life for various accounting requirements. Units of Property, with this justification, are new items to Table 7 that were merged from the USACE ER-37-1-30, wherein the SMEs and the Steering Committee approved the use of the USACE existing stated service life. The results of this merger are now located in Chapter 4, Table 7 (the Blue Pages). As part of the Steering Committee and SME Review prior to the Beta Test, each of the USACER ER 37-1-30 Plant Items was considered as part of the merger. If there was no such Unit of Property listed in the Reclamation Table 6, the USACE item was added with its USACE service life (with few exceptions). If there was a similar Plant Item/Unit of property in both the 37-1-30 and Table 6 with differing service life designation, the Steering Committee (with SME input) made the determination as to what service life would be used.

The bigger question is: Should each Unit of Property/Plant Item have a Justification? Historically only those items wherein the existing Service Life was changed had a justification. Justifications were cheated in the book update in the late 1980's and have carried forward since with justifications added and updated each revision. None of the ER 37 items merged had a Justification (approximately 300 items) and were given the Justification No. 76 to document that they were items merged from the USACE ER 37.

Historical Background. The Department of Energy, the Department of the Interior, and the Department of the Army through the U.S. Army Corps of Engineers (collectively the "Agencies") signed the Memorandum of Understanding (MOU) for Hydropower on March 24, 2010, and extended it on March 24, 2017 for another 5 years. The MOU is helping meet the nation's need for reliable, affordable, and environmentally sustainable hydropower by strengthening a long-term working relationship, prioritizing similar goals, and aligning ongoing and future renewable energy development efforts between the Agencies.

Within the spirit of the MOU, the agencies collaborated to produce this new revision of the Replacements Book, to better standardize between the agencies the accounting treatment of facility maintenance, equipment replacement, and capitalization. The goal of this effort is to standardize the use plant equipment associated with FERC accounts and their assigned service life in years and capitalization versus expense designation.

Justification No. 77 Plant Life Safety and Security

Account(s): 334

Service Life: Variable; see Table 7 (Items 694-791)

2017 Summary and Recommendations. These items were added in 2017 to comply with Reclamation Manual D&S SLE 05-01. User should always check SLE 05-01 Appendix A for updates.

Historical Background. Section 513 of the Consolidated Natural Resources Act of 2008 is titled Bureau of Reclamation Site Security, and includes provisions for the treatment of Reclamation site security costs, as well as an annual report to Congress. SLE 05-01 Appendix A establishes procedures for appropriate classification, tracking, and reimbursement of costs in accordance with the Act.

Service lives for security equipment established in SLE 05-01 Appendix A have been incorporated into Table 7. Future updates of the Replacements Book will reflect any changes made to SLE 05-01 Appendix A.

Justification No. 78 Flow Meter System

Account(s): 331, 333

Service Life: 15 years

2017 Summary and Recommendations. This is a new item added to the 2017 revision. This item was assessed by the multiagency SME team and it was determined that the service life for Flow Meter System is 15 years. As technology has improved over the past 20 years, these items are being installed to improve water facility operations. These are flow meters on major water passages (costs $100k) and exclude flow meters on process piping (costs $500). These larger systems will likely be maintained by replacing individual components rather than wholesale system replacements. The initial installation can be considered a capitalized improvement which may improve the facility operation at large. Replacement of component parts of these units such as sensors, transducers, power supplies and circuit cards are considered maintenance items.

Justification No. 79 Machine Monitoring System (Vibration, Air Gap, Partial Discharge, etc.)

Account: 333

Service Life: 15 years

2017 Summary and Recommendations. This is a new item added to the 2017 revision. This item was assessed by the multiagency SME team and determined that the service life for these types of machine monitoring systems are 15 to 20 years. As technology has improved over the past 20 years, these items are being installed as condition-based monitoring systems for the generator units. The initial installation can be considered a capitalized improvement, which may increase the longevity of the generator unit at large. Replacement of component parts of these units such as sensors and transducers and even electronic circuit cards or other sup-components are considered maintenance items.