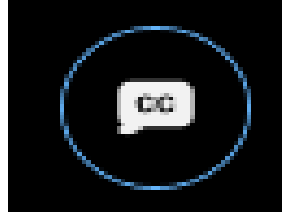


Webex Accessibility tools

To enable Closed Captions

Select the **CC icon** in the lower-left of the WebEx screen



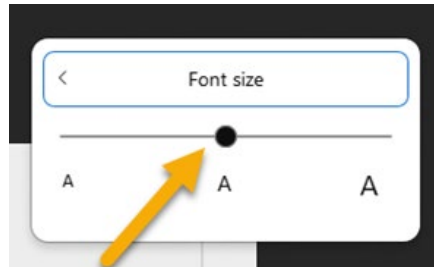
Note: CC is set individually by each person who wants to enable them.

Change font size

Select the **ellipsis** in the lower right



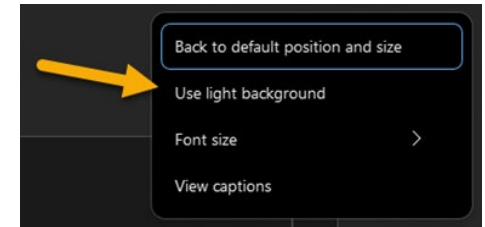
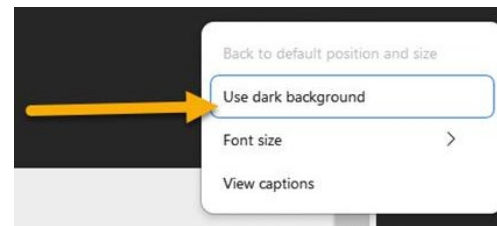
Select **font size**



Use the slider to select the desired size

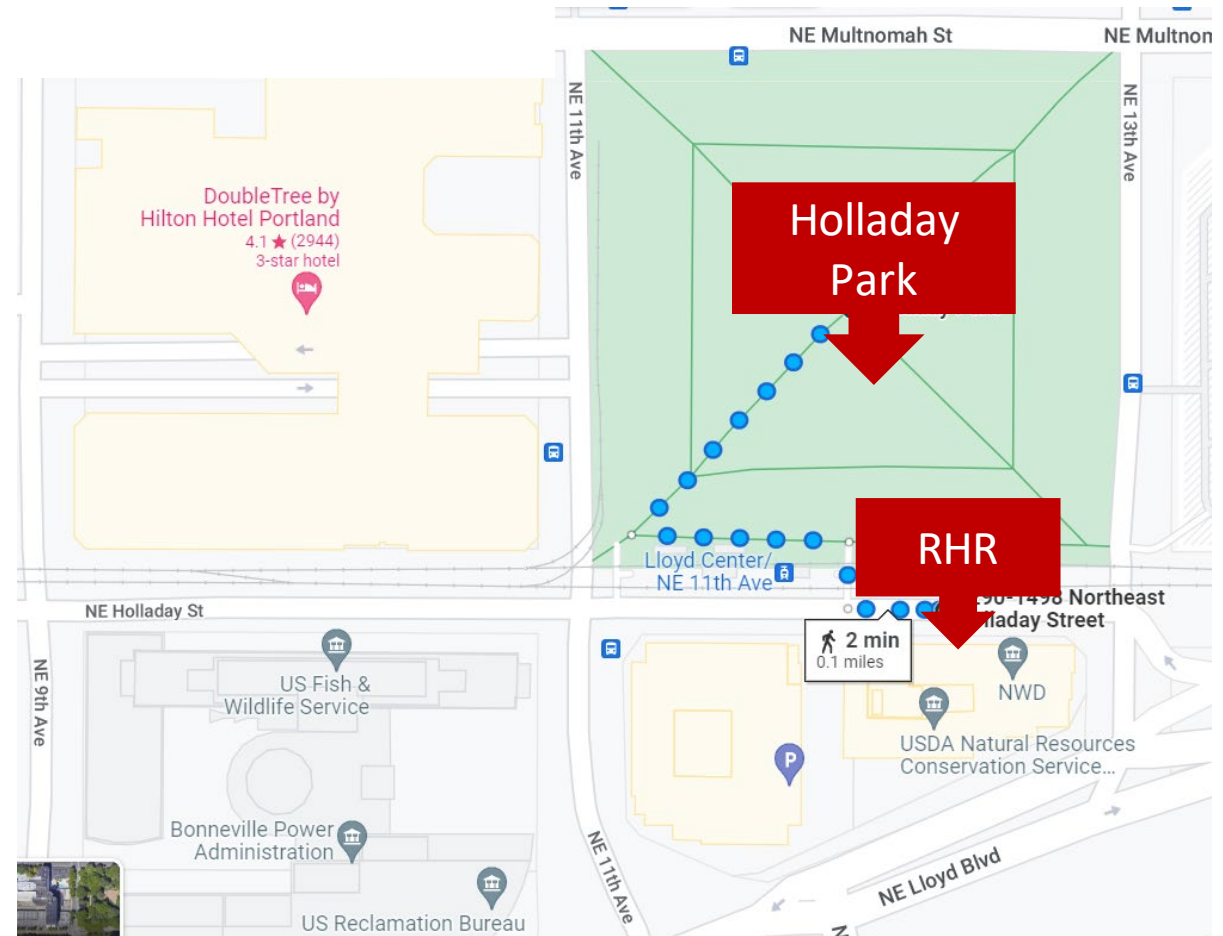
Change background contrast

1. Select the **ellipsis** in the lower right
2. Select the **dark or light background**



Safety Moment

- The Rates Hearing Room has two exits.
- In the event an alarm sounds, please meet at Holladay Park across the street.





BP-26 INTEGRATED PROGRAM REVIEW

Federal Hydropower

July 1, 2024



US Army Corps
of Engineers®



— BUREAU OF —
RECLAMATION



Federal Columbia River Power System

Presenters:

- **Bonneville Power Administration**
 - Doug Komoroski, Federal Hydropower Manager
 - Gordon Ashby, Asset Strategy Manager
 - Ryan Bliss, FCRPS Asset Program Manager (Acting)
- **Bureau of Reclamation – Columbia-Pacific Northwest Region**
 - Joe Summers, Regional Power Manager
 - Craig Parker, Deputy Regional Power Manager
 - Colton Reid, Asset Manager
- **USACE – Northwestern Division**
 - Josh Erickson, Hydropower Business Line Manager
 - Roger James, O&M and Capital Program Manager
 - Mike Villamar-Vader, Hydropower O&M Strategic Planner

Agenda

Topic	Minutes	Presenter
Federal Hydropower	10	Doug Komoroski
FCRPS Asset Management	15	Colton Reid
USBR O&M	15	Colton Reid
USACE O&M	15	Mike Villamar-Vader
Cost Effectiveness	15	Gordon Ashby
USBR O&M Budget Forecast	20	Joe Summers
USACE O&M Budget Forecast	20	Josh Erickson
FCRPS Capital Program	25	Gordon Ashby
USBR Major Capital Projects	10	Craig Parker
USACE Major Capital Projects	10	Roger James
FCRPS Long Term Program Summary	10	Gordon Ashby

Overview of Federal Hydro

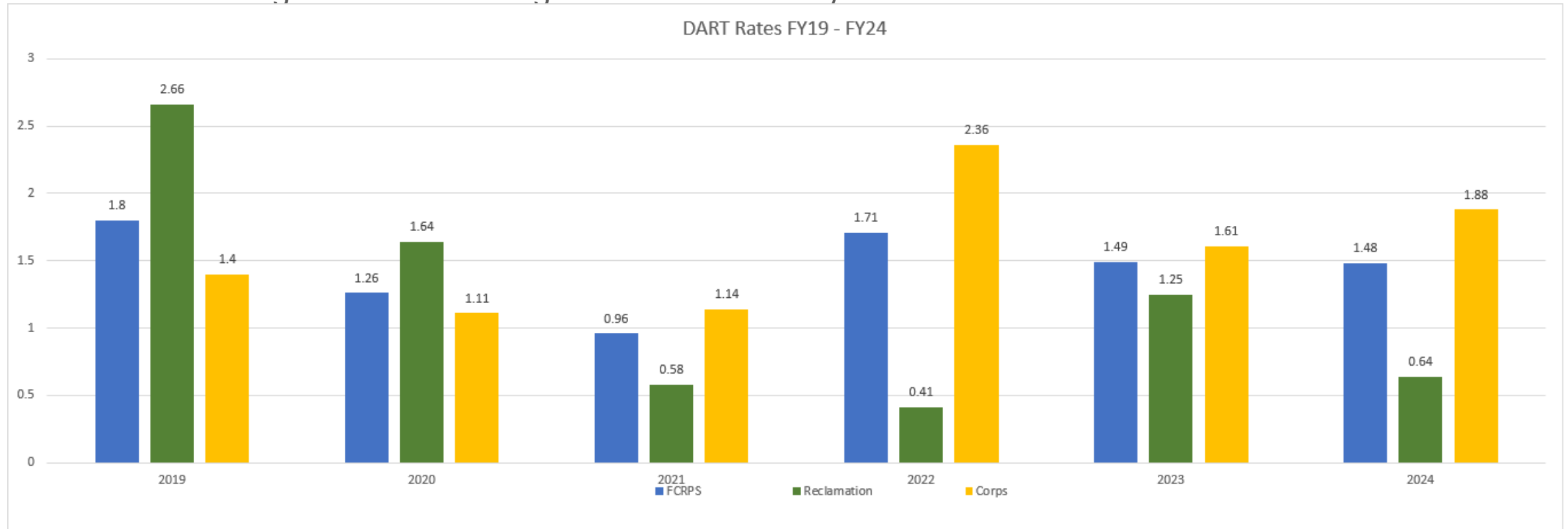
- Largest hydropower system in the U.S.
- Supplies low-cost, carbon-free power to the Pacific Northwest
- Partnership between BPA, USBR, and USACE

Program Objectives in IPR

- Continue to produce cost effective, reliable power
- Maintain strategic approach to Operations and Maintenance of hydropower facilities
- Utilize new process to build on strategic investment initiatives

Safety

- Days Away, Restricted, or Transferred
 - Min target and Stretch target are established by the Performance Subcommittee



Fed Hydro Commitment

- Safety First - protect our people and equipment
- Asset Management principles that improve efficiency, affordability and reliability
 - Process improvements for program execution
- Cost effective operation and maintenance
 - Balance cost, performance, and risk
- Risk informed investment decisions
- Deliver value to customers and stakeholders

Direct Funding History: USACE and BOR

- 1992 National Energy Policy Act
 - Section 2406: Direct Funding Legislation
 - Capital investments, operations, and maintenance
 - Power specific and joint costs
- Memoranda of Agreement between Agencies
 - Bureau of Reclamation
 - 1993: Capital
 - 1996: O&M
 - USACE
 - 1994: Capital
 - 1997: O&M

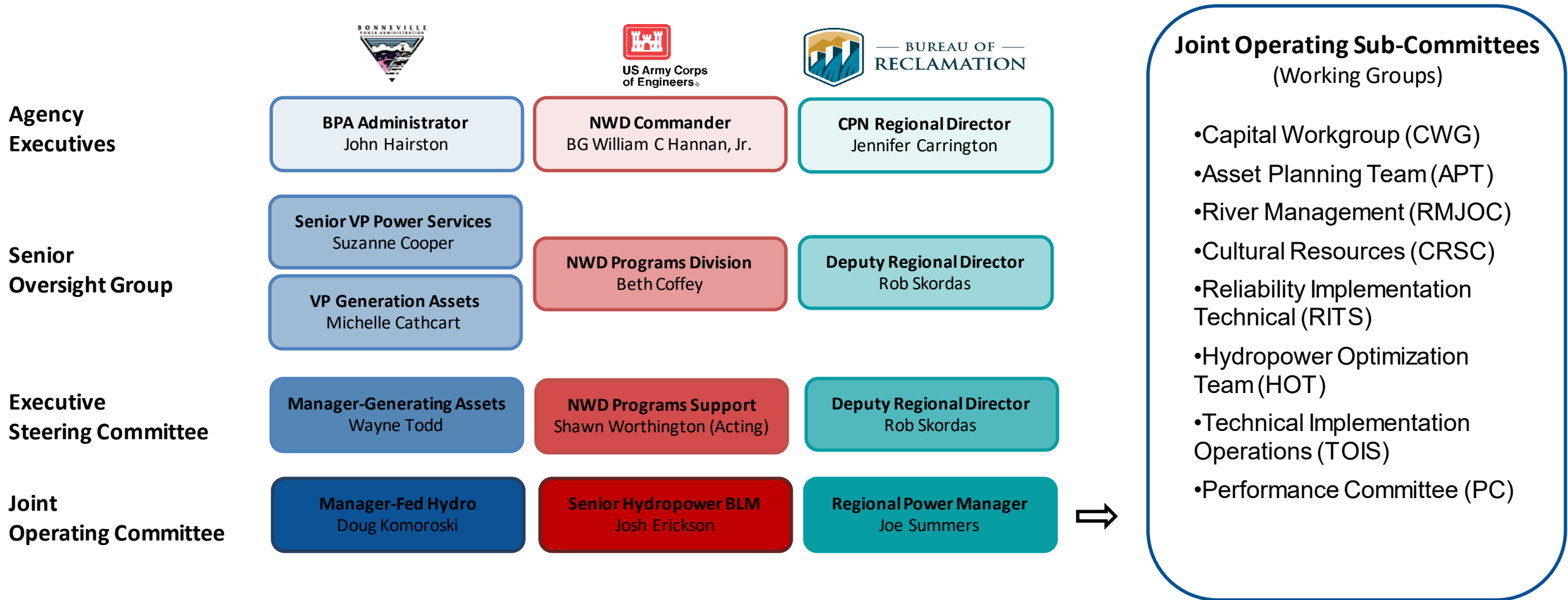


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RECLAMATION

FCRPS Organization



FCRPS Asset Management Commitment

FCRPS Asset Management Commitment

Vision

The FCRPS agencies will strive to sustain the efficiency, affordability and reliability of the System's long-term value through business processes that reflect industry best-practices in asset management. These processes include all aspects of planning, resourcing, and approving work, while informing strategies for operations, maintenance, and reinvestments of FCRPS assets.

Background

The U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and Bonneville Power Administration act together through a strong three-agency alliance as responsible stewards of the Federal Columbia River Power System (FCRPS). The FCRPS is comprised of billions of dollars in assets and provides great economic and social benefits for the Pacific Northwest and beyond.

Mission

The FCRPS exists to deliver benefits to power, irrigation, navigation, and other customers and key stakeholders. We owe it to those customers and stakeholders to proactively implement and utilize industry leading asset management practices. This will enable us to provide those products and services with the highest regard to safety, environment, reliability, reputation, and cost.

Asset Management Values

Customers

- Embrace the FCRPS' role as a service provider to a broad range of customers and stakeholders. Cultivate a culture of commitment as federal partners to deliver demonstrated value to those customers.
- Establish ourselves as competent and transparent providers of the services expected by our customers and stakeholders while being good stewards of the public's assets.

People

- Value safety above all else – every process and action first identifies risks and preventative measures to protect our greatest asset, our employees.
- Ensure that roles and responsibilities of our organizations are clear, meaningful, valuable and rewarding.
- Enable staff to exercise leadership and appropriate levels of decision-making.
- Invest in employee training and development to effectively accomplish their function.


Process/Information

- Balance cost, performance, and risk through a consistent and credible decision-making process. Key stakeholders understand and have confidence in its integrity.
- Manage and utilize information and knowledge to enable informed decisions and effective work execution.
- Leverage innovative solutions and industry best practices to continuously improve achievement of FCRPS objectives.


Plant

- Operate, maintain, and invest in our facilities to optimize their value to customers and stakeholders over the long term that is consistent with the financial health and stability of the FCRPS.
- Identify the business value of each facility, asset, and component and align performance expectations with that value, including all areas listed below:

○ Generation & Capacity	○ Environmental responsibilities
○ Cost	○ Legislative risks/requirements
○ Risk tolerance	○ Regulatory requirements
○ Health & safety	○ Cultural Resource responsibilities

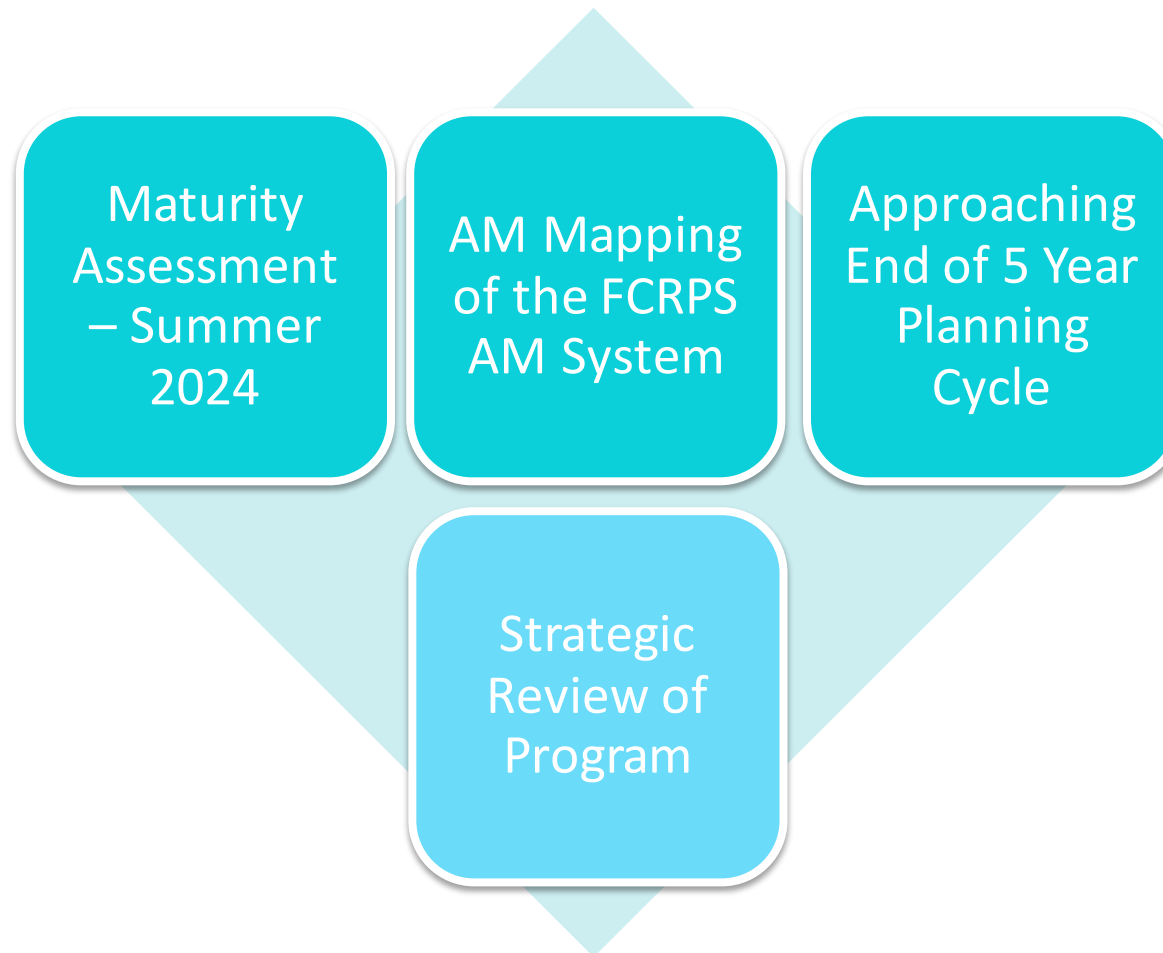

 Colonel Geoffrey Van Epps
 Commander, Northwestern Division
 U.S. Army Corps of Engineers


 Jennifer Cragg
 Regional Director
 Columbia-Pacific Northwest Region
 U.S. Bureau of Reclamation

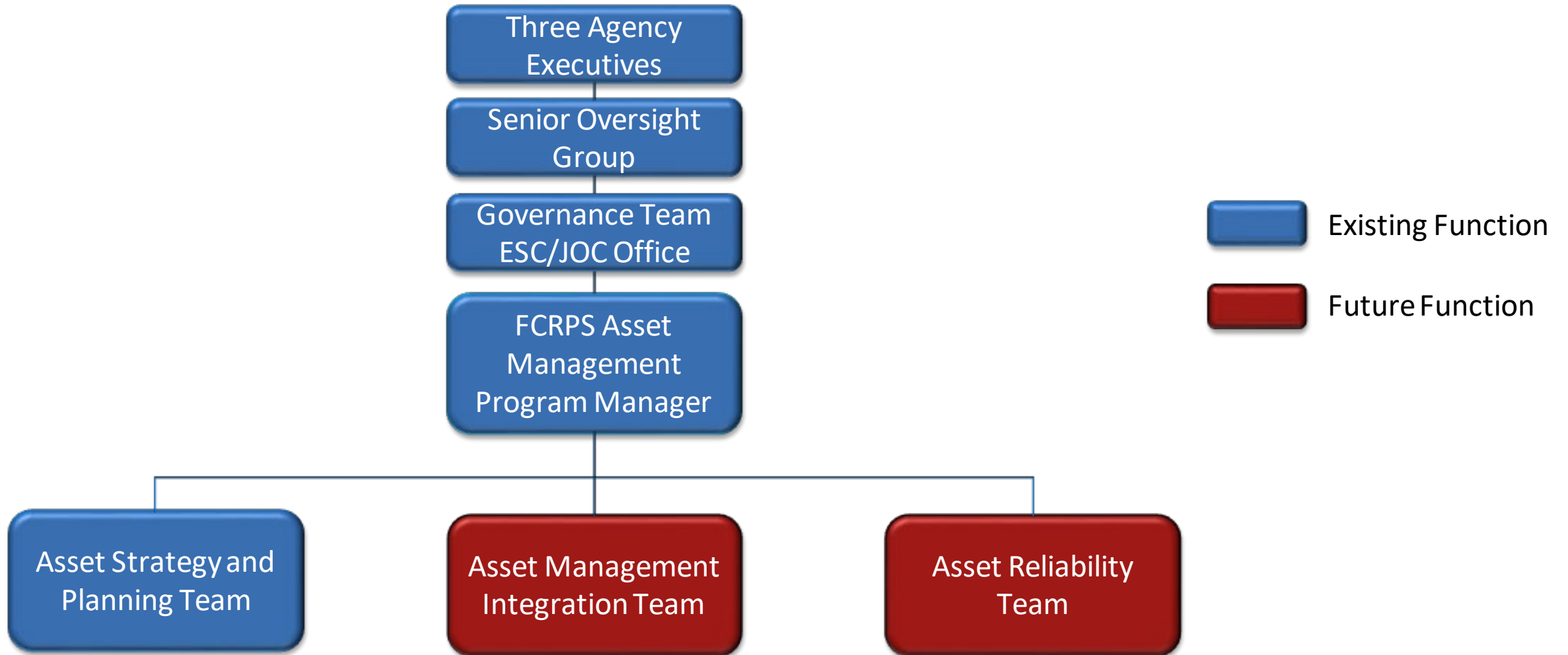

 John Hairston
 Administrator
 Bonneville Power Administration

Overall Program Condition

Time is right to reassess the direction of the program

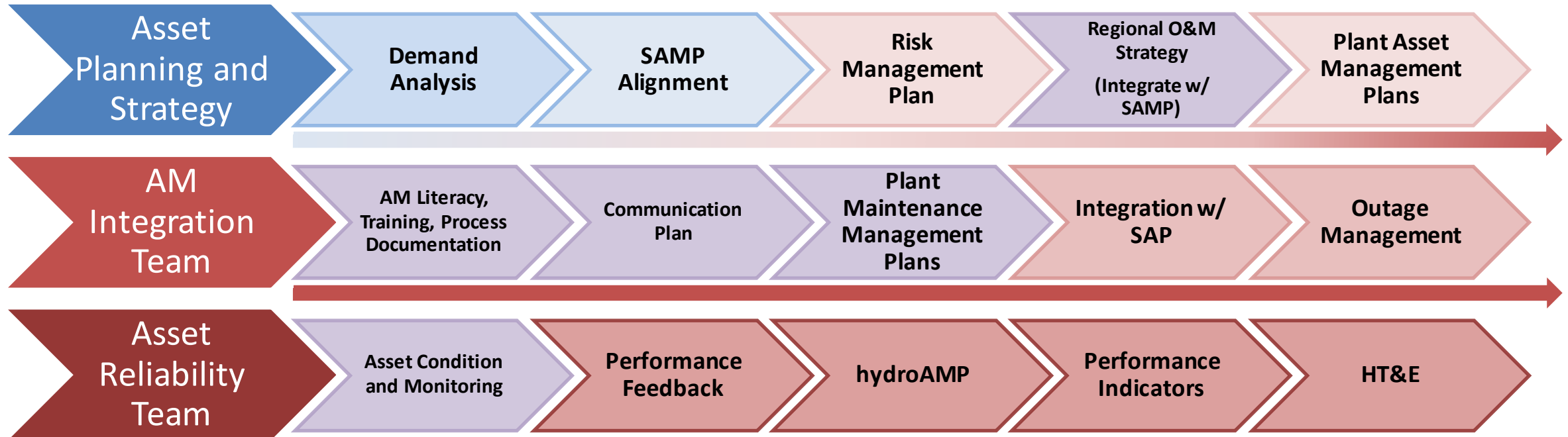


FCRPS Asset Management Structure



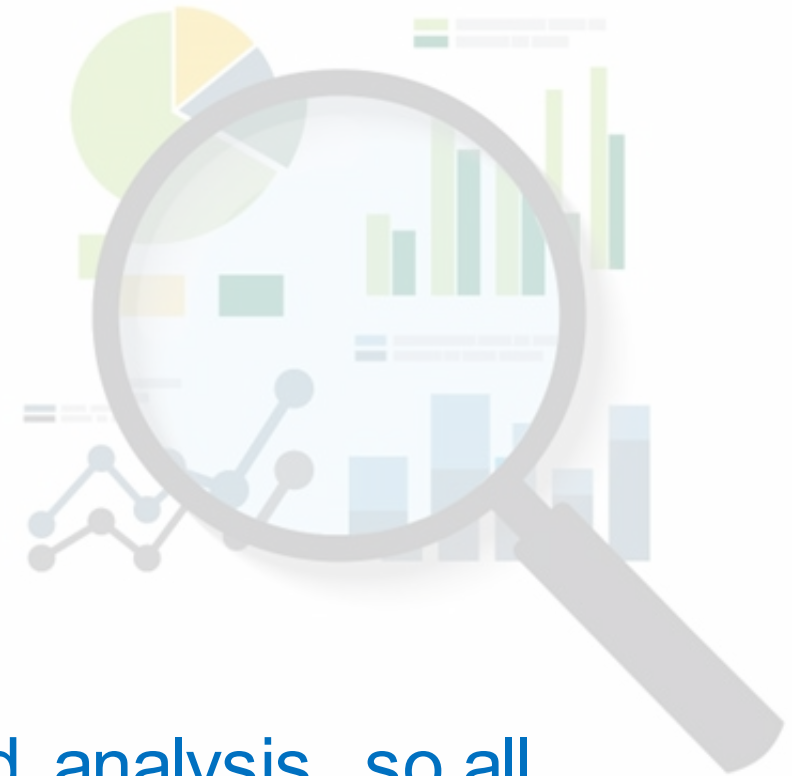
FCRPS Asset Management – Roadmap

FY24



Demand Analysis Review

- Commitment document: “Identify the business value of each facility, asset, and component”
- USACE and USBR Demand Analysis complete and represents a good step forward in this direction
- 3-agency partnership needs a strong demand analysis, so all partners understand the value that each dam provides to the PNW, and not just in power production



USBR – O&M

- **Monitoring and Analytics**
 - Piloting Condition Monitoring at three different sized facilities
 - Multiple technologies being used
 - Generator Machine Condition Monitor (in-house development)
 - SEL Real-Time Automation Controller (RTAC)
 - Doble Calisto 9 Online Transformer DGA Monitors
 - Researching Doble Calisto T1 Bushing Monitors (Next Year)
- **Data Analysis**
 - PI Historians installed at two sites
 - Working towards secure remote access
 - Plans to install predictive AI software
 - Partnership with National Labs and Institutes
 - Idaho National Labs
 - Argonne National Labs
 - Hydropower Research Institute

USBR – O&M

- Strategy
 - Hydropower Value Analysis (HVA)
 - Data Strategy Initiative
- Operations & Maintenance Improvements
 - Maintenance Improvement Initiative (MII)
 - Maximo CARMA2.0

USACE – O&M

- **Hydropower Maintenance Standards Initiative**
 - Published in 2022 as Appendix B of ER 1130-2-510 HYDROELECTRIC POWER OPERATIONS AND MAINTENANCE POLICIES
 - The hydropower maintenance standards [HMS] provides a standard baseline frequencies for 721 routine tasks across 16 asset categories
 - Air Systems
 - Breakers
 - Bulkheads
 - Buswork
 - Cranes
 - DC Systems
 - Diesel Generators
 - Disconnects
 - Exciters
 - Fire Systems
 - Generators
 - Governors
 - Relays & Meters
 - Transformers
 - Turbines
 - Water Systems
 - Implemented via Project Maintenance Management Plans (PMMP's) demonstrating how each power plant satisfies maintenance standards

USACE O&M – PMMP INITIATIVE

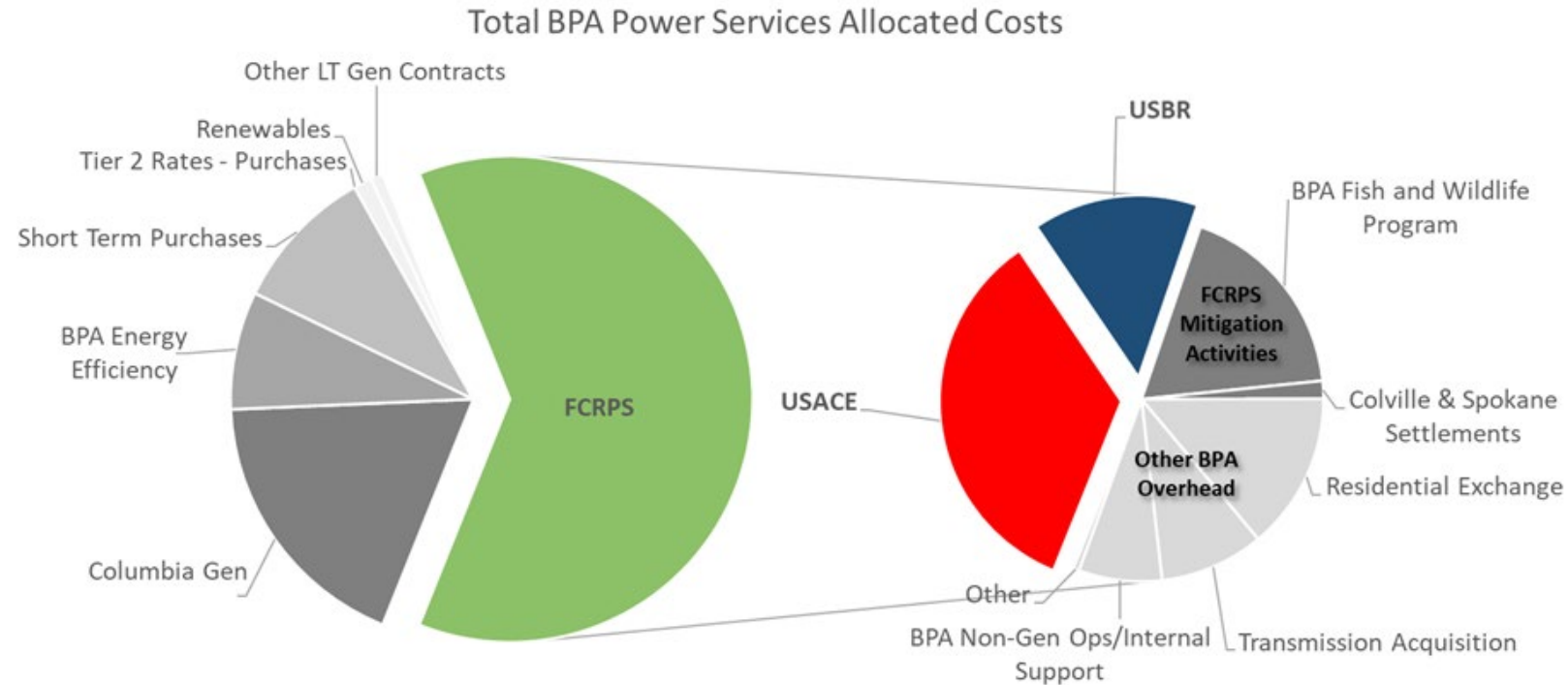
- PMMP effort:
 - Aligns our levels of maintenance with the importance of each generator that was established with the O&M Optimization Initiative [OMOI]
 - Identify opportunities to reduce O&M cost by comparing cost of maintenance practices on similar assets at different operating projects
 - Identify areas to improve the efficiency on the maintenance to sustain the desired levels of performance

USACE O&M – PMMP CURRENT PROGRESS

- Pilot effort began fall of 2022
 - 2 of the 9 pilot projects were within the FCRPS region
 - Cougar
 - Lower Monumental
 - Both projects are on track to have their PMMP report finalized and signed by this summer
- What we have learned from our pilot sites
 - PMMP ensures that operating projects are comprehensive in documenting maintenance needs (and their costs) in FEM [MAXIMO]
 - Line-by-line review of PM Job Plans triggers determination of whether each task is truly needed or provides value
 - Variance process allows for leadership to drive strategic direction into the O&M program and provides visibility into risks of our current approach
- Enterprise rollout to begin with four waves the first starting this summer

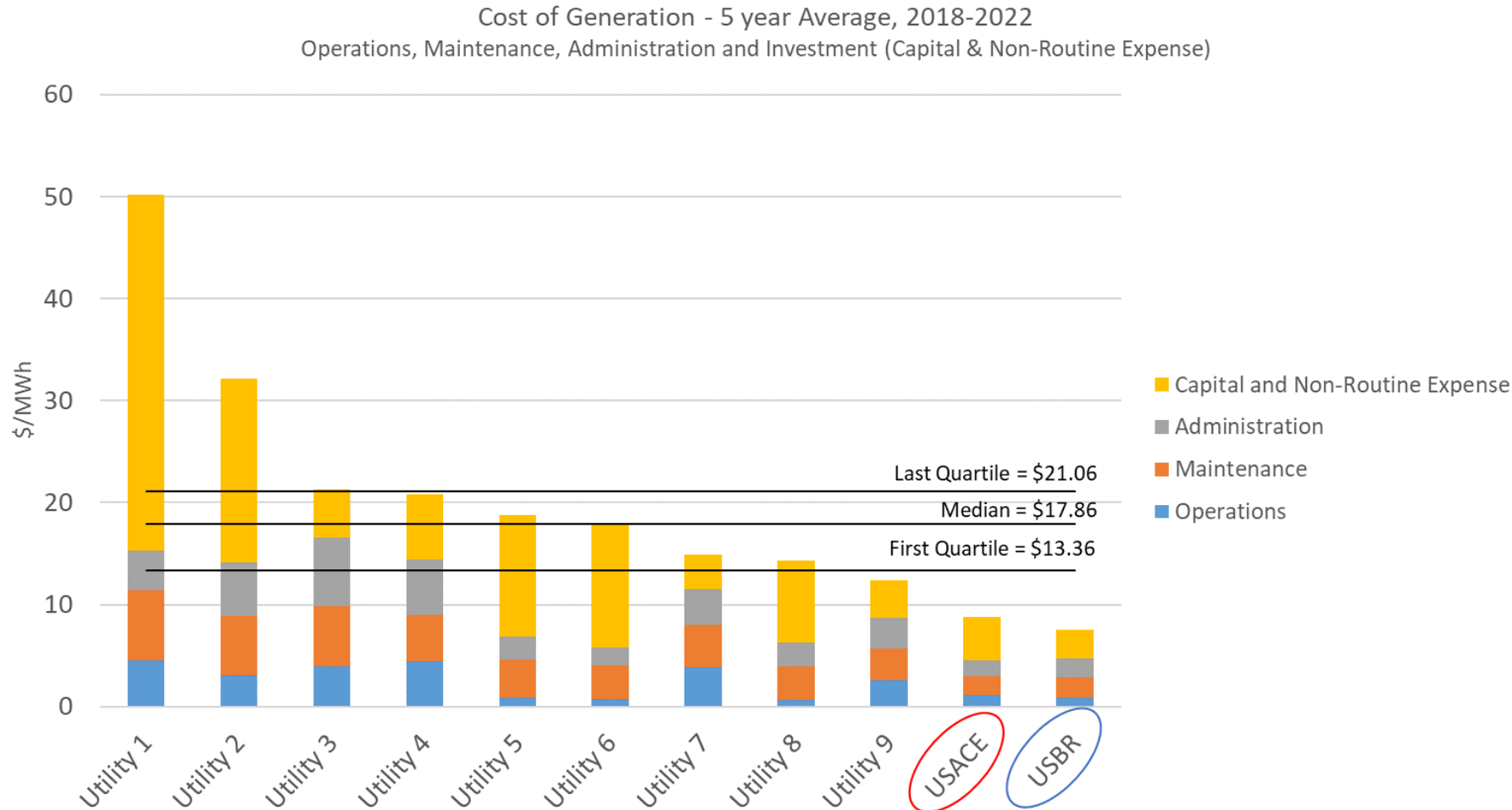
Cost Effectiveness

- FCRPS related costs represent about 62% of Power Services total costs
- USACE and Reclamation costs (O&M and Capital-related costs) represent 50% of the fully-loaded Federal Hydro System costs



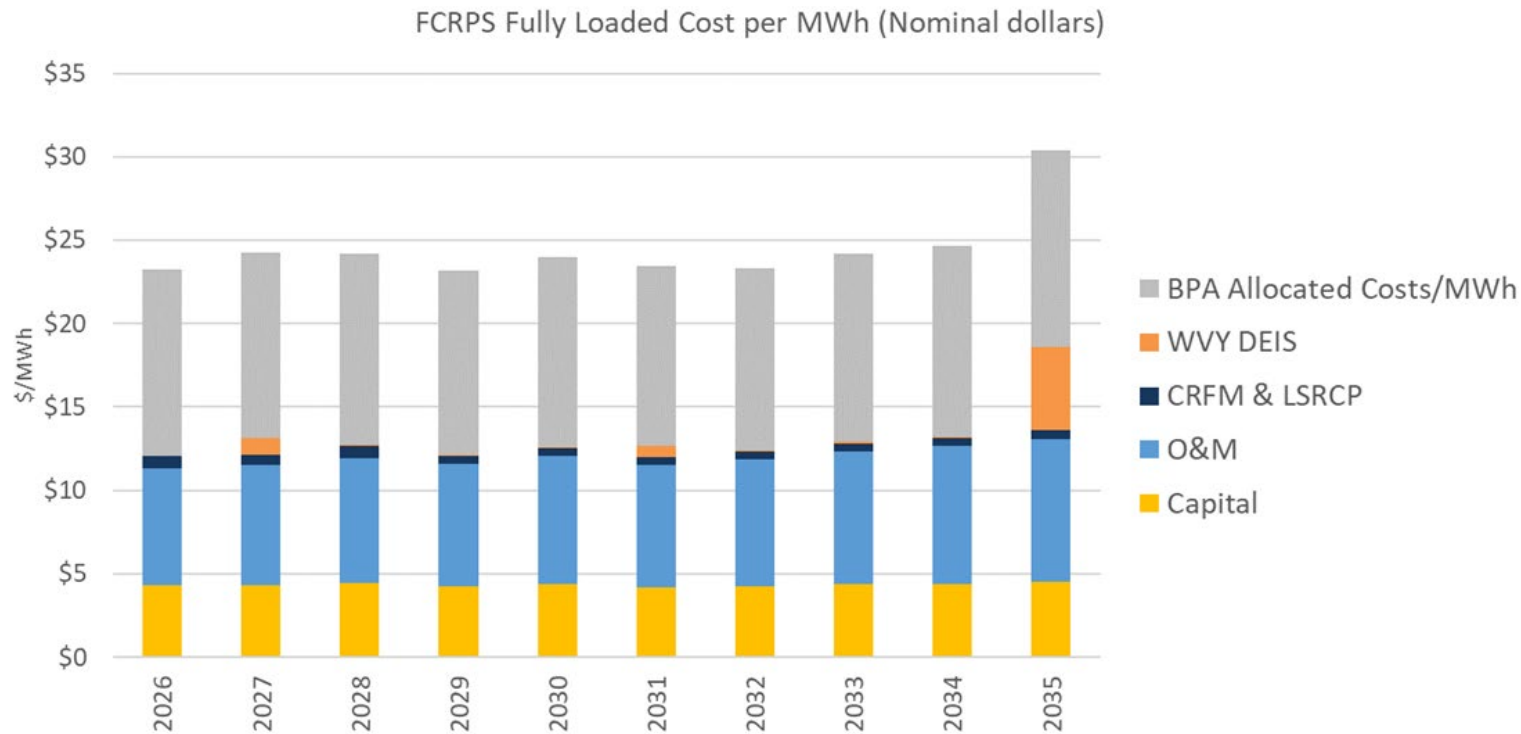
- Total Power Services costs
- Break down of all costs allocated to the FCRPS.

Cost Effectiveness



- Cost of Generation represents the Capital and O&M costs associated with producing power at the facilities
- USACE and USBR are first quartile performers among 11 North American utilities
- BPA costs (asset management, generation planning, etc.) are allocated to USACE and USBR facilities and included in benchmark costs

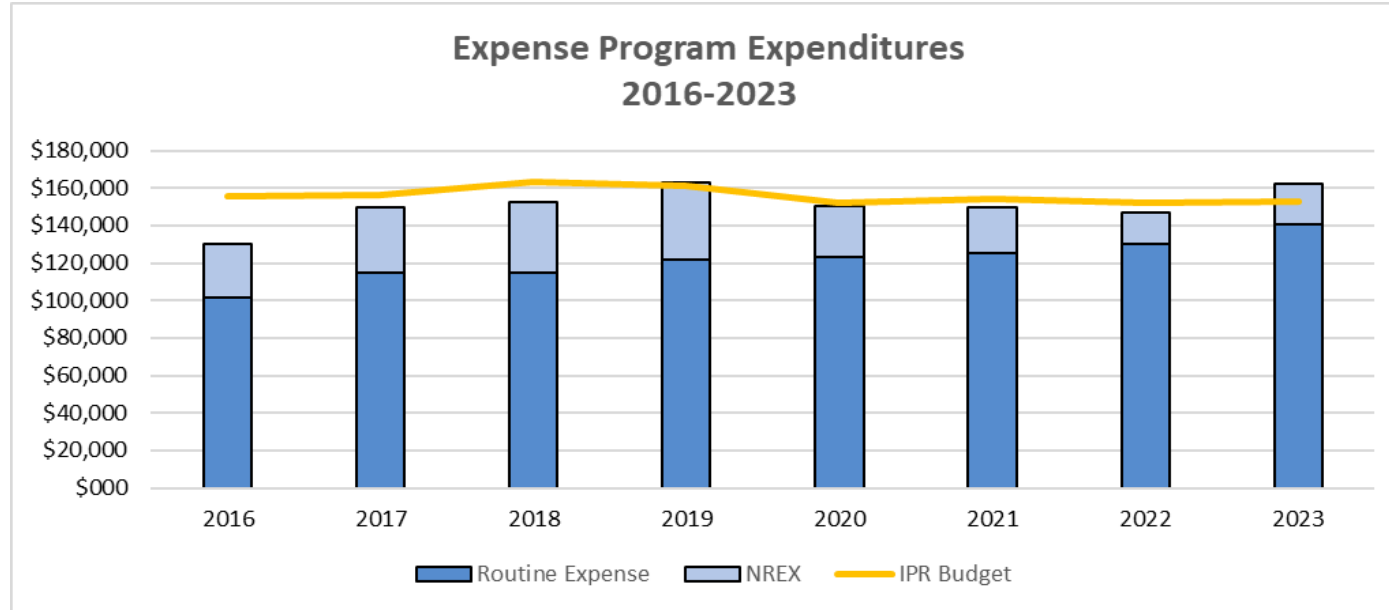
Cost Effectiveness



- Fully Loaded Cost represent all Power Services costs attributable to the FCRPS (including Fish and Wildlife)
- Increases in capital investment are offset by mitigated lost generation risk
- Average annual expense increase of approximately 5.5%

Reclamation – O&M Expenditures

- Expenditures



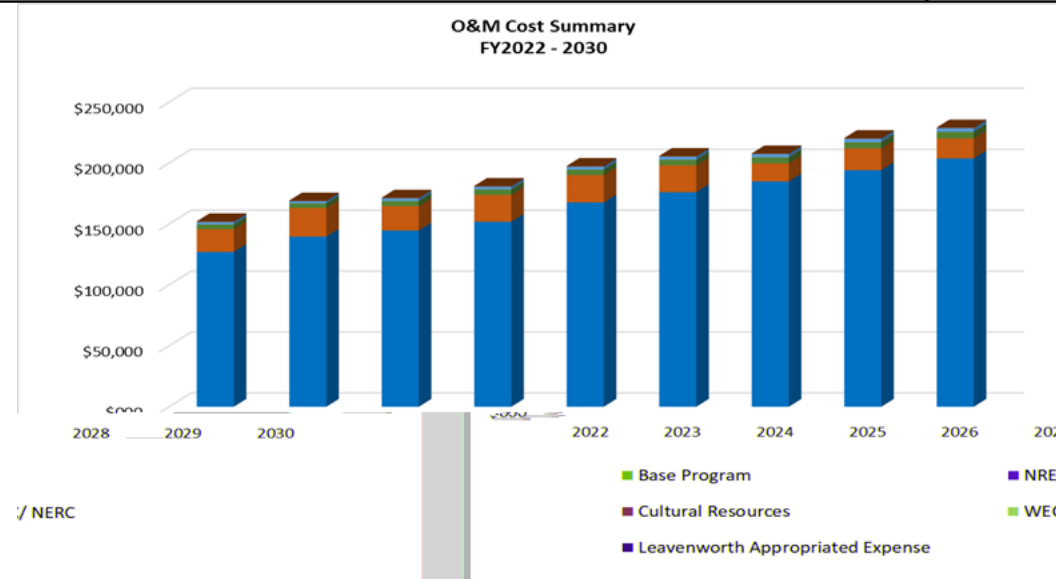
	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>
Routine Expense	\$101,617	\$114,481	\$114,817	\$121,971	\$122,862	\$125,464	\$130,249	\$140,287
NREX	\$28,591	\$35,177	\$37,288	\$40,780	\$27,204	\$24,165	\$16,515	\$21,648
Total Expense	\$130,208	\$149,658	\$152,105	\$162,751	\$150,066	\$149,629	\$146,764	\$161,935
IPR Budget	\$155,272	\$156,121	\$163,109	\$161,123	\$151,899	\$154,379	\$151,769	\$152,463

Note: 2023 WPP G22-24 Overhaul Substantially Complete. Contract closed February 2024

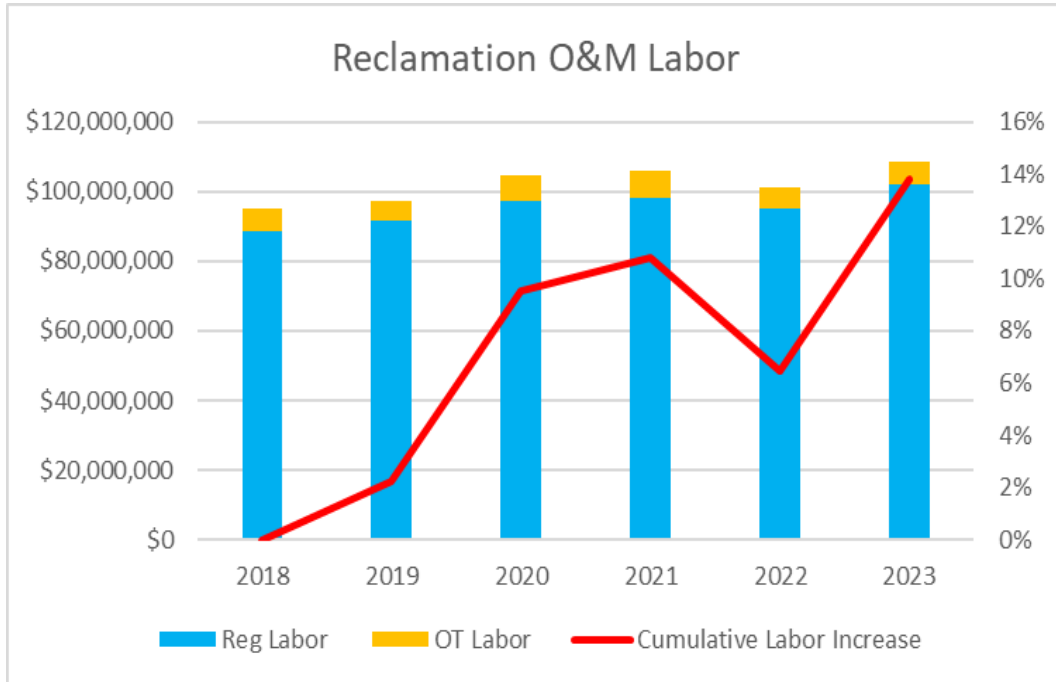
Reclamation – O&M Cost Forecast

- Reclamation Detailed Cost Forecast

Fiscal Year	Base Program	NREX	Cultural Resources	WECC/ NERC	TOTAL BOR APB EXPENSE FORECAST	Leavenworth Appropriated Expense	TOTAL FORECAST
2022	\$127,133	\$18,522	\$3,932	\$2,182	\$151,769	\$500	\$152,269
2023	\$139,672	\$23,520	\$3,700	\$1,908	\$168,800	\$500	\$169,300
2024	\$144,674	\$20,000	\$4,236	\$2,290	\$171,200	\$500	\$171,700
2025	\$151,907	\$22,000	\$4,448	\$2,405	\$180,760	\$500	\$181,260
2026	\$167,693	\$22,488	\$4,457	\$2,547	\$197,185	\$500	\$197,685
2027	\$176,078	\$21,980	\$4,680	\$2,675	\$205,413	\$500	\$205,913
2028	\$184,882	\$14,885	\$4,914	\$2,808	\$207,489	\$500	\$207,989
2029	\$194,125	\$17,835	\$5,160	\$2,949	\$220,069	\$500	\$220,569
2030	\$203,832	\$16,418	\$5,418	\$3,097	\$228,765	\$500	\$229,265



Reclamation – Labor



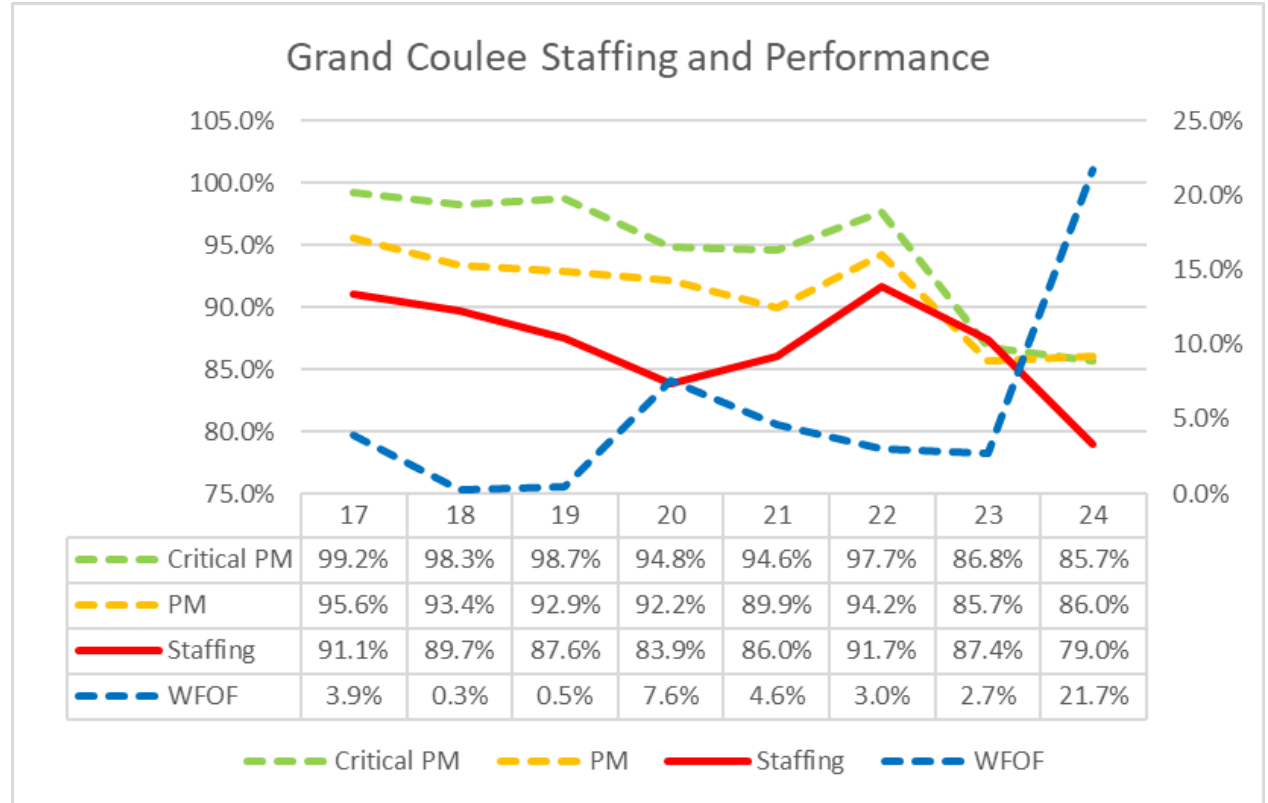
- \$13.4M Increase in Labor Costs
- Overtime at Pre-2020 Levels
- 3.8% Cumulative Increase In Labor Costs
- Overall Staffing Levels Down from 2019
- Labor Cost Increases Outpace Vacancies

- Wage Increase Summary

FY	Average Craft Wage Increase at Grand Coulee	Average Craft Wage Increase at Snake River Area Office	GS Wage Increase
2018	4.77%	2.92%	1.40%
2019	3.16%	3.00%	1.40%
2020	3.46%	2.96%	2.60%
2021	2.80%	2.93%	1.00%
2022	6.06%	8.55%	2.20%
2023	5.31%	5.25%	4.10%

Reclamation – Performance and Labor

- Declining Staff Levels
- Decreased Ability to Perform Maintenance
- Increasing Forced Outages



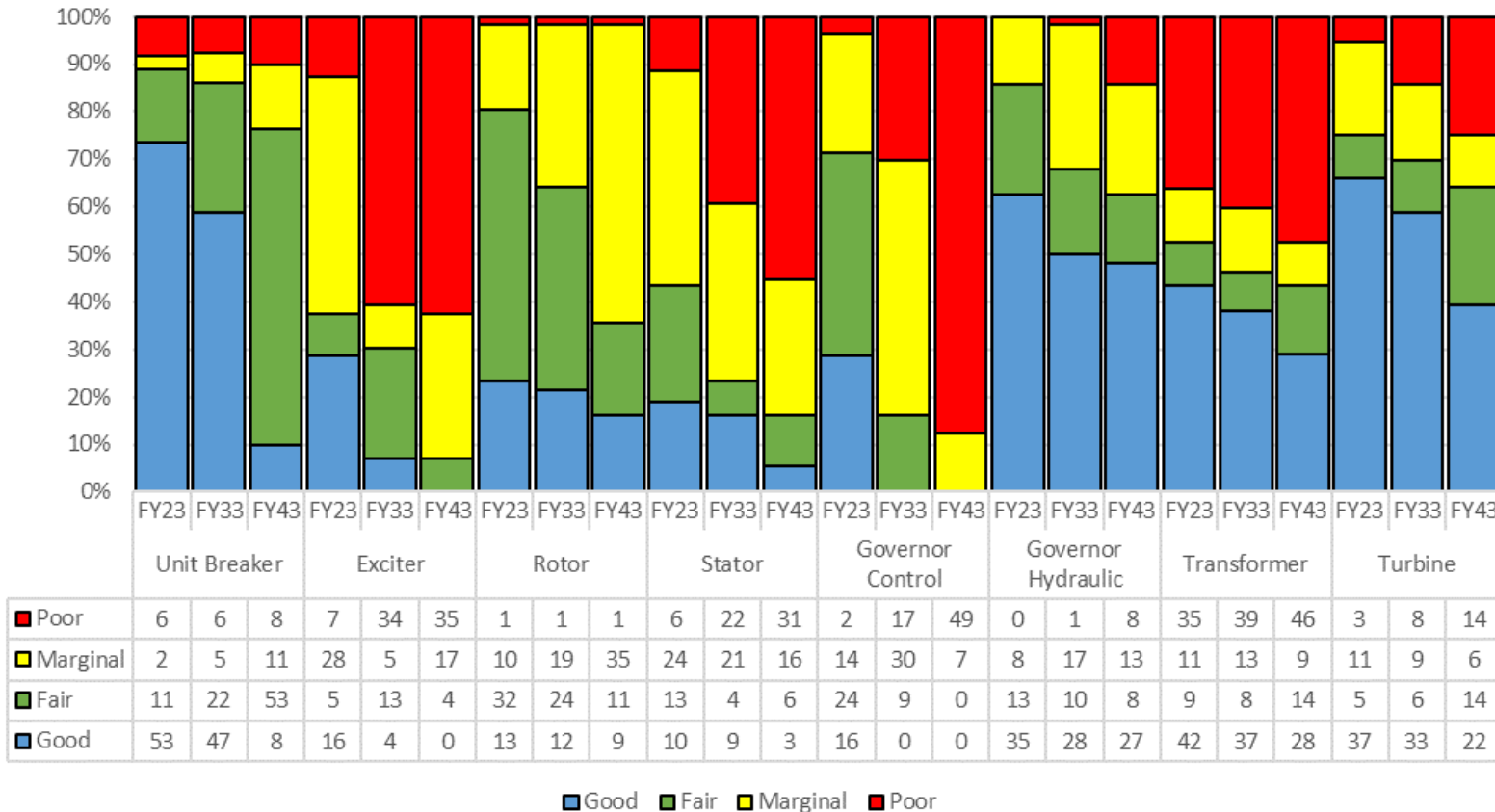
Notes:

- Left Axis Correlates to Critical PM, PM, and Staffing
- Right Axis: Weighted Forced Outage Factor (WFOF)
- FY24 Data is Thru April

Reclamation – Equipment Condition

- Critical Powertrain Equipment Condition

HydroAMP Condition Projections FY23+



- Forecast Condition Based on Predictive Lifecycle analysis and Assumes Routine O&M and Current Planned NREX Projects
- O&M, NREX and Capital Funding Needed to Address Bow Wave

Reclamation – Equipment Condition

- Poor Condition Components (Red) Planning

Asset	Rotor	Stator	Transformer	Turbine Runner			Exciter			Breakers	
	GCL 19	HGH G3-G4	GCL G21	AND G2	HGH G4	MIN G7	GCL G4 & 17	HGH G1-4	PAL G2	MIN	ROZ
Large Cap	FY27	FY30	FY24	Ongoing	FY30	FY45	Planning	FY25			
Small Cap									FY25	Ongoing	Ongoing

Notes:

- The indicated FY is year construction begins
- Planning indicates scoping is ongoing, and a schedule is not determined.
- Ongoing means construction has begun.

Facility Legend	
Anderson Ranch	ARD
Boise Diversion	BDD
Black Canyon	BCD
Chandler	CDR
Hungry Horse	HGH
Green Springs	GSP
Grand Coulee	GCL
Minidoka/Inman	MIN
Palisades	PAL
Roza	ROZ



Reclamation – Equipment Condition

- Marginal Condition Components (Yellow) Planning

Asset	Rotor		Stator				Transformer	Turbine Runner				
	GCL 10-12	G2-21	CDR G1-2	GCL*	HGH G1-2	MIN G7	ROZ G1	GCL**	GCL 19-21	GCL 22-24	HGH G1-3	AND G1
Large Cap	Planning	FY27	FY42	Planning	FY30	Planning	Planning	Ongoing	FY27	Ongoing	FY30	Ongoing
Small Cap												

* GCL Stators: G1-3, 6, 8, 11, 13, 17

** GCL Transformers: 3, 7, 12, 14, 16 (long lead time expected)

Asset	Exciter		Breakers		Governor Controls			Governor Hydraulics			
	GCL G1-18	PAL G1, 3-4	MIN	ROZ	MIN G6-7	CDR G2	BDD G1-3	HGH G1-4	BDD G2	HGH G1-4	MIN G6
Large Cap	Planning				Planning	Planning	Ongoing	Ongoing	Ongoing	Ongoing	Planning
Small Cap		FY25	Ongoing	Ongoing							

Notes:

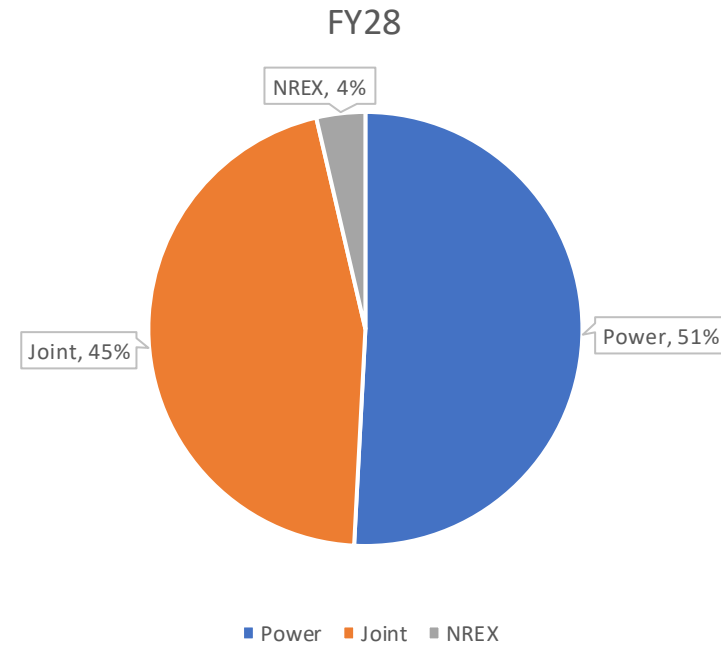
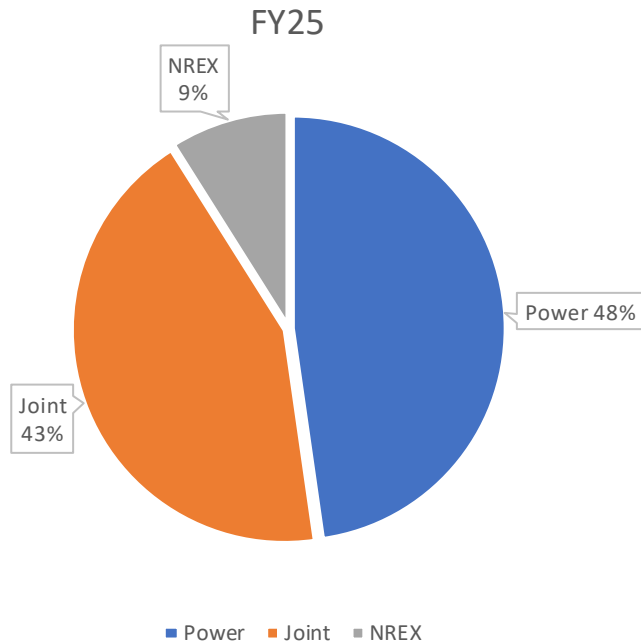
- The indicated FY is year construction begins
- Planning indicates scoping is ongoing, and a schedule is not determined.
- Ongoing means construction has begun.

Reclamation – Major NREX Projects

Facility	Activity	FY24	FY25	FY26	FY27	FY28
AND	Radial Gate Coating				Acquisition	Acquisition
BCD	Switchyard Grounding Modernization	Acquisition	Construction	Construction		
BCD	Drum Gate Coating Repair (AP2759)		Scoping			
BCD	Drum Gate Rehab (AP6423)			Scoping		
BCD	Intake Gate Repair (2760)			Acquisition	Construction	Construction
CDR	Penstock Lining		Acq/Const			
ROZ	Penstock Lining				Acq/Const	
HGH	Fixed Wheel Gate Refurbish (AP2793)	Design	Construction			
HGH	Penstock Recoating	Design	Acquisition	Construction	Construction	Construction
HGH	Parking Lot Chip Seal (AP6544)	Design	Construction			
HGH	Left Abutment Rock Scaling/Netting	Scoping	Acquisition	Construction	Closeout	
HGH	Visitor Center Rehab and HVAC (AP2790)		Construction			
HGH	Selective Withdrawl Refurbishment		Acquisition	Construction	Construction	Closeout
HGH	Road Asphalt SWYD, VSB, PP (AP2792)			Design	Acq/Const	
HGH	Hollow Jet Valve and Outlet Tube Refurb				Planning	Design
HGH	Lighting Distribution Panel				Planning	Design
HGH	Spillway Refurbishment				Planning	Design
HGH	Sump Pump Motors				Design	Acquisition
GCL	PGP Rev Flow Coaster Gates	Construction	Construction	Construction	Construction	Construction
GCL	PGP Discharge Tube and Recoating	Construction	Construction	Construction	Construction	Construction
GCL	Power Circuit Breaker Reconditioning	Acquisition	Construction	Construction	Closeout	Closeout
GCL	G1-18 Paint Penstocks	Construction	Construction	Construction	Construction	Closeout
GCL	Left Stairway Replacement	Acquisition	Construction			
GCL	PGP Siphon Breaker Upgrades	Scoping	Design	Design	Design	Design
GCL	PG10 Head Cover		Design	Design		
GCL	WPP Fixed Wheel Gate Refurbishment			Scoping		
GCL	RPH Stairway Upgrade			Design	Construction	

USACE O&M Budget Summary

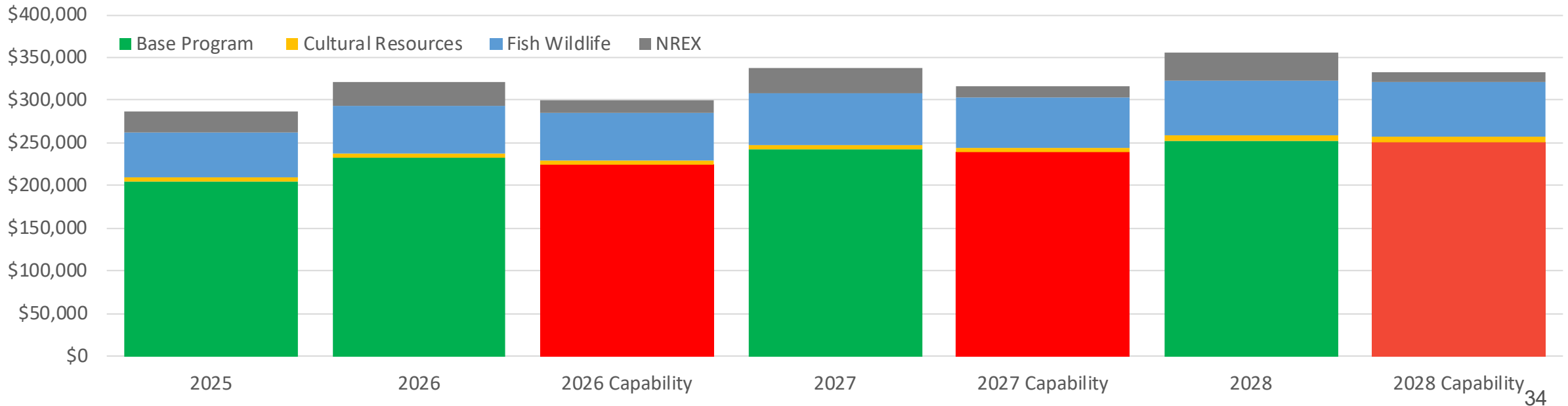
- Sustain O&M program to current levels to maintain reliability
 - Balance: No growth in staff and Increased labor rates
- Meet new and existing environmental requirements
- Focus on protecting workforce and public
- To minimize impacts of labor rates we plan to reduce commitments in NREX



USACE O&M Forecast

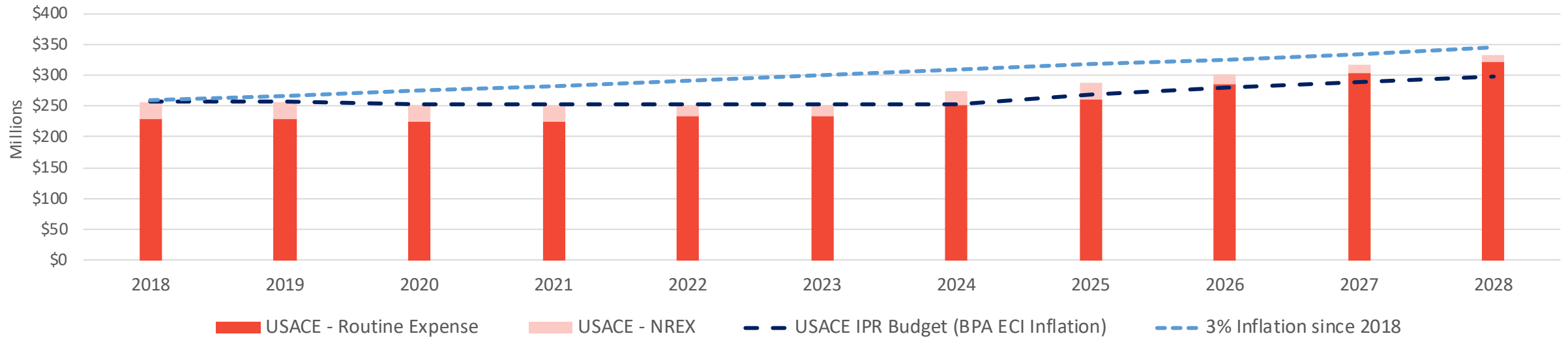
- USACE Proposed and Updated Capabilities

FY	Base Program	Cultural Resources	Fish Wildlife	NREX	Total USACE APB Expense Forecast
2025	\$205,387	\$4,520	\$51,557	\$25,435	\$261,464
2026	\$232,556	\$4,982	\$55,441	\$28,367	\$292,979
2026 Capability	\$225,174	\$4,982	\$55,441	\$15,000	\$285,597
2027	\$242,616	\$5,327	\$59,785	\$30,487	\$307,728
2027 Capability	\$238,837	\$5,327	\$59,785	\$12,000	\$303,949
2028	\$252,649	\$5,691	\$64,374	\$32,727	\$322,714
2028 Capability	\$251,056	\$5,691	\$64,374	\$12,000	\$321,121



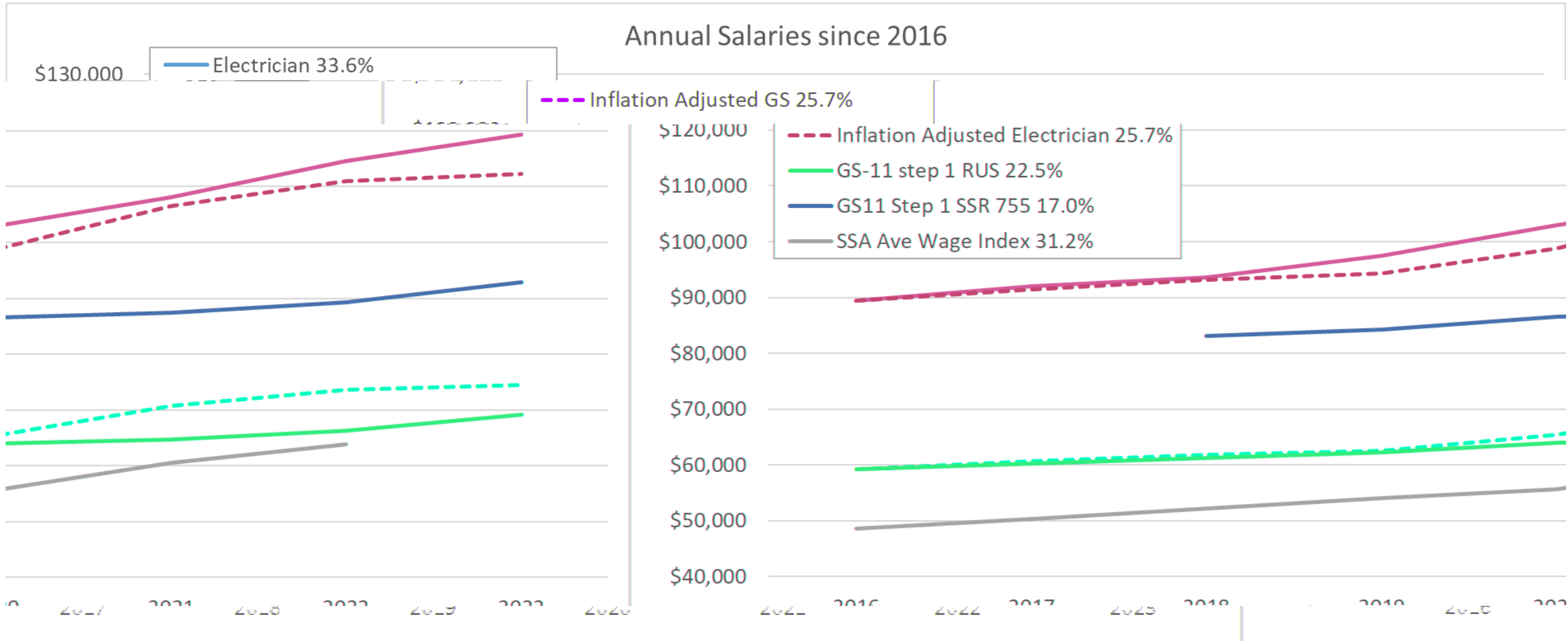
USACE O&M Historic Budget and Forecast

Expense Program Expenditures and Forecasts
2018-2028



(All values x1000)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
USACE - Routine Expense	\$227,957	\$227,957	\$224,457	\$224,457	\$233,572	\$233,057	\$252,450	\$261,464	\$285,598	\$303,949	\$321,121
USACE - NREX	\$28,100	\$28,100	\$28,100	\$28,100	\$18,985	\$19,500	\$20,987	\$25,435	\$15,000	\$12,000	\$12,000
USACE IPR Budget (BPA ECI Inflation)	\$256,057	\$256,057	\$252,557	\$252,557	\$252,557	\$252,557	\$252,557	\$269,392	\$278,794	\$288,105	\$297,671
3% Inflation since 2018	\$258,510	\$266,265	\$274,254	\$282,481	\$290,956	\$299,684	\$308,675	\$317,935	\$324,365	\$334,096	\$344,119

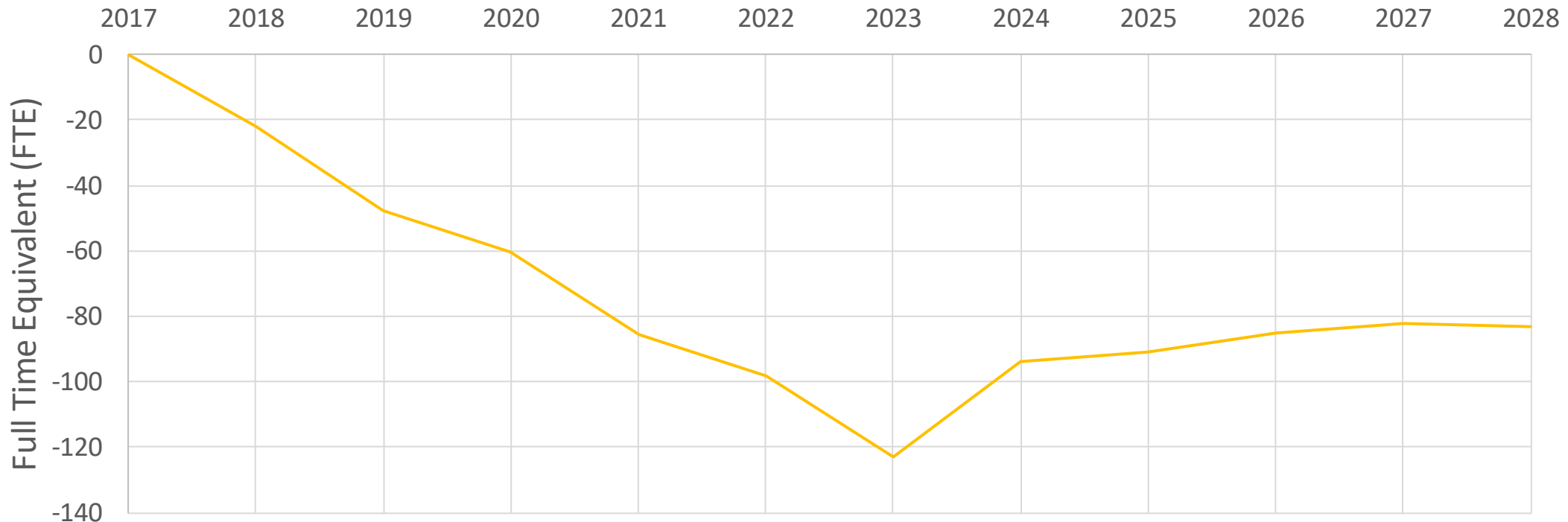
USACE – Labor Costs



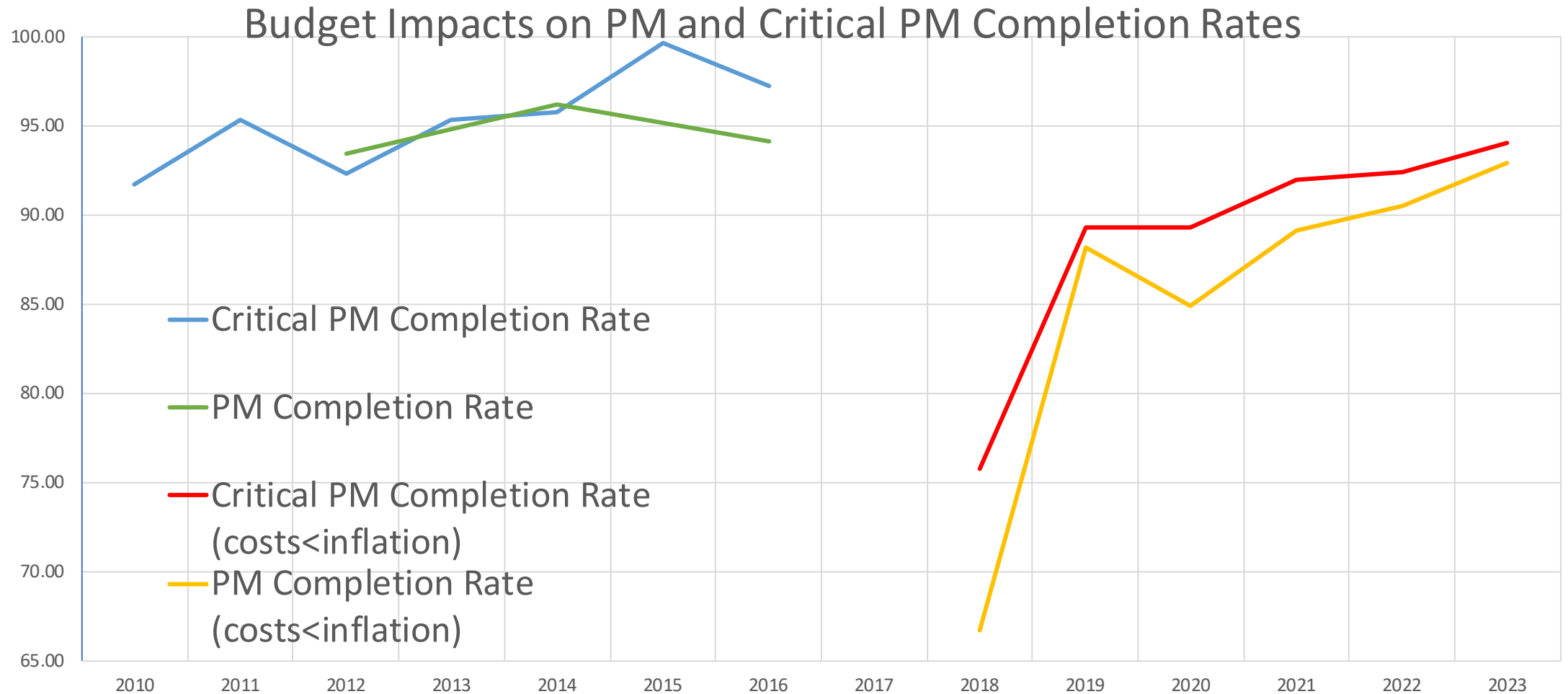
USACE – Staffing

- Labor force has been reduced ~123 FTE however labor costs remain the same
- Material prices and contract costs continue to escalate
- Labor costs represent 84% of the budget for hydropower and 51% for joint efforts
- In FY22/23 labor costs increased 13% for hydropower and 10% for joint

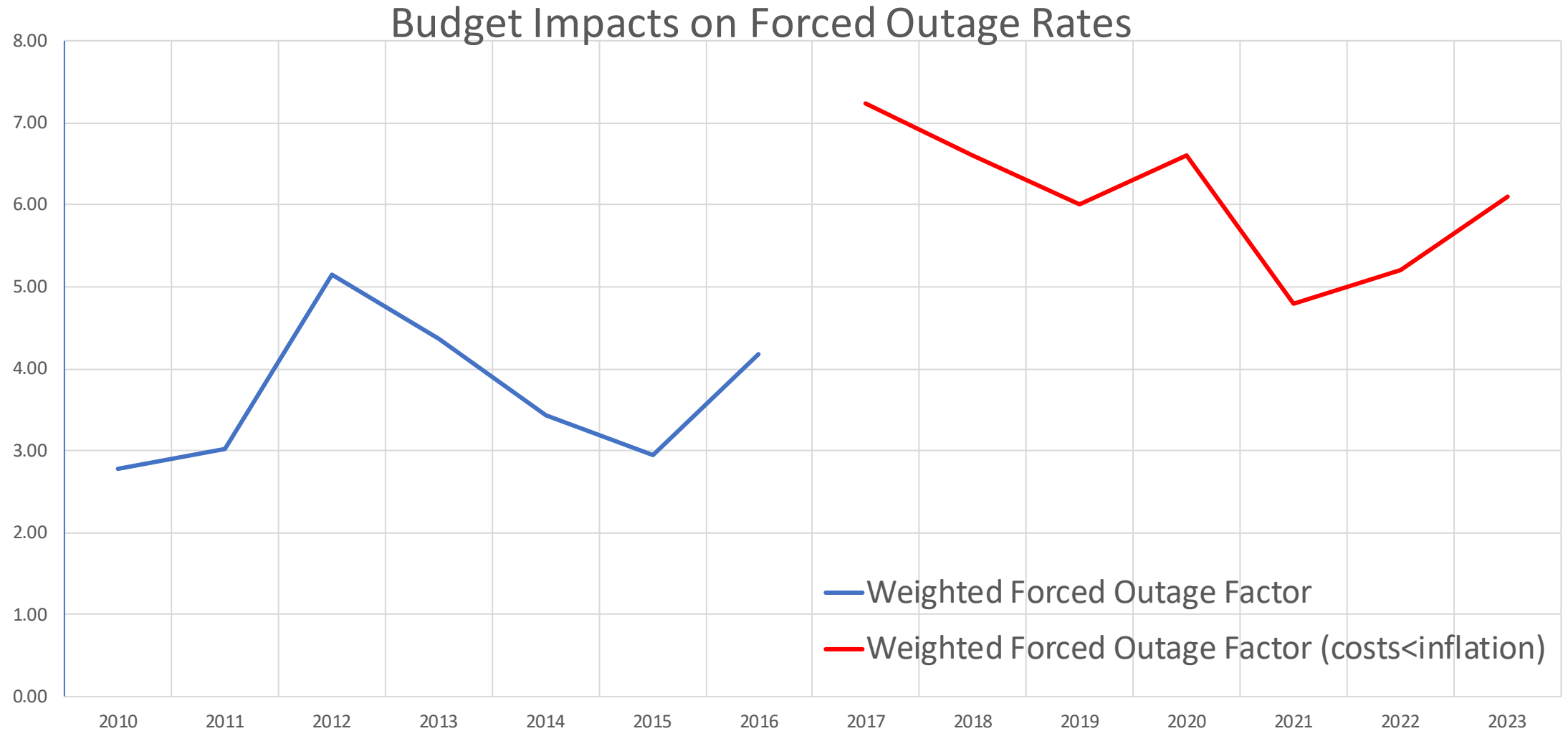
USACE FTE Reductions



USACE – PM and Critical PM History



USACE – Forced Outage Rates



USACE O&M Summary

Opportunities if proposed forecasts are increased

- Increased ability to support the Capital Program
- Decreased forced outages
- Increased reliability
- Reduction of unpredictable equipment failures
- Reduced exposure to Cyber and Physical Security Threats
- Increased ability to train staff
- Improved staff retention
- Bolster Critical spares inventories
- Improved ability to maintain safety standards

USACE – Major NREX Projects



McNary

- GSU T1-T7 Oil Leak Repair
- Tennessee Valley Authority (TVA) is on site completing repairs



Lower Granite

- LWG GSU T1 & T2 Transformer Repair and DGA Install
- Construction in progress



Albeni Falls

- Spillway Gate Recoating and HSS weld repair
- On-site HSS inspections with paint removed revealed structural issues



John Day

- Fish Pumps emergency repair
- Scoping and design in progress
- MU10 & 13
- Headcover leak repairs



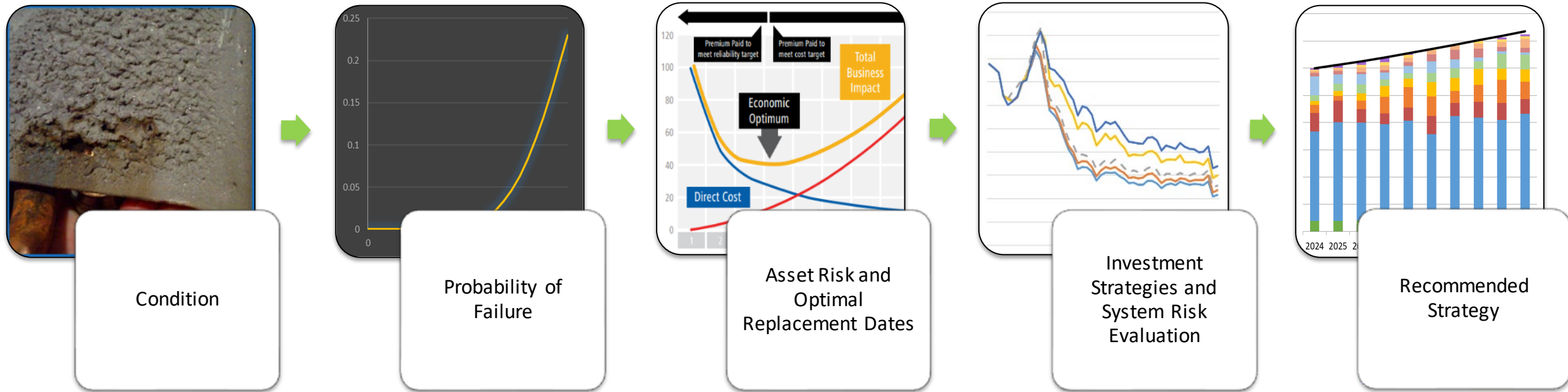
Bonneville Powerhouse 1

- Oil Accountability Inspections and Repairs
- Scoping and repairs in progress

USACE – Future NREX Potential Projects

- ALB Main Unit Blade Seals
- ALB Trash racks
- BON 1 A Branch AWS Repair
- BON 1 Gantry 3 Corrosion Prevention
- BON 1 Preferred AC/DC Improvement
- BON 1 Spillway Gates
- BON 1 Spillway Rock Removal
- BON 2 Forebay Dredging - 1st periodic
- BON 2 Forebay Dredging - 2nd period
- CHJ Intake Gates Rehabilitation
- CHJ Penstock Seals Units 17-27
- CHJ SF6 Breaker Refurbishment
- CHJ Turbine Runner Cavitation Repair Units 17-27
- DWR Clean Foundation Drains
- IHR Turbine Runner Design & Repl. Units 1,2,3
- JDA Bridge Crane Rails
- JDA Fish Pumps Emergency Repair
- JDA Main Unit 7 Generator Repair
- LGS Foundation Drain Sealing
- LGS MU 1-6 Discharge Ring Upgrade and Turbine Blade Cavitation Repair
- LIB Powerhouse Joint Sealant
- LIB Selective Withdrawal Pressure Relief Bulkheads
- LIB SF Breaker
- LIB T1 Transformer
- LIB T2 Transformer Rehabilitation
- LWG U4 Thrust Bearing Replacement and Spare Rehab
- MCN Machine Shop Temporary Roof Repair
- MCN Powerhouse Bridge Crane Spare Wheels
- TDA East and North Fishway Diffuser Valves
- TDA Headgate Rehabilitation
- TDA Thrust Bearing Oil Coolers MU 1-14

Capital Investment Strategy Development



Strategic Asset Management Plan (SAMP) – Capital Forecast Process

Asset Condition

Jim's Sample Utility > Region 2 > Area Office 1 > Plant 5 > Powerhouse > Powertrain (incl.Main, SS, & Fish) > Turbine Runner (Francis) > UNIT 2

+ New Assessment Assessments: Feb. 24, 2021, 12:37 p.m. Turbine Runner (Francis)

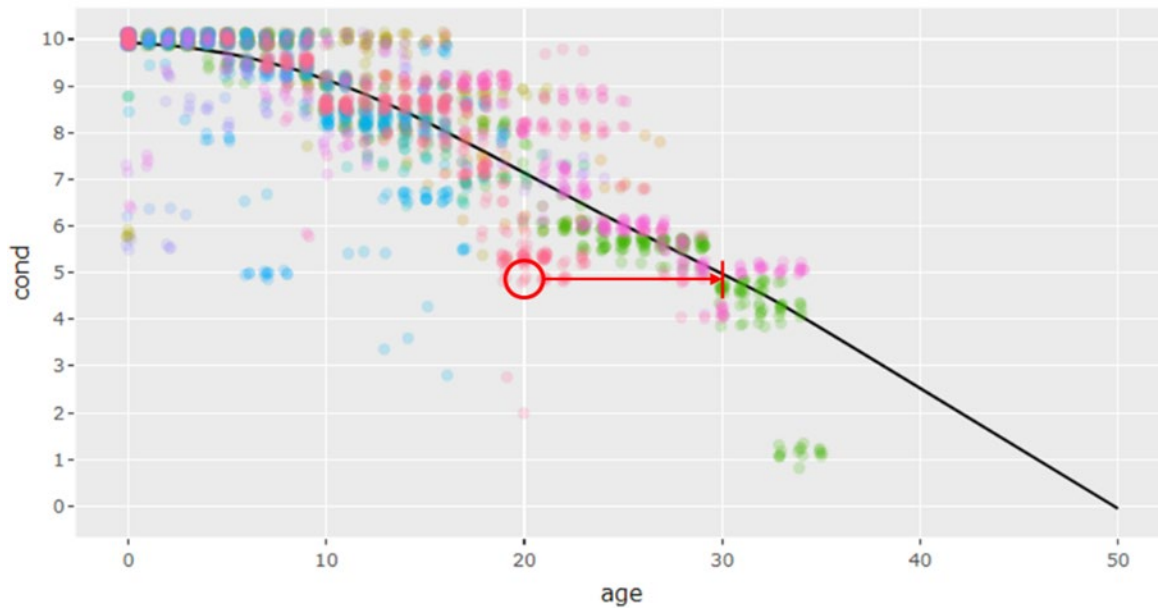
ASSESSMENT NOTES ATTACHMENTS AUDIT ASSET DETAILS

In Service Year	2021	3.0
Maintenance History Scoring	(3) Only maintenance that would be scheduled for a new unit is required. Any cavitation repair	3.0
Operational Performance Scoring	(1) Moderate operating limitations or effects in excess of any restrictions when the unit was ne	1.0
Physical Condition - Surface Scoring	(3) Frosting only (in small areas)	3.0
	(3) Frosting only (in small areas)	3.0
	(2) Visible pitting or loss of thickness up to a depth of 10% of the section thickness	
	(1) Loss of cross sectional thickness is greater than 10% but less than 25%, and not in high stress area	
	(0) Loss of cross sectional thickness is greater than 25%, or significant loss in high stress area	
Data Quality Indicator	(10) All Tier 1 inspections, tests and measurements were completed within the normal testing t	10.0
Tier 2 Turbine Runner (Francis) Condition Assessment		
Additional Physical Inspection Scoring	(0) No significant change from what was determined in Tier 1	0.0
Additional Crack Evaluation Inspection Scoring	(-1) Moderate concern to structural integrity of the runner or the risk of future failure	-1.0
Paint Film Quality Test		0.0
Other Specialized Diagnostic Tests		0.0
Tier 1 Condition Index		9.0

- Asset health is assessed with the hydroAMP condition assessment framework
- Condition is assessed for 10,000+ assets/systems of assets
- hydroAMP is a hydro industry framework that provides guides to objectively assess equipment condition

Asset Probability of Failure

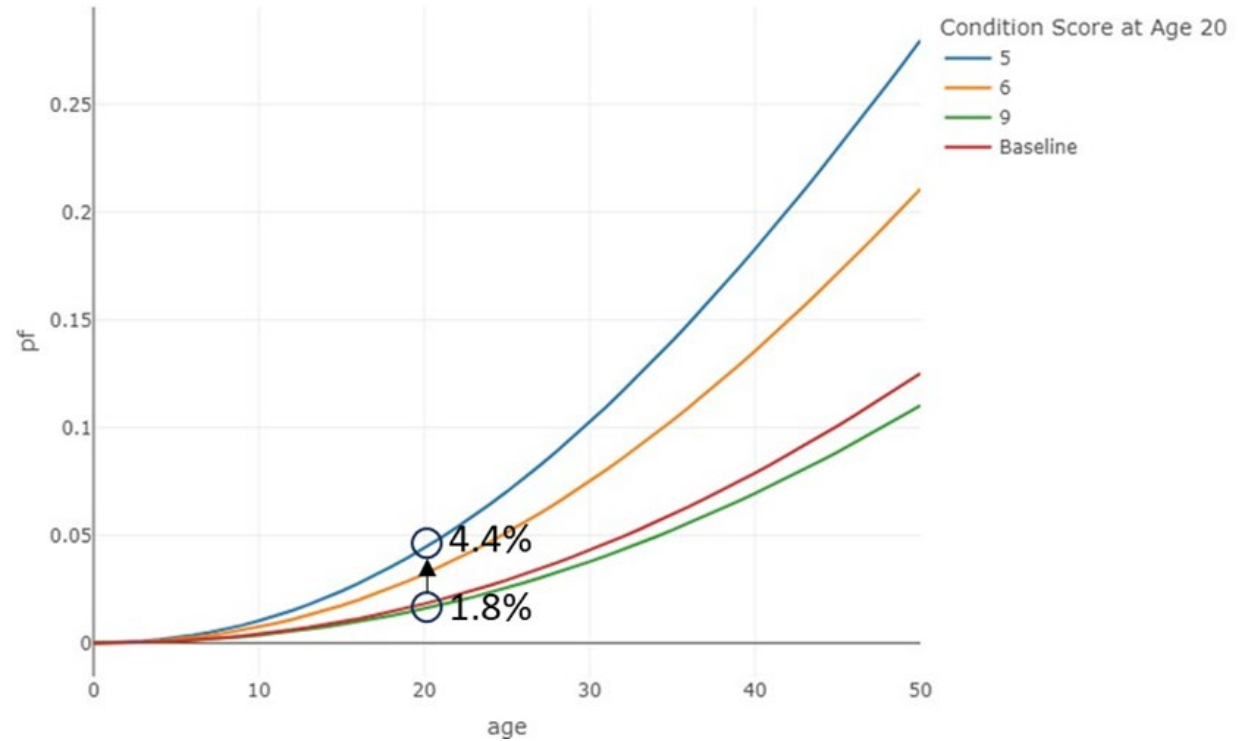
Actual Conditions vs Expected Condition Curve



Actual condition relative to expected condition shifts baseline failure curve for each asset



Probability of Failure Modification



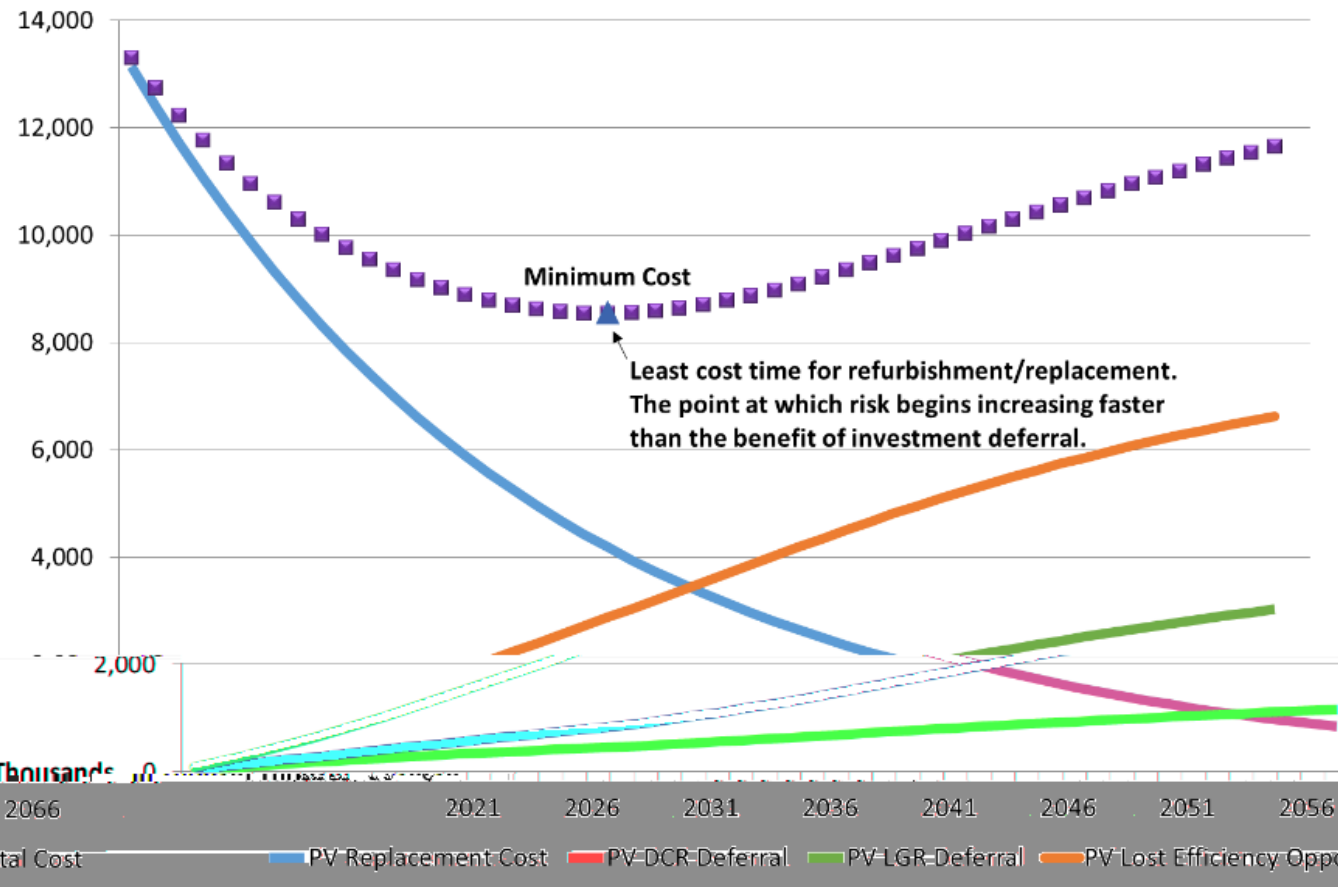
Creates a unique failure curve for each asset based on its latest condition assessment

Asset Risk and Optimal Intervention Calculation

Example Asset (Condition Score of 10)

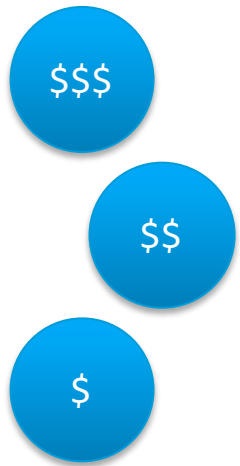
Factors contributing to optimal replacement timing:

- Lost Generation Risk (LGR)
- Direct Cost Risk (DCR)
- Lost Efficiency Opportunity
- Asset Replacement Cost

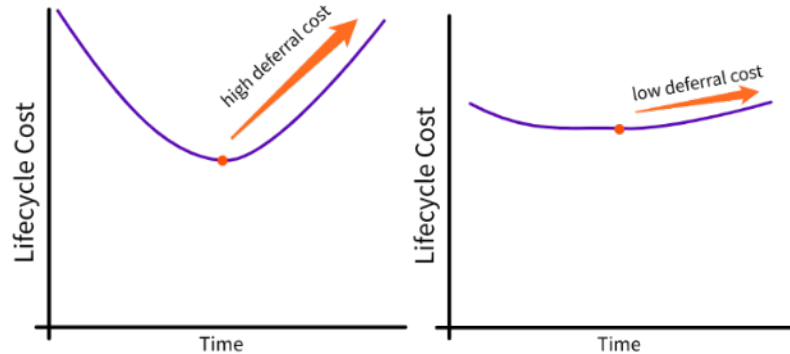
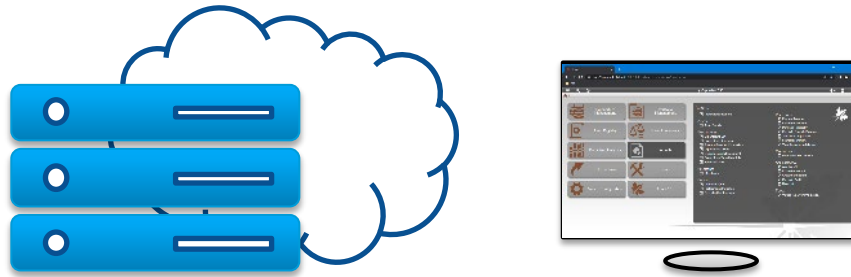


Capital Budget Alternatives Analysis

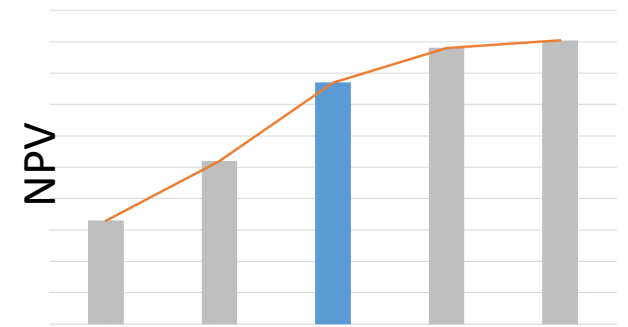
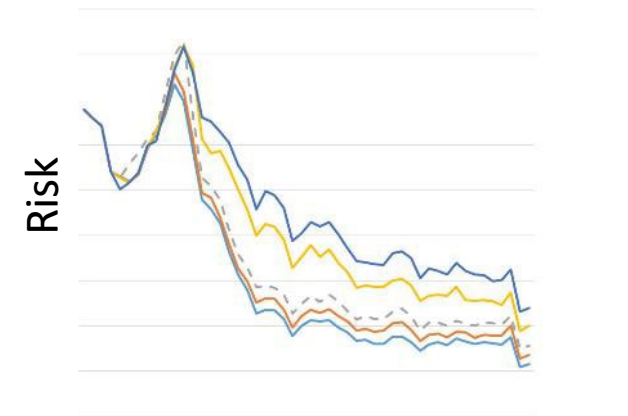
Evaluate different levels of investment



Model asset replacements under each investment level

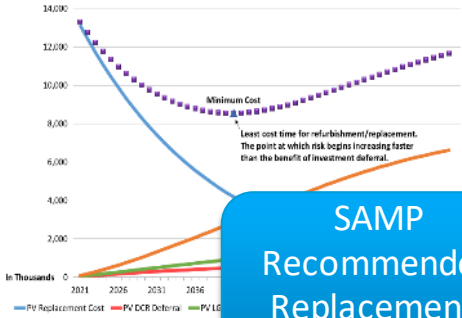


Evaluate impacts on condition, risk, and value

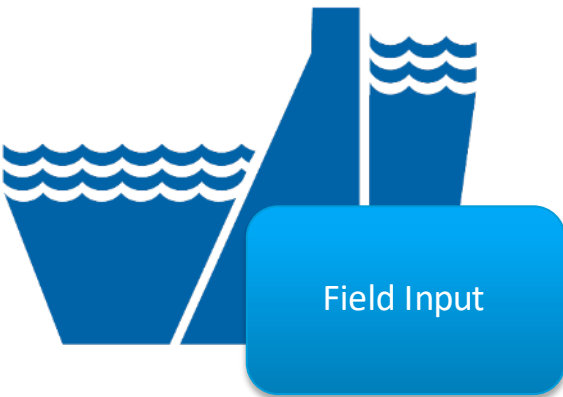


SAMP Recommended Strategy 47

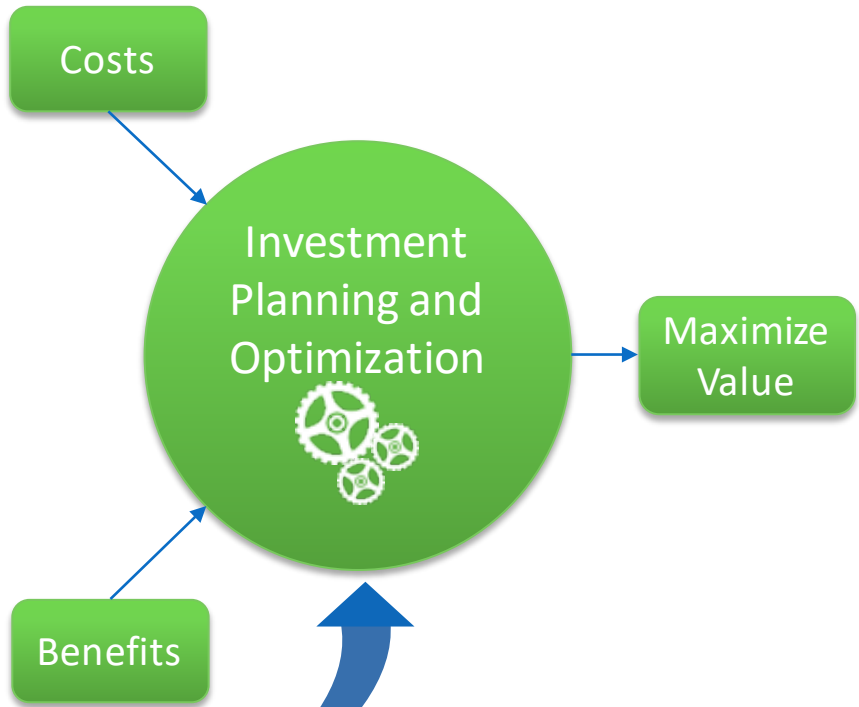
Converting Strategy to a Plan



SAMP Recommended Replacements Dates



20-year Plan - Updated Annually



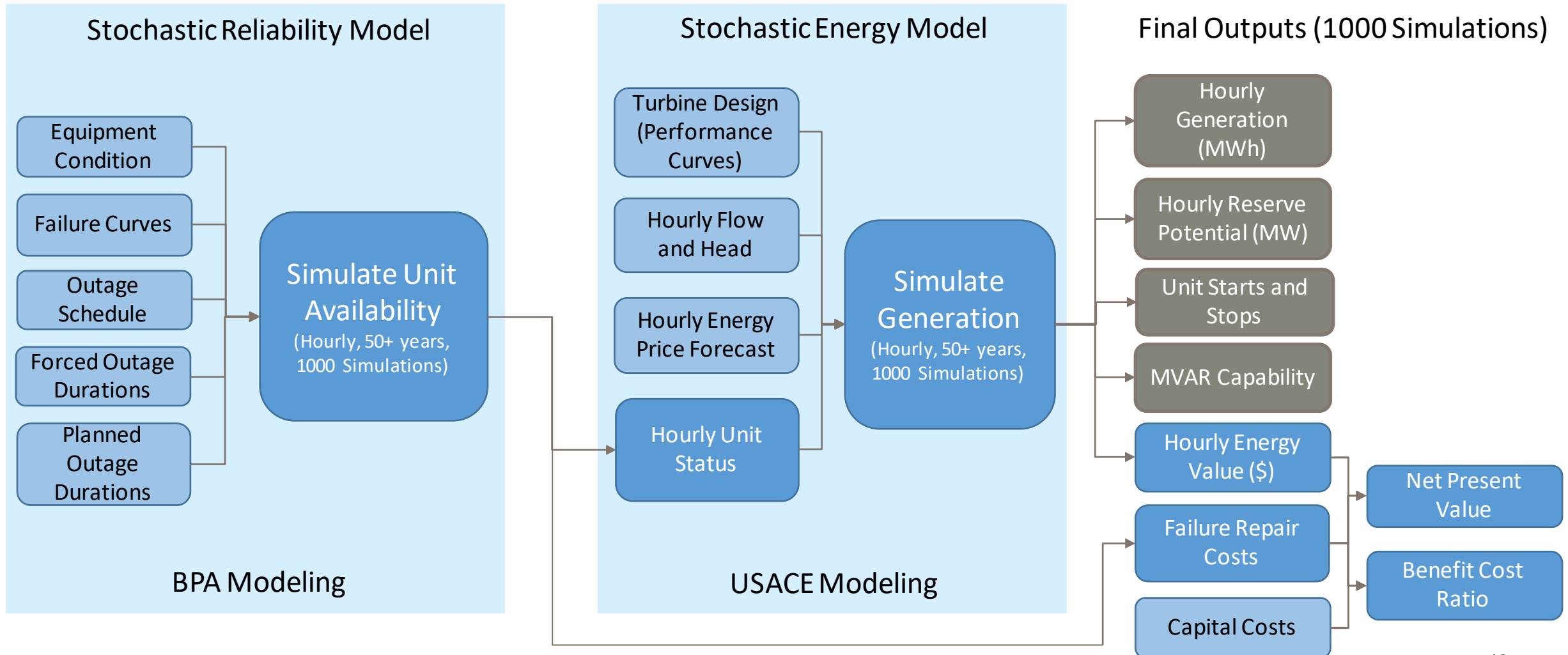
Hydropower System Asset Plan
2024 Edition

Asset Planning Team
Jake Nink, Reclamation Chair
Micah Koller, BPA Chair
Tatyana Dhalwal, Corps Chair

APT Support
Roger James, Corps
Gordon Astby, BPA

FOR AGENCY USE ONLY

Investment Alternative Optimization



Flexible Analysis Framework

What we have analyzed with this framework

Optimal timing and alternative for investment

Optimal number of units to modernize

Optimal design (Flexible vs Peak)

Optimal # of Spares

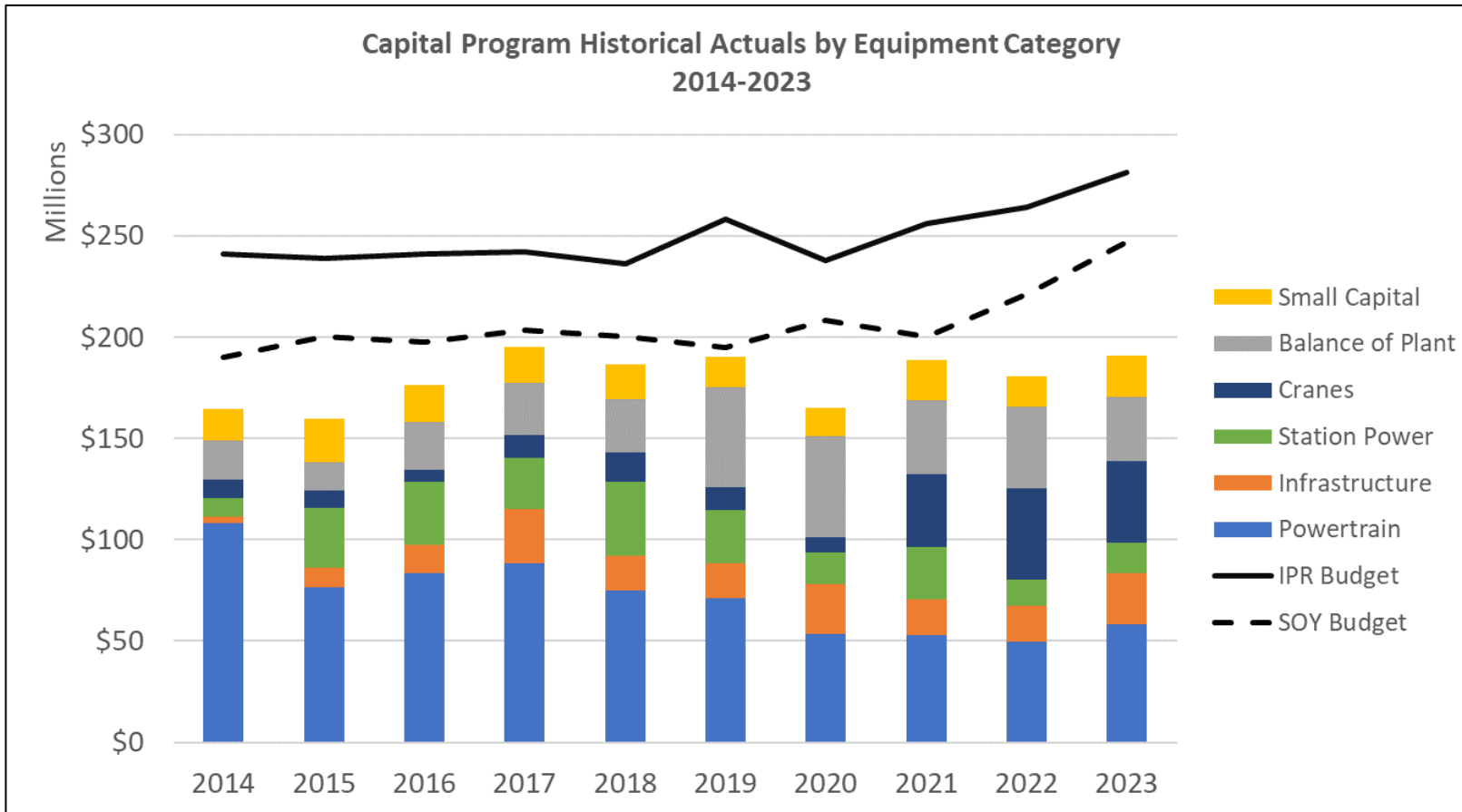
Tradeoffs of Fixed vs Adjustable Turbines

Value of New Units

Transmission Line Impacts on Generation

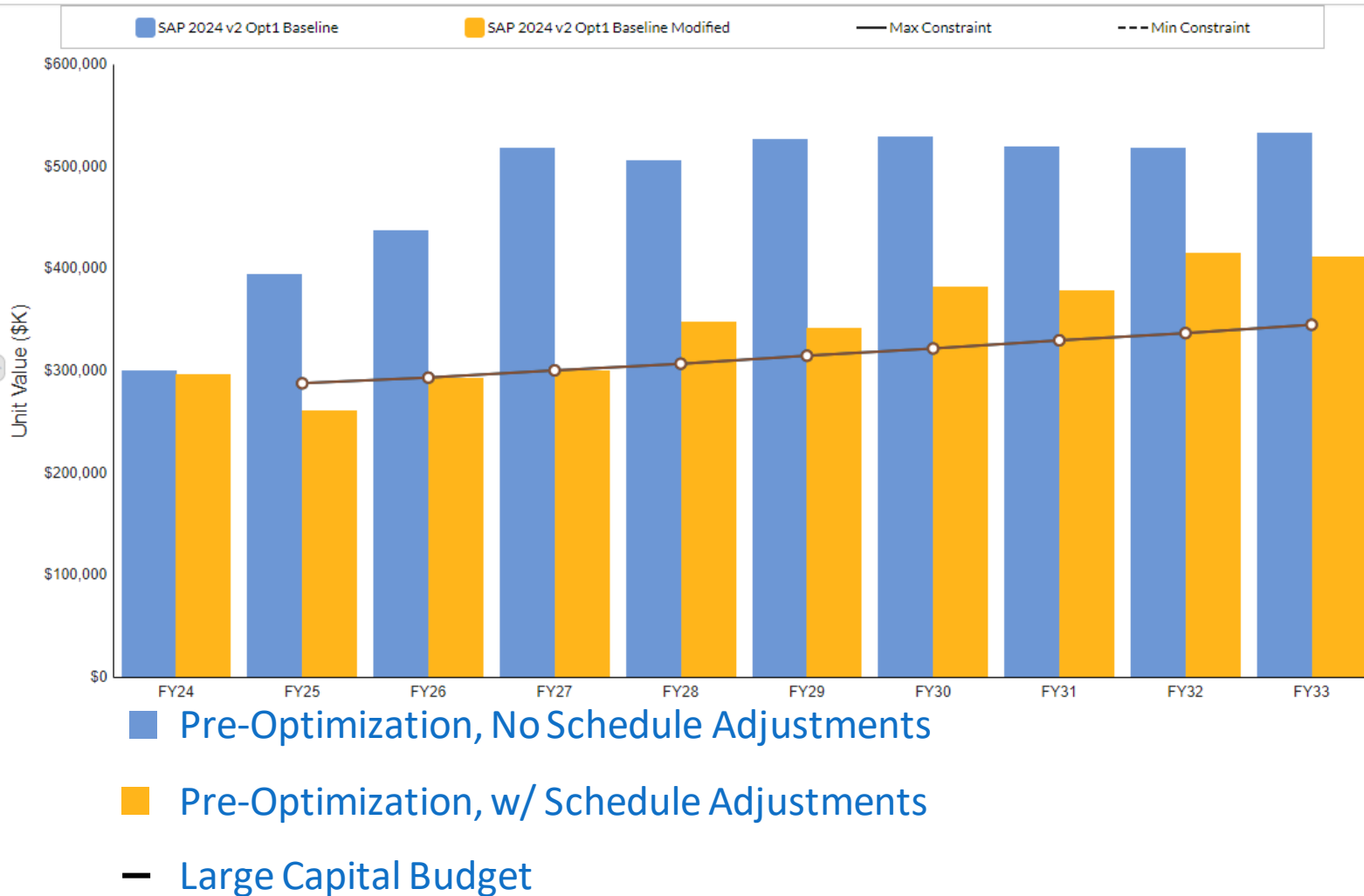
Reserve Capability and Voltage Support

Historical Program Execution



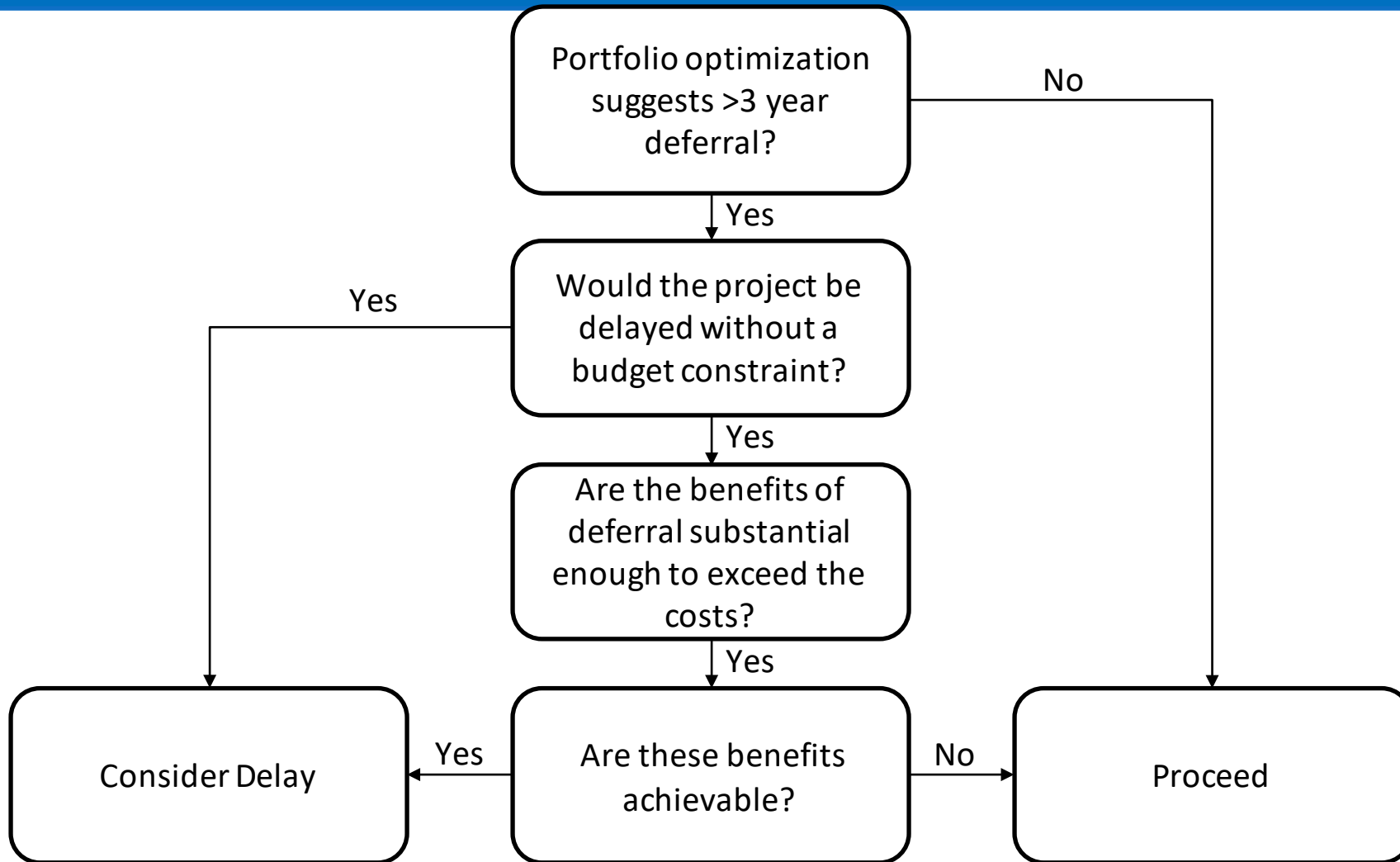
- Executing capital budget remains a challenge
- Major powertrain projects have taken longer than expected to reach construction phase
- Many of those projects are now in construction or will be in the next rate period
- New planning process improvements expected to reduce risk of underexecution

Asset Planning Process Changes



- Project schedules are adjusted based on analysis of past performance
- Far less project shifts necessary after adjustments to stay within budget
- Assures that projects are not unnecessarily delayed due to overly optimistic schedules
- Expected to contribute to increased execution relative to IPR budget

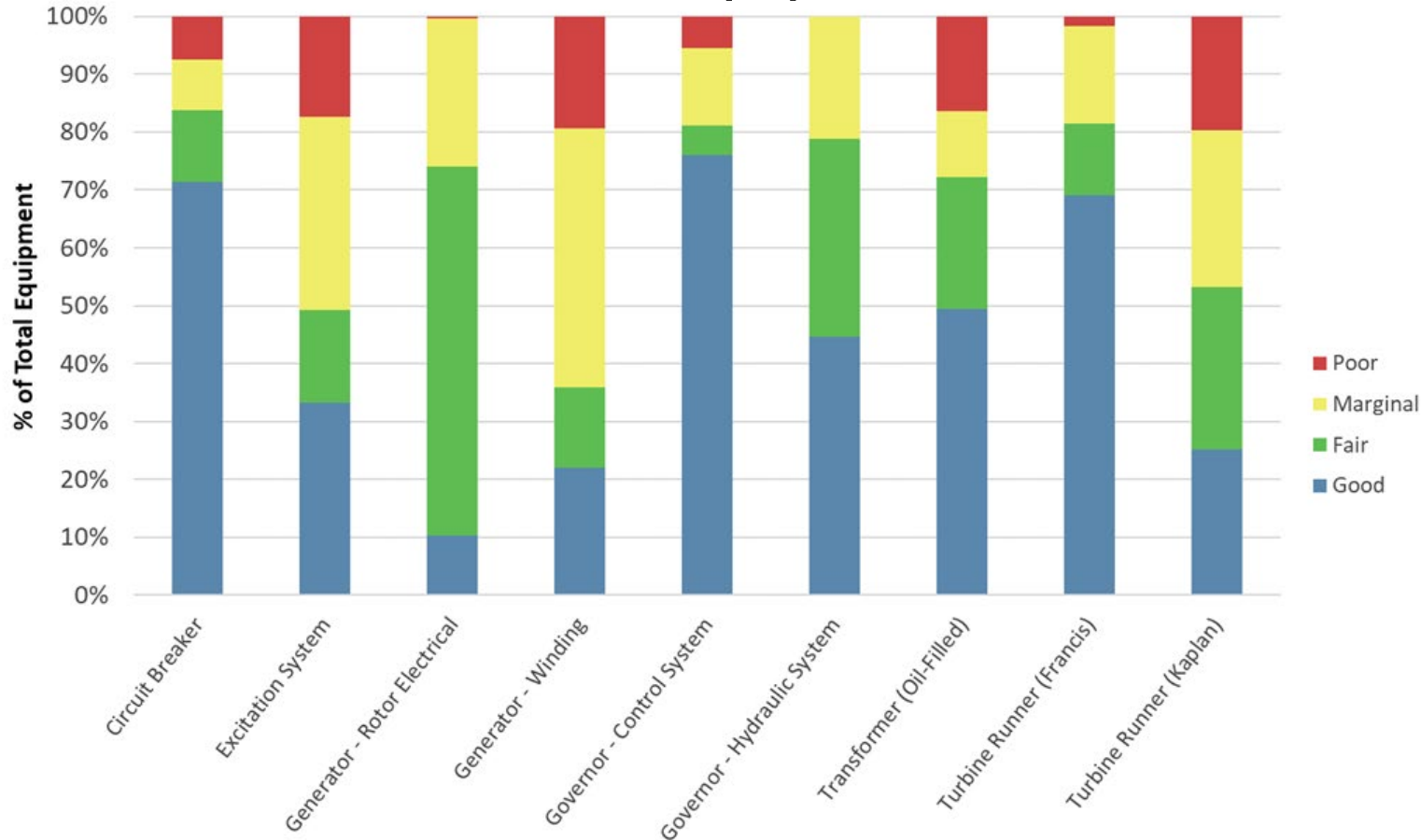
Investment Approval Process Changes



- Smooths project approval process
- Focuses discussion of delay to projects where it would be beneficial and achievable
- Reduces likelihood of project approval being in limbo and impacting execution

Current Equipment Condition

Critical Powertrain Equipment Condition



62%

of Generating Windings are in Marginal or Poor Condition

48%

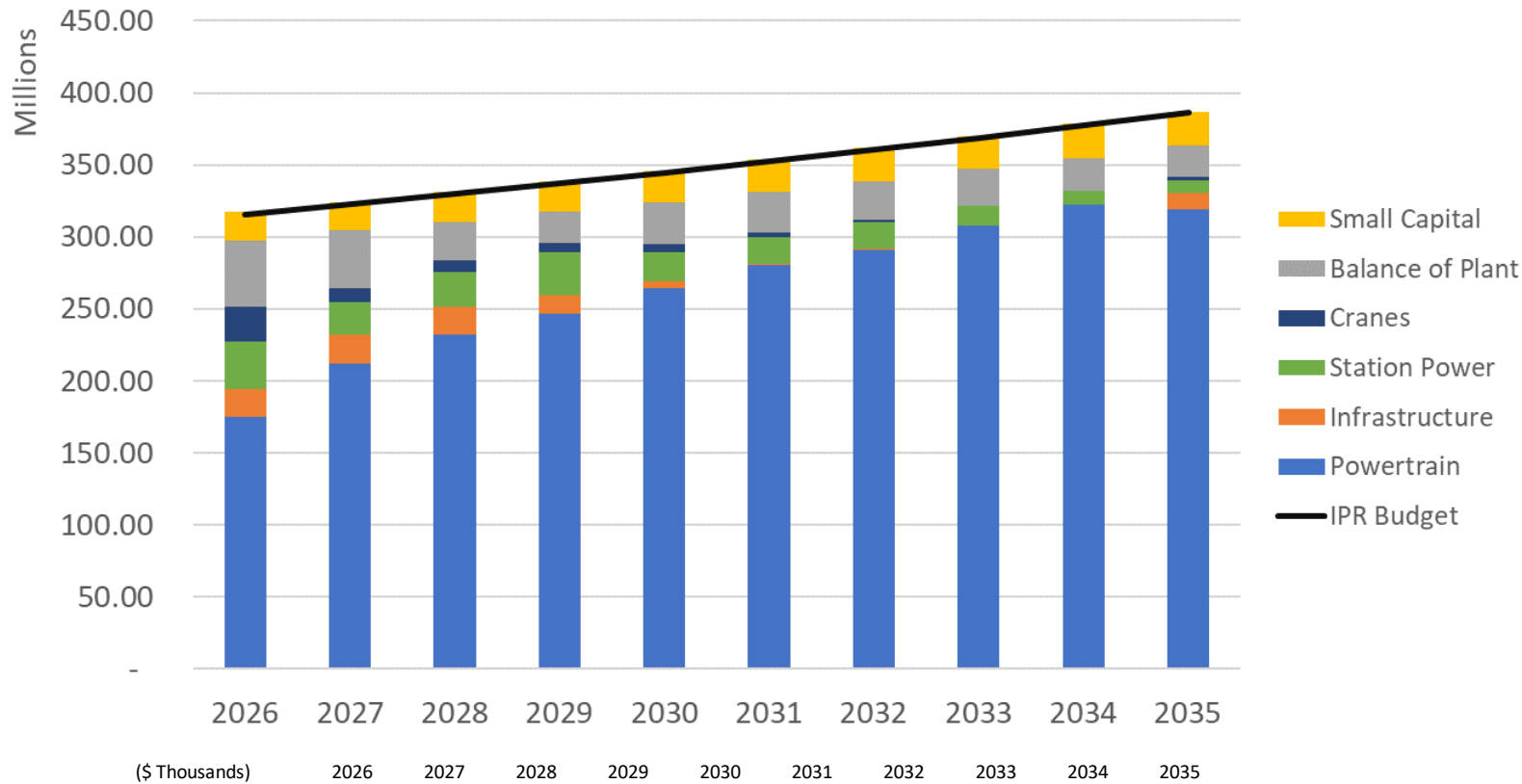
of Kaplan Turbines are in Marginal or Poor condition

45%

of the costs of a generating unit are represented by Turbines and Windings

10-year Forecast

Recommended Capital Program Forecast by Equipment Category
2026-2035



Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Capital (Sustain + Expand)	315,678	322,623	329,785	337,172	344,725	352,481	360,553	368,846	377,366	386,008

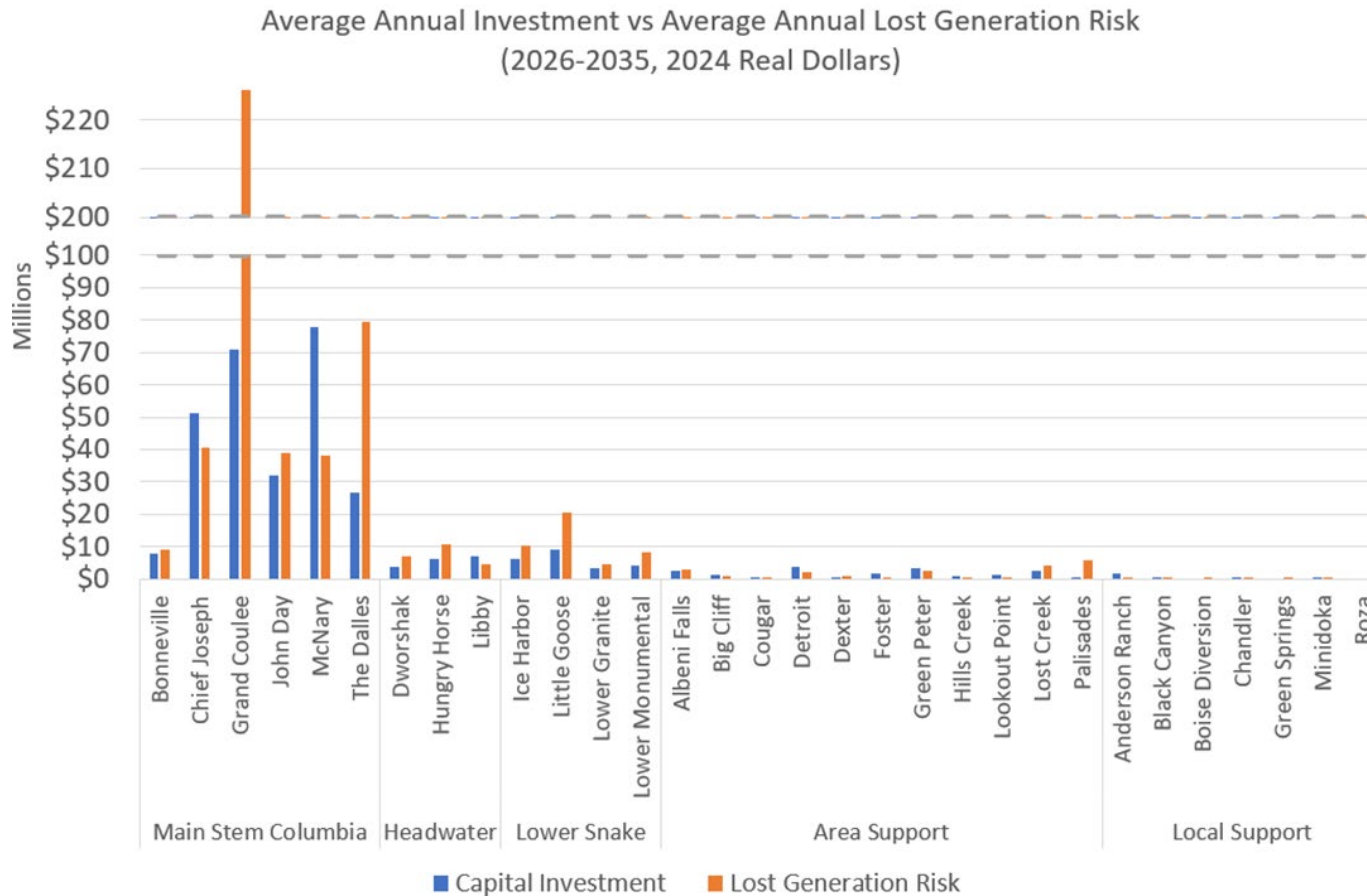
- Powertrain investment expected to increase as major projects enter construction phase
- 2.3% average annual inflation rate

BP26 Capital Investment

(\$ Thousands)	2026 OPTIMAL	2026 EXPECTED	2026 DELTA (EXPECTED-OPTIMAL)	2027 OPTIMAL	2027 EXPECTED	2027 DELTA (EXPECTED-OPTIMAL)	2028 OPTIMAL	2028 EXPECTED	2028 DELTA (EXPECTED-OPTIMAL)
Capital Sustain (CapEx)									
Corps of Engineers	265,794	256,928	-8,866	260,824	249,597	-11,227	254,368	238,771	-15,597
Bureau of Reclamation	41,368	40,031	-1,337	57,257	54,834	-2,423	70,945	66,670	-4,275
Total Capital Sustain	307,162	296,958	-10,204	318,081	304,431	-13,650	325,313	305,441	-19,872
Capital Expand (CapEx)									
Corps of Engineers	8,516	8,516	0	4,542	4,542	0	4,472	4,472	0
Bureau of Reclamation	0	0	0	0	0	0	0	0	0
Total Capital Expand	8,516	8,516	0	4,542	4,542	0	4,472	4,472	0
Total Capital (Sustain + Expand)	315,678	305,474	-10,204	322,623	308,973	-13,650	329,785	309,913	-19,872

- Minimal changes from BP24 optimal forecast
- Expected execution modeled via a machine learning tool trained on past cost and schedule changes over the lifetime of investments

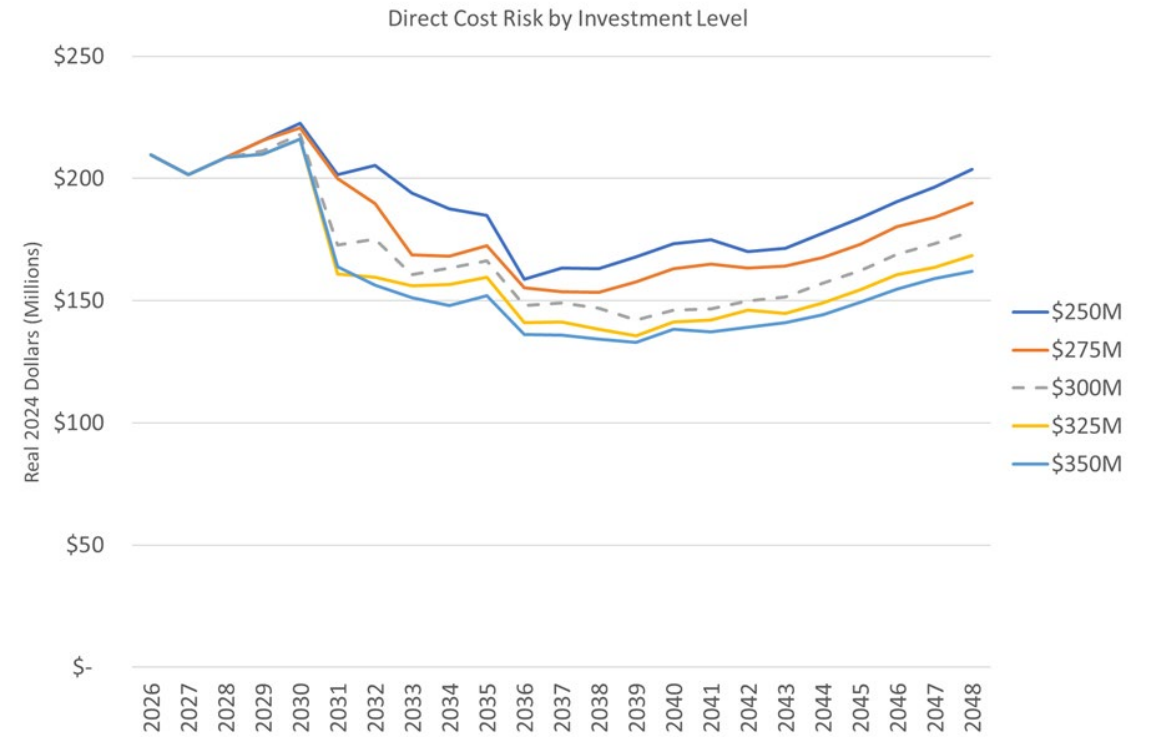
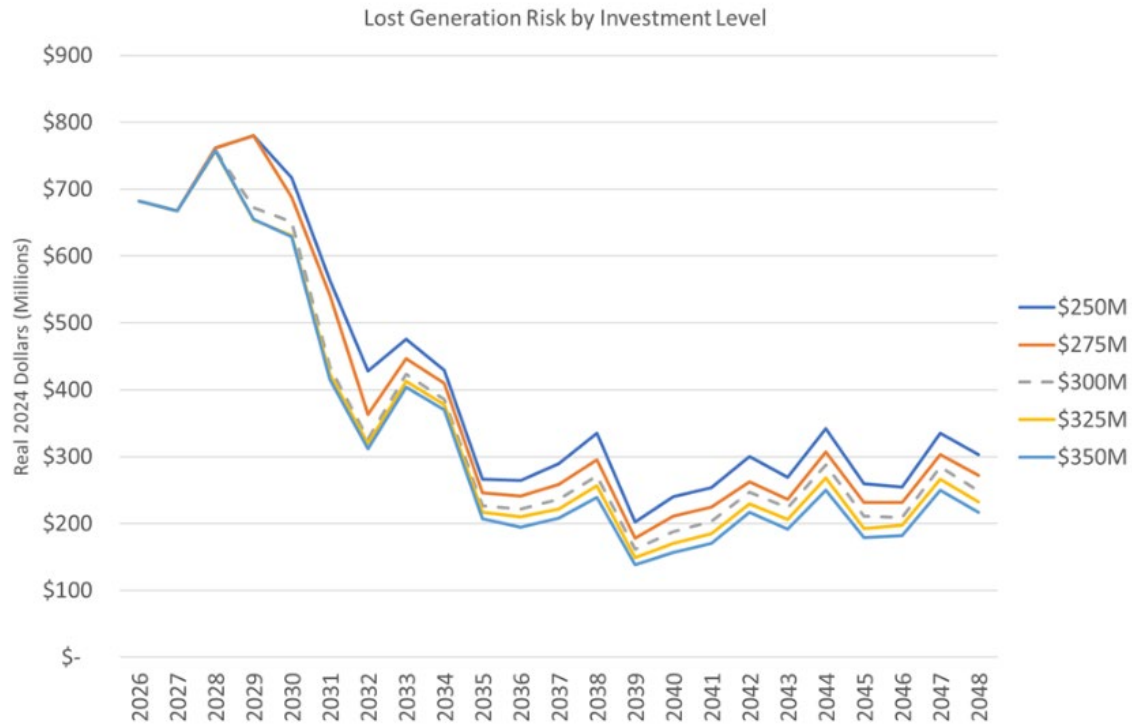
Capital Investment by Plant



- Capital investment closely aligns with lost generation risk
- Mitigating lost generation is not the *only* reason for investment, but tends to be the primary driver
- Other investments support multipurpose missions

*Lost Generation Risk is the expected value of lost revenue from replacement power purchases or lost sales due to equipment failure. It is the product of equipment probability of failure times outage consequences at average water conditions. Current Lost Generation Risk by plant is a sum of the lost generation risk for each piece of equipment based on current equipment condition.

Financial Risk Reduction Benefits



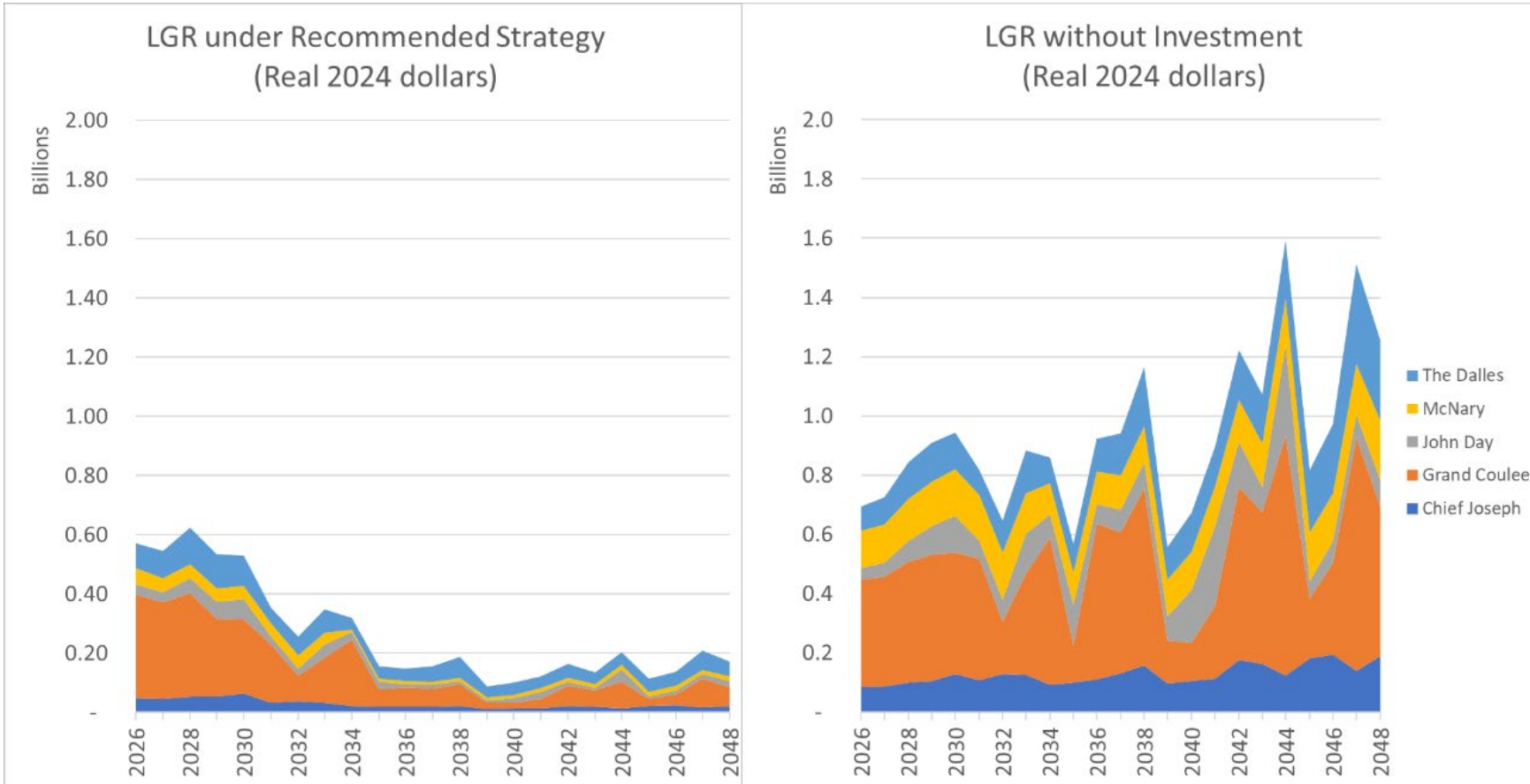
\$250 million → \$300 million: \$52 million/year LGR reduction

\$300 million → \$350 million: \$23 million/year LGR reduction

\$250 million → \$300 million: \$18.2 million/year DCR reduction

\$300 million → \$350 million: \$9.8 million/year DCR reduction

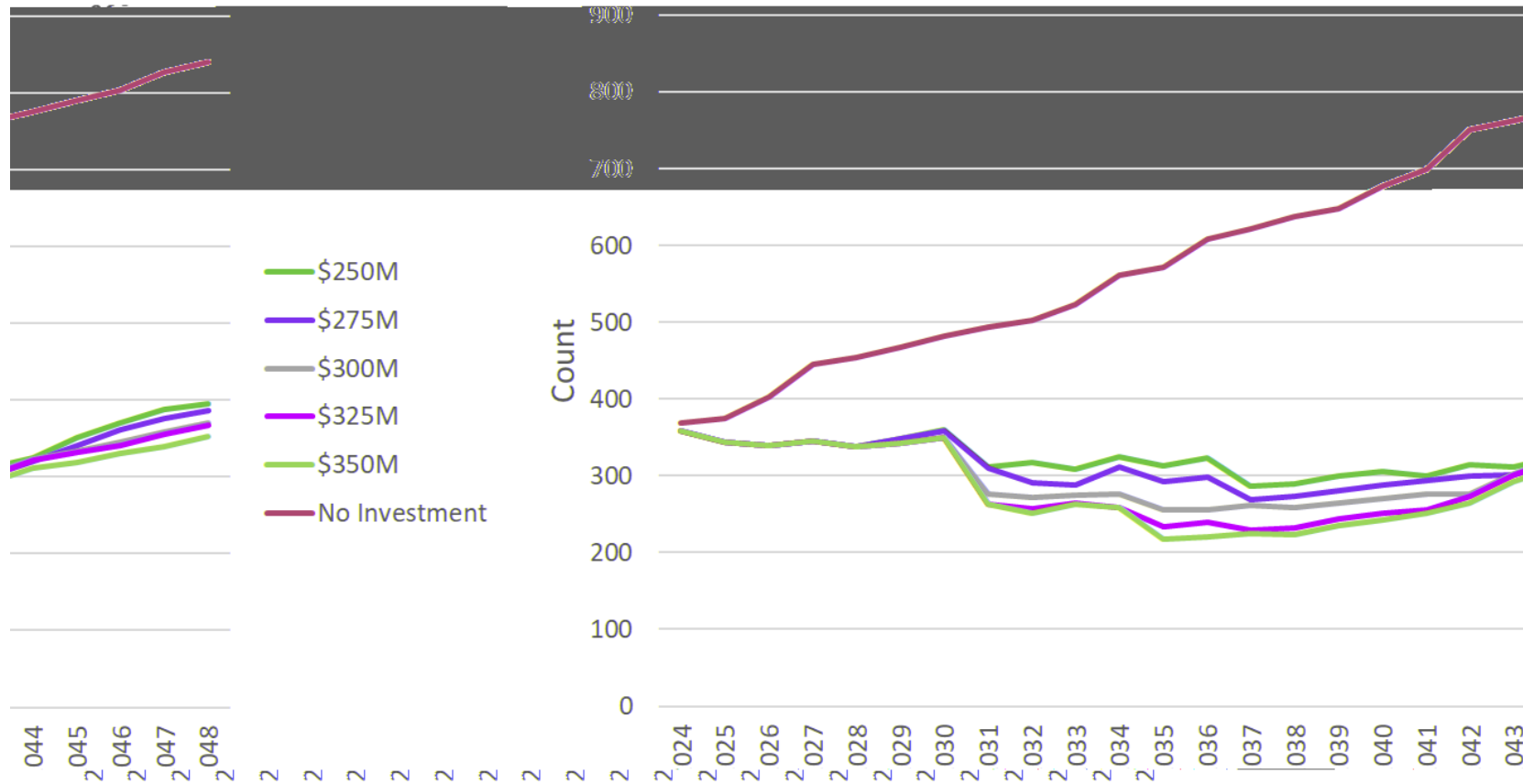
Lost Generation Risk – Plant Detail



- 84% of current LGR represented by 5 plants
- LGR would be \$15 billion higher at these plants without investments over the next 20 years

Non-Financial Risks

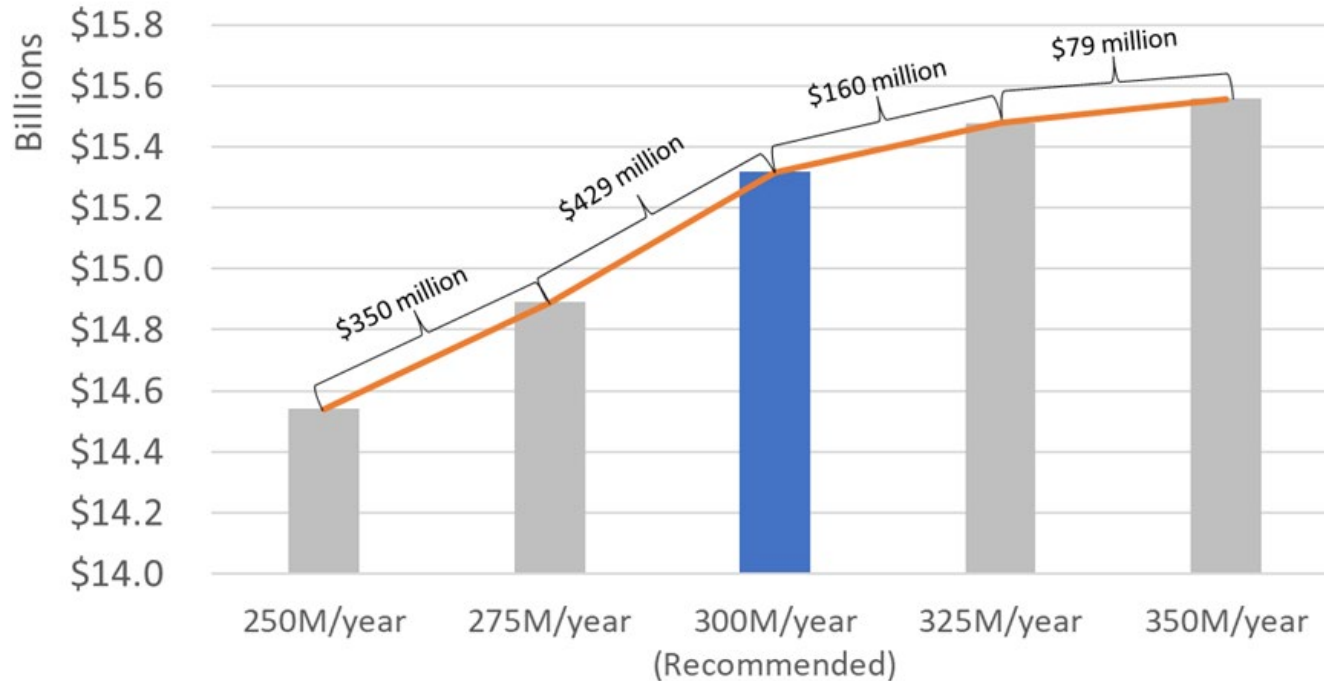
Count of Assets in High-Risk Category of Non-Financial Risk Maps



*Note that operational measures are employed to mitigate high-risk assets before investments are complete

Net Present Value of Investment

25-Year NPV by Investment Level (FY2024, 7.96% Discount Rate)



\$15.3 billion NPV for Recommended investment level

*Net Present Values greater than 0 mean annual benefits are higher than costs

Reclamation Major Capital Projects

Grand Coulee Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
LPH/RPH Bridge Cranes	Construction	--	--	current – 26	4.7
G11-18 & WPP Transformer Replacement	Construction	--	--	25 – 29*	27.7 & 2.6
G19-G21 Modernization	Scoping	current – 24	25 – 32	32-39**	TBD
LPH/RPH Gantry Cranes	Design	--	24	25 - 28	4.7
Fire Protection Modernization	Scoping	current - 24	25 – 26	27-39	TBD
Arc Flash Mitigation (LPH/RPH)	Design	--	24-26	27-32	32.8

*Supply chain issues will likely delay current project milestones

**Results of design will influence planned construction timeframe

Reclamation Major Capital Projects

Hungry Horse Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
Iso-phase Bus Enclosure Repl.	Scoping	24-25	26-29	30-33	5.6
Static Exciters	Construction	--	--	26-28	2.4

Palisades Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
Hollow Jet Valve	Construction	--	--	24-26	0.7
Butterfly Valve Replacement	Planning	24	28-29	30-37	-0.6

Corps Major Capital Projects

McNary Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
MCN Turbine Design & Replacement	Construction	--	--	24 – 38*	3.14
MCN Headgate System Rehab	Construction	--	--	22 – 32*	-0.12
MCN Iso-phase, Bus & Switch Upgr	Construction	--	--	24 – 33*	20.05
MCN Levee Drainage Pump Station Upgrades	Construction	--	--	24 – 29*	0.68
MCN Exciters Upgrade	Construction	--	--	24 – 26*	1.71
MCN Spillway Gate Hoists Replacement	Design	--	24	24 – 35**	1.0
MCN Spillway Gates Replacement	Scoping	24 – 25	25 – 26	26 – 39**	1.95
MCN Spillway Cranes Replacement	Scoping	24	25	26 - 30**	0.30

*Supply chain issues will likely delay current project milestones

**Results of design and cost share funding availability may influence planned construction timeframe

Corps Major Capital Projects

Chief Joseph Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
CHJ Unit 1-16 Generator Rewind	Construction	--	--	24 – 32**	2.21
CHJ Intake Gantry Crane	Construction	--	--	24 – 25*	2.68
CHJ Upgrades for Station Service Units SS01 & SS02	Construction	--	--	24 – 27*	-0.43

John Day Projects					
Project Title	Current Phase	Planned Schedule			Value to Cost Ratio
		Scoping (FY)	Design (FY)	Construction (FY)	
JDA Turbine Runner Replacement and Generator Rewind	Design	--	24 – 25	25 – 53**	2.16
JDA Exciters	Scoping	24 – 25	26 – 27	28 – 32**	7.04

*Supply chain issues will likely delay current project milestones

**Results of design may influence planned construction timeframe

FCRPS Long-Term Program Summary

Strategic Class	% of FCRPS Average Annual Generation	% of 50-Year Capital Forecast	% of 50-Year Expense Forecast	50-Year Cost of Generation (\$/MWh) ¹	50-Year Fully Loaded Cost (\$/MWh) ²
Main Stem Columbia	79%	72%	66%	\$10.92	\$21.25
Lower Snake	9%	13%	13%	\$21.76	\$36.69
Headwater	7%	7%	8%	\$14.60	\$25.74
Area Support (Non-WVY)	2%	2%	4%	\$23.68	\$32.99
Area Support (WVY)	2%	5%	6%	\$61.31	\$77.56
Local Support	1%	1%	3%	\$43.98	\$56.40
FCRPS	100%	100%	100%	\$13.41	\$24.29

- Capital and Expense programs are heavily driven by generation importance but support multiple missions for the three agencies
- The long-term programs developed for this IPR result in a 50-year Cost of Generation of \$13.41/MWh and a fully loaded cost of \$24.29/MWh

1/ Cost of Generation represents the forecasted levelized capital and expense costs associated with producing power at the facilities for the next 50 years.

2/ Fully Loaded Cost includes the Cost of Generation plus allocations for all remaining Power Services costs attributable to the FCRPS including Fish and Wildlife. The majority of these costs are system-wide costs that would still be incurred and reapportioned across other Strategic Classes if generation ceased at a certain project or projects.



Questions



**US Army Corps
of Engineers®**



— BUREAU OF —
RECLAMATION

Bonneville
POWER ADMINISTRATION



Submitting Comments

- Comment Period: July 2nd – August 5th
- Comments can be submitted through:
 - Online: www.bpa.gov/comment
 - Mail: BPA Public Involvement, P.O. Box 14428, Portland, OR 97293
- Webpages:
 - IPR: <https://www.bpa.gov/about/finance/bp-26-ipr>
 - SAMPs: <https://www.bpa.gov/about/finance/strategic-asset-management-plans>

Publication

The BP-26 Initial Publication and other materials are available at:
<https://www.bpa.gov/about/finance/bp-26-ipr>

Strategic Asset Management Plans (SAMPs) are available at:
<https://www.bpa.gov/about/finance/strategic-asset-management-plans>

Questions can be submitted to BPAFinance@BPA.gov

FINANCIAL DISCLOSURE

This information was publicly available on June 25, 2024, and contains information not sourced directly from BPA financial statements.

