Financial Plan Refresh

Public Workshop

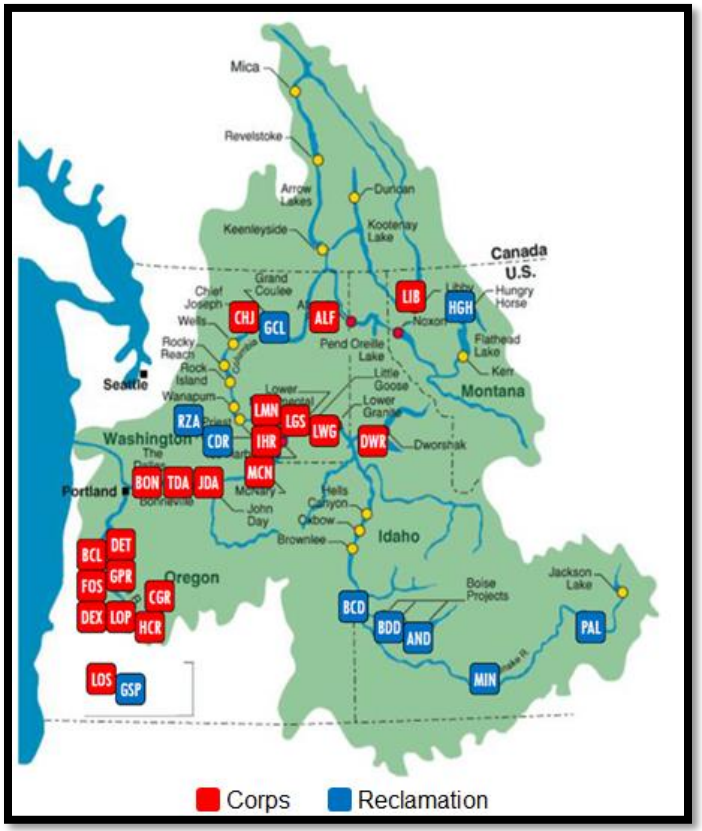
Feb 9, 2022

Fed Hydro

Executive Ownership: Susanne Cooper, Senior Vice President, Power Services

Today's Presenter: Gordon Ashby, Public Utilities Specialist

Asset Overview



- 31 hydropower plants (21 USACE, 10 USBR)
- 196 main generating units
- 22,050 MW of Capacity
- Annual average generation of 8,705 aMW (76 million MWh)
- BPA directly funds USACE and USBR operations, maintenance and capital for power assets and joint features
- Operations, maintenance and capital activities are carried out by USACE and USBR at their respective facilities

FCRPS Plants

Plant	ID	Units	MW Capacity	aMW Energy	Strategic Class	Operator
Grand Coulee	GCL	24	6,735	2,422	Main Stem Columbia	Reclamation
Chief Joseph	CHJ	27	2,614	1,377	Main Stem Columbia	Corps
McNary	MCN	14	1,120	549	Main Stem Columbia	Corps
John Day	JDA	16	2,480	1017	Main Stem Columbia	Corps
The Dalles	TDA	22	2,052	805	Main Stem Columbia	Corps
Bonneville	BON	18	1,195	552	Main Stem Columbia	Corps
Dworshak	DWR	3	465	216	Headwater	Corps
Lower Granite	LWG	6	930	250	Lower Snake	Corps
Little Goose	LGS	6	930	255	Lower Snake	Corps
Lower Monumental	LMN	6	930	300	Lower Snake	Corps
Ice Harbor	IHR	6	693	227	Lower Snake	Corps
Libby	LIB	5	605	227	Headwater	Corps
Hungry Horse	HGH	4	428	94	Headwater	Reclamation
Albeni Falls	ALF	3	49	21.6	Area Support	Corps
Detroit	DET	2	115	49	Area Support	Corps
Big Cliff	BCL	1	21	12.2	Area Support	Corps
Green Peter	GPR	2	92	29.3	Area Support	Corps
Foster	FOS	2	23	11.9	Area Support	Corps
Lookout Point	LOP	3	138	41.1	Area Support	Corps
Dexter	DEX	1	17	11.2	Area Support	Corps
Cougar	CGR	2	28	19.9	Area Support	Corps
Hills Creek	HCR	2	34	22.5	Area Support	Corps
Lost Creek	LOS	2	56	45.4	Area Support	Corps
Palisades	PAL	4	176	84	Area Support	Reclamation
Minidoka	MIN	4	28	16.6	Local Support	Reclamation
Anderson Ranch	AND	2	40	19.6	Local Support	Reclamation
Boise Diversion	BDD	3	3	1.3	Local Support	Reclamation
Black Canyon	BCD	2	10	7.5	Local Support	Reclamation
Roza	ROZ	1	13	7.6	Local Support	Reclamation
Chandler	CDR	2	12	6.3	Local Support	Reclamation
Green Springs	GSP	1	18	7.3	Local Support	Reclamation
TOTAL		**196**	**22050**	**8705**		

FCRPS Strategic Classes

Purpose	Main Stem Columbia	Headwater/Lower Snake	Area Support	Local Support
Power	Provides 76% of energy and capacity, and 30% of storage from the FCRPS Provides nearly all the reserves and other ancillary services for supporting the 500 KV grid	Provides 20% of energy and capacity, and 50% of storage from the FCRPS Provides supplementary ancillary services for supporting the 500 KV grid	Provides 3% of energy and capacity, and 18% of storage from the FCRPS Provides voltage support to specific areas of the regional transmission grid	Provides 1% of energy and capacity, and 2% of storage from the FCRPS Provides limited voltage support to local areas of the Pacific Northwest
Flood Damage Reduction	Seasonal flood reduction and water management storage affecting significant parts of the Columbia River basin	Seasonal flood reduction and water management storage affecting significant parts of the Columbia River basin	Provides flood reduction benefits primarily in the Willamette Valley, but does not contribute significantly to the flood reduction capability of the overall Columbia River basin	Provides flood reduction benefits in a local area
Navigation	Provides navigation for the lower Columbia River from below Cascade Locks to the Tri-Cities	Provides navigation for the lower Snake River from the Tri-Cities to Lewiston, ID	None	None
Irrigation	Primary source of irrigation for the Columbia River Basin	Provides incidental irrigation	Primary source of irrigation within a specific region (Palisades Dam only)	Primary source of irrigation within a specific region
Recreation	Significant recreation for boating and camping Includes several “destination” recreation sites and numerous local sites	Major recreation for boating and camping Includes several “destination” and local sites	Major recreation for boating and camping Includes several “destination” and local sites	Some boating and camping at local sites

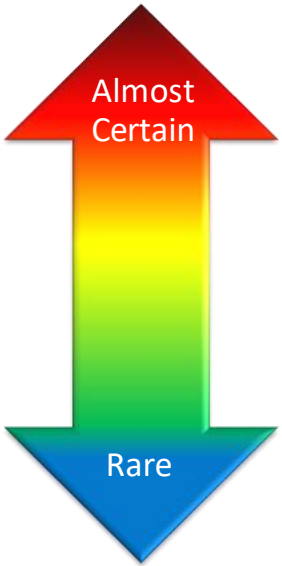
FCRPS Asset Criticality

Value Measure Categories	Value Measures	Organizational Goals
Financial	Financial Benefits	Maximize cost savings and increase efficiency to ensure low cost power Maintain ability to reliably supply energy to the grid
	Generation Efficiency Benefits	
	Direct Cost Risk	
	Lost Generation Risk	
Trusted Stewardship	Compliance Risk	Reduce Safety, Environmental and Compliance risks to as low as reasonably practicable. Ensure employee and public safety Maintain mandate to operate
	Environmental Risk	
	Productive Workplace Benefit	
Safety	Safety Risk	
Community	Public Perception Risk	

Directly quantified from asset information

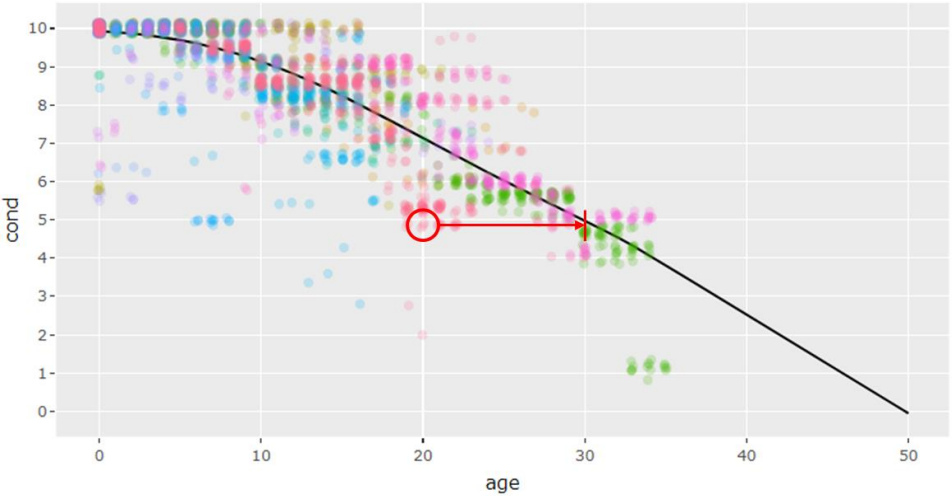
Estimated on 5x5 risk matrix

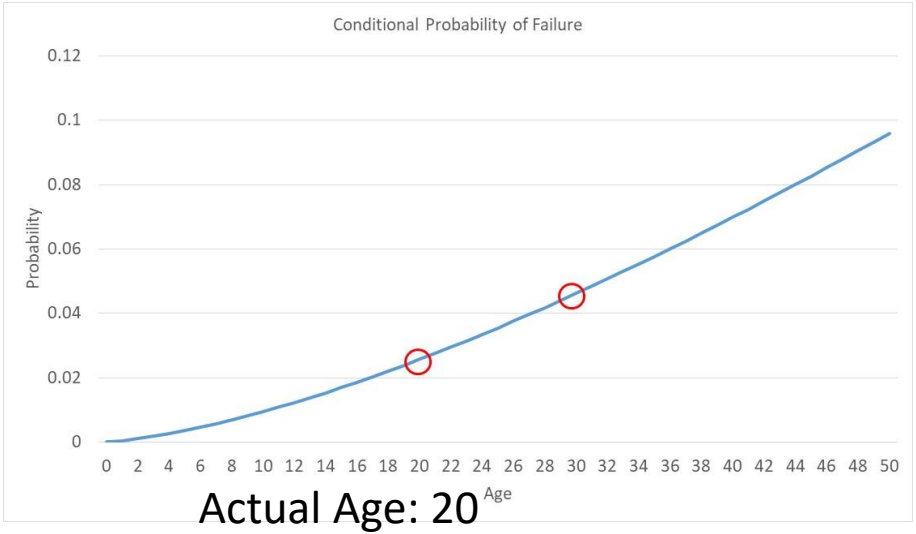
FCRPS Asset Health

Likelihood	Condition Index	Description
	0 to 0.9	Poor
	1 to 1.9	
	2 to 2.9	
	3 to 3.9	Marginal
	4 to 4.9	
	5 to 5.9	
	6 to 6.9	Fair
	7 to 7.9	
	8 to 8.9	Good
	9 to 10	

- 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

Assessing Risk – Condition to Probability of Failure





- Each circle represents a condition assessment at a given age
- Darker shades illustrate overlap of multiple data points

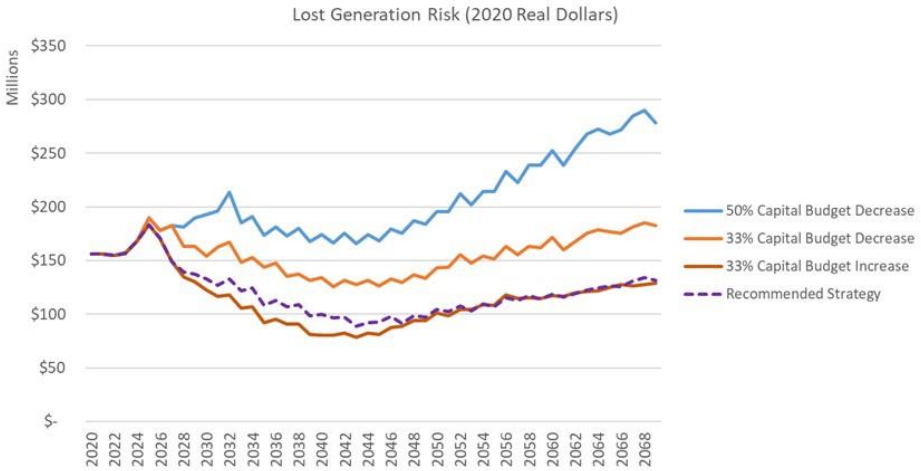
Actual Age: 20
Age-based p(f): 2.6%

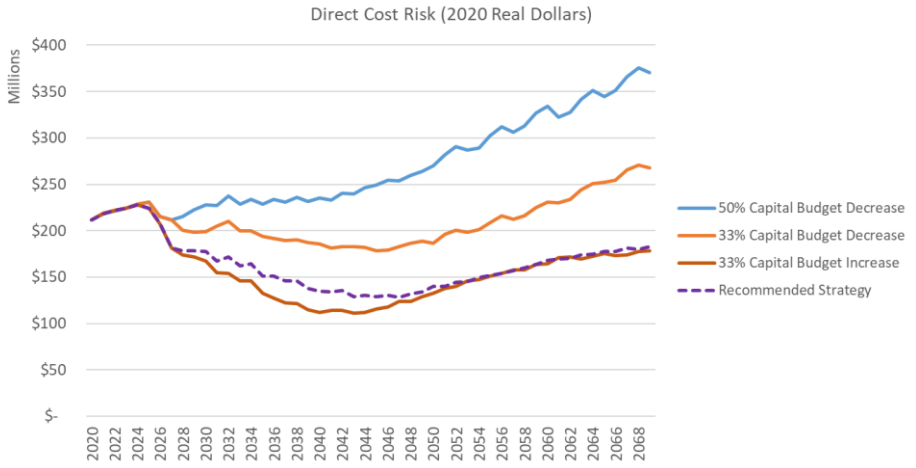
Effective Age: 30
Condition-based p(f): 4.6%

Assessing Risk – Directly Quantified Risk

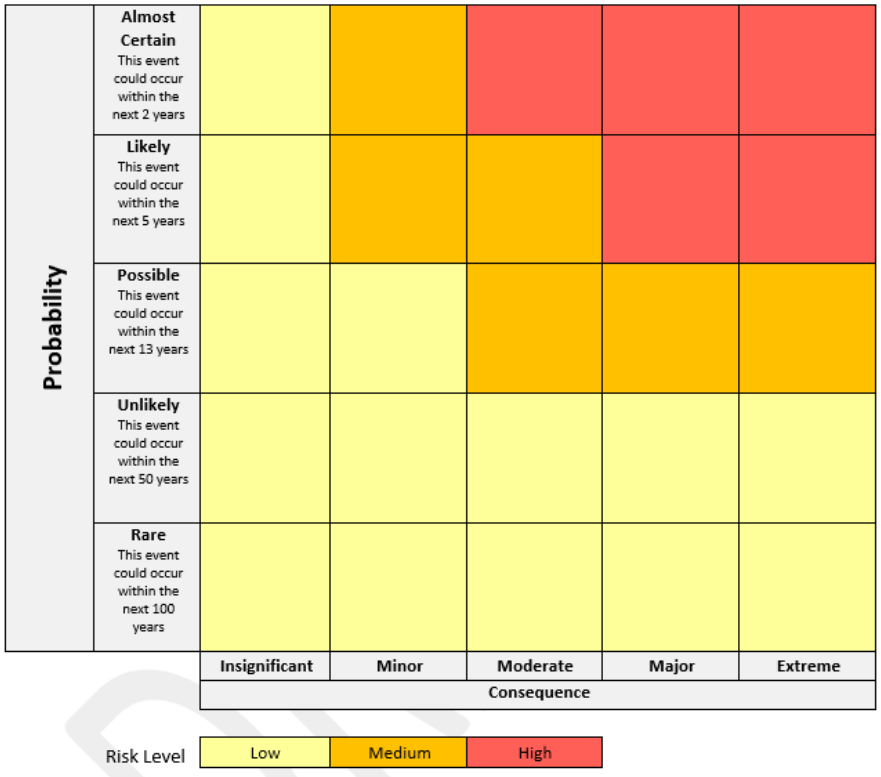
Two primary risks are directly quantified for each asset:

- Lost Generation Risk (LGR) = p(f) * Annual Outage Consequence * Equipment Outage Duration * Energy Price
- Direct Cost Risk (DCR) = p(f) * Direct Cost Ratio * Full Replacement Cost





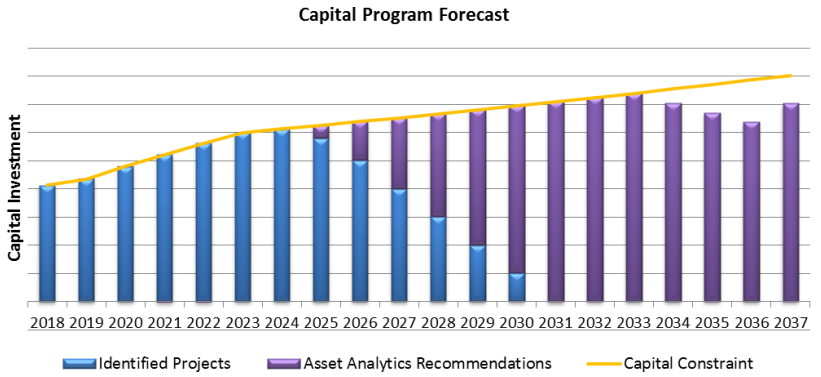
Assessing Risk – Risk Assessed with Risk Matrix

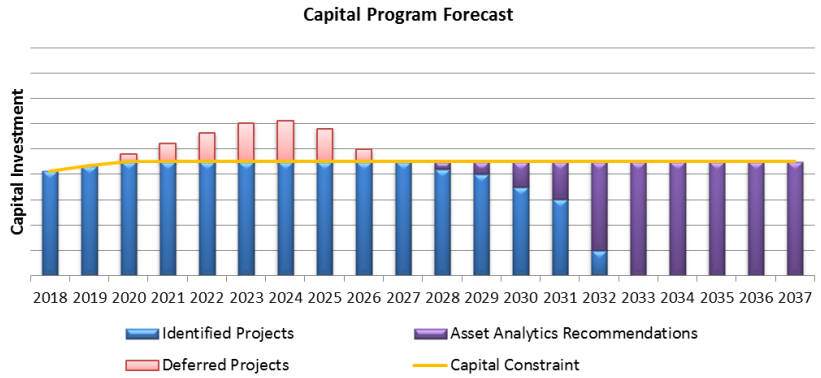


- Non-financial metrics are assessed on a 5x5 risk matrix.
- Non-financial metrics are equated to an equivalent financial risk and weighted for use in project prioritization

Insignificant	Minor	Moderate	Major	Extreme
<$10k	$10k - $100k	$100k - $1M	$1M - $10M	>$10M

Capital Portfolio Optimization



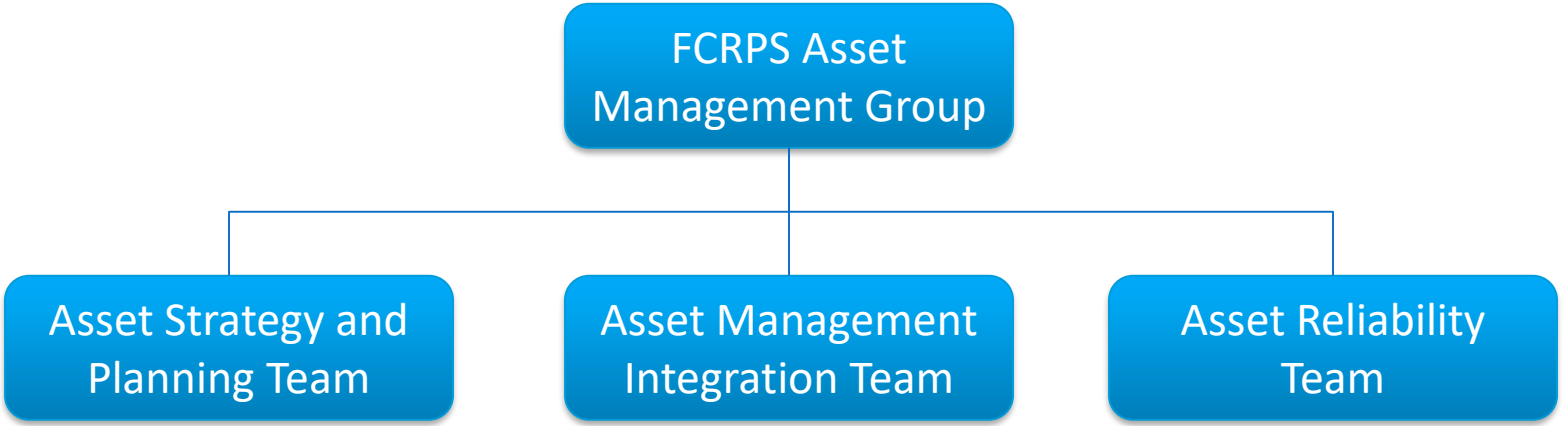


- Benefits and costs are assessed for capital projects in 20-year window
- Projects are optimized using the Copperleaf portfolio optimizer with goal of maximizing total portfolio value
- Optimal project timing and, in some cases, alternatives are suggested by the optimizer
- FCRPS Asset Planning Team uses this information to develop 20-year plan

Current State – Inventoried Assets

- Nearly all critical powertrain components are inventoried across the FCRPS
- Joint assets (assets funded by both BPA power customers and federal appropriations) are inconsistently inventoried
- Corps and Reclamation have on-going initiatives to expand asset registry

Future Improvements



- Owns FCRPS strategies, plans and associated models
- Largely consists of teams and processes that already exist

- New function to bridge gap between strategy, planning and execution ensuring strategies and plans are implementable in the field

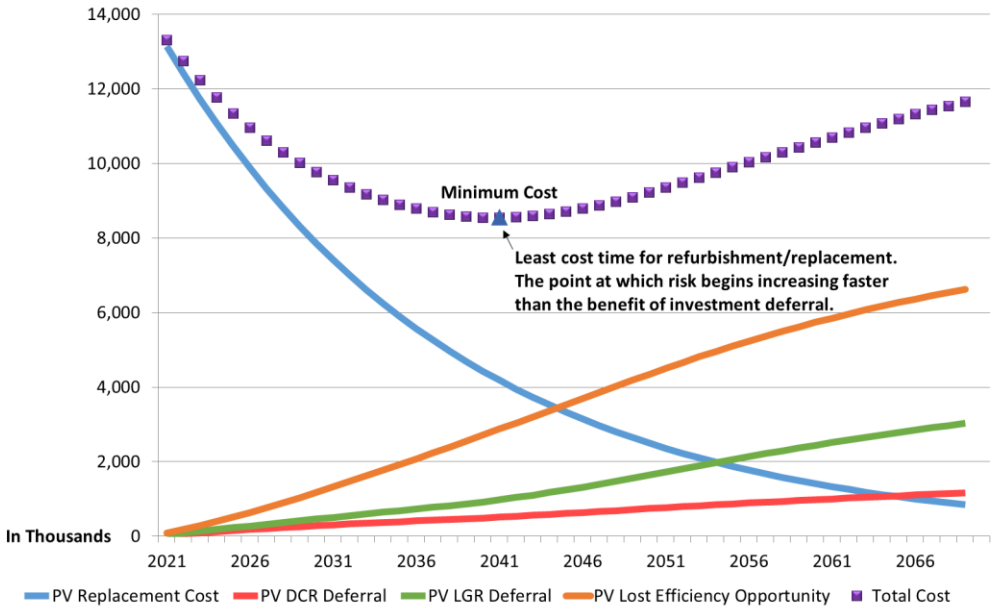
- New function tasked with using condition monitoring data to provide condition based and predictive maintenance recommendations

Current State – Maintenance Prioritization

- Operations and maintenance (O&M) activities are owned by the Corps and Reclamation

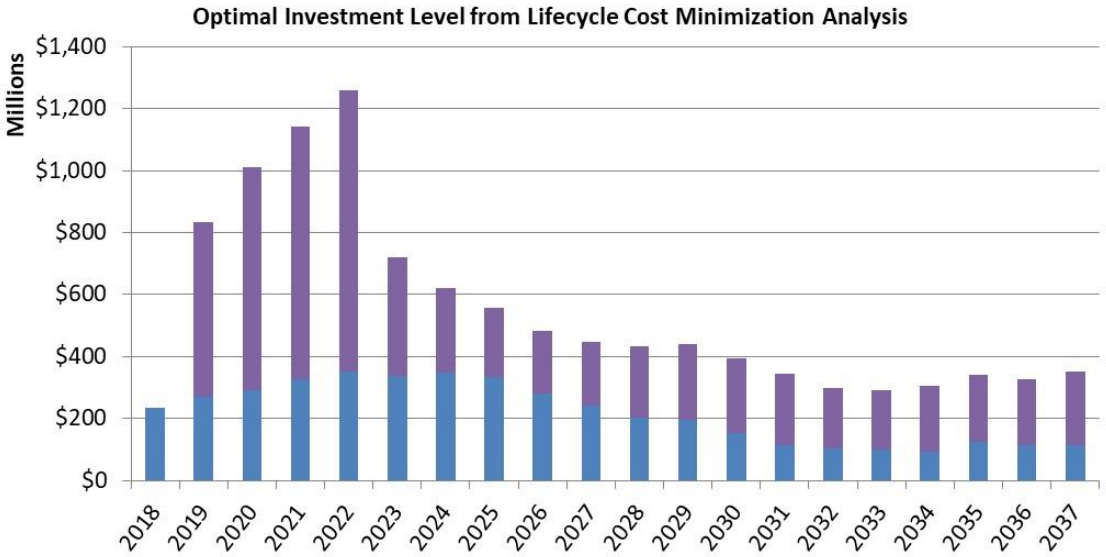
- Maintenance is currently timed-based but the FCRPS is investigating other alternatives informed by equipment condition and criticality

Capital Forecast Process



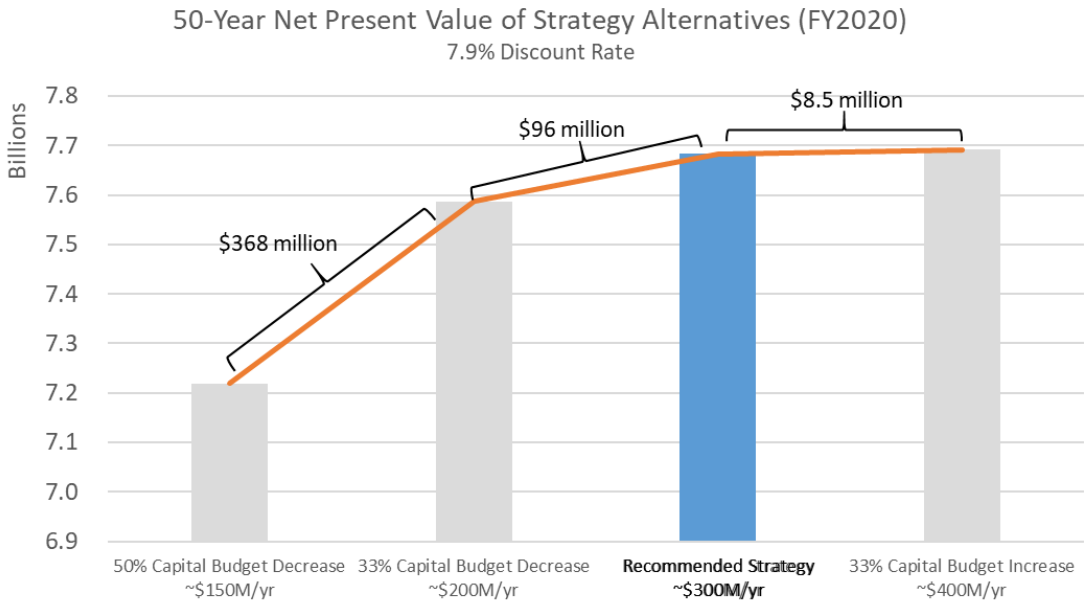
- Capital forecast are developed by analyzing current equipment condition, probability of failure and risk to determine the optimal time to replace equipment
- Optimal replacement dates are identified for 10,000+ assets
- Capital forecasts are built up from these optimal replacement dates

Capital Forecast Process



- *Hypothetical* optimal investment level if all assets could be replaced at their calculated optimal replacement date
- Actual investments need to consider logistical constraints so this *hypothetical* forecast is not executable
- Budget constraints are introduced into the model to evaluate risk trade-offs and arrive at a recommended capital investment level

Capital Forecast Process



- With budget constraints introduced, the model will defer investment in assets if necessary based on each asset's respective cost of deferral
- Some assets can be deferred with little incremental cost, resulting in diminishing returns for higher levels of investment
- A budget level is selected that is believed to provide the best trade-offs between risk, cost, execution and affordability.

FCRPS Capital Project Duration and Complexity

- FCRPS investments can take well over a decade to plan and execute
- Outage times for major work on a single unit can take anywhere from 6 months to multiple years
- Modernization projects must take into account changes over the last 30-50 years and anticipate how best to design for the next 30-50 years
- Modernization projects are “once in a generation” or even less frequent
- Due to their complex nature, delays in these large modernization projects can result in underexecution of capital forecasts as there may not be other projects that can be advanced quickly to fill the gaps

Questions?