

# Rock Island Powerhouse 2 Rehabilitation

## Board Presentation

November 20, 2017



CHELAN COUNTY



# Objectives

- Present recommendation for scope, schedule and budget for Rock Island Powerhouse 2 (RI PH2) Rehabilitation program
- Seek Board concurrence of RI PH2 Rehabilitation program
- Seek Board approval to execute new service agreement in support of RI PH2 Rehabilitation program

# Discussion Topics

- Background
- Condition Indicators
- Alternatives Explored
- Recommendations
- Economics
- Ongoing Risks and Issues
- Planning and Coordination
- Resources
- Next Steps





# Team

Alternatives and recommendations include input and review from a District wide team comprised of:

- Risk
- Accounting
- Licensing
- Dam Safety
- Fish & Wildlife
- Transmission
- Generation
- Energy Planning and Training
- Safety
- Human Resources
- Finance
- Legal
- Central Maintenance
- Shared Services

# Rock Island PH2 Background

- Eight horizontal bulb units rated at 51 MW each with ~40 years of service
- Designed for low head, high flow installations and extremely efficient
- Commercial operation in 1977/78
- Generator frame cracking issues 1985.
- Generators replaced/repared in 1988-1990

# Condition Indicators

- Stator windings
- Rotor poles
- Trunnion seals
- Turbine blades
- Lube oil injection pumps



# Alternatives Explored

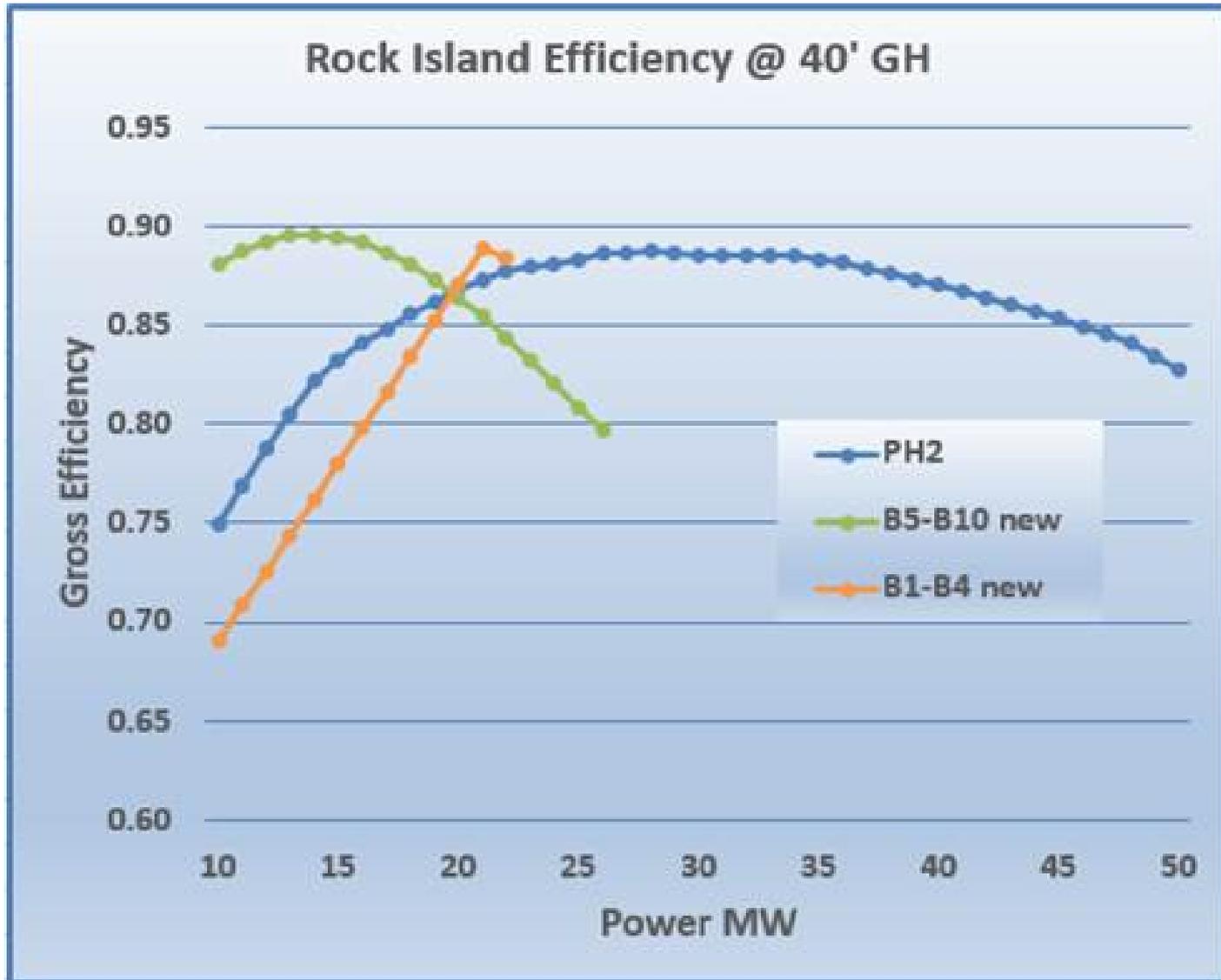
- New turbines and generators
- Rehabilitated turbines and generators



# New Turbines and Generators

- Lower return on investment (ROI) relative to rehabilitation option
- Potential impacts to relicensing efforts
- Significant time and cost to evaluate how new design may impact habitat conservation plan (HCP) and total dissolved gas (TDG) programs
- New design creates uncertainty with reliability, operations and maintenance

# Efficiency Comparison



# Scope Recommendation

- Rehabilitate major components that have > 40 years of remaining life if rehabbed (turbine runner, shafts, rotor, stator)
- Replace wear components (bushings, seals, fasteners, instrumentation, motors, pumps)
- Procure new one generator for first unit to accelerate overall schedule by approximately 2 years
- Procure some new components for schedule and cost risk mitigation

# Proposed Wear Components to Replace

- All seals and wear elements
- High pressure bearing pumps
- Heat exchangers and oil filters
- Wicket gate pins
- Wicket gate link bearings
- Wicket gate bushings, thrust washers and wear elements
- Discharge ring
- Expansion joint to draft tube and associated hardware, gland rings, etc.
- Piston rings for runner blade position
- Turbine shaft bolt cover, instruments, and directional valves
- Turbine shaft coupling hardware
- Intermediate shaft coupling hardware
- Carbon seal segments and keeper rings
- Inflatable shaft seal
- All piping inside the bulb
- All wire and instrumentation inside the bulb
- Stator winding, core and clamping system
- Generator cooling fans
- Generator air coolers
- Generator air cooler and fan removal system
- Brake pads and seals
- Bulb heaters
- Fire detection
- Generator supports
- Generator shaft coupling hardware
- Blade restoring mechanism parts
- Exciter diodes and heat sinks
- Slip rings
- Generator humidifier
- All varistors

# Risk Mitigation Components

Major components to purchase new to mitigate cost and schedule risk:

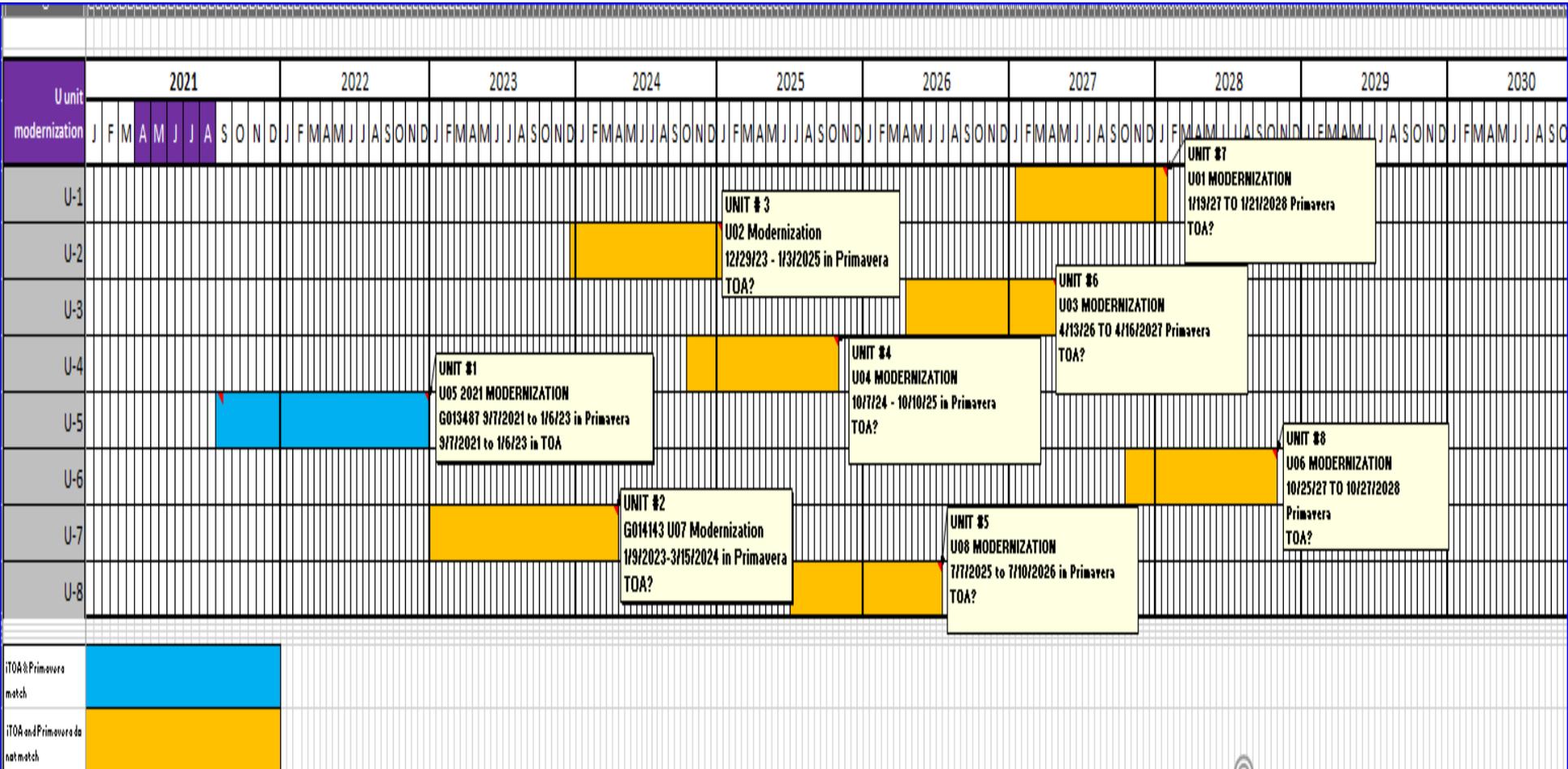
- Outer wicket gate ring
- Inner wicket gate ring
- Turbine guide bearing supports
- Turbine shaft
- Intermediate shaft
- Turbine hub cover
- Wicket gates for 1 unit (20)
- Stator frame
- Rotor poles for 1 Unit (72)

# Recommendation - Schedule

- Outages start 2021, and complete 2029
- First unit outage planned for 16 months
- Second unit outage starts after first unit outage is complete
- Third unit outage overlaps second unit outage
- Subsequent unit outages have similar planned durations and overlap to optimize schedule
- Schedule supports having all units in operation for expected 2030 HCP check-in

# Recommendation – Schedule

Supports fish passage and asset management objectives



# Recommendation – Budget

(in \$Nominal)

- Total budget \$313M
- Additional \$39M for balance of plant (BoP) projects
  - BoP projects have been (or soon will be) justified and funded as standalone projects through the normal budgeting process
- \$352M total RI PH2 expenditures between now and 2029
- \$1.8M included in 2018 capital budget

# Economics (in \$Nominal)

## Key metrics of economic analysis with selected sensitivities:

- Estimated Project Budget – \$352M
- 16.2% - Internal rate of return (IRR)
  - Values include energy capacity, carbon, and encroachment using forward price curves
  - Cost includes unit costs, risk mitigation components, on-site rehab capability, necessary balance of plant work, District labor, additional material and labor costs to support schedule
  - Utilized Asset Management to inform unit failure impacts to identify preferred scheduled

## Sensitivities

- 10.9% IRR using the lower future energy prices
  - Sensitivities pencil out to provide economic value to customers
  - Before District awards contract, key assumptions and value components will be revisited to confirm economic value

# Ongoing Risks and Issues

- Component condition – failure rate
  - Recommended schedule balances predicted failure rate with achievability. Expect forced outages during the term of the project
- Impacts to plant operations
- Other necessary RI Projects
- Site Facilities



# Planning and Coordination

- Bid prep and solicitation of proposals
- Safety evaluation
- Site Utilization
- Facilities Improvement Program
- RI PH1 Rehabilitation
- RI Spillway Modernization

# Resources

- Significant resources required to execute project scope
- Dedicated staff of 10 people
  - Includes District and contracted staff
  - Includes project managers, construction managers, engineers, admin support
- Three new limited assignment positions required
- Additional contracted support estimated at \$5.25M between now and 2022

# Next Steps – Rehab Contract

## Future Board Actions

- 11/20/2017 – Resolution for service agreement for consulting engineering support
- Q2 2018 – Request to Advertise
- Q4 2018 – Authorization to Award
  - Re-evaluation of project feasibility
  - Release one unit at a time
- Q3 2021 – Start first unit outage



# Appendix

# Decision Evaluation Criteria

## 1. What are the impacts to our customer owners?

- Economic value to customer owners returning an expected internal rate of return of ~16% with increased energy, capacity, carbon and encroachment values
- Many of existing components have remaining life of 40 or more years
- Rehabilitation provides the earliest schedule to mitigate failure risk of units out at the end of the rehab schedule period
- Rehabilitation provides more operational certainty and reduces the overall failure risk, particularly early in the life

# Decision Evaluation Criteria

## 2. Are there stewardship implications?

- Supports reinvestment in District hydro assets
- Rehabilitation is the most cost-effective path that reduces failure risk seeking long-term sustainability of operations
- Hydraulic capacity is maintained through rehabilitation
- Rehabilitation is likely the most efficient path forward from an HCP perspective
- Schedule considers avoiding rehabilitating two adjacent units at the same time which could create a predator rich environment
  - if working on adjacent units concurrently is necessary, then mitigation steps will be taken

# Decision Evaluation Criteria

## **3. What are the legal implications?**

- Rehabilitation is the most efficient path forward from a relicensing perspective
  - it will most likely be considered maintenance from FERC's perspective and not result in a lengthy amendment process

# Decision Evaluation Criteria

## 4. What are the workforce/operations implications?

- Rehabilitation has condition uncertainty on existing components that could result in project delays and/or new scoping for future units
- Resource requirements for staffing, contracted employees, and consultants increase beginning in 2018 through the duration of the project, particularly during simultaneously PH1 work.
  - results in 4 additional District FTEs during those years
- Proposed bidding strategy creates optionality for future units to allow the benefit of time and further development of known unknowns to inform project scope

# Decision Evaluation Criteria

## 5. What are other stakeholder implications?

- Maintaining capacity and energy capability and operational flexibility will be preferred by power purchasers
- Cost-plus purchasers have contract provisions that provide capital support
- Rating agencies would be supportive of the most cost-effective solution
- Fish agencies and the HCP Coordinating Committee should be supportive of rehabilitation
- Rehabilitation does not result in decreased hydraulic capacity, thus FERC should be supportive

# Decision Evaluation Criteria

## 6. What are impacts to Values?

- **Safety**: PH2 offers unique challenges due to the bulb design and confined space, however there may be opportunities to improve conditions through engineering and design of rehabbed units
- **Stewardship**: maintains hydraulic capacity, supportive of maintaining fish passage, provides incremental value to customer owners
- **Trustworthiness**: supports long-term relationships with power purchasers through value creation, supports current power contracts, avoids costs and uncertainty associated with alternatives, consistent with strategic plan
- **Operational Excellence**: supports reducing failure risk by pursuing a known design, creates opportunities for continuous knowledge building for engineers and crews, supports prudent financial decision making during a period of many District priorities



# Questions?

