Group-2 Exercise (Feb 17)

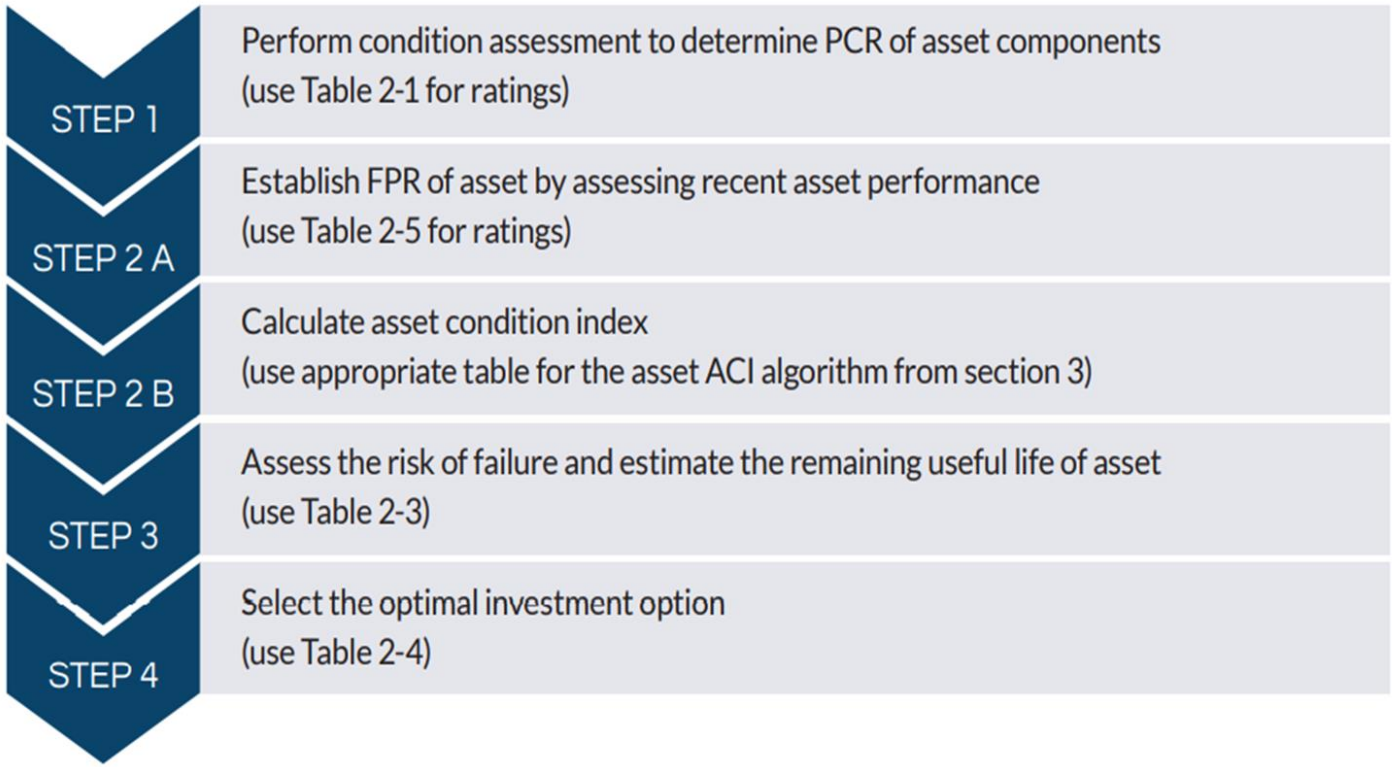
Water

Asset Condition Assessment For Water Pumping Station

- A water pumping station in Palau employs a 150 kW rated pump, which is about 20 years old. The pump motor is badly rusted and the pump suffers frequent breakdowns, resulting in numerous public complaints. .
- Calculate asset condition index for the plant and develop an investment plan.

Asset Condition Assessment of Power line

Since we have information available on both physical condition and functional performance of the water pumping station, to calculate condition assessment index and develop investment plan for this pumping plant, we will use the second approach which consists of the following steps, Figure 2-2 (Section 2):



Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)

To assess the condition of water pumping plant, we will need to assess physical condition of the plant and assign an appropriate rating from Table 2-1 in Section 2, to each main component of the water pump (described in Section 3.7.

Table 2-1 (Section 2)

Asset Component Condition	Physical Condition Rating	Interpretation
Asset Component in brand new condition, with no wear, no damage, no deformation, no defects, no deterioration, no impairment	5	Excellent
Asset Component in “like new” condition, with minor wear and no damage, no defects, no deformation, no deterioration and no impairment	4	Good
Asset Component shows minor wear, minor deformation, minor damage, minor defects, minor deterioration, minor impairment, asset condition can be maintained through normal preventative maintenance	3	Fair
Asset Component with major deformation, degradation, deterioration, damage or defects and serious impairment in condition; however component condition can be restored through economically efficient rehabilitation/refurbishment of degraded/faulty components.	2	Poor
Asset Component with major degradation, deterioration, damage or defects and serious impairment in condition, and it is not possible to restore the component condition through economically efficient rehabilitation/refurbishment	1	Very Poor

Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)

Section 3.7 describes the components of a water pumping plant to focus our assessment on. Water pumping plant is treated as a single component plant for the purpose of condition assessment.

Let’s perform condition assessment based on the information given: the pump motor is badly rusted and the pump suffers frequent breakdowns.

Step 1

- Perform condition assessment to determine PCR of asset components (use Table 2-1 for ratings)

Physical Condition Rating	Interpretation
5	Excellent
4	Good
3	Fair
2	Poor
1	Very poor

- Which rating would you give to water pumping plant, based on the given information about its condition?
- Please discuss within your group and assign a rating.

Step 2A

- Establish FPR of asset by assessing recent asset performance (use Table 2-5 for ratings)

To establish the Functional Performance Rating, we need recent performance assessment. Based on the initial description, we know this water pumping station has been experiencing frequent breakdowns, resulting in numerous public complaints. Use Table 2-5 to assign a functional performance rating to this water plant.

Table 2-5: Asset Functional Performance Ratings

Asset Functional Performance Rating	Condition Score	Interpretation
Asset's functional performance exceeds the upper limit of the desired service levels.	5	Excellent
Asset's functional performance meets the upper limit of the desired service levels.	4	Good
Asset's functional performance meets the lower limit of the service level requirements.	3	Fair
Asset's functional performance does not meet the lower limit of the service level requirements, however through refurbishment/renewal it is possible to restore the performance to acceptable level.	2	Poor
Asset's functional performance does not meet the lower limit of the service level requirements, and it is not possible to restore the performance to acceptable levels through renewal/refurbishment.	1	Very poor

Step 2B

• Calculate the Asset Condition Index

Now that we have assessed the physical condition rating and the functional performance rating of the water pumping plant, we will input them into Table 3-18 to calculate the Asset Condition Index.

Table 3-18 (Section 3)

Condition Criteria	Weight	Condition Ratings	Maximum Score	Actual Score
Physical Condition	3	?	15	#VALUE!
Asset Functional Performance	6	?	30	#VALUE!
Total Score			45	#VALUE!
Asset Condition Assessment Index (ACI) = (Actual Score / Maximum Score) x 100				#VALUE!

Risk of Failure and Remaining Useful Life

Step 3

- Assess the risk of asset failure and remaining useful life Use Table 2-3 (Section 2) shown below

Based on the Asset Condition Index value calculated in the previous slide, find the correct row in the first column of the table and then move to column 3 in the same row to find the remaining useful and move to column 4 in the same row to find the risk of asset failure.

Table 2:3 (Section 2)

Asset Condition Index	Interpretation	Remaining Useful Life	Risk of Failure in Service
0 to 20	Very Poor	< 5% of TUL	Very High
21 to 40	Poor	<20% and ≥5% of TUL	High
41 to 60	Fair	<50% and ≥20% of TUL	Moderate
61 to 80	Good	<85% and ≥50% of TUL	Low
81 to 100	Excellent	≥85% of TUL	Very Low

Investment plan

Step 4

- Select the optimal investment plan Use Table 2-4 (Section 2) shown below

- Based on the Asset Condition Index value calculated in the previous slide, what is the recommended action?

Table 2-4 (Section 2)

Asset or Component Condition	Recommended Action for Investment Planning
ACI = 0 to 20	Plan Asset Replacement - with High Priority
ACI = 21 to 40	Plan Asset Replacement
ACI>40, but one or more component's Rating 2 or Less	Plan Renewal of Components with Condition Rating of 2 or Less
ACI >50 and all components with rating of 3 or higher	Only Scheduled Maintenance and inspectuibs are Required

Water pumping Station – Cost Estimate

Table 4-12: Unit Costs for Water Production and Distribution Infrastructure

Infrastructure Asset	Unit	Cost
Cost of water desalination plant	$/m³/day	$1,000
Cost of ground level water storage tanks	300 m³	$220,000
	500 m³	$360,000
	1000 m³	$470,000
	2000 m³	$760,000
Cost of pressurized PVC water lines	$/m for 100 mm pipe	$100
	$/m for 150 mm pipe	$170
	$/m for 200 mm pipe	$230
	$/m for 250 mm pipe	$270
Cost of water manholes	Each	$10,000
Cost of pumping stations	$/kW of Capacity	$4,500

Note: kW = kilowatt, M = meter, mm = millimeter, m³ = cubic meter, PVC = polyvinyl chloride.

Water pumping Station Specifications			Units
Capacity of pump motor (power)	P	150	kW
Unit Costs for new pump (From Section 4)			
Unit cost for water pumping station (Table 4-12)	C_{wp}	$4,500.00	USD/kW
Price Adjustment Factor for Palau (Table 4-2)	P_{af}	1.3	
Cost Estimate			
Estimated Cost of new pumping station	P x C_{wp} x P_{af}	$1,170,000	USD

Group 2 Exercise Results

Condition Assessment of Distribution Line

- A water pumping station in Palau employs a 150 kW rated pump, which is about 20 years old. The pump motor is badly rusted and the pump suffers frequent breakdowns, resulting in numerous public complaints. .
- Calculate asset condition index for the plant and develop an investment plan.

Physical Condition Ratings	
Water pump	
Functional Performance Rating	
Asset Condition Index	
Remaining Useful Life	
Risk of Failure	
Estimated Investment	