

1. EVALUATION OF ALTERNATIVES

1.1. INTRODUCTION

Each alternative was evaluated using a point based matrix approach. The framework for matrix is shown in Figure 5-1. The matrix includes the following evaluation factors: biological benefits, construction costs, construction time, operating and maintenance cost, operational effectiveness, reliability, impacts to power revenues, and environmental factors. Numerical scoring for construction cost, operations and maintenance cost, and impacts to power revenue range from 0 to 4, with 0 being a highly unfavorable score and 4 being a highly favorable score. The numerical scoring for the remainder of the evaluation factors range from 1 to 4, with 1 being a highly unfavorable score and 4 being a highly favorable score. Weighting was applied to each factor to describe the relative importance of each on with respect to the others. The value of the weight was determined qualitatively using “professional judgment”.

1.2. EVALUATION FACTORS

This section describes the evaluation factors that were used to score the alternatives under consideration.

- Biological benefits evaluation factors were based on the ability of the alternative to meet the fish passage goals.
- Construction costs are considered in the evaluation of each alternative. Construction costs are qualitative in nature.
- Construction time is the overall difficulty or ease of constructing the alternative.
- Operation and maintenance cost considers the overall maintenance and cost of the alternative. For example, if a component needs to be inspected weekly, it will receive a low ranking score. If an alternative that has yearly maintenance or components that require less frequent inspections, it will receive a higher ranking score.
- Reliability evaluation factors are based on the overall ease to operate the alternative. For example, if the alternative had complicated steps required to operate or needed to be monitored on a continuous basis, it will receive a low score. If the alternative required few steps, less frequent monitoring, or required little or no adjustments to operate, it will receive a higher score.
- Impacts to power revenues were considered in the evaluation of each alternative.
- Environmental factors are based on the alternatives overall effect on water quality (total dissolved gas) in the river. Alternatives that increase the level of total dissolved gas from current estimated levels without the alternative will receive lower scores.

1.3. EVALUATION OF ALTERNATIVE A1 – FLOW CONTROL DEVICE ADJUSTABLE LOUVER

Alternative A1 has an Overall Score of 25.1 and a Total Biological Benefit Score of 4.5, which ranks this as the lowest ranked alternative. Impacts to Power Revenue costs were scored “Low” since the turbine unit could operate at full load. Construction Costs and Construction Time were scored “Medium” and “Fair”, respectively. This alternative would be somewhat difficult to construct because of the existing infrastructure and the confined space issues and could take up to 3 years to implement.

This alternative was scored “Good” for OPE since survival in the gatewell would be improved due to the less turbulent conditions as a result of the reduced discharge in the gatewell. However, this alternative was scored between “Poor” to “Fair” for Overall FGE. Because of the reduction in flow, less fish are diverted for the turbine into the gatewell and are forced to enter the turbine either below the fish screen or through the gap at the upper end of the fish screen.

1.4. EVALUATION OF ALTERNATIVE A2 – FLOW CONTROL DEVICE, SLIDING PLATE

Alternative A2 has an Overall Score of 25.8 and a Total Biological Benefit Score of 4.5, which ranks this as one of the lower ranked alternatives. Impacts to Power Revenue costs were scored “Low” since the turbine unit could operate at full load. Construction Costs and Construction Time were scored “low-medium” and “Fair”, respectively. This alternative would be somewhat difficult to construct because of the existing infrastructure and the confined space issues and could take up to 3 years to fully implement.

This alternative was scored “Good” for OPE since survival in the gatewell would be improved due to the less turbulent conditions as a result of the reduced discharge in the gatewell. However, this alternative was scored between “Poor” to “Fair” for Overall FGE. Because of the reduction in flow, less fish are diverted for the turbine into the gatewell and are forced to enter the turbine either below the fish screen or through the gap at the upper end of the fish screen.

1.5. EVALUATION OF ALTERNATIVE A3 – MODIFY VERTICAL BARRIER SCREEN PLATES

Alternative A3 has an Overall Score of 25.1 and a Total Biological Score of 4.5. Construction Costs were scored as “Medium”. The current VBS slot would need to be modified to accept an adjustable VBS. Construction Time was scored “Good” since it could be installed in one season. Reliability was rated as “Fair”. This alternative would require monitoring and adjustment to maintain the hydraulic conditions in the gatewell for fish survival.

This alternative was scored “Good” for OPE since survival in the gatewell would be improved due to the less turbulent conditions as a result of the reduced discharge in the gatewell. However, this alternative was scored between “Poor” to “Fair” for Overall FGE. Because of the reduction in flow, less fish are diverted from the turbine into the gatewell and are forced to enter the turbine either below the fish screen or through the gap at the upper end of the fish screen.

1.6. EVALUATION OF ALTERNATIVE A4 – MODIFY TURNING VANE AND/OR GAP DEVICE

Alternative A4 has an Overall Score of 25.6 and a Total Biological Benefit Score of 4.5. Impacts to Power Revenue costs were scored “Low” since the turbine unit could operate at full load. Construction Costs and Construction Time were scored “Medium” and “Fair”. This alternative may require the fabrication of new turning vanes and gap closure devices and could take up to 3 years to fully implement. Modifications to the existing gatewell are not anticipated with this alternative.

This alternative was scored “Good” for OPE since survival in the gatewell would be improved due to the less turbulent conditions as a result of the reduced discharge in the gatewell. However, this alternative

was scored between “Poor” to “Fair” for Overall FGE. Because of the reduction in flow, less fish are diverted for the turbine into the gatewell and are forced to enter the turbine either below the fish screen or through the gap at the upper end of the fish screen.

1.7. EVALUATION OF ALTERNATIVE B1 – OPERATE MAIN UNIT OFF 1% PEAK

Alternative B1 has an Overall Score of 27.9 and a Total Biological Score of 5.0. Impacts to Power Revenue costs were scored “Poor” since the turbine unit would not operate at peak operating efficiency. Environmental Factors was scored “Fair” since increased TDG may result if spill is needed to manage the excess flow from the curtailed unit operation.

This alternative was scored “Good” for OPE since survival in the gatewell would be improved due to the reduced turbulent conditions as a result of the reduced discharge in the gatewell. However, this alternative was scored “Fair” for Overall FGE. Because of the reduction in flow, less fish are diverted from the turbine into the gatewell.

1.8. EVALUATION OF ALTERNATIVE B2 - OPEN SECOND DSM ORIFICE

Alternative B2 has an Overall Score of 34.3 and a Total Biological Score of 7.0. This alternative is the highest ranked alternative. Construction Costs was scored “Low-medium” since a second orifice would be needed only in units 15-18 (units 11-14 are already have 2 orifices in each bay) and assumes DSM operating at fingerling criteria. Construction Time was scored “Good” since it could take to 2 years to complete.

This alternative was scored “Excellent” for OPE since survival in the gatewell would be improved due to the reduced time fish would be in the gatewell as a result of operating a second orifice. This alternative was scored “Good” for Overall FGE since the unit could be operated at peak efficiency.

1.9. EVALUATION OF ALTERNATIVE B3 – HORIZONTAL SLOT

Alternative B3 has an Overall Score of 30.9 and a Total Biological Score of 7.0. Construction Costs was scored “Med -High” due to the need to construct new slots and overflow weirs. Construction Time was scored “Poor” because construction could possibly take up to 4 years. Reliability was scored “Poor” since this is a new untested concept and the current downstream migrant system is successful.

This alternative was scored “Excellent” for OPE since survival in the gatewell would be improved due to the reduced time fish would be in the gatewell as a result of operating the horizontal slot. This alternative can take advantage of passing fish at the gatewell water surface.

1.10. EVALUATION OF ALTERNATIVE C1 – GATESLOT FILLERS

Alternative C1 has an Overall Score of 31.8 and a Total Biological Score of 6.5, which ranks this alternative in second place. O&M Costs were scored “Medium”. There is the potential for conflict with the existing operating equipment. The STSs and the video camera used to inspect the STS and VBS use the same gateslot. Construction time was scored as “Fair” since it may take 3years to fully implement.

This alternative was scored “Good” for FGE since the turbine can be operated at peak efficiency. This alternative was scored “Good” for OPE since survival in the gateway would be improved due to the reduction of turbulence in the gateway as a result of gateslot filler.

1.11. SUMMARY OF EVALUATION

Total Score was developed for alternatives considered. Within the Total Score a Total Biological Benefit score is shown. Weighting factors were included and adjusted to reflect the relative importance of the evaluation factors. Since this project is biologically driven, the Biological Benefit section received more weight than the non biological factors.

In the evaluation of alternatives, the Total Score and as well as the Total Biological Benefit score were considered in the decision. Since this is a biologically driven project, the Total Biological Benefit score was considered a very important factor in selecting which alternatives to further pursue. Based on that reasoning, Alternatives A1, A2, A3 and A4 were selected to no longer be pursued. Each of those Alternatives had relatively low Total Biological Benefit scores of 4.5. Each all had Total Scores ranging from 25.1 to 25.8. To put it in perspective, the Total Biological Benefit and Total Score for the Baseline Condition are 4.0 and 24.5, respectively.