Foster EDR FBW parameters

Dam Passage Efficiency (DPE)

**All life stages**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pool elev.** | **Baseline** | **Fish Weir 300cfs** | **Fish Weir 500cfs** | **Fish Weir 860cfs** | **Spillbay 4 low pool** | **Spillbay 4 high pool** | **Single Bypass 300cfs** | **Double Bypass 860cfs** | **Turbine Screens** |
| 637.00 | 0.80 | 0.80 | 0.90 | 0.95 | 0.98 | 0.95 | 0.95 | 0.95 | 0.98 |
| 614.00 | 0.80 | 0.90 | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| 613.00 | 0.80 | 0.90 | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| 609.00 | 0.80 | 0.90 | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| 596.80 | 0.80 | 0.90 | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| 583.25 | 0.80 | 0.90 | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |

Information sources used to prepare *DPE* assumptions:

* PNNL, 2014
* PNNL, 2015
* Also see summary of PNNL hydroacoustics and radio telemetry study results prepared by Fenton Khan

Route Survival

Chinook and Steelhead

Fry

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Baseline** | **Fish Weir 300cfs** | **Fish Weir 500cfs** | **Fish Weir 860cfs** | **Spillbay 4 low pool** | **Spillbay 4 high pool** | **Single Bypass 300cfs** | **Double Bypass 860cfs** | **Turbine Screens** |
| Spillway Survival | 0.937 | 0.95 | 0.95 | 0.95 | 0.98 | 0.95 | 0.98 | 0.98 | 0.95 |
| Turbine Survival | 0.882 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| Fish Passage Survival | 0.937 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |

Sub-yearlings

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Baseline** | **Fish Weir 300cfs** | **Fish Weir 500cfs** | **Fish Weir 860cfs** | **Spillbay 4 low pool** | **Spillbay 4 high pool** | **Single Bypass 300cfs** | **Double Bypass 860cfs** | **Turbine Screens** |
| Spillway Survival | 0.937 | 0.94 | 0.94 | 0.94 | 0.98 | 0.92 | 0.98 | 0.98 | 0.92 |
| Turbine Survival | 0.807 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| Fish Passage Survival | 0.937 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |

Yearlings

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Baseline** | **Fish Weir 300cfs** | **Fish Weir 500cfs** | **Fish Weir 860cfs** | **Spillbay 4 low pool** | **Spillbay 4 high pool** | **Single Bypass 300cfs** | **Double Bypass 860cfs** | **Turbine Screens** |
| Spillway Survival | 0.82 | 0.94 | 0.94 | 0.94 | 0.98 | 0.90 | 0.98 | 0.98 | 0.90 |
| Turbine Survival | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 |
| Fish Passage Survival | 0.82 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |

Information sources used to prepare *route survival* assumptions:

* Weir and Turbine: PNNL, 2014; Normandeau, 2013
* Spillway: based on John Day spillway route survival, given similar configuration/conditions.

Percent Fish Approaching

**For Baseline and Spillbay 4 Low Pool**

**Chinook salmon**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **fry** | | **subyr** | | **yearlings** | |
| **% Fish Approaching** | | **% Fish Approaching** | | **% Fish Approaching** | |
| September | 0.00 | September | 0.10 | September | 0.00 |
| October | 0.00 | October | 0.15 | October | 0.00 |
| November | 0.00 | November | 0.15 | November | 0.00 |
| December | 0.07 | December | 0.10 | December | 0.00 |
| January | 0.14 | January | 0.0 | January | 0.25 |
| February | 0.32 | February | 0.0 | February | 0.25 |
| March | 0.32 | March | 0.0 | March | 0.25 |
| April | 0.10 | April | 0.05 | April | 0.15 |
| May | 0.05 | May | 0.12 | May | 0.07 |
| June | 0.00 | June | 0.15 | June | 0.03 |
| July | 0.00 | July | 0.13 | July | 0.00 |
| August | 0.00 | August | 0.05 | August | 0.00 |

**Steelhead**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **fry** | | **subyr** | | **yearlings** | |
| **% Fish Approaching** | | **% Fish Approaching** | | **% Fish Approaching** | |
| September | 0.35 | September | 0.05 | September | 0.05 |
| October | 0.15 | October | 0.10 | October | 0.05 |
| November | 0.10 | November | 0.10 | November | 0.05 |
| December | 0.05 | December | 0.05 | December | 0.05 |
| January | 0.00 | January | 0.05 | January | 0.10 |
| February | 0.05 | February | 0.05 | February | 0.10 |
| March | 0.05 | March | 0.10 | March | 0.20 |
| April | 0.05 | April | 0.15 | April | 0.20 |
| May | 0.00 | May | 0.25 | May | 0.10 |
| June | 0.00 | June | 0.10 | June | 0.05 |
| July | 0.05 | July | 0.00 | July | 0.05 |
| August | 0.15 | August | 0.00 | August | 0.00 |

Percent Fish Approaching

**For All Alternatives except Baseline and Spillbay 4 Low Pool**

**Chinook salmon**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **fry** | | **subyr** | | **yearlings** | |
| **% Fish Approaching** | | **% Fish Approaching** | | **% Fish Approaching** | |
| September | 0.00 | September | 0.10 | September | 0.00 |
| October | 0.00 | October | 0.15 | October | 0.00 |
| November | 0.00 | November | 0.15 | November | 0.00 |
| December | 0.07 | December | 0.10 | December | 0.00 |
| January | 0.14 | January | 0.0 | January | 0.25 |
| February | 0.32 | February | 0.0 | February | 0.25 |
| March | 0.32 | March | 0.05 | March | 0.25 |
| April | 0.10 | April | 0.10 | April | 0.15 |
| May | 0.05 | May | 0.10 | May | 0.07 |
| June | 0.00 | June | 0.10 | June | 0.03 |
| July | 0.00 | July | 0.05 | July | 0.00 |
| August | 0.00 | August | 0.10 | August | 0.00 |

**Steelhead**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **fry** | | **subyr** | | **yearlings** | |
| **% Fish Approaching** | | **% Fish Approaching** | | **% Fish Approaching** | |
| September | 0.09 | September | 0.19 | September | 0.07 |
| October | 0.12 | October | 0.42 | October | 0.38 |
| November | 0.03 | November | 0.15 | November | 0.11 |
| December | 0.01 | December | 0.01 | December | 0.00 |
| January | 0.00 | January | 0.00 | January | 0.09 |
| February | 0.00 | February | 0.00 | February | 0.02 |
| March | 0.00 | March | 0.00 | March | 0.01 |
| April | 0.00 | April | 0.00 | April | 0.11 |
| May | 0.00 | May | 0.00 | May | 0.14 |
| June | 0.04 | June | 0.00 | June | 0.02 |
| July | 0.32 | July | 0.03 | July | 0.01 |
| August | 0.39 | August | 0.20 | August | 0.02 |

Information sources used to prepare *% fish approaching* assumptions:

* Fred Monzyk, personal communication (email) to Fenton Khan, December, 2015.

Route Effectiveness (RE)

**All life stages**

**BASELINE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.20 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.30 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.40 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.50 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.60 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.70 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.80 | 0.50 | 2.90 | 0.00 | 1.10 |
| 0.90 | 0.50 | 2.90 | 0.00 | 1.10 |
| 1.00 | 0.50 | 2.90 | 0.00 | 1.10 |

**Fish Weir, 300 cfs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.20 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.30 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.40 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.50 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.60 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.70 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.80 | 0.80 | 0.50 | 0.00 | 1.10 |
| 0.90 | 0.80 | 0.50 | 0.00 | 1.10 |
| 1.00 | 0.80 | 0.50 | 0.00 | 1.10 |

**Fish Weir 500 cfs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.80 | 5.0 | 0.00 | 1.10 |
| 0.20 | 0.80 | 5.0 | 0.00 | 1.10 |
| 0.30 | 0.80 | 5.0 | 0.00 | 1.10 |
| 0.40 | 0.80 | 5.0 | 0.00 | 1.10 |
| 0.50 | 0.80 | 5.0 | 0.00 | 1.10 |
| 0.60 | 0.80 | 5.0 | 0.00 | 1.10 |

**Fish Weir 860cfs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.20 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.30 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.40 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.50 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.60 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.70 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.80 | 0.80 | 10.0 | 0.00 | 1.10 |
| 0.90 | 0.80 | 10.0 | 0.00 | 1.10 |
| 1.00 | 0.80 | 10.0 | 0.00 | 1.10 |

**Spill bay 4 (low pool)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.20 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.30 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.40 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.50 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.60 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.70 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.80 | 10.0 | 0.00 | 0.00 | 0.8 |
| 0.90 | 10.0 | 0.00 | 0.00 | 0.8 |
| 1.00 | 10.0 | 0.00 | 0.00 | 0.8 |

**Spill bay 4 (high pool)**

**All life stages**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.20 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.30 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.40 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.50 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.60 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.70 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.80 | 10.0 | 0.00 | 0.00 | 0.3 |
| 0.90 | 10.0 | 0.00 | 0.00 | 0.3 |
| 1.00 | 10.0 | 0.00 | 0.00 | 0.3 |

**Single Bypass (300cfs)**

**All life stages**

**Rational for RE of fish passage route: single bypass will only be located along one shoreline and operated at 300cfs. Only fish approaching from shoreline where bypass canal is located will use the canal, and therefore used 7.0, as compared to 10.0 for the double bypass.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.20 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.30 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.40 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.50 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.60 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.70 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.80 | 0.8 | 7.0 | 0.00 | 1.10 |
| 0.90 | 0.8 | 7.0 | 0.00 | 1.10 |
| 1.00 | 0.8 | 7.0 | 0.00 | 1.10 |

**Double Bypass (860 cfs)**

**Rational for RE of fish passage route: double bypass will have canals along both shorelines and each operated at 430cfs (860cfs total). Fish approaching from either shoreline could encounter the bypass canals, and therefore used 10.0, as compared to 7.0 for the single bypass.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.20 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.30 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.40 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.50 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.60 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.70 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.80 | 0.8 | 10.0 | 0.00 | 1.10 |
| 0.90 | 0.8 | 10.0 | 0.00 | 1.10 |
| 1.00 | 0.8 | 10.0 | 0.00 | 1.10 |

**Turbine Screen**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Route Effectiveness Curves | |  |  |  |
| Q Ratio | Spill | Fish Pass | RO | Turb |
| 0.10 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.20 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.30 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.40 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.50 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.60 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.70 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.80 | 0.80 | 0.00 | 0.00 | 0.001 |
| 0.90 | 0.80 | 0.00 | 0.00 | 0.001 |
| 1.00 | 0.80 | 0.00 | 0.00 | 0.001 |

Information sources used to prepare RE assumptions:

* PNNL, 2014
* PNNL, 2015

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