Northwest **Power** and **Conservation** Council



September 7, 2022

**MEMORANDUM**

**TO:** **Fish and Wildlife Committee Members**

**FROM:** **Mark Fritsch**

**SUBJECT:** **Fish Passage Manual and Introduction of New Climate Change Guidance for Fish Passage Projects**

## BACKGROUND:

Presenter: Jeff Brown, *Hydraulic Engineer, West Coast Region, NOAA Fisheries*

Summary: Jeff will provide a brief update on the history and status overview of NOAA's recently released updated passage design manual. The manual provides general guidance for the design, operation, and maintenance of fishways throughout the Pacific Northwest. In addition, Jeff will highlight efforts for expanding the use of climate science in management applications fish passage projects and modifications.

Relevance: Fish and Wildlife managers use this manual for the design and operation of facilities at barriers to fish migration and water intakes (including screens), as well as all the habitat restoration efforts including weirs, channel construction (floodplain reconnect), stream crossings, passage and road crossings (culverts) to create safe passage routes for adult and juvenile salmonids in the rivers and streams in the Columbia Basin.

Workplan: Fish and Wildlife Division work plan 2022; Program Implementation.

More Info:

- NMFS (National Marine Fisheries Service). 2022. Guidelines for Salmonid Passage at Stream Crossings in Oregon, Washington, and Idaho. NMFS. WCR. Portland, Oregon.
- NMFS (National Marine Fisheries Service). 2021. DRAFT Western Regional Action Plan to Implement the NOAA Fisheries Climate Science Strategy in 2022 – 2024. NMFS. WCR. Portland, Oregon.
- Northwest Power and Conservation Council, Program Tracker, Fish Screens resource map web-site.

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# NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual-An Update

Jeff Brown, P.E.
Hydraulic Engineer
National Marine Fisheries Service

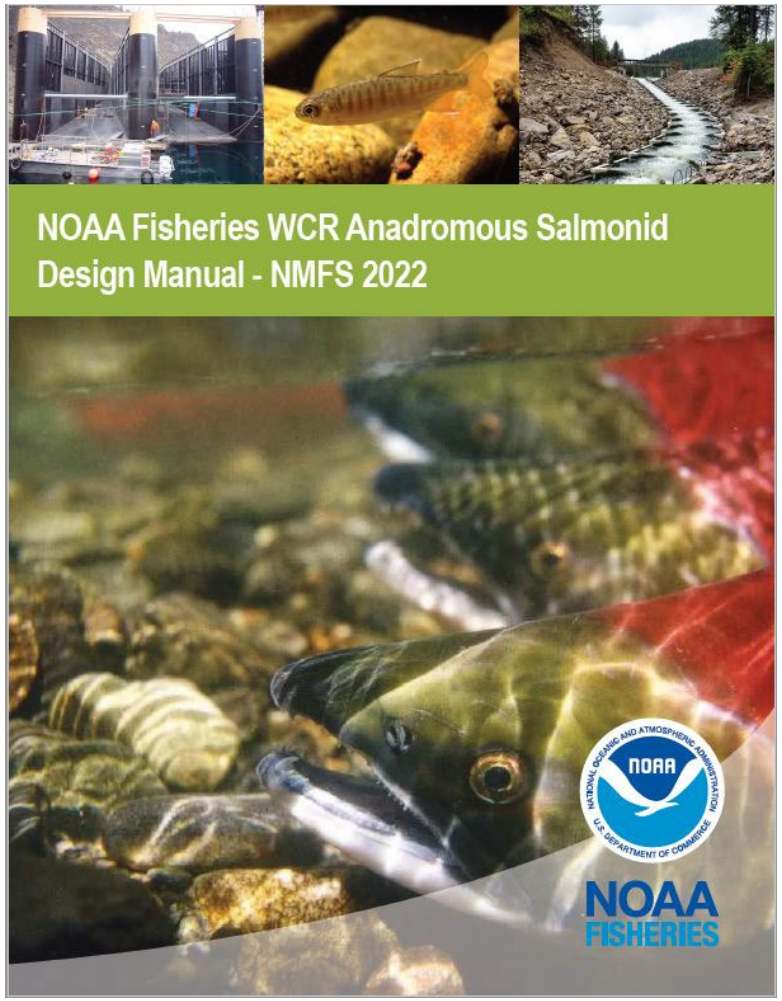
# History of NMFS Passage Criteria

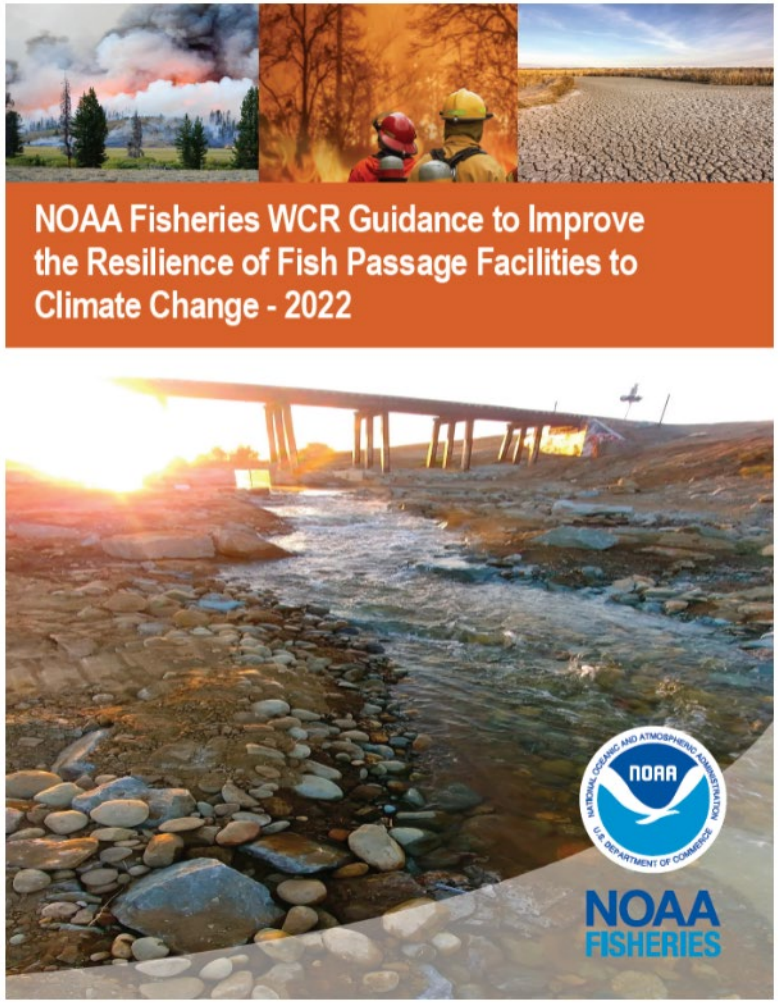
- 11/19/1993, *working paper* The Use of Barriers to Prevent Adult Salmon Delay And Injury at Hydroelectric Powerhouses and Wasteways (NWR)
- 1/1994: Experimental Fish Guidance Devices (Position Statement) (SWR)
- 11/1994, National Marine Fisheries Service Northwest Region Position Paper on Experimental Technology for Managing Downstream Salmonid Passage (NWR)
- 2/16/1995, Juvenile Fish Screen Criteria (NWR)
- 5/9/1996, Juvenile Fish Screen Criteria for Pump Screen Intakes (Addendum to 1995) (NWR)
- 1/1997: Fish Screening Criteria for Anadromous Salmonids (SWR)
- 8/2001: Water Drafting Specifications (SWR)
- 2/2008, Anadromous Salmonid Passage Facility Design (NWR)
- 7/2011, Update to Anadromous Salmonid Passage Facility Design (NWR)
- 9/2001: Guidelines for Salmonid Passage at Stream Crossings (Update in 2019 remains current) (SWR)

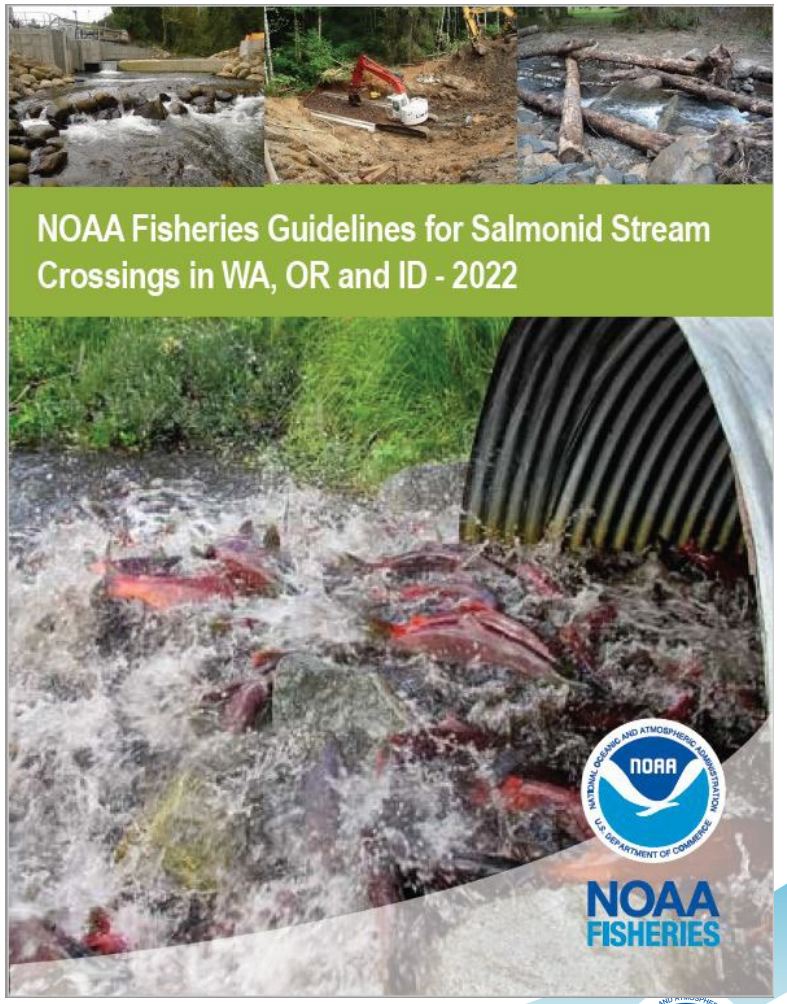
# Purpose of Recent Revisions

- Integrate SWR and NWR design criteria subsequent to merger of regions.
- Update for new information.
- Focus on inclusion of underlying science.
- Implementation of climate resilience into designs.
- Maintain consistency with State Agency criteria where possible/appropriate.

# Documents



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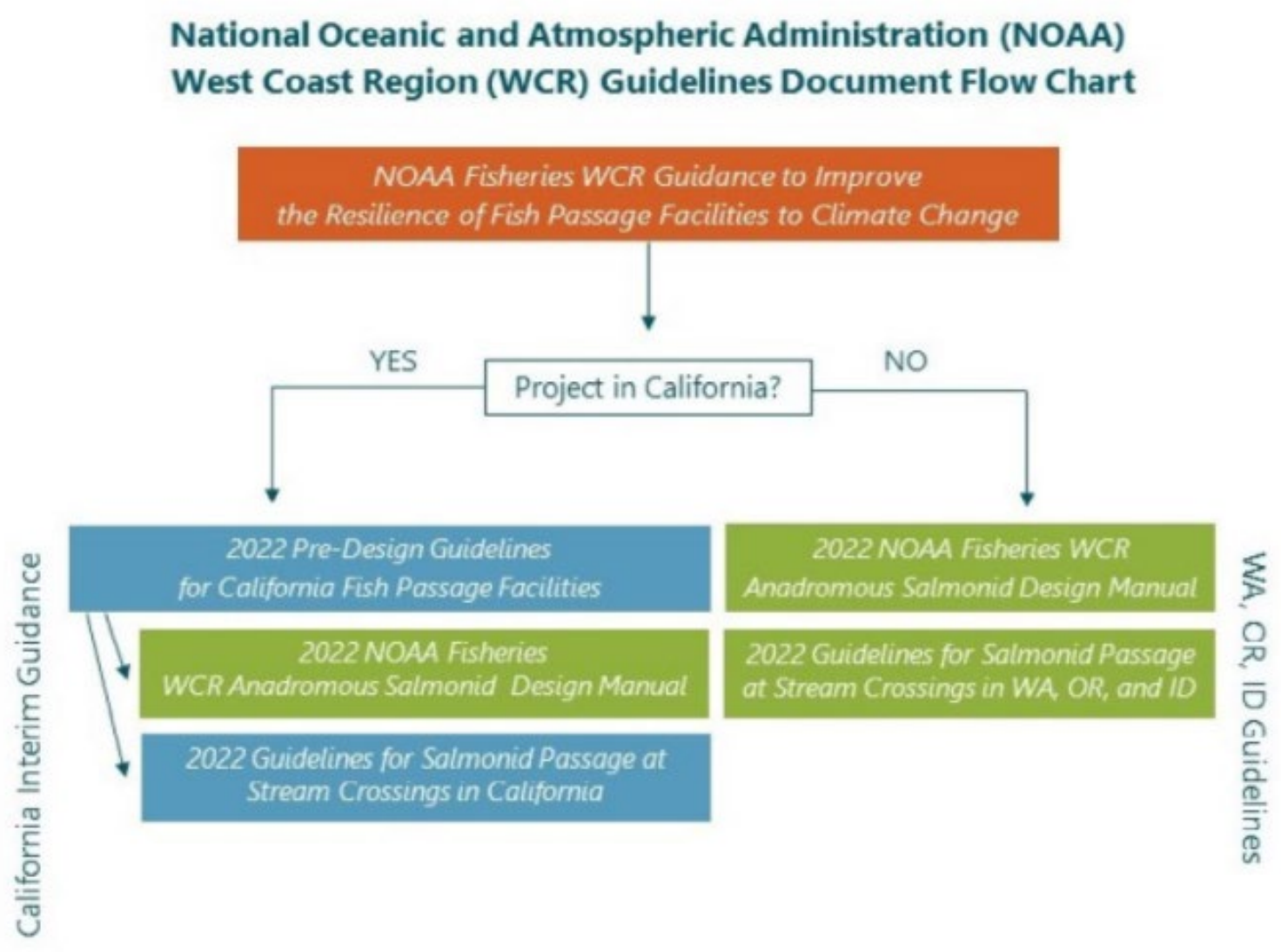
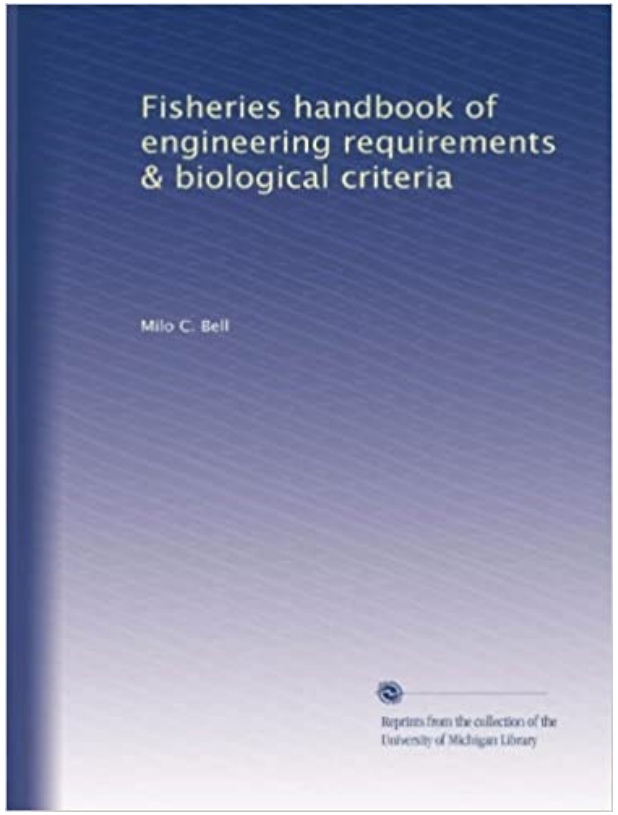
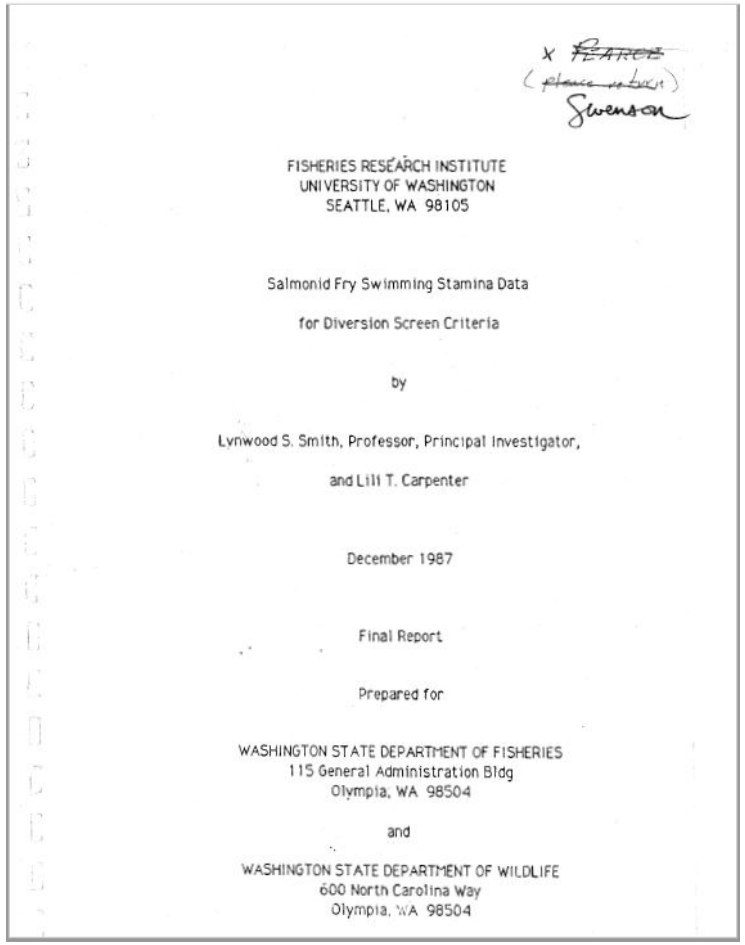
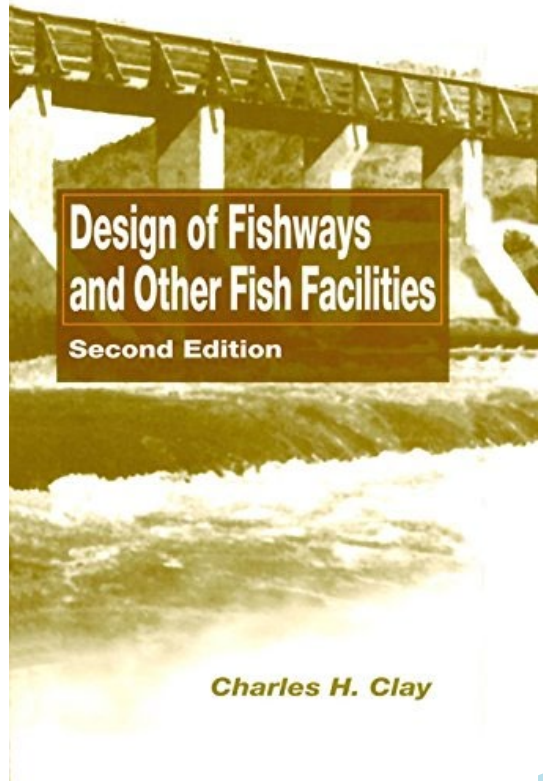
# Interaction of Documents



# Primary Focus: Inclusion of Underlying Science



# Significant Changes

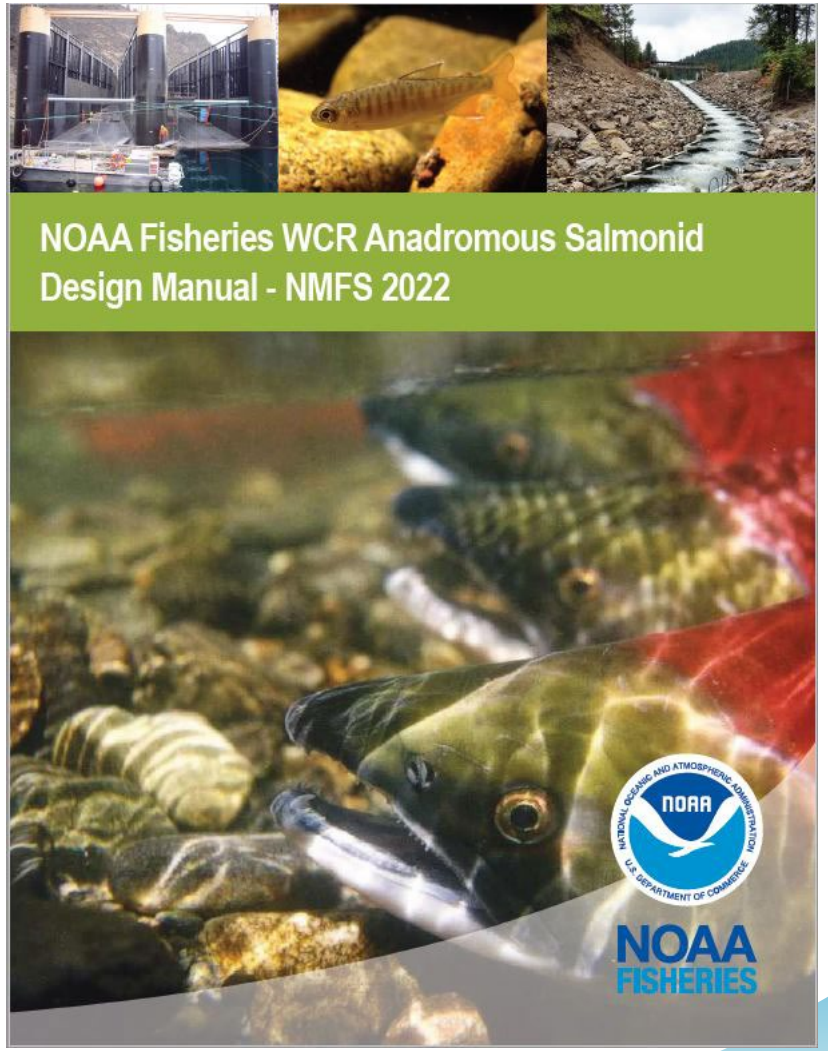
- Sections moved to Appendices:
  - Tide Gates.
  - Infiltration Galleries
- Other new appendices
  - Major expansion of experimental technology approval process.
  - Surface collection of juveniles
- Stream Crossings moved to separate document.
  - *Some replication of content related to grade control/nature-like fishways

# Significant Changes

- Upstream Fish Passage:
  - Expanded section on Nature Like Fishways
  - More detailed design information (formulas, equations, etc)
  - Significantly more detail on Denil, Alaska Steep-Pass Fishways
- Fish Screens:
  - Added cone screen section

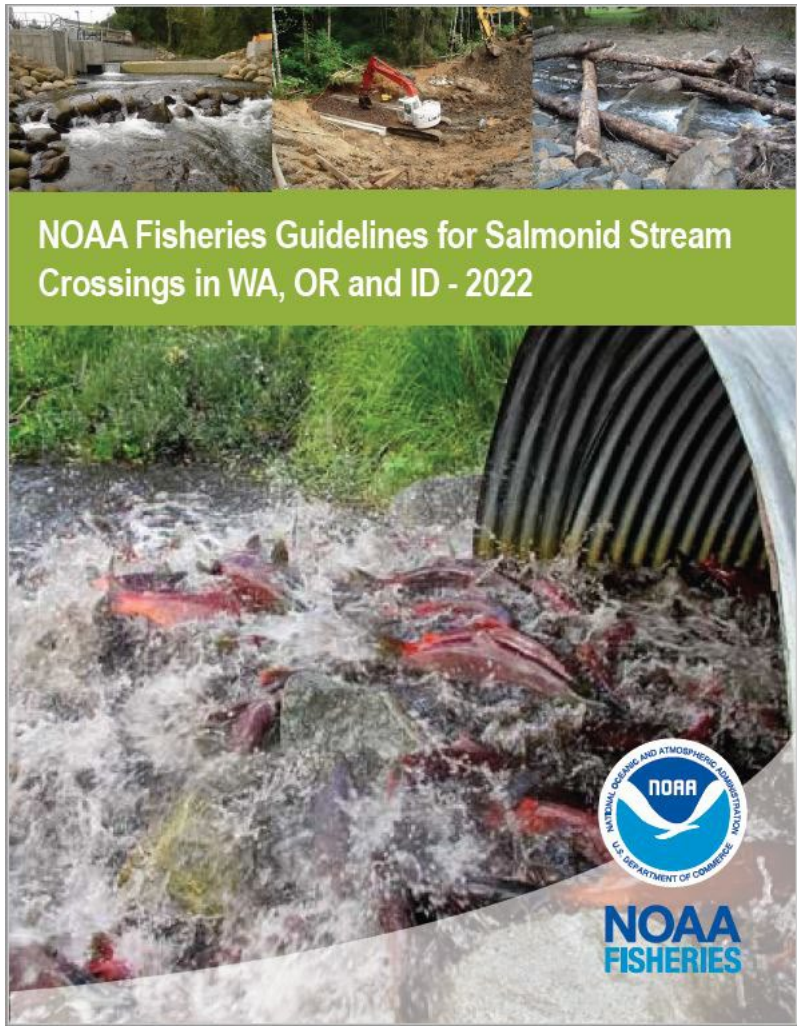
# Contents of Design Manual

- Ch 1&2: Intro and Terms
- Ch 3: Design and Review Process
- Ch 4: Design Flow Range (Hydrology)
- Ch 5: Upstream Adult Fish Passage (Fishways)
- Ch 6: Exclusion Barriers
- Ch 7: Adult Fish Traps and Transport
- Ch 8: Fish Screens and Bypass Systems
- Ch 9: Operations and Maintenance



# Contents of Stream Crossing Manual

- Ch 1 & 2: Introduction & Terms
- Ch 3: Culverts/Bridges
- Ch 4: Grade Control



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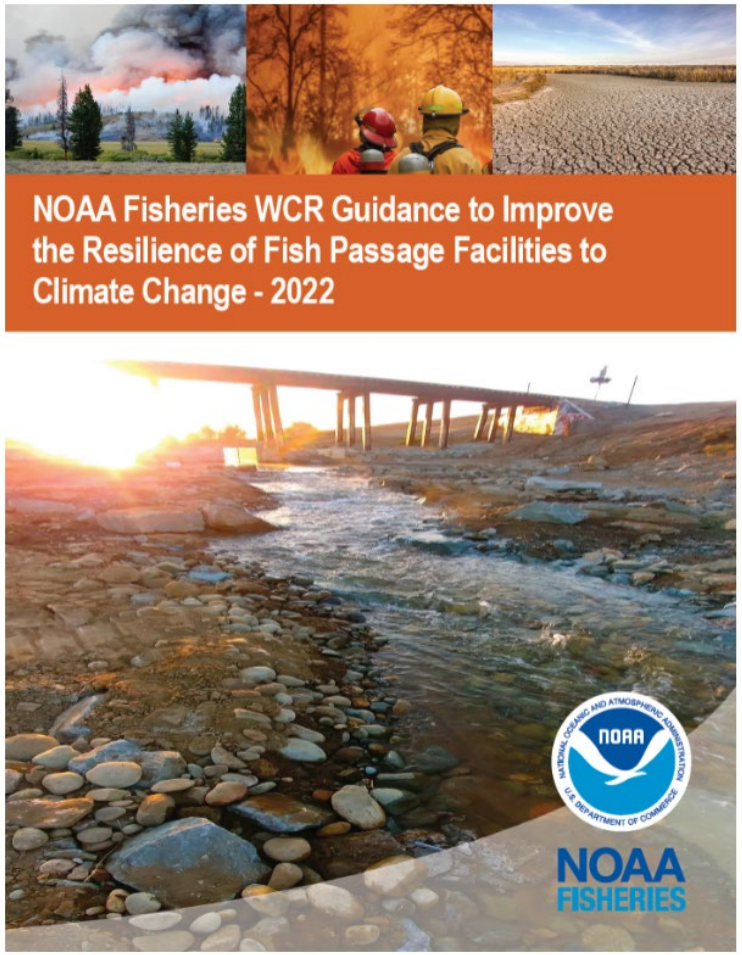
# Appendices

- Appendix A: Near-Field Hydraulics that Affect Salmonid Passage in Tide Gates
- Appendix B: Infiltration Galleries
- Appendix C: Experimental Technologies
- Appendix D: Surface Collection
- Appendix E: Performing Hydraulic Evaluations
- Appendix F: Juvenile Fish Collection and Evaluation Facilities
- Appendix G: Columbia and Snake River Fish Passage Facilities
- Appendix H: Sizing Fish Ladder Pools Based on Energy Dissipation and Fish Run Size
- Appendix I: Upstream Juvenile Fish Passage

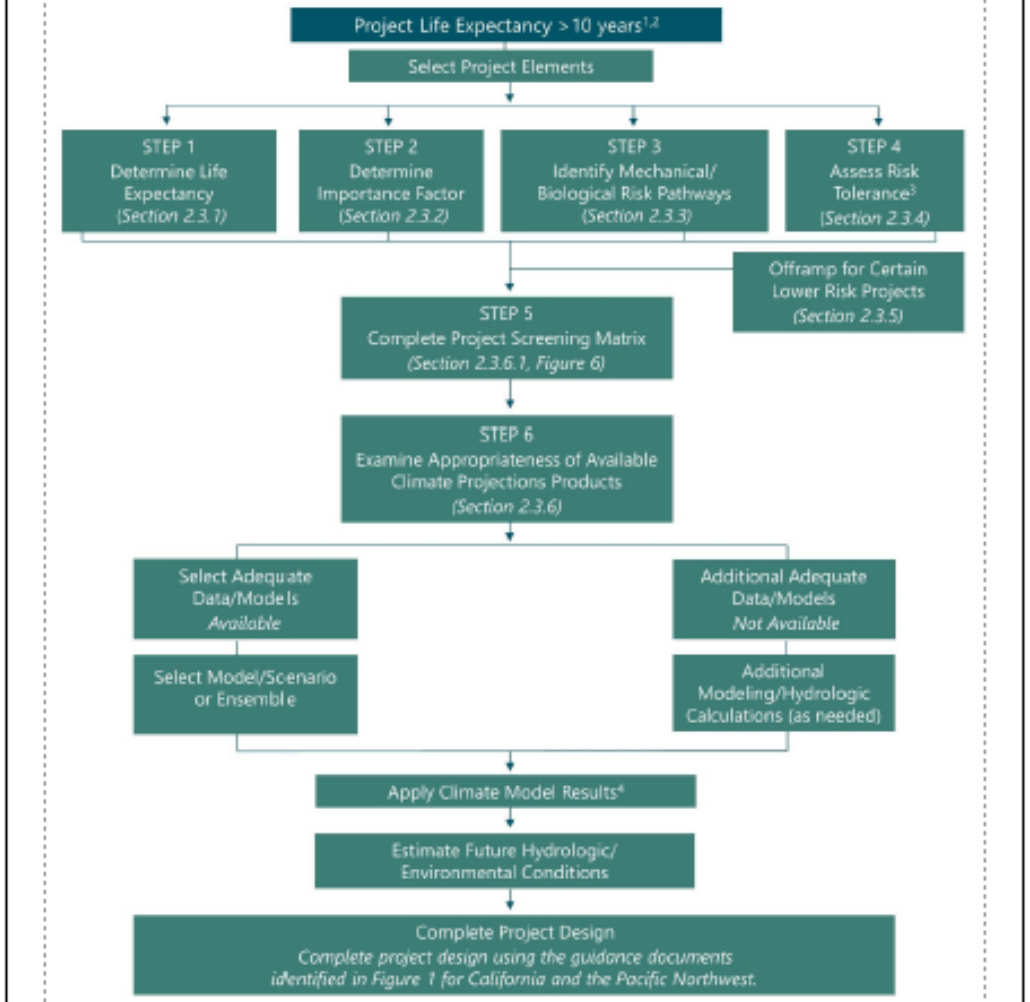
# Climate Change Resilience

- NMFS directed line offices in 2016 to incorporate climate change into project designs.
  - Minimal guidance provided on how to do so.
- This effort is focused on a user oriented process
  - Includes sources for appropriate climate modelling dat
  - Organized around process flow-chart and risk tables.
- Expected to be published in next 2-3 weeks.



# Climate Resilience, Cont.

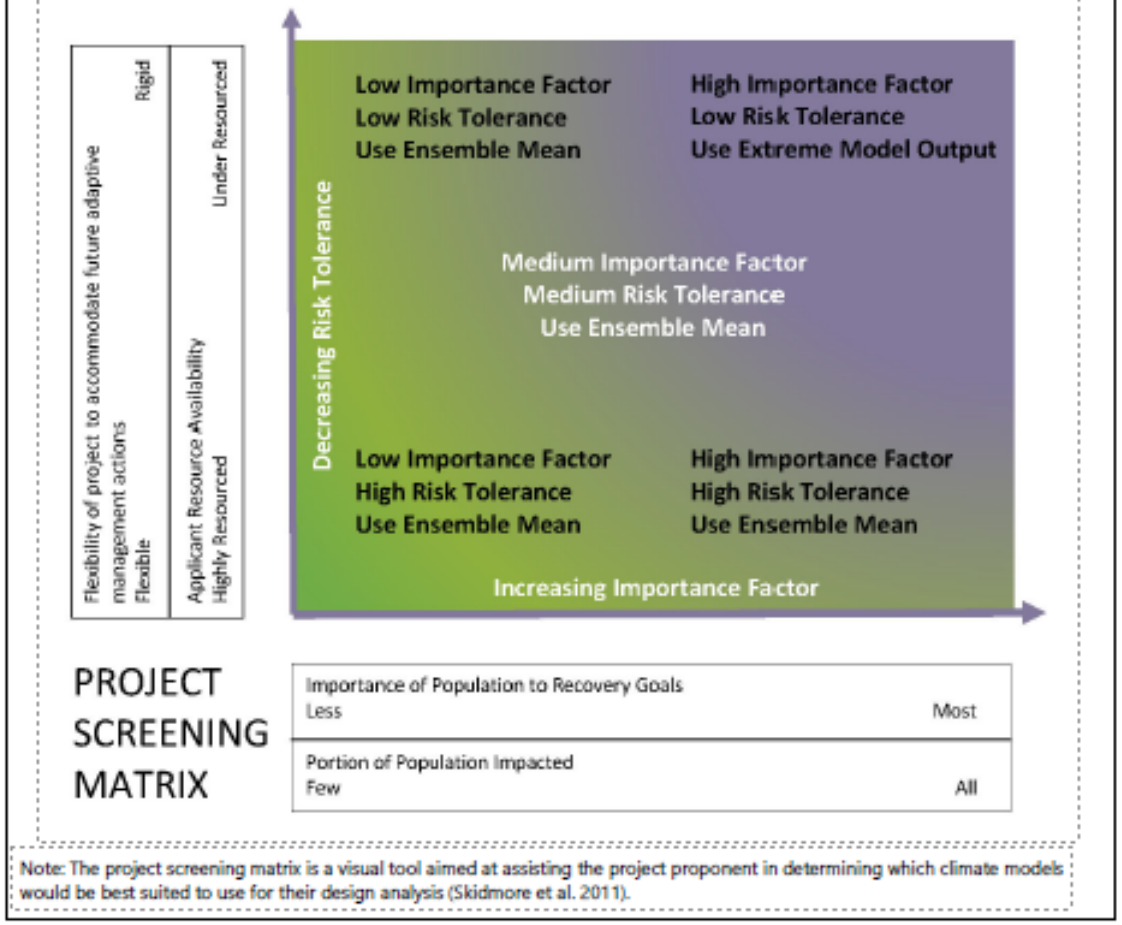
**Figure 5**
**Process Flowchart for Long-Term Projects (>10 years)**




Notes:

1. Project may include but is not limited to elements such as water diversions, fish screens, fish bypasses, fish ladders, AWS systems, fish traps, juvenile fish collection systems, adult barriers, bridges, culverts, grade control fishways, and roughened channels.
2. Life expectancy is defined as the anticipated duration of time that the project is in place before it is removed or replaced.
3. Assess risk tolerance of NMFS and Applicant.
4. Apply climate model results in the form of adjustment factor to current environmental conditions. Integrate recalculated environmental conditions to Risk Pathways matrix.

**Figure 6**
**Project Screening Matrix**




Note: The project screening matrix is a visual tool aimed at assisting the project proponent in determining which climate models would be best suited to use for their design analysis (Skidmore et al. 2011).

# Climate Resilience, Cont.

**Table 4**
**Fish Element Risk Pathways**
**Element: Screen Bypass Systems (in Tributary-Scale Streams)**

| Wet/Dry Periods | | Streamflows | | | Water Temperature | Wildfires | |
|---|---|---|---|---|---|---|---|
| Wet Extremes | Dry Extremes | Increased Max Flow | Decreased Min Flow | Runoff Timing Shift | Increase | Effects | Sediment and Debris |
| **Transportation Systems**[1] | | | | | | | |
| No additional risks due to climate change effects are identified at this time. | RISK: In some cases, water diversions can remove most or all of the flow from the stream. The flow rate in the bypass can be insufficient to pass fish downstream of the bypass discharge point.<br><br>ACTIONS TO CONSIDER: Transportation of juveniles and adults may be required if the stream has insufficient instream flow downstream of the screen bypass discharge point. | No additional risks due to climate change effects are identified at this time. | RISK: In some cases, water diversions can remove most or all of the flow from the stream. The flow rate in the bypass can be insufficient to pass fish downstream of the bypass discharge point.<br><br>ACTIONS TO CONSIDER: Transportation of juveniles and adults may be required if the stream has insufficient instream flow downstream of the screen bypass discharge point. | RISK: Juvenile outmigration dates may shift with runoff timing. Presumably the shift would be earlier. Allowable maintenance periods may shift or shrink with changes in run timing.<br><br>ACTIONS TO CONSIDER: Complete winter maintenance earlier to ensure screens are operational during earlier runoff and migration. | RISK: In some cases, water diversions can remove most or all of the flow from the stream. The water temperature in the bypass and in the river below the bypass can be too warm to safely pass fish downstream of the bypass discharge point.<br><br>ACTIONS TO CONSIDER: Transportation of juveniles and adults may be required if water is too warm downstream of the screen bypass discharge point. | RISK: Effects of wildfires are increased sediment and wood accumulation and increased risk of flash floods and debris flows. Debris accumulation reduces flow capacity and blocks fish passage.<br><br>ACTIONS TO CONSIDER: Additional monitoring, debris removal, and maintenance. | RISK: Increased peak flows and floods may increase sediment and debris movement, occlude fishway entrances, and affect volitional passage.<br><br>ACTIONS TO CONSIDER: Additional monitoring, debris removal, and maintenance. |
| **Channel Stability** | | | | | | | |
| RISK: High flows in gravel bed rivers can destroy the outfall and move the main channel away from the bypass outfall discharge location.<br><br>ACTIONS TO CONSIDER: Use fluvial geomorphology design techniques to modify the channel to maintain dynamic equilibrium (continuity of sediment discharge) during high flows, while maintaining bank stability and fish passage. | No additional risks due to climate change effects are identified at this time. | RISK: High flows in gravel bed rivers can destroy the outfall and move the main channel away from the bypass outfall discharge location.<br><br>ACTIONS TO CONSIDER: Use fluvial geomorphology design techniques to modify the channel to maintain dynamic equilibrium (continuity of sediment discharge) during high flows, while maintaining bank stability and fish passage. | No additional risks due to climate change effects are identified at this time. | No additional risks due to climate change effects are identified at this time. | No additional risks due to climate change effects are identified at this time. | RISK: Effects of wildfires are increased sediment and wood accumulation and increased risk of flash floods and debris flows. Debris accumulation reduces flow capacity and blocks fish passage.<br><br>ACTIONS TO CONSIDER: Additional monitoring, debris removal, and maintenance. | RISK: Increased max flows may mobilize sediment and debris at higher levels than currently occurs, risking blockage of bypass outfall.<br><br>ACTIONS TO CONSIDER: Use fluvial geomorphology design techniques to modify the channel to maintain dynamic equilibrium (continuity of sediment discharge) during high flows, while maintaining bank stability and fish passage. |

# Questions?

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