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April 3, 2018

### MEMORANDUM

**TO: Council Members**

**FROM: Erik Merrill, Manager, Independent Scientific Review**

**SUBJECT: Independent Scientific Advisory Board (ISAB) Review of the 2014  
Columbia River Basin Fish and Wildlife Program**

### BACKGROUND:

**Presenters:** Alec Maule, ISAB Chair, and Stan Gregory, ISAB member

**Summary:** In a [September 2017 letter](#), the Northwest Power and Conservation Council asked the ISAB to evaluate the Council's 2014 Columbia River Basin Fish and Wildlife Program on its scientific merits in time to inform amendments to the Program and before the Council requests recommendations from the region. In its review, the ISAB used previous ISAB reports, including earlier reviews of the Program, and other documents including the Council staff's Program Implementation Assessment Report. The ISAB's report evaluates the scientific merit of each of the 2014 Program's strategies and makes suggestions for modifications to improve scientific aspects of the strategies. In an [October 2017 message](#), the Council asked the ISAB to answer seven questions as part of the review. Those questions and answers can be found just below the Executive Summary in the report. Overall the ISAB found that most sections of the 2014 Program provide sound scientific guidance for actions to mitigate for hydrosystem impacts and move toward recovery of fish and wildlife resources in the Columbia River Basin.

The ISAB found many strengths in the Program. Among these strengths is Mainstem Hydrosystem passage research, which focuses mainly on survival of anadromous salmonids. The ISAB also sees great value in the Program's Protected Areas, which currently protect over 44,000 miles of rivers and streams of the Northwest from hydropower development, and the potential for the Stronghold Habitat strategy to protect native, wild, and natural-origin fish. The ISAB applauds the Program's strategy for Anadromous Fish Mitigation in Blocked Areas as first steps toward reestablishing salmon and steelhead in one third of their original habitat. Public Engagement is also a strength of the Program as descriptions of strategy, rationale, principles, and general measures are well-articulated. Although it is not a specific strategy of the Program, the ISAB also supports the Council's interest in life-cycle models, which the ISAB sees as key to evaluating many proposed changes in the system.

The ISAB also identified several major weaknesses including the majority of Program goals need corresponding objectives, key Program strategies lack monitoring or evaluation plans or funding, and the Program provides limited guidance and use of adaptive management. The ISAB also noted that cost-effectiveness analysis has not been systematically undertaken to rank and prioritize projects. The ISAB's report suggests approaches to improve strengths and address weaknesses. The ISAB recognizes that the Program is a living document, one that is evolving to incorporate new information and to meet ever changing conditions in the Basin. The ISAB hopes that its recommendations will prove useful to the Council, its staff, and others in the Basin as they develop the next Fish and Wildlife Program.

The ISAB's presentation will highlight the report's conclusions and recommendations.

**Relevance:** The Program and ISAB Terms of Reference call for the ISAB's review of the Program on its scientific merits in time to inform the Program amendments. Council staff are currently drafting a request for recommendations to amend the 2014 Program, and the ISAB review is intended to inform the region when developing recommendations for the 2018 Program amendment process.

**Workplan:** Scientific reviews are an integral part of the Fish and Wildlife Program's work plan.

**More Info:** The report is posted ([link](#)) and available as a Word document in BOX ([link](#)).

# Evaluate scientific merits of 2014 Fish and Wildlife Program to inform 2018 Program amendments

Northwest Power & Conservation Council  
April 11, 2018

INDEPENDENT SCIENTIFIC ADVISORY BOARD

## Review of the 2014 Columbia River Basin Fish and Wildlife Program

ISAB 2018-3 MARCH 23, 2018



# Strengths in the 2014 Program

- Mainstem Hydrosystem salmonid passage
- Protected Areas – over 44,000 river miles protected
- Stronghold Habitats—protect wild & natural-origin fish
  - Key Watersheds – NW Forest Plan (not part of Program)—provide high-quality habitat, refugia for aquatic- and riparian-dependent species (PNW-GTR-856, February 2012)
- Anadromous fish mitigation in blocked areas
- Public engagement – well articulated
- Life-cycle models – key to evaluating changes

# Some general Program weaknesses

- Many goals lack objectives
- Key strategies lack monitoring & evaluation plans
- Funds are lacking for monitoring & evaluation
- Limited guidance & use of Adaptive Management

ISAB recommendations are aimed at strengthening Program

# Program Framework

- Vision
- Scientific Principles
- Program Goals and Objectives
- Adaptive Management Strategy
- Strategies

# **Council's Questions to the ISAB**

# Q1. Changes to ensure mitigation investments perform in face of threats?

- ISAB offers changes throughout the report to Program's framework, vision, objectives, strategies and measures, and research, monitoring, and evaluation
- Investment strategy time frame (1-20 yrs) is unrealistic
  - Highly altered state of Basin ecosystem
  - Scientific uncertainty – existing & future threats
- Comprehensive strategic plan for M & E is needed
- Adaptive Management highest priority
- Need: quantitative cost-effectiveness analysis to set priorities & select projects



## Q2. Guidance on type & scale of objectives & reporting indicators for Program?

- Set objectives at the **subbasin level** – aggregate to overarching goals
- Productivity, **diversity** (genetic and life history), and spatial structure
  - specific to subbasins and fish stocks
  - aggregated to larger spatial scales.
- **Life-history diversity critical** to prevent extinction in face of Climate Change.
- **Experts in each subbasin** best suited to develop specific, measurable, achievable, relevant and time-limited (SMART) objectives

# Q3: Does 2014 Program improve on 2009?

## Valid scientifically & on trajectory to achieve basinwide objectives?

- 2014 Program includes **indirect** (protect habitat) & **direct objectives** (survival: abundance, diversity & adaptability)
- ISAB support of objectives (Crit. Uncertainty Report)
- Most of Program has valid scientific basis; some quantitative objectives not based on scientific principles
- ISAB does not believe **5 million adults at Bonneville is realistic**
  - **Historic abundance 5-9 million** (Density Dep. Rept. ISAB 2015-1)
  - One third of **historic habitat blocked**
  - Remaining **habitat damaged** by human influences
  - **Density dependence** population regulation in many subbasins

# Q4. What guidance can ensure Life-Cycle Models are appropriate and address Program needs?

- Important tools; should be incorporated into Adaptive Management cycle
- Help understanding of current system & limiting factors at each life stage
- Explore impact of management on long-term performance
- Useful for ranking actions but not predicting specific outcomes
- Can incorporate cost-effectiveness analysis

# Q5. Can mainstem hydro flow & passage be strengthened to improve adult & juvenile survival?

- Improvements have benefited survival of anadromous salmonids & should be continued in context of total life cycle
- Effects on other fish (lamprey, eulachon & sturgeon) are not well understood
- An ecosystem approach would address impacts on other species including non-natives, primary & secondary production (i.e., food)
- The Program also needs to consider mainstem habitat and floodplain connectivity

## Q6. Improvements in survival, productivity, capacity by mitigation (habitat, art. prod.)?

- **Cannot estimate** – data limitations (uneven across the Basin). Four areas of information needed:
- **Population-specific** estimates of current capacity, productivity & survival
- Comprehensive assessments on a **reach scale** to determine opportunity to expand habitat capacity
- Assess genetic **diversity** & life history expressions of fish used in conservation or supplementation programs
- **Cumulative effect** of all fish (hatchery & natural) on survival & productivity (most difficult to obtain)

# Q7. Approach to refine Program's 2-6% SAR objectives to meet needs for assessment & reporting?

Readily measured, first-order objective. Key issues:

- **Discrepancies** in SARs of PIT-tagged vs non-PIT-tagged fish
- How does **age at maturation** affect SARs?
- Contribution of **mini-jacks** to SARs
- Relationship between **SARs and biomass** of adult returns
- Causes of variation in SARs in relation to **uncontrollable-** (climate change) & **controllable-factors** (hydro operations and transport).

# Scientific Principles

- The principles recommended previously are [scientifically sound](#) (Link to crosswalk footnote on page 24)
- The ISAB recommends the principles be reduced to four
- Revised to aim at management of Basin power-generating & irrigation-supporting ecosystem
- Principles imply certain actions and conditions are needed to restore salmon, steelhead, and other native fish and wildlife in the Basin.
- We continue to emphasize the 2014 themes of [resilience, socioeconomics, and public engagement](#), but also emphasize the [importance of connectivity](#).

Principle 1. Take the entire ecosystem into account including freshwater, estuary, and ocean, and the linkages and feedbacks between the natural and human systems.



Principle 2. Provide the diverse array of habitats and connections among them that organisms require throughout their life cycles to restore and sustain diverse, abundant, resilient populations.

Principle 3. Maintain the diversity of genes, life histories, populations, and biological communities that allows ecosystems to adapt to environmental change.

Principle 4. Fish and wildlife live in complex ecosystems dominated by humans; to achieve system resilience and persistence, we need to understand societal values and incorporate these in decision making.

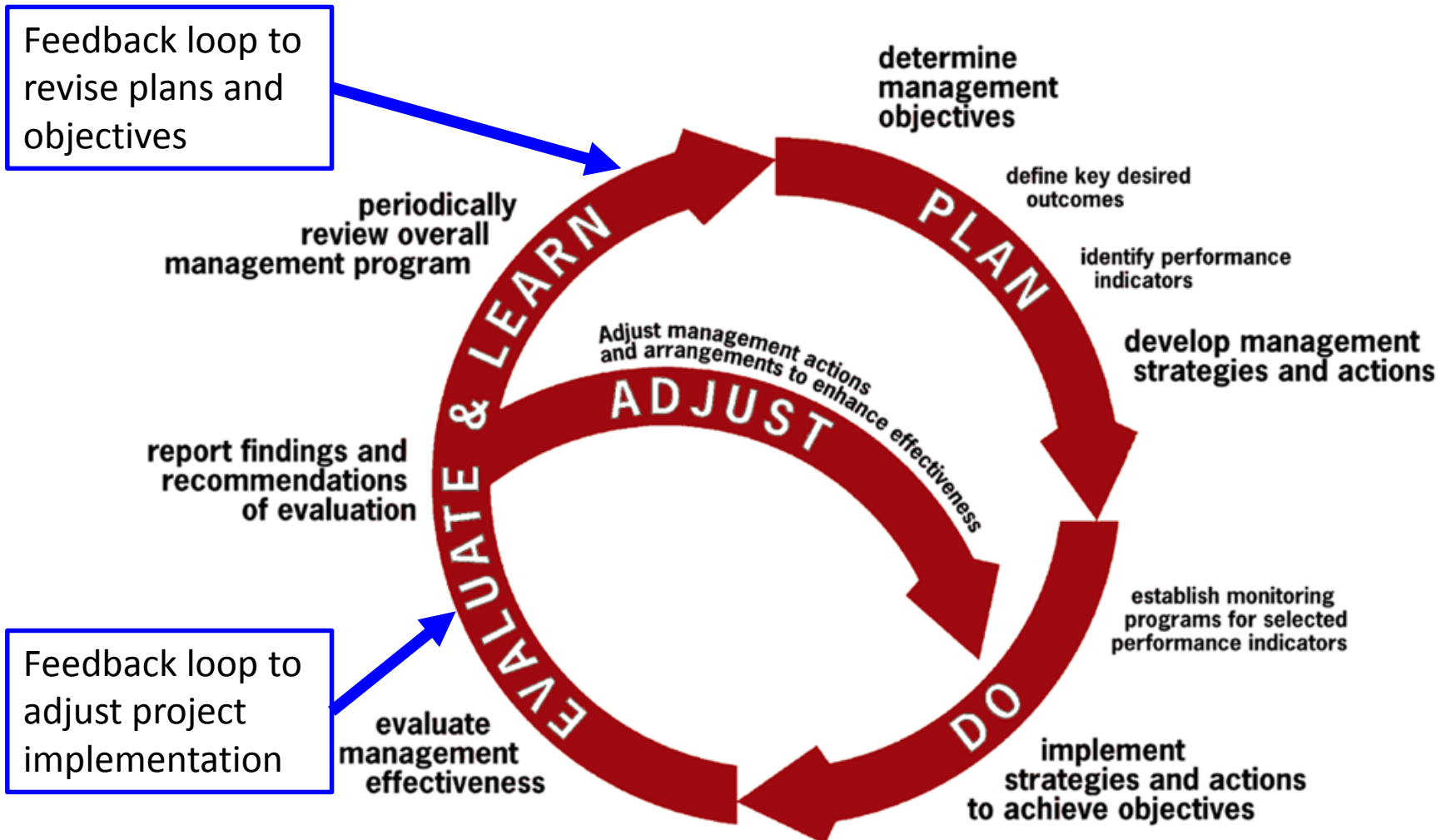
# ADAPTIVE MANAGEMENT

- In the 2017 Wildlife Project Review, ISRP found that **70%** of the 29 projects lacked an adaptive management plan and **90%** lacked quantitative objectives with explicit timelines.
- A **feedback loop** to evaluate outcomes and adjust either project implementation or management plans and objectives is commonly missing.

# ADAPTIVE MANAGEMENT

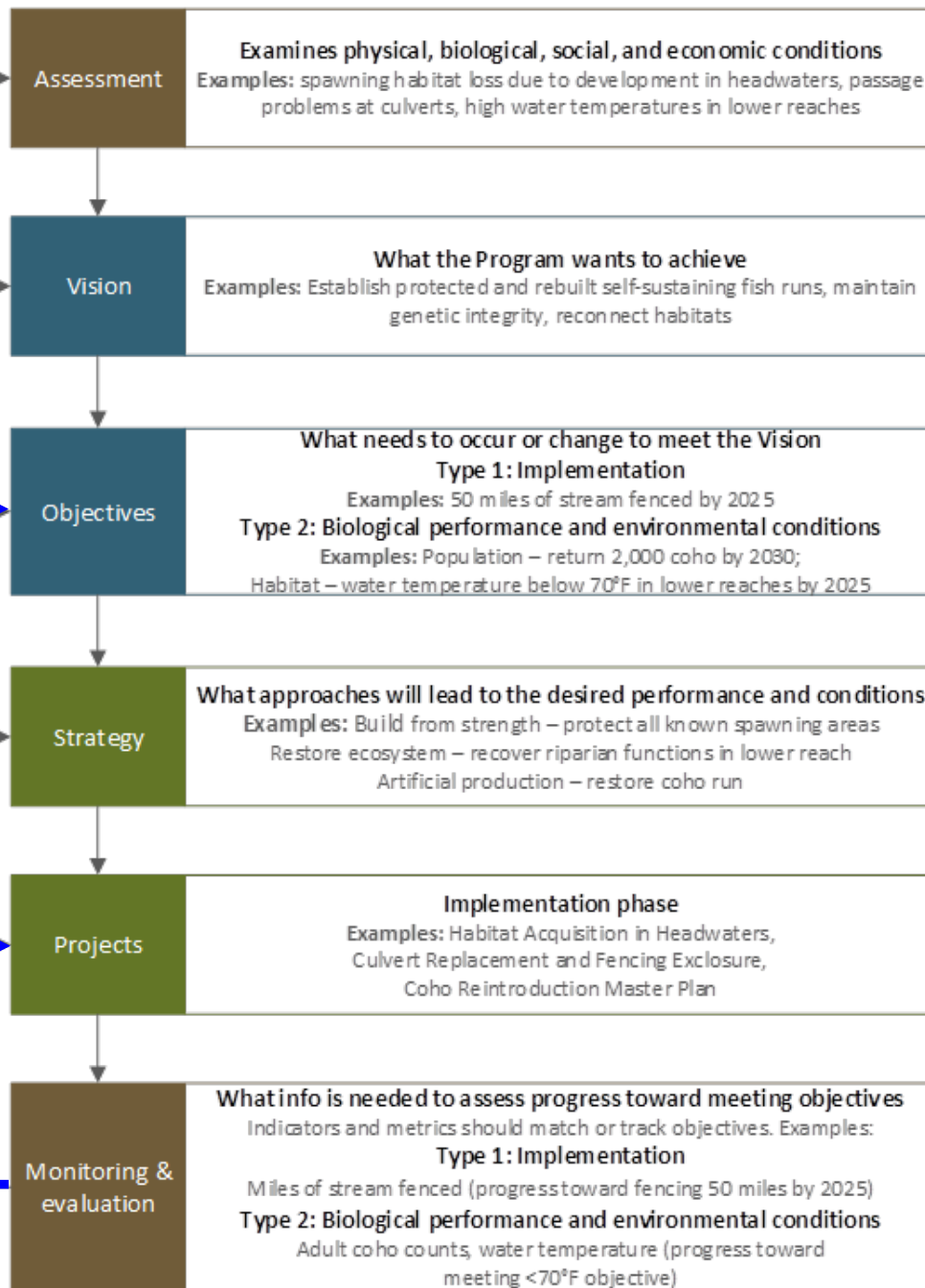
- The Program provides limited scientific guidance for adaptive management of projects.
- The Program should develop rigorous decision-making processes
  - based on regional strategies,
  - address quantitative project objectives,
  - develop coordinated monitoring and evaluation,
  - and incorporate outcomes into decision-making cycles.

# ADAPTIVE MANAGEMENT



# Feedback Loops

Information and decision-making channel and loop  
(FWP amendment, project selection, recovery planning)



Internal project loop

# Strategy: Ecosystem function

- The 2014 Program makes useful points about:
  - 1) the need to consider the Basin as a **system**, rather than isolated components, and
  - 2) the need to regenerate **natural processes** rather than relying on technological solutions.
- Focus on the **entire Columbia River ecosystem**, rather than focusing on habitat, for which there is a separate strategy



# Strategy: Ecosystem function

- “What are we trying to conserve?”
- At least **six key ecosystem elements** are important.
  - Water quality, including temperature
  - Physical habitat structure
  - Floods and other disturbances
  - Linkages to the riparian zone
  - Riverscape connectivity
  - Co-evolved biota

# Strategy: Habitat

- The Program is a “habitat-based” plan.
- Restoration of salmon, steelhead, and other native fish populations cannot be successful without adequate suitable habitat.

# Strategy: Habitat

- In general, this section of the 2014 Program provides sound scientific guidance.
- Several important elements are missing.
- Surprisingly, the Habitat strategy does not mention a [landscape perspective](#) and does not have a landscape or subbasin context
- Even more surprisingly, the Habitat strategy does not provide links to the [subbasin plans](#).

# Strategy: Habitat

- Neither the Principles nor General Measures of the Habitat strategy mention anything about **research, monitoring, or evaluation** (RME).
- At a time when information needs are growing, recent decisions have sharply reduced funding for the RM&E component of the Habitat strategy.

# Strategy: Habitat

- The General Measures section of the Habitat strategy should refer to the **syntheses needed to determine the effectiveness** of habitat restoration.
- This **key uncertainty** will require large-scale regional or subbasin integration.
- A more logical framework should be developed that **integrates** habitat restoration in tributaries, mainstem, estuary and ocean – all within a landscape and ecosystem perspective

# Strategy: Climate Change

- Additional actions are needed by the Council to ensure that the seriousness of limiting the advance of climate change is relayed to project sponsors and the general public.
- The Council and action agencies should insist that project sponsors include **planning and monitoring of climate change effects** in their research and restoration activities.

# Strategies: Estuary, Plume & Ocean (combines several)

- The Council's guidance for estuary projects and actions is sound.
- The ISAB recommends updating this strategy to better focus on the most important information gap – the lack of **quantitative estimates of survival** of juvenile salmon, steelhead, and other focal species in the Columbia River estuary.

# Strategies: Estuary, Plume & Ocean (combines several)

- These strategies should be updated to fill large gaps in population-specific information on effects on survival in a **full ecosystem and life-cycle** context.
- The Program should be expanded to include monitoring **adult salmonid survival** in the Columbia River plume/nearshore ocean.



# Strategy: Cost-effectiveness

- This 2014 Program section provides some guidance for project review and implementation to ensure appropriate methods are used to **prioritize the use of limited funds**.
- Current prioritization among subbasin projects often lacks quantitative estimates of either the cost or the biophysical impact.

# Strategy: Cost-effectiveness

- Cost-effectiveness analysis could increase biological benefits of the Program.
- Cost-effectiveness analysis is also valuable as a counterweight against competing interests which seek to spread funds broadly across activities, geographies, and interest groups.
- Using CE analysis at broader Program levels or spatial scales is challenging.

# Strategy: Cost-effectiveness

Cost-effectiveness ratio

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$$\frac{\text{Expected biological improvement (biophysical units)}}{\text{Expected cost (monetary units)}}$$

# Hypothetical set of project alternatives

Project	Effectiveness (change in adult returns)	Cost (\$ thousands)	CE ratio (Effectiveness/cost)
A	7700	150	51
B	7600	150	51
C	7300	100	73
D	7300	60	122
E	6900	60	115
F	6800	50	136
G	5500	40	138
H	5000	40	125
I	4500	25	180
J	4000	25	160
K	3800	25	152
L	90	25	4
M	60	25	2
N	50	25	2
O	40	20	2
P	30	20	2
Q	20	20	1
R	10	10	1

# Concluding Remarks

- 2014 Program has **many strengths** – but can be improved
- The Program is a **living document**, evolving to incorporate new information & meet changing conditions in the Basin.
- The report has additional points re: the Program:
  - Non-native fish, water quality, wildlife mitigation, lamprey, sturgeon, and eulachon strategies.
- The ISAB hopes that its recommendations will prove useful to the Council & others in the Basin as they amend the Fish and Wildlife Program.



# Questions?

