Normative Flow Analysis: An Ecosystem-Based Approach in a Local Government Setting

or

Crazy? ... or just gluttons for punishment?

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We Aren't That Crazy …

"…whenever possible, the natural river system should be allowed to repair itself. ***This approach is likely to be the most successful and least expensive way to restore and maintain the ecological integrity of flow-altered rivers****.*

Although the most effective mix of human-aided and natural recovery methods will vary with the river… ***existing knowledge*** *makes a strong case that restoring natural flows should be a cornerstone of our management approach to river ecosystems."*

LeRoy Poff et al., 1997, from Bioscience article *The Natural Flow Regime*

What are We Trying to Accomplish?

- Increase the effectiveness of King County's flow-related authorities and responsibilities for protecting or restoring habitat conditions for native species - including salmon
- Support a scientific and policy dialogue with interested parties that improves our understanding of our management opportunities related to flow
- Develop analytical and decision-making tools that better connect our knowledge of hydrology and ecology to our decisions

See "Return of the Kings" at www.metrokc.gov/exec/esa/king_county.htm

What are Our Drivers?

- ***Regulations:*** ESA, GMA and CWA, e.g. stormwater, land use decisions
- ***Regulators:*** NMFS, USFWS, etc.
- ***Science:*** The Independent Science Panel, the Instream Flow Council
- ***Processes:*** DOE flow setting in critical basins, WRIA planning
- ***Tribal Interests:*** Treaty Rights

How Did We Get Here?

- ***1999*** - *Return of the Kings* published
- ***2000*** - *WRIA 9 Limiting Factors* report: Index of Hydrologic Alteration (IHA) analysis complete
- ***2000 - 2001*** - WRIA 8 Managed Water analysis
- ***Fall 2001*** - we conclude that our goals, the regulatory and conservation context, and the experience of others make a Normative Flow Analysis approach a logical, but not risk-free, choice

What Does "Normative" Flow Mean to Us?

- A flow regime that resembles the natural flow regime sufficiently to sustain all life stages of a diverse suite of native species, including salmonid populations
- Timing, duration, magnitude, frequency and rate of change are all important and should be reflected in flow management programs - setting minimums isn't enough
- It does not dictate that the ultimate outcome of the project must be recreating pre-settlement conditions

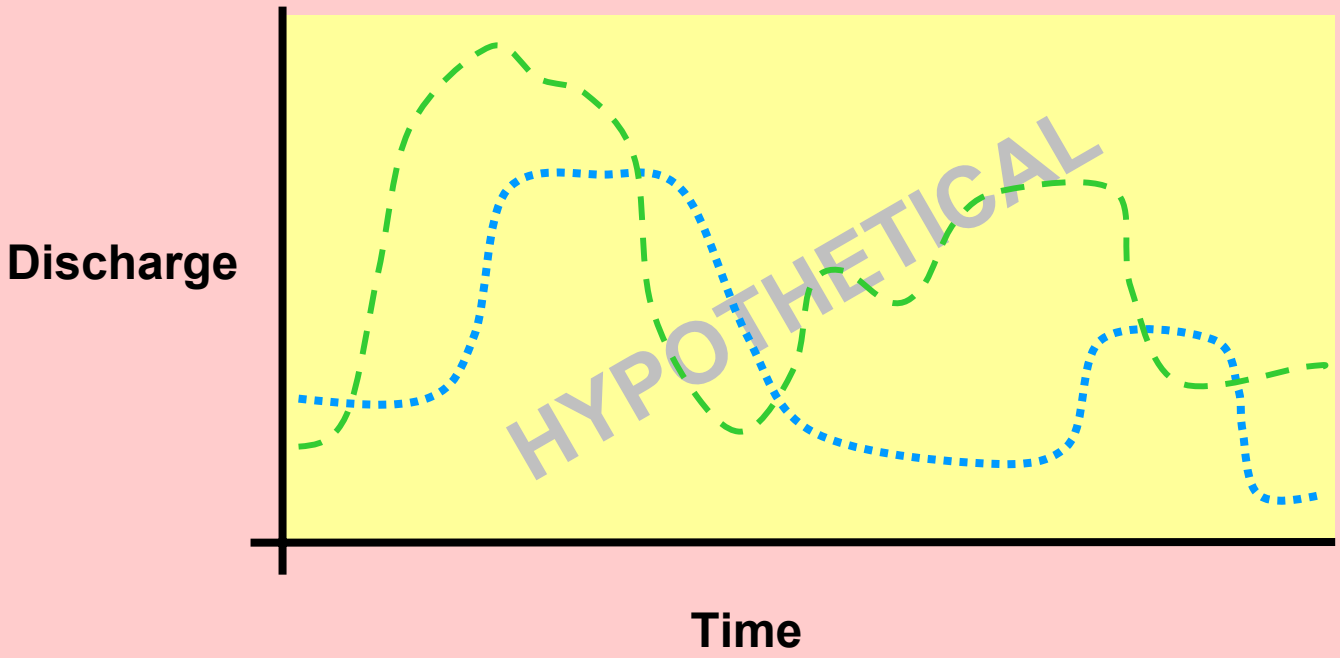
What Relevant Analysis Examples Can We Find?

• ***Roanoke (VA), Apalachicola (FL), San Pedro (AZ)***	• *IHA / RVA Approach "…bridge a chasm between applied river management and current theories of aquatic ecology…"*
• ***Colorado - Glen Canyon Dam (AZ), Kissimmee (FL)***	• *Provide flood flows to rejuvenate downstream habitat*
• ***Pecos (NM)***	• *Provide spring freshets as spawning cue*
• ***Trinity (CA)***	• *Provide flows for outmigration and to rejuvenate gravel habitat*

Project Assumptions

- ***We can't recreate pre-settlement hydrology.***
- ***History gives us clues.*** The better the future flow regime mimics key parameters of the less altered flow regime the better off listed salmon and other native species will be because they evolved successfully within that flow regime
- ***King County can contribute to solutions.*** King County can implement/adapt our programs and policies at meaningful time and space scales in response to the ecosystem effects of our management actions

Hydrographically Speaking



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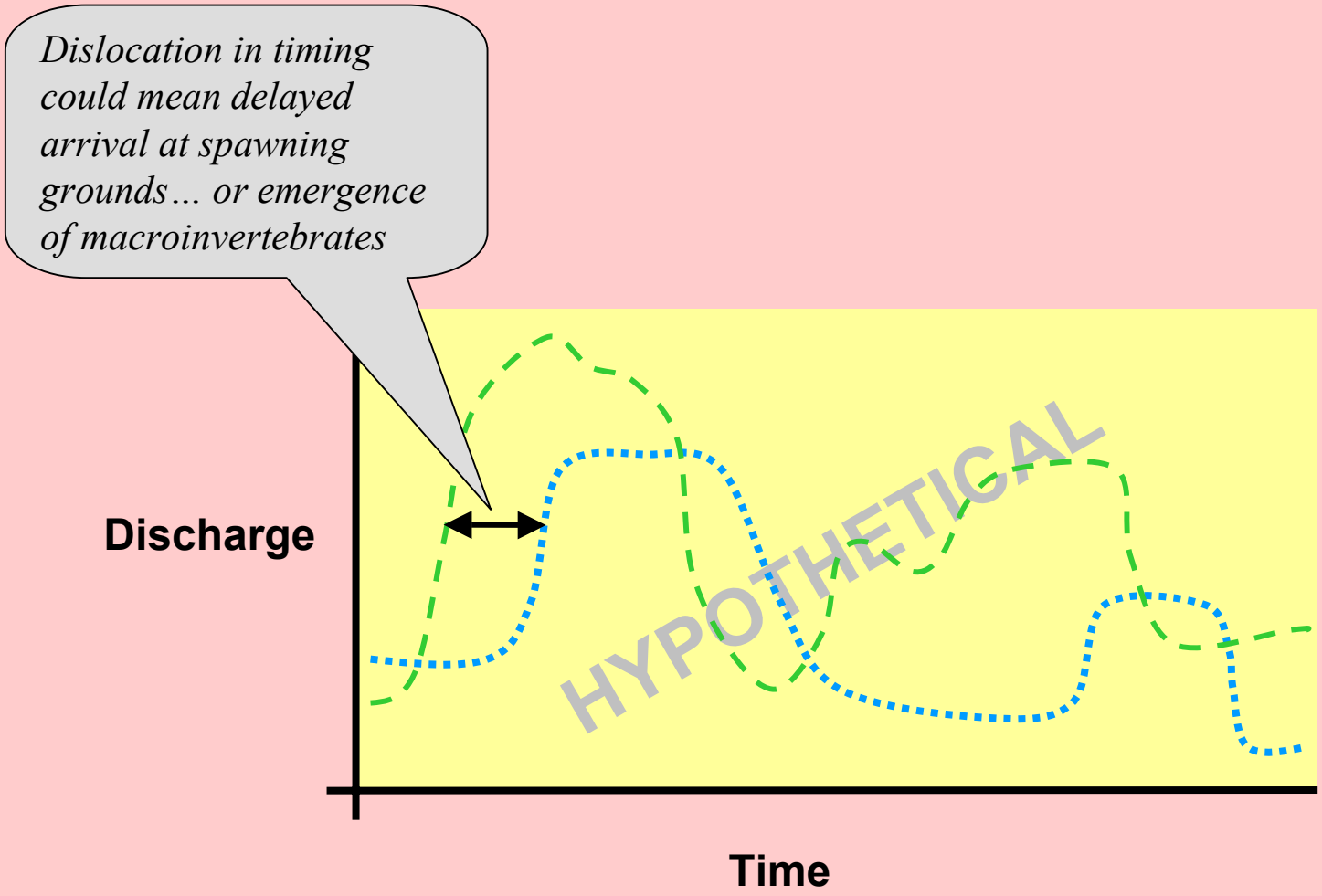

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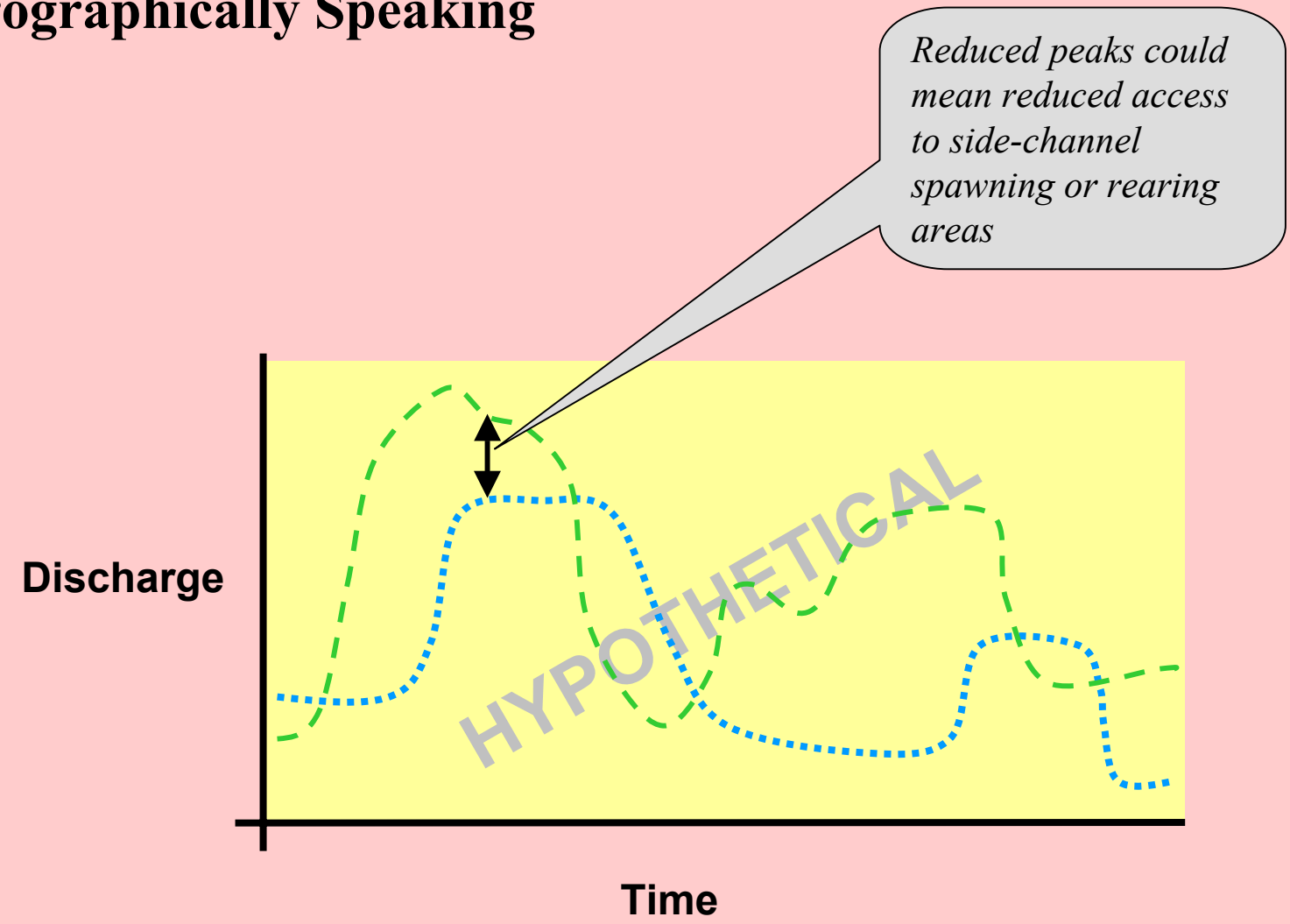

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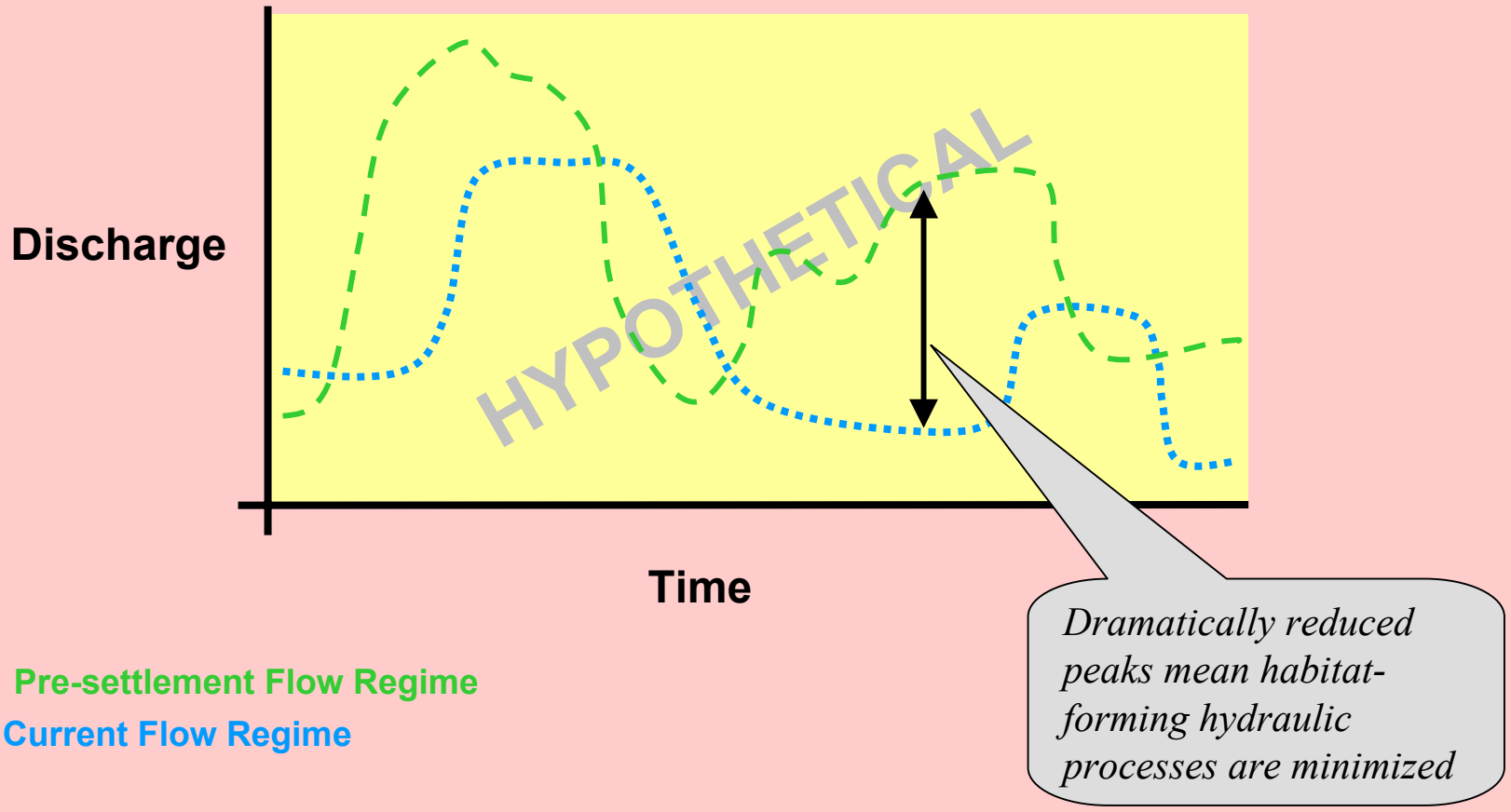

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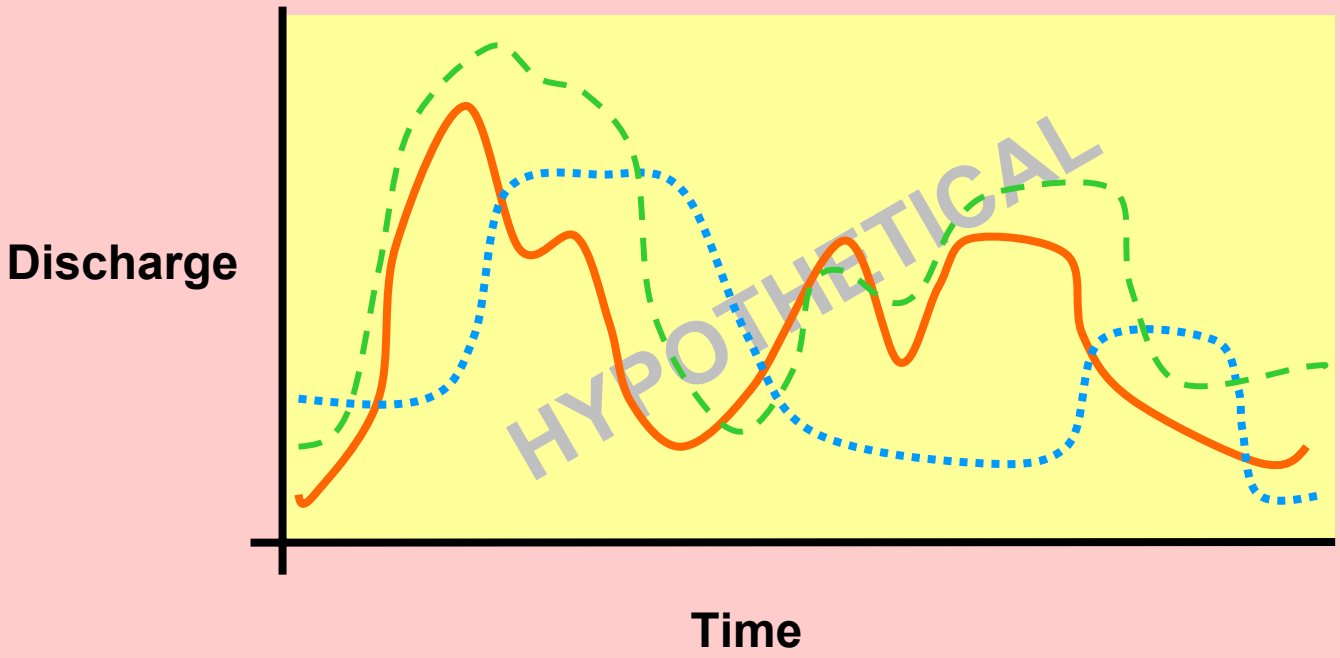


Analysis to Action

King County has several ways to contribute ***hydrologically***…

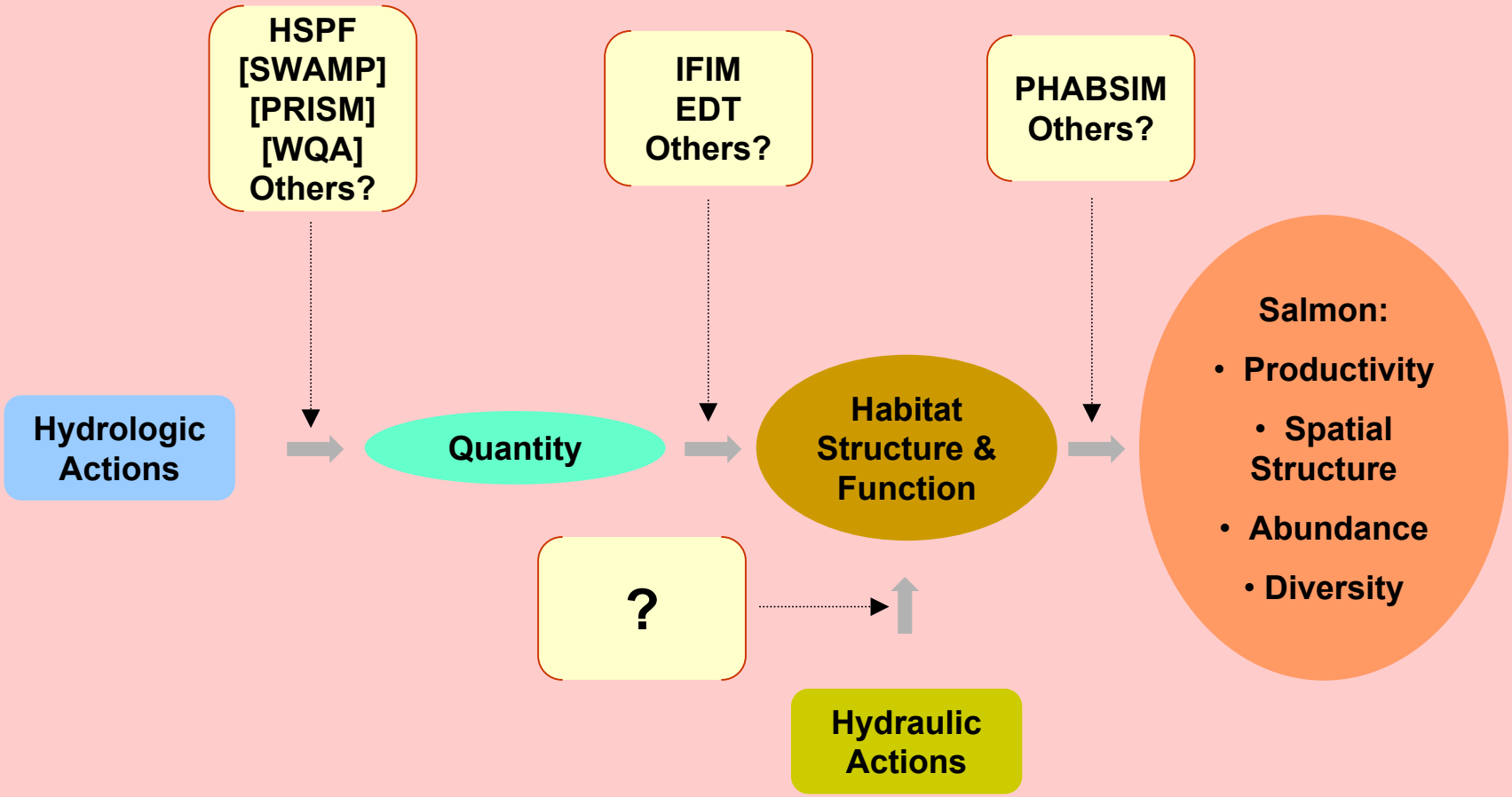
- Development and use of reclaimed water resources
- Regulation of and planning for land use in floodplains and in upland areas
- Implementation of stormwater management requirements
- Operation and maintenance of a regional wastewater management system
- Coordination with others in watershed that have hydrologic effects

Analysis to Action

King County has several ways to contribute ***hydraulically*** (tricky in highly altered systems)…

- Implementation of aquatic/riparian habitat restoration projects
- Maintenance, restoration and/or removal of flood management facilities (e.g., setback levees, flood control structures)
- Acquisition of floodprone properties
- Regulation of clearing and grading in riparian areas
- Coordination with others in watershed that have hydrologic effects

Analysis to Action: Relationships and Tools

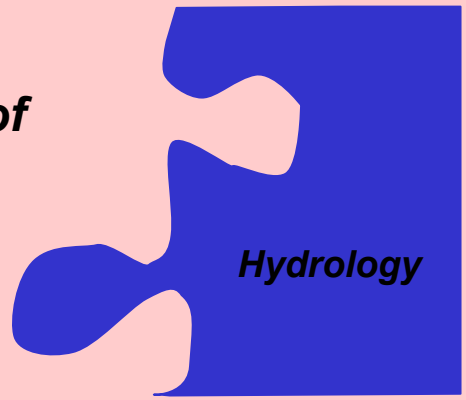


Normative Flow Parameters of Interest

Hydrologic Characterization

- Magnitude and Frequency - How much water and how often?
- Duration - How long do flow conditions persist?
- Timing - When do flow events occur?
- Rate of Change - Is the flow regime flashy or stable?

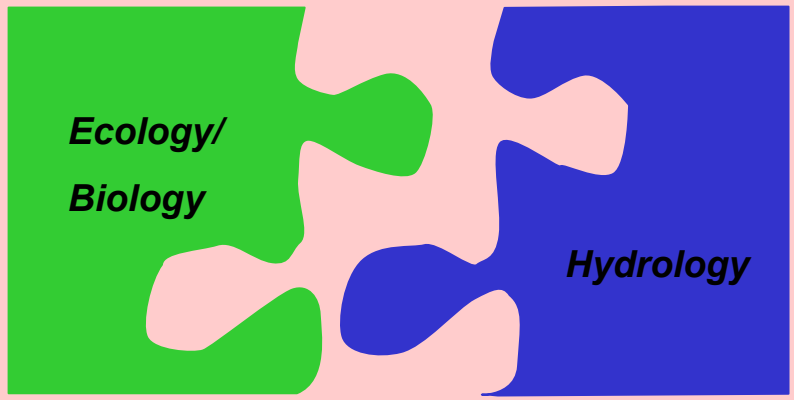
That's only a piece of the puzzle...



Normative Flow Parameters of Interest

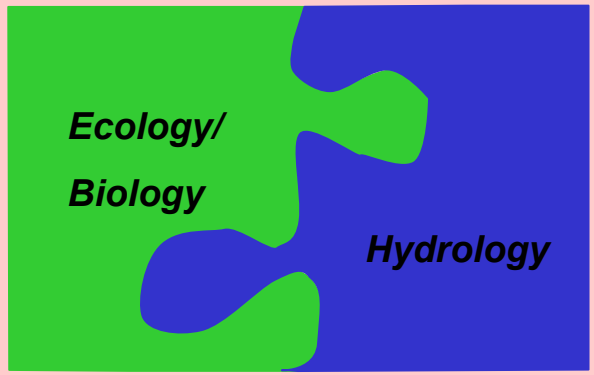
Ecological/Biological Response

- River productivity
- Substrate size distributions
- Channel and floodplain morphology and connectivity
- Benthic macroinvertebrate distribution, diversity, and productivity
- Floodplain vegetation communities
- Aquatic species interactions (trophic interactions, competition)
- Species life history and habitat use
- Other(s)?

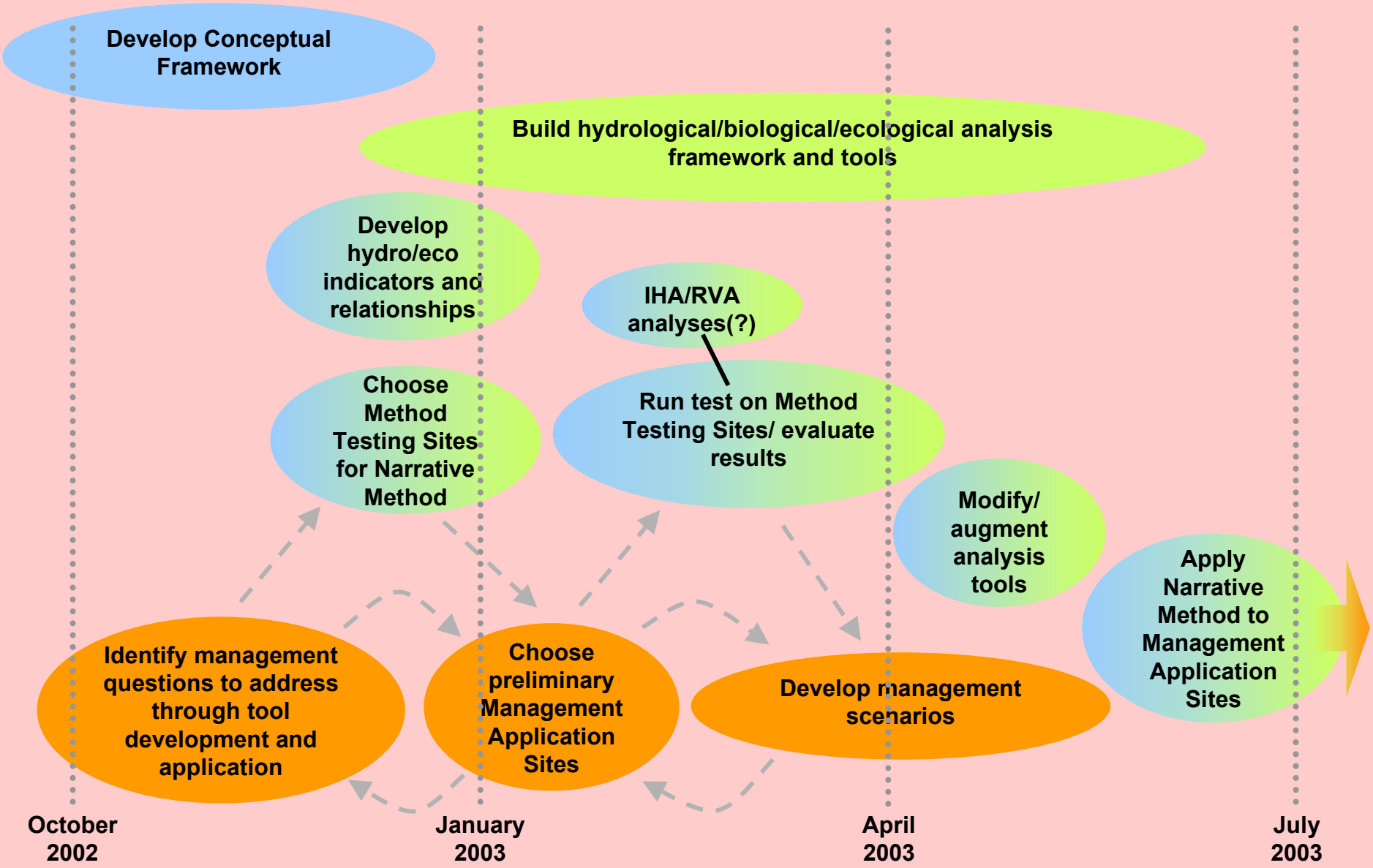


Examples of Key Study Questions

- Which flow parameters "matter most" to the conservation and recovery of current and potential future ESA-listed species?
- How should stream order affect the application of natural flow regime analysis and normative flow management?
- Are there existing ecosystem models that can be used to incorporate normative flow concepts?
- What do natural flow analysis and normative concepts offer for highly modified systems or rivers with highly altered channel and floodplain morphology?
- Are there flow regime scaling factors to maintain ecological function in rivers with flood control levees and dams?



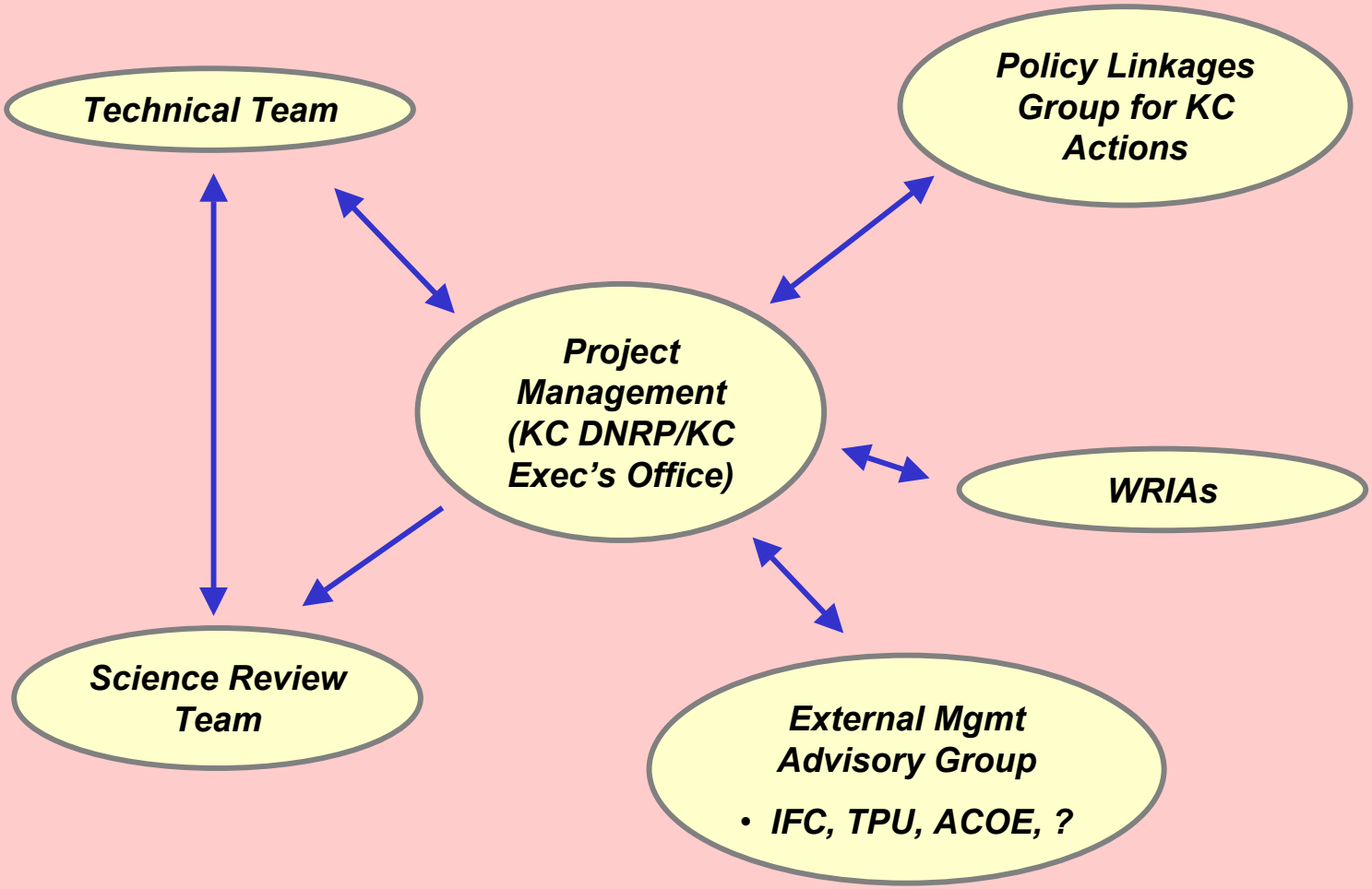
When?


Develop Conceptual Framework
Build hydrological/biological/ecological analysis framework and tools
Develop hydro/eco indicators and relationships
IHA/RVA analyses(?)
Choose Method Testing Sites for Narrative Method
Run test on Method Testing Sites/ evaluate results
Modify/ augment analysis tools
Apply Narrative Method to Management Application Sites
Identify management questions to address through tool development and application
Choose preliminary Management Application Sites
Develop management scenarios
October 2002
January 2003
April 2003
July 2003

What is a "Narrative Method"?

- A non-mathematical expression of flow-ecology relationships
- Non-mathematical hypotheses
- A first step toward developing a mathematical method
- May take the form of "if-then" statements
- May be quantitative but use thresholds or categories
- A prudent response to realities of data, time, and dollar limitations

Project Organization



Some Challenges (aka "Punishment")

- Ecological info unevenness… or unavailability
- King County doesn't control all aspects of flow or actions that affect flow
- Timescale of hydrological and ecological response to actions is variable, and can be l...o….n……...g
- Pessimism about anyone's ability to do anything about flow problems (reversibility?)
- Inertia around commonly used analytical approaches - reductionism
- Regulation endpoint still is minimum flow
- Integration with water quality analysis and actions

Find project info at this King County web site:

www.metrokc.gov/wlr/BASINS/flows/index.htm

or send an e-mail to:

david.stjohn@metrokc.gov

Thank You!