Green River Fish Habitat Restoration, Gravel and Wood Debris Nourishment Project

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Project Description

The Green River has experienced habitat degradation downstream from Howard Hanson Dam as a result of reductions in transport of sediment and large wood debris and hydromodification from dam operations, in addition to other anthropomorphic changes including habitat fragmentation, floodplain connectivity loss, stormwater quality inputs, from logging and urbanization of the watershed.

- Green River Watershed, King County
- Howard Hanson Dam – Corps of Engineers Dam at RM 63
- Project located Middle 1/3 of the watershed RM 60 ~ RM 30
- Project goals: Provide Chinook spawning and rearing habitat by reestablishing fluvial processes downstream from the dam
    - Gravel nourishment
    - Large wood debris nourishment
    - Construction of log jams
- The project is a partial restoration project that is part of a larger watershed scale restoration efforts. The project does not address certain processes including;
    - Dam operations and the resulting hydromodification
    - Landscape and watershed urbanization and forestry practices
    - The project is not self-sustaining and will require ongoing maintenance and funding in perpetuity.

Guiding Principles

The following process-based principles apply to this project:

- Principle #1: Target root causes of habitat and ecosystem change
    - Loss of sediment and bedload transport resulting in: channel degradation, reduction in floodplain connectivity, armoring of channel
    - Loss of wood transport resulting in: reductions in-channel habitat complexity, floodplain connectivity, channel dynamics, stream and bank derived sediment and wood inputs
- Principle #2: Tailor restoration actions to local potential
    - Gravel nourishment to offset trapping of sediment behind dam
    - Large wood debris nourishment to offset trapping of wood behind dam
    - Engineered log jam construction to reactivate abandoned side channels, and restore lost in-channel habitat complexity
- Principle #3: Match the scale of restoration to the scale of physical and biological processes
    - Gravel nourishment → similar in scale to annual bedload transport volumes
    - Wood loading → load wood on scale as a function of incoming loads to the dam
    - ELJs were used to reestablish in-stream habitat complexity and reconnect spawning side channel
    - Gravel and wood nourishment → Restore miles of river processes and functions

- Principle #4: Be explicit about expected outcomes, including recovery time
    - 10 – 20 year timescale for reestablishment of gravel bed and wood conditions
    - Increase usable spawning areas for Chinook, reduce bed armoring
    - Increase floodplain and side channel connectivity
    - Increases in-stream and floodplain habitat complexity and channel dynamics

Constraints

- Project constraints
    - Permitting
        - Placement of sediment in river (fill activity 401/404 permits)
            - 401 permit was perceived as water quality violation
            - Engineered log jam construction was actual water quality issue
        - King County floodplain management code
            - No rise in flood water surface elevations → direct conflict with majority of the restoration components including floodplain and side channel connectivity
    - Boating, recreational interests
        - Rafting and kayaking community opposed to wood in river
- Constraints' effects on project
    - Gravel nourishment
        - extremely low content of sands and fine (interstitial) sediments
    - Large wood debris nourishment
        - Required significant outreach with boating community
        - Tagging of wood placed in stream
    - Engineered log jam
        - WQ monitoring and inspections for gravel nourishment and ELJs
        - Revised construction methods
- How does the completed project compare to your initial goals for the project?
    - Incremental improvements in-stream bed conditions for Chinook spawning along 20-mile study reach
    - Increases in side channel connectivity
    - Unstable gravel beds (marbles) needed revised material specifications
    - Short term large wood debris loading has development of a few small jams
    - Localized flood water surface increases and minor bank erosion from ELJs and gravel waves
    - Unknown long term effects on downstream flood conditions
- How will this experience shape how you approach projects in the future?
    - Invest resources in addressing process-based restoration
    - Restoring sediment and wood processes provides "miles" of river restoration versus "feet"
    - WQ monitoring → new ELJ construction methods (piles vs. ballast)
    - Dam relicensing should include sediment, wood and nutrient provisions
    - Sustainability - nourishment vs. dam material flushing and transport designs
    - Use higher end models to predict long term sediment mobility and depositional patterns to understand effects on flooding