An integrated approach to maintaining levees and protecting salmon

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Levee Management Considerations

• Public safety is paramount
• Levees vegetated with trees & shrubs support the protection and recovery of ESA-listed salmon
• Woody vegetation on levees helps stabilize riverbanks which enhances levee safety for the public and provides quality habitat for salmon.
Managing Levees for Public Safety & Salmon – Options for the Future

• Differences between the USACE levee vegetation standards and salmon habitat needs when levees form the riverbanks, creates a conflict
• We can work together to find compatible solutions that better balance the risk and provides for both salmon habitat and levee safety
• Alternatively, we can fight this issue out in court over the next decade
USACE Policies are driving the issues in the Rehabilitation & Inspection program (P.L. 84-99)

A Levee sponsor must comply with the Engineering Technical Letter (ETL) 1110-2-571 to participate in the Rehabilitation and Inspection Program

Or

Develop a variance under either the Policy Guidance Letter (PGL) or System Wide Improvements Framework (SWIF)
Some key policy questions are:

• Does the USACE levee vegetation guidance under the ETL satisfy as Best Available Science under the Endangered Species Act?

• Do the PGL and SWIF options properly reflect the USACE obligations to conserve salmon under ESA section 7?

• Currently our answers to these questions are “NO” and “Maybe, with the right amount of collaboration”
Biological Needs of Salmon

• Cool water temperatures
• Complex habitat with irregular shorelines, large wood, and insects
• Rearing habitat that includes off channel refuges and shade. This enables juveniles to mature as they transition to the marine environment and increases their ocean survival rate.
Levees Adjacent To Rivers Impact Salmon By...

- *Simplifying habitat structure* and limiting litter fall, insect drop, shade, woody material, and bank-cover.
- *Disconnecting floodplains and riparian areas*, thus blocking natural processes that produce healthy fish habitat.
- *Adding thermal load* to waters that fish inhabit.
- *Altering hyporheic flows*, which reduces or eliminates subsurface cool water inputs necessary for salmon survival.
Levees with Trees and Shrubs Support Habitat Function for Salmon By...

- Decreasing flow velocity near the levee, thereby supporting juvenile fish rearing and adult migration.
- Thermal regulation of nearby waters (shade, micro-climate, hyporheic flows).
- Assure inputs of leaves that are the base of the food chain that supplies food for rearing fish.
- Provide substrate for both emerging aquatic insects and insect-drop from branches to water for fish food.
- Delivering woody material to aquatic ecosystems.
Geographic Case Study: Puget Sound & The Impacts of Levees on Chinook Recovery

• Low gradient floodplain habitat is reduced or absent in many Puget Sound watersheds

• Levees occupy much of this habitat, eliminating the diverse habitat salmon need

• Salmon cannot recover without improving the habitat quality in these areas

• 44% of 198 levees in western WA (est. 105 miles) are eligible for USACE’s levee RIP in 7 basins. This issue is an important factor affecting salmon recovery.
Case Study: Sacramento River Flood Control Project

Mainstem Sacramento River = 397 mi
Major tributaries and sloughs = 388 mi
Flood bypasses and canals = 307 mi
Total levee miles = 1,092 mi
Riparian Habitat Loss = ~95%
Case Study: USACE Sacramento River Bank Protection Project

- Draft Jeopardy Biological Opinions were issued to the USACE Sacramento District in 2001 for levee maintenance actions associated with the Sacramento River Bank Protection Project.

- The draft jeopardy conclusions were largely associated with impacts to river function, including loss of riparian habitat.

- Protection and enhancement of riparian vegetation were key actions adopted by the USACE necessary to avoid jeopardy.
Case Study: USACE Sacramento River Bank Protection Project

Zone 2B
Riparian Bench, Anchored IWM

Zone 2A
Upper Riparian

Zone 1
Vegetation Free

Top of Levee

Soil and Revetment

Revetment
Biological Results

There are 5.4 times as many juvenile Chinook salmon in natural wood banks as hydromodified banks.
Science Supporting Woody Vegetation on Levees
Woody Vegetation Protects Human Safety By Providing Levee Stability

- Roots bind soil network
- Transpired moisture from soils aids stability
- Slows floodwaters near banks
- Buffers against abrasive effect of sediment
- Induces fine-sediment deposition
- Reduces scouring and slumping potential
Strategies for Managing Levees for Human Safety & Salmon Recovery

- Include trees and shrubs in levee projects, & *strategically manage* their growth to better achieve public safety and fish habitat functions.

- Plant trees near the toe of the levee slope to increase safety. Doing so will reinforce the effects of the roots and increase the counterweight effect of the tree to slope movement (ERDC 2011).

- Design plantings to allow equipment access during floods.

- Encourage more research and monitoring to improve results for levee safety and habitat quality.
Management Ideas for Existing Trees

• Holistically assess the risk on a case-by-case basis.
• Allow trees and other woody vegetation to grow on the lower half of the riverside levee face.
• Plant appropriate species in suitable sites to minimize safety risk while increasing habitat function.
### Management Responses

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<th>Potential Negative</th>
<th>Response</th>
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| **Isolated Trees Falling Over** | • Coppice (top) the isolated tall tree, if possible.  
• Plant to create overlapping root system. |
| **Difficult to inspect** | • Use boats, foot trails, or thin for narrow ‘view corridors’. Keep levee crown clear. |
## Management Responses

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<td>Flood fighting capability</td>
<td>• Provide access corridors into the riparian design, if necessary.</td>
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<td>Loss of conveyance</td>
<td>• Thought to be negligible on large rivers</td>
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Additional Research Needs to Refine an Approach:

- Scope, fund and implement locally relevant scientific studies on the effect of woody vegetation on levee performance and assessment.

- The research needs to recognize the local hydrology, types of vegetation and soils, endangered species, and probable failure modes of the typical levees.
Collaboration Supports Levee Integrity & Salmon Habitat

- Cooperate in the management of levees for public safety and conservation of salmon and bull trout habitat.

- Apply the intent and ideas identified in salmon recovery plans to guide repairs undertaken in flood fights and P.L. 84-99 projects when documented or negotiated with local sponsors.

- When levee maintenance or flood related activities can be managed with willing partners (e.g. in a SWIF or PGL) develop programmatic consultations for specific geographies.
Collaboration in Puget Sound

- Use the Seattle District Framework project to manage levee woody vegetation for fish AND public safety.
- Identify flexible treatment regimes by site for vegetation maintenance, and monitor the results.
- Conduct watershed workshops to share information with other levee sponsors to better manage for salmon habitat recovery.
- Share information to help guide regional responses on levee woody vegetation maintenance for the RIP.
Some key points from Donald Gray, Civil Engineer (Emeritus) regarding woody vegetation on levees

• Most woody vegetation appears to have a beneficial influence on structural integrity and stability of levees.
• The roots of woody vegetation reinforce the soil mantle and can significantly increase the resistance to shallow, sloughing failures.
• Vegetation also improves resistance to scour and erosion that can occur during overtopping.
• Seepage erosion and piping problems attributed to the presence of trees have been greatly exaggerated.
Moving Forward: Managing Levees for Public Safety & Salmon

• Will the USACE, NMFS, and levee sponsors work together in WA and CA to find compatible solutions to woody vegetation on levees in the P.L. 84-99 program or will we fight it out in court?

• NMFS remains hopeful a collaborative solution is possible, and will work towards that end now and in the near term

• But not forever….salmon recovery will require positive action different from the status quo