

2006 Northwest Stream
Restoration Design Symposium

The National Evaluation of the One-Percent (100-Year) Flood Standard and Potential Implications on Stream Restoration Projects

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Presentation Overview

- Brief history of the 1% standard.
- Recognition of floodplain natural and beneficial function (NBF) interest in federal policy.
- Mandate for an evaluation of the NFIP
- NFIP evaluation framework
- Preliminary observations of potential new standards.
- Relationships between new standards and stream restoration practice.
- Discussion.

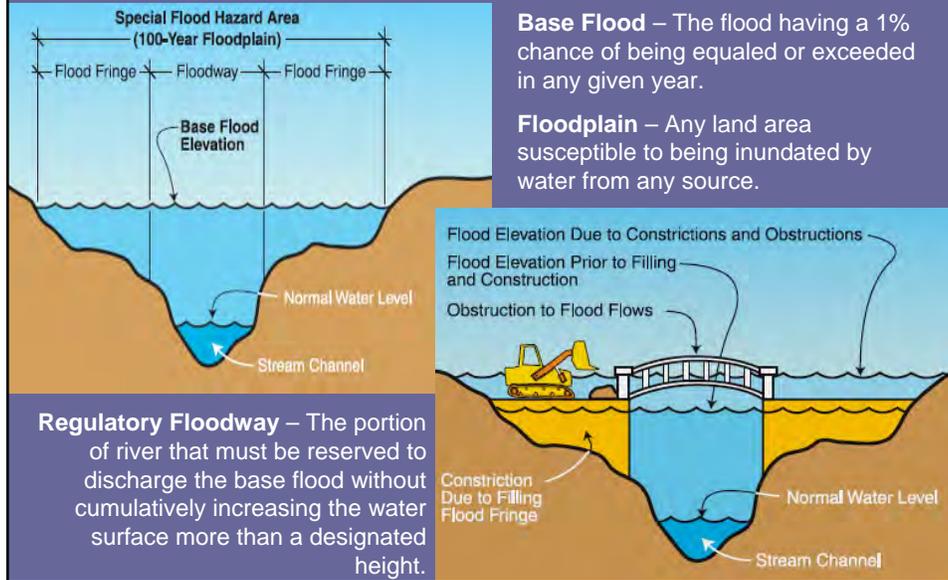
What is the 1%
flood
standard?



The 1% Chance Flood Standard

- Established to shift the burden of flood protection and relief from the federal government.
- Recommended by experts convened by HUD in 1969.
- Already used by some agencies at the time.
- No data on 100-year floods at the time, few gauges had recorded 100-year flow.
- Had a “nice sound” to it and would give an allusion of safety.
- A compromise from the beginning.
- FEMA trying to play down “100-year” relationship in recent years.

The Floodplain and Floodway



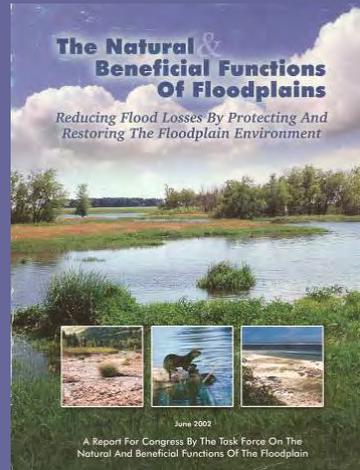
What are natural and beneficial functions of floodplains?

Sec. 512 National Flood Insurance Act of 1968 (Amended)

- (12) the term ‘natural and beneficial functions’ (NBF) means –
 - (A) the functions associated with the natural or relatively undisturbed floodplain that (i) moderate flooding, retain flood waters, reduce erosion and sedimentation, and mitigate the effects of waves and storm surge from storms, and (ii) reduce flood related damage; and
 - (B) ancillary beneficial functions, including maintenance of water quality and recharge of groundwater, that reduce flood related damage.

Past Federal NBF Initiatives

- 1968 – National flood Insurance Act established NFIP, marking shift to non-structural approaches.
- 1976 - “Unified National Program” report.
- 1977 – EO 11988 called for restoration of natural values.
- 1979 – Update to “Unified National Program” report.
- 1986 – Another update.
- 1992 – Report on difficulty to quantify natural values of floodplains.
- 1993 – The “Galloway” Report.
- 1994 – Another update to the “Unified National Program” report.
- 1994 – NFIRA interagency task force on NBF.
- 2002 – Task force report on NBF of floodplains (Tillamook Bay study!).





Why is the standard being evaluated?

NFIP Evaluation Mandate

- 1968 - In passing the National Flood Insurance Act, Congress intended the NFIP to be continually re-appraised for effects on land use.
- 1973, 1976, 1982, - Sporadic evaluations for varying reasons.
- 1983 - Presidential Task Force on Regulatory Relief concluded standard ok.
- 1999 – FEMA initiated effort for first comprehensive evaluation of the NFIP to assess effectiveness and efficiency of the program.

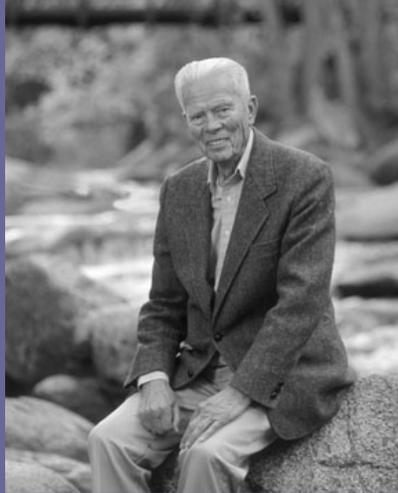
How is the standard being evaluated?



Evaluation of the 1% Standard

- 1999 - American Institutes for Research NFIP Evaluation – 6 areas of inquiry.
- 2004 - Gilbert F. White National Flood Policy Forum – *Is the 1% Standard Sufficient?*
- 2004 - University of Maryland (et al) research contract to American Institutes for Research for 5th area of inquiry – *Evaluation of the Adequacy of the 1% National Flood Standard.*

Gilbert F. White



- Most influential floodplain management policy expert of the 20th century.
- Landmark 1942 thesis started U.S. floodplain management movement.
- Akin to hydraulic engineering's "Manning" or "Rouse".
- Dr. White attended the forum.

What are the pertinent findings?



AIR NFIP Evaluation Findings

- All studies still in progress.
- *Developmental and Environmental Impacts of the NFIP – A Literature Review.*
 - Accounts of the environmental impacts of the NFIP are primarily anecdotal-need more data.
 - Public development of infrastructure has increased the market appeal of floodplains for development.
 - Floodplain development pressures may be intensified by local political cultures.

<http://www.fema.gov/nfip/nfipeval.shtm>

The screenshot displays the FEMA website's 'Flood Insurance' section. At the top, the FEMA logo and navigation menu are visible. The main content area is titled 'Flood Insurance' and includes a search bar, a breadcrumb trail (Home > Hazards > Flood Insurance), and a 'National Flood Insurance Program' link. The 'NFIP Evaluation' section is highlighted, featuring a 'Background' subsection with three links: 'A Chronology of Major Events Affecting the NFIP, December 2005 -- 905 KB, text version -- 223 KB', 'NFIP: An Annotated Bibliography, January 2006 -- 2 MB, text version -- 1 MB', and 'Design For the Evaluation of the NFIP -- 93.5 KB'. Below this is the 'Annual Reports' section with three links: 'Annual Report - 2004-2005 -- 385 KB, text version -- 26 KB', 'Annual Report - 2003-2004 -- 87 KB, text version -- 28 KB', and 'Annual Report - 2002-2003 -- 26 KB, text version -- 18 KB'. The 'Study Reports' section follows with three links: 'Market Penetration Rate: Estimates and Policy Implications -- 991 MB, text version -- 359 KB', 'Mandatory Purchase Report -- 870 MB, text version -- 394 KB', and 'The Developmental & Environmental Impacts of the NFIP: A Review of Literature -- 163 KB, text version -- 71 KB'. A footer note states: '(Many of the PDF documents available on the FEMA web site require the most recent version of the Adobe Acrobat Reader, you may download it free from the Adobe® web site.)'

Flood Policy Forum Findings

- Highest priority issues
 - Increased flood damage can be directly related to increased urbanization of watersheds.
 - **Floodplain development affects natural resources.**
 - Levee and dam failures lead to catastrophic damage.
 - Understanding flood risk can reduce flood losses.

Encouraging Outcomes of the 1% Standard

- Satisfied societal need for uniformity.
- Buildings in 1% floodplains built safer and sustain less flood damage.
- Standard well institutionalized.
- **Thousands of riparian acres protected.**
- Costs of flood prevention/damage spread more widely.
- Many communities exceeding minimum standard.

Shortfalls of the 1% Standard

- Flood losses are rising.
- Development clusters just outside the 1% floodplain.
- **Natural & beneficial functions of floodplains ignored in setting standard.**
- Standard not readily integrated in other programs.
- 1% concept confusing to the public.
- Standard is inadequate when applied to levees.
- Extreme uncertainty in calculation and mapping of 1% discharge and floodplain.

Uncertainty and the 1% Standard

- Shortness in rainfall/runoff records; national stream gauge network shrinking.
- Hydrologic modeling an art and science.
- Hydraulics modeling requires judgment.
- Base map accuracy varies.
- **Climate variability not accounted for.**
- Watersheds continually changing, while flood maps are static until updated.

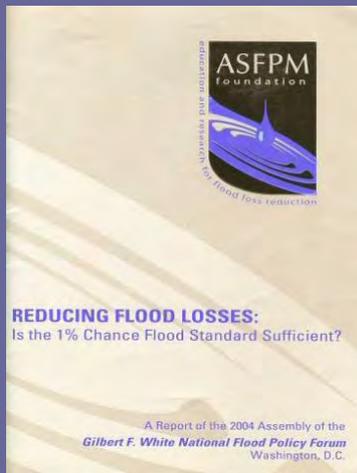
Optional Approaches

- Determine the actual level of protection provided by the 1% chance approach.
- **Improve the application of the existing 1% standard – especially to address natural & beneficial functions.**
- Adopt a two-tiered standard – keep existing standard but add higher standard where necessary.
- Use a vertical standard – flood insurance for all, rates based on height above floodplain.
- Apply a benefit/cost model – analyze probability of flooding and consequences for every activity.
- Take an incentive-based approach – abandon the standard and let market forces take over.

Data/Policy/Research Needs

- Obtain more stream gauge data.
- Establish standard method for defining future conditions.
- Re-examine the role of levees in floodplain management.
- Quantify accuracy of 1% standard after riverine/coastal flood events.
- Improve communication of flood risk.
- **Determine effect of 1% standard on natural & beneficial functions of floodplains.**
- Quantify economic costs/benefits from application of the 1% standard.

<http://www.floods.org/Foundation/Forum.asp>



- Flood Policy Forum Report Issued August 2005.
- Table of contents:
 - How we got here.
 - How the 1% standard has served us well.
 - Where the 1% standard has fallen short.
 - Conclusions and the future.
 - An agenda for action.
 - Supplemental materials.

University of Maryland Findings

- The 1% standard should remain the NFIP standard for land use regulation in the floodplain.
- Mandatory insurance requirements should extend to the 0.2% (500-year) floodplain – Director Maurstad CSPAN interview.
- Floodplain NBFs need to be considered in setting standards.

University of Maryland Findings

- A fundamental change in FEMA's traditional narrow focus of flooding (e.g., as a single discrete event with clear water flow) should be broadened to:
 - a) better account for the complex physical, biological and ecological processes that occur on floodplains; and,
 - b) facilitate refinements to the 1% standard where necessary to protect and restore floodplain functions and achieve greater reductions in flood risk.

Policy Observations

- Design Standard Example
 - Less restrictive national standards often viewed more favorably to reduce costs.
 - For bridge clearance design, going from 6-foot county std. to 3-foot FHWA std., lowers the required height and length of a bridge and its approaches and, consequently, lowers the cost of a project.
- This can impact floodplain hydraulics and NBF.

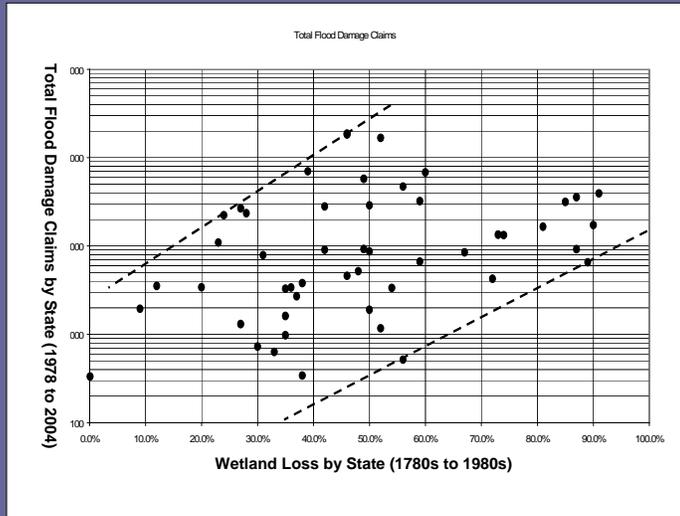
Policy Observations

- Cost Share Requirement Example
 - FHWA/local cost share is 75/25 for the bridge structure itself and, interestingly, 15/85 for the bridge approaches.
 - Creates a disincentive for locals to “do the right thing” in the floodplain.
 - Will opt for the lowest cost alternative, which is typically embankment fill across floodplain.
- This can impact floodplain topography and NBF.

Physical Process Observations

- The 1% floodplain has no scientific connection to the NBFs of floodplains.
- Within the 1% floodplain NBFs are more prevalent closer to the channel.
- The temporal characteristics of flooding are important in defining the NBFs of floodplains.
- The data and relationships between wetlands and flooding are lacking.

Wetland Loss and Flood Damage



Map Change Observations

- Existing LOMR-F standards allow filling in the floodplain fringe.
 - LOMR-F can be submitted “after-the-fact”.
 - Cumulative Effects of floodplain filling not adequately understood.
 - Can reduce sediment “sink” function and impact habitat.
- This is a point of contention in recent FEMA ESA lawsuit.



Legislative Observations

- ESA Section 7 - “Consultation”
 - NFIP mapping standards affect patterns of development impacting habitat.
 - Land use influenced by insurance standards.
 - This is a point of contention in recent FEMA ESA lawsuit.
- ESA Section 9 - “Critical habitat”
 - Protection of habitat and food supply.
 - Floodplain fringe may provide these functions.

How may changes in the 1% standard affect stream restoration?



Changing Flood Standards May...

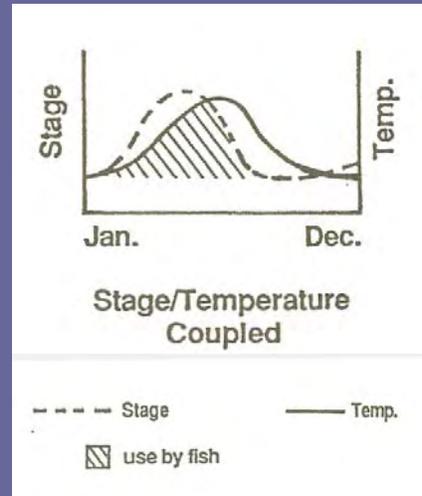
- Lead to revised design standards.
- Lead to revised cost share requirements.
- Accelerate basic research.
- Guide prioritization of restoration projects on a basin or watershed scale.
- Guide the spatial extent of restoration projects on a reach scale.
- Guide the type of design elements at the site scale.

Accelerate Basic Research

- A database on wetland losses—and gains—and their relationship to 1% floodplains needs to be compiled to guide the development of higher NBF standards
> *Pre- and post-project monitoring of restoration projects needs to be done to better quantify benefits of restoration, e.g., reduction in flood damages (\$\$\$), to justify more restoration!*

Restoration Project Prioritization

- Higher floodplain standards should apply where the seasonal flood pulse coincides with water temperature increase to optimize biological production > Prioritize restoration projects in these systems.



Junk et al, 1989

Restoration Project Prioritization

- The economic value of floodplain functions should be factored into new standards > A true benefit/cost ratio of restoration projects may dramatically refine priorities.



Spatial Extent of Restoration

- As the larger 0.2% (500-year) floodplain is now being considered for mandatory insurance purchase, so to should a larger and/or more internally complex floodplain be considered for defining NBFs > Restoration design should involve the “minimum dynamic area” of a floodplain where natural disturbances can occur to rejuvenate the floodplain; design should not be performed in a piecemeal fashion.

What goes on inside the floodplain?



Spatial Extent of Restoration

- Some NBFs of floodplains (e.g., hyporheic zones) may extend beyond the 1% floodplain > Restoration design should consider the potential for physical/ecological linkages beyond the 100-year floodplain.

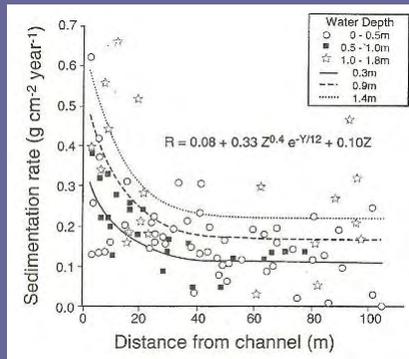
Reach Scale

- The 10-year floodplain may define the upper threshold of floodplain storage in NW streams > Restoration design should incorporate natural hydraulic roughness to optimize flood storage to the 10-year flood stage.



Site Scale

- A “natural floodway” and “flow duration floodplains” should be defined within the 1% floodplain to identify and protect site scale NBFs > Restoration design should consider local stages, flow depth, duration, etc. that trigger key processes.



Walling et al, 1996

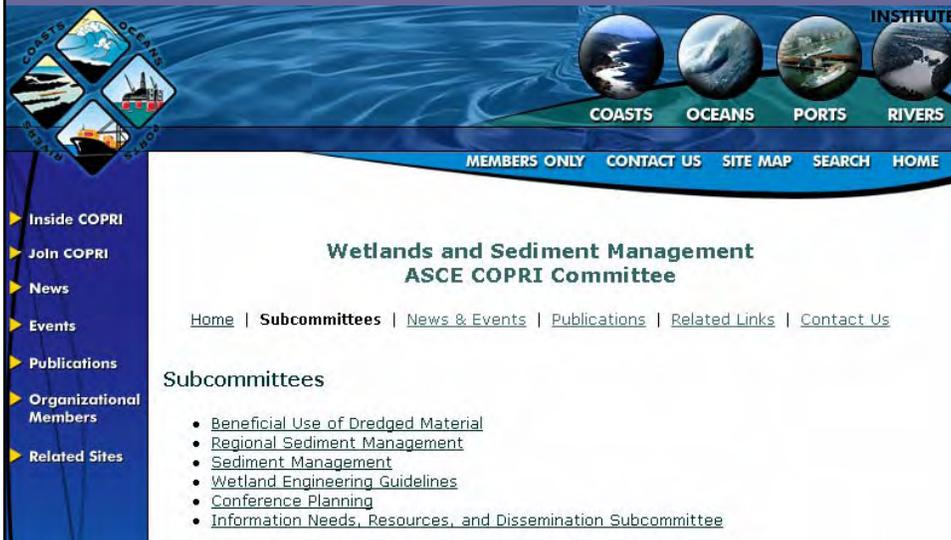
The cartoons were graciously “lifted” from
The Natural Hazards Observer,
the bimonthly periodical of the Natural
Hazards Center.

<http://www.colorado.edu/hazards/o/>



HELP!

Pending White Paper on "Flood Hazard Reduction and Habitat Protection through Wetland and Sediment Management"



The screenshot shows the ASCE COPRI website. At the top, there is a navigation bar with icons for COASTS, OCEANS, PORTS, and RIVERS, and the text 'INSTITUTE'. Below this is a blue banner with the text 'MEMBERS ONLY CONTACT US SITE MAP SEARCH HOME'. The main content area features the title 'Wetlands and Sediment Management ASCE COPRI Committee' and a list of subcommittees: Beneficial Use of Dredged Material, Regional Sediment Management, Sediment Management, Wetland Engineering Guidelines, Conference Planning, and Information Needs, Resources, and Dissemination Subcommittee. A left sidebar contains a menu with items like 'Inside COPRI', 'Join COPRI', 'News', 'Events', 'Publications', 'Organizational Members', and 'Related Sites'. A top navigation bar includes links for 'Home', 'Subcommittees', 'News & Events', 'Publications', 'Related Links', and 'Contact Us'.

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