

## *Development of Interim Hydrograph Modification Criteria for the San Diego County HMP*



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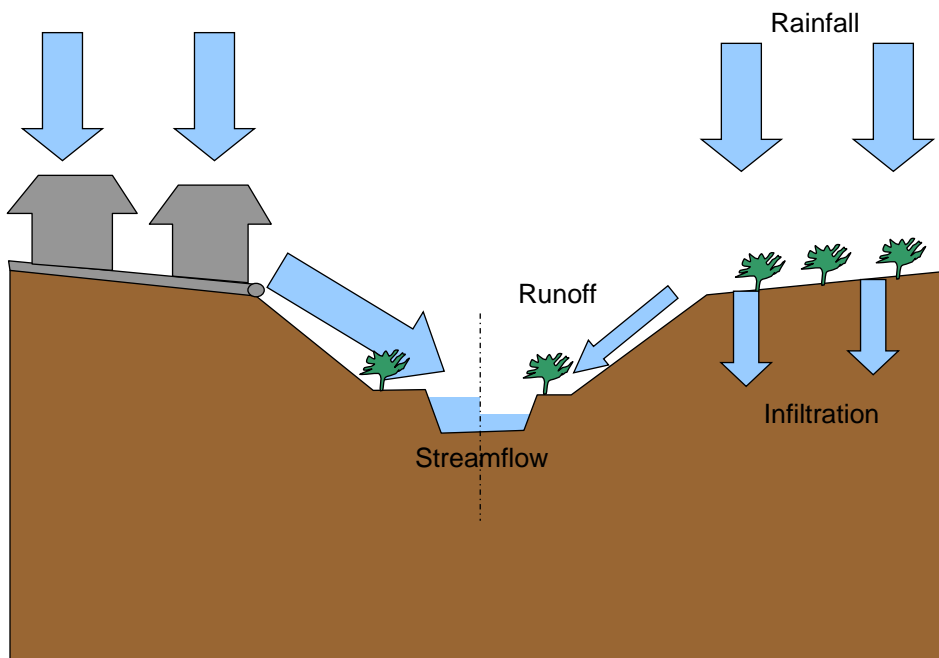


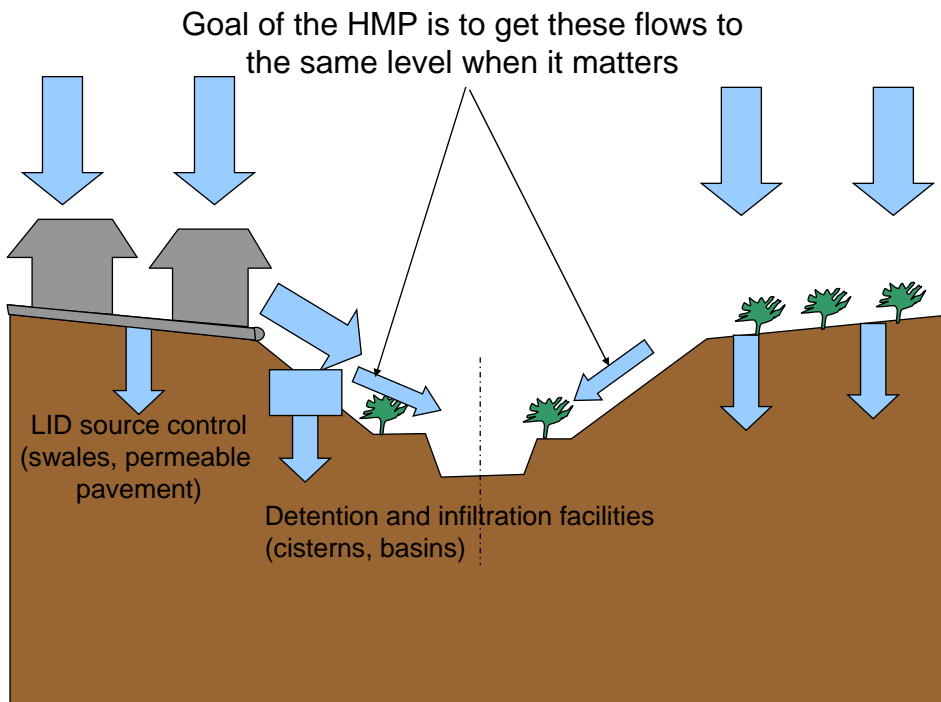
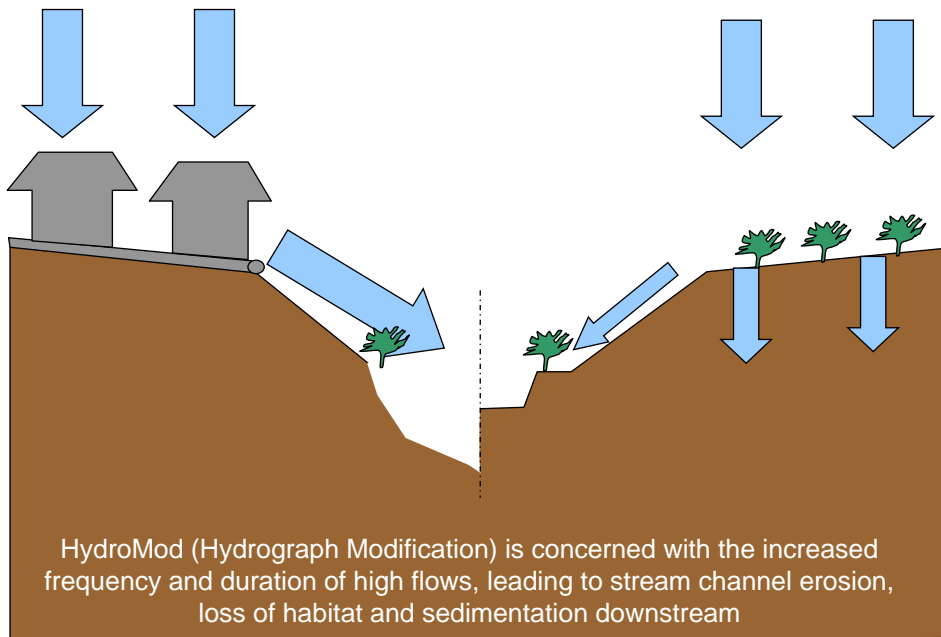
## *Development of Interim Hydrologic Criteria for the San Diego HMP*

- ☞ Introduction to Hydrograph Modification Management Flow Control Criteria
- ☞ Existing Flow Control Criteria
- ☞ Adapting Flow Control Criteria to San Diego County
- ☞ The Draft Interim Hydrologic Criteria

## Hydrograph Modification Basics

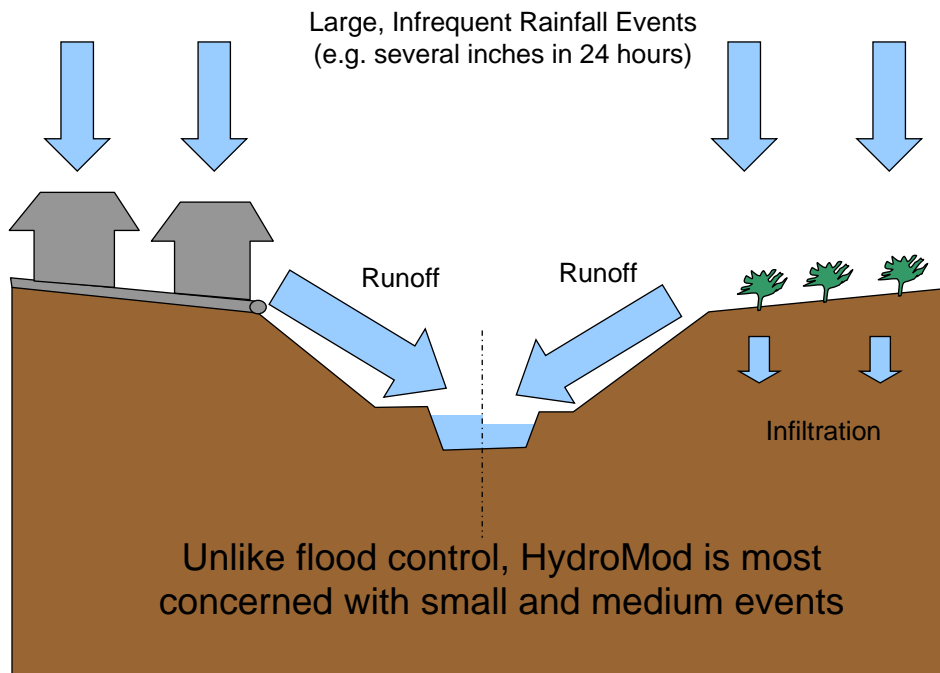
- ☞ Hydrograph modification: Increases in the frequency and duration of runoff as a result of watershed development
- ☞ Increases caused by added impermeable area, higher drainage density, more efficient channel network
- ☞ Flow increases can cause or accelerate erosion of stream bed and/or banks

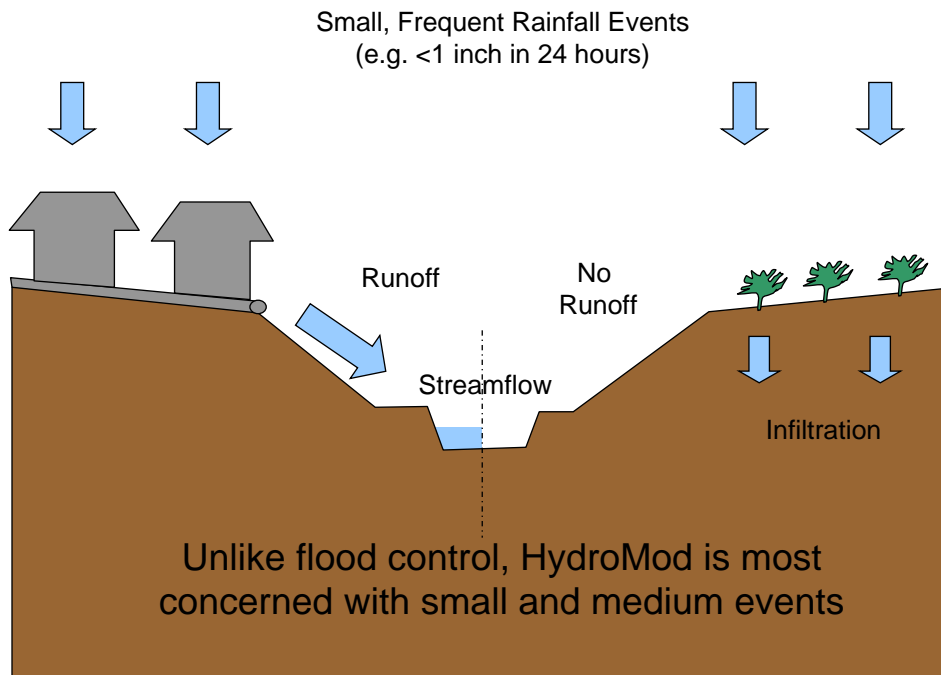




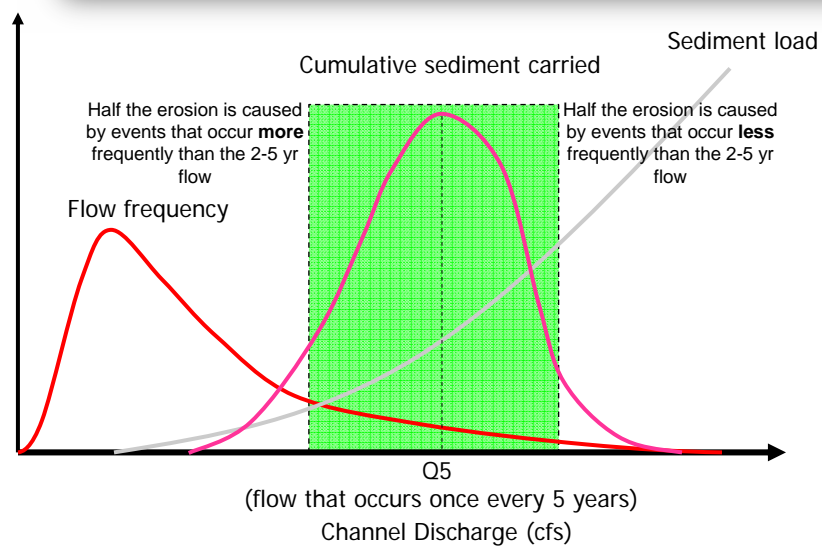
## When does it matter? Language from RWQCB permit.

- ☞ Purpose of the IHC is to mitigate the effects of hydrograph modification to prevent, or avoid exacerbating/accelerating, erosion
- ☞ RWQCB Order requires that the IHC:
  - Utilize continuous simulation
  - Define a “range of flows” to be controlled
- ☞ IHC should apply to flows that are geomorphically significant (ie likely to cause erosion)

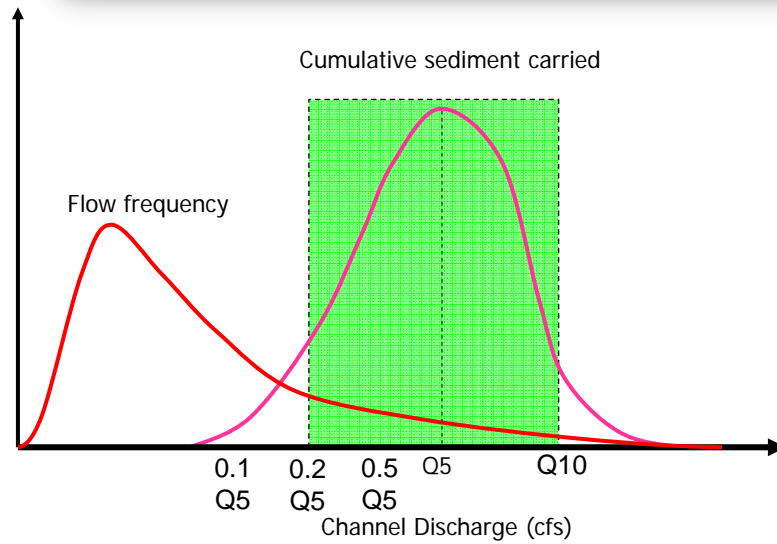




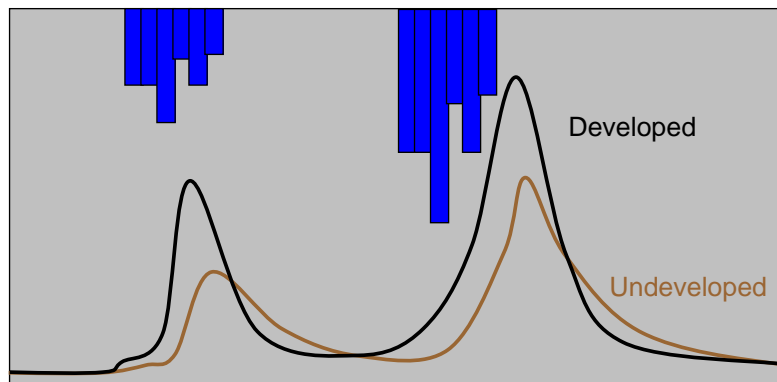
*Medium sized events cause the most erosion*



*HydroMod Flow Control Standards Aim to Control the Flows that Cause Most of the Erosion*

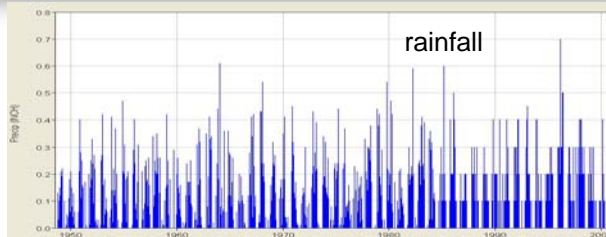


*Because HMP is concerned with small events we need to use Continuous Simulation Modeling*

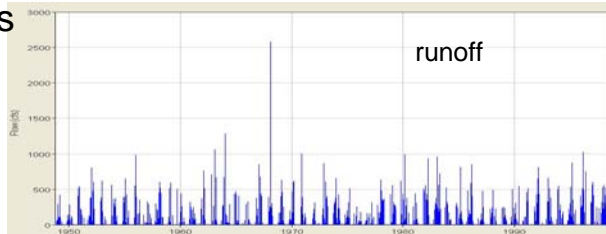


*Because HMP is concerned with small events we need to use Continuous Simulation Modeling*

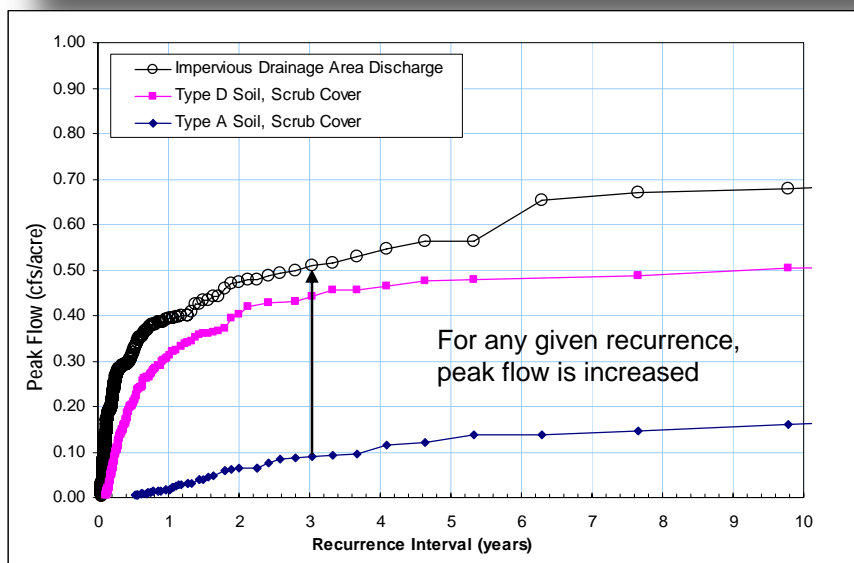
Long-term, continuous simulation of **runoff** based on historic **rainfall** record



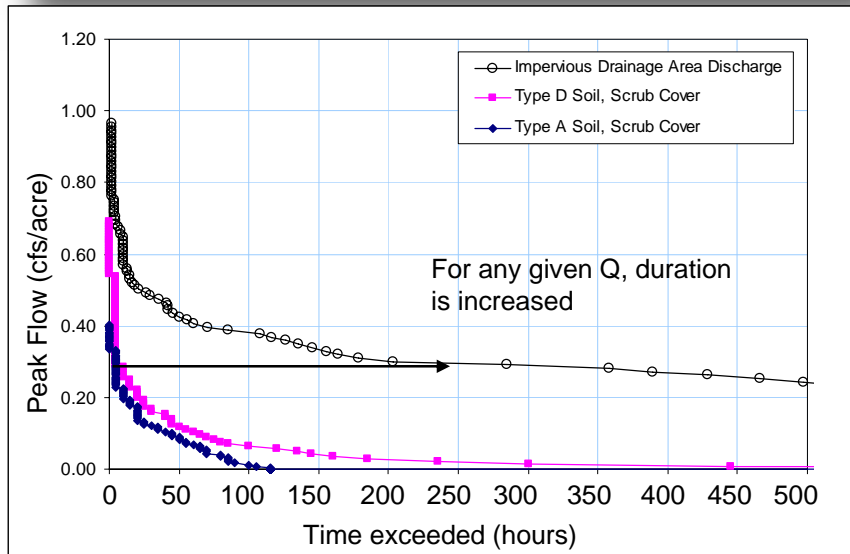
Statistical analysis of **peak flow** frequency, and **duration** of flows at a given Q



*Impact of development on Peak Flow*



## Impact of development on Flow Duration



## IHC - Recommended Approach

- ☞ Define the IHC as a curve-matching standard for pre- and post-development peak flow and duration curves derived from project-specific continuous simulation
- ☞ Define curve-matching range and tolerances based upper and lower Q considered geomorphically-significant
- ☞ Provide LID option that does not require project-specific modeling

## Defining the curve-matching standard

- ☞ Stream channel response depends on hydrology, geology, position in the watershed, etc.
- ☞ Selecting a single threshold for flow control compliance is difficult
- ☞ Different regulatory approaches have led to different approaches for defining this threshold
- ☞ Examples:
  - Santa Clara: 0.1Q2
  - Contra Costa: 0.1Q2
  - LA (interim): Q2



## Defining the curve-matching standard

- ☞ Bay Area criteria based on Q2 – dominant discharge for NorCal but Q5 more appropriate for Southern CA
- ☞ Santa Clara and Contra Costa threshold (0.1Q2) based on critical flow for 2 incised Santa Clara creeks with fine sediment



Matadore Creek, Santa Clara



San Diego Creek, San Diego

## Defining the curve-matching standard

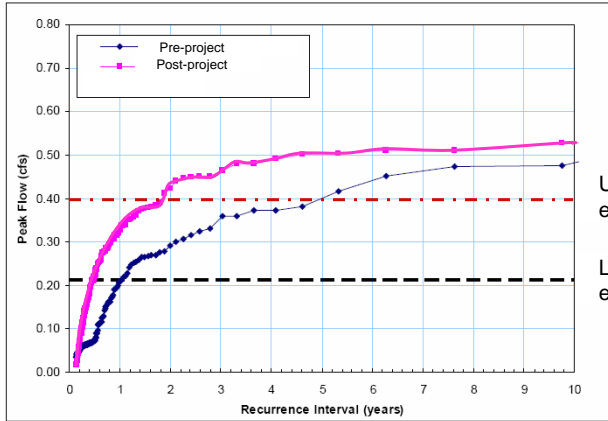
- ☞ Q10 is widely accepted in N CA – value above which little cumulative work is done by flow
- ☞ However – in S CA may need to look higher as more work done by less frequent flows
- ☞ Lower Q boundary is less well defined
- ☞ Most conservative approach ~ Q at which any work starts to be performed (critical shear stress)
- ☞ This varies with sediment type and channel geometry

## Comparing thresholds with Southern CA conditions



Recurrence Interval (existing conditions)	Canyon A 0.5 sq mi	Canyon B 5 sq mi
Q2	24	106
Q1.01	15	72
0.5 Q2	12	53
Q.5	8	41
0.2 Q2	4.8	21
0.1 Q2	2.4	11
Q5	80	311
0.5 Q5	40	156
0.3 Q5	24	93
0.2 Q5	16	62
0.1 Q5	8	31

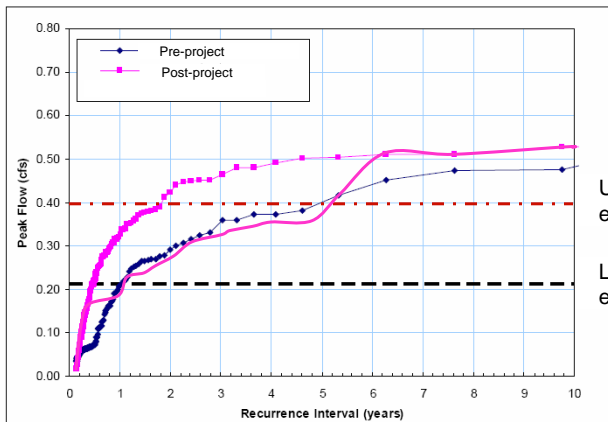
# Using curve matching to demonstrate compliance



Upper threshold  
e.g. Q10

Lower threshold  
e.g. 0.2Q5

# Using curve matching to demonstrate compliance



Upper threshold  
e.g. Q10

Lower threshold  
e.g. 0.2Q5

## Draft IHC – Flow Control Standard

1. **Post-project runoff durations and peak flows do not exceed pre-project durations and peak flows.**
  - a. For flow rates from 20% of the pre-project 5-year runoff event (0.2Q5) to the pre-project 10-year runoff event (Q10), the post-project *discharge durations* shall not deviate above the pre-project durations by more than 10% over more than 10% of the length of the flow duration curve.
  - b. For flow rates from 0.2Q5 to Q5, the post-project *peak flows* shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post-project peak flows may exceed pre-project flows by up to 10% for a 1-year frequency interval.

## Draft IHC – LID Option for Final HMP

2. **Low Impact Development Integrated Management Practices (LID IMPs) implemented using approved criteria.**
  - a. The project proponent may implement LID IMPs to manage hydrograph modification impacts, using design procedures, criteria, and sizing factors (ratios of LID IMP volume or area to tributary area) specified by the permittees. The permittees' LID IMP designs and sizing factors shall be determined using continuous simulation of runoff from a long-term rainfall record.

## *Draft IHC – Exemptions*

**The Board Order allows exemptions from the IHC for projects discharging to:**

- ☞ **Hardened channels (concrete, rip rap etc);**
- ☞ **Storm drains discharging directly to the ocean or bay;**
- ☞ **Channels whose watershed is already highly impervious (e.g. >70%)**
- ☞ **Applicant can do a geomorphic study to demonstrate that flow increases will not cause erosion**