California NPS Conference – Hydromodification Workshop

Potential Solutions: Flow Duration Control Approach

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Presentation Overview

- Permit Requirements for Hydromodification Management
- Hydromodification Control Strategies
- The Flow Duration Control Approach
- Flow Duration Controls + LID
- Flow Duration Basin Sizing Examples

Hydromodification Control Requirements

SCVURPPP Permit Provison C.3.f.i.:

- Increases in runoff peak flow, volume, and duration shall be managed for all Group 1 Projects*, where such increased flow and/or volume can cause increased erosion of creek beds and banks…
  - * Group 1 = > 1 acre impervious surface

Hydromodification Control Requirements, continued

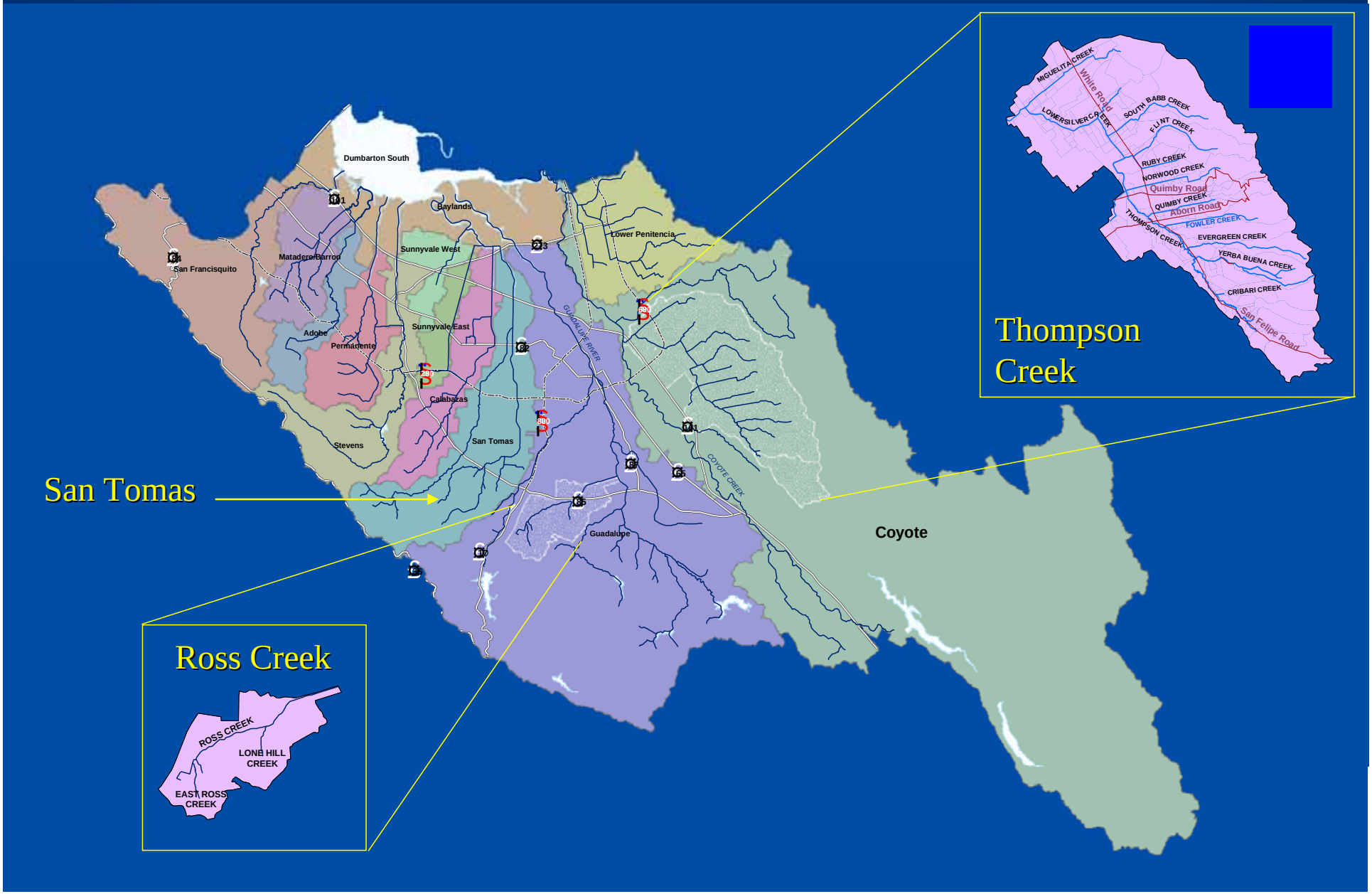
SCVURPPP Permit Provison C.3.f.i.:

- Post-project runoff shall not exceed estimated pre-project rates and/or durations, where the increased stormwater discharge rates and/or durations will result in increased potential for erosion…

Development of Hydromodification Management Plan for Santa Clara Valley

- Conducted literature review
- Developed and applied a watershed assessment methodology to predict stream instability & evaluate controls
- Developed design criteria, control measures, management strategies
- Developed performance criteria and guidance for implementation
- Conducted public outreach

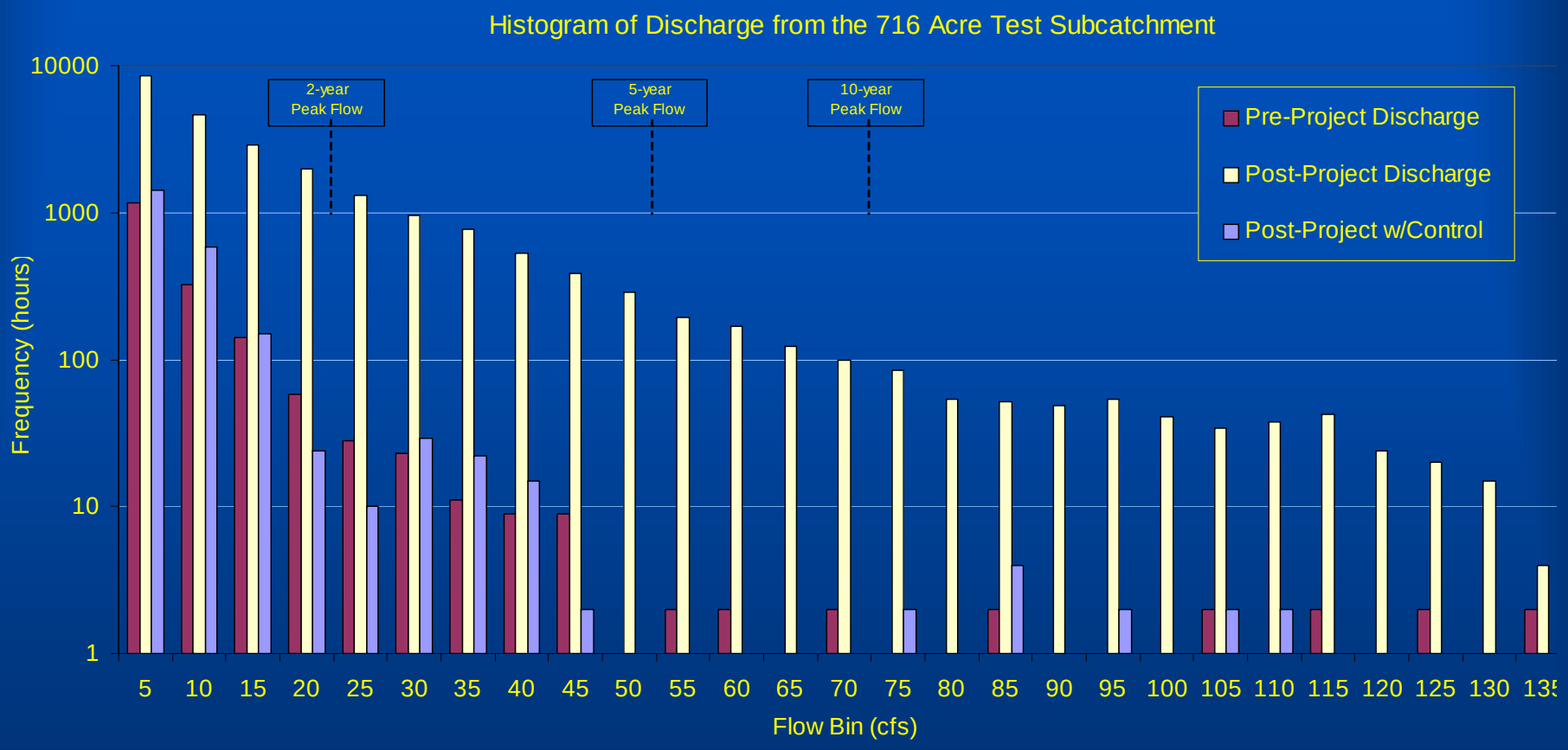
HMP Assessment Subwatersheds



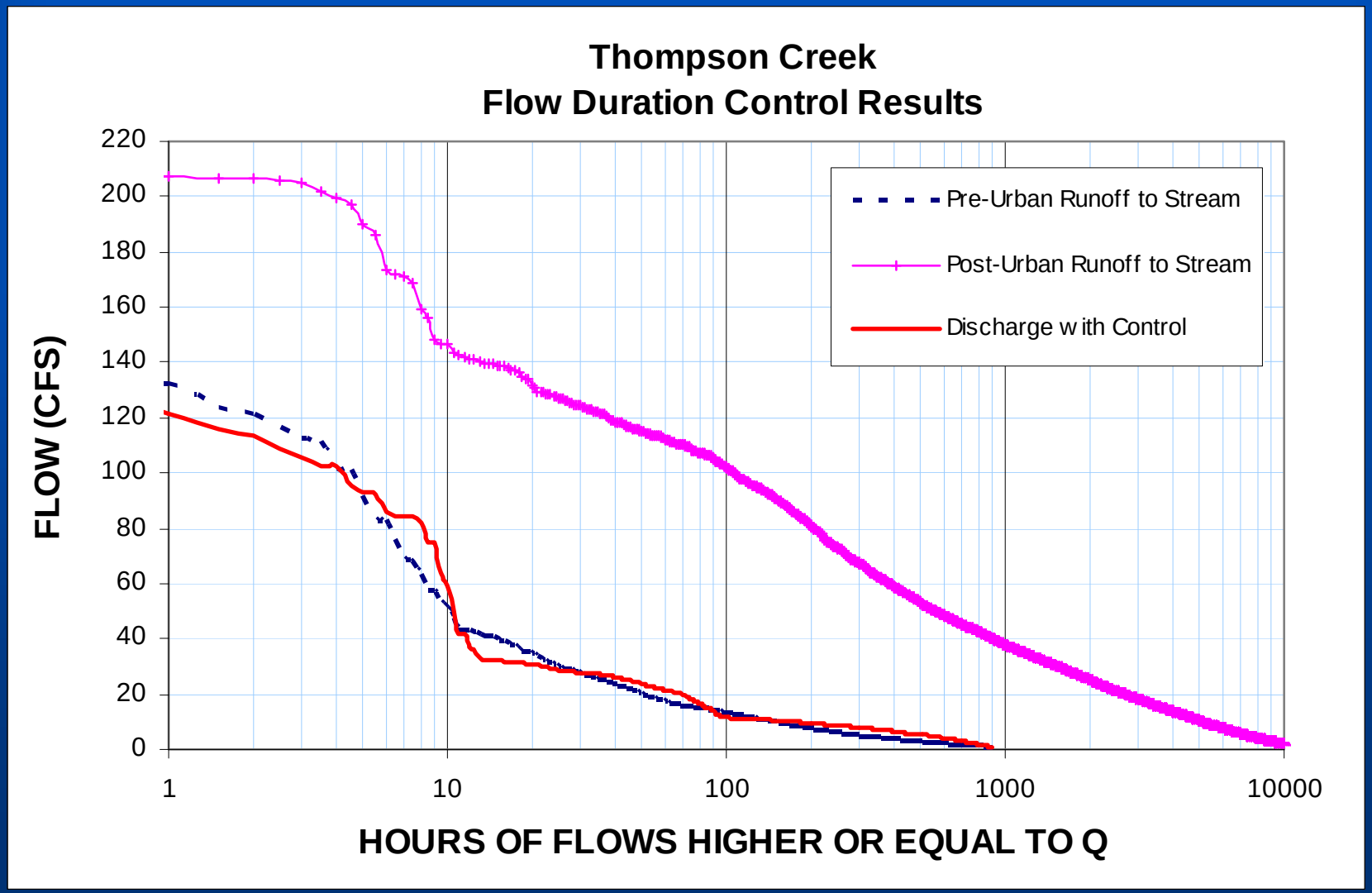
Control Strategies

- Peak flow control - not effective for erosion control (per MacRae's studies)
- Single event/design storm approaches – not adequate hydromod control
- Low flows matter!
- Flow duration control - recommended
  - Maintain magnitude and duration of post-project flows same as pre-project
  - Considers multi-year discharge record

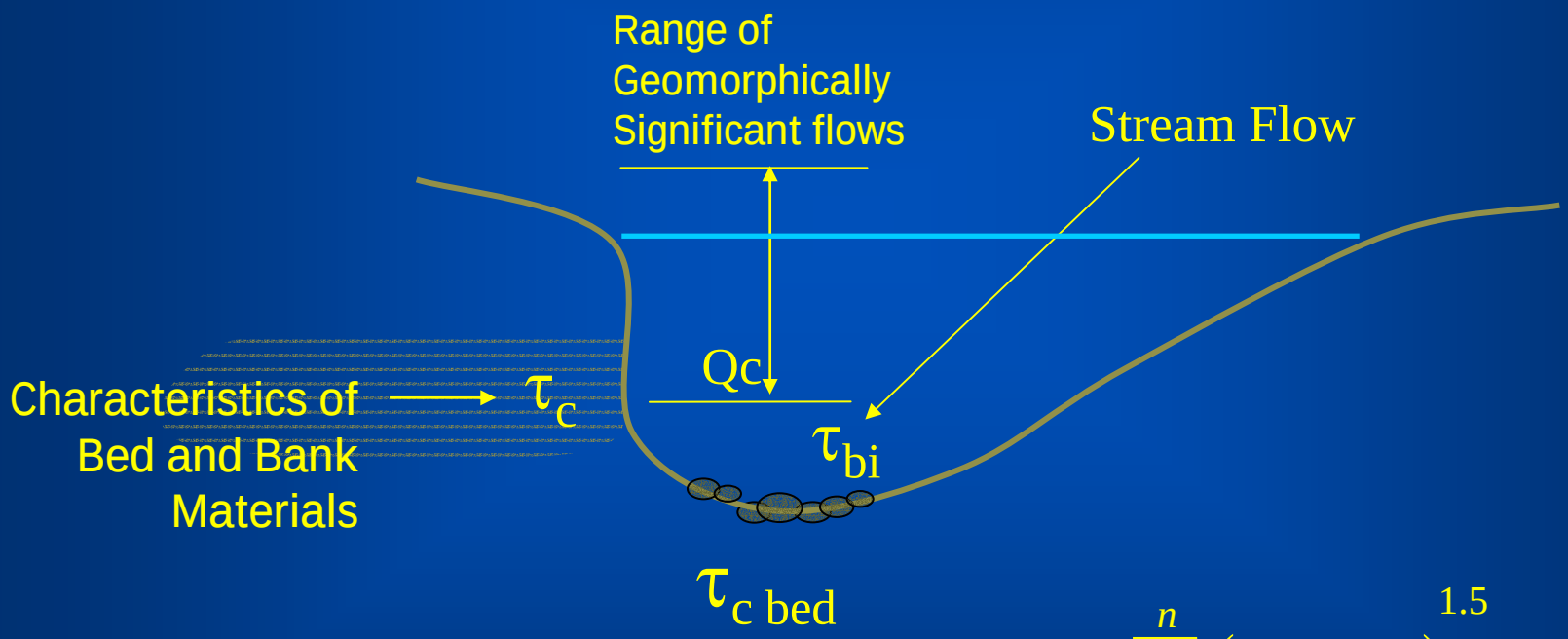
Flow Duration Histograms



Flow Duration Curves



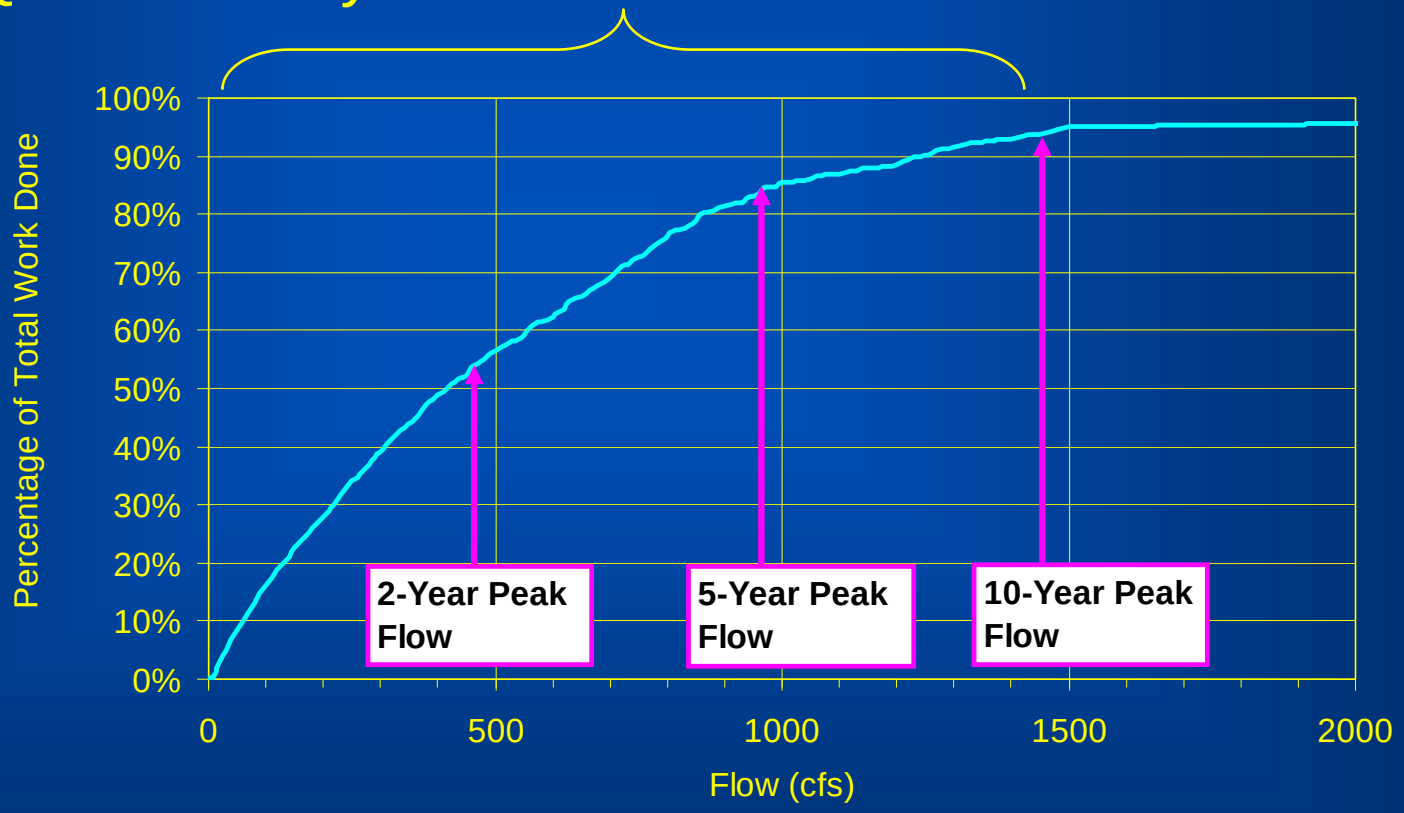
Effective Work Index (W)



$$W = \sum_{i=1}^{n} \left(\tau_{bi} - \tau_c\right)^{1.5} \cdot V \cdot \Delta t$$

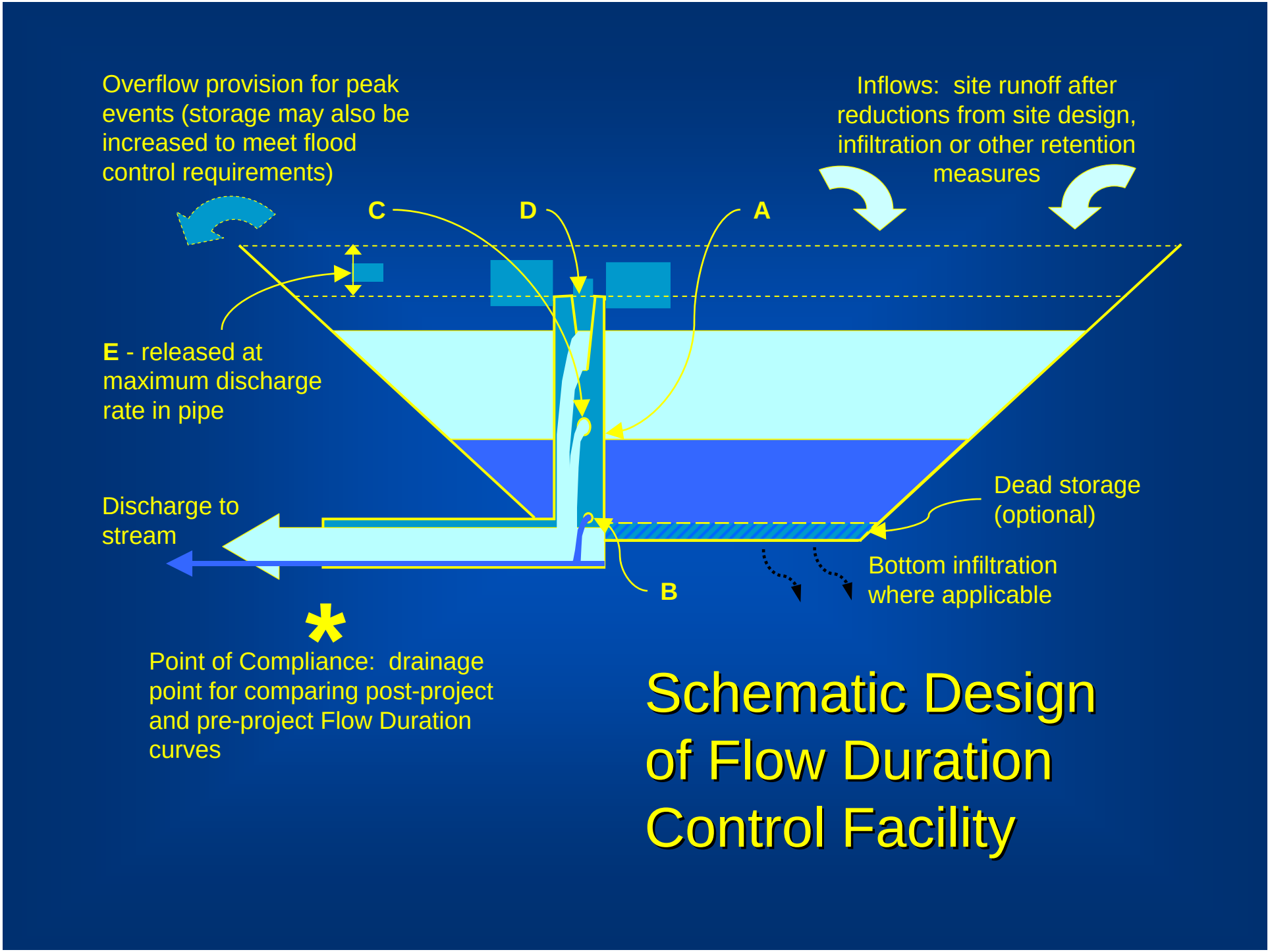
Range of Storms to Manage
(Set of Design Storms)

- Qc to the 10-year event



Summary of Estimated Critical Flow Values

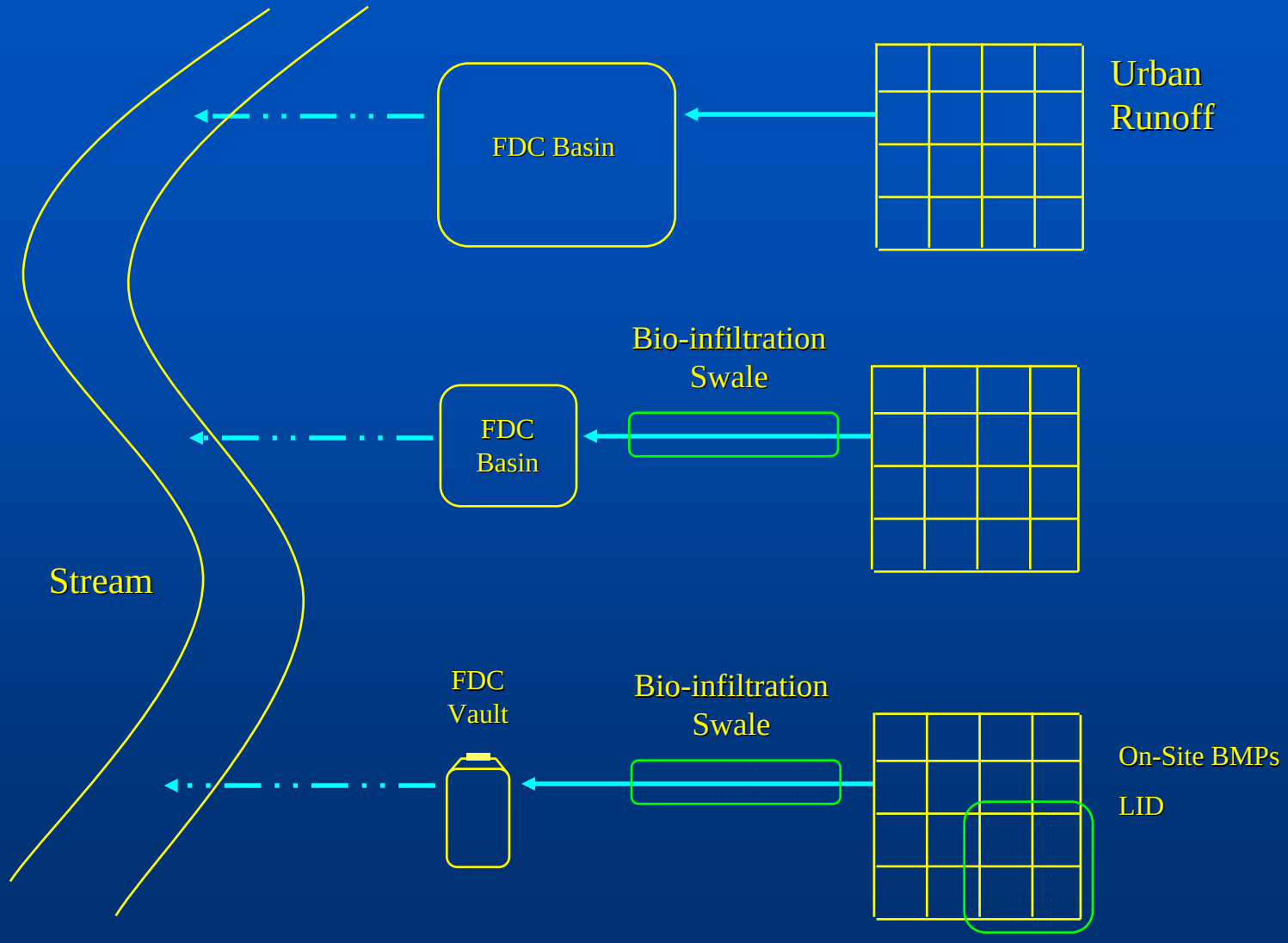
Subwatershed and Reach	Critical Flow in Stream (Qc, cfs)	Percent of 2-Year Peak Flow in Stream
Thompson Creek		
J-1	10	18
J-5	3-7	2-4
J-12	40	8
Yerba Buena		
YB-6/7	4-5	6-7
YB-2/4	3-10	5-18
Ross Creek		
J-1	25	12
J-5	15-20	11-14
Estimated Qc		**10% of 2-year peak**


Overflow provision for peak events (storage may also be increased to meet flood control requirements)
Inflows: site runoff after reductions from site design, infiltration or other retention measures
C
D
A
E - released at maximum discharge rate in pipe
Discharge to stream
Dead storage (optional)
Bottom infiltration where applicable
B
Point of Compliance: drainage point for comparing post-project and pre-project Flow Duration curves
Schematic Design of Flow Duration Control Facility

Types of Flow Duration Controls

- Flow control structures
  - Retention/detention basins
  - Underground vaults/tanks
- Combine flow control with flood control or treatment facilities
  - Detention basins
  - Wet ponds

Integrating Flow Duration Control (FDC) with Other BMPs



Examples of Flow Duration Basin Sizing

- Thompson Creek
  - 716 acres, “D” soils, mixed use, 71% impervious
- San Jose Example
  - 3.6 acres, “D” soils, residential, 45% impervious
- Alameda County Example
  - 12.2 acres, “B” soils, commercial, 67% impervious

Flow Duration Basin Sizing Results

	Thompson	**San Jose**	**Alameda**
Basin Depth Basin Area	4 feet 30 acres	2.25 feet 0.06 acres	2 feet 0.8 acres
Basin Size %DCIA	5.7% (4% catchment)	3.7% (1.7% catchment)	10% (7% catchment)
Drain time	3 days	< 1 day	1 day
Qcp (low flow)	2.4 cfs	0.1 cfs	0.25 cfs
Infiltration Rate	0.2 in/hr (5.5 cfs)	0.2 in/hr (0.012 cfs)	0.5 in/hr (0.4 cfs)

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