Bay Area Hydrology Model

Doug Beyerlein, P.E.
Joe Brascher
Shanon White

Clear Creek Solutions, Inc.
www.clearcreeksolutions.com

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Bay Area Hydrology Model

This introductory presentation was given at BAHM workshops held in November 2006 at:

San Jose, CA

San Mateo, CA

Hayward, CA

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Bay Area Hydrology Model

Developed for:

Alameda Countywide Clean Water Program

Santa Clara Valley Urban Runoff Pollution Prevention Program

San Mateo Countywide Stormwater Pollution Prevention Program

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Presentation

Introduction

BAHM Background and Theory

BAHM and HSPF

BAHM Application

BAHM Demo

Questions & Answers

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Introduction

BAHM software platform was originally developed for the State of Washington Department of Ecology.

Project Manager: Dr. Foroozan Labib
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600
(360) 407-6439
email: flab461@ecy.wa.gov

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BAHM Background and Theory

Flow duration standard: based on erosive flows.

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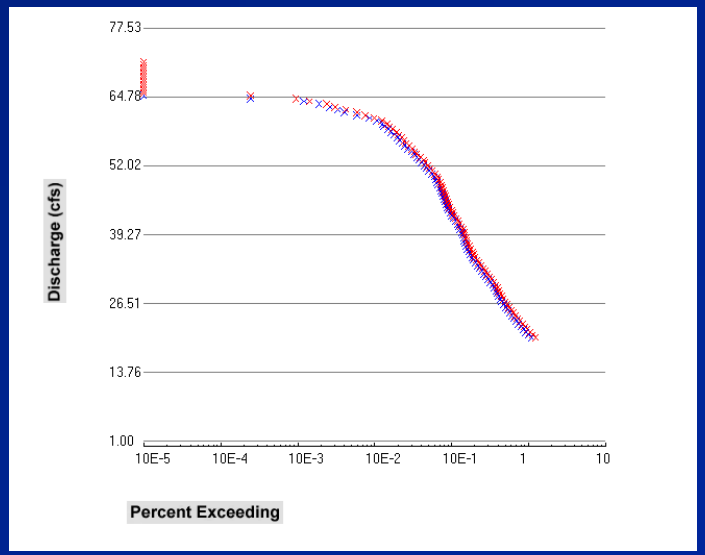
BAHM Background

Flow Duration Analysis: Percent of time the flow exceeds a specific value.

Requires continuous simulation hydrology to compute flow duration.



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BAHM Background

Single event modeling doesn't work because:

- Single-event flow frequency standards are based on inappropriate assumptions.

- Single-event modeling cannot compute flow durations (percent of time flows exceed a specific value). For BAHM the flow duration range of concern is from 10% of the 2-year to 10-year flow event.

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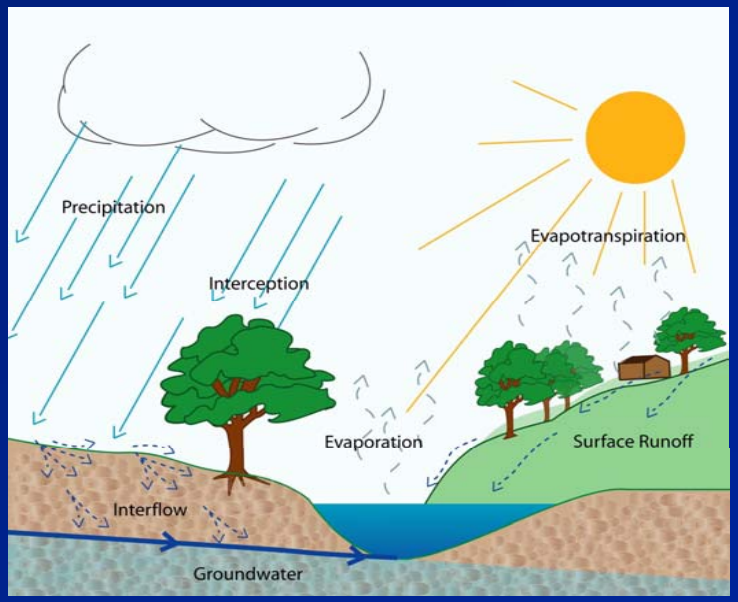
BAHM Background

Continuous simulation hydrology models the entire hydrologic cycle for multiple years.



Stormwater runoff = surface runoff + interflow.

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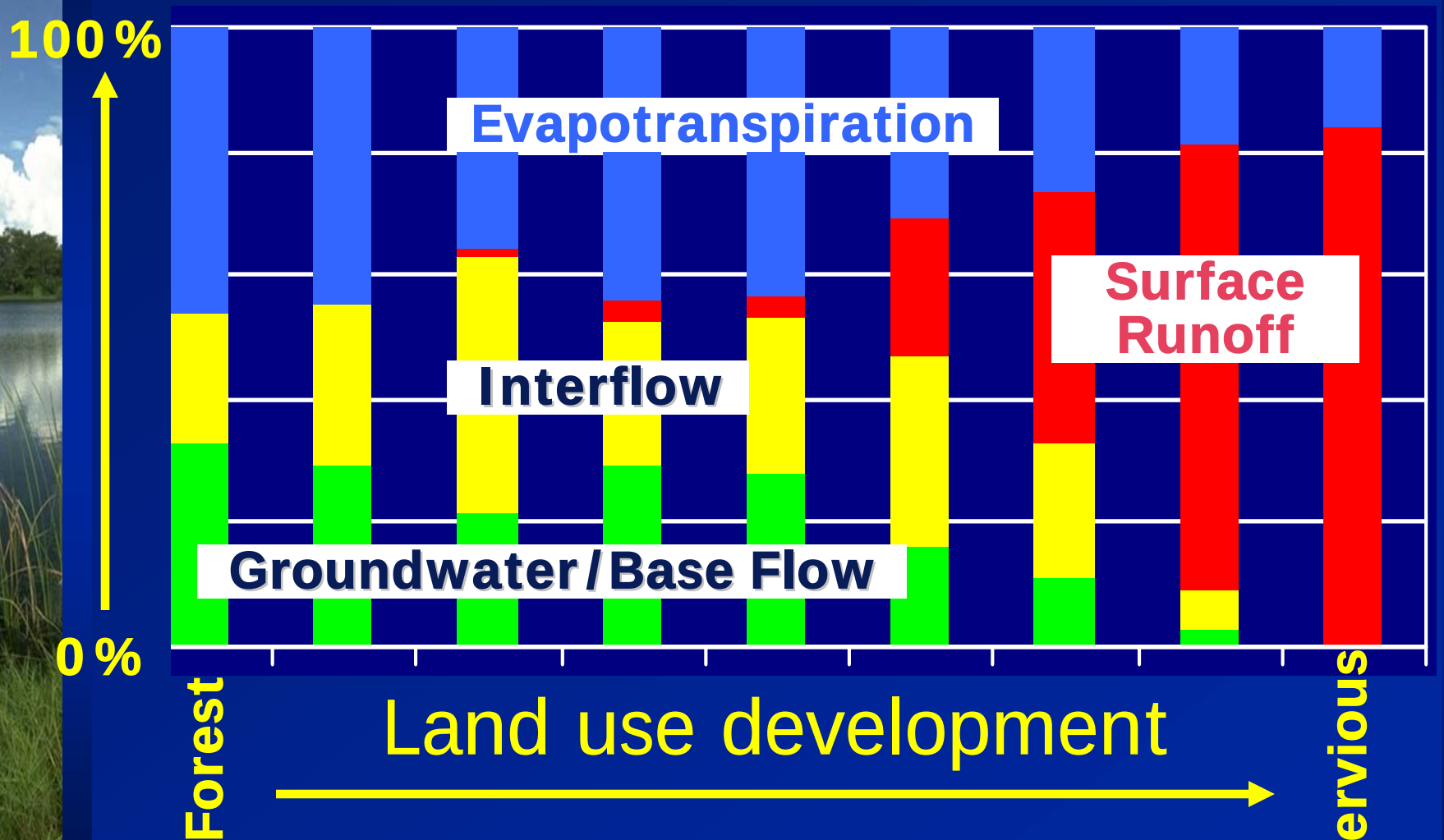
Where the rain goes:



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BAHM Capabilities

BAHM uses continuous simulation hydrology to compute stormwater runoff for both pre-project and post-development conditions.

Pre-project

Post-development

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BAHM Capabilities

- BAHM continuous simulation computations from HSPF (included in BAHM software).

- HSPF runs in the background with calibrated parameter values and local meteorological data.

- HSPF sponsored and funded by EPA and USGS.

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How HSPF works

- Drainage areas are divided into pervious land segments based on soil, vegetation, and land slope and impervious land segments.

- Pervious and impervious segments are linked to conveyance pathways (pipes, ditches, ponds, streams, rivers, lakes, etc.)

- Historic rainfall and evaporation are used as input.

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How HSPF works

- The entire water cycle is modeled on an hourly or shorter time step for multiple years.

- The model computes changes in soil moisture, evapotranspiration, and runoff every time step.

- Three types of runoff:
  - surface runoff
  - interflow
  - groundwater/base flow

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How HSPF works

- Pervious and impervious parameter values are calibrated using observed streamflow data.

- Calibration uses multiple years of observed flow data so that the model is calibrated for both dry years and wet years.

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How BAHM works

- Calibrated parameter values are built into BAHM (different calibrated parameter values are used for different counties).

- Local precipitation and evaporation data are included in BAHM.

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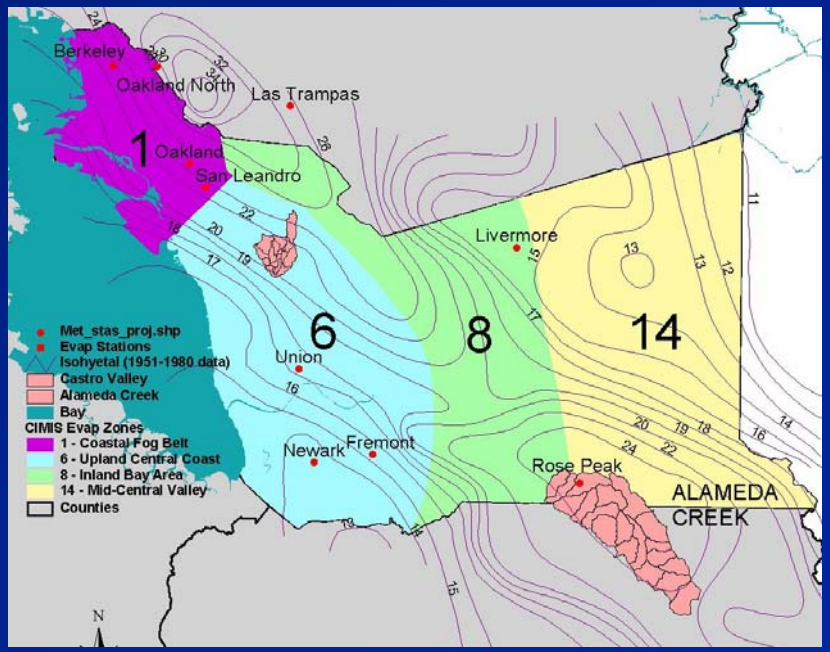
How BAHM works

- HSPF model construction/calibration/parameterization

  Castro Valley Creek, Alameda County
  Alameda Creek, Alameda and Santa Clara counties
  Ross Creek, Santa Clara County



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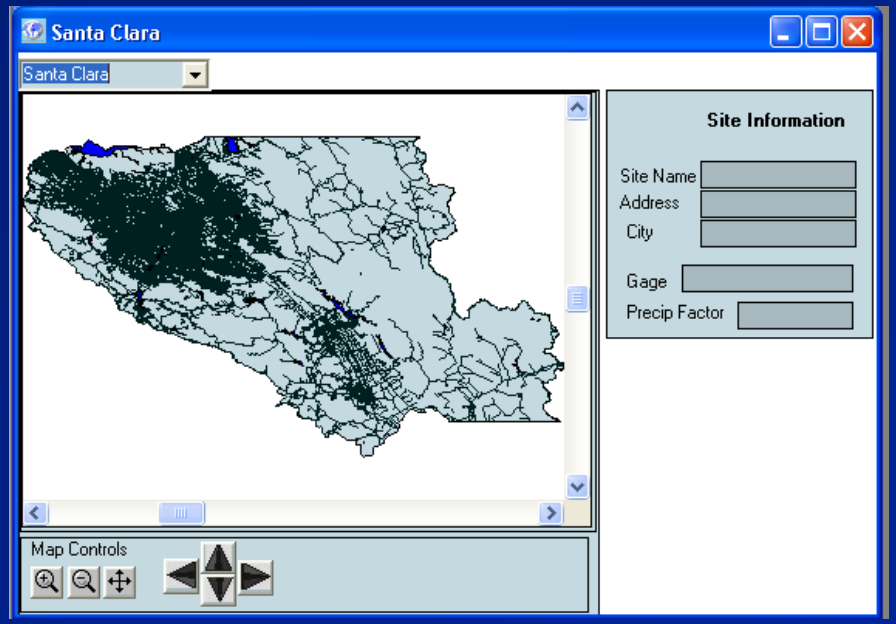
How BAHM works

- Meteorological data: Santa Clara County



San Jose

Morgan Hill

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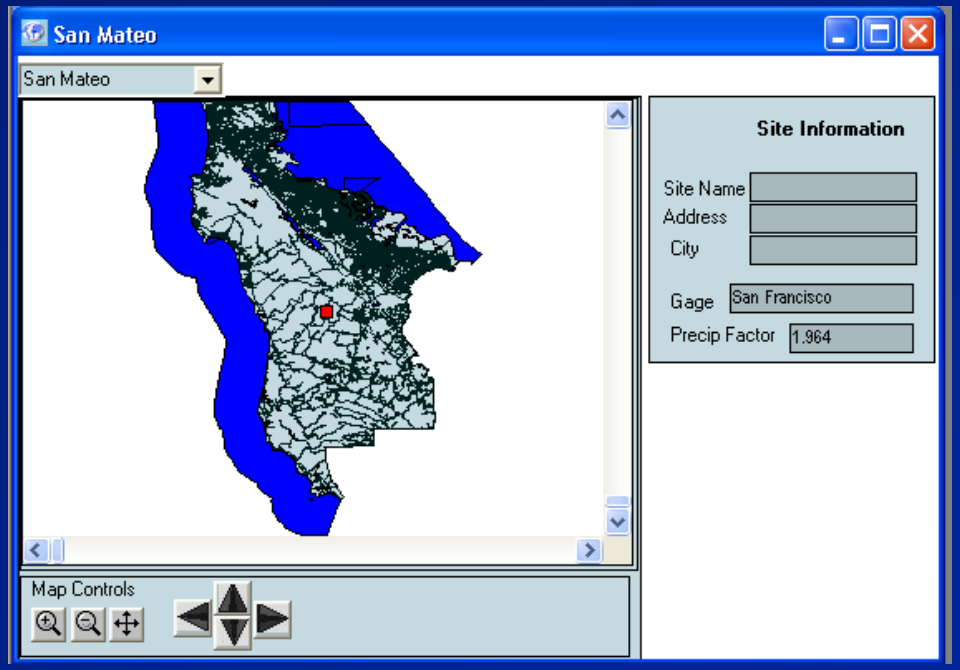
How BAHM works

- Meteorological data: San Mateo County



San Francisco

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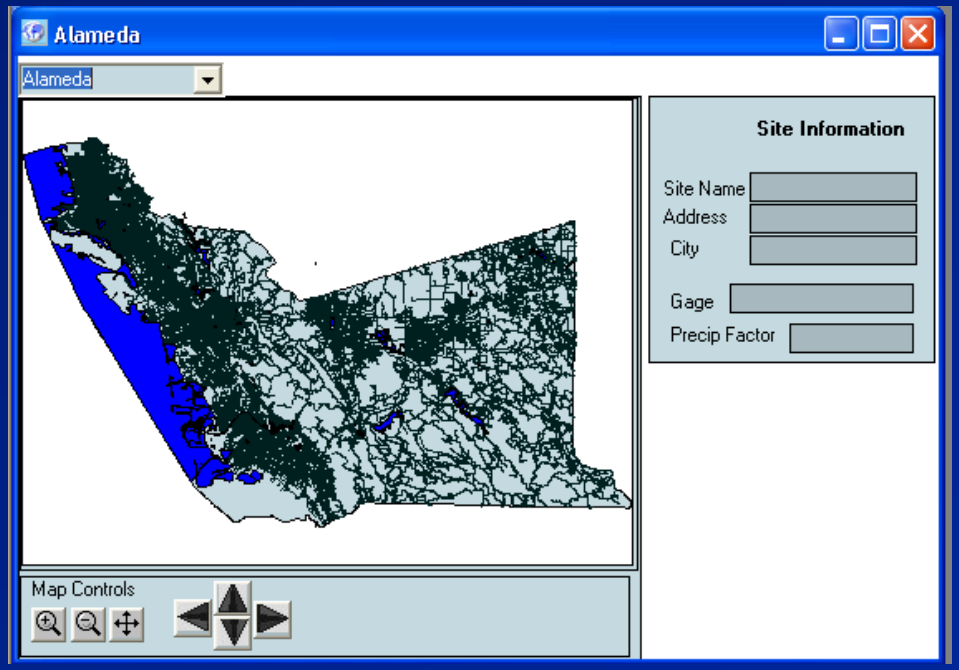
How BAHM works

- Meteorological data: Alameda County



Berkeley

Newark

Livermore

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How BAHM works

- User locates project on county map, inputs pre-project and post-development land use, and proposed mitigation measure(s).

- Pre-project and mitigated flows are compared at Point of Compliance (POC).

- Mitigated flows are not allowed to exceed flow duration standards.

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How BAHM works

- User outputs report file and project file.
- Output files can be submitted to the permitting agency for approval.
- Permitting agency can load project file and rerun analysis, if needed.
- Report file summarizes input data and output results.

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How BAHM works

- Guidance/help is provided by
  - User Manual
  - Training Workshops
  - CCS Project Book

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BAHM Application:

Example: Convert undeveloped land to suburban residential housing.

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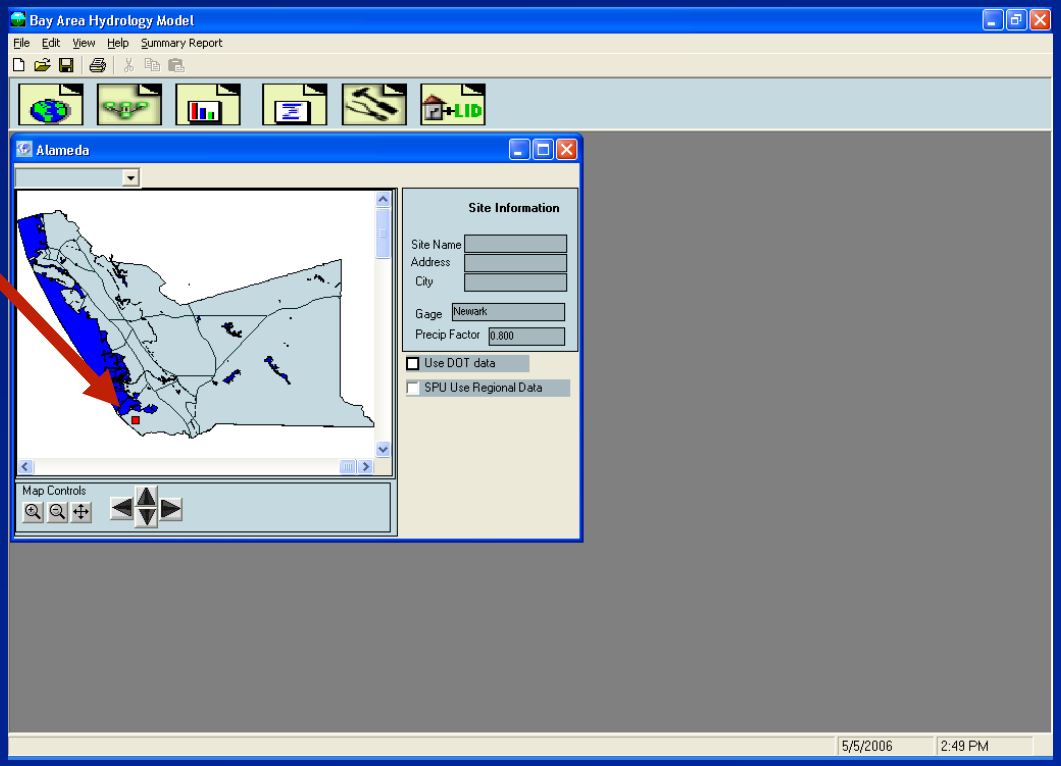
BAHM Application: Step 1

User selects land development location and places red dot on map.



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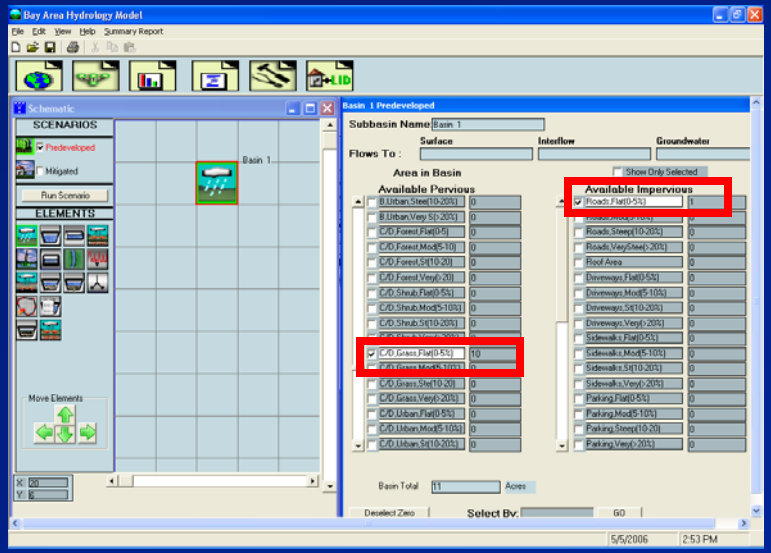
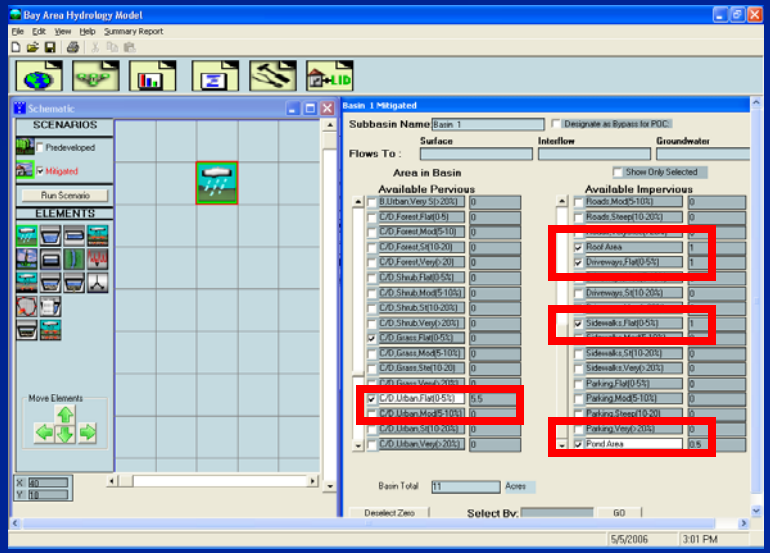
BAHM Application: Step 2

User inputs pre-project and post-development land use.

Pre: grassland & pavement



Post: urban landscaping, roof, street, sidewalk, driveways, & pond



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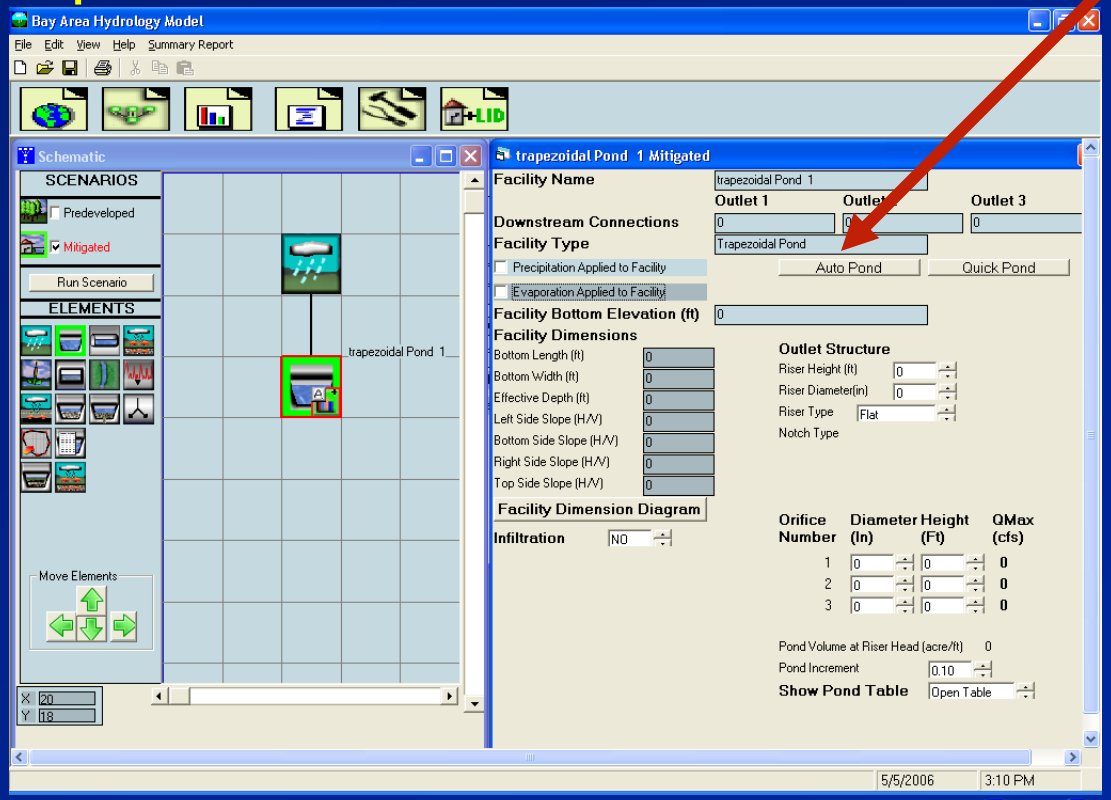
BAHM Application: Step 2 cont'd.

User inputs initial pond specifications or uses AutoPond to optimize pond size.



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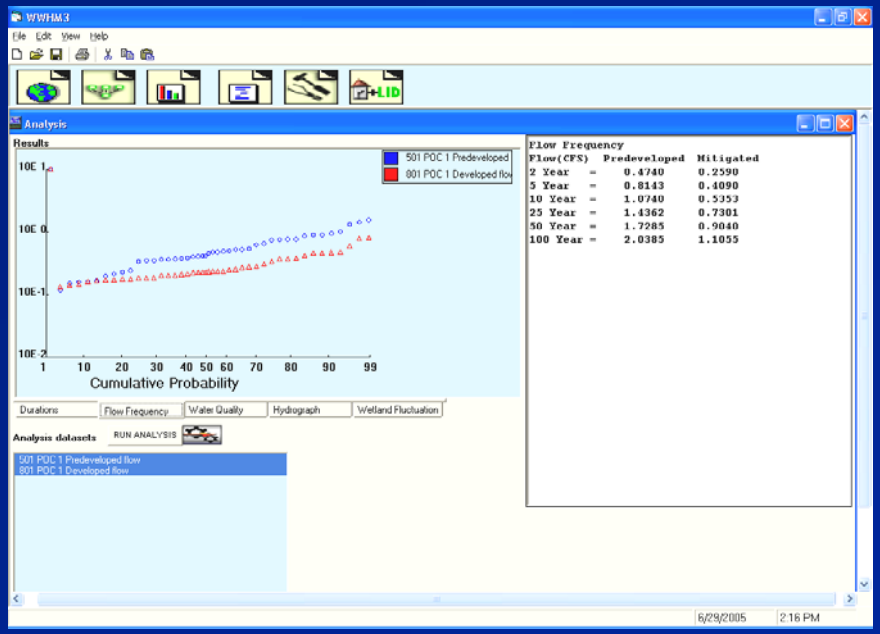
BAHM Application: Step 3

BAHM computes and compares pre-project and post-development routed runoff statistics

Flow frequency (2-year to 100-year):



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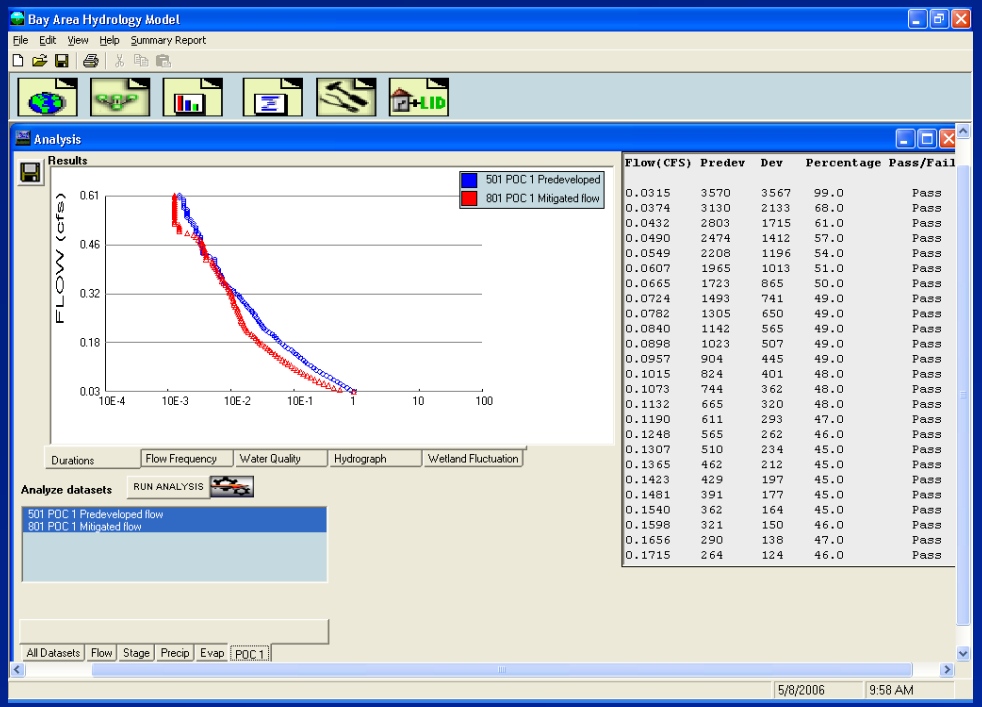
BAHM Application: Step 3 cont'd.

BAHM compares pre-project and post-development routed runoff statistics

Flow duration (10% of 2-year to 100% of 10-year):



Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0315	3570	3567	99.0	Pass
0.0374	3130	2133	68.0	Pass
0.0432	2803	1715	61.0	Pass
0.0490	2474	1412	57.0	Pass
0.0549	2208	1196	54.0	Pass
0.0607	1965	1013	51.0	Pass
0.0665	1723	865	50.0	Pass
0.0724	1493	741	49.0	Pass
0.0782	1305	650	49.0	Pass
0.0840	1142	565	49.0	Pass
0.0898	1023	507	49.0	Pass
0.0957	904	445	49.0	Pass
0.1015	824	401	48.0	Pass
0.1073	744	362	48.0	Pass
0.1132	665	320	48.0	Pass
0.1190	611	293	47.0	Pass
0.1248	565	262	46.0	Pass
0.1307	510	234	45.0	Pass
0.1365	462	212	45.0	Pass
0.1423	429	197	45.0	Pass
0.1481	391	177	45.0	Pass
0.1540	362	164	45.0	Pass
0.1598	321	150	46.0	Pass
0.1656	290	138	47.0	Pass
0.1715	264	124	46.0	Pass

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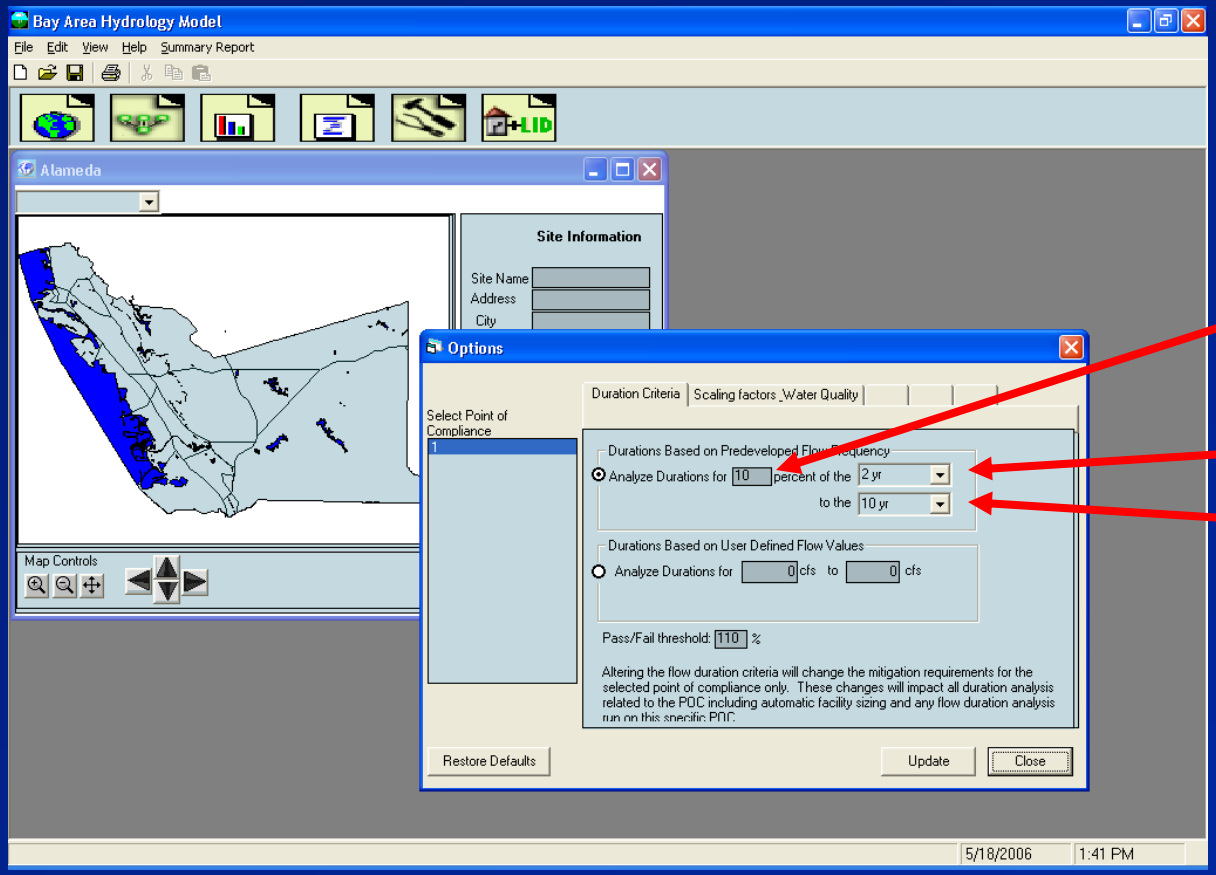
BAHM Application: Step 3 cont'd.

Flow duration criteria can be changed:



% of lower limit, 10%

Lower limit, 2-yr

Upper limit, 10-yr

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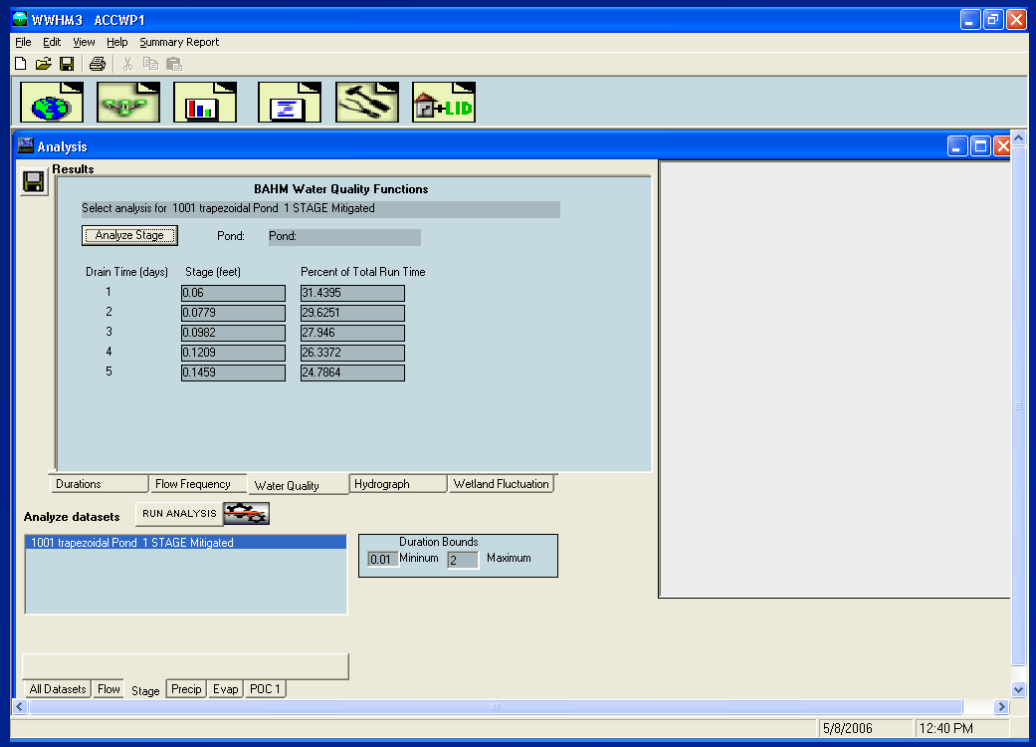
BAHM Application: Step 3 cont'd.

BAHM computes the pond drawdown/retention depth (stage) for 1-5 days:



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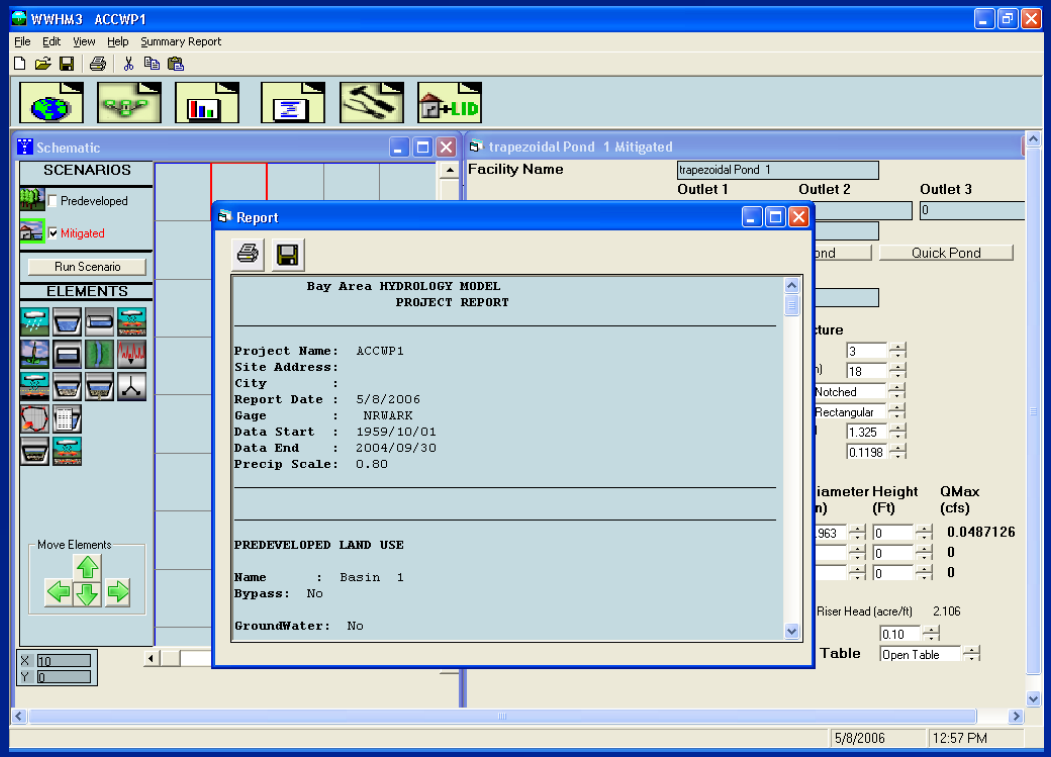
BAHM Application: Step 4

BAHM output summarizes statistics and whether or not the facility meets the jurisdiction's standards:



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BAHM: LID Options

BAHM includes the following LID options:

- Dispersion of impervious surface runoff on adjacent pervious surface (example: roof runoff to lawn)
- Infiltration of impervious surface runoff on adjacent pervious surface (soil dependent)
- Bioretention/rain gardens/landscape swales to retain and infiltrate stormwater

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Questions?

Contact:

Doug Beyerlein 425.892.6454
beyerlein@clearcreeksolutions.com

Joe Brascher 360.943.0304
brascher@clearcreeksolutions.com

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