A Comparison of 2 Dimensional Models
Floodplain Management Association’s 2-D Challenge

The AECOM Experience
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Andrew Shields
Sam Marginson
 Agenda

- Floodplain Management Association
- The Challenge
- AECOM’s response
- Preliminary comparison
- Issues raised
- Questions/discussion
Floodplain Management Association

• Regional chapter of ASFPM
• Annual membership conference
The Challenge
The Challenge

• What it was
• What it wasn’t
• Goals
  – Notes
  – White Paper
• Timeline
The Challenge (continued)

- Varied scenarios
- Obscured source data
- Anonymous submittals
- Other parameters
Urban Riverine Floodplain

Scenario 1

• Unnamed city
• Channel
  – ~4 miles
  – 3 reaches

• 8 Structures
• 15 Inflow points
• Varied land use
• Free flow outfall
Urban Riverine Floodplain
Model Domain Overview
Urban Riverine Floodplain
Data Supplied

• 2’ Contour data
• Channel centerlines
• Cross section alignments
• Cross section profiles
• Most structures’ survey information
• Aerial orthophotography
• Various inflow locations
Urban Riverine Floodplain Deliverables

- Maximum inundation shapefile
- Maximum depth/WSE raster
- Flood profile*
- Outflow hydrograph
Tidally Influenced Floodplain

Scenario 2

- Unnamed location
- Model area 53 square miles
- Flooding from both riverine & tidal sources
Tidally Influenced Floodplain
Model Domain Overview
Tidally Influenced Floodplain

Data Supplied

- 5 meter digital elevation model
- Orthophotography
- Inflow location
- Tidal patterns
- 53 high water marks
Tidally Influenced Floodplain

Deliverables

• Maximum inundation shapefile

• Calibration results
Non-urban Riverine with Levees Floodplain

Scenario 3

• Unnamed location
• Flooding originating in foothills
• Significant amount of levees
• Relatively little development
• 125 square miles
Non-urban Riverine with Levees Floodplain

Model Domain Overview
Non-urban Riverine with Levees Floodplain

Data supplied

- Digital elevation model
- Orthophotography
- Inflow hydrograph
- General soil data & land use information
- Levee information

- Potential terrain errors polygon
- Water body locations
- Impervious area polygons
- 22 structure surveys
Non-urban Riverine with Levees Floodplain

Deliverables

• Maximum inundation shapefile*

• Outflow hydrograph

• Levee overtopping locations

• Infiltration losses (optional)
AECOM’s Response

• Focus on 1 scenario, many models
• Comparison
• Models selected
Preliminary Comparison
# Preliminary Comparison

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<tr>
<th>Category</th>
<th>Number*</th>
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<tr>
<td>Total number of data requests</td>
<td>100+</td>
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<tr>
<td>Total number of models submitted</td>
<td>32</td>
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<tr>
<td>Number of participating entities</td>
<td>11</td>
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<tr>
<td>Estimated number of different models</td>
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*Numbers are accurate as of challenge deadline*
<table>
<thead>
<tr>
<th>Numerical Calculation Scheme</th>
<th>Finite Difference, Grid based</th>
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<tr>
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<td>1D/2D linked - Estry computational engine</td>
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<td>Computation Time</td>
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### XPSWMM-2D Numerical Calculation Scheme

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<td><strong>Outfall Condition</strong></td>
<td>Head condition</td>
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<td><strong>Computation Time</strong></td>
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# FLO-2D

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<td>1D/2D linked, FLO-2D’s proprietary computational engine</td>
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<tr>
<td>TUFLOW (MapInfo Interface)</td>
<td>• Full SWEs</td>
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<td>• Versatile input/format</td>
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<td>• Excellent visualizations</td>
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<td>• Text based</td>
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<tr>
<td>xp2D</td>
<td>• Full SWEs</td>
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<td>• Excellent visualizations</td>
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<tr>
<td>FLO-2D</td>
<td>• License inexpensive</td>
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<td>• Very good volume conservation</td>
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<tr>
<td></td>
<td>• Structures</td>
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<td>• Variable timestep</td>
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Comparison (continued) – TUFLOW

Boundaries

TUFLOW
Comparison (continued) – xp2D
Comparison (continued) – FLO-2D

Boundaries

FLO-2D
Comparison (continued) - All
Issues Raised
Issues/Challenges Raised
From our Experience

Standardization
Lack of calibration data
Terrain source
Cross section alignment
Cross section breadth
Mixed units
Issues Raised At the Symposium

Dispersed hydrology
Mass conservation
Roughness coefficients
DCS standards
Calibration
Buildings
Terrain
Element size
And so on…
Questions?
Questions for you

Is anyone aware of research on depth varying ‘n’ values?

Is anyone aware of research into lump sum hydrology compared to dispersed hydrology?
Thanks