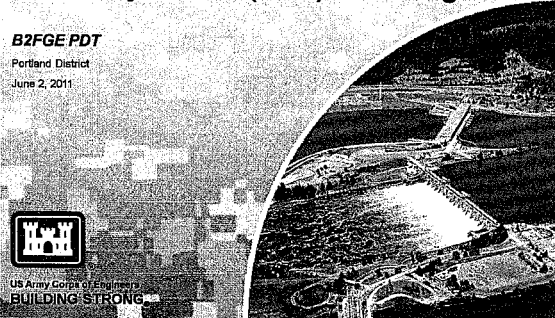


## Bonneville 2<sup>nd</sup> Powerhouse Fish Guidance Efficiency Computational Fluid Dynamics (CFD) Modeling

**B2FGE PDT**  
Portland District  
June 2, 2011




US Army Corps of Engineers  
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### B2 FGE CFD Modeling

Model selection:

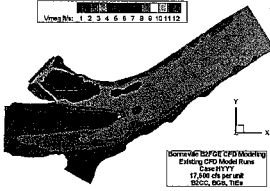
- ▶ CFD Model advantages:
  - Sectional CFD Model can be linked to full forebay CFD model
  - Relevant geometric features can be easily included in model
  - Model results can be queried at any location for velocity, pressure, turbulence
  - Alternatives can be tested relatively efficiently
- ▶ CFD Model limitations
  - Significant changes to VBS velocities may require physical modeling for updated panel porosities
  - Additional prototype data required if CFD model is to be used to develop gatewell flow rating curves


  
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### B2 FGE CFD Modeling

CFD Modeling objectives:

- ▶ USACE has an existing B2 forebay CFD model developed by PNNL
- ▶ B2 forebay CFD model needed to be updated to include current VBS and gate well geometry.




  
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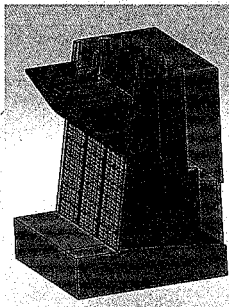
### B2 FGE CFD Modeling

CFD Modeling objectives:

- ☑ Develop an updated and validated CFD model of a single unit
- ☑ Characterize baseline conditions in the B2 unit gatewells
- ☑ Identify hydraulic metrics for alternative evaluation
- ☑ Analyze alternatives using CFD model
- ☐ Document alternative performance over a range of conditions and under forebay influence with full forebay model

  
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### B2 FGE CFD Modeling



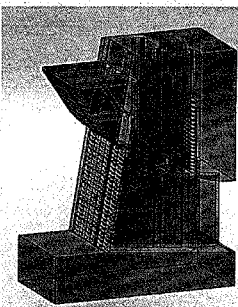
Isometric view

CFD Model Development:

- ▶ TIEs
- ▶ Trash rack
- ▶ STS
- ▶ Gap closure device
- ▶ Beam modifications
- ▶ Turning vane
- ▶ VBS
- ▶ Gate slots
- ▶ Fish orifice openings
- ▶ Emergency gate

  
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### B2 FGE CFD Modeling

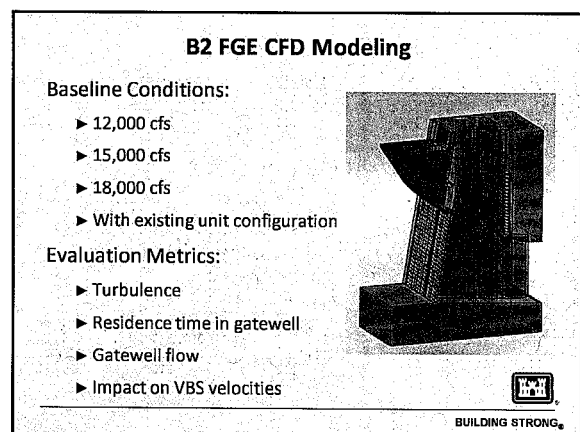
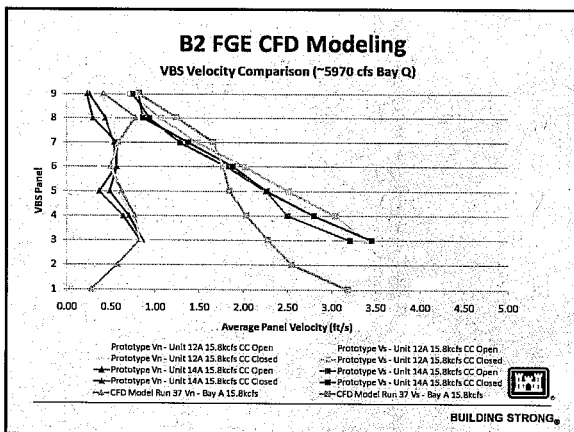
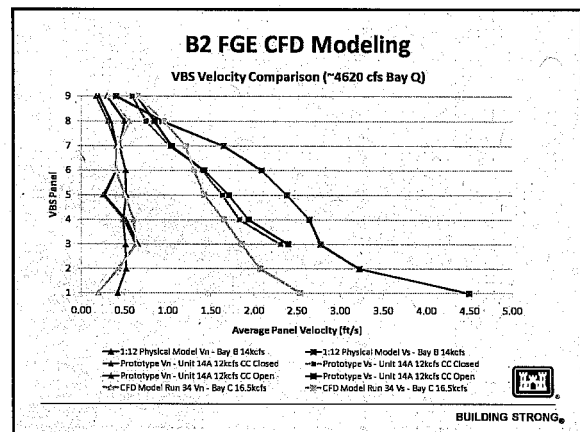
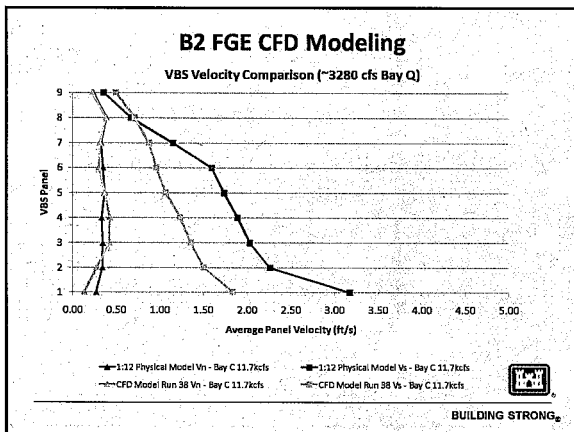
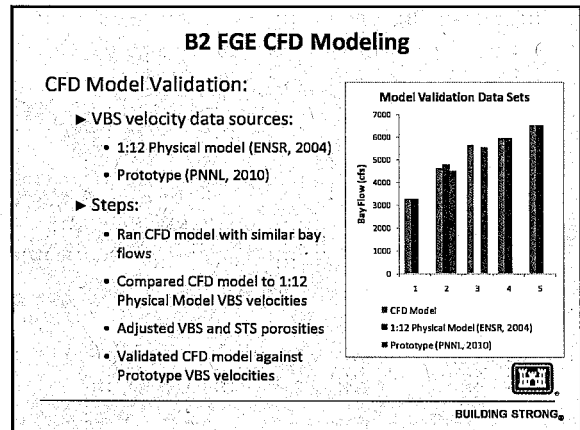
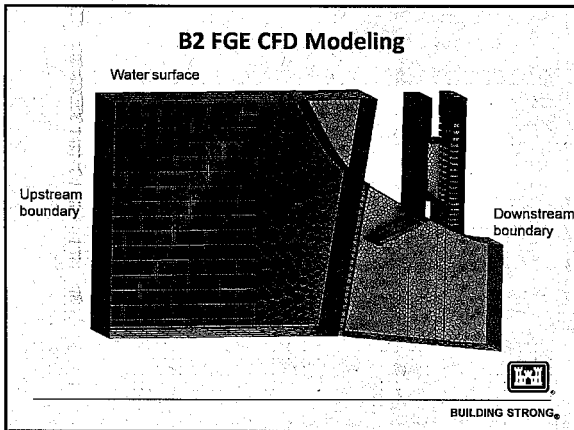


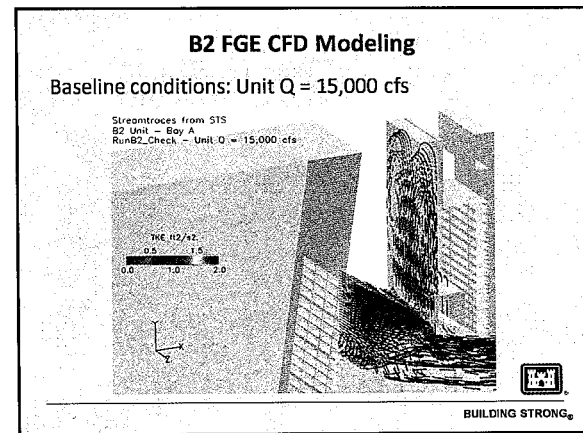
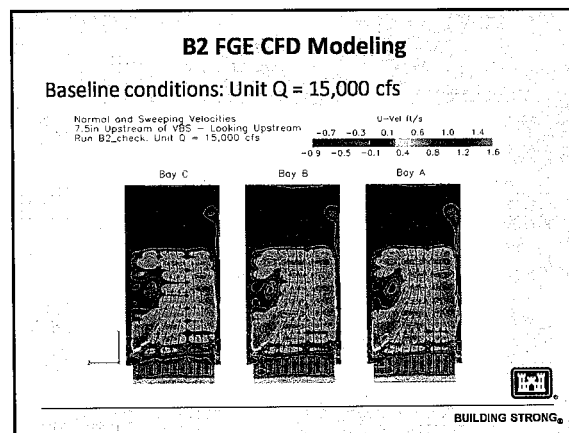
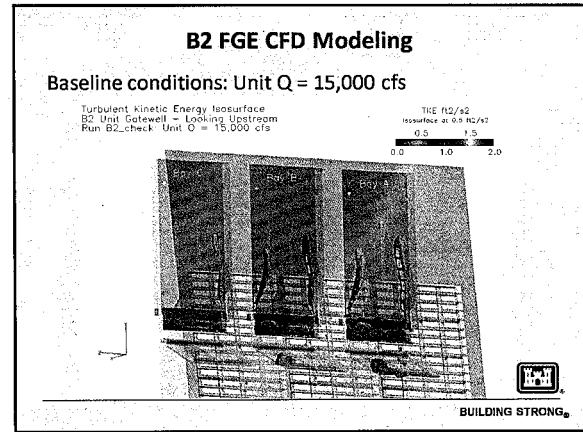
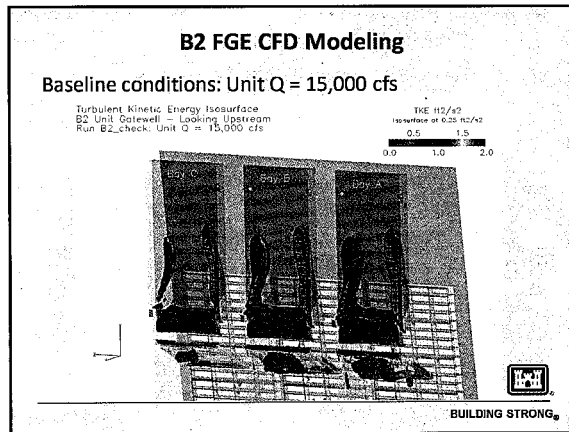
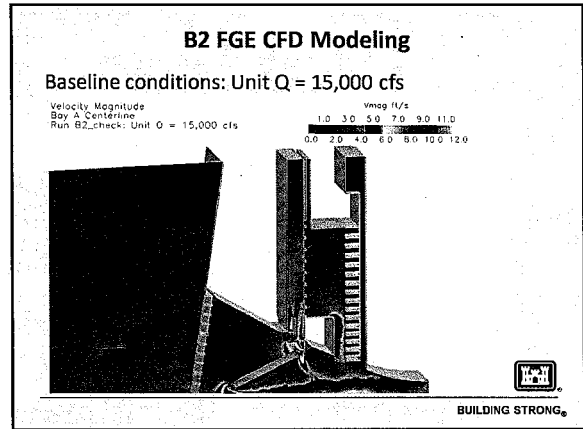
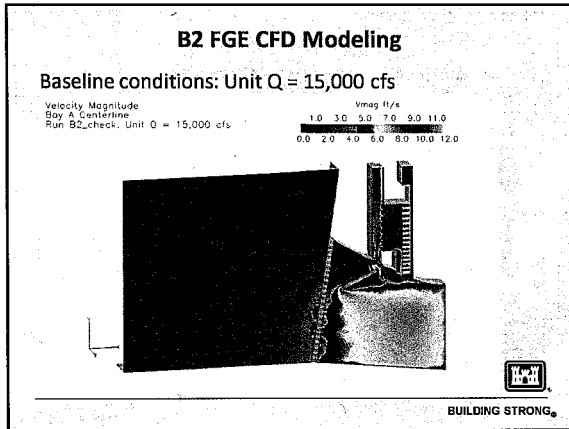
Section view

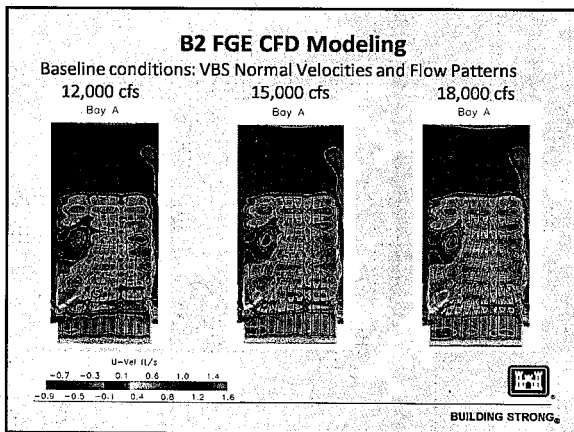
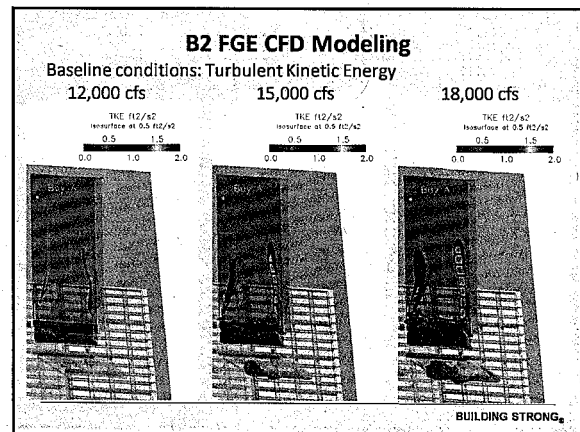
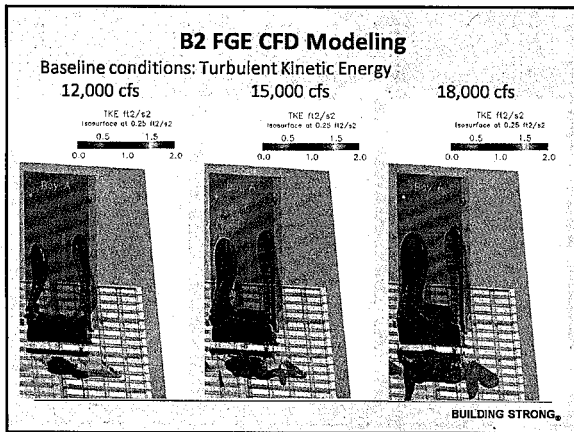
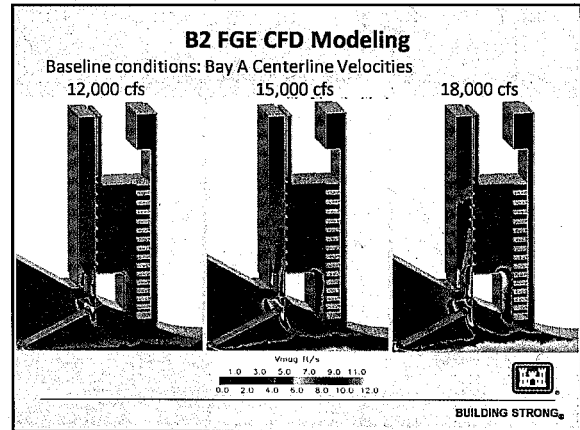
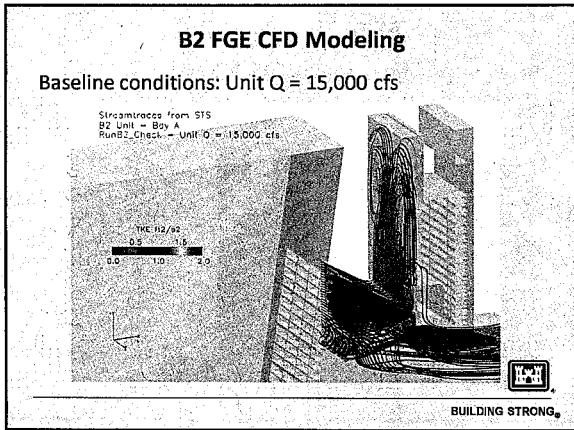
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- ▶ VBS
- ▶ Gate slots
- ▶ Fish orifice openings
- ▶ Emergency gate

  
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### B2 FGE CFD Modeling

Alternatives Evaluation:

- ▶ Operational
  - Operate 2 fish orifices per bay
  - Decrease unit flow (and therefore gatewell flow)
- ▶ Flow Control
  - Remove gap closure device
  - Add flow control device on gatewell return to intake
- ▶ Flow Pattern Change
  - Add gateslot fillers to streamline flow

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