
DETENTION INTERVENTION:
A "101" LOOK AT DETENTION POND ANALYSIS & DESIGN
MARCH 25, 2025
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Former Director of Water Resources
TNP Principal
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Team Leader – Water Resources

- Texas Tech University
- 8 Years of Experience
- TNP Team Leader
- Nickname: *"The Detention Pond Whisperer"*

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BACKGROUND & PURPOSE

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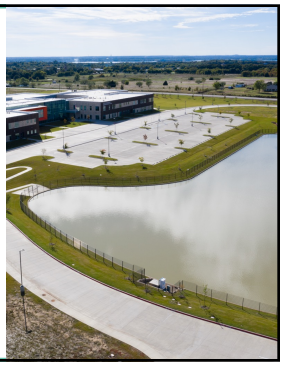
This is Just an Intro!

- Terminology and concepts
- Sizing methods
- Challenges and best practices



What This is Not…

- Detailed design review
- All encompassing discussion
- Methodology debate

Our Background with Stormwater Detention

49 Years of experience

17 Cities and counties served on-call

200+ Detention projects

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Detention and Its Benefits

- A basin that provides temporary storage of runoff and discharges runoff at a controlled and managed release rate
  - Decrease downstream runoff
  - Improve conveyance in downstream systems
  - Capture and reduce sediment loads
  - Capture surface water for future irrigation
  - Amenity and recreational uses

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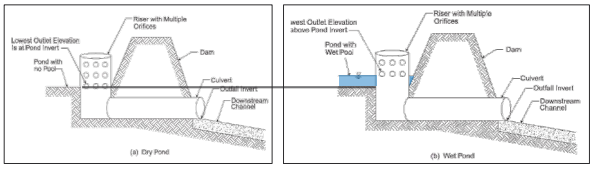
DRY POND

WET POND/ RETENTION POND



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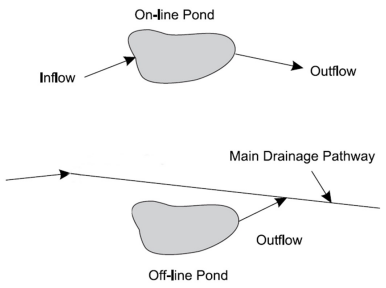

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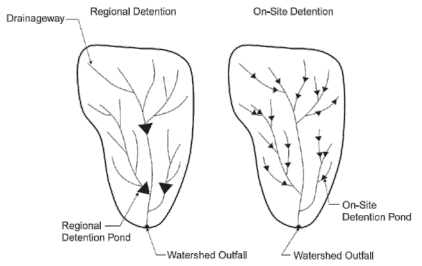


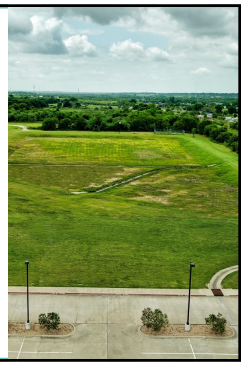
METHODOLOGY

Sizing Methods

- Multiple methods available
  - Modified Rational
  - NRCS (SCS) Unit Hydrograph
  - Other unit hydrographs
  - TR-55
  - Debo & Reese
  - Storage Indication Methods
- Understand the limitations of each one

Modified Rational Method

- Adaptation of the Rational Method (Q = CIA)
- Accurate for smaller drainage areas (25 to 50 acres)
- Time assumptions produce hydrographs



"HYDROGRAPHS"

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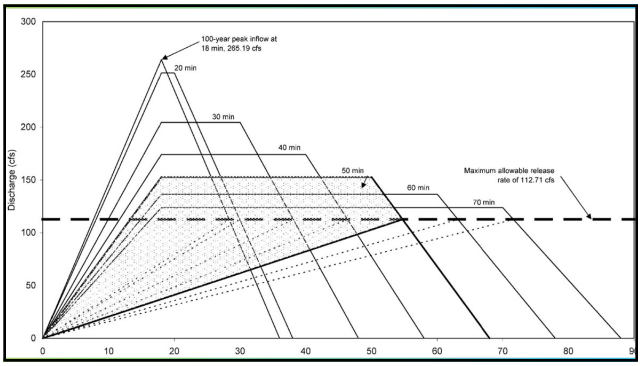

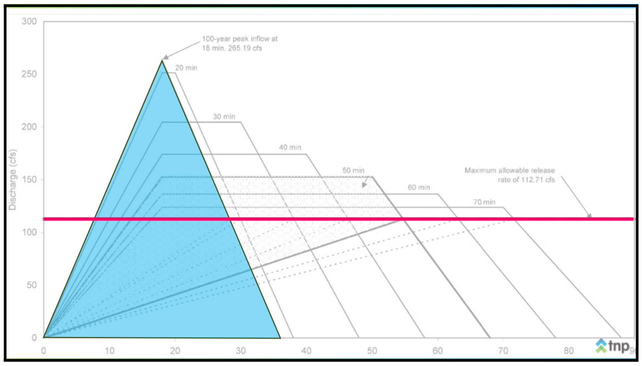
100-year peak inflow at 18 min, 265.19 cfs
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30 min
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Maximum allowable release rate of 112.71 cfs
Discharge (cfs)
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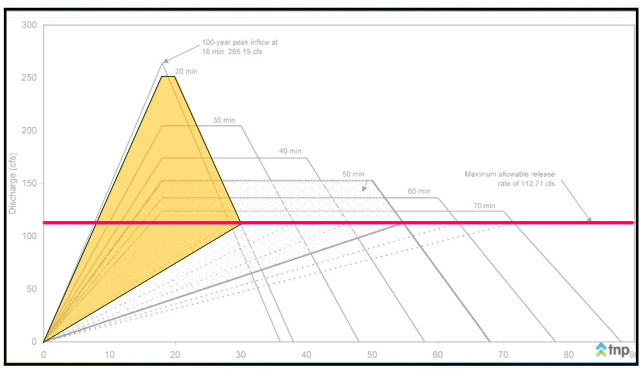
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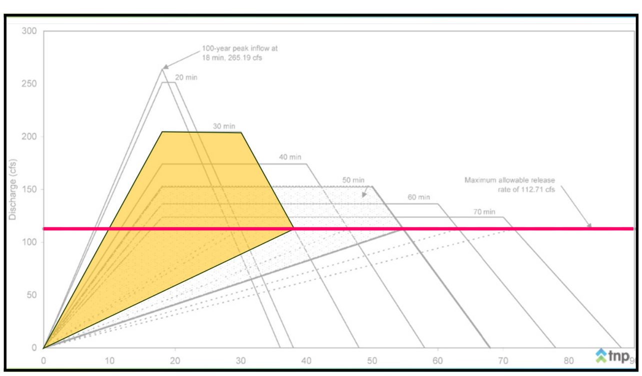
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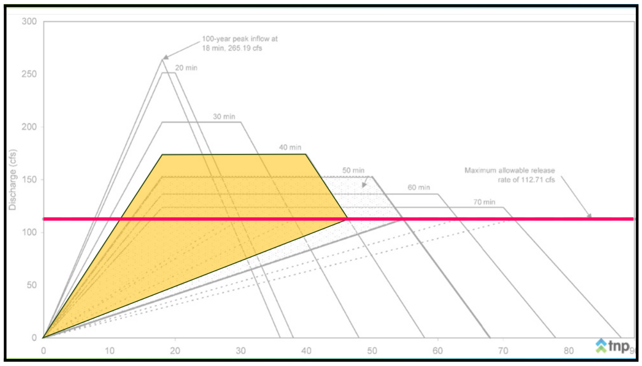
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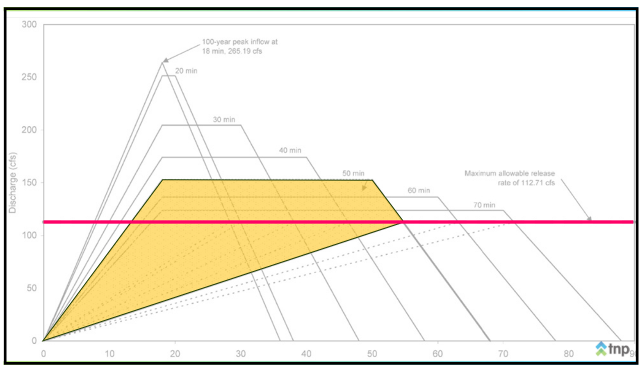
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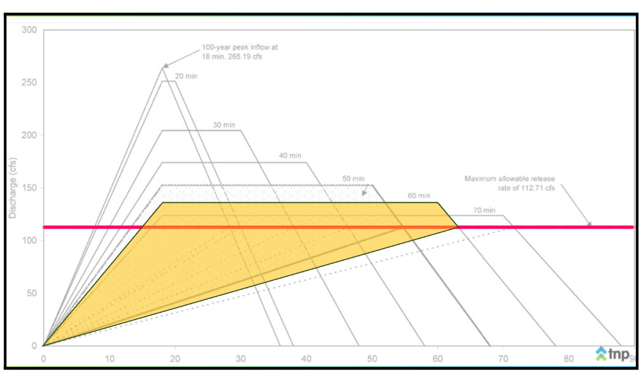
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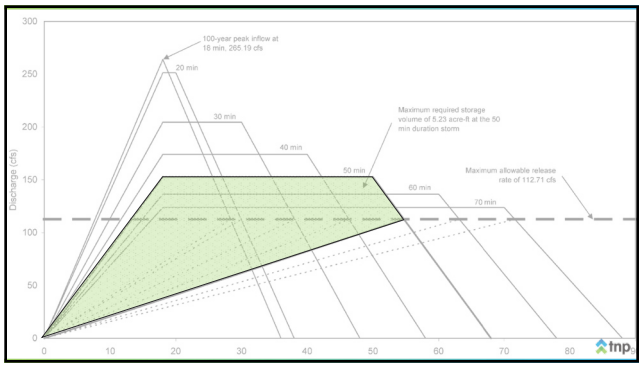
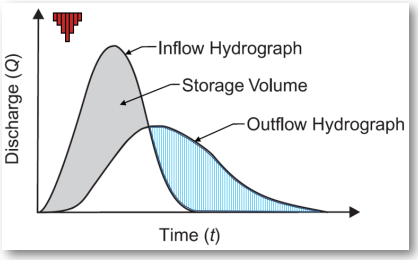


NRCS Unit Hydrograph Method

- Larger drainage areas (>25 acres)
- Requires temporal rainfall distribution (24-hour storm is typical)
- Produces direct runoff hydrographs
- No iteration necessary

NRCS Unit Hydrograph Method



Comparing the Two Methods

- MRM easier to compute (SCS typically requires software)
- MRM yields a smaller outlet structure (typically marginal)
- NRCS method yield pond volumes 25% to 50% larger than MRM

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Tools to Estimate Required Pond Volume

- Abilene Method
  - V = (**90**) * (Tp) * ($\boldsymbol{Qpost} - \boldsymbol{Qpre}$) * FS
- Fort Worth Estimation Method
  - For drainage areas < 25 acres: V = 0.20 x drainage area
  - For drainage areas > 25 acres: V = 0.25 x drainage area
- Debo & Reese Method
  - V = 60[CAa-(2CabAQa)1/2 + (Qa/2)(b-tc)]
  - See NCTCOG iSWM Manual for full explanation

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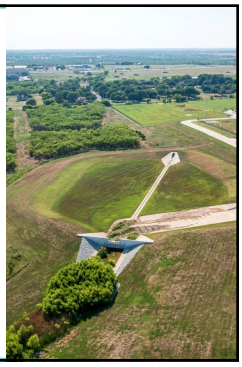
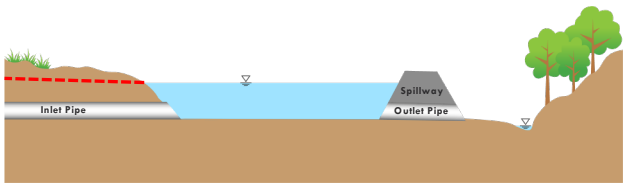
Outlet Structures

- Control pond discharge and surface
- They are dynamic!
- Affected by tailwater
- Designed to control multiple return events



No Downstream Constraint



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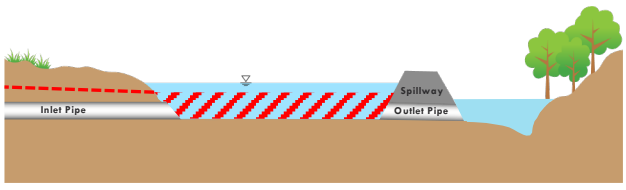
Downstream Floodplain or Stream



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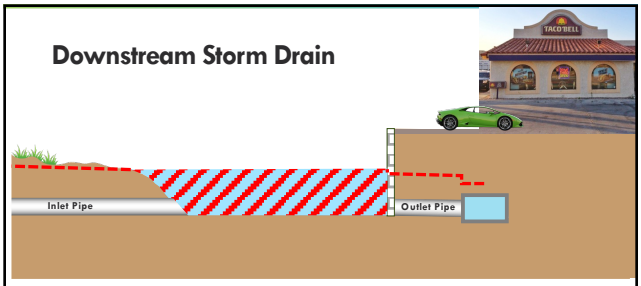
Downstream Storm Drain



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Software Tools Help Analysis *(When Used Properly!)*

- Software can help account for complex dynamics
- Use software if possible *(computers are better at complex math than we are)*

HEC-HMS HEC-RAS XPSWMM InfoWorks HydroCAD PondPack

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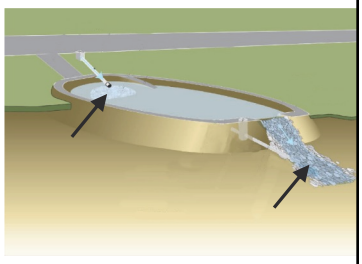
Design Considerations & Best Practices

- Erosion Control



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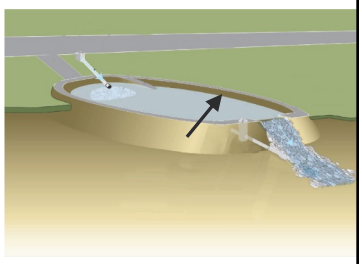
Design Considerations & Best Practices

- Erosion Control
- Freeboard



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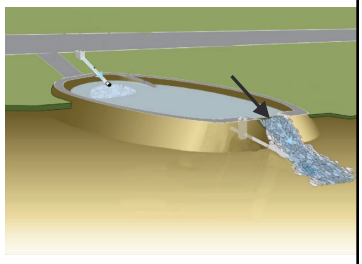
Design Considerations & Best Practices

- Erosion Control
- Freeboard
- Emergency Overflow



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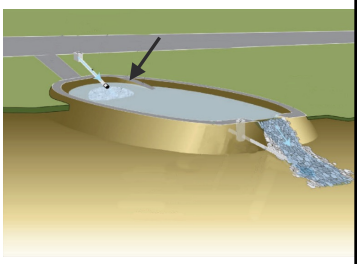
Design Considerations & Best Practices

- Erosion Control
- Freeboard
- Emergency Overflow
- **Access Considerations**



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Design Considerations & Best Practices

- Erosion Control
- Freeboard
- Emergency Overflow
- Access Considerations
- **Slopes, Benches, Landings**
  - **4:1 (max sideslope)**
  - **2% landings for safety**

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Maintenance Considerations

- Routine maintenance
- Design forethought reduces maintenance
- Do you have requirements for routine pond maintenance?

Famous Quotes & Perceptions

- "That pond is going to flood me more!"
- "That pond is eroding my property!"
- "The location of flow has changed on my property!"
- "That pond is backing water up into my storm drain system!"

Parting Thoughts

- Know your methodology
- Outlet structure sizing
- Consider tailwater
- Consider constructability and maintenance

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