FORT WORTH

Navigating the Stormwater Permitting Landscape: A Multi-Perspective Analysis

Presented by: FORT WORTH HALFF Westwood

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STORMWATER DEVELOPMENT TEAM

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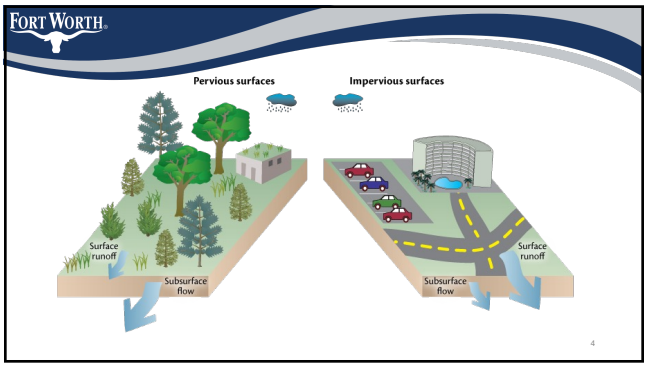
WHAT IS OUR PURPOSE?

Stormwater Development Services (SDS) works to **safeguard citizens and resources and guide sustainable development while promoting quality growth**. SDS serves the City by reviewing drainage & flood studies, floodplain development permits, and storm drain construction plans associated with development projects within the City of Fort Worth and Extra Territorial Jurisdiction (ETJ).

SDS reviews for conformance to City drainage design and floodplain management criteria, as it relates hydraulics, hydrology, and construction standards.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Pervious surfaces
Impervious surfaces
Surface runoff
Subsurface flow
Surface runoff
Subsurface flow
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FORT WORTH
From Years Ago….
No rip rap at outfall; also not in direction of flow
"Grade to Drain"
Work performed prior to plan submittal obstructing creek


FORT WORTH
Stormwater Development Functions
• Drainage Studies
• Flood Studies
• Floodplain Development Permits
• Infrastructure Plan Review
• Plats (Prelim, Final, etc.)
• SW Waiver Requests
• Grading Permits
• Stormwater Facility Maintenance Agreements
• Building Permits
• Development related Drainage Complaints
• Stormwater PDC
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Common SDS Terminology

- **Drainage Study** (DS or SWM) - Based on NCTCOG iSWM Technical Manual
  - **Adequate Outfall** (No Adverse Impact through Zone of Influence)
- **Grading Permit** (CG – Commercial Grading; Early and Final)
- **S**torm**W**ater **F**acilities **M**aintenance **A**greement (**SWFMA**)
- **Existing**, **Proposed**, and Fully Developed Conditions (**Ultimate**)
- **Floodplain/Floodway**
  - 100-YR Storm Event (1% annual chance)
  - Floodplain Development Permit (FDP)

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Drainage Study

- Analysis of proposed development and associated drainage areas, drainage facilities and flood risk.
- What development phase is the project seeking?
- Some bearing on level of detail of the study
- Typical review time of 10 days per cycle.

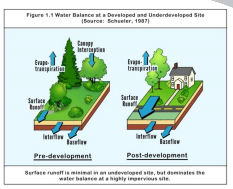

Figure 1.1 Water Balance at a Developed and Underdeveloped Site (Source: Schueler, 1987)

Surface runoff is minimal in an undeveloped site, but dominates the water balance at a highly impervious site.

This Drainage Study is submitted for the purpose of supporting the following development applications (check all that apply):

☐ Single-Phase Preliminary Plat	☐ Multi-Phase Preliminary Plat	☐ Concept Plan (Multi-Phase)	☐ Infrastructure Plan Review
☐ Grading Permit	☐ Final Plat	☐ Zone A (only) Flood Study	☐ Update To Previous Study ____ – 20__ – 0____

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When is a Drainage Study needed?

- A Drainage Study is required for:
  - Any developments disturbing **1.0 acre or more** of land **OR** **part of a common** area of development.
  - Plat application that is less than 1 acre, but needs to determine a DE, FPE, or Minimum FFE
- Most Drainage Studies include a **downstream assessment**
- Drainage Study requirements are listed in the Drainage Study Checklist and Stormwater Criteria Manual – July 2024 (Newest)

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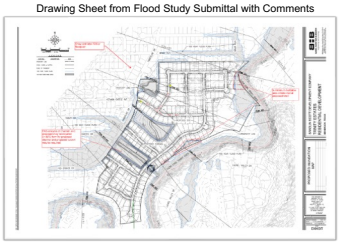
1.1 Drainage Study / Flood Study

- Drainage Study is one of the first items that need to be submitted/addressed by the applicants/developers engineer.
- Stormwater Criteria Manual and iSWM Technical Manuals are the basis of the reviews
- Very detailed criteria to be followed for storm drain infrastructure
- Adverse impacts assessment
- Typically - Timing Study or Mitigation or adequately sized outfall/s
- Development in the Floodplain – Flood Studies

Flood Study

- Must Meet FEMA and City Criteria
- 15 Day Review Cycle
- Proposed grading that would result in reclamation or alteration of the FEMA regulatory floodplain will require the submittal of a pre-project flood study followed by a post-construction flood study and request for Letter of Map Revision (LOMR) from FEMA.

Drawing Sheet from Flood Study Submittal with Comments



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Floodplain Development Permit: Federal Regulations & Local Ordinance

- Floodplain Development Permit (FDP) is required for City's participation in the National Flood Insurance Program (NFIP).
- Federal flood insurance not available in Fort Worth unless we participate.
- Several Federal grants require NFIP participation.
- Community Rating System (CRS) provides lower cost flood insurance.
- The 100-year FEMA floodplain covers almost 50 square miles of land within the 350 square mile City. Approximately 14% of the City within the 100-year FEMA floodplain.

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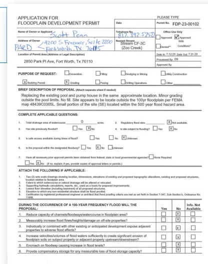
Floodplain Development Permit (FDP)

Proposed development within the FEMA regulatory floodplain or floodplain easement (i.e. proposed grading, headwalls, fences, etc.) will require a Floodplain Development Permit (FDP), please submit your application package on-line in Accela.

For questions or concerns about development specifically in a floodplain within the City of Fort Worth, contact the Stormwater Development Services department at SDS@fortworthtexas.gov or floodplain@fortworthtexas.gov



APPLICATION FOR FLOODPLAIN DEVELOPMENT PERMIT

PLEASE TYPE

Date | Permit No. FDP-23-00102

Name of Owner or Applicant: Scott Penn | Telephone No. 817.392.5750

Address of Owner: PARD 4200 S. Freeway, Suite 2200 Fort Worth, TX. 76115 | Nearest Stream: Stream CF-3C (Zoo Creek)

Office Use Only: ☐ Approved ☑ Approved With Conditions* ☐ Denied**

Location of Permit Area (Address or Legal Description): 2850 Park Pl Ave, Fort Worth, Tx 76110

Date In: 7.12.23 Date Out: 7.21.23

Processed By: DS

Approved By:

PURPOSE OF REQUEST: ☐ Excavation ☐ Filling ☐ Dredging or Mining ☐ Utility Construction ☒ Building Permit ☒ Grading ☐ Paving ☐ Drilling Operations ☐ Other

BRIEF DESCRIPTION OF PROPOSAL (Attach separate sheet if needed)

Replacing the existing pool and pump house in the same approximate location. Minor grading outside the pool limits. No fill. Site appears to be locate outside the 100yr floodplain per FEMA map 48439C0305L. Small portion of the site (SE) located within the 500 year flood hazard area.

COMPLETE APPLICABLE QUESTIONS:

1. Total drainage area of watercourse 0 acres.
2. Regulatory flood elev. ☒ Not available.
3. Has site previously flooded? ☐ Yes ☒ No
4. Is site subject to flooding? ☐ Yes ☒ No
5. Is safe access available during times of flood? ☐ Yes ☐ No ☒ Unknown
6. Is the proposal within the designated floodway? ☐ Yes ☒ No ☐ Unknown
7. Have all necessary prior approval permits been obtained from federal, state or local governmental agencies? ☐ None Required ☐ Yes ☒ No (If no, explain; if yes, provide copies of approval letters or permits.)

ATTACH THE FOLLOWING IF APPLICABLE:

1. Two (2) sets scale drawings showing location, dimensions, elevations of existing and proposed topographic alterations, existing and proposed structures, location relative to floodplain area.
2. Extent to which watercourse or natural drainage will be altered or relocated.
3. Supporting hydraulic calculations, reports, etc., used as a basis for proposed improvements.
4. Lowest floor elevation (including basement) of all proposed structures.
5. Elevation to which any non-residential structure shall be flood proofed.
6. Certification by registered professional engineer or architect that flood proofing criteria are met as set forth in Section 7-347, Sub-Section b, Ordinance No. 11998.

DURING THE OCCURRENCE OF A 100-YEAR FREQUENCY FLOOD WILL THE PROPOSAL:	Yes	No	Info. Not Available
1. Reduce capacity of channels/floodways/watercourse in floodplain area?	☐	☒	☐
2. Measurably increase flood flows/heights/damage on off-site properties?	☐	☒	☐
3. Individually or combined with other existing or anticipated development expose adjacent properties to adverse flood effects?	☐	☒	☐
4. Increase velocities/volumes of flood waters sufficiently to create significant erosion of floodplain soils on subject property or adjacent property upstream/downstream?	☐	☒	☐
5. Encroach on floodway causing increase in flood levels?	☐	☒	☐
6. Provide compensatory storage for any measurable loss of flood storage capacity?	☐	☒	☐

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1.2 Grading Permit

- Early Grading & Final Grading
- **Requirements**
  - Drainage Study need to be Accepted
  - Encroachment Agreements (Private utilities crossing or tying to Public utilities) to be identified and executed
  - Stormwater Facility Maintenance Agreement to be submitted or "In Review"
  - Any TXDOT permits to be at least under review. Proof of coordination with TXDOT needed.
  - Any concurrence/approvals official documentation with affected parties (adjacent property owners, private utility companies)
  - Six Different Departments check the plans including Environmental Review of the SWPPP document.

Types of Grading Permits

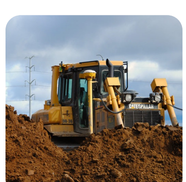
Early Grading Permit:

- Clearing, grubbing, and grading only. Building and/or infrastructure construction is **not** allowed, including excavation for utilities, detention structures, and cutting streets. Does not allow for changes to the existing drainage patterns.

Final / Commercial Grading Permit

- Can "go vertical" from a Stormwater perspective

Website:
Grading Permit Process



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Potential Impacts of Grading

The disturbance of land can create flooding and erosion conditions when done improperly.

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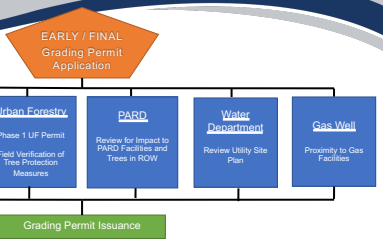

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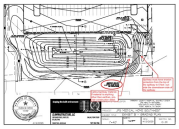
STORMWATER FACILITY MAINTENANCE AGREEMENTS (SWFMA)

A Stormwater Facility Maintenance Agreement must be prepared by the engineer for each stormwater control that will not be wholly maintained by the CFW, as part of the Operations and Maintenance Plan submittal. This agreement must outline both preventive maintenance tasks as well as major repairs, identify the schedule for each task, assign clear roles to affected parties, and provide a maintenance checklist to guide future owners, including an annual self-inspection to be provided to the CFW.

Drainage Swale



Typical SWFMA Exhibits with Reviewer Comments

Detention Pond

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1.3 Infrastructure Plan Review Center (IPRC)

- Miscellaneous Projects

  Include small projects such as utility connections

  Fire Hydrant relocation.
- Parkway Permit (Street Permit)
  - Driveways, sidewalks, curb ramps, etc in the Public ROW
- IPRC Plan Review - The proposed drainage infrastructure in the PUBLIC Right of Way shall meet all applicable criteria from the Stormwater Criteria Manual

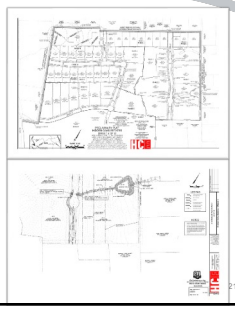
  Storm Drain Lines, Water and Sewer Lines, Roadway in the public ROW.
  - Preliminary Submittal – Review and general comments provided
  - Compliance Review – Full Review
    - Iterations until acceptance

1.4 Building Permit

- Floodplain nearby Check
- City Flood Risk Areas Check
- Elevation Certificate if needed
- Grading Permit Approval Check
- Building Plan Review of Building Components
- Certificate of Occupancy – Last item after construction and inspection is completed
- Retaining Walls 4-feet or greater need Building Permit

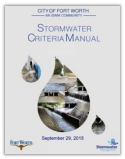
Plat Review

- Check for necessary easements, floodplain delineation, minimum finish floor elevations, and other stormwater related items.
- Shown easements should correlate to storm drainage infrastructure in accepted drainage study.



SDS References

- Stormwater Criteria Manual (2024)
- NCTCOG iSWM Technical Manual
- Subdivision Ordinance
- Grading Ordinance
- Floodplain Ordinance



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Coordination with TPW-Floodplain

TPW Floodplain Management:
- Technical expertise, training, & guidance
- Mapping updates, LOMRs, NFIP, CRS
- Related policy development

SDS manages review of:
- Dual Studies (Combined Drainage Study and Floodplain Study)
- Flood Studies (FEMA criteria)
- Floodplain Development Permits

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SDS Resources

- Flood Risk Viewer - Public
- SDS Viewer-Internal
- Stormwater Download Viewer- Public
- FEMA National Flood Hazard Layer Viewer - Public
- Other (FEMA Flood Map Service Center, One Address, etc.)

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Flood Risk Viewer - Public

- Grading & FDP Permits
- FEMA Floodplain/Floodway
- Potential High-Water Areas (PHWA)
- City Flood Risk Areas (CFRA)
- Aerials
- Additional Information

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SDS Viewer-Internal

- Plat Info
- Parcel Info
- Building Permit
- Drainage Studies
- SDS Notes
- Depth and Water Surface Elevations for PHWA
- Stormwater/Water & Sewer Assets

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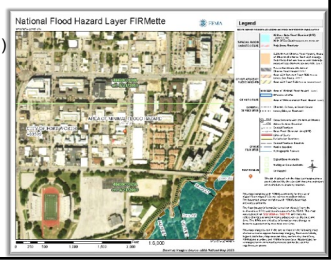
FEMA National Flood Hazard Layer(NFHL) Viewer - Public

- Flood Insurance Rate Map (FIRM)
- Letter of Map Revision (LOMR)
- Base Flood Elevations (BFE)
- Other FEMA Information



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From SDS Viewer

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Example: Golden Triangle Boulevard near Beach Street

Normal Condition

November 2023 Rain Event

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From SDS Viewer

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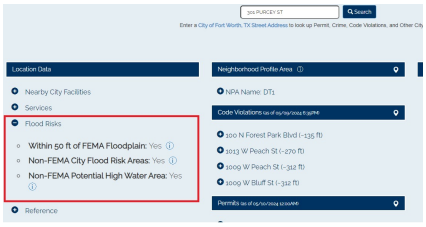
Building Permit Review – Which Workflow?

- One Address



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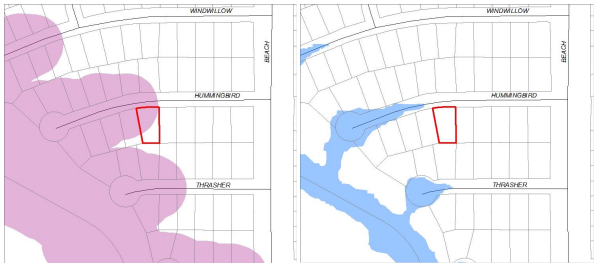
Floodplain Permit Buffer



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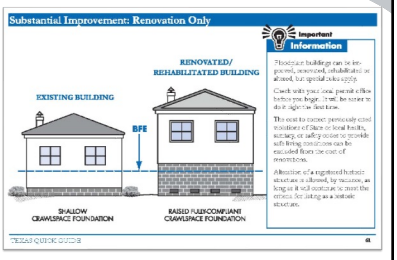
Why does SDS need to review residential building permits when the structure footprint isn't changing?

- The City participates in the NFIP(National Flood Insurance Program) which provides a resource for our citizens to purchase flood insurance.
- Any homes that existed prior to a BFE(Base Flood Elevation) being established in a floodplain must meet our floodplain ordinance requirements if improvements exceed 50% of the improvement value of the existing structure.



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Key Considerations and Challenges

- Understanding the Permitting Process
- Understanding the City Stormwater Criteria
- Meeting Submittal Expectations
- Performing Adequate Analysis and Design

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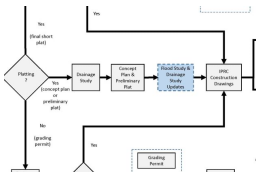
Understanding the Permitting Process

- **Order of Permitting Process / Permitting Holds**
  - Understanding the sequence of permits and approvals
  - Identifying common reasons for holds and how to resolve them
- **FDPs, Flood Studies (FDP/Mapping), CLOMRs**
  - Clarifying requirements and how they affect project timelines



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Understanding the Permitting Process

- **Coordination Between Agencies**
  - Managing overlapping requirements between City, State, and Federal agencies (e.g., FEMA, USACE, TCEQ, TRWD, CDC)
- **Integration with Other Permits**
  - How stormwater permitting fits into broader development approvals, such as Plats, Grading and Building permits?
- **Review Timeframes & Expectations**
  - Setting realistic expectations for review timelines and potential revisions

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Best Practices - Understanding the Permitting Process

- General Pre-Development Conference
- Stormwater Pre-Development Conference
- Floodplain Pre-Submittal Conference

- Accela Electronic Data Review platform

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Understanding the City Stormwater Criteria

- Understanding criteria determines the scope of the study
- Impact Assessment for increase in Flow / WSELs
- When and Where Increases in Velocities are allowed
- No-Rise Criteria
- Dry Lane Criteria

Table 3.1 Zone of Influence and Adequate Outfall Determination

Item	Parameter	Requirements
1	Habitable Structures	• No new or increased flooding (0.00 feet) of existing insurable (FEMA) structures (habitable buildings).
2	Flood Elevations	• No increase greater than 0.1 feet in 1-, 5-, and 100-year flood elevations over existing roadways. No increase greater than 0.1 feet and 100-year flood elevations, unless contained in existing public channel, roadway, drainage easement and/or R.O.W.
3	Floodplain Ordinance	• Where provisions of the City's floodplain ordinance may be more restrictive, the floodplain ordinance shall have authority over the above provisions. •
4	Channel Velocities	• Proposed channel velocities for 1-, 5-, and 100-year storms cannot exceed the applicable maximum permissible velocity shown in Table 3.16 and Table 3.17 of this manual. Exceptions to these criteria will require certified geotechnical /geomorphologic studies that provide documentation that the higher velocities will not create additional erosion. • If existing channel velocities exceed maximum permissible velocities shown in Table 3.16 and Table 3.17, no more than a 5% increase in velocities will be allowed.
5	Downstream Discharges	• No increase in downstream discharges caused by the proposed Development that, in combination with existing discharges, exceeds the existing capacity of the downstream storm drainage system or existing right-of- way.

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Understanding the City Stormwater Criteria

- Freeboard Criteria
- Detention and Mitigation Requirements
- Channel Stability and Erosion Control design
- Outfall and Discharge Considerations

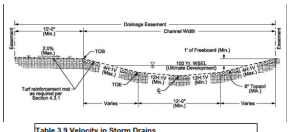

Table 3.9 Velocity in Storm Drains

Description	Maximum Allowable Velocity
Culverts (All types)	15 fps
Storm Drains (Inlet laterals)	25 fps
Storm Drains (Mains)	20 fps

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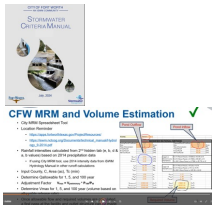
Best Practices – Understanding the City Stormwater Criteria

- **Stormwater Criteria Manual**
  - Table 3.5 of the manual (2025) is a good starting point
  - Refer to design criteria sections
- **Utilizing City training material**
  - Video presentations based on most frequent comments generated
- **Early and Ongoing Communication**
  - Mandatory introductory PDCs to discuss study expectations and best available data to use
  - PDCs (or) Review meetings during the review



Meeting Submittal Expectations

- Gaps in Understanding Stormwater Criteria
- What is the Required Documentation?
- What City Resources are available?

Best Practices - Submittal Expectations

- Effective Use of Checklists
- City Training videos
- Communication for clarifying submittal expectations
- Goal is to submit a complete Drainage Study

8. **Hydrologic Analysis**			
a. Analysis methodology and inputs conform to Chapter 3.4 and relevant sections of the NCTCOG iSWM Technical Manuals.	X		
b. Selected hydrologic methods per Table 3.4	X		
c. Runoff coefficient and curve numbers per Table 3.5	X		
9. **Hydraulic Analysis**			
a. Analysis methodology and inputs conform to Chapter 3.8 and other relevant sections of the Stormwater Criteria Manual, the NCTCOG iSWM Technical Manuals, and applicable references (e.g. HEC-RAS manual).	X		
b. Standard modelling conventions are adhered to (e.g. ineffective flow areas at culverts, cross-sections perpendicular to flow, bank stations contained well inside the floodplain, etc.)	X		
c. For 1D analysis, Manning's n per Table 3.15, Table 3.16 and other relevant technical references			X
d. Proposed multi-barrel culverts designed with one of the barrel flow lines at the stream centerline, and other barrels set higher to establish a single low flow drainage path			X
e. Provide a hydraulic work map including, but not limited to: aerial imagery, cross sections, inundation limits, stream centerline, structures, flow change locations, labels, proposed easement limits, etc.			X

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Performing Adequate Analysis and Design

- **Adequately considering hydrology and hydraulics (H&H)**
  - Complicated existing drainage patterns and topography
  - Unaccounted offsite flows
  - Surcharged storm drains and flooded roadways
  - Steep channel designs - energy dissipation and erosion protection
  - Inadequate modeling assumptions (for eg: overlooked tailwater)

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Performing Adequate Analysis and Design

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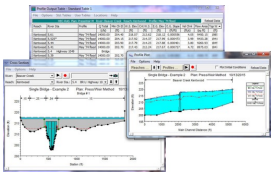
Best Practices - Adequate Analysis and Design

- **Engaging H&H professionals early**
  - Use appropriate models & methods
  - Complete Studies and Detailed Information on Maps and Exhibits
- **Utilize City tools & resources**
  - Download Viewer - past studies/available models
  - CFRA and CFW Floodplain Studies - established floodplains
  - City's Potential Highwater Layer
- **Collaboration**



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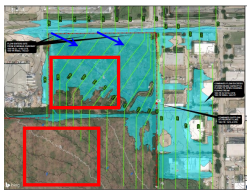
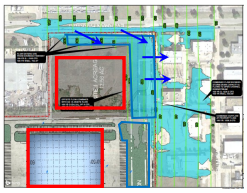
Best Practices - Adequate Analysis and Design





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Best Practices - Performing Adequate Analysis and Design

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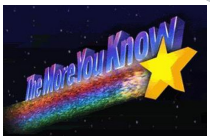
Knowledge is Power

- Schedule a predevelopment conference to get specific answers:
  - What is the zone of influence / limits of study?
  - Is there an existing study we should use as a starting point?
  - Are there any special requirements or conditions?
    - Part of a common plan of development
    - Subject to non-FEMA mapped flooding



Follow City Criteria

- Detention ponds
  - Slopes (side slopes and bottom/flowline slope)
  - Flumes
  - Access ramp
  - Berm dimensions
  - Emergency overflow
  - Erosion protection

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Follow City Criteria

- Open channels
  - Minimum channel slope
  - 4:1 side slopes
  - Velocity limits
  - Freeboard
  - Know when HEC-RAS modeling is required

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Follow City Criteria

- Public storm drain
  - Minimum cover/freeboard
  - Minimum/maximum velocity
  - Allowable pipe sizes
  - Manhole spacing
  - Match flowlines, not crowns

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Follow City Criteria

- Culverts
  - Allowable freeboard (know how this is measured)
  - Allowable sizes (there is a chart)
  - Differential flowlines (for sediment transport)

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Communicate Throughout the Process

- Hold a predevelopment conference and make it productive!
- Don't negotiate through letters
  - Seek clarification before resubmitting
  - Resolve disagreements through Teams calls or meetings
- You can contest interpretations of rules, but difficult to try to change rules during a review
- Sometimes rules do not fit all situations – consider a waiver

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Lessons Learnt

- Stormwater permitting process is dependent on many factors.
  - Familiarity of the applicants with COFW Stormwater Processes and Criteria tend to affect the permitting timeline.
  - Quality and complete deliverables that meet technical criteria and supporting data tend to reduce the overall review time.
- City is developing tools and training to bridge the gap.
- Early and ongoing communication helps identify applicable stormwater criteria and navigate permitting process more smoothly.