The FEQ Model for Municipal Engineers

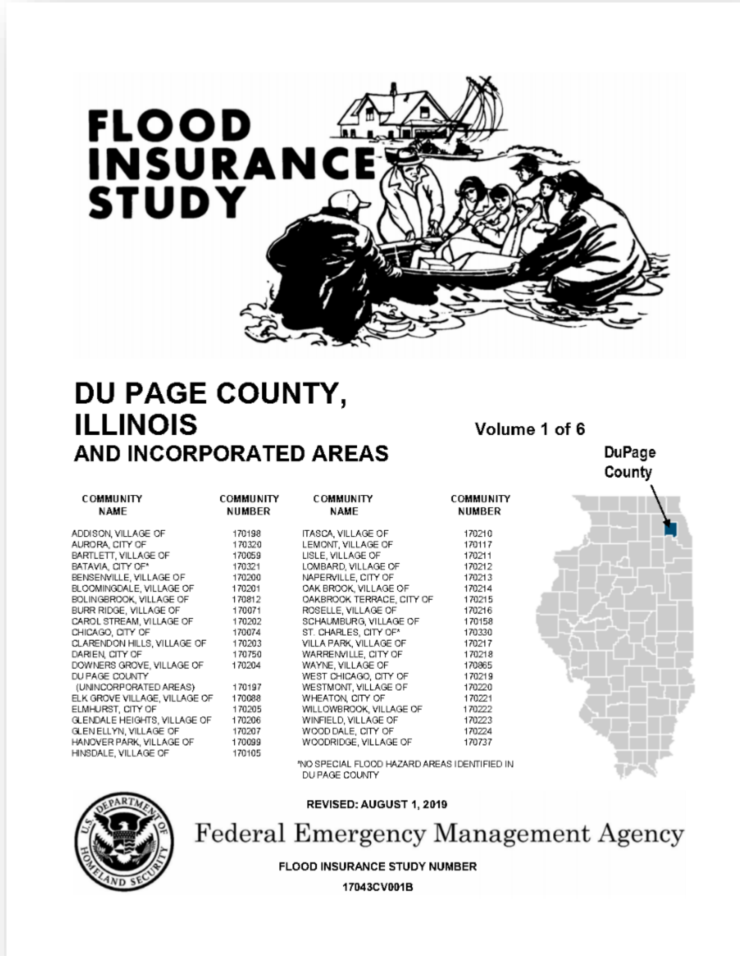
How to Find What You Need

Data Collection from FEMA

Download FIS Report

Step by Step process for obtaining regulatory information, like the Flood Insurance Study, from FEMA:

https://scribehow.com/shared/Flood_Insurance_Studies_from_FEMA__4qgsaHD6Q8OgbqH9kTAc2Q



FLOOD INSURANCE STUDY

DU PAGE COUNTY, ILLINOIS AND INCORPORATED AREAS

Volume 1 of 6

COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER
ADDISON, VILLAGE OF	170198	ITASCA, VILLAGE OF	170210
AURORA, CITY OF	170320	LEMONT, VILLAGE OF	170117
BARTLETT, VILLAGE OF	170059	LISLE, VILLAGE OF	170211
BATAVIA, CITY OF*	170321	LOMBARD, VILLAGE OF	170212
BENSENVILLE, VILLAGE OF	170200	NAPERVILLE, CITY OF	170213
BLOOMINGDALE, VILLAGE OF	170201	OAK BROOK, VILLAGE OF	170214
BOLINGBROOK, VILLAGE OF	170812	OAKBROOK TERRACE, CITY OF	170215
BURR RIDGE, VILLAGE OF	170071	ROSELLE, VILLAGE OF	170216
CAROL STREAM, VILLAGE OF	170202	SCHAUMBURG, VILLAGE OF	170158
CHICAGO, CITY OF	170074	ST. CHARLES, CITY OF*	170330
CLARENDON HILLS, VILLAGE OF	170203	VILLA PARK, VILLAGE OF	170217
DARIEN, CITY OF	170750	WARRENVILLE, CITY OF	170218
DOWNERS GROVE, VILLAGE OF	170204	WAYNE, VILLAGE OF	170865
DU PAGE COUNTY		WEST CHICAGO, CITY OF	170219
(UNINCORPORATED AREAS)	170197	WESTMONT, VILLAGE OF	170220
ELK GROVE VILLAGE, VILLAGE OF	170088	WHEATON, CITY OF	170221
ELMHURST, CITY OF	170205	WILLOWBROOK, VILLAGE OF	170222
GLENDALE HEIGHTS, VILLAGE OF	170206	WINFIELD, VILLAGE OF	170223
GLEN ELLYN, VILLAGE OF	170207	WOOD DALE, CITY OF	170224
HANOVER PARK, VILLAGE OF	170099	WOODRIDGE, VILLAGE OF	170737
HINSDALE, VILLAGE OF	170105		

*NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED IN DU PAGE COUNTY

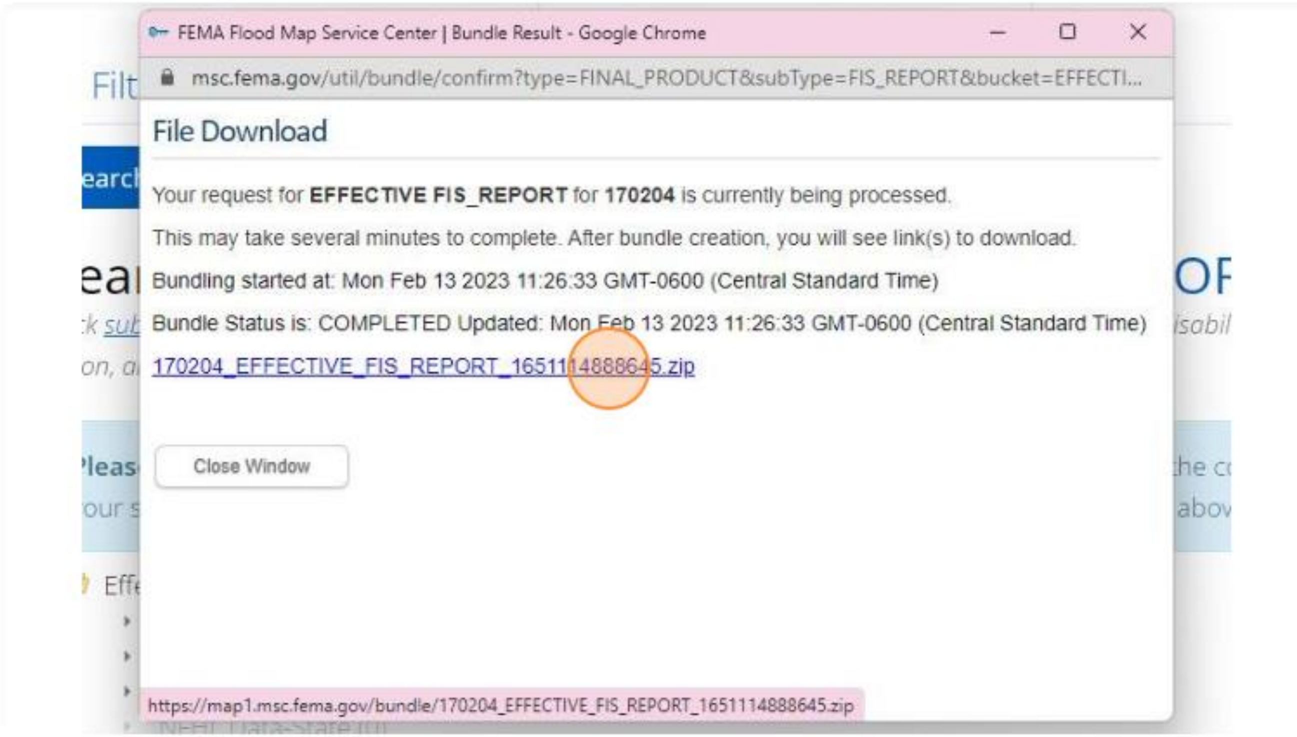
REVISED: AUGUST 1, 2019

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

17043CV001B

8 Click on the link to open up the zip file with the Flood Insurance Report. You can do this for any community in Illinois that has an FIS.



Data Collection from FEMA

Which waterways are mapped using FEQ

3.0 ENGINEERING METHODS

3.1 Hydrologic Analyses

3.2 Hydraulic Analyses

3.3 Vertical Datum

Flooding Source	Report Title and Date
Armitage Creek (EBAR)	*Floodplain Mapping Report and Documentation for Armitage Creek*, January 31, 2013 (Reference 40)
Army Trail Road Tributary (EBAT) Swift Meadows (EBSM)	*Floodplain Mapping Report for Swift Meadows and Army Trail Road Tributaries of the East Branch DuPage River*, March 30, 2012 (Reference 41)
Crabtree Creek (EBCR)	*Flood Plain Mapping Report and Documentation for Crabtree Creek*, April 2012 (Reference 42)
East Branch DuPage River (EBEB)	*Floodplain Mapping Report and Documentation for East Branch of the DuPage River Watershed*, July 2013 (Reference 23)
East Branch Tributary No. 2 (EBE2)	*Floodplain Mapping Report and Documentation for East Branch Tributary No. 2*, October 2011 (Reference 43)
Glen Crest Creek (EBGL)	*Floodplain Mapping Report and Documentation for: Glencrest Creek Tributary to the East Branch DuPage River*, September 27, 2011 (Reference 44)
Lacey Creek (EBLA)	*Floodplain Mapping Report and Documentation for Lacey Creek*, January 31, 2013 (Reference 45)
Prentiss Creek (EBPR)	*Floodplain Mapping Report for Prentiss Creek Tributary of the East Branch DuPage River*, April 6, 2012 (Reference 46)
Rott Creek (EBRC)	*Floodplain Mapping Report and Documentation for Rott Creek*, December 14, 2012 (Reference 47)
St. Joseph Creek (EBSJ)	*Floodplain Mapping Report and Documentation for St. Joseph Creek Watershed in the East Branch DuPage River Basin*, June 2012 (Reference 48)
Willoway Brook (EBWI)	*Floodplain Mapping Report and Documentation for Willoway Brook*, January 31, 2013 (Reference 49)
Bronswood Tributary (SCBW)	*Floodplain Mapping Report and Documentation for: Bronswood Creek Tributary to the Salt Creek*, June 13, 2012 (Reference 50)
Devon Avenue Tributary (SCDA)	*Floodplain Mapping Report and Documentation for Devon Avenue Tributary in the Salt Creek Watershed*, June 2016 (Reference 51)
Ginger Creek (SCGC)	*Floodplain Mapping Report and Documentation for Ginger Creek*, January 31, 2013 (Reference 52)

Flooding Source	Report Title and Date
Oak Brook Tributary (SCOB)	*Floodplain Mapping Report and Documentation for Oak Brook Tributary in the Salt Creek Watershed*, January 2012 (Reference 53)
Spring Brook Creek (SCSB)	*Floodplain Mapping Report and Documentation: Salt Creek Spring Brook*, September 2012 (Reference 54)
Salt Creek (SCSC)	*Floodplain Mapping Report and Documentation for Lower Salt Creek Watershed*, November 2011 (Reference 24)
Sugar Creek (SCSU)	*Floodplain Mapping Report and Documentation for Salt Creek Sugar Creek*, December 2013, Revised 2016 (Reference 55)
Westwood Creek (SCWC)	*Floodplain Mapping Report and Documentation for West Creek Watershed*, August 2011(Reference 56)
Sawmill Creek (SWSW)	*Floodplain Mapping Report and Documentation for Sawmill Creek Watershed*, June 2011 (Reference 57)
Wards Creek (SWWD)	*Floodplain Mapping Report and Documentation for Wards Creek in the Sawmill Creek Watershed*, January 2012 (Reference 25)
Spring Brook No. 1 (WBSP)	*Floodplain Mapping Report and Documentation for West Branch Springbrook No. 1*, March 2012 (Reference 58)
Steeple Run Tributary (WBSR)	*Floodplain Mapping Report for Steeple Run Tributary of the West Branch DuPage River*, April 9, 2013 (Reference 59)

Data Collection from FEMA

https://www.fema.gov/sites/default/files/documents/fema_flood-insurance-study-data-request-form.pdf

Federal Emergency Management Agency
Washington, D.C. 20472

Flood Insurance Study (FIS) Data Requests

The Federal Emergency Management Agency (FEMA) has identified seven categories into which requests for Flood Insurance Study (FIS) backup (i.e., technical and administrative support) are separated. These categories and their associated fees are below:

Requests for Flood Insurance Backup Data	Fee
1. Portable Document Format (PDF) or Diskettes of hydrologic and hydraulic backup data for current or historical FISs	An initial, non-refundable $300, plus a $93 per-case surcharge fee to recover the cost of library maintenance and archiving. For larger requests that require more than 4 hours of research, additional hours will be charged at $40 per hour.
2. PDF or Mylar copies of topographic mapping developed during FIS process	An initial, non-refundable $300, plus a $93 per-case surcharge fee to recover the cost of library maintenance and archiving. For larger requests that require more than 4 hours of research, additional hours will be charged at $40 per hour.
3. PDF of survey notes developed during FIS process	An initial, non-refundable $300, plus a $93 per-case surcharge fee to recover the cost of library maintenance and archiving. For larger requests that require more than 4 hours of research, additional hours will be charged at $40 per hour.
4. PDF of individual Letters of Map Change (LOMCs)	$40 for first letter; $10 for each additional letter in the same request. Requesters will be notified about availability of the data and the fees associated with the requested data.
5. PDF of preliminary map panels	$35 for first panel; $2 for each additional panel in the same request. Requesters will be notified about availability of the data and the fees associated with the requested data.
6. DVDs of Digital Line Graph files, FIRM files or Digital LOMR attachment files	$150 per county or Digital LOMR attachment shape file. Requesters will be notified about availability of the data and the fees associated with the requested data.
7. Computer diskettes and user manuals for FEMA computer programs	$25 per copy. Requesters will be notified about availability of the data and the fees associated with the requested data.

Data Collection from FEMA

FIS Data Request Form

Federal Emergency Management Agency
Washington, D.C. 20472

Flood Insurance Study (FIS) Data Request

Please provide the following information as applicable for the area where you require data:

- Complete community name (including county and state):
- Community identification number, if known:
- Name(s) of flooding source(s) and specific location(s) for which data are needed (Attach FIRM panel showing subject area if available):
- Specific data needed (see list of available categories on page 1):
- Effective date of FIRM for which data are requested (enclose an annotated copy of FIRM/FBFM, if available, identifying area of interest):

- Contact person's name:
- Firm Name:
- Email Address:
- Daytime Phone/fax number

  Phone #:

  Fax #:
- Mailing Address:
- I am employed by (choose one):

☐ Private Firm ☐ State Agency ☐ Federal Agency ☐ Local Gov't ☐ FEMA Study Contractor* ☐ Other

* Please provide contract number

Data Collection from DuPage County

St. Joseph Creek

- 0_Complete Report
- A_Basic Information
- B_Cross-Section Data
- C_Tributary Area
- D Hydraulic Structures
- E_Model
- F_Calibration Results
- G_Statistics
- H_Floodway
- I_Survey Notes
- EBSJ QAQC FEQ Hydraulics 20121018.xls

Crabtree Creek

- Appendix A FEQ Model
- Appendix B FEQ Input Information
- Appendix C PVSTATS
- Appendix D Floodway
- Appendix E Reference Information
- CRABTREE Report.pdf

Workshop Activity: FIS Report

Identifying FEQ as the regulatory model.

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23	Steeple Run Tributary (WBSR)	*Floodplain Mapping Report for Steeple Run Tributary of the West Branch DuPage River*, April 9, 2013 (Reference 59)

WHERE ARE YOU IN THIS MODEL?

AKA SCHEMATICS, SCHEMATICS, SCHEMATICS...

WHERE ARE YOU IN THIS MODEL?

General Info on FEQ Schematics

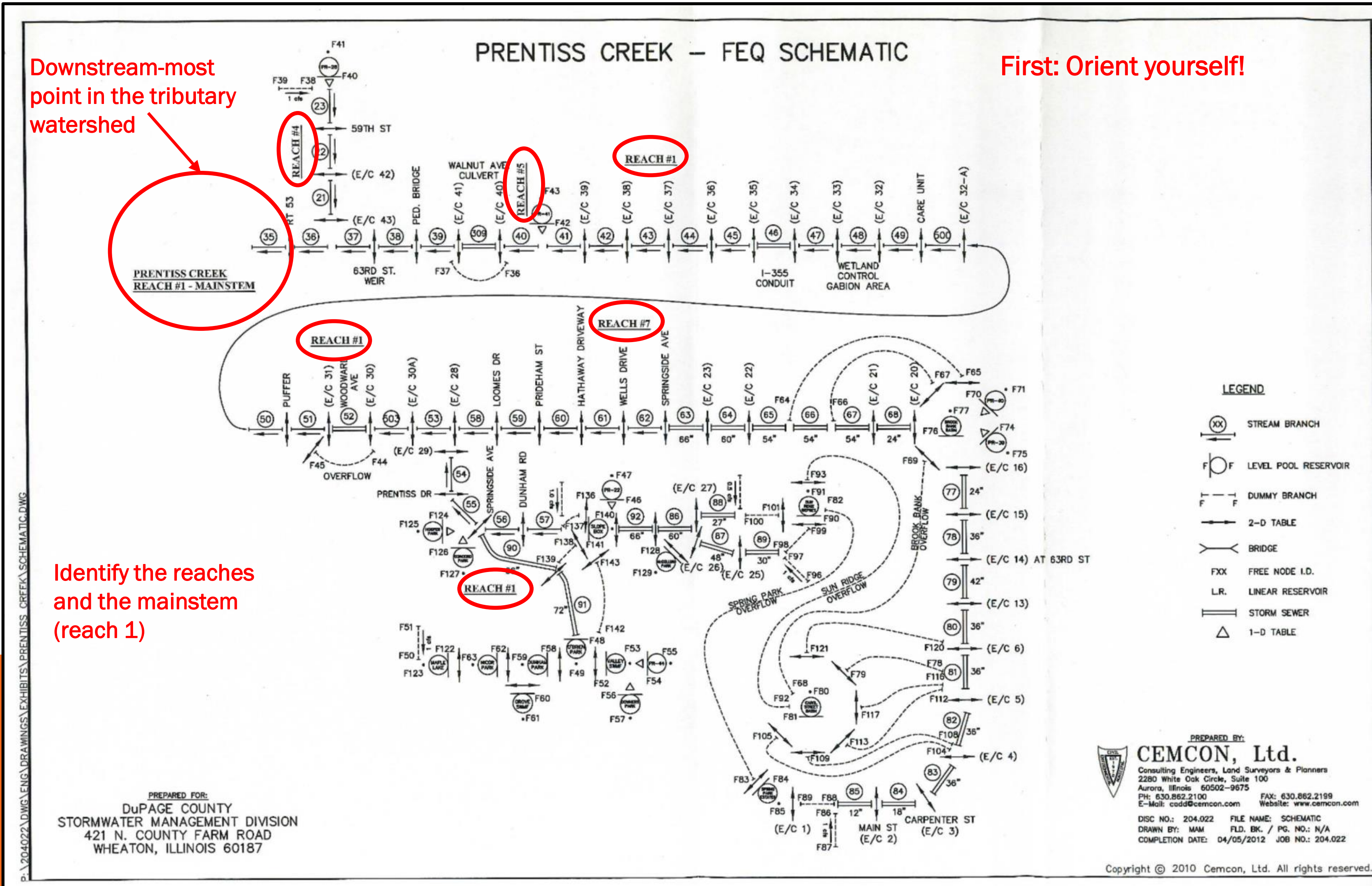
- FEQ schematics are manually created to graphically represent the FEQ model. Most schematics share the same, basic legend.

- Schematics, if not regularly updated with changes to an FEQ model, may have some incorrect information, but on the whole is a good guide to the FEQ model.

- There is a lot of creativity in the format of schematics – as you will see…

WHERE ARE YOU IN THIS MODEL?

Looking for Springside Avenue



Date 2/17/23

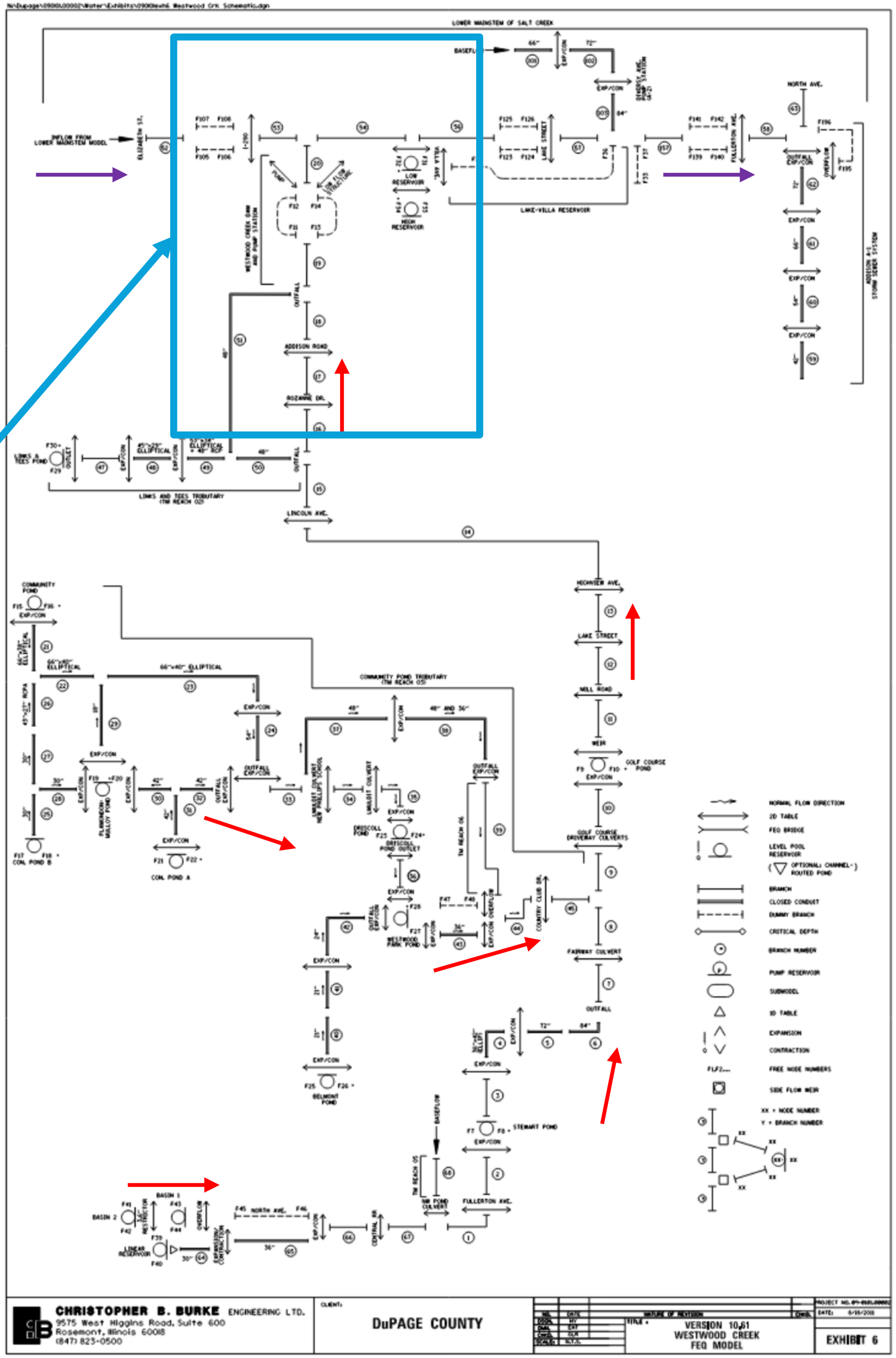
Springside Ave
Branch 56 - upstream
Branch 55 - downstream
Branch 90 - storm sewer (u/s)

EXAMPLE OF A TRIBUTARY WATERSHED MODEL WITH A MAINSTEM STUB

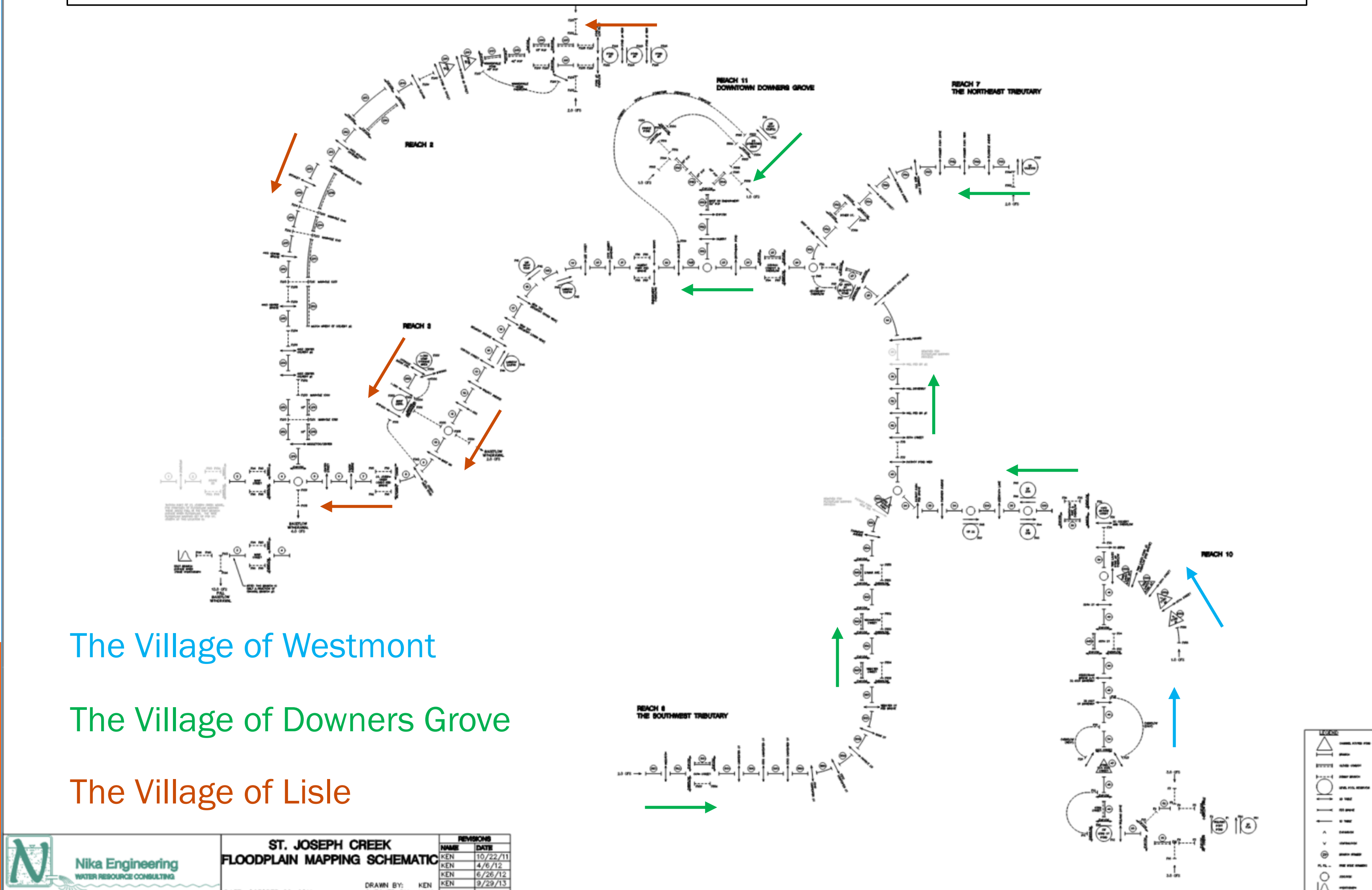
Tributary Watershed Flow…

Salt Creek Mainstem Flow…

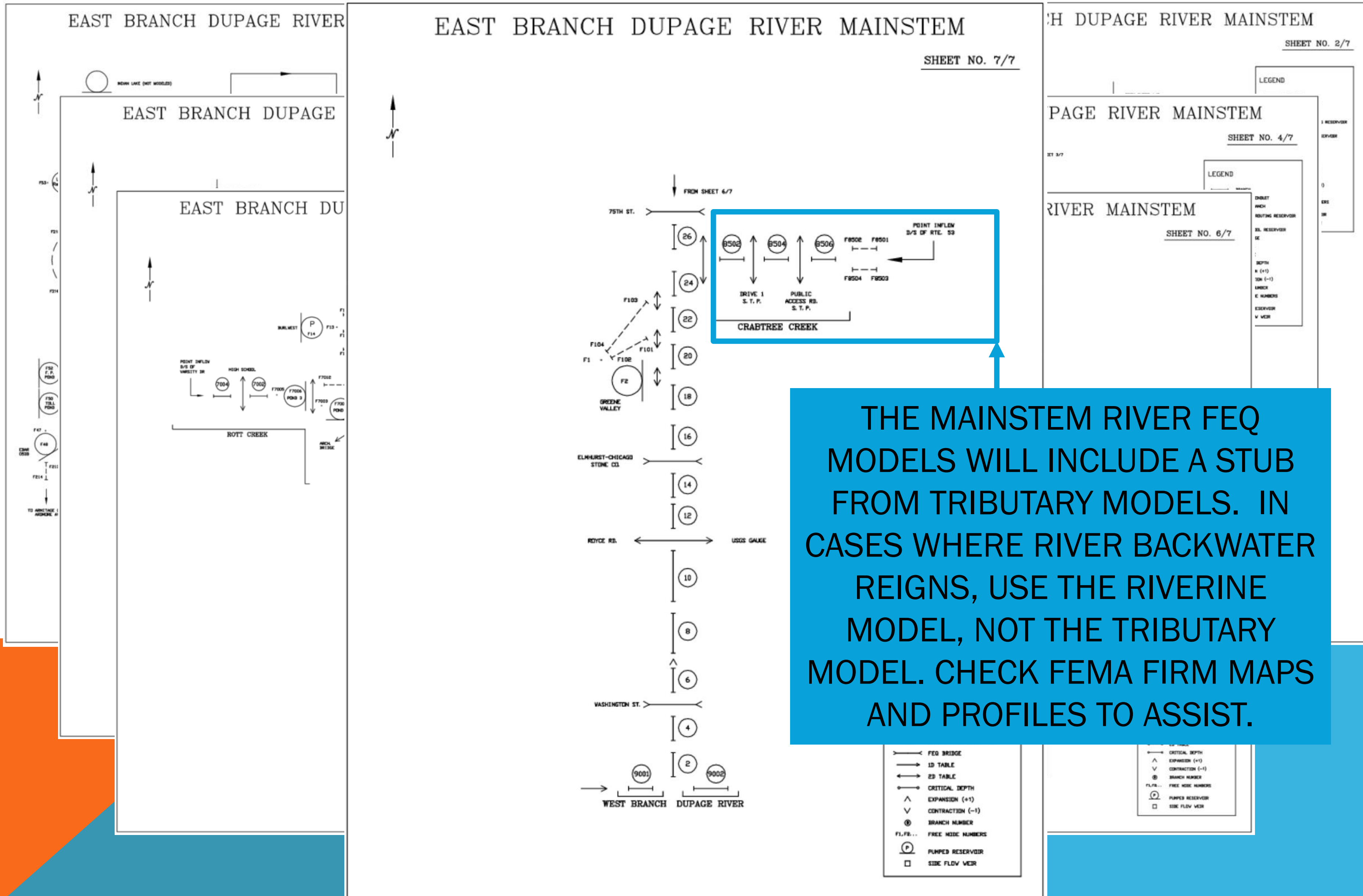
IF YOU REALIZE THAT YOUR PROJECT LOCATION IS IN THIS ZONE, YOU MAY NEED TO RECONSIDER USING THE TRIBUTARY FEQ MODEL IN FAVOR OF THE MAIN STEM MODEL.



EXAMPLE OF A TRIBUTARY WATERSHED MODEL SCHEMATIC ROUGHLY MATCHING THE GEOGRAPHICAL CHARACTERISTICS OF THE WATERSHED



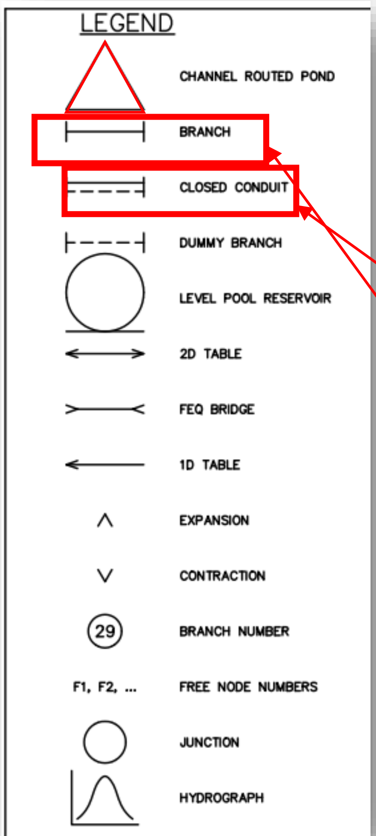
EXAMPLE OF A MAINSTEM RIVER MODEL SCHEMATIC

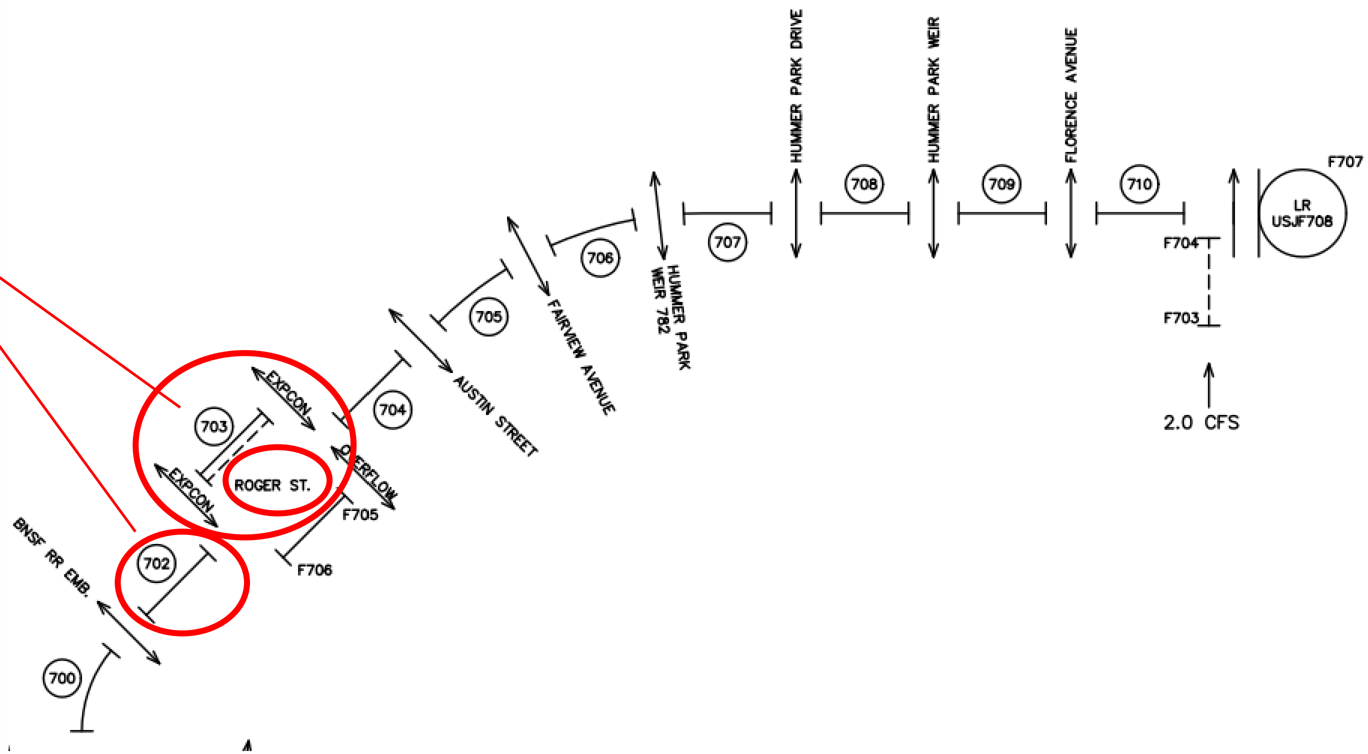


THE MAINSTEM RIVER FEQ MODELS WILL INCLUDE A STUB FROM TRIBUTARY MODELS. IN CASES WHERE RIVER BACKWATER REIGNS, USE THE RIVERINE MODEL, NOT THE TRIBUTARY MODEL. CHECK FEMA FIRM MAPS AND PROFILES TO ASSIST.

Workshop Activity: Schematic

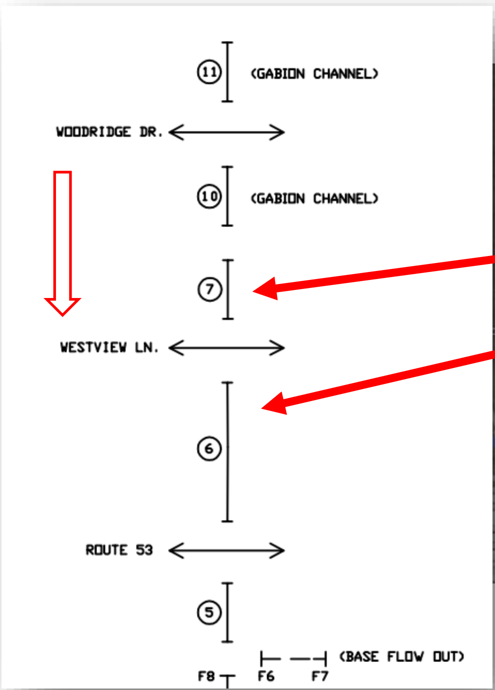
What am I?

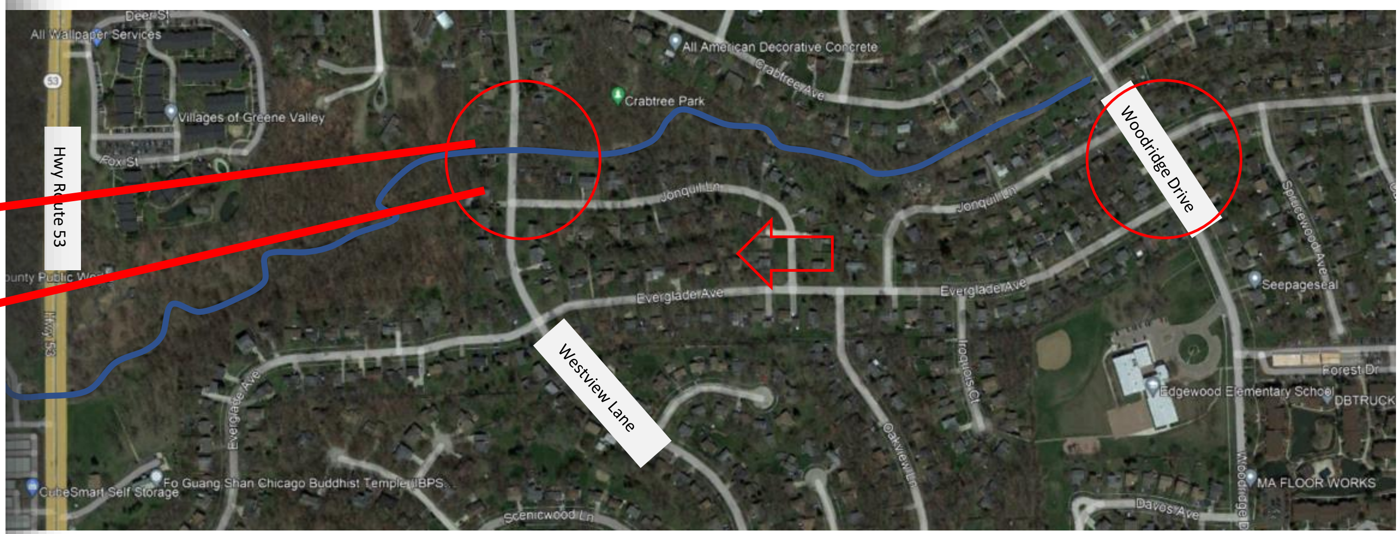




Workshop Activity: Schematic

Location Services Requested





The FEQ Model for Municipal Engineers

How to find what you need

General FEQ Model Info & Setup

AKA YOU CAN DO THIS!

GENERAL FEQ MODEL INFO & SETUP

A model is in your possession and now it is time to figure it out. Where to begin?

- Take a deep breath, a moment of meditation, then get to it!
- Open the FEQ input file. This file is commonly found in the FEQ folder and has a *.feq, *.inp or *.in nomenclature.

GENERAL FEQ MODEL INFO & SETUP

THE FEQ MODEL FEATURES CREATIVE MODELING STYLES, such as:

- Incorporating logical statements “IF, THEN, ELSE” to perform iterative analysis on various scenarios
- Ordering sections in various ways
- Relying on table file references to supply inverts and stations
- Copious annotation may be found in some inputs, and others contain very little
- Some models have long lists of table files to reference, while others are rather short.

GENERAL FEQ MODEL INFO & SETUP

C:\SpBrk1\E_FEQ\FEQ\LONG\wbsp_long.feq

```
SPRINGBROOK CREEK NO 1, WEST BRANCH DuPAGE RIVER (WBSP_LONG.FEQ)
DuPAGE CO PLANNING AND FLOODPLAIN MAPPING MODEL - EXISTING CONDITIONS
TSF:tsflng08.dtsf USING ONLY WHEATON GAUGE FOR Floodplain Mapping CDM March 2013
*******************************************************************************
* AUGUST 2010 EXISTING CONDITIONS MODEL FOR FLOODPLAIN MAPPING
*
* LAND USE BASED ON 2006 CONDITIONS
*
* HYDRAULIC CONDITIONS REVIEWED AND UPDATED IN 2009
* includes new Praire Path bridge over WBSP
* and resurvey at the DPCFPD service Road in Blackwell
* current conditions near St. James driveway,
* destruction of Horse Crossing Bridge during spring of 1997,
* and Arrow Road improvements in the Blackwell Forest Preserve
* Added Evergreen Pond from As builts
* Added Linear Reservoir in Subbasin 21 Due to large Area (EDL Apr 2011)
* Added DLAY in Upper Wheaton for overland flow
* Added internally drained areas in Subcatchments 64 and 21 based on CoW comments
* Added CAT Clinic storage U/S of President Street
* Added 48-inch Sewer Draining Wheaton College EDL March 2013
*******************************************************************************
RUN CONTROL BLOCK
NBRA=00054
NEX=00208
SOPER=NO
POINT=NO
DIFFUS=YES
WIND=NO
UNDERFLOW=NO
ZL=2.0
STIME=1925/01/01: 0.00
ETIME=2010/01/01: 0.00
```

<u>FEQ HEADER</u>

3 DEDICATED LINES OF COMMENTS AND IS PRESENT ON EVERY FEQ MODEL

MOST MODELS INCLUDE ADDITIONAL NOTES DISCUSSING UPDATES AND WHO PERFORMED THE UPDATES.

GENERAL FEQ MODEL INFO & SETUP

TYPICAL FEQ BLOCKS & GENERAL ORDER IN THE INPUT

- RUN CONTROL BLOCK
- BRANCH DESCRIPTION TABLES
- TRIBUTARY AREA BLOCK
- NEW NETWORK MATRIX CONTROL
- SPECIAL OUTPUT LOCATIONS BLOCK
- INPUT FILE SPECIFICATIONS BLOCK
- OUTPUT FILE SPECIFICATIONS BLOCK
- FUNCTION TABLES BLOCK
- FREE NODE INITIAL CONDITIONS BLOCK
- BACKWATER ANALYSIS BLOCK

GENERAL FEQ MODEL INFO & SETUP

TYPICAL FEQ BLOCKS & GENERAL ORDER IN THE INPUT

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- FREE NODE INITIAL CONDITIONS BLOCK
- BACKWATER ANALYSIS BLOCK

Date 2/17/23

Springside Ave
Branch 56 - upstream
Branch 55 - downstream
Branch 90 - storm sewer (u/s)

U/S cross sections

	4060	21684.92	728.94
	4059	21129.30	724.50

D/S cross sections

→ copied?	4058	21047.54	721.44
	4058	20972.22	72144
	4057	20703.59	719.73

u/s face of existing structur
be at 21108.94 ft

GENERAL FEQ MODEL INFO & SETUP

C:\Prentiss\FEQ\PRLngDR4A.inp

```
TRIBUTARY AREA BLOCK
TSFDSN=    L:\204022PR\FEQ\TSF\tsflng08.mpn
FFFDSN=    L:\204022PR\FEQ\EBPRLNGDR4.PEK
NLUSE=   36
NGAGE=    6
 GAGE  NLU
    1    6
    2    6
    3    6
    4    6
    5    6
    6    6
;gage 1: O'Hare (DR2)
;gage 2: Wheaton (DR2)
;gage 3: O'Hare (DR4)
;gage 4: Wheaton (DR4)
;gage 5: O'Hare (DR6)
;gage 6: Wheaton (DR6)
;lsro 1: imperviousness
;lsro 2: flat grass
;lsro 3: moderate grass
;lsro 4: steep grass
;lsro 5: forest
;lsro 6: ag
BRANCH=    0 FAC=1.0
 NODE GAGE IMPRV FGRSS MGRSS SGRSS MFRST AGRIC TOTAL
  F84    4 .0544 .1387 .0579 .0361 .0330 .0000 .3201   PR38  SPRING PARK ESTATES DETENTION AREA
  F80    4 .0174 .0237 .0066 .0151 .0076 .0000 .0704   PR35A CAROL STREET DEPRESSION
  F76    4 .0081 .0112 .0041 .0107 .0040 .0000 .0381   PR36  BROOKBANK BASIN
  F74    4 .0058 .0004 .0027 .0008 .0012 .0000 .0109   PR39  LINEAR RESERVOIR
  F70    4 .0342 .0362 .0367 .0117 .0137 .0000 .1325   PR40  LINEAR RESERVOIR
  F90    4 .0392 .0796 .0655 .0110 .0000 .0000 .1953   PR37  SUNRIDGE DEPRESSION
  F46    4 .0226 .0392 .0404 .0069 .0141 .0000 .1232   PR22  LINEAR RESERVOIR
```

FOR MOST CULVERT REPLACEMENT PROJECTS, HYDROLOGY IS LARGELY UNCHANGED, BUT TAKE NOTE OF THE PEAK FILE NAME. IF YOU WANT SPECIFIC RUN INFORMATION AT YOUR PROJECT LOCATION, THIS FILE IS YOUR GO-TO.

Date 2/17/23

Springside Ave
Branch 56 - upstream
Branch 55 - downstream
Branch 90 - storm sewer (u/s)

U/S cross sections

4060	21684.92	728.94
4059	21129.30	724.50

D/S cross sections

→ copied?	4058	21047.54	721.44
	4058	20972.22	721.44
	4057	20703.59	719.73

u/s face of existing structure may be at 21108.94 ft

Springside Rating Tables

3541	724.50	Culvert
3542	730.19	Chanrat
3543	731.94	Chanrat
3544	729.99	Embank

F124? F126?

GENERAL FEQ MODEL INFO & SETUP

FUNCTION TABLE BLOCK

- Lists actual, individual tables to be used in the model, whether they are called out in the BRANCH DESCRIPTION BLOCK or the NETWORK MATRIX
- List file locations for tables to be used in the model

C:\Prentiss\FEQ\PRLngDR4A.inp

```
FUNCTION TABLES BLOCK
FILE= L:\204022PR\FEQ\TAB\TABS\STORAGE.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\CULVERT.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\EXPCON.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\EMBANKQ.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\CHANRAT.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\LEVEEPC.TAB
FILE= L:\204022PR\FEQ\TAB\MANUAL\T-8GRATE.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR1XS.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR4XS.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR7XS.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\oned.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\STOR.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\twoD.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\xsection.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\expcon.TAB

TABID=    -1
```

ALL OUR CROSS SECTION AND STRUCTURE RATING FILES WILL BE IN ONE OR MORE OF THESE TABLE FILES LISTED IN THE FUNCTION TABLES BLOCK

GENERAL FEQ MODEL INFO & SETUP

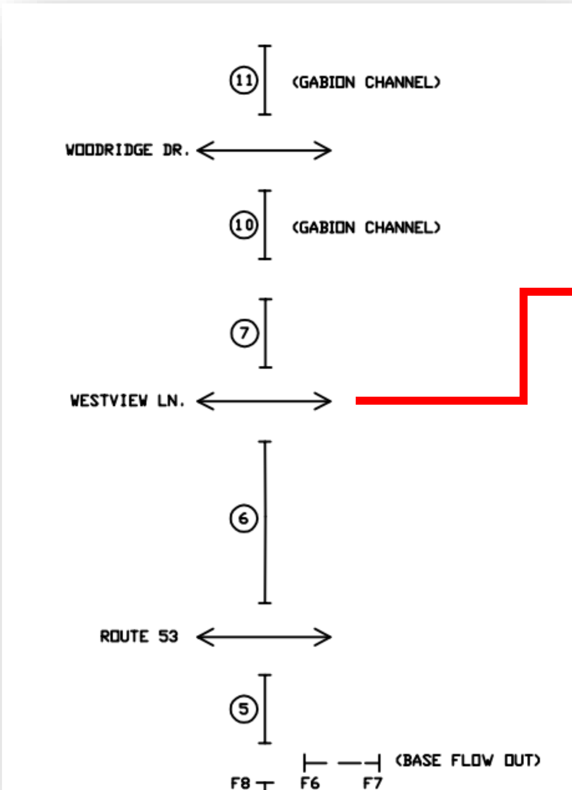
FREE NODE INITIAL CONDITIONS BLOCK - Identifies all free nodes that are not attached to a branch (i.e. dummy branch and reservoirs)

C:\Prentiss\FEQ\PRLngDR4A.inp

```
 F124 HOOPERSW    735.20      0.0      0.00
 F125 HOOPERSW    735.20      0.0      0.00
 F126 CONCORDS    734.44      0.0      0.00
 F127 CONCORDS    734.44      0.0      0.00
 F128 MCCOLLUM    739.10      0.0      0.00
```

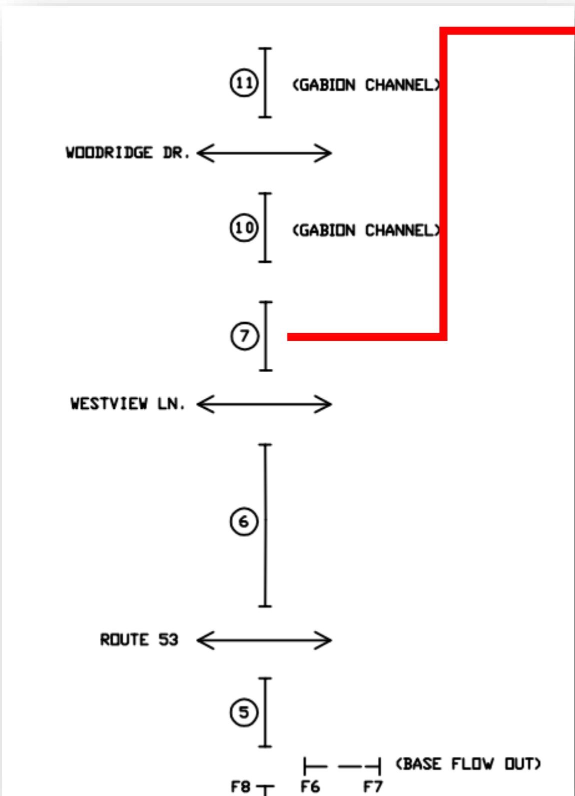
THE ONLY FREE NODES TIED IN AT SPRINGSIDE ARE CALLED OUT AS F124 AND F126. ACCORDING TO THE SCHEMATIC BOTH ARE LEVEL-POOL RESERVOIRS. NOT LIKELY AN ISSUE FOR THE PROJECT AT THIS TIME.

Workshop Activity: FEQ




```
* BOX CULVERT AT WESTVIEW
    5    6   D7   U6   D7 1130 1130                       673.73  /'
                          1131 1131                       683.66  /'
                          1132 1132                       683.97   '
    1    7                                                         '
    2    2   U7  D10                                               '
    3   U7  D10                                                    '
```

Workshop Activity: FEQ




```
BNUM=    7 INERTIA=0.7
 NODE NodeId     XNUM   STATION ELEVATION   KA   KD HTAB  AZM
  701 NO GAB   CR2016   5638.70    697.38    0    0    0    0
                    -
                    -
                    -
                    -
               CR2008   5174.67    691.40    0    0    0    0
                    -
                    -
                    -
                    -
                    -
                    -
                    -
                    -
                    -
                    -
               CR0012   4160.86    680.28    0    0    0    0
                    -
                    -
                    -
                    -
                    -
      WESTVW   CR0011   3620.30    673.73    0    0    0    0
   -1
```

THE FEQ MODEL FOR MUNICIPAL ENGINEERS

HOW TO FIND WHAT YOU NEED

FEQUTL NAVIGATION

AKA ALL THE RATING TABLES YOU COULD EVER WANT

FEQUTL BASICS

General FEQUTL Information

- FEQUTL is responsible for creating most table files used in the FEQ model.
- This software is still “card” based in that most of the functions within FEQUTL are column dependent.
- It is highly recommended to use the template approach where appropriate.

FEQUTL BASICS

FEQ Table Types

- Type 2 and 3 – very simple tables usually describing linear reservoirs, level-pool reservoirs and 1-d flow ratings.

```
*-----------------------------------------------------------------------
* KING ARTHUR COURT POND STAGE-STORAGE-AREA TABLE
* REACH 1
*
TABLE#=   914
TYPE=   -3
REFL= 0.0          FAC=   43560.00
 ELEVATION    STORAGE         AREA         '(STAGE STORAGE AT KAC POND)
      0.00       0.00         0.10
    714.00       0.01         0.20
    720.00     0.8373       1.6746
    721.00     2.5895       1.8298
    722.00     4.4932       1.9778
    723.00     7.0173       3.0704
    724.00    11.7122       6.3194
     -1.00
```

```
TABLE#=   900
TYPE=    -2
REFL=     0.00
 ELEVATION    STORAGE          'LINEAR RESERVOIR LSJ-F50
    999.00       0.00
   1000.00       0.01
   1037.68    1.642E6
   1188.42    8.208E6
   1376.86    1.642E7
     -1.00
```

FEQUTL BASICS

FEQ Table Types

Type 22, 23, 24, and 25 – x-section table file numbers. The floodplain mapping versions should be in this table type range.

```
TABID= 713
TYPE=  -25
STATION= 4.28472E+03 GISID=713                  EASTING=   -33000000.00 NORTHING=   -33000000.00
ELEVATION= 7.20330E+02                      EXT=-99.900000 FAC=1.000 SLOT=     0.000 FP_AXIS=unknown
    Depth Top_width         Area  Sqrt(Conv)        Beta First_moment      Alpha        Critq        Ma        Mq
 0.0000000 2.1300001 0.0000000000 0.0000000000  1.018142 0.0000000000  1.046257 0.0000000000 1.0000000 1.0000000
 0.0800171 2.9891043 0.2048079220 1.29863                                                      0000000 1.0000000
 0.8999634 11.792467 6.2648549100 14.0885                                                      0000000 1.0000000
 1.2000122 12.130017 9.8538112600 20.1758                                                      0000000 1.0000000
 2.0333252 16.434431 21.755374900 35.0499                                                      0000000 1.0000000
 2.8666992 20.739161 37.245124800 50.5794                                                      0000000 1.0000000
 3.7000122 25.043573 56.320800800 66.8781                                                      0000000 1.0000000
 3.7999878 56.120720 60.378025100 69.0057                                                      0000000 1.0000000
 3.8999634 71.851440 66.775070200 71.6646                                                      0000000 1.0000000
 4.5999756 94.888901 125.13520800 92.8444                                                      0000000 1.0000000
 5.2999878 117.92636 199.62184100 116.334                                                      0000000 1.0000000
 6.0000000 140.96382 290.23498500 141.342                                                      0000000 1.0000000
 6.2000122 203.77448 324.71090700 148.734                                                      0000000 1.0000000
 6.5000000 215.72455 387.63320900 160.885                                                      0000000 1.0000000
 7.2500000 255.20139 564.23040800 192.158                                                      0000000 1.0000000
 8.0000000 294.67819 770.43530300 223.405                                                      .0000000 1.0000000
 8.1499634 305.82352 815.46191400 229.62713600  1.786224 1582.8796400  4.083305 4175.7353500 1.0000000 1.0000000
 8.3699951 469.52316 900.76232900 238.76985200  1.846772 1771.0310100  4.374484 4525.7807600 1.0000000 1.0000000
 8.4299927 489.58807 929.53454600 241.29557800  1.872180 1825.9316400  4.498735 4620.2934600 1.0000000 1.0000000
 9.2699585 560.23309 1370.4415300 277.04876700  2.181633 2787.7287600  6.177433 6174.7807600 1.0000000 1.0000000
 10.109985 630.88324 1870.7263200 313.07241800  2.417245 4144.9082000  7.672717 8043.3090800 1.0000000 1.0000000
 10.279968 643.70300 1979.0551800 320.38211100  2.458674 4472.0761700  7.956561 8456.5488300 1.0000000 1.0000000
      -1.
```

THE CROSS-SECTION ID, AS REFERENCED IN THE FEQ MODEL IS CALLED OUT HERE, AS WELL AS THE LOWEST INVERT ELEVATION.

UNLESS CHANGED IN THE BRANCH DESCRIPTION, THIS SHOULD BE THE RATING TABLE ACTIVATION ELEVATION.

FEQUTL BASICS

Table Types

Type 6 and 13 - These tables are 2-d generated tables - table output for CULVERT, CHANRAT and EMBANKQ.

```
TABID= 6325
TYPE= -13 HDATUM=     721.580  CHANRAT zrhufd=    0.0000
LABEL=  LEFT CHANRAT AT KING ARTHUR COURT OVERFLOW
NHUP=   14
NPFD=   10
HUP     1000-4 2000-4 3000-4 4000-4 5000-4 1000-3 1250-3 1500-3 1750-3 2000-3
FDROP   9244-5 1807-4 2688-4 3569-4 4440-4 8699-4 1082-3 1295-3 1507-3 1719-3
   PFD          Flows for HUP and Proportion of FDROP
 3162-6 8740-8 8378-7 2675-6 5888-6 1196-5 9367-5 1736-4 2847-4 4316-4 6227-4
 1789-5 2033-7                                           6677-4 1012-3 1460-3
 4930-5 3221-7                                           1076-3 1629-3 2352-3
 1012-4 4273-7                                           1468-3 2222-3 3207-3
 1768-4 5059-7                                           1807-3 2738-3 3945-3
 2789-4 5547-7                                           2065-3 3134-3 4509-3
 4100-4 5861-7                                           2229-3 3388-3 4877-3
 5724-4 6019-7                                           2308-3 3512-3 5058-3
 7684-4 6066-7                                           2329-3 3548-3 5112-3
 1000-3 6070-7 6332-6 2107-5 4730-5 9086-5 7462-4 1406-3 2331-3 3551-3 5117-3
```

THESE TABLES ARE USED FOR CODE 5 TYPE 6 IN THE MATRIX, OR THE "HEART" OF THE FEQ MODEL.
THE H-DATUM IS THE ACTIVATION ELEVATION FOR THIS RATING TABLE.

FEQUTL BASICS

Table Types

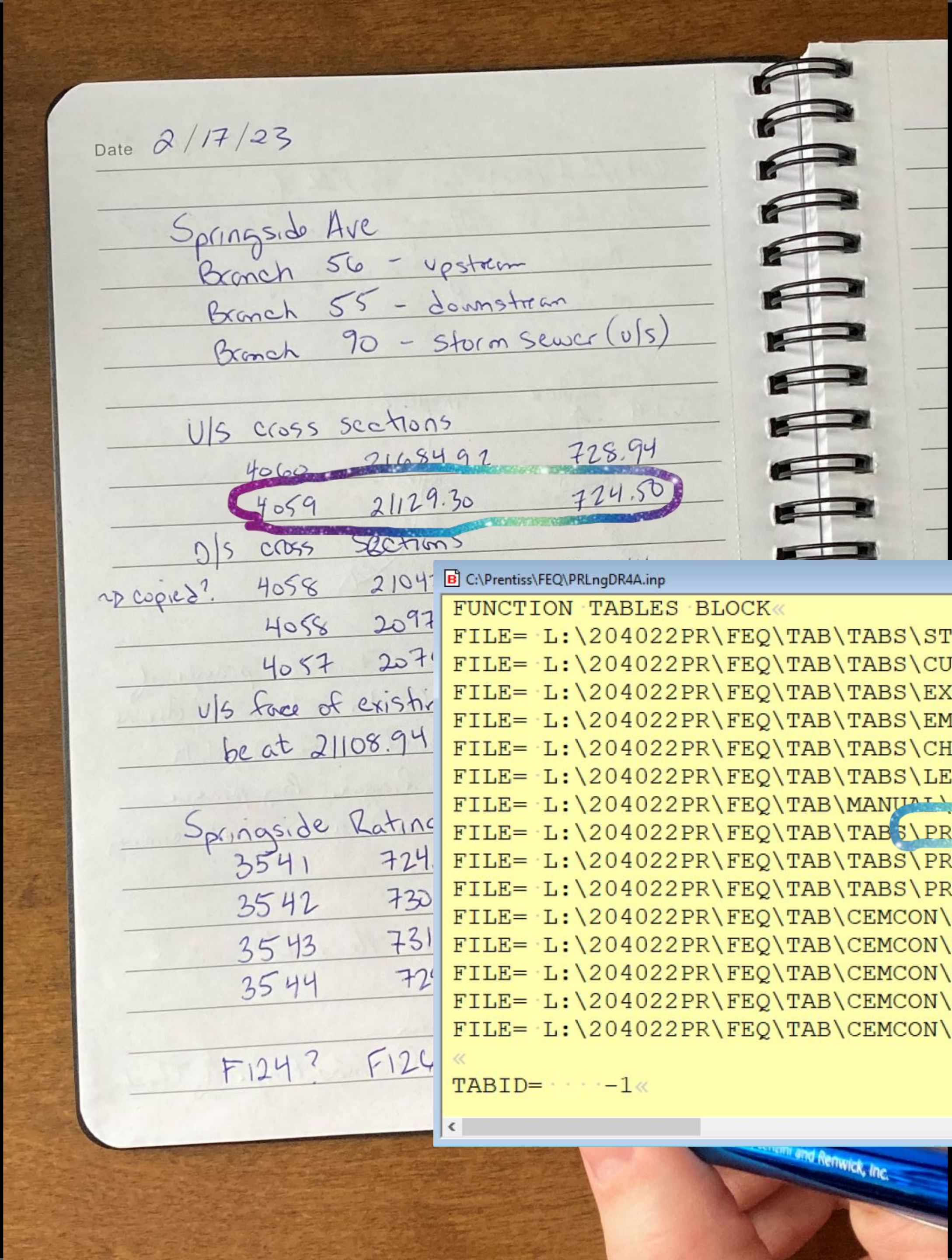
Another 2-D table type. This table is incompatible with type 6 or 13 tables and must be made part of a separate link in the model.

```
TABID= 6003
TYPE=  -14 HDATUM=    735.730    EXPCON
LABEL=SWALE
NHDN=    29
NPFQ=    10
QFREE    1166-4 6596-4 1819-3 3734-3 6524-3 3690-2 6447-2 1017-1 1466-1 2054-1
HDN      1000-4 2000-4 3000-4 4000-4 5000-4 1000-3 1250-3 1500-3 1750-3 2000-3
   PFQ           Ups heads for HDN and Proportion of QFREE
 3162-5 1000-4 2000-4 3000-4 4000-4 5000-4 1000-3 1250-3 1500-3 1750-3 2000-3
 8944-5 9997-5 1999-4 2999-4 3999-4 4999-4 9997-4 1250-3 1500-3 1750-3 1999-3
 1643-4 9990-5 1998-4 2997-4 3996-4 4995-4 9990-4 1249-3 1499-3 1748-3 1998-3
 2530-4 9975-5 1995-4 2992-4 3990-4 4987-4 9975-4 1247-3 1496-3 1746-3 1995-3
 3536-4 9950-5 1990-4 2985-4 3980-4 4975-4 9950-4 1244-3 1493-3 1742-3 1991-3
 4648-4 9912-5 1982-4 2974-4 3965-4 4956-4 9912-4 1239-3 1487-3 1736-3 1984-3
 5857-4 9858-5 1972-4 2957-4 3943-4 4929-4 9858-4 1232-3 1479-3 1727-3 1974-3
 7155-4 9781-5 1956-4 2934-4 3912-4 4890-4 9781-4 1223-3 1467-3 1714-3 1960-3
 8538-4 9673-5 1935-4 2902-4 3869-4 4836-4 9673-4 1209-3 1451-3 1696-3 1940-3
 1000-3 9525-5 1905-4 2857-4 3809-4 4762-4 9524-4 1190-3 1429-3 1671-3 1912-3
QFREE    3899-1 6937-1 1199+0 2025+0 3140+0 5444+0 7901+0 1197+1 1658+1 2166+1
HDN      2500-3 3000-3 3500-3 4000-3 4500-3 5300-3 6000-3 7000-3 8000-3 9000-3
```

NOW THAT WE KNOW WHAT THE RATING TABLE FILES LOOK LIKE, ITS TIME TO CHECK OUT THE INPUT FILES THAT MAKE THOSE RATING TABLE FILES.

HERE'S OUR LIST.

LET'S TRY TO FIND APPROACH XS 4059



C:\Prentiss\FEQ\PRLngDR4A.inp

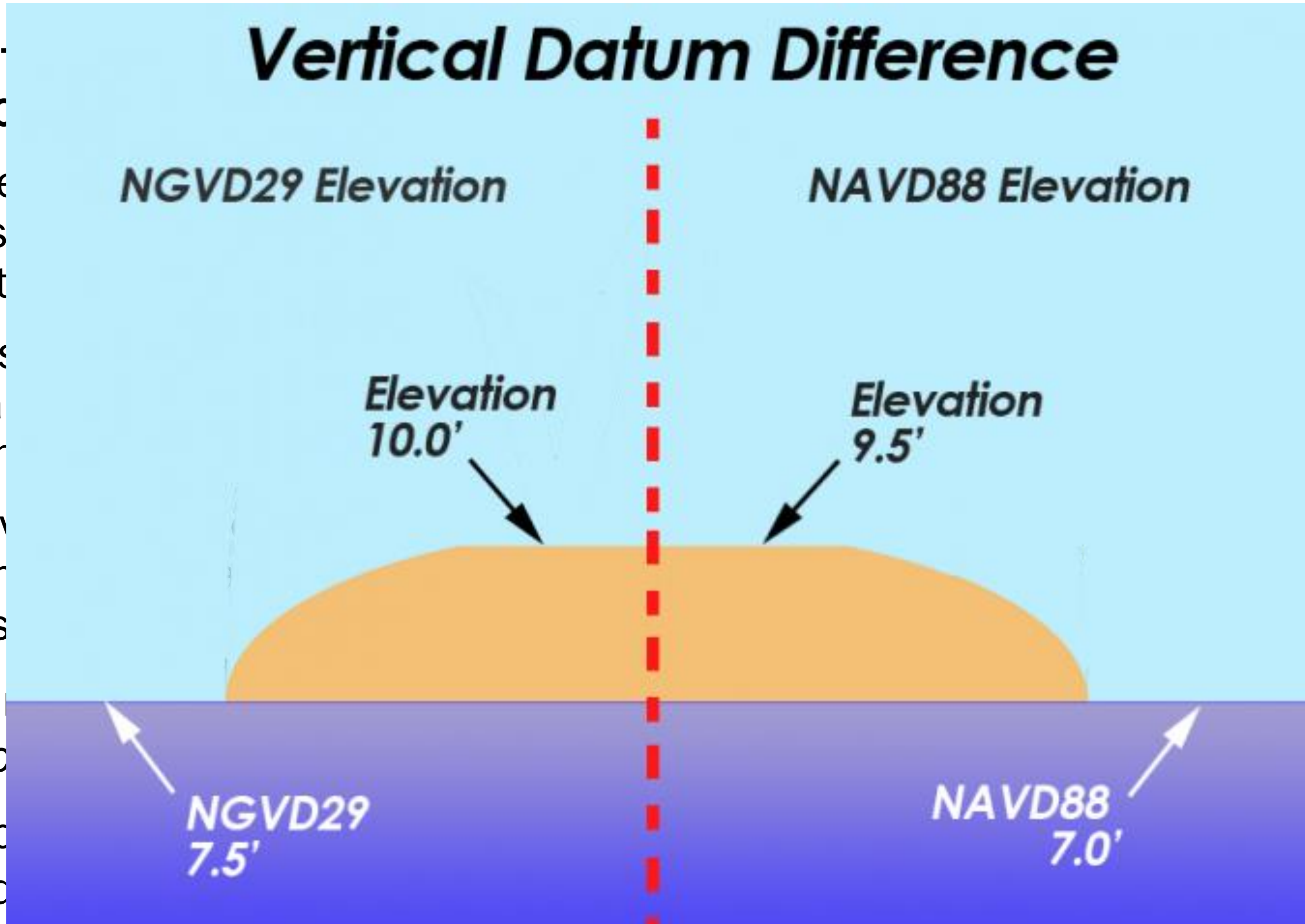
```
FUNCTION TABLES BLOCK
FILE= L:\204022PR\FEQ\TAB\TABS\STORAGE.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\CULVERT.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\EXPCON.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\EMBANKQ.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\CHANRAT.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\LEVEEPC.TAB
FILE= L:\204022PR\FEQ\TAB\MANUAL\T_0GRATE.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR1XS.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR4XS.TAB
FILE= L:\204022PR\FEQ\TAB\TABS\PR7XS.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\oned.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\STOR.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\twoD.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\xsection.TAB
FILE= L:\204022PR\FEQ\TAB\CEMCON\expcon.TAB

TABID=    -1
```

THE MOST COMMON FEQUTL COMMAND INPUTS

FEQX -
sec

- Stre
ass
wat
- Offs
tha
har
- Elev
hur
pos
- Ma
eac
- Coc
and
extensions - options

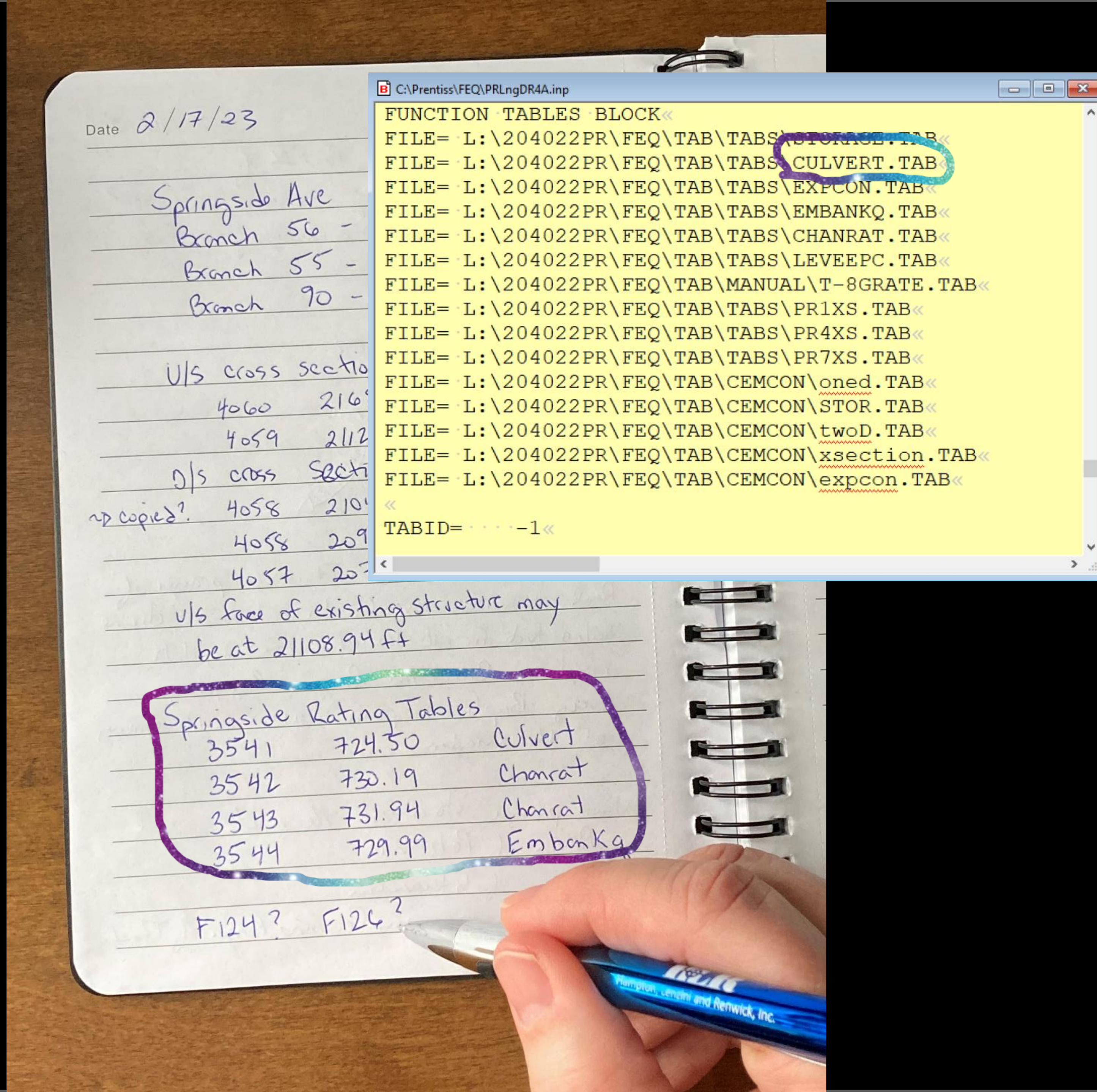



```
NGVD29
00
040   0.050
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
GND 1006
TOP 1007
TOE 1008
CLC 1009
TOE 1010
TOP 1011
GND 1012
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
XDI Ext. Sta.
```

WE HAD GREAT SUCCESS LOCATING THE CROSS SECTIONS, ONTO THE STRUCTURE RATING TABLE FILES

HERE'S OUR LIST.

LET'S TRY TO FIND CULVERT INPUT RATING 3541 AND OTHER ASSOCIATED RATINGS…



C:\Prentiss\FEQUTL\CULVERT\Culvert.ftl

```
CULVERT
TABLE#= 3541
TYPE=  13
LABEL=SPRINGSIDE DRIVE TWIN BOX CULVERT ON PRENTISS CREEK
APPROACH SECTION DATA
APPTAB#= 4059
APPELV=724.50
APPLEN=20.00
APPLOS=0.40
APPEXP=1.0
TWIN BOX CULVERT DESCRIPTION
NODEID=YES
SFAC=1.0
 NODE NODENAME  XTAB   STATION ELEVATION
    1 UPSTREAM   203     52.1     724.50


      DNSTREAM   203      0.0     721.44
-1
CULCLS=BOX
DEPARTURE SECTION DATA
DEPTAB#= 4058  BEGTAB#=5058
DEPELV=   721.44   721.44     1.00
LOSOPT=MOMENTUM
DISCHARGE COEFFICIENT DATA
KRB=1.00
KWING=1.06
KPROJ=1.00
C46=0.75
```

CULVERT RATING TABLE# AND GENERAL DESCRIPTION

UPSTREAM CHANNEL INFO

STRUCTURE LENGTH, OPENING REFERENCE AND U/S & D/S INVERTS

DOWNSTREAM CHANNEL INFO

ADDITIONAL FEATURES LIKE ROUNDING, BEVELING AND WINGWALLS

THE MOST COMMON FEQUTL COMMAND INPUTS

MULCON – Similar to FEQX, used in describing conduits

- Table is called out in the structure description of the CULVERT routine.
- Multiple pipes shapes may be assigned with different inverts and roughnesses.
- Additional variables can assign a mudline and the associated Manning's roughness coefficients

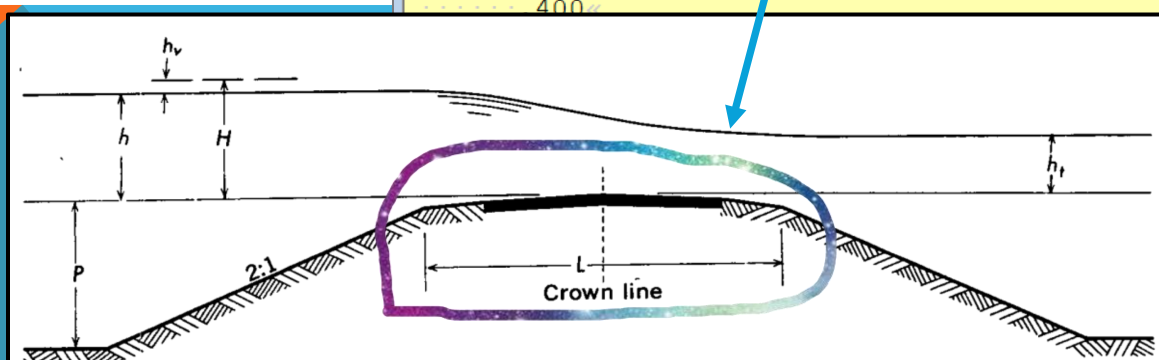
```
MULCON
TABLE#=  203 SAVE25 OLDBETA NOOUT
WSLOT= 0.01
HSLOT= 20.0
NPIPES=    2
TYPE=       BOX       BOX
SPAN=       9.0       9.0
RISE=       6.0       6.0
BOTT=       0.0       0.0
ROUG=     0.015     0.015
MUDL=      1.25      1.25
ROUG=     0.035     0.035
```

THE MOST COMMON FEQUTL COMMAND INPUTS

- EMBANKQ – Flow over roads, dams and other embankments
- Compares the crest against an approach section. The rating activation elevation is the lowest point on the CREST.
- The width is described by "L" in this figure and can be different from the length of the conduit.

C:\Prentiss\FEQUTL\CULVERT\Culvert.ftl

```
EMBANKQ
TABID= 3544  CSHIFT= 0.00
PLCWTB= 9994
GLCWTB= 9995
PHCWTB= 9996
GHCWTB= 9997
PSUBTB= 9998
GSUBTB= 9999
LABEL=EMBANKQ FLOW OVER THE ROAD FOR SPRINGSIDE DR. CULVERT
    OFFSET     CREST     WIDTH  APPROACH SURFACE
   -21.210   730.194   40.000   729.660 PAVED
   -10.340   730.089            724.950
      .000   729.990            724.500
    10.200   730.245            726.080
    18.960   730.465            729.150
    77.800   731.939            730.920 END
UPSTREAM HEADS TO USE IN COMPUTING THE TABLE
NFRAC=40
POWER=2.0
LIPREC=0.02
MINPFD=0.01
      .100
      .200
      .300
      .400
```



THE MOST COMMON FEQUTL COMMAND INPUTS

CHANRAT – Channel Routing

- Used primarily for very long overflow routes, as EMBANKQ is not appropriate in these cases
- Heavily used for overbank areas to supplement CULVERT routines

* C:\Prentiss\FEQUTL\CULVERT\Culvert.ftl

```
;SPRINGSIDE LEFT OVERBANK
FEQX
TABLE#=  402 SAVE25 NEWBETAM EXTEND NOOUT
STATION=3.192
NAVM=    0
NSUB    7    0.060    0.040    0.001    0.040    0.060    0.040
              0.001
CHANRAT SECTION FOR SPRINGSIDE DR - LEFT OVERBANK OF XS 59
   -593.14    736.07    1 1857672.88 584679.63 0001 XDI Ext. Sta.
   -493.14    735.37    1 1857772.25 584668.63 0002 XDI Ext. Sta.
   -393.14    734.57    1 1857871.63 584657.63 0003 XDI Ext. Sta.
   -293.14    733.85    1 1857971.00 584646.69 0004 XDI Ext. Sta.
   -193.14    731.24    2 1858070.38 584635.69 0005 XDI Ext. Sta.
    -93.14    731.92    2 1858169.75 584624.69 0006 GND 1006
    -22.05    730.19    3 RD
    -22.04    775.00   -1 VERTICAL FRICTIONLESS WALL (MAN 02/06/06)
CHANRAT
TABLE#= 3542
TYPE=   13
LABEL= SPRINGSIDE LEFT OVERBANK FLOW USING CHANRAT
XSTAB#=  402
BOTSLP=   0.0000
LENGTH=      85.3 MIDELEV=    730.19
UPSTREAM HEADS USED IN COMPUTING THE TABLE
NFRAC=   11
POWER=   2.5
      .250
      .500
      .750
     1.000
     1.250
     1.500
     1.750
```

THE MOST COMMON FEQUTL COMMAND INPUTS

EXPCON – Expansion / Contraction

- Used when difficulties arise in model runs where a x-sections transition is too challenging to converge the FEQ model.
- Commonly used for entrances and exits to conduits.

```
;Williamsport Pond to overland swale
EXPCON
CROSS SECTION TABLES
 LOC TAB# DIST     DATUM
  UP 187A  0.0    710.00
  DN 187   5.0    735.73
COEFFICIENTS AND OUTPUT TABLES
 DIR TAB#   KA   KD LABEL
  UD 6002  0.5  0.8 WILLIAMSPORT POND TO SWALE
  DU 6003  0.5  0.8 SWALE TO WILLIAMSPORT POND
SMOOTH=0.1
GMEAN= 0.5
DOWNSTREAM HEAD SEQUENCE FOR THE TABLE
NFRAC= 11
POWER= 1.5
     0.100
     0.200
     0.300
     0.400
     0.500
     1.000
     1.250
```

THE MOST COMMON FEQUTL COMMAND INPUTS

If you believe you are looking at a WSPRO Bridge on a schematic, you will most likely come across the corresponding files under a WSPRO folder. Look for the WSPRO input (*.dat) to gather details on the design

```
***********************************************
* DEFINING THE GEOMETRY OF THE CULVERT BARREL *
***********************************************
MULCON
TABID= 1133 SAVE22 NOOUT
WSLOT= 0.01
HSLOT= 20.0
NPIPES=    2
TYPE= BOX      BOX
SPAN= 8.0      8.0
RISE= 6.0      6.0
BOTT= 0.0      0.03
ROUG= 0.015    0.015
MUDL= 0.25     0.25
ROUG= 0.045    0.045
```

Workshop Activity: FEQUTL


```
FEQX
GISID=   001EBCR0011   ' 468.000 468.000 468.000 468.000 468.000 468.000 NGVD29
TABID=   CR0011  SAVE22 OUT22 MONOTONE NEWBETAM
STATION= 3620.3
NAVM=    0 LEFT= 0.00 RIGHT= 0.00 SCALE= 1.00 SHIFT= 0.00
NORTHING= 1849694.12 EASTING= 1059754.91
NSUB     6   0.001   0.041   0.058   0.060   0.036   0.001
CRABTREE I
   -182.69    700.00    1
   -182.68    687.54    2 1849512.01 1059749.75 %0001% 385 GR
   -155.31    687.24    2 1849539.34 1059751.15 %0002% 384 GR
   -131.30    686.53    2 1849563.35 1059751.44 %0003% 383 GR
   -104.73    684.00    2 1849589.92 1059752.00 %0004% 382 GR
    -81.19    682.38    2 1849613.45 1059752.29 %0005% 381 GR
    -62.20    681.57    2 1849632.43 1059752.95 %0006% 380 GR
    -39.27    680.83    2 1849655.34 1059751.90 %0007% 379 GR
    -24.43    679.68    3 1849670.18 1059751.98 %0008% 378 CB_WOODS
    -13.45    675.87    3 1849680.83 1059754.64 %0009% 377 WOODS
    -10.38    674.40    3 1849683.90 1059754.61 %0010% 376 WOODS
     -6.67    674.08    3 1849687.49 1059755.57 %0011% 375 WOODS
     -0.03    673.86    3 1849694.09 1059754.91 %0012% 374 TE
      2.24    673.73    3 1849696.36 1059754.76 %0013% 373 H2O
      4.84    673.91    3 1849698.95 1059754.59 %0014% 372 H2O
      6.28    674.06    3 1849700.31 1059755.06 %0015% 371 TE
     12.77    679.38    4 1849706.79 1059754.59 %0016% 370 CB_WOODS
     17.88    681.21    5 1849711.90 1059754.67 %0017% 369 WOODS
     30.68    684.77    5 1849724.57 1059752.87 %0018% 368 GR
     40.50    685.61    5 1849734.38 1059753.34 %0019% 367 GR
     46.62    686.70    5 1849740.47 1059753.92 %0020% 366 GR
     48.32    688.26    5 1849742.09 1059753.41 %0021% 365 GR
     50.73    688.23    5 1849744.50 1059753.36 %0022% 364 GR
     52.52    690.18    5 1849746.29 1059753.31 %0023% 363 GR
     62.85    691.59    5 1849756.59 1059754.09 %0024% 362 GR
     76.59    691.77    5 1849770.33 1059754.28 %0025% 361 GR
     89.46    690.73    5 1849783.19 1059754.77 %0026% 360 GR
    108.11    691.09    5 1849801.74 1059752.80 %0027% 359 GR
    122.79    695.49    5 1849816.37 1059753.91 %0028% 358 GR
    141.15    697.71    6 1849834.73 1059754.01 %0029% 357 G
    141.16    700.00   -1
```