MODELING AND EVALUATING THE INFLUENCES OF CLASS V INJECTION WELLS ON URBAN KARST HYDROLOGY

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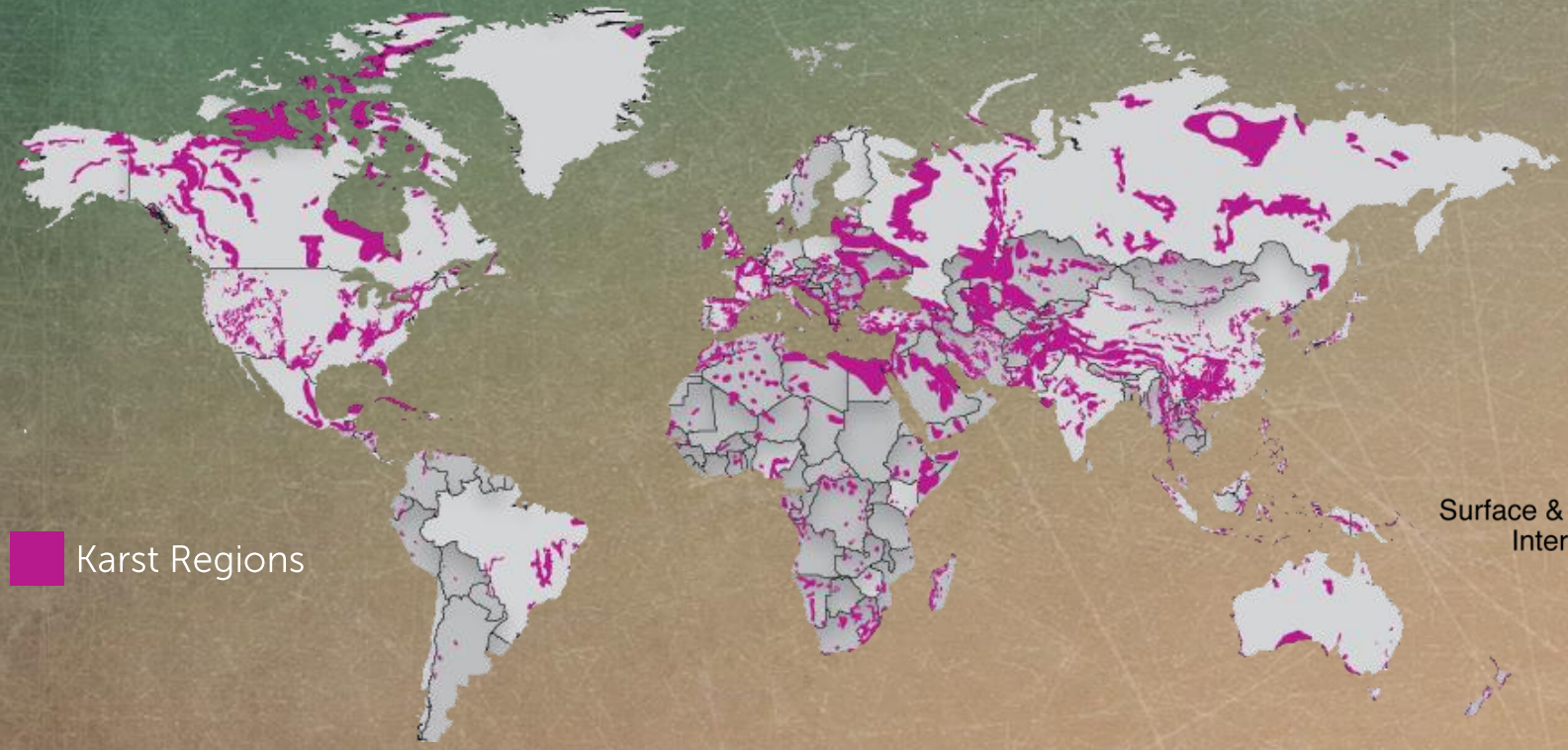
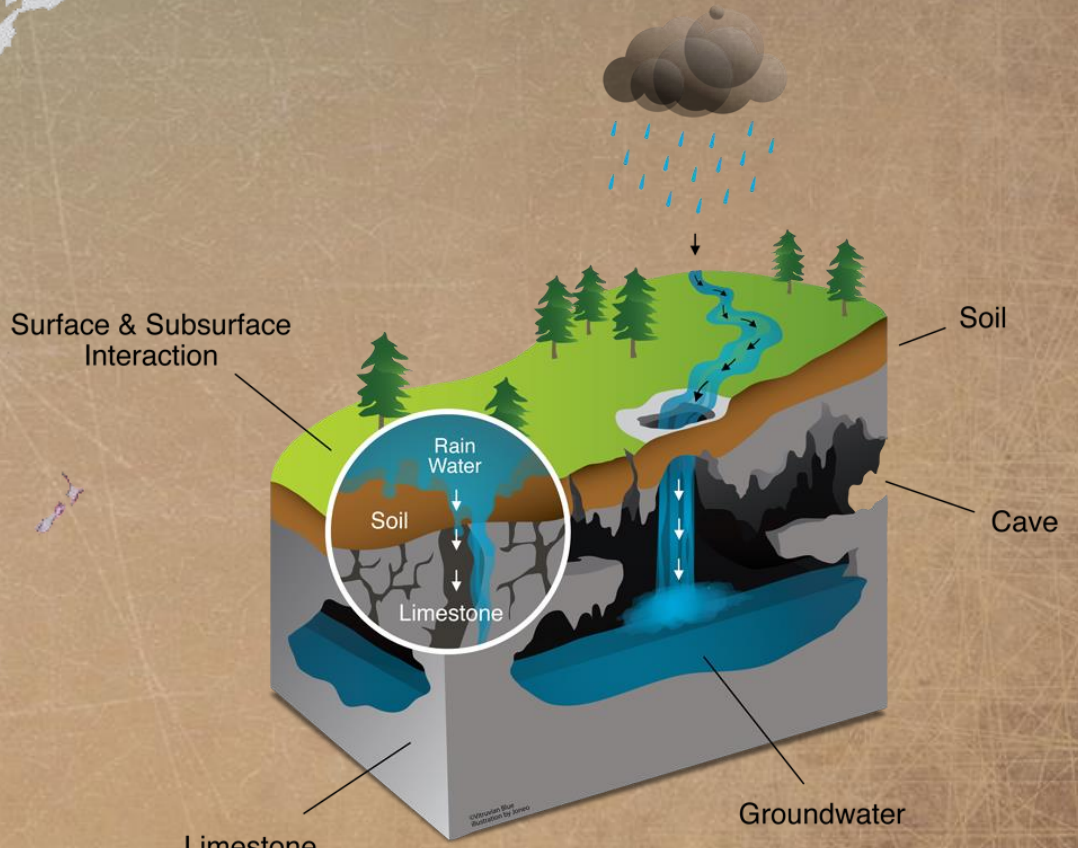
KARST LANDSCAPES



(CIRCLE OF BLUE 2017)

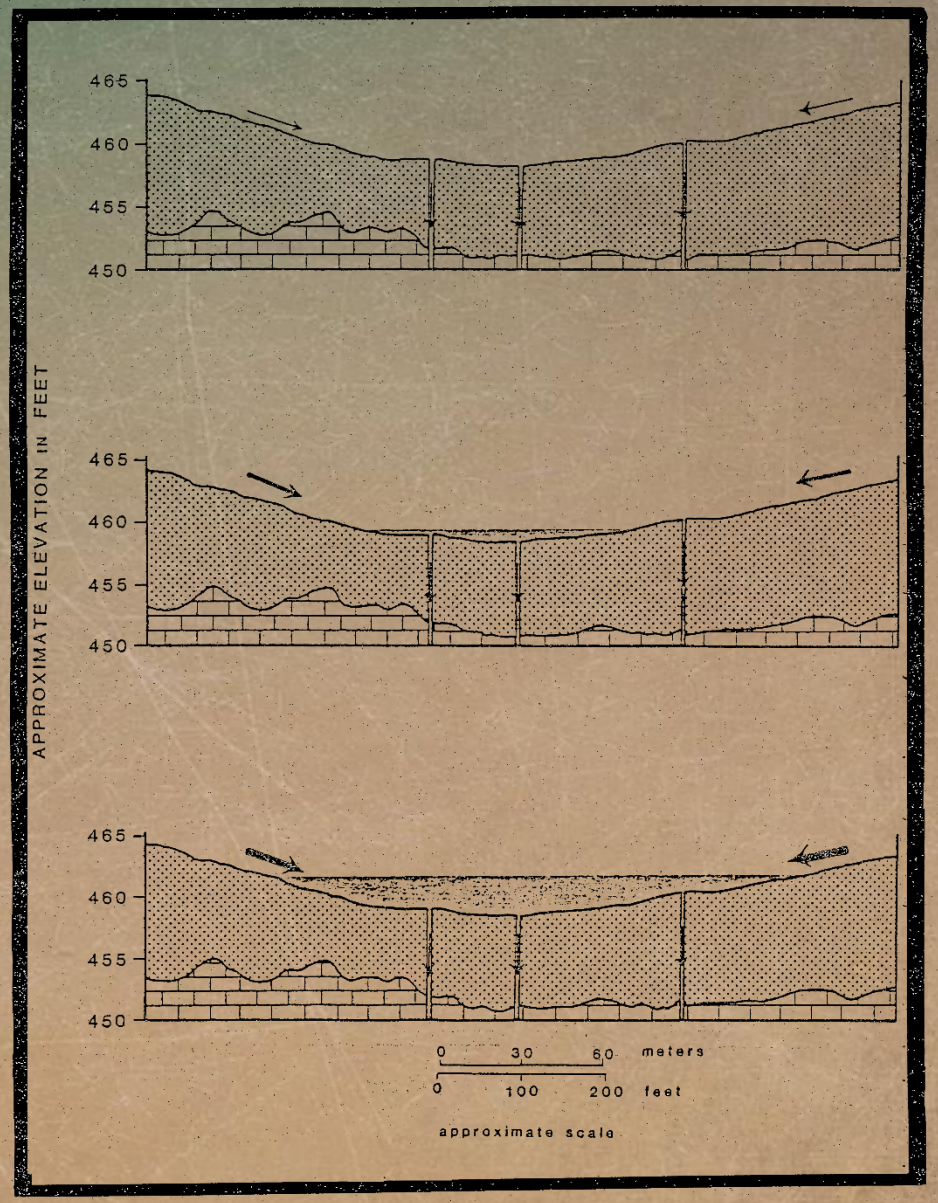


(OGLESBY 2014)

- 20% of the land surface in the United States is underlain by karst geology (Williams 1993; White et al. 1995; Veni et al. 2001)

KARST FLOODING

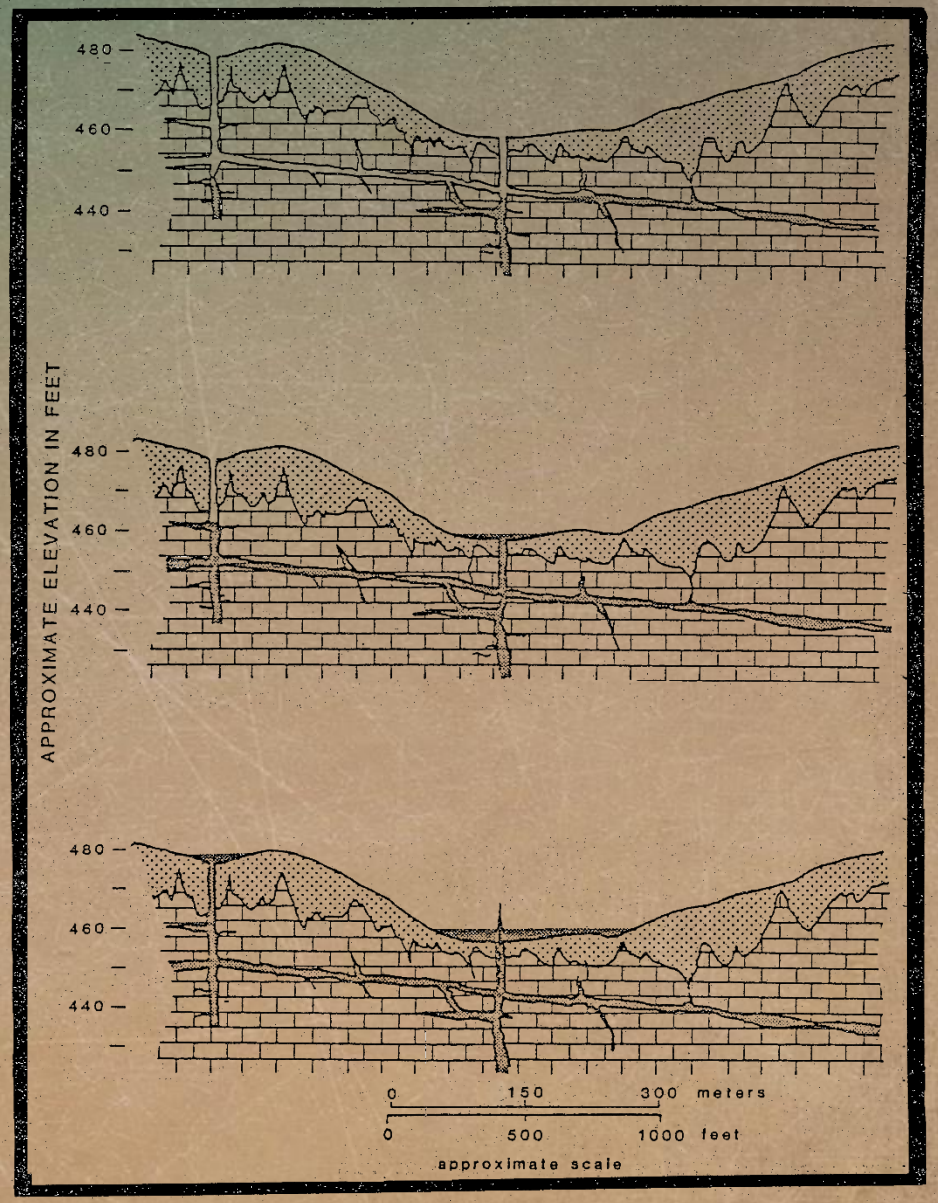
- RECHARGE-RELATED



(CRAWFORD 1987)

KARST FLOODING

- RECHARGE-RELATED
- FLOW-RELATED



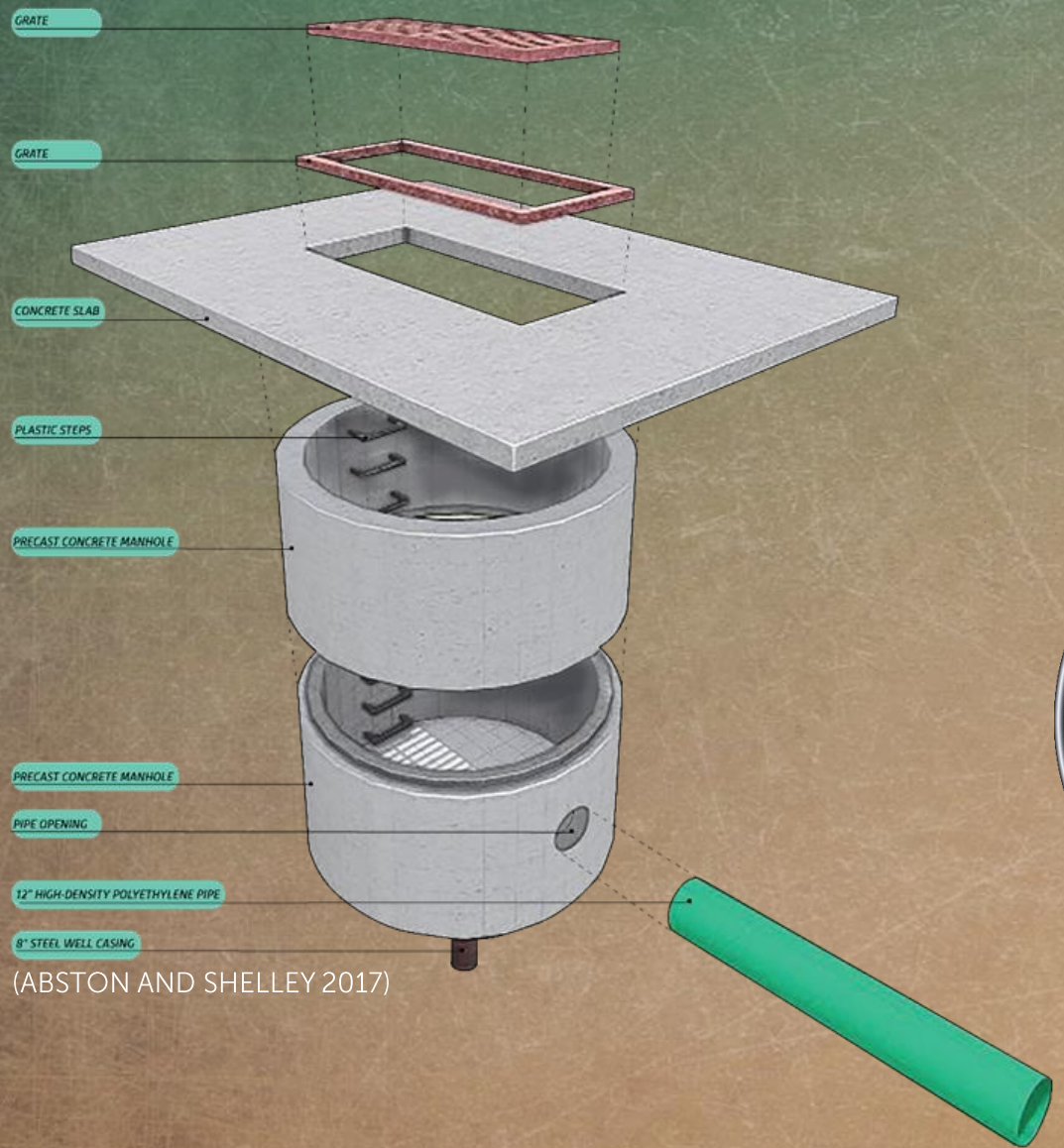
(CRAWFORD 1987)

KARST FLOODING

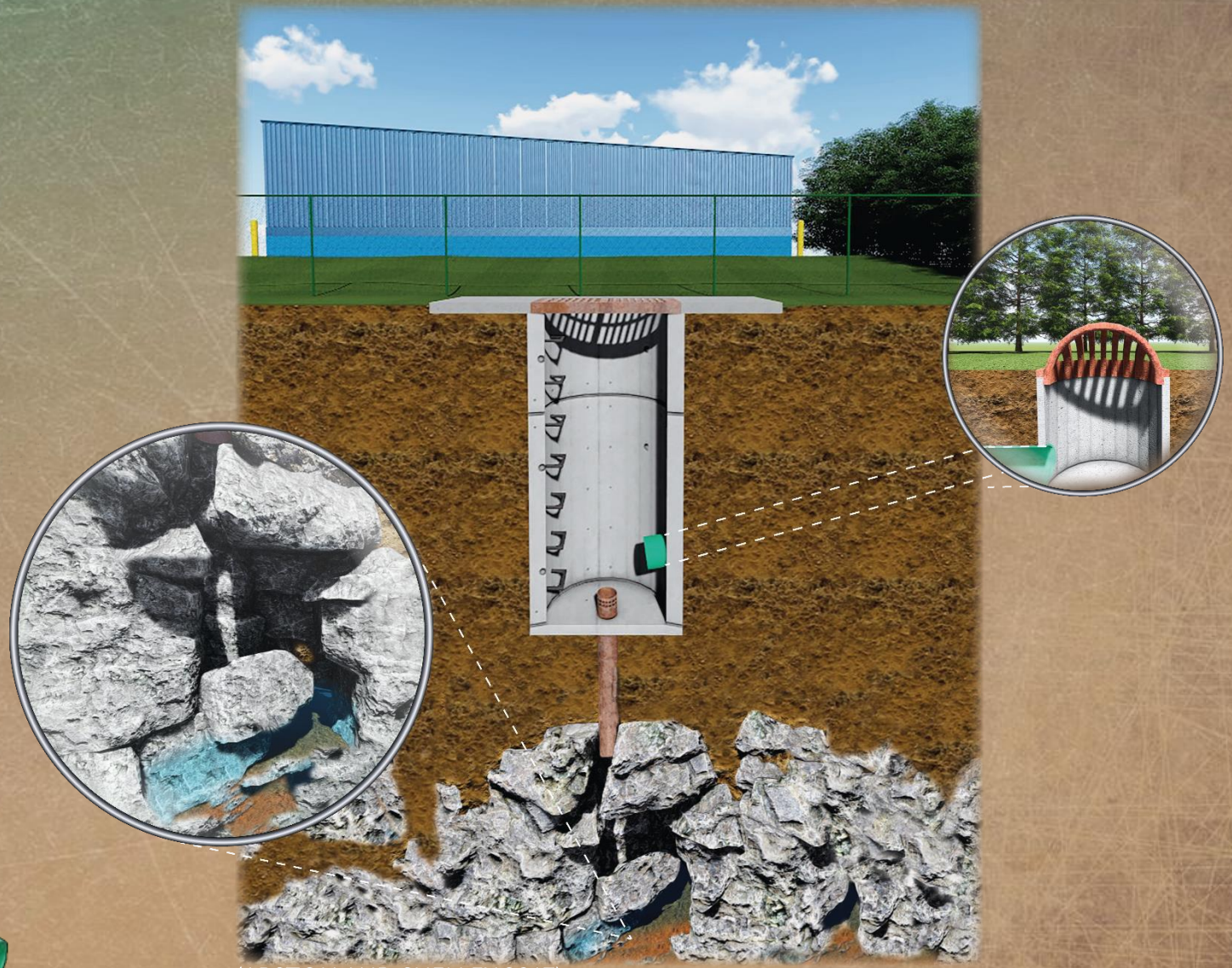
- RECHARGE-RELATED
- FLOW-RELATED
- DISCHARGE-RELATED

(CRAWFORD 1987)

CLASS V INJECTION WELL

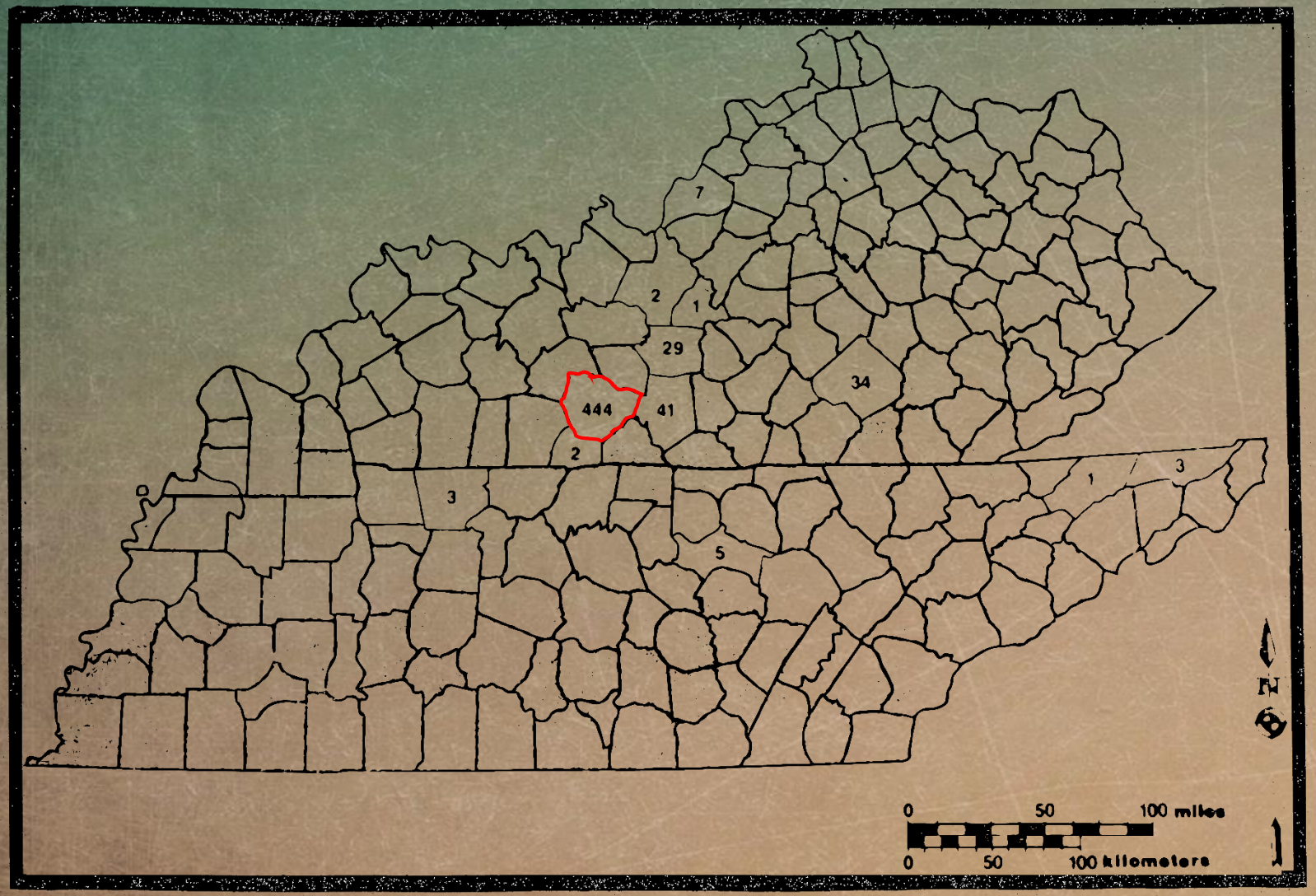


(ABSTON AND SHELLEY 2017)



(ABSTON AND SHELLEY 2017)

LITERATURE REVIEW



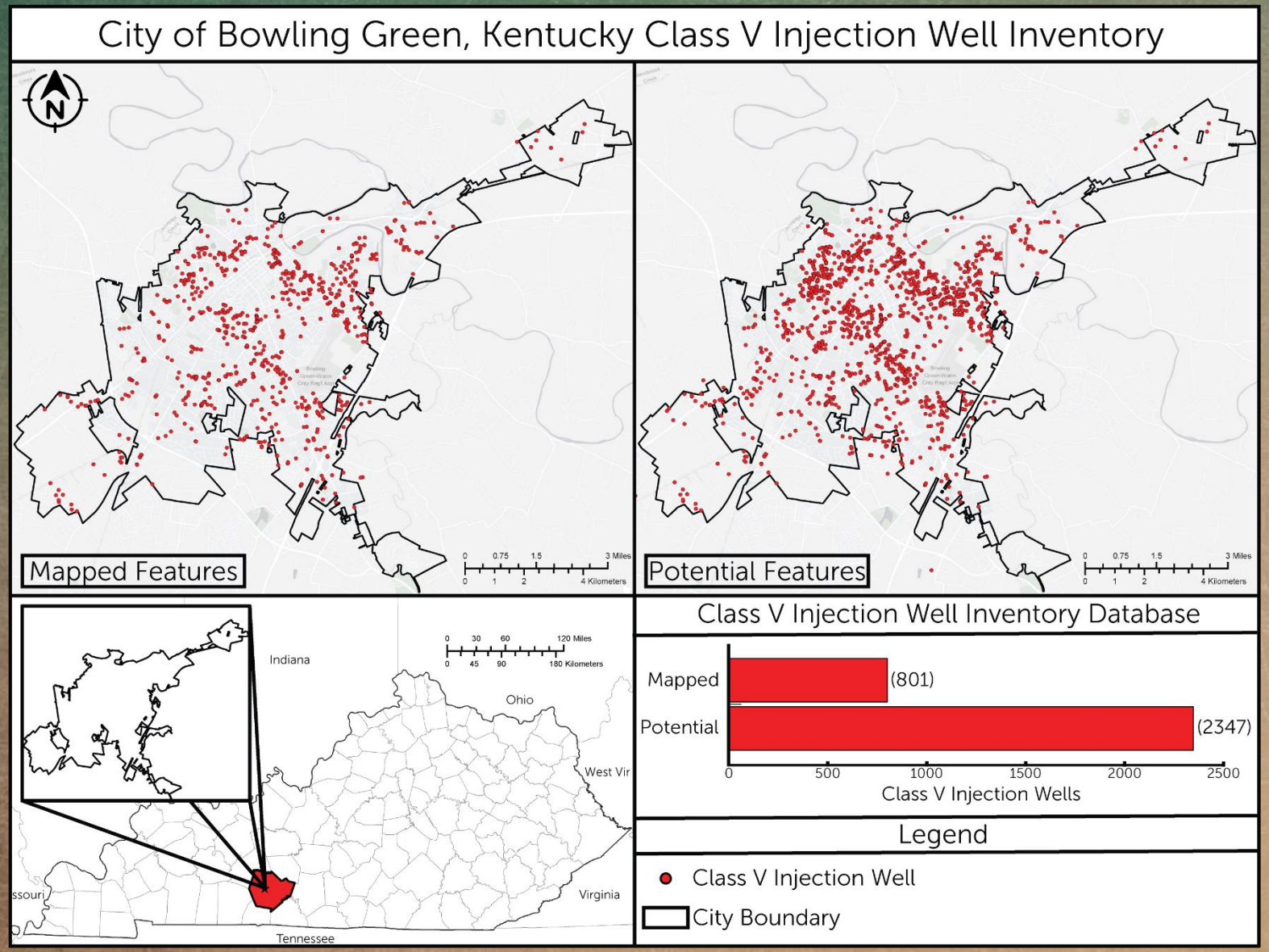
(CRAWFORD AND GROVES 1984A)

- 572 Injection Wells Identified
- 444 Located in Bowling Green

(BG DAILY 2017)

(SHELLEY 2017)

CURRENT CONDITIONS



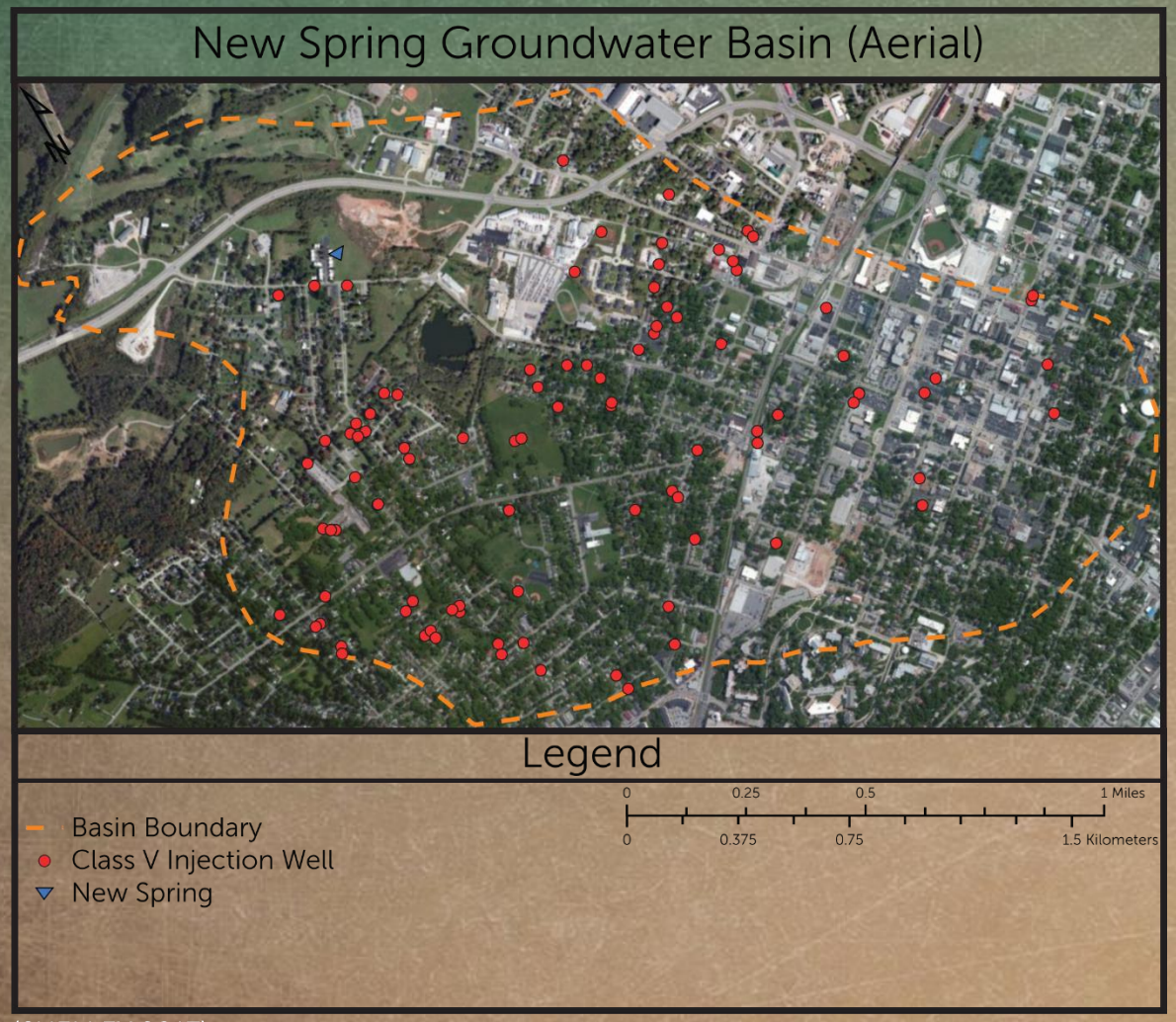
RESEARCH QUESTIONS

- Can monitoring and modeling the response of Class V Injection Wells, and the primary drainage basin outlet to which they flow, under variable storm conditions prove to be a reliable method for assessing flood risk in UKAs?

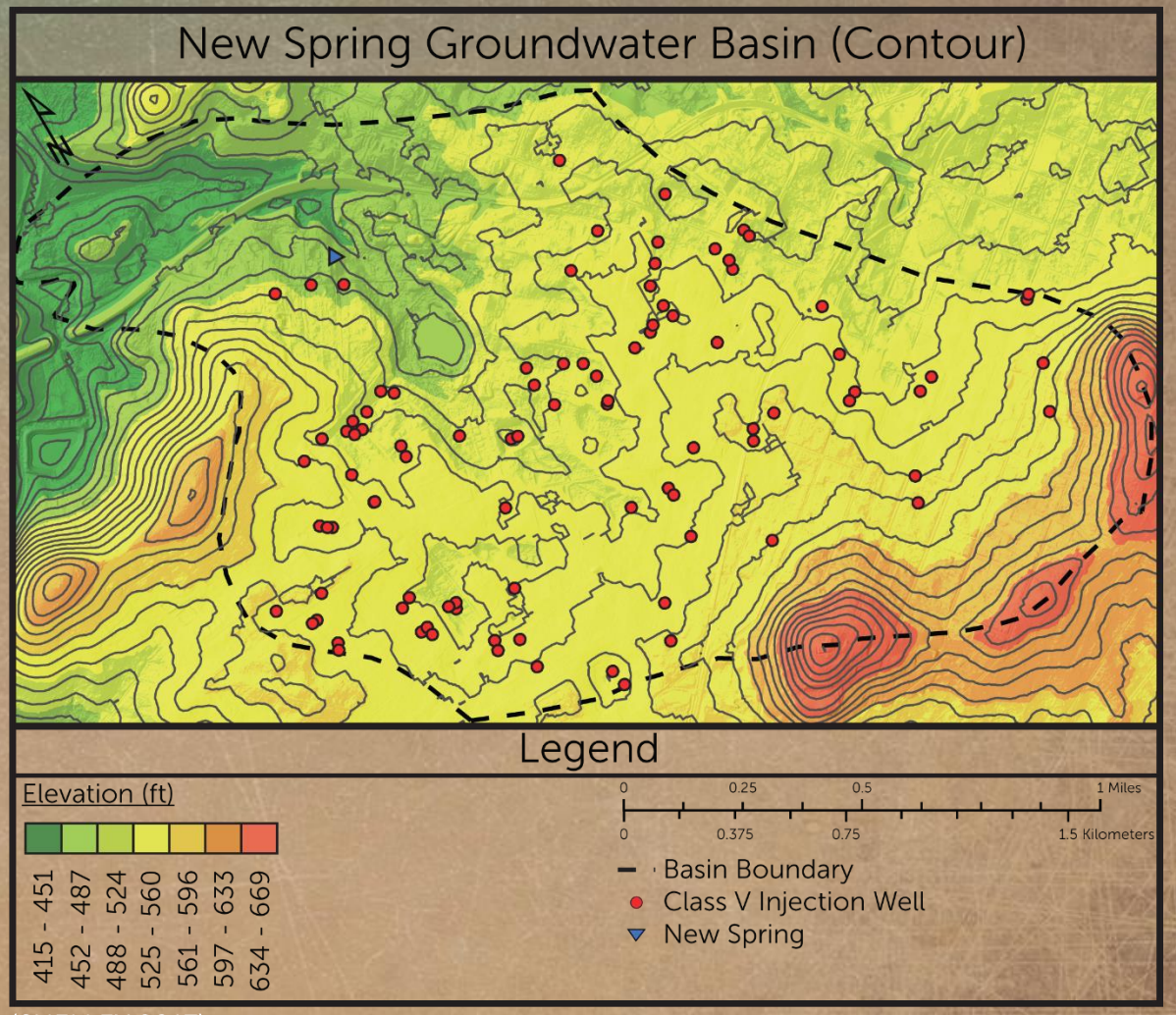
- Are the current guidelines regulating the siting, design, and best management practices for Class V Injection Wells in the CoBG effective at mitigating flood risk for the more probabilistic design storms?

- What siting, design, and maintenance BMP's would be effective at improving the drainage capacity and prolonging the longevity of Class V Injection Wells?

STUDY AREA

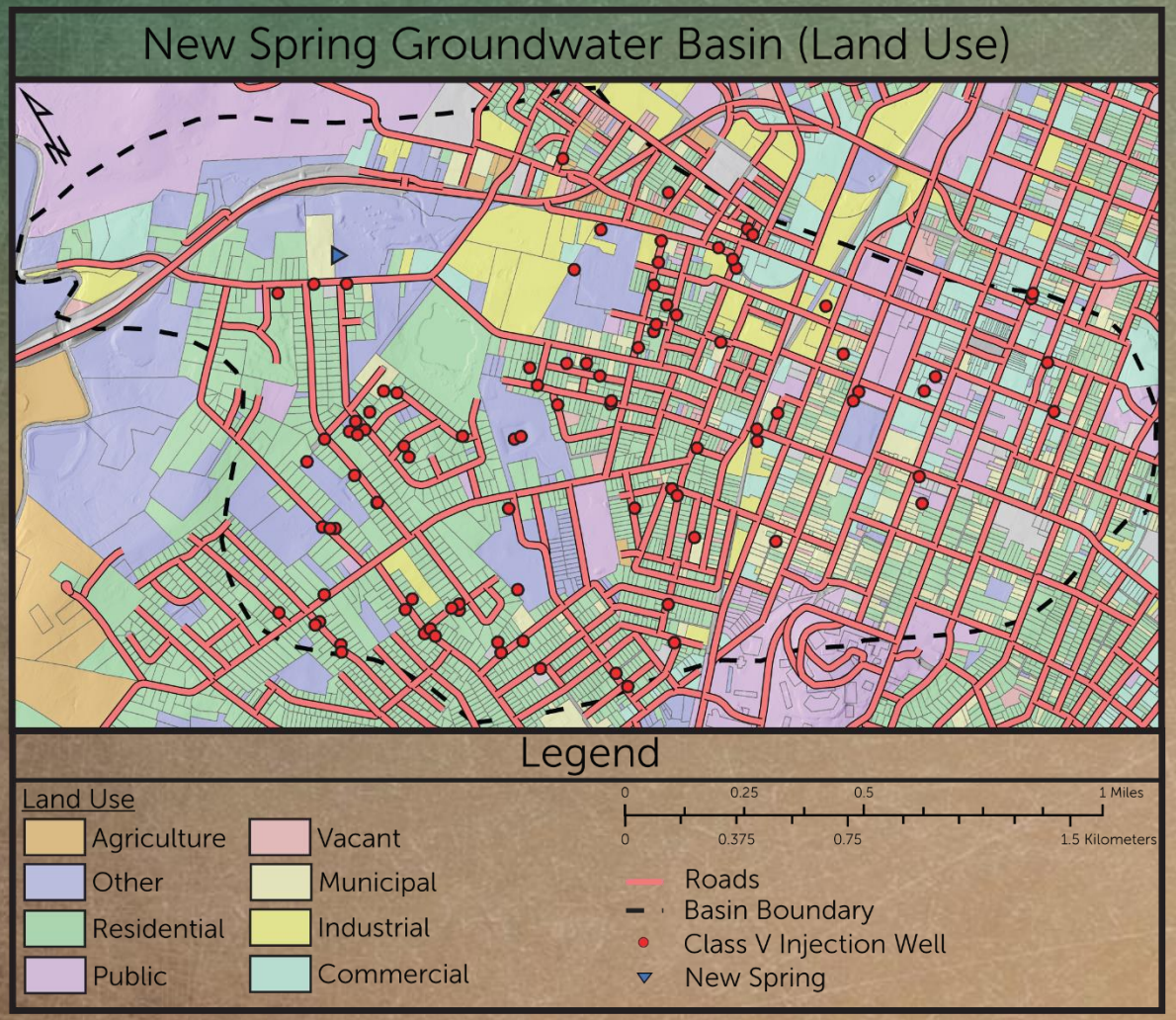


(SHELLEY 2017)

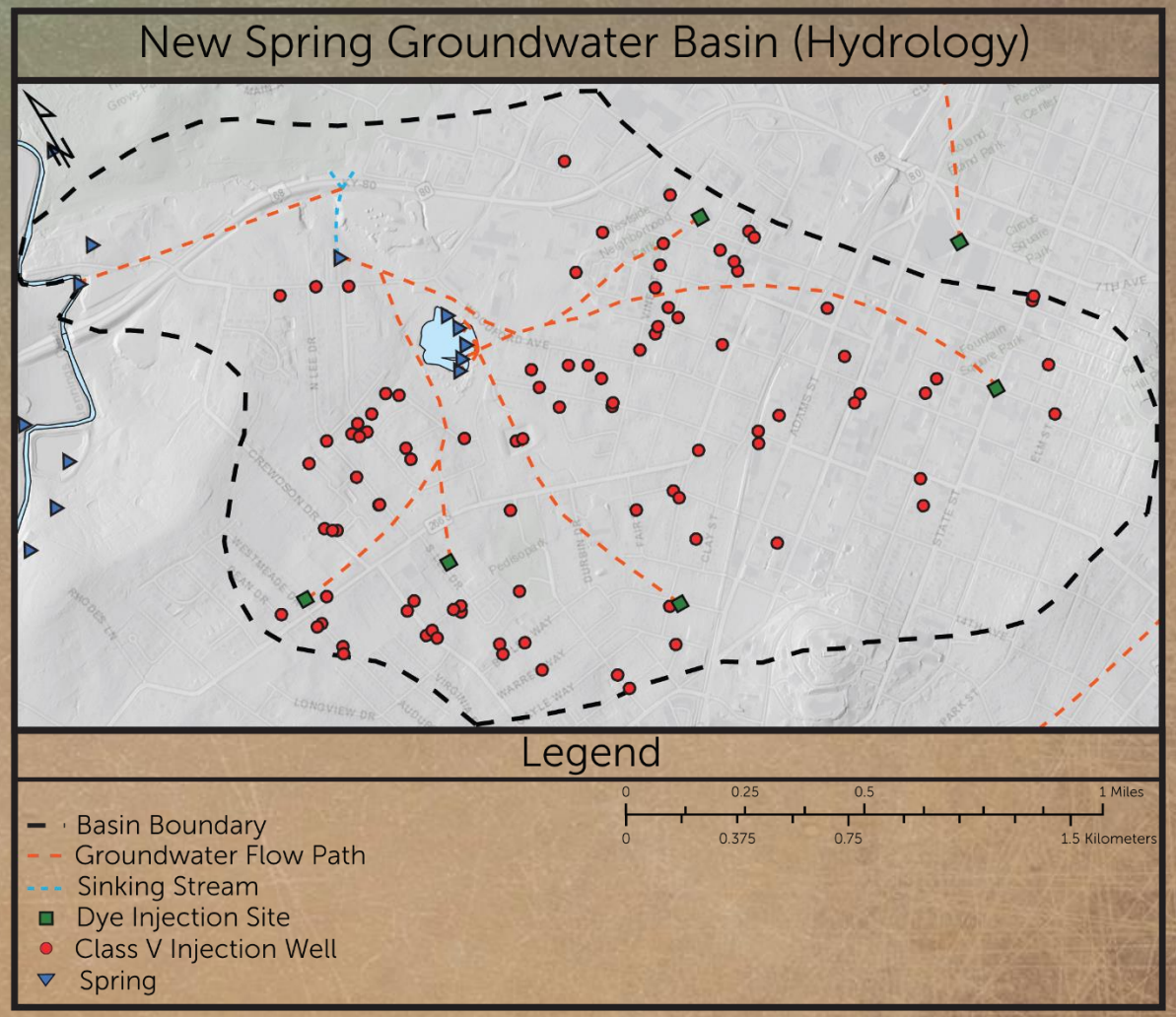


(SHELLEY 2017)

STUDY AREA

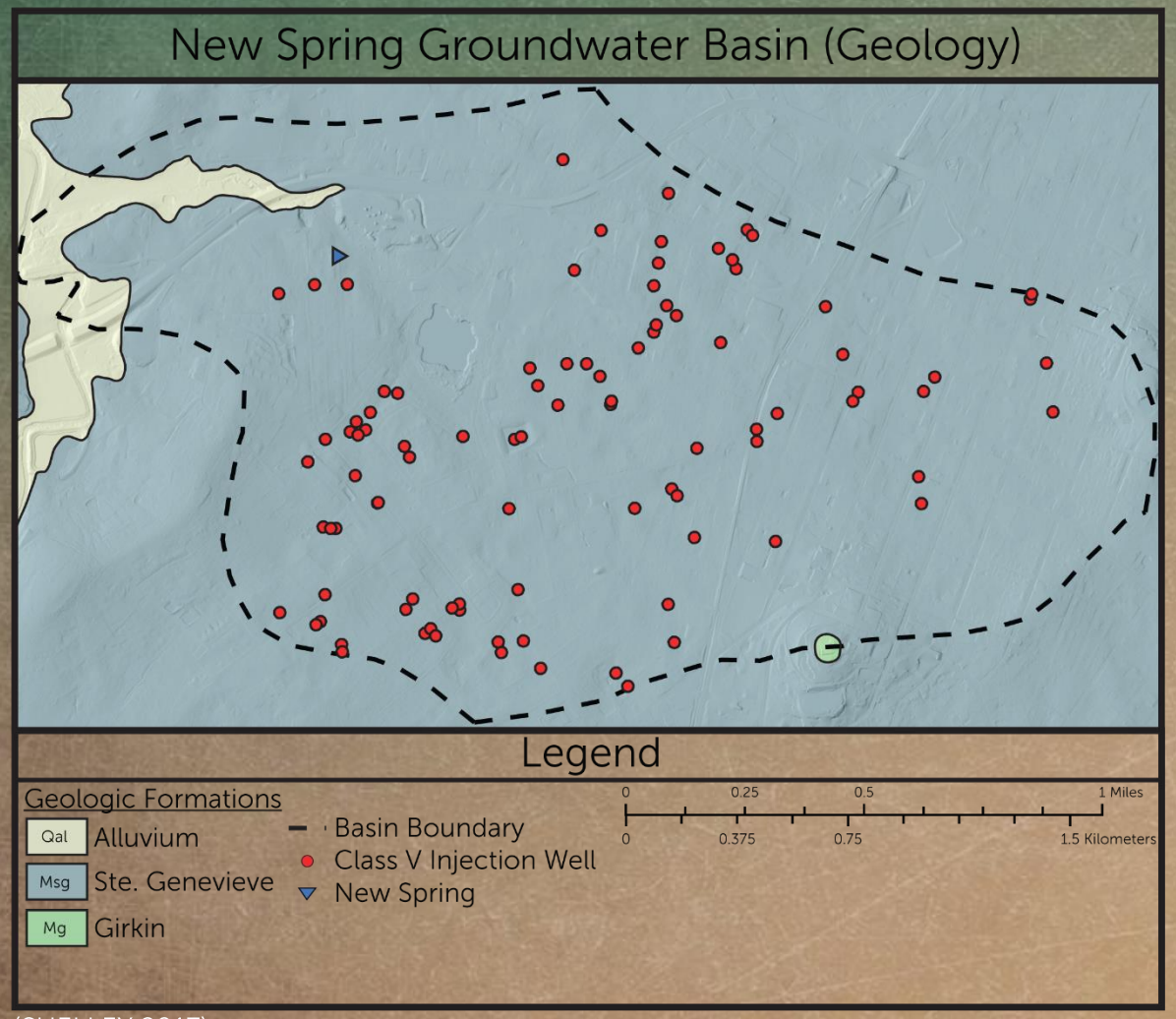


(SHELLEY 2017)

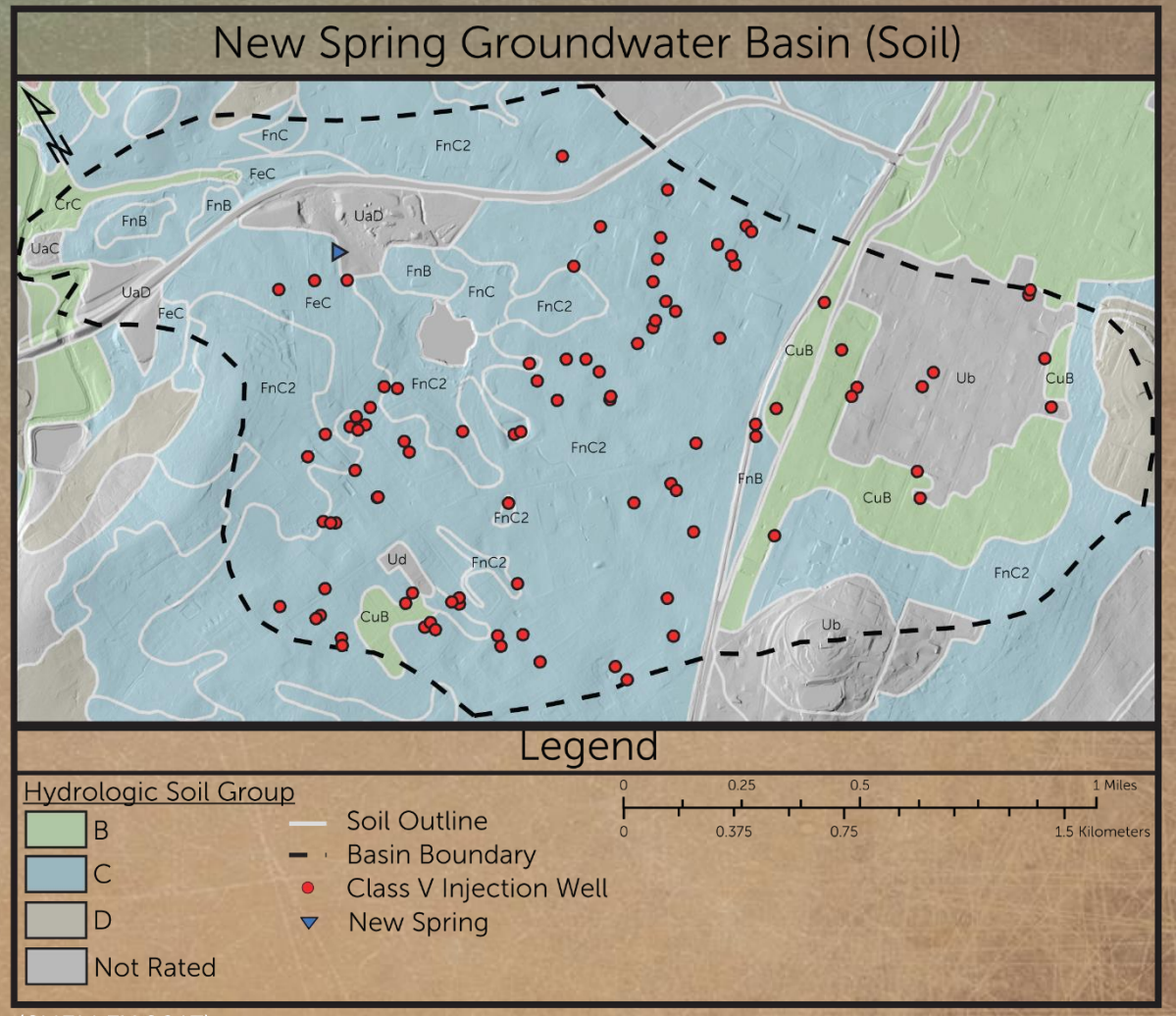


(SHELLEY 2017)

STUDY AREA

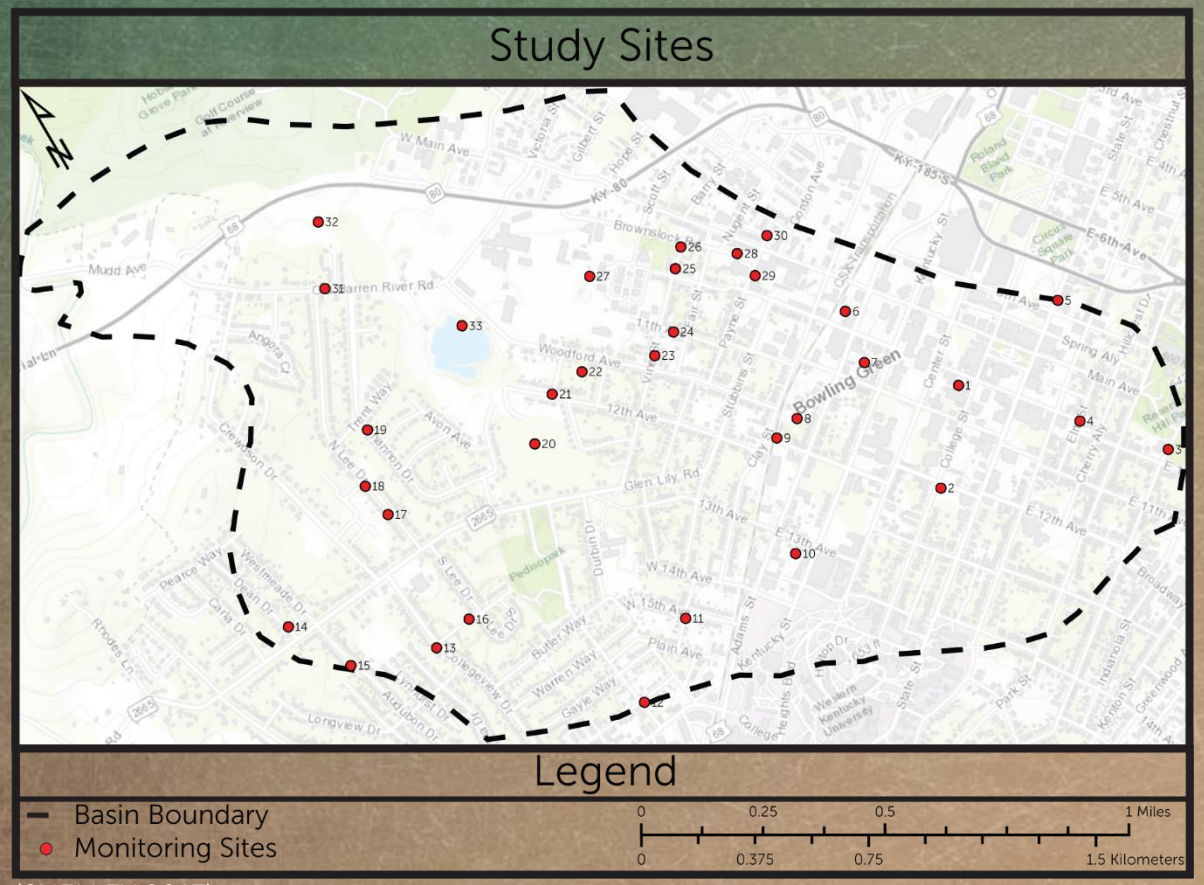


(SHELLEY 2017)

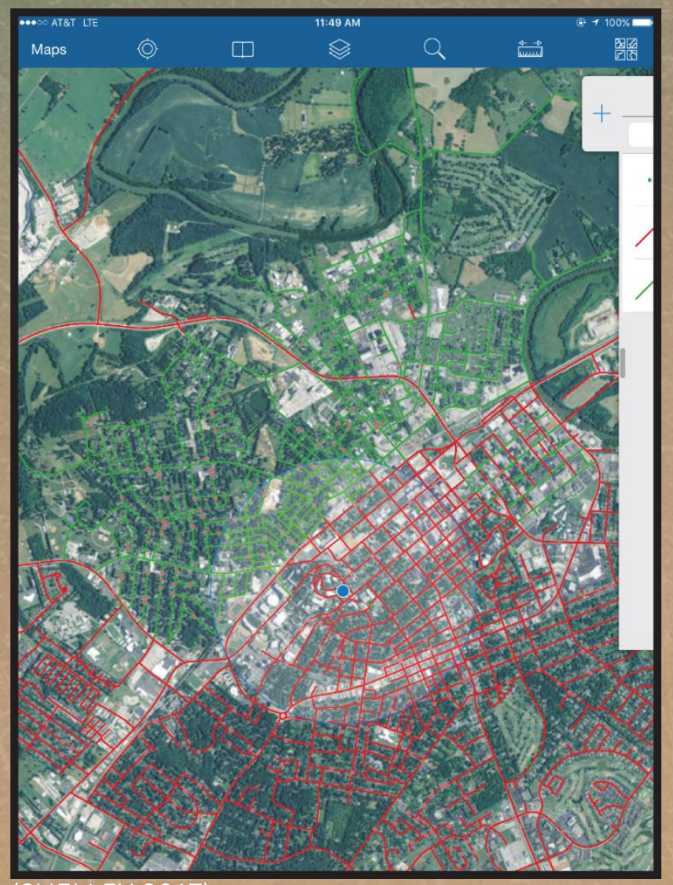


(SHELLEY 2017)

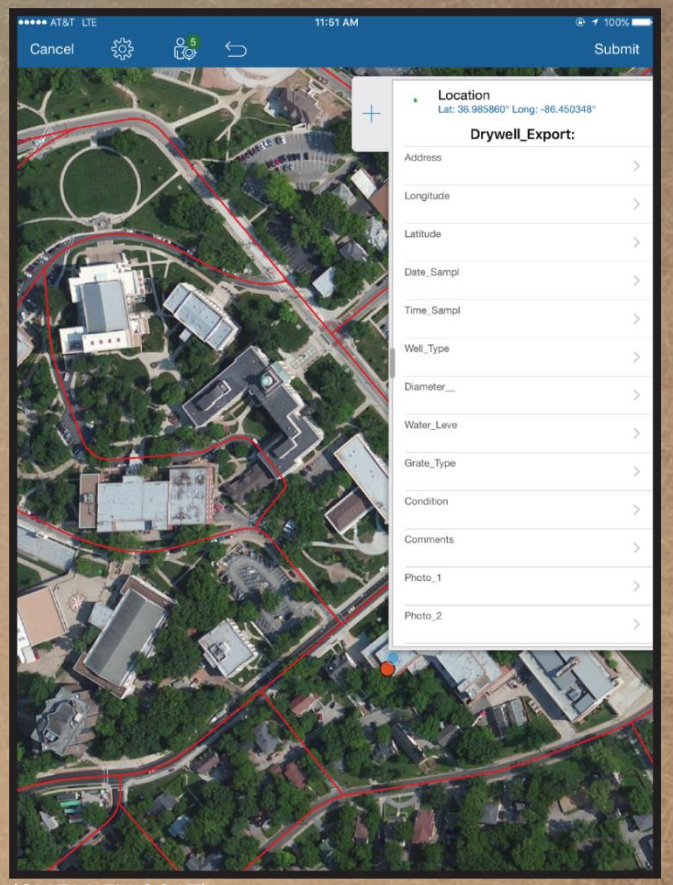
METHODS (SITE SELECTION)



(SHELLEY 2017)



(SHELLEY 2017)



(SHELLEY 2017)

METHODS (MONITORING)

WEATHER CONDITIONS

(SHELLEY 2017)

GROUNDWATER FLUCTUATIONS

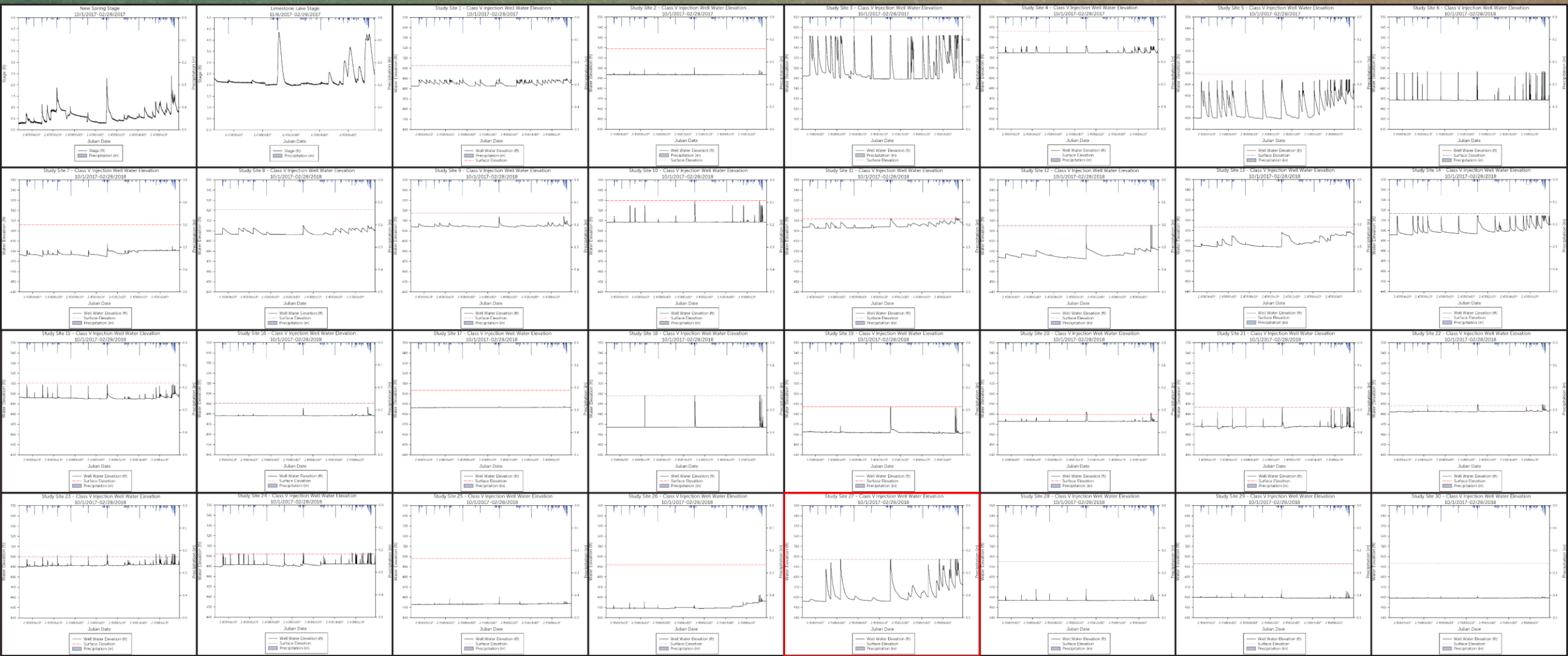
(POLK 2017)

OUTLET SPRING DISCHARGE

(KAISER 2017)

METHODS (ANALYSIS)

- Runoff, Well, and Spring Hydrograph Time-Series Analysis



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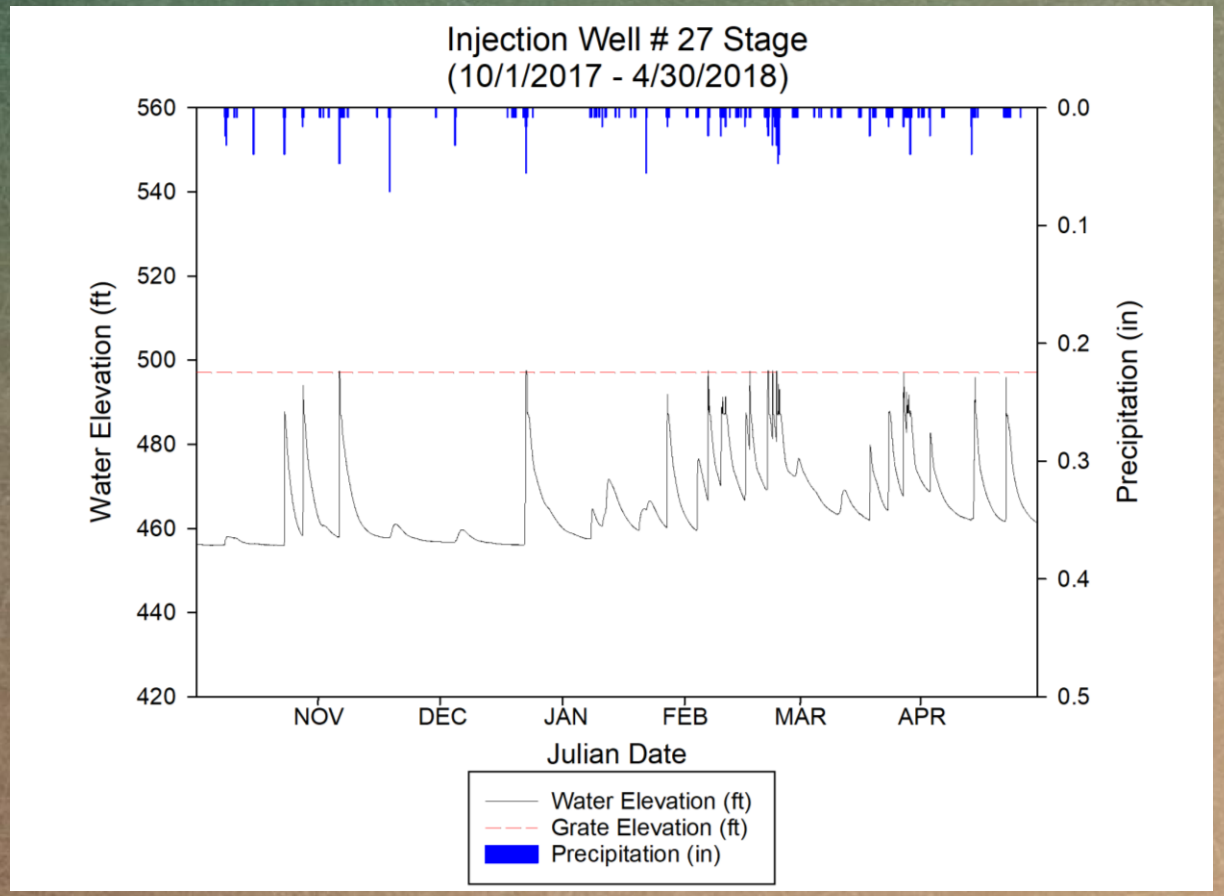
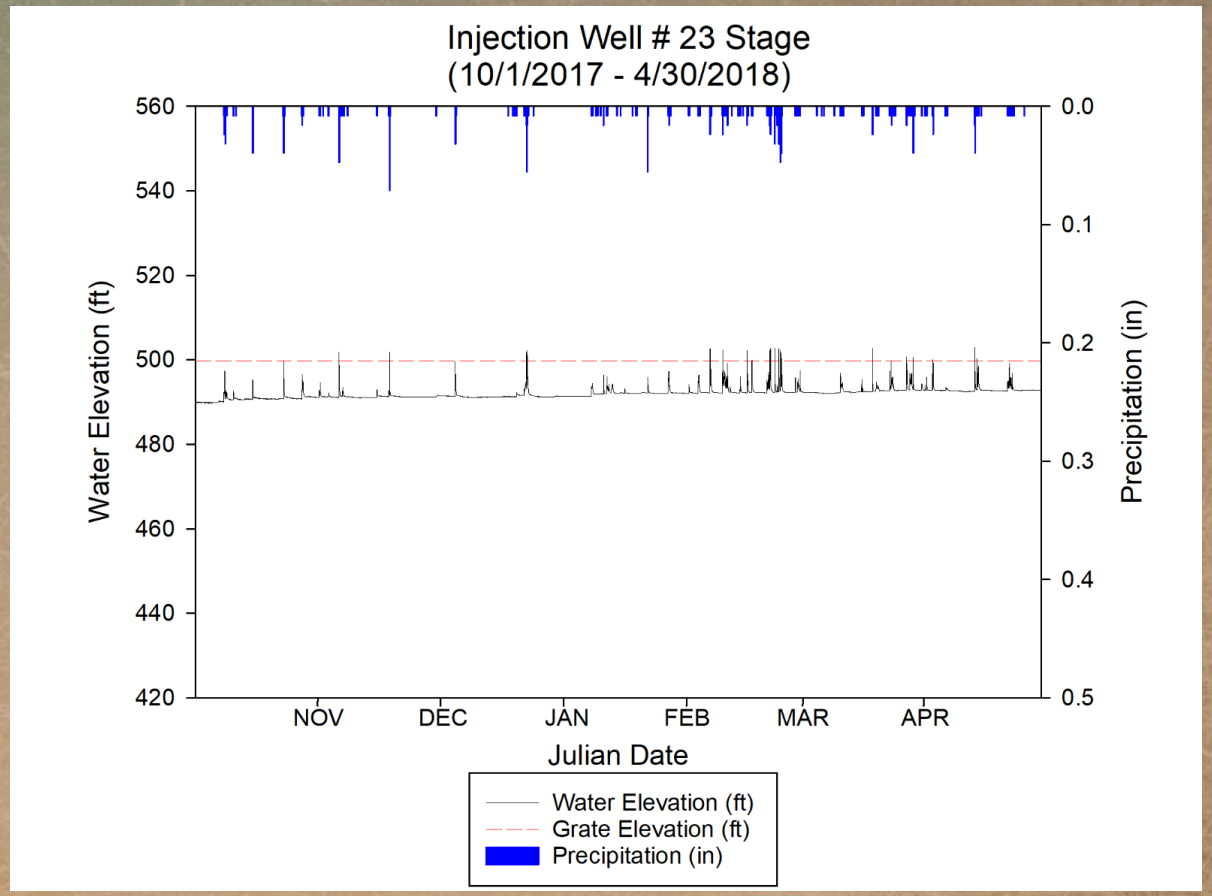
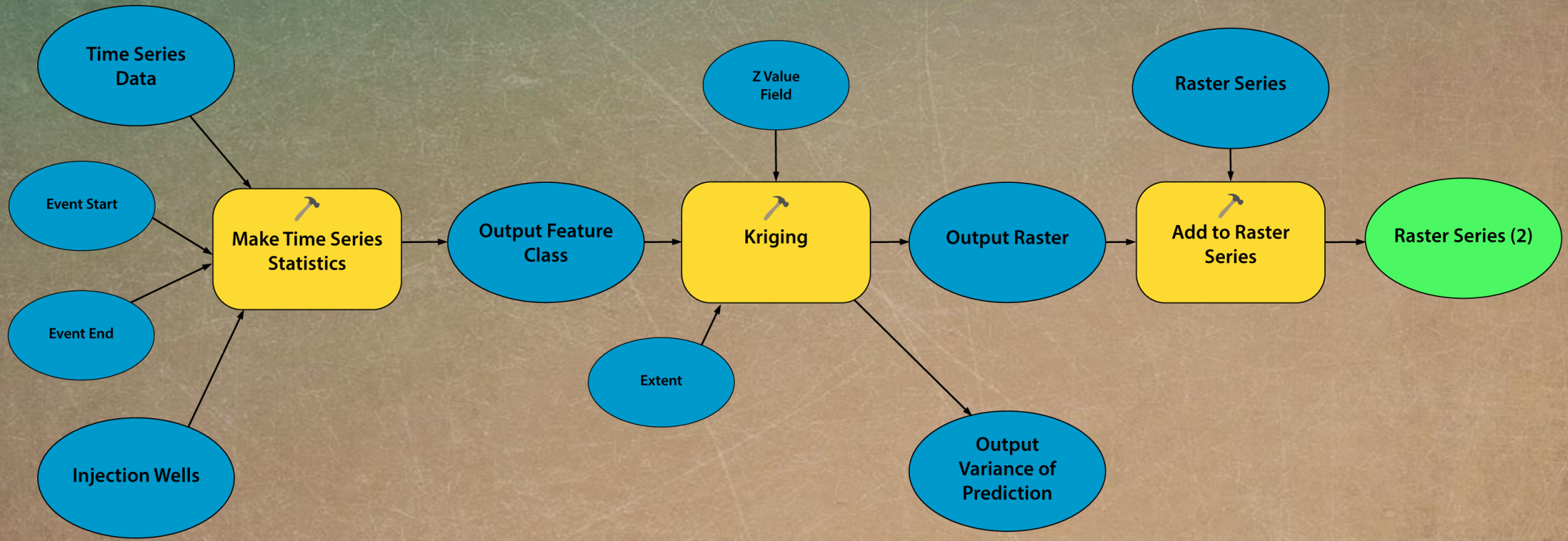


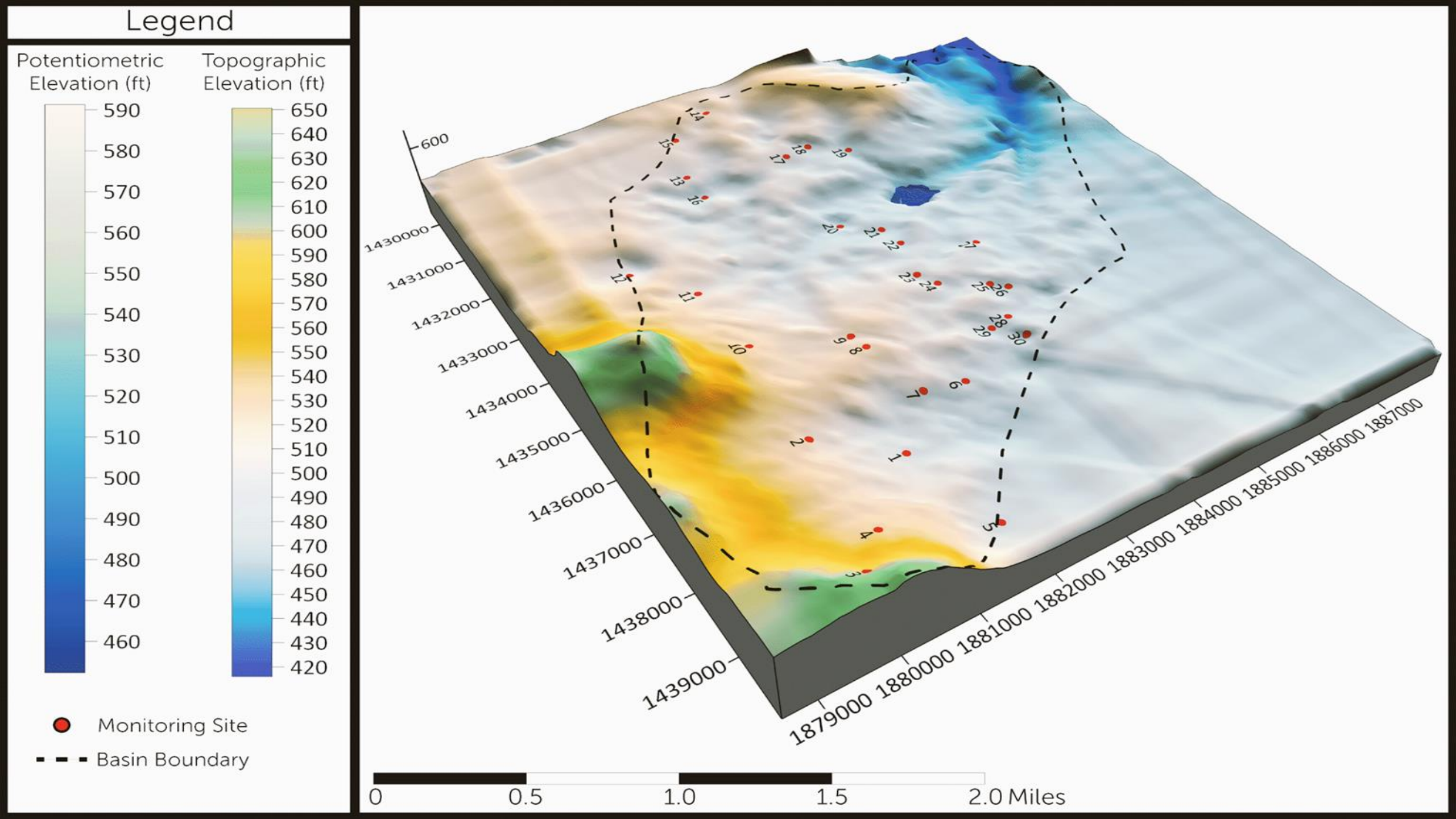


METHODS (ANALYSIS)

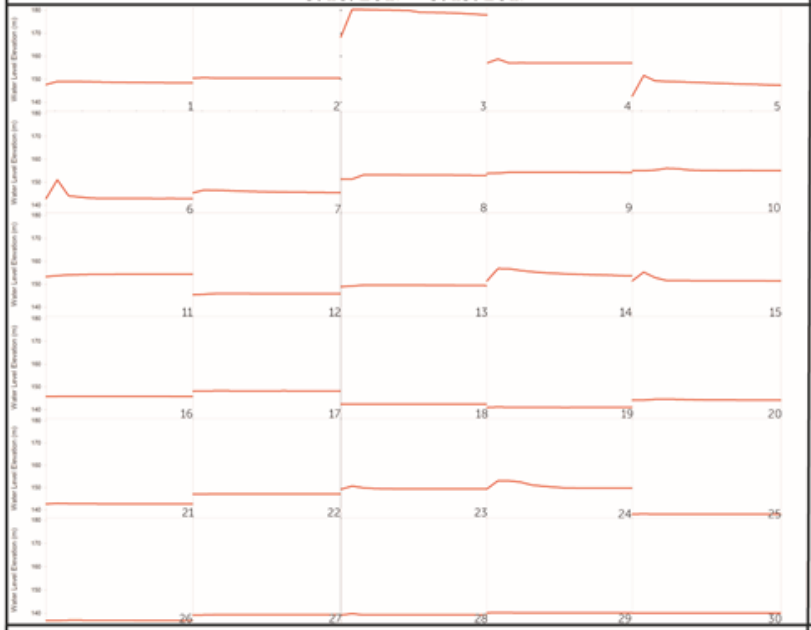
Universal Kriging Model



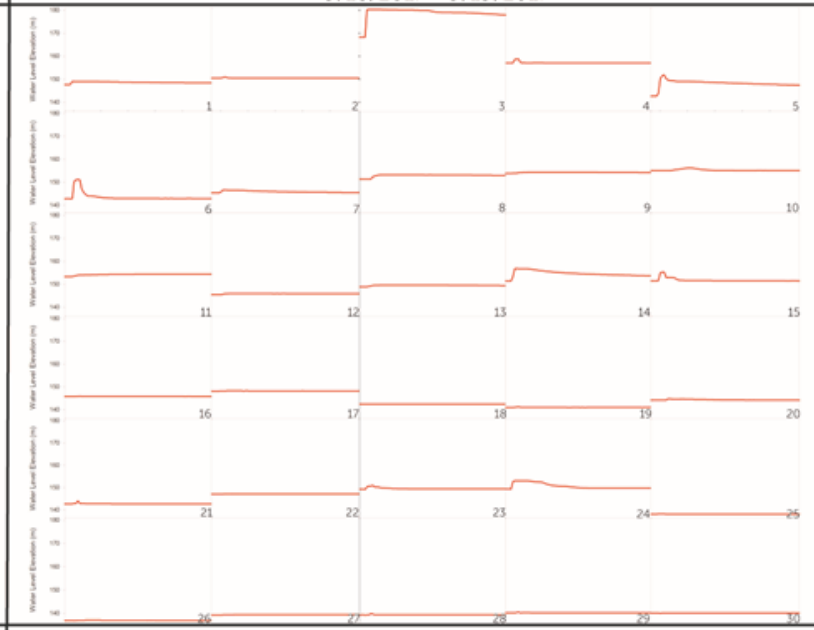
(SHELLEY 2016, ADAPTED FROM STRASSBERG ET AL. 2011)


Legend
Potentiometric Elevation (ft)
590
580
570
560
550
540
530
520
510
500
490
480
470
460
Topographic Elevation (ft)
650
640
630
620
610
600
590
580
570
560
550
540
530
520
510
500
490
480
470
460
450
440
430
420
Monitoring Site
Basin Boundary
600
1430000
1431000
1432000
1433000
1434000
1435000
1436000
1437000
1438000
1439000
1879000
1880000
1881000
1882000
1883000
1884000
1885000
1886000
1887000
0
0.5
1.0
1.5
2.0 Miles

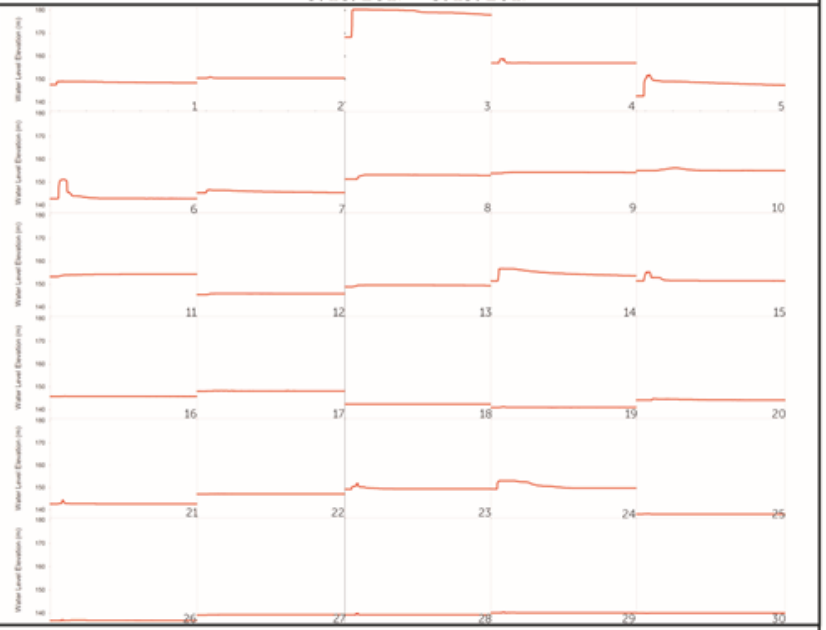
Well Hydrographs (1-30) 1-Hour Resolution
9/18/2017 - 9/19/2017



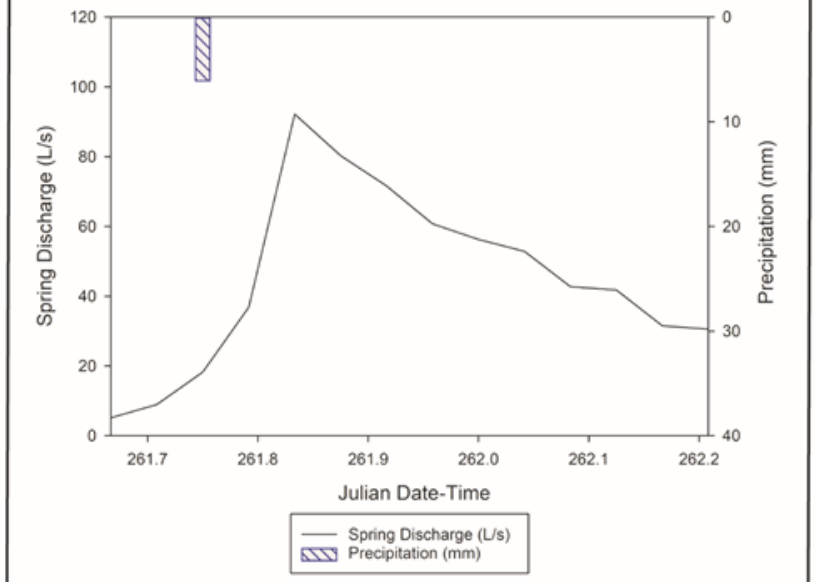
Well Hydrographs (1-30) 10 Minute Resolution
9/18/2017 - 9/19/2017



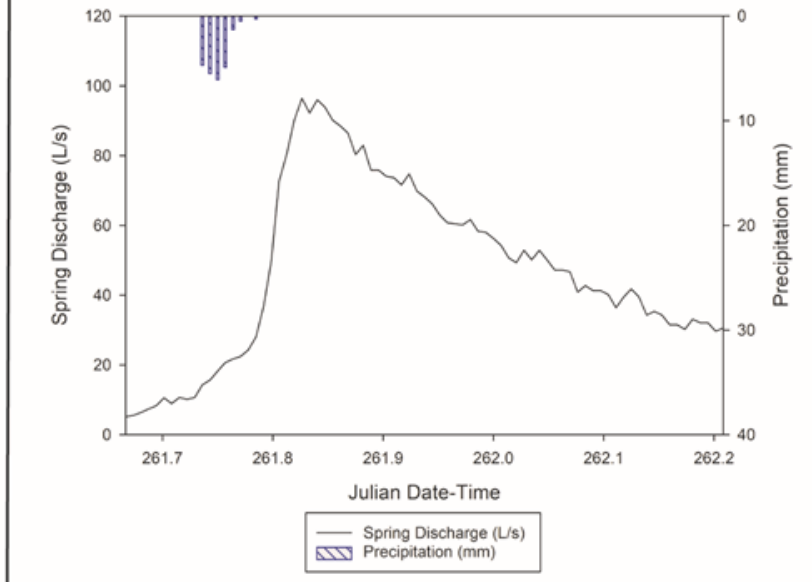
Well Hydrographs (1-30) 1 Minute Resolution
9/18/2017 - 9/19/2017



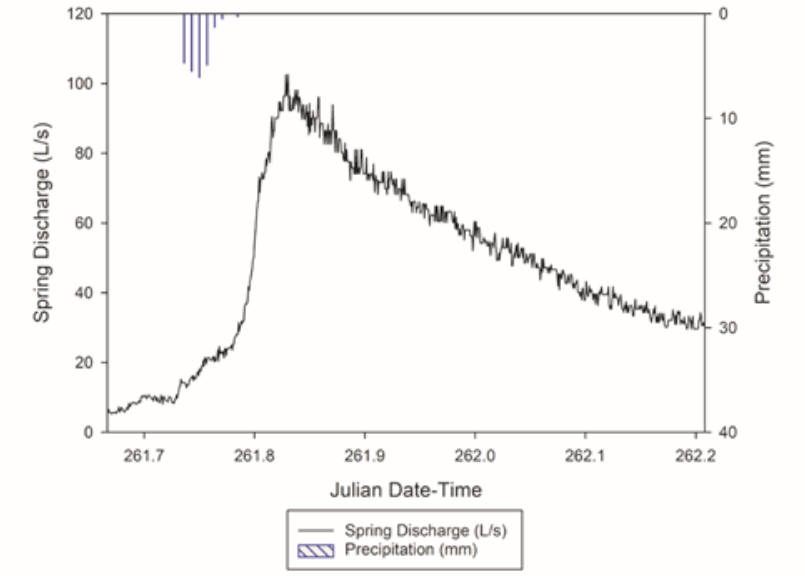
Spring Hydrograph 1-Hour Resolution
9/18/2017 - 9/19/2017



Spring Hydrograph 10-Minute Resolution
9/18/2017 - 9/19/2017



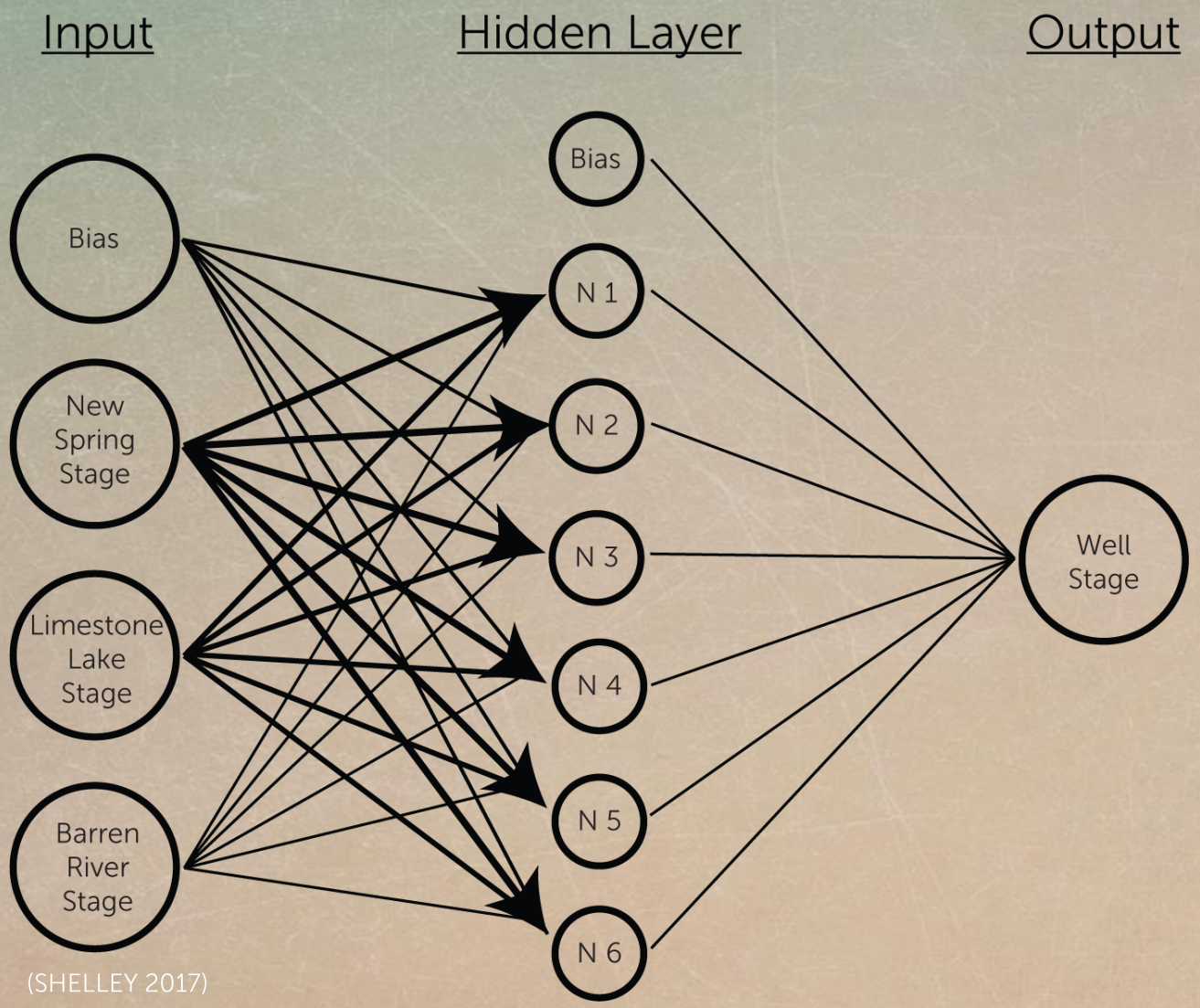
Spring Hydrograph 1-Minute Resolution
9/18/2017 - 9/19/2017



EXPECTED RESULTS

- Policy Recommendations and Informed Stormwater Management Practices.
- Methodology for flood hazard mapping in Urban Karst Areas.
- Improvements in Class V Injection Well siting and design criterion.
- Early Warning System.

FUTURE WORK



(SHELLEY 2017)