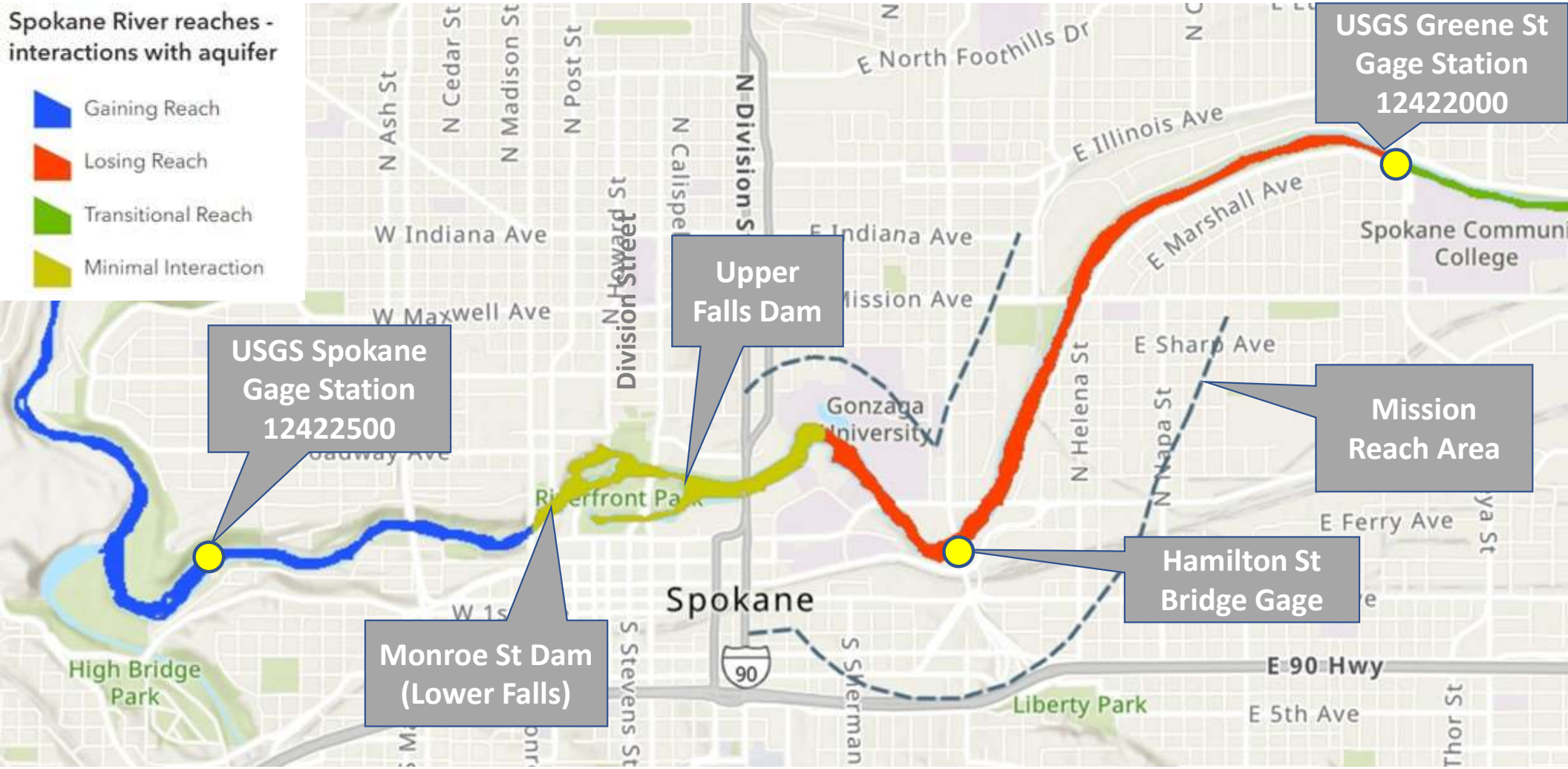
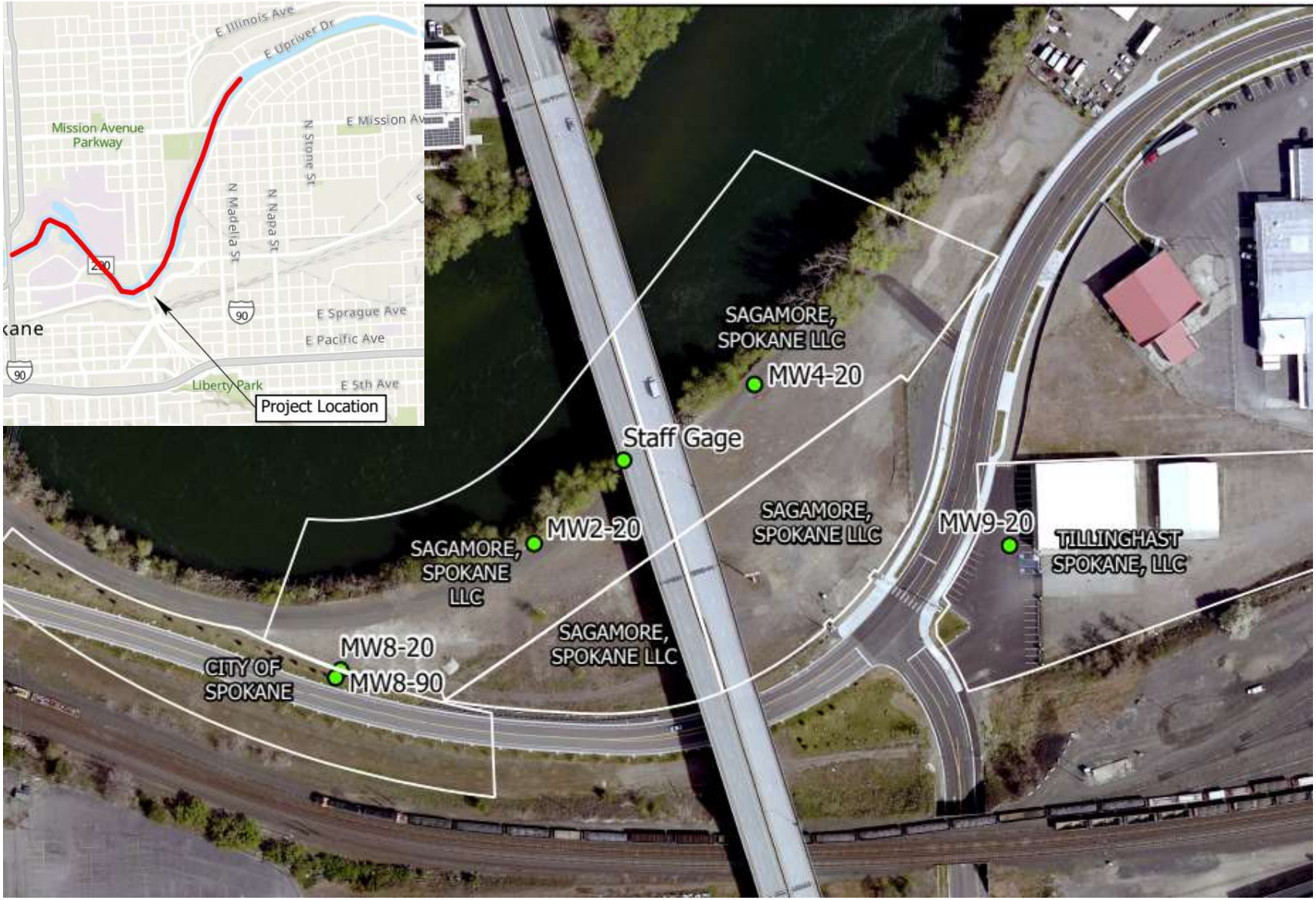
Mission Reach Groundwater Data Evaluations

- Purpose of the Task
  - Collect & examine well information in Mission Reach Area
  - Prepare interactive map
  - Draw whatever conclusions the available data allow about groundwater (GW) flow direction
- Analysis Update
  - Hamilton Street Bridge continuous monitoring data
  - Information on local geology/hydrogeology & general GW flow direction(s)
  - Artesian well/pipe evaluation
- Current Observations & Conclusions

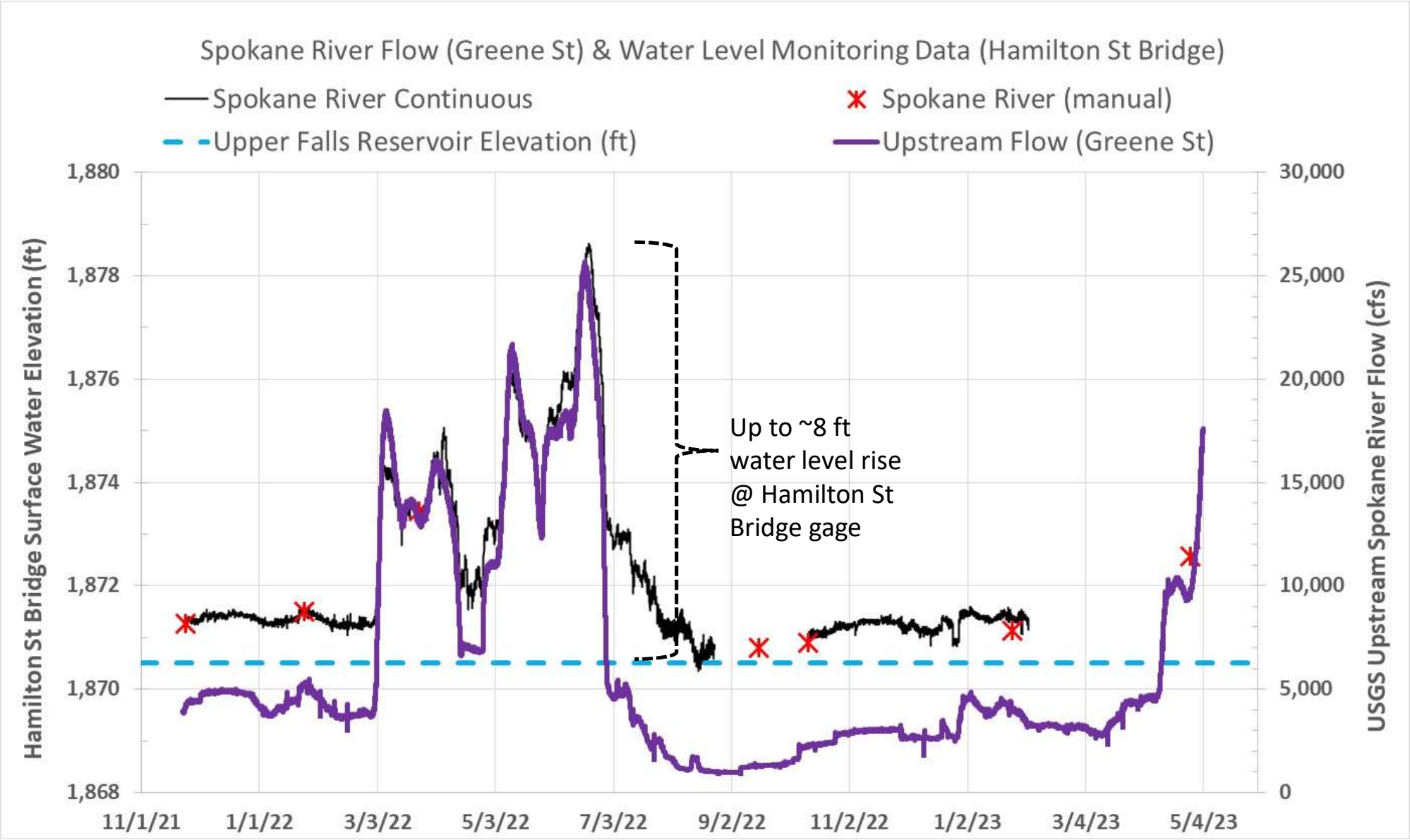
Spokane River Reach Interactions With Groundwater

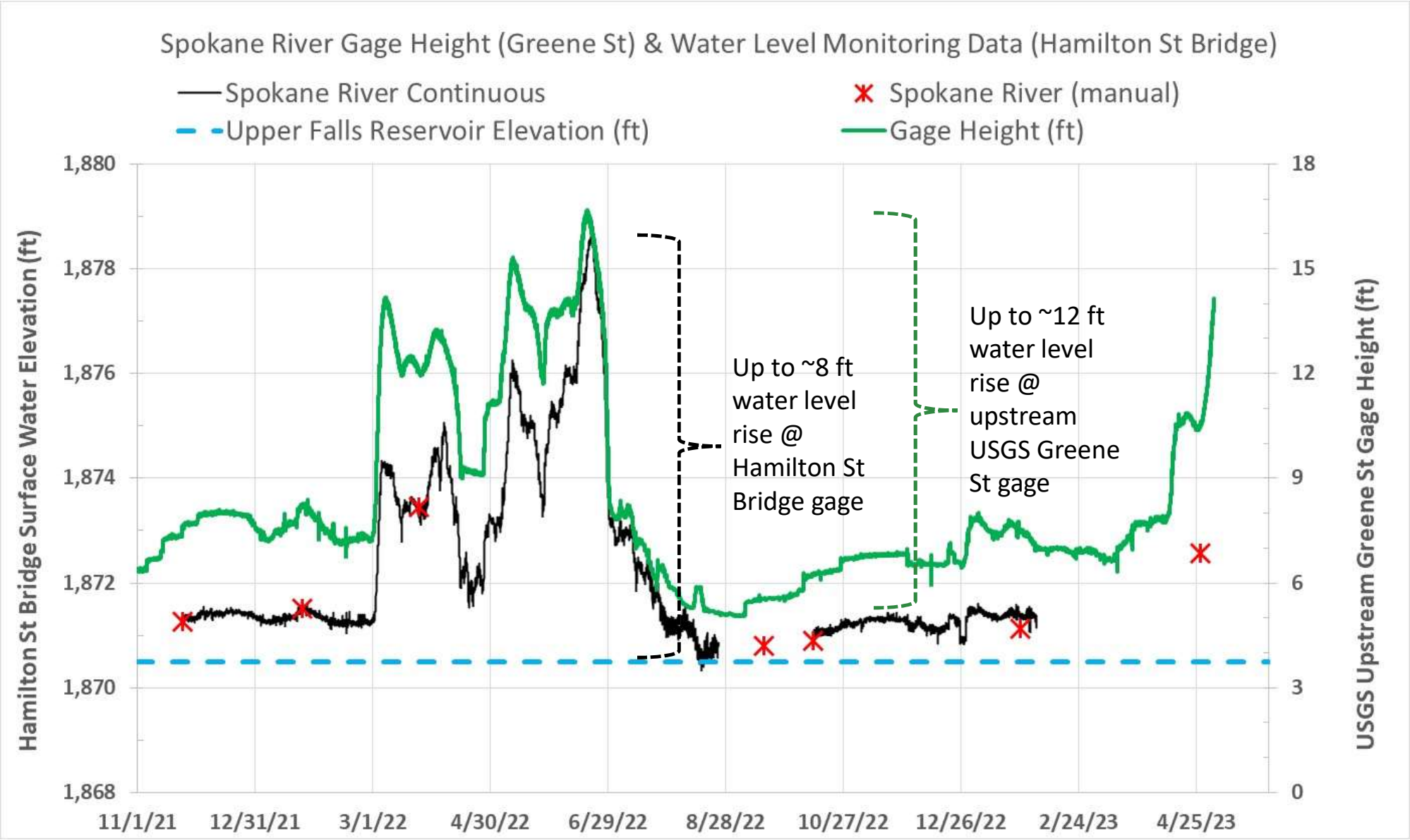


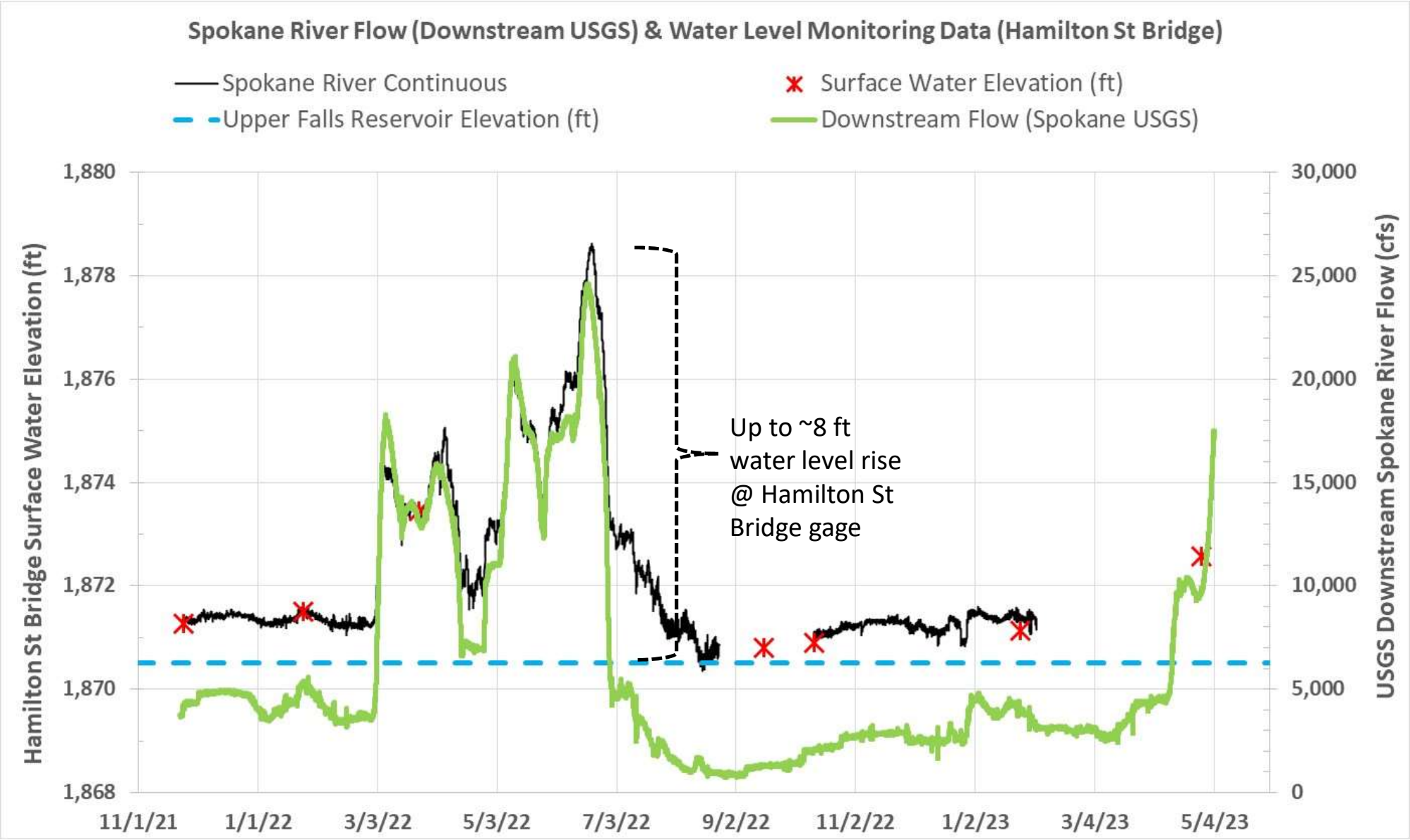

E Illinois Ave
E Upriver Dr
Mission Avenue Parkway
E Mission Av
N Stone St
N Madelia St
N Napa St
290
90
E Sprague Ave
E Pacific Ave
Liberty Park
E 5th Ave
Project Location
SAGAMORE, SPOKANE LLC
MW4-20
Staff Gage
MW2-20
SAGAMORE, SPOKANE LLC
SAGAMORE, SPOKANE LLC
MW9-20
TILLINGHAST SPOKANE, LLC
SAGAMORE, SPOKANE LLC
MW8-20
MW8-90
CITY OF SPOKANE

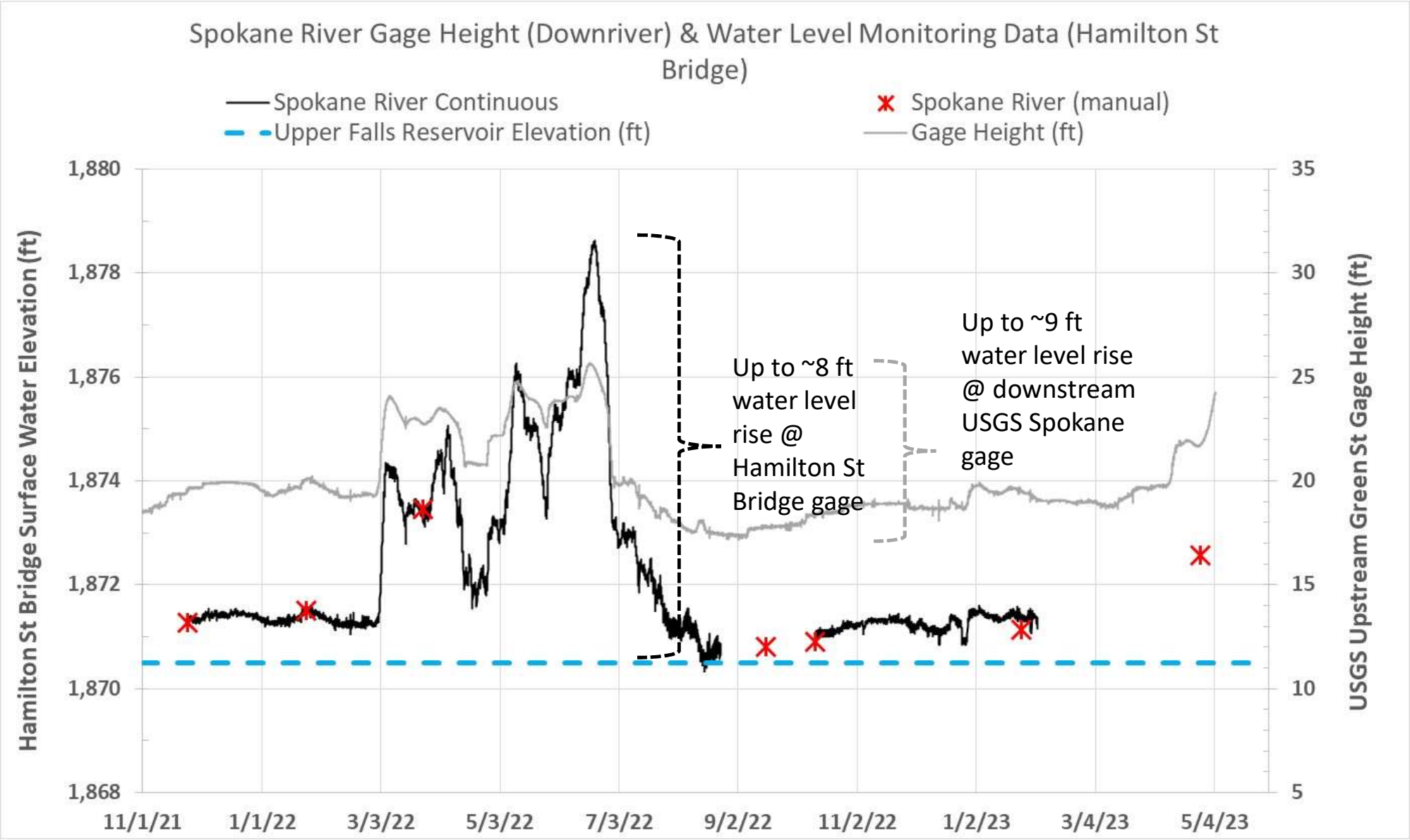
Hamilton St Bridge Continuous Groundwater Data

- Periods of Record evaluated by location
  - Shallow wells MW2-20 & MW4-20:
    noon November 23, 2021 thru 9:00 am April 27, 2023
  - Shallow well MW8-20:
    noon November 23, 2021 thru 10:00 am April 27, 2023
  - Shallow well MW9-20:
    1:00 pm November 23, 2021 thru 2:00 pm March 2, 2022. After this, the pressure transducer ceased to work properly & no additional data was recorded.
  - Deep well MW8-90:
    10:00 am November 24, 2021 thru 2:00 pm March 2, 2022. After this, the pressure transducer ceased to work properly and no additional data was recorded.
  - Surface water gage:
    noon November 23, 2021 thru 8:00 am August 24, 2022 &
    2:00 pm on October 11, 2022 thru 8:00 am February 2, 2023, after which the pressure transducer stopped working.


Spokane River Flow (Greene St) & Water Level Monitoring Data (Hamilton St Bridge)
Spokane River Continuous
Spokane River (manual)
Upper Falls Reservoir Elevation (ft)
Upstream Flow (Greene St)
Hamilton St Bridge Surface Water Elevation (ft)
USGS Upstream Spokane River Flow (cfs)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
30,000
25,000
20,000
15,000
10,000
5,000
0
11/1/21
1/1/22
3/3/22
5/3/22
7/3/22
9/2/22
11/2/22
1/2/23
3/4/23
5/4/23
Up to ~8 ft
water level rise
@ Hamilton St
Bridge gage

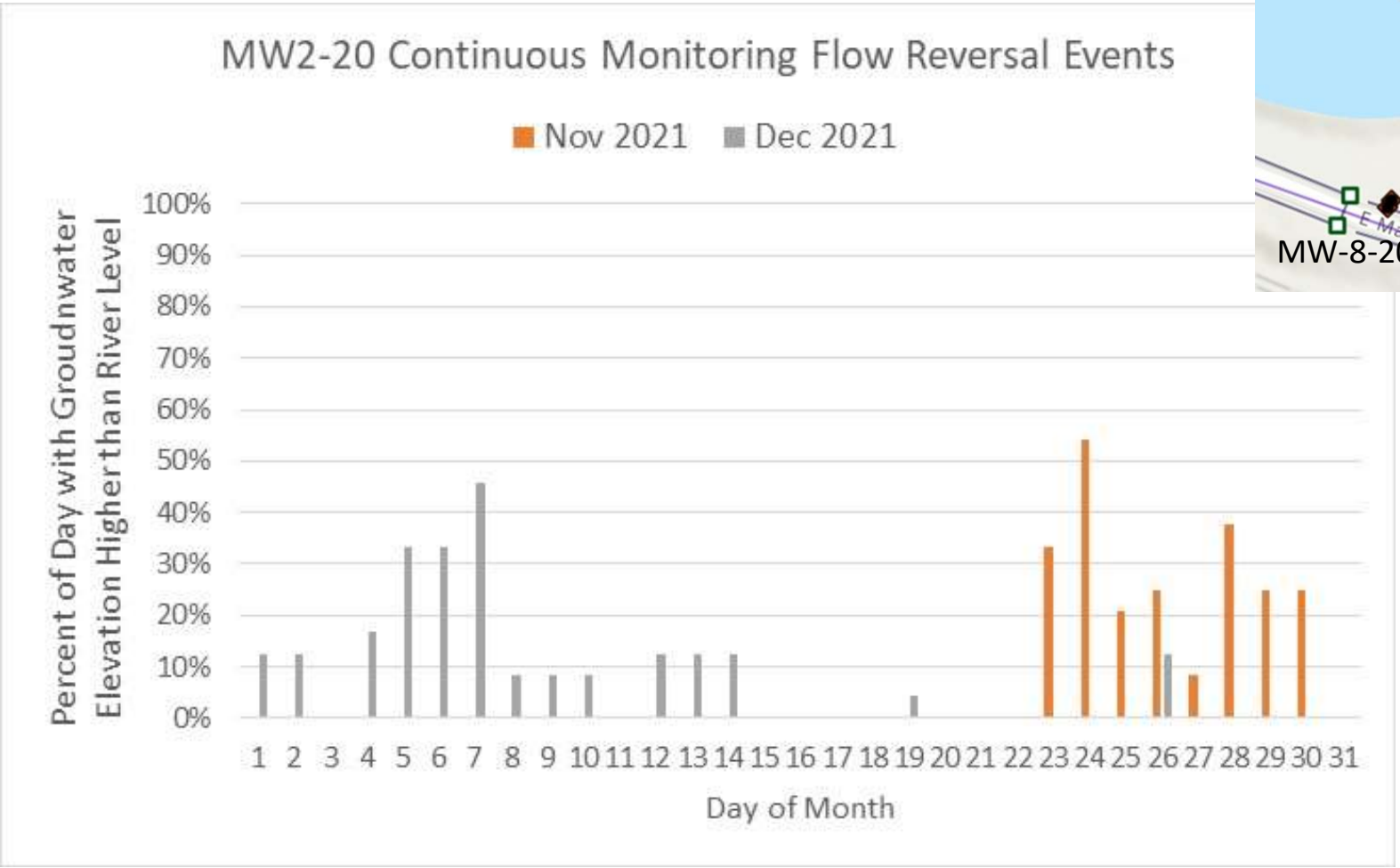

Spokane River Gage Height (Greene St) & Water Level Monitoring Data (Hamilton St Bridge)
Spokane River Continuous
Spokane River (manual)
Upper Falls Reservoir Elevation (ft)
Gage Height (ft)
Hamilton St Bridge Surface Water Elevation (ft)
USGS Upstream Greene St Gage Height (ft)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
18
15
12
9
6
3
0
11/1/21
12/31/21
3/1/22
4/30/22
6/29/22
8/28/22
10/27/22
12/26/22
2/24/23
4/25/23
Up to ~8 ft water level rise @ Hamilton St Bridge gage
Up to ~12 ft water level rise @ upstream USGS Greene St gage

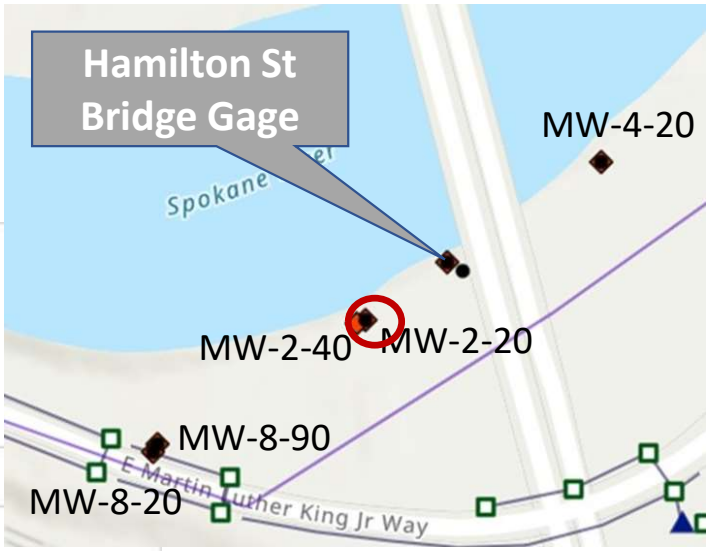

Spokane River Flow (Downstream USGS) & Water Level Monitoring Data (Hamilton St Bridge)
Spokane River Continuous
Surface Water Elevation (ft)
Upper Falls Reservoir Elevation (ft)
Downstream Flow (Spokane USGS)
Hamilton St Bridge Surface Water Elevation (ft)
USGS Downstream Spokane River Flow (cfs)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
30,000
25,000
20,000
15,000
10,000
5,000
0
11/1/21
1/1/22
3/3/22
5/3/22
7/3/22
9/2/22
11/2/22
1/2/23
3/4/23
5/4/23
Up to ~8 ft
water level rise
@ Hamilton St
Bridge gage


Spokane River Gage Height (Downriver) & Water Level Monitoring Data (Hamilton St Bridge)
Spokane River Continuous
Upper Falls Reservoir Elevation (ft)
Spokane River (manual)
Gage Height (ft)
Hamilton St Bridge Surface Water Elevation (ft)
USGS Upstream Green St Gage Height (ft)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
35
30
25
20
15
10
5
11/1/21
1/1/22
3/3/22
5/3/22
7/3/22
9/2/22
11/2/22
1/2/23
3/4/23
5/4/23
Up to ~8 ft water level rise @ Hamilton St Bridge gage
Up to ~9 ft water level rise @ downstream USGS Spokane gage

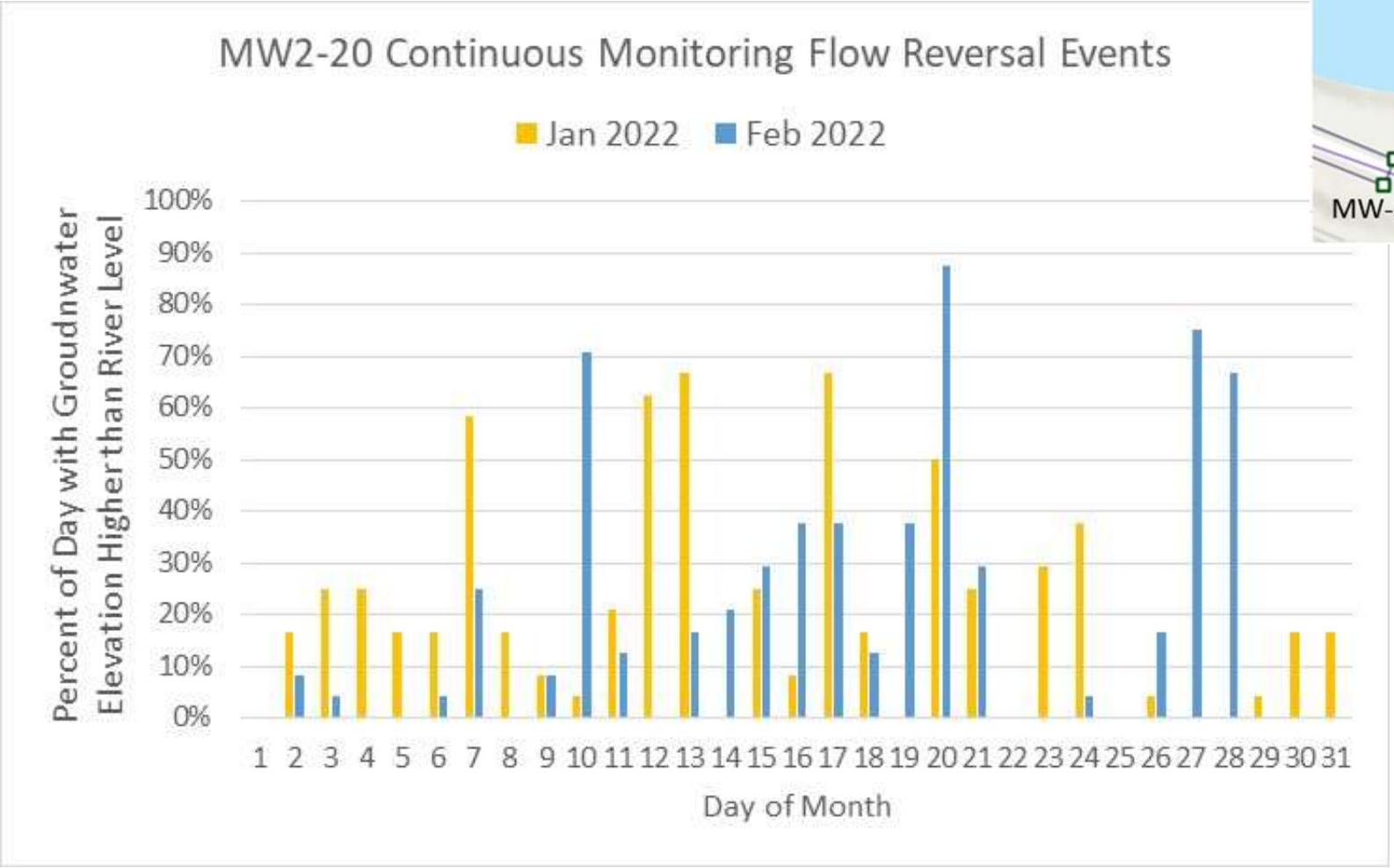

Hamilton Street Bridge Monitoring Well & River Gage Continuous Water Level Monitoring Data
Nov 23, 2021 thru Apr 27, 2023
Spokane River Continuous
MW8-20
MW2-20
MW4-20
MW8-90
losing
Water Elevation (ft)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
11/1/21
1/1/22
3/3/22
5/3/22
7/3/22
9/2/22
11/2/22
1/2/23
3/4/23
5/4/23

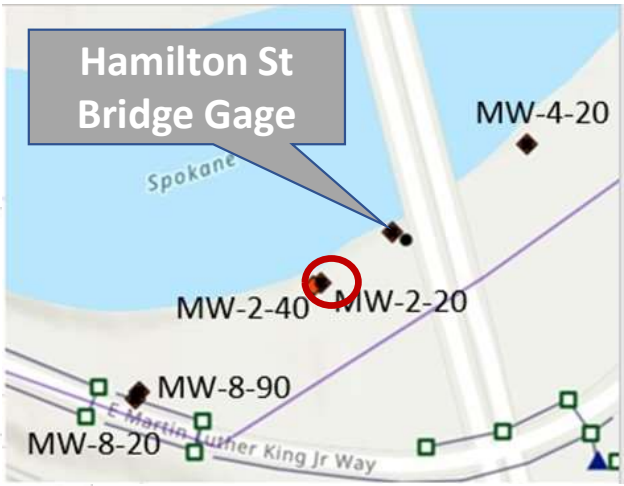
When Is Shallow Groundwater Level Above Surface Water Level? MW2-20 (Nov-Dec 2021)



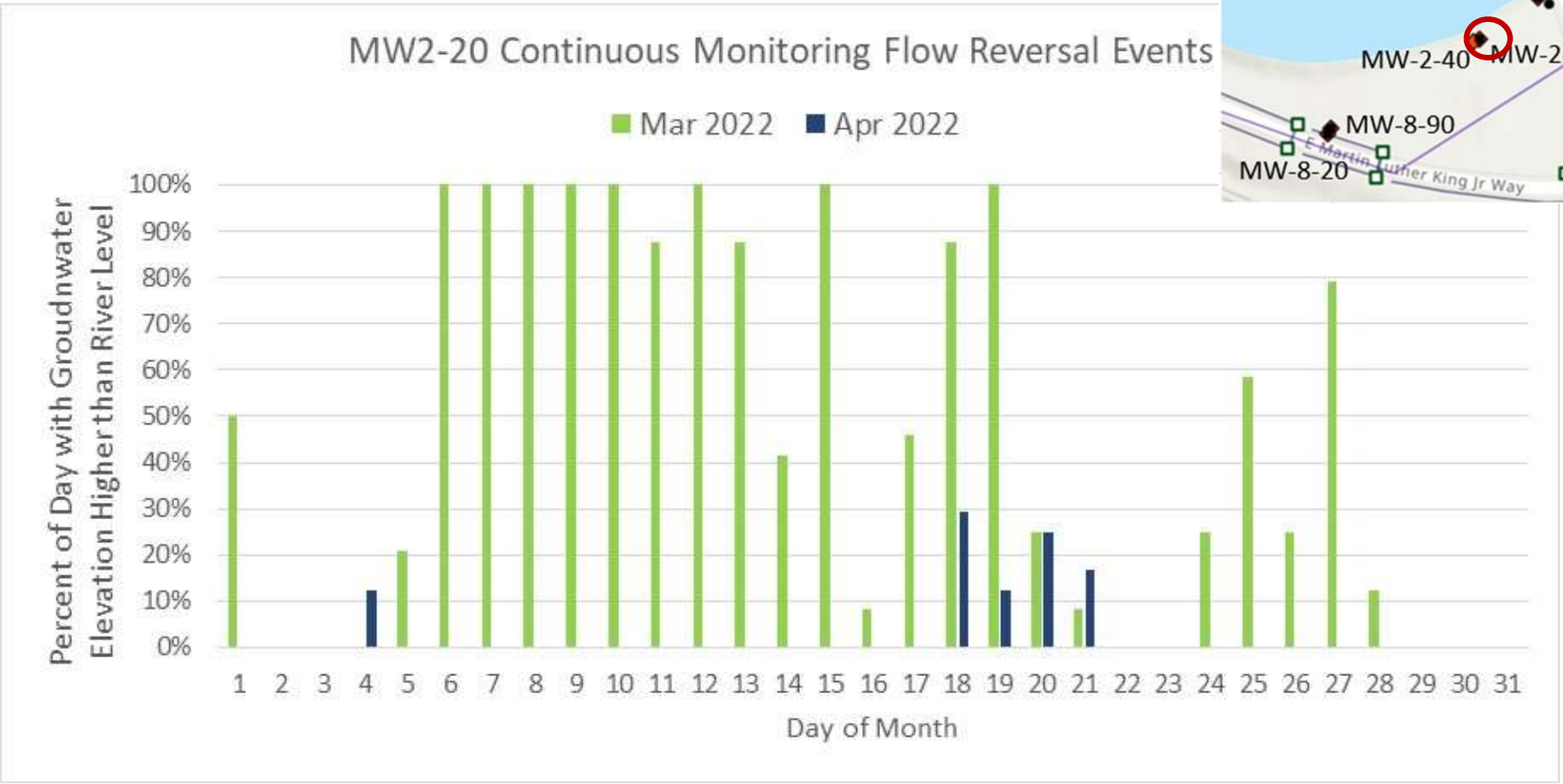


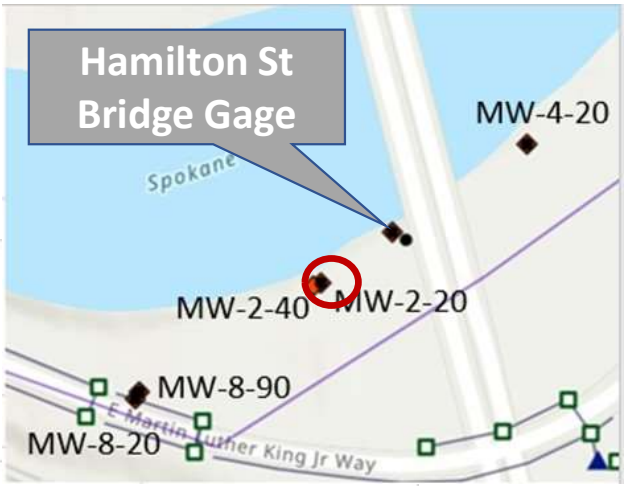
When Is Shallow Groundwater Level Above Surface Water Level? MW2-20 (Jan-Feb 2022)



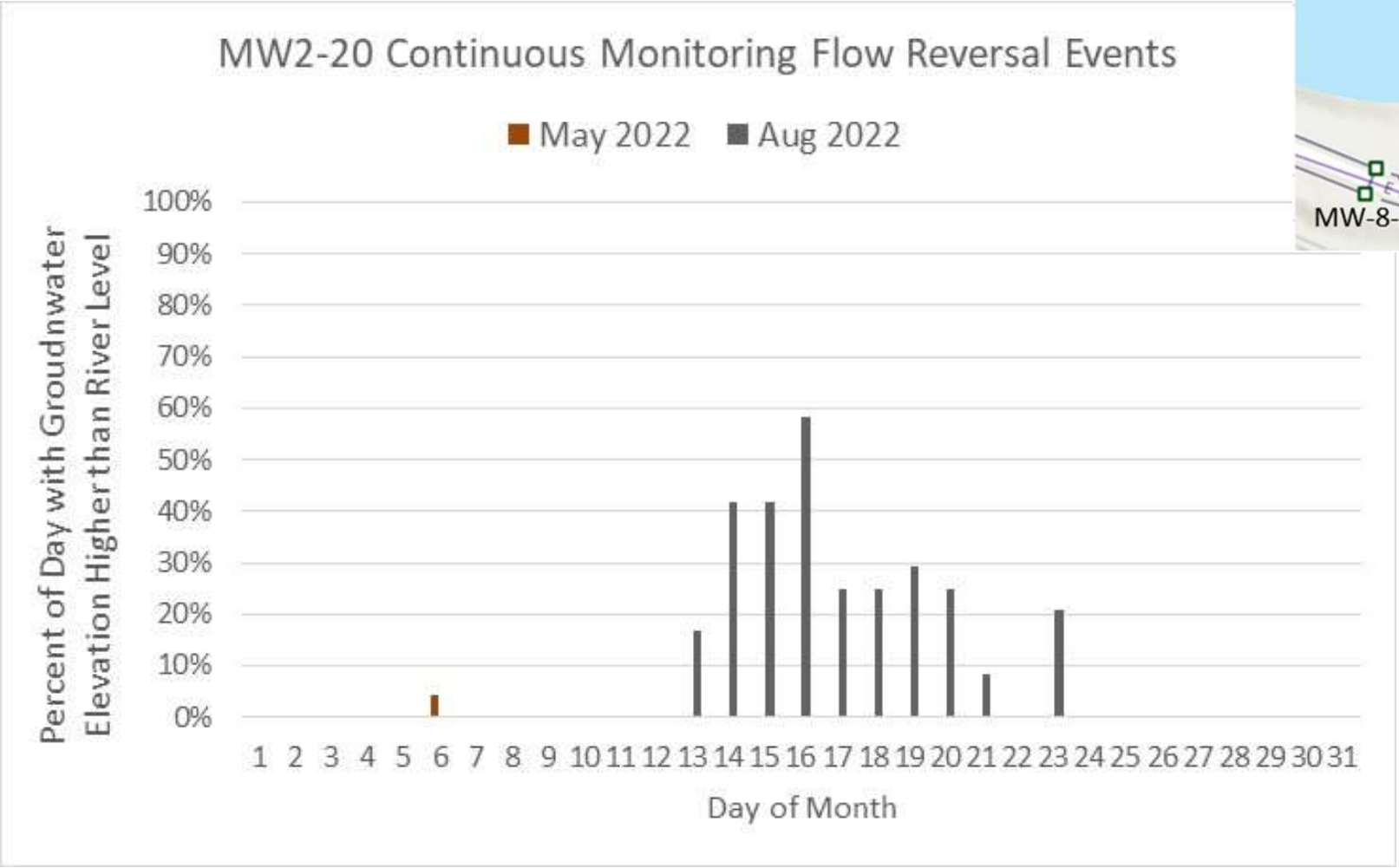


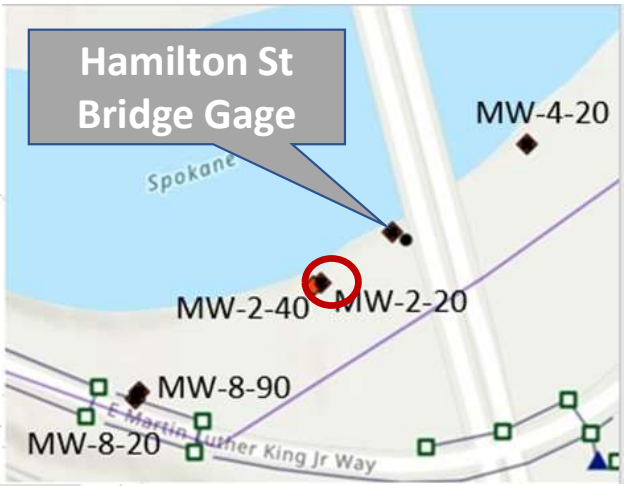
When Is Shallow Groundwater Level Above Surface Water Level? MW2-20 (Mar-Apr 2022)



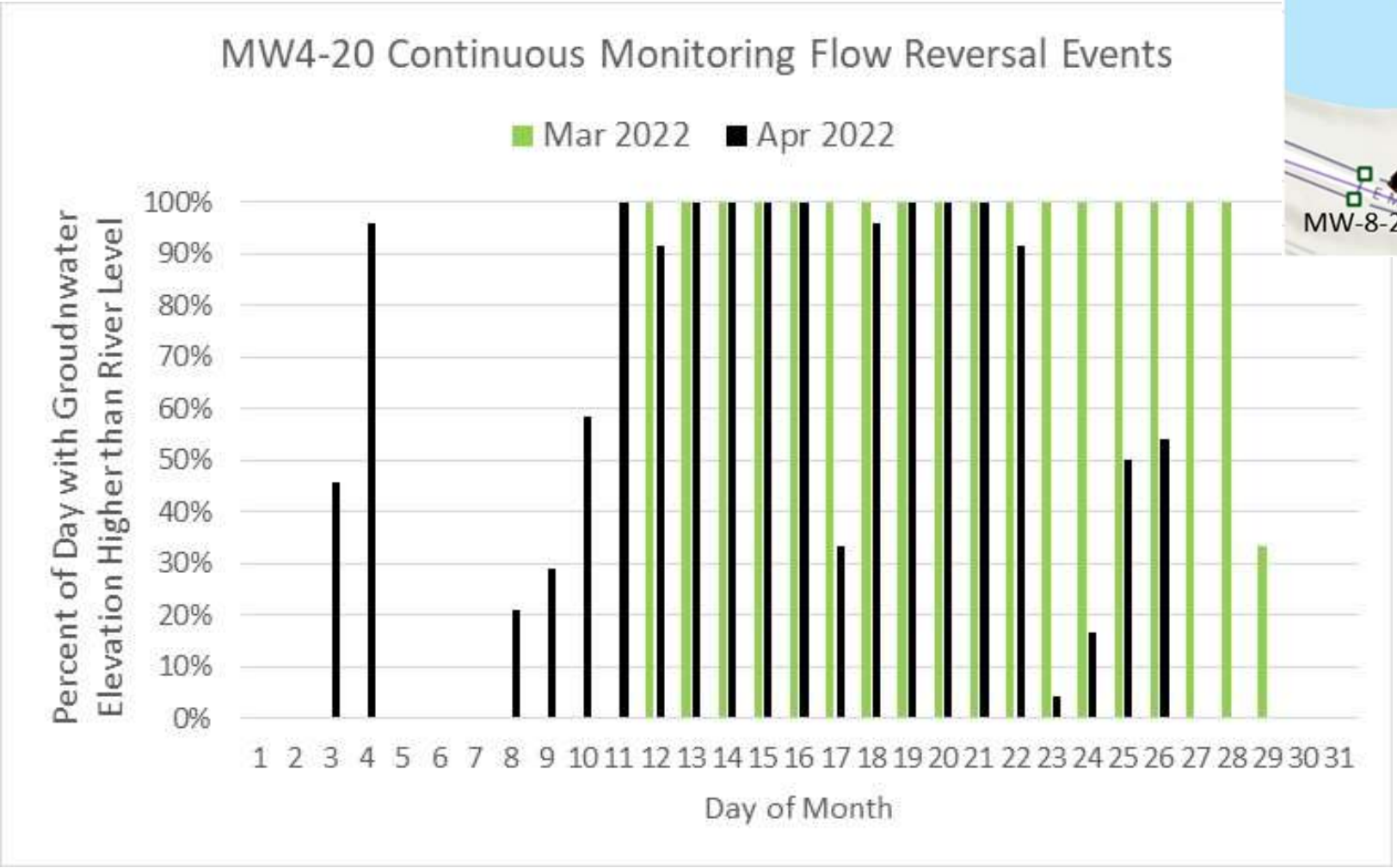


When Is Shallow Groundwater Level Above Surface Water Level? MW2-20 (May & -Aug 2022)

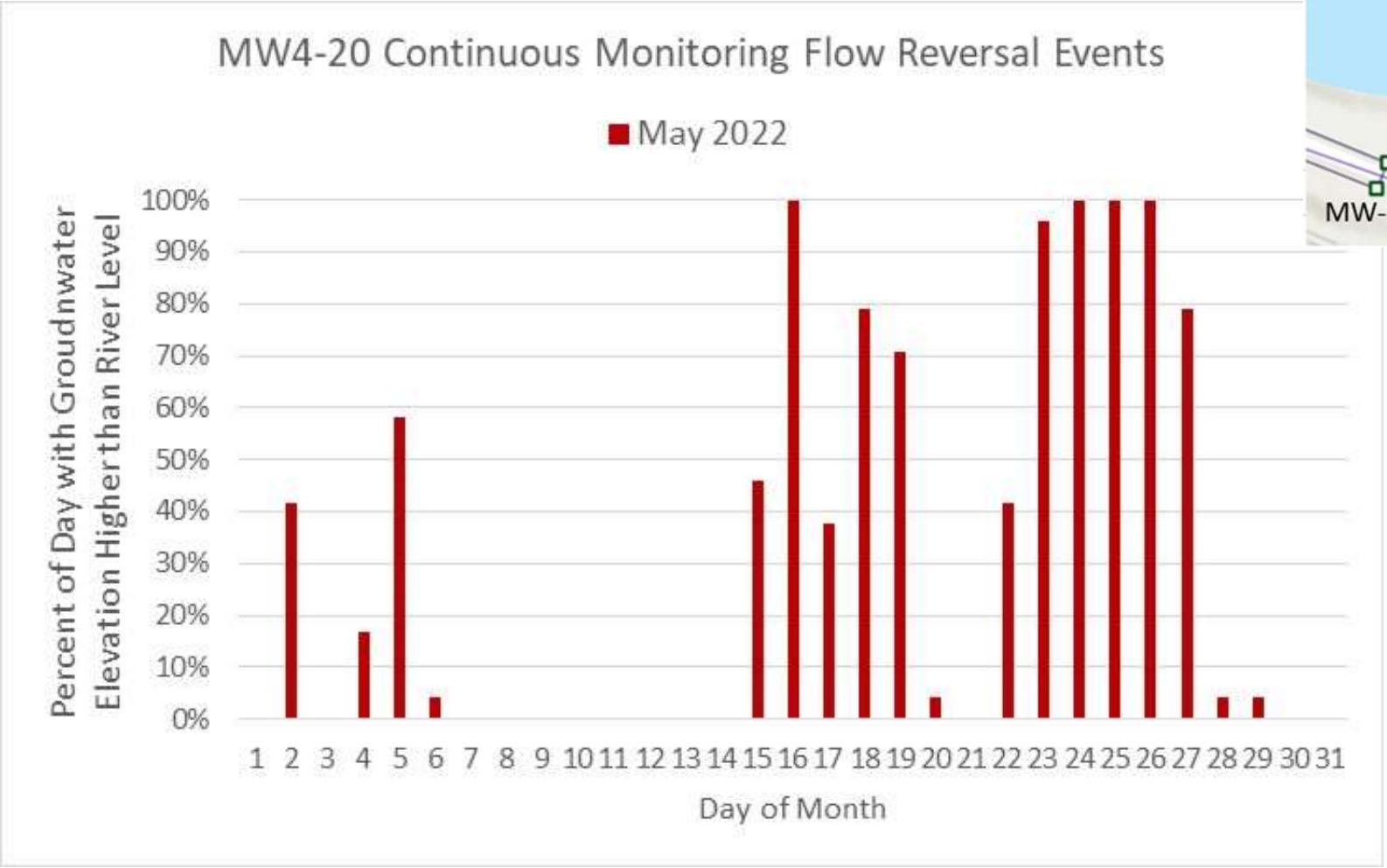




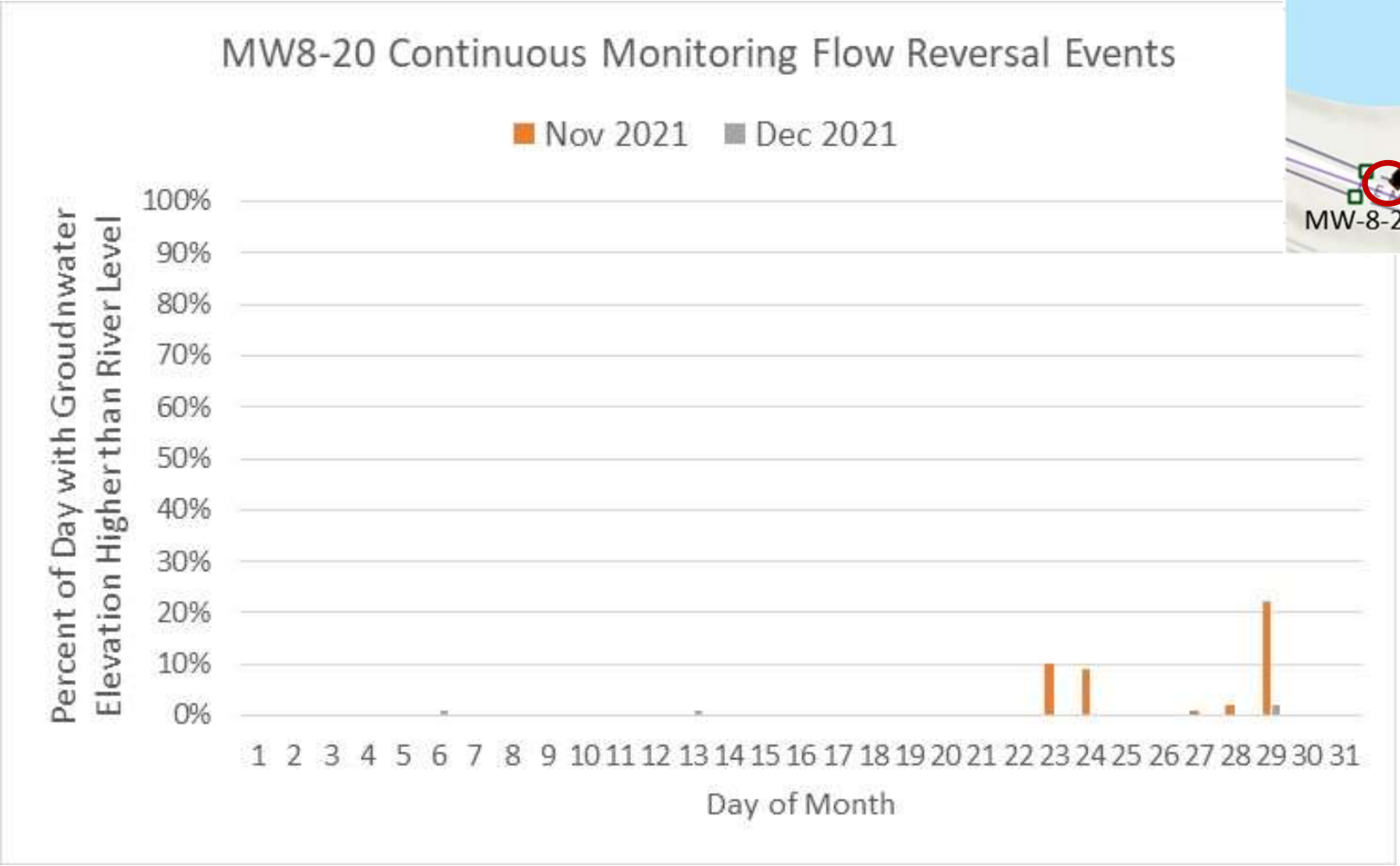
When Is Shallow Groundwater Level Above Surface Water Level? MW4-20 (Mar-Apr 2022)

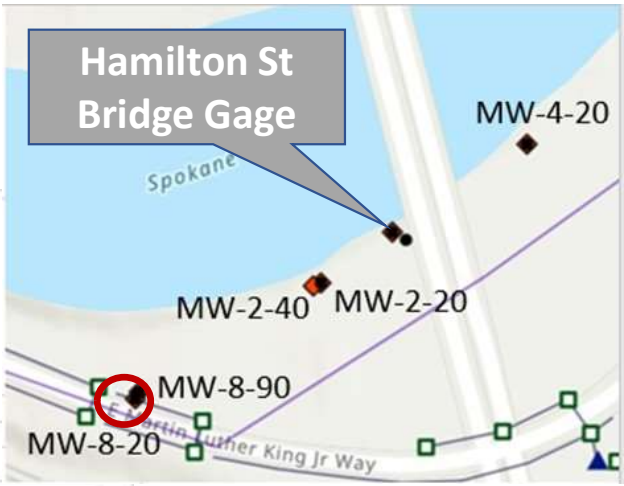


When Is Shallow Groundwater Level Above Surface Water Level? MW4-20 (May 2022)

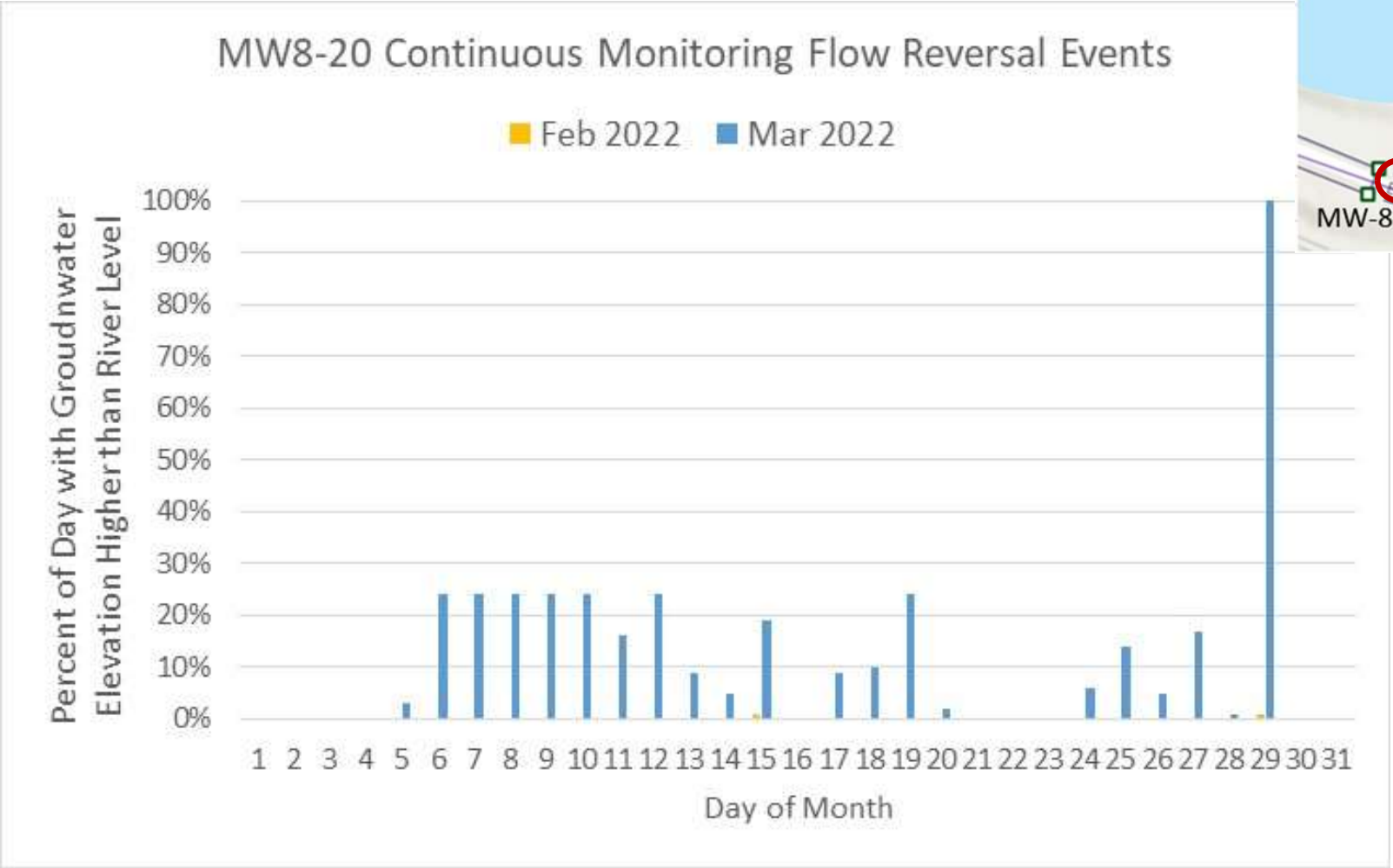


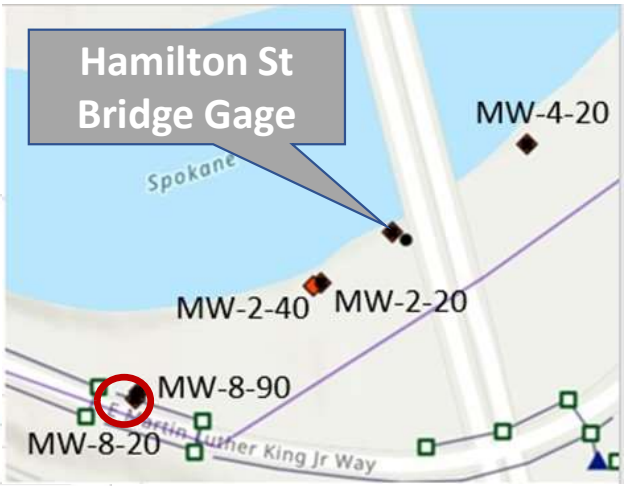
When Is Shallow Groundwater Level Above Surface Water Level? MW8-20 (Nov-Dec 2021)



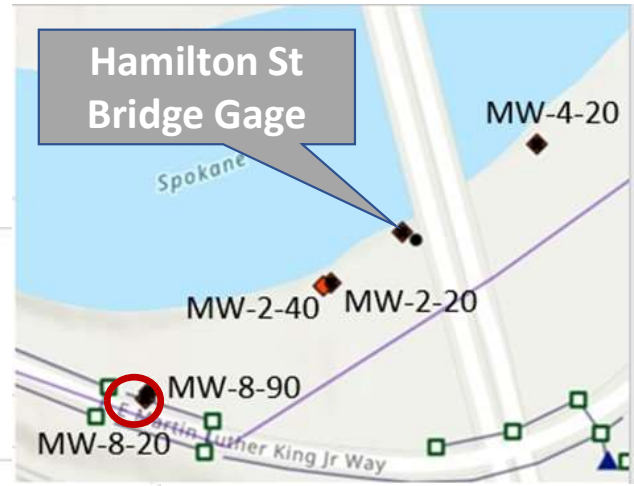


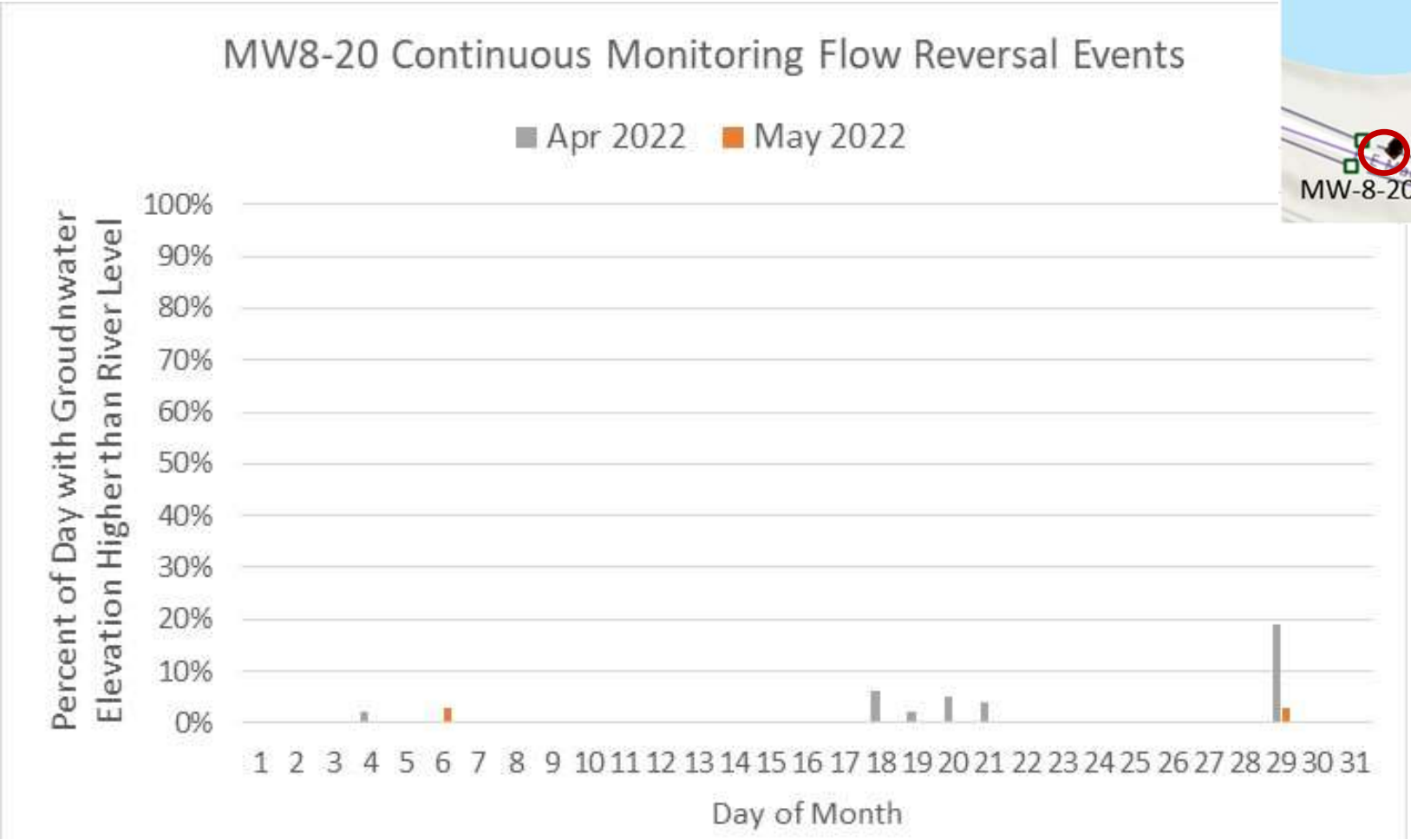
When Is Shallow Groundwater Level Above Surface Water Level? MW8-20 (Feb-Mar 2022)



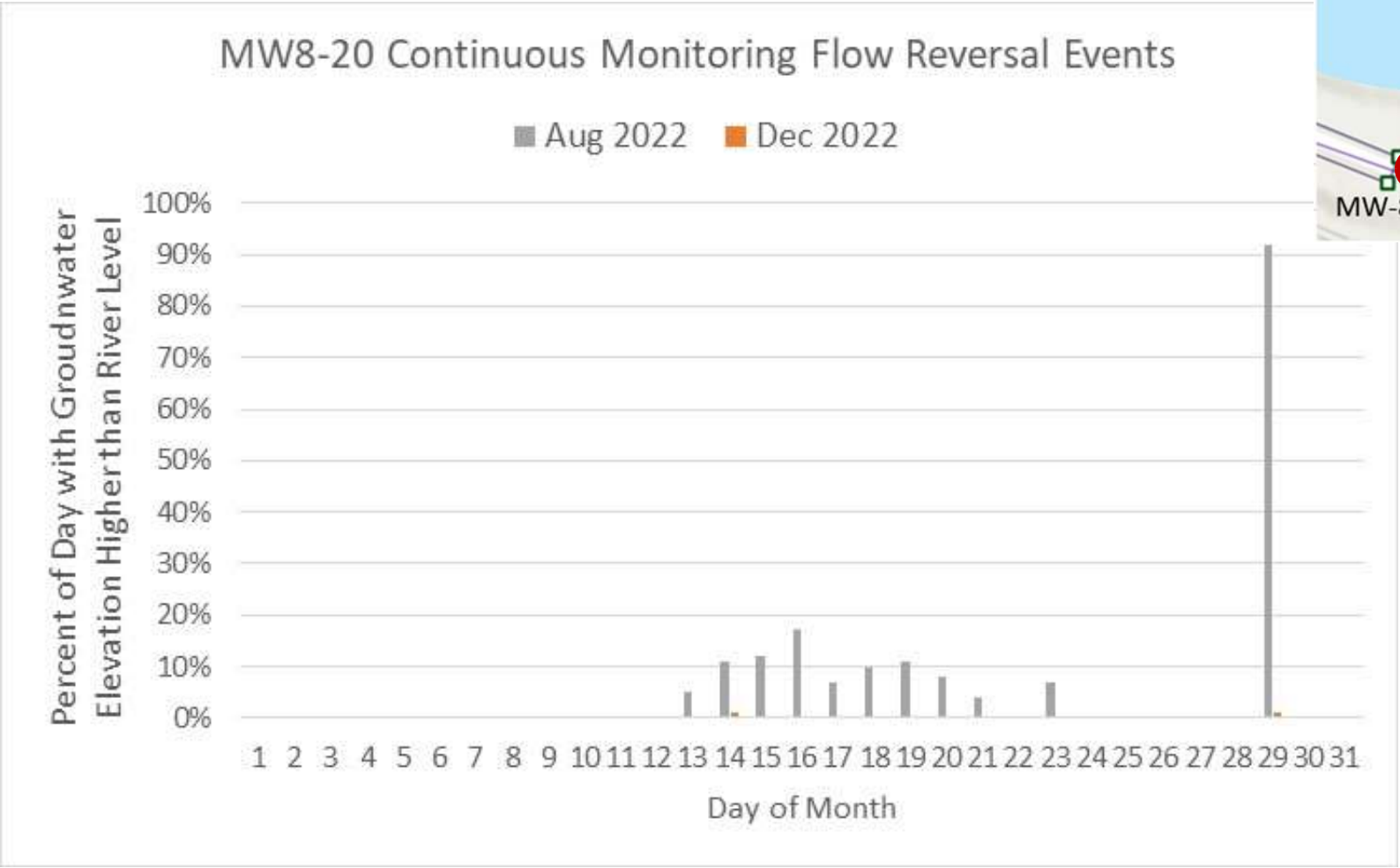


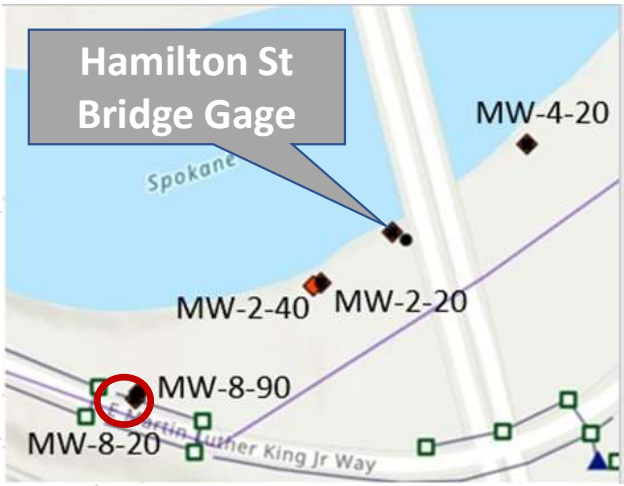
When Is Shallow Groundwater Level Above Surface Water Level? MW8-20 (Apr-May 2022)



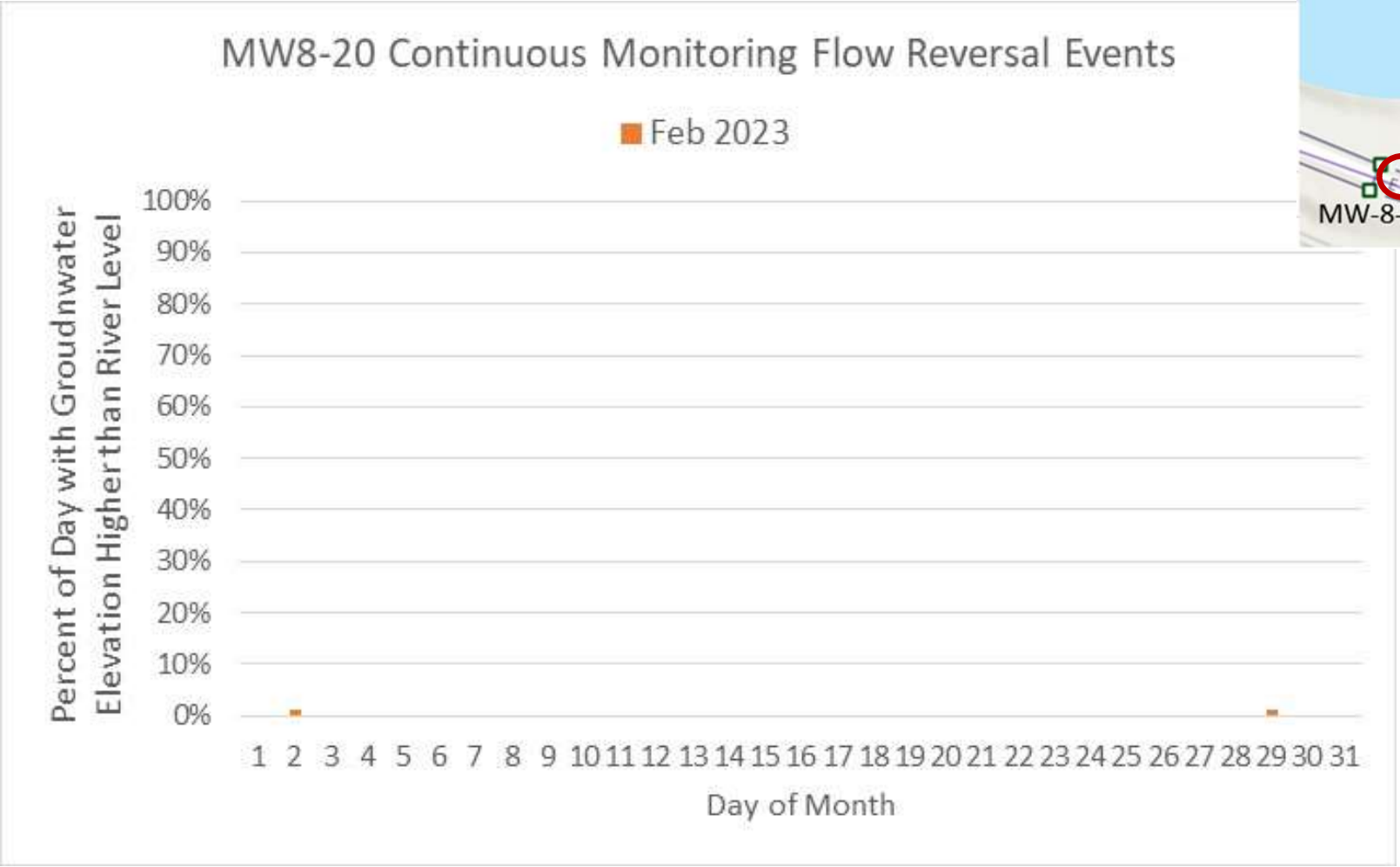


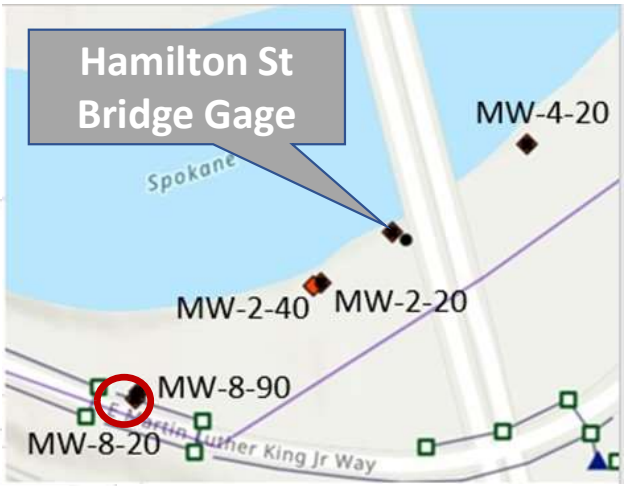
When Is Shallow Groundwater Level Above Surface Water Level? MW8-20 (Aug & Dec 2022)

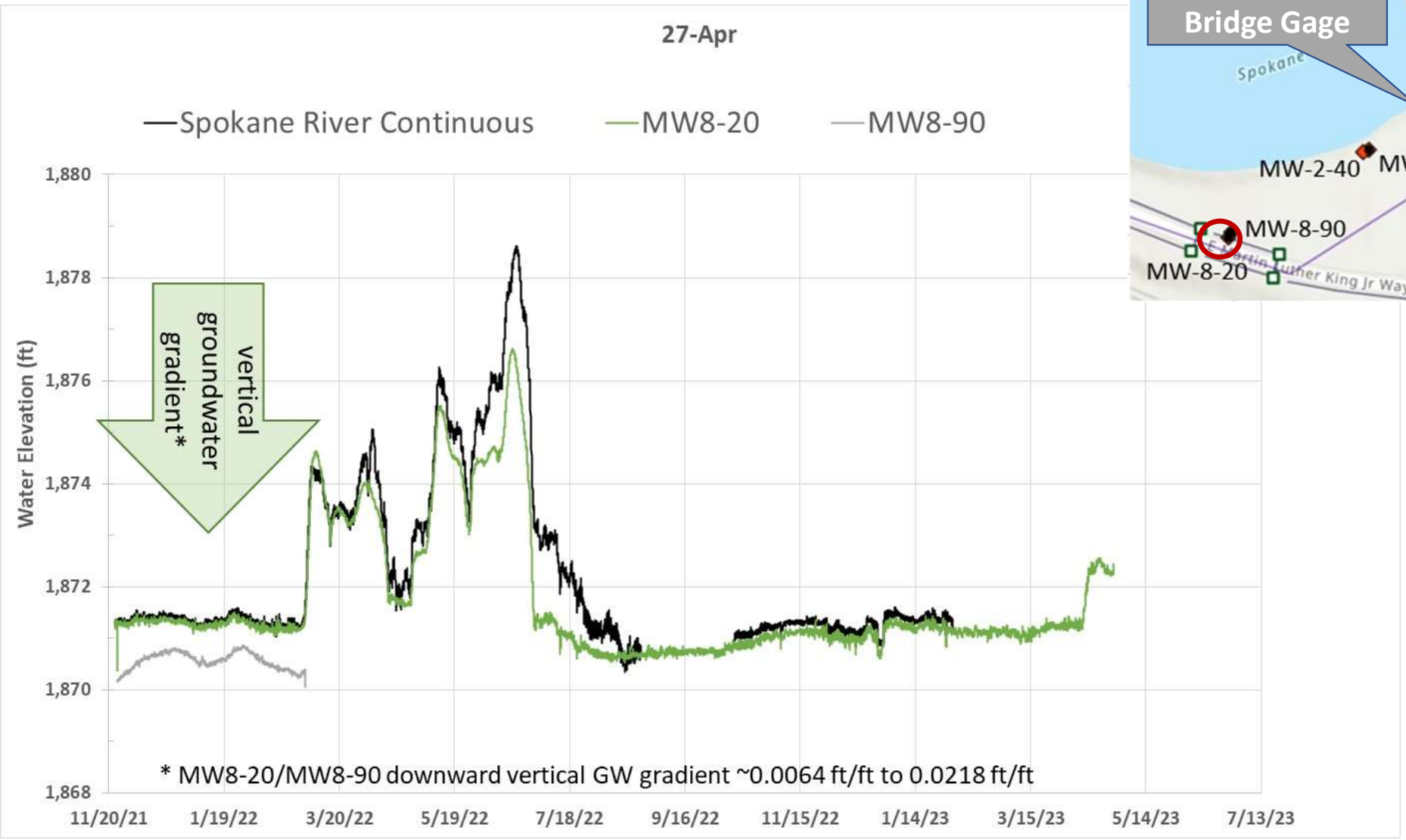


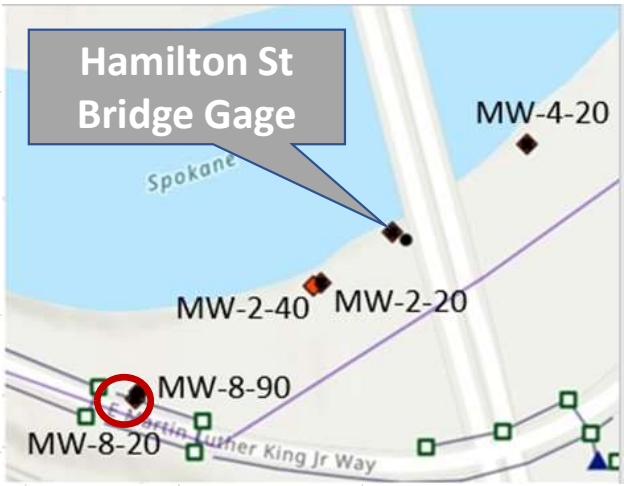


When Is Shallow Groundwater Level Above Surface Water Level? MW8-20 (Feb 2023)





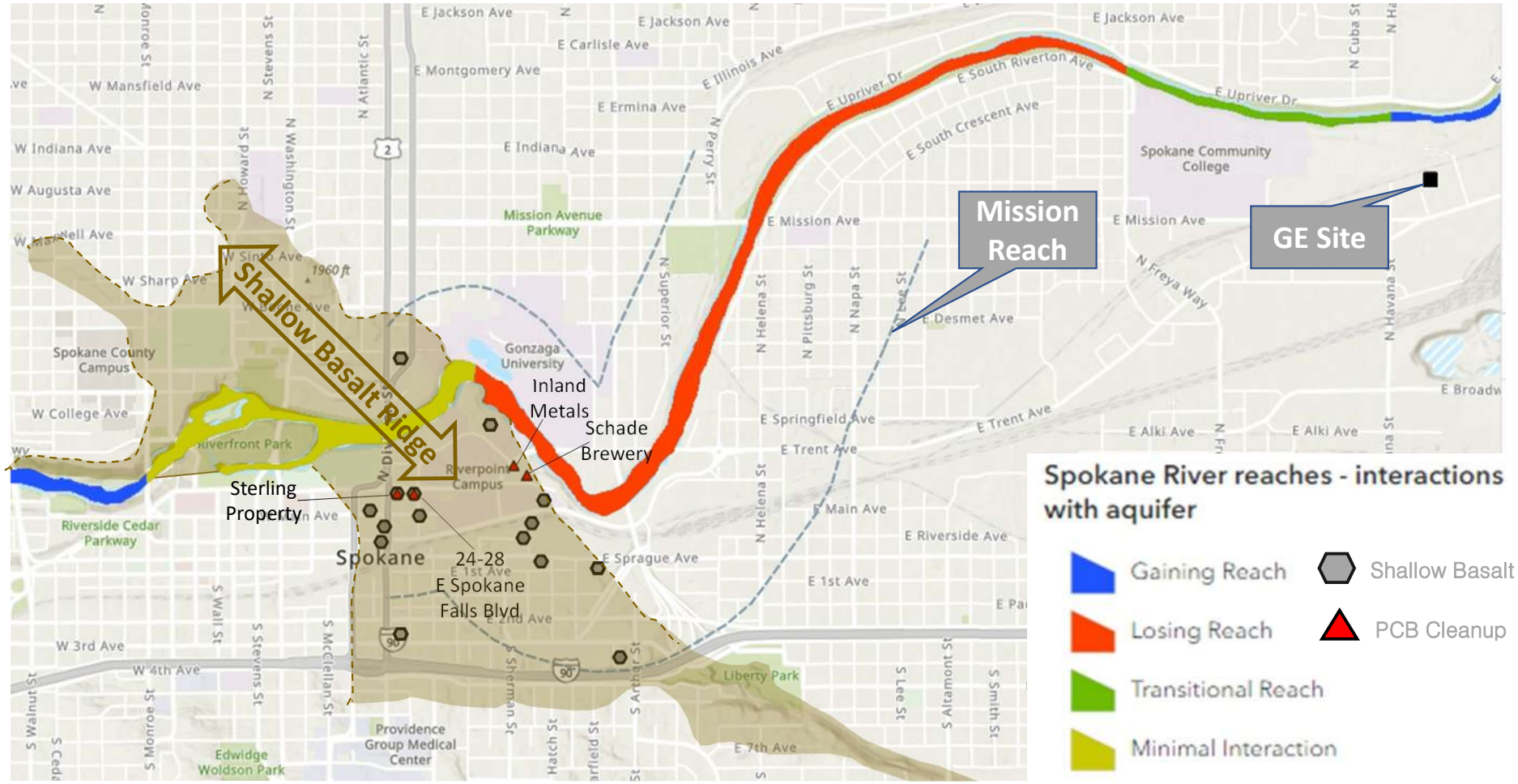

27-Apr
Spokane River Continuous
MW8-20
MW8-90
Water Elevation (ft)
1,880
1,878
1,876
1,874
1,872
1,870
1,868
vertical groundwater gradient*
* MW8-20/MW8-90 downward vertical GW gradient ~0.0064 ft/ft to 0.0218 ft/ft
11/20/21
1/19/22
3/20/22
5/19/22
7/18/22
9/16/22
11/15/22
1/14/23
3/15/23
5/14/23
7/13/23


Hamilton St Bridge Gage
MW-4-20
Spokane
MW-2-40
MW-2-20
MW-8-90
MW-8-20
Martin Luther King Jr Way

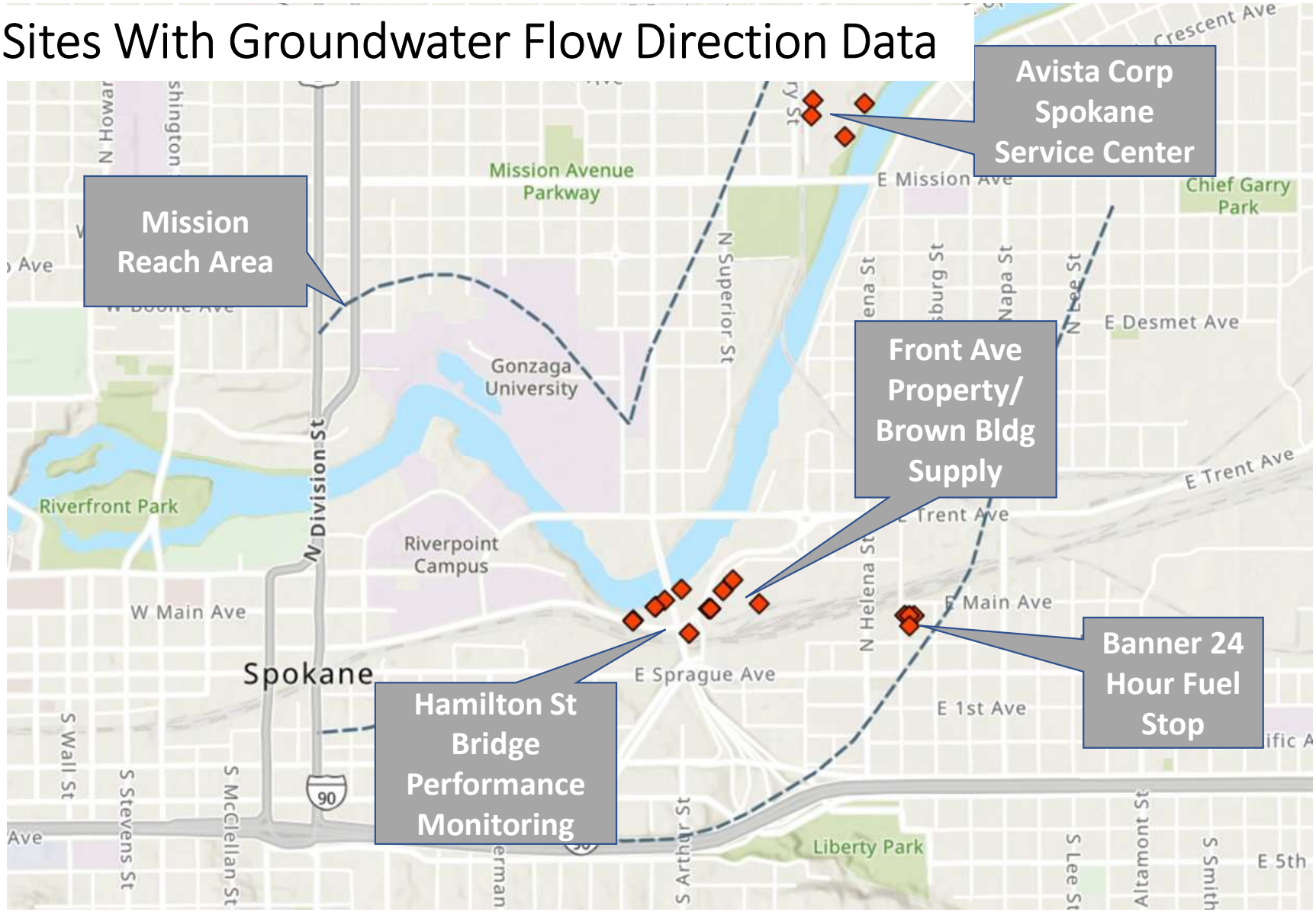
Exposed/Shallow Basalt Ridge at Surface (Columbia River Group)

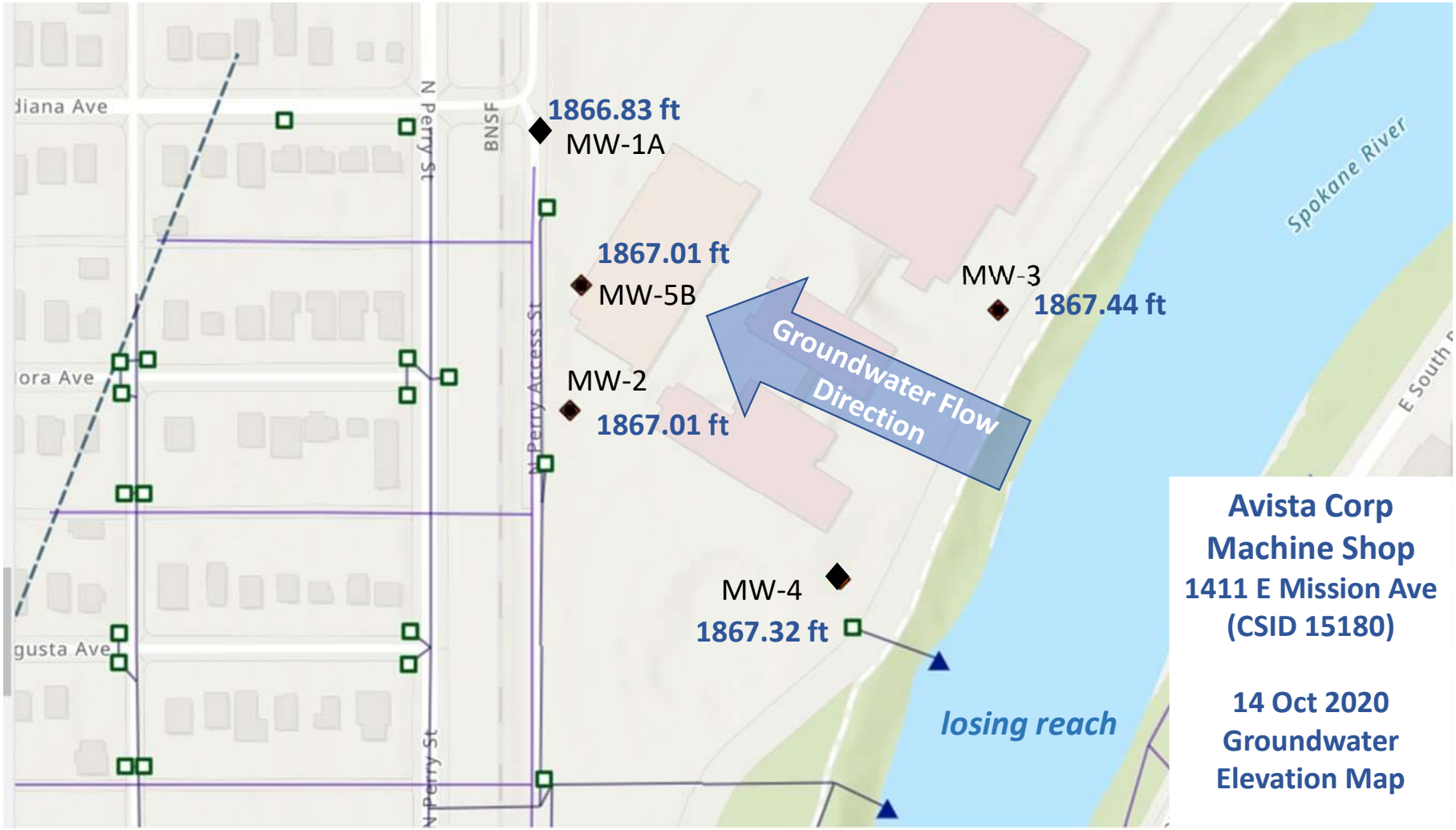
Groundwater Generally Absent or Perched in Depressions on Top of Basalt

Basalt Ridge Coincides With Zone of “Minimal Interaction” in River

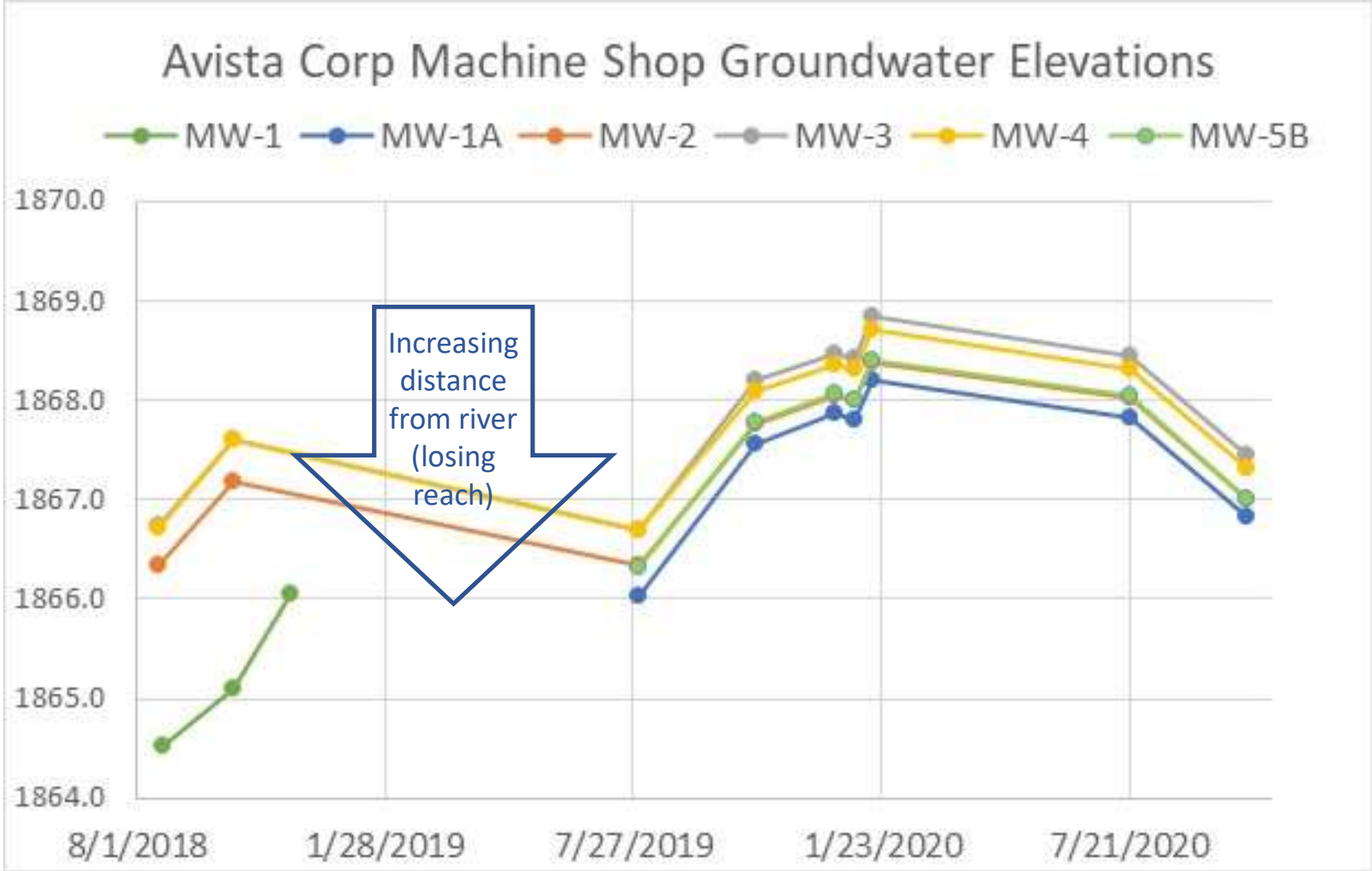


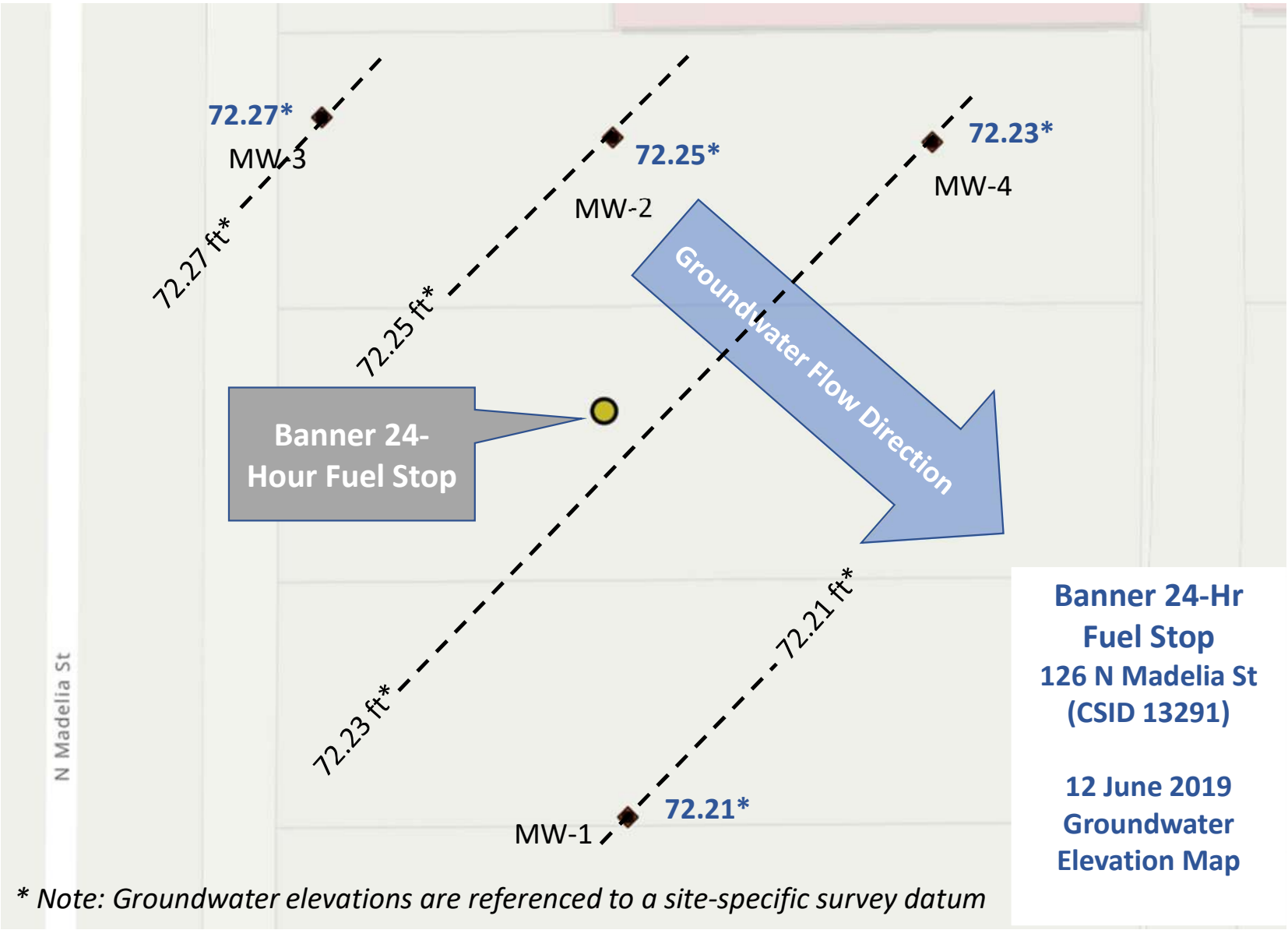
Other Sites With Groundwater Flow Direction Data





Seven sets of Avista groundwater elevation data show flow away from river (i.e., west to northwest, Jul 2019 – Oct 2020)

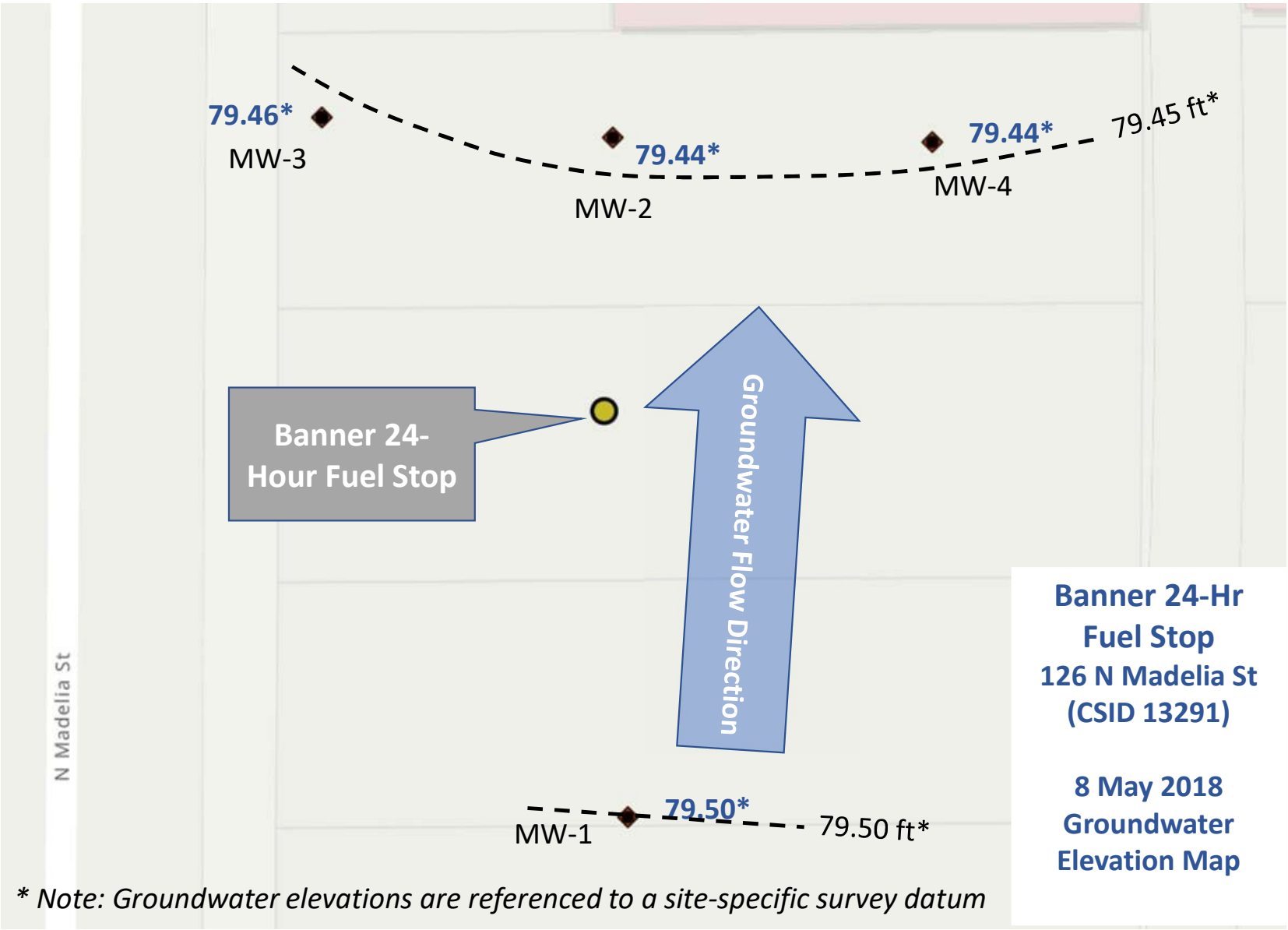

Avista Corp Machine Shop Groundwater Elevations
MW-1
MW-1A
MW-2
MW-3
MW-4
MW-5B
1870.0
1869.0
1868.0
1867.0
1866.0
1865.0
1864.0
8/1/2018
1/28/2019
7/27/2019
1/23/2020
7/21/2020
Increasing distance from river (losing reach)



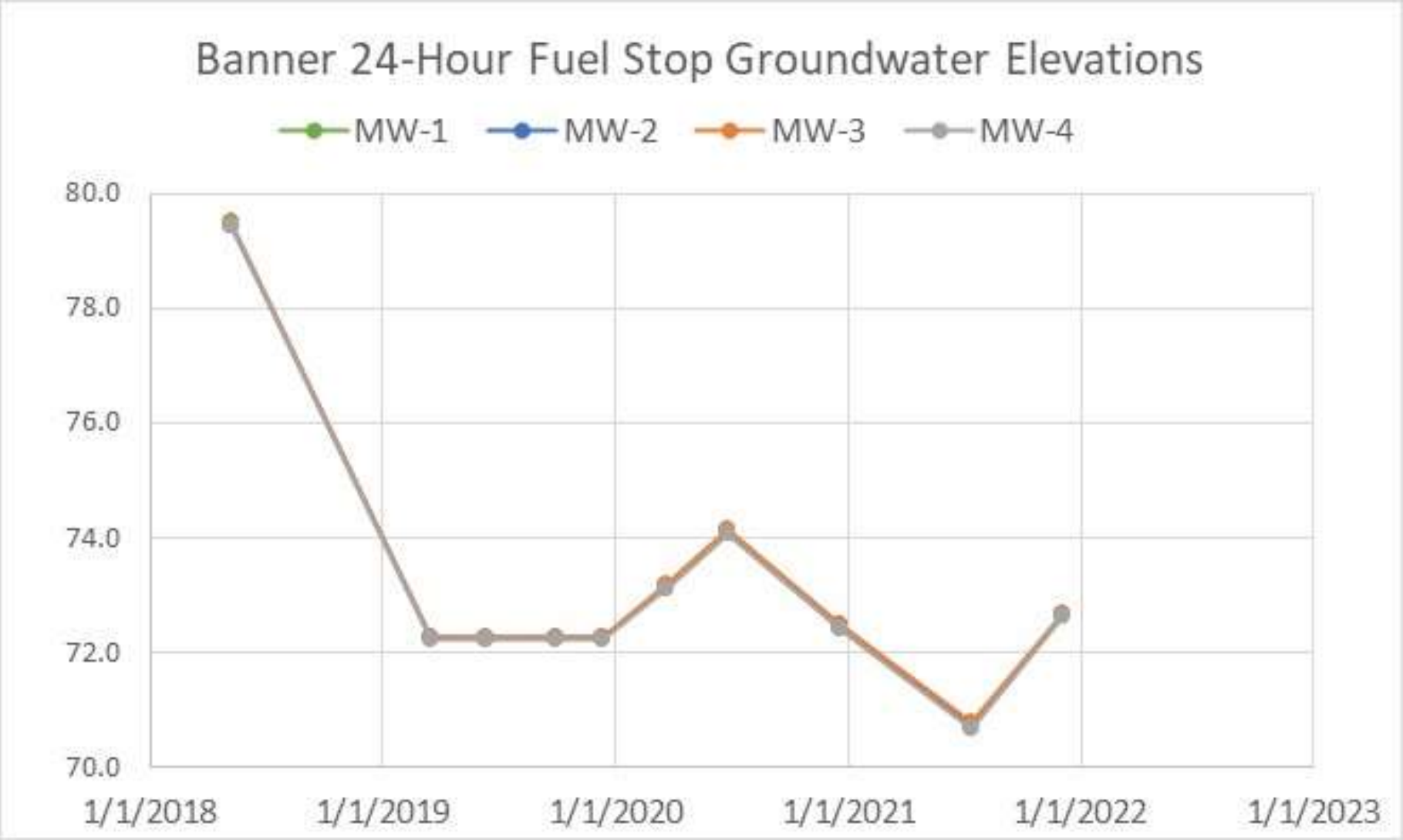
Banner 24-Hr Fuel Stop
126 N Madelia St
(CSID 13291)

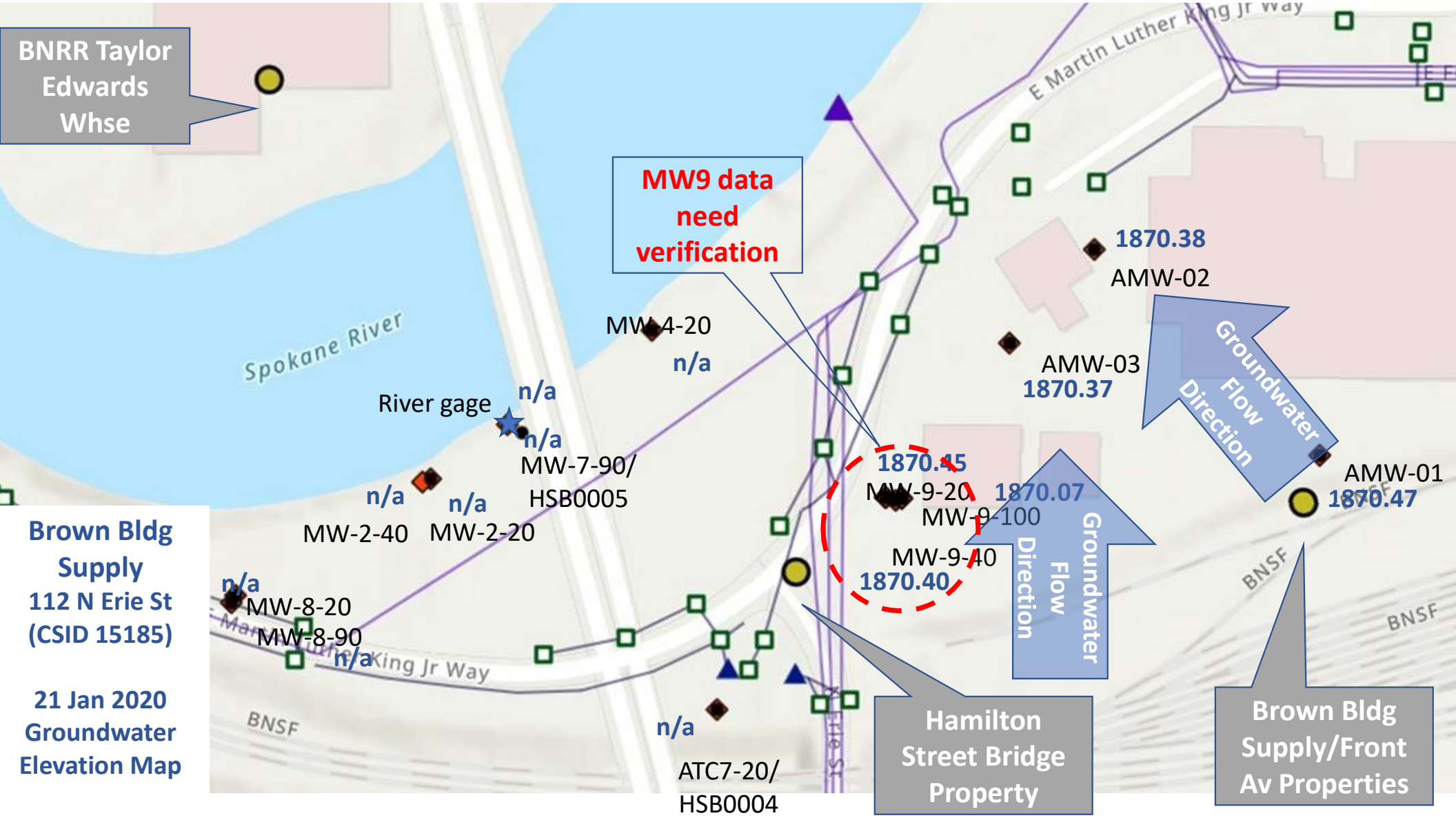
12 June 2019 Groundwater Elevation Map

** Note: Groundwater elevations are referenced to a site-specific survey datum*



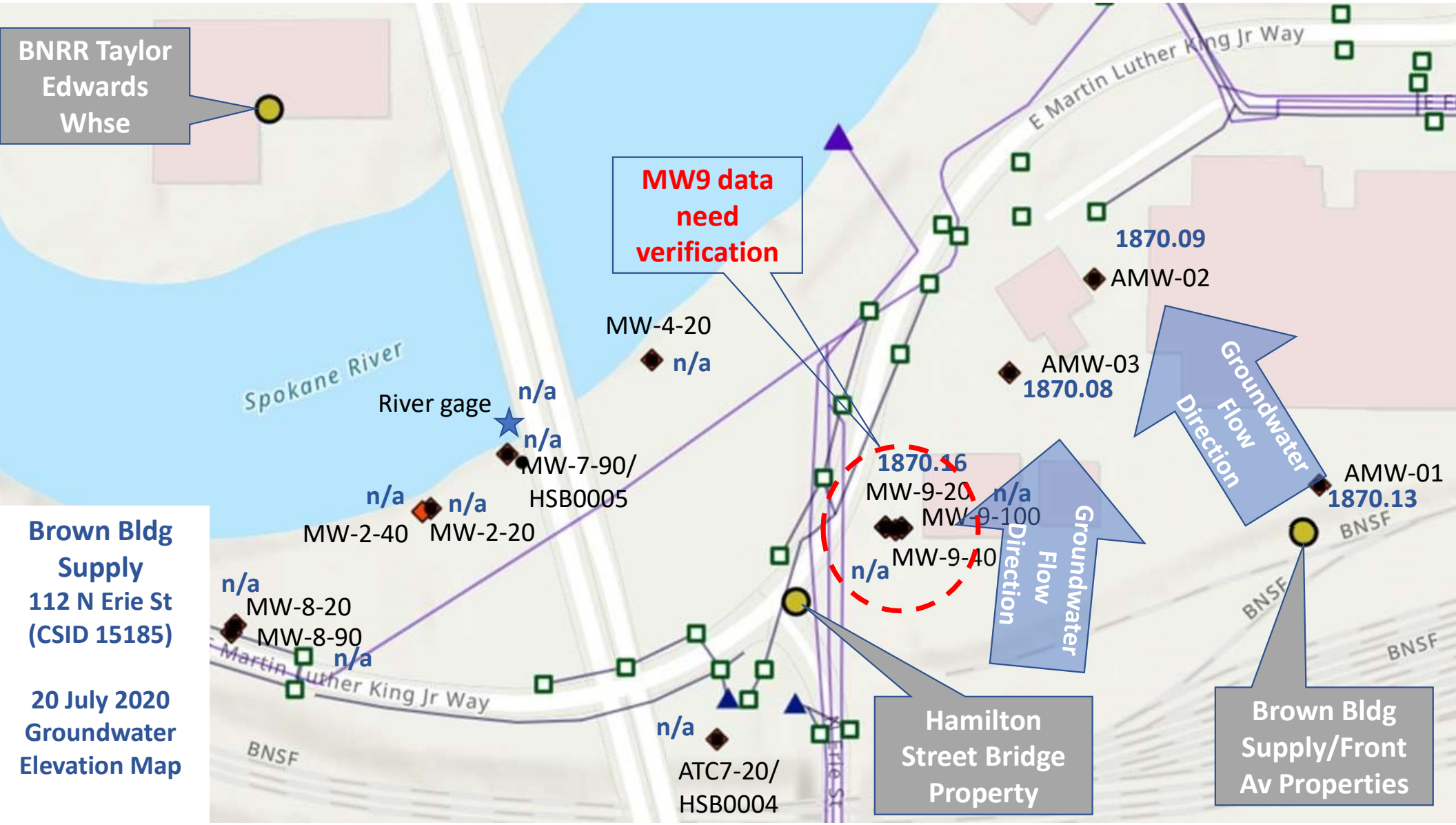
** Note: Groundwater elevations are referenced to a site-specific survey datum*


Banner 24-Hour Fuel Stop Groundwater Elevations
MW-1
MW-2
MW-3
MW-4
80.0
78.0
76.0
74.0
72.0
70.0
1/1/2018
1/1/2019
1/1/2020
1/1/2021
1/1/2022
1/1/2023



Brown Bldg Supply
112 N Erie St
(CSID 15185)

21 Jan 2020 Groundwater Elevation Map



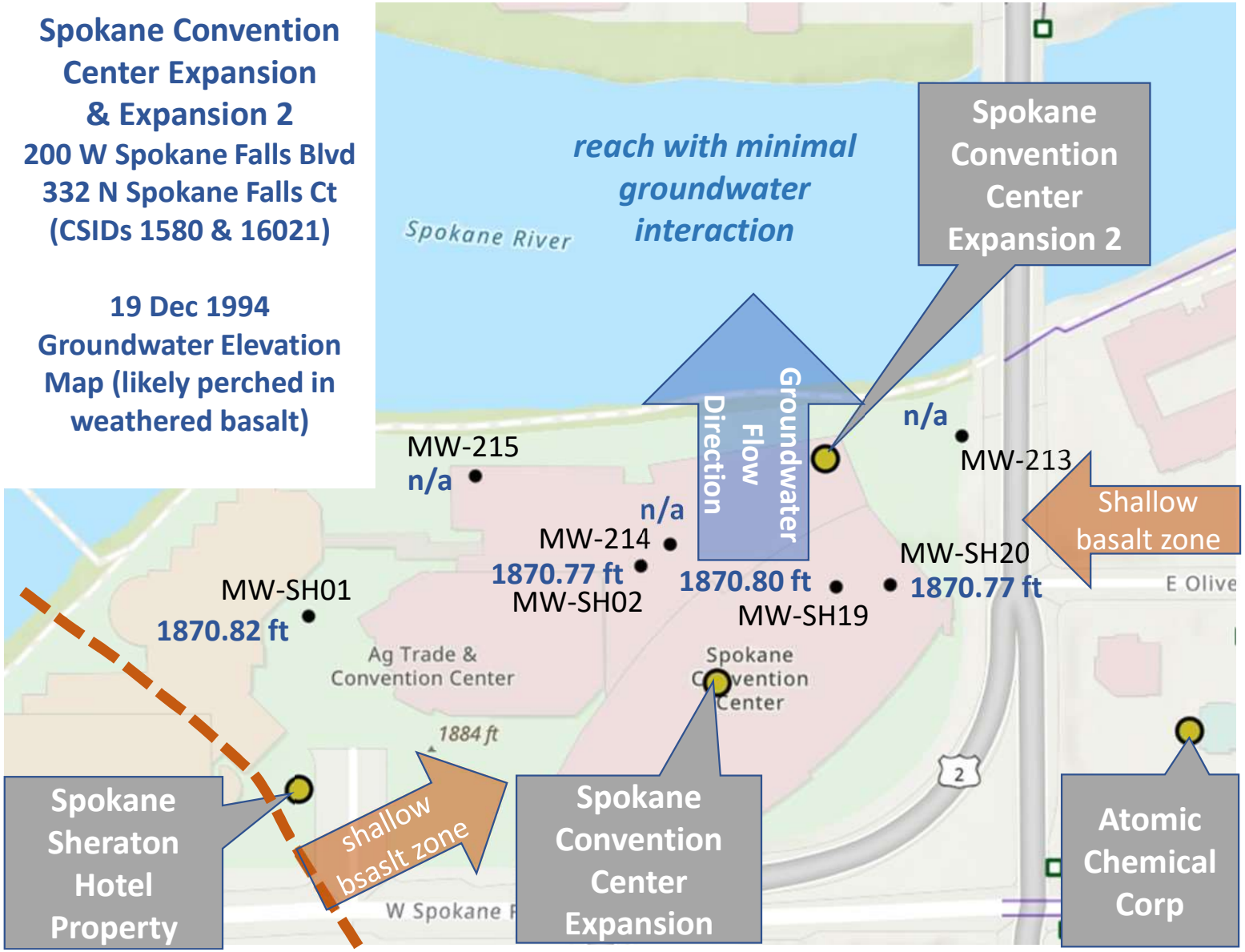
Brown Bldg Supply
112 N Erie St (CSID 15185)

20 July 2020 Groundwater Elevation Map


Brown Bldg Supply/Front Av Properties Groundwater Elevations
AMW-01
AMW-02
AMW-03
MW-9-20
MW-9-40
MW-9-100
1870.4
1870.3
1870.2
1870.1
1870.0
12/31/2019
3/30/2020
6/28/2020
9/26/2020

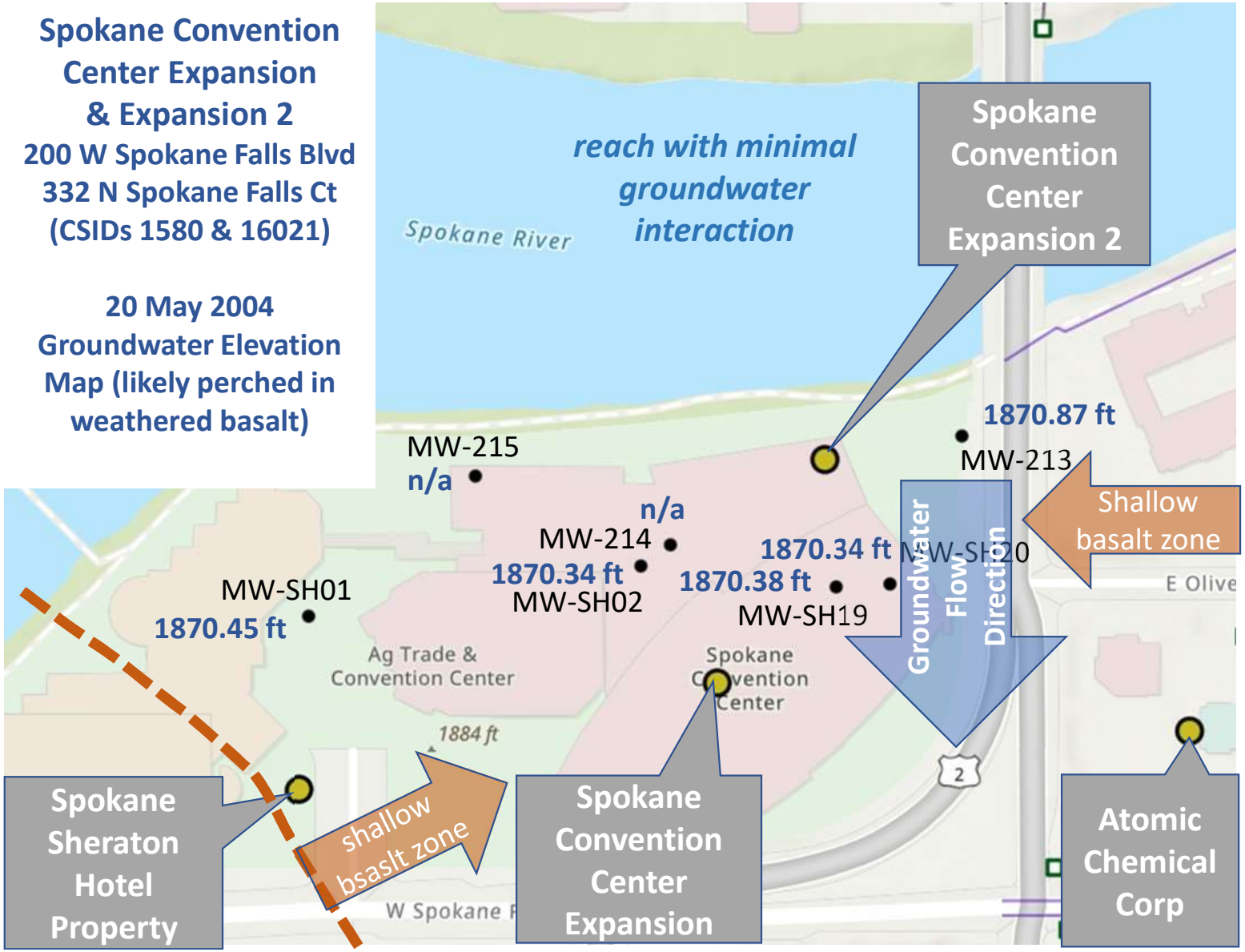
Spokane Convention Center Expansion & Expansion 2
200 W Spokane Falls Blvd
332 N Spokane Falls Ct
(CSIDs 1580 & 16021)

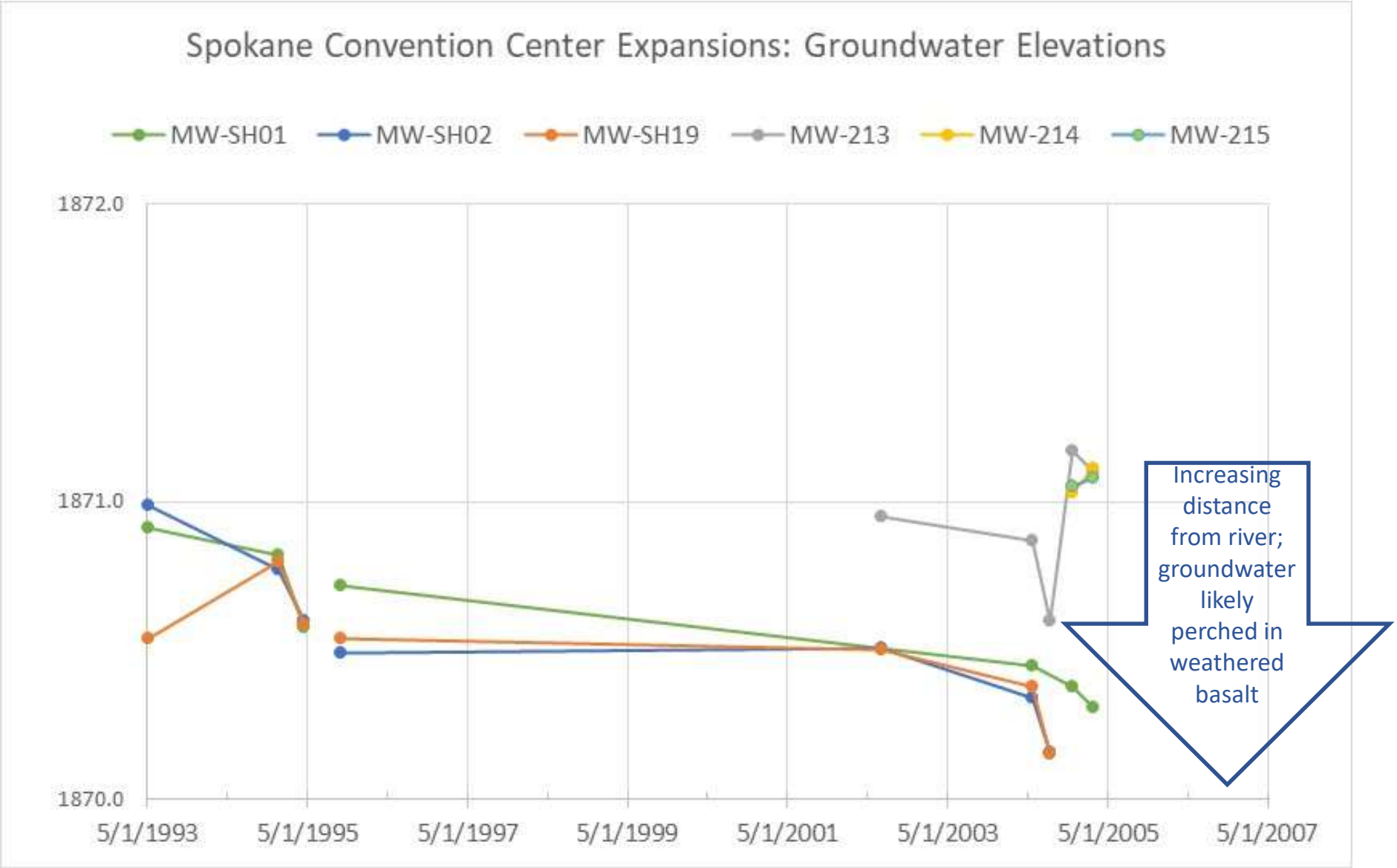
19 Dec 1994 Groundwater Elevation Map (likely perched in weathered basalt)

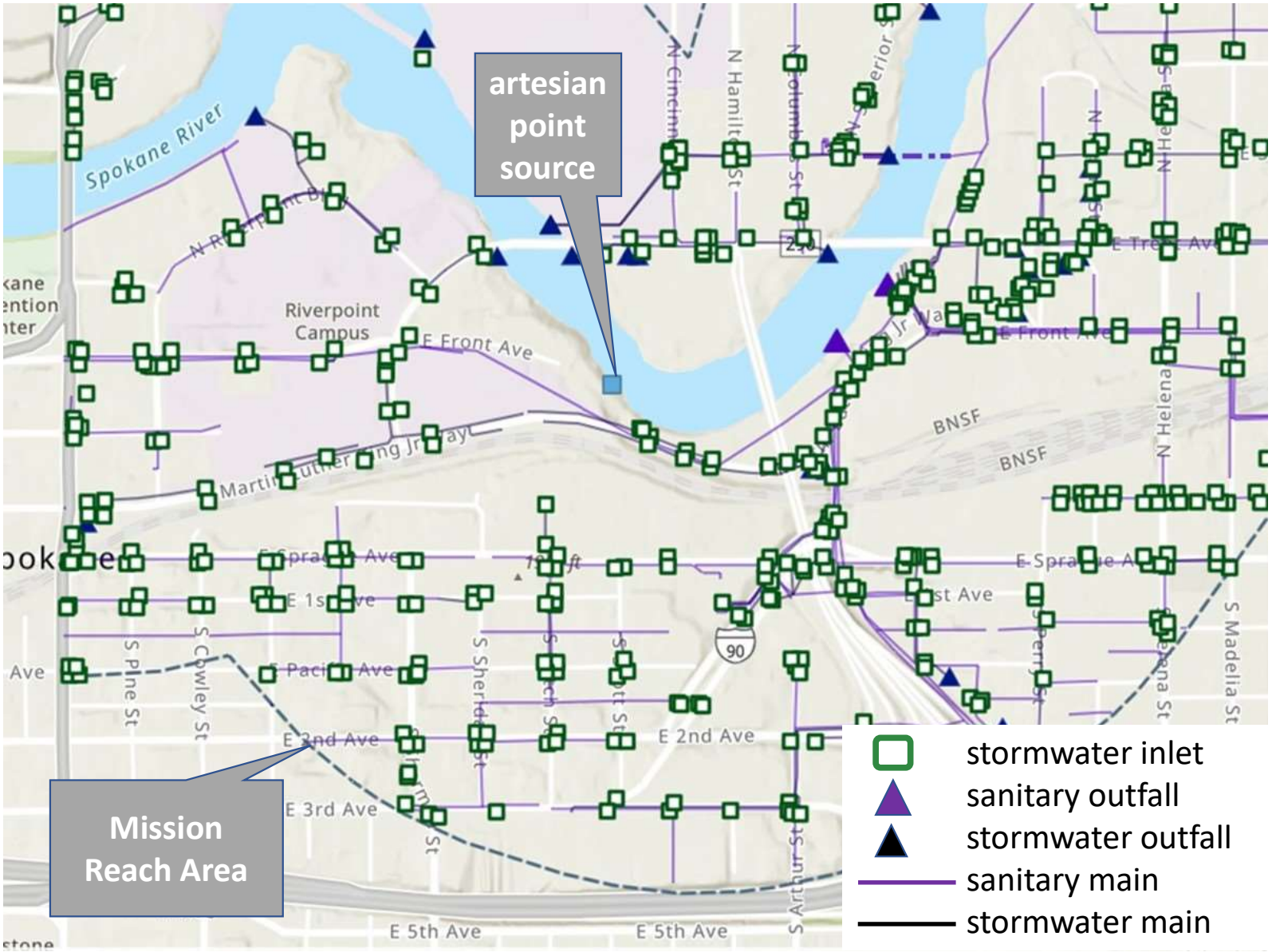


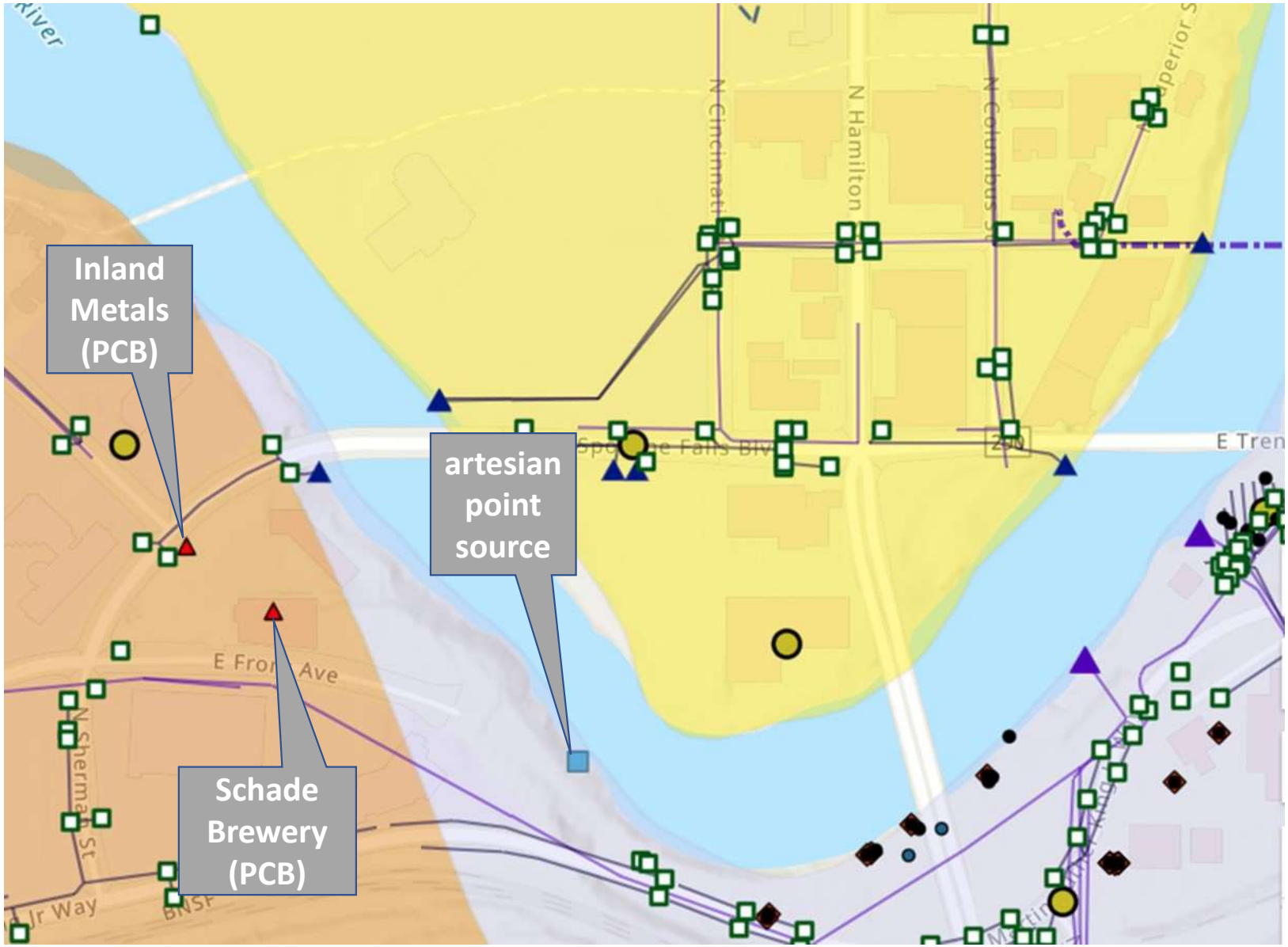
Spokane Convention Center Expansion & Expansion 2
200 W Spokane Falls Blvd
332 N Spokane Falls Ct
(CSIDs 1580 & 16021)

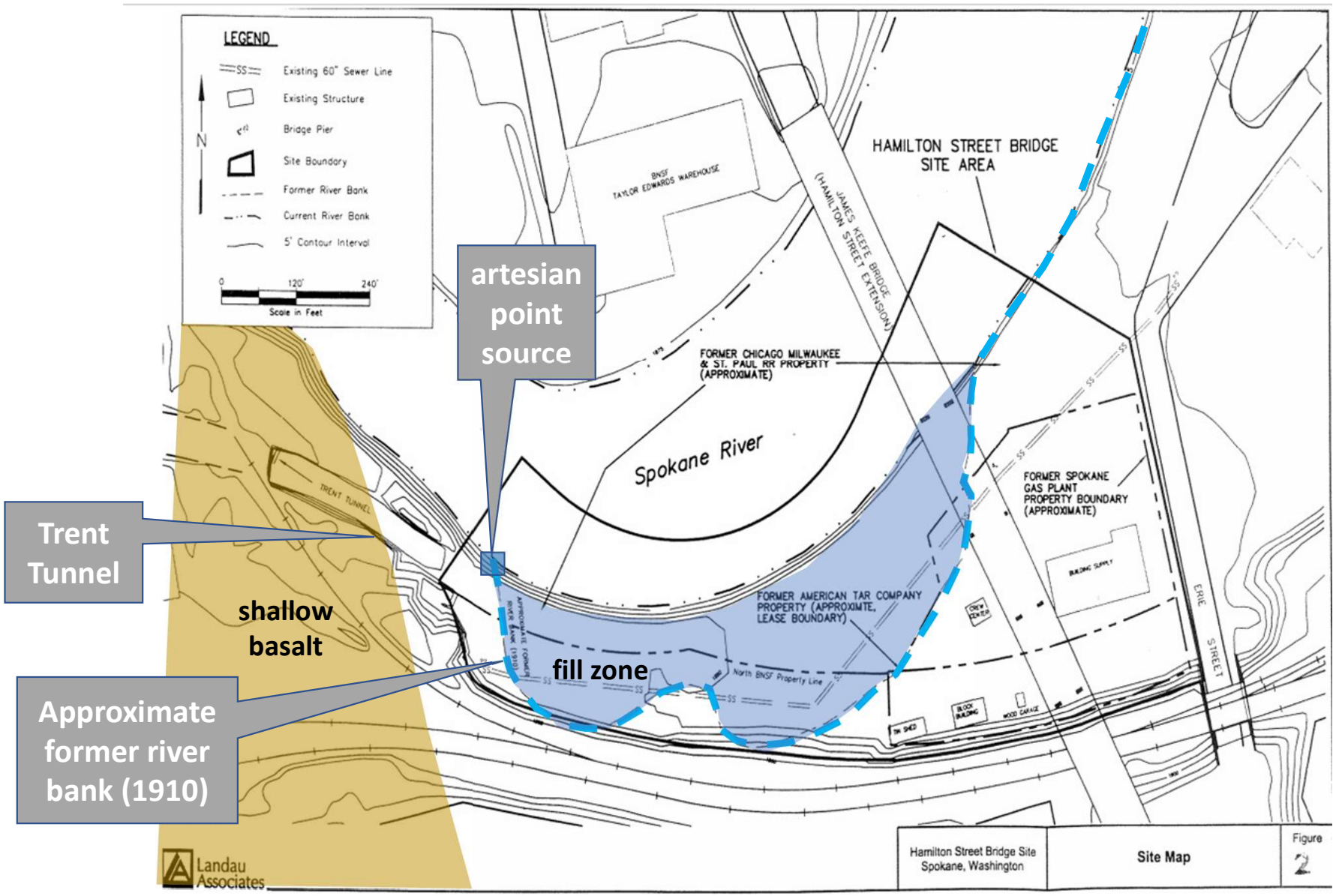
20 May 2004 Groundwater Elevation Map (likely perched in weathered basalt)




Spokane Convention Center Expansions: Groundwater Elevations
MW-SH01
MW-SH02
MW-SH19
MW-213
MW-214
MW-215
1872.0
1871.0
1870.0
5/1/1993
5/1/1995
5/1/1997
5/1/1999
5/1/2001
5/1/2003
5/1/2005
5/1/2007
Increasing distance from river; groundwater likely perched in weathered basalt


artesian point source
Mission Reach Area
Spokane River
Riverpoint Campus
E Front Ave
BNSF
E 2nd Ave
E 3rd Ave
E 5th Ave
N Hamilton St
N Heleana St
S Madelia St
S Pine St
S Cowley St
S Arthur St
stormwater inlet
sanitary outfall
stormwater outfall
sanitary main
stormwater main


Inland Metals (PCB)
artesian point source
Schade Brewery (PCB)
N Hamilton
N Cincinnati
N Columbus
E Fron Ave
N Sherman St
BNSF
E Tren


LEGEND
Existing 60" Sewer Line
Existing Structure
Bridge Pier
Site Boundary
Former River Bank
Current River Bank
5' Contour Interval
0
120'
240'
Scale in Feet
N
artesian point source
Trent Tunnel
shallow basalt
Approximate former river bank (1910)
fill zone
HAMILTON STREET BRIDGE SITE AREA
BNSF TAYLOR EDWARDS WAREHOUSE
JAMES KEEFE BRIDGE (HAMILTON STREET EXTENSION)
FORMER CHICAGO MILWAUKEE & ST. PAUL RR PROPERTY (APPROXIMATE)
Spokane River
TRENT TUNNEL
FORMER SPOKANE GAS PLANT PROPERTY BOUNDARY (APPROXIMATE)
FORMER AMERICAN TAR COMPANY PROPERTY (APPROXIMTE. LEASE BOUNDARY)
North BNSF Property Line
ERIE STREET
Landau Associates
Hamilton Street Bridge Site
Spokane, Washington
Site Map
Figure
2

Hamilton Street Bridge Continuous Monitoring Data Current Observations & Conclusions

- Hamilton St Bridge continuous monitoring data are helpful in assessing losing/gaining periods within Mission Reach
  - Trends consistent with upsteam & downstream river flow & gage data
  - Data show gaining periods predominantly in early spring
  - Still confirming MW9 data processing
  - Downstream dam level maintained at 1870.5 ft + 0.5ft since Nov 2021 per Avista
- MW8-20/MW8-90 cluster well data show downward vertical gradients (losing) during low flow winter months
  - Cannot confirm vertical groundwater gradient directions during high flow periods
  - If present, upward gradients would indicate groundwater discharge to river

Mission Reach: General Observations & Conclusions

- Limited groundwater flow direction data from sources other than Hamilton Street
  - Consistent with losing river reach at Avista
  - Variable at Banner 24-hr fuel stop (very flat gradient) & Spokane Convention Center Expansion (likely perched groundwater in shallow basalt zone)
  - Suggests gaining periods at Brown Bldg Supply/Front St but MW9 data need verification
  - Seasonal data important
- Basalt ridge to west appears to be a groundwater boundary
  - Basalt crosses river in "*minimal interaction*" reach zone
  - Suggests limited/no interaction with shallow sand/gravel aquifer ***– need to confirm***
- Artesian well/pipe - possible origins to investigate
  - Sewer infrastructure
  - Possible association with Inland Metals and/or Schade Brewery PCB cleanup sites
  - Possible association with former riverbank/fill zone and/or Trent Tunnel

Discussion

Mission Reach Sites With Limited Groundwater Flow Direction Data