APPENDIX 24

ARCADIS 100 MGD MEMO

Memo

SUBJECT
Mr. Philip DePoe
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Lehigh County Authority
1053 Spruce Road
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FROM
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1600 Market Street, Suite 1810
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SUBJECT
No New Conveyance Evaluation

COPIES TO
Jim Shelton, PE
Julia Manzano

OUR REF
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DATE
November 8, 2024

Background and Purpose

Arcadis has modeled the Kline's Island Sewer System (KISS) with the planned upgrade of the Main and Auxiliary Pump Stations (MPS-APS) to 100 MGD, both with and without planned Signatory SRPs, but without upstream conveyance improvements. The goal is to evaluate the impacts of only upgrading the MPS-APS with no other changes to conveyance using both the 2021 and 2050 future flows, including anticipated development, water conservation, and I&I creep impacts. Results were both tabulated and displayed in blossom diagrams.

The existing capacity of the MPS-APS is 84 MGD. Modeling incorporated the new pump curves and on-off logic of the MPS-APS but assumed that the MPS-APS maximum capacity will be 100 MGD to prevent issues within the Kline's Island Wastewater Treatment Plant (KIWWTP) and with PADEP and DRBC permitting. Outfall 003 was assumed to remain open.

This evaluation was completed using Hurricane Ida as presented at the Allentown Airport NOAA station which has been selected by the Signatories as the alternative evaluation surrogate event for a 5-year recurrence event. The August-September 2021 period that was used for previous analyses has three separate events as shown in Figure 1: Hurricane Fred, Hurricane Henri, and Hurricane Ida. For the blossom diagrams, the three rainfall events during this period were evaluated separately and referred to as "Storm 1", "Storm 2", and "Storm 3".

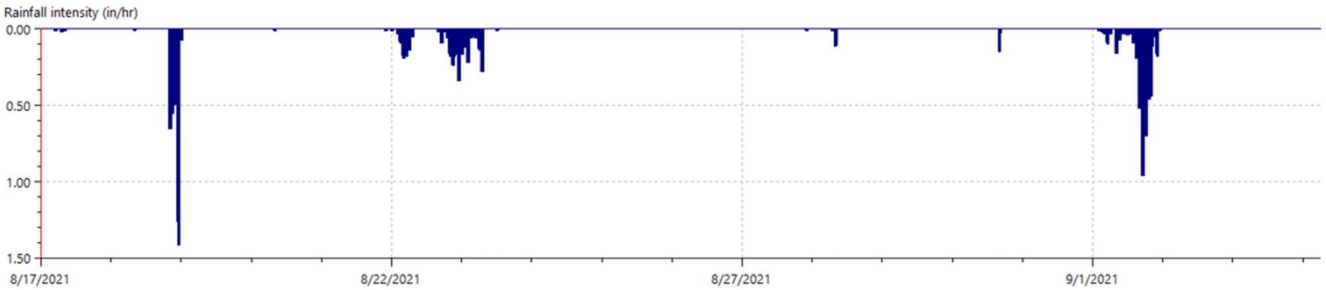

Figure 1. August-September 2021 Rainfall Period

Total Flow Per Day at KIWWTP

Results of total flow per day during the August-September 2021 period were tabulated for four model simulations: 2021 model without planned Signatory SRPs, 2021 model with planned Signatory SRPs, 2050 model without

planned Signatory SRPs, and 2050 model with planned Signatory SRPs. Results are shown in Table 1. On average, daily flows in 2021 decreased by 2.8% during the modeled period with the addition of the planned Signatory SRPs, consistent with previous modeling reports. The three peak flow days decreased by an average of 8.6% in the 2021 model. Average daily flows in 2050 decreased by an average of 5.5% with the addition of planned Signatory SRPs, and the three peak days decreased by an average of 8.7%.

Table 1. Total Flow Per Day at KIWWTP

	2021 No SRP (MGD)	*2021 With SRP (MGD)*	*2050 No SRP (MGD)*	*2050 With SRP (MGD)*
August 17, 2021	31.9	31.7	40.1	38.6
August 18, 2021	34.7	33.6	42.5	39.5
August 19, 2021	63.6	58.1	72.0	65.5
August 20, 2021	38.2	37.9	46.1	44.2
August 21, 2021	34.0	33.7	42.1	40.5
August 22, 2021	41.0	38.8	50.4	46.3
August 23, 2021	68.4	62.1	77.4	70.2
August 24, 2021	43.8	42.7	52.0	49.6
August 25, 2021	37.8	37.5	46.2	44.3
August 26, 2021	35.3	35.2	43.9	42.0
August 27, 2021	34.2	34.1	42.9	41.1
August 28, 2021	33.5	33.4	42.0	40.1
August 29, 2021	33.0	32.8	41.3	39.7
August 30, 2021	33.5	33.3	41.7	40.1
August 31, 2021	33.3	33.2	41.6	40.0
September 1, 2021	51.3	47.2	58.2	53.6
September 2, 2021	68.9	64.7	76.3	70.8
September 3, 2021	48.4	47.2	57.0	53.9
September 4, 2021	38.5	37.7	46.0	43.4

Blossom Diagrams

Sixteen blossom diagrams were created. No new conveyance were added to these models – only the upgrade to the MPS-APS to allow capacity of 100 MGD. The following scenarios and the corresponding figure are as follows, all located in Appendix A:

- August-September 2021 period Storm 1
    1. 2021 model without planned Signatory SRPs (Figure A-1)

2. 2021 model with planned Signatory SRPs (Figure A-2)
3. 2050 model without planned Signatory SRPs (Figure A-3)
4. 2050 model with planned Signatory SRPs (Figure A-4)

- August-September 2021 period Storm 2
  5. 2021 model without planned Signatory SRPs (Figure A-5)
  6. 2021 model with planned Signatory SRPs (Figure A-6)
  7. 2050 model without planned Signatory SRPs (Figure A-7)
  8. 2050 model with planned Signatory SRPs (Figure A-8)
- August-September 2021 period Storm 3
  9. 2021 model without planned Signatory SRPs (Figure A-9)
  10. 2021 model with planned Signatory SRPs (Figure A-10)
  11. 2050 model without planned Signatory SRPs (Figure A-11)
  12. 2050 model with planned Signatory SRPs (Figure A-12)
- September 26, 2021, Dry Day
  13. 2021 model without planned Signatory SRPs (Figure A-13)
  14. 2021 model with planned Signatory SRPs (Figure A-14)
  15. 2050 model without planned Signatory SRPs (Figure A-15)
  16. 2050 model with planned Signatory SRPs (Figure A-16)

September 26, 2021, was chosen as the dry day as it is a good representation of a “normal” dry day, rather than a dry day during a dry year and/or drought.

Conclusions

The tabulated daily flows at KIWWTP and the blossom diagrams all draw the same conclusions:

1. The planned Signatory SRPs are focused primarily on peak flow during rain events and have only a nominal impact on average dry day flows.
2. There are no average dry day overflow, but SSO do occur during the wet periods such as the August 2018- May 2019 period; the increased MPS-APS does not impact these overflows.
3. Increasing capacity of the MPS-APS does nothing to reduce normal dry weather flows in the KISS system and does not reduce dry day peak hydraulic grade line in the lower Little Lehigh Interceptor.
4. During peak wet weather conditions, there is benefit to having the additional 17 MGD pumping capacity at the MPS-APS but only in the final few miles of the interceptors near the KIWWTP. SSOs occurring upstream are not impacted.

APPENDIX A

Blossom Diagrams

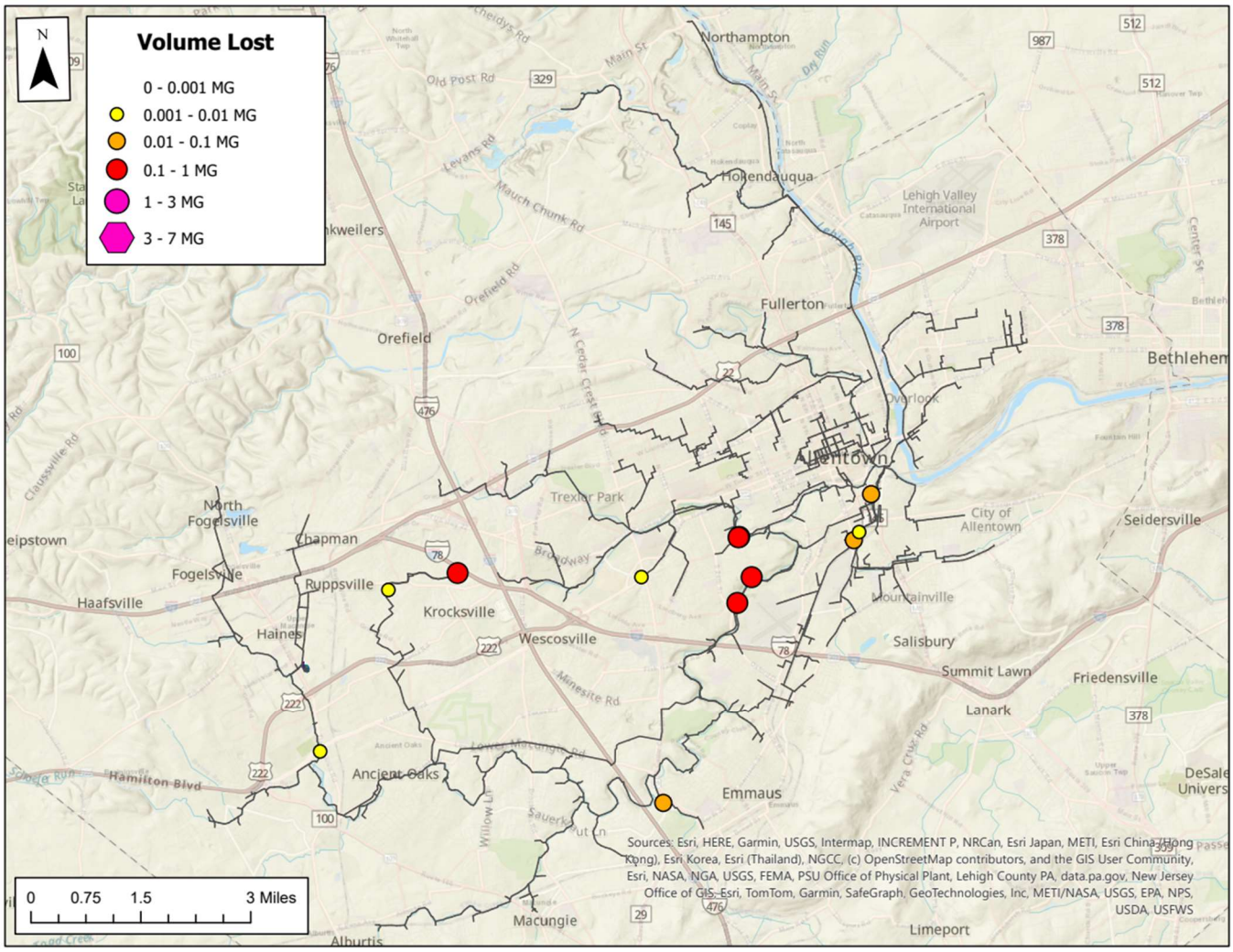

Figure A-1. August-September 2021 period Storm 1 – 2021 model without planned Signatory SRPs

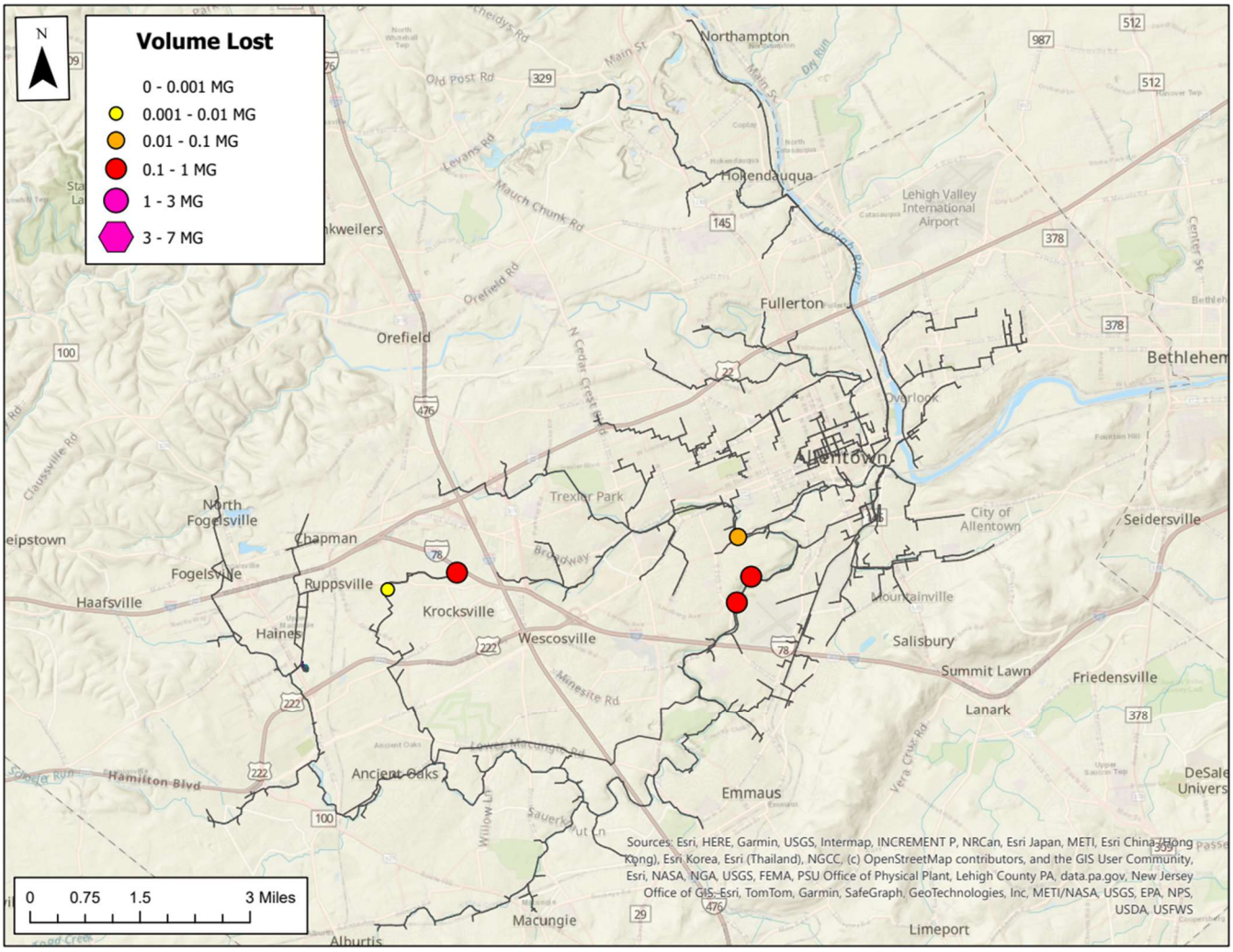

Figure A-2. August-September 2021 period Storm 1 – 2021 model with planned Signatory SRPs

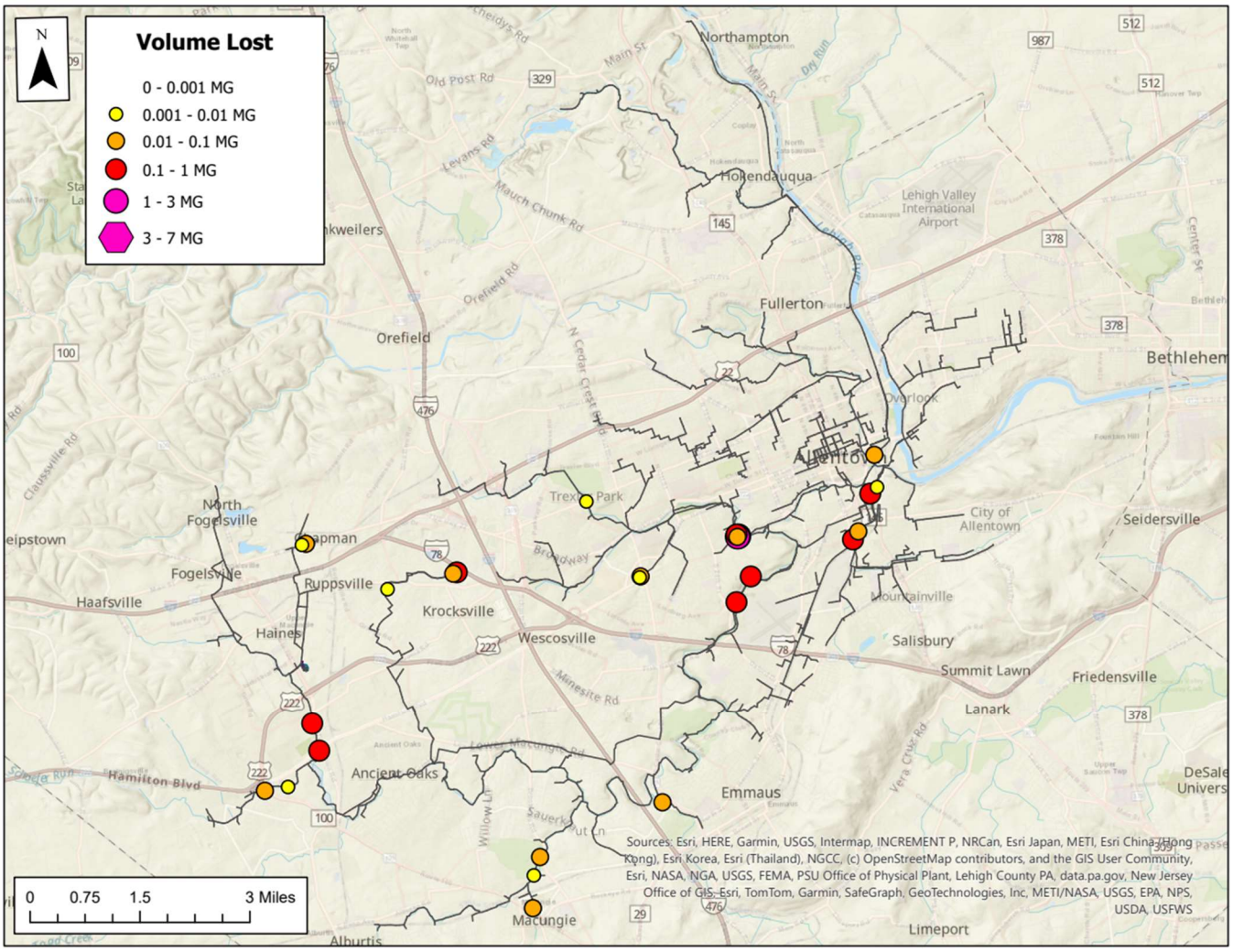

Figure A-3. August-September 2021 period Storm 1 – 2050 model without planned Signatory SRPs

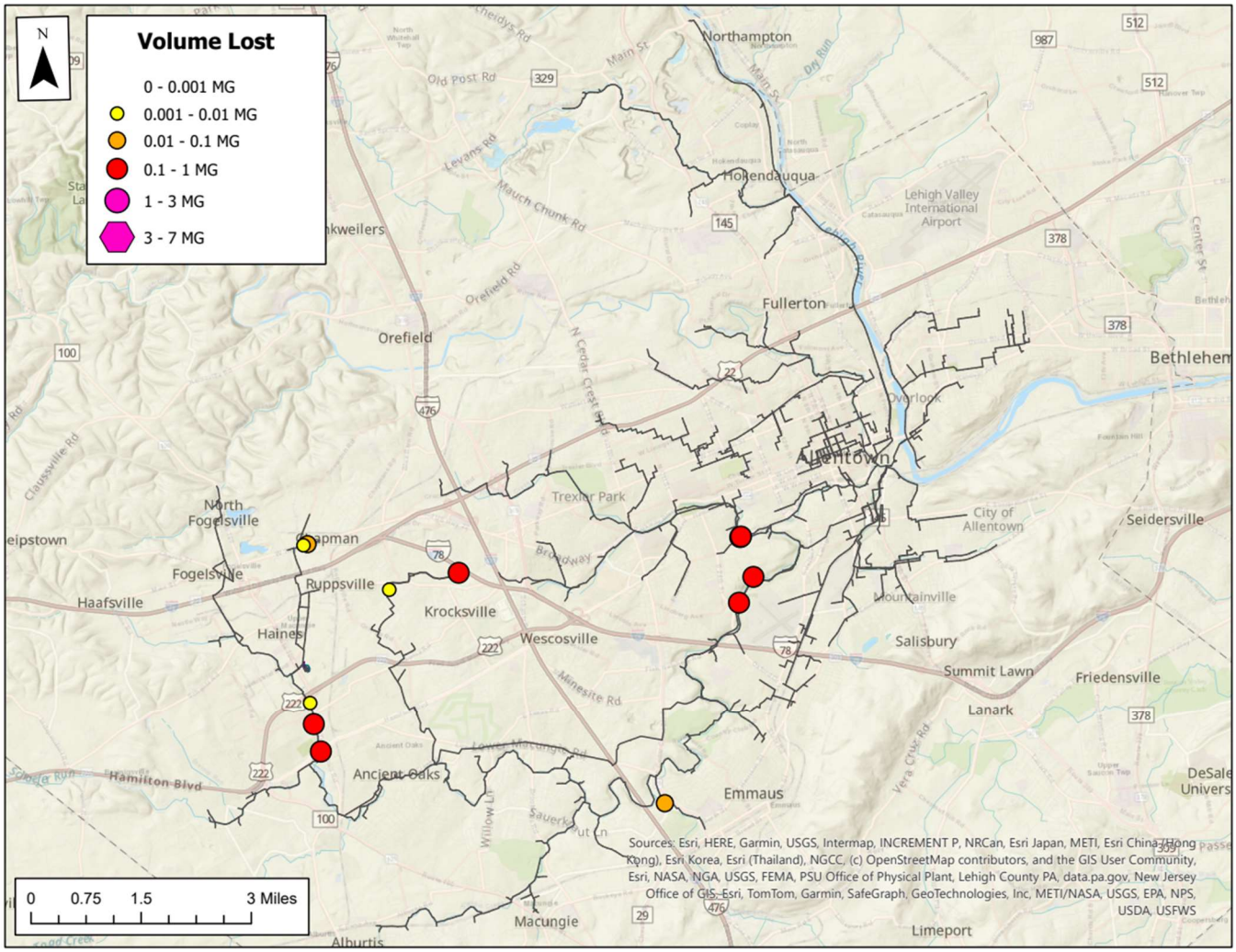

Figure A-4. August-September 2021 period Storm 1 – 2050 model with planned Signatory SRPs

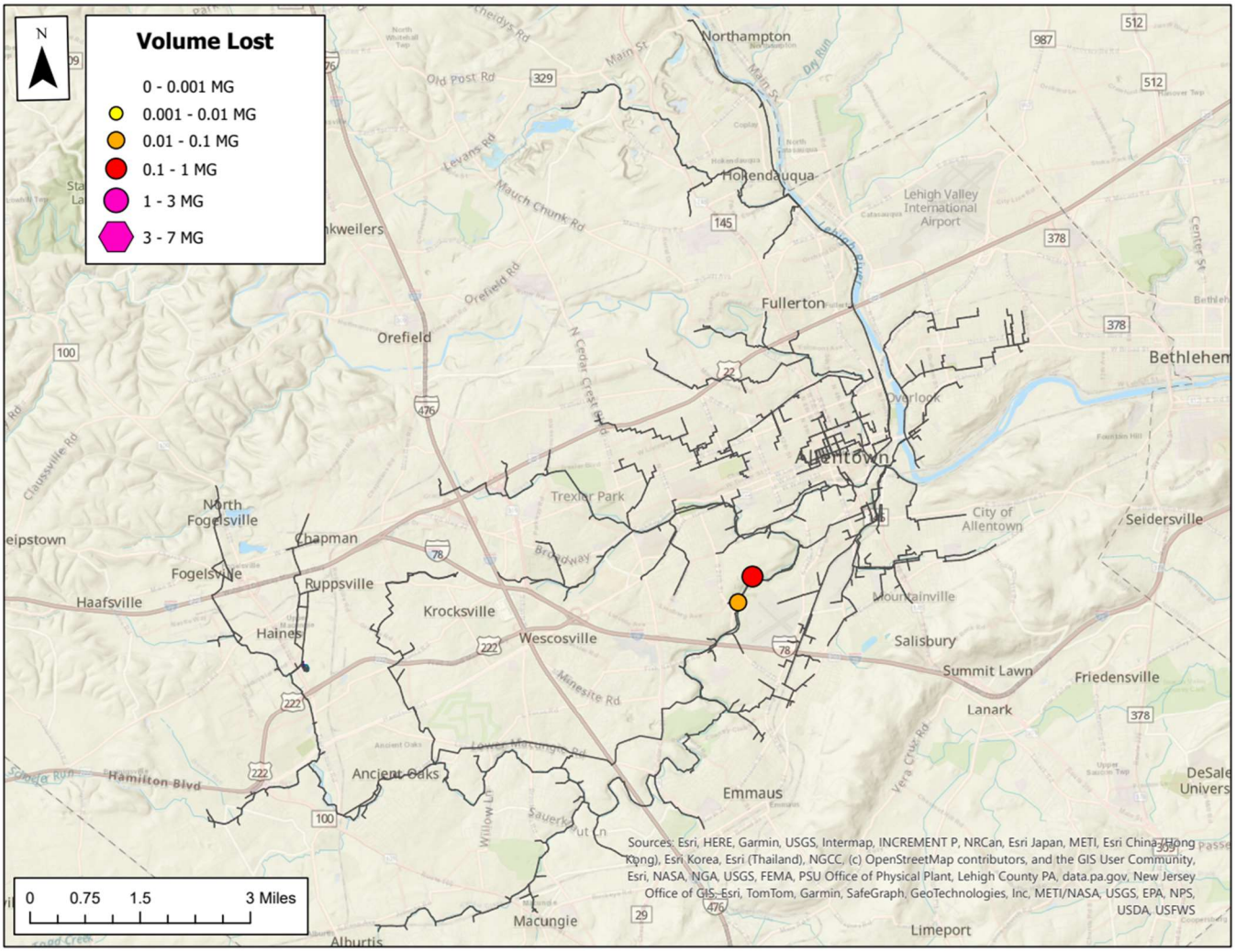

Figure A-5. August-September 2021 period Storm 2 – 2021 model without planned Signatory SRPs

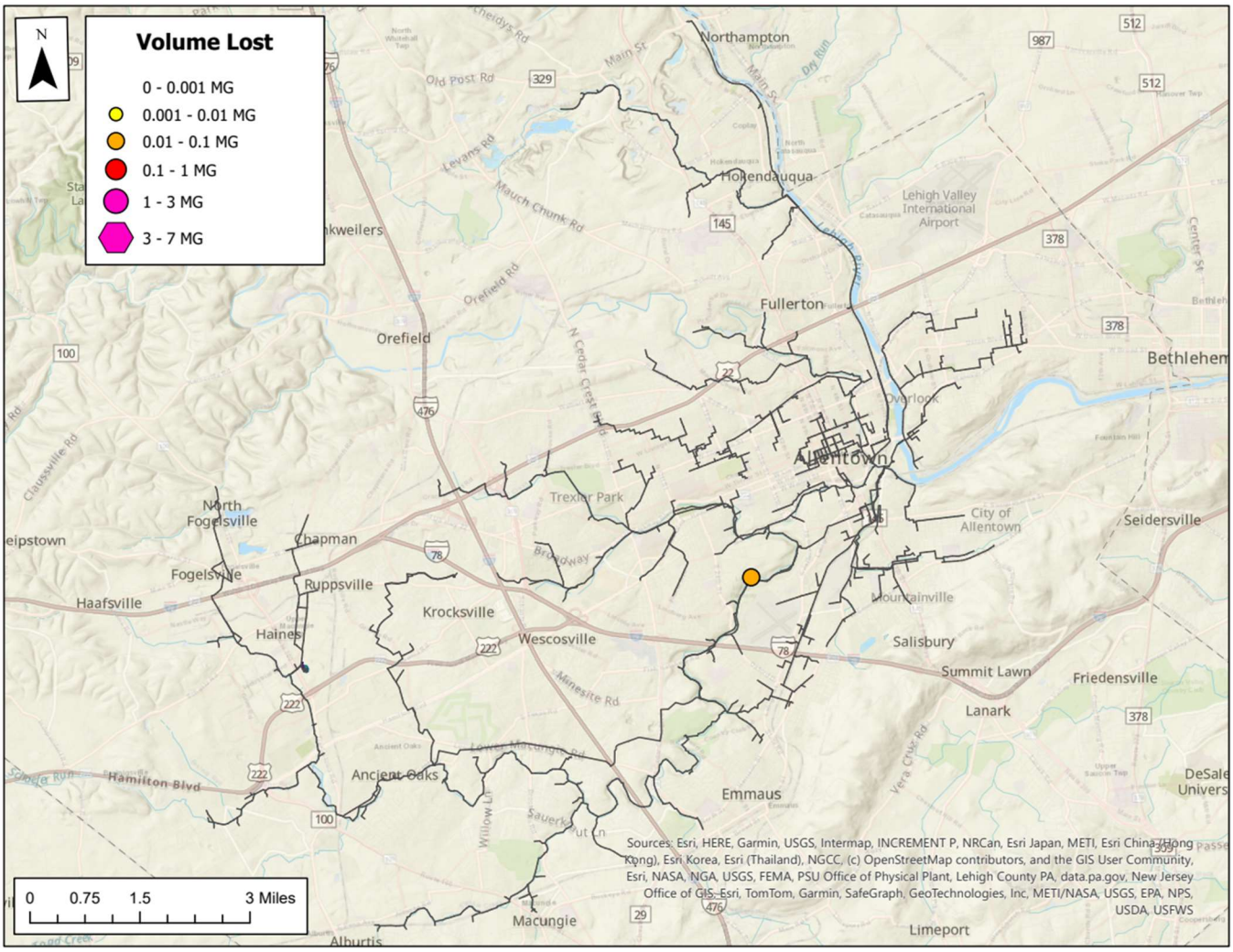

Figure A-6. August-September 2021 period Storm 2 – 2021 model with planned Signatory SRPs

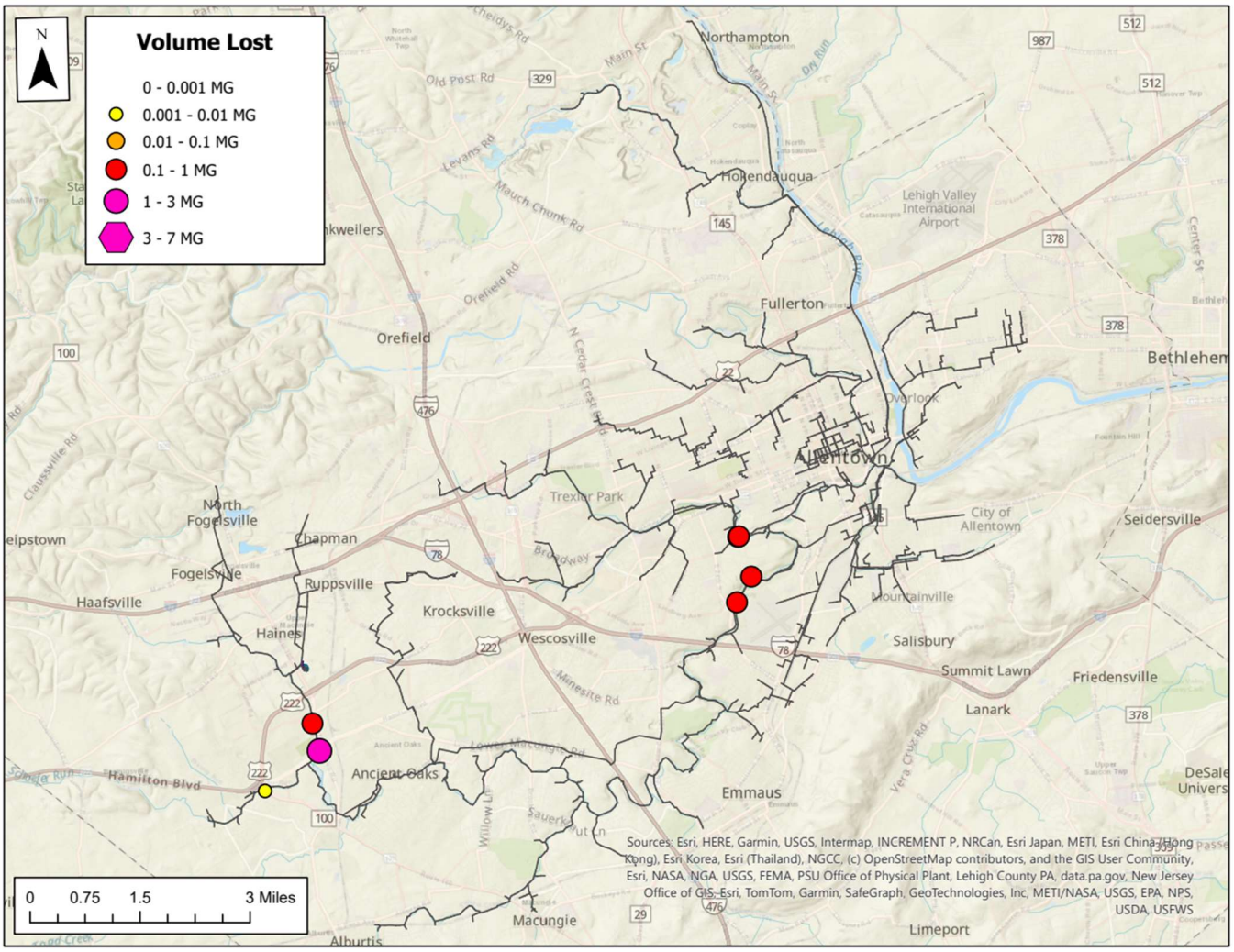

Figure A-7. August-September 2021 period Storm 2 – 2050 model without planned Signatory SRPs

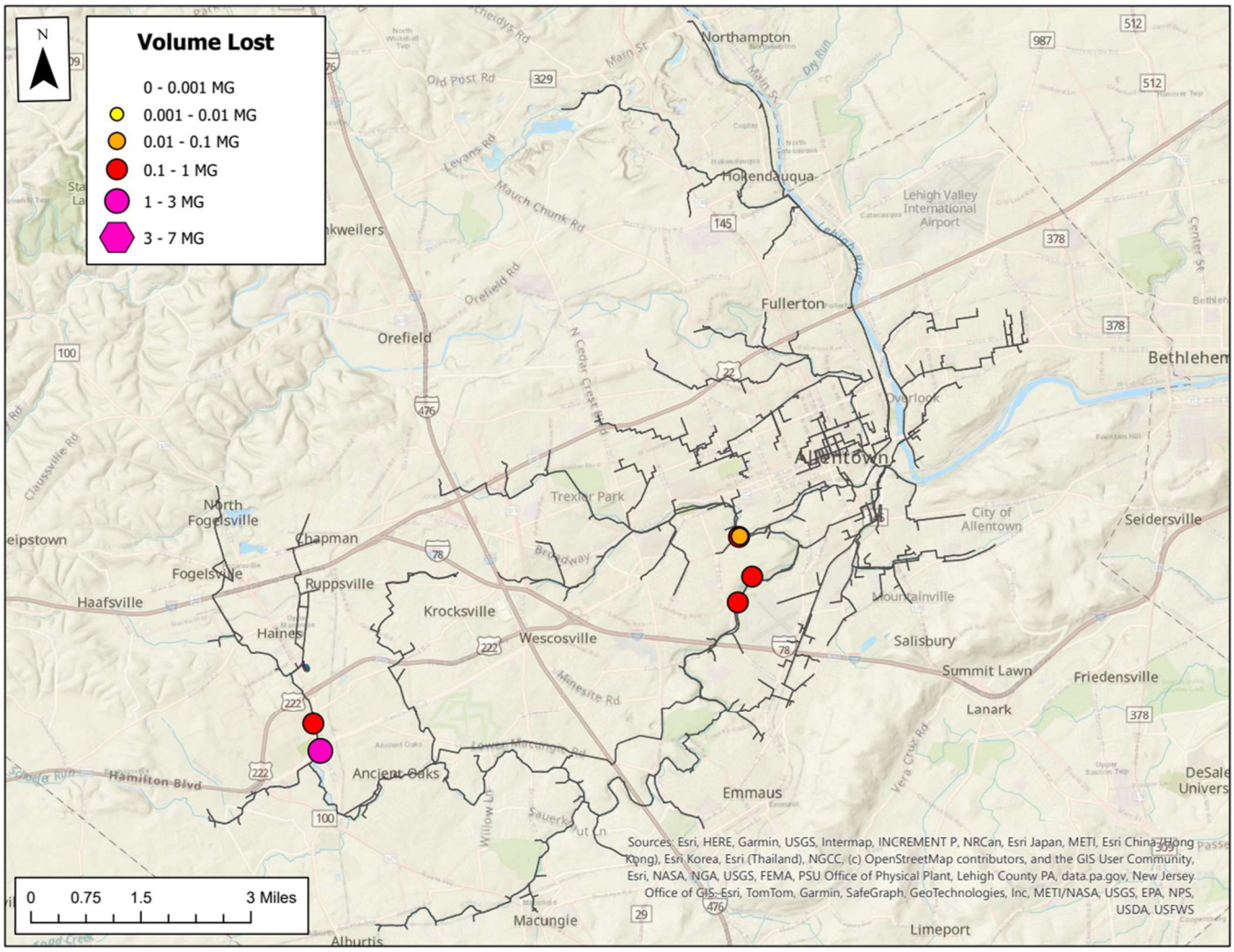

Figure A-8. August-September 2021 period Storm 2 – 2050 model with planned Signatory SRPs

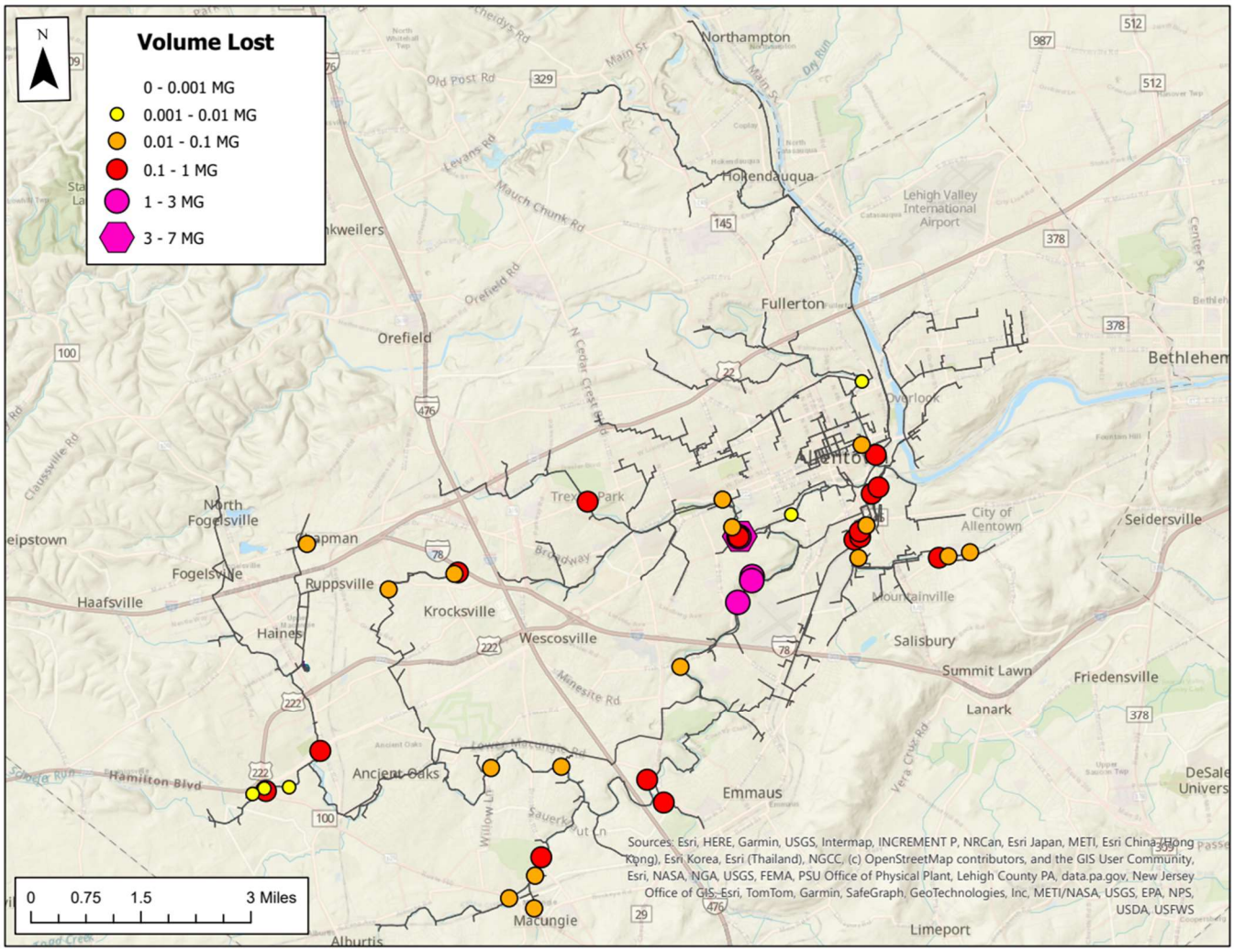

Figure A-9. August-September 2021 period Storm 3 – 2021 model without planned Signatory SRPs

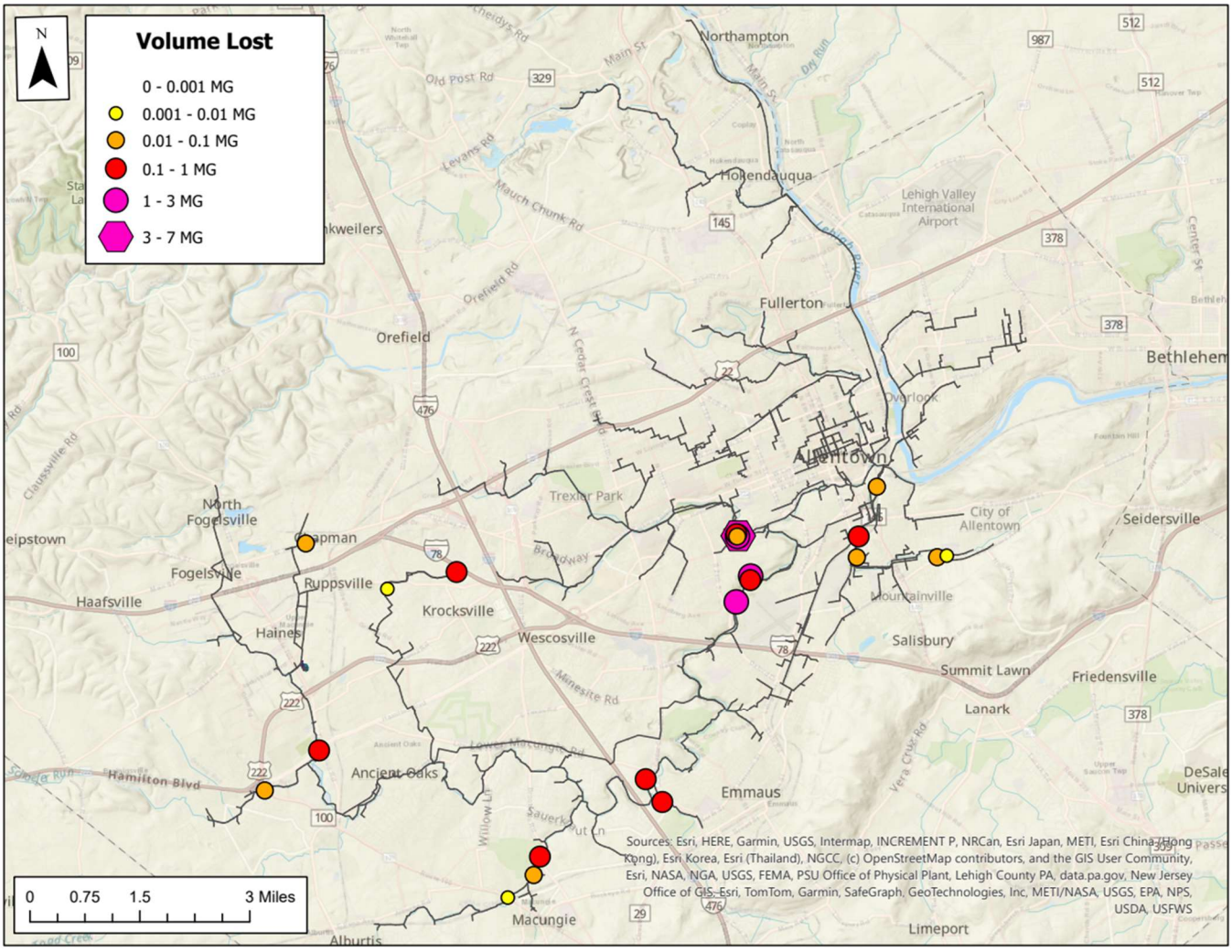

Figure A-10. August-September 2021 period Storm 3 – 2021 model with planned Signatory SRPs

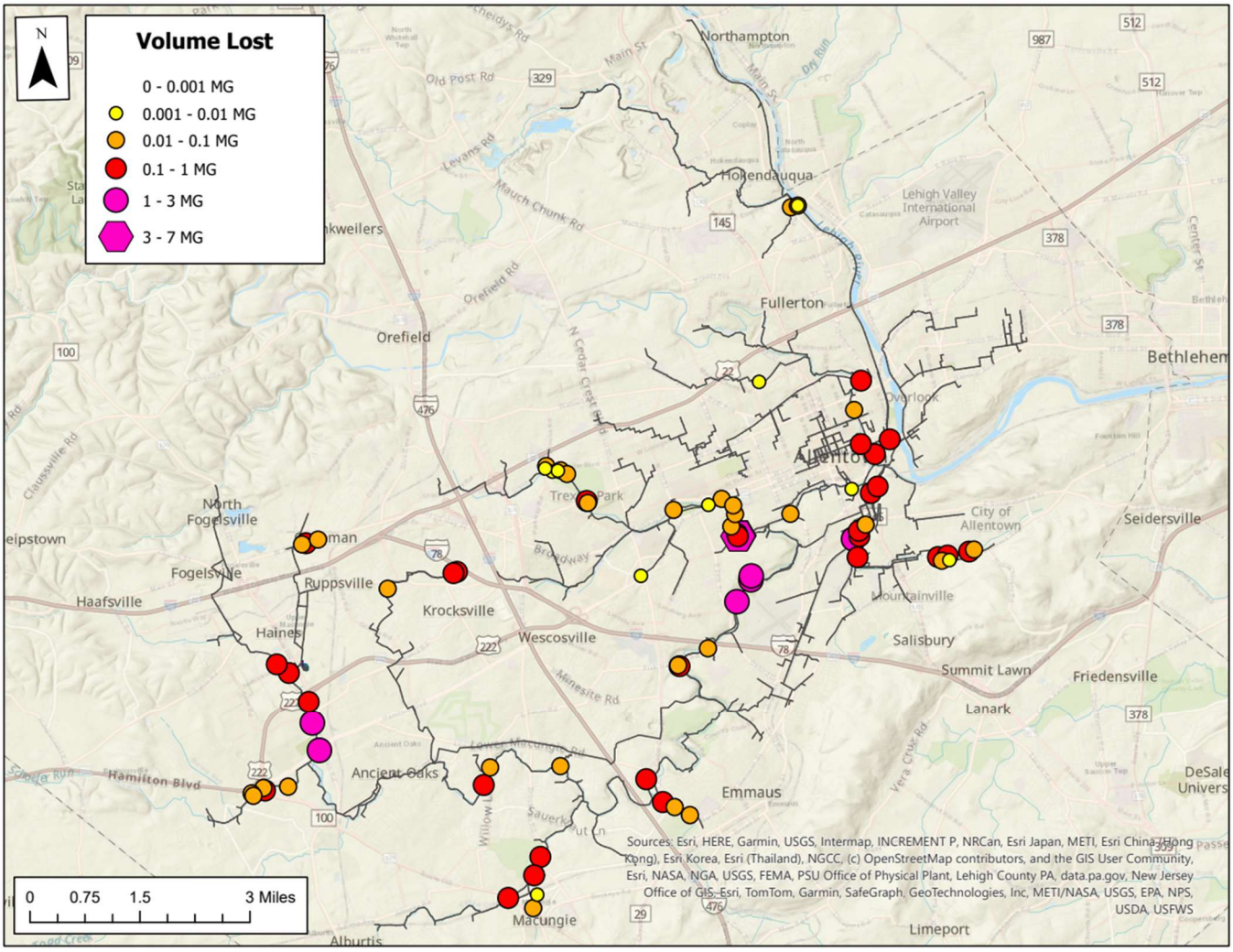

Figure A-11. August-September 2021 period Storm 3 – 2050 model without planned Signatory SRPs

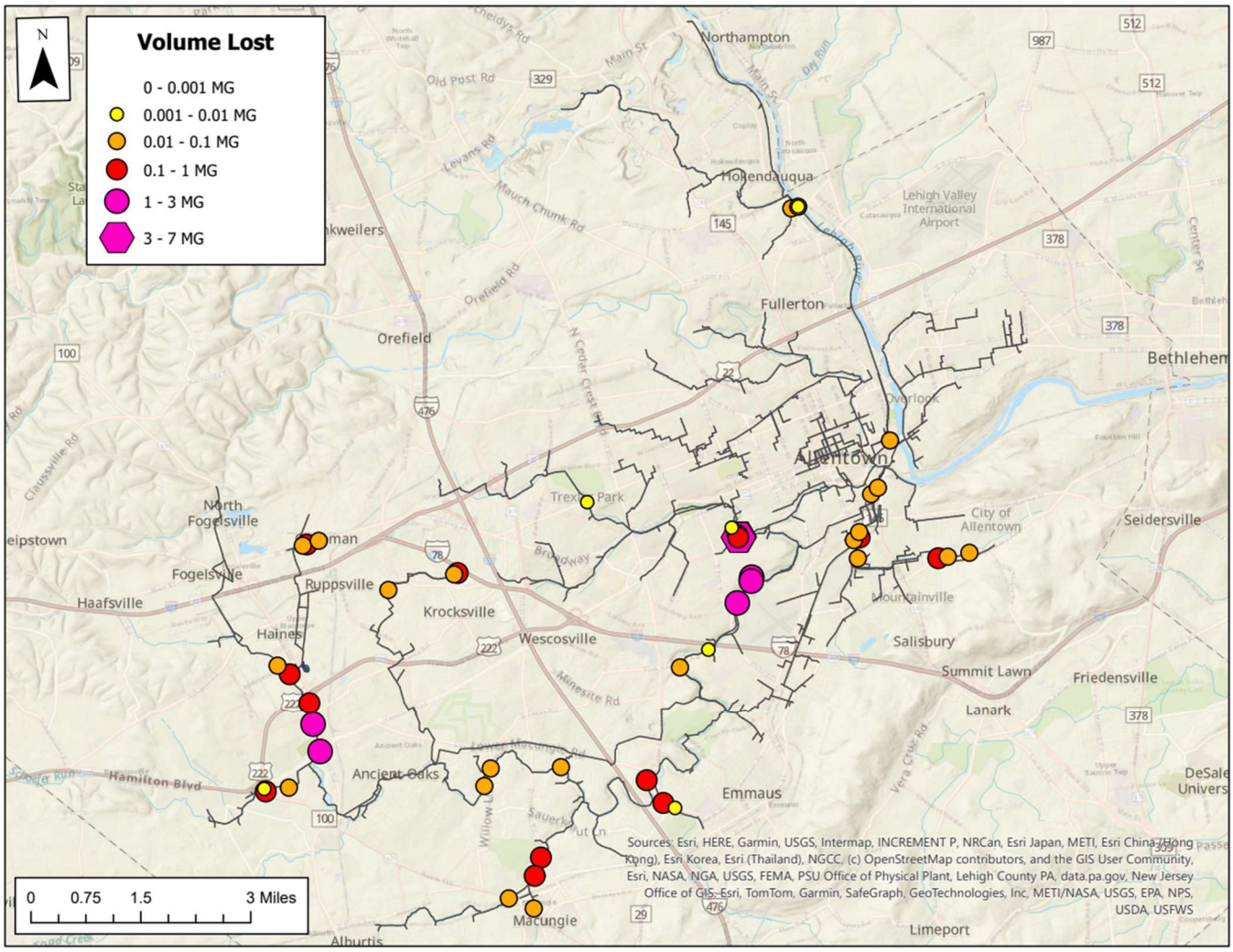

Figure A-12. August-September 2021 period Storm 3 – 2050 model with planned Signatory SRPs

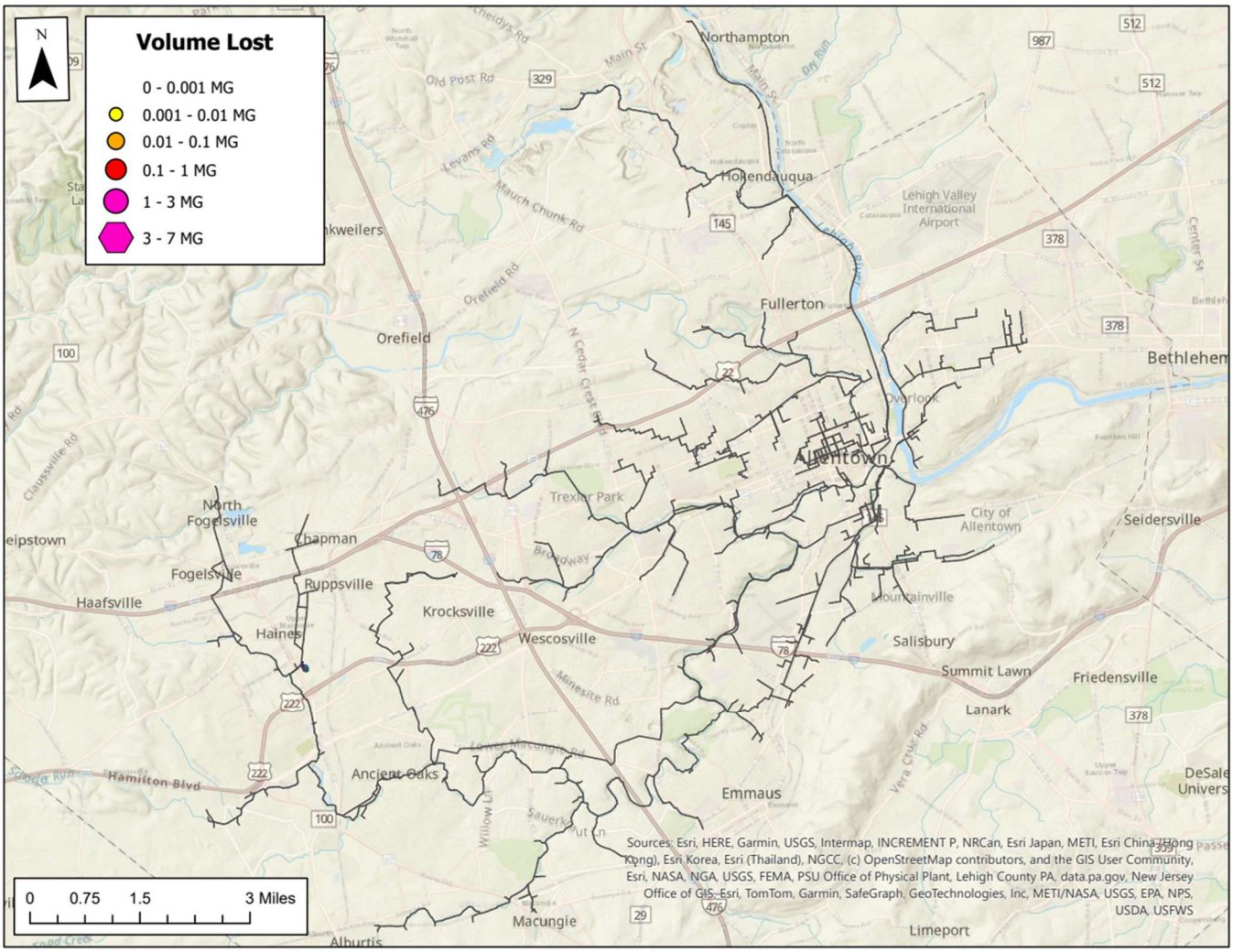

Figure A-13. September 26, 2021, dry day – 2021 model without planned Signatory SRPs (no SSOs)

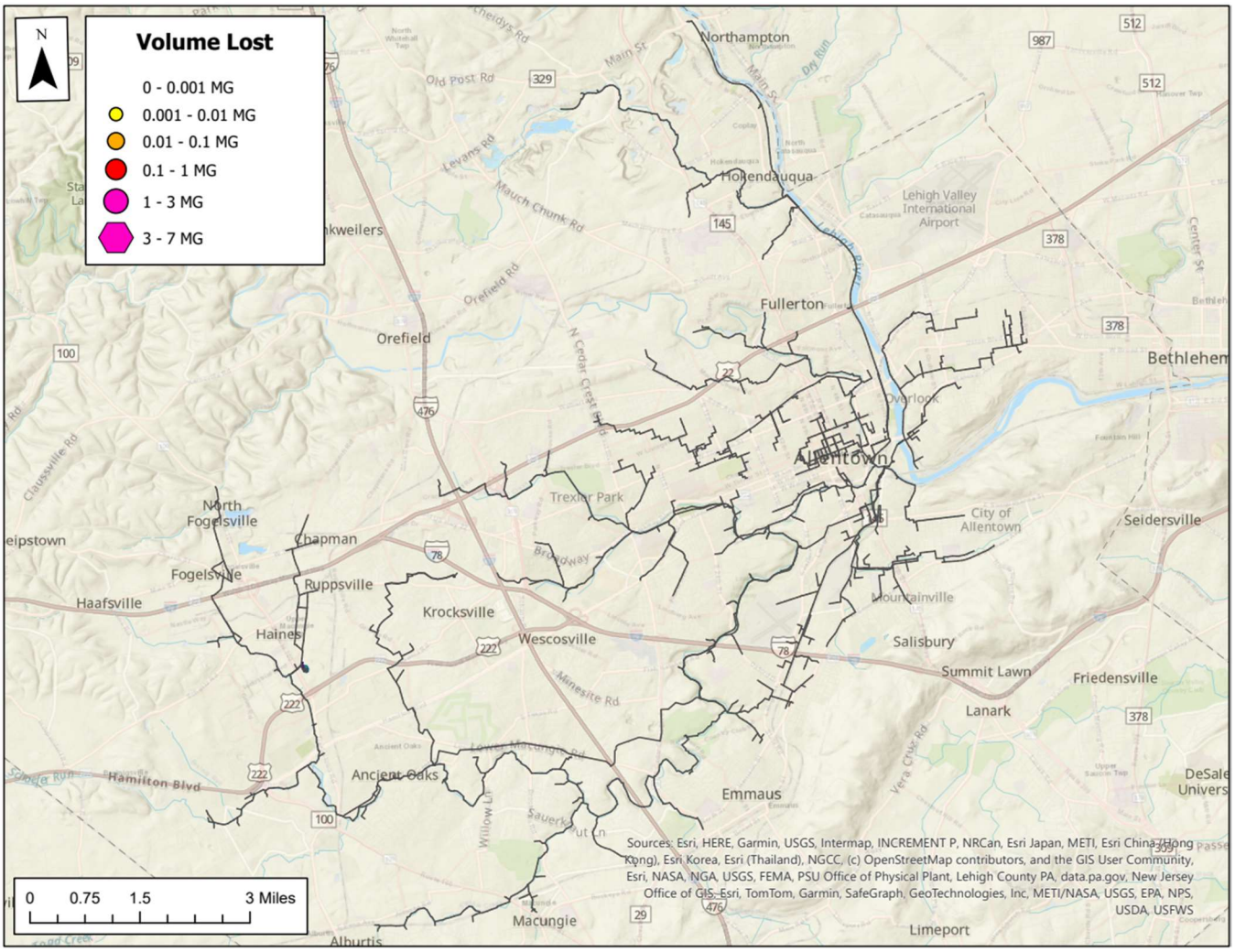

Figure A-14. September 26, 2021, dry day – 2021 model with planned Signatory SRPs (no SSOs)

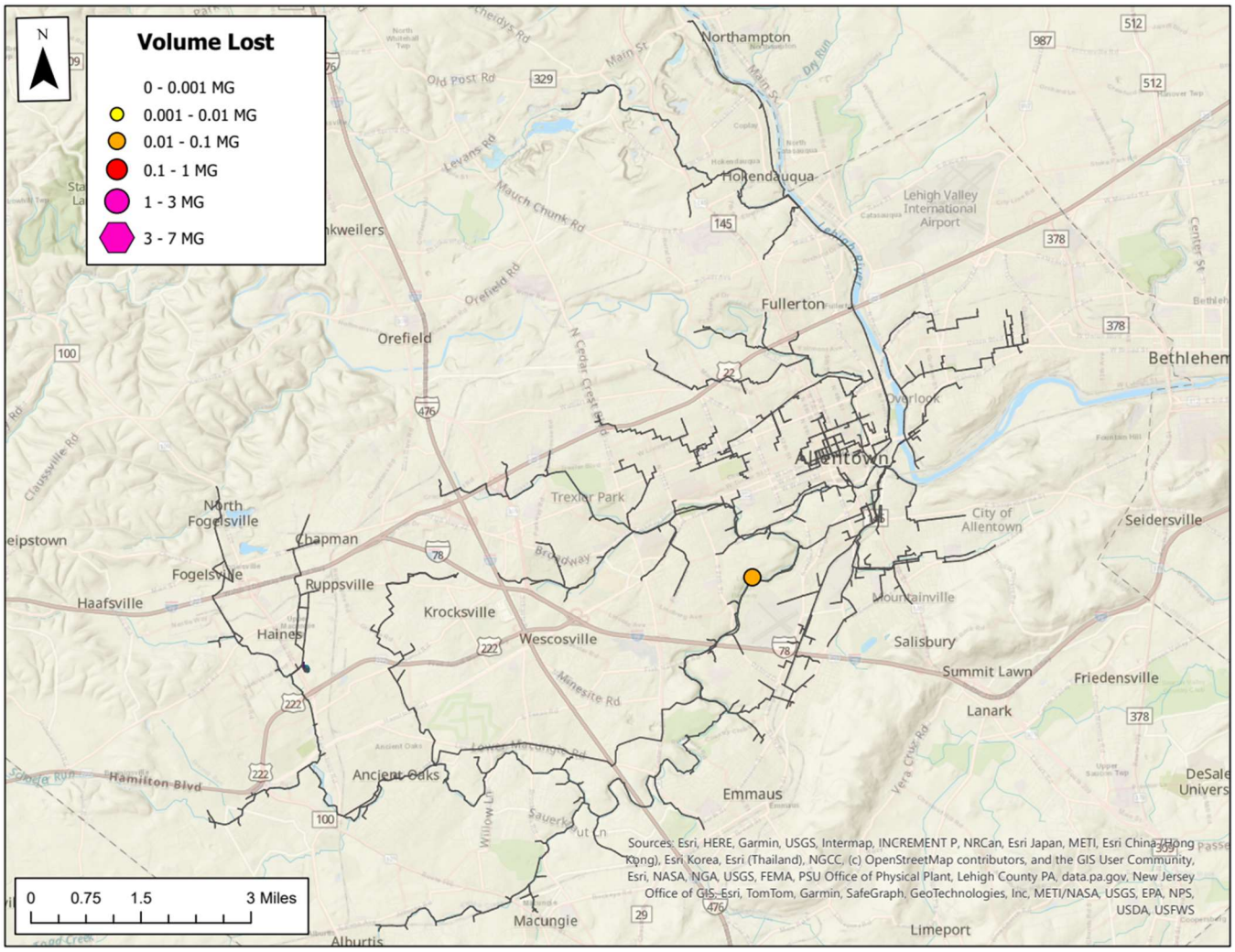

Figure A-15. September 26, 2021, dry day – 2050 model without planned Signatory SRPs

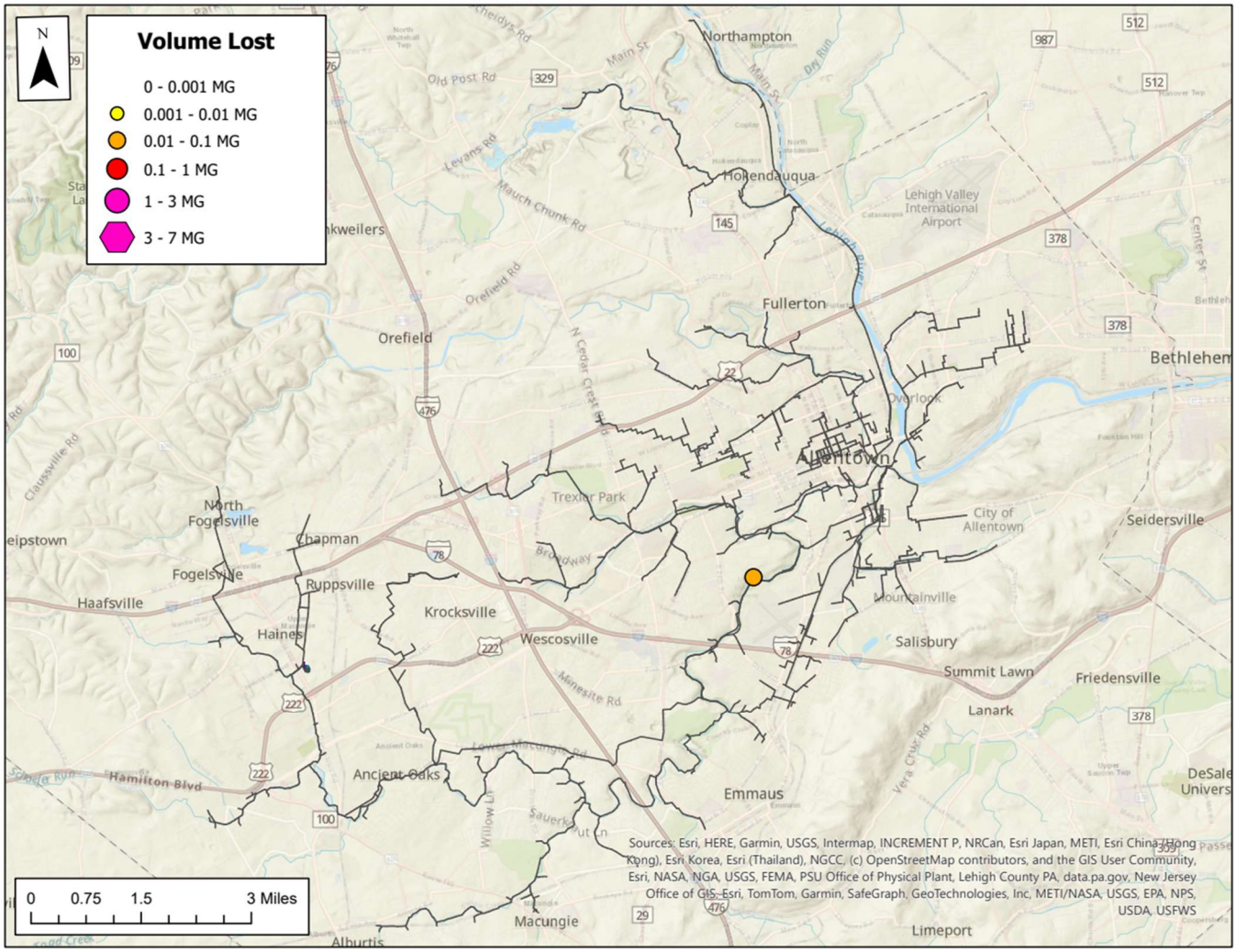

Figure A-16. September 26, 2021, dry day – 2050 model with planned Signatory SRPs