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February 7, 2006

Norman Shopay
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California Department of Toxic Substances Control
Geology and Corrective Action Branch
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Subject: Technical Addendum No. 2
Well Installation Work Plan for Interim Measures Performance Monitoring Program
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

This letter transmits the *Technical Addendum No. 2, Well Installation Work Plan for Interim Measures Performance Monitoring Program*. The technical addendum is submitted in conformance with Condition 10 in DTSC's January 6, 2006 letter, and describes the approach for hydraulic testing of wells at Locations 1, 2, and 4.

Please contact me at (805) 546-5243 if you have any questions on the work plan.

Sincerely,

Julie Eakins for Yvonne Meeks

cc. Kate Burger/ DTSC

Enclosure

Technical Addendum No. 2: Approach for Hydraulic Testing of Wells at Locations 1, 2, and 4 Interim Measures Performance Monitoring, PG&E Topock Compressor Station, Needles, California

Date: February 7, 2006

Introduction

On November 30, 2005, PG&E submitted to the California Department of Toxic Substances Control (DTSC) a *Well Installation Work Plan for Interim Measures Performance Monitoring Program* (IMPM Work Plan). The IMPM Workplan described the rationale, locations, and methods for the installation of new groundwater monitoring wells to address expansion and modifications to the IM performance monitoring network in the floodplain area of the Pacific Gas and Electric Company (PG&E) Topock Compressor Station near Needles, California.

The scope of work presented in the IMPM Work Plan was conditionally approved by DTSC in a letter dated January 6, 2006 (hereafter referred to as the "DTSC approval letter"). DTSC's conditional approval required further groundwater investigation and installation of wells at up to five additional locations in the IM performance monitoring area. Test wells will be installed at three of these locations (1, 2, and 4 if possible) and will undergo hydraulic testing after well completion and development. Technical Addendum No. 1 to the IMPM Work Plan was submitted in compliance with DTSC's approval letter on January 27, 2006. This document described the proposed locations, a well drilling and completion plan, and the anticipated schedule for the fieldwork. This Technical Memorandum is the 2nd addendum to the IMPM Workplan, and describes the proposed approach for hydraulic testing of wells installed at Locations 1, 2 and 4.

Scope

The scope of this addendum includes:

- the approach for the hydraulic tests
- management of aquifer test water
- testing schedule

A location map showing the test wells at Locations 1, 2, and 4 is presented as Figure 1.

Technical Procedures

Well Development

Test wells will be developed using a combination of surge block, bailer, and pumping. During development, temperature, pH, specific conductance, and turbidity will be measured using calibrated field instruments. Well development will continue until field parameters stabilize, and turbidity is reduced to less than 50 nephelometric turbidity units (NTUs). Documentation of well development activity will include development procedure, time and date of development, volume of water removed, and field parameter measurements.

Well development will be conducted in accordance with methods and procedures in the *Field Procedures Manual* (CH2M HILL 2005).

Step Testing

As a final stage of well development, a step drawdown test will be conducted at each test well. The step tests will provide estimates of specific capacity and well yield, and estimates of aquifer properties. The proposed step test for each well will comprise of four 15-minute steps at pumping rates of approximately 10, 30, 50 and 70 gpm. Approximately 2,400 gallons will be generated at each location. However, the final design for the step test at each well will be re-evaluated in the field, based on observations of well yield during well development. For example, pumping rates may be reduced or increased at low or high yielding wells, respectively. A test at Location 4 is contingent upon a test well being installed at this location.

Design of Hydraulic Tests

A groundwater model has been developed for the Topock site using the MicroFem model. This model is currently undergoing revision and recalibration; however, the current version of the model does a good job of matching observed hydraulic responses to pumping in the TW-2 well cluster. It is considered the best available method for designing the pumping tests. The current version of the model was used to simulate the extent of drawdown for constant rate extraction tests at each test well. The model simulations show plots of drawdown for the four model layers. These results are provided in Appendix A.

The influence of the changing river levels on groundwater levels has been a complicating factor in previous aquifer tests in the floodplain. A new spreadsheet-based drawdown analysis tool developed by the USGS has recently been applied to filter the effects of the river level changes (Halford, 2006). Using this spreadsheet, the groundwater level rebound was analyzed after a shutdown of pumping from TW-2D in October 2005. This analysis indicated that the minimum observable drawdown that could be distinguished from the "noise" of the daily river level changes was about 0.05 feet. The 0.05 foot contour of projected drawdown in model simulations was therefore used to estimate the maximum radius at which we might expect to observe the effects of the pumping tests. The groundwater model simulations were run in steady state and do not simulate the daily or seasonal river fluctuations, but rather indicate what the effects of pumping would be in the absence of river fluctuations. By using the deconvolution spreadsheet to analyze the aquifer

test data, we can minimize the "noise" caused by the river fluctuations and measure the actual drawdown caused by pumping.

The groundwater model predicts that pumping at a constant rate of 50 gpm for two hours would provide measureable drawdown (>0.05 feet) at nearby monitoring wells in the middle and deep intervals at test well Locations 1 and 2. A longer duration test may be required at Location 4 (i.e., a 4-hr test) to observe drawdown at monitoring wells, since the wells are further away from the test well. Based on stratigraphy data from MW-26, there is limited aquifer thickness at Location 4 (this well may have a screened interval less than 40 feet in length) and this may limit well yield. Final design of the constant rate tests will be evaluated in the field following well completion. If well yield is significantly less than or greater than the rate assumed here (50 gpm), the model will be used to re-estimate the time and rates that will produce optimal results.

Pumping rates and water levels were evaluated to determine whether operation of the existing extraction wells (TW-3D and PE-1) would interfere with hydraulic testing of the new test wells. Model results indicate that, if pumping rates remain constant, pumping at these wells will produce minimal variations in water levels at surrounding monitoring wells. Therefore, it is not anticipated that the IM-3 extraction system will need to be shut down during hydraulic testing of the new test wells.

Constant Rate Extraction Testing

A constant rate extraction test will be conducted at each test well. Water levels will be monitored in all monitoring wells to ensure sufficient time between the step test and the constant rate test to provide full recovery. The pumping rate for the constant rate test will be established after evaluating the step test results. However, for planning purposes and based upon the modeling results, the following test is proposed:

Locations 1, 2, and 4: 50 gpm x 2 hrs = 6,000 gallons per test

Manual water level measurements will be taken at regular intervals in test wells. In addition, water levels will be monitored with pressure transducers at the test wells and nearby monitoring wells, at one-minute intervals during the constant rate testing. River stage data from the the I-3 gauging station and barometric pressure will be measured for at least two weeks prior to the tests begin, to provide baseline data for the filtering de-convolution of river effects. Barometric pressure (necessary for de-convolution of river effects) will be monitored using an In-Situ Troll9000™.

Hydraulic testing will be conducted in accordance with methods and procedures in the *Field Procedures Manual* (CH2M HILL 2005).

Sampling

Initial sampling will occur at the end of the step drawdown test. Results will be used to provide an initial indication of the water quality from the well. This data will be primarily used to evaluate options for storage and treatment of the water to be generated during the subsequent aquifer testing. If different wells produce water of different quality, it may be advantageous to segregate the water produced during the aquifer testing.

Management of Aquifer Test Water

Disposal / Treatment of Water Generated From Tests

It is estimated that the three step and constant rate tests will generate approximately 30, 000 to 45, 000 gallons of groundwater. This water will be stored in temporary tanks already located at the MW-20 bench. Pending approval from DTSC and RWQCB, the water will be treated at the IM3 treatment facility.

The water will be transported from the temporary well head staging areas to the MW-20 bench using trucks. The water at the MW-20 bench will be stored in 21,000 gallon tanks within secondary containment until transportation to the IM-3 treatment plant can occur.

Approval to treat purge and aquifer testing water at the IM-3 treatment plant was granted by the California Regional Water Quality Control Board (RWQCB) on January 26, 2006. Pending approval from DTSC, PG&E plans to treat the water generated during the aquifer testing at the IM-3 treatment plant.

Prior to conveying the aquifer test water to the IM-3 facility, it will be sampled to confirm it can be blended with the plant influent without causing any problems in the treatment process. Water will then be conveyed to the IM3 treatment plant at a rate that is consistent with the plant's available capacity to process the water. The water will be conveyed either by pumping the water through the existing pipeline to the IM3 treatment plant from the MW-20 bench (at vault #1), or by tanker truck. If the water is conveyed by truck, a total of 6 to 8 truck trips will be necessary to transport the volume of water generated during aquifer testingto the IM-3 treatment plant.

Given the relatively small volumes of water that are expected to be produced during aquifer testing and development (15,000 gallons per well), the period needed for reduced pumping at TW-3D and PE-1 would be minimal and of short duration. For example, reducing the total extraction rate from 135 gpm to 100 gpm for 5 to 7 hours would be sufficient to treat all of the water from one test well location. PG&E will not reduce the extraction rate without DTSC approval.

Management of Water at Wells

During testing activities, water will be pumped through flexible hose from the wells directly into trucks at a location near the well. A temporary secondary containment pad will be placed beneath any removable couplings, beneath any storage tanks and any truck transfer areas to prevent the possibility of any leaks during the pumping tests. At each location, two trucks will collect and transfer water from the test well site to storage tanks within the secondary containment at the MW-20 bench. Each truck will have a 40 foot long trailer equipped with a 5,000-gallon tank (60 feet long overall). Trucks will be connected to the submersible pump piping used for hydraulic testing by a valve and manifold that will split flow to allow pumping into either truck or both trucks simultaneously. Details specific to each test well location follow:

Location 1

Figure 2 shows the proposed locations of trucks at Location 1. It is near existing monitoring well MW-19 at the junction of Park Moabi Road and the access road to the IM3 facility. Trucks will have direct access to the Location 1 well head from Park Moabi Road. There is also sufficient area to stage two trucks to simultaneously, without restricting traffic on either the IM3 access road or Park Moabi Road.

Location 2

Figure 3 shows the proposed locations of trucks at Location 2. It is approximately 50 ft east of Park Moabi Road and 600 ft southeast of the MW-35 staging area. Discharge from Location 2 would be pumped to trucks parked either on Park Moabi Road or at the MW-35 staging area. Positioning trucks at Park Moabi Road would require closure of one lane during testing activities. Piping the water to the MW-35 staging area would create less potential traffic issues, but would require a longer pipeline. Due to the long distance between MW-35 and Location 2 (600 ft), it will be preferable to run temporary hose or pipe from Location 2 to Park Moabi Road.

Location 4

Figure 4 shows the proposed locations of trucks at Location 4, near existing monitoring well MW-26. A temporary closure of one lane of Park Moabi Road will be required to conduct the pumping test at Location 4. The lane closures necessary for hydraulic testing at Locations 2 and 4 will be coordinated with San Bernardino County before testing begins, in conjunction with traffic control planning required for the well installation at Location 4.

Testing Schedule

The schedule for the drilling and well installation for the additional IM drilling Locations 1 to 5 is subject to review and approval from Bureau of Land Management and Havasu National Wildlife Refuge. Review and approvals by San Bernardino County will also be required for the well drilling and a traffic control plan for the proposed drilling along Park Moabi Road (Location 4). Additionally, review and consultation with the California Department of Fish and Game is anticipated for drilling activities at floodplain Locations 2 and 3.

The duration of drilling and well installation activities for IMPM Work Plan Sites A, B, and C are estimated to be 4 weeks, and this work is anticipated to commence during the second week of February 2006. The anticipated duration for well installation and completion at Locations 1 to 5, including contingent Location 3, is estimated to be an additional 6 weeks. Assuming this schedule is correct, hydraulic testing will begin after completion of all new IMPM wells in mid- to late-April. All new wells will be instrumented with pressure transducers prior to hydraulic testing. The tests should be completed within approximately one week.

Reporting

Hydraulic test results will be reported 6 weeks after the tests are completed. Results will also be included in the revised RCRA Facility Investigation/ Remedial Investigation Report.

Hydraulic test data will be analyzed using the USGS de-convolution spreadsheet in combination with the program Muli-layer Unsteady State (MLU) (Hemker, 1999a and 1999b) to estimate aquifer properties. The de-convolution process will allow measurement of the drawdown and recovery after filtering the noise of the river level changes. The drawdown and recovery data will also be used in the re-calibration of the groundwater flow model.

Certification

This work plan was prepared by CH2M HILL under the supervision of the professional whose seal and signature appears hereon, in accordance with currently accepted professional practices; no warranty, expressed or implied, is made.

Paul F. Bertucci
Certified Engineering Geologist

References

California Department of Toxic Substances Control (DTSC). 2006. Letter to PG&E. "Conditional Approval of the Draft Well Installation Work Plan for Interim Measures Performance Monitoring Program, Dated November 30, 2005 PG&E Topock Compressor Station, Needles California." January 6.

California Regional Water Quality Control Board (RWQCB). 2006. Letter to PG&E. "Request to Treat Groundwater Generated through Groundwater Monitoring and Other Field Activites Through Interim Measure No. 3 Groundwater Remediation Facility, PG&E Topock Compressor Station, Needles California." January 26.

CH2M HILL. 2005. Well Installation Work Plan for Interim Measures Performance Monitoring Program, *PG&E Topock Compressor Station, Needles, California.* November 30.

_____. 2005b. Technical Addendum No. 1: Well Installation Work Plan for Interim Measures Performance Monitoring, *PG&E Topock Compressor Station, Needles, California.* January 27.

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Halford, K.J. 2006, Documentation of a Spreadsheet for Time-Series Analysis and Drawdown Estimation, USGS Scientific Investigation Report 2006-5024

Hemker, C.J. 1999a. Transient well flow in layered aquifer systems: the uniform well-face drawdown solution, Journal of Hydrology, 225: 19-44

_____. 1999b. Transient well flow in vertically heterogeneous aquifers, Journal of Hydrology, 225: 1-18._____. 2002. MLU: DOS Program for the Analysis of Aquifer Tests in Layered Systems available from the author at http://www.microfem.com/.

Figures

Technical Addendum No.2 2/7/06

FIGURE 1
PROPOSED LOCATIONS FOR ADDITIONAL GROUNDWATER WELLS FOR IM PERFORMANCE MONITORING

WELL INSTALLATION WORK PLAN FOR
IM PERFORMANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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Technical Addendum No.2 2/7/06

FIGURE 2
PROPOSED LOCATIONS FOR WATER MANAGEMENT AT LOCATION 1 IM HYDRAULIC TESTING

WELL INSTALLATION WORK PLAN FOR
IM PERFORMANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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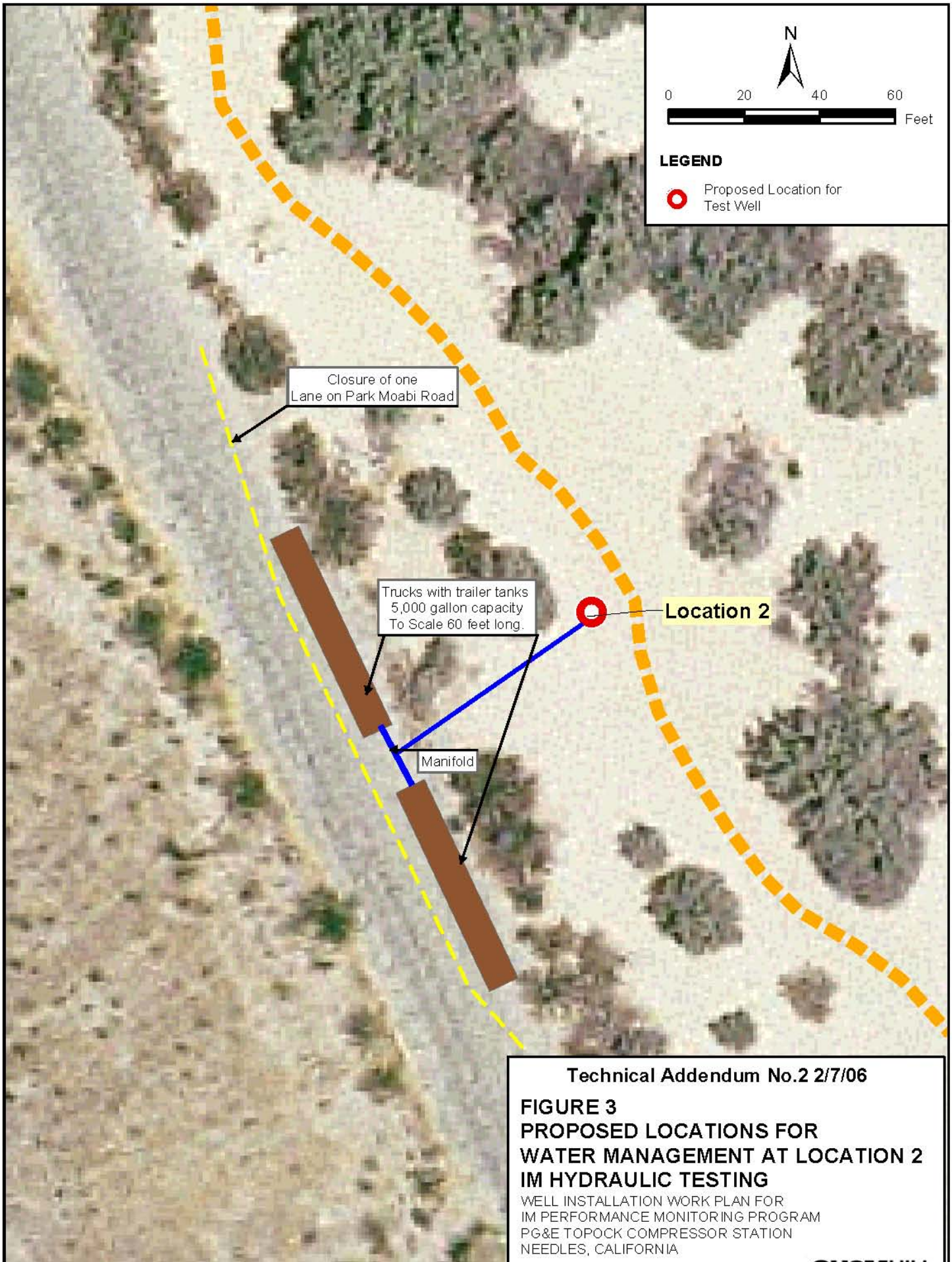

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FIGURE 3
PROPOSED LOCATIONS FOR WATER MANAGEMENT AT LOCATION 2 IM HYDRAULIC TESTING

WELL INSTALLATION WORK PLAN FOR
IM PERFORMANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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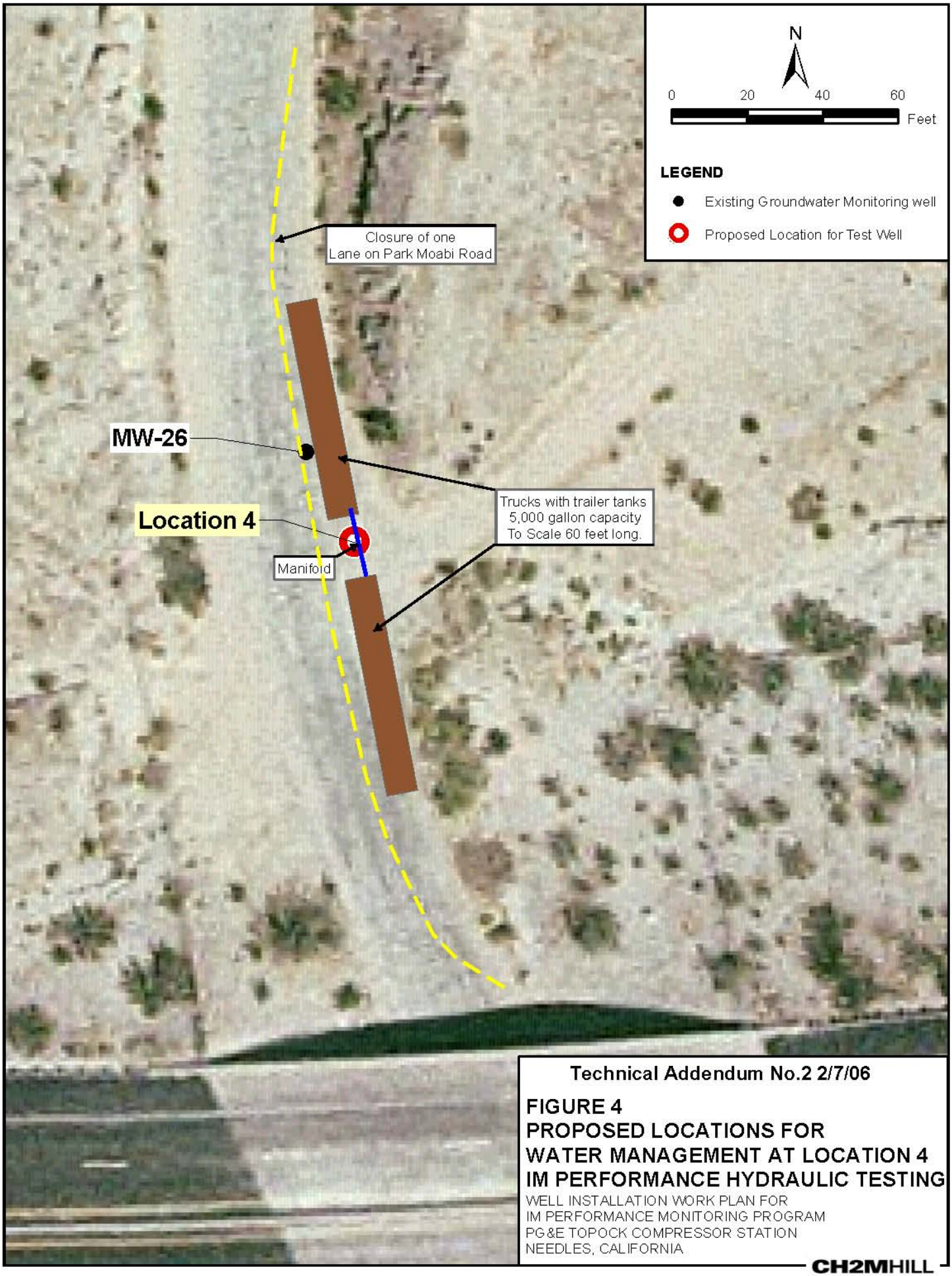

Technical Addendum No.2 2/7/06

FIGURE 4
PROPOSED LOCATIONS FOR
WATER MANAGEMENT AT LOCATION 4
IM PERFORMANCE HYDRAULIC TESTING

WELL INSTALLATION WORK PLAN FOR
IM PERFORMANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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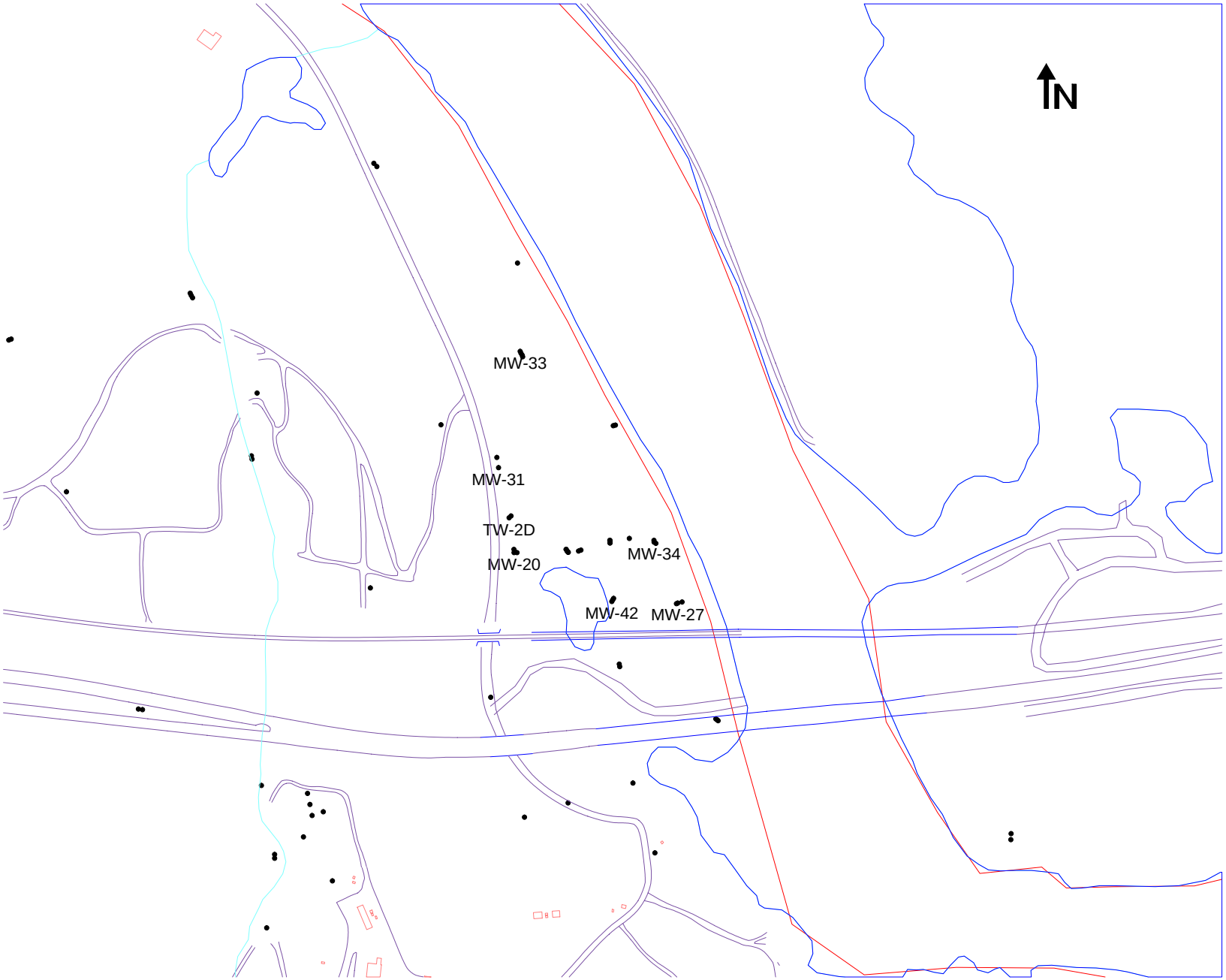
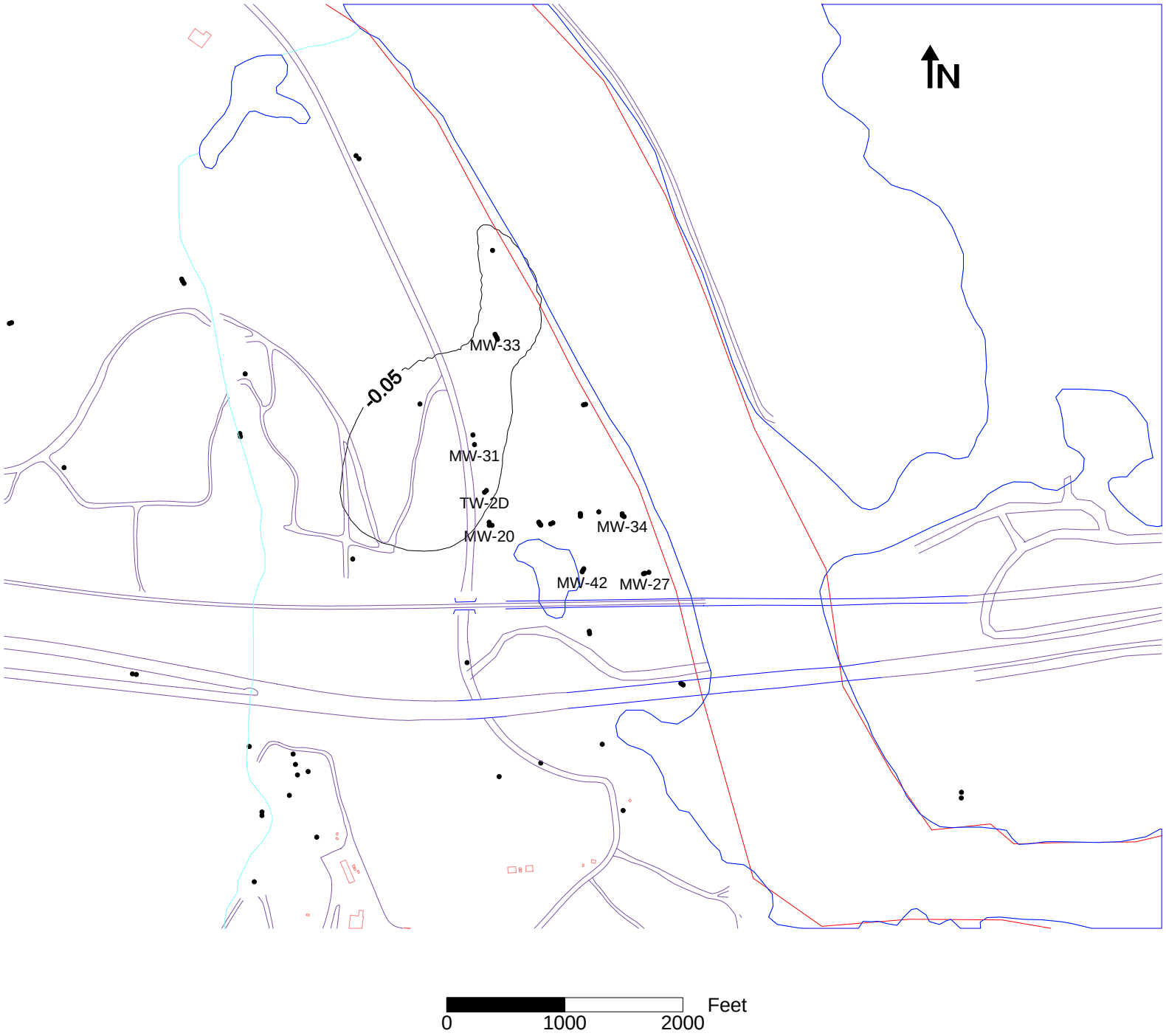
Appendix A Results of Model Simulations

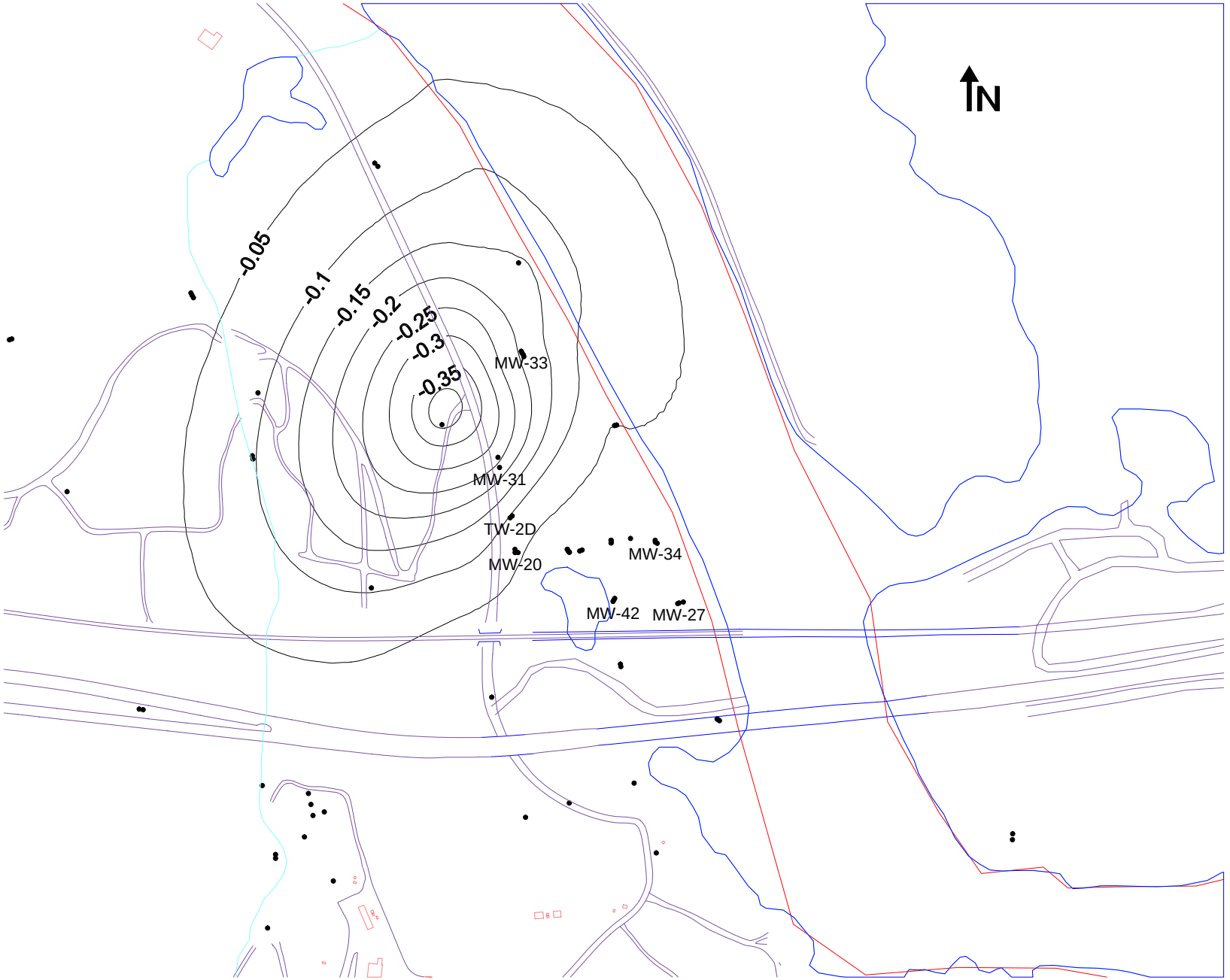
Location 1 Layer 1: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



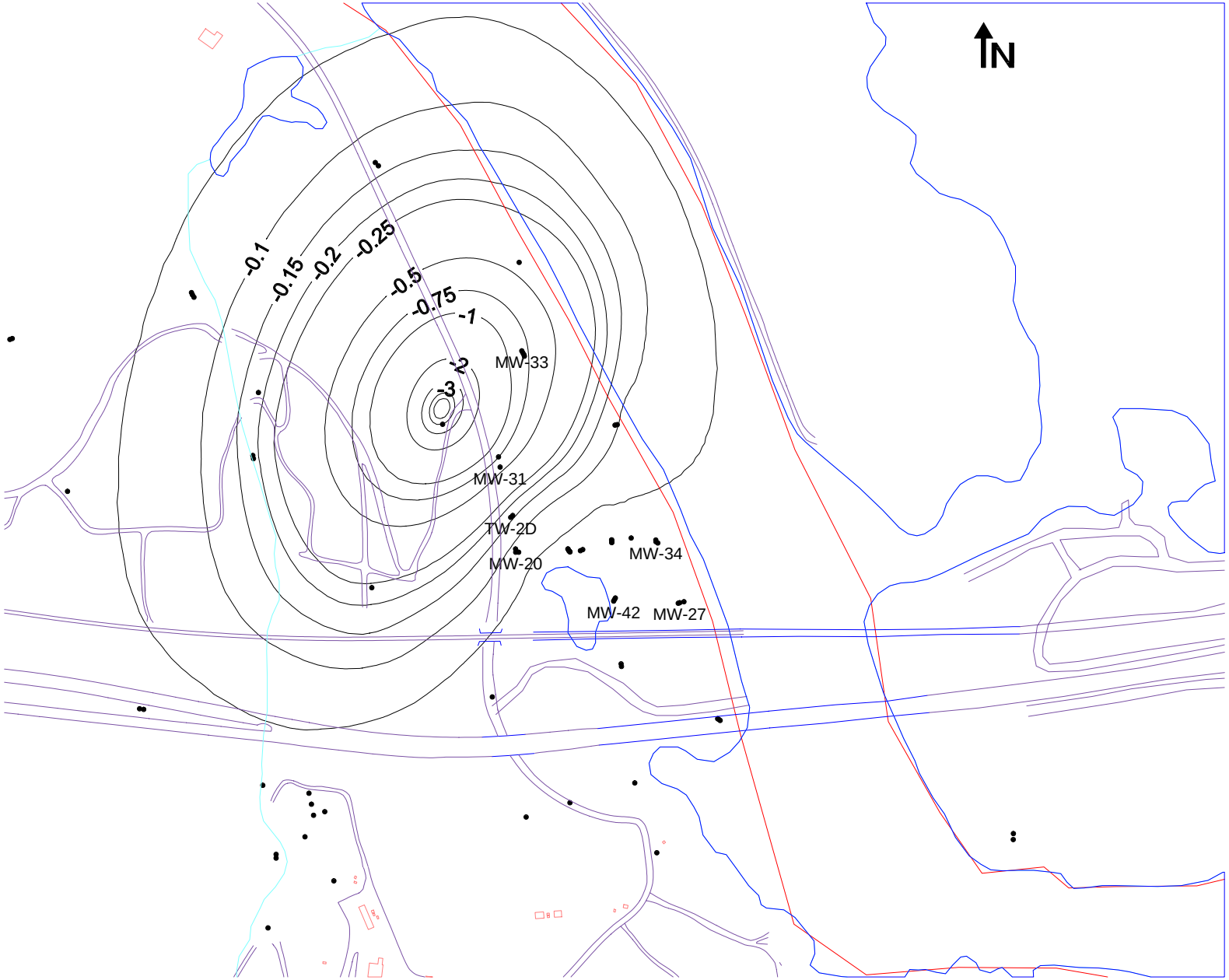
Location 1 Layer 2: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



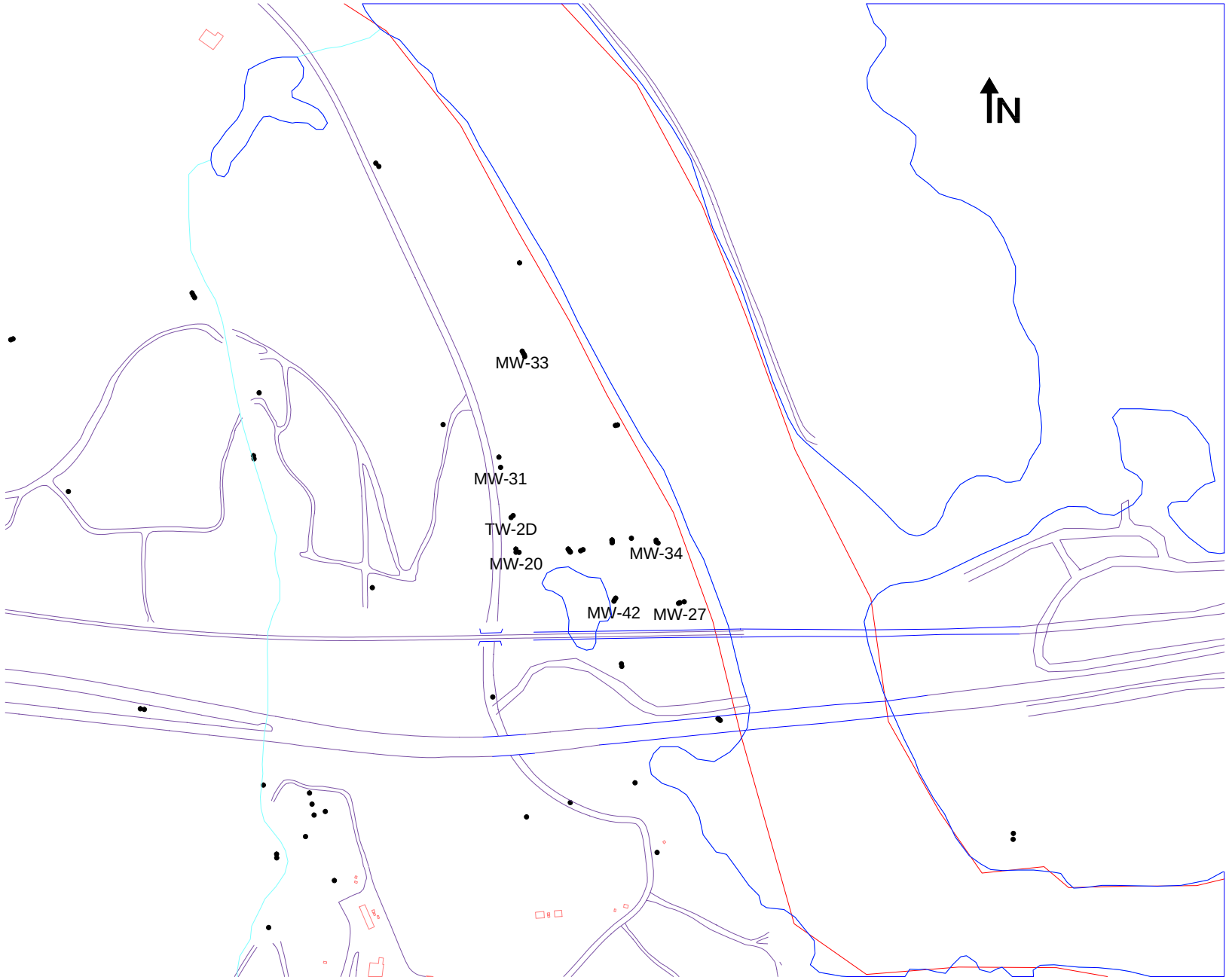
Location 1 Layer 3: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



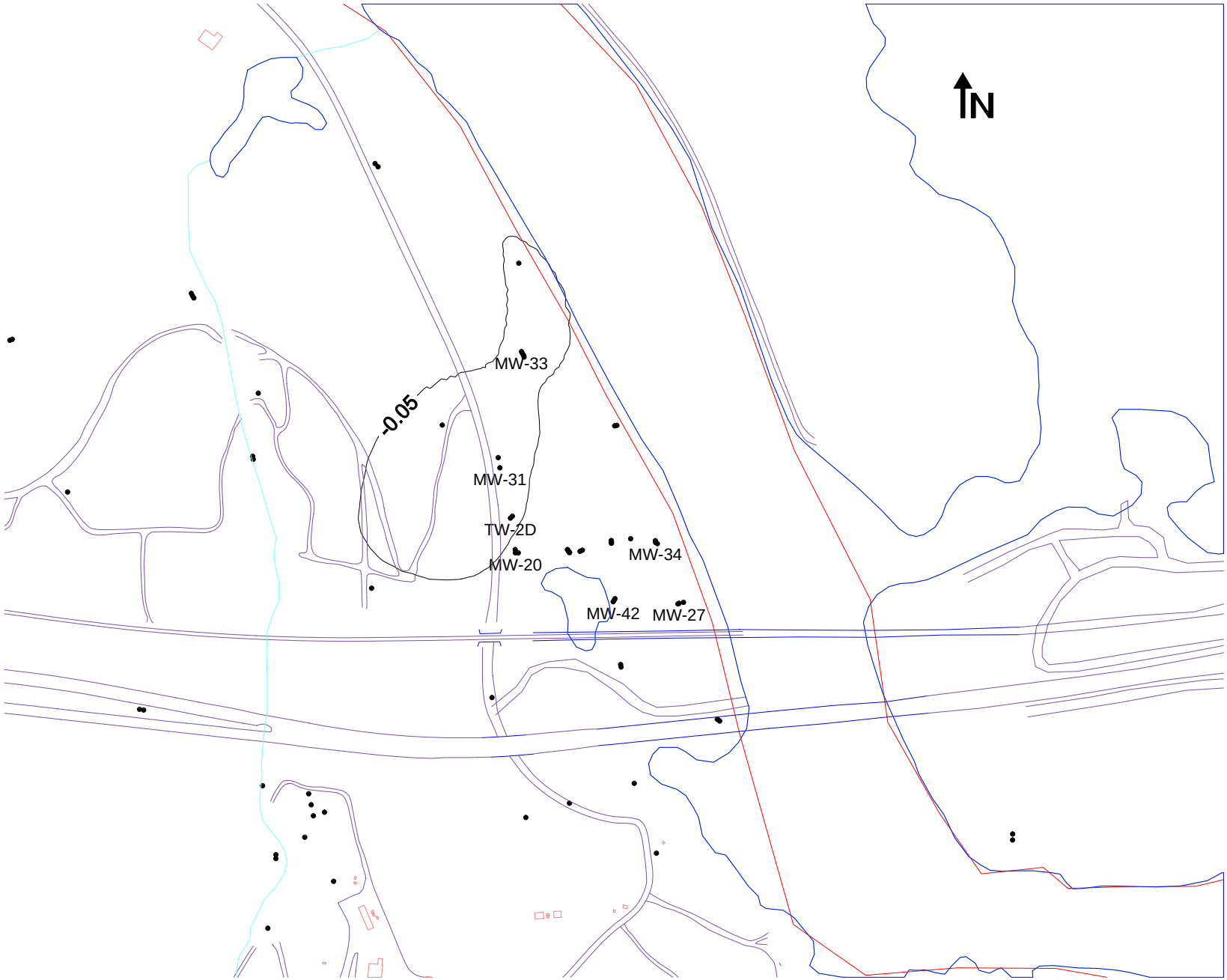
Location 1 Layer 4: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



Location 1 Layer 1: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



Location 1 Layer 2: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



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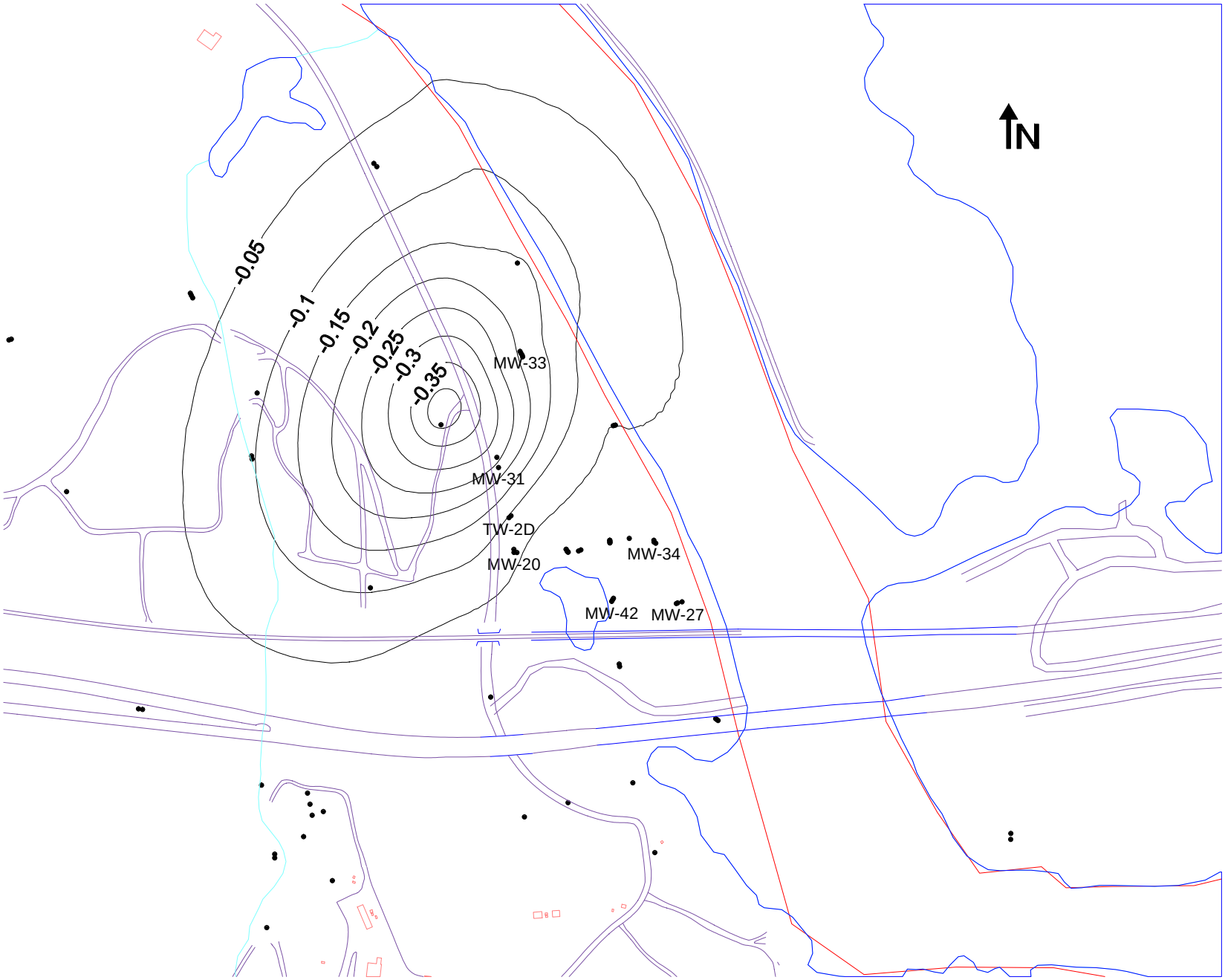
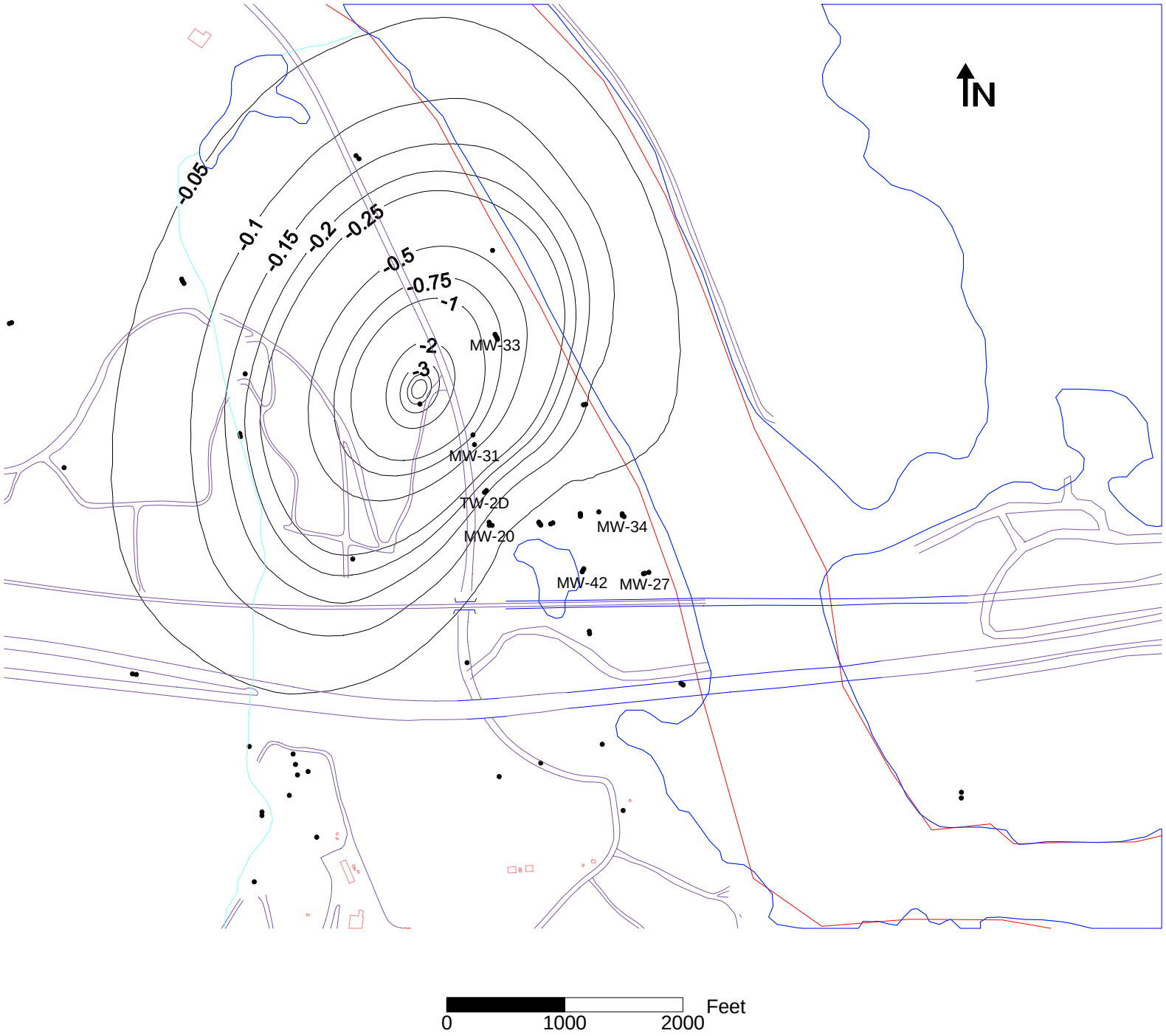
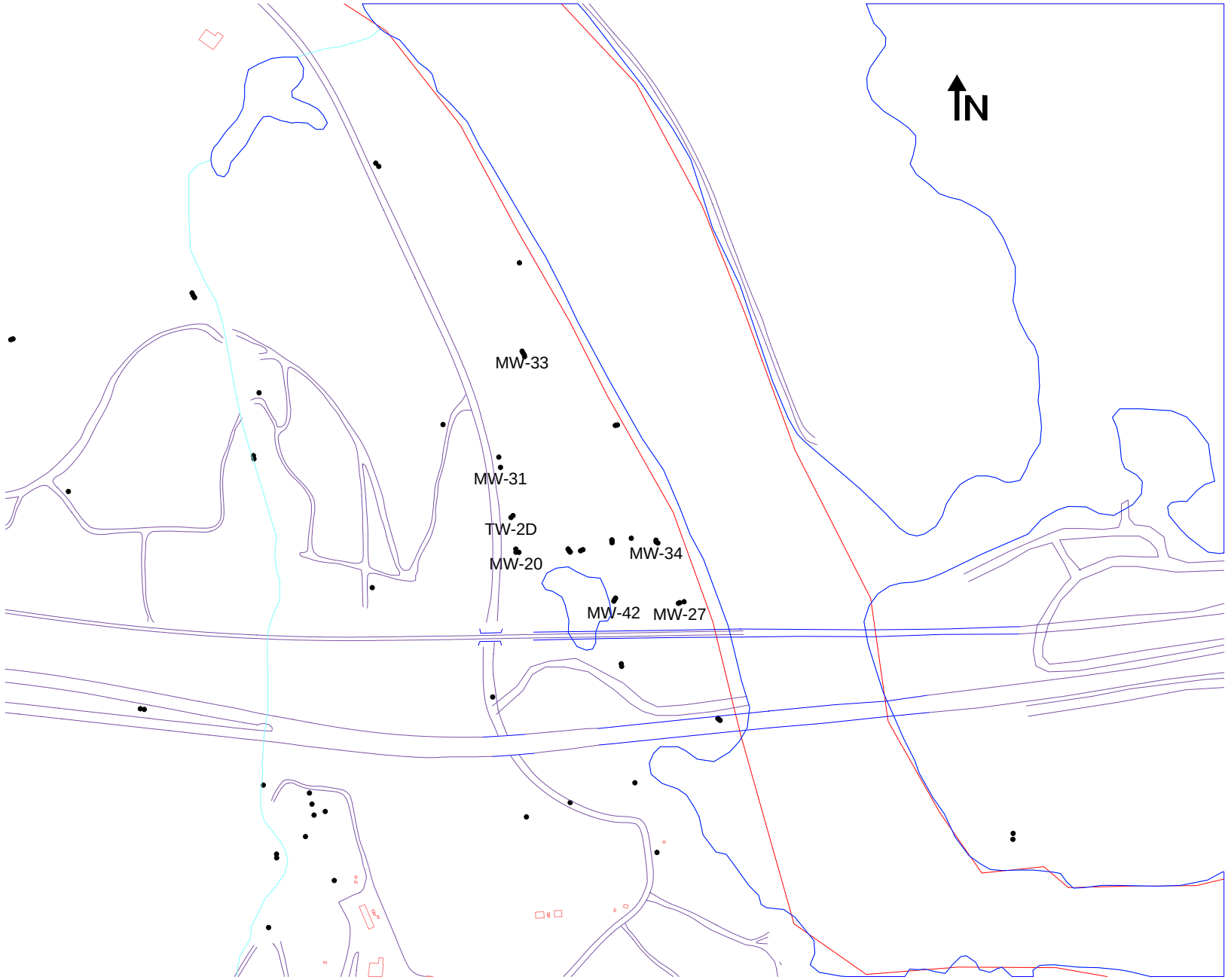


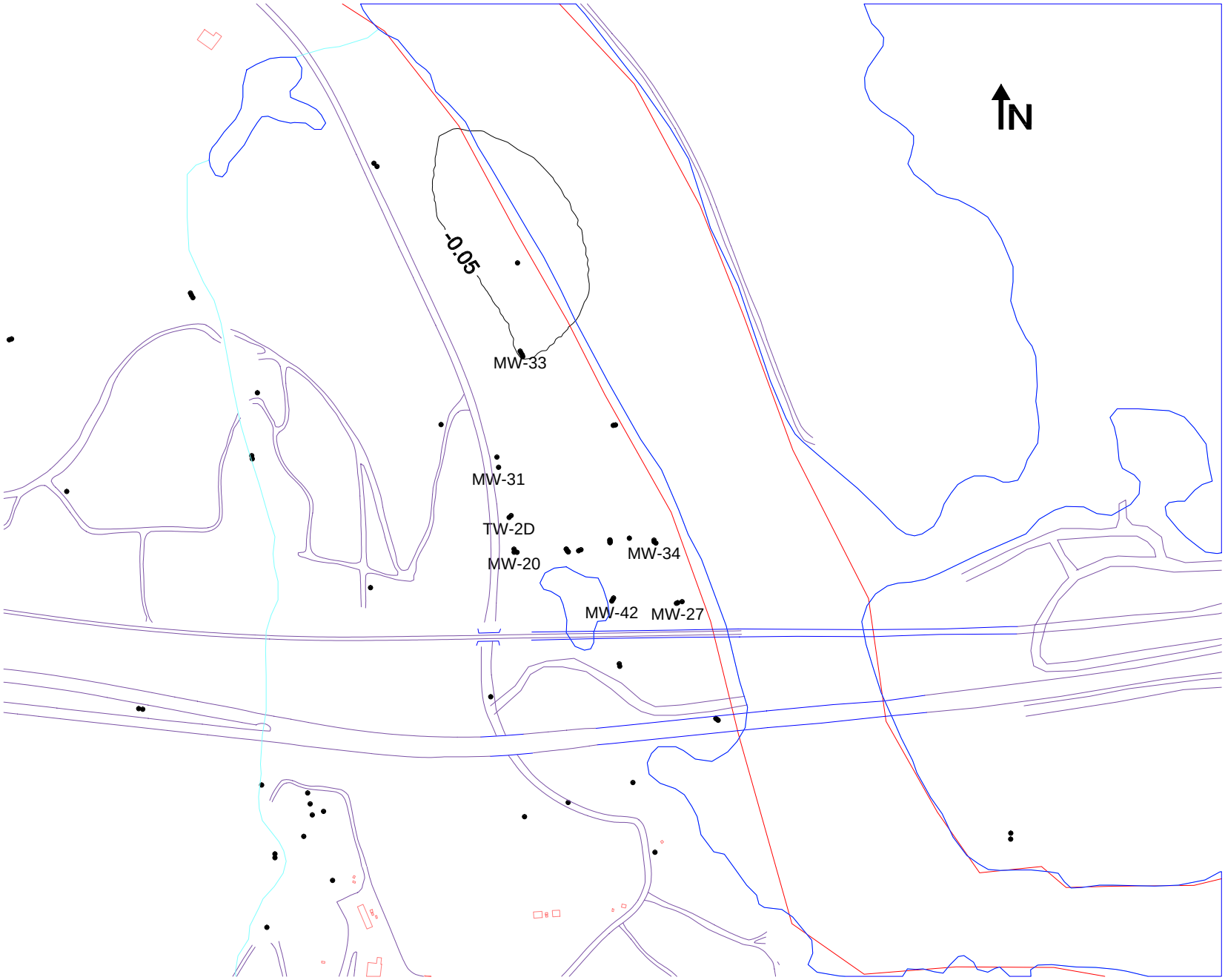
Location 1 Layer 4: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



Location 2 Layer 1: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



Location 2 Layer 2: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



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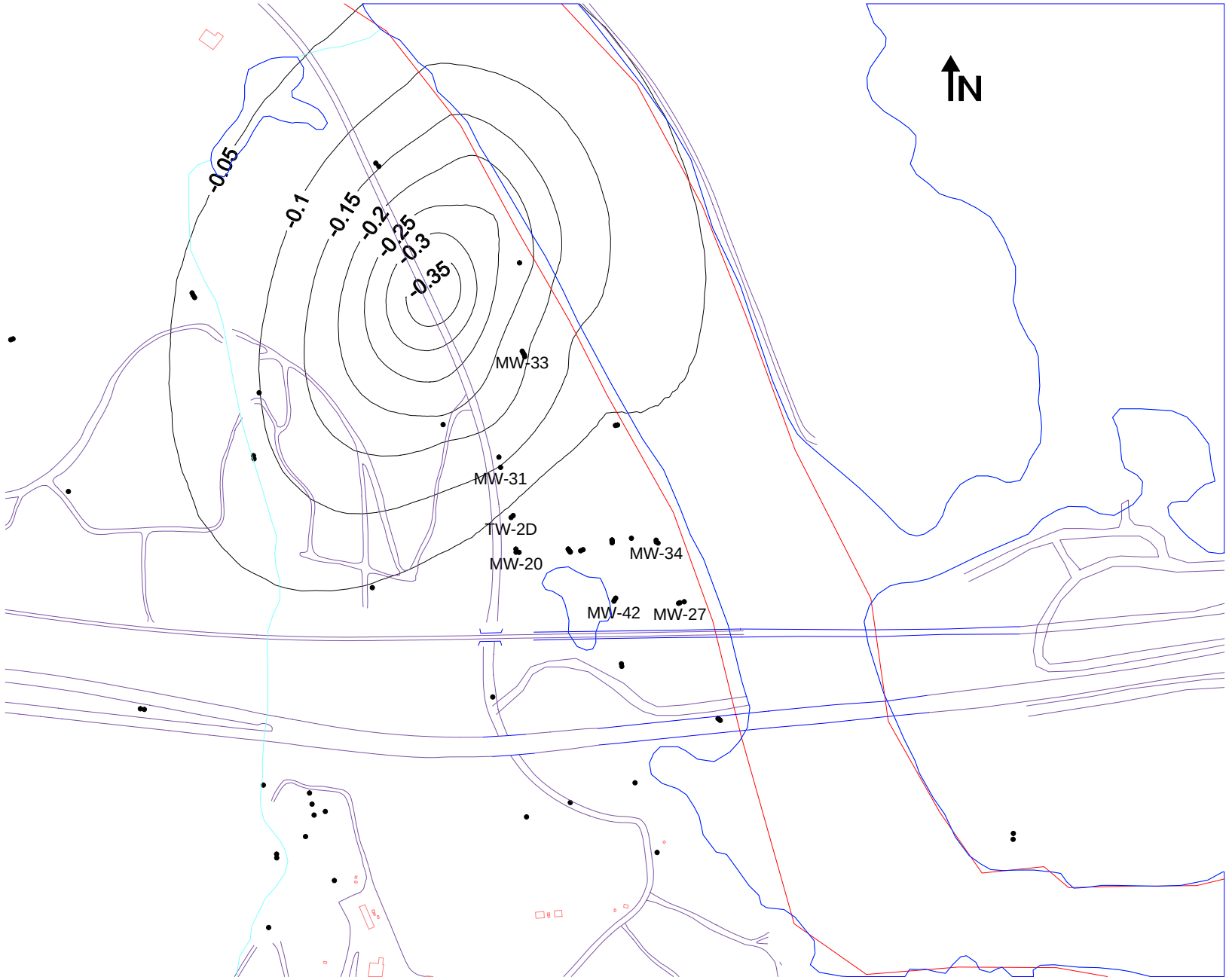

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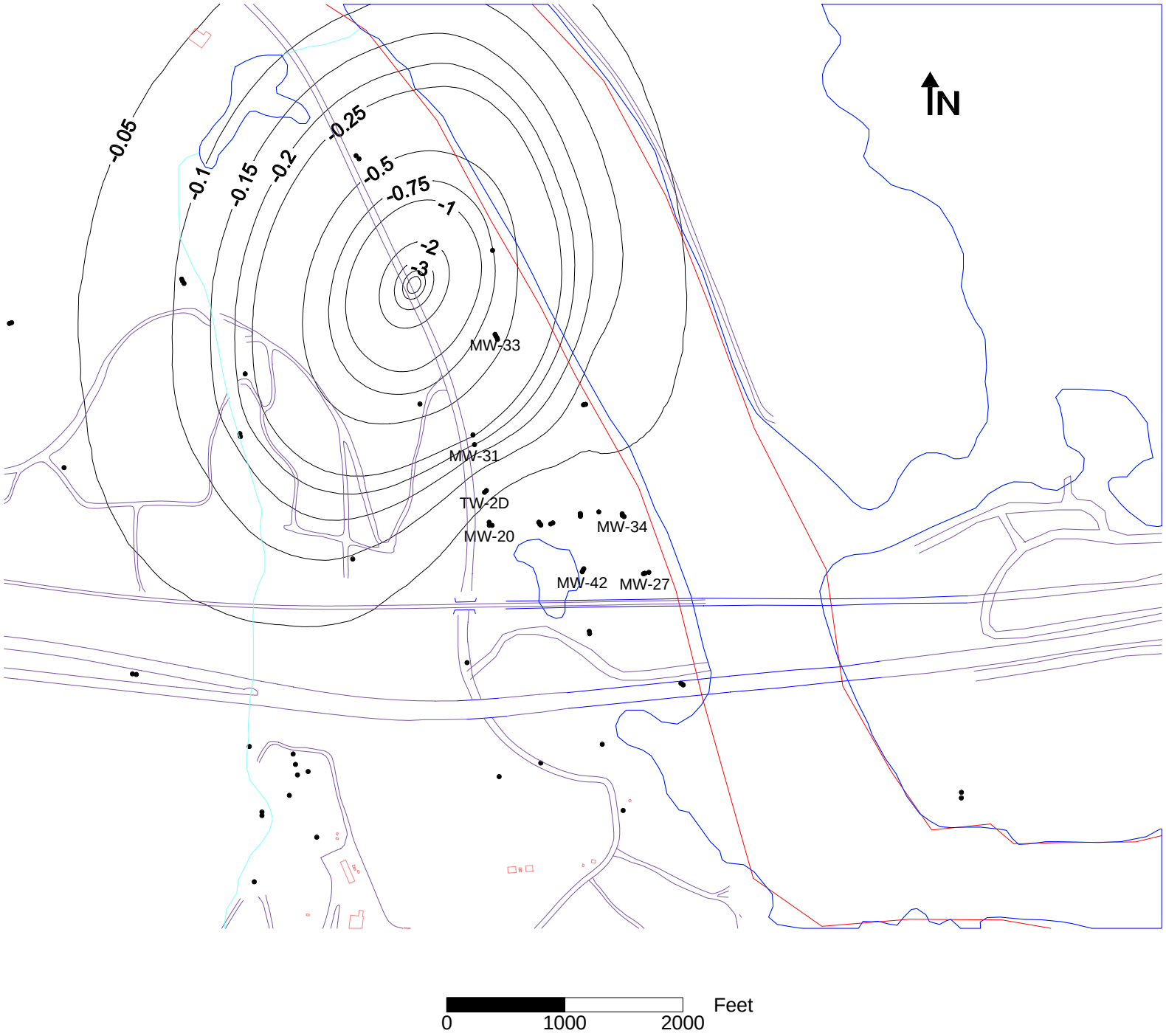
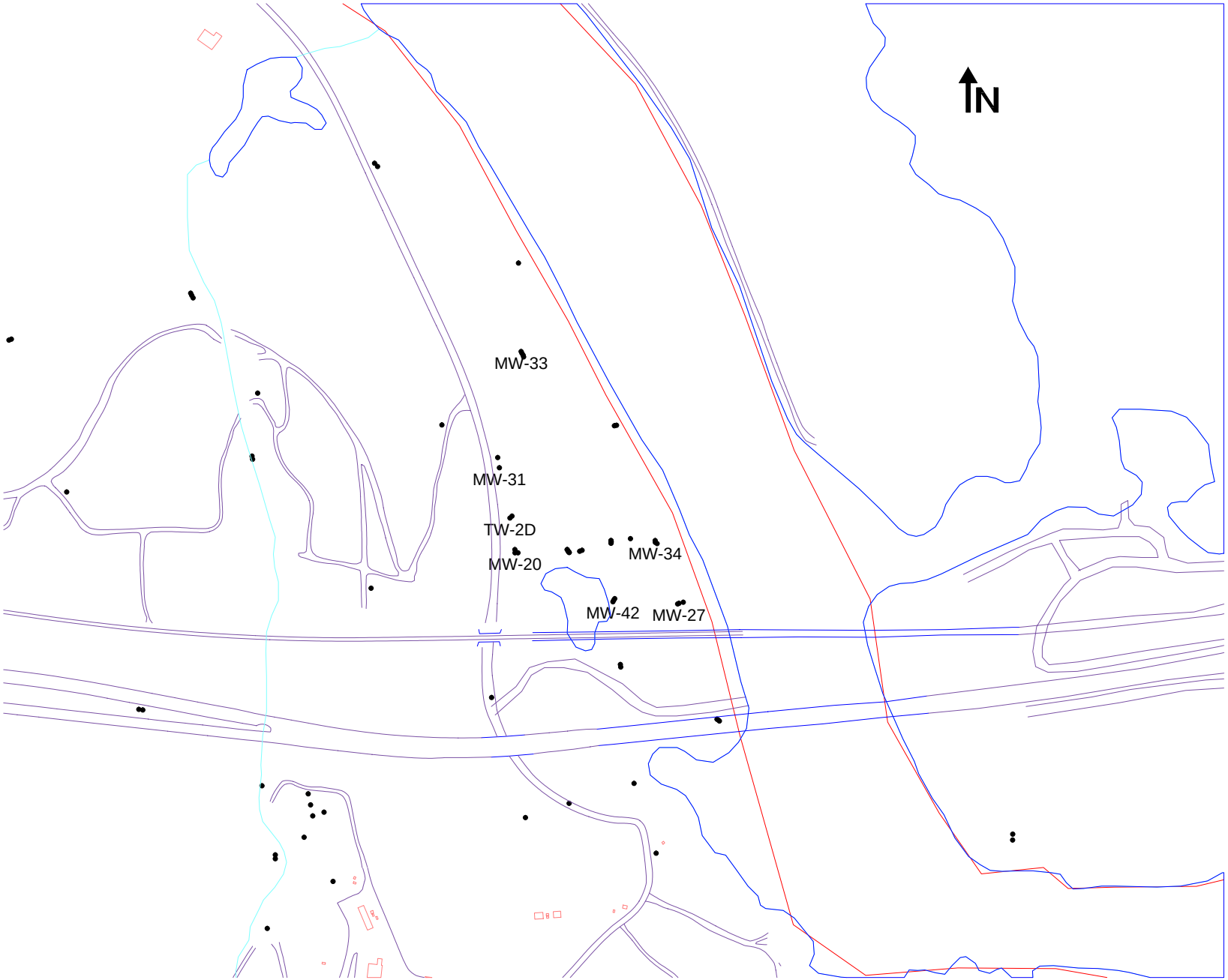


Location 2 Layer 1: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



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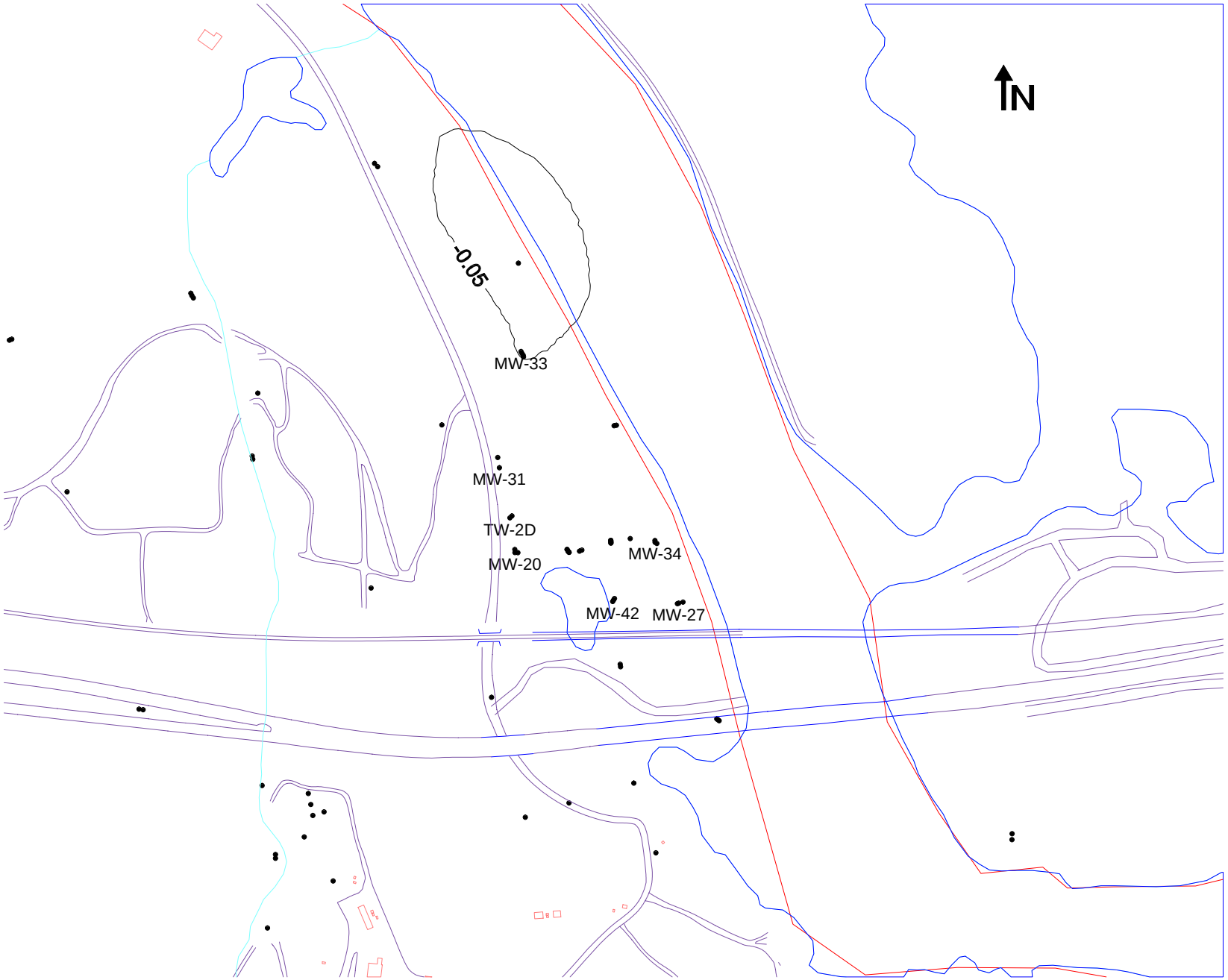
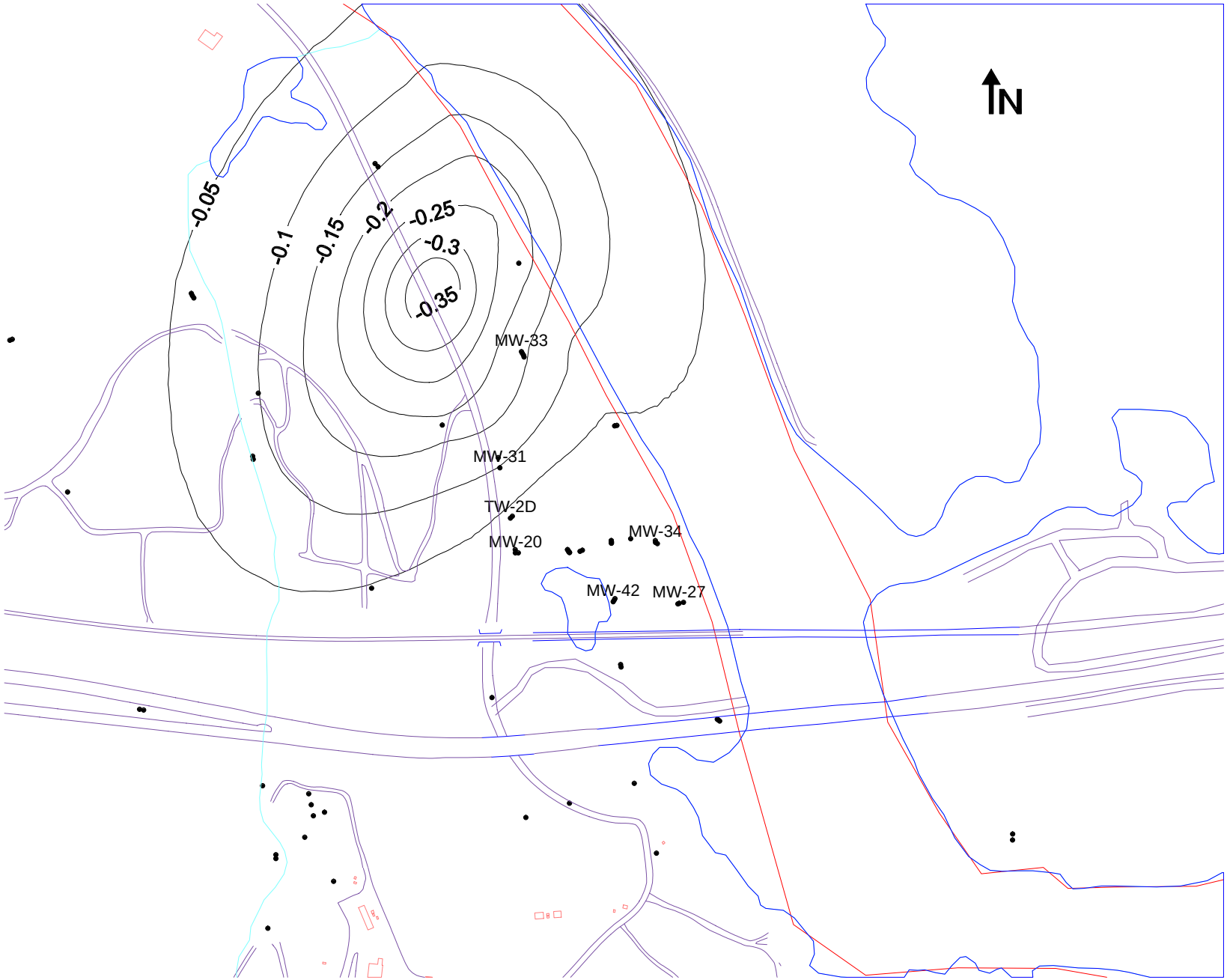
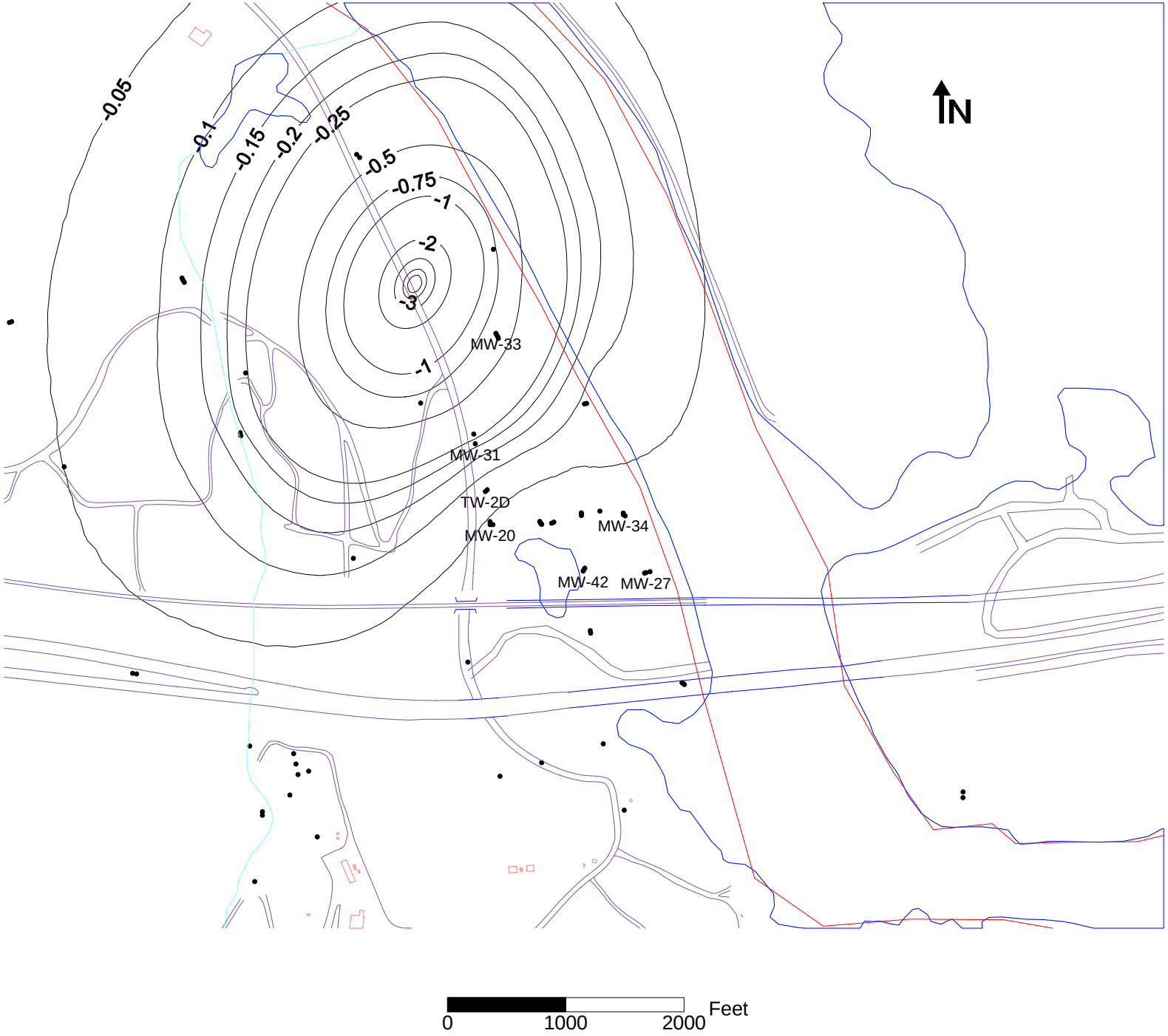


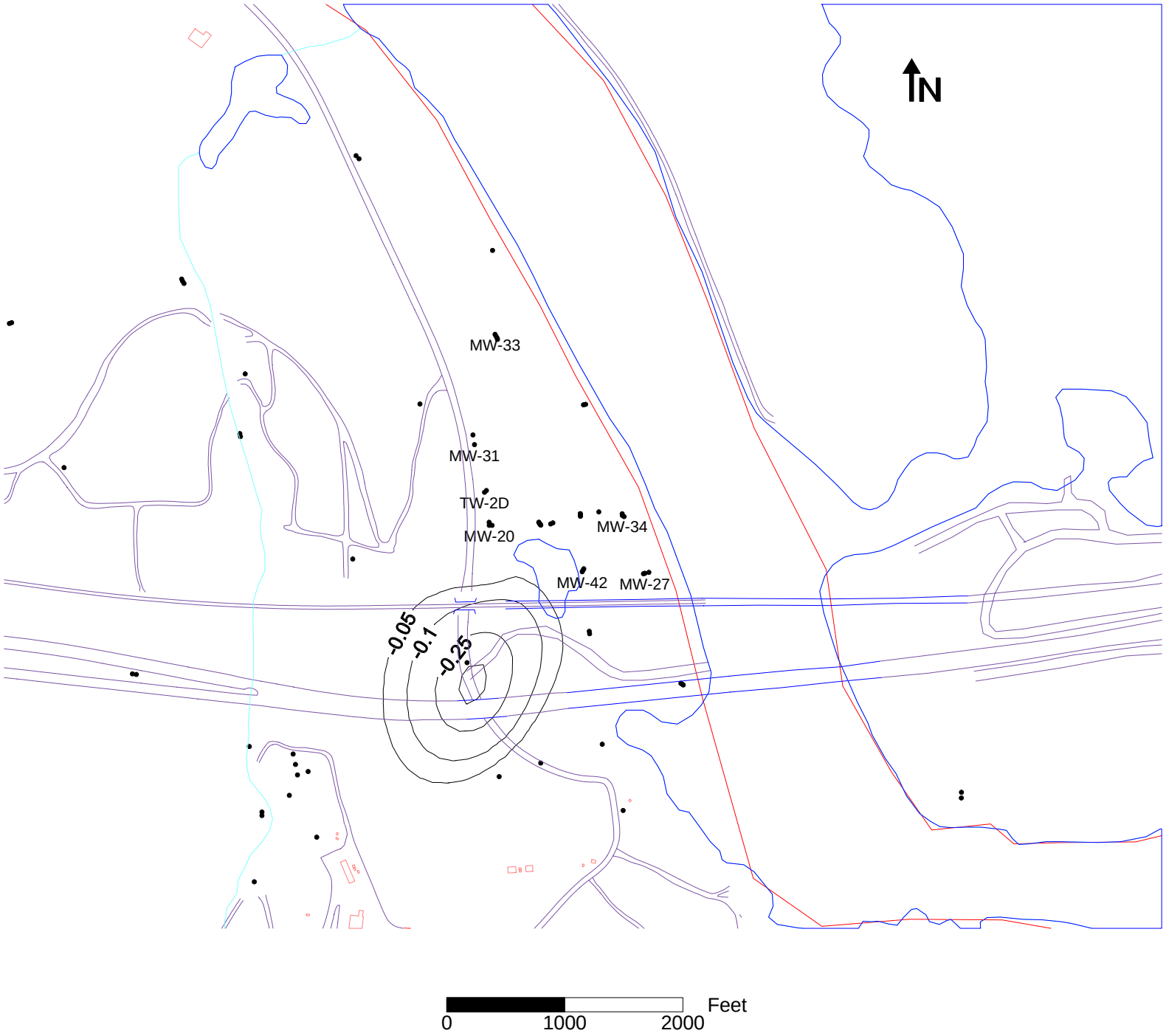
Location 2 Layer 3: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



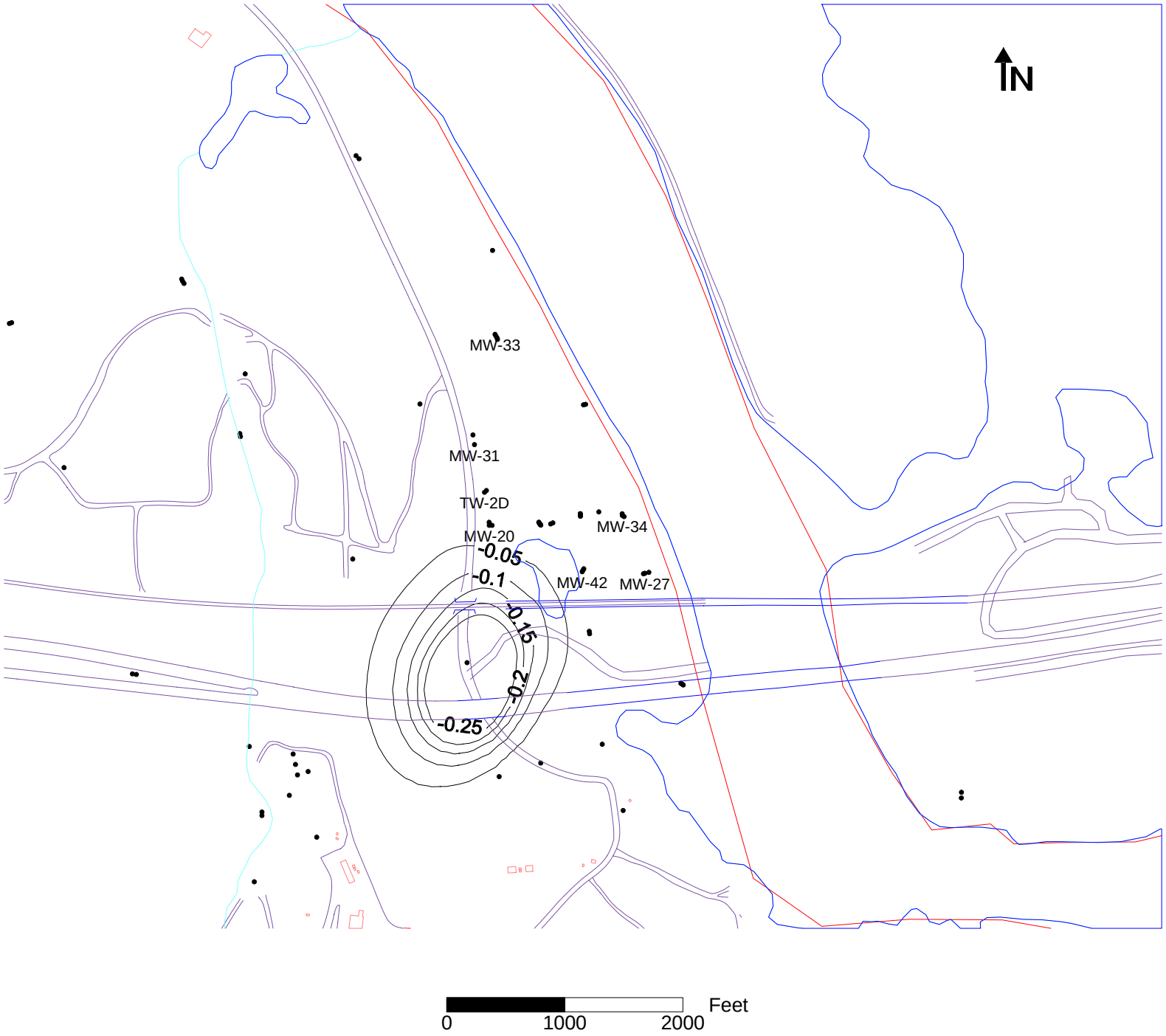
Location 2 Layer 4: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



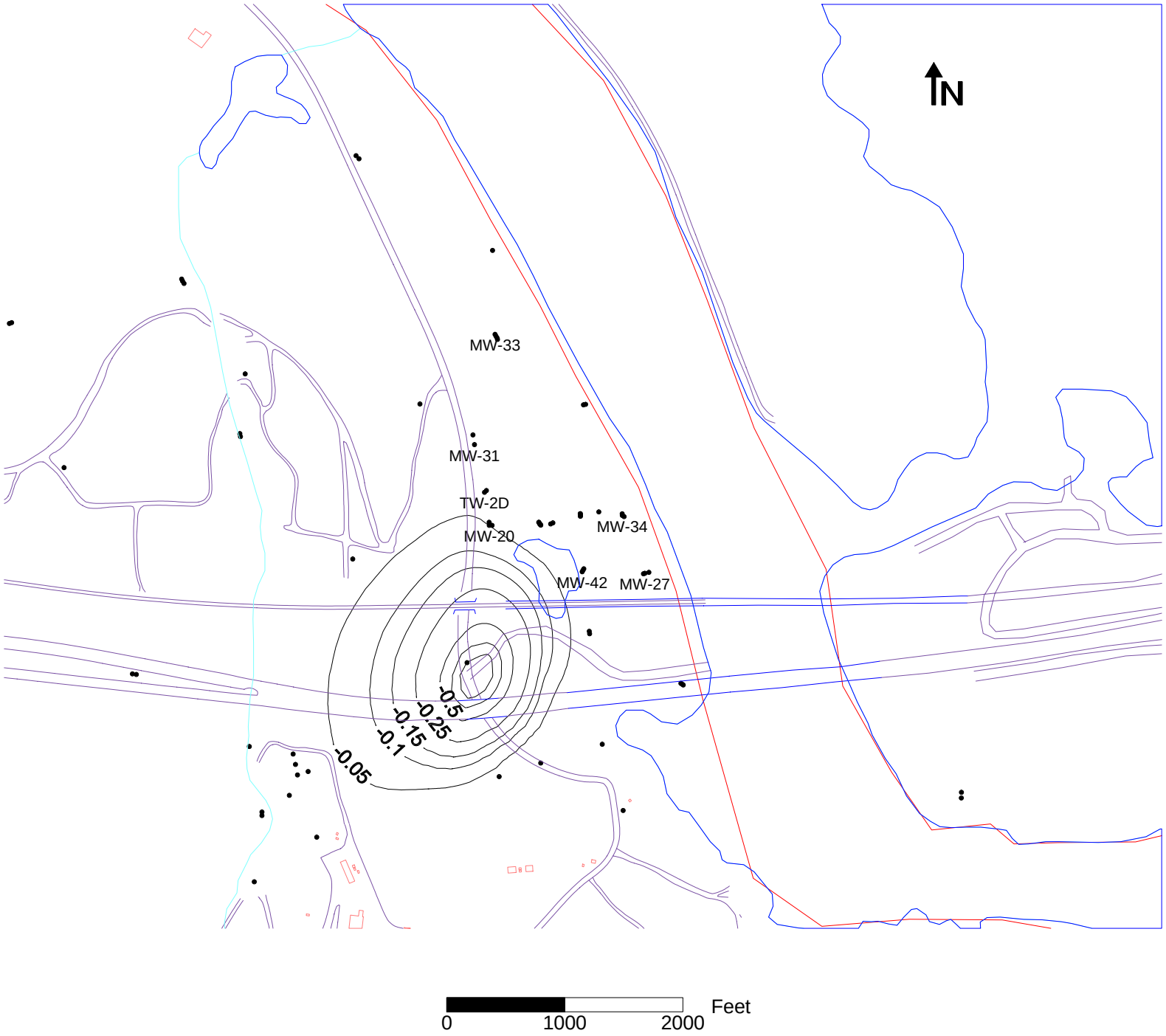
Location 4 Layer 1: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



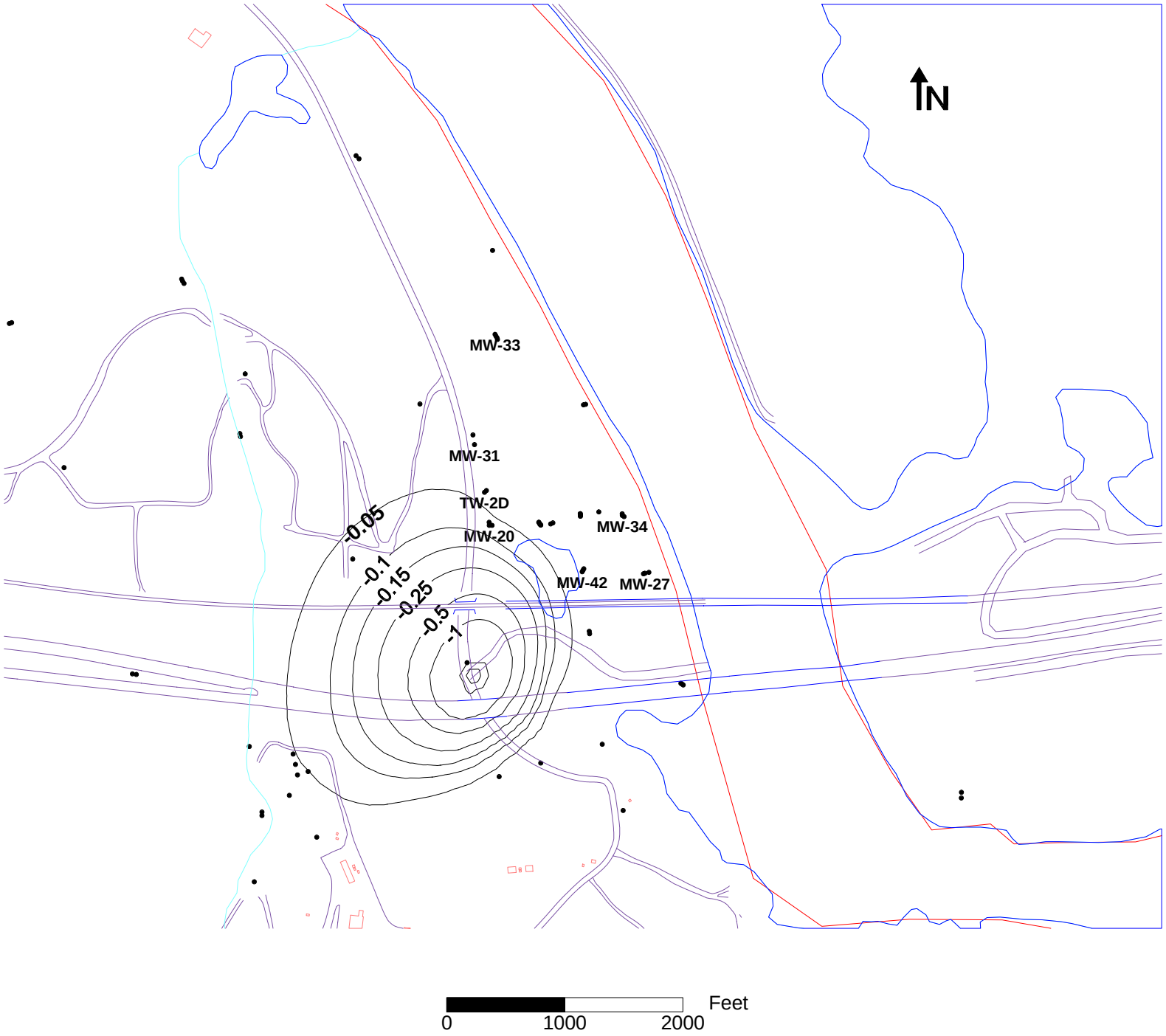
Location 4 Layer 2: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



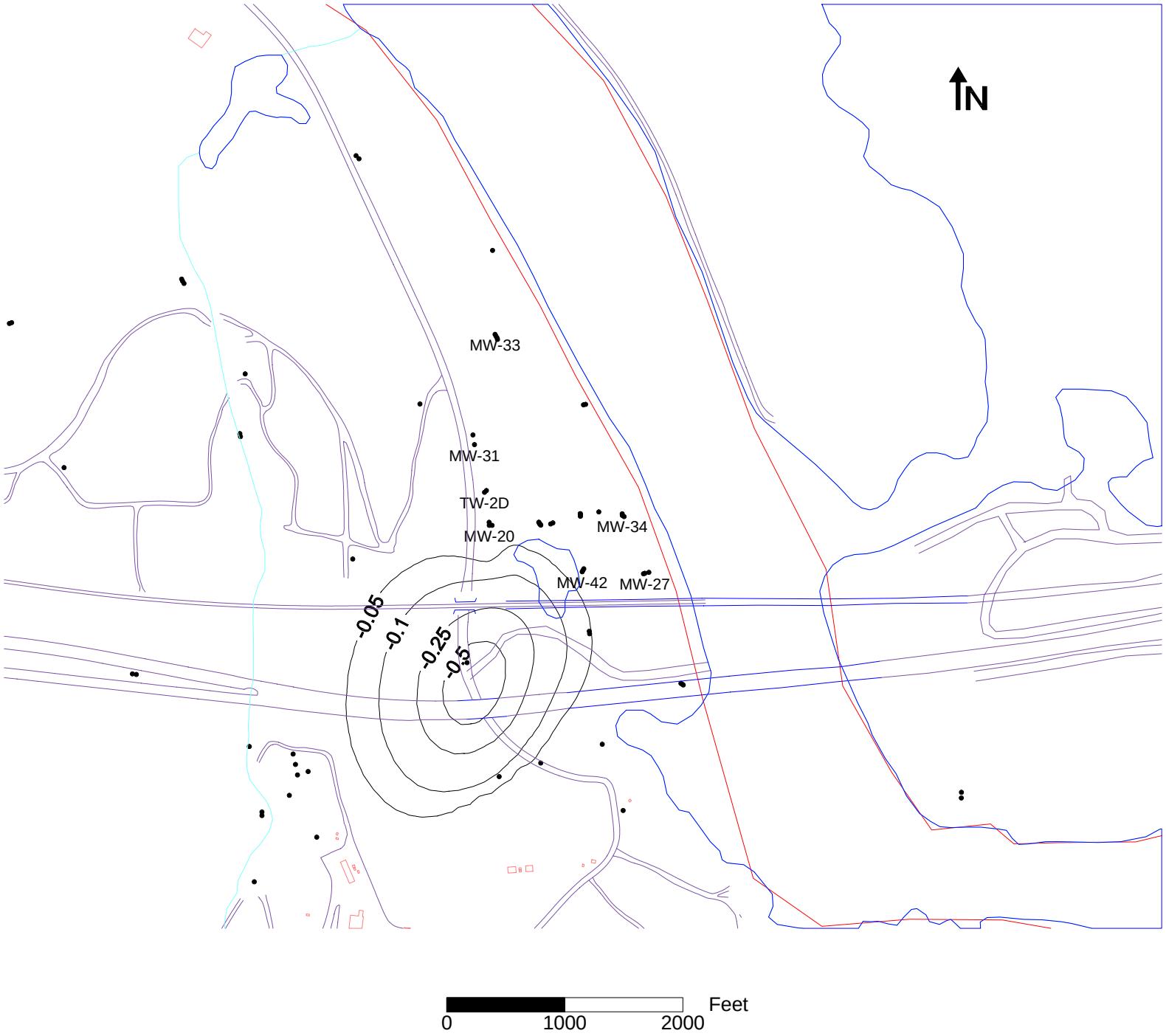
Location 4 Layer 3: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



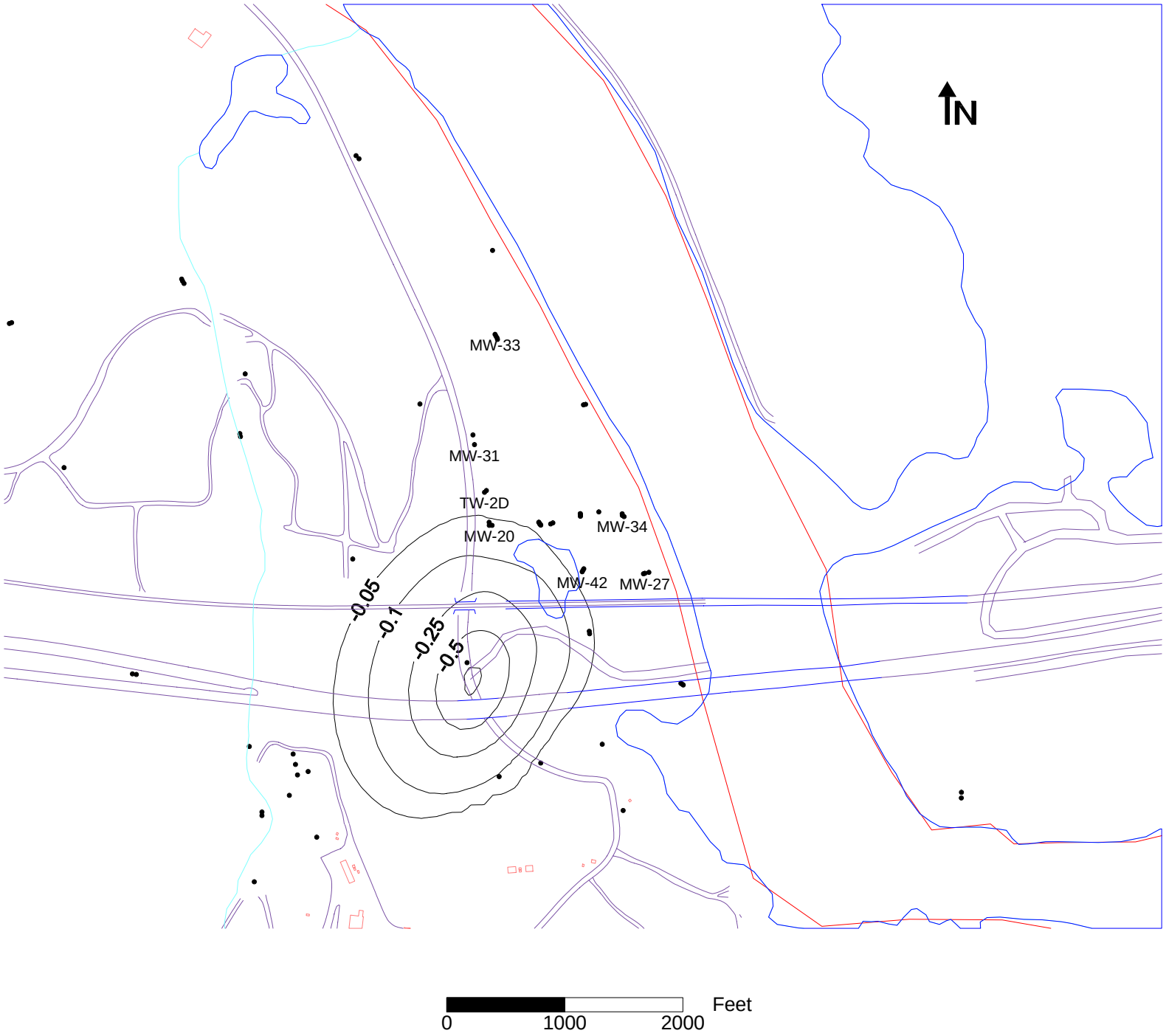
Location 4 Layer 4: Drawdown (ft) After 2 hrs of Pumping at 50 gpm



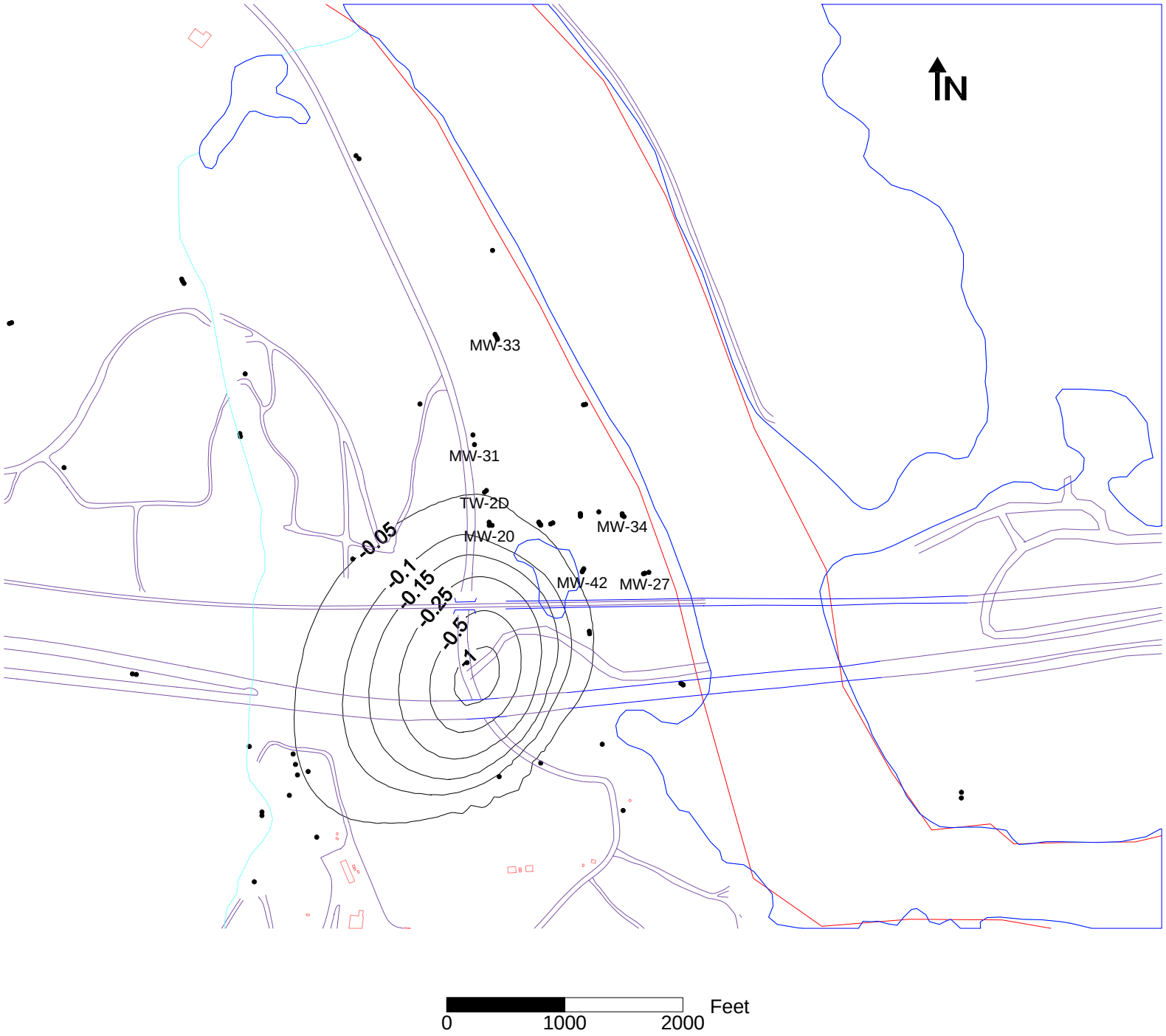
Location 4 Layer 1: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



Location 4 Layer 2: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



Location 4 Layer 3: Drawdown (ft) After 4 hrs of Pumping at 50 gpm



Location 4 Layer 4: Drawdown (ft) After 4 hrs of Pumping at 50 gpm