Appendix F
Draft Groundwater Flow
Modeling Report Correspondence

Environmental Resources Management

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16 May 2013

Via Electronic Mail

Mr. Wayne Praskins
Remedial Project Manager
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105

Subject: Groundwater Flow Model Files
Source Area Operable Unit, B.F. Goodrich Superfund Site

Dear Mr. Praskins:

On behalf of Emhart Industries, Inc. (Emhart), ERM-West, Inc. (ERM), submits this package of model files and input data associated with the Draft Groundwater Flow Modeling Report for the Source Area Operable Unit at the B.F. Goodrich Superfund Site. This work is associated with implementing the remedial actions described within the *Statement of Work for Remedial Design and Remedial Action for the Source Area Operable Unit, B.F. Goodrich Superfund Site*, which is Appendix F to the Consent Decree that was lodged on 4 December 2012 with the U.S. District Court for the Central District of California in *City of Colton v. American Promotional Events, Inc. West et al.*, Case No. ED CV 09-01864 PSG.

ERM submits this information package in response to the U.S. Environmental Protection Agency's request, as communicated on 10 May 2013 via electronic mail. The information package includes:

- Input and output model files for the calibrated model and the following predictive simulation models: Scenario 2B, 2D-1, 2D-2, and 2D-3 (including gwv files);
- Input and output Modpath files for Scenarios 2B, 2D-1, 2D-2, and 2D-3;
- Spreadsheets detailing boundary condition inflows to the model;
- Files developed for pre- and post-processing;

- Pumping data; and
- Spreadsheet detailing model targets.

Please note the following concerning the files provided in this package:

- In the area east of the Santa Ana River, there are differences in Layer 1 and Layer 2 hydraulic conductivity values between the calibrated model and the model used for predictive scenarios. These differences are due to an oversight during model development that was corrected in the calibrated model, but not in the predictive scenario model. Please consider the hydraulic conductivity values in the calibrated model.
- In the vicinity of the Unnamed Fault, Layer 3 bottom elevations in the calibrated model differ from those in the model used for the predictive scenarios. Most of the differences are located northeast of the Unnamed Fault, although some are located southwest of the fault. These differences are due to an oversight during incorporation of Geo-Logic Associates' Layer 3 bottom elevations into the model that was corrected in the predictive scenario model, but not in the calibrated model. Please consider the elevations in the predictive scenario model.
- A discrepancy was identified for inflow values reported in Table B-1. The spreadsheet provided with this memo has been revised to address the discrepancy. The discrepancy is limited to Table B-1; model inputs are not affected.

If you have any questions or concerns, please contact Mr. Truong Mai at (949) 623-4700 or Ms. Heather Balfour at (916) 924-9378.

Sincerely,

Heather D. Balfour, P.E.
Project Manager

Truong T. Mai, P.E.
Partner

Attachments

cc:
Darren Meadows, CH2M HILL
David Towell, CH2M HILL (cover letter only)
Joseph W. Hovermill, Miles & Stockbridge P.C. (cover letter only)
James L. Meeder, Allen Matkins Leck Gamble Mallory & Natsis LLP (cover letter only)
Kamran Javandel, Allen Matkins Leck Gamble Mallory & Natsis LLP (cover letter only)

Heather Balfour

From: Praskins, Wayne <Praskins.Wayne@epa.gov>
Sent: Wednesday, May 29, 2013 8:48 AM
To: Truong Mai; Heather Balfour
Cc: David.Towell@ch2m.com
Subject: Additional EPA comments, questions, and requests related to the Emhart/ERM/Environ Source Area Operable Unit groundwater modeling effort

Truong and Heather –

We are continuing our review of the April 10, 2013, Groundwater Flow Modeling Report for the Source Area Operable Unit at the B.F. Goodrich Superfund Site and the model files and input data that you provided in response to our May 10, 2013, request. Thank you for providing the model files and data. We have the following comments, questions, and additional requests. Comments #1 and #2 request additional modeling simulations. Please email or call if you would like to discuss. We would appreciate responses by June 7, 2013.

No.	Location	Comment
#1.		The April 10, 2013 modeling report recommends the extraction well locations and pumping rates in a predictive simulation described as "Scenario 2B." Figure 5-16, showing the "frequency of capture" for Scenario 2B, indicates greater than 90% capture of most but not all particles included in the simulation. Capture is weakest in layer 4. To assist EPA in evaluating the adequacy of this scenario, we request that the following additional simulations be run: - a variation on Scenario 2B in which the combined pumping rate for Rialto-3 and the proposed new extraction well is increased from 3,016 gpm to 3,250 gpm; - a variation on Scenario 2B in which the combined pumping rate for Rialto-3 and the proposed new extraction well is increased from 3,016 gpm to 3,500 gpm.
#2.		In its 2012 simulations, EPA/CH2M Hill assumed pumping rates for the Fontana Water Company (FWC) F49, F11, and F10 well clusters that are about 1,300 gpm (25%) higher than those assumed in the predictive simulations presented in the report. EPA used rates reported by FWC for 2010; ERM used rates reported for 2011. Given the effects of FWC pumping on groundwater flow in and near the target area, and uncertainty about future rates, we request that the following additional simulation be run: - a variation on Scenario 2B in which future pumping at the F49, F11, and F10 well clusters is increased by 25%.
#3.		Figure 5-25 provides particle tracking simulations for scenario 2B, with particles started in both the County remedy and Source Area Operable Unit target areas (i.e., the "combined target area"). Please provide a frequency of capture figure for this scenario.
#4.	Pg. 13, Sec. 3.6/ Figure 3-5	Were there any dry cells in any of the layers at the beginning of the simulation period?
#5.	Pg. 20, Sec.	We disagree with the statement that calibration of the model "confirmed" that the Chino

No.	Location	Comment
	3.7.5/	Basin boundary is effectively a no-flow boundary (i.e., that there is no subsurface flow across the Rialto-Colton Fault). Changing the magnitude of subsurface flow across the Rialto-Colton Fault in the model and citing the poorer correlation between simulated and target heads without attempting to adjust other parameters to improve calibration summary statistics does not prove there is no flow across this fault.
#6.	Figure 3-6	The figure shows the Chino Basin boundary as an outflow boundary, rather than a no-flow boundary. Please clarify whether this boundary is a no-flow boundary or a fixed (non-zero) flux boundary?
#7.	Pg. 22, Sec. 3.7.6.2	Return flows were calculated as 15 and 30 percent of the total pumping for the first and fourth quarters and second and third quarters, respectively. Were comparisons to wastewater treatment plant inflows from indoor water use made to develop the assumed return flow percentages associated with outdoor water use?
#8.	Pg. 23, Sec. 3.8.1 Figure 3-10	Do presented values represent the hydraulic conductivity associated with each Horizontal Flow Barrier (HFB) or hydraulic characteristic, which is the hydraulic conductivity of the HFB divided by the HFB width? The presented values are significantly lower than those used in the USEPA/CH2M Hill 2012 Model. The answer to this question may also affect the "conductivity" values listed in Table 4-3 for Barrier H.
#9.	Pg. 23, Sec. 3.8.2 Figure 3-11	Does the increased horizontal hydraulic conductivity over what the USEPA 2012 Model has in Layer 4 near Barrier H result in less response to pumping at Fontana?
#10.	Pg. 27, Sec. 4.5, Figure 4-10	Figure 4-10 suggests that the model generally underpredicts heads in Layer 2, as opposed to overpredicting them, as is stated in the last bullet. Please clarify.
#11.	Pgs. 27-28, Sec. 4.5	Please provide a figure showing the spatial distribution of RMSE associated with simulated heads by layer to allow an evaluation of spatial bias.
#12.	Pg. 34, Sec. 5.2.1, last bullet	The text states that quarterly variation for the County remedy pumping in the predictive simulations was based on the actual variations observed in 2011 basin-wide pumping data. Why weren't the actual seasonal pumping variations recorded at Rialto-3 from the last several years used?
#13.	Pg. 40, 1st Par., 1st. sen.	The text states that use of the any of the Cactus Basins for recharge has a number of adverse impacts, including reductions in the County's ability to capture the County Remedy area. We do not see support for this statement in the graphics provided in the report.
#14.	Pgs. 45-46, Sec. 6.0	The text proposes that "The capacity of the County treatment system ...be expanded to approximately 4,000 gpm, to accommodate seasonal variability of flow rate/water demand, and the anticipated installation and use of a second extraction well." Please specify or describe the expected seasonal variation in remedy extraction rates. The text (section 5.2.1) states that extraction and treatment rates at the County remedy average 1,157 gpm and vary from 900 to 1,850 gpm (i.e., at rates up to 60% above the average). If a similar range is expected for the combined remedy, the proposed 4,000 gpm capacity is

No.	Location	Comment
		too low.
#15.	Figure 4-3	The simulated 2011 water level contours for Model Layer 1 show a small groundwater mound in the vicinity of the Linden Ponds. Is recharge in the Linden Ponds included in the model during 2011?

Wayne Praskins | Superfund Project Manager
U.S. Environmental Protection Agency Region 9
75 Hawthorne St. (SFD-7-3)
San Francisco, CA 94105
415-972-3181

Memorandum

Environmental Resources Management

2875 Michelle Drive
Suite 200
Irvine CA, 92606
(949) 623-4700
(949) 623-4711 (fax)

To: Mr. Wayne Praskins

From: Truong T. Mai, P.E.

Date: 12 June 2013

Subject: Additional Groundwater Flow Modeling Simulations Alternative EW-1 Location

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On behalf of Emhart Industries, Inc. (Emhart), ERM-West, Inc. (ERM) prepared this memorandum to summarize additional groundwater flow modeling activities performed for the Source Area Operable Unit (SAOU) at the B.F. Goodrich Superfund Site. After Emhart's submission of the Draft Groundwater Flow Modeling Report (Modeling Report) (ERM, 10 April 2013), the City of Rialto (Rialto) requested that Emhart locate proposed extraction well EW-1 at the northwest corner of Jerry Eaves Park, approximately 150 feet east of the location proposed in the Modeling Report (Figure 1). To evaluate whether installing EW-1 at the location requested by Rialto is likely to materially impact hydraulic capture of the SAOU remedy, Emhart performed two additional predictive simulations using the Emhart Groundwater Flow Model and incorporating Rialto's requested location for EW-1:

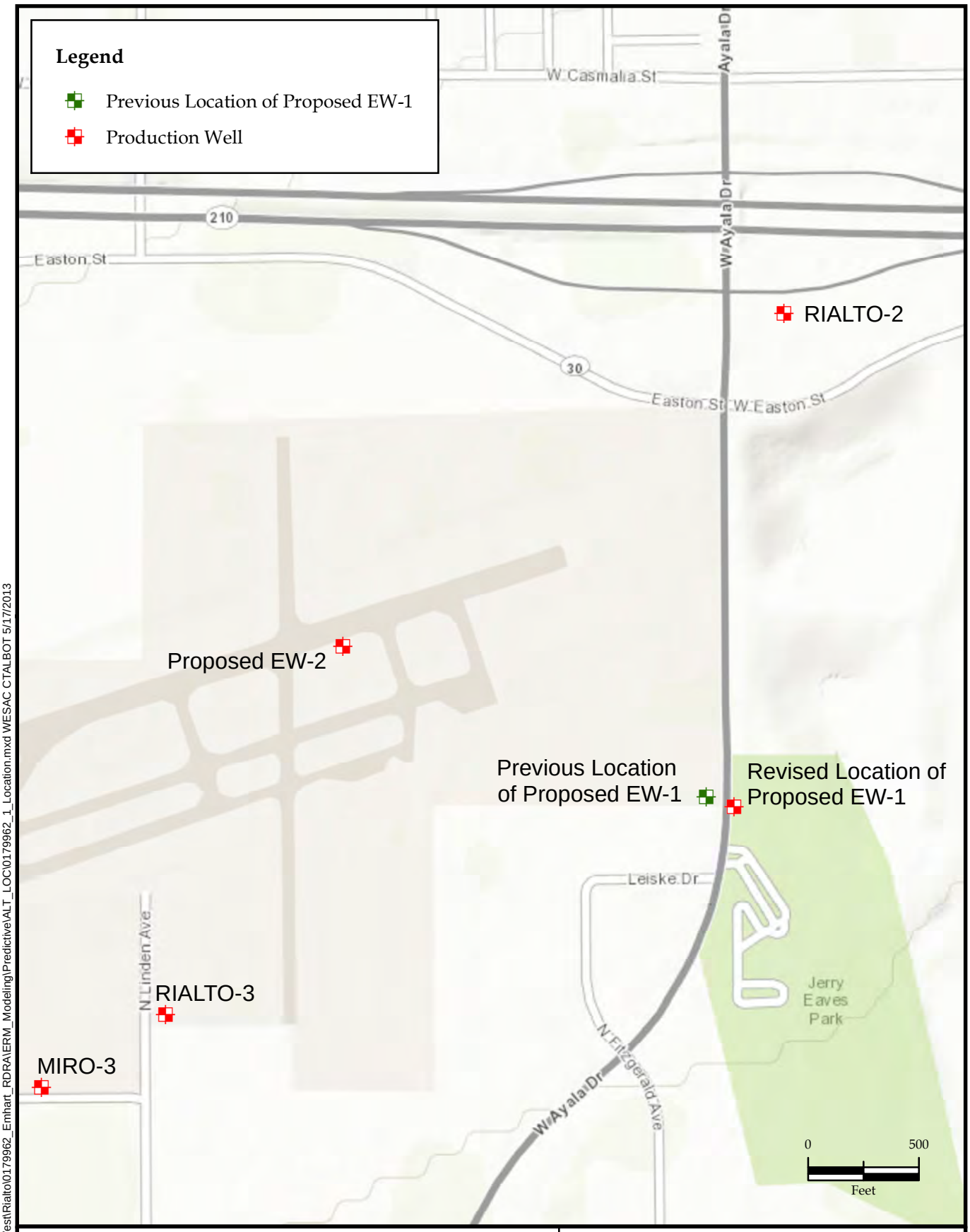
- Scenario 2B includes pumping from EW-1, at Rialto's requested location, in combination with Rialto-3; and
- Scenario 2D-3 includes pumping from EW-1, at Rialto's requested location, in combination with Rialto-3 and a second new extraction well (EW-2) located to the northwest of EW-1.

The pumping rates used for both predictive simulations are identical to those presented for Scenarios 2B and 2D-3 in the Modeling Report. Please note that the responses to USEPA's comments (transmitted on 12 June 2013) include different pumping rates based on updated information confirmed with the County of San Bernardino.

Based on a review of particle tracking and frequency of capture results for these additional simulations, pumping from EW-1 at the location requested by Rialto rather than the location identified in the Modeling Report is expected to have no material impact on anticipated hydraulic capture of the SAOU remedy. Figures 2 and 3 present the particle tracking results and frequency of capture plots, respectively, for Scenario 2B. These results show no material impact due to the revised location of the proposed extraction well EW-1. In addition, the average frequency of

capture for cells in model Layers 1, 3, and 4 is calculated as nearly 99 percent for a 42-year simulation period. Figures 4 and 5 present the particle tracking and frequency of capture plots, respectively, for Scenario 2D-3. These results also show no material impact on hydraulic capture resulting from the revised location of EW-1. The average frequency of capture for cells in model Layers 1, 3, and 4 is calculated as over 99 percent for a 42-year simulation period.

As presented in this memorandum, the requested relocation of extraction well EW-1 to the northwest corner of Jerry Eaves Park is estimated to have no material impact on hydraulic capture of the SAOU remedy.



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Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

ERM

FIGURE 1
PROPOSED WELL LOCATION
SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

PREPARED BY: CTALBOT (ERM)	JOB NO. 0179962.03A FILE: 0179962_1.MXD

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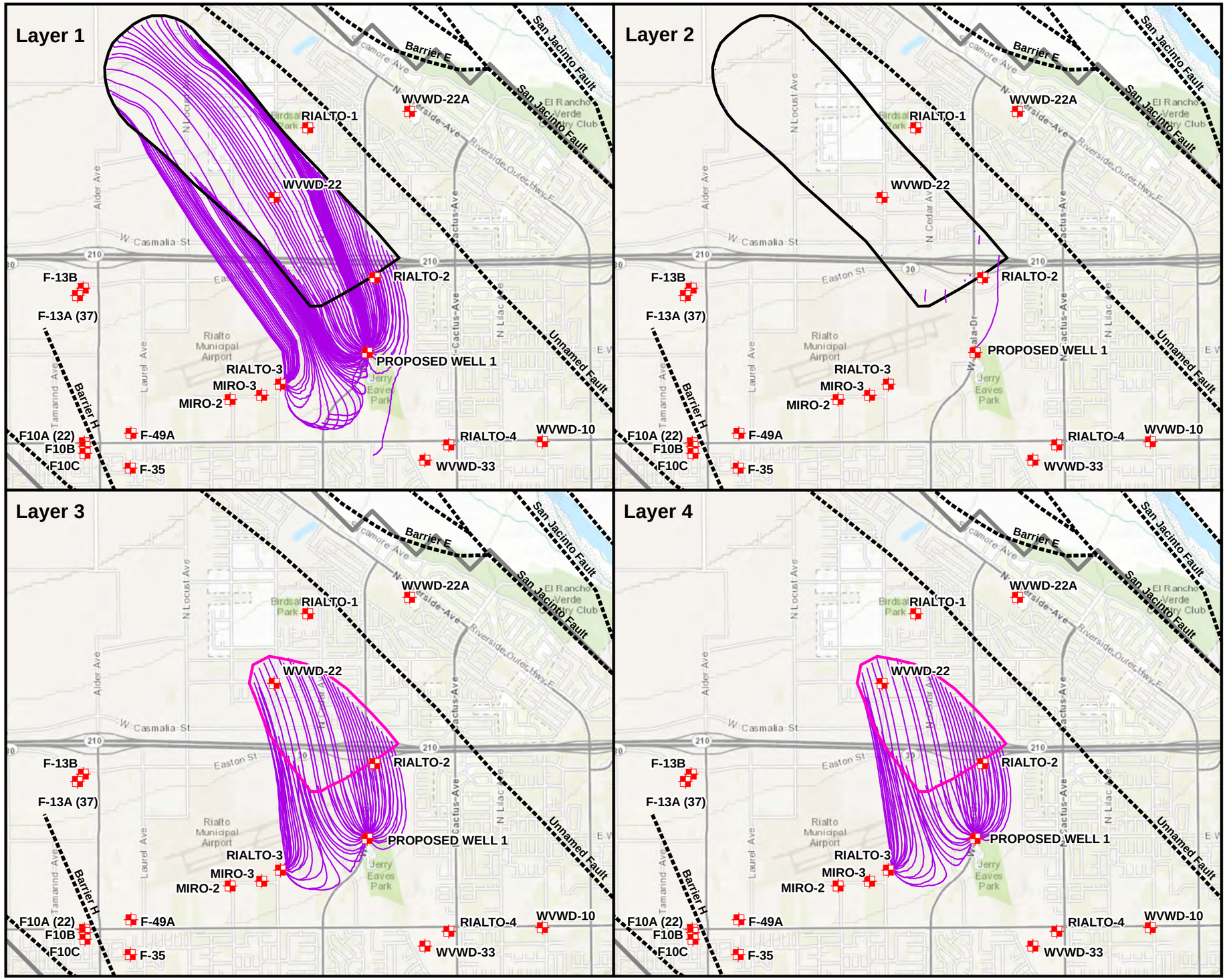

Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User

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SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 2

SCENARIO 2B
UPDATED PARTICLE
TRACK SIMULATION

ERM

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CTALBOT (ERM)

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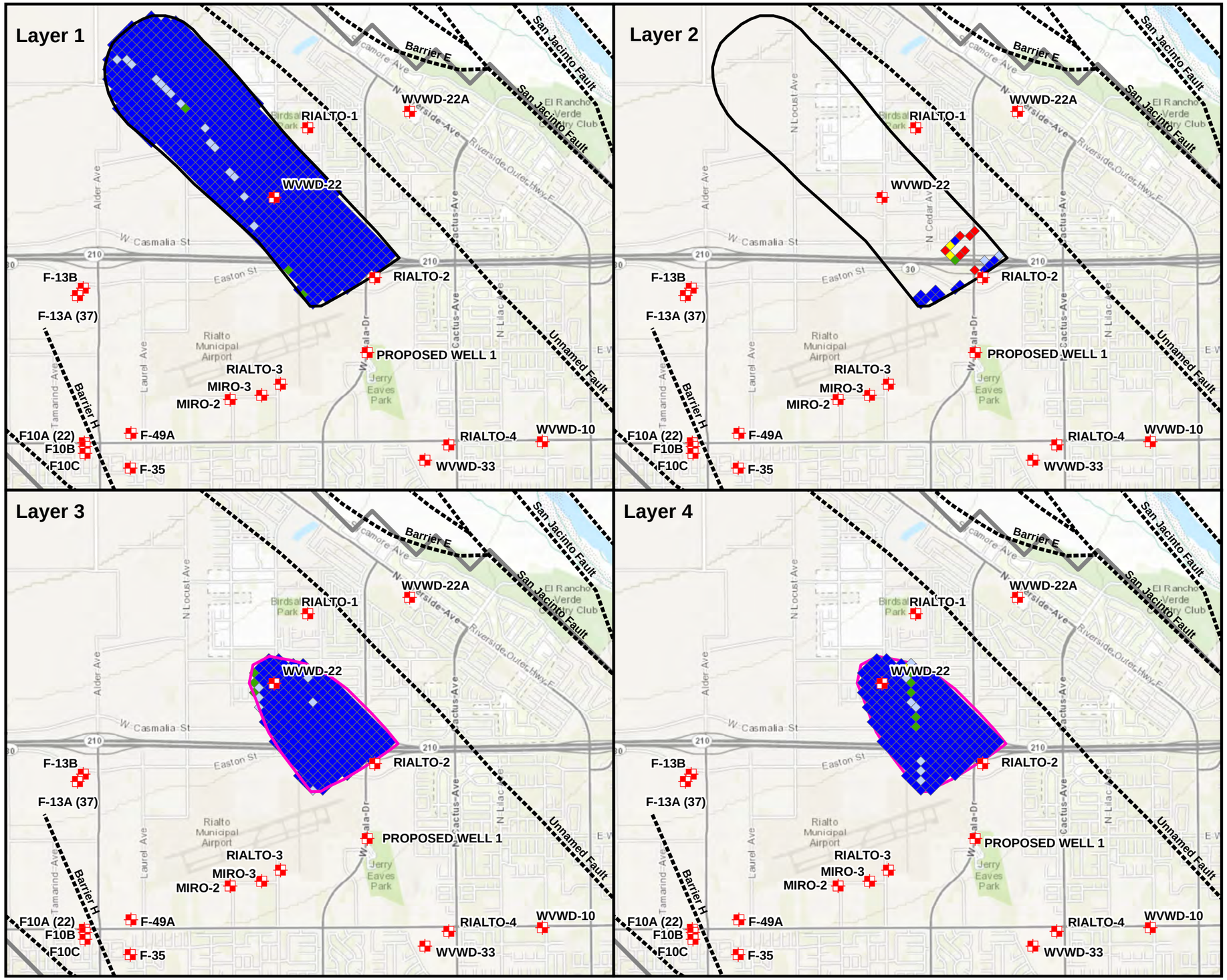

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
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Rialto-3	1,157	1,868	789 - 1,299
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SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 3

SCENARIO 2B
UPDATED
FREQUENCY OF CAPTURE

ERM

PREPARED BY:
CTALBOT (ERM)

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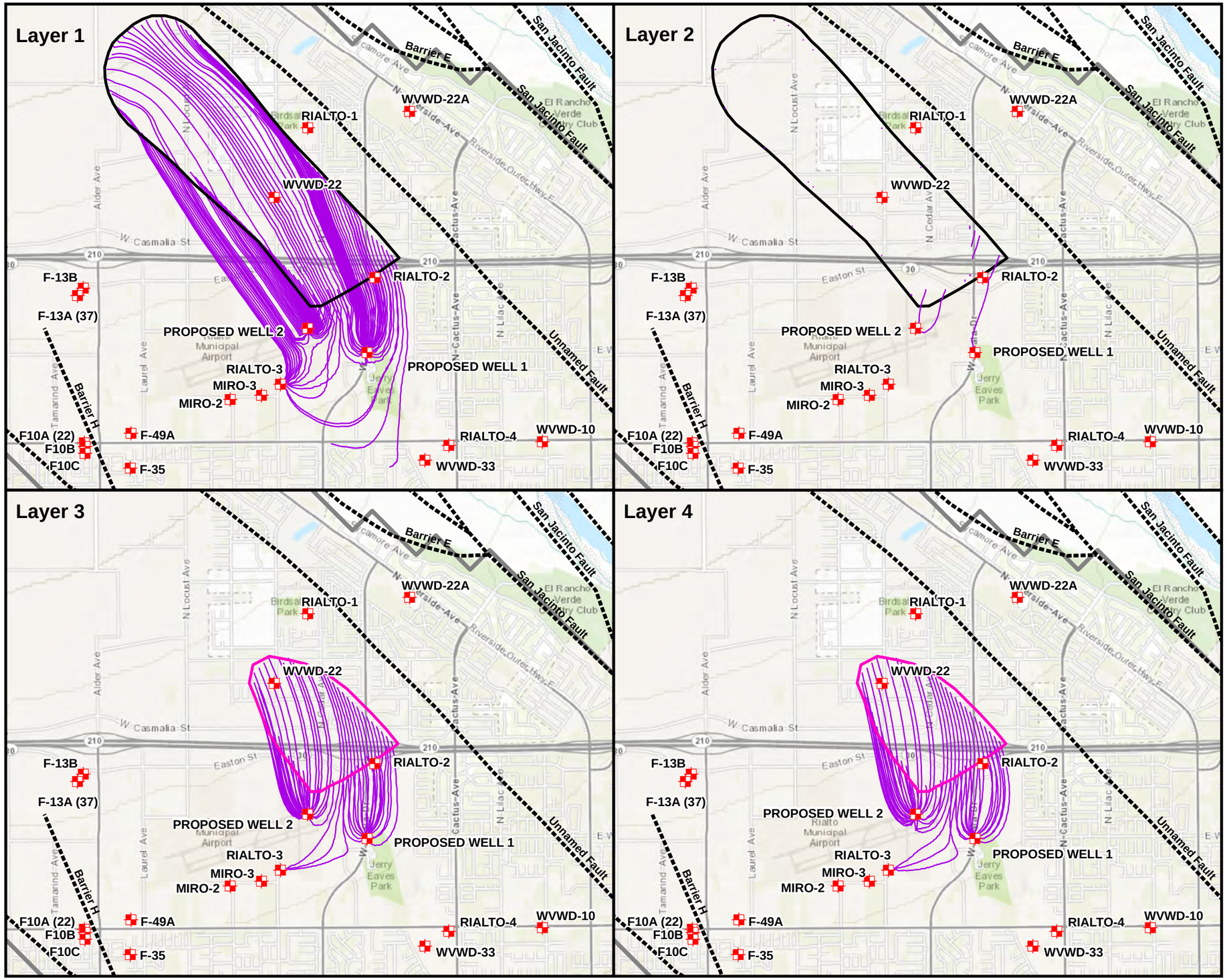

Legend

- Production Well
- Model Particle Tracks
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	929	1,500	633 - 1,043
Proposed Well 2	1,239	2,000	844 - 1,391
Total Flow Rate	3,325	5,368	2,266 - 3,733

Notes:
1) GPM = Gallons per Minute.
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Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

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SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 4

SCENARIO 2D-3
UPDATED PARTICLE
TRACK SIMULATION

ERM

PREPARED BY:
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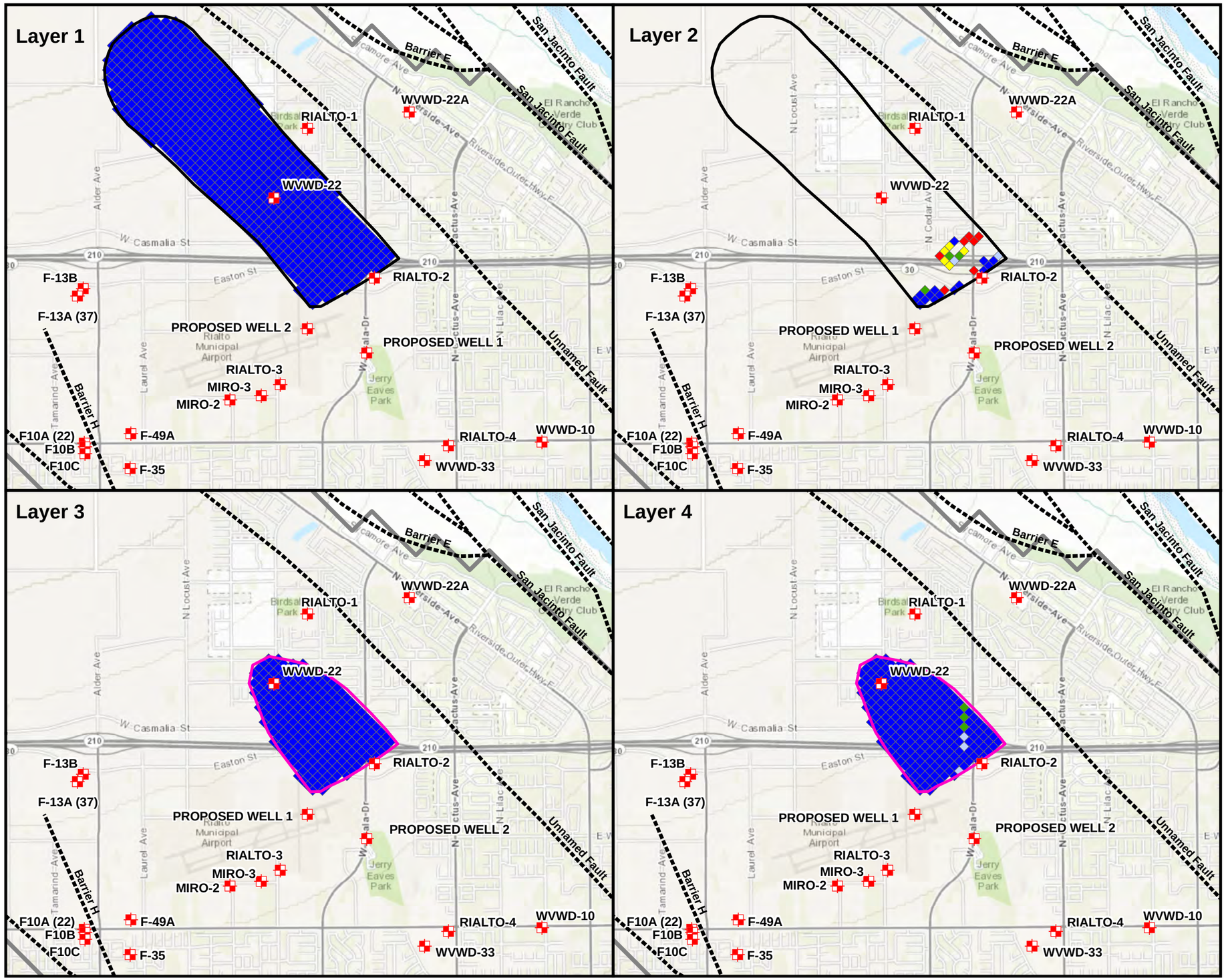

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Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 5

SCENARIO 2D-3
UPDATED FREQUENCY
OF CAPTURE

ERM

PREPARED BY:
CTALBOT (ERM)

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Response to 29 May 2013 USEPA Comments
"Draft Groundwater Flow Modeling Report, Source Area Operable Unit,
B.F. Goodrich Superfund Site" (10 April 2013)
Prepared for Emhart Industries, Inc.

Comment #1: ***The April 10, 2013 modeling report recommends the extraction well locations and pumping rates in a predictive simulation described as "Scenario 2B." Figure 5-16, showing the "frequency of capture" for Scenario 2B, indicates greater than 90% capture of most but not all particles included in the simulation. Capture is weakest in layer 4. To assist EPA in evaluating the adequacy of this scenario, we request that the following additional simulations be run:***

- ***a variation on Scenario 2B in which the combined pumping rate for Rialto-3 and the proposed new extraction well is increased from 3,016 gpm to 3,250 gpm; and***
- ***a variation on Scenario 2B in which the combined pumping rate for Rialto-3 and the proposed new extraction well is increased from 3,016 gpm to 3,500 gpm.***

Response: In preparing Emhart's response to this comment, the modeling team determined that, when properly calculated, there is, in fact, no material difference between the overall frequency of capture (Layers 1, 3, and 4) and frequency of capture in Layer 4. Specifically, the modeling team discovered that instead of calculating frequency of capture for a 42-year predictive simulation period, a 35-year predictive simulation period was erroneously used in the frequency of capture analysis presented in the Draft Groundwater Modeling Report.

Because frequency of capture is a measurement of the percentage of particles captured within the duration of the model simulation, the lower percentage for Layer 4 in the erroneously short simulation reflected the fact that some particles that would ultimately be captured had not yet reached an extraction well by the end of the simulation. Thus, in this case, simulation time, rather than pump rate, was the primary controlling factor for capture of particles in Layer 4.

With the shorter 35-year simulation period, some particles released in the simulation did not have sufficient time to travel to and be captured by the remedy wells. As a result, these particles were not counted as captured and the calculated frequency of capture was understated in the Draft Groundwater Modeling Report. When this error is corrected, the overall frequency of capture for the recommended Scenario 2B changes from 96 % (for a 35-year simulation period) to 99 % (for a 42-year simulation period) and the frequency of capture for Layer 4 is 98%. The 7-year difference in simulation period increased the frequency of capture without modifying pump rates.

Further, during work on this response, on Wednesday, 5 June 2013, Emhart received clarification that the County of San Bernardino (County) is currently

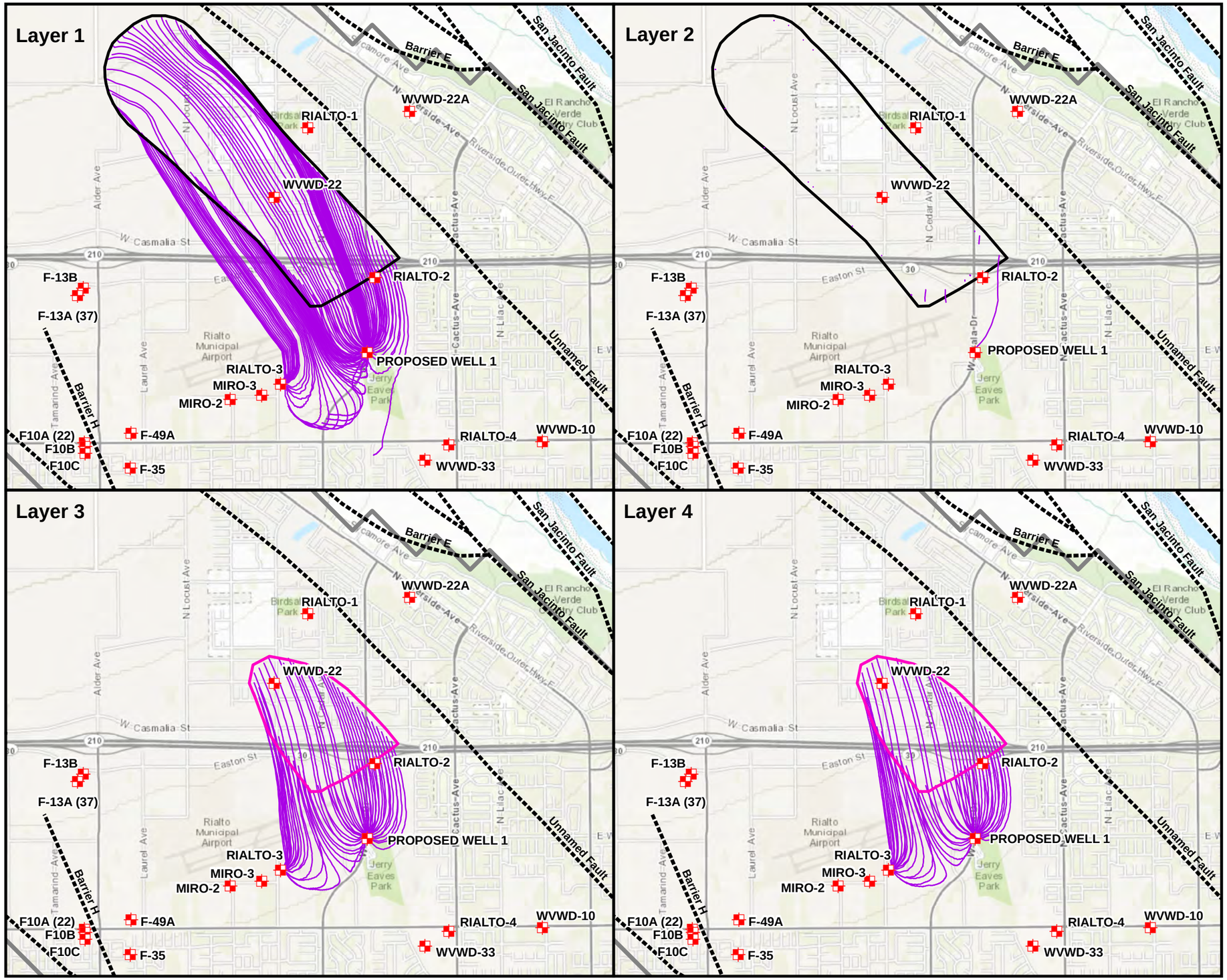
required by the Regional Water Quality Control Board (Regional Board) to operate Rialto-3 at an annual average flow rate of 1,300 gallons per minute (gpm). Additionally, the City of Rialto (Rialto) has requested that EW-1 (originally proposed to be located west of Ayala Drive) be relocated approximately 150 feet east of its original proposed location, in Jerry Eaves Park. Emhart is concurrently submitting a separate memorandum that describes the updated EW-1 location. The analysis below is based on the clarified Rialto-3 pump rate (1,300 gpm) and modified location of EW-1.

Based on all of the above, Emhart used the groundwater flow model to simulate four additional scenarios (identified as Alternatives 1 through 4), as listed in the table below, to address this comment. As requested, Alternatives 3 and 4 in the table below simulate pumping from Rialto-3 and EW-1 at a combined total rate of 3,250 and 3,500 gpm, respectively.

Scenarios	Rialto-3 Flow Rate (gpm)	EW-1 Flow Rate (gpm)	Total Flow Rate (gpm)	Frequency of Capture Layers 1, 3 & 4	Frequency of Capture Layer 4
2B	1,157	1,859	3,016	99%	98%
Alternative 1	1,300	1,450	2,750	96%	97%
Alternative 2	1,300	1,700	3,000	98%	98%
Alternative 3	1,300	1,950	3,250	99%	98%
Alternative 4	1,300	2,200	3,500	99%	99%

Particle tracking simulation and frequency of capture maps for Scenario 2B (included in the separate memorandum regarding EW-1 location and also attached for completeness with this response [attached Figures 2 and 3]) and Alternatives 1 through 4 are attached as Figures 1-1A through 1-4B. Adjusting the distribution of flow between Rialto-3 and EW-1, while maintaining a similar total combined flow (i.e., comparing Scenario 2B with Alternative 2), does not materially change the frequency of capture. Decreasing the total combined flow to 2,750 gpm (Alternative 1) maintains substantially comprehensive capture overall (96%) and in Layer 4 (97%). Extending the simulation duration for Alternative 1 will increase the predicted frequency of capture. Increasing the total combined flow (Alternatives 3 and 4) does not materially increase the frequency of capture.

The above information does not alter Emhart's recommendation for the immediate installation of EW-1 at the location requested by Rialto; however, based on the corrected frequency of capture data and the adjusted pump rate for Rialto-3, Emhart modifies its proposed pump rates for Scenario 2B to an initial combined flow rate of 2,750 gpm (1,300 gpm at Rialto-3 [as required by the Regional Board] and 1,450 gpm at EW-1), which is Alternative 1 in the table above.



Legend

- Production Well
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- Regional Aquifer Target Capture Zone
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Well	Pumping Rate		
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Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User

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Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 2

SCENARIO 2B
UPDATED PARTICLE
TRACK SIMULATION

ERM

PREPARED BY:
CTALBOT (ERM)

JOB NO. 0179962.03.A
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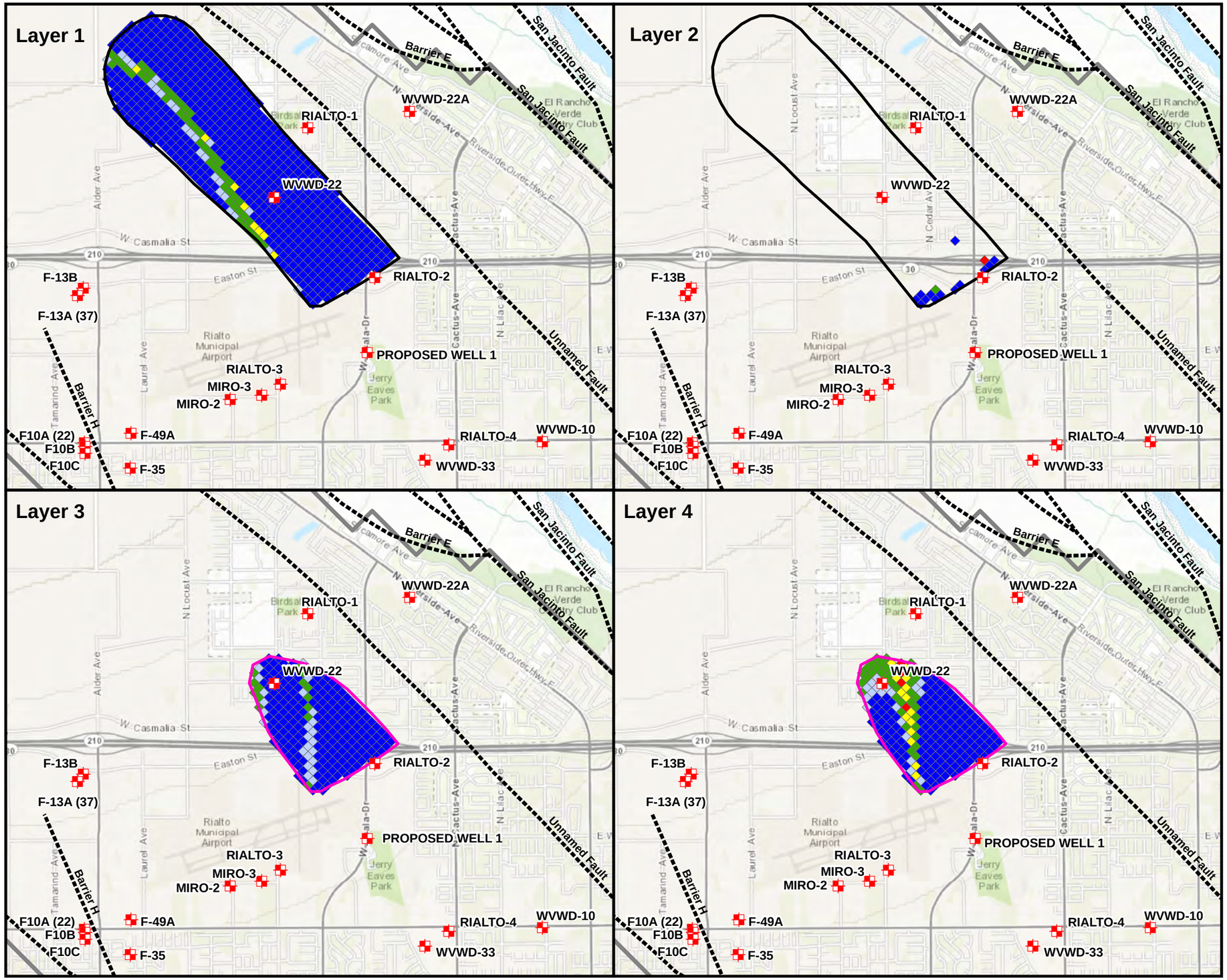

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong),

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0 3,000
Feet

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FIGURE 3

SCENARIO 2B
UPDATED
FREQUENCY OF CAPTURE

ERM

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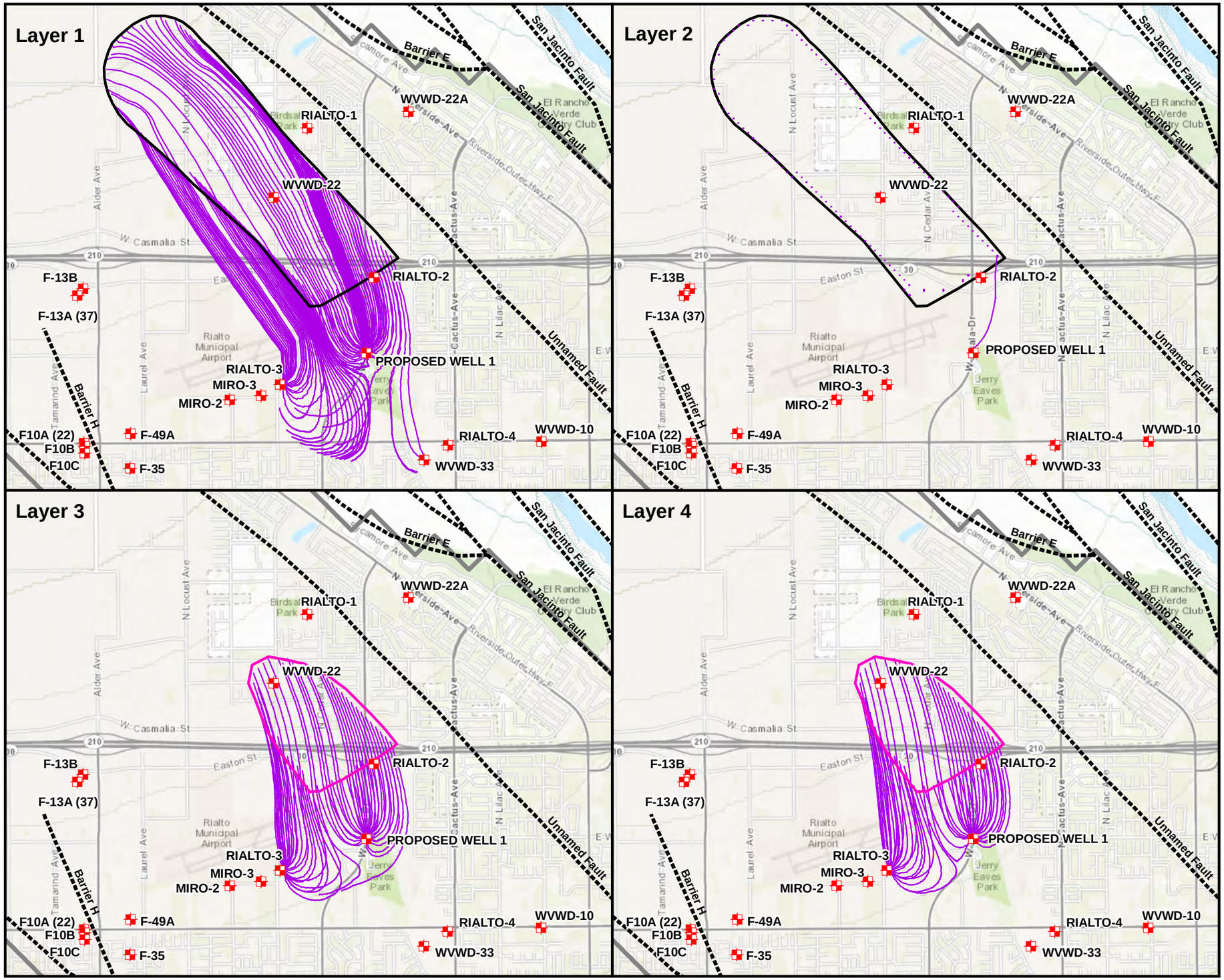

Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
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FIGURE 1-1A

SCENARIO 2B
ALTERNATIVE 1
PARTICLE TRACK SIMULATION

ERM

PREPARED BY: CTALBOT (ERM)	JOB NO. 0179962.03.A FILE: 0179962_RC_1-1Alt.mxd

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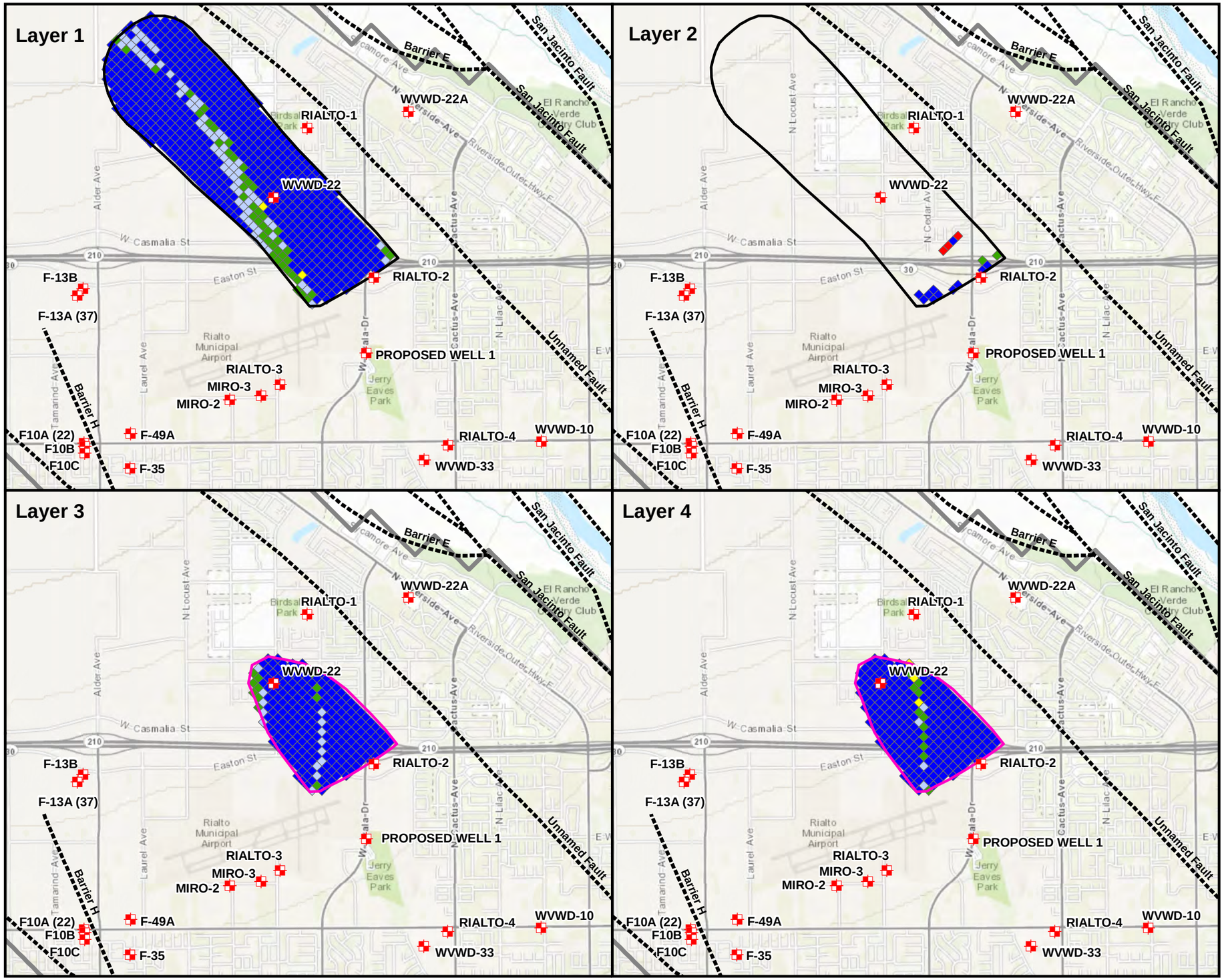

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

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FIGURE 1-1B

SCENARIO 2B
ALTERNATIVE 1
FREQUENCY OF CAPTURE

ERM

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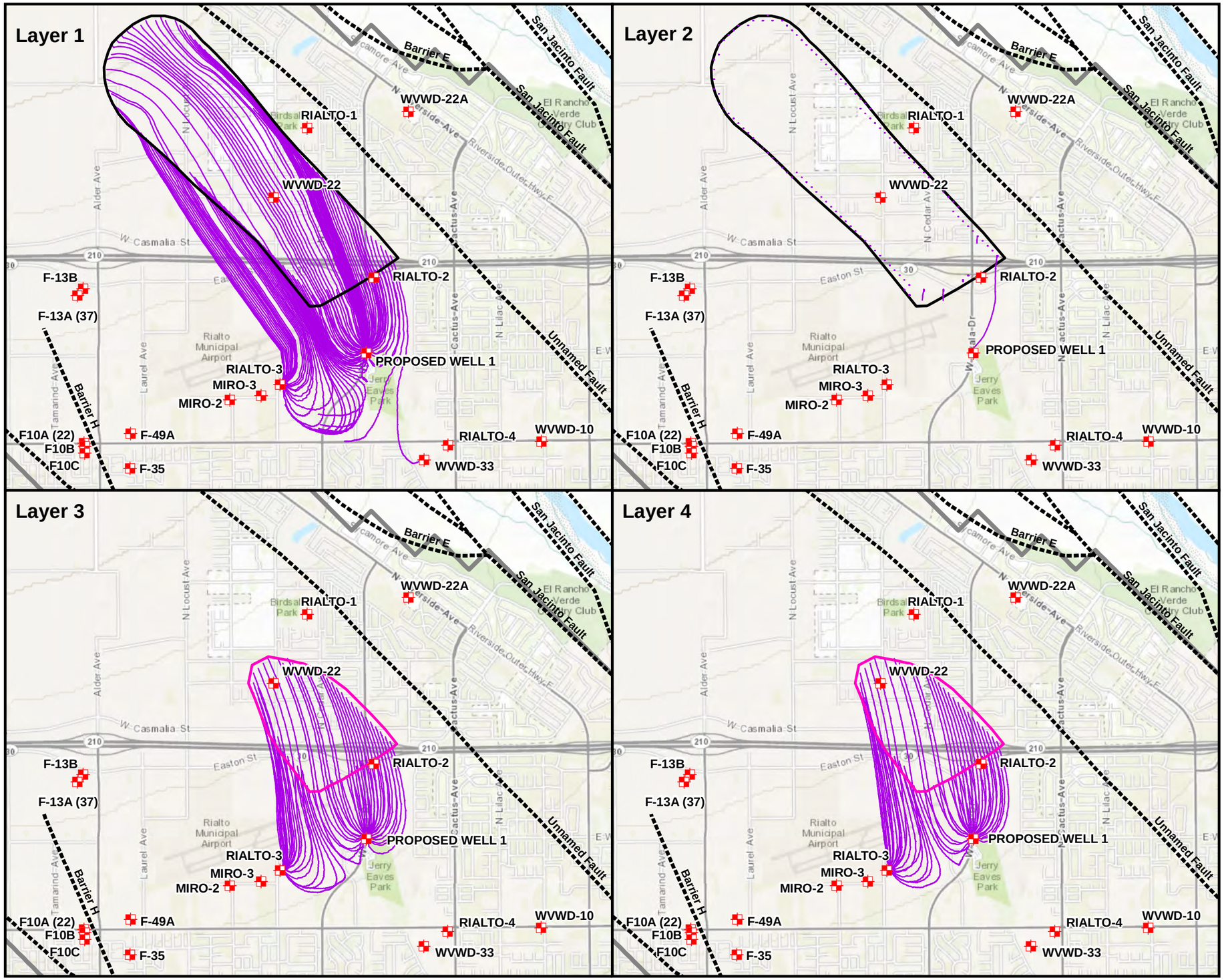

Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,700	2,744	1,159 - 1,910
Proposed Well 2	0	0	0
Total Flow Rate	3,000	4,842	2,045 - 3,370

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

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FIGURE 1-2A

SCENARIO 2B
ALTERNATIVE 2
PARTICLE TRACK SIMULATION

ERM

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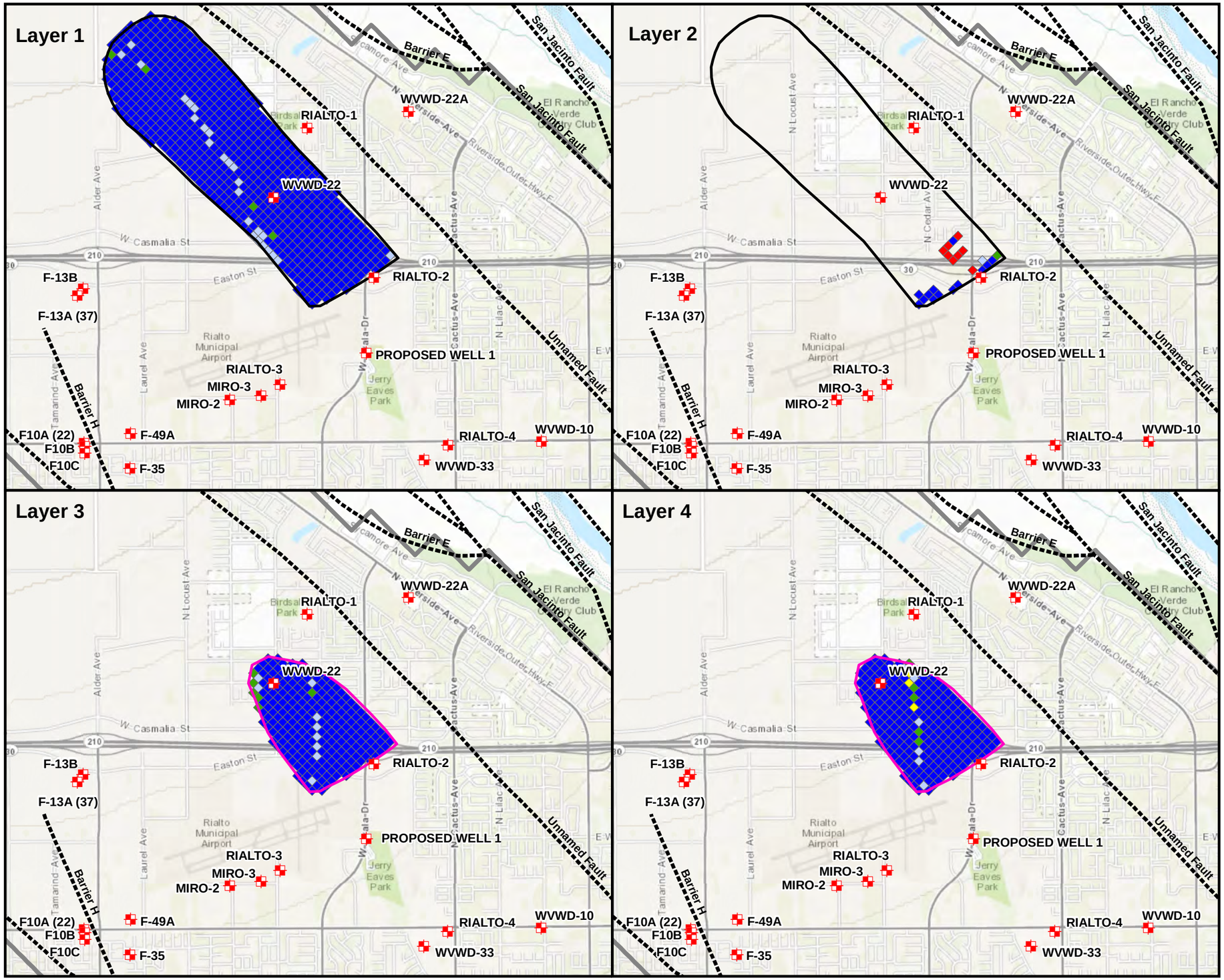

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,700	2,744	1,159 - 1,910
Proposed Well 2	0	0	0
Total Flow Rate	3,000	4,842	2,045 - 3,370

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
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FIGURE 1-2B

SCENARIO 2B
ALTERNATIVE 2
FREQUENCY OF CAPTURE

ERM

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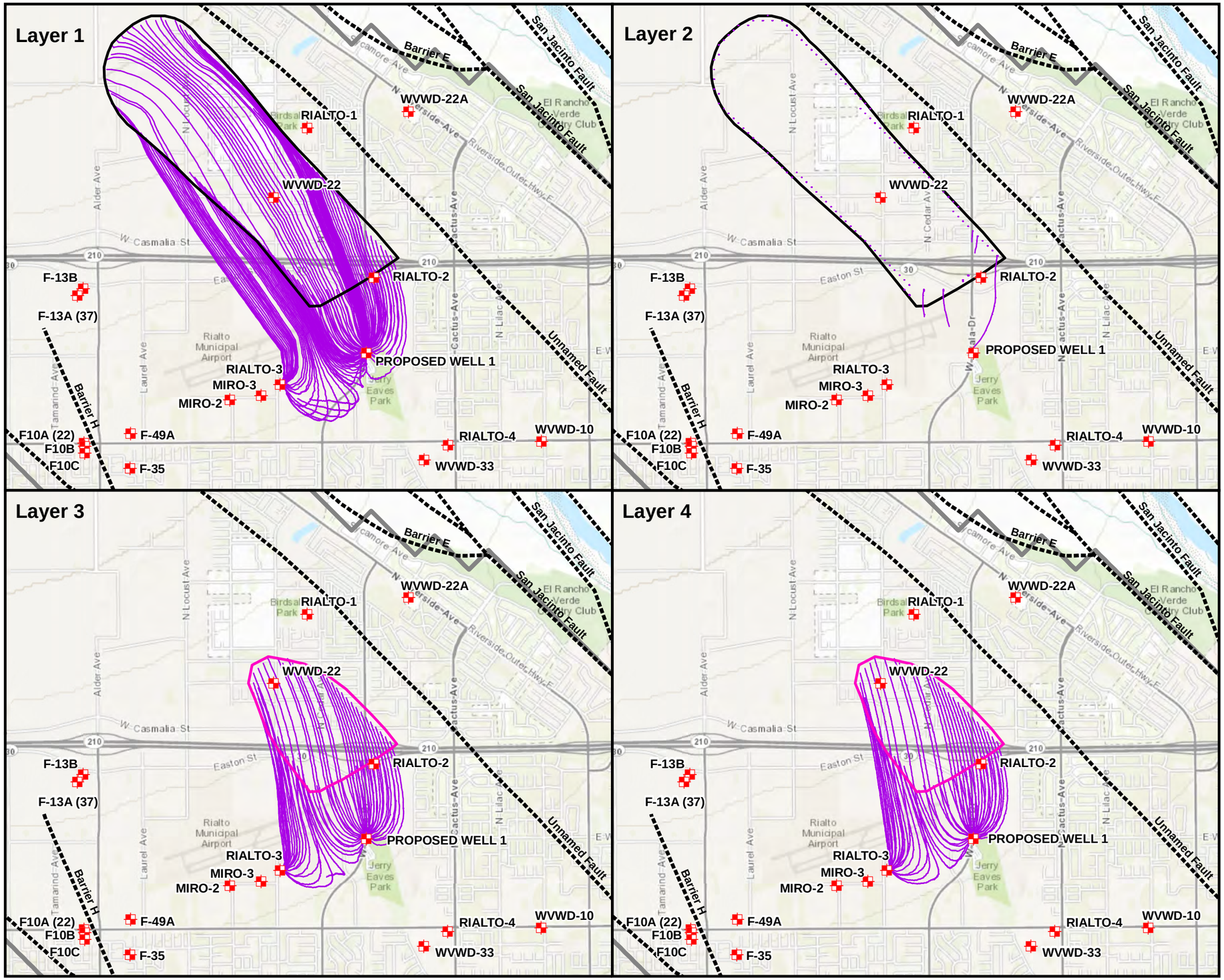

Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,950	3,147	1,330 - 2,190
Proposed Well 2	0	0	0
Total Flow Rate	3,250	5,246	2,216 - 3,651

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

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FIGURE 1-3A

SCENARIO 2B
ALTERNATIVE 3
PARTICLE TRACK SIMULATION

ERM

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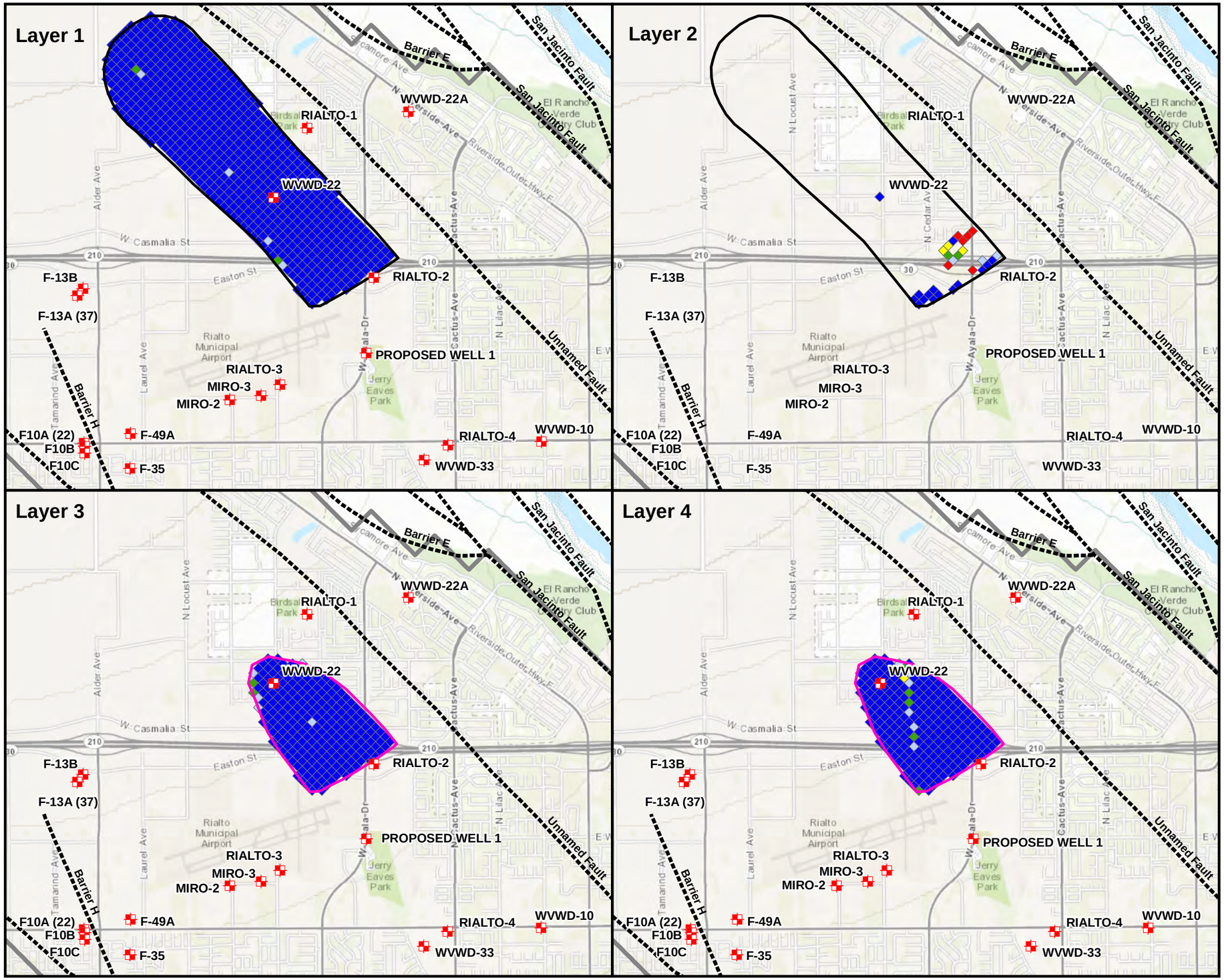

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,950	3,147	1,330 - 2,190
Proposed Well 2	0	0	0
Total Flow Rate	3,250	5,246	2,216 - 3,651

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
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FIGURE 1-3B

SCENARIO 2B
ALTERNATIVE 3
FREQUENCY OF CAPTURE

ERM

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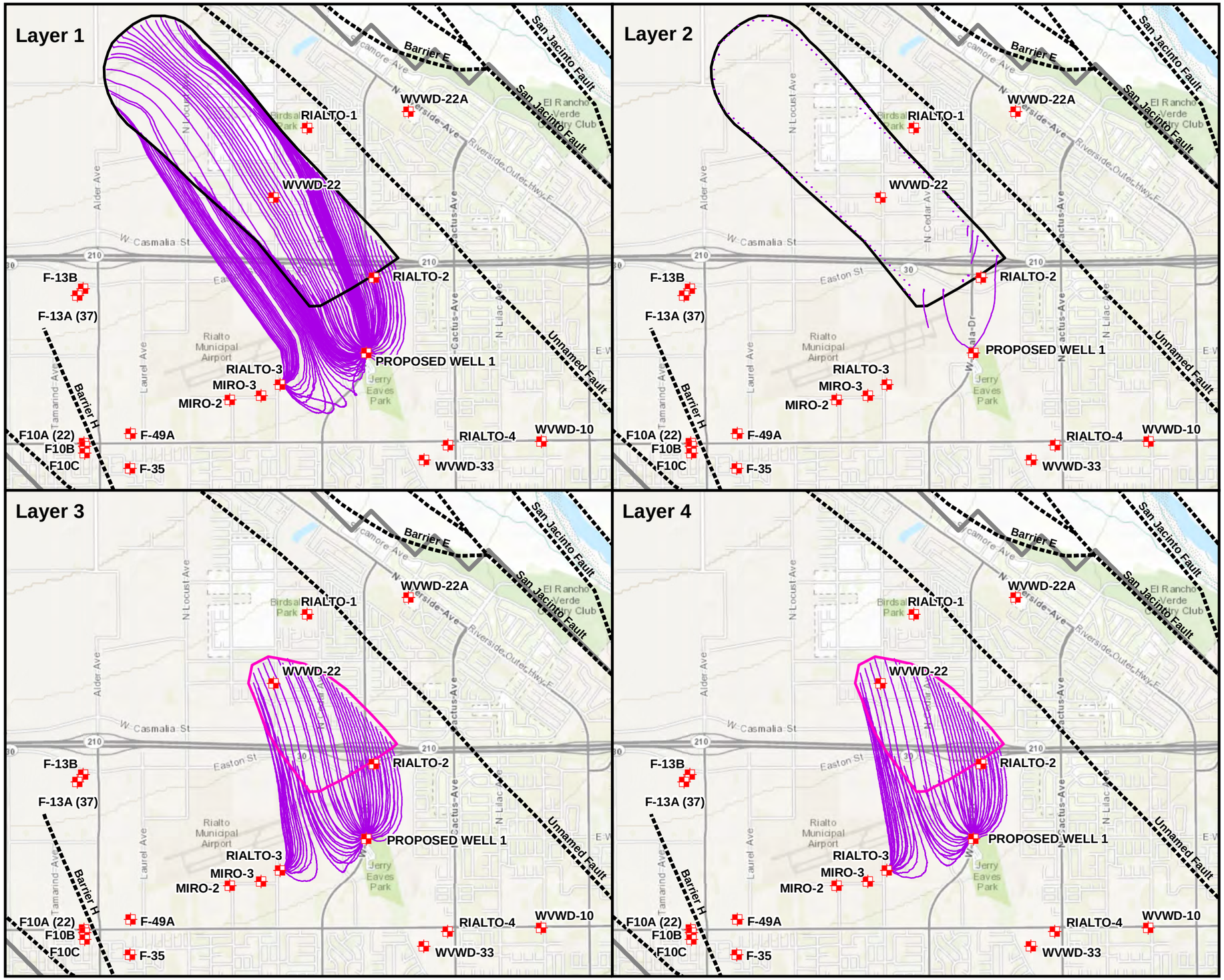

Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	2,200	3,551	1,432 - 2,360
Proposed Well 2	0	0	0
Total Flow Rate	3,500	5,649	2,319 - 3,820

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
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FIGURE 1-4A

SCENARIO 2B
ALTERNATIVE 4
PARTICLE TRACK SIMULATION

ERM

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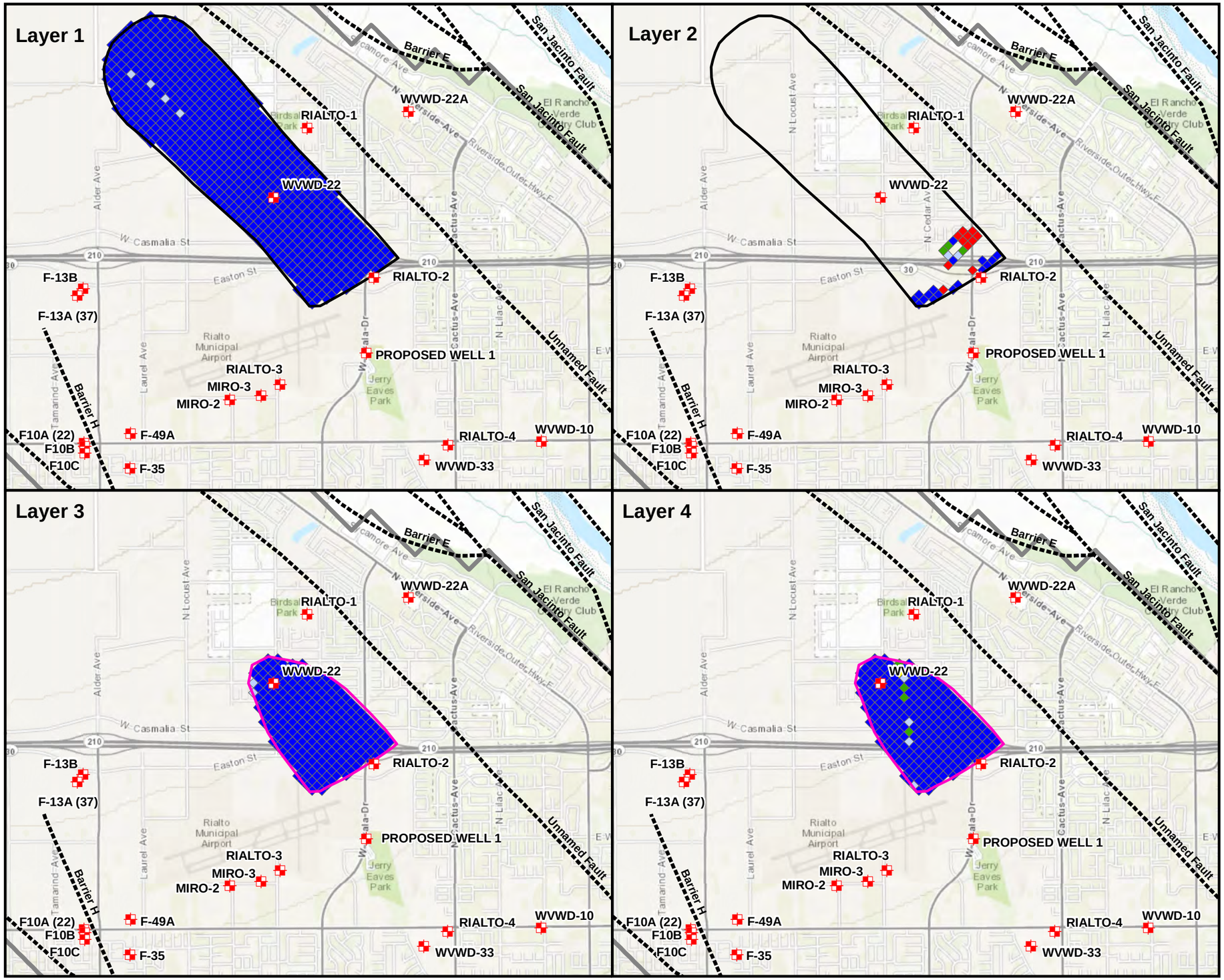

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	2,200	3,551	1,432 - 2,360
Proposed Well 2	0	0	0
Total Flow Rate	3,500	5,649	2,319 - 3,820

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 1-4B

SCENARIO 2B
ALTERNATIVE 4
FREQUENCY OF CAPTURE

ERM

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Comment #2: ***In its 2012 simulations, EPA/CH2M Hill assumed pumping rates for the Fontana Water Company (FWC) F49, F11[sic], and F10 well clusters that are about 1,300 gpm (25%) higher than those assumed in the predictive simulations presented in the report. EPA used rates reported by FWC for 2010; ERM used rates reported for 2011. Given the effects of FWC pumping on groundwater flow in and near the target area, and uncertainty about future rates, we request that the following additional simulation be run:***

- ***a variation on Scenario 2B in which future pumping at the F49, F11, and F10 well clusters is increased by 25%.***

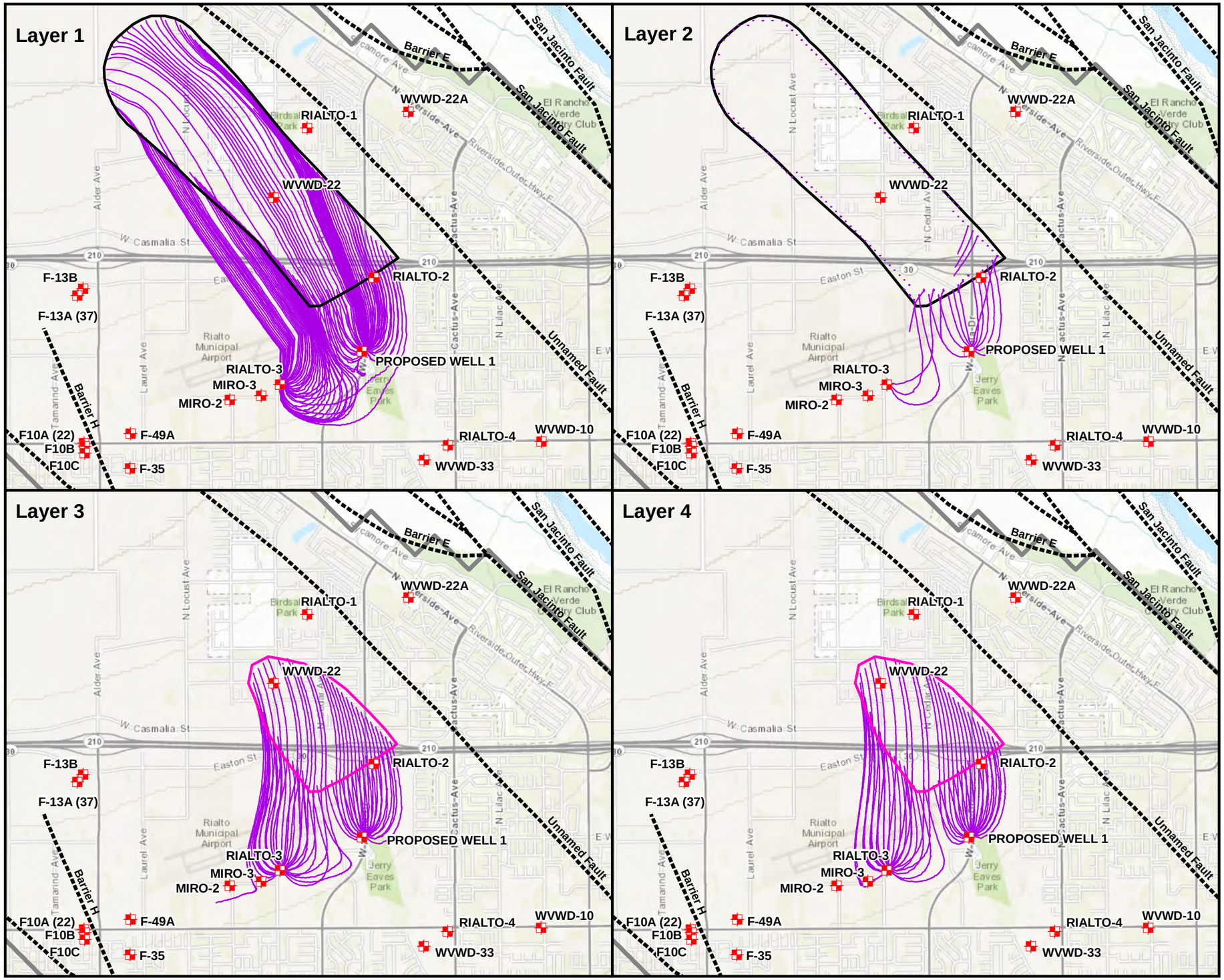
Response: Based on subsequent correspondence with U.S. Environmental Protection Agency (USEPA), the list of Fontana Water Company (FWC) Wells was corrected to read as follows: F10A, F10B, F13A (FU37), F13B, and F49A.

The table below presents a comparison of the pumping rates for FWC wells for: the USEPA 2012 Model (2010 reported rates), Emhart's Draft Groundwater Flow Modeling Report (2011 reported rates), and the rates requested for analysis in this comment.

Wells	2012 USEPA Model (2010 reported rates in gpm)	2013 Emhart Model (2011 reported rates in gpm)	Comment 2 Rates (increased by 25% over 2011, in gpm)
F-49A	1,914	1,451	1,813
F-13B	1,148	875	1,094
F-10B	1,206	1,201	1,502
F-10C	1,534	903	1,129
FU-37	916	1,011	1,263

Attached Figures 2-1A and 2-1B present the particle tracking and frequency of capture results where the future pumping rates in FWC production wells F10A, F10B, F13A (FU37), F13B, and F49A were increased by 25% over 2011 rates. These results indicate that, even with those increased pumping rates, frequency of capture would be 94%.

Emhart understands that the above listed pumping rates for FWC wells exceed the water rights allotted to FWC under the 1961 Consent Decree. Further, the Emhart Model predicts that groundwater levels in the basin will continue to drop; thus, requiring a 1% reduction in pumping by each purveyor for each 1-foot drop in water level as measured in the index wells.



Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 2-1A
INCREASED FONTANA WATER COMPANY WELL PUMPING SCENARIO 2B
PARTICLE TRACK SIMULATION

ERM

PREPARED BY: CTALBOT (ERM)	JOB NO. 0179962.03.A FILE: 0179962_RC_2-1Alt.mxd

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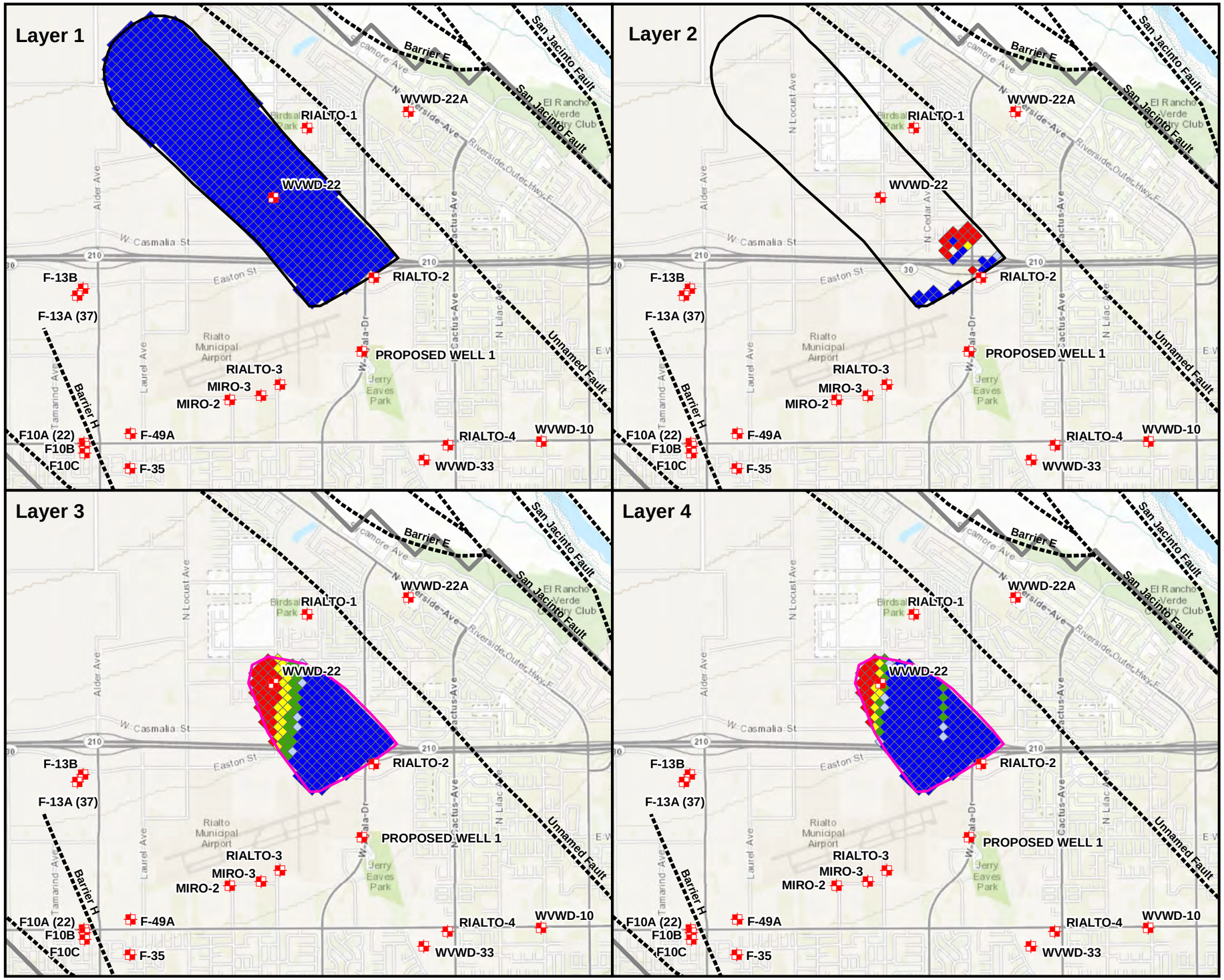

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

SOURCE AREA OPERABLE UNIT
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FIGURE 2-1B
INCREASED FONTANA WATER COMPANY WELL PUMPING SCENARIO 2B
FREQUENCY OF CAPTURE

ERM

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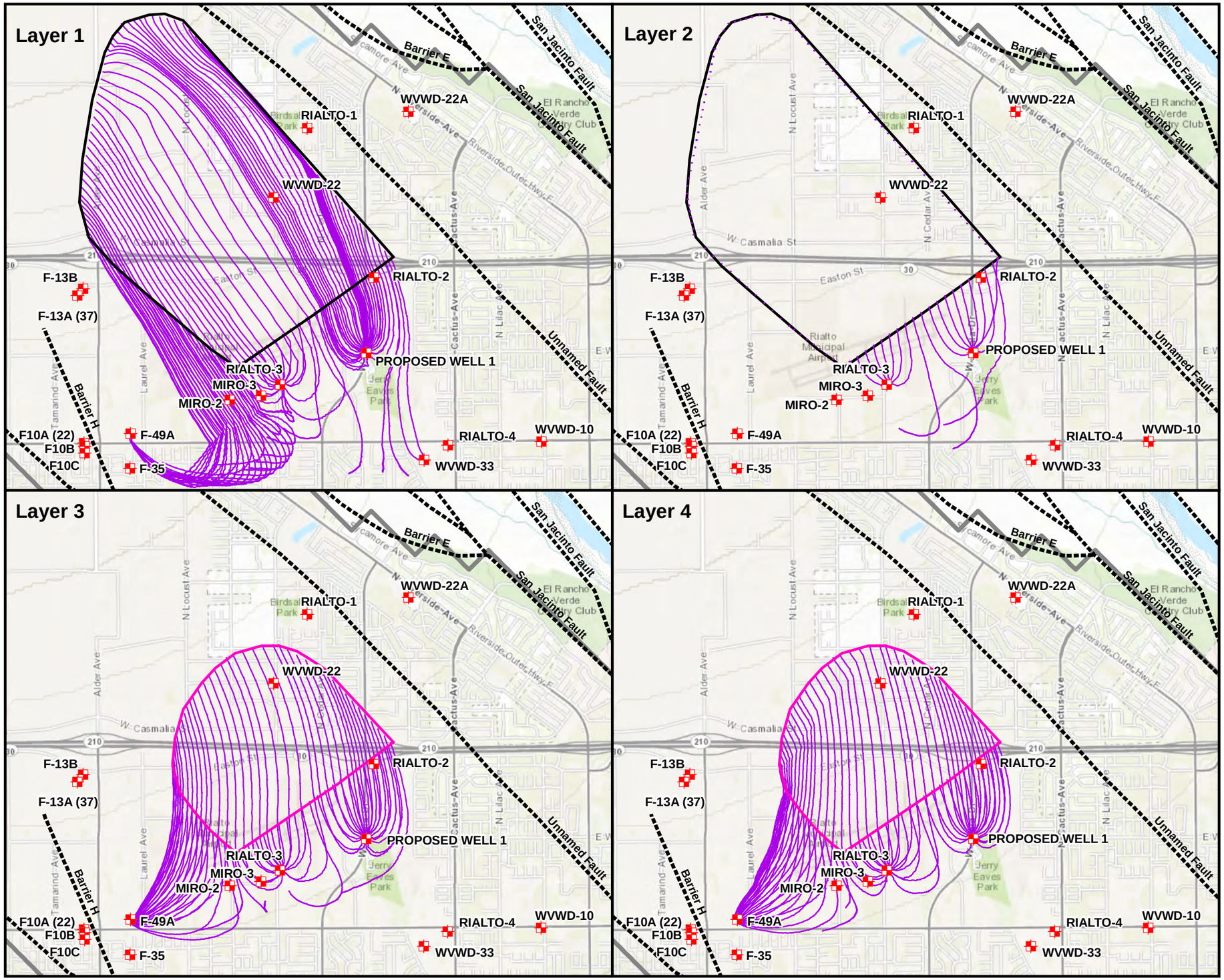
Comment #3: ***Figure 5-25 provides particle tracking simulations for Scenario 2B, with particles started in both the County remedy and Source Area Operable Unit target areas (i.e., the "combined target area"). Please provide a frequency of capture figure for this scenario.***

Response: Attached Figures 3-1A and 3-1B present the particle track simulation and frequency of capture, respectively, for Scenario 2B – Combined Capture.



Legend

- Production Well
- Faults
- Model Particle Tracks
- Regional Aquifer Target Capture Zone
- Intermediate Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

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FIGURE 3-1A

COMBINED CAPTURE - SCENARIO 2B
PARTICLE TRACK SIMULATION

ERM

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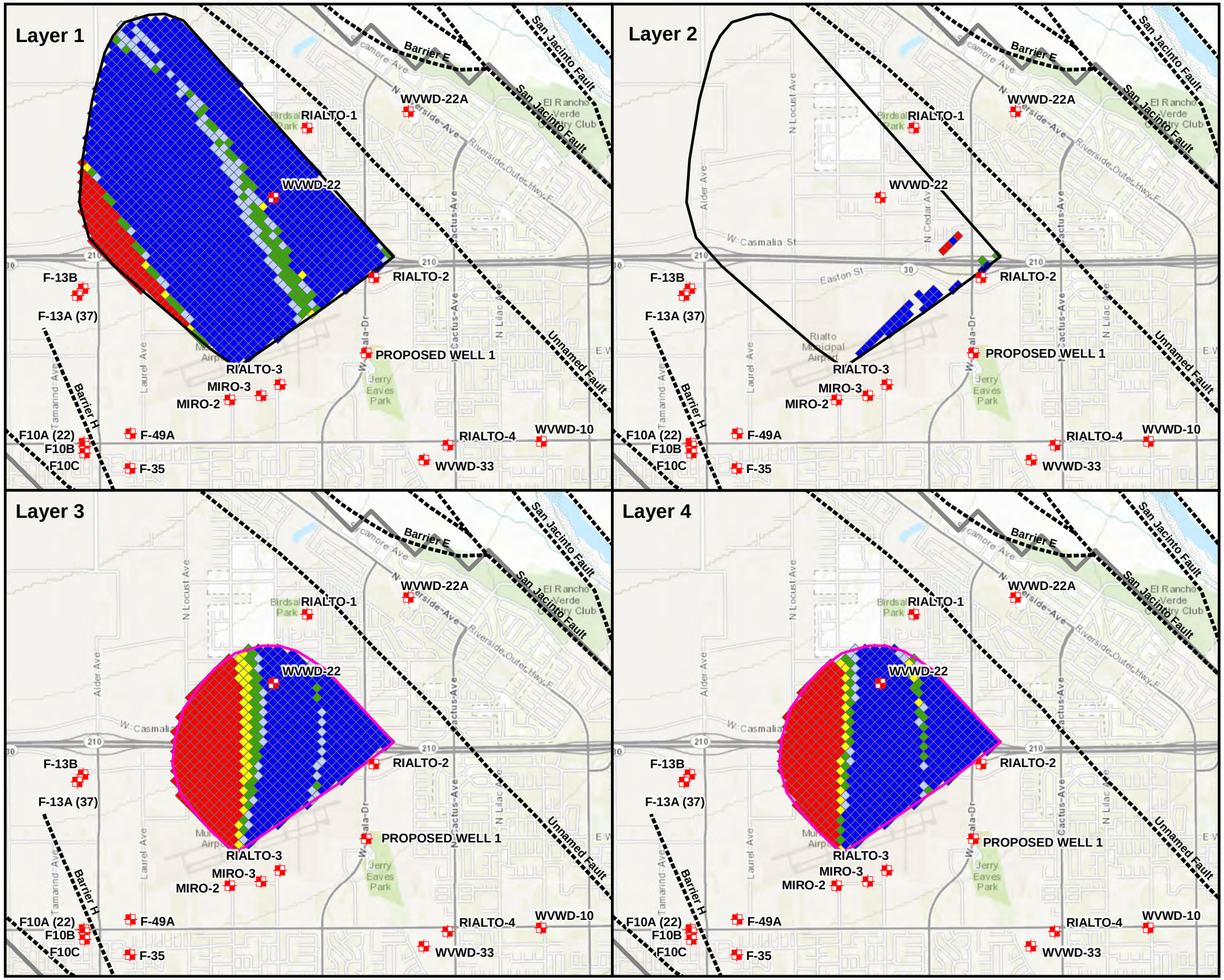

Legend

- Production Well
- Frequency of Capture (%)
  - < 40
  - 40 to 60
  - 60 to 80
  - 80 to 90
  - 90 to 100
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
RIALTO-2	0	0	0
RIALTO-3	1,300	2,098	886 - 1,460
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,450	2,340	989 - 1,629
Proposed Well 2	0	0	0
Total Flow Rate	2,750	4,439	1,875 - 3,089

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,000
Feet

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FIGURE 3-1B

COMBINED CAPTURE - SCENARIO 2B
FREQUENCY OF CAPTURE

ERM

PREPARED BY:
RK (ERM)

JOB NO. 0179962.03.A
FILE: 0179962_RC_3-1B_v1.mxd

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Comment #4: ***Pg. 13, Sec. 3.6/ Figure 3-5. Were there any dry cells in any of the layers at the beginning of the simulation period?***

Response: Yes, dry cells were present in Layers 1 and 2 at the beginning of the simulation period as shown on attached Figure 4-1.

Note that the initial heads from the USEPA 2012 Model were used as initial heads in the Emhart Model. As a result, dry cells are present in both models at the beginning of the simulation period in the same general locations. Minor differences to dry cells in the Emhart Model are a result of slight modifications to the model grid.

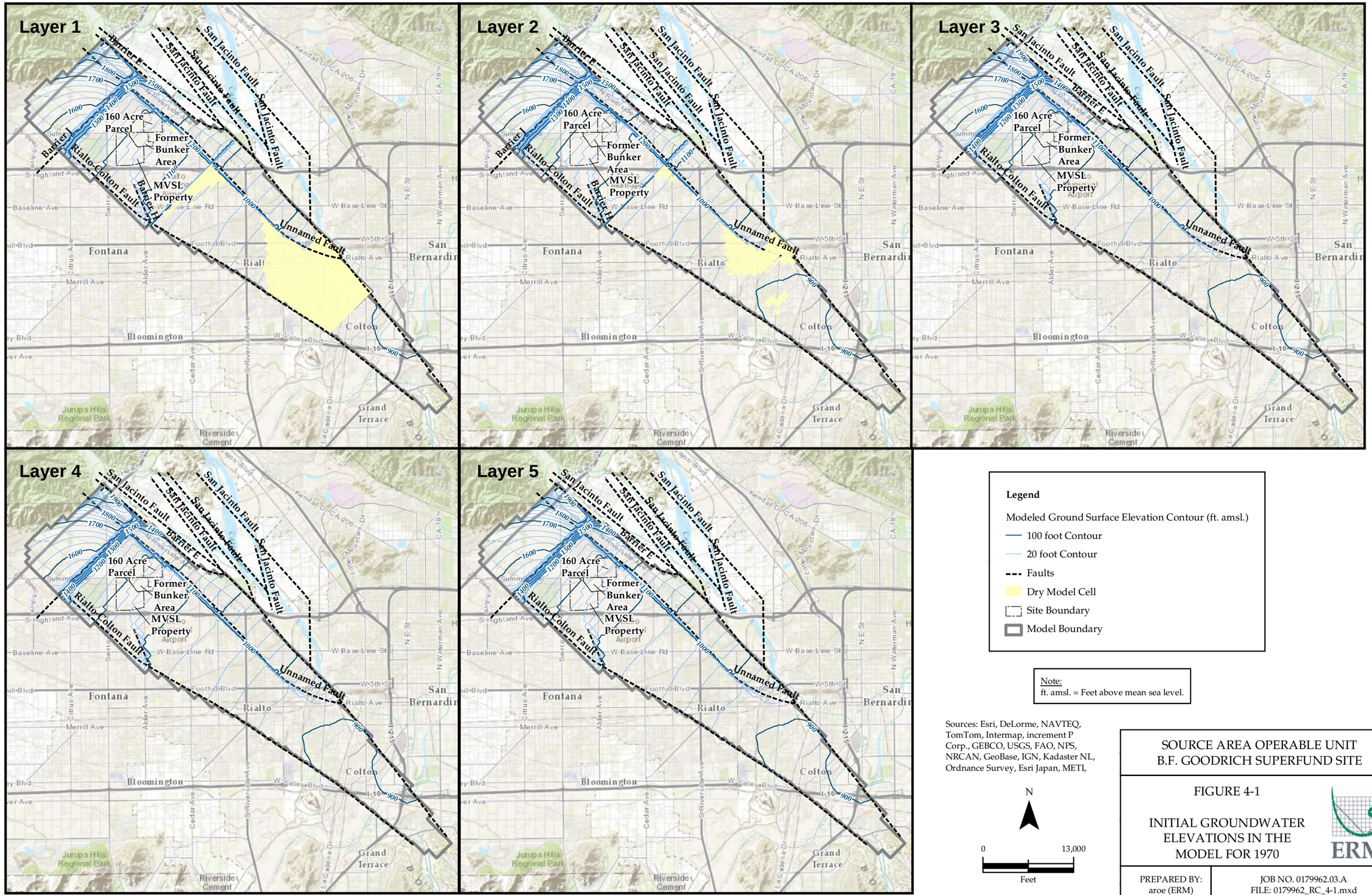

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FIGURE 4-1

INITIAL GROUNDWATER ELEVATIONS IN THE MODEL FOR 1970

ERM

PREPARED BY: aroe (ERM)

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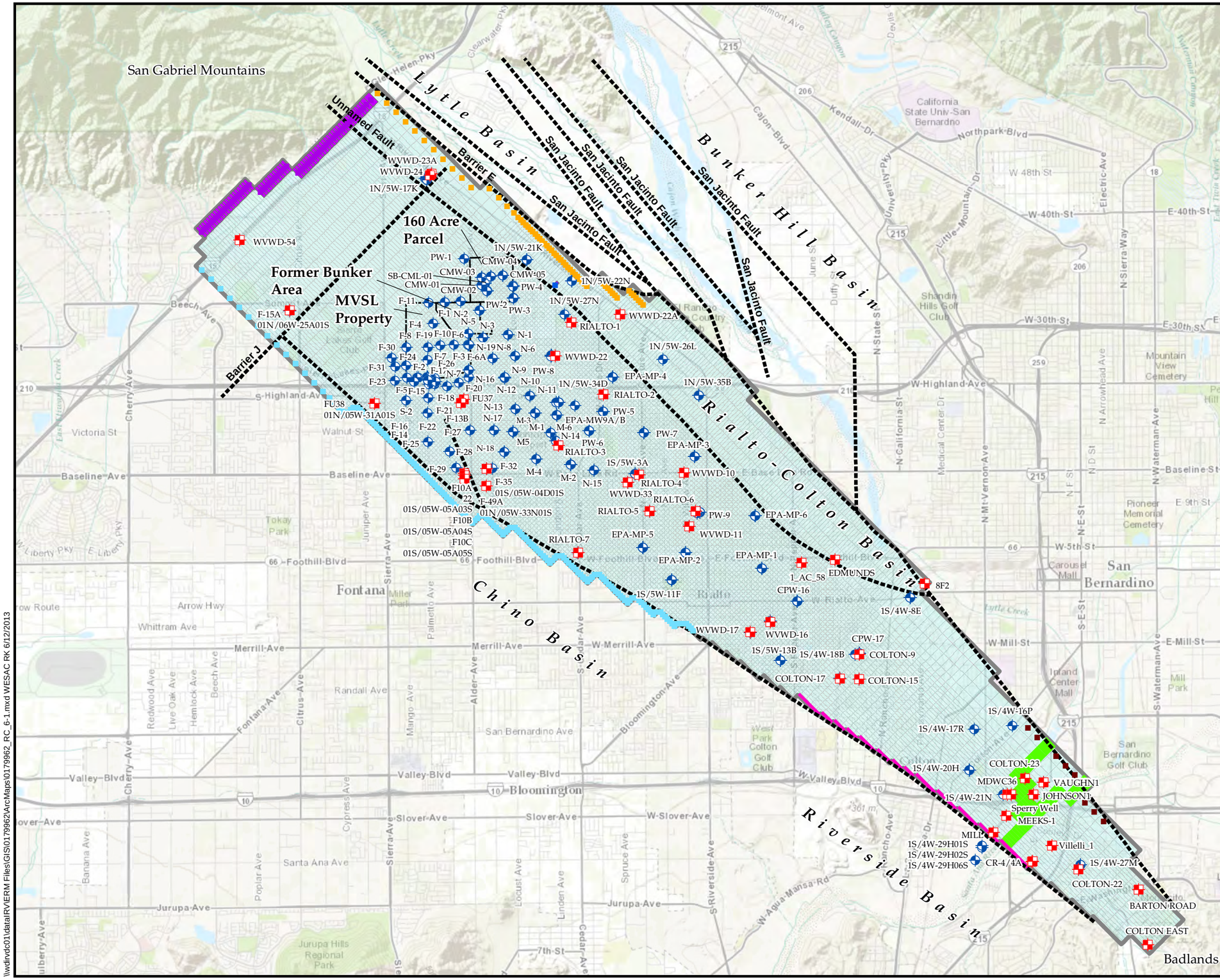
Comment #5: ***Pg. 20, Sec. 3.7.5. We disagree with the statement that calibration of the model "confirmed" that the Chino Basin boundary is effectively a no-flow boundary (i.e., that there is no subsurface flow across the Rialto-Colton Fault). Changing the magnitude of subsurface flow across the Rialto-Colton Fault in the model and citing the poorer correlation between simulated and target heads without attempting to adjust other parameters to improve calibration summary statistics does not prove there is no flow across this fault.***

Response: Emhart has reviewed the referenced text and proposes to modify the last bullet of Section 3.7.5 (page 20) to read as follows:

> "When used with all other inflow and outflow data-driven assumptions, the assumption that the Chino Basin boundary is effectively a no-flow boundary (i.e., that any flow across the boundary is negligible) was corroborated by and is consistent with the calibration of the Emhart Model and all relevant available information, see Table 4-3. As can be seen in Table 4-3, when either 2,000 or 4,000 AF/yr values are assumed to cross the Chino Basin boundary, the Emhart Model statistics in the AOI indicate poorer correlation between simulated and actual conditions."

Comment #6: ***Figure 3-6. The figure shows the Chino Basin boundary as an outflow boundary, rather than a no-flow boundary. Please clarify whether this boundary is a no-flow boundary or a fixed (non-zero) flux boundary?***

Response: The Chino Basin boundary is assumed to be a no-flow boundary. Attached Figure 6-1 is a revised version of Figure 3-6 from the report with the legend updated to reflect that Chino Basin is a no-flow boundary.



Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

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FIGURE 6-1

MODEL BOUNDARY CONDITIONS

ERM

PREPARED BY: RK (ERM)	JOB NO. 0179962.03.A FILE: 0179962_RC_6-1.mxd

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Comment #7: ***Pg. 22, Sec. 3.7.6.2. Return flows were calculated as 15 and 30 percent of the total pumping for the first and fourth quarters and second and third quarters, respectively. Were comparisons to wastewater treatment plant inflows from indoor water use made to develop the assumed return flow percentages associated with outdoor water use?***

Response: No, Emhart did not compare wastewater treatment plant inflows to develop the assumed return flow percentages. For its models of the Bunker Hill and Rialto-Colton Basins, the U.S. Geological Survey (USGS) applied a return flow rate equivalent to 30% of the pumping rate. The Emhart model uses the USGS's 30% rate in the warmer months and a lower value of 15% in the cooler months based on the understanding that application of water for irrigation and lawn watering are greater in the warmer months than in the cooler months.

Comment #8: ***Pg. 23, Sec. 3.8.1 Figure 3-10. Do presented values represent the hydraulic conductivity associated with each Horizontal Flow Barrier (HFB) or hydraulic characteristic, which is the hydraulic conductivity of the HFB divided by the HFB width? The presented values are significantly lower than those used in the USEPA/CH2M Hill 2012 Model. The answer to this question may also affect the "conductivity" values listed in Table 4-3 for Barrier H.***

Response: The presented values represent the "hydraulic characteristic" as defined by the Horizontal Flow Barrier (HFB) package to be the hydraulic conductivity of the HFB divided by the width of the HFB. Tables 3-5 and 4-3 and Figure 3-10 refer to hydraulic characteristic rather than hydraulic conductivity. In general, the hydraulic conductivity values associated with the HFBs in the Emhart Model are consistent with those in the USEPA 2012 Model. The hydraulic conductivity values associated with Barrier H in the Emhart Model are identical to those used in the USEPA 2012 Model.

Comment #9: ***Pg. 23, Sec. 3.8.2 Figure 3-11. Does the increased horizontal hydraulic conductivity over what the USEPA 2012 Model has in Layer 4 near Barrier H result in less response to pumping at Fontana?***

Response: No, it does not appear that the change in hydraulic conductivity over what USEPA 2012 Model has in Layer 4 results in less response to FWC pumping.

Attached Figure 9-1 shows the locations of the target wells screened in Layer 4 near Barrier H. Attached Figures 9-2A through 9-2I show simulated and observed hydrographs from the USEPA Model and the Emhart Model. With the exception of Figure 9-2D (N-17C-1), the simulated water levels in the Emhart Model and the USEPA 2012 Model are generally in agreement. As Figure 9-2C shows, for example, in the case of F-49, for the period in which observations are available, the Emhart Model's simulated water levels are within 20 feet of the USEPA Model's simulated water levels. Although the Emhart Model's simulated water levels are higher than the corresponding water levels in the USEPA Model, they show better agreement with observed water levels. Figure 9-2D shows that in the case of N-17C-1, the simulated water levels in the Emhart Model are less than the simulated water levels in the USEPA Model during the period of increased FWC pumping (i.e., after approximately 2000).

The general agreement of water levels indicates that the simulated response to FWC pumping in the Emhart Model is similar to the response in the USEPA Model.

The figures also indicate that, with the exception of N-17C-1, the agreement between the Emhart Model's simulated and observed heads is slightly better than the agreement between USEPA 2012 Model's simulated and observed heads. This observation is consistent with the calibration statistics presented in attached Table 9-1.

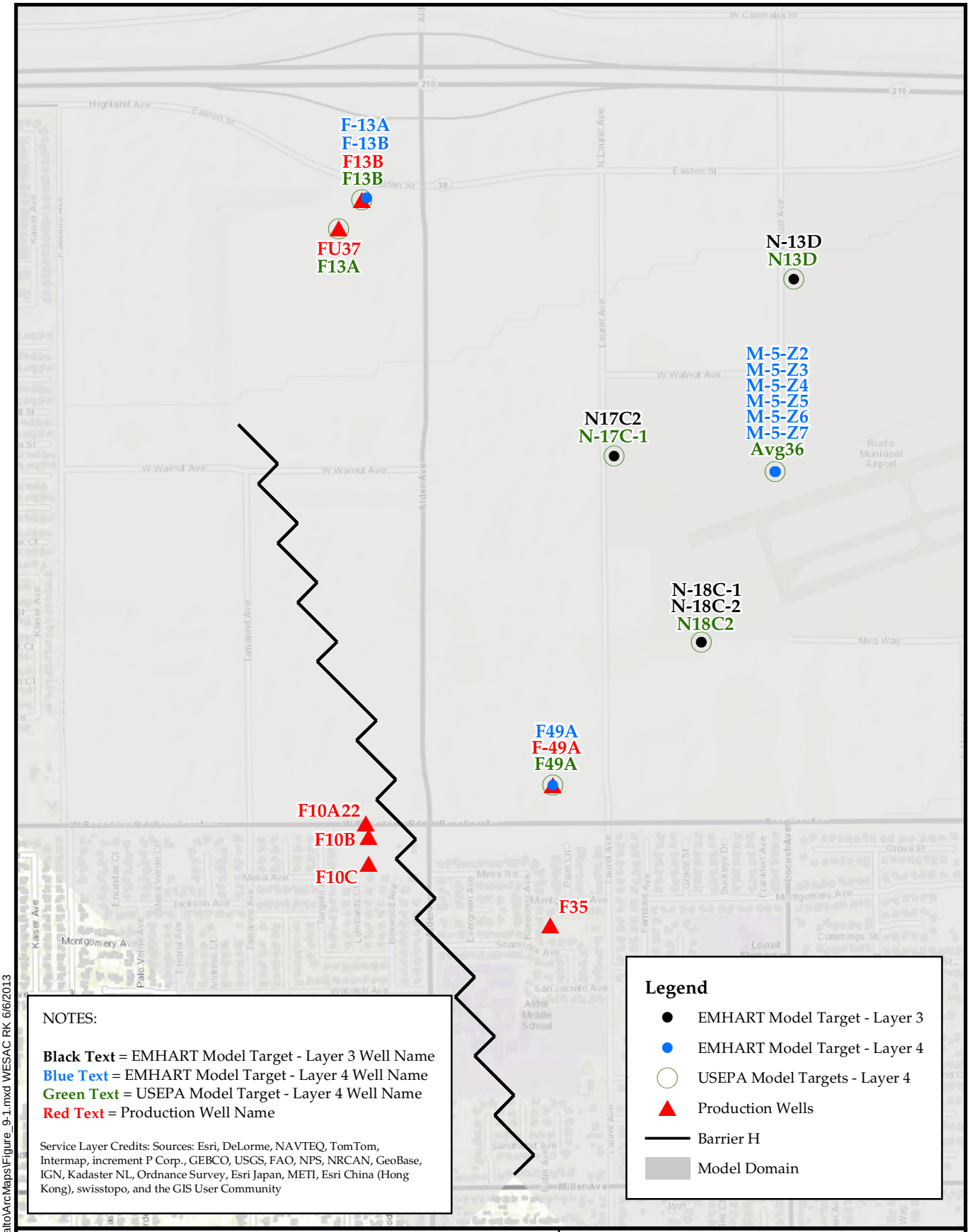

FIGURE 9-1

TARGETS NEAR BARRIER H

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Figure 9-2A - F-13A (Layer-4)

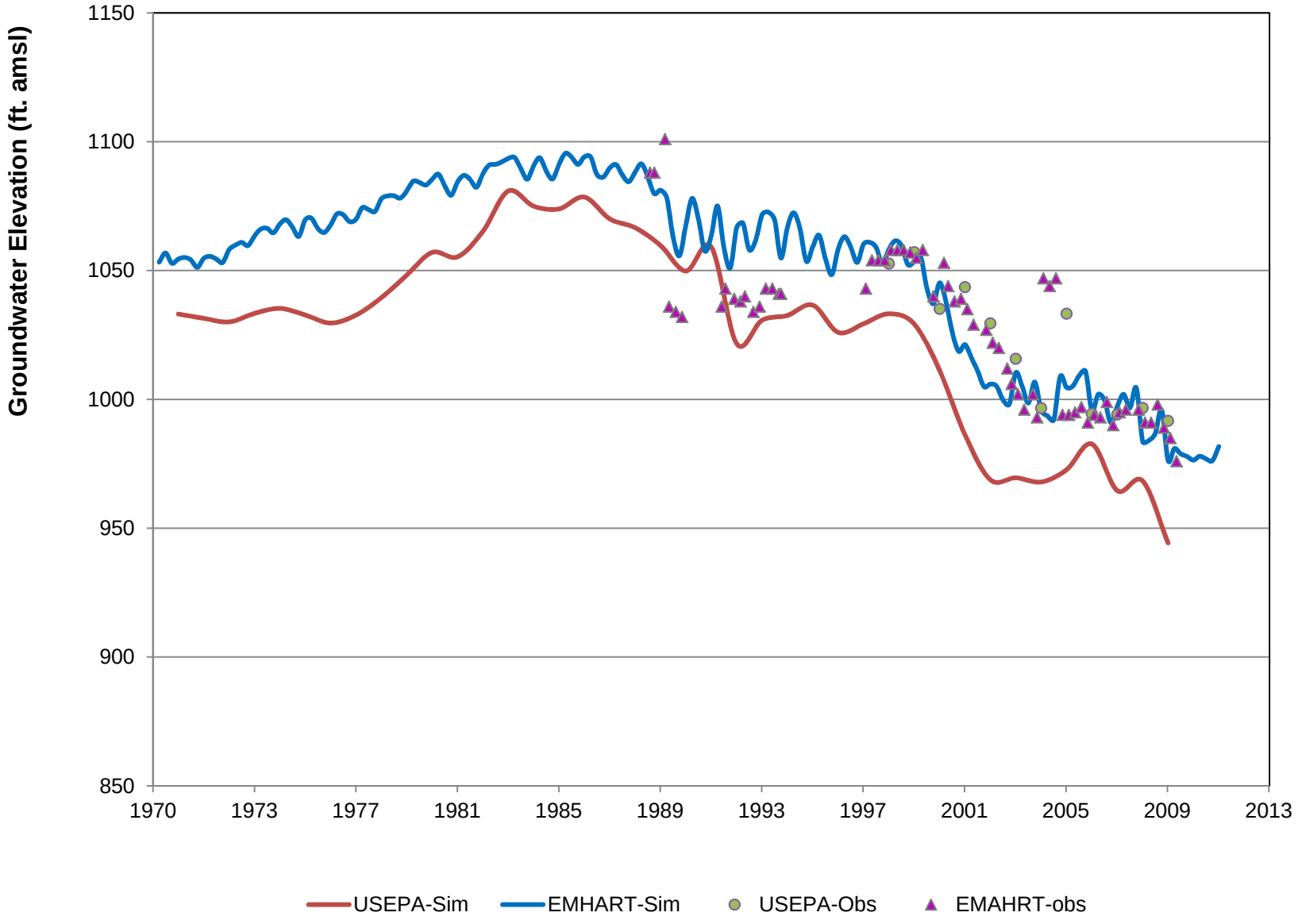


Figure 9-2B - F-13B (Layer 4)

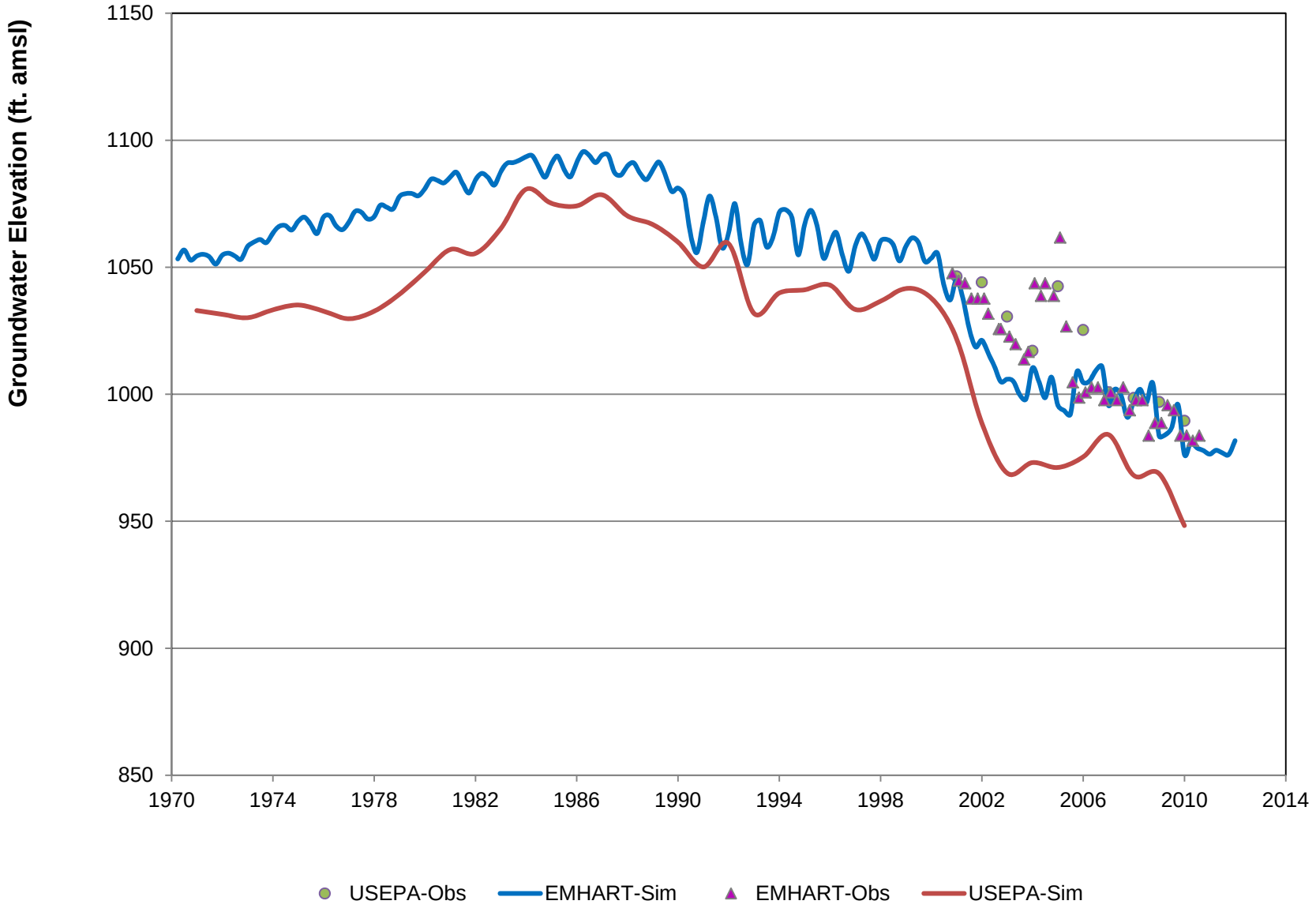


Figure 9-2C - F-49A (Layer-4)

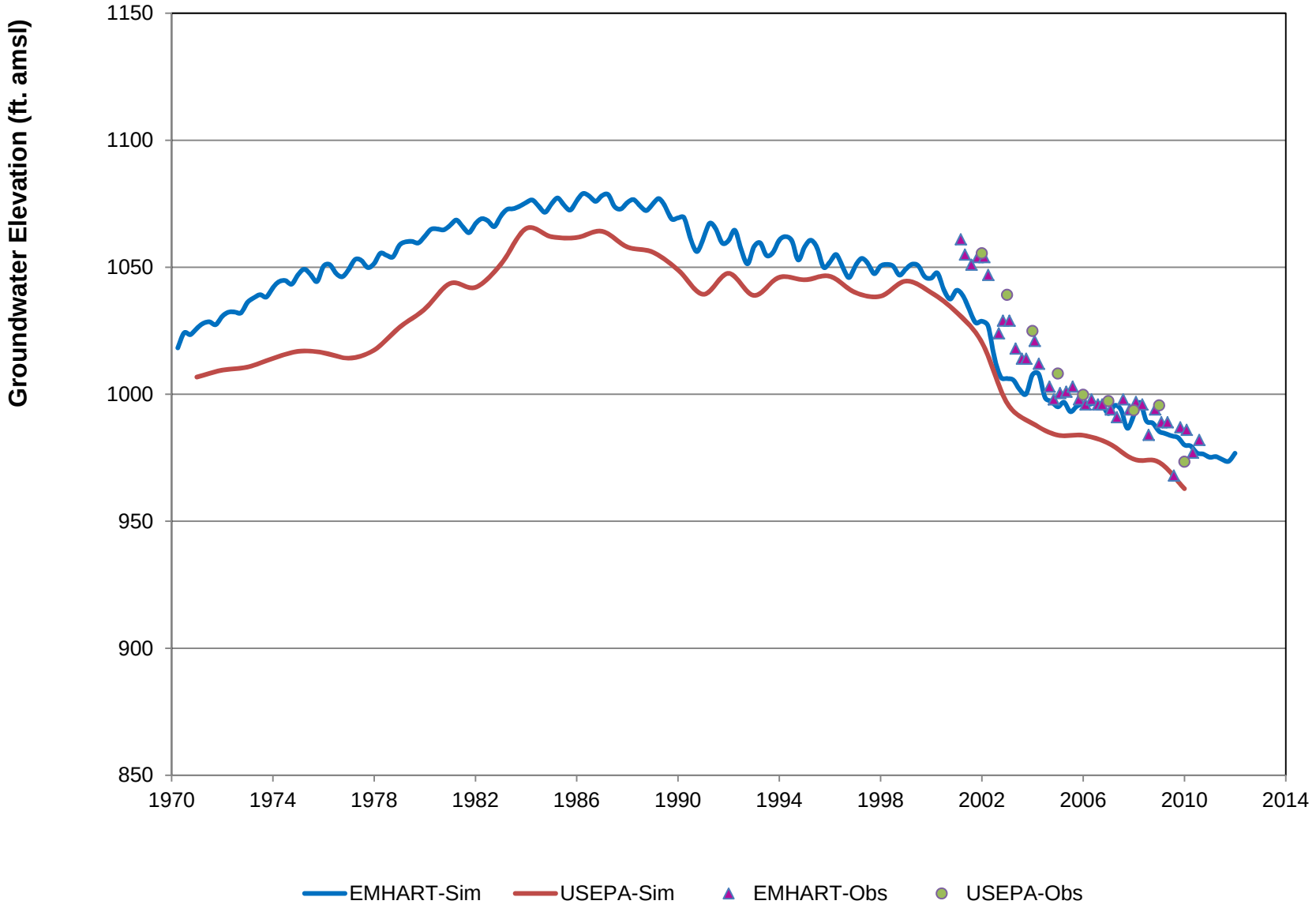


Figure 9-2D - N-17-C-1 (Layer-3)

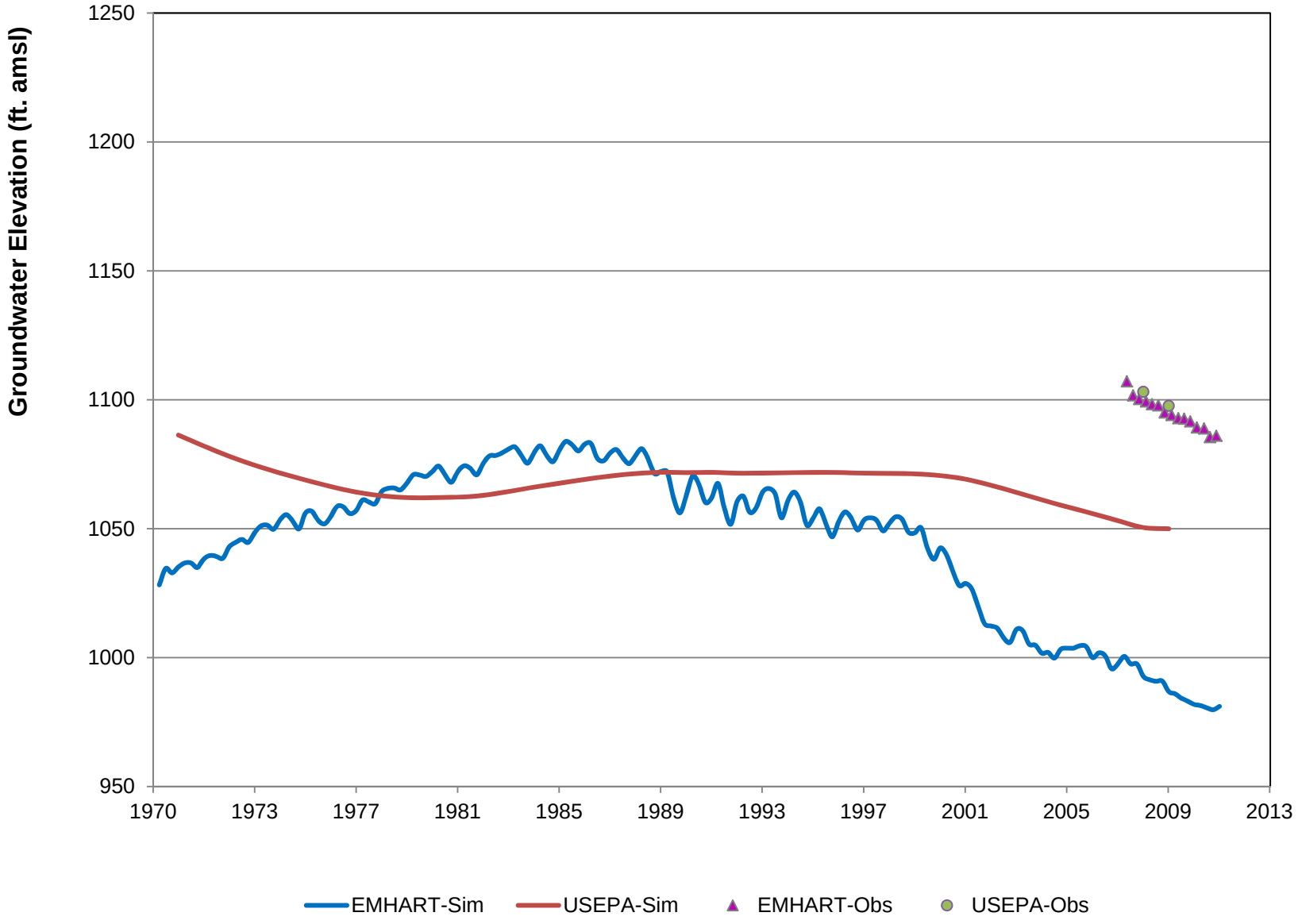


Figure 9-2E - N-18-C-1 (Layer-3)

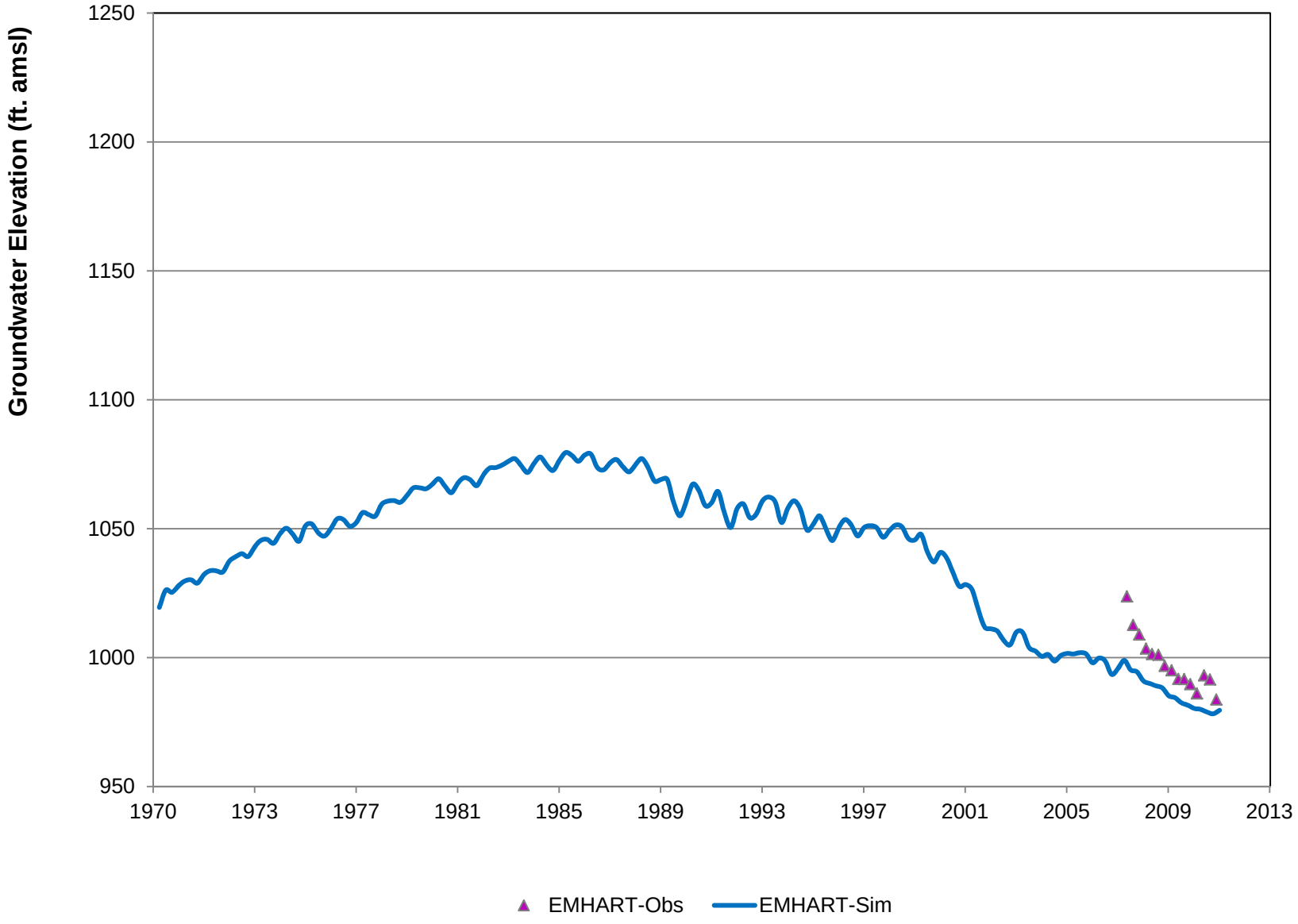


Figure 9-2F - N-18C-2 (Layer-3)

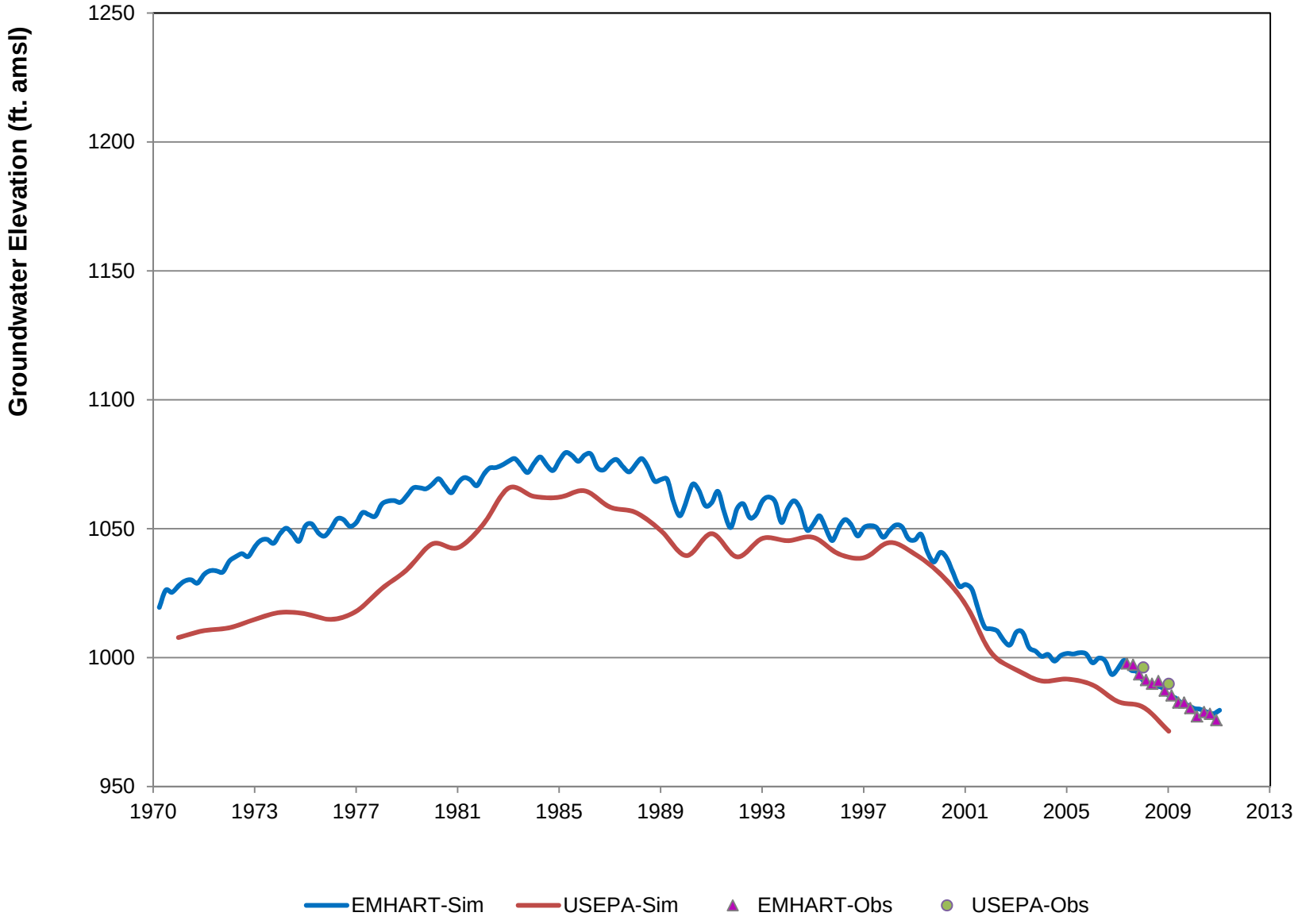


Figure 9-2G - N-13D (Layer 3)

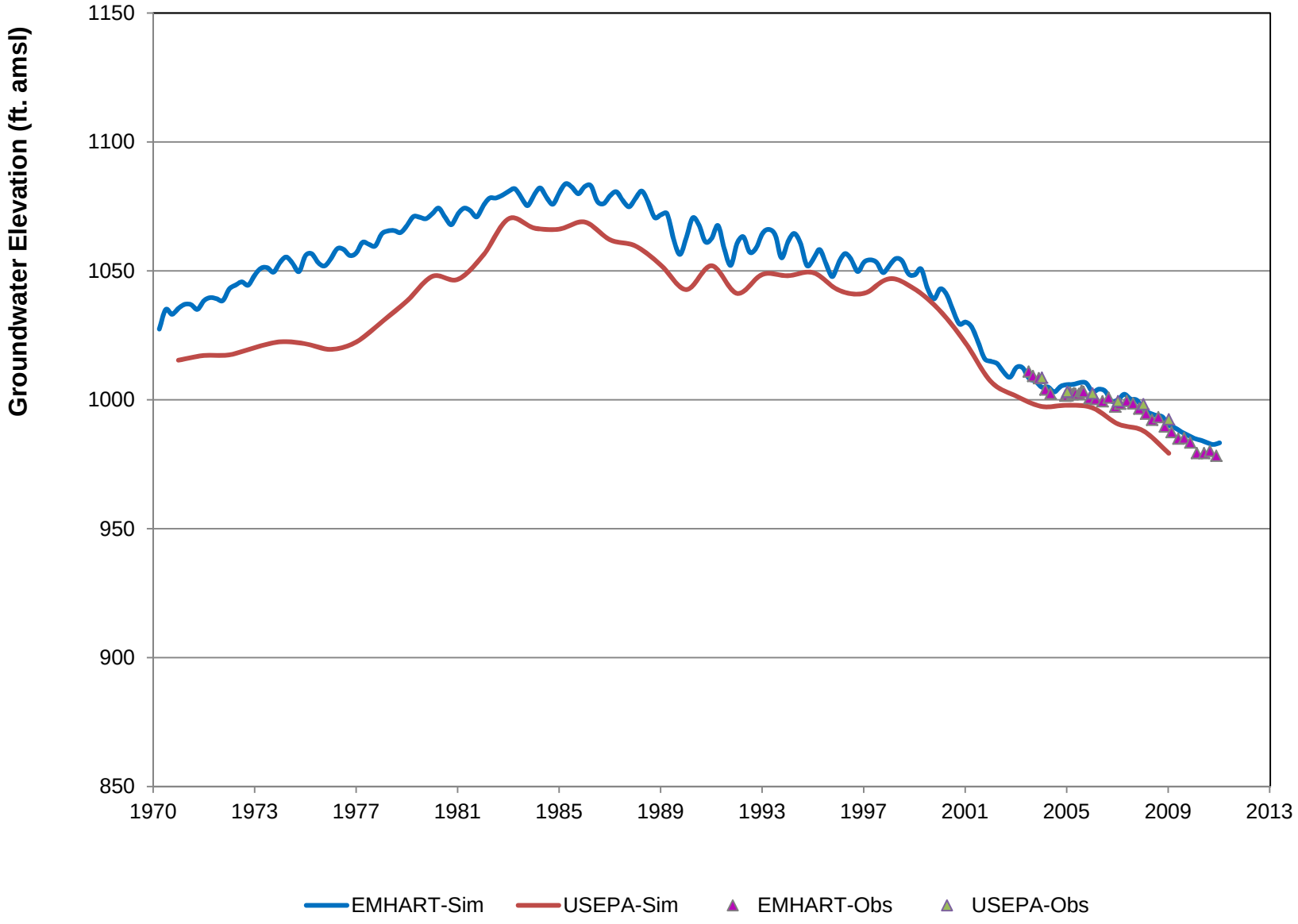


Figure 9-2H - M-5-Z2 through M-5-Z4 (Layer 3)

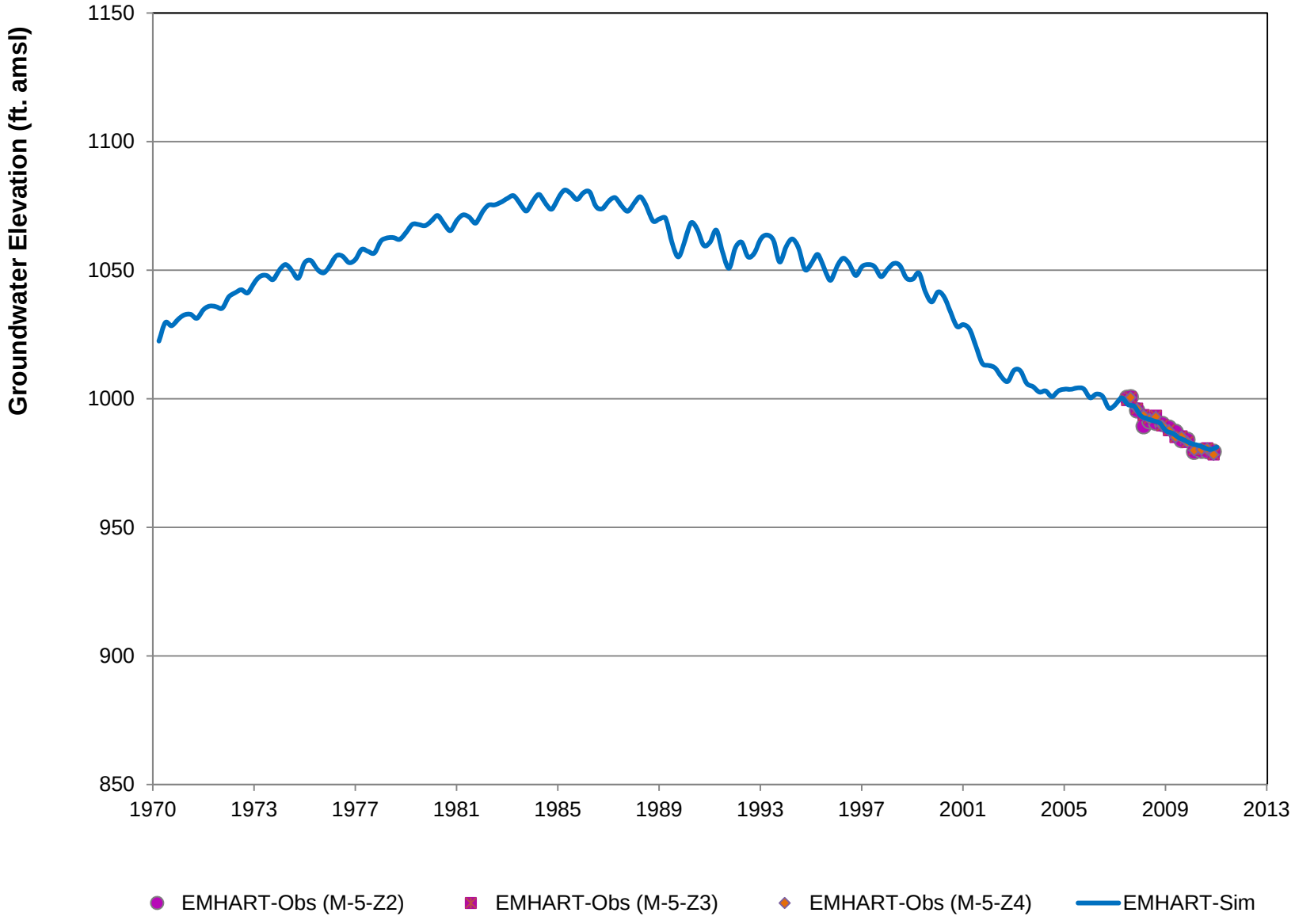


Figure 9-2I - M-5-Z5 through M-5-Z7 (Layer 4)

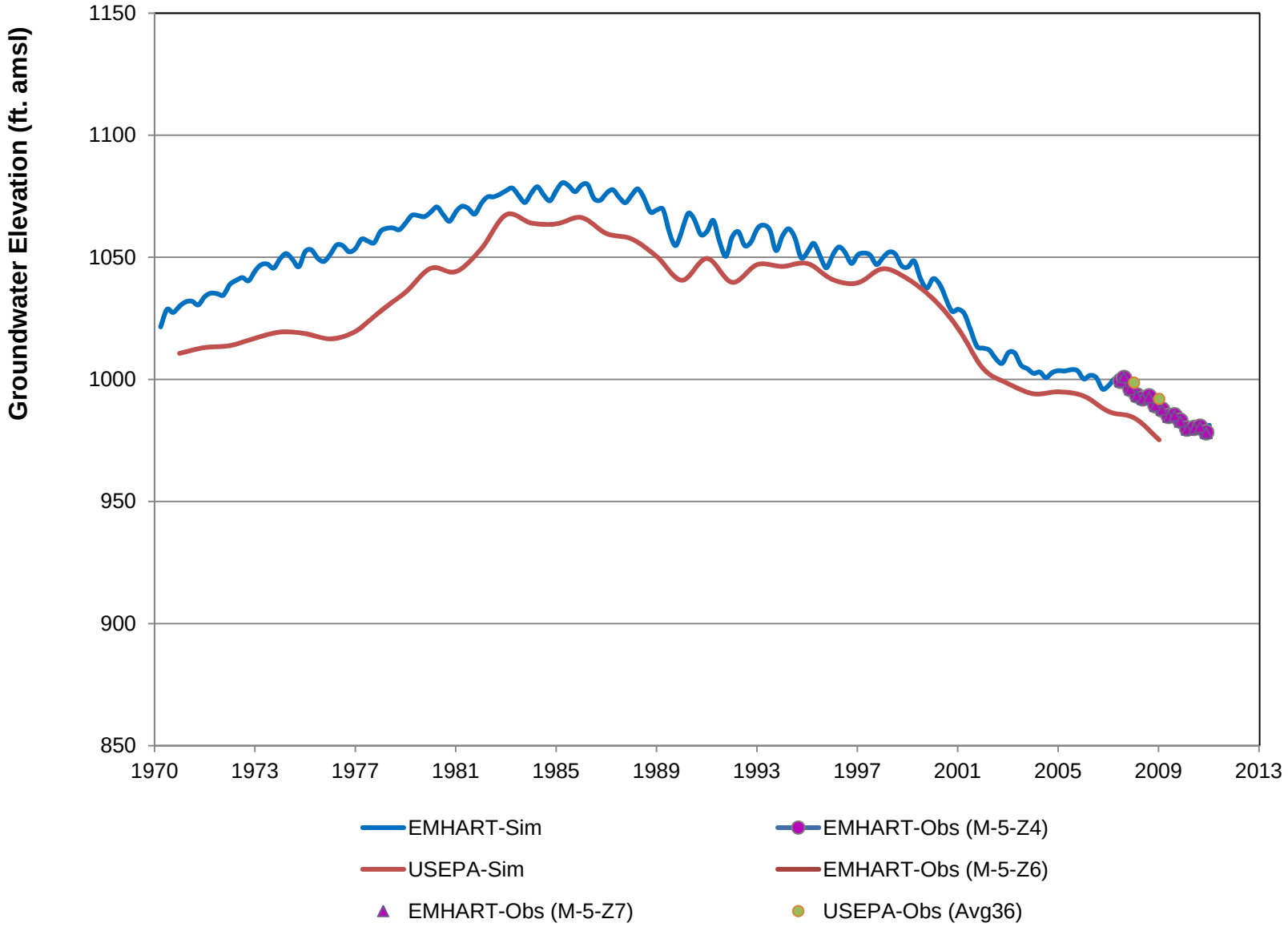


Table 9-1: Model Calibration Statistics in Selected Wells near Barrier H

Target	X	Y	Row	Column	Layer	Number of Times	Mean	Absolute Mean	Std. Dev.	RMSE	SOSR	Range
F13A	6737033	1871424	80	46	4	12	36.80	36.80	16.14	40.18	19375.76	65.45
F-13A	6737235	1871647	79	46	4	64	-1.83	14.04	18.59	18.68	22331.64	125.00
F13B	6737203	1871633	79	46	4	10	42.34	42.34	16.63	45.49	20692.15	56.85
F-13B	6737235	1871647	79	46	4	40	10.50	13.91	16.53	19.58	15339.96	80.00
F49A	6738608	1867331	84	66	4	9	24.78	24.78	10.23	26.81	6470.39	82.08
F-49A	6738610	1867330	89	66	4	39	7.74	9.12	9.15	11.99	5603.85	93.00
N17C1	6739058	1869748	79	59	2	2	50.18	50.18	2.47	50.24	5047.64	5.44
N-17C-1	6739058	1869748	79	59	3	15	106.90	106.90	1.44	106.91	171447.30	21.64
N18C2	6739703	1868376	81	66	4	2	16.88	16.88	1.48	16.95	574.32	6.33
N-18C-2	6739703	1868376	81	66	3	15	-0.09	1.02	1.42	1.43	30.54	22.01
N13D	6740381	1871048	70	59	4	6	9.07	9.07	2.88	9.51	542.99	16.13
N-13D	6740381	1871048	70	59	3	36	-2.46	2.82	1.83	3.07	338.58	32.62
Avg36	6740244	1869633	75	63	4	2	15.55	15.55	1.15	15.60	486.49	6.70
M-5-Z5	6740244	1869633	75	63	4	15	0.40	1.20	1.46	1.51	34.35	22.25
M-5-Z6	6740244	1869633	75	63	4	14	0.05	1.04	1.30	1.30	23.72	21.06
M-5-Z7	6740244	1869633	75	63	4	15	0.22	1.20	1.55	1.57	36.78	22.78

EMHART

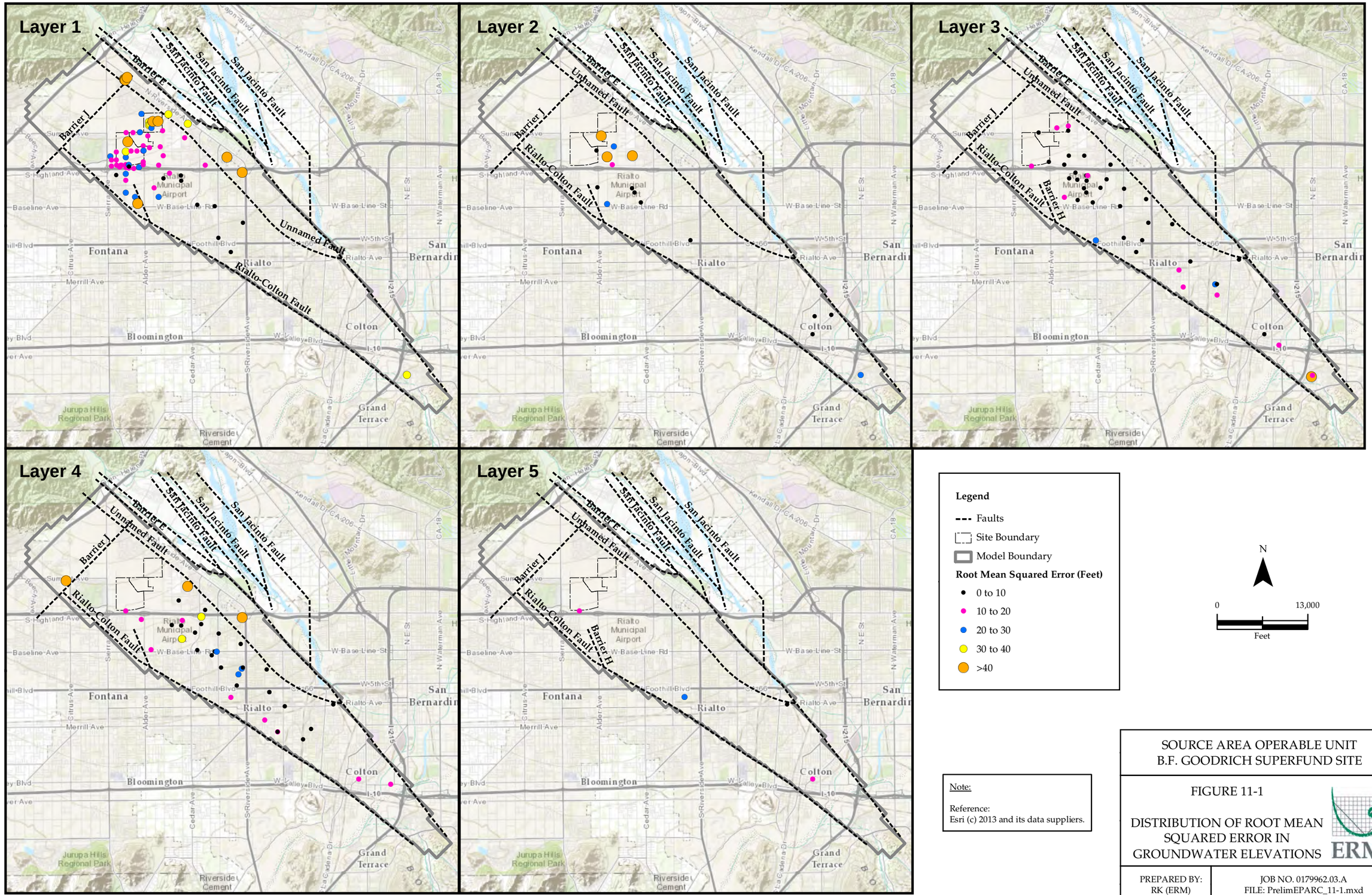
EPA

Comment #10: ***Pg. 27, Sec. 4.5, Figure 4-10. Figure 4-10 suggests that the model generally underpredicts heads in Layer 2, as opposed to overpredicting them, as is stated in the last bullet. Please clarify.***

Response: Agreed. The text should read: "The Emhart Model generally under-predicts heads in this layer."

Comment #11: ***Pgs. 27-28, Sec. 4.5. Please provide a figure showing the spatial distribution of RMSE associated with simulated heads by layer to allow an evaluation of spatial bias.***

Response: The requested figure is attached (Figure 11-1). Comparison of Figure 11-1 with Figure 4-9 in the USEPA 2012 Model shows that the root mean squared error (RMSE) values are generally similar between the Emhart Model and the USEPA 2012 Model.



Note:

Reference:
Esri (c) 2013 and its data suppliers.

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FIGURE 11-1

DISTRIBUTION OF ROOT MEAN SQUARED ERROR IN GROUNDWATER ELEVATIONS

ERM

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Comment #12: ***Pg. 34, Sec. 5.2.1, last bullet. The text states that quarterly variation for the County remedy pumping in the predictive simulations was based on the actual variations observed in 2011 basin-wide pumping data. Why weren't the actual seasonal pumping variations recorded at Rialto-3 from the last several years used?***

Response: Prior to 2012, the County did not use seasonal pumping variation at Rialto-3 (with higher pumping in the summer and lower pumping in the winter). Thus, the best available data for comparison among scenarios was the historical quarterly pumping rates for existing production wells.

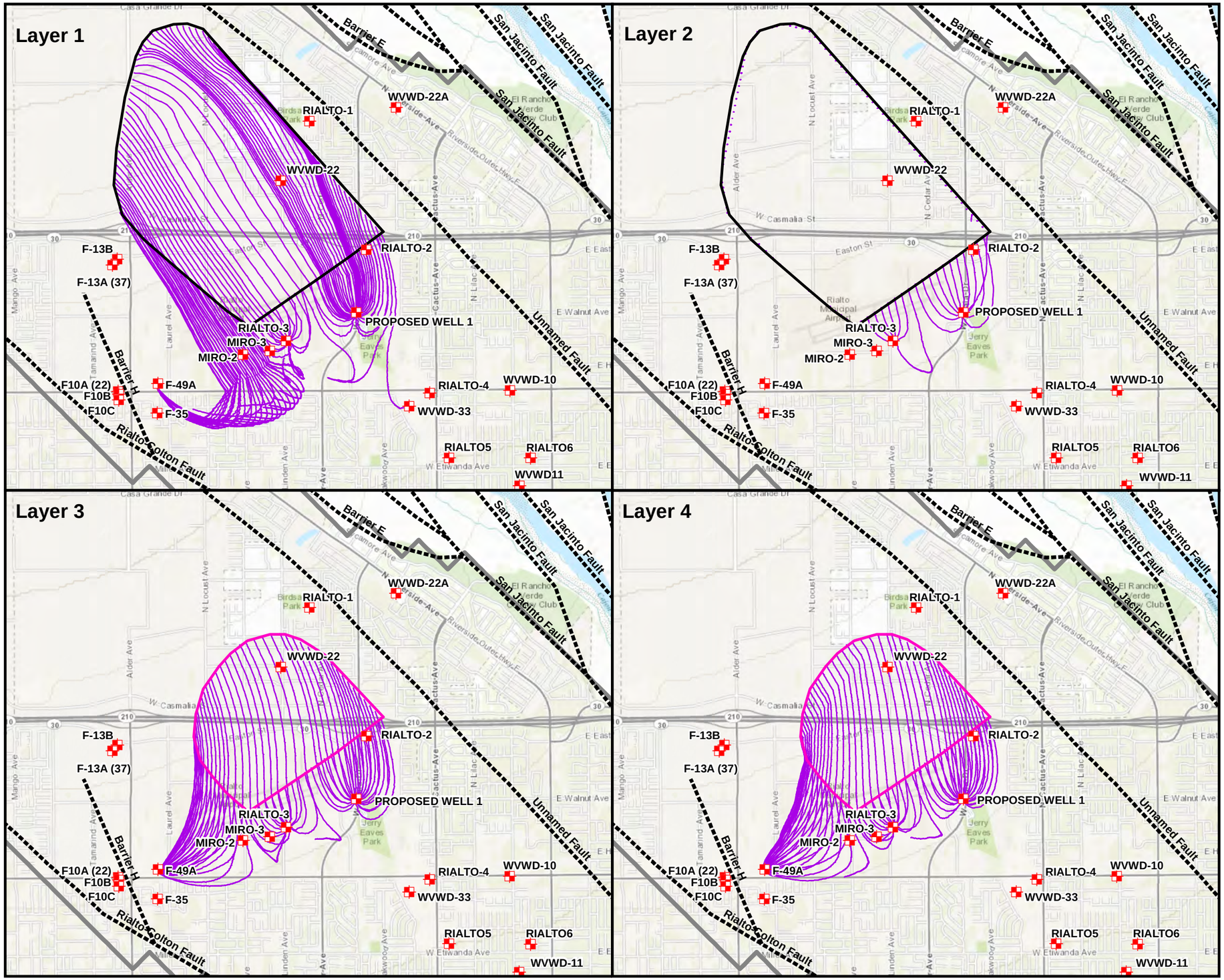
Comment #13: ***Pg. 40, 1st Par., 1st. sentence. The text states that use of the any of the Cactus Basins for recharge has a number of adverse impacts, including reductions in the County's ability to capture the County Remedy area. We do not see support for this statement in the graphics provided in the report.***

Response: The following attached figures present the particle track simulation for Scenario 2B – Combined Capture:

- Figure 13-1 – Combined Capture
- Figure 13-2 – Combined Capture with Cactus Basins 1 & 2 Recharge
- Figure 13-3 - Combined Capture with Cactus Basins 1, 2 & 3 Recharge
- Figure 13-4 - Combined Capture with Cactus Basins 1, 2, 3, 4, and 5 Recharge

These figures correlate to those presented in the modeling report (Figure 5-25, 5-29, 5-37, and 5-45), but show the combined capture area rather than the Emhart Target Area only. These figures show the adverse impacts referred to in the Draft Groundwater Flow Modeling Report. These particle track simulations did not include any modifications discussed earlier in this response (modification of extraction rate at Rialto-3 and relocation of EW-1).

Since the Cactus Basins are located downgradient of the BC Aquitard terminus, hydraulic impacts are limited to Layers 3 and 4. The model predicts, as shown most clearly on Figure 13-4, that the particles from the western part of the combined target area that were captured by Rialto-3 without Cactus Basin recharge escape capture and migrate further westward to the FWC production wells.



Legend

- Production Well
- Model Particle Tracks
- Faults
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate		
	Annual Average		Range
	GPM	AF/yr	GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,500
Feet

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FIGURE 13-1

COMBINED CAPTURE - 2B PARTICLE TRACK SIMULATION

ERM

PREPARED BY: CTALBOT (ERM)

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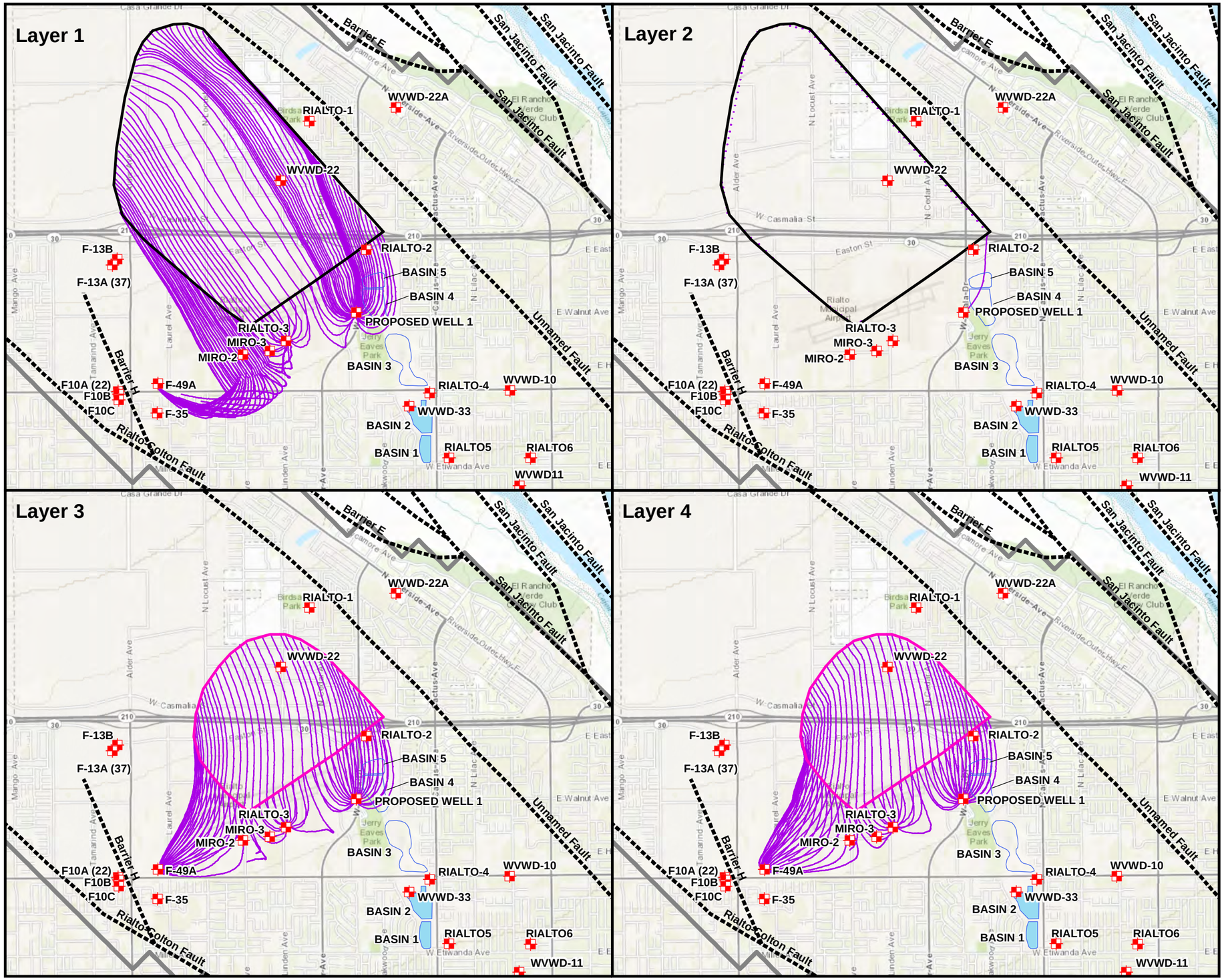

Legend

- Production Well
- Model Particle Tracks
- Faults
- Detention Basins in Simulation
- Detention Basins not in Simulation
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate Annual Average GPM	AF/yr	Range GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,500
Feet

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FIGURE 13-2
COMBINED CAPTURE - SCENARIO 3A - 2B PARTICLE TRACK SIMULATION WITH CACTUS BASINS 1 & 2 RECHARGE

ERM

PREPARED BY: CTALBOT (ERM)

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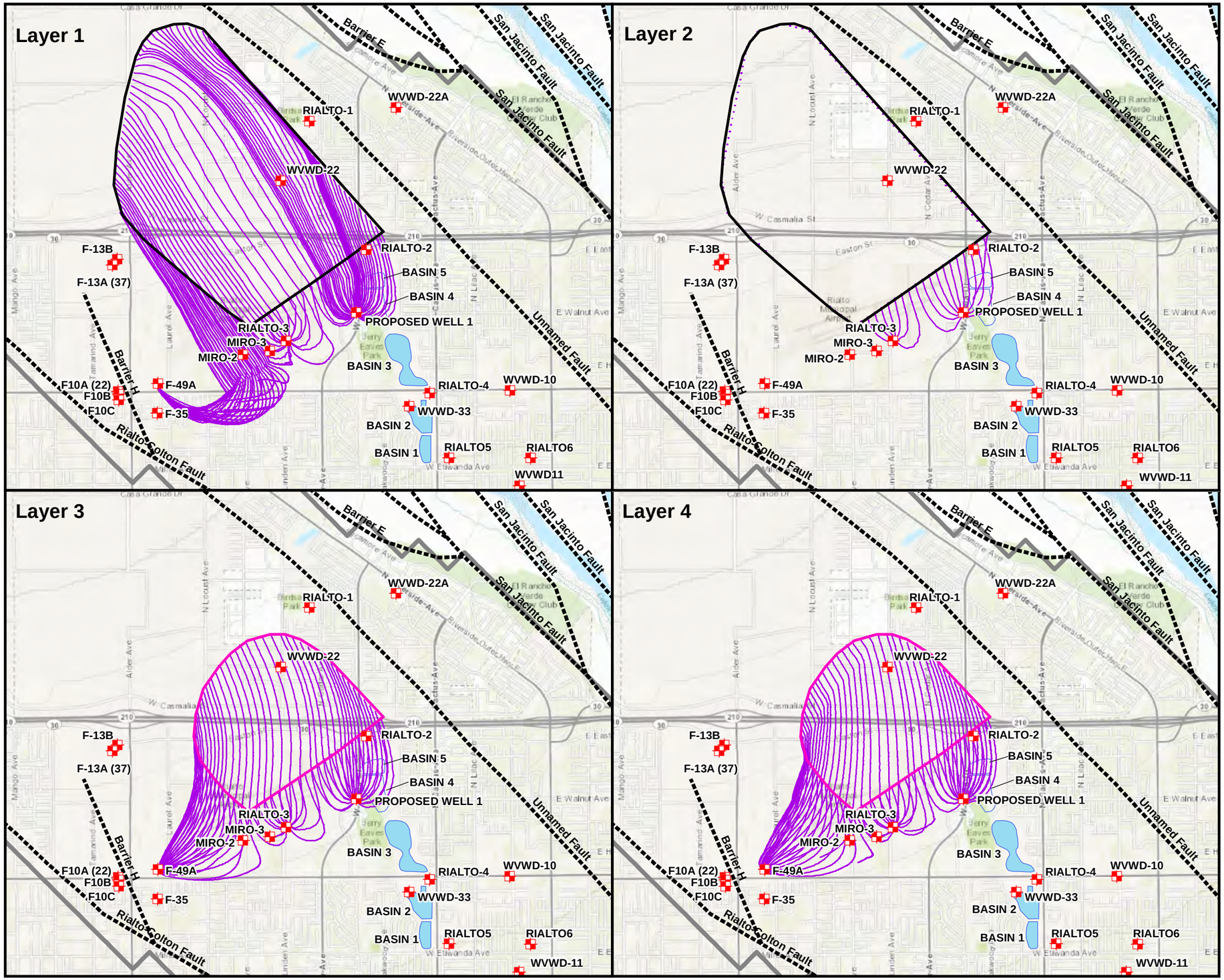

Legend

- Production Well
- Model Particle Tracks
- Faults
- Detention Basins in Simulation
- Detention Basins not in Simulation
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate Annual Average GPM	AF/yr	Range GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,500
Feet

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FIGURE 13-3
COMBINED CAPTURE - SCENARIO 3A - 2B PARTICLE TRACK SIMULATION WITH CACTUS BASINS 1, 2, & 3 RECHARGE

ERM

PREPARED BY: CTALBOT (ERM)

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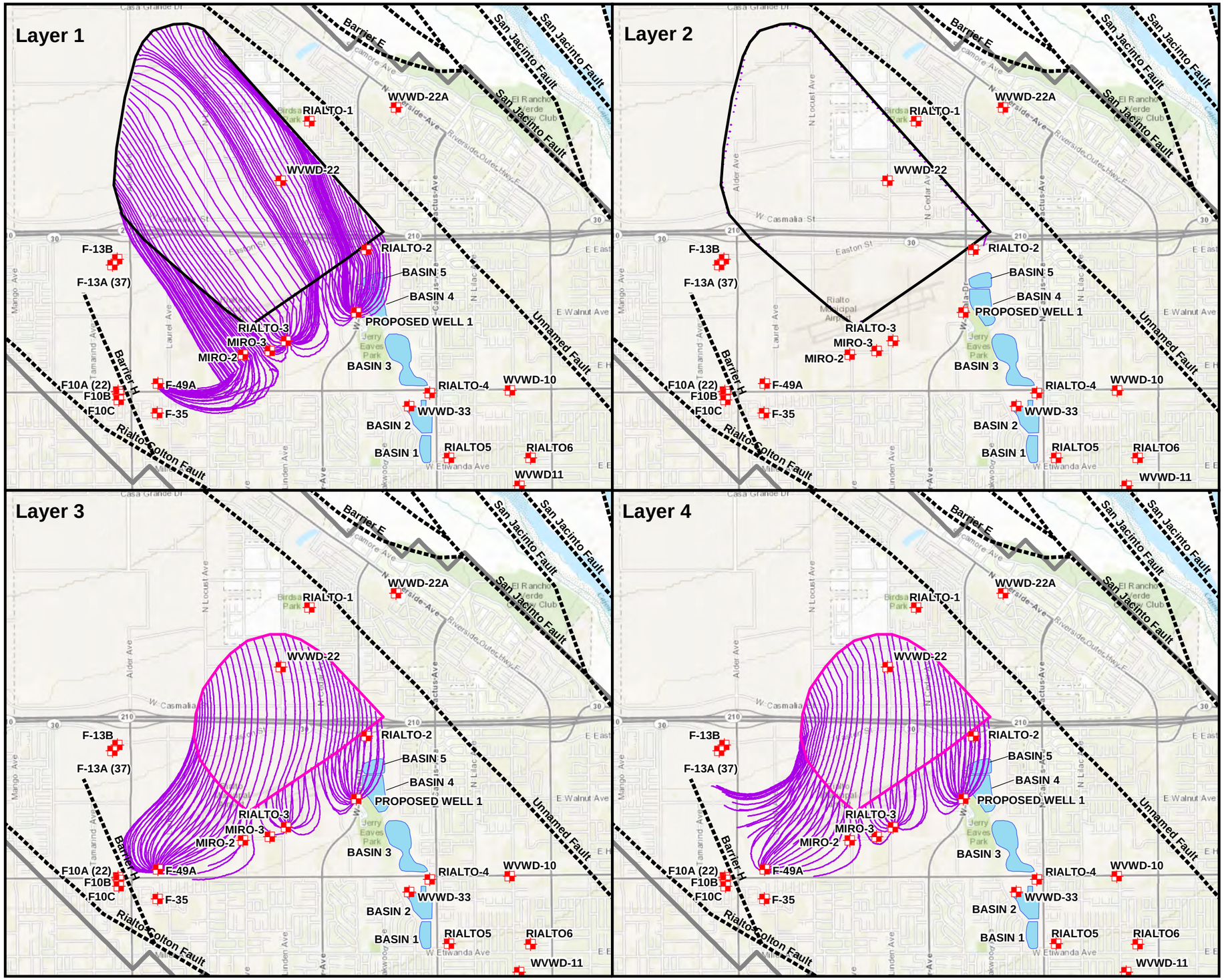

Legend

- Production Well
- Model Particle Tracks Released After 10 Years
- Faults
- Detention Basins in Simulation
- Intermediate Aquifer Target Capture Zone
- Regional Aquifer Target Capture Zone
- Model Boundary

Well	Pumping Rate Annual Average GPM	AF/yr	Range GPM
Rialto-2	0	0	0
Rialto-3	1,157	1,868	789 - 1,299
Miro-2	0	0	0
Miro-3	0	0	0
Proposed Well 1	1,859	3,000	1,267 - 2,086
Proposed Well 2	0	0	0
Total Flow Rate	3,016	4,868	2,055 - 3,386

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Notes:
1) GPM = Gallons per Minute.
2) AF/yr = Acre-Feet per Year.

N

0 3,500
Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 13-4
COMBINED CAPTURE - SCENARIO 3A - 2B PARTICLE TRACK SIMULATION WITH CACTUS BASINS 1, 2, 3, 4, & 5 RECHARGE

ERM

PREPARED BY: CTALBOT (ERM)

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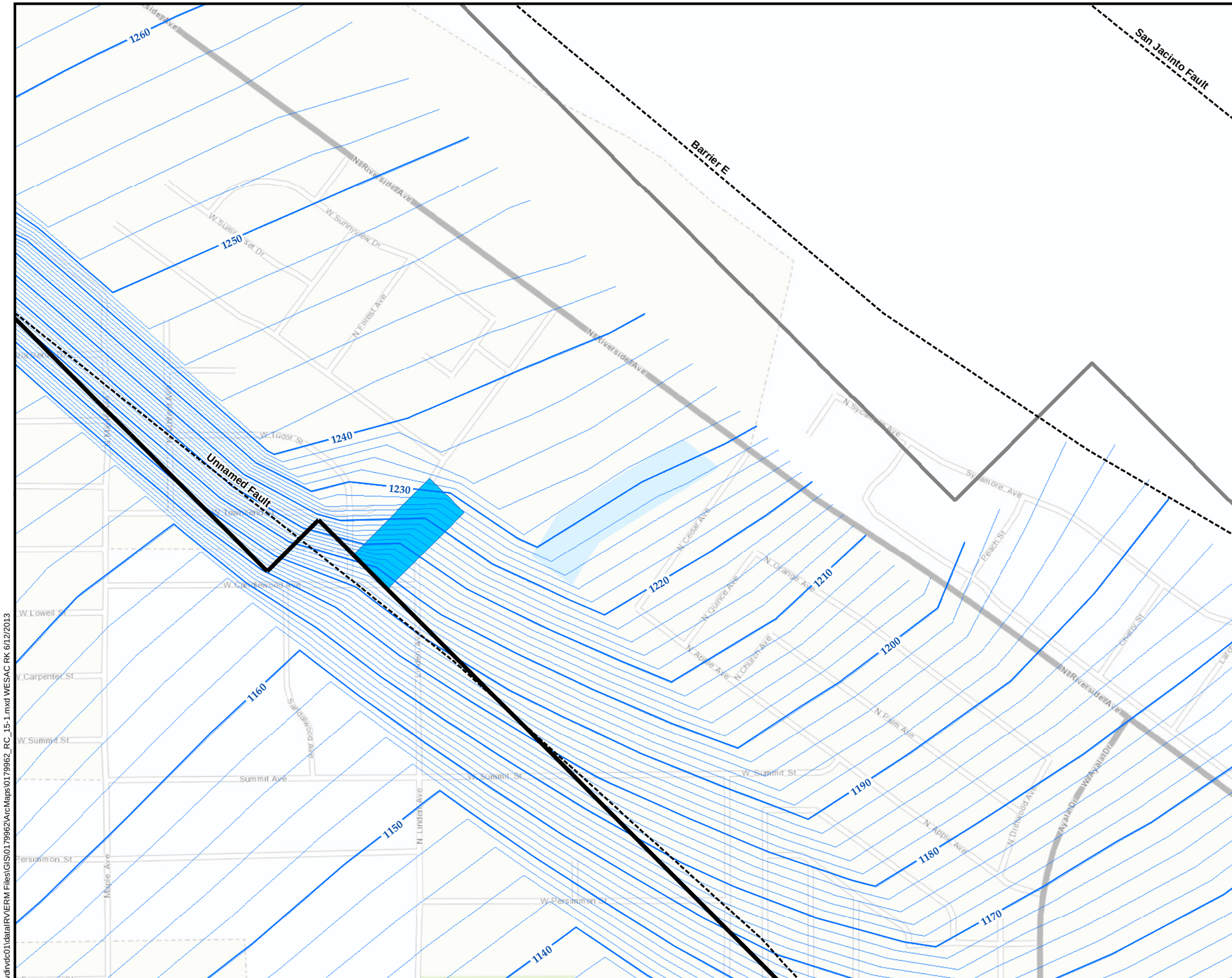
Comment #14: ***Pgs. 45-46, Sec. 6.0. The text proposes that "The capacity of the County treatment system ...be expanded to approximately 4,000 gpm, to accommodate seasonal variability of flow rate/water demand, and the anticipated installation and use of a second extraction well." Please specify or describe the expected seasonal variation in remedy extraction rates. The text (section 5.2.1) states that extraction and treatment rates at the County remedy average 1,157 gpm and vary from 900 to 1,850 gpm (i.e., at rates up to 60% above the average). If a similar range is expected for the combined remedy, the proposed 4,000 gpm capacity is too low.***

Response: As USEPA is aware, Emhart, County, and the Cities of Rialto and Colton are in active discussion regarding implementation agreements to design, construct, and operate the combined remedy. As part of these discussions, the County and Emhart are jointly developing a pumping scheme for Rialto-3 and EW-1 to achieve our respective remedial action objectives, subject to Regional Board and USEPA approval/concurrence. The pumping scheme in discussion identifies a pumping range of 1,085 gpm (winter conditions) to 1,600 gpm (summer conditions) for Rialto-3 and a relatively constant rate of 1,860 gpm for EW-1 throughout the calendar year. This pumping scheme would range from a low of 2,945 gpm for the winter months to a high of 3,460 gpm for the summer months, well within the 4,000 gpm capacity of the proposed expanded treatment system. Based on the County's experience with Rialto and recent information provided by Colton, we believe that this pumping scheme should closely match the water supply/demand needs and minimize the County's need to purchase replacement water for Rialto. In the immediate weeks ahead, the four parties will be meeting to validate the accuracy of the assumptions regarding water supply and demand. Additionally, the updated simulations presented in the response to USEPA Comment #1 suggest that a lower total flow rate from the combined capture system (i.e., 2,750 gpm annual average) is likely to achieve substantial capture. As such, Emhart believes that the proposed 4,000 gpm capacity of the expanded system should be adequate and appropriate. Emhart will continue to update USEPA if there is any material change in these working assumptions.

Comment #15: ***Figure 4-3. The simulated 2011 water level contours for Model Layer 1 show a small groundwater mound in the vicinity of the Linden Ponds. Is recharge in the Linden Ponds included in the model during 2011?***

Response: Recharge in Linden Ponds was not included in the Emhart Model, as simulated for 2011 conditions. As shown on Figure 15-1, there does not appear to be a groundwater mound in the vicinity of Linden Ponds. Groundwater elevation contours presented in this figure suggest changes in groundwater flow direction in the vicinity of Linden Ponds, which might be interpreted as mounding due to recharge from Linden Ponds. However, no recharge was applied in the model in simulations of 2011 conditions. These contours are likely a result of the influence of the hydraulic flow barrier representing the Unnamed Fault, which causes changes to groundwater flow velocities and directions of groundwater flow in cells adjacent to the hydraulic flow barrier boundary. The apparent groundwater mounding noted by the USEPA might also be influenced by the larger grid sizes in this area.



Legend

- Groundwater Elevation Contour
- Approximate Location Fault/Geologic Contact
- Fault Depicted in the Emhart Model
- Site Boundary
- Model Boundary
- Model Cell Representing Linden Ponds

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

N

0 500

Scale in Feet

SOURCE AREA OPERABLE UNIT
B.F. GOODRICH SUPERFUND SITE

FIGURE 15-1
2011 BASIN-WIDE SIMULATED GROUNDWATER ELEVATIONS - MODEL LAYER 1 IN THE VICINITY OF LINDEN PONDS

ERM

PREPARED BY: RK (ERM)	JOB NO. 0179962 FILE: 0179962_RC_15-1.mxd

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

SENT VIA EMAIL AS PDF

June 28, 2013

Truong T. Mai
Environmental Resources Management
2875 Michelle Drive, Suite 200
Irvine, California 92606

Subject: EPA Approval of Groundwater Extraction Rates and Locations
B.F. Goodrich Superfund Site, Source Area Operable Unit

Dear Mr. Mai:

We have reviewed the Groundwater Flow Modeling Report for the Source Area Operable Unit at the B.F. Goodrich Superfund Site, and related submittals provided over the last four months (collectively, the "modeling submittals"). The modeling report is dated April 10, 2013; supplemental information was provided on February 28, 2013, March 13, 2013, May 16, 2013 (electronic modeling files), and June 12, 2013. The submittals were prepared by Environmental Resources Management (ERM) on behalf of Emhart Industries.

The modeling submittals describe the development and calibration of a groundwater flow model of the Rialto-Colton groundwater basin ("the ERM model"), modeling simulations of various remedial pumping scenarios, and other information intended to support the design of the remedy described in EPA's 2010 Record of Decision ("the ROD"). EPA's remedial objectives are to intercept contaminated groundwater moving from a targeted area of contamination defined in the ROD and remove contaminants from the groundwater.

The modeling work was carried out in accordance with the statement of work included as Appendix F to the Consent Decree lodged on December 4, 2012 (the "Emhart CD"), in which Emhart agreed to implement EPA's 2010 Source Area Operable Unit groundwater remedy (the "Source Area remedy"), and communications between EPA, Emhart, and ERM over the last several months. The Emhart CD was lodged with the United States District Court for the Central District of California in City of Colton v. American Promotional Events, Inc. West et al., Case No. ED CV 09-01864 PSG.

Four local water agencies and the County of San Bernardino (the "County") submitted comments on the modeling effort: West Valley Water District (comments dated March 19 and May 3, 2013), Fontana Water Company (March 4, April 30, and May 2, 2013), the city of Rialto (May 23, 2013), San Bernardino Valley Municipal Water District (May 6, 2013), and the County (June 14, 2013).

After a careful review of the modeling submittals and agency comments, a review of the electronic model files, and simulation of several proposed pumping scenarios using the EPA/CH2M Hill model, we have concluded that that the model is adequately calibrated for the "Area of Interest" described in the report and the modeling simulations provide EPA with sufficient information to select groundwater extraction rates and locations for the Source Area remedy.

The modeling submittals recommend that the remedy include the installation and use of two new extraction wells, the use of one existing extraction well (the Rialto-03 well), and the extraction and treatment of groundwater at an average rate of 2,750 gallons per minute (gpm). This scenario is described as "Alternative 1" in the June 12 submittal. The June 12 submittal also evaluates Alternatives 2, 3, and 4 with rates of 3,000, 3,250, and 3,500 gpm respectively.

The recommended alternative (Alternative 1) does not demonstrate adequate hydraulic containment of the targeted area of contamination, whereas the higher rates simulated in Alternatives 2, 3, and, 4 provide acceptable results. Based on our review, we hereby approve the pumping rates assumed in Alternative 2, contingent on implementation of an acceptable groundwater monitoring program (as discussed below). The approved scenario (Alternative 2) includes:

- Installation of two new groundwater extraction wells;
- Average annual groundwater extraction rates of 1,700 gpm at EW-1 and 1,300 gpm at existing well Rialto -03;
- Installation of the first groundwater extraction well EW-1 at the north end of Jerry Eaves Park in Rialto;
- Future installation of the second well EW-2 at a location to be determined;
- Increasing the treatment capacity at the existing Rialto 3 water treatment plant to accommodate groundwater from the Source Area remedy. The treatment capacity must be sufficient to achieve the annual average extraction rates noted above, accounting for seasonally-variable extraction rates and typical plant downtime;
- Installation of new groundwater monitoring wells and piezometers as described below.

Our determination that the model is adequately calibrated does not mean that we agree with all of the modeling assumptions or that there is not room for further improvement. We do not, however, believe that it is necessary or worthwhile to invest additional time and effort into further improving the model at this time. Further improvements are unlikely to result in a substantive change in the approved pumping scenario.

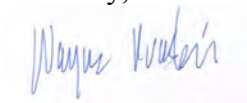
The ERM groundwater model, like most models, simplifies natural processes, extrapolates from the available data, and must rely on uncertain estimates of important physical processes. We do not know how closely many of the assumed model parameters match current conditions. Assumptions about future conditions, such as climatic conditions and pumping rates at non-remedy wells, can be guessed at but are not known. To address these limitations, the cleanup project must include a robust groundwater monitoring and evaluation program to evaluate the accuracy of the predictive simulations.

The monitoring program must include three new groundwater monitoring wells downgradient of the targeted area of groundwater contamination, at least one new well located to the southwest of West Valley Water District Well 22 to determine whether Source Area Operable Unit contamination is moving to the southwest, one or more wells to better define the upgradient boundary of the Regional Aquifer target area, periodic monitoring of selected "N" and "M" series monitoring wells (installed by the County), and new groundwater piezometers to directly measure the effects of each groundwater extraction well on nearby water levels and refine hydraulic capture estimates. After the remedy begins operating, the data generated by the monitoring program will be used to periodically evaluate whether EPA's remedial objectives, and the performance criteria included in the ROD, are being achieved and

identify any needed changes to extraction rates and locations. As new data are generated, and our understanding of the groundwater system improves, we also expect improvements to be made in the groundwater flow model.

For compliance with the schedule in the approved RD Work Plan, this letter serves as approval of the Groundwater Flow Modeling Report. Please submit, by July 19, 2013, a revised version of the April 10, 2013, report that reflects the correction(s) and revisions, and incorporates the supplemental information, provided in the June 12, 2013, submittal. Please call or email with any questions.

Sincerely,



Wayne Praskins
Project Manager

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