STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF PROPOSED AMENDMENTS
TO 20.6.2 NMAC, THE COPPER MINE RULE

New Mexico Environment Department,
Petitioner.

WQCC 12-01 (R)

FREEPORT-McMoRAN
REBUTTAL EXHIBIT BLANDFORD – 8

Written Testimony of Thomas Neil Blandford, P.G.
(July 9, 2007)

STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF:	)	
APPEAL OF SUPPLEMENTAL DISCHARGE	)	**Docket Nos.**
PERMIT FOR CLOSURE (DP-1341) FOR	)	**WQCC 03-12(A)**
PHELPS DODGE TYRONE, INC.	)	**WQCC-03 13(A)**
	)	**(Consolidated)**
PHELPS DODGE TYRONE, INC.,	)	
	)	
Petitioner.	)	
	)	

TESTIMONY

OF

THOMAS NEIL BLANDFORD, P.G.

Remand Hearing from the New Mexico Court of Appeals decision in *Phelps Dodge Tyrone, Inc. v. Water Quality Control Comm'n*, Appeal No. 25,027 (July 2006).

July 9, 2007

TYRONE/REMAND EXHIBIT
905

Q: STATE YOUR NAME, PLACE OF EMPLOYMENT AND POSITION WITH YOUR FIRM, AND GENERALLY DESCRIBE THE TECHNICAL SERVICES YOUR FIRM HAS PROVIDED IN CONNECTION WITH THE TYRONE MINE?

A: My name is Thomas Neil Blandford. I am a Vice President and Senior Hydrologist with Daniel B. Stephens & Associates, Inc. (DBS&A), which is an environmental consulting firm headquartered in Albuquerque. DBS&A has provided extensive technical and regulatory compliance support, including assistance with numerous closure issues, to the Tyrone Mine for more than 15 years, and it was extensively involved in developing the Closure/Closeout Plan ("CCP") for Phelps Dodge that resulted in the issuance of the Supplemental Discharge Plan for Closure (DP-1341) for the Tyrone Mine.

Q: WHAT IS YOUR GENERAL EDUCATIONAL BACKGROUND AND WORK EXPERIENCE?

A: I hold a B.A. in Environmental Science from the University of Virginia (courses of study were hydrology, geology, meteorology and ecology), and a M.S. in Hydrology from New Mexico Tech. I have been a consulting groundwater hydrologist since 1987. My work experience includes numerous groundwater investigations to evaluate groundwater supply and quality, both nationally and internationally. A copy of my professional resume is attached to this written testimony as Attachment 1.

Q: ARE YOU FAMILIAR WITH THE MMD PERMIT BOUNDARY FOR THE TYRONE MINE AND TYRONE'S PLANS TO LIMIT THE FUTURE DRILLING OF NEW FRESH WATER SUPPLY WELLS?

A. Yes. The New Mexico Mining and Minerals Division (MMD) Permit Boundary is depicted on all of the maps I am providing with my testimony. I understand Tyrone proposes that, on its private lands within that Permit Boundary, only wells used for mining or closure activities would be permitted in the future. Residential development in the future would also be prohibited on its lands within the Permit Boundary. Industrial activity would be limited to a 50 acre site, as discussed in Mr. Rick Mohr's testimony.

Q: HAVE YOU REVIEWED THE WRITTEN TESTIMONY OF ANY OTHER WITNESS IN THIS PROCEEDING?

A: Yes, I have reviewed Rick Mohr's testimony. Mr. Mohr is Phelps Dodge Corporation's person in charge of New Mexico operations, including the Tyrone Mine. I also reviewed the written testimony of Messrs. Bruce Garber, Alberto Gutierrez and Charles Voss.

Q. ARE YOU TESTIFYING AS AN EXPERT WITNESS IN THIS CASE AND, IF SO, PLEASE SUMMARIZE THE SUBJECT AREAS WITH RESPECT TO WHICH YOU WILL BE OFFERING OPINION TESTIMONY?

A: I am testifying both as a fact witness and as an expert witness in this proceeding. The factual part of my testimony will include a general overview of the kinds and locations of wells associated with the company's ongoing mining and remediation operations at the Tyrone Mine, including wells for monitoring, wells for intercepting and

pumping impacted water, and production wells for producing potable water. The expert testimony I am providing will include a description of the groundwater flow in the immediate vicinity of the Tyrone Mine, including delineation of certain areas which are up gradient from, and other areas which are down gradient from, the disturbed areas contained within the MMD Permit Boundary. Finally, taking into account site specific conditions and Tyrone's long-term commitments regarding the site, I offer my opinion about where, in relation to the Tyrone Mine, I believe it would make the most sense—hydrogeologically—to measure compliance with groundwater standards so as to avoid impairment of groundwater at places of withdrawal of water for present or reasonably foreseeable future use.

Q: WHAT ARE THE ESSENTIAL POINTS OF YOUR TESTIMONY?

A: First, taking into account the extent of mine disturbances inside the MMD Permit Boundary and Tyrone's long-term commitments regarding the site, I conclude that the location of the Fortuna wells is the only place on Tyrone's lands inside the MMD Permit Boundary that is a "place of withdrawal of water for present or reasonably foreseeable future use." Second, other locations at which I believe it would make sense to determine compliance with standards include various lands at the perimeter of, and outside, the MMD Permit Boundary, primarily along the northwestern extent of the boundary in the Mangas Valley, along the western edge of mine disturbances, and along the southeastern extent of the boundary in the general vicinity of Highway 90 and Oak Grove Wash (Att. 2 Blandford-1 and Blandford-3).

Q: DID YOU TESTIFY IN THE 2003 TYRONE HEARING BEFORE THE WATER QUALITY CONTROL COMMISSION, AND IF SO, PLEASE BRIEFLY DESCRIBE THE BASIC SUBJECTS ON WHICH YOU TESTIFIED?

A: I did testify in the 2003 Tyrone hearing before the Commission, as well as in the hearing that occurred at the department. The primary subjects on which I testified include:

1. The nature of groundwater occurrence, groundwater flow and the extent of impacted groundwater at the Tyrone Mine.
2. An overview of the water yield and physical characteristics of the various geologic materials found at Tyrone.
3. The feasibility and likelihood that construction of water supply wells would occur through the stockpiles at Tyrone.
4. The location of existing off-site wells in the vicinity of Tyrone, and the possibility or lack thereof concerning potential future impacts by mine-related groundwater contamination.
5. Explanation of how groundwater flow at the mine was accounted for in formulation of the dynamic systems model.
6. Explanation of the formation and extent of the open-pit capture zone, and the future condition of the open-pit capture zone.

Q: WOULD YOU PLEASE GENERALLY IDENTIFY ANY MAPS YOU HAVE PREPARED FOR YOUR PRESENTATION IN THIS PROCEEDING?

A: I have prepared two sets of maps in connection with my testimony in this proceeding as follows:

1. Attachment 2 consists of three maps that reflect wells associated with Tyrone's operations within and in the immediate vicinity of the Tyrone Mine. Att. 2 Blandford-1 and Blandford-2 are maps of the southern half of the Tyrone Mine area, often referred to as the Mine/Stockpile unit. The maps' base is an aerial photograph taken in 2004, so the photograph itself is not completely up to date. Specifically, there has been reclamation work conducted on the east and south sides of the mine and for some of the Mangas Valley tailing impoundments since the aerial photograph was taken. Superimposed on the aerial photograph are the MMD Permit Boundary and existing wells in the regional aquifer (Blandford-1) and shallow zones (Blandford-2). Att. 2 Blandford-3 is a map of the northern half of the Tyrone mine area, often referred to as the Tailing or Mangas Valley area. This map also illustrates the MMD Permit Boundary and reflects existing operational wells both in the regional aquifer and in the shallow zones.
2. Attachment 3 consists of two maps. Att. 3 Blandford-4 and Blandford-5 are maps that reflect the direction of groundwater flow in the immediate vicinity of the Tyrone Mine under existing conditions for the southern and northern portions of the mine, respectively. The direction of groundwater flow in the future under closure conditions will be similar to that illustrated in the Att. 3 maps.

Q: USING THE MAPS PROVIDED IN ATTACHMENT 2, PLEASE PROVIDE A GENERAL OVERVIEW OF THE KINDS AND LOCATIONS OF WELLS THAT CURRENTLY EXIST WITHIN THE MMD PERMIT BOUNDARY?

A. The Attachment 2 maps illustrate the locations of wells that currently exist within or near the MMD Permit Boundary for the southern and northern portions of the mine area. With the exception of the Fortuna wells (denoted as wells 1 and 2 in Att. 2 Blandford-1), all of the other wells within the MMD Permit Boundary exist for mining, groundwater monitoring or abatement purposes. On the mine-wide scale, most wells exist to address impacts adjacent to or downgradient of leach stock piles where there have been impacts to groundwater due to fugitive PLS (see Att. 2 Blandford-1 and Blandford-2 maps). Relatively few wells exist within the area of active operations, because they are difficult to construct and are often destroyed due to mine operations. In the future Tyrone will continue to use these wells for mining, groundwater monitoring or abatement purposes.

Q: WHAT TYPES OF WELLS WILL TYRONE USE DURING CLOSURE ACTIVITIES AT THE SITE?

A: The mine will be using existing and new monitoring wells to sample groundwater quality. In addition, the mine will pump an array of existing interceptor wells and new wells constructed for abatement of perched and regional groundwater. Tyrone will also continue to dewater the pits and route that water to the treatment facility. The mine will also continue to use the Fortuna supply wells.

Q: IS THE COMPANY'S PROPOSAL TO RESTRICT DRILLING OF NEW WATER SUPPLY WELLS ON PROPERTY IT CONTROLS WITHIN THE MMD PERMIT BOUNDARY APPROPRIATE FROM A HYDROLOGIC PERSPECTIVE?

A: In my opinion it is entirely consistent with the site conditions which generally make this site unsuitable for withdrawal of water for future use, and it is also otherwise appropriate. First, closure maintenance activities will continue for a long time once mining ceases, necessitating an active on-site presence by company personnel or their designees. Second, a large portion of the area within the MMD Permit Boundary is not well-suited for drilling water supply wells, as it consists of mine facilities such as tailing impoundments, stockpiles, mine pits and other disturbances. At some of these facilities, such as stockpiles, it is very difficult and expensive to drill wells. Once all of the facilities are reclaimed, it makes common sense that 1) construction of wells and boreholes through the facility (stockpiles and tailing) covers should be avoided, and 2) groundwater beneath a mine facility is not a good target for potable groundwater supply due to the potential presence of past or current seepage. Third, the aquifer yield across much of the mine site in the igneous rocks is limited, and in some places the concentration of some constituents can be naturally elevated and even exceed standards for certain elements or compounds such as fluoride and manganese. Finally, the location of the MMD Permit Boundary at many locations provides a reasonable buffer zone between the facility footprint (i.e. existing or potential sources of seepage) and adjacent areas.

Q: ARE THERE STRETCHES ALONG THE MMD PERMIT BOUNDARY WHERE THE GRADIENT OF GROUNDWATER FLOW ALONE LEADS YOU TO CONCLUDE THAT GROUNDWATER UNDER THOSE STRETCHES CANNOT BE IMPACTED BY TYRONE'S MINE OPERATIONS OR MINE FACILITIES?

A: Yes, there are stretches along the MMD Permit Boundary where the direction of groundwater flow will preclude impacts to groundwater due to Tyrone Mine operations. One such area is the northwestern extent of the MMD Permit Boundary, beginning from the area north of the Burro Mountain Tailing east of Highway 90, and continuing all the way to the northwest in the Mangas Valley to the northwest corner of the No. 3 Tailing (see Att. 3 Blandford-4 and Blandford-5 maps). Groundwater flow along this entire portion of the MMD Permit Boundary is toward the mine area, parallel to the boundary, or is separated from the mine area by the Mangas Fault. Impacted groundwater in the mine area, therefore, will not flow across this section of the Permit Boundary and cause impacts to water quality outside the boundary. I would also point out, as I did in the 2003 hearing, that in my opinion the Fortuna wells, which are near this boundary, will not be impacted by seepage through mine facilities given the direction of groundwater flow where the Fortuna wells are located (Att. 3 Blandford-4 map).

Another such area is the portion of the MMD Permit Boundary that runs approximately northwest to southeast in the vicinity of well 2-15 (Att. 3 Blandford-4). Groundwater flow in this area is north or northeast toward Tyrone mine facilities, and

there are no potential sources of groundwater contamination upgradient (southwest) of this portion of the MMD Permit Boundary.

Q: ARE THERE SOME AREAS ALONG THE PERIMETER OF THE MMD PERMIT BOUNDARY WHERE TYRONE OR A SUBSIDIARY THEREOF IS NOT THE OWNER OF THE PROPERTY AND, IF SO, ARE OR WILL THE GROUNDWATER AT THOSE LOCATIONS BE IMPACTED BY CONTAMINATION DURING OPERATIONS OR FOLLOWING CLOSURE?

A: There are several discrete areas along the perimeter of the MMD Permit Boundary where Tyrone is not the property owner, all of which are apparent on Att. 2 (Blandford-1 and Blandford-3 maps). There is a small piece of private property known as the Schiff property west of Highway 90, north of the mine entrance, another very small piece of private property on the west side of Deadman Canyon northwest of the No. 2B Waste Stockpile, a small corner of state land northwest of the No. 1X Tailing in the Mangas Valley, and three areas of BLM property on the west side of the mine. I will discuss each of these areas below.

Groundwater beneath the Schiff property is highly unlikely to ever be influenced by mining activities. This property is topographically and hydrologically upgradient of existing zones of impacted water and potential source areas. Groundwater beneath this property flows toward the mine facilities. Likewise, groundwater beneath the small piece of private property on the west side of Deadman Canyon flows toward the mine site, and is topographically and hydrologically upgradient of existing zones of impacted water and potential source areas (this sliver of property is located on a very steep

hillside). Groundwater beneath this property is also highly unlikely to ever be influenced by Tyrone mining activities.

The small corner of state land within the MMD Permit Boundary occurs approximately 1,000 feet northwest of the No. 1X Tailing (Att. 2 Blandford-3). Groundwater beneath this property is also unlikely to be impacted due to Tyrone mining operations, since groundwater flow in this area is funneled toward the main stem of the Mangas Valley, which contains high-permeability alluvium that acts as a drain (focal point) for groundwater. In addition, impacted groundwater beneath the No. 1X Tailing is concentrated in the shallow alluvium of the original Deadman Canyon drainage, on top of which the tailing impoundment was constructed.

The piece of BLM property south of the No. 1A Tailing southwest of well 26 (Att. 2 Blandford-1) also is unlikely to become impacted. This property is upgradient of the No. 1A Tailing, and therefore will not be affected by that potential source. If groundwater were to be impacted beneath the No. 2A Leach Stockpile complex to the south of this well, the impacted groundwater would flow to the east toward the Main Pit, not north toward this property, since the stockpile is within the open-pit capture zone (Att. 3 Blandford-4). The closest well to this piece of property that may give some indication of groundwater quality beneath the property is well 166-2006-06, which meets all water quality standards. Nearby wells 26 and TWS-19 are on the opposite side of the Southern Star Fault from the majority of this piece of property, and are therefore less likely to be indicative of water quality beneath the property. Well 26 meets groundwater

standards, and well TWS-19 exceeds standards for copper, manganese, and possibly flouride.

Compared to the other pieces of non-Tyrone property within the MMD Permit Boundary discussed above, the two relatively small BLM parcels near the Copper Mountain Pit have a greater potential for groundwater impacts from mining activities due to their close proximity to active mine facilities (Att. 2 Blandford-1 map). Regional groundwater flow in this region is to the northeast toward the mine facilities (Att. 3 Blandford-4 map). Existing regional monitor wells in or near the southernmost BLM parcel (see wells TWS-8 and 2-16 on Att. 2 Blandford-1 map) meet all groundwater standards, as do shallow wells TWS-33 and 166-2006-01 located in Deadman Canyon (see Att. 2 Blandford-2 map). The closest regional monitor wells to the BLM parcel south of the No. 2B Waste Stockpile are wells TWS-9 and 2-4. Well TWS-9 meets groundwater standards, while well 2-4 east of the parcel within the active mining area exceeds standards for fluoride and manganese. Accordingly, groundwater beneath these properties may or may not become impacted by Tyrone mining activities. The potential for groundwater impacts beneath these pieces of property will be reduced considerably once mining and leaching activities have ceased during closure.

Q: IF YOU WERE A COMMISSIONER, WHAT LOCATIONS WOULD YOU IDENTIFY AS PLACES FOR DETERMINING COMPLIANCE WITH STANDARDS IN RELATION TO THIS SITE, AND WHY?

A: To begin with, I would select the location of the Fortuna wells, because it is the one place of withdrawal of water for future use on company lands within the MMD

Permit Boundary that Tyrone and third party successors-in-interest will be able to use as a water source for non-mining purposes. All other wells on Tyrone lands within the MMD Permit Boundary are or will be used solely in connection with mining, monitoring and abatement purposes during the operational and closure phases of mining.

I would also select various locations along the MMD Permit Boundary, primarily along the northwestern extent of the boundary in the Mangas Valley and the southeastern extent of the boundary in the general vicinity of Highway 90 and Oak Grove Wash (Att. 2 Blandford-1 and -3 maps). I would monitor these areas in particular because they are downgradient of regions of impacted water within the active mining area, and groundwater not captured by pumping at one of the open pits or at an interceptor well system will eventually flow toward and through one of these two areas.

I would also select the location of one or both of the BLM lands that are just inside the MMD Permit Boundary near the Copper Mountain Pit given the uncertainties about whether those areas might become impacted, as I discussed previously.

Finally, I would also select locations in areas of existing groundwater contamination outside or on the Permit Boundary, such as Deadman Canyon and the south side of the mine near Upper Oak Grove Wash.

Q: HAVE YOU CONDUCTED ANY SPECIFIC MODELING OR OTHER ANALYSES TO DETERMINE WHETHER TYRONE'S CLOSURE PLAN (WITHOUT THE ADDITIONAL COVERS AND REGRADING PROPOSED BY NMED) WILL OR WILL NOT ACHIEVE COMPLIANCE AT PARTICULAR

LOCATIONS OUTSIDE THE AREAS TYRONE INTENDS TO CONTROL WITHIN THE MMD PERMIT BOUNDARY?

A: No, I have not conducted any detailed simulations or other analyses to determine if groundwater standards will be met at specific points. The specific points for measuring compliance have not been identified yet, and it would be premature to attempt an assessment of closure success and compliance with standards when compliance locations have yet to be selected.

Q. IS IT YOUR UNDERSTANDING THAT TYRONE STANDS READY TO CONDUCT ANALYSES OF PLACES WHICH THE COMMISSION MAY HEREAFTER SELECT TO BE PLACES OF WITHDRAWAL OF WATER FOR PRESENT OR REASONABLY FORESEEABLE FUTURE USE?

A. Yes, my understanding is that Tyrone is ready to conduct such an analysis. I would likely be extensively involved in such analyses. The overarching vehicle that Tyrone would use for such an analysis is the dynamic systems model developed by Golder & Associates, as reflected in the testimony of Mr. Charles Voss.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes

STATE OF NEW MEXICO)
)
BERNALILLO COUNTY)

I HAVE READ the foregoing PREPARED DIRECT TESTIMONY OF THOMAS NEIL BLANDFORD and the statements contained therein are true and correct to the best of my knowledge, information and belief.

T. Neil Blandford
Thomas Neil Blandford

SUBSCRIBED, SWORN TO AND ACKNOWLEDGED before me this 6th day of July, 2007.

Jane L. Valentine
Notary Public

(Seal)

My Commission expires: 8-12-08

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Attachment 1
(intentionally omitted)

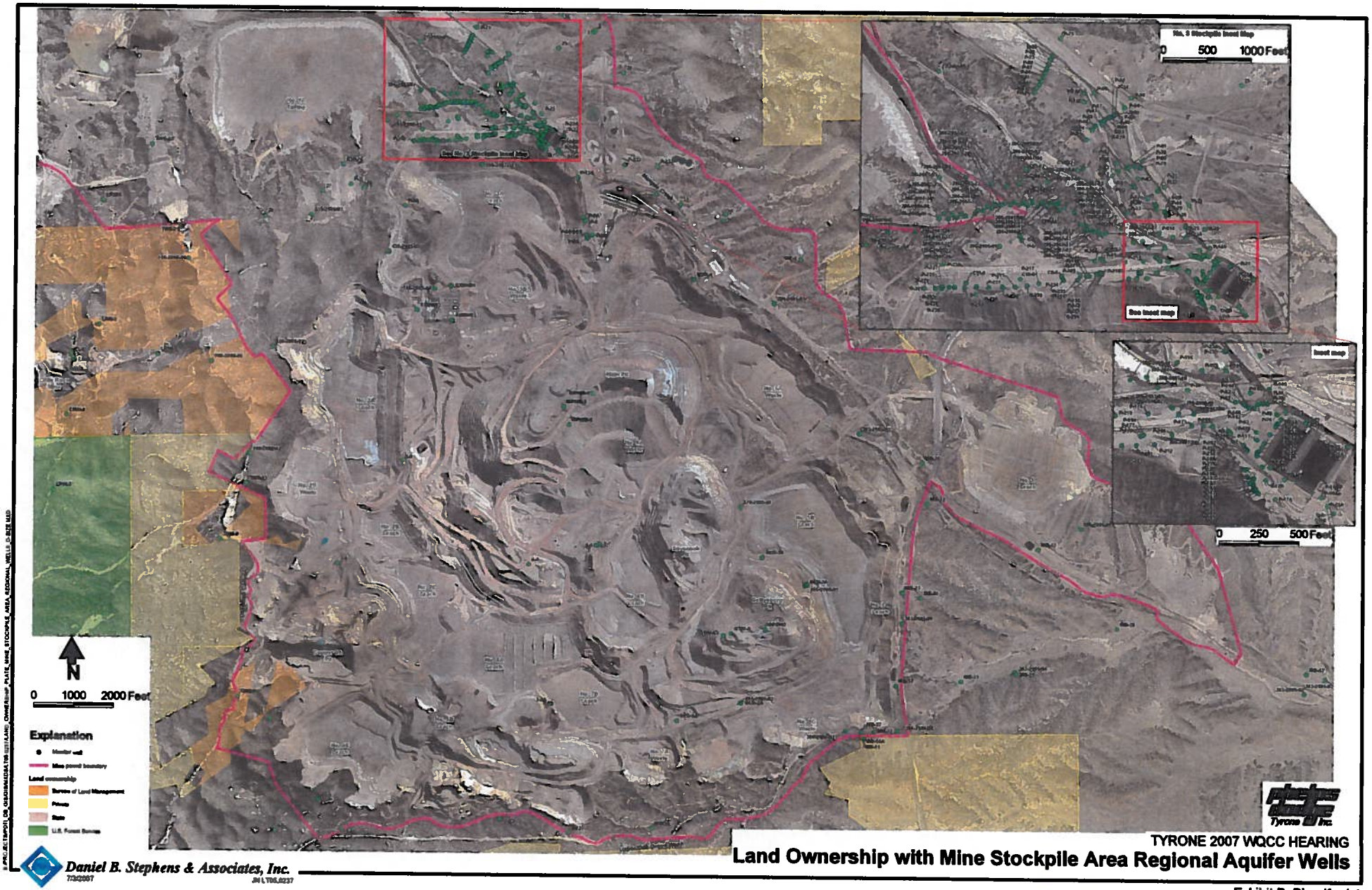
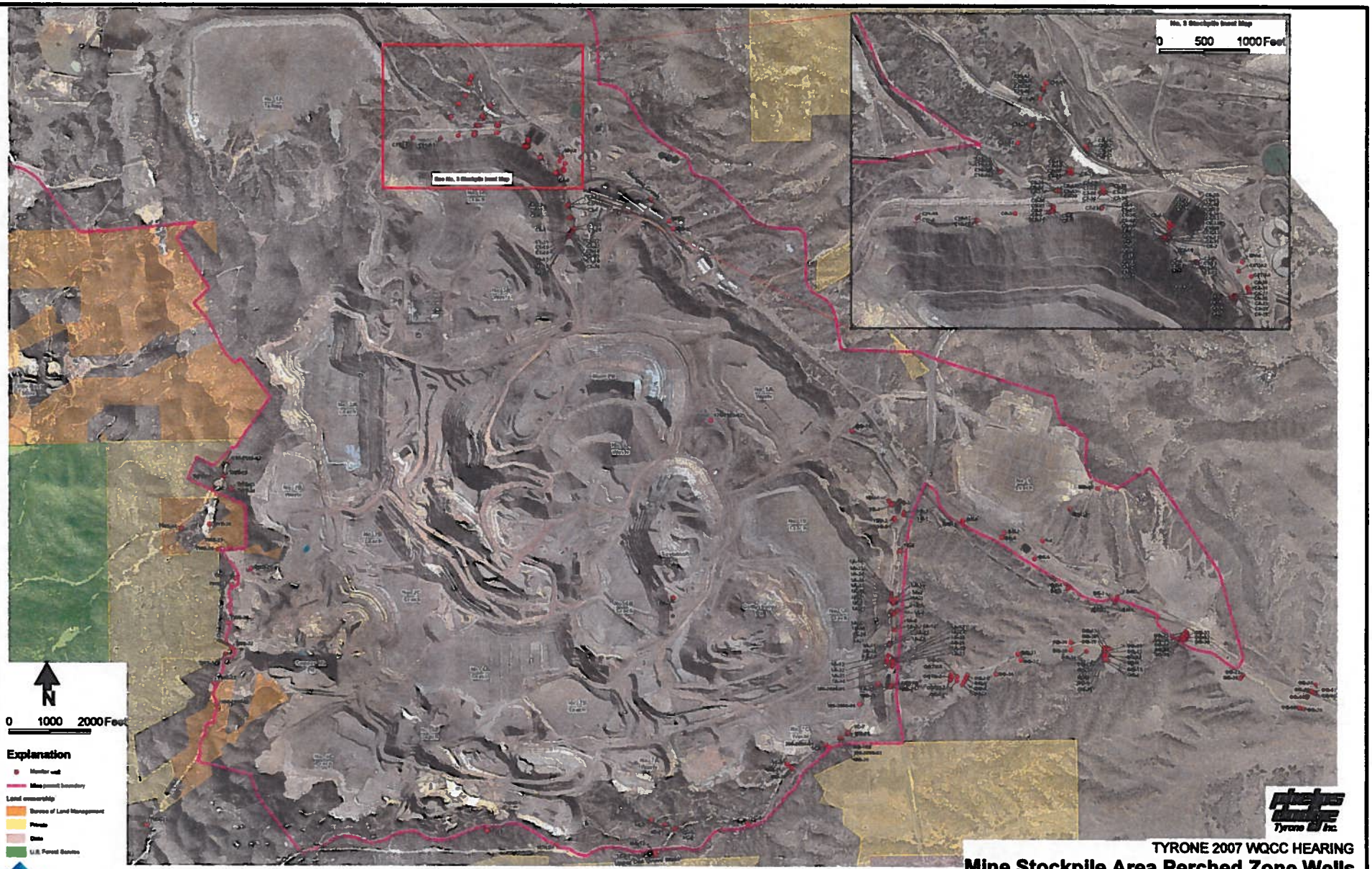


Exhibit B Blandford-1

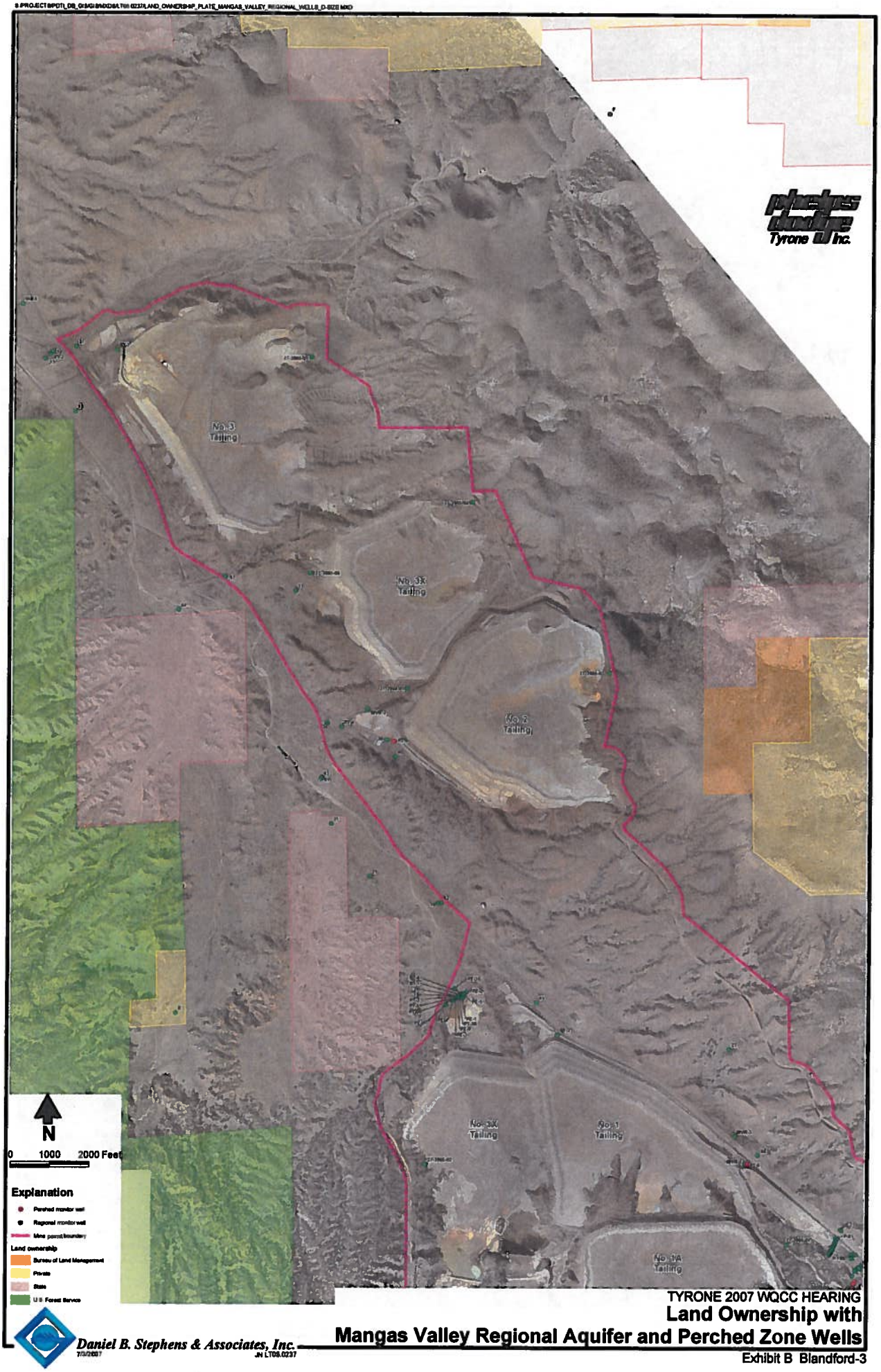


Daniel B. Stephens & Associates, Inc.

TYRONE 2007 WQCC HEARING

Mine Stockpile Area Perched Zone Wells

Exhibit B Blandford-2

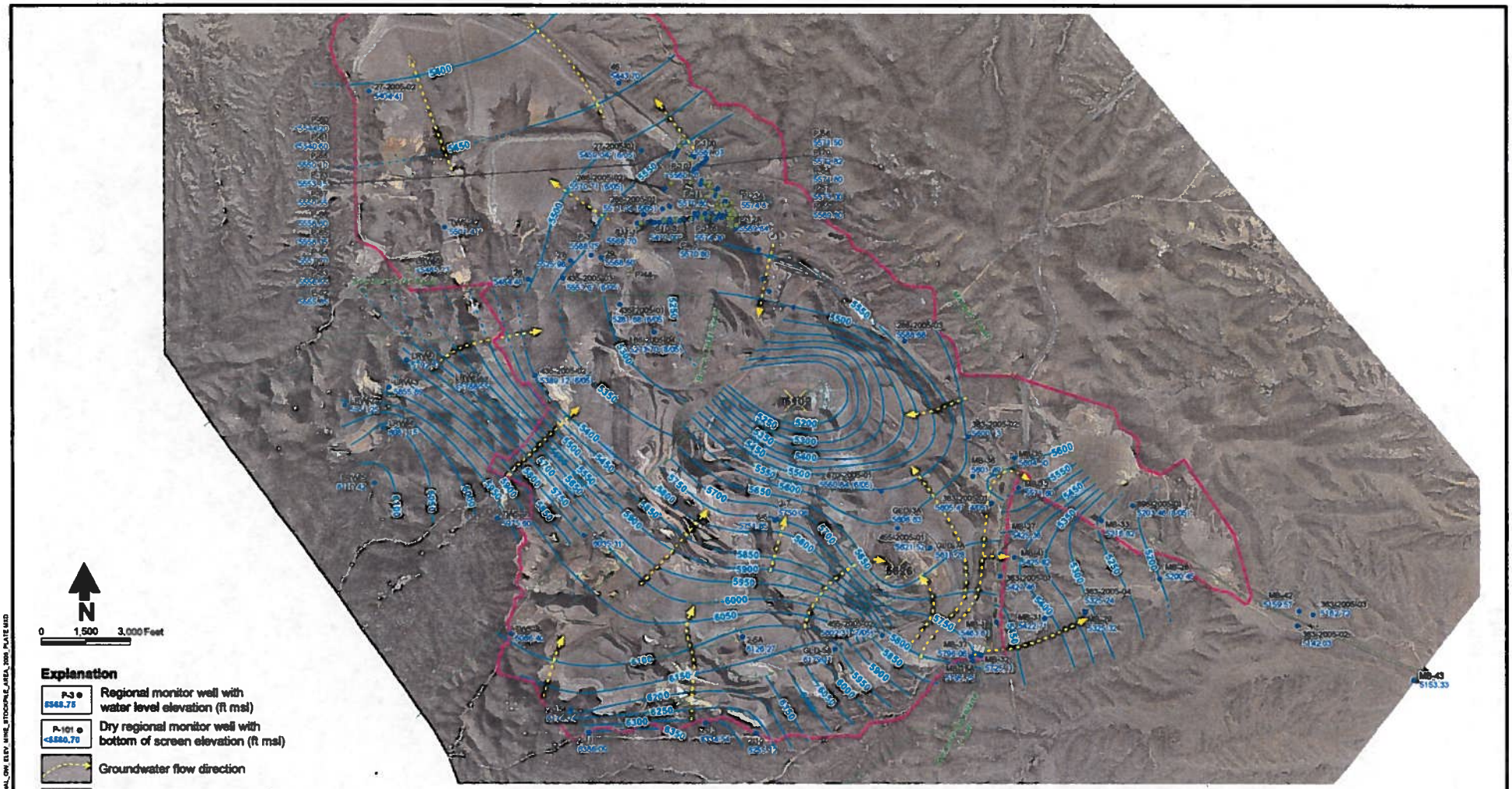


Daniel B. Stephens & Associates, Inc.
JN LT06.0237

TYRONE 2007 WQCC HEARING

Land Ownership with Mangas Valley Regional Aquifer and Perched Zone Wells

Exhibit B Blandford-3



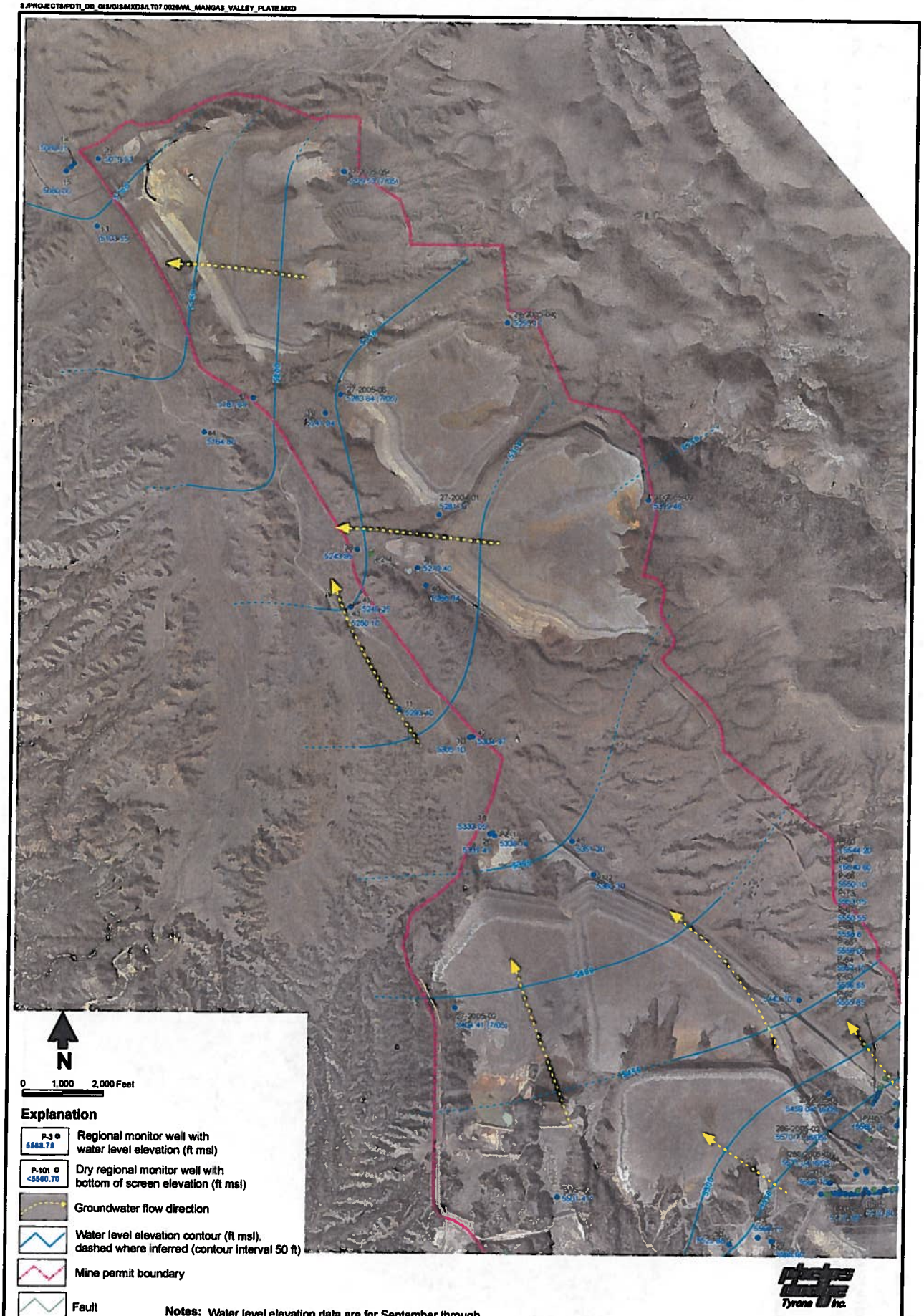
Notes: Water level elevation data are for September through November 2005 unless otherwise noted.
* Water level appears anomalous; not used for contouring.

Daniel B. Stephens & Associates, Inc.
07/05/2007 JN LT07.0029

TYRONE 2007 WQCC HEARING

Regional Groundwater Elevations for Mine/Stockpile Area, 2005

Exhibit C Blandford-4


N
0 1,000 2,000 Feet
Explanation
Regional monitor well with water level elevation (ft msl)
Dry regional monitor well with bottom of screen elevation (ft msl)
Groundwater flow direction
Water level elevation contour (ft msl), dashed where inferred (contour interval 50 ft)
Mine permit boundary
Fault
Notes: Water level elevation data are for September through November 2005 unless otherwise noted.
* Water level appears anomalous (e.g., 7/05); not used for contouring.
Tyrone Inc.
TYRONE 2007 WQCC HEARING
Regional Groundwater Elevations for Mangas Valley Tailing Area, 2005
Daniel B. Stephens & Associates, Inc.
07/03/2007
JN LT07.0029
Exhibit C Blandford-5