# TECHNICAL MEMORANDUM

MWH

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| **To:** | Inyo/LA Cooperative Team | **Date:** | July 10, 2008 |
| **From:** | Victor Harris, MWH<br>Karen Miller, MWH<br>Jim Yoon, MWH | **Reference:** | 1343024 |

**Subject:** Radius of Influence Analysis – Big Pine and Taboose-Aberdeen Wellfield

## Introduction

The procedure for completing the radius of influence (ROI) analysis described in Cooperative Workplan IA-1 (Subtask 1) was developed during the Inyo/LA Cooperative Team meetings on December 13th 2007 and January 10th 2008, as well as subsequent e-mail correspondence. This memorandum serves to document the procedures discussed, present results from the ROI analysis for the Big Pine and Taboose-Aberdeen wellfields, and serve as a guide to subsequent modeling efforts.

## Radius of Influence Analysis Procedure

- The procedure will be implemented in the following two Owens Valley wellfields:

    1. Big Pine Wellfield
    2. Taboose-Aberdeen Wellfield

- Several groundwater models exist for the study area. The table below summarizes which groundwater models will be utilized to conduct the analyses. The analysis will be completed using two different models for each wellfield.

**Table 1**
**Summary of Groundwater Models to be used for the Radius of Influence Analysis**

| Wellfield | Model | Responsible Party |
|---|---|---|
| Big Pine | MWH/LADWP Big Pine Wellfield Model (2004) | LADWP |
| | USGS Owens Valley Model (Danskin, 1998) | ICWD |
| Taboose-Aberdeen | MWH/LADWP Taboose-Thibaut Wellfield Model (2004) | LADWP |
| | USGS Owens Valley Model (Danskin, 1998) | ICWD |

- Production well pumping rates to be used in this analysis are summarized in **Attachment A**. The rationale associated with the selection of these rates is also provided in this attachment.

- Key indicator wells or discrete locations where drawdown will be documented are provided in **Attachment B**.

- A study area map showing the location of the discrete points where drawdown is to be observed (listed in **Attachment B**) is provided as **Attachment C**. These locations generally consist of:

    1. Key indicator wells
    2. Permanent monitoring sites
    3. Other locations of interest

- Using the appropriate model, each modeler will perform the following steps at each wellfield:

    1. Begin with the existing steady-state condition already developed for the model to be used (note that this may involve different initial conditions for different models).
    2. Modify the existing steady-state model run to exclude all pumping wells.
    3. Re-run the steady-state simulation with the new pumping assumptions (no pumping wells) and save the computed heads.
    4. Convert model to transient mode, using the computed steady-state heads as the starting heads for the transient simulation.
    5. Keeping all boundary conditions the same as the steady-state run (no pumping wells), run the model in a transient mode for one (1) year. Confirm that the starting heads are the same as the head after one (1) year.
    6. For each production well identified in **Attachment A**, run a transient simulation exactly the same as Step 5 above, except set the production at one well of interest to the production rate noted in **Attachment A**. Document the change in groundwater level throughout the wellfield as a result of pumping the one well of interest for one (1) year. The change in

groundwater level need only be documented for the shallowest layer of the model. The layer from which the well produces water should be based on the construction characteristics of each well and should be documented for future use.

7. Repeat Step 6 for each pumping well listed in **Attachment A**, evaluating the production from only one well at a time for a period of (1) one year.

- Deliverables associated with these model runs include:

1. Create an XYZ data table of the wellfield that represents contours of equal drawdown in the shallowest model layer as a result of pumping at each well identified in **Attachment A** for a period of one (1) year. The X and Y dimensions shall be in NAD_1927_UTM_Zone_11N coordinates while the Z dimension will be in feet. This data table should be transferable to a variety of contouring software.
2. Create a contour map of the drawdown at each well. Each modeler may select the contouring software of their choice (GMS, ArcView, Surfer). The maps should show other pumping wells and key geographic features of well fields for reference.
3. For each indicator location identified in **Attachment B**, create a table (using Excel) similar to the following example:

**Table 2**
**Example Indicator Location T425**

| Production Well | Model Layer that the Well Produces From | Shallow drawdown at T425 as a Result of Pumping the Production Well for One (1) Year | % of Total Drawdown |
|---|---|---|---|
| Well AQ1 | 1 | 4 | To be calculated (i.e. =4/36) |
| Well AQ2 | 3 | 10 | To be calculated |
| Well AQ3 | 2 | 16 | To be calculated |
| Well EM1 | 1 | 6 | To be calculated |
| | **Total Drawdown** | **36** | |

## Model Updates

The ROI analysis results presented in this memorandum are obtained from performing runs on the MWH/LADWP versions of the groundwater models for the Big Pine and Taboose-Aberdeen wellfields. Results from the USGS Owens Valley model will be prepared separately by the Inyo County Water Department (ICWD). Updates that were made to the MWH/LADWP groundwater models for the ROI analysis are described below.

## Radius of Influence Analysis

### Big Pine Wellfield

The Big Pine groundwater model was originally created by MWH and subsequently calibrated by the LADWP. The latest transient model files for the calibrated Big Pine model were provided by Saeed Jorat (LADWP) to MWH for use in the radius of influence analysis on April 10, 2008. These transient model files were then converted to a steady-state model by using inputs from the first stress period of the model.

The original Big Pine model utilized the algebraic multi-grid solver package (LINK-AMG) distributed by the USGS. Due to licensing restrictions, this solver package is no longer publicly distributed by the USGS and is therefore not available for use in the current analysis. The model is updated to utilize the PCG2 solver package, which provides similar results as the LINK-AMG package.

To perform the radius of influence analysis, all of the production wells are removed from the model. After removal of these production wells, a steady-state model run was performed to obtain resulting model heads, which are then used to replace the starting head values in the model. These updates provide a base model from which to perform the radius of influence analysis.

### Taboose-Aberdeen Wellfield

The Taboose-Aberdeen groundwater model was originally created by MWH and subsequently calibrated by the LADWP. The latest transient model files for the calibrated Taboose-Aberdeen model were provided by Saeed Jorat (LADWP) to MWH for use in the radius of influence analysis on April 10, 2008. These transient model files were then converted to a steady-state model by using inputs from the first stress period of the model.

To perform the radius of influence analysis, all of the production wells were removed from the model. After removal of these production wells, a steady-state model run was performed to obtain resulting model heads, which were then used to replace the starting head values in the model. These updates provide a base model from which to perform the radius of influence analysis.

## Radius of Influence Analysis Results

The radius of influence analysis was performed on a set of individual production wells throughout the wellfields (included wells and pumping rates shown in **Table 3** and **Table 4** for Big Pine and Taboose-Aberdeen, respectively). For each of these production wells, the model was run for a one-year period (i.e. two model stress periods) using the defined pumping rate at the model cell of the well location.

**Table 3**
**Analysis Rates for Big Pine Pumping Wells**

| Well ID | Analysis Rate (acre-ft/yr) | Analysis Rate (ft3/day) |
|---|---|---|
| 210 | 1,540 | 183,787 |
| 218 | 2,470 | 294,776 |
| 219 | 3,360 | 400,991 |
| 220 | 1,750 | 208,849 |
| 222 | 950 | 113,375 |
| 223 | 1,960 | 233,911 |
| 229 | 1,060 | 126,503 |
| 231 | 1,450 | 173,047 |
| 232 | 1,380 | 164,693 |
| 330 | 6,100 | 727,989 |
| 331 | 5,150 | 614,614 |
| 332 | 11,500 | 1,372,438 |
| 341 | 450 | 53,704 |
| 352 | 50 | 5,967 |
| 374 | 4,000 | 477,370 |
| 375 | 3,420 | 408,151 |
| 378 | 3,150 | 375,929 |
| 379 | 3,200 | 381,896 |
| 389 | 3,000 | 358,027 |
| 409 | 2,150 | 256,586 |

**Table 4**
**Analysis Rates for Taboose-Aberdeen Pumping Wells**

| Well ID | Analysis Rate (acre-ft/yr) | Analysis Rate (ft3/day) |
|---|---|---|
| 106 | 2,140 | 255,393 |
| 110 | 3,650 | 435,600 |
| 111 | 2,260 | 269,714 |
| 114 | 2,200 | 262,553 |
| 118 | 1,800 | 214,816 |
| 342 | 8,160 | 973,835 |
| 347 | 8,960 | 1,069,308 |
| 349 | 10,500 | 1,253,096 |
| 109 | 2,870 | 342,513 |
| 370 | 2,300 | 274,488 |
| 159 | 1,100 | 131,277 |
| 155 | 700 | 83,540 |
| 103 | 1,100 | 131,277 |
| 104 | 780 | 93,087 |
| 382 | 1,260 | 150,372 |
| 351 | 7,300 | 871,200 |
| 356 | 4,700 | 560,910 |
| 380 | 2,350 | 280,455 |
| 381 | 2,330 | 278,068 |

The model run produces a set of resulting head and drawdown values in each model cell at the end of the run. The drawdown values in the upper layer of each model have been compiled into XYZ data tables of the wellfield for each of the runs, with the X and Y dimensions in the NAD 1927 UTM Zone 11N coordinate system and the Z dimension in feet of drawdown. Due to their large size, these tables are not included in this memorandum (available electronically upon request). In addition to the XYZ table, a map showing contours of equal drawdown in the upper layer of the models due to pumping at various production wells are shown on **Figure 1-Figure 21** for the Big Pine wellfield, and **Figure 22-Figure 41** for the Taboose-Aberdeen wellfield.

The proposed radius of influence analysis procedure also includes the identification of a series of indicator locations at which drawdown due to pumping at each of the production wells is determined. For each of the indicator locations, the drawdown due to production at each pumping well is determined from the model results. These results are presented for each indicator location on **Table 5-Table 12** for the Big Pine wellfield, and **Table 13-Table 24** for the Taboose-Aberdeen wellfield.

In addition to the model runs with pumping at individual production wells, one run was performed with all listed wells running for each of the wellfields. The drawdown contours for these runs are shown on **Figure 21** and **Figure 41** for the Big Pine and Taboose-Aberdeen weillfields, respectively. The drawdown at each indicator location due to pumping at all wells is also included on **Table 5-Table 24**. Following the principal of superposition, the sum of the drawdown values due to pumping at individual wells should equal the total drawdown due to pumping all the wells simultaneously, provided that the influence of boundary conditions and aquifer heterogeneity are negligible. In the case of the Big-Pine wellfield, pumping at all wells simultaneously invokes influences of the model domain boundary, thereby increasing the drawdown in this scenario relative to the sum of the drawdown due to pumping at individual wells at any given indicator location. In the case of the Taboose-Aberdeen wellfield, the drawdown is apparently less affected by the model domain boundary, and therefore the drawdown due to pumping all wells simultaneously approximates the sum of the drawdown due to pumping at individual wells at any given indication location (i.e. the principal of superposition holds). The relative significance of boundary effects in the two wellfields is highlighted by the fact that drawdown on the western and eastern boundaries of the Big Pine wellfield is 45 and 20 feet, respectively. By comparison, drawdown at both the western and eastern boundaries of the Taboose-Aberdeen wellfield is only 4 feet (with all wells pumping).

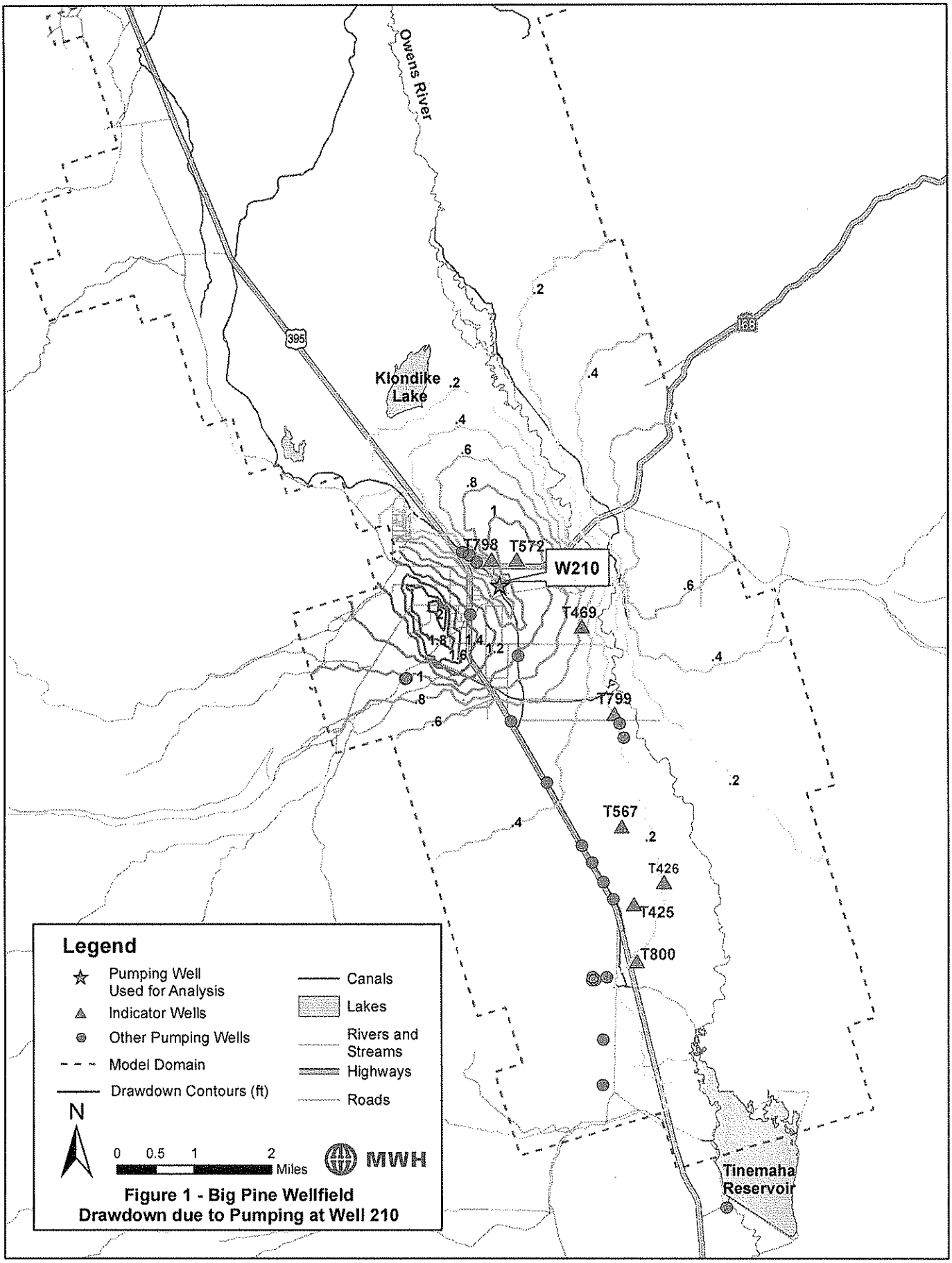


**Figure 1 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 210**

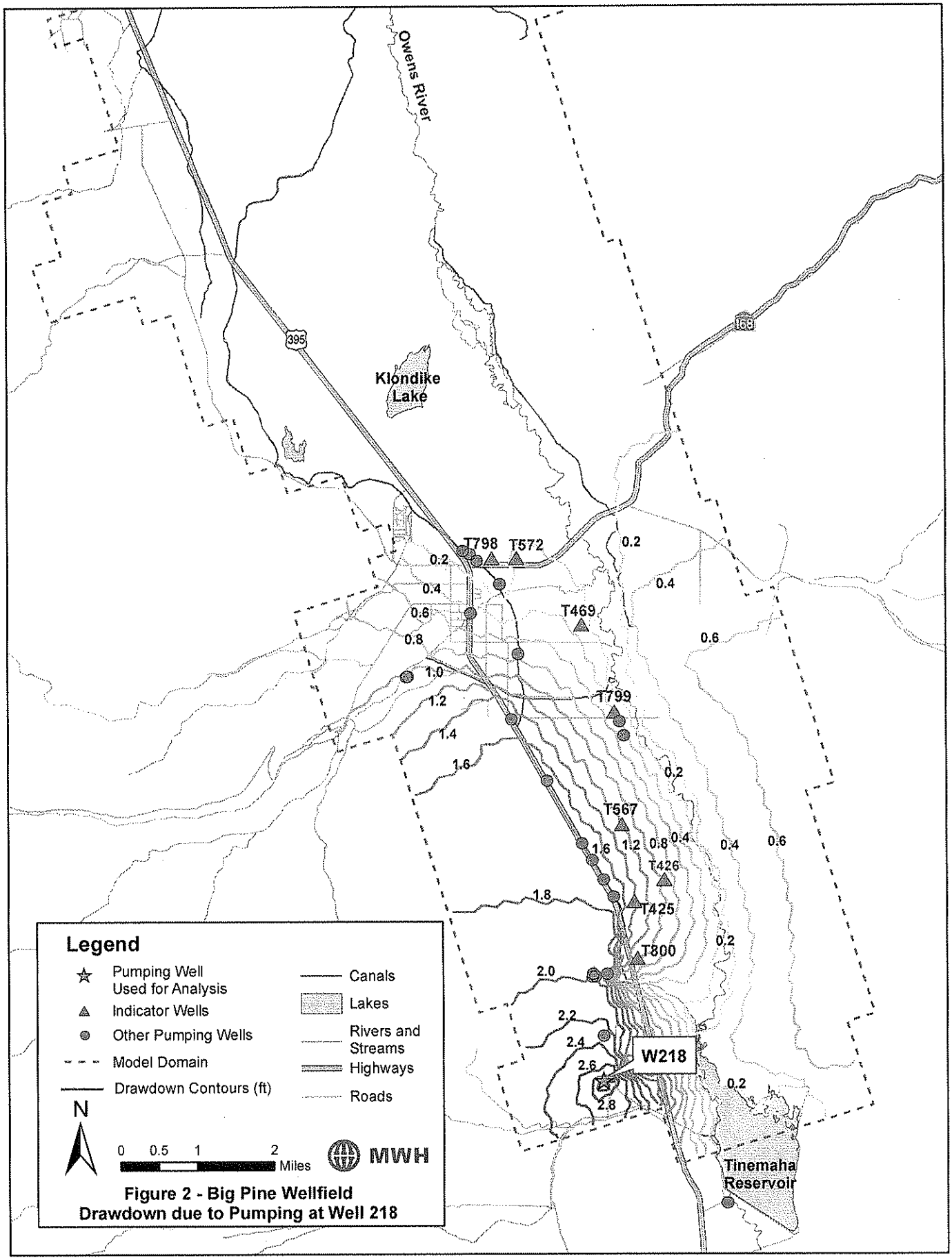


**Figure 2 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 218**

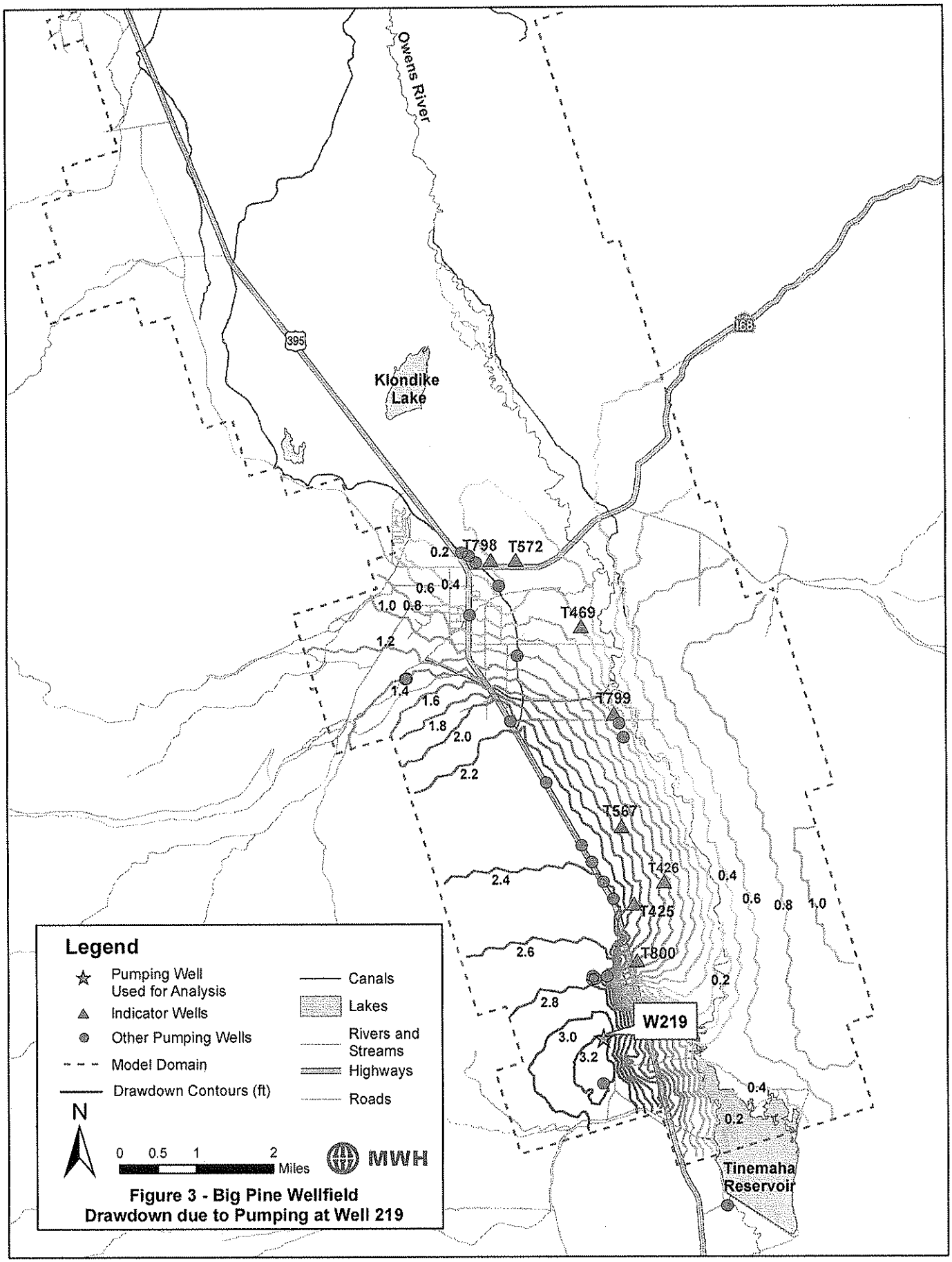


**Figure 3 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 219**

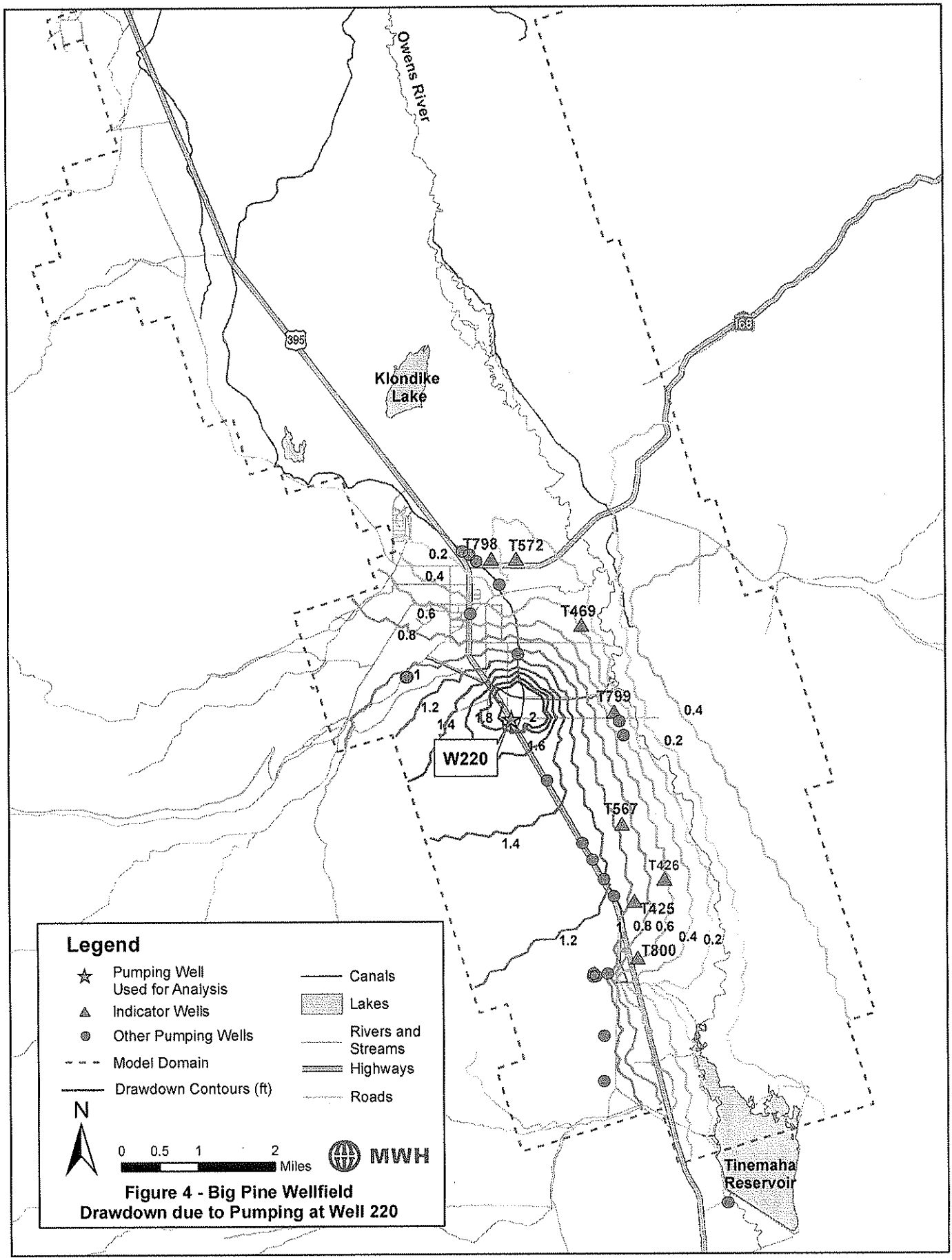


**Figure 4 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 220**

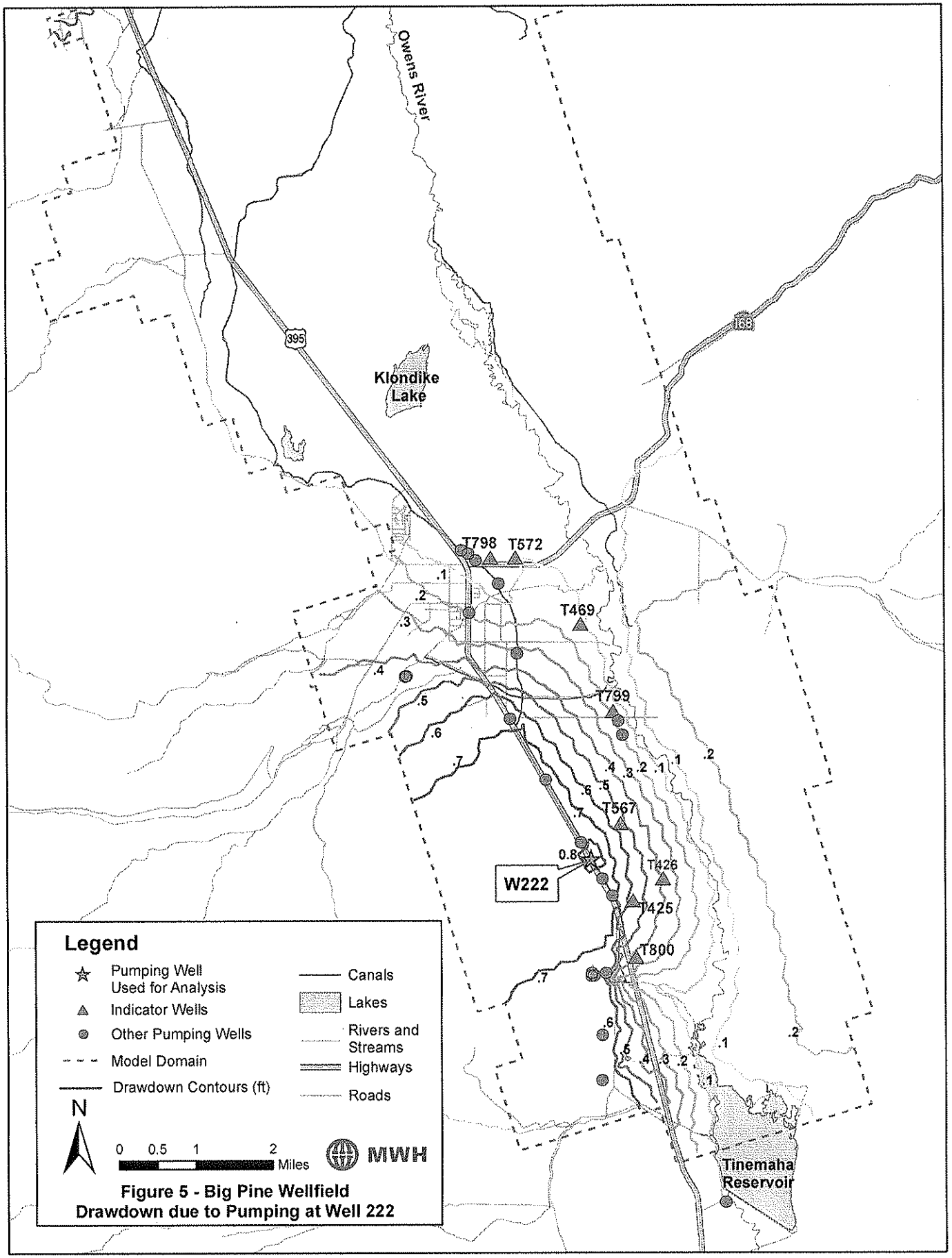


**Figure 5 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 222**

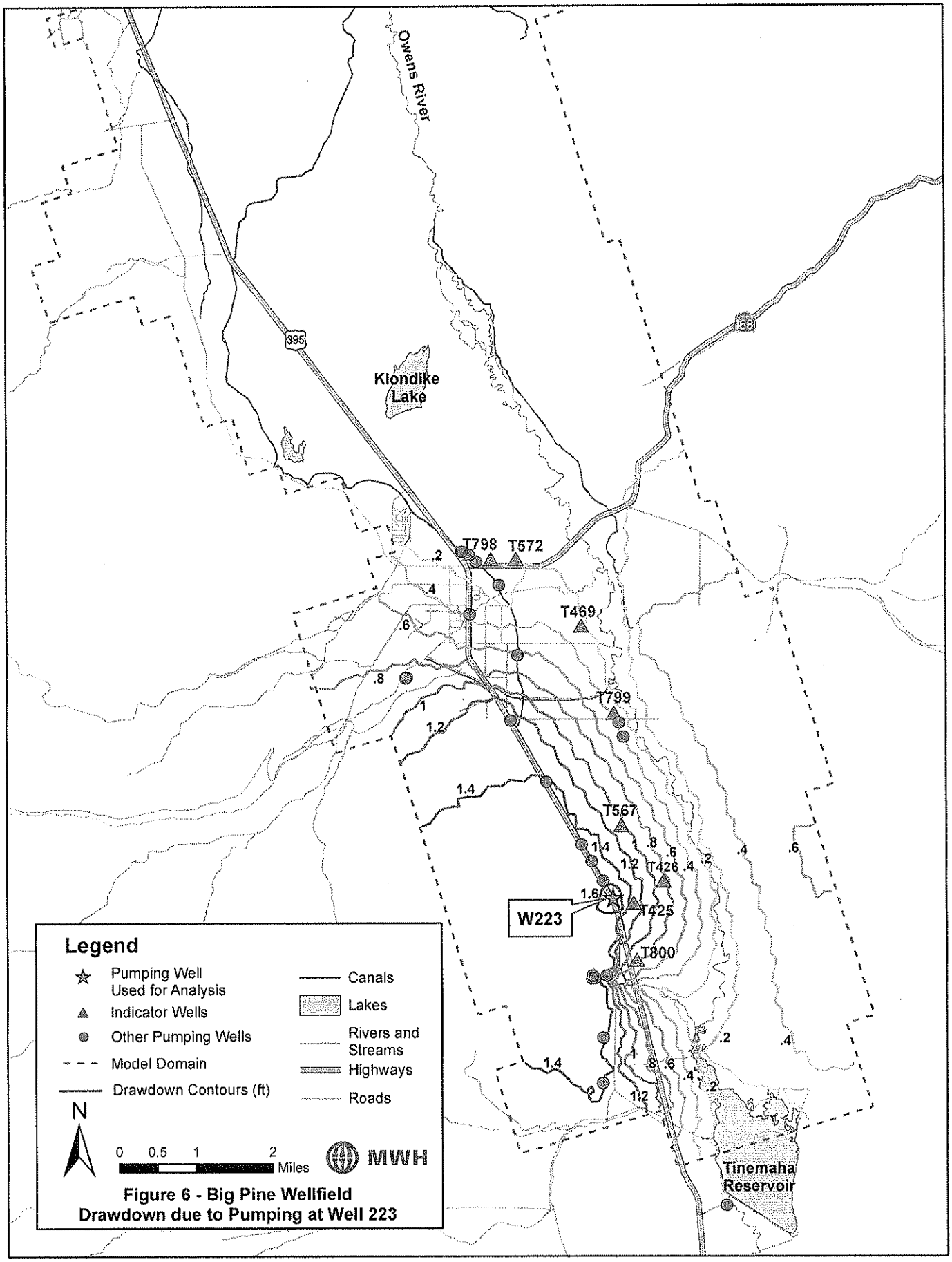


**Figure 6 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 223**

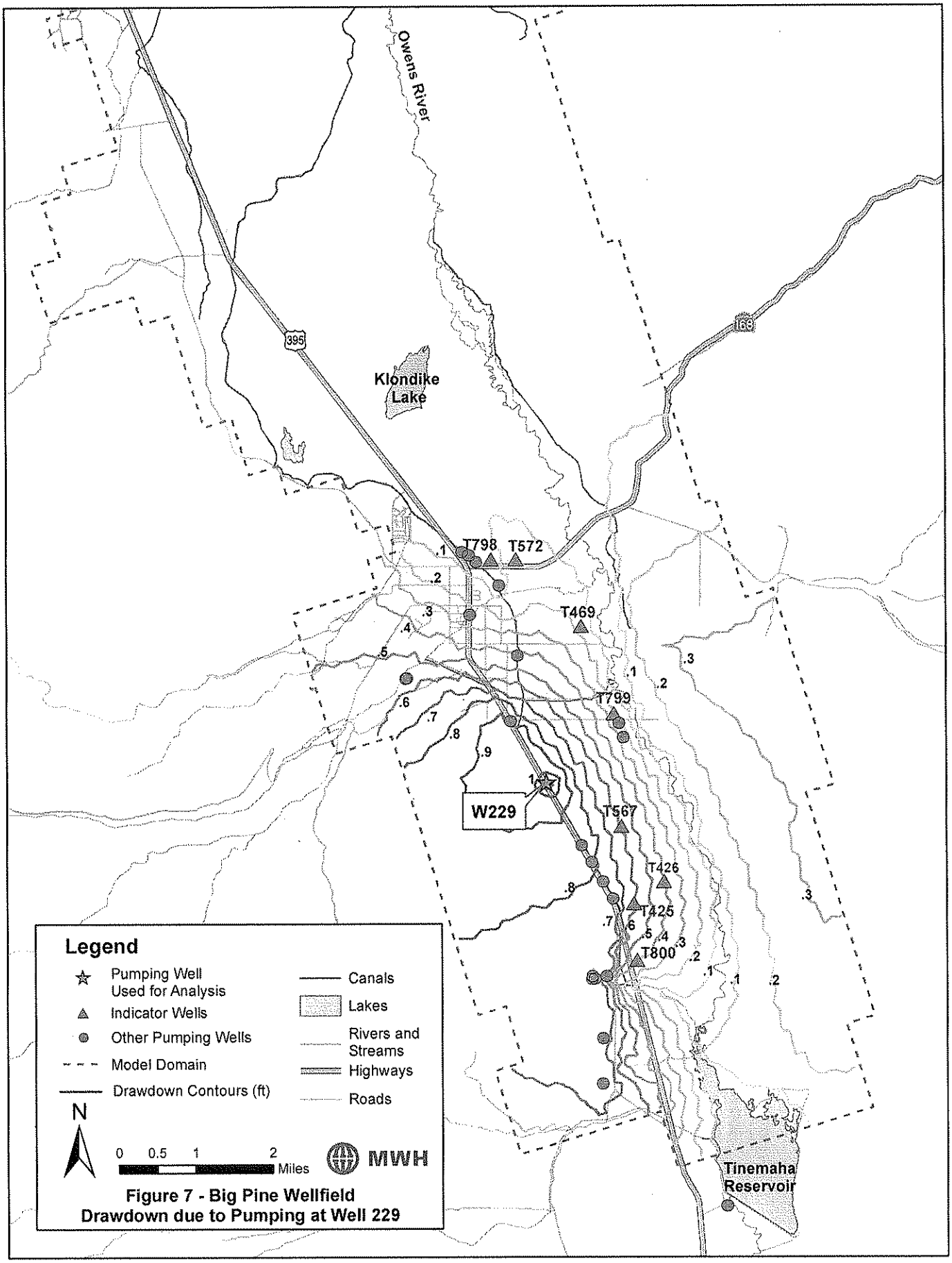


**Figure 7 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 229**

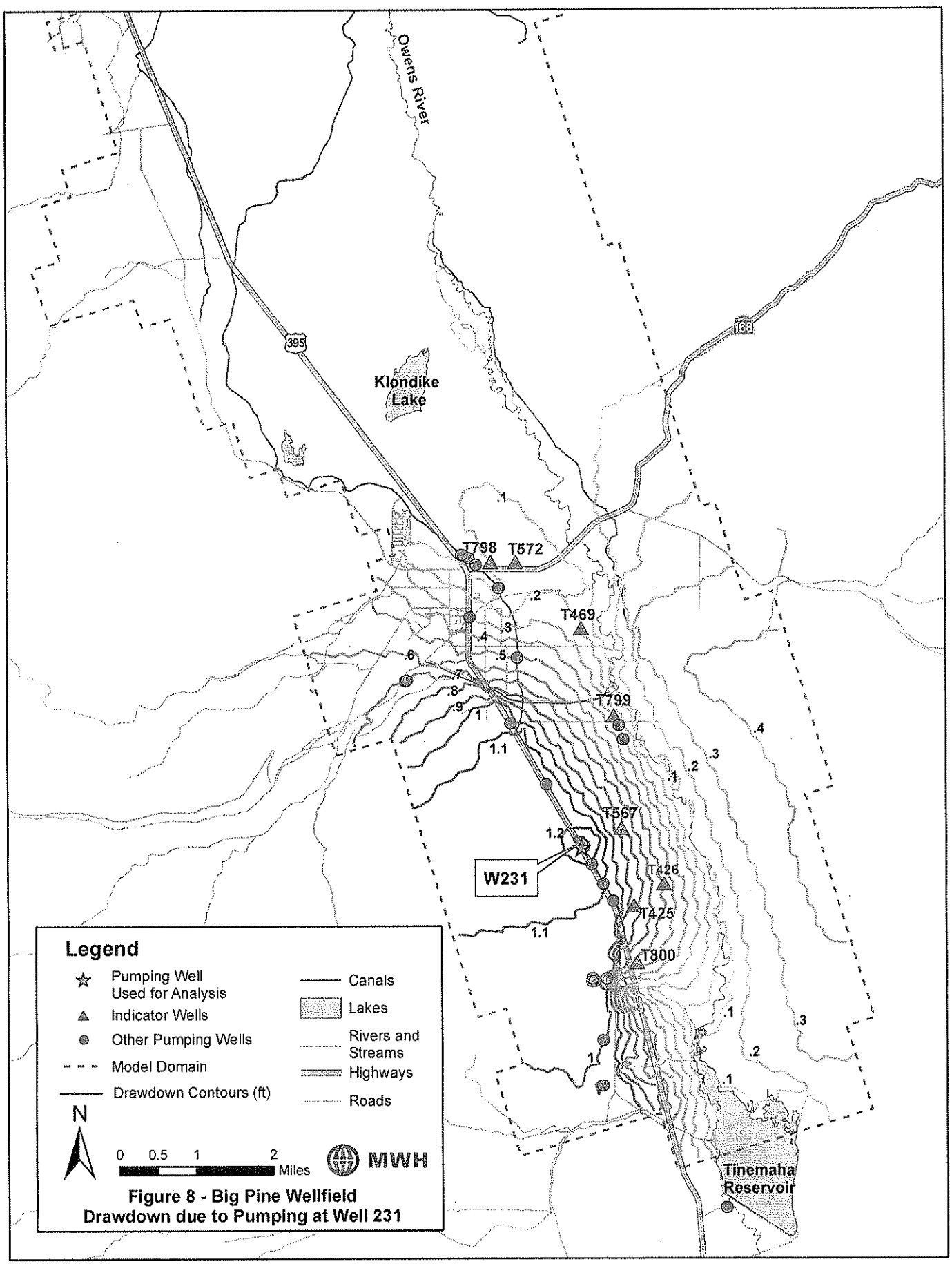


**Figure 8 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 231**

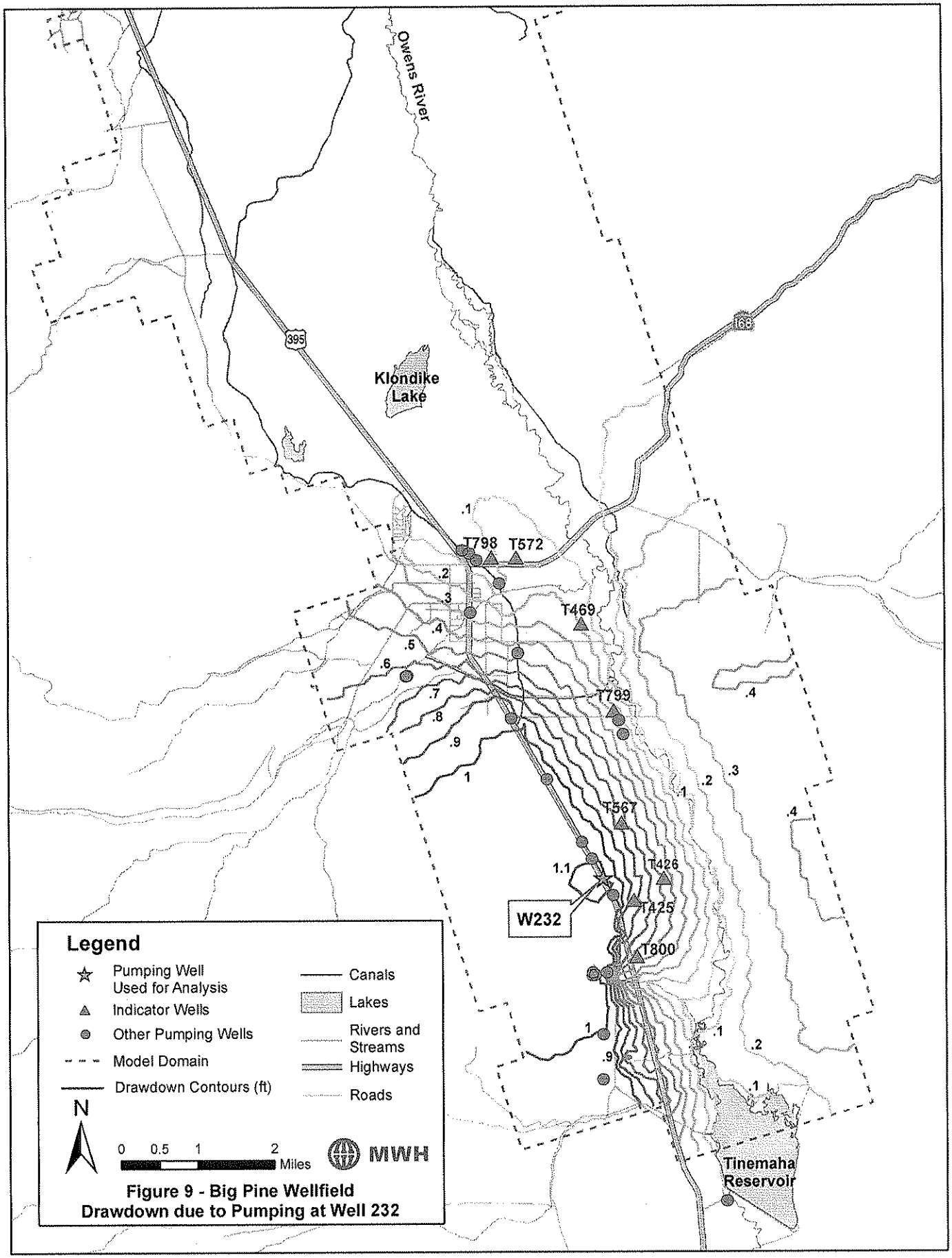


**Figure 9 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 232**

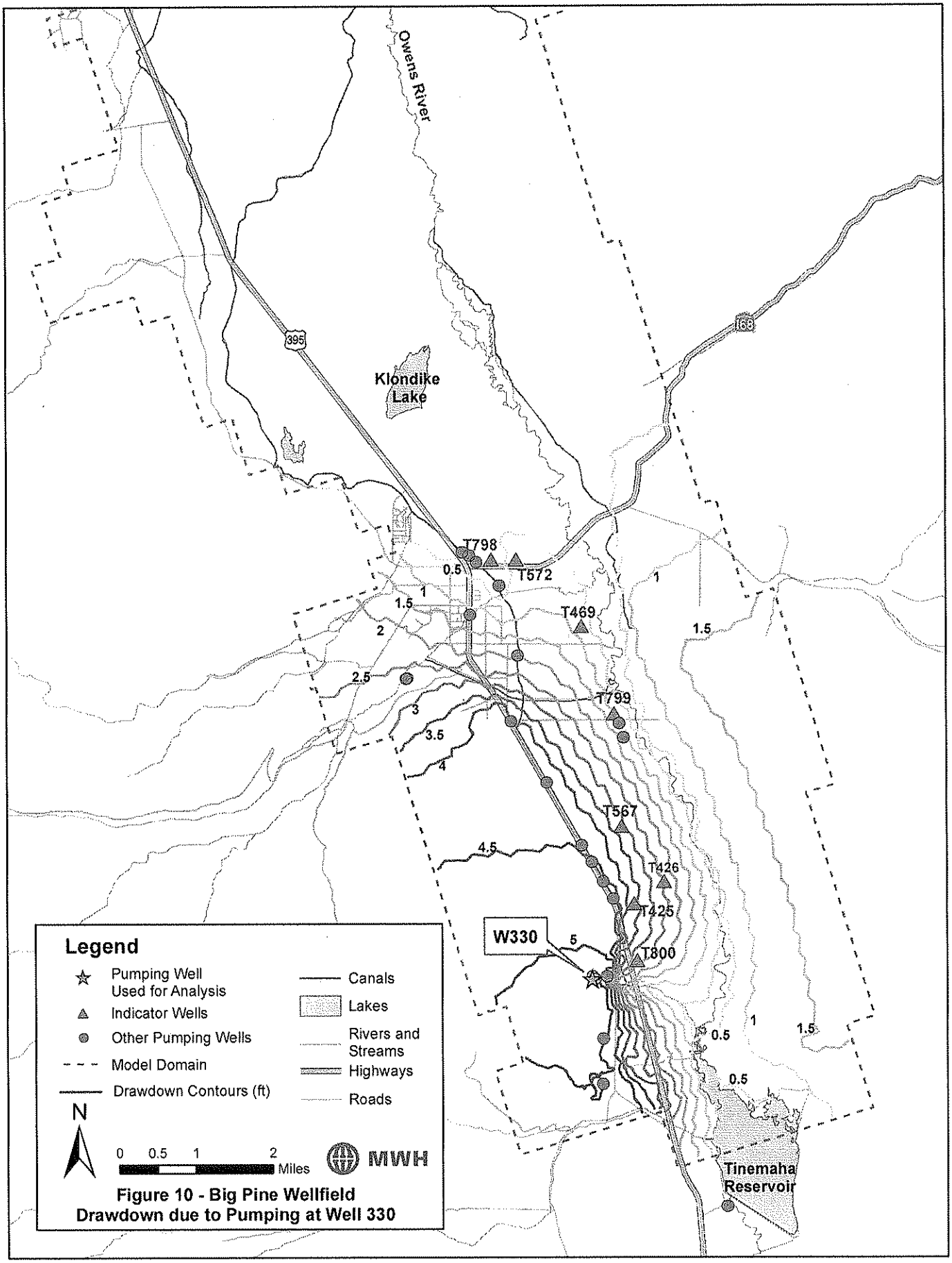


**Figure 10 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 330**

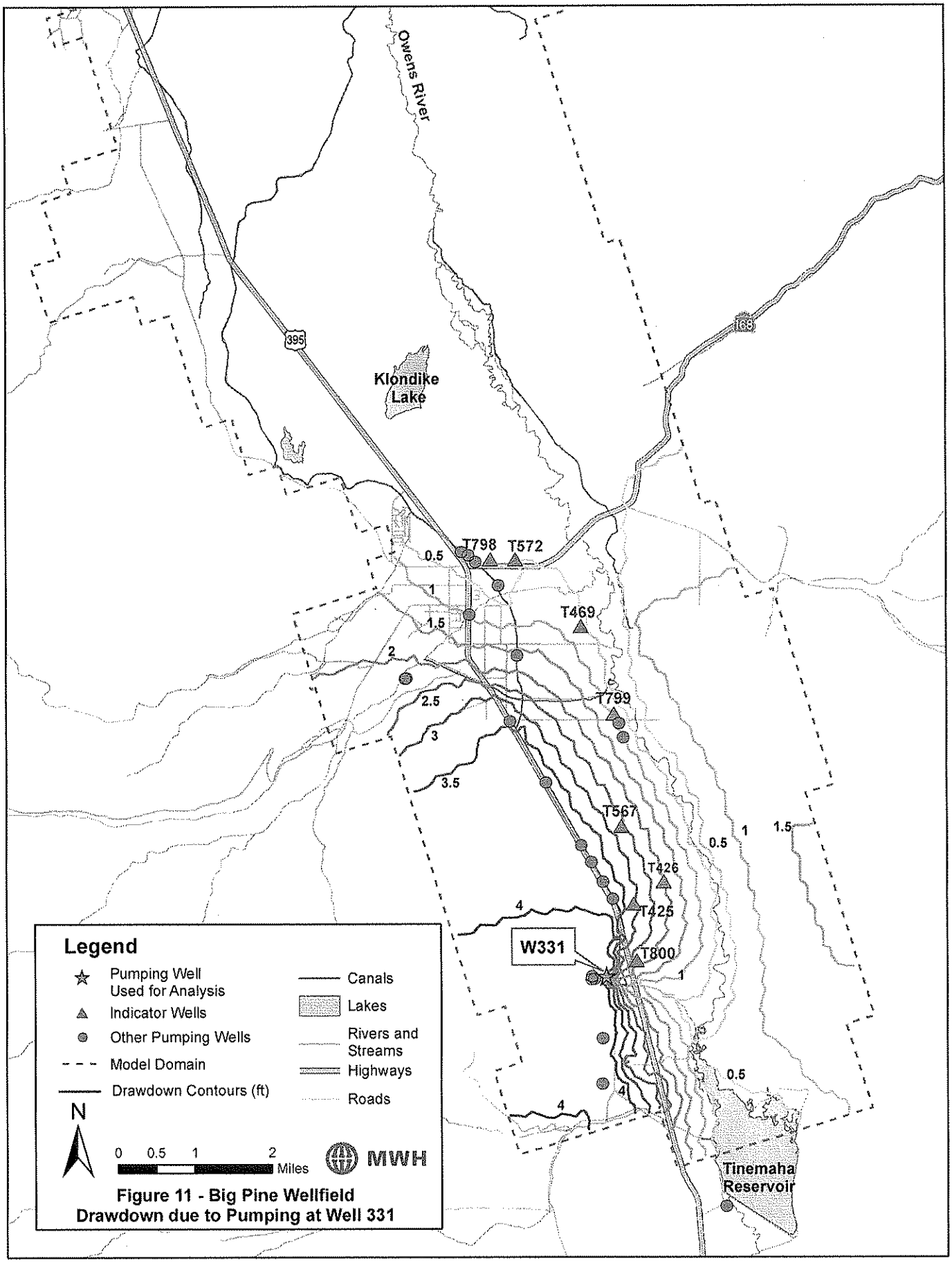


**Figure 11 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 331**

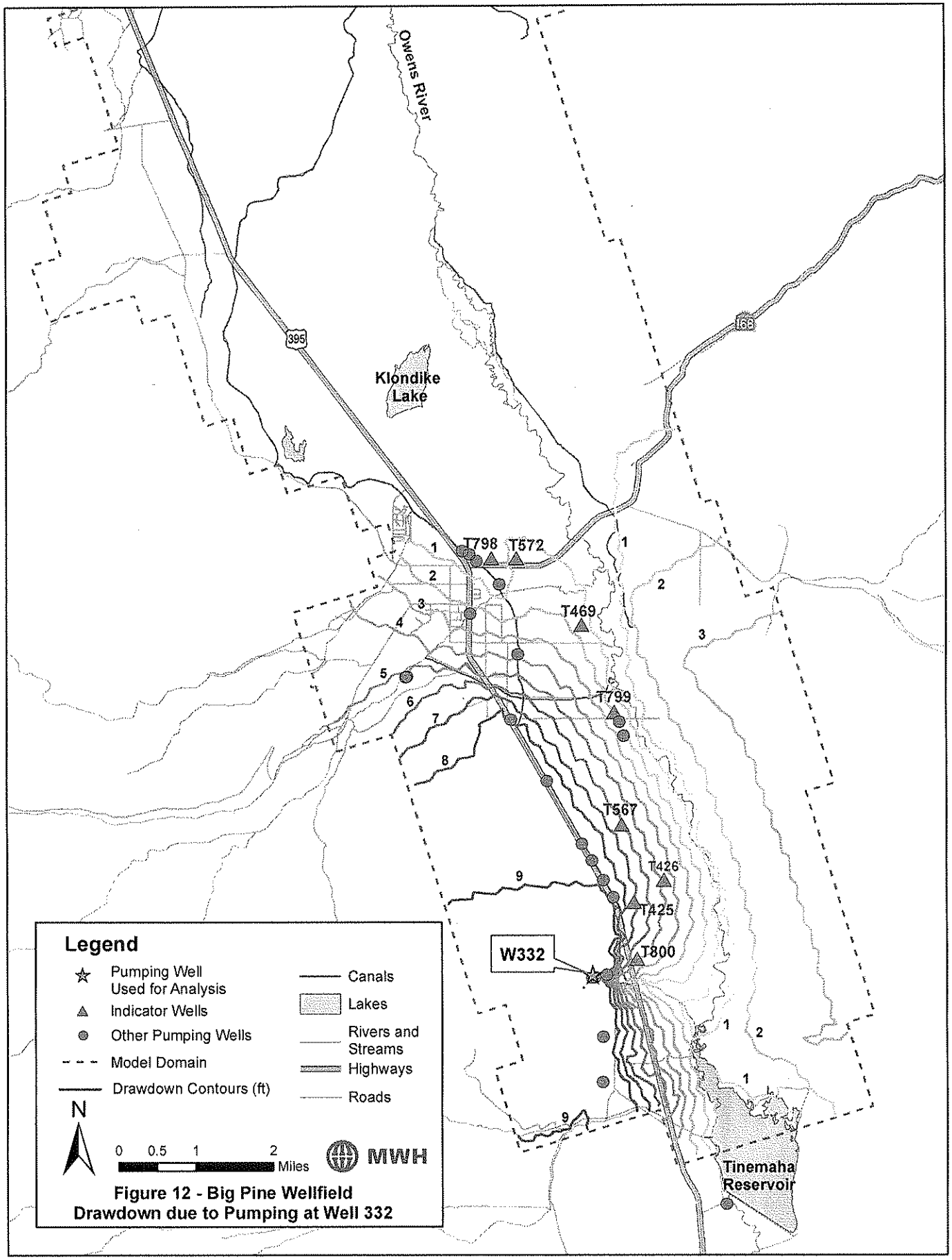


**Figure 12 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 332**

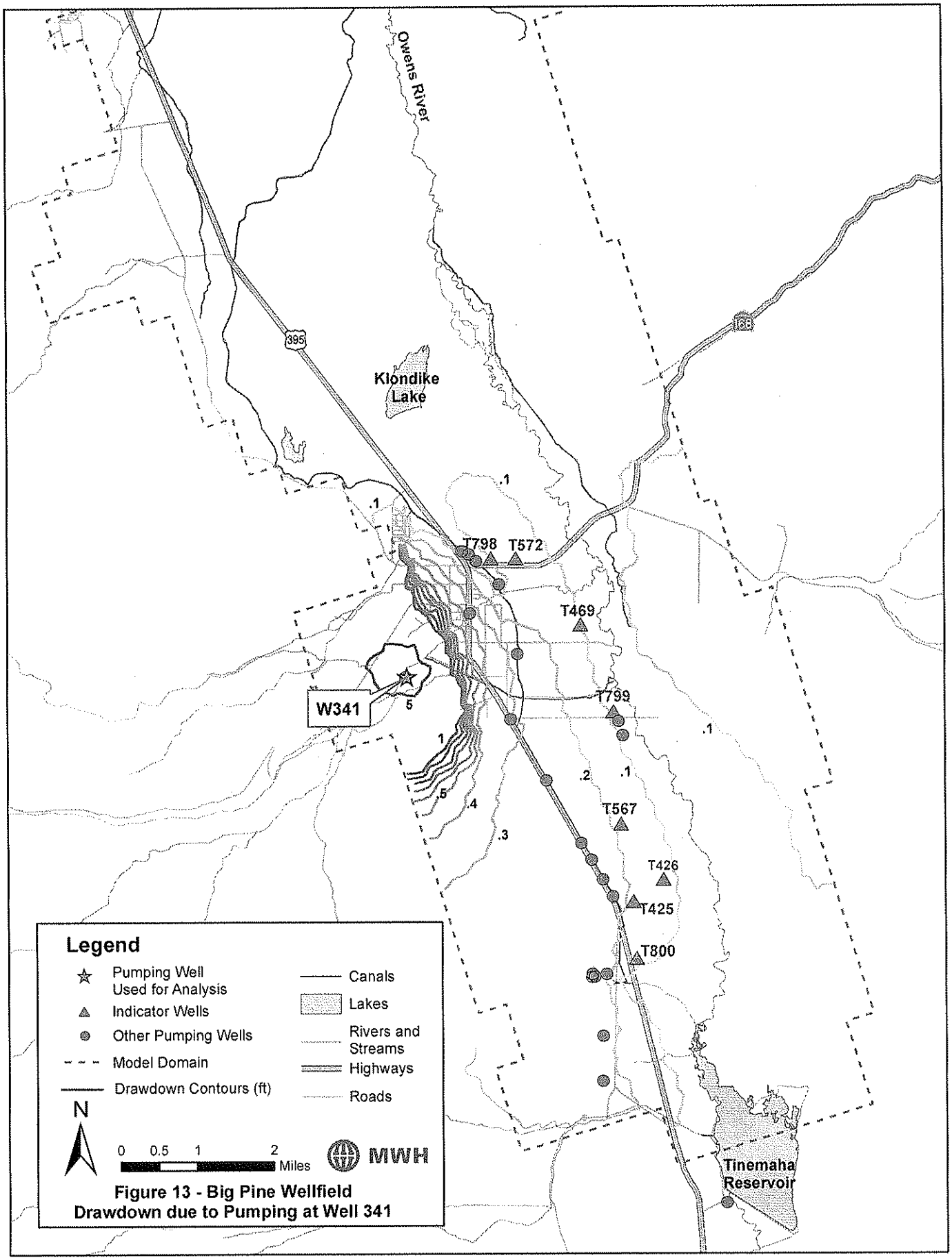


**Figure 13 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 341**

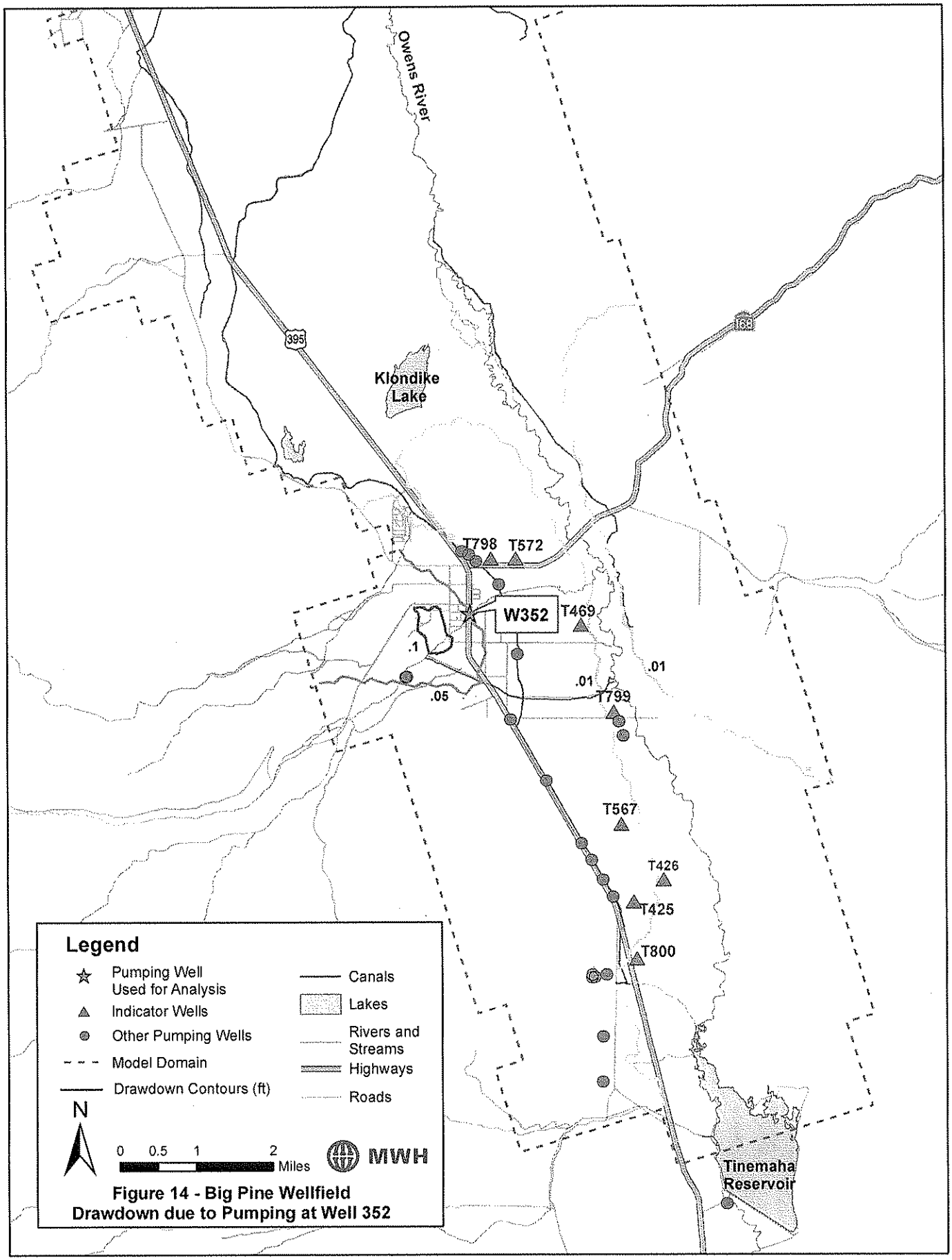


**Figure 14 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 352**

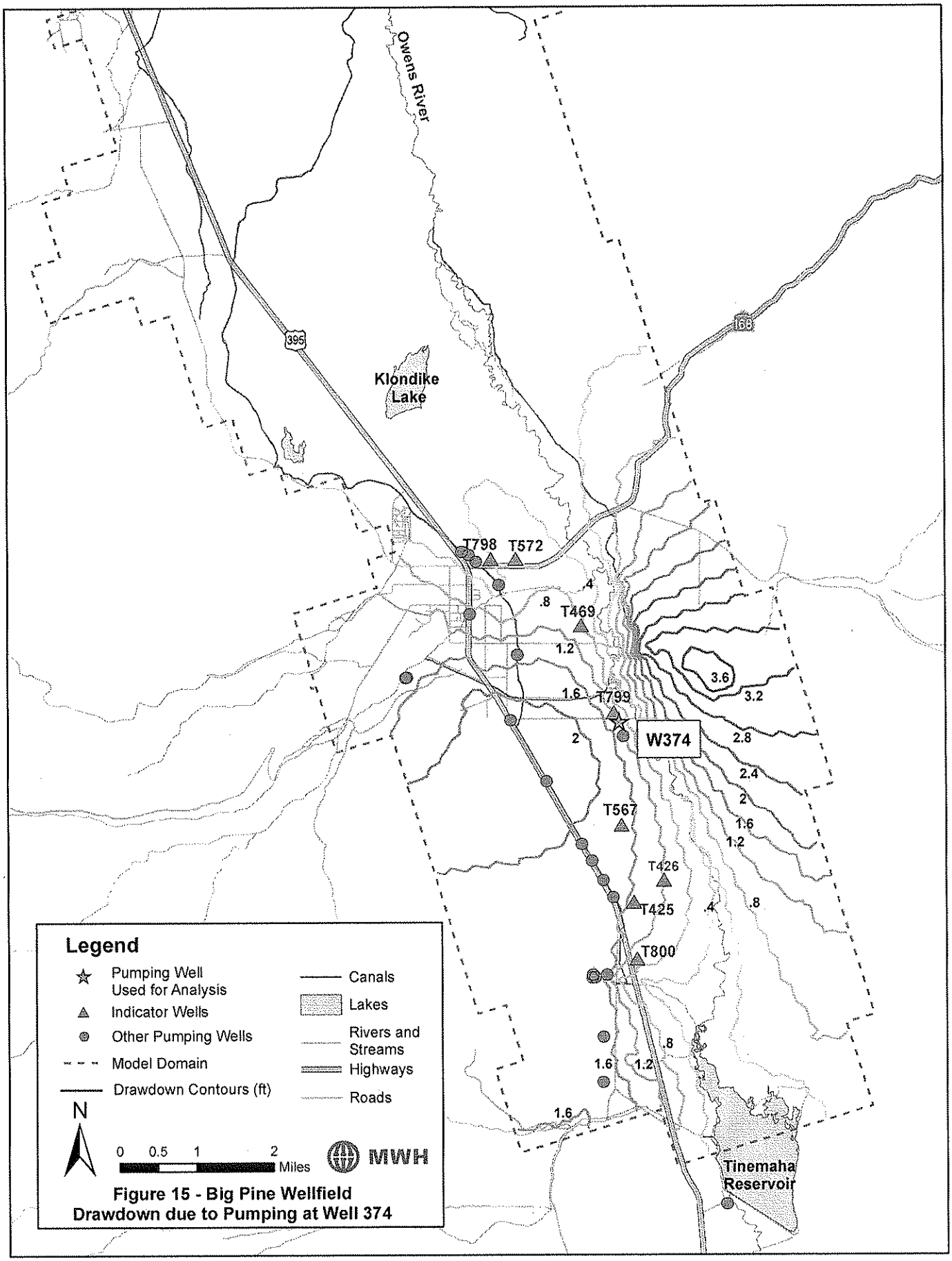


**Figure 15 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 374**

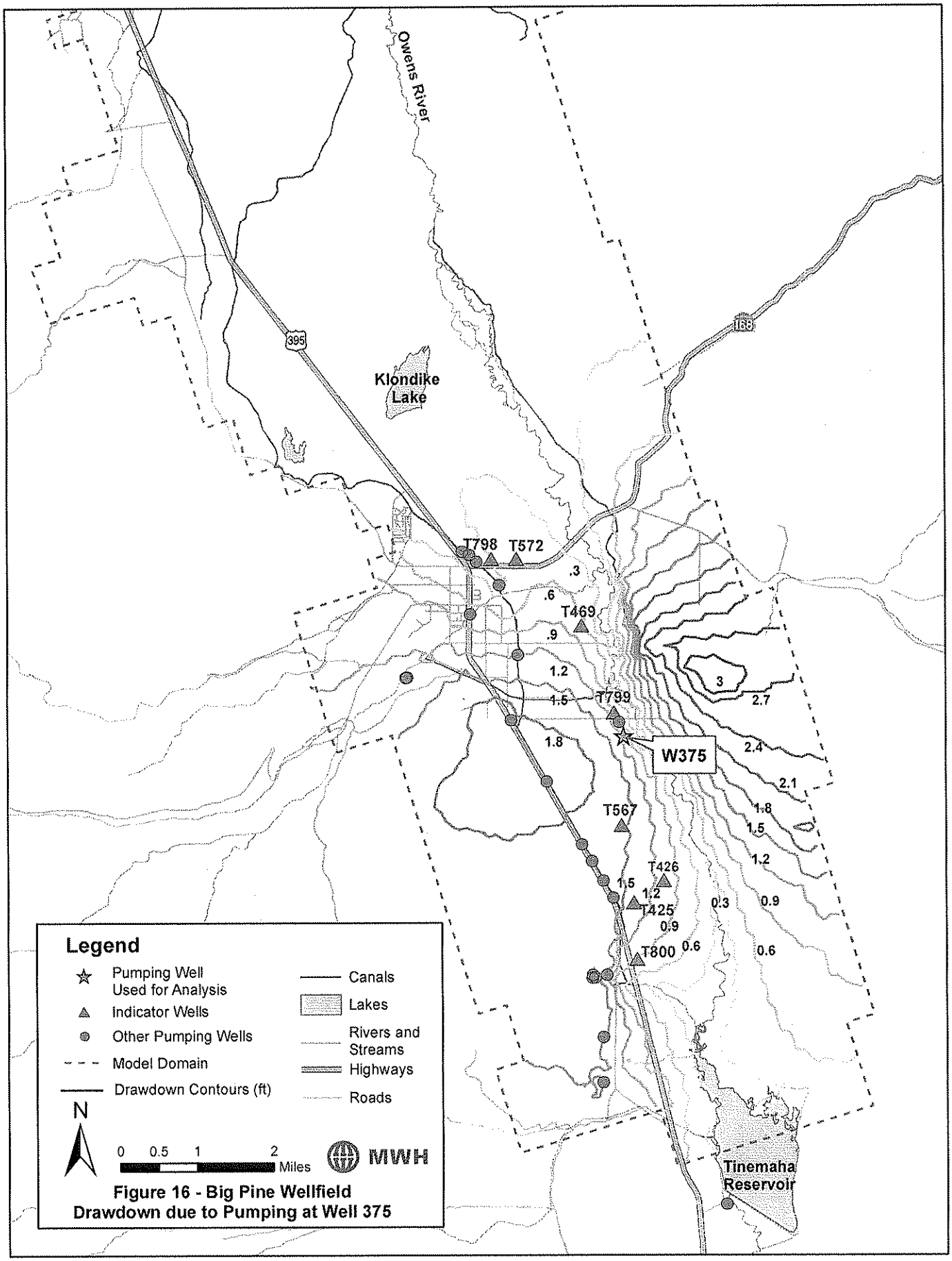


**Figure 16 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 375**

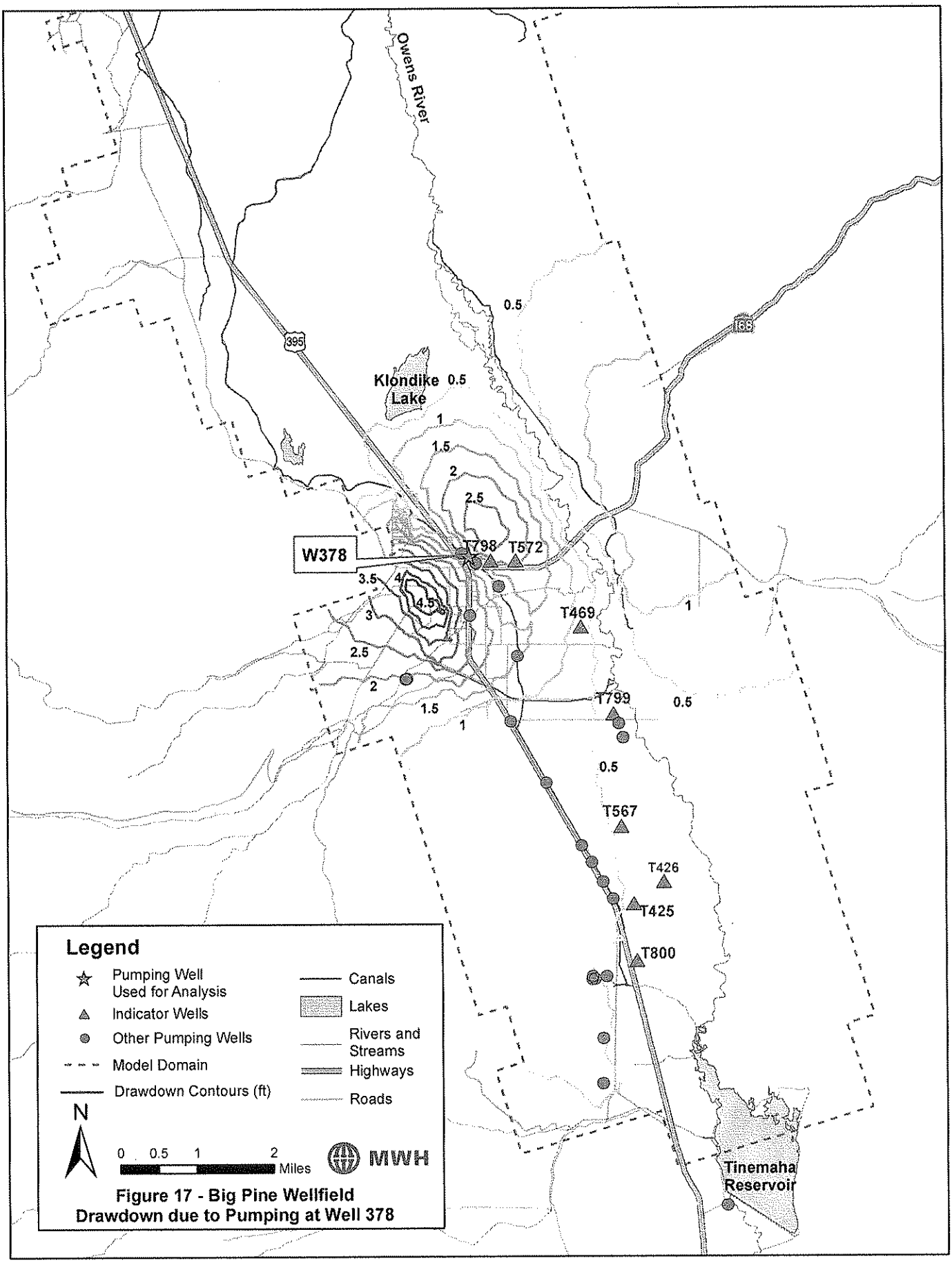


**Figure 17 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 378**

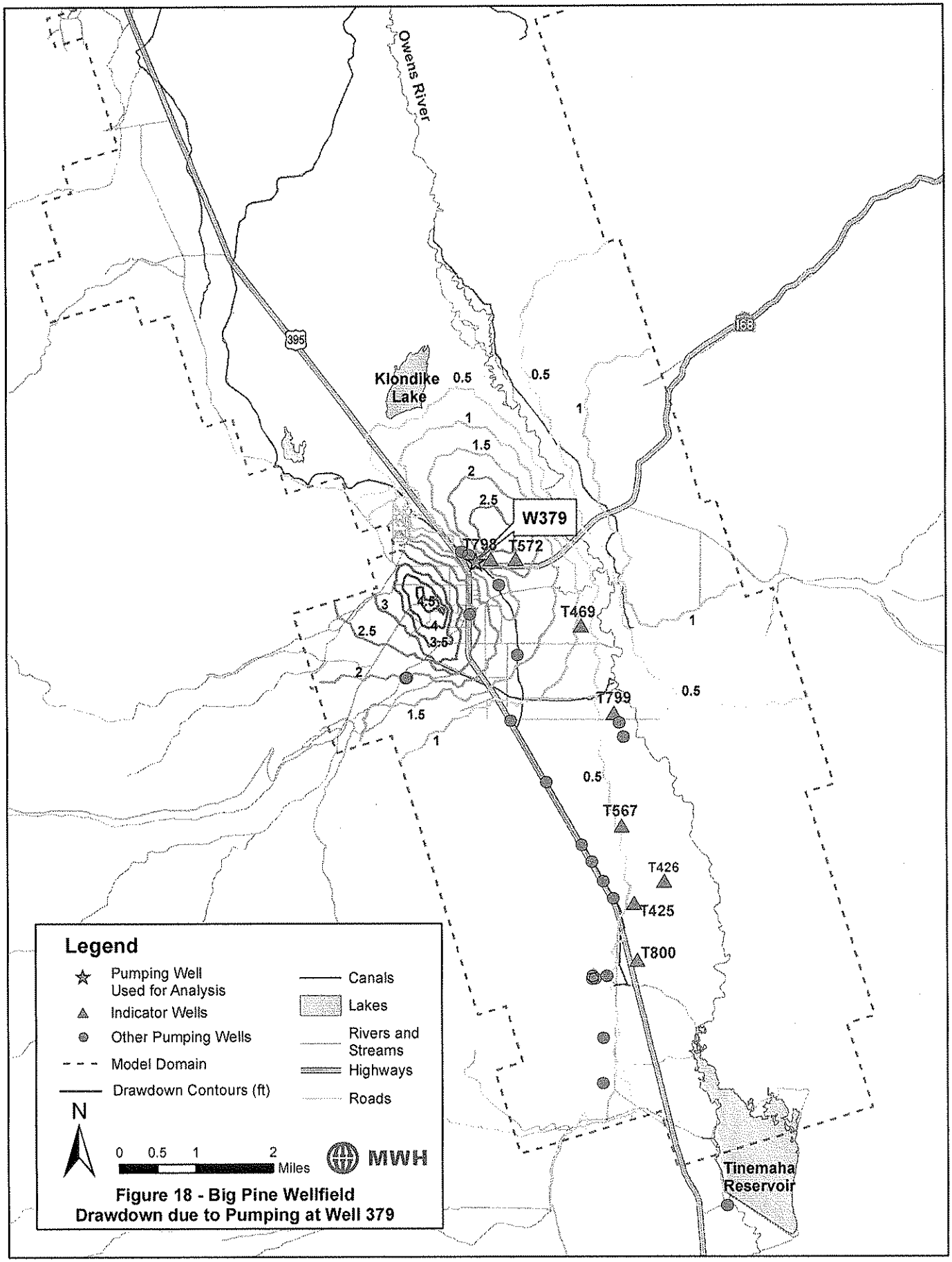


**Figure 18 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 379**

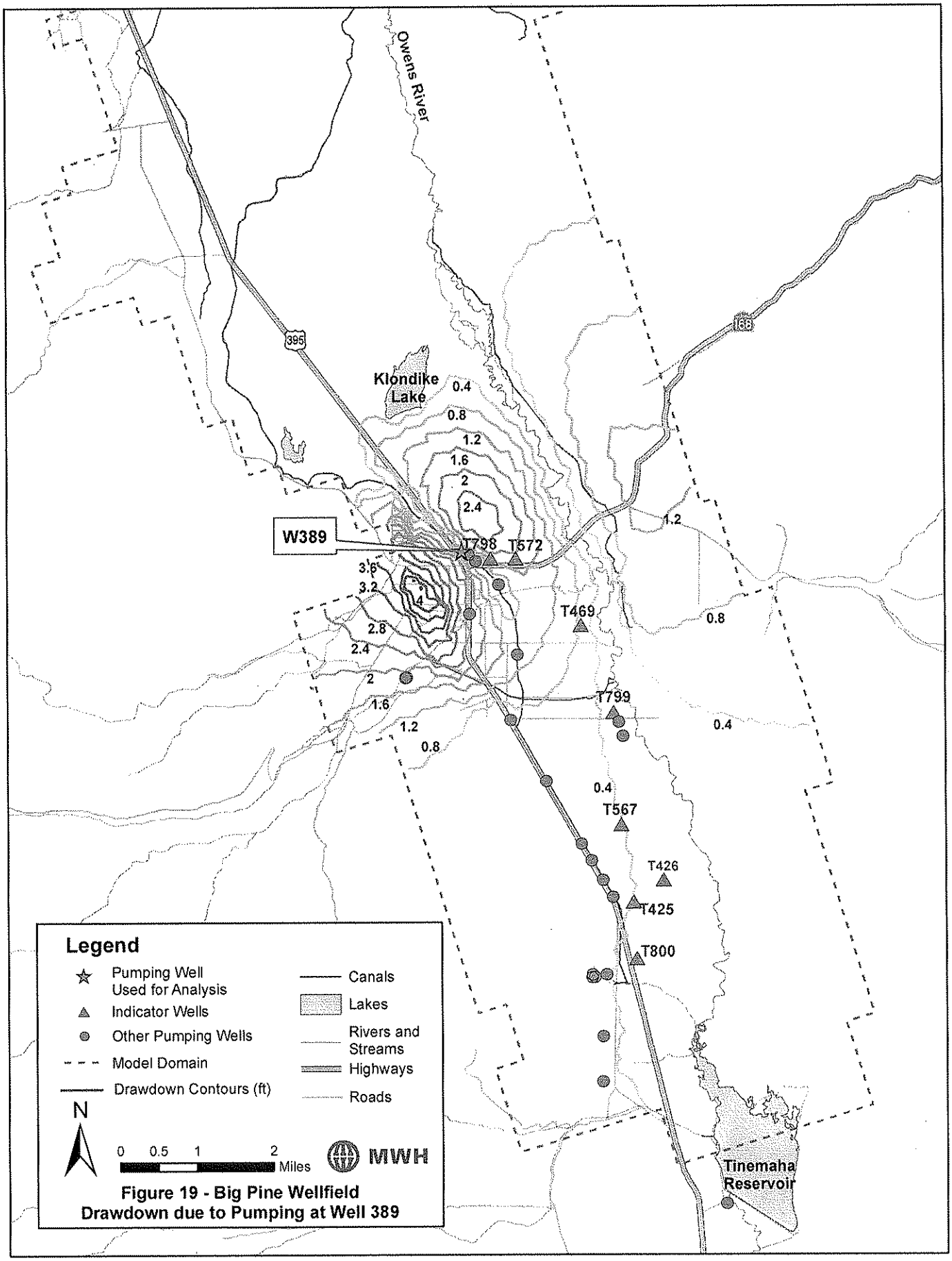


**Figure 19 - Big Pine Wellfield Drawdown due to Pumping at Well 389**

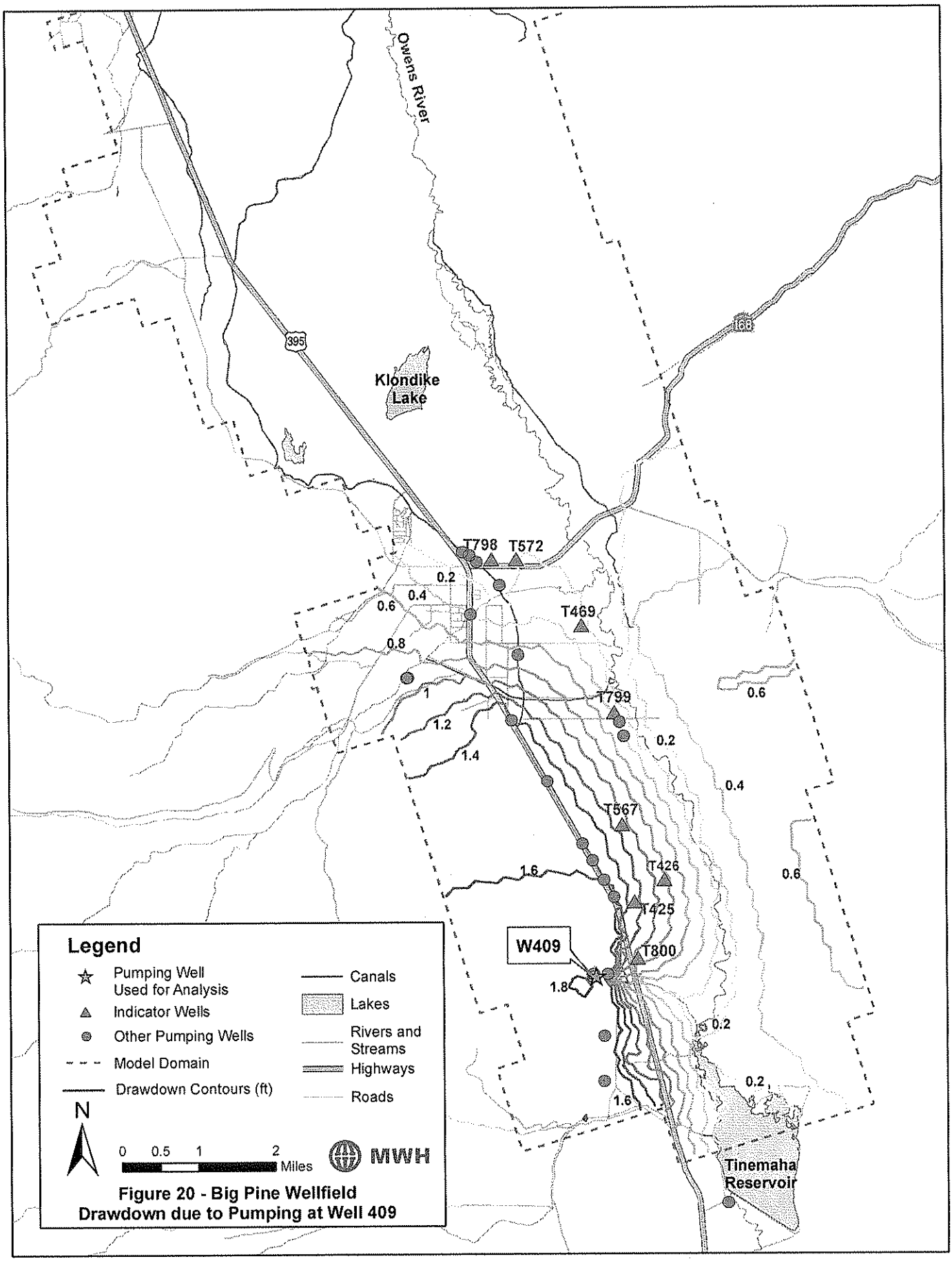


**Figure 20 - Big Pine Wellfield**
**Drawdown due to Pumping at Well 409**

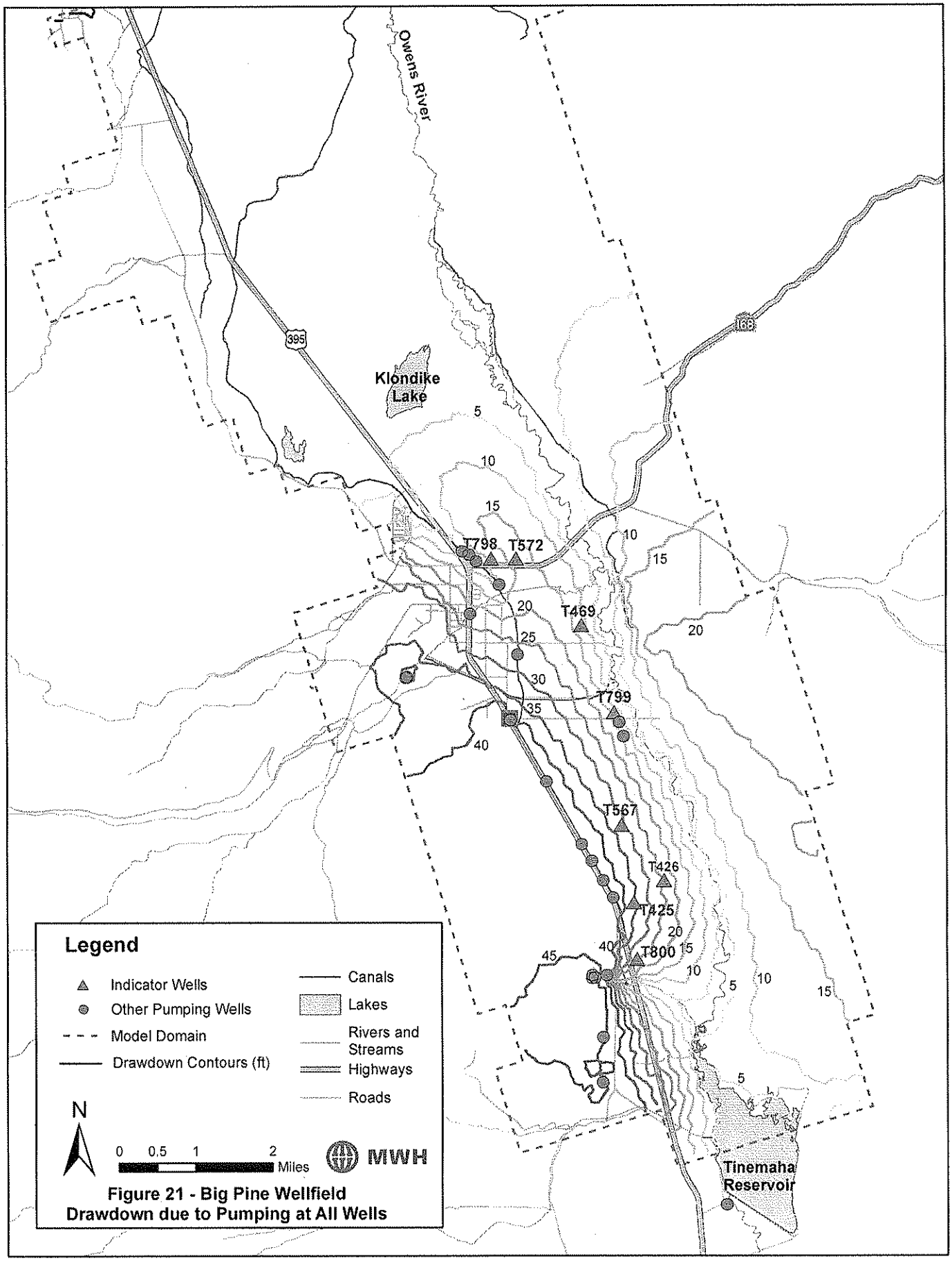


**Figure 21 - Big Pine Wellfield**
**Drawdown due to Pumping at All Wells**

## Table 5
## Indicator Location T798 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T798 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 1.0 | 8.8% |
| Well 218 | 1, 2 | 0.2 | 1.5% |
| Well 219 | 2 | 0.2 | 2.0% |
| Well 220 | 1 | 0.2 | 1.7% |
| Well 222 | 1 | 0.1 | 0.6% |
| Well 223 | 1,2 | 0.1 | 1.2% |
| Well 229 | 1 | 0.1 | 0.8% |
| Well 231 | 1 | 0.1 | 1.0% |
| Well 232 | 2 | 0.1 | 0.9% |
| Well 330 | 3 | 0.4 | 3.8% |
| Well 331 | 3 | 0.4 | 3.2% |
| Well 332 | 3 | 0.8 | 7.4% |
| Well 341 | 1,2,3 | 0.1 | 1.0% |
| Well 352 | 3 | 0.0 | 0.2% |
| Well 374 | 3 | 0.4 | 3.7% |
| Well 375 | 3 | 0.3 | 3.0% |
| Well 378 | 2 | 2.1 | 19.5% |
| Well 379 | 2 | 2.3 | 21.2% |
| Well 389 | 2 | 1.8 | 17.0% |
| Well 409 | 3 | 0.1 | 1.3% |
| **Total Drawdown (sum of pumping individual wells)** | | **10.8** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **13.3** | |

## Table 6
## Indicator Location T572 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T572 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 1.2 | 9.4% |
| Well 218 | 1, 2 | 0.2 | 1.7% |
| Well 219 | 2 | 0.3 | 2.3% |
| Well 220 | 1 | 0.2 | 1.9% |
| Well 222 | 1 | 0.1 | 0.7% |
| Well 223 | 1,2 | 0.2 | 1.4% |
| Well 229 | 1 | 0.1 | 1.0% |
| Well 231 | 1 | 0.2 | 1.2% |
| Well 232 | 2 | 0.1 | 1.0% |
| Well 330 | 3 | 0.6 | 4.5% |
| Well 331 | 3 | 0.5 | 3.8% |
| Well 332 | 3 | 1.1 | 8.7% |
| Well 341 | 1,2,3 | 0.1 | 1.0% |
| Well 352 | 3 | 0.0 | 0.2% |
| Well 374 | 3 | 0.6 | 4.6% |
| Well 375 | 3 | 0.5 | 3.6% |
| Well 378 | 2 | 2.2 | 17.3% |
| Well 379 | 2 | 2.4 | 19.0% |
| Well 389 | 2 | 1.9 | 15.2% |
| Well 409 | 3 | 0.2 | 1.5% |
| **Total Drawdown (sum of pumping individual wells)** | | **12.5** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **15.9** | |

## Table 7
## Indicator Location T469 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T469 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.5 | 5.2% |
| Well 218 | 1, 2 | 0.3 | 3.1% |
| Well 219 | 2 | 0.4 | 4.3% |
| Well 220 | 1 | 0.4 | 3.8% |
| Well 222 | 1 | 0.1 | 1.3% |
| Well 223 | 1,2 | 0.2 | 2.6% |
| Well 229 | 1 | 0.2 | 1.7% |
| Well 231 | 1 | 0.2 | 2.1% |
| Well 232 | 2 | 0.2 | 2.0% |
| Well 330 | 3 | 0.7 | 8.1% |
| Well 331 | 3 | 0.6 | 6.8% |
| Well 332 | 3 | 1.4 | 15.7% |
| Well 341 | 1,2,3 | 0.1 | 1.0% |
| Well 352 | 3 | 0.0 | 0.1% |
| Well 374 | 3 | 0.8 | 9.1% |
| Well 375 | 3 | 0.7 | 7.1% |
| Well 378 | 2 | 0.7 | 7.8% |
| Well 379 | 2 | 0.8 | 8.5% |
| Well 389 | 2 | 0.6 | 6.9% |
| Well 409 | 3 | 0.3 | 2.8% |
| **Total Drawdown (sum of pumping individual wells)** | | **9.1** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **11.3** | |

## Table 8
## Indicator Location T799 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T799 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.2 | 1.9% |
| Well 218 | 1, 2 | 0.3 | 3.9% |
| Well 219 | 2 | 0.5 | 5.3% |
| Well 220 | 1 | 0.4 | 4.1% |
| Well 222 | 1 | 0.1 | 1.6% |
| Well 223 | 1,2 | 0.3 | 3.3% |
| Well 229 | 1 | 0.2 | 2.1% |
| Well 231 | 1 | 0.2 | 2.6% |
| Well 232 | 2 | 0.2 | 2.4% |
| Well 330 | 3 | 0.9 | 10.1% |
| Well 331 | 3 | 0.7 | 8.5% |
| Well 332 | 3 | 1.7 | 19.5% |
| Well 341 | 1,2,3 | 0.1 | 0.8% |
| Well 352 | 3 | 0.0 | 0.1% |
| Well 374 | 3 | 1.0 | 11.8% |
| Well 375 | 3 | 0.8 | 9.8% |
| Well 378 | 2 | 0.3 | 2.9% |
| Well 379 | 2 | 0.3 | 3.2% |
| Well 389 | 2 | 0.2 | 2.6% |
| Well 409 | 3 | 0.3 | 3.5% |
| **Total Drawdown (sum of pumping individual wells)** | | **8.5** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **10.5** | |

## Table 9
## Indicator Location T567 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T567 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.3 | 1.1% |
| Well 218 | 1, 2 | 1.2 | 4.6% |
| Well 219 | 2 | 1.7 | 6.4% |
| Well 220 | 1 | 0.9 | 3.6% |
| Well 222 | 1 | 0.5 | 2.1% |
| Well 223 | 1,2 | 1.0 | 4.1% |
| Well 229 | 1 | 0.6 | 2.3% |
| Well 231 | 1 | 0.8 | 3.3% |
| Well 232 | 2 | 0.8 | 2.9% |
| Well 330 | 3 | 3.1 | 12.2% |
| Well 331 | 3 | 2.6 | 10.2% |
| Well 332 | 3 | 6.1 | 23.7% |
| Well 341 | 1,2,3 | 0.2 | 0.7% |
| Well 352 | 3 | 0.0 | 0.0% |
| Well 374 | 3 | 1.8 | 6.9% |
| Well 375 | 3 | 1.6 | 6.2% |
| Well 378 | 2 | 0.5 | 1.8% |
| Well 379 | 2 | 0.5 | 1.9% |
| Well 389 | 2 | 0.4 | 1.6% |
| Well 409 | 3 | 1.1 | 4.3% |
| **Total Drawdown (sum of pumping individual wells)** | | **25.6** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **31.3** | |

## Table 10
## Indicator Location T426 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T426 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.2 | 1.0% |
| Well 218 | 1, 2 | 1.0 | 4.8% |
| Well 219 | 2 | 1.3 | 6.7% |
| Well 220 | 1 | 0.7 | 3.3% |
| Well 222 | 1 | 0.4 | 2.0% |
| Well 223 | 1,2 | 0.9 | 4.4% |
| Well 229 | 1 | 0.4 | 2.2% |
| Well 231 | 1 | 0.6 | 3.0% |
| Well 232 | 2 | 0.6 | 2.9% |
| Well 330 | 3 | 2.5 | 12.7% |
| Well 331 | 3 | 2.1 | 10.6% |
| Well 332 | 3 | 4.9 | 24.5% |
| Well 341 | 1,2,3 | 0.1 | 0.7% |
| Well 352 | 3 | 0.0 | 0.1% |
| Well 374 | 3 | 1.2 | 6.2% |
| Well 375 | 3 | 1.1 | 5.6% |
| Well 378 | 2 | 0.3 | 1.6% |
| Well 379 | 2 | 0.3 | 1.7% |
| Well 389 | 2 | 0.3 | 1.5% |
| Well 409 | 3 | 0.9 | 4.4% |
| **Total Drawdown (sum of pumping individual wells)** | | **19.8** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **24.7** | |

## Table 11
## Indicator Location T425 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T425 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.3 | 1.0% |
| Well 218 | 1, 2 | 1.4 | 4.9% |
| Well 219 | 2 | 1.9 | 6.9% |
| Well 220 | 1 | 0.9 | 3.3% |
| Well 222 | 1 | 0.6 | 2.0% |
| Well 223 | 1,2 | 1.3 | 4.7% |
| Well 229 | 1 | 0.6 | 2.1% |
| Well 231 | 1 | 0.8 | 3.0% |
| Well 232 | 2 | 0.8 | 3.0% |
| Well 330 | 3 | 3.6 | 13.0% |
| Well 331 | 3 | 3.0 | 10.8% |
| Well 332 | 3 | 7.0 | 25.1% |
| Well 341 | 1,2,3 | 0.2 | 0.7% |
| Well 352 | 3 | 0.0 | 0.0% |
| Well 374 | 3 | 1.5 | 5.5% |
| Well 375 | 3 | 1.3 | 4.8% |
| Well 378 | 2 | 0.4 | 1.6% |
| Well 379 | 2 | 0.5 | 1.6% |
| Well 389 | 2 | 0.4 | 1.4% |
| Well 409 | 3 | 1.3 | 4.5% |
| **Total Drawdown (sum of pumping individual wells)** | | **27.7** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **34.5** | |

## Table 12
## Indicator Location T800 – Big Pine

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T800 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 210 | 2 | 0.2 | 0.9% |
| Well 218 | 1, 2 | 1.0 | 5.2% |
| Well 219 | 2 | 1.4 | 7.2% |
| Well 220 | 1 | 0.6 | 3.2% |
| Well 222 | 1 | 0.4 | 1.9% |
| Well 223 | 1,2 | 0.8 | 4.1% |
| Well 229 | 1 | 0.4 | 2.0% |
| Well 231 | 1 | 0.6 | 2.9% |
| Well 232 | 2 | 0.5 | 2.8% |
| Well 330 | 3 | 2.6 | 13.4% |
| Well 331 | 3 | 2.2 | 11.3% |
| Well 332 | 3 | 5.0 | 25.9% |
| Well 341 | 1,2,3 | 0.1 | 0.6% |
| Well 352 | 3 | 0.0 | 0.1% |
| Well 374 | 3 | 1.0 | 5.1% |
| Well 375 | 3 | 0.9 | 4.4% |
| Well 378 | 2 | 0.3 | 1.5% |
| Well 379 | 2 | 0.3 | 1.6% |
| Well 389 | 2 | 0.3 | 1.3% |
| Well 409 | 3 | 0.9 | 4.7% |
| **Total Drawdown (sum of pumping individual wells)** | | **19.1** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **24.4** | |

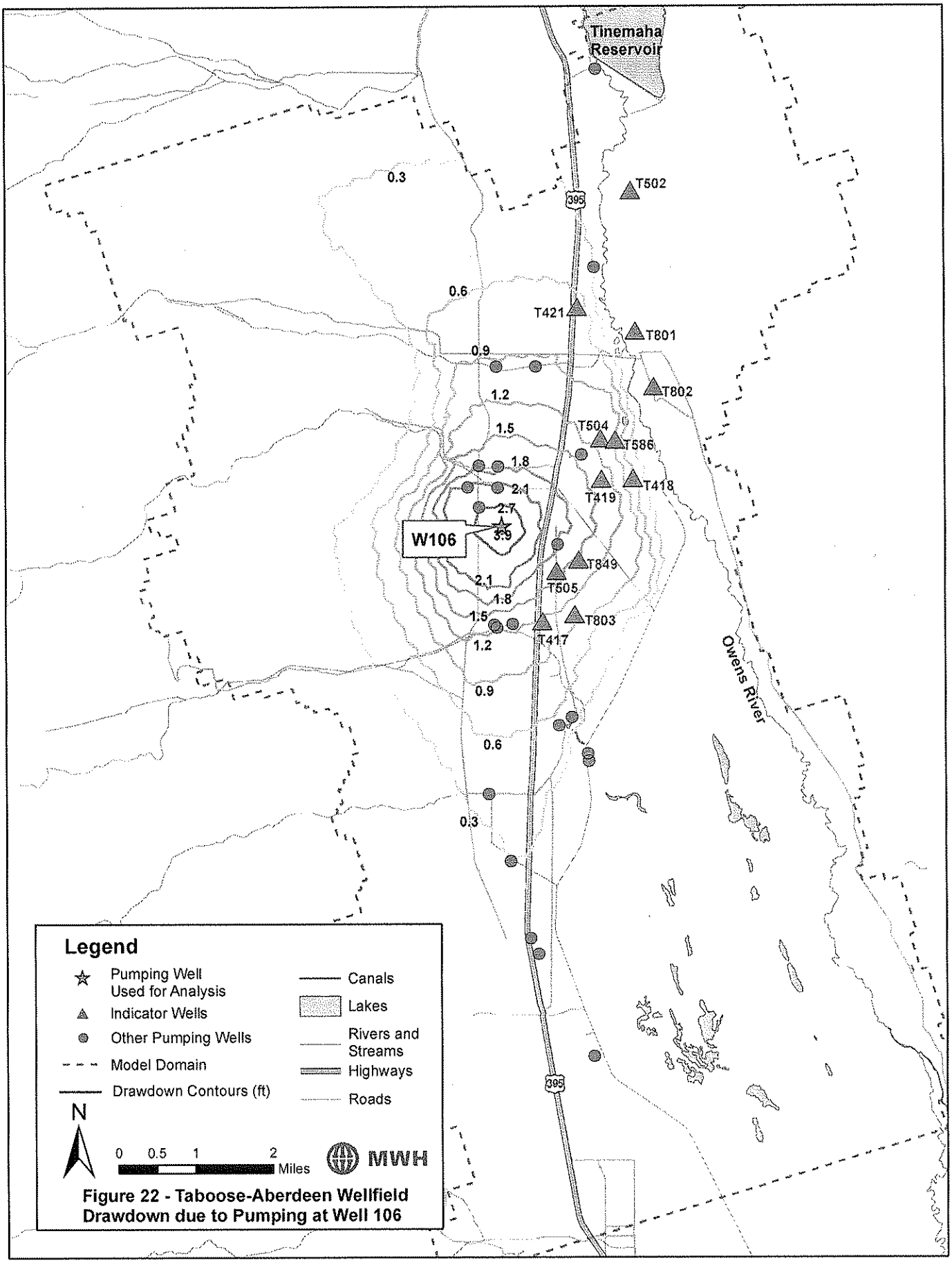


**Figure 22 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 106**

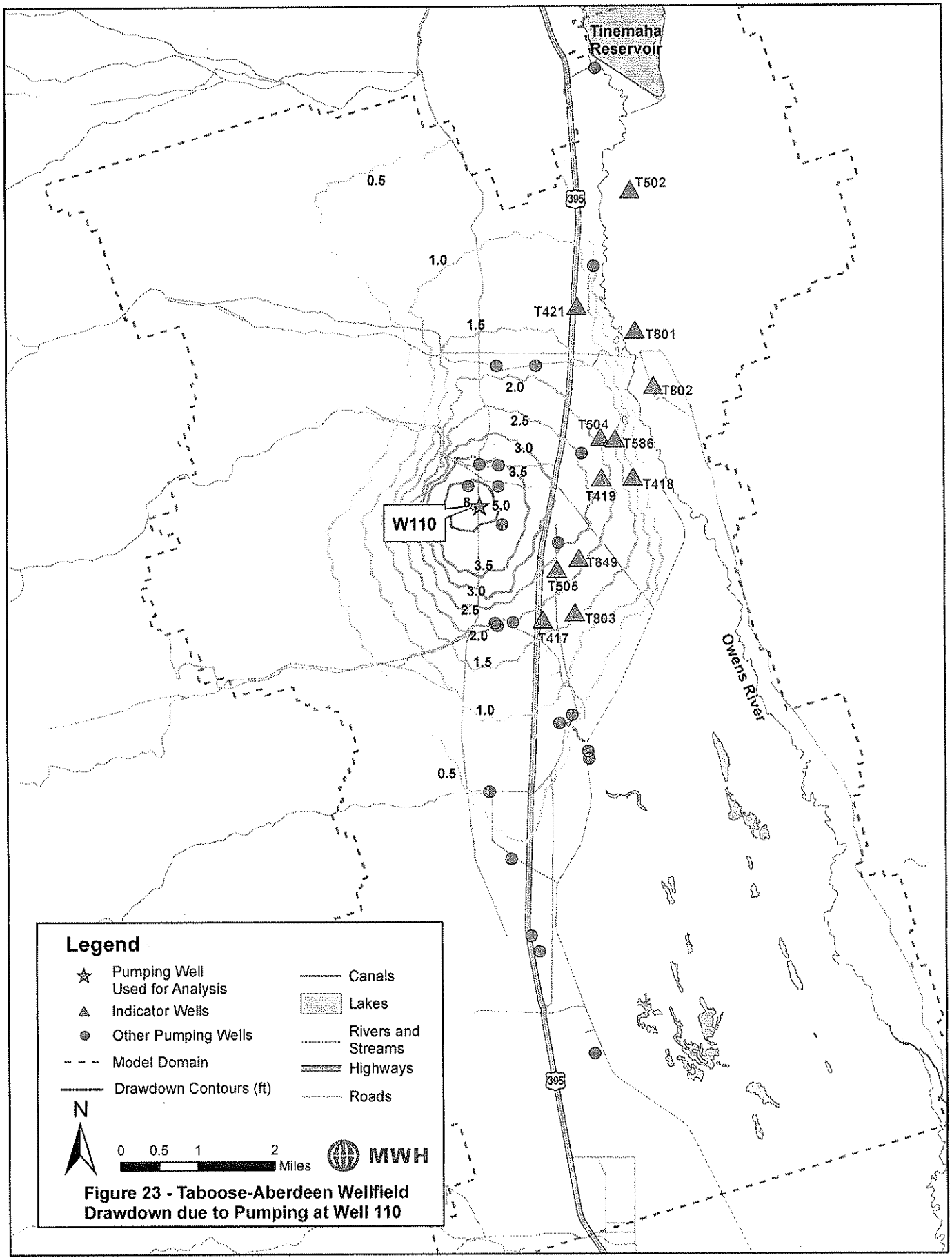


**Figure 23 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 110**

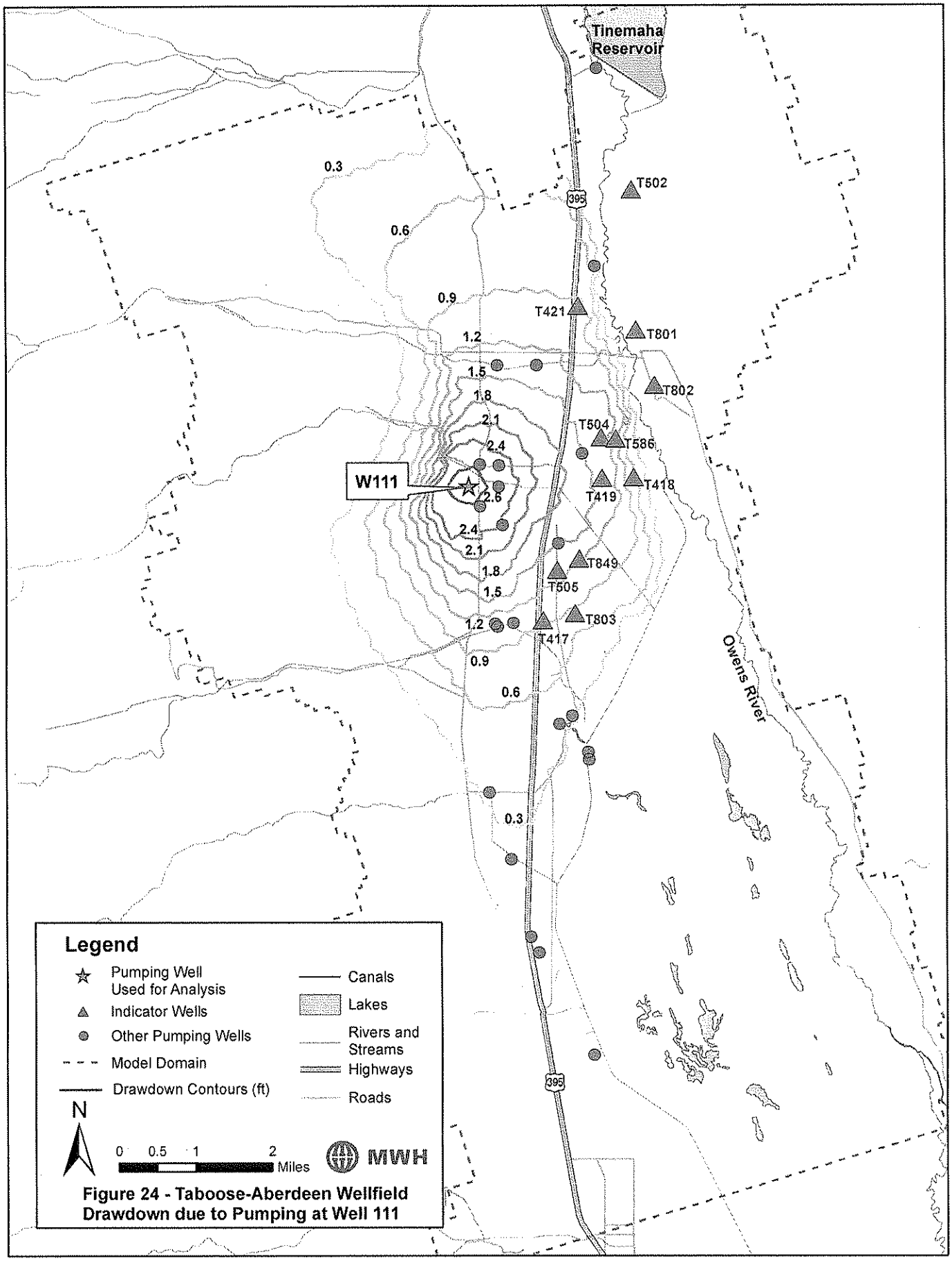


**Figure 24 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 111**

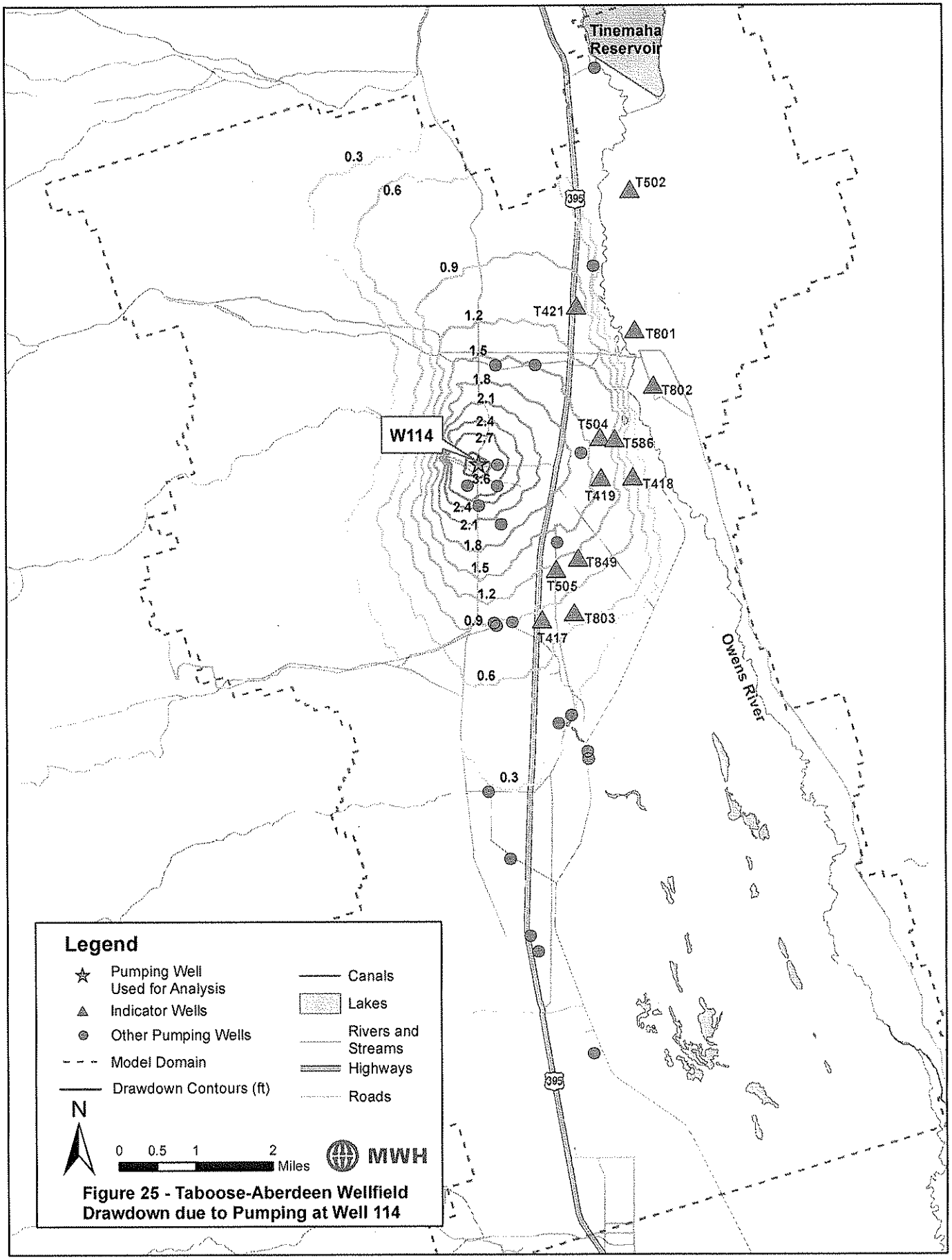


**Figure 25 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 114**

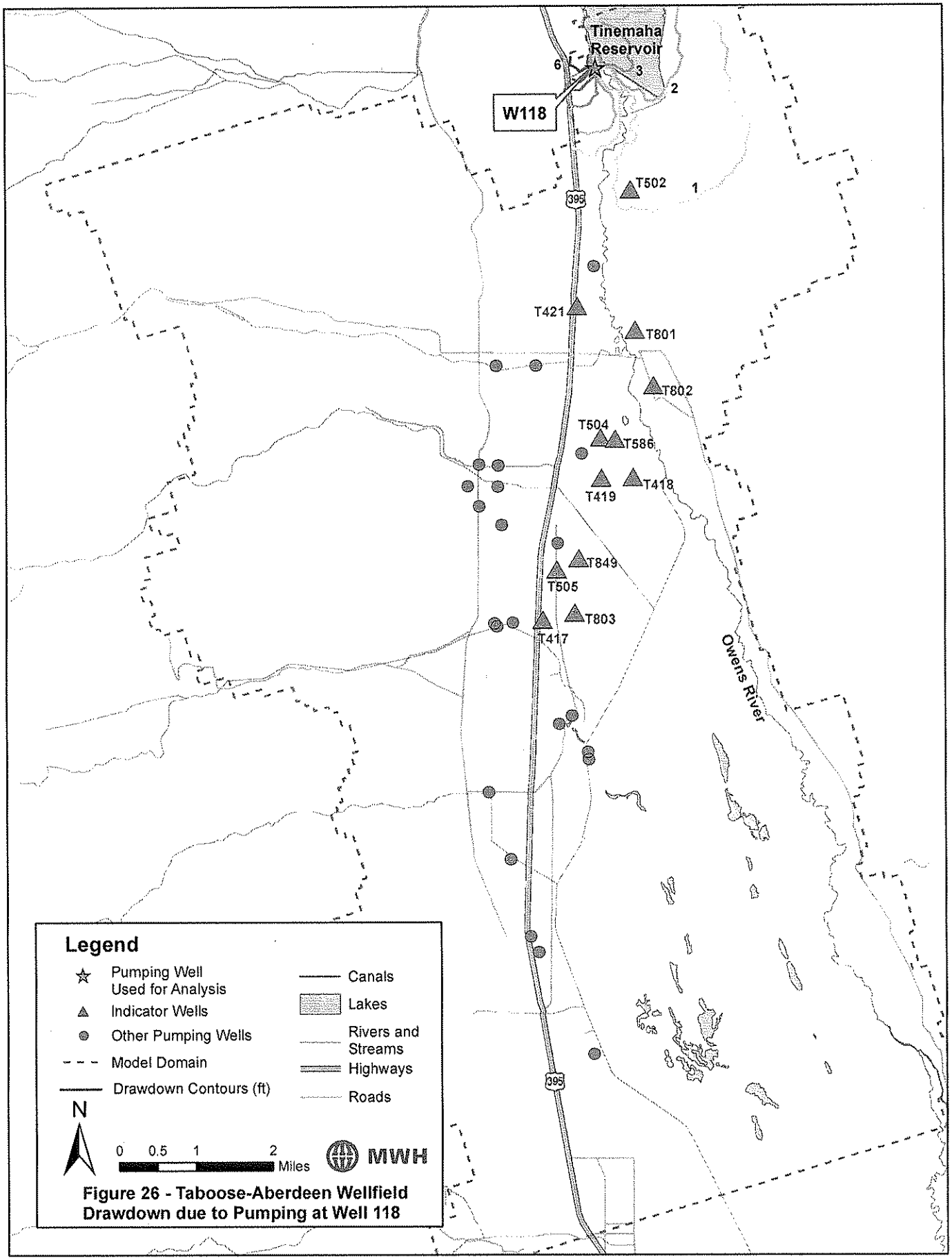


**Figure 26 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 118**

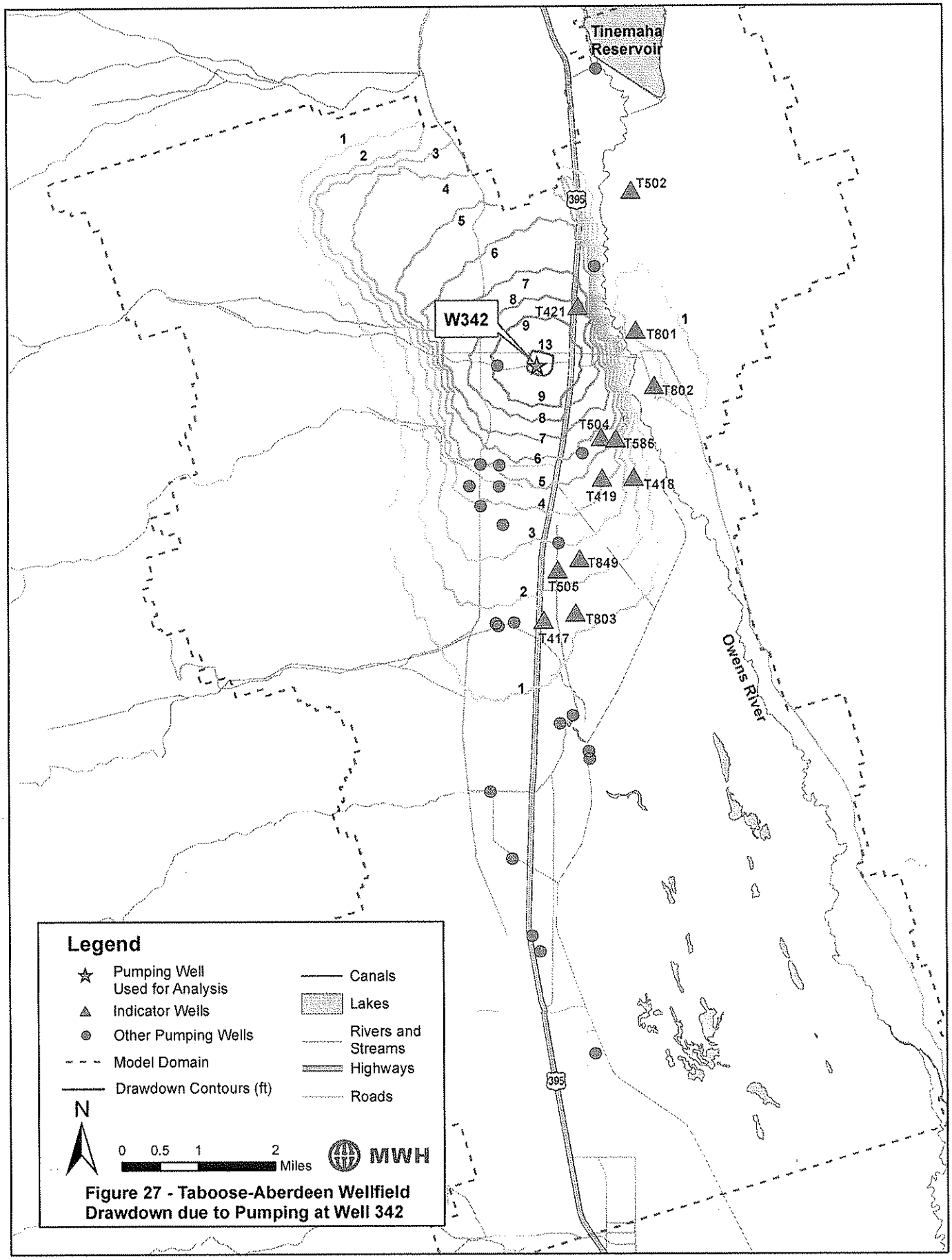


**Figure 27 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 342**

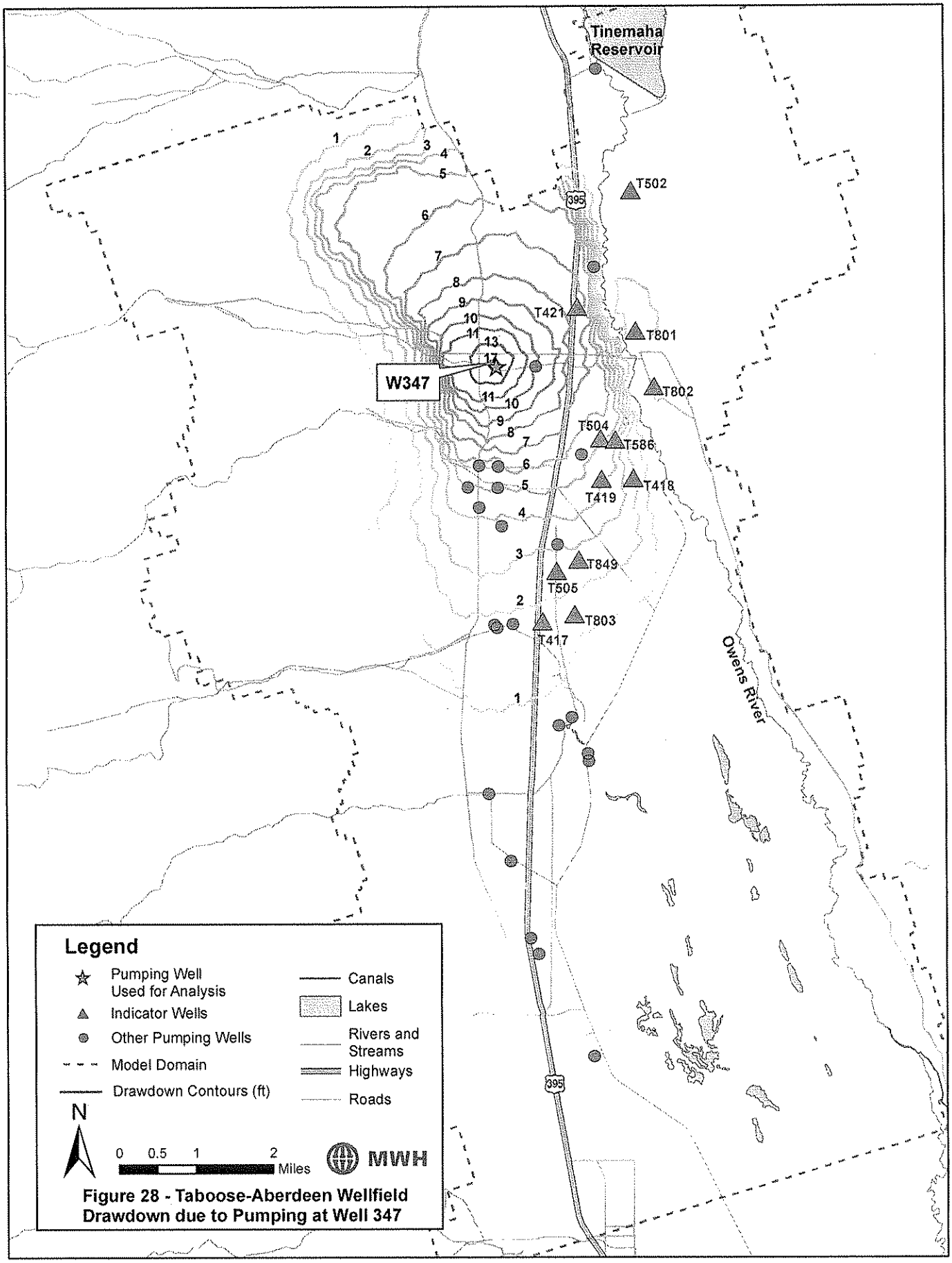


**Figure 28 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 347**

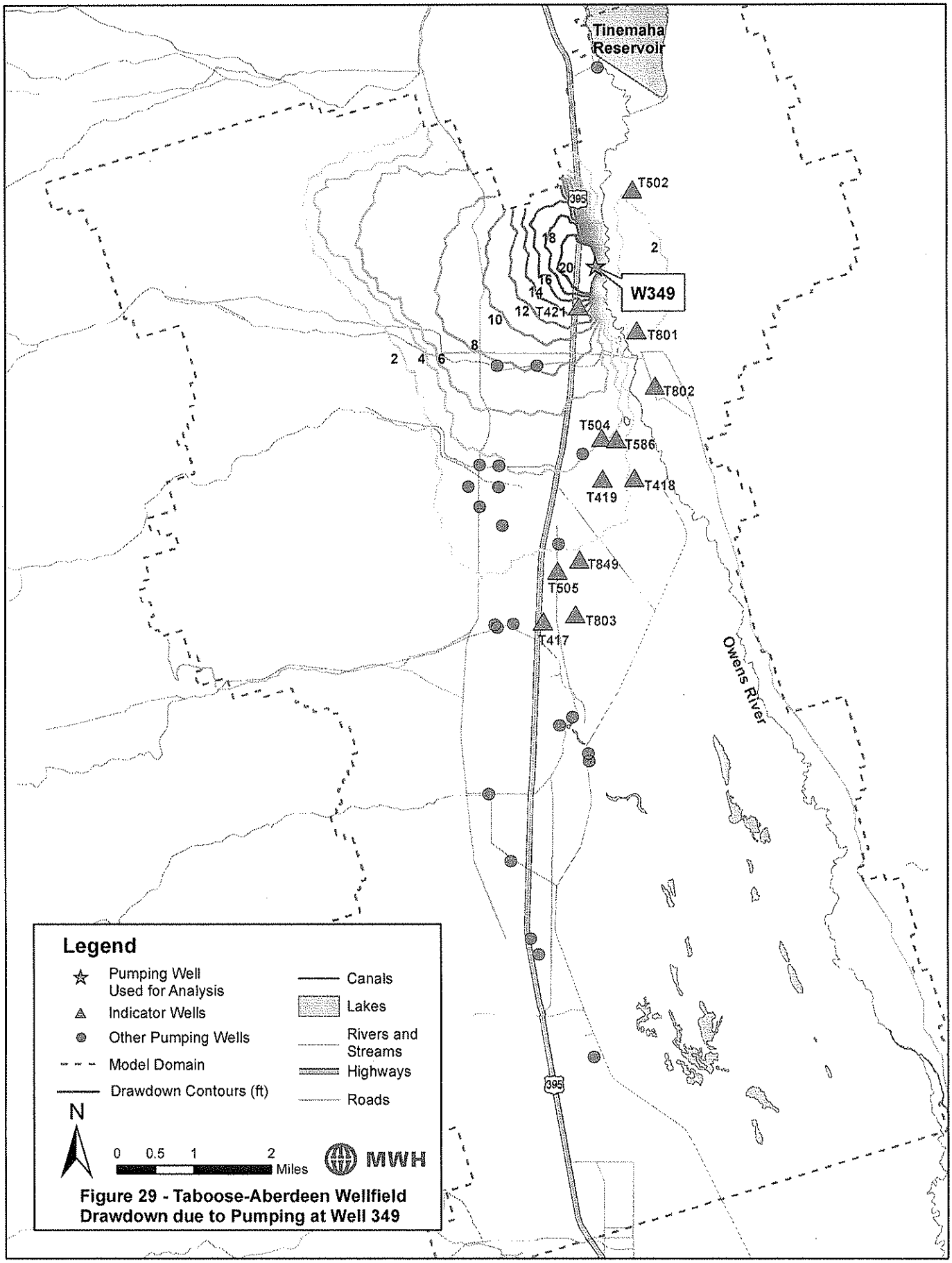


**Figure 29 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 349**

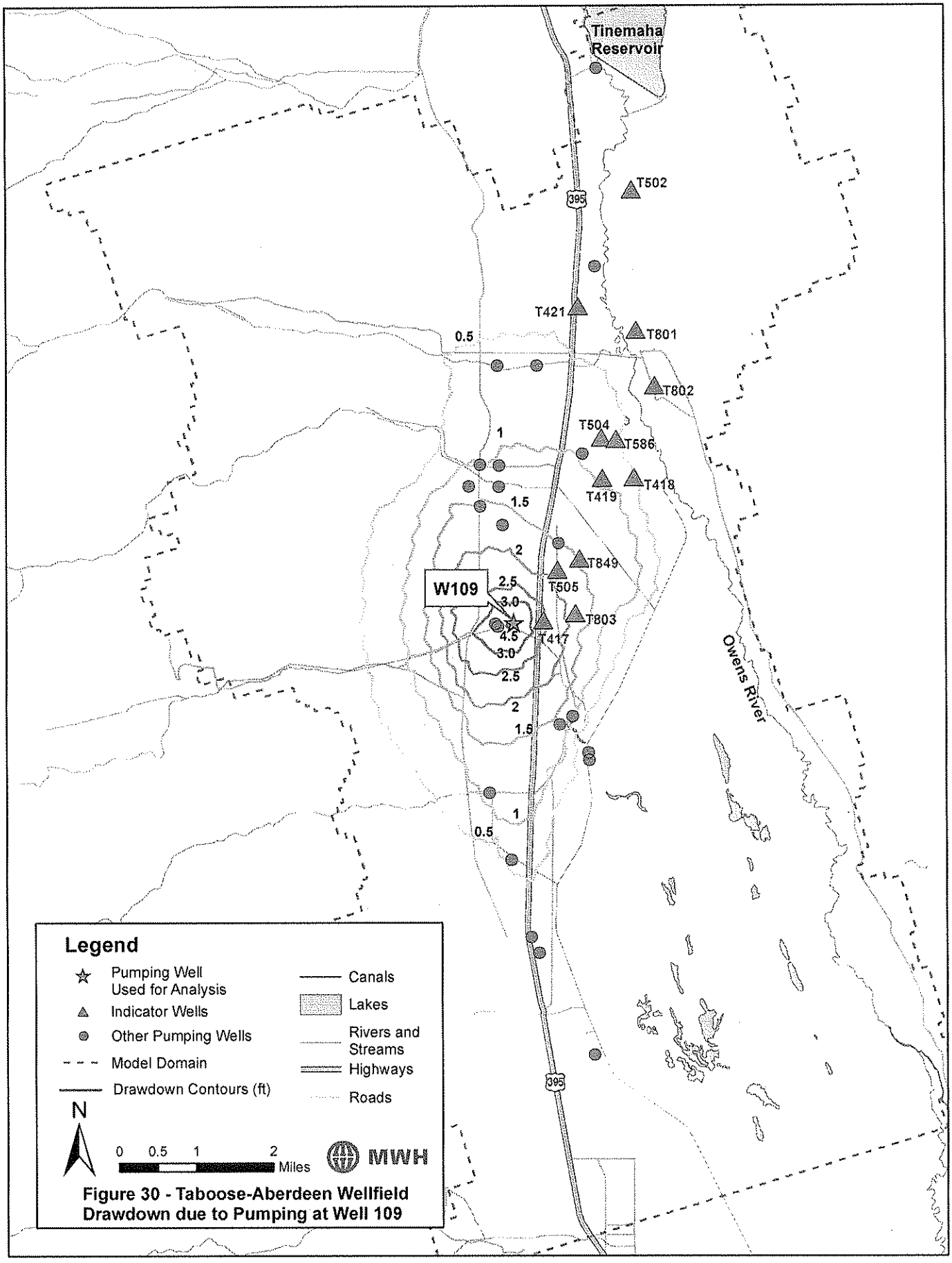


**Figure 30 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 109**

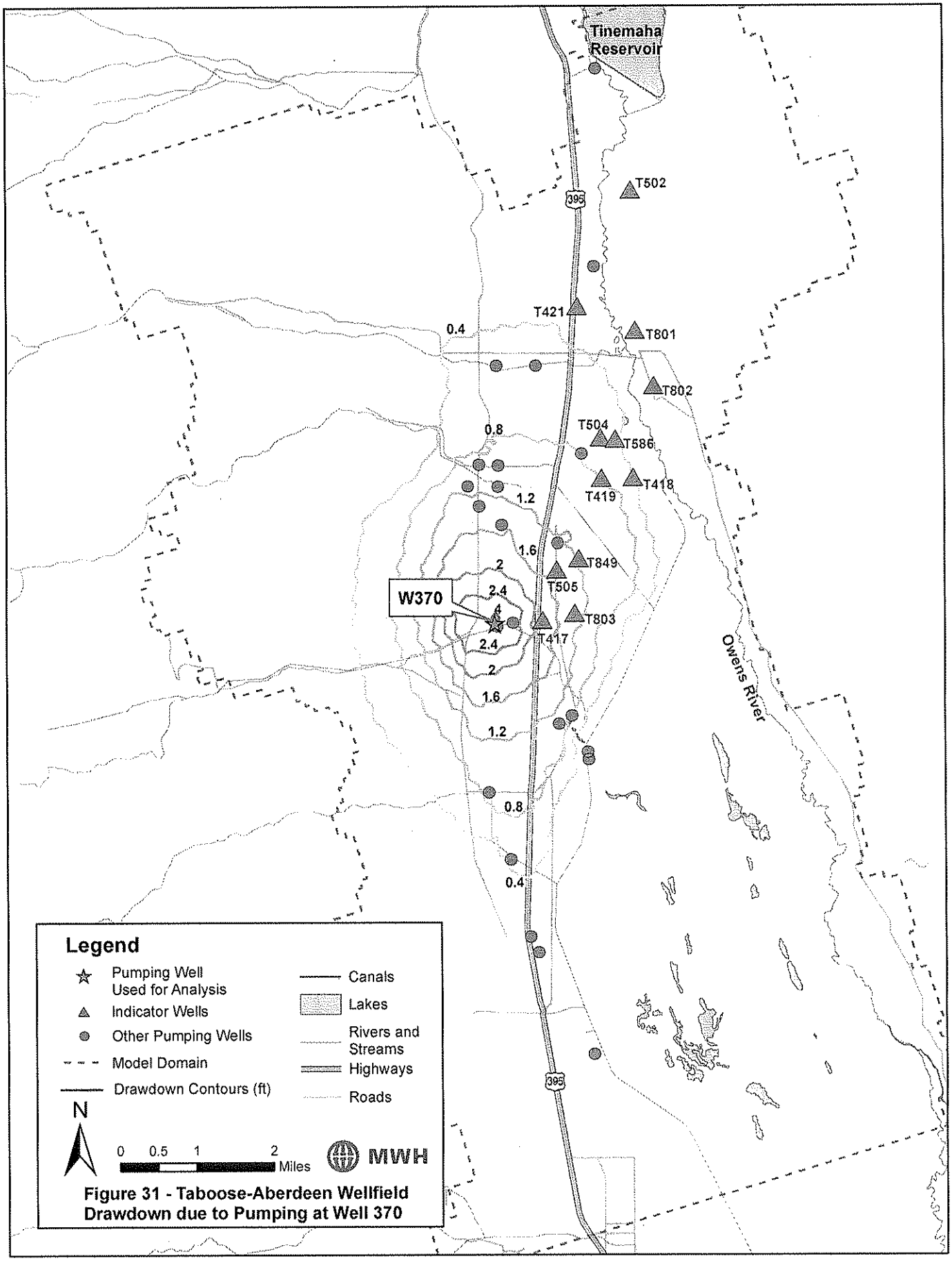


**Figure 31 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 370**

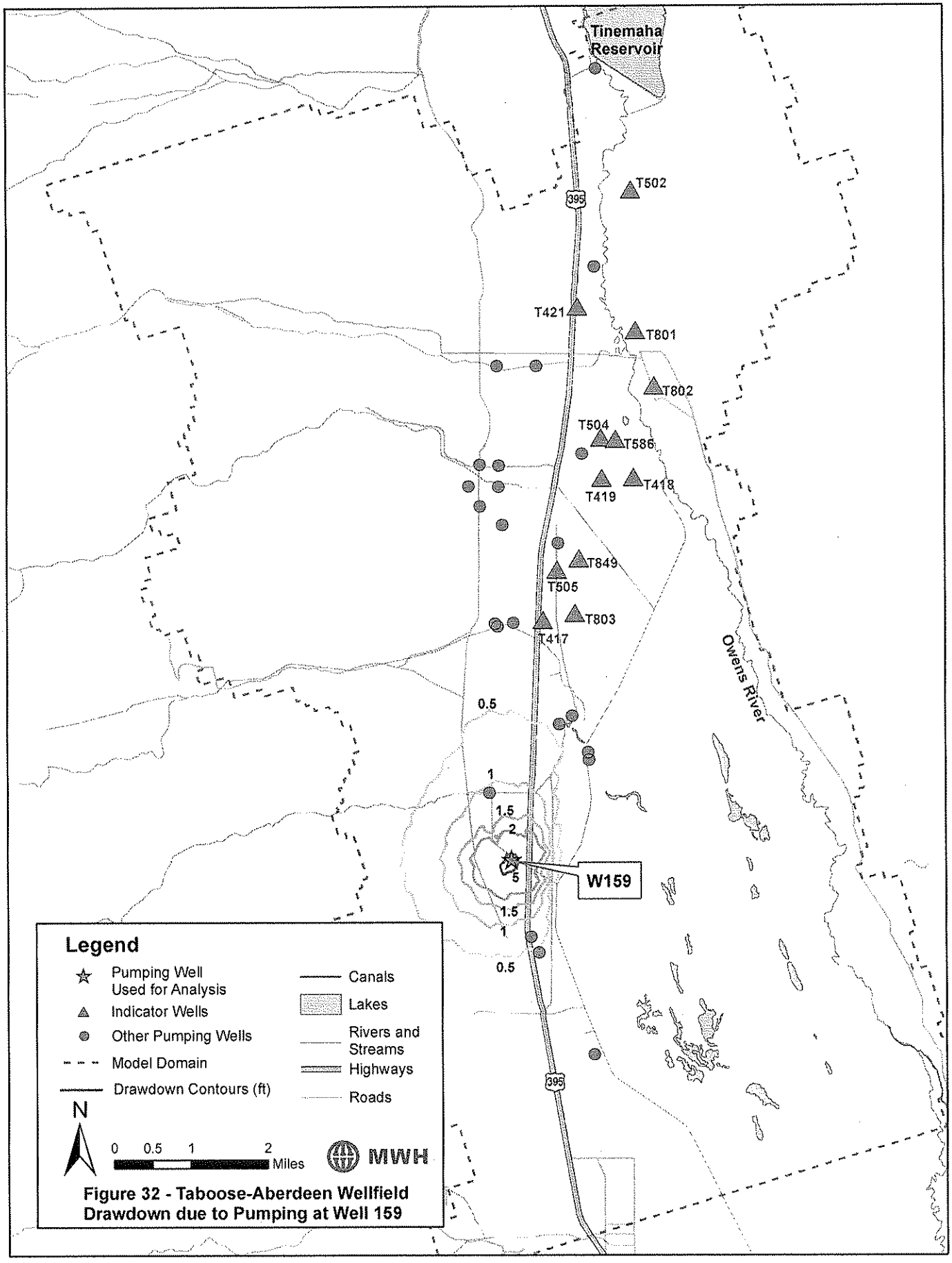


**Figure 32 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 159**

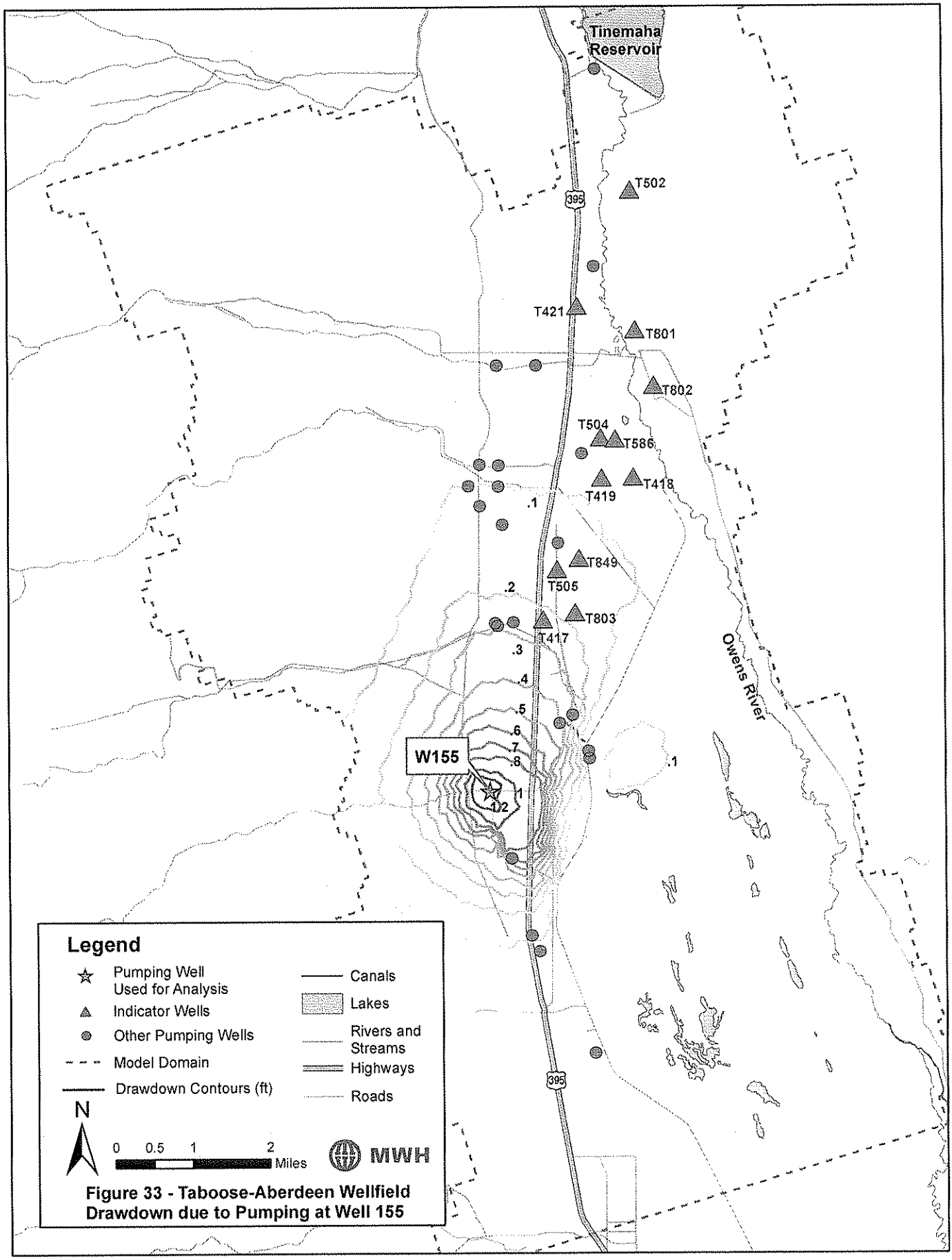


**Figure 33 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 155**

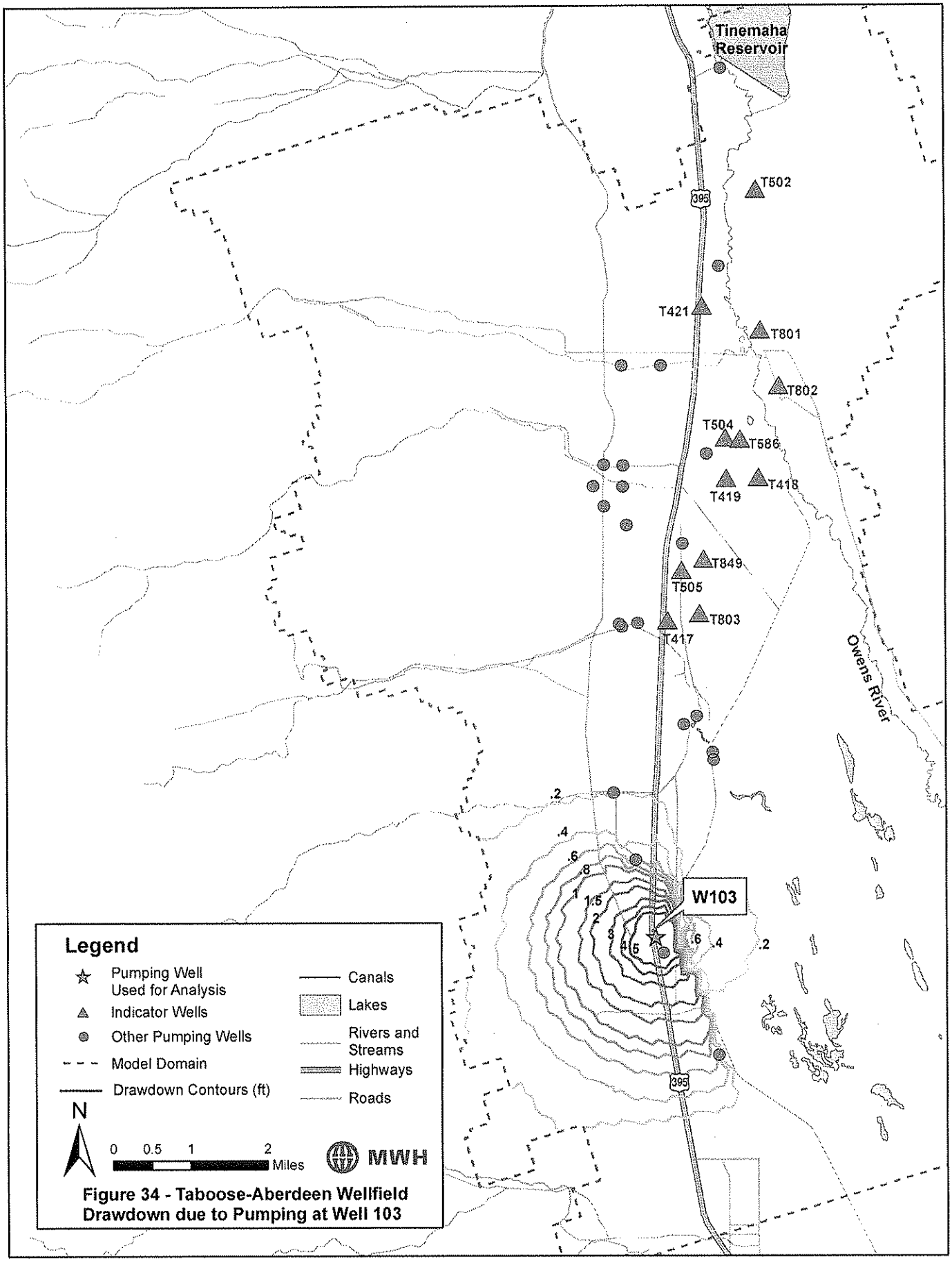


**Figure 34 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 103**

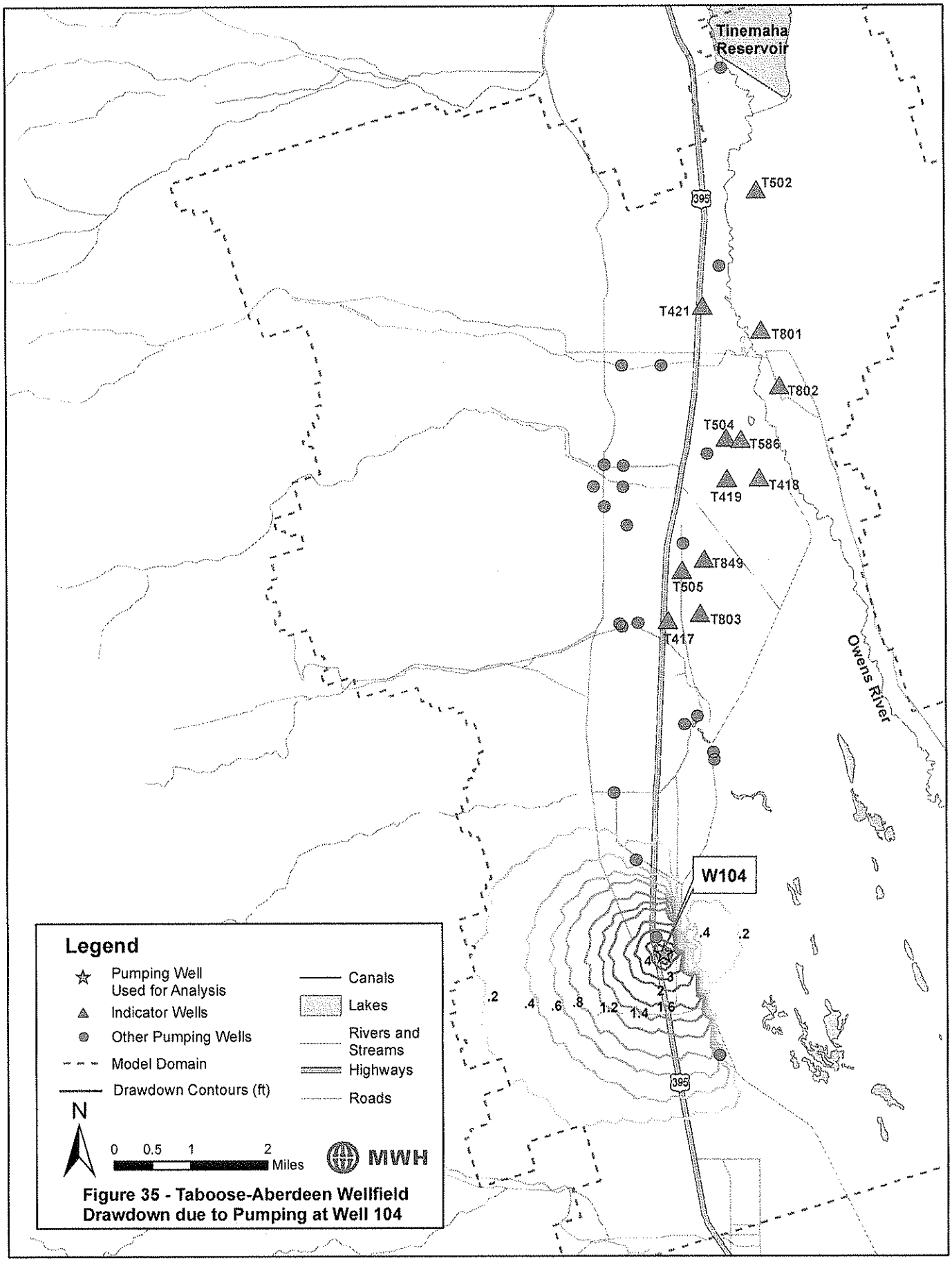


**Figure 35 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 104**

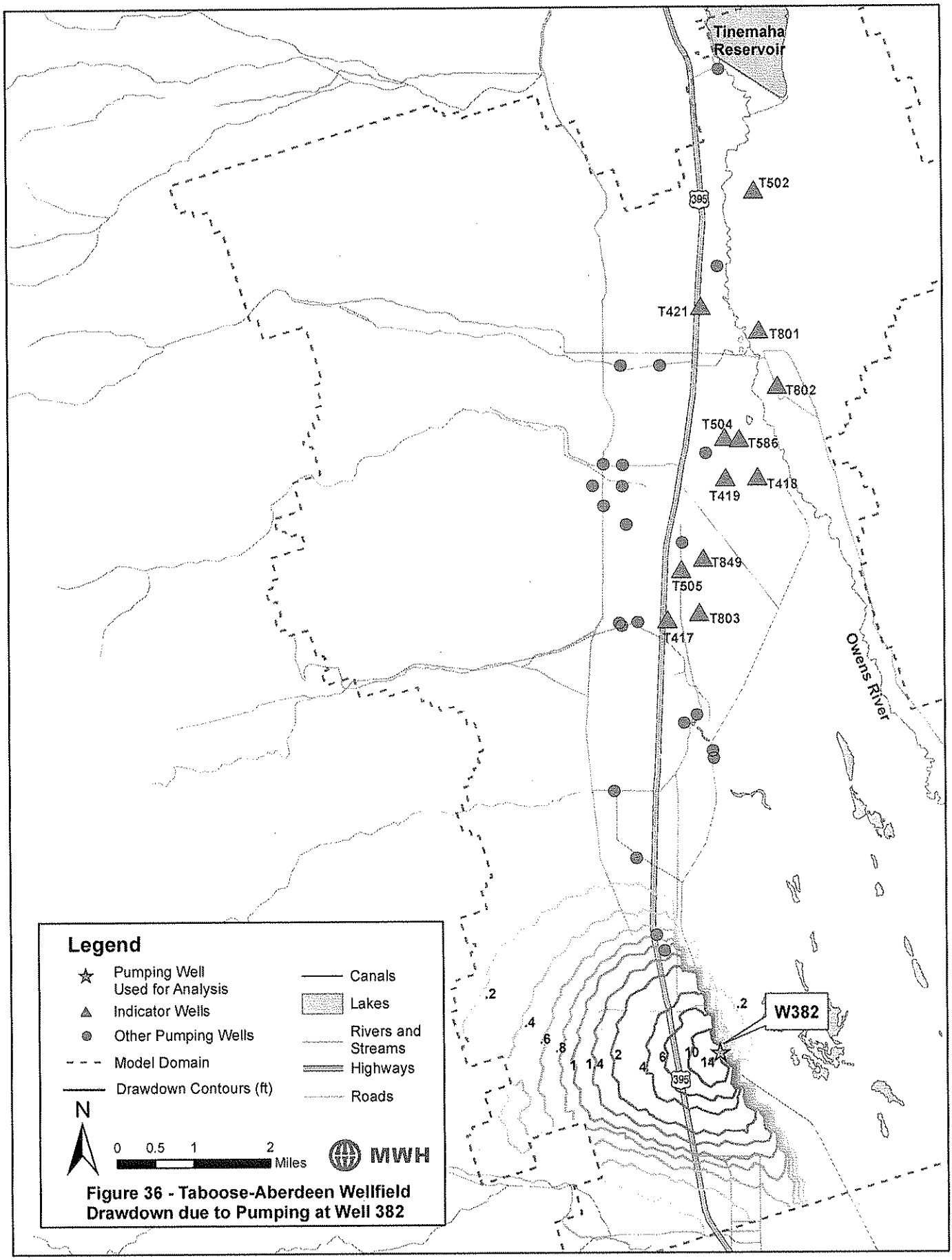


**Figure 36 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 382**

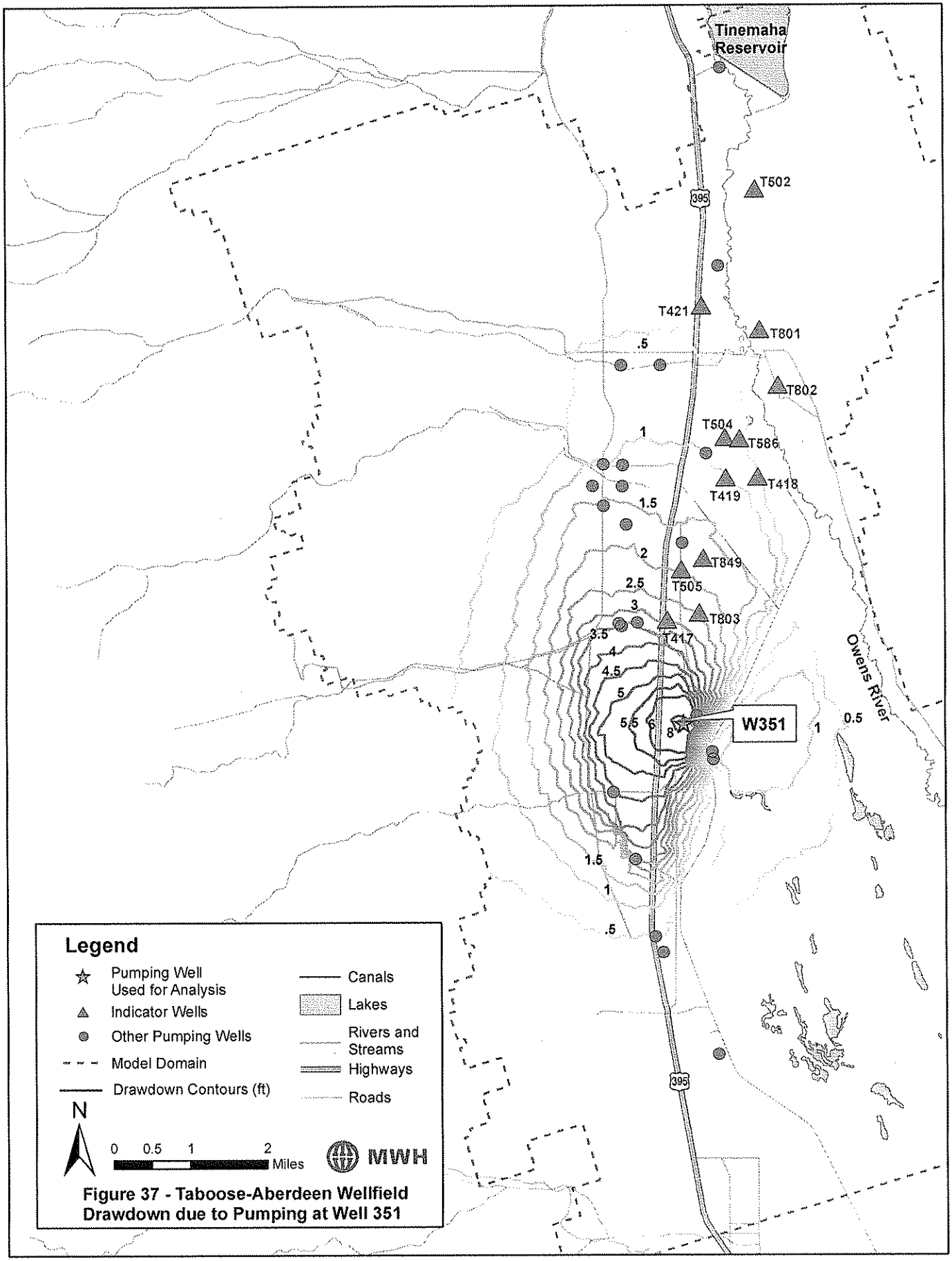


**Figure 37 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 351**

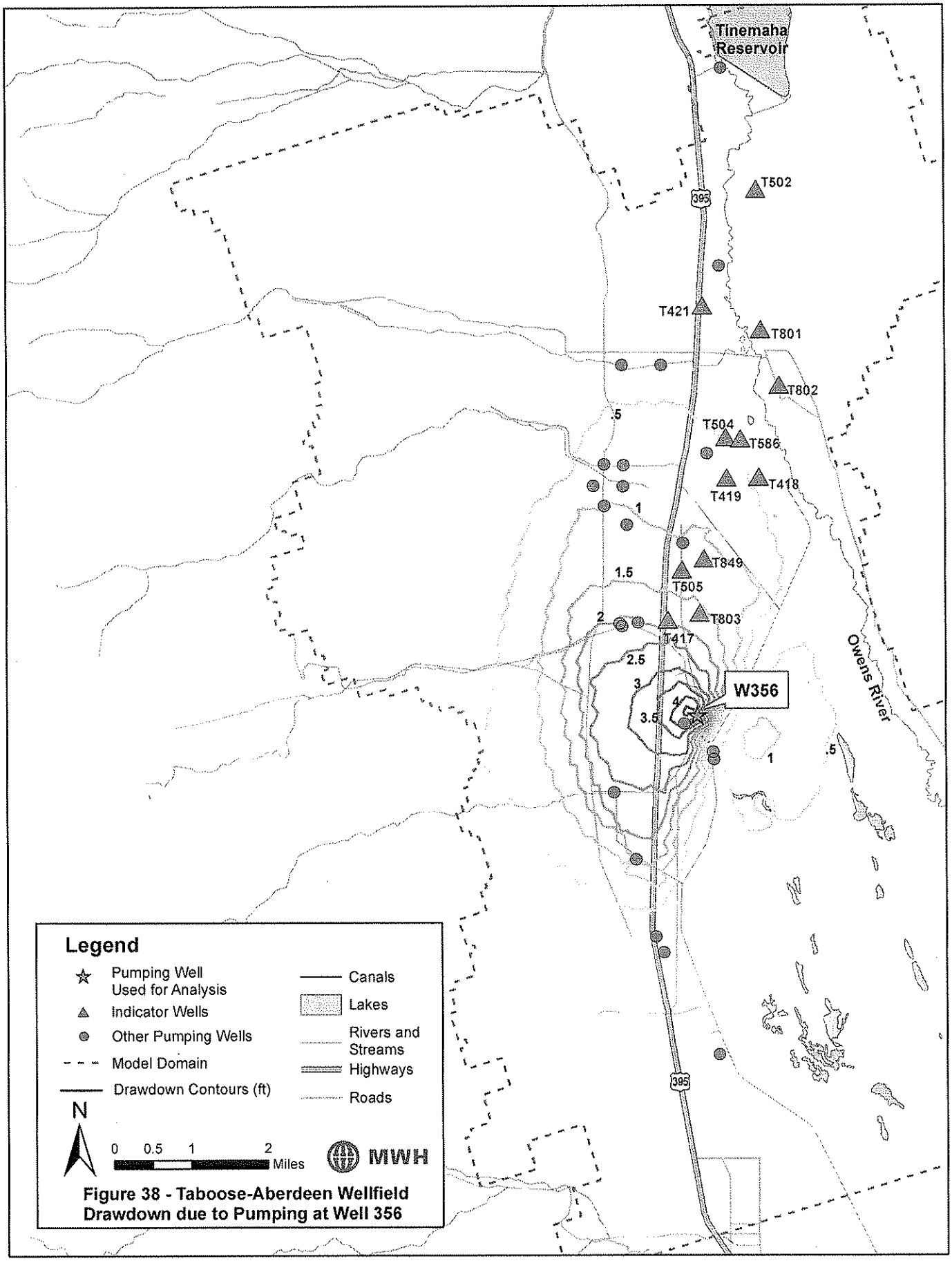


**Figure 38 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 356**

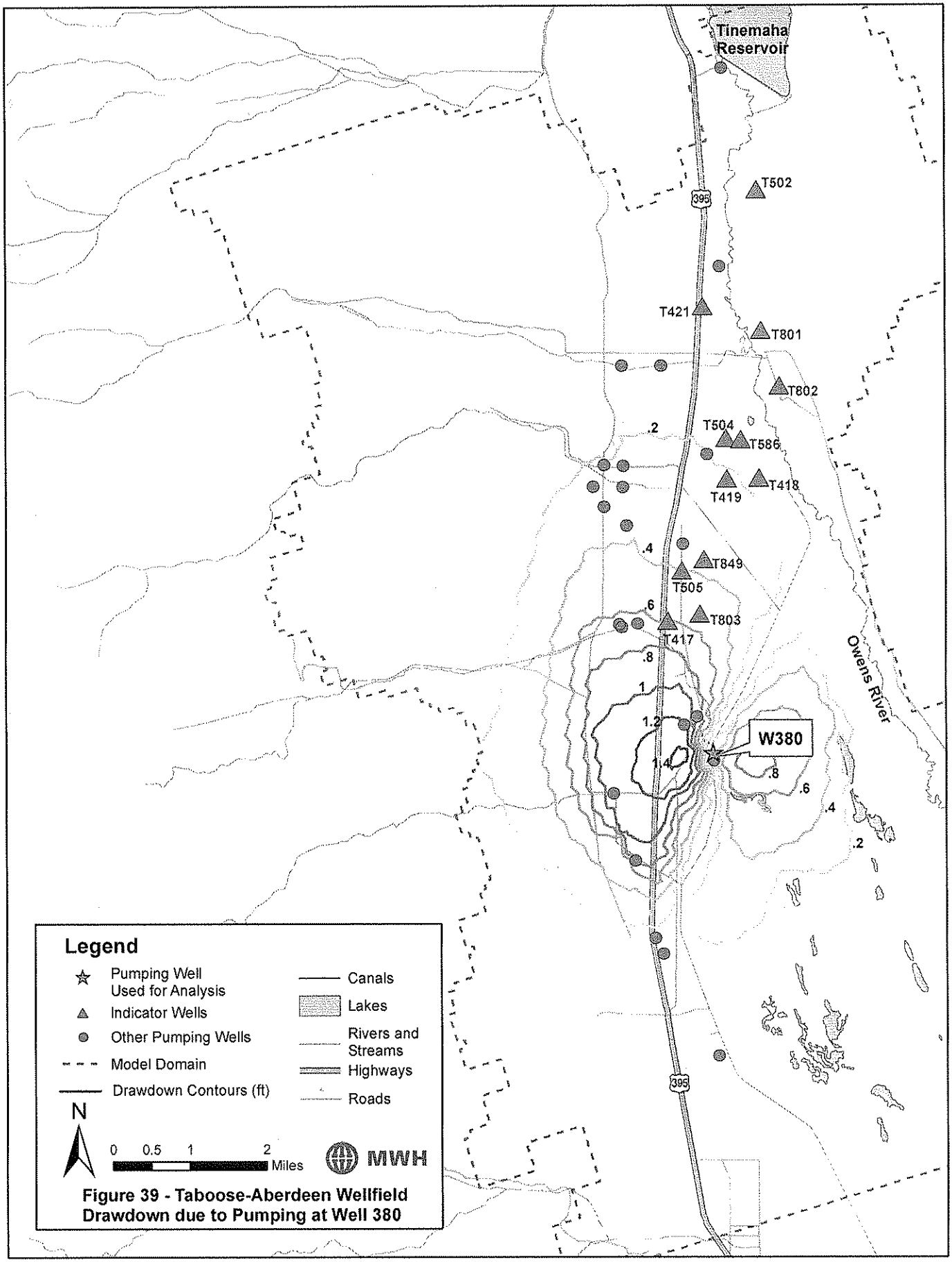


**Figure 39 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 380**

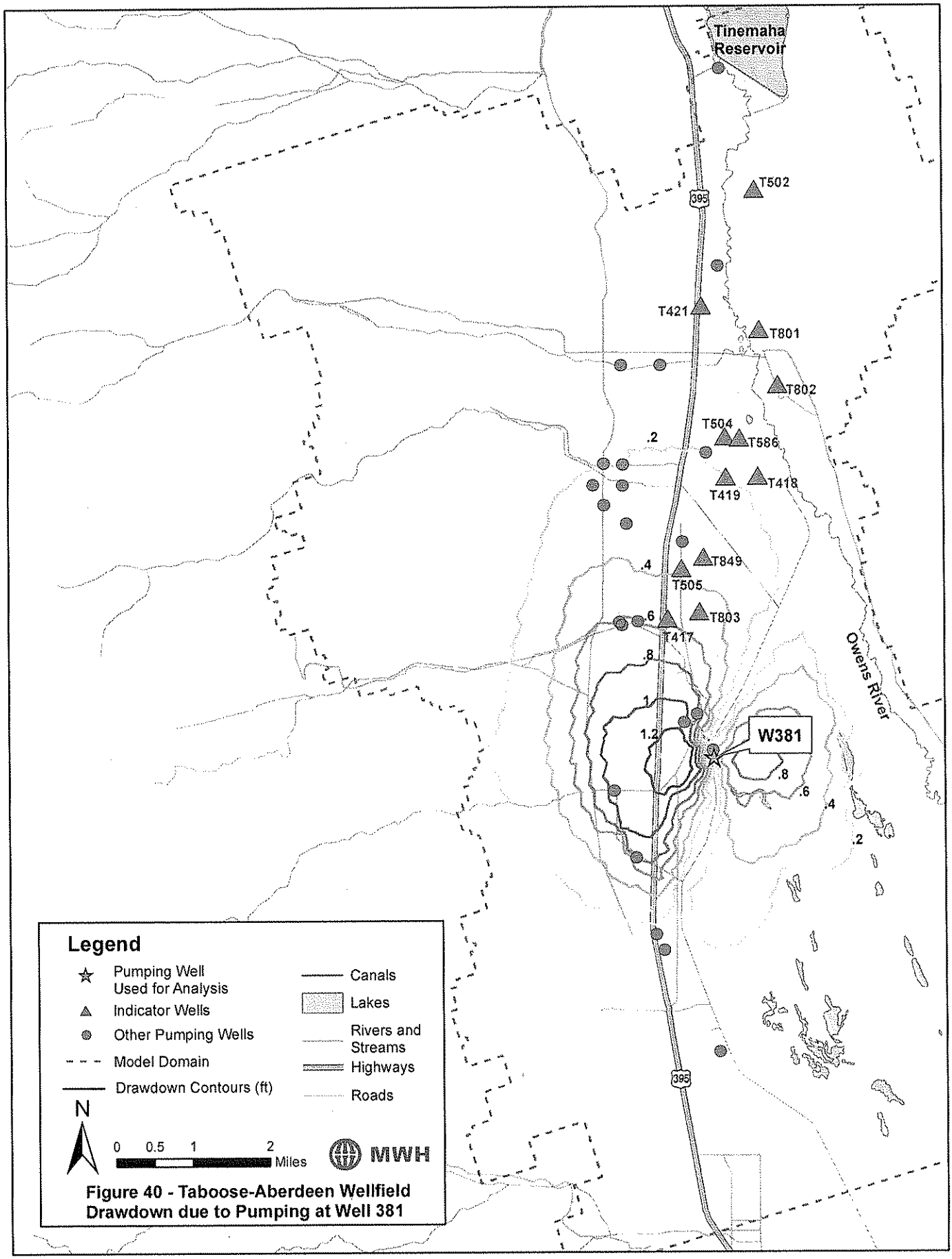


**Figure 40 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at Well 381**

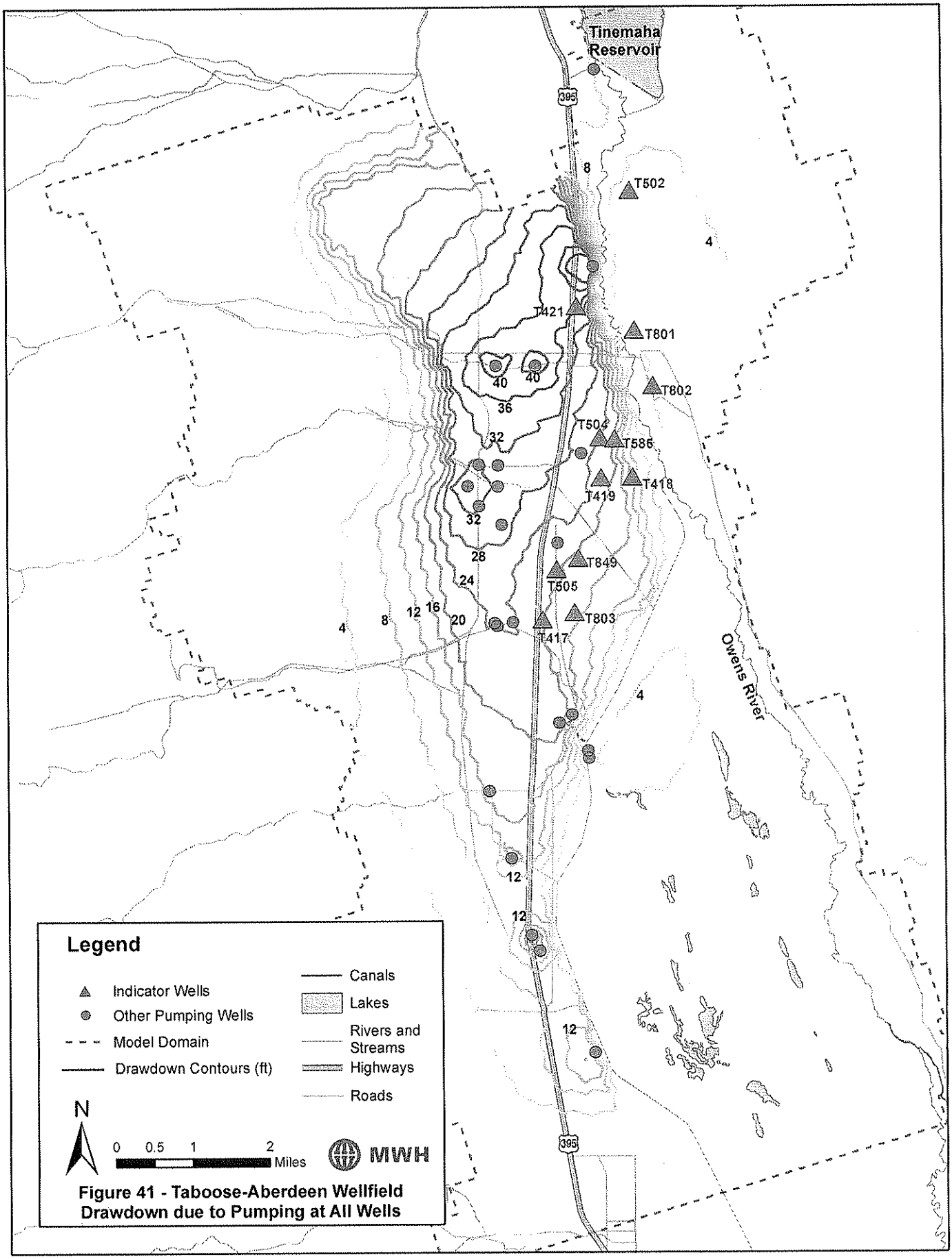


**Figure 41 - Taboose-Aberdeen Wellfield Drawdown due to Pumping at All Wells**

## Table 13
## Indicator Location T502 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T502 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.1 | 1.4% |
| Well 110 | 2 | 0.1 | 2.6% |
| Well 111 | 2 | 0.1 | 1.8% |
| Well 114 | 2 | 0.1 | 2.0% |
| Well 118 | 2 | 1.1 | 22.9% |
| Well 342 | 2 | 0.7 | 14.5% |
| Well 347 | 2 | 0.7 | 13.9% |
| Well 349 | 1 | 1.9 | 37.1% |
| Well 109 | 2 | 0.1 | 1.0% |
| Well 370 | 2 | 0.0 | 0.8% |
| Well 159 | 2 | 0.0 | 0.0% |
| Well 155 | 2 | 0.0 | 0.0% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.1 | 1.0% |
| Well 356 | 2 | 0.0 | 0.6% |
| Well 380 | 3 | 0.0 | 0.2% |
| Well 381 | 3 | 0.0 | 0.2% |
| **Total Drawdown (sum of pumping individual wells)** | | **5.0** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **4.9** | |

## Table 14
## Indicator Location T421 – Taboose-Aberden

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T421 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.7 | 1.8% |
| Well 110 | 2 | 1.3 | 3.5% |
| Well 111 | 2 | 0.9 | 2.5% |
| Well 114 | 2 | 1.1 | 2.9% |
| Well 118 | 2 | 0.1 | 0.3% |
| Well 342 | 2 | 8.3 | 22.6% |
| Well 347 | 2 | 7.8 | 21.2% |
| Well 349 | 1 | 14.7 | 40.4% |
| Well 109 | 2 | 0.4 | 1.2% |
| Well 370 | 2 | 0.4 | 1.0% |
| Well 159 | 2 | 0.0 | 0.1% |
| Well 155 | 2 | 0.0 | 0.1% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.4 | 1.2% |
| Well 356 | 2 | 0.3 | 0.7% |
| Well 380 | 3 | 0.1 | 0.2% |
| Well 381 | 3 | 0.1 | 0.2% |
| **Total Drawdown (sum of pumping individual wells)** | | **36.5** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **36.6** | |

## Table 15
## Indicator Location T801 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T801 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.1 | 2.1% |
| Well 110 | 2 | 0.2 | 4.0% |
| Well 111 | 2 | 0.2 | 2.8% |
| Well 114 | 2 | 0.2 | 3.1% |
| Well 118 | 2 | 0.4 | 6.9% |
| Well 342 | 2 | 1.2 | 20.3% |
| Well 347 | 2 | 1.1 | 18.3% |
| Well 349 | 1 | 2.2 | 36.4% |
| Well 109 | 2 | 0.1 | 1.5% |
| Well 370 | 2 | 0.1 | 1.2% |
| Well 159 | 2 | 0.0 | 0.2% |
| Well 155 | 2 | 0.0 | 0.2% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.1 | 1.5% |
| Well 356 | 2 | 0.1 | 1.0% |
| Well 380 | 3 | 0.0 | 0.3% |
| Well 381 | 3 | 0.0 | 0.3% |
| **Total Drawdown (sum of pumping individual wells)** | | **6.1** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **6.0** | |

## Table 16
## Indicator Location T802 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T802 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.1 | 3.0% |
| Well 110 | 2 | 0.2 | 5.3% |
| Well 111 | 2 | 0.2 | 3.4% |
| Well 114 | 2 | 0.2 | 3.9% |
| Well 118 | 2 | 0.2 | 5.5% |
| Well 342 | 2 | 0.9 | 21.5% |
| Well 347 | 2 | 0.8 | 19.2% |
| Well 349 | 1 | 1.3 | 29.7% |
| Well 109 | 2 | 0.1 | 2.1% |
| Well 370 | 2 | 0.1 | 1.6% |
| Well 159 | 2 | 0.0 | 0.2% |
| Well 155 | 2 | 0.0 | 0.2% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.1 | 2.1% |
| Well 356 | 2 | 0.1 | 1.4% |
| Well 380 | 3 | 0.0 | 0.5% |
| Well 381 | 3 | 0.0 | 0.5% |
| **Total Drawdown (sum of pumping individual wells)** | | **4.4** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **4.3** | |

## Table 17
## Indicator Location T504 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T504 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.1 | 4.6% |
| Well 110 | 2 | 2.0 | 8.1% |
| Well 111 | 2 | 1.3 | 5.4% |
| Well 114 | 2 | 1.4 | 5.8% |
| Well 118 | 2 | 0.1 | 0.2% |
| Well 342 | 2 | 5.7 | 23.8% |
| Well 347 | 2 | 5.3 | 21.9% |
| Well 349 | 1 | 4.2 | 17.4% |
| Well 109 | 2 | 0.8 | 3.1% |
| Well 370 | 2 | 0.6 | 2.6% |
| Well 159 | 2 | 0.1 | 0.2% |
| Well 155 | 2 | 0.1 | 0.2% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.8 | 3.2% |
| Well 356 | 2 | 0.5 | 2.1% |
| Well 380 | 3 | 0.2 | 0.7% |
| Well 381 | 3 | 0.2 | 0.6% |
| **Total Drawdown (sum of pumping individual wells)** | | **24.1** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **24.2** | |

## Table 18
## Indicator Location T586 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T586 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.9 | 4.7% |
| Well 110 | 2 | 1.5 | 8.1% |
| Well 111 | 2 | 1.0 | 5.4% |
| Well 114 | 2 | 1.1 | 5.7% |
| Well 118 | 2 | 0.1 | 0.3% |
| Well 342 | 2 | 4.4 | 23.5% |
| Well 347 | 2 | 4.0 | 21.5% |
| Well 349 | 1 | 3.3 | 17.5% |
| Well 109 | 2 | 0.6 | 3.2% |
| Well 370 | 2 | 0.5 | 2.6% |
| Well 159 | 2 | 0.0 | 0.2% |
| Well 155 | 2 | 0.1 | 0.3% |
| Well 103 | 2 | 0.0 | 0.1% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.6 | 3.3% |
| Well 356 | 2 | 0.4 | 2.2% |
| Well 380 | 3 | 0.1 | 0.7% |
| Well 381 | 3 | 0.1 | 0.6% |
| **Total Drawdown (sum of pumping individual wells)** | | **18.6** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **18.4** | |

## Table 19
## Indicator Location T419 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T419 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.3 | 5.9% |
| Well 110 | 2 | 2.1 | 9.7% |
| Well 111 | 2 | 1.3 | 6.2% |
| Well 114 | 2 | 1.4 | 6.3% |
| Well 118 | 2 | 0.0 | 0.2% |
| Well 342 | 2 | 4.3 | 20.0% |
| Well 347 | 2 | 4.2 | 19.4% |
| Well 349 | 1 | 3.1 | 14.4% |
| Well 109 | 2 | 0.9 | 4.3% |
| Well 370 | 2 | 0.8 | 3.5% |
| Well 159 | 2 | 0.1 | 0.3% |
| Well 155 | 2 | 0.1 | 0.3% |
| Well 103 | 2 | 0.0 | 0.0% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 1.0 | 4.5% |
| Well 356 | 2 | 0.6 | 2.9% |
| Well 380 | 3 | 0.2 | 1.0% |
| Well 381 | 3 | 0.2 | 0.9% |
| **Total Drawdown (sum of pumping individual wells)** | | **21.6** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **21.7** | |

## Table 20
## Indicator Location T418 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T418 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 0.6 | 5.8% |
| Well 110 | 2 | 0.9 | 9.4% |
| Well 111 | 2 | 0.6 | 5.9% |
| Well 114 | 2 | 0.6 | 6.0% |
| Well 118 | 2 | 0.1 | 0.6% |
| Well 342 | 2 | 1.8 | 19.3% |
| Well 347 | 2 | 1.8 | 18.6% |
| Well 349 | 1 | 1.4 | 15.2% |
| Well 109 | 2 | 0.4 | 4.4% |
| Well 370 | 2 | 0.4 | 3.7% |
| Well 159 | 2 | 0.0 | 0.3% |
| Well 155 | 2 | 0.0 | 0.3% |
| Well 103 | 2 | 0.0 | 0.1% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 0.5 | 5.0% |
| Well 356 | 2 | 0.3 | 3.2% |
| Well 380 | 3 | 0.1 | 1.1% |
| Well 381 | 3 | 0.1 | 1.0% |
| **Total Drawdown (sum of pumping individual wells)** | | **9.5** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **9.3** | |

## Table 21
## Indicator Location T849 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T849 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.5 | 7.5% |
| Well 110 | 2 | 2.2 | 11.2% |
| Well 111 | 2 | 1.4 | 7.2% |
| Well 114 | 2 | 1.1 | 5.8% |
| Well 118 | 2 | 0.0 | 0.1% |
| Well 342 | 2 | 2.5 | 12.7% |
| Well 347 | 2 | 2.6 | 13.2% |
| Well 349 | 1 | 1.8 | 9.1% |
| Well 109 | 2 | 1.5 | 7.7% |
| Well 370 | 2 | 1.2 | 6.2% |
| Well 159 | 2 | 0.1 | 0.6% |
| Well 155 | 2 | 0.1 | 0.7% |
| Well 103 | 2 | 0.0 | 0.1% |
| Well 104 | 2 | 0.0 | 0.1% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 1.7 | 8.7% |
| Well 356 | 2 | 1.1 | 5.6% |
| Well 380 | 3 | 0.4 | 1.8% |
| Well 381 | 3 | 0.3 | 1.7% |
| **Total Drawdown (sum of pumping individual wells)** | | **19.5** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **19.5** | |

## Table 22
## Indicator Location T505 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T505 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.6 | 7.8% |
| Well 110 | 2 | 2.3 | 11.4% |
| Well 111 | 2 | 1.3 | 6.3% |
| Well 114 | 2 | 1.1 | 5.6% |
| Well 118 | 2 | 0.0 | 0.1% |
| Well 342 | 2 | 2.3 | 11.4% |
| Well 347 | 2 | 2.5 | 12.0% |
| Well 349 | 1 | 1.7 | 8.2% |
| Well 109 | 2 | 1.8 | 8.9% |
| Well 370 | 2 | 1.4 | 7.0% |
| Well 159 | 2 | 0.1 | 0.7% |
| Well 155 | 2 | 0.2 | 0.7% |
| Well 103 | 2 | 0.0 | 0.1% |
| Well 104 | 2 | 0.0 | 0.0% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 2.0 | 9.6% |
| Well 356 | 2 | 1.3 | 6.2% |
| Well 380 | 3 | 0.4 | 2.0% |
| Well 381 | 3 | 0.4 | 1.9% |
| **Total Drawdown (sum of pumping individual wells)** | | **20.4** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **20.6** | |

## Table 23
## Indicator Location T803 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T803 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.1 | 6.2% |
| Well 110 | 2 | 1.6 | 9.2% |
| Well 111 | 2 | 0.9 | 5.1% |
| Well 114 | 2 | 0.8 | 4.5% |
| Well 118 | 2 | 0.0 | 0.1% |
| Well 342 | 2 | 1.5 | 9.1% |
| Well 347 | 2 | 1.6 | 9.6% |
| Well 349 | 1 | 1.1 | 6.5% |
| Well 109 | 2 | 1.8 | 10.5% |
| Well 370 | 2 | 1.3 | 7.8% |
| Well 159 | 2 | 0.2 | 1.0% |
| Well 155 | 2 | 0.2 | 1.0% |
| Well 103 | 2 | 0.0 | 0.2% |
| Well 104 | 2 | 0.0 | 0.1% |
| Well 382 | 3 | 0.0 | 0.0% |
| Well 351 | 2 | 2.4 | 14.0% |
| Well 356 | 2 | 1.6 | 9.2% |
| Well 380 | 3 | 0.5 | 3.0% |
| Well 381 | 3 | 0.5 | 2.8% |
| **Total Drawdown (sum of pumping individual wells)** | | **16.9** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **17.0** | |

## Table 24
## Indicator Location T417 – Taboose-Aberdeen

| Production Well | Model Layer that the Well Produces From | Shallow Drawdown at T417 as a Result of Pumping the Production Well for One (1) Year in feet | % of Total Drawdown |
|---|---|---|---|
| Well 106 | 2 | 1.2 | 5.8% |
| Well 110 | 2 | 1.7 | 8.7% |
| Well 111 | 2 | 0.9 | 4.7% |
| Well 114 | 2 | 0.8 | 4.1% |
| Well 118 | 2 | 0.0 | 0.1% |
| Well 342 | 2 | 1.5 | 7.7% |
| Well 347 | 2 | 1.6 | 8.2% |
| Well 349 | 1 | 1.1 | 5.5% |
| Well 109 | 2 | 2.6 | 13.1% |
| Well 370 | 2 | 1.9 | 9.3% |
| Well 159 | 2 | 0.2 | 1.1% |
| Well 155 | 2 | 0.2 | 1.1% |
| Well 103 | 2 | 0.0 | 0.2% |
| Well 104 | 2 | 0.0 | 0.1% |
| Well 382 | 3 | 0.0 | 0.1% |
| Well 351 | 2 | 3.0 | 15.0% |
| Well 356 | 2 | 1.9 | 9.6% |
| Well 380 | 3 | 0.6 | 3.1% |
| Well 381 | 3 | 0.6 | 2.8% |
| **Total Drawdown (sum of pumping individual wells)** | | **20.0** | |
| **Total Drawdown (pumping all wells simultaneously)** | | **20.2** | |