

**Yorktown, Indiana**  
**2012 Wellhead Protection Area Delineation**  
***Executive Summary***

The attached report has come about as a result of increased pumping on the part of the Town of Yorktown. Pumping data as evaluated for the 2001 Phase I of the Wellhead Protection Area Delineation, with a 10% addition for modeling purposes, has been exceeded sufficiently in the last few years to require a revised model.

All current modeling was done using Aquifer<sup>win32</sup> (Winflow) software as developed by Jim Rumbaugh. This is the same model used in the original work but is the current version.

Current modeling, utilizing pumping information for years 2005-2009, and as reported to the IDNR in their annual High Capacity Usage report, was used for all model runs. The scenarios followed were the same as those upon which the original approved model was calibrated and completed.

All model inputs, targets, stream segments, and other existing high capacity wells were also used in the model runs. A new irrigation well, installed by the Town in a sports park approximately  $\frac{3}{4}$  miles north of Wells 1 & 2, was also placed in the model for all runs. Particle traces were not completed for the "Park" well but potential influence from this well is reflected in the composite Time of Travel outlines.

New composite delineations for the 1 year, 5 year, and 10 year delineations were completed and overlain on the existing topographic map.

Differences in individual well usage are also reflected in the modified delineations and based on this usage these composite outlines do not show significant changes in aerial distribution as may have been expected when considering total pumping alone.

All new data is outlined in the attached report. Base model input as well as all scenarios has also been outlined but the individual model output files have not been reprinted. Digital input files are available on request.

**Yorktown, Indiana**  
**Wellhead Protection Area Delineation Revision**  
**2012**

## **Background**

The Town of Yorktown, located in Delaware County, completed their original Wellhead Protection Area Delineation in December, 2000. The delineation was completed utilizing a two-dimensional model, Winflow, to generate 1, 5, and 10 year capture zone areas.

These areas were then used to perform the required contaminant source inventory database and windshield surveys as part of the original Wellhead Protection Plan, which was submitted in March, 2002.

Re-delineation of the 1 and 5 Year Time of Travel capture areas has been necessitated by the increased pumping from the three supply wells utilized by the Town.

## **Updated Model**

The updated model has again used the Winflow model, now referenced as Aquifer<sup>win32</sup> (Winflow) software as originally developed and currently maintained by Jim Rumbaugh through Environmental Simulations, Inc.

The updated model references and uses all of the original data acquisition, base modeling, well log inventory, high capacity users (with one exception to be noted later), and all other aquifer characteristics as defined in the original documentation.

Model run scenarios, established for original model work, were also observed and used for new composite delineation generation.

Modifications to the original data for all model runs is based on increased pumping and the addition of an irrigation well that was installed by the Town for use in the new Sports Park. Data for this well, including well log, pump set sheet, and pumping test are included in this documentation.

## **Model Data**

The current model represents use of the original calibrated model with all approvals from IDEM. Modified data includes the following:

### **Sports Park Well**

Located approximately 1 mile north of wells 1 & 2, this well is completed in a thick sand and gravel sequence that, based on other well information, trends to the southwest into a tributary of the buried Anderson Valley. This well was pump tested at approximately 100gpm for a period of 8 hours with 6' of drawdown. Well data included in Addendum 1.

This well is used for irrigation only and runs approximately 30-50 days per year for up to 6 hours per day.

Model input used for this well includes the approximate location as noted on the delineation map and a pump rate of 4,320ft<sup>3</sup>/day (32,400gpd). Location is noted on updated maps.

No other aquifer characteristics were changed to accommodate this well.

### Pumping Rates – Municipal Wells

Modifications to the pumping rates for each well are as follows (all data in ft<sup>3</sup>/day):

<u>Well ID</u>	<u>2000 Pump Rates</u>	<u>2000 Model Rates</u>	<u>2011 Pump Rates</u>	<u>2011 Model Rates</u>
1	13,034	14,376	20,346	22,321
2	15,609	17,216	22,205	24,360
3	17,819	19,654	17,793	19,520

Wells 1 & 2 show increased in pumping rates but well 3 has seen little change over the past few years. The 2011 model rates represent a 4-year average + 10% buffer for increases in demand.

The values noted for original model design in 2000 are based on the data from the original report. The 2011 Pump Rates are based on the IDNR High Capacity data submitted by the Town (Addendum 2)

### Model Inputs

The following table shows the original base model inputs that were used for the delineation. These include all Scenarios used for the composite delineation generation for the 1, 5, and 10 year time of travel and also represent the variables utilized for the updated delineation.

Scenario #	Aquifer Thickness	Recharge	Hydraulic Conductivity	Porosity	Storage Coefficient
1	100'	4.2 in/yr	75 ft/d	15%	1e-006
2	100'	4.2 in/yr	37.5 ft/d	15%	1e-006
3	100'	4.2 in/yr	112.5 ft/d	15%	1e-006
4	100'	2.19 in/yr	75 ft/d	15%	1e-006
5	100'	6.57in/yr	75 ft/d	15%	1e-006
6	100'	4.2 in/yr	75 ft/d	15%	1e-006

Model Scenario #6 also assumed that the line sinks representing Buck Creek in the vicinity of any of the wells did not contribute directly to the aquifer and that all contribution came from up gradient and precipitation rather than direct surface interaction.

### Other Exceptions

Other exceptions that need to be noted involve other High Capacity wells in the area. As noted in the original report, Borg Warner has three wells that were operating on a regular basis. This facility has been closed and the property is for sale. One of the wells has been re-started at an unknown pump rate.

Since these wells have not been abandoned and the property may see revitalization, it seems prudent to leave the wells in the new model to reflect the potential for operation in the near future.

## Notes

Comparisons of the current delineations with the original delineations would seem to indicate that the capture zones have decreased in aerial extent when in fact they should have increased due to increased pumping.

Examination of the original model, as obtained from the previous contractor, when all 6 scenarios are modeled and the resulting particle trace files are “layered”, the resulting maximum dimension for the 5year Time of Travel composite outline is approximately 6000’.

This dimension of the 5year Time of Travel on the original report maps, based on the scale as shown and as compared to the underlying 1:24000 topographic base map, is approximately 7700’. I am not certain of where this apparent error in scaling was introduced.

Please see the figures below for visual comparison of the 5year delineations. While these drawings are to the scale of the modeling program, they do not have a reference scale with them. Bear in mind that these drawings are from a program that allows layering of the particle traces and translating to the appropriate geographic coordinate for overlay onto the topographic map base but for this discussion they have not been moved or altered.

As noted, this is the raw data output from the Winflow model. Note the relative position of the furthest extent of the traces in relation to the wells, 1 & 2 to the upper right, and 3 to the lower left. This is the 5year Time of Travel output.

This drawing represents the original output data files as modeled with the original pumping rates, all six scenarios and all other model parameters constant.



This second drawing shows the raw data from the 2011 modeling. Note the relative differences between the previous model and this one in terms of the length and aerial distribution of the traces.



In viewing the original delineation map alone this difference in the relative size of the 5year Time of Travel is not apparent. Only in viewing the two maps can the differences be noted and the incorrect scaling be seen. These dimensions were also checked in the Winflow software after successive model runs. The variation from model to map in the 5year Time of Travel for the 2000 delineation represents approximately 21% increase.

### **Summary**

The updated maps for the 1, 5, and 10 year Time of Travel represent all new pumping information, the addition of the irrigation well, and using the originally calibrated model which incorporates the original aquifer parameters and high capacity wells.

All Time of Travel delineations were generated and scaled based on model data and transferred to appropriately scaled topographic base maps.

Updated delineations should form the basis for the updated Wellhead Protection Plan on which the Town is actively working.

### **Submitted by:**

**Phillip R. Bonneau, LPG 1723  
Ortman Drilling & Water Services**

# ADDENDUM 1 – Sports Park Water Well Record

PRB-09-04

well # 09-07



**RECORD OF WATER WELL**  
State Form 35680 (RS / 9-04)

Driller—Mail complete record in 30 days to:  
INDIANA DEPT. OF NATURAL RESOURCES  
Division of Water  
402 W. Washington St., Rm. W264  
Indianapolis, IN 46204-2641  
(877) 928-3755 toll-free or (317) 232-4160

County Permit Number	
DNR Variance Number	

Fill in completely

Include if applicable

WELL LOCATION									
County where drilled Delaware		Civil township name Mt. Pleasant		Township number (N-S) 20n		Range number (E-W) 9e		Section 15	
Driving directions to the well location (include trip origin, street & road names, intersecting roads, and compass directions). Show well address below and subdivision in box at lower right. There is space for a map on the reverse side. East of I-69 on SR 332 to 800 West- south on 800 west on east side						UTM Northing 4449669		UTM Easting 627737	
same						Datum <input checked="" type="checkbox"/> NAD 27 <input type="checkbox"/> NAD 83		GPS used	
						Subdivision name & lot number (if applicable)			
If drilled for water supply, this well is: <input checked="" type="checkbox"/> first well on property <input type="checkbox"/> Replacement well <input type="checkbox"/> Additional well on property <input type="checkbox"/> Dry hole									
OWNER -CONTRACTOR									
Owner Yorktown									
Building contractor-name			Address (number and street, city, state, ZIP code)				Telephone Number		
Drilling contractor-name Ortman Drilling			Address (number and street, city, state, ZIP code) 241 N. 300 W. Kokomo, Indiana 46901				Telephone number 785-459-4125		
Equipment operator-name Eric Hooper-Kirby Hall-Jason Souply			License Number 1961		Date of well completion 3/4/2009				
CONSTRUCTION DETAILS					WELL LOG				
Use of well <input checked="" type="checkbox"/> Home <input type="checkbox"/> Public supply <input type="checkbox"/> Industrial / commercial <input type="checkbox"/> Livestock <input checked="" type="checkbox"/> Irrigation <input type="checkbox"/> Monitoring / environ. <input type="checkbox"/> Test hole other		Drilling method <input checked="" type="checkbox"/> Rotary <input type="checkbox"/> Reverse rotary <input type="checkbox"/> Cable tool <input type="checkbox"/> Jet Bucket / bore <input type="checkbox"/> Auger (including HSA) <input type="checkbox"/> Direct push Other:		Type of pump <input checked="" type="checkbox"/> Submersible <input type="checkbox"/> Shallow-well jet <input type="checkbox"/> Deep-well jet <input type="checkbox"/> No pump installed Other:		FORMATIONS: Type of material		From (feet)	To (feet)
Total depth of well (feet) 77		Borehole diameter (in.) 9 7/8		Gravel pack inserted <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Brown clay		0	11
Casing length (feet) 72+ 2'up		Casing diameter (in.) 8.9		Casing material <input checked="" type="checkbox"/> pvc <input type="checkbox"/> Steel		gray clay		11	22
Screen length (feet) 5		Screen diameter (in.) 8		Screen material <input type="checkbox"/> PVC <input checked="" type="checkbox"/> Steel		sand and gravel		22	26
Screen slot size 0.05		Water quality (clear, odor, etc.) clear		Pump depth setting (feet)		gray clay		26	28
Test method <input checked="" type="checkbox"/> Air <input type="checkbox"/> Bailing home		Static level below surface 11 feet		Gallons per min. 200		Hours tested 2		Drawdown (change in level) feet	
Grout material Benseal		Grout depth from to 50 0		Material American		Depth filled from to 77 50		f-m sand and gravel	
Installation method Pumped (tremmie)		No. of bags used 5		Installation method washed in		quantity 150 gal.		f-m gravel w/ medium sand	
I hereby swear or affirm, under the penalties for perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate, and complete.		Signature of drilling contractor or authorized representative <b>bobroberts</b>				MUST BE SIGNED OR STAMPED		Date 3/6/2009	
Additional space for well log and comments on reverse side									

**ADDENDUM 1 – Sports Park Pump Set Sheet**



**Owner**  
Town of Yorktown

**Contact Person**  
Wayne Studebaker

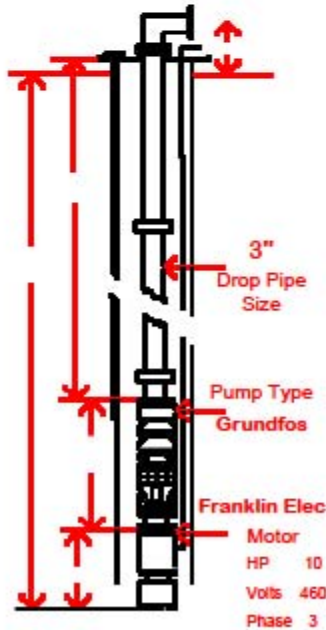
**City/State**  
Yorktown, IN

**Phone Number**  
[Redacted]

**Date**  
5/12/09

**Well Location**  
approx 30' south of retention pond, 100' east of CR500W

**Well Number**  
sports park



Pump Discharge			
Type	well seal	Size	6"
Elbow		Size	
Fig		Discharge Size	3"
Size		Lifting Stub	

Drop Pipe			
Pipe Size	3"	Type	certa-lok
Check Valves	1	Size	3"
3/4" Pe	xx	Airline	
		Location	up 1 jt
		Length	

Pump			
Make	Grundfos	Model	85S100
Stages	9	Serial #	A12B60009
		Size	6"
		O.D.	5.375

Wire			
Size	12	Length	70'
		Type	pvc

Motor			
Make	Franklin Elec	Diameter	6"
HP	10	Amps	14.2
RPM	3450	Volts	460
		Phase	3
		Serial #	08C19-19-6198

Starter			
Make	na	Size	
Heaters		Fuses	
Coil Volts		Location	
		Disconnect at	

Installed			
Who	G ehmk, S Barker	Date	5/12/09

Well Info			
Well Number		Type	gravel
Depth	77'	Diameter	6.9"
SW	11'	Screen Size	6"
		Screen Length	5'

Pump Test			
GPM	100	PSI	
Date		Water Level	26

**Special Notes**  
Well is 6.9", coupled down to 6" for the well seal.

## **ADDENDUM 2 – Pumping Data**

Town of Yorktown  
PWSID 5218014

Preliminary submittal of average daily pumping information.

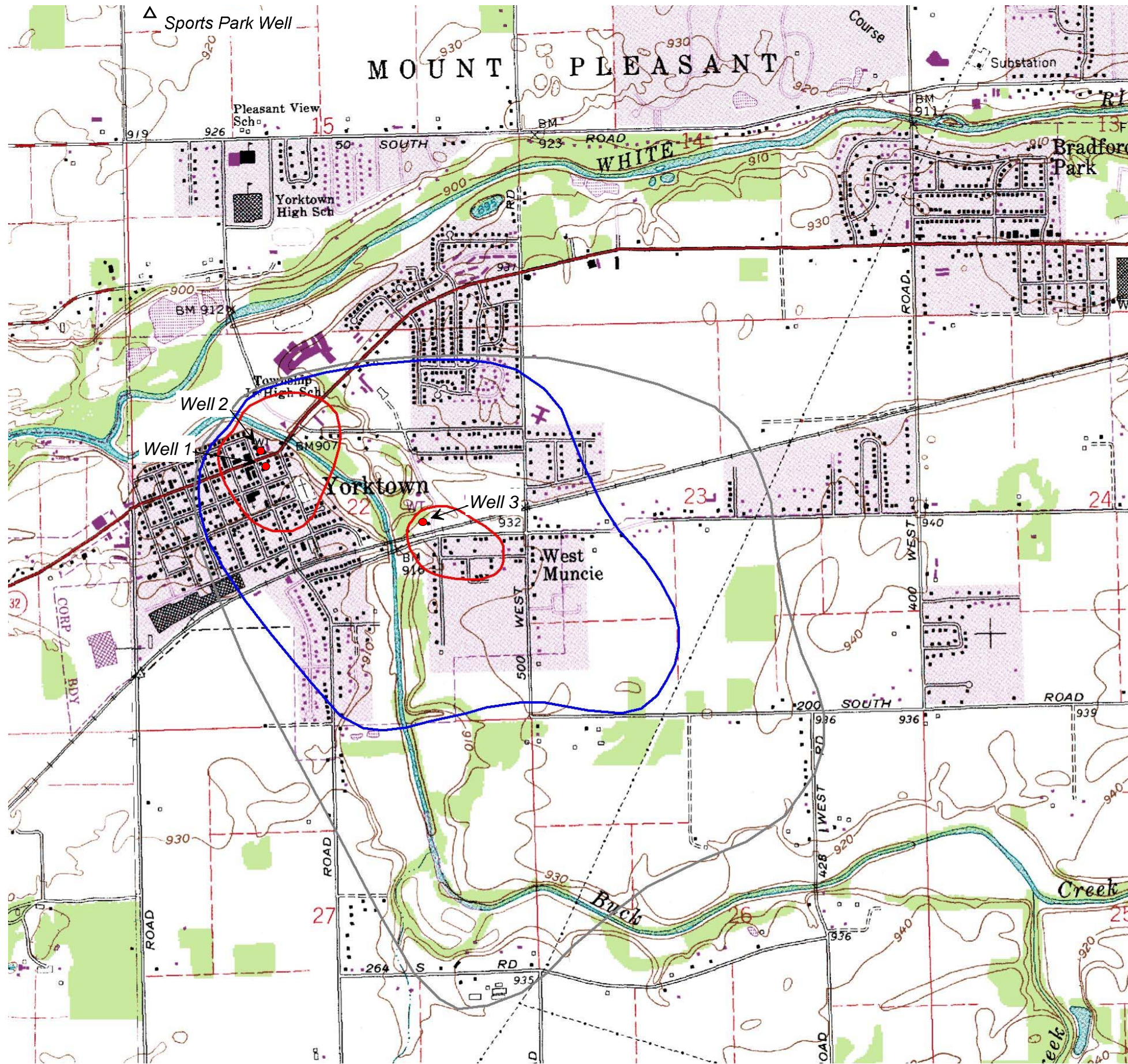
Wellfield	Well ID	Average Daily Pumping Rate by Year				
		2005	2006	2007	2008	2009
	1	146062	134903	138373	184449	157161
	2	158681	100495	168251	208150	194862
	3	83070	71095	146177	189380	175726

Units (Please Check the Appropriate Box)

ft <sup>3</sup> /day	<input type="checkbox"/>	Gallons Per Minute (GPM)	<input type="checkbox"/>
Gallons Per Day (GPD)	<input checked="" type="checkbox"/>		






Pumping data originally submitted for evaluation. Values subsequently used to determine a 5-year average pumping rates as previously noted in the report.

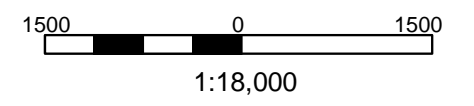




LEGEND



-  1 Year Time of Travel
-  5 Year Time of Travel
-  10 Year Time of Travel
-  Irrigation Well
-  Municipal Well



241 North 300 West  
Kokomo, IN 46901

Figure 1

2011 Delineation

Town of Yorktown  
2011 Revised Delineation  
PB11093