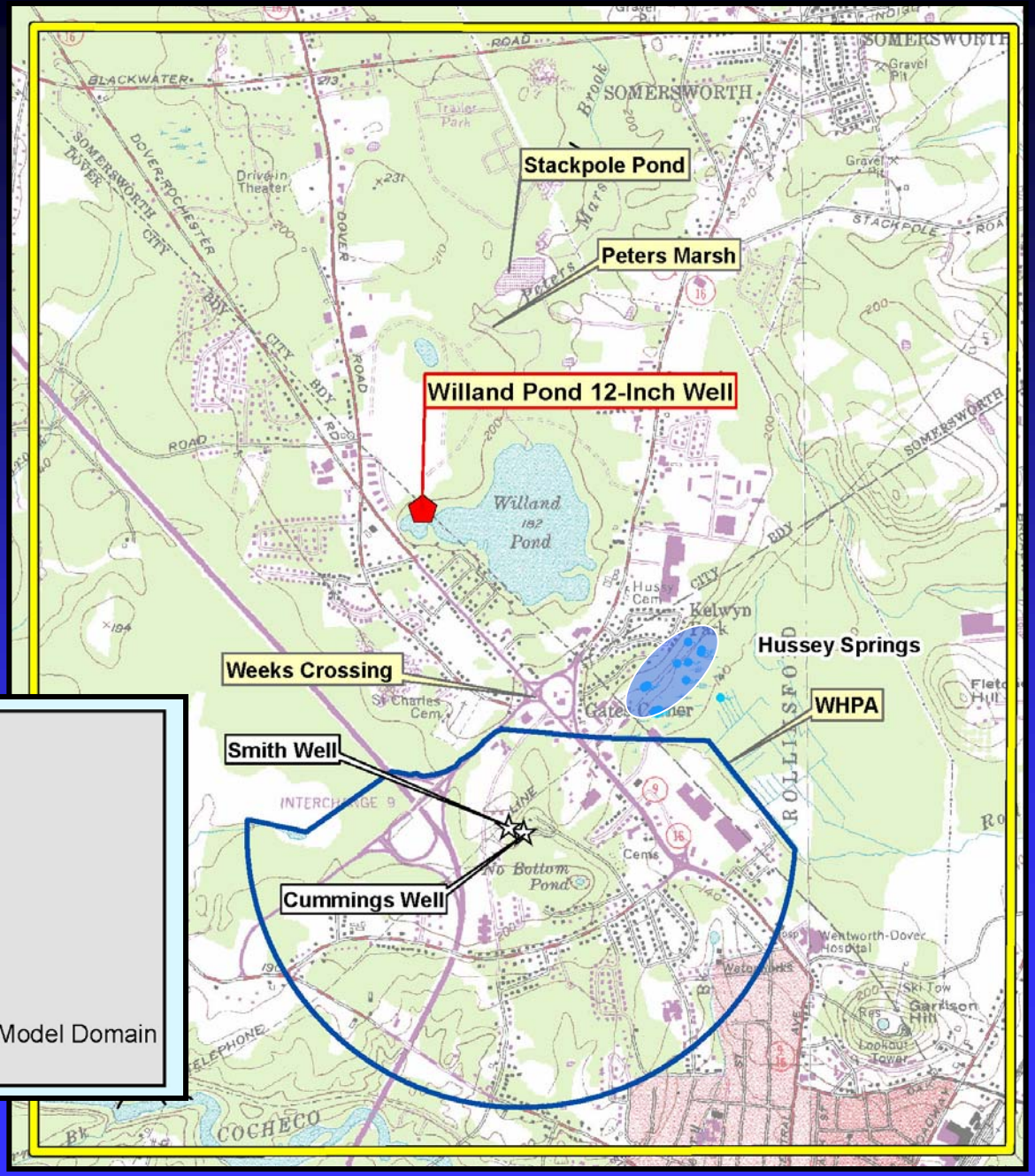
PHASES II and III

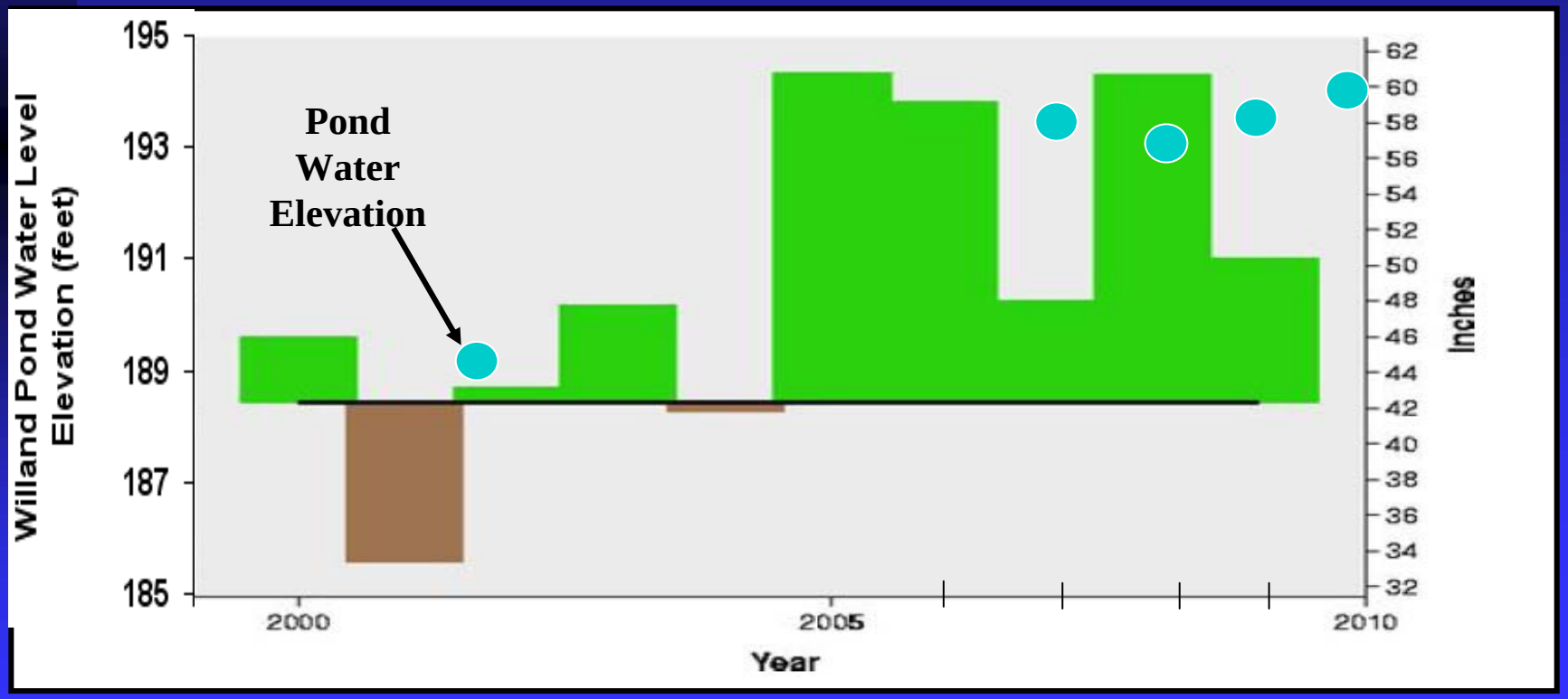
PROJECT UPDATE

WILLAND POND WELL INVESTIGATION HYDROGEOLOGIC ASSESSMENT

Location Map



Above average precipitation between 2002 and 2010 has resulted in higher groundwater levels in the Willand Pond Aquifer, and higher surface water levels in Willand Pond.



The City of Dover initiated a program to evaluate if the existing Willand Pond 12-Inch-Diameter Well could be used to:

- Lower water levels in Willand Pond; and
- Serve as a public potable water supply for the City.

Willand Pond Water Resource Assessment Program

Phase I

Fatal Flaw Assessment

Phase II

Numerical Modeling of Willand Pond Aquifer

Willand Pond Water Resource Assessment Program

Phase III – Part I

Preliminary Well Evaluation and Geophysics

(Current) Phase III – Part II

Long-Term Pumping Test Program

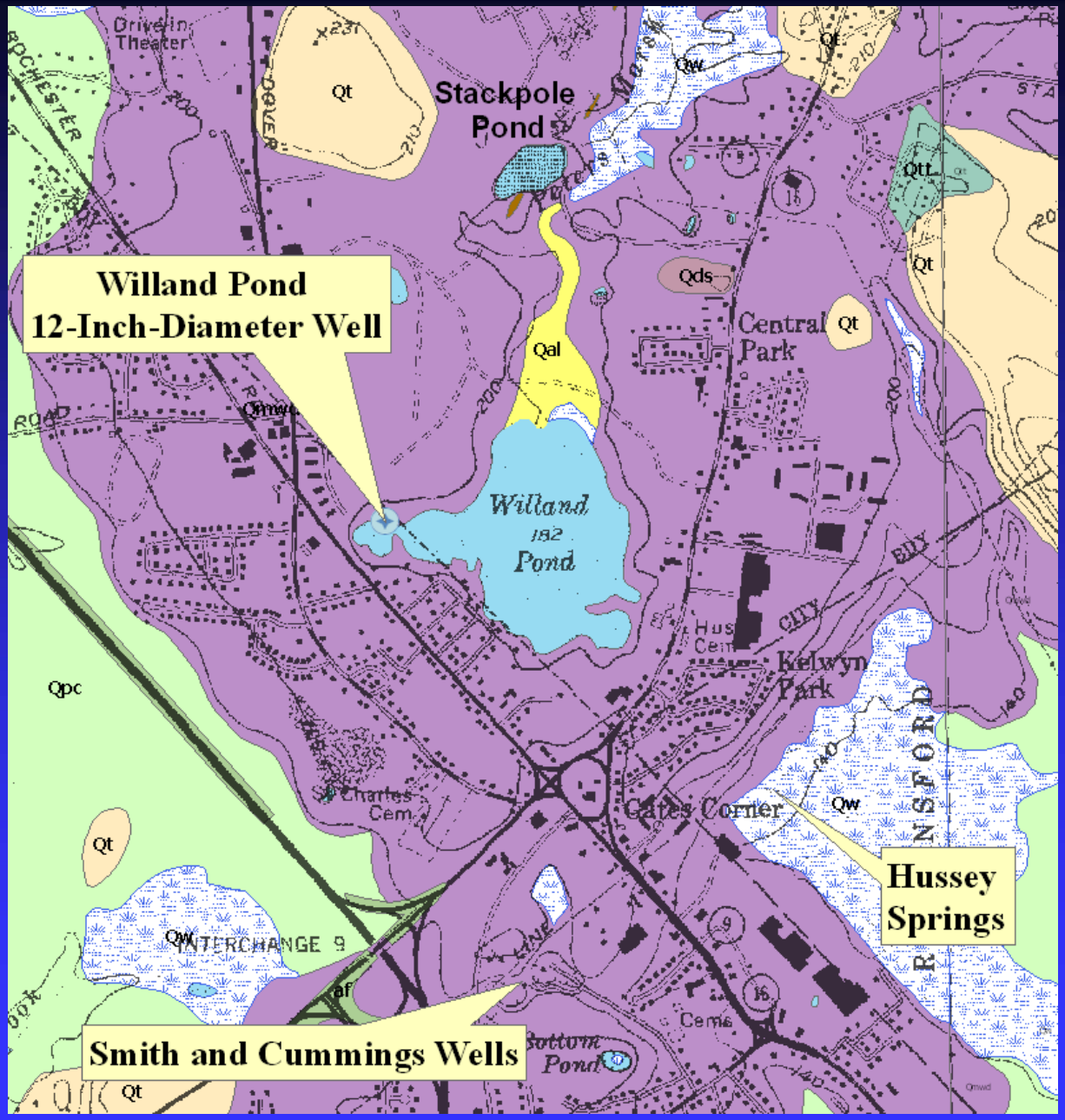
(Future) Phase III – Part III

Data Compilation, Analyses, and Permitting

Phase II

Develop a Numerical Groundwater Flow Model to assess on a preliminary basis the relationship between pumping the Willand Pond 12-Inch Production Well and water levels in Willand Pond and the Willand Pond Aquifer.

Example of Hydrogeologic Data Included in Model



Legend

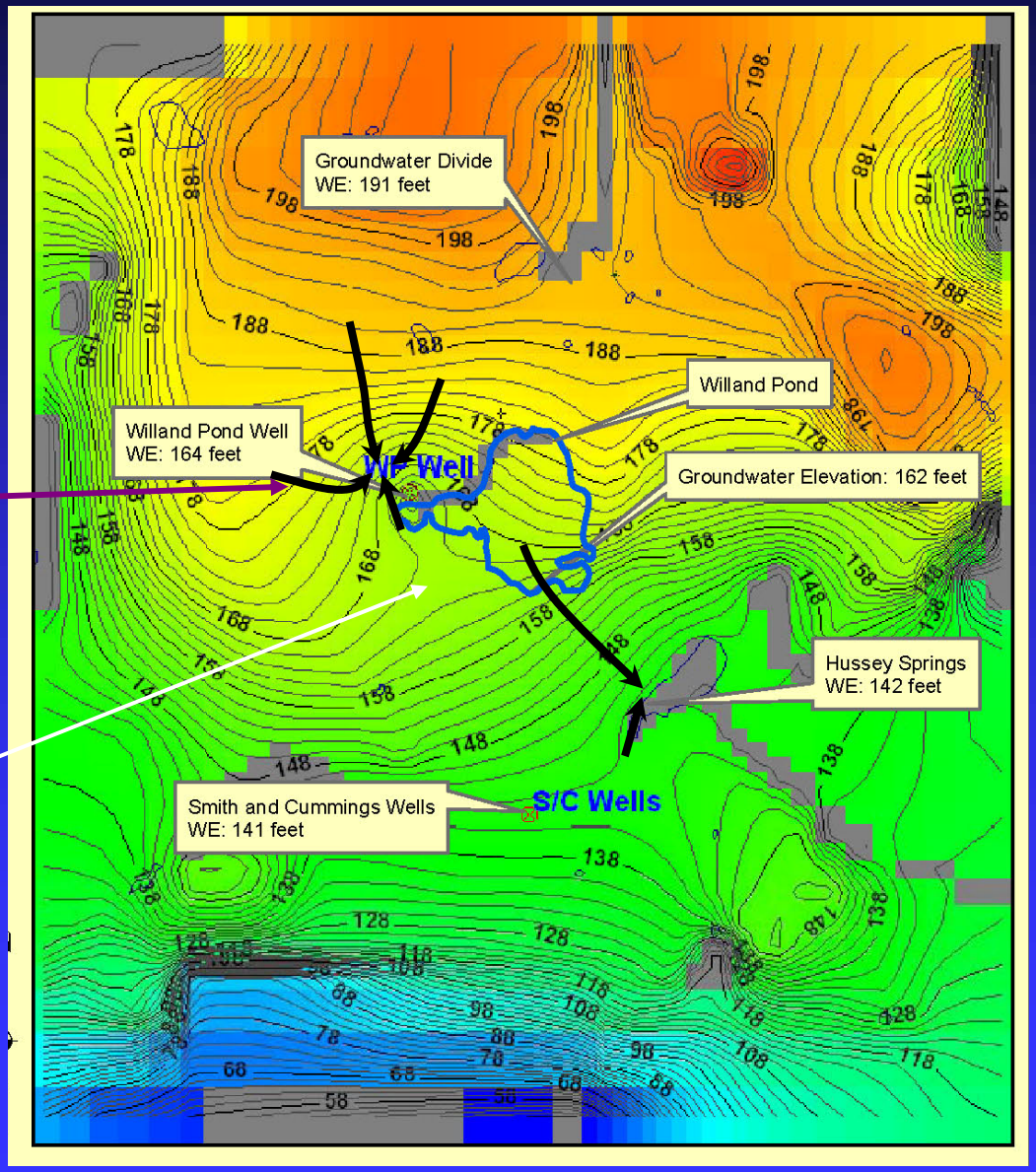
Surficial Geology

- af - Artificial Fill
- Qa - Alluvium
- Qw - Wetland
- Qds - Sand
- Qpc Presumpscot Formation
- Qmwd - Marine Delta
- Qt - Till
- Qtt - Thin Till
- bedrock
- water

Water Level Contour Map for 500 gpm Pumping Scenario

Groundwater Flow Lines

Groundwater Divide



Results of Numerical Modeling

- The water table in the Willand Pond Aquifer slopes southward from the area of Stackpole Pond towards the Smiths and Cummings Wells and various springs.
- Groundwater flows into Willand Pond along the north shore of the Pond.
- Willand Pond surface water is “perched” above the groundwater table along the south shore of the Pond.

Phase III - Part I

- Evaluate the construction status of the Existing Willand Pond 12-Inch Well. (Screen at 50-70 feet below ground surface).

- Evaluate the Willand Pond Aquifer through Geophysical Methods.

Rehabilitation of 12-Inch Well

Video Log – Selected Photographs

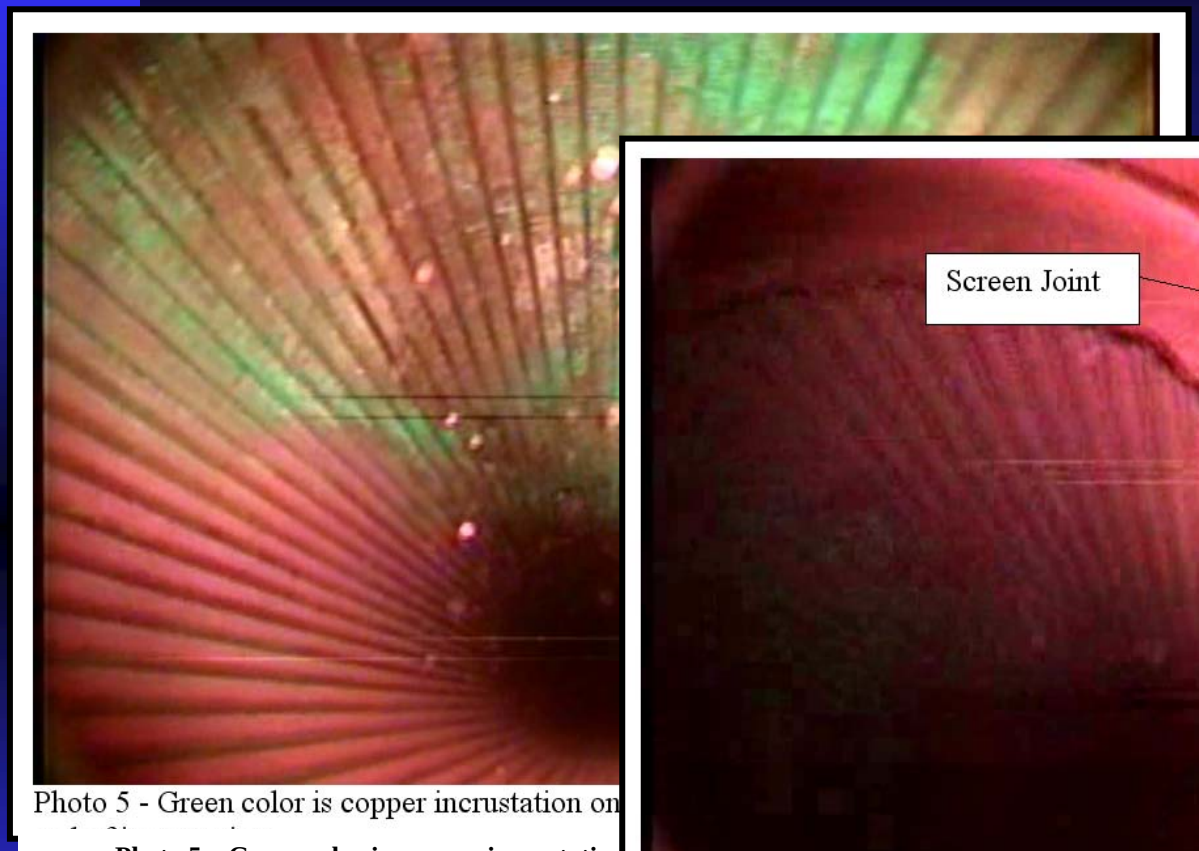


Photo 5 - Green color is copper incrustation on

Photo 5 – Green color is copper incrustation

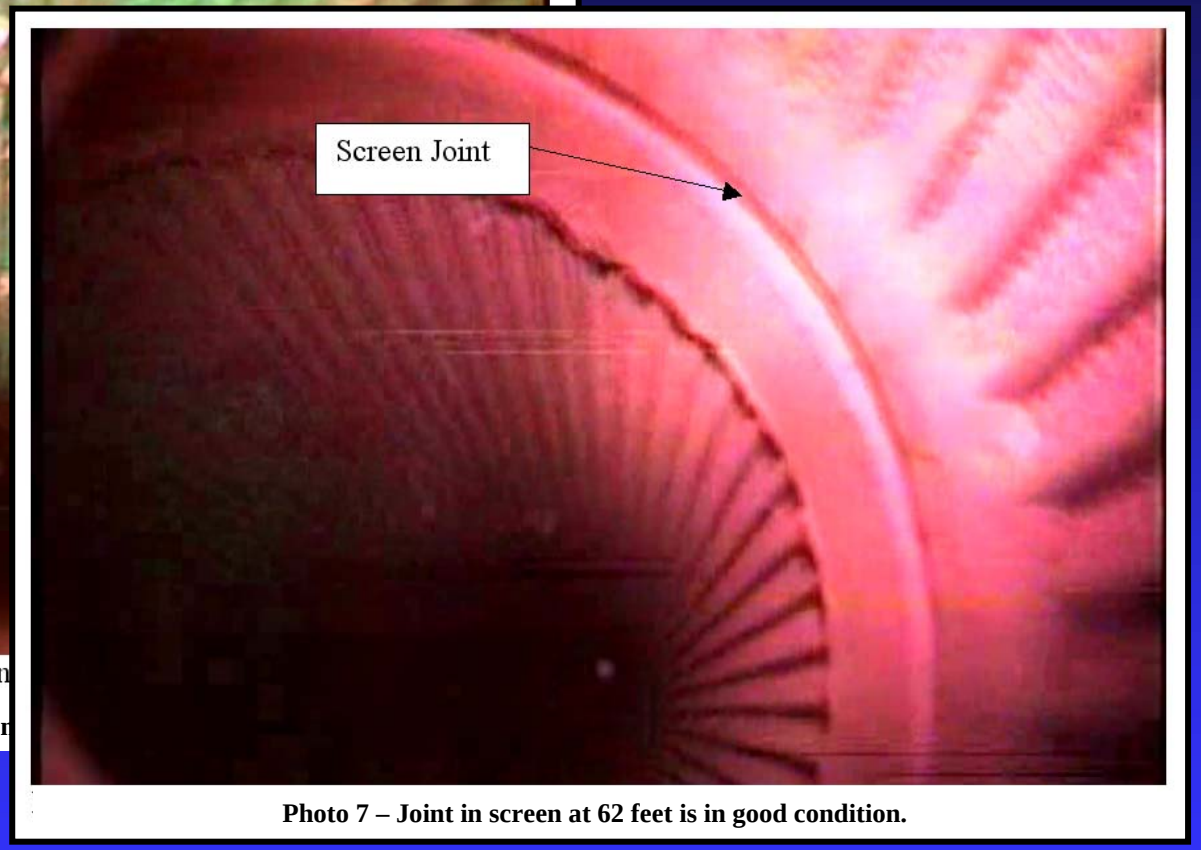


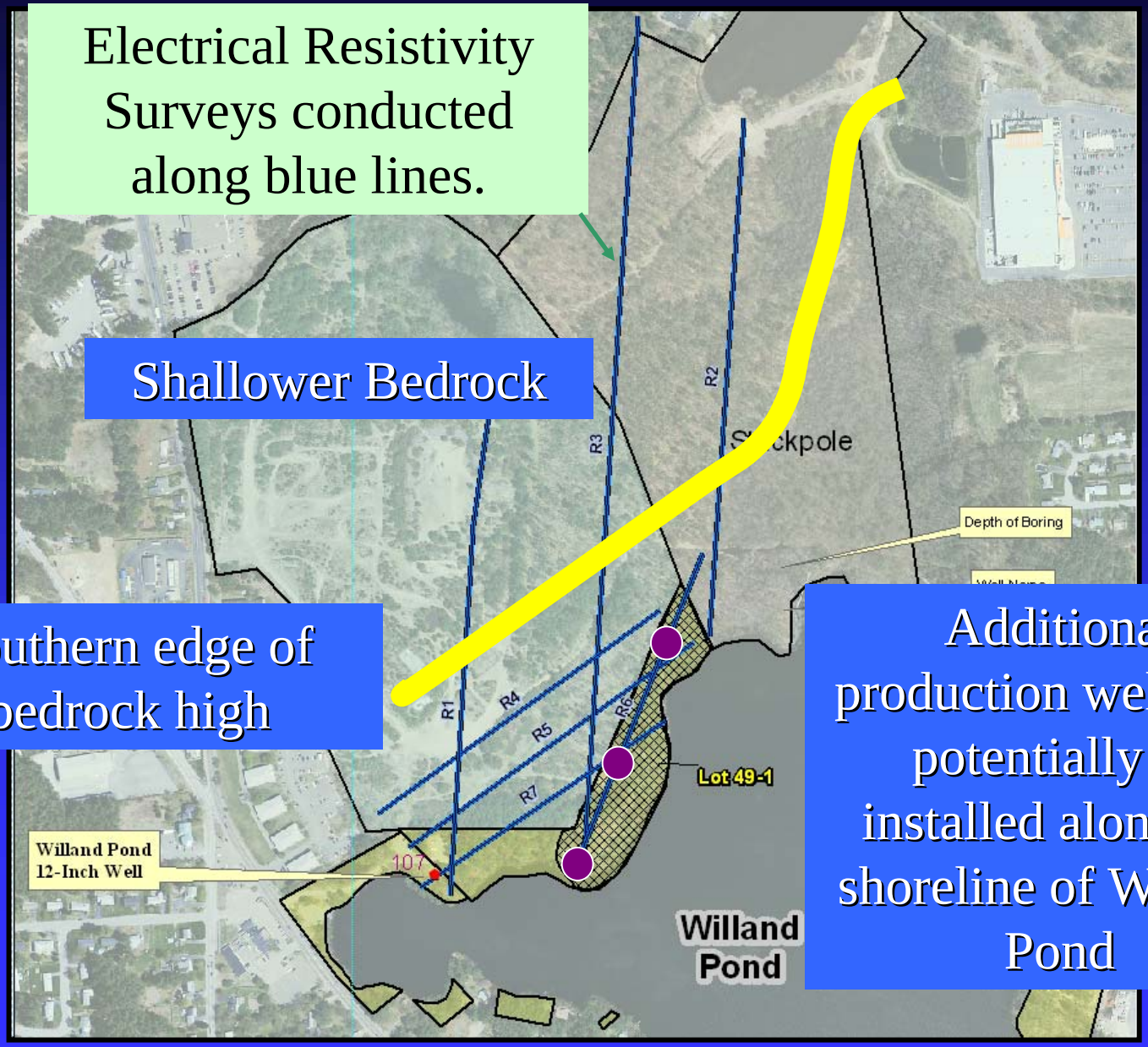
Photo 7 – Joint in screen at 62 feet is in good condition.

Well condition deemed sufficient for testing and potential long-term use.

Additional Evaluation of Willand Pond 12-Inch Production Well

- Eight-Hour Step Test
- Ambient Monitoring of Water Levels in Willand Pond 12-Inch Well and Willand Pond

Results of Geophysical Assessment



CURRENT WORK

Phase III - Part II

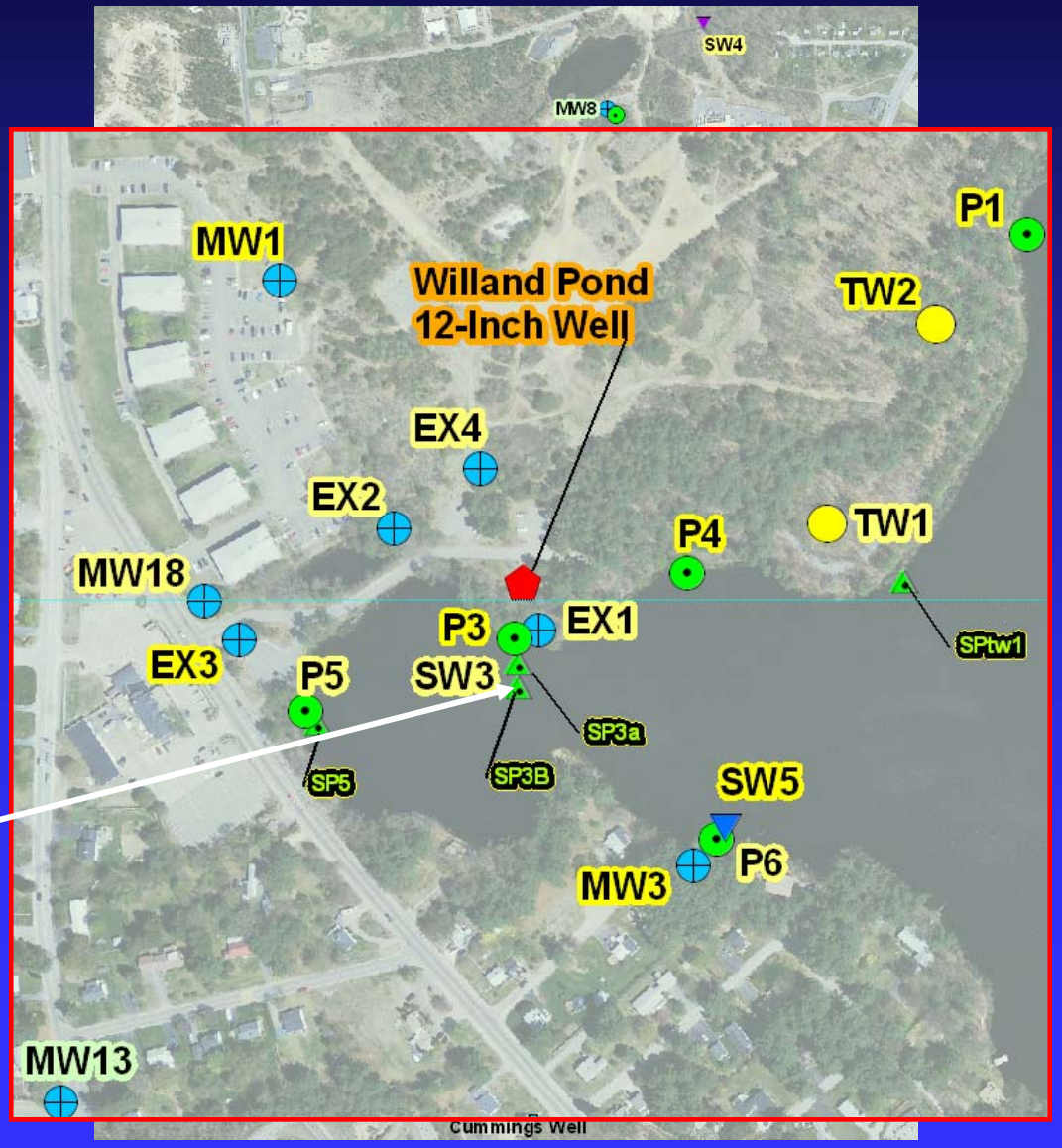
- NHDES Meeting – PT Plan Approval
- Purchase and Install Submersible Pump
- Install Monitoring Wells and Piezometers
- Conduct Exploratory Drilling
- Install Groundwater Monitoring Equipment at 41 Monitoring Stations
- Conduct a 90-Day Pumping Test and Water Quality Assessment Program

Drilling of 4 Exploratory Test Wells and 18 Monitoring Wells

Flush mount for public safety

Monitoring Locations Used During Pumping Test

- 18 Monitoring Wells
- 8 Piezometers
- 4 Surface Water Stations
- 5 Existing Wells
- 4 Exploratory Wells
- 9 Seepage Meters



Phase III Work Efforts

Phase III - Part II

City Tasks

- Install Pipeline for Discharge of Groundwater Pumped during the 90-Day Test
- Install 3-Phase Power to Willand Pond 12-Inch Well

Phase III - Part II

- **Permit and Construct Groundwater Discharge Location**

- **Groundwater discharged off Maplewood Avenue into the Indian Brook watershed.**
- **Approximately 2,300 feet of discharge line.**

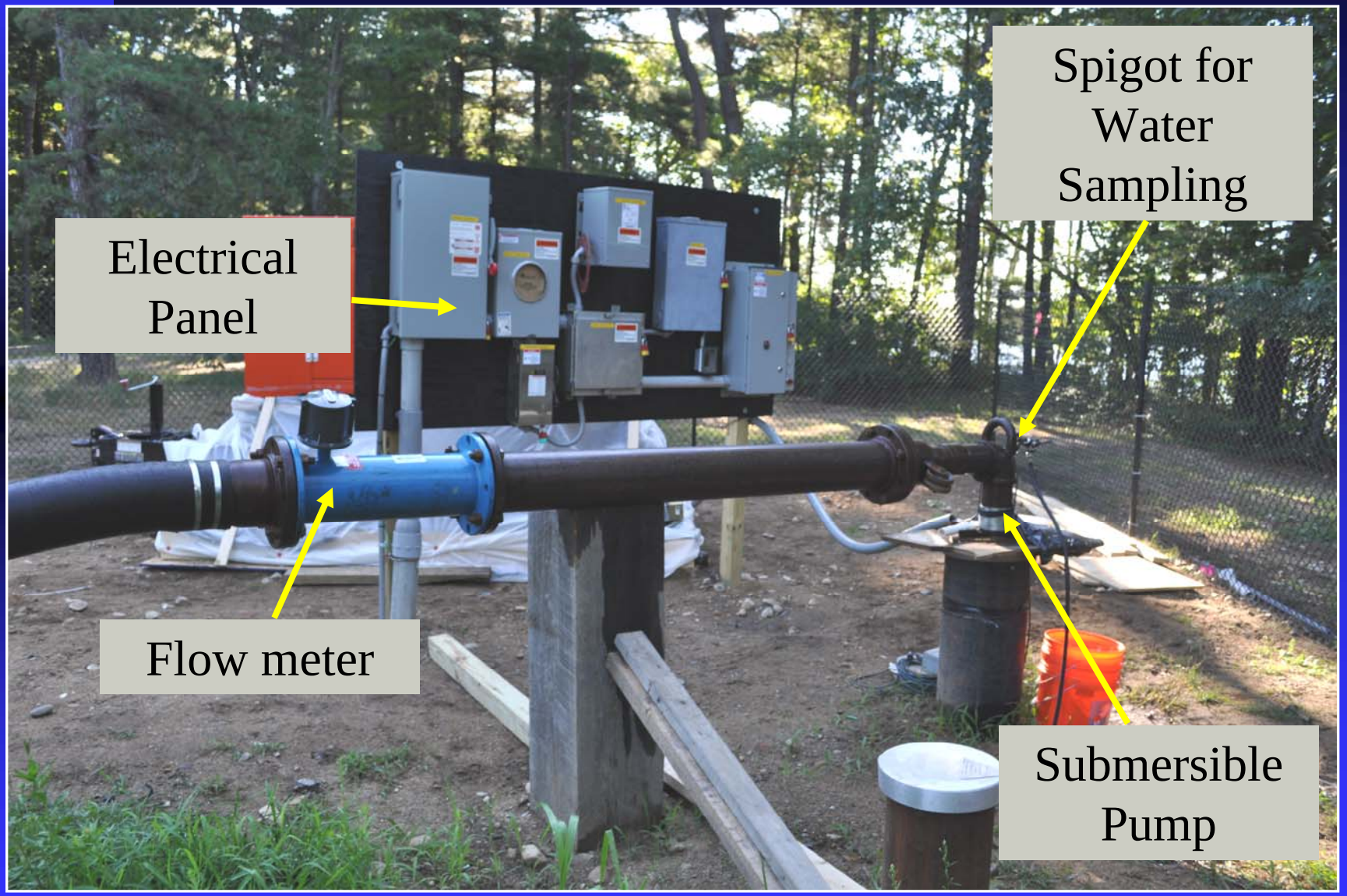
Groundwater Discharge

Phase III - Part II

Long-Term Pumping Test Program

- Pumping Rate: 600 gpm.
- Start of Pumping: July 22, 2010
- Pumping Period: 90 Days (it is now Day 84 of pumping)
- 30+ Days of water level monitoring prior to and after the pump period.

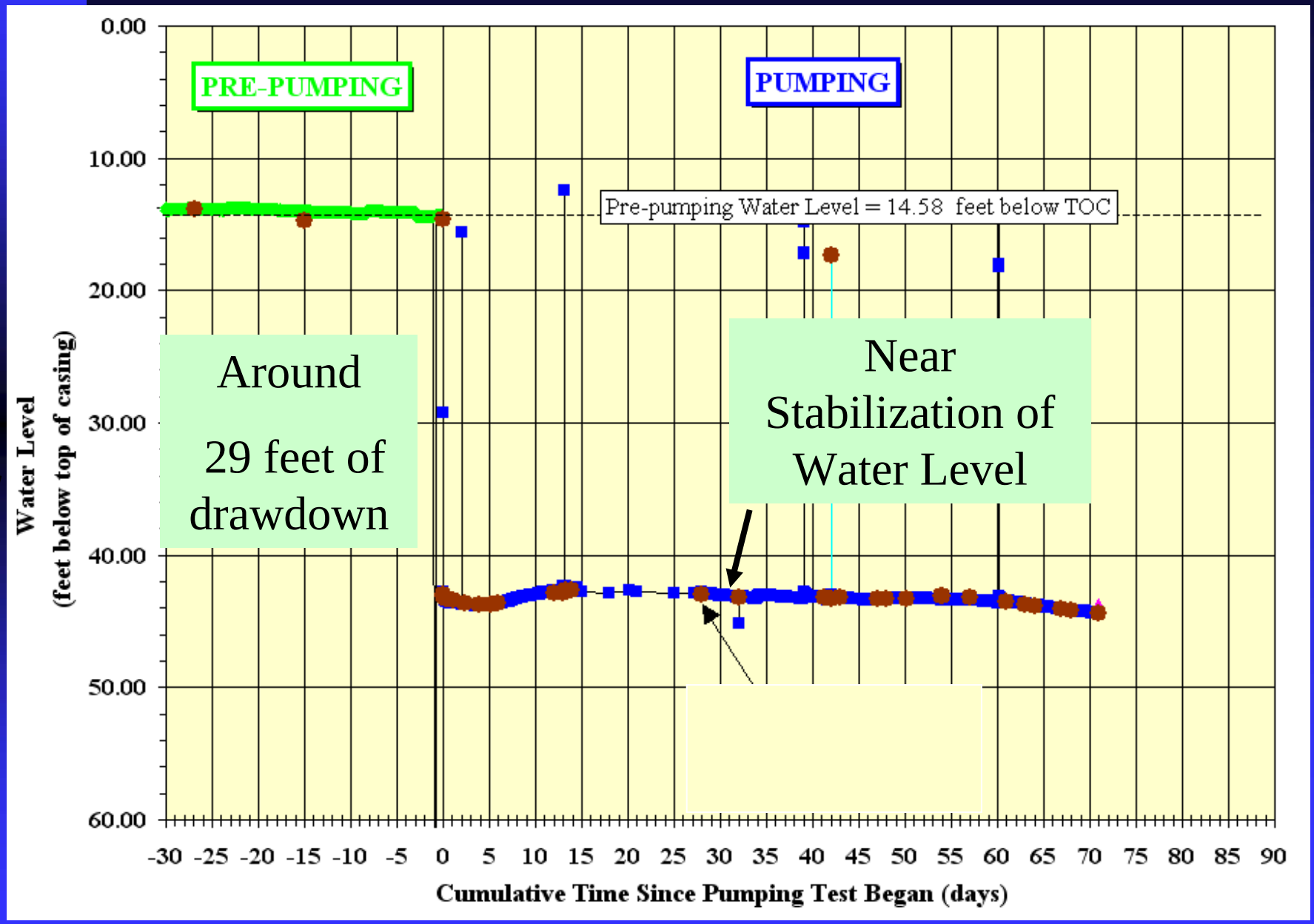
Pump Setup


Spigot for Water Sampling
Electrical Panel
Flow meter
Submersible Pump

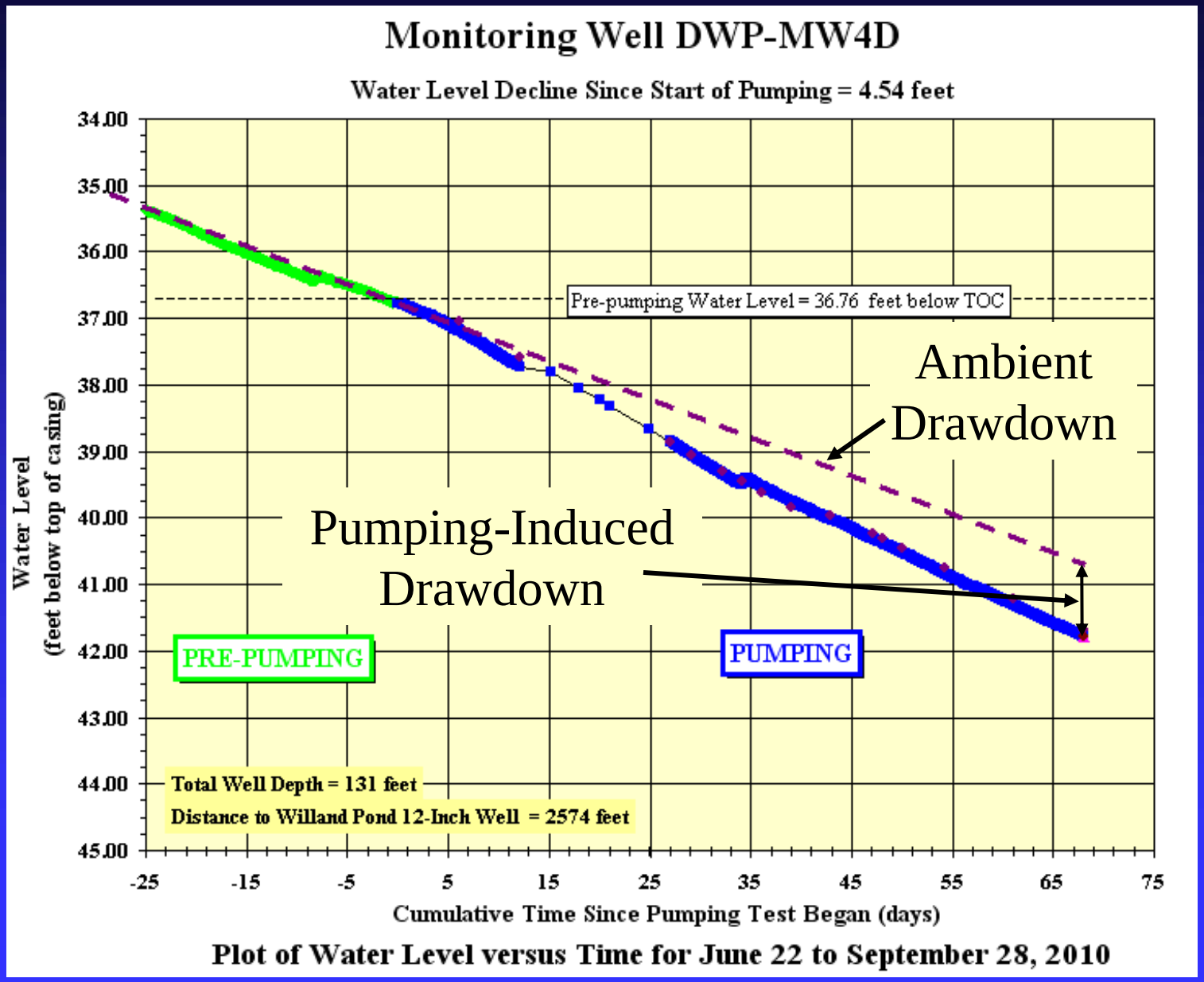
Phase III - Part II

- **Amount of Water Withdrawn from Aquifer During the Pumping Test**
  - Approximately 0.86 million gallons per day.
  - 77 million gallons during the 90-Day period.

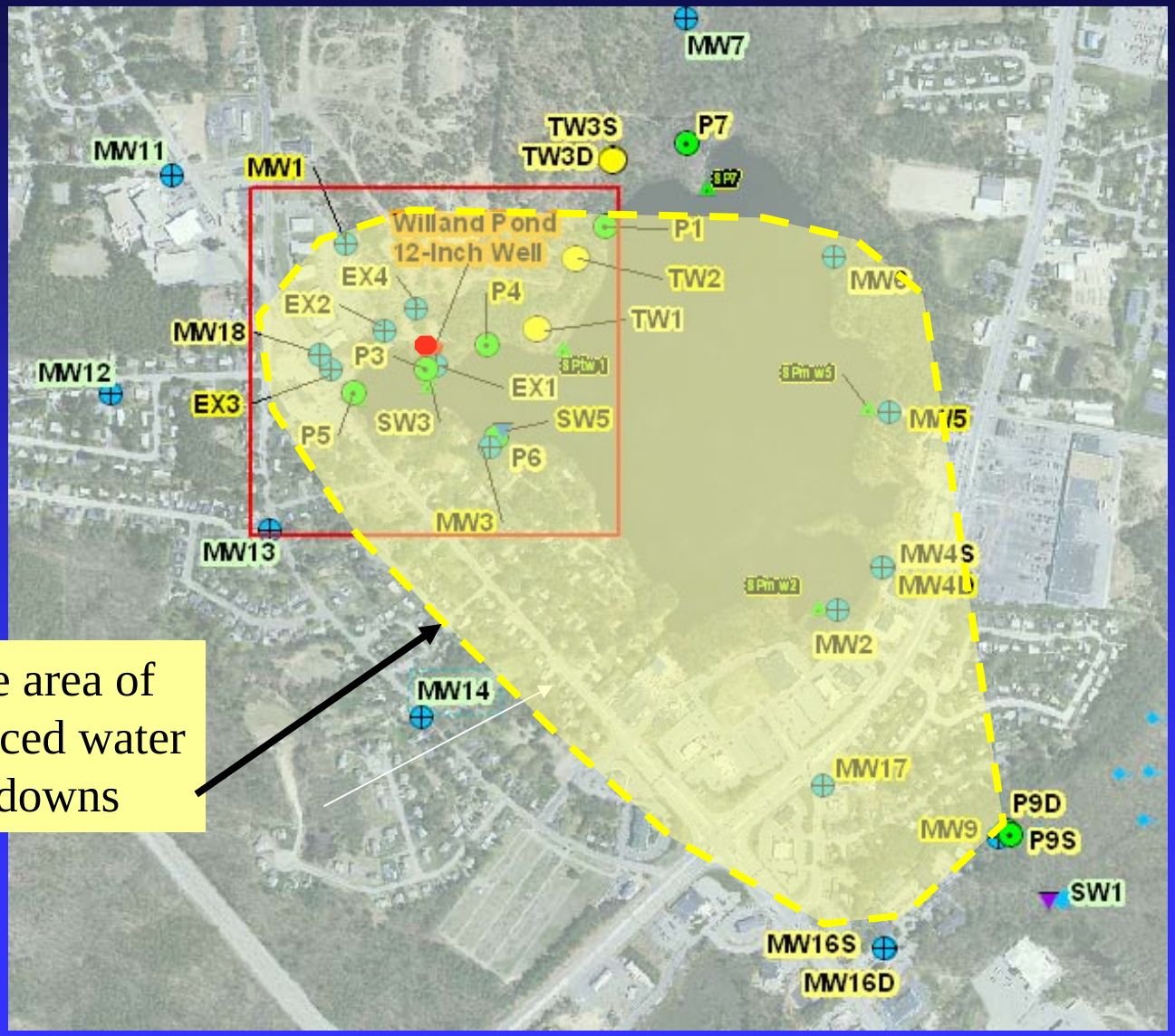
Water Level Drawdown in Pumping Well



Pumping-Induced Water Level Drawdown

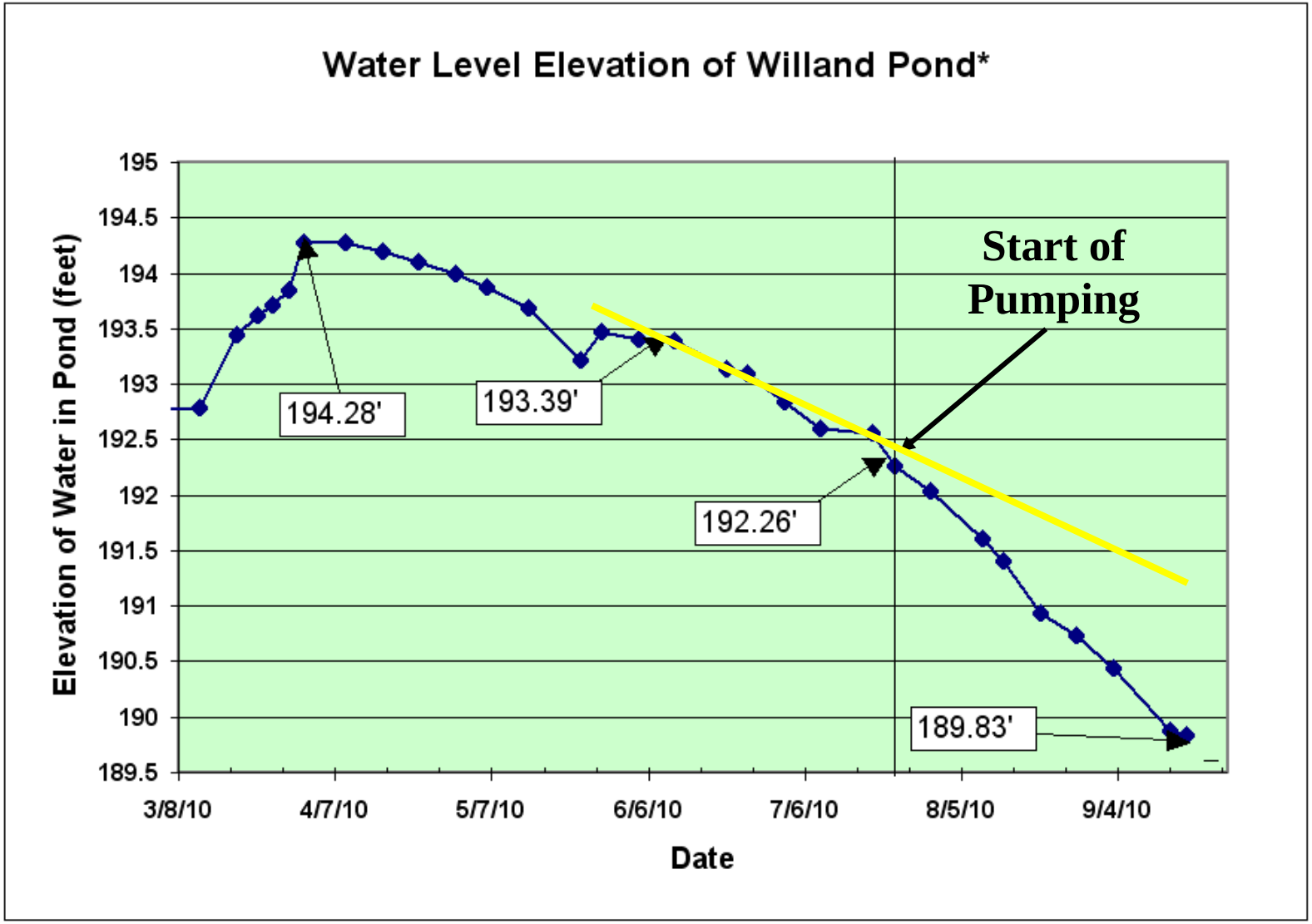


Area with Wells having Pumping-Induced Water Level Impacts



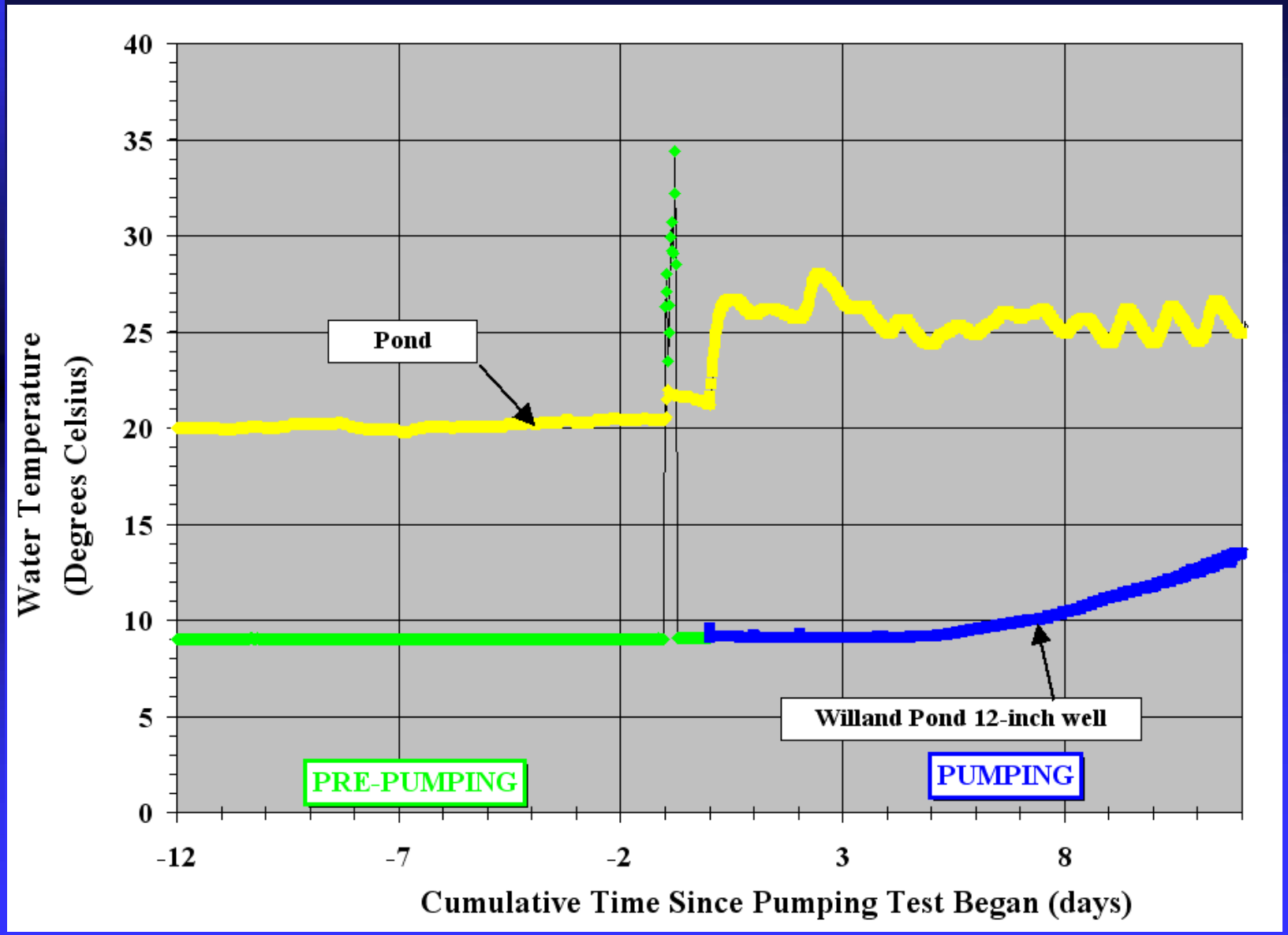
Approximate area of pumping-induced water level drawdowns

Pumping-Induced Water Level Drawdown in Willand Pond



* Data Source: Friends of Willand Pond

Additional Evidence for Pumping-Induced Recharge from Pond into Aquifer



Phase III - Part III

- **Results of Preliminary Data Analysis**

- **The pumping of Willand Pond 12-inch Well was effective at lowering the water level in Willand Pond.**
- **The Willand Pond 12-Inch Well can be pumped at 600 gpm for extended periods during under specific climatic conditions and water levels in Willand Pond.**

Phase III - Part II

Water Quality Analysis

- Full suite of drinking water parameters at start, middle, and end of pumping
- Weekly transient data
- Weekly bacteria analyses of Well water
- “Water Under Surface Water Influence” Analyses

Water Quality Sampling and Field Analyses

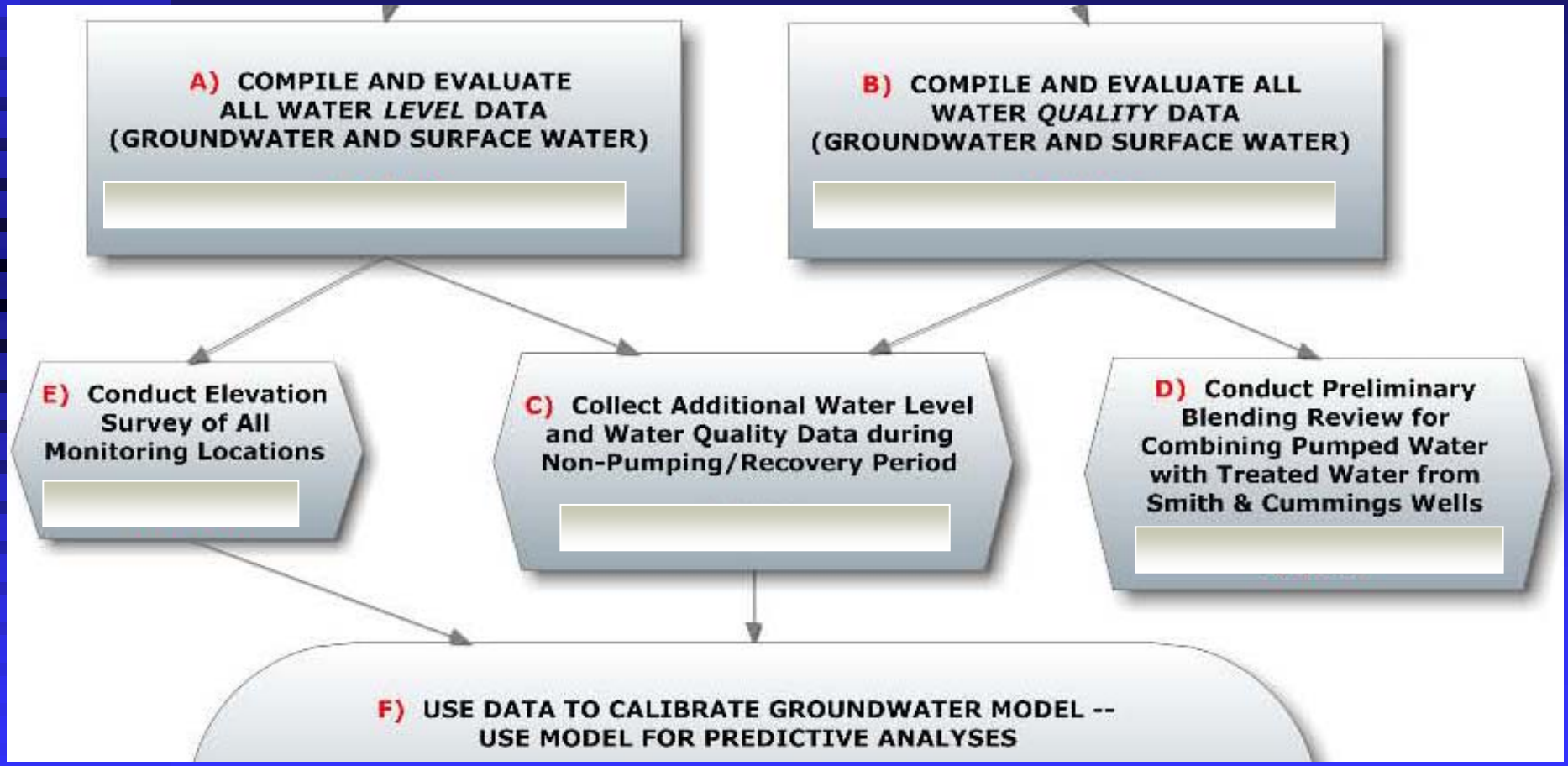
Phase III - Part II

Results of Preliminary Water Quality Analysis

- Groundwater derived from the Willand Pond Well meets all primary drinking water standards (Maximum Contaminant Levels (MCLs)).
- Will require treatment or mixing to reduce iron and manganese concentrations to below their respective secondary MCLs.
- Is at low risk of being under the influence of surface water.

Next Steps - Continued

Phase III - Part III

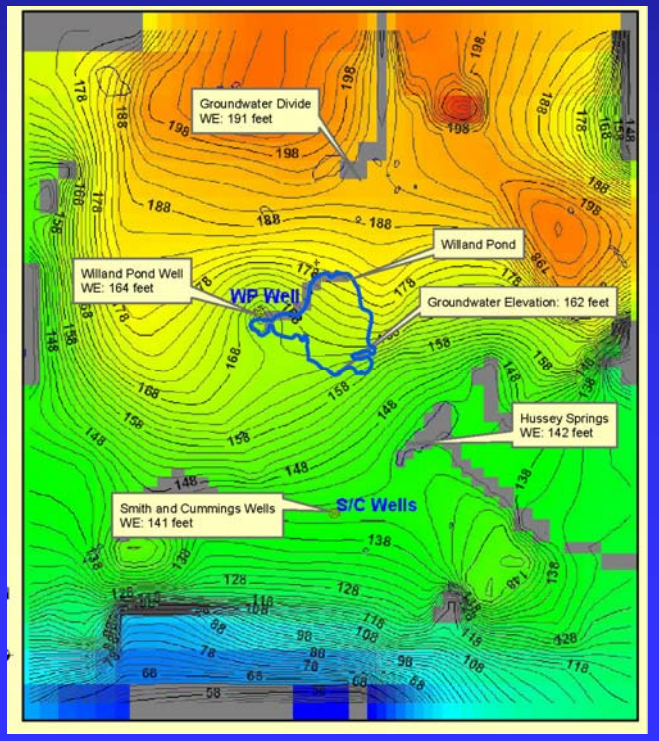


Next Steps - Continued

Phase III - Part III

Update Numerical Model and Use to Create Water Management Plan for Willand Pond 12-Inch Well Under Varying Climatic Conditions to:

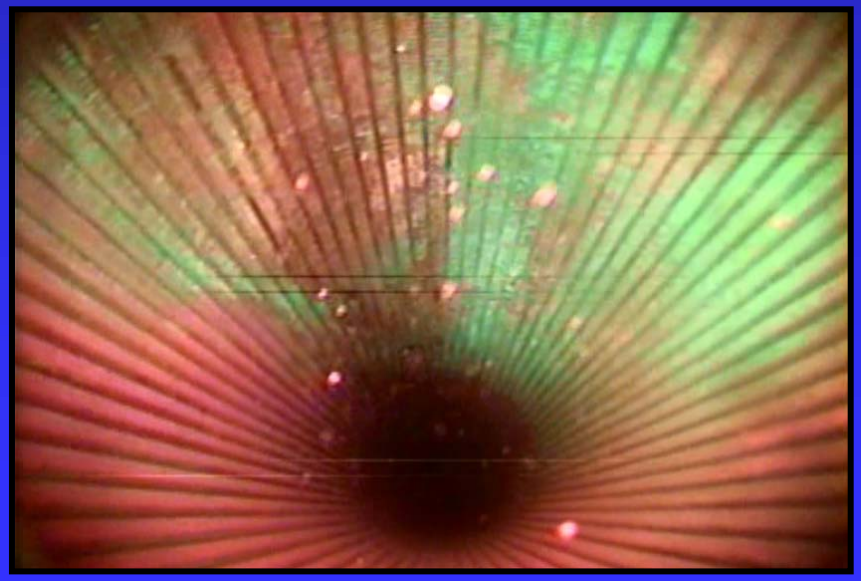
- **Supply Potable Water to the City of Dover and**
- **Dewater Willand Pond as Needed.**



Next Steps - Continued

Phase III - Part III

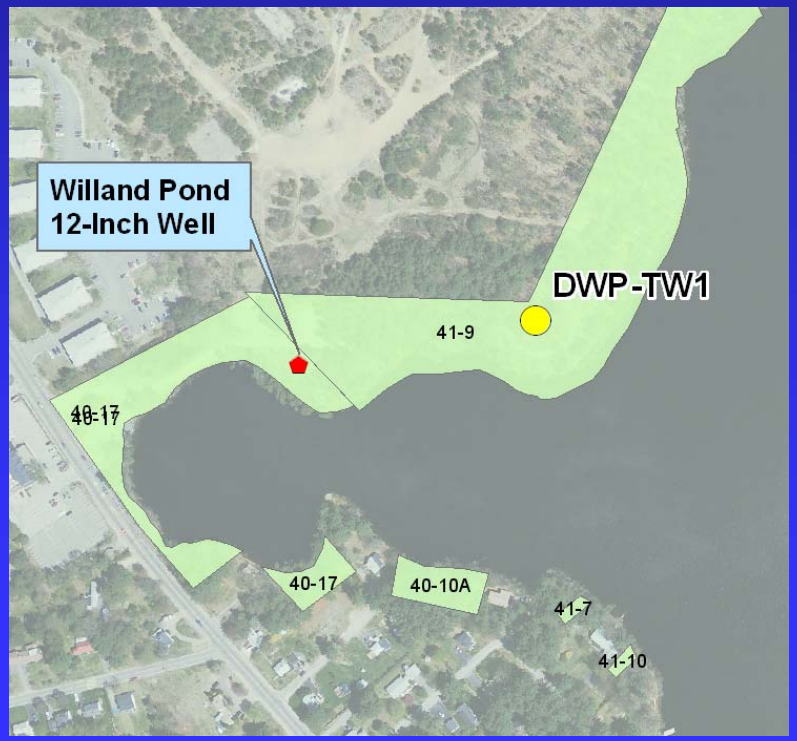
Perform a Post Pumping Video Log of Well to Assess Well Condition After 90-Days of Pumping.



Next Steps - Continued

Phase III - Part III

Assess the Potential for Developing an Additional Production Well on the North Shore of Willand Pond.



Next Steps - Continued

Phase III - Part III

- Obtain an approval from the NHDES for withdrawing groundwater from the existing Willand Pond 12-Inch Production Well; or
- Obtain a Groundwater Withdrawal Permit from the NHDES for a new groundwater supply well on the north shore of Willand Pond.

End of Presentation

Pumping Test Results – Water Quality Data – Willand Pond Well

Day of Testing Period	Date	Iron (mg/L)	Manganese (mg/L)	Sodium (mg/L)	Chloride (mg/L)	E-Coli Duplicates (mg/L)	(mg/l	Cyanobacteria Toxin (ppb)	Radon (pCi/L)	Turbidity (NTU)	Color (PtCo)
Primary MCL											
Secondary MCL		***0.3***	***0.05***		***250***						
Water Quality Sampled During Period of Pumping											
1	07/22/10	0.2	0.02	<5	1	na	na	na	1,370	na	na
3	07/24/10	0.48	0.021	<5	2	na	na	na	na	<1	<5
5	07/26/10	0.5	0.024	<5	6	<1	na	na	na	<1	<5
8	07/29/10	0.41	0.027	11	25	<1	<1	na	na	<1	<5
15	08/05/10	0.46	0.43	18	36	<1	<1	na	na	<1	<5
16	08/06/10	na	na	na	na	na	na	<0.5	na	na	na
28	08/18/10	0.41	0.062	20	42	<1	<1	na	na	<1	<5
35	08/25/10	0.48	0.078	21	46	Absent	Absent	na	na	<1	<5
42	09/01/10	0.69	0.099	24	48	Absent	Absent	<0.5	na	1	<5
49	09/08/10	0.84	0.11	23	50	<1	<1	na	na	<1	<5
51	09/10/10	0.77	0.099	23	48	<1	na	na	1214	na	<5
55	09/14/10	1.0	0.11	25	50	<1	<1	na		<1	<5
62	09/21/10	1.2	0.12	23	47	<1	<1			<1	<5

Pumping Test Results – Water Quality Data – Willand Pond Well

Day of Testing Period	Date	Iron (mg/L)	Manganese (mg/L)	Sodium (mg/L)	Chloride (mg/L)	E-Coli Duplicates (mg/L)	(mg/l	Cyanobacteria Toxin (ppb)	Radon (pCi/L)	Turbidity (NTU)	Color (PtCo)
Primary MCL											
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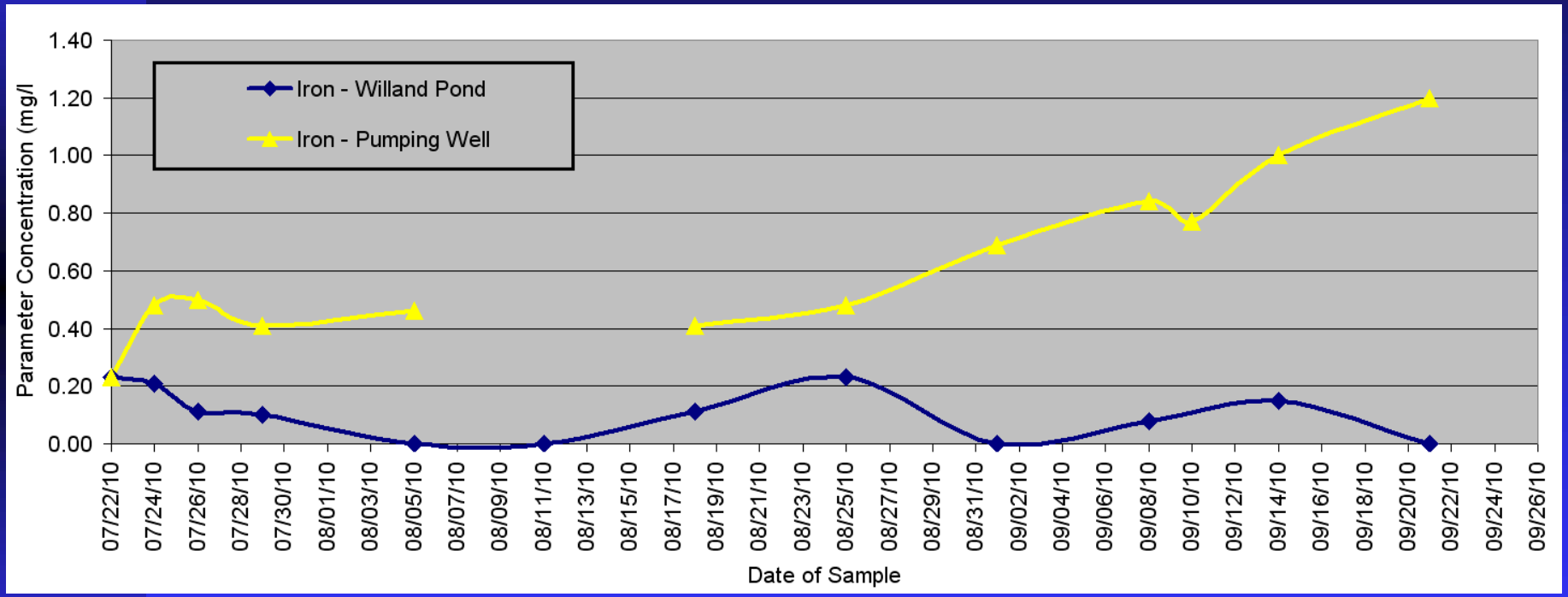
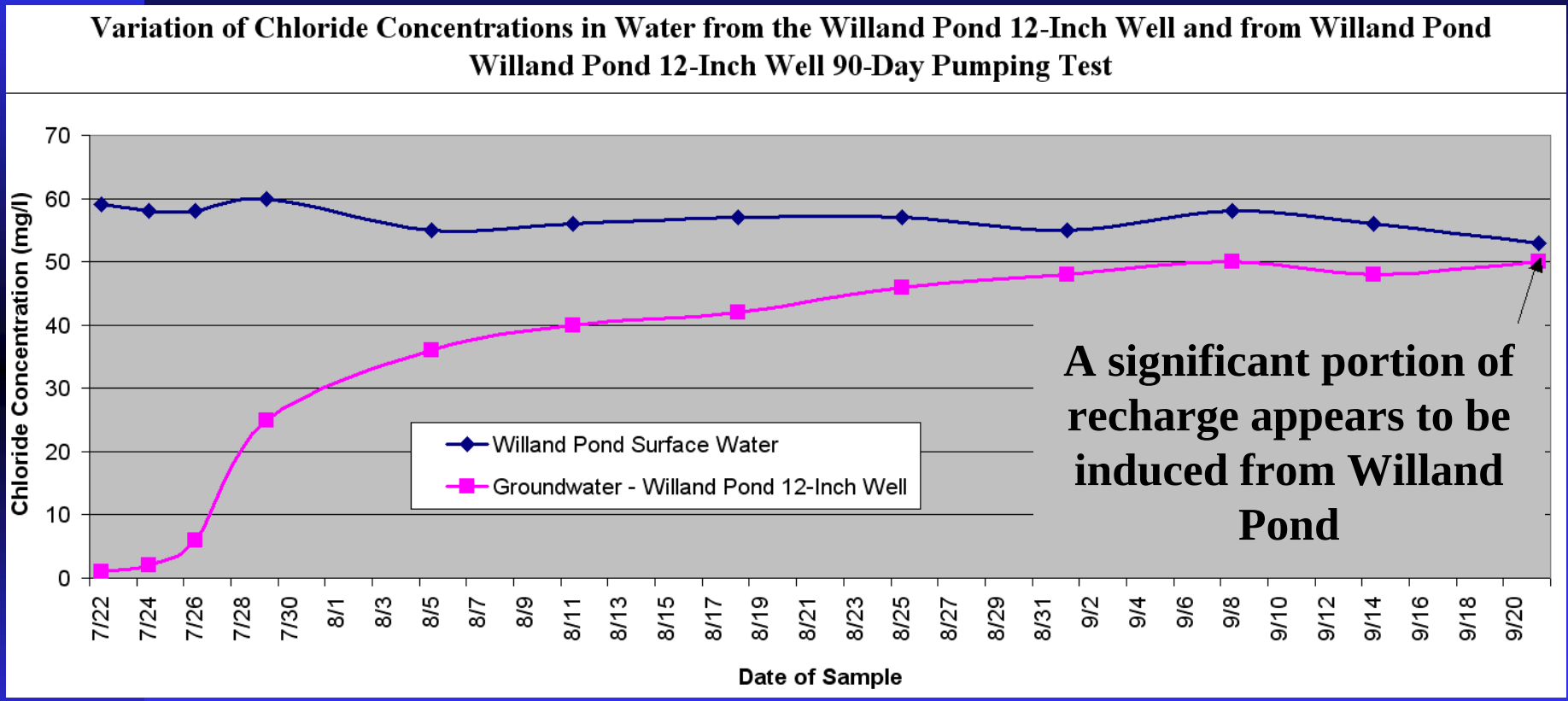
16	08/06/10	na	na	na	na	na	na	<0.5	na	na	na
28	08/18/10	0.41	0.062	20	42	<1	<1	na	na	<1	<5
35	08/25/10	0.48	0.078	21	46	Absent	Absent	na	na	<1	<5
42	09/01/10	0.69	0.099	24	48	Absent	Absent	<0.5	na	1	<5
49	09/08/10	0.84	0.11	23	50	<1	<1	na	na	<1	<5
51	09/10/10	0.77	0.099	23	48	<1	na	na	1214	na	<5
55	09/14/10	1.0	0.11	25	50	<1	<1	na		<1	<5
62	09/21/10	1.2	0.12	23	47	<1	<1			<1	<5

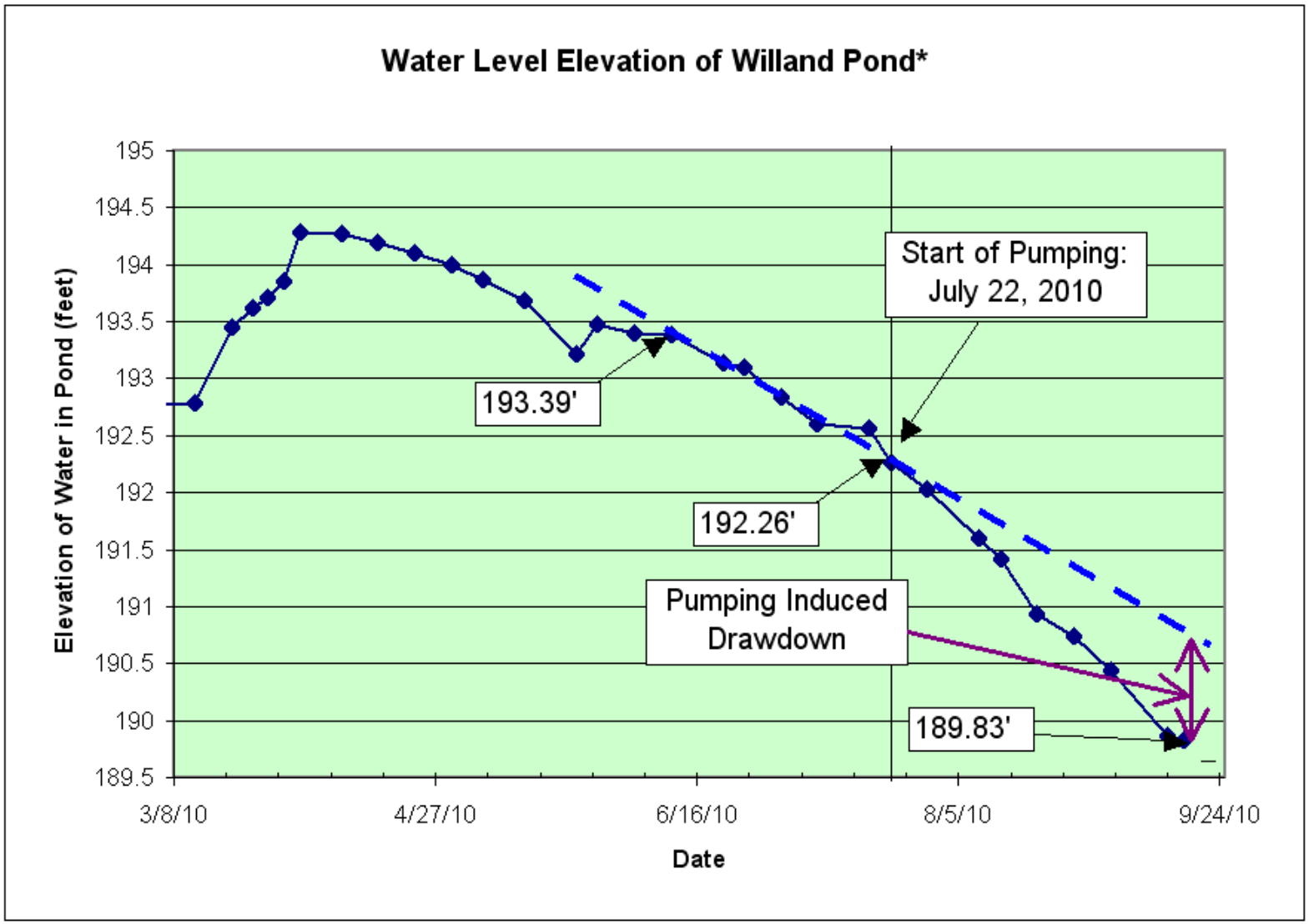
Pumping Test Results – Variations in Iron Concentrations



Pumping Test Results – Induced Recharge



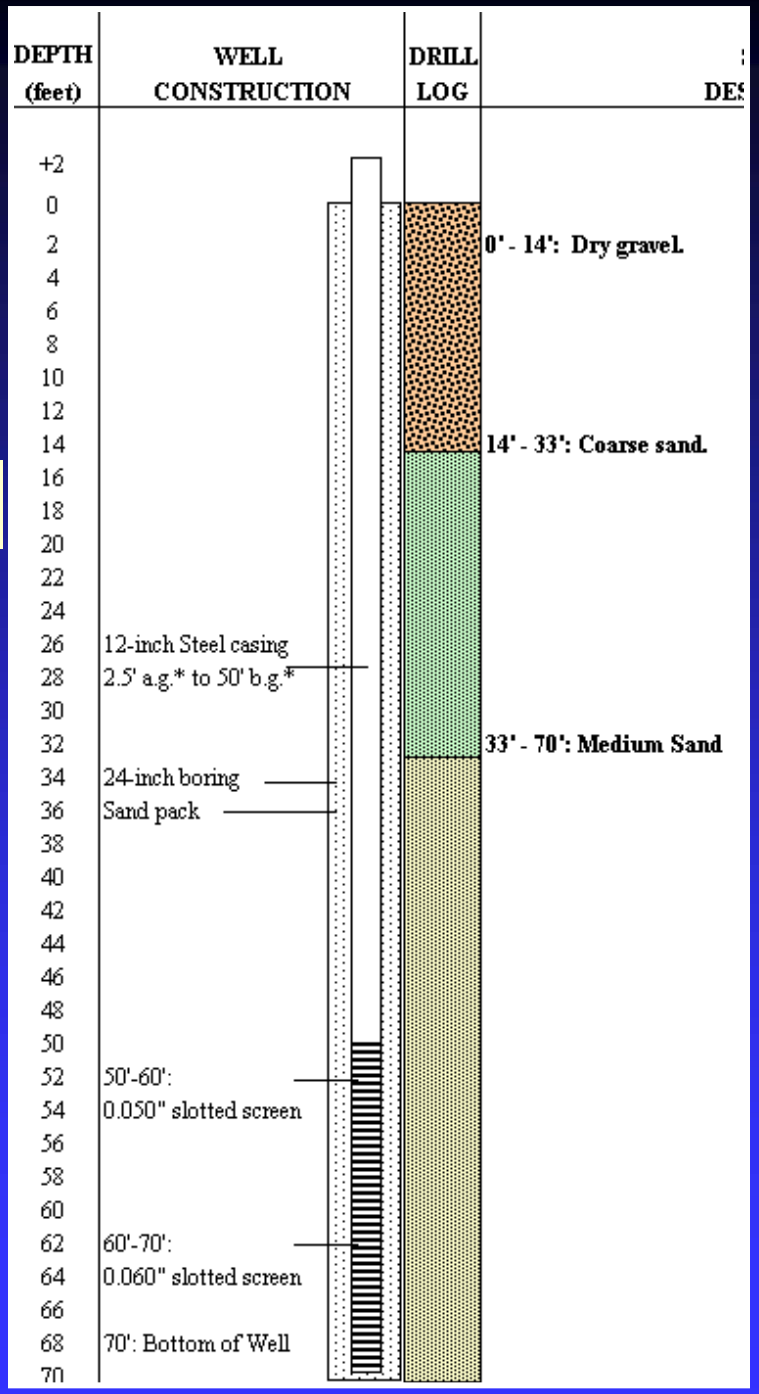
Pumping-Induced Water Level Drawdown in Willand Pond



* Data Source: Friends of Willand Pond

Willand Pond 12-Inch Well

Hydrogeologic log created from information on R.E. Chapman 1961 well completion form.



Additional Pumping Well Location Drilling Results

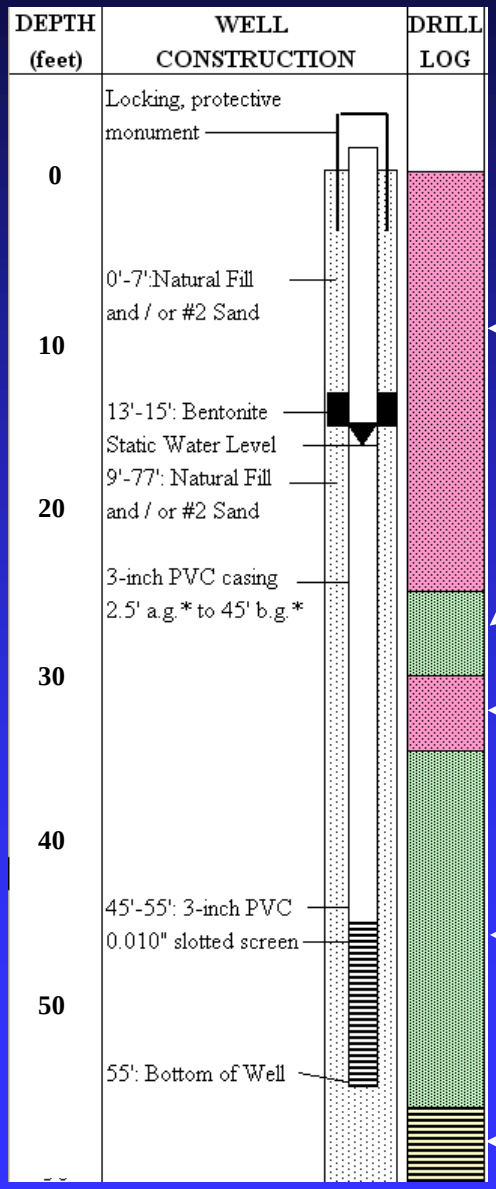
Depth of Bedrock: 77’

Depth of Well: 55’

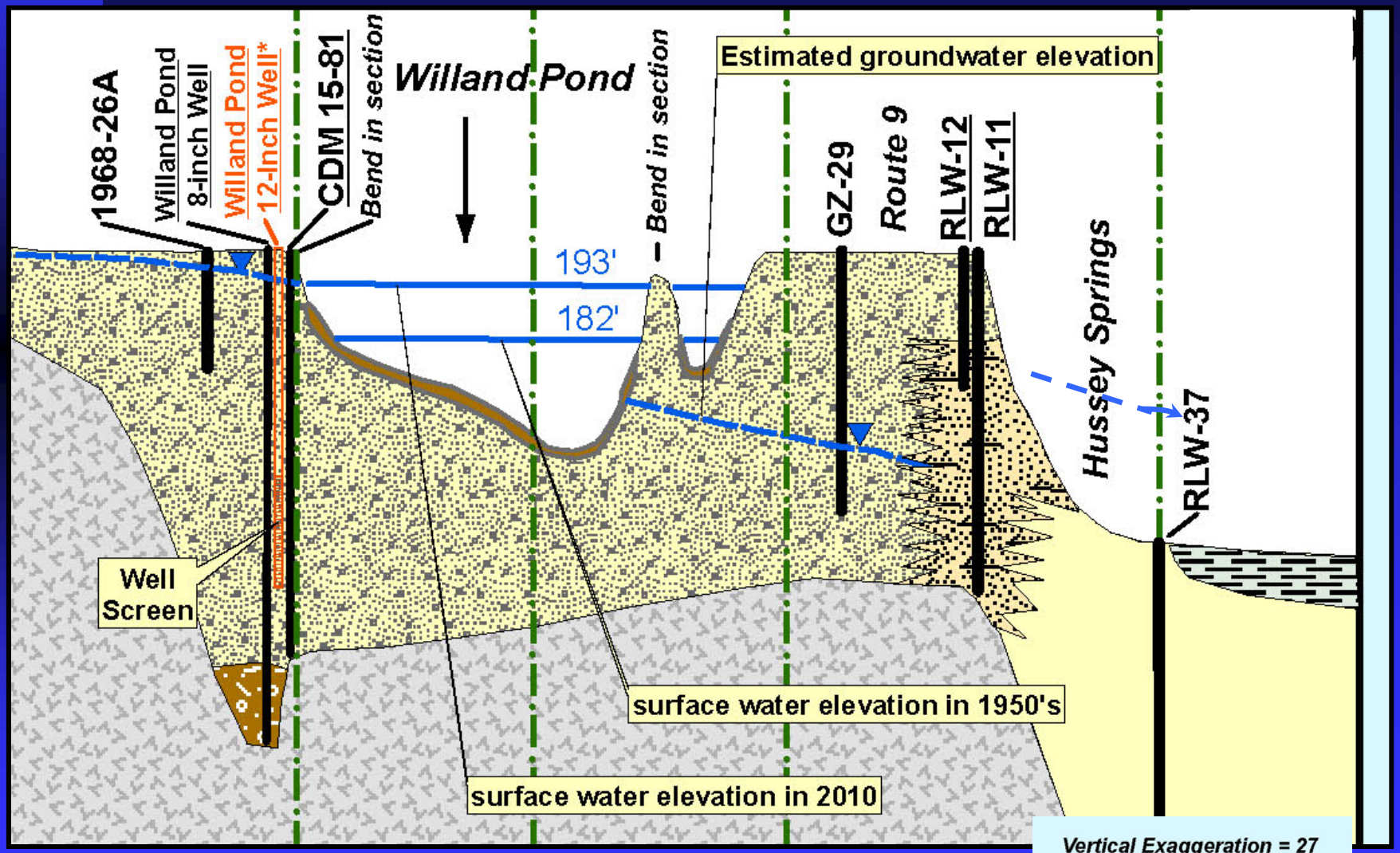
Specific Capacity: 9.3 gpm/ft

Available Drawdown: 29’

Yield Potential: 250 gpm



Hydrogeologic Cross-Section



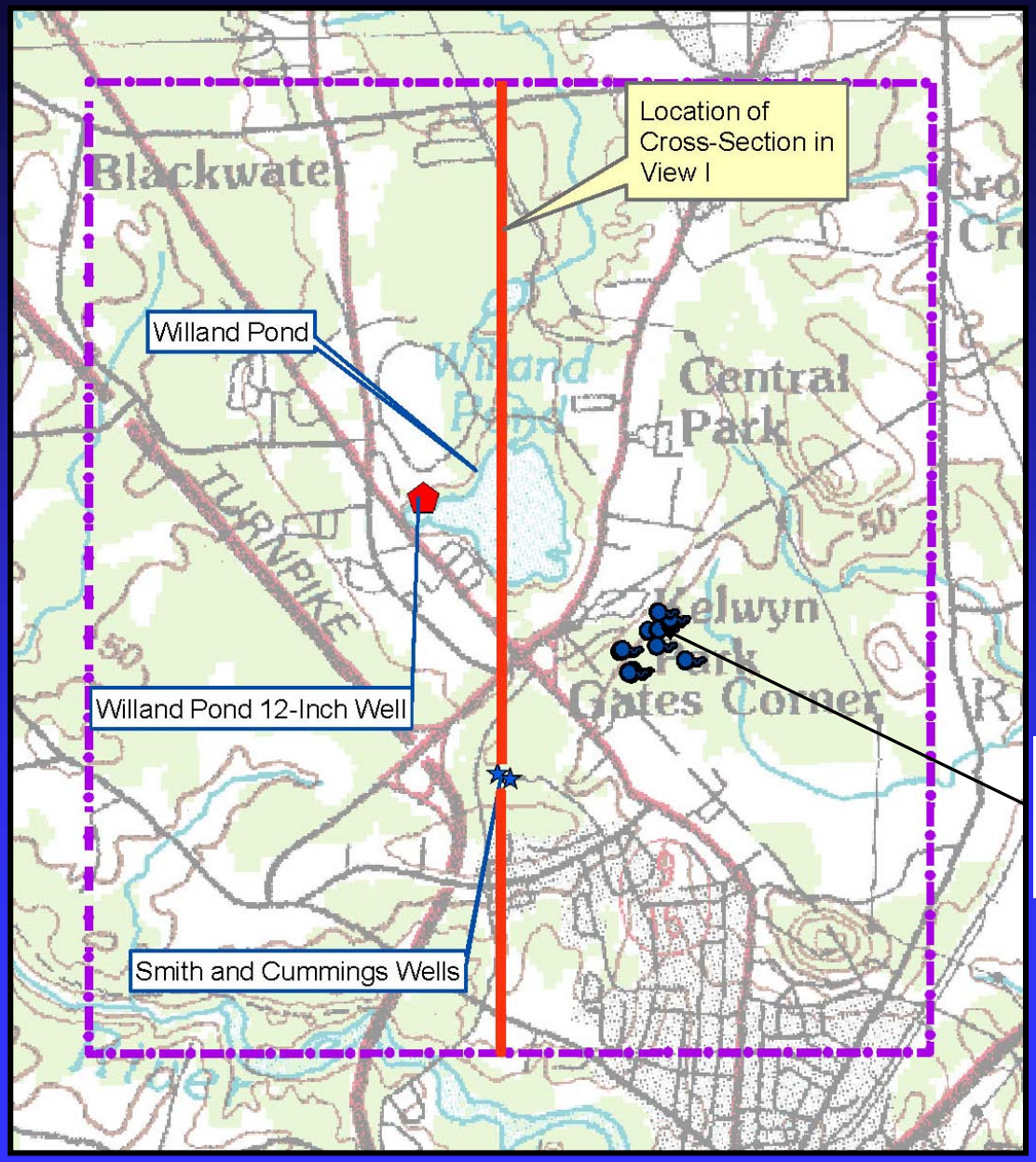
Phase III - Part II

- **Submersible Pump Purchase and Installation**

- Pump designed for temporary use during pumping test and permanent use.
- Pump: Gould 7THC 700 gpm,
  7.5-Inch-Diameter, 5-Stage, 50 hp.
- Top of Pump set at 47.5 feet below top of casing.

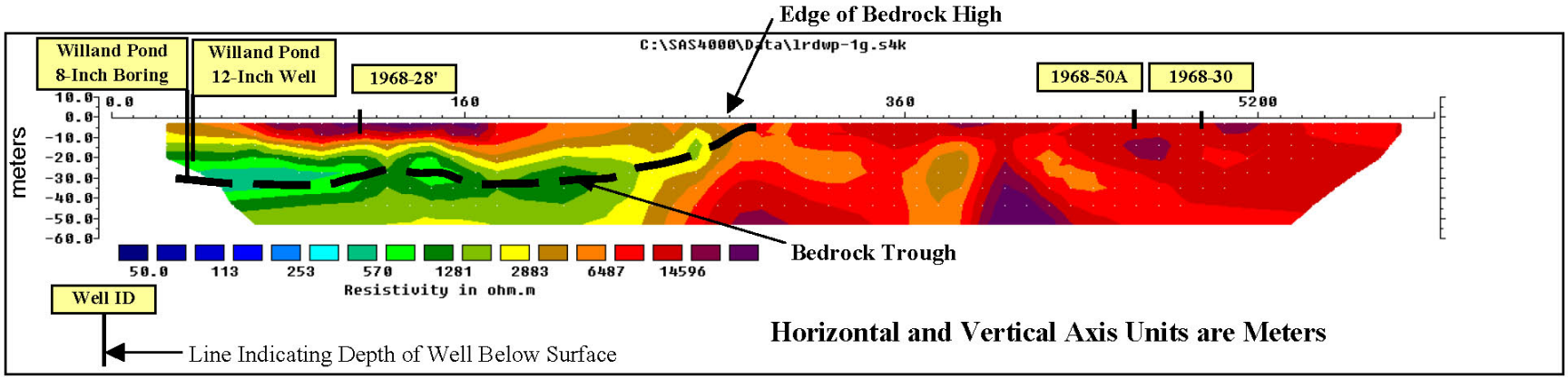
Installation of Piezometers

• Model Domain

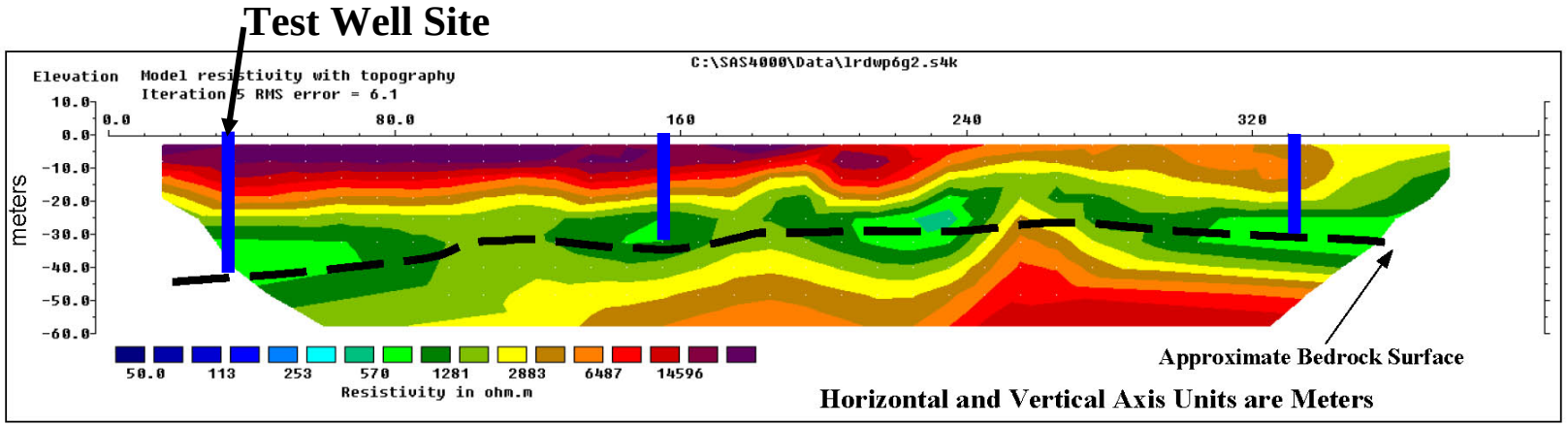


South North

Electrical Resistivity Survey Line R1 - Gradient Method



Electrical Resistivity Survey Line R6 - Gradient Method



Phase III - Part II

- **NHDES Meeting**

- Reviewed project findings to date;
- Reviewed proposed 90-Day pumping test and monitoring plan; and
- Discussed opportunities for developing additional groundwater supply wells

Phase III - Part II

- **Results of Preliminary Data Analysis**
  - Water level in pumping well nearly stabilized until Day 60.

Evaluation of the Willand Pond Aquifer through Geophysical Methods

Pump Setup

Water Table – Static Conditions