City of Troy I-35 Well

A Lower Trinity Public Water Supply Well
Case Study

Clearwater Underground Water Conservation District
Every drop counts!

BRAUN INTERTEC
The Science You Build On.

CITY OF TROY
ESTABLISHED 1892

BSP engineers

PROJECT TEAM

City of Troy – Jeff Straub (City Manager)

Clearwater Underground Water Conservation District

– Dirk Aaron (General Manager)

BSP Engineers – Anthony Beach

Braun Intertec Corporation – William Gamblin

Texas Water Development Board

Texas Commission on Environmental Quality

Hydro Resources Mid-Continent

City of Troy Needs Assessment

- Accelerated Growth Expected
  - I-35 Construction
  - Commute to Waco and Temple
  - Water Usage Expected to be 4 times Current in 2035
- City Strives to a Balance an Diversity of Sources
  - 60/40 split between surface and groundwater.
- Currently Operates one Public Supply Well (City of Troy Well #2).
  - Historical Use Permit
  - Declining Yield
- City of Temple “Take or Pay” Contract

CUWCD Drilling Permit

- Drilling Permit Submitted in 2015
  - Class 2 Non Exempt
  - Proposed Well Location
    - Setback Criteria
  - Proposed Well Construction Details
    - Gauge Lines
  - Engineered Drawings and Specifications
  - Proposed CUWCD Forms and Checklists
  - Drought Contingency Plan
  - Projection of an Additional 250 ac-ft/year
    - 220.5 ac- ft Existing Use
    - 470.5 Needed in 2035

CUWCD Drilling Permit

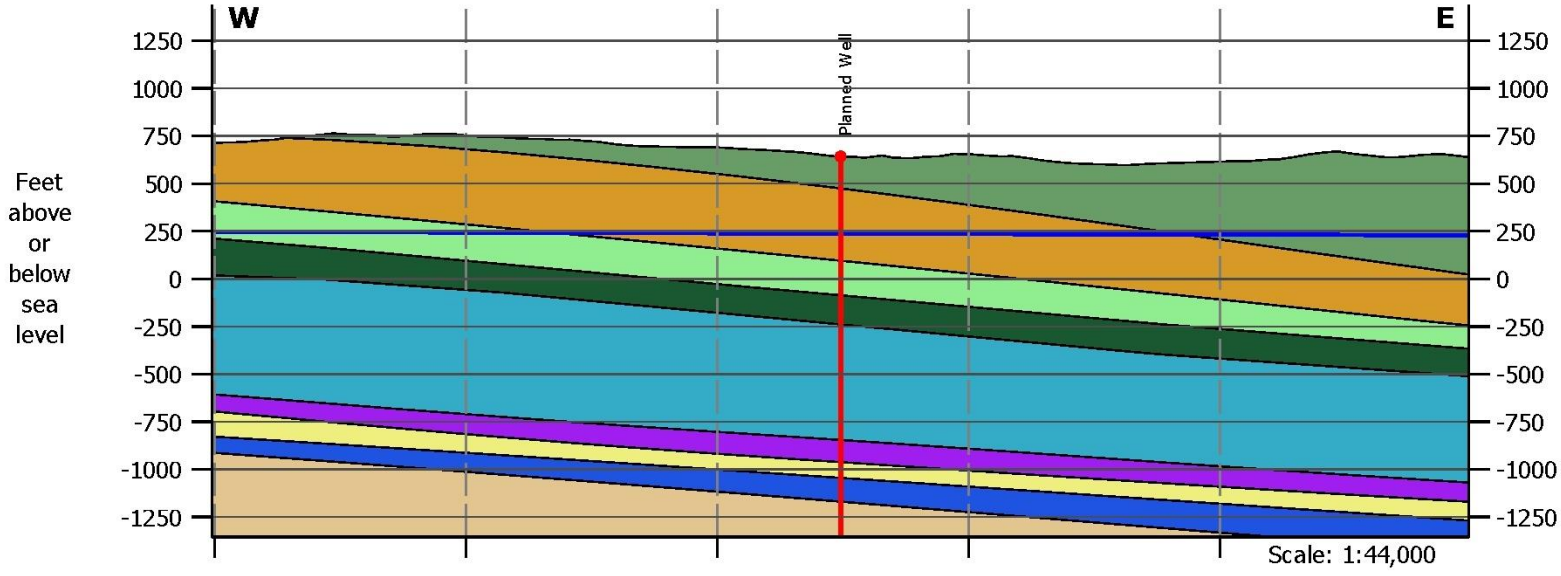
- Lower Trinity Aquifer
  - Hosston Formation
    - Artesian conditions
  - Other Possible Aquifers
    - Edwards BFZ
    - Upper Trinity
    - Middle Trinity

CUWCD Drilling Permit

- Clearwater Underground Water Conservation District
  - Pro-Active
  - Guidance and Assistance
    - Pre-Permit Meeting
    - Administrative Assistance with Notifications
      - Surrounding Property and Well Owners
      - Local Media Notifications
  - Virtual Core

West - East Fence Diagram #2

(Lat: 31.217931, Long: -97.295158)



Potentiometric Surfaces

2012-2013 Hosston Water Level Elevation (Confined Conditions)

Geology

- Layer 1 - Taylor Marl and Austin Chalk
- Layer 2 - Del Rio, Georgetown, Main Street and Paw Paw Limestone
- Layer 3 - Edwards and Comanche Peak Limestone
- Layer 4 - Walnut
- Layer 5 - Glen Rose
- Layer 6 - Hensell
- Layer 7 - Pearsall, Cow Creek Limestone and Hammett Shale
- Layer 8 - Hosston
- Layer 9 - Undifferentiated

Wells are labeled with tracking numbers from 3-D Hydrostratigraphic Model, Standen et al., 2014.

Location (State Plane 4203)

W: 3232950, 10419660

E: 3259350, 10419660

Drilling Prognosis for Planned Well

Depth (feet bgs)		***Predicted Geology**
From	To	Geology
0	168	Taylor Marl and Austin Chalk
168	547	Del Rio, Georgetown, Main Street and Paw Paw Limestone
547	729	Edwards and Comanche Peak Limestone
729	882	Walnut
882	1489	Glen Rose
1489	1605	Hensell
1605	1688	Pearsall, Cow Creek Limestone and Hammett Shale
1688	1812	Hosston

*The formation surfaces in this 3-D model are based on geological intepretation and extrapolation of available well data by Allan R. Standen LLC. Additional well data may modify the interpretation and extrapolation of these formation surfaces.

CUWCD Drilling Permit

- Drilling Permit was submitted in June 2015 and approved by the CUWCD Board in August 2015.
- Subsequent drilling permit extensions extended the active Drilling Permit through November 2018.
- Drilling Operations began in July 2018.

TCEQ “Approval to Construct” Permit

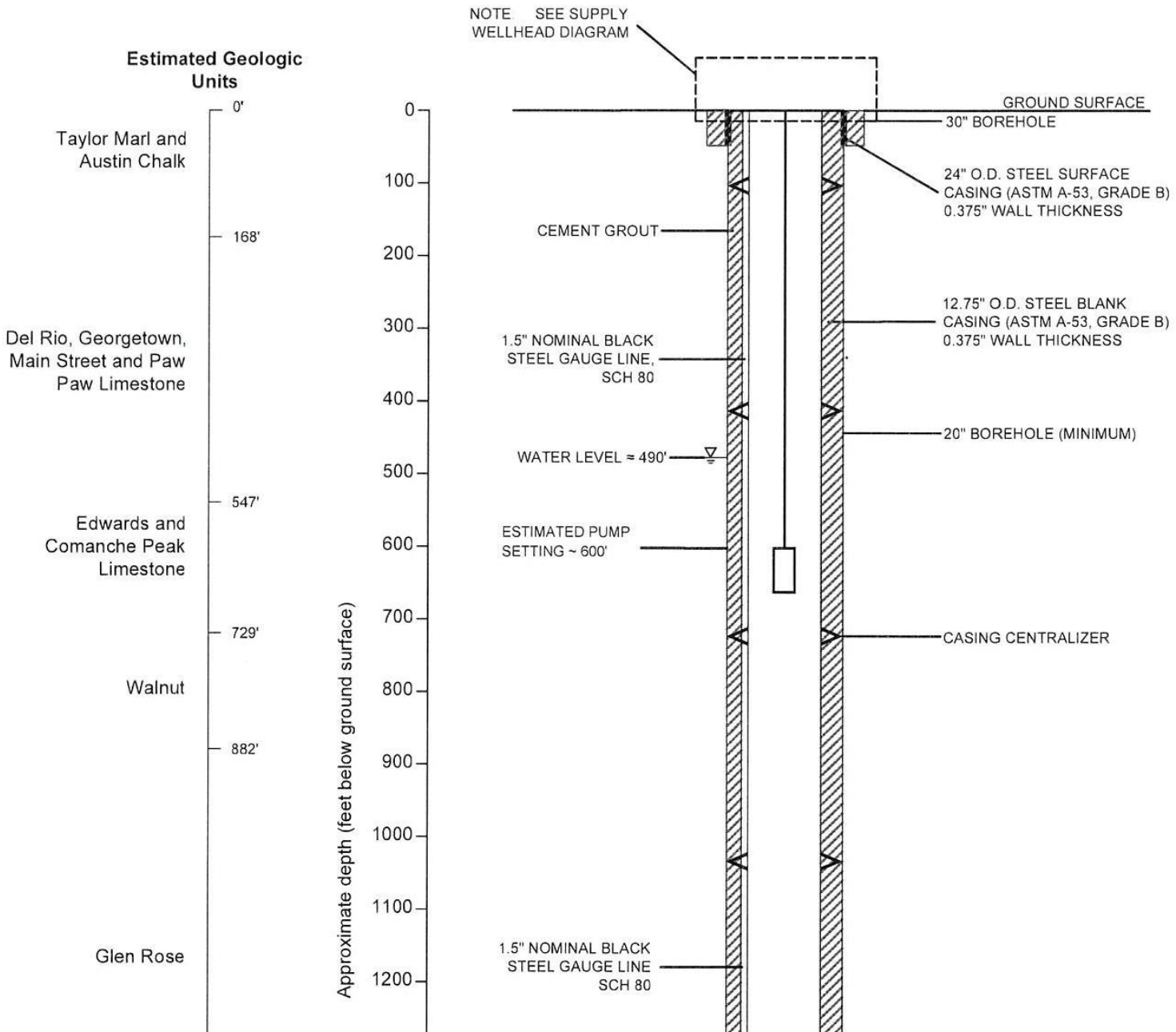
- Texas Commission on Environmental Quality
  - Conformance with TAC Title 30 Chapter 290 Regulations
  - Business Plan
  - Engineering Report
  - Project and Hydrogeologic Background
  - Set Back Criteria
  - Sanitary Control Easements
  - Proposed Well Construction Details
  - Engineered Drawings and Specifications

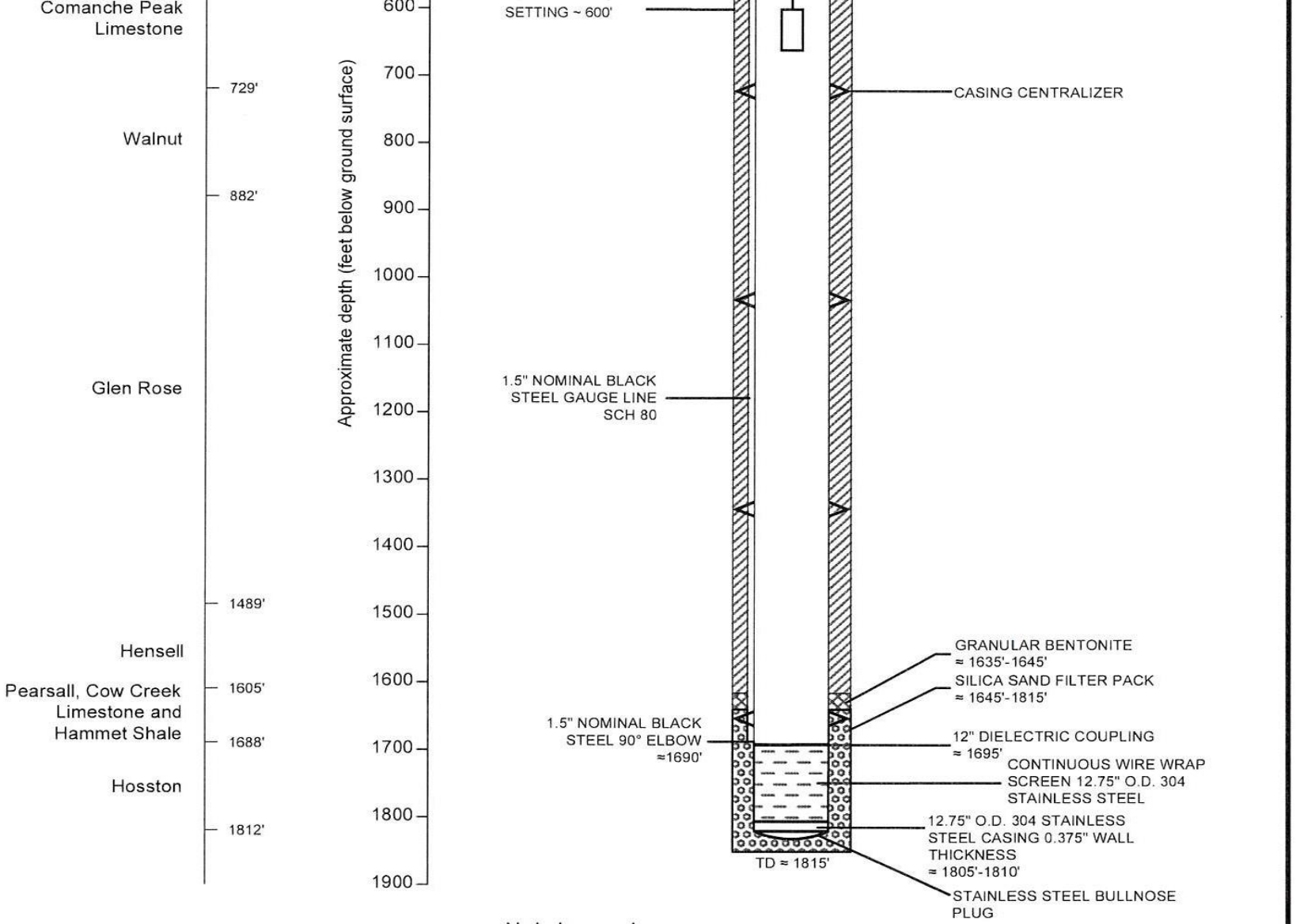
Contract Documents

- Detailed Contract Documents (~300 Pages)
  - Utilized EJCDC Format
  - Instruction to Bidders
  - Bid Forms
  - Bonding Requirements
  - Standard and Supplementary Conditions
  - TWDB Requirements
    - MBE
    - Davis Bacon Act
  - Detailed Specifications

Drilling Design

- Basic Design
  - Single Tube Design
    - Differs from the traditional drilling method of telescoping
    - Better control of screen construction
    - Flexibility of downhole pump placement as aquifer conditions change.


Estimated Geologic Units
0'
Taylor Marl and Austin Chalk
168'
Del Rio, Georgetown, Main Street and Paw Paw Limestone
547'
Edwards and Comanche Peak Limestone
729'
Walnut
882'
Glen Rose
Approximate depth (feet below ground surface)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
NOTE SEE SUPPLY WELLHEAD DIAGRAM
GROUND SURFACE
30" BOREHOLE
24" O.D. STEEL SURFACE CASING (ASTM A-53, GRADE B) 0.375" WALL THICKNESS
CEMENT GROUT
12.75" O.D. STEEL BLANK CASING (ASTM A-53, GRADE B) 0.375" WALL THICKNESS
1.5" NOMINAL BLACK STEEL GAUGE LINE, SCH 80
20" BOREHOLE (MINIMUM)
WATER LEVEL ≈ 490'
ESTIMATED PUMP SETTING ~ 600'
CASING CENTRALIZER
1.5" NOMINAL BLACK STEEL GAUGE LINE SCH 80



Not to scale

BSP engineers

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
Texas P.E. Firm #12228

Note: Casing centralizers installed every 80'

City of Troy, Tx
North I–35 Water Well Design

DRAWING 3

Supply Well Construction

Casing and Screen

- All materials conform to AWWA A100-15
- Engineer will determine final well construction details
- Surface Casing
  - 24” Carbon steel
- Production Well Casing
  - 12” Carbon steel
- Dielectric coupling
- Screens
  - 12” Wire Wrap, Rod Based, Stainless Steel
- Gauge Line – 1.5” Steel

Supply Well Construction

- Filter Pack Material
  - Finalized after Geophysical Logs and Gradation Tests have been reviewed

Supply Well Construction

Well Drilling

- Pilot/Test Borehole
  - Minimum 7 & 7/8” (larger is acceptable)
  - Geophysical Logging and Formation Sampling
  - If not reamed, it must be Plugged and Abandoned
- Surface Casing Borehole
  - 30” diameter borehole to ~40 feet bgs
- Production Borehole
  - 20” diameter borehole
  - Caliper and Deviation Logs
- Formation Sampling
  - 10’ intervals or as directed
  - During all drilling activities

Supply Well Construction

Casing, Screen, Gauge Line Installation

- Drilling fluid thinned
- Centering guides will be employed
- Utilize Certified Welders

Filter Pack Installation

- Drilling fluid removed as filter pack installed
- Placed vis tremie pipe
- Disinfected
- Flushed and swabbed as need to settle

Supply Well Construction

Grout

- Bentonite Plug place on top of filter pack ~10 feet
- Pump through Tremie Pipe - Positive Displacement Method
- Gravity Feed is Unacceptable
- 48 Hour Minimum Set Up Time

Sanitary Seal and Vents

- Install as in Drawings

Well Cap

- Whenever Work Ceases, the Top of Casing shall be Capped

Plumbness and Alignment

- Drift Indicator Survey Shall be Conducted

Well Development

- ~300 feet of discharge pipe will be needed
- Swabbing and Zoned Air Lift Pumping
  - Intervals of 20 foot sections of screen
  - No less than one hour of rig time per five feet of screen
- Bailing
  - Dropped to just above the bottom of the well
  - Ten hour duration

Well Development

- Pumping
  - Driller Furnish a Pump
  - Dedicated Water Level Transducer
  - Furnish and install a 1.25 “ diameter PVC water level gauging access pipe
  - Pump and Surge
  - Minimum of 12 hours
  - Sand Production will Dictate Duration

Supply Well Construction

Test Pumping

- Furnish a Pump
- Furnish a Wire-Line Electric Sounder
- Provide a Dedicated Water Level Transducer
- Furnish and install a 1.25 “ diameter PVC water level gauging access pipe
- 800-minute (13.3 hour) Step Test
  - Minimum 12 hour Recovery
- Two Day (48 hour) Constant Rate Test
  - Minimum 24 hour Recovery

Water Quality Testing

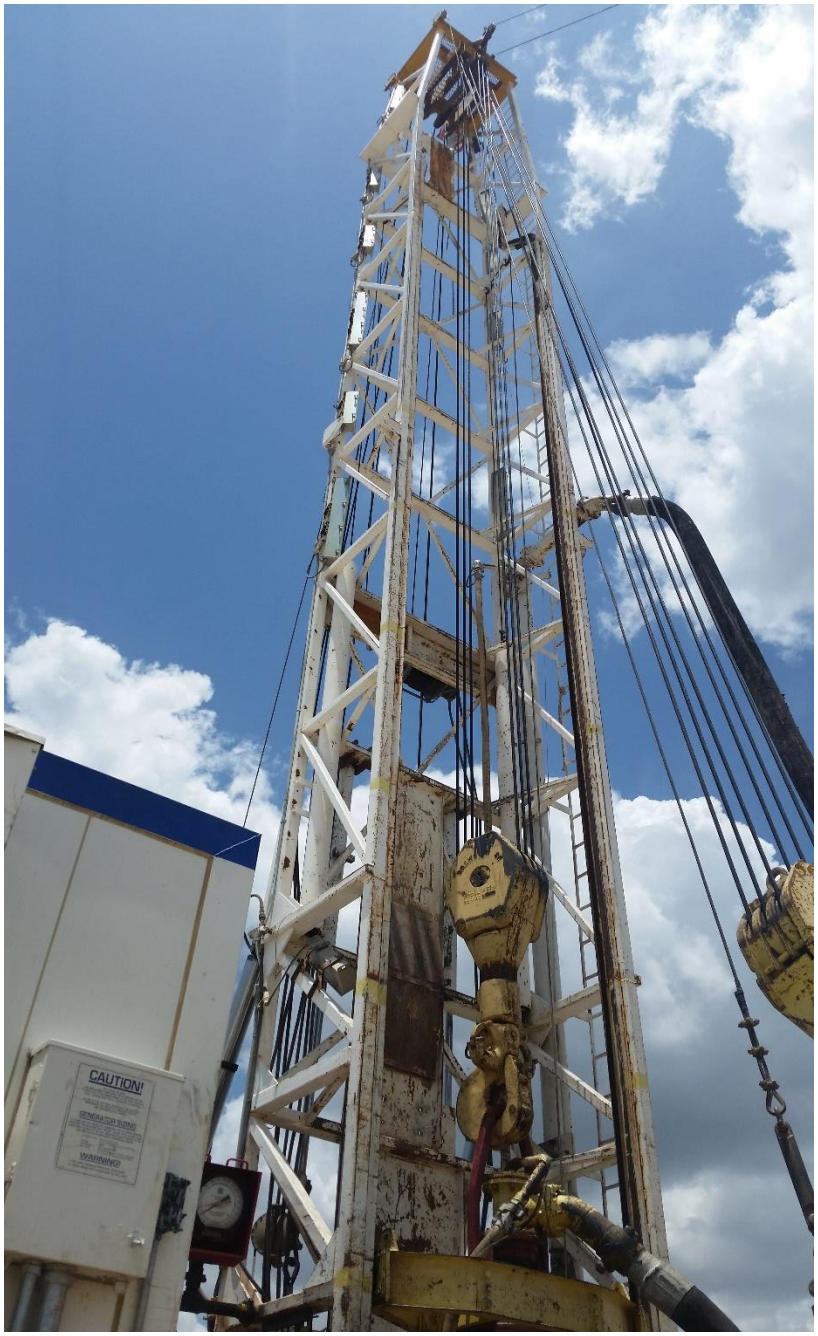
- Water Sample Collected Near the End of the Constant Rate Pumping Test
- Laboratory Analysis
- Coliform Water Analysis

Wellhead Completion

- Area to be Graded to Ensure Water Will Drain Away
- Concrete Sealing Block
  - As in Drawings
  - **Sloped 0.5 inches per foot**
- Locking Cap on Well
- Seal and Vent the Wellhead

Bid Process

- Bids Solicited in Spring 2018
  - Hydro Resources Mid-Continent Selected
  - Drilling Began in July 2018
  - Surface Casing was installed to 40 feet
  - Pilot Test hole was installed to 1,799 ft bgs.
  - Test bore was plugged up to the bottom of the Hosston and reamed to 22 inches in diameter.


CAUTION!

Grouting Operations

Drill Bits

Broken Shank

Cutting Samples

Geophysical Logging by Legacy – Geocam

Casing and Screens

Well Head

CUWCD Hydrogeological Report

- Required for obtaining an Operating Permit
- Includes Details on
  - Well Construction
  - Pumping Tests
  - Aquifer Parameter Derivations
  - Drawdown Projections

As Built – Lower Section

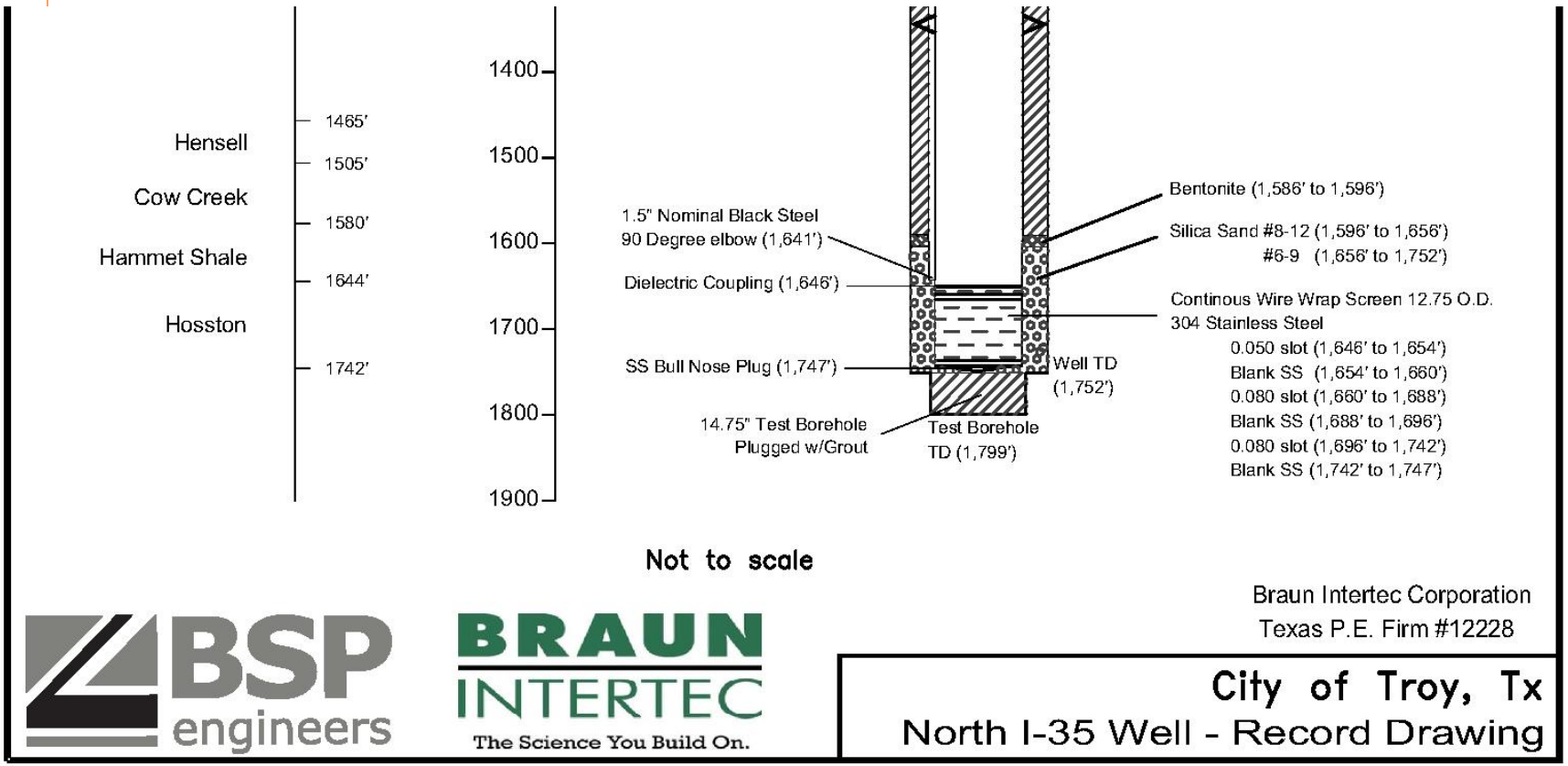
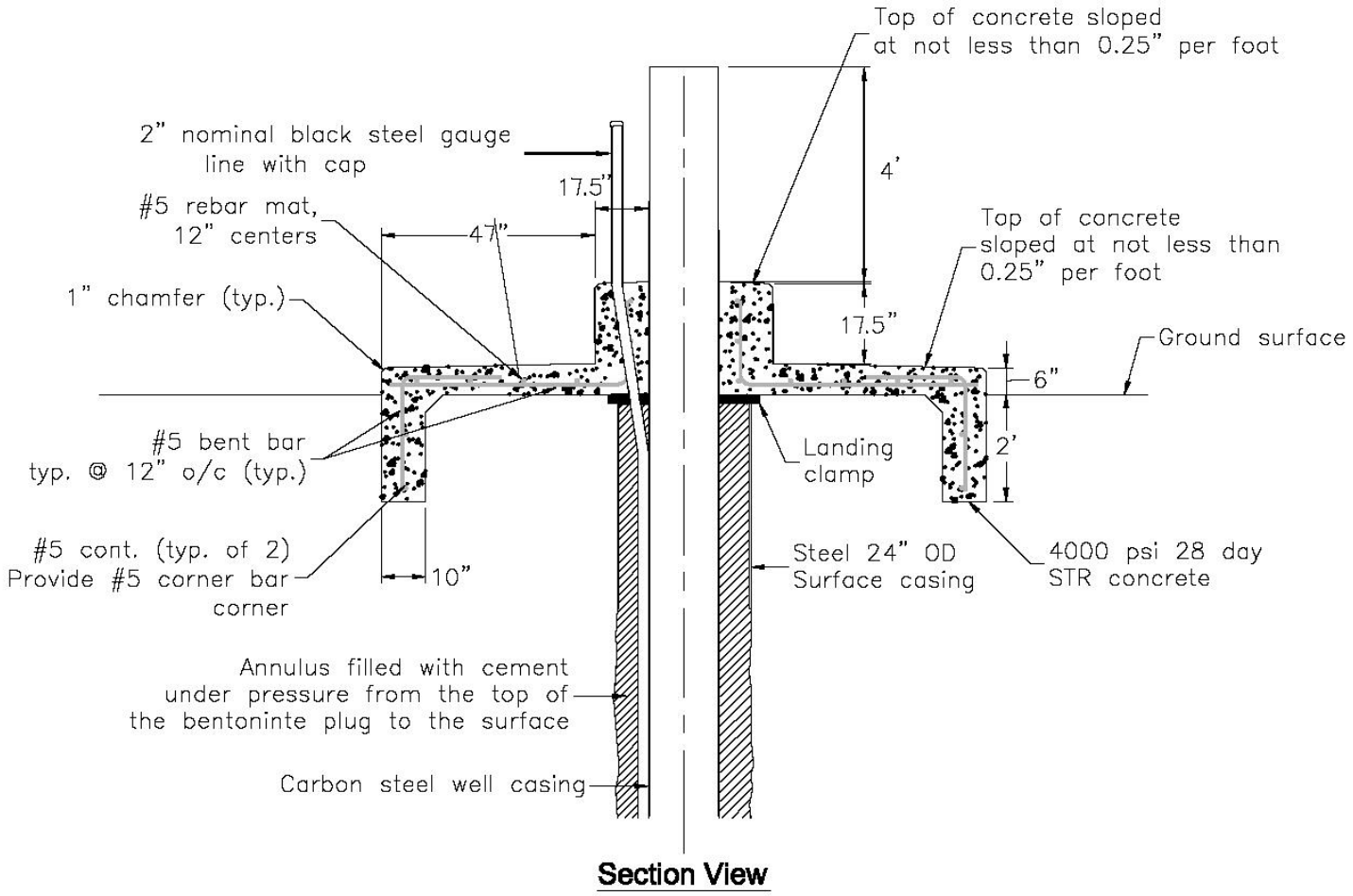


Figure 4

As Built – Well Head



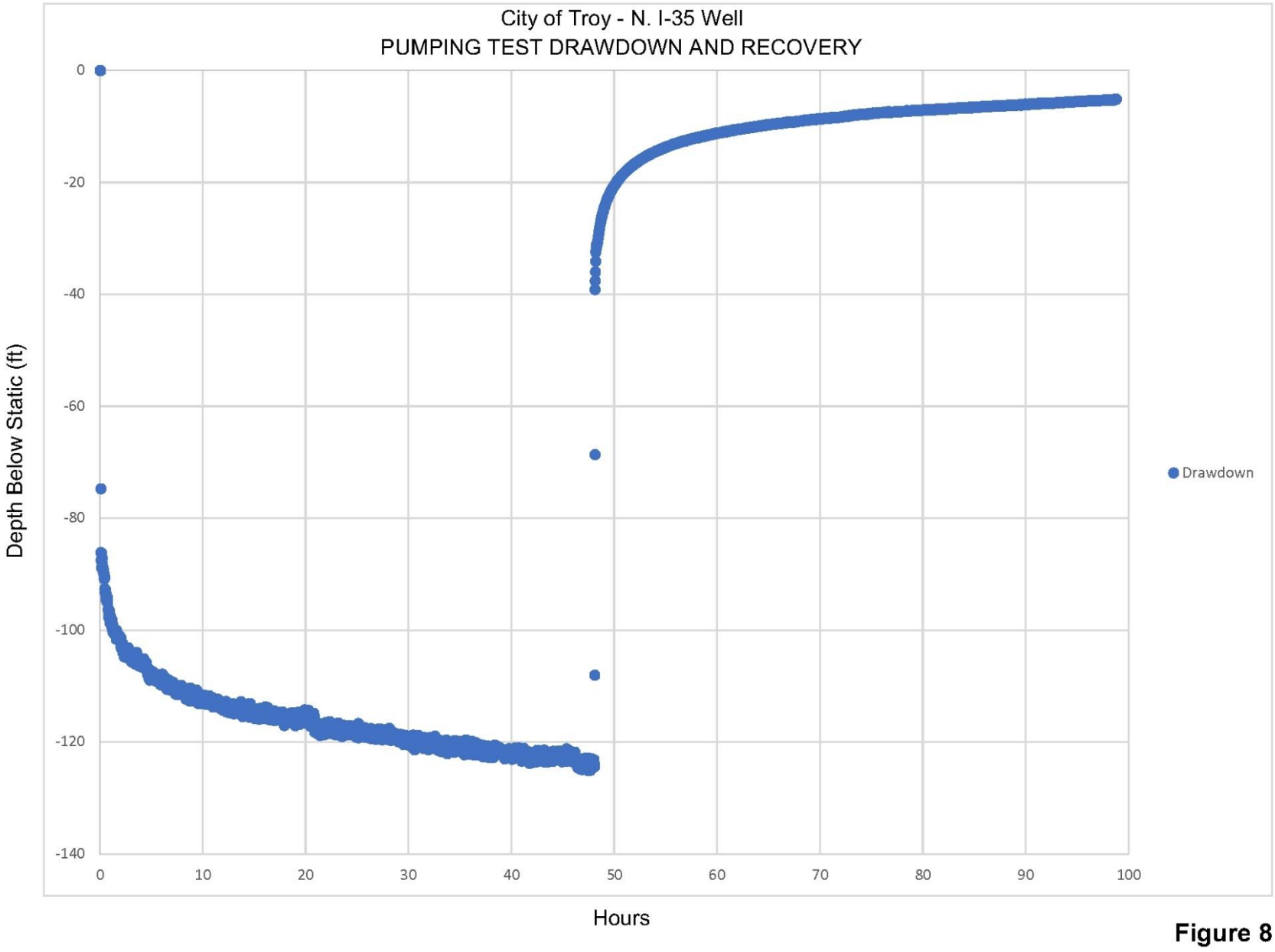
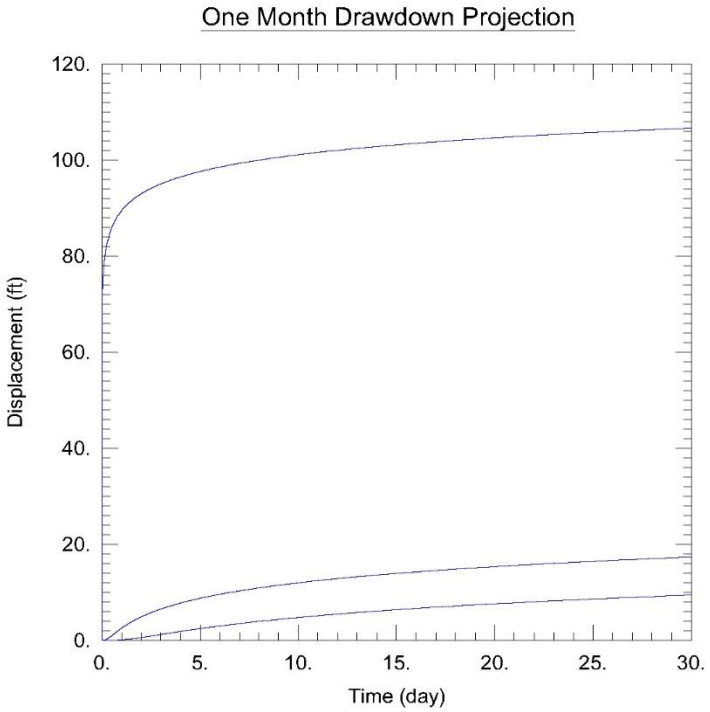

City of Troy - N. I-35 Well
PUMPING TEST DRAWDOWN AND RECOVERY
Depth Below Static (ft)
0
-20
-40
-60
-80
-100
-120
-140
0
10
20
30
40
50
60
70
80
90
100
Hours
Drawdown

Figure 8



WELL TEST ANALYSIS

Data Set: C:\Clients\City of Troy\2018\Permitting\CUWCD\Troy Forward Solution - 30 day.aqt
Date: 08/20/19 Time: 09:40:29

PROJECT INFORMATION

Company: Braun Intertec
Client: City of Troy
Project: North I-35 Well
Test Well: North I-35 Well
Test Date: 11/26/18

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
North I-35 Well	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
North I-35 Well	0	0
Troy #2	5808	0
Pendleton #2	13200	0

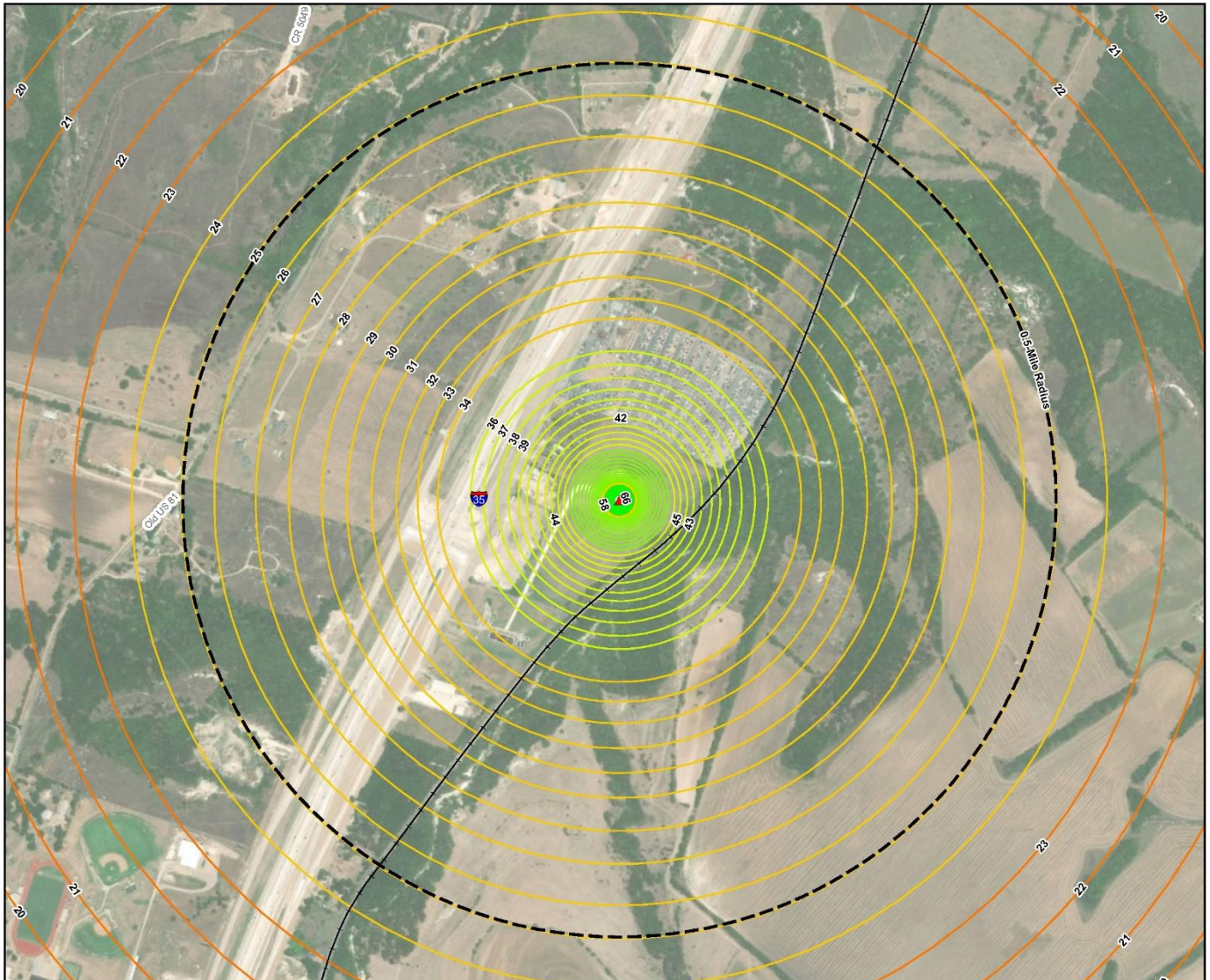
SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 1516.3 ft^2/day
S = 0.0001
Kz/Kr = 1.
b = 98. ft

Figure 9

Drawdown Projections



Distance from Pumping Well (ft)	Drawdown Depth (ft)	Distance from Pumping Well (ft)	Drawdown Depth (ft)
31	70	100	35
35	69	1,100	34
38	68	1,220	33
42	67	1,350	32
46	66	1,500	31
52	65	1,650	30
58	64	1,800	29
62	63	2,000	28
69	62	2,200	27
77	61	2,450	26
84	60	2,650	25
93	59	2,950	24
101	58	3,300	23
113	57	3,650	22
125	56	4,050	21
138	55	4,400	20
152	54	4,900	19
168	53	5,400	18
185	52	5,950	17
205	51	6,600	16
228	50	7,300	15
250	49	8,100	14
275	48	9,000	13
300	47	10,100	12
335	46	11,200	11
370	45	12,400	10
410	44	13,800	9
450	43	15,200	8
500	42	17,000	7
560	41	20,000	6
610	40	22,000	5
670	39	25,000	4
740	38	29,000	3
820	37	35,000	2
900	36	44,000	1

Legend

- Well Head
- Missouri-Kansas-Texas Railroad
- 0.5-Mile Radius

0 300 600 1,200 Feet

SCALE: 1" = 600'

N

30-Day Radius of Influence

City of Troy N. I-35 Well
Troy, Texas

BRAUN INTERTEC

Question or Comments?

William Gamblin, P.E.
Braun Intertec Corporation
wgamblin@braunintertec.com
(512) 484-2033