North Slope Borough

THE ONLY U.S. NATIONAL LABORATORY DEVOTED TO FOSSIL ENERGY TECHNOLOGY

NSB – DOE/NETL Barrow Methane Hydrate Project

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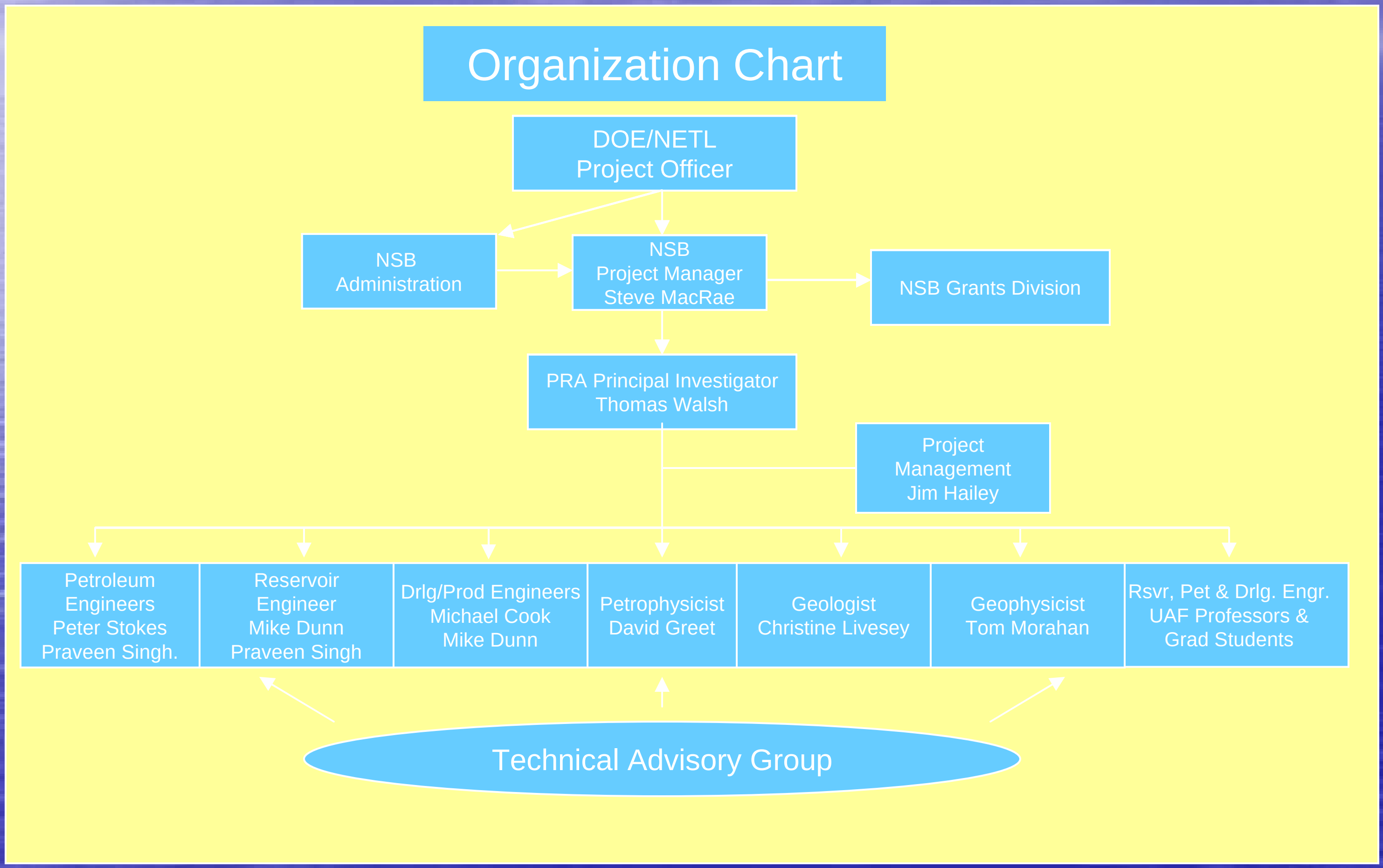
ANS Field Project Kickoff Meeting
1/22/08

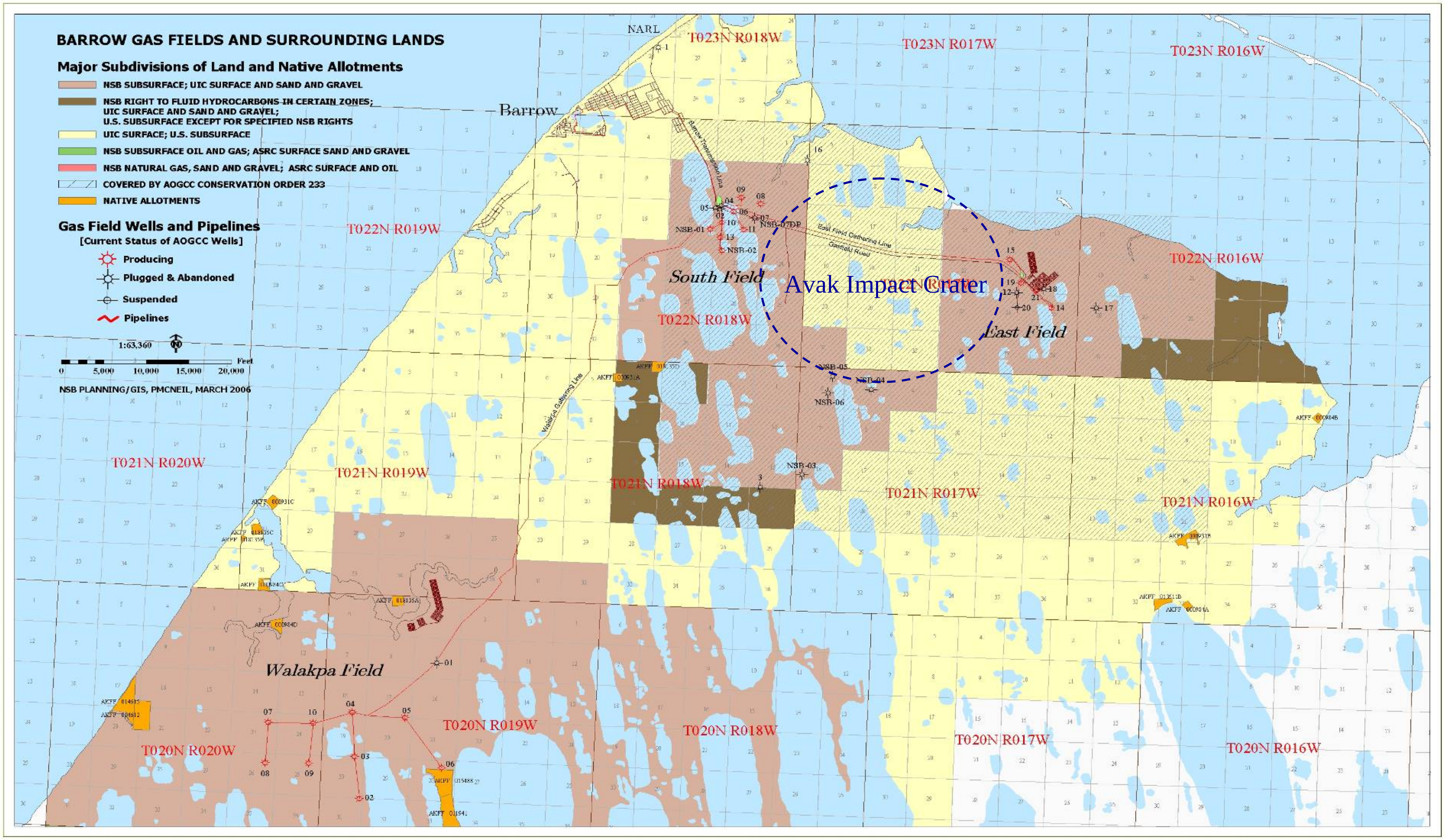
UNIVERSITY OF ALASKA FAIRBANKS
A 360+ Million-Acre Classroom

- Introduction
- Phase 1 Summary
  - Stability/Material Balance/Full-field modeling
- Phase 2 Objectives
  - Prove existence of hydrates
  - Prove production from hydrates
  - Data gathering objectives
    - Core/LWD/Wireline
    - Pressure/temp
  - Schedule and PMP Overview
  - Well modeling
  - Well design
  - Project Execution
    - Procurement/Logistics/Operational Procedures
    - Core handling/Data acquisition specs/Decision point criteria

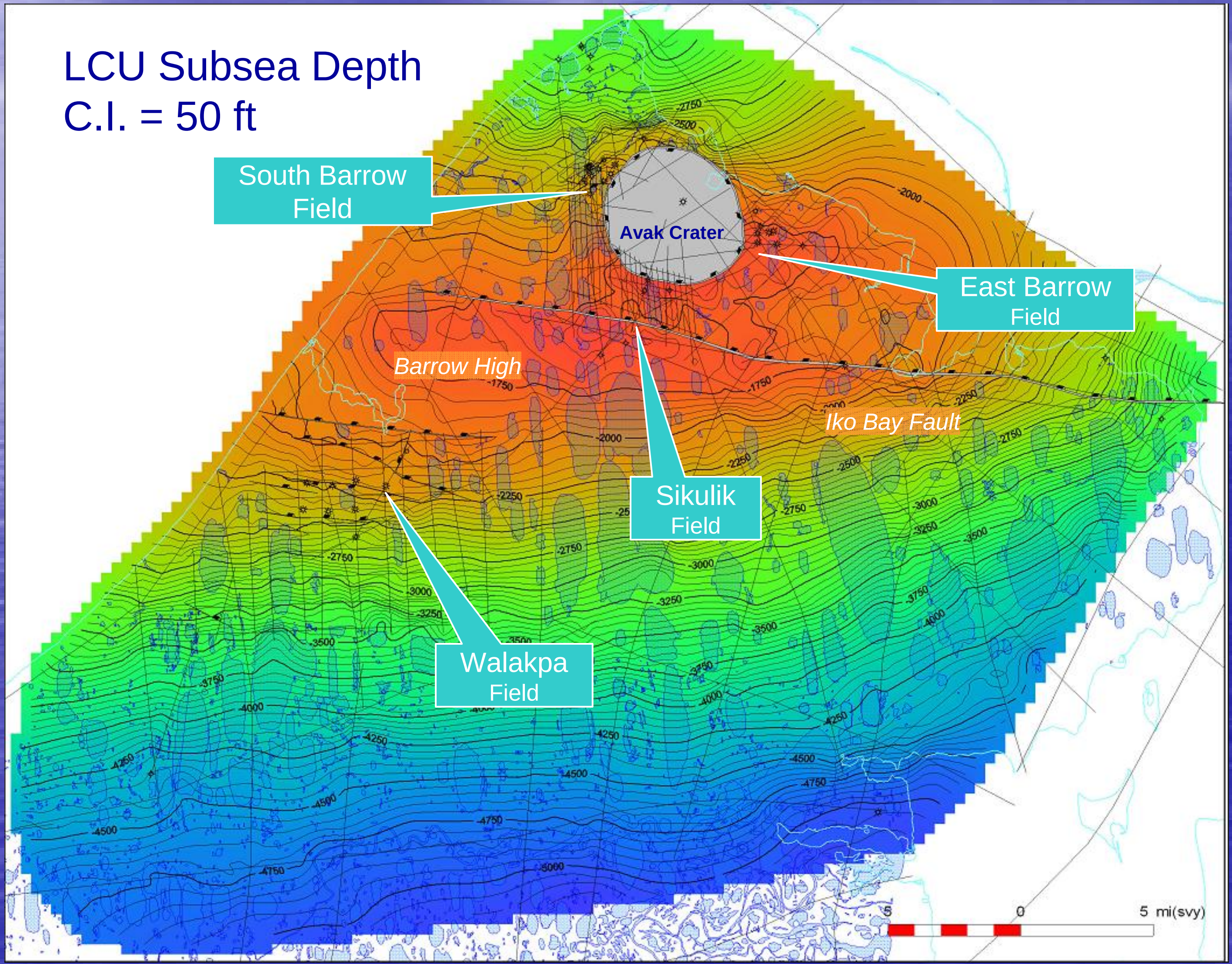
Phase II Org Chart 12/31/08



Barrow Gas Fields



Regional Structure Map



Barrow Gas Fields

- Original exploration by US Navy 1944-49
- Further Investigations by Department of the Interior in the 1970's
- Congress transfers BGF to North Slope Borough in 1984.
- Local control (NSB) since 1984

Barrow Gas Fields

- East Barrow Gas Field
  - Discovered in 1949 by U.S. Navy
- South Barrow Gas Field
  - Discovered in 1974
- Walakpa Gas Field
  - Discovered 1980 by Husky for U.S. DOI

Project Objectives

- DOE-NETL/NSB 80-20% Funded Research
- Characterize and Quantify Methane Hydrate Resource Associated With Barrow Gas Fields
- Contribute to Global Research Effort Through Practical Research
- Advance North Slope Borough's Understanding of It's Energy Supply
- Prove Hydrate Productivity
- Add Gas Reserves and Production

Scope

- Integrated Study (Seismic, Well Log, Production History, Geochem)
- Focus on Barrow Gas Fields—East Field, South Field, Walakpa
- Phased Approach
- Integrate Prior Research Efforts/Current Knowledge

Project Status

- Project start Nov. 14, 2006
- Phase 1A completed in July, 2007, with positive results from Hydrate Stability Model
- Phase 1B initiated August 1, 2007 and completed March 2008. Supported decision to proceed to Phase 2
- Phase 2 initiated December 1, 2008. Design and drill dedicated hydrate production test and observation well

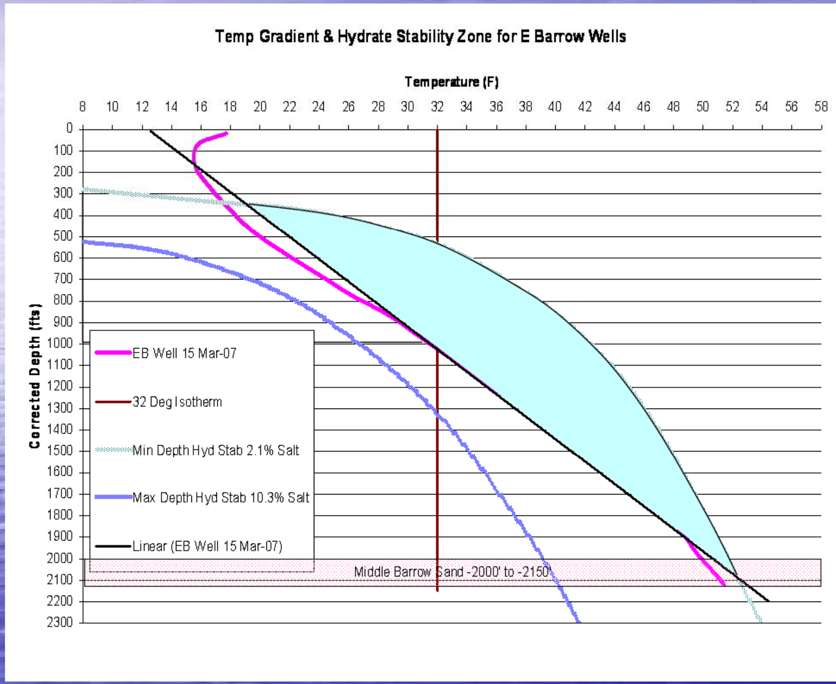
Phase 1A Results

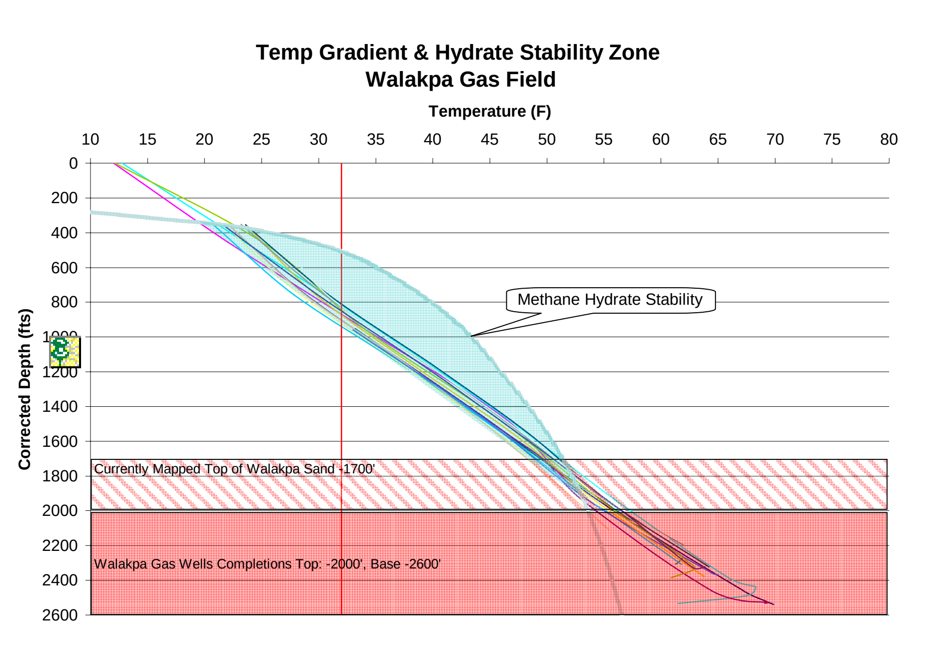
- Temperature Gradients and Hydrate Stability Zone Modeling support Hydrate Stability Zone in East Barrow and Walakpa Fields

- Material Balance studies in East Barrow and Walakpa Field suggest external recharge but with no water production or breakthrough.
  - Suggests pressure support by methane hydrate dissociation

- Objectives for Phase 1A of the Study have been met, and support further reservoir study.

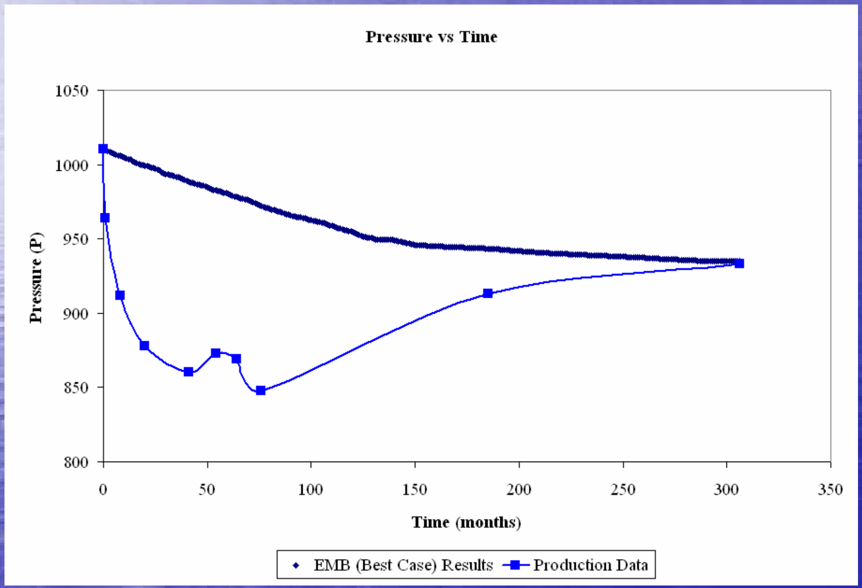
Stability Zone Modeling

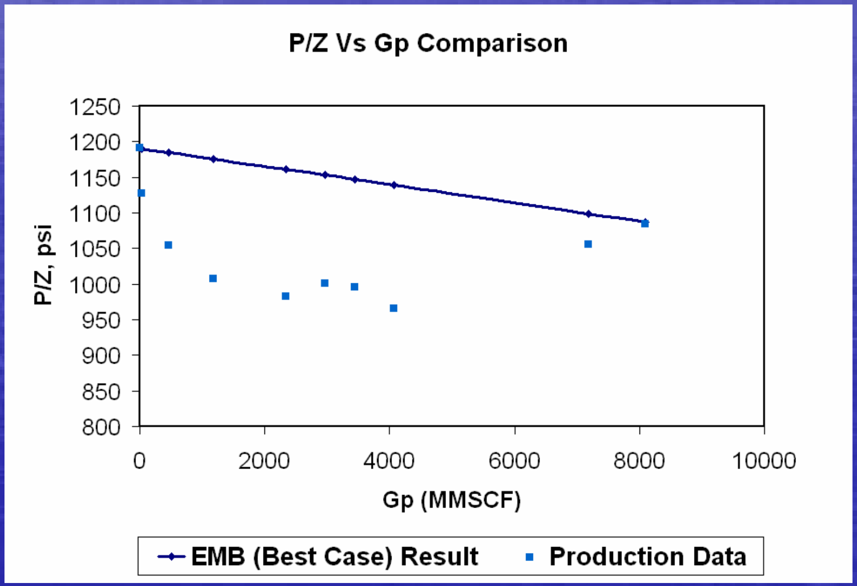




Methane Hydrate Stability Zone Modeling for East Barrow and Walakpa Gas Fields

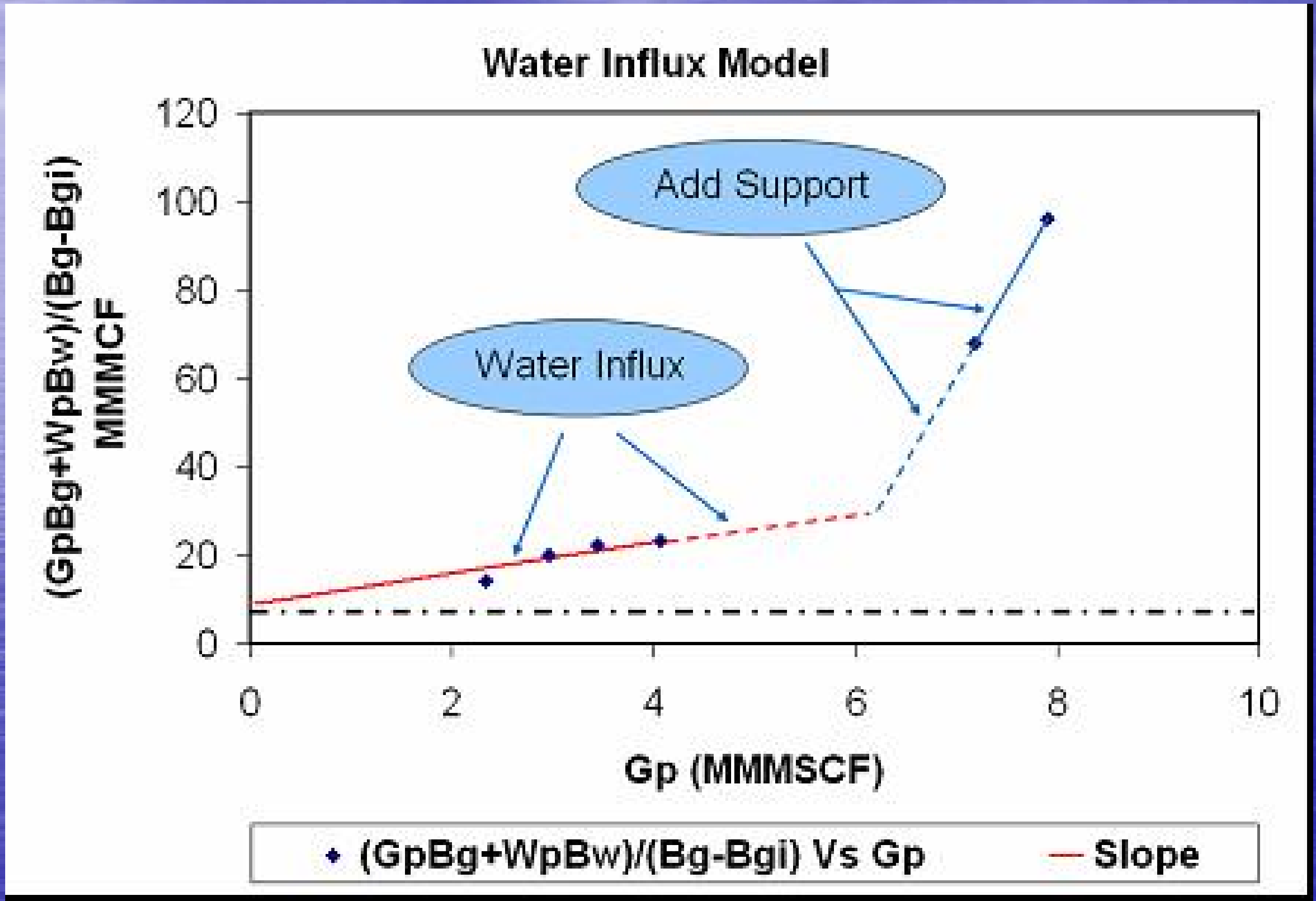
Material Balance





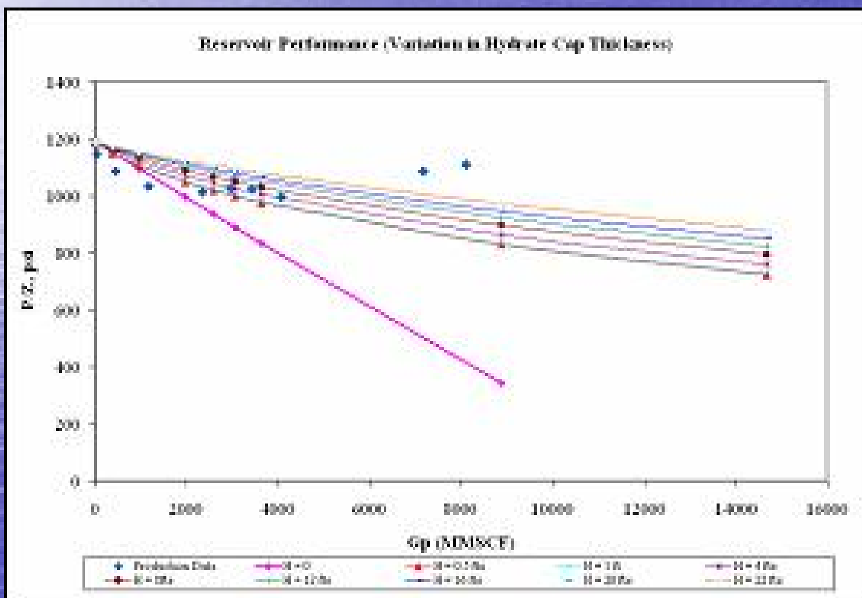
EMB Model – Pressure (P) vs. Time plot and P/Z vs. Gp plot for East Barrow gas reservoir

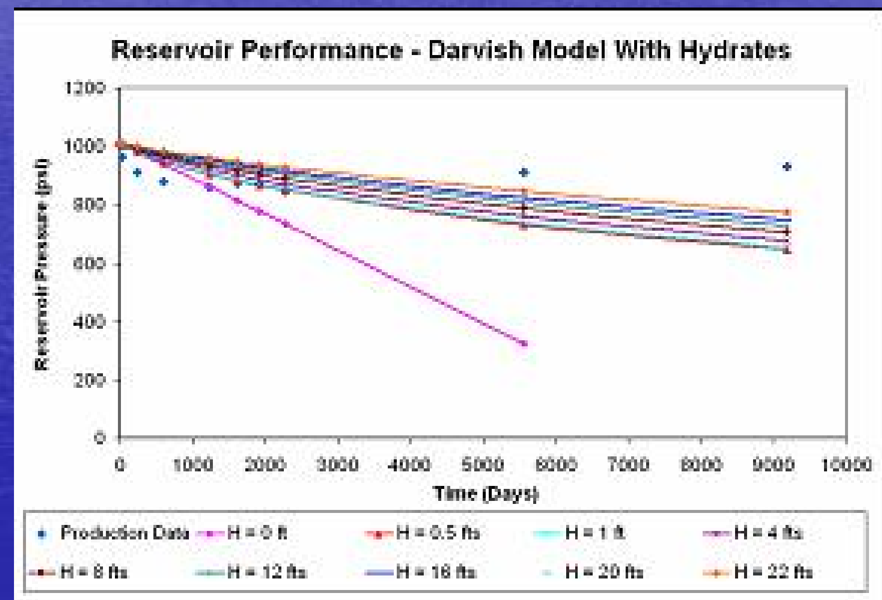
Water Influx Model, E. Barrow



Water in Influx Model - (*G*p*B*g + *W*p*B*w) / *(B*g – *B*gi) vs. *Gp* plot

Material Balance, E. Barrow



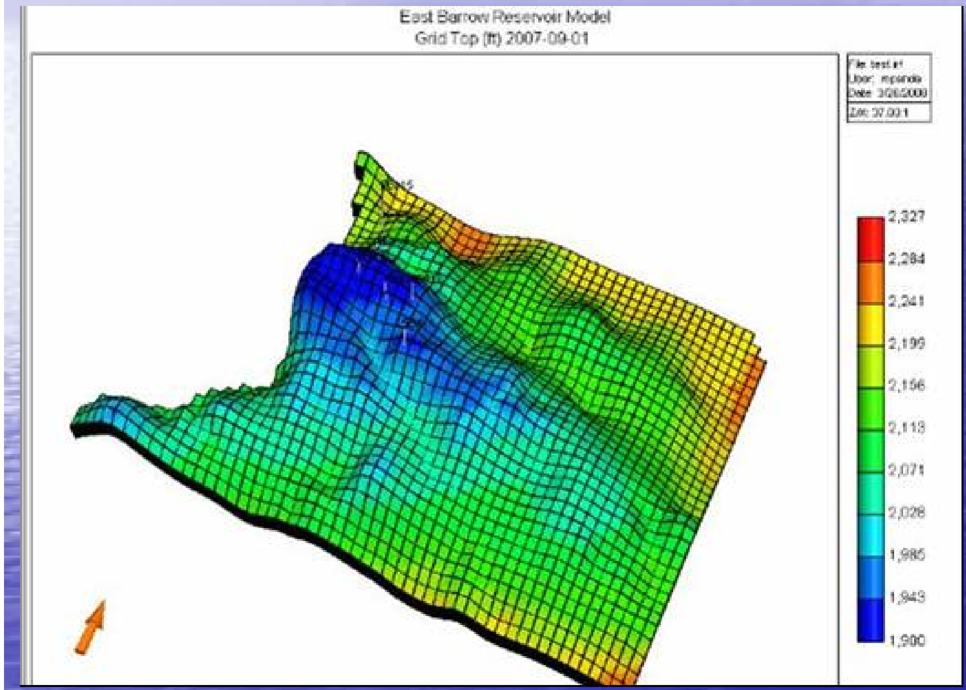


Hydrate Model: P/Z vs. Gp and Pressure vs. Time comparison for Darvish model

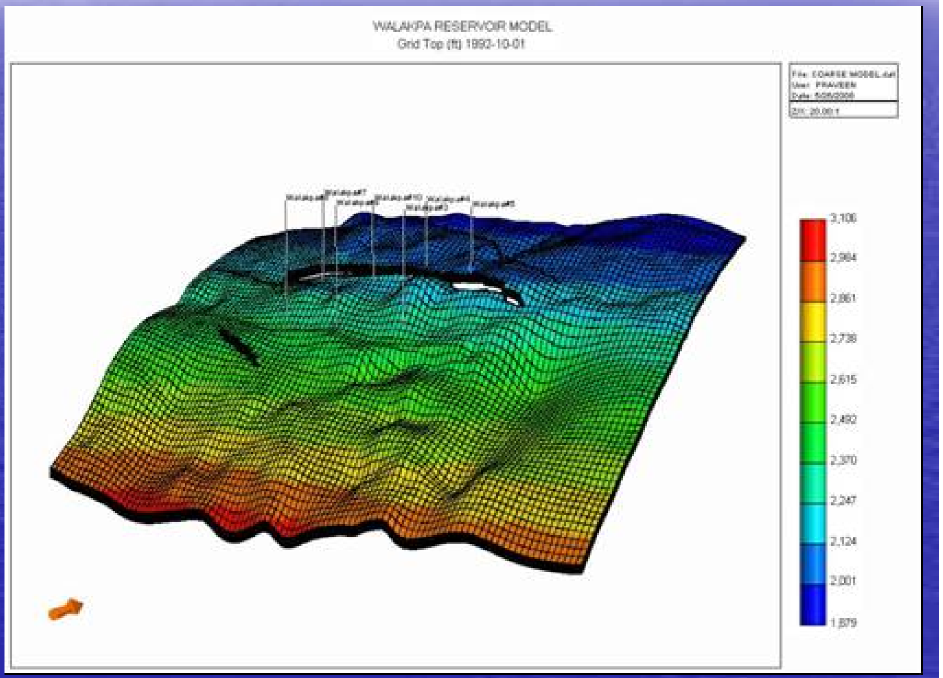
Phase I B Results

- Geologic Model
  - Completed mapping and log analysis of Walakpa, E&S Barrow Pool reservoirs
  - 3-D geostatistical model built for E. Barrow and Walakpa Fields
- Reservoir Modeling
  - Material balance and full-field reservoir simulation results support hydrate influence

Depth Mapping

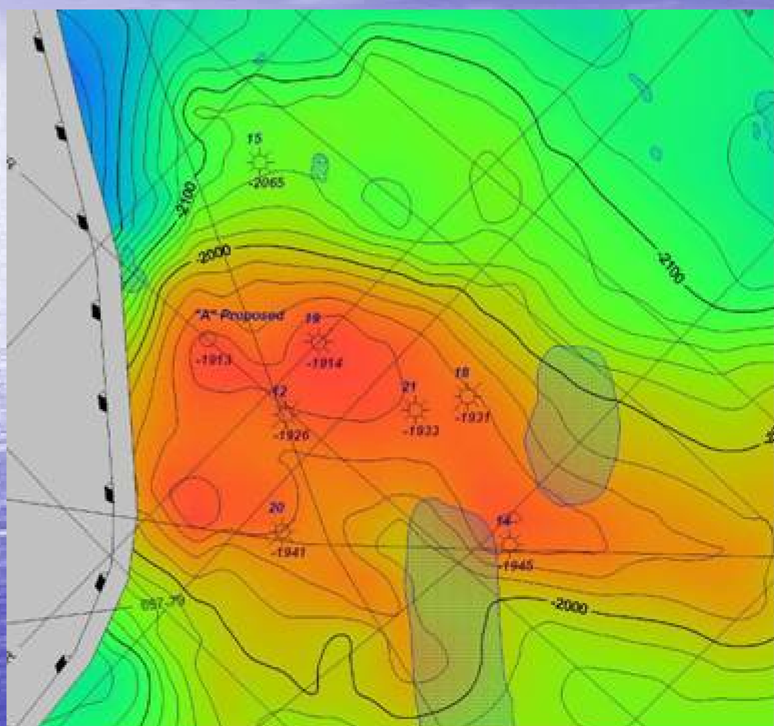


Depth grid on Top Upper Barrow Sandstone, E Barrow Field

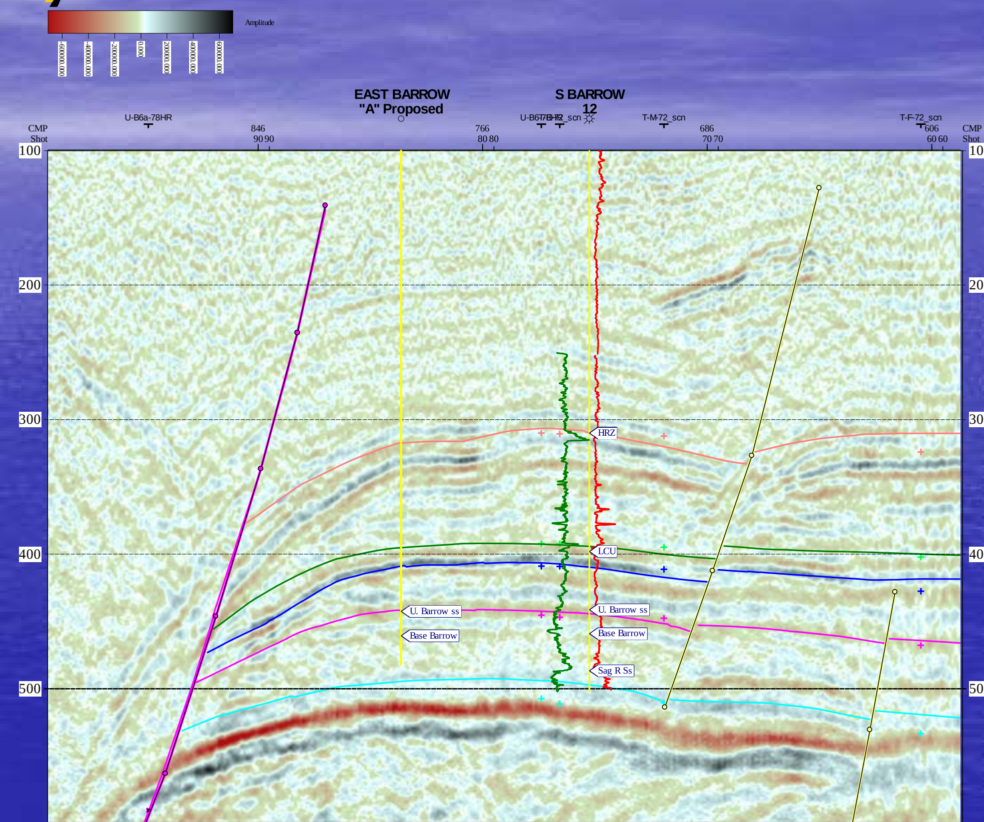


Depth Grid on Top Walakpa Sandstone, Walakpa Gas Field

Seismic Interp, E. Barrow

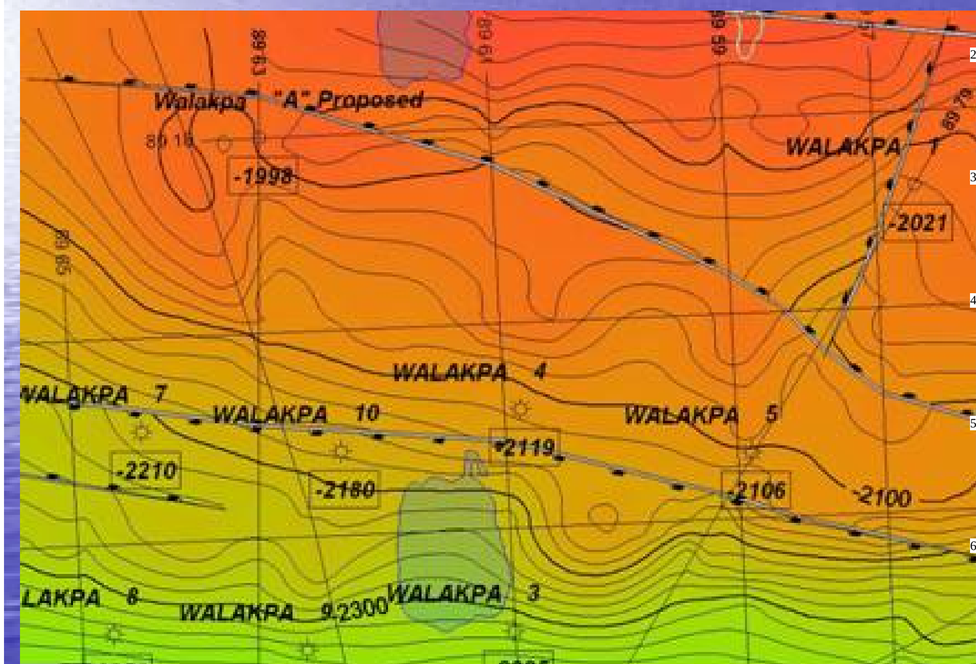


Map of East Barrow Gas Field with Proposed Hydrate Test Well Location

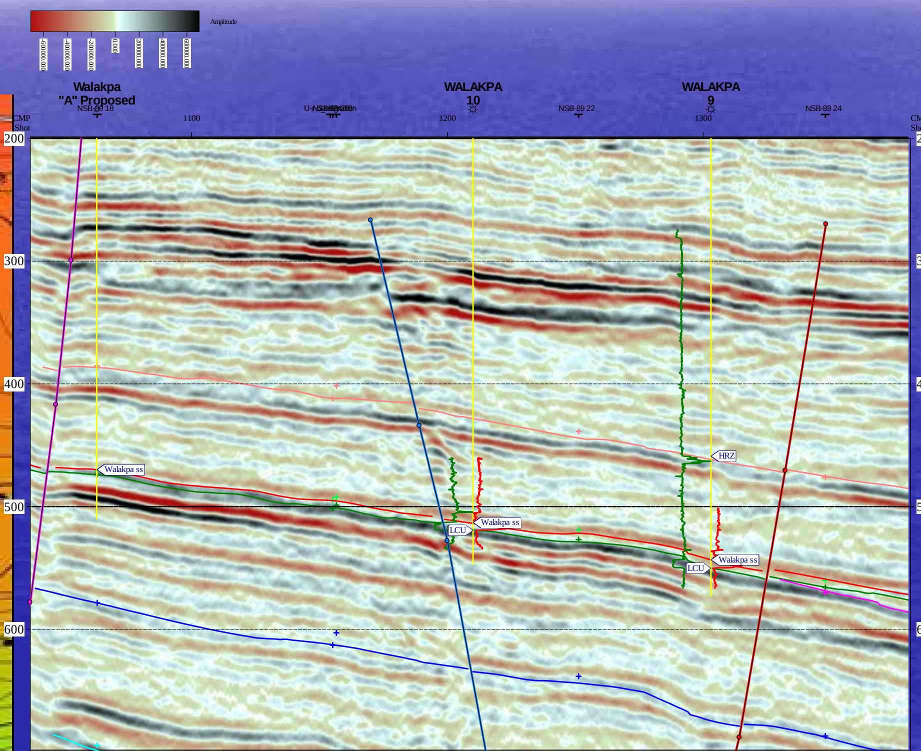


Seismic Line through Proposed East Barrow Hydrate Test Well Location

Seismic Interp, Walakpa

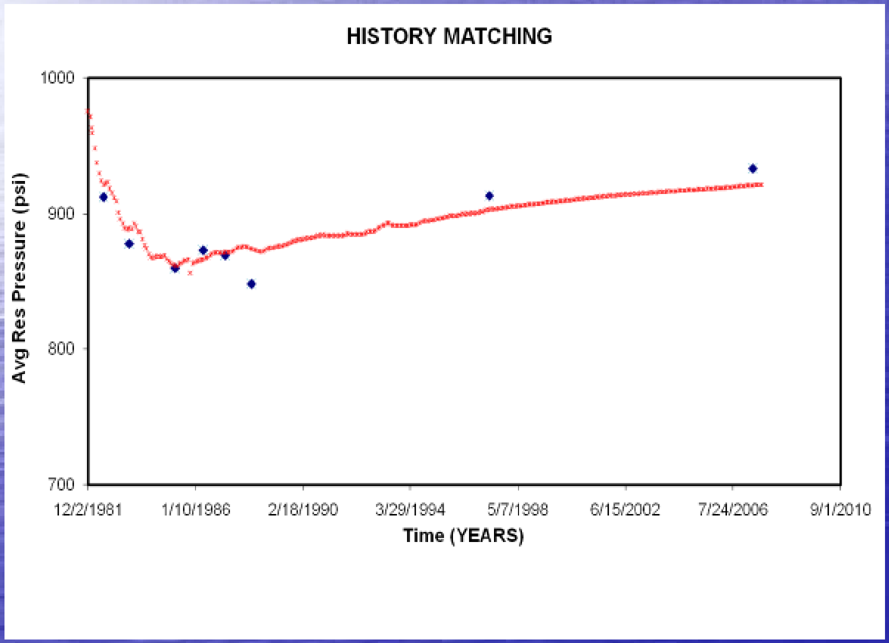


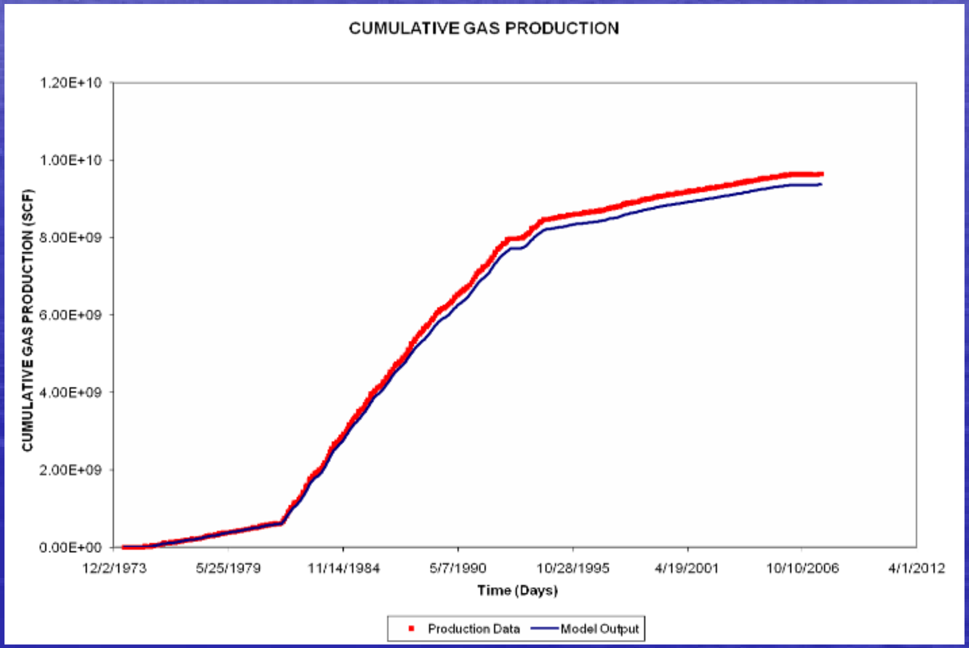
Map of Walakpa Gas Field with Proposed Hydrate Test Well Location



Seismic Line through Proposed Walakpa Hydrate Test Well Location

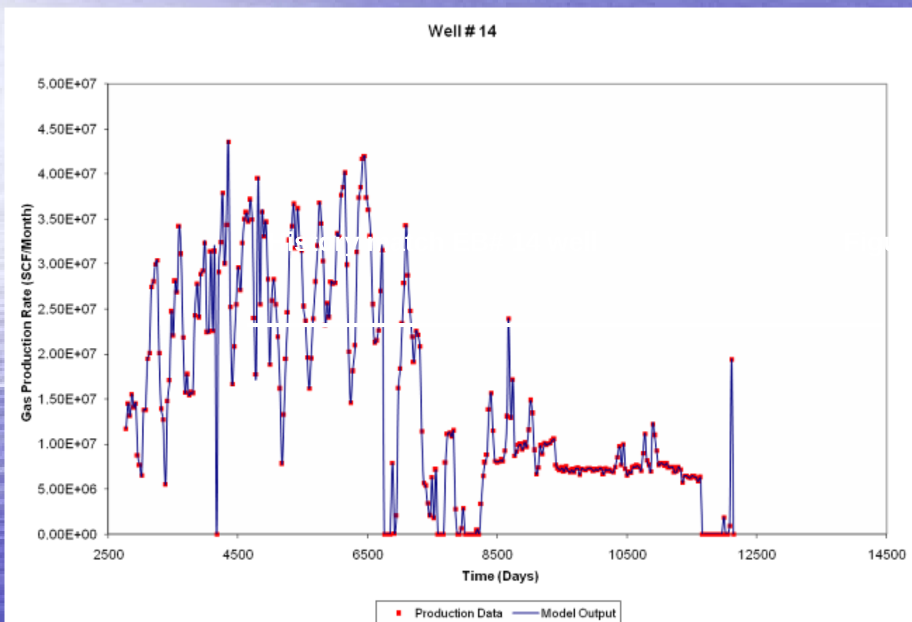
Pressure and Production History Match, E. Barrow



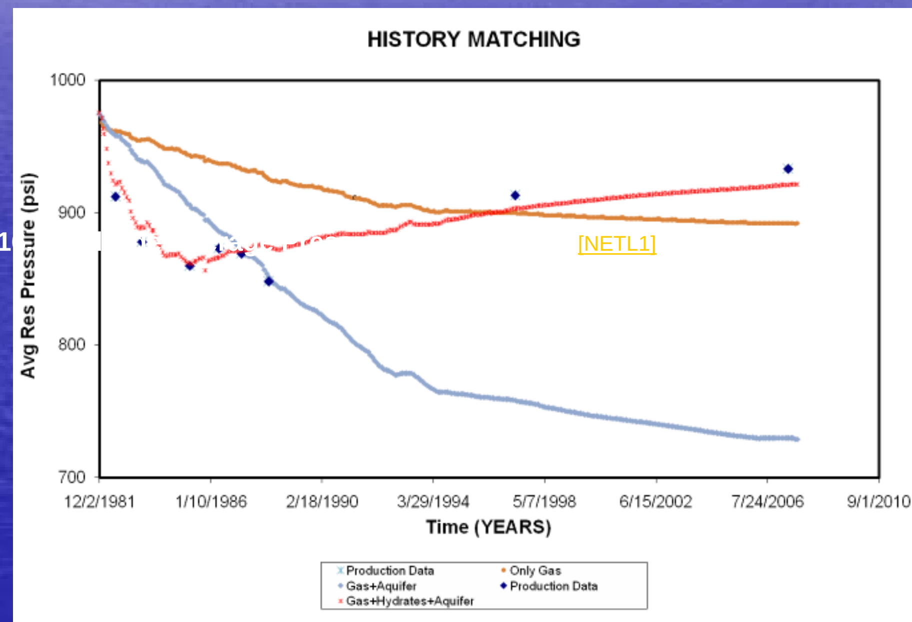


Barrow Field Average Reservoir Pressure and Cumulative Production History Match

E. Barrow #14 History Match



History match EB# 14 well



Fieldwide Average Pressure History Match

E. Barrow Best Case Model Input

- 5-24% Porosity
- 55% Bound water
- 45% Free gas saturation below BHSZ
- 31% Hydrate saturation above BHSZ
- 14% Free gas above BHSZ
- 1-50 mD permeability
- BHSZ 2050’ sstvd
- GWC 2080’ sstvd

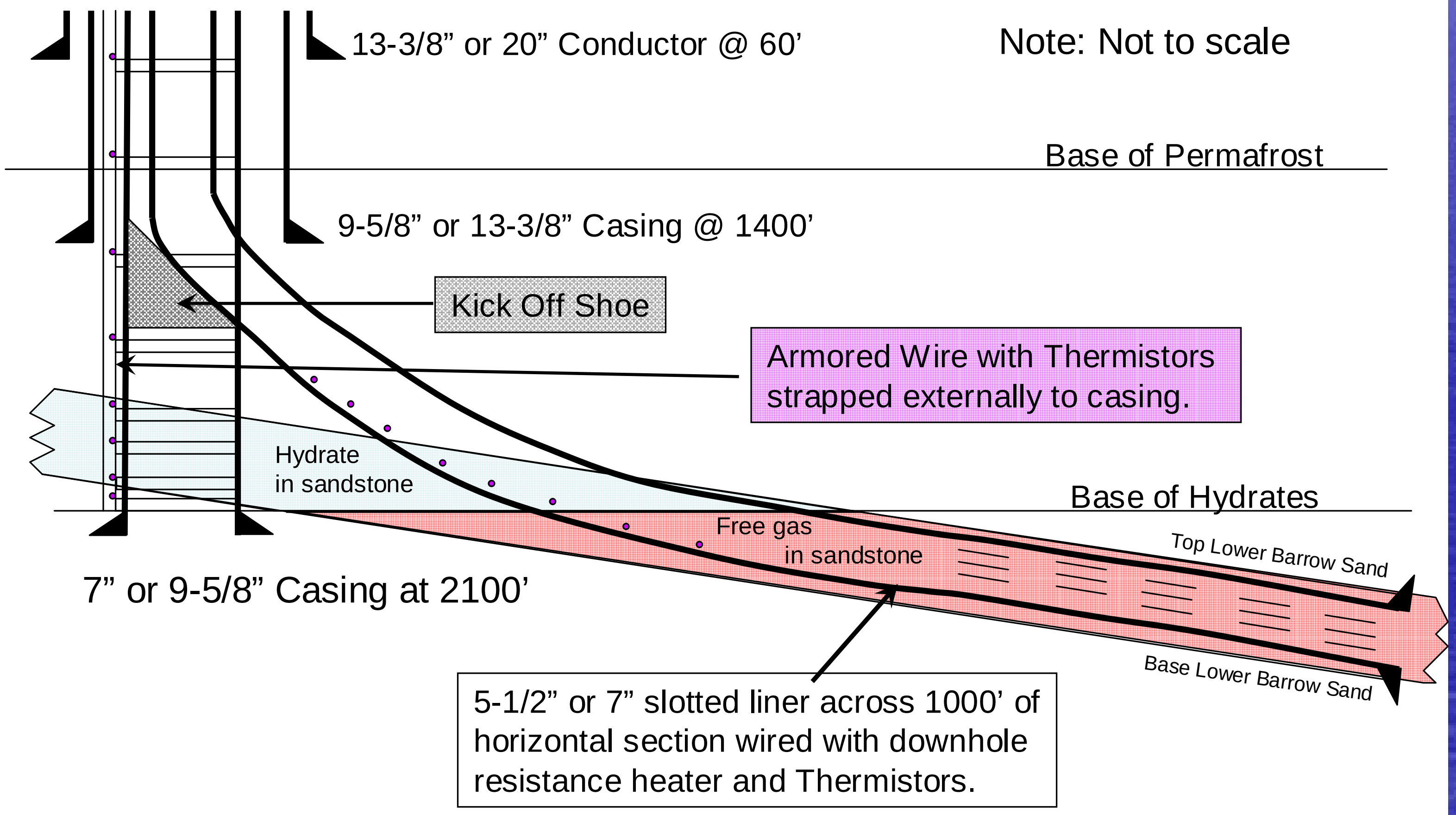
Conclusions of Modeling

- 100% of 26 BSCF of MH will be produced in E. Barrow through depressurization from 1981-2037
- 20% of 284 BSCF (56BSCF) of MH will be produced in Walakpa from 1981-2037 assuming current well set and rates

Phase II Objectives

- Prove existence of in situ methane hydrates
- Prove hydrate dissociation and production
- Design and drill methane hydrate production test well
  - E. Barrow in Q3-2010
    - If hydrates are encountered, complete and test
    - If no hydrates, move to Walakpa for hydrate test
  - Walakpa Well Q1-2011
    - If hydrates are encountered, complete and test

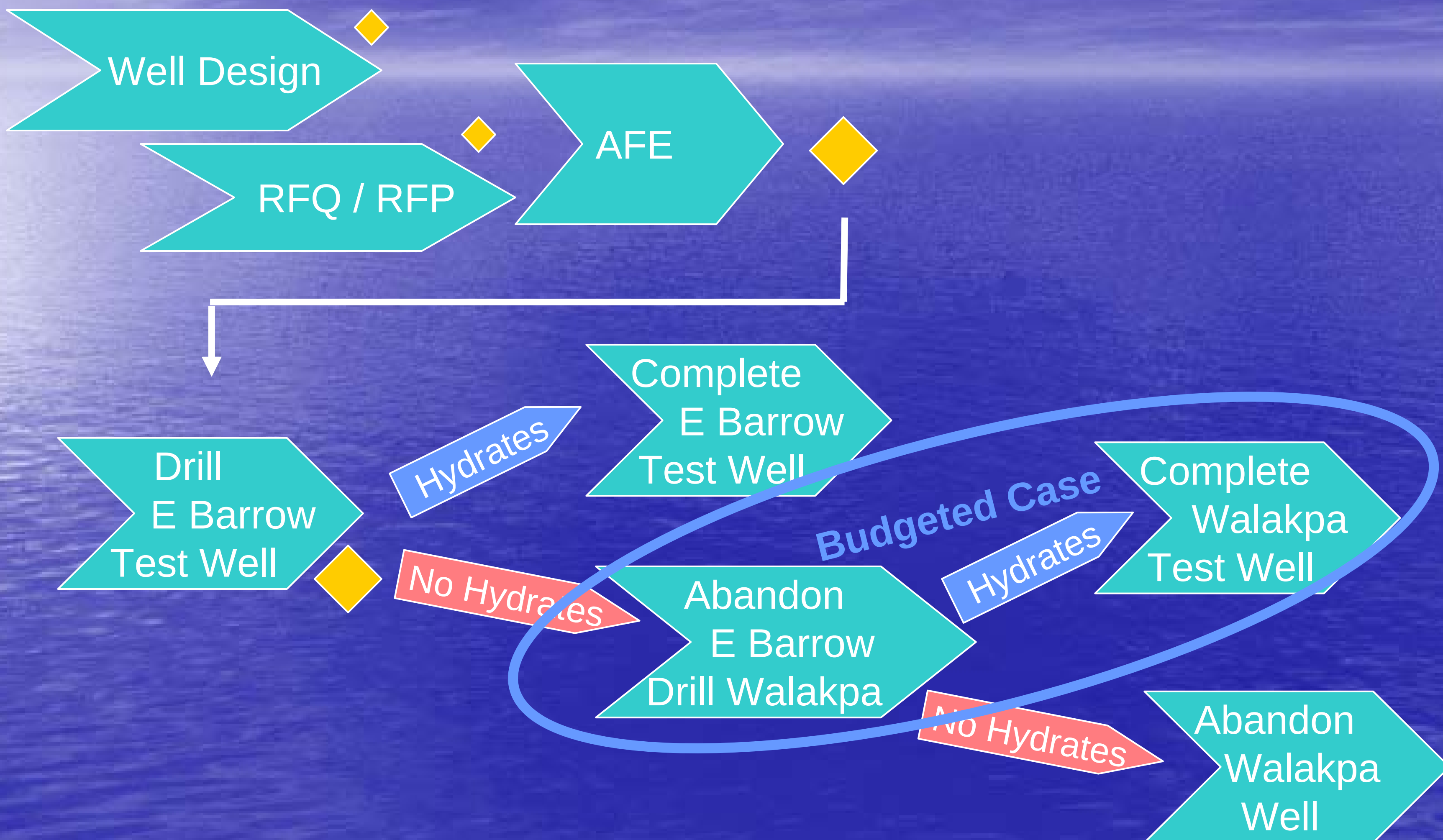
E Barrow Hydrate Test Well Conceptual Design



Schedule

- Commence Phase 2 Dec. 1, 2008
- December ’08 – September ‘09
  - Design well
  - Acquire permits
  - Select Contractors
- October ’09-August ’10
  - Secure contracts for operator, drilling contractor, rig, equipment spread
  - Plan and oversee logistics
- September ’10 – April ’11
  - Drill and complete hydrate test well(s)
  - Recover core in hydrate stability zone and analyze, make decision on program completion
- May ’11 – September ’13
  - Production surveillance of hydrate test well
  - Collect samples and data from well and analyze results

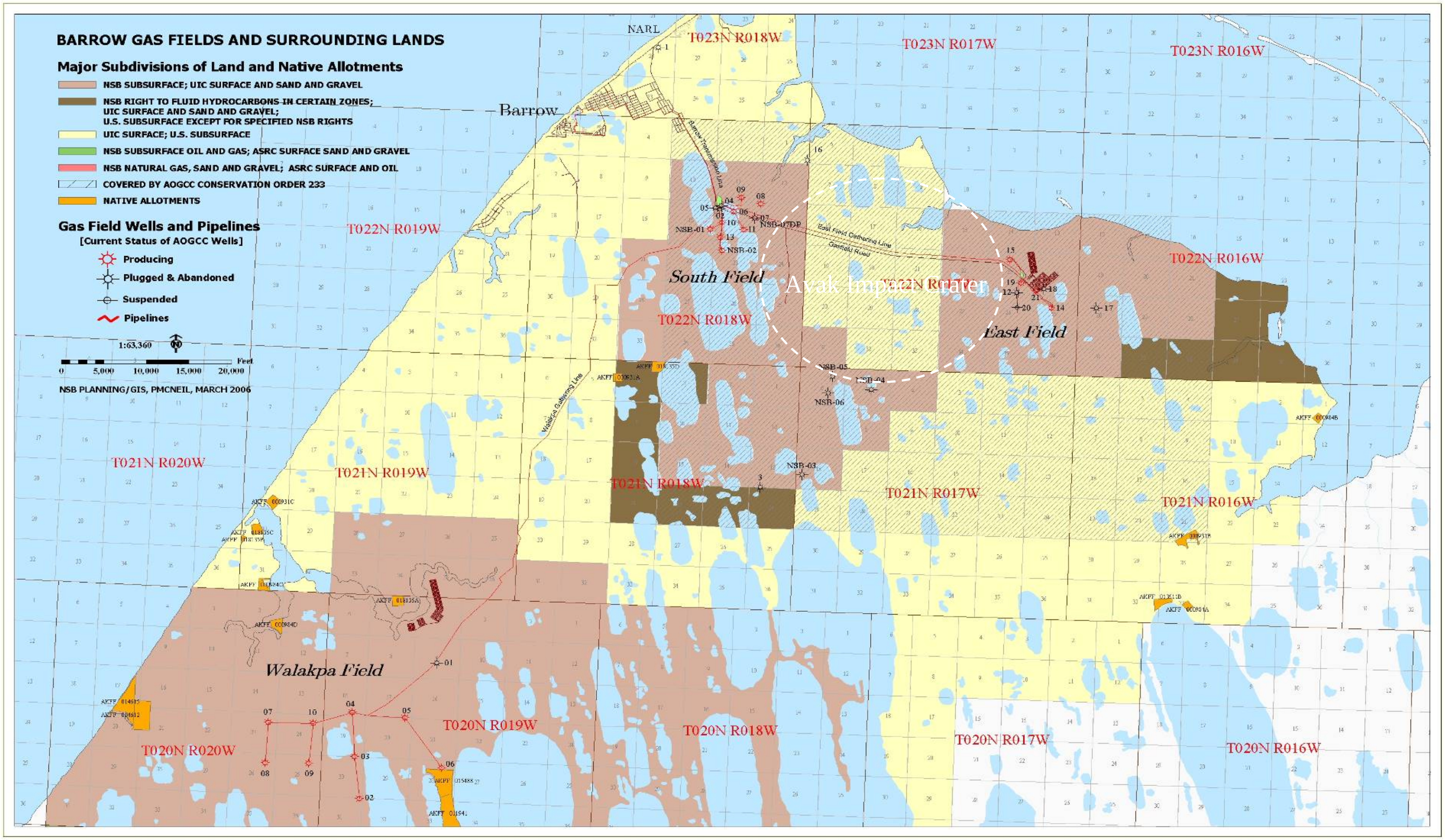
NSB Hydrates Phase 2 Plan



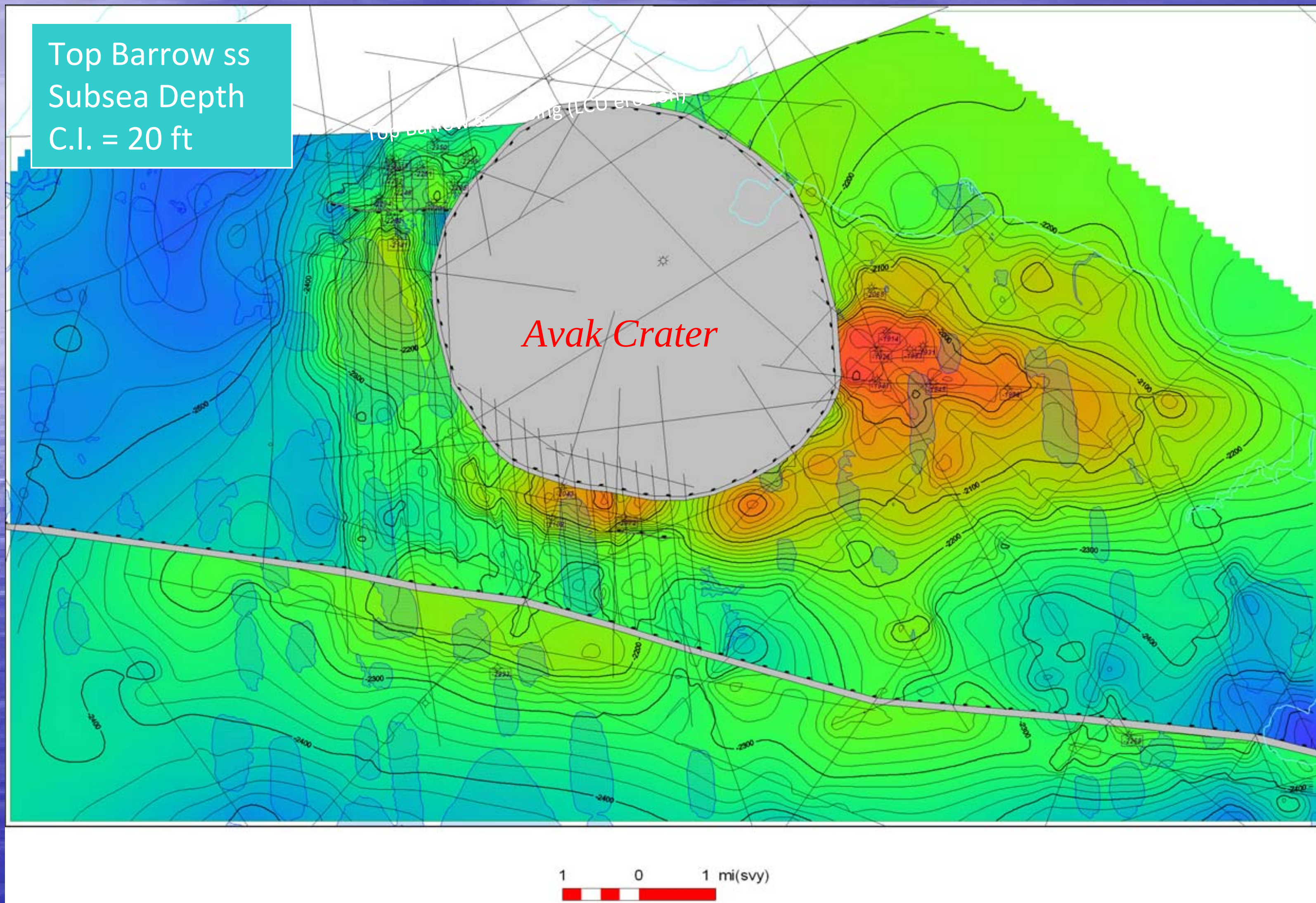
Well Modeling Simulation

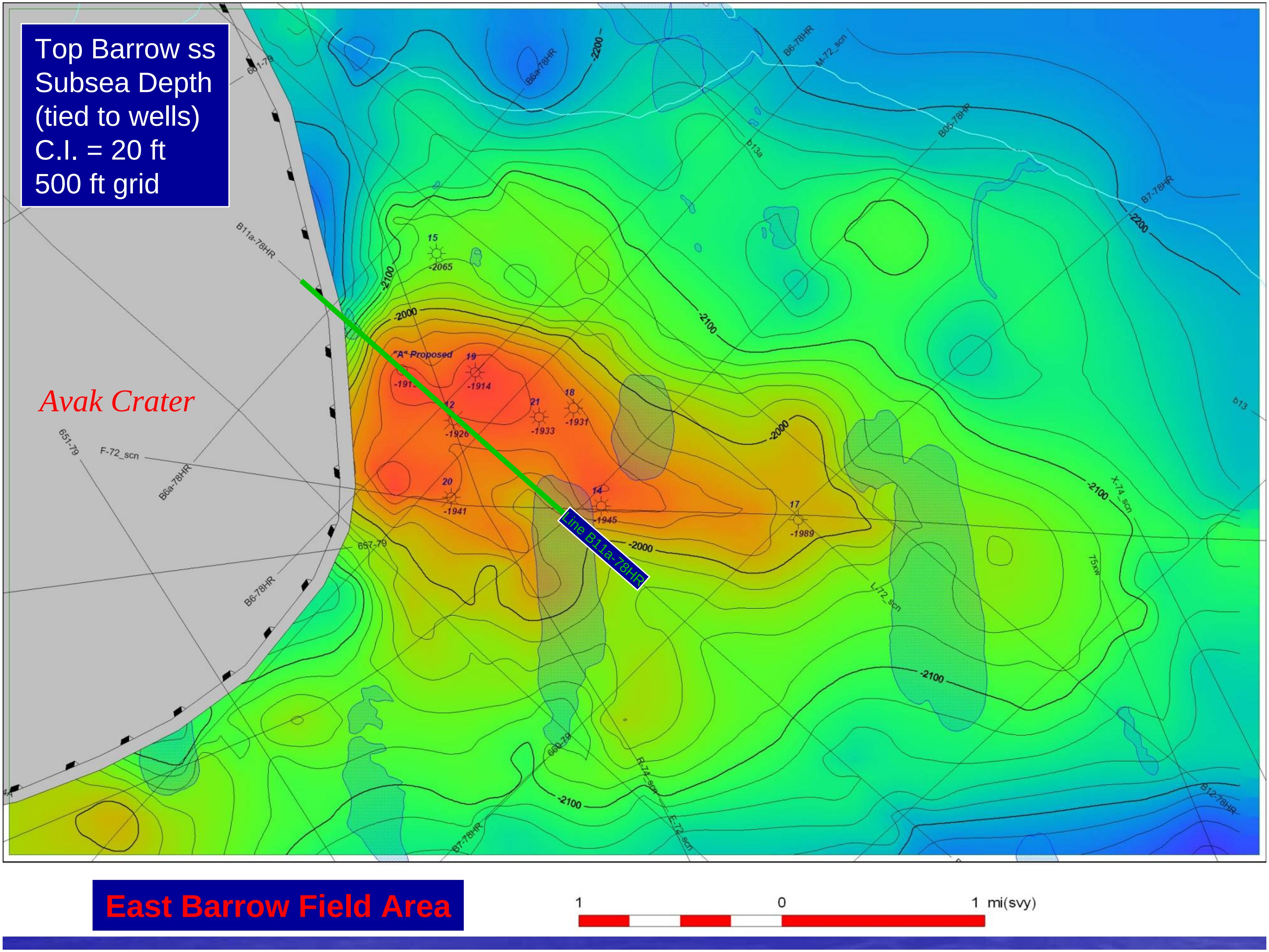
- Background
- Simulation Results
- Impacts on Well Location/Design

Barrow Gas Fields

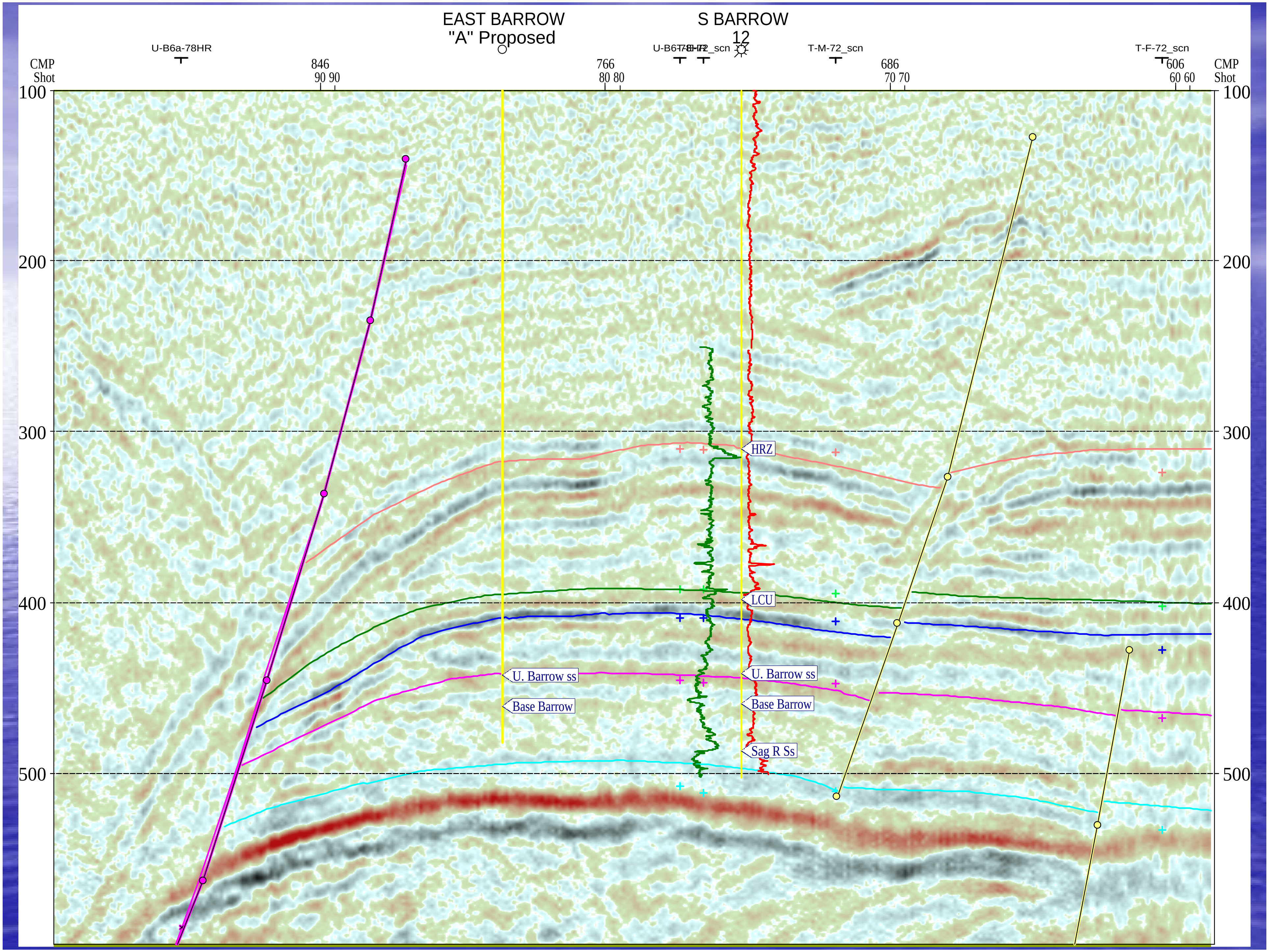


Structure Map Top Barrow Sand

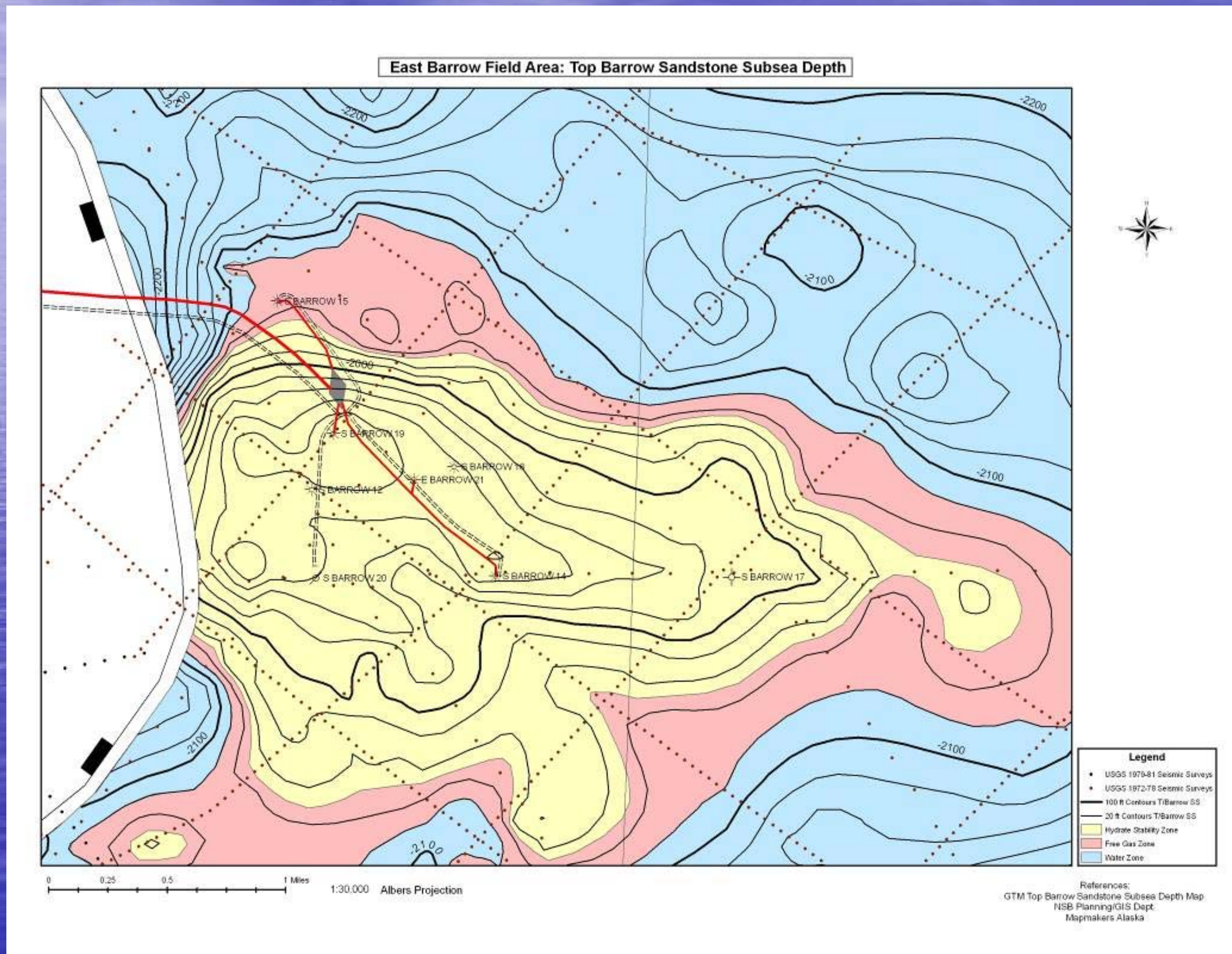




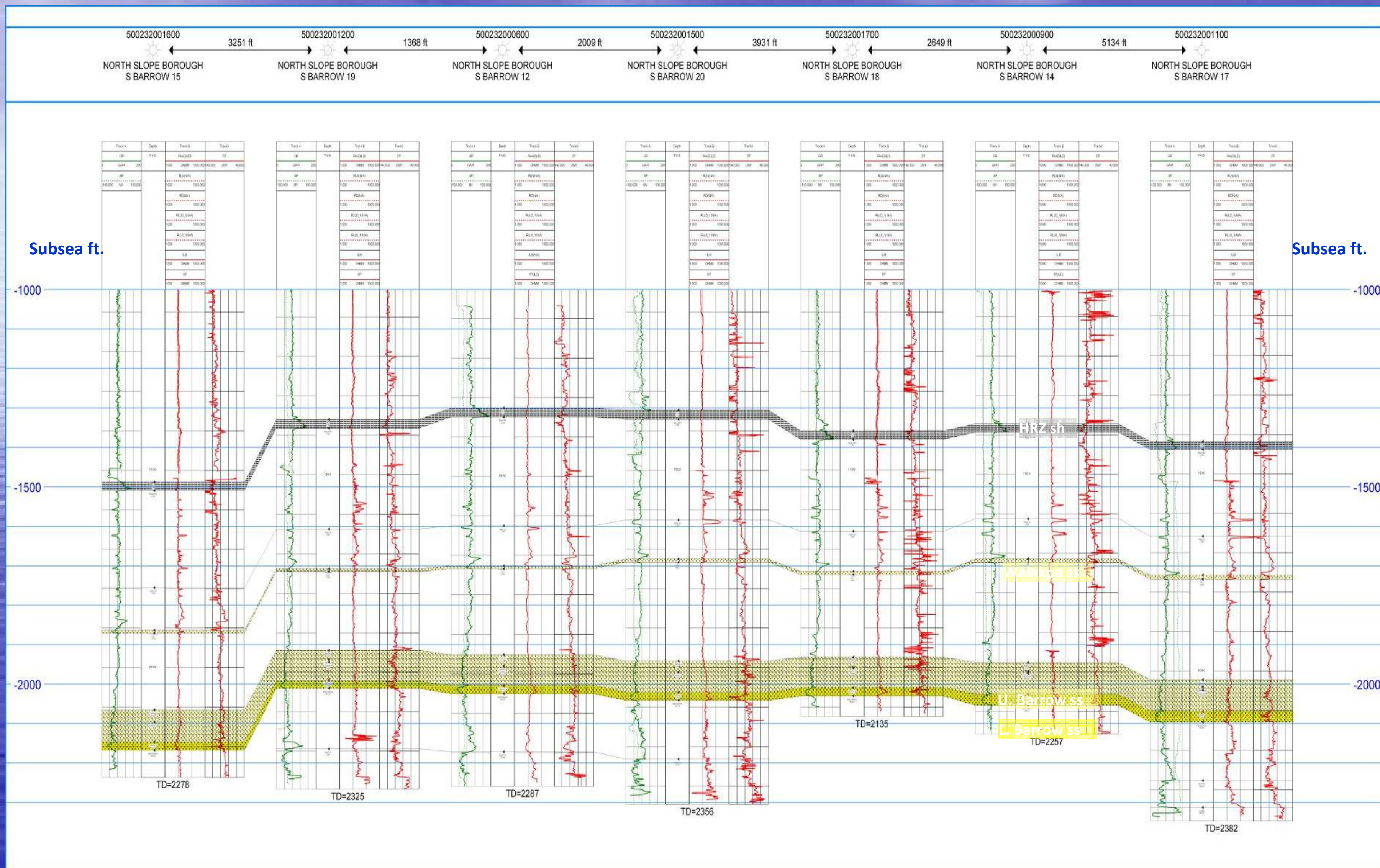
East Barrow Field Area


EAST BARROW
"A" Proposed
S BARROW
12
U-B6a-78HR
T-M-72_scn
T-F-72_scn
CMP
Shot
846
90 90
766
80 80
686
70 70
606
60 60
100
200
300
400
500
HRZ
LCU
U. Barrow ss
Base Barrow
Sag R Ss

Modeled most likely hydrate stability zone depth in East Barrow Field



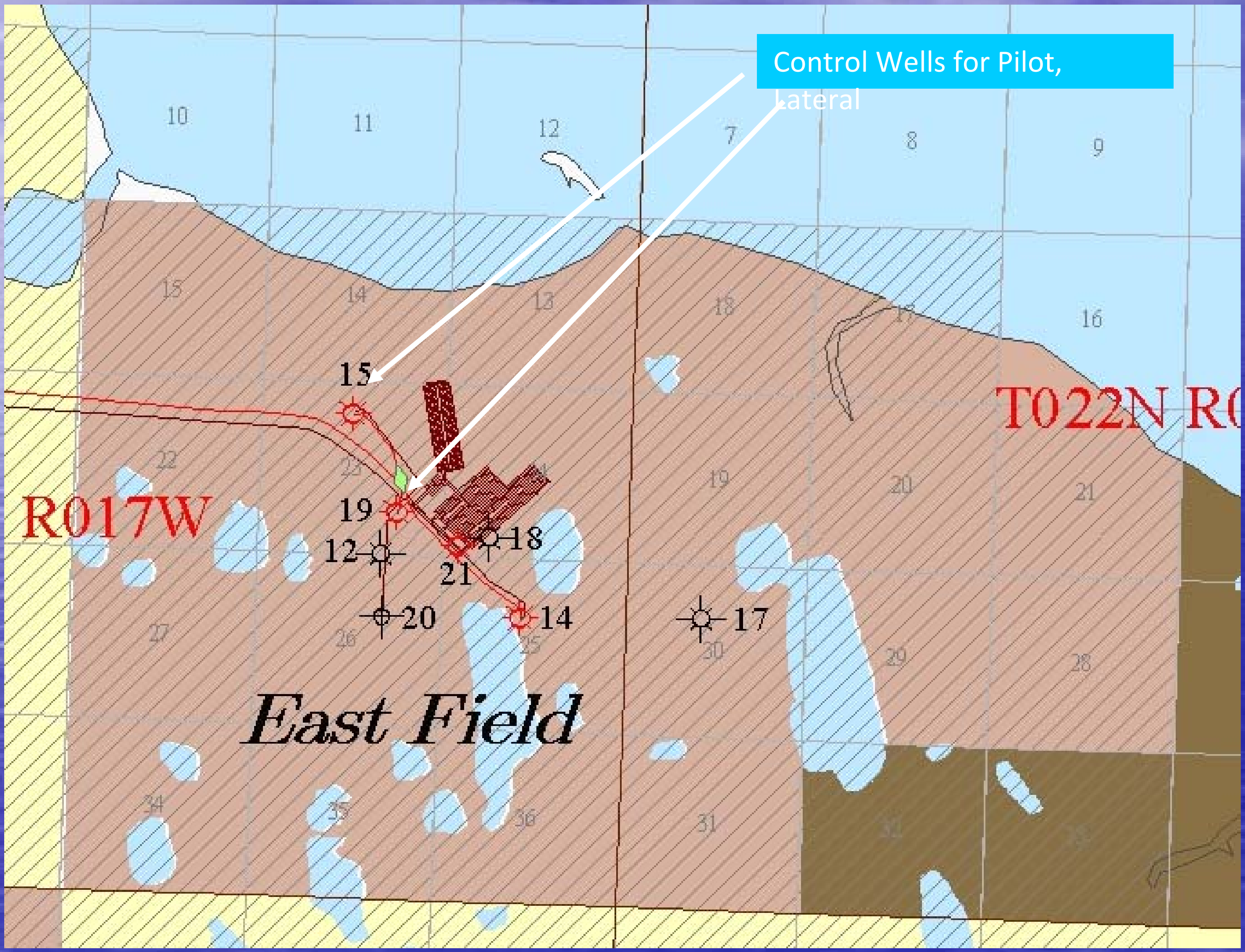
East Barrow Field Structural Cross-Section (no horizontal scale)



Results from Phase I B

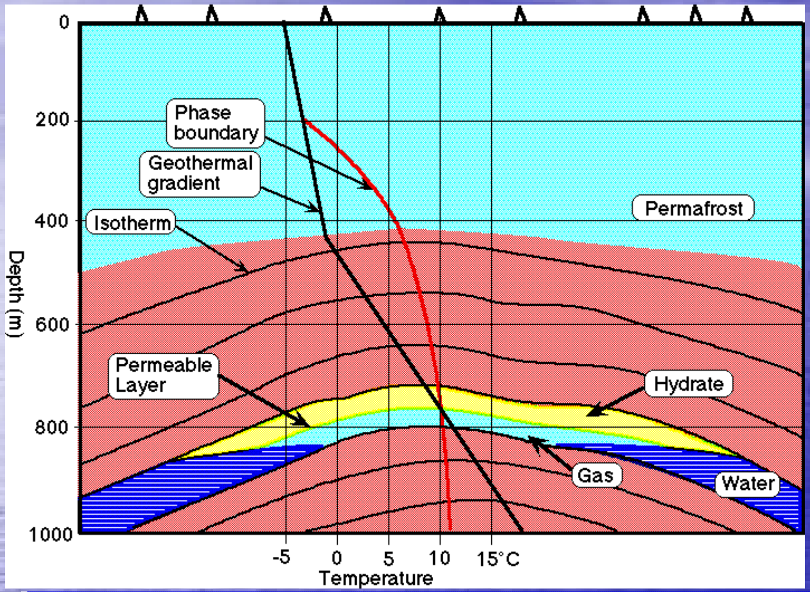
- Material Balance modeling in E. Barrow indicates the pressure response can not be explained with conventional pressure depletion and/or aquifer support. Explanation: the free gas zone is being recharged by hydrates.
- Geologic mapping and analyses was performed resulting in a robust geologic (static) model for reservoir simulation.
- Full Field reservoir simulation with CMG STARS was performed with a history match on production and pressure, confirming likelihood of methane hydrates in E. Barrow and Walakpa fields.
- Narrowed the selection of locations for hydrate test wells in E. Barrow and Walakpa.

East Barrow Infrastructure and Well Control

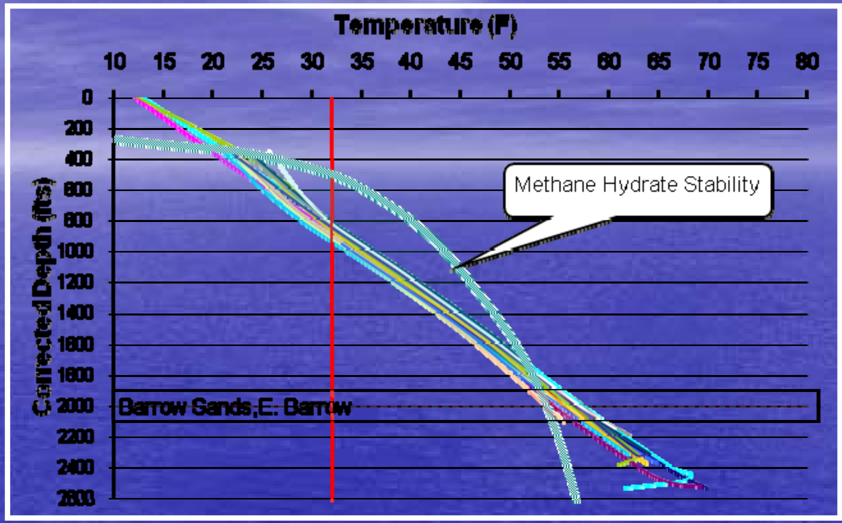


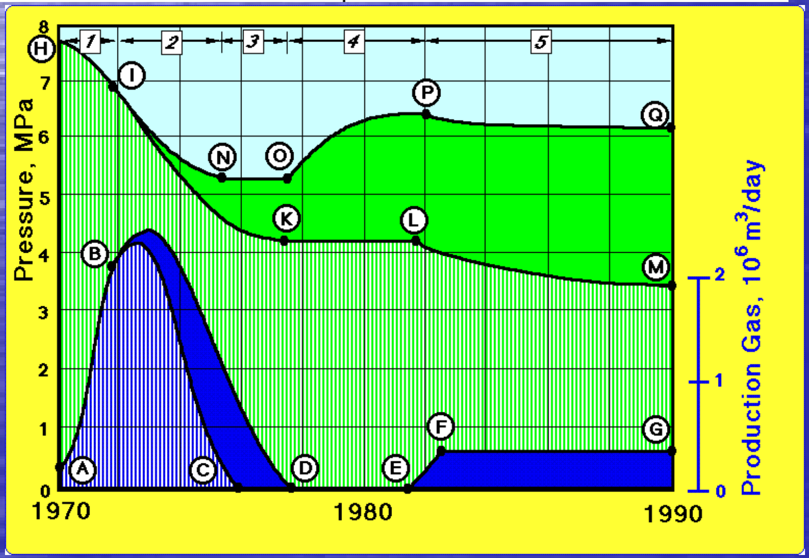
Producing Class I Deposits: Analogs

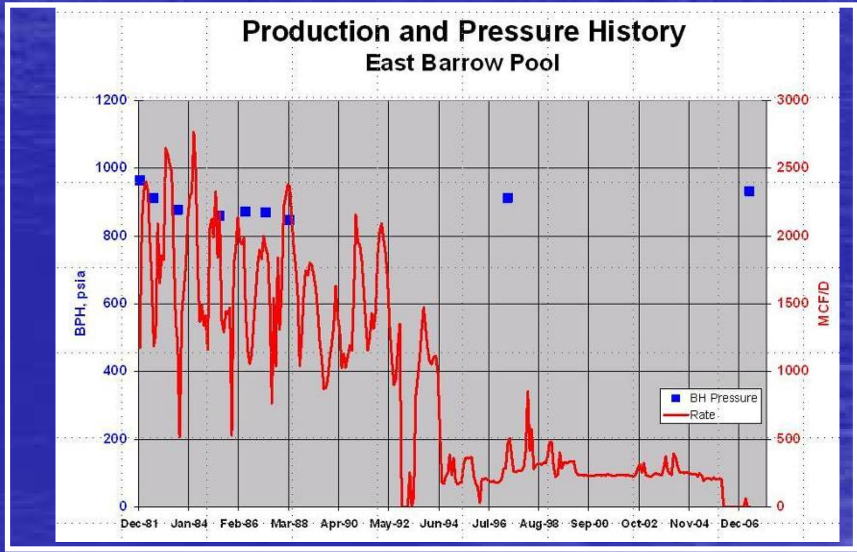
Messoyakha Field[1]



E. Barrow Field[2]







1. Makogan, Grover, Moridis, et. al. 2. Stokes, Singh, Walsh

Objectives of Phase 2

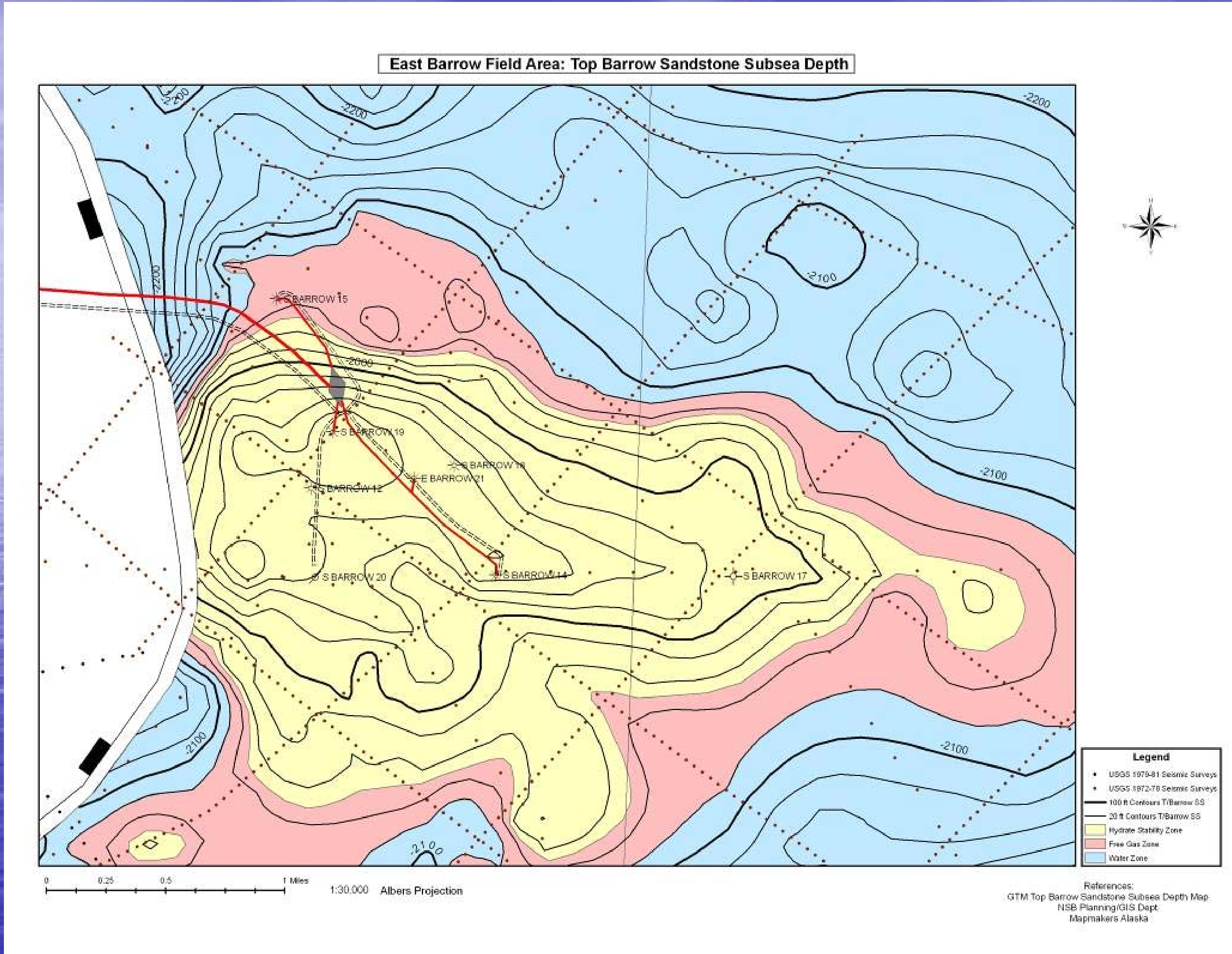
- Support hydrate production with additional simulation
  - Well level modeling. Preliminary results presented here.
- Confirm physical presence of hydrates
  - Drill a stratigraphic test well; core and log
- Produce free gas below the interface, monitor hydrates, prove that gas production is supported by hydrate disassociation
  - Transect Hydrate/Free gas interface with 1st or 2nd pilot hole
  - Produce methane through conventional techniques at rates that will disassociate hydrate in the observation well in less than 5 years.
  - Conduct periodic and ongoing production surveillance
    - Real-time temperature/pressure changes – history match
    - Time-lapse Neutron and Sonic logging to monitor change in hydrate
    - Water/gas ratio changes
    - Water/gas compositional changes

Fine Grid Simulation Work Plan

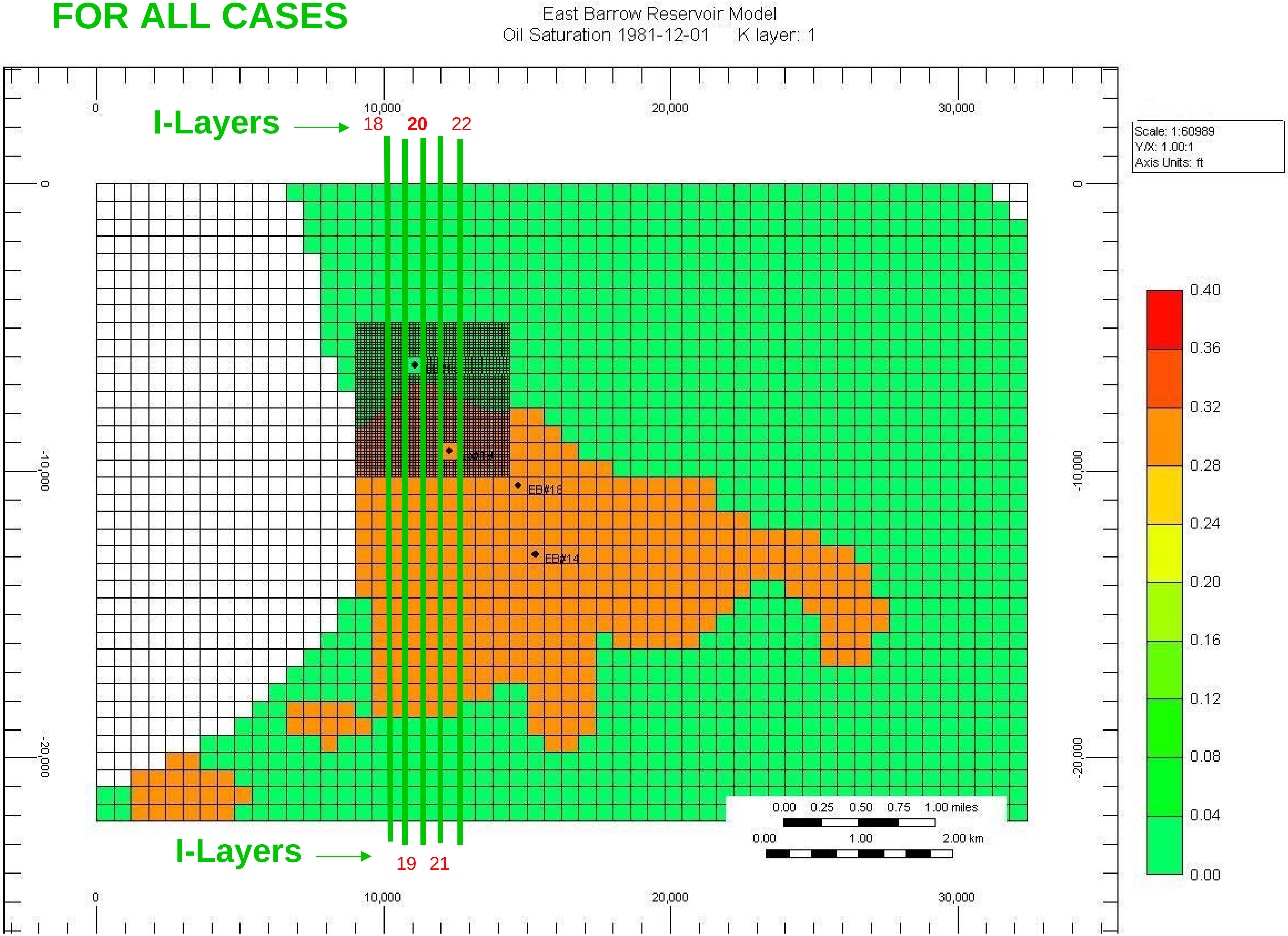
Objectives:

1. Use fine grid simulation to determine optimal location of observation well and production well, and
2. Estimate the response at the observation well due to production (pressure reduction) from the high angle producer.

- Task 1 – Pick a general area that is best suited to see a movement or change in the hydrate as gas is removed down dip.
  - Result: the area around wells #15 and #19 were chosen due to adequate well & seismic control and relatively high dip angle.
- Task 2 - apply local grid refinement around the area between wells #15 and #19 and simulate the hydrate layer at time 0 and current time over a broad area. Run the expected case and create “artificial cases” to account for other possible scenarios.
- Task 3 – Simulate the response at the observation well, due to production from a high angle producer in the free gas leg.


East Barrow Field Area: Top Barrow Sandstone Subsea Depth
-2200
-2200
-2200
-2200
-2100
-2000
-2100
-2100
-2100
-2100
S BARROW 15
S BARROW 19
S BARROW 18
E BARROW 21
S BARROW 12
S BARROW 20
S BARROW 14
S BARROW 17
Legend
USGS 1979-81 Seismic Surveys
USGS 1972-78 Seismic Surveys
100 ft Contours T/Barrow SS
20 ft Contours T/Barrow SS
Hydrate Stability Zone
Free Gas Zone
Water Zone
0
0.25
0.5
1 Miles
1:30,000 Albers Projection
References:
GTM Top Barrow Sandstone Subsea Depth Map
NSB Planning/GIS Dept
Mapmakers Alaska

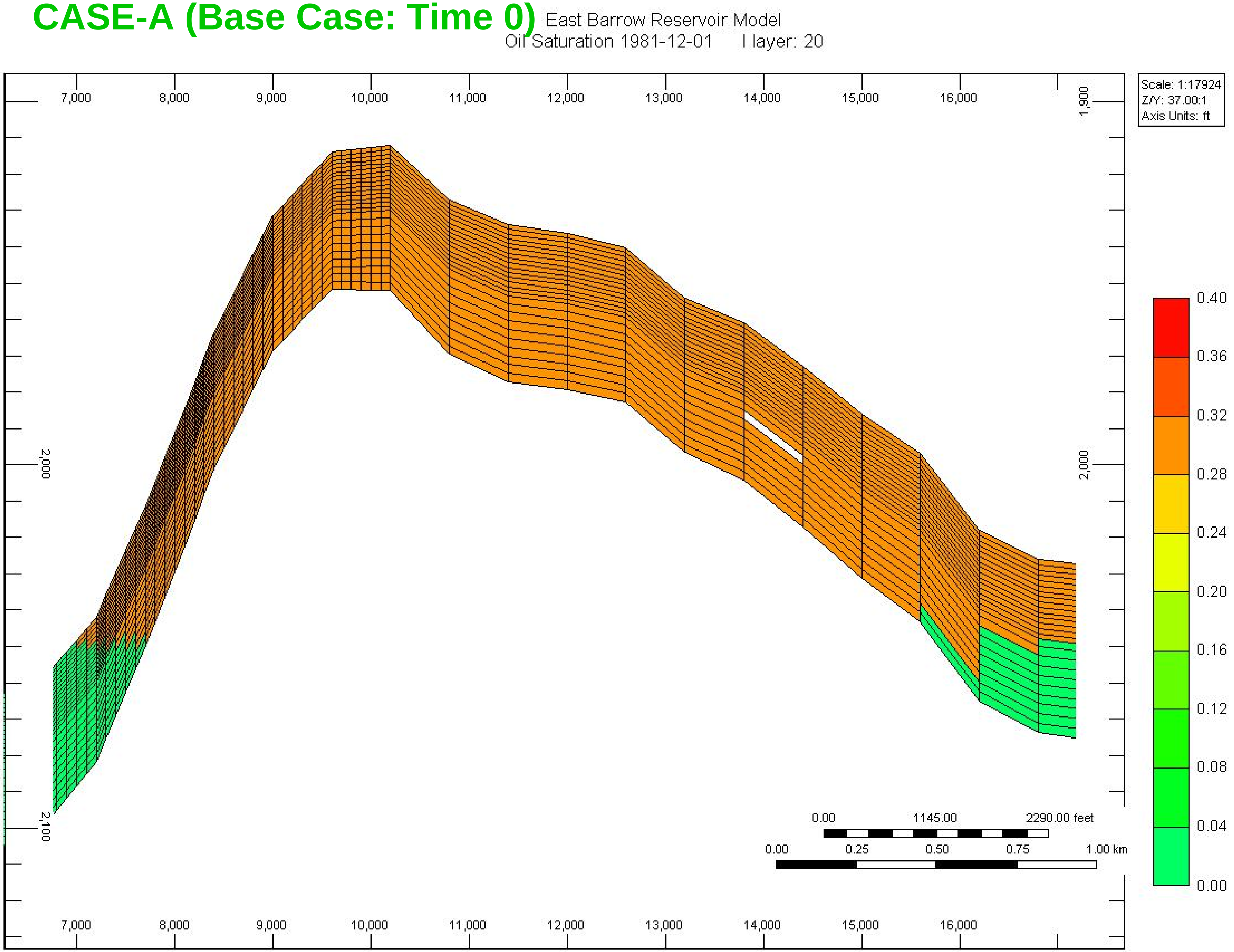
FOR ALL CASES



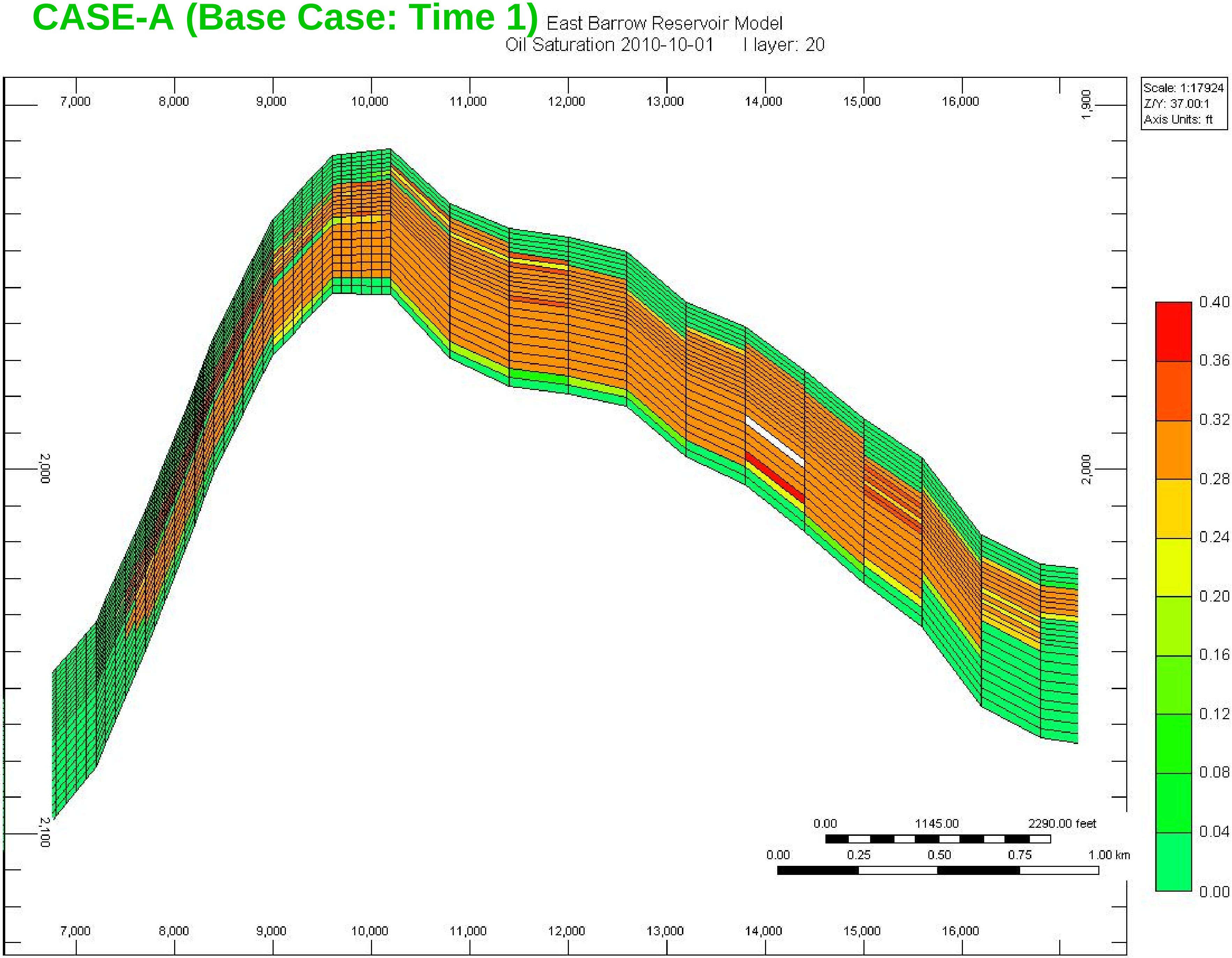
Fine Grid Simulation Work Summary – Task 2

- The history matched full field coarse gridded (600’ X 600’) model was used as the basis for fine-gridded (100’ X 100’) , well level model.
- Time 0 is field start-up. Time 1 is proposed time of completion of observation well.
- Production ongoing with well EB#14 continuing to produce at a constant rate of 625 MSCF/Day
- Case A is the **expected case** with all history matched properties assumed.
- Case B is an “artificial case” to depict a scenario with a full column of hydrate still intact at the location of the observation well. Note: This does not history match.
- Case D is an “artificial case” to depict a scenario where the hydrate column is almost gone at the location of the observation well. Note: This does not history match.

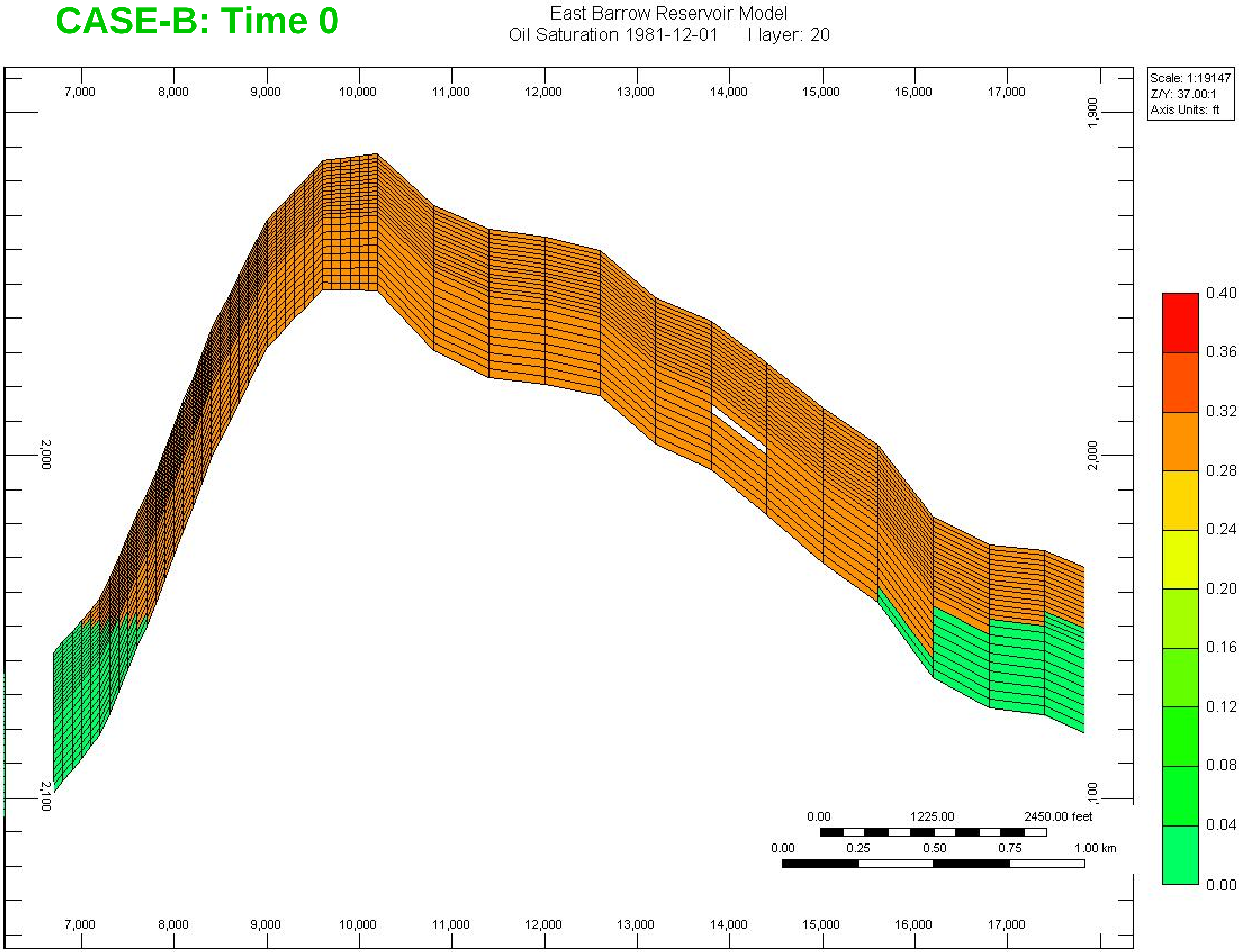
CASE-A (Base Case: Time 0)



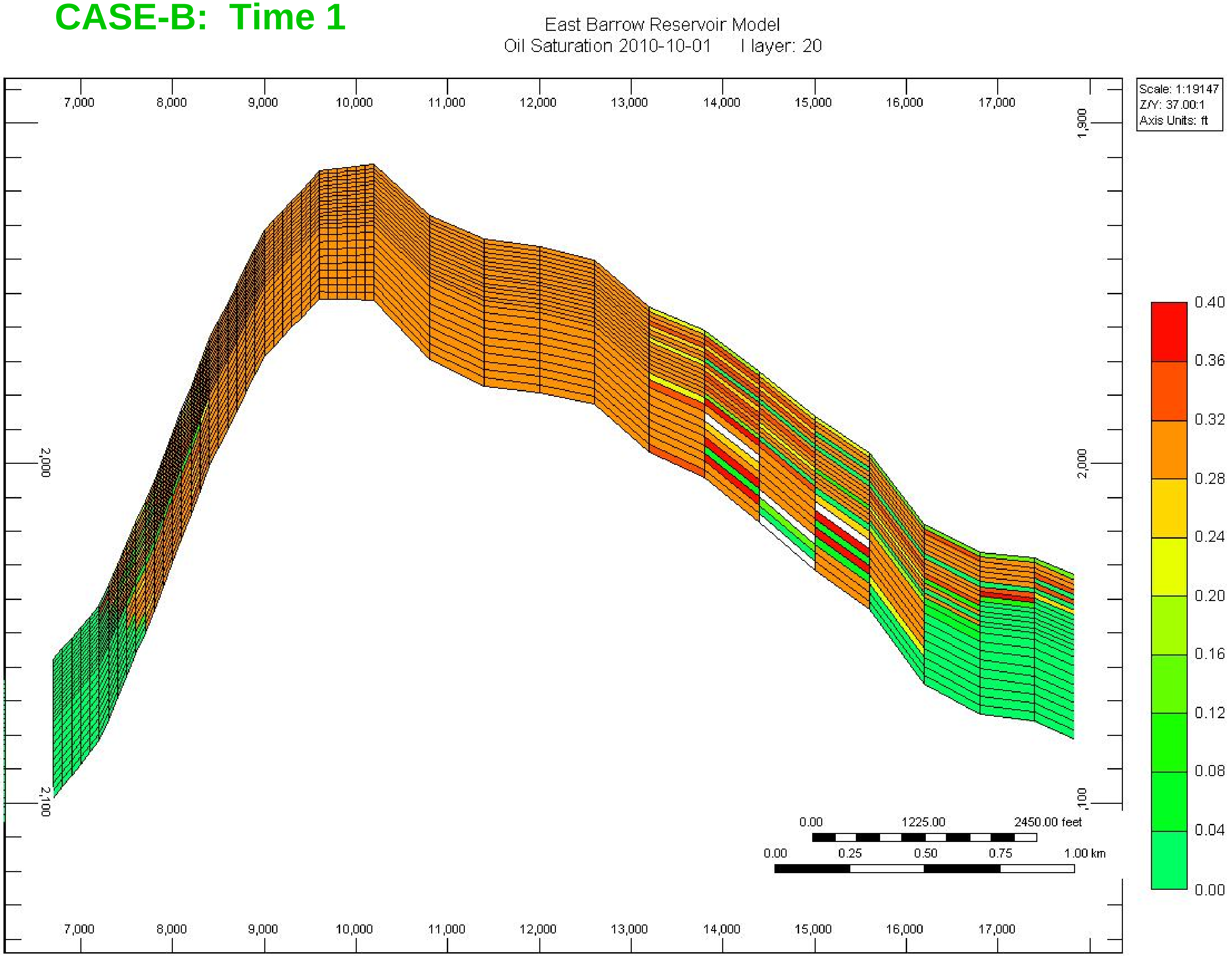
CASE-A (Base Case: Time 1)



CASE-B: Time 0


East Barrow Reservoir Model
Oil Saturation 1981-12-01 I layer: 20
Scale: 1:19147
Z/Y: 37.00:1
Axis Units: ft
7,000
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
1,900
2,000
2,100
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00
0.00
1225.00
2450.00 feet
0.00
0.25
0.50
0.75
1.00 km

CASE-B: Time 1



East Barrow Reservoir Model
Oil Saturation 2010-10-01 I layer: 20
Scale: 1:19147
Z/Y: 37.00:1
Axis Units: ft
7,000
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
1,900
2,000
2,100
0.00
1225.00
2450.00 feet
0.00
0.25
0.50
0.75
1.00 km
0.40
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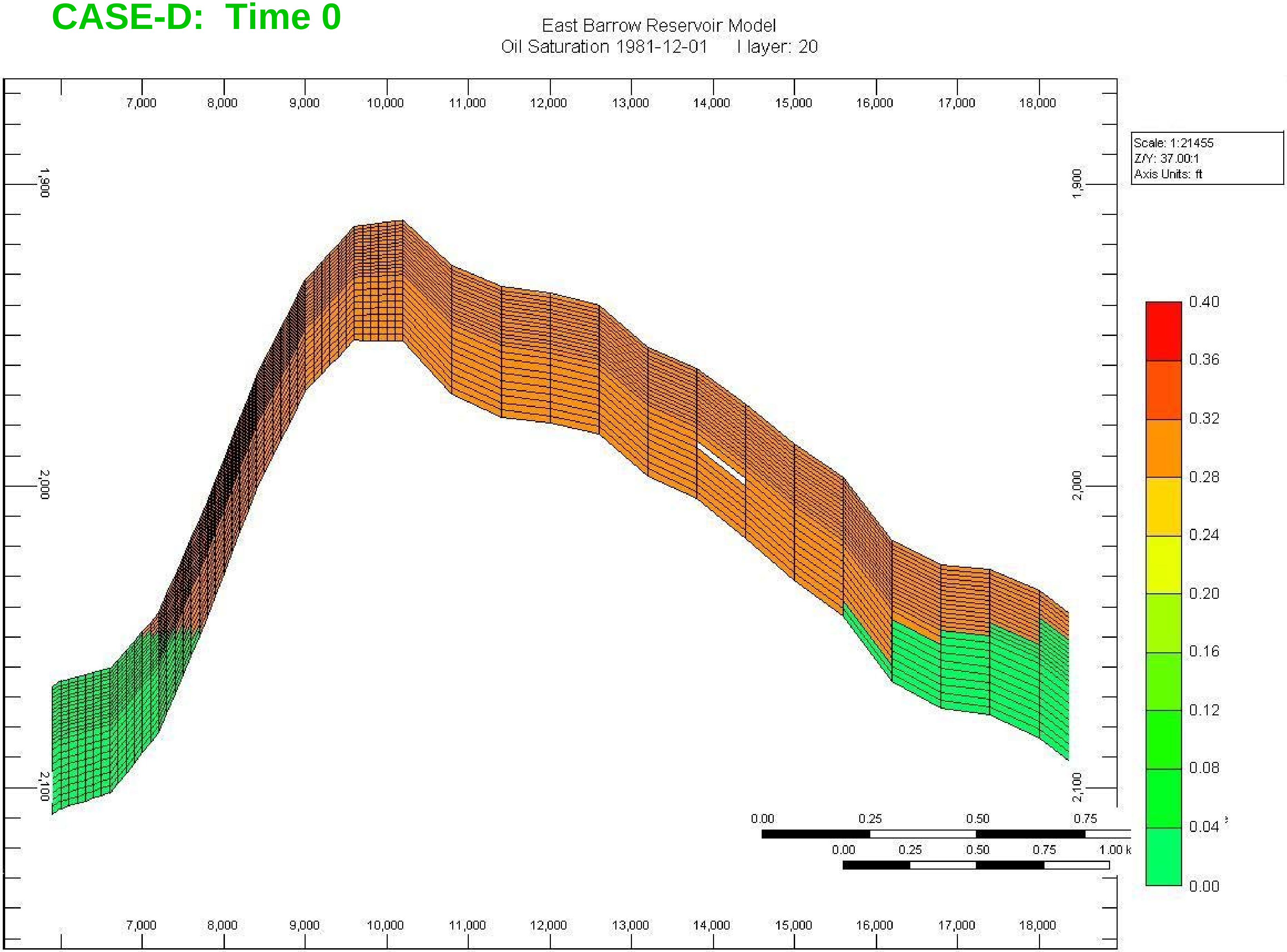
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00

CASE-D: Time 0



East Barrow Reservoir Model
Oil Saturation 1981-12-01 I layer: 20
7,000
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Scale: 1:21455
Z/Y: 37.00:1
Axis Units: ft
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0.20
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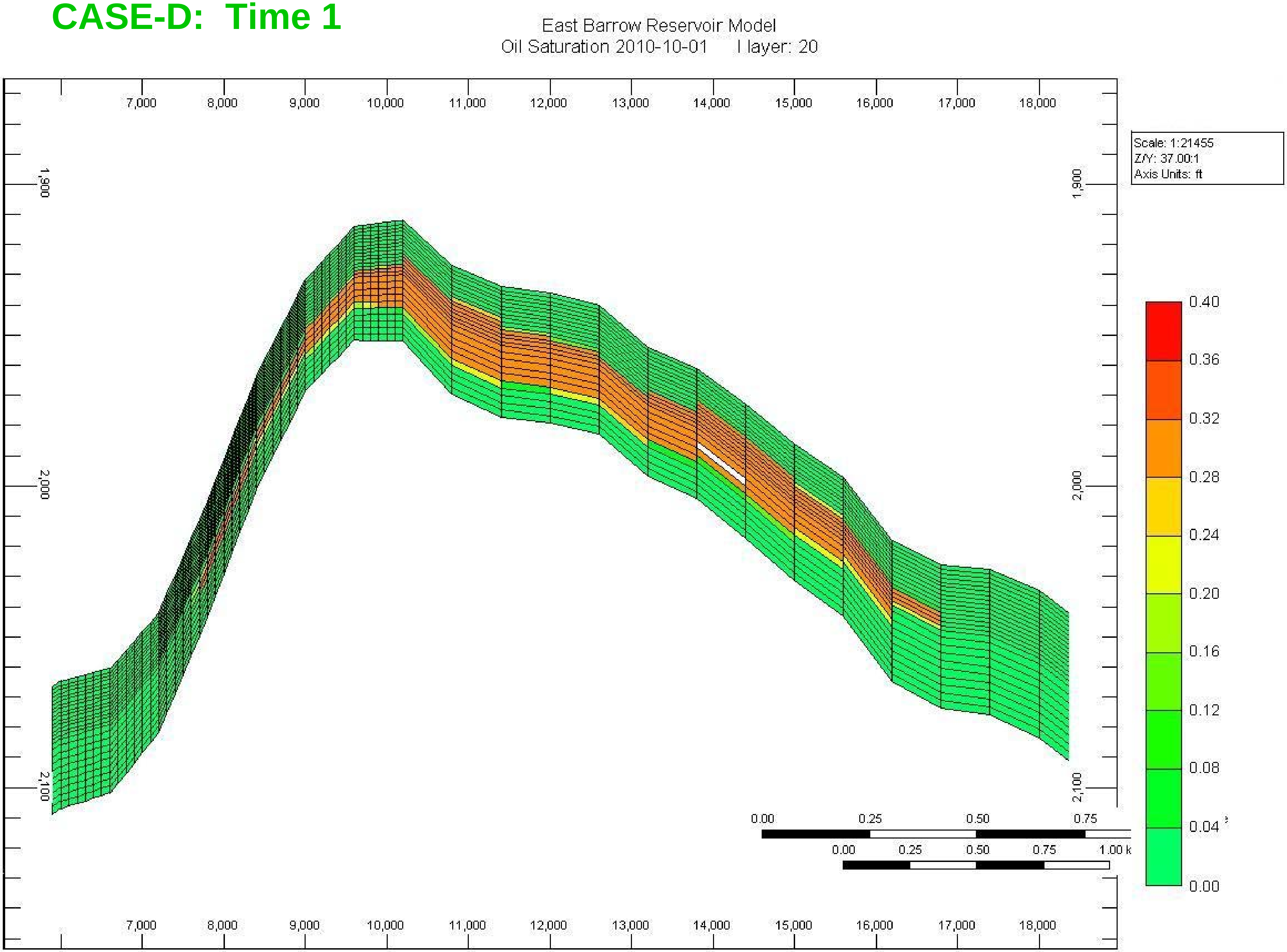
CASE-D: Time 1



East Barrow Reservoir Model
Oil Saturation 2010-10-01 I layer: 20
7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000 17,000 18,000
1,900
2,000
2,100
Scale: 1:21455
Z/Y: 37.00:1
Axis Units: ft
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00
0.00 0.25 0.50 0.75
0.00 0.25 0.50 0.75 1.00 k

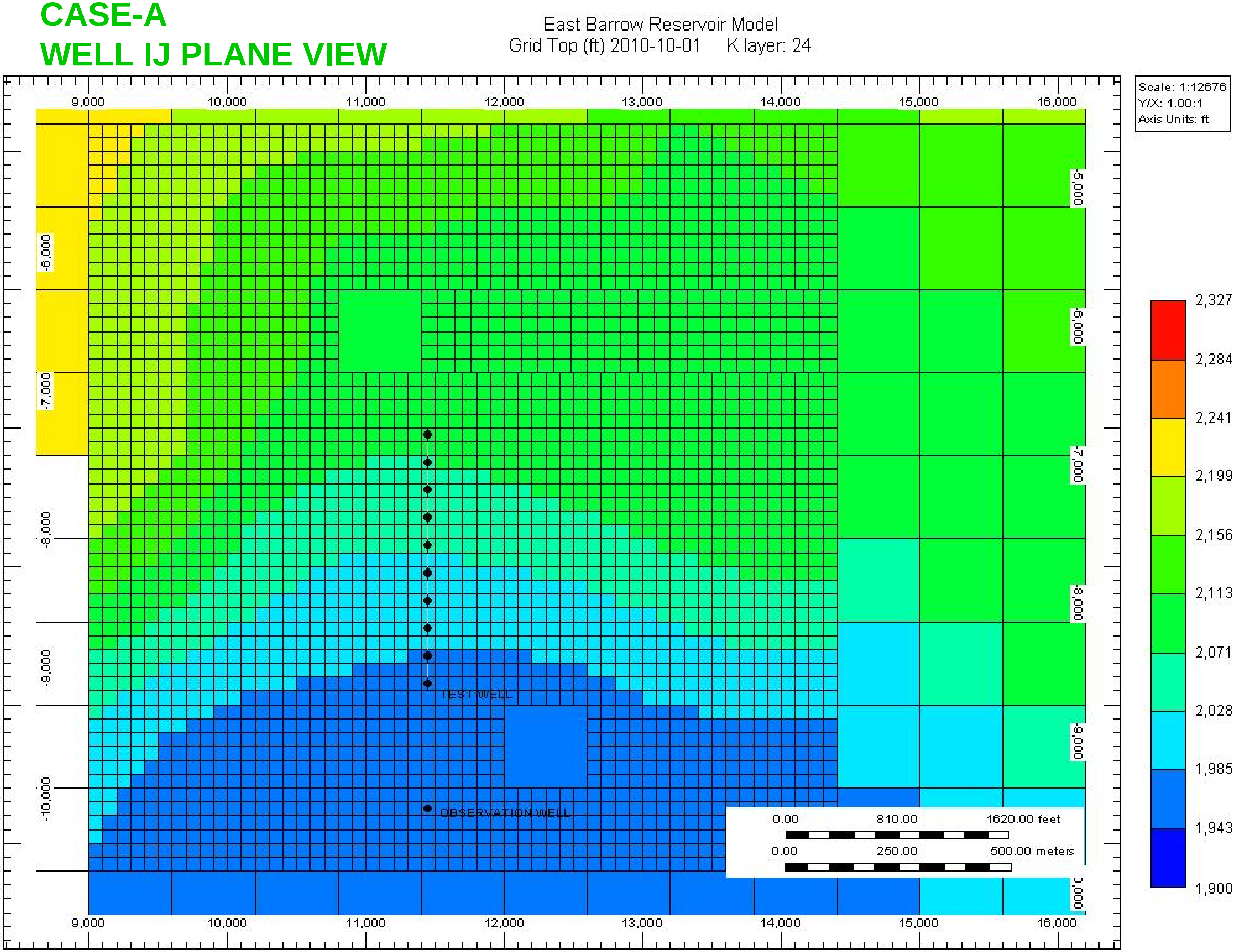
Observations of Task 2 - Simulation Work to Pick Well Location based on Time 0 and Current Time

- The expected case shows hydrate decomposition from below (from the original free gas/hydrate interface), and from the overburden and underburden. At the time the observation well is drilled, at least one interface is expected.
- As a practical matter, other possible scenarios may be found at the observation well including 2.) a full column of hydrate, with no interface. Or, 3.) very little to no hydrate.
- The full column of hydrate case was artificially created by turning off thermal properties of the overburden and underburden. This could have also been created by tweaking other input values.
- The smaller column of hydrate was created by using a higher temperature of overburden and underburden, leading to more hydrate dissociation.
- This work suggests that an observation well near EB#19 is a good location and is expected to see adequate hydrate and an interface to monitor. However, the best placement of the producer well, and/or relocation of the observation well is dependent on what is found in the pilot (stratigraphic) hole.

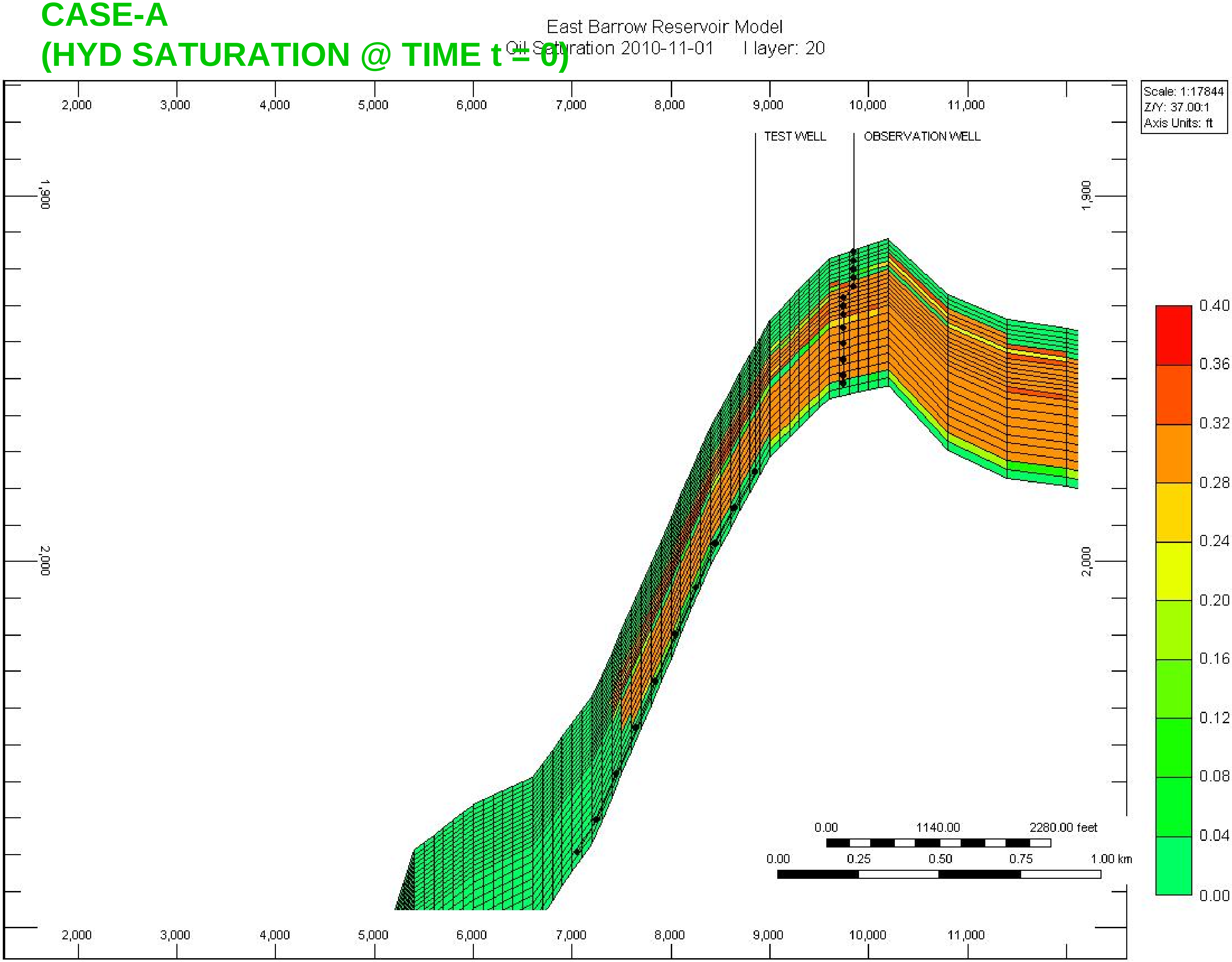
Work Scope of Fine-Grid Simulation Task 3

- Uncertainty and actual location of hydrate column/interface must be acknowledged.
- Create simulation models with two sets of an observation well and a producer well to account for these uncertainties.
- Run the simulation out 5 years (duration of surveillance program) to show the response in the observation well due to downdip production in the free gas leg.
- Use simulation results and observations to plan the well design.

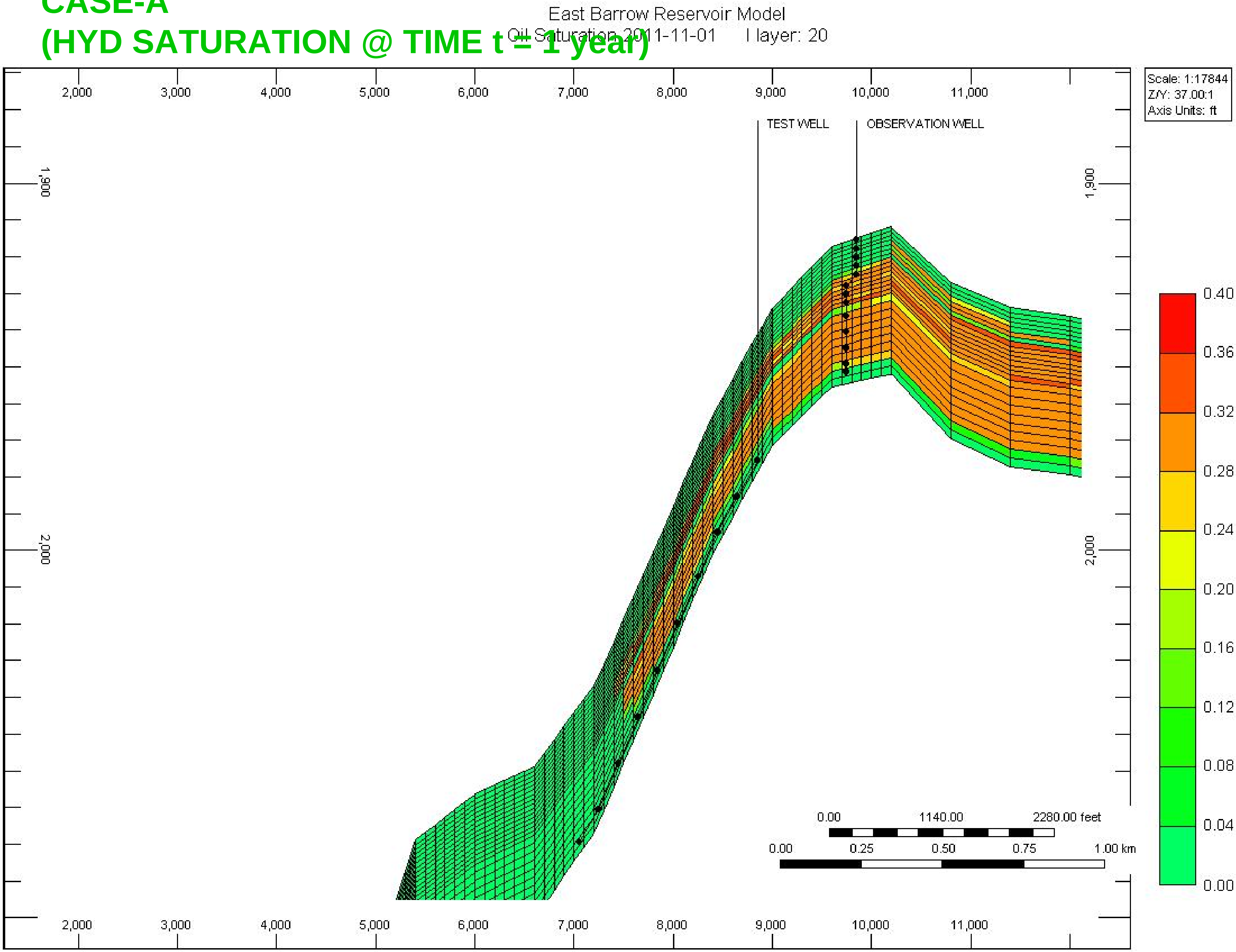
CASE-A
WELL IJ PLANE VIEW



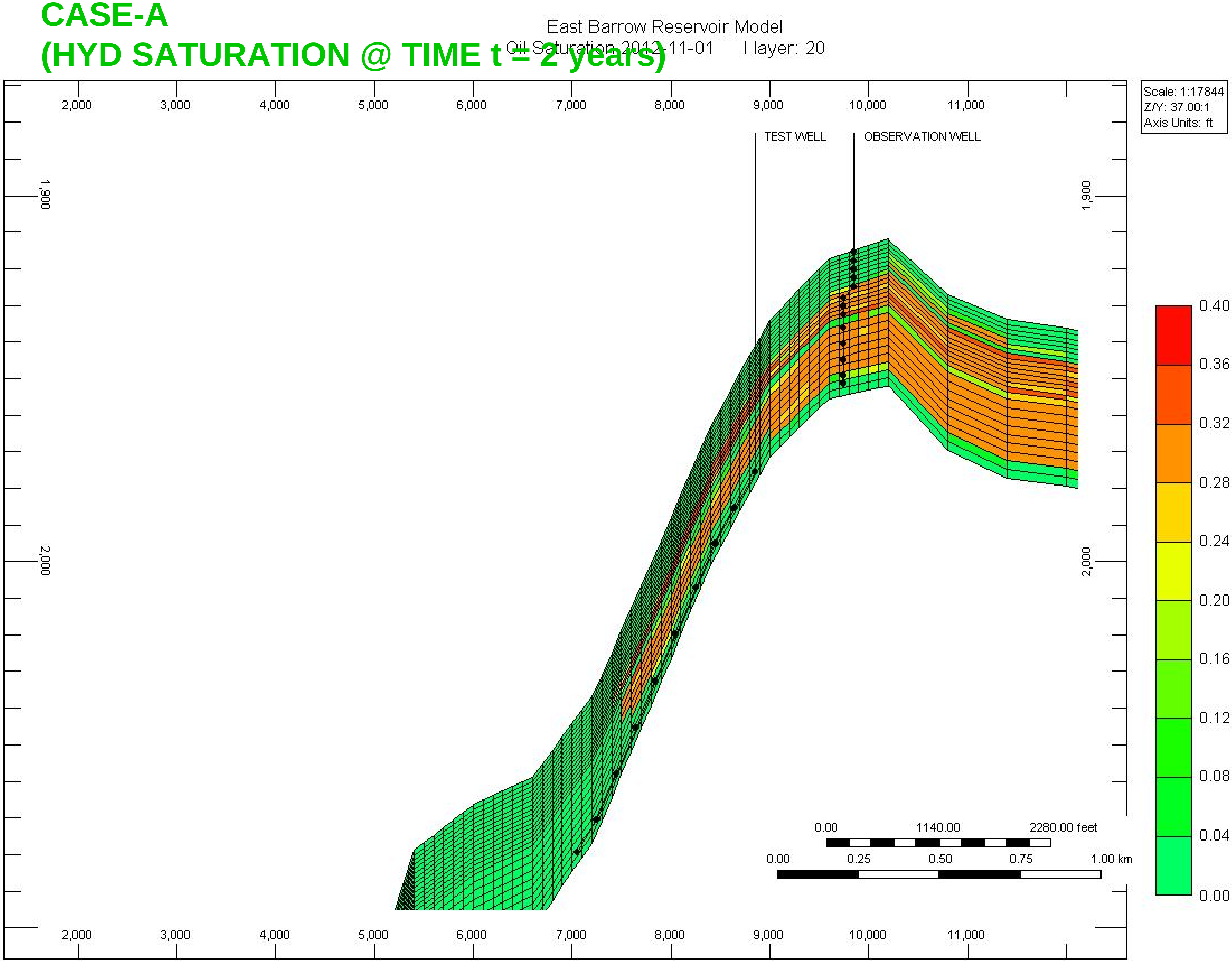
CASE-A
(HYD SATURATION @ TIME t = 0)



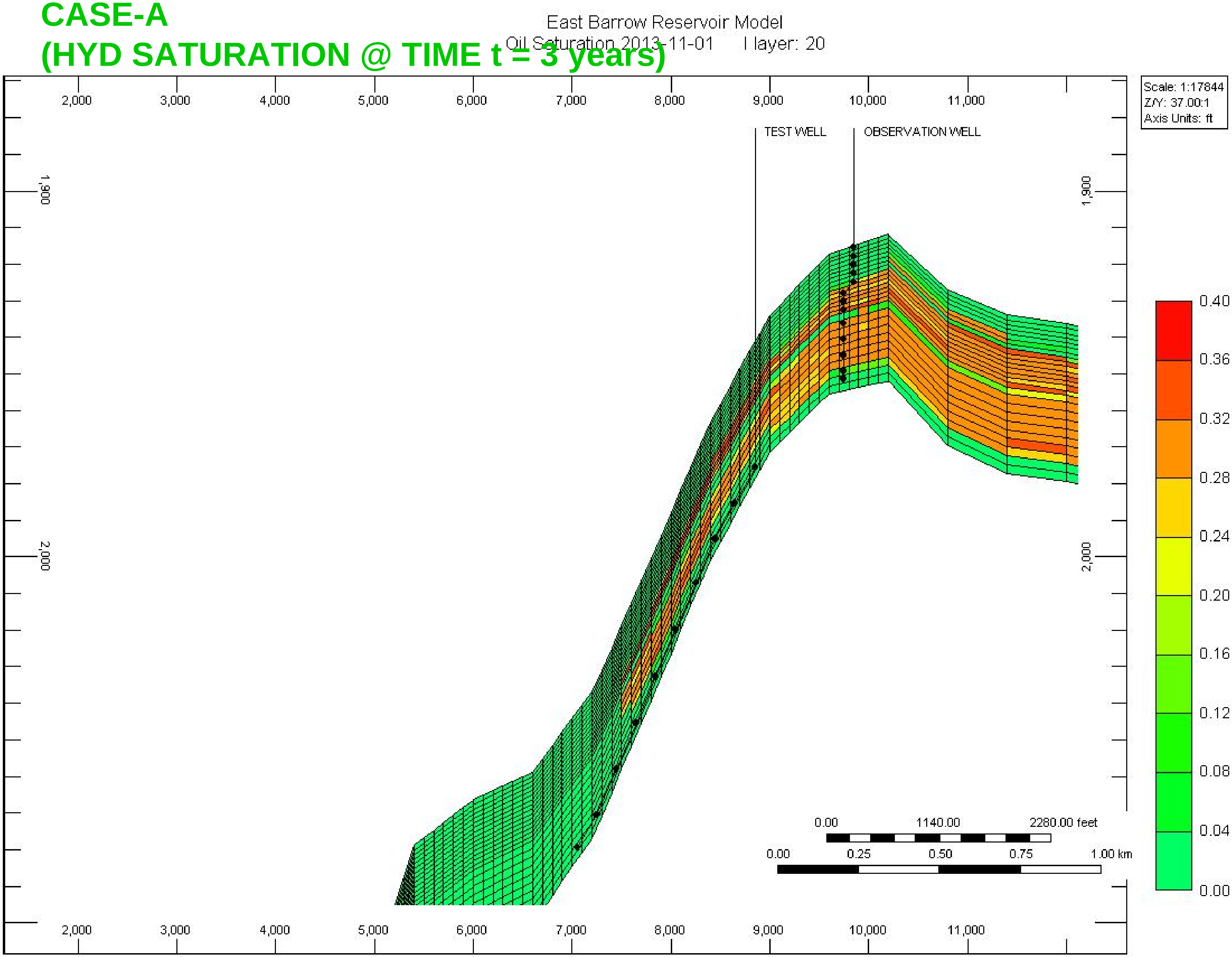
CASE-A
(HYD SATURATION @ TIME t = 1 year)



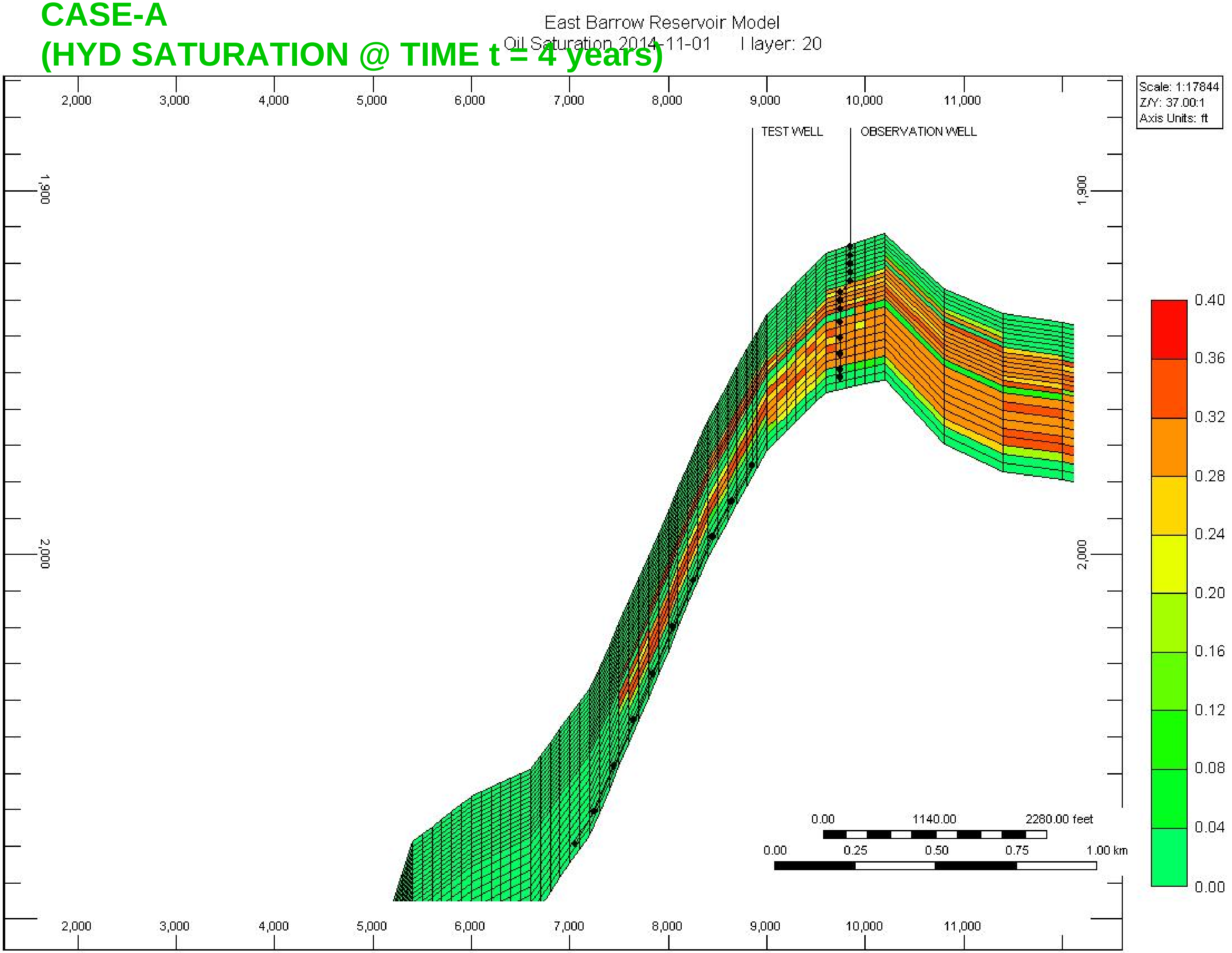
CASE-A
(HYD SATURATION @ TIME t = 2 years)



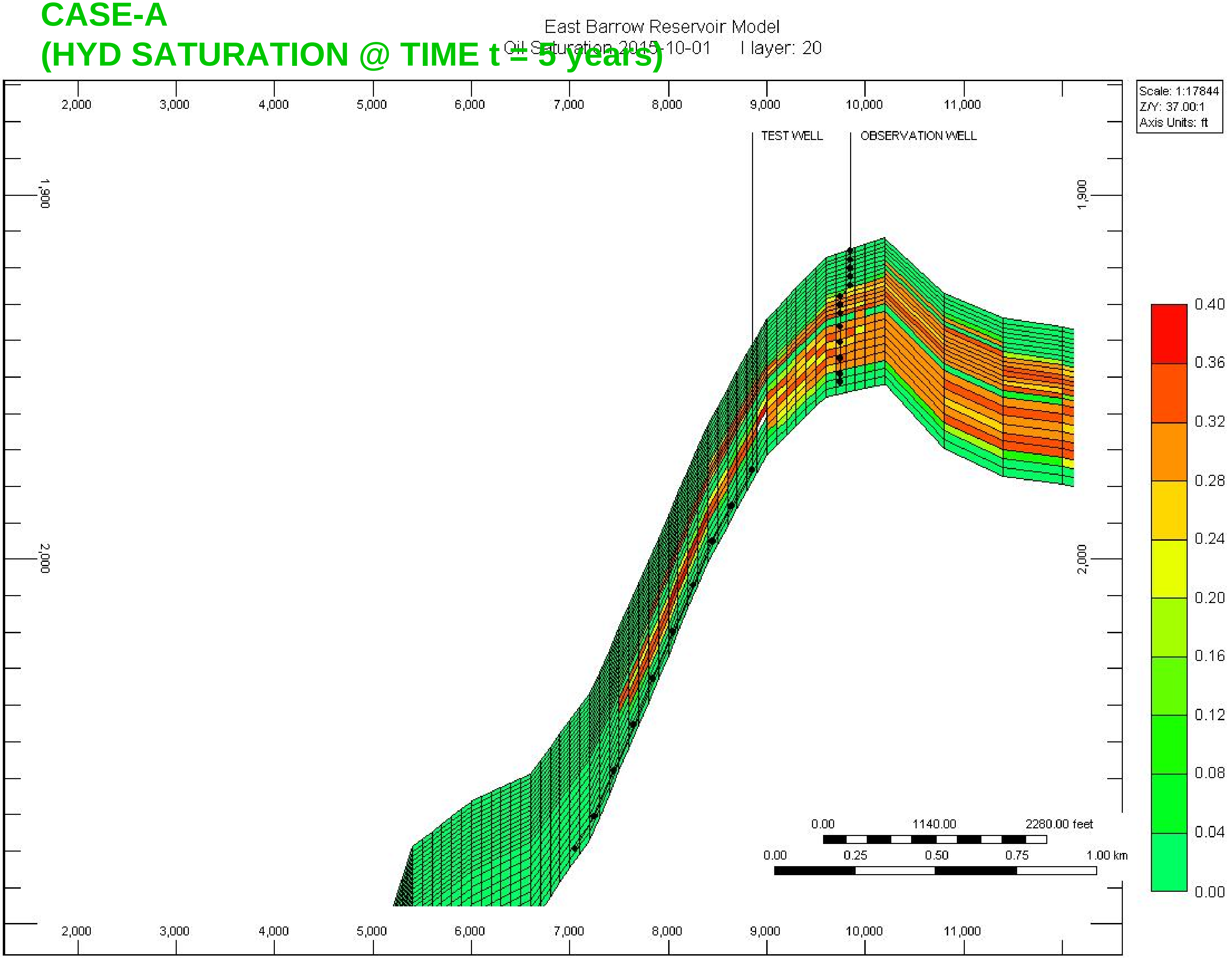
CASE-A
(HYD SATURATION @ TIME t = 3 years)



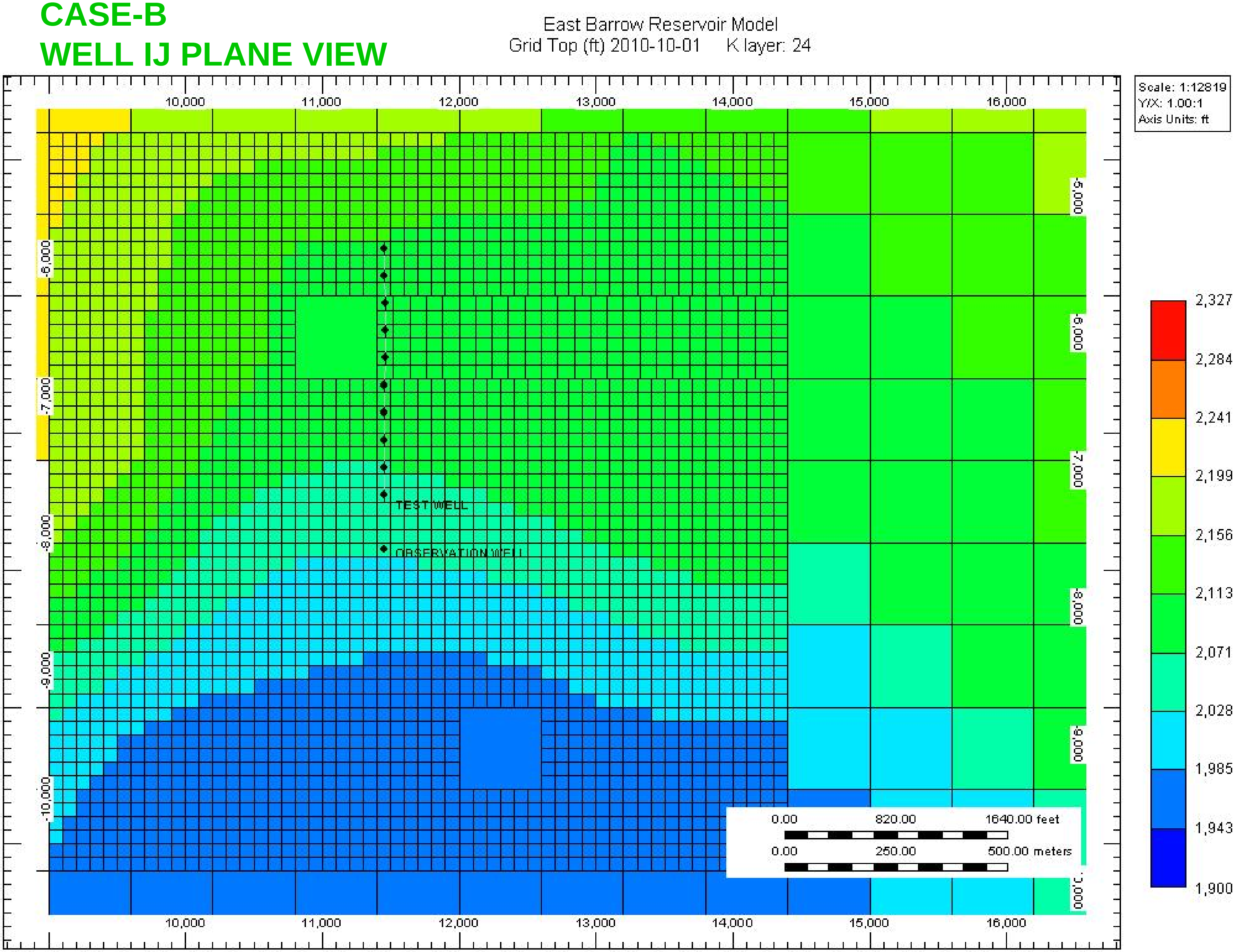
CASE-A
(HYD SATURATION @ TIME t = 4 years)



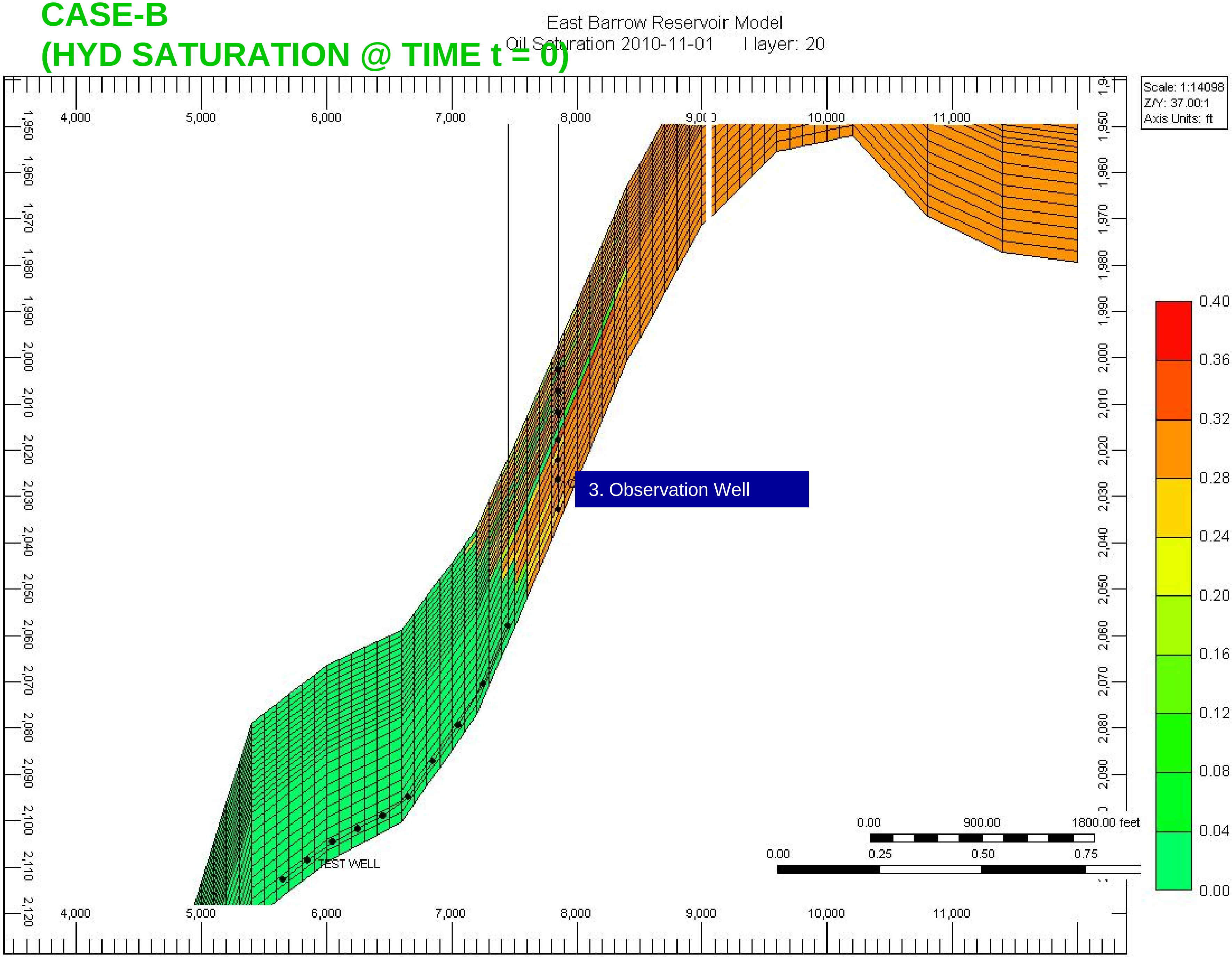
CASE-A
(HYD SATURATION @ TIME t = 5 years)



CASE-B
WELL IJ PLANE VIEW

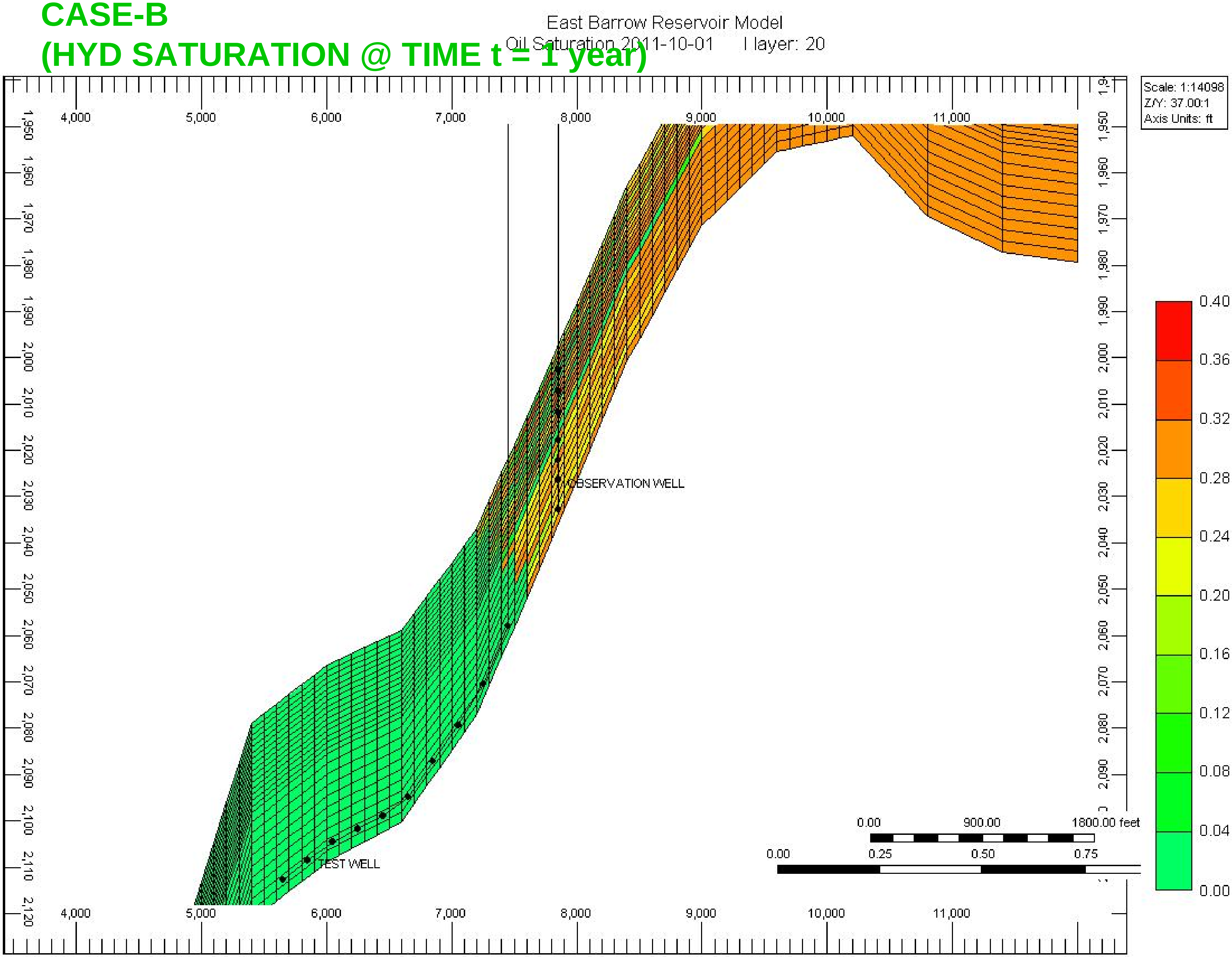


CASE-B
(HYD SATURATION @ TIME t = 0)

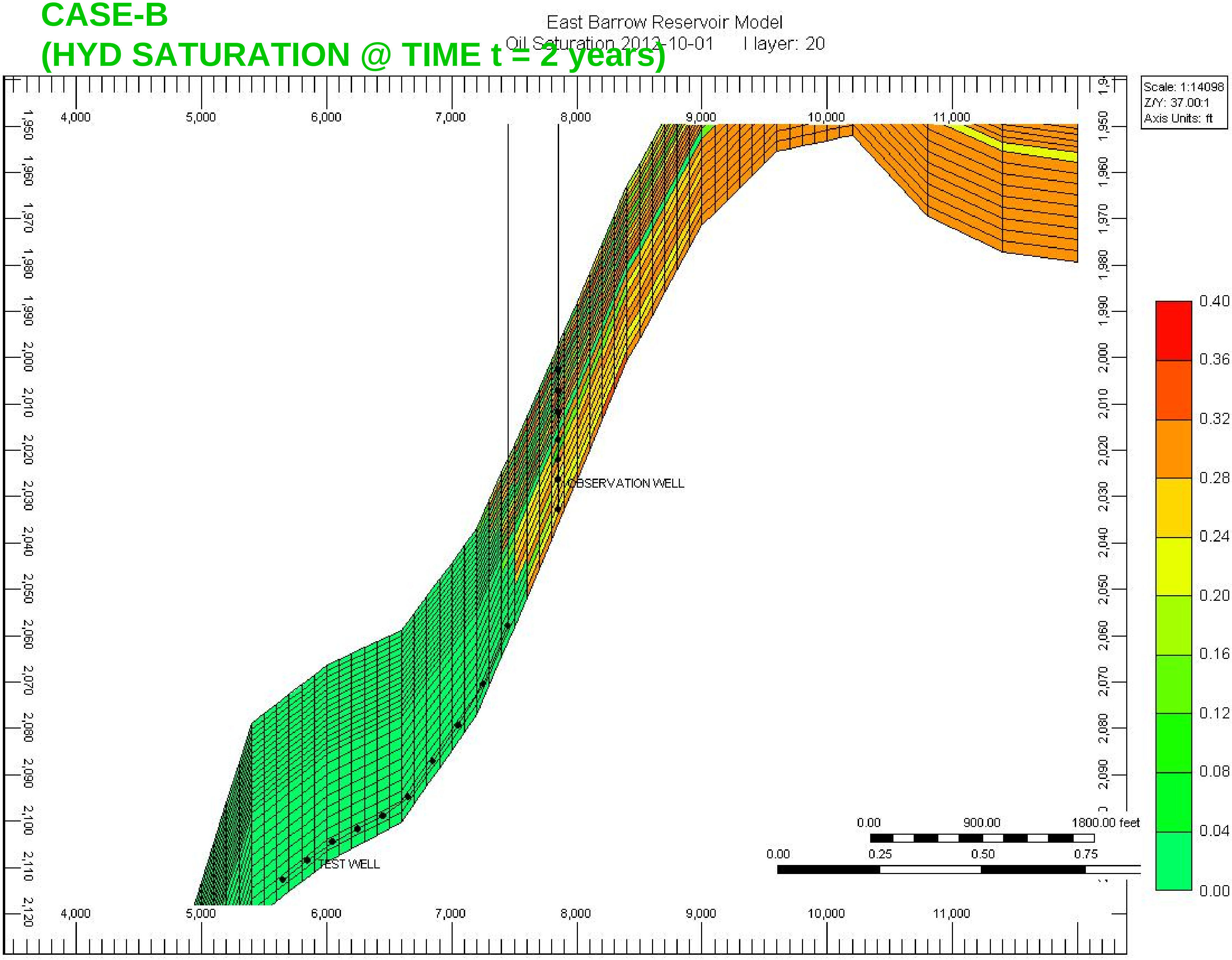


CASE-B

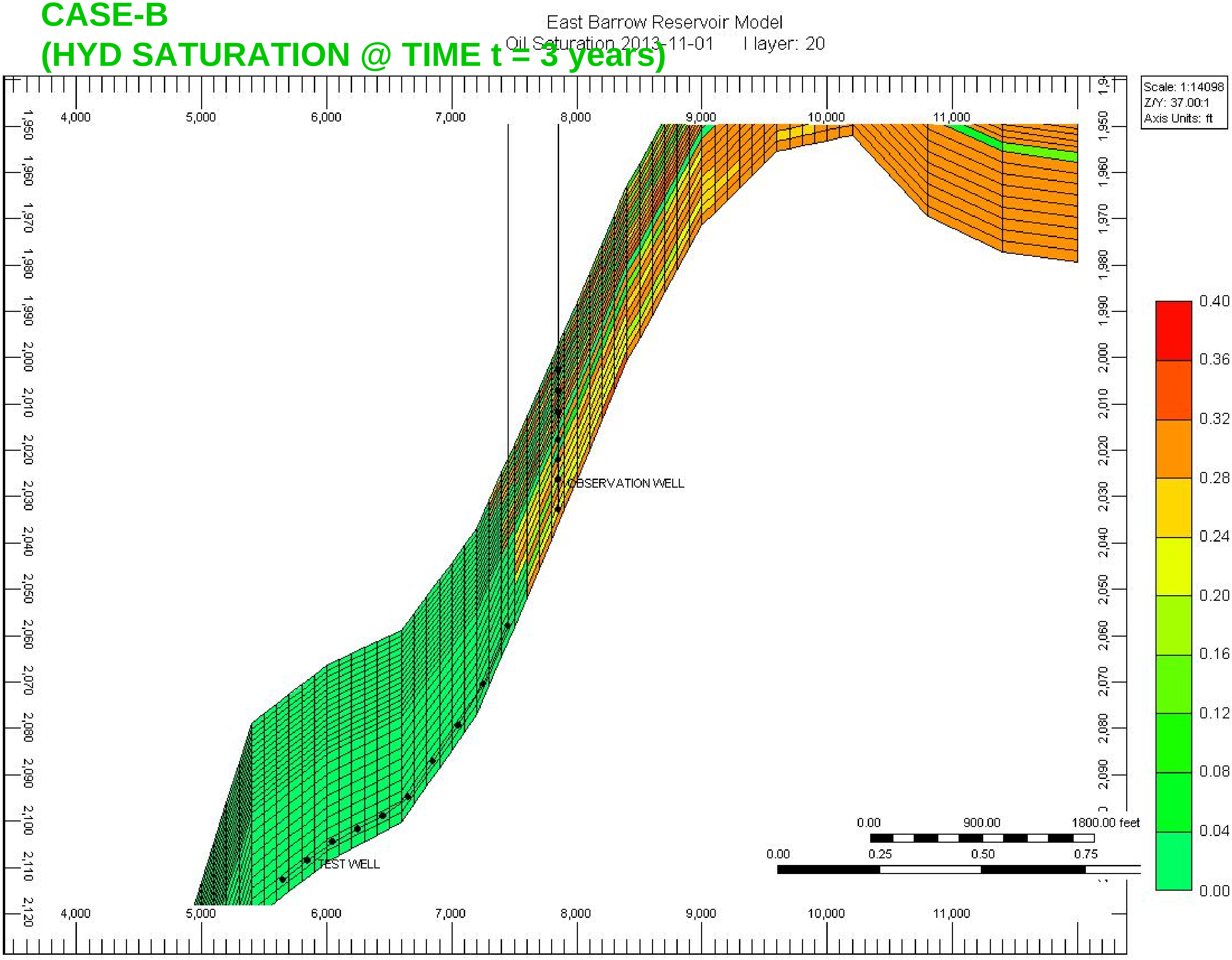
(HYD SATURATION @ TIME t = 1 year)



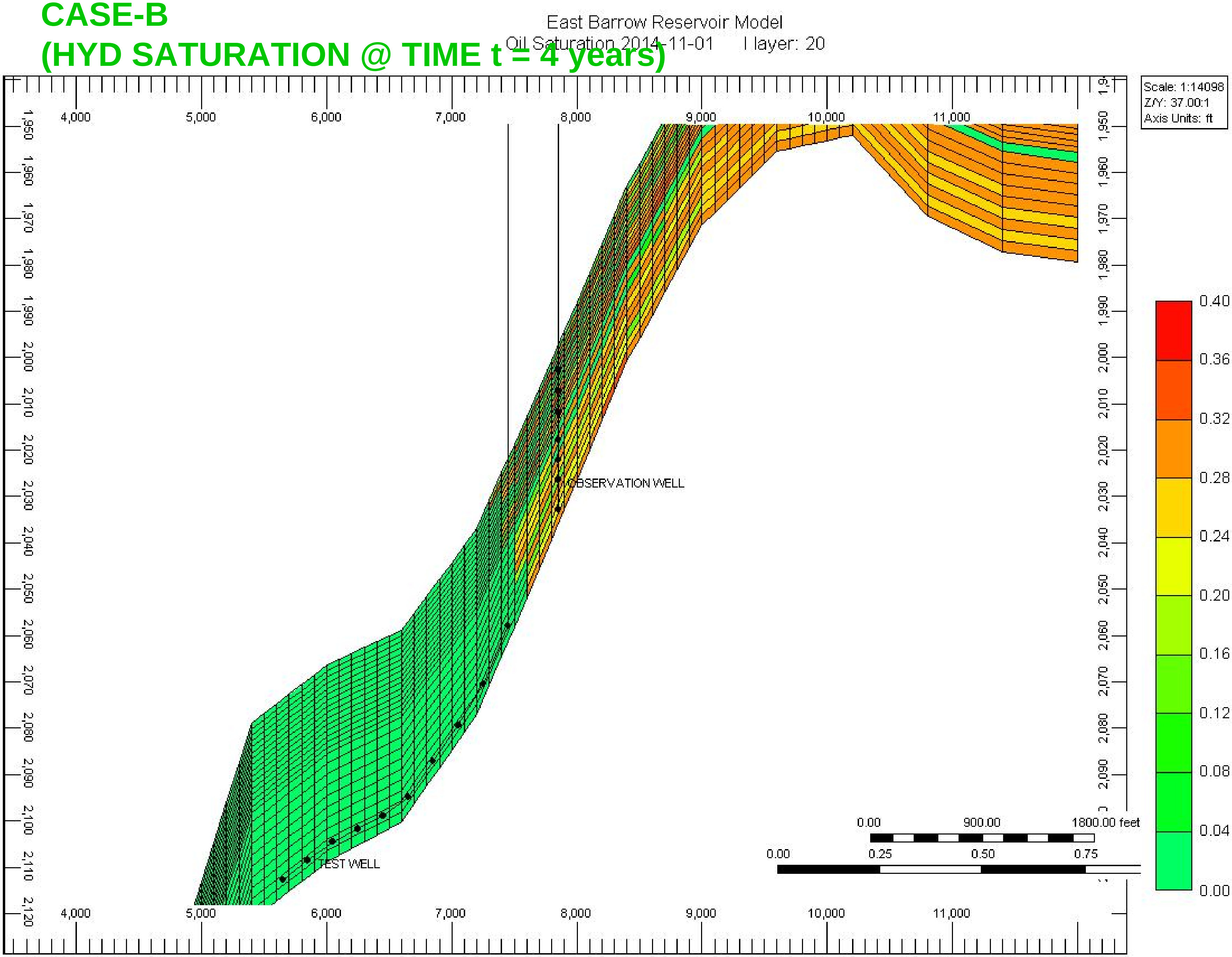
CASE-B
(HYD SATURATION @ TIME t = 2 years)



CASE-B
(HYD SATURATION @ TIME t = 3 years)

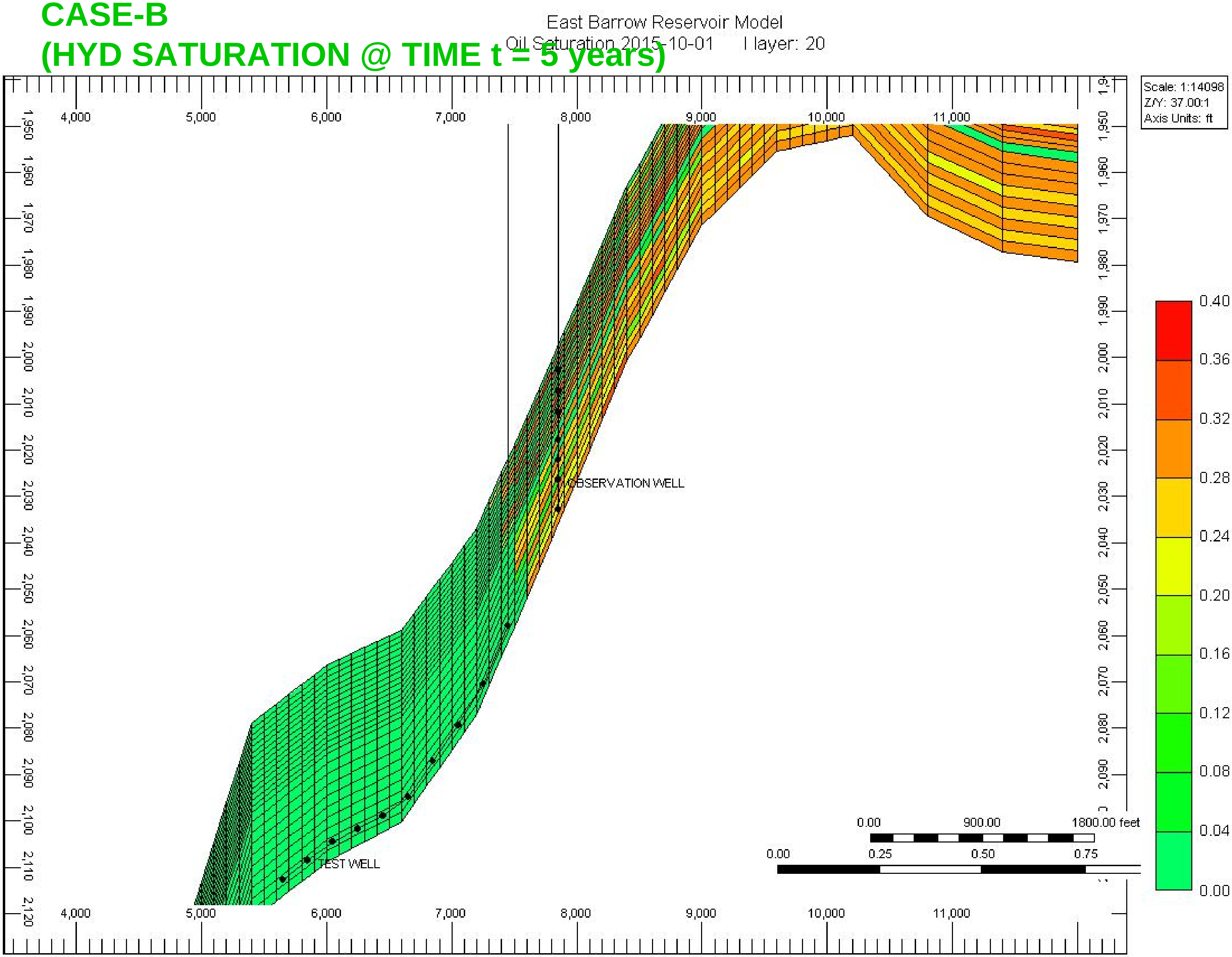


CASE-B
(HYD SATURATION @ TIME t = 4 years)

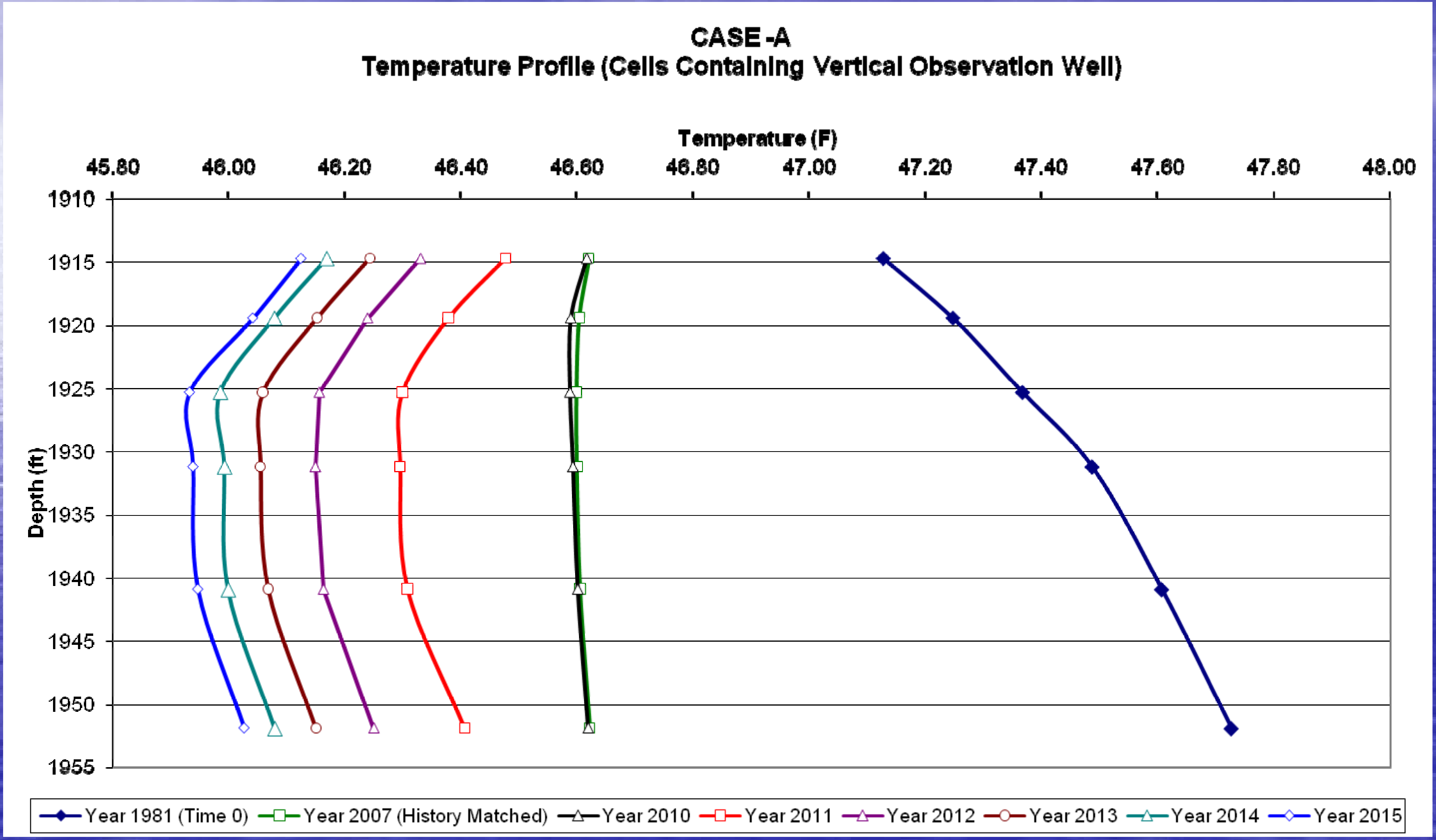


CASE-B

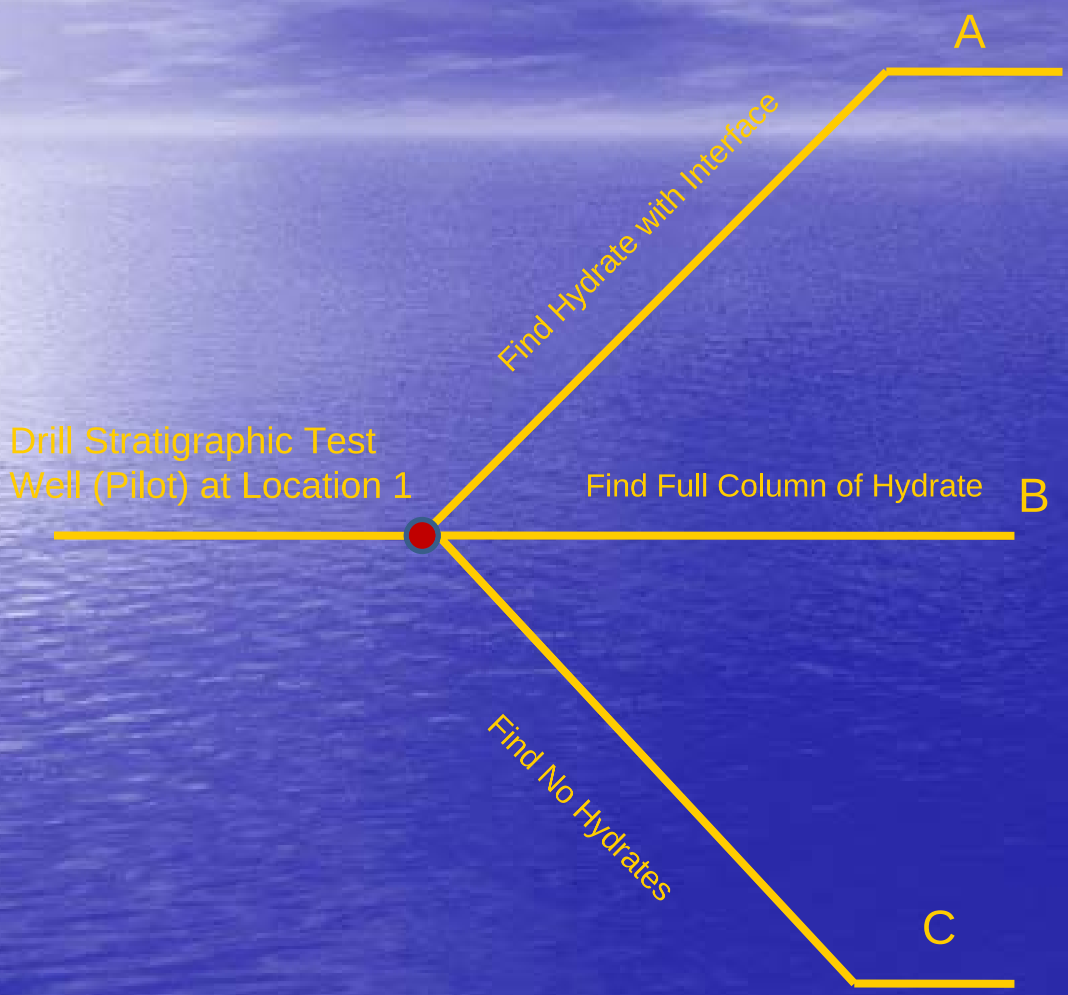
(HYD SATURATION @ TIME t = 5 years)



Temperature Response in Observation Well



Decision Tree from Results of Stratigraphic Test Well



A

1. Complete Stratigraphic Well as an Observation Well;
2. Drill HAW downdip to free gas leg and produce.

B

1. Sidetrack and drill a HAW downdip to intersect interface; complete the well as a producer in the free gas leg.
2. Drill an observation well offset to the producer and intersect the interface.

C

- Move to Walakpa, drill stratigraphic test well in crest of structure.

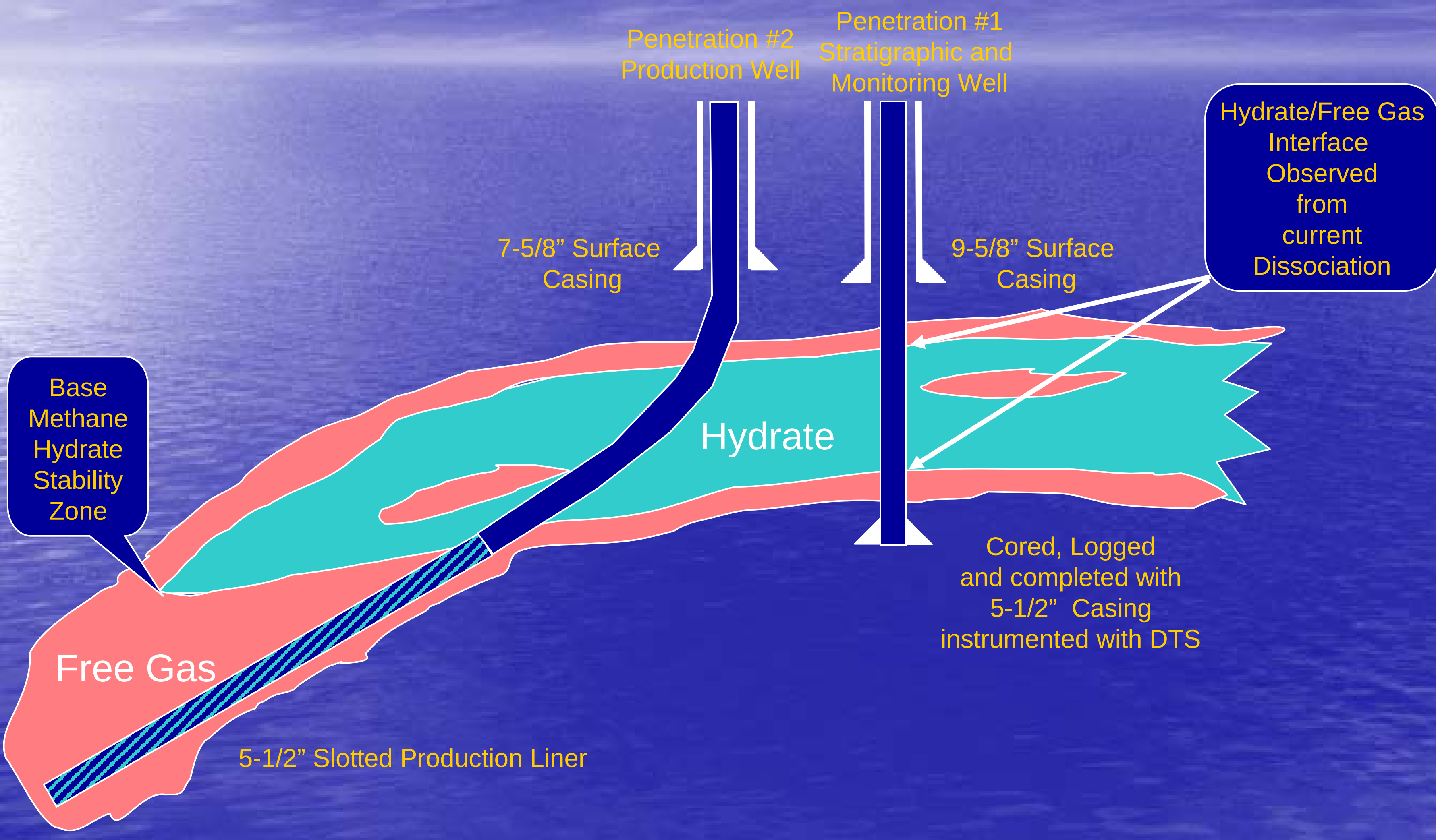
Well Design Objectives

- Producer can produce at sufficient rates to change the hydrate layer at the observation well.
- The response at the observation well should not be affected by near wellbore production affects.
- Conclusion – Dedicated single wells, producer drilled as a high angle or horizontal well.

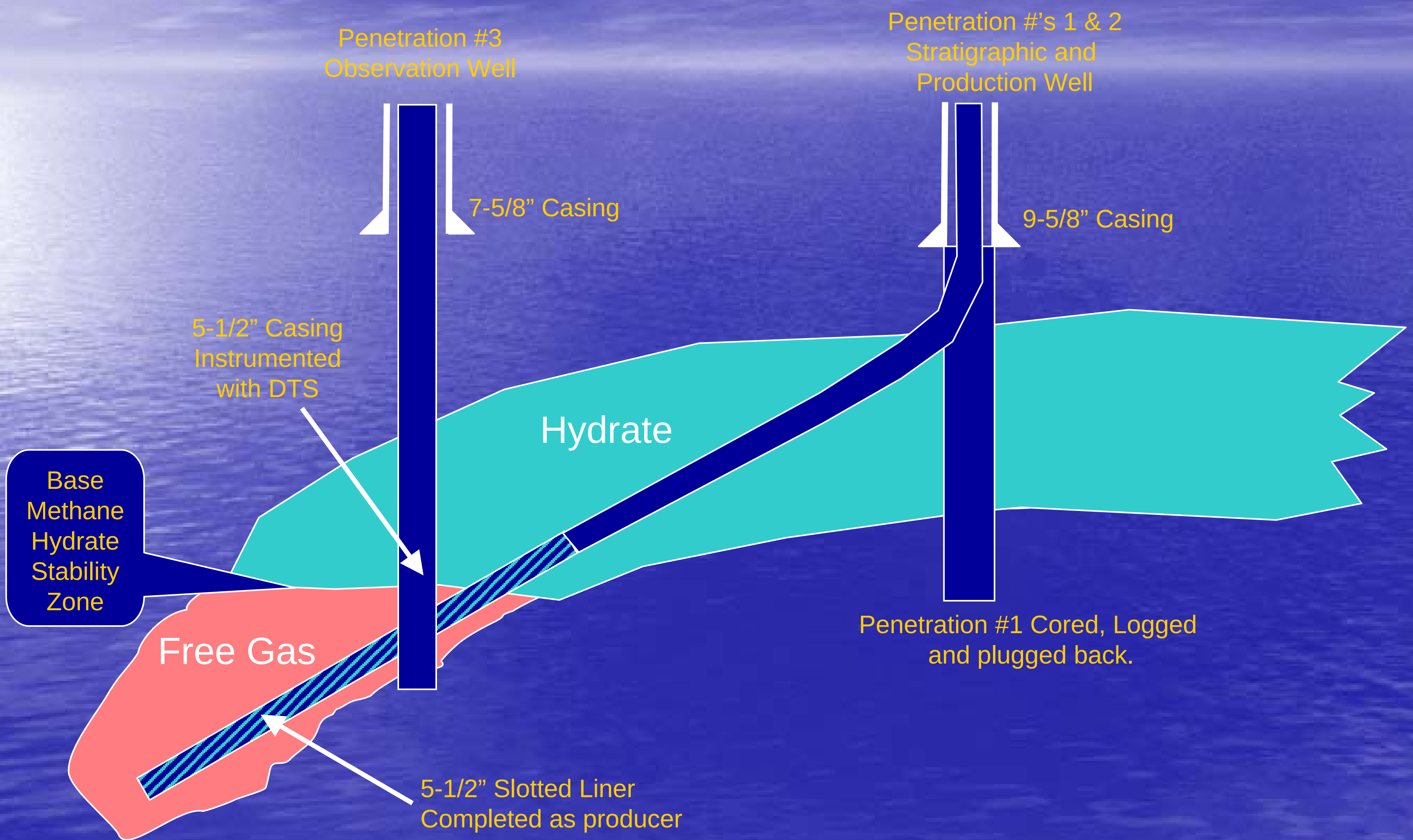
Coring and Data Acquisition

- Logging: LWD and Wireline
- Coring best practices from Mallik and Mt. Elbert
  - TAG member(s) to be selected from those involved
  - Interviewing of technologists for state of art
  - Lead and support functions to be worked

E Barrow Methane Hydrate Well Drilling/Completion Sequence Scenario A



E Barrow Methane Hydrate Well Drilling/Completion Sequence Scenario B



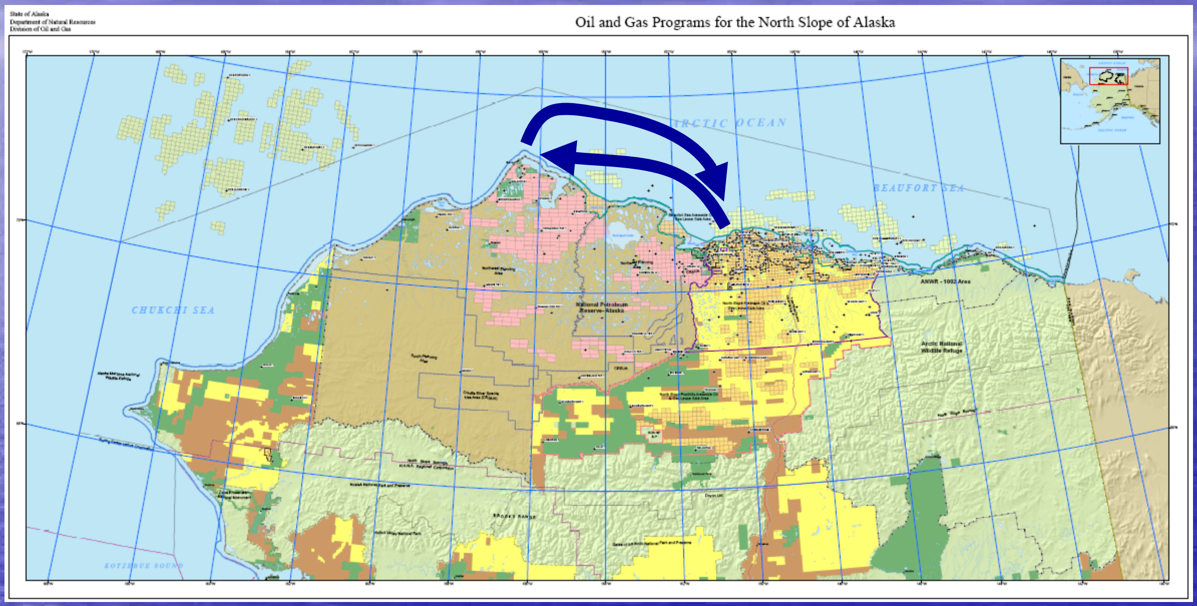
Well Design Alternatives

A very high level cost and economic evaluation suggests that two wells are required, one to produce and one to observe and to find hydrate interface.

The state of art of multilateral technology is still being investigated to see what is possible.

It is likely at this shallow depth, the cost and simplification of completion may suggest two wellbores are preferred to one well with multi-lateral completions.

Program 2010 -2011 Operations/Logistics Profile

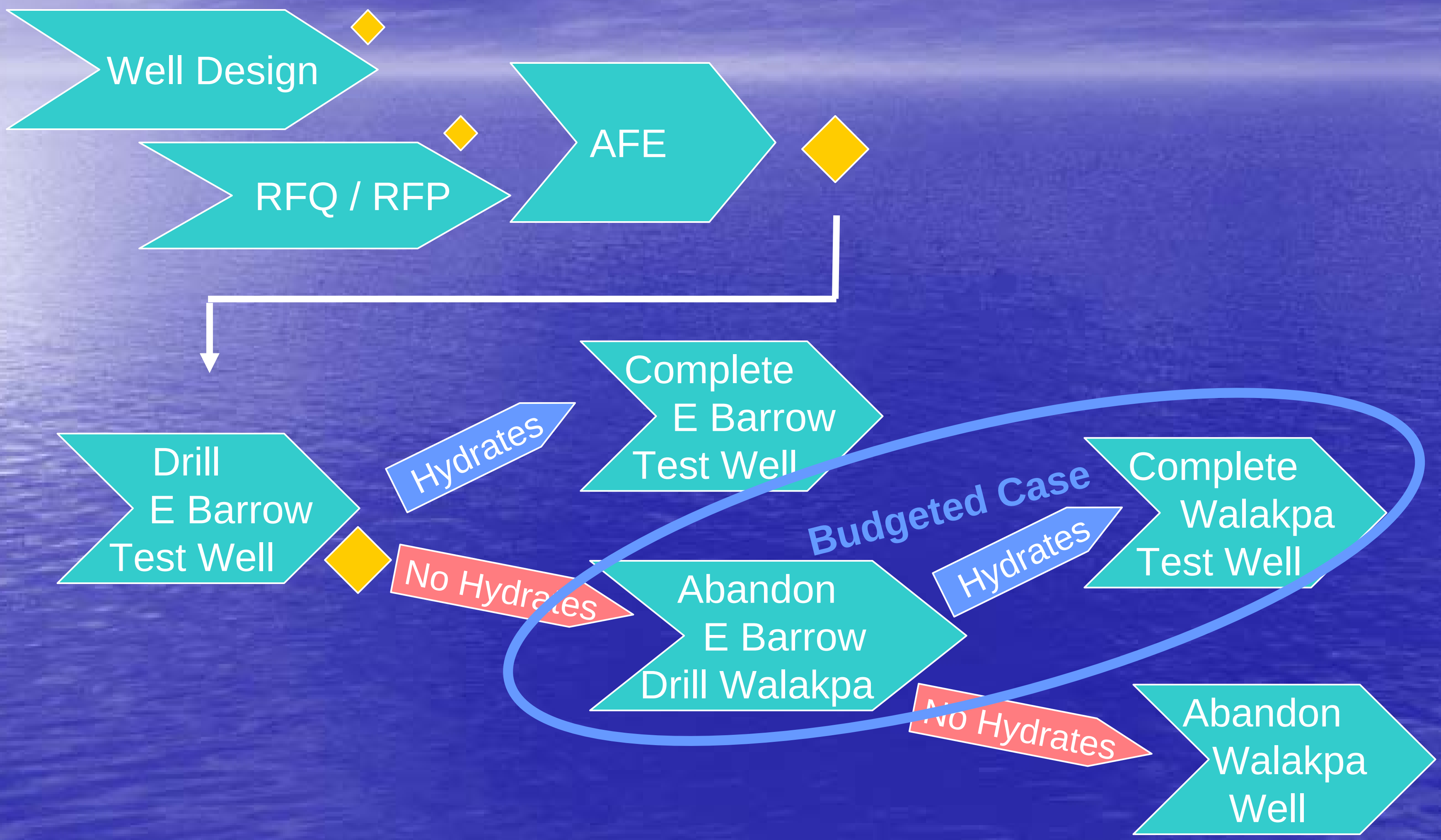


- Stage Rig and Support Services in Prudhoe Bay
- Barge operating Spread to Barrow
- Mobilize to E. Barrow
- Ice/Snow road to Walakpa (if necessary)
- Demob rig and support back to Prudhoe Bay

Methane Hydrate - East Barrow Gas Field Logistics Supply Chain Management

- Critical Planning Elements
  - Beaufort Sea - seasonal barging transit period from PRB to Barrow,Ak
  - Federal/BLM and State of Alaska Tundra travel access limitations
  - Remote Arctic drilling, completions, testing operations requiring continuous logistical support.
  - Logistics operations assets will include barges, aircraft, helicopter & vehicles – air/land/sea.
  - Service sector representation to approach 23-25 different companies with varying logistics support requirements
  - Need for identifying logistic synergies amoung service providers and ensuring proper integration from point of manufacture to end user
  - Logistics support equipment inventory will be non static. Assets will be de-mobilized as required back to PRB
  - Fuel burn management : rig/camp/vehicles/lighting/heaters
  - Well Construction supply chain inventory management
  - Walakpa access : snow pak trail vs. ice road
  - Field Environmental Coordination (FEC) monitoring and reporting of tundra travel routes

NSB Hydrates Phase 2 Plan

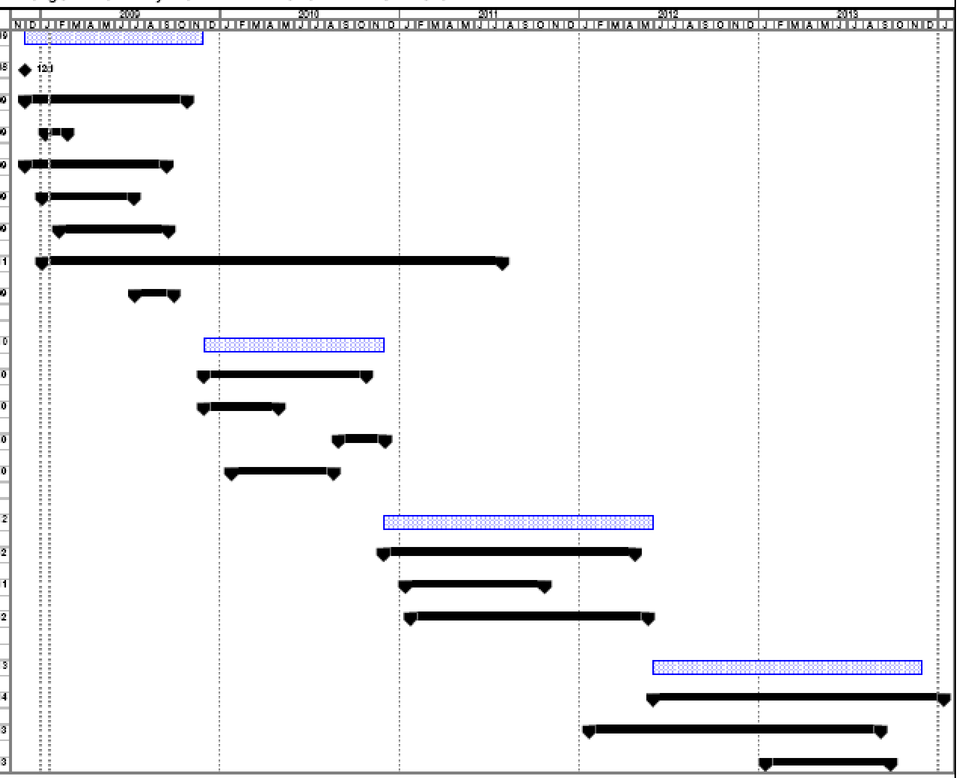


NSB Hydrates Phase 2 PMP Gantt

DE-FC26-06NT42962

Phase II Driling and Production Testing the Methane Hydrate Resource Potential associated with the Barrow Gas Fields

ID	Task Name	Duration	Start	Finish
1	Phase IIA Budget Period 3 (12 Mo)	261 days	Mon 12/1/08	Fri 11/27/09
2				
3	Awarded Project & Contract Start Date	0 days	Mon 12/1/08	Mon 12/1/08
4				
5	Task 1 Project Management Plan (PMP) and Reporting	237 days	Mon 12/1/08	Tue 10/27/09
30				
31	Task 2 Establish Technical Advisory Group (TAG)	33 days	Mon 1/12/09	Wed 2/25/09
36				
37	Task 3 Design optimized well drilling and completion	207 days	Mon 12/1/08	Tue 9/15/09
85				
86	Task 4 Design Surveillance & Smart Well; Ph IIA Surveillance	136 days	Mon 1/5/09	Fri 7/10/09
111				
112	Task 5 Prepare RFP & Evaluate Contractor Bids	161 days	Mon 2/9/09	Fri 9/18/09
148				
149	Task 6 Permits to Drill & Complete Well	671 days	Mon 1/5/09	Fri 7/29/11
178				
179	Task 7 Approval for Drilling	57 days	Mon 7/13/09	Wed 9/30/09
191				
192				
193	Phase IIB Budget Period 4 (12 Mo)	261 days	Tue 12/1/09	Tue 11/30/10
194				
195	Task 8 Project Management Plan (PMP) and Reporting	237 days	Mon 11/30/09	Wed 10/27/10
217				
218	Task 9 Contract with prime contractors to provide drilling rig, equipment	110 days	Mon 11/30/09	Fri 4/30/10
225				
226	Task 10 Drilling and completion of production test well – East Barrow Fi	69 days	Tue 8/31/10	Fri 12/3/10
239				
240	Task 11 Phase IIB surveillance program	150 days	Mon 1/25/10	Fri 8/20/10
263				
264				
265	Phase IIB Budget Period 5 (18 Mo)	392 days	Wed 12/1/10	Wed 5/30/12
266				
267	Task 12 Project Management Plan (PMP) and Reporting	368 days	Wed 12/1/10	Wed 4/25/12
295				
296	Task 13 Drilling and completion of production test well – Walakpa Field	202 days	Fri 1/14/11	Mon 10/24/11
310				
311	Task 14 Continue Phase IIB surveillance program	347 days	Mon 1/24/11	Tue 5/22/12
337				
338				
339	Phase IIB Budget Period 6 (18 Mo)	391 days	Fri 6/1/12	Fri 11/29/13
340				
341	Task 15 Project Management Plan (PMP) and Reporting	421 days	Fri 6/1/12	Mon 1/13/14
375				
376	Task 16.0 - Continue Phase IIB surveillance program	425 days	Mon 1/23/12	Fri 9/6/13
416				
417	Task 17.0 - Technology Transfer	182 days	Wed 1/16/13	Fri 9/27/13



Project: Revised Project Plan 011809y
Date: Sun 1/18/09

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Task 3: Well Design Gantt

DE-FC26-06NT42962

Phase II Driling and Production Testing the Methane Hydrate Resource Potential associated with the Barrow Gas Fields

ID	Task Name	Duration	Start	Finish
1				
2	**Task 3 Design optimized well drilling and completion**	**207 days**	**Mon 12/1/08**	**Tue 9/15/09**
3				
4	3.1 Solicit Methane Hydrate well design technology inputs from: Mt. Elber	85 days	Mon 12/1/08	Thu 3/26/09
5				
6	**3.2 Gather offset/North Slope well data including well histories, bit r**	**85 days**	**Mon 12/1/08**	**Thu 3/26/09**
7	3.2.1 Review recent North Slope grass roots wells and create an hc	85 days	Mon 12/1/08	Thu 3/26/09
8				
9	**3.3 Design Methane Hydrate Well Program(s): BGF - East Barrow ar**	**108 days**	**Thu 1/1/09**	**Fri 5/29/09**
10	**3.3.1.1 Define Well Objectives/Well Type**	**42 days**	**Thu 1/1/09**	**Fri 2/27/09**
11	3.3.1.1.1 Define Geophysical/Geoscience E Barrow Well Obje	42 days	Thu 1/1/09	Fri 2/27/09
12	3.3.1.1.2 Define surface location plan for E Barrow well	42 days	Thu 1/1/09	Fri 2/27/09
13	3.3.1.1.3 Establish E Barrow well data/surveillance requiremen	42 days	Thu 1/1/09	Fri 2/27/09
14	3.3.1.1.4 Establish E Barrow well type: pilot hole/single/dual lat	42 days	Thu 1/1/09	Fri 2/27/09
15	3.3.1.1.5 Directional Plan / Torque and Drag Analyes for E Barr	42 days	Thu 1/1/09	Fri 2/27/09
16	3.3.1.2.1 Define Geophysical/Geoscience Walakpa Well Objec	42 days	Thu 1/1/09	Fri 2/27/09
17	3.3.1.2.2 Define surface location plan for Walakpa well	42 days	Thu 1/1/09	Fri 2/27/09
18	3.3.1.2.3 Establish Walakpa well data/ surveillance requiremen	42 days	Thu 1/1/09	Fri 2/27/09
19	3.3.1.2.4 Establish Walakpa well type: pilot hole/single/dual lat	42 days	Thu 1/1/09	Fri 2/27/09
20	3.3.1.2.5 Directional Plan / Torque and Drag Analyes for Walal	42 days	Thu 1/1/09	Fri 2/27/09
21	3.3.2 Evaluate hole size/casing size alternatives for application.	20 days	Mon 2/2/09	Fri 2/27/09
22	**3.3.2.1 TAG Review of Well Design**	**20 days**	**Mon 3/16/09**	**Fri 4/10/09**
23	3.3.2.1.1 Submit Draft Well Design to TAG	0 days	Mon 3/16/09	Mon 3/16/09
24	3.3.2.1.2 Recive and incorporate TAG comments on Well Desi	10 days	Mon 3/30/09	Fri 4/10/09
25	**3.3.3 Evaluate Rig systems requirements**	**20 days**	**Mon 2/2/09**	**Fri 2/27/09**
26	3.3.3.1 Detail and Design Drilling Mechanics, Drilling Hydraulic:	20 days	Mon 2/2/09	Fri 2/27/09
27				
28	**3.3.4 Evaluate Rig Systems Market: Alaska/Canada/L48**	**25 days**	**Mon 2/2/09**	**Fri 3/6/09**
29	3.3.4.1 Investigate Drilling Systems Alternatives to the Status C	20 days	Mon 2/2/09	Fri 2/27/09
30	3.3.4.2 Write Rig Specification	5 days	Mon 3/2/09	Fri 3/6/09
31	3.3.5 Detail design specifications for Logging Program	46 days	Mon 2/16/09	Fri 4/17/09
32	3.3.6 Detail design specifications for Coring Program	46 days	Mon 2/16/09	Fri 4/17/09
33	3.3.7 Detail design specifications for Mud & Cuttings/Waste Manag	46 days	Mon 2/16/09	Fri 4/17/09
34	3.3.8 Detail design specifications for Mud Chilling	46 days	Mon 2/16/09	Fri 4/17/09
35	3.3.9 Detail design specifications for Cementing	46 days	Mon 2/16/09	Fri 4/17/09
36	3.3.10 Detail design specifications for Directional Equipment	46 days	Mon 2/16/09	Fri 4/17/09
37	3.3.11 Detail design specifications for Downhole Equipment	46 days	Mon 2/16/09	Fri 4/17/09
38	3.3.12 Detail design specifications for Tubulars	46 days	Mon 2/16/09	Fri 4/17/09
39	3.3.13 Detail design specifications for Wellhead	46 days	Mon 2/16/09	Fri 4/17/09
40	**3.3.14 Design Integrated Supply Chain Model: PRB/Barrow/BG**	**75 days**	**Tue 2/17/09**	**Fri 5/29/09**
41	3.3.14.1 Personnel Logistics: Air/Billeting (Barrow vs. Camp)	75 days	Tue 2/17/09	Fri 5/29/09
42	3.3.14.2 Equipment Logistics/Staging/Receiving/ Expediting	75 days	Tue 2/17/09	Fri 5/29/09
43	3.3.14.3 Logistics Specifications Developed for RFP's	0 days	Wed 4/15/09	Wed 4/15/09
44	3.3.15 Write Specifications for HSE	46 days	Mon 2/16/09	Fri 4/17/09
45	3.3.16 Determine Fuel Burn: Rig/Camp/Vehicles/Tioga Heaters/Ligh	46 days	Mon 2/16/09	Fri 4/17/09
46	3.3.17 Create a sequential task list and project schedule of all oper	55 days	Tue 2/17/09	Fri 5/1/09
47				
48	**3.4 RFP Specification Review by TAG**	**25 days**	**Mon 4/20/09**	**Fri 5/22/09**
49	3.4.1 Prepare RFP Specifications for TAG Review	10 days	Mon 4/20/09	Fri 5/1/09
50	**3.4.2 Submit RFP Specifications to TAG & PO**	0 days	Fri 5/1/09	Fri 5/1/09
51	3.4.3 Receive and incorporate TAG comments into RFP's	6 days	Fri 5/15/09	Fri 5/22/09
52				
53	**3.5 Technical Presentation Year 1 on Well Design**	**10 days**	**Tue 9/1/09**	**Tue 9/15/09**
54	3.5.1 Prepare Presentation	10 days	Tue 9/1/09	Mon 9/14/09
55	3.5.2 Travel and Attend	0 days	Tue 9/15/09	Tue 9/15/09

Project: Revised Project Plan 01 2009y
Date: Tue 1/20/09

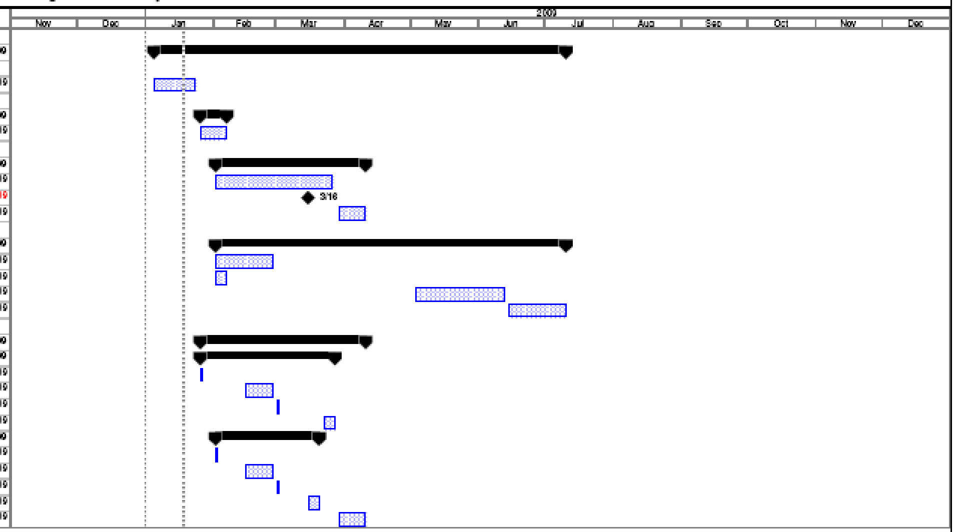
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Task 4: Monitoring / Surveillance Gantt

DE-FC26-06NT42962

Phase II Driling and Production Testing the Methane Hydrate Resource Potential associated with the Barrow Gas Fields

ID	Task Name	Duration	Start	Finish
1				
2	**Task 4 Design Surveillance & Smart Well; Ph IIA Surveillance**	**136 days**	**Mon 1/5/09**	**Fri 7/10/09**
3				
4	4.1 Reservoir Simulation to determine well design and data required to m	15 days	Mon 1/5/09	Fri 1/23/09
5				
6	**4.2 Define types of data to be collected from observation and produ**	**10 days**	**Mon 1/26/09**	**Fri 2/6/09**
7	4.2.1 Document study on production monitoring	10 days	Mon 1/26/09	Fri 2/6/09
8				
9	**4.3 Design instrumentation to be run in wells, and surface data reco**	**51 days**	**Mon 2/2/09**	**Fri 4/10/09**
10	4.3.1 Document study on well instrumentation	40 days	Mon 2/2/09	Thu 3/26/09
11	4.3.2 Sumit well instrumation design for TAG Review	0 days	Mon 3/16/09	Mon 3/16/09
12	4.3.3 Recive and incorporate TAG comments on Well Design into Fi	10 days	Mon 3/30/09	Fri 4/10/09
13				
14	**4.4 2009 Collection of pressure data in E. Barrow and Walakpa Fielc**	**116 days**	**Mon 2/2/09**	**Fri 7/10/09**
15	4.4.1 Contract with downhole pressure contractor	20 days	Mon 2/2/09	Fri 2/27/09
16	4.4.2 Write plan for wells and types of pressure and temperature inf	5 days	Mon 2/2/09	Fri 2/6/09
17	4.4.3 Coordinate pressure data gathering with contractor and field o	30 days	Mon 5/4/09	Fri 6/12/09
18	4.4.4 Analyze pressure data and write report per Monitoring Plan	20 days	Mon 6/15/09	Fri 7/10/09
19				
20	**4.5 2009 Collection of gas samples and water samples**	**56 days**	**Mon 1/26/09**	**Fri 4/10/09**
21	**4.5.1 Gas Sampling and Analysis Process**	**46 days**	**Mon 1/26/09**	**Fri 3/27/09**
22	4.5.1.1 Obtain Isotube gas sample chambers	1 day	Mon 1/26/09	Mon 1/26/09
23	4.5.1.2 Have operations personnel obtain gas samples from we	10 days	Mon 2/16/09	Fri 2/27/09
24	4.5.1.3 Send samples to Isotech for composition and isotopic a	1 day	Mon 3/2/09	Mon 3/2/09
25	4.5.1.4 Compare to previous collected samples	5 days	Mon 3/23/09	Fri 3/27/09
26	**4.5.2 Water Sampling and Analysis Process**	**36 days**	**Mon 2/2/09**	**Fri 3/20/09**
27	4.5.2.1 Obtain lab water sample containers	1 day	Mon 2/2/09	Mon 2/2/09
28	4.5.2.2 Have operations personnel obtain water samples from w	10 days	Mon 2/16/09	Fri 2/27/09
29	4.5.2.3 Send samples to lab for composition analysis	1 day	Mon 3/2/09	Mon 3/2/09
30	4.5.2.4 Compare to previous collected samples	5 days	Mon 3/16/09	Fri 3/20/09
31	4.5.3 Write report of 2009 Gas and Water Sample Analysis	10 days	Mon 3/30/09	Fri 4/10/09



Project: Revised Project Plan 01 1809y
Date: Sun 1/18/09

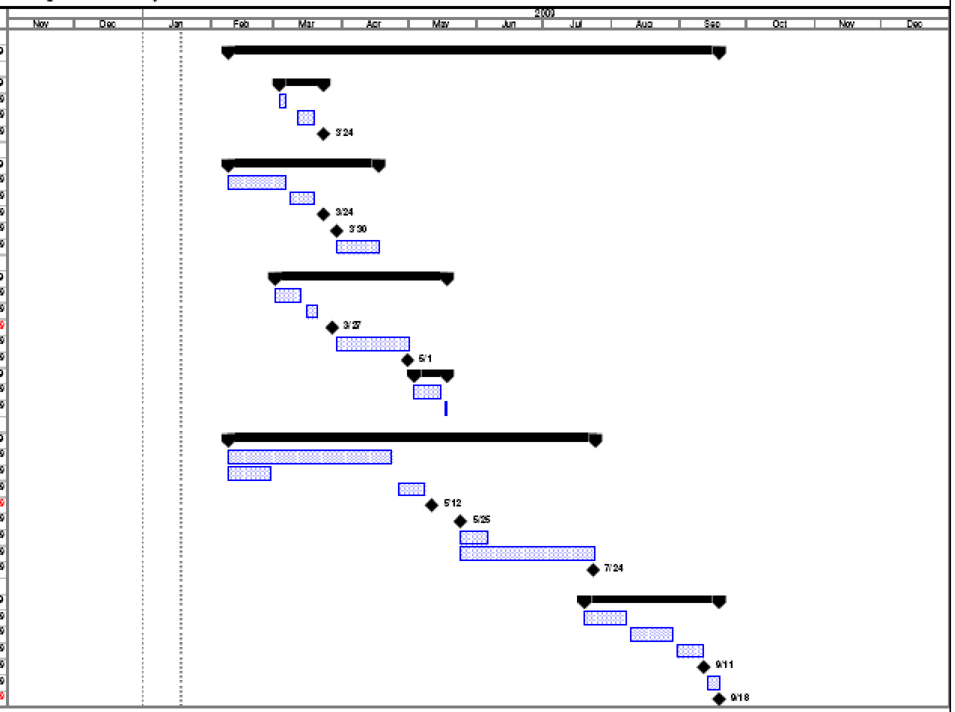
Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Task 5: Procurement Gantt

DE-FC26-06NT42962

Phase II Driling and Production Testing the Methane Hydrate Resource Potential associated with the Barrow Gas Fields

ID	Task Name	Duration	Start	Finish
1				
2	**Task 5 Prepare RFP & Evaluate Contractor Bids**	**161 days**	**Mon 2/9/09**	**Fri 9/18/09**
3				
4	**5.1 Authority to Advertise (ATA) Document**	**15 days**	**Wed 3/4/09**	**Tue 3/24/09**
5	5.1.1 S. MacRae to request ATA	3 days	Wed 3/4/09	Fri 3/6/09
6	5.1.2 NSB ATA Approval Process	7 days	Thu 3/12/09	Thu 3/19/09
7	5.1.3 NSB Mayor Signs ATA	0 days	Tue 3/24/09	Tue 3/24/09
8				
9	**5.2 Notice to Bidders Document (NTB)**	**51 days**	**Mon 2/9/09**	**Fri 4/17/09**
10	5.2.1 PRA to write NTB Draft	20 days	Mon 2/9/09	Fri 3/6/09
11	5.2.2 Send Draft NTB to NSB-CIPM for Revision/Approval	10 days	Mon 3/9/09	Thu 3/19/09
12	5.2.3 NSB-CIPM Approves NTB	0 days	Tue 3/24/09	Tue 3/24/09
13	5.2.4 Post NTB for 20 Days in BRW/ANC/FBX/PetNews/Hstn/Calg	0 days	Mon 3/30/09	Mon 3/30/09
14	5.2.5 Period for Publication	15 days	Mon 3/30/09	Fri 4/17/09
15				
16	**5.3 Request for Unpriced Technical Offer/Request for Qualifications**	**57 days**	**Mon 3/2/09**	**Mon 5/18/09**
17	5.3.1 PRA to write RUTO/RFQ Draft	10 days	Mon 3/2/09	Fri 3/13/09
18	5.3.2 Send Draft RUTO/RFQ to NSB CIPM for Revision/Approval	5 days	Mon 3/16/09	Fri 3/20/09
19	5.3.3 RUTO/RFQ Document Complete	0 days	Fri 3/27/09	Fri 3/27/09
20	5.3.4 Period for Request of RUTO/FRQ and UTO/RFQ Submission	25 days	Mon 3/30/09	Fri 5/1/09
21	5.3.5 UTO/RFQ Submission Deadline	0 days	Fri 5/1/09	Fri 5/1/09
22	**5.3.6 UTO/RFQ Evaluation**	**11 days**	**Mon 5/4/09**	**Mon 5/18/09**
23	5.3.6.1 NSB-CIPM & PRA to Evaluate UTO/RFQ	10 days	Mon 5/4/09	Fri 5/15/09
24	5.3.6.2 Finalize List of Technically Qualified Bidders	1 day	Mon 5/18/09	Mon 5/18/09
25				
26	**5.4 Request for Proposal (RFP) with Specifications**	**121 days**	**Mon 2/9/09**	**Fri 7/24/09**
27	5.4.1 PRA to write RFP's w/ detailed specifications for products/ser	55 days	Mon 2/9/09	Thu 4/23/09
28	5.4.1.1 Draft RFP Template	15 days	Mon 2/9/09	Fri 2/27/09
29	5.4.2 NSB-CIPM Review of RFP's	10 days	Mon 4/27/09	Fri 5/8/09
30	5.4.3 NSB-CIPM Approves RFP's	0 days	Tue 5/12/09	Tue 5/12/09
31	5.4.4 Send RFP's to Qualified Bidders	0 days	Mon 5/25/09	Mon 5/25/09
32	5.4.5 Public Pre Bid Conference Meetings	10 days	Mon 5/25/09	Fri 6/5/09
33	5.4.6 Period for Sealed Bid Submission	45 days	Mon 5/25/09	Fri 7/24/09
34	5.4.7 Sealed Bid Submission Deadline	0 days	Fri 7/24/09	Fri 7/24/09
35				
36	**5.5 RFP Evaluation**	**46 days**	**Mon 7/20/09**	**Fri 9/18/09**
37	5.5.1 NSB-CIPM & PRA to Evaluate	15 days	Mon 7/20/09	Fri 8/7/09
38	5.5.2 Individual Discussion with responsive bidders	15 days	Mon 8/10/09	Fri 8/28/09
39	5.5.3 Best and Final Bid Submission Period	10 days	Mon 8/31/09	Fri 9/11/09
40	5.5.4 Best and Final Bids Due	0 days	Fri 9/11/09	Fri 9/11/09
41	5.5.5 Final NSB-CIPM & PRA Evaluation	5 days	Mon 9/14/09	Fri 9/18/09
42	5.5.6 Select Prime Contractor for each Service	0 days	Fri 9/18/09	Fri 9/18/09



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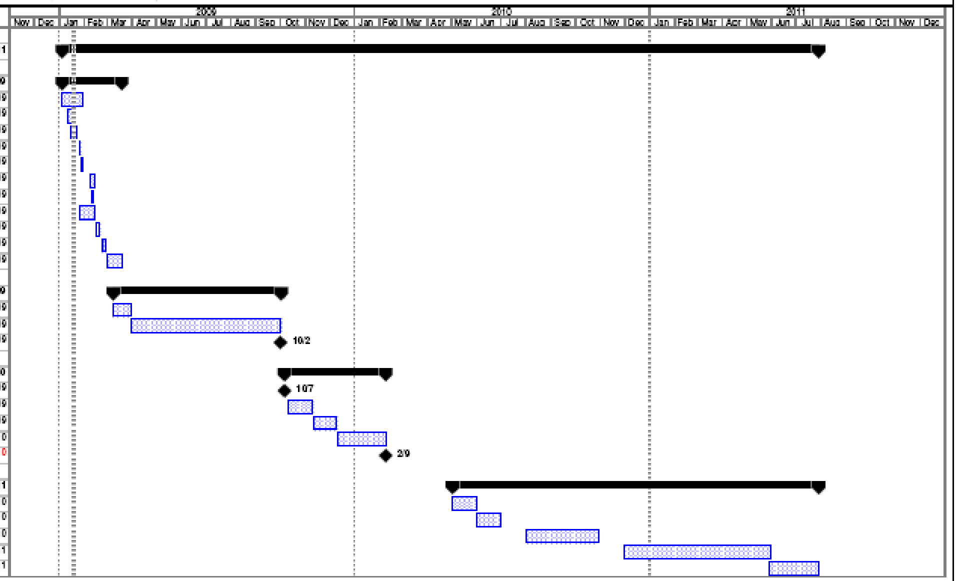
Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Task 6: Permitting Gantt

DE-FC26-06NT42962

Phase II Driling and Production Testing the Methane Hydrate Resource Potential associated with the Barrow Gas Fields

ID	Task Name	Duration	Start	Finish
1				
2	**Task 6 Permits to Drill & Complete Well**	**671 days**	**Mon 1/5/09**	**Fri 7/29/11**
3				
4	**6.1 Compile listing of all required permits**	**55 days**	**Mon 1/5/09**	**Thu 3/19/09**
5	6.1.1 Permit Scoping Document outlining surface use proposed, rou	20 days	Mon 1/5/09	Fri 1/30/09
6	6.1.2 Finalize research on elders and lake level recovery.	5 days	Mon 1/12/09	Fri 1/16/09
7	6.1.3 Determine if additional lake study data is available for east gas	5 days	Fri 1/16/09	Fri 1/23/09
8	6.1.4 Determine BLM right-of-way applicability and timeline	2 days	Mon 1/26/09	Wed 1/28/09
9	6.1.5 Determine Spill contingency applicability and timeline	3 days	Wed 1/28/09	Fri 1/30/09
10	6.1.6 Research NSB permit history	5 days	Mon 2/9/09	Fri 2/13/09
11	6.1.6.1 Evaluate need for gavel placement	1 day	Wed 2/11/09	Wed 2/11/09
12	6.1.7 Solicit and incorporate input into Draft Scoping Document for a	15 days	Mon 1/26/09	Fri 2/13/09
13	6.1.8 If appropriate, utilize technical consultants to identify any long l	5 days	Mon 2/16/09	Fri 2/20/09
14	6.1.9 Develop list of permits and permit schedule	5 days	Mon 2/23/09	Fri 2/27/09
15	6.1.10 Conduct agency outreach to validate permit list and schedule	15 days	Mon 3/2/09	Thu 3/19/09
16				
17	**6.2 Prepare and submit required permits to agencies**	**151 days**	**Mon 3/9/09**	**Fri 10/2/09**
18	6.2.1 Research and advance permitting for summer studies	18 days	Mon 3/9/09	Tue 3/31/09
19	6.2.2 Prepare and review drilling permit applications	133 days	Wed 4/1/09	Fri 10/2/09
20	6.2.3 Submit permit applications for East Barrow and Walakpa wells	0 days	Fri 10/2/09	Fri 10/2/09
21				
22	**6.3 Monitor permit status and provide Agency Follow-up**	**89 days**	**Wed 10/7/09**	**Tue 2/9/10**
23	6.3.1 Conduct application meeting with agencies	0 days	Wed 10/7/09	Wed 10/7/09
24	6.3.2 Respond to agency questions/clarifications	22 days	Mon 10/12/09	Tue 11/10/09
25	6.3.3 Attend public meetings/ respond to agency questions	22 days	Wed 11/11/09	Thu 12/10/09
26	6.3.4 Track permit review	42 days	Fri 12/11/09	Mon 2/8/10
27	**6.3.5 Obtain permits (must be 130 days from application submi**	0 days	Tue 2/9/10	Tue 2/9/10
28				
29	**6.4 Plan and Monitor Field Operations and Post Well Follow-up**	**325 days**	**Mon 5/3/10**	**Fri 7/29/11**
30	6.4.1 Prepare field compliance manual	21 days	Mon 5/3/10	Mon 5/31/10
31	6.4.2 Conduct training for drilling operations	22 days	Tue 6/1/10	Wed 6/30/10
32	6.4.3 Track fieldwork and provide support on permit compliance - E	65 days	Mon 8/2/10	Fri 10/29/10
33	6.4.4 Track fieldwork and provide support on permit compliance - W	130 days	Wed 12/1/10	Tue 5/31/11
34	6.4.5 Follow up on permitting post wells	45 days	Mon 5/30/11	Fri 7/29/11



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