

01/30/2017
Presentation:
Oil Production
Forecast
Methodology

<TARGET><BILL></BILL><SUBJECT>01-30-2017 Presentation
Oil Production Forecast
Methodology</SUBJECT><COMM>SRES30</COMM></TARGET>



State of Alaska Department of Revenue

Fall 2016 Production Forecast Presentation

Senate Resources Committee

January 30, 2017

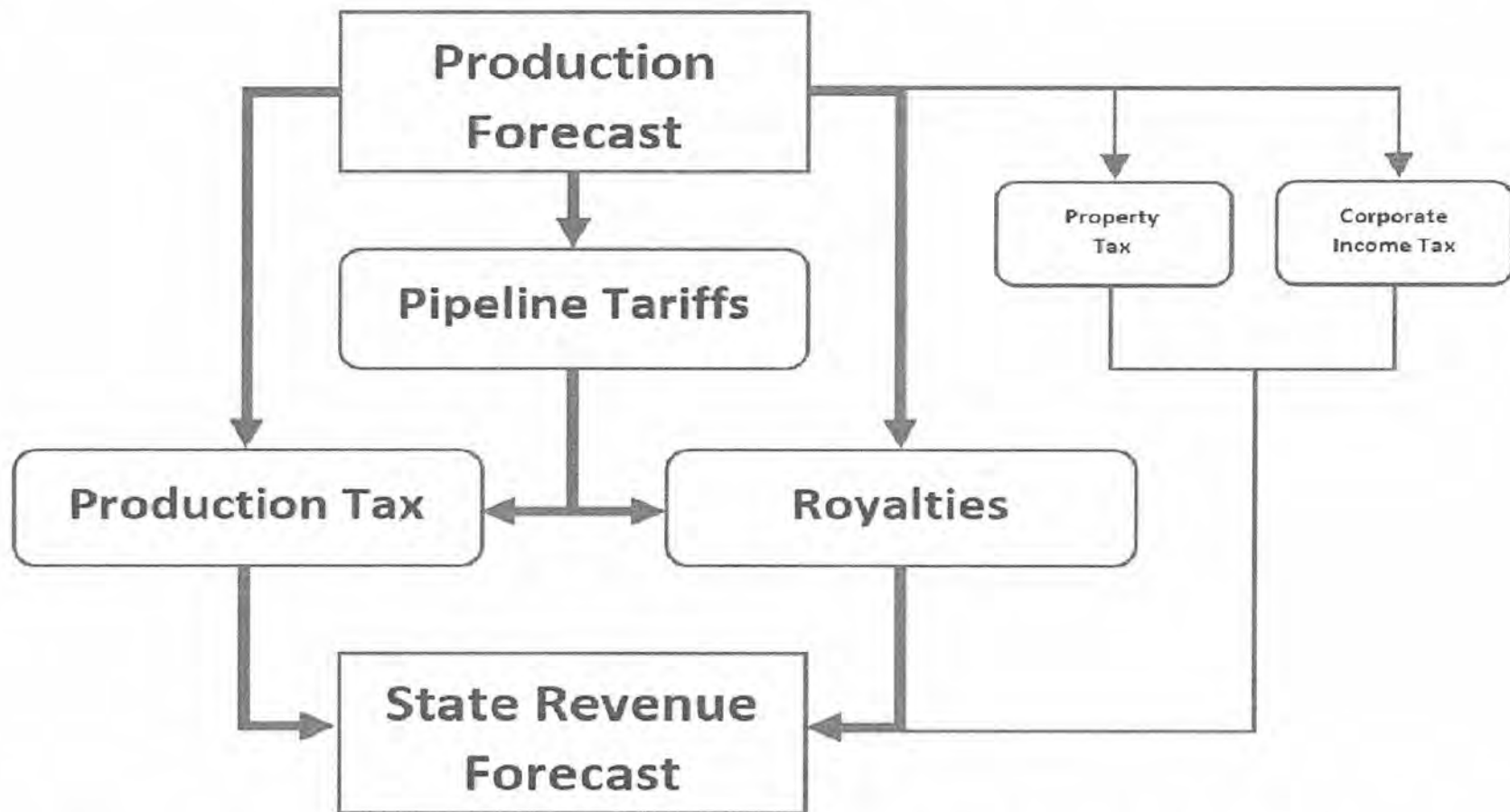
Dan Stickel
Chief Economist
Alaska Department of Revenue



Overview

- How the production forecast is used
- Recent history of the production forecast
- Department of Revenue (DOR) and Department of Natural Resources (DNR) roles
- Fall 2016 Production Forecast
- Technical discussion of methodology will be addressed by DNR

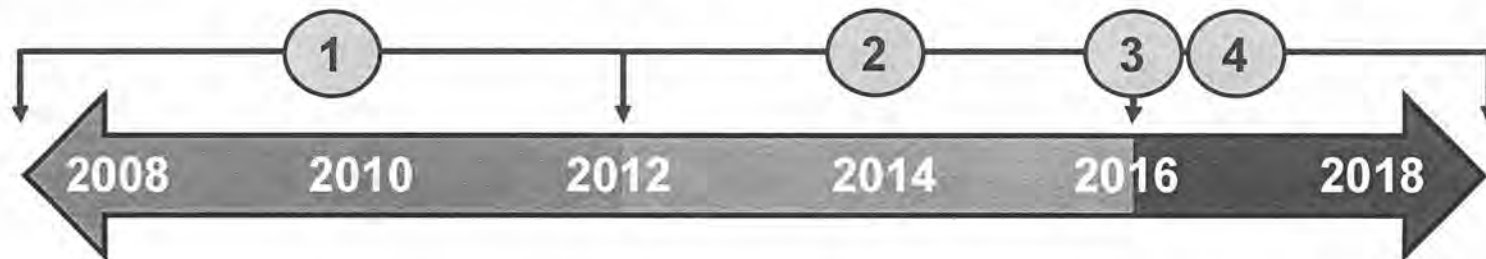
Production Forecast: What is it used for?



- Used to provide information to policy makers and the general public.

Production Forecast: An Evolution

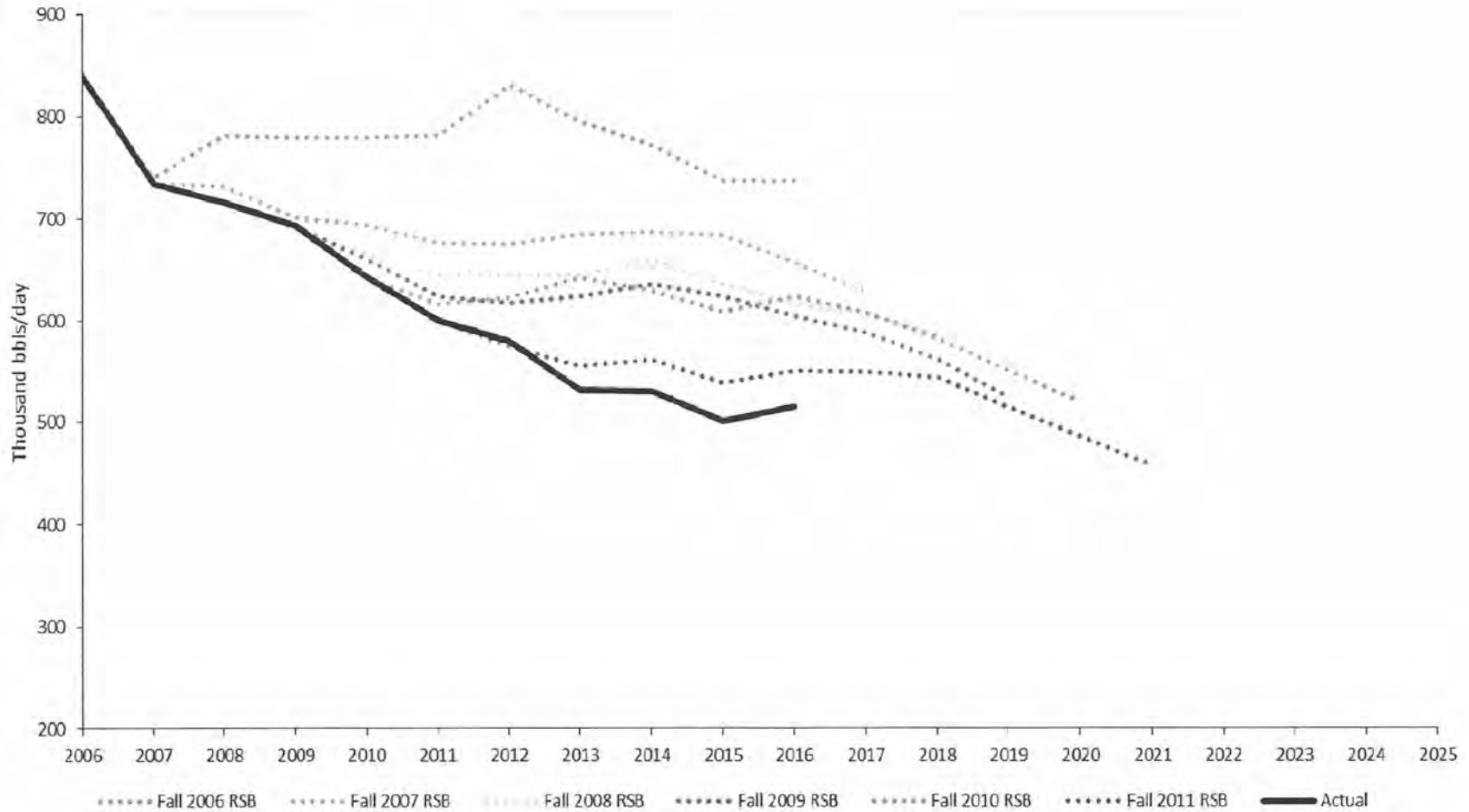
- 1) Prior to fall 2016, the Department of Revenue used an outside consultant to develop the production forecast.
- 2) Beginning with fall 2012, the Department of Revenue added risk adjustments to the consultant's forecasts.
- 3) The consultant contract expired Summer of 2016.
- 4) Starting with fall 2016, the Department of Revenue collaborated with the Department of Natural Resources to develop the production forecast.



Source: Department of Revenue

Historical Forecasts: Pre 2012

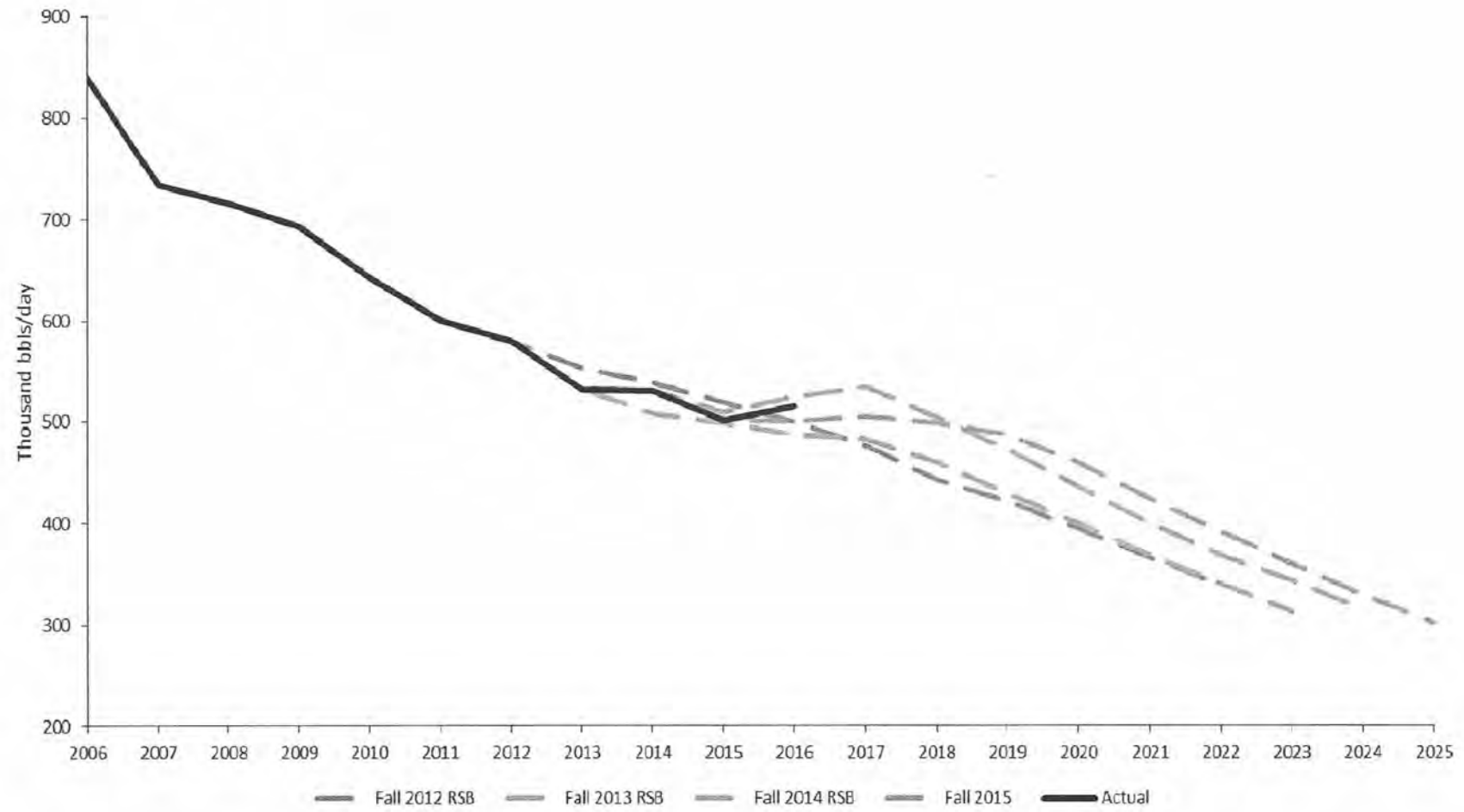
ANS Oil Production Forecast Comparison



Source: Department of Revenue - Revenue Sources Book Fall 2006-2011

Historical Forecasts: 2012-2015

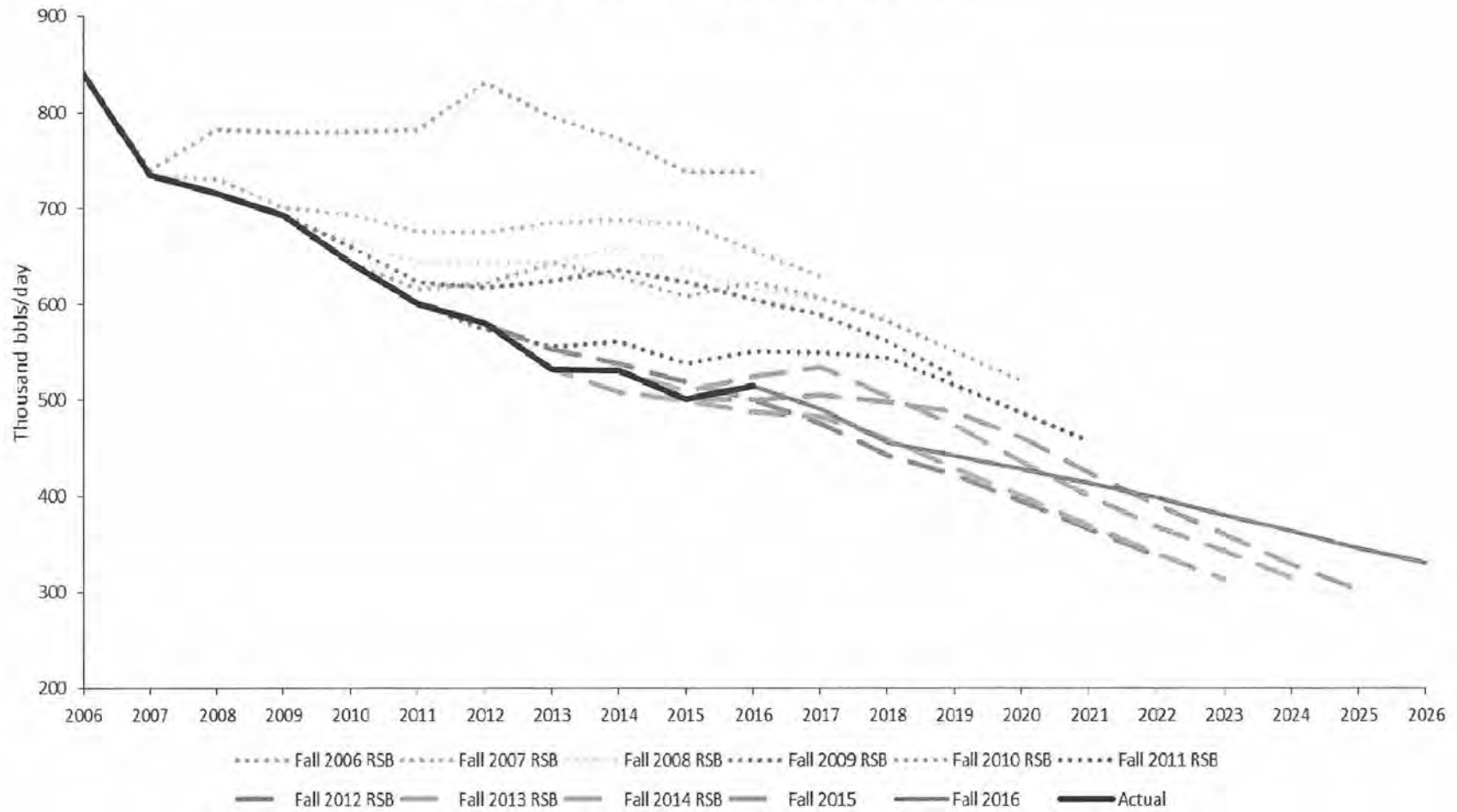
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Historical Forecasts: 2006-2016

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Production Forecast: Who Does What?

Department of Revenue

- Publishes the forecast:
 - Conducts operator interviews and development surveys.
 - Adjusts DNR forecast for seasonality and replaces initial months with actuals.
 - Aggregates DNR data to show production by unit, area, and total.
- Creates a revenue forecast

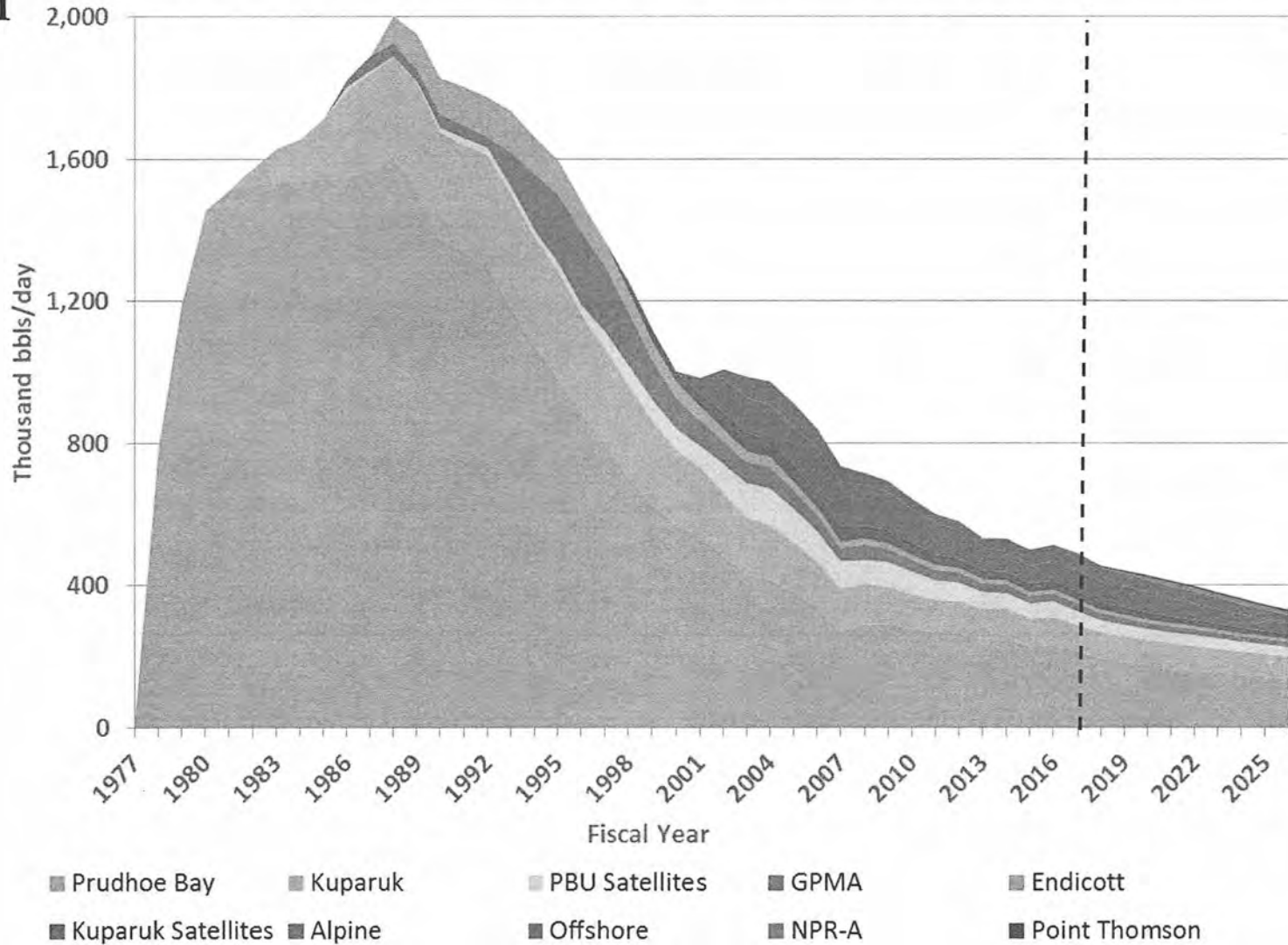
Department of Natural Resources

- Produces the forecast:
 - Reviews surveys, plans of development, etc.
 - Determines proper forecasting methods.
 - Creates models to account for reservoir and well characteristics.
 - Delivers a probabilistic forecast of barrels of oil per day by pool.

Fall 2016 Production Forecast



PRODUCTION FORECAST: ANS History and Forecast by Pool



Source: Department of Revenue - Revenue Sources Book Fall 2016

PRODUCTION FORECAST: Categories

Volumes from Currently Producing (CP):

- Oil from all currently producing pools.

Volumes from Under Development (UD):

- Ongoing development wells in existing, mature fields above and beyond CP and expected to produce within 1 year.

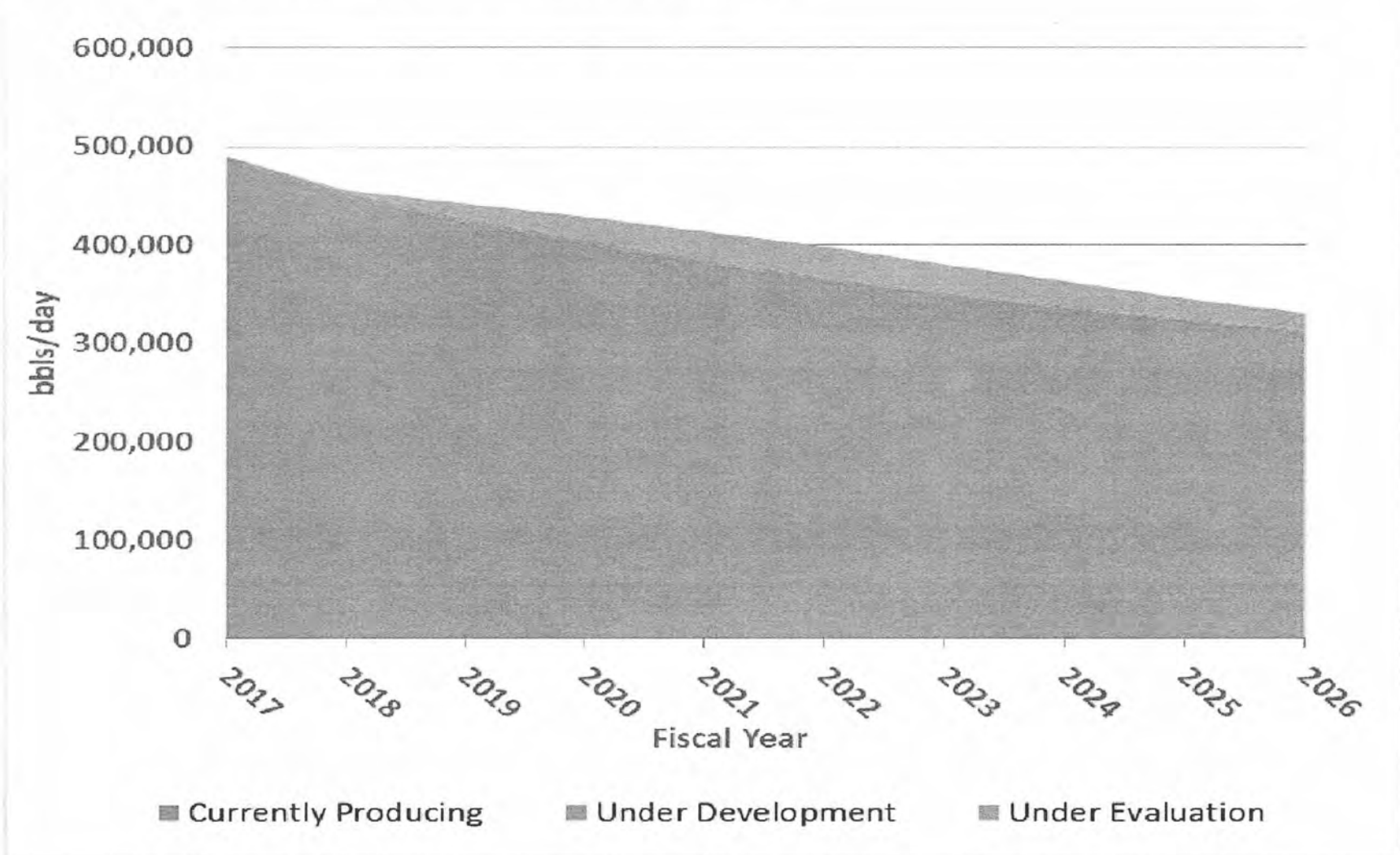
Volumes from Under Evaluation (UE):

- New fields expected to produce within 2-5 years.

Excluded from forecast:

- First oil date greater than 5 years and very uncertain.
- Examples: Pikka, Ugnu, Placer, Tofkat, Liberty, Fiord West, Smith Bay, Willow

PRODUCTION FORECAST: ANS



Source: Department of Revenue - Revenue Sources Book Fall 2016

PRODUCTION FORECAST: DOR Cases

➤ High Case (P10):

- Based on DNR modeling, oil production would have a 10% probability of exceeding this level.

▪ Official Forecast (Pmean):

- Based on DNR modeling, the average production profile that considers both high and low sides.

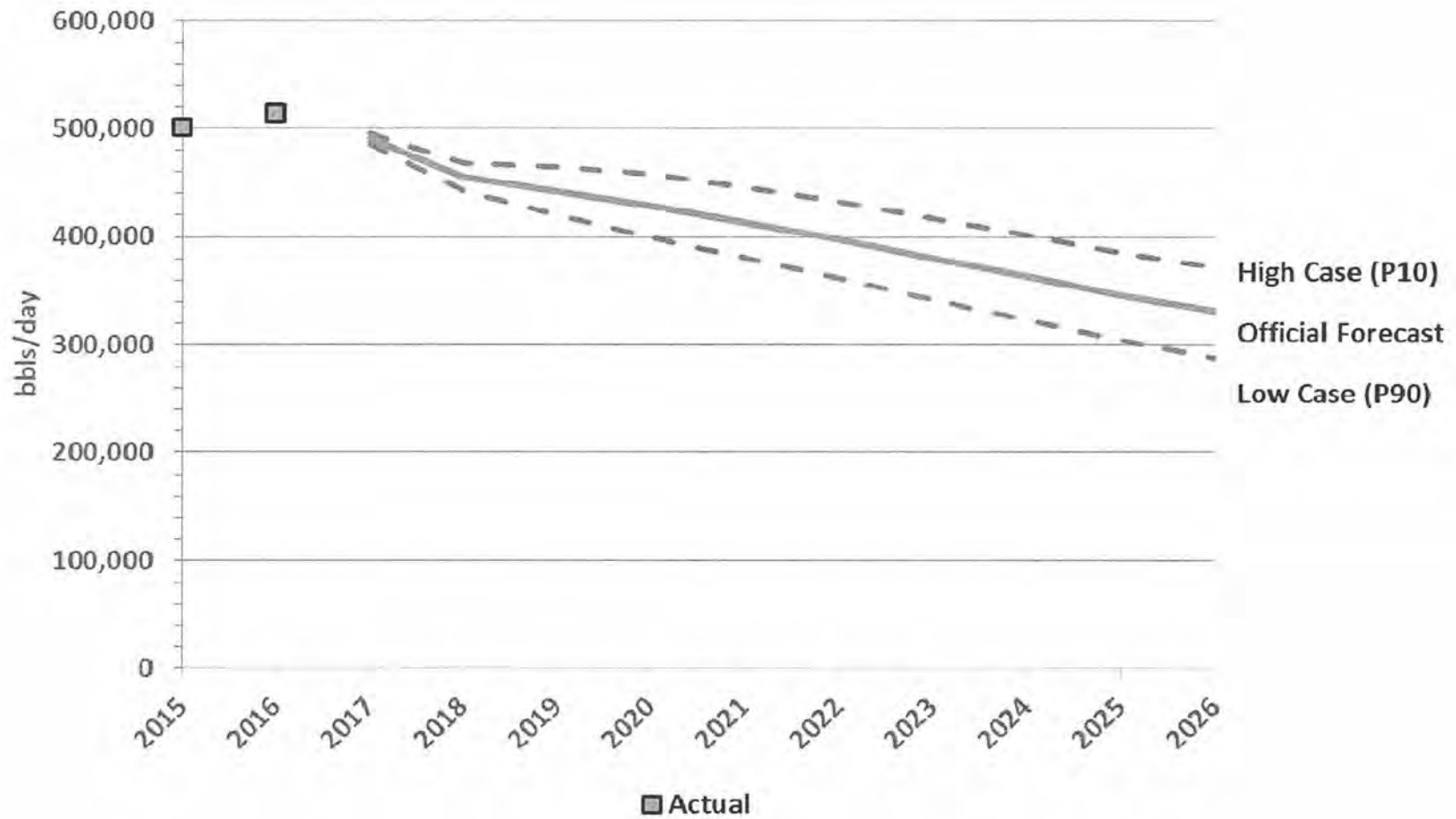
➤ Low Case (P90):

- Based on DNR modeling, oil production would have a 90% probability of exceeding this level.

➤ Note: None of the cases include any of the “Excluded from forecast window” fields.

- With these fields, production could exceed the high case.

PRODUCTION FORECAST: ANS by Case



Source: Department of Revenue - Revenue Sources Book Fall 2016

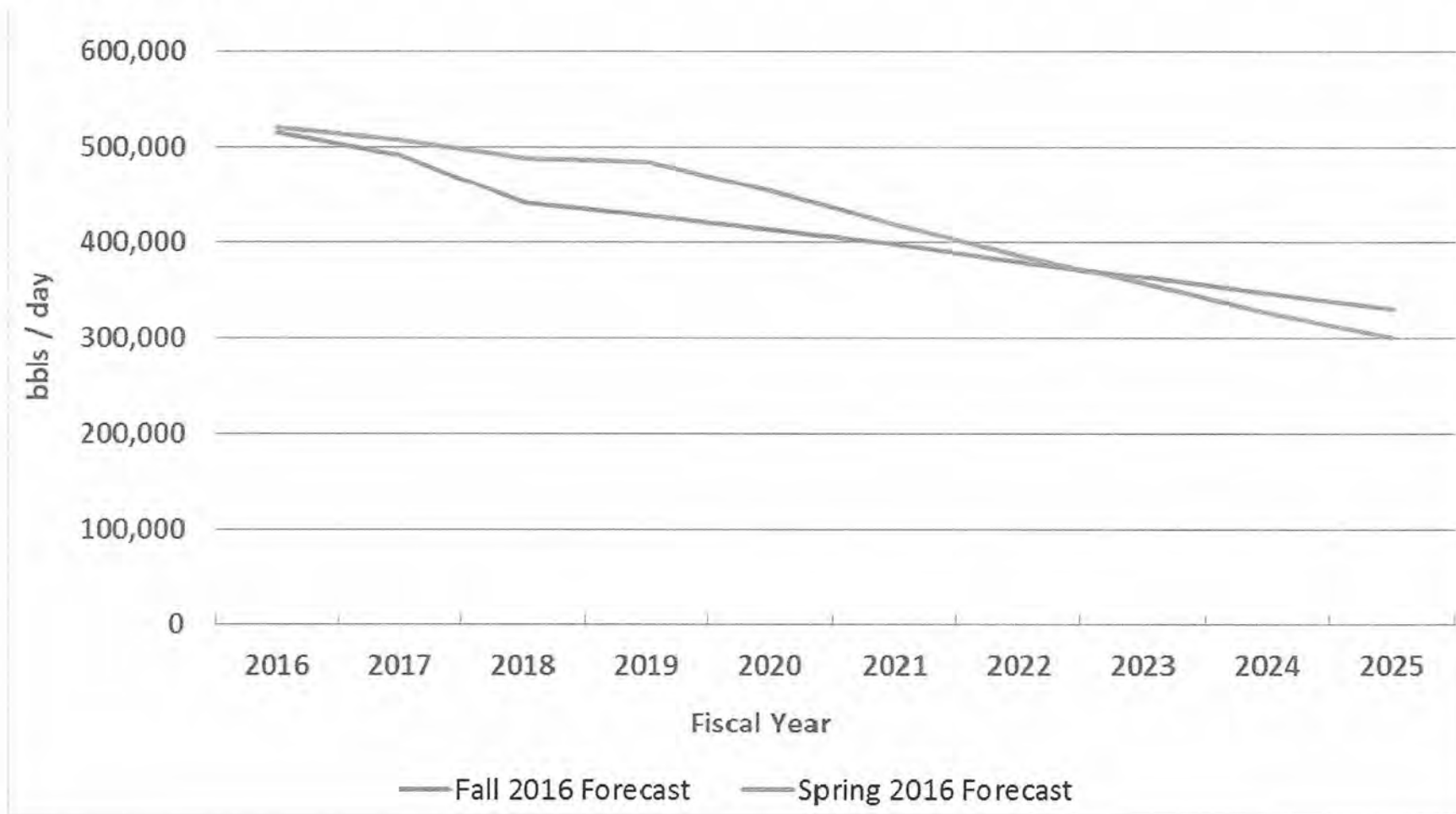
PRODUCTION FORECAST: ANS Details

Fall 2016 ANS Oil Production Forecast

Fiscal Year	(bbls/day)									
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Low Case (P90)	485,437	443,130	420,468	399,452	380,773	362,396	342,498	323,061	304,545	288,085
Decline Rate	-6%	-9%	-5%	-5%	-5%	-5%	-5%	-6%	-6%	-5%
Official Forecast (P50)	490,289	455,550	442,100	428,564	413,481	398,226	380,352	363,447	345,867	330,973
Decline Rate	-5%	-7%	-3%	-3%	-4%	-4%	-4%	-4%	-5%	-4%
High Case (P10)	495,504	467,715	464,292	457,841	446,209	432,753	417,186	402,099	385,324	371,733
Decline Rate	-4%	-6%	-1%	-1%	-3%	-3%	-4%	-4%	-4%	-4%
GVR Eligible under Official Forecast	41,771	40,051	43,025	48,430	50,465	49,255	29,116	11,208	4,697	-
% GVR Eligible under Official Forecast	9%	9%	10%	11%	12%	12%	8%	3%	1%	0%

Source: Department of Revenue - Revenue Sources Book Fall 2016

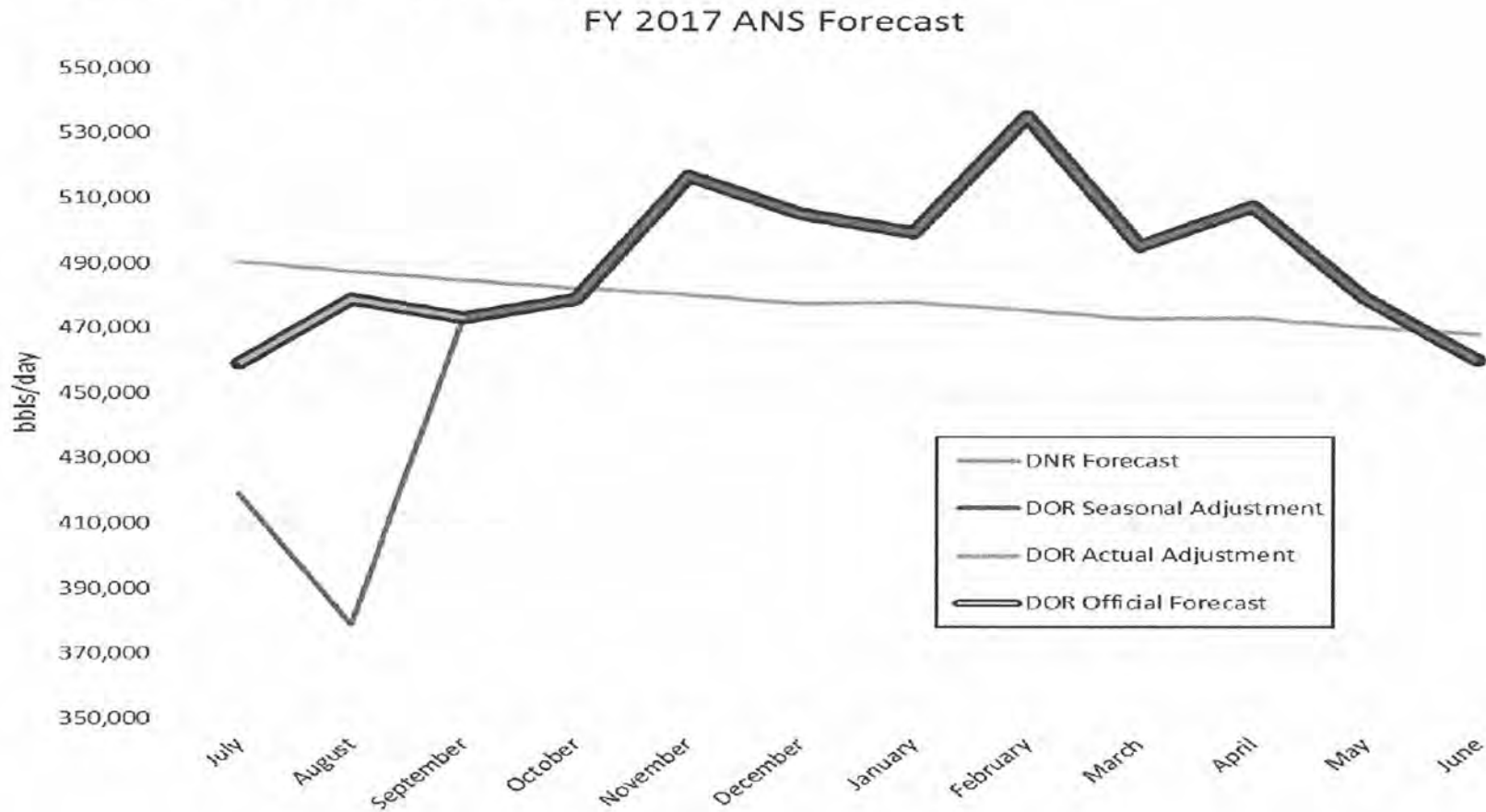
PRODUCTION FORECAST: ANS Comparison to Prior Forecast



Source: Department of Revenue - Revenue Sources Book Fall 2016

Forecasting Methods: Seasonality

- DOR adds seasonality to the DNR forecast and replaces initial months with actual values.



Source: Department of Revenue

THANK YOU

Please find our contact information below:

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Presented by:

Paul Decker and Ed King

Division of Oil and Gas

Alaska Department of Natural Resources

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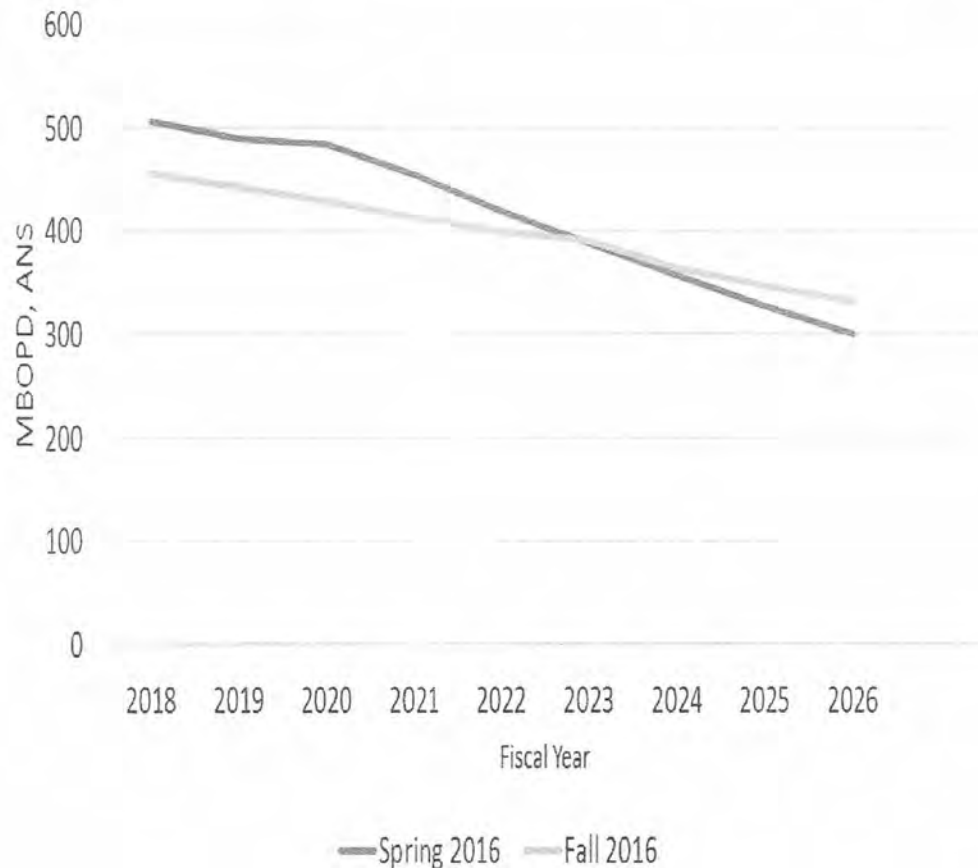
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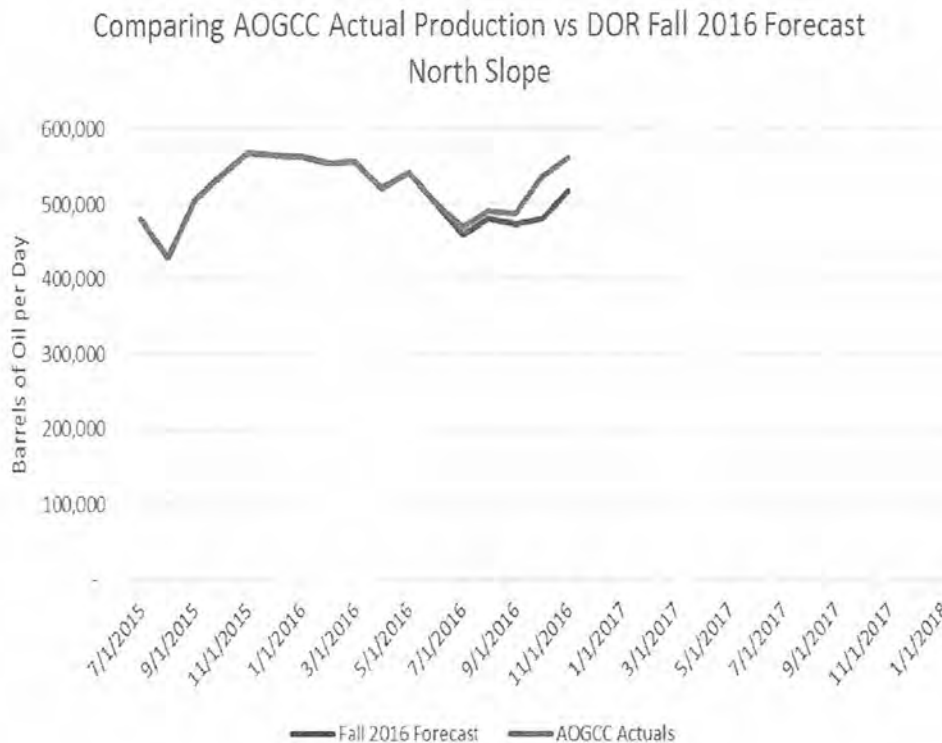
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- The forecast was developed independently of previous forecasts, applying industry-standard engineering and commercial analysis
- Major goals included minimizing the difference between forecast and actual values, relying on industry best practices, and avoiding subjectivity and speculation
- DNR acknowledges the difference between the Fall 2016 forecast versus today's actual production and past forecasts

DIFFERENCES BETWEEN SPRING AND FALL 2016 FORECASTS



- Methodology change between the two forecasts
- Reflects change in operators' plans and activity level
- Since the Spring 2016 forecast there have been several months of activity levels significantly lower than in the past

DIFFERENCES BETWEEN DOR'S FALL 2016 AND ACTUALS



- Why the difference between today's actuals and forecast?
 - Chart shows forecasting of seasonality versus actual seasonality
 - Production from new areas along with less maintenance contributed to actual production exceeding forecast
 - There is a lag in the production impact of changes in operator activity levels such as:
 - PBU Laydown of drilling rigs
 - Nikaitchuq suspended drilling
 - Oooguruk suspended drilling

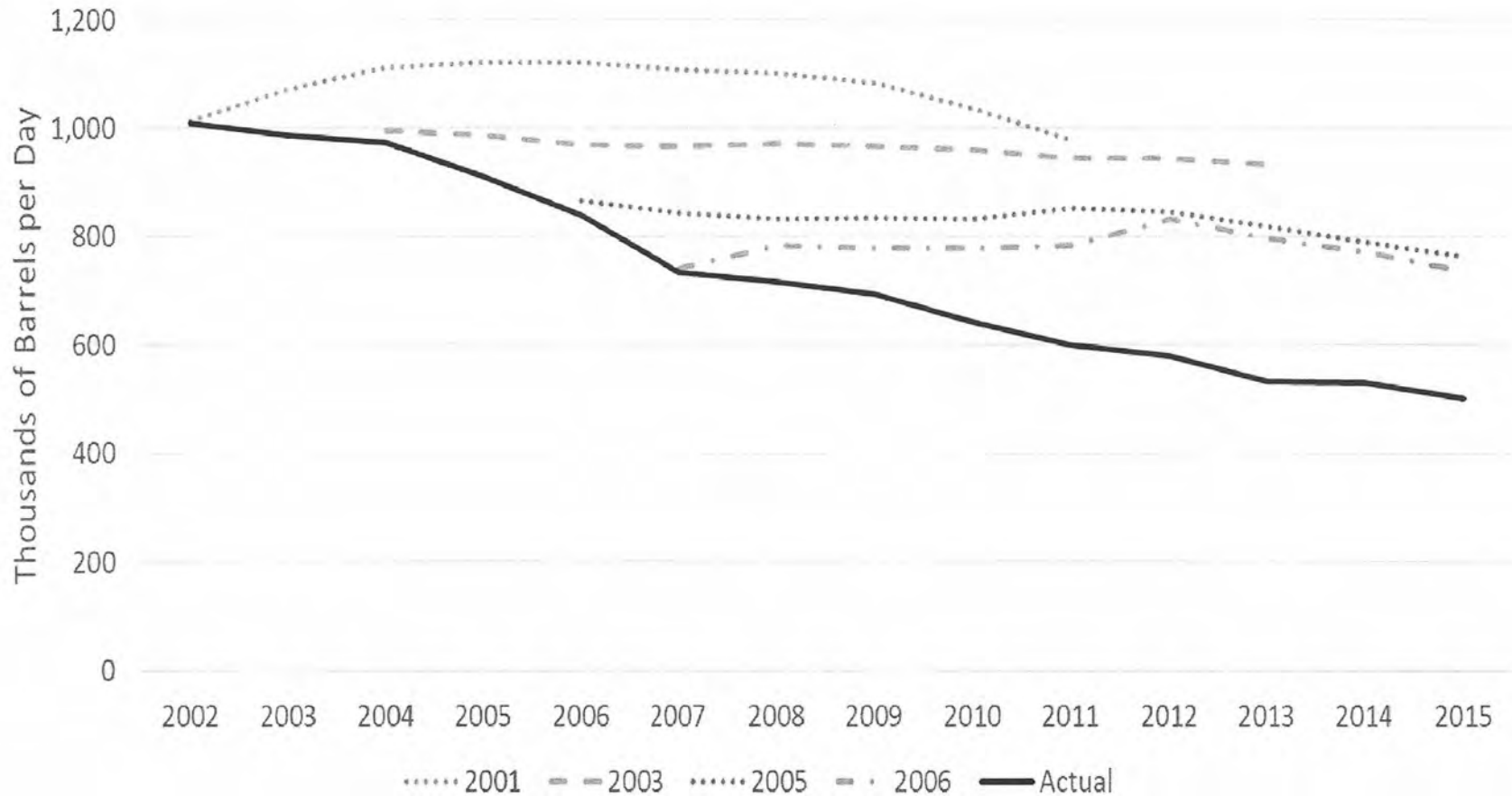
HIGHLIGHTS

- DNR has developed a new forecast methodology using industry standard probabilistic techniques designed to improve forecast accuracy
- Mean production forecast over 10 year period shows a smaller decline rate (4%) versus historic decline rate since 1988 (5%)
- By employing a probabilistic approach, the range of outcomes can be compared in a statistically quantitative manner (P90, Mean, and P10)
- Method assigns price-dependency and occurrence risks to future activity
- Projects are included or excluded from forecast based on objective criteria

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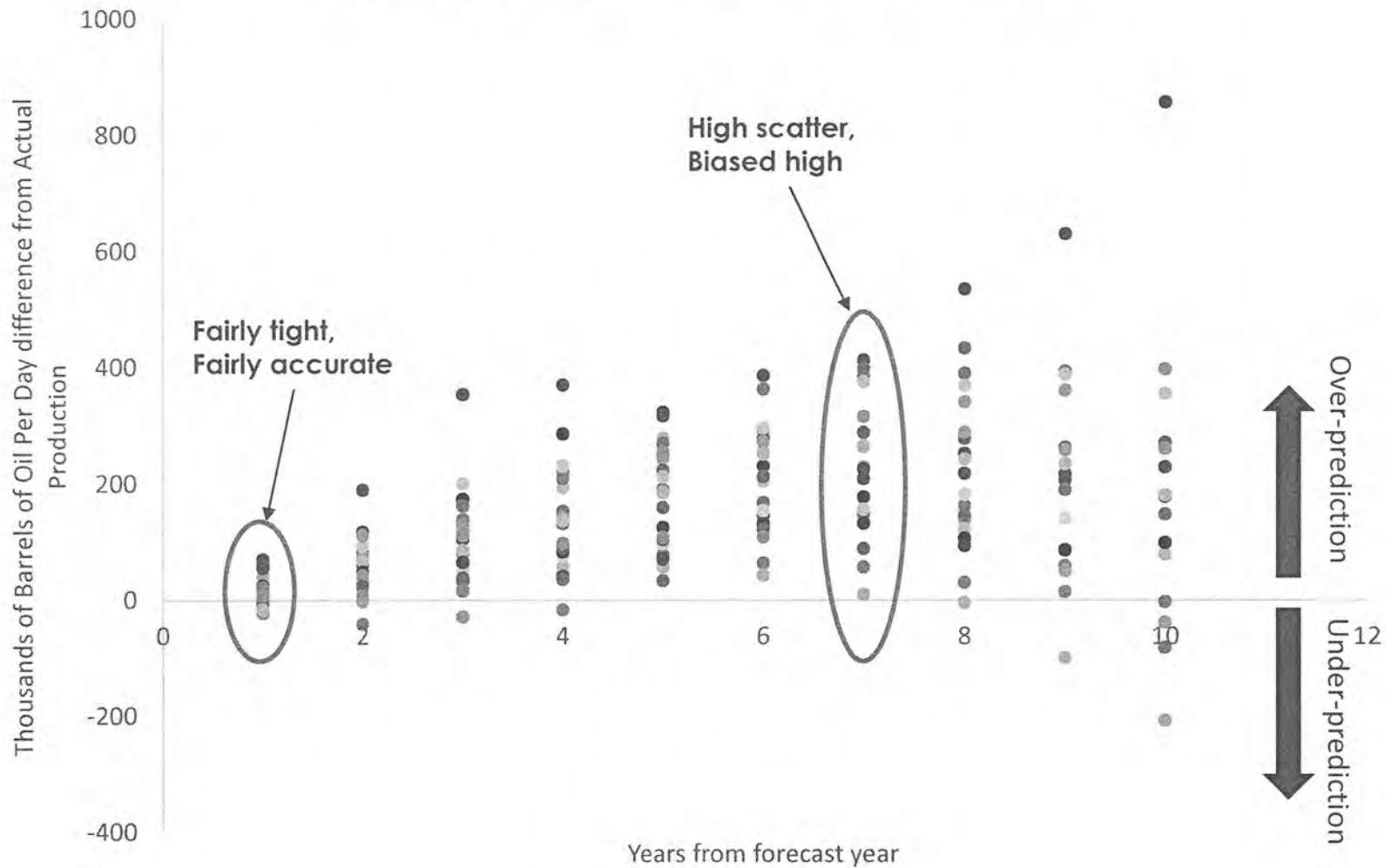
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PREVIOUS FORECASTS vs ACTUAL PRODUCTION



PREVIOUS FORECASTS vs ACTUAL PRODUCTION: STRONG BIAS TOWARD OVERPREDICTION

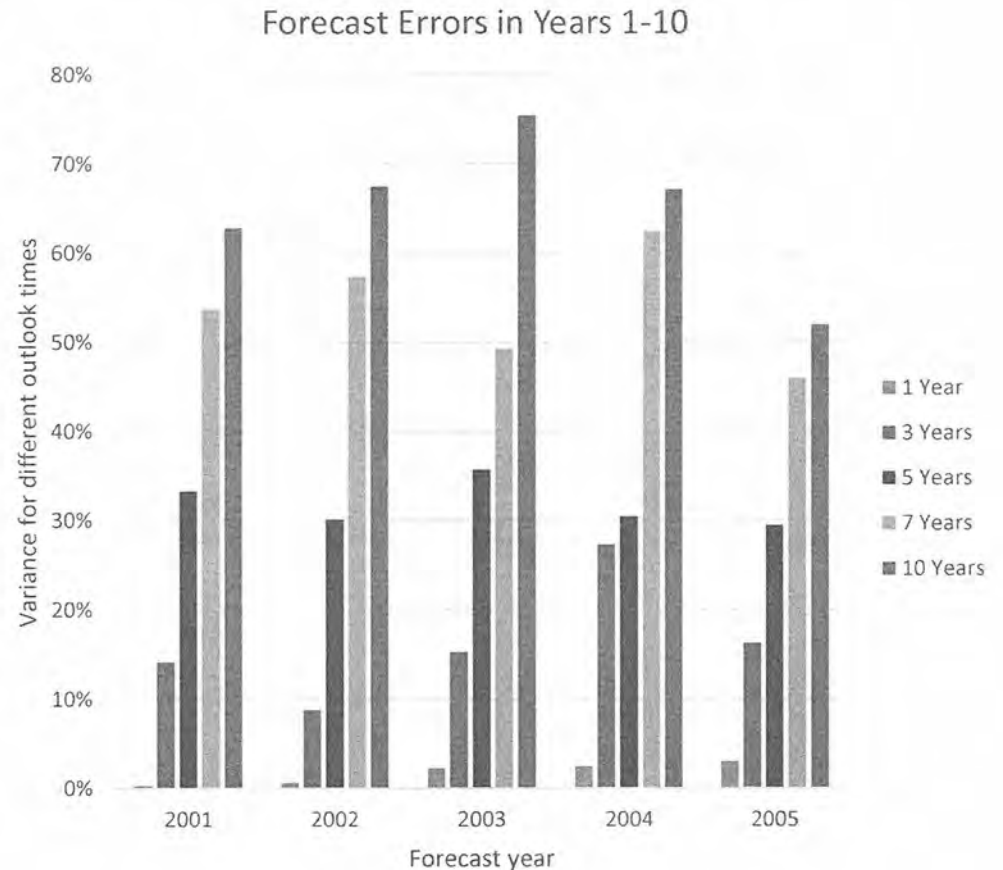
Fall Forecasts vs Actual Production from 1990 through 2015



WHAT OUTLOOK TIME WOULD WE RECOMMEND?

- Forecast error (uncertainty) increases with number of years into the future
- Even the operators' long-range plans may change with market conditions
- The accuracy of the forecast is reduced as projects further out in time are included

**2001 to 2005 allows for analysis of 10 year prediction vs actual*



REASONS FOR REVISING METHODOLOGY

- Previous forecasts included projects with first oil production expected as far as 10 years into the future
 - This was the biggest reason for over-prediction, since many future fields did not come online when expected
- Current forecast method employs shorter 5-year time period for inclusion of projects, excluding highly uncertain future projects

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2012 METHODOLOGICAL CHANGE

- Acknowledgment of upward bias
- Application of “risk factors” honored some uncertainty in new developments
- “Risking” applied by the department, not the contractor
- Not perfect, but an improvement over past methods
 - Better method would use stochastic approach

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FORECASTED PRODUCTION CATEGORIES

- Current and previous forecasts each divided production into three different categories:
 - Currently Producing (CP):
 - Oil from currently producing pools.
 - Under Development (UD):
 - Oil from well defined projects that are not yet contributing to production.
 - Under Evaluation (UE):
 - Oil from more speculative projects under consideration.
- The revised methodology has adjusted the terms for inclusion in the UD and UE categories in an attempt to decrease persistent over-prediction of rate seen in previous forecasts.

DIFFERENCES BETWEEN FORECAST METHODS

	1989 - 2009	2009 – Spring 2016	Fall 2016 - present
Under Development Tranche	10-year outlook	10-year outlook	1-year outlook
Under Evaluation Tranche	10-year outlook	10-year outlook	5-year outlook
Approach towards Uncertainty	Deterministic (some scenarios)	Deterministic	Probabilistic
Oil Price Dependency for Risking	None	None	Dependence on oil price
Risking	N/A	CP not Risked First UD/UE risking in 2012 Fall forecast	Probabilistic technical and non-technical risk
Type wells for future production	N/A	Single type well, by field	Pool-by-pool type wells
Forecast Level	Field-Level Forecast	Well-Level Forecast	Pool-Level forecast

*Probabilistic methodology allows for statistical quantification of the range of forecast outcomes

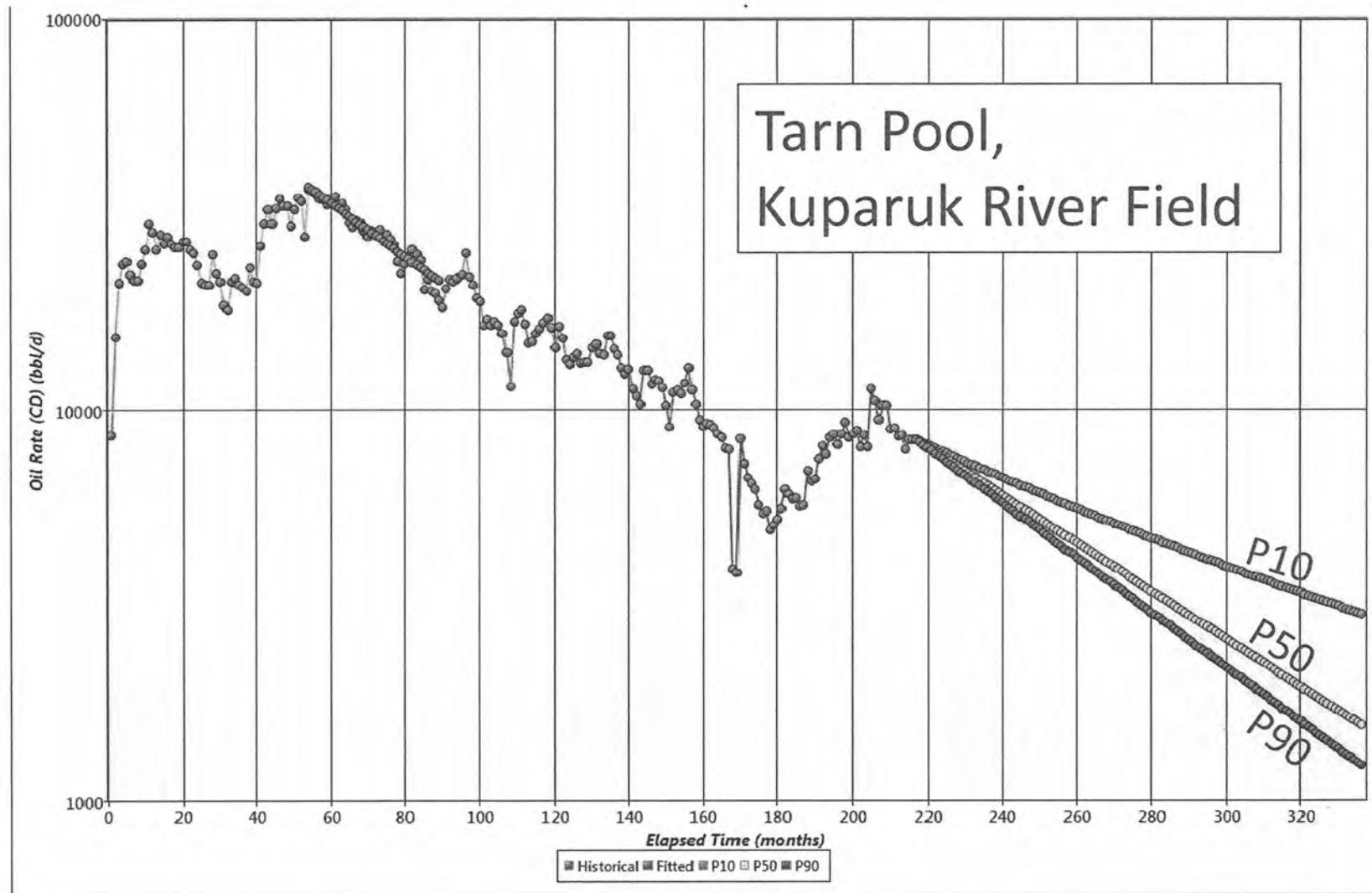
CATEGORY: CURRENTLY PRODUCING (CP)

- Constitutes more than 90% of total forecast
- All currently producing pools
 - North Slope: 34 individual oil pools
 - Cook Inlet: One aggregated oil 'pool' and Cosmo oil pool
- Based on public AOGCC production data. Two month lag in availability; data cutoff at 6/30/2016 (end FY16)
- Decline Curve Analysis (DCA) forecast at pool level inherently includes 'background' ongoing development activity, facility maintenance, turn-around events.

HOW PROBABILISTIC DCA WORKS

- Decline Curve Analysis (DCA) applies trends on historical production data to forecast production based on an understanding of reservoir and operational performance of producing fields/wells.
- Probabilistic DCA includes uncertainty analysis to produce a range of future production rather than a single deterministic forecast profile.
- Software used:
 - Schlumberger's Oil Field Manager (OFM) alongside a probabilistic suite.
 - Uncertainty analysis in excel used @Risk by Palisade

PROBABILISTIC DCA CP FORECAST EXAMPLE



CATEGORY: UNDER DEVELOPMENT (UD)

First production expected by 06/30/2017

- Includes incremental wells added in currently producing fields in excess of 'background' drilling levels ('background' is inherently captured in CP Decline Curve Analysis)
- Defined to include new fields expected to produce within 1 year.
 - *None in this year's forecast, but there could be next year.*
- Probabilistic type wells were developed from analogue fields, capturing uncertainty around well performance.
- A 90% chance of occurrence was applied to each UD and UE well based on Plan of Development lookback.
- Economic risk was applied to all UD and UE production based on Department of Revenue's Price Outlook.

CATEGORY: UNDER EVALUATION (UE)

First production expected between 7/1/2017 and 6/30/2021

- Development plans in place
- Significant sunk cost or sources of funding secured
- Facilities or facility-sharing agreements in place
- National Environmental Policy Act (NEPA) analysis in progress or completed
- The same chance of occurrence and economic risks were applied to both UE and UD
- Examples: Oooguruk Nuna, Greater Mooses Tooth 1, Mustang, Kuparuk Moraine, 1H NEWS, Oooguruk Nuiqsut Expansion, Greater Mooses Tooth 2

CATEGORY: EXCLUDED FROM PRODUCTION FORECAST FOR REVENUE PURPOSES

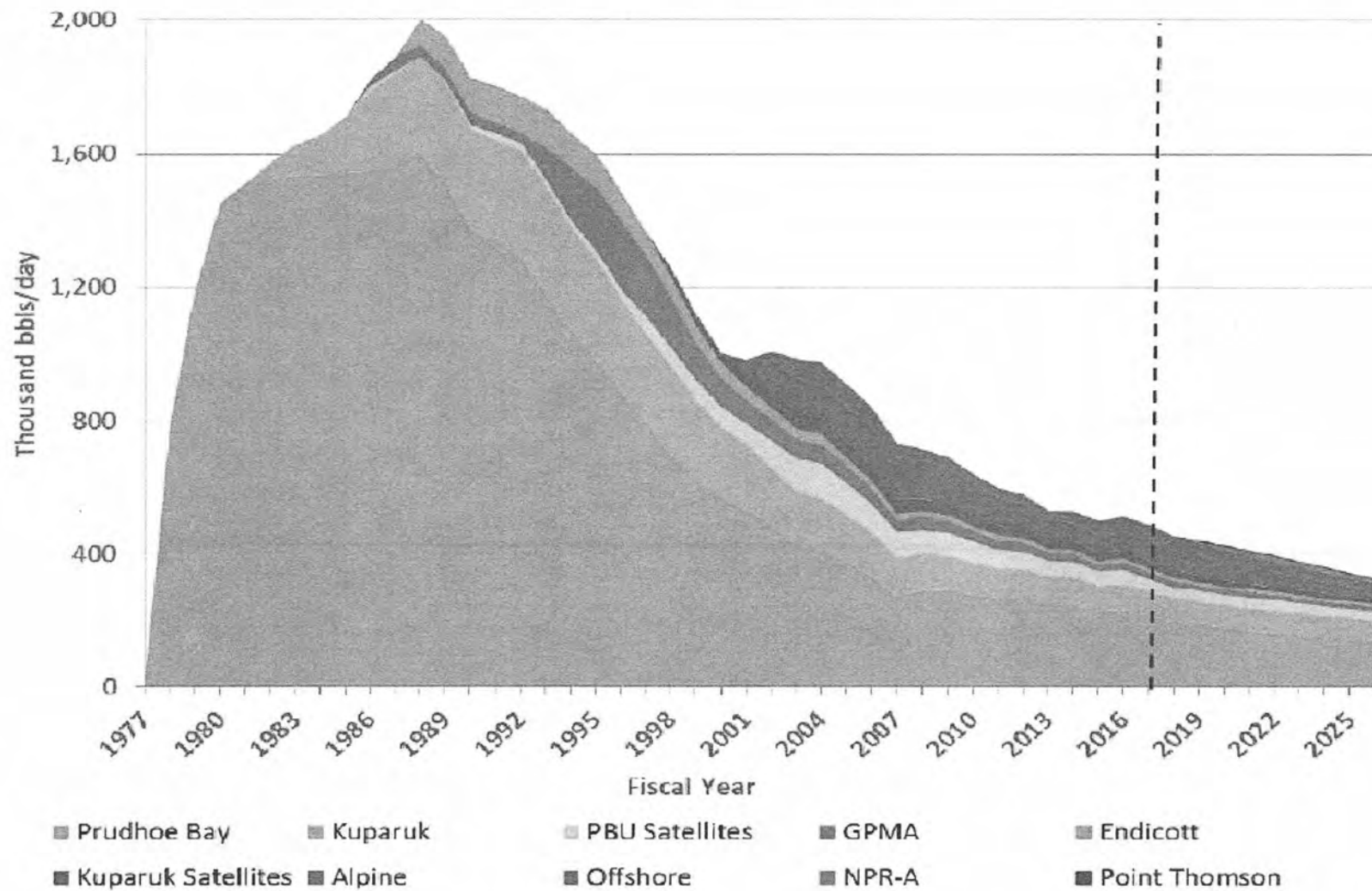
Factors considered:

- First-oil date estimated beyond five years
- Discovery (contingent resource) or just prospects (prospective resource)
- Projects still in appraisal
- Uncertain funding
- Facilities incomplete or nonexistent
- Commercial uncertainty
- Technological challenges
- Environmental/permitting challenges
- Examples: Pikka, Ugnu, Placer, Tofkat, Pt Thomson (Major Gas Sales case), Liberty, Fiord West, Smith Bay, Willow, ANWR

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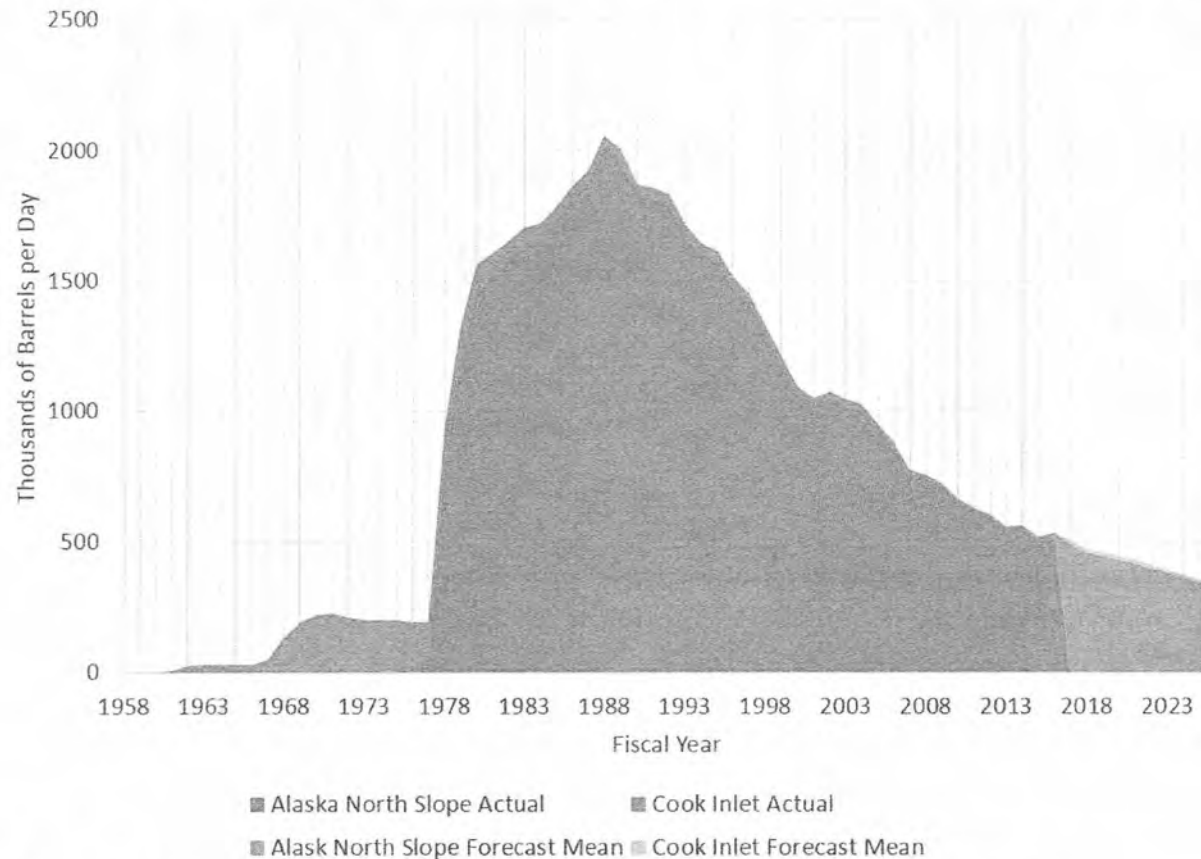
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FALL 2016 REVENUE SOURCES BOOK



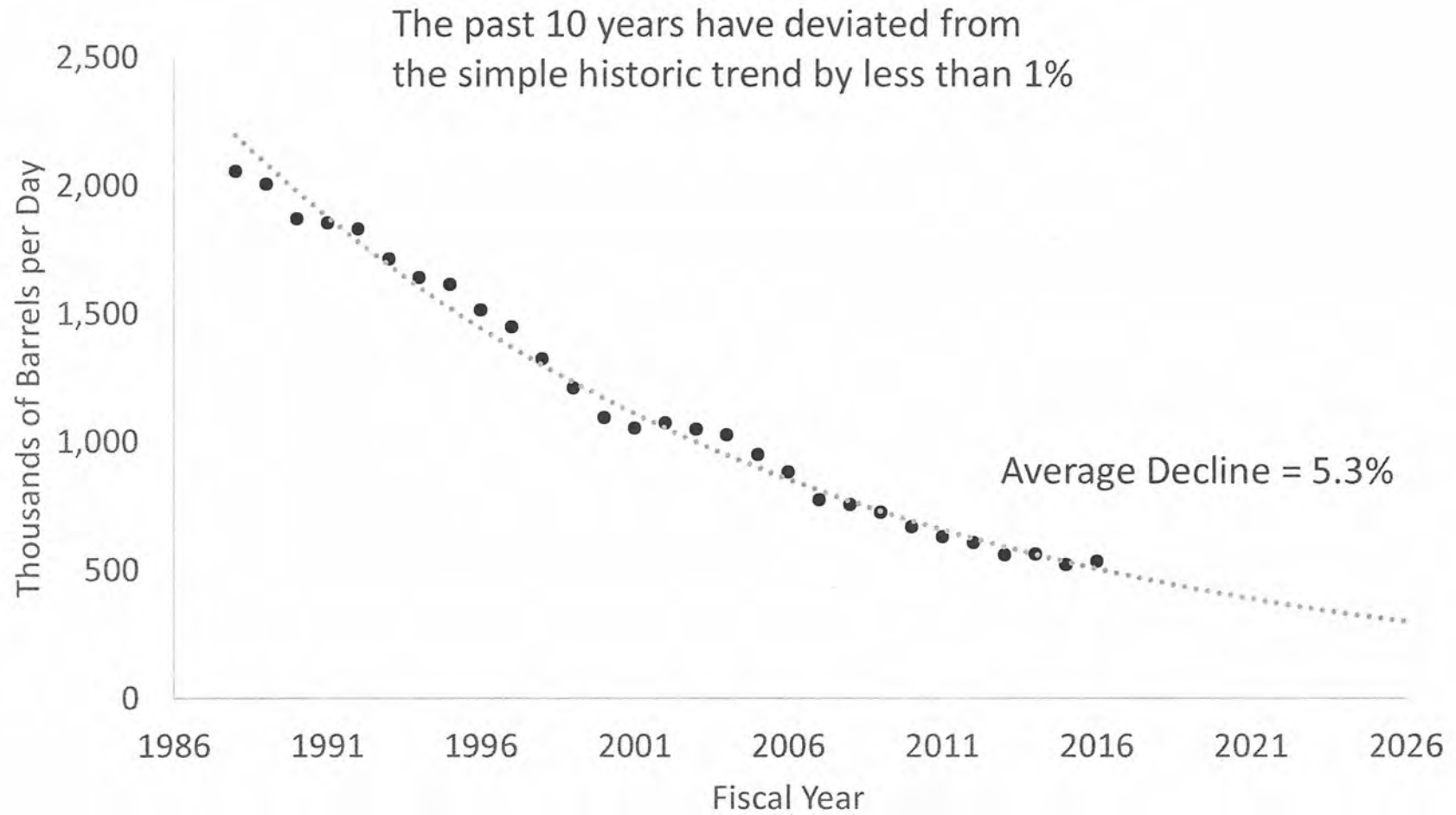
Source: Fall 2016 Revenue Sources Book

NORTH SLOPE VS. COOK INLET PRODUCTION AND FORECAST

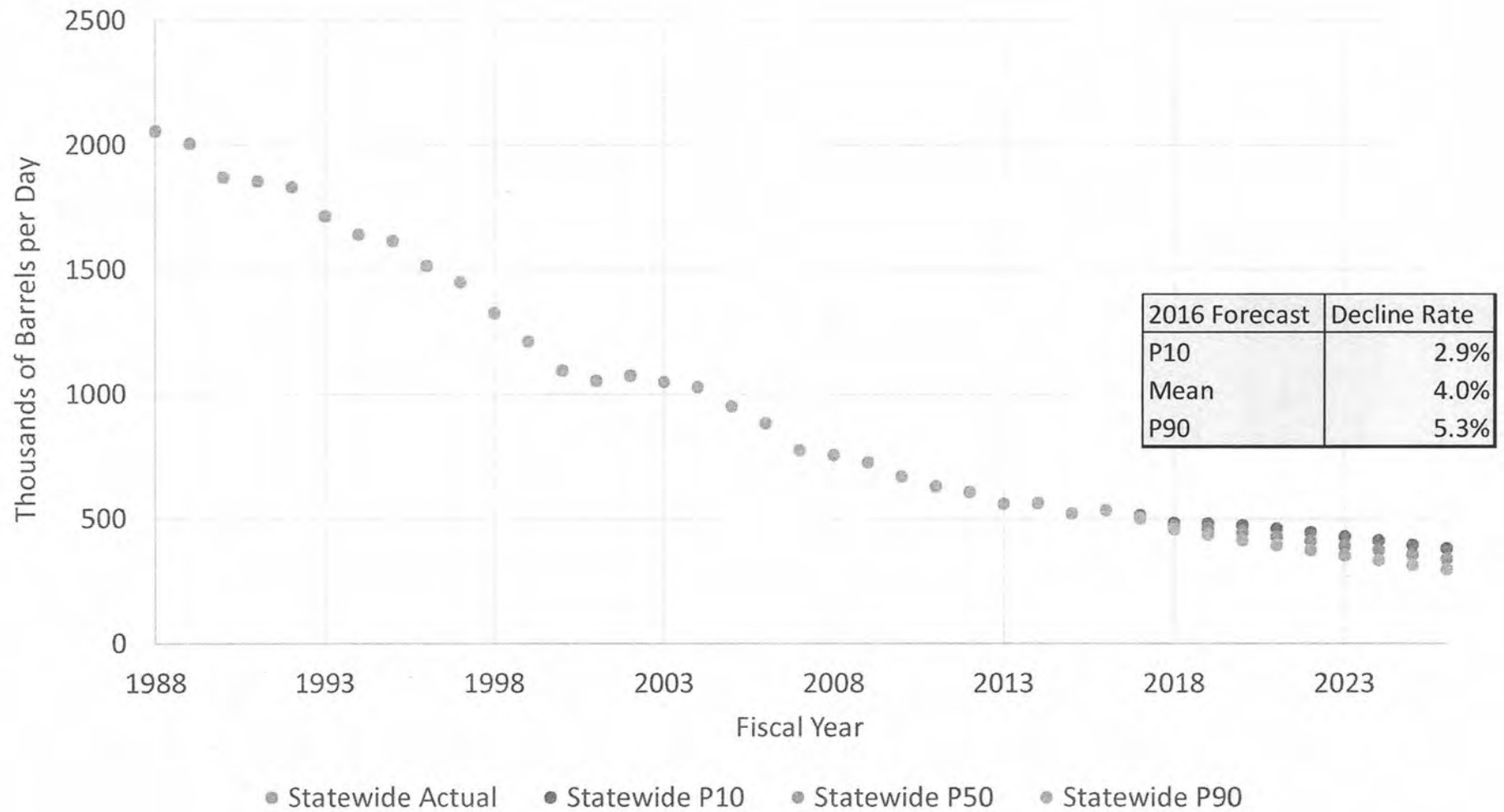


- Alaska North Slope is the major part of statewide forecast
- Over the 10-year forecast period, 3% of oil and NGLs production come from the Cook Inlet
- Chart shows annualized average production per year

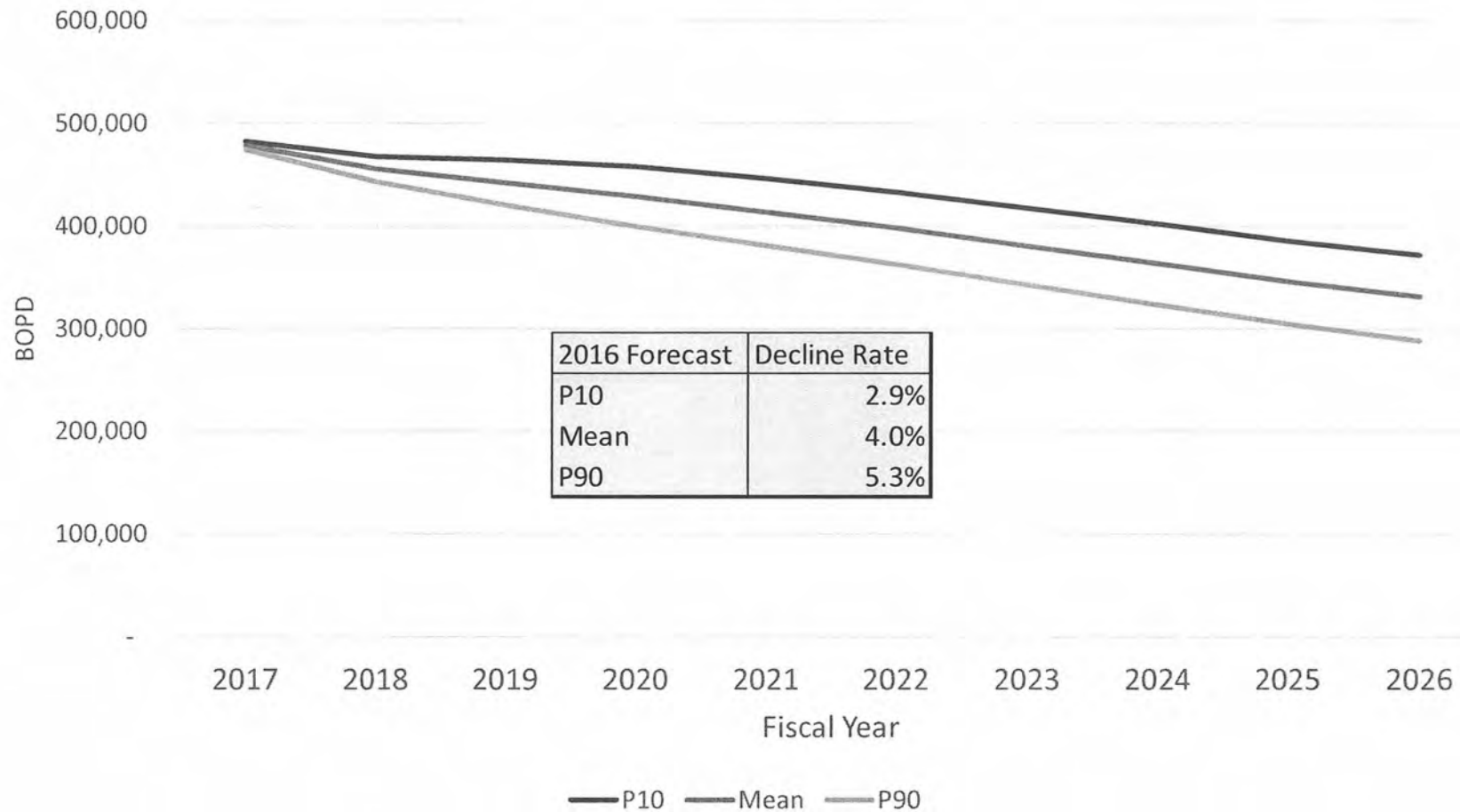
STATEWIDE PRODUCTION TREND



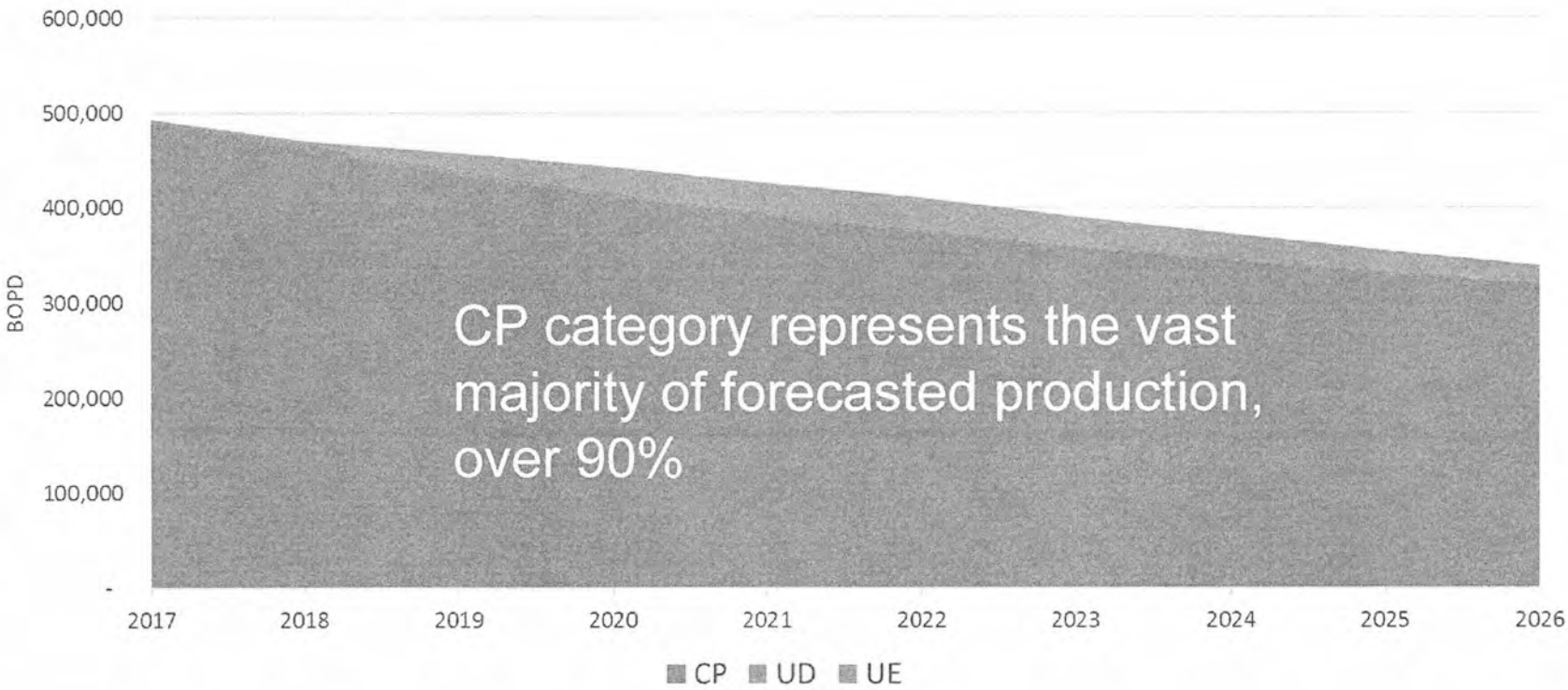
STATEWIDE ANNUALIZED OIL + NGL ACTUAL & FORECAST



STATEWIDE PRODUCTION FORECAST RANGE

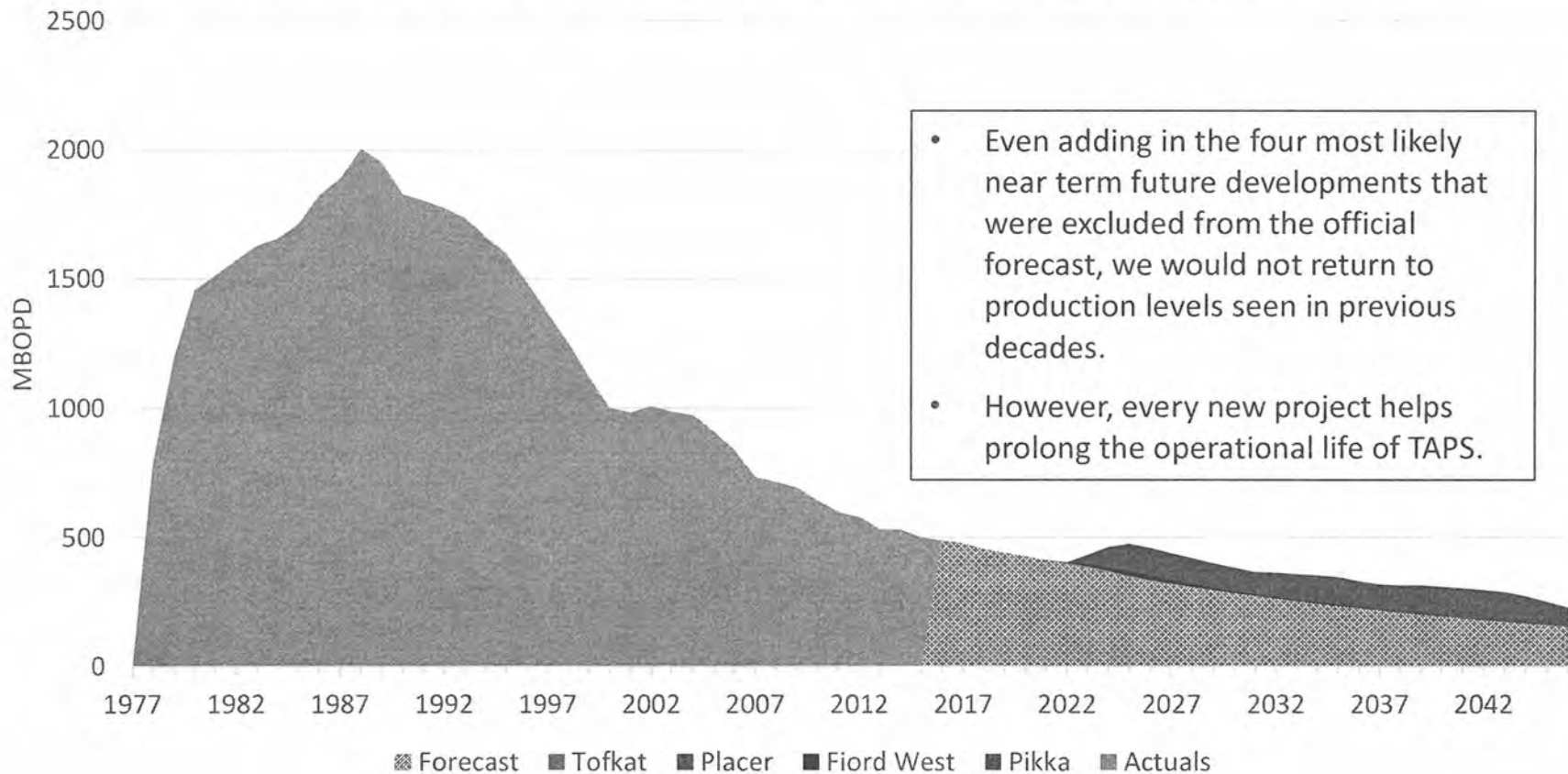


STATEWIDE PRODUCTION FORECAST



IMPACT OF SPECULATIVE FUTURE DEVELOPMENTS EXCLUDED FROM FORECAST

Historical ANS production, Official ANS forecast + 4 Most Likely Future Developments



SUMMARY

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- Mean production forecast over 10 year period shows a smaller decline rate (4%) versus historic decline rate since 1988 (5%)
- By employing a probabilistic approach, the range of outcomes can be compared in a statistically quantitative manner (P90, Mean, and P10)
- Method assigns price-dependency and occurrence risks to UD and UE production
- Projects are included or excluded from forecast based on estimated first oil date, factoring in technical, commercial and environmental considerations

THANK YOU!



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Division of Oil and Gas 2016 Fall Production Forecast

Senate Resources Committee

Presented by:

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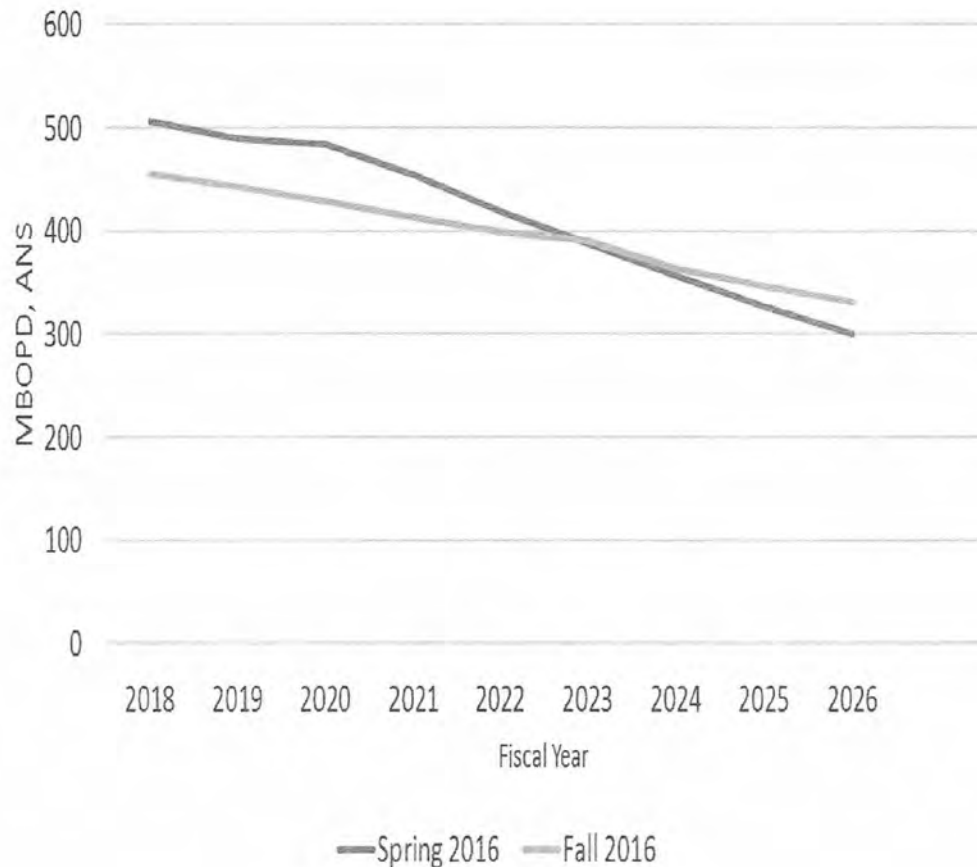
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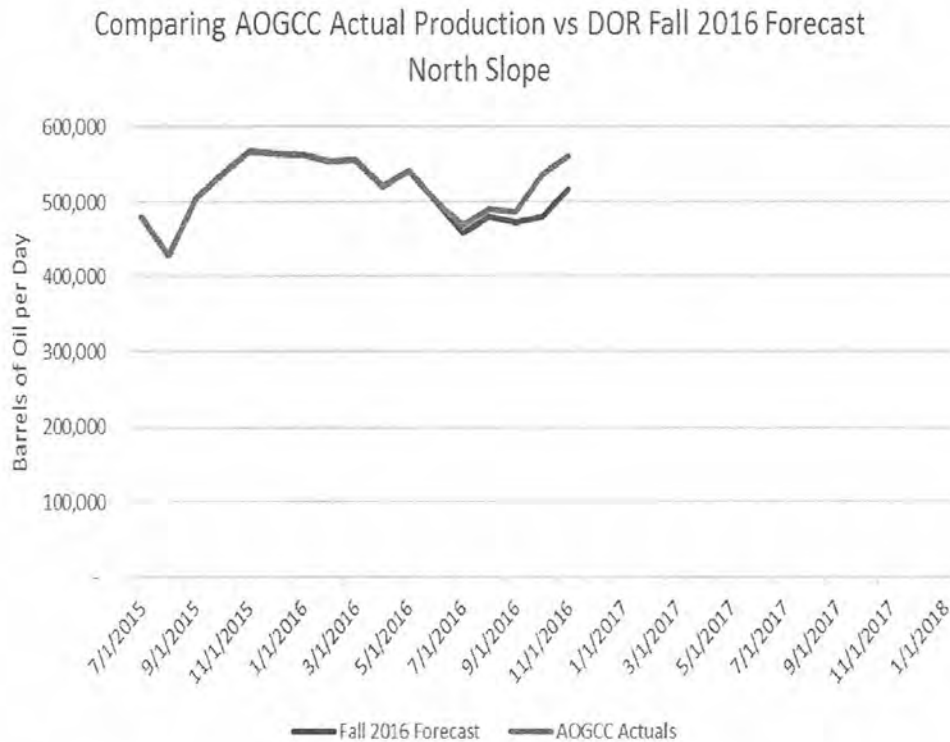
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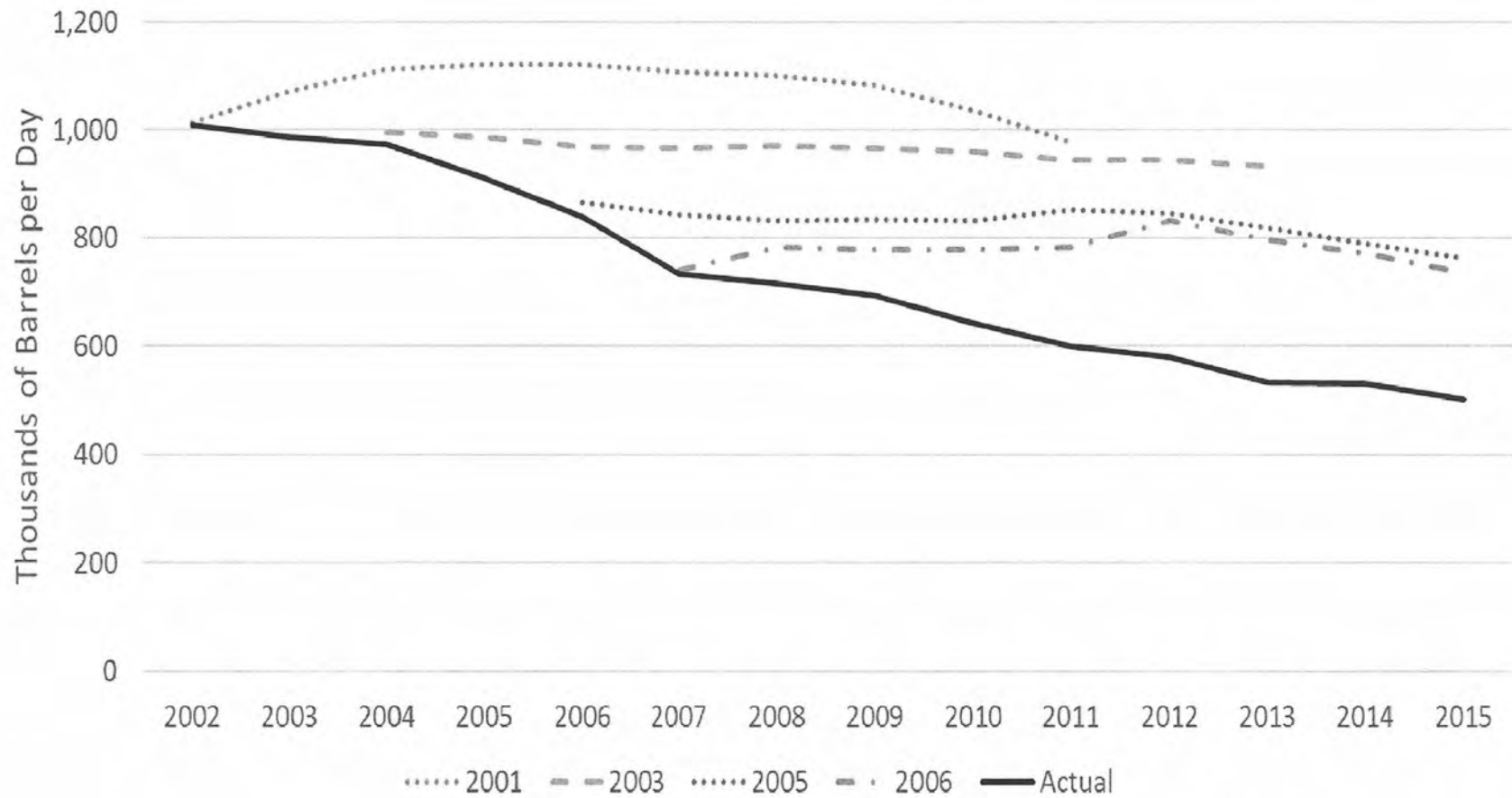
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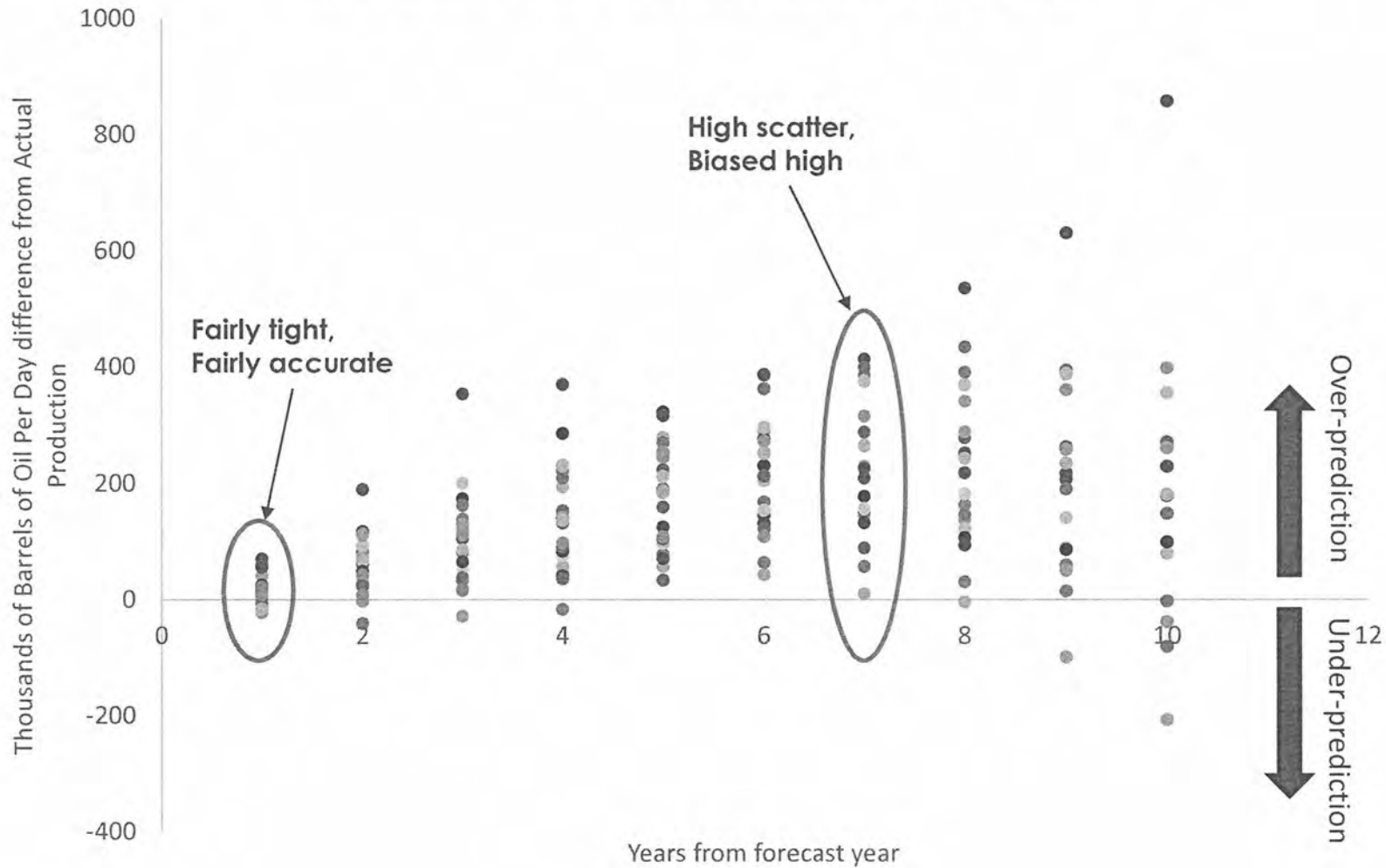
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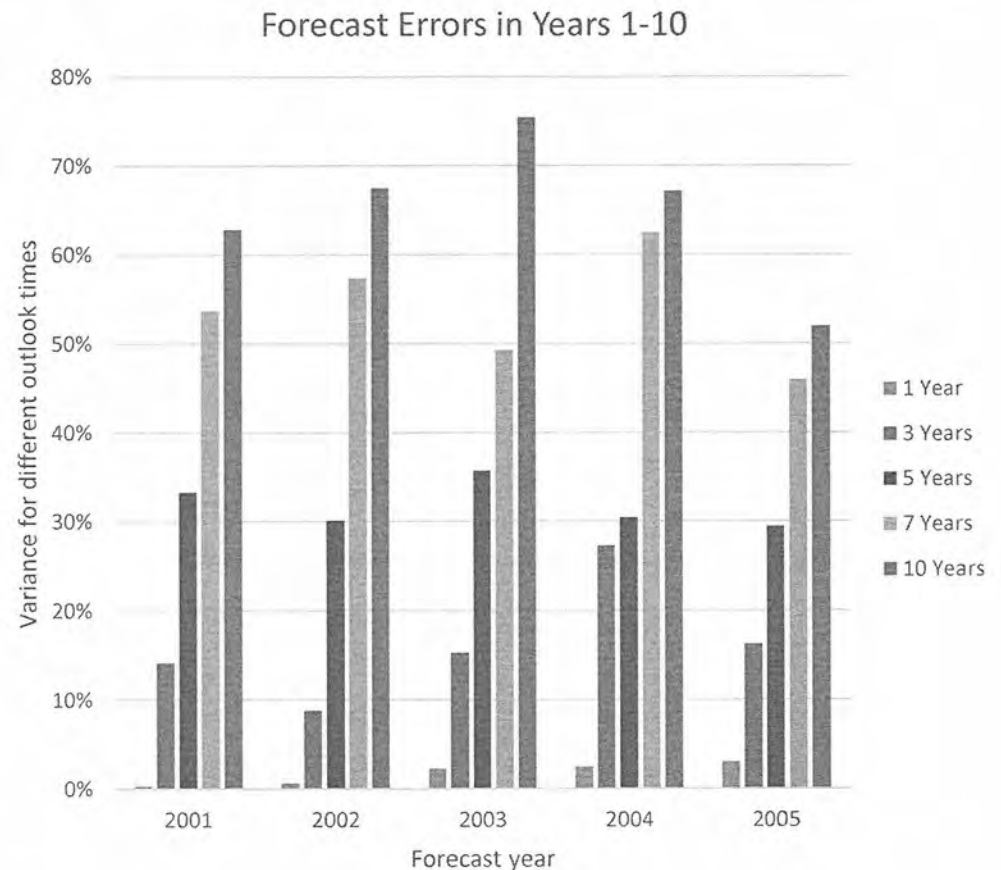
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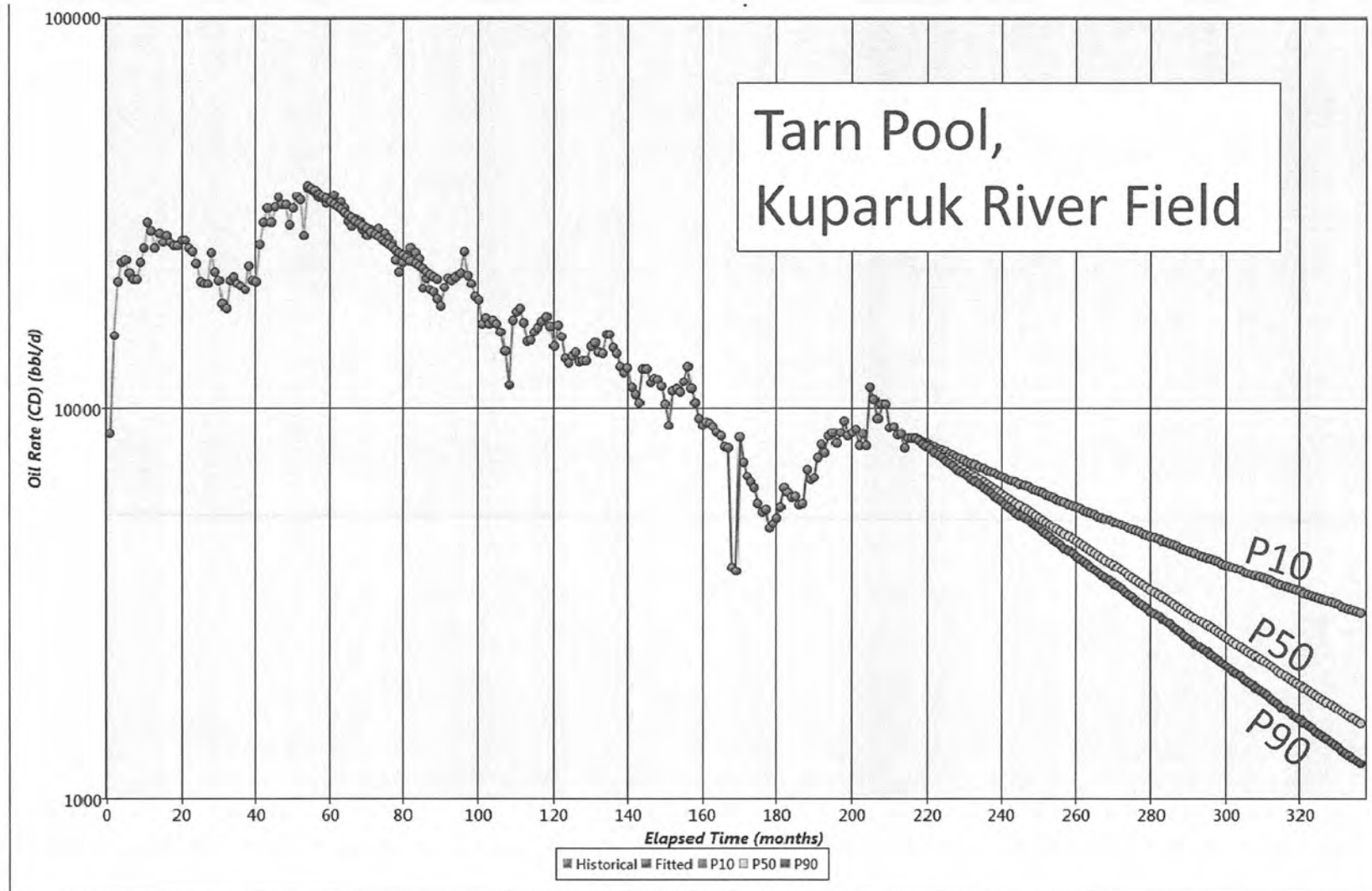
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- Probabilistic type wells were developed from analogue fields, capturing uncertainty around well performance.
- A 90% chance of occurrence was applied to each UD and UE well based on Plan of Development lookback.
- Economic risk was applied to all UD and UE production based on Department of Revenue's Price Outlook.

CATEGORY: UNDER EVALUATION (UE)

First production expected between 7/1/2017 and 6/30/2021

- Development plans in place
- Significant sunk cost or sources of funding secured
- Facilities or facility-sharing agreements in place
- National Environmental Policy Act (NEPA) analysis in progress or completed
- The same chance of occurrence and economic risks were applied to both UE and UD
- Examples: Oooguruk Nuna, Greater Mooses Tooth 1, Mustang, Kuparuk Moraine, 1H NEWS, Oooguruk Nuiqsut Expansion, Greater Mooses Tooth 2

CATEGORY: EXCLUDED FROM PRODUCTION FORECAST FOR REVENUE PURPOSES

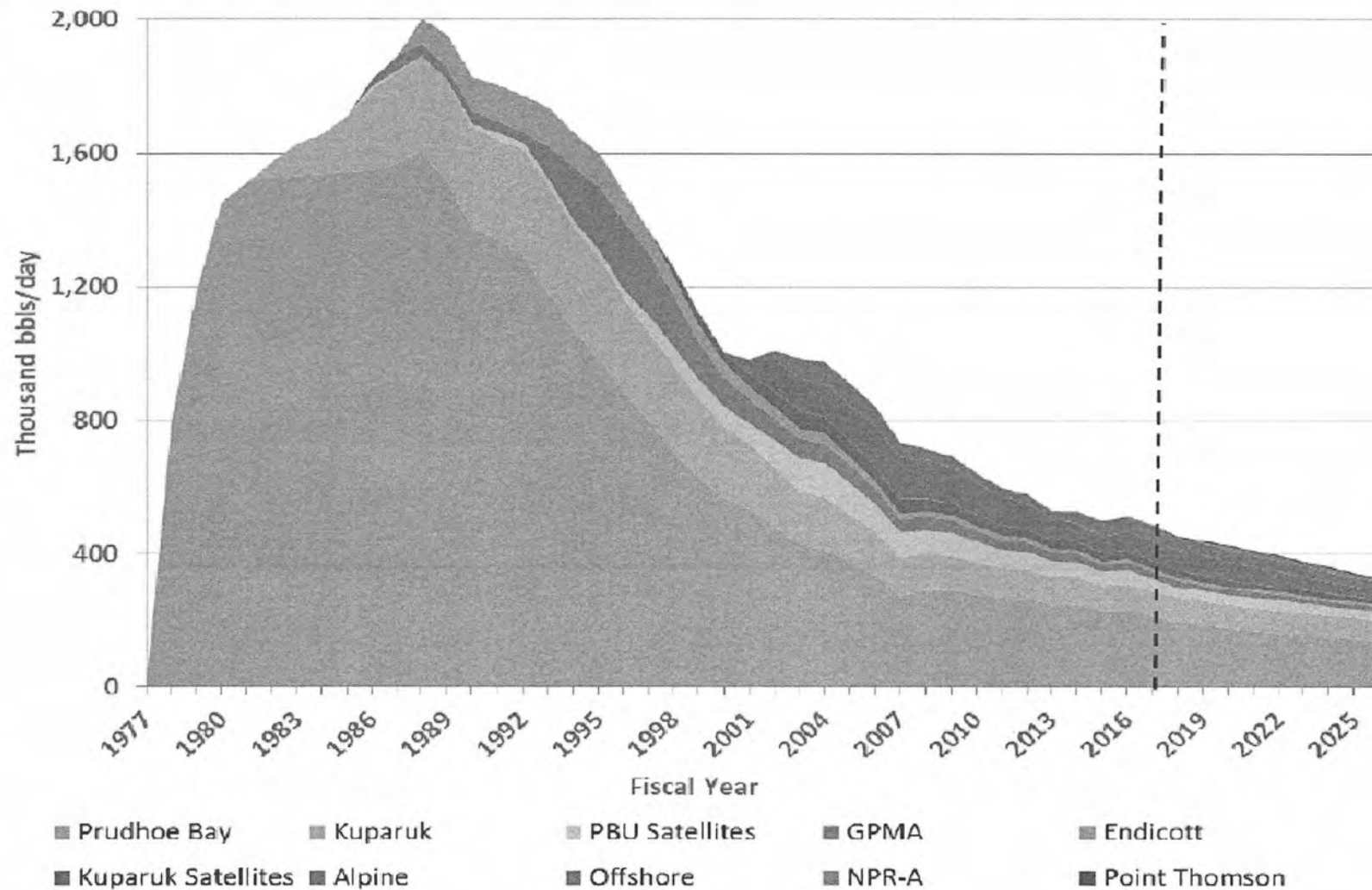
Factors considered:

- First-oil date estimated beyond five years
- Discovery (contingent resource) or just prospects (prospective resource)
- Projects still in appraisal
- Uncertain funding
- Facilities incomplete or nonexistent
- Commercial uncertainty
- Technological challenges
- Environmental/permitting challenges
- Examples: Pikka, Ugnu, Placer, Tofkat, Pt Thomson (Major Gas Sales case), Liberty, Fiord West, Smith Bay, Willow, ANWR

AGENDA

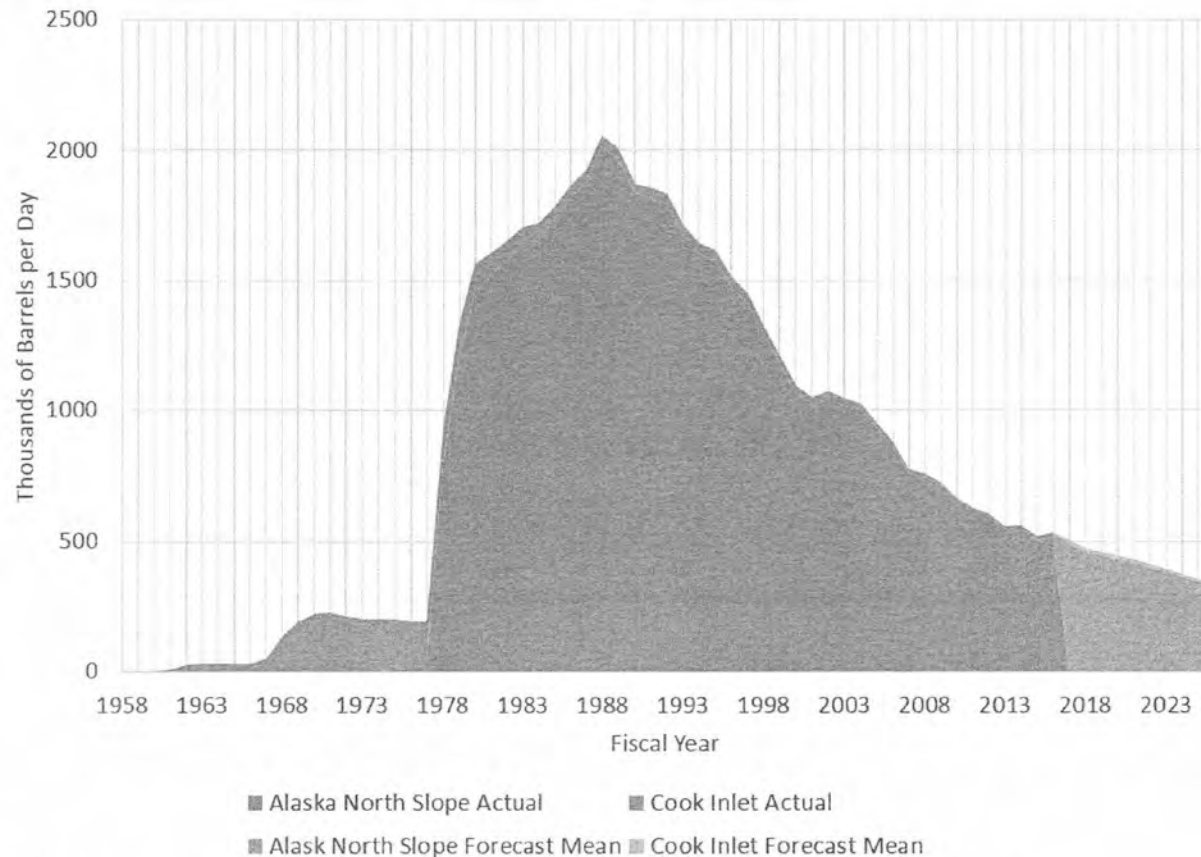
- EXECUTIVE SUMMARY
- REVIEW OF PAST FORECASTS
- 2012 METHOD CHANGES (DOR)
- 2016 FORECAST METHOD
- **2016 FORECAST RESULTS**
- SUMMARY

FALL 2016 REVENUE SOURCES BOOK



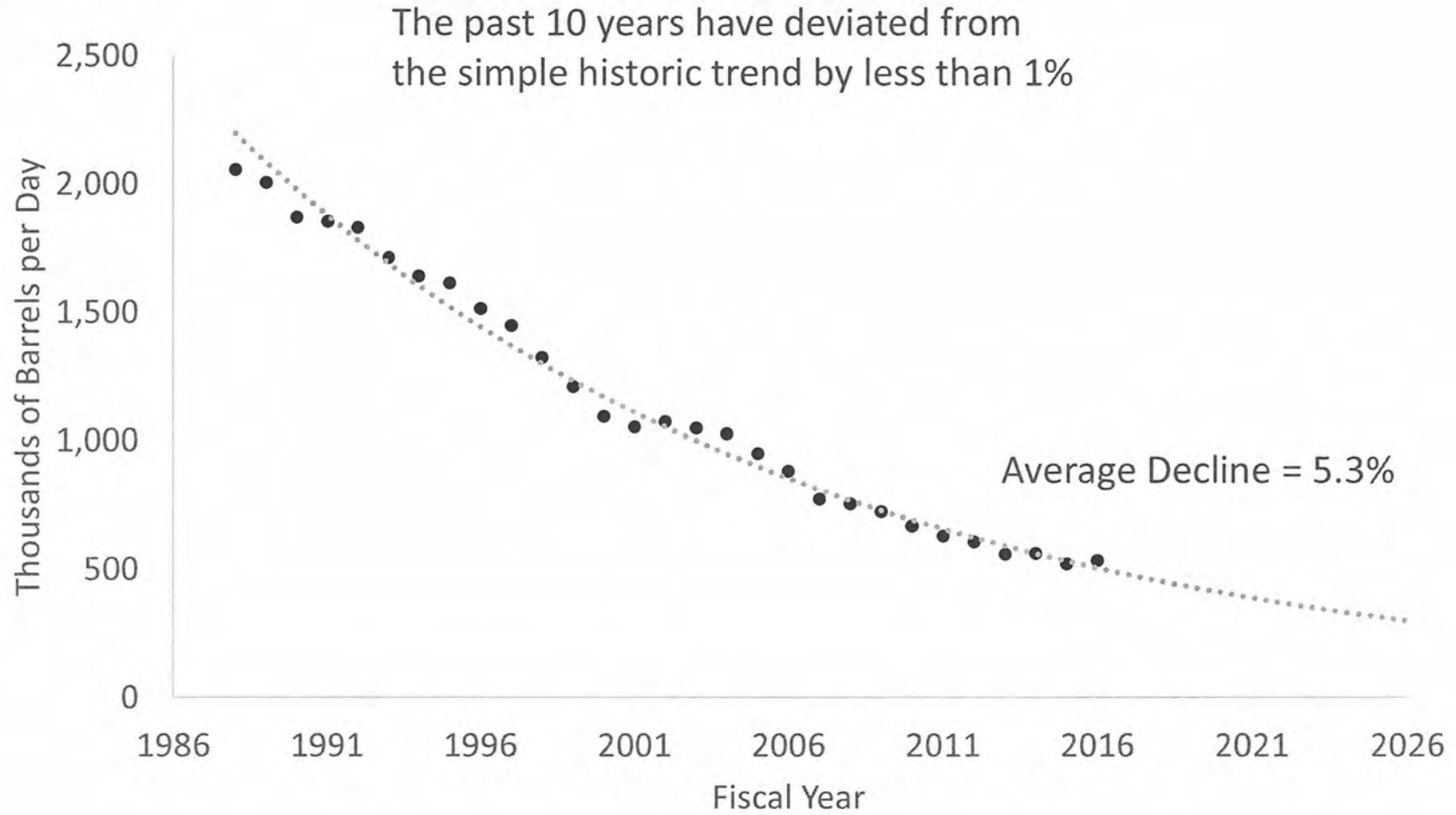
Source: Fall 2016 Revenue Sources Book

NORTH SLOPE VS. COOK INLET PRODUCTION AND FORECAST

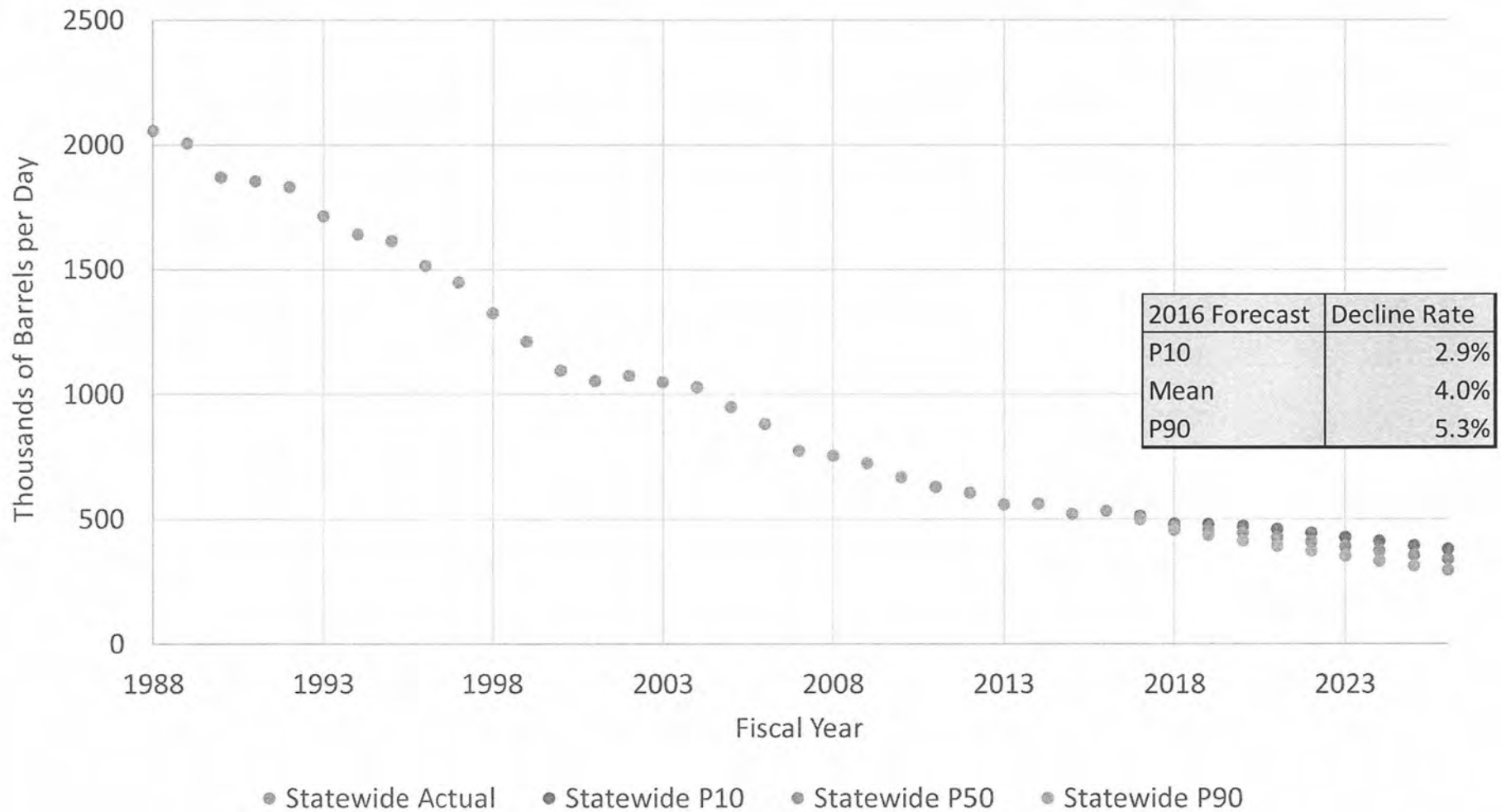


- Alaska North Slope is the major part of statewide forecast
- Over the 10-year forecast period, 3% of oil and NGLs production come from the Cook Inlet
- Chart shows annualized average production per year

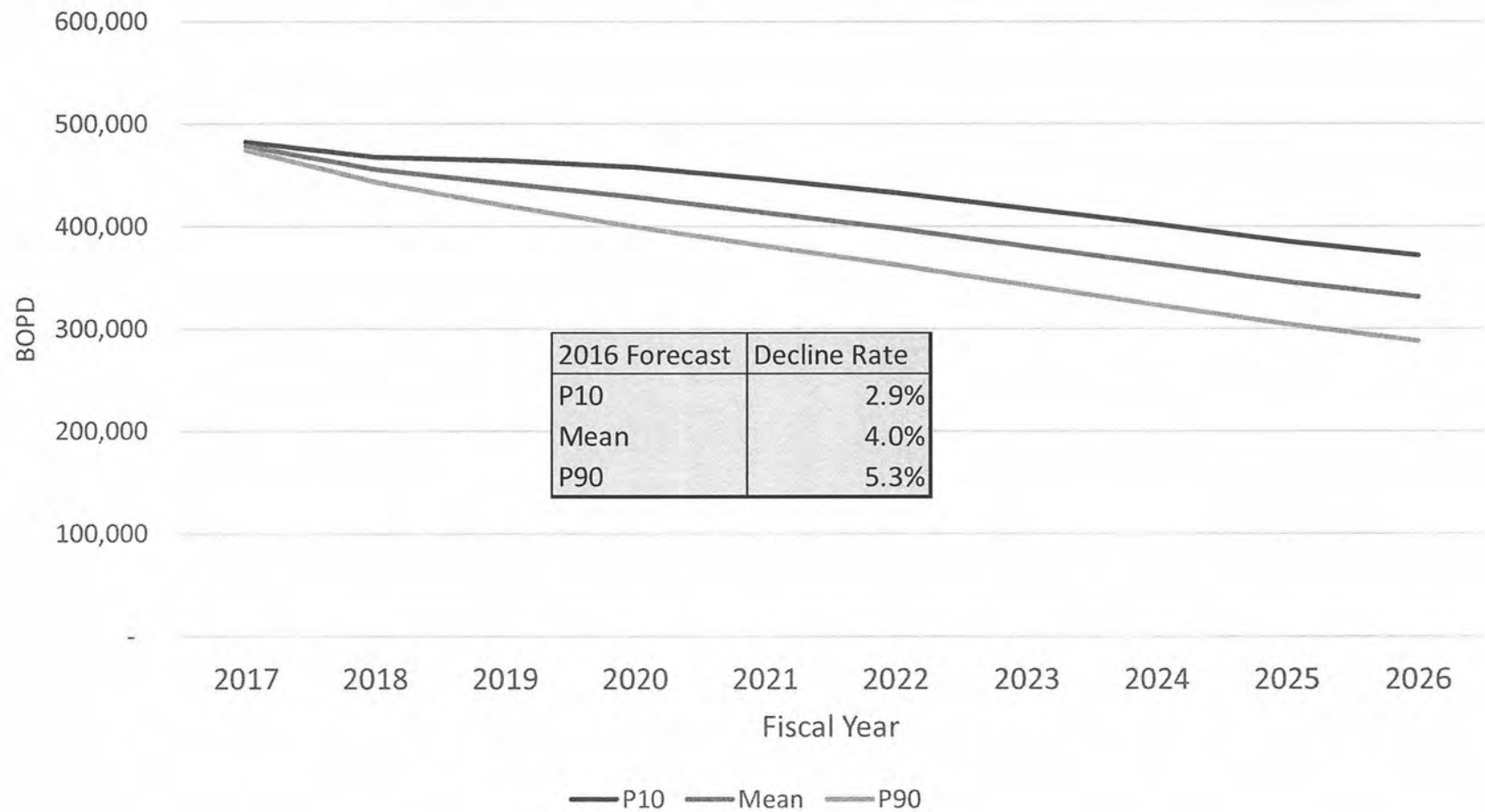
STATEWIDE PRODUCTION TREND



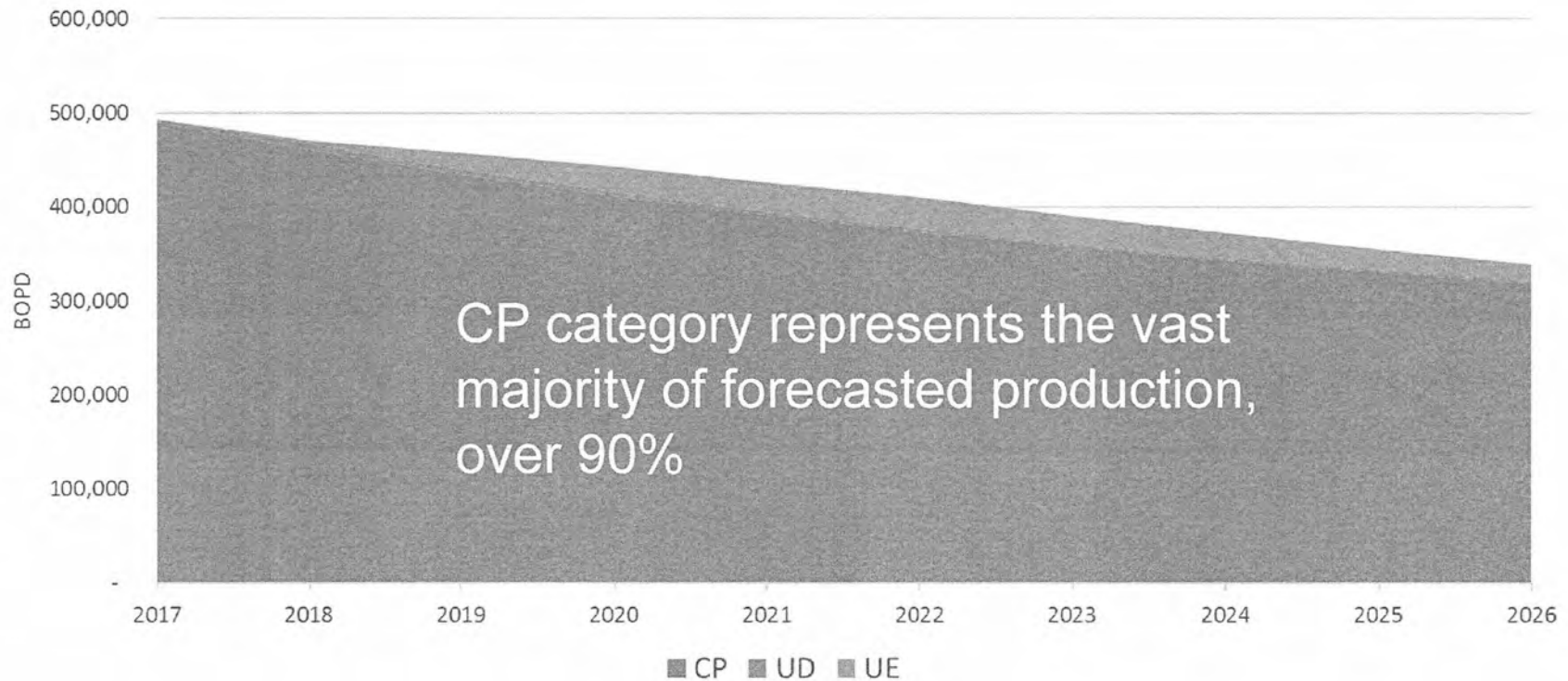
STATEWIDE ANNUALIZED OIL + NGL ACTUAL & FORECAST



STATEWIDE PRODUCTION FORECAST RANGE

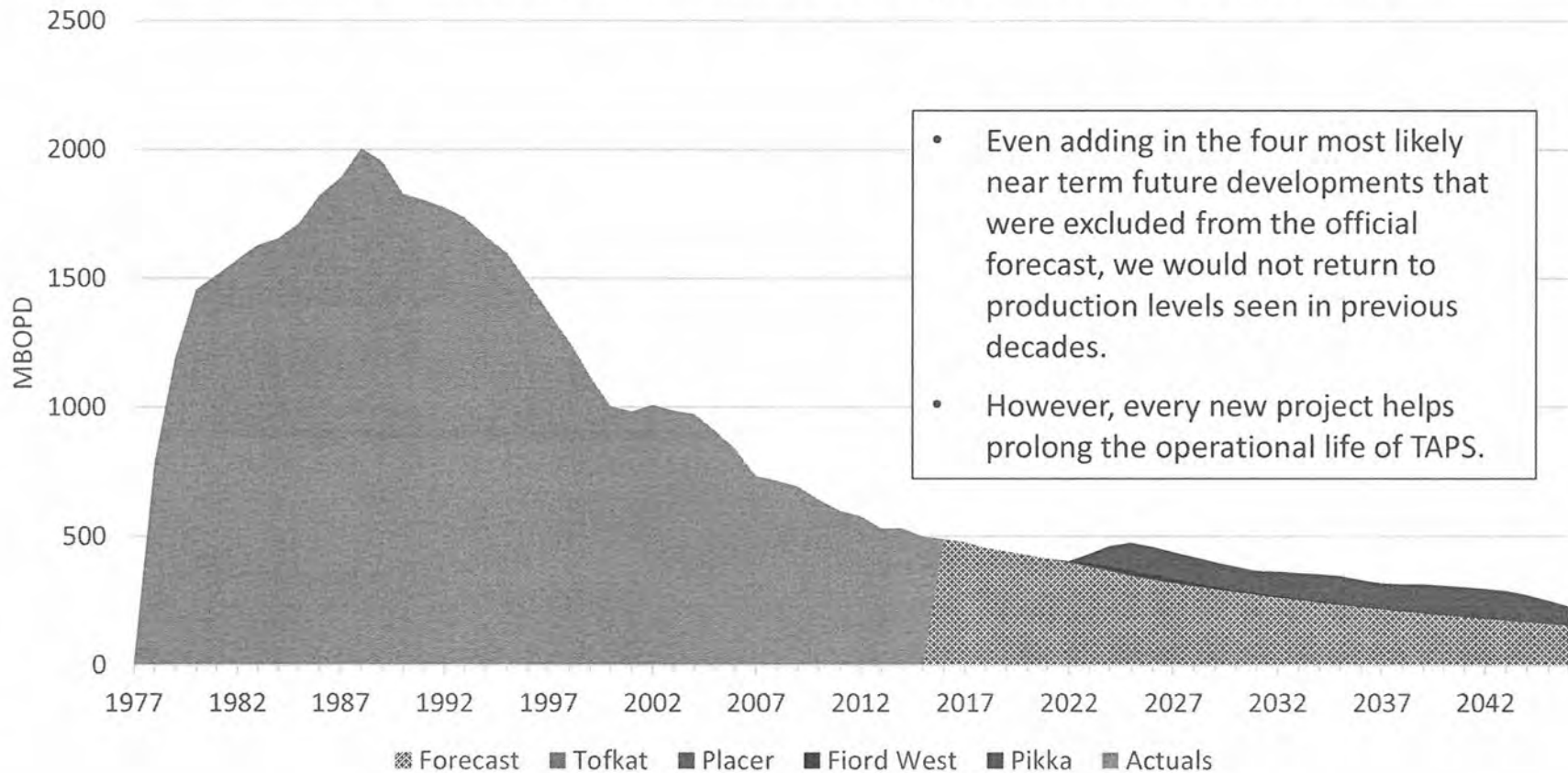


STATEWIDE PRODUCTION FORECAST



IMPACT OF SPECULATIVE FUTURE DEVELOPMENTS EXCLUDED FROM FORECAST

Historical ANS production, Official ANS forecast + 4 Most Likely Future Developments



- Even adding in the four most likely near term future developments that were excluded from the official forecast, we would not return to production levels seen in previous decades.
- However, every new project helps prolong the operational life of TAPS.

SUMMARY

- DNR has developed a new forecast methodology using industry standard probabilistic techniques designed to improve forecast accuracy.
- Mean production forecast over 10 year period shows a smaller decline rate (4%) versus historic decline rate since 1988 (5%)
- By employing a probabilistic approach, the range of outcomes can be compared in a statistically quantitative manner (P90, Mean, and P10)
- Method assigns price-dependency and occurrence risks to UD and UE production
- Projects are included or excluded from forecast based on estimated first oil date, factoring in technical, commercial and environmental considerations

THANK YOU!



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