Introductions

WHEN TRUST MATTERS

Navigation Risk Study of Central Atlantic Fairways

Presented by DNV
September 28, 2023

Agenda

The Assignment

Conclusions

Results

Modeling Details (Optional)

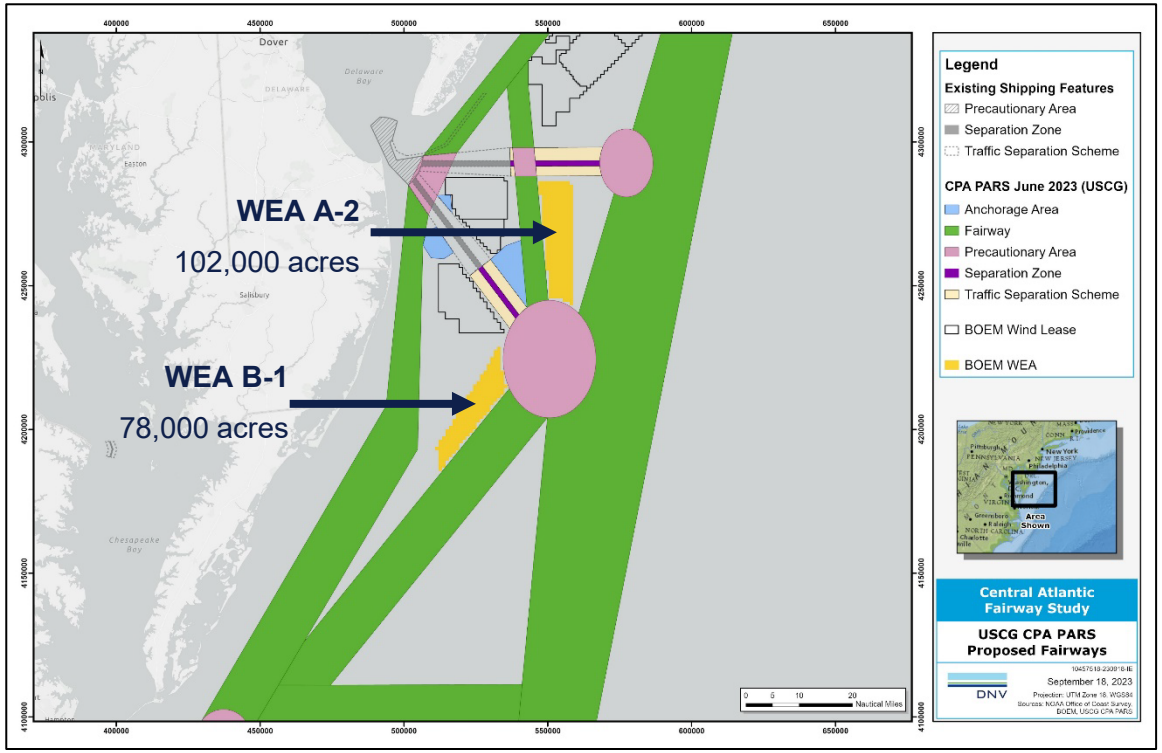
Assignment:

Compare two Fairway schemes:

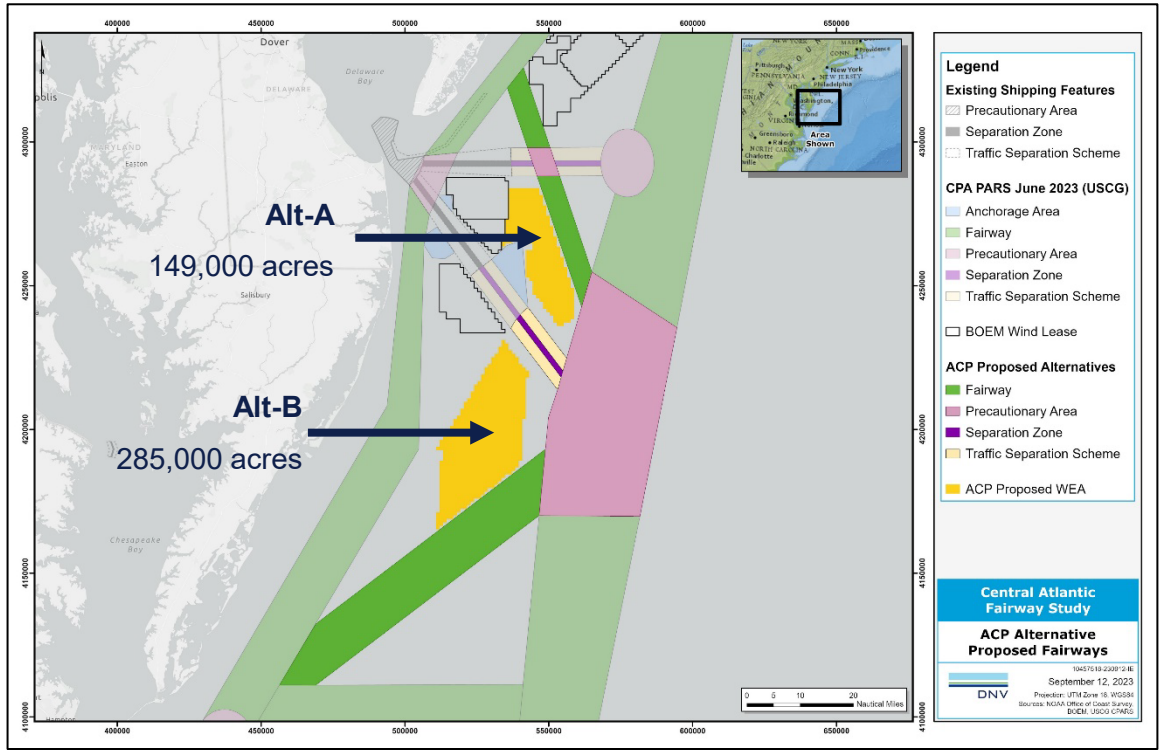
1. Risk (frequency) of collision, allision, grounding
2. Change in distance sailed/fuel consumed

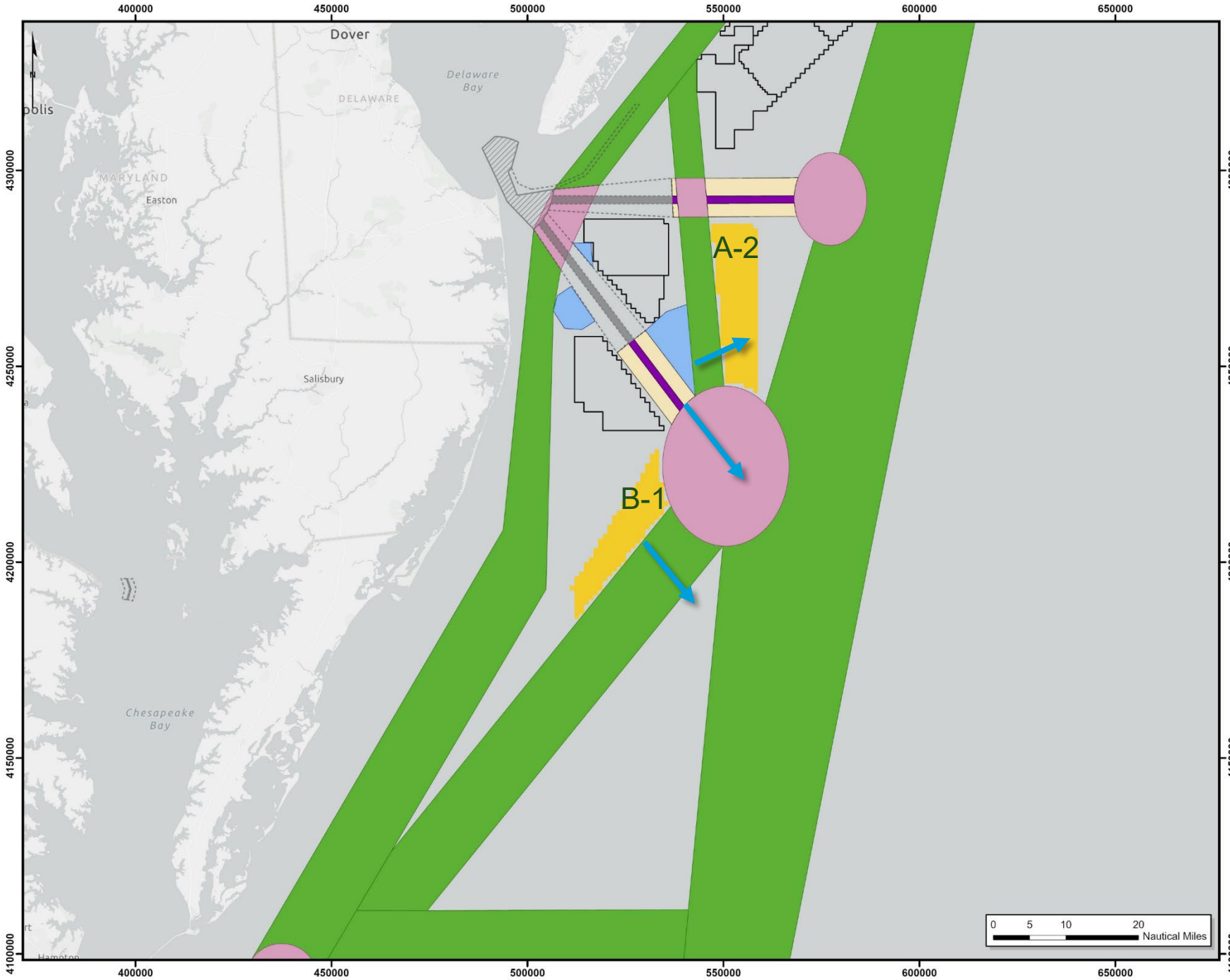
Fairways have a relationship to the potential size of WEAs

Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies (CPAPARS)



Suggested Alternative Fairways





Legend

Existing Shipping Features

- Precautionary Area
- Separation Zone
- Traffic Separation Scheme

CPA PARS June 2023 (USCG)

- Anchorage Area
- Fairway
- Precautionary Area
- Separation Zone
- Traffic Separation Scheme
- BOEM Wind Lease
- BOEM WEA

Central Atlantic Fairway Study

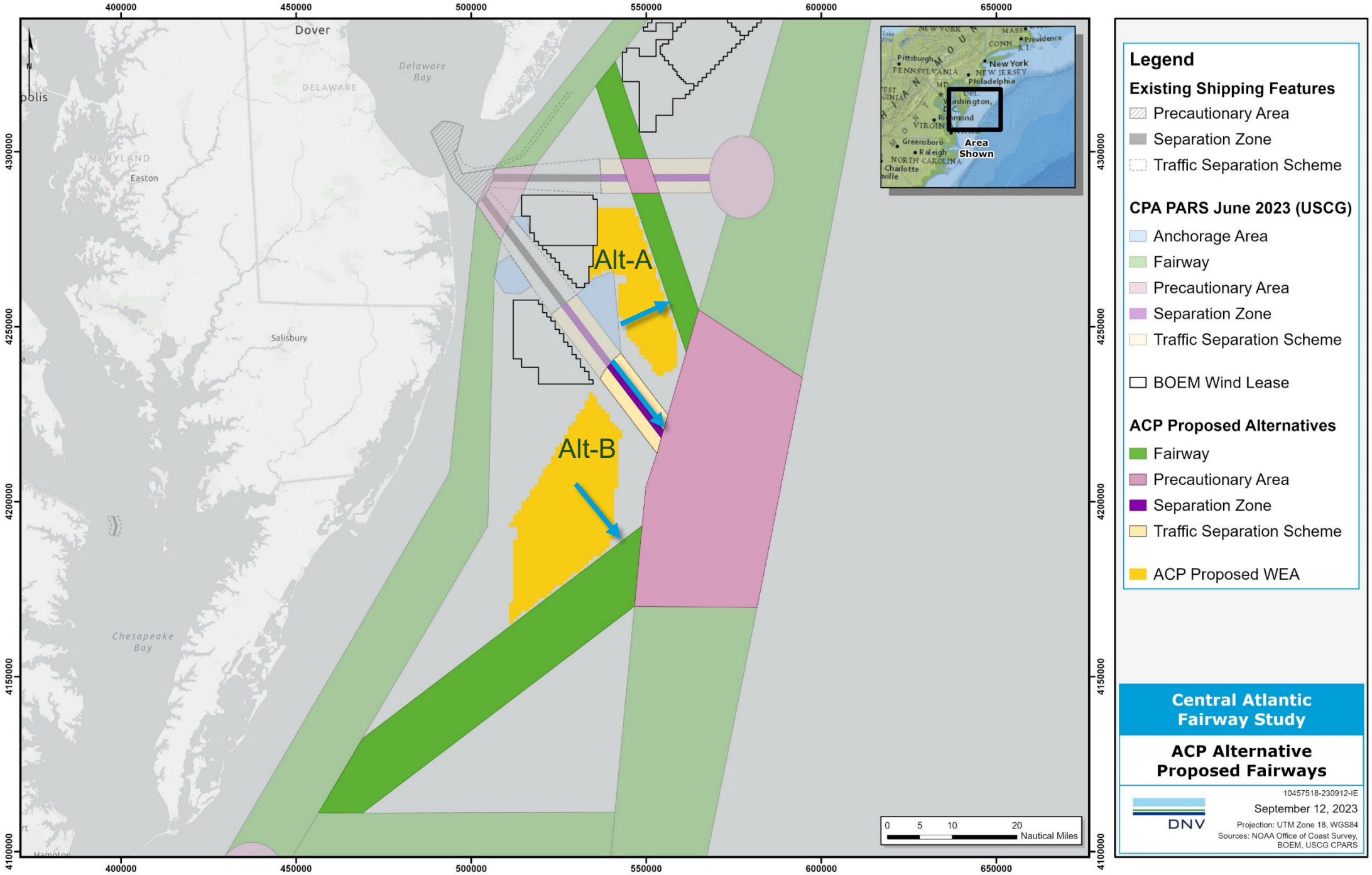
USCG CPA PARS Proposed Fairways

10457518-230918-IE

September 18, 2023

Projection: UTM Zone 18, WGS84

Sources: NOAA Office of Coast Survey, BOEM, USCG CPA PARS


400000
450000
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4150000
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Dover
Delaware Bay
DELAWARE
MARYLAND
Easton
Salisbury
Chesapeake Bay
Hampton
Alt-A
Alt-B
Area Shown
0 5 10 20
Nautical Miles
Legend
Existing Shipping Features
Precautionary Area
Separation Zone
Traffic Separation Scheme
CPA PARS June 2023 (USCG)
Anchorage Area
Fairway
Precautionary Area
Separation Zone
Traffic Separation Scheme
BOEM Wind Lease
ACP Proposed Alternatives
Fairway
Precautionary Area
Separation Zone
Traffic Separation Scheme
ACP Proposed WEA
Central Atlantic Fairway Study
ACP Alternative Proposed Fairways
10457518-230912-IE
September 12, 2023
Projection: UTM Zone 18, WGS84
Sources: NOAA Office of Coast Survey, BOEM, USCG CPARS
DNV

Conclusions - No major risk increases

Immaterial difference (≤1%) between CPAPARS and Alternative Fairways for:

- Grounding risk
- Collision risk for fishing/passenger/ pleasure vessels
- Nautical miles sailed per year by tugs

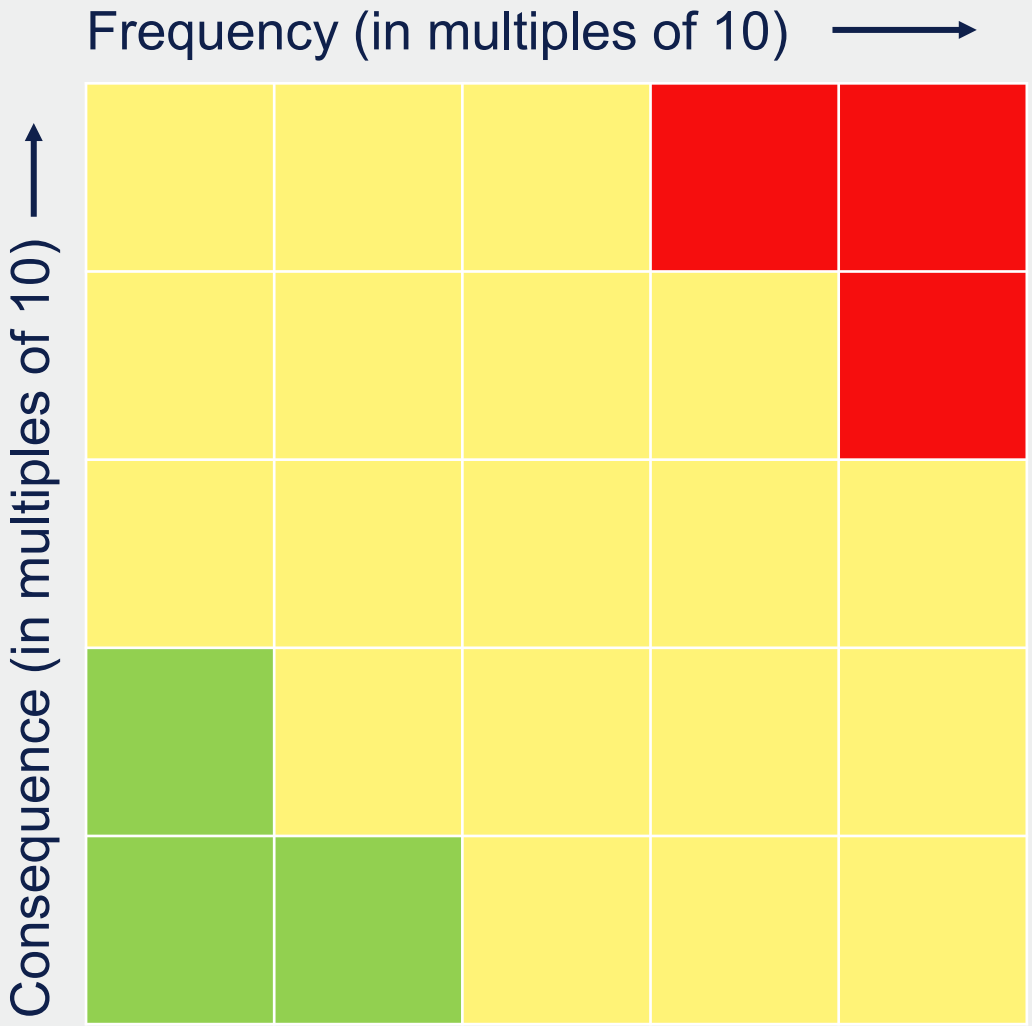
Small but meaningful differences between CPAPARS and Alternative Fairways (AF) for:

- Alternative has additional 26,000 NM/year (+5%) for Cargo/Tanker, due to longer TSS
- Increased allision and collision frequencies

	Collision (vessel-vessel)	Powered Allision (vessel-object)	Drift Allision (vessel-object)
CPAPARS	1 in 42 years	1 in 3.4 years	1 in 1.1 years
Alternative	1 in 40 years	1 in 2.9 years	1 in 1.0 years
Change in frequency	+4%	+17%	+11%

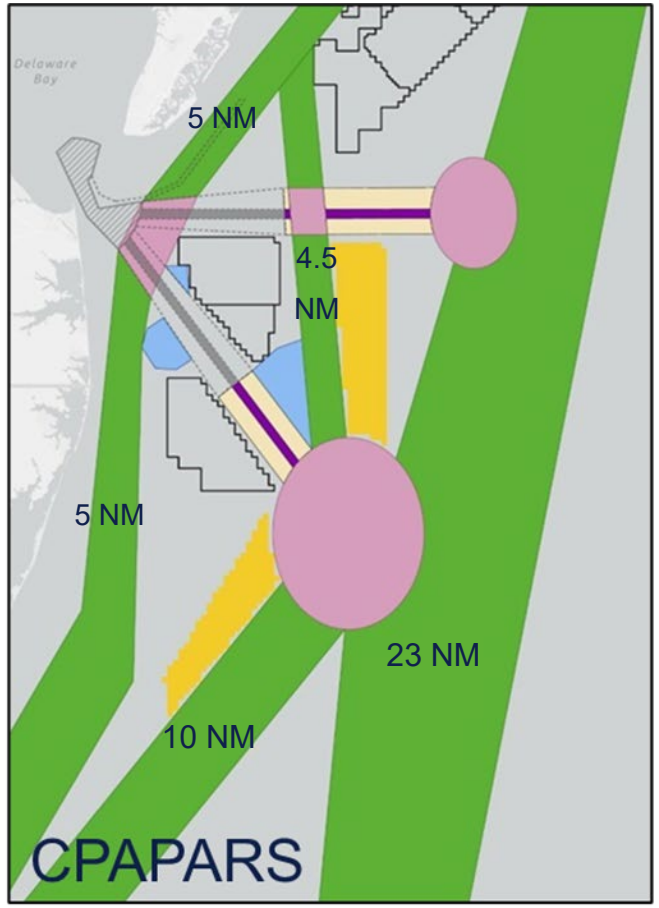
* Allision risk for the Alternative Fairways model is higher because it contains more wind turbine structures: 664 in the CPAPARS model versus 967 in the Alternative Fairways model. This is 303 more turbines, a 46% increase.

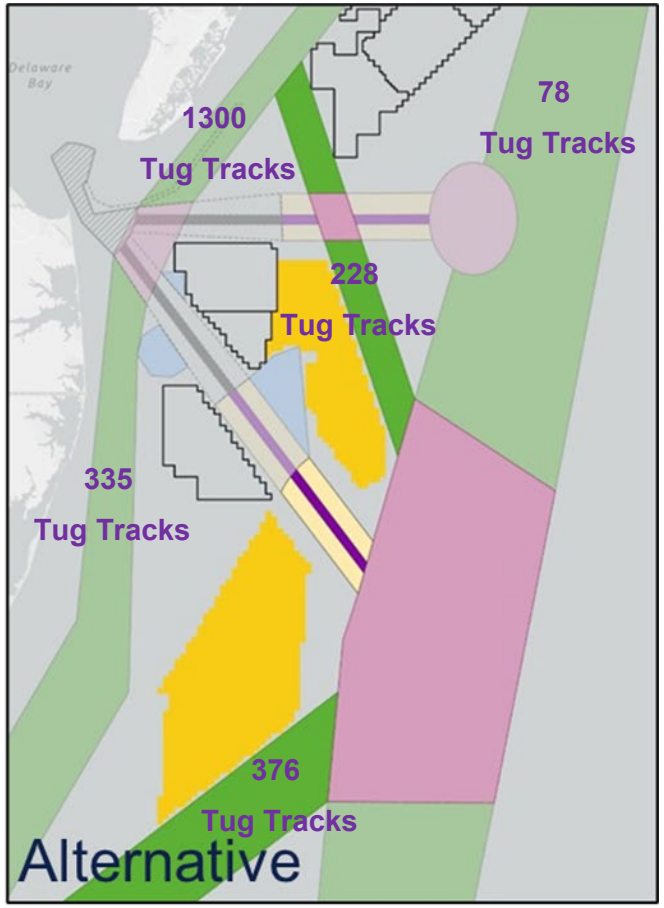
Risk Context



- The risks under discussion fall in the yellow area of a plausible risk matrix. Within the yellow area, the risks merit mitigation when it is cost-effective to do so.
- The modeling shows that the risks from the CPAPARS fairways and the Alternative fairways lie within the same 5x5 risk matrix box.
- The Alternative fairways do not affect the risk enough to change which box any particular risk lies within.

Collision Results Overview



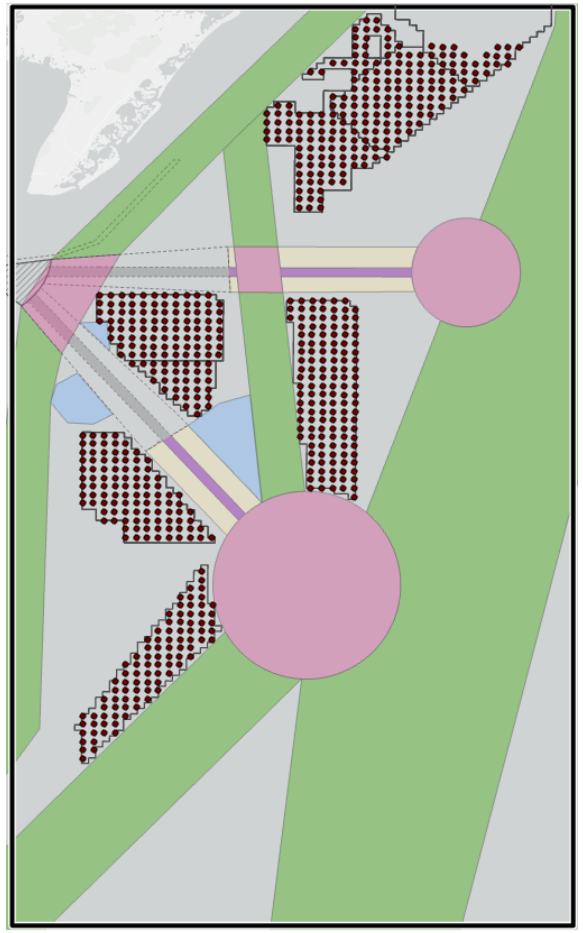


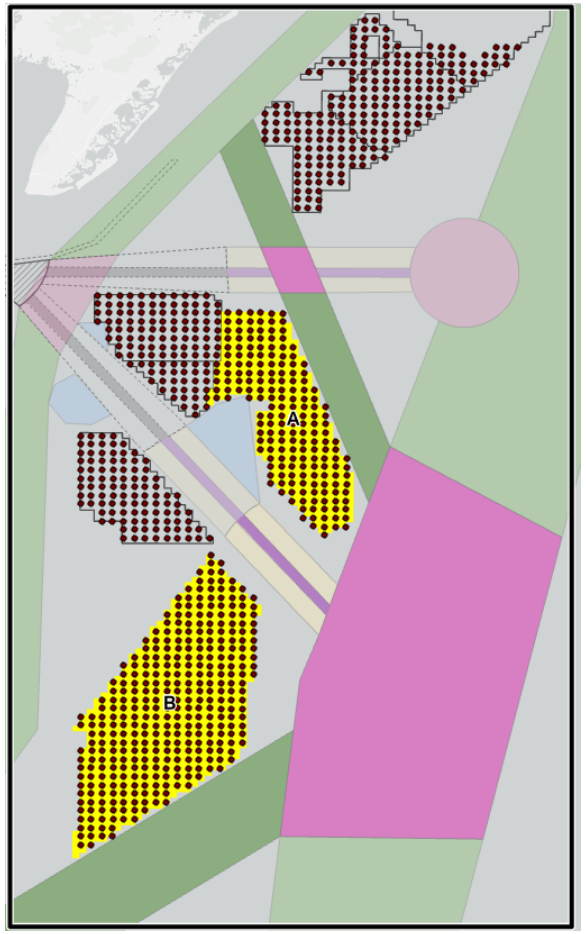
Difference in collision recurrence

Tug	Collision
CPAPARS	1 in 840 years
Alternative	1 in 820 years
Change	+2%

Cargo/Tanker	Collision
CPAPARS	1 in 120 years
Alternative	1 in 110 years
Change	+13%

Allision Results Overview



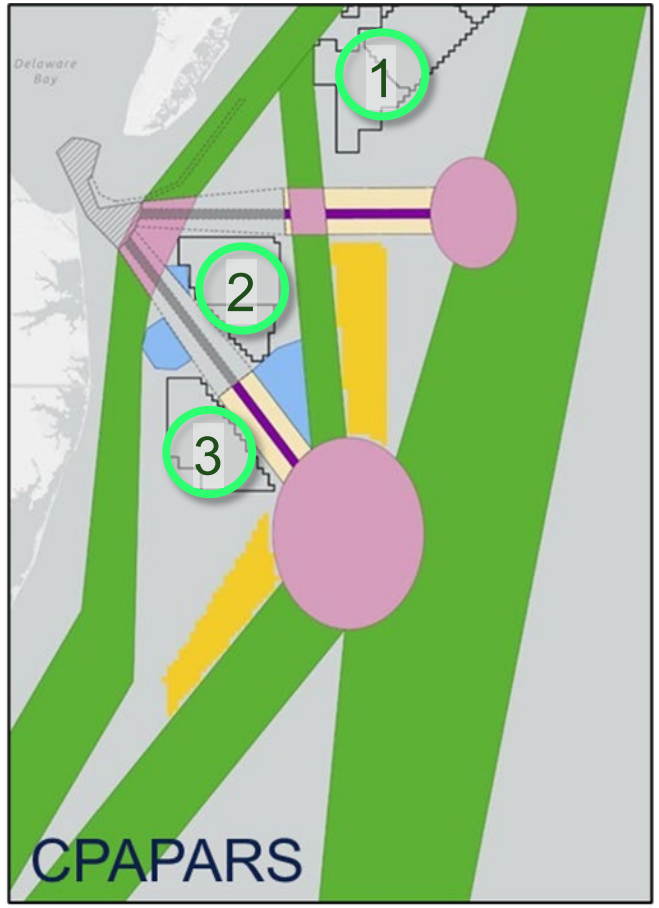


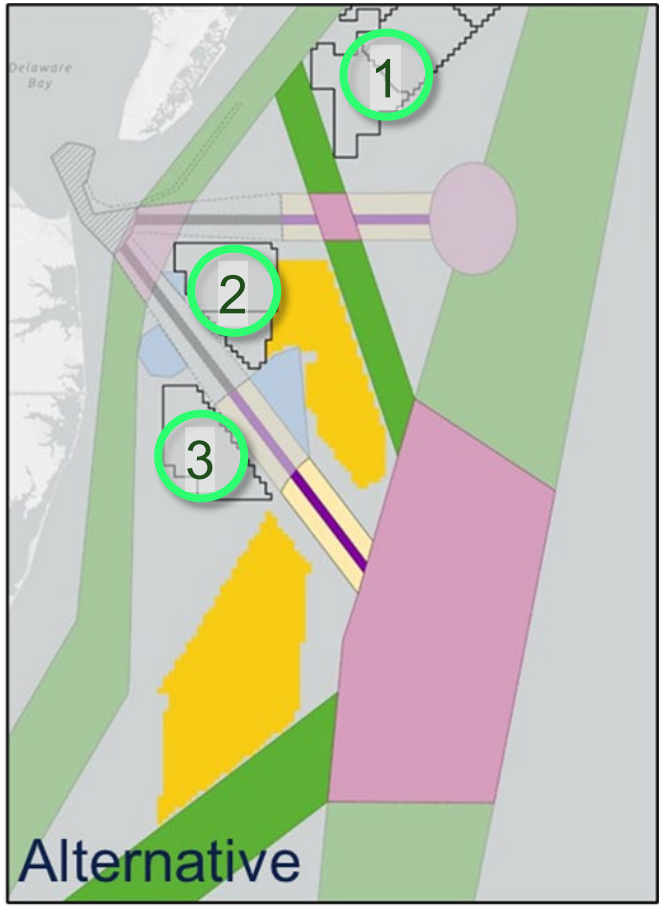
Difference in allision recurrence

Tugs	Powered allision	Drift allision
CPAPARS	1 every 14 years	1 every 2.8 years
Alternative	1 every 12 years	1 every 2.9 years
Change	+12%	-4%

Cargo/ Tanker	Powered allision	Drift allision
CPAPARS	1 every 18 years	1 every 3.8 years
Alternative	1 every 16 years	1 every 2.9 years
Change	+15%	+32%

Allision – Differences by location
Existing Offshore Wind Leases





(1) Ocean Wind/Atlantic Shores S

Tug	0.004 allisions/yr	+2%
Cargo	<0.0005 allisions/yr	-1%

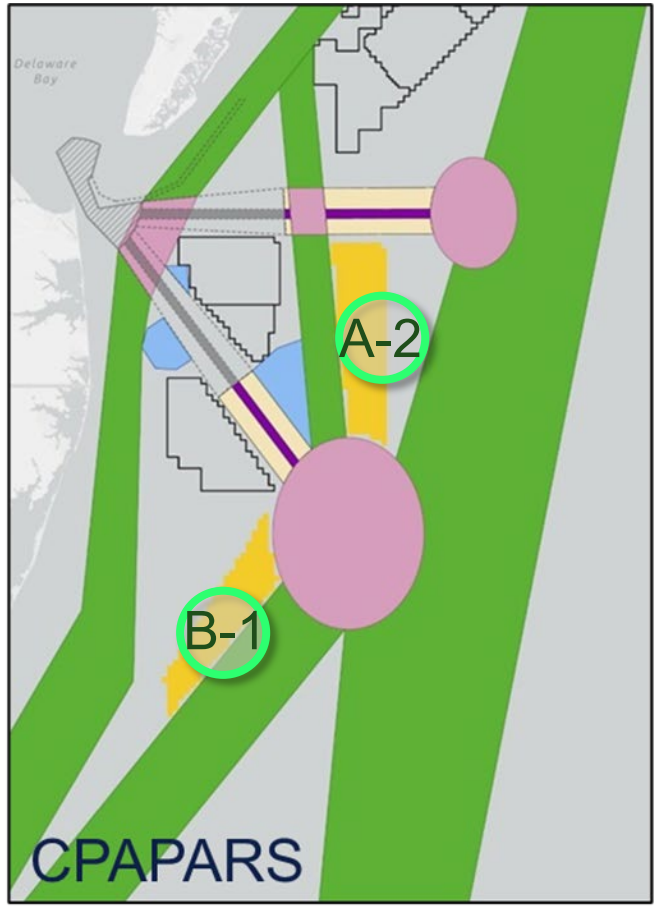
(2) Garden State/Skipjack

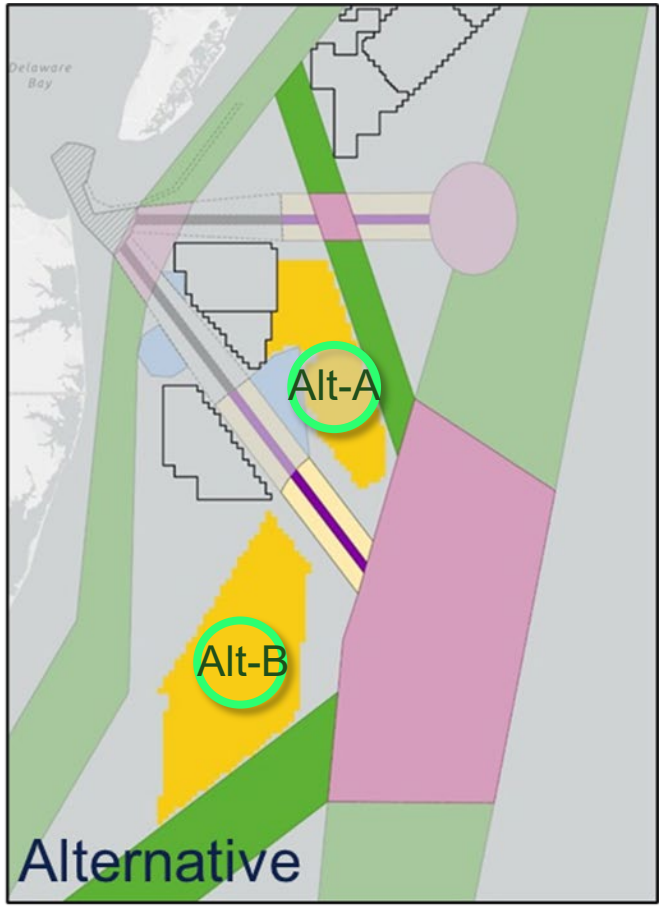
Tug	-0.011 allisions/yr	-12%
Cargo	-0.001 allisions/yr	-1%

(3) US Wind

Tug	-0.005 allisions/yr	-14%
Cargo	-0.001 allisions/yr	-1%

Allision – Differences by location
Wind Energy Areas





Alt-A compared to WEA A-2

Tug	0.005 allisions/yr	+7%
Cargo	0.029 allisions/yr	+41%

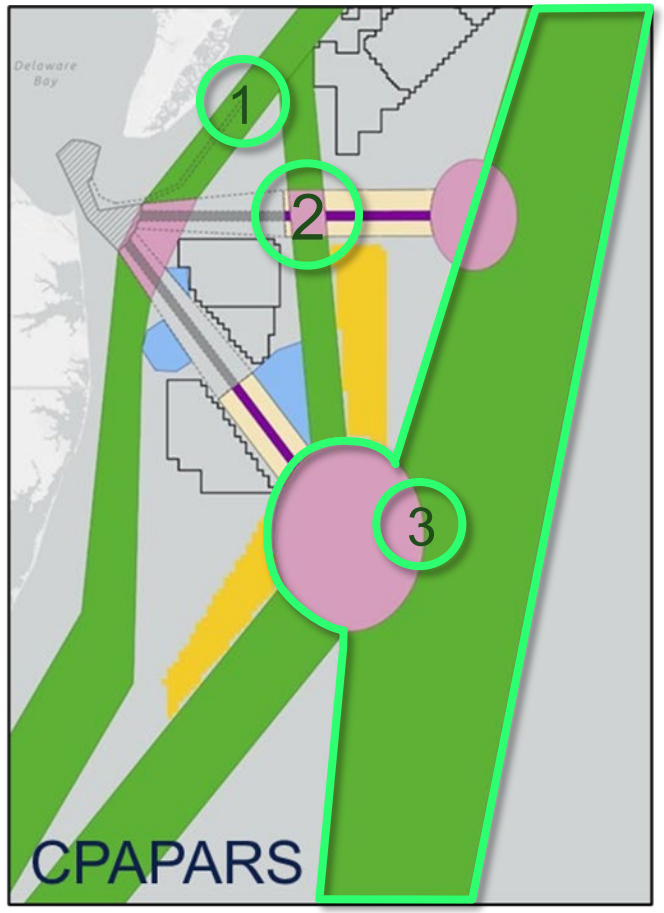
Alt-B compared to WEA B-1*

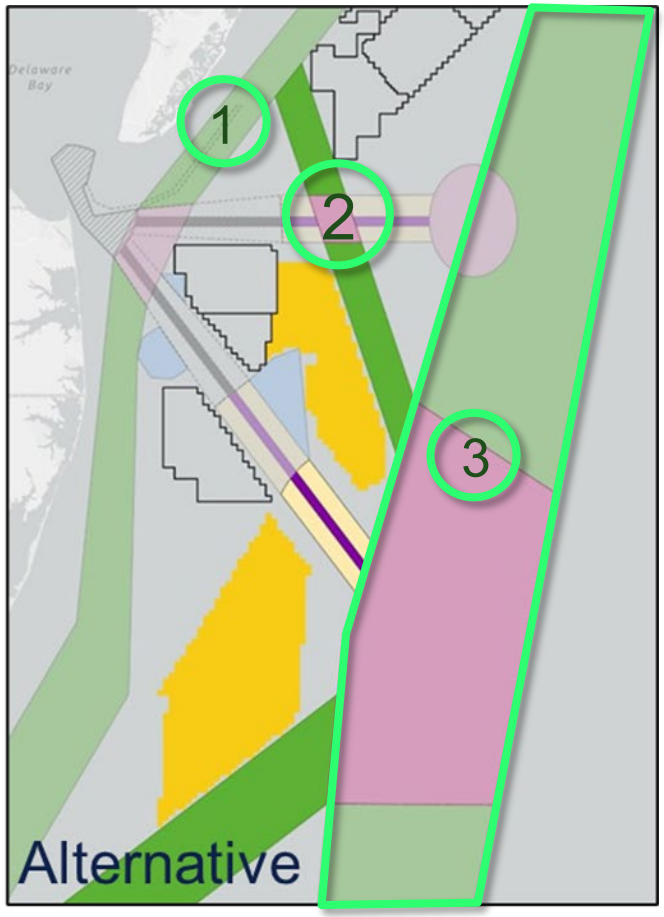
Tug	0.002 allisions/yr	+3%
Cargo	0.065 allisions/yr	+148%

*If Alt-B is set back from the fairway, the cargo and tug allision risk will decrease significantly

* <0.0001 allisions per year

Collision – Differences by location





(1) Coastal fairway incl merge from (2)

Tug	<0.0005 collisions/yr	-
Cargo	<0.0005 collisions/yr	-

(2) TSS + fairway

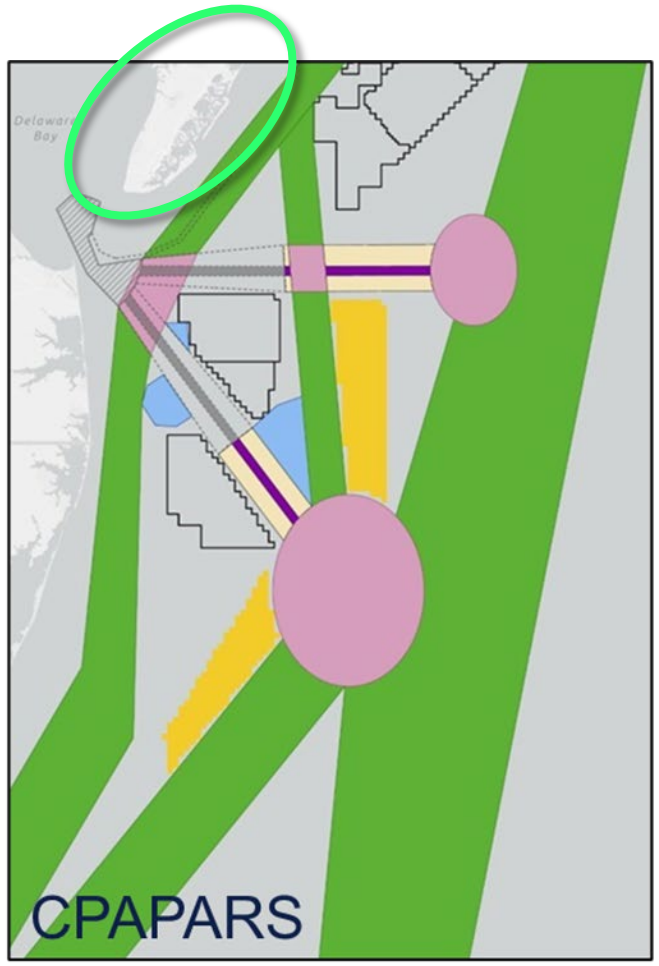
Tug	<0.0005 collisions/yr	-
Cargo	<0.0005 collisions/yr	-

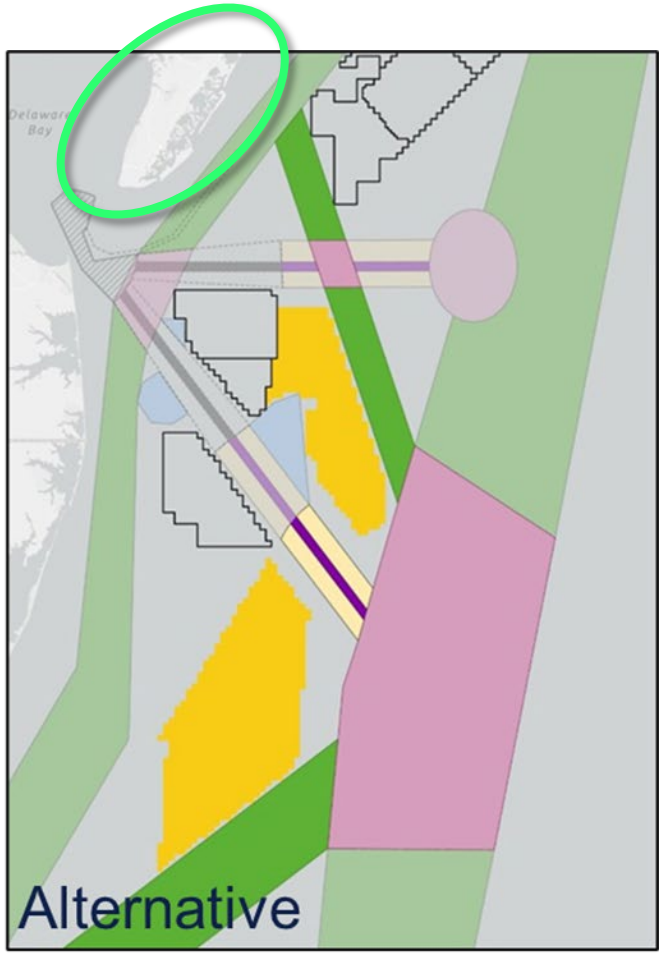
(3) Precautionary Area and offshore fairway

Tug	<0.0005 collisions/yr	-
Cargo	0.001 collisions/yr	-

* <0.0001 collisions per year

Grounding Results Overview



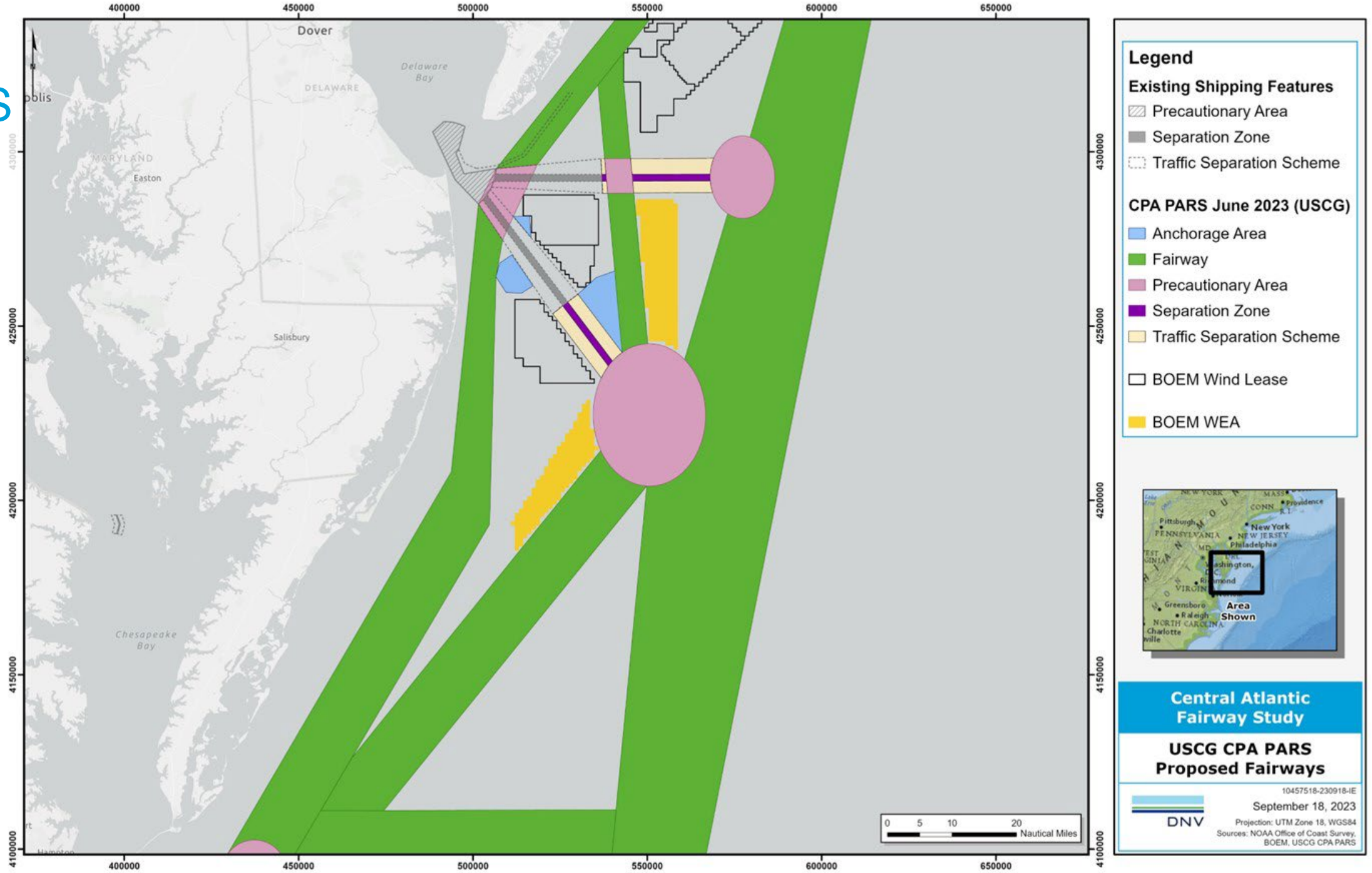


Difference in grounding recurrence

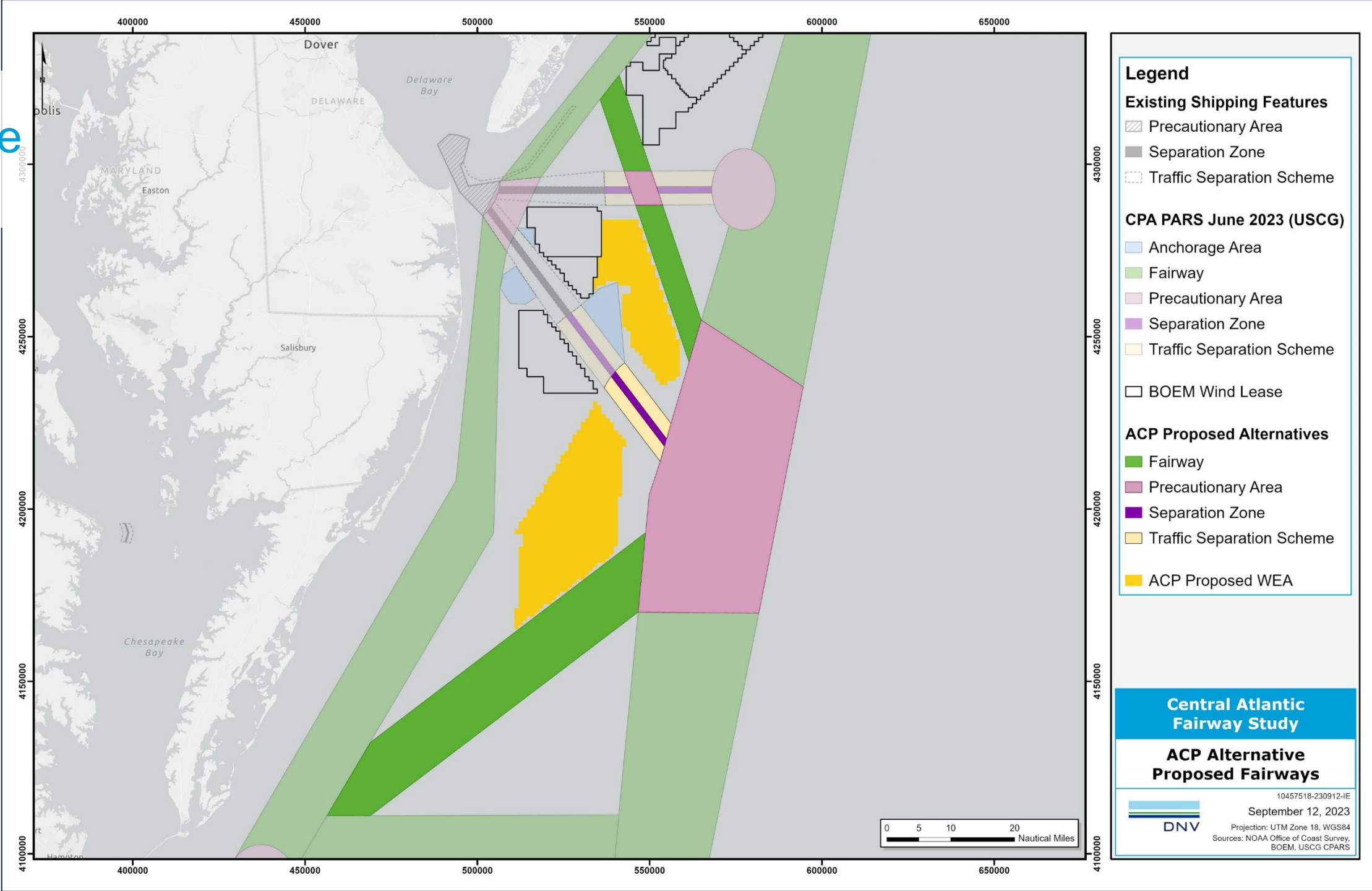
Tugs	Powered grounding	Drift grounding
CPAPARS	1 every 1,200 years	1 every 19 years
Alternative	1 every 1,200 years	1 every 19 years
Change	+3%	<1%

Cargo/ Tanker	Powered grounding	Drift grounding
CPAPARS	1 every 11 million years	1 every 980 years
Alternative	1 every 13 million years	1 every 980 years
Decrease	-9%	<1%

CPAPARS Fairways



Proposed Alternative Fairways



Thank You

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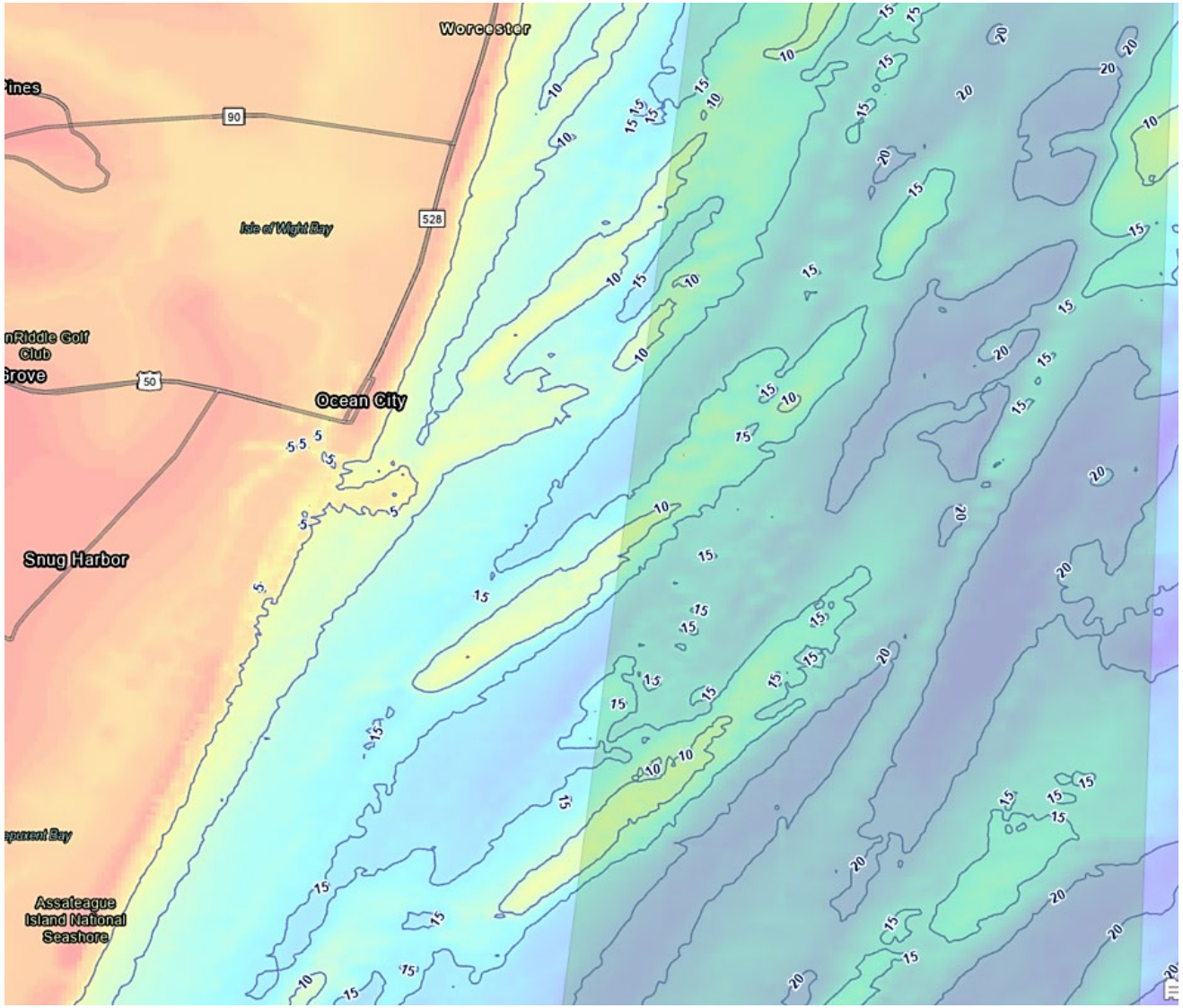
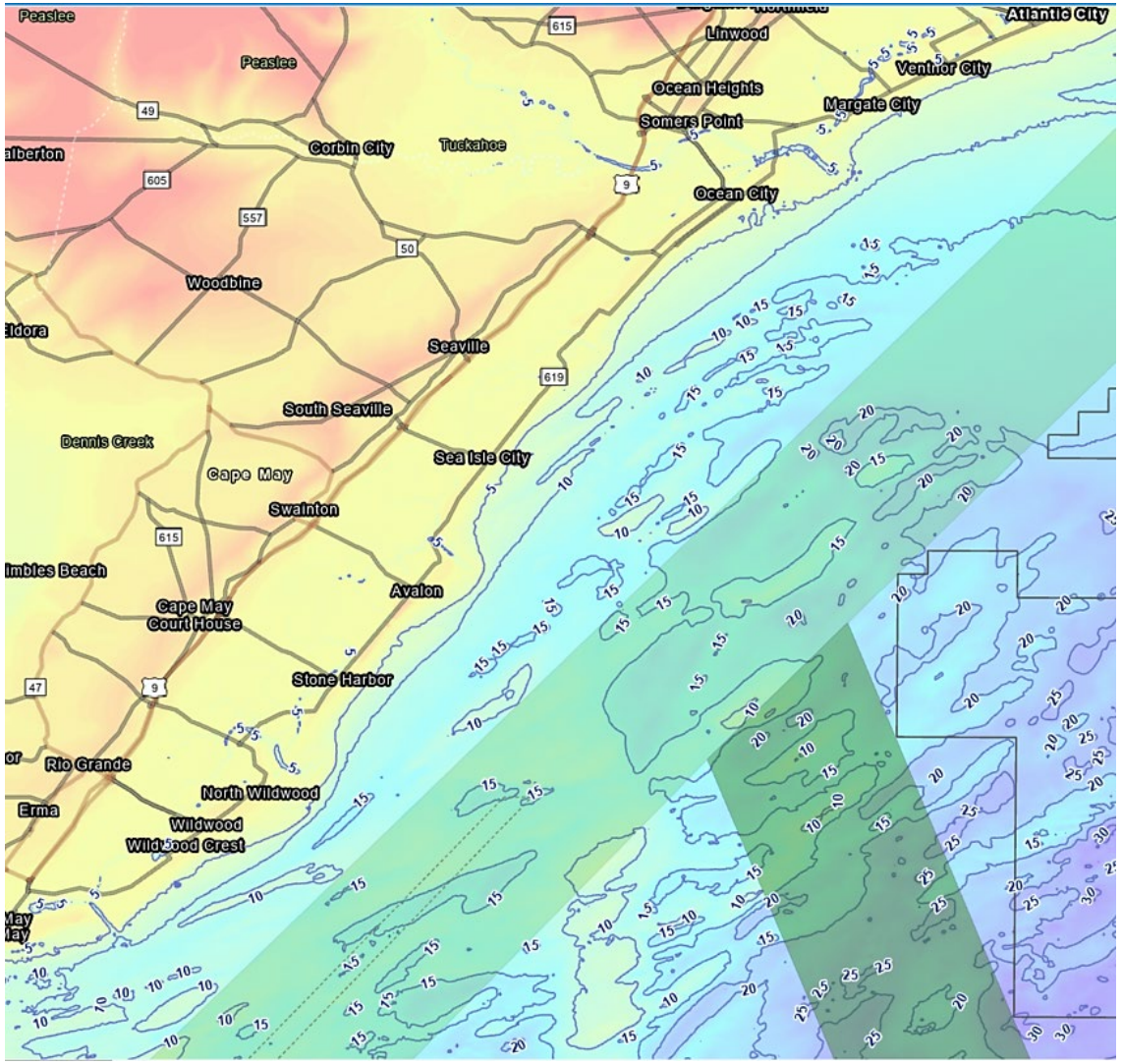
Bathymetry Ocean City, MD Inlet



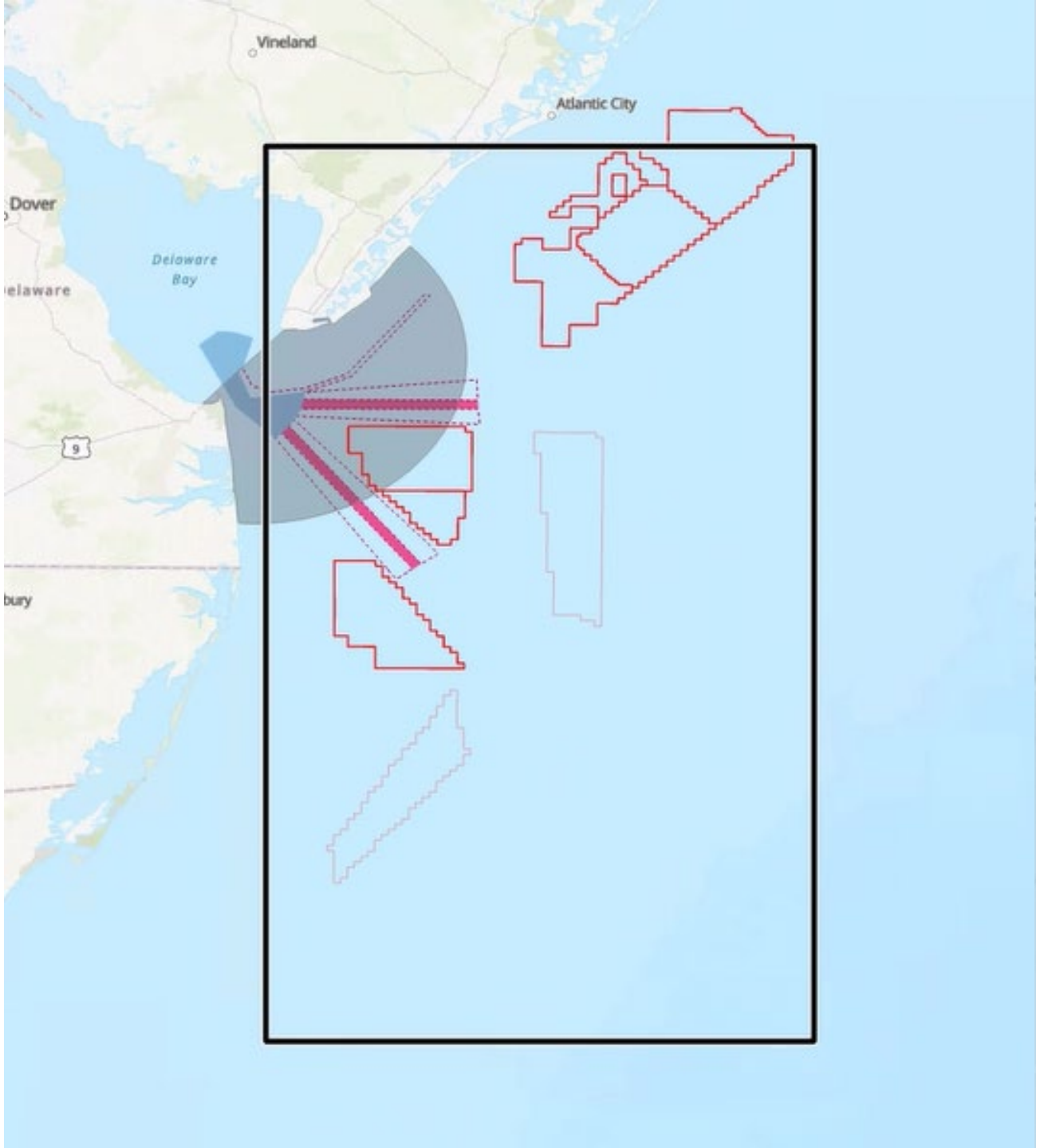
Bathymetry Hereford Inlet and Ocean City, NJ



Model Documentation

Model Study Area

- Modeling focused on the area with changes to traffic interactions which are meaningful to safety risk.
- The only coast in the model was the southern NJ coast.



Modeling Cases

ID	Description	Purpose	Marine Traffic Routes for Commercial Vessels*	Offshore Wind Structures (20 m diameter**)

1a	Case 1 Verification	For DNV verification purposes	• Commercial vessels take only:
			  • TSS and
			  • CPAPARS fairways
				None

1b	**CPAPARS Case**	Baseline	• Commercial vessels take only:
			  • TSS and
			  • CPAPARS fairways
				• Existing leases and BOEM WEAs filled with turbines
				• Assumed 1x1 NM layout
				• WEA turbines do not encroach within 2 NM of a TSS
				• Structures removed at north end of Study Area to maintain <1000 structures for all models

2a	Case 2 Verification	For DNV verification purposes	• Commercial vessels take only
			  • TSS,
			  • CPAPARS fairways except where they take the two Alternative Fairways†
				None

2b	**Alternative Fairways Case**	Alternative	• Commercial vessels take only
			  • TSS,
			  • CPAPARS fairways except where they take the two Alternative Fairways†
				Existing leases and alternative WEAs filled with turbines
				Assumed 1x1 NM layout
				WEA turbines do not encroach within 2 NM of a TSS
				Structures removed at north end of Study Area to maintain <1000 structures for all models

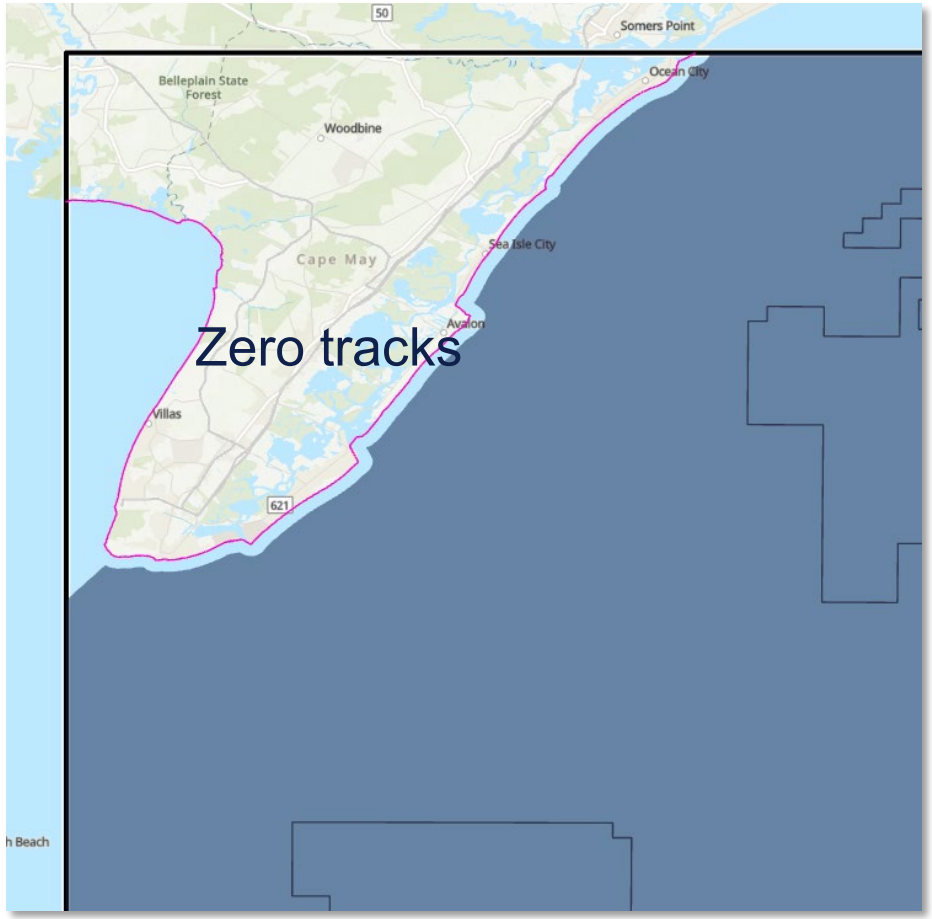
* All passenger, pleasure (recreational), fishing, and other vessel traffic were assigned routes based on AIS data traffic patterns

** A 28 m square is modeled because it encompasses the assumed 20 m diameter monopile

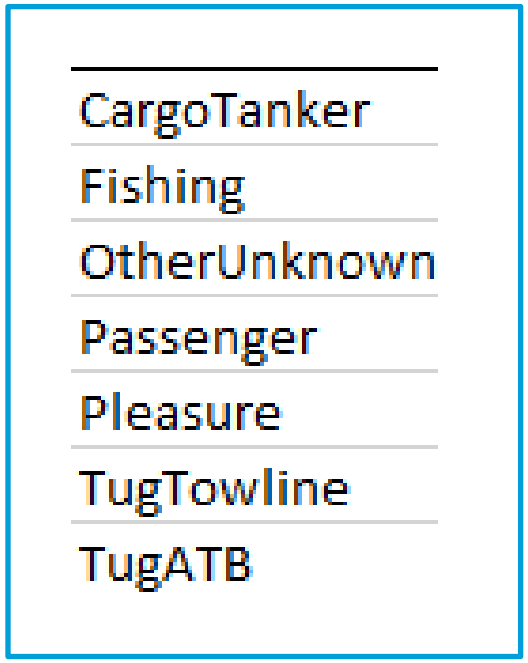
† The Off Delaware Bay to New Jersey Connector Fairway and the Chesapeake Bay to Delaware Bay Eastern Approach Cutoff Fairway

DNV

Inshore and Coastal AIS Tracks Clipped Out of Modeling Effort



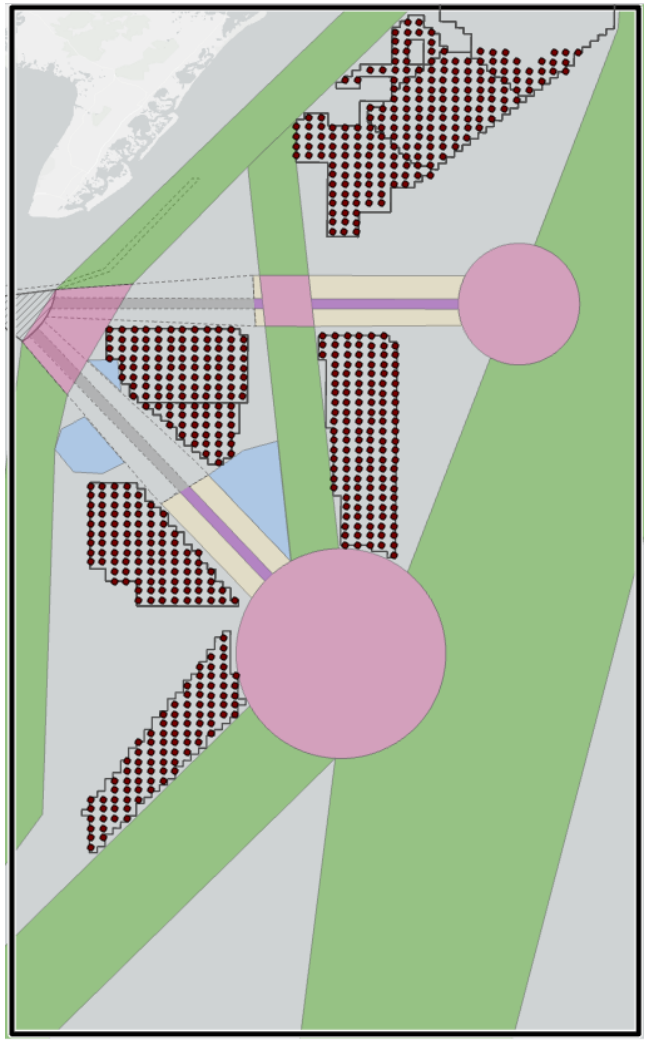
Vessel Types



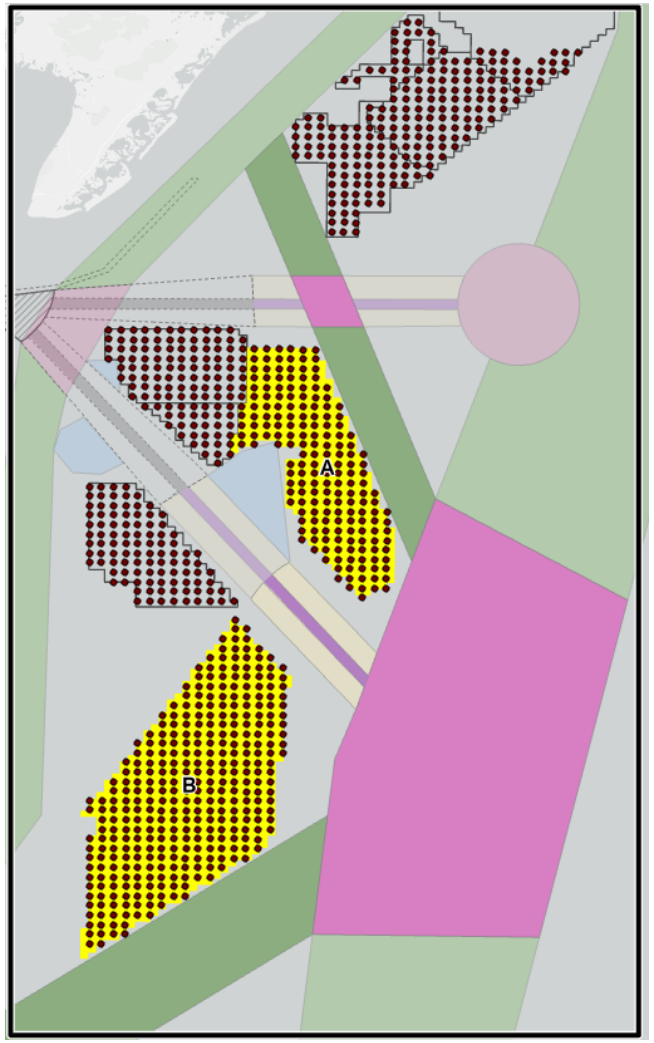
CargoTanker
Fishing
OtherUnknown
Passenger
Pleasure
TugTowline
TugATB

AIS tug transits in the Study Area were assumed to be 50% towline and 50% ATB. Towlines were assumed to be 920 m in length to account for the length of the tow.

Modeled layouts of wind turbine structures

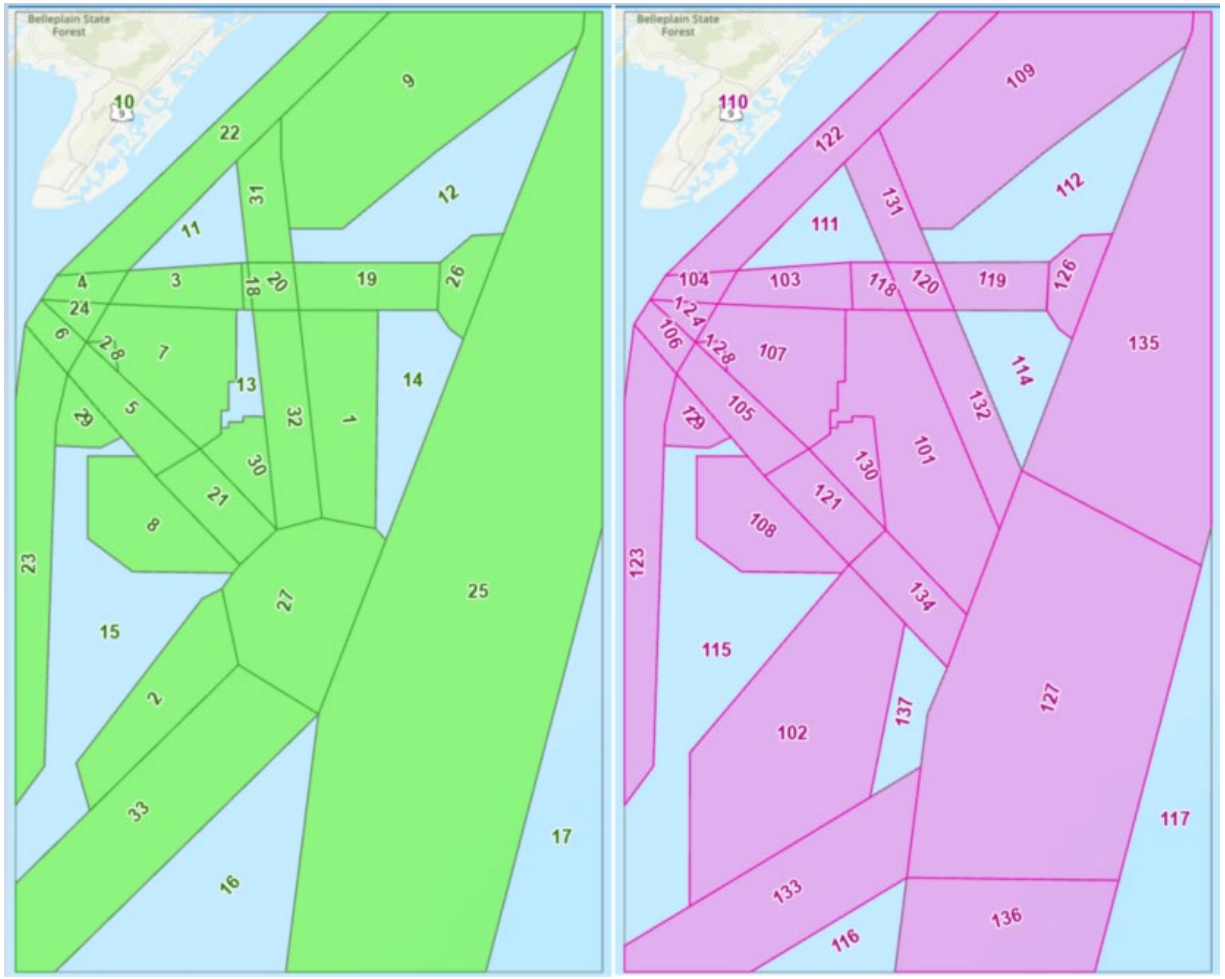


CPAPARS



Alternative

Subareas Enable Spatial Summary of Results

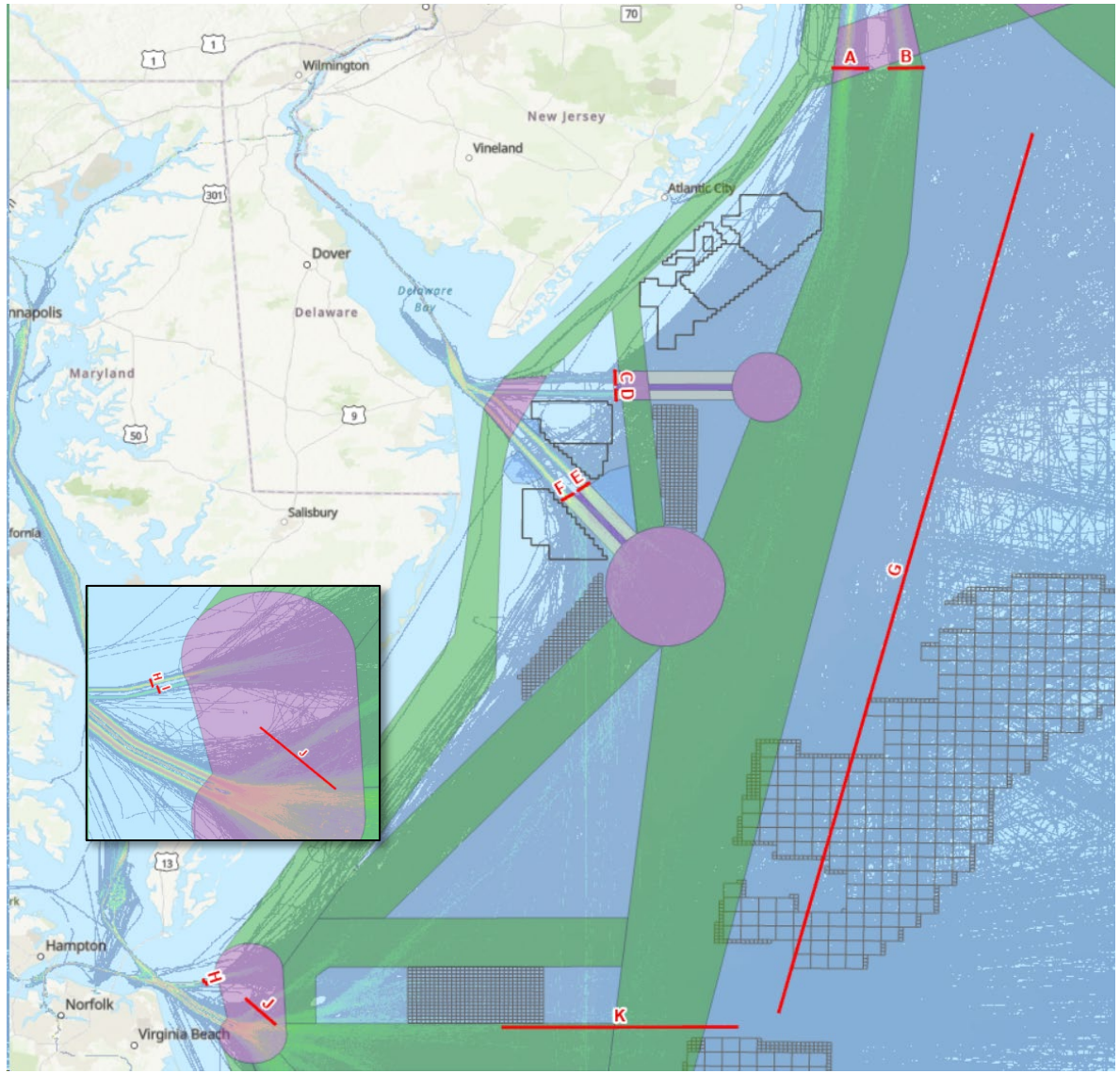


CPAPARS Alternative

Subareas from CPAPARS and Alternative Fairways were “mapped” to enable a comparison

Information on AIS Traffic: Cargo and Tanker Vessels

Transect	AIS Track count
A	1692
B	1194
C	359
D	512
E	1556
F	1677
G	2717
H	418
I	168
J	1327
K	2078

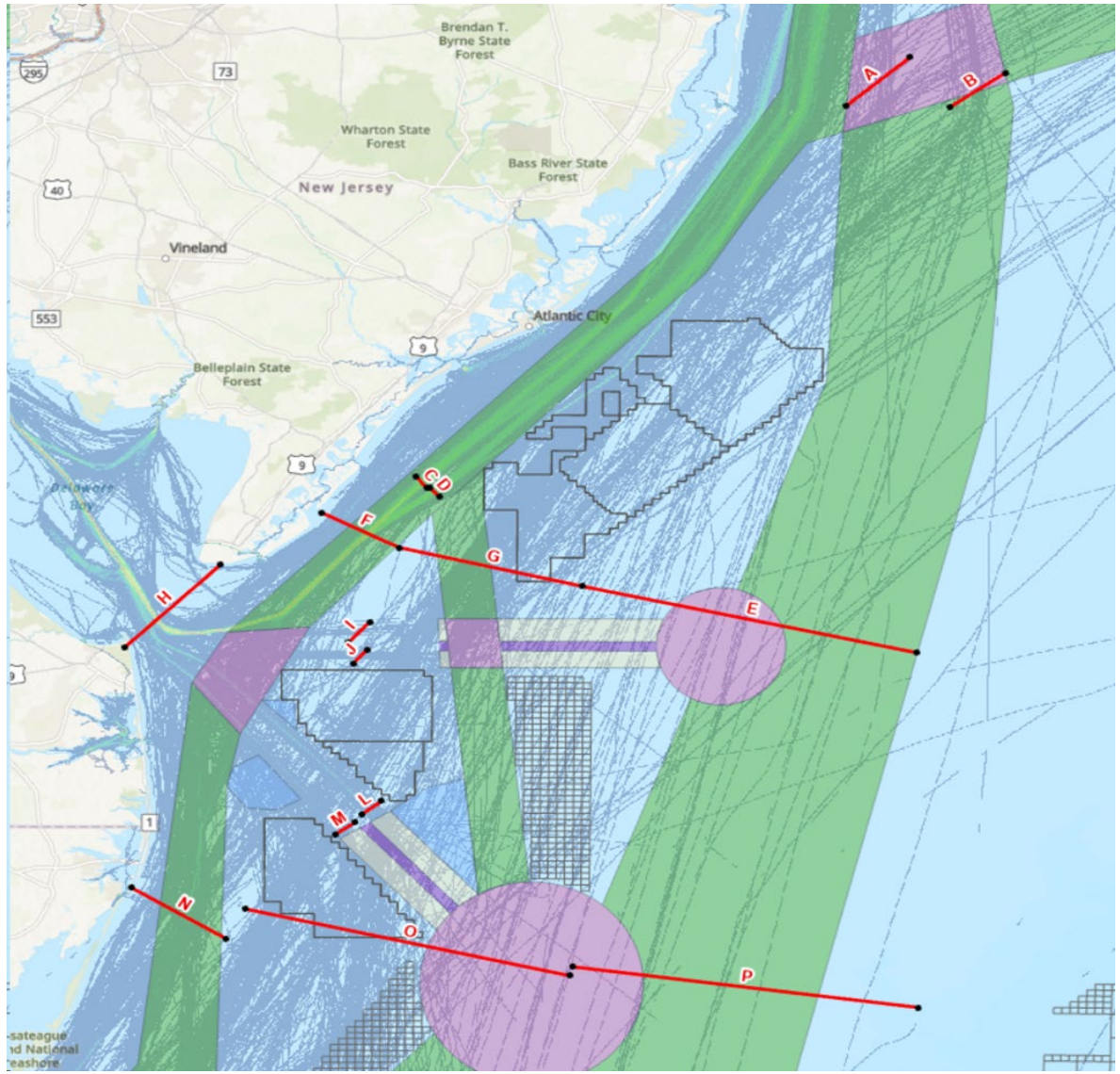


National AIS data: March 29, 2022 - March 28, 2023

Baseline AIS Traffic: Tug Vessels

Transect	AIS Track count
A	41
B	37
C	519
D	417
E	54
F	1072
G	244
H	990
I	14
J	47
L	91
M	57
N	335
O	376
P	17

National AIS data: March 29, 2022 - March 28, 2023

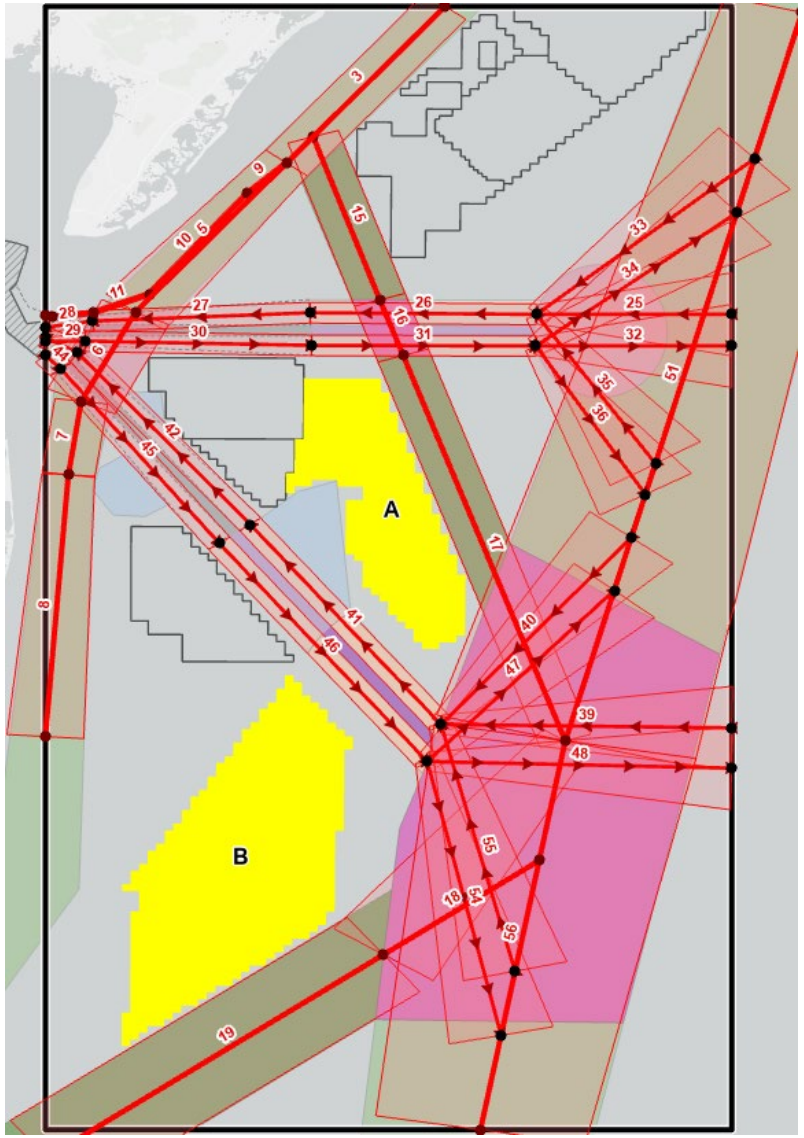


Routes Represent the Traffic for Modeling

Each route line has:

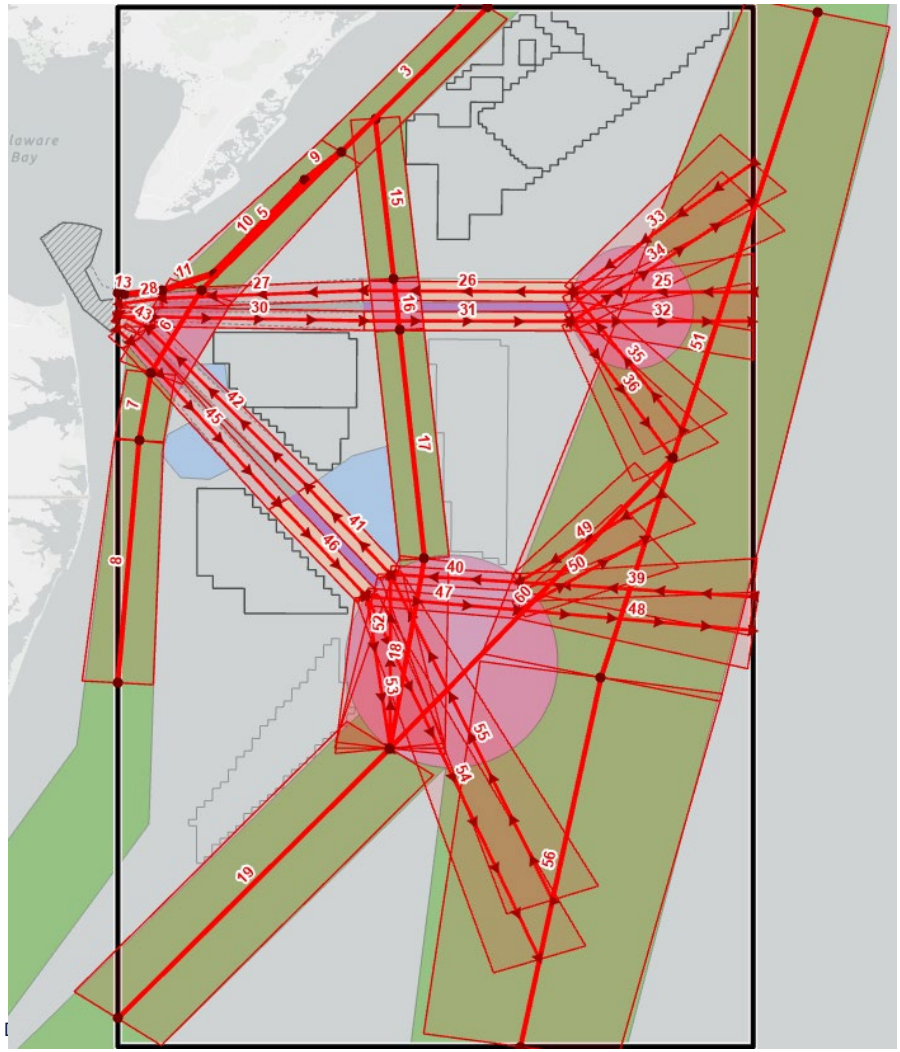
- A width at each end.
- A traffic density distribution across the width.
- Assigned transiting traffic appropriate to each vessel type based on AIS tracks.
- A separate, analogous set of routes were developed for the Alternative Fairways.

- Routing effort focused on route structure for merchant traffic.
  - A simplified approach was taken to represent other types of traffic in the model.
  - Cruise ships were not identified and assigned deep draft routes, but typically receive special attention because they are very large ships in the generally small passenger ship type.



Route Structure for CPAPARS Scenario

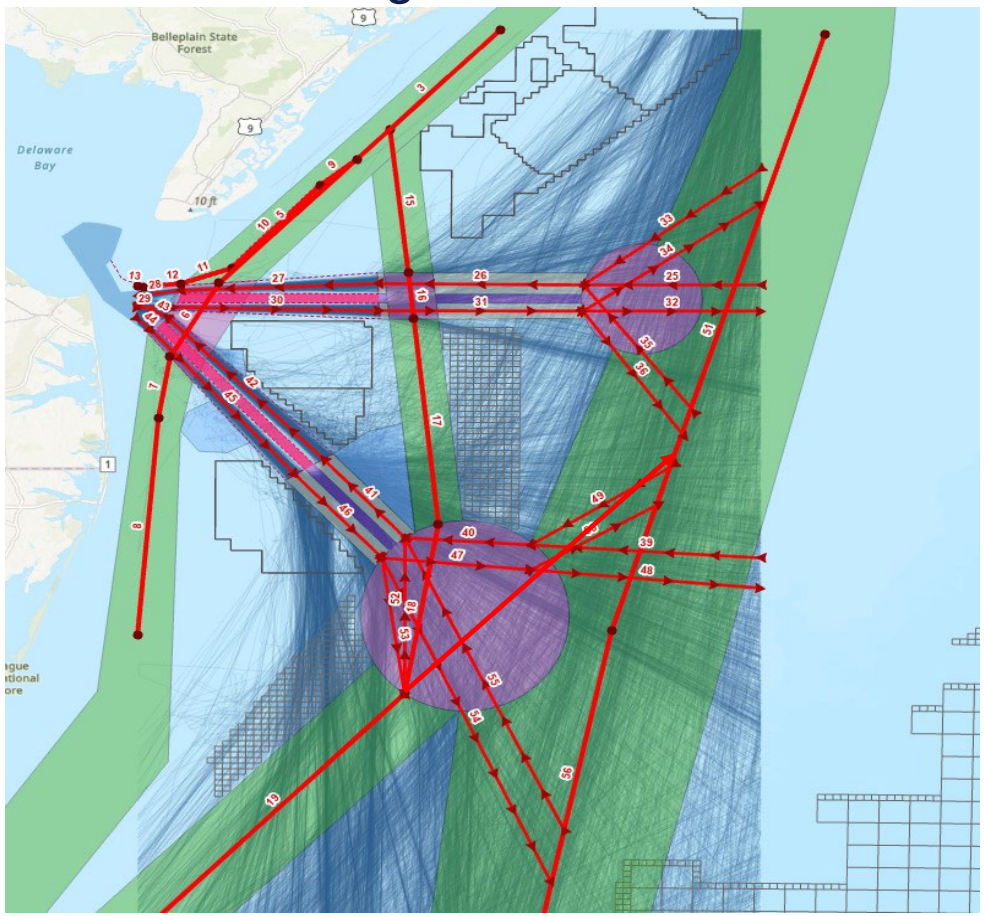
Cargo and tug traffic



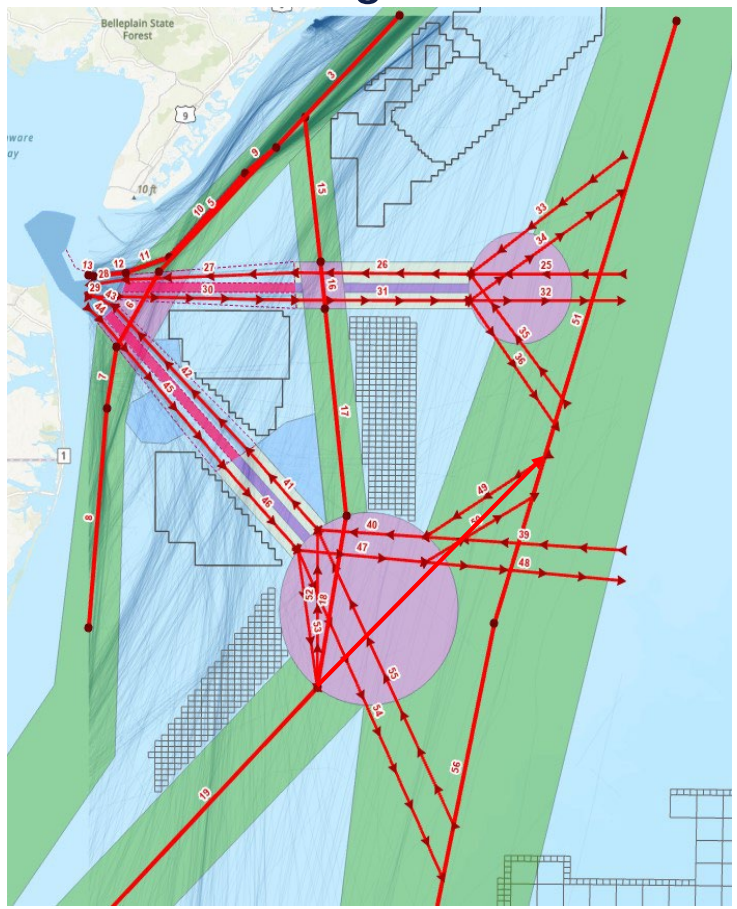
All other traffic

Route Schemes for CPAPARS Merchant Traffic with Tracks

Routes and Cargo/Tanker Tracks

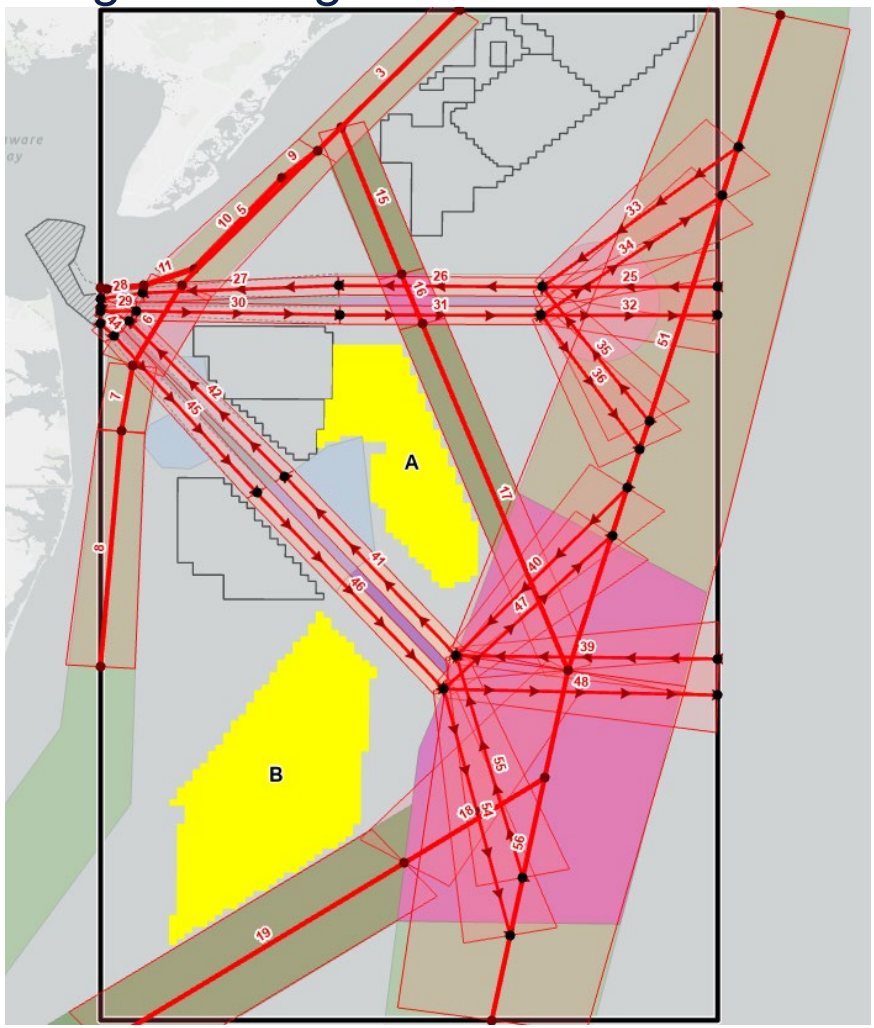


Routes and Tug Tracks

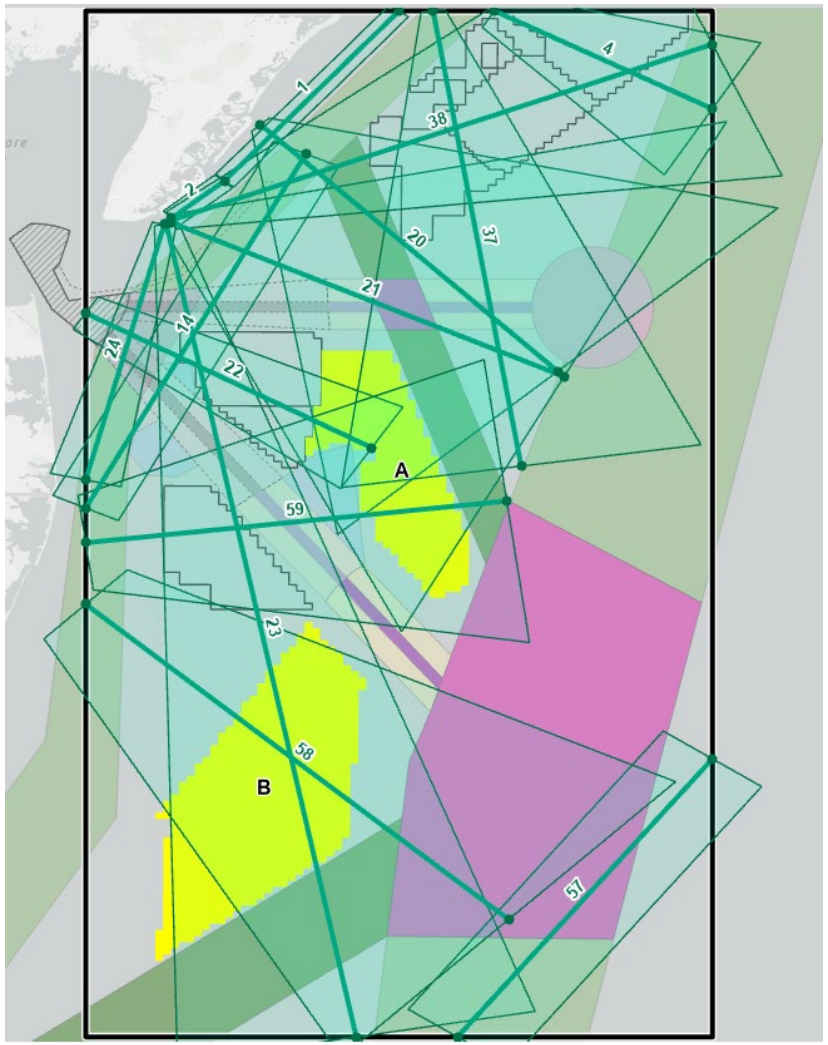


Route Structure for Alternative Scenario

Cargo and tug traffic



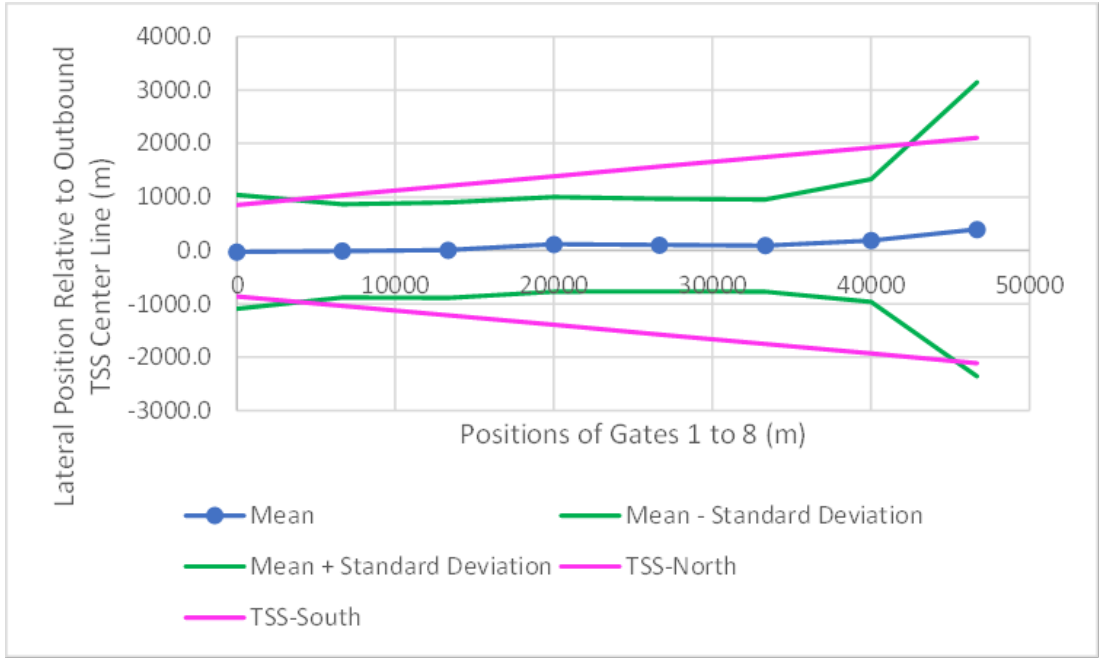
All other traffic



Philosophy for Assigning Merchant AIS Traffic to Fairways

- Based on analysis of tracks per vessel type from Virginia to New York.
- All merchant traffic was required to be assigned to a TSS or fairway – none were assigned to any other routes.
- Based on AIS, cargo/tankers solely approach ports via TSS, so none were assigned to the coastal fairways.
- All northbound traffic from VA bound to/from NY was assigned to the furthest offshore fairway.
- Only ATBs transit the NY TSS. All other tugs were assigned to either the coastal or the cutoff fairways based on which half of the DE SE TSS they cross. (NW -> coastal; SW -> cutoff fairway).

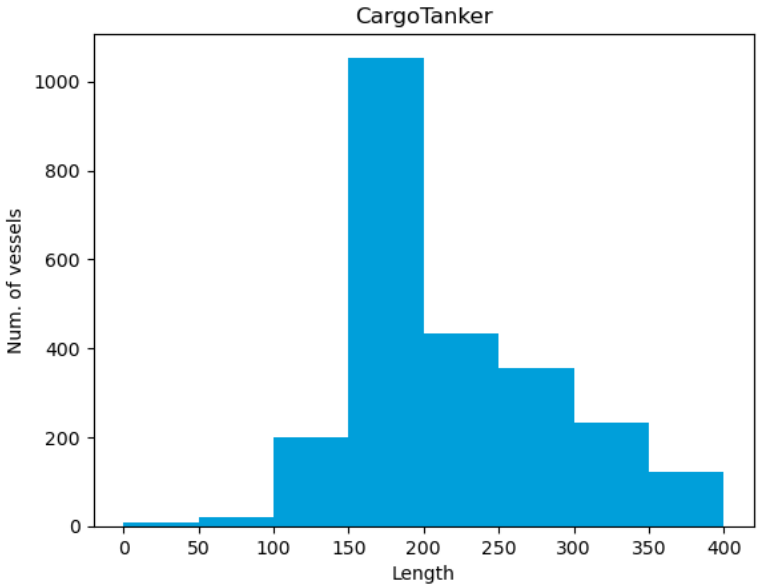
Traffic Distributions Across TSS were based on Previous DNV Work in the Public Domain



See US Wind NSRA Appendix E

Vessel Size Distributions Affect Specific Accident Types

- Were based on AIS data, so are representative rather than accurate in detail.
- The exception: all tug lengths were manually assigned as follows
  - Towlines were assigned 927m and widths of 463m to account for the barge and the long line.
  - ATBs were assigned 50:50 to length bins of 125-150m and 150-175m.



Wind Direction/Speed Affects Specific Accident Types

(COGOW point at 38.25 N, 74.75 W)

Wind Speed in knots	N	NE	E	SE	S	SW	W	NW	Total
< 20 (Calm)	5.14%	4.92%	4.13%	3.95%	4.16%	4.54%	5.21%	5.62%	37.66%
20 – 30 (Fresh)	9.06%	9.13%	8.75%	0.00%	8.30%	8.63%	8.83%	8.89%	61.58%
30 – 45 (Gale)	0.24%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.74%
> 45 (Storm)	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%
Total	14.44%	14.30%	12.88%	3.95%	12.45%	13.17%	14.04%	14.76%	100.00%

*Per DNV practice, for this region 2% of Gale winds were added to Storm in every cardinal direction

Visibility Affects Specific Accident Types (Wildwood Cape May Airport)

Visibility < 2 NM 7.60% of an average year
Visibility > 2 NM 92.4% of an average year

Thank You

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