Modeling Vessel Traffic, Risks and Economic Impact in Delaware River and Bay Area

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Delaware Valley Goods Movement Task Force
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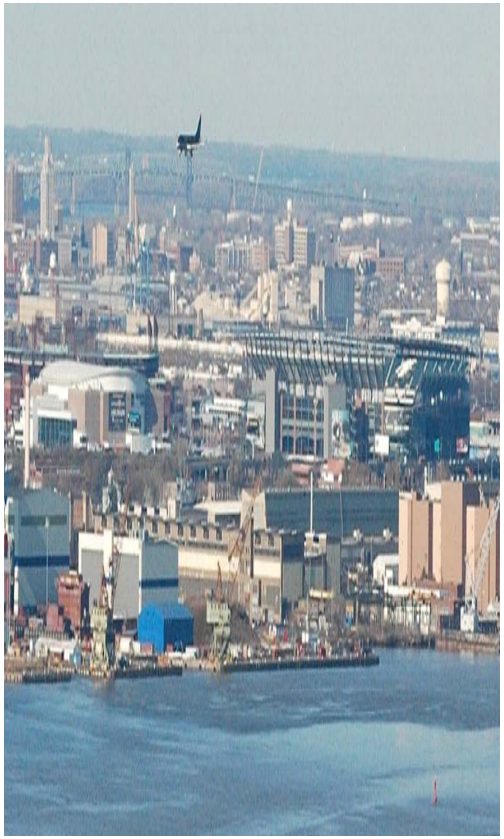

Rutgers CAIT Laboratory for Port Security

Research - Application - Training

- Safety and security of ports &waterways
- Port and terminal logistics
- Waterway/canal vessel traffic logistics
- Preparedness and recovery

Using

- Large-Scale Simulation modeling
- Risk Analysis, and
- Queueing/performance analysis

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Modeling Project: Maritime Traffic in DRB

Objectives:

- Modeling of maritime traffic logistics
- Economic Impact of the maritime study
- Risk assessment of the maritime traffic
- Preparedness and recovery

Funded by

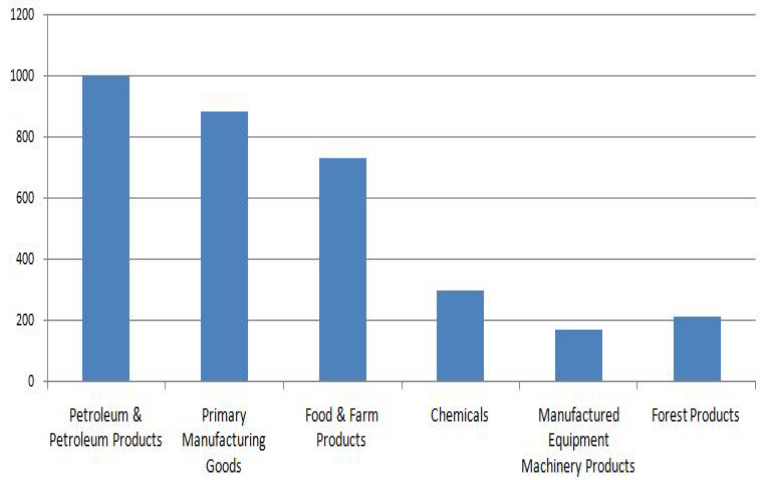
STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION

Office of Maritime Resources

In cooperation with the AMSC, Sector Delaware Bay

Port Calls / Cargo Type

Anual Average Port Calls (by sector)



Source: MEX

	No of Vessels			
Vessel/Cargo Categories	2006	2007	2008	Grand Total
BO	1	1	1	3
BU	518	373	270	1161
CB	15	4	5	24
CC	574	523	494	1591
CE		1	0	1
CH	83	59	79	221
CL	1	2	4	7
CO			1	1
CR	51	53	47	151
CT	2			2
FS		1		1
GC	271	253	223	747
HL	3	1	1	5
LV	4	5	7	16
OO		1		1
OR	1		1	2
PC	70	61	64	195
PD		1		1
PG	37	48	32	117
PR	40	27	14	81
RC	43	50	55	148
RF	322	324	329	975
RR	97	64	72	233
TA	951	940	903	2794
TS			1	1
VE	316	275	300	891
YT		1		1
Grand Total	3400	3068	2903	9371

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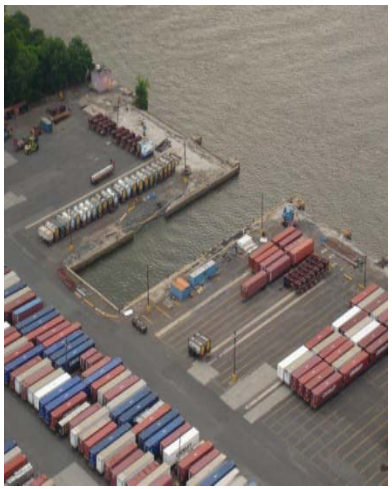
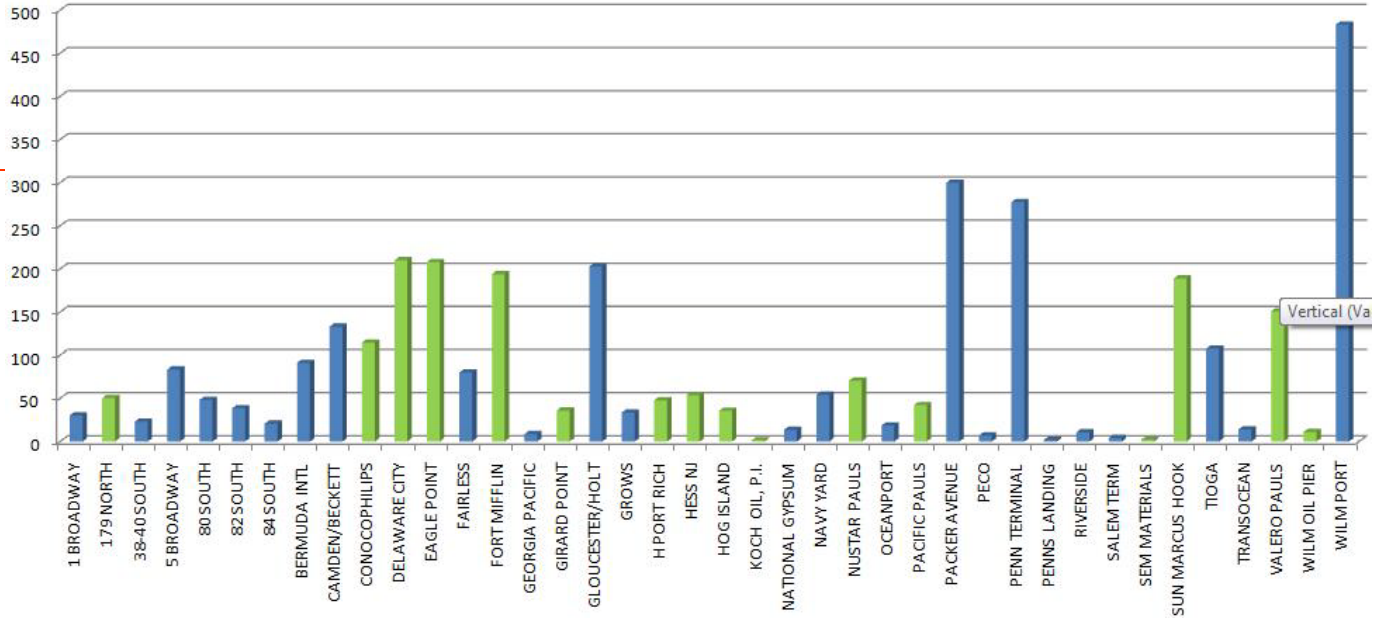
Vessel calls

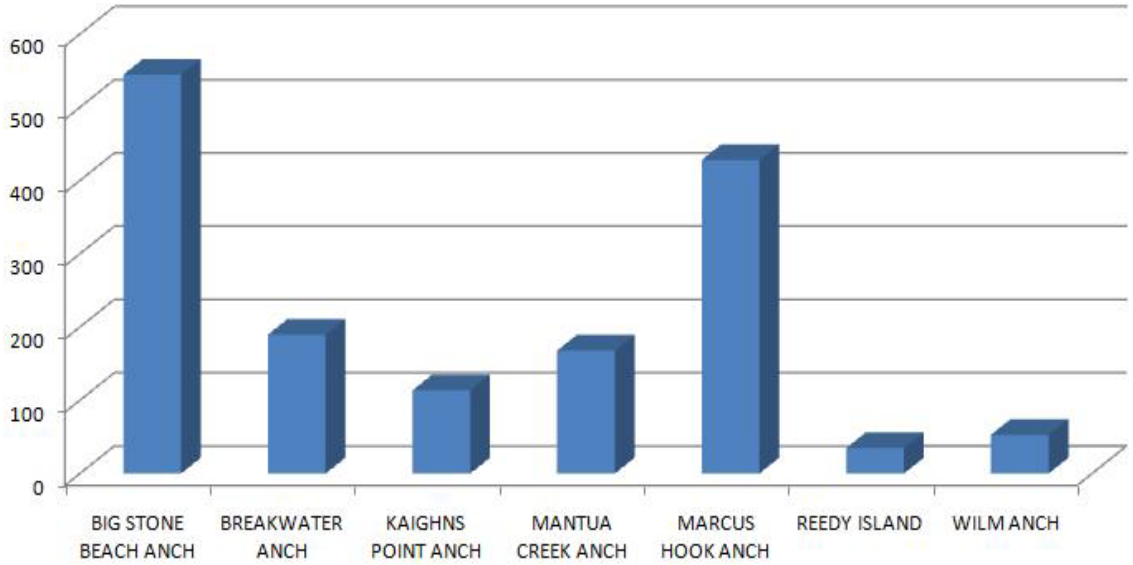
(Avg. over 3 years)



Terminals



Anchorages



Source: MEX

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Project Particulars

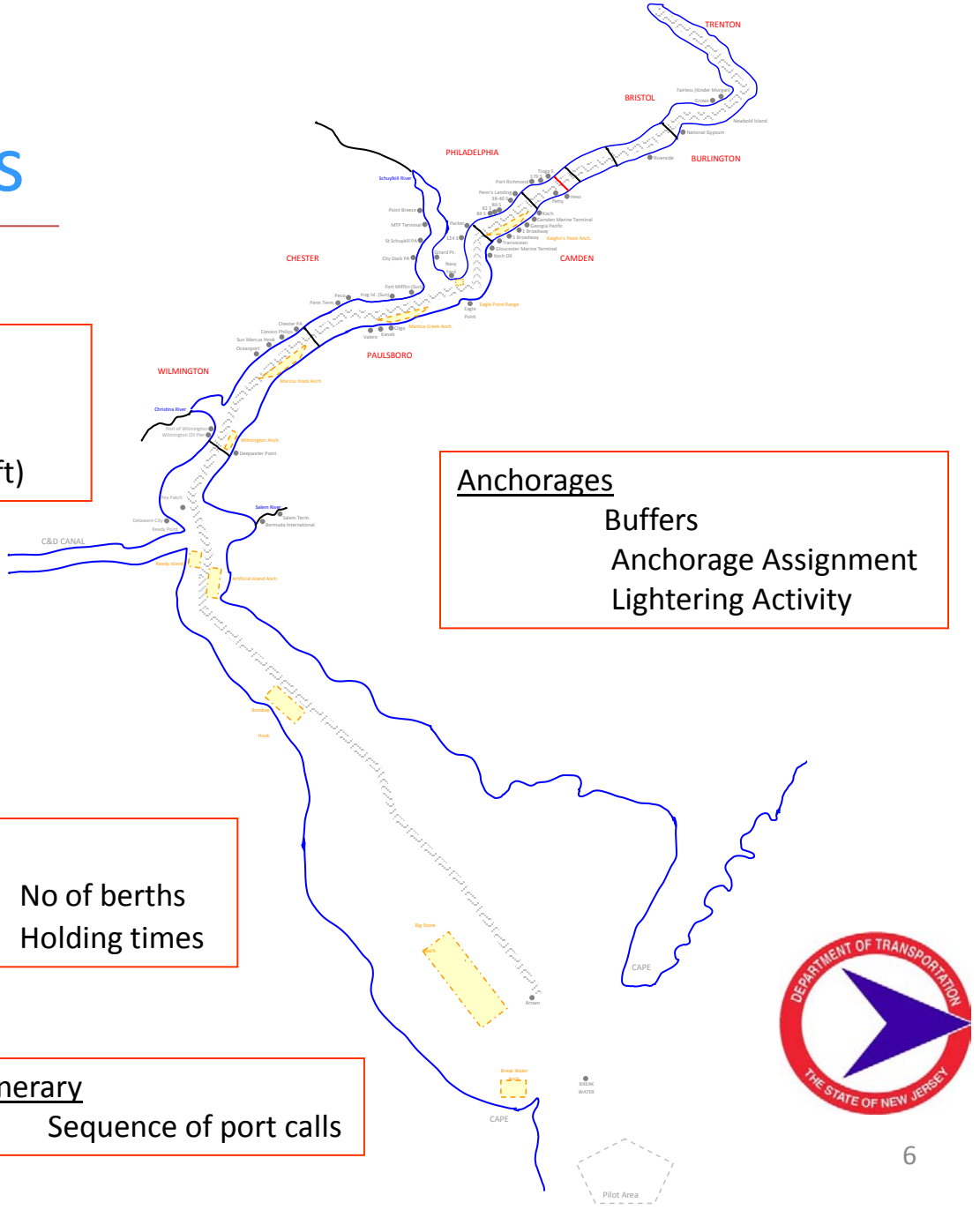
Vessel arrivals
- Cargo type
- Arrival frequency
- vessel specifics (length, beam, draft)

Movement
- Tide
- Rules of the Road (Coast Pilot Detail)

Terminals
- No of berths
- Holding times

Vessel itinerary
- Sequence of port calls

Anchorages
- Buffers
- Anchorage Assignment
- Lightering Activity



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Sources of Data

- Vessel arrival and movement data
  - Maritime Exchange
  - U.S. Army Corps of Engineers
  - Industry (OSG, Sunoco, Moran Shipping, and others)
- Regulations
  - USCG – Sector Delaware
  - Capt. John Cuff
  - AMSC
  - Coast Pilot (The Book!)
- Tidal Dynamics
  - NOAA

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The Model


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Average Annual Port Calls

Vessel Type	Actual (04 - 06)	Simulation
BU	472	476
CB	15	16
CC	454	453
CH	89	90
CR	52	52
GC	296	299
PC	46	44
PG	26	25
PR	42	44
RC	40	36
RF	343	348
RR	100	102
TA	905	900
VE	309	307
TG	673	688
Overall Average	**3862**	**3880**

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Average Vessel Port Times

Vessel Type	Actual (04 - 06) (min)	Simulation (min)	Per Cent Difference
BU	5678.32	5630.70	-0.01
CB	6948.07	6968.00	0.00
CC	2050.50	2149.80	0.05
CH	3676.58	3573.60	-0.03
CR	2597.92	2715.50	0.05
GC	3760.35	3792.70	0.01
PC	5393.37	5467.90	0.01
PG	5848.05	5662.10	-0.03
PR	1224.09	1253.90	0.02
RC	525.00	463.25	-0.12
RF	4242.26	4057.50	-0.04
RR	3309.04	3189.50	-0.04
TA	4919.72	4961.20	0.01
VE	639.78	662.70	0.04
TG	4549.50	4191.80	-0.08
Overall Average	**3824.80**	**3830.14**	**0.001**

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Average Anchorage Vessel Delays

Anchorage	Actual (04 - 06) (min)	Simulation (min)	Per Cent Difference
Breakwater Anch.	794.00	799.31	0.01
Big Stone Beach Anch.	3369.95	3307.30	-0.02
Reedy Point Anch.	1004.24	923.42	-0.08
Wilmington Anch.	1149.65	1217.74	0.06
Marcus Hook Anch.	1413.42	1327.69	-0.06
Mantua Creek Anch.	1798.25	1828.58	0.02
Kaighn's Point Anch.	1129.58	1072.20	-0.05

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Port/Berth Occupancy

Approximately 20%

Port / berth availability is 80%

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Uses and Benefits of the Model

- Impact of port expansion (South Port, Paulsboro, etc.)
- Impact of dredging,
- Risk analysis (addl' tanker and/or LNG traffic)
- Issues of port resiliency and recovery policies

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Impact of Dredging Using the Model

Following analysis is very preliminary
and considerations are based on
Comprehensive Economic Reanalysis Report (2002) of
Delaware River Main Channel Deepening Project,
prepared by the U.S. Army Corp of Engineers,
Philadelphia District, North Atlantic Division.

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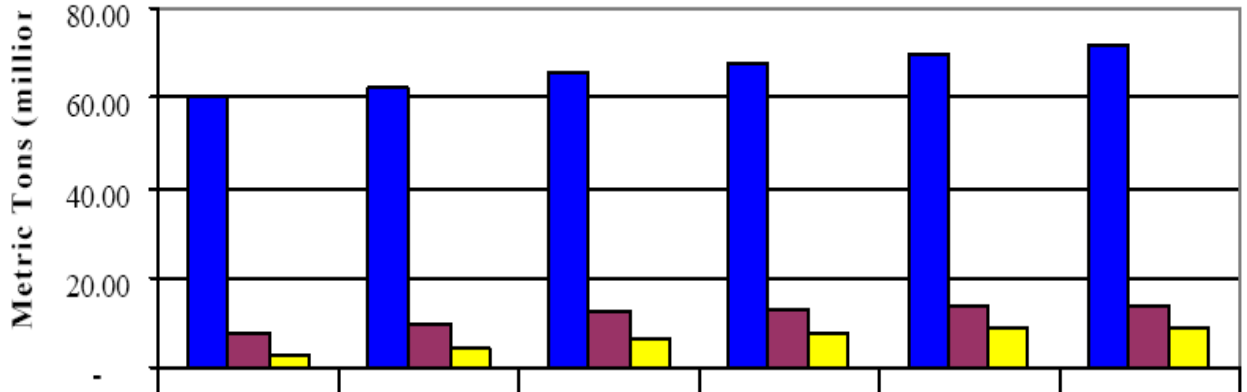
Expected Annual Cargo Tonnages *

Delaware River Tonnage Trade
Handled By Select Ship Types, 2000-2050



	2000	2010	2020	2030	2040	2050
Tanker	60.02	62.48	65.33	67.85	69.94	71.62
Dry Bulk	7.49	9.53	11.99	13.26	13.76	13.87
Container	2.56	3.88	6.05	7.76	8.81	9.15

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Oil Terminals Impacted

Terminal/Company	Berth	Depth (ft.)
Fort Mifflin	A	38 → 45
	B	37 → 45
Marcus Hook	3C	40 → 45
	3A	remains 39
	2A	remains 37
	3B	remains 17
Valero	1 (Tanker Berth)	40 → 45
	Berth # 2	remains 30
Eagle point	Berth # 1	remains 34
	Berth # 2	40 → 45
	Berth # 3	40 → 45
Conoco Philips	Berth # 1	38 → 45
Valero/Premcor	Berth # 1	→ 45
	Berth # 2	→ 45
	Berth # 3	→ 45
Wilmington Oil Pier	Liquid Bulk Berth	38 → 45

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Cargo Terminals Impacted

(Bulk, Break Bulk and General Cargo)

Name of Terminal	Berth	Depth (ft.)
Packer Avenue	5 front berths	40 → 45
	the bottom berth	remains the same
Beckett Street	Berth # 4	40 → 45
	Berth # 3	remains 35
	Berth # 2	remains 30
Wilmington Port	All in Christina River other than the oil pier	38 → 42

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Dredging Assumptions

Assumptions

- Channel is dredged 5 feet deeper up to Ben Franklin Bridge
- Inbound and Outbound tide regulations relaxed by 5 feet

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Dredging Scenarios

1. **Current State**
2. **Dredge River**
3. **Dredge River, Deepen Terminals**
4. **Dredge River, Deepen Terminals, Change Vessel Particulars**
5. **Dredge River, Deepen Terminals, Change Vessel Specs with 30 Years of Trade Forecast**
6. **Dredge River, Deepen Terminals with 30 Years of Trade Forecast**

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Dredging Impact

Average Port Time / Vessel (Days)

	Deepen Channel	Deepen Channel and Terminals	Deepen Channel and Terminals Bigger Vessels
Bulk	Slight decrease	No change	Up to 50 % Increase
Container	Slight decrease	No change	Up to 100 % Increase
General Cargo	Slight decrease	No change	Up to 60 % Increase
Tankers	Slight decrease	No change	Slight Decrease

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No of Vessels in Channel Entrance Queues (Breakwater/Big Stone)

Bulk (70/7)	Significant Decrease 22/8	No change	Slight Increase
Container (21/0)	Significant Decrease 1/0	No change	Slight Increase
Tanker (130/372)	Significant Decrease 0/368	Increase 84/225	Slight Increase

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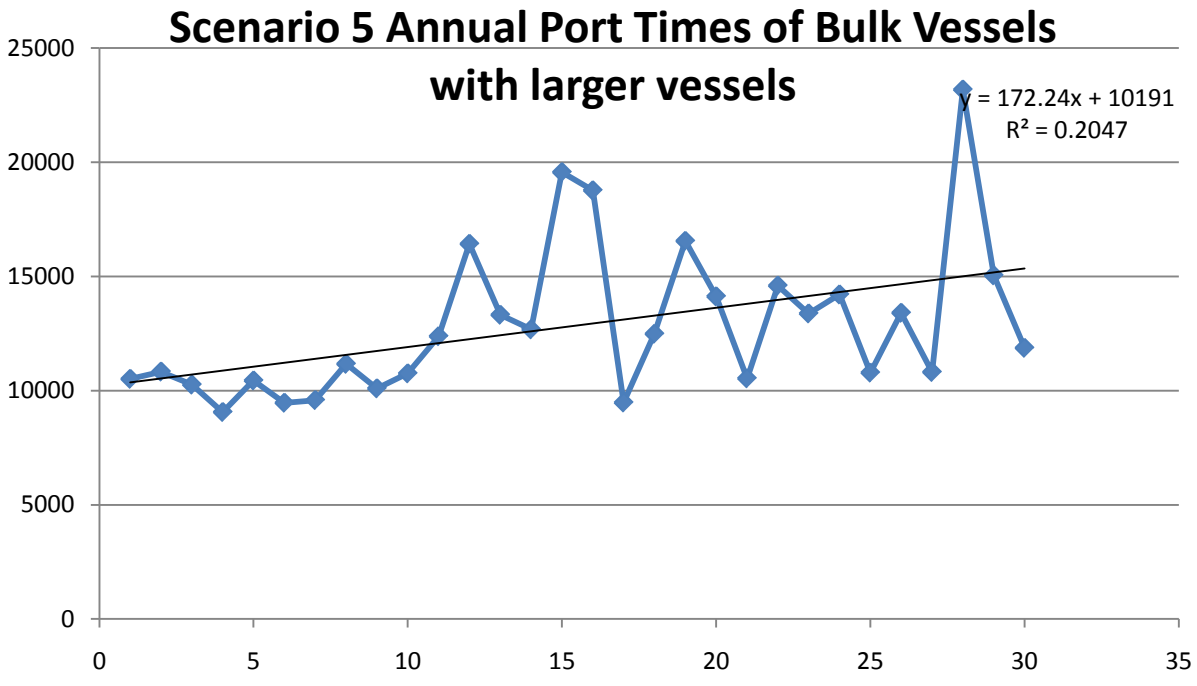
Dredging Impact



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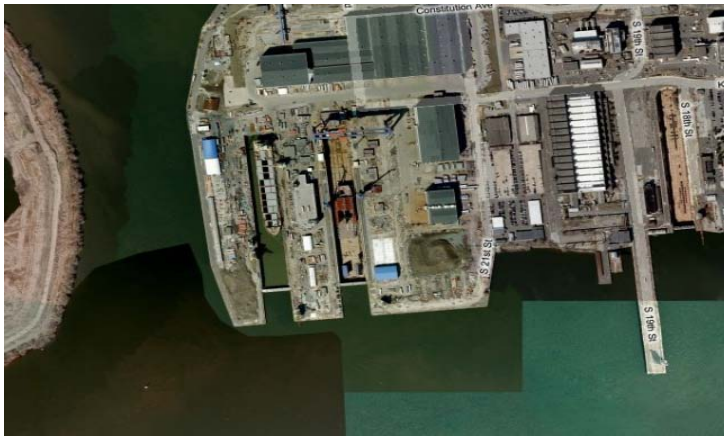
Status

- Model is complete
- Dredge impact analysis
- Risk analysis
- Closure recovery analysis



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Your Opportunities for Input

- Delaware Valley Goods Movement Task Force

- *Rutgers CAIT – LPS Website:*

www.cait.rutgers.edu/lps

- *Contact Project Team:*

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