Quantifying Impacts to Shipping from Vessel Draft Restrictions

Kenneth Ned Mitchell
USACE-ERDC
Coastal and Hydraulics Lab

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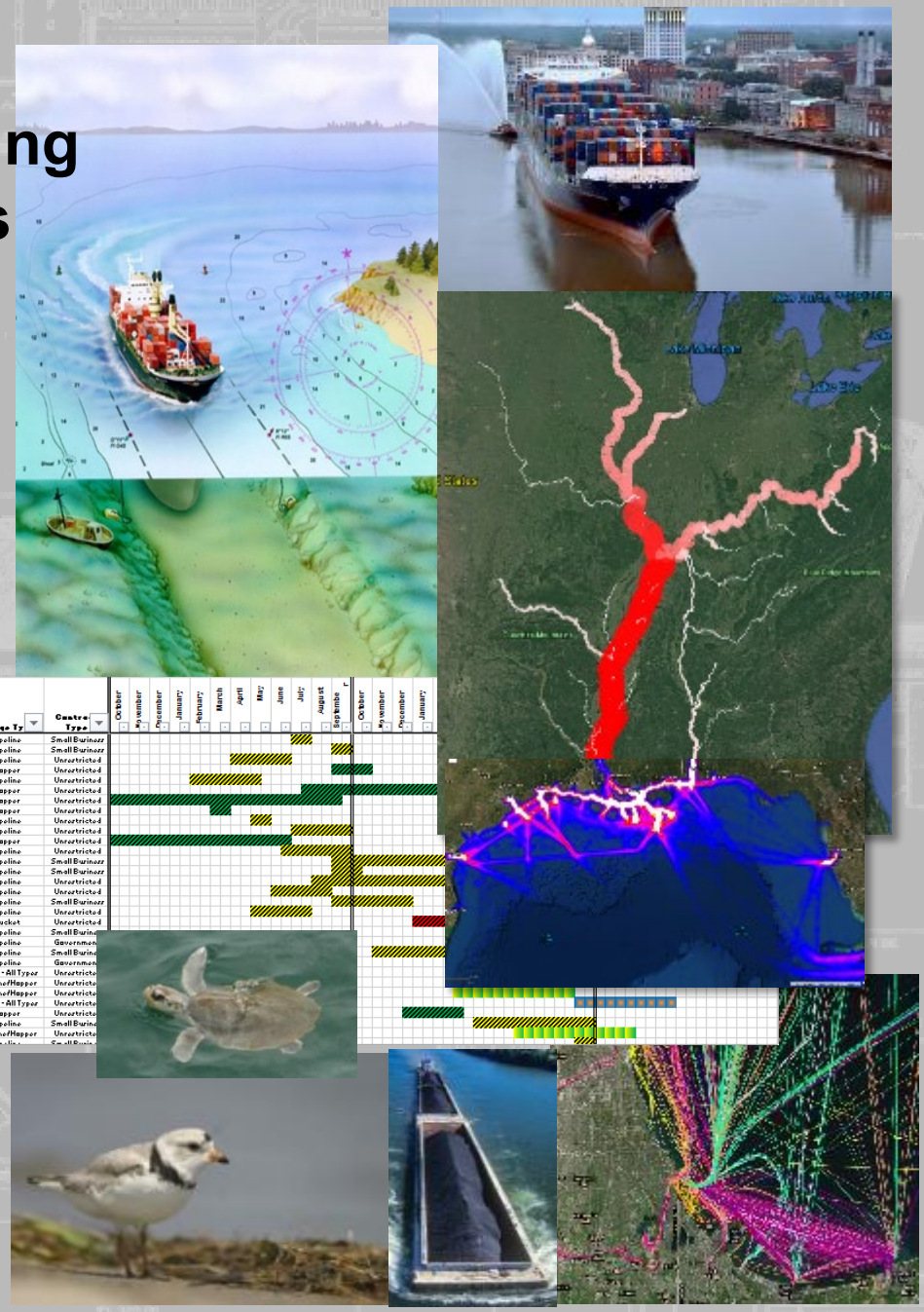
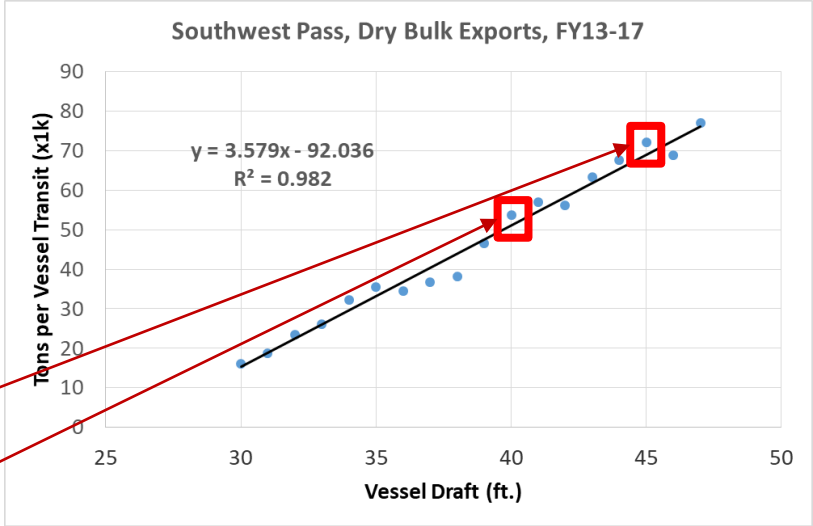


US Army Corps of Engineers®

Draft vs Tonnage per Voyage

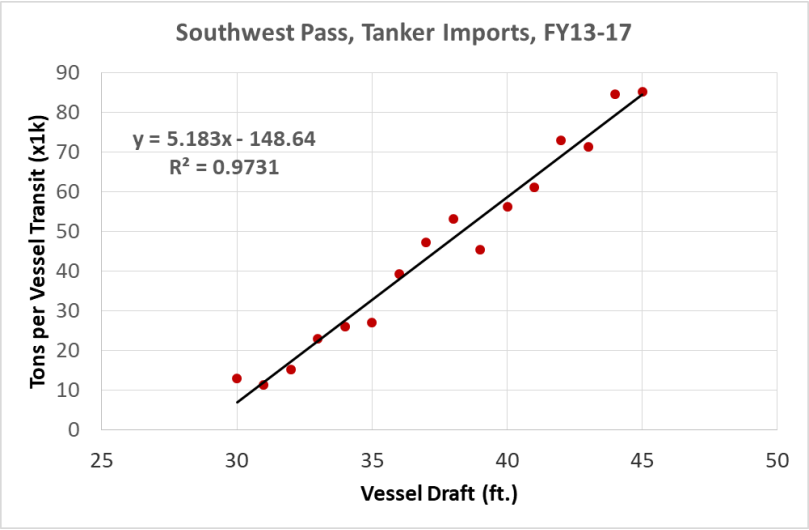
- Via the Corps' Waterborne Commerce Statistics Center, we can show how sensitive the cargo throughput trends are to reductions in vessel draft (or available depth).
- Same general trends hold, albeit with different slopes and offsets, for various ports, regions, coasts, etc.

At 45-ft, average voyage carries 70k tons. At 40-ft, average voyage carries 50k tons.



- At Southwest Pass, a 1-ft reduction in vessel draft results in an average of 3,600 fewer tons per vessel transit for dry bulk exports, 5,200 fewer tons per transit for tanker imports.

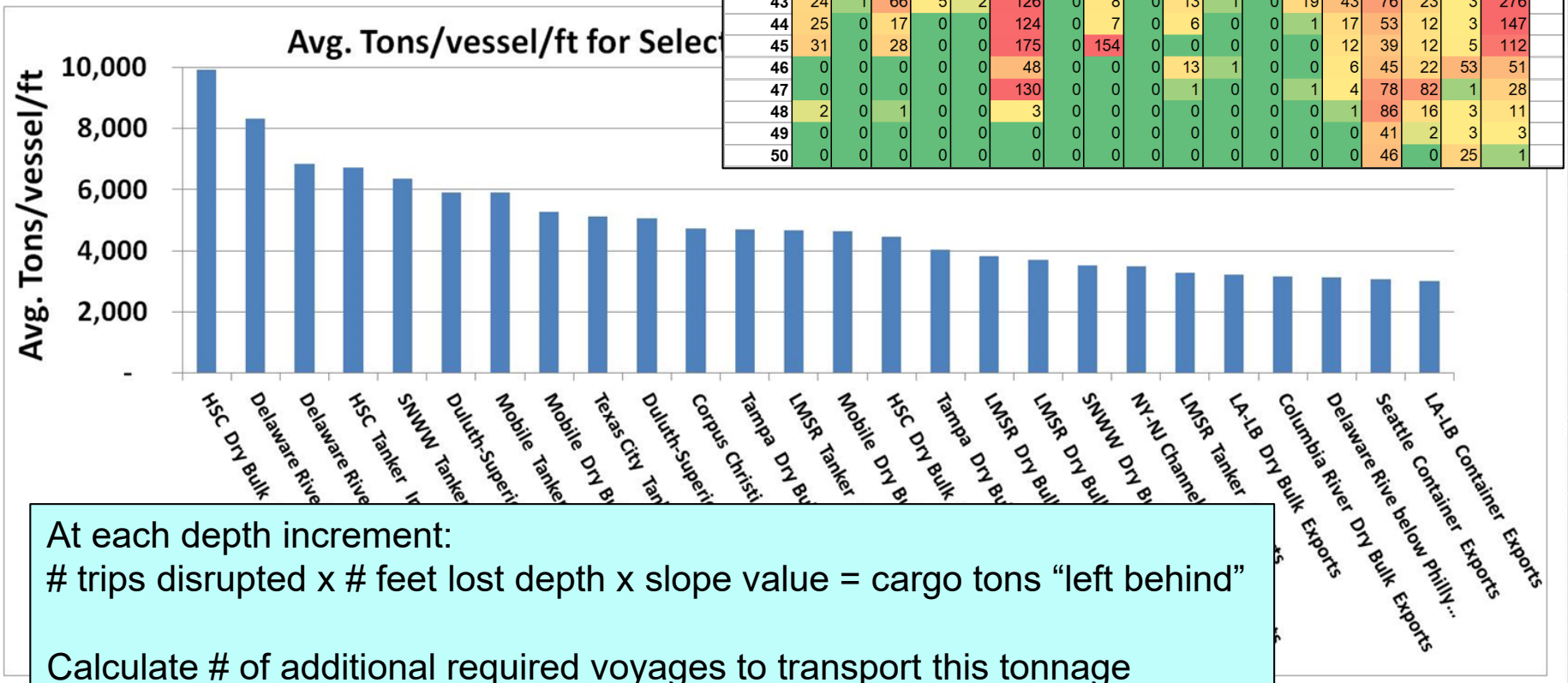
- Useful for quickly gaging magnitude of impacts to industrial sectors from specified restriction scenarios.



Draft vs Tonnage per Voyage

- Slope/offset values are part of story, but trip counts at deepest, shoal-vulnerable depths are perhaps a greater driver of total economic impacts.

Draft (ft)	Corpus Christi	Freeport	Houston-Galveston	Beaumont/Port Arthur	Lake Charles	Lower Miss. River	Pascagoula	Mobile	Tampa	Miami	Port Everglages	Jacksonville	Savannah	Charleston	Norfolk	Baltimore	Delaware River	New York
40	106	40	616	442	98	1291	15	95	54	45	57	55	214	138	216	72	80	386
41	44	27	115	3	1	157	0	7	0	28	11	1	143	79	153	60	11	363
42	38	55	85	3	0	180	0	9	1	12	3	0	129	99	104	38	5	247
43	24	1	66	5	2	126	0	8	0	13	1	0	19	43	76	23	3	276
44	25	0	17	0	0	124	0	7	0	6	0	0	1	17	53	12	3	147
45	31	0	28	0	0	175	0	154	0	0	0	0	0	12	39	12	5	112
46	0	0	0	0	0	48	0	0	0	13	1	0	0	6	45	22	53	51
47	0	0	0	0	0	130	0	0	0	1	0	0	1	4	78	82	1	28
48	2	0	1	0	0	3	0	0	0	0	0	0	0	1	86	16	3	11
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	2	3	3
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	25	1

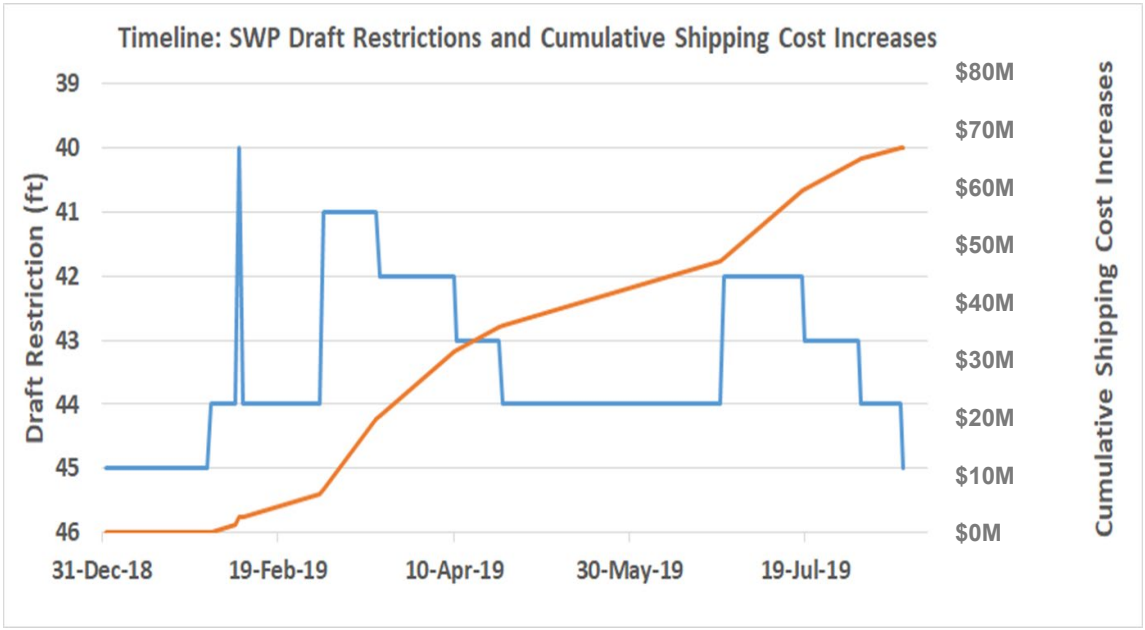


At each depth increment:
trips disrupted x # feet lost depth x slope value = cargo tons “left behind”

Calculate # of additional required voyages to transport this tonnage

Estimating Costs of Additional Voyages

- U.S. Customs data provides voyage distance information for international ports of origin/destination → longer distances = higher shipping costs
- Assumptions for average vessel operating costs complete the estimate for economic impacts of draft restrictions in terms of severity and duration.



Lower Miss. River Average Voyage Distances (nautical miles) Vessels drafting >= 40-ft	
Tanker Imports: 3539	Dry Bulk Imports: 4607
Tanker Exports: 4440	Dry Bulk Export: 7703

Estimating Costs of Additional Voyages

Monthly Impacts by Project

	Throughput Utilizing 6 Deepest ft.			6-ft Draft Restriction Impacts	
Project	**Tonnage (x1k)**	**Cargo Value ($x1k)**	**Trips**	**Tonnage "Left Behind" (x 1k)**	**Additional Shipping Costs (x$1k)**
Calcasieu	2,117	$ 588,921	44	747.4	$ 9,611
Columbia and Lower Willamette	3,250	$ 927,235	59	1,189	$ 21,833
Corpus Christi	2,232	$ 793,670	35	492.0	$ 5,007
Freeport	1,031	$ 287,430	20	474.0	$ 8,474
Houston/Galveston	5,818	$ 2,239,317	109	667.9	$ 5,616
Mobile	1,620	$ 370,760	23	432.8	$ 5,870
Southwest Pass	5,737	$ 1,349,413	86	1,644.8	$ 30,277
Tampa	1,713	$ 412,127	51	230	$ 4,861
Thimble Shoals	1,765	$ 263,435	25	241.6	$ 2,550
Wilmington	158	$ 88,348	11	18.3	$ 908

* Assumes hourly vessel operating costs of $2500 for tankers and $2000 for dry bulk. Container ships not included within this analysis.

Estimating Costs of Additional Voyages

Monthly Impacts by Project and Restriction Severity (x$1k)

Project	6-ft	4-ft	2-ft
Calcasieu	$ 9,611	$ 3,286	$ 662
Columbia and Lower Willamette	$ 21,833	$ 11,529	$ 5,095
Corpus Christi	$ 5,007	$ 1,795	$ 470
Freeport	$ 8,474	$ 1,679	$ 229
Houston/Galveston	$ 5,616	$ 1,068	$ 229
Mobile	$ 5,870	$ 2,768	$ 1,100
Southwest Pass	$ 30,277	$ 12,489	$ 5,036
Tampa	$ 4,861	$ 1,541	$ 323
Thimble Shoals	$ 2,550	$ 1,105	$ 213
Wilmington	$ 908	$ 776	$ 110

* Assumes hourly vessel operating costs of $2500 for tankers and $2000 for dry bulk. Container ships not included within this analysis.

Case Study: LNG Exports from Lake Charles, LA

Depth-sensitivity analysis for tanker exports shows roughly 2,800 tons/ft/vessel as applicable slope → provides basis to gage impacts of restrictions but also to evaluate benefits from a fully maintained channel.

Sources such as EIA and U.S. Customs Entrances and Clearances provide way to estimate voyage distances

U.S. Natural Gas Exports and Re-Exports by Country

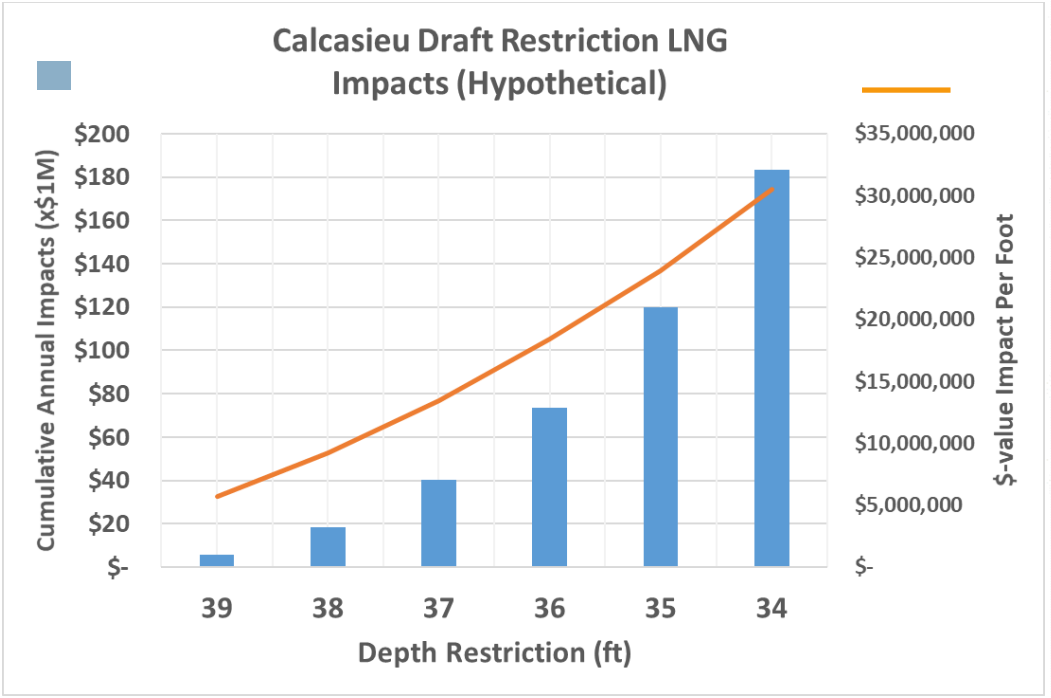
(Volumes in Million Cubic Feet, Prices in Dollars per Thousand Cubic Feet)

Period: Annual

Download Series History | Definitions, Sources & Notes

Type - Area	Graph / Clear	2014	2015	2016	2017	2018	2019	View History
Export Volumes								
Total		1,514,242	1,783,512	2,335,448	3,153,804	3,607,418	4,654,808	1973-2019
Pipeline		1,497,771	1,754,918	2,148,399	2,446,091	2,524,077	2,835,459	1985-2019
Canada		769,258	700,647	771,094	916,380	835,982	970,465	1973-2019
Mexico		728,513	1,054,271	1,377,305	1,529,711	1,688,095	1,864,994	1973-2019
LNG		16,255	28,381	186,841	707,542	1,083,118	1,819,087	1985-2019
Exports		13,590	16,756	184,250	707,120	1,083,118	1,819,086	2012-2019
By Vessel		13,310	16,519	183,873	706,424	1,082,511	1,817,956	2012-2019
Argentina			0	16,661	16,276	27,560	38,323	2015-2019
Bahamas				0	2	137	156	2016-2019
Bangladesh							3,419	2019-2019
Barbados			0	100	200	174	211	2015-2019

* Assumes hourly vessel operating costs of $4,900 for LNG carriers, and 120 shipments per year drafting >= 38 ft.



SOUTHWEST PASS DRAFT RESTRICTIONS

Shipping Cost Increases

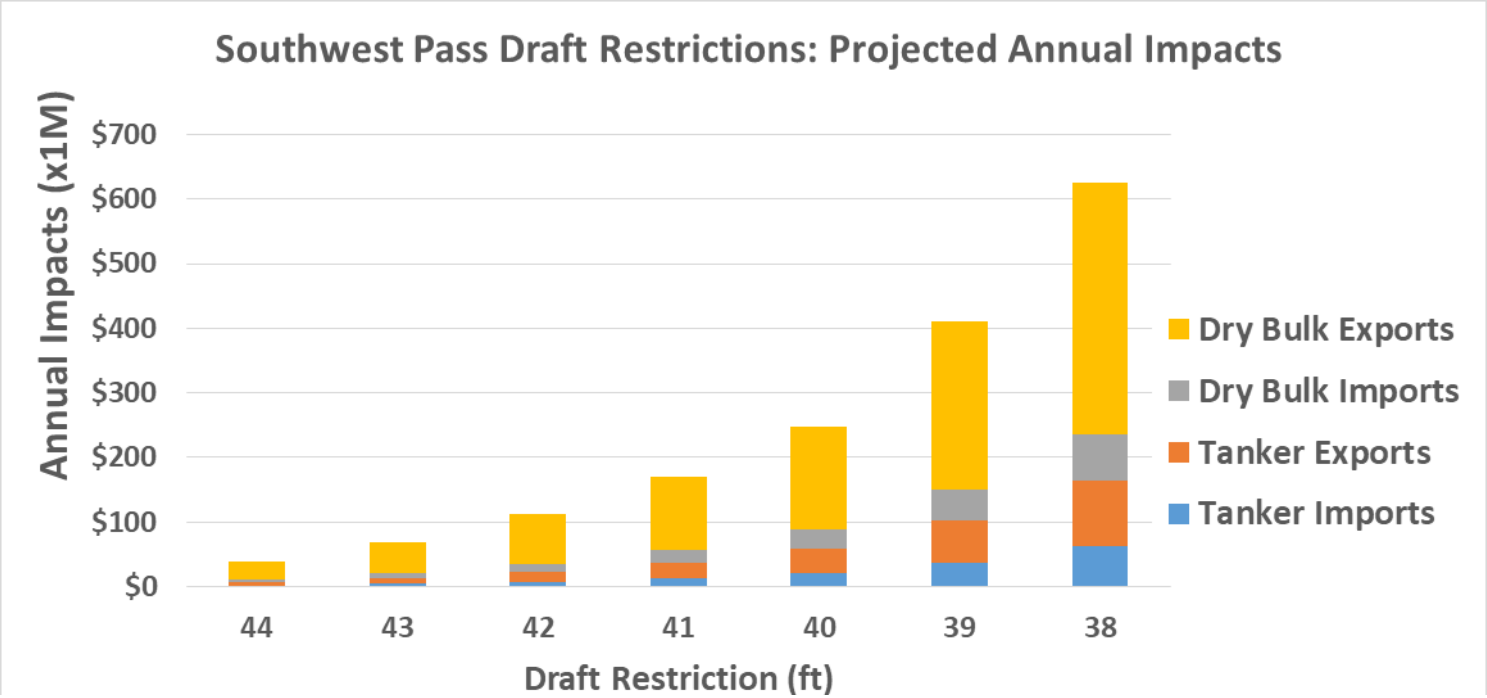
Draft Restriction (ft)	Tanker Imports (x1M)	Tanker Exports (x1M)	Dry Bulk Imports (x1M)	Dry Bulk Exports (x1M)	Total
44	$ 1.77	$ 4.45	$ 4.22	$ 27.82	**$ 38.3M**
43	$ 4.03	$ 9.01	$ 7.01	$ 49.20	**$ 69.3M**
42	$ 7.48	$ 15.28	$ 11.47	$ 77.50	**$111.7M**
41	$ 12.66	$ 24.43	$ 19.72	$ 113.74	**$170.6M**
40	$ 20.54	$ 37.62	$ 30.71	$ 159.04	**$247.9M**
39	$ 36.99	$ 64.36	$ 48.43	$ 260.89	**$410.7M**
38	$ 61.52	$ 102.59	$ 72.39	$ 389.77	**$626.3M**

Annualized shipping cost increases due to additional required voyages necessitated by respective draft restrictions. Divide by 12, 52, etc. for monthly, weekly, etc. impacts. Figures based on $2500/hr operating costs for vessels underway.

SOUTHWEST PASS DRAFT RESTRICTIONS

Shipping Cost Increases

FY19 dredging expenditures at Southwest Pass of $236M(!) in FY19 kept channel conditions stable and prevented even *higher* shipping cost impacts. For example, a 39-ft draft restriction would have incurred $410M in additional shipping costs over the same time period.



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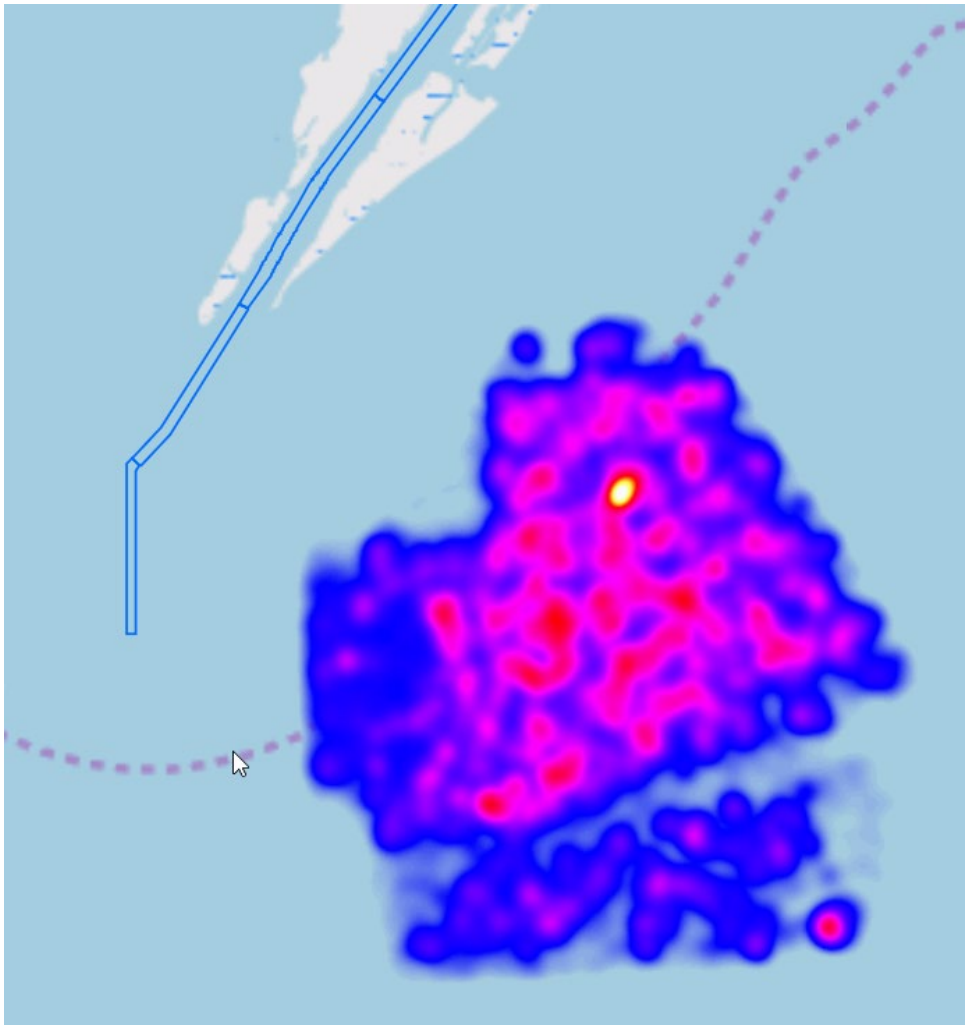
SOUTHWEST PASS DRAFT RESTRICTIONS

Anchorage Delay Costs

Increased shipping costs are not the only impacts due to channel depth restrictions.

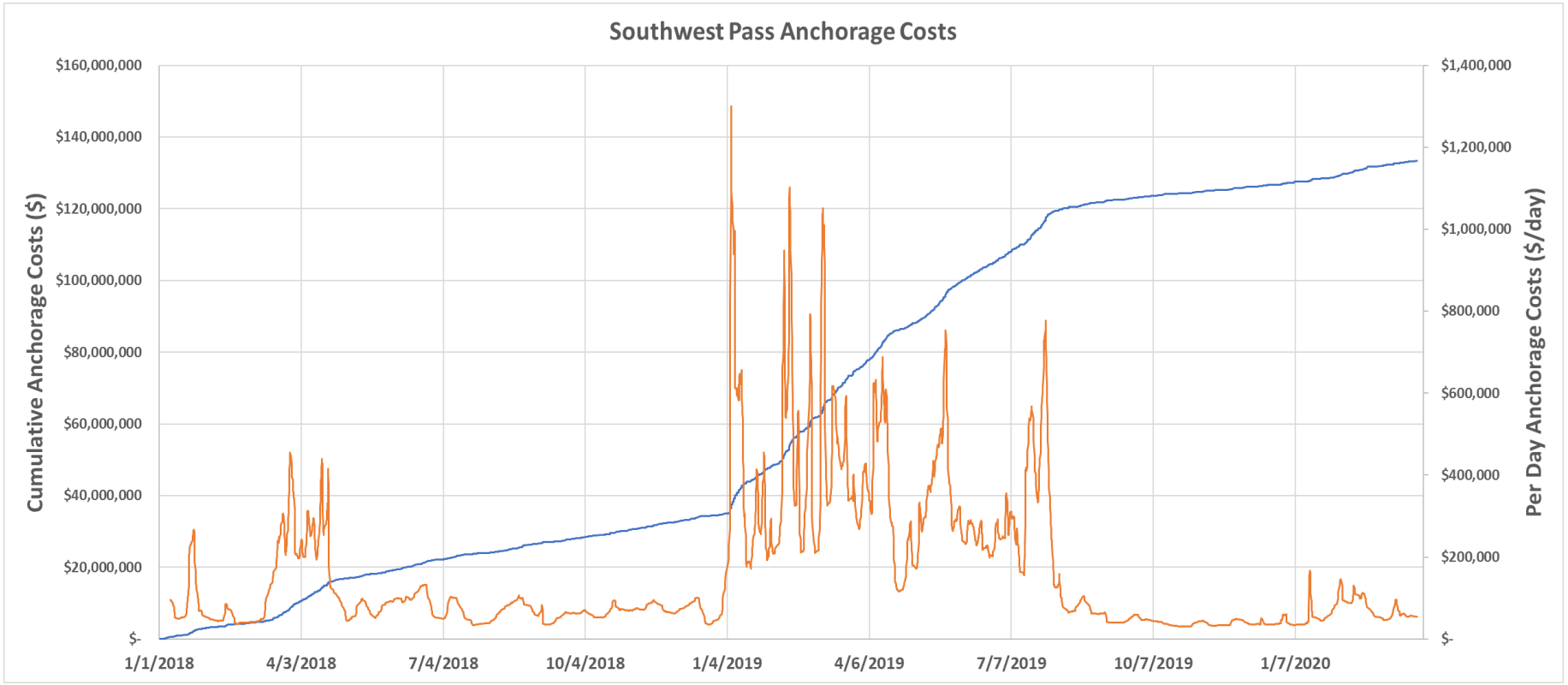
Daylight restrictions and other constraints on normal traffic often lead to backlogs of vessels queueing up in outer anchorage zones.



SOUTHWEST PASS DRAFT RESTRICTIONS

Anchorage Delay Costs

Derived from AIS vessel position reports. Assumes $1,000/hr operating costs for vessels waiting at anchor of Southwest Pass. Cumulative figures reflect both the number of vessels at anchor as well as the duration of wait times.



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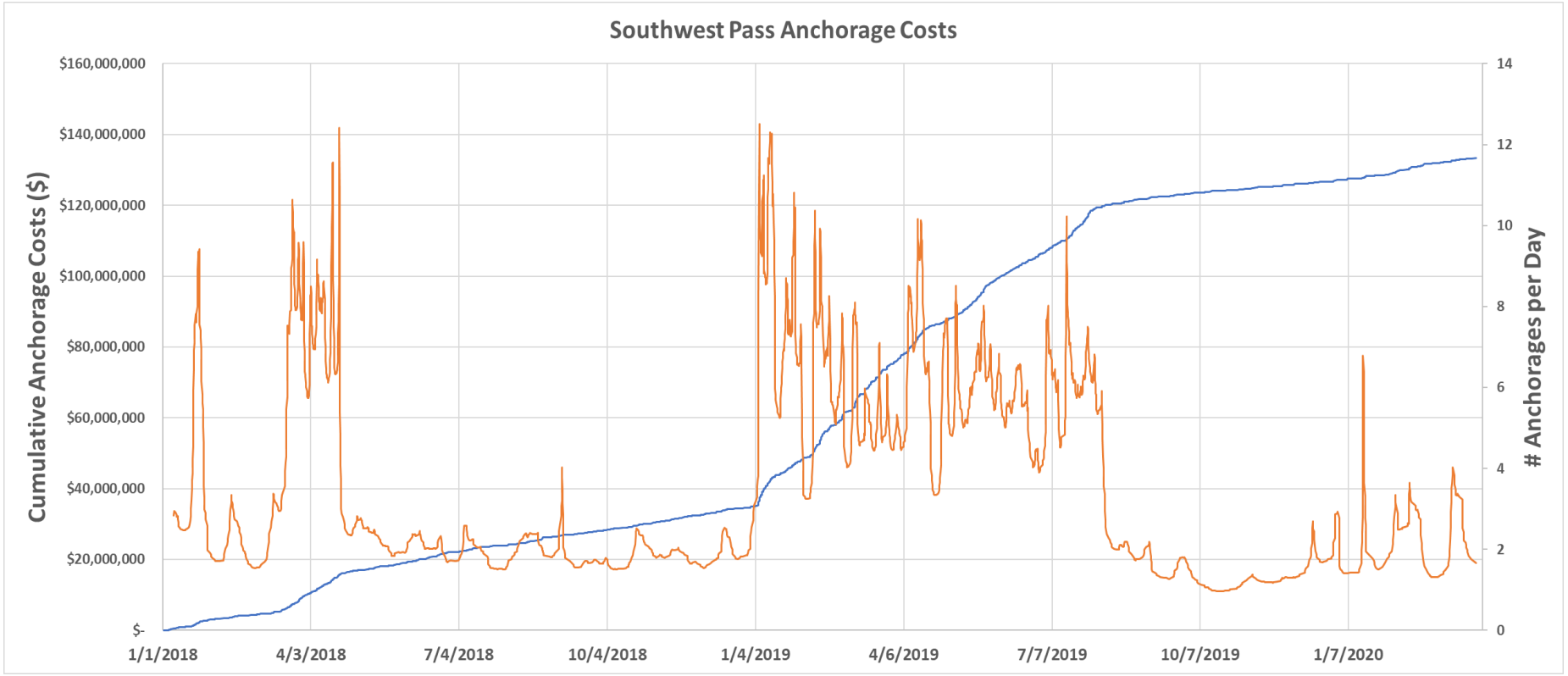

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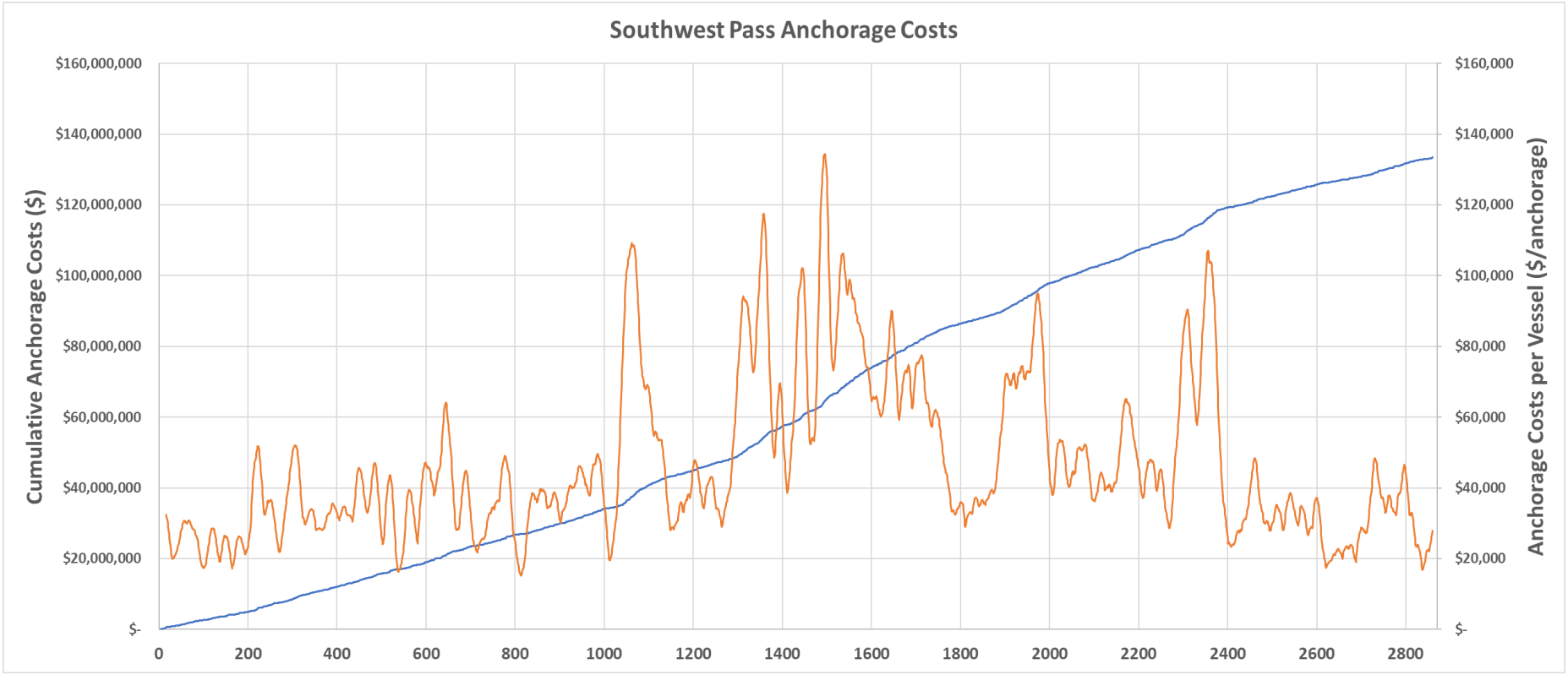
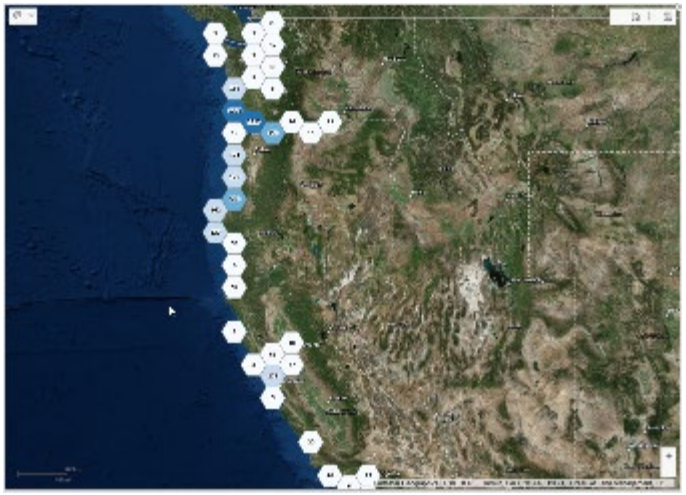
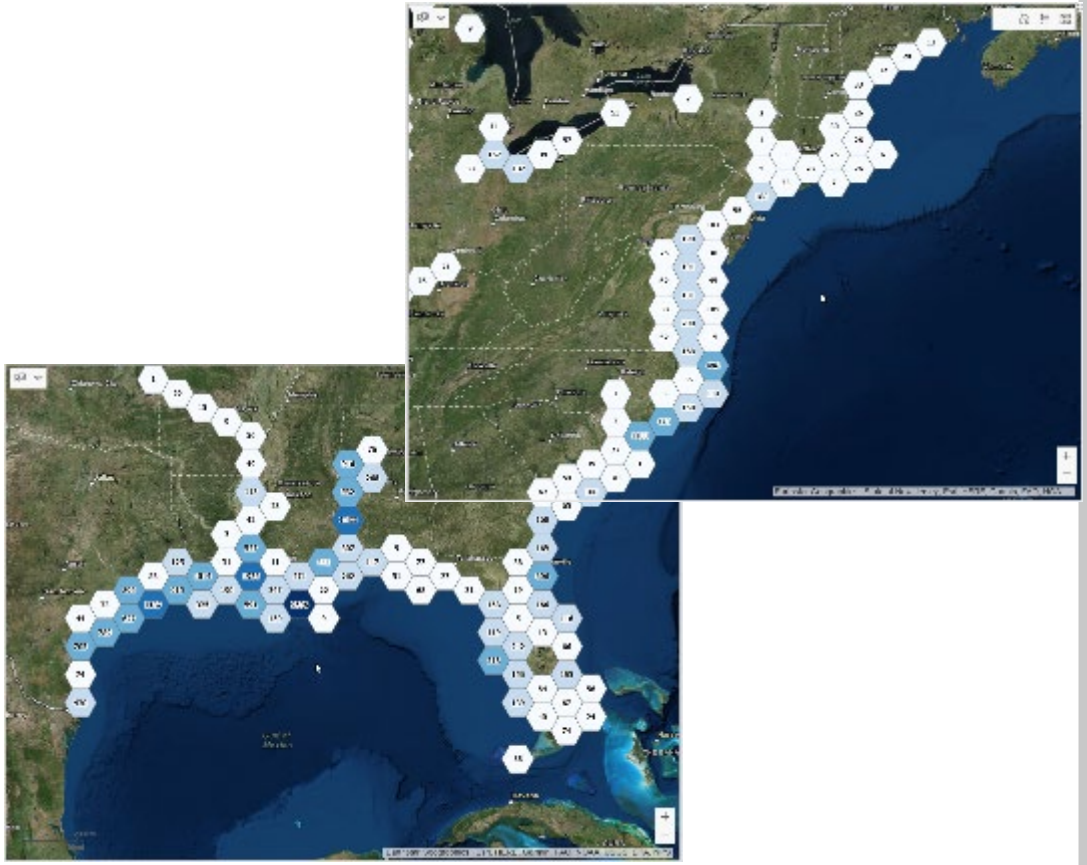


SOUTHWEST PASS DRAFT RESTRICTIONS

Understanding Shoaling Dynamics

Corps' eHydro repository of 57k+ hydrographic surveys is providing unprecedented insight into channel conditions across the pull portfolio and trends through time.





Number of Surveys

57,652

1,079 last 60 days

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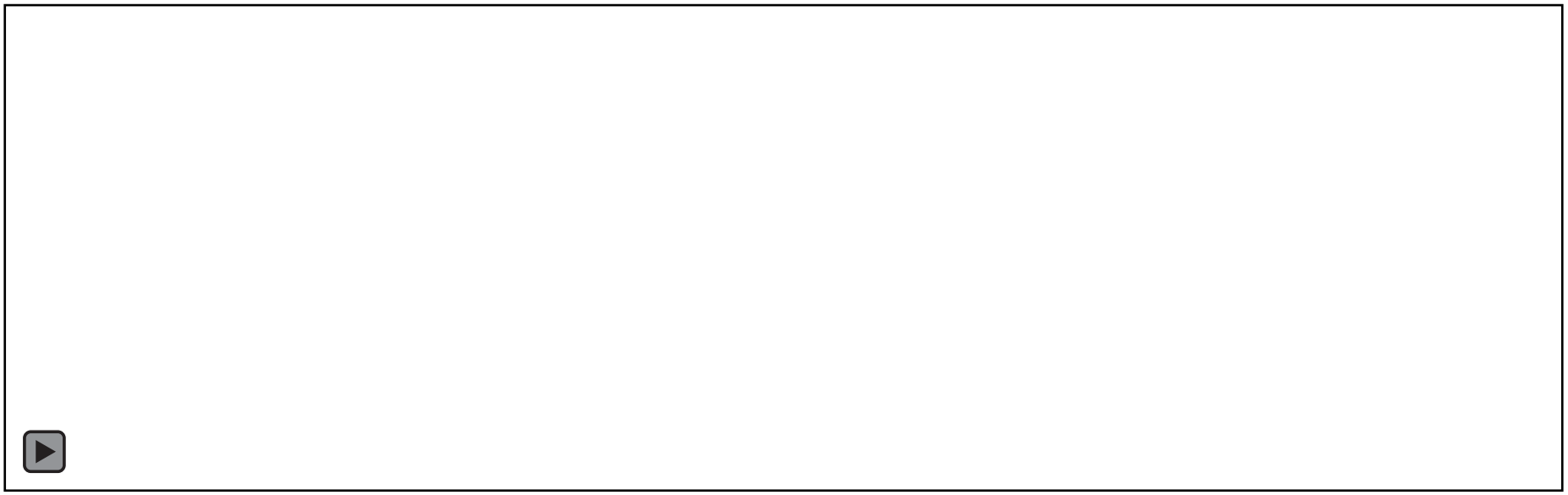

Questions?

Kenneth.n.Mitchell@usace.army.mil
601-529-9005