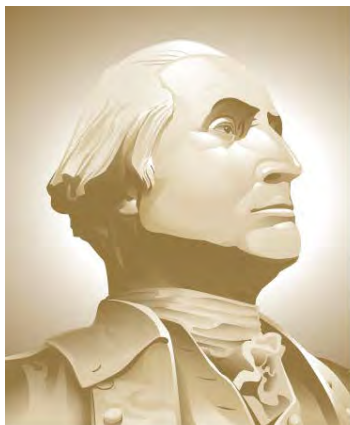


VTRA 2010 BASE CASE RESULTS BY ACCIDENT TYPE

Presentation by: J. Rene van Dorp



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CASE T: Gateway, Kinder Morgan, Delta Port

GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

AUGUST 5, 2013

PRELIMINARY

Table. Focus Vessel (FV) Classification for the 26 VTOSS vessel type classification used in the GW/VCU MTS simulation model.

- NON – FV** : Those vessels that Interacting Vessels (IV) with Focus Vessels (FV)
- BASE CASE CARGO – FV** : Bulk Carriers, Container Vessels, Other Cargo Vessels that travel in VTRA 2010 Base Case
- BASE CASE TANK – FV** : Oil Barge, Oil Tankers, Chemical Carrier, ATB 's that travel in VTRA 2010 Base Case
- WHAT IF – FV** : CARGO AND TANK FV'S added to VTRA 2010 Base Case to model What-If Scenario

Note: Focus Vessels (FV's) are also considered as Interacting Vessels (IV's) when interacting with another Focus Vessel.

#	VESSEL TYPE	FOCUS VESSEL?	#	VESSEL TYPE	FOCUS VESSEL?
1	BULKCARRIER	CARGO - FV	14	PASSENGERSHIP	NO
2	CHEMICALCARRIER	TANK - FV	15	REFRIGERATEDCARGO	CARGO-FV
3	CONTAINERSHIP	CARGO - FV	16	RESEARCHSHIP	NO
4	DECKSHIPCARGO	CARGO - FV	17	ROROCARGOSHIP	CARGO-FV
5	FERRY	NO	18	ROROCARGOCONTSHIP	CARGO-FV
6	FERRYNONLOCAL	NO	19	SUPPLYOFFSHORE	NO
7	FISHINGFACTORY	NO	20	TUGTOWBARGE	NO
8	FISHINGVESSEL	NO	21	UNKNOWN	NO
9	LIQGASCARRIER	TANK - FV	22	USCOASTGUARD	NO
10	NAVYVESSEL	NO	23	VEHICLECARRIER	CARGO-FV
11	OILTANKER	TANK - FV	24	YACHT	NO
12	OTHERSPECIALCARGO	CARGO - FV	25	ATB	TANK - FV
13	OTHERSPECIFCSERV	NO	26	OIL BARGE	TANK - FV

IMPORTANT:

THE OPERATIVE WORD IN PRESENTING THESE ANALYSIS RESULTS IS THE USE OF THE WORD

POTENTIAL

TO INDICATE THAT THESE ANALYSIS RESULTS DO NOT FOLLOW FROM AN HISTORICAL DATA ANALYSIS, BUT THROUGH THE USE OF AN ANALYSIS TOOL THAT EVALUATES SUCH **POTENTIAL**.

THE 2010 YEAR IS CONSIDERED **THE BASE CASE YEAR** AND A BASE CASE YEAR POTENTIAL IS EVALUATED.

NEXT, **WHAT-IF SCENARIOS** ARE DEVELOPED FROM THE BASE CASE BY ADDING ADDITIONAL HYPOTHETICAL TRAFFIC AND A WHAT-IF POTENTIAL IS EVALUATED AND COMPARED **RELATIVE TO THE BASE CASE** TO INFORM **RISK MANAGEMENT**.

CASE T: GW 487, KM 348, DP 348 and 67:

**BASE CASE 2010 TRAFFIC WITH
FOLLOWING WHAT-IF FOCUS VESSELS**

487 Gateway Bulk Carriers + Bunkering Barges

348 Kinder Morgan Tankers + Bunkering Barges

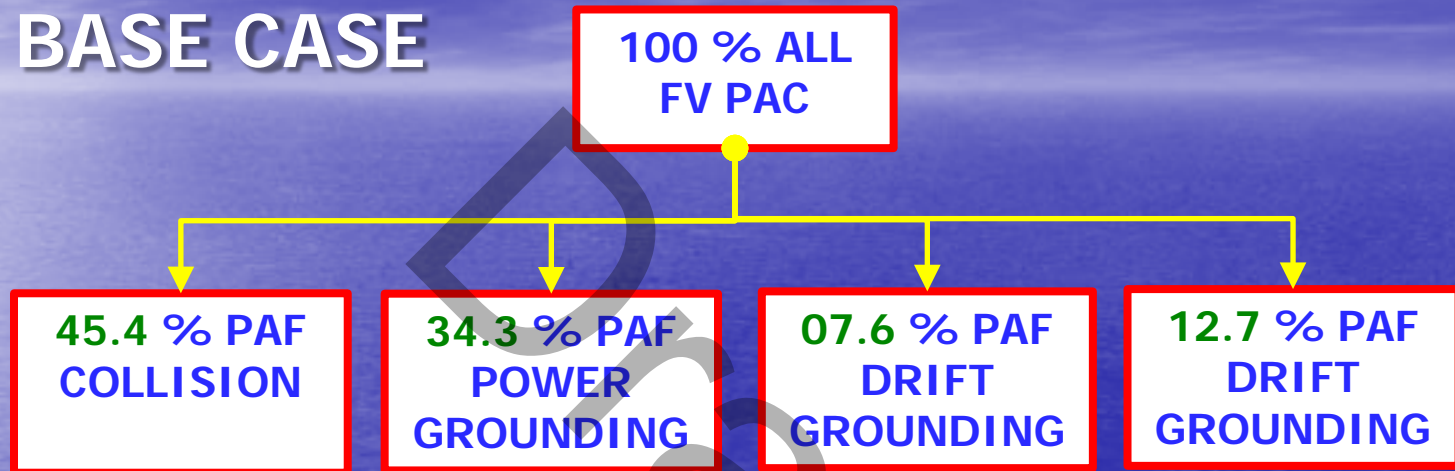
348 Delta Port Bulk Carriers + Bunkering Barges

67 Delta Port Container Ships + Bunkering Barges

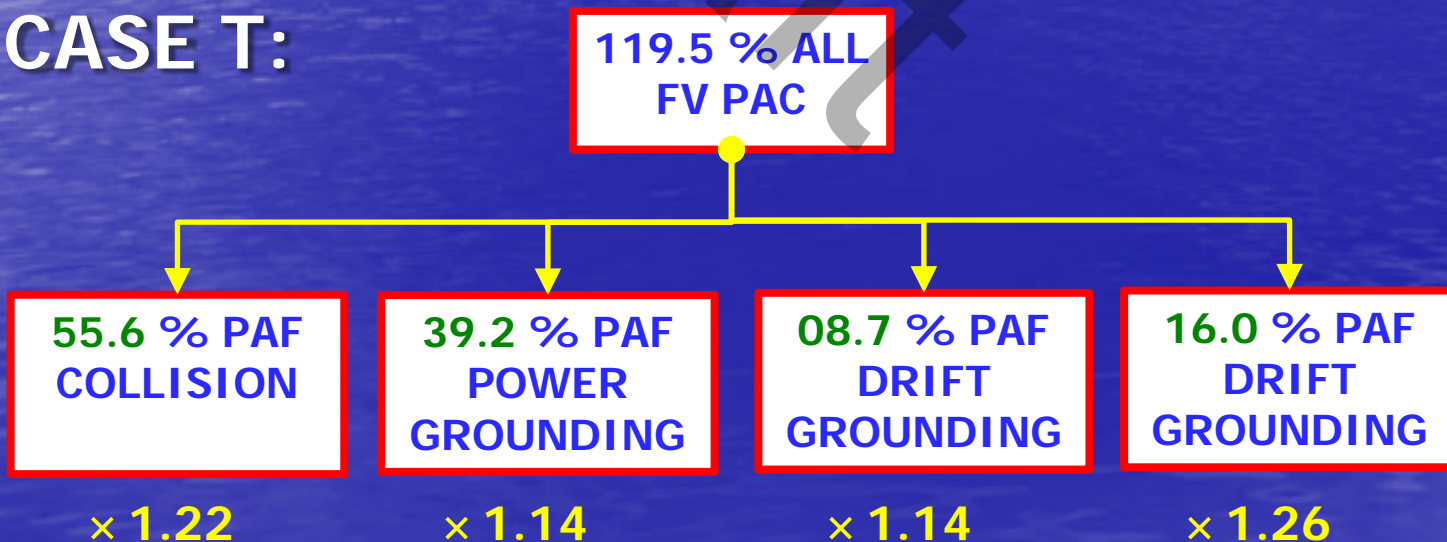
A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ANNUAL ACCIDENT FREQUENCY

PAF : POTENTIAL ACCIDENT FREQUENCY - PER YEAR

2010 BASE CASE

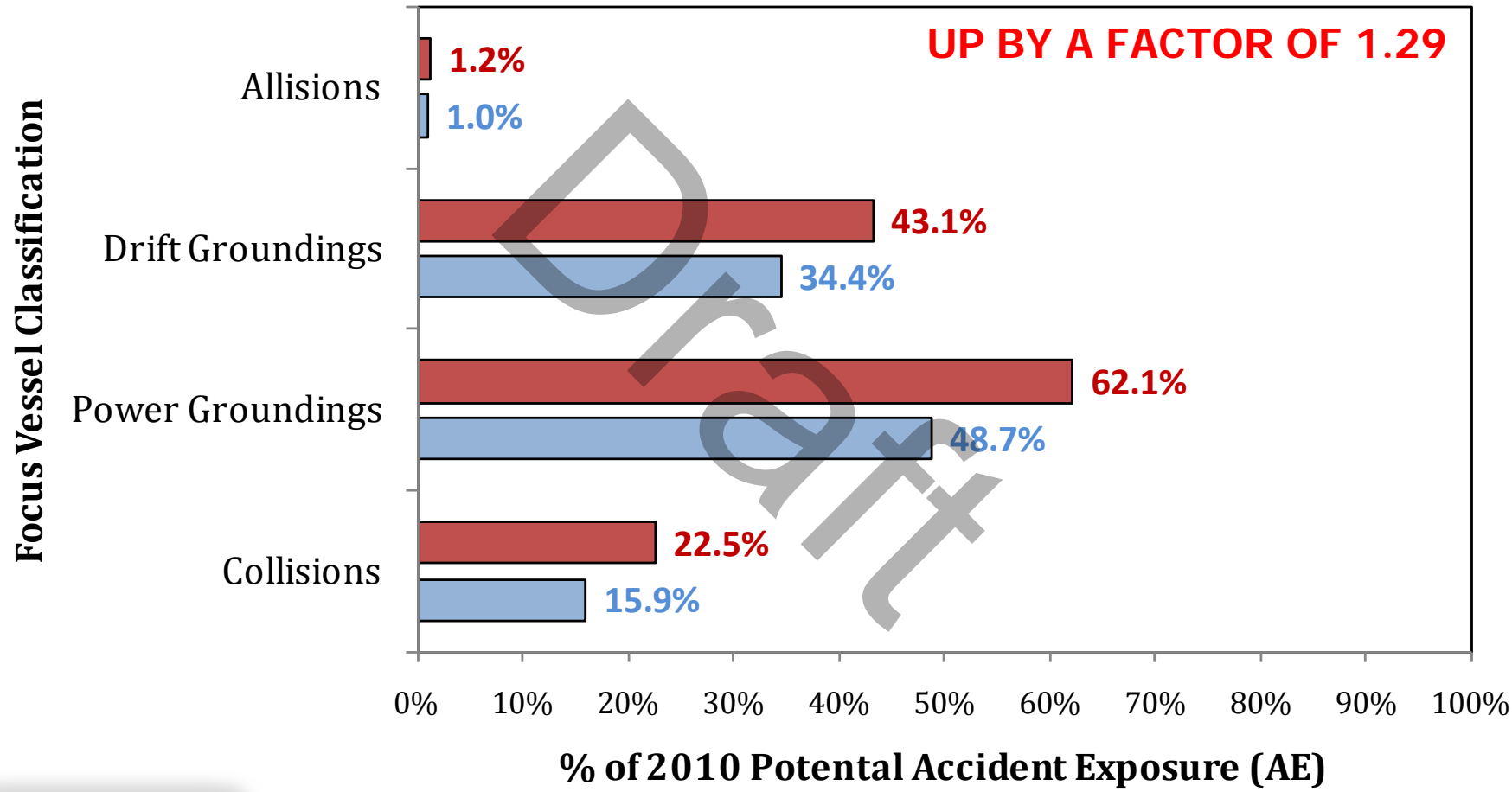


2010 CASE T:



CASE T: GW 487, KM 348, DP 348 and 67:

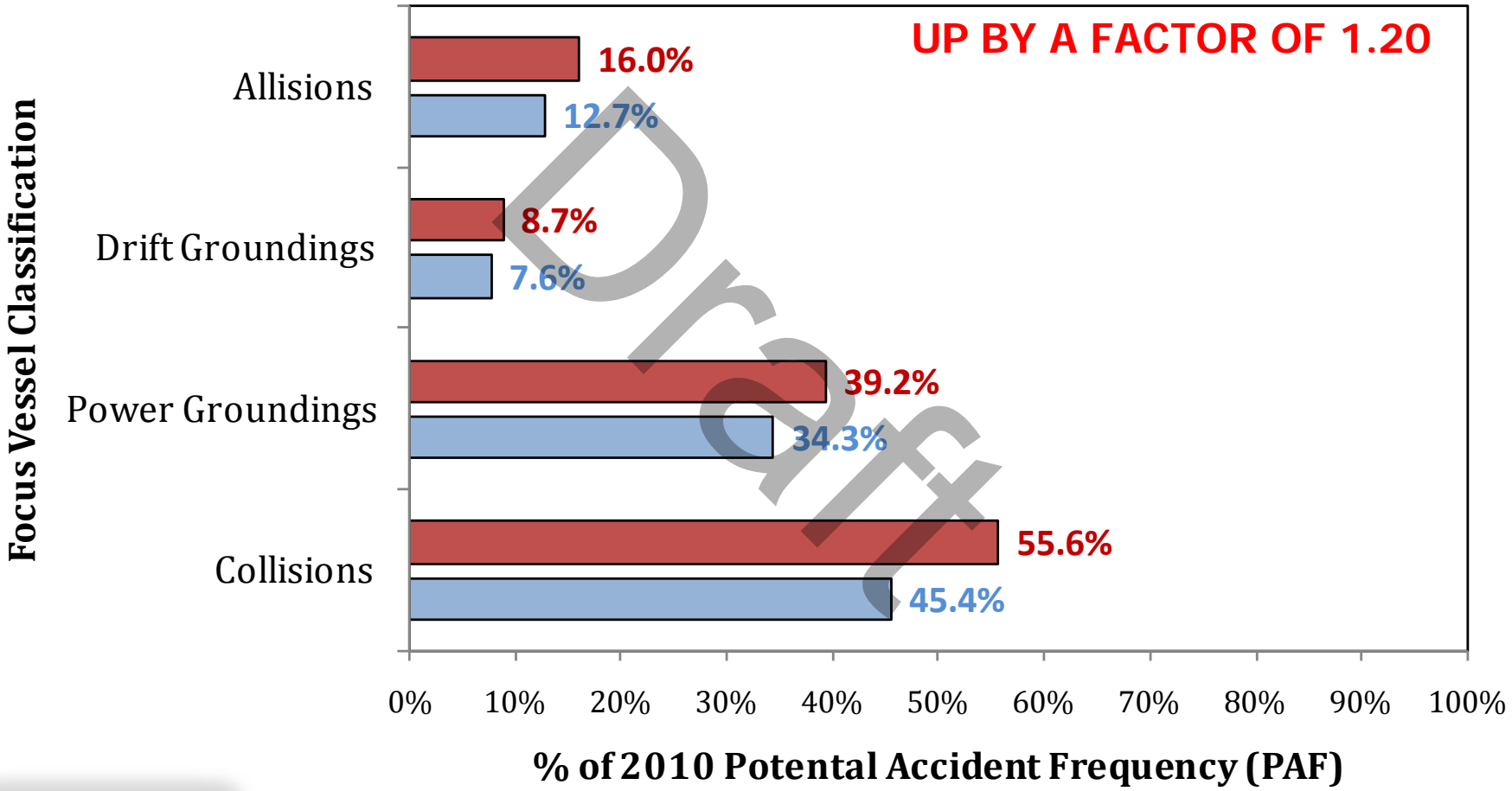
VTRA 2010 - ACCIDENT EXPOSURE



■ T: GW - KM - DP - 128.9% ■ P: BASE CASE 2010 - 100.0%

CASE T: GW 487, KM 348, DP 348 and 67:

VTRA 2010 - ACCIDENT FREQUENCY

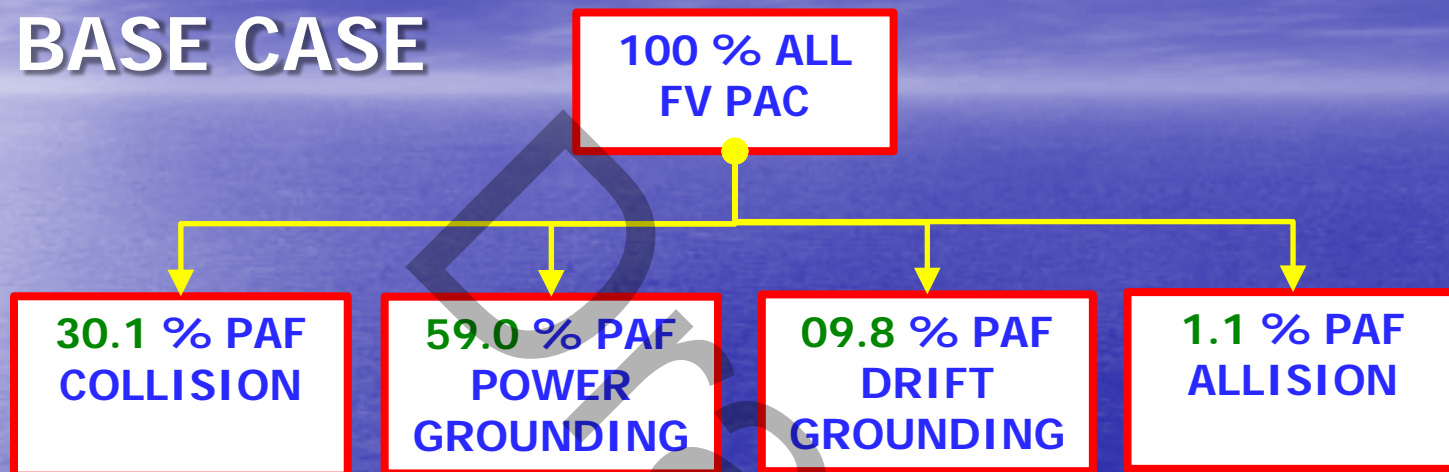


■ T: GW - KM - DP - 119.5% ■ P: BASE CASE 2010 - 100.0%

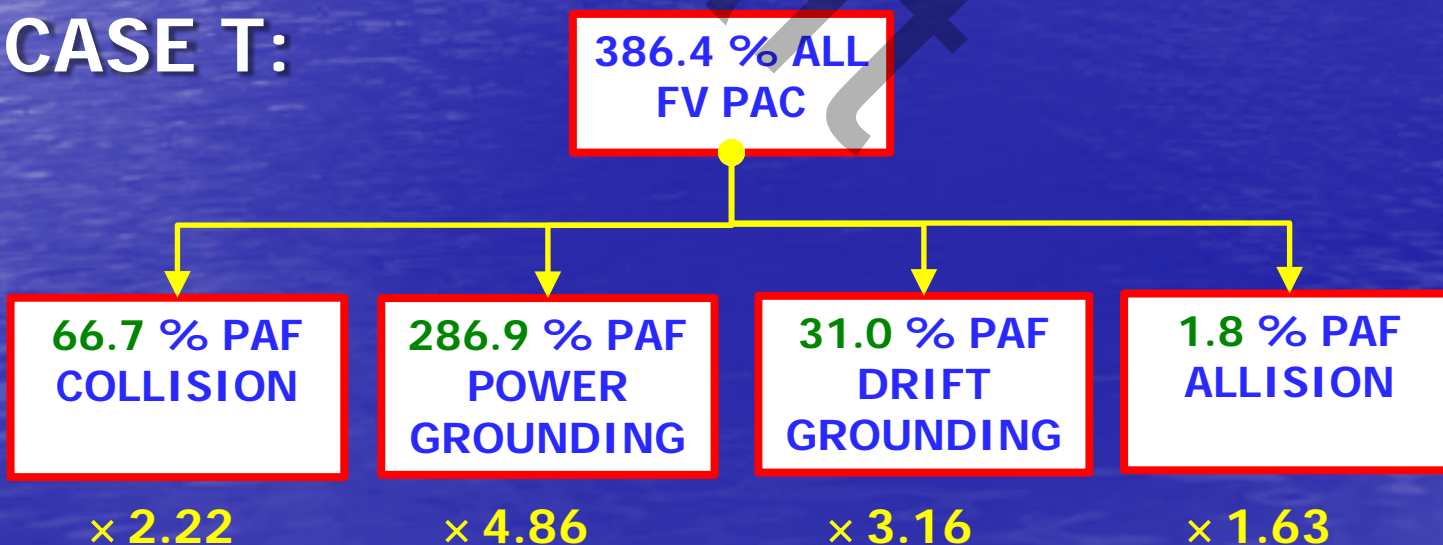
A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ANNUAL ACCIDENT OIL (CARGO + FUEL) LOSS

PAF : POTENTIAL ACCIDENT FREQUENCY - PER YEAR

2010 BASE CASE

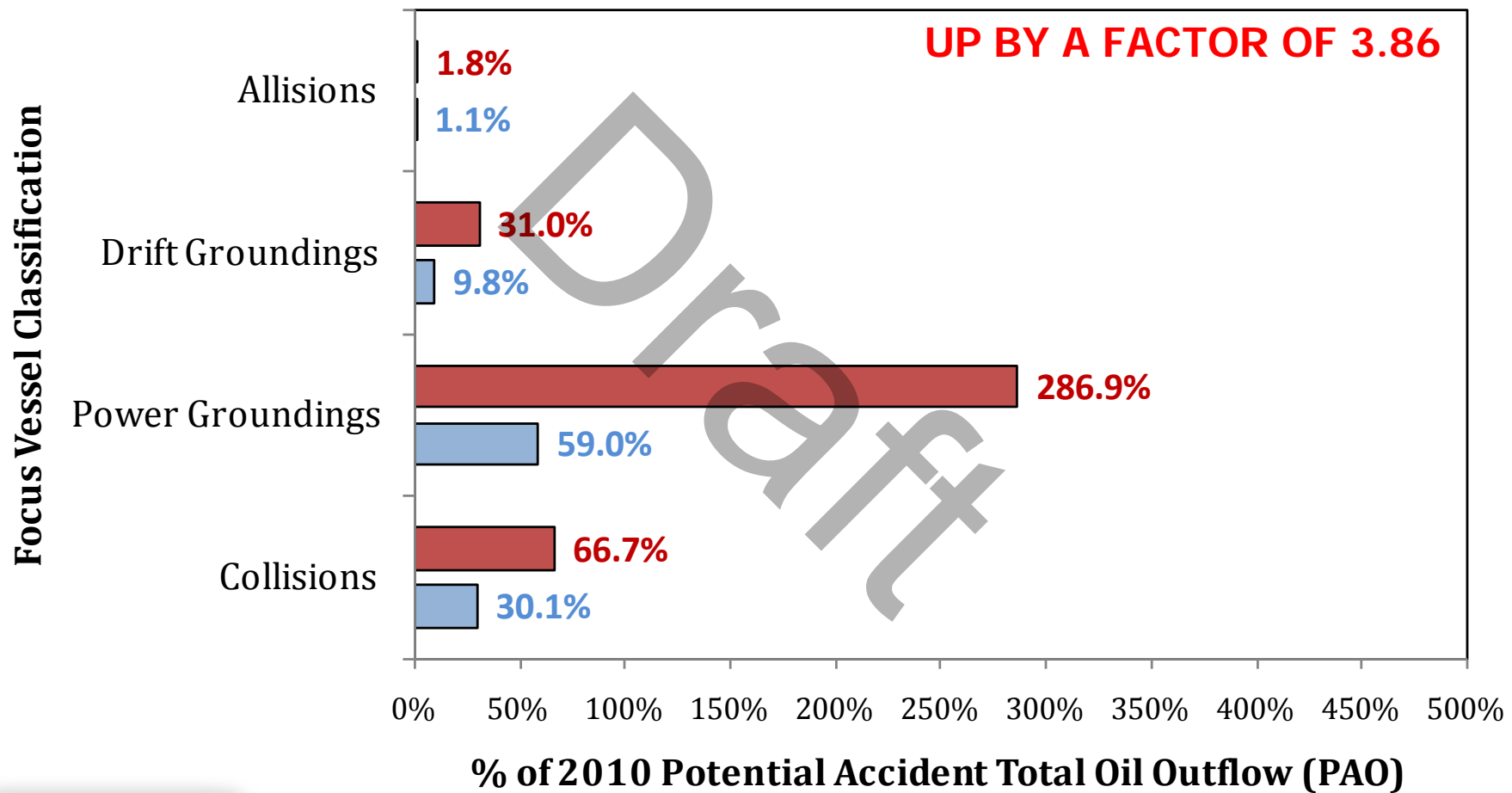


2010 CASE T:



CASE T: GW 487, KM 348, DP 348 and 67:

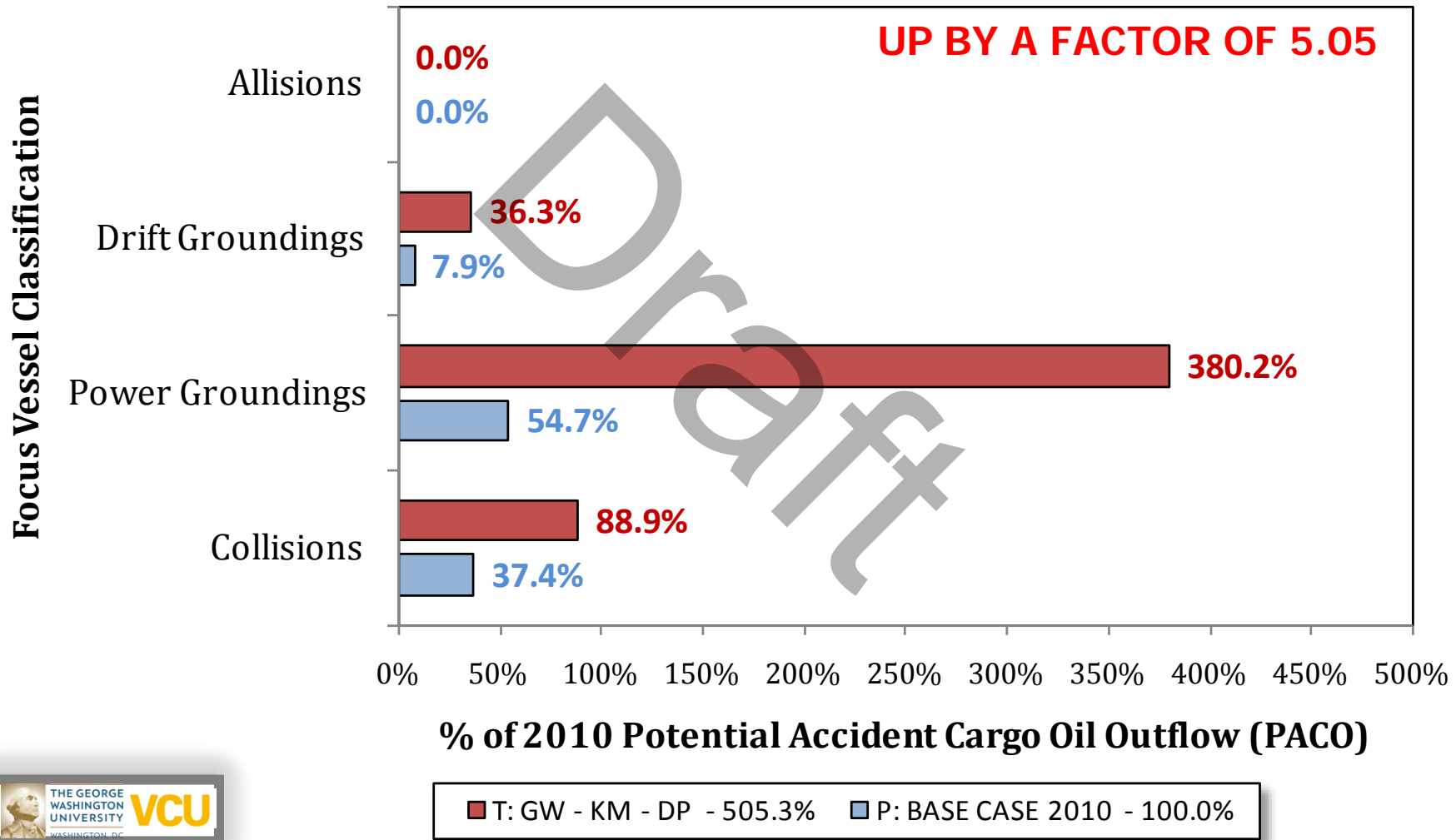
VTRA 2010 - ACCIDENT OIL LOSS (CARGO + FUEL)



■ T: GW - KM - DP - 386.4% ■ P: BASE CASE 2010 - 100.0%

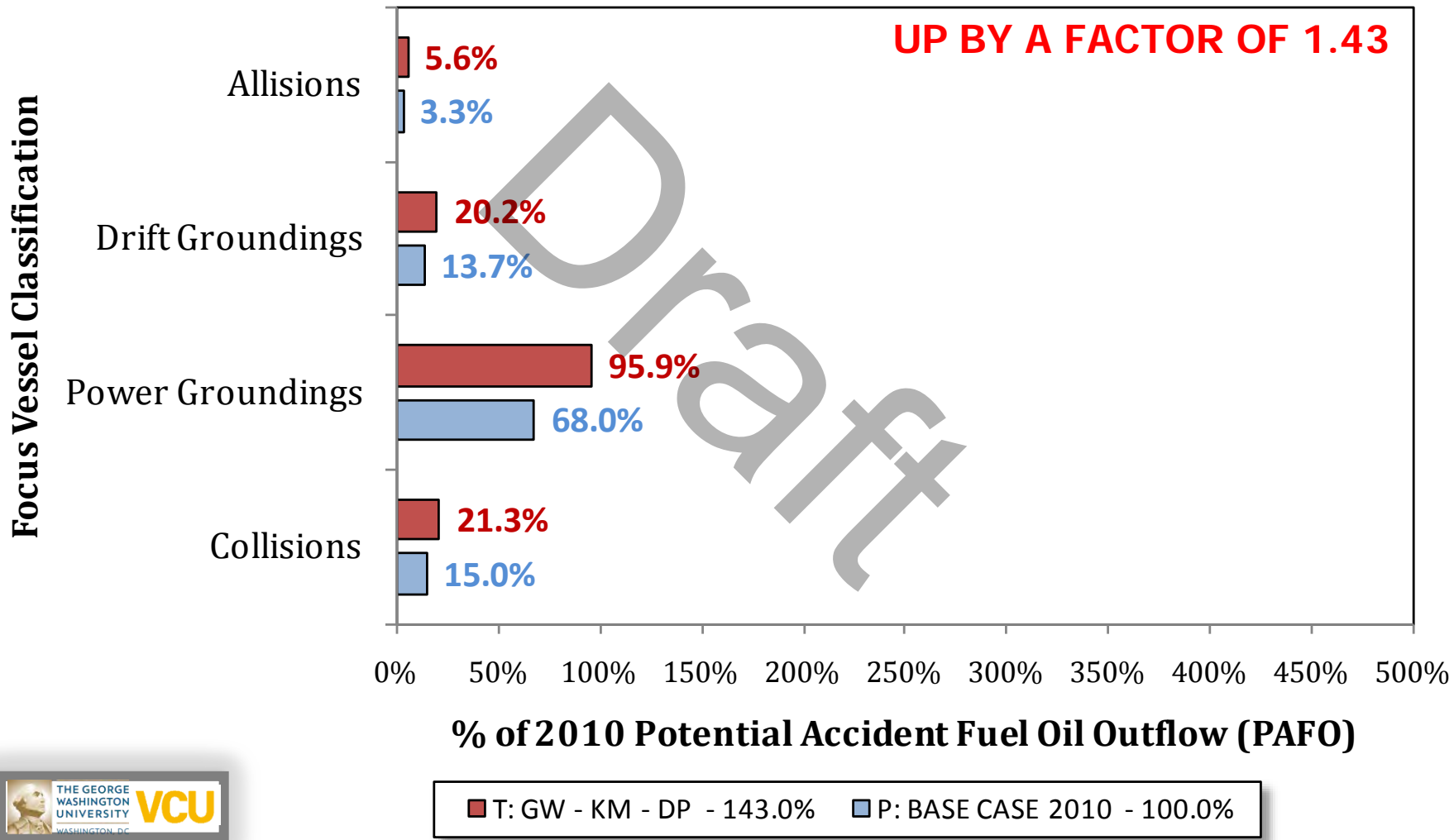
CASE T: GW 487, KM 348, DP 348 and 67:

VTRA 2010 - ACCIDENT CARGO OIL LOSS



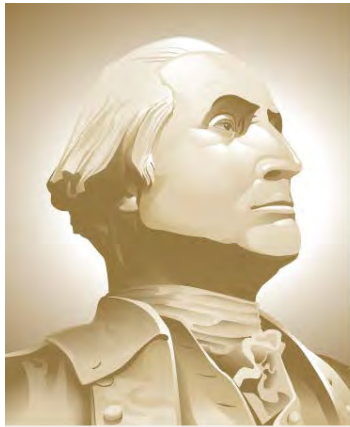
CASE T: GW 487, KM 348, DP 348 and 67:

VTRA 2010 - ACCIDENT FUEL OIL LOSS



VTRA 2010 CASE T RESULTS – COLLISION EXPOSURE AND ACCIDENT GEOGRAPHIC PROFILES

Presentation by: J. Rene van Dorp



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CASE T: Gateway, Kinder Morgan, Delta Port

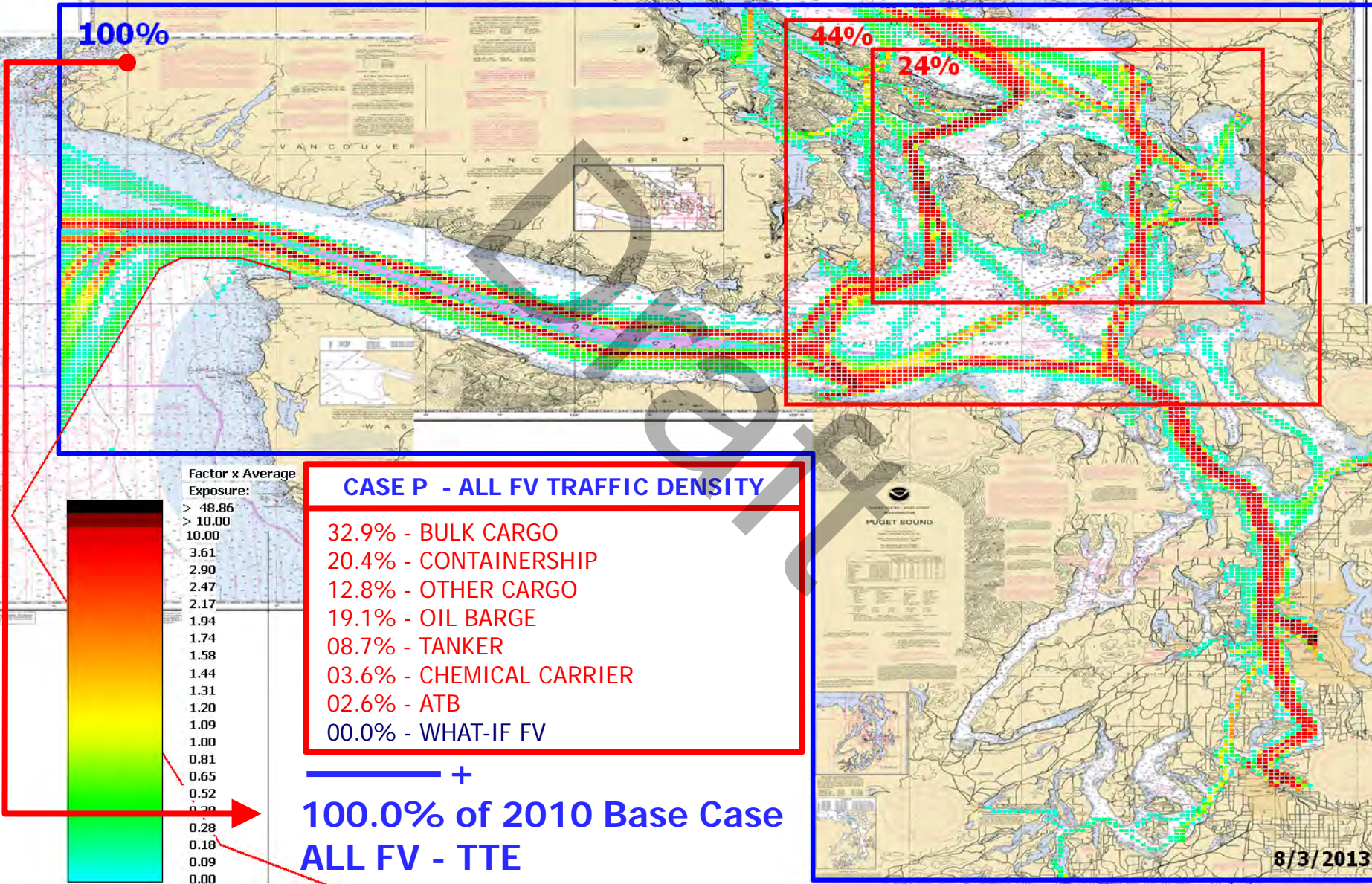
GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

AUGUST 5, 2013

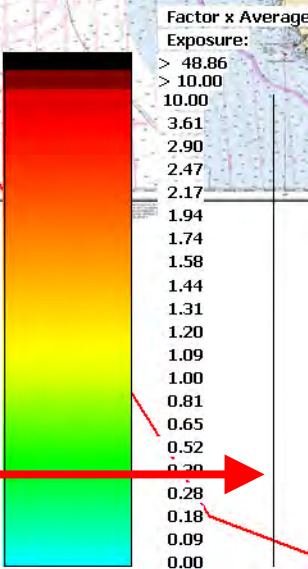
P: All FV TOTAL TIME OF EXPOSURE (TTE)

P: VTRA 2010 - BASE CASE - All FV



CASE P - ALL FV TRAFFIC DENSITY

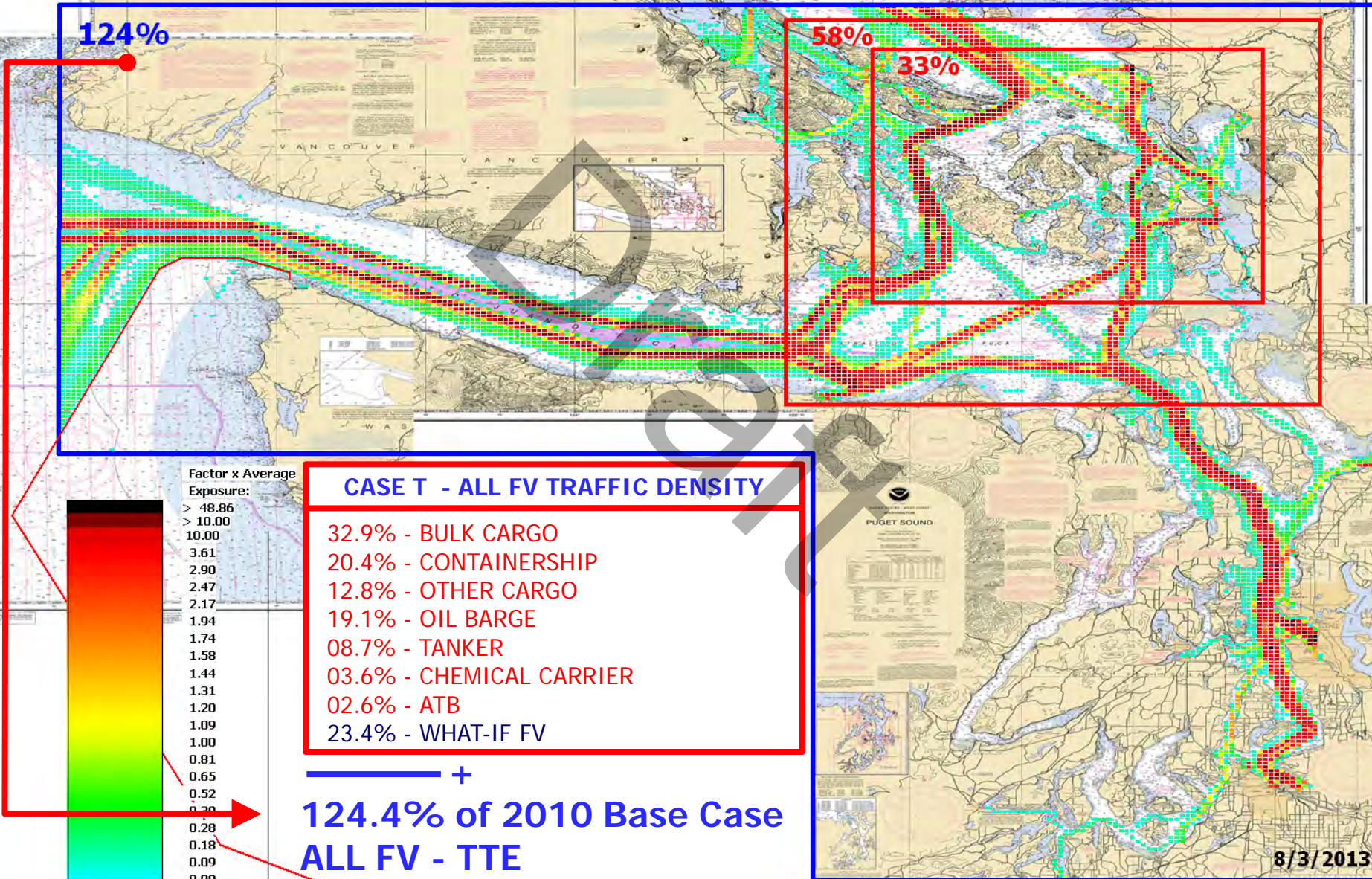
- 32.9% - BULK CARGO
- 20.4% - CONTAINERSHIP
- 12.8% - OTHER CARGO
- 19.1% - OIL BARGE
- 08.7% - TANKER
- 03.6% - CHEMICAL CARRIER
- 02.6% - ATB
- 00.0% - WHAT-IF FV



100.0% of 2010 Base Case ALL FV - TTE

T: All FV TOTAL TIME OF EXPOSURE (TTE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348 - All FV



124%

58%

33%

Factor x Average Exposure:

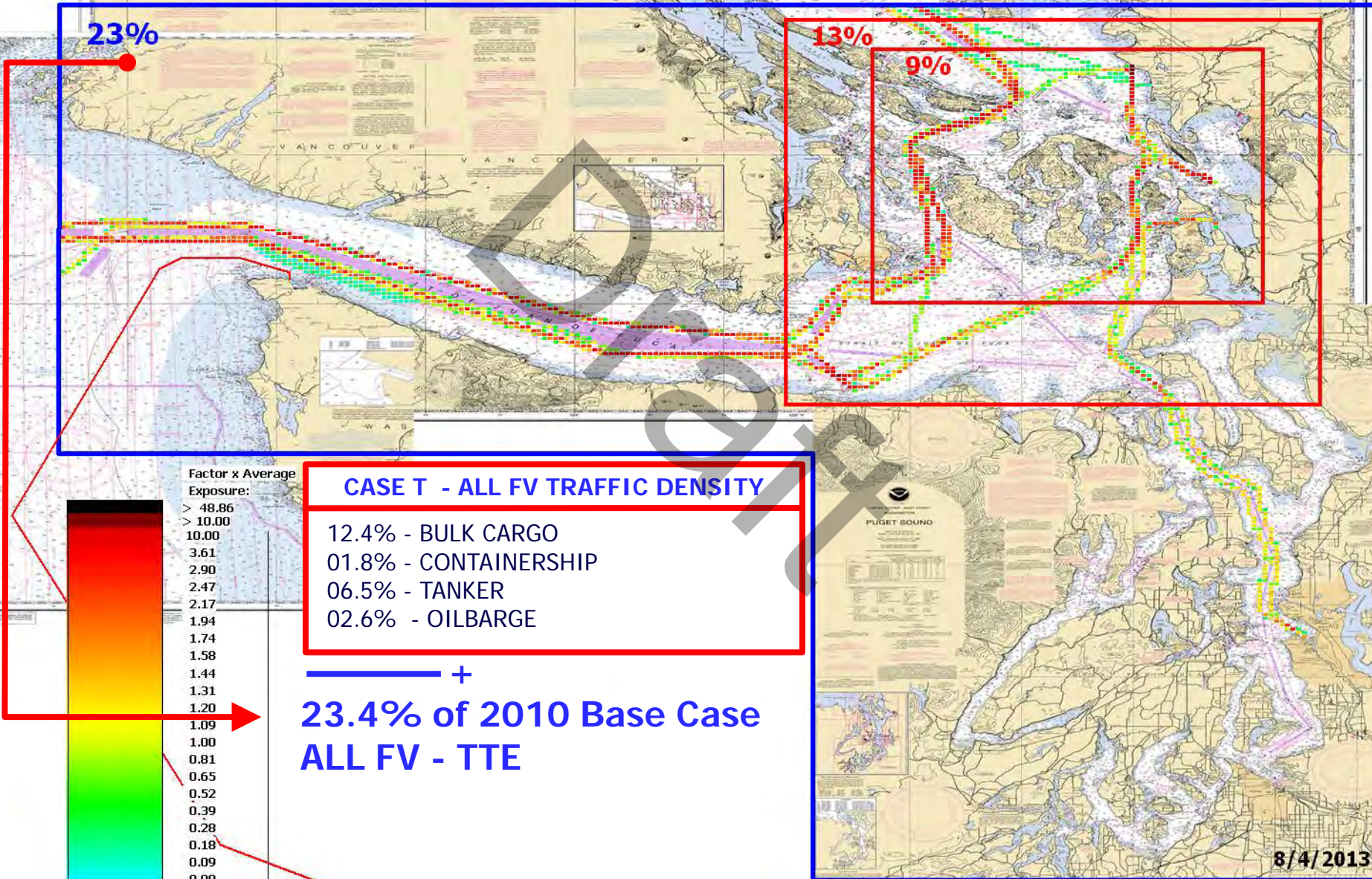
> 48.86
> 10.00
10.00
3.61
2.90
2.47
2.17
1.94
1.74
1.58
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.52
0.39
0.28
0.18
0.09
0.00

- CASE T - ALL FV TRAFFIC DENSITY**
- 32.9% - BULK CARGO
 - 20.4% - CONTAINERSHIP
 - 12.8% - OTHER CARGO
 - 19.1% - OIL BARGE
 - 08.7% - TANKER
 - 03.6% - CHEMICAL CARRIER
 - 02.6% - ATB
 - 23.4% - WHAT-IF FV

+
124.4% of 2010 Base Case
ALL FV - TTE

T: WHAT-IF FV TOTAL TIME OF EXPOSURE (TTE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



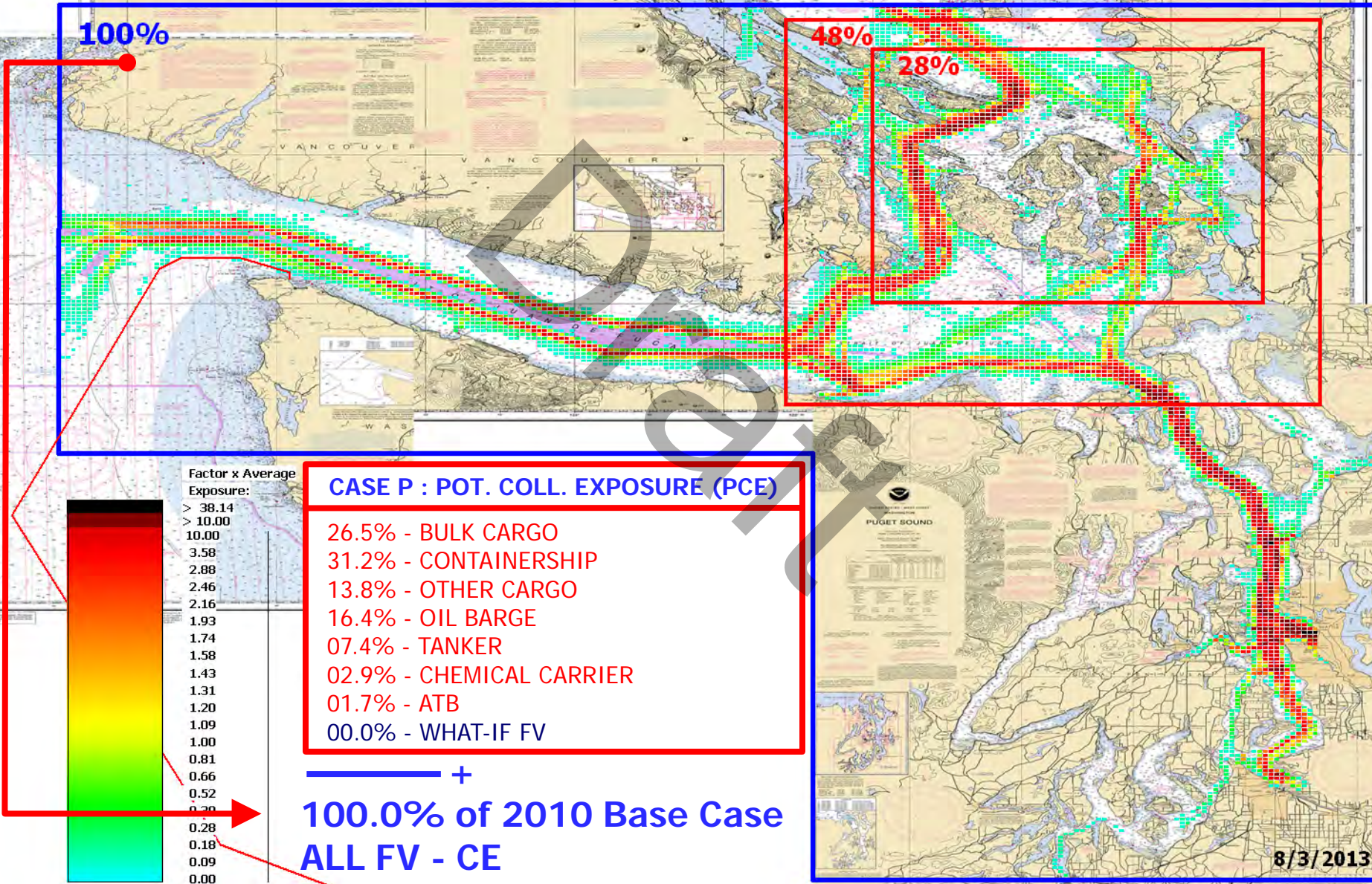
CASE T - ALL FV TRAFFIC DENSITY

- 12.4% - BULK CARGO
- 01.8% - CONTAINERSHIP
- 06.5% - TANKER
- 02.6% - OILBARGE

23.4% of 2010 Base Case ALL FV - TTE

P: ALL FV POTENTIAL COLLISION EXPOSURE (PCE)

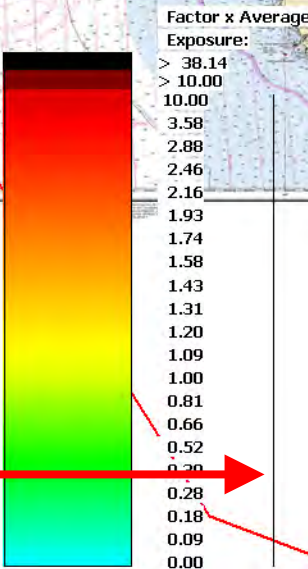
P: VTRA 2010 - BASE CASE - All FV



CASE P : POT. COLL. EXPOSURE (PCE)

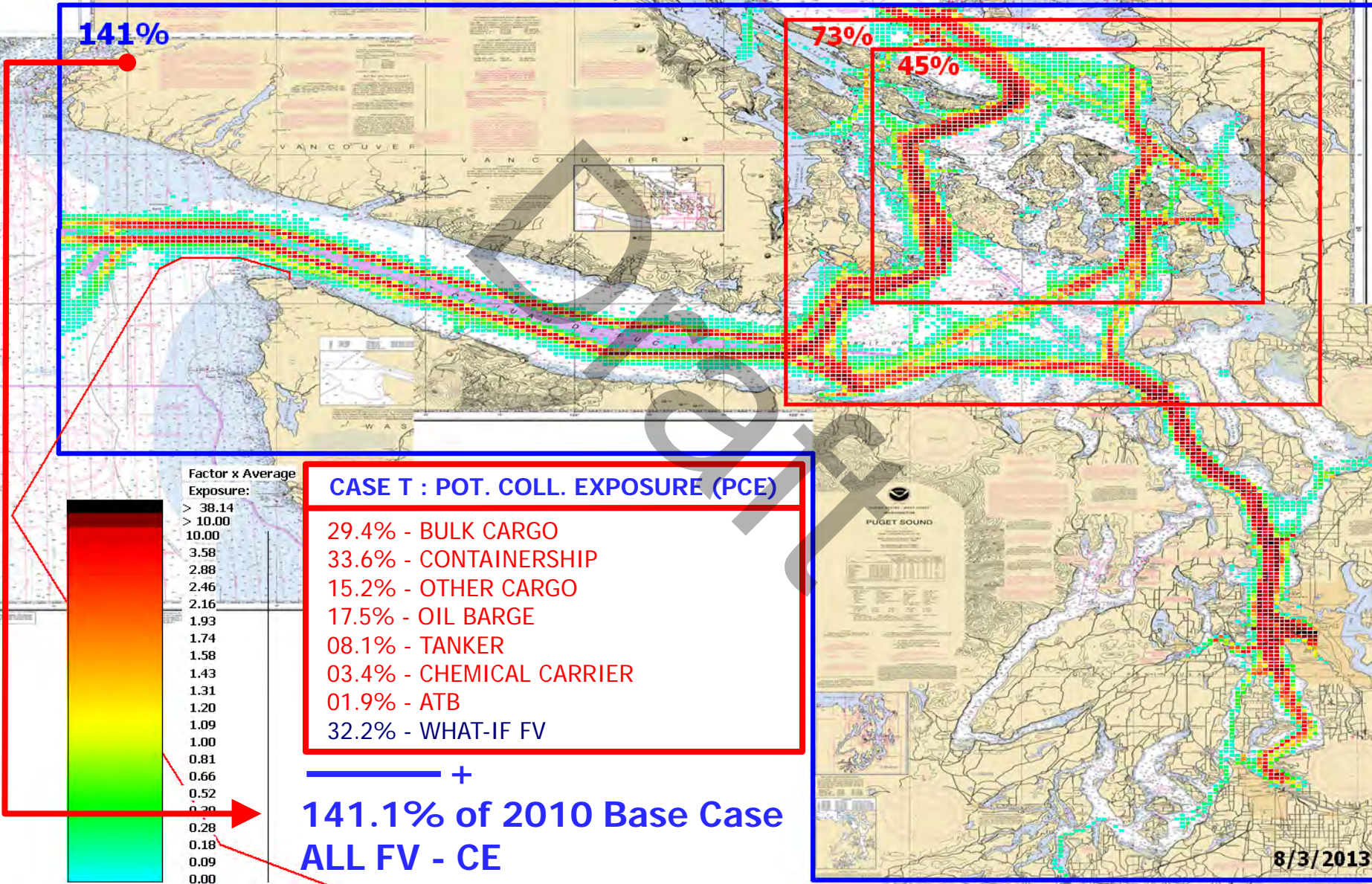
- 26.5% - BULK CARGO
- 31.2% - CONTAINERSHIP
- 13.8% - OTHER CARGO
- 16.4% - OIL BARGE
- 07.4% - TANKER
- 02.9% - CHEMICAL CARRIER
- 01.7% - ATB
- 00.0% - WHAT-IF FV

**100.0% of 2010 Base Case
ALL FV - CE**



T: All FV POTENTIAL COLLISION EXPOSURE (PCE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348 - All FV



141%

73%

45%

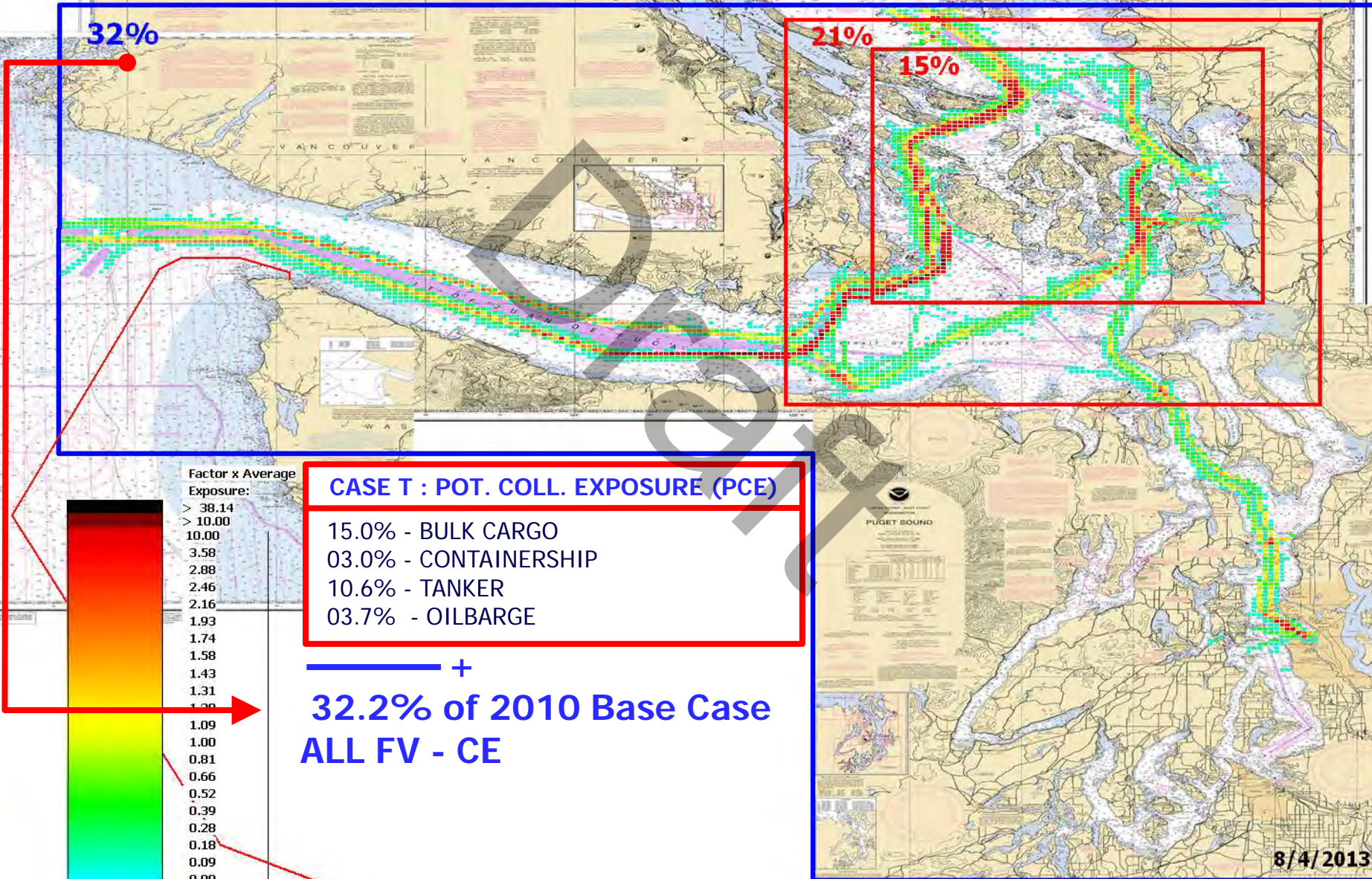


- CASE T : POT. COLL. EXPOSURE (PCE)**
- 29.4% - BULK CARGO
 - 33.6% - CONTAINERSHIP
 - 15.2% - OTHER CARGO
 - 17.5% - OIL BARGE
 - 08.1% - TANKER
 - 03.4% - CHEMICAL CARRIER
 - 01.9% - ATB
 - 32.2% - WHAT-IF FV

+
141.1% of 2010 Base Case
ALL FV - CE

T: WHAT-IF FV POTENTIAL COLLISION EXPOSURE (PCE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



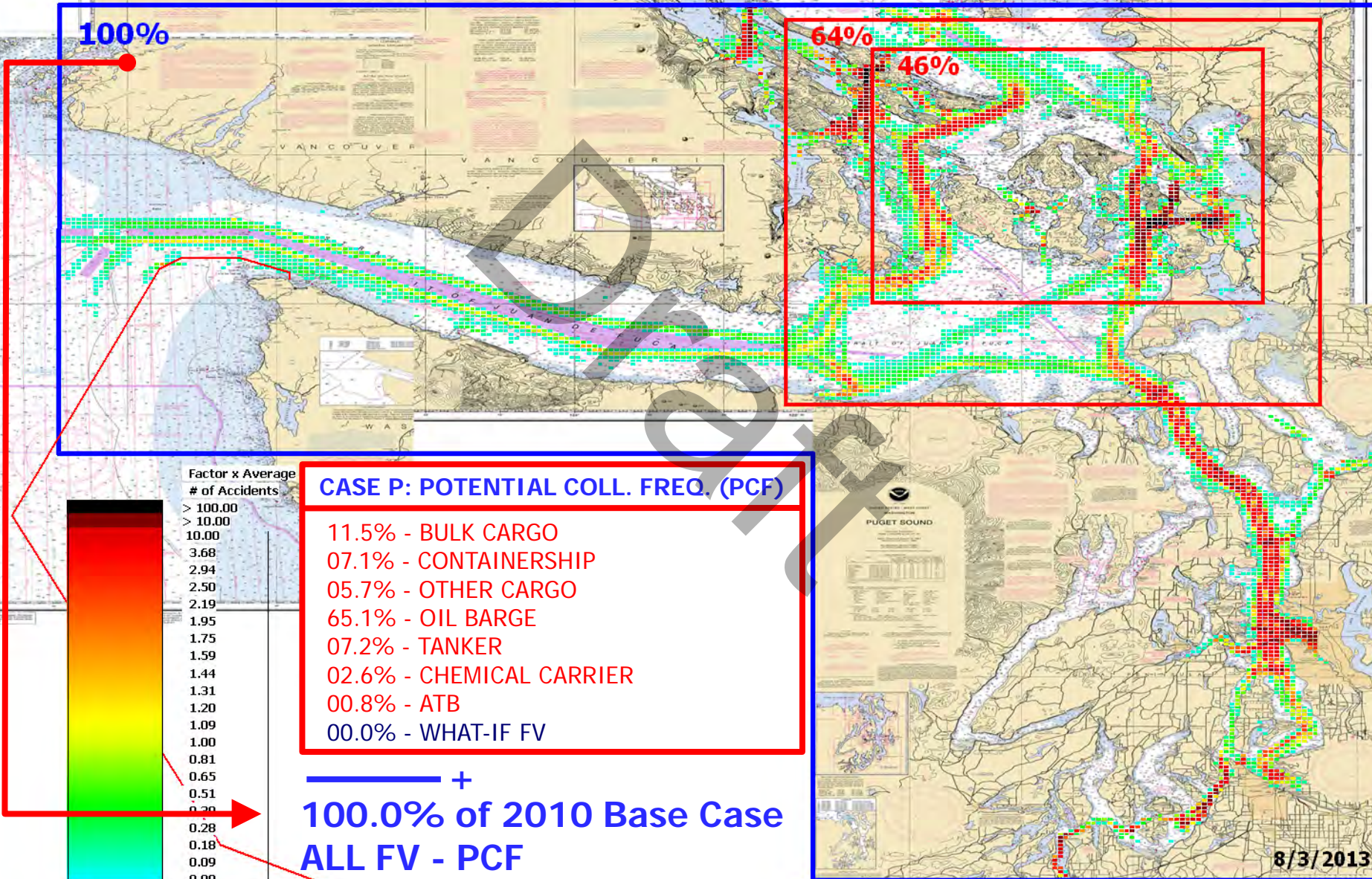
CASE T : POT. COLL. EXPOSURE (PCE)

- 15.0% - BULK CARGO
- 03.0% - CONTAINERSHIP
- 10.6% - TANKER
- 03.7% - OILBARGE

— +
32.2% of 2010 Base Case
ALL FV - CE

P: ALL FV POTENTIAL COLLISION FREQUENCY (PCF)

P: VTRA 2010 - BASE CASE - All FV



100%

64%

46%

Factor x Average # of Accidents
> 100.00
> 10.00
3.68
2.94
2.50
2.19
1.95
1.75
1.59
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.51
0.39
0.28
0.18
0.09
0.00

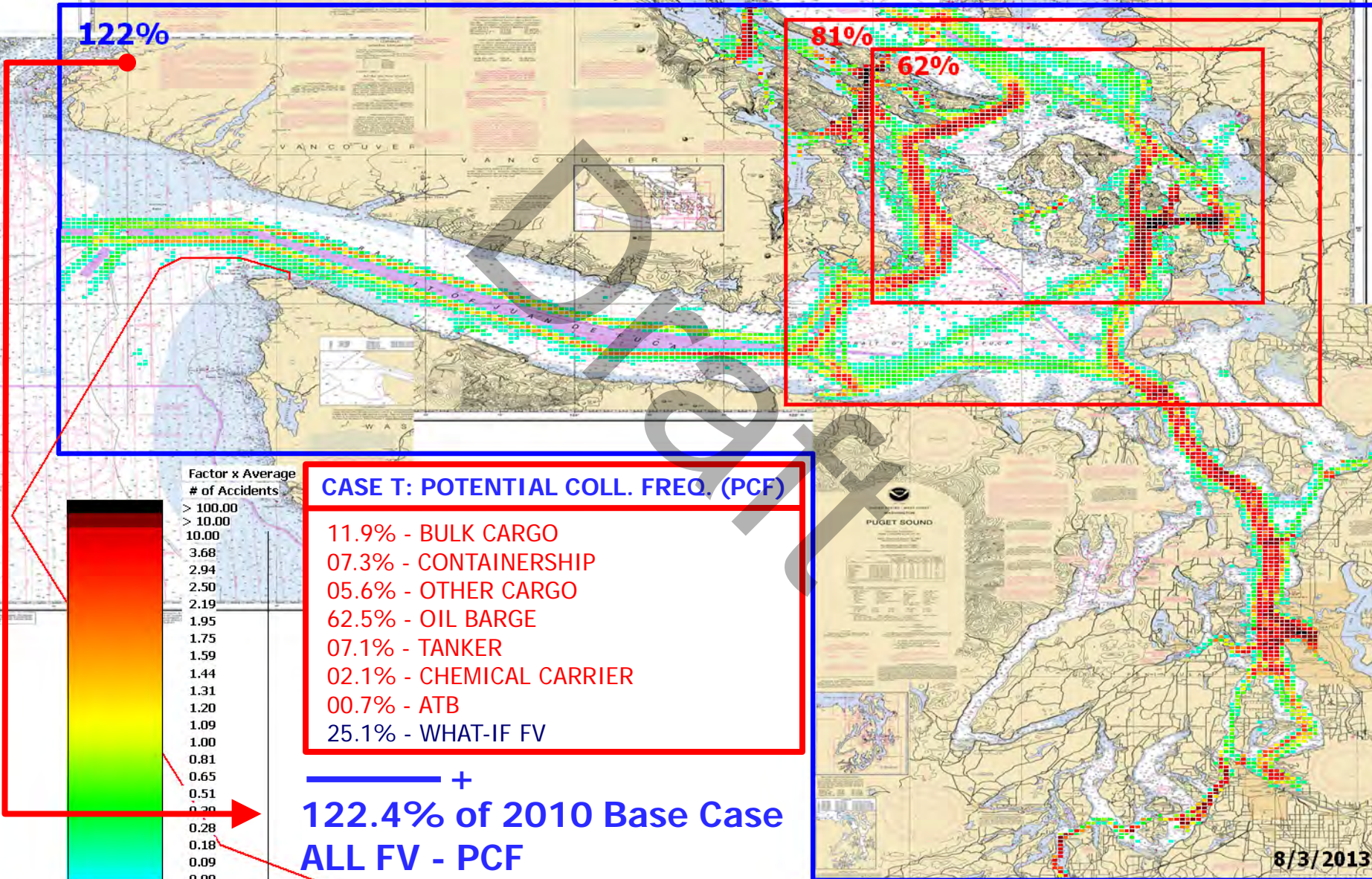
CASE P: POTENTIAL COLL. FREQ. (PCF)

- 11.5% - BULK CARGO
- 07.1% - CONTAINERSHIP
- 05.7% - OTHER CARGO
- 65.1% - OIL BARGE
- 07.2% - TANKER
- 02.6% - CHEMICAL CARRIER
- 00.8% - ATB
- 00.0% - WHAT-IF FV

— +
**100.0% of 2010 Base Case
ALL FV - PCF**

T: ALL FV POTENTIAL COLLISION FREQUENCY (PCF)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348 - All FV



CASE T: POTENTIAL COLL. FREQ. (PCF)

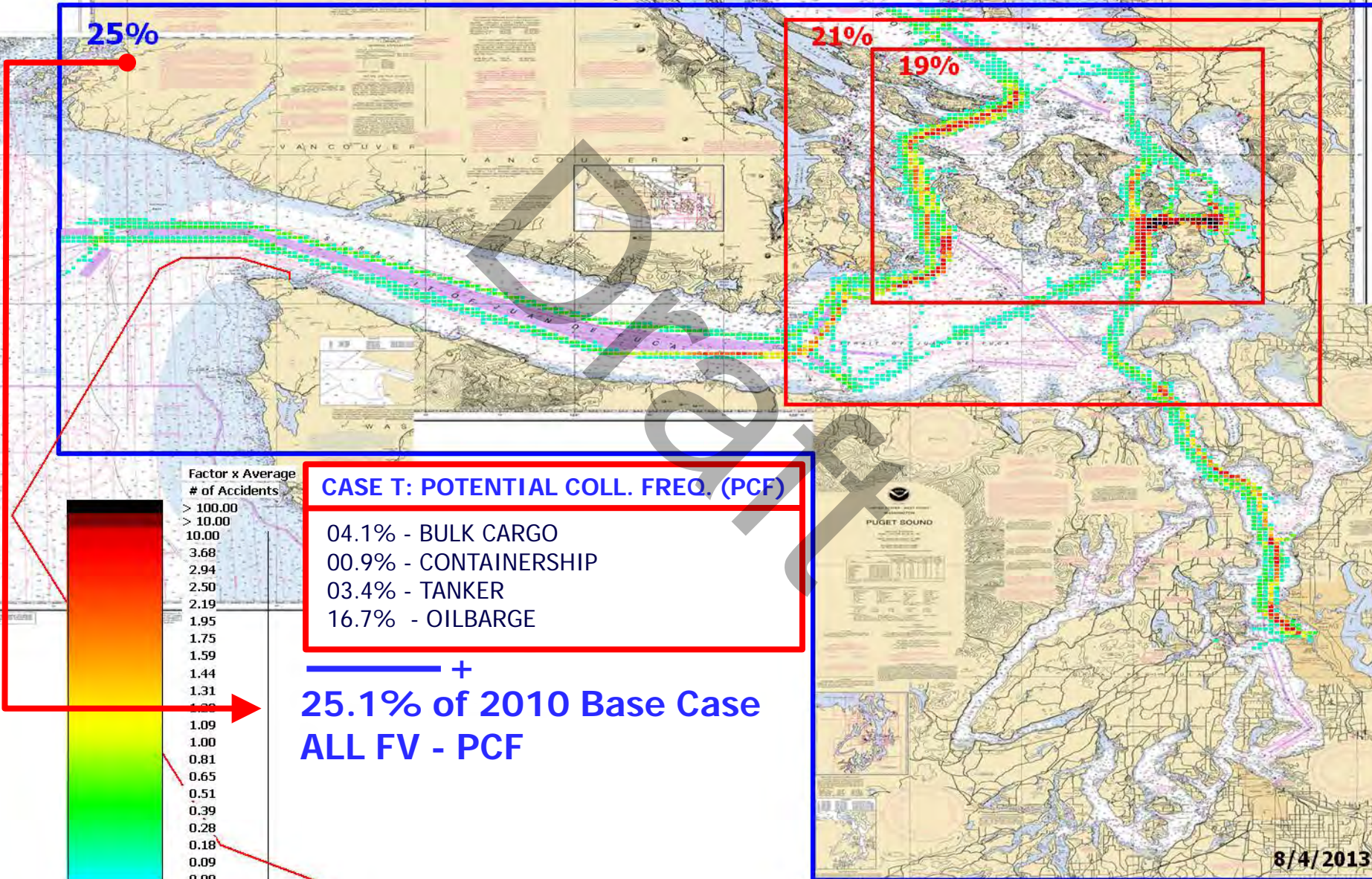
- 11.9% - BULK CARGO
- 07.3% - CONTAINERSHIP
- 05.6% - OTHER CARGO
- 62.5% - OIL BARGE
- 07.1% - TANKER
- 02.1% - CHEMICAL CARRIER
- 00.7% - ATB
- 25.1% - WHAT-IF FV

**+
122.4% of 2010 Base Case
ALL FV - PCF**

Factor x Average # of Accidents
> 100.00
> 10.00
3.68
2.94
2.50
2.19
1.95
1.75
1.59
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.51
0.39
0.28
0.18
0.09
0.00

T: WHAT-IF FV POTENTIAL COLLISION FREQUENCY (PCF)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



25%

21%

19%

CASE T: POTENTIAL COLL. FREQ. (PCF)

- 04.1% - BULK CARGO
- 00.9% - CONTAINERSHIP
- 03.4% - TANKER
- 16.7% - OILBARGE

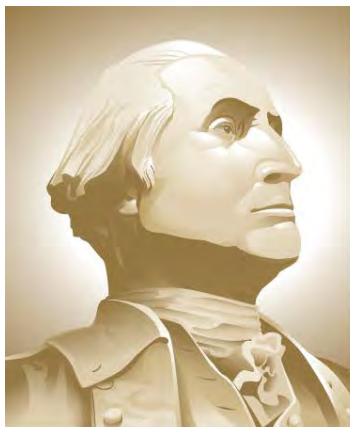
**+
25.1% of 2010 Base Case
ALL FV - PCF**

Factor x Average # of Accidents

> 100.00
> 10.00
10.00
3.68
2.94
2.50
2.19
1.95
1.75
1.59
1.44
1.31
1.19
1.09
1.00
0.81
0.65
0.51
0.39
0.28
0.18
0.09
0.00

VTRA 2010 CASE T RESULTS – COLLISION OIL (CARGO + FUEL), CARGO AND FUEL OIL GEOGRAPHIC PROFILES

Presentation by: J. Rene van Dorp



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CASE T: Gateway, Kinder Morgan, Delta Port

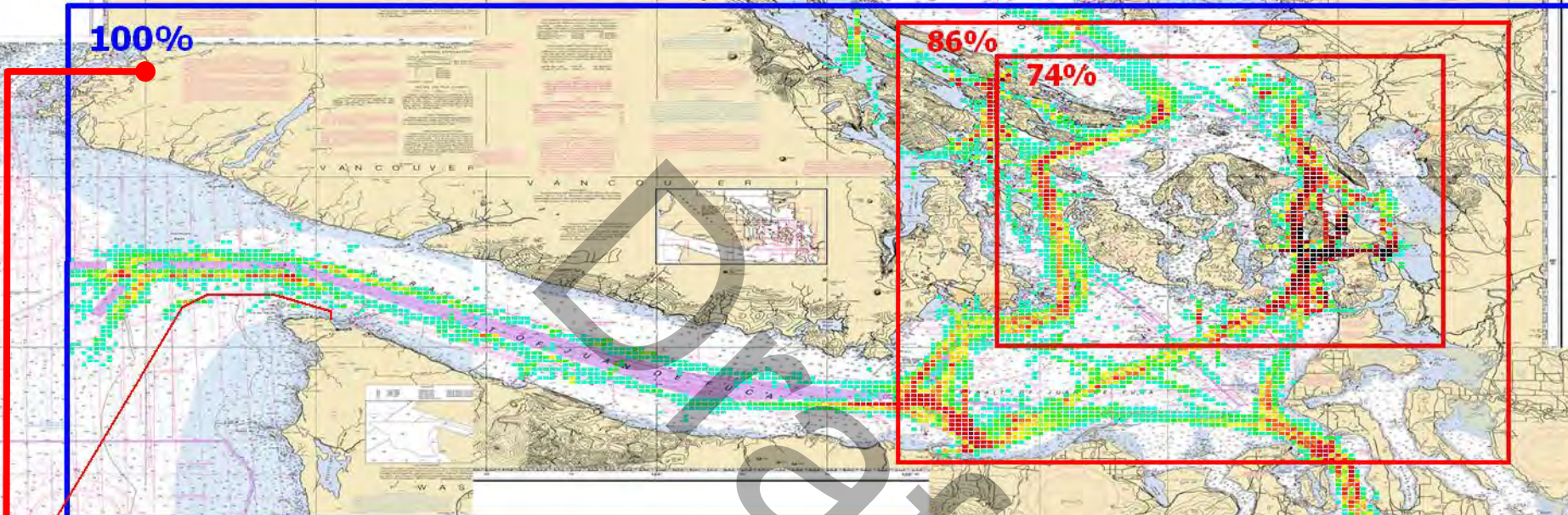
GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

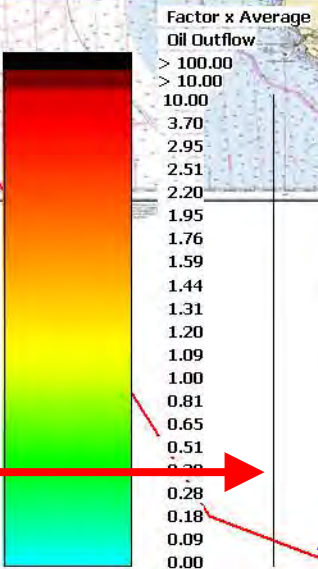
AUGUST 5, 2013

P: ALL FV POTENTIAL COLLISION OIL LOSS (PCO)

P: VTRA 2010 - BASE CASE - All FV



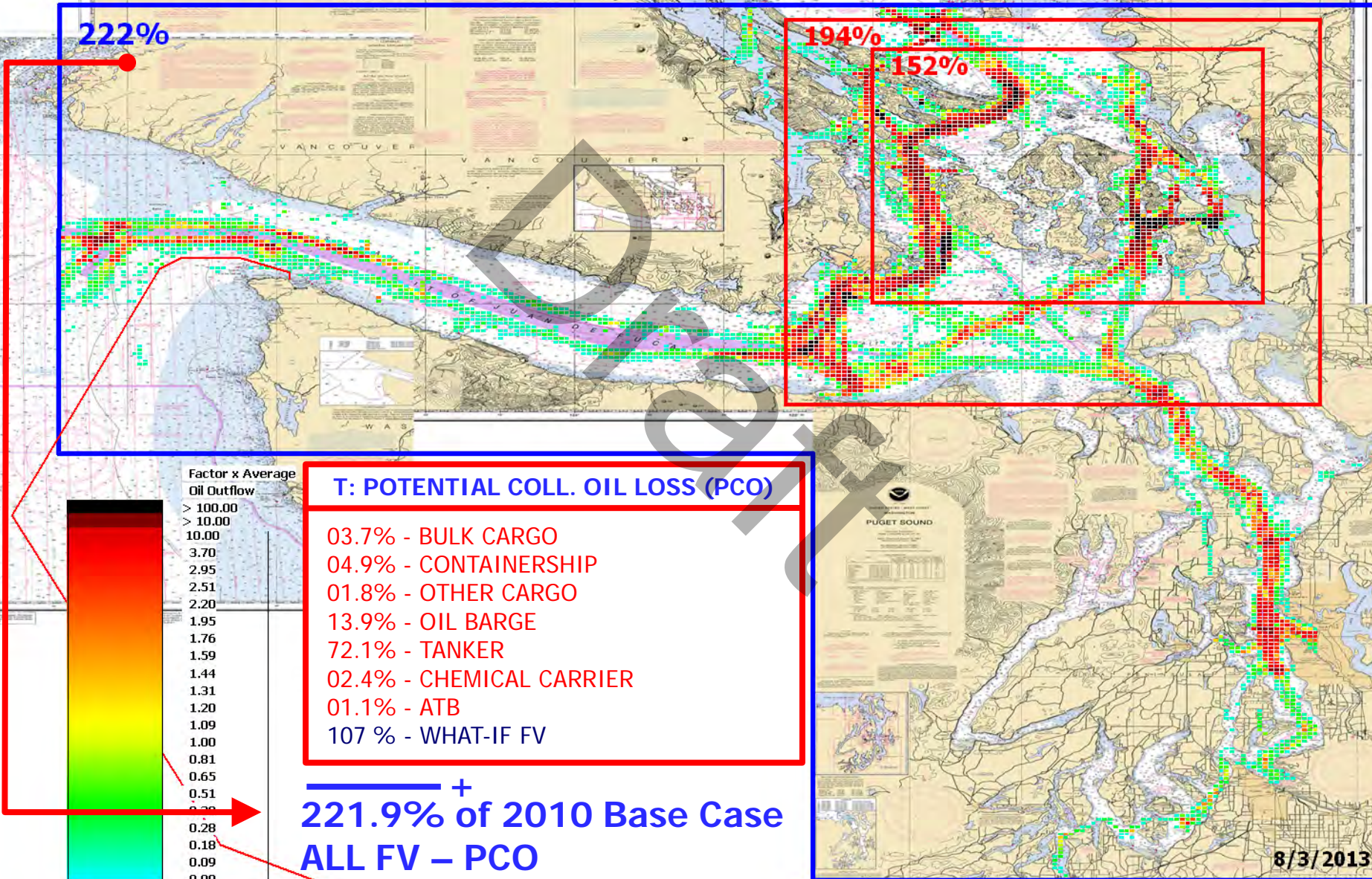
- P: POTENTIAL COLL. OIL LOSS (PCO)**
- 03.7% - BULK CARGO
 - 04.9% - CONTAINERSHIP
 - 01.8% - OTHER CARGO
 - 13.9% - OIL BARGE
 - 72.1% - TANKER
 - 02.4% - CHEMICAL CARRIER
 - 01.1% - ATB
 - 00.0% - WHAT-IF FV



100.0% of 2010 Base Case ALL FV – PCO

T: ALL FV POTENTIAL COLLISION OIL LOSS (PCO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348 - All FV



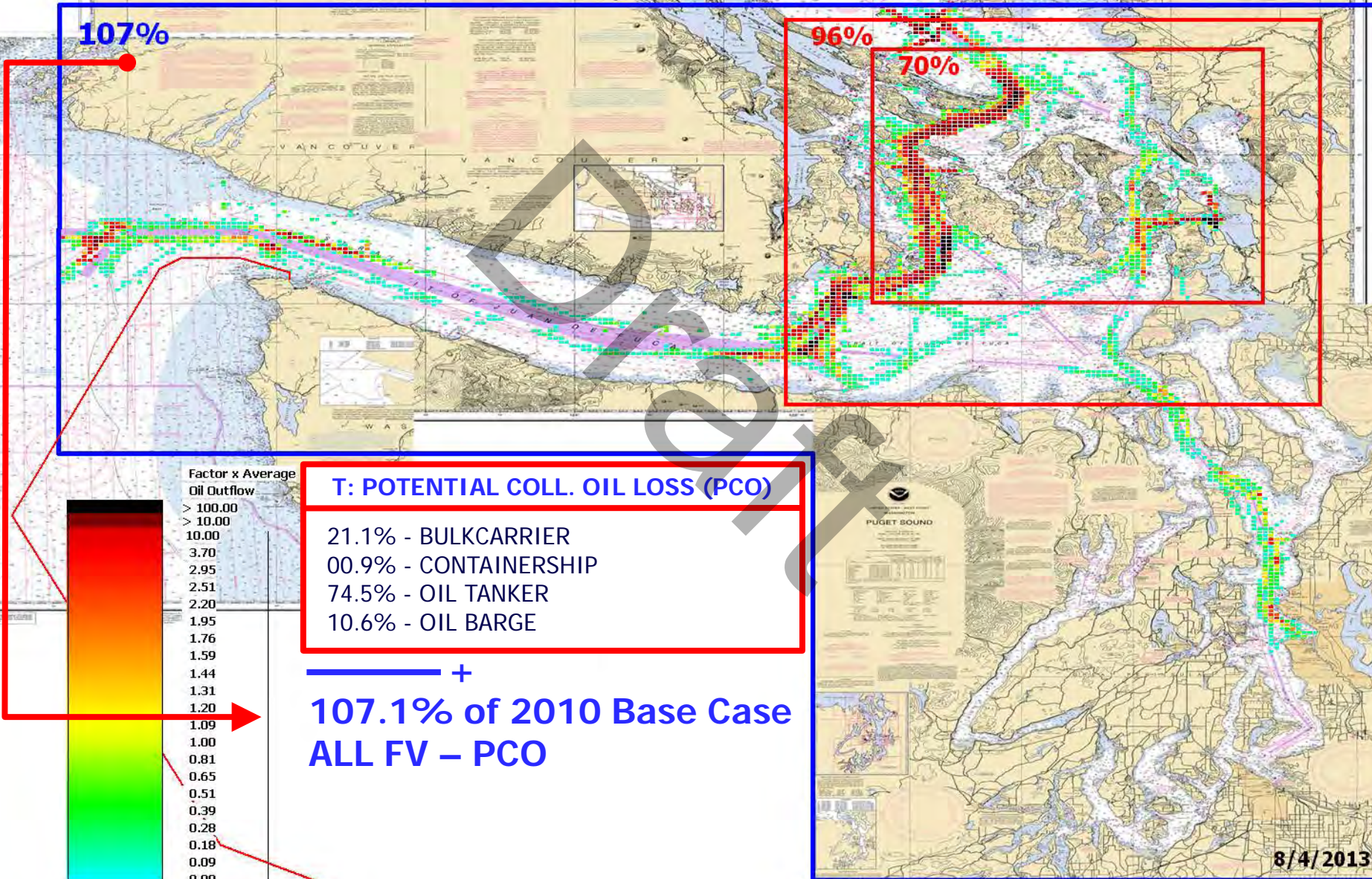
T: POTENTIAL COLL. OIL LOSS (PCO)

- 03.7% - BULK CARGO
- 04.9% - CONTAINERSHIP
- 01.8% - OTHER CARGO
- 13.9% - OIL BARGE
- 72.1% - TANKER
- 02.4% - CHEMICAL CARRIER
- 01.1% - ATB
- 107 % - WHAT-IF FV

221.9% of 2010 Base Case ALL FV – PCO

T: WHAT-IF FV POTENTIAL COLLISION OIL LOSS (PCO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



107%

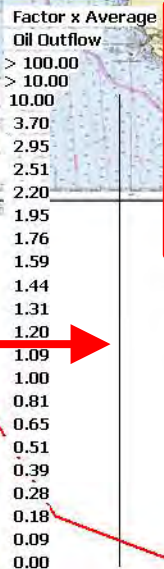
96%

70%

T: POTENTIAL COLL. OIL LOSS (PCO)

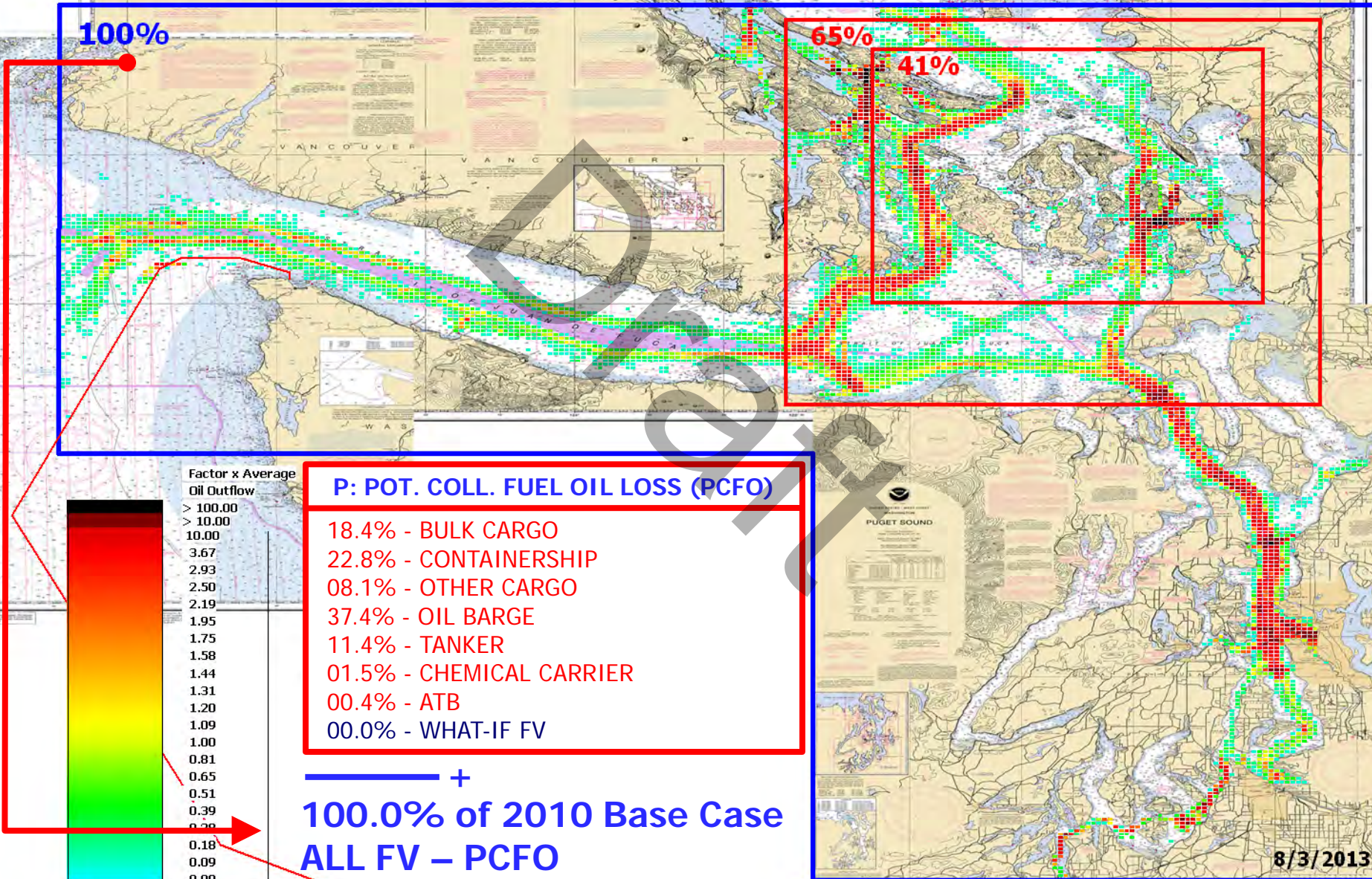
- 21.1% - BULKCARRIER
- 00.9% - CONTAINERSHIP
- 74.5% - OIL TANKER
- 10.6% - OIL BARGE

+
107.1% of 2010 Base Case
ALL FV – PCO



P: ALL FV POTENTIAL COLLISION FUEL OIL LOSS (PCFO)

P: VTRA 2010 - BASE CASE



Factor x Average Oil Outflow

> 10.00
> 10.00
10.00
3.67
2.93
2.50
2.19
1.95
1.75
1.58
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.51
0.39
0.29
0.18
0.09
0.00

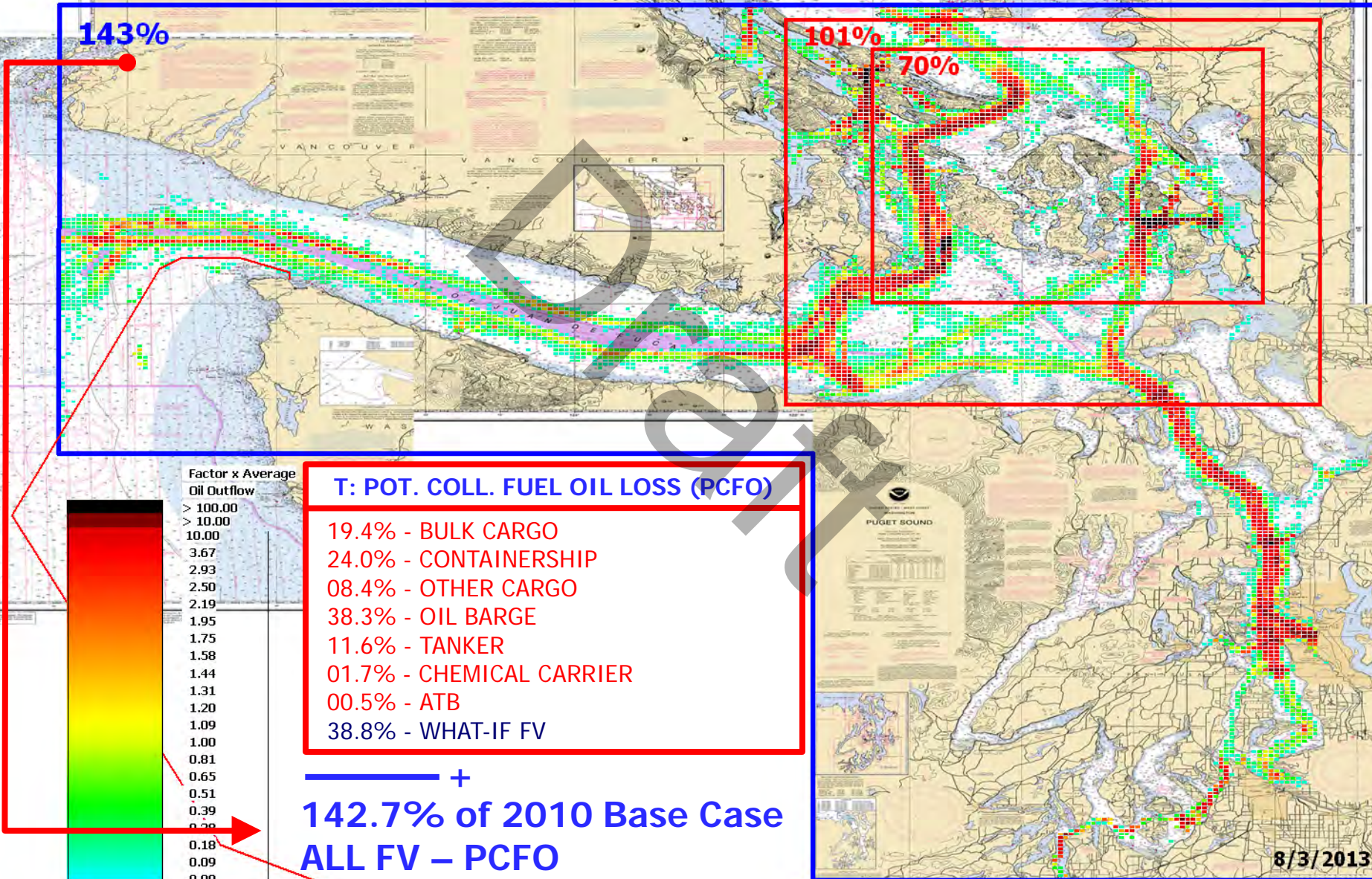
P: POT. COLL. FUEL OIL LOSS (PCFO)

- 18.4% - BULK CARGO
- 22.8% - CONTAINERSHIP
- 08.1% - OTHER CARGO
- 37.4% - OIL BARGE
- 11.4% - TANKER
- 01.5% - CHEMICAL CARRIER
- 00.4% - ATB
- 00.0% - WHAT-IF FV

+ 100.0% of 2010 Base Case ALL FV - PCFO

T: ALL FV POTENTIAL COLLISION FUEL OIL LOSS (PCFO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



143%

101%

70%

Factor x Average Oil Outflow

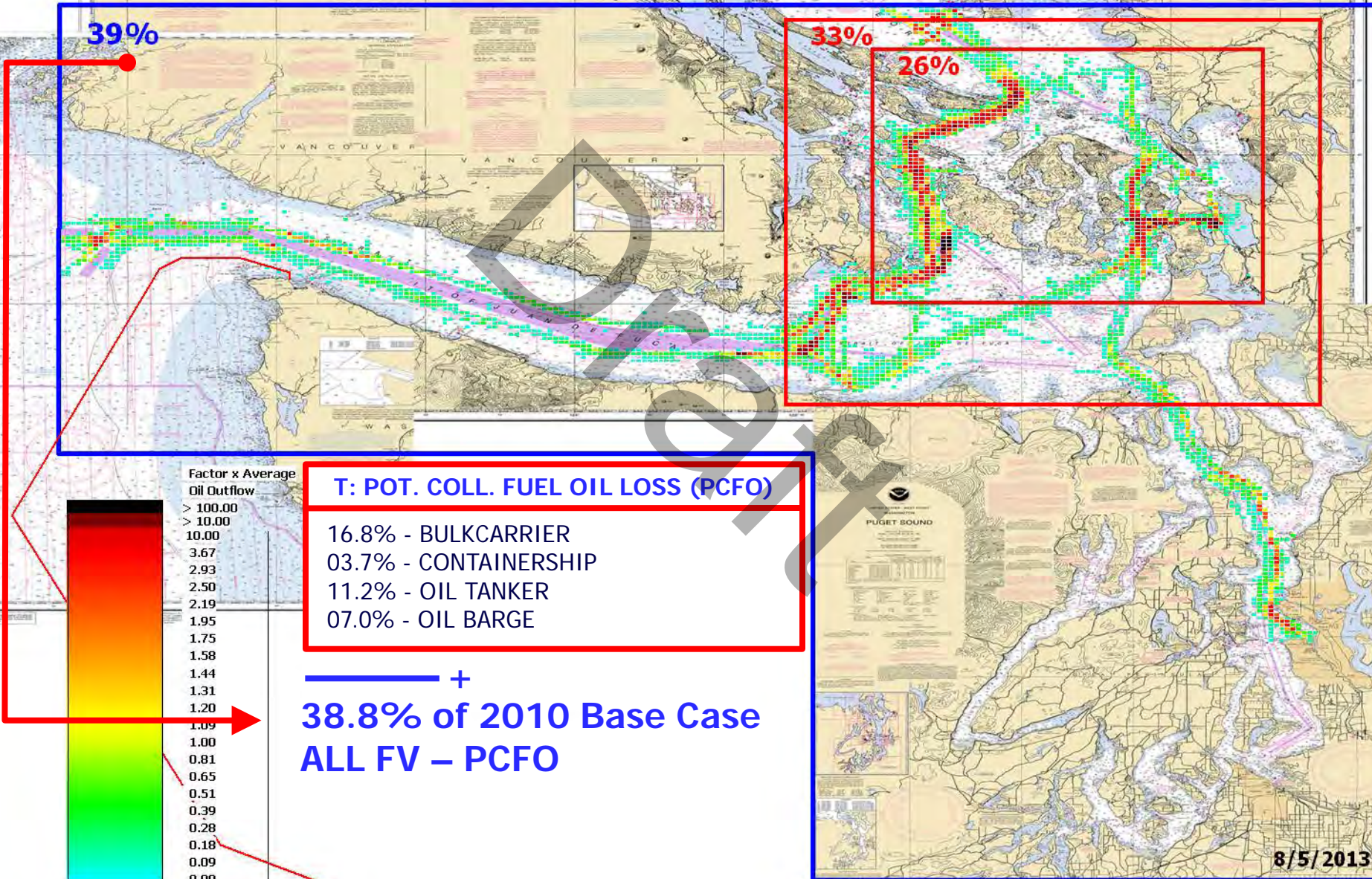
> 100.00
> 10.00
10.00
3.67
2.93
2.50
2.19
1.95
1.75
1.58
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.51
0.39
0.29
0.18
0.09
0.00

- T: POT. COLL. FUEL OIL LOSS (PCFO)**
- 19.4% - BULK CARGO
 - 24.0% - CONTAINERSHIP
 - 08.4% - OTHER CARGO
 - 38.3% - OIL BARGE
 - 11.6% - TANKER
 - 01.7% - CHEMICAL CARRIER
 - 00.5% - ATB
 - 38.8% - WHAT-IF FV

+
**142.7% of 2010 Base Case
ALL FV - PCFO**

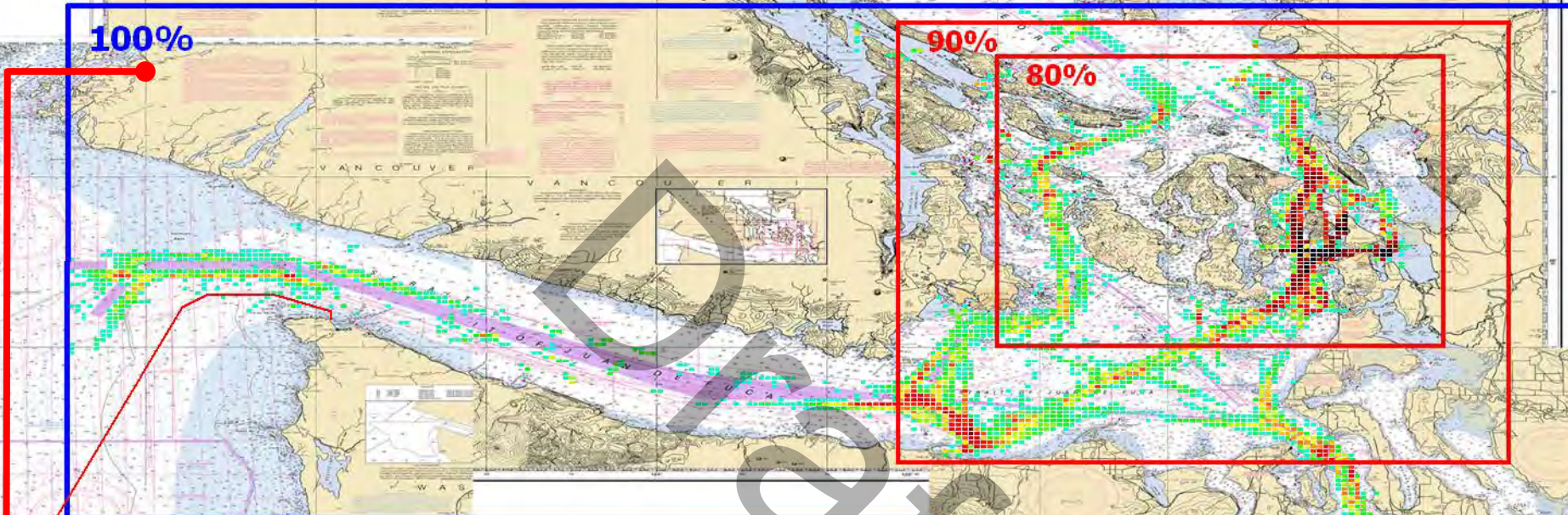
T: WHAT-IF FV POTENTIAL COLLISION FUEL OIL LOSS (PCFO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



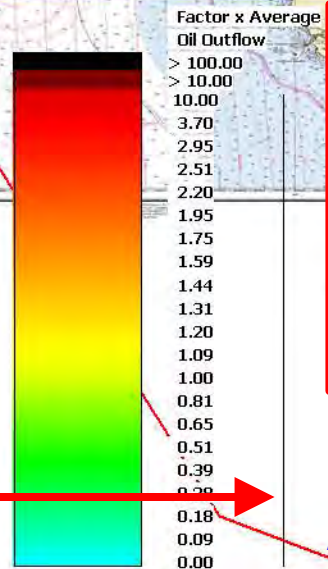
P: ALL FV POTENTIAL COLLISION CARGO OIL LOSS (PCCO)

P: VTRA 2010 - BASE CASE



P: POT. COLL. CARGO OIL LOSS (PCCO)

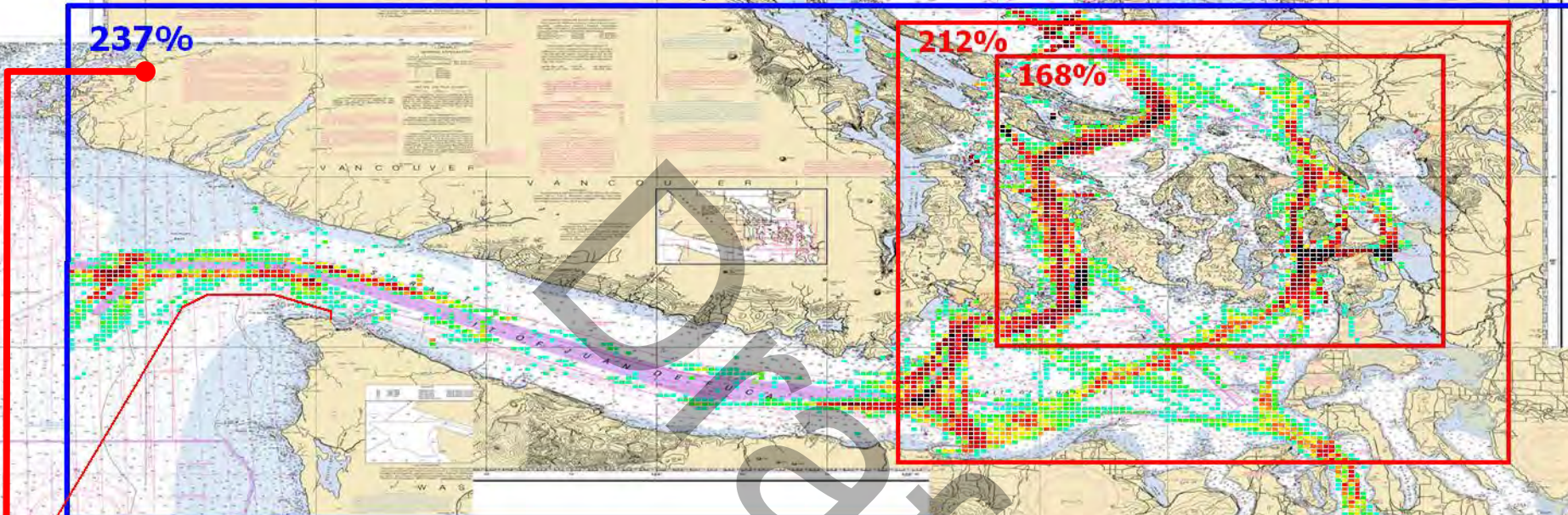
- 00.8% - BULK CARGO
- 01.4% - CONTAINERSHIP
- 00.6% - OTHER CARGO
- 09.3% - OIL BARGE
- 84.0% - TANKER
- 02.5% - CHEMICAL CARRIER
- 01.3% - ATB
- 00.0% - WHAT-IF FV



100.0% of 2010 Base Case ALL FV – PCCO

T: ALL FV POTENTIAL COLLISION CARGO OIL LOSS (PCCO)

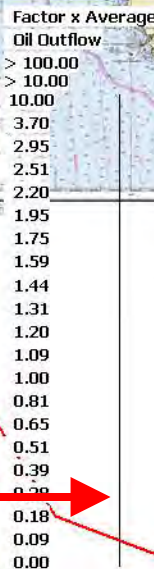
T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



237%

212%

168%

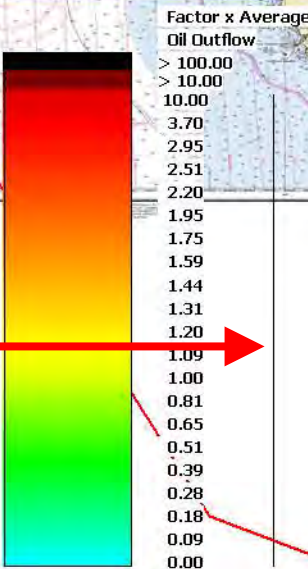
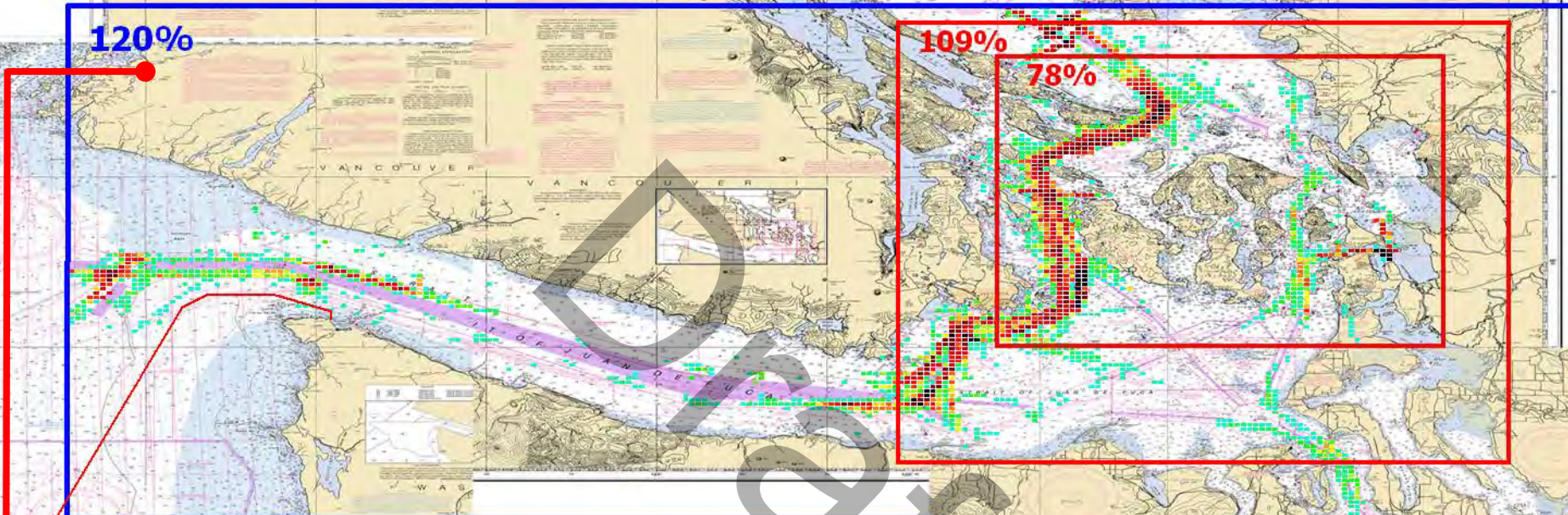


- T: POT. COLL. CARGO OIL LOSS (PCCO)**
- 03.9% - BULK CARGO
 - 04.1% - CONTAINERSHIP
 - 01.8% - OTHER CARGO
 - 24.2% - OIL BARGE
 - 78.8% - TANKER
 - 02.9% - CHEMICAL CARRIER
 - 01.3% - ATB
 - 120% - WHAT-IF FV

+
237.3% of 2010 Base Case
ALL FV - PCCO

T: WHAT-IF FV POTENTIAL COLLISION FUEL OIL LOSS(PCFO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



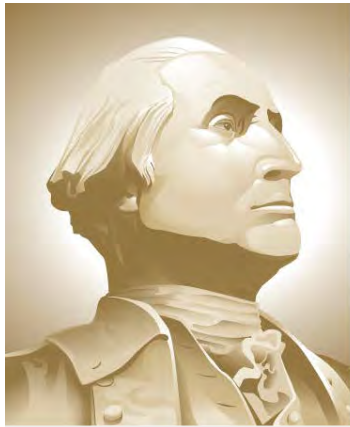
T: POT. COLL. CARGO OIL LOSS (PCCO)

- 22.0% - BULKCARRIER
- 00.3% - CONTAINERSHIP
- 86.8% - OIL TANKER
- 11.3% - OIL BARGE

+ 120.4% of 2010 Base Case ALL FV – PCCO

VTRA 2010 CASE T RESULTS – GROUNDING EXPOSURE AND ACCIDENT GEOGRAPHIC PROFILES

Presentation by: J. Rene van Dorp



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WASHINGTON, DC

VCU

CASE T: Gateway, Kinder Morgan, Delta Port

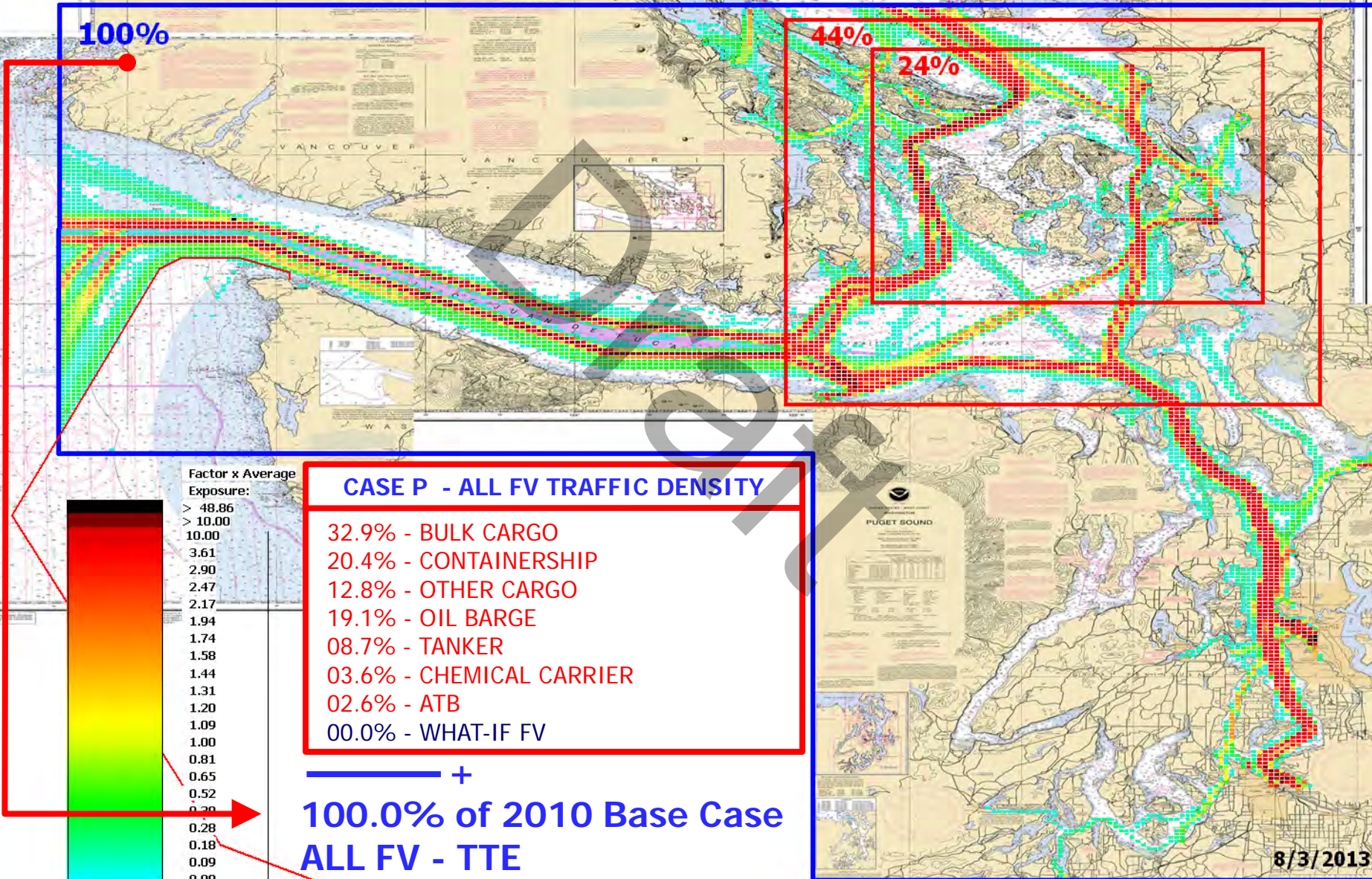
GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

AUGUST 5, 2013

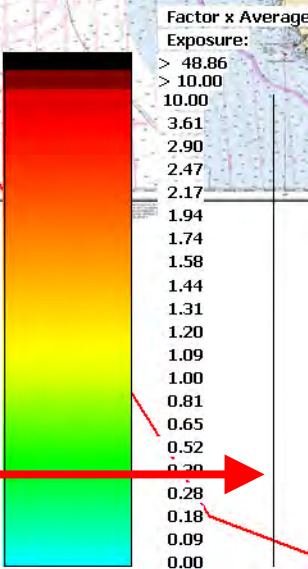
P: All FV TOTAL TIME OF EXPOSURE (TTE)

P: VTRA 2010 - BASE CASE - All FV



CASE P - ALL FV TRAFFIC DENSITY

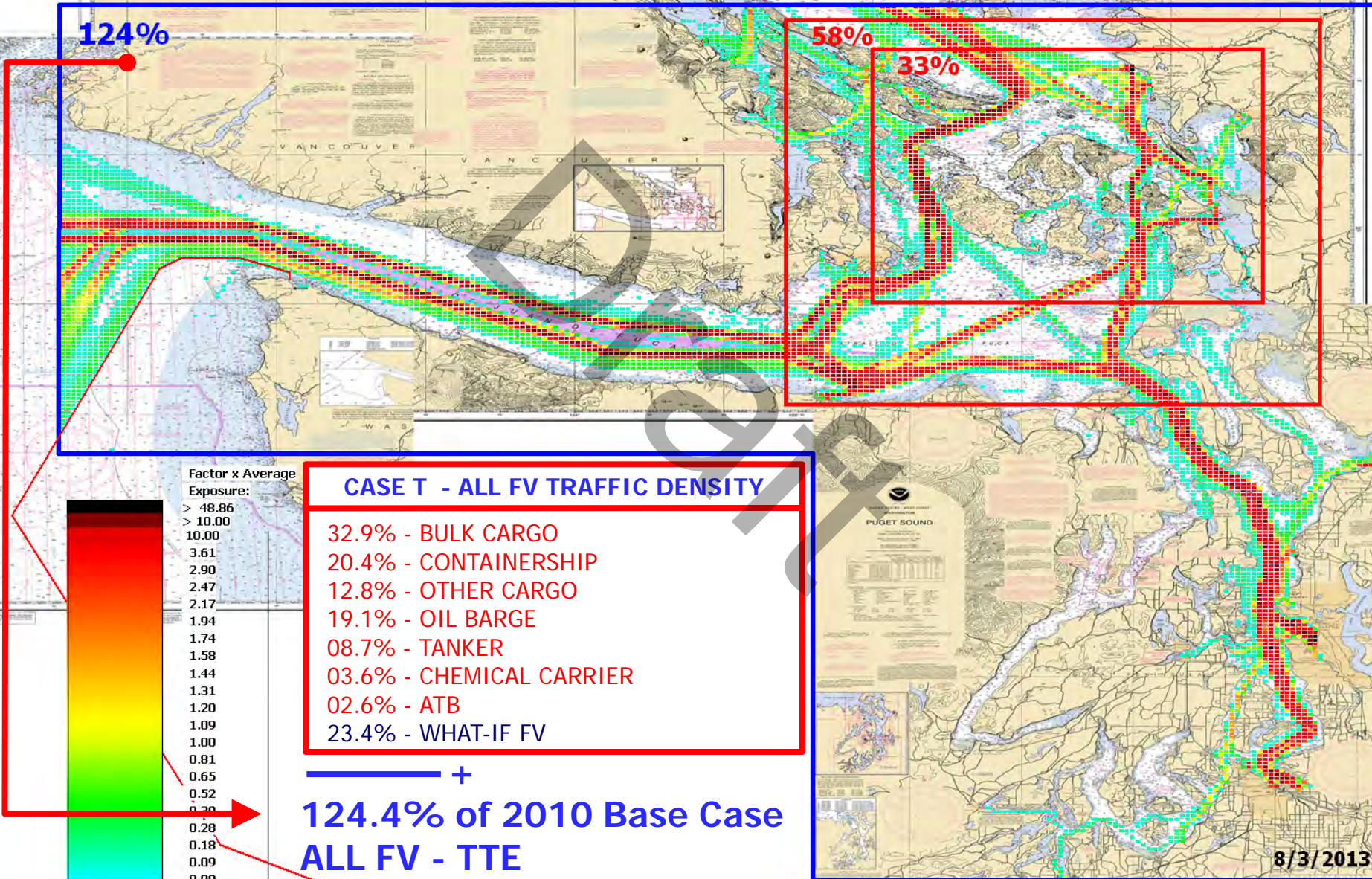
- 32.9% - BULK CARGO
- 20.4% - CONTAINERSHIP
- 12.8% - OTHER CARGO
- 19.1% - OIL BARGE
- 08.7% - TANKER
- 03.6% - CHEMICAL CARRIER
- 02.6% - ATB
- 00.0% - WHAT-IF FV



100.0% of 2010 Base Case ALL FV - TTE

T: All FV TOTAL TIME OF EXPOSURE (TTE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348 - All FV



124%

58%

33%

CASE T - ALL FV TRAFFIC DENSITY

- 32.9% - BULK CARGO
- 20.4% - CONTAINERSHIP
- 12.8% - OTHER CARGO
- 19.1% - OIL BARGE
- 08.7% - TANKER
- 03.6% - CHEMICAL CARRIER
- 02.6% - ATB
- 23.4% - WHAT-IF FV

+

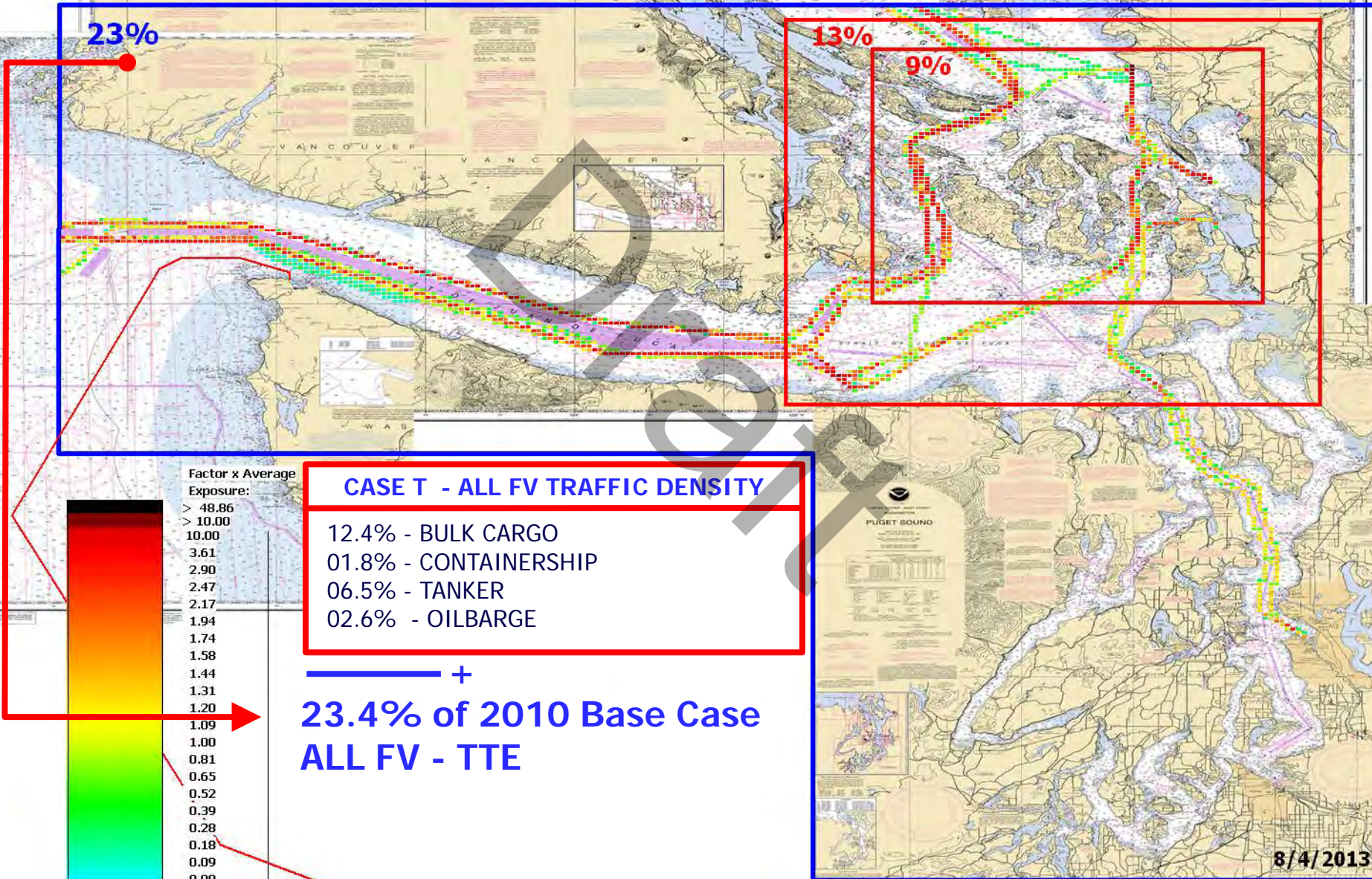
**124.4% of 2010 Base Case
ALL FV - TTE**

Factor x Average Exposure:

> 48.86
> 10.00
3.61
2.90
2.47
2.17
1.94
1.74
1.58
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.52
0.39
0.28
0.18
0.09
0.00

T: WHAT-IF FV TOTAL TIME OF EXPOSURE (TTE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



CASE T - ALL FV TRAFFIC DENSITY

- 12.4% - BULK CARGO
- 01.8% - CONTAINERSHIP
- 06.5% - TANKER
- 02.6% - OILBARGE

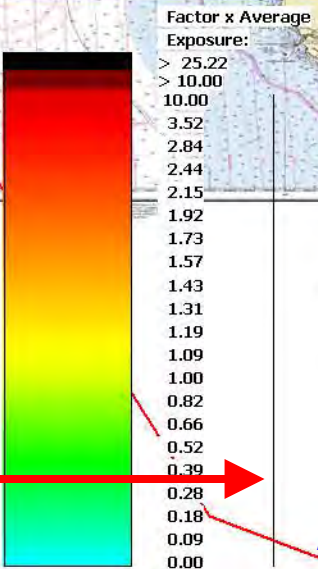
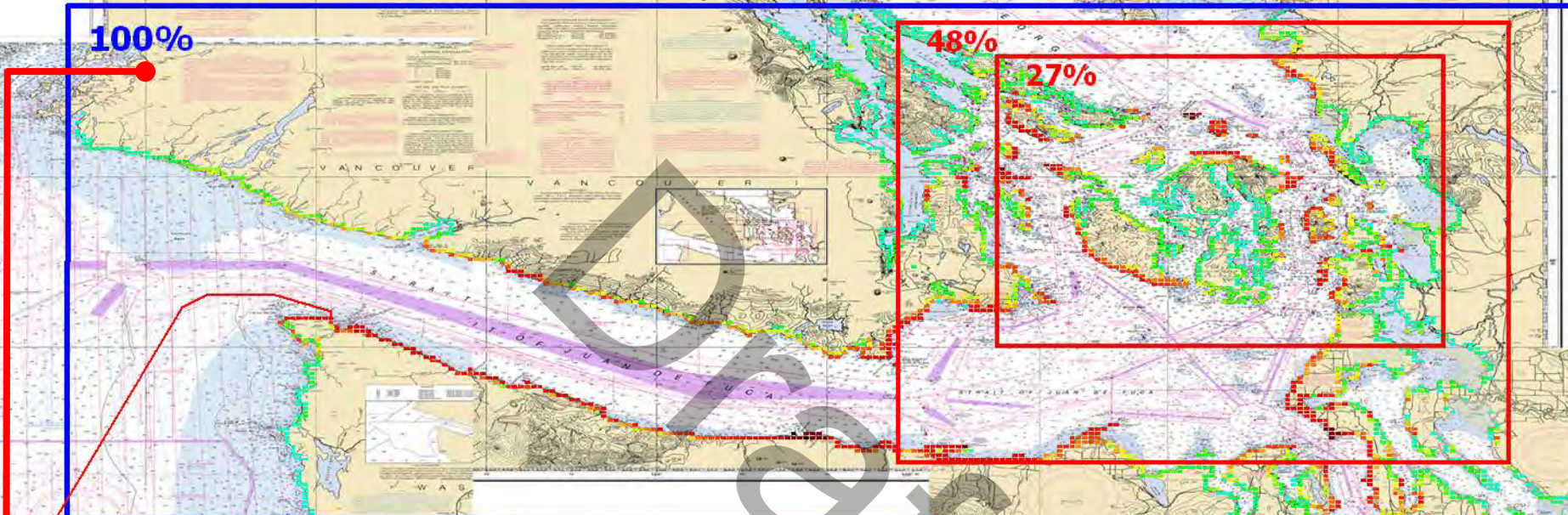
— +
23.4% of 2010 Base Case
ALL FV - TTE

Factor x Average Exposure:

> 48.86
> 10.00
3.61
2.90
2.47
2.17
1.94
1.74
1.58
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.52
0.39
0.28
0.18
0.09
0.00

P: ALL FV POTENTIAL GROUNDING EXPOSURE (PGE)

P: VTRA 2010 - BASE CASE

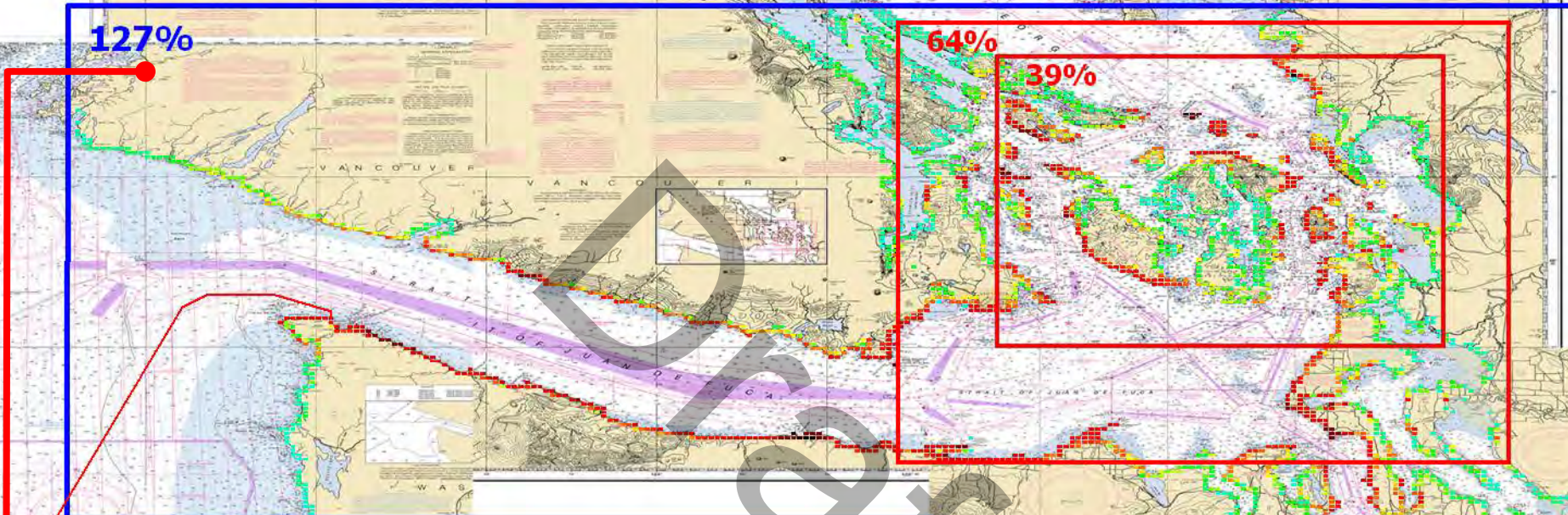


- P: POT. GROUND. EXPOSURE (PGE)**
- 28.5% - BULK CARGO
 - 22.0% - CONTAINERSHIP
 - 13.0% - OTHERCARGO
 - 22.2% - OIL BARGE
 - 08.7% - TANKER
 - 03.2% - CHEMICAL CARRIER
 - 02.5% - ATB
 - 00.0% - WHAT-IF FV

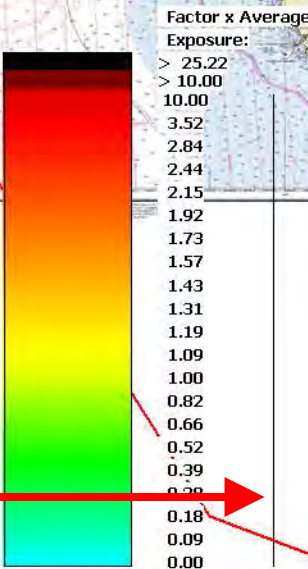
100.0% of 2010 Base Case ALL FV - PGE

T: ALL FV POTENTIAL GROUNDING EXPOSURE (PGE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



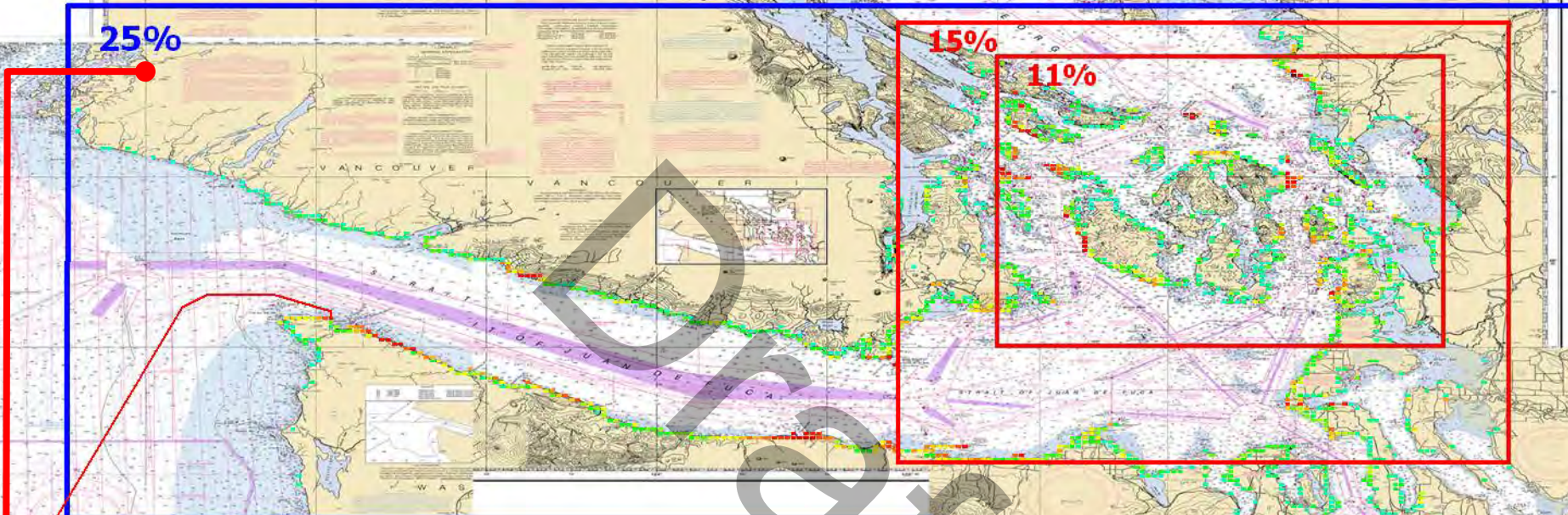
- T: POT. GROUND. EXPOSURE (PGE)**
- 28.9% - BULK CARGO
 - 22.2% - CONTAINERSHIP
 - 13.2% - OTHERCARGO
 - 22.8% - OIL BARGE
 - 08.8% - TANKER
 - 03.2% - CHEMICAL CARRIER
 - 02.5% - ATB
 - 25.0% - WHAT-IF FV



+ 126.6% of 2010 Base Case ALL FV - PGE

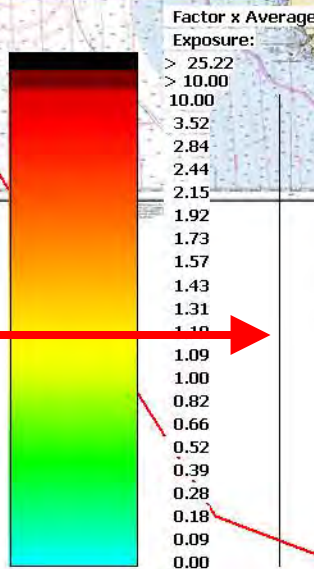
T: ALL FV POTENTIAL GROUNDING EXPOSURE (PGE)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



T: POT. GROUND. EXPOSURE (PGE)

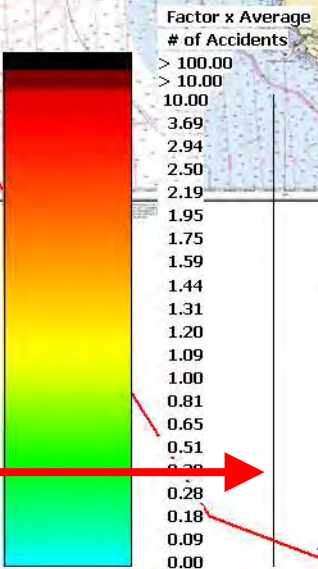
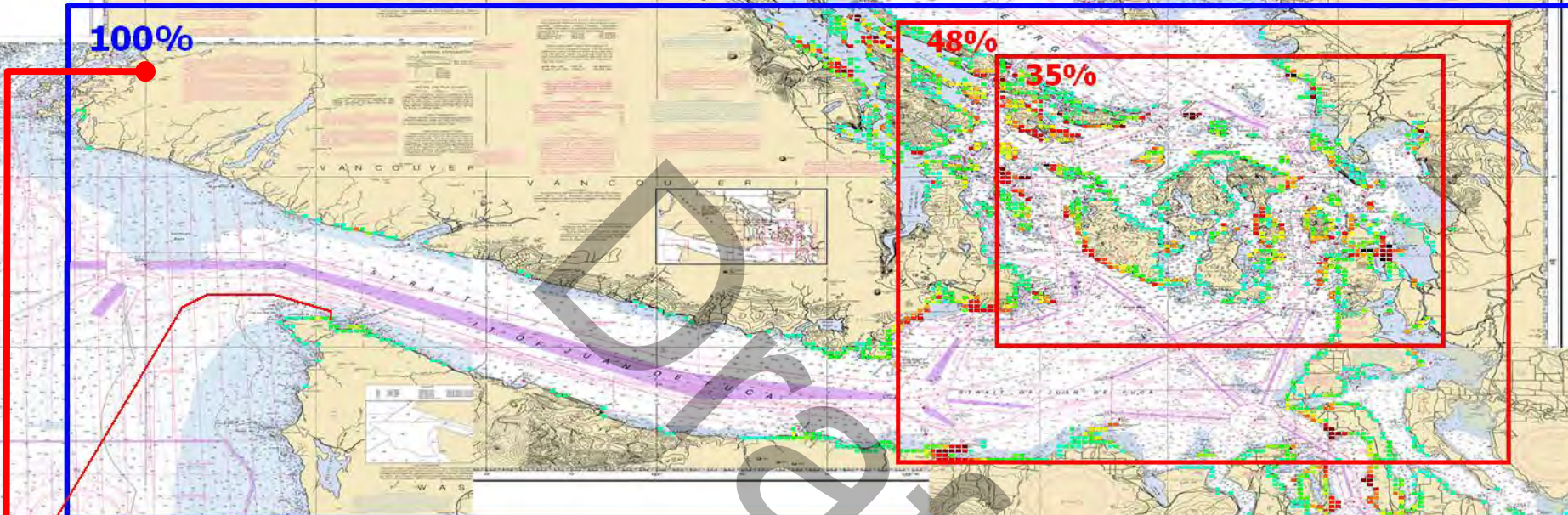
- 12.8% - BULK CARGO
- 01.8% - CONTAINERSHIP
- 06.7% - TANKER
- 03.7% - OILBARGE



25.0% of 2010 Base Case ALL FV - PGE

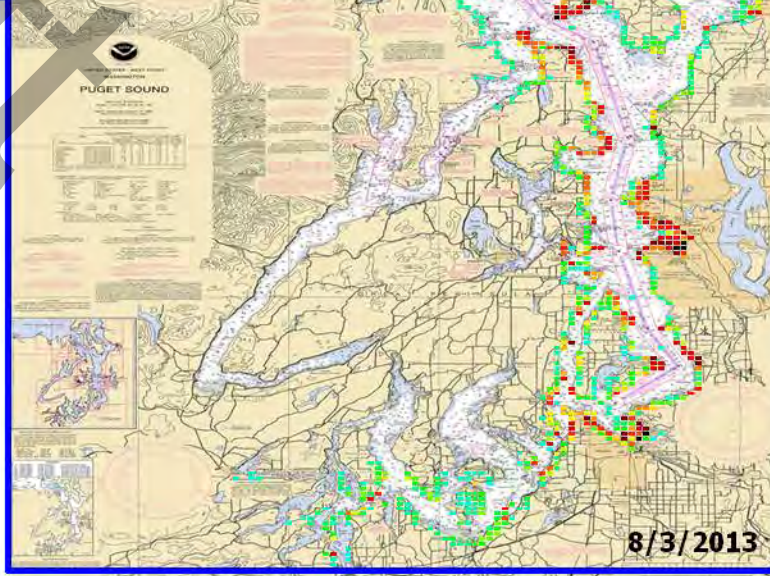
**P: ALL FV POTENTIAL
GROUNDING FREQUENCY (PGF)**

P: VTRA 2010 - BASE CASE



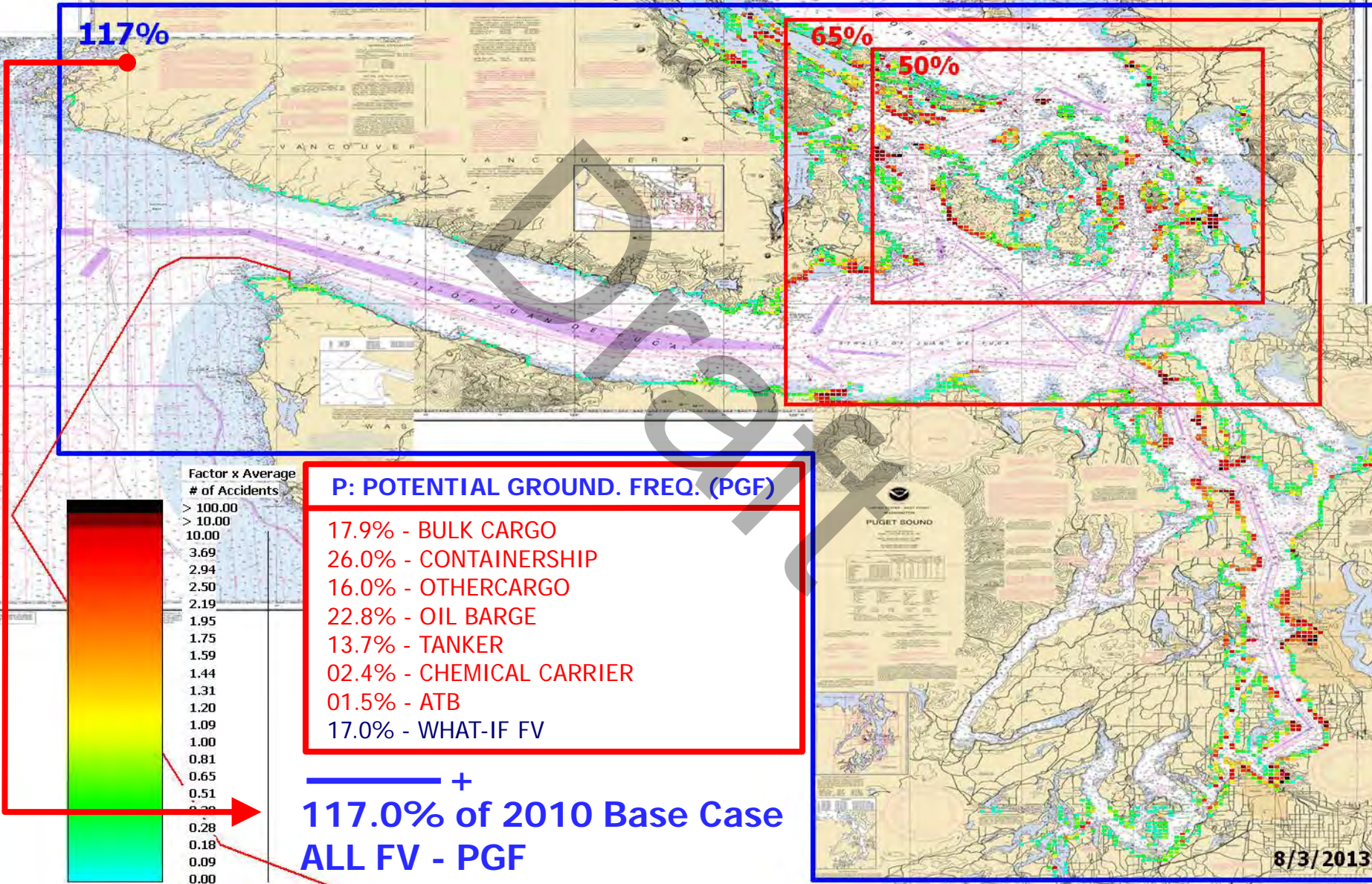
- P: POTENTIAL GROUND. FREQ. (PGF)**
- 18.1% - BULK CARGO
 - 26.1% - CONTAINERSHIP
 - 16.0% - OTHERCARGO
 - 22.6% - OIL BARGE
 - 13.3% - TANKER
 - 02.4% - CHEMICAL CARRIER
 - 01.5% - ATB
 - 00.0% - WHAT-IF FV

**100.0% of 2010 Base Case
ALL FV - PGF**



**T: ALL FV POTENTIAL
GROUNDING FREQUENCY (PGF)**

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



117%

65%

50%

Factor x Average
of Accidents

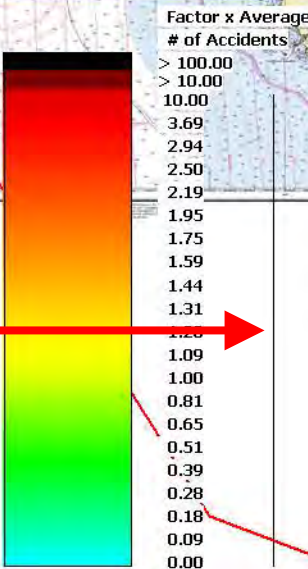
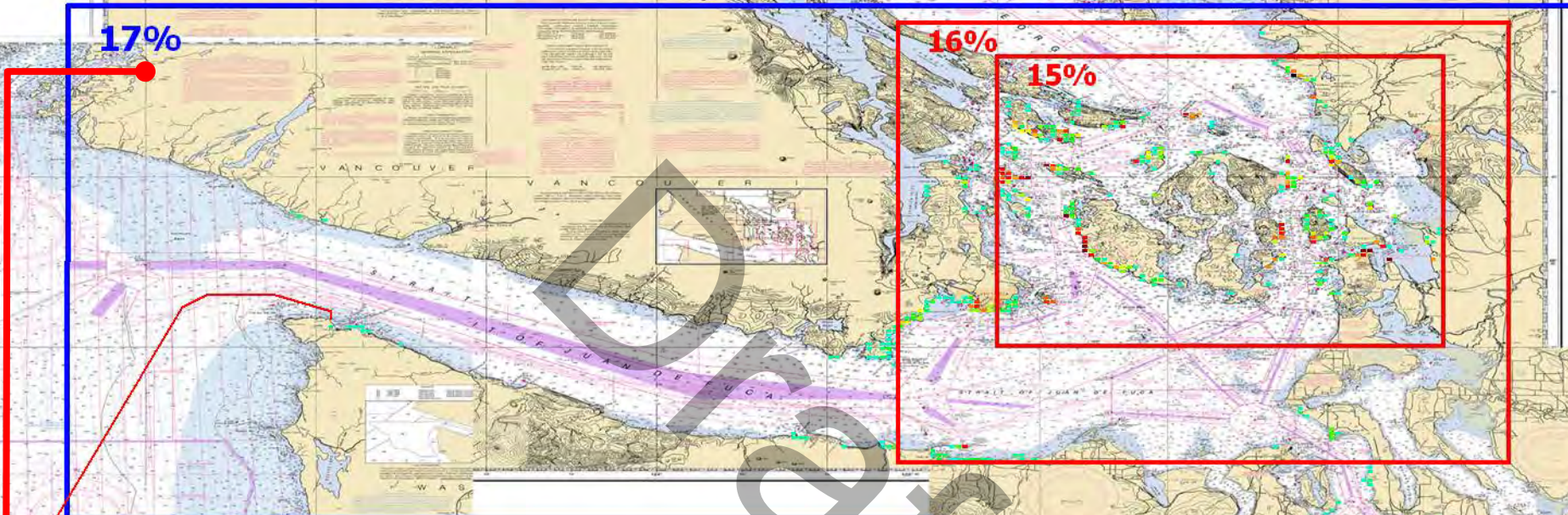
> 100.00
> 10.00
10.00
3.69
2.94
2.50
2.19
1.95
1.75
1.59
1.44
1.31
1.20
1.09
1.00
0.81
0.65
0.51
0.38
0.28
0.18
0.09
0.00

- P: POTENTIAL GROUND. FREQ. (PGF)**
- 17.9% - BULK CARGO
 - 26.0% - CONTAINERSHIP
 - 16.0% - OTHERCARGO
 - 22.8% - OIL BARGE
 - 13.7% - TANKER
 - 02.4% - CHEMICAL CARRIER
 - 01.5% - ATB
 - 17.0% - WHAT-IF FV

**117.0% of 2010 Base Case
ALL FV - PGF**

**T: ALL FV POTENTIAL
GROUNDING FREQUENCY (PGF)**

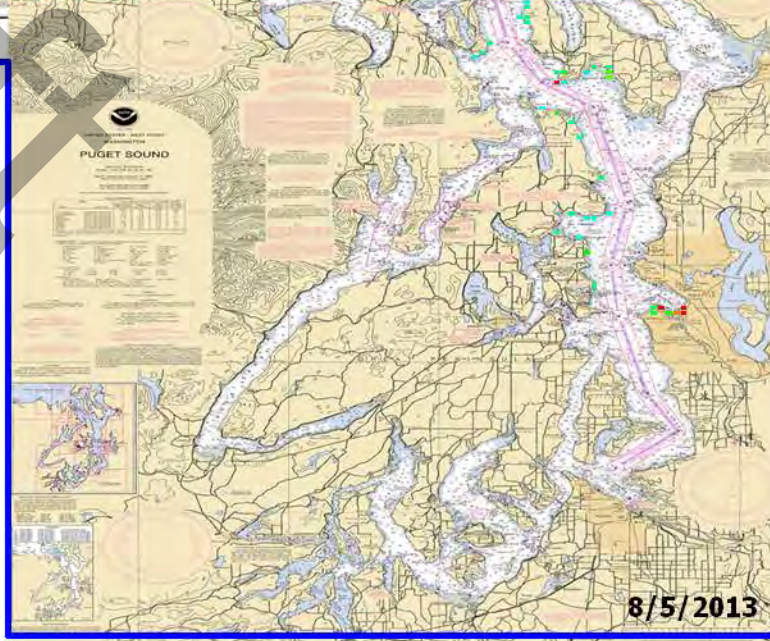
T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



P: POTENTIAL GROUND. FREQ. (PGF)

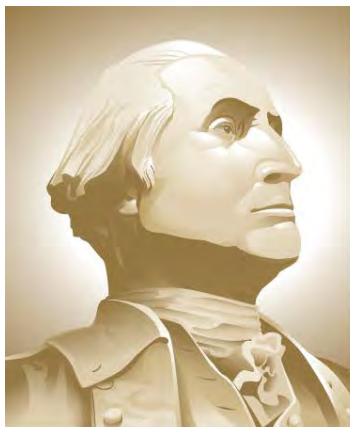
- 09.4% - BULK CARGO
- 01.4% - CONTAINERSHIP
- 02.9% - TANKER
- 03.2% - OILBARGE

**+
17.0% of 2010 Base Case
ALL FV - PGF**



VTRA 2010 CASE T RESULTS – GROUNDING OIL (CARGO + FUEL), CARGO AND FUEL OIL GEOGRAPHIC PROFILES

Presentation by: J. Rene van Dorp



THE GEORGE
WASHINGTON
UNIVERSITY

WASHINGTON, DC

VCU

CASE T: Gateway, Kinder Morgan, Delta Port

GWU Personnel: Dr. J. Rene van Dorp

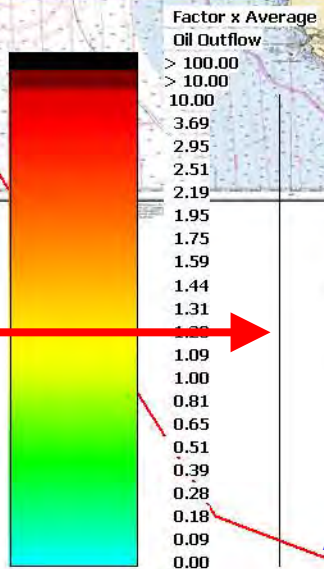
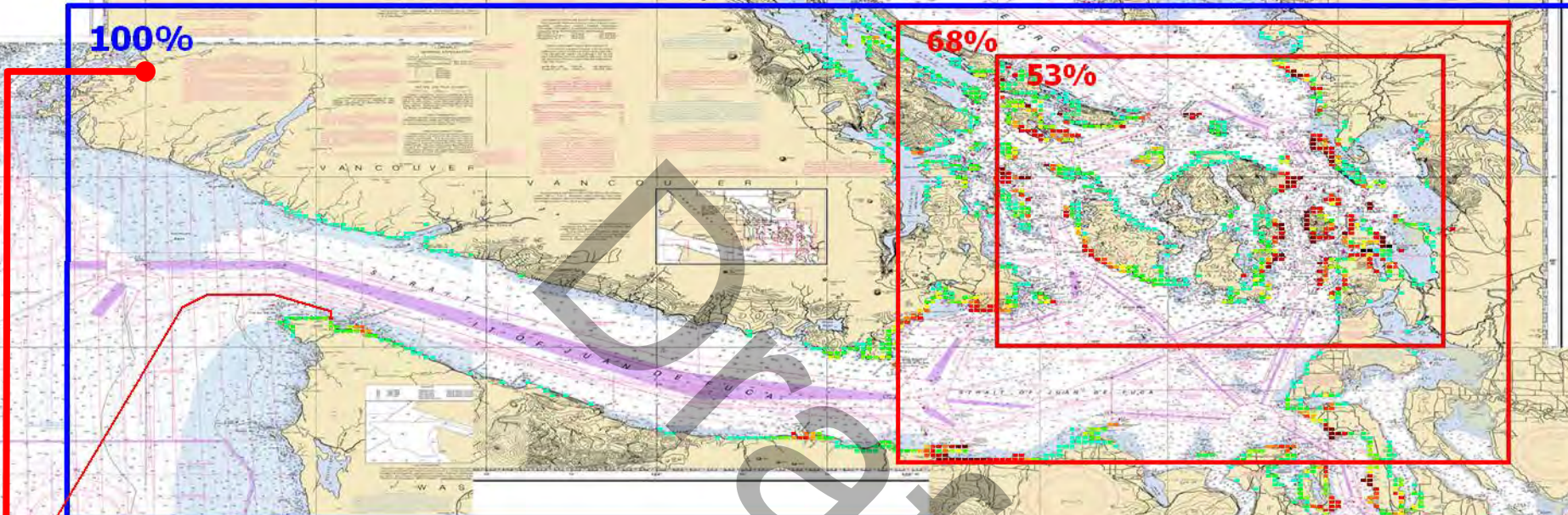
VCU Personnel: Dr. Jason R. W. Merrick

AUGUST 5, 2013

P: ALL FV POTENTIAL GROUNDING OIL LOSS (PGO)



P: VTRA 2010 - BASE CASE



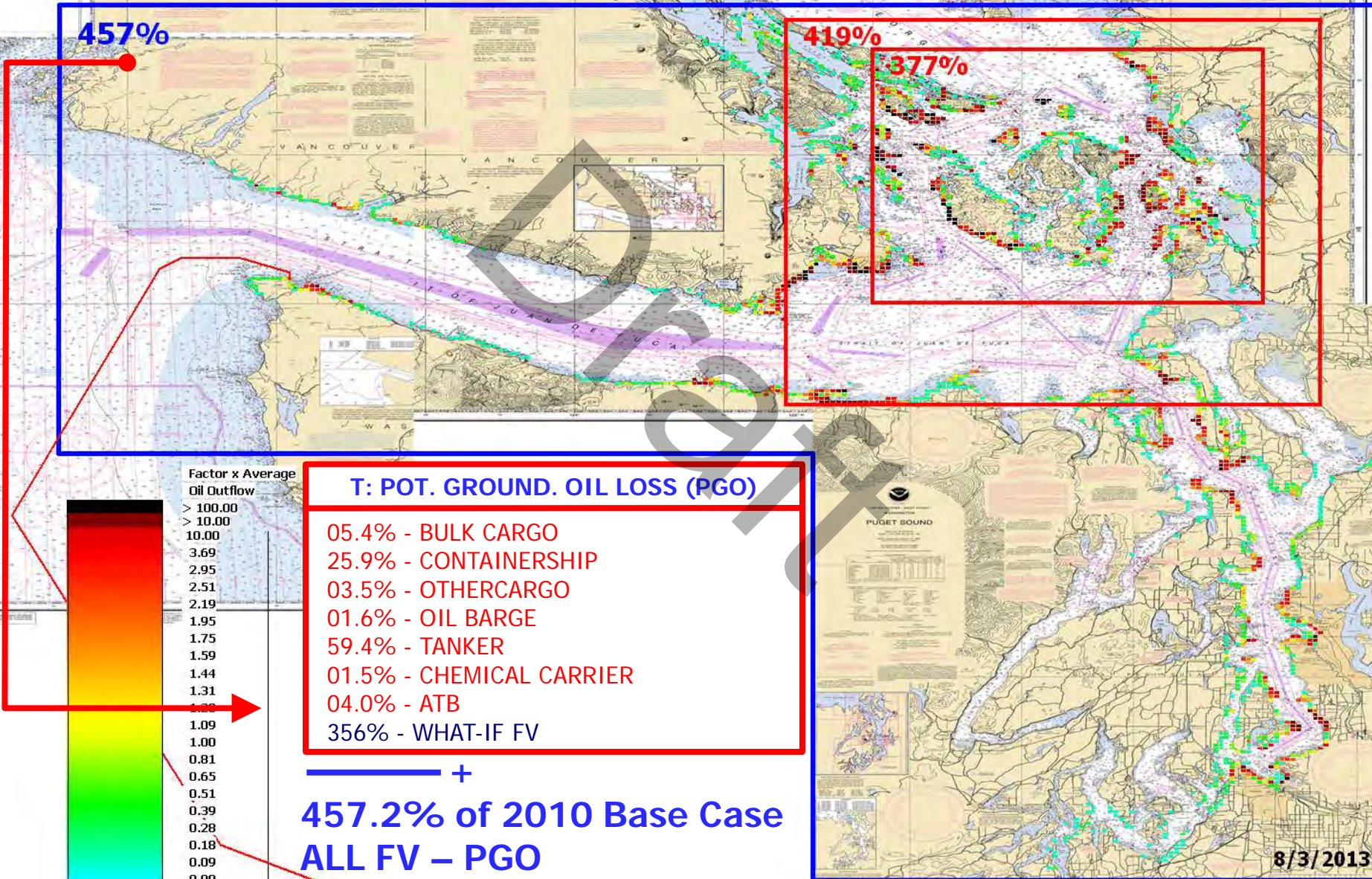
- P: POT. GROUND. OIL LOSS (PGO)**
- 05.5% - BULK CARGO
 - 26.1% - CONTAINERSHIP
 - 03.5% - OTHERCARGO
 - 01.5% - OIL BARGE
 - 57.7% - TANKER
 - 01.5% - CHEMICAL CARRIER
 - 04.3% - ATB
 - 00.0% - WHAT-IF FV

+

100.0% of 2010 Base Case
ALL FV – PGO

T: ALL FV POTENTIAL GROUNDING OIL LOSS (PGO)

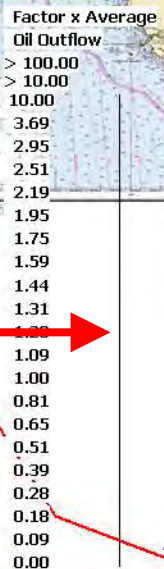
T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



457%

419%

377%



T: POT. GROUND. OIL LOSS (PGO)

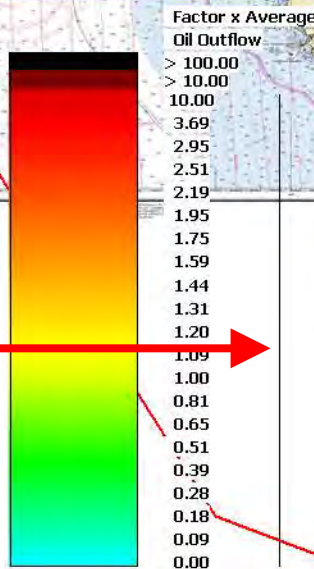
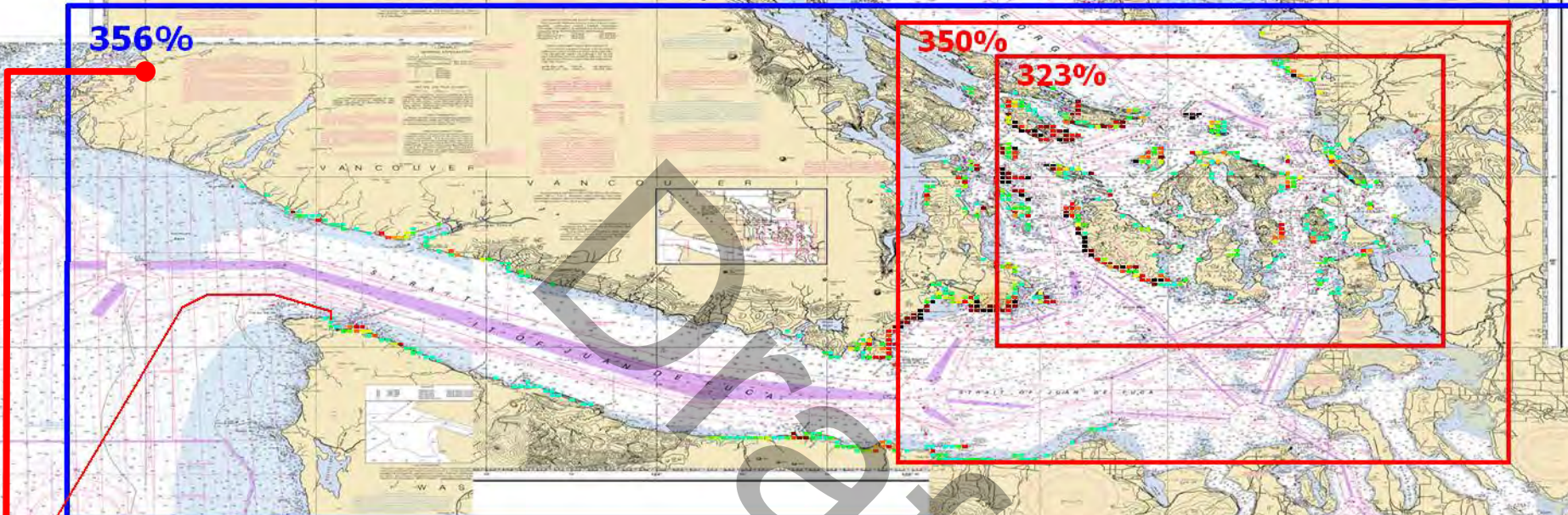
05.4%	- BULK CARGO
25.9%	- CONTAINERSHIP
03.5%	- OTHERCARGO
01.6%	- OIL BARGE
59.4%	- TANKER
01.5%	- CHEMICAL CARRIER
04.0%	- ATB
356%	- WHAT-IF FV

+
457.2% of 2010 Base Case
ALL FV – PGO

T: WHAT-IF FV POTENTIAL GROUNDING OIL LOSS (PGO)



T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



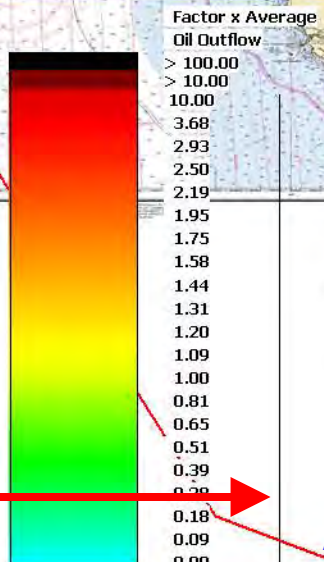
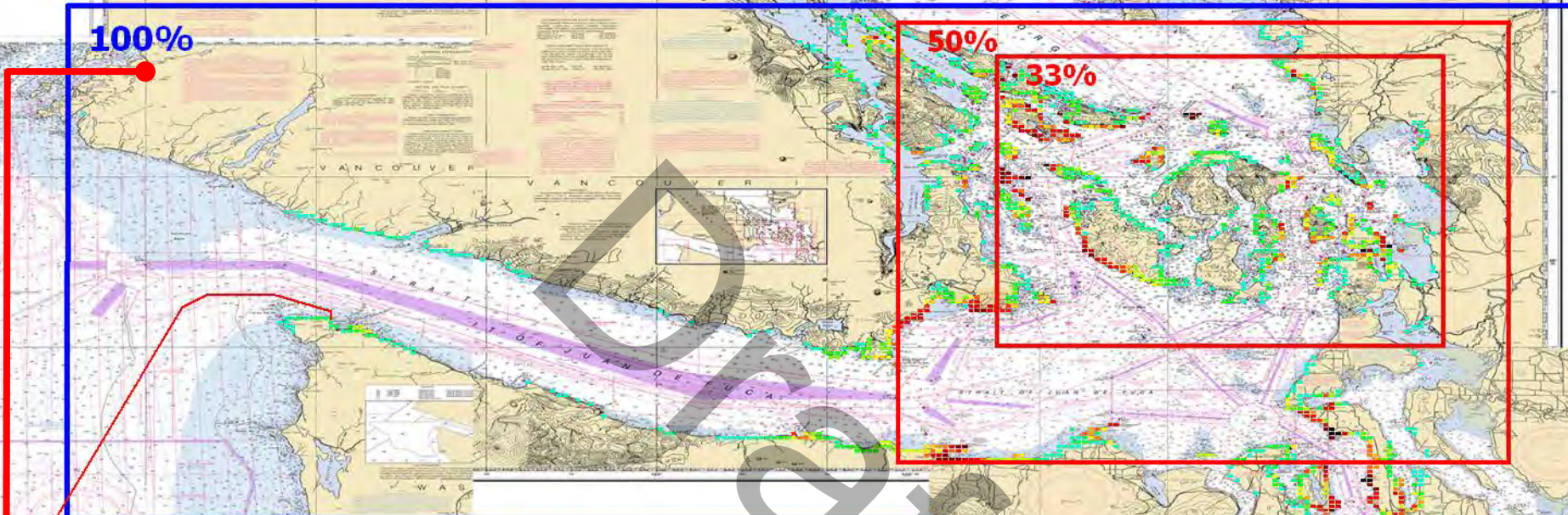
T: POT. GROUND. OIL LOSS (PGO)
08.9% - BULKCARRIER
03.0% - CONTAINERSHIP
344% - OIL TANKER
00.2% - OIL BARGE

+
**355.9% of 2010 Base Case
ALL FV – PGO**

P: ALL FV POT. GROUND. FUEL OIL LOSS (PGFO)



P: VTRA 2010 - BASE CASE

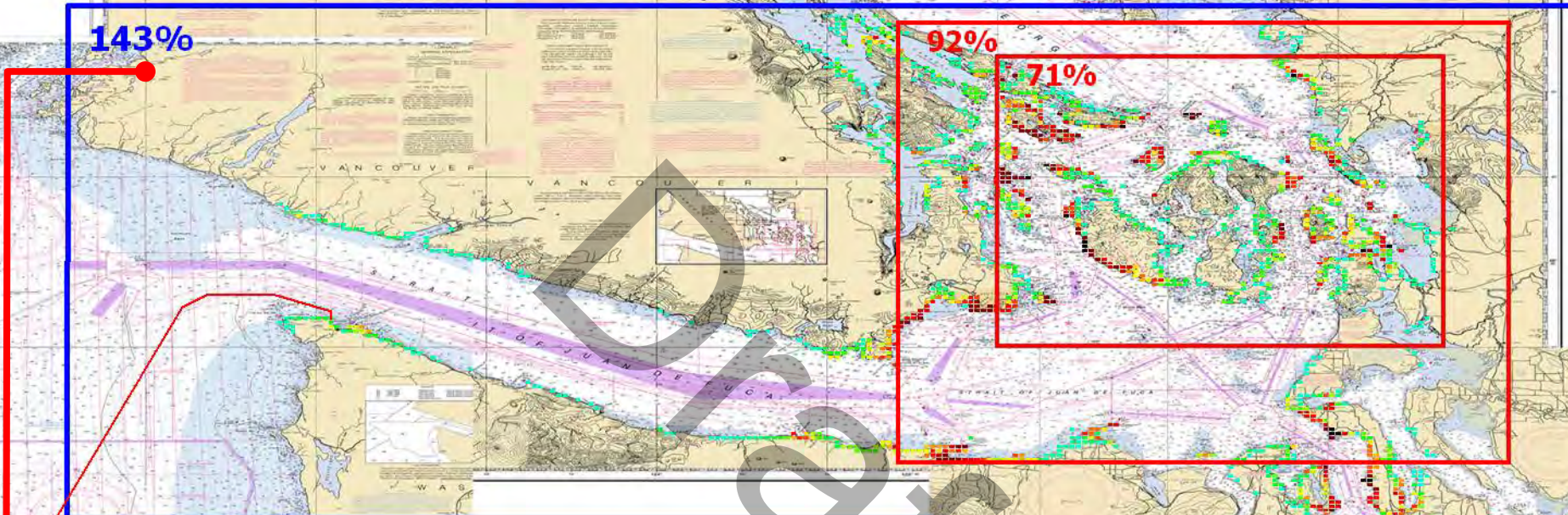


- ### P: POT. GROUND. FUEL OIL (PGFO)
- 13.7% - BULK CARGO
 - 65.3% - CONTAINERSHIP
 - 08.7% - OTHERCARGO
 - 00.6% - OIL BARGE
 - 06.8% - TANKER
 - 00.4% - CHEMICAL CARRIER
 - 04.5% - ATB
 - 00.0% - WHAT-IF FV

— +
100.0% of 2010 Base Case
ALL FV – PGFO

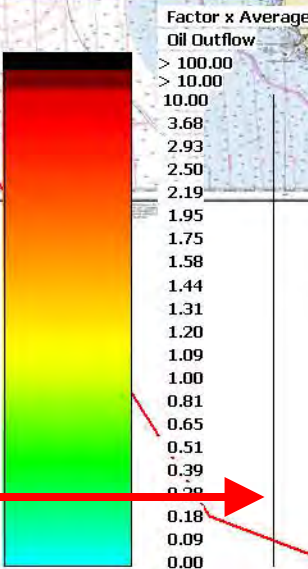
**T: ALL FV POTENTIAL
GROUNDING FUEL OIL LOSS (PGFO)**

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



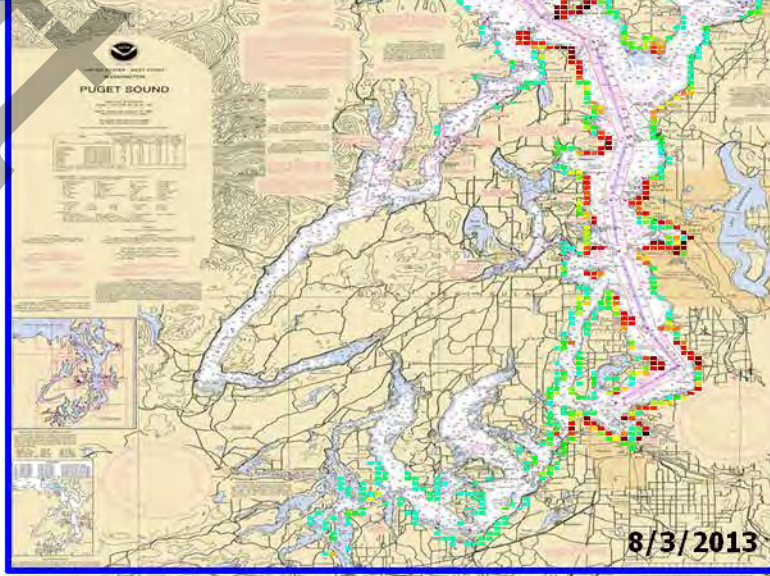
T: POT. GROUND. FUEL OIL (PGFO)

- 13.5% - BULK CARGO
- 64.9% - CONTAINERSHIP
- 08.8% - OTHERCARGO
- 00.6% - OIL BARGE
- 06.9% - TANKER
- 00.4% - CHEMICAL CARRIER
- 04.4% - ATB
- 43.6% - WHAT-IF FV



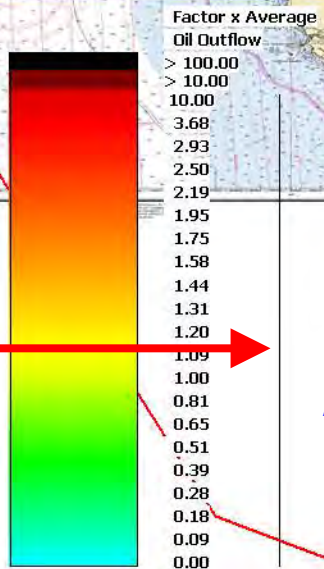
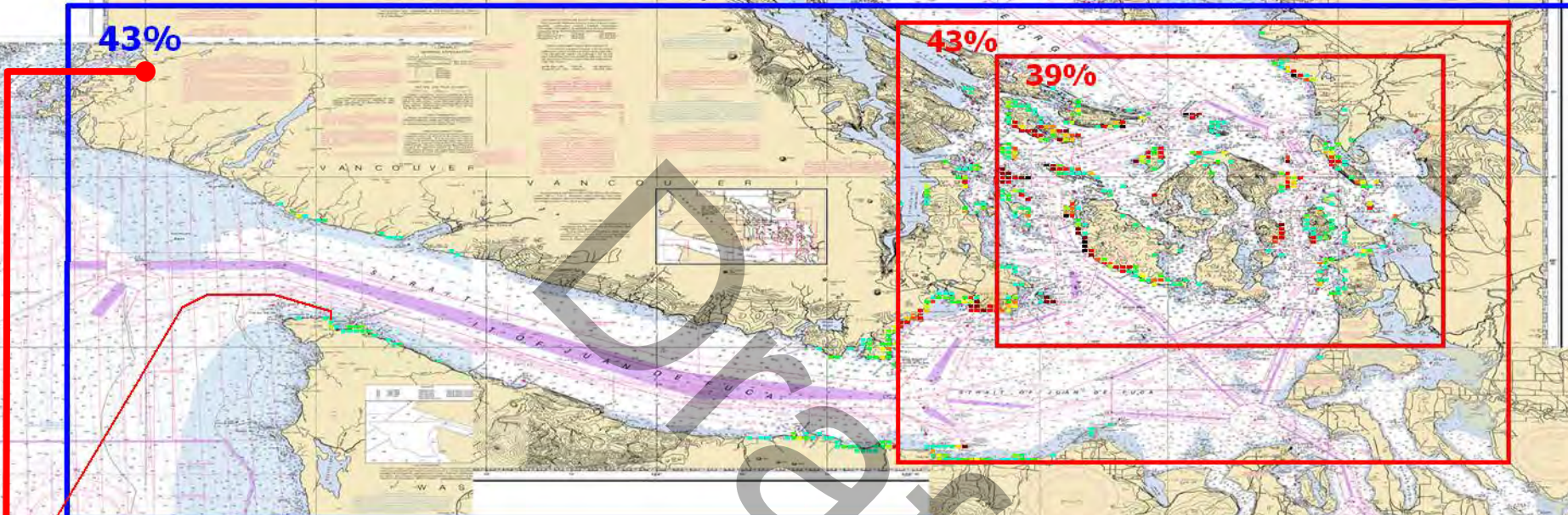
+

**143.0% of 2010 Base Case
ALL FV - PGFO**



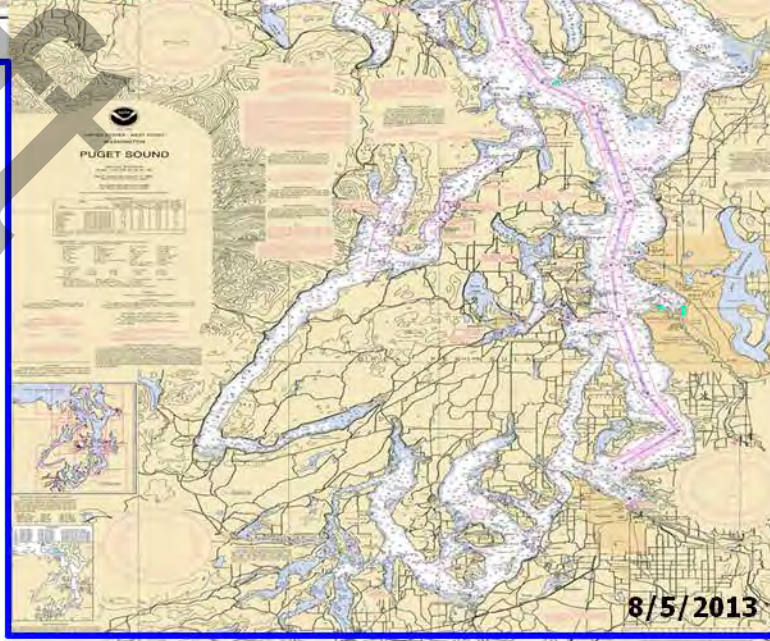
T: WHAT-IF FV POTENTIAL GROUNDING FUEL OIL LOSS (PGFO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



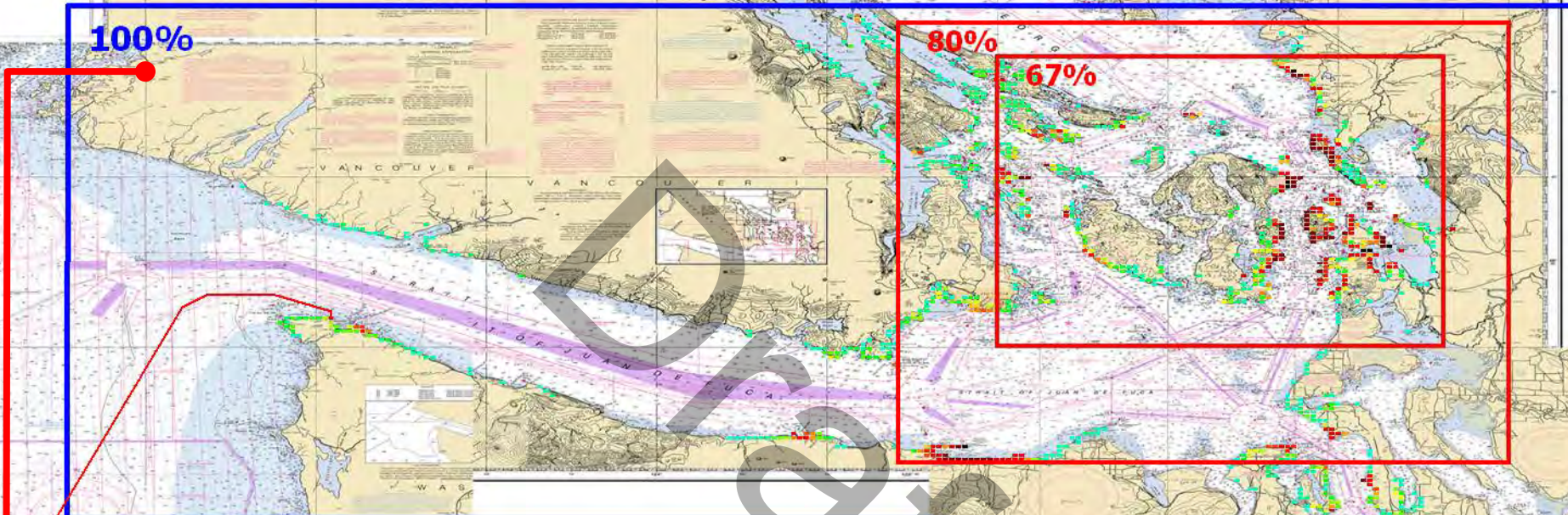
T: POT. GROUND. FUEL OIL (PGFO)
22.3% - BULKCARRIER
07.5% - CONTAINERSHIP
13.8% - OIL TANKER
00.1% - OIL BARGE

+
43.6% of 2010 Base Case
ALL FV – PGFO



P: ALL FV POTENTIAL GROUNDING CARGO OIL LOSS (PGCO)

P: VTRA 2010 - BASE CASE



100%

80%

67%



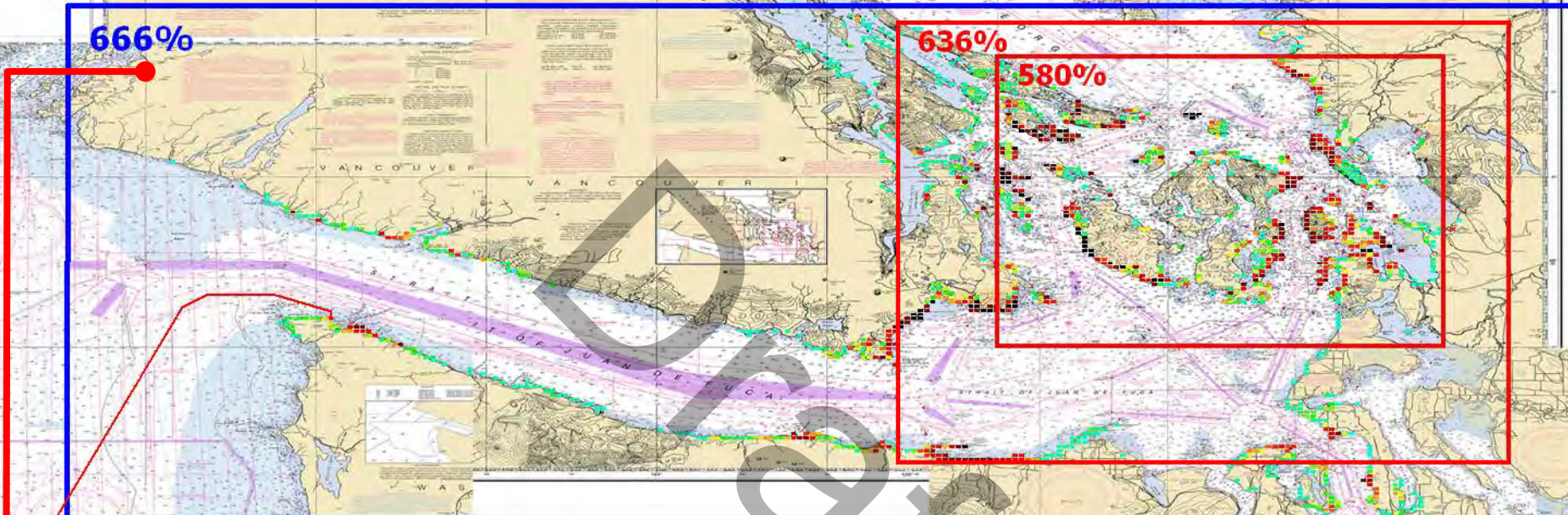
P: POT. GROUND CARGO OIL (PGCO)

- 00.0% - BULK CARGO
- 00.0% - CONTAINERSHIP
- 00.0% - OTHERCARGO
- 02.2% - OIL BARGE
- 91.4% - TANKER
- 02.3% - CHEMICAL CARRIER
- 04.1% - ATB
- 00.0% - WHAT-IF FV

100.0% of 2010 Base Case ALL FV - PGCO

T: ALL FV POTENTIAL GROUNDING CARGO OIL LOSS (PGCO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



T: POT. GROUND CARGO OIL (PGCO)

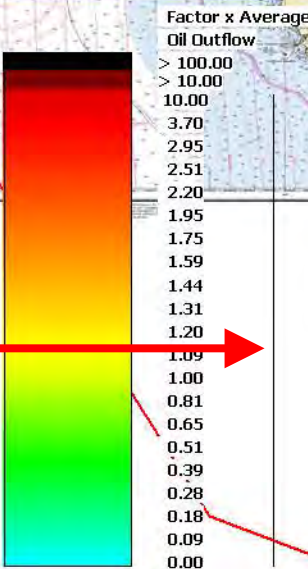
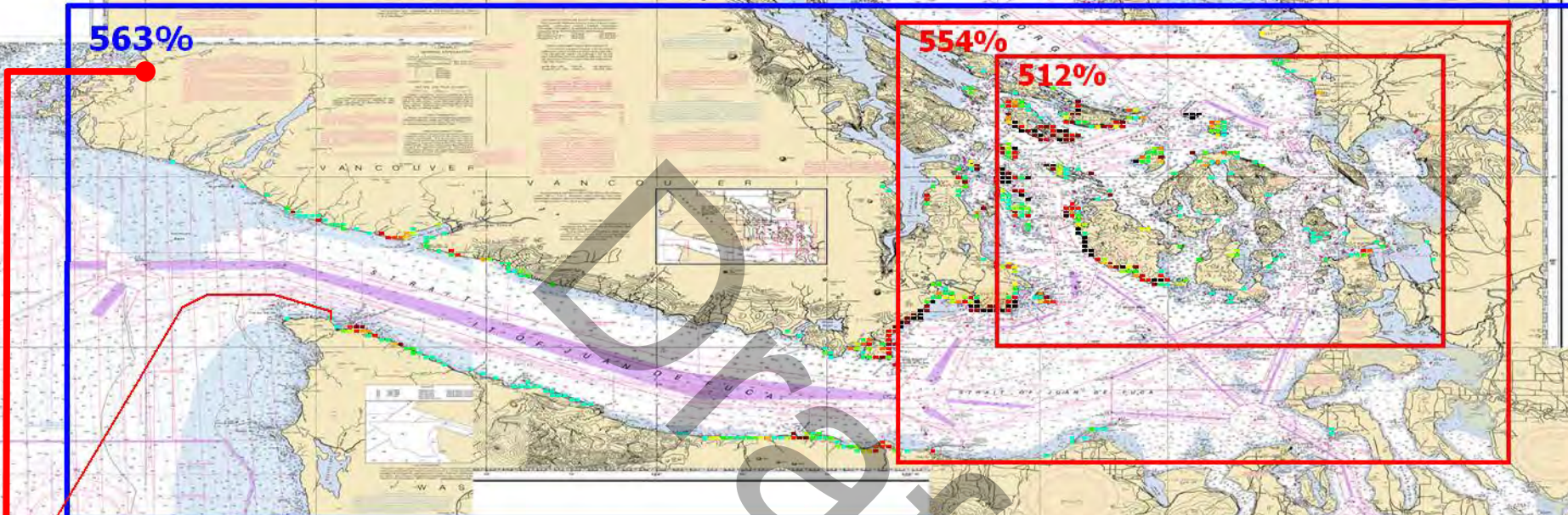
- 00.0% - BULK CARGO
- 00.0% - CONTAINERSHIP
- 00.0% - OTHERCARGO
- 02.2% - OIL BARGE
- 94.2% - TANKER
- 02.3% - CHEMICAL CARRIER
- 03.8% - ATB
- 563% - WHAT-IF FV

+
665.7% of 2010 Base Case
ALL FV - PGCO

T: WHAT-IF FV POTENTIAL GROUNDING CARGO OIL LOSS (PGCO)



T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



T: POT. GROUND. OIL LOSS (PGCO)
00.0% - BULKCARRIER
00.0% - CONTAINERSHIP
563% - OIL TANKER
00.3% - OIL BARGE

+
**563.1% of 2010 Base Case
ALL FV - PGCO**