

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

3D Relative Risk Profile Comparison
Potential Collision Oil Loss

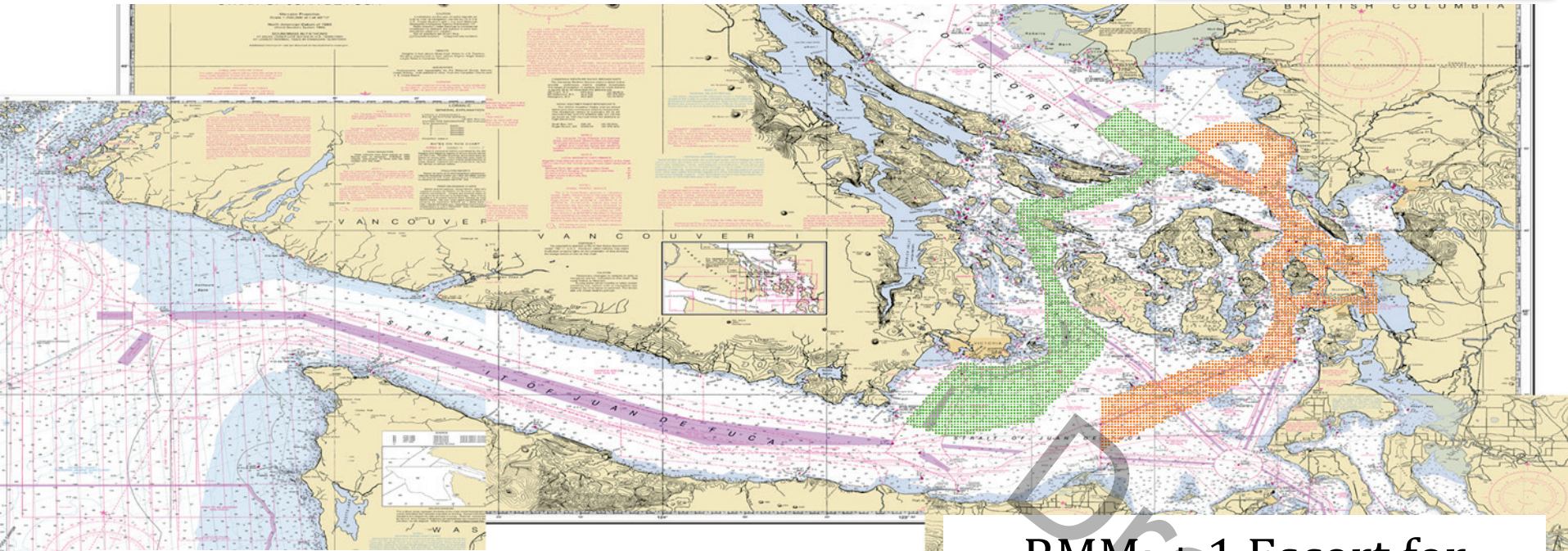
**CASE T: GW – KM – DP & +1 Escort Rosario – Laden
Tankers, Chem. Carrier, ATB & Cape Size Bulker**

Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

November 2013



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

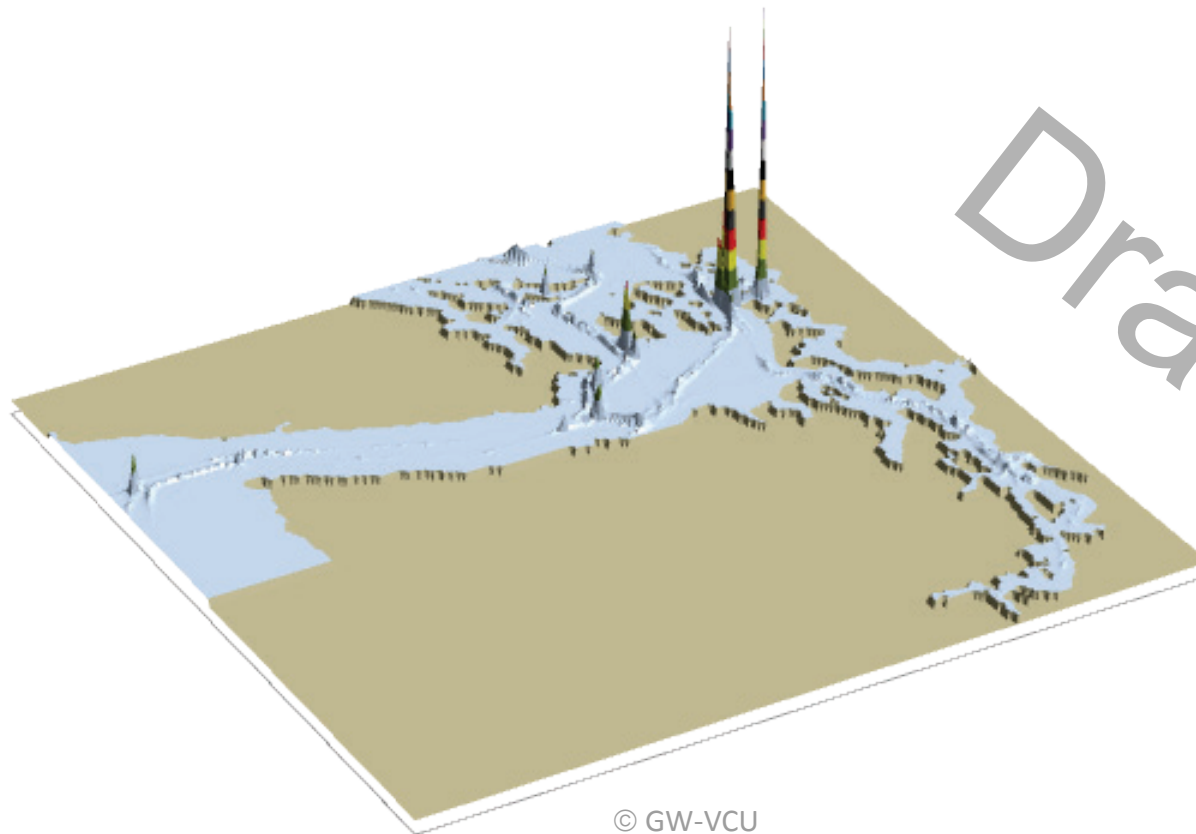


**DEFINITION OF ASSUMED LOCATIONS
FOR ADDED ESCORT VESSEL
FOR HARO-BOUNDARY ROUTES (GREEN)
AND
FOR ROSARIO ROUTES (ORANGE)**

RMM: + 1 Escort for
Laden Tankers, Chem.
Carrier, ATB & Cape Size
Bulkler on Rosario Routes
(Orange)

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

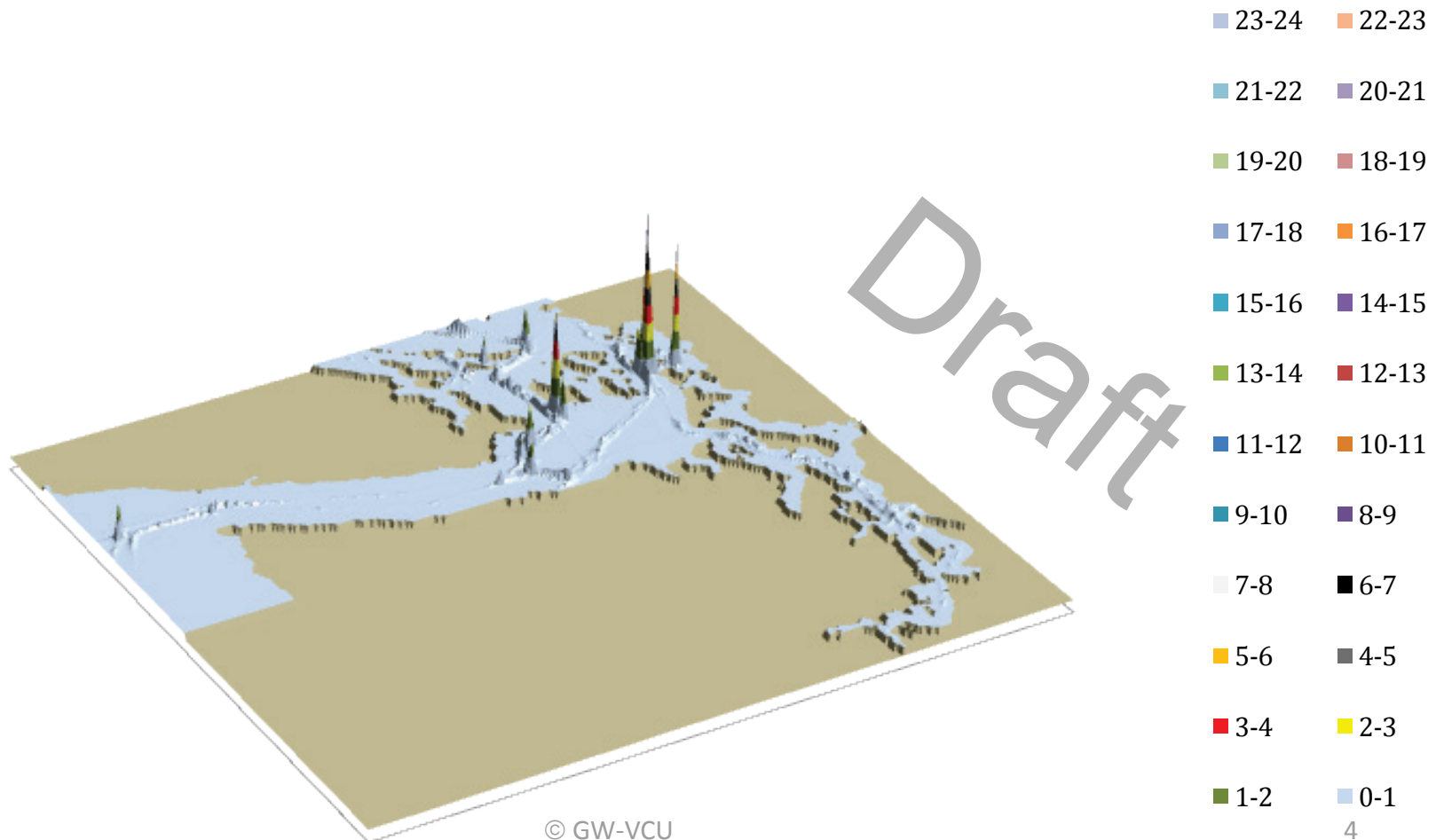
T: GW - KM - DP & EH 3D Risk Profile All FV - Pot. Collision Oil Loss: 170% of Base Case PCO



- | | |
|---------|---------|
| ■ 23-24 | ■ 22-23 |
| ■ 21-22 | ■ 20-21 |
| ■ 19-20 | ■ 18-19 |
| ■ 17-18 | ■ 16-17 |
| ■ 15-16 | ■ 14-15 |
| ■ 13-14 | ■ 12-13 |
| ■ 11-12 | ■ 10-11 |
| ■ 9-10 | ■ 8-9 |
| ■ 7-8 | ■ 6-7 |
| ■ 5-6 | ■ 4-5 |
| ■ 3-4 | ■ 2-3 |
| ■ 1-2 | ■ 0-1 |

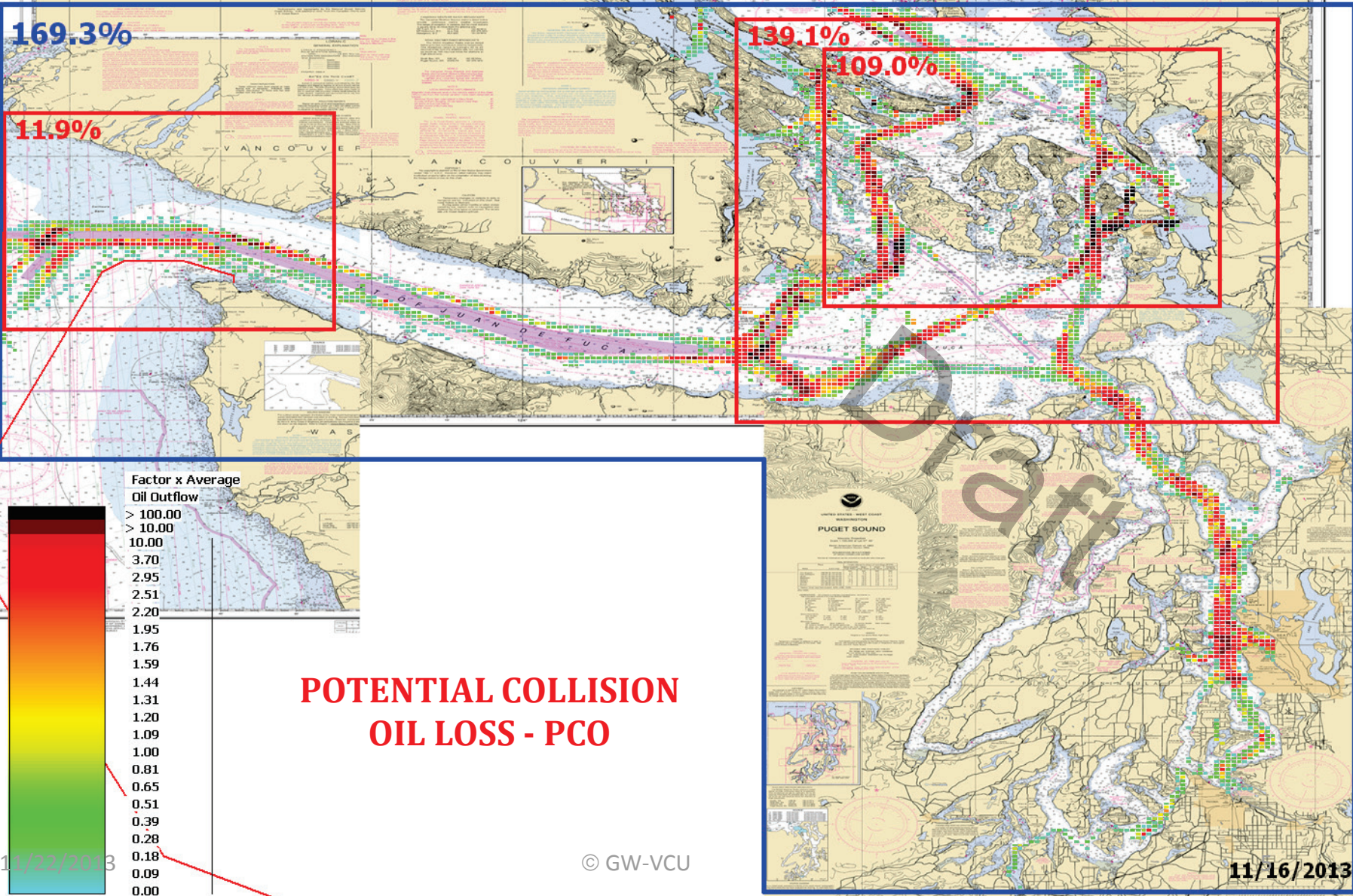
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & ER 3D Risk Profile All FV - Pot. Collision Oil Loss: 164% of Base Case PCO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT HARO-BOUNDARY - All FV



POTENTIAL COLLISION
OIL LOSS - PCO

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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT ROSARIO - All FV

163.4%

11.9%

133.2%

99.9%

Factor x Average
Oil Outflow

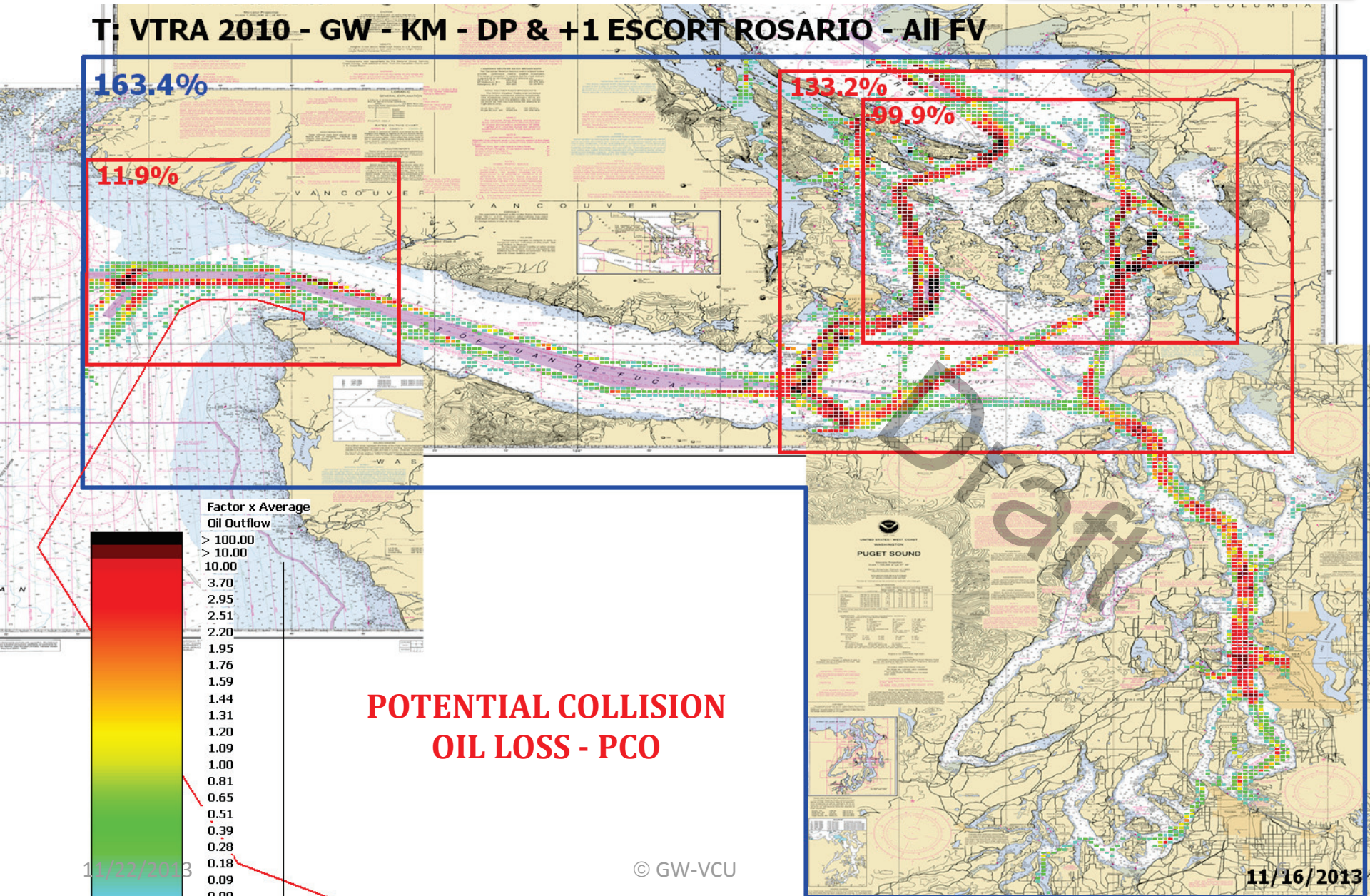
- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.20
- 1.95
- 1.76
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.28
- 0.18
- 0.09
- 0.00

POTENTIAL COLLISION
OIL LOSS - PCO

11/22/2013

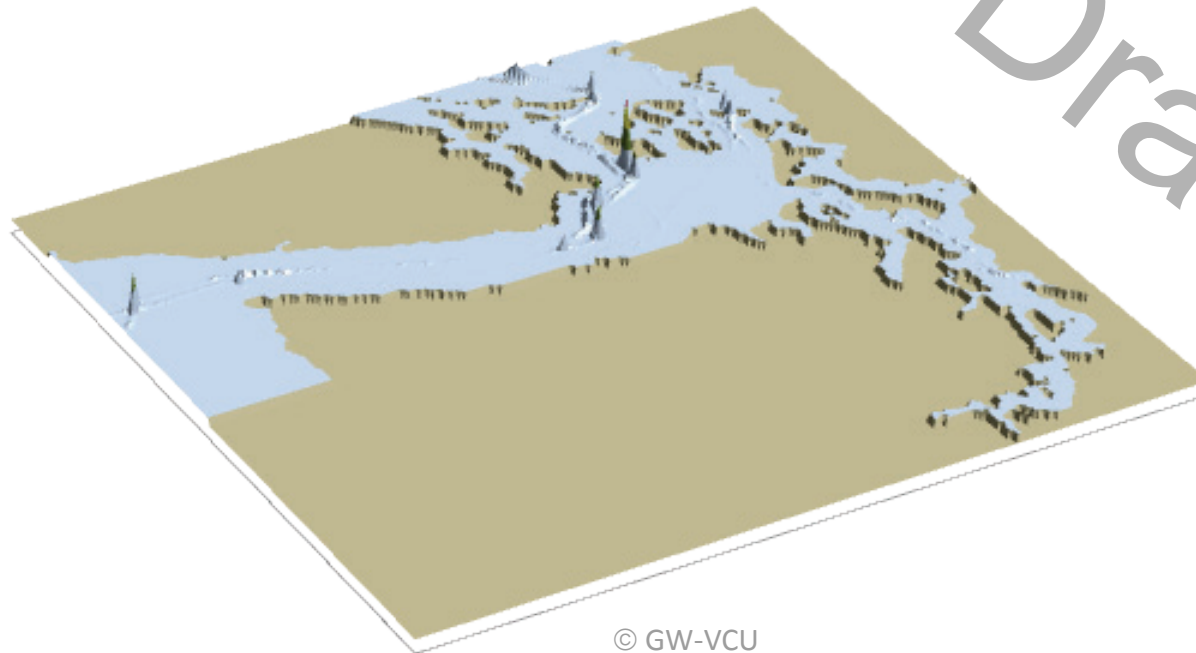
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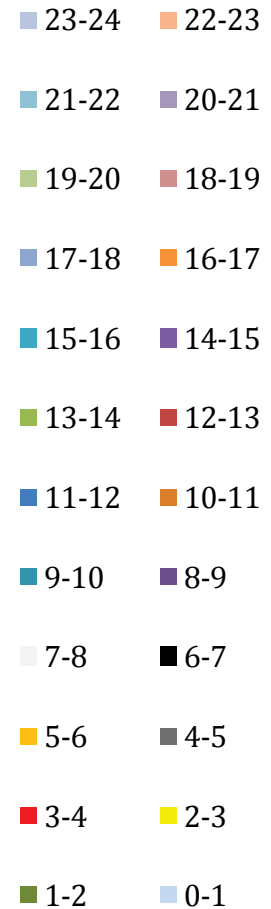
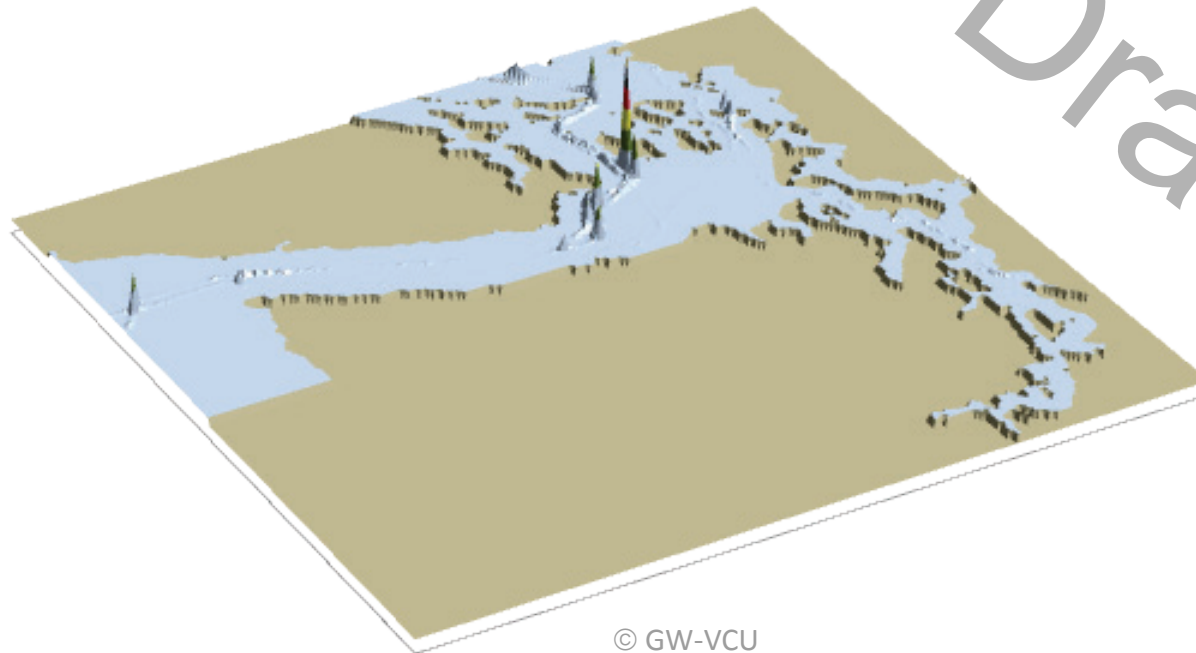
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & EH 3D Risk Profile What If FV - Pot. Coll. Oil Loss: 47% of Base Case PCO



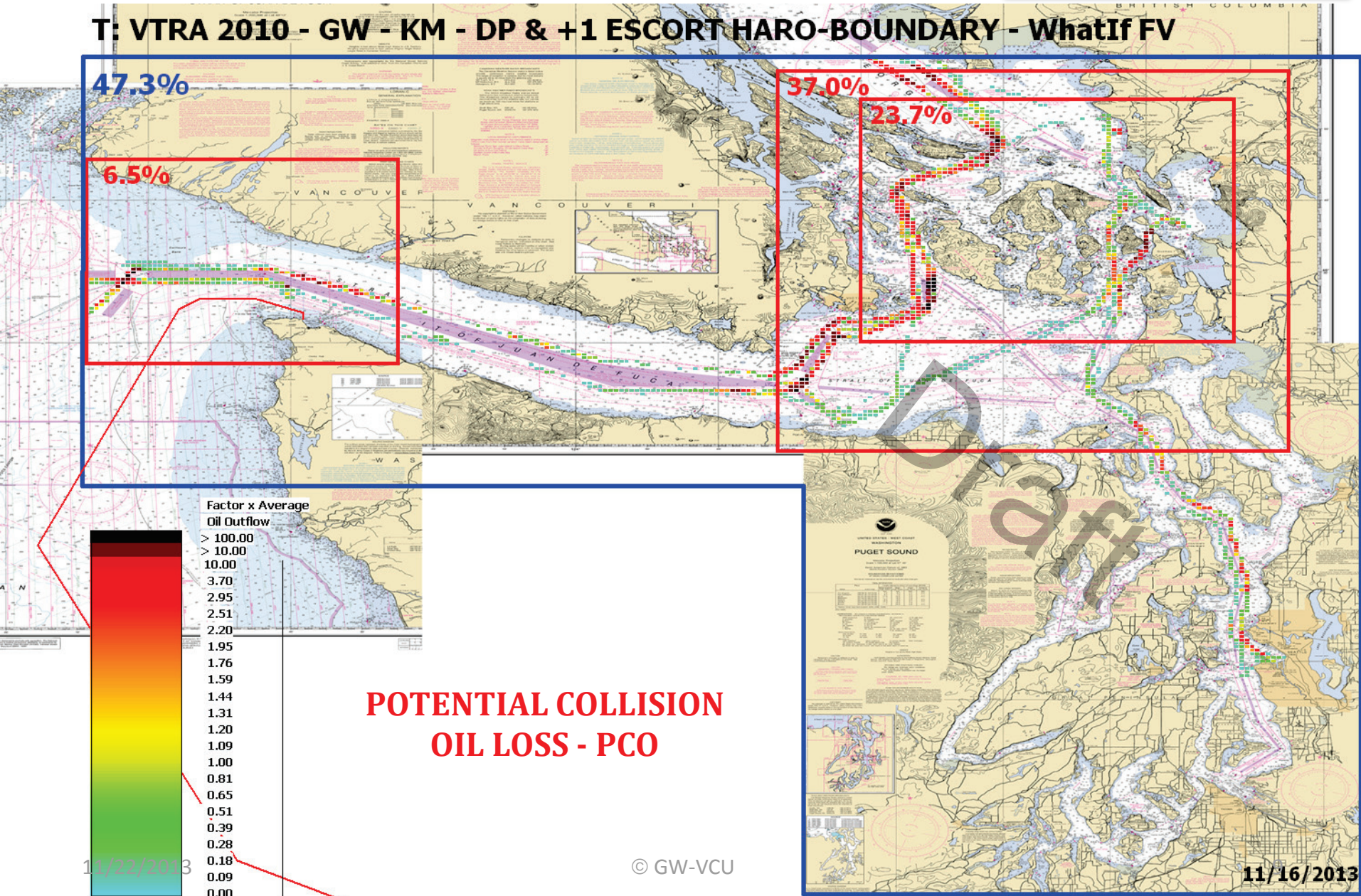
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & ER 3D Risk Profile What If FV - Pot. Coll. Oil Loss: 62% of Base Case PCO



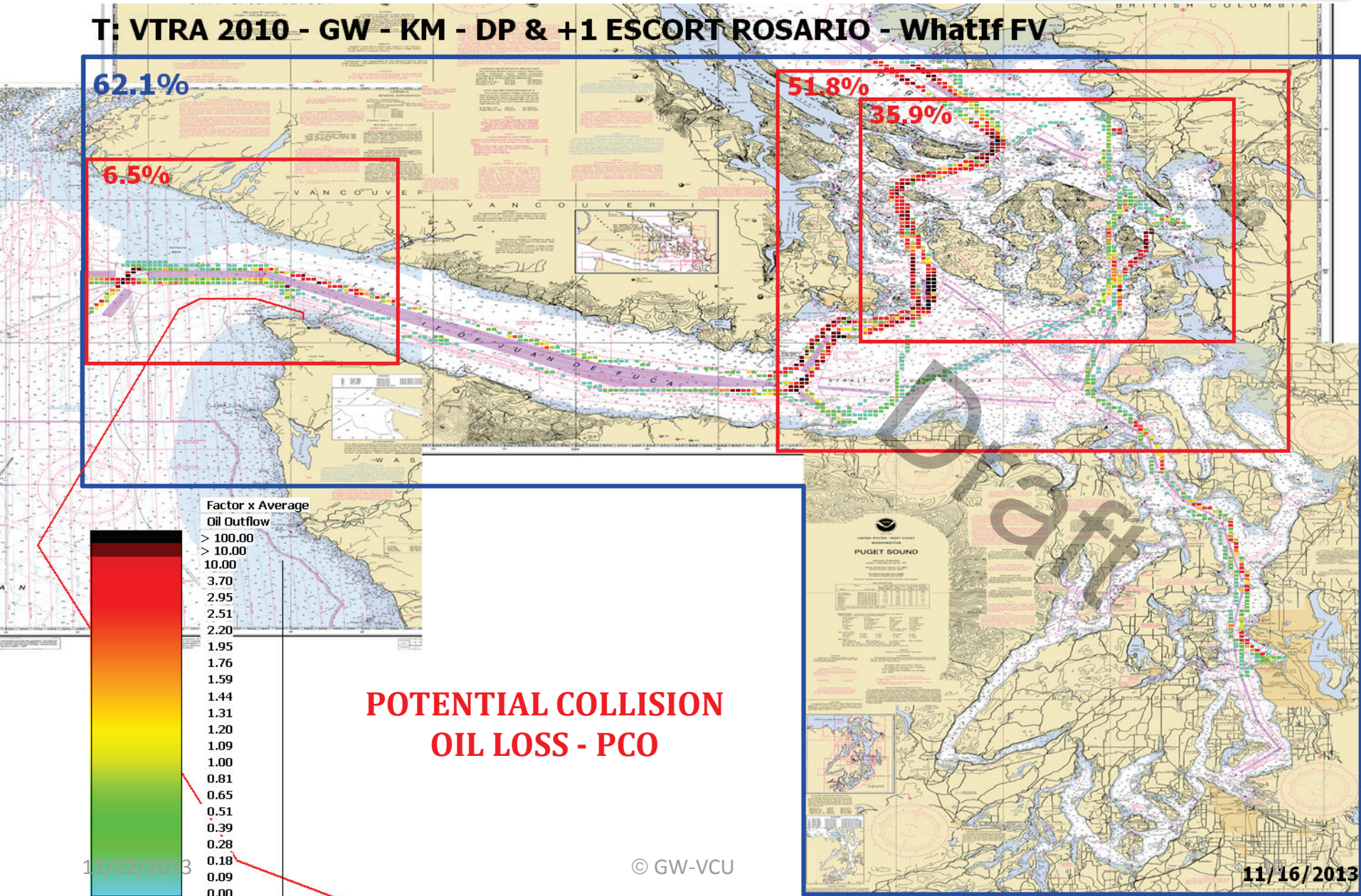
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT HARO-BOUNDARY - WhatIf FV



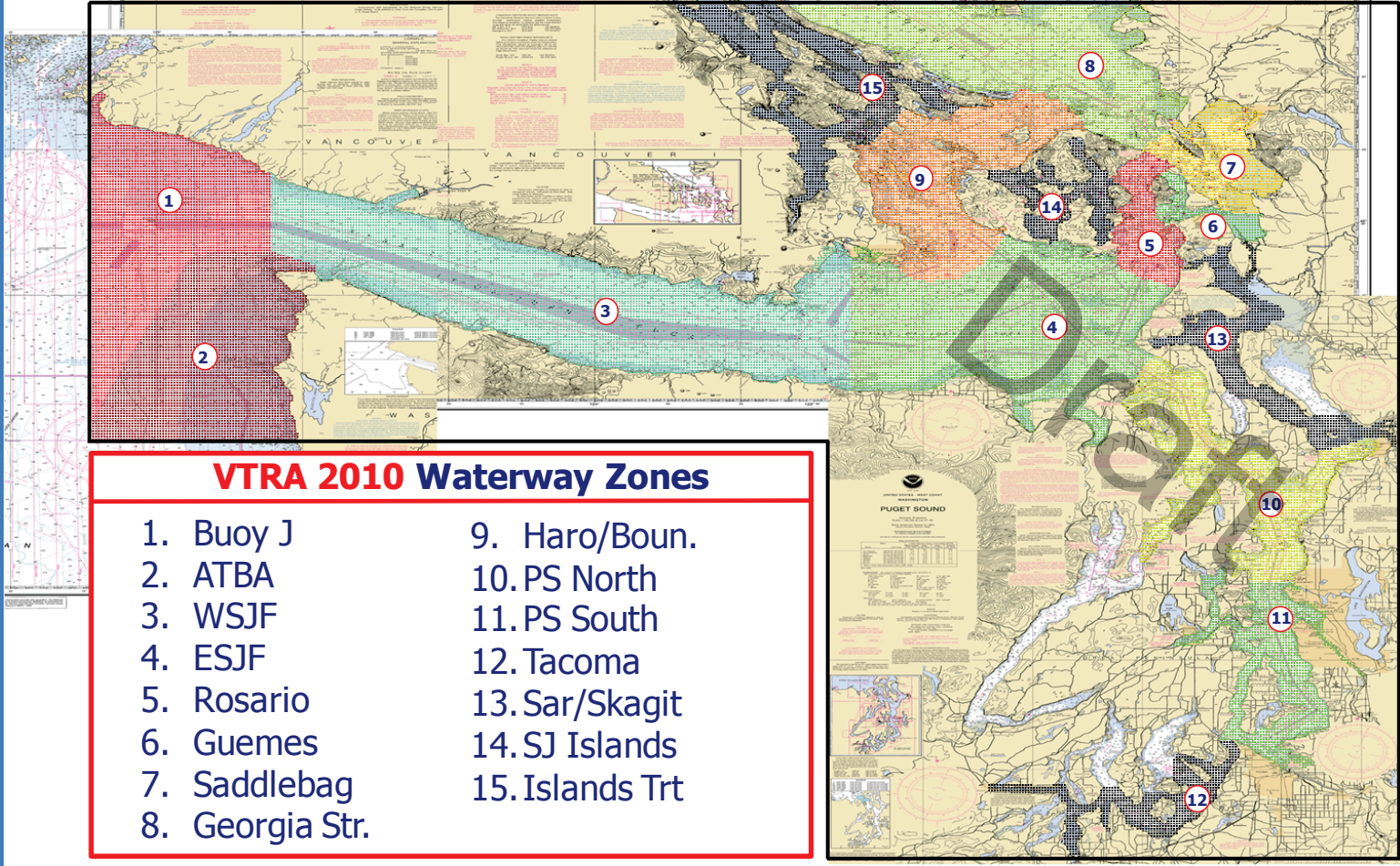
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT ROSARIO - WhatIf FV



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

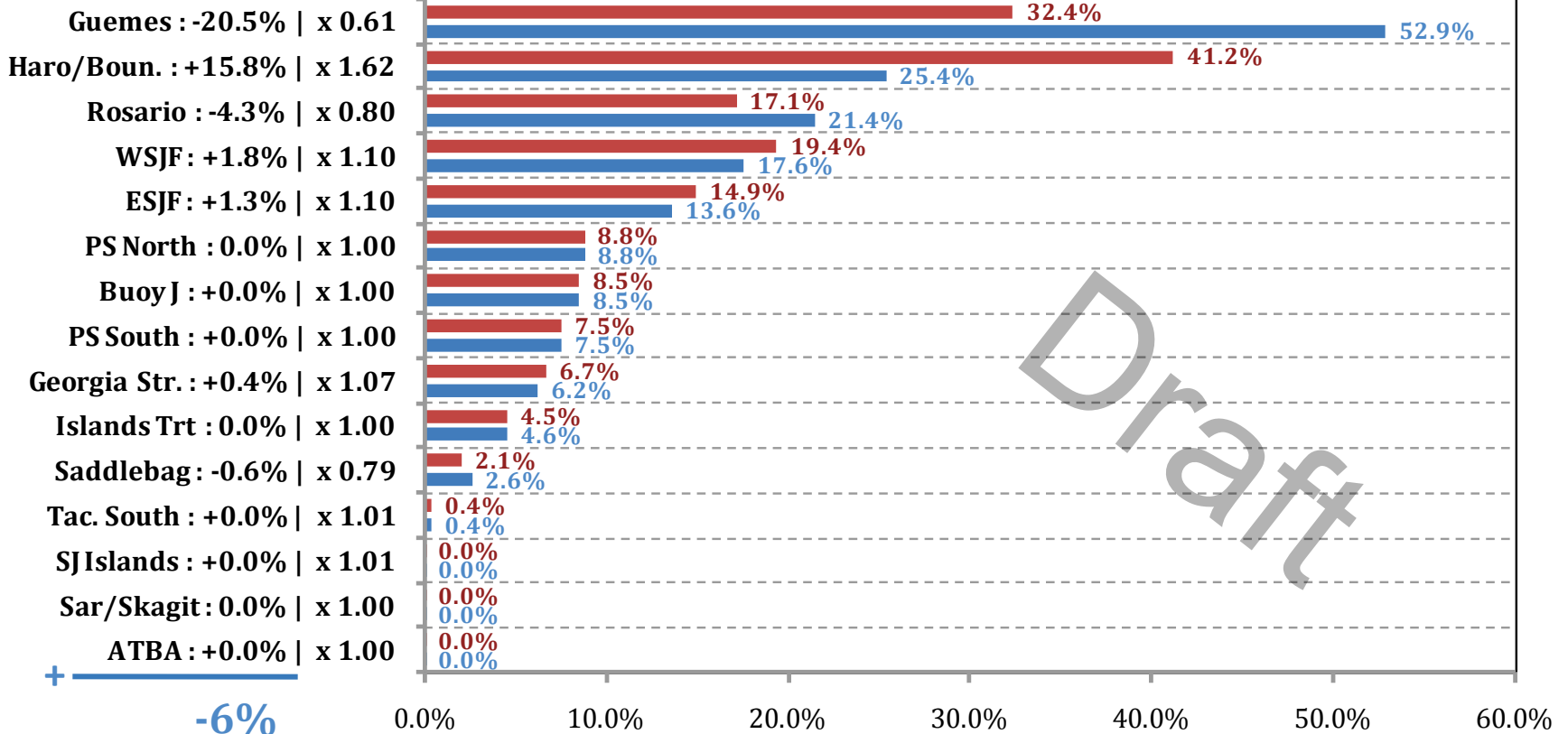
DEFINITION OF 15 WATERWAY ZONES



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Collision Oil Loss - ALL_FV

Waterway Zone:



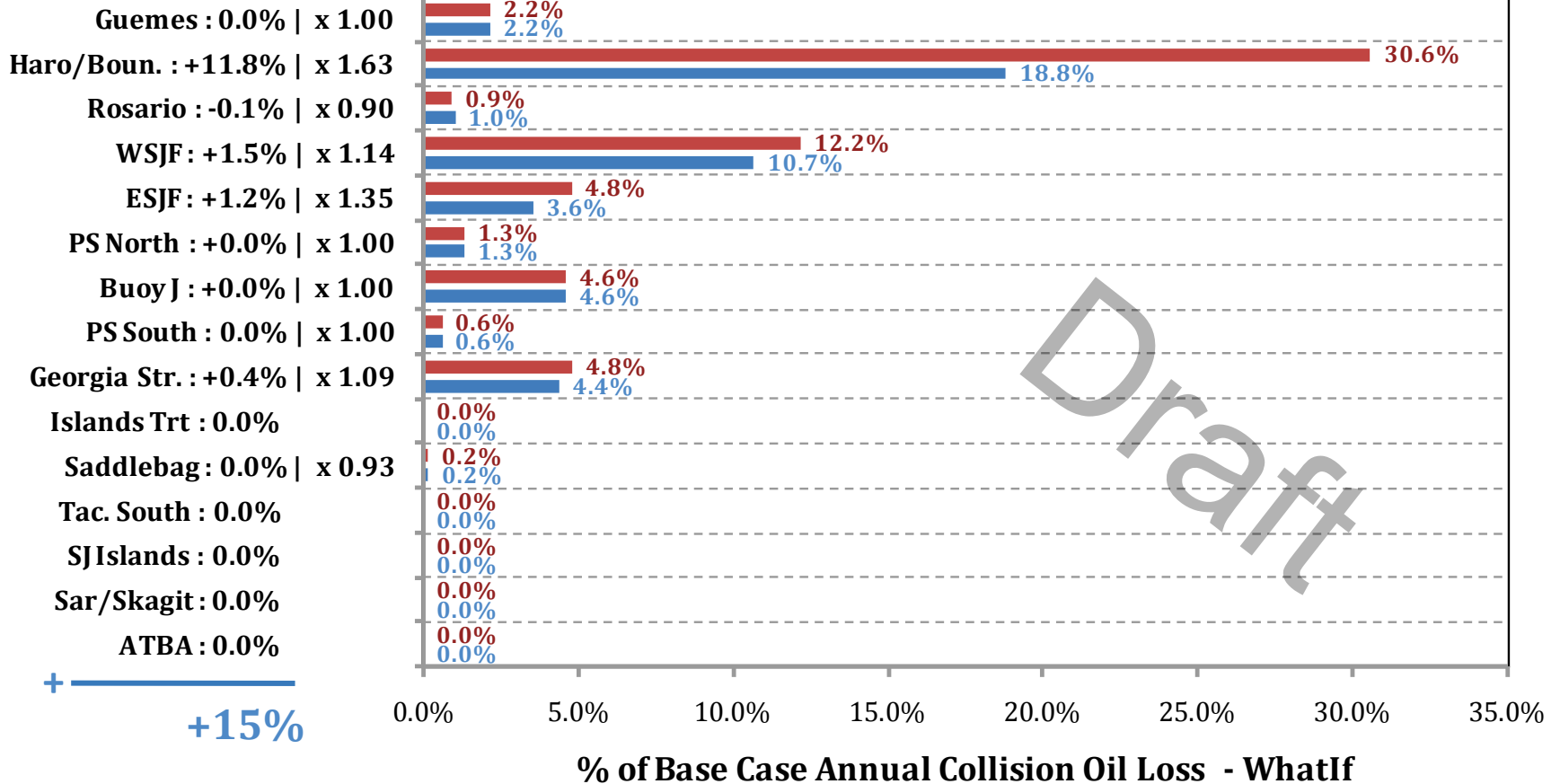
% of Base Case Annual Collision Oil Loss - ALL_FV

■ T:GW - KM - DP & ER : 163% (-6% | x 0.97) ■ T:GW - KM - DP & EH : 169%

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Collision Oil Loss - WhatIf

Waterway Zone:



■ T:GW - KM - DP & ER : 62% (+15% | x 1.31)

■ T:GW - KM - DP & EH : 47%