

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

3D Relative Risk Profile Comparison
Potential Collision Oil Loss

CASE T – GW 487 – KM 348 – DP 415

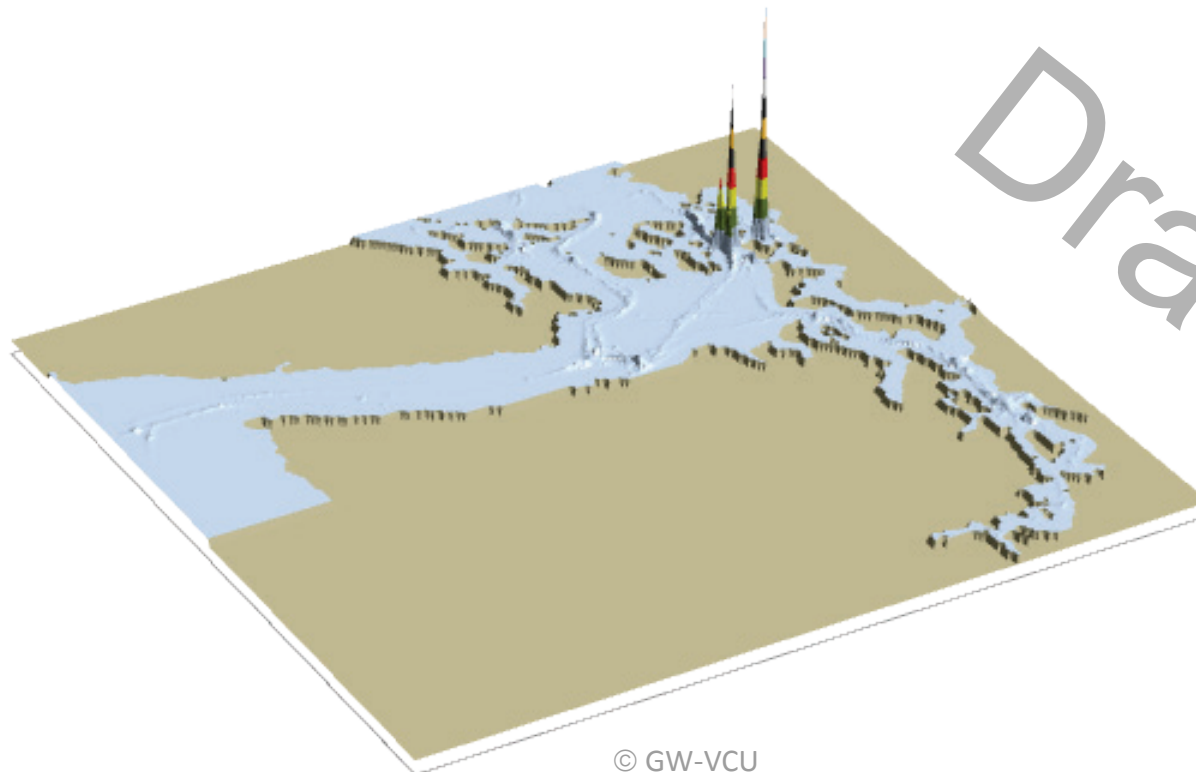
Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

November 2013



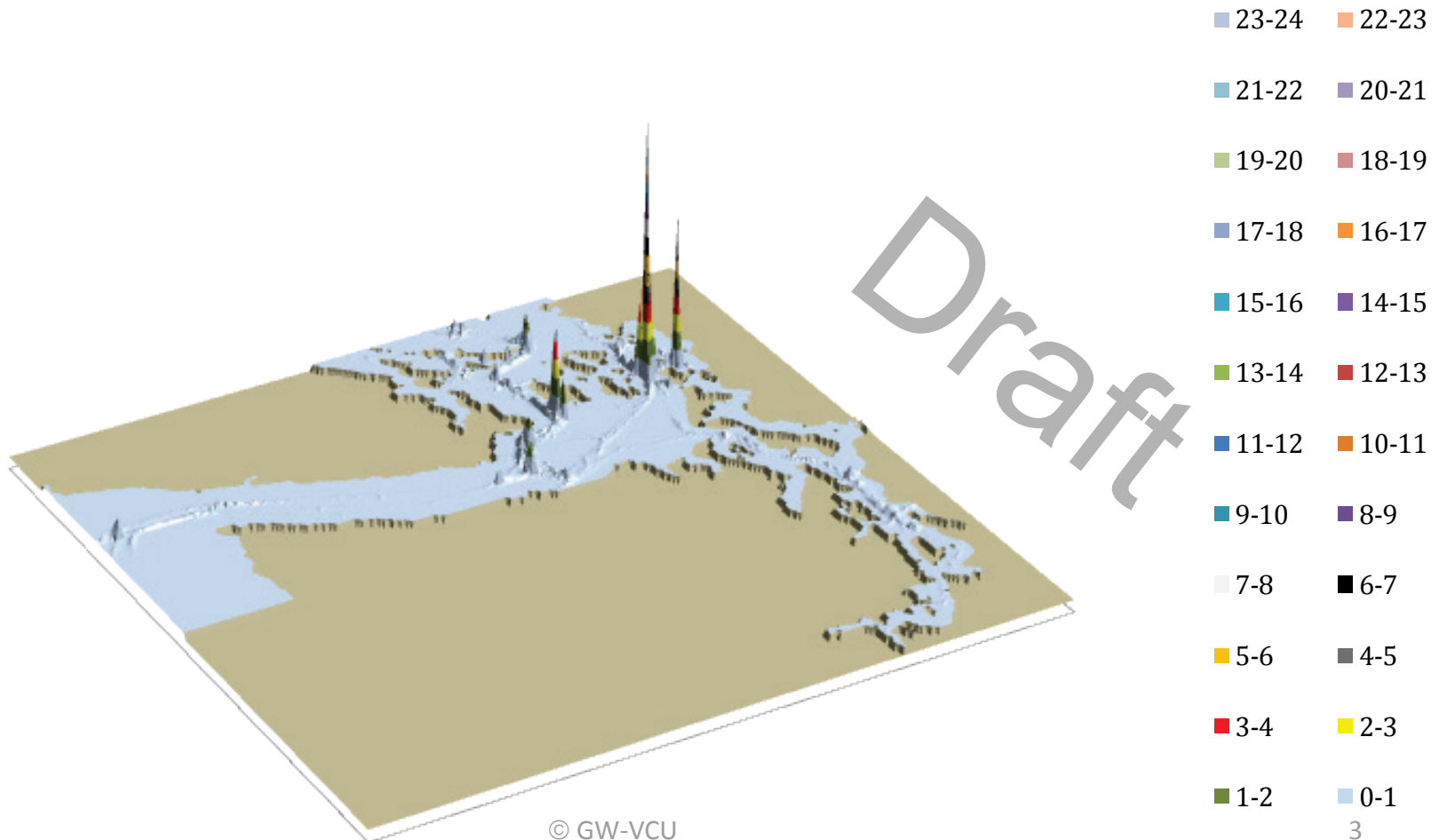
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

P: Base Case 3D Risk Profile All FV - Pot. Collision Oil Loss: 100% of Base Case PCO



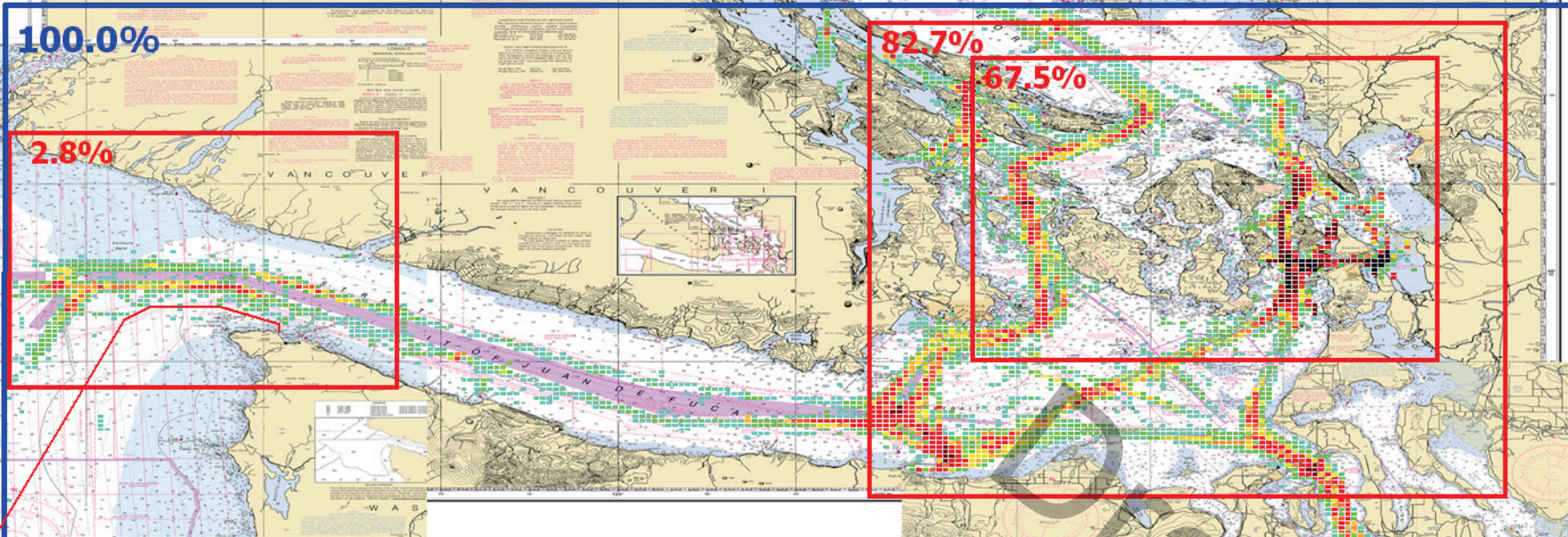
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP 3D Risk Profile All FV - Pot. Collision Oil Loss: 189% of Base Case PCO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

P: VTRA 2010 - BASE CASE - All FV



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

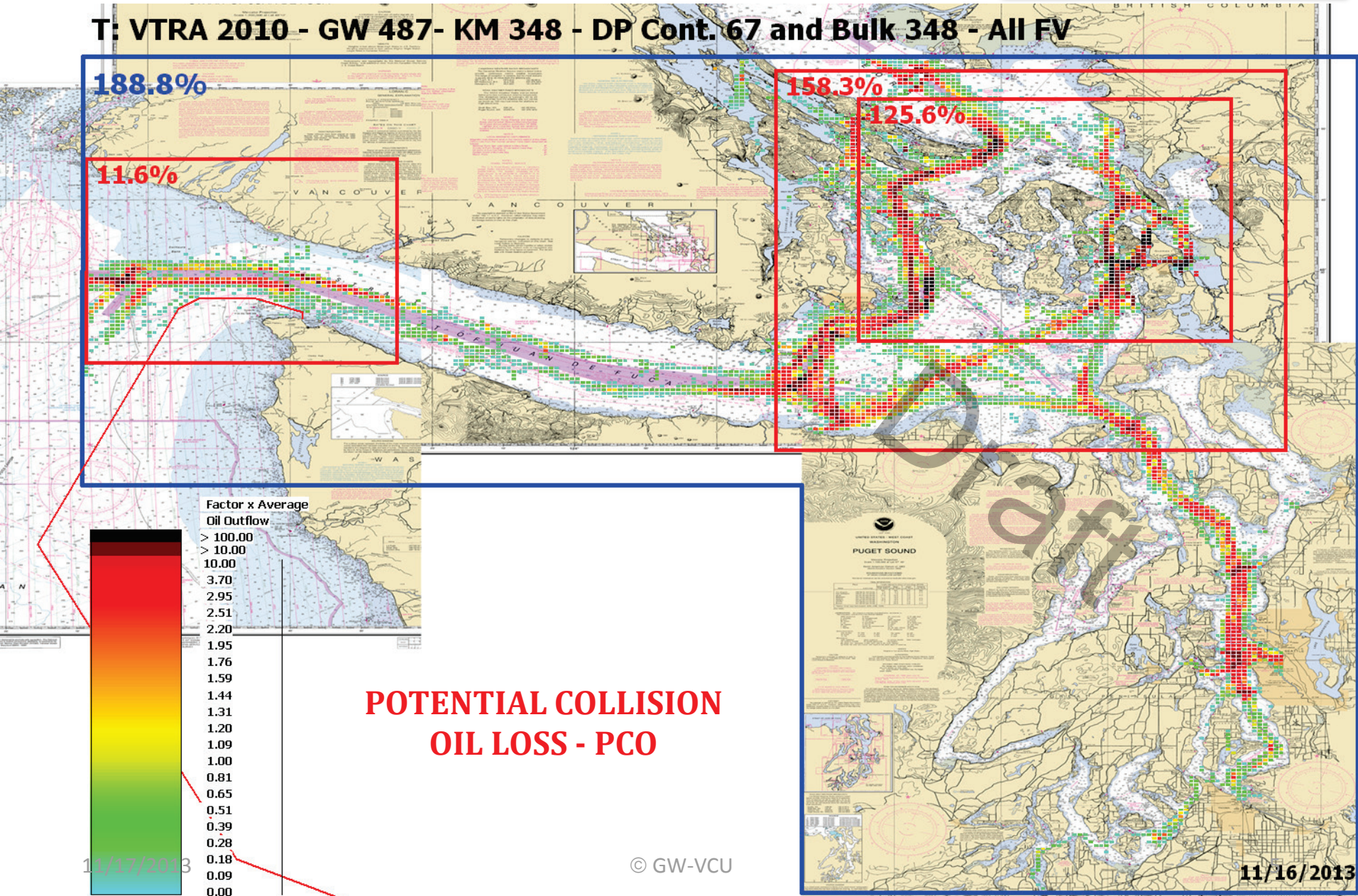
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

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



POTENTIAL COLLISION OIL LOSS - PCO

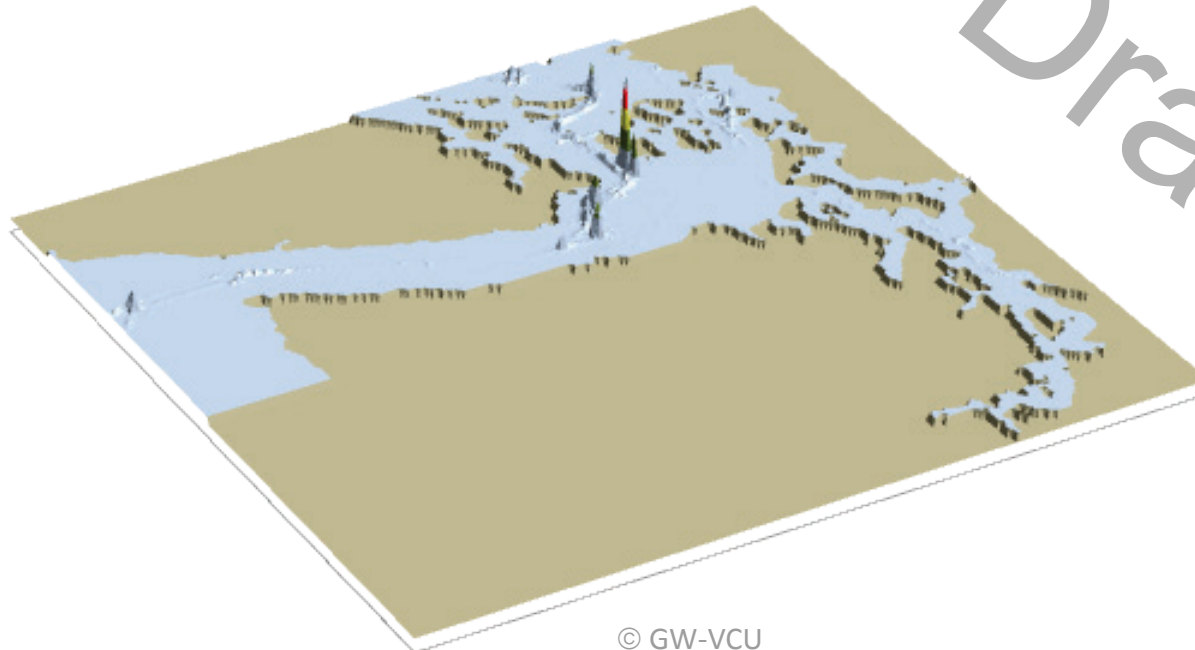
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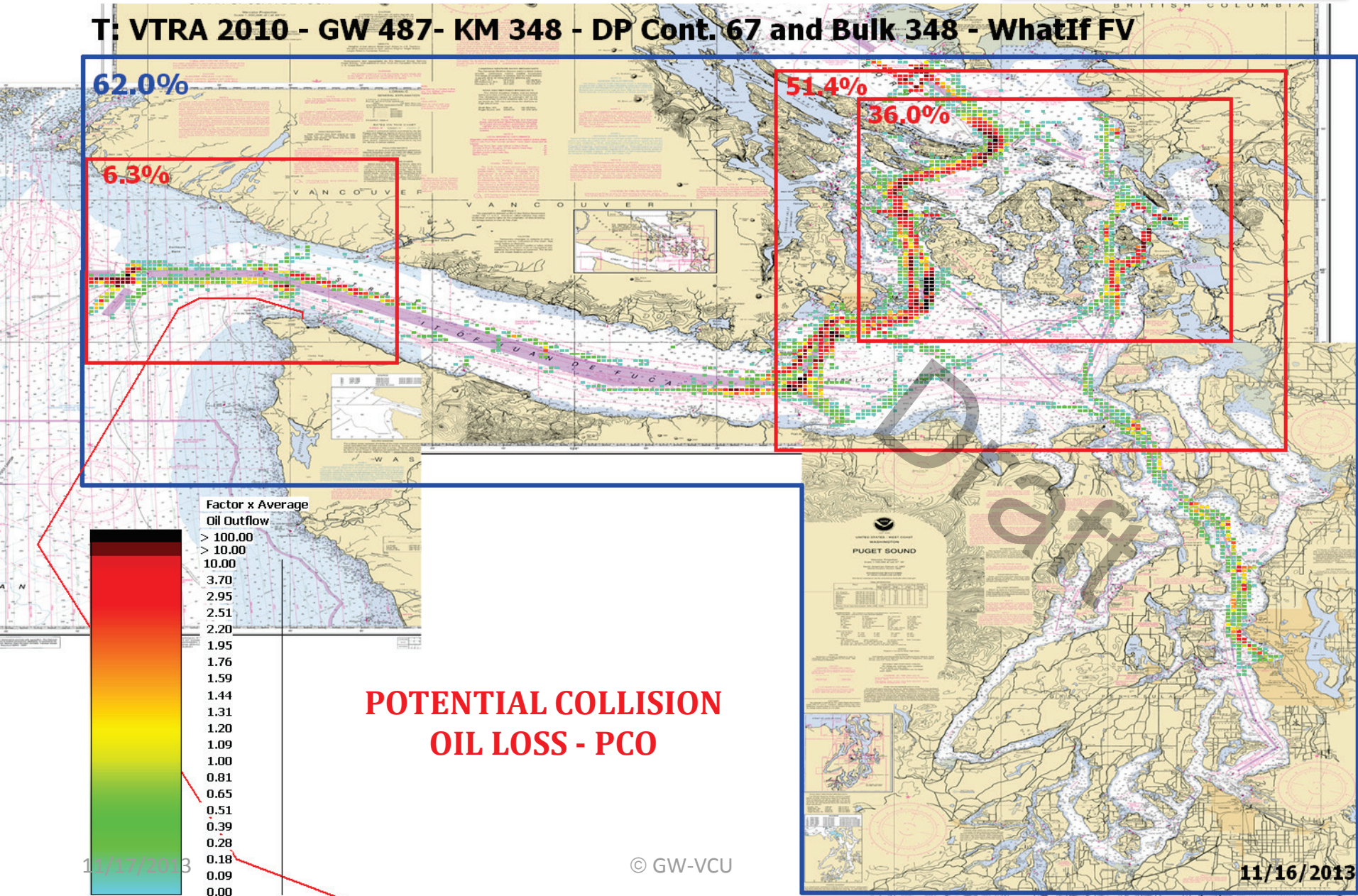
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP 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 487- KM 348 - DP Cont. 67 and Bulk 348 - WhatIf FV



POTENTIAL COLLISION OIL LOSS - PCO

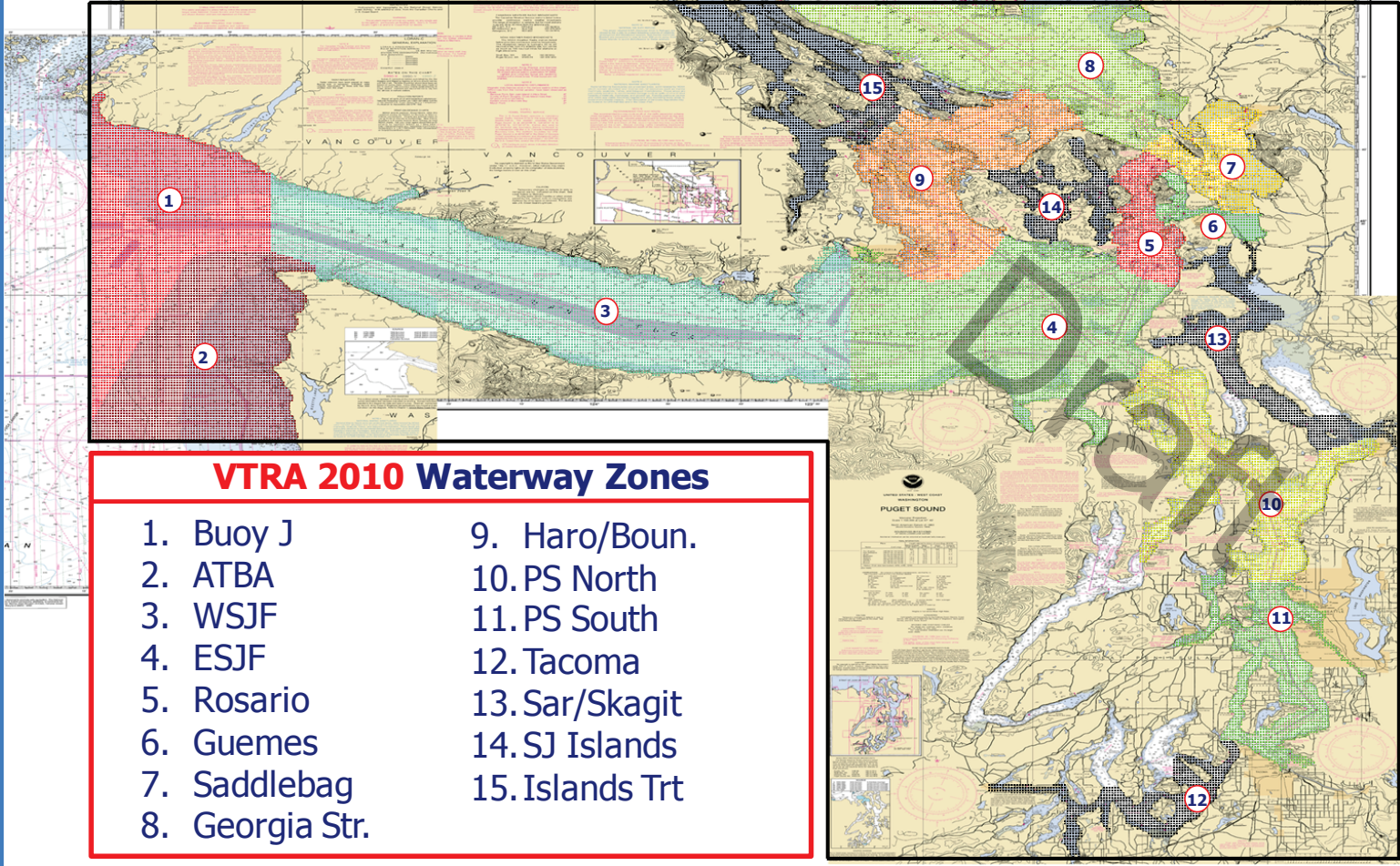
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

DEFINITION OF 15 WATERWAY ZONES



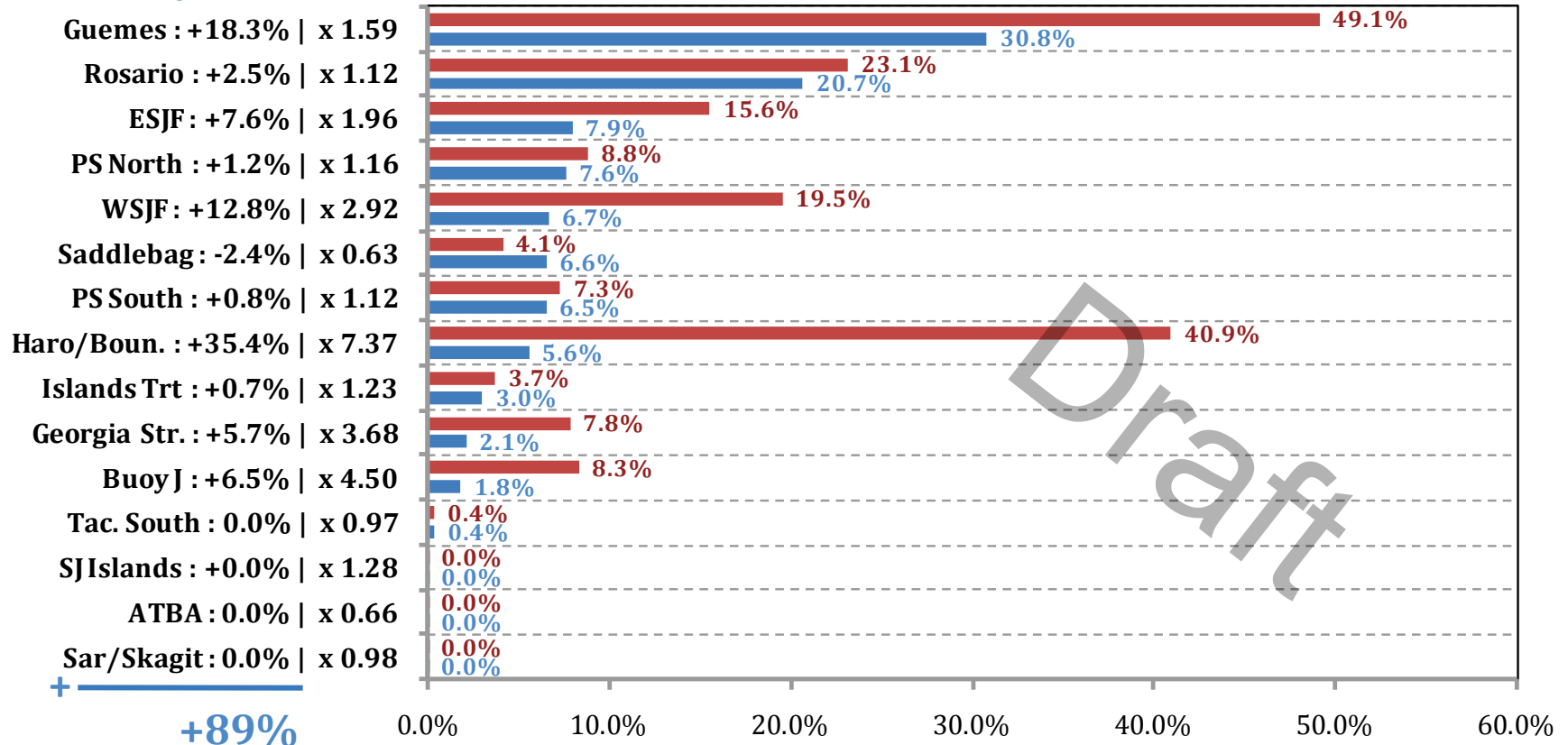
VTRA 2010 Waterway Zones

- | | |
|-----------------|-----------------|
| 1. Buoy J | 9. Haro/Boun. |
| 2. ATBA | 10. PS North |
| 3. WSJF | 11. PS South |
| 4. ESJF | 12. Tacoma |
| 5. Rosario | 13. Sar/Skagit |
| 6. Guemes | 14. SJ Islands |
| 7. Saddlebag | 15. Islands Trt |
| 8. Georgia Str. | |

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 : 189% (+89% | x 1.89)

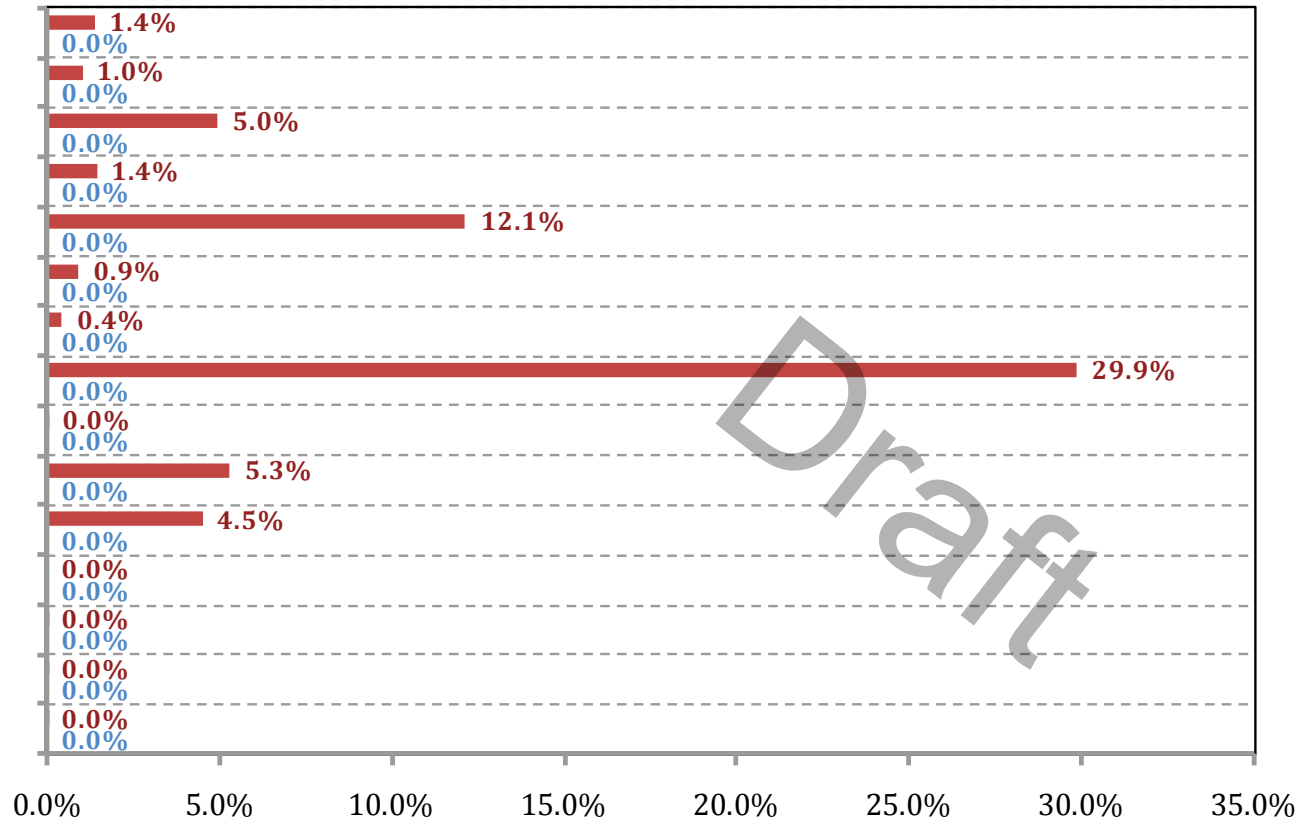
■ P: Base Case : 100%

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Collision Oil Loss - WhatIf

Waterway Zone:

| |
|----------------------|
| Guemes : +1.4% |
| Rosario : +1.0% |
| ESJF : +5.0% |
| PS North : +1.4% |
| WSJF : +12.1% |
| Saddlebag : +0.9% |
| PS South : +0.4% |
| Haro/Boun. : +29.9% |
| Islands Trt : +0.0% |
| Georgia Str. : +5.3% |
| Buoy J : +4.5% |
| Tac. South : 0.0% |
| SJ Islands : +0.0% |
| ATBA : +0.0% |
| Sar/Skagit : +0.0% |
| + +62% |



% of Base Case Annual Collision Oil Loss - WhatIf

■ T: GW - KM - DP : 62% (+62%)

■ P: Base Case : 0%