

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

3D Relative Risk Profile Comparison
Potential Grounding Oil Loss

CASE T: GW – KM – DP & One Way ATB's Rosario

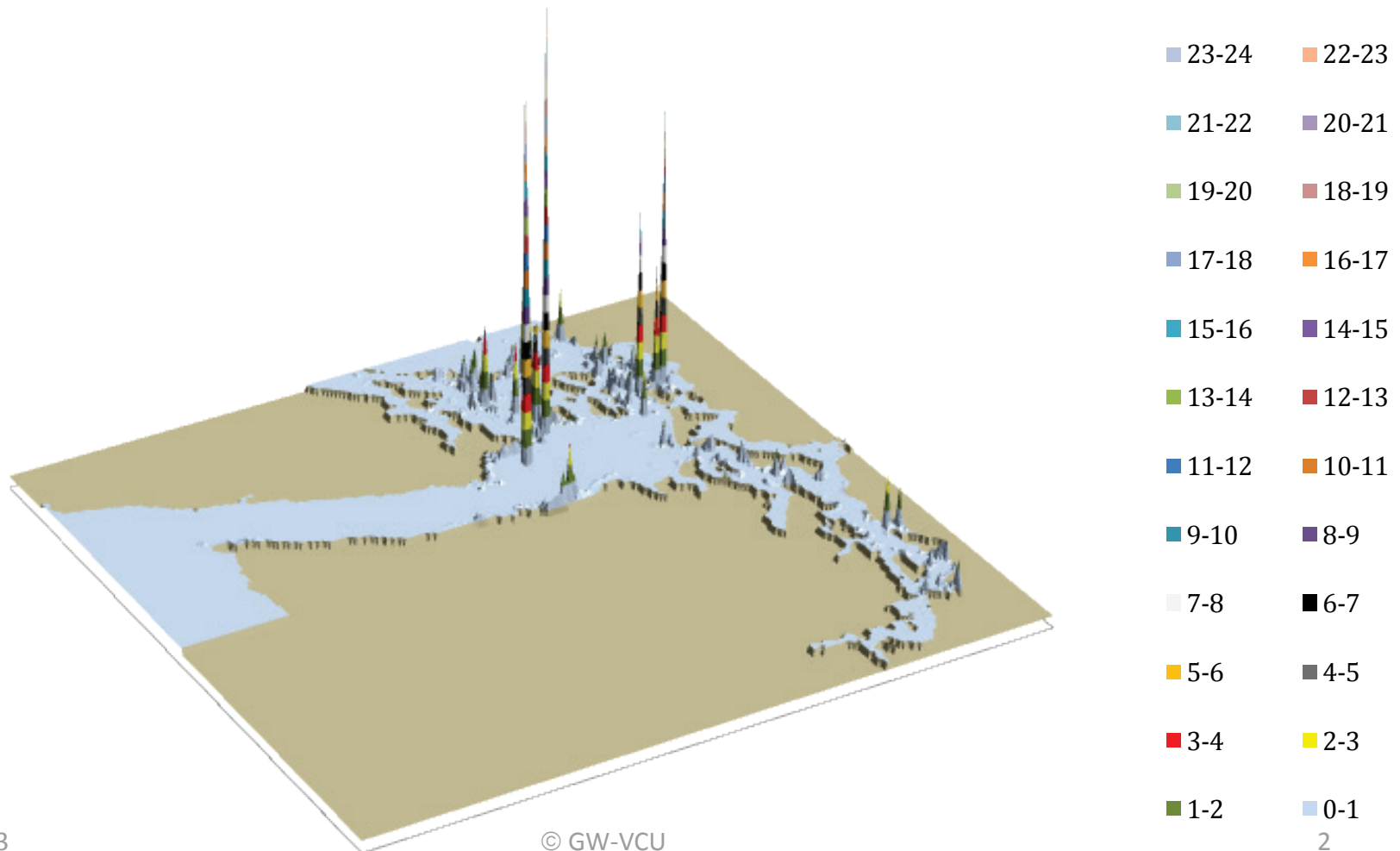
Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

November 2013



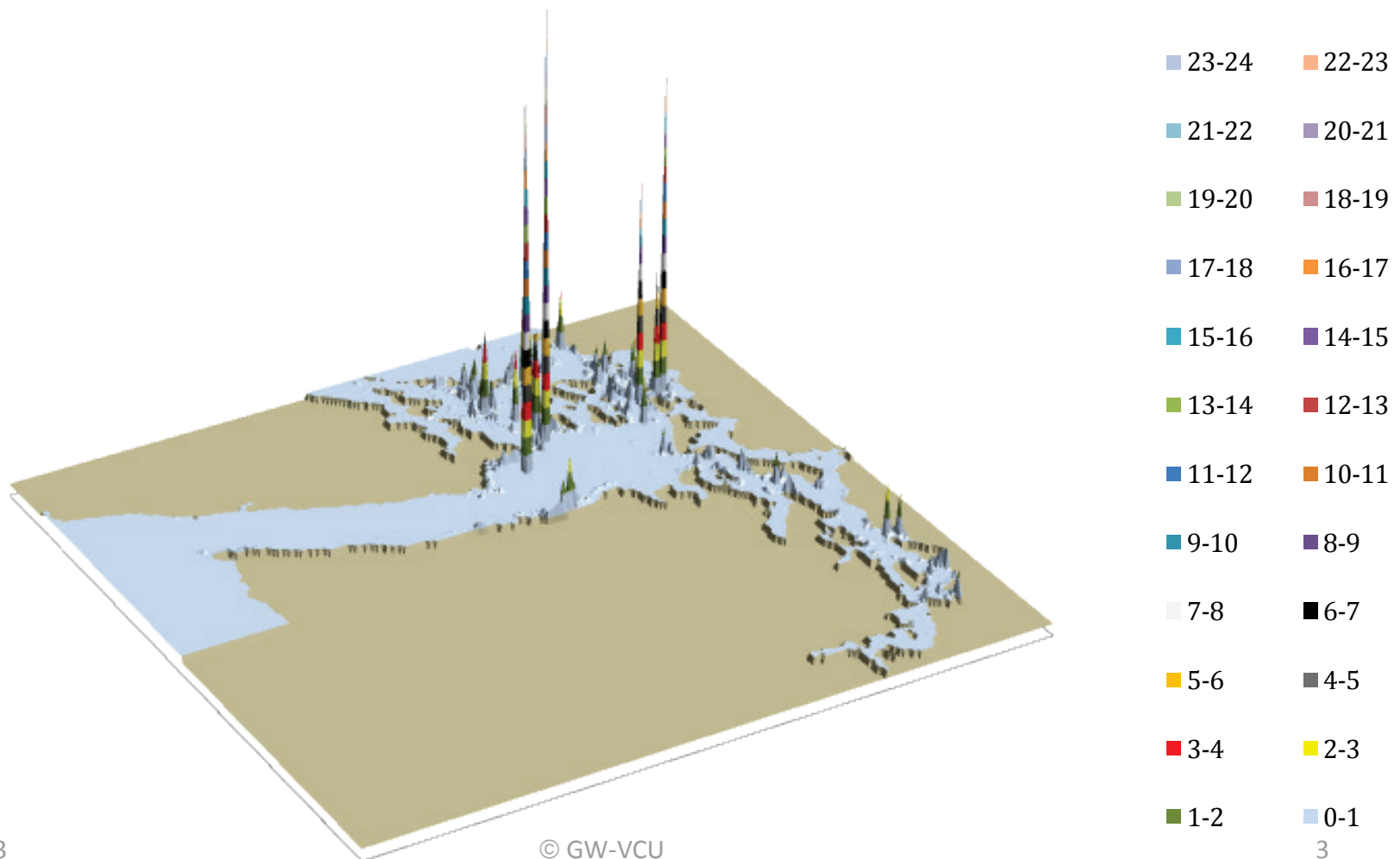
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP 3D Risk Profile All FV - Pot. Ground. Oil Loss: 159% of Base Case PGO



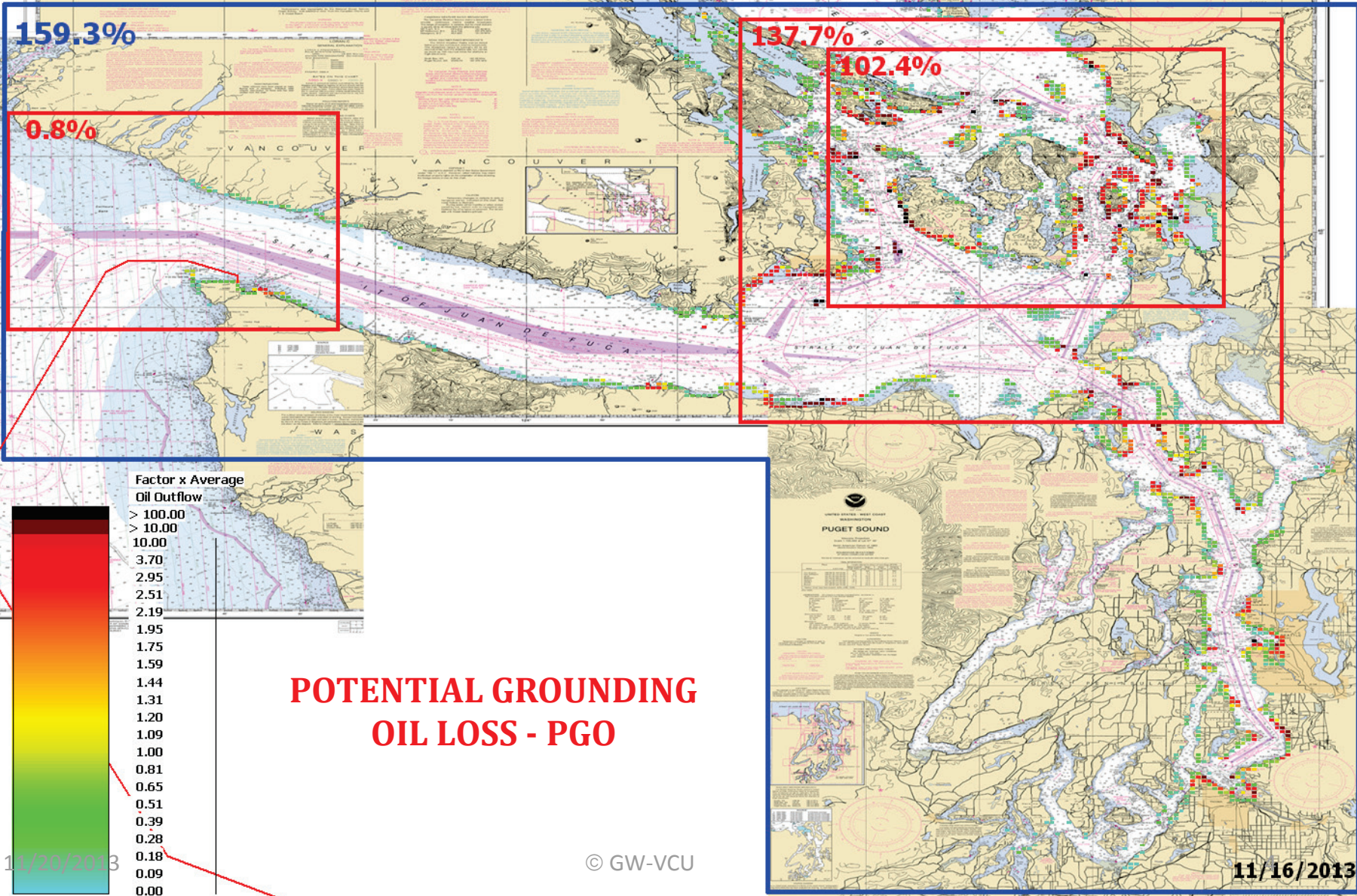
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & OW ATB 3D Risk Profile All FV - Pot. Ground. Oil Loss: 164% of Base Case PGO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

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



POTENTIAL GROUNDING OIL LOSS - PGO

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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & ONE WAY ATB ROSARIO - ALL FV

163.7%

0.8%

141.8%

106.3%

Factor x Average
Oil Outflow

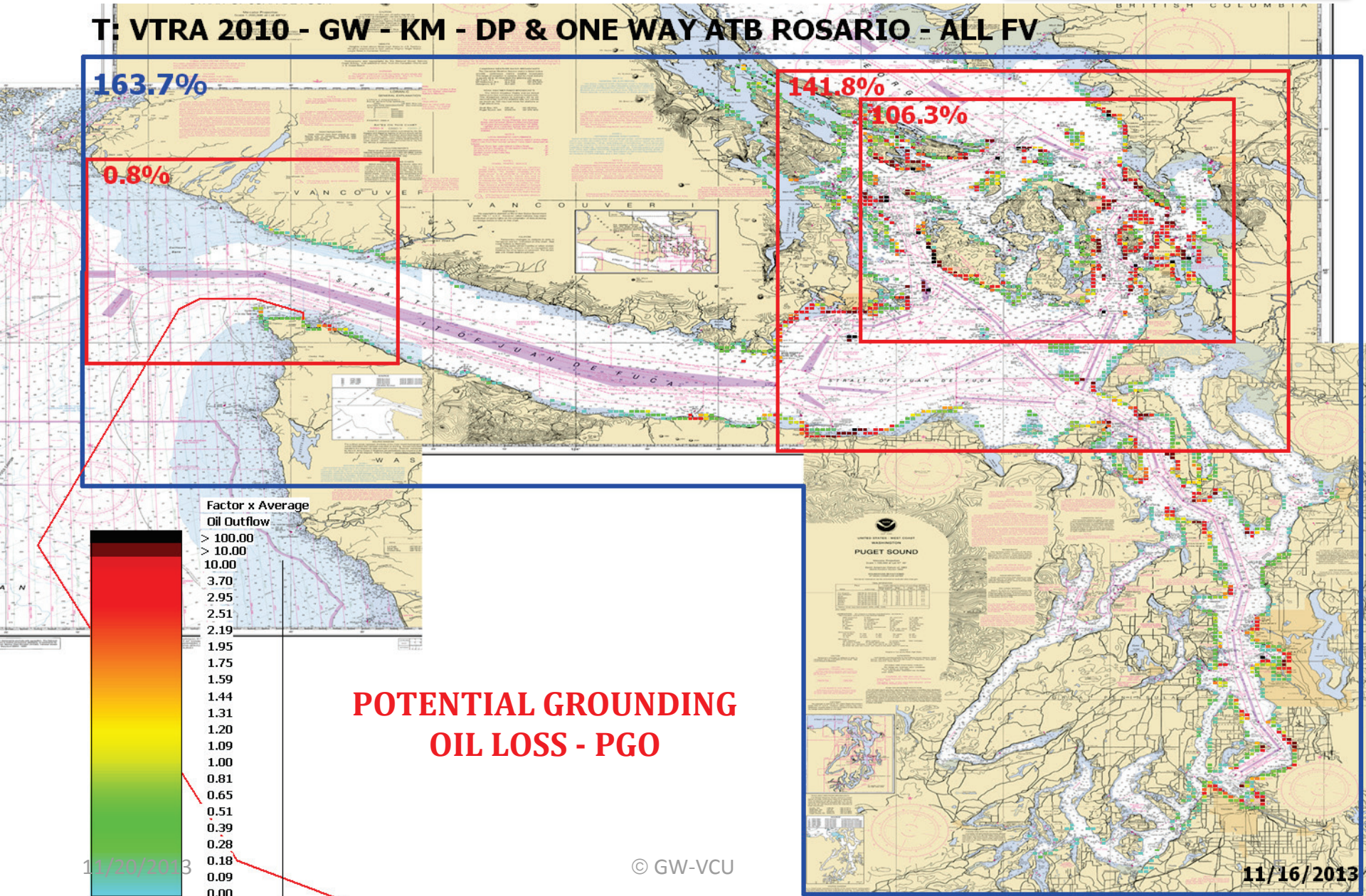
- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.19
- 1.95
- 1.75
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.28
- 0.18
- 0.09
- 0.00

POTENTIAL GROUNDING
OIL LOSS - PGO

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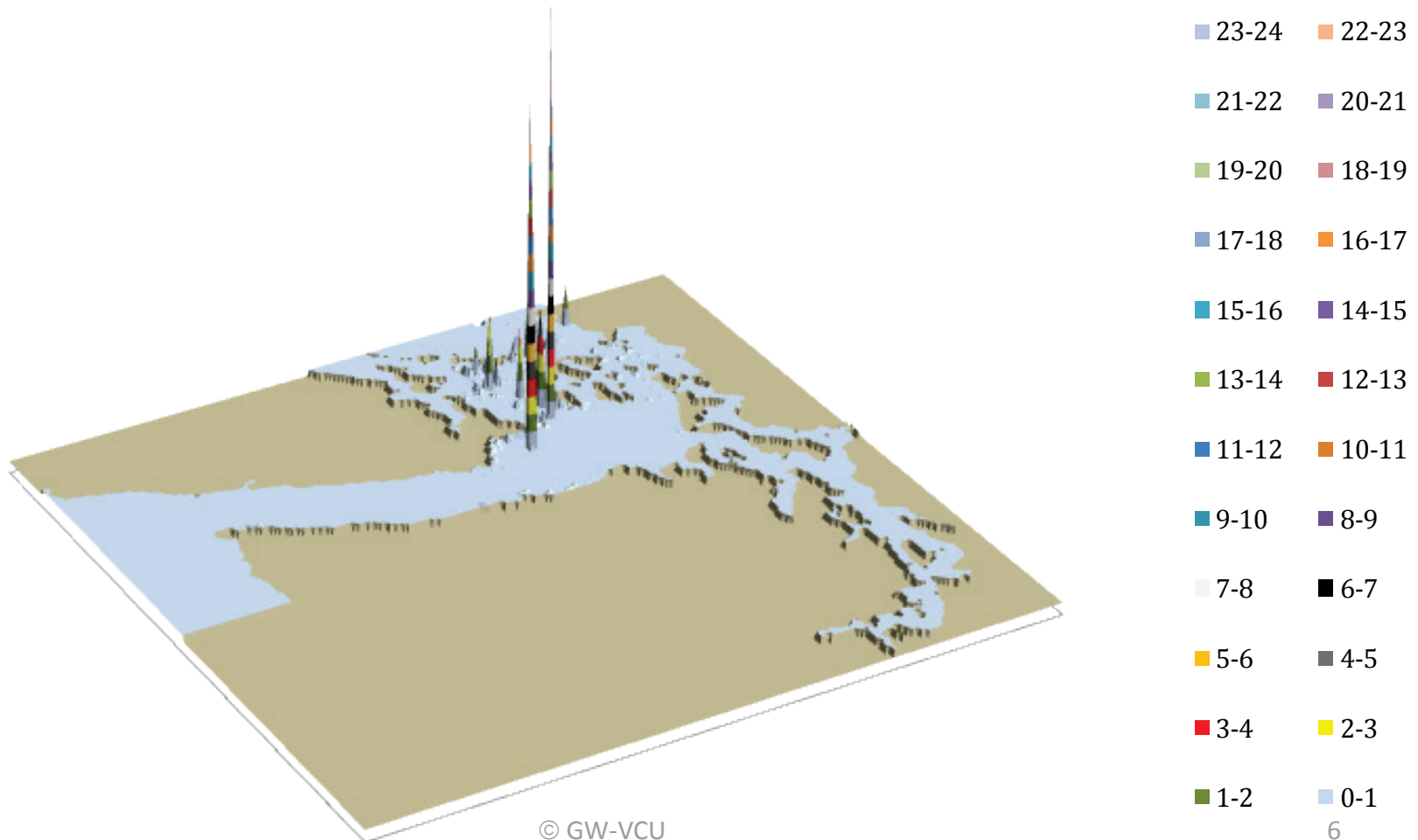
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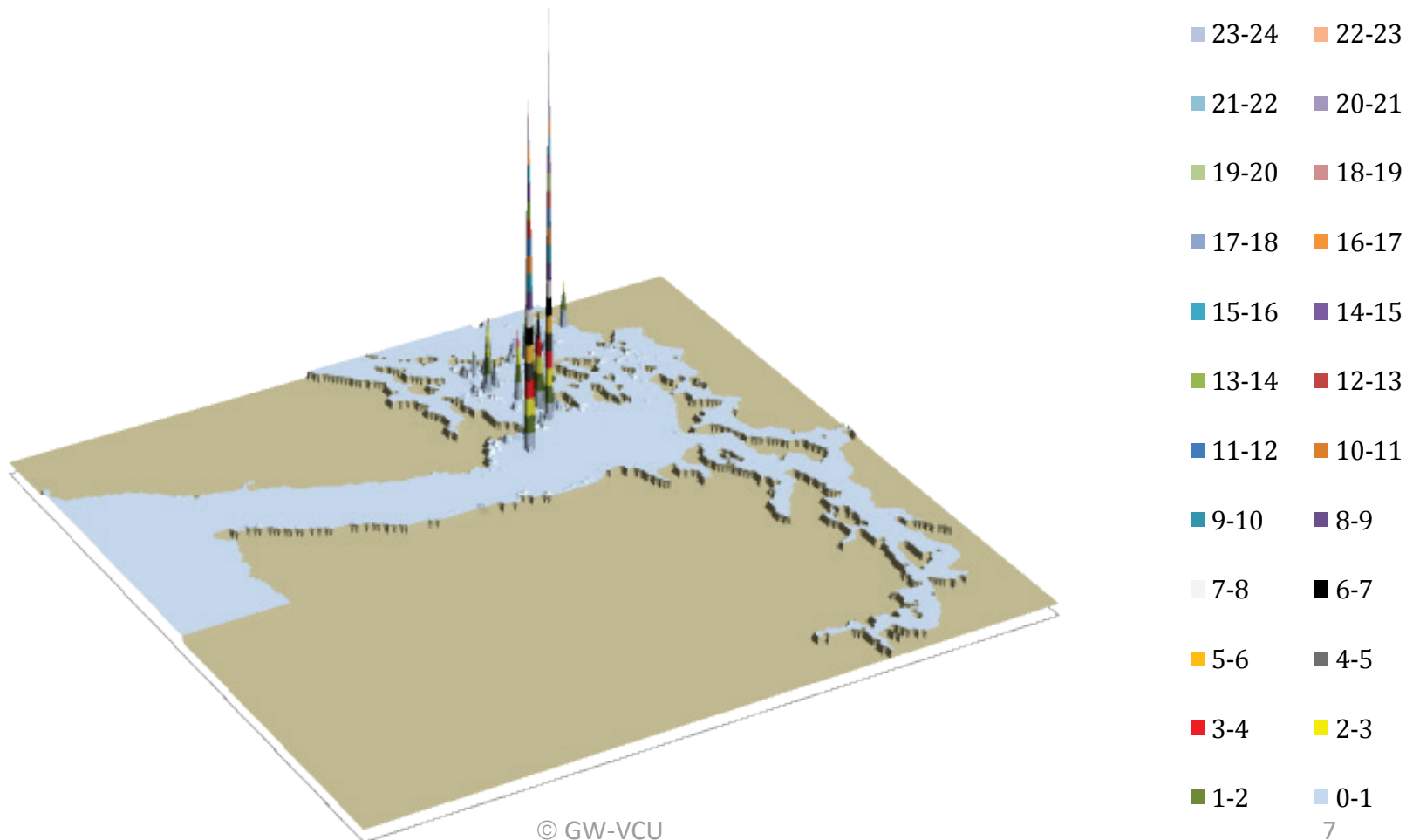
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP 3D Risk Profile What-If FV - Pot. Grou. Oil Loss: 61% of Base Case PGO



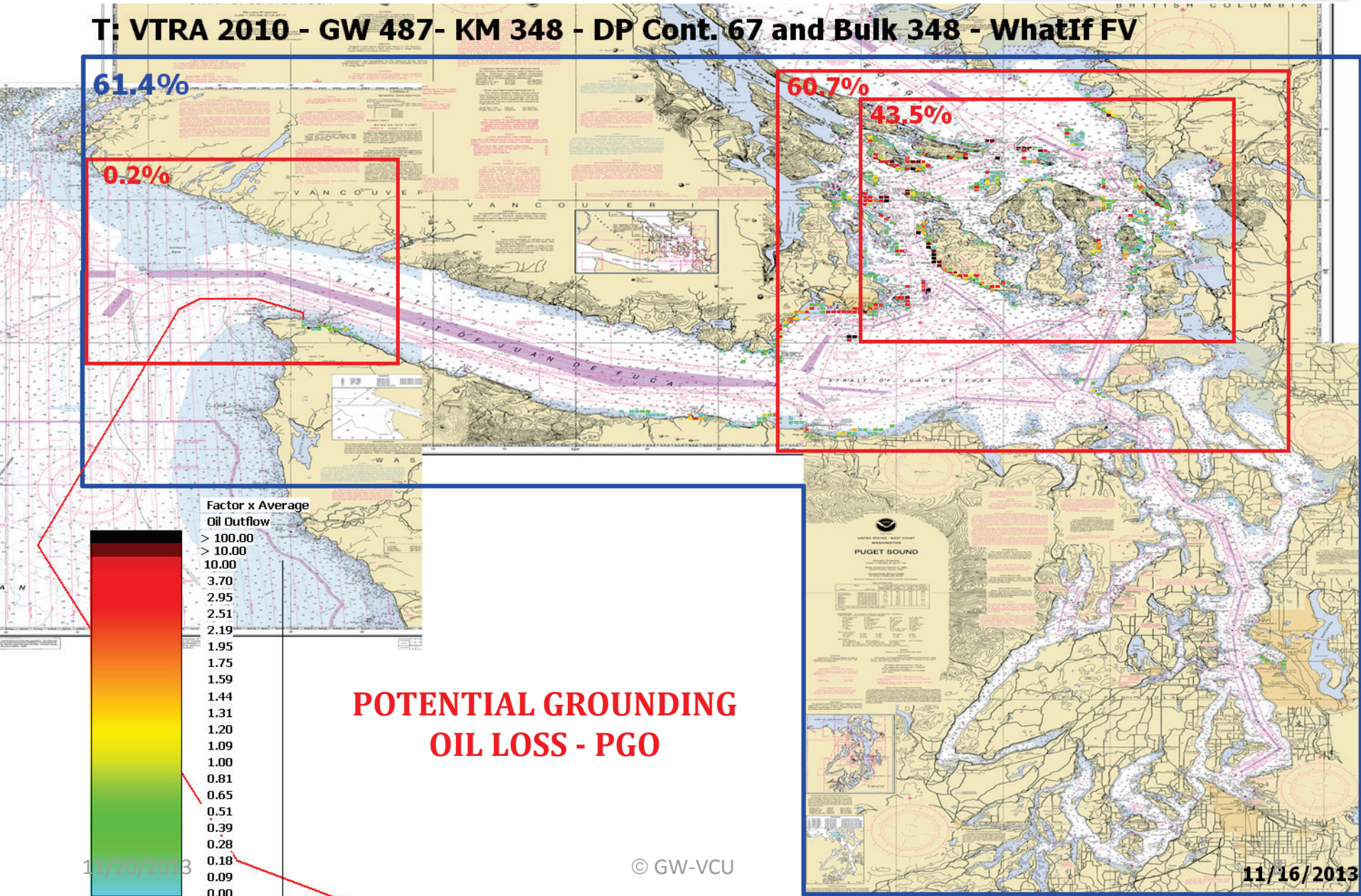
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & OW ATB 3D Risk Profile What-If FV - Pot. Grou. Oil Loss: 62% of Base Case PGO



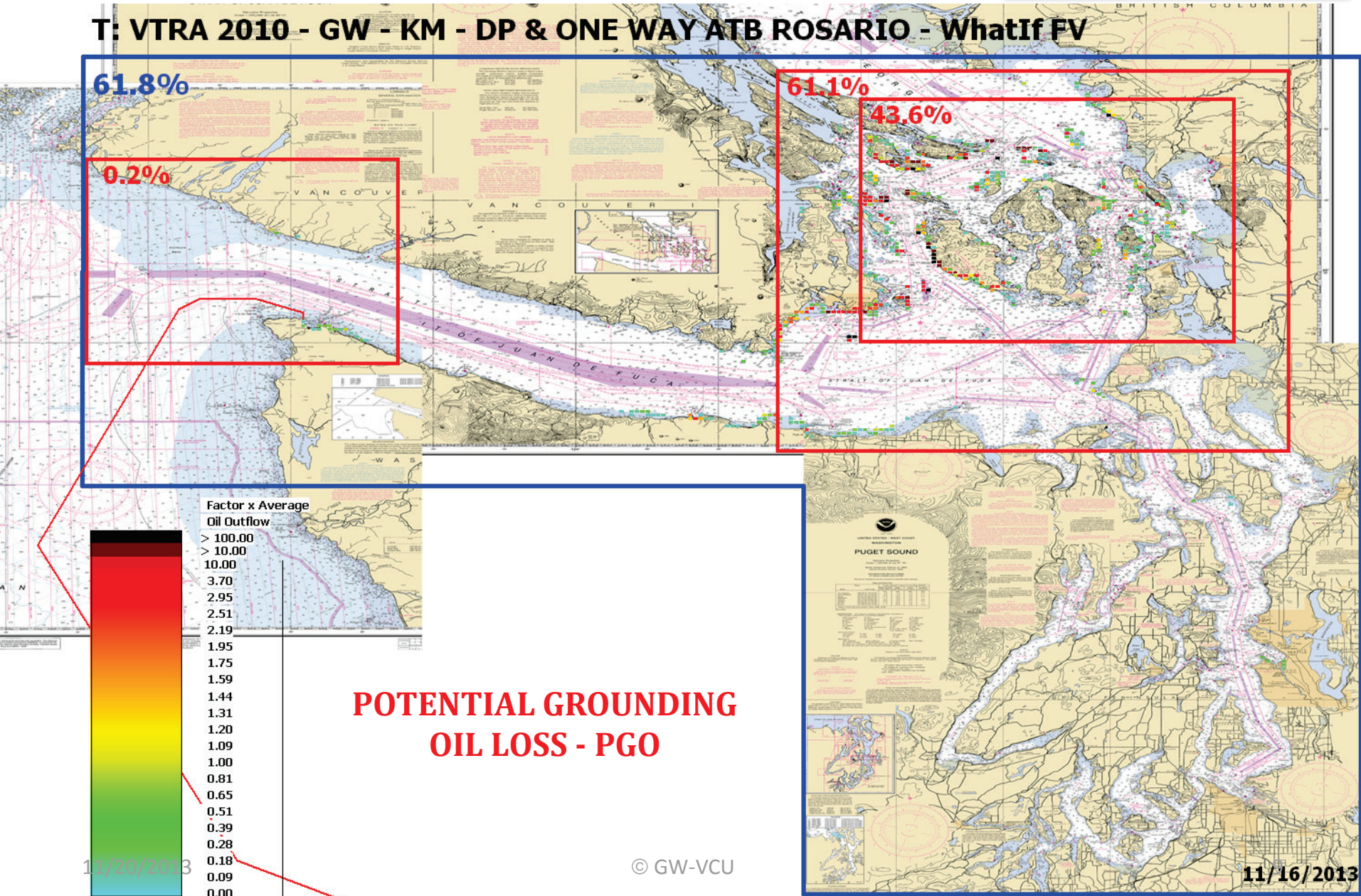
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

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



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & ONE WAY ATB ROSARIO - WhatIf FV



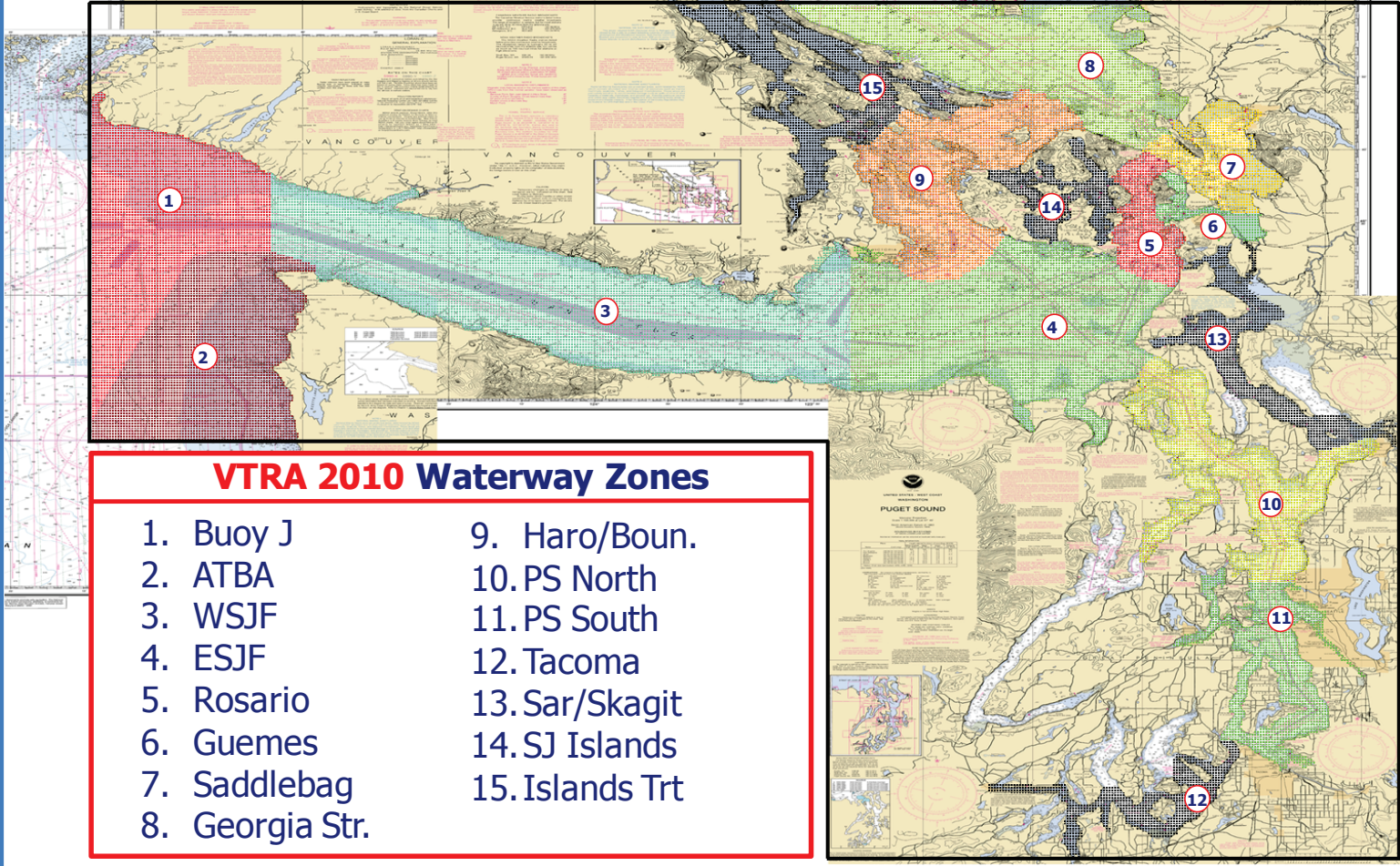
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

DEFINITION OF 15 WATERWAY ZONES



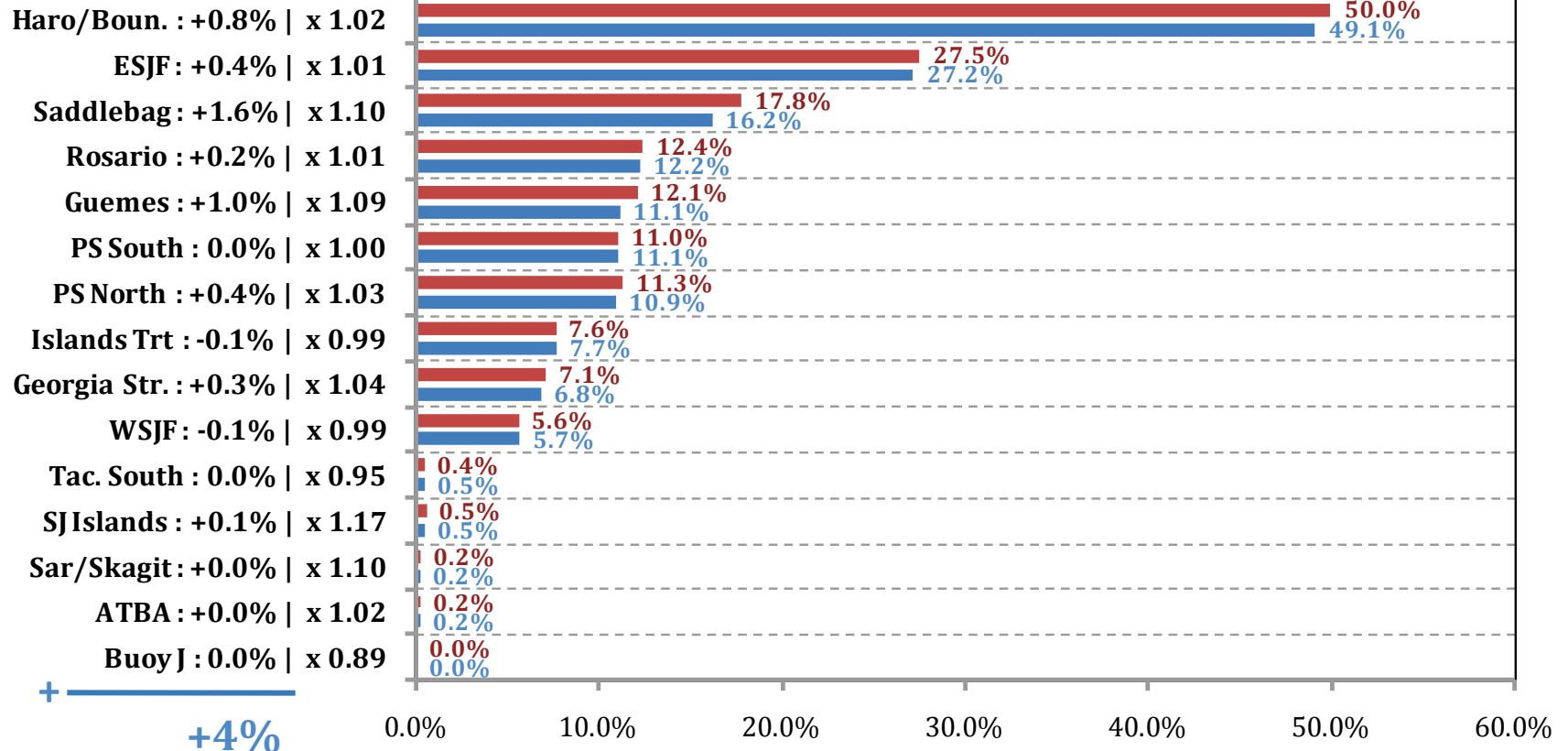
VTRA 2010 Waterway Zones

- | | |
|-----------------|-----------------|
| 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 Grounding Oil Loss - ALL_FV

Waterway Zone:



% Base Case Grounding Oil Loss (GOL) - ALL_FV

■ T:GW - KM - DP & OW ATB: 164% (+4% | x 1.03) ■ T:GW - KM - DP: 159%

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Grounding Oil Loss - WhatIf

Waterway Zone:

Haro/Boun. : +0.2% | x 1.01

ESJF : +0.2% | x 1.01

Saddlebag : 0.0% | x 0.99

Rosario : -0.2% | x 0.73

Guemes : +0.0% | x 1.01

PS South : +0.0% | x 1.00

PS North : 0.0% | x 1.00

Islands Trt : 0.0% | x 0.98

Georgia Str. : +0.1% | x 1.06

WSJF : +0.0% | x 1.02

Tac. South : +0.0% | x 1.52

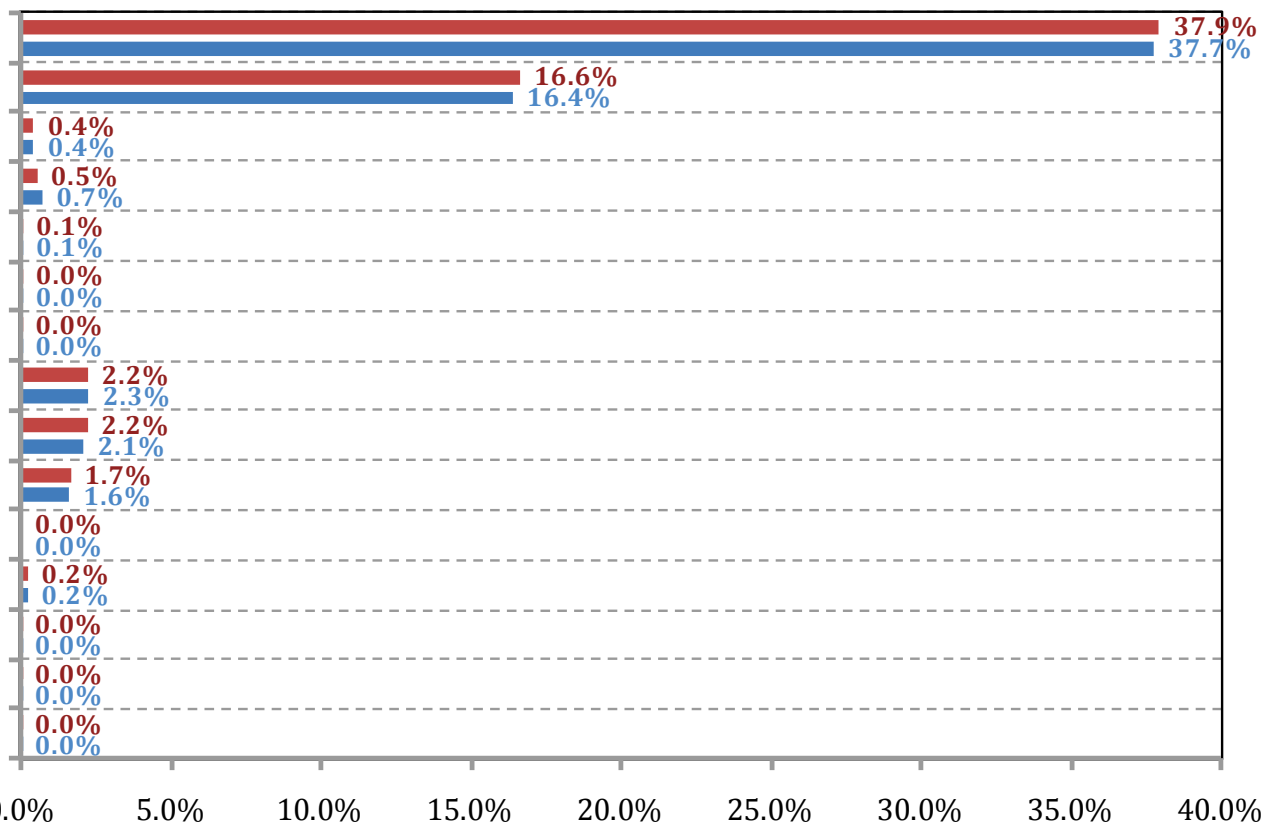
SJ Islands : 0.0% | x 1.00

Sar/Skagit : 0.0% | x 0.94

ATBA : +0.0% | x 1.01

Buoy J : 0.0% | x 1.00

+ **+0%**



% Base Case Grounding Oil Loss (GOL) - WhatIf

■ T:GW - KM - DP & OW ATB: 62% (+0% | x 1.01) ■ T:GW - KM - DP: 62%