



Risk Assessment and Mitigation Phase

(Chapter SCG-Risk-2-QWP) Excavation Damage (Dig-In) on the Gas System Workpapers

May 17, 2021

Overall Workpaper Description	This workpaper file explains the risk scoring and Risk Spend Efficiency (RSE) quantification. It contains necessary information and sources for calculating the risk score and RSE for respective mitigations and controls filed in the 2021 RAMP.
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"Master Inputs" Tab	This sheet contains the major MAVF inputs for risk scoring
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"RSE Summary" Tab	This sheet presents a summarized view of RSE scoring
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RSE Equation	$\text{Risk Reduction} = (\text{Pre} - \text{Mitigated LoRE} * \text{Pre} - \text{Mitigated CoRE}) - (\text{Post} - \text{Mitigated LoRE} * \text{Post} - \text{Mitigated CoRE})$
Discounted Time	$1 - \left(\frac{1}{\frac{(1 + \text{Benefit Discount Rate})^{\text{Benefits Lifetime}}}{\text{Benefit Discount Rate}}} \right)$
RSE per \$M	$\frac{\text{Risk Reduction} * \text{Discounted Time}}{\text{Total Cost} (\$M)}$

Master Inputs

Discount Factors

Benefit Discount Factor	3.00%
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MAVF Framework

	Range	Weight
Safety Index	20	60%
Reliability Index	1	23%
Financial Cost	500	15%
Stakeholder Satisfaction Index	100	2%

Safety Sub-Attribute

	Value
Fatalities	1
Serious Injuries	0.25

Reliability Sub-Attribute

	Range	Weight
Gas Meters	100,000	50%
Gas Curtailment	666	50%

2021 RAMP
SCG-RISK-2-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE	Pre-Mitigated LoRE
SCG-RISK-2-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	1.0	\$340	0%	0.70
SCG-RISK-2-A02	ALTERNATIVE - Virtual Reality Training	1.0	\$104	0%	0.70
SCG-RISK-2-M2	Automate Third Party Excavation Incident Reporting	5.0	\$33	0%	0.70
SCG-RISK-2-C14	Damage Prevention Analyst Program	1.0	\$294	1%	0.70
SCG-RISK-2-C34	Enhance Ticket Management Software	5.0	\$129	0%	0.70
SCG-RISK-2-C36	Leverage Data Gathered by Locating Equipment	5.0	\$93	0%	0.70
SCG-RISK-2-C04	Locate and Mark Activities	1.0	\$4,443	11%	0.70
SCG-RISK-2-C06	Locate and Mark Annual Refresher Training and Competency Program	1.0	\$14	0%	0.70
SCG-RISK-2-M4	Locate and Mark Photographs	50.0	\$97	0%	0.70
SCG-RISK-2-C10	Locate and Mark Quality Assurance	1.0	\$375	0%	0.70
SCG-RISK-2-C36	Locating Equipment	5.0	\$4,081	1%	0.70
SCG-RISK-2-C26	Pipeline Patrol and Pipeline Markers	1.0	\$486	1%	0.70
SCG-RISK-2-C21	Prevention & Improvements-Fiber Optics	20.0	\$7,975	0%	0.70
SCG-RISK-2-C16-T01	Public Awareness	1.0	\$192	0%	0.70
SCG-RISK-2-C16-T02	Public Awareness	1.0	\$3	0%	0.70
SCG-RISK-2-C16-T04	Public Awareness	1.0	\$56	0%	0.70
SCG-RISK-2-C16-T03	Public Awareness	1.0	\$5	0%	0.70
SCG-RISK-2-C32	Ticket Risk Assessment, and evaluating City permit data	1.0	\$47	0%	0.70
SCG-RISK-2-C30	Warning Mesh	50.0	\$189	0%	0.70

**2021 RAMP
SCG-RISK-2-QWP**

High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE Safety	CoRE Financial	CoRE Reliability	CoRE Stakeholder Satisfaction
SCG-RISK-2-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	467.73	32.50	2,274.13	340.00
SCG-RISK-2-A02	ALTERNATIVE - Virtual Reality Training	467.73	32.50	2,274.13	340.00
SCG-RISK-2-M2	Automate Third Party Excavation Incident Reporting	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C14	Damage Prevention Analyst Program	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C34	Enhance Ticket Management Software	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C36	Leverage Data Gathered by Locating Equipment	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C04	Locate and Mark Activities	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C06	Locate and Mark Annual Refresher Training and Competency Program	467.73	32.50	2,274.13	340.00
SCG-RISK-2-M4	Locate and Mark Photographs	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C10	Locate and Mark Quality Assurance	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C36	Locating Equipment	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C26	Pipeline Patrol and Pipeline Markers	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C21	Prevention & Improvements-Fiber Optics	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C16-T01	Public Awareness	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C16-T02	Public Awareness	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C16-T04	Public Awareness	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C16-T03	Public Awareness	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C32	Ticket Risk Assessment, and evaluating City permit data	467.73	32.50	2,274.13	340.00
SCG-RISK-2-C30	Warning Mesh	467.73	32.50	2,274.13	340.00

**2021 RAMP
SCG-RISK-2-QWP**

High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE	Post-Mitigated LoRE	Risk Reduction
SCG-RISK-2-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	3114.36	0.70	0.00
SCG-RISK-2-A02	ALTERNATIVE - Virtual Reality Training	3114.36	0.70	0.01
SCG-RISK-2-M2	Automate Third Party Excavation Incident Reporting	3114.36	0.70	0.50
SCG-RISK-2-C14	Damage Prevention Analyst Program	3114.36	0.70	11.03
SCG-RISK-2-C34	Enhance Ticket Management Software	3114.36	0.70	3.24
SCG-RISK-2-C36	Leverage Data Gathered by Locating Equipment	3114.36	0.70	0.04
SCG-RISK-2-C04	Locate and Mark Activities	3114.36	0.62	249.85
SCG-RISK-2-C06	Locate and Mark Annual Refresher Training and Competency Program	3114.36	0.70	1.70
SCG-RISK-2-M4	Locate and Mark Photographs	3114.36	0.70	0.08
SCG-RISK-2-C10	Locate and Mark Quality Assurance	3114.36	0.70	8.28
SCG-RISK-2-C36	Locating Equipment	3114.36	0.69	27.58
SCG-RISK-2-C26	Pipeline Patrol and Pipeline Markers	3114.36	0.69	19.54
SCG-RISK-2-C21	Prevention & Improvements-Fiber Optics	3114.36	0.70	5.15
SCG-RISK-2-C16-T01	Public Awareness	3114.36	0.70	6.62
SCG-RISK-2-C16-T02	Public Awareness	3114.36	0.70	0.07
SCG-RISK-2-C16-T04	Public Awareness	3114.36	0.70	4.46
SCG-RISK-2-C16-T03	Public Awareness	3114.36	0.70	0.50
SCG-RISK-2-C32	Ticket Risk Assessment, and evaluating City permit data	3114.36	0.70	0.50
SCG-RISK-2-C30	Warning Mesh	3114.36	0.70	3.56

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SCG-RISK-2-QWP

High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SCG-RISK-2-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.97	0.01	> Internal DIRT Database > SME Input
SCG-RISK-2-A02	ALTERNATIVE - Virtual Reality Training	0.97	0.12	> Internal DIRT Database > SME Input
SCG-RISK-2-M2	Automate Third Party Excavation Incident Reporting	4.58	69.59	> Internal DIRT Database > SME Input
SCG-RISK-2-C14	Damage Prevention Analyst Program	0.97	36.43	> Internal DIRT Database > SME Input
SCG-RISK-2-C34	Enhance Ticket Management Software	4.58	114.93	> Internal DIRT Database > SME Input
SCG-RISK-2-C36	Leverage Data Gathered by Locating Equipment	4.58	2.08	> Internal DIRT Database > SME Input
SCG-RISK-2-C04	Locate and Mark Activities	0.97	54.60	> Internal DIRT Database > SME Input
SCG-RISK-2-C06	Locate and Mark Annual Refresher Training and Competency Program	0.97	120.80	> Internal DIRT Database > SME Input
SCG-RISK-2-M4	Locate and Mark Photographs	25.73	20.12	> Internal DIRT Database > SME Input
SCG-RISK-2-C10	Locate and Mark Quality Assurance	0.97	21.45	> Internal DIRT Database > SME Input
SCG-RISK-2-C36	Locating Equipment	4.58	30.95	> Internal DIRT Database > SME Input
SCG-RISK-2-C26	Pipeline Patrol and Pipeline Markers	0.97	39.03	> Internal DIRT Database > SME Input
SCG-RISK-2-C21	Prevention & Improvements-Fiber Optics	14.88	9.61	> Internal DIRT Database > SME Input > Internal Fiber Optics Mileage Data
SCG-RISK-2-C16-T01	Public Awareness	0.97	33.46	> Internal DIRT Database > SME Input
SCG-RISK-2-C16-T02	Public Awareness	0.97	22.05	> Internal DIRT Database > SME Input
SCG-RISK-2-C16-T04	Public Awareness	0.97	77.39	> Internal DIRT Database > SME Input
SCG-RISK-2-C16-T03	Public Awareness	0.97	96.83	> Internal DIRT Database > SME Input
SCG-RISK-2-C32	Ticket Risk Assessment, and evaluating City permit data	0.97	10.36	> Internal DIRT Database > SME Input
SCG-RISK-2-C30	Warning Mesh	25.73	484.03	> Internal DIRT Database > SME Input > National PHMSA Data

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SCG-RISK-2-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE	Pre-Mitigated LoRE	CoRE Safety
SCG-RISK-2-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	1.0	\$340	0%	2914.10	0.25
SCG-RISK-2-A01	ALTERNATIVE - Virtual Reality Training	1.0	\$104	0%	2914.10	0.25
SCG-RISK-2-M1	Automate Third Party Excavation Incident Reporting	5.0	\$138	0%	2914.10	0.25
SCG-RISK-2-C11	Damage Prevention Analyst Program	1.0	\$1,454	5%	2914.10	0.25
SCG-RISK-2-C33	Enhance Ticket Management Software	5.0	\$537	1%	2914.10	0.25
SCG-RISK-2-C24	Excess Flow Valve or Curb Valve Installation	67.0	\$2,648	1%	2914.10	0.25
SCG-RISK-2-C35	Leverage Data Gathered by Locating Equipment	5.0	\$17,090	6%	2914.10	0.25
SCG-RISK-2-C03	Locate and Mark Activities*	1.0	\$19,487	1010%	2914.10	0.25
SCG-RISK-2-C05	Locate and Mark Annual Refresher Training and Competency Program	1.0	\$50	0%	2914.10	0.25
SCG-RISK-2-M3	Locate and Mark Photographs	50.0	\$436	0%	2914.10	0.25
SCG-RISK-2-C09	Locate and Mark Quality Assurance	1.0	\$1,944	0%	2914.10	0.25
SCG-RISK-2-C13	Locating Equipment	5.0	\$395	0%	2914.10	0.25
SCG-RISK-2-C25	Pipeline Patrol and Pipeline Markers	1.0	\$86	0%	2914.10	0.25
SCG-RISK-2-C15-T02	Public Awareness	1.0	\$13	0%	2914.10	0.25
SCG-RISK-2-C15-T04	Public Awareness	1.0	\$233	1%	2914.10	0.25
SCG-RISK-2-C15-T01	Public Awareness	1.0	\$803	1%	2914.10	0.25
SCG-RISK-2-C15-T03	Public Awareness*	1.0	\$21	0%	2914.10	0.25
SCG-RISK-2-C31	Ticket Risk Assessment, and evaluating City permit data	1.0	\$196	0%	2914.10	0.25
SCG-RISK-2-C29	Warning Mesh*	50.0	\$792	0%	2914.10	0.25

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SCG-RISK-2-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE Financial	CoRE Reliability	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE
SCG-RISK-2-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.06	0.14	0.08	0.52	2914.10
SCG-RISK-2-A01	ALTERNATIVE - Virtual Reality Training	0.06	0.14	0.08	0.52	2914.08
SCG-RISK-2-M1	Automate Third Party Excavation Incident Reporting	0.06	0.14	0.08	0.52	2910.75
SCG-RISK-2-C11	Damage Prevention Analyst Program	0.06	0.14	0.08	0.52	2776.70
SCG-RISK-2-C33	Enhance Ticket Management Software	0.06	0.14	0.08	0.52	2894.87
SCG-RISK-2-C24	Excess Flow Valve or Curb Valve Installation	0.06	0.14	0.08	0.52	2895.61
SCG-RISK-2-C35	Leverage Data Gathered by Locating Equipment	0.06	0.14	0.08	0.52	2746.54
SCG-RISK-2-C03	Locate and Mark Activities*	0.06	0.14	0.08	0.52	32351.46
SCG-RISK-2-C05	Locate and Mark Annual Refresher Training and Competency Program	0.06	0.14	0.08	0.52	2911.83
SCG-RISK-2-M3	Locate and Mark Photographs	0.06	0.14	0.08	0.52	2913.68
SCG-RISK-2-C09	Locate and Mark Quality Assurance	0.06	0.14	0.08	0.52	2903.03
SCG-RISK-2-C13	Locating Equipment	0.06	0.14	0.08	0.52	2913.52
SCG-RISK-2-C25	Pipeline Patrol and Pipeline Markers	0.06	0.14	0.08	0.52	2903.65
SCG-RISK-2-C15-T02	Public Awareness	0.06	0.14	0.08	0.52	2913.74
SCG-RISK-2-C15-T04	Public Awareness	0.06	0.14	0.08	0.52	2890.23
SCG-RISK-2-C15-T01	Public Awareness	0.06	0.14	0.08	0.52	2874.32
SCG-RISK-2-C15-T03	Public Awareness*	0.06	0.14	0.08	0.52	2911.43
SCG-RISK-2-C31	Ticket Risk Assessment, and evaluating City permit data	0.06	0.14	0.08	0.52	2913.90
SCG-RISK-2-C29	Warning Mesh*	0.06	0.14	0.08	0.52	2913.25

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SCG-RISK-2-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per \$Million	Data Sources
SCG-RISK-2-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.00	0.97	0.00	> Internal DIRT Database > SME Input
SCG-RISK-2-A01	ALTERNATIVE - Virtual Reality Training	0.01	0.97	0.09	> Internal DIRT Database > SME Input
SCG-RISK-2-M1	Automate Third Party Excavation Incident Reporting	1.75	4.58	58.13	> Internal DIRT Database > SME Input
SCG-RISK-2-C11	Damage Prevention Analyst Program	71.82	0.97	47.96	> Internal DIRT Database > SME Input
SCG-RISK-2-C33	Enhance Ticket Management Software	10.05	4.58	85.74	> Internal DIRT Database > SME Input
SCG-RISK-2-C24	Excess Flow Valve or Curb Valve Installation	9.67	28.73	104.89	> Internal DIRT Database > SME Input > National PHMSA Data
SCG-RISK-2-C35	Leverage Data Gathered by Locating Equipment	87.59	4.58	23.47	> Internal DIRT Database > SME Input
SCG-RISK-2-C03	Locate and Mark Activities*	15386.90	0.97	766.60	> Internal DIRT Database > SME Input
SCG-RISK-2-C05	Locate and Mark Annual Refresher Training and Competency Program	1.19	0.97	23.07	> Internal DIRT Database > SME Input
SCG-RISK-2-M3	Locate and Mark Photographs	0.22	25.73	13.03	> Internal DIRT Database > SME Input
SCG-RISK-2-C09	Locate and Mark Quality Assurance	5.79	0.97	2.89	> Internal DIRT Database > SME Input
SCG-RISK-2-C13	Locating Equipment	0.30	4.58	3.53	> Internal DIRT Database > SME Input
SCG-RISK-2-C25	Pipeline Patrol and Pipeline Markers	5.46	0.97	61.64	> Internal DIRT Database > SME Input
SCG-RISK-2-C15-T02	Public Awareness	0.19	0.97	14.22	> Internal DIRT Database > SME Input
SCG-RISK-2-C15-T04	Public Awareness	12.48	0.97	51.98	> Internal DIRT Database > SME Input
SCG-RISK-2-C15-T01	Public Awareness	20.79	0.97	25.14	> Internal DIRT Database > SME Input
SCG-RISK-2-C15-T03	Public Awareness*	1.42	0.97	65.48	> Internal DIRT Database > SME Input
SCG-RISK-2-C31	Ticket Risk Assessment, and evaluating City permit data	0.11	0.97	0.52	> Internal DIRT Database > SME Input
SCG-RISK-2-C29	Warning Mesh*	0.59	25.73	19.20	> Internal DIRT Database > SME Input > National PHMSA Data

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.