

Assessing Risk Using Condition & Consequence

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Risk = Condition + Consequence

Individual assets are evaluated on multiple aspects of condition and consequence of failure to create comprehensive numerical assessment of risk.

Condition

► Where PACP rating is available, condition is evaluated using PACP.

► When PACP is not available, condition is assumed using a combination of material and install year.

dentify from:	<top-most layer=""></top-most>	-
SEWER_P	IPE	
CROS	S COUNTRY	
Location:	1,031,386.867 132,380.917 Feet	3
Field	Value	
FID	823	
Shane	Polyline	
OBJECTID	827	
EacilityID	16009-16008	
Diameter	18	
Diameter 1	18	
Material	DCD	
StreetName	CROSS COUNTRY	
UpstroomTo	110.65	
Dewestroom	110.05	
Downstream	110.42	
Jope	0.00155	
Disclonath	1972	
PlanLength	150	
Dischlass	ACT	
Malasita, d	contract 3 a.b.	E
Velocity_d	1.1/	
Cee OMeri	0.13	
Сар_QMax	5.05	
PrivateOwn	N	
Comments		
SHAPE_Leng	150.000126	
Enabled	1	
rkinstall	1972	
Snape_Le_1	150.000126	
	1031325.029	
	132343.40675	
	1031458.5855	
ToNodeY	132413.61225	
UpstreamMH	\$12-7	
DwnstrmMH	512-6	
RISK_SW	3	
Risk_FUNCT	2	
Risk_STRM	0	
Risk_SIZE	1	
Risk_SPEC	0	





Method: Defect Deduction		Index Name:				Abbr	eviation:	
Categories Ratings								
Rating Categories				Items	to be l	Rate	ł	
+	Category Name	Category Label	Weight	+			Name	Weight
1 🧪 🝵 🕇 🤳 O&M Con	dition Index	O&M Defects	20	1	1 1	4	Structure Hi defect rating	1
2 🦯 🝵 🕇 🧍 Structural	Condition Index	Structural Defects	80	2	/ 💼 1	r 4	Structure 2nd defect rating	1
		Method:		11			F Index Name:	
		Defect Deduction					PACP rating	
		Like New Value: 10 Failed Value: 60 Not Rated Value: -1 Number of decimal places t Failed and Like New Values than 0.1	(Best Condition r (Poorest Condition r (Used for Field t o display 0 s can be any values with a	ating possible) ating possible) Maps Out) difference great	1 1 2 1 3 1	Rating Value 0 1 2 3	Text to Display in Picklist Control 00 11 12 13	
		Rate Defects by Seve Rate Defects by Seve Rate Defects by Seve	rity Only		5 1	4	14	
			ny and 70 Extent		6 1	5	15	
		Category Ratings	atings from the sum of De	fect Deductions		7	16	
		Calculate Category R Calculate Category R	atings from the largest De atings from the weighted a	fect Deduction	9 1	8	18	
		Defect Deductions weightings are applie	d only when the weighted	average	10 1	9	19	
		method is selected	a only monthe weighted	arorago	11 2	:0	1>9	
		Condition Index-			12 2	:1	21	
		Calculate Condition In Deductions	dex from the sum of Cate	gory	13 2	2	22	
		Calculate Condition In	dex from the largest Cate	gory Deduction	14 2	3	23	
		 Calculate Condition In Category Ratings 	dex from the weighted av	erage of	15 2	4	24	
		weightings are applied method is selected	d only when the weighted	average	16 2	5	25	

Consequence

► Multiple aspects of consequence of failure are evaluated using weighted values.

uentity		4 X
dentify from:	<top-most layer=""></top-most>	-
⊡ · SEWER_PI	ipe S COUNTRY	
		(
Location:	1,031,386.867 132,380.917 Feet	2
Field	Value	
FID	823	
Shape	Polyline	
OBJECTID	827	
FacilityID	16009:16008	
Diameter	18	
Diameter 1	18	
Material	RCP	
StreetName	CROSS COUNTRY	
UpstreamIn	110.65	
Downstream	110.42	
Slope	0.00153	
InstallYea	1972	
PlanLength	150	
LifeCycleS	ACT	
PlanName	contract 3 a.b.	
Velocity d	1.17	E
Design_MGD	0.13	
Cap QMax	5.05	
PrivateOwn	N	
Comments		
SHAPE Leng	150.000126	
Enabled	1	
YRinstall	1972	
Shape Le 1	150.000126	
FromNodeX	1031326.029	
FromNodeY	132343.40675	
ToNodeX	1031458.5855	
ToNodeY	132413.61225	
UpstreamMH	S12-7	
DwnstrmMH	S12-6	
Risk_SW	3	
Risk FUNCT	2	
Risk STRM	0	
Risk SIZE	1	
_		
Risk SPEC	0	

1029761.867 133675.188 Feet

Consequence Factors	Point Criteria	Point Value	Factor Weight	Impact Description
Proximity to surface	>50'	0	1	containment ability
water	<50'	3		containine ni abinty
Pipe Function	Service	0	1	
	Gravity Line - Branch	1		Quantity/Cost
	Gravity Line - Main	2		Quantity/Cost
	Force Main	3		
Proximity to stormwater	>10'	0	1	containment ability
piping	<10'	3		containment ability
Proximity to	>400'	0	1	proximity to sensitive
Hospital/School	<400'	3		populations
Zoning Area	Manufacturing	0	1	affect on income
	Residential	1		earners/Health Protection
	Commercial	2		
	Park/Recreation	2		
	Drinking Water Protection Area	3		
Pipe Size	≤8"	0	1	Cost/Population Affected
	8" to ≤24"	1		
	24 to ≤30"	2		
	>30"	3		
Depth	≤5'	0	1	Cost
	5' to ≤10'	2		
	>10'	3		
Roadway	Off Road	0	1	traffic control requirements
	On Road - Detour	2		
	On Road - No Detour	3		
Crossing	None	0	1	installation cost
	Rail	1		
	Bridge/Interstate	2		
	River	3		

🗄 • | 君 • | 🖬 🕅 🕅 🖉 🛷 🗙 -SEWER_PIPE

Т	PrivateOwn	Comments	SHAPE Leng	Enabled	YRinstall	Shape Le 1	FromNodeX	FromNodeY	ToNodeX	ToNodeY	UpstreamMH	DwnstrmMH	Risk SW	Risk FUNCT Risk	STRM Risk S	ZE Risk SPE	C Risk ROAD	Risk CROSS Risk DEPTH	DS RIM PipeDepth	
F	Y	PRV	207.027035	1	0	207.027035	1030829.38	123037.27	1030856.5077	122832.028	PRV	PRV	0	1	0	0	0 2		0 0	Л г
T	Y		295.241228	1	0	295.241228	1036210.69	147952.25	1036339.17	147686.43	3 S38-32-1	S38-32-1	0	1	0	0	0 2	0 0	0 0	1 -
٦	Y		169.566424	1	0	169.566424	1036339.17	147686.43	1036297.9987	147521.9377	7 S38-32-1	S38-32-1	0	1	0	0	0 2	0 0	0 0	1
	Y		228.235726	1	0	228.235726	1036137.72	147359.45	1036297.9987	147521.9377	7 S38-32-1	S38-32-1	0	1	0	0	0 2	0 0	0 0	1
	Y		196.637041	1	0	196.637041	1036057.95	147179.72	1036137.72	147359.45	5 S38-32-1	S38-32-1	0	1	0	0	0 2	0 0	0 0	1
	Y		354.034399	1	0	354.034399	1036445.86	147207.44	1036297.9987	147521.9377	7 S38-32-1	S38-32-1	0	1	0	0	0 2	0 0	0 0	1
	Y		510.0073	1	0	510.0073	1033862.86	147791.89	1033911.8802	147284.244	S38-38	S38-38	0	1	0	0	0 0	0 0	0 0	/
	Y		616.768636	1	0	616.768636	1033209.704	147954.1827	1033826.3517	147966.3935	5 S38-39	S38-38	0	1	0	0	o c	0 0	0 0	/
	Y		178.281586	1	0	178.281586	1033826.3517	147966.3935	1033862.86	147791.89	S38-38	S38-38	0	1	0	0	0 0	0 0	0 0	/
	Y		150.628006	1	0	150.628006	1034010.67	147820.89	1033862.86	147791.89	9 S38-37	S38-38	0	1	0	0	0 2	: 0 0	0 0	
	Y		155.418712	1	0	155.418712	1034214.046	148155.6617	1034104.1485	148045.764	\$ S38-37	S38-37	0	1	0	0	0 2	: 0 0	0 0	1
	Y		143.995916	1	0	143.995916	1034104.1485	148045.764	1034027.8307	147923.6557	7 S38-37	S38-37	0	1	0	0	0 2	. 0 0	0 0	1
	Y		104.188726	1	0	104.188726	1034027.8307	147923.6557	1034010.67	147820.89	9 S38-37	S38-37	0	1	0	0	0 2	: O O	0 0	
	Y		259.498457	1	0	259.498457	1035038.2782	147755.7565	1034778.7977	147752.7037	7 S38-34	S38-35	0	1	0	0	0 2	: 0 0	0 0	
	Y		539.383922	1	0	539.383922	1034778.7977	147752.7037	1034732.6537	147215.2972	2 S38-35	S38-35	0	1	0	0	0 0	0 0	0 0	
	Y		99.61236	1	0	99.61236	1034679.3407	147758.265	1034778.7977	147752.7037	7 S38-35	S38-35	0	1	0	0	0 2	2 O O	0 0	
	Y		201.449528	1	0	201.449528	1034572.08	148122.39	1034668.18	147945.34	\$ S38-36	S38-36	0	1	0	0	0 2	2 0 0	0 0	
	Y		187.407625	1	0	187.407625	1034668.18	147945.34	1034679.3407	147758.265	5 S38-36	S38-35	0	1	0	0	0 2	: 0 0	0 0	1
	Y		322.381958	1	0	322.381958	1035104.309	148071.3037	1035038.2782	147755.7565	5 S38-34	S38-34	0	1	0	0	0 2	: 0 0	0 0	1
	Y		226.498844	1	0	226.498844	1034997.6502	147532.9312	1035038.2782	147755.7565	5 S38-34	S38-34	0	1	0	0	0 2	· 0 0	0 0	1
	Y		160.446611	1	0	160.446611	1040089.91	146527.36	1040240.415	146471.76	3 S64	S64	0	1	0	0	0 0	0 0	0 0	1
Τ	Y		102.264322	1	0	102.264322	1040422.93	146575.64	1040505.4747	146515.2715	5 S65	S65	3	1	0	0	0 0	0 0	0 0	1
Т	Y		116.630975	1	0	116.630975	1040311.252	146609.2675	1040422.93	146575.64	\$ S65	S65	0	1	0	0	0 0	0 0	0 0	1
Π	Y		154.68094	1	0	154.68094	1040240.415	146471.76	1040311.252	146609.2675	5 S64	S65	0	1	0	0	0 0	0 0	0 0	1
Π	Y		685.351351	1	0	685.351351	1031223.38	141249.36	1031248.1392	141803.2087	S22-50	S22-50	0	1	3	0	0 2	0 0	0 0	1
П	Y		153.222153	1	0	153.222153	1031385.7952	141425.6725	1031232.8375	141416.675	5 S22-50	S22-50	0	1	0	0	0 2	0 0	0 0	1
Π	Y		701.49961	1	0	701.49961	1031551.9505	140955.7985	1031836.7282	140388.3032	2 S22-50	S22-29	0	1	0	0	0 0	0 0	0 0	1
Т	Y		182.043308	1	0	182.043308	1031702.1	141058.73	1031551.9505	140955.7985	5 S22-50	S22-50	0	1	0	0	0 2	0 0	0 0	1
Π	Y		696.579941	1	0	696.579941	1031836.7282	140388.3032	1031316.737	139924.8027	522-29	S22-30	0	1	0	0	0 0	0 0	0 0	1
Π	Y		154.201797	1	0	154.201797	1031826.988	140730.604	1031978.6577	140702.7745	5 S22-30	S22-30	0	1	0	0	0 2	0 0	0 0	1
	Y		345.016159	1	0	345.016159	1031978.6577	140702.7745	1031836.7282	140388.3032	2 S22-30	S22-29	0	1	0	0	0 2	0 0	0 0	1
Π	Y		254.027057	1	0	254.027057	1032273.79	140935.87	1032130.52	140726.1	S22-50	S22-29	0	1	0	0	0 2	0 0	0 0	1
П	Y		166.82575	1	0	166.82575	1032258.48	140541.53	1032277.13	140707.31	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	1
٦	Y		154.75957	1	0	154.75957	1032524.1122	140602.589	1032514.372	140757.0417	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	1
	Y		178.646861	1	0	178.646861	1032515.7635	140846.0955	1032693.05	140868.1	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	1
1	Y		194.894099	1	0	194.894099	1032870.84	140947.94	1032693.05	140868.1	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
	Y		217.554092	1	0	217.554092	1032895.6337	140684.6855	1032706.3942	140775.1307	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
	Y		93.922045	1	0	93.922045	1032693.05	140868.1	1032706.3942	140775.1307	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
	Y		192.872384	1	0	192.872384	1032706.3942	140775.1307	1032514.372	140757.0417	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
1	Y		249.347694	1	0	249.347694	1032514.372	140757.0417	1032277.13	140707.31	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
1	Y		152.744312	1	0	152.744312	1032277.13	140707.31	1032130.52	140726.1	S22-29	S22-29	0	1	0	0	0 2	0 0	0 0	
	Y		96.326521	1	0	96.326521	1032130.52	140726.1	1032052.6372	140782.784	\$ S22-29	S22-30	0	1	0	0	0 2	0 0	0 0	
	Y		108.970118	1	0	108.970118	1032052.6372	140782.784	1031978.6577	140702.7745	5 S22-30	S22-30	0	1	0	0	0 2	0 0	0 0	/
1	Y		399.144691	1	0	399.144691	1036352	139256.04	1036626.5757	139545.7375	5 S31	S32	0	1	0	0	0 2	0 0	0 0	
1	Y		250	1	0	250	1036798.5532	139727.1865	1036626.5757	139545.7375	5 533	S32	0	1	0	0	0 2	0 0	0 0	
Ī	Y		78.364236	1	0	78.364236	1036626.5757	139545.7375	1036681.0757	139489.4285	5 S32	S32	0	1	0	0	0 0	0 0	0 0	
	Y		388.531115	1	0	388.531115	1035750.5225	139927.3027	1035894.3842	139684.9302	2 S30-4	S30-3	0	1	0	0	3 0	0 0	0 0	
	Y		627.183403	1	0	627.183403	1035894.3842	139684.9302	1036352	139256.04	\$30-3	S31	0	1	0	0	3 0	0 0	0 0	
J	Y		159.64406	1	0	159.64406	1036134.6347	139986.1965	1036113.6605	139827.9362	2 S34-1-5	S34-1-5	0	1	0	0	0 2	0 0	0 0	1
1	Y		91.485135	1	0	91.485135	1036113.6605	139827.9362	1036023.28	139842.11	S34-1-5	S34-1-5	0	1	0	0	0 2	0 0	0 0	
•																111				- F

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	(
Risk Settings Administrator					-	×
Risk Settings For: Sewer		•	(Asset Class))		
Failure Modes Consequences Terms						
Settings For: Sanitary Pipe (Asset	et Type)					 ,
Consequences Rating Source Ratings	_	_	_			
+ Consequence Name	Weight	Use for Criticality	% Life Left			
1 🧪 🝵 Proximity to Surface Water	1					
2 💉 🝵 Pipe Function	1	✓				
3 💉 🝵 Proximity to Stormwater Piping	1		*			
4 🧪 🗃 Proximity to Hospital/School	1	V				
5 🧪 💼 Zoning Area	1					
6 🧪 📅 Pipe Size	1	✓				
7 🧪 📅 Pipe Depth	1					
8 🧪 🖮 Roadway	1					
9 🧪 📅 Crossing	1					
Export To Excel						
L						
	Copy Consec	quences S	ave Clos	se		
			_			



(Risk Settings Administrator	-	×
	Risk Settings For: Sewer (Asset Class) GIS Facility		
	Failure Modes Consequences Terms		
	Settings For: Sanitary Pipe (Asset Type)		
	Consequences Rating Source Ratings	-	
	Criticality Calculation		
	Use highest value		
	Use weighted average		
	Ratings		
	Number of Rating Values: 4 Apply		
	Rating Rating Name		
	1 🖍 0 0		
	2 🖋 1 1		
	3 2 2		
	4 💉 3 3		
	🕱 Export To Excel		
	Copy Consequences Save Close		
(

ter is OFF - Current list contains														-
	s 1705 out o	of 1719 Asse	ts	_										
Form View Table View	Filter R	Reports	Calculation	IS										
sset Class: Sewer	•	I I I I I I I I I I I I I I I I I I I	 Facility 											
Summary Filter Statement	Filter	_			_	_		_	_	_				
All	•	All As	ssets	_	leply		When a v	alue is 🔘 .	Add to Select	tion Set				
Overall Factors	0.00 -	1.00 -	2.00 -	3.00 -	4.00 -	5.00 -	6.00 -	7.00 -	8.00 -	9.00 -	10.00	Not	Total	Total
Risk Factor	0.99	1.99	2.99	3.99	4.99	5.33	6.99	7.99	6.99	9.99		1705	Rated	1705
Criticality Factor	64	199	10	31								1401	304	1705
Consequence Factor		<u>59</u>	160	34								1452	253	1705
Failure Probabilities	0.0% -	10.0% -	20.0% -	30.0% - 39.9%	40.0% - 49.9%	50.0% - 59.9%	60.0% - 69.9%	70.0% - 79.9%	80.0% - 89.9%	90.0% -	100%	Not Rated	Total Rated	Total Assets
Overall Failure Probability	3.376	15.576	23.3 %	33.376	43.376	33.3 10	03.3 %	13.376	03.376	33.370		<u>1705</u>	Malou	1705
% Life Left												<u>1705</u>		1705
Consequence Scores	0.0 - 0.99	1.0 - 1.99	2.0 - 2.99	3.0 - 3.99	4.0 - 4.99	5.0 - 5.99	6.0 - 6.99	7.0 - 7.99	8.0 - 8.99	9.0 - 9.99	10.00	Not Rated	Total Rated	Total Assets
Crossing			1									<u>1701</u>	1	1702
Pipe Depth												<u>1702</u>		1702
Pipe Function		<u>87</u>	<u>161</u>	<u>23</u>								<u>1431</u>	<u>271</u>	1702
Pipe Size	<u>8</u>											<u>1694</u>	<u>8</u>	1702
Proximity to Hospital/School				1								<u>1701</u>	1	1702
Proximity to Stormwater Piping												<u>1702</u>		1702
Proximity to Surface Water	<u>239</u>			<u>37</u>								<u>1426</u>	<u>276</u>	1702
Roadway												<u>1702</u>		1702
Zoning Area	<u>3</u>	1	<u>5</u>									<u>1693</u>	<u>9</u>	1702
Zoning Area	<u>3</u>	1	<u>5</u>	_								<u>1693</u>	<u>9</u>	170

Lessons Learned

- Evaluations are only as good as your data.
- QA/QC is key.
- Risk assessment takes time.

The better the starting data, the easier the process.

Existing Forms	Condition Settings			
Imported - BUR-Gravel 2013	Method: Defect			
Itemized Manholes	Index Name: PACP rating			
PACP SIMPLE	Category Name	Category	Label	Weight
	O&M Condition Index	O&M Defects	2	0
	Structural Condition Index	Structural Defects	8	0
	Associations for PACP SIMPL Asset Class	E	GIS / Facilities	
	Wastewater Department GIS	Sewer Pipes		