Rocky Mountain Power
Reliability Management
September 27, 2016




PacifiCorp

Let's turn the answers on.

Reliability Reporting - Today

- To provide transparency to the reliability process RMP annually selects five circuits based on Circuit Performance Index (CPI) score
  - CPI based on weighted values of sustained outages, momentary outages, and breaker operations
  - Develop and implement a proposed work plan to improve composite CPI score by 20% within five years
- Track and report annually on Worst Performing Circuits annually
- Part of the SQR

Reliability Today

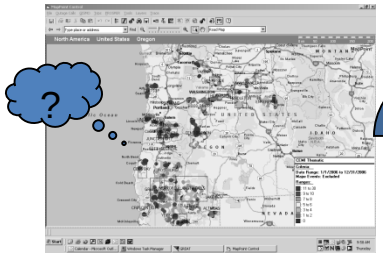
- Parallel to the Worst Performing Circuit process RMP monitors reliability using near real time tools to identify and correct emerging reliability issues

- RMP proposes the existing WPC process be eliminated and implement an Open Reliability and Reporting (ORR) process
  - A summary of all reliability work is reported on a semi-annual basis
  - All reliability work is subject to audit

Reliability Management - ORR

1. Monthly Area Improvement Team (AIT) meetings are held to assess current reliability issues.
   - Participants include Operations management, Engineering, Substation Operations, and Capital Delivery
2. Close to real time
   - Close to real-time: Interruptions beyond threshold based on specific devices and numbers of customers served → FIRE Report
3. Periodic review of area reliability performance → GREAT Tool & other data
4. Implement plans that are developed and monitor their delivery
5. Review results & modify plan as needed

Reliability Management

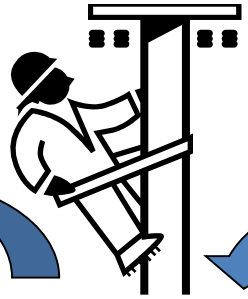


1 Using FIRE and other tools AIT look at emerging reliability trends

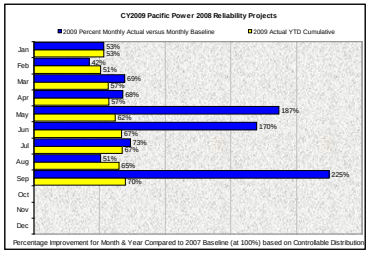
2A Scope and develop Reliability Work Plans (RWP)

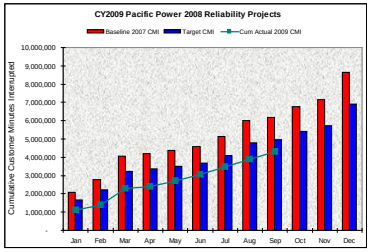
2B Develop first -cut costs and forecast potential improvements

3 Identify budget and resources to establish plan



4 Construct projects





5 Monitor andReport

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Reliability Management - FIRE

FIRE notification lets operations and engineering know when an interrupting device has experienced operations beyond expectable levels

FIRE

Frequent **I**nterrupters **R**equiring **E**valuation

Back to History

Report Date: 9/5/2016

Previous Report Next Report

Summary:

Select a device to see exceeded thresholds and outage details.

There is a CAIDI investigation in this report

	Op Area	Substation	Circuit	Device	FP	Thresholds Exceeded	Comments	Comments on other report dates	Reviews By AE	Reviews By NP	Reviews By OM
Select	BUFFALO	BUFFALO	4H425	OH_346000_492910201		1	2	0	2	0	0
Select	BUFFALO	BUFFALO	4H425	OH_346002_492910203		1	1	0	2	0	0
Select	CASPER	BAR NUNN	2G1	OH_178505_821990438		1	0	6	1	0	0
Select	REXBURG	SOUTH FORK	SFK13	SFK_CB13		2	2	2	2	0	2
Select	RIVERTON	LANDER	5H738	OH_079101_847940374		1	0	2	1	0	0
Select	ROCK SPRINGS	WESTVACO	9H300	WVA_CB9H300		2	1	7	2	1	0
Select	SLC METRO	OLYMPUS	OLY13	OH_367504__3486889		1	2	0	2	0	0
Select	TREMONTON	ROCKY POINT	RKP17	OH_088900_1711178518		1	0	1	2	0	2

1

Reliability Management -FIRE

Investigation into device performance can be performed by any FIRE user

This report has been reviewed by:

Area Engineer: Yes Area Engineering Manager: Yes Area Engineering Director: No
Operations Manager: No Operations Director: No Operations Support Services: No
Transmission Planning: No Reliability: Yes Executive: No

Outages:

View Complete History for this Device | View 12 Month Outage History for Circuit

Outage #	Out Date Time	Cause Category	Direct Cause	Contributory Cause	Description	Customers Interrupted	Momentary Customers Interrupted	Customer Minutes Interrupted	Duration(mins)	Restoration Stages	Phase	Component	Safety Hold Flag	Begin Dev ID	End Dev ID
CWCC361522	9/4/2016 11:21:30 AM	OTHER	UNKNOWN		9H300 tripped open, patroling. no cause found, closed & held. lightning suspected	48		10,119	211	1	ABC	NO DISTRIBUTION DAMAGE	N		
CWCC349978	2/21/2016 4:30:36 PM	PLANNED	INTENTIONAL TO CLEAR TROUBLE		opened to tie damaged CB 9H174 feeder to 9H300		36	106	3	1	ABC	PLANNED OUTAGE	N		
CWCC348971	2/6/2016 5:11:45 AM	OTHER	UNKNOWN		closed CB at sub on test held 1st responder will patrol line to 1st set of protection	39		621	16	1	ABC	NO DISTRIBUTION DAMAGE	N		
CWCC342351	10/9/2015 10:24:33 AM	OTHER	UNKNOWN		Circuit breaker locked open at substation	44		5,570	127	1	ABC	NO DISTRIBUTION DAMAGE	N		

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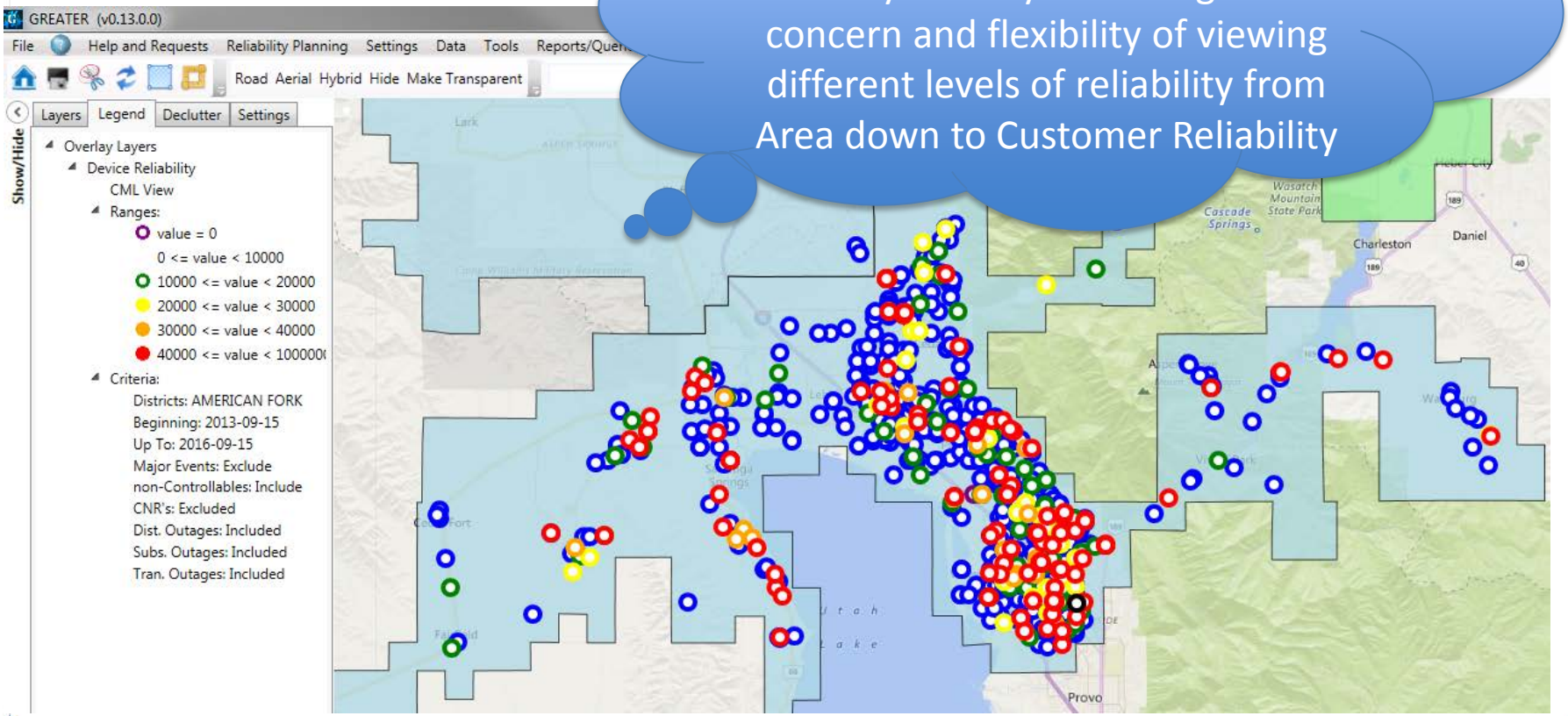
Reliability Management - GREATER

Greater Thematics allow users to visually identify areas of greater concern and flexibility of viewing different levels of reliability from Area down to Customer Reliability



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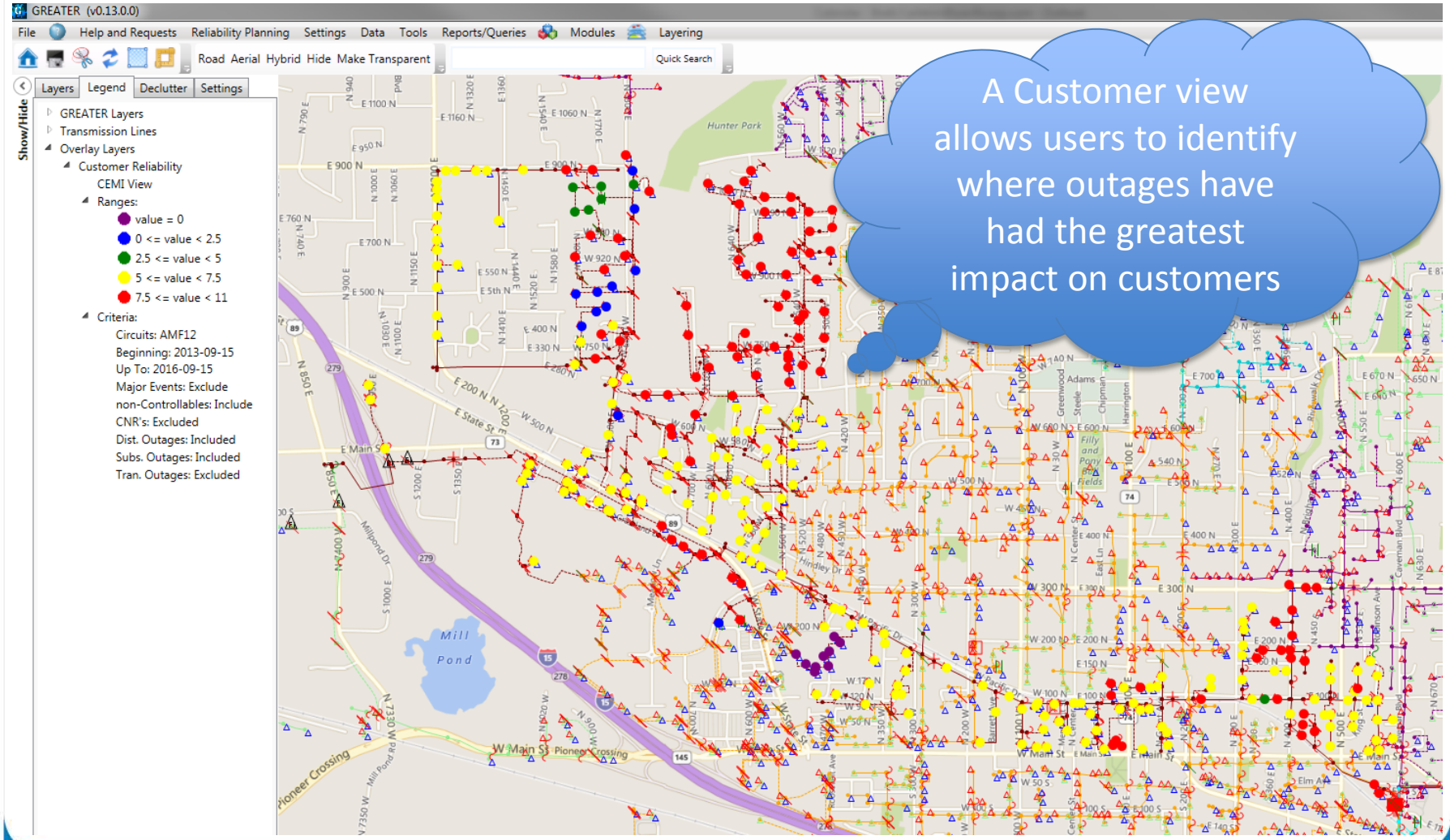
Reliability Management - GREATER



2A Reliability Management – Typical RWP

ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

Create Name

Reliability Work Plan

AIT_16_07_20_Jordan Valley_Sandy_SDY16

Operations Manager: Kim Felice	District: Jordan Valley		
Prepared By: Patricio Hernandez	Substation: Sandy		
Date Created: 7/20/2016	Feeder Number/Name: SDY16		
Program: AIT	Investment Reason: UR	Capital Cost: $130,000	O&M Cost: $5,500
State: Utah	Vegetation Management: No	Construction Year: 2017	Construction Year: 2017

Benefit of Plan Data

Years of Data Represented	2
Circuit Total Number of Incidents	157
Circuit Total Customer Minutes Lost	2,241,451
Circuit Total Customer Interrupted	8,998

Operations Manager:	**Kim Felice**	**Approved Date**	**08/18/16**
Field Engineering Manager:	**Brian Oakeson**	**Approved Date**	**08/18/16**
Field Engineering Director:	**Ken Shortt**	**Approved Date**	**08/22/16**

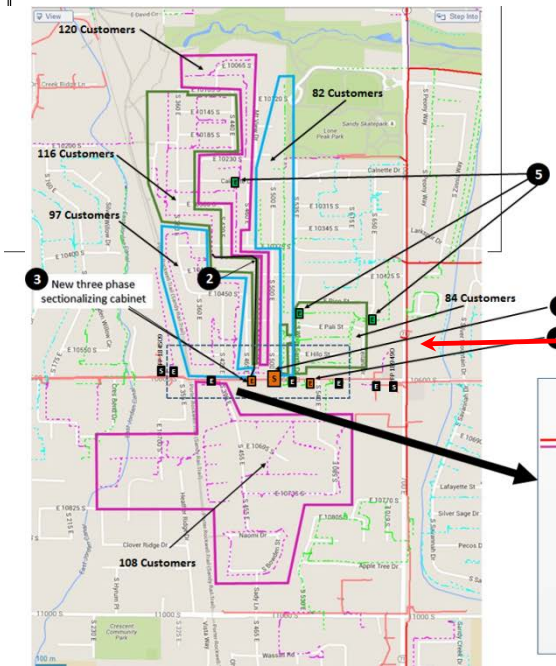
Recommendations:

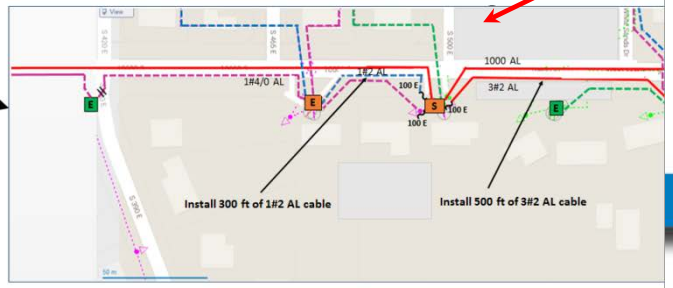
Capital

1. Intercept existing 1000 AL cable and install one PME-9
2. Remove 1-phase sectionalizing cabinets and install two 3-phase sectionalizing cabinets, FP# 18
3. Replace 3 bituminous vaults with 1-phase sectionalizing cabinets, FP# 187613, 189608, 186906
4. Install 500 ft of 3#2 AL from new PME-9 (FP# 187480 to 187484)
5. Install 300 ft of 1#2 AL from new PME-9 (FP#187480 to 186481)

O&M

2. Repair 1-ph #2 AL cable from FP# 187480 to FP# 186705





POWER
A DIVISION OF PACIFICORP

Project Title: AIT_16_07_20_Jordan Valley_Sandy_SDY16

Auto Isolation Point	Number of Downstream Customers	# of Incidents	Total CML	Total CI	Annual Benefit of Plan: % of Total CML	% of Total CI	% Work Plan Fix?	CML Benefit of Plan	CI Benefit of Plan	Annual Improved CML	Annual Improved CI	Annual Improved RMP SAIDI	Annual Improved RMP SAIFI	Recommended Improvements
JG184509_1518611699	261	11	373475	2872	16.66%	31.92%	75%	12.50%	23.94%	140,053	1,077	0.1280	0.0010	Adding new source to the area
					0.00%	0.00%		0.00%	0.00%	0	0			
Total Improvement Benefit					16.66%	31.92%		12.50%	23.94%	140,053	1,077	0.1280	0.0010	

Years of Data Represented	2
Circuit Total No of Incidents	157
Circuit Total Customer Minutes Lost	2241451
Circuit Total Customers Interrupted	8998
Annual Improved CML Total	140,053

Capital Cost	$ 130,000	O&M Cost	$ 5,500	Cost/CML or CI Saved	$ 0.93	$ 121
Total Capital and O&M Cost	$130,000					

Manually populated
Auto-populated

Written Documentation

Benefit of Plan Analysis

One or more drawings and/or pictures

Reliability Data – not shown

2B Reliability Management – Cost & Improvement

ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

Create Name

Reliability Work Plan

AIT_16_07_20_Jordan Valley_Sandy_SDY16

Operations Manager: Kim Felice		District: Jordan Valley			
Prepared By: Patricio Hernandez		Substation: Sandy			
Date Created: 7/20/2016		Feeder Number/Name: SDY16			
Program: AIT	Investment Reason: UR	Capital Cost: $130,000	O&M Cost: $5,500		
State: Utah	Vegetation Management: No	Construction Year: 2017	Construction Year: 2017		

Benefit of Plan Data

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Recommendations:

Capital

1. Intercept existing 1000 AL cable and install one PME-9
2. Remove 1-phase sectionalizing cabinets and install two 3-phase sectionalizing cabinets, FP# 187484, 186481.
3. Replace 3 bituminous vaults with 1-phase sectionalizing cabinets, FP# 187613, 189608, 186906. (At existing vaults that serve as open points to loops)
4. Install 500 ft of 3#2 AL from new PME-9 (FP# 187480 to 187484)
5. Install 300 ft of 1#2 AL from new PME-9 (FP#187480 to 186481)

O&M

2. Repair 1-ph #2 AL cable from FP# 187480 to FP# 186705

Summary:

This area has experienced 11 outages in the past 2 years due to a variety of causes: bad transformer, bad elbow, dig-in, bad cables. This will create an additional source into the area to serve customers, reducing the CML due to fewer customers affected.

2B Reliability Management – Cost and Improvement

POWER

A DIVISION OF PACIFICORP

Project Title:	AIT_16_07_20_Jordan Valley_Sandy_SDY16

					Annual Benefit of Plan									
Auto Isolation Point	**Number of Downstream Customers**	**# of Incidents**	**Total CML**	**Total CI**	**% of Total CML**	**% of Total CI**	**% Work Plan Fix?**	**CML Benefit of Plan**	**CI Benefit of Plan**	**Annual Improved CML**	**Annual Improved CI**	**Annual Improved RMP SAIDI**	**Annual Improved RMP SAIFI**	**Recommended Improvements**
JG184509_1518611699	261	11	373475	2872	16.66%	31.92%	75%	12.50%	23.94%	140,053	1,077	0.1280	0.0010	Adding new source to the area
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
					0.00%	0.00%		0.00%	0.00%	0	0			
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Capital Cost	$ 130,000	O&M Cost	$ 5,500	Cost/CML or CI Saved	$ 0.93	$ 121
Total Capital and O&M Cost	$130,000					

(orange)	Manually populated
(green)	Auto-populated

Reliability Management – Budgeting

- Submit RWP for approval
  - Review committee consisting of:
    - Director, Area Planning and Field Engineering
    - Director of Operations
    - Director, Investment Delivery (Capital)
    - Manager, Wires Work Planning (O&M)
  - Four possible outcomes
    - Accepted and funded
    - Sent back for clarification
    - Held for future funding
    - Rejected

Reliability Management - Construction

- Project is detail estimated and constructed using standard processes
  - Tracking database updated with actual estimated cost
  - Tracking database updated with actual construction cost
  - Tracking begins when both capital and O&M work is completed

5

Reliability Management – Monitor and Report

Plan Title	Circuit Tag	District	State	Approved Date	Plan Capital Cost	Actual Capital Cost	O&M Cost	Actual O&M Cost	Capital Work Complete	O&M Work Complete	Date Threshold	Years of Data	CML affected by plan	Projected Benefit of Plan	Meeting Plan (<1yr)	Meeting Plan (1 yr)	Meeting Plan (>1 yr)
WP_15_05_06_American Fork_Lindon_LDN12	LDN12	American	UT	5/8/2015	$18,300.00	$11,138.52			7/22/2015		7/22/2015	1	8,717	100%	Yes	Yes	Yes
IT_15_05_06_Metro_Meadowbrook_MEA13	MEA13	Metro	UT	5/8/2015	$20,000.00	$15,824.82			7/1/2015		7/1/2015	3	36,653	60%	Yes	Yes	Yes
IT_15_02_27_American Fork_Saratoga_SAR15	SAR15	American	UT	4/3/2015	$159,796.00	$188,909.02			7/11/2015		7/11/2015	1	48,360	100%	Yes	Yes	Yes
IT_15_03_19_Rock Springs_Astle_5H328_Uinta	5H328_UI	Rock Spri	WY	4/3/2015	$10,800.00	$23,542.86			5/23/2015		5/23/2015	5	23,357	35%	Yes	Yes	Yes
IT_15_01_21_American Fork_WRG11_UR	WRG11	American	UT	1/23/2015	$24,000.00	$19,670.44			4/17/2015		4/17/2015	1	98,925	60%	No	No	No
IT_15_01_13_American Fork_ORE 11_RA	ORE11	American	UT	1/16/2015	$16,100.00	$11,337.08			7/3/2015		7/3/2015	1	1,585	65%	Yes	Yes	Yes
IT_15_01_09_Moab_RAT21_UR	RAT21	Moab	UT	1/16/2015	$39,500.00	$54,426.09			7/10/2015		7/10/2015	3	210,380	25%	Yes	Yes	Yes
IT_14_12_19_American Fork_CHW 11_RA	CHW11	American	UT	1/9/2015	$39,000.00	$36,874.68			4/10/2015								
VR_14_11_19_Riverton_NahneJensen 9H264_UR	9H264	Riverton	WY	1/9/2015			$28,500.00	$35,572.00									
IT_14_12_17_Layton_CLN15_UR	CLN15	Layton	UT	1/16/2015	$85,000.00	$117,017.81			7/3/2015								
IRE_14_11_18_Jordan Valley_DMP12_RA	DMP12	Jordan Va	UT	12/17/2014	$46,000.00	$49,886.18			5/23/2015								
IT_14_12_04_Smithfield_NIB#11_UR	NIB11	Smithfiel	UT	12/12/2014	$9,400.00	$20,641.59	$600.00	$0.00	3/12/2015								
IRE_14_11_25_Jordan Valley_Taylorsville 15_RB	TAY15	Jordan Va	UT	12/5/2014	$17,200.00	$54,451.60			2/28/2015								
IT_14_11_26_Layton_GAV11_RA	GAV11	Layton	UT	12/5/2014	$26,600.00	$72,787.48			6/4/2015								
IT_14_11_24_Price_HPM 11_RA	HPM11	Price	UT	12/12/2014	$53,000.00	$66,960.99			2/20/2015								
IT_14_10_01_SLMetro_TRM19_UR	TRM19	Metro	UT	11/21/2014	$36,000.00	$45,542.08	$37,000.00	$27,361.00	4/30/2015								
IT_14_10_30_JORDAN VALLEY_WELBY 14_RA	WEL14	Jordan Va	UT	10/31/2014	$14,000.00	$63,866.07			2/28/2015								
IT_14_10_15_Lava_Cove_12_UR	COV12	Lava	ID	10/31/2014	$4,500.00	$4,347.47	$30,000.00	$9,335.00	1/21/2015								
IRE_14_10_24_American Fork_Highland 13_RA	HIG13	American	UT	10/31/2014	$22,000.00	$19,243.32			3/27/2015								
IT_14_10_07_Ogden_SWR 13_RA	SWR13	Ogden	UT	10/21/2014	$50,000.00	$41,941.18			2/26/2015								
IRE_14_10_03_Jordan Valley_West Jordan 13_RA	WJD13	Jordan Va	UT	10/10/2014	$58,000.00	$54,613.70			2/28/2015								
IT_14_09_02_Richfield_GUN 11_RA	GUN11	Richfield	UT	10/3/2014	$9,886.00	$13,189.44			2/3/2015								
IRE_14_09_24_Tooele_Pine Canyon 16_RA	PCN16	Tooele	UT	9/26/2014	$26,600.00	$39,041.53			3/7/2015								

Approved $/Avoided CML	1st Year Total Circuit CML	Cumulative Total Circuit CML	Feeder Hardening?	Total Auto Isol CML (1 yr)	Total Auto Isol CML (>1yr)	Days since project completi	Actual $/Avoided CML	Annual CML @ Auto Isol Pt(-1)	Annual Improved CML	Max expected CML (prorated < 1yr)	Max expected CML	Max expected CML (>1
$2.10	5,141	5,141		0	0	371	**$1.28**	8,717	8,717	0	0	
$2.73	135,795	136,203		0	0	392	**$1.30**	12,218	7,331	4,887	4,887	5,24
$3.30	3,079	3,079		0	0	382	**$3.91**	48,360	48,360	0	0	
$6.61	0	0		5,333	5,333	431	**-$35.58**	4,671	1,635	3,036	3,036	3,58
$0.40	1,064,638	1,078,802		13,065	13,065	467	**$0.23**	98,925	59,355	39,570	39,570	50,62
$15.63	4,043	4,043		0	0	390	**$7.15**	1,585	1,030	555	555	59
$2.25	69,034	69,034		0	0	383	**$0.78**	70,127	17,532	52,595	52,595	55,18
$0.97	538,210	599,157		0	34,452	474	**$0.41**	89,341	40,203	49,138	49,138	63,81
$1.04	35,812	35,812		0	0	418	**$0.91**	39,130	27,374	11,756	11,756	13,46
$0.79	258,628	258,878		0	0	390	**$0.66**	178,358	107,015	71,343	71,343	76,23
$1.89	587,449	631,316		0	0	431	**$0.82**	60,932	24,373	36,559	36,559	43,17
$1.02	1,039,145	1,040,248		12,429	12,429	503	**$3.21**	18,858	9,806	9,052	9,052	12,47
$0.27	183,672	186,370		104,816	104,816	515	**$1.42**	143,216	64,447	78,769	78,769	111,13
$2.65	255,573	264,478		0	0	419	**$5.79**	12,568	10,054	2,514	2,514	2,88
$9.94	54,009	78,724		0	0	523	**$12.55**	5,335	5,335	0	0	
$2.33	4,748	4,754		0	0	454	**$1.63**	44,720	31,304	13,416	13,416	16,68
$1.80	4,631	13,131		0	0	515	**$6.16**	10,362	7,772	2,591	2,591	3,65
$1.86	185,334	190,466		0	0	462	**$0.37**	37,117	18,558	18,558	18,558	23,49
$2.03	111,871	192,831		0	0	488	**$1.33**	14,453	10,840	3,613	3,613	4,83
$1.05	492,290	1,546,562		0	0	517	**$0.75**	56,280	47,838	8,442	8,442	11,95
$1.13	126,069	137,010		0	0	515	**$0.69**	79,049	51,382	27,667	27,667	39,03
$28.35	38,381	52,037		0	0	540	**$37.83**	349	349	0	0	
$0.90	15,118	75,739		0	0	508	**$0.72**	54,563	29,464	25,099	25,099	34,93

Reliability Management – Monitor and Report

- Analyze failures
  - Is the project still good?
  - Are benefits being realized?
    - Was benefit over-estimated?
    - Uncontrollable or controllable addressed by the RWP

Meeting Plan (<1yr)	Meeting Plan (1 yr)	Meeting Plan (>1 yr)
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
No	No	No
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
No	No	Yes
No	No	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes
Yes	Yes	Yes

Reliability Management - Summary

- The company is diligent in delivering projects designed to improve system reliability.
- As better and more tactical approaches are devised the company evoles its processes to deliver better results at better costs.
- The company uses state of the art tools to support its improvement decisions.
- The company continually monitors performance to rapidly respond as conditions and facilities change.

Reliability Management - Summary

- The company proposes to eliminate the Worst Performing Circuit process and implement an Open Reliability and Reporting process

Reliability Management