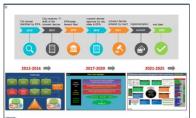


Digital Reporting for Capacity Remedial Measures Planning: A Case Study of Houston's Digital Transformation Journey



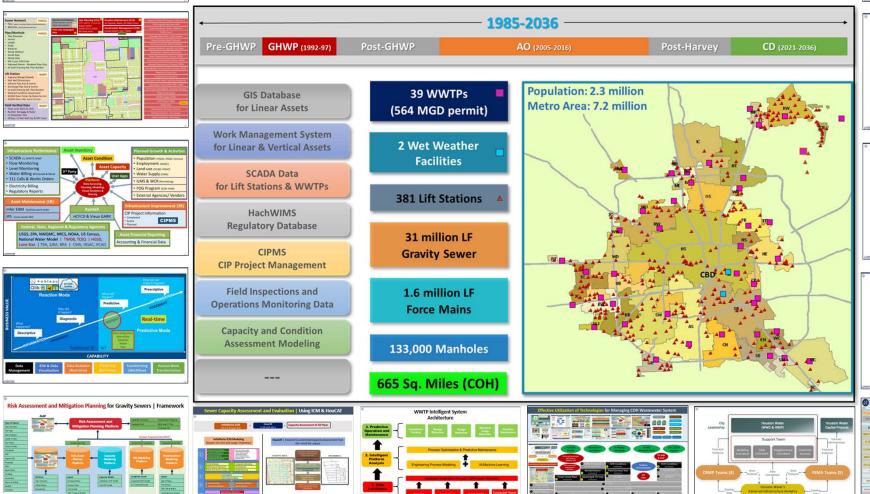
Fazle Rabbi, P.E., Managing Engineer, City of Houston Alexis (Gathings) Winder, EIT, ENV SP Graduate Engineer, STV



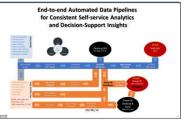


Houston's Wastewater System and Its Digital Transformation Journey













Sample Reports | HachWIMS Regulatory Data



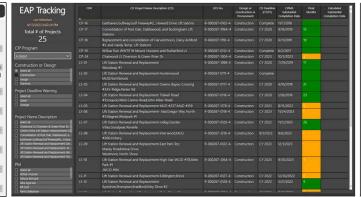
Sample Customized Reports | CIP Project Management System



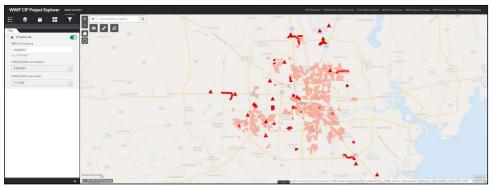
Service Line		CIP_Program		P_NUMBER		STATUS		P_NAME							36	Last Refres
R	×	All	· V	All		Active	×	All							Project Count	41101202
P NUMBER	150	NAME							PROLMSR	PSTAILS	NTP_DATE	NO_DAYS	C_END_DATE	Subs_CDate	ORIG CAMOUNT	DRAWG_N
R-000019-EWSR-		ergency Wastewate							Jack Carrfield	Active		5999			1	
R-000035-0012-4				and Replacement -:			r1, and West	Park #1	Christopher Goodwin	Active	7/7/2000		2/14/2022	11/28/2022	12,690,060	
R-000035-0013-4				wert - Eldridge Park					Sekhar Ambadapudi- COH	Active	11/24/2020		11/21/2022	11/21/2022	10,489,070	66286
F-000035-011E-4				ment for Plum Creel	Tanya Circle, a	nd Old Stone Try	el (Feckage 2	1	Rajesh Danayak	ACDVE	12/15/2020		11/20/2021	04/24/2022	1,002,769	
R-000265-0112-4		occlate Sayou WW							Michael Alfred	Active	11/27/2017		5/25/2020	11/01/2023	6,006,710	
R-000265-0124-4				d Plant (WWTP) Jety					Gauher Khan	Active.	5/17/2021		5/6/2023	08/31/2023	6,467,147	
R-000265-0125-4 R-000265-0152-4				t Plant (WWTP) (mg	Oversents				Washua Lin	Active	1/25/2021		6/24/2023	02/24/2023	10,996,660	65446
R-000265-0152-4 R-000265-1448-4		istewater Process U		g and Evaluation plate Bayou WWTF I					Talo Fang Birthuan Zhu	Active	7/15/2021		7/14/2024		5,411,350	
R-000265-1448-4		egans sayou-North Fahab Package 1: 8		oate sayou www.rr	St. 2046u N/2 C	rating Reproces	vent		Alienza Debzadi	Active	7/19/2021		12/1/2023	12/36/2022	8,735,000	
R-000267-0127-4				ment - Aureshine, Sci	makes Souther				iohn Okafor	Active	7/6/2000		3/29/2022	03/21/2022	4252963	
R-000267-0129-4				ment - MacGregor #					John Clarfor	Active	1/20/2020		7/19/2022	11/10/2022	9,700,821	
E-000267-0130-4				ment - Enetshire No.					Jing He	Active	4/11/2022		10/11/2023	10/13/2022	11,212,350	
	Mi	edow Lift Stations,														10396
R-000267-0161-4		Station Renewal as frmond #1 and Bon		ment - Northbolous IR Stations	5 Crive #1, Nort	hborough Drive	#2, Old Katy	Foat,	Sayed Jafar	Active	3/15/2022	570	10/6/2023	01/09/2024	9,453,532	
R-000267-1218-4	i Ab	andonment and Flo	w Diversio	n of interwood, Mill	D. #266, and Vio	kery citt Station	5		Raghad Alhaji	Active	10/11/2019	556	7/19/2021	09/06/2023	14,912,792	
R-000267-126A-4	£ 1/2	Station Removal &	Replacem	ent High Star WOD	#70, Selle Park	#1, WOO #94			Alireza Behzadi	Active	12/6/2021	540	5/90/2023	09/30/2023	0.999,366	69442
E-000267-130A-4	4 Gr	een River Drive and	Chatmood	Lift Station Diversio					Jing He	Active	4/11/2022	540	10/3/2023	10/03/2023	22,599,925	71117
	A.Se	meda Siens WWTP is	TECOVERDE	ris.					Xiaohua Lin	ACTIVE	2/14/2022	700	1/15/2024	01/14/2023	19,154,720	55740
Total			STATE OF THE PARTY OF	200					0.000	and the same	New York Control	10000	NAME OF TAXABLE PARTY.	AND DESCRIPTION	332,199,888	MALES



Projects in Design Projects in Construction			Construction Projects At-a-Glance				Substantial Completion Dates			
NUNSER	P_NAME		Status	NTP_DATE	Subs Completion (Schedule)	Subs Completion (Actual)	PROVINCE		Last Re	efresh
			Closed		- Contracting	Veriff.		4.87	4/13/	2023
T13840-0001-4	Sanitary Sever Rehabilitation / Substitute Servi			2/28/2012			Gary Hill	-11		
-002015-0018-4	New Froint Easement Reconnections, WWS159	Closed	7/19/2016	10/13/2017		Mary Eac	- 1	(CD) WBS No		
002015-0017-4	Wastewater Substitute Service Project - Work C	Closed	5/28/2015	5/26/2017		Mary fac				
002014-0002-4	4795-1 PWSD #23 & RED GULLY INFILTRATION	Archived-Offsite	8/6/2001			Mike Walker		All		
002013-0046-4	Sanitary Sewer Rehabilitation by Cured-in-Place		Closed	12/5/2016			Mary Bac		All	
002013-0047-4	Sanitary Sever Rehabilitation by Cured-in-Plac		Closed	11/3/2016			Mary flac			
-002013-0046-4	Sanitary Sawer Rehabilitation by Cured-in-Plac	Closed	1/28/2016	7/20/2017		Mary Eac		Contract Ends		
002013-0045-4	Liner Removal in 72-inch Sanitary Sever (WWS	Arthred	7/6/2015	12/24/2015		Mary Bac		The second second		
002013-0044-4	Large Diameter Sanitary Sewer Inspection Usin	g Robotic Technology (WWI 4277-67)	Active	7/30/2015	7/28/2017		Matt bahena		12/9/1997	12/31/2025
-002012-0043-4	Sanitary Sever Rehabilitation by Cured-in-Plac	Closed	6/1/2015	11/23/2016		Mary Eac			-	
-002013-0042-4	Sanitary Sewer Rehabilitation by Cured-in-Plac	Closed	1/14/2015	11/3/2016		Mary Sec		_	-	
002012-0036-4	(WW4250-58) PV2014 Sanitary Sewer Rahabilit.	Closed	7/24/2014	1/14/2016		Mary Eac				
002011-0015-4	(WW4250-50) FV2014 Sanitary Sewer Rehability	Closed	7/17/2014	1/7/2016		Mary Bac		Service Line		
002013-0032-4	Large Diameter Sanitary Sewer Inspection Usin	Closed	7/23/2013	7/2/2015		Robert Deese		loo.		
002013-0031-4	FY2013 - Sanitary Sewer Rehabilitation by Cure	Arthred	4/23/2013	3/11/2014		Mary Bac		R	~	
002013-0030-4	FY2013 - Sanitary Sewer Rehabilitation by Cure		Archived	2/13/2013	2/28/2014		Mary Bac			
002013-0029-4	Sanitary Sewer Rehabilitation by Cured-in-Plac		Archived	3/21/2012	8/3/2013		Mary Eac		CIP Program	
002013-0026-4	Sanitary Sever Rehabilitation by Cured in Place	Actived	12/13/2011	6/6/2013		Mary Bac		Cir_Program		
002013-0027-4	Sanitary Sever Rehabilitation by Cured in Plac	Closed	8/17/2011	7/31/2012		Mary fac		All	V	
002013-0026-4	Santary Sever Rehabilitation by Cured in Plac	Closed	3/19/2011			Mary fac		All		
002013-0025-4	Sanitary Sever Rehabilitation by Cured-in-Plac		Closed	2/31/2010	3/16/2011		Mary Eac			
002011-067A-4	Naighborhood Sewer System Improvements - I	Complete	9/23/2019	8/7/2020	8/18/2020	Sam Kanu		P.STATUS		
002011-0067-4	Neighborhood Sewer System Improvements -	Complete	12/11/2017	2/4/2019	2/4/2019	Sam Kanu				
	Docharge							All	~	
002011-0076-4	Work Order 60 12-inch Senitary Sewer along 8	astrop	Closed	2/21/2011	5/2/2011	3/10/2011	James Wilson			
002011-0067-4	heighborhood Sewer System Improvements to	Archived	5/19/2014	4/22/2015	5/15/2015	John Mwandia		P NUMBER		
002011-0065-4	Neighborhood Sewer Systems Improvements 5	orhood Sewer Systems Improvements-Surget Blvd., University Blvd. and Westherner St.		11/20/2015	6/29/2016	8/29/2016	Willie Raymondo		L'acoustion	
-002011-0064-4	Neighborhood Sewer Systems Improvements L Street Area	righbothcod Sewer Systems Improvements Lenore Avenue, Texas & Havriburg Bhit, Sherman wat Area		5/19/2014	2/10/2015	2/10/2015	Cory Jerome		All	Y
-002011-0062-4	lever Line Replacement - Sims Bayou Utility Conflict Relocation From Almeda Road to the vicinity of Lineda Sims WWTP		Archived	1/23/2009	4/27/2010	3/17/2010	Jody Craze		PROJ_MGR	
-002011-0061-4	Evaluation of Almeda Sims Treatment Plant Ser Ambrose Avenue Gravity Sewes	Archived-Offsite	10/20/2008	11/13/2009	12/29/2009	Jody Craze		All	V	
002011-0060-4		Sever Line Replacement - Sims Sayou Utility Conflict Relocation between Almeece/White Heather.			8/13/2009	9/10/2009	Wojcech Mrugala		10000	
002011-0057-4	Dora Street Sanitary Sever Raplacement		Archived	6/29/2009	5/25/2010	6/4/2010	Jody Craze		P_NAME	
002011-0055-4	Neighborhood Sewer Systems Improvements -	Archived	3/35/2014	9/29/2015	9/26/2015	Salen Ausib		The state of the s		
002011-0054-4	Neighborhood Seiver System Improvements: P Substantions and Radio Rd.	Closed	8/19/2013	8/12/2014	8/12/2014	Cory Jerome	*	All	×	

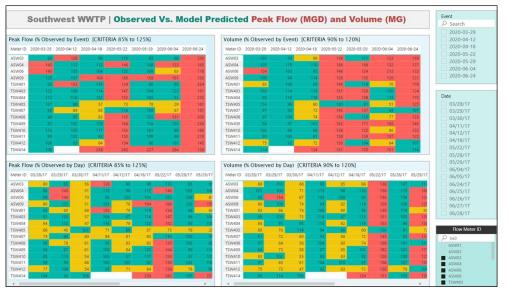


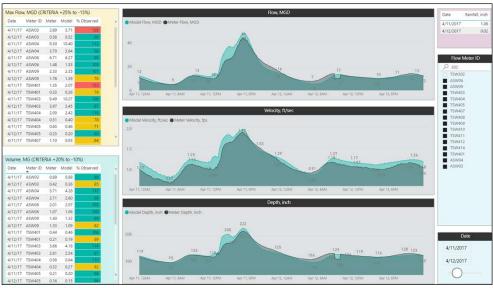




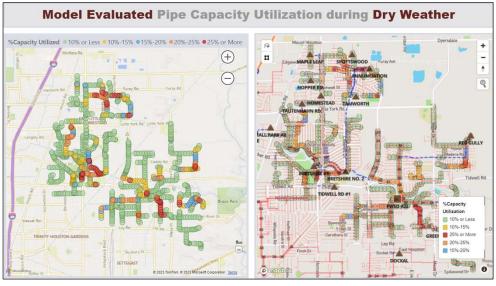


Sample Reports | ICM Hydraulic Modeling







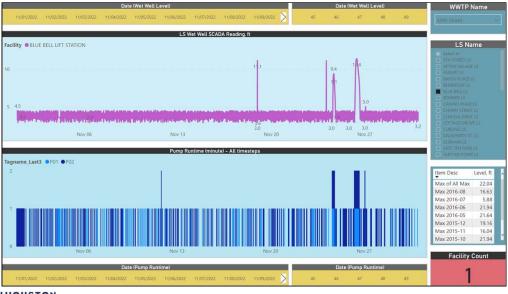




Sample Reports | SCADA Data Visualization



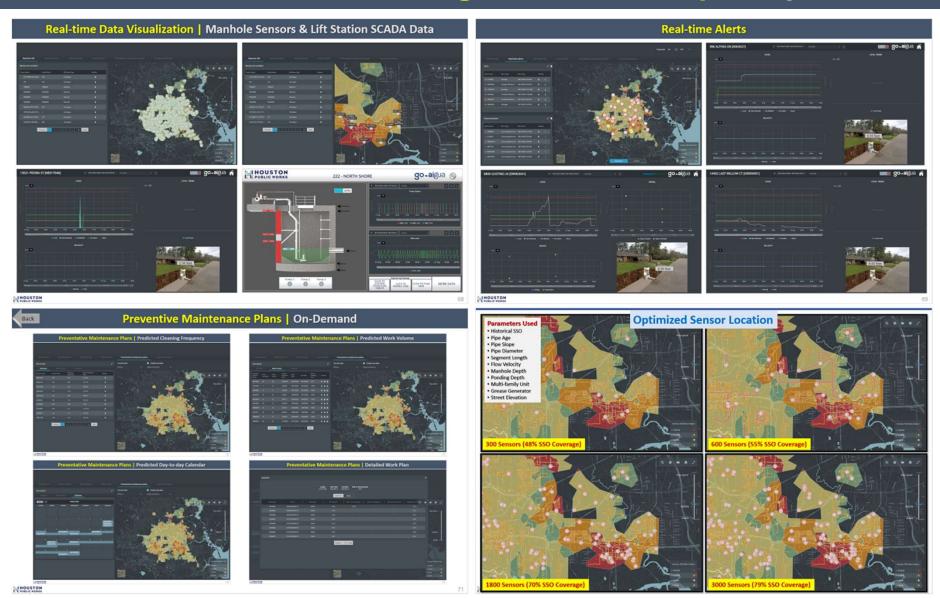






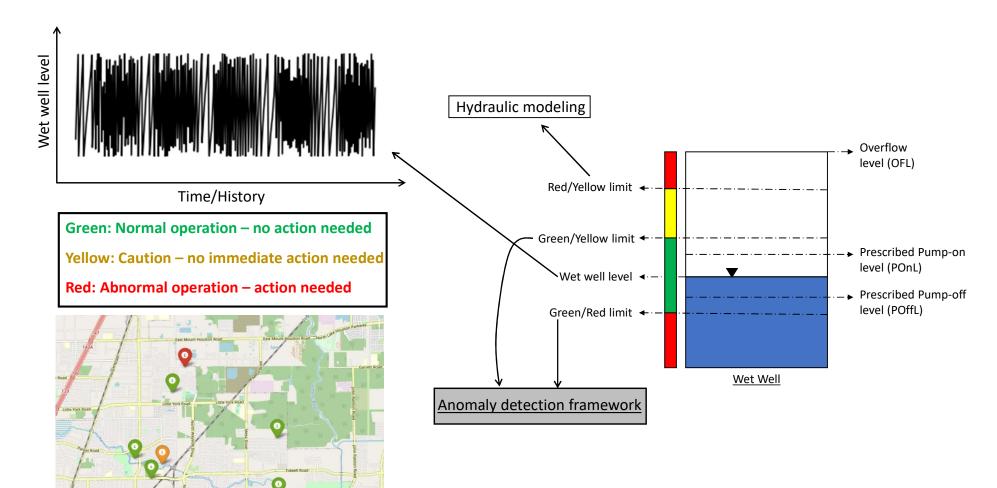
HOUSTON

Real-time Event Monitoring and Prediction | Sample 1



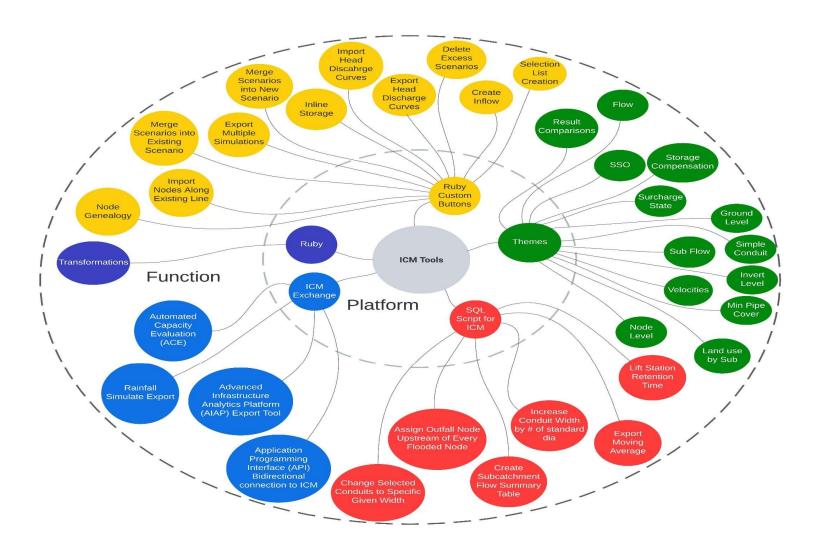
Real-time Event Monitoring and Prediction | Sample 2

ML Application of Anomaly Detection for LS Wet Well Levels





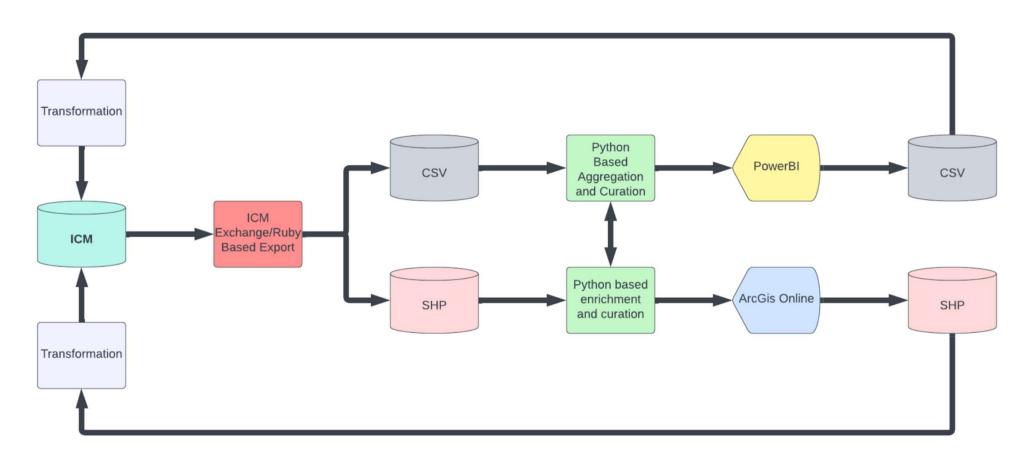
Productivity Tools | Sample Tools for ICM Modeling





Automation | Sample Process for Capacity Evaluation

Automation of Collection System Capacity Evaluation & Reporting using Hydraulic Model, PBI, Python, & AGOL





City of Houston Capacity Remedial Measures Plans & the Dynamic, Digital Approach



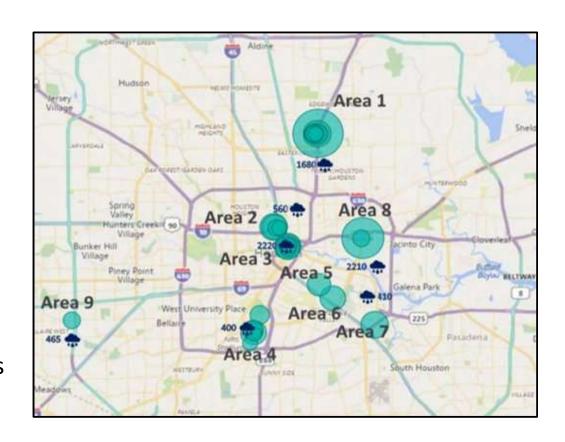


Capacity Remedial Measures Plans (CRMP) Reports

The CD identified 9 Areas and required CRMP reports to determine cause of wet weather SSOs and develop remedial action design

CRMP Reports were required to be submitted to the EPA within 2 years of the Effective Date

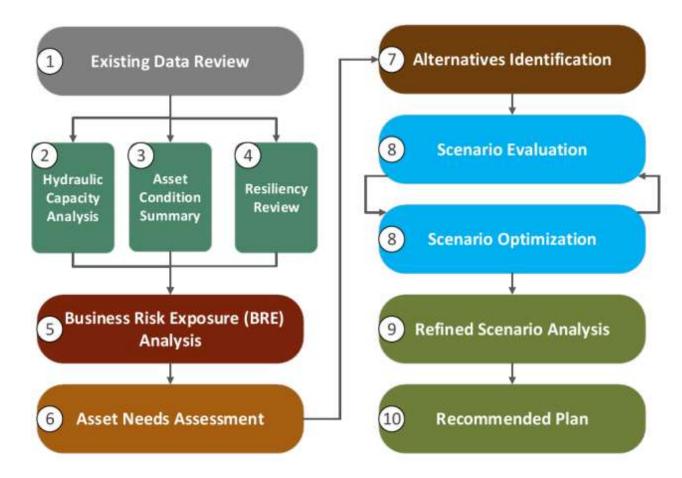
Over the 15-year span of the CD, the City will continue to evaluate wet weather SSOs to identify any additional areas







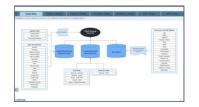
COH 10-Step Risk-Based Wastewater Planning







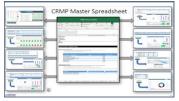
Documentation and Metadata are Critical for Digital Reporting



Develop pipeline from data source to end-product



Document Content Lineage to facilitate sharing and report maintenance



Establish consistent practice to automate data processing

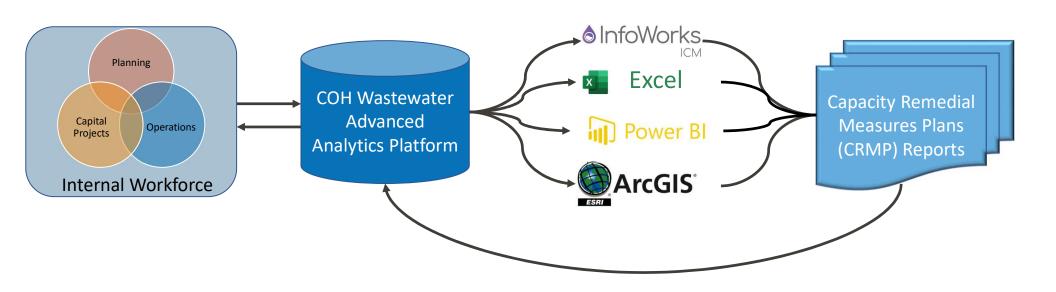


Build self-serve QA/QC capability into your work





Integrating Work Products for Continuity



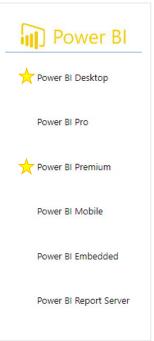




CRMP Digital Report Components















Capacity Remedial Measures Plans (CRMP) Digital Reports

Introduction Frame

Framework

Root-Cause Analysis

Alternative Evaluation

Report Summary



CD SSO Live Web Map



Remediation Alternatives Evaluation



CRMP Methodology



Construction Cost Estimate



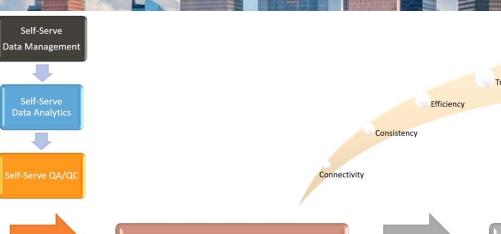
Capacity Analysis



Recommended Project Web Map







Digital Transformation

- Develop automated pipelines from data source to end-product
- Easily extract and integrate data from different sources
- Supports continuity and consistency

Digital Reporting

- On-Demand Reports available with live connections
- Digitalize work products for future use
- Platform to provide data for any other use

Benefits

On-Demand Decision
Support

- Data is authoritative and up-todate
- Ready to use "data as a product" with actionable insights
- Efficient for data and report sharing
- Information available for reference at-a-glance





Thank you!

Questions?







