Implementing EVM for a Complex Joint Venture Engineering Project

Keith Anderson

EcoSys

Agenda

- Take-Aways
- Introduction
- Project Overview
- Earned Value Planning Process
- Earned Value Executing Process
- Earned Value Monitoring and Controlling Process
- Challenges
- Successes
- EVM Takeaways

Take-Aways

- Practice EVM “right sized” as part of IPM
- A common portal is key to involving all stakeholders
- Commitments are key for understanding material variances
- Technology is here to help the People and Processes

Introduction

Market Leader

- EcoSys founders were the original developers of Primavera P6
- First to market and industry leader in new project controls capabilities
- Deep project portfolio & cost management expertise across the company

Business Momentum

- 50%+ revenue growth in each of the last 3 years
- Largest user adoption in project controls industry
- Global presence – users in 20+ countries.
- Purchased by Intergraph October 2015

Loyal & Growing Customer Base

- 500+ clients globally
- Strong partnerships with the likes of Oracle, SAP, Microsoft, and IBM

Introduction

Key Characteristics of EcoSys

- Integrates portfolio management with project execution
- Integrates all vital source data
- Single source of truth for costs/funds, schedule, scope, resources
- Enforces standardized processes when and where appropriate

Project Overview

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Project Overview

EcoSys™

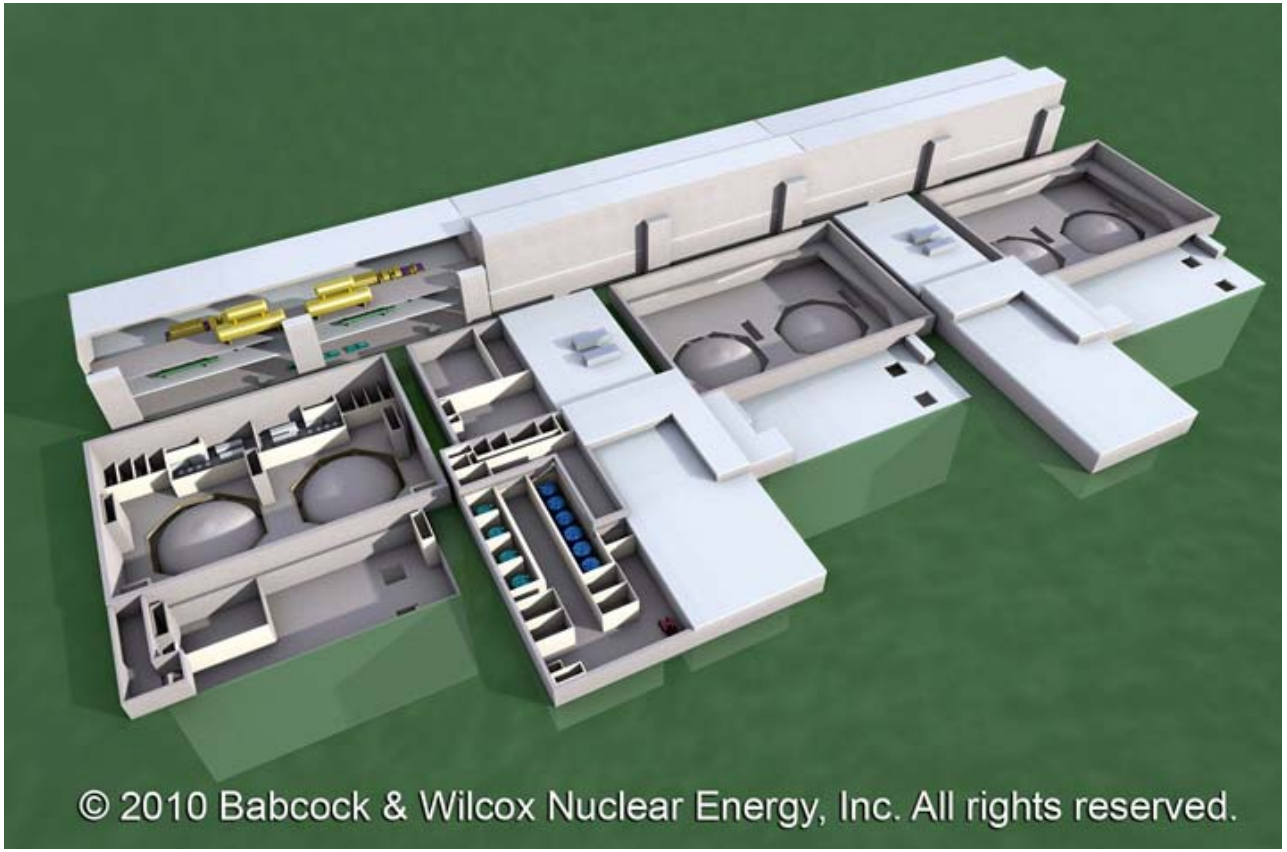
- Engineering and Design Phase
- 125 megawatt small modular reactor (SMR)
- Generation III++ technology
  - Integral nuclear system design
  - Passive safety systems
  - Two year operating cycle between refueling
  - Five-percent enriched fuel
  - Secure underground containment
  - Scalable, modular design is flexible for local needs

Conceptual drawing of B&W mPower™ nuclear reactor design.

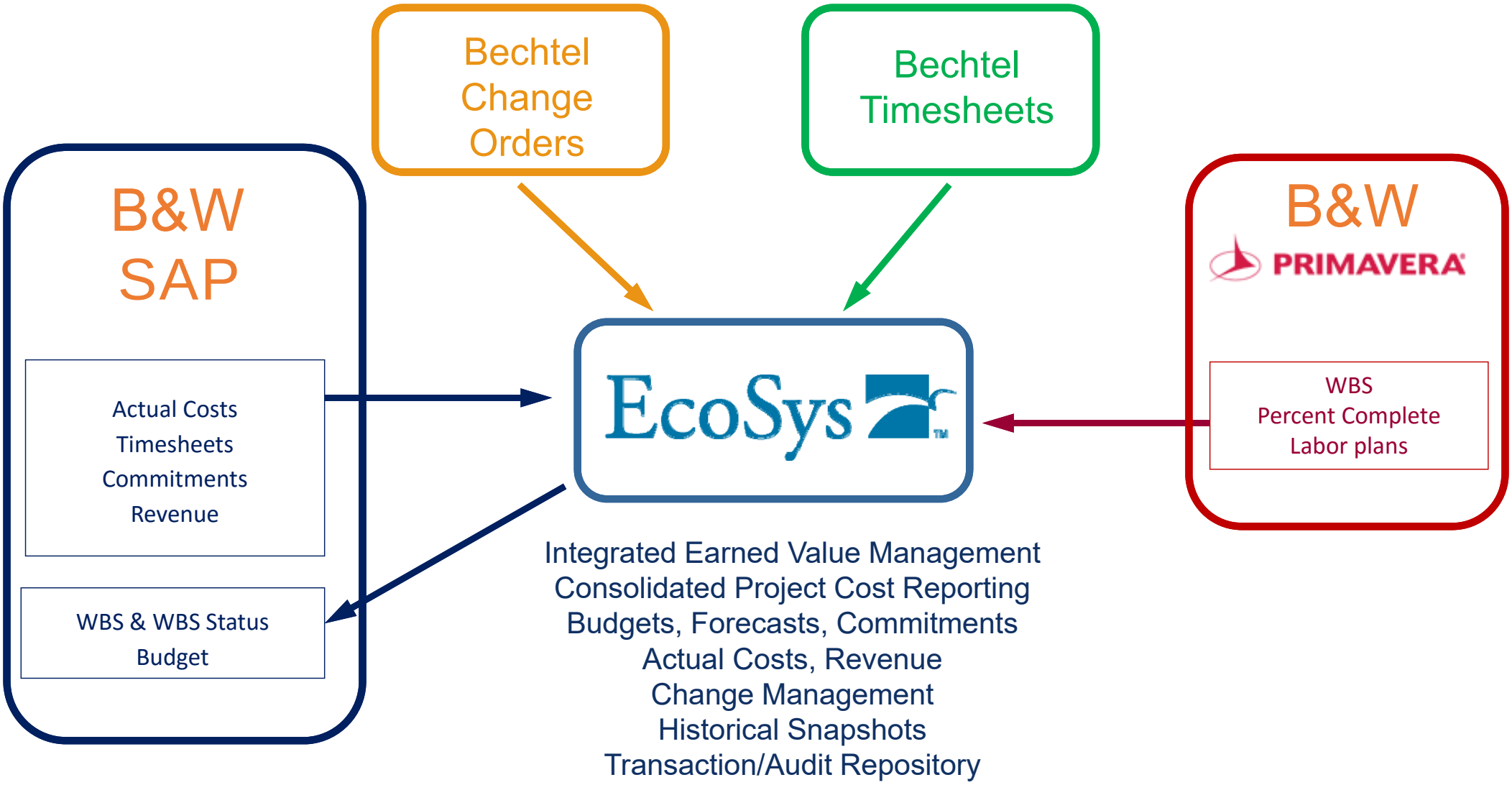
Project Overview

EcoSys™

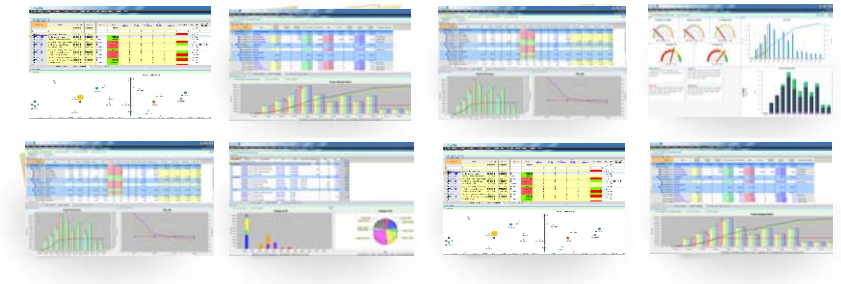
- Integrated reactor modules
- Multi-unit (1 to 10+) plant
- North American shop-manufactured
- Rail-shippable nuclear steam supply system (NSSS)



Common Portal



Common Portal



EcoSys EPC

B&W Bechtel

- 100% Web / Browser Based
- Zero Client Software to Install
- Users can access anywhere
- Multi-Project / Multi-User
- Run from Browser (Chrome, Firefox, Safari, IE) on any OS
- Run from Mobile (iOS, Android)

Common Portal

Analyst

- Easy to use in a familiar spreadsheet interface
- Integration with schedule to quickly bring in baseline
- Centralized collection and storage of project data
- Increased ability to connect the dots and deliver business value

CAM

- Reduced administrative burden to manage Control Accounts
- Real time access to project information

PM

- Real time visibility into project metrics
- Increased communication and collaboration

Executive Mgmt

- Portfolio Management
- Portfolio Analysis
- Consistent processes

Organize Process

- Practice EVM because it makes sense
- WBS Restructure
- Created one for one WBS and Charge Number
- Defined Alternate Breakdown Structure
- Identified Control Account Managers
- Created month end close out schedule
- Completed required desktop procedures
- Developed Cost Management Plan
- Developed Deliverables Matrix and Schedule

Organize Process

- Defined Report Requirements
  - Earned Value
    - Dollars
    - Hours
    - Monthly, Yearly, Inception to Data
    - EV on both Budget and Forecast
  - Planned FTEs vs. Actual FTEs
  - Change Management
  - Variance Analysis Reports
  - Estimate at Complete Analysis
    - Using CPI and combination of CPI and SPI

Organize Process

Control Account Detail Example

Project	WBS / OBS					
	WBS Level 1	Project.1				
	WBS Level 2	Project.1.1				
	WBS Level 3	Project.1.1.1	Project.1.1.2	Project.1.1.3	Project 1.1.4	
	OBS Level 1	OBS Level 2				
Project	Project Manager	Struc Superintendent		Project.1.1.2.Struc		Project.1.1.4.Struc
		Elec Superintendent	Project.1.1.1.Elec	Project.1.1.2.Elec		
		Mech Superintendent			Project.1.1.3.Mech	Project.1.1.4.Mech

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Organizing | Baseline Management | Progress | Actuals | Forecasting | Issues | Reporting | Maintenance | User Data | Admin

Organizing > WBS Maintenance

* Project: EV-ECO - EcoSys User Acceptance Testing Project

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WBS ID	WBS Path	WBS Name	WBS Type	Edit Dictionary	SAPWBS24	P6 WBS Type	Earned Value Method	IPT Name	OBS Area	Reporting Level	Reporting WBS Additive	CAWP Status	CAM
EV-ECO	EV-ECO	EcoSys User Acceptance Testing Project	Project	EV-ECO				1Project		Yes	Additive		
0	EV-ECO.0	Milestones	WBS	EV-ECO.0									
1	EV-ECO.1	Air Vehicle	WBS	EV-ECO.1									
01	EV-ECO.1.01	Airframe	WBS	EV-ECO.1.01									
01	EV-ECO.1.01.01	Airframe Integration, Assembly, Test, and Checkout	WBS	EV-ECO.1.01.01									
02	EV-ECO.1.01.01.02	(CA) IAT&CO Test	Control Account	EV-ECO.1.01.01		CA		OPR	Engr Bol	Yes	Additive		Naples, T.
01	EV-ECO.1.01.01.02.01	(WP) Rate Testing Supply Specialist	Work Package		EV-ECO.1.01.01	WP	LOE	ARV	Engr Bol				
02	EV-ECO.1.01.01.02.02	(PP) Rate Testing Back Shop Labor	Planning Package	EV-ECO.1.01.01	EV-ECO.1.01.01	PP	PCT Complete	OPR	Engr Bol				
03	EV-ECO.1.01.01.02.03	(PP) Rate Testing Operations Florida	Planning Package	EV-ECO.1.01.01	EV-ECO.1.01.01	PP	PCT Complete	TEV	Engr Bol				
04	EV-ECO.1.01.01.02.04	(PP) Rate Testing FAFP	Work Package		EV-ECO.1.01.01	PP	PCT Complete	TEV	Engr Bol				
02	EV-ECO.1.01.02	Fuselage	WBS	EV-ECO.1.01.02									
01	EV-ECO.1.01.02.01	(CA) Bolinger Test Area Fuselage	Control Account	EV-ECO.1.01.02		CA		ARV	Engr Bol	Yes	Additive		Perron, M.
01	EV-ECO.1.01.02.01.01	(WP) Rate Testing Input Conn Aircaft Engr	Work Package		EV-ECO.1.01.02	WP	PCT Complete	AVI	Engr Bol				
02	EV-ECO.1.01.02.01.02	(WP) Rate Testing Input Avionics Engr	Work Package		EV-ECO.1.01.02	WP	PCT Complete	ARV	Engr Bol				
07	EV-ECO.1.01.02.01.07	(WP) Rate Test CT Mfg Labor	Work Package		EV-ECO.1.01.02	WP	PCT Complete	TEV	Engr Bol				
08	EV-ECO.1.01.02.01.08	(WP) Rate Test ACTMAT	Work Package		EV-ECO.1.01.02	WP	PCT Complete	TEV	Engr Bol				
09	EV-ECO.1.01.02.01.09	(WP) Rate Test Florida	Work Package		EV-ECO.1.01.02	WP	PCT Complete	TEV	Engr Bol				
12	EV-ECO.1.01.02.01.12	(WP) Rate Test Supportability (ILS)	Work Package		EV-ECO.1.01.02	WP	PCT Complete	TEV	Engr Bol				

Planning Process

- Resourced Loaded Schedule to determine required manhours and corresponding budget
- Created time-phased budget in EPC for Materials, Subcontracts, and Other Directs Costs
- Load Commitments from SAP
- Gathered all required approvals for final budget
- Developed CPI and SPI thresholds for variance analysis
- Held kick off meeting to review all reports and performance metrics (education process continues throughout remainder of project)

Time Phased Budget

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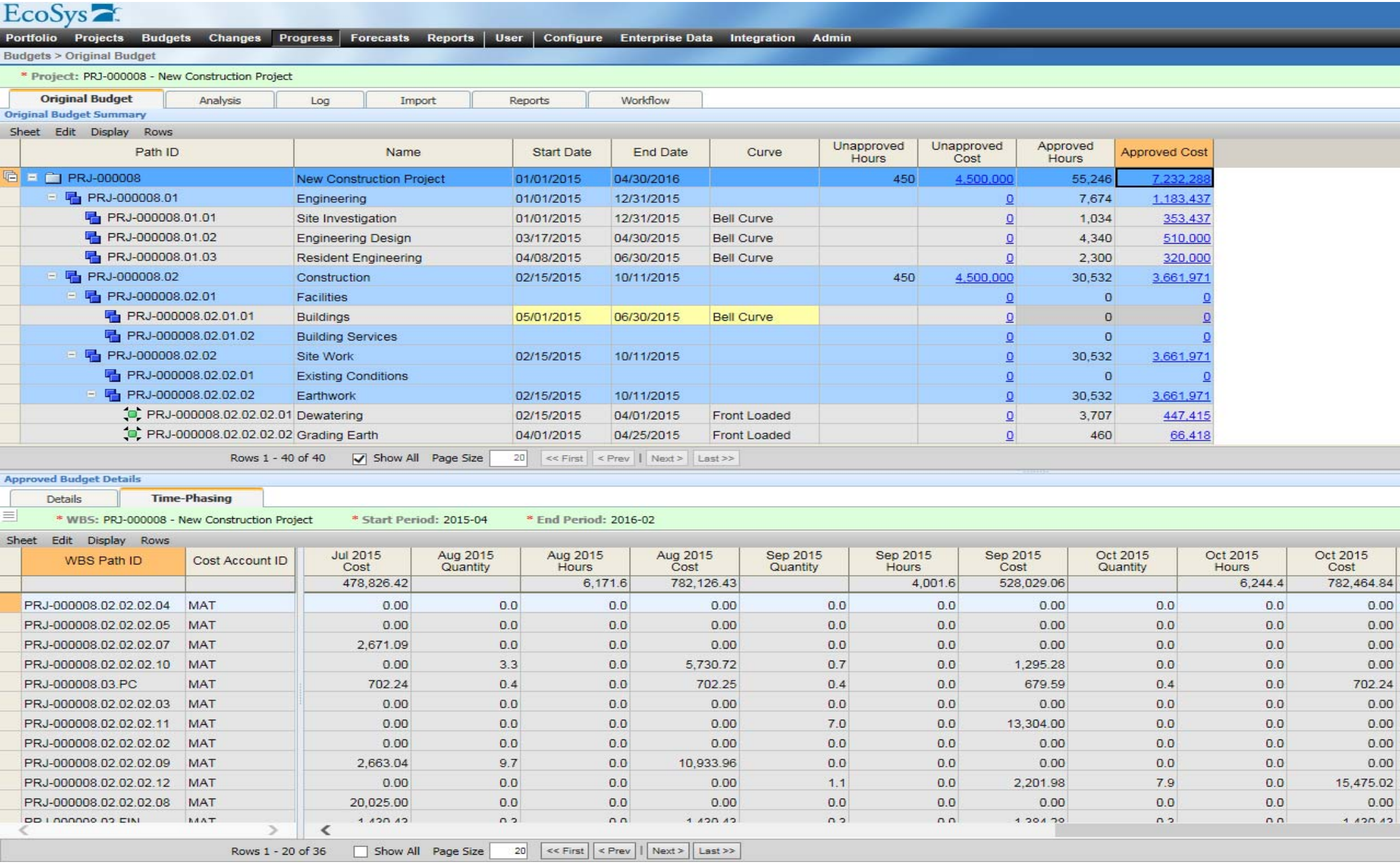

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Portfolio | Projects | Budgets | Changes | Progress | Forecasts | Reports | User | Configure | Enterprise Data | Integration | Admin

Budgets > Original Budget

* Project: PRJ-000008 - New Construction Project

Original Budget | Analysis | Log | Import | Reports | Workflow

Original Budget Summary

Sheet Edit Display Rows

Path ID	Name	Start Date	End Date	Curve	Unapproved Hours	Unapproved Cost	Approved Hours	Approved Cost
PRJ-000008	New Construction Project	01/01/2015	04/30/2016		450	4,500,000	55,246	7,232,288
PRJ-000008.01	Engineering	01/01/2015	12/31/2015			0	7,674	1,183,437
PRJ-000008.01.01	Site Investigation	01/01/2015	12/31/2015	Bell Curve		0	1,034	353,437
PRJ-000008.01.02	Engineering Design	03/17/2015	04/30/2015	Bell Curve		0	4,340	510,000
PRJ-000008.01.03	Resident Engineering	04/08/2015	06/30/2015	Bell Curve		0	2,300	320,000
PRJ-000008.02	Construction	02/15/2015	10/11/2015		450	4,500,000	30,532	3,661,971
PRJ-000008.02.01	Facilities					0	0	0
PRJ-000008.02.01.01	Buildings	05/01/2015	06/30/2015	Bell Curve		0	0	0
PRJ-000008.02.01.02	Building Services					0	0	0
PRJ-000008.02.02	Site Work	02/15/2015	10/11/2015			0	30,532	3,661,971
PRJ-000008.02.02.01	Existing Conditions					0	0	0
PRJ-000008.02.02.02	Earthwork	02/15/2015	10/11/2015			0	30,532	3,661,971
PRJ-000008.02.02.02.01	Dewatering	02/15/2015	04/01/2015	Front Loaded		0	3,707	447,415
PRJ-000008.02.02.02.02	Grading Earth	04/01/2015	04/25/2015	Front Loaded		0	460	66,418

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Approved Budget Details

Details | Time-Phasing

* WBS: PRJ-000008 - New Construction Project * Start Period: 2015-04 * End Period: 2016-02

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WBS Path ID	Cost Account ID	Jul 2015 Cost	Aug 2015 Quantity	Aug 2015 Hours	Aug 2015 Cost	Sep 2015 Quantity	Sep 2015 Hours	Sep 2015 Cost	Oct 2015 Quantity	Oct 2015 Hours	Oct 2015 Cost
		478,826.42		6,171.6	782,126.43		4,001.6	528,029.06		6,244.4	782,464.84
PRJ-000008.02.02.02.04	MAT	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.05	MAT	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.07	MAT	2,671.09	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.10	MAT	0.00	3.3	0.0	5,730.72	0.7	0.0	1,295.28	0.0	0.0	0.00
PRJ-000008.03.PC	MAT	702.24	0.4	0.0	702.25	0.4	0.0	679.59	0.4	0.0	702.24
PRJ-000008.02.02.02.03	MAT	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.11	MAT	0.00	0.0	0.0	0.00	7.0	0.0	13,304.00	0.0	0.0	0.00
PRJ-000008.02.02.02.02	MAT	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.09	MAT	2,663.04	9.7	0.0	10,933.96	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.02.02.12	MAT	0.00	0.0	0.0	0.00	1.1	0.0	2,201.98	7.9	0.0	15,475.02
PRJ-000008.02.02.02.08	MAT	20,025.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00
PRJ-000008.02.FIN	MAT	1,430.43	0.0	0.0	1,430.43	0.0	0.0	1,384.28	0.0	0.0	1,430.43

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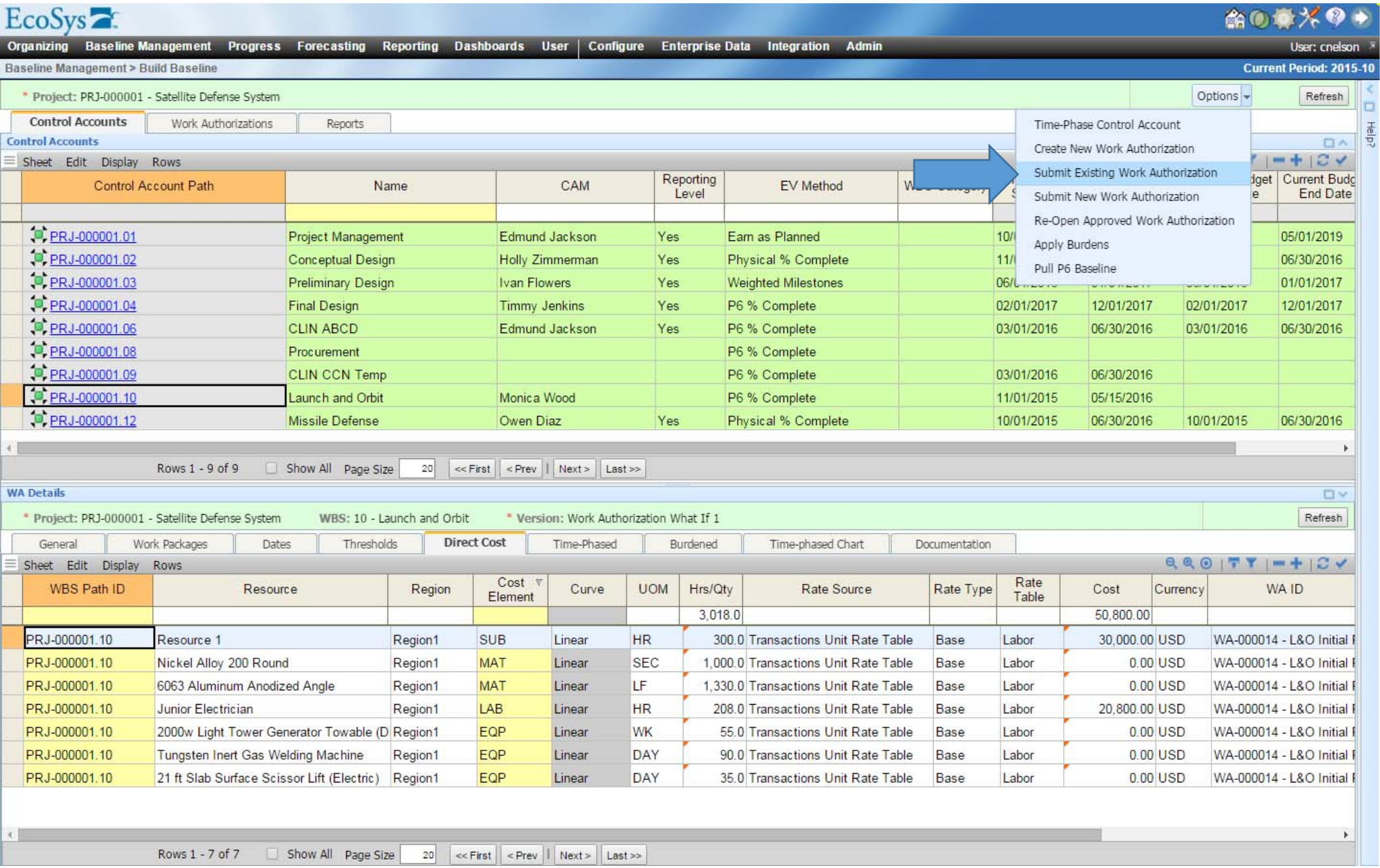
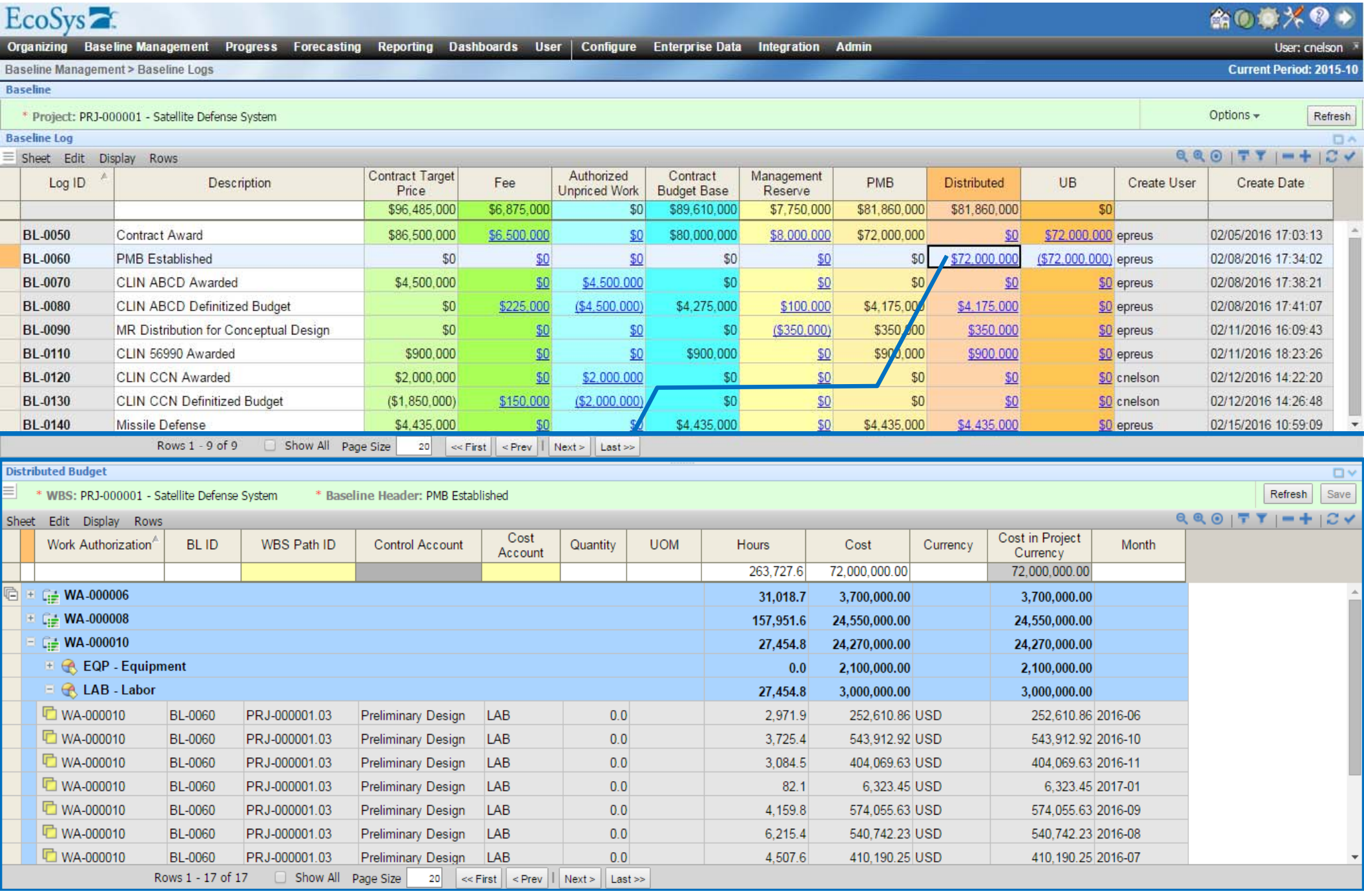
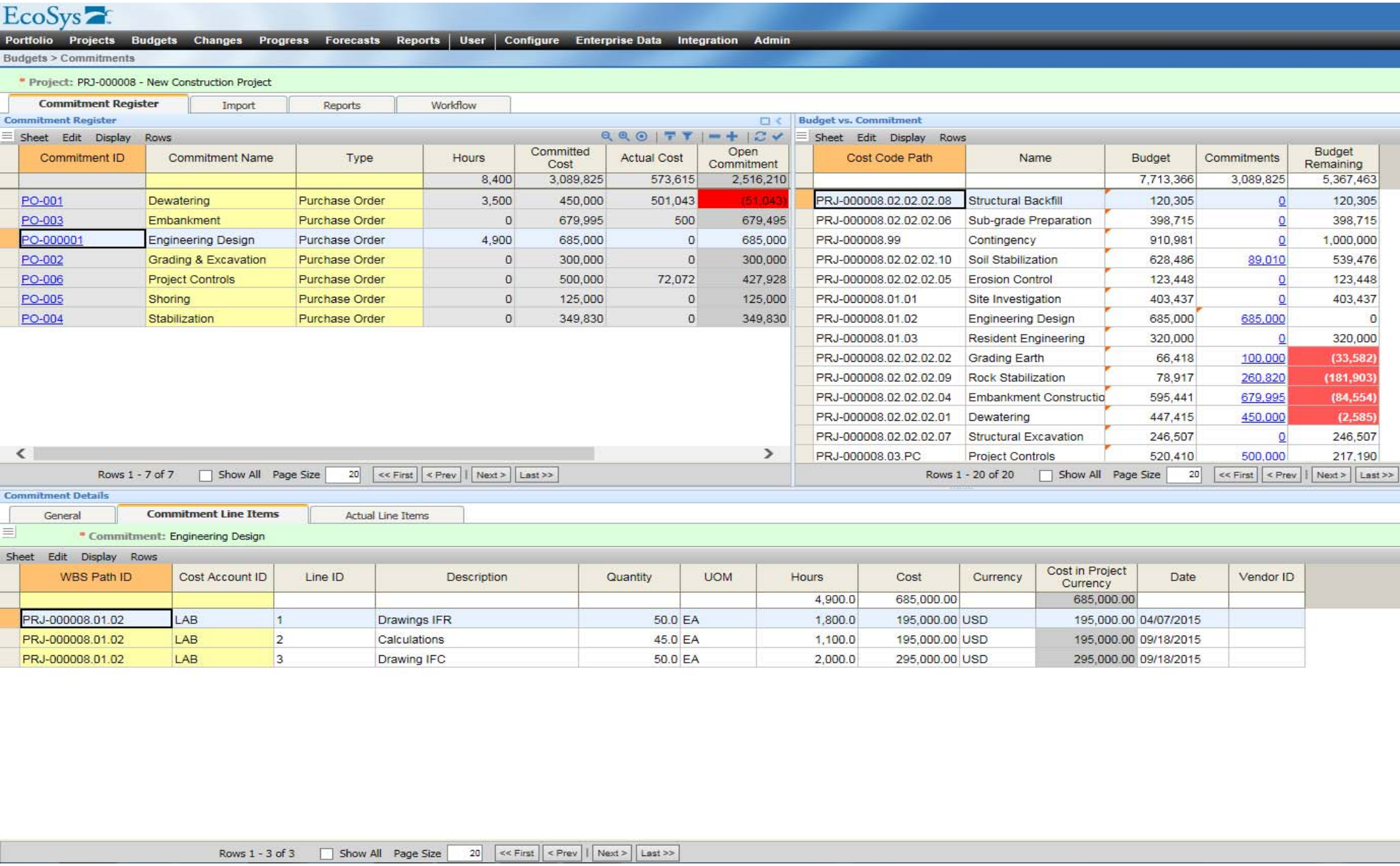
Building Baseline



Set Baseline



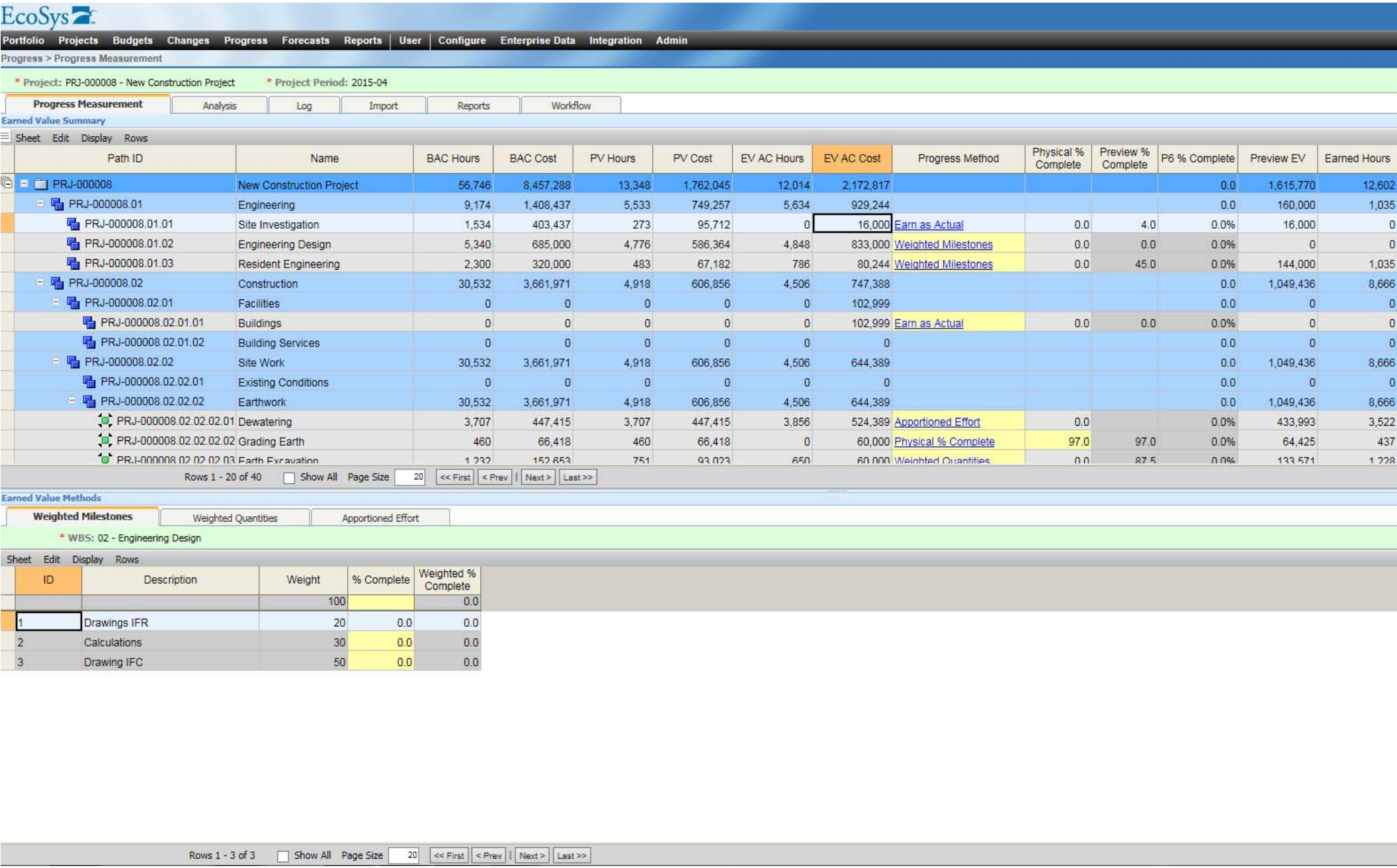
Commitment Register



Monitor and Control

- Change Management
- Load Actual Costs from SAP
- Load Bechtel timesheet details
- Update Commitments
- Audit procedures and revise as necessary
- Work closely with Control Account Managers
- Use CPI and SPI metrics to calculate ETC and EAC
- Refine CPI and SPI thresholds as necessary
- Document mitigation plans
- Anticipate and communicate anomalies

Progress Measurement



Performance Analysis

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Portfolio | Projects | Budgets | Changes | Progress | Forecasts | Reports | User | Configure | Enterprise Data | Integration | Admin — User: admin

Progress > Productivity Analysis — Current Period: 2015-01

* Project: PRJ-000008 - New Construction Project * Project Period: 2015-04 * Chart Start Period: 2015-01 * Chart End Period: 2015-12 Refresh

Productivity Cost | Productivity Hours

Productivity Analysis

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Path ID	Name	BAC	Planned	% Complete	Earned	Actual	CPI Cost	SPI Cost	TCPI Cost	TSPI Cost	Cost Variance	Schedule Variance	IEAC1 Cost	IEAC2 Cost	IEAC3 Cost	IEAC4 Cost
PRJ-000008	New Construction Project	8,457,288	1,762,045	19.0	1,608,098	2,172,817	0.74	0.91	1.09	1.02	(564,719)	(153,947)	11,427,251	13,740,859	12,313,202	9,022,007
PRJ-000008.01	Engineering	1,408,437	749,257	10.2	144,000	929,244	0.15	0.19	2.64	1.92	(785,244)	(605,257)	9,088,763	11,128,643	43,384,663	2,193,681
PRJ-000008.01.01	Site Investigation	403,437	95,712	0.0	0	16,000	0.00	0.00	1.04	1.31	(16,000)	(95,712)	0	0	0	419,437
PRJ-000008.01.02	Engineering Design	685,000	586,364	0.0	0	833,000	0.00	0.00	-4.63	6.94	(833,000)	(586,364)	0	0	0	1,518,000
PRJ-000008.01.03	Resident Engineering	320,000	67,182	45.0	144,000	80,244	1.79	2.14	0.73	0.70	63,756	76,818	178,320	202,839	126,000	256,244
PRJ-000008.02	Construction	3,661,971	606,856	28.9	1,057,763	747,388	1.42	1.74	0.89	0.85	310,376	450,908	2,587,452	3,047,468	1,803,062	3,351,595
PRJ-000008.02.01	Facilities	0	0	0.0	0	102,999	0.00	0.00	0.00	0.00	(102,999)	0	0	0	0	102,999
PRJ-000008.02	Buildings	0	0	0.0	0	102,999	0.00	0.00	0.00	0.00	(102,999)	0	0	0	0	102,999
PRJ-000008.02	Building Services	0	0	0.0	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0
PRJ-000008.02.02	Site Work	3,661,971	606,856	28.9	1,057,763	644,389	1.64	1.74	0.86	0.85	413,375	450,908	2,230,870	2,627,490	1,554,578	3,248,596
PRJ-000008.02	Existing Conditions	0	0	0.0	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0
PRJ-000008.02	Earthwork	3,661,971	606,856	28.9	1,057,763	644,389	1.64	1.74	0.86	0.85	413,375	450,908	2,230,870	2,627,490	1,554,578	3,248,596
PRJ-000008	Dewatering	447,415	447,415	95.0	425,044	524,389	0.81	0.95	-0.29	0.00	(99,344)	(22,371)	551,988	558,888	553,441	546,759
PRJ-000008	Grading Earth	66,418	66,418	95.0	63,097	60,000	1.05	0.95	0.52	0.00	3,097	(3,321)	63,158	63,948	63,324	63,321

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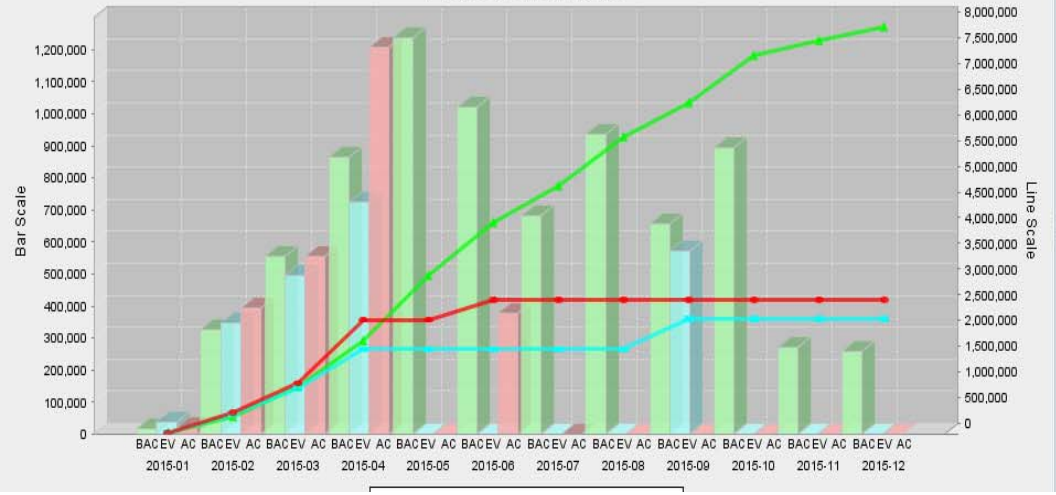
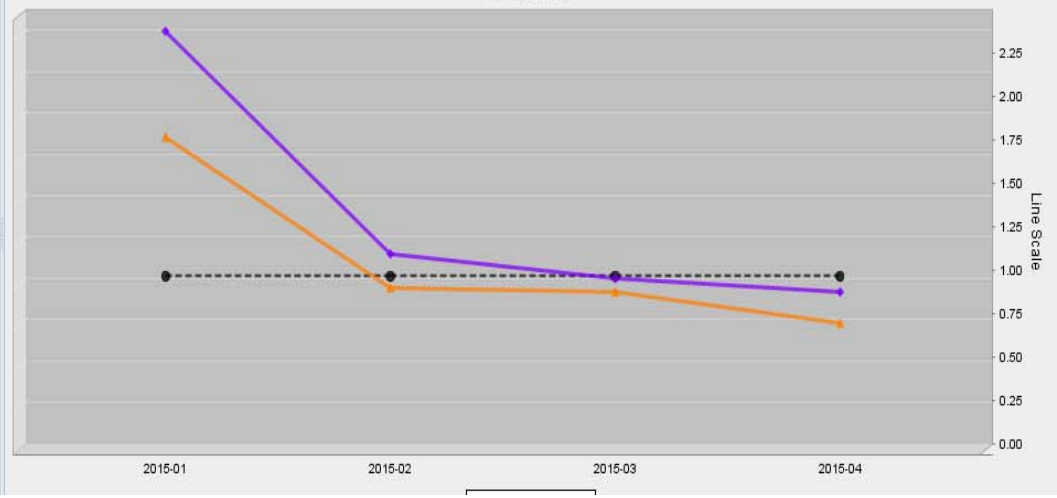
Project Performance Chart



Performance Factor Chart



Change Management

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Changes > Project Change Status

* Project: PRJ-000008 - New Construction Project

Change Register

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Group: Status	Change ID	Change Name	Type	Status	Approval Date	Estimated Cost	Hours	Cost	Transfer Value
						15,000	3,544	1,066,213	1,200,810
Submitted						**15,000**	**115**	257,000	**257,000**
	CHG-017	Documentation spec change	Scope Change	Submitted		0	0	200,000	200,000
	CHG-009	Expand Dewatering Site Scope	Scope Change	Submitted		5,000	65	7,000	7,000
	CHG-015	Front Loader Maintenance	Scope Change	Submitted		0	0	25,000	25,000
	CHG-005	New change	Scope Change	Submitted		10,000	50	25,000	25,000
Approved						**0**	**3,429**	729,213	**863,810**
	CHG-003	Construction Change	Scope Change	Approved	09/02/2015	0	0	230,000	230,000
	CHG-004	Demo Change Example	Scope Change	Approved	04/23/2015	0	500	50,000	50,000
	CHG-001	Design Change	Scope Change	Approved	05/15/2015	0	1,000	175,000	175,000
	CHG-006	Forecast Variance 2015-03	Forecast Variance	Approved	04/10/2015	0	1,929	274,213	408,810
Open						**0**	**0**	80,000	**80,000**
	CHG-010	Additional Scaffolding Required	Budget Change	Open		0	0	0	0
	CHG-011	Demo Change	Scope Change	Open		0	0	0	0
	CHG-012	Demo Change 1	Scope Change	Open		0	0	80,000	80,000
	CHG-016	Labor Availability	Scope Change	Open		0	0	0	0

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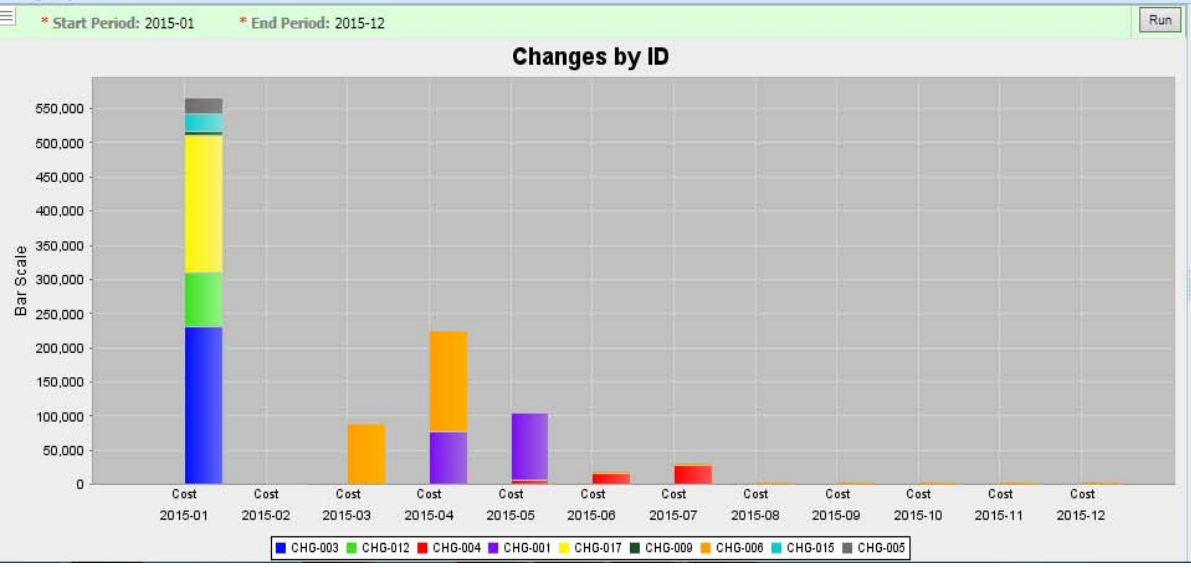
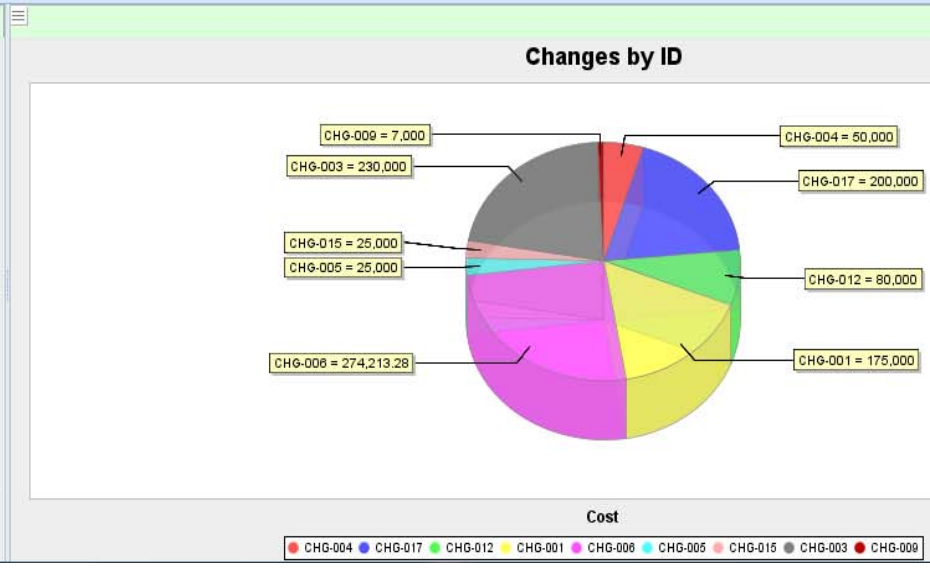
Changes by ID

* Start Period: 2015-01 * End Period: 2015-12 Run





EAC Analysis

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Portfolio | Projects | Budgets | Changes | Progress | Forecasts | Reports | User | Configure | Enterprise Data | Integration | Admin

Forecasts > Forecast Comparison

* Project: PRJ-000008 - New Construction Project * Historical Forecast: 2015-01 - Jan 2015

Forecast Comparison Summary

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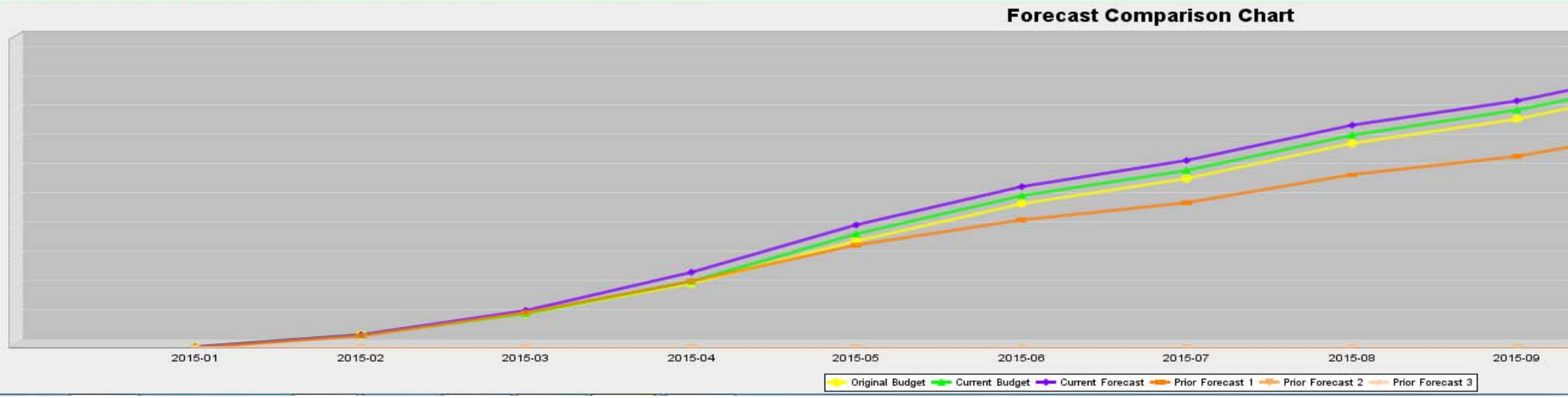
Path ID	Name	Original Budget	Current Budget	Current Forecast	Prior Forecast 1	Prior Forecast 2	Prior Forecast 3	Historical Snapshot	Responsible Manager
PRJ-000008	New Construction Project	8,232,288	8,457,288	8,731,502	6,833,064	0	0	0	
PRJ-000008.01	Engineering	1,183,437	1,408,437	1,639,178	740,741	0	0	0	
PRJ-000008.01.01	Site Investigation	353,437	403,437	403,437	0	0	0	0	Chad Williams
PRJ-000008.01.02	Engineering Design	510,000	685,000	915,741	740,741	0	0	0	Lindsey Plano
PRJ-000008.01.03	Resident Engineering	320,000	320,000	320,000	0	0	0	0	Patrick Nunn
PRJ-000008.02	Construction	3,661,971	3,661,971	3,661,971	3,661,971	0	0	0	
PRJ-000008.02.01	Facilities	0	0	0	0	0	0	0	
PRJ-000008.02	Buildings	0	0	0	0	0	0	0	Lindsey Plano
PRJ-000008.02	Building Services	0	0	0	0	0	0	0	
PRJ-000008.02.02	Site Work	3,661,971	3,661,971	3,661,971	3,661,971	0	0	0	
PRJ-000008.02	Existing Conditions	0	0	0	0	0	0	0	
PRJ-000008.02	Earthwork	3,661,971	3,661,971	3,661,971	3,661,971	0	0	0	
PRJ-000008	Dewatering	447,415	447,415	447,415	447,415	0	0	0	Patrick Nunn
PRJ-000008	Grading Earth	66,418	66,418	66,418	66,418	0	0	0	Steph Rogers

Rows 1 - 20 of 40 Show All Page Size 20 << First | < Prev | Next > | Last >>

Forecast Comparison Chart

* WBS: PRJ-000008 - New Construction Project * Start Period: 2015-01 * End Period: 2015-12



EAC Analysis

EcoSys™

EAC - Forecast Comparison

						EAC Using CPI only			Weighted Combo of CPI & SPI			EAC using CPI x SPI		
WBS DESCRIPTION	BASELINE BUDGET	CURRENT BUDGET	CURRENT FORECAST	SPI	CPI	ETC	EAC	EAC to CURRENT BUDG VAR	ETC	EAC	EAC to CURRENT BUDG VAR	ETC	EAC	EAC to CURRENT BUDG VAR
Nuclear Island	16,808	16,808	16,808	1.06	1.02	15,403	16,548	260	14,915	16,060	748	14,568	15,713	1,095
Turbine Island	2,017	2,367	2,367	1.06	1.03	2,367	2,017	350	1,971	2,243	124	1,579	1,851	166
Balance of Plant	11,389	11,389	13,889	0.89	0.97	11,031	11,781	-392	11,776	12,526	-1,137	12,390	13,140	-1,751
TOTAL:	30,214	30,564	33,064			28,801	30,346	218	28,662	30,829	-265	28,537	30,704	-490

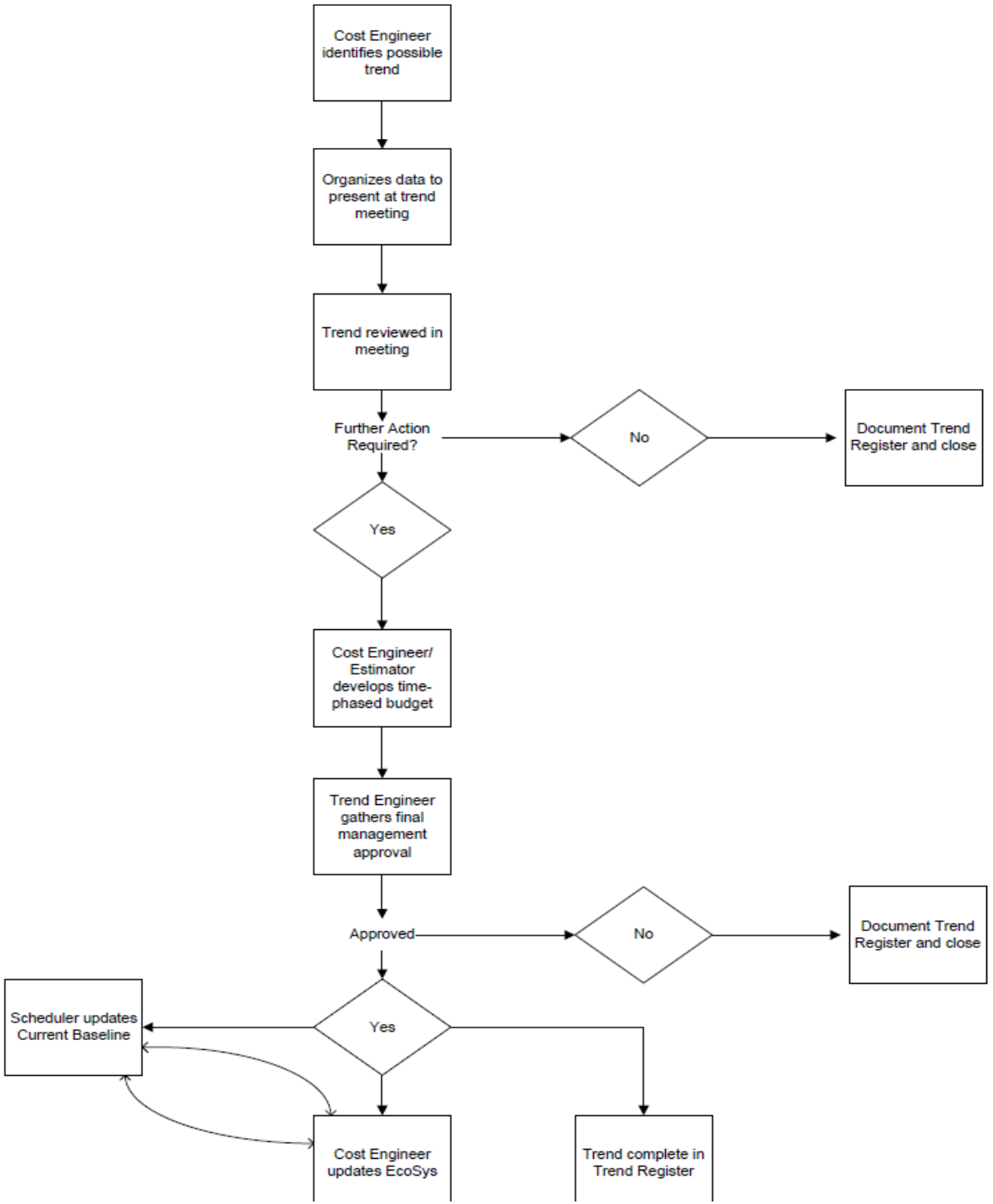
Trend Analysis

EcoSys™

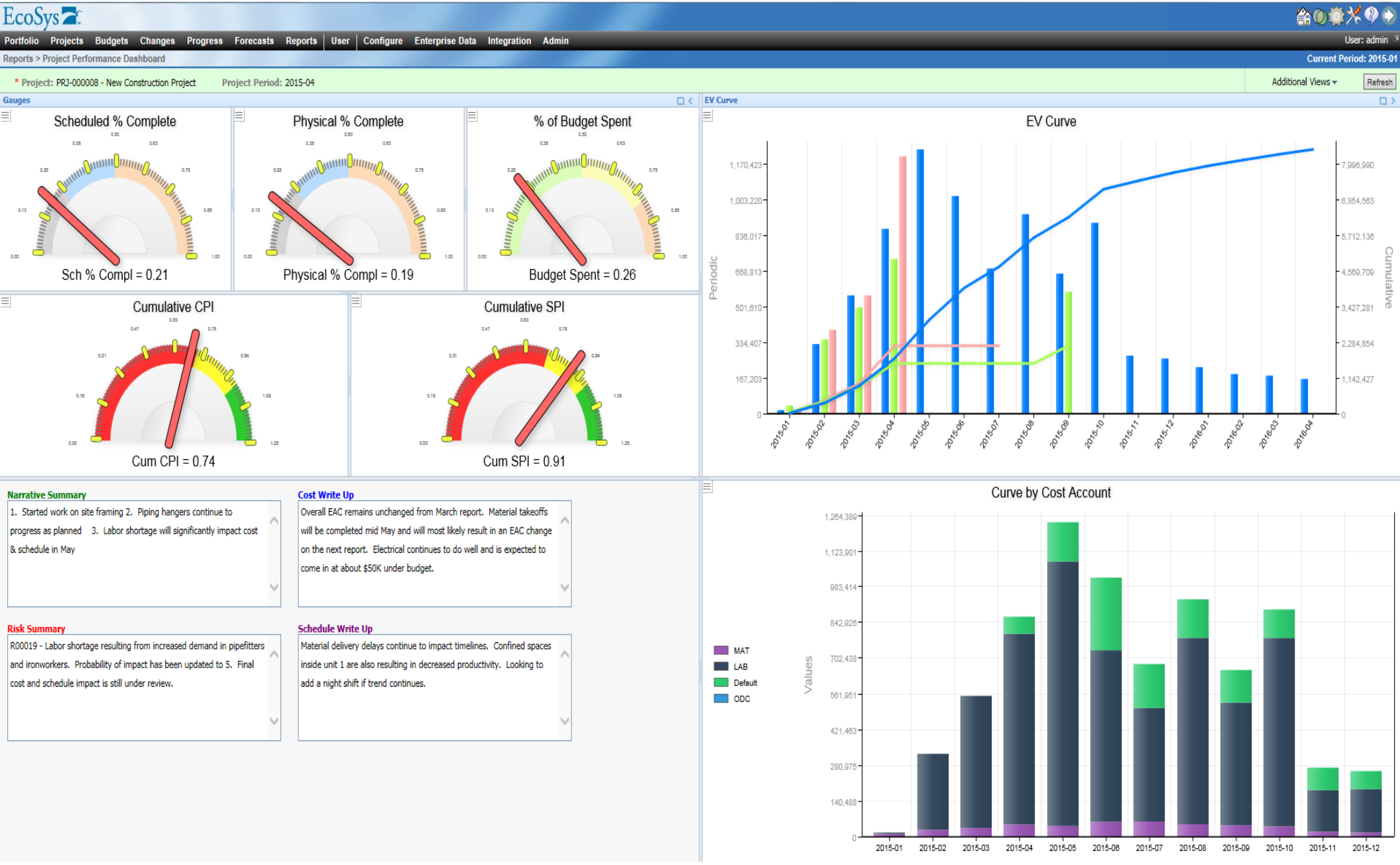
		Negative Thresholds	0.75	0.75	-50	-50		Negative Thresholds	0.85	0.85	-125	-125		Negative Thresholds	0.90	0.90	-300	-300	
		Positive Thresholds	1.25	1.25	50	50		Positive Thresholds	1.15	1.15	125	125		Positive Thresholds	1.10	1.10	300	300	
		Hours																	
		Periodic						YTD							ITD							
WBS Description	% Comp	Planned	Earned	Actuals	CPI	SPI	Earn Var	Sch Var	Planned	Earned	Actuals	CPI	SPI	Earn Var	Sch Var	Planned	Earned	Actuals	CPI	SPI	Earn Var	Sch Var	Variance Explanation
Reports	43.0%	155	102	106	0.97	0.66	-4	-53	672	362	314	1.15	0.54	48	-310	1,023	1,200	950	1.26	1.17	250	177	
Drawings / Sketches	2.0%	100	95	111	0.86	0.95	-16	-5	198	212	234	0.91	1.07	-22	14	198	212	234	0.91	1.07	-22	14	
Calculations	35.7%	82	112	95	1.19	1.37	18	30	356	340	400	0.85	0.96	-60	-16	356	340	400	0.85	0.96	-60	-16	
Specifications	22.0%	175	250	230	1.09	1.43	20	75	800	700	950	0.74	0.88	-250	-100	800	700	950	0.74	0.88	-250	-100	
Design Modeling	19.0%	27	10	20	0.50	0.37	-10	-17	112	130	99	1.31	1.16	31	18	500	520	498	1.04	1.04	22	20	

Recognized performance trends impact Forecast (EAC)

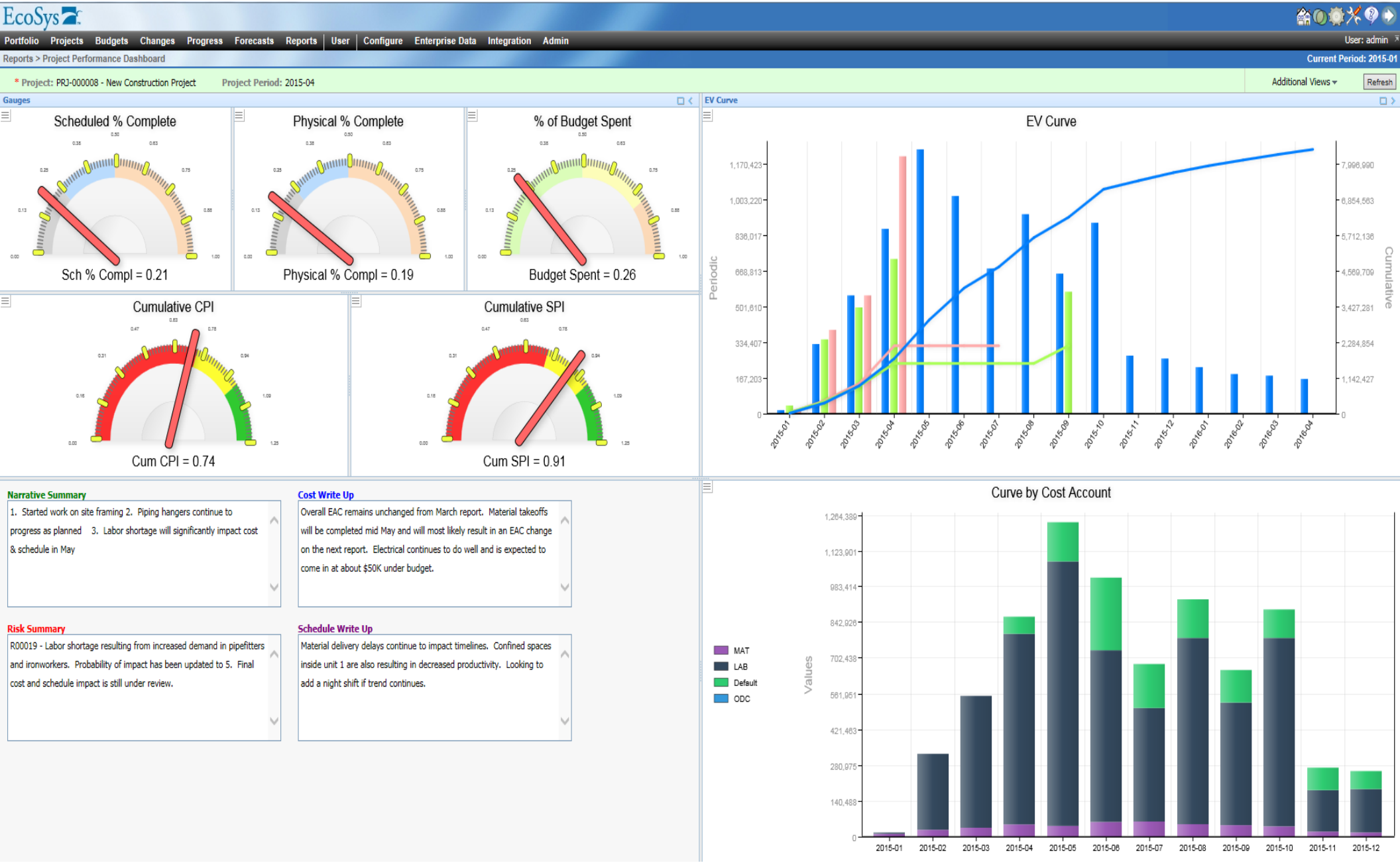
Trend Analysis



Variance Analysis



Variance Analysis



Challenges

- Users charging to the correct codes in SAP
- Getting Control Account Managers to be responsible for their data
- Making sure all changes are run through the official change management process
- Gathering meaningful and timely variance feedback from Control Account Managers

Successes

- Additional analysis time
- Increased visibility by all stakeholders
- Easy adoption by project stakeholders
- Ability to drill down to specific performance issues
- Consistency in numbers increases credibility
- Ability to place accountability/recognition where it belongs
- Project stakeholders working from common portal

Contact Me

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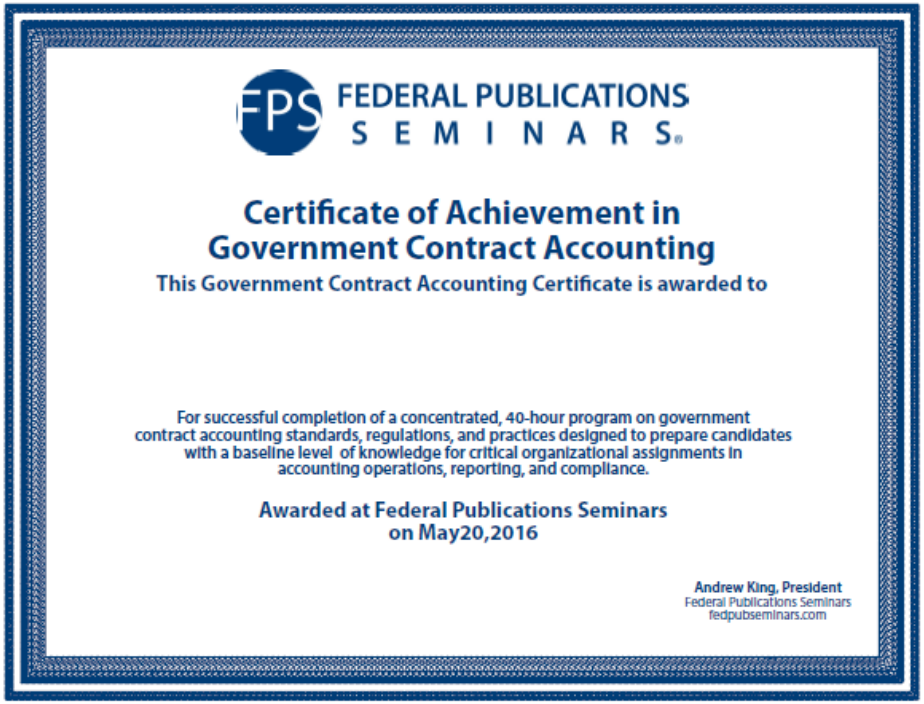

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