Effective Use of Earned Value for Controlling Construction Projects

Laurie Bowman CCP, PSP, EVP, DRMP

BIO of Laurie Bowman

SYNCHRONY

Laurie Bowman CCP, PSP, EVP, DRMP

- Principal of Synchrony
- 16 years experience in Planning, Scheduling, Contract Administration and Cost Engineering primarily in the Oil & Gas and Mining Industries.
- In My Free Time I Like to…
  - Practice Yoga
  - Participate in Triathlons & Obstacle Races

Controlling Construction Projects

SYNCHRONY

Project Set Up

- Baseline
- Progress Updates
- Change Management

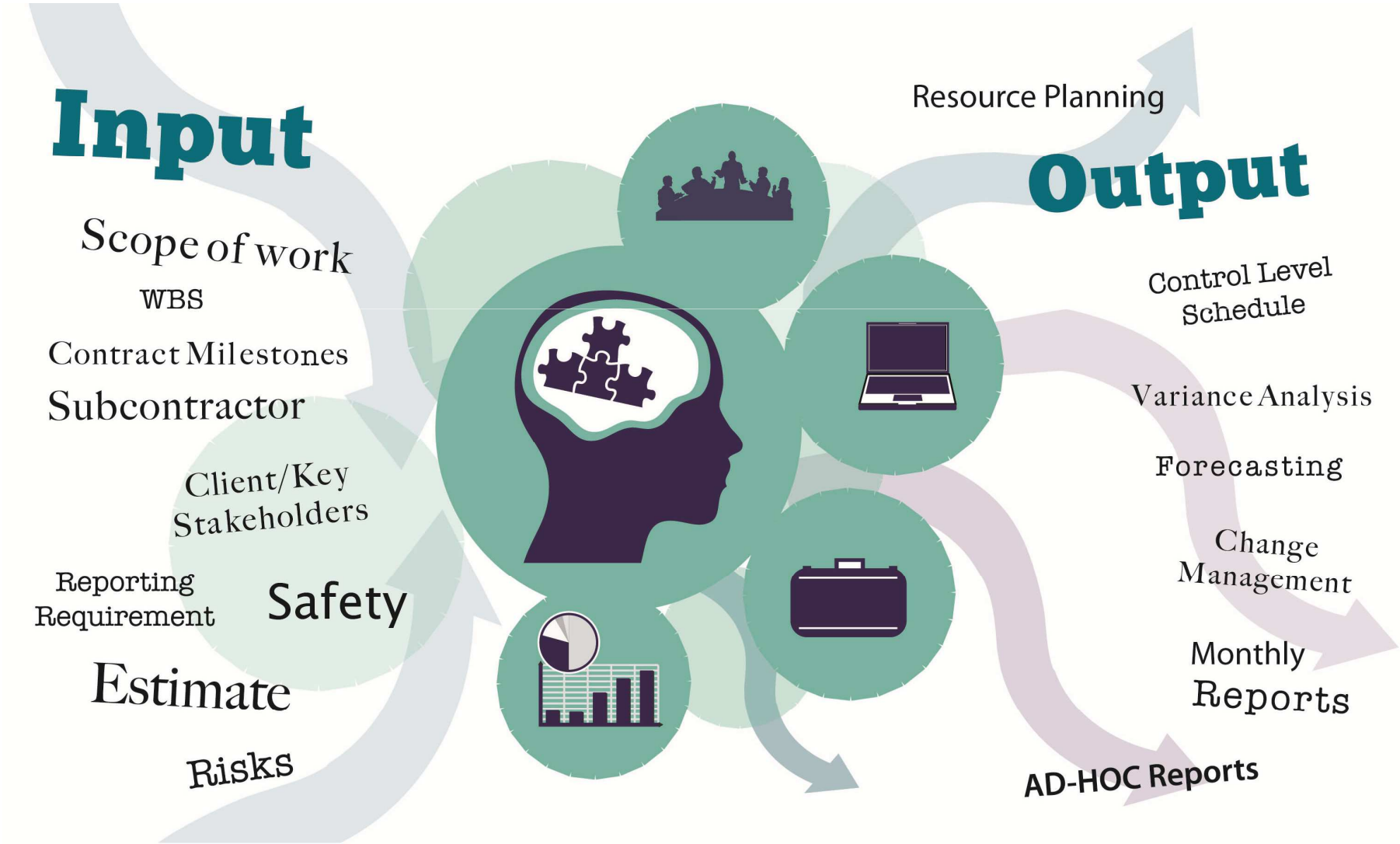
Case Study Results

- Cost Performance Analysis
- Schedule Performance Analysis
- Cost & Schedule Performance Analysis Combined
- Resource Forecasting
- External Interfaces
- Weather Impacts
- Delay and Disruption Analysis

Discussion / Lessons Learned

- Structure
- The Drum Beat
- Tailoring Communication
- Mitigation of Disputes
- Training/

Controlling Construction Projects

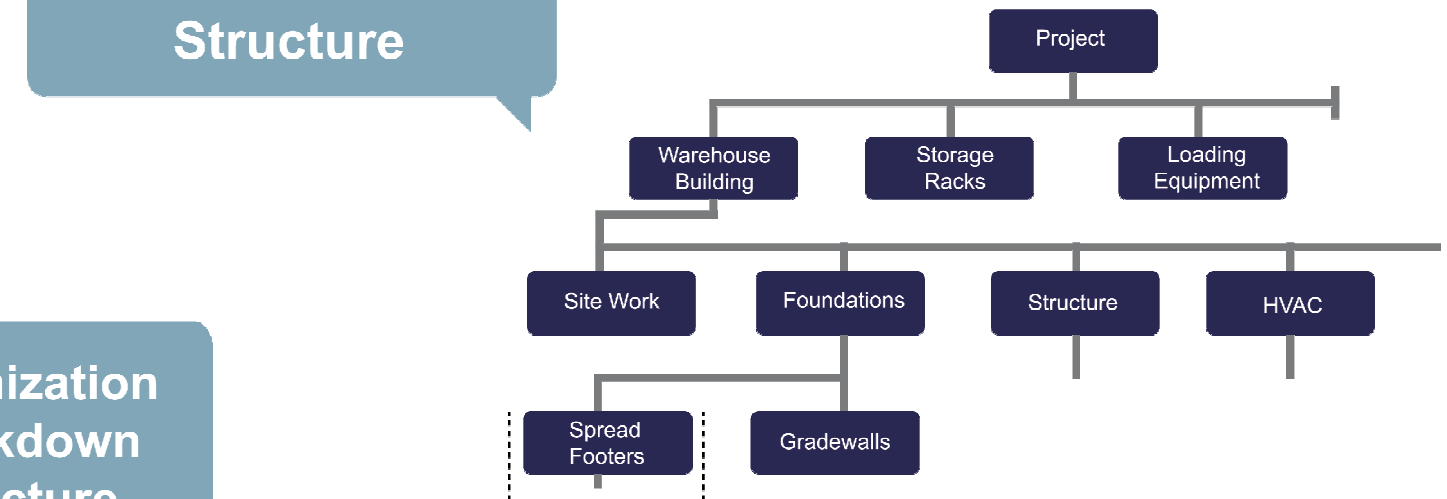


Setting a Project up for EVM

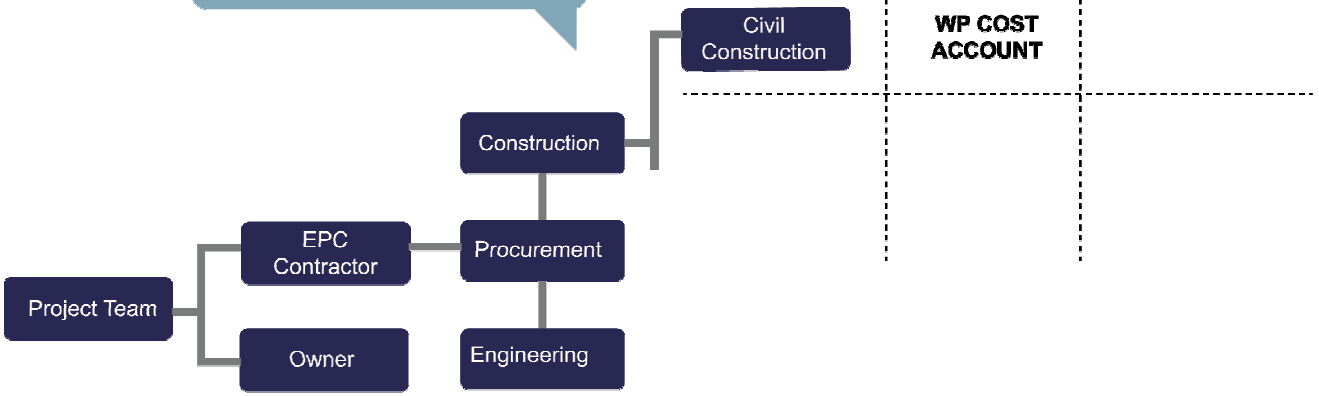
Performance Measurement Baseline

Organising the Work

Work Break Down Structure

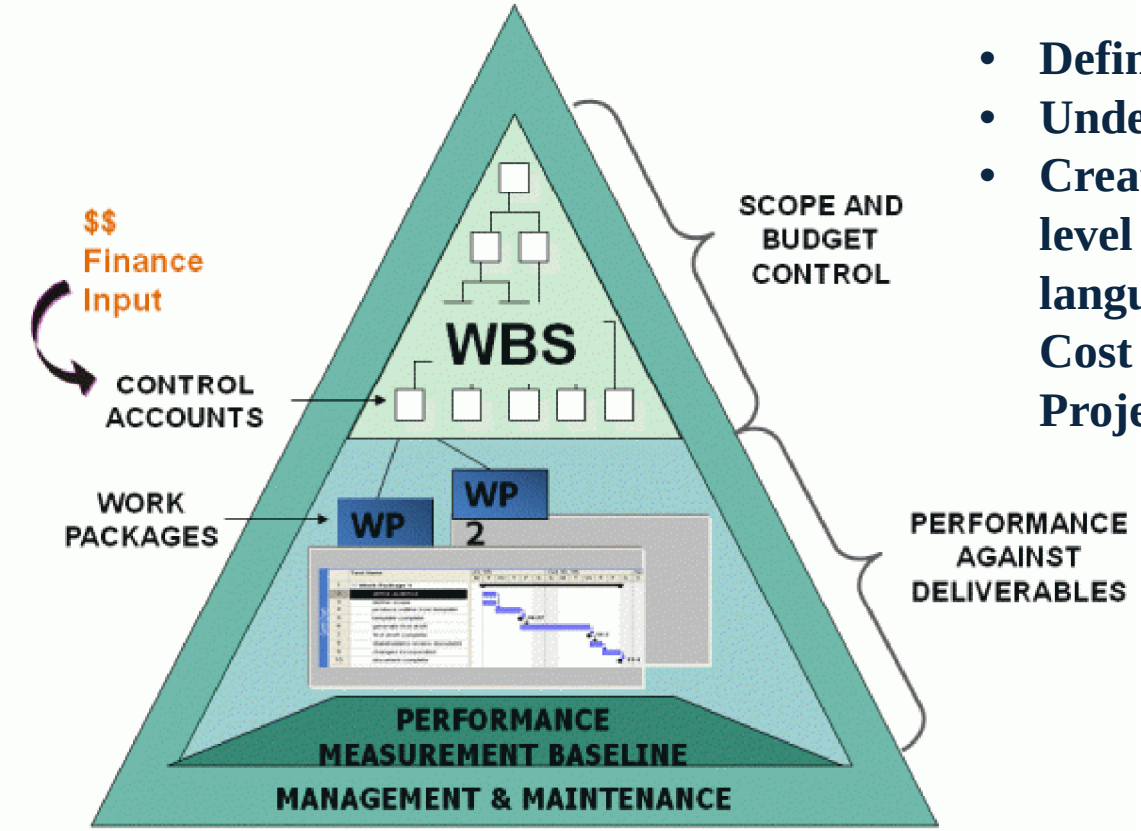


Organization Breakdown Structure



Source: Figure 7.1.2 of AACE's TCM Framework, Part III Project Control

The WBS



- **Define the Scope of Work**
- **Understand the contract**
- **Create WBS, at Control Account level it becomes a common language between Estimators, Cost Engineers, Planners and the Project Team**

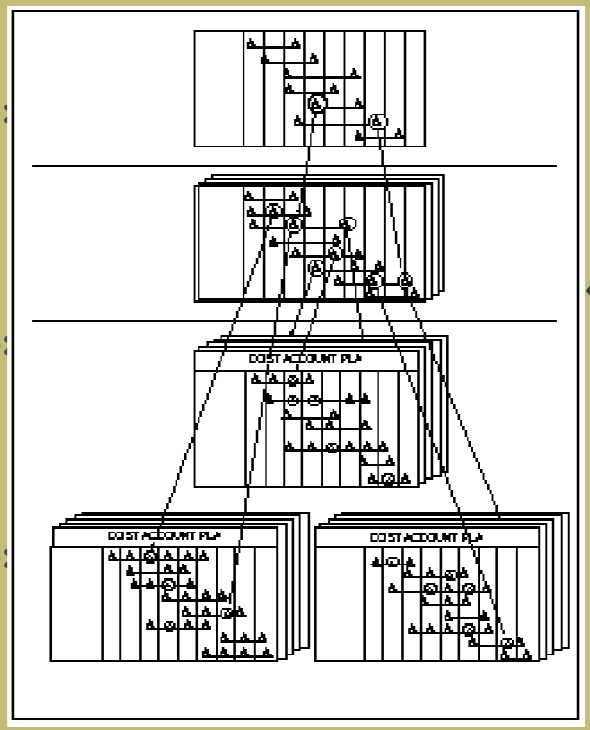
Schedule Creation

Hierarchy of Schedules

1 High Level Schedule

2 Intermediate Schedule

3 Detail Level



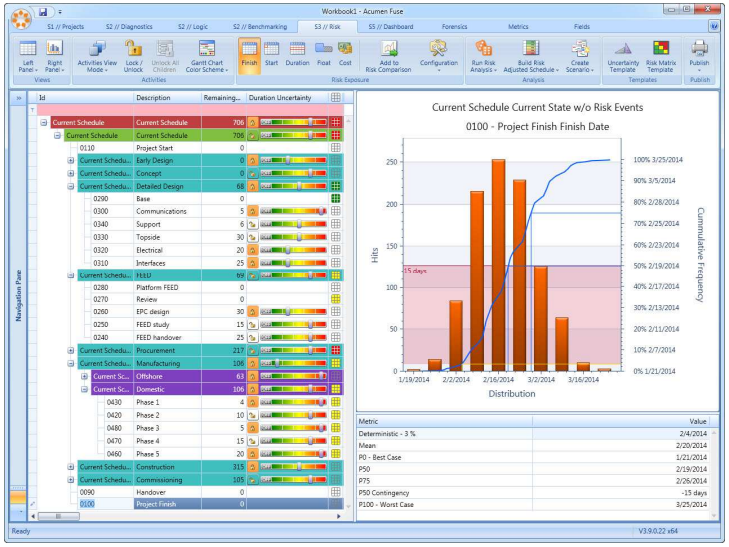
Schedules are developed from the top down

Schedules are statused and monitored from the bottom up

ALL LOWER LEVEL SCHEDULES ARE DERIVED FROM AND ARE CONSISTENT WITH HIGHER LEVEL SCHEDULES

Modelling Risk

- Allows for uncertinity & complexity
- provides probabilities of achieving project deadlines
- improves forecasting
- identifies main drivers of schedule
- Identifies risks for management attention



Integrated Baseline Review (IBR)

BASELINING

IBR BENEFITS

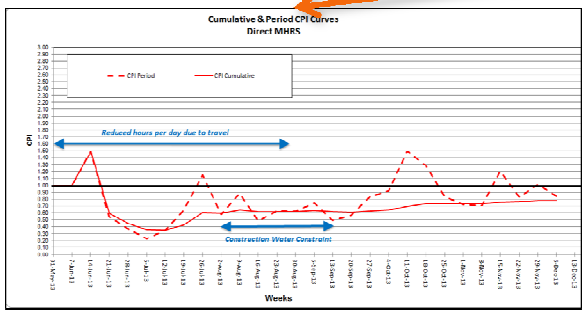
- ✓ Scope Clarified
- ✓ Optimized Plan
- ✓ Risks and Opportunities Understood
- ✓ Improved Benchmark for Measuring Performance
- ✓ PMB Confidence improvement
- ✓ Methods of Measurement Clarified
- ✓ Reporting Requirements Clarified
- ✓ Team alignment and commitment to the plan

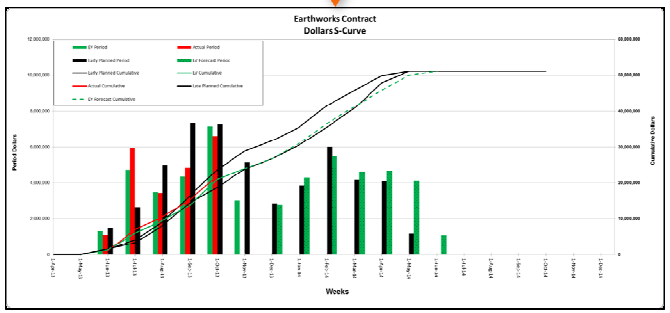
Systematic Project Updating and Forecasting "The Drum Beat"

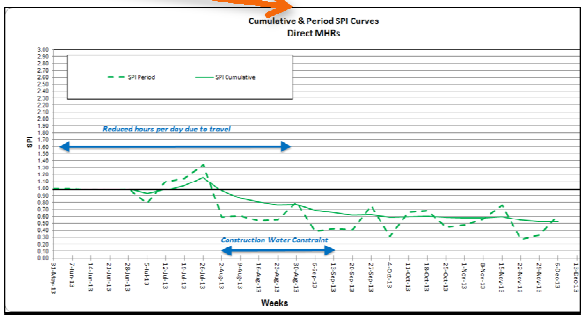
Project Updating

- Update Project
- Analyse variances
- Analyse Slippages
- Analyse performance
- Forecasting
- Seek & incorporate feedback
- Issue Reports

Controlling Construction Performance

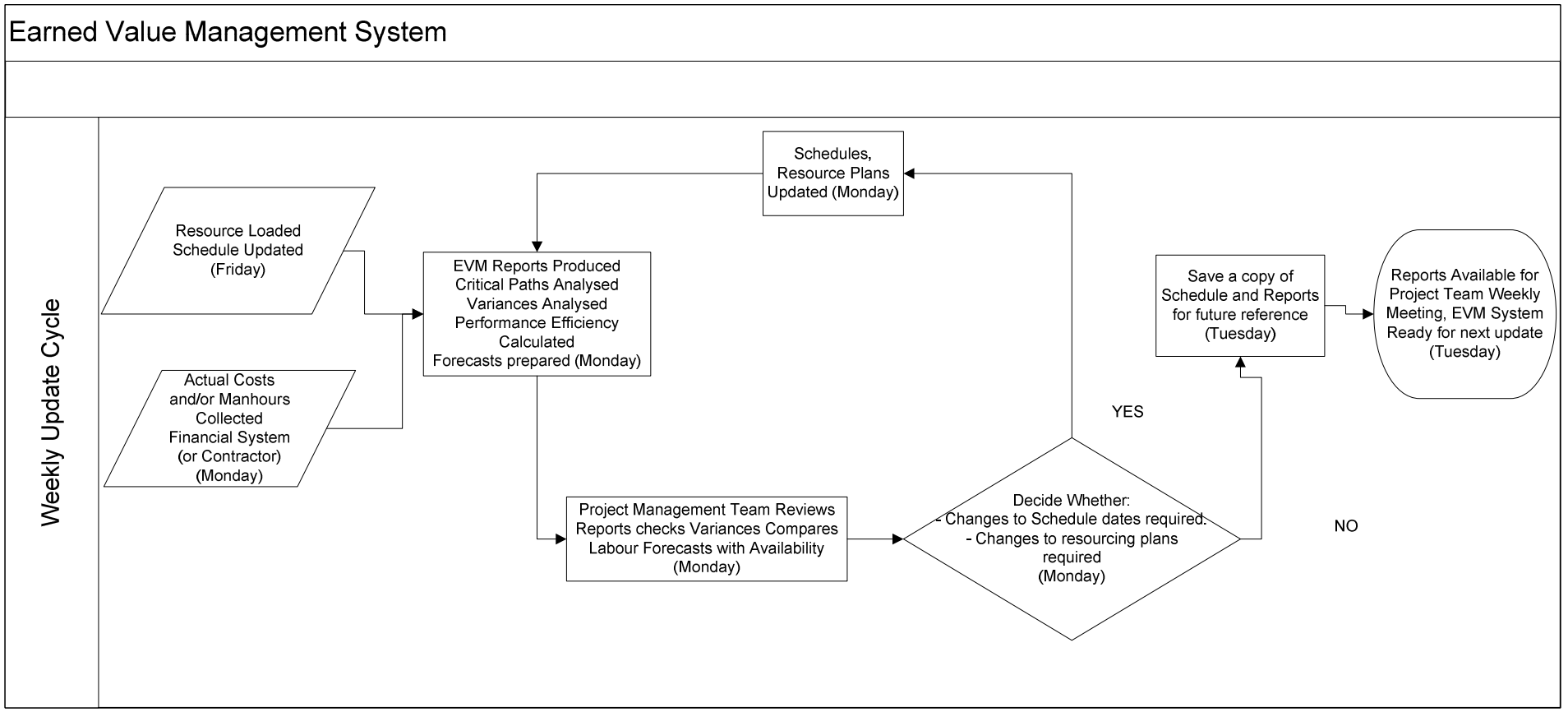






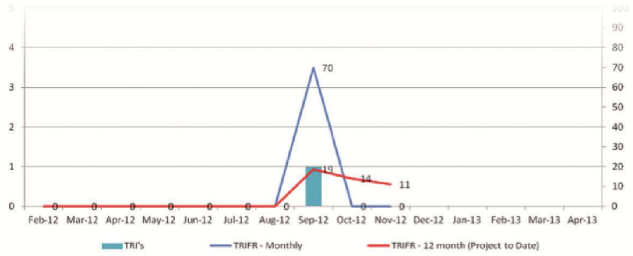
Weekly Reporting Cycle

Progress Updates – The Drum Beat

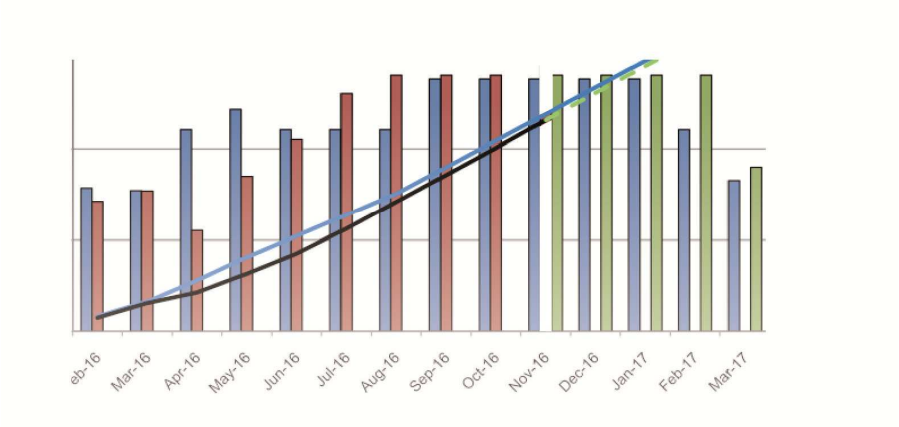


Weekly Analysis and Reporting

- **Key Milestone slippages**
- **Cost variance & CPI, productivity factors**
- **Schedule variances & SPI, quite limited - consider float**
- **Critical path & total float**
- **Identify root causes & rectiflication actions if required**
- **Resource forecasts, bottoms up ETC or productivity factor**



OwnersTeam on site



The Drum Beat

Establish a Performance Culture on the Project

- Collection of Actual Costs, Progress and Forecast becomes a weekly routine
- Review of Variance and other reports becomes a weekly routine
- ‘No Surprises’ as Project Managers receive live feedback on project progress providing the opportunity to identify trends quickly
- Goal setting as teams and contractors become accountable for their performance
- Creates a great contemporaneous record throughout the project and helps mitigate disputes.

Change Management

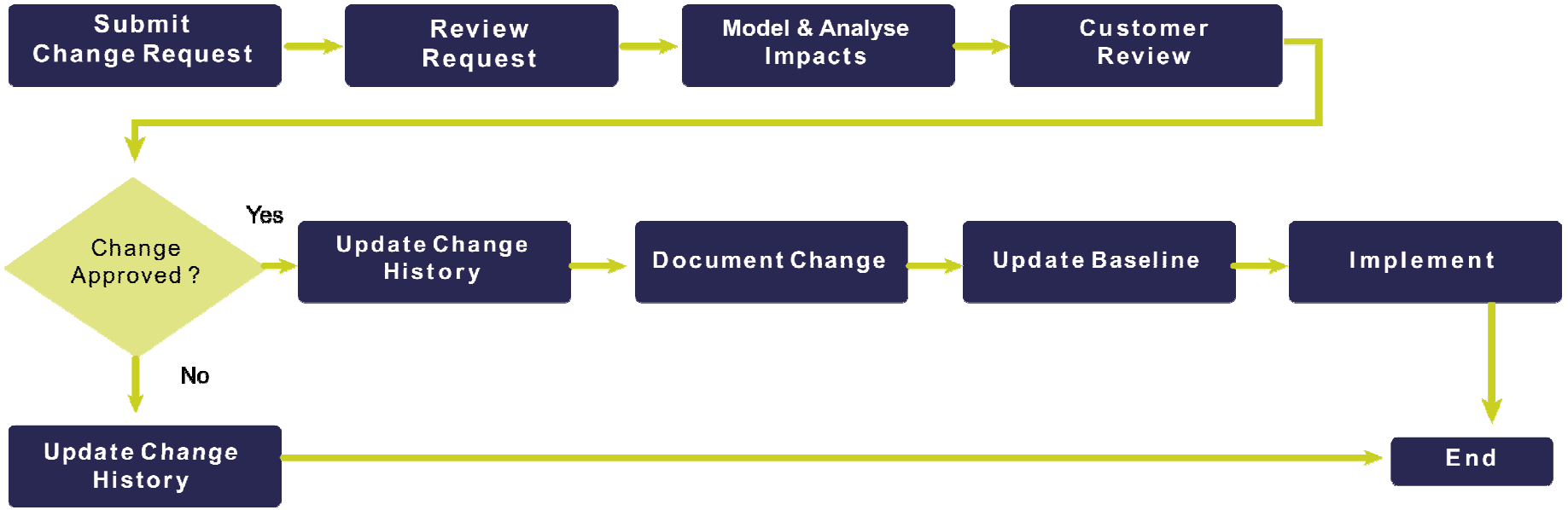
Change Management

Model Potential Changes

Incorporate approved External & Internal Scope changes

Model Risks and incorporate mitigation activities

Typical Change Cycle



Sources of change

- Unclear Scope
- External (Customer Requirements)
- Internal
- Design Development

- Rolling Wave Planning
- Value Engineering / Constructability Reviews
- Risk & Opportunity decisions
- Weather and Force Majeure

Risks are a source of Project Changes

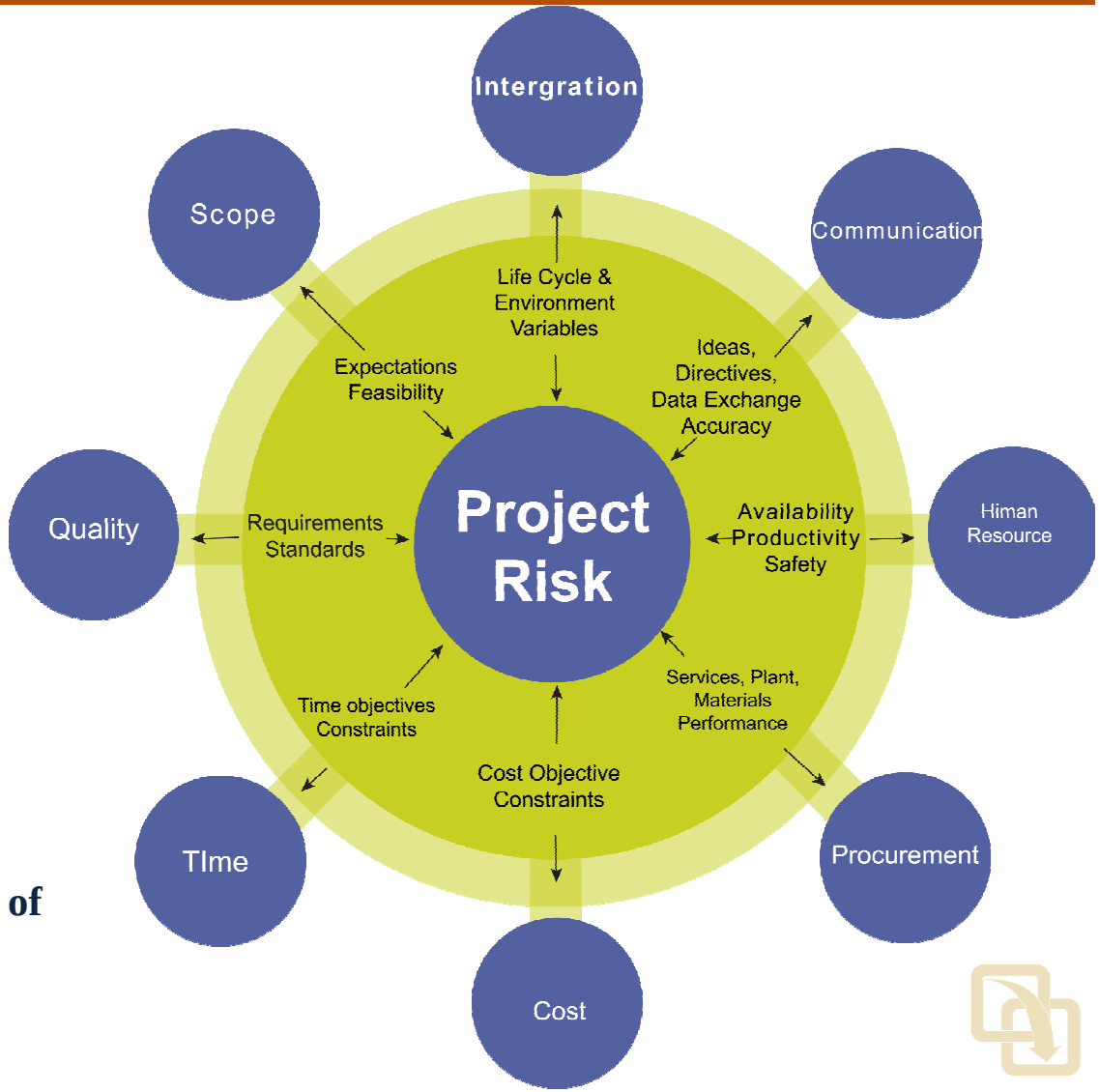
Risk Management

Identify opportunities and Risks

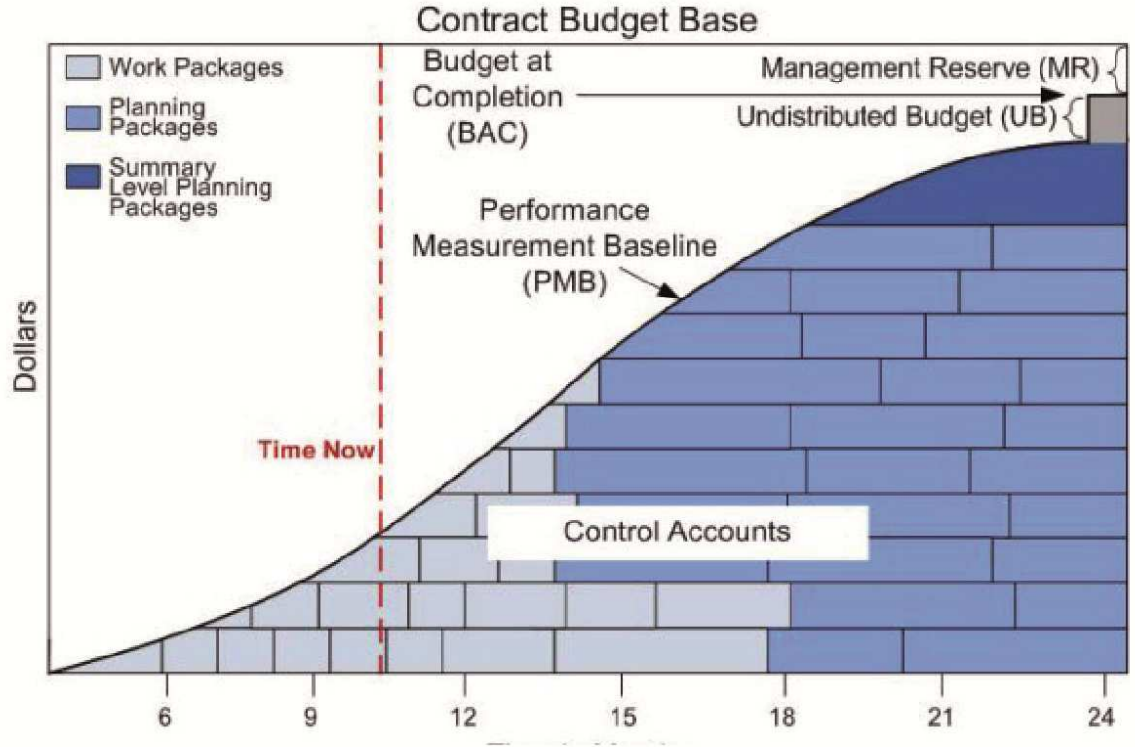
Mitigate risks

Incorporate in plan

- **Planners and cost engineers need to be integrally involved in risk workshops including;**
  - **HAZIDs / HAZOPs.**
  - **Value Engineering / Constructability**
- **Schedules provide models to enhance timeliness & quality of decision making**
- **Update the PMB to capture all impacts of changes once they are approved**



Rolling Wave Planning



Change Management Key Points

- **Change Management protects the project from unauthorised work**
- **Disciplined change management processes & short cycle times are vital for scope clarity & performance measurement**
- **Schedule provides a model for scenarios to support decision making with respect to proposed changes**
- **Design package risks need to minimised**
- **Weather risk (excluding force majeure) should be allocated to contractor to improve planning, align goals and reduce changes and disputes**
- **Process needs to be agile – e.g. templates for site variations that can be recorded with a smart phone**

Case Study Results

- Cost Performance Analysis
- Schedule Performance Analysis
- Cost and Schedule Performance Analysis Combined
- Improved Resource Forecast
- Interfaces
- Mitigation of Weather Impacts
- Delay and Disruption Analysis

Cost Performance Analysis

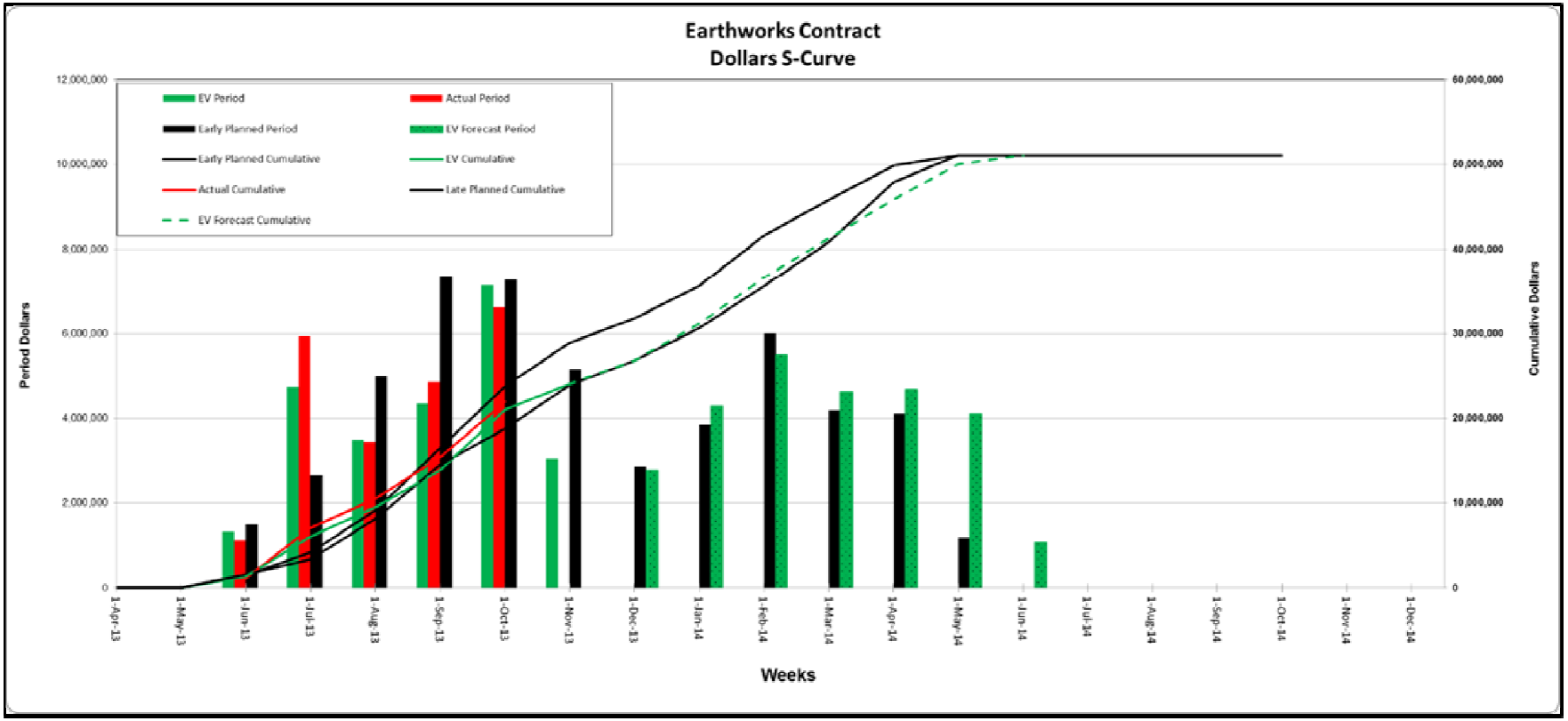
Cost performance management enables:

- Visibility of efficiency and identification of root causes
- Corrective actions to be taken
- Resource and cash-flow forecasts to be improved

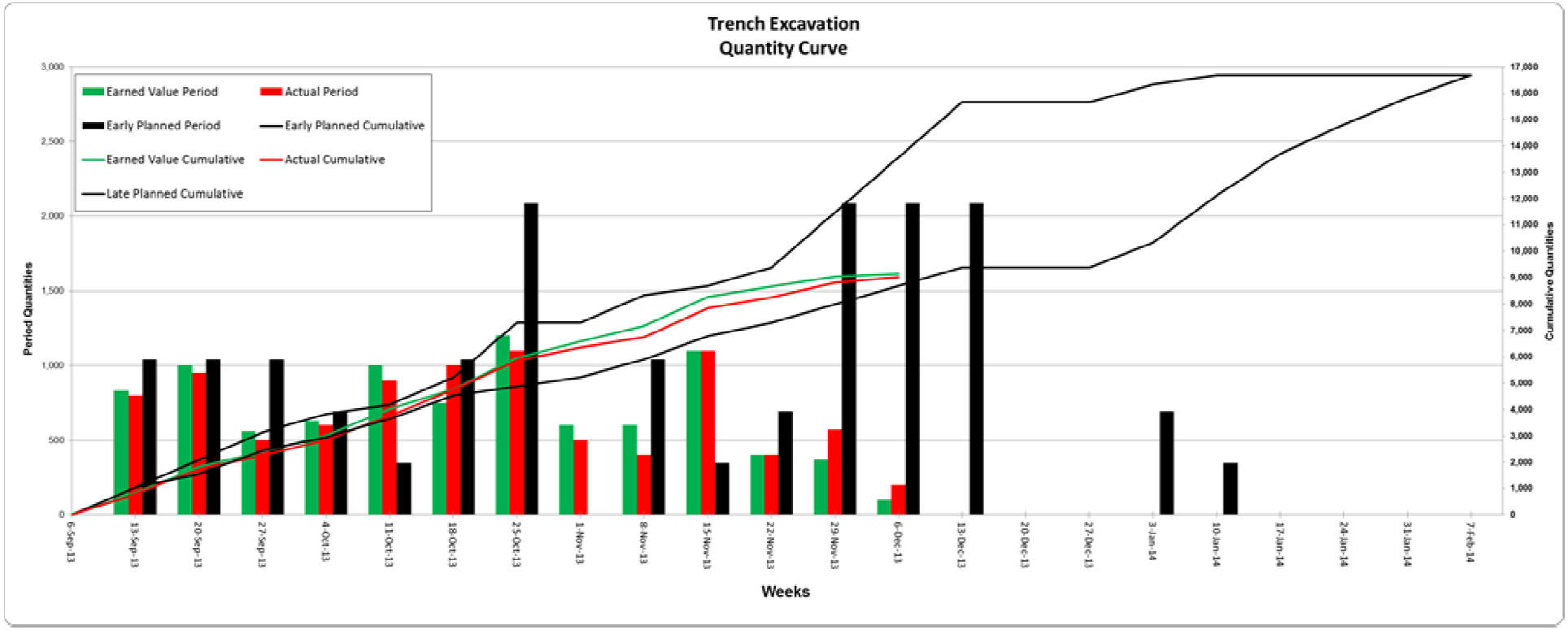
S-Curves and cost performance metrics can be based on quantities, dollars and man-hours to suit the information needs of different stakeholder groups.

Cost Performance Analysis

S-Curve in Dollars

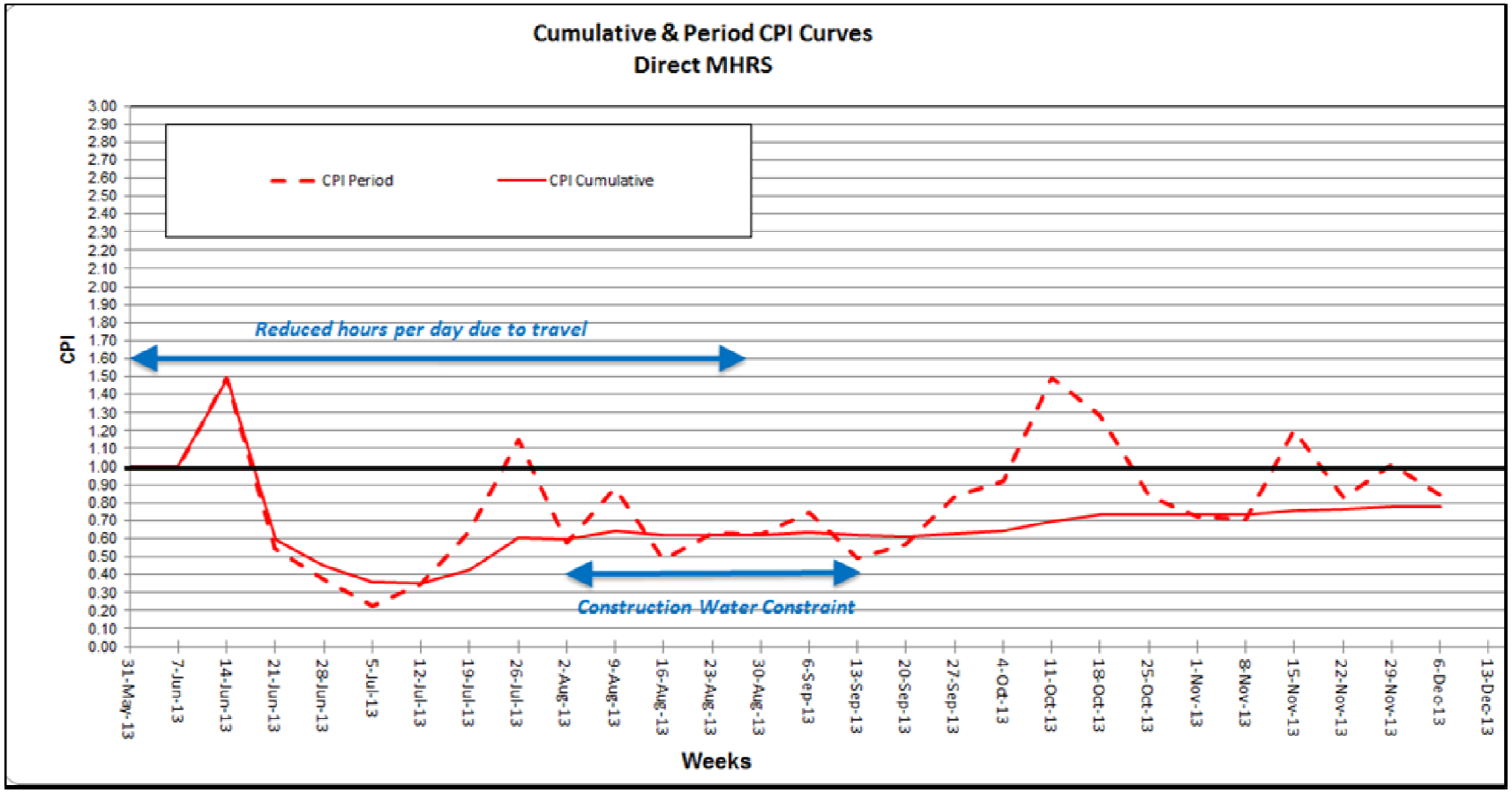


Quantity Curves



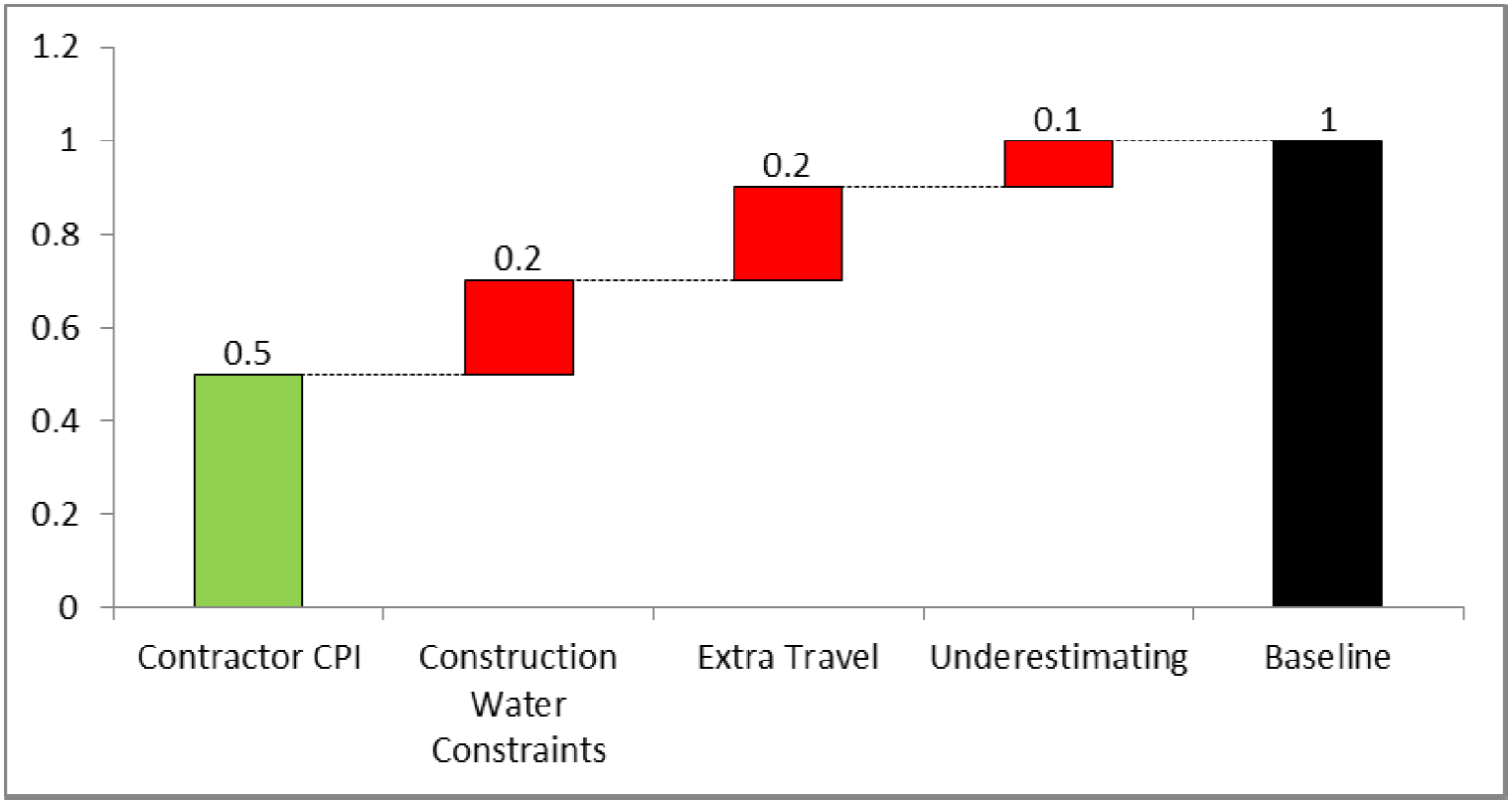
Cost Performance Analysis

Period and Cumulative CPI curve



Cost Performance Analysis

CPI (hrs) Analysis for one week



Schedule Performance Analysis

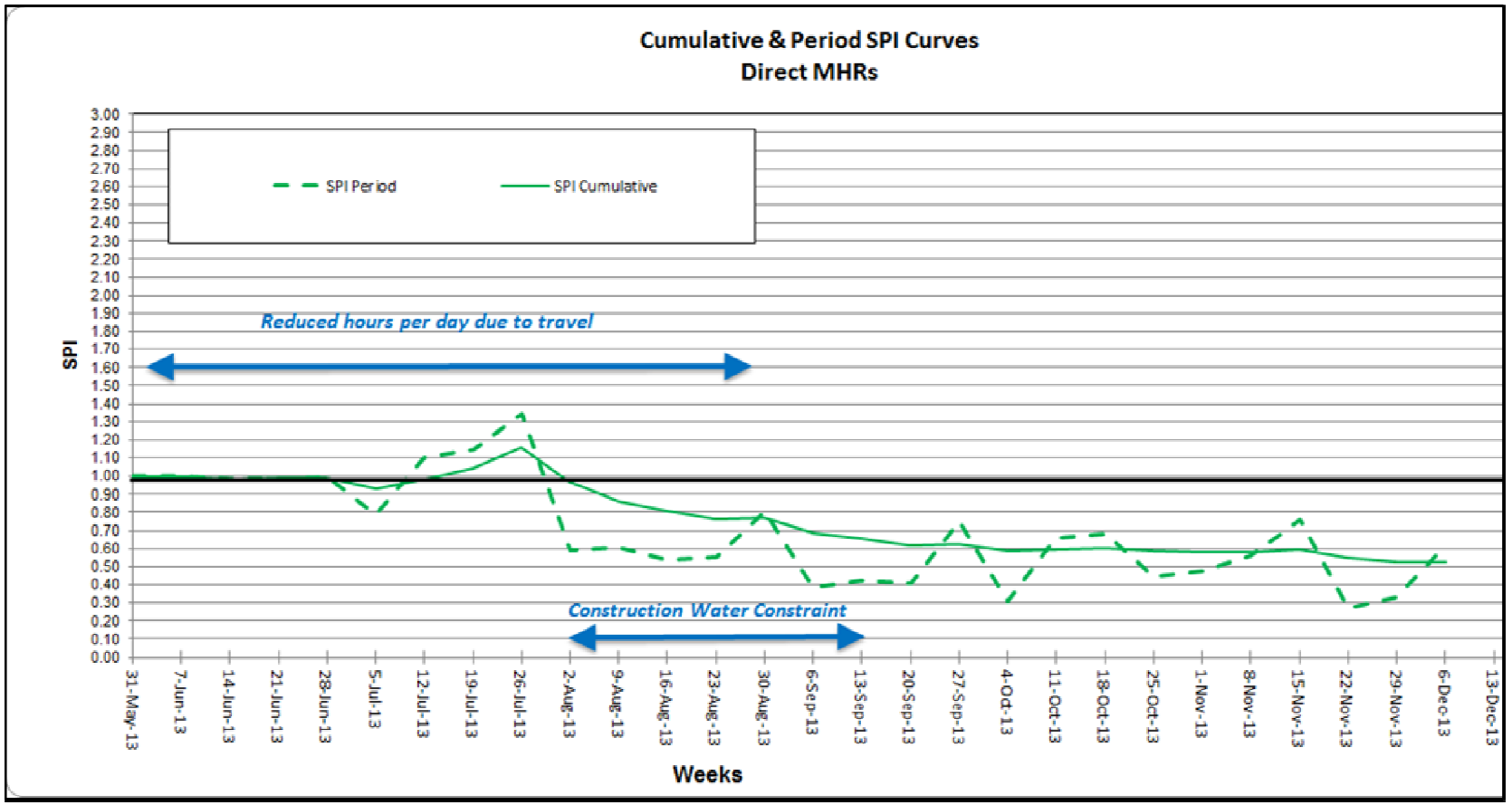
- SPI = EV/PV
- Earned Value and Planned Value expression in

  1- Dollars

  2- Hours

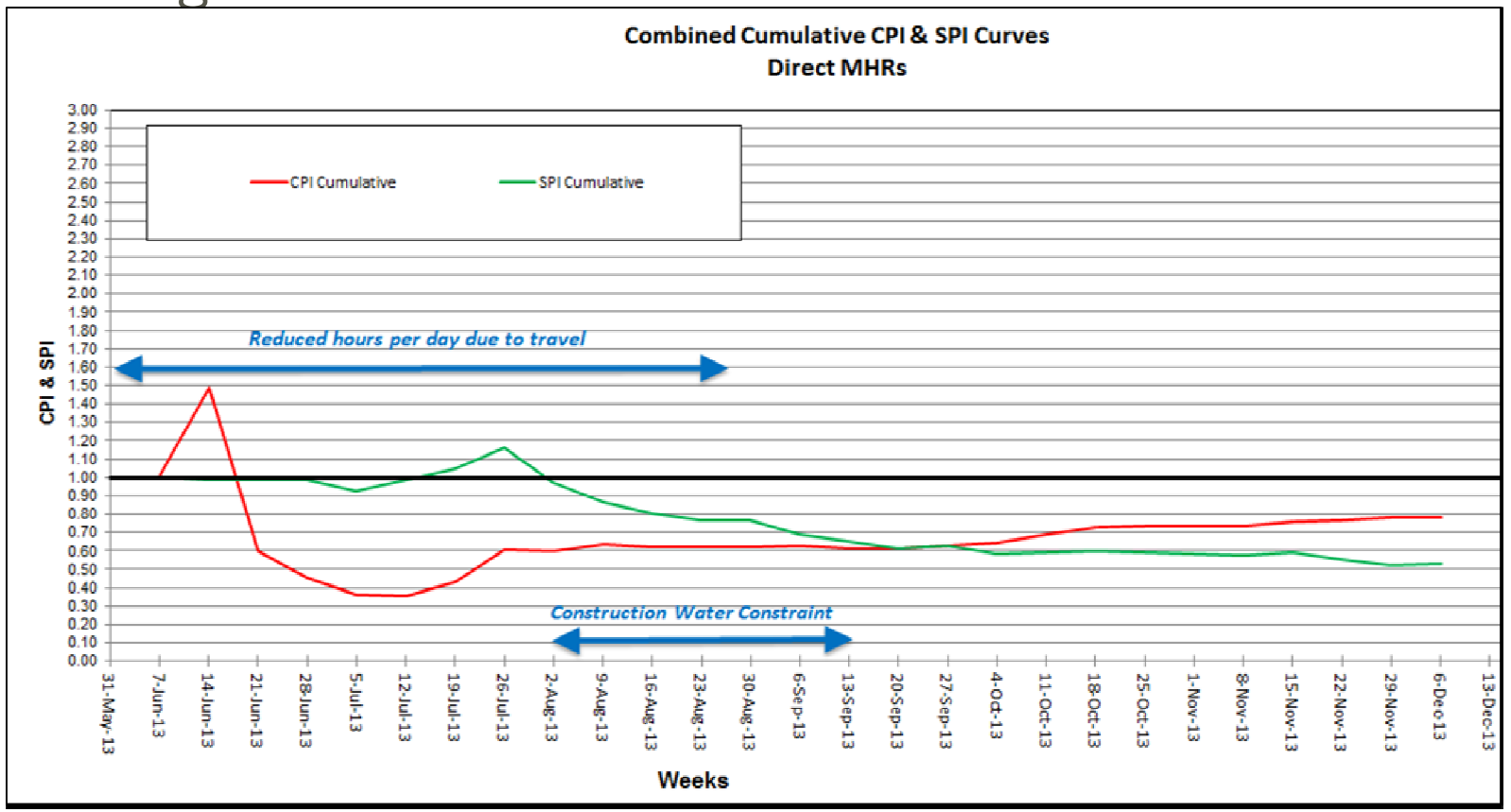
  3-Any other appropriate unit of measure for quantities (m^3, m^2, tonnes, units installed or man-hours)

Schedule Performance Analysis



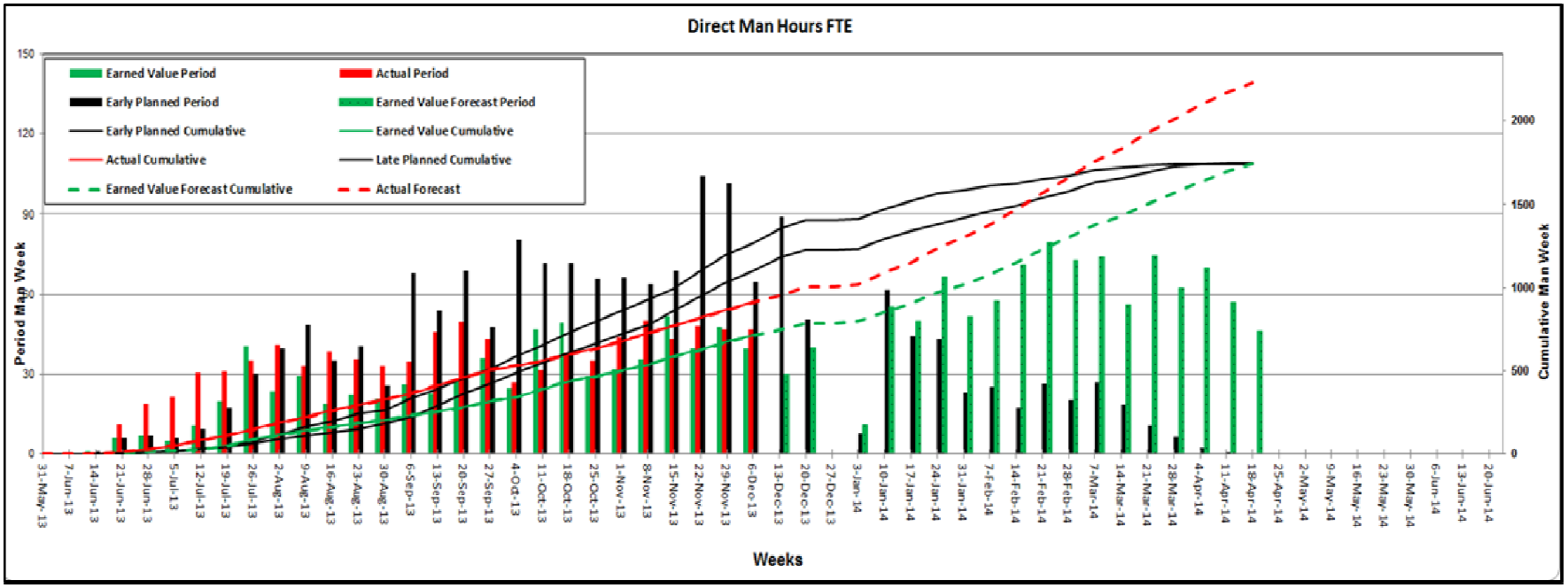
Cost and Schedule Performance Analysis

- Greater insights into the performance of the project than looking at either index in isolation.



Improved Resource Forecast

ETC Forecast = Remaining Budget/CPI

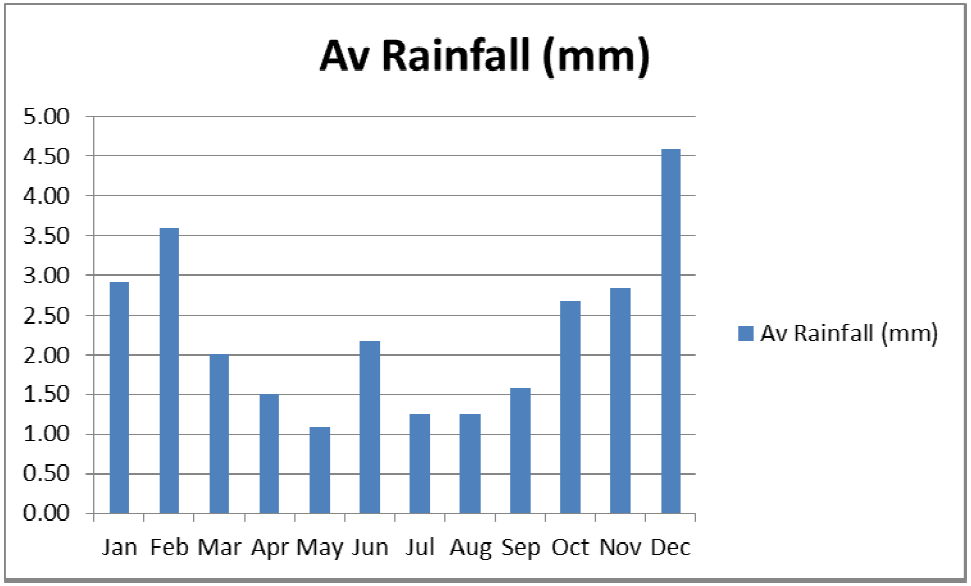


Key Interfaces

- Site access
- Traffic management on access roads
- Interfaces with existing operations
- arrival of free-issue materials and equipment on site
- Construction water availability
- Commissioning water availability

Analysis and Mitigation of Weather Impacts

Sample of Average Rainfall Chart:

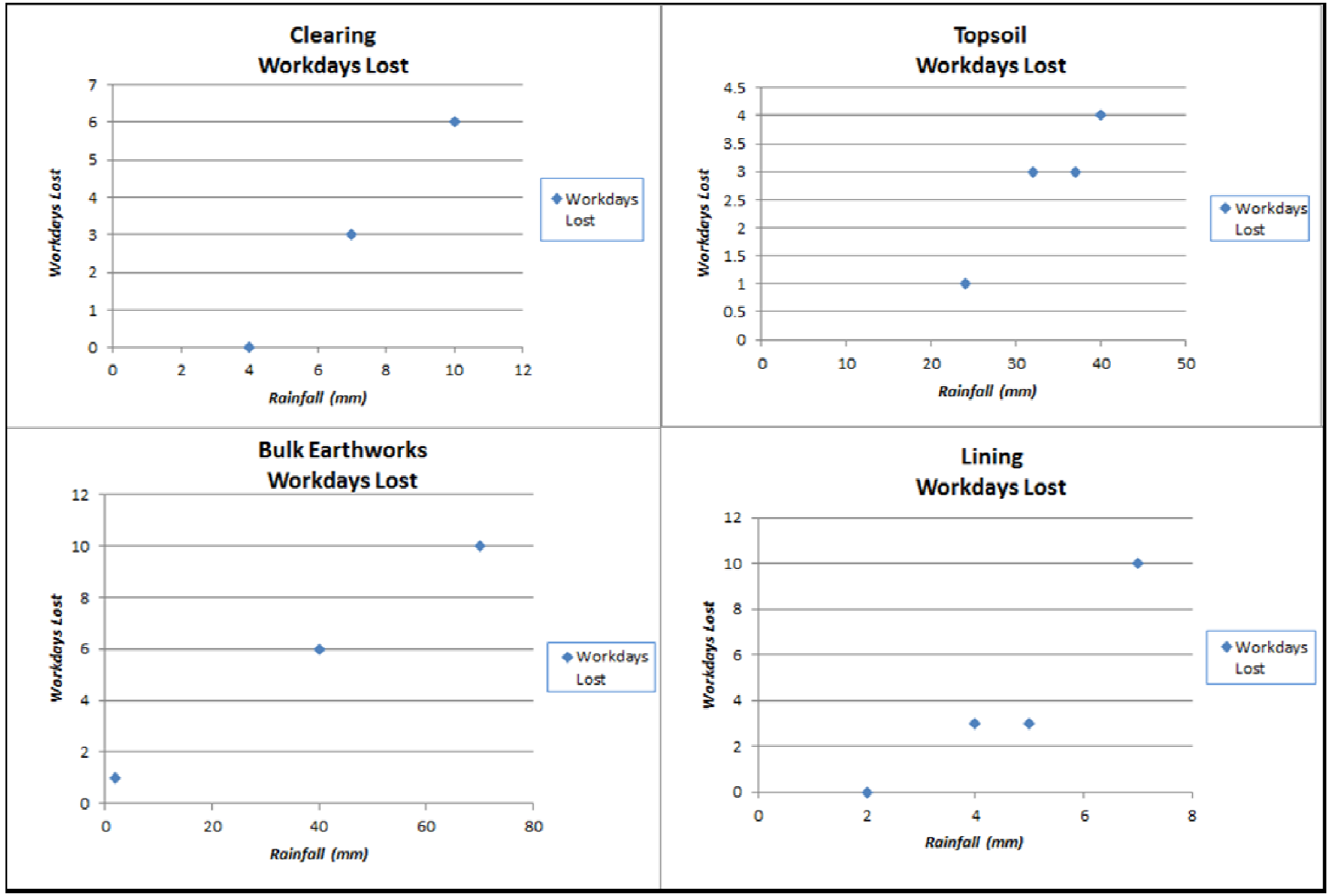


Contractor was proactively mitigating weather impacts e.g.

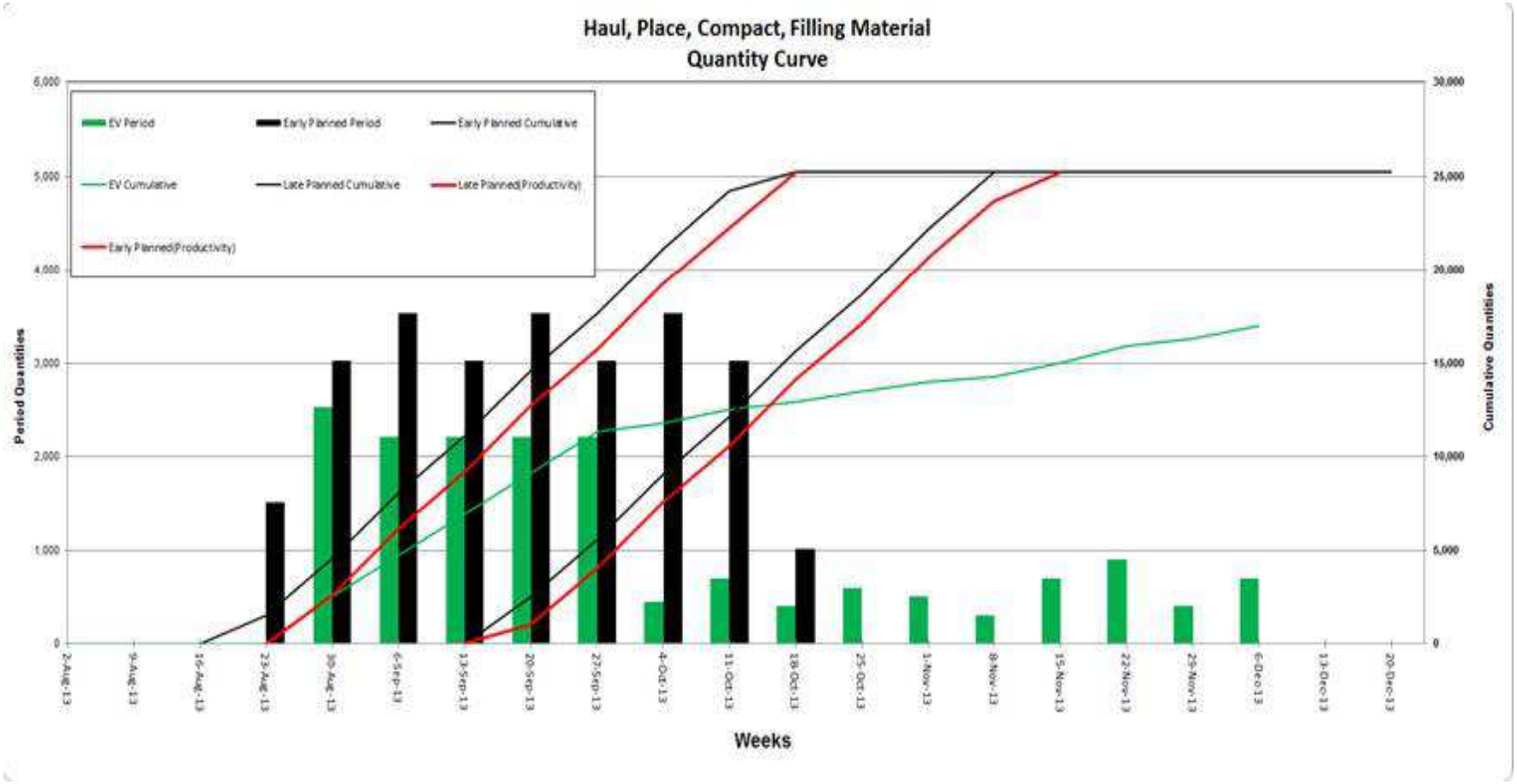
- Access Road Upgrades / laying gravel
- Procuring Pumps
- Contouring the worksite for water run off
- Suitable Sumps to remove water and Dams to transfer water to

Analysis and Mitigation of Weather Impacts

Civil Works Sensitivity to Rainfall:



Delay and Disruption Analysis



Discussion and Lessons Learned

- Structure
- The Drum Beat
- Tailoring reports for stakeholders
- Mitigation of Disputes
- Training

Structure

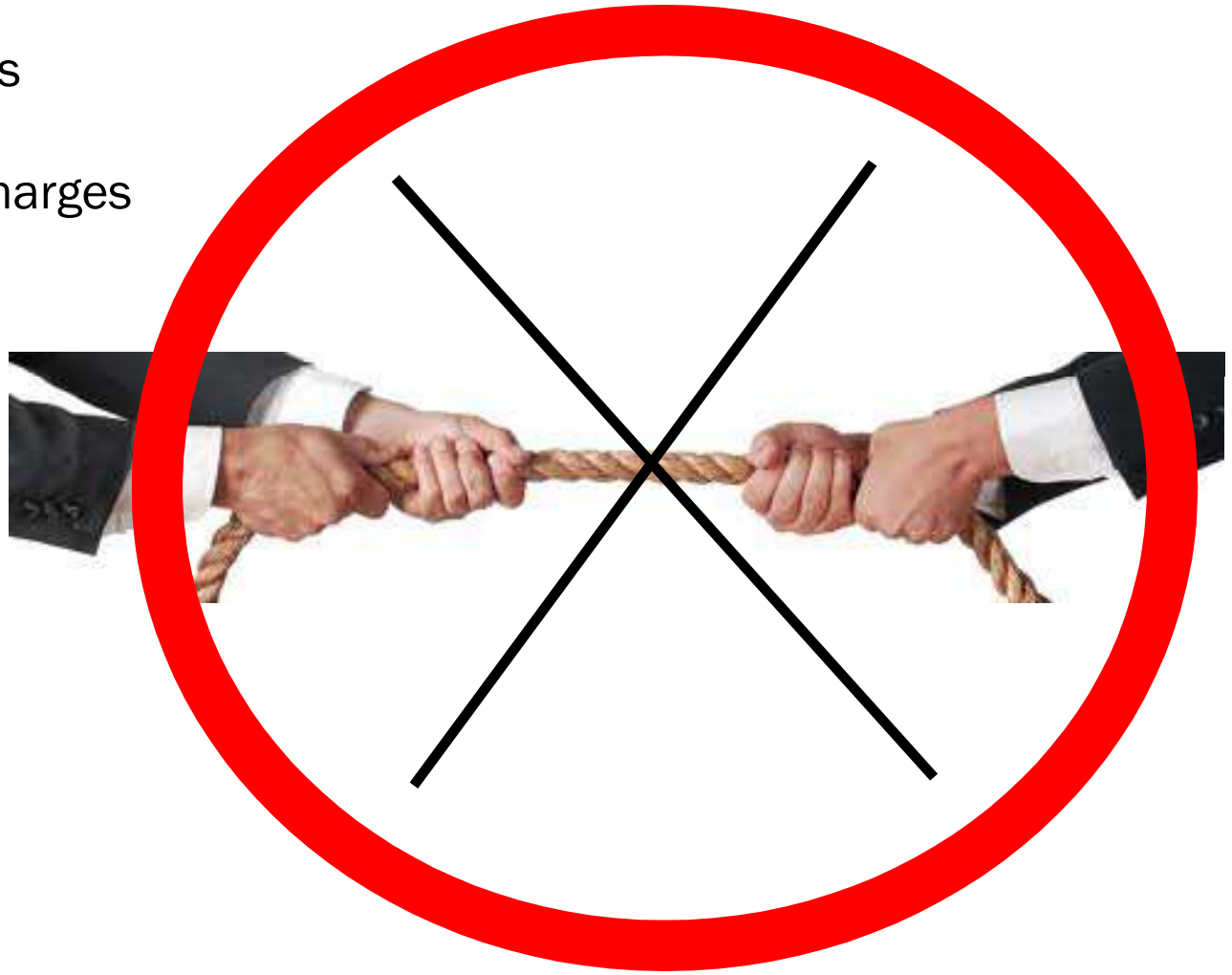
Successfully enabled;

- Common language between estimators, planners, cost engineers and contract administrators.
- Vertical alignment of lower level schedules and reporting with higher level schedules and reporting.
- Alignment between Owner's team and Contractors scheduling and progress claims processes.

The Drum Beat

Mitigation of Disputes

Progress Claims
EOTs
NCRs & Backcharges



Training

Stakeholders had differing knowledge and acceptance of EVM

We could have invested more in EVM Training early in the project


Questions