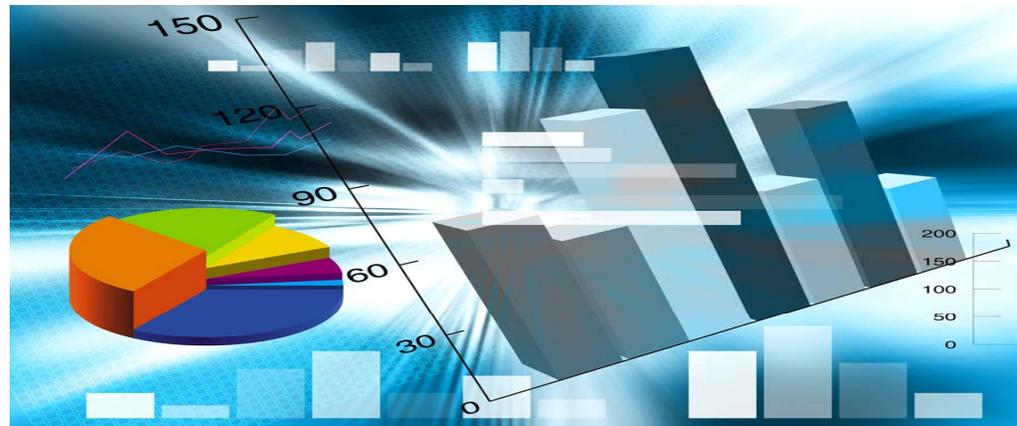


RISK ANALYSIS PROCESS TRAINING



Design Training Expo
Disney's Coronado Springs Resort
Lake Buena Vista, FL

Presentation Format

- **Risk Analysis Process Overview**
Greg Davis, PE
State Estimates Engineer
- **Risk Analysis Workshop**
Kurt Lieblong, PE, CVS
State Project Review Administrator
- **Project Manager Roles**
Rob Quigley, PE
State Project Management Engineer



What is Risk?

- Project Management Institute (PMI) Says:
“An uncertain event or condition that, if it occurs, has a positive or negative effect on the project’s objectives.”



What is Risk Management?

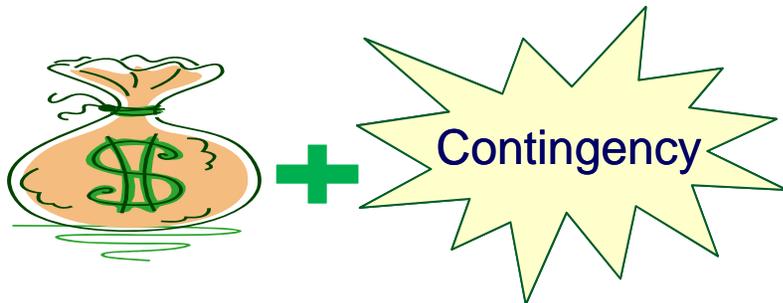


- The systematic process of identifying, assessing, and responding to risks in order to manage or reduce potential adverse effects on the achievement of program and project goals.
- **Goal:** To increase the likelihood of meeting on-time and on-budget project mandates.

Why Risk Analysis?

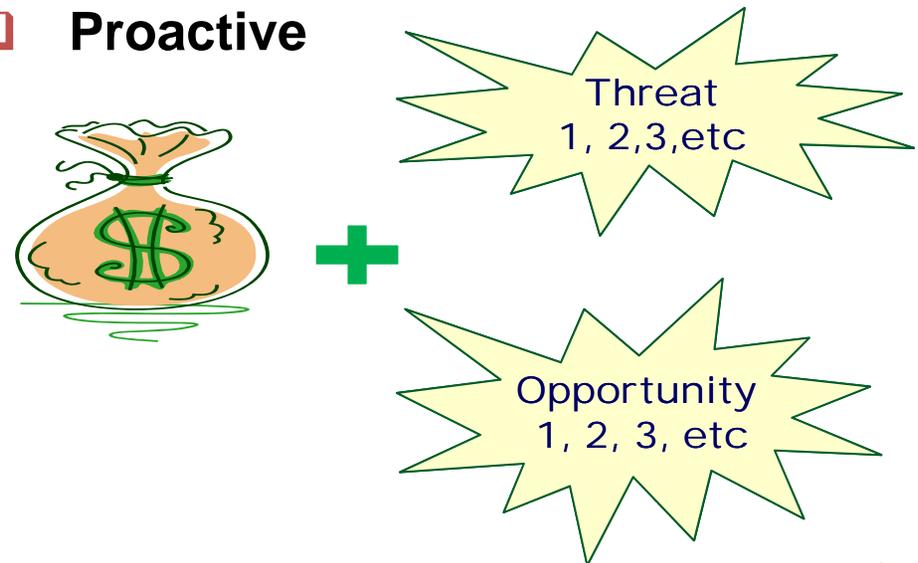
Traditional

- Contingency is intended to include all risk (known & unknown)
- Little control of cost and schedule
- Reactive



Risk-Based

- Risk are clearly identified and quantified
- Reasonable control of cost and schedule
- Proactive



Why Risk Analysis?

- Stabilize & Support Work Program with better cost estimates and schedules
 - Validate cost & schedule for accurate project delivery
 - Replace general project contingency with risk-based cost
 - Quantify District Work Program Contingency.
- Enhance Risk Assessment/Mitigation activities in Project Management
- Support FHWA requirement for financial plans on major projects by providing risk-based cost estimates

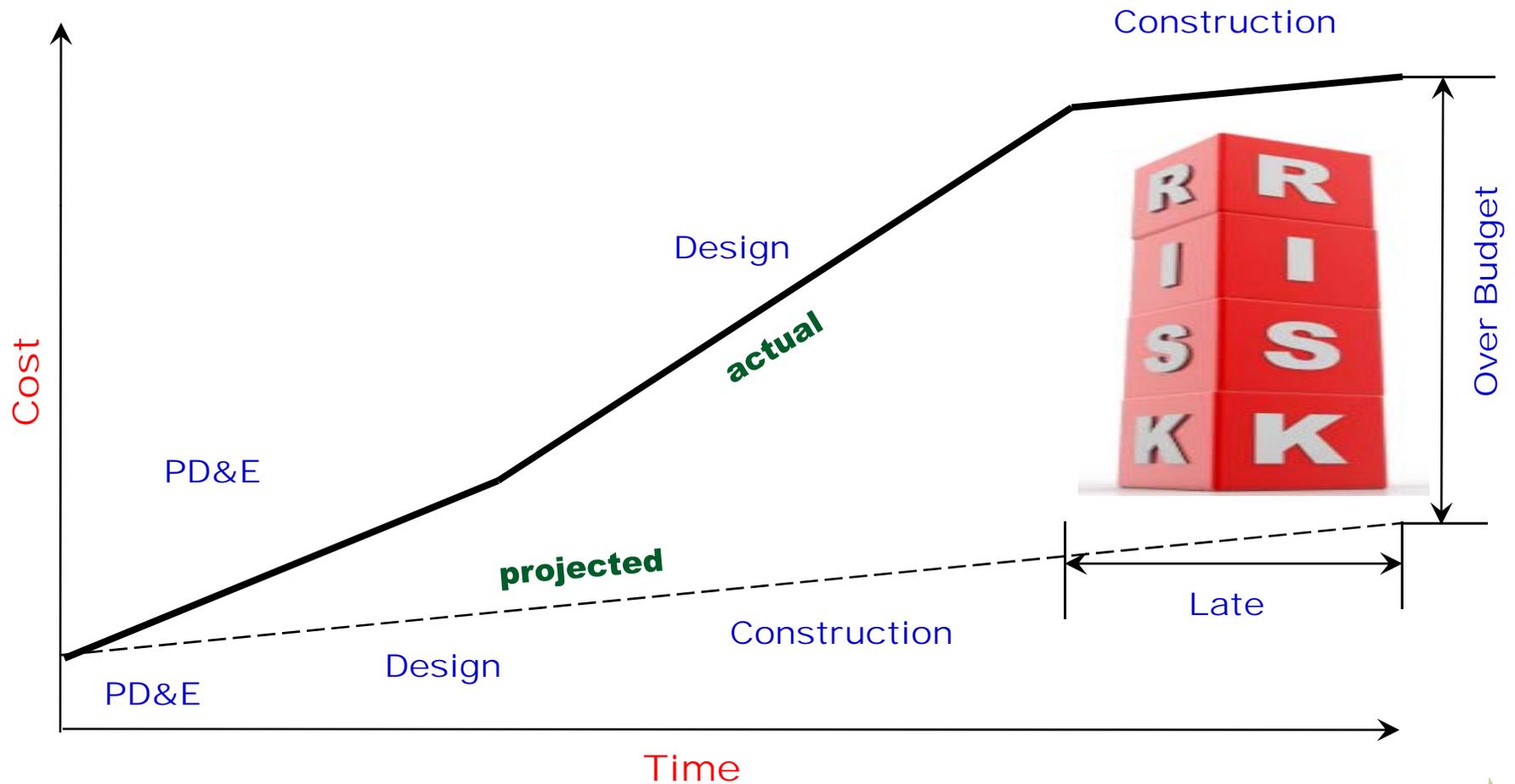


Why Risk Management?

- Encouraging pro-activity and early planning
- Building confidence and credibility in project's plans and estimates
- Developing targeted mitigation strategies for all anticipated threats
- Better allocation of risks and identification of project delivery methods
- Ensuring transparency, integrity, and accountability throughout the life-cycle of the project

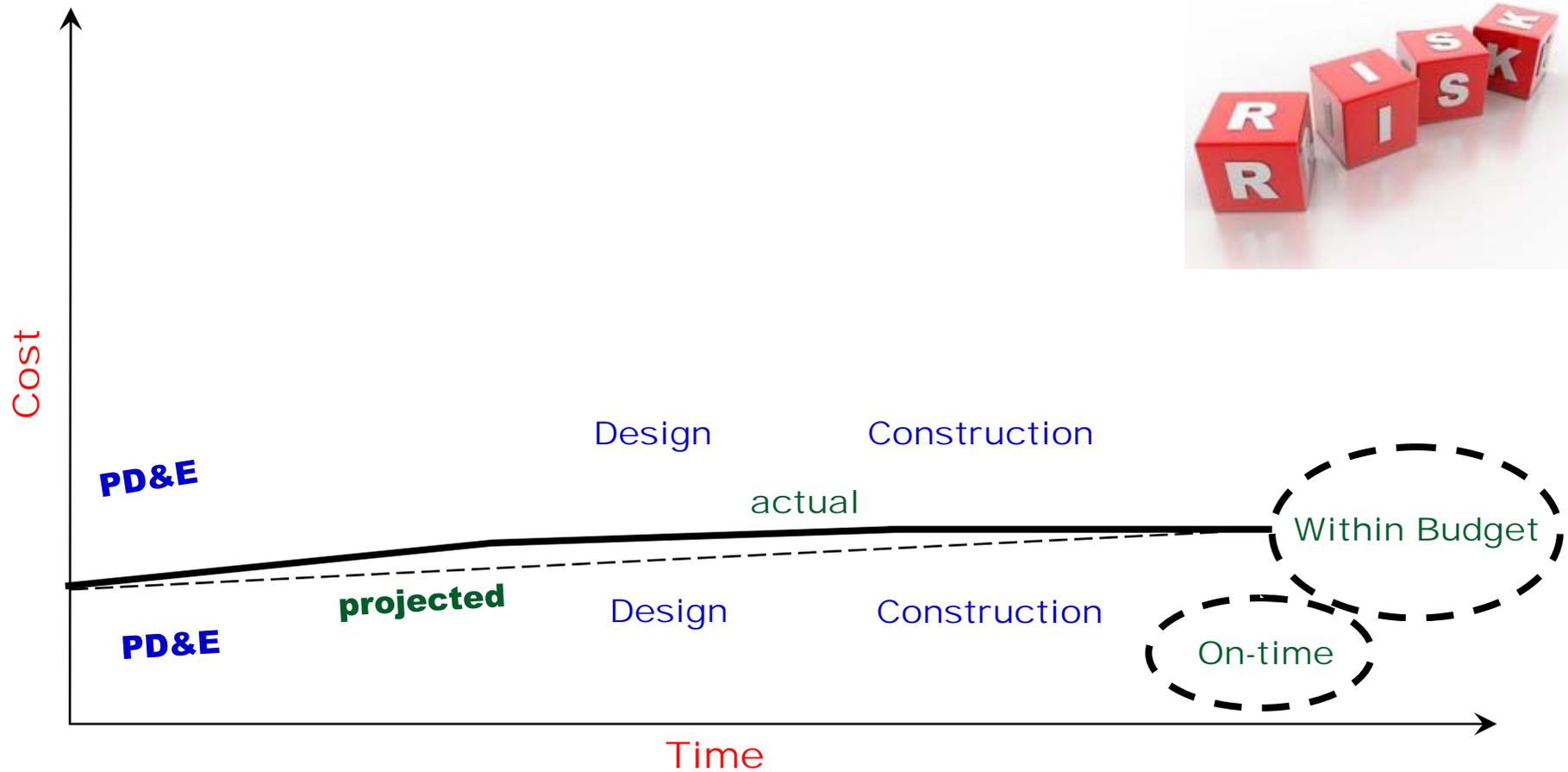
**Maximizing the Likelihood of Meeting
Time & Budget Goals**

Typical Project Scenario without Risk Management



Time
(nationwide trend)

Typical Project Scenario with Risk Management



(nationwide trend)

When to Use Risk Management

- Early planning and budgeting
- Evaluation of project delivery alternatives
- Financial Planning Support
- Establishing Risk Allocation between parties
- Preparation of project contract documents
- **Throughout Project Delivery Lifecycle**



Risk Management Objectives

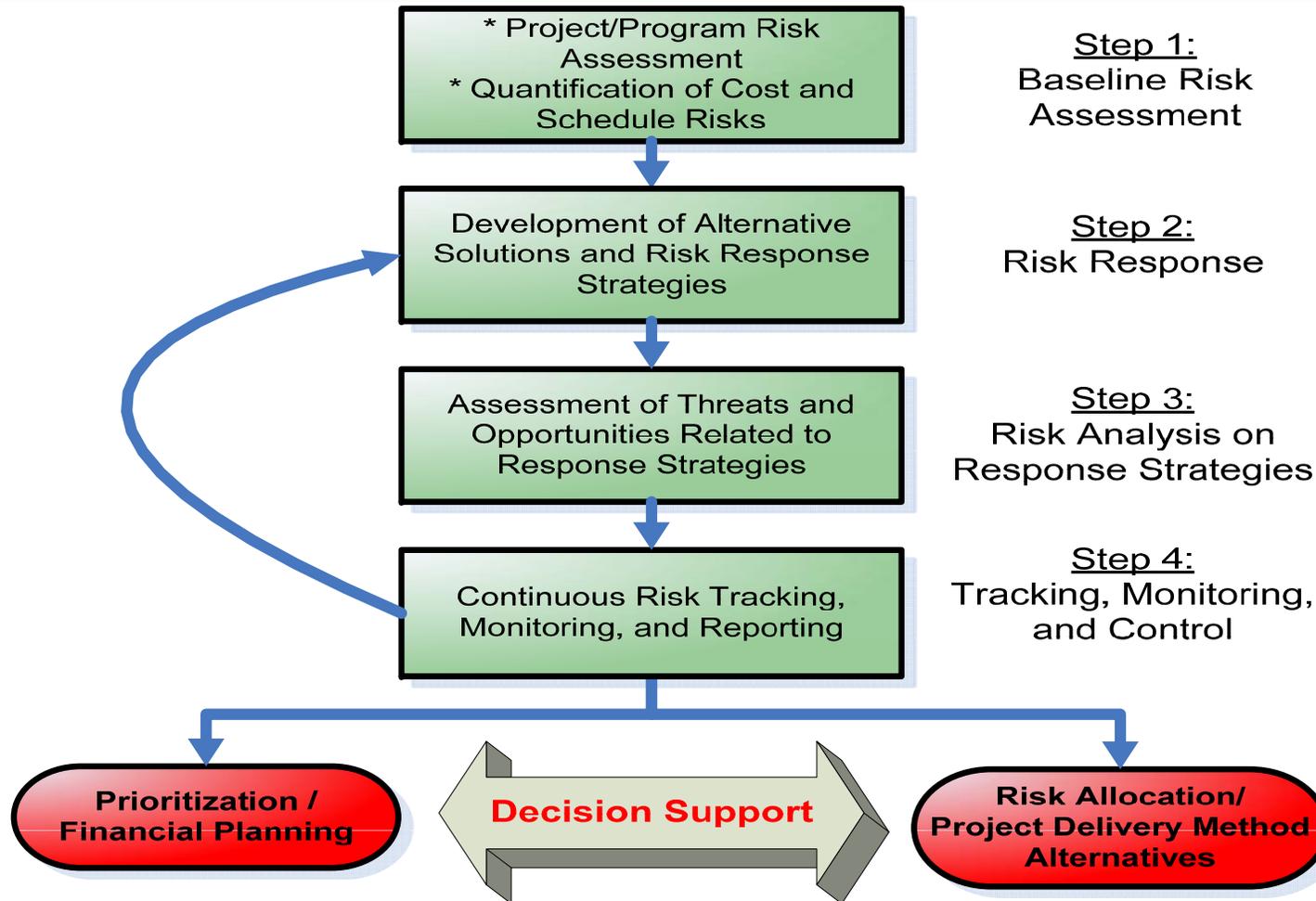
- “...to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project.”*
- Make better decisions
- Allocate risks to those who can best control them
- Increase agency credibility
- Foster good relationships with project stakeholders

* Source: PMI

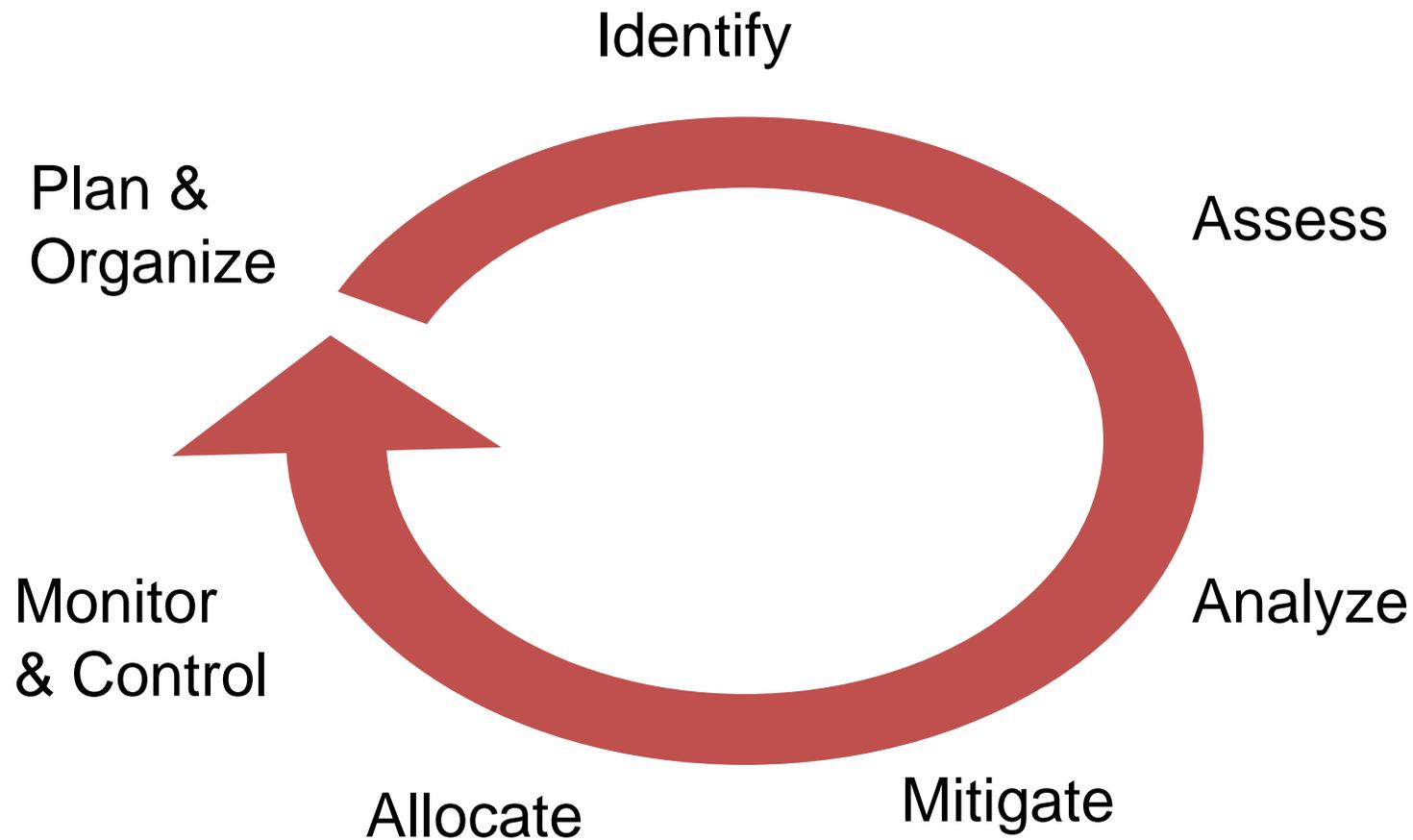
Risk Management Outcomes

- ❑ Validation of Project Cost and Schedule
- ❑ Managed Risk Response Plan
 - Identification of high cost and schedule risk drivers
- ❑ Managed District Contingency Box
 - Reduced Contingency as project evolves
- ❑ Understand and Communicate Cash Flow Requirements and Financial Plans

Risk Management Process



Risk Management Process



Risk Management Process

Plan & Organize

- Review purpose & need
- Gather project information & data



Risk Management Process

Identify

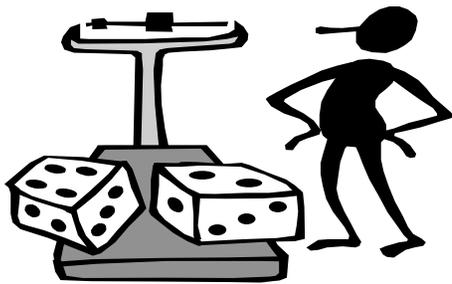


•Where to Start?

- Start-up Risk List
- Lessons Learned
- Project Knowledge
- Project History
- Brainstorming in Team Setting

Risk Management Process

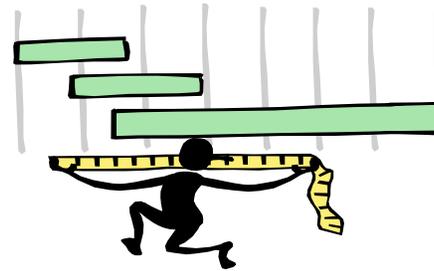
Assess



Probability

40%

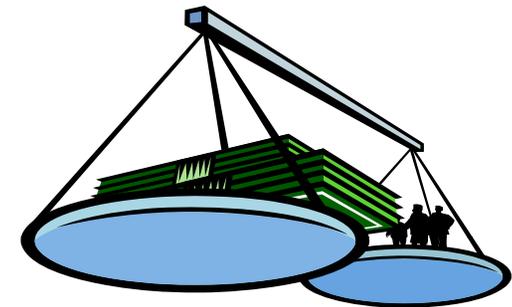
x



Impact to Schedule

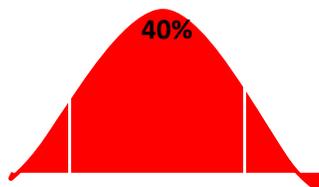
60 Days

and/or



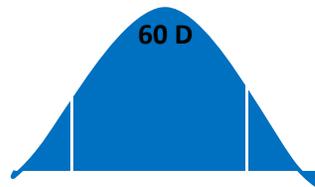
Impact to Cost

\$100,000



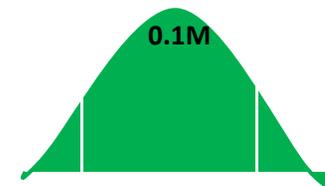
10%

90%



10%

90%



10%

90%

Risk Management Process

Qualitative Analysis

Likelihood of Occurrence (*Explanation/justification for rating*)

**Risk Likelihood
Assessment Guide**

Very High (VH)	0.7 to 1.0 (1:1)
High (H)	0.4 to 0.7 (2:3)
Moderate (M)	0.2 to 0.4 (2:5)
Low (L)	0.05 to 0.2 (1:5)
Very Low (VL)	0.0 to 0.05 (1:20)

Indications of Occurrence (*Red flags*)

Related Risks

Risk to Cost (*Explanation/justification for rating*)

**Cost Risk
Assessment Guide**

VH	>25% of project cost
H	10% to 25%
M	3% to 10%
L	1% to 3%
VL	<1%

Cost Risk	
Likelihood	Consequence
VH	L M H H H
H	L M H H H
M	L L M H H
L	L L M H H
VL	L L L M H
	VL L M H VH

Risk to Schedule (*Explanation/justification for rating*)

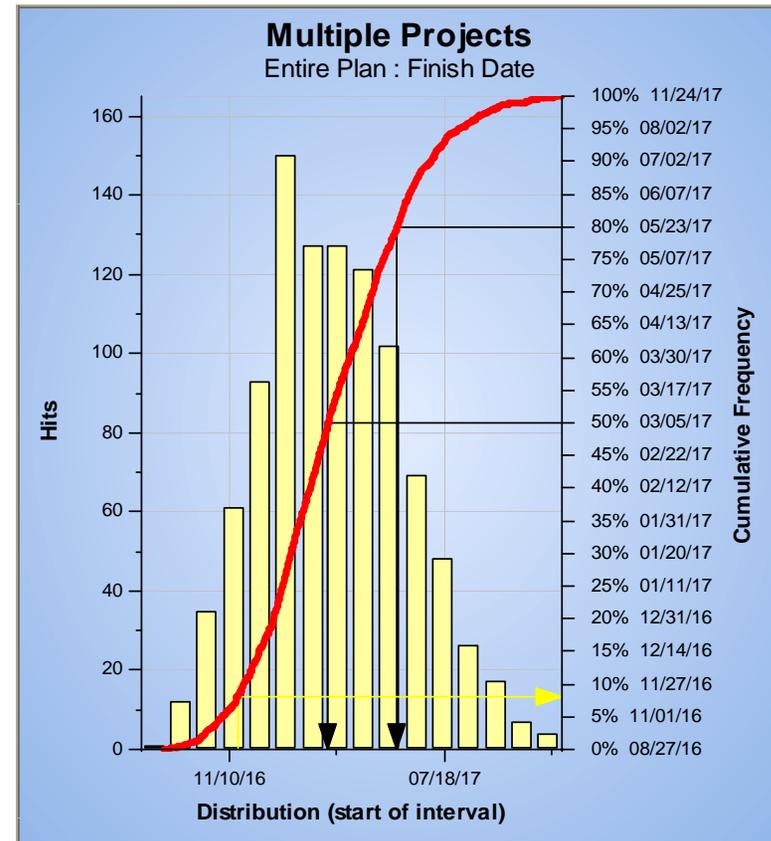
**Schedule Risk
Assessment Guide**

VH	>12 months
H	6 to 12
M	3 to 6
L	1 to 3
VL	<1

Schedule Risk	
Likelihood	Consequence
VH	L M H H H
H	L M H H H
M	L L M H H
L	L L M H H
VL	L L L M H
	VL L M H VH

Risk Management Process

Quantitative Analysis - Monte Carlo Simulation

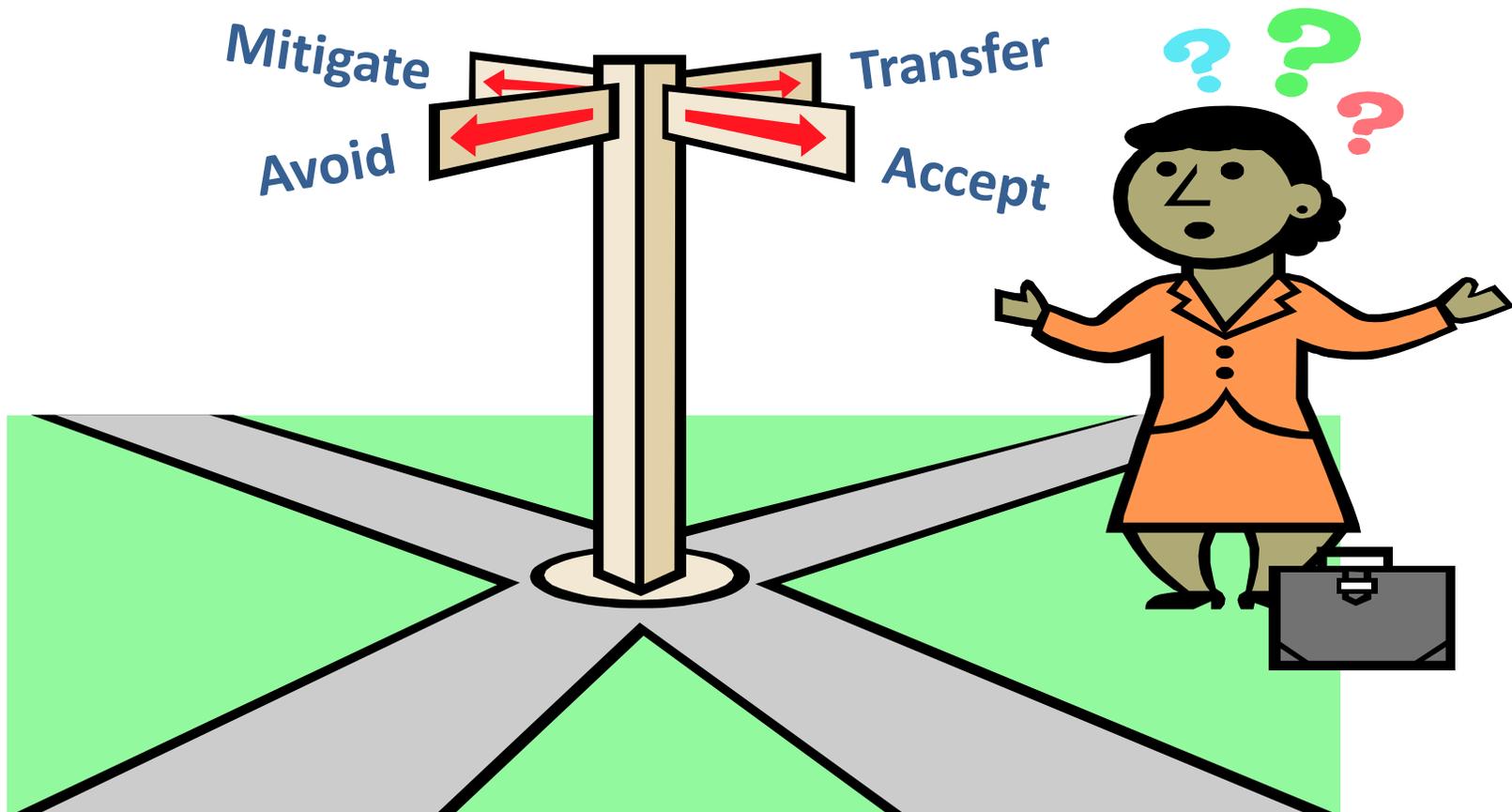


Source: Primavera Risk Analyst



Risk Management Process

Risk Response Strategies



Risk Management Process

Risk Response Strategies



“Hope is not a Strategy”

Risk Management Process

Allocation



Risk Management Process

Monitor & Control



The Big Picture

- Better Management of Program Contingencies
- Opportunity to Reallocate Funds
- Enables Cash-Flow Financial Management

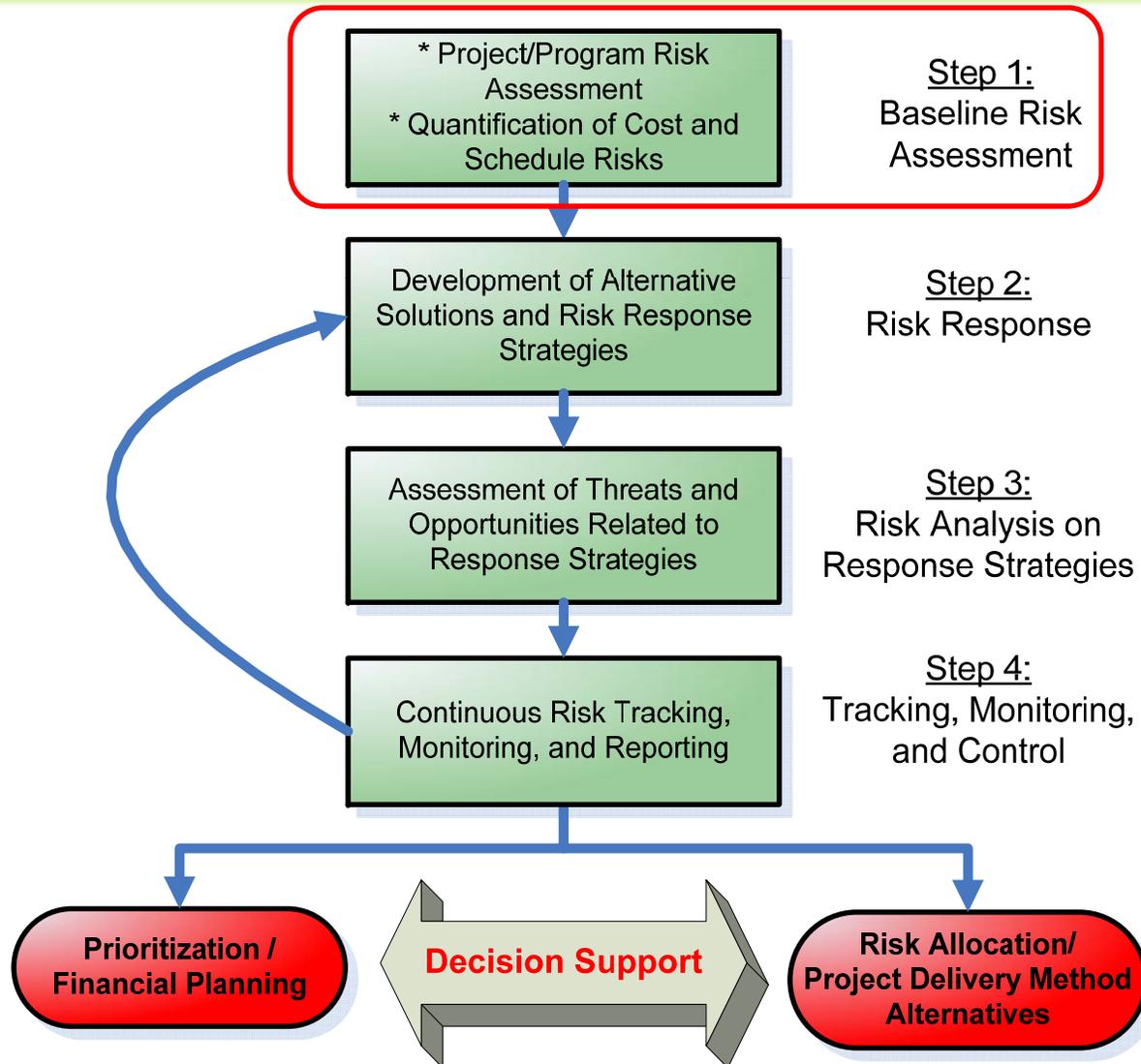


Risk Analysis

Risk Analysis Workshop

Kurt Lieblong

Risk Management Process Overview



Qualitative vs Quantitative Analysis?

- Risk Based Graded Approach Worksheet (total project cost \$20 million or less)
- Risk Analysis Self Modeling Tool (total project cost \$20 - \$50 million)
- Risk Analysis Workshop and Commercial Risk Modeling Program (total project cost greater than \$50 million)
- Consultant-led Workshop (complex or total projects greater than \$500 million)

Risk Based Graded Approach Worksheet

ITEM	RISK ELEMENT	RISK ASSESSMENT	PRIORITY	TOTAL
1	Utility Involvement	1	3	3
2	Project Schedule	5	5	25
3	Interfaces	3	1	3
4	Experience/Capability	3	3	9
5	Right-of-Way Involvement	5	5	25
6	Environmental Impacts/Contamination	1	1	1
7	Regulatory Involvement	3	3	9
8	Contractor Issues	5	3	15
9	Resource and Material Availability	3	3	9
10	Project Funding	1	1	1
11	Political Visibility	3	5	15
12	Public Involvement	3	3	9
13	Safety	3	3	9
14	Construction Complexity	1	1	1
15	Weather Sensitivity	3	1	3

Risk Score

137

Low Risk	0 - 90
Medium Risk	90 - 150
High Risk	>150

Baseline Risk Assessment

- Review base cost and schedule estimate and scope
- Validate base cost estimate
- Develop project flowchart
- Conduct Risk Assessment Workshop to identify and quantify risk factors
- Identify or Develop Cost Escalation Factors
- Develop Risk Analysis Model
- Produce Cost and Schedule Risk-Adjusted Results
- Ranking of key risk factors

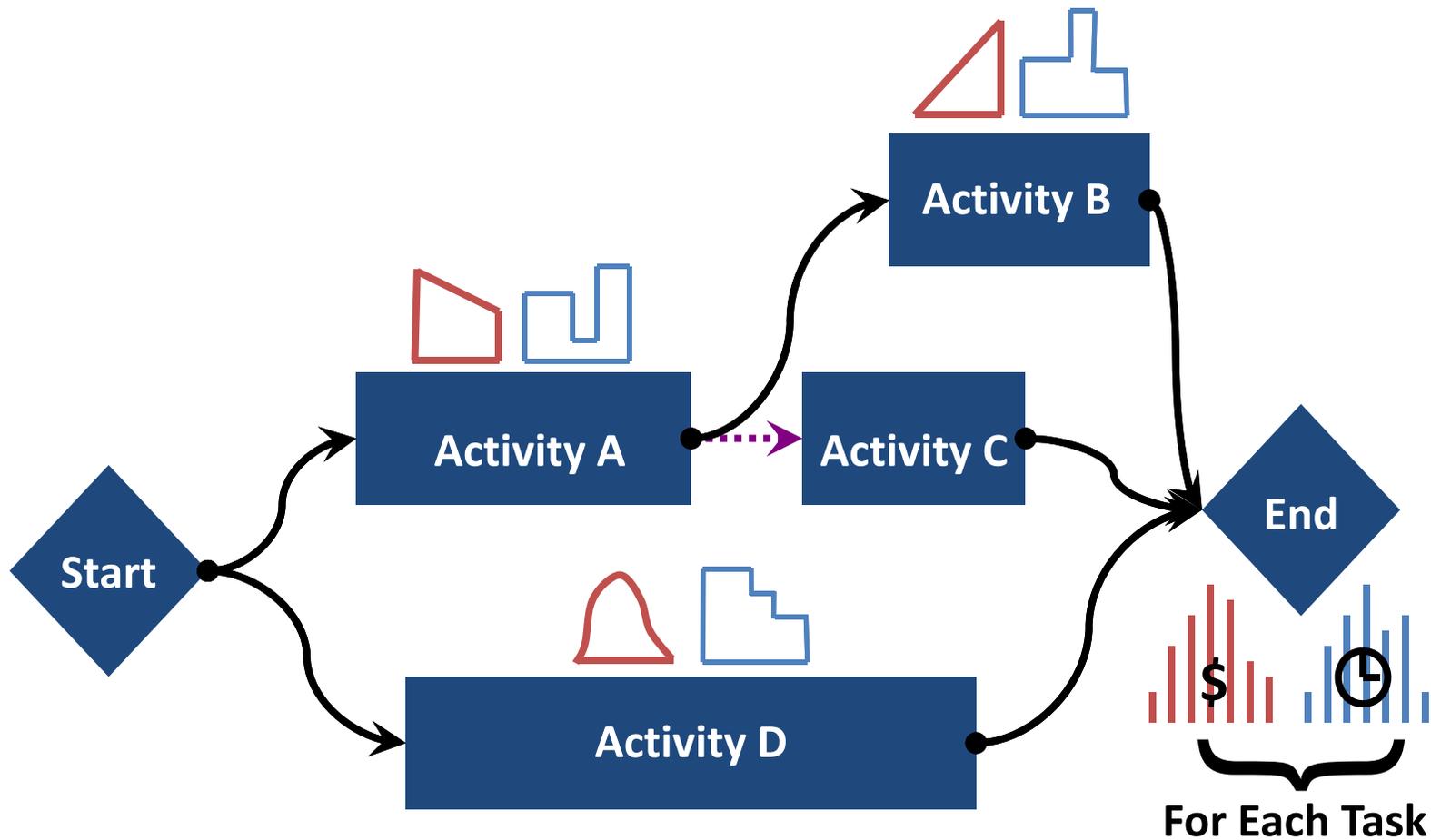
Cost Risk Analysis Workshop

- ***Preparation Session*** with the project team to Educate, Plan, Set the stage, and Build expectation with the project team.
- ***Workshop*** to elicit project characteristics and develop understanding, solicit inputs, develop ranges, identify and quantify risk factors, identify opportunities, and develop mitigation strategies.
- ***Modeling and reporting*** to summarize all the project aspects in terms of risk as applied to: budget, schedule, and management plan.

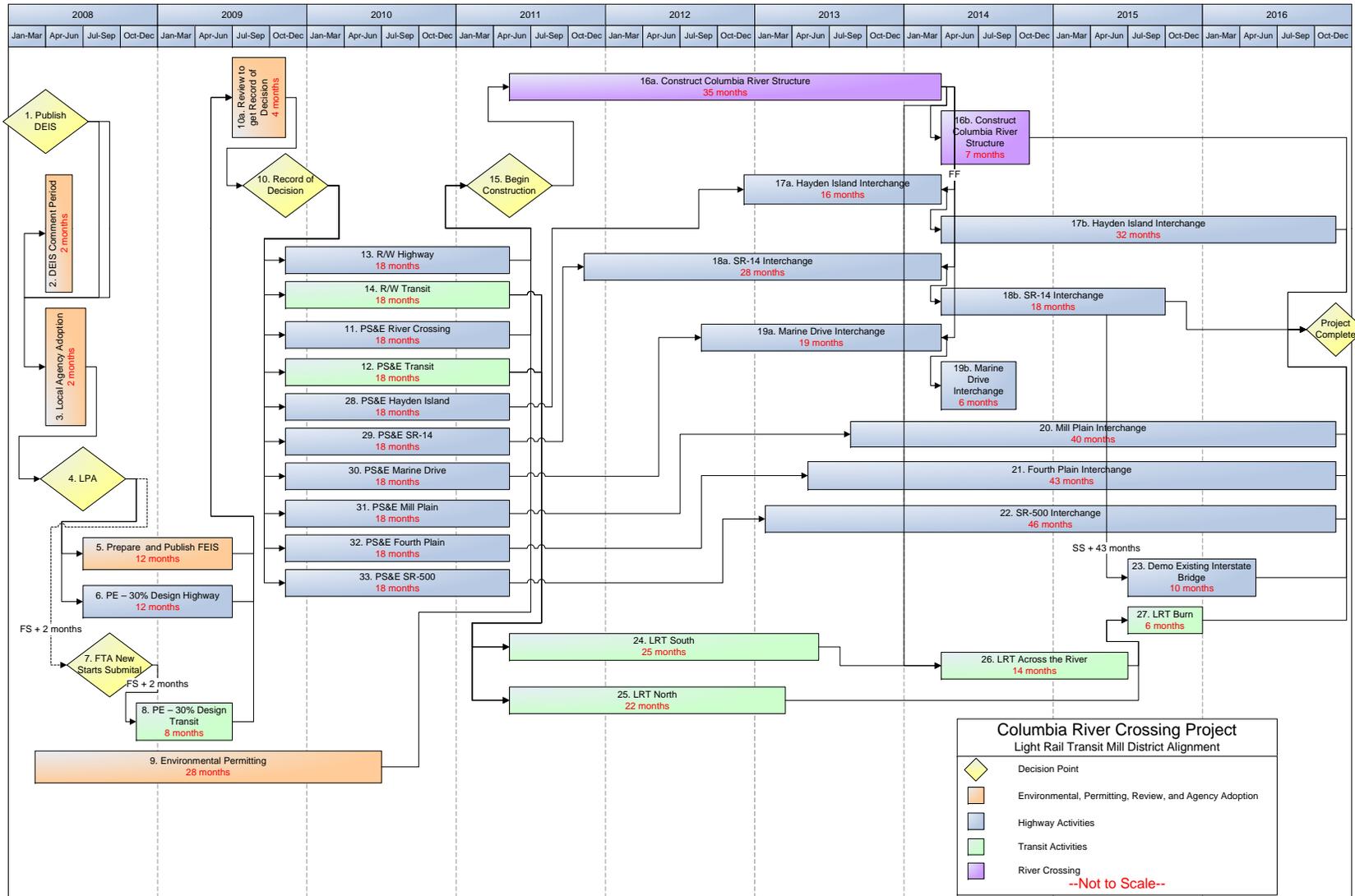
Preparation Session

- Risk Assessment Process overview
- Presentation of the project overview
- Building a flowchart diagram to serve as the backbone for the analysis
- Discuss base cost estimates
- Develop initial list of risks
- Assign tasks to the project team
- Set the agenda for the workshop

Risk Analysis Flowchart



Flowchart – An Illustration



Principles of the Risk Assessment Workshop Approach

- Collaborative, team approach
- Look at all project costs, including design, right-of-way, and construction
- Define threats and opportunities individually (to the extent possible)
- Provide broad flexibility to represent uncertainty and correlation
- Identify risk management strategies

Objectives of the Workshops

- Assess the project risk to account for uncertainty surrounding scope, cost and schedule;
- Elicit information on the cost and schedule risks associated with the project; and
- Full re-baseline of cost estimates, identification of risk factors, and development of mitigation strategies.

Workshop

- Structured Workshops to Build Consensus Among Various Stakeholders
- Engagement of Internal and External Subject-Matter Experts
- Sessions by Functional Assignment to:
 - Identify Risks
 - Quantify Risks
 - Discuss Risk Response and Mitigation Strategies

Who Should Attend Workshop

- Project Manager
- External Subject Matter Experts
- Internal and External Stakeholders
- Disciplines
 - Construction
 - Bridge & Structures
 - Environmental
 - Right of Way
 - Geotechnical
 - Construction
 - Utilities
 - Local agencies
 - Others depending on project scope

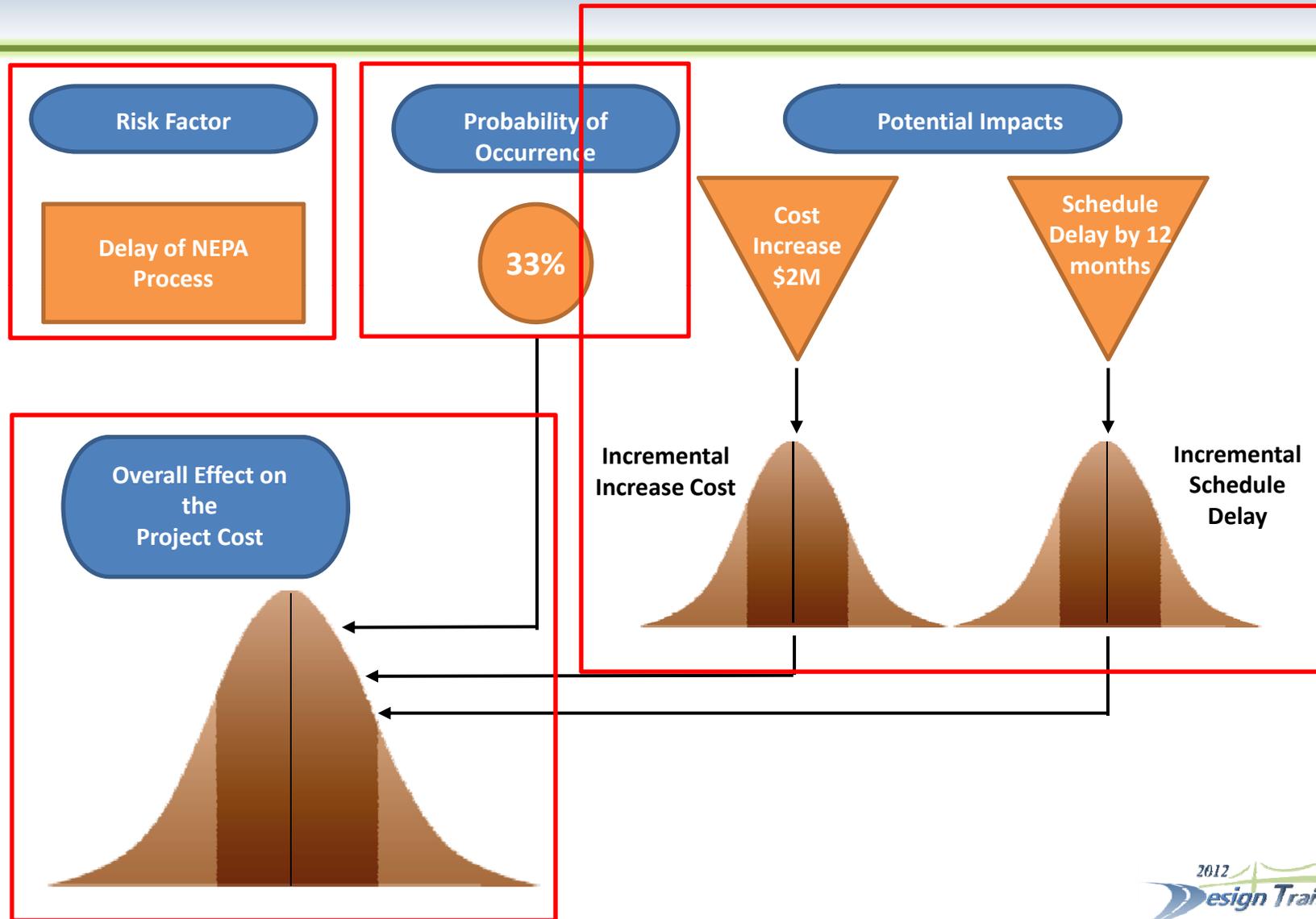
Project Team Roles

- Provide Project Information:
 - Project location maps, overheads, etc.
 - Project cost estimate and backup
 - Design and construction schedule or flow chart
 - Develop comprehensive list of risks, typically using starter risk list
- Workshop Support:
 - Provide input on risk identifying, quantification and mitigate
 - Provide information on project history and key decisions as these items come up in discussion

Type of Risks

- **Budget Risks** (base cost uncertainty)
 - Risk that budget elements will deviate from the estimate.
 - Examples: deviations in unit prices, deviations in quantities.
- **Event Risks**
 - Risk of internal or external events that force the project team to work beyond the estimate just to meet the Project Scope and SOW.
 - Examples: Extreme weather, contractor non-performance.
- **Scope Risks**
 - Risk of significant changes to project scope due to external pressures.
 - Examples: community pressures for changes in alignment.

Quantifying Individual Risks



Risk Register: Risk Identification

Risk Register for I-4						Initial Risk Quantification												
Risk Information						Cost Risk Information (Millions \$)						Schedule Risk Information (Months)						
Record #	Risk ID	Risk Agenda Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
1	DES 01	Design, Structures, and Geotech Risks	118	Add South Street Modification	Need mod to make plan work. Additional construction cost. Related ROW is being purchased separately. From URS estimate, \$93.4M plus ROW (which is already captured in the base ROW numbers). Includes related utility risk (FDOT is paying, so unlikely to significantly affect schedule).	100%	\$93.40	\$93.40	\$93.40				0	0	0			

Risk Register for I-4

Risk Information																		
Record #	Risk ID	Risk Agenda Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
1	18	21	22	23	24								0	0	0			
1	DES 01	Design, Structures, and Geotech Risks	118	Add South Street Modification	Need mod to make plan work. Additional construction cost. Related ROW is being purchased separately. From URS estimate, \$93.4M plus ROW (which is already captured in the base ROW numbers). Includes related utility risk (FDOT is paying, so unlikely to significantly affect schedule).	100%	\$93.40	\$93.40	\$93.40				0	0	0			
12	PS-A	Design, Structures, and Geotech Risks	117, 118, 119 (Cost), 104 (Schedule)	agreements with local governments (A)	agreement, and/or save costs if no agreement (down to 1% of construction costs). Potential (mutually exclusive) scenarios: A, as planned B, no agreement (save costs) and no delay C, delay in agreement D, delay and then no agreement (save costs)	85%	\$0.00	\$0.00	\$0.00				0	0	0			

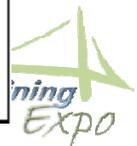


Risk Register: Risk Quantification

Risk Register for I-4						Initial Risk Quantification												
Risk Information						Cost Risk Information (Millions \$)			Schedule Risk Information (Months)									
Record #	ID #	Risk Agenda Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
1	DES 01	Design, Structures, and Geotech Risks	11B	Add South Street Modification	Need need to make plan work. Additional construction cost. Related ROW is being purchased separately. From USIS estimate. (\$1.4M plus ROW (which is already captured in the base ROW numbers). Include related utility risk (FOOT is paying, so unlikely to significantly affect schedule).	100%	\$93.40	\$93.40	\$93.40				0	0	0			

Initial Risk Quantification												
Initial Probability of Occurrence (%)	Cost Risk Information (Millions \$)						Schedule Risk Information (Months)					
	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
29	30	31	32	34	35	36	38	39	40	42	43	44
100%	\$93.40	\$93.40	\$93.40				0	0	0			

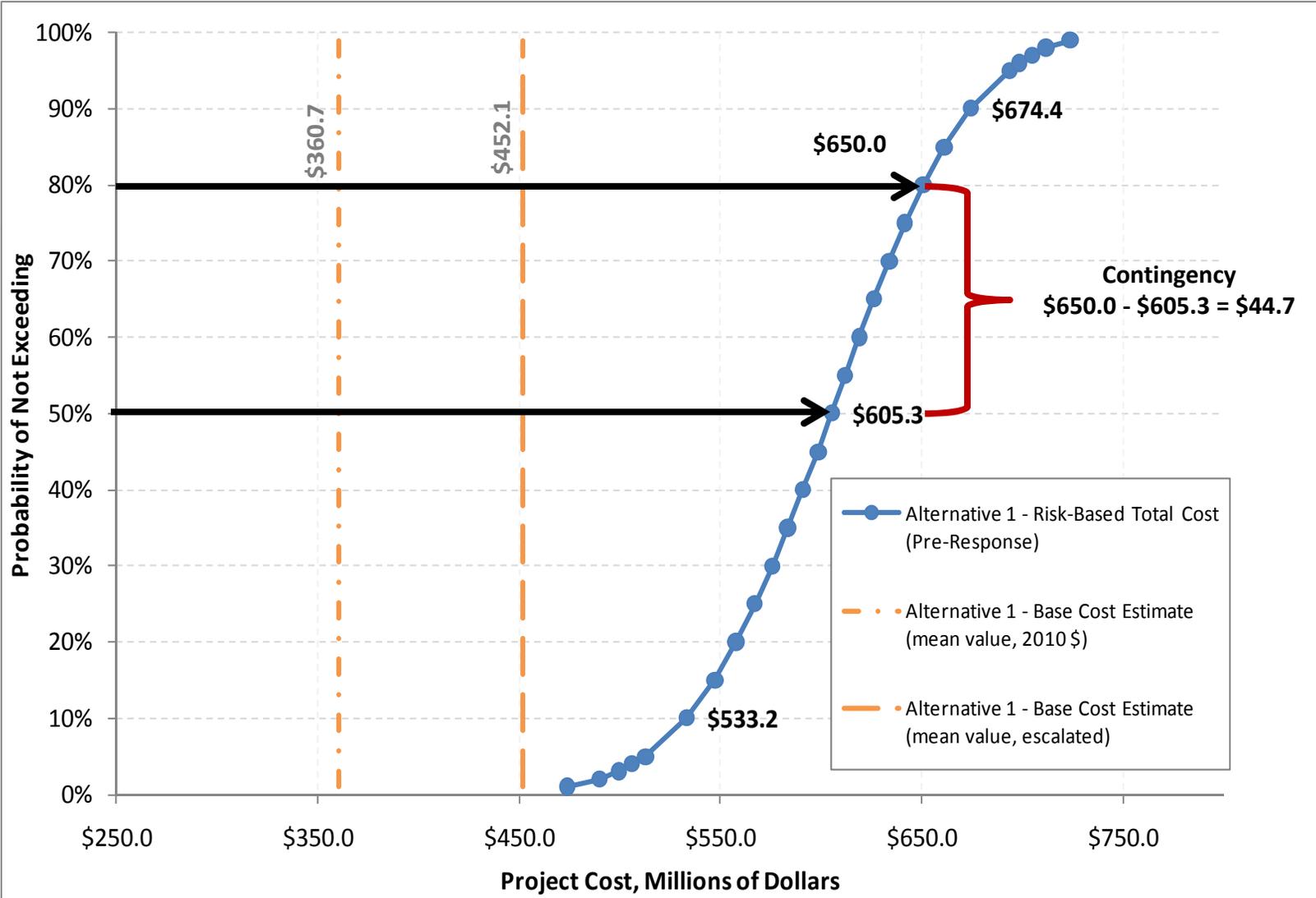
12	PS-A	Design, Structures, and Geotech Risks	115, 116, 117, 118, 119 (Cost), 104 (Schedule)	Delay in obtaining agreements with local governments (A)	For example, agreement re: aesthetics and maintenance agreements / fire protection on bridge (excluding streets near new arena, Grand National overpass, South St/Anderson, which are captured separately). Delay in procurement to achieve agreement, and/or save costs if no agreement (down to 1% of construction costs). Potential (mutually exclusive) scenarios: A, as planned B, no agreement (save costs) and no delay C, delay in agreement D, delay and then no agreement (save costs)	85%	\$0.00	\$0.00	\$0.00				0	0	0			
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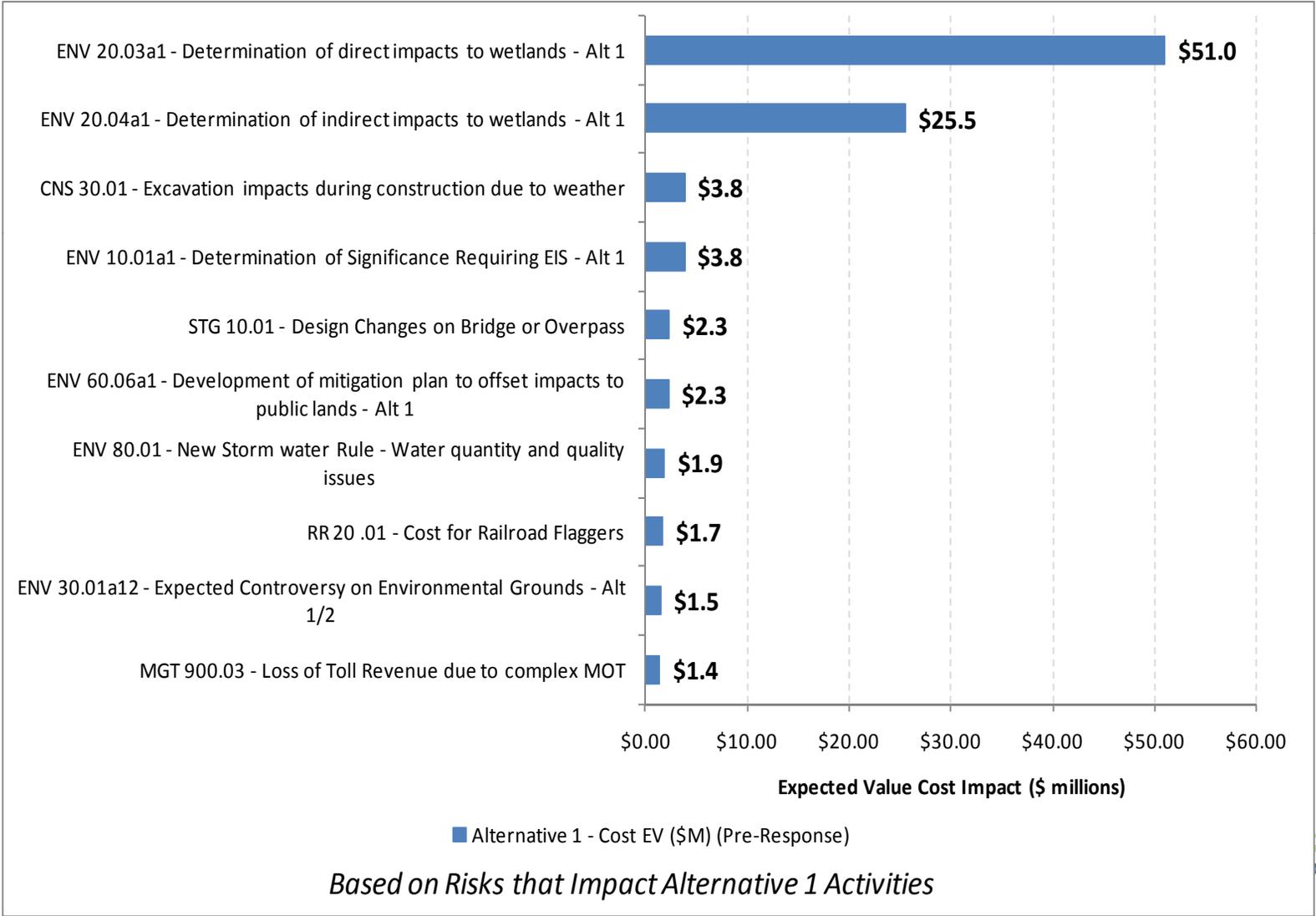
Modeling and Presentation

- Within or following the workshop, preliminary results are generated
- Results are presented to the project team for feedback and review
- Results are finalized and include risk based cost and schedule estimates, ranking of key drivers of risks and detailed information on each risk factor
- Results are used by the project team to develop a risk management plan

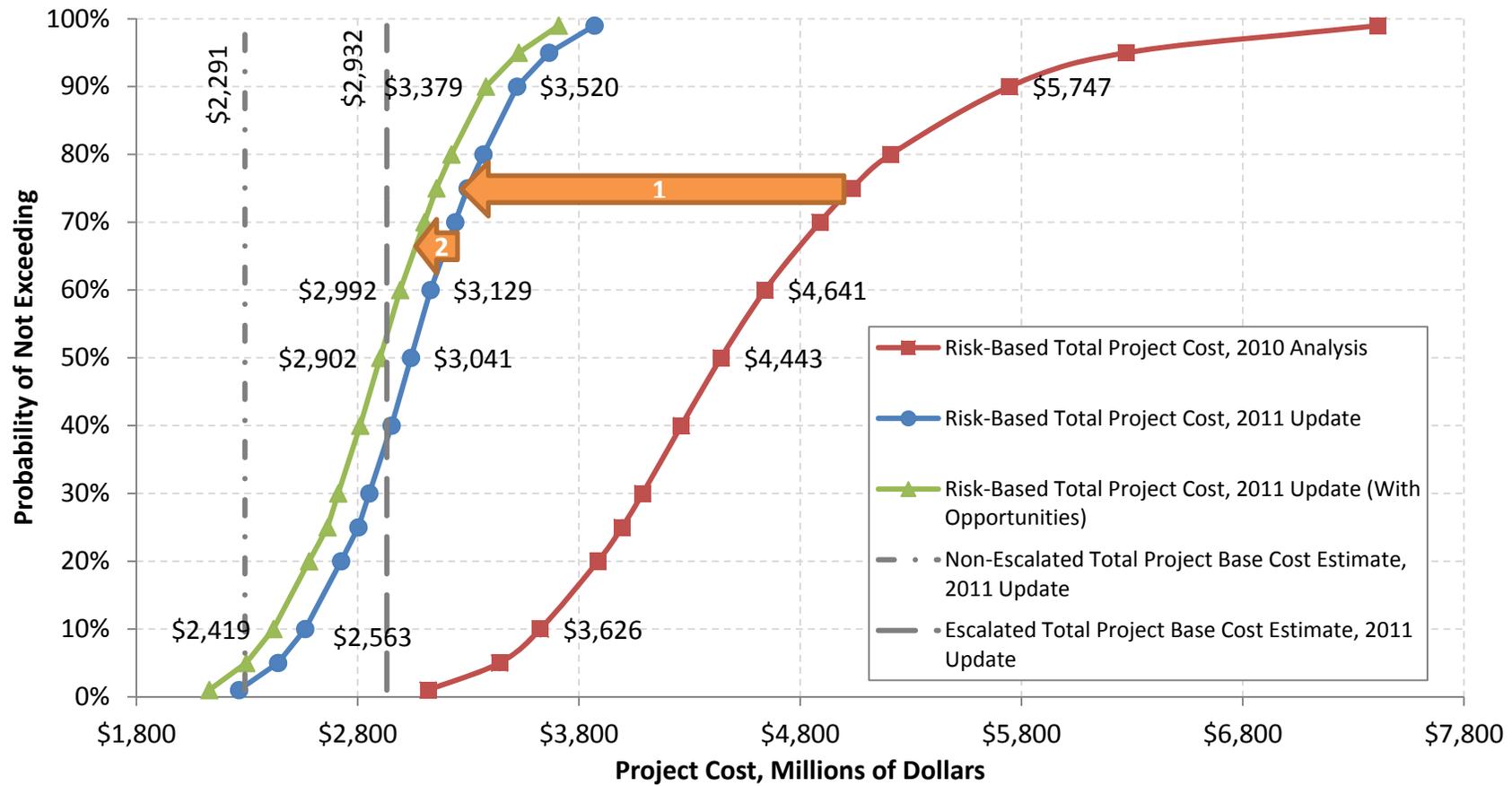
Baseline Risk Assessment Results



Baseline Risk Assessment Results



Comparison of Risk Based Costs



Workshop Deliverables

- Final report detailing the results of the workshop
- Final Risk Register for Project Manager to use managing the identified risks



References

- Project Management Handbook Chapter 19

<http://www.dot.state.fl.us/projectmanagementoffice/PMHandbook/pmhandbookindex.shtm>

- Washington State Department of Transportation

<http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/>

- FHWA Risk Assessment

<http://international.fhwa.dot.gov/riskassess/index.cfm>

http://www.fhwa.dot.gov/ipd/project_delivery/resources/risk_management/



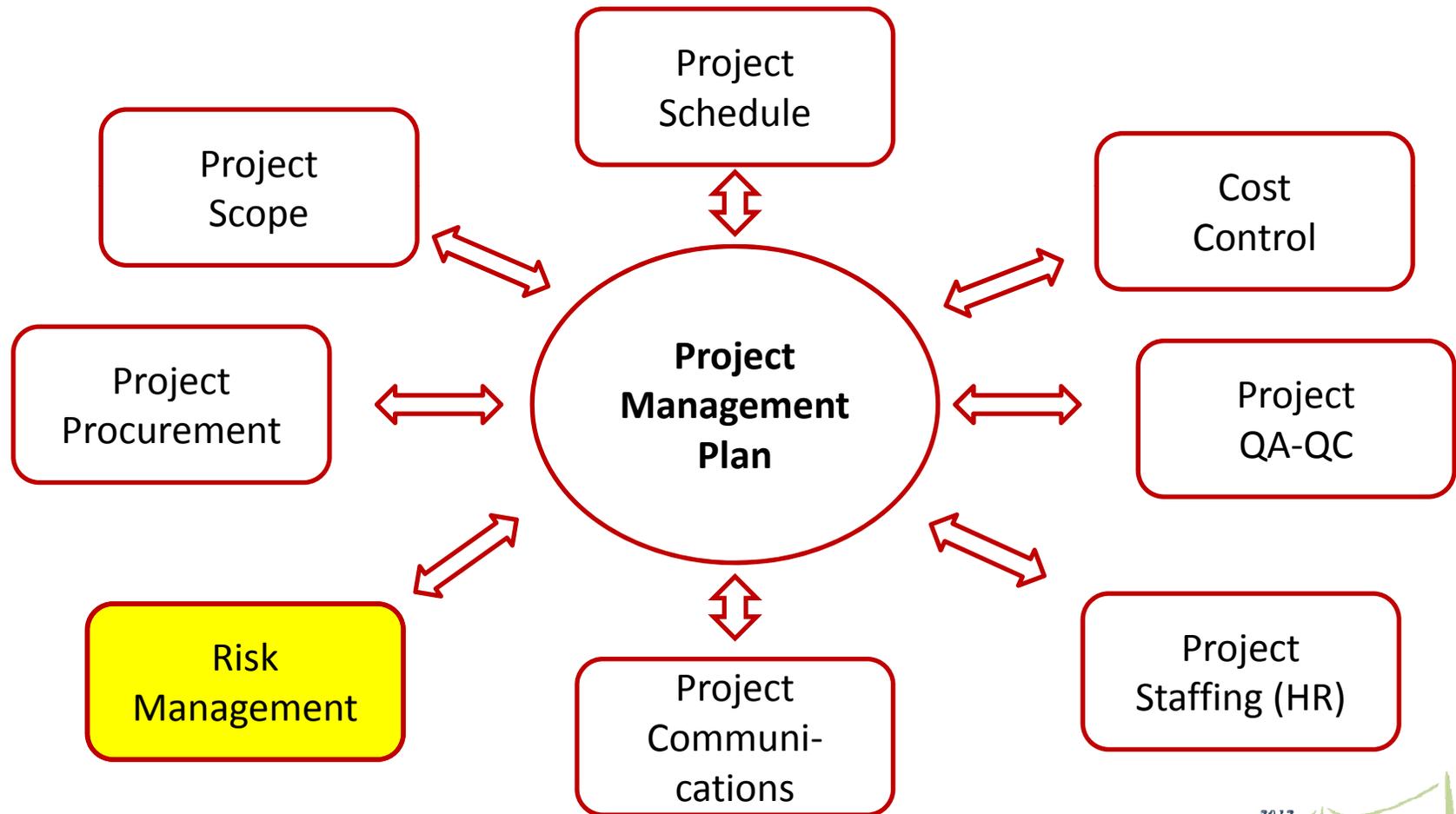
Risk Analysis Project Manager Roles

Rob Quigley

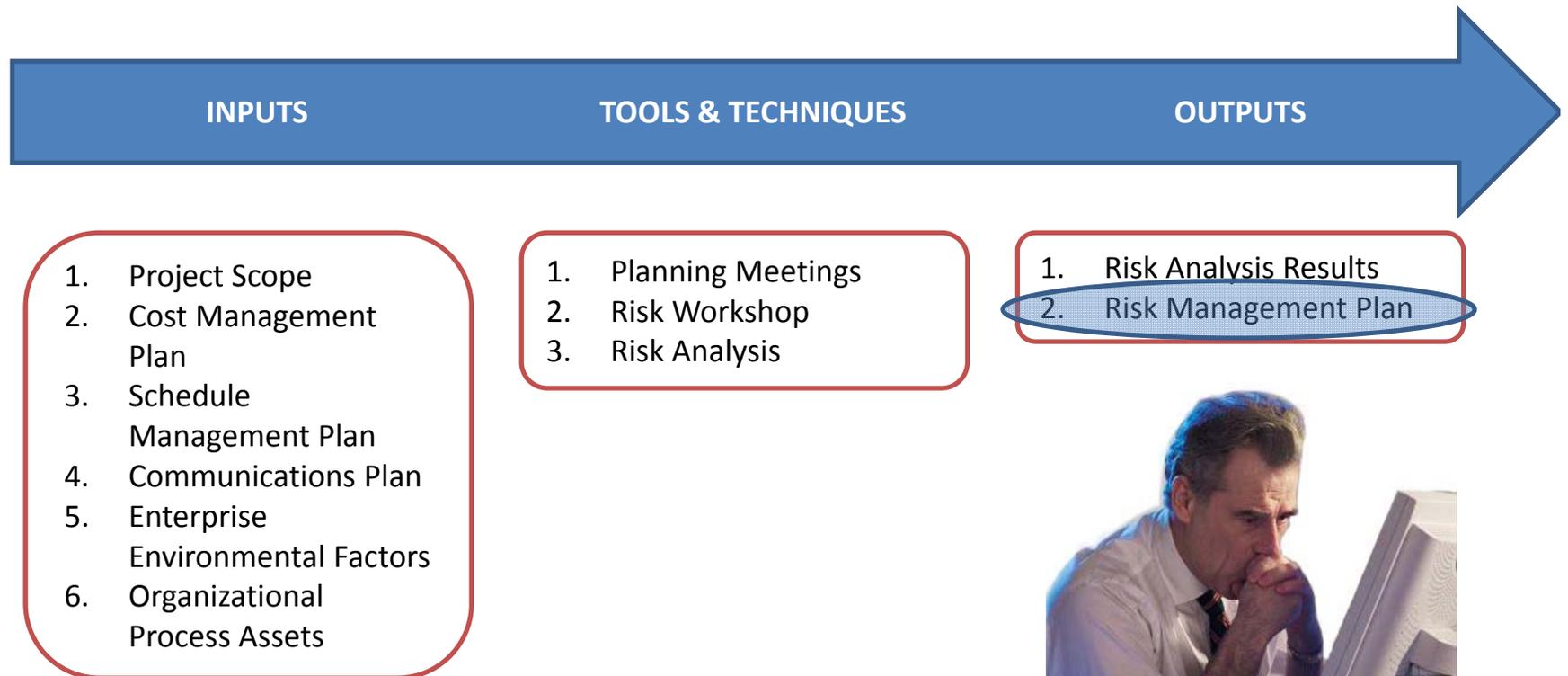
Objectives

- Understand how the Risk Management Plan fits into the overall Project Management Plan
- Describe Project Manager's Roles in Risk Analysis and Management for the life of project
 - Risk Response Strategies
 - Risk Tracking
- Integrate Risk Management into regular project delivery activities...consistently applied on every project - CPR

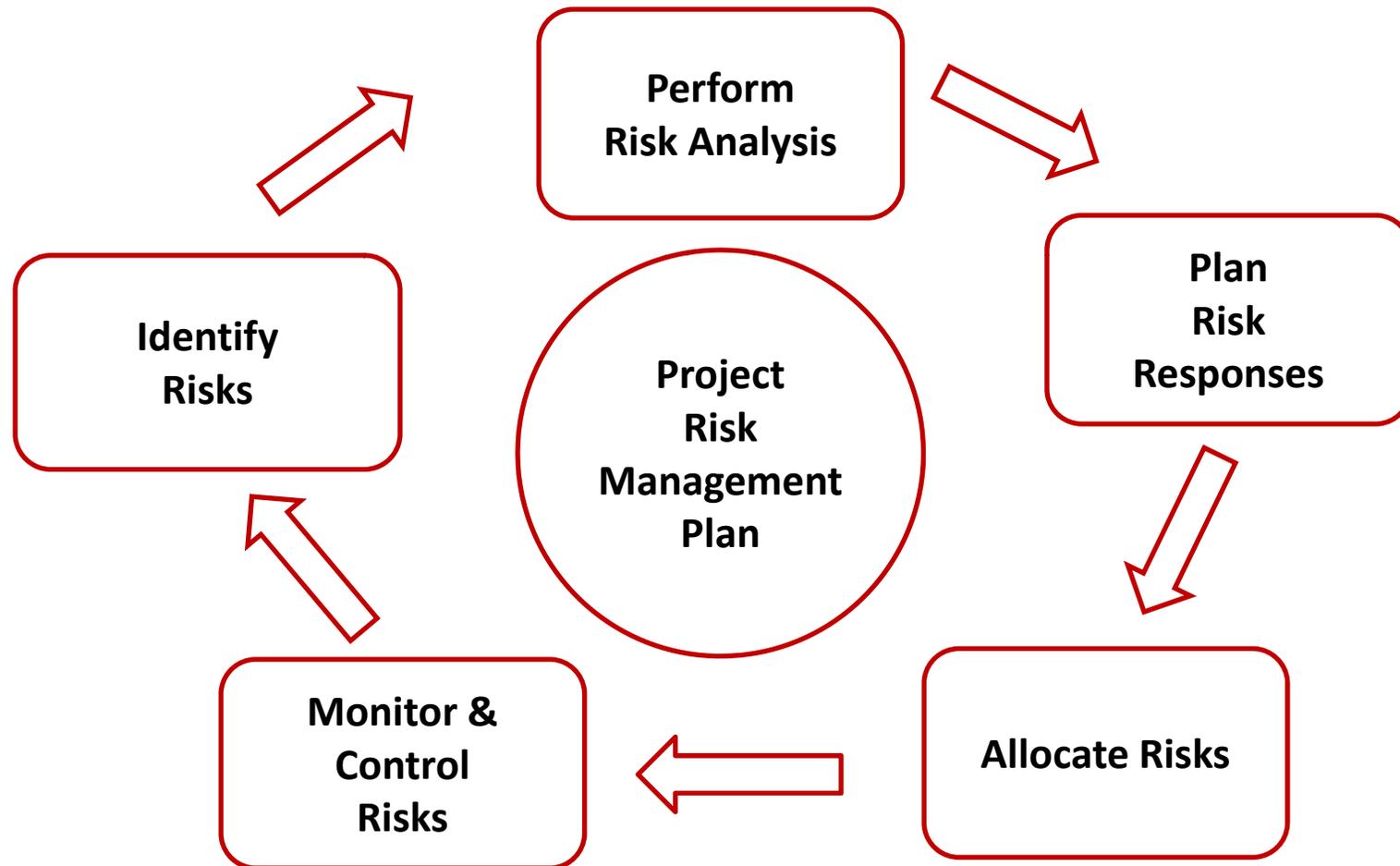
Risk Management within the Overall Project Management Plan



Risk Management

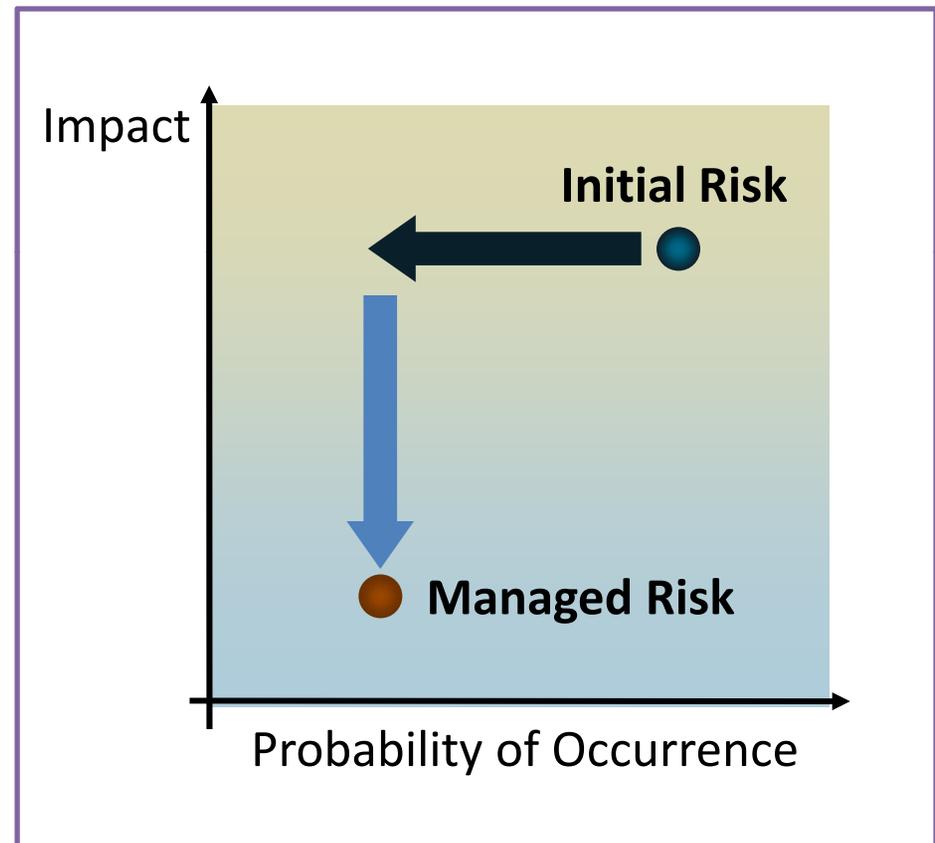


Risk Management Plan – Detailed Flow Diagram

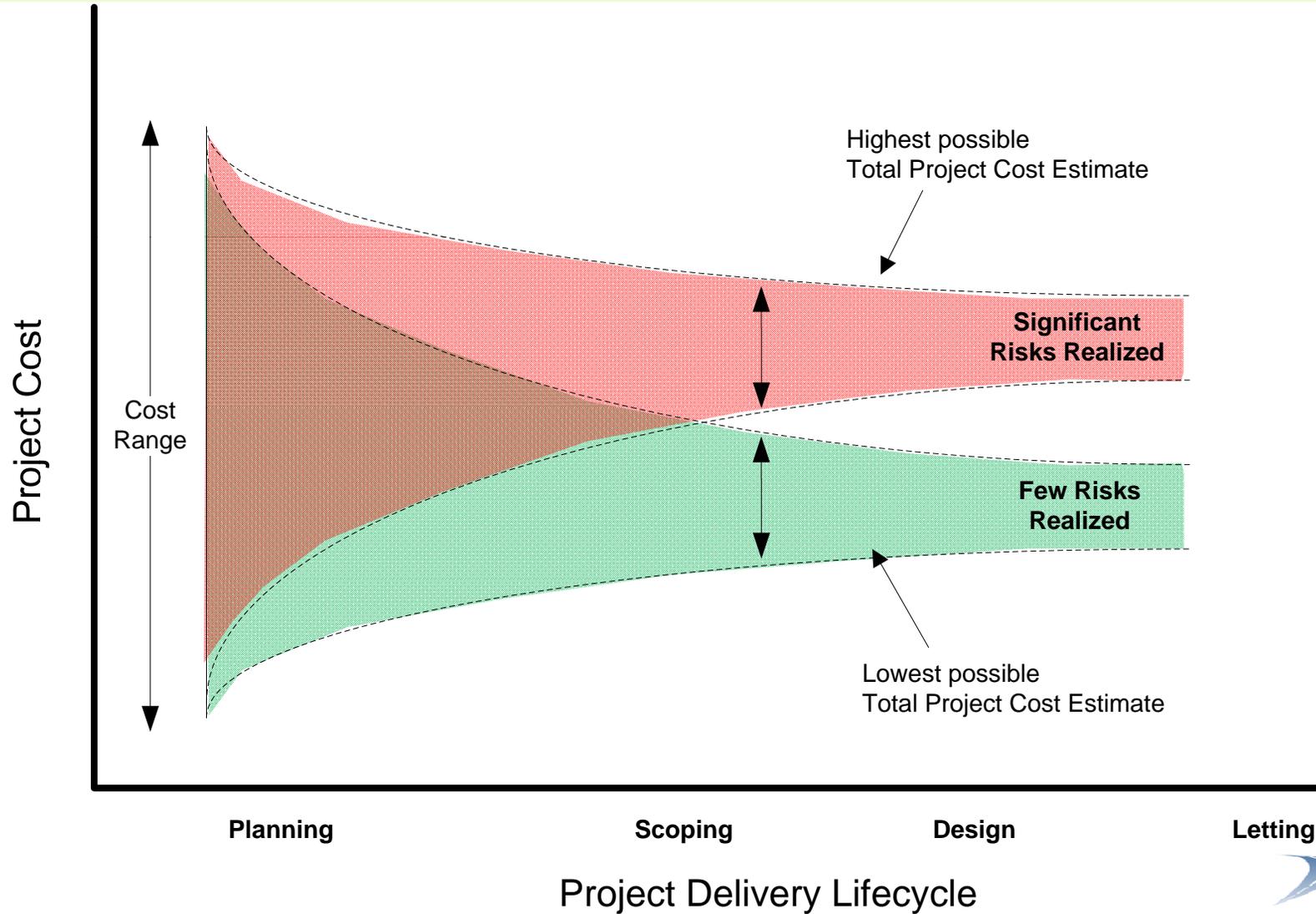


Goal of Risk Management

- Risk Assessment's aim is to assess potential impact of various scope, event, and budget risks on the project's cost and schedule.
- Risk Management's aim is to identify opportunities and mitigation strategies to reduce both the likelihood of an event occurrence and the potential effect if it occurs.

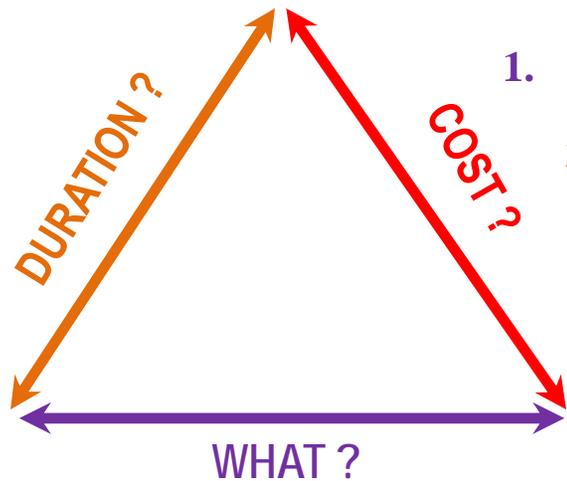


Managing Potential Outcomes



Needs & Management Fundamentals

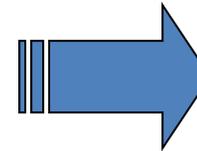
What People Need To Know



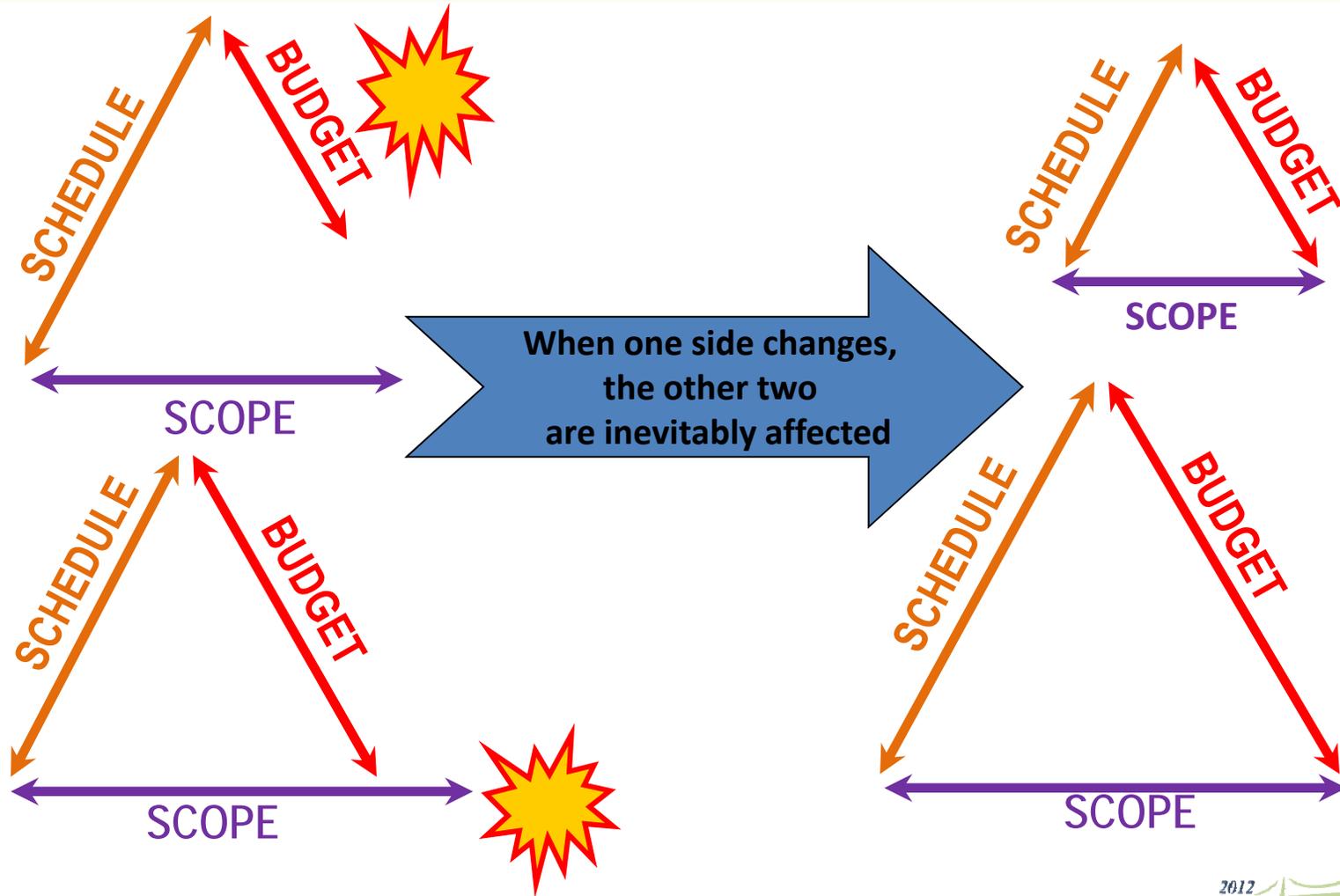
1. What are we getting?
2. How long will it take?
3. What's it going to cost?

Triple Constraints

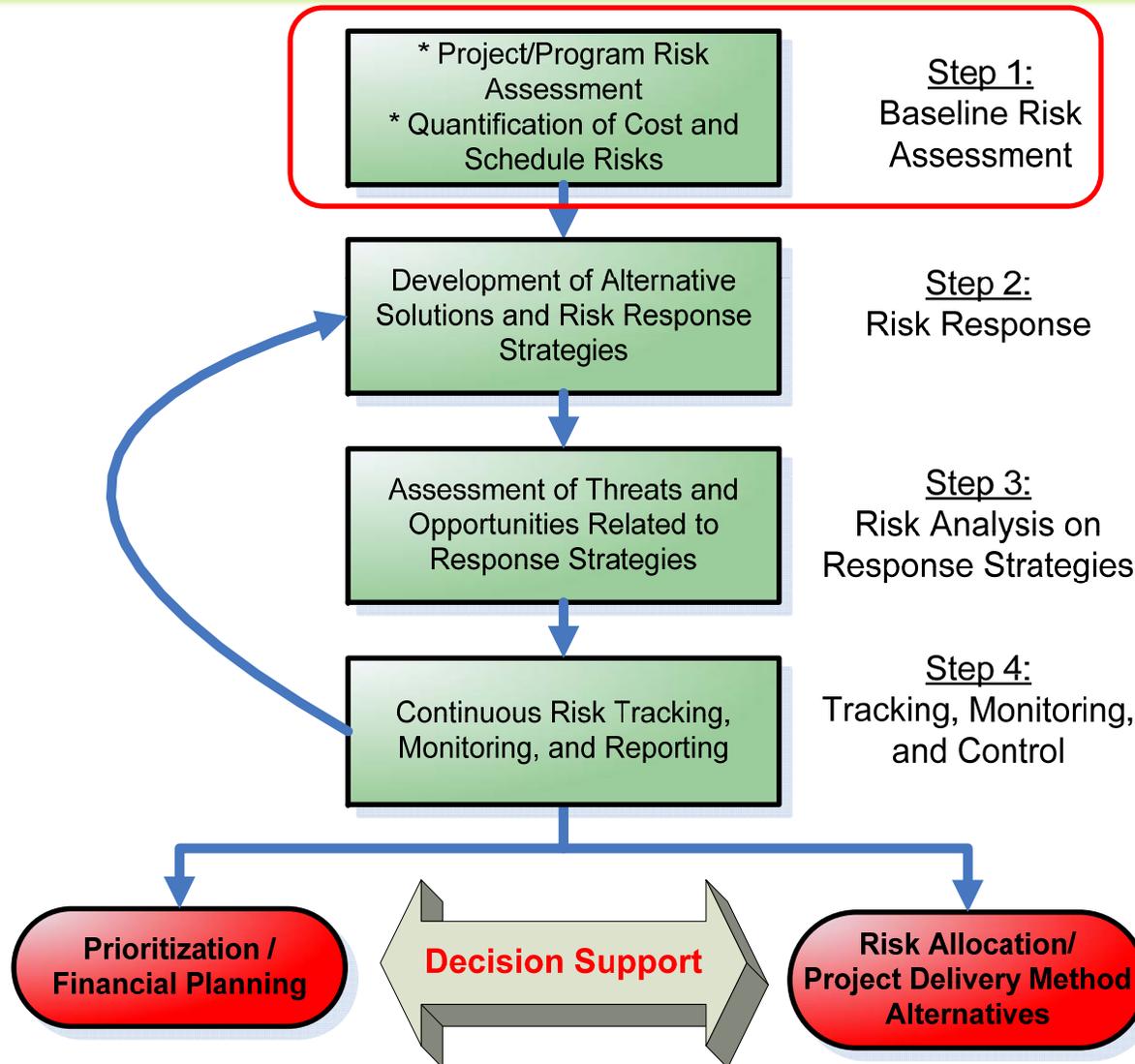
1. **Prioritize**
2. **Optimize**
3. **Accept**



Risk Constraints



Risk Management Process Overview



Addressing Cost and Schedule Concerns

Usual
Questions

- How much will it cost?
- How long will it take?
- Why does it cost that much?
- Why does it take that long?

Analysis
Needs

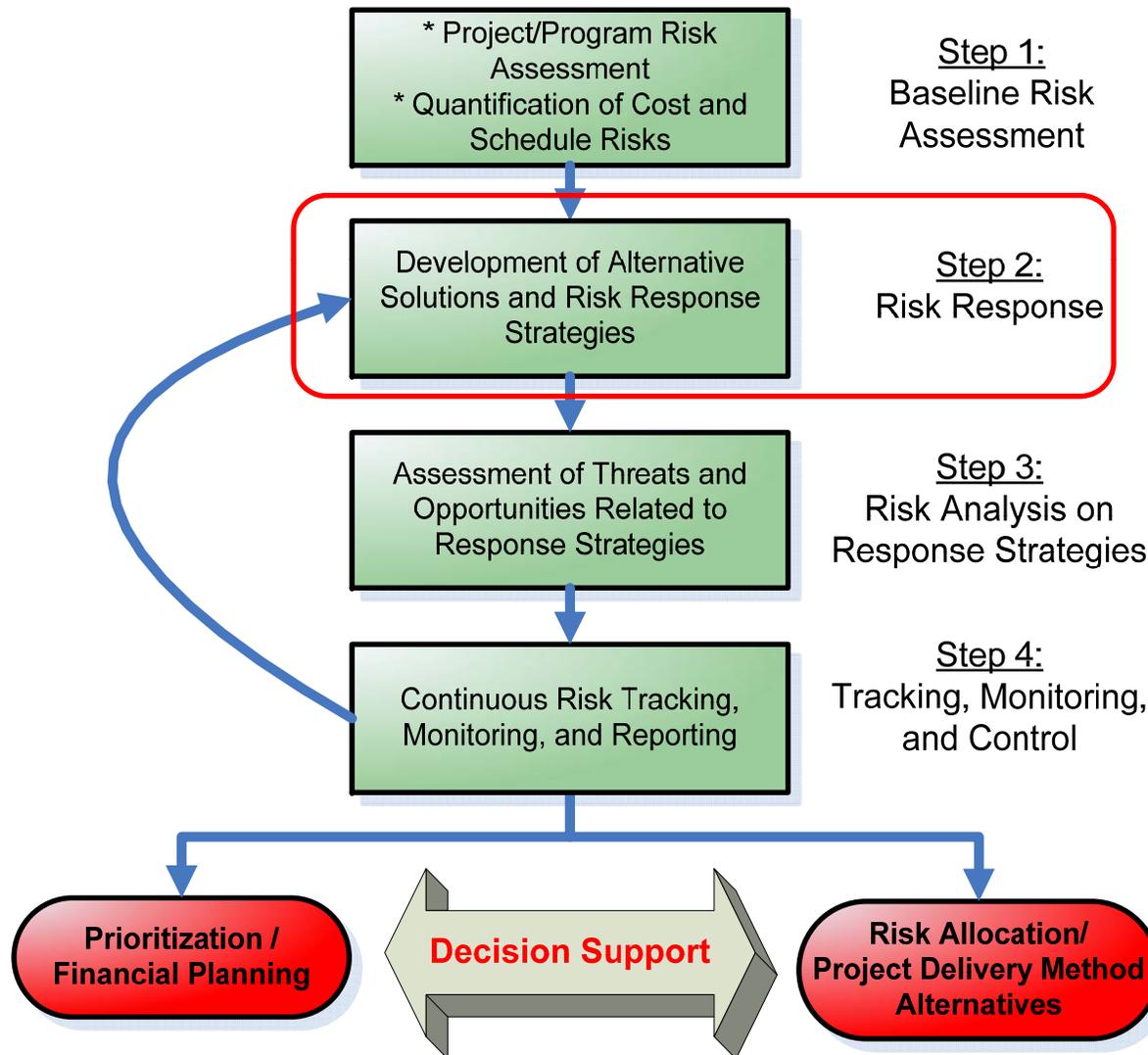
- Risk Identification
- Qualitative and Quantitative Risk Analysis
- Mitigation Strategy
- Risk Monitoring & Control

Risk Register

- Identify
- Quantify
- Mitigate
- Tracking, Monitoring, and Control
 - Adequate & Continuous Reporting

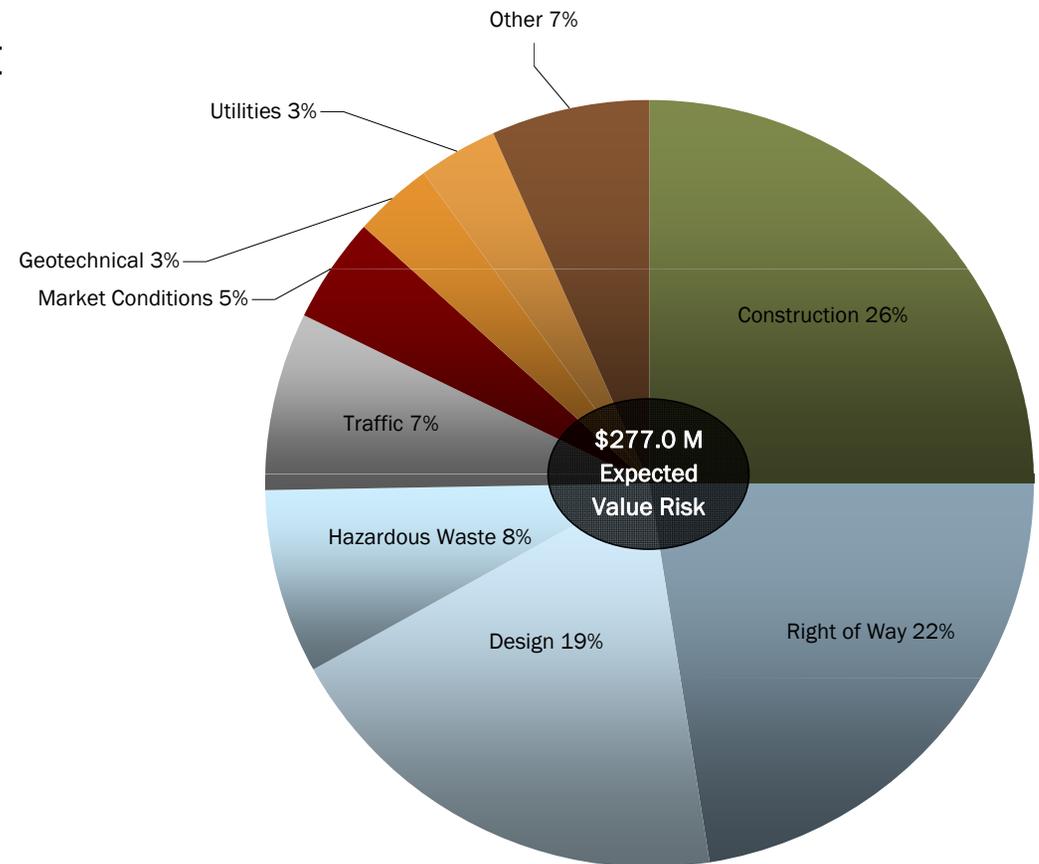


Risk Management Process Overview



Step 2: Develop Risk Response Strategies

- Avoidance is a change to the project scope to eliminate the impact of a risk.
- Transference of a risk to another party who is more capable at handling the risk (such as the contractor or insurance company).
- Mitigation is seeking to lessen the impact of a specific risk items, which may involve the consumption of additional time and/or money.
- Acceptance is recognition by the project team of a specific risk and decision to not take action to deal with the risk.



Risk Strategies - Avoid

- Some threats can be avoided entirely. This can be done by changing the way the project is performed or by de-scoping the portion of the project that contains the risk element.
- This will often have a cost. Completing the job done in a risk free environment is likely to cost more.
- Eliminating the risky scope might disappoint a critical stakeholder or degrade the business reason for performing the project.

Risk Strategies - Transfer

- This involves moving the responsibility for a risk to another party usually by payment of a fee (outsourcing to a skilled expert or fixed price construction contracts) or a premium (insurance).
- Transferring risk will almost always have an added cost. Some risk, such as schedule risk, cannot be transferred. Even though the owner can contract (transfer) the schedule responsibility to third parties, if they are late, the project is still late.

Risk Strategies - Mitigate

- This involves taking positive actions to reduce either the impact of a threat or the probability of it occurring.
- Mitigation usually requires positive action and has a cost. These actions should be reflected in project work packages and controlled like any other part of the project. They will affect your budget and schedule.
- Mitigation can be a very effective strategy. It's often better than a 'do nothing' approach.

Risk Strategies - Accept

- After trying to avoid, transfer, or mitigate the threats to the project, residual risk may remain - threats that can't be reduced further
 - In active acceptance, the project cost is revised to take the residual expected value of the remaining risk
 - Passive acceptance involves acknowledging the risk and moving forward on the project without reserves, which may make sense for risks with small expected values
 - The third form of risk acceptance is called denial and professional risk management seeks to reduce the use of denial as a strategy

Response Planning

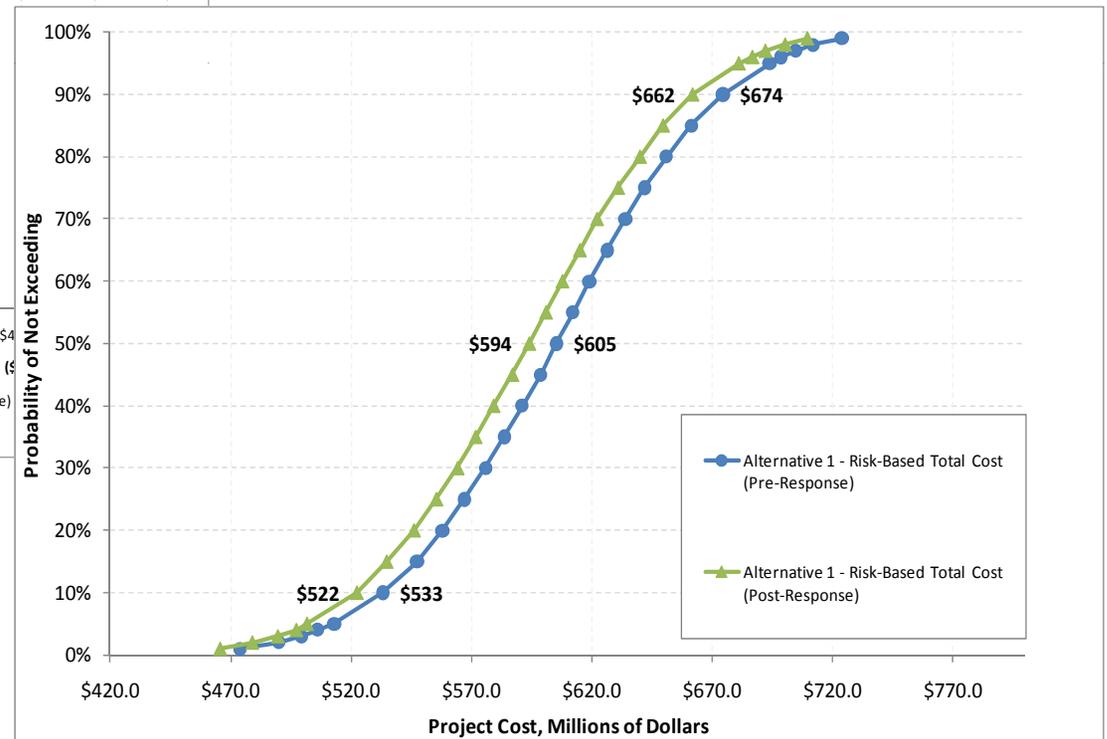
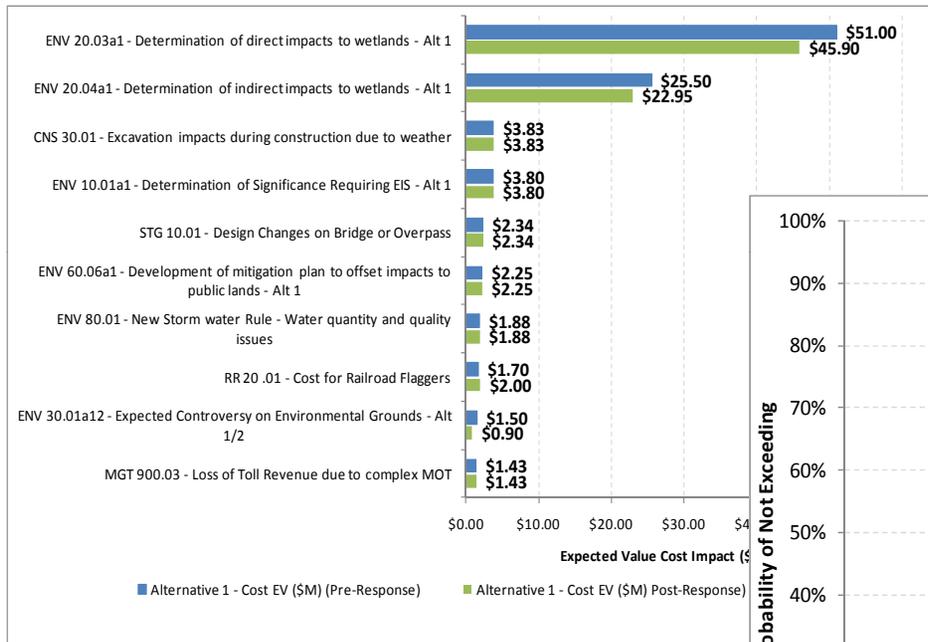
- **Risk Response Plan** – A plan of action designed to reduce the impact once a risk event has occurred
 - **Planning** – Prior to the risk event occurring as though it will occur
 - **Trigger** – Identifies that the risk event has occurred and notifies the team to implement the risk response plan
 - **Implementation** – Actions to take after the risk event has occurred



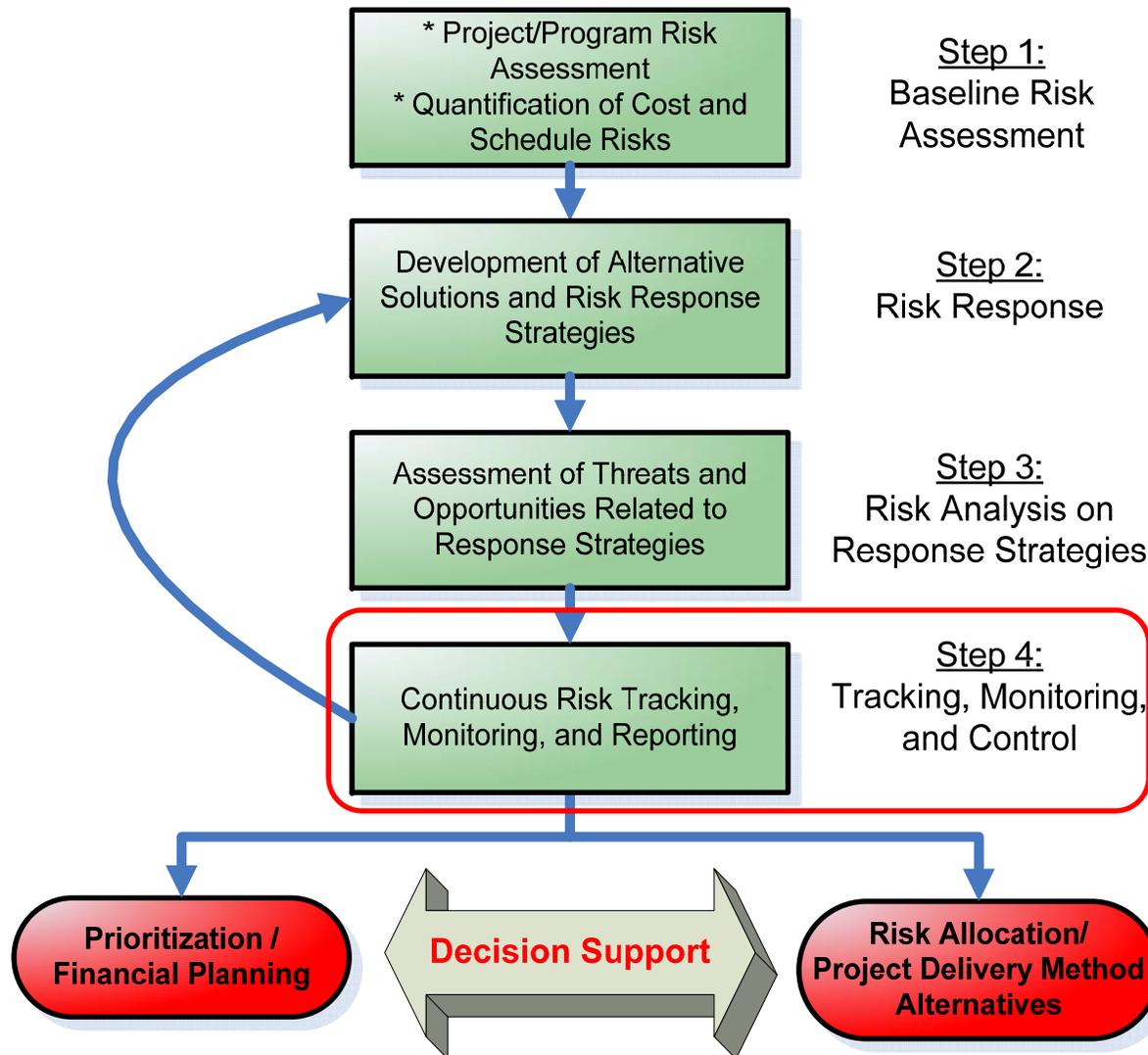
Risk Management Process Overview



Step 3: Risk Analysis on Risk Response



Risk Management Process Overview



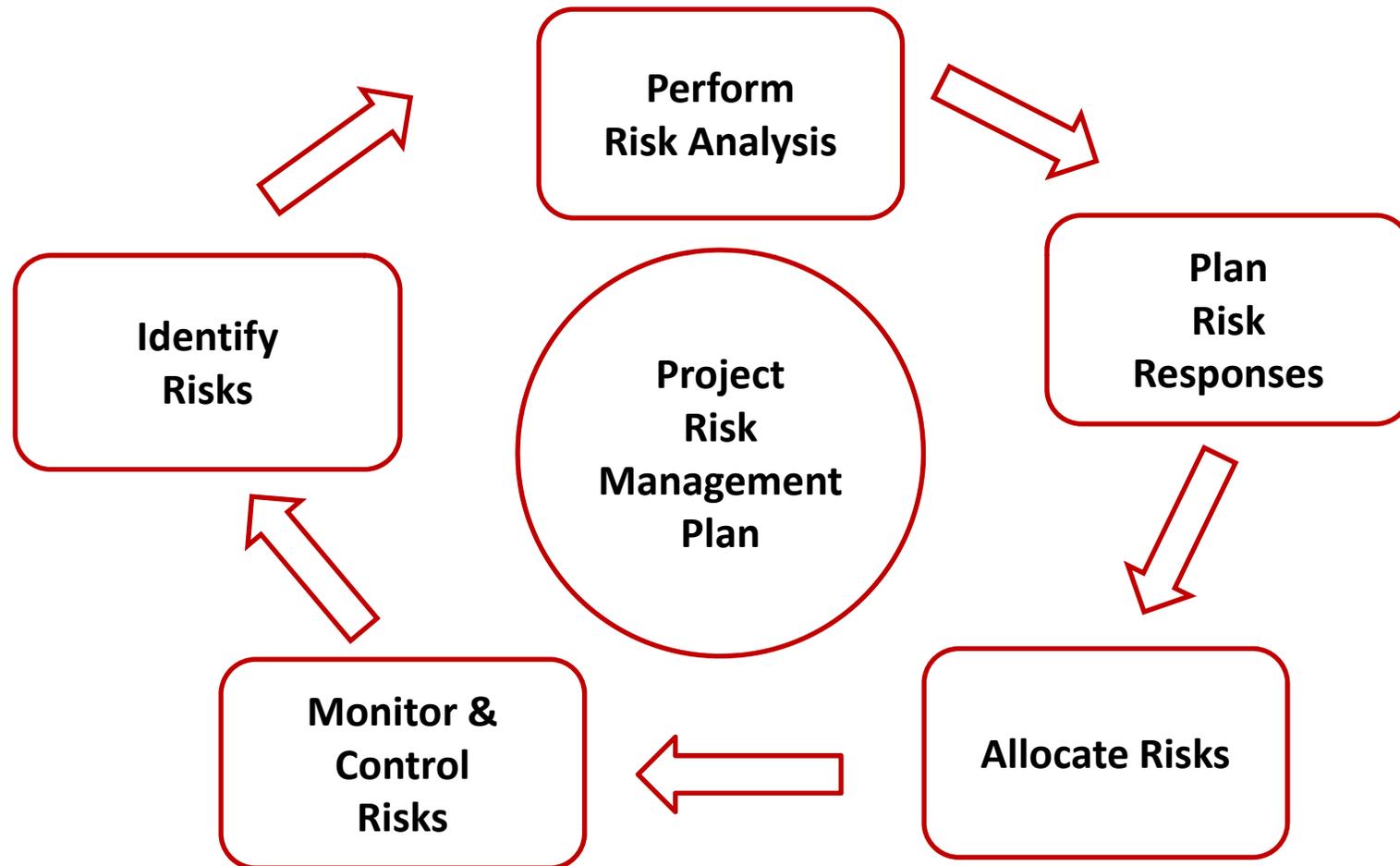
Step 4: Tracking, Monitoring and Control

- Development of Risk Management Plan involves:
 - Identifying Risk Owners to take responsibility for key risk factors and associated risk response strategies
 - Identifying the Monitoring Frequency for risk updates and feedback on the effectiveness of risk response strategies
 - Updates to the risk assessment model and results at key milestones and when baseline cost and schedules are updated
 - Continuous updates to Risk Management Plan that document and report progress

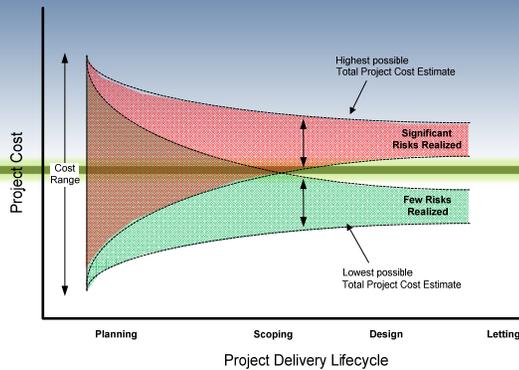
Monitoring and Control

Risk Response Plan		Monitoring and Control		
Strategy	Action To Be Taken (response actions including advantages and disadvantages. Specify the time frame)	Risk Owner	Risk Review Dates	Date, Status and Review Comments (to show the history of risk's monitoring do not delete previous comments)
Mitigation	Finalize design to identify all wetlands that are impacted. Early coordination with the outside agencies to determine mitigation ratio.	Design Leader/Enviro. mgr	2008-Dec-2 2008-Jan-2	As of Nov. 15, 2008 there are only two potential areas where there could be additional wetland impacts. As of Dec. 2, 2008 agency has initially determined that mitigation ration would be 4:1.

Risk Management Plan Detailed Flow Diagram



Risk Management



What's the Return?

- Helps manage expectations for budget and schedule
- Improved Communication between stakeholders
- Risk management shown to
 - decrease 90% of project problems ⁽¹⁾ and
 - generate 5% cost savings ⁽²⁾



Source: FHWA Risk Management Workshop course materials, Golder Associates Inc. & Dr. Keith Molenaar, October 9, 2007; attributed to (1) Project Management Institute, and (2) Construction Management Institute

Summary

- Risk Analysis Process
 - Terms
 - Process
 - Big Picture
- Risk Analysis Workshop
 - Assessment
 - Workshops
- Project Manager Roles
 - Risk Management Plan
 - Risk response strategies
 - Assessment
 - Risk Tracking



Questions?

➤ **Risk Analysis Process Overview**

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