

Design Planning & Decision-Making for a Water Tunnel Program with NetPoint

Presented by:
Weeraya Orwatthana

AGENDA



Planning Considerations for Multi-year Projects

Understand key concerns about multi-year projects



Planning & Scheduling Concepts

Understand schedule levels and rolling wave planning, and utilize NetPoint for scheduling explanation



Case Study Introduction

Metropolitan Water Tunnel Program by Massachusetts Water Resources Authority



NetPoint for Initial Planning

Top-Down planning and NetPoint tips for team collaboration



Program Schedules & Decision Making

Bottom-Up planning and different schedule levels, layouts, and formats to assist team's decision



Conclusions

Lesson Learned, Q&A

MEET THE PRESENTER

Weeraya Orwatthana (Wee)
PMP, LEED AP BD+C, WELL AP, MCPPO, CMIT

Senior Associate

- BE Industrial Engineering, Chulalongkorn University, Bangkok, Thailand
- MS Civil Engineering, Construction Management, Northeastern University, Boston, MA

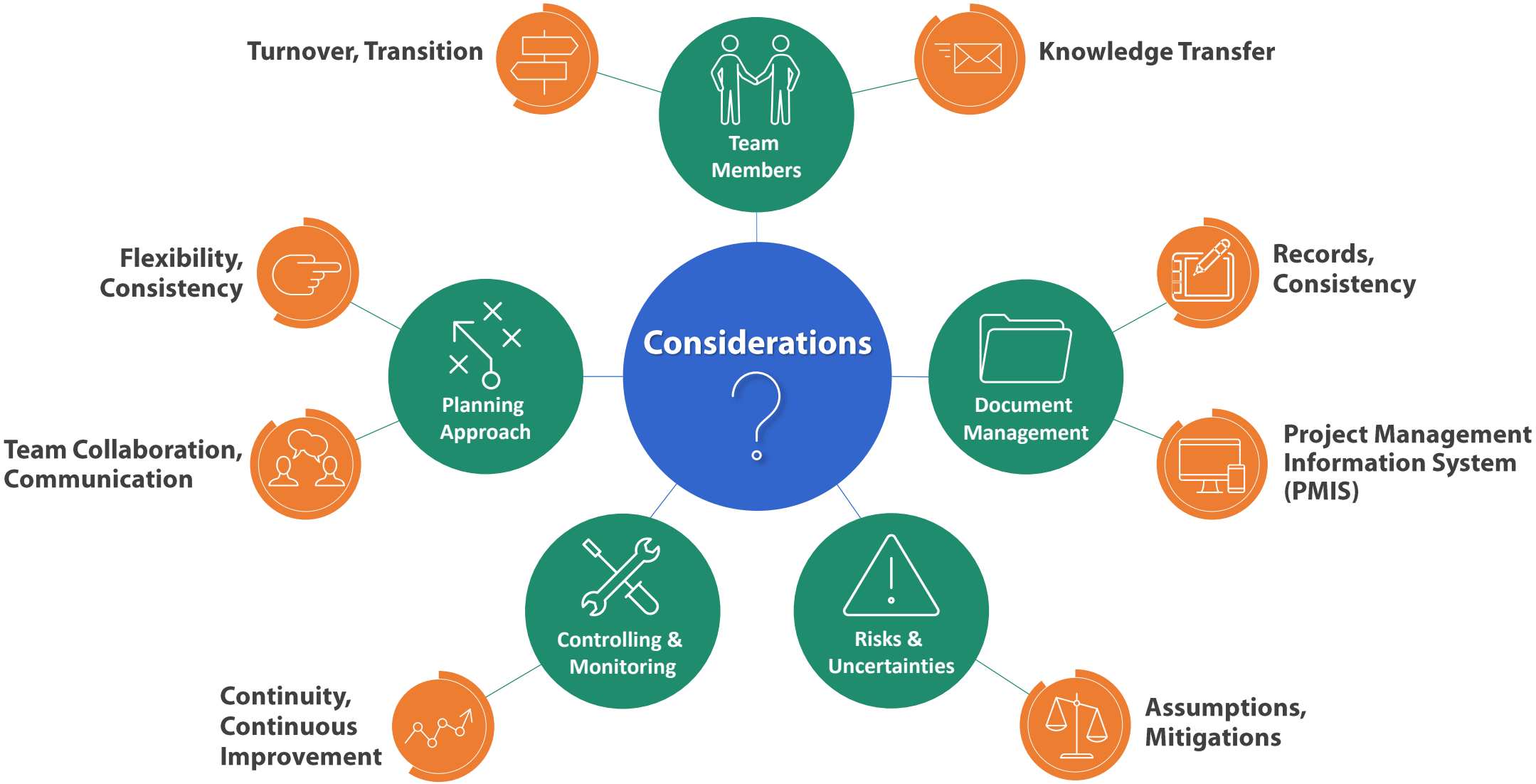
Weeraya Orwatthana is a project control specialist with ~8 years of experience with PMA and diverse background in public and private construction projects including pharmaceutical, transportation, and public infrastructures. She is skilled in construction management, project management, budget and cost control and analysis, planning and scheduling, quality assurance and control, and risk management. Her scheduling software knowledge includes Primavera P6, MS Project, and NetPoint.



Planning Considerations for Multi-year Projects

Understand key concerns about multi-year projects

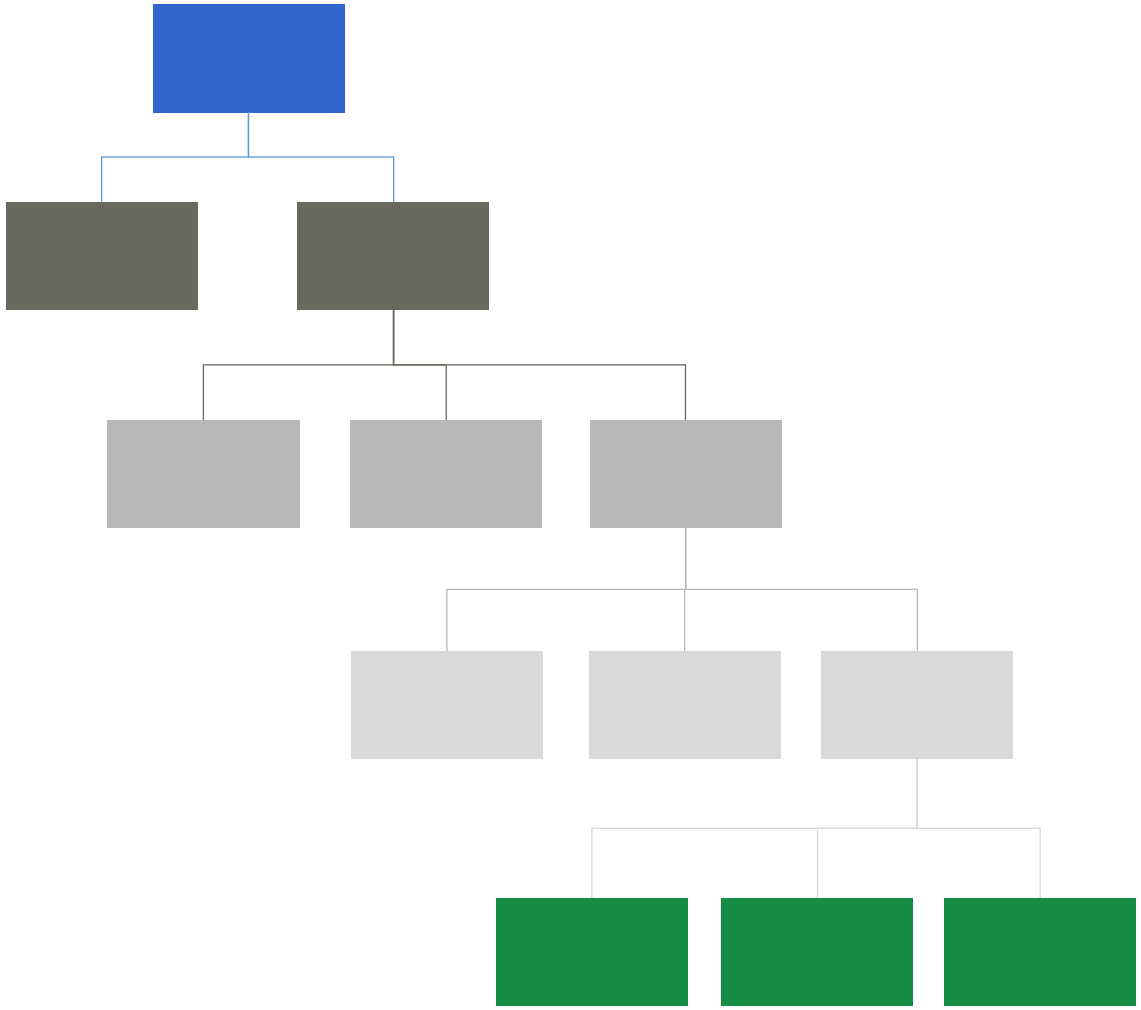
Planning Multi-year Projects



Planning & Scheduling Concepts

Understand schedule levels and
rolling wave planning, and utilize
NetPoint for scheduling explanation

Schedule Levels



L1. Executive Summary

Overall High-Level Schedule, One-Page, Contractual Milestones

L2. Management Summary

Project Phases & Major Components, Key Milestones, Targets

L3. Progress / Coordination

Monthly Updates, Major Elements, Milestones, Team Inputs, Critical Paths

L4. Working / Execution

All major milestones and elements developed by **consultants and contractors**. Presenting critical paths.

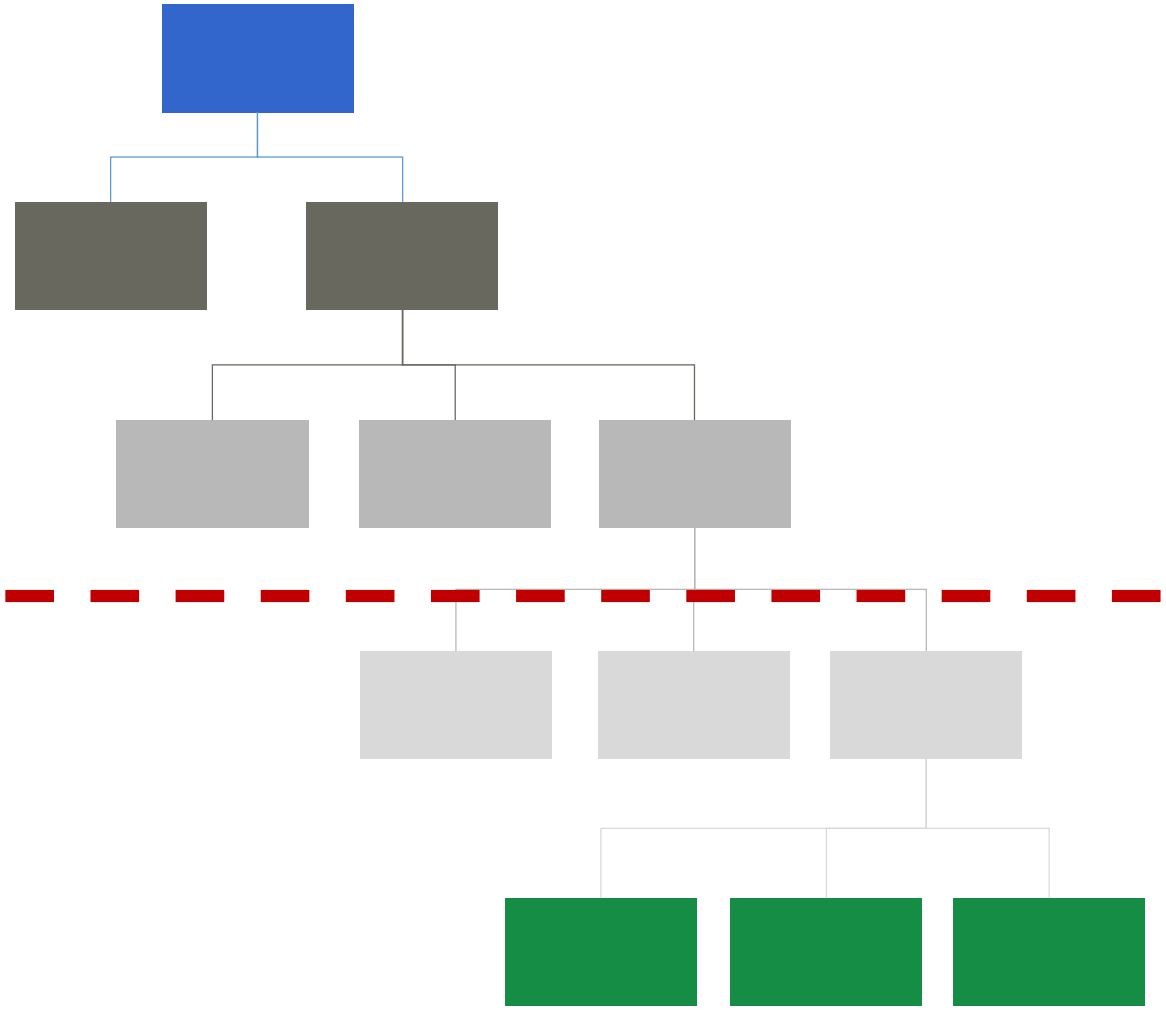
L5. Look-Ahead

Tasks for **day-to-day work**.

Unofficial Names

Schedule Levels

Project Planning



L1. Executive Summary

Overall High-Level Schedule, One-Page, Contractual Milestones

High Level

L2. Management Summary

Project Phases & Major Components, Key Milestones, Targets

Medium Level

L3. Progress / Coordination

Monthly Updates, Major Elements, Milestones, Team Inputs, Critical Paths

Detailed Level

L4. Working / Execution

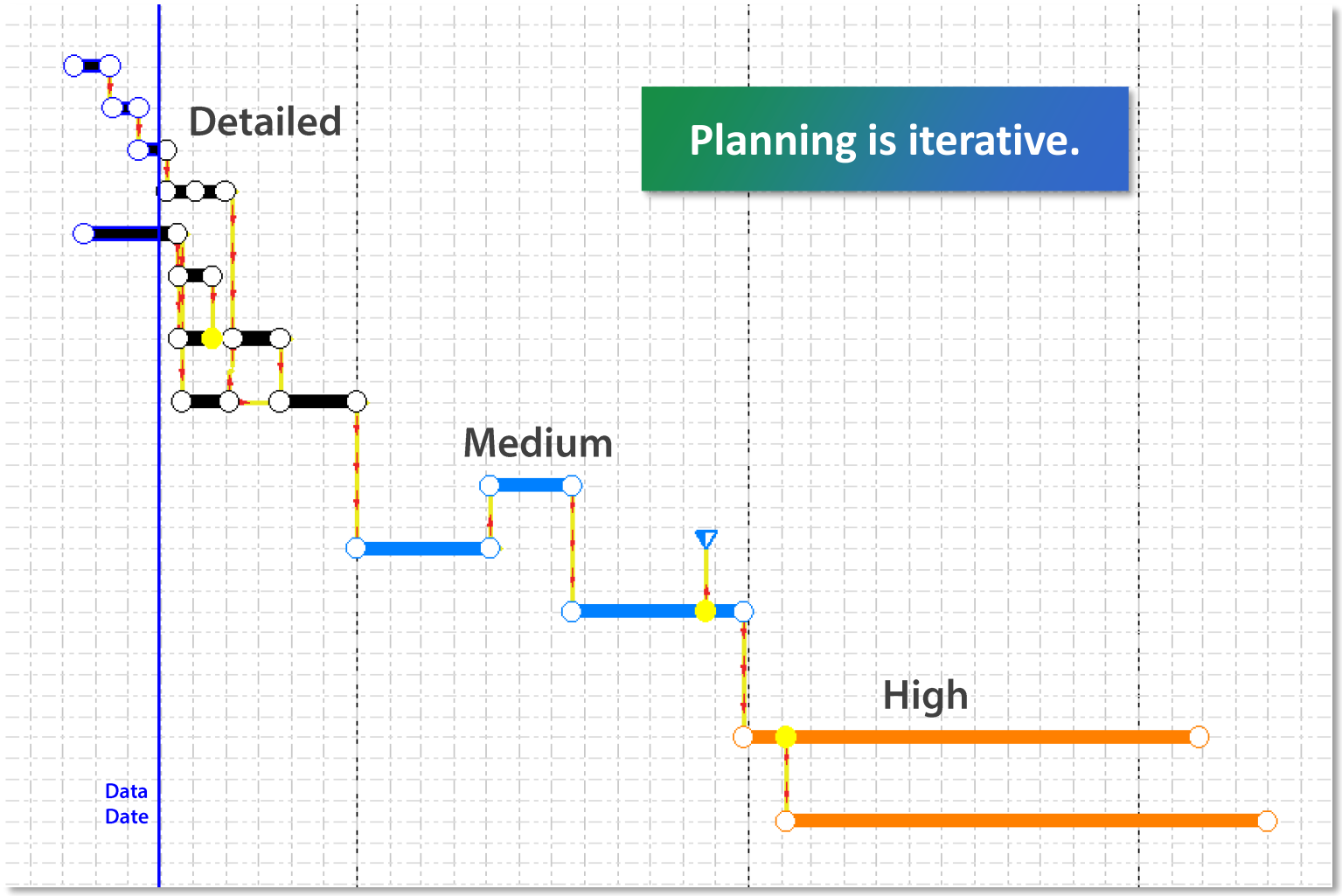
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L5. Look-Ahead

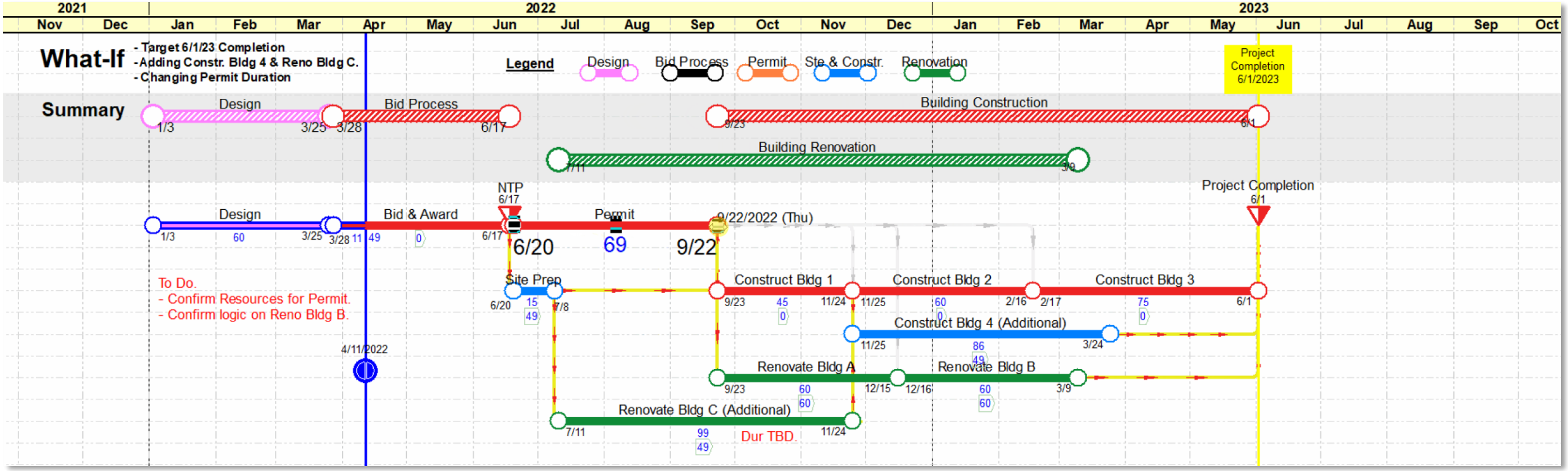
Tasks for **day-to-day work**.

Rolling Wave Planning

Planning in phases/waves and adding more details as the project evolves and when information is available.



NetPoint



Graphical Path Method

Objects, Logic, Planned Dates

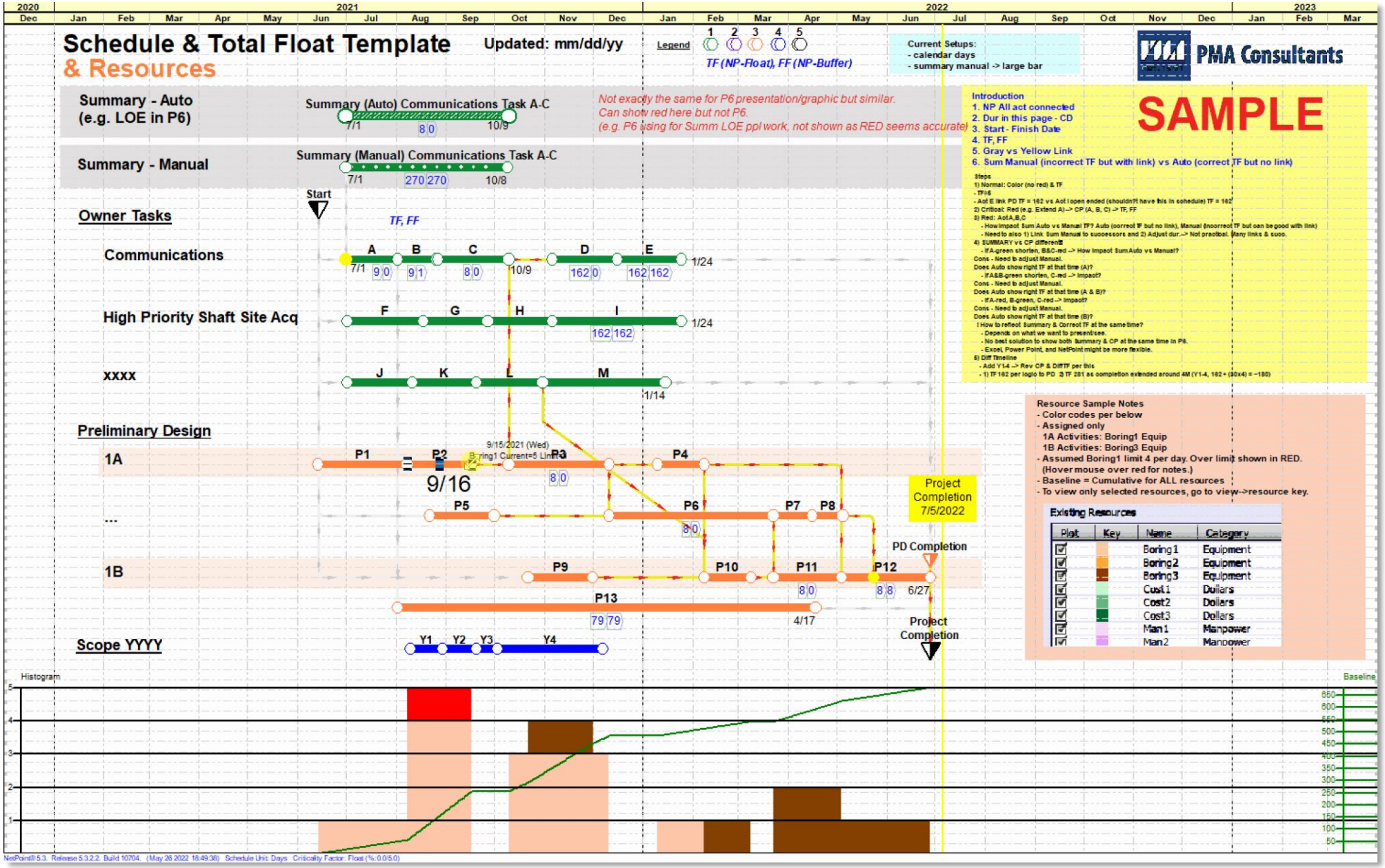
Real-Time Changes & Informative

Useful Details,
Self Explanatory / Customized

Interactive

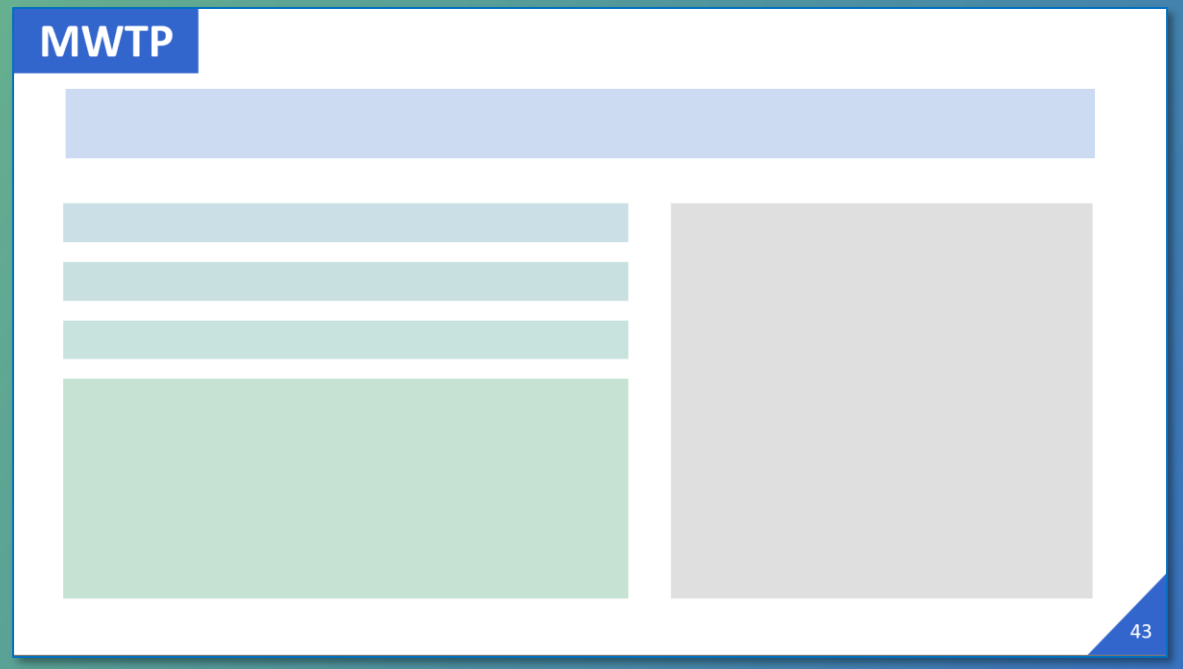
Facilitate Team Communication & Collaboration

NetPoint for Scheduling Explanation



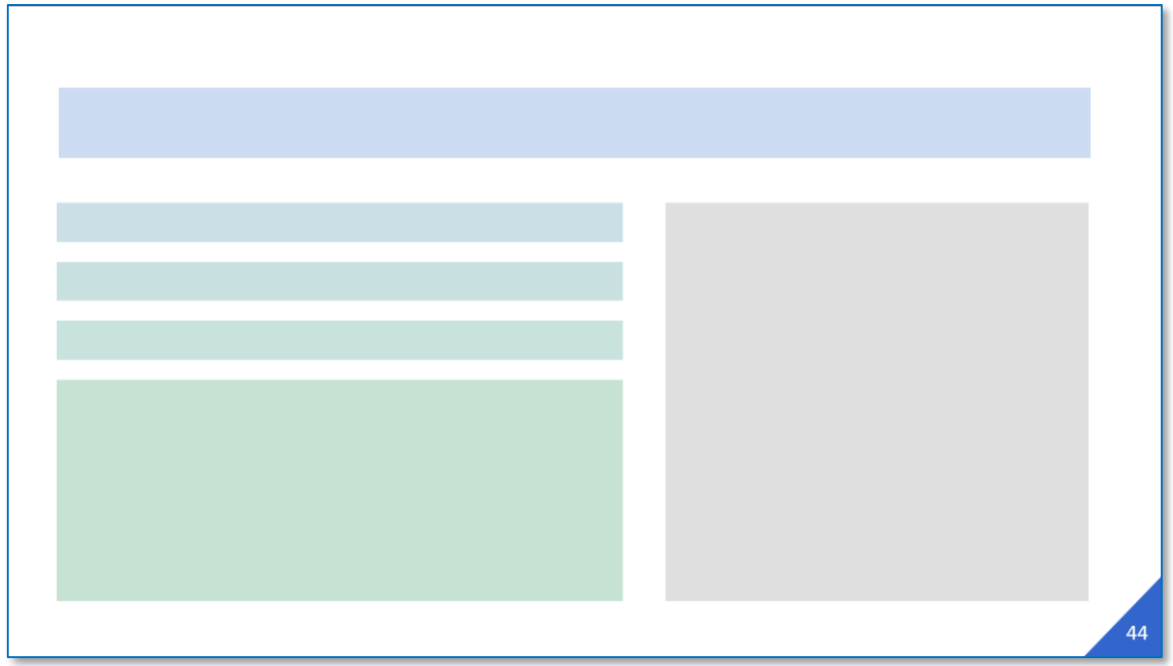
Case Study Introduction
Metropolitan Water Tunnel Program

by Massachusetts Water Resources Authority (MWRA)



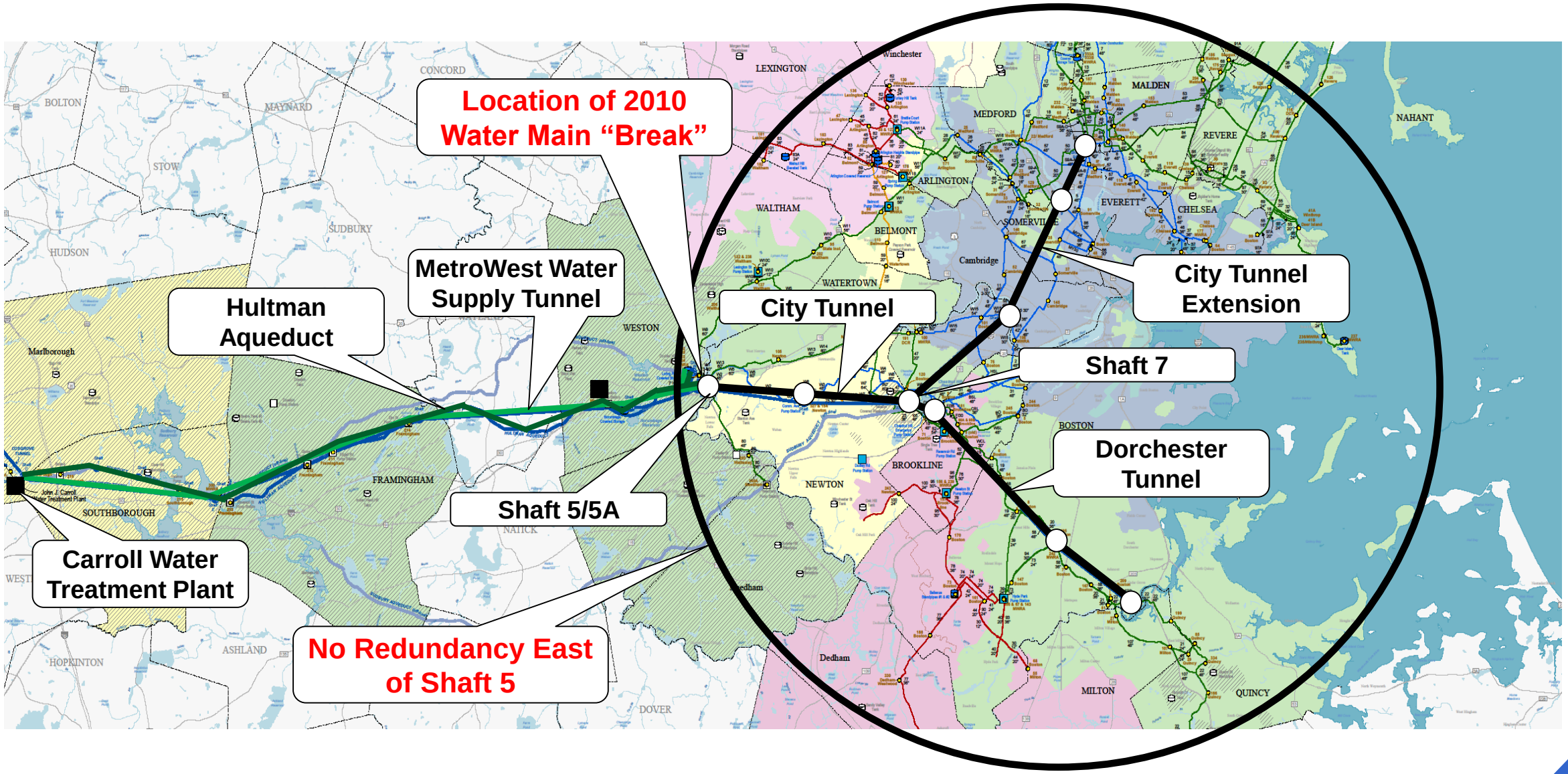
Slides with real project data and information

This presentation focuses on general project concept and approach.



Slides with general project concept and approach without real project results, data, or dates

MWRA's Metropolitan Water Tunnel Program (MWTP)



MWRA's Metropolitan Water Tunnel Program (MWTP)

Owner: Massachusetts Water Resources Authority (MWRA)

Estimate (2017 $): ~$1.5B Construction

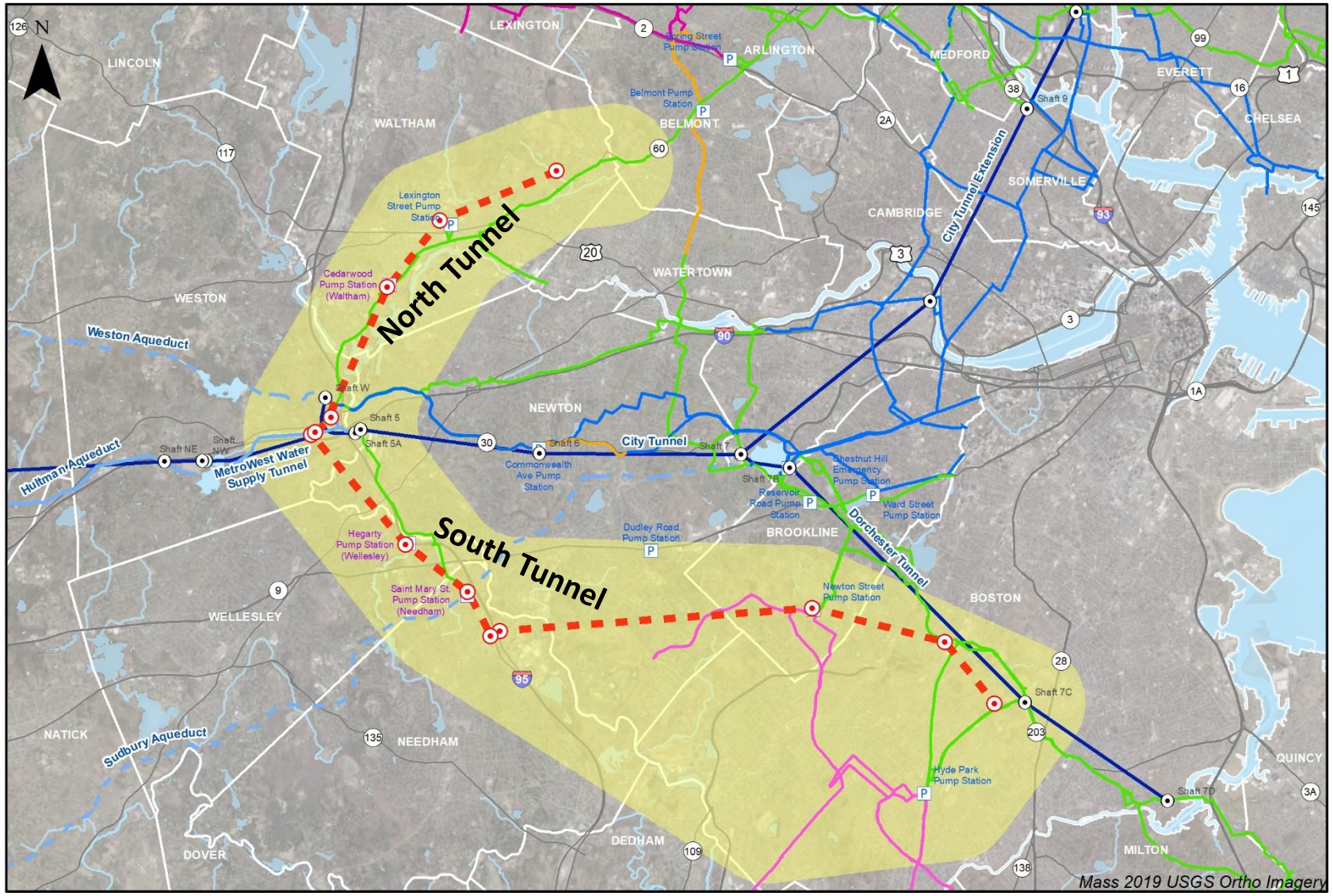
Duration: ~17-23 years

Scope:

- Long-Term Water Tunnel Redundancy
- ~14.5mi: ~4.5mi North & ~10mi South of I90/I95 Interchange
- Deep, hard rock, pressure tunnel
- 200'-500' underground
- TBM; finished diameter ~10'

Status, start

Program Support Services Consultant (PSS), 2019
Preliminary Design Engineer (PDE), 2020
Geotechnical Support Services (GSS), 2023
Final Design, target ~2024
Tunnel Construction, target ~ 2027



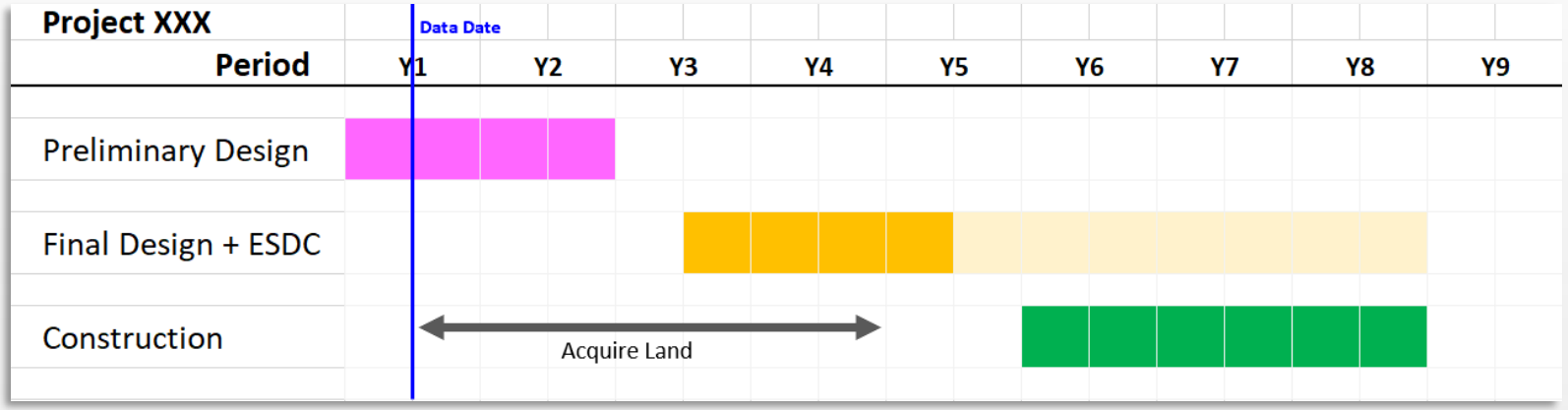
NetPoint for Initial Planning

Top-down planning and
NetPoint tips for team collaboration


Top-Down
Planning
to Program
Master
Schedule

Level 1 Schedule Planning

Executive Summary (High Level) Schedule per team planning in NetPoint/Excel/etc. based on history, existing information, and subject matter experts

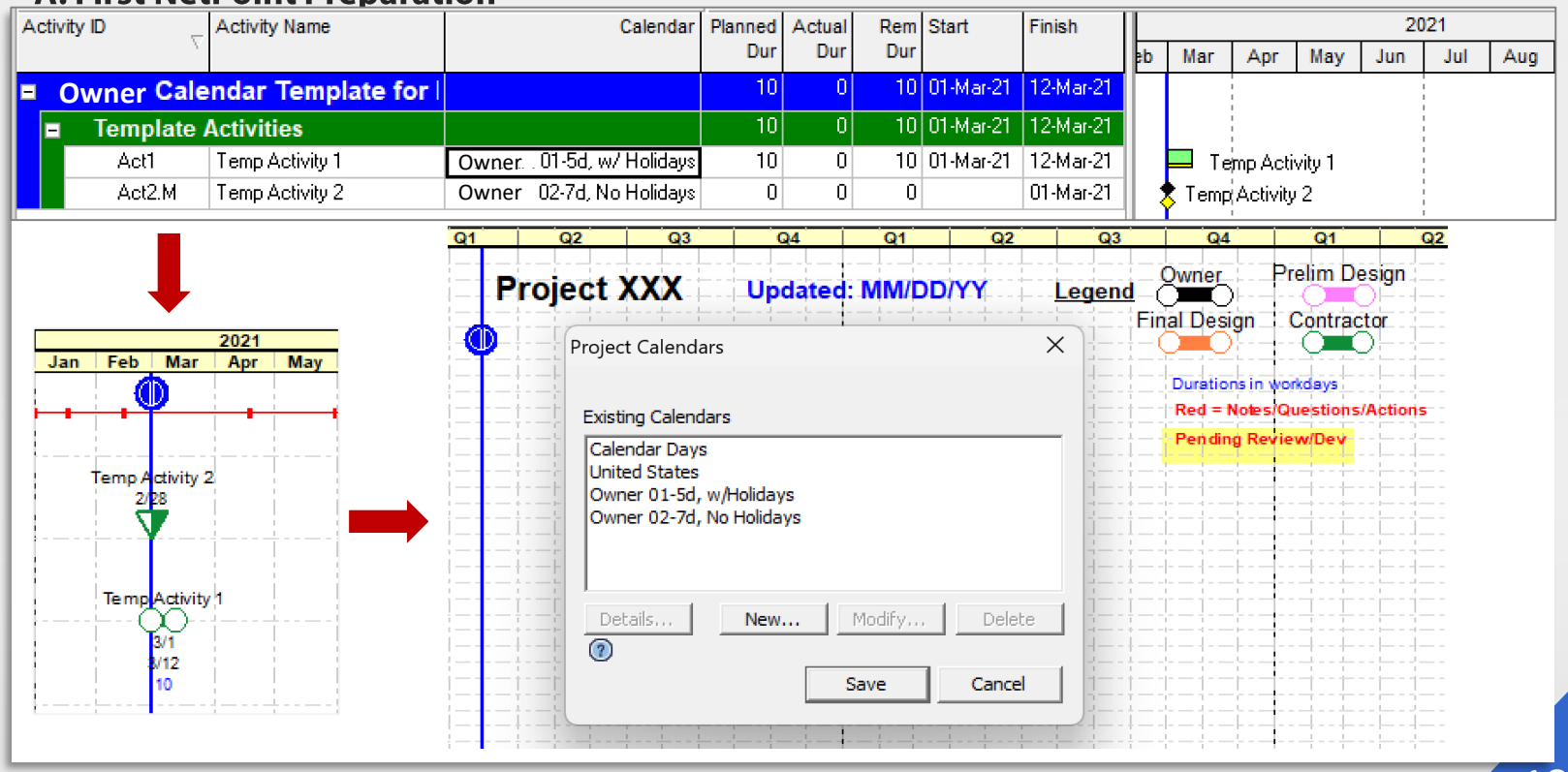


Level 2 Schedule Planning

A. For first NetPoint, prepare calendars (and WBS) in Primavera P6, and import to and modify in NetPoint.

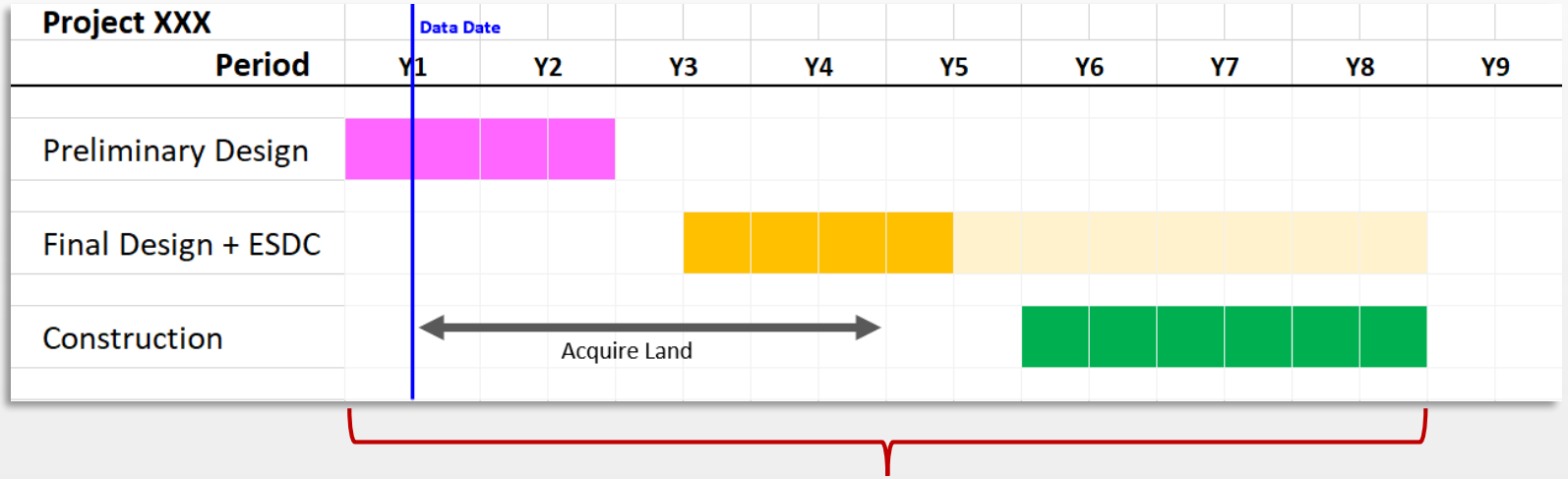
B. Develop Management Summary (Medium Level) Schedule per team planning in NetPoint

A. First NetPoint Preparation



Level 1 Schedule Planning

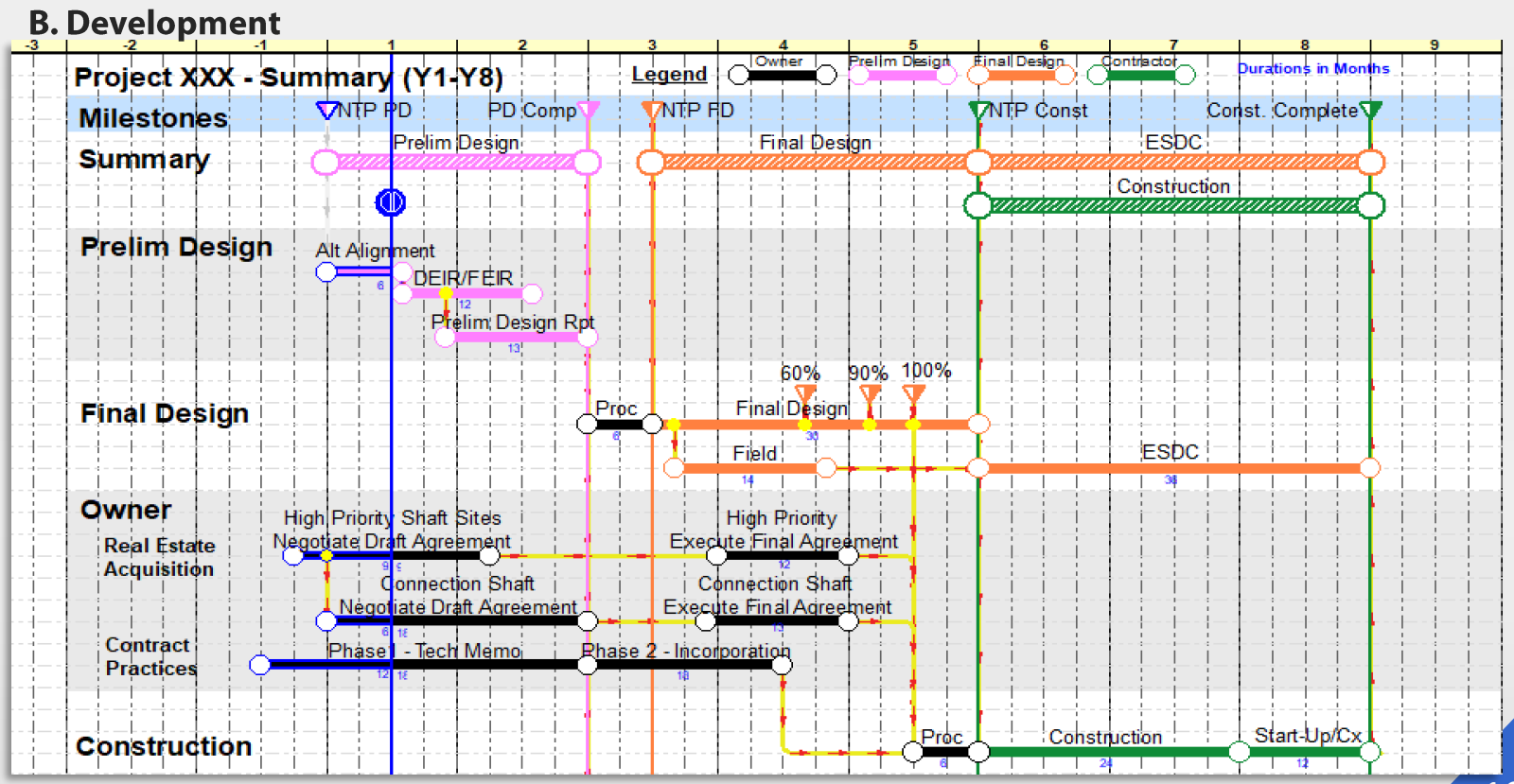
Executive Summary (High Level) Schedule per team planning in NetPoint/Excel/etc. based on history, existing information, and subject matter experts



Level 2 Schedule Planning

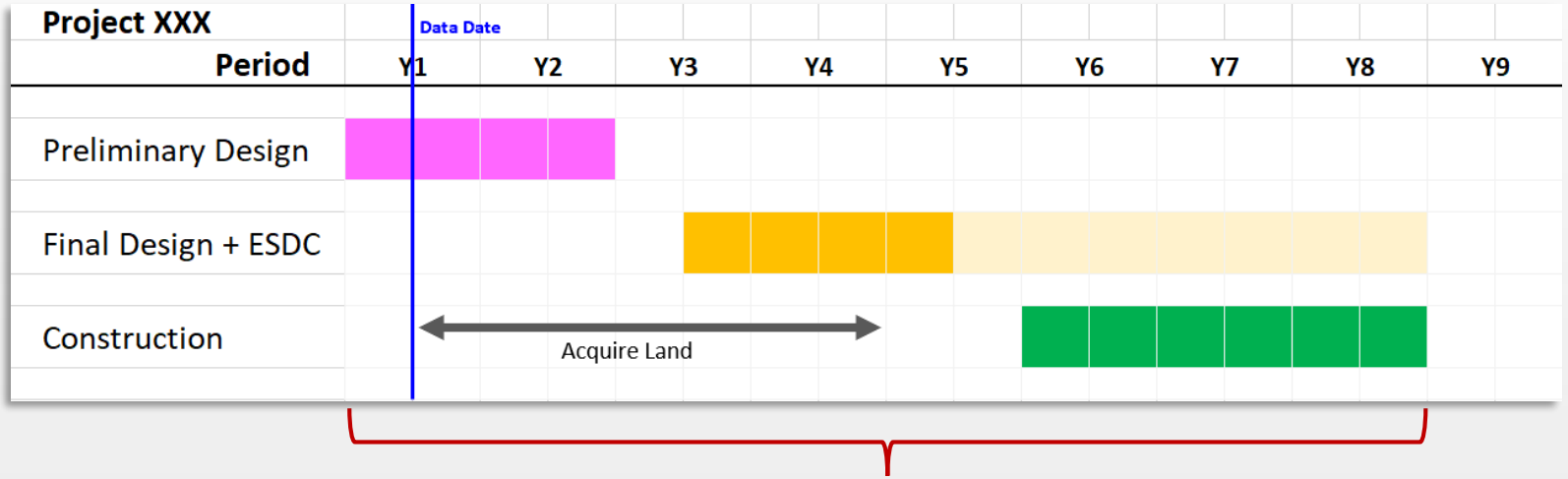
A. For first NetPoint, prepare calendars (and WBS) in Primavera P6, and import to and modify in NetPoint.

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Level 1 Schedule Planning

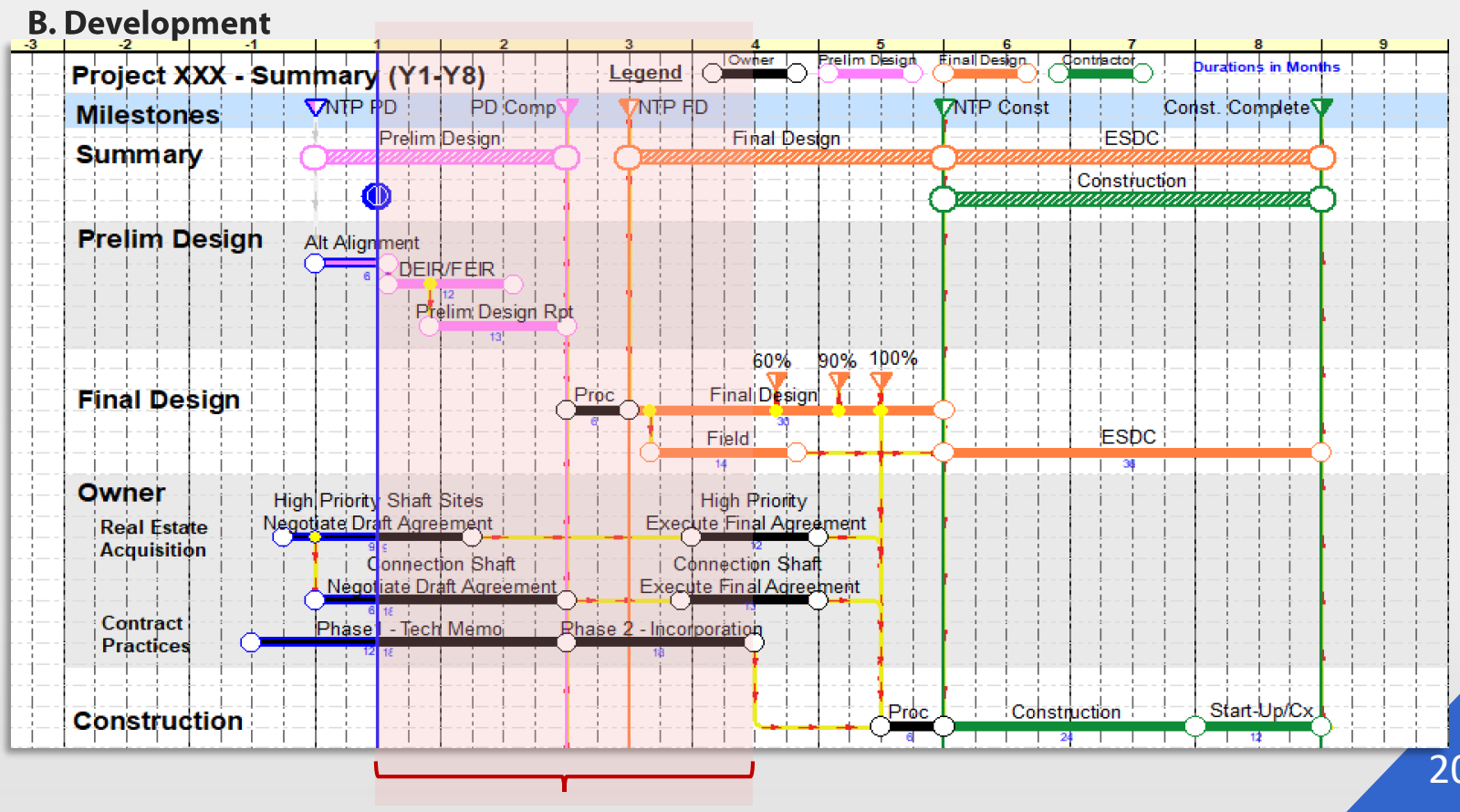
Executive Summary (High Level) Schedule per team planning in NetPoint/Excel/etc. based on history, existing information, and subject matter experts



Level 2 Schedule Planning

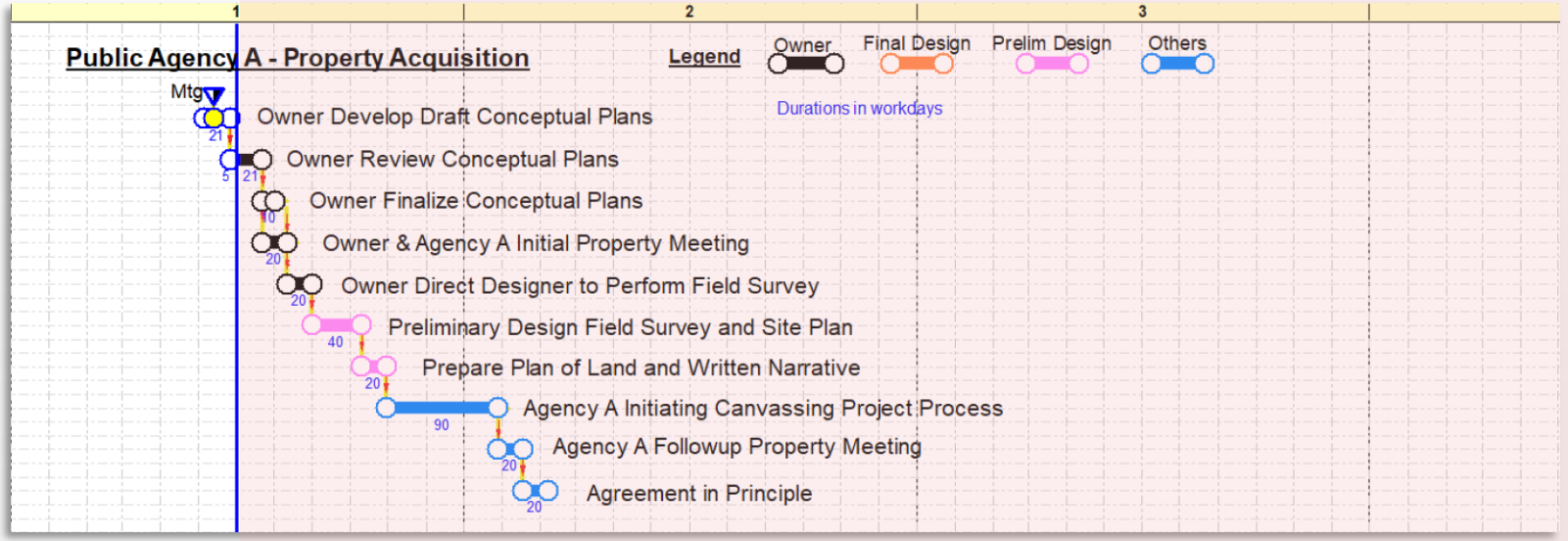
A. For first NetPoint, prepare calendars (and WBS) in Primavera P6, and import to and modify in NetPoint.

B. Develop Management Summary (Medium Level) Schedule per team planning in NetPoint



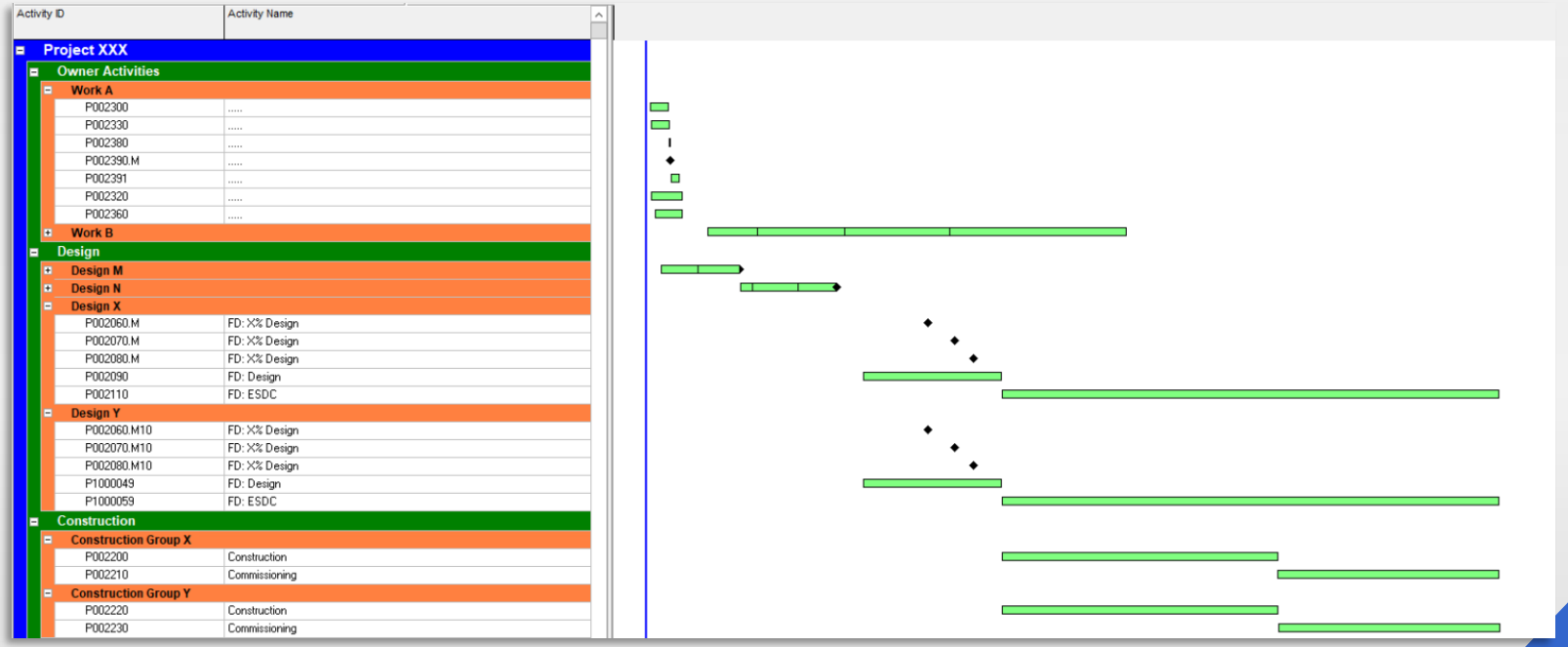
Level 3 Schedule Planning

Develop Progress / Coordination (Detailed Level) Schedule from the Medium Level schedule per the program team planning in NetPoint.



Program Master Schedule

Upon the team agreement, **PMA incorporated NetPoint** schedule fragnets at the **right level of details** into Primavera P6 schedule.



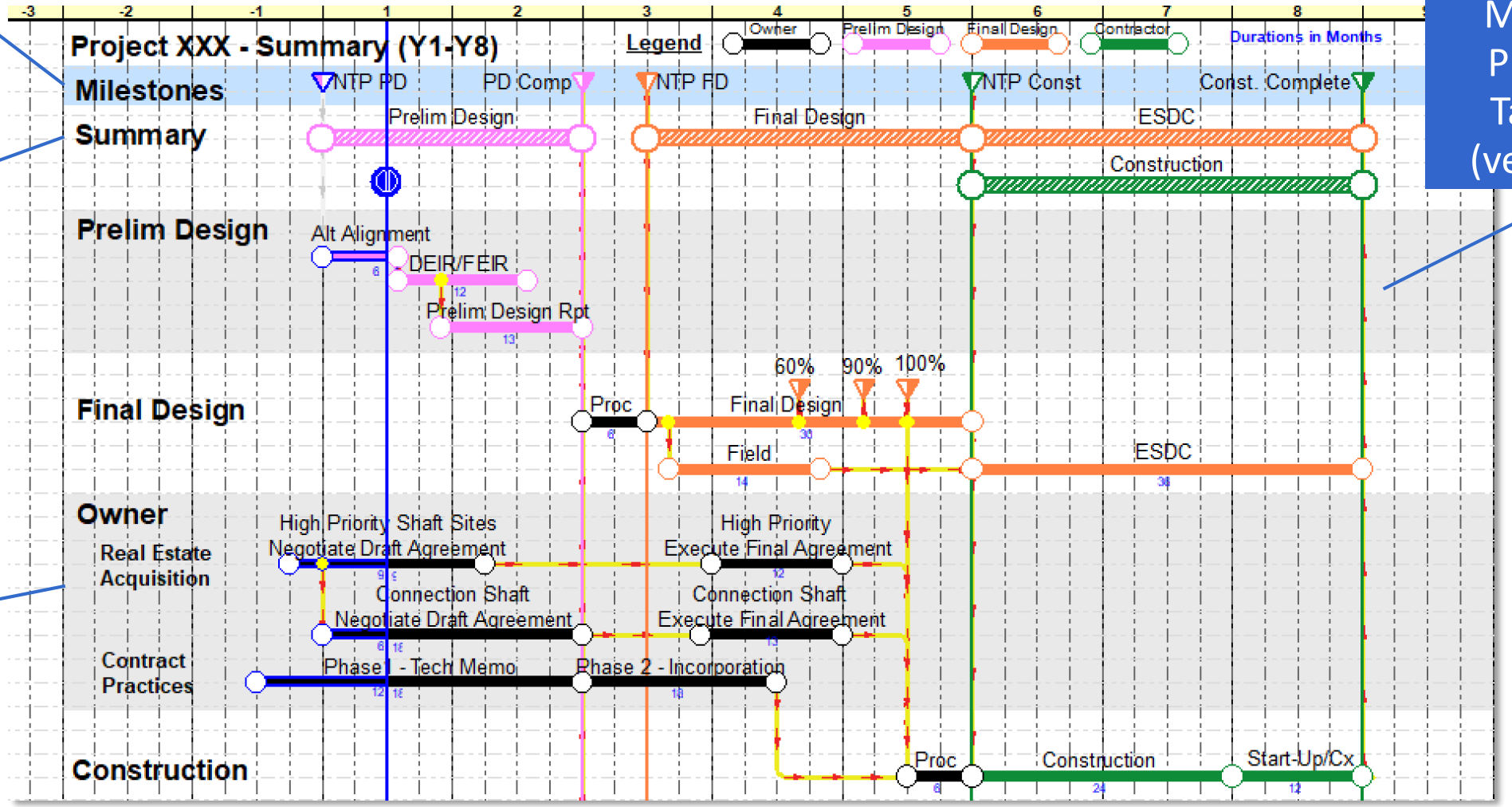
NetPoint Tips

to facilitate team collaboration

Milestones

Summary (Hammock vs. Manual)

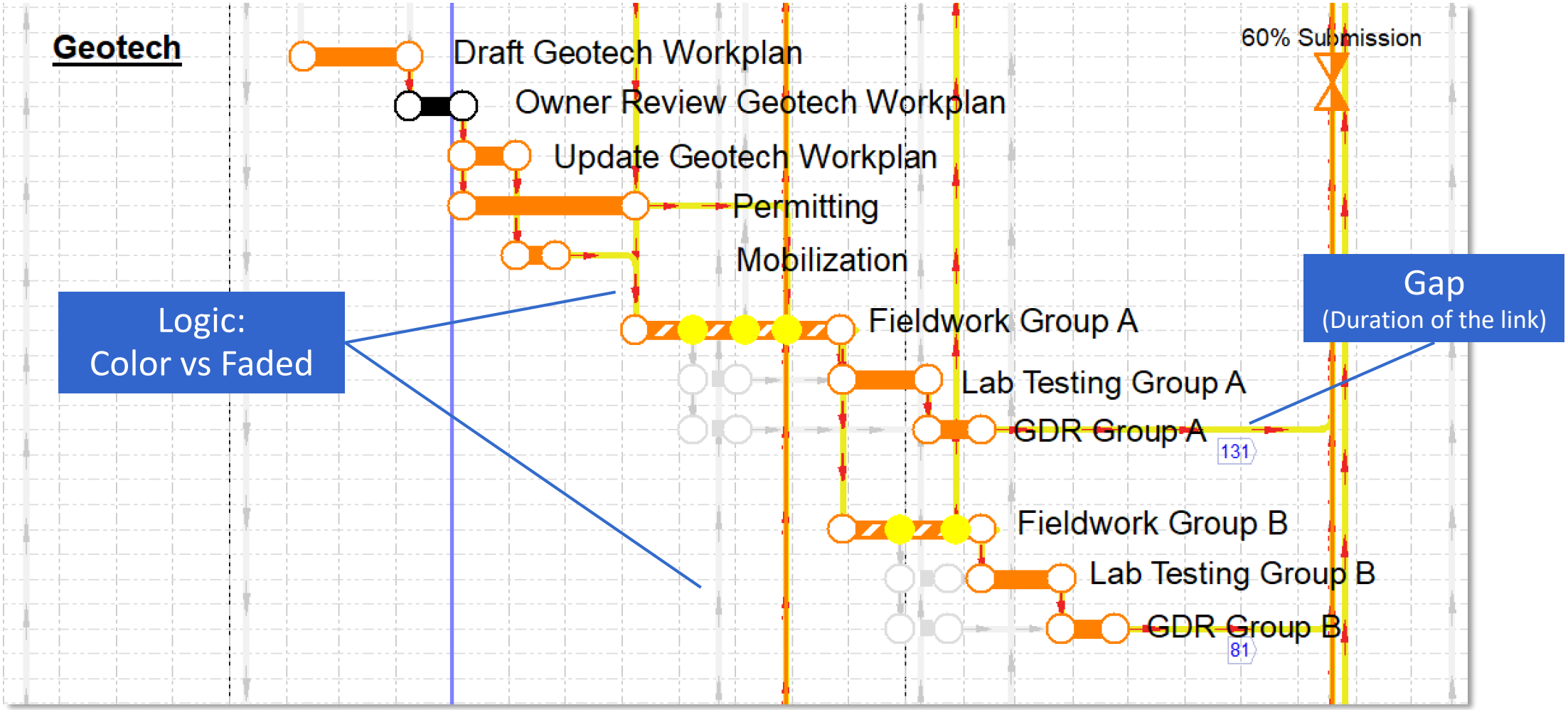
Shaded objects for each scope / WBS



Milestone's Properties: Tail Length (vertical line)

NetPoint Tips

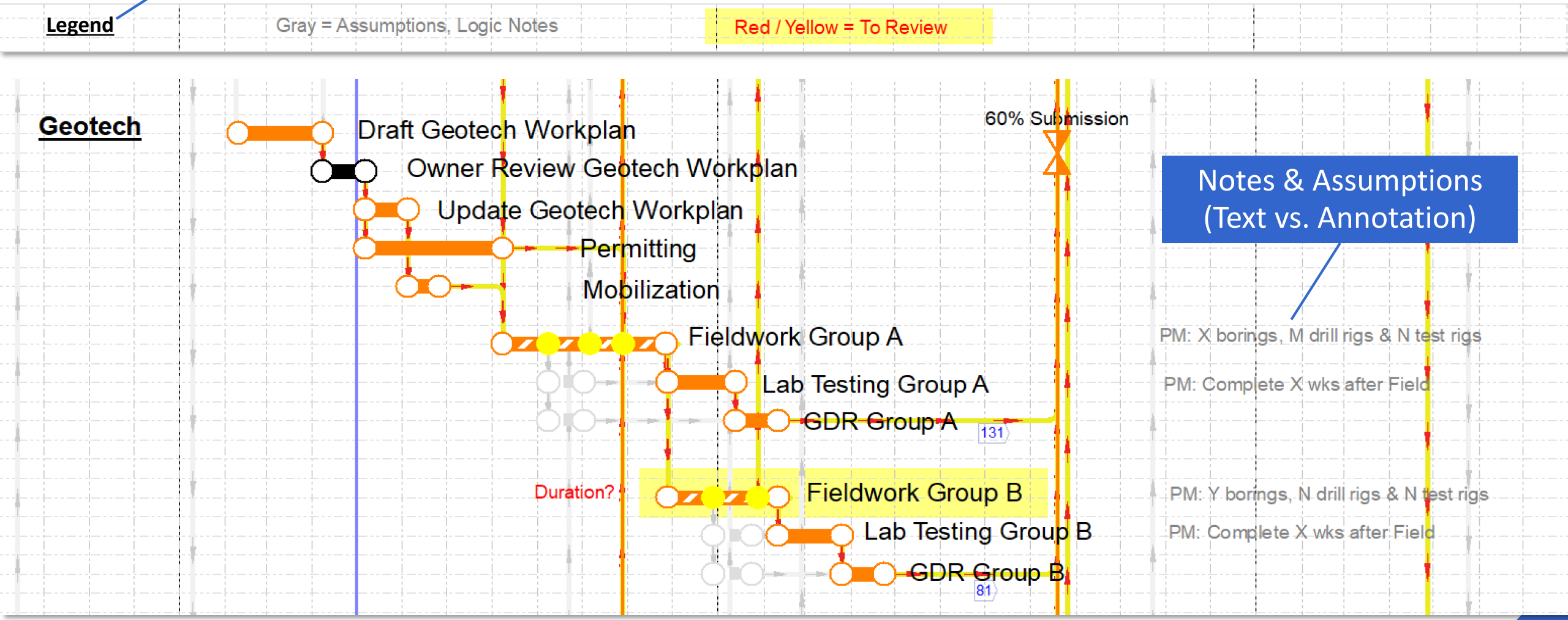
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NetPoint Tips

to facilitate team collaboration

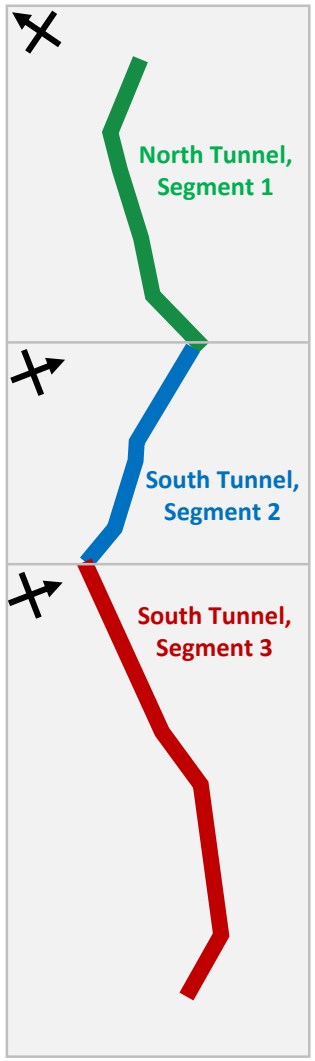
Consistency



Program Schedules & Decision Making

Bottom-Up planning and different schedule levels,
layouts, and formats to assist team's decision

MWTP Schedules & Decision Making



Preliminary Design → Final Design → Construction

Many Alternatives	Screening & Ranking →	Selected Alternative	Develop **Anticipated Construction Schedule**	Refine **Anticipated Construction Schedule**	Detail **Construction Schedule**

Shaft Sites & Function, Direction & Length, Connection Points → Tunnel Alignment, Contract Packaging, #TBMs, Schedule, Cost

- Program Study Area
- System Hydraulics
- Connection Points
- Possible Shaft Sites
- Operations
- Environmental & Social
- Reasonableness
- Draft Environmental Impact Report
- Land Availability
- Constructability
- Contract Pkg
- Sequencing
- Schedule & Cost
- etc.

Program Management

Scope / Quality / Cost / Time

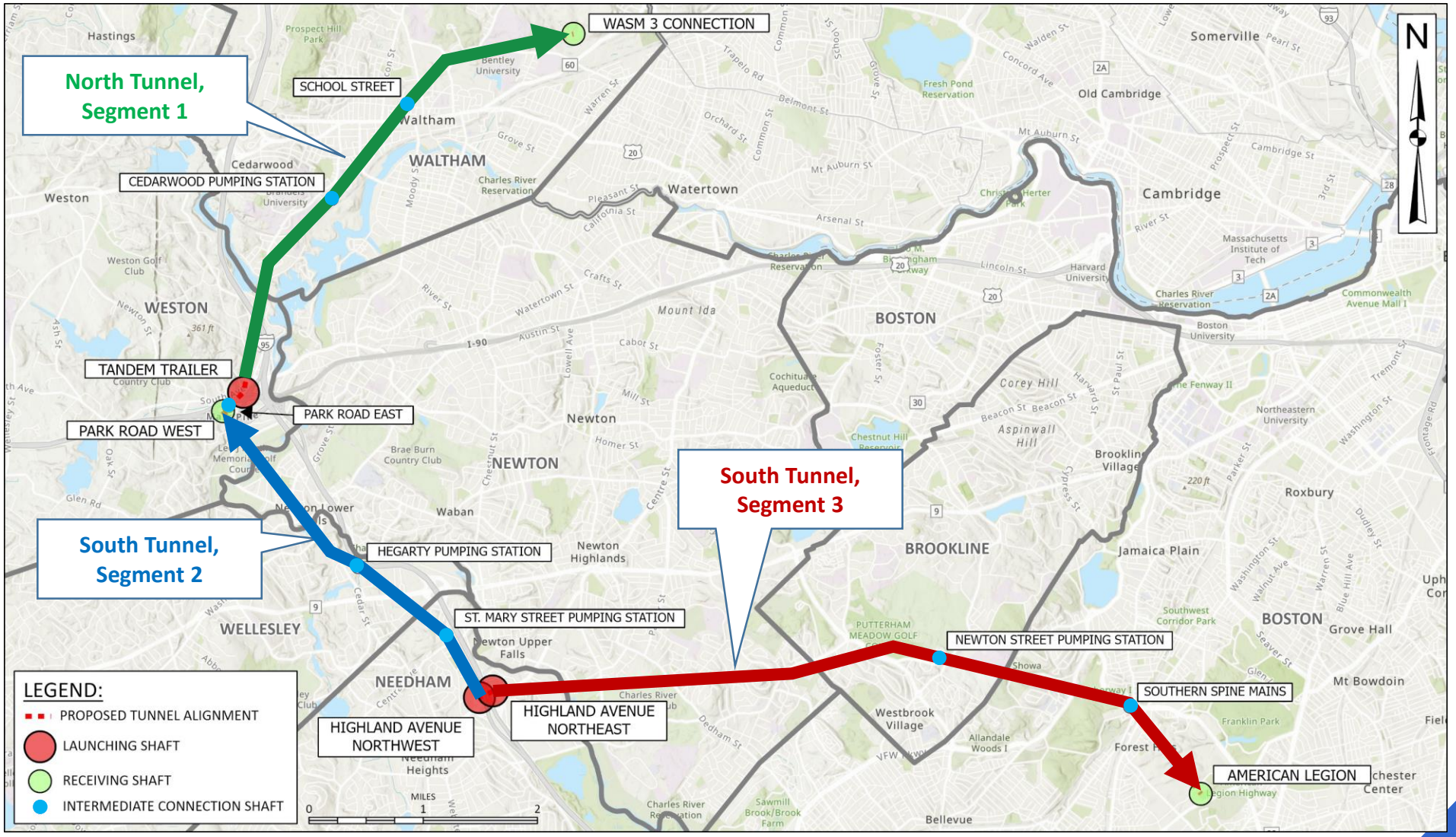
Program Master Schedule	Planning & Many Schedule Scenarios	Decision on #Design & #Const Pkgs, Schedule/Sequence, Cost	Risk Management

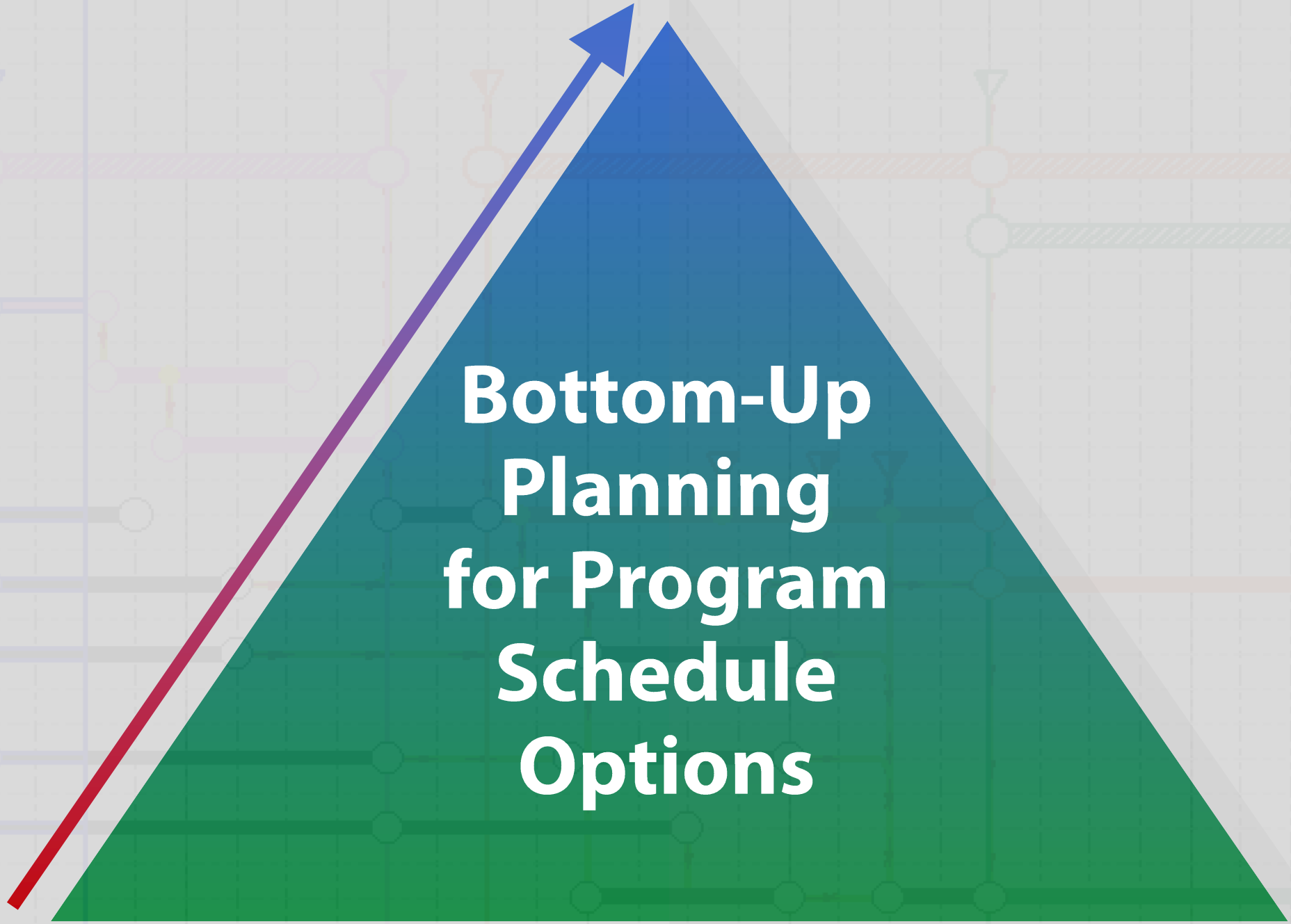
Planning, Executing, Monitoring & Controlling, Close Out

MWTP's Selected Alternative

Includes:

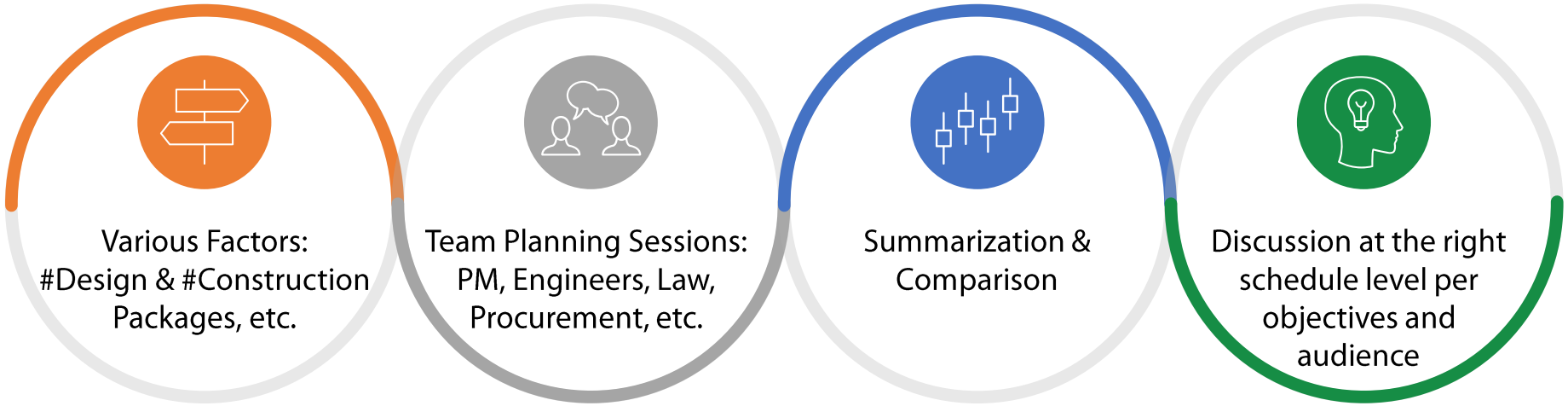
- 14.7 miles to deep rock tunnel
- 3 launching shaft sites
- 3 receiving shaft sites
- 1 large connection shaft site
- 6 connection shaft sites
- **3 tunnel segments with directions**
  - **Segment 1 ~4.5 miles**
  - **Segment 2 ~3.4 miles**
  - **Segment 3 ~6.8 miles**
- Tunnel system will operate as 2 tunnels (North Tunnel & South Tunnel)




Bottom-Up
Planning
for Program
Schedule
Options

Selected Alternative to Program Schedule Options

Bottom-Up Planning



01 Identify Program Schedule **Options**

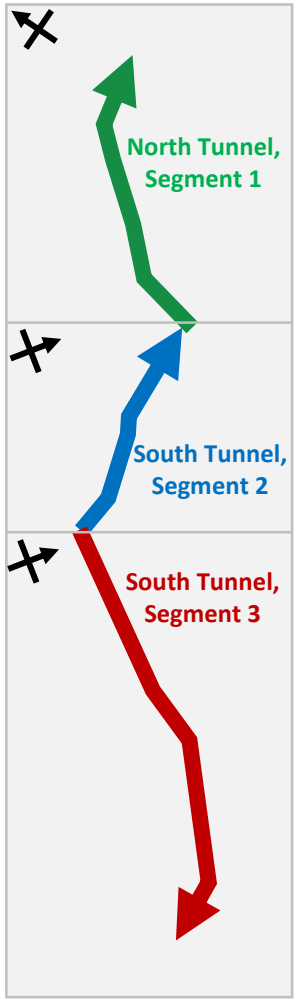
02 **Level 3** Schedule Development of an option **(Detailed Level)**

03 **Level 2 & 1** Summary **(Medium & High Level)**

04 **Review**, **Repeat** Step 2 & 3 for other options, and **Report**

Step1: Identify Schedule Options

Various Factors Based On Complexity

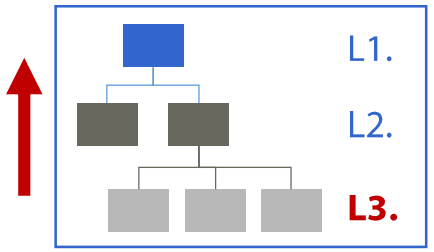


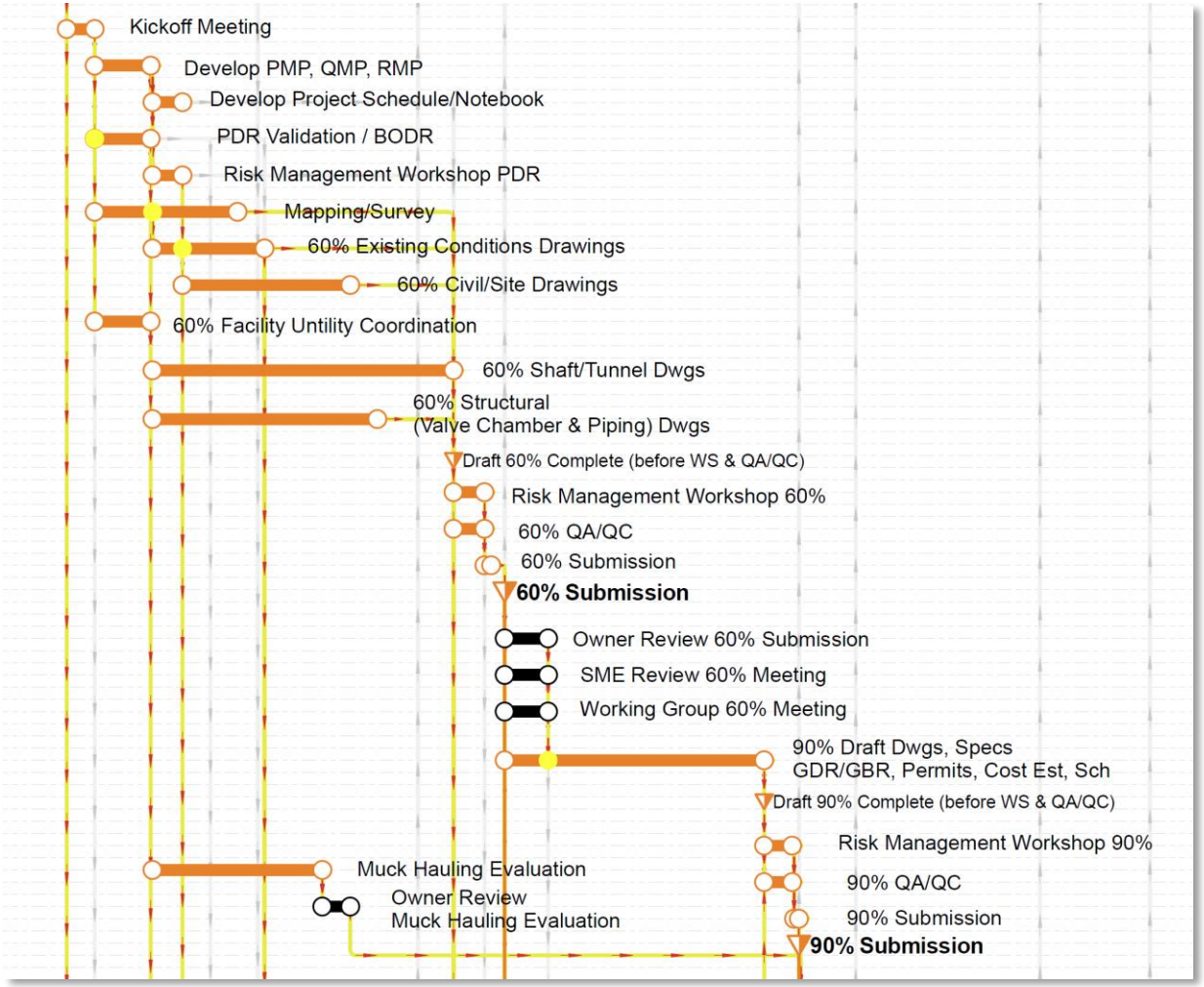
# Final Design (FDs)	# Construction Packages (CPs)	# Tunnel Boring Machines (TBMs)	Sequence	Potential Option (Y/N)
1 FD	1 CP	1 TBM	Segment 1 → 2 → 3	?
		2 TBMs	Segment 1 → 3 → 2	?
		3 TBMs	Segment 2 → 1 → 3	?
	2 CPs	1 TBM	Segment 2 → 3 → 1	?
		2 TBMs	Segment 3 → 1 → 2	?
		3 TBMs	Segment 3 → 2 → 1	?
	3 CPs	1 TBM	Segment 1 & 2 → 3	?
		2 TBMs	Segment 1 & 3 → 2	?
		3 TBMs	Segment 2 & 3 → 1	?
>1 FD (2 or 3)	1 CP	1 TBM	...	...
		2 TBMs		
		3 TBMs	Segment 1 & 2 & 3	?
	2 CPs	1 TBM		
		2 TBMs		
		3 TBMs		
	3 CPs	1 TBM		
		2 TBMs		
		3 TBMs		

Step2: Develop Schedule Level 3

Team Planning Discussion: Start with a possible option

Level 3 Schedule – Progress / Coordination (Detailed Level)

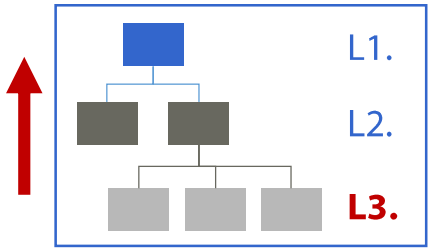


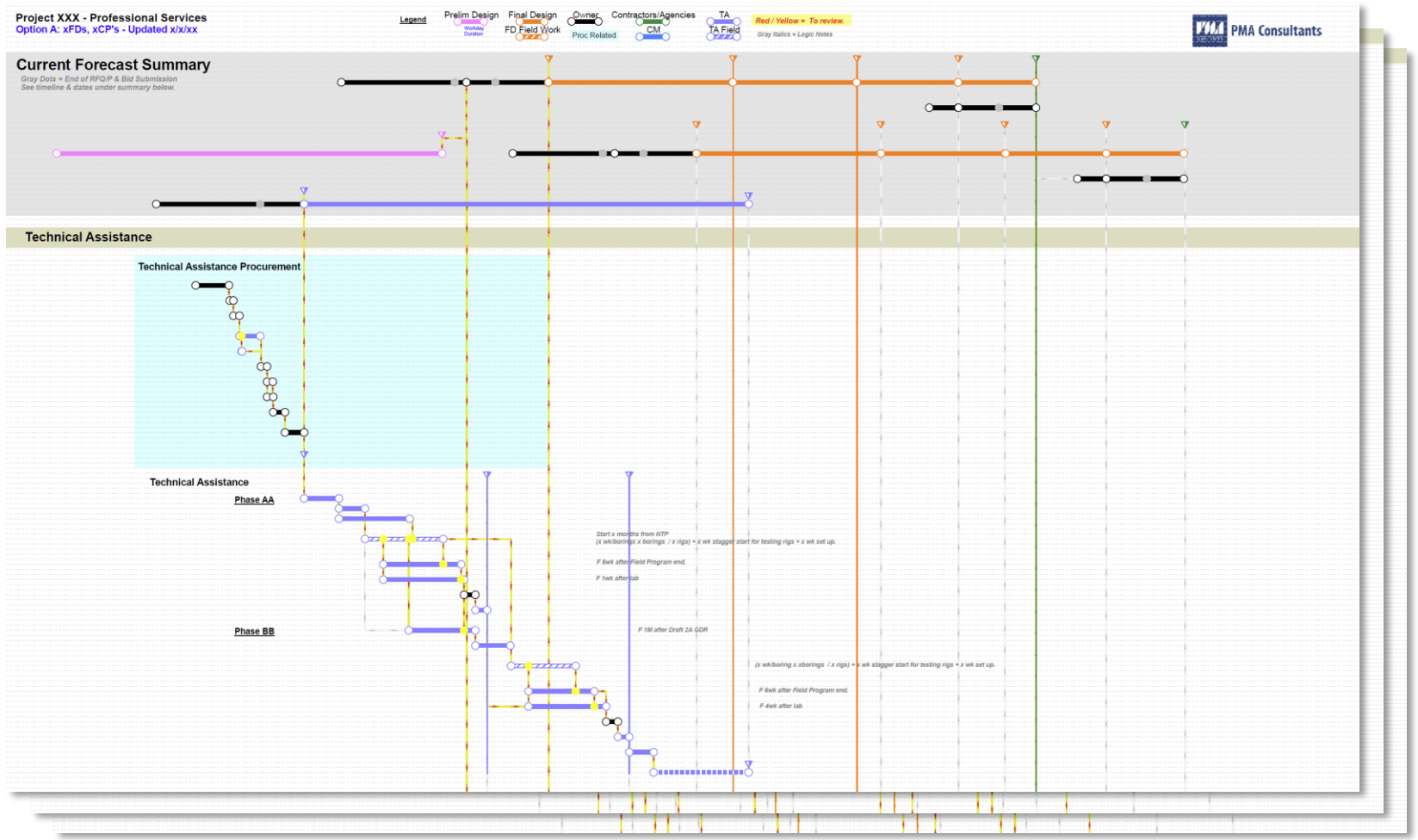


Step2: Develop Schedule Level 3

Team Planning Discussion: Start with a possible option

Level 3 Schedule – Progress / Coordination (Detailed Level)





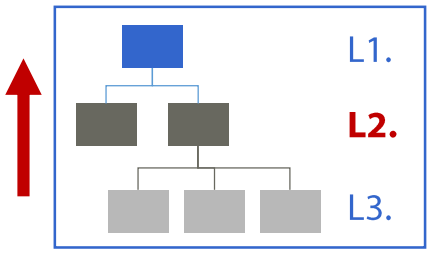
Detail

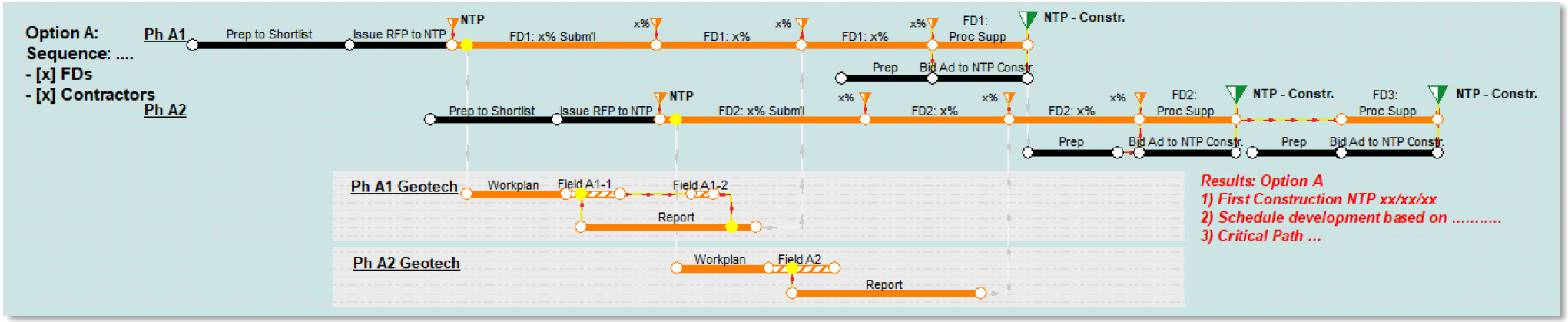
Owner Activities
Procurement
Design
Land Acquisitions
3rd Party Utilities
etc.

Step3: Summarize to Level 2 & 1

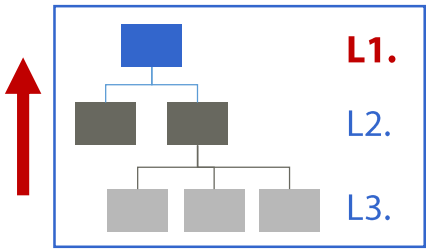
Summarization

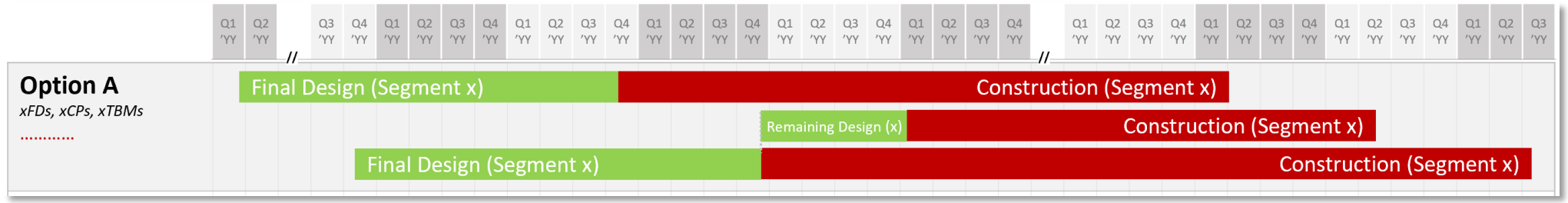
Level 2 Schedule – Management Summary (Medium Level)





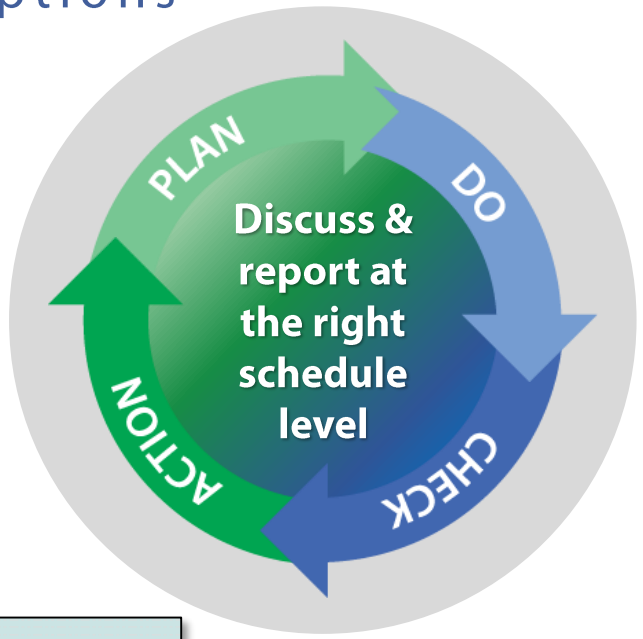
Level 1 Schedule – Executive Summary (High Level)

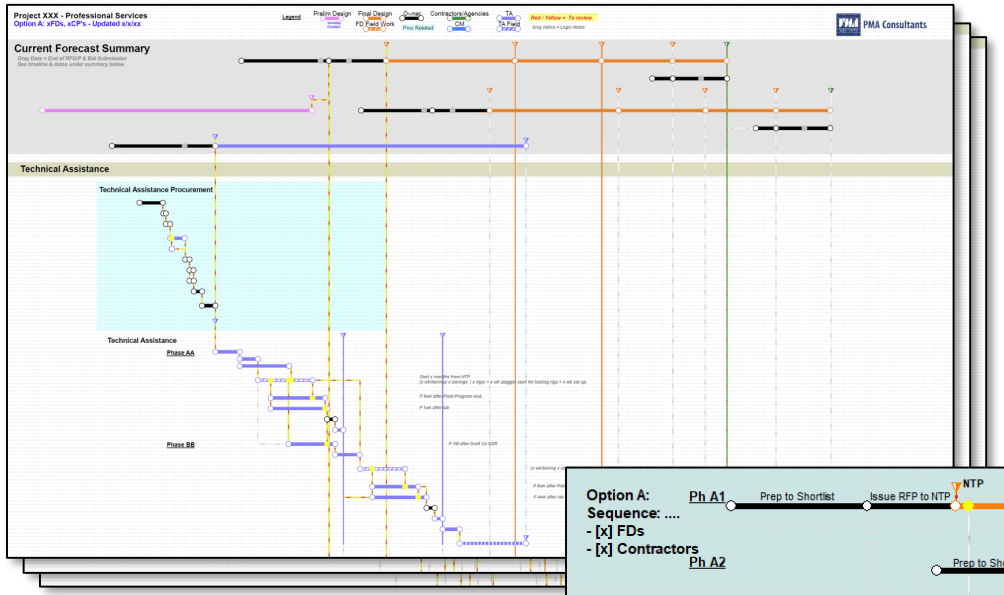




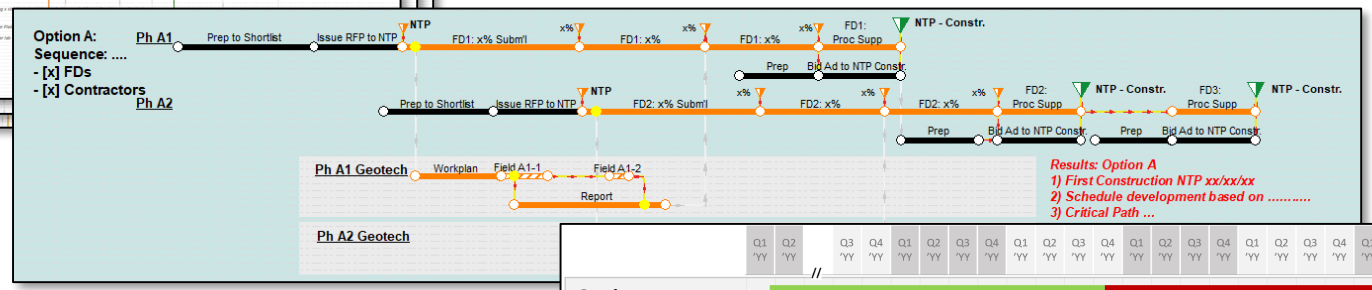
Step4: Review, Repeat, Report

Current Option and Step 2 & 3 Other Options

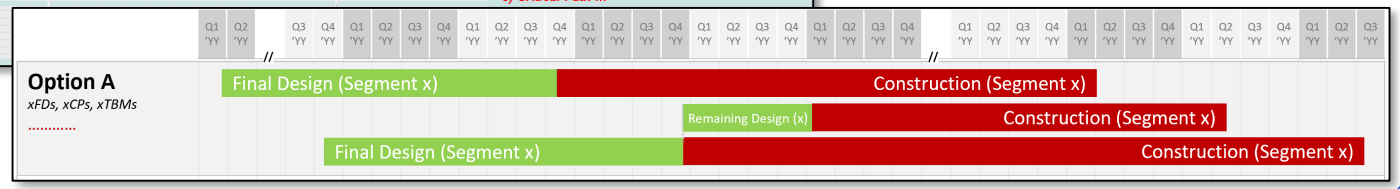




Level 3



Level 2

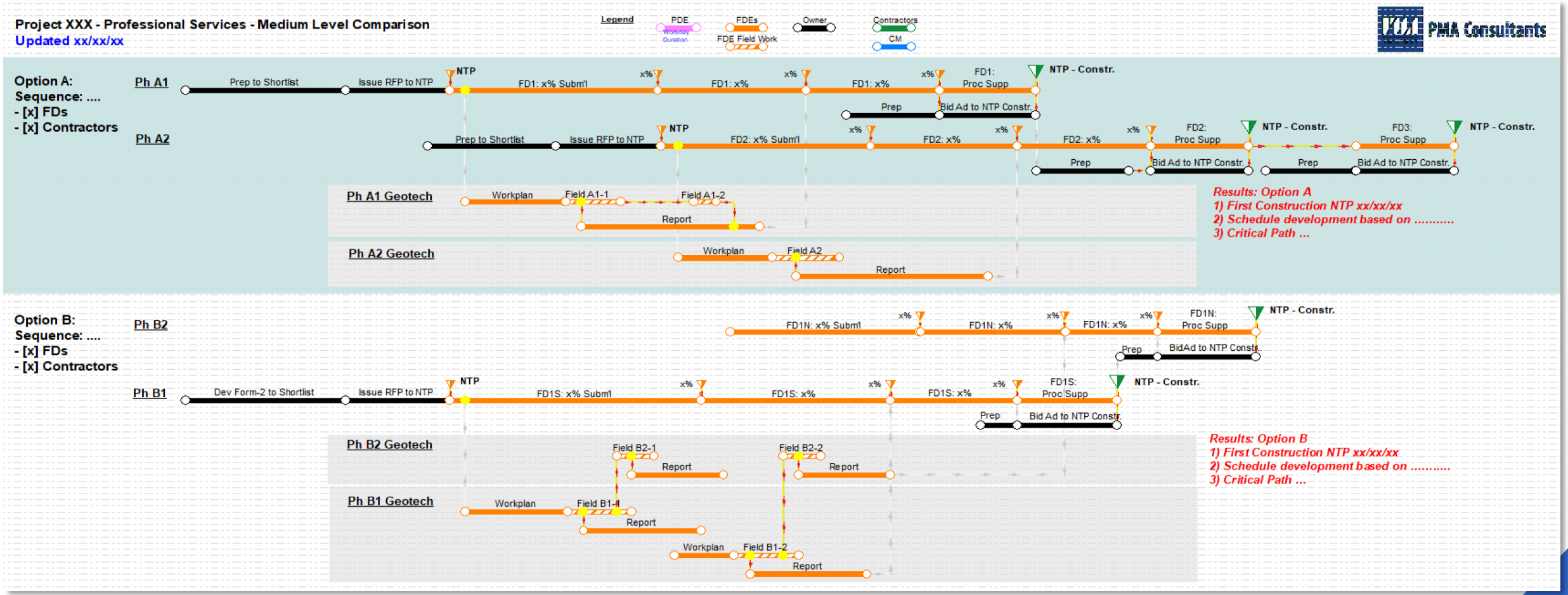


Level 1

Step4: Review, Repeat, Report

Comparison

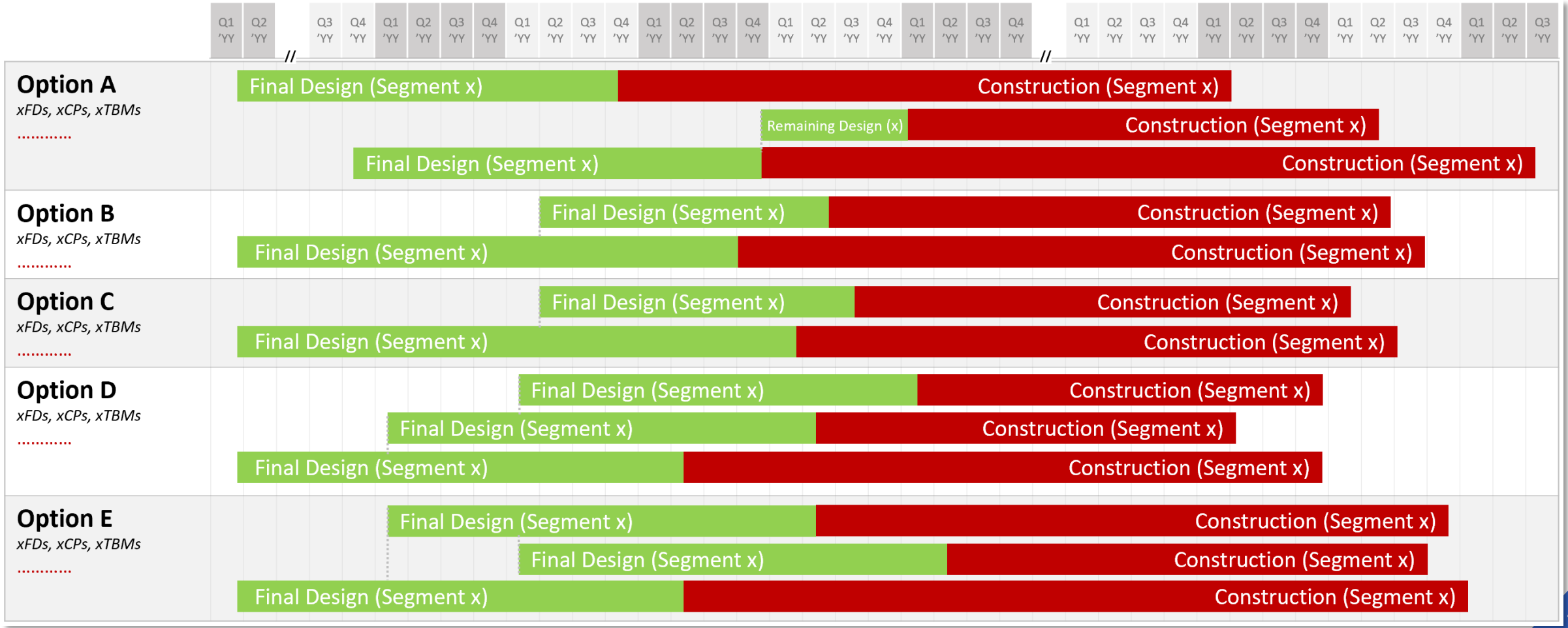
Level 2 Schedule – Management Summary (Medium Level)



Step4: Review, Repeat, Report

Comparison

Level 1 Schedule – Executive Summary (High Level)



Schedule Options Assist Team's Decisions

Continuous Improvement

Quantitative Risk Analysis
(Time & $)

Decision Matrix
Factors vs. Options

Value Engineering
Potential Changes
(Time & $)

Scope Refinement
Alignment & Confirmation

Conclusions

Lesson Learned, Q&A

CONCLUSIONS



Right Level of Information:
Level 1, 2, 3, etc.

Communication & Collaboration:
Openminded & Appropriate Tools

Right People:
Attendees & Audience

Understanding:
Top-Down & Bottom-Up

Right time:
Proactive & Rolling Wave Planning

Expectation Management:
Integrative & Iterative Process

Q & A TIME

No one can whistle a symphony.
It takes a whole orchestra to play it.

- Halford Edward Luccock -



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Senior Associate, PMA Consultants

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Massachusetts Water Resources Authority's Metropolitan Water Tunnel Program

https://www.mwra.com/mwtp.html

THANK YOU