MWRA Water System Expansion Evaluation to MetroWest Communities

Presentation to MetroWest Community Group

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Agenda

- Project Background
- MWRA Water System Model Evaluation
- Development of Conceptual Expansion Projects
- Infrastructure Components
- Water Quality Considerations
- Conceptual Expansion Project Cost Estimates
- Implementation Considerations
- Conclusions and Recommendations

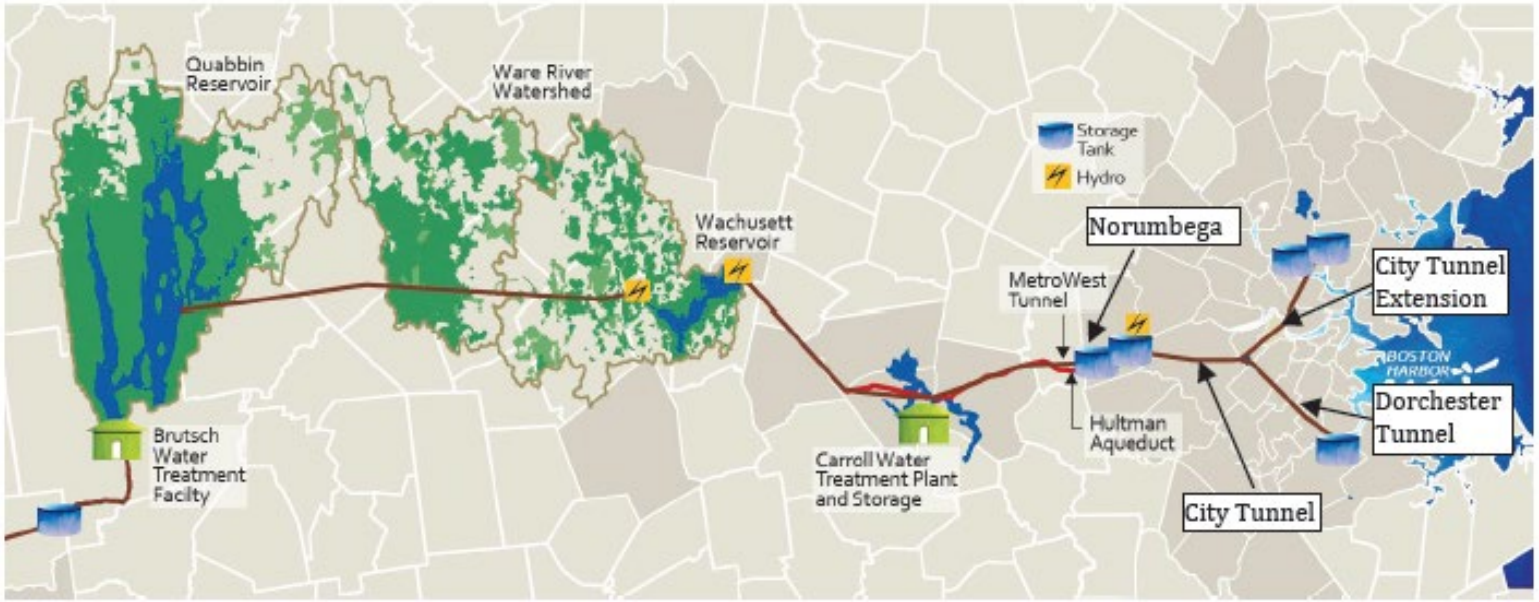
Purpose of Study

- Planning level study to aid MWRA in better understanding the infrastructure investment needed to expand its water service area to MetroWest communities
  - Confirm MWRA's existing water system capacity available
  - Identify critical infrastructure needed to deliver capacity to new communities
  - Provide planning level cost estimates for the additional MWRA infrastructure needed to serve these new customers
- No new study communities have yet committed to joining the MWRA
- Future study is needed should a community more seriously consider joining the MWRA

Project Background

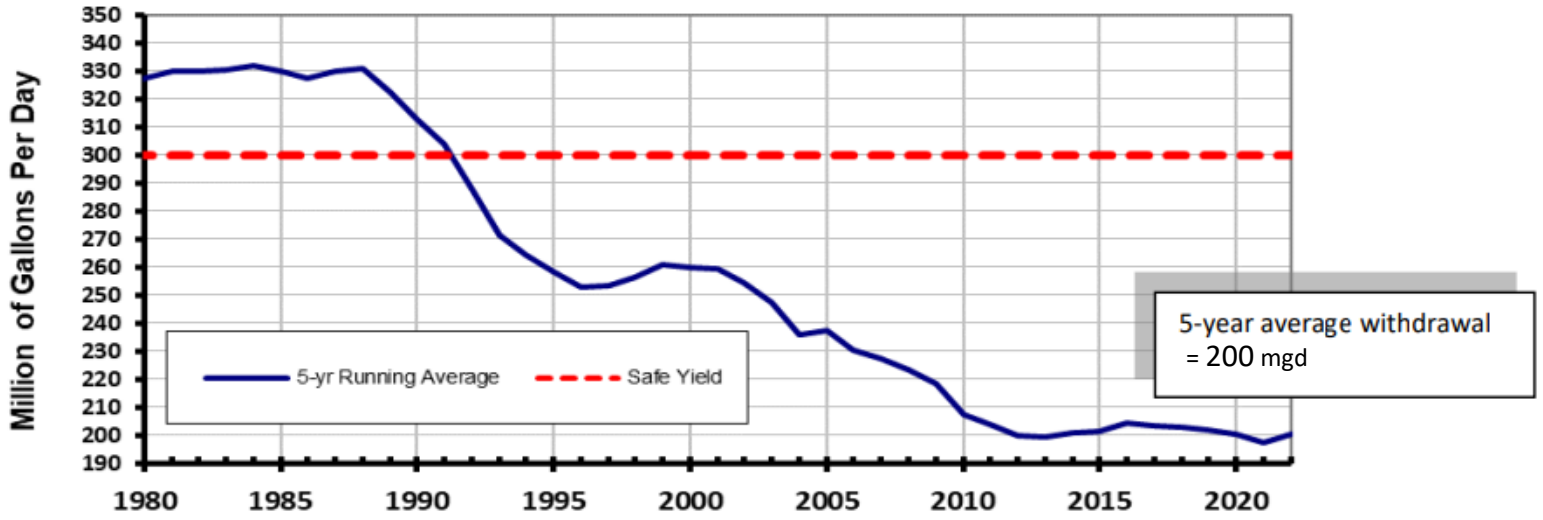
MWRA Water System

- MWRA supplies wholesale water services to 53 communities
- Average 200 million gallons per day (MGD), with maximum day demand of approximately 290 MGD
- Source Water – Protected Quabbin and Wachusett Reservoirs
- Carroll Water Treatment Plant – Ozone and UV
- Transmission and Distribution System



MWRA's Capacity to Provide Additional Water

- Declining Demand → Excess Water to Sell
  - MWRA Safe Yield: **300 MGD**
  - 5-year average reservoir withdrawals is approximately **200 MGD**
  - Available Supply for new communities is approximately **50 MGD**
  - How to deliver abundant source water to communities who need it?



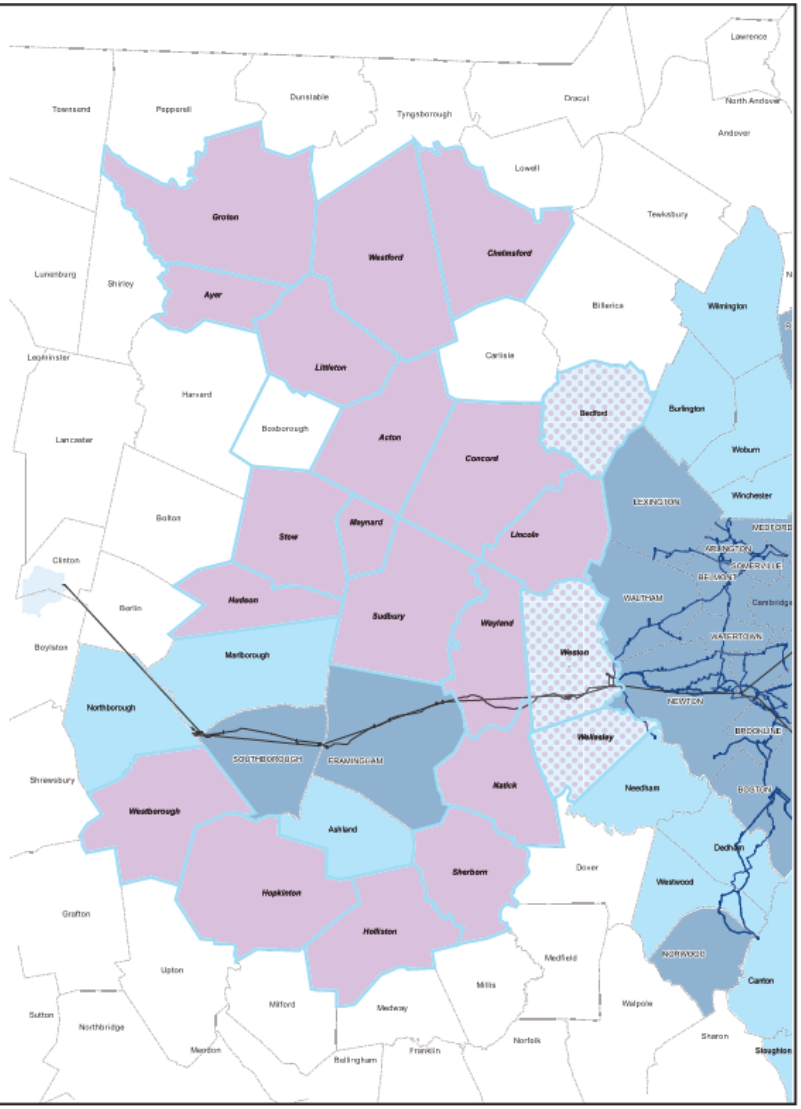
Water System Expansion Studies – Why Now?

- Pace of Communities joining MWRA has been slow
- Drought and seasonal restrictions
- PFAS concerns
- No MWRA Admission Fee through 2027
- Communities organized and approached MWRA
  - Needs/interest vary: Immediate, partial, emergency, redundancy, future

MetroWest Communities

- Acton
- Ayer
- Bedford
- Chelmsford
- Concord
- Groton
- Holliston
- Hopkinton
- Hudson
- Lincoln
- Littleton
- Maynard
- Natick
- Sherborn
- Stow
- Sudbury
- Wayland
- Wellesley
- Westborough
- Westford
- Weston

Note: The Town of Boxborough was not included as a study community but has expressed interest in any future MetroWest expansion discussions.



CDM Smith

MetroWest Community Engagement

- Study unique regarding community participation
- MetroWest requested this study
- A number of community engagement meetings held
- Meeting participants provided valuable information on their respective systems and “big picture” insights on how system expansion may impact the region

Thank you, MetroWest Group!

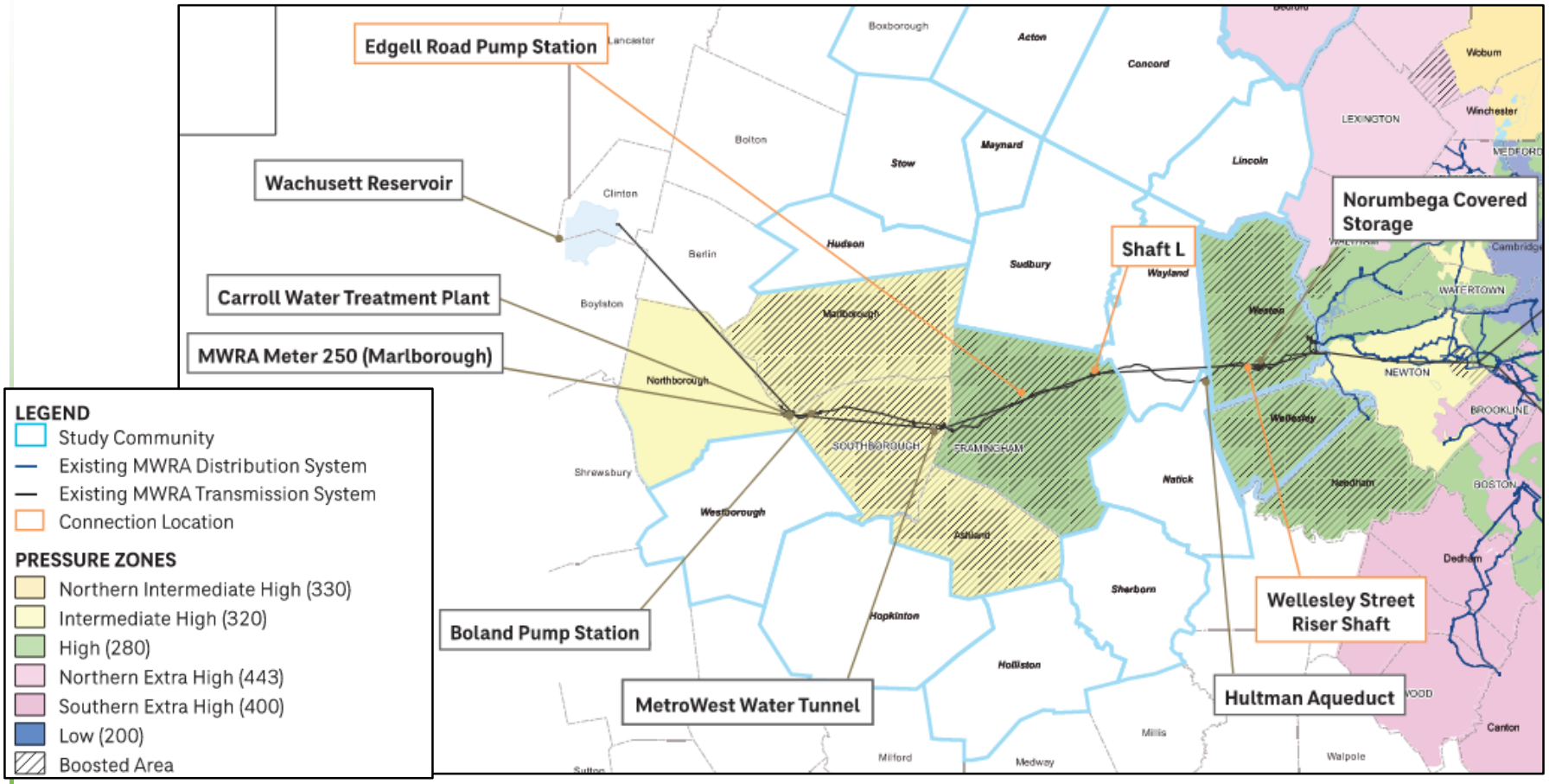
Report Contents

1. Review of existing information and determination of potential connection locations
2. Model evaluation to confirm capacity is available in the MWRA Water Distribution and Transmission System to supply study communities
3. Development of conceptual expansion projects to convey supply to MetroWest
4. Consider water quality changes
5. Develop planning level project cost estimates
6. Implementation considerations and recommendations for further study

MWRA Water System Model Evaluation

MWRA Facilities Review

- Expansion supply from the MetroWest Water Tunnel (MWWT)
- Identified potential connection locations along the MWWT



Water System Model Evaluation

- Integrated transmission system model into existing distribution system model
- Objective to confirm capacity available to supply MetroWest
  - Supply existing maximum day demand of about 50 MGD to study communities
  - Simulation assumes 5 consecutive maximum days
  - Supply from the MetroWest Tunnel – Shaft L, Wellesley Riser, Edgell Road PS
  - Assumed some expansion to the Metropolitan Boston system
- Key assets (MWRA meters, tanks, PS, etc.) evaluated to ensure performance met for existing system

Key Modeling Takeaway:

- Sufficient capacity under normal operating conditions

Future Model Considerations:

- Water Age Modeling
- Consider impacts to capacity during emergency and construction conditions
- Simulate proposed infrastructure
- Consider future water demands

Conceptual Expansion Projects

Development of Conceptual Expansion Projects

- Hydraulic analysis confirmed sufficient capacity available within MWRA's existing system to supply MetroWest
  - 5 concept level projects developed
  - Assumes connection to the MWRA system to supply MDD
  - Conceptual pipeline routes developed to target specific communities
  - Transmission assumed to be surface piping and are dependent upon geography served and proximity to connections along the MWWT
  - Routes utilize rail trails (Bruce Freeman Rail Trail) and local roadways
  - Communities north of the MWWT grouped together
- Projects subject to change based on community interest

Conceptual Projects Overview

Project No.	Connection Location	Capacity Provided (MGD)	Communities Served and Expected Demands
1a/1b	MWRA Shaft L	34.2	Communities north of MWWT, with goal of meeting existing MDDs
2	Wellesley Street Riser Shaft	7.4	Natick, Wellesley, and Weston, with goal of meeting existing MDD for Natick; additional supply to meet Wellesley's MDD (partially served by MWRA); and redundant connection for Weston (fully served by MWRA)
3	Edgell Road Pump Station	1.5	Holliston with goal of meeting existing MDD
4	Existing Pipeline at Northborough border	2.4	Westborough with goal of meeting existing MDD
5	Wheeling	2.1	Hopkinton and Sherborn assuming existing MDDs

Conceptual Projects Overview

CONCEPTUAL PROJECTS:

Projects 1a (and 1b) - Service to Communities North of the MetroWest Water Tunnel

Project 2 - Service to Weston, Wellesley, and Natick

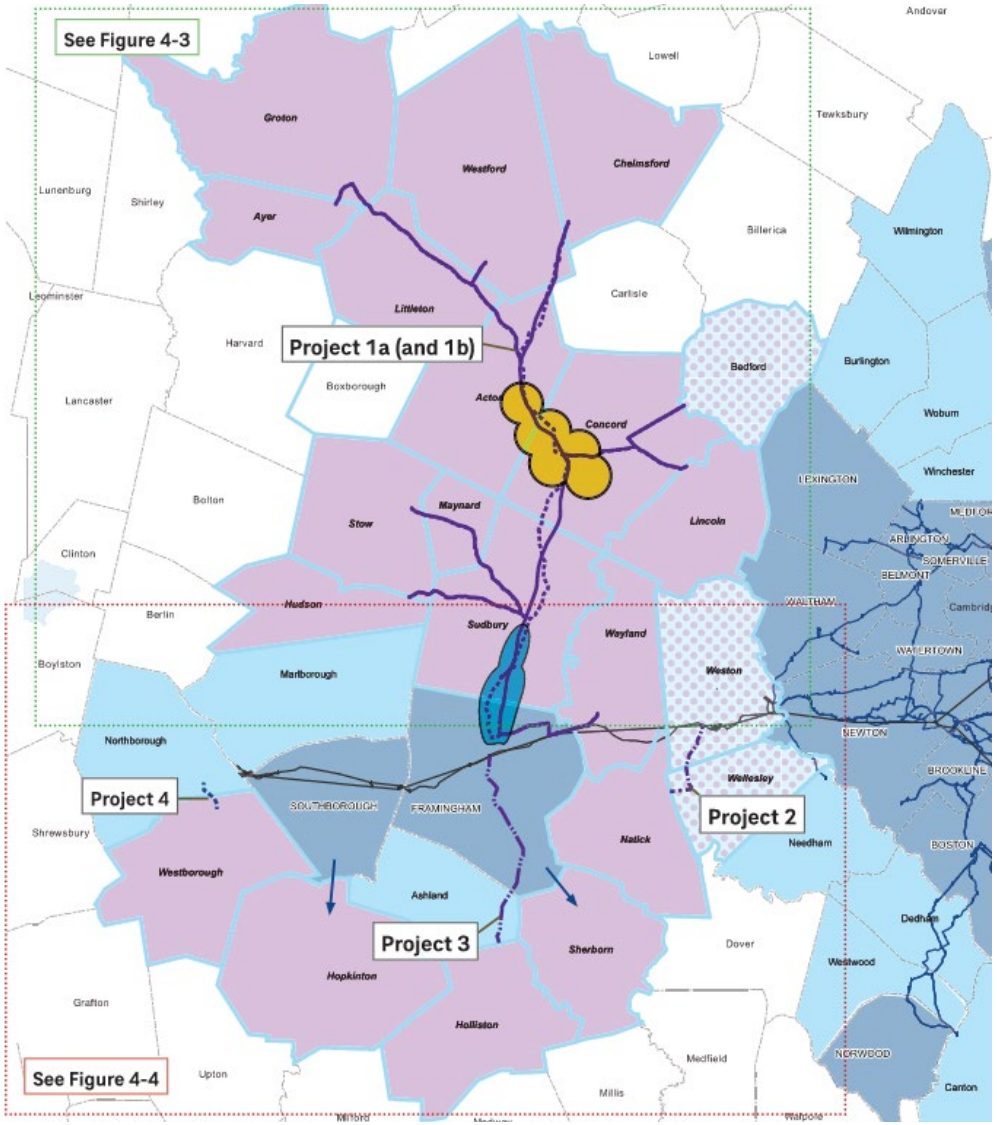
Project 3 - Service to Holliston

Project 4 - Service to Westborough

Project 5 - Wheeling to Hopkinton and Sherborn

LEGEND

- Study Community
- Study Community (MWRA served)
- MWRA Member Community
- MWRA Partially Served Community
- Expanded MWRA Service Area
- Existing MWRA Distribution System
- Existing MWRA Transmission System
- Proposed Pipe Route (Project 1a)
- Proposed Pipe Route (Project 1b)
- Proposed Pipe Route (Project 2)
- Proposed Pipe Route (Project 3)
- Existing Pipe Route (Project 4)
- Represents Wheeling (Project 5)
- Assumed Transmission Main Pumping Station (Location TBD)
- Assumed MWRA Storage (Location TBD)



Conceptual Projects 1a and 1b

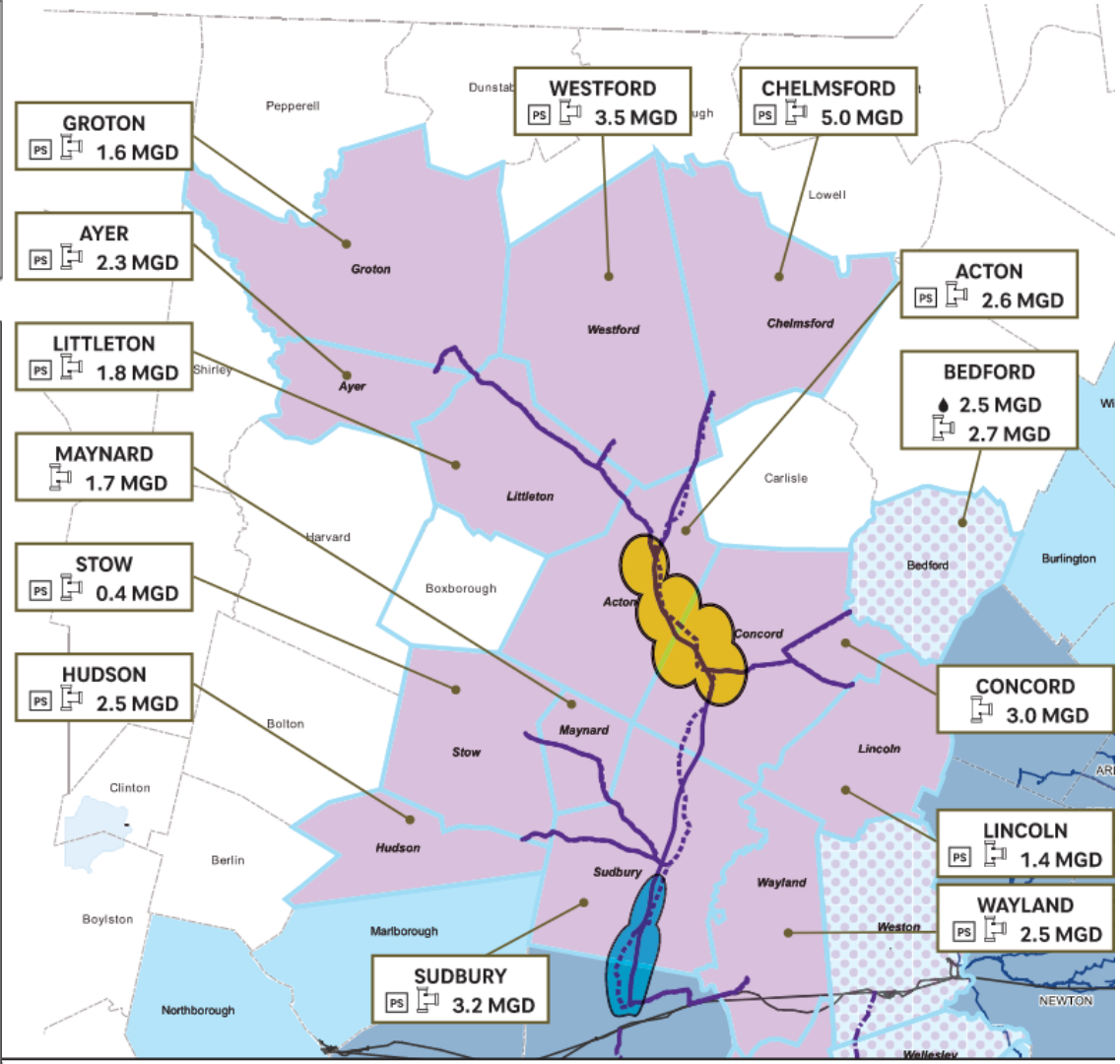
CONCEPTUAL PROJECTS:

Project 1a - Service to Communities North of the MetroWest Water Tunnel using Bruce Freeman Rail Trail

Project 1b - Service to Communities North of the MetroWest Water Tunnel using Local Roadways

LEGEND

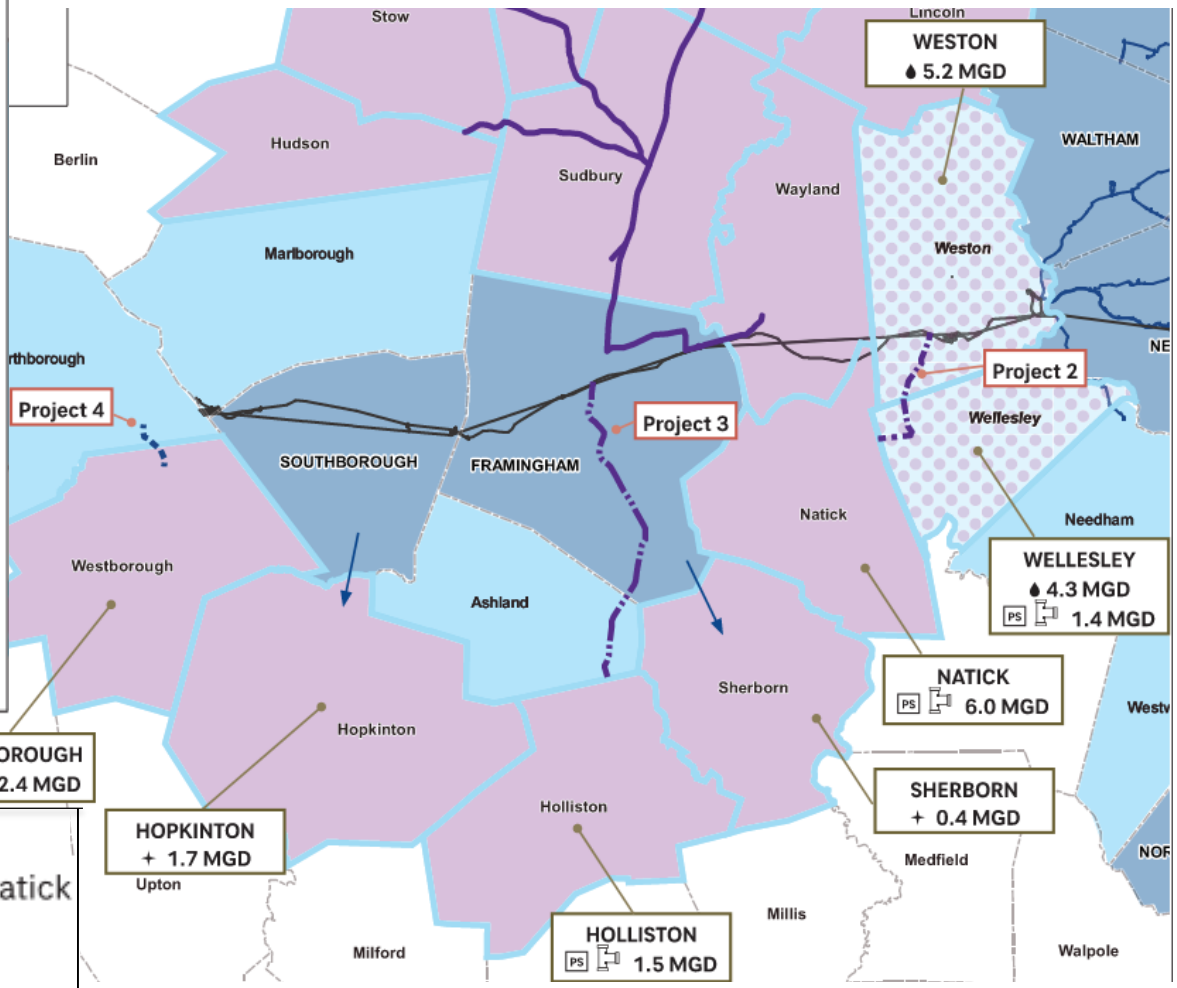
- Study Community
- Study Community (MWRA served)
- MWRA Member Community
- MWRA Partially Served Community
- Expanded MWRA Service Area
- Existing MWRA Distribution System
- Existing MWRA Transmission System
- Proposed Pipe Route (Project 1a)
- Proposed Pipe Route (Project 1b)
- Assumed Transmission Main Pumping Station (Location TBD)
- Assumed MWRA Storage (Location TBD)
- Proposed Community Pipe Connection with Expected Service Volume
- Proposed Community Pump Station
- Existing MWRA Service Volume



Conceptual Projects 2, 3, 4, and 5

LEGEND

- Study Community
- Study Community (MWRA served)
- MWRA Member Community
- MWRA Partially Served Community
- Expanded MWRA Service Area
- Existing MWRA Distribution System
- Existing MWRA Transmission System
- Proposed Pipe Route (Project 2)
- Proposed Pipe Route (Project 3)
- Existing Pipe Route (Project 4)
- Represents Wheeling (Project 5)
- Assumed Community Wheeling Service Volume
- Proposed Community Pipe Connection with Expected Service Volume
- Proposed Community Pump Station
- Existing MWRA Service Volume



CONCEPTUAL PROJECTS:

Project 2 - Service to Weston, Wellesley, and Natick
Project 3 - Service to Holliston
Project 4 - Service to Westborough
Project 5 - Wheeling to Hopkinton and Sherborn

Infrastructure Components

Water Transmission Mains

Conceptual Project No.	Length of Transmission Main	Transmission Main Size
1a	50 miles	12- to 54-in
1b	50 miles	12- to 54-in
2	3 miles	24- to 30-in
3	7 miles	12-in

Pipe ≤ 48-in: Class 52, zinc-coated, cement-lined ductile iron (CLDI)

Pipe > 48-in: Cathodically protected cement-lined steel

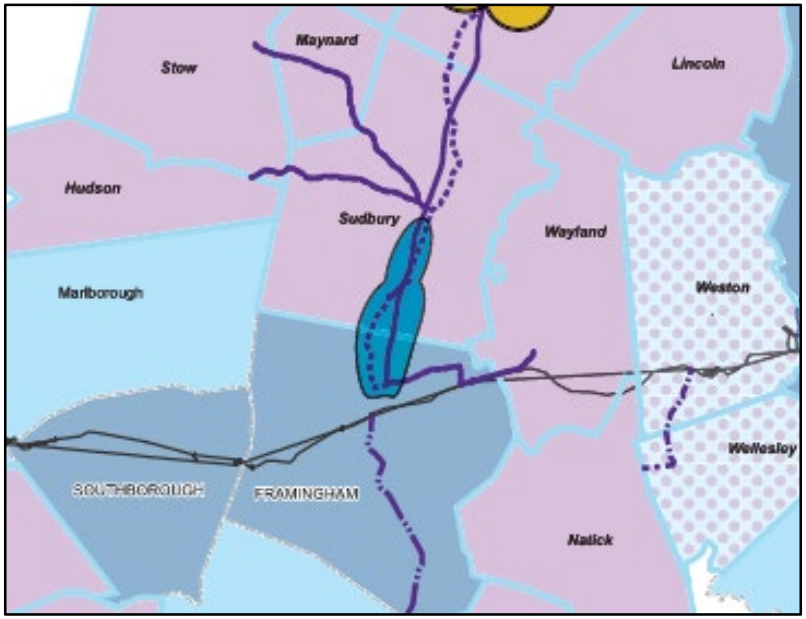
Projects 4 and 5 assume no new pipe:

- Project 4 assumes use of the existing 16-in water main that extends to the Westborough State Hospital at the Northborough border
- Project 5 assumes wheeling of water from Southborough to Hopkinton, and Framingham to Sherborn

Transmission System Pump Station

- Goal: Maintain minimum 20 psi of pressure along entirety of transmission main
- Result: Transmission system pump station required only for Project 1a (and 1b)
- MWRA owned and operated

Conceptual Project No.	Capacity	
	Flow rate (MGD)	Total Dynamic Head (Feet)
1a	30	160
1b	30	160



Assumed Transmission Main
Pumping Station (Location TBD)

Community Owned Pump Stations

- Goal: Provide minimum 35 psi of pressure at service area high point

Pump station sizing varies based on community maximum day demand

Conceptual Project No.	Number of Community Pump Stations	Pump Station Capacities
1	Project 1a: 11 Project 1b: 10	0.4 to 5 MGD
2	2	1.4 and 6 MGD
3	1	1.5 MGD
4	1	2.4 MGD

Note: Due to differences in hydraulics between Projects 1a and 1b, it is anticipated that Sudbury will not require its own community pump station for Project 1b

Terminal Storage

- Improves MWRA operations and provides redundancy
- Sized to meet ADDs of communities served along the pipeline
- To be installed as pairs (MWRA preference)
- Assumed to be precast, circular tanks

Terminal Storage	Communities Served
Twin 9 MG Tanks (18 MG total)	Communities north of MWWT for Projects 1a / 1b

Terminal storage sized to meet the average day demand of communities served along the pipeline

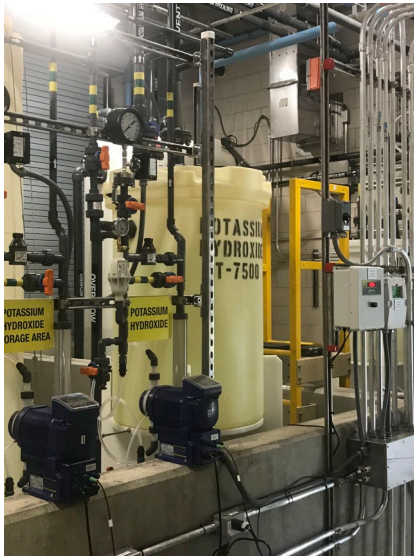
Assumed MWRA Storage (Location TBD)

Water Quality Considerations

Water Quality and Blending – Preliminary Considerations

- Blending MWRA with community source waters will require assessment
  - Different quality, potentially impacting SDWA and MassDEP compliance
  - Determine need for chemical feed facilities
  - Requires MassDEP review/permit
- Blending scenarios: continuous, seasonal, seasonal changeover, one-time transition
- When wheeling - consider MWRA, the wheeling community, and the receiving community source water

Chemical feed facility assumed for each community and sized based on average day demand



Water Quality – Additional Considerations

Water Quality Concerns to Evaluate	
Lead & Copper Compliance	Solubility and corrosion differences
Need to Maintain Chlorine Residual	Impacts to chlorine chemistry from MWRA chloraminated water
Disinfection Byproducts (DBPs) Rule Compliance	Mixing relative to DBP formation potential
Aesthetic Concerns	Reversal of flow could create turbidity, discoloration, suspended solids

Future Planning Studies to Assess Water Quality Compatibility May Include

- Blending Analysis
- Water Age Modeling
- Tank Operations
- Bench-Scale Testing
- Full-Scale Pilot
- Pipe Loop Study
- Flushing
- Monitoring

Conceptual Expansion Project Cost Estimates

Key Cost Estimating Assumptions and Limitations

- All costs are in April 2023 dollars and rounded to the nearest $10 million and $1 million, where necessary
- Construction costs include direct costs, indirect costs, general contractor conditions, and contractor overhead and profit
- Design and engineering services during construction based on 25% of construction cost
- Project contingency allowance of 25%
- Annual escalation of 3.5% for a five-year period

OPPC estimates do not include the following:

- Community costs that may be incurred to connect to the MWRA system
- Study and pre-design costs
- Community mitigation costs, finance or funding costs, legal fees, etc.
- No specific allowances for rock excavation, dewatering, contaminated soils, and utility relocation
- Costs associated with wheeling of water between communities

Opinion of Probable Project Costs – By Project

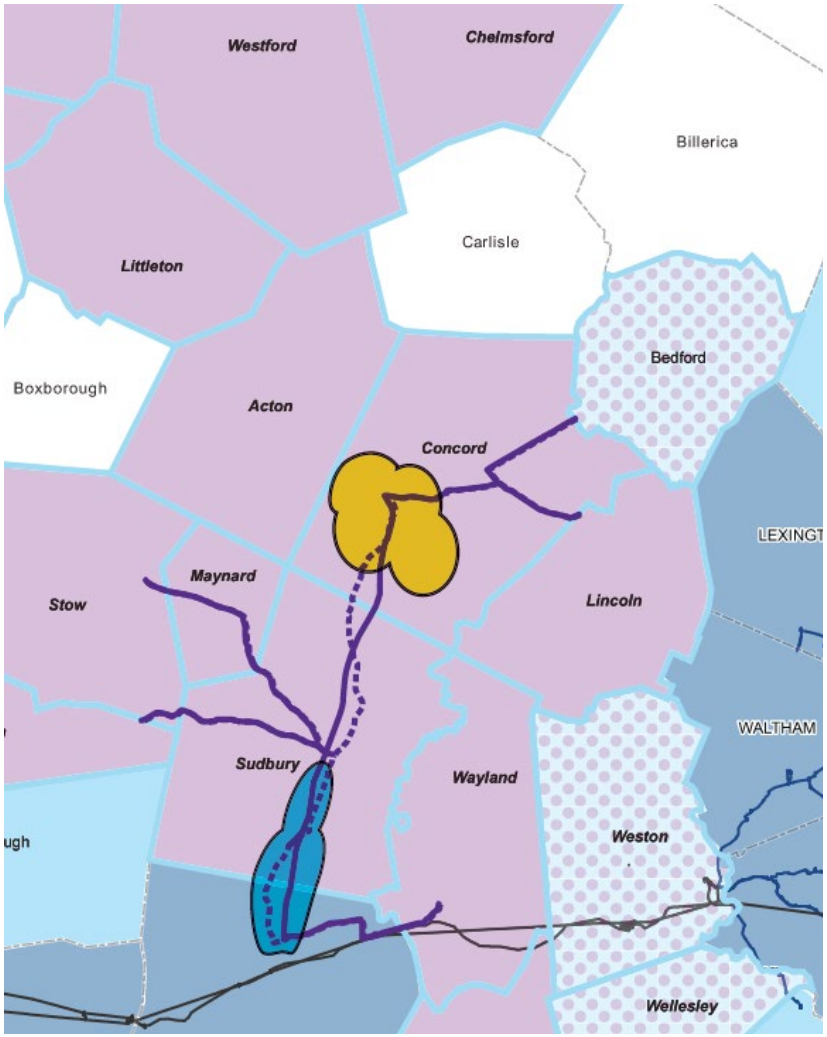
	Cost ($ Million)				
Item Description	**1a**	**1b**	**2**	**3**	**4**
Pipes and Appurtenances	$470	$490	$20	$20	$1
Allowance for Pumping Stations, Storage, and Chemical Feed Station Construction	$130	$130	$20	$10	$6
Subtotal Construction Costs	***$600***	***$620***	***$40***	***$30***	***$7***
Design and Construction Phase Engineering (25%)	$150	$160	$10	$10	$2
Subtotal Engineering and Construction	***$750***	***$780***	***$50***	***$40***	***$9***
Project Contingency (25%)	$190	$200	$10	$10	$2
Conceptual Project Cost (2023 Dollars)	**$940**	**$980**	**$60**	**$50**	**$11**
Conceptual Project Cost (2028 Dollars)	**$1,120**	**$1,160**	**$70**	**$60**	**$13**

Approximate cost of all projects (either 1A or 1B) in 2028 Dollars is $1.3 Billion

Example Alternative Scenario – Communities North of the MetroWest Water Tunnel

- One example for a phased approach
- Transmission to Concord with service to Sudbury, Hudson, Maynard, Stow, Concord, Lincoln, Bedford, Wayland
- Cost assumes facilities are the same as Projects 1a/1b, up to Concord

OPPC ($ Million)	
Service via Rail Trail	**Service via Local Roadways**
$600 (2023 Dollars)	$630 (2023 Dollars)
$710 (2028 Dollars)	$750 (2028 Dollars)



Implementation Considerations

Project Implementation Considerations

- Significant number of permits and approvals required for any new connection
  - Local, State, Federal, and those required by utilities
  - Type and number vary by project, community, pipeline route, and facilities to be sited
- Any community seeking a connection must comply with the Authority's *Operating Policy #10 Admission of New Community to MWRA Water System* (OP.10)
- Communities seeking admission must demonstrate local support
- Admission requires review under both MEPA and the ITA by the WRC

Schedule Considerations

- Construction would begin closest to connection points and proceed outward
- Multiple construction contracts could be awarded so that work could be conducted in parallel
- Communities looking for a new connection should consider their individual capital improvements programs in relation to the pipeline routes to minimize disruption to public
- Schedule should be revisited if and when specific communities enter into discussions with the Authority regarding a new connection

Conceptual Estimates of Design/Construction Durations

Conceptual Project No.	Communities Served	Duration for Design and Construction
1a/1b	Communities north of the MWWT	25 – 30 years (35 – 40 years without simultaneous construction)
2	Natick, Wellesley, and Weston	5 – 7 years
3	Holliston	5 – 7 years
4	Westborough	4 – 5 years
5	Hopkinton and Sherborn	Dependent on community needs

- Projects 1 – 4 assume simultaneous construction contracts where possible
- Project 4 assumes no new pipelines

Conclusion and Recommendations

Conclusions

- MWRA's water system has sufficient capacity to supply current MDD of MetroWest under normal operating conditions
- Given geographic location of MetroWest, 5 independent projects developed
  - Basis of each project is to meet current MDDs
  - Projects may proceed independently or in parallel
- Conceptual cost estimates for Projects 1 - 4 range from $13 Million to $1.2 Billion in 2028 dollars
  - Costs for project 5 (wheeling) were not estimated
- Durations for Projects 1 - 4 design and construction range from 4 to 5 years – 25 to 30 years, assuming simultaneous construction contracts where possible

Given the conceptual nature of this study, costs & schedule represent the relative magnitude of the investment required.

Recommendations & Next Steps

- Additional studies required to establish specific infrastructure requirements and associated costs for connections
- Implementation efforts would need to address changes in water quality due to blending, permit applications and approvals, and MWRA admission process

Future studies dependent on community interest & demand:

- MWRA water system modeling to confirm available capacity
- Pre-design efforts to determine Infrastructure components for conveyance
- Community infrastructure assessment, hydraulics, and demand projections
- Water quality evaluations
- Implementation costs and schedule updates

Thank you!