Englishmen River Water Service Water Treatment Plant Expansion Project

Background

Today's presentation

- Results from the Phasing Options meeting
  - Re-scope project in phases to minimize impacts on water rates and development cost charges
  - Review of four phasing options
  - Selection of the best phasing option based on technical and cost criteria
  - Is a phased approach better than the pre-design option?

Water Demand and Planning Horizons

Predesign

- 24 ML/d WTP by 2016
- Design based on industry standard practices
  - A planning horizon of 20 years (up to 2035)
  - Water demand projections that include a 25% safety factor
    - Uncertainties in population growth
    - changes in water use
    - Impacts of climate change on irrigation
  - Flexibility to expand as demand increases

Let us put water demand into context

- 2014 water demand for Parksville and Nanoose
  - Water demands are increasing
  - Existing river intake capacity is limited to 12.2 ML/d
- Groundwater wells
  - Current ERWS wells have a maximum capacity of 11.8 ML/d
  - New wells outside of ERWS are being developed in the same aquifer
  - Therefore existing wells/aquifer capacity declining over time
  - Need to reduce reliance on groundwater

Water Demand and Planning Horizons – Phased Approach

- Phase 1 WTP capacity of 16 ML/d (2016)
  - Minimum capacity ***without*** a safety factor
  - Typically not good industry practice

- Phase 2 expansion planned for 2024 to meet the 24 ML/d demand by 2026

Phased Expansion Options

Phased Expansion Options

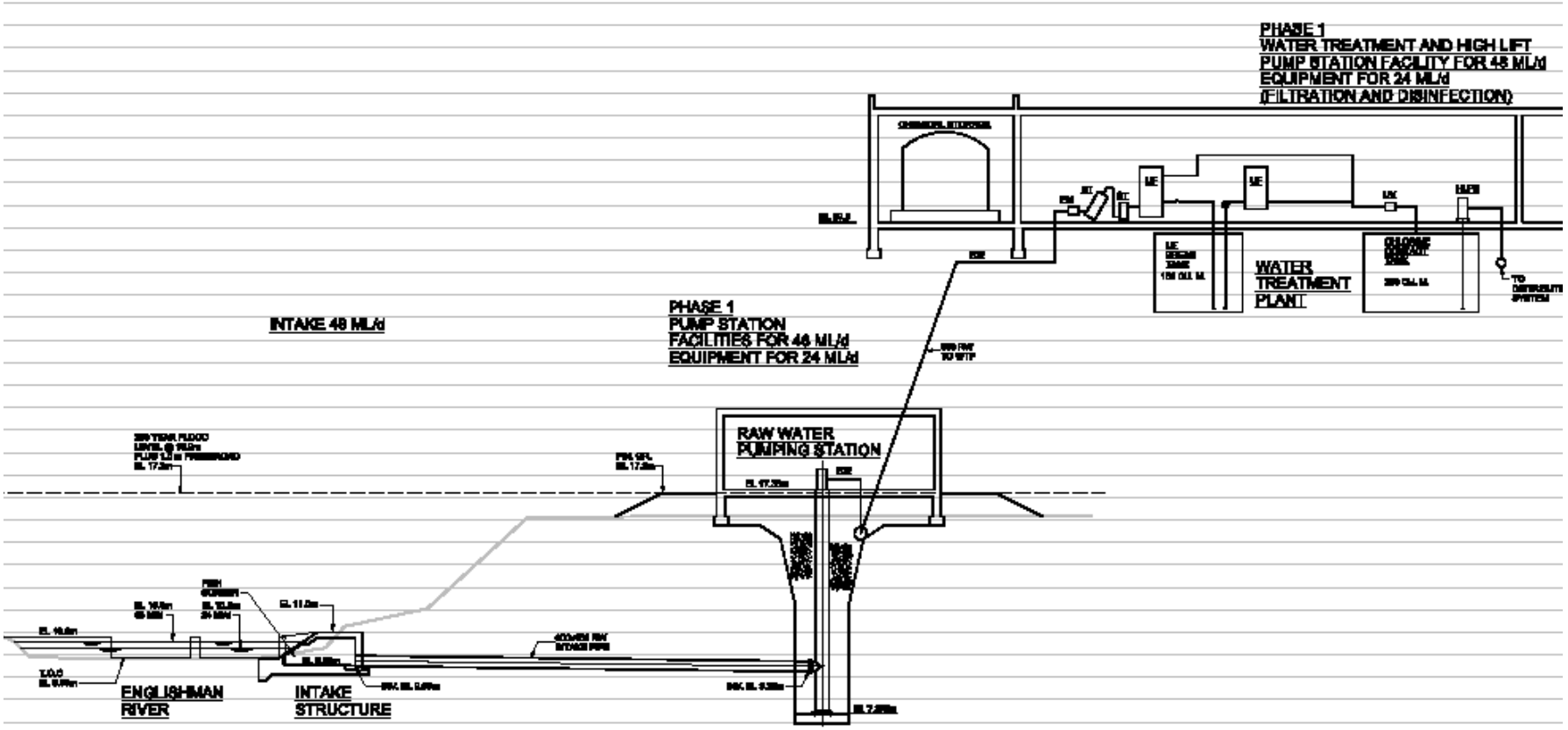
- As a phasing option, can the new WTP be located at the existing intake site?
  - Short answer is no
  - Intake has limited capacity
    - 40 year old infrastructure
    - Capacity limited to approximately 12 ML/d
  - Location not suitable
    - In an existing neighbourhood (limited space)
    - Downstream of urban development (risk of contamination)
    - In a floodplain

Phased Expansion Options

- Expand WTP in two phases
- Phase 1
  - Meet demand
  - Meet regulatory requirements
  - Meet a budget of approximately $20M
- Phase 2
  - Match the scope in Pre-design report
- Four options identified

Preliminary Design Report

- 24 ML/d of filtration, disinfection and corrosion control
- Transmission mains connecting to the Springwood and the Top Bridge reservoirs



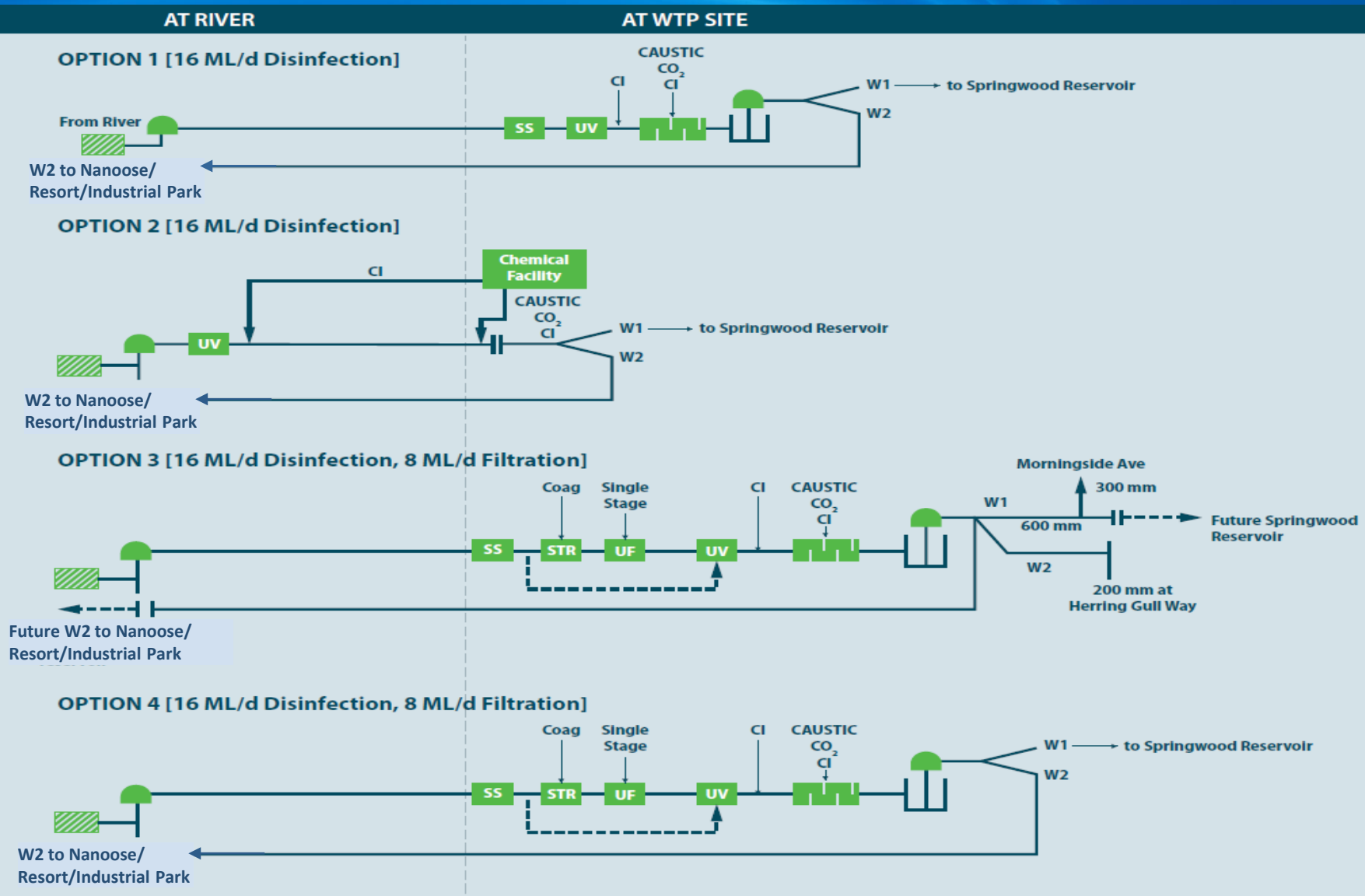
Transmission Mains: PDR, Options 1, 2 and 4

Parksville System Improvements

Transmission Mains: PDR, Options 1, 2 and 4

Nanoose and Craig Bay Pump Station

Options

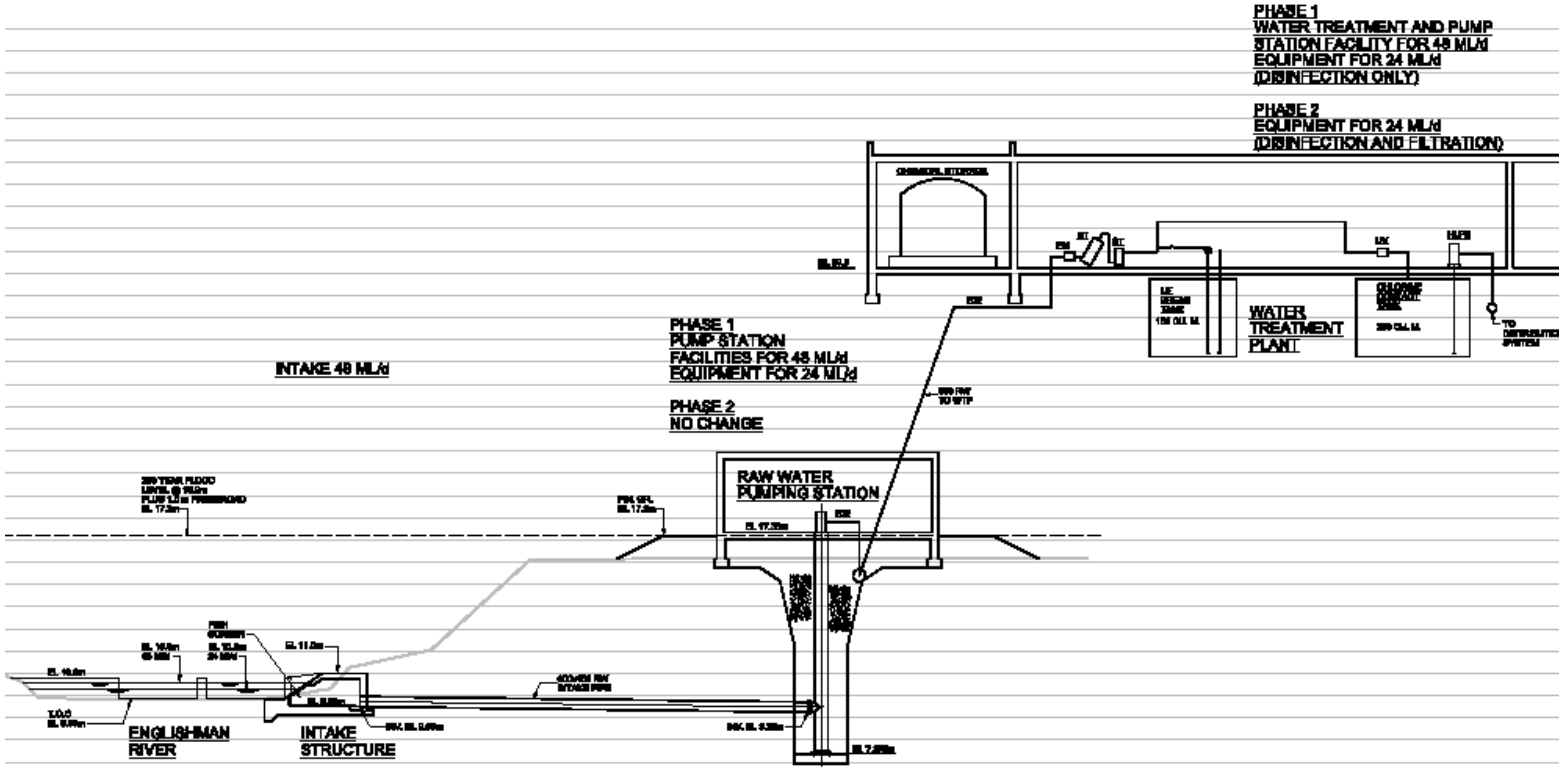

AT RIVER
AT WTP SITE
OPTION 1 [16 ML/d Disinfection]
From River
SS
UV
CI
CAUSTIC
CO_2
CI
W1
to Springwood Reservoir
W2
W2 to Nanoose/
Resort/Industrial Park
OPTION 2 [16 ML/d Disinfection]
CI
Chemical Facility
CAUSTIC
CO_2
CI
UV
W1
to Springwood Reservoir
W2
W2 to Nanoose/
Resort/Industrial Park
OPTION 3 [16 ML/d Disinfection, 8 ML/d Filtration]
Coag
Single Stage
SS
STR
UF
UV
CI
CAUSTIC
CO_2
CI
Morningside Ave
300 mm
W1
600 mm
Future Springwood Reservoir
W2
200 mm at Herring Gull Way
Future W2 to Nanoose/
Resort/Industrial Park
OPTION 4 [16 ML/d Disinfection, 8 ML/d Filtration]
Coag
Single Stage
SS
STR
UF
UV
CI
CAUSTIC
CO_2
CI
W1
to Springwood Reservoir
W2
W2 to Nanoose/
Resort/Industrial Park

Phased Expansion Options

- All phased options require compromises
- Identified options that meet the budget and require the least compromises
- A few examples:
  - Partial treatment (disinfection only)
  - Reduced capacity (filtration only in a portion of the flow)
  - Less operational flexibility
  - Limited or no use of WTP during high turbidity events in the summer
  - Some infrastructure that would be abandoned in Phase 2

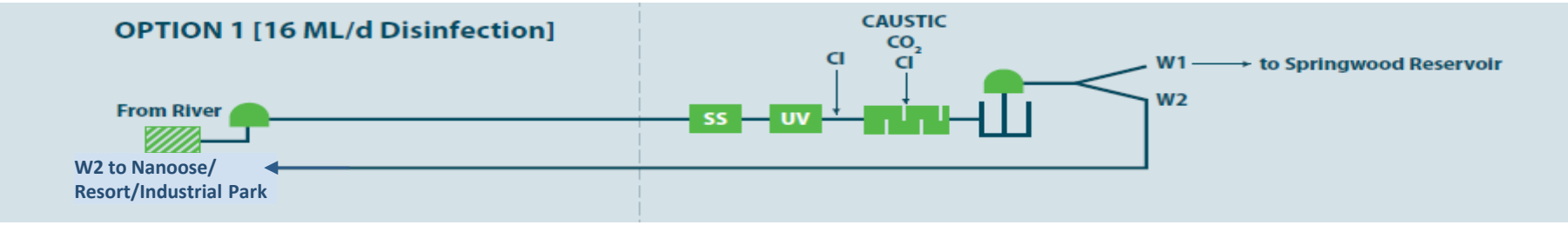
Option 1: 16 ML/d Disinfection

- 16 ML/d of disinfection and corrosion control
- Membrane filtration deferred to Phase 2
- Phase 1 includes the WTP building including foundations and buried tanks
- Transmission mains connecting to the Springwood and the Top Bridge reservoirs



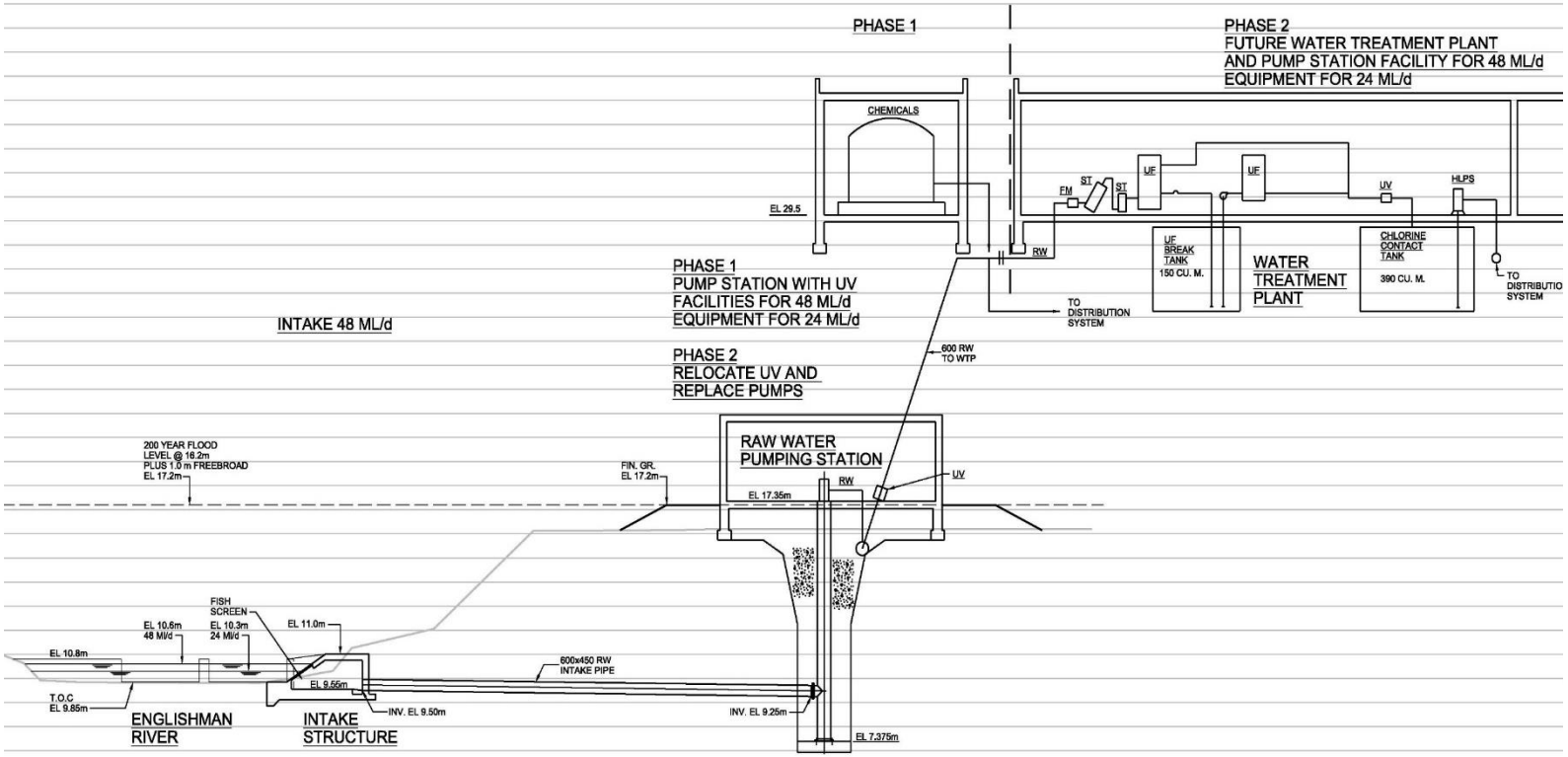
Option 1: 16 ML/d Disinfection

- Advantages
  - Phase 1 infrastructure re-usable for the future expansion
  - Improved operation of distribution system (mixing groundwater and surface water at reservoirs)
- Disadvantages
  - Does not meet IH 4.3.2.1.0
  - Operation limited to low color and turbidity days (Summer use only)
  - 1.5 years to add filtration (delivery, installation and commissioning)



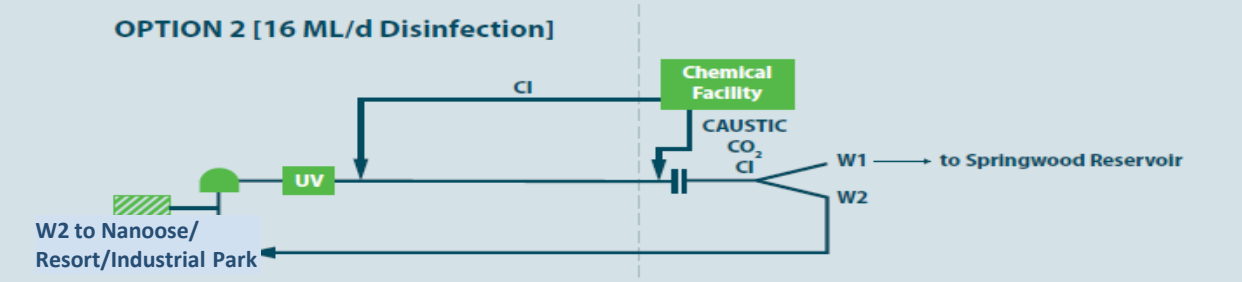
Option 2: 16 ML/d Disinfection + Chemical Facility

- 16ML/d of disinfection and corrosion control
- Membrane filtration deferred to Phase 2
- Same treatment performance and capacity as Option 1
- Defers construction of WTP foundation/building except chemical storage facility



Option 2: 16 ML/d Disinfection + Chemical Facility

- Advantages
  - Phase 1 infrastructure re-usable for the future expansion (with modifications)
  - Improved operation of distribution system (mixing groundwater and surface water at reservoirs)
- Disadvantages
  - Does not meet IH 4.3.2.1.0
  - Operation limited to low color and turbidity days (Summer use only)
  - Most WTP infrastructure deferred to Phase 2
  - 2.5 years to add filtration (tender, delivery, installation and commissioning)

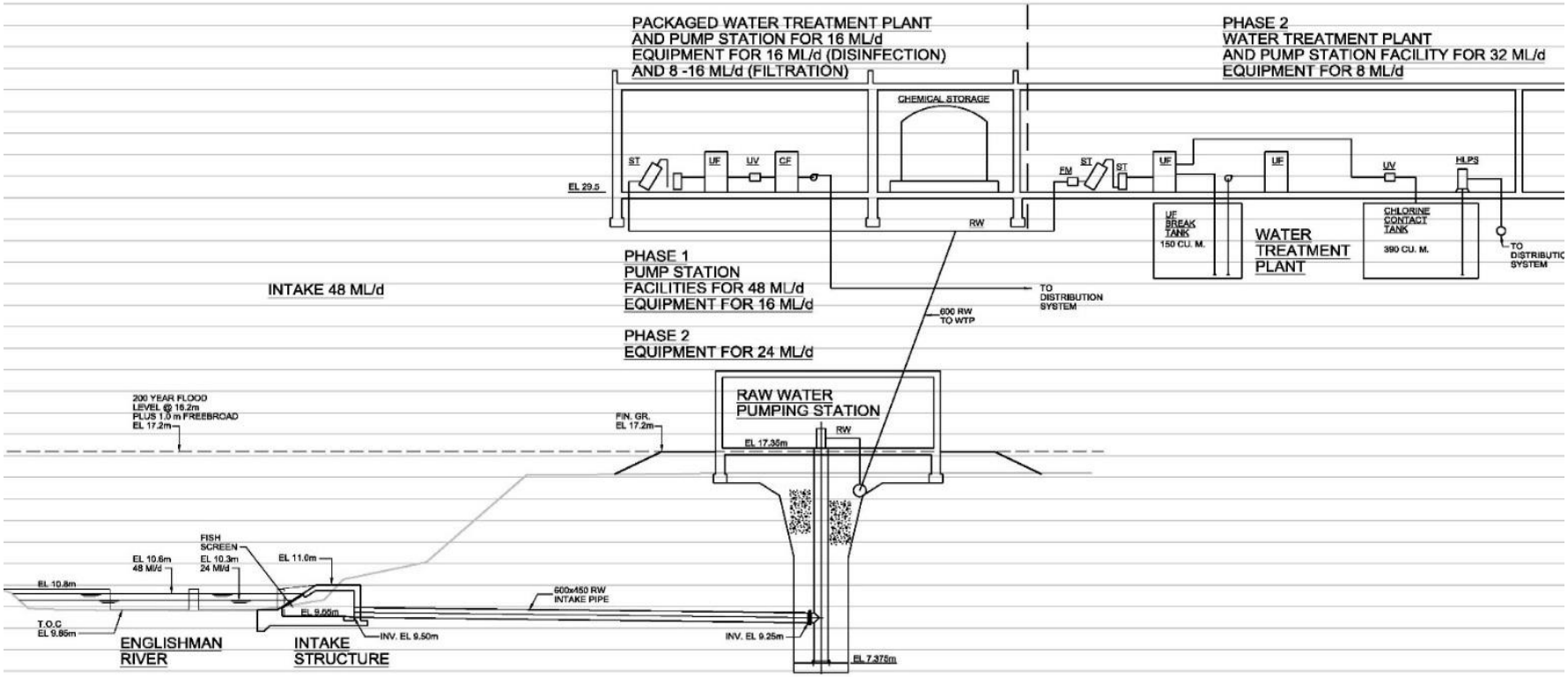


What are the filtration options in Phase 1?

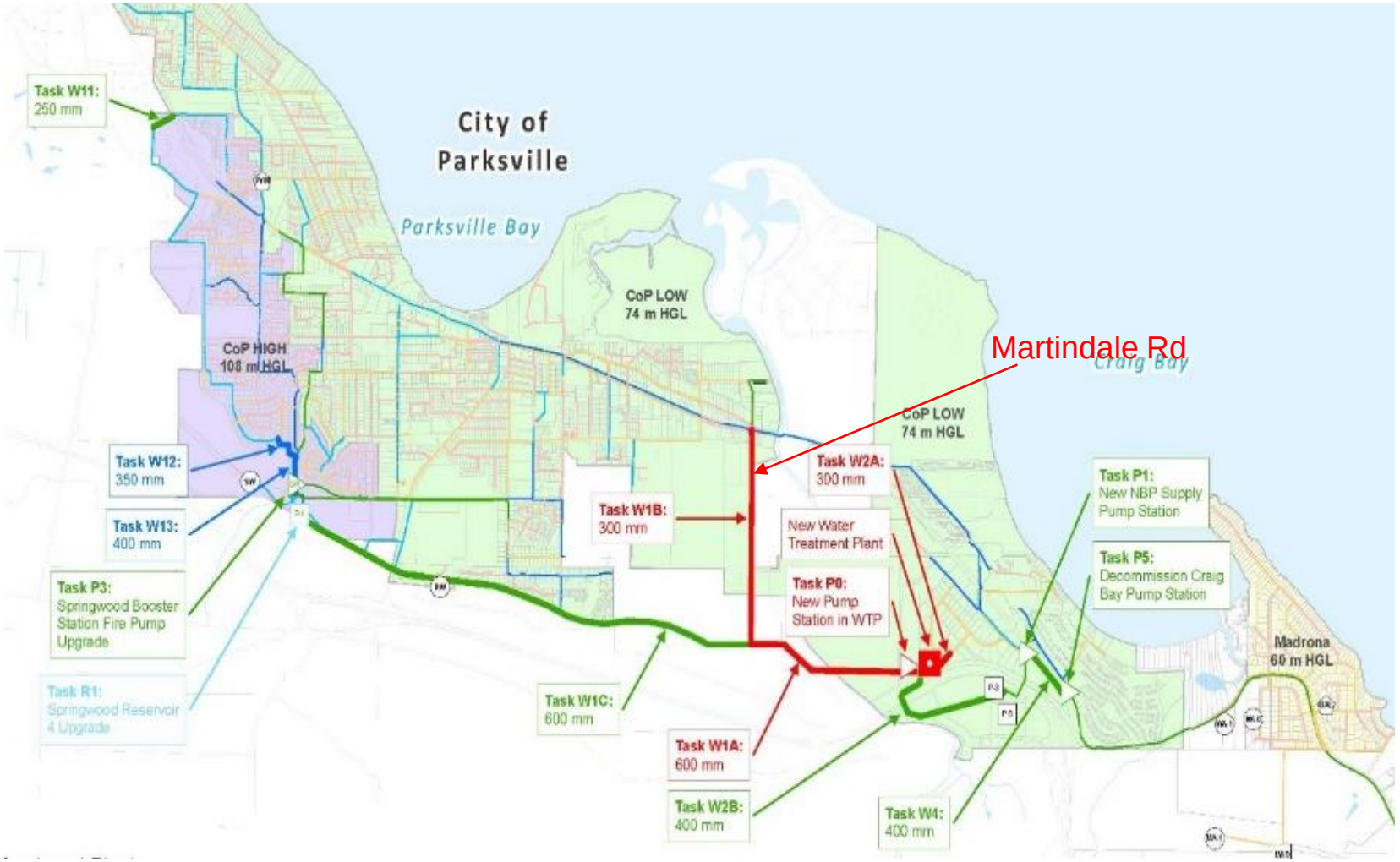
- Pre-design uses an engineered filtration system that is appropriate for larger facilities (economy of scale)
- Making the WTP smaller and adding the same filtration system would exceed the budget
- To meet the Phase 1 budget with filtration, need trade-offs:
  - Packaged filtration systems
    - (cost effective up to 16 ML/d)
  - No high recovery
  - Slab on grade construction
- Phase 2
  - Separate WTP building
  - Engineered filtration system

Option 3: 16 ML/d Disinfection + 8 ML/d Filtration

- 16 ML/d of disinfection and corrosion control, 8 ML/d packaged filtration
- Need to defer construction of full transmission mains to offset cost of filtration

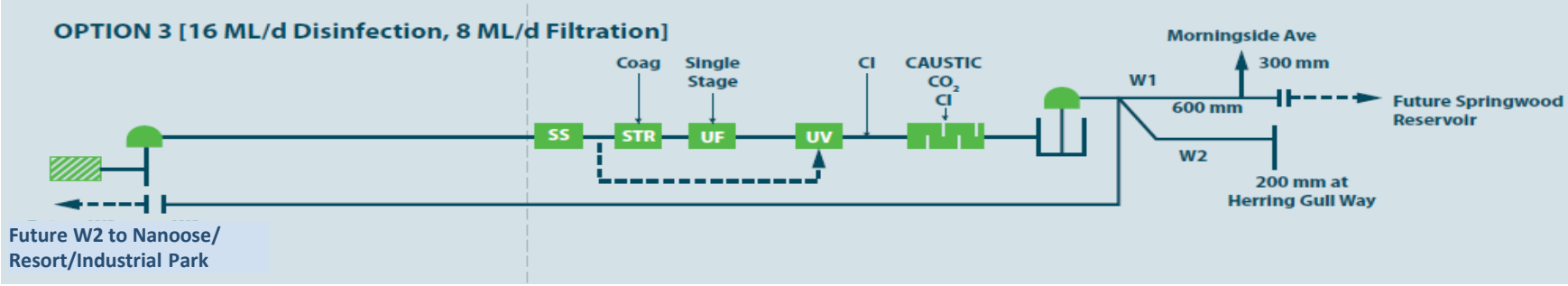


Option 3: Transmission Mains



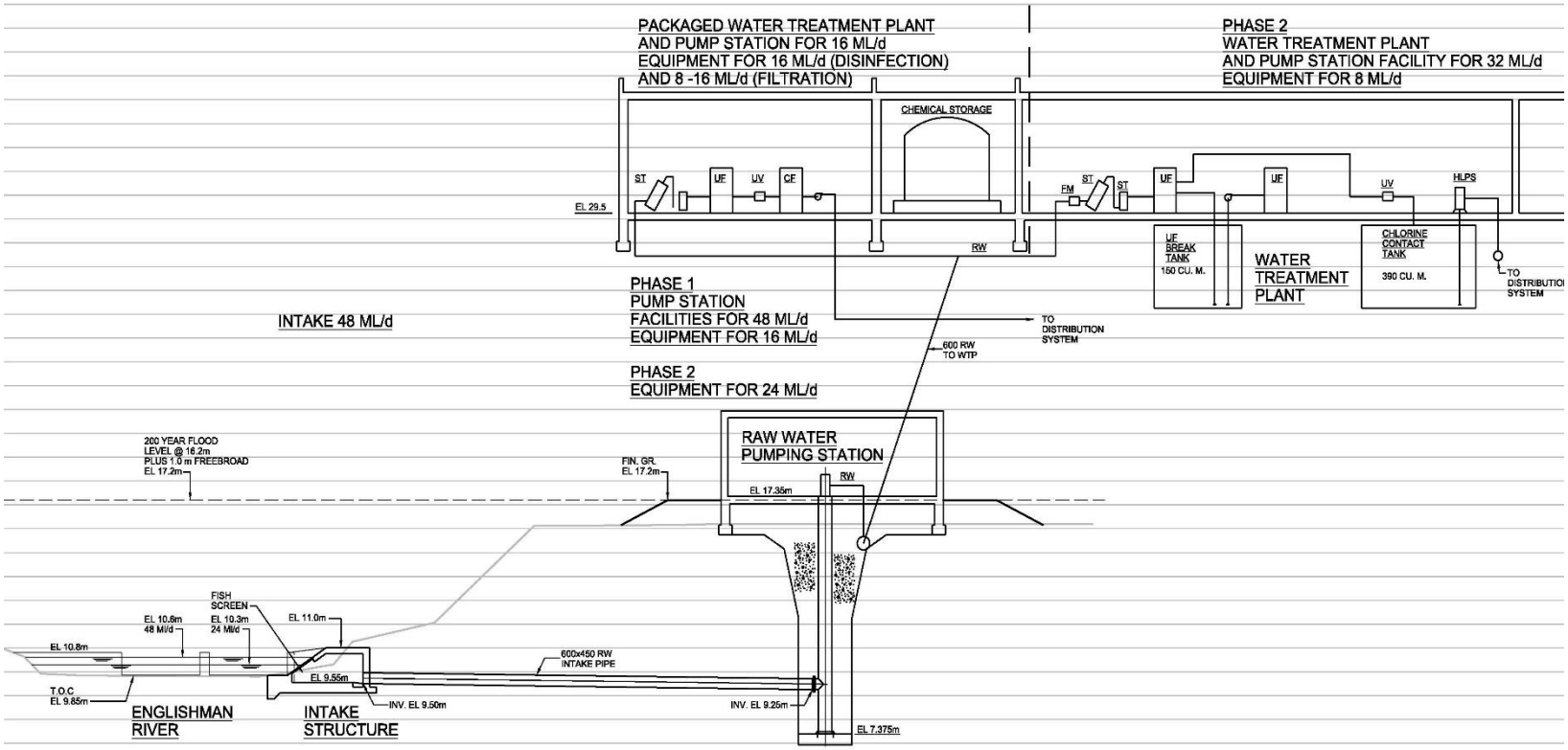
Option 3: 16 ML/d Disinfection + 8 ML/d Filtration

- Advantages
  - Meets all IH 4.3.2.1.0 requirements.
  - Year round operation
  - Relief to the groundwater wells during the winter
  - Quick filtration expansion to 16 ML/d (5 months)
- Disadvantages
  - Additional cost to integrate Phases 1 and 2
  - Operational complexity in distribution system (no blending)
  - Watermain route on Martindale prone to flooding, abandoned for Phase 2
  - Additional 1.5 year to implement Phase 2



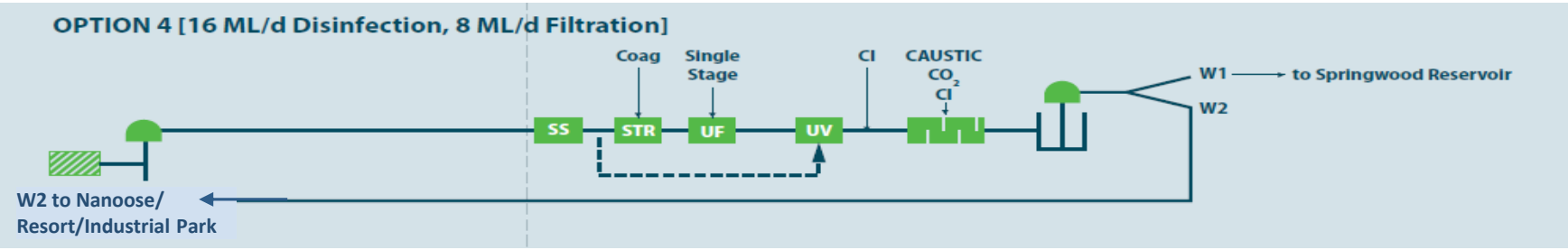
Option 4: 16 ML/d Disinfection + 8 ML/d Filtration

- 16 ML/d of disinfection and corrosion control, 8ML/d packaged filtration
- All transmission mains to Springwood and Top Bridge reservoirs
- Same as Option 3 but with construction of all transmission mains



Option 4: 16 ML/d Disinfection + 8 ML/d Filtration

- Advantages
  - Meets all IH 4.3.2.1.0 requirements
  - Year round operation
  - Relief to the groundwater wells during the winter
  - Quick filtration expansion to 16 ML/d
  - Flexibility to provide consistent blended water (filtration & direct connection to reservoirs)
- Disadvantages
  - Additional cost to integrate Phases 1 and 2
  - Additional 1.5 year to implement Phase 2



Treatment Provided

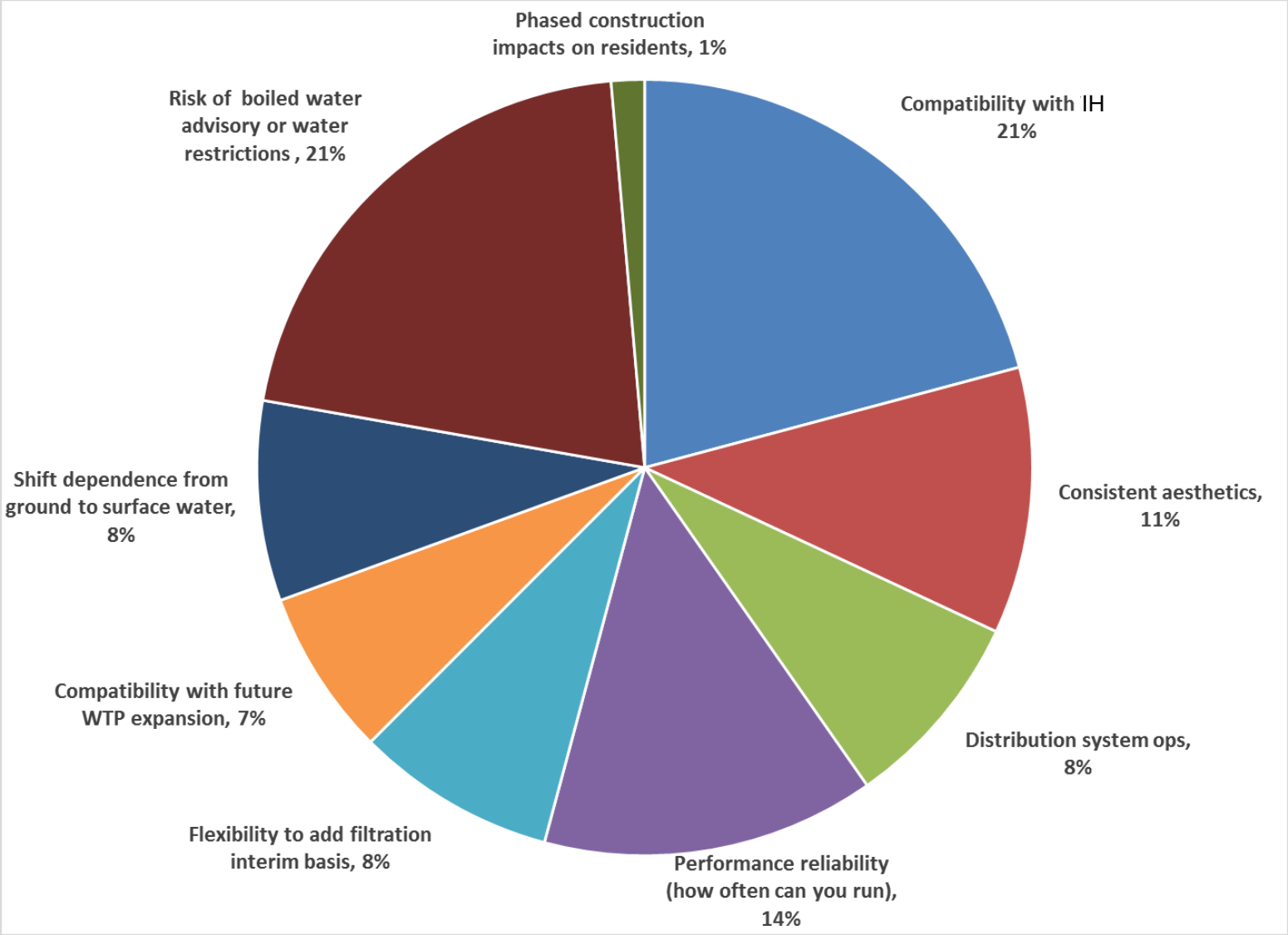
Process	PDR	Option 1	Option 2	Option 3	Option 4
Vortex Sand Separators	✓	✗	✗	✓	✓
Fine Strainers	✓	✓	✗	✓	✓
Coagulation	✓	✗	✗	✓	✓
Membranes – UF or MF	✓	✗	✗	✓	✓
UV Disinfection	✓	✓	✓	✓	✓
Chlorination	✓	✓	✓	✓	✓
Corrosion Control	✓	✓	✓	✓	✓
Residuals	✓	✓	✓	✓	✓

Evaluation of Options

Evaluation Criteria and Weighting

Primary Criteria	Secondary Criteria
Water Quality	• Compatibility with IH 4.3.2.1.0 and disinfection by product requirements • Consistent aesthetics
Technical Considerations	• Ease of operation of distribution system • Performance reliability • Flexibility for interim expansion • Compatibility with site • Shift dependence from ground water to surface water
Social Considerations	• Relative risk and impact of requiring boiled water advisory or water restrictions • Impacts to resident by phasing construction of water transmission mains
Natural Environmental Considerations	• All options deemed equal in this category
Economic Considerations	• Captured in capital cost estimates

Evaluation Criteria and Weighting



Technical Scoring

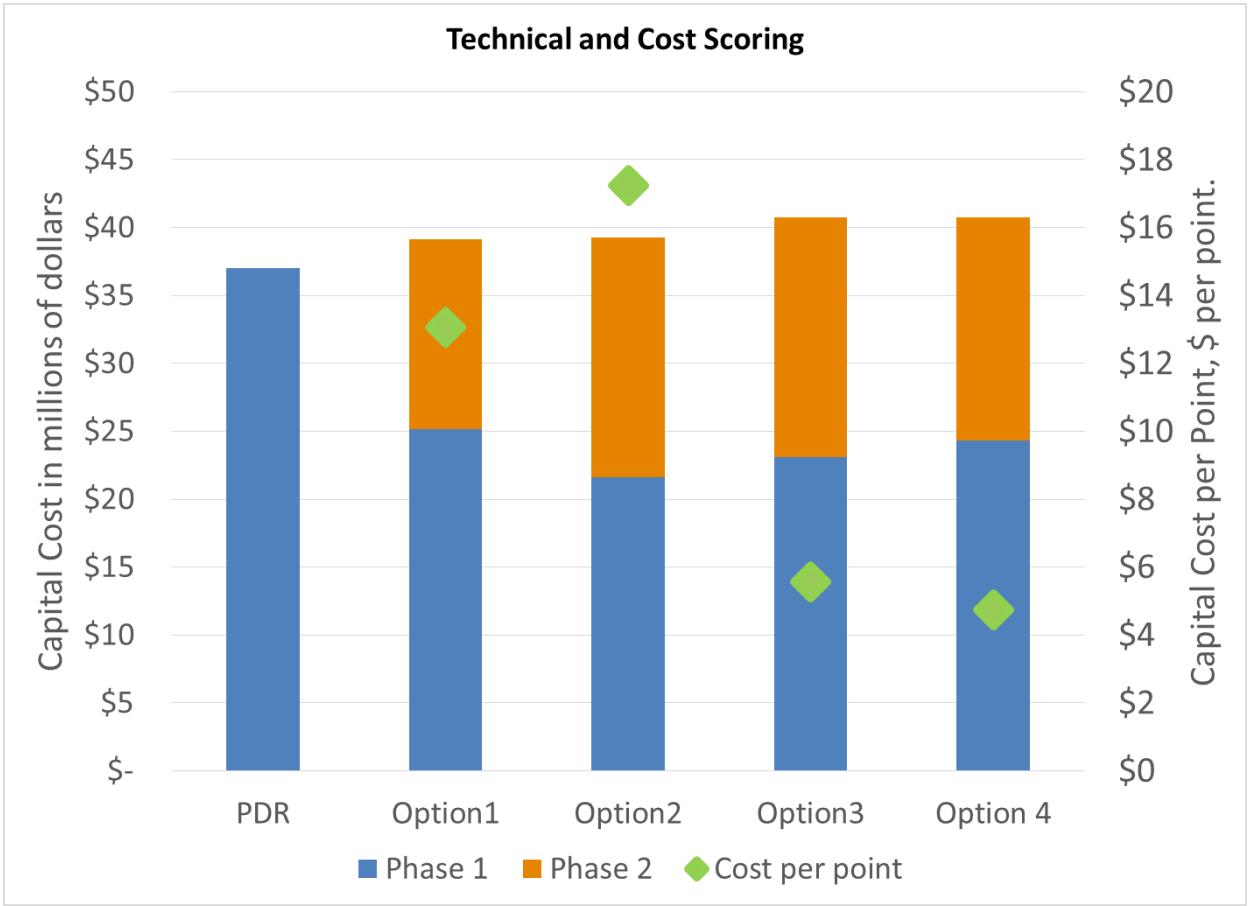
	Option 1 16 ML/d Disinfection	Option 2 16 ML/d Disinfection + Chem. Facility	Option 3 16 ML/d Disinfection + 8 ML/d Fltr.	Option 4 16 ML/d Disinfection + 8 ML/d Fltr.
Raw Score	35	25	57	75
Weighted Score	3.0	2.3	7.3	8.6
Rank by Weighted Score	3	4	2	1

Capital Cost Estimate

	PDR	Option 1	Option 2	Option 3	Option 4
Total – 2016	$35.16 M	$25.16 M	$21.59 M	$23.11 M	$24.32 M
Total – 2018/2024	$1.83 M	$14.00 M	$17.66 M	$17.62 M	$16.41 M
Total Capital Cost	**$36.98 M**	**$39.17 M**	**$39.25 M**	**$40.73 M**	**$40.74 M**

Best Value Option

- Benefits and costs compared:
  - Total costs Phase 1 and 2
  - Cost per point
  - Option 4: best value



Recommendation

- For a phased option to be more financially attractive than the PDR
  - Lower capital cost, and/or
  - Phase 2 be implemented in 20 years or later
- Analysis indicates
  - Phased options have a lower cost for Phase 1 compared to the PDR
  - Phase options have a higher overall project cost compared to the PDR
  - Phase 2 expansion must start within 8 years to meet 2026 water demands (no safety factor)

➢ Proceed with design outlined in the Pre-Design Report (PDR)