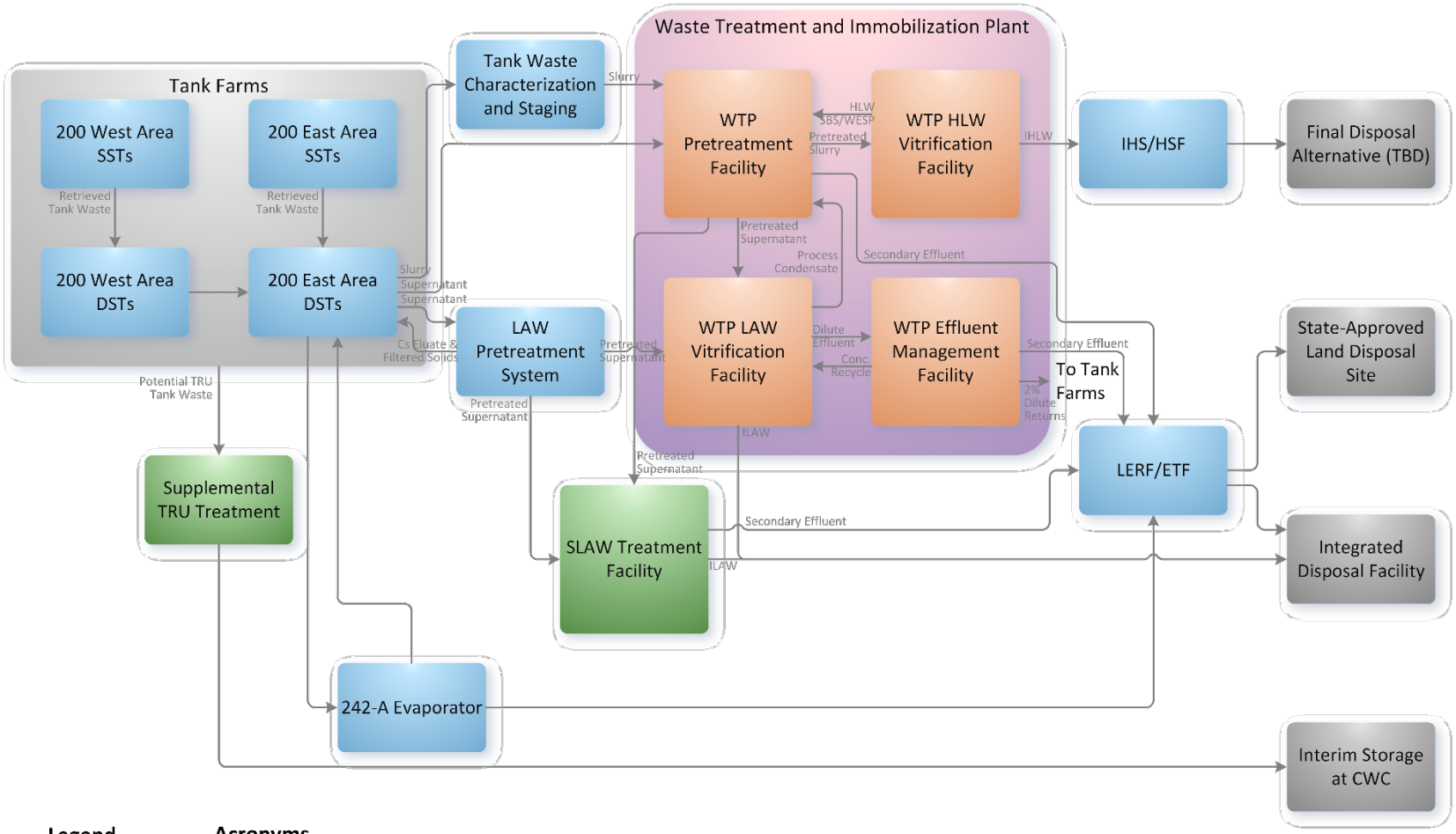
System Plan 8 Baseline Case Supplemental LAW Sizing

WRPS System Planning and Modeling
February 28, 2018

System Plan Background

- System Plan 8 is based on computer modeling that provides rough cost and-schedule estimates for a set of technical scenarios for completing the River Protection Project mission.
- The scenarios analyzed in System Plan 8 include a baseline case and 10 other scenarios jointly selected by DOE and Washington Department of Ecology in 2016.
- A joint working group from ORP, Ecology and Washington River Protection Systems (WRPS) coordinated the Plan's scenarios, assumptions and modeling approach.
- The modeling results project a cost increase of approximately $62 billion (unescalated) and a schedule increase of approximately 19 years.

Baseline Case – Flowsheet



Legend

- Tank Farms
- WTP
- Supp. Treatment
- Other

Acronyms

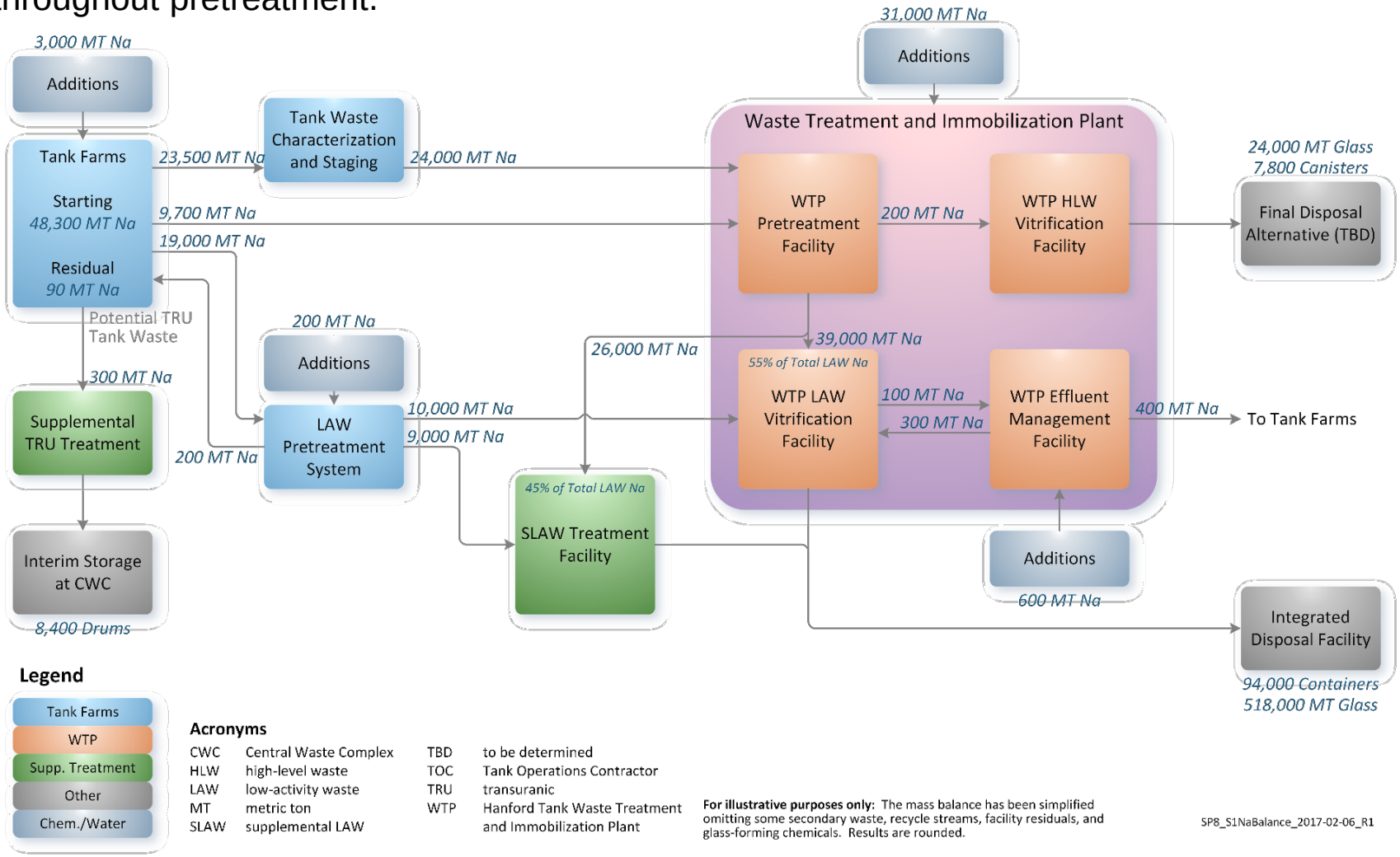
CWC	Central Waste Complex
DST	double-shell tank
ETF	Effluent Treatment Facility
HLW	high-level waste
HSF	Hanford Shipping Facility
IHS	Interim Hanford Storage
LAW	low-activity waste
LERF	Liquid Effluent Retention Facility
MT	metric ton
SLAW	supplemental LAW
SST	single-shell tank
TBD	to be determined
TOC	Tank Operations Contractor
TRU	transuranic
WTP	Hanford Tank Waste Treatment and Immobilization Plant

For illustrative purposes only: The flowsheet presented here has been simplified for presentation purposes.

SP8_S1SFS_2017-01-[illegible]

Baseline Case – Sodium Balance

- Total sodium in ILAW glass is ~84,000 MT of which about 57% is waste sodium.
- Large amount of sodium added for caustic leaching and to keep aluminum in solution throughout pretreatment.



Acronyms

CWC	Central Waste Complex	TBD	to be determined
HLW	high-level waste	TOC	Tank Operations Contractor
LAW	low-activity waste	TRU	transuranic
MT	metric ton	WTP	Hanford Tank Waste Treatment and Immobilization Plant
SLAW	supplemental LAW		

For illustrative purposes only: The mass balance has been simplified omitting some secondary waste, recycle streams, facility residuals, and glass-forming chemicals. Results are rounded.

SP8_S1NaBalance_2017-02-06_R1

System Plan Rev 8 High Level Assumptions

Revised or new assumptions

- Incorporation of DFLAW approach
- Facility operations start dates align with facility start milestones in Amended Consent Decree
- Tank retrieval durations are informed by actual data from C-Farm performance
- No constraints placed on waste treatment or single-shell tank retrieval completion dates

Assumptions consistent with prior plans

- Does not account for delays associated with the expanded and extended use of self-contained breathing apparatus (SCBA) within all tank farms
- Does not factor in anticipated budgetary constraints
- WTP operates at 70 percent availability
- “The net capacity of a LAW supplemental treatment will be selected with the goal that the combined LAW treatment capacity will be large enough so as to not drive the mission duration”

(ORP-11242, Rev. 8. Assumption A1.4.1.5)

Baseline Case – Key Assumptions

Objective:

- To evaluate the RPP mission as it is currently planned/thought to proceed and derive estimated retrieval and treatment completion dates utilizing the dates of the Amended Consent Decree as bounding dates.

Programmatic Assumptions

- LAWPS
  - Operational on 10/01/2023
- WTP PT
  - Operational by 12/31/2033
- WTP HLW
  - Operational on 12/31/2033
- WTP LAW
  - Operational on 12/31/2023
  - Fed by LAWPS until 11/30/2033
- Supplemental LAW
  - Operational on 12/31/2034
- CH-TRU
  - Processing starts 2031
- Glass Models
  - DOE 2013 LAW and DOE 2013 HLW glass formulation models

Baseline Case – Key Dates / Metrics

Metric	Scenario 1: Baseline Case
Complete 241-C Tank Farm Retrievals (Existing CD 03/31/2024)	08/2017
Complete Five Additional SST Retrievals (Existing CD 12/31/2020)	04/2019
Complete Nine Additional SST Retrievals (Existing CD 03/31/2024)	05/2022
Complete 241-A-103 (Existing TPA 09/30/2022)	11/2022
Complete All SST Retrievals	12/2056
Complete Group A Mitigations	01/2033
First Cross-Site Transfer	07/2025
Projected East Area WRF Required Date	01/2035
Projected West Area WRF Required Date	04/2040
DST Completion	11/2062
Treat All Tank Waste	11/2063
Complete Potential TRU Waste Packaging	01/2036
IHLW Glass Canisters	7,800
IHLW Glass Waste Oxide Loading	44%
Total ILAW Glass Containers	94,000
ILAW Glass Sodium Oxide Loading (wt%)	22%
Percent ILAW from SLAW	45%
Sodium to ILAW Glass (MT)	84,100
Potential TRU Tank Waste (Drums)	8,400
SLAW Estimated Grout Volume	419K yd^3

Supplemental LAW Grout Estimate

- The quantity of ILAW grout produced from feed to the SLAW process was estimated assuming:*
  - Constant water/dry mix ratio of 0.6 (mass ratio)
  - Standard dry blend composition of 8:47:45 OPC:BFS:FA**
  - Dry material density of 2.79 g/cm^3
- For the Baseline Case
  - 55.8 Mgal of LAW waste estimated to produce 84.2 Mgal grout (419,000 yd^3)
  - 16% waste loading and 8% equivalent Na_2O loading.
- For every liter of waste approximately 1.5 liters of grout is produced.

*Based on Memorandum from Dave Swanberg to Linda Bergmann, *Recommended Assumptions for Waste Loading in Low-Activity Waste Grout for System Plan 8*, Feb. 2017, WRPS.

**Ordinary Portland Cement (OPC), Blast Furnace Slag (BFS) and Fly Ash (FA)