A VE Study of the

D_2O Storage Facility

Darlington Nuclear Generating Station

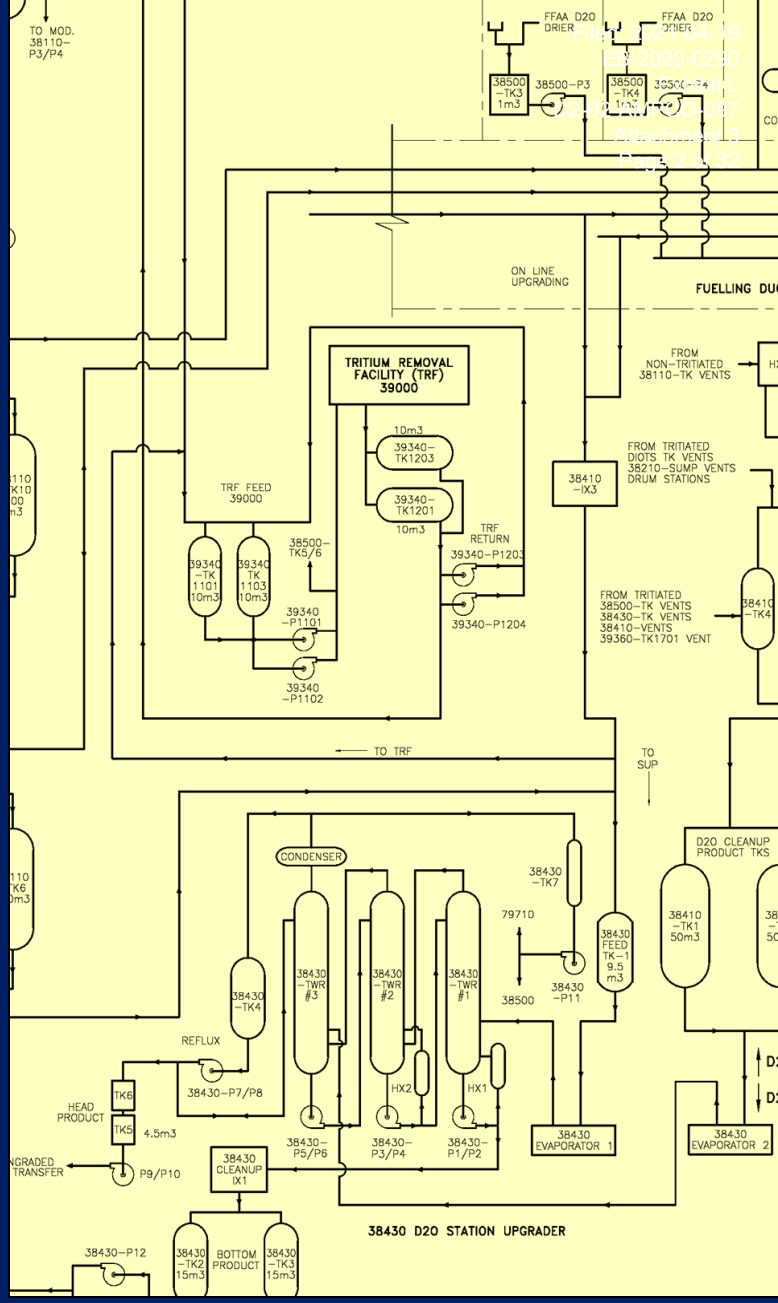
Preliminary Results Presentation

VE Study Team

June 28, 2011
Darlington, ON

This Presentation…

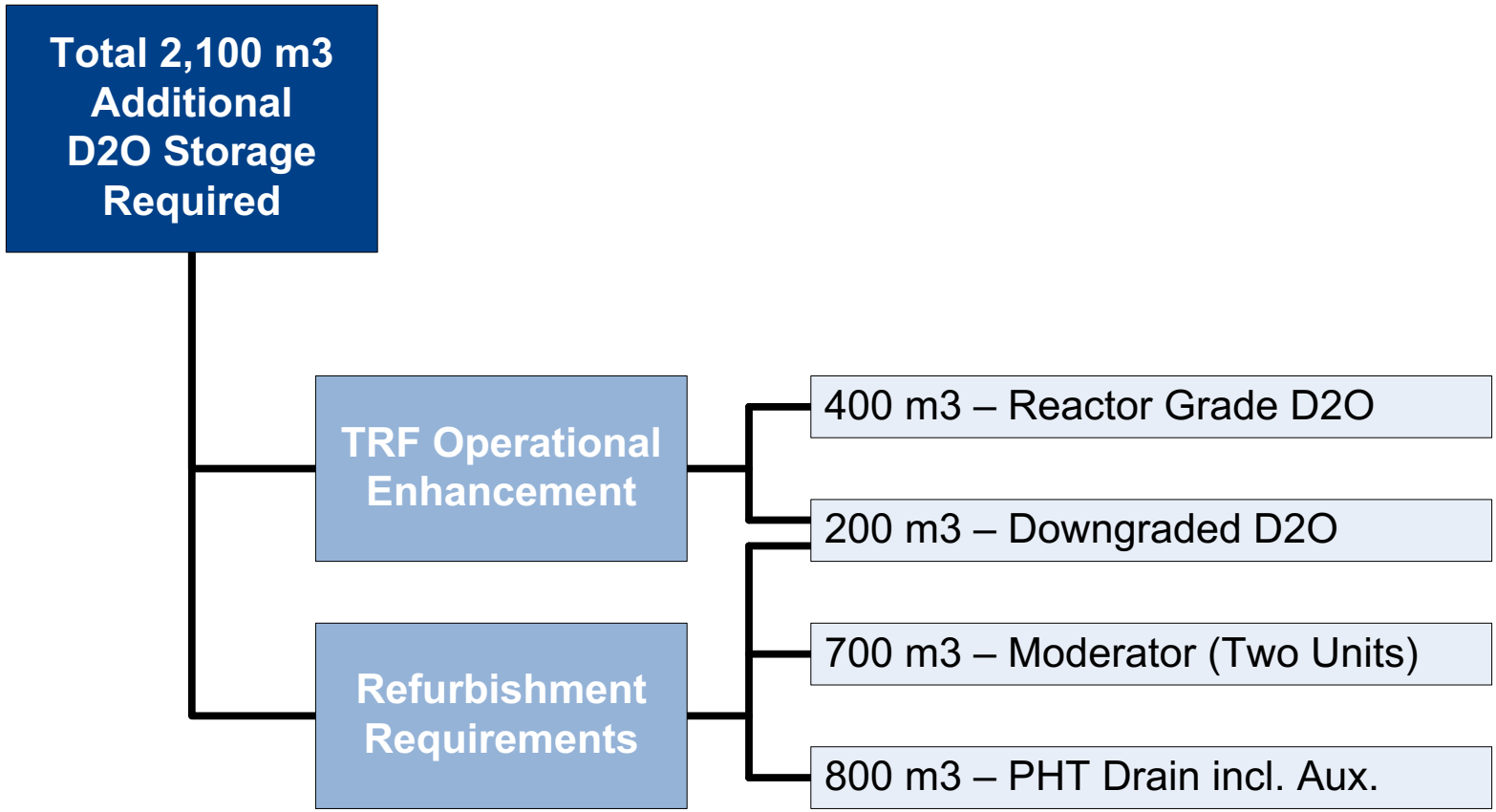
- **Four Aspects:**
  - Goals
  - Value Engineering Methodology
  - Value Opportunities
  - Next Steps



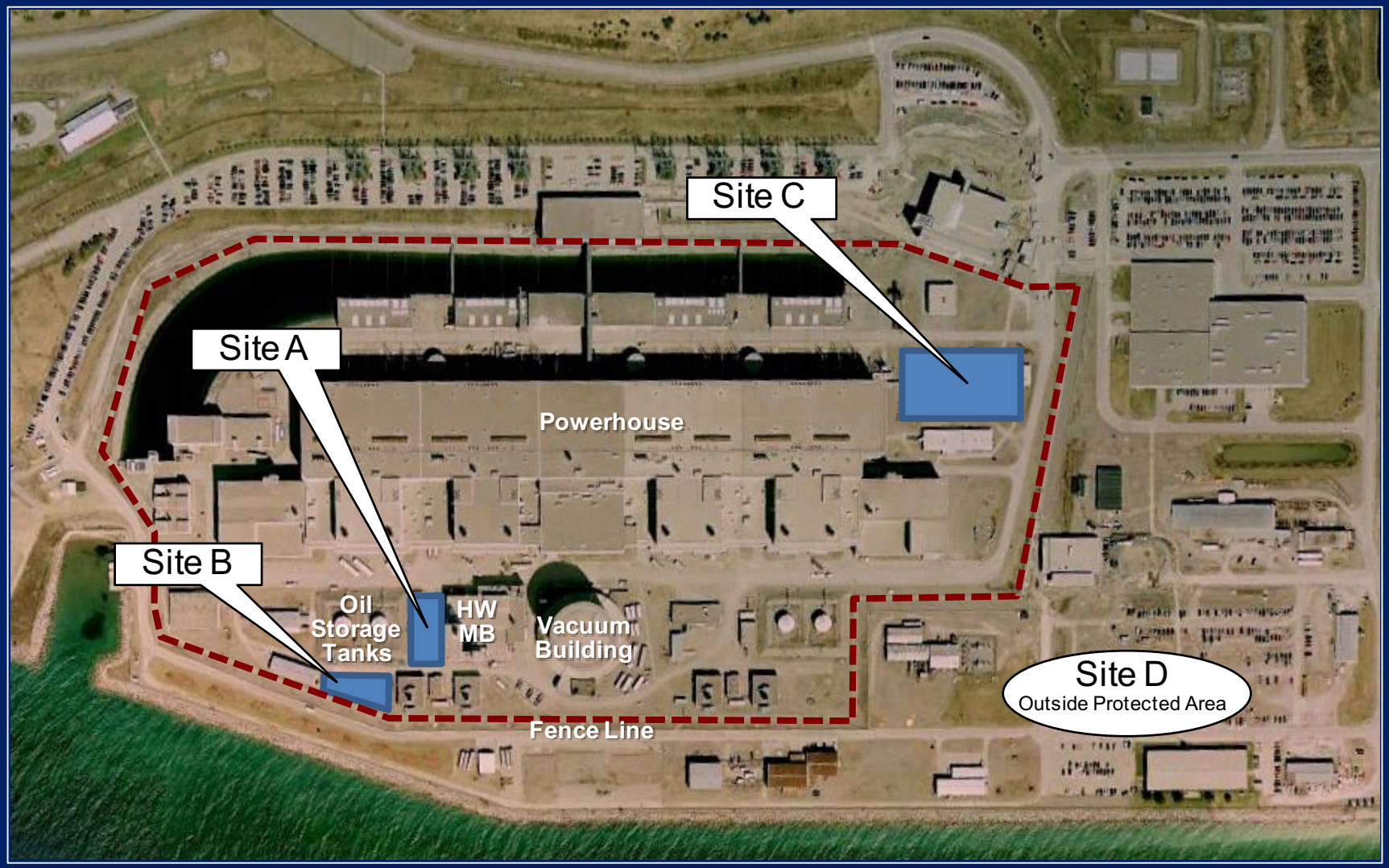
Key Project Goals

- **Expand existing heavy water management function**
  - Increase D_2O storage
  - Drum handling
  - Office space
- **D_2O storage**
  - Station unit refurbishment

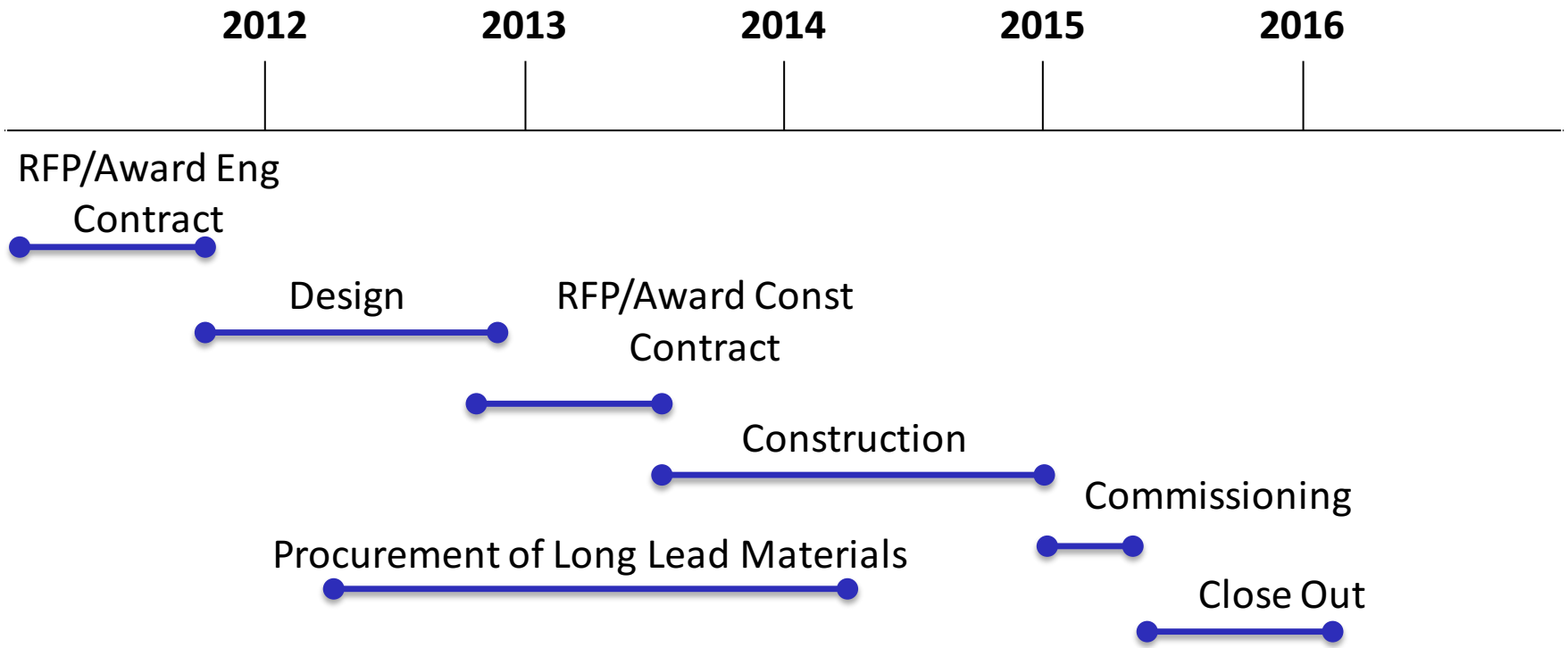
D_2O Storage Model



Site Location Opportunities



Project Schedule



Key Project Challenges

- **Limited site opportunities**
- **Refurbishment schedule**
  - Outage in 2016
  - Need to be ready

Value Engineering Overview

- **VM Definition:**
  - Value Management is a systematic, creative, function-oriented, team approach to optimize project performance/quality for the resources spent

- **Another way of looking at it:**

$$\text{Value} \sim \frac{\text{Function}}{\text{Cost*}}$$

* monetary, schedule, environmental or property impacts, space, etc.

VE Job Plan

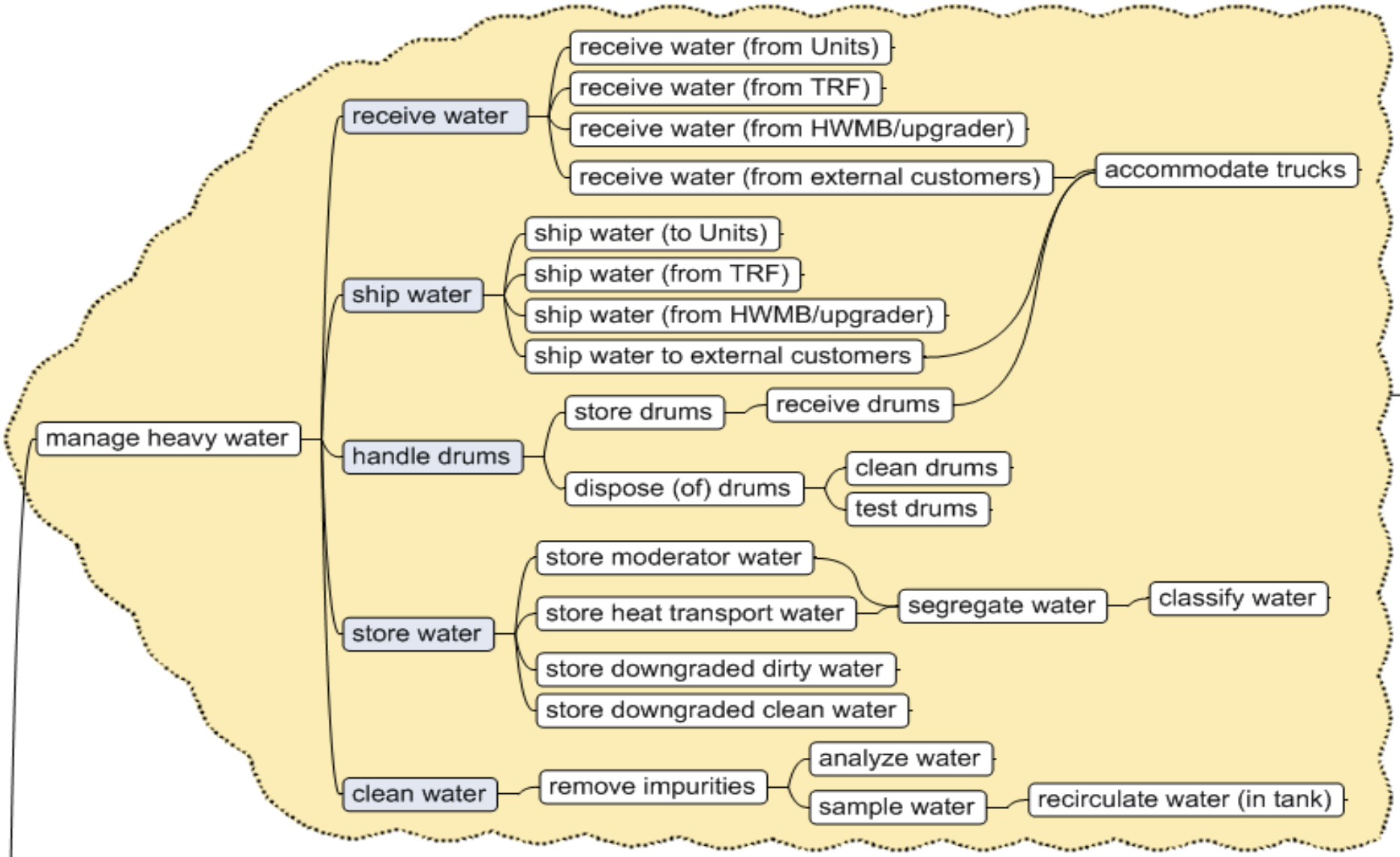
- **A defined sequence of study activities**

- Scope definition
- Data collection
- VE Team selection
- Quality model
- Cost/Worth models
- Other data models

- Information Phase
- Function Analysis Phase
- Creativity Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

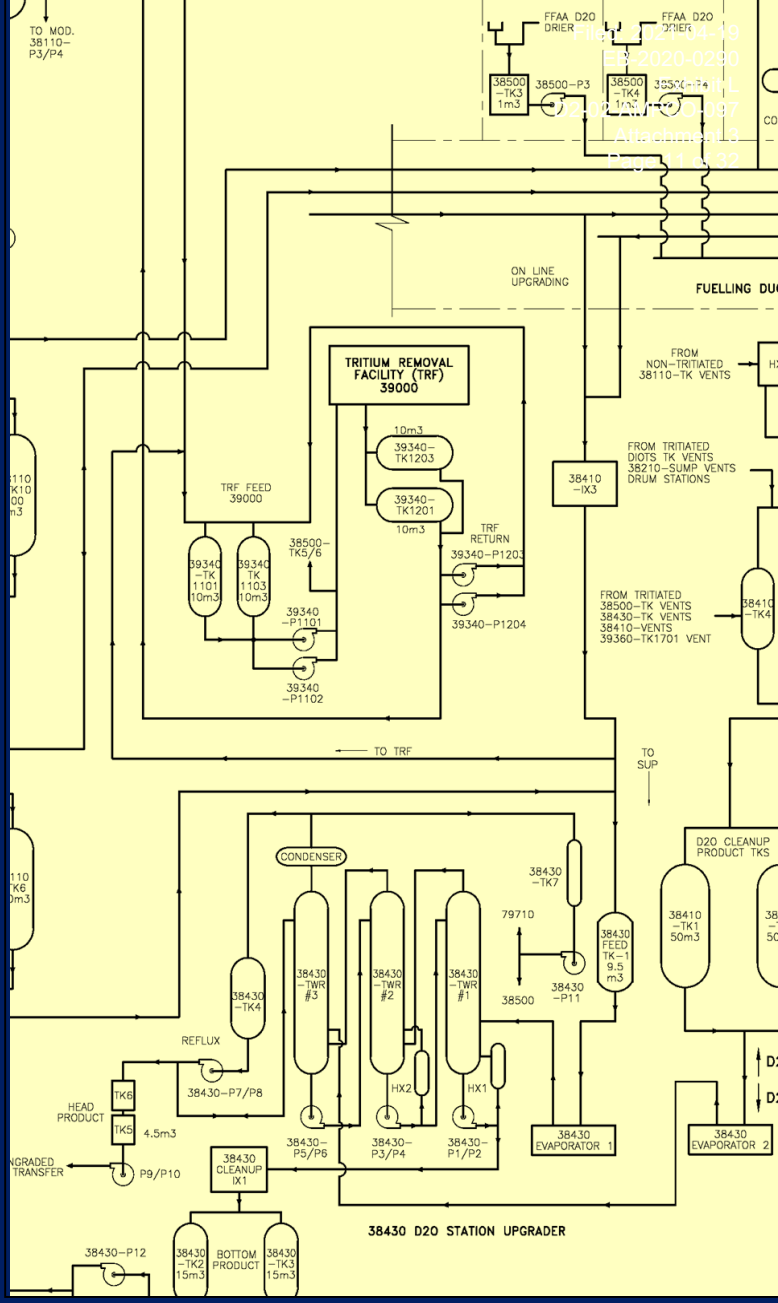
- Workshop summary
- Report preparation
- Recommendations
- Implementation

Function Analysis



Function Analysis

- **Functional gaps identified**
  - New tanks
    - Chemical addition
    - Clean up

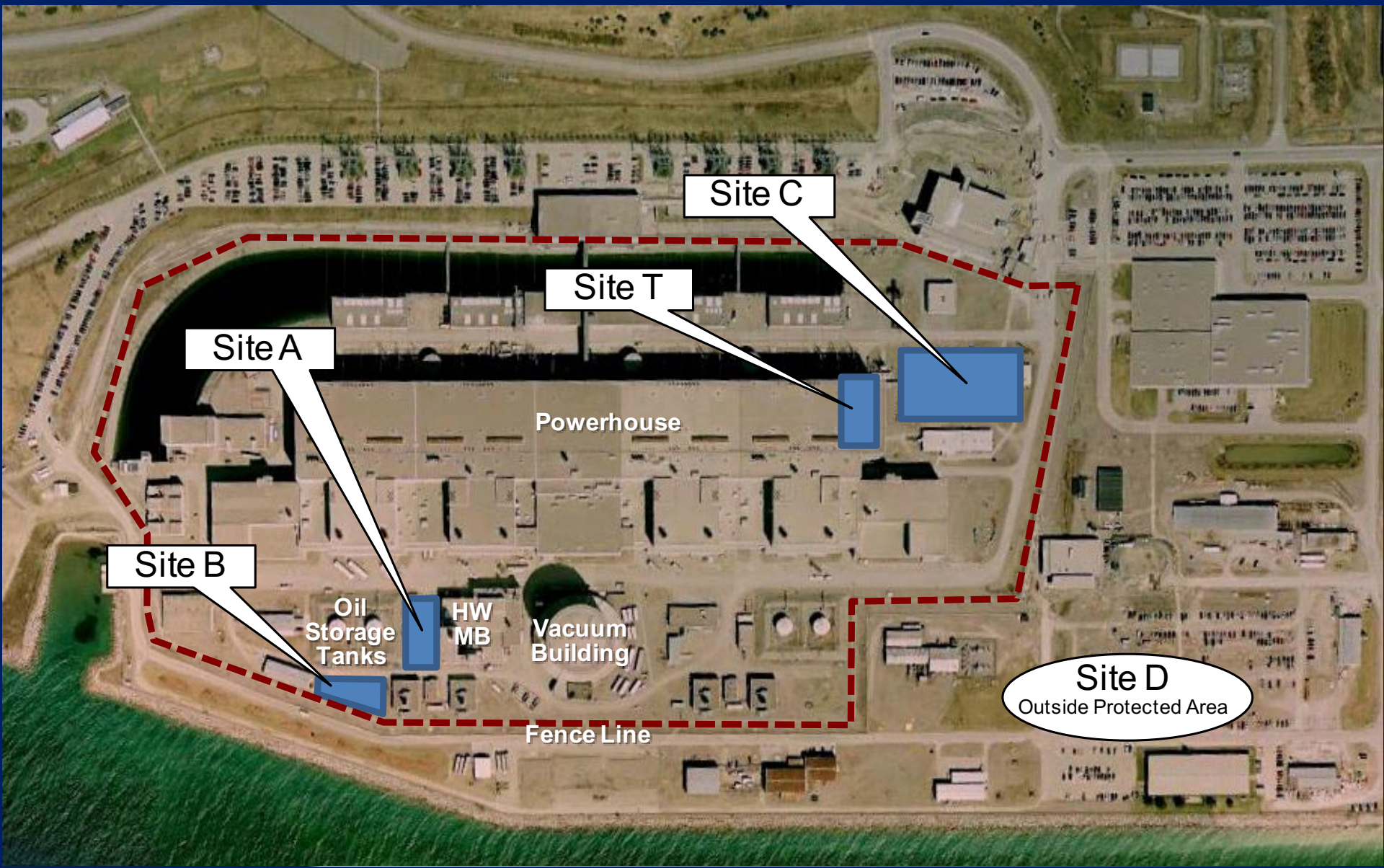


Creativity/Evaluation/Development

- **Ideas**
  - 179 Generated
  - 132 Further consideration

Strategy to Move Forward

Alternative Sites Considered



Alternative Sites Considered

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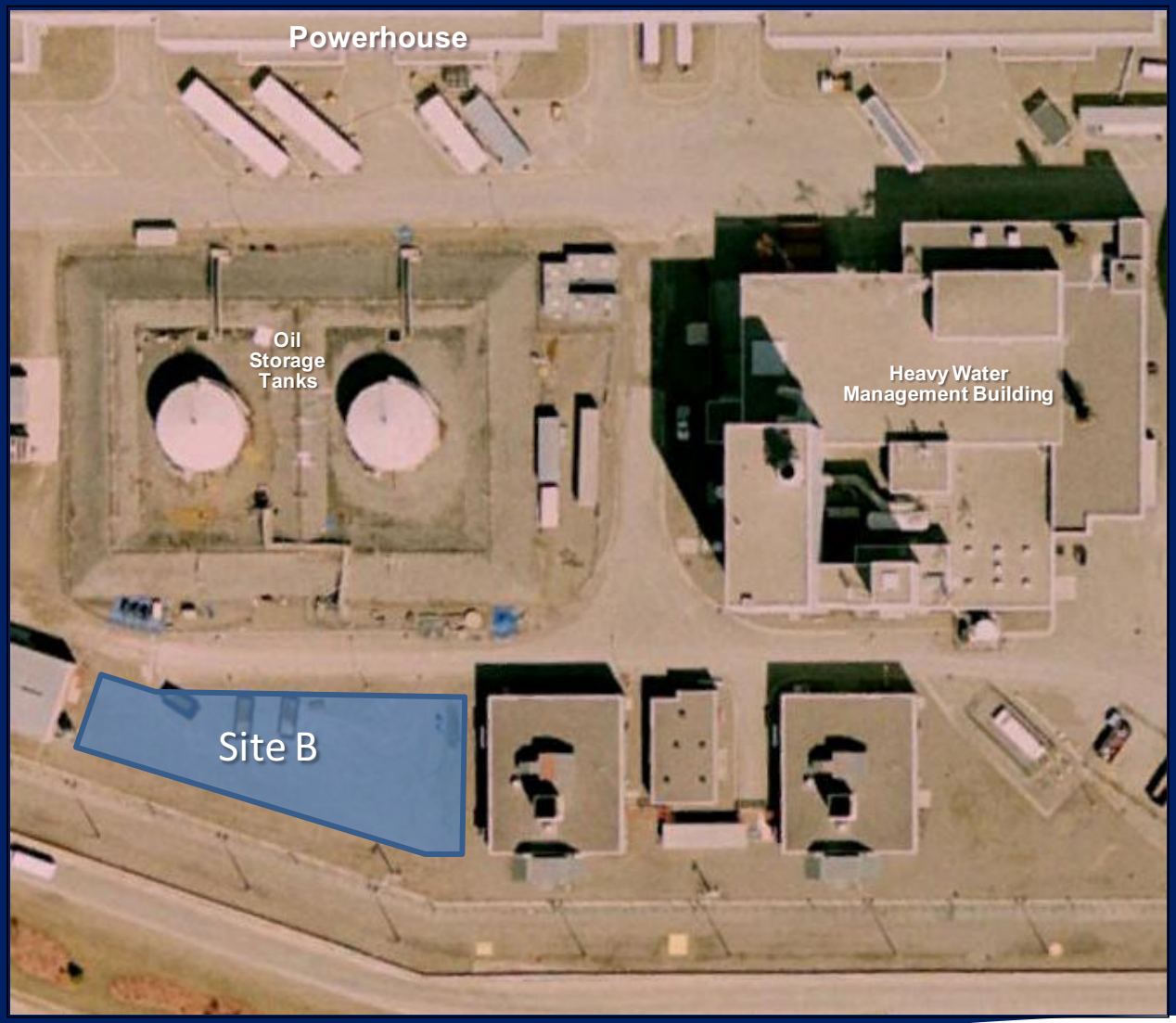

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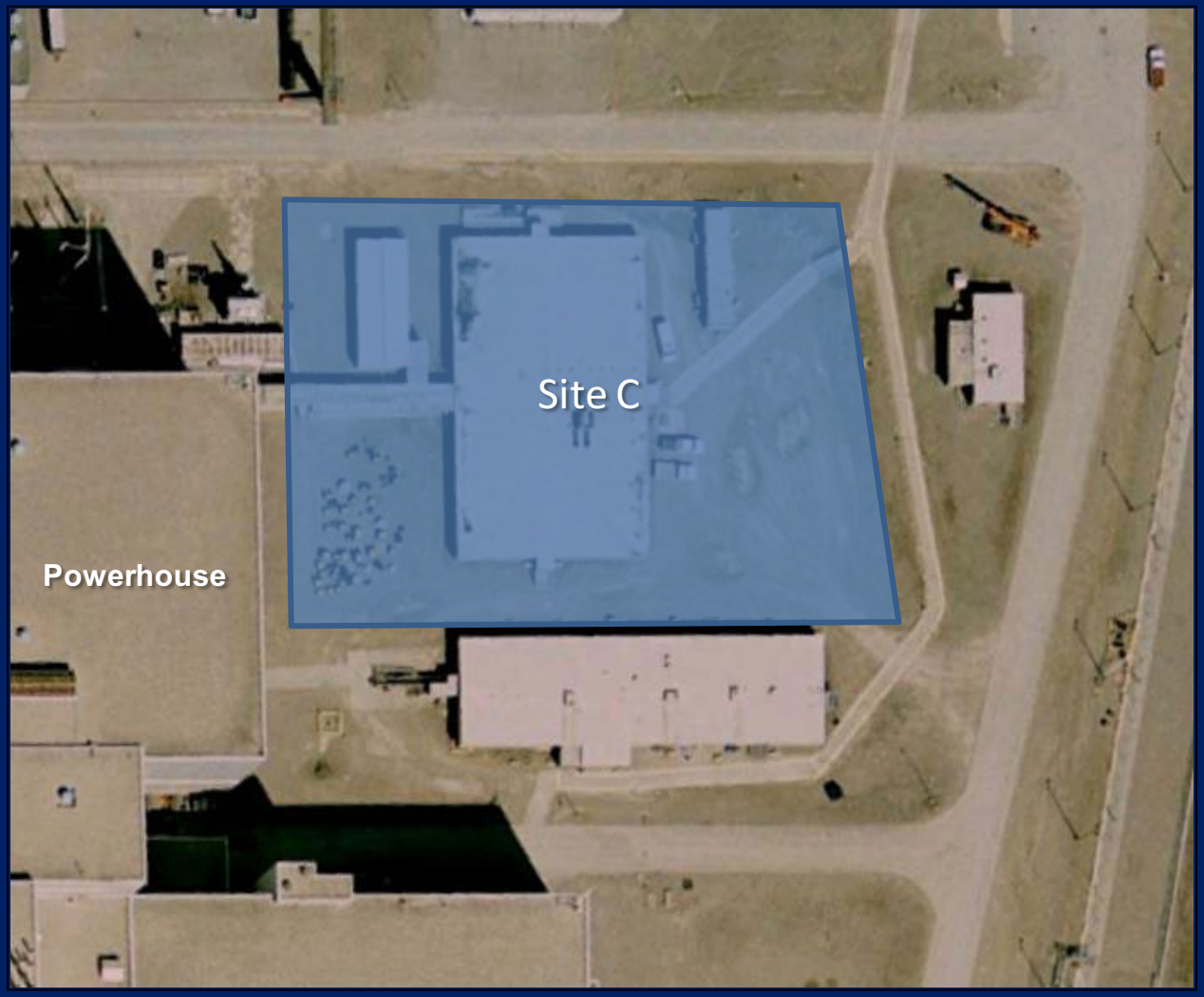

Alternative Sites Considered

Alternatives

- **Location combinations**
  - TRF operations
  - Refurbishment D_2O storage

TRF Operations	Refurbishment D_2O Storage			
	A	B	C	T
A	Alt 1	Alt 4	Alt 5	Alt 10
B	Alt 6	Alt 2	Alt 7	-
C	Alt 8	Alt 9	Alt 3	-
T	-	-	-	-

Assumptions

- **Key information not available**
  - Geotechnical
  - Costs
- **Assumed**
  - Remediation Cost (highest to lowest) - Sites A, B, C, and T
  - Baseline cost of $150M at Site A
  - All other costs relative

Evaluation - Weighting

Criteria/Team Members		Team Member Weighting Preferences											Total	Weight (Norm)*
		1	2	3	4	5	6	7	8	9	10	11		
1	Operations	40	35	20	30	25	30	20	45	20	30	14	**309**	**28**
2	Security	5	5	5	5	5	5	0	5	4	5	14	**58**	**5**
3	Environmental	10	20	10	10	10	10	20	10	30	15	14	**159**	**15**
4	Site Size	10	10	10	15	10	10	0	10	2	10	14	**101**	**9**
5	Site Preparation	10	10	15	20	25	10	30	10	3	10	14	**157**	**14**
6	Constructability	10	10	25	15	15	30	20	10	26	20	14	**195**	**18**
7	Approvals	15	10	15	5	10	5	10	10	15	10	16	**121**	**11**
Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**1100**	**100**

*Note: * Average weightings are normalized using base-100.*

Evaluation – Performance

Criteria/Alternatives		Weight (Norm)*	VE Alt. 1 (Site A)		VE Alt. 2 (Site B)		VE Alt. 3 (Site C)		VE Alt. 4 (Site A/B)		VE Alt. 5 (Site A/C)		VE Alt. 6 (Site A/T)	
Description (Differing Elements)	Storage Tanks (1500m3)		Located at Site A		Located at Site B		Located at Site C		Located at Site B		Located at Site C		Located at Site T	
	TRF Tanks (600m3)		Located at Site A		Located at Site B		Located at Site C		Located at Site A		Located at Site A		Located at Site A	
	Offices		Located at Site A		Located at Site B		Located at Site C		Located at Site A		Located at Site A		Located at Site A	
	Drum Handling		Located at Site A		Located at Site B		Located at Site C		Located at Site A		Located at Site A		Located at Site A	
Criteria			Score	Total	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total
1	Operations	28	10	280	4	112	2	56	8	224	6	168	6	168
2	Security	5	10	50	7	35	8	40	8	40	9	45	10	50
3	Environmental	15	1	15	3	45	5	75	3	45	7	105	9	135
4	Site Size	9	5	45	4	36	10	90	8	72	9	81	4	36
5	Site Preparation	14	3	42	5	70	10	140	4	56	7	98	6	84
6	Constructability	18	5	90	3	54	10	180	1	18	8	144	3	54
7	Approvals	11	9	99	6	66	7	77	7	77	7	77	5	55
Total		100		621		418		658		532		718		582
Rank (Best Performance = 1)				3		6		2		5		1		4

Rating	*Rating Definition*
10	Alternative concept is *extremely* preferred
9	Alternative concept is *very strongly* preferred
8	Alternative concept is *strongly* preferred
7	Alternative concept is *moderately* preferred
6	Alternative concept is *slightly* preferred
5	Original and Alternative concept equally preferred
4	Original concept is *slightly* preferred
3	Original concept is *moderately* preferred
2	Original concept is *strongly* preferred
1	Original concept is *very strongly* preferred
0	Original concept is *extremely* preferred

Evaluation – Cost (Assumed)

Cost Components/Alternatives		VE Alt. 1 (Site A)	VE Alt. 2 (Site B)	VE Alt. 3 (Site C)	VE Alt. 4 (Site A/B)	VE Alt. 5 (Site A/C)	VE Alt. 6 (Site A/T)
Description (Differing Elements)	Storage Tanks (1500m3)	Located at Site A	Located at Site B	Located at Site C	Located at Site B	Located at Site C	Located at Site T
	TRF Tanks (600m3)	Located at Site A	Located at Site B	Located at Site C	Located at Site A	Located at Site A	Located at Site A
	Offices	Located at Site A	Located at Site B	Located at Site C	Located at Site A	Located at Site A	Located at Site A
	Drum Handling	Located at Site A	Located at Site B	Located at Site C	Located at Site A	Located at Site A	Located at Site A
Baseline Capital Cost		$150,000,000	$150,000,000	$150,000,000	$150,000,000	$150,000,000	$150,000,000
Adjustment to Capital Cost			$17,000,000	$14,000,000	$13,000,000	$12,000,000	$2,000,000
Total Capital Cost		**$150,000,000**	**$167,000,000**	**$164,000,000**	**$163,000,000**	**$162,000,000**	**$152,000,000**
Baseline Future Cost (incl. societal costs)							
Adjustment to Future Cost			$0	$0	$0	$0	$0
Total Future Cost		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Life Cycle Cost		**$150,000,000**	**$167,000,000**	**$164,000,000**	**$163,000,000**	**$162,000,000**	**$152,000,000**
Rank (Lowest Cost = 1)		**1**	**6**	**5**	**4**	**3**	**2**

Evaluation – Best Value

Cost Components/Alternatives		VE Alt. 1 (Site A)	VE Alt. 2 (Site B)	VE Alt. 3 (Site C)	VE Alt. 4 (Site A/B)	VE Alt. 5 (Site A/C)	VE Alt. 6 (Site A/T)
Description (Differing Elements)	Storage Tanks (1500m3)	Located at Site A	Located at Site B	Located at Site C	Located at Site B	Located at Site C	Located at Site T
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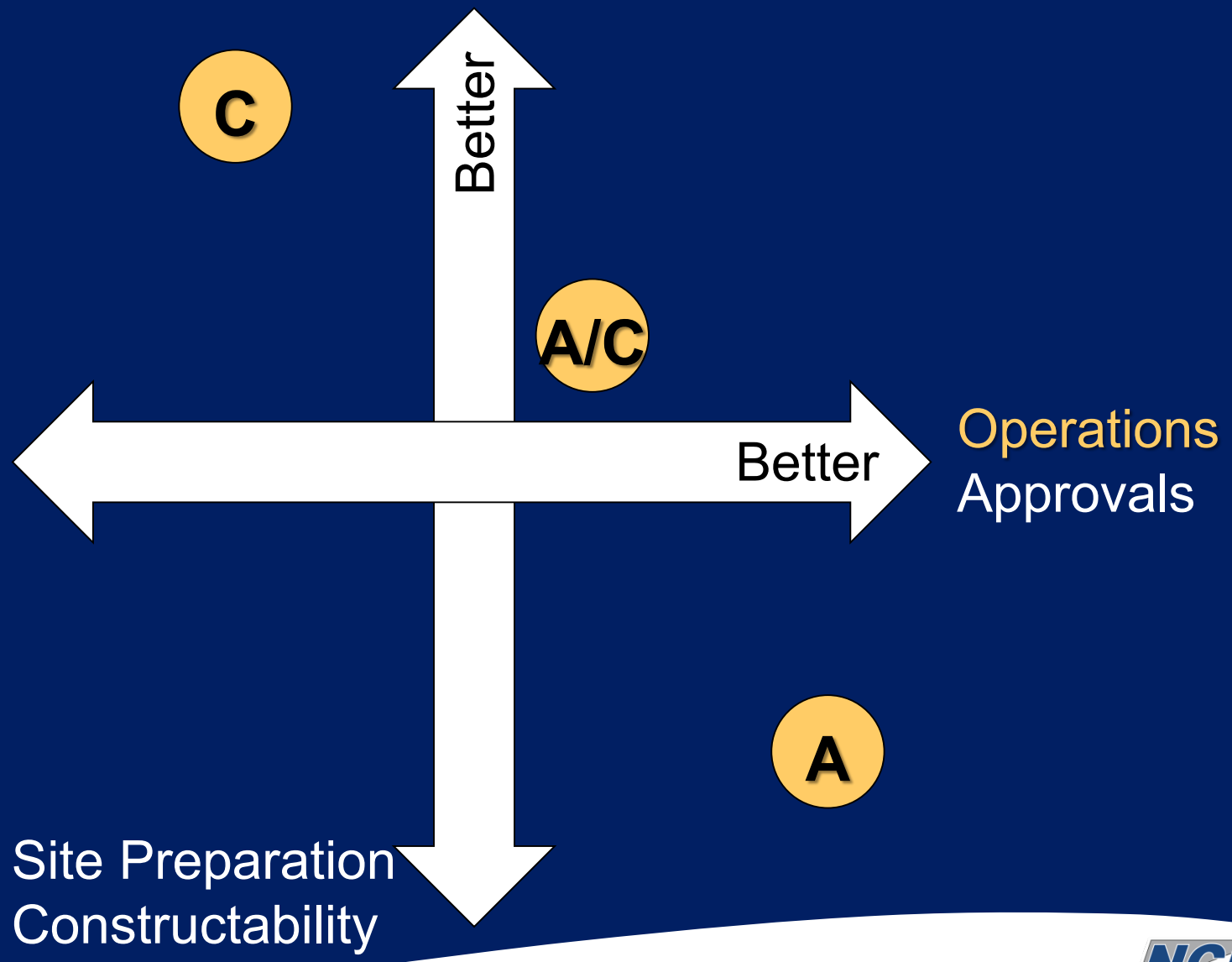
	Drum Handling	Located at Site A	Located at Site B	Located at Site C	Located at Site A	Located at Site A	Located at Site A
Performance		621	418	658	532	718	582
Total Life Cycle Cost		$150,000,000	$167,000,000	$164,000,000	$163,000,000	$162,000,000	$152,000,000
Value Ratio V ~ P/C		4.14	2.50	4.01	3.26	4.43	3.83
Rank (Most Preferred = 1)		2	6	3	5	1	4

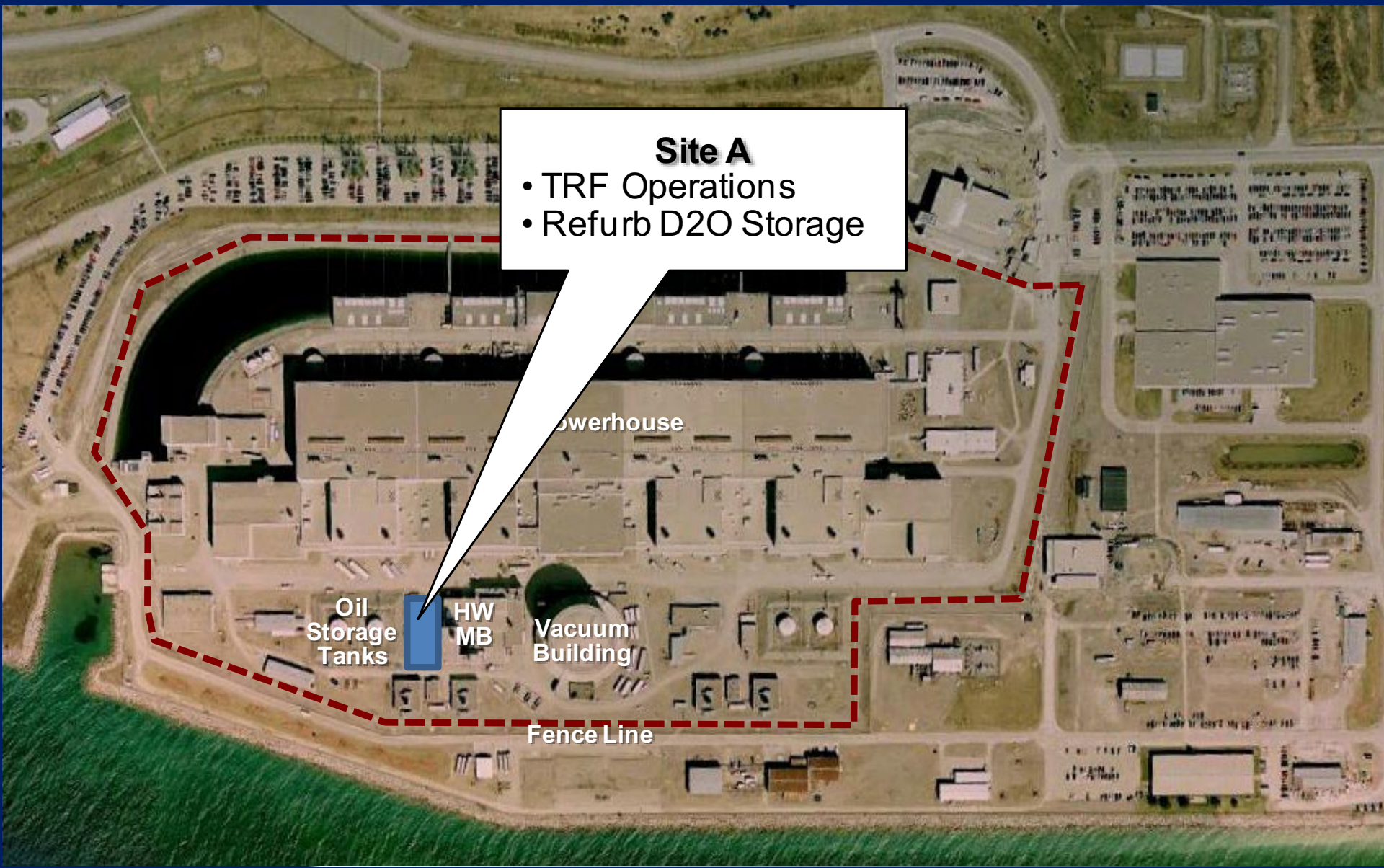
Evaluation – What it Means?



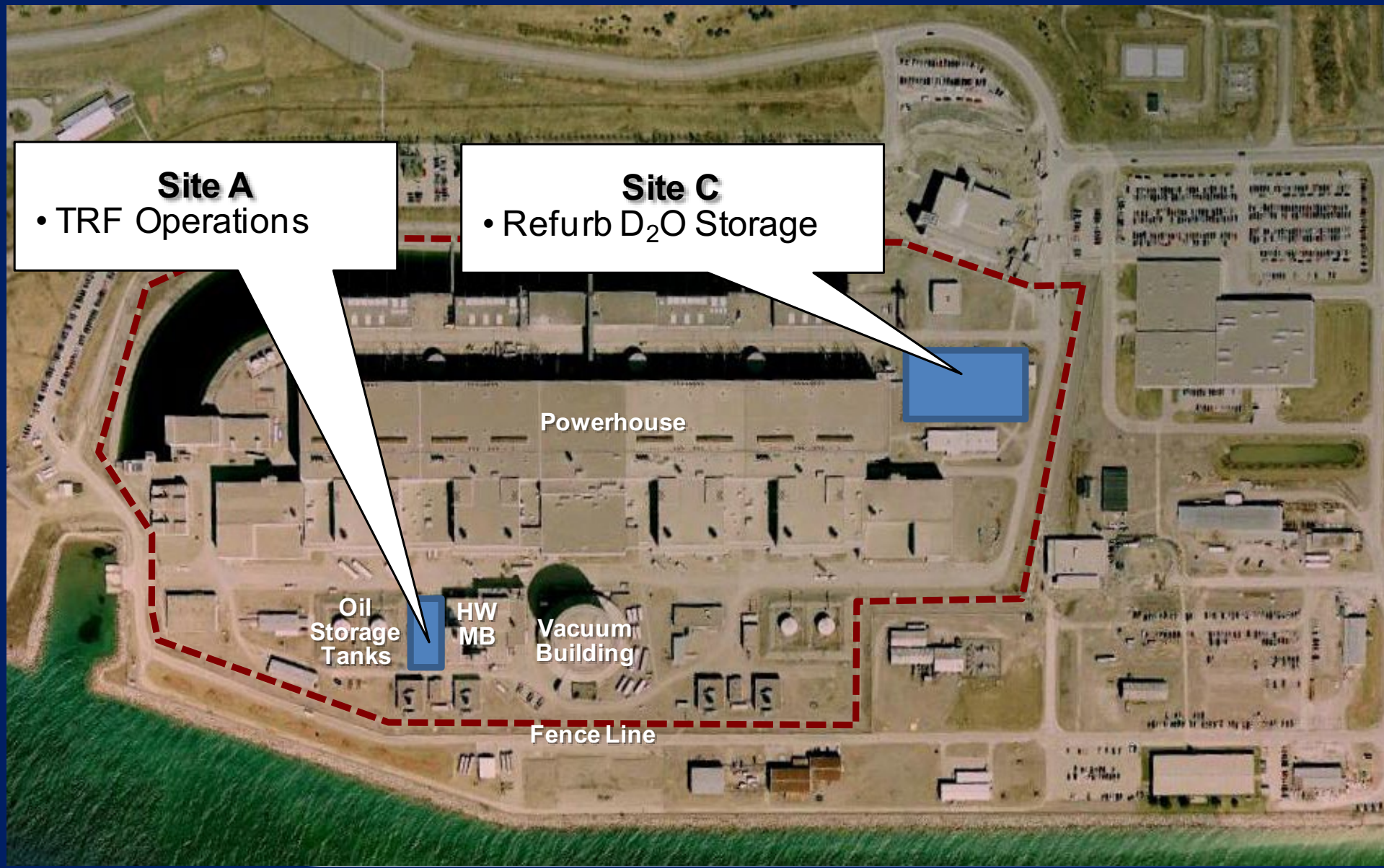
Evaluation – What it Means?

- **Site A would be best…**
  - Soil remediation is not as bad as assumed

Conclusions – Preferred Alternative



Conclusions – Fallback Alternative



Ideas, Ideas,…More Ideas

DRAFT REPORT

ONTARIO POWER GENERATION
DNGS D_2O STORAGE FACILITY
VALUE ENGINEERING STUDY

2.0 VE RECOMMENDATIONS

The VE team identified a number of VE ideas that the project team should consider when developing the project concept. These are presented in **Exhibit 2.1**. The initial savings, future cost savings, and total life cycle costs (LCC) associated with the VE recommendations are unknown at this time.

Exhibit 2.1 – VE Ideas to be Considered

Ref.	VE Proposals
CW-01	Commissioning existing oil/water separator
CW-02	Second permanent cleaning system (fixed or skid-mounted)
CW-03	Run multiple IX (existing) simultaneously with different feed
CW-04	SARX for oil removal (currently used at PNGS)
CW-05	Install online sampling/analyzing system or GRAB sample station
CW-06	Tanks close to IX to improve efficiency of re-circulation (cleanup)
CW-07	Tie-in to existing UVO Xidizer for cleanup independent of supply feed tanks
CW-08	Facility for portable I/X column hookup for cleaning
CW-09	Clean Refurb water in the unit prior to shipping to TRF
CW-10	A number of smaller tanks for downgraded D_2O
CW-11	Ability to clean 3,500 backlog of D_2O drums
CW-12	Clean dirty water from external customers
CW-13	Resin and charcoal disposal
CW-14	De-deut tanks if new IXcu
CP-02	Provide temporary washrooms during construction
CP-03	Ensure design is constructible
CP-05	Railings on roof for roof access
CP-06	Construct in 3 phases: 1st unit refurb, 2nd unit refurb and TRF/HWMB upgrade
CP-07	Green roof
CP-08	Proper radio communication infrastructure
CP-09	Orientate equipment for ease of maintenance and operation
CP-10	Storm water management (surface and roof drains)
CP-11	Sediment and erosion control during construction
CP-13	TRF staff involved in "site technical assessment" by Design Agency
CP-14	Consider quality of soils (rad – tritium and conv – hydrocarbon)
CP-15	TRF involved in design requirements decided by Design Agency (weekly meeting representative)
CP-16	TRF staff involved in scope definition and preliminary engineering (in addition to COMS process) (weekly meeting representative)
CP-18	Modular construction
CP-19	Dedicated Traffic Officer
CP-20	Site "A" logistics preferred
CP-21	More risk to lake if construction is near lake

NCE 2011-005

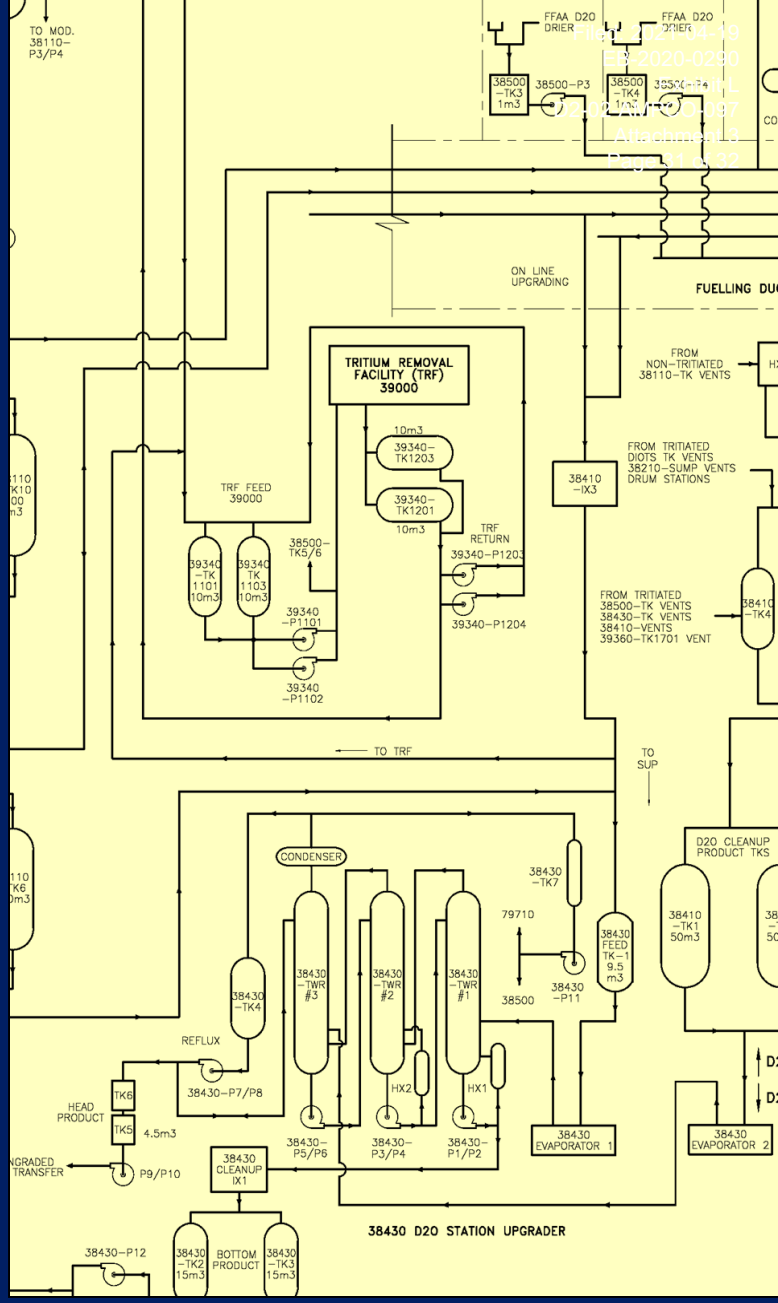
VALUE MANAGEMENT SPECIALISTS 2-1

Path-Forward

- **Confirm assumptions**
  - Geotechnical information
  - Cost data
- **Confirm evaluation**
- **Develop RFP…**

Summary…

- **Four Aspects:**
  - Goals
  - Value Engineering Methodology
  - Value Opportunities
  - Path-Forward



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