

OWNER

Risk Register and Contingency Analysis



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TORUS

[REDACTED] [REDACTED], [REDACTED] County, [REDACTED]

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ISSUE SUMMARY AND APPROVAL

This page records each issue of EST-EST-003. The preparer, reviewer and approver sign for each revision.

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1. INTRODUCTION

This report quantifies the cost and schedule risk in the base estimate (EST-EST-002, Detailed Cost Estimate) and the project schedule (EST-SCH-001), sets the contingency needed to reach 50 % and 80 % confidence, and records the risk register with an owner and a response for each risk. It covers risks within the defined scope. Scope changes, the exclusions of the basis of estimate and management reserve are outside it.

The analysis gives a total installed cost of \$17.57 million at P50 and \$18.24 million at P80, against a base estimate of \$15.65 million. The performance test, planned for February 7, 2028, is reached by March 17, 2028 at P50 and March 30, 2028 at P80.

2. METHOD

TORUS followed AACE International Recommended Practice 41R-08 for range estimating on the cost groups and treated the discrete risks as events in the manner of Recommended Practice 57R-09 for integrated cost and schedule risk analysis. Each of 20,000 iterations samples the activity durations and the risk events, recalculates the critical path through the full Level 3 network, and then prices the estimate. The contractor's time-based general conditions and the Owner's construction management scale with the field duration, the Owner's project team with the project duration, and escalation with the shift in the spend midpoint, so that a delay carries its cost.

Independent ranges would understate the spread, because in practice material prices move together and a poor labor market affects both cost and duration. The model therefore uses a shared material market factor, a shared estimate-basis factor that represents pricing without quotations at this level of definition, and a single labor productivity factor that drives both labor cost and construction durations. One mitigation is modeled: pre-commissioning does not wait for utility power, because a rental generator can bridge a late connection; its cost is charged when needed. Table 2-1 lists the ranges.

Table 2-1: Ranges on Cost Groups and Durations (Triangular, Low / Most Likely / High)

Group	Range (multiplier)	Base value (USD)
Labor productivity and quantities (also drives durations)	0.92 / 1.03 / 1.30	1,516,876
Labor rate	0.97 / 1.00 / 1.10	-
Construction equipment	0.90 / 1.00 / 1.20	482,706
Owner-furnished equipment	Market x 0.95 / 1.00 / 1.15	4,216,211
Owner-furnished bulk, electrical and instrument material	Market x 0.95 / 1.00 / 1.12	386,971
Contractor-furnished material	Market x 0.93 / 1.00 / 1.12	1,452,972
Contractor subcontracts	0.90 / 1.00 / 1.25	418,817
Owner-direct services	0.90 / 1.00 / 1.25	586,000
Receiving pipeline operator allowance	0.80 / 1.00 / 1.50	428,000
Utility allowance	0.40 / 1.00 / 2.50	165,280
Escalation rates	0.60 / 1.00 / 1.60	512,558
Shared material market factor	0.94 / 1.00 / 1.12	-
Shared estimate-basis factor	0.95 / 1.00 / 1.10	-
Procurement lead times	Half market, half own range, up to +25 %	-
Permit durations	Low, mid and high lead times of REG-RPT-002	-

3. RISK REGISTER

Table 3-1 lists the sixteen risks with their probability, their cost and schedule impact and their contribution to the mean cost. The contribution is the expected direct cost of the risk plus its probability times the mean delay to the performance test when it occurs, priced at the time-dependent cost of \$13,065 per working day.

Table 3-1: Risk Register: Probability and Impact

ID	Risk	Probability	Cost impact, \$ thousand (low / likely / high)	Schedule or percentage impact	Contribution to mean, \$ thousand
RK-01	Receiving-operator () hot tap slot or IOA signature late (H-01, H-04)	30 %	10 / 30 / 80	Hot tap slot +4 to 20 wk; IOA +4 to 16 wk	12
RK-02	Utility service later than 35 wk (cooperative line extension, transformer; H-10)	40 %	Through delay	Energization +5 to 25 wk; rental generator bridges pre-commissioning	0
RK-03	Expansive red-bed clay needs deeper piers, over-excavation or lime stabilization (H-07)	40 %	40 / 90 / 220	Foundations +2 to 10 wd	47
RK-04	Rock in drilled shafts or trenches (H-07)	25 %	15 / 45 / 120	Foundations and underground +1 to 8 wd	15
RK-05	Adverse weather beyond the 5 % productivity allowance (rain, tornado stand-downs, winter hydrotest and gas-in)	50 %	Through delay	+3 to 20 wd across grading, foundations, piping, hydrotest, gas-in	22
RK-06	Major vendor lead-time slip (SK-110 / USM calibration slot, V-101 plate, G-101, SDV actuators, FCVs)	45 %	Through delay	One package +2 to 12 wk	32
RK-07	Steel, pipe and copper price spike (tariffs, mill slots) before orders are placed	30 %	Percentage, see schedule column	Cost only: +5 to 20 % on steel-intensive material	89

ID	Risk	Probability	Cost impact, \$ thousand (low / likely / high)	Schedule or percentage impact	Contribution to mean, \$ thousand
RK-08	sales/use tax treatment differs from the 5.5 % carried (H-EST-01)	100 %	Percentage, see schedule column	Cost only: 25 % chance exempt (saving), 20 % chance +1.5 points	-69
RK-09	American burying beetle presence/absence survey required instead of the 4(d) assume-presence path	20 %	25	ABB clearance +0 to 30 wd (seasonal window)	5
RK-10	Stormwater permitting authority (H-17) resolution or NOI delayed	20 %	5	NOI coverage +5 to 25 wd	1
RK-11	air registration required before construction with a longer review	25 %	8	Air determination +10 to 40 wd	2
RK-12	HOLD-driven design growth between IFR and IFC (H-04, H-07, H-14, H-15, vendor data)	100 %	Percentage, see schedule column	Quantities +0 to 10 % (mode 3 %); final design +0 to 15 wd	306
RK-13	Receiving-operator measurement, quality or SCADA requirements add scope (H-01, H-13, H-14)	30 %	30 / 80 / 200	None expected (inside E&I float)	31
RK-14	Station classified as transmission (H-18): rupture-mitigation valve and control room management evaluations	15 %	60 / 150 / 350	None expected	28
RK-15	H-101 certified weight above the Rev A value needs a larger crane or shorter radius (CON-CAL-001)	30 %	8 / 15 / 30	None	5
RK-16	Thin station-contractor bid market in 2027 raises the contract price	35 %	Percentage, see schedule column	Cost only: contract +3 to 15 %	208

Table 3-2 gives the owner and the response for each risk.



Table 3-2: Risk Register: Owners and Responses

ID	Risk owner	Response
RK-01	Owner commercial	Open IOA at IFR; book tap window at IFC; do the hot tap early (about 23 weeks of float)
RK-02	Owner	Apply at IFR with load letter; rental generator and fuel plan
RK-03	EOR / geotech	Geotech before IFC; unit-price items 02.04, 02.08, 03.04 in bid
RK-04	Contractor / Owner	Unit-price items 02.05, 06.05; borings to refusal
RK-05	Contractor	Float in plan; winter nitrogen pre-pressurization before gas-in; heated test water
RK-06	Owner procurement	Early RFQ at IFR approval; expediting; certified-drawing clauses
RK-07	Owner procurement	Place pipe and fittings orders early; price validity in RFQs
RK-08	Owner tax	Owner tax review before AFE release
RK-09	Owner environmental	Decide the 4(d) path by week 4; survey in the late-May to September window
RK-10	Owner regulatory	SWPPP already written for both permits; resolve H-17 by week 4
RK-11	Owner regulatory	File with the updated emissions inventory at design approval
RK-12	EOR	Close HOLDS before IFC; vendor data in POs
RK-13	Owner / EOR	Submit measurement design and point list with the IOA request
RK-14	Owner regulatory	Obtain the 192.8 determination by IFC
RK-15	Contractor	Certified weight and CG in RFQ-04
RK-16	Owner	Pre-qualify 4 to 6 bidders; package attractive to regional contractors

Utility power contributes almost nothing because the application will be filed at design approval, which leaves the line extension about 25 weeks of float to pre-commissioning; it was late in only 0.35 % of iterations. That holds only if the application is filed immediately. The receiving pipeline operator's hot tap also carries large float when it is booked at Issued for Construction.

4. RESULTS

4.1. COST

Figure 4-1 shows the distribution of total installed cost and Figure 4-2 the cumulative probability. The distribution is skewed to the high side, which is typical of an estimate priced without quotations: the most likely values sit at the base, so the base estimate itself has only a 0.1 % chance of not being exceeded.

Figure 4-1. Distribution of Total Installed Cost

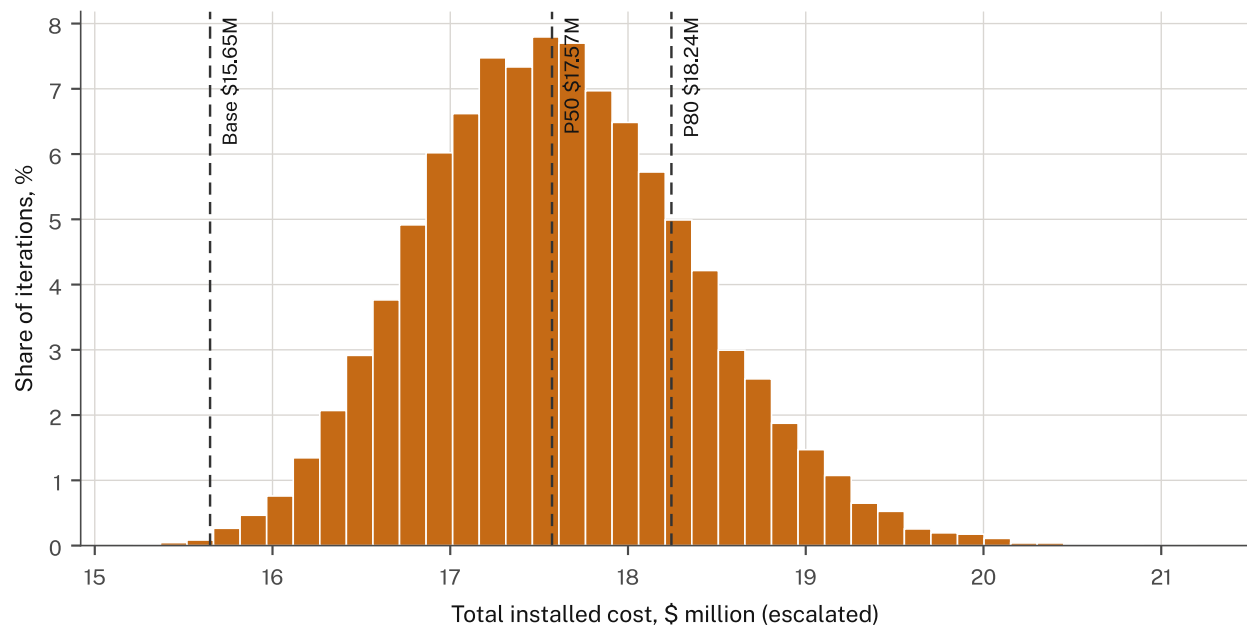


Figure 4-2. Cumulative Probability of Total Installed Cost

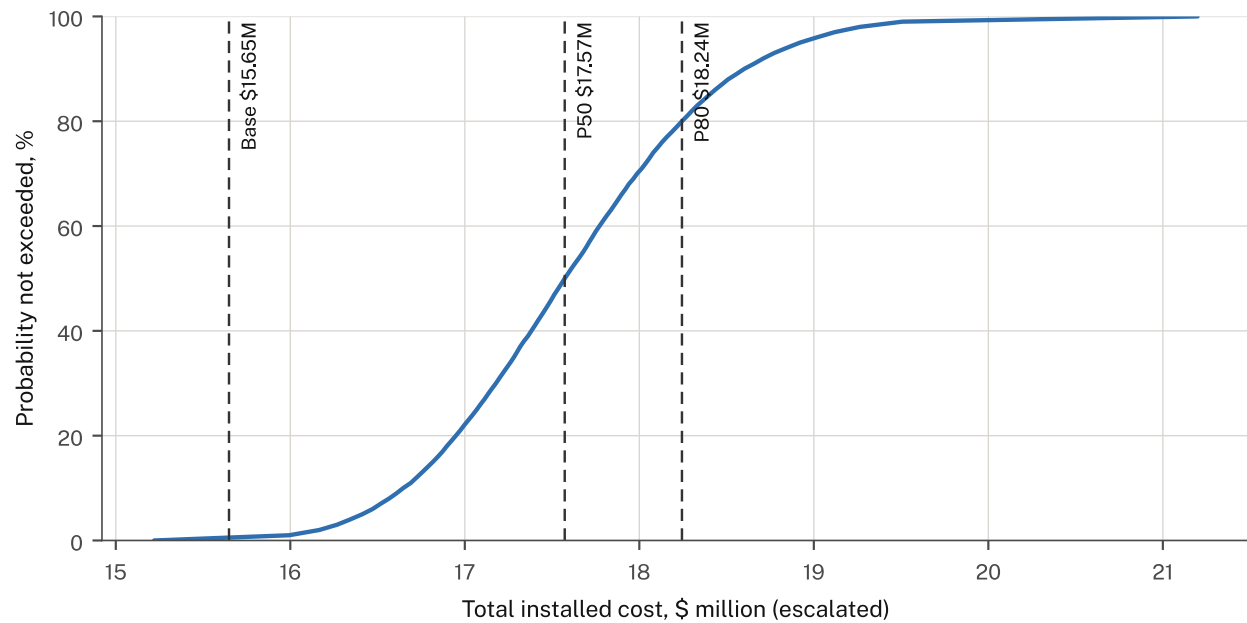


Table 4-1 gives the percentiles.

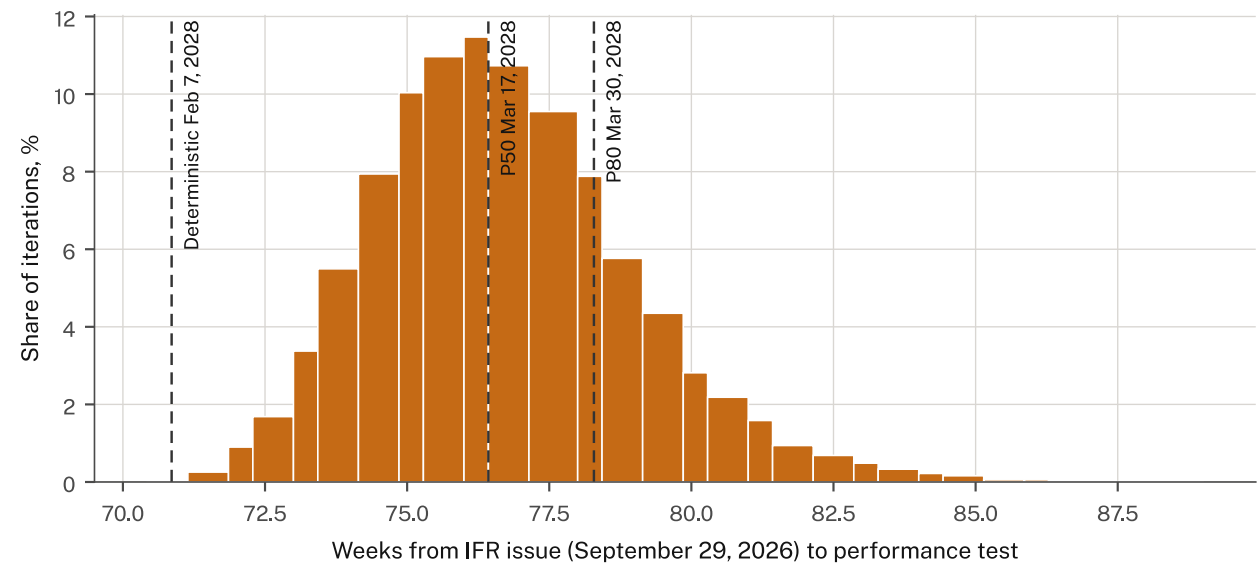
Table 4-1: Total Installed Cost Percentiles

Statistic	Cost (USD)	Above base
Base estimate (escalated, no contingency)	15,648,734	-
Mean	17,607,453	12.5 %
Standard deviation	763,985	4.9 %
P10	16,647,407	6.4 %
P20	16,948,832	8.3 %
P50	17,572,514	12.3 %
P80	18,244,266	16.6 %
P90	18,601,594	18.9 %

4.2. SCHEDULE

Figure 4-3 shows the date of the performance test. The deterministic plan reaches it on February 7, 2028; the P50 date is March 17, 2028 and the P80 date March 30, 2028. The spread comes mainly from procurement lead times, the contractor's productivity and the permit durations. The contractor's field duration rises from 31.4 weeks in the plan to 34.0 weeks at P50 and 35.6 weeks at P80.

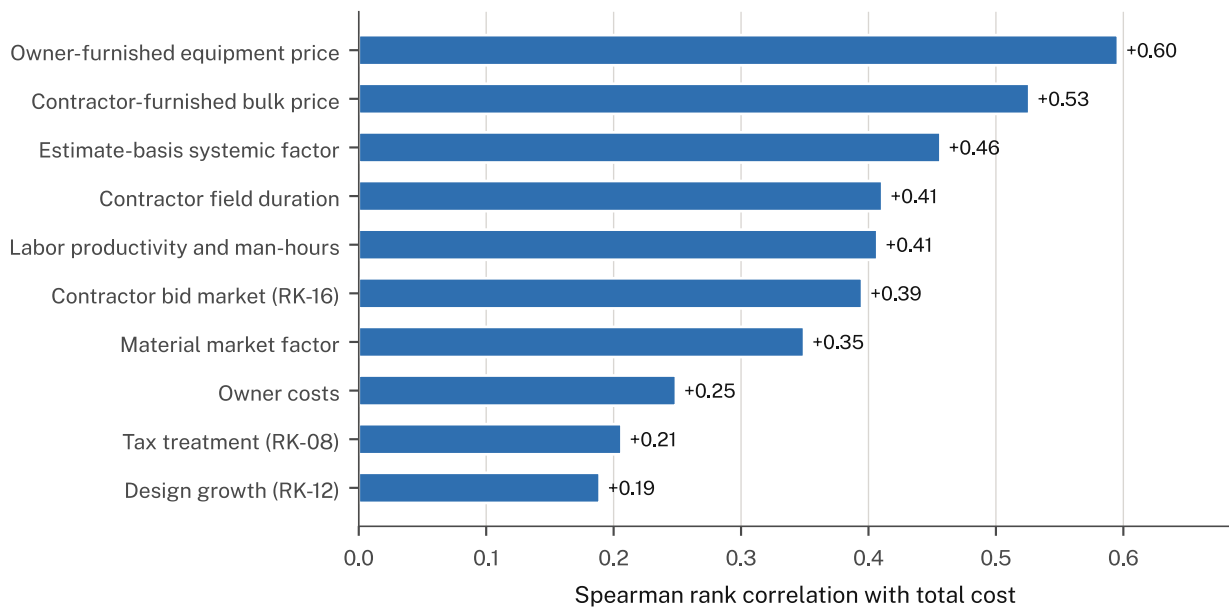
Figure 4-3. Distribution of the Performance Test Date



5. SENSITIVITY

Figure 5-1 ranks the drivers by their rank correlation with total cost. Equipment and bulk prices lead, followed by the estimate-basis uncertainty, the contractor's field duration and labor productivity. Budget quotations would narrow the first three most.

Figure 5-1. Drivers of Total Cost



6. CONTINGENCY

Table 6-1: Contingency Required

Confidence	Contingency (USD)	Share of base	Total installed cost (USD)
P50	1,923,780	12.3 %	17,572,514
P80	2,595,531	16.6 %	18,244,266

Table 6-1 gives the contingency. TORUS recommends funding at P80. Because the most likely outcome already lies above the base, approving at P50 would leave an even chance of an overrun on a project whose price has not yet been tested by quotation. The contingency should be managed by drawdown against this register, with the portion between P50 and P80 released only by the Owner.

7. CONCLUSIONS AND NEXT STEPS

The estimate needs 16.6 % contingency to reach 80 % confidence. The risks that matter most are price risks that quotations can close, the contractor market, and design growth as the holds close. TORUS recommends that before funds are released the Owner obtain budget quotations for the major packages, complete the tax review (HOLD H-EST-01), commission the geotechnical investigation (H-07) and obtain the transmission or gathering determination (H-18), and that it file the utility application and the interconnect request at design approval. The analysis will be rerun at Issued for Construction.