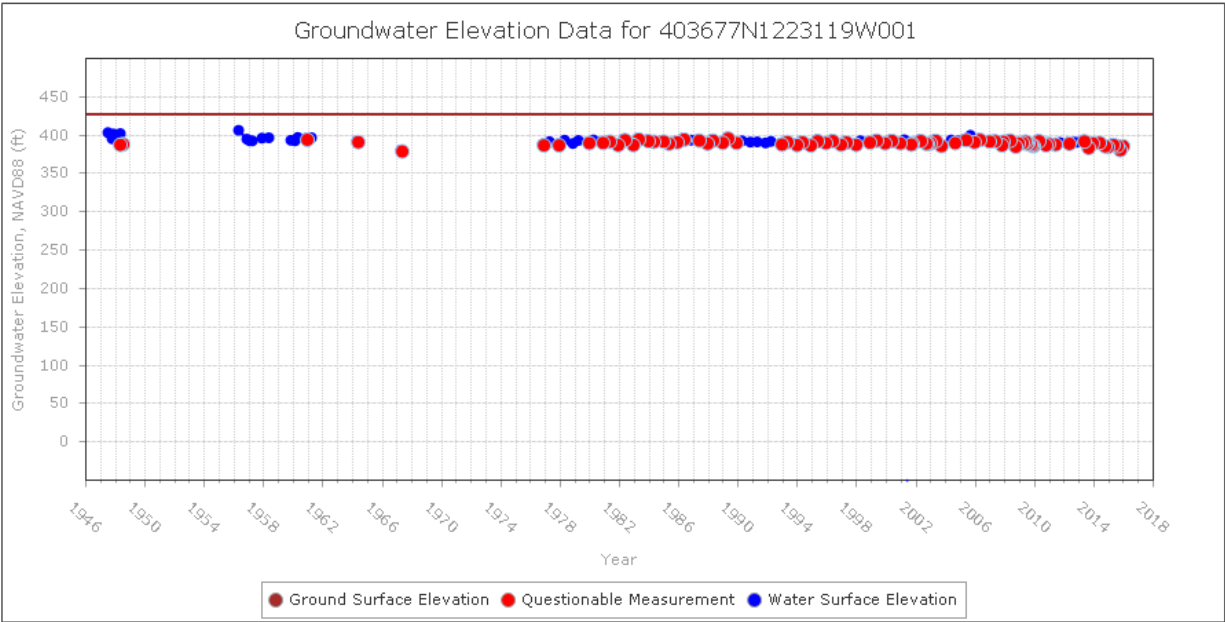
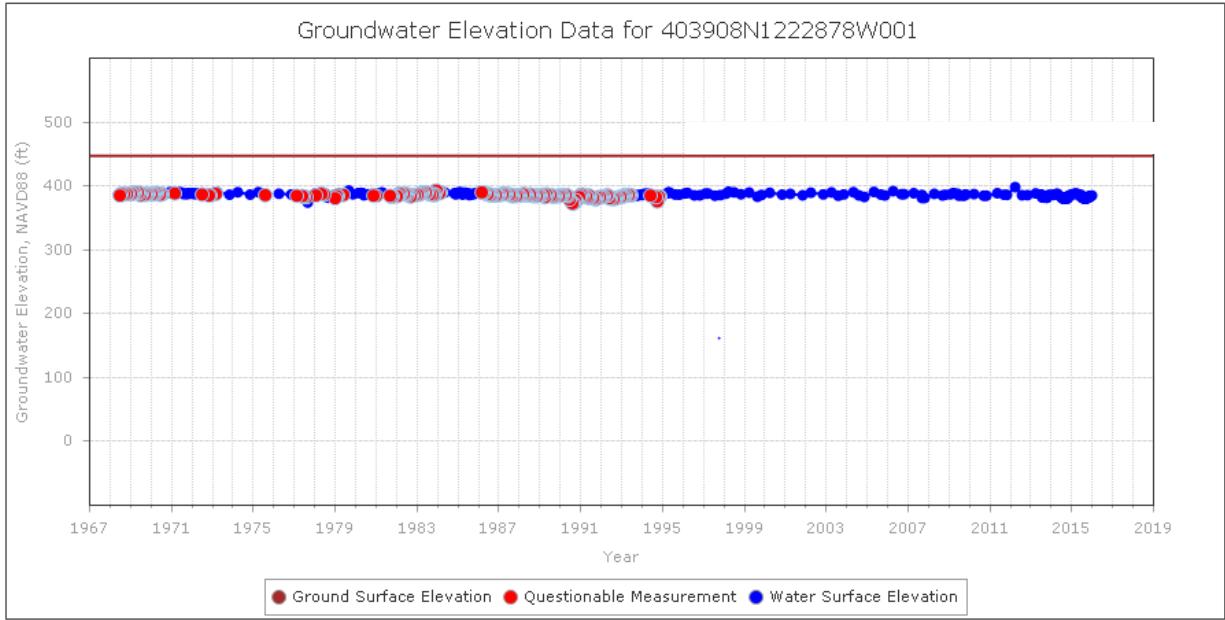


Anderson-Cottonwood Irrigation District
State Well ID 29N04W15E002M



Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

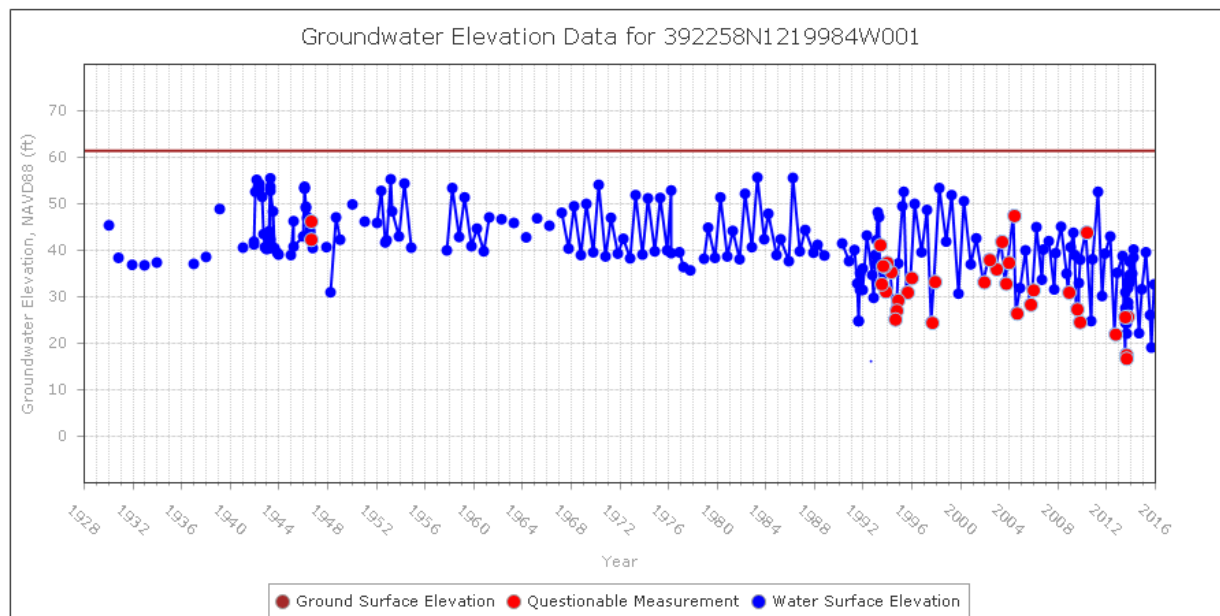
State Well ID 29N04W02P001M



Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

Eastside Mutual Water Company

State Well ID 16N01W20F001M

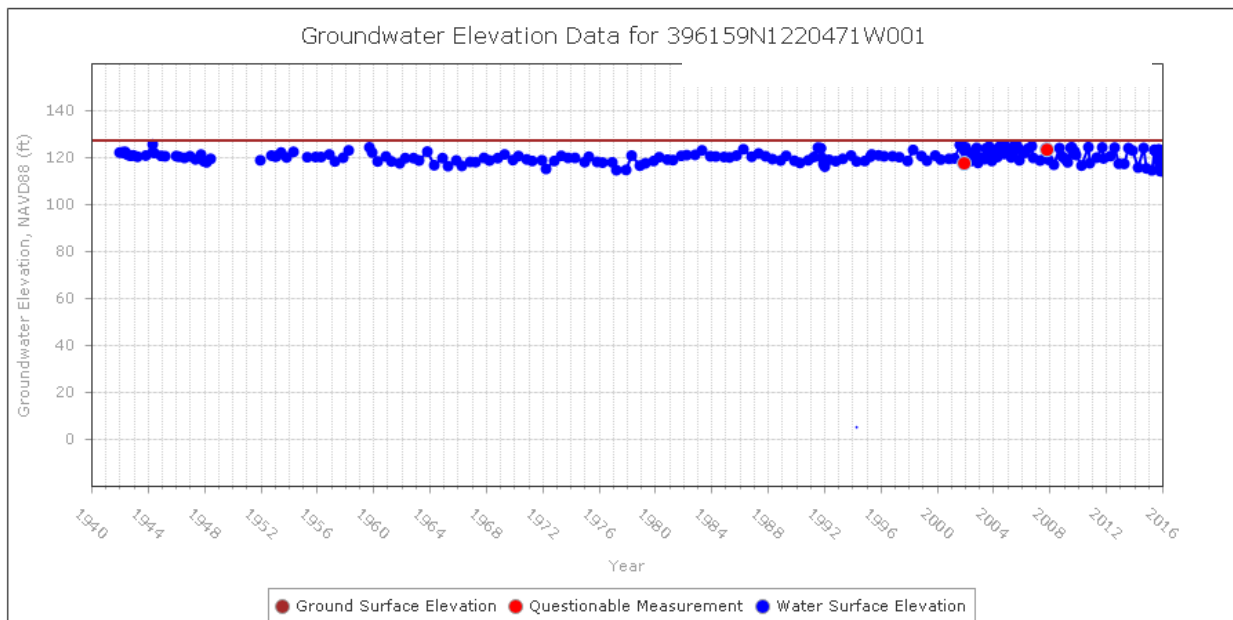


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Glenn-Colusa Irrigation District

State Well ID 20N02W02J001M

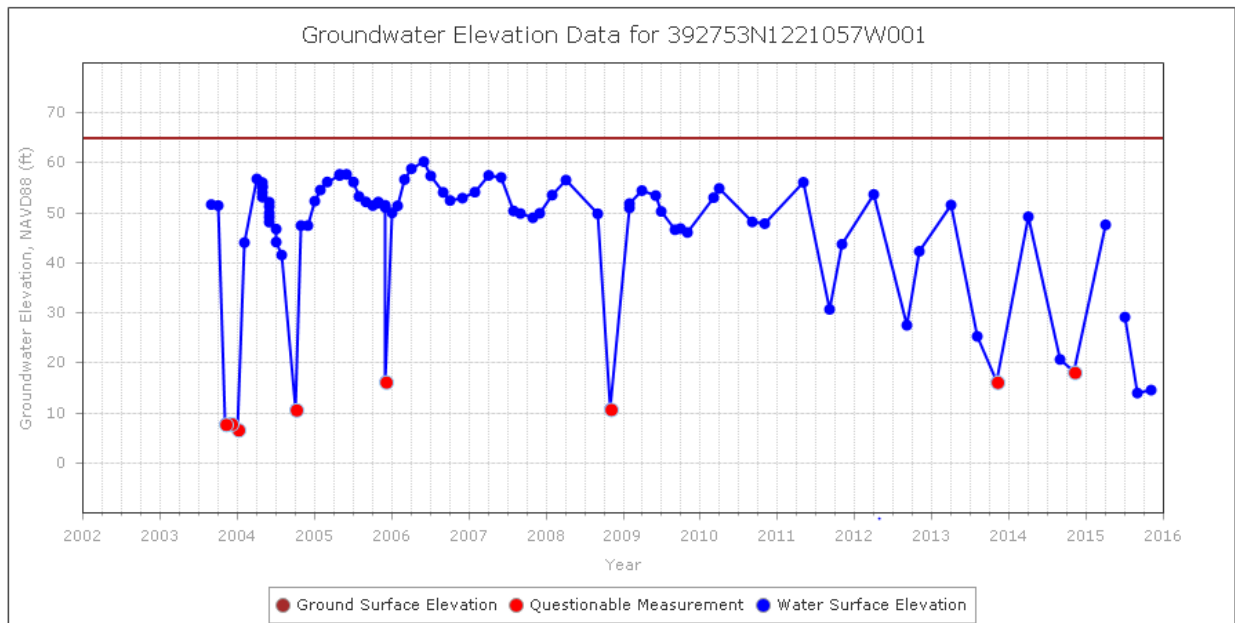


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Maxwell Irrigation District

State Well ID 16N02W05B001M (Deep well; Depth=797 feet)

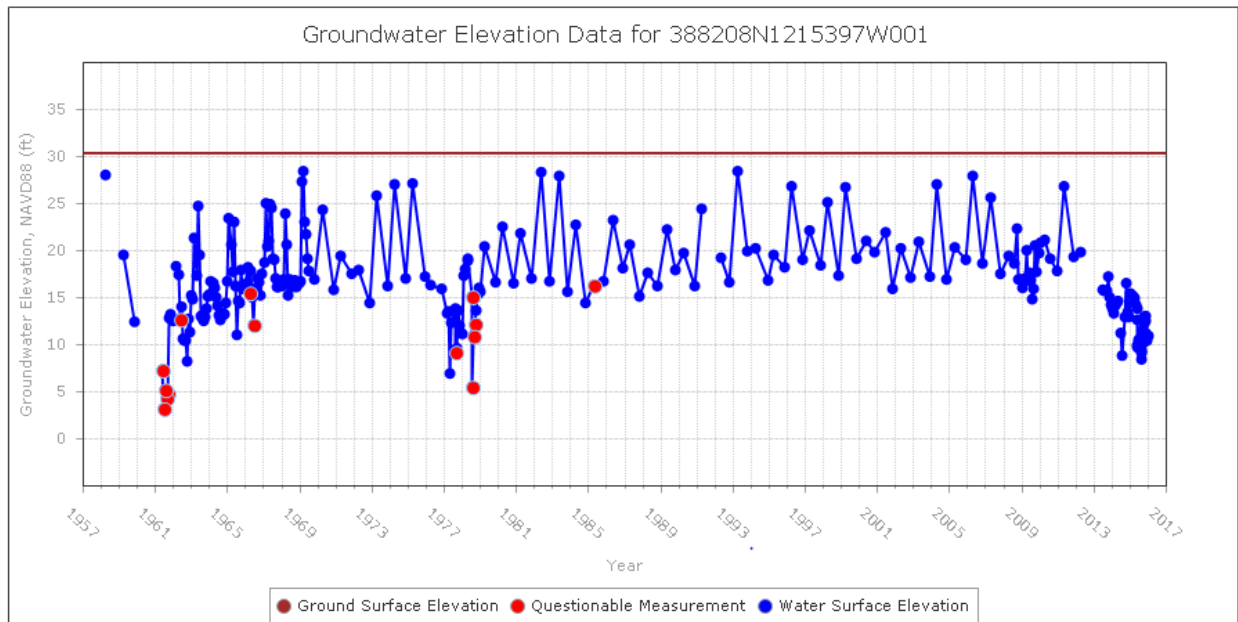


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Natomas Central Mutual Water Company

State Well ID 11N04E09D002M

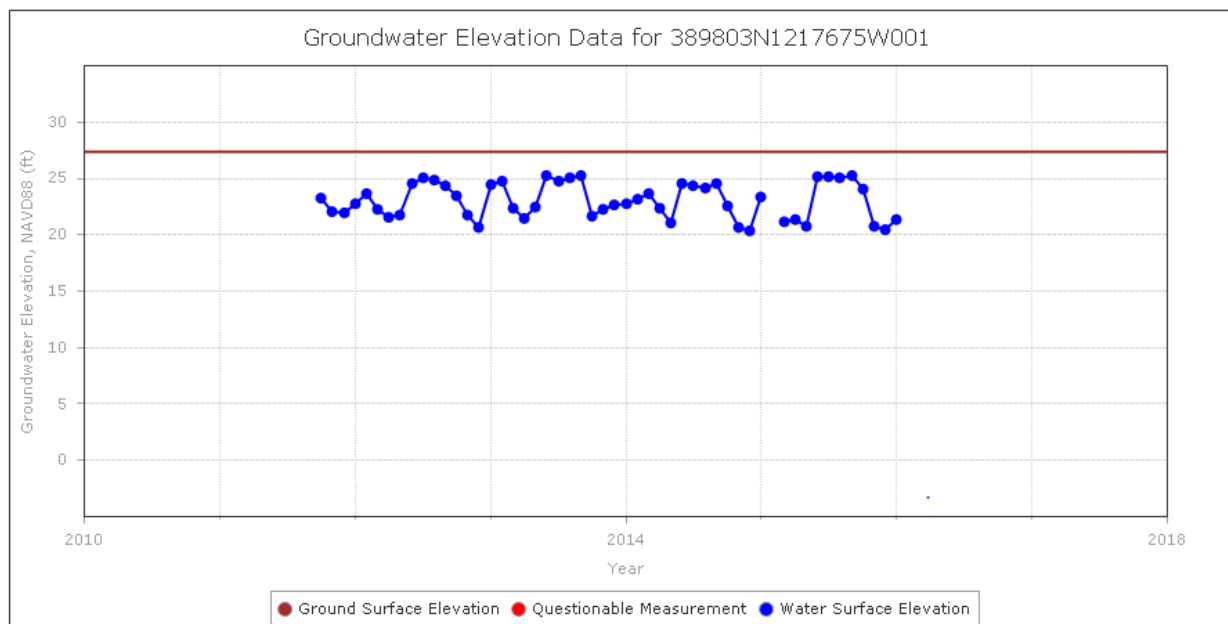


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Pelger Mutual Water Company

State Well ID 13N02E17A001M

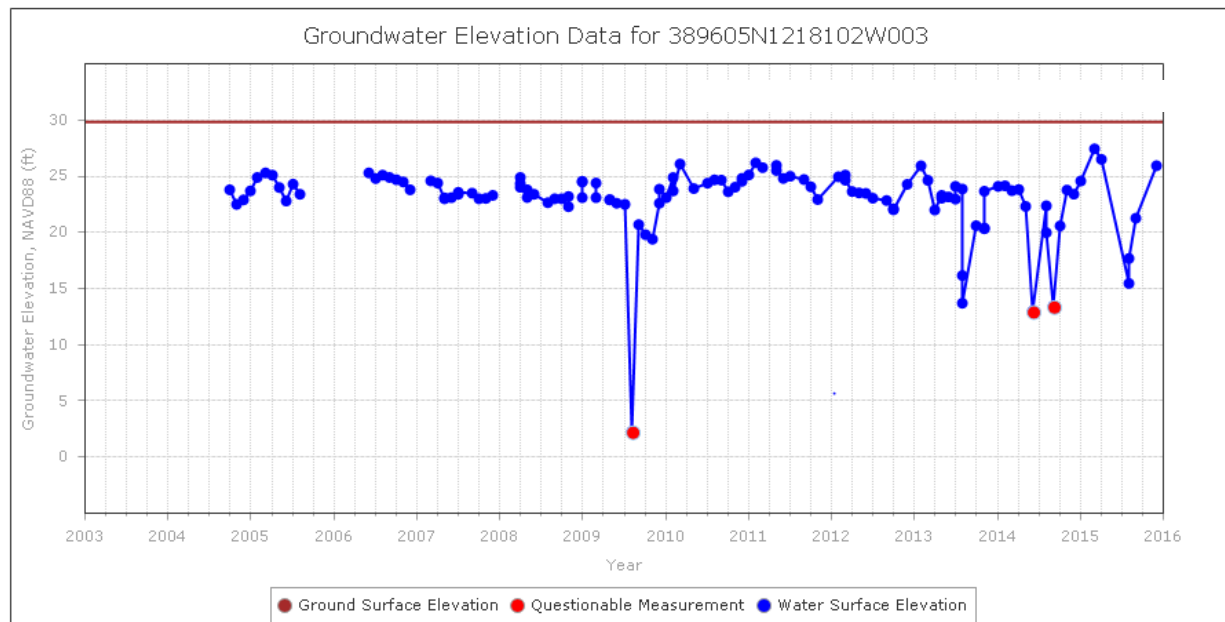


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Pelger Road 1700 LLC

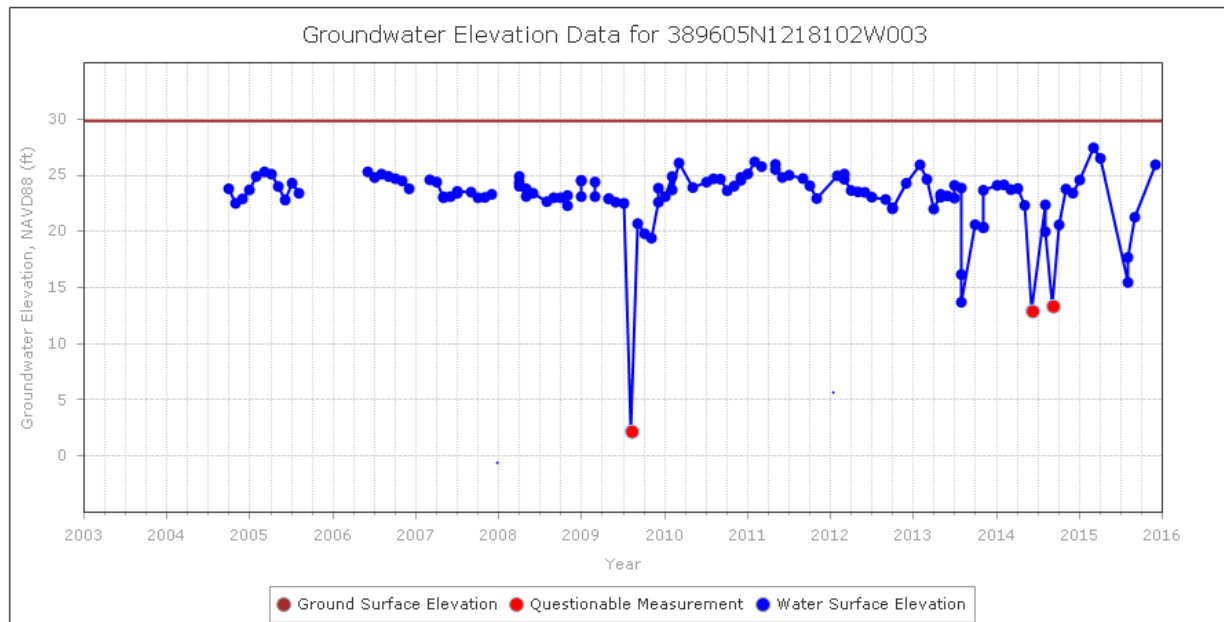
State Well ID 13N01E24G004M (Shallow well; Depth=100 feet)



Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

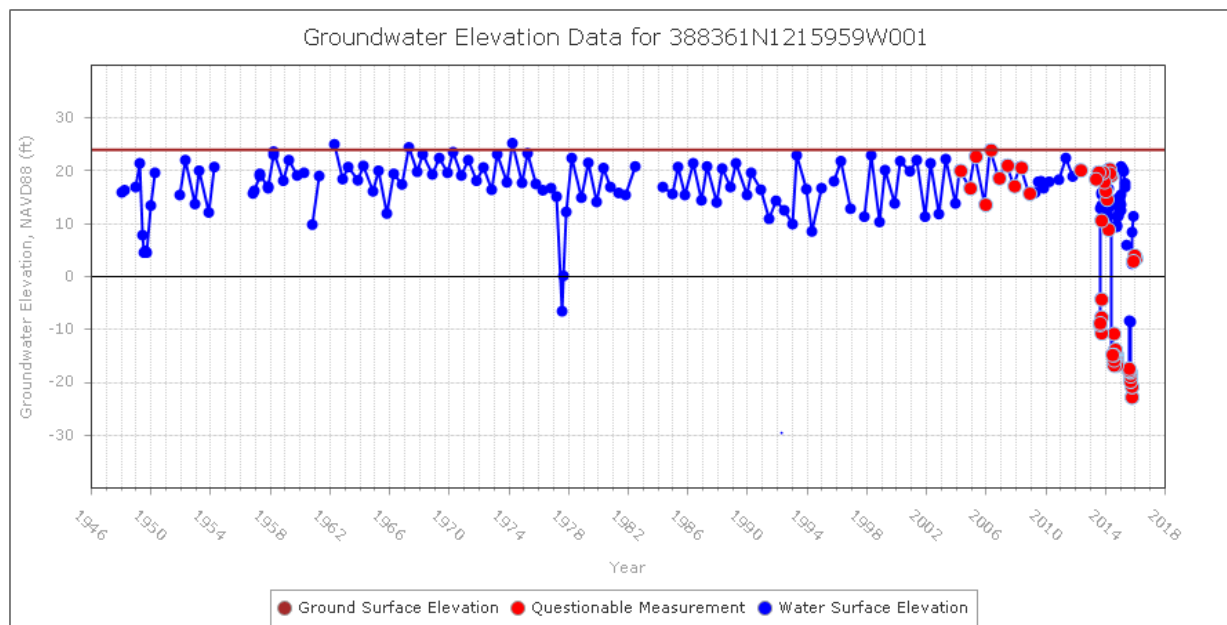
State Well ID 13N01E24G002M (Deep well; Depth=310 feet)



Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

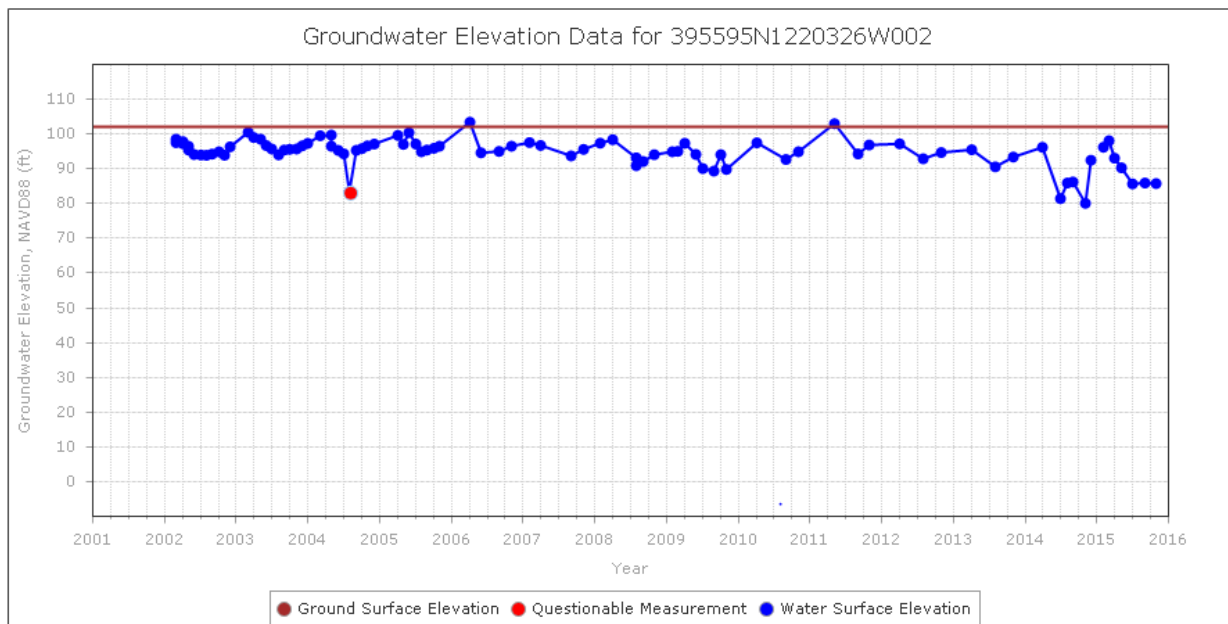
Pleasant Grove-Verona Mutual Water Company
State Well ID 11N03E01D001M



Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

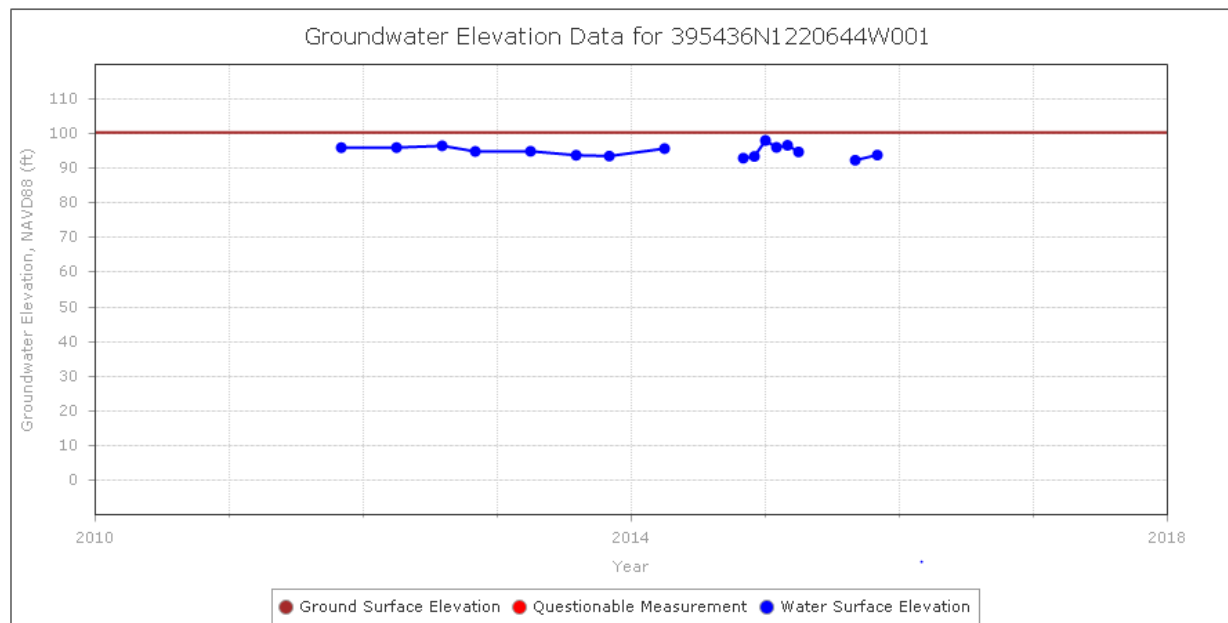
Princeton-Codora-Glenn Irrigation District and Provident Irrigation District
State Well ID 20N02W25F002M (Depth= 513 ft)



Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

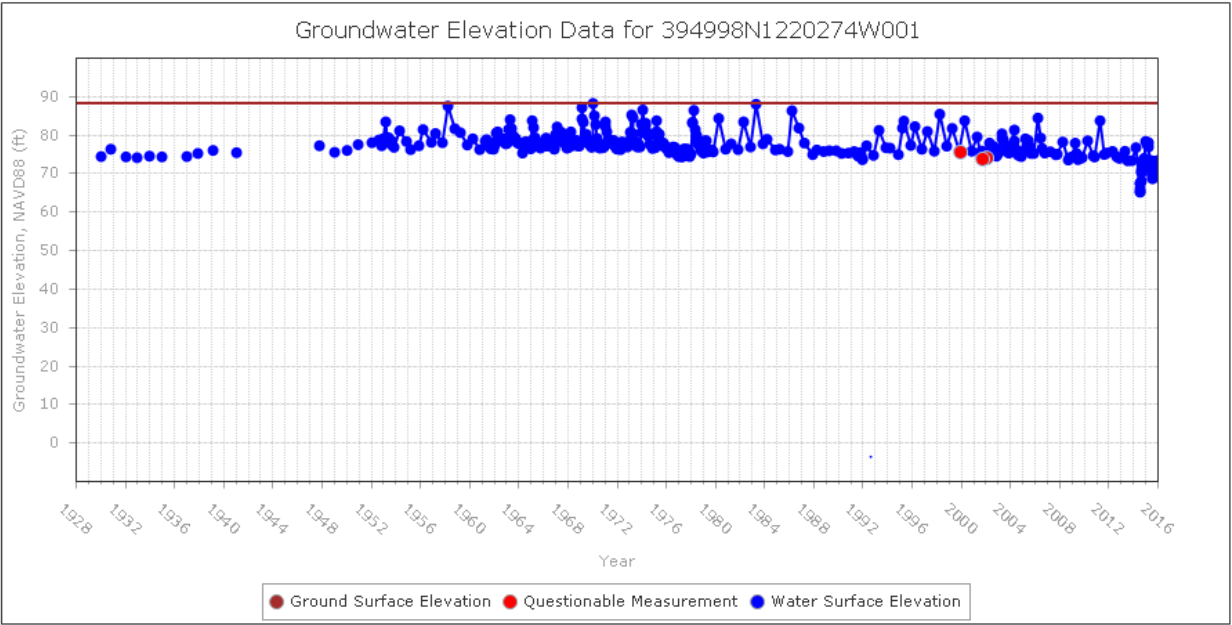
State Well ID 20N02W34J001M



Source: DWR's CASGEM website.

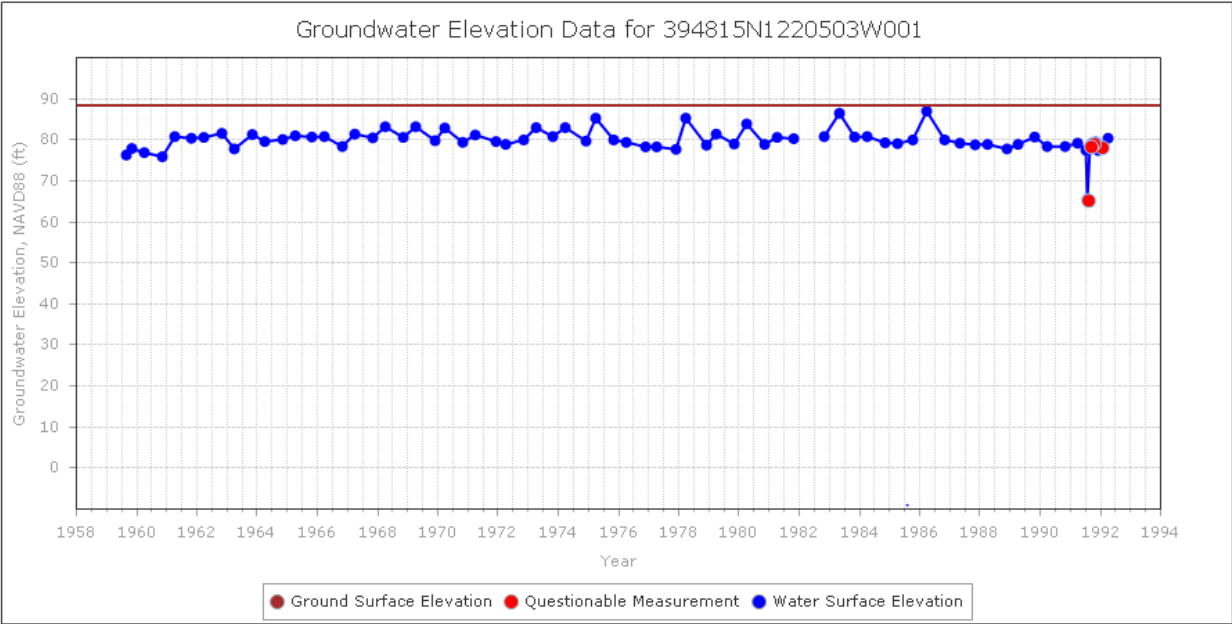
Note: Well number in the title of the figure is the CASGEM Well Number.

State Well ID 19N02W13J001M



Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

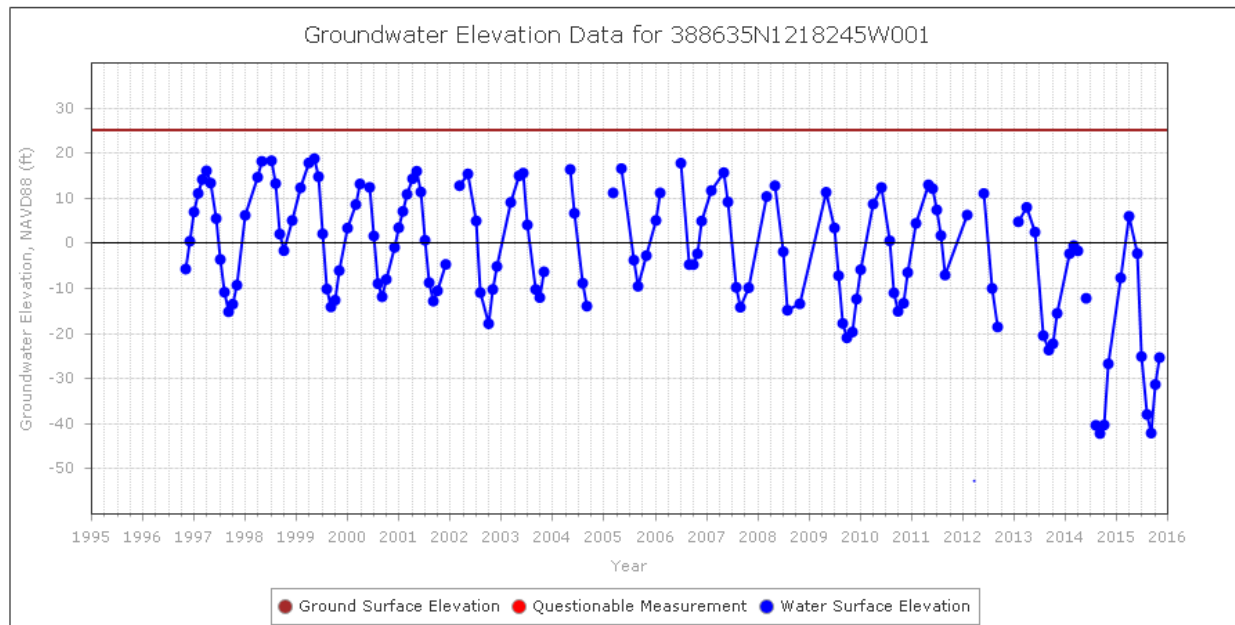
Provident Irrigation District
State Well ID 19N02W23Q002M



Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

Reclamation District 108

State Well ID 12N01E26A001M (Deep; Depth= 670 ft)

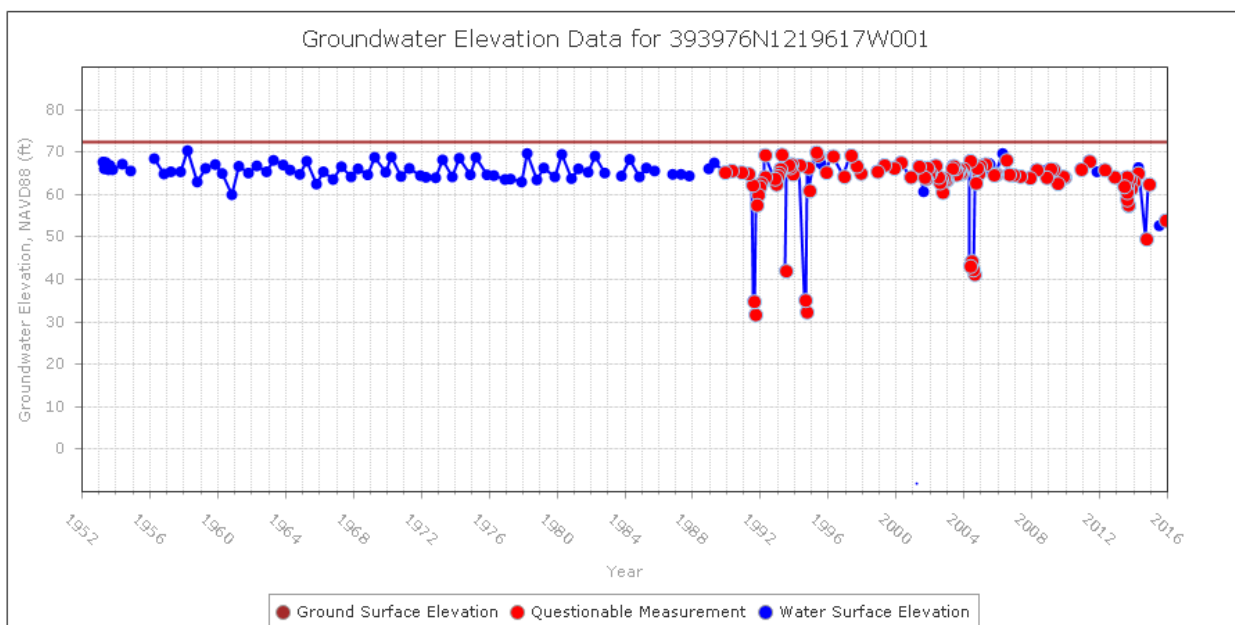


Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Reclamation District 1004

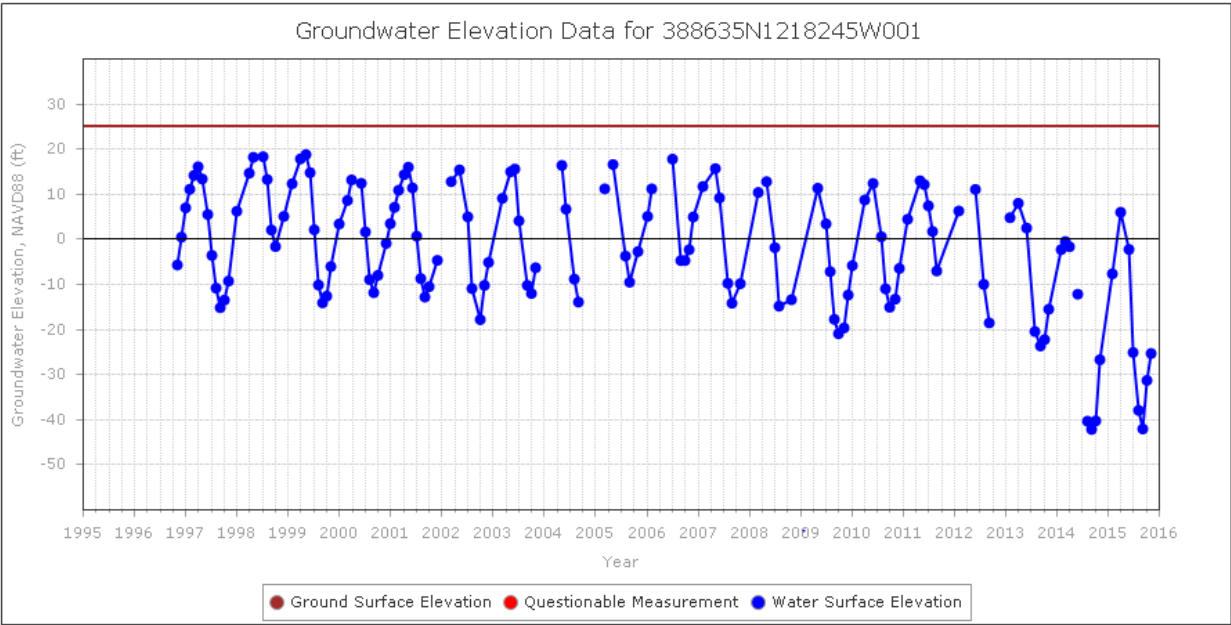
State Well ID 18N01W22L001M



Source: DWR's CASGEM website.

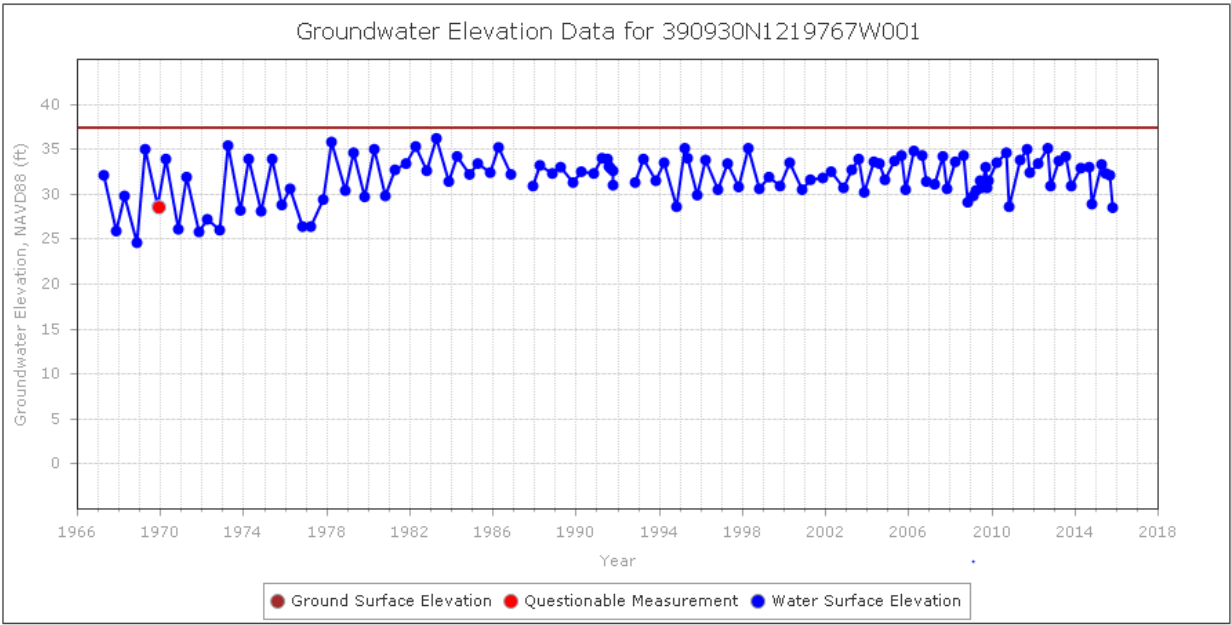
Note: Well number in the title of the figure is the CASGEM Well Number.

River Garden Farms
State Well ID 12N01E26A001M



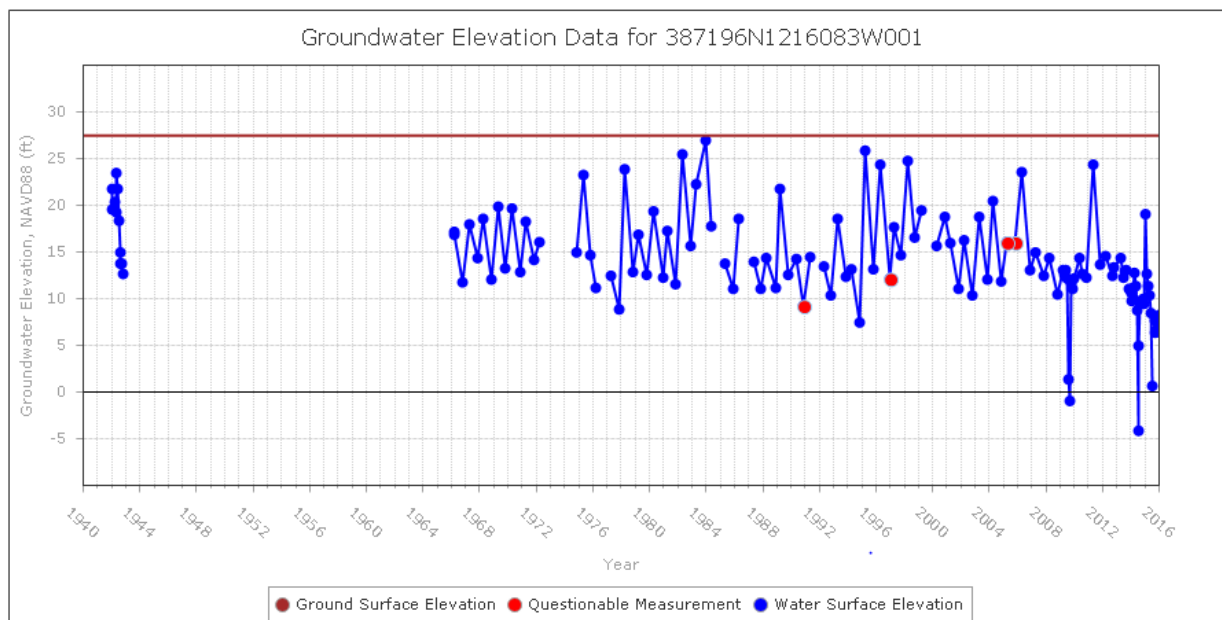
Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

Sycamore Mutual Water Company
State Well ID 14N01W04K003M (Shallow Well; Depth= 73 ft)



Source: DWR's CASGEM website.
Note: Well number in the title of the figure is the CASGEM Well Number.

Te Velde Revocable Family Trust
State Well ID 10N03E14C001M



Source: DWR's CASGEM website.

Note: Well number in the title of the figure is the CASGEM Well Number.

Appendix D

Air Quality Emissions Calculations

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Table 1. General Conformity Applicability Evaluation (Unmitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
	Sacramento Metro ¹	Sacramento Metro ¹	Sacramento Area ²	Sacramento ^{3,4}	Sacramento Co.	Sacramento ⁴
Colusa	n/a	n/a	n/a	n/a	n/a	n/a
Glenn	n/a	n/a	n/a	n/a	n/a	n/a
Sacramento	0.0	2.9	0.1	1.4	0.0	0.0
Shasta	n/a	n/a	n/a	n/a	n/a	n/a
Sutter ⁵	1.8	14.9	n/a	2.3	n/a	0.4
Tehama	n/a	n/a	n/a	n/a	n/a	n/a
Yolo	0.0	0.0	0.0	0.0	n/a	0.0
Total	1.8	17.8	0.1	3.7	0.0	0.5
Classification	Severe-15	Severe-15	Maintenance	PM2.5 Precursor	Maintenance	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100
Exceed?	No	No	No	No	No	No

Note:

¹The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

²The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

³All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

⁴The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

⁵VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

Table 2. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Pelger Road 1700 LLC	Sutter	All Electric	All Electric
Pelger Mutual Water Company	Sutter	0.0	0.8
Reclamation District 1004	Sutter	No Engines	No Engines
Total		0.0	0.8

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Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 3. Daily VOC Emissions (Unmitigated)

Water Agency	Daily VOC Emissions (pounds per day)							
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	Total
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	1.54							1.54
Conaway Preservation Group	No Groundwater Substitution							
Eastside Mutual Water Company	58.76							58.76
Guisti Farms					3.02			3.02
Glenn-Colusa Irrigation District	11.95	2.99						14.94
Lewis Ranch	No Groundwater Substitution							
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.08		0.32			0.40
Pelger Mutual Water Company					0.99			0.99
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					30.27			30.27
Princeton-Codora-Glenn Irrigation District	No Engines	39.32						39.32
Provident Irrigation District	No Engines	61.67						61.67
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	34.81	2.95			No Engines			37.76
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	109.54	106.92	0.08	0.00	34.60	0.00	0.00	251.15

Key:

VOC = volatile organic compounds

Table 4. Daily NOx Emissions (Unmitigated)

Water Agency	Daily NOx Emissions (pounds per day)							
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	Total
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	3.08							3.08
Conaway Preservation Group	No Groundwater Substitution							
Eastside Mutual Water Company	30.18							30.18
Guisti Farms					6.03			6.03
Glenn-Colusa Irrigation District	147.33	36.83						184.17
Lewis Ranch	No Groundwater Substitution							
Maxwell Irrigation District	47.21							47.21
Natomas Central Mutual Water Company			31.01		11.55			42.56
Pelger Mutual Water Company					18.76			18.76
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					271.10			271.10
Princeton-Codora-Glenn Irrigation District	No Engines	468.83						468.83
Provident Irrigation District	No Engines	730.51						730.51
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	444.92	36.38			No Engines			481.31
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	672.73	1,272.56	31.01	0.00	307.44	0.00	0.00	2,283.74

Key:

NOx = nitrogen oxides

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 5. Daily CO Emissions (Unmitigated)

Water Agency	Daily CO Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	6.17							6.17
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	57.02							57.02
Guisti Farms					12.07			12.07
Glenn-Colusa Irrigation District	31.75	7.94						39.68
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	43.49							43.49
Natomas Central Mutual Water Company			0.79		2.53			3.31
Pelger Mutual Water Company					24.68			24.68
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					137.13			137.13
Princeton-Codora-Glenn Irrigation District	No Engines	141.49						141.49
Provident Irrigation District	No Engines	221.44						221.44
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	127.07	7.84			No Engines			134.91
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	265.49	378.71	0.79	0.00	176.40	0.00	0.00	821.39

Key:

CO = carbon monoxide

Table 6. Daily SOx Emissions (Unmitigated)

Water Agency	Daily SOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	20.30							20.30
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	9.74	2.44						12.18
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	15.48							15.48
Natomas Central Mutual Water Company			14.77		3.36			18.12
Pelger Mutual Water Company					6.15			6.15
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					35.33			35.33
Princeton-Codora-Glenn Irrigation District	No Engines	41.05						41.05
Provident Irrigation District	No Engines	67.06						67.06
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	38.74	2.41			No Engines			41.15
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	84.27	112.95	14.77	0.00	44.84	0.00	0.00	256.82

Key:

SOx = sulfur oxides

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Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 7. Daily PM10 Emissions (Unmitigated)

Water Agency	Daily PM10 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.02							0.02
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.26							3.26
Guisti Farms					0.03			0.03
Glenn-Colusa Irrigation District	2.31	0.58						2.88
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.13		0.07			0.20
Pelger Mutual Water Company					1.48			1.48
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					7.84			7.84
Princeton-Codora-Glenn Irrigation District	No Engines	6.68						6.68
Provident Irrigation District	No Engines	9.48						9.48
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.66	0.39			No Engines			7.05
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.73	17.12	0.13	0.00	9.43	0.00	0.00	41.40

Key:

PM10 = inhalable particulate matter

Table 8. Daily PM2.5 Emissions (Unmitigated)

Water Agency	Daily PM2.5 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.02							0.02
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.21							3.21
Guisti Farms					0.03			0.03
Glenn-Colusa Irrigation District	2.25	0.56						2.81
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.13		0.07			0.20
Pelger Mutual Water Company					1.48			1.48
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					7.69			7.69
Princeton-Codora-Glenn Irrigation District	No Engines	6.52						6.52
Provident Irrigation District	No Engines	9.25						9.25
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.56	0.38			No Engines			6.94
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.53	16.71	0.13	0.00	9.27	0.00	0.00	40.63

Key:

PM2.5 = fine particulate matter

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 9. Annual VOC Emissions (Unmitigated)

Water Agency	Annual VOC Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.12							0.12
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.20							3.20
Guisti Farms					0.28			0.28
Glenn-Colusa Irrigation District	1.11	0.28						1.39
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.03			0.04
Pelger Mutual Water Company					0.04			0.04
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.48			1.48
Princeton-Codora-Glenn Irrigation District	No Engines	2.25						2.25
Provident Irrigation District	No Engines	5.74						5.74
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.42	0.12			No Engines			1.54
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	6.01	8.39	0.01	0.00	1.83	0.00	0.00	16.23

Key:

VOC = volatile organic compounds

Table 10. Annual NOx Emissions (Unmitigated)

Water Agency	Annual NOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.25							0.25
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	1.64							1.64
Guisti Farms					0.56			0.56
Glenn-Colusa Irrigation District	13.70	3.43						17.13
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.88							2.88
Natomas Central Mutual Water Company			2.88		1.07			3.96
Pelger Mutual Water Company					0.79			0.79
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					13.25			13.25
Princeton-Codora-Glenn Irrigation District	No Engines	26.89						26.89
Provident Irrigation District	No Engines	67.94						67.94
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	18.10	1.48			No Engines			19.58
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	36.58	99.73	2.88	0.00	15.67	0.00	0.00	154.87

Key:

NOx = nitrogen oxides

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Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 11. Annual CO Emissions (Unmitigated)

Water Agency	Annual CO Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.50							0.50
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.11							3.11
Guisti Farms					1.12			1.12
Glenn-Colusa Irrigation District	2.95	0.74						3.69
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.65							2.65
Natomas Central Mutual Water Company			0.07		0.23			0.31
Pelger Mutual Water Company					1.03			1.03
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					6.70			6.70
Princeton-Codora-Glenn Irrigation District	No Engines	8.11						8.11
Provident Irrigation District	No Engines	20.59						20.59
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	5.17	0.32			No Engines			5.49
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.38	29.77	0.07	0.00	9.09	0.00	0.00	53.32

Key:

CO = carbon monoxide

Table 12. Annual SOx Emissions (Unmitigated)

Water Agency	Annual SOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	1.11							1.11
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.91	0.23						1.13
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.94							0.94
Natomas Central Mutual Water Company			1.37		0.31			1.69
Pelger Mutual Water Company					0.26			0.26
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.73			1.73
Princeton-Codora-Glenn Irrigation District	No Engines	2.35						2.35
Provident Irrigation District	No Engines	6.24						6.24
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.58	0.10			No Engines			1.67
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	4.53	8.92	1.37	0.00	2.30	0.00	0.00	17.12

Key:

SOx = sulfur oxides

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 13. Annual PM10 Emissions (Unmitigated)

Water Agency	Annual PM10 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group								0.00
Eastside Mutual Water Company	0.18							0.18
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.21	0.05						0.27
Lewis Ranch								0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.01			0.02
Pelger Mutual Water Company					0.06			0.06
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					0.38			0.38
Princeton-Codora-Glenn Irrigation District	No Engines	0.38						0.38
Provident Irrigation District	No Engines	0.88						0.88
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.29
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company								0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	0.82	1.33	0.01	0.00	0.46	0.00	0.00	2.62

Key:

PM10 = inhalable particulate matter

Table 14. Annual PM2.5 Emissions (Unmitigated)

Water Agency	Annual PM2.5 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group								0.00
Eastside Mutual Water Company	0.18							0.18
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.21	0.05						0.26
Lewis Ranch								0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.01			0.02
Pelger Mutual Water Company					0.06			0.06
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					0.38			0.38
Princeton-Codora-Glenn Irrigation District	No Engines	0.37						0.37
Provident Irrigation District	No Engines	0.86						0.86
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.28
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company								0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	0.80	1.30	0.01	0.00	0.45	0.00	0.00	2.57

Key:

PM2.5 = fine particulate matter

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Anderson-Cottonwood Irrigation District		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,400 acre-feet	(Apr-Jun)	800 AF/month
	2,400 acre-feet	(Jul-Sep)	800 AF/month
	4,800 acre-feet/year		

Table 15. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Shasta	0	2	0	0	2
Tehama	0	0	0	0	0
Total	0	2	0	0	2

Table 16. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Barney Street	Shasta	Electric	2012	200	n/a	5,500	85%	677	4,062	22	4,010
Crowley Gulch	Shasta	Electric	2012	50	n/a	1,000	15%	123	738	22	4,010
Total						6,500	100%	800	4,800	43	8,021
Total (Shasta County)						6,500	100%	800	4,800	43	8,021

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

	Shasta	Tehama
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Peak Month

800 AF/month
5,840 gallons/minute
90% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Burroughs Farms	Peak Pumping by Transfer Period
Transfer Volume	1,000 acre-feet (Apr-Jun)	333 AF/month
	1,000 acre-feet (Jul-Sep)	333 AF/month
	2,000 acre-feet/year	

Table 17. Burroughs Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	3	0	0	3
Total	0	3	0	0	3

Table 18. Burroughs Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Ag Well #1	Sutter	Electric	2013	200	n/a	3,200	42%	139	831	8	1,411
Ag Well #3	Sutter	Electric	unknown	unknown	n/a	2,500	32%	108	649	8	1,411
Ag Well #4	Sutter	Electric	unknown	unknown	n/a	2,000	26%	87	519	8	1,411
Total						7,700	100%	333	2,000	23	4,232
Total (Sutter County)						7,700	100%	333	2,000	23	4,232

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Sutter

PM10 A

PM2.5 M

O3 N

Engines subject to ATCM.

Peak Month

333 AF/month

2,433 gallons/minute

32% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Canal Farms		Peak Pumping by Transfer Period
Transfer Volume	575 acre-feet	(Apr-Jun)	192 AF/month
	425 acre-feet	(Jul-Sep)	142 AF/month
	1,000 acre-feet/year		

Table 19. Canal Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	1	3
Total	0	2	0	1	3

Table 20. Canal Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(MMBtu/yr)	(g/hp-hr)			(lb/MMBtu)			VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
													VOC	NOx	CO	SOx	PM10	PM2.5												
Dennis Well North	Colusa	Electric	unknown	125	n/a	3,500	29%	56	292	3	453	n/a																		
Dennis Well South	Colusa	Electric	unknown	125	n/a	3,500	29%	56	292	3	453	n/a																		
East Well	Colusa	Propane	unknown	250	n/a	5,000	42%	80	417	3	453	288	1.0	2.0	4.0	0.00059	0.00999	0.00999	1.54	3.08	6.17	0.00	0.02	0.02	0.12	0.25	0.50	0.000085	0.0014	0.0014
Total						12,000	100%	192	1,000	8	1,358	288							1.54	3.08	6.17	0.00	0.02	0.02	0.12	0.25	0.50	0.000085	0.0014	0.0014
Total (Colusa County)						12,000	100%	192	1,000	8	1,358	288							1.54	3.08	6.17	0.00	0.02	0.02	0.12	0.25	0.50	0.000085	0.0014	0.0014

Note: Natural gas emission factors used for propane.

Key:

AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Colusa
PM10 A
PM2.5 A
O3 A
Engines not subject to ATCM if remotely-located.

Peak Month
192 AF/month
1,399 gallons/minute
12% peak pump rate

Legend

	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

2016 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Eastside Mutual Water Company		<u>Peak Pumping by Transfer Period</u>	
Transfer Volume	1,067 acre-feet	(Apr-Jun)	634 AF/month	
	1,163 acre-feet	(Jul-Sep)	443 AF/month	
	2,230 acre-feet/year			

Table 21. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 22. Eastside Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
ATW-1	Colusa	Diesel	2006	215	T3	2,500	45%	288	1,014	20	2,202	26,559	0.1	2.8	2.6	0.93	0.15	0.15	1.43	27.16	25.02	8.91	1.43	1.43	0.08	1.48	1.36	0.49	0.08	0.08
ATW-2	Colusa	Diesel	2002	275	T2	3,000	55%	346	1,216	20	2,202	33,971	4.7	0.2	2.6	0.93	0.15	0.15	57.33	3.02	32.00	11.39	1.83	1.78	3.12	0.16	1.74	0.62	0.10	0.10
Total						5,500	100%	634	2,230	40	4,404	60,531							58.76	30.18	57.02	20.30	3.26	3.21	3.20	1.64	3.11	1.11	0.18	0.18
Total (Colusa County)						5,500	100%	634	2,230	40	4,404	60,531							58.76	30.18	57.02	20.30	3.26	3.21	3.20	1.64	3.11	1.11	0.18	0.18

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Colusa
PM10 A
PM2.5 A
O3 A
Engines not subject to ATCM if remotely-located.

Peak Month
634 AF/month
4,631 gallons/minute
84% peak pump rate

Legend

Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Glenn-Colusa Irrigation District		Peak Pumping by Transfer Period
Transfer Volume	5,650 acre-feet	(Apr-Jun)	1,883 AF/month
	5,650 acre-feet	(Jul-Sep)	1,883 AF/month
	11,300 acre-feet/year		

Table 23. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	6	0	0	7
Colusa	4	6	0	0	10
Total	5	12	0	0	17

Table 24. Glenn-Colusa Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
15-3-22H-3	Colusa	Diesel	unknown	121	T0	800	2%	45	269	10	1,826	12,398	1.1	14.1	3.0	0.93	0.22	0.21	2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
17-2-6B-1	Colusa	Electric	unknown	121	n/a	3,000	9%	168	1,009	10	1,826	n/a																		
GRS-22H-1	Glenn	Electric	unknown	121	n/a	2,300	7%	129	774	10	1,826	n/a																		
GRS-34N-1	Glenn	Diesel	unknown	121	T0	2,500	7%	140	841	10	1,826	12,398	1.1	14.1	3.0	0.93	0.22	0.21	2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
GRS-35A-2	Glenn	Electric	unknown	121	n/a	4,300	13%	241	1,446	10	1,826	n/a																		
GRS-84A-1	Glenn	Electric	unknown	121	n/a	2,500	7%	140	841	10	1,826	n/a																		
Haymen	Colusa	Diesel	unknown	121	T0	2,250	7%	126	757	10	1,826	12,398	1.1	14.1	3.0	0.93	0.22	0.21	2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
LaCroix 1	Glenn	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
LaCroix 2	Glenn	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
LaCroix 3	Glenn	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
Lagrande	Colusa	Diesel	unknown	121	T0	3,000	9%	168	1,009	10	1,826	12,398	1.1	14.1	3.0	0.93	0.22	0.21	2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
Reister 1	Colusa	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
Reister 2	Colusa	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
Reister 3	Colusa	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
Reister 4	Colusa	Electric	unknown	121	n/a	850	3%	48	286	10	1,826	n/a																		
Vann 1	Colusa	Diesel	unknown	121	T0	3,000	9%	168	1,009	10	1,826	12,398	1.1	14.1	3.0	0.93	0.22	0.21	2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
Vann 2	Colusa	Electric	unknown	121	n/a	4,000	12%	224	1,345	10	1,826	n/a																		
Total						33,600	100%	1,883	11,300	167	31,050	61,992							14.94	184.17	39.68	12.18	2.88	2.81	1.39	17.13	3.69	1.13	0.27	0.26
Total (Glenn County)						14,150	42%	793	4,759	69	12,785	12,398							2.99	36.83	7.94	2.44	0.58	0.56	0.28	3.43	0.74	0.23	0.05	0.05
Total (Colusa County)						19,450	58%	1,090	6,541	98	18,264	49,593							11.95	147.33	31.75	9.74	2.31	2.25	1.11	13.70	2.95	0.91	0.21	0.21

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Glenn
Colusa
PM10 A A
PM2.5 A A
O3 A A
Engines not subject to ATCM if remotely-located.

Peak Month
1,883 AF/month
13,747 gallons/minute
41% peak pump rate

Legend

Engine power rating equal to average horsepower of all wells in GCID's well database

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Guisti Farms		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	500 acre-feet	(Apr-Jun)	167 AF/month
	500 acre-feet	(Jul-Sep)	167 AF/month
	1,000 acre-feet/year		

Table 25. Guisti Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	0	0	2	2
Total	0	0	0	2	2

Table 26. Guisti Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Guisti Well 1	Sutter	Propane	2015	150	n/a	3,200	50%	83	500	5	849	7,141	1.0	2.0	4.0	0.00059	0.00999	0.00999	1.51	3.02	6.03	0.00	0.02	0.02	0.14	0.28	0.56	0.000095	0.0016	0.0016
Guisti Well 2	Sutter	Propane	2015	150	n/a	3,200	50%	83	500	5	849	7,141	1.0	2.0	4.0	0.00059	0.00999	0.00999	1.51	3.02	6.03	0.00	0.02	0.02	0.14	0.28	0.56	0.000095	0.0016	0.0016
Total						6,400	100%	167	1,000	9	1,697	14,282							3.02	6.03	12.07	0.00	0.03	0.03	0.28	0.56	1.12	0.00019	0.0032	0.0032
Total (Sutter County)						6,400	100%	167	1,000	9	1,697	14,282							3.02	6.03	12.07	0.00	0.03	0.03	0.28	0.56	1.12	0.00019	0.0032	0.0032

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Sutter
PM10 A
PM2.5 M
O3 N
Engines subject to ATCM.

Peak Month
167 AF/month
10 gallons/minute
0% peak pump rate

Legend

Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008

Conversion Factors

1 bhp-hr = 2,542.5 Btu

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)

7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Maxwell Irrigation District	Peak Pumping by Transfer Period
Transfer Volume	1,000 acre-feet (Apr-Jun)	595 AF/month
	2,000 acre-feet (Jul-Sep)	762 AF/month
	3,000 acre-feet/year	

Table 27. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 28. Maxwell Irrigation District Criteria Pollutant Emissions

	Well Location (County)			Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gall/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
Well		Fuel Type	Model Year			(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
MainWell	Colusa	Diesel	2,006	215	T3	3,800	50%	381	1,500	18	2,144	25,857	0.1	2.8	2.6	0.93	0.14925	0.15	1.24	23.61	21.74	7.74	1.24	1.24	0.08	1.44	1.33	0.47	0.08	0.08
TuttieWell	Colusa	Diesel	2,006	215	T3	3,800	50%	381	1,500	18	2,144	25,857	0.1	2.8	2.6	0.93	0.14925	0.15	1.24	23.61	21.74	7.74	1.24	1.24	0.08	1.44	1.33	0.47	0.08	0.08
Total						7,600	100%	762	3,000	35	4,288	51,715							2.48	47.21	43.49	15.48	2.48	2.48	0.15	2.88	2.65	0.94	0.15	0.15
Total (Colusa County)						7,600	100%	762	3,000	35	4,288	51,715							2.48	47.21	43.49	15.48	2.48	2.48	0.15	2.88	2.65	0.94	0.15	0.15

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Colusa
PM10 A
PM2.5 A
O3 A
Engines not subject to ATCM if remotely-located.

Peak Month
762 AF/month
5,562 gallons/minute
73% peak pump rate

Legend
Engine information assumed to be equivalent to Eastside MWC because it is the adjacent water district.
Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Natomas Central Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	10,000 acre-feet	(Apr-Jun)	3,333 AF/month
	10,000 acre-feet	(Jul-Sep)	3,333 AF/month
	20,000 acre-feet/year		

Table 29. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	3	6	0	0	9
Sutter	1	14	0	0	15
Total	4	20	0	0	24

Table 30. Natomas Central Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)					Daily Emissions (pounds per day)					Annual Emissions (tons per year)							
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
L-1	Sutter	Diesel	2013	120	T4I	1,600	4%	125	748	14	2,538	17,085	0.09	3.2	0.7	0.93	0.02	0.02	0.32	11.55	2.53	3.36	0.07	0.07	0.03	1.07	0.23	0.31	0.01	0.01
L-2	Sutter	Electric	unknown	30	n/a	1,900	4%	148	888	14	2,538	n/a																		
L-3	Sutter	Electric	unknown	125	n/a	1,300	3%	101	607	14	2,538	n/a																		
L-4	Sutter	Electric	unknown	125	n/a	1,300	3%	101	607	14	2,538	n/a																		
L-6	Sutter	Electric	unknown	125	n/a	2,000	5%	156	935	14	2,538	n/a																		
L-7	Sutter	Electric	unknown	125	n/a	1,200	3%	93	561	14	2,538	n/a																		
L-8	Sutter	Electric	unknown	125	n/a	2,800	7%	218	1,308	14	2,538	n/a																		
L-9	Sutter	Electric	unknown	125	n/a	1,500	4%	117	701	14	2,538	n/a																		
L-10	Sutter	Electric	unknown	125	n/a	1,000	2%	78	467	14	2,538	n/a																		
L-11	Sutter	Electric	unknown	125	n/a	1,500	4%	117	701	14	2,538	n/a																		
L-12	Sutter	Electric	unknown	125	n/a	1,500	4%	117	701	14	2,538	n/a																		
MAP	Sacramento	Electric	unknown	125	n/a	2,000	5%	156	935	14	2,538	n/a																		
Ose-1	Sacramento	Diesel	2013	200	T4I	1,800	4%	140	841	14	2,538	28,474	0.003	1.7	0.03	0.93	0.01	0.01	0.02	10.23	0.18	5.59	0.06	0.06	0.00	0.95	0.02	0.52	0.01	0.01
Ose-2	Sacramento	Electric	unknown	150	n/a	1,600	4%	125	748	14	2,538	n/a																		
Perry	Sacramento	Electric	unknown	125	n/a	2,000	5%	156	935	14	2,538	n/a																		
Spangler	Sutter	Electric	unknown	80	n/a	2,400	6%	187	1,121	14	2,538	n/a																		
TNBC Frazer	Sutter	Electric	unknown	125	n/a	2,000	5%	156	935	14	2,538	n/a																		
TNBC Bennett North	Sutter	Electric	unknown	125	n/a	2,000	5%	156	935	14	2,538	n/a																		
TNBC Atkinson	Sutter	Electric	unknown	125	n/a	1,800	4%	140	841	14	2,538	n/a																		
TNBC Fisherman's Lake	Sacramento	Electric	unknown	125	n/a	1,500	4%	117	701	14	2,538	n/a																		
TNBC Silva Dairy	Sacramento	Electric	unknown	125	n/a	1100	3%	86	514	14	2,538	n/a																		
TNBC Betts	Sacramento	Electric	unknown	125	n/a	1,500	4%	117	701	14	2,538	n/a																		
Dhaliwal	Sacramento	Diesel	2013	180	T4I	2,500	6%	195	1,168	14	2,538	25,627	0.003	1.7	0.03	0.93	0.01	0.01	0.02	9.20	0.16	5.03	0.05	0.05	0.00	0.86	0.02	0.47	0.01	0.00
Wiley	Sacramento	Diesel	2012	148	T4I	3,000	7%	234	1,402	14	2,538	21,071	0.01	2.6	0.10	0.93	0.003	0.003	0.04	11.57	0.45	4.14	0.01	0.01	0.00	1.08	0.04	0.38	0.00	0.00
Total						42,800	100%	3,333	20,000	327	60,907	92,257							0.40	42.56	3.31	18.12	0.20	0.20	0.04	3.96	0.31	1.69	0.02	0.02
Total (Sacramento County)						17,000	40%	1,324	7,944	123	22,840	75,172							0.08	31.01	0.79	14.77	0.13	0.13	0.01	2.88	0.07	1.37	0.01	0.01
Total (Sutter County)						25,800	60%	2,009	12,056	205	38,067	17,085							0.32	11.55	2.53	3.36	0.07	0.07	0.03	1.07	0.23	0.31	0.01	0.01

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Sacramento Sutter
PM10 M A
PM2.5 N M
O3 N N

Engines subject to ATCM.

Peak Month
3,333 AF/month
24,332 gallons/minute
57% peak pump rate

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

2016 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pelger Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	2,000 acre-feet	(Apr-Jun)	1,189 AF/month
	2,670 acre-feet	(Jul-Sep)	1,017 AF/month
	4,670 acre-feet/year		

Table 31. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	1	2	0	0	3
Total	1	2	0	0	3

Table 32. Pelger Mutual Water Company Criteria Pollutant Emissions

	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
Well				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
PMWC#1	Sutter	Electric	unknown	150	n/a	3,100	25%	293	1,149	24	2,013	n/a																		
Well 1 Tucker	Sutter	Electric	unknown	75	n/a	3,100	25%	293	1,149	24	2,013	n/a																		
Well 2 Flopet	Sutter	Diesel	2,008	125	T3	2,100	17%	198	778	24	2,012	14,109	0.1	2.8	3.7	0.93	0.22	0.22	0.99	18.76	24.68	6.15	1.48	1.48	0.04	0.79	1.03	0.26	0.06	0.06
Well 3 Klein	Sutter	Electric	unknown	150	n/a	4,300	34%	406	1,594	24	2,013	n/a																		
Total						12,600	100%	1,190	4,670	96	8,051	14,109							0.99	18.76	24.68	6.15	1.48	1.48	0.04	0.79	1.03	0.26	0.06	0.06
Total (Sutter County)						12,600	100%	1,190	4,670	96	8,051	14,109							0.99	18.76	24.68	6.15	1.48	1.48	0.04	0.79	1.03	0.26	0.06	0.06

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Sutter
PM10 A
PM2.5 M
O3 N
Engines subject to ATCM.

Peak Month
1,189 AF/month
8,681 gallons/minute
69% peak pump rate

Legend

Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pelger Road 1700 LLC	Peak Pumping by Transfer Period
Transfer Volume	2,200 acre-feet (Apr-Jun)	733 AF/month
	2,200 acre-feet (Jul-Sep)	733 AF/month
	4,400 acre-feet/year	

Table 33. Pelger Road 1700 LLC Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	4	0	0	4
Total	0	4	0	0	4

Table 34. Pelger Road 1700 LLC Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
North Well	Sutter	Electric	unknown	125	n/a	3,500	28%	202	1,213	10	1,882
South Well	Sutter	Electric	unknown	125	n/a	3,000	24%	173	1,039	10	1,882
Well #3	Sutter	Electric	unknown	125	n/a	3,100	24%	179	1,074	10	1,882
Well #4	Sutter	Electric	unknown	125	n/a	3,100	24%	179	1,074	10	1,882
Total						12,700	100%	733	4,400	40	7,526
Total (Sutter County)						12,700	100%	733	4,400	40	7,526

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Sutter

PM10 A

PM2.5 M

O3 N

Engines subject to ATCM.

Peak Month

733 AF/month

5,353 gallons/minute

42% peak pump rate

Legend

 Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)

7.13 lb/gal

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pleasant Grove-Verona Mutual Water Company		Peak Pumping by Transfer Period	
Transfer Volume	8,000 acre-feet	(Apr-Jun)	4,757 AF/month	
	7,000 acre-feet	(Jul-Sep)	2,667 AF/month	
	15,000 acre-feet/year			

Table 35. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 36. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Well	Location	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr) - diesel (MMBtu/yr) - propane	Emission Factors (g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
													VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(MMBtu/yr) - propane	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	n/a	2,000	2%	110	348	10	946	n/a																		
Kelly Windmill Field Well #2	Sutter	Electric	2002	62	n/a	2,000	2%	110	348	10	946	n/a																		
Kelly Windmill North Field Well	Sutter	Propane	2014	133	T2	1,750	2%	97	305	10	946	320	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	2.84	5.68	11.35	0.00	0.03	0.03	0.14	0.28	0.55	0.00	0.00	0.00
Kelly306	Sutter	Electric	unknown	60	n/a	2,600	3%	144	453	10	946	n/a																		
MLF Clubhouse B Well	Sutter	Electric	unknown	300	n/a	2,500	3%	138	436	10	946	n/a																		
MLF Marsh Well	Sutter	Electric	unknown	300	n/a	2,500	3%	138	436	10	946	n/a																		
MLF Monster Well	Sutter	Electric	unknown	60	n/a	3,100	4%	171	540	10	946	n/a																		
MLF Well #1	Sutter	Electric	unknown	30	n/a	2,000	2%	110	348	10	946	n/a																		
MLF Well #16	Sutter	Electric	unknown	50	n/a	1,700	2%	94	296	10	946	n/a																		
MLF Well#11	Sutter	Diesel	2004	250	T2	4,200	5%	232	732	10	946	13,270	0.2	4.7	2.6	0.93	0.15	0.15	1.31	24.96	13.93	4.96	0.80	0.80	0.06	1.22	0.68	0.24	0.04	0.04
MLF Well#12/17	Sutter	Electric	unknown	50	n/a	1,500	2%	83	261	10	946	n/a																		
MLF Well#13	Sutter	Electric	2000	215	n/a	4,800	6%	265	836	10	946	n/a																		
MLF Well#2B	Sutter	Electric	2000	300	n/a	2,500	3%	138	436	10	946	n/a																		
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	n/a	5,000	6%	276	871	10	946	n/a																		
Nicholas 72-Acree Field South	Sutter	Diesel	2002	62	T1	2,000	2%	110	348	10	946	3,296	1.1	6.9	3.0	0.93	0.30	0.29	1.51	9.10	4.01	1.23	0.40	0.39	0.07	0.44	0.20	0.06	0.02	0.02
Nicholas BBC Well	Sutter	Electric	unknown	30	n/a	2,500	3%	138	436	10	946	n/a																		
Nicholas Filipino Camp South	Sutter	Diesel	2002	62	T1	2,000	2%	110	348	10	946	3,296	1.1	6.9	3.0	0.93	0.30	0.29	1.51	9.10	4.01	1.23	0.40	0.39	0.07	0.44	0.20	0.06	0.02	0.02
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	n/a	2,000	2%	110	348	10	946	n/a																		
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	n/a	2,000	2%	110	348	10	946	n/a																		
Nicholas Sand Field Well	Sutter	Diesel	2002	62	T2	2,000	2%	110	348	10	946	3,296	0.3	5.3	3.7	0.93	0.30	0.29	0.37	7.05	4.94	1.23	0.40	0.39	0.02	0.34	0.24	0.06	0.02	0.02
RiverRanch#19	Sutter	Diesel	2008	99	T3	2,500	3%	138	436	10	946	5,255	0.2	3.3	3.7	0.93	0.30	0.29	0.37	7.04	7.88	1.96	0.63	0.62	0.02	0.34	0.39	0.10	0.03	0.03
S&O#16	Sutter	Electric	2014	159	n/a	2,000	2%	110	348	10	946	n/a																		
S&O#17	Sutter	Diesel	1999	101	T0	3,000	3%	166	523	10	946	5,361	1.1	14.1	3.0	0.93	0.22	0.21	2.46	30.30	6.53	2.00	0.47	0.46	0.12	1.48	0.32	0.10	0.02	0.02
S&O#18A	Sutter	Diesel	1999	101	T0	2,250	3%	124	392	10	946	5,361	1.1	14.1	3.0	0.93	0.22	0.21	2.46	30.30	6.53	2.00	0.47	0.46	0.12	1.48	0.32	0.10	0.02	0.02
S&O#19	Sutter	Diesel	2007	215	T3	1,800	2%	99	314	10	946	11,412	0.1	2.8	2.6	0.93	0.15	0.15	0.68	13.01	11.98	4.27	0.68	0.68	0.03	0.64	0.59	0.21	0.03	0.03
S&O#20	Sutter	Propane	2014	154	n/a	2,150	2%	119	375	10	946	370	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	3.29	6.57	13.14	0.00	0.04	0.04	0.16	0.32	0.64	0.00	0.00	0.00
Willey#1	Sutter	Diesel	2000	168	T1	2,250	3%	124	392	10	946	8,917	1.1	6.9	3.0	0.93	0.22	0.21	4.09	24.61	10.86	3.33	0.79	0.77	0.20	1.20	0.53	0.16	0.04	0.04
Willey#2	Sutter	Diesel	unknown	250	T2	3,000	3%	166	523	10	946	13,270	0.2	4.7	2.6	0.93	0.15	0.15	1.31	24.96	13.93	4.96	0.80	0.78	0.06	1.22	0.68	0.24	0.04	0.04
Willey#3	Sutter	Electric	unknown	75	n/a	3,000	3%	166	523	10	946	n/a																		
Willey#4	Sutter	Diesel	1974	150	T0	2,000	2%	110	348	10	946	7,962	1.1	14.1	3.0	0.93	0.22	0.21	3.65	45.01	9.70	2.98	0.70	0.69	0.18	2.20	0.47	0.15	0.03	0.03
Will-Lee Well#30	Sutter	Diesel	2000	100	T2	2,500	3%	138	436	10	946	5,308	0.2	4.7	3.7	0.93	0.22	0.21	0.53	9.98	7.96	1.98	0.47	0.46	0.03	0.49	0.39	0.10	0.02	0.02
Will-Lee Well#31	Sutter	Electric	unknown	50	n/a	2,500	3%	138	436	10	946	n/a																		
Will-Lee Well#32	Sutter	Electric	unknown	300	n/a	2,500	3%	138	436	10	946	n/a																		
Will-Lee Well#33	Sutter	Electric	unknown	75	n/a	2,500	3%	138	436	10	946	n/a																		
Will-Lee Well#4A	Sutter	Diesel	2000	160	T1	1,500	2%	83	261	10	946	8,493	1.1	6.9	3.0	0.93	0.22	0.21	3.89	23.44	10.34	3.17	0.75	0.73	0.19	1.15	0.51	0.16	0.04	0.04
Total						86,100	100%	4,757	15,000	339	33,115	95,188							30.27	271.10	137.13	35.33	7.84	7.69	1.48	13.25	6.70	1.73	0.38	0.38
Total (Sutter County)						86,100	100%	4,757	15,000	339	33,115	95,188							30.27	271.10	137.13	35.33	7.84	7.69	1.48	13.25	6.70	1.73	0.38	0.38

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Sutter
PM10 A
PM2.5 M
O3 N
Engines subject to ATCM.

Peak Month
4,757 AF/month
34,722 gallons/minute
40% peak pump rate

Legend	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Emission factors based on NMHC+NOx standard
	Emission factor from AP-42 because emission standards for pollutant not available for emissions tier

Conversion Factors

1 bhp-hr =	2,542.5 Btu
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

2016 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Princeton-Codora-Glenn Irrigation District		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,500 acre-feet	(Apr-Jun)	1,486 AF/month
	3,000 acre-feet	(Jul-Sep)	1,143 AF/month
	5,500 acre-feet/year		

Table 37. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	4	0	0	0	4
Colusa	0	0	0	0	0
Total	4	0	0	0	4

Table 38. Princeton-Codora-Glenn Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Joel Mann	Glenn	Diesel	unknown	170	T0	2,211	25%	372	1,375	29	3,377	32,211	1.1	14.1	3.0	0.93	0.22	0.21	12.58	155.18	33.44	10.26	2.43	2.37	0.72	8.90	1.92	0.59	0.14	0.14
D.Withrow	Glenn	Diesel	unknown	170	T0	2,211	25%	372	1,375	29	3,377	32,211	1.1	14.1	3.0	0.93	0.15	0.15	12.58	155.18	33.44	10.26	1.66	1.62	0.72	8.90	1.92	0.59	0.09	0.09
Chrisman	Glenn	Diesel	unknown	170	T0	2,211	25%	372	1,375	29	3,377	32,211	1.1	14.1	3.0	0.93	0.22	0.21	12.58	155.18	33.44	10.26	2.43	2.37	0.72	8.90	1.92	0.59	0.14	0.14
D.Schmidt	Glenn	Diesel	2,013	170	T4I	2,211	25%	372	1,375	29	3,377	32,211	0.14	0.3	3.7	0.93	0.01	0.01	1.56	3.29	41.18	10.26	0.16	0.16	0.09	0.19	2.36	0.59	0.01	0.01
Total						8,844	100%	1,486	5,500	118	13,510	128,843							39.32	468.83	141.49	41.05	6.68	6.52	2.25	26.89	8.11	2.35	0.38	0.37
Total (Glenn County)						8,844	100%	1,486	5,500	118	13,510	128,843							39.32	468.83	141.49	41.05	6.68	6.52	2.25	26.89	8.11	2.35	0.38	0.37
Total (Colusa County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

	Glenn	Colusa
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Peak Month

1,486 AF/month
10,851 gallons/minute
123% peak pump rate

Legend

	Tier 4 Exhaust Emission Standards, Phase-In (100<=hp<=175, 2012-2014 model year)
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Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Provident Irrigation District		<u>Peak Pumping by Transfer Period</u>	
Transfer Volume	3,500 acre-feet	(Apr-Jun)	1,167 AF/month	
	3,500 acre-feet	(Jul-Sep)	1,167 AF/month	
	7,000 acre-feet/year			

Table 39. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	7	0	0	0	7
Colusa	0	0	0	0	0
Total	7	0	0	0	7

Table 40. Provident Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Weller62V	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	0.14	0.3	2.6	0.93	0.01	0.01	1.46	3.08	26.91	9.58	0.15	0.15	0.14	0.29	2.50	0.89	0.01	0.01
L Hansen#1	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	1.1	14.1	3.0	0.93	0.15	0.15	11.75	144.87	31.22	9.58	1.55	1.51	1.09	13.47	2.90	0.89	0.14	0.14
L Hansen#2	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	0.14	0.3	3.7	0.93	0.01	0.01	1.46	3.08	38.44	9.58	0.15	0.15	0.14	0.29	3.58	0.89	0.01	0.01
K Hansen#1	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	1.1	14.1	3.0	0.93	0.15	0.15	11.75	144.87	31.22	9.58	1.55	1.51	1.09	13.47	2.90	0.89	0.14	0.14
K Hansen#2	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	1.1	14.1	3.0	0.93	0.22	0.21	11.75	144.87	31.22	9.58	2.27	2.21	1.09	13.47	2.90	0.89	0.21	0.21
E Weller	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	1.1	14.1	3.0	0.93	0.15	0.15	11.75	144.87	31.22	9.58	1.55	1.51	1.09	13.47	2.90	0.89	0.14	0.14
Weller#4	Glenn	Diesel	unknown	170	T0	1,062	14%	167	1,000	27	5,113	48,765	1.1	14.1	3.0	0.93	0.22	0.21	11.75	144.87	31.22	9.58	2.27	2.21	1.09	13.47	2.90	0.89	0.21	0.21
Total						7,435	100%	1,167	7,000	192	35,792	341,354							61.67	730.51	221.44	67.06	9.48	9.25	5.74	67.94	20.59	6.24	0.88	0.86
Total (Glenn County)						7,435	100%	1,167	7,000	192	35,792	341,354							61.67	730.51	221.44	67.06	9.48	9.25	5.74	67.94	20.59	6.24	0.88	0.86
Total (Colusa County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

<u>Federal Attainment Status</u>		
	Glenn	Colusa
PM10	A	A
PM2.5	A	A
O3	A	A
Engines not subject to ATCM if remotely-located.		
<u>Peak Month</u>		
	1,167 AF/month	
	8,516 gallons/minute	
	115% peak pump rate	

<u>Legend</u>	
	Information on engine not available; therefore, engine assumed to be diesel as worst-case.
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

<u>Conversion Factors</u>	
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf	
<u>Diesel Engine Fuel Consumption</u>	
0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 108	<u>Peak Pumping by Transfer Period</u>
Transfer Volume	7,500 acre-feet (Apr-Jun)	2,500 AF/month
	7,500 acre-feet (Jul-Sep)	2,500 AF/month
	15,000 acre-feet/year	

Table 41. Reclamation District 108 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	3	0	0	3
Yolo	0	2	0	0	2
Total	0	5	0	0	5

Table 42. Reclamation District 108 Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)
Well #4 Huff	Colusa	Electric	unknown	250	n/a	4,000	21%	524	3,141	23	4,265	n/a
Well #5 RiggsRanch	Colusa	Electric	unknown	150	n/a	1,700	9%	223	1,335	23	4,265	n/a
Well #6 CountyLine	Yolo	Electric	unknown	250	n/a	5,900	31%	772	4,634	23	4,265	n/a
Well#1 Heidrick	Colusa	Electric	unknown	100	n/a	3,500	18%	458	2,749	23	4,265	n/a
Well#7 Tract 6	Yolo	Electric	unknown	250	n/a	4,000	21%	524	3,141	23	4,265	n/a
Total						19,100	100%	2,500	15,000	115	21,325	0
Total (Colusa County)						9,200	48%	1,204	7,225	69	12,795	0
Total (Yolo County)						9,900	52%	1,296	7,775	46	8,530	0

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

	Colusa	Yolo
PM10	A	A
PM2.5	A	N
O3	A	N

Engines subject to ATCM.

Peak Month

2,500 AF/month

18,249 gallons/minute

96% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 1004		Peak Pumping by Transfer Period	
Transfer Volume	0 acre-feet	(Apr-Jun)	0 AF/month	
	7,175 acre-feet	(Jul-Sep)	2,733 AF/month	
	7,175 acre-feet/year			

Table 43. Reclamation District 1004 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	5	0	0	6
Colusa	17	5	0	0	22
Sutter	0	0	0	0	0
Total	18	10	0	0	28

Table 44. Reclamation District 1004 Criteria Pollutant Emissions

	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm) (% of Total)		Transfer Volume (AF/month) (AF/year)		Operations (hours/day) (hours/year)		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)					Daily Emissions (pounds per day)					Annual Emissions (tons per year)								
Well													VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	
Barale Well	Colusa	Diesel	TBD	225	T0	4,000	4%	119	313	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2,008	225	T3	5,800	6%	173	453	5	424	5,358	0.1	2.8	2.6	0.93	0.15	0.15	0.39	7.34	6.76	2.41	0.39	0.39	0.02	0.30	0.27	0.10	0.02	0.02	
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	n/a	3,400	4%	101	266	5	424	n/a																			
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	T0	1,000	1%	30	78	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Behring Ranch West Well No.97863	Colusa	Electric	unknown	unknown	n/a	2,300	3%	68	180	5	424	n/a																			
Drumheller Well No.7	Colusa	Diesel	TBD	225	T0	4,000	4%	119	313	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
17N01W14N001M	Colusa	Diesel	TBD	225	T0	2,600	3%	77	203	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
17N01W15Q001M	Colusa	Diesel	TBD	225	T0	1,300	1%	39	102	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Gardener No. 374672	Colusa	Diesel	2,008	215	T3	3,500	4%	104	274	5	424	5,120	0.1	2.8	2.6	0.93	0.15	0.15	0.37	7.01	6.46	2.30	0.37	0.37	0.02	0.29	0.26	0.09	0.02	0.02	
Gardener No. 498178	Colusa	Diesel	2,009	215	T3	3,500	4%	104	274	5	424	5,120	0.1	2.8	2.6	0.93	0.15	0.15	0.37	7.01	6.46	2.30	0.37	0.37	0.02	0.29	0.26	0.09	0.02	0.02	
Hall Well No. X	Glenn	Electric	TBD	125	n/a	4,500	5%	134	352	5	424	n/a																			
Hall Well No.369428	Glenn	Electric	2,011	125	n/a	4,500	5%	134	352	5	424	n/a																			
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	n/a	4,500	5%	134	352	5	424	n/a																			
Myers Well #1 No.3457	Glenn	Electric	2,006	40	n/a	2,200	2%	66	172	5	424	n/a																			
Myers Well #2 No. 340884	Glenn	Electric	1,982	100	n/a	4,100	4%	122	320	5	424	n/a																			
Rancho Caleta No. 726883	Colusa	Diesel	2,004	170	T2	4,500	5%	134	352	5	424	4,048	0.2	4.7	3.7	0.93	0.22	0.22	0.48	9.15	7.29	1.82	0.44	0.44	0.02	0.37	0.30	0.07	0.02	0.02	
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2,006	173	T2	4,000	4%	119	313	5	424	4,120	0.2	4.7	3.7	0.93	0.22	0.22	0.49	9.31	7.42	1.85	0.45	0.45	0.02	0.38	0.30	0.08	0.02	0.02	
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2,008	150	T3	4,000	4%	119	313	5	424	3,572	0.1	2.8	3.7	0.93	0.22	0.22	0.26	4.89	6.44	1.60	0.39	0.39	0.01	0.20	0.26	0.07	0.02	0.02	
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	T0	4,800	5%	143	375	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Stone Well #6 No.11334	Colusa	Electric	2,006	40	n/a	1,800	2%	54	141	5	424	n/a																			
Wilder Farms Well	Glenn	Electric	unknown	125	n/a	2,500	3%	74	195	5	424	n/a																			
Dan Charter Well#1	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Dan Charter Well#2	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
GVL Well#1	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Behring Ranch Well	Colusa	Electric	unknown	125	n/a	4,000	4%	119	313	5	424	n/a																			
Claudia Charter	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
GVL Well#2	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Total						91,800	100%	2,733	7,175	146	11,885	91,633							37.76	481.31	134.91	41.15	7.05	6.94	1.54	19.58	5.49	1.67	0.29	0.28	
Total (Glenn County)						22,600	25%	673	1,766	31	2,547	5,358							2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02	
Total (Colusa County)						69,200	75%	2,060	5,409	115	9,338	86,275							34.81	444.92	127.07	38.74	6.66	6.56	1.42	18.10	5.17	1.58	0.27	0.27	
Total (Sutter County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status			
	Glenn	Colusa	Sutter
PM10	A	A	A
PM2.5	A	A	M
O3	A	A	N

Engines subject to ATCM.

Peak Month
2,733 AF/month
19,952 gallons/minute
22% peak pump rate

Legend

	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	River Garden Farms	Peak Pumping by Transfer Period
Transfer Volume	5,000 acre-feet (Apr-Jun)	1,667 AF/month
	5,000 acre-feet (Jul-Sep)	1,667 AF/month
	10,000 acre-feet/year	

Table 45. River Garden Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	7	0	0	7
Total	0	7	0	0	7

Table 46. River Garden Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations	
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Field 65 PW	Yolo	Electric	2,008	unknown	n/a	2,500	12%	204	1,226	14	2,663
Field 71 PW	Yolo	Electric	2,001	unknown	n/a	1,700	8%	139	834	14	2,663
Field 98 PW	Yolo	Electric	1,963	unknown	n/a	2,900	14%	237	1,422	14	2,663
Field 104 PW	Yolo	Electric	2,008	unknown	n/a	2,500	12%	204	1,226	14	2,663
Field 104-09 PW	Yolo	Electric	2,009	unknown	n/a	2,990	15%	244	1,466	14	2,663
Field 91-09 PW	Yolo	Electric	2,009	unknown	n/a	2,840	14%	232	1,392	14	2,663
Field 117 PW	Yolo	Electric	2,009	unknown	n/a	1,965	10%	161	963	14	2,663
Shop PW	Yolo	unknown	2,009	unknown	n/a	3,000	15%	245	1,471	14	2,663
Total						20,395	100%	1,667	10,000	115	21,303
Total (Yolo County)						20,395	100%	1,667	10,000	115	21,303

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Yolo

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

1,667 AF/month

12,166 gallons/minute

60% peak pump rate

Conversion Factors

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Sycamore Mutual Water Company	<u>Peak Pumping by Transfer Period</u>
Transfer Volume	4,000 acre-feet (Apr-Jun)	1,333 AF/month
	4,000 acre-feet (Jul-Sep)	1,333 AF/month
	8,000 acre-feet/year	

Table 47. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	5	0	0	5
Total	0	5	0	0	5

Table 48. Sycamore Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations	
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Well #15	Colusa	Electric	unknown	unknown	n/a	3,270	15%	197	1,183	11	1,966
Well #14	Colusa	Electric	unknown	unknown	n/a	3,270	15%	197	1,183	11	1,966
Well #11	Colusa	Electric	unknown	unknown	n/a	6,409	29%	387	2,320	11	1,966
Well #2b	Colusa	Electric	unknown	unknown	n/a	4,578	21%	276	1,657	11	1,966
Well #2a	Colusa	Electric	unknown	unknown	n/a	4,578	21%	276	1,657	11	1,966
Total						22,104	100%	1,333	8,000	53	9,828
Total (Colusa County)						22,104	100%	1,333	8,000	53	9,828

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

1,333 AF/month

9,733 gallons/minute

44% peak pump rate

Legend

 Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	T&P Farms		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	650 acre-feet	(Apr-Jun)	386 AF/month
	550 acre-feet	(Jul-Sep)	210 AF/month
	1,200 acre-feet/year		

Table 49. T&P Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 50. T&P Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
NW-3	Colusa	Electric	unknown	unknown	n/a	3,500	47%	180	560	9	869
NW-4	Colusa	Electric	unknown	unknown	n/a	4,000	53%	206	640	9	869
Total						7,500	100%	386	1,200	18	1,738
Total (Colusa County)						7,500	100%	386	1,200	18	1,738

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

386 AF/month

2,821 gallons/minute

38% peak pump rate

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Te Velde Revocable Family Trust		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,700 acre-feet	(Apr-Jun)	1,605 AF/month
	4,394 acre-feet	(Jul-Sep)	1,674 AF/month
	7,094 acre-feet/year		

Table 51. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	5	0	0	5
Total	0	5	0	0	5

Table 52. Te Velde Revocable Family Trust Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
GW1	Yolo	Electric	unknown	unknown	n/a	4,656	29%	493	2,090	19	2,438
GW10	Yolo	Electric	unknown	unknown	n/a	2,833	18%	300	1,272	19	2,438
GW9	Yolo	Electric	unknown	unknown	n/a	2,400	15%	254	1,077	19	2,438
GW3	Yolo	Electric	unknown	unknown	n/a	3,715	24%	393	1,668	19	2,438
GW4	Yolo	Electric	unknown	unknown	n/a	2,200	14%	233	988	19	2,438
Total						15,804	100%	1,674	7,094	93	12,189
Total (Yolo County)						15,804	100%	1,674	7,094	93	12,189

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Yolo

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

1,674 AF/month

12,219 gallons/minute

77% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Table 53. General Conformity Applicability Evaluation (Mitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
	Sacramento Metro ¹	Sacramento Metro ¹	Sacramento Area ²	Sacramento ^{3,4}	Sacramento Co.	Sacramento ⁴
Colusa	n/a	n/a	n/a	n/a	n/a	n/a
Glenn	n/a	n/a	n/a	n/a	n/a	n/a
Sacramento	0.0	2.9	0.1	1.4	0.0	0.0
Shasta	n/a	n/a	n/a	n/a	n/a	n/a
Sutter ⁵	0.9	3.4	n/a	2.3	n/a	0.1
Tehama	n/a	n/a	n/a	n/a	n/a	n/a
Yolo	0.0	0.0	0.0	0.0	n/a	0.0
Total	0.9	6.3	0.1	3.7	0.0	0.2
Classification	Severe-15	Severe-15	Maintenance	PM2.5 Precursor	Maintenance	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100
Exceed?	No	No	No	No	No	No

Note:

¹The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

²The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

³All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

⁴The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

⁵VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

Table 54. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Pelger Road 1700 LLC	Sutter	All Electric	All Electric
Pelger Mutual Water Company	Sutter	0.0	0.8
Reclamation District 1004	Sutter	No Engines	No Engines
Total		0.0	0.8

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Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 55. Daily VOC Emissions (Mitigated)

Water Agency	Daily VOC Emissions (pounds per day)							
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	Total
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	1.54							1.54
Conaway Preservation Group	No Groundwater Substitution							
Eastside Mutual Water Company	58.76							58.76
Guisti Farms					3.02			3.02
Glenn-Colusa Irrigation District	11.95	2.99						14.94
Lewis Ranch	No Groundwater Substitution							
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.08		0.32			0.40
Pelger Mutual Water Company					0.99			0.99
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					8.71			8.71
Princeton-Codora-Glenn Irrigation District	No Engines	39.32						39.32
Provident Irrigation District	No Engines	61.67						61.67
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	34.81	2.95			No Engines			37.76
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	109.54	106.92	0.08	0.00	13.04	0.00	0.00	229.58

Key:

VOC = volatile organic compounds

Table 56. Daily NOx Emissions (Mitigated)

Water Agency	Daily NOx Emissions (pounds per day)							
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	Total
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	3.08							3.08
Conaway Preservation Group	No Groundwater Substitution							
Eastside Mutual Water Company	30.18							30.18
Guisti Farms					6.03			6.03
Glenn-Colusa Irrigation District	147.33	36.83						184.17
Lewis Ranch	No Groundwater Substitution							
Maxwell Irrigation District	47.21							47.21
Natomas Central Mutual Water Company			31.01		11.55			42.56
Pelger Mutual Water Company					18.76			18.76
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					25.00			25.00
Princeton-Codora-Glenn Irrigation District	No Engines	468.83						468.83
Provident Irrigation District	No Engines	730.51						730.51
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	444.92	36.38			No Engines			481.31
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	672.73	1,272.56	31.01	0.00	61.34	0.00	0.00	2,037.64

Key:

NOx = nitrogen oxides

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 57. Daily CO Emissions (Mitigated)

Water Agency	Daily CO Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	6.17							6.17
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	57.02							57.02
Guisti Farms					12.07			12.07
Glenn-Colusa Irrigation District	31.75	7.94						39.68
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	43.49							43.49
Natomas Central Mutual Water Company			0.79		2.53			3.31
Pelger Mutual Water Company					24.68			24.68
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					191.15			191.15
Princeton-Codora-Glenn Irrigation District	No Engines	141.49						141.49
Provident Irrigation District	No Engines	221.44						221.44
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	127.07	7.84			No Engines			134.91
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	265.49	378.71	0.79	0.00	230.42	0.00	0.00	875.41

Key:

CO = carbon monoxide

Table 58. Daily SOx Emissions (Mitigated)

Water Agency	Daily SOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	20.30							20.30
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	9.74	2.44						12.18
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	15.48							15.48
Natomas Central Mutual Water Company			14.77		3.36			18.12
Pelger Mutual Water Company					6.15			6.15
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					53.59			53.59
Princeton-Codora-Glenn Irrigation District	No Engines	41.05						41.05
Provident Irrigation District	No Engines	67.06						67.06
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	38.74	2.41			No Engines			41.15
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	84.27	112.95	14.77	0.00	63.10	0.00	0.00	275.08

Key:

SOx = sulfur oxides

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Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 59. Daily PM10 Emissions (Mitigated)

Water Agency	Daily PM10 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.02							0.02
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.26							3.26
Guisti Farms					0.03			0.03
Glenn-Colusa Irrigation District	2.31	0.58						2.88
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.13		0.07			0.20
Pelger Mutual Water Company					1.48			1.48
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.34			1.34
Princeton-Codora-Glenn Irrigation District	No Engines	6.68						6.68
Provident Irrigation District	No Engines	9.48						9.48
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.66	0.39			No Engines			7.05
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.73	17.12	0.13	0.00	2.93	0.00	0.00	34.90

Key:

PM10 = inhalable particulate matter

Table 60. Daily PM2.5 Emissions (Mitigated)

Water Agency	Daily PM2.5 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.02							0.02
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.21							3.21
Guisti Farms					0.03			0.03
Glenn-Colusa Irrigation District	2.25	0.56						2.81
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.48							2.48
Natomas Central Mutual Water Company			0.13		0.07			0.20
Pelger Mutual Water Company					1.48			1.48
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.34			1.34
Princeton-Codora-Glenn Irrigation District	No Engines	6.52						6.52
Provident Irrigation District	No Engines	9.25						9.25
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.56	0.38			No Engines			6.94
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.53	16.71	0.13	0.00	2.93	0.00	0.00	34.28

Key:

PM2.5 = fine particulate matter

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 61. Annual VOC Emissions (Mitigated)

Water Agency	Annual VOC Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.12							0.12
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.20							3.20
Guisti Farms					0.28			0.28
Glenn-Colusa Irrigation District	1.11	0.28						1.39
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.03			0.04
Pelger Mutual Water Company					0.04			0.04
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					0.57			0.57
Princeton-Codora-Glenn Irrigation District	No Engines	2.25						2.25
Provident Irrigation District	No Engines	5.74						5.74
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.42	0.12			No Engines			1.54
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	6.01	8.39	0.01	0.00	0.92	0.00	0.00	15.32

Key:

VOC = volatile organic compounds

Table 62. Annual NOx Emissions (Mitigated)

Water Agency	Annual NOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.25							0.25
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	1.64							1.64
Guisti Farms					0.56			0.56
Glenn-Colusa Irrigation District	13.70	3.43						17.13
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.88							2.88
Natomas Central Mutual Water Company			2.88		1.07			3.96
Pelger Mutual Water Company					0.79			0.79
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.75			1.75
Princeton-Codora-Glenn Irrigation District	No Engines	26.89						26.89
Provident Irrigation District	No Engines	67.94						67.94
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	18.10	1.48			No Engines			19.58
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	36.58	99.73	2.88	0.00	4.17	0.00	0.00	143.37

Key:

NOx = nitrogen oxides

2016 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 63. Annual CO Emissions (Mitigated)

Water Agency	Annual CO Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.50							0.50
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	3.11							3.11
Guisti Farms					1.12			1.12
Glenn-Colusa Irrigation District	2.95	0.74						3.69
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	2.65							2.65
Natomas Central Mutual Water Company			0.07		0.23			0.31
Pelger Mutual Water Company					1.03			1.03
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					7.32			7.32
Princeton-Codora-Glenn Irrigation District	No Engines	8.11						8.11
Provident Irrigation District	No Engines	20.59						20.59
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	5.17	0.32			No Engines			5.49
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	14.38	29.77	0.07	0.00	9.72	0.00	0.00	53.94

Key:

CO = carbon monoxide

Table 64. Annual SOx Emissions (Mitigated)

Water Agency	Annual SOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	1.11							1.11
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.91	0.23						1.13
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.94							0.94
Natomas Central Mutual Water Company			1.37		0.31			1.69
Pelger Mutual Water Company					0.26			0.26
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					1.73			1.73
Princeton-Codora-Glenn Irrigation District	No Engines	2.35						2.35
Provident Irrigation District	No Engines	6.24						6.24
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.58	0.10			No Engines			1.67
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	4.53	8.92	1.37	0.00	2.30	0.00	0.00	17.13

Key:

SOx = sulfur oxides

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 65. Annual PM10 Emissions (Mitigated)

Water Agency	Annual PM10 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	0.18							0.18
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.21	0.05						0.27
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.01			0.02
Pelger Mutual Water Company					0.06			0.06
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					0.07			0.07
Princeton-Codora-Glenn Irrigation District	No Engines	0.38						0.38
Provident Irrigation District	No Engines	0.88						0.88
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.29
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	0.82	1.33	0.01	0.00	0.14	0.00	0.00	2.31

Key:

PM10 = inhalable particulate matter

Table 66. Annual PM2.5 Emissions (Mitigated)

Water Agency	Annual PM2.5 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group	No Groundwater Substitution							0.00
Eastside Mutual Water Company	0.18							0.18
Guisti Farms					0.00			0.00
Glenn-Colusa Irrigation District	0.21	0.05						0.26
Lewis Ranch	No Groundwater Substitution							0.00
Maxwell Irrigation District	0.15							0.15
Natomas Central Mutual Water Company			0.01		0.01			0.02
Pelger Mutual Water Company					0.06			0.06
Pelger Road 1700 LLC					All Electric			0.00
Pleasant Grove-Verona Mutual Water Company					0.07			0.07
Princeton-Codora-Glenn Irrigation District	No Engines	0.37						0.37
Provident Irrigation District	No Engines	0.86						0.86
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.28
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	0.80	1.30	0.01	0.00	0.14	0.00	0.00	2.26

Key:

PM2.5 = fine particulate matter

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pleasant Grove-Verona Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	8,000 acre-feet	(Apr-Jun)	4,757 AF/month
	7,000 acre-feet	(Jul-Sep)	2,667 AF/month
	15,000 acre-feet/year		

Table 67. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 68. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Well	Well	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel	Emission Factors						Daily Emissions						Annual Emissions					
	Location											Consumption (gal/yr) - diesel (MMBtu/yr) - propane	(g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane						(pounds per day)						(tons per year)					
	(County)			(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	n/a	2,000	2%	111	350	19	951	n/a																		
Kelly Windmill North Field Well	Sutter	Propane	2014	133	n/a	1,750	2%	97	306	2	951	321	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	0.46	0.92	1.84	0.00	0.01	0.01	0.14	0.28	0.56	0.00	0.00	0.00
Kelly306	Sutter	Electric	unknown	60	n/a	2,600	3%	144	455	19	951	n/a																		
MLF Clubhouse B Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	19	951	n/a																		
MLF Marsh Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	19	951	n/a																		
MLF Monster Well	Sutter	Electric	unknown	60	n/a	3,100	4%	172	543	19	951	n/a																		
MLF Well #1	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
MLF Well #16	Sutter	Electric	unknown	50	n/a	1,700	2%	94	298	19	951	n/a																		
MLF Well#11	Sutter	Diesel	2011	250	T4I	4,200	5%	233	735	14	951	13,332	0.14	0.30	2.61	0.93	0.01	0.01	1.12	2.36	20.68	7.36	0.12	0.12	0.04	0.08	0.68	0.24	0.00	0.00
MLF Well#12/17	Sutter	Electric	unknown	50	n/a	1,500	2%	83	263	19	951	n/a																		
MLF Well#13	Sutter	Electric	2000	215	n/a	4,800	6%	266	840	19	951	n/a																		
MLF Well#2B	Sutter	Electric	2000	300	n/a	3,700	4%	205	648	19	951	n/a																		
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas 72-Acree Field South	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
Nicholas BBC Well	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Filipino Camp South	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Sand Field Well	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
RiverRanch#19	Sutter	Diesel	2012	99	T4I	2,000	2%	111	350	17	951	5,279	0.14	0.30	3.73	0.93	0.01	0.01	0.54	1.13	14.15	3.53	0.06	0.06	0.01	0.03	0.39	0.10	0.00	0.00
S&O#16	Sutter	Electric	2014	159	n/a	3,000	4%	167	525	19	951	n/a																		
S&O#17	Sutter	Diesel	2012	101	T4I	2,250	3%	125	394	17	951	5,386	0.14	0.30	3.73	0.93	0.01	0.01	0.55	1.15	14.41	3.59	0.06	0.06	0.02	0.03	0.39	0.10	0.00	0.00
S&O#18A	Sutter	Diesel	2012	101	T4I	1,800	2%	100	315	17	951	5,386	0.14	0.30	3.73	0.93	0.01	0.01	0.55	1.15	14.41	3.59	0.06	0.06	0.02	0.03	0.39	0.10	0.00	0.00
S&O#19	Sutter	Diesel	2011	215	T4I	2,150	3%	119	376	15	951	11,465	0.14	0.30	2.61	0.93	0.01	0.01	1.01	2.13	18.65	6.64	0.11	0.11	0.03	0.07	0.59	0.21	0.00	0.00
S&O#20	Sutter	Propane	2014	154	n/a	2,250	3%	125	394	0	951	372	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.32	0.65	0.00	0.00	0.00
Willey#1	Sutter	Diesel	2012	168	T4I	3,000	4%	167	525	16	951	8,959	0.14	0.30	3.73	0.93	0.01	0.01	0.84	1.77	22.12	5.51	0.09	0.09	0.02	0.05	0.66	0.16	0.00	0.00
Willey#2	Sutter	Diesel	2011	250	T4I	3,000	4%	167	525	14	951	13,332	0.14	0.30	2.61	0.93	0.01	0.01	1.12	2.36	20.68	7.36	0.12	0.12	0.04	0.08	0.68	0.24	0.00	0.00
Willey#3	Sutter	Electric	unknown	75	n/a	2,000	2%	111	350	19	951	n/a																		
Willey#4	Sutter	Diesel	2012	150	T4I	2,000	2%	111	350	16	951	7,999	0.14	0.30	3.73	0.93	0.01	0.01	0.77	1.62	20.19	5.03	0.08	0.08	0.02	0.05	0.59	0.15	0.00	0.00
Will-Lee Well#30	Sutter	Diesel	2012	100	T4I	2,500	3%	139	438	17	951	5,333	0.14	0.30	3.73	0.93	0.01	0.01	0.54	1.14	14.28	3.56	0.06	0.06	0.01	0.03	0.39	0.10	0.00	0.00
Will-Lee Well#31	Sutter	Electric	unknown	50	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#32	Sutter	Electric	unknown	300	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#33	Sutter	Electric	unknown	75	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#4A	Sutter	Diesel	2012	160	T4I	1,500	2%	83	263	16	951	8,532	0.14	0.30	3.73	0.93	0.01	0.01	0.81	1.70	21.27	5.30	0.09	0.09	0.02	0.05	0.63	0.16	0.00	0.00
Total						85,700	100%	4,757	15,000	567	33,270	95,632							8.71	25.00	191.15	53.59	1.34	1.34	0.57	1.75	7.32	1.73	0.07	0.07
Total (Sutter County)						85,700	100%	4,757	15,000	567	33,270	95,632							8.71	25.00	191.15	53.59	1.34	1.34	0.57	1.75	7.32	1.73	0.07	0.07

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

Sutter
A
M
N
Engines subject to ATCM.

Peak Month

4,757 AF/month
34,722 gallons/minute
41% peak pump rate

Legend

	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Mitigation requirement

Conversion Factors

1 bhp-hr =	2,542.5 Btu
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

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CARB Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines

Table 69. Summary of the Emission Standards for New Stationary Diesel-Fueled CI Engines > 50 BHP used in Agricultural Operations

Horsepower Range	Diesel PM [1] (g/bhp-hr)	HC (g/bhp-hr)	NOx (g/bhp-hr)	NMHC+NOx (g/bhp-hr)	CO (g/bhp-hr)
50<HP<100	0.3				
100<=HP<175	0.22				
175<=HP	0.15				

Source: See Section 93115.8(a)

Notes:

[1] Less than or equal to the emission standard OR Off-Road CI Engine Certification Standard for an off-road engine of the maximum rated power, whichever is more stringent.

[2] Off-Road CI Engine Certification Standard for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards.

[3] Prior to January 1, 2008, these limits shall not apply to engines sold from one agricultural operation to another and funded under State or federal incentive.

Table 70. Emission Standards for Noncertified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower (HP) Range	Compliance Date [1]	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2011	0.3				
75<=HP<100	2011	0.3				
100<=HP<175	2010	0.22				
175<=HP<=750	2010	0.15				
750<HP	2014	0.075				

Source: See Sections 93115.8(b) (2) and (4)

Note:

[1] Compliance date on or after December 31

[2] Engine Certification Standards for off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in Title 13.

Table 71. Emission Standards Tier 1- and Tier 2-Certified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower Range (hp)	Compliance Date	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2015	0.02				
75<=HP<175	2015	0.01				
175<=hp<=750	2014	0.01				
750<HP	2014	0.075				

Source: See Sections 93115.8(b)(3) and (4)

Notes:

[1] Compliance date on or after December 31 or 12 years after the date of initial installation, whichever is later.

[2] Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in agricultural operation shall not exceed Tier 1 standards in Tier 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

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Table 72. Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards

Maximum Rated Power	Tier	Model Year	(g/kW-hr)					(g/hp-hr)				
			NOx	HC	NMHC+NOx	CO	PM	NOx	HC	NMHC+NOx	CO	PM
kW<8 hp <11	T1	2000-2004	-	-	10.5	8.0	1	-	-	7.8	6.0	0.7
	T2	2005 -2007	-	-	7.5	8.0	0.8	-	-	5.6	6.0	0.6
8≤kW<19 11≤hp<25	T1	2000-2004	-	-	9.5	6.6	0.8	-	-	7.1	4.9	0.6
	T2	2005 -2007	-	-	7.5	6.6	0.8	-	-	5.6	4.9	0.6
19≤kW<37 25≤hp<50	T1	2000-2003	-	-	9.5	5.5	0.8	-	-	7.1	4.1	0.6
	T2	2004 -2007	-	-	7.5	5.5	0.6	-	-	5.6	4.1	0.4
37≤kW<56 50≤hp<75	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.3
	T3	2008 -2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.3
56≤kW<75 75≤hp<100	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.3
	T3	2008-2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.3
75≤kW<130 100≤hp<175	T1	2000-2002	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2003-2006	-	-	6.6	5.0	0.3	-	-	4.9	3.7	0.2
	T3	2007 -2011	-	-	4.0	5.0	0.3	-	-	3.0	3.7	0.2
130≤kW<225 175≤hp<300	T1	1996-2002	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2003-2005	-	-	6.6	3.5	0.2	-	-	4.9	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
225≤kW<450 300≤hp<600	T1	1996-2000	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2001-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
450≤kW≤560 600≤hp<750	T1	1996-2001	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2002-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
kW>560 hp>750	T1	2000-2005	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2006 -2010	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1

Source: Title 13, California Code of Regulations, Division 3, Chapter 9, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

NOx and NMHC fraction - Table B-26

NOx 95%
NMHC 5%

http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf

PM Size Fractions

PM10 0.96
PM2.5 0.937
Ratio 0.98

CARB PMSIZE Profile No. 116 (STAT. I.C. ENGINE-DIESEL)

Table 73. Tier 4 Exhaust Emission Standards

MAXIMUM ENGINE POWER	MODEL YEAR	TYPE	PM	NMHC+NOx	NMHC	NOx	CO
			grams per horsepower-hour				
hp<11	2008 and later	FINAL	0.30	5.6	-	-	6.0
11<=hp<25							4.9
25<=hp<50	2008-2012	INTERIM	0.22	5.6	-	-	4.1
	2013 and later	FINAL	0.02	3.5			
50<=hp<75	2008-2012	INTERIM	0.22	3.5	-	-	3.7
	2013 and later	FINAL	0.02				
75<=hp<100	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.5	-	-	
		or/ ALT NOx			0.14	2.5	
	2015 and later	FINAL		-		0.3	
100<=hp<175	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	2.5	
	2015 and later	FINAL			0.14	0.3	
175<=hp<=750	2011-2013	PHASE-IN	0.01	-	0.14	0.3	2.6
	2014 and later	PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	1.5	
		FINAL				0.3	
750 hp<GEN<=1205 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.02		0.14	0.5	
GEN>1205 hp	2011-2014	INTERIM	0.07	-	0.30		2.6
	2015 and later	FINAL	0.02		0.14	0.5	
ELSE>750 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.03	-	0.14		

Source: Title 13, California Code of Regulations, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

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Table 74. Engine Tier Matrix

HP Range	Year																			
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
hp <11	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
11<=hp<25	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
25<=hp<50	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
50<=hp<75	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
75<=hp<100	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T4I	T4I	T4I	T4
100<=hp<175	T0	T0	T0	T0	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
175<=hp<300	T1	T1	T1	T1	T1	T1	T1	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
300<=hp<600	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
600<=hp<750	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
hp>750	T0	T0	T0	T0	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4

Key:

T0 = Tier 0 (Noncertified)
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
T4 = Tier 4
T4I = Tier 4 Interim

AP-42 Emission Factors

Table 75. Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines [a]

Pollutant	Gasoline Fuel		Diesel Fuel		Emission Factor Rating
	Emission Factor		Emission Factor		
	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	
NOx	0.011	1.63	0.031	4.41	D
CO	6.96E-03 [d]	0.99 [d]	6.68E-03	0.95	D
SOx	5.91E-04	0.084	2.05E-03	0.29	D
PM-10 [b]	7.21E-04	0.1	2.20E-03	0.31	D
CO2 [c]	1.08	154	1.15	164	B
Aldehydes	4.85E-04	0.07	4.63E-04	0.07	D
TOC					
Exhaust	0.015	2.1	2.47E-03	0.35	D
Evaporative	6.61E-04	0.09	0.00	0.00	E
Crankcase	4.85E-03	0.69	4.41E-05	0.01	E
Refueling	1.08E-03	0.15	0.00	0.00	E

Source: U.S. Environmental Protection Agency. 1996. *Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.3: Gasoline and Diesel Industrial Engines.*

Notes:

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kwhr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 μ m aerodynamic diameter. All particulate is assumed to be 10 μ m in size.

[c] Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

For large stationary diesel engines (greater than 600 horsepower [hp]) see Chapter 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines.

Table 76. Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines [a]

Pollutant	Emission Factor (lb/MMBtu) [b] (fuel input)	Emission Factor Rating
NOx [c] 90 - 105% Load	4.08E+00	B
NOx [c] <90% Load	8.47E-01	B
CO [c] 90 - 105% Load	3.17E-01	C
CO [c] <90% Load	5.57E-01	B
CO2 [d]	1.10E+02	A
SO2 [e]	5.88E-04	A
TOC [f]	1.47E+00	A
Methane[g]	1.25E+00	C
VOC [h]	1.18E-01	C
PM10 (filterable) [i]	7.71E-05	D
PM2.5 (filterable) [i]	7.71E-05	D
PM Condensable [j]	9.91E-03	D

Source: U.S. Environmental Protection Agency. 2000. *Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.2: Natural Gas-Fired Reciprocating Engines*. July.
Notes:

[a] Reference 7. Factors represent uncontrolled levels. For NOx, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, the data set may include units with control techniques used for NOx control, such as PCC "uncontrolled" means no oxidation control; and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μ) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10⁶ scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$\text{lb/hp-hr} = (\text{lb/MMBtu}) (\text{heat input, MMBtu/hr}) (1/\text{operating HP, 1/hp})$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO2. $\text{CO}_2 [\text{lb/MMBtu}] = (3.67)(\% \text{CON})(C)(D)(1/h)$, where %CON = percent conversion of fuel carbon to CO2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10⁶ scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60EF).

[e] Based on 100% conversion of fuel sulfur to SO2. Assumes sulfur content in natural gas of 2,000 gr/10⁶scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered $\leq 1 \mu$ in aerodynamic diameter. Therefore, for filterable PM emissions, $\text{PM}_{10}(\text{filterable}) = \text{PM}_{2.5}(\text{filterable})$.

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

Engine Size Summary

Table 77. Engine Power Rating Summary by Fuel Type

Fuel Type	No. Engines	Avg. HP	Max HP	Min HP
Diesel	23	170	250	60
Electric	47	125	300	30
Natural Gas	0	n/a	0	0
Propane	3	180	250	135

Summary of Crop Idling Emissions by Air District

Table 78. Reduced Exhaust Emissions from Cropland Idling

Air District	Peak Daily Emissions (lbs/day)						Annual Project Emissions (tpy)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa County APCD												
Canal Farms	(0)	(5)	(6)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(10)	(10)	(0)	(5)	(7)	(2)	(0)	(0)
Lewis Ranch	(1)	(17)	(22)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Maxwell Irrigation District	(2)	(37)	(49)	(12)	(3)	(3)	(0)	(2)	(2)	(1)	(0)	(0)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Provident Irrigation District	(2)	(37)	(48)	(12)	(3)	(3)	(0)	(2)	(2)	(1)	(0)	(0)
Reclamation District 108	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(4)	(1)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(2)	(0)	(0)	(0)
Sycamore Mutual Water Company	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(3)	(1)	(0)	(0)
T&P Farms	(0)	(7)	(9)	(2)	(1)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Colusa County APCD Subtotal	(22)	(418)	(550)	(137)	(33)	(33)	(1)	(18)	(23)	(6)	(1)	(1)
Glenn County APCD												
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(10)	(10)	(0)	(5)	(7)	(2)	(0)	(0)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Provident Irrigation District	(2)	(37)	(48)	(12)	(3)	(3)	(0)	(2)	(2)	(1)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(2)	(0)	(0)	(0)
Glenn County APCD Subtotal	(11)	(214)	(281)	(70)	(17)	(17)	(0)	(9)	(12)	(3)	(1)	(1)
Feather River AQMD												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Guisti Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Pelger Road 1700 LLC	0	0	0	0	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(5)	(5)	(0)	(3)	(4)	(1)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(2)	(0)	(0)	(0)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(11)	(11)	(0)	(6)	(7)	(2)	(0)	(0)
Feather River AQMD Subtotal	(13)	(249)	(328)	(82)	(20)	(20)	(1)	(10)	(14)	(3)	(1)	(1)
Yolo-Solano AQMD												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(12)	(12)	(0)	(7)	(9)	(2)	(1)	(1)
Reclamation District 108	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(4)	(1)	(0)	(0)
River Garden Farms	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(4)	(1)	(0)	(0)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(3)	(1)	(0)	(0)
Yolo-Solano AQMD Subtotal	(19)	(357)	(470)	(117)	(28)	(28)	(1)	(15)	(20)	(5)	(1)	(1)
GRAND TOTAL	(65)	(1,238)	(1,630)	(406)	(98)	(98)	(3)	(52)	(68)	(17)	(4)	(4)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

Table 79. Reduced Peak Daily Fugitive Dust Emissions from Cropland Idling

Air District	Peak Daily PM10 Emissions (lbs/day)				Peak Daily PM2.5 Emissions (lbs/day)			
	Land Prep	Harvest	Wind Erosion	Total	Land Prep	Harvest	Wind Erosion	Total
Colusa County APCD								
Canal Farms	(11)	(1)	2	(9)	(2)	(0)	0	(1)
Eastside Mutual Water Company	(31)	(3)	7	(26)	(5)	(0)	1	(4)
Glenn-Colusa Irrigation District	(274)	(23)	66	(231)	(41)	(3)	13	(31)
Lewis Ranch	(38)	(3)	9	(33)	(6)	(0)	2	(4)
Maxwell Irrigation District	(83)	(7)	20	(70)	(12)	(1)	4	(10)
Princeton-Codora-Glenn Irrigation District	(55)	(5)	13	(46)	(8)	(1)	3	(6)
Provident Irrigation District	(82)	(7)	20	(69)	(12)	(1)	4	(9)
Reclamation District 108	(166)	(14)	22	(158)	(25)	(2)	4	(23)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Sycamore Mutual Water Company	(116)	(10)	27	(99)	(17)	(1)	5	(13)
T&P Farms	(15)	(1)	3	(13)	(2)	(0)	1	(2)
Colusa County APCD Subtotal	(940)	(79)	202	(817)	(141)	(12)	40	(112)
Glenn County APCD								
Glenn-Colusa Irrigation District	(274)	(23)	66	(231)	(41)	(3)	13	(31)
Princeton-Codora-Glenn Irrigation District	(55)	(5)	13	(46)	(8)	(1)	3	(6)
Provident Irrigation District	(82)	(7)	20	(69)	(12)	(1)	4	(9)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Glenn County APCD Subtotal	(480)	(40)	111	(410)	(72)	(6)	22	(56)
Feather River AQMD								
Burroughs Farms	0	0	0	0	0	0	0	0
Guisti Farms	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(42)	(4)	1	(45)	(6)	(1)	0	(7)
Pelger Road 1700 LLC	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	(149)	(13)	3	(159)	(22)	(2)	1	(24)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Sutter Mutual Water Company	(299)	(25)	6	(318)	(45)	(4)	1	(47)
Feather River AQMD Subtotal	(518)	(43)	20	(541)	(78)	(7)	4	(80)
Yolo-Solano AQMD								
Conaway Preservation Group	(355)	(30)	11	(373)	(53)	(4)	2	(55)
Reclamation District 108	(166)	(14)	22	(158)	(25)	(2)	4	(23)
River Garden Farms	(166)	(14)	5	(175)	(25)	(2)	1	(26)
Te Velde Revocable Family Trust	(116)	(10)	4	(122)	(17)	(1)	1	(18)
Yolo-Solano AQMD Subtotal	(802)	(67)	42	(828)	(120)	(10)	8	(122)
GRAND TOTAL	(2,740)	(230)	374	(2,596)	(411)	(34)	75	(370)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

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Table 80. Reduced Annual Fugitive Dust Emissions from Cropland Idling

Air District	Annual PM10 Emissions (tpy)				Annual PM2.5 Emissions (tpy)			
	Land Prep	Harvest	Wind Erosion	Total	Land Prep	Harvest	Wind Erosion	Total
Colusa County APCD								
Canal Farms	(1)	(0)	0	(1)	(0)	(0)	0	(0)
Eastside Mutual Water Company	(3)	(0)	1	(2)	(0)	(0)	0	(0)
Glenn-Colusa Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Lewis Ranch	(3)	(0)	1	(3)	(1)	(0)	0	(0)
Maxwell Irrigation District	(7)	(1)	2	(6)	(1)	(0)	0	(1)
Princeton-Codora-Glenn Irrigation District	(5)	(0)	1	(4)	(1)	(0)	0	(1)
Provident Irrigation District	(7)	(1)	2	(6)	(1)	(0)	0	(1)
Reclamation District 108	(15)	(1)	2	(14)	(2)	(0)	0	(2)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Sycamore Mutual Water Company	(10)	(1)	2	(9)	(2)	(0)	0	(1)
T&P Farms	(1)	(0)	0	(1)	(0)	(0)	0	(0)
Colusa County APCD Subtotal	(85)	(7)	18	(74)	(13)	(1)	4	(10)
Glenn County APCD								
Glenn-Colusa Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Princeton-Codora-Glenn Irrigation District	(5)	(0)	1	(4)	(1)	(0)	0	(1)
Provident Irrigation District	(7)	(1)	2	(6)	(1)	(0)	0	(1)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Glenn County APCD Subtotal	(43)	(4)	10	(37)	(6)	(1)	2	(5)
Feather River AQMD								
Burroughs Farms	0	0	0	0	0	0	0	0
Guisti Farms	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(4)	(0)	0	(4)	(1)	(0)	0	(1)
Pelger Road 1700 LLC	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	(13)	(1)	0	(14)	(2)	(0)	0	(2)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Sutter Mutual Water Company	(27)	(2)	0	(29)	(4)	(0)	0	(4)
Feather River AQMD Subtotal	(47)	(4)	2	(49)	(7)	(1)	0	(7)
Yolo-Solano AQMD								
Conaway Preservation Group	(32)	(3)	1	(34)	(5)	(0)	0	(5)
Reclamation District 108	(15)	(1)	2	(14)	(2)	(0)	0	(2)
River Garden Farms	(15)	(1)	0	(16)	(2)	(0)	0	(2)
Te Velde Revocable Family Trust	(10)	(1)	0	(11)	(2)	(0)	0	(2)
Yolo-Solano AQMD Subtotal	(72)	(6)	4	(75)	(11)	(1)	1	(11)
GRAND TOTAL	(247)	(21)	34	(234)	(37)	(3)	7	(33)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

Table 81. Combined Emissions by Air District

Air District	Peak Daily Emissions (lbs/day)						Annual Project Emissions (tpy)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa County APCD												
Canal Farms	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(1)	(1)	(0)	(2)	(0)
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(240)	(41)	(0)	(5)	(7)	(2)	(21)	(3)
Lewis Ranch	(1)	(17)	(22)	(6)	(34)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Maxwell Irrigation District	(2)	(37)	(49)	(12)	(73)	(13)	(0)	(2)	(2)	(1)	(6)	(1)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(48)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Provident Irrigation District	(2)	(37)	(48)	(12)	(72)	(12)	(0)	(2)	(2)	(1)	(6)	(1)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(4)	(1)	(14)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Sycamore Mutual Water Company	(3)	(52)	(68)	(17)	(103)	(18)	(0)	(2)	(3)	(1)	(9)	(1)
T&P Farms	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Colusa County APCD Subtotal	(22)	(418)	(550)	(137)	(850)	(145)	(1)	(18)	(23)	(6)	(75)	(11)
Glenn County APCD												
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(240)	(41)	(0)	(5)	(7)	(2)	(21)	(3)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(48)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Provident Irrigation District	(2)	(37)	(48)	(12)	(72)	(12)	(0)	(2)	(2)	(1)	(6)	(1)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Glenn County APCD Subtotal	(11)	(214)	(281)	(70)	(427)	(73)	(0)	(9)	(12)	(3)	(38)	(6)
Feather River AQMD												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Guisti Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pelger Road 1700 LLC	0	0	0	0	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(3)	(4)	(1)	(15)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(6)	(7)	(2)	(29)	(5)
Feather River AQMD Subtotal	(12)	(230)	(303)	(76)	(559)	(98)	(1)	(10)	(13)	(3)	(49)	(8)
Yolo-Solano AQMD												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(7)	(9)	(2)	(34)	(6)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(4)	(1)	(14)	(2)
River Garden Farms	(4)	(74)	(97)	(24)	(181)	(32)	(0)	(3)	(4)	(1)	(16)	(3)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(3)	(1)	(11)	(2)
Yolo-Solano AQMD Subtotal	(19)	(357)	(470)	(117)	(856)	(150)	(1)	(15)	(20)	(5)	(76)	(12)
GRAND TOTAL	(64)	(1,220)	(1,605)	(400)	(2,692)	(467)	(3)	(51)	(67)	(17)	(238)	(37)

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Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Anderson-Cottonwood Irrigation District												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Anderson-Cottonwood Irrigation District Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Burroughs Farms												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Burroughs Farms Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Canal Farms												
Exhaust Emissions	(0)	(5)	(6)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(11)	(2)	--	--	--	--	(1)	(0)
Harvesting	--	--	--	--	(1)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	2	0	--	--	--	--	0	0
Canal Farms Subtotal	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Conaway Preservation Group												
Exhaust Emissions	(8)	(158)	(208)	(52)	(12)	(12)	(0)	(7)	(9)	(2)	(1)	(1)
Land Preparation	--	--	--	--	(355)	(53)	--	--	--	--	(32)	(5)
Harvesting	--	--	--	--	(30)	(4)	--	--	--	--	(3)	(0)
Wind Erosion	--	--	--	--	11	2	--	--	--	--	1	0
Conaway Preservation Group Subtotal	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(7)	(9)	(2)	(34)	(6)
Eastside Mutual Water Company												
Exhaust Emissions	(1)	(14)	(18)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(31)	(5)	--	--	--	--	(3)	(0)
Harvesting	--	--	--	--	(3)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	7	1	--	--	--	--	1	0
Eastside Mutual Water Company Subtotal	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(1)	(1)	(0)	(2)	(0)
Guisti Farms												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Guisti Farms Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Glenn-Colusa Irrigation District												
Exhaust Emissions	(13)	(244)	(321)	(80)	(19)	(19)	(1)	(10)	(13)	(3)	(1)	(1)
Land Preparation	--	--	--	--	(548)	(82)	--	--	--	--	(49)	(7)
Harvesting	--	--	--	--	(46)	(7)	--	--	--	--	(4)	(1)
Wind Erosion	--	--	--	--	132	26	--	--	--	--	12	2
Glenn-Colusa Irrigation District Subtotal	(13)	(244)	(321)	(80)	(481)	(82)	(1)	(10)	(13)	(3)	(42)	(6)

Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Lewis Ranch												
Exhaust Emissions	(1)	(17)	(22)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(38)	(6)	--	--	--	--	(3)	(1)
Harvesting	--	--	--	--	(3)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	9	2	--	--	--	--	1	0
Lewis Ranch Subtotal	(1)	(17)	(22)	(6)	(34)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Maxwell Irrigation District												
Exhaust Emissions	(2)	(37)	(49)	(12)	(3)	(3)	(0)	(2)	(2)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(83)	(12)	--	--	--	--	(7)	(1)
Harvesting	--	--	--	--	(7)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	20	4	--	--	--	--	2	0
Maxwell Irrigation District Subtotal	(2)	(37)	(49)	(12)	(73)	(13)	(0)	(2)	(2)	(1)	(6)	(1)
Natomas Central Mutual Water Company												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	-
Natomas Central Mutual Water Company Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company												
Exhaust Emissions	(1)	(19)	(25)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(42)	(6)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	1	0	--	--	--	--	0	0
Pelger Mutual Water Company Subtotal	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pelger Road 1700 LLC												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	-
Pelger Road 1700 LLC Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company												
Exhaust Emissions	(4)	(67)	(88)	(22)	(5)	(5)	(0)	(3)	(4)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(149)	(22)	--	--	--	--	(13)	(2)
Harvesting	--	--	--	--	(13)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	3	1	--	--	--	--	0	0
Pleasant Grove-Verona Mutual Water Company Subtotal	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(3)	(4)	(1)	(15)	(2)
Princeton-Codora-Glenn Irrigation District												
Exhaust Emissions	(3)	(49)	(64)	(16)	(4)	(4)	(0)	(2)	(3)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(110)	(16)	--	--	--	--	(10)	(1)
Harvesting	--	--	--	--	(9)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	26	5	--	--	--	--	2	0
Princeton-Codora-Glenn Irrigation District Subtotal	(3)	(49)	(64)	(16)	(96)	(16)	(0)	(2)	(3)	(1)	(8)	(1)

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Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Provident Irrigation District												
Exhaust Emissions	(4)	(73)	(96)	(24)	(6)	(6)	(0)	(3)	(4)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(164)	(25)	--	--	--	--	(15)	(2)
Harvesting	--	--	--	--	(14)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	40	8	--	--	--	--	4	1
Provident Irrigation District Subtotal	(4)	(73)	(96)	(24)	(144)	(25)	(0)	(3)	(4)	(1)	(13)	(2)
Reclamation District 108												
Exhaust Emissions	(8)	(148)	(195)	(48)	(12)	(12)	(0)	(6)	(8)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(332)	(50)	--	--	--	--	(30)	(4)
Harvesting	--	--	--	--	(28)	(4)	--	--	--	--	(3)	(0)
Wind Erosion	--	--	--	--	44	9	--	--	--	--	4	1
Reclamation District 108 Subtotal	(8)	(148)	(195)	(48)	(327)	(57)	(0)	(6)	(8)	(2)	(29)	(5)
Reclamation District 1004												
Exhaust Emissions	(5)	(92)	(122)	(30)	(7)	(7)	(0)	(4)	(5)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(208)	(31)	--	--	--	--	(19)	(3)
Harvesting	--	--	--	--	(17)	(3)	--	--	--	--	(2)	(0)
Wind Erosion	--	--	--	--	35	7	--	--	--	--	3	1
Reclamation District 1004 Subtotal	(5)	(92)	(122)	(30)	(198)	(34)	(0)	(4)	(5)	(1)	(17)	(3)
River Garden Farms												
Exhaust Emissions	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(4)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(166)	(25)	--	--	--	--	(15)	(2)
Harvesting	--	--	--	--	(14)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	5	1	--	--	--	--	0	0
River Garden Farms Subtotal	(4)	(74)	(97)	(24)	(181)	(32)	(0)	(3)	(4)	(1)	(16)	(3)
Sutter Mutual Water Company												
Exhaust Emissions	(7)	(133)	(175)	(44)	(11)	(11)	(0)	(6)	(7)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(299)	(45)	--	--	--	--	(27)	(4)
Harvesting	--	--	--	--	(25)	(4)	--	--	--	--	(2)	(0)
Wind Erosion	--	--	--	--	6	1	--	--	--	--	0	0
Sutter Mutual Water Company Subtotal	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(6)	(7)	(2)	(29)	(5)
Sycamore Mutual Water Company												
Exhaust Emissions	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(3)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(116)	(17)	--	--	--	--	(10)	(2)
Harvesting	--	--	--	--	(10)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	27	5	--	--	--	--	2	0
Sycamore Mutual Water Company Subtotal	(3)	(52)	(68)	(17)	(103)	(18)	(0)	(2)	(3)	(1)	(9)	(1)
T&P Farms												
Exhaust Emissions	(0)	(7)	(9)	(2)	(1)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(15)	(2)	--	--	--	--	(1)	(0)
Harvesting	--	--	--	--	(1)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	3	1	--	--	--	--	0	0
T&P Farms Subtotal	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)

Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Te Velde Revocable Family Trust												
Exhaust Emissions	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(3)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(116)	(17)	--	--	--	--	(10)	(2)
Harvesting	--	--	--	--	(10)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	4	1	--	--	--	--	0	0
Te Velde Revocable Family Trust Subtotal	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(3)	(1)	(11)	(2)
Exhaust Emissions Total	(65)	(1,238)	(1,630)	(406)	(98)	(98)	(3)	(52)	(68)	(17)	(4)	(4)
Land Preparation Total	0	0	0	0	(2,782)	(417)	0	0	0	0	(250)	(38)
Harvesting Total	0	0	0	0	(234)	(35)	0	0	0	0	(21)	(3)
Wind Erosion Total	0	0	0	0	375	75	0	0	0	0	34	7
GRAND TOTAL	(65)	(1,238)	(1,630)	(406)	(2,738)	(475)	(3)	(52)	(68)	(17)	(242)	(38)

Table 83. Summary of Cropland Idling Emissions by County

County	Daily Emissions (lbs/day)						Annual Emissions (tons/yr)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa												
Canal Farms	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(1)	(1)	(0)	(2)	(0)
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(240)	(41)	(0)	(5)	(7)	(2)	(21)	(3)
Lewis Ranch	(1)	(17)	(22)	(6)	(34)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Maxwell Irrigation District	(2)	(37)	(49)	(12)	(73)	(13)	(0)	(2)	(2)	(1)	(6)	(1)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(48)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Provident Irrigation District	(2)	(37)	(48)	(12)	(72)	(12)	(0)	(2)	(2)	(1)	(6)	(1)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(4)	(1)	(14)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Sycamore Mutual Water Company	(3)	(52)	(68)	(17)	(103)	(18)	(0)	(2)	(3)	(1)	(9)	(1)
T&P Farms	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Colusa Subtotal	(22)	(418)	(550)	(137)	(850)	(145)	(1)	(18)	(23)	(6)	(75)	(11)
Glenn												
Glenn-Colusa Irrigation District	(6)	(122)	(160)	(40)	(240)	(41)	(0)	(5)	(7)	(2)	(21)	(3)
Princeton-Codora-Glenn Irrigation District	(1)	(24)	(32)	(8)	(48)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Provident Irrigation District	(2)	(37)	(48)	(12)	(72)	(12)	(0)	(2)	(2)	(1)	(6)	(1)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Glenn Subtotal	(11)	(214)	(281)	(70)	(427)	(73)	(0)	(9)	(12)	(3)	(38)	(6)
Sutter												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Guisti Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pelger Road 1700 LLC	0	0	0	0	0	0	0	0	0	0	0	0
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(3)	(4)	(1)	(15)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(2)	(0)	(6)	(1)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(6)	(7)	(2)	(29)	(5)
Sutter Subtotal	(13)	(249)	(328)	(82)	(606)	(106)	(1)	(10)	(14)	(3)	(54)	(9)
Yolo												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(7)	(9)	(2)	(34)	(6)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(4)	(1)	(14)	(2)
River Garden Farms	(4)	(74)	(97)	(24)	(181)	(32)	(0)	(3)	(4)	(1)	(16)	(3)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(3)	(1)	(11)	(2)
Yolo Subtotal	(19)	(357)	(470)	(117)	(856)	(150)	(1)	(15)	(20)	(5)	(76)	(12)
GRAND TOTAL	(65)	(1,238)	(1,630)	(406)	(2,738)	(475)	(3)	(52)	(68)	(17)	(242)	(38)

Table 84. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution (acre-feet/year)	Cropland Idling/ Crop Shifting (acre-feet/year)	GW Pumping Equivalent (acre-feet/year)	Reduced Daily Emissions (lbs/day)						Reduced Annual Emissions (tons/year)					
				VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Anderson-Cottonwood Irrigation District	4,800	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burroughs Farms	2,000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canal Farms	1,000	635	149	0.25	4.68	6.16	1.53	0.37	0.37	0.01	0.20	0.26	0.06	0.02	0.02
Conaway Preservation Group	0	21,350	5,024	8.31	157.83	207.68	51.75	12.46	12.46	0.35	6.62	8.71	2.17	0.52	0.52
Eastside Mutual Water Company	2,230	1,846	434	0.72	13.63	17.94	4.47	1.08	1.08	0.03	0.57	0.75	0.19	0.05	0.05
Guisti Farms	1,000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Glenn-Colusa Irrigation District	11,300	33,000	7,765	12.84	243.95	320.98	79.99	19.26	19.26	0.54	10.23	13.45	3.35	0.81	0.81
Lewis Ranch	0	2,310	544	0.90	17.09	22.49	5.60	1.35	1.35	0.04	0.72	0.94	0.23	0.06	0.06
Maxwell Irrigation District	3,000	5,000	1,176	1.94	36.95	48.61	12.11	2.92	2.92	0.08	1.55	2.04	0.51	0.12	0.12
Natomas Central Mutual Water Company	20,000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pelger Mutual Water Company	4,670	2,538	597	0.99	18.76	24.68	6.15	1.48	1.48	0.04	0.79	1.03	0.26	0.06	0.06
Pelger Road 1700 LLC	4,400	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	3.50	66.54	87.55	21.82	5.25	5.25	0.15	2.79	3.67	0.91	0.22	0.22
Princeton-Codora-Glenn Irrigation District	5,500	6,600	1,553	2.57	48.79	64.20	16.00	3.85	3.85	0.11	2.05	2.69	0.67	0.16	0.16
Provident Irrigation District	7,000	9,900	2,329	3.85	73.17	96.27	23.99	5.78	5.78	0.16	3.07	4.04	1.01	0.24	0.24
Reclamation District 108	15,000	20,000	4,706	7.78	147.84	194.53	48.48	11.67	11.67	0.33	6.20	8.15	2.03	0.49	0.49
Reclamation District 1004	7,175	12,500	2,941	4.86	92.39	121.57	30.30	7.29	7.29	0.20	3.87	5.10	1.27	0.31	0.31
River Garden Farms	10,000	10,000	2,353	3.89	73.92	97.27	24.24	5.84	5.84	0.16	3.10	4.08	1.02	0.24	0.24
Sutter Mutual Water Company	0	18,000	4,235	7.00	133.05	175.06	43.63	10.50	10.50	0.29	5.58	7.34	1.83	0.44	0.44
Sycamore Mutual Water Company	8,000	7,000	1,647	2.72	51.74	68.08	16.97	4.08	4.08	0.11	2.17	2.85	0.71	0.17	0.17
T&P Farms	1,200	890	209	0.35	6.57	8.64	2.15	0.52	0.52	0.01	0.28	0.36	0.09	0.02	0.02
Te Velde Revocable Family Trust	7,094	6,975	1,641	2.71	51.55	67.83	16.90	4.07	4.07	0.11	2.16	2.84	0.71	0.17	0.17
Total	130,369	167,544	39,421	65.18	1,238.46	1,629.55	406.10	97.77	97.77	2.73	51.91	68.31	17.02	4.10	4.10

Notes:
Pelger Mutual Water District used to estimate emissions for other water agencies.
Engine power rating equal to 250 hp for Pelger Mutual Water District engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
Pelger Mutual Water District engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing
Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

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Fugitive Dust Emissions from Cropland Idling

Table 85. Land Preparation (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Burroughs Farms	Sutter	0	0	0
Canal Farms	Colusa	192	11	1
Conaway Preservation Group	Yolo	6,470	355	32
Eastside Mutual Water Company	Colusa	559	31	3
Guisti Farms	Sutter	0	0	0
Glenn-Colusa Irrigation District	Glenn/Colusa	10,000	548	49
Lewis Ranch	Colusa	700	38	3
Maxwell Irrigation District	Colusa	1,515	83	7
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	42	4
Pelger Road 1700 LLC	Sutter	0	0	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	149	13
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	2,000	110	10
Provident Irrigation District	Glenn/Colusa	3,000	164	15
Reclamation District 108	Colusa/Yolo	6,061	332	30
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	208	19
River Garden Farms	Yolo	3,030	166	15
Sutter Mutual Water Company	Sutter	5,455	299	27
Sycamore Mutual Water Company	Colusa	2,121	116	10
T&P Farms	Colusa	270	15	1
Te Velde Revocable Family Trust	Yolo	2,114	116	10
Total		50,771	2,782	250

Table 86. Harvesting (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Burroughs Farms	Sutter	0	0	0
Canal Farms	Colusa	192	1	0
Conaway Preservation Group	Yolo	6,470	30	3
Eastside Mutual Water Company	Colusa	559	3	0
Guisti Farms	Sutter	0	0	0
Glenn-Colusa Irrigation District	Glenn/Colusa	10,000	46	4
Lewis Ranch	Colusa	700	3	0
Maxwell Irrigation District	Colusa	1,515	7	1
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	4	0
Pelger Road 1700 LLC	Sutter	0	0	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	13	1
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	2,000	9	1
Provident Irrigation District	Glenn/Colusa	3,000	14	1
Reclamation District 108	Colusa/Yolo	6,061	28	3
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	17	2
River Garden Farms	Yolo	3,030	14	1
Sutter Mutual Water Company	Sutter	5,455	25	2
Sycamore Mutual Water Company	Colusa	2,121	10	1
T&P Farms	Colusa	270	1	0
Te Velde Revocable Family Trust	Yolo	2,114	10	1
Total		50,771	234	21

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Table 87. Windblown Dust (Increased Emissions)

		Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
District	County	Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	--	--
Burroughs Farms	Sutter	0	--	--
Canal Farms	Colusa	192	2	0
Conaway Preservation Group	Yolo	6,470	11	1
Eastside Mutual Water Company	Colusa	559	7	1
Guisti Farms	Sutter	0	--	--
Glenn-Colusa Irrigation District	Glenn/Colusa	10,000	132	12
Lewis Ranch	Colusa	700	9	1
Maxwell Irrigation District	Colusa	1,515	20	2
Natomas Central Mutual Water Company	Sacramento/Sutter	0	--	--
Pelger Mutual Water Company	Sutter	769	1	0
Pelger Road 1700 LLC	Sutter	0	--	--
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	3	0
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	2,000	26	2
Provident Irrigation District	Glenn/Colusa	3,000	40	4
Reclamation District 108	Colusa/Yolo	6,061	44	4
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	35	3
River Garden Farms	Yolo	3,030	5	0
Sutter Mutual Water Company	Sutter	5,455	6	0
Sycamore Mutual Water Company	Colusa	2,121	27	2
T&P Farms	Colusa	270	3	0
Te Velde Revocable Family Trust	Yolo	2,114	4	0
Total		50,771	375	34

Note:

Fraction of PM10 (FRPM10) from wind erosion: 0.50
(PM10 Emissions = PM x FRPM10)

Conversions

1 ton = 2,000 pounds
1 year = 365 days
Project duration = 180 days (assumes 6-month crop idling season)

Legend

	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available.
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Yolo County only).
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Sutter County only).

Agricultural Land Preparation

Table 88. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs/Acre-pass)	Crop (lbs/Acre/year)
Alfalfa	Unspecified	Discing	1.25	1.2	4
	Land Maintenance	Land Planing	0.2	12.5	
Almonds	Float	Land Planing	0.25	12.5	3.13
Citrus	Unspecified	Discing	0.06	1.2	0.07
Corn	List & Fertilize	Weeding	1	0.8	6.9
	Mulch Beds	Discing	1	1.2	
	Finish Disc	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Cotton	Land Preparation	Discing	4	1.2	8.9
	Land Maintenance	Land Planing	0.2	12.5	
	Seed Bed Preparation	Weeding	2	0.8	
DryBeans	Land Maintenance	Land Planing	0.2	12.5	7.7
	Chisel	Discing	1	1.2	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Listing	Weeding	1	0.8	
Garbanzo	Chisel	Discing	1	1.2	7.7
	Listing	Weeding	1	0.8	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Garlic	Land Maintenance	Land Planing	0.2	12.5	6.5
	Disc & Roll	Discing	1	1.2	
	Chisel	Discing	1	1.2	
	List	Weeding	1	0.8	
	Shape Beds	Weeding	1	0.8	
Grapes-Raisin	Terrace	Weeding	1	0.8	2.6
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	1	1.2	
	Level (new vineyard)	Land Planing	0.02	12.5	
Grapes-Table	Subsoil	Ripping	0.05	4.6	0.83
	Disc & Furrow-out	Discing	0.5	1.2	
Grapes-Wine	Level (new vineyard)	Land Planing	0.02	12.5	1.5
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	0.75	1.2	
Lettuce*	Land Maintenance	Land Planing	0.2	12.5	12.75
	Disc & Roll	Discing	2/2	1.2	
	Chisel	Discing	2/2	1.2	
	List	Weeding	2/2	0.8	
	Plane	Land Planing	½	12.5	
	Shape Beds & Roll	Weeding	2/2	0.8	
Melon	Plow	Discing	1	1.2	5.7
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Disc	Discing	1	1.2	
No Land Prep.	Unspecified	Discing	0	1.2	0
Onions	List	Weeding	1	0.8	6.5
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Chisel	Discing	1	1.2	
	Disc & Roll	Discing	1	1.2	

Agricultural Land Preparation

Table 88. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs/Acre-pass)	Crop (lbs/Acre/year)
Rice	Chisel	Discing	1	1.2	20
	Land Maintenance	Land Planing	0.2	12.5	
	Post Burn/Harvest Disc	Discing	0.5	1.2	
	Roll	Weeding	1	0.8	
	3 Wheel Plane	Land Planing	1	12.5	
	Harrow Disc	Discing	1	1.2	
	Stubble Disc	Discing	1	1.2	
Safflower	List	Weeding	1	0.8	4.5
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Sugar Beets	Disc	Discing	1	1.2	22.8
	Land Plane	Land Planing	1	12.5	
	Subsoil-deep chisel	Ripping	1	4.6	
	Stubble Disc	Discing	1	1.2	
	List	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
Tomatoes	Bed Preparation	Weeding	2	0.8	10.1
	Land Preparation	Discing	5	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Vegetables	Land Maintenance	Land Planing	0.2	12.5	8.5
	Unspecified	Discing	5	1.2	
Wheat	Stubble Disc	Discing	1	1.2	3.7
	Land Maintenance	Land Planing	0.2	12.5	

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproccresfarmop.htm>.

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
101999	WHEAT ALL	Wheat	Wheat/1	5.8
104999	RYE FOR GRAIN	Wheat	Wheat/1	5.8
106199	RICE, FOR MILLING	Rice	Cotton/2	1.68
106269	FIELD CROP BY PRODUCTS	Cotton	Cotton/20	0.17
108999	FOOD GRAINS, MISC	Corn	Cotton/2	1.68
111559	CORN, WHITE	Corn	Cotton/40	0.08
111991	CORN FOR GRAIN	Corn	Cotton/2	1.68
111992	CORN FOR SILAGE	Corn	Cotton/20	0.17
112999	OATS FOR GRAIN	Wheat	Wheat/1	5.8
113994	BARLEY, MALTING	Wheat	Wheat/1	5.8
113995	BARLEY, FEED	Wheat	Wheat/1	5.8
113999	BARLEY, UNSPECIFIED	Wheat	Wheat/1	5.8
114991	SORGHUM, GRAIN	Wheat	Wheat/1	5.8
121219	COTTON LINT, UPLAND	Cotton	Cotton/1	3.37
121229	COTTON LINT, PIMA	Cotton	Cotton/1	3.37
121299	COTTON LINT, UNSPEC	Cotton	Cotton/1	3.37
132999	SUGAR BEETS	Sugar Beets	Cotton/2	1.68
151999	COTTONSEED	Cotton	Cotton/1	3.37
153999	PEANUTS, ALL	Safflower	Cotton/2	1.68
158269	SAFFLOWER	Safflower	Wheat/1	5.8
158316	SUNFLOWER SEED, PLANTING	Corn	Wheat/1	5.8
158319	SUNFLOWER SEED	Corn	Wheat/1	5.8
158499	JOJOBA	Melon	Cotton/40	0.08
161131	BEANS, LIMAS, LG. DRY	DryBeans	Cotton/2	1.68
161132	BEANS, LIMAS, BABY DRY	DryBeans	Cotton/2	1.68
161199	LIMA BEANS, UNSPECIFIED	DryBeans	Cotton/2	1.68
161717	BEANS, RED KIDNEY	DryBeans	Cotton/2	1.68
161721	BEANS, PINK	DryBeans	Cotton/2	1.68
161741	BEANS, BLACK EYE (PEAS)	DryBeans	Cotton/2	1.68
161742	BEANS, GARBANZO	Garbanzo	Cotton/2	1.68
162399	BEANS, FAVA	DryBeans	Cotton/2	1.68
163999	PEAS, DRY EDIBLE	DryBeans	Cotton/20	0.17
169999	BEANS, UNSPEC. DRY EDIBLE	DryBeans	Cotton/2	1.68
171019	SEED WHEAT	Wheat	Wheat/1	5.8
171049	SEED RYE	Wheat	Wheat/1	5.8
171069	SEED RICE	Rice	Cotton/2	1.68
171129	SEED OATS	Wheat	Wheat/1	5.8
171139	SEED BARLEY	Wheat	Wheat/1	5.8
171519	SEED, COTTON FOR PLANTING	Cotton	Cotton/1	3.37
171582	SEED, SAFFLOWER, PLANTING	Safflower	Wheat/1	5.8
171619	SEED BEANS	DryBeans	Cotton/2	1.68
171639	SEED PEAS	DryBeans	Cotton/20	0.17
171949	SEED, MISC FIELD CROP	Corn	Cotton/20	0.17
171959	SEED, VEG & VINECROP	Vegetables	Cotton/20	0.17
172119	SEED, ALFALFA	Alfalfa	Zero/1	0
172289	CLOVER, UNSPECIFIED SEED	Alfalfa	Zero/1	0
173079	SEED, BERMUDA GRASS	Alfalfa	Zero/1	0
173669	SEED, SUDAN GRASS	Alfalfa	Zero/1	0
173999	SEED, GRASS, UNSPECIFIED	Alfalfa	Zero/1	0
178999	SEED, OTHER (NO FLOWERS)	Alfalfa	Cotton/20	0.17
181999	HAY, ALFALFA	Alfalfa	Zero/1	0

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
188499	HAY, GRAIN	Alfalfa	Cotton/2	1.68
188799	HAY, WILD	Alfalfa	Cotton/2	1.68
188899	HAY, SUDAN	Alfalfa	Zero/1	0
188999	HAY, OTHER UNSPECIFIED	Alfalfa	Cotton/2	1.68
194599	PASTURE, IRRIGATED	No Land	Zero/1	0
194699	PASTURE, RANGE	No Land	Zero/1	0
194799	PASTURE, MISC. FORAGE	No Land	Zero/1	0
195199	SILAGE	Wheat	Cotton/20	0.17
195299	HAY, GREEN CHOP	Alfalfa	Zero/1	0
195399	STRAW	Alfalfa	Wheat/1	5.8
198199	RICE, WILD	Rice	Cotton/2	1.68
198999	FIELD CROPS, UNSPEC.	Corn	Cotton/20	0.17
201119	ORANGES, NAVEL	Citrus	Cotton/40	0.08
201519	ORANGES, VALENCIAS	Citrus	Cotton/40	0.08
201999	ORANGES, UNSPECIFIED	Citrus	Cotton/40	0.08
202999	GRAPEFRUIT, ALL	Citrus	Cotton/40	0.08
203999	TANGERINES & MANDARINS	Citrus	Cotton/40	0.08
204999	LEMONS, ALL	Citrus	Cotton/40	0.08
205999	LIMES, ALL	Citrus	Cotton/40	0.08
206999	TANGELOS	Citrus	Cotton/40	0.08
207999	KUMQUATS	Citrus	Cotton/40	0.08
208059	CITRUS, MISC BY-PROD	Citrus	Cotton/40	0.08
209999	CITRUS, UNSPECIFIED	Citrus	Cotton/40	0.08
211999	APPLES, ALL	Citrus	Cotton/40	0.08
212199	PEACHES, FREESTONE	Citrus	Cotton/40	0.08
212399	PEACHES, CLINGSTONE	Citrus	Cotton/40	0.08
212999	PEACHES, UNSPECIFIED	Citrus	Cotton/40	0.08
213199	CHERRIES, SWEET	Citrus	Cotton/40	0.08
214199	PEARS, BARLETT	Citrus	Cotton/40	0.08
214899	PEARS, ASIAN	Citrus	Cotton/40	0.08
214999	PEARS, UNSPECIFIED	Citrus	Cotton/40	0.08
215199	PLUMS	Citrus	Cotton/40	0.08
215399	PLUMCOTS	Citrus	Cotton/40	0.08
215999	PRUNES, DRIED	Citrus	Cotton/40	0.08
216199	GRAPES, TABLE	Grapes-Table	Cotton/20	0.17
216299	GRAPES, WINE	Grapes-Wine	Cotton/20	0.17
216399	GRAPES, RAISIN	Grapes-Raisin	Cotton/20	0.17
216999	GRAPES, UNSPECIFIED	Grapes-Wine	Cotton/20	0.17
217999	APRICOTS, ALL	Citrus	Cotton/40	0.08
218199	NECTARINES	Citrus	Cotton/40	0.08
218299	PERSIMMONS	Citrus	Cotton/40	0.08
218399	POMEGRANATES	Citrus	Cotton/40	0.08
218499	QUINCE	Citrus	Cotton/40	0.08
218839	CHERIMOYAS	Citrus	Cotton/40	0.08
218889	ORCHARD BIOMASS	Almonds	Cotton/40	0.08
218899	FRUITS & NUTS, UNSPEC.	Citrus	Cotton/40	0.08
221999	AVOCADOS, ALL	Citrus	Cotton/40	0.08
224999	DATES	Citrus	Almonds/20	2.04
225999	FIGS, DRIED	Citrus	Almonds/20	2.04
226999	OLIVES	Citrus	Cotton/40	0.08
228019	GUAVAS	Citrus	Cotton/40	0.08

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
229999	KIWIFRUIT	Citrus	Cotton/40	0.08
230639	BERRIES, BLACKBERRIES	Grapes-Table	Cotton/40	0.08
230869	BERRIES, BOYSENBERRIES	Grapes-Table	Cotton/40	0.08
234799	BERRIES, LOGANBERRIES	Grapes-Table	Cotton/40	0.08
236199	BERRIES, RASPBERRIES	Grapes-Table	Cotton/40	0.08
237199	STRAWBERRIES, FRESH MKT	Melon	Cotton/40	0.08
237299	STRAWBERRIES, PROC	Melon	Cotton/40	0.08
237999	STRAWBERRIES, UNSPECIFIED	Melon	Cotton/40	0.08
239999	BERRIES, BUSH, UNSPECIFIED	Grapes-Table	Cotton/40	0.08
261999	ALMONDS, ALL	Almonds	Almonds/1	40.77
263999	WALNUTS, ENGLISH	Almonds	Almonds/1	40.77
264999	PECANS	Almonds	Almonds/10	4.08
265999	WALNUTS, BLACK	Almonds	Almonds/1	40.77
266999	CHESTNUTS	Almonds	Almonds/10	4.08
267999	MACADAMIA NUT	Almonds	Almonds/10	4.08
268079	PISTACHIOS	Almonds	Almonds/10	4.08
268099	ALMOND HULLS	Almonds	Almonds/1	40.77
301999	ARTICHOKES	Melon	Cotton/40	0.08
302199	ASPARAGUS, FRESH MKT	Melon	Cotton/2	1.68
302299	ASPARAGUS, PROC	Melon	Cotton/2	1.68
302999	ASPARAGUS, UNSPECIFIED	Melon	Cotton/2	1.68
303999	BEANS, GREEN LIMAS	DryBeans	Cotton/2	1.68
304199	BEANS, SNAP FR MKT	DryBeans	Cotton/20	0.17
304299	BEANS, SNAP PROC	DryBeans	Cotton/20	0.17
304399	BEANS FRESH UNSPECIFIED	DryBeans	Cotton/20	0.17
304999	BEANS, UNSPECIFIED SNAP	DryBeans	Cotton/20	0.17
305999	BEETS, GARDEN	Sugar Beets	Cotton/2	1.68
306999	RAPINI	Sugar Beets	Cotton/40	0.08
307189	BROCCOLI,FOOD SERV	Vegetables	Cotton/40	0.08
307199	BROCCOLI, FR MKT	Vegetables	Cotton/40	0.08
307299	BROCCOLI, PROC	Vegetables	Cotton/40	0.08
307919	BROCCOLI, UNSPECIFIED	Vegetables	Cotton/40	0.08
308999	BRUSSELS SPROUTS	Melon	Cotton/40	0.08
309999	CABBAGE, CH. & SPECIALTY	Lettuce	Cotton/40	0.08
310999	CABBAGE, HEAD	Lettuce	Cotton/40	0.08
313189	CARROTS, FOOD SERV	Sugar Beets	Cotton/20	0.17
313199	CARROTS, FR MKT	Sugar Beets	Cotton/20	0.17
313299	CARROTS, PROC	Sugar Beets	Cotton/20	0.17
313999	CARROTS, UNSPECIFIED	Sugar Beets	Cotton/20	0.17
314189	CAULIFLOWER, FOOD SERV	Vegetables	Cotton/40	0.08
314199	CAULIFLOWER, FR MKT	Vegetables	Cotton/40	0.08
314299	CAULIFLOWER, PROC	Vegetables	Cotton/40	0.08
314999	CAULIFLOWER, UNSPECIFIED	Vegetables	Cotton/40	0.08
316189	CELERY, FOOD SERV	Lettuce	Cotton/40	0.08
316199	CELERY, FR MKT	Lettuce	Cotton/40	0.08
316299	CELERY, PROC	Lettuce	Cotton/40	0.08
316999	CELERY, UNSPECIFIED	Lettuce	Cotton/40	0.08
318999	RADICCHIO	Lettuce	Cotton/40	0.08
320999	CHIVES	Lettuce	Cotton/40	0.08
322999	COLLARD GREENS	Lettuce	Cotton/40	0.08
323999	CORN, SWEET ALL	Corn	Cotton/40	0.08

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
325999	CUCUMBERS	Vegetables	Cotton/40	0.08
330999	EGGPLANT, ALL	Vegetables	Cotton/40	0.08
331999	ENDIVE, ALL	Lettuce	Cotton/40	0.08
332999	ESCAROLE, ALL	Lettuce	Cotton/40	0.08
333999	ANISE (FENNEL)	Lettuce	Cotton/2	1.68
335999	GARLIC, ALL	Garlic	Cotton/2	1.68
337999	KALE	Lettuce	Cotton/40	0.08
338999	KOHLRABI	Lettuce	Cotton/40	0.08
339196	LETTUCE, BULK SALAD PRODS.	Lettuce	Cotton/40	0.08
339999	LETTUCE, UNSPECIFIED	Lettuce	Cotton/40	0.08
340999	LETTUCE, HEAD	Lettuce	Cotton/40	0.08
341999	LETTUCE, ROMAINE	Lettuce	Cotton/40	0.08
342999	LETTUCE, LEAF	Lettuce	Cotton/40	0.08
343999	MELON, CANTALOUPE	Melon	Cotton/40	0.08
348999	MELON, HONEYDEW	Melon	Cotton/40	0.08
354299	MELON, UNSPECIFIED	Melon	Cotton/40	0.08
354999	MELON, WATER MELONS	Melon	Cotton/40	0.08
355999	MUSHROOMS	No Land Prep.	Zero/1	0
356999	MUSTARD	Lettuce	Cotton/40	0.08
357999	OKRA	Lettuce	Cotton/40	0.08
358999	ONIONS	Onions	Cotton/2	1.68
359999	PARSLEY	Lettuce	Cotton/40	0.08
361299	PEAS, GREEN, PROCESSING	DryBeans	Cotton/20	0.17
361999	PEAS, GREEN, UNSPECIFIED	DryBeans	Cotton/20	0.17
363999	PEPPERS, BELL	Tomatoes	Cotton/40	0.08
364999	PEPPERS, CHILI, HOT	Tomatoes	Cotton/40	0.08
366999	PUMPKINS	Melon	Cotton/20	0.17
367999	RADISHES	Sugar Beets	Cotton/40	0.08
368999	RHUBARB	Lettuce	Cotton/40	0.08
370999	RUTABAGAS	Sugar Beets	Cotton/2	1.68
372999	ONIONS, GREEN & SHALLOTS	Onions	Cotton/40	0.08
374189	SPINACH, FOOD SERV	Lettuce	Cotton/40	0.08
374199	SPINACH, FR MKT	Lettuce	Cotton/40	0.08
374299	SPINACH, PROC	Lettuce	Cotton/40	0.08
374999	SPINACH UNSPECIFIED	Lettuce	Cotton/40	0.08
375999	SQUASH	Melon	Cotton/20	0.17
376999	SWISSCHARD	Lettuce	Cotton/40	0.08
378199	TOMATOES, FRESH MARKET	Tomatoes	Cotton/40	0.08
378299	TOMATOES, PROCESSING	Tomatoes	Cotton/20	0.17
378999	TOMATOES, UNSPECIFIED	Tomatoes	Cotton/20	0.17
380999	TURNIPS, ALL	Sugar Beets	Cotton/2	1.68
381999	GREENS, TURNIP & MUSTARD	Lettuce	Cotton/40	0.08
387999	LEEKs	Onions	Cotton/40	0.08
391999	POTATOES, IRISH ALL	Sugar Beets	Cotton/2	1.68
392999	SWEET POTATOES	Sugar Beets	Cotton/2	1.68
393999	HORSERADISH	Onions	Cotton/40	0.08
394199	SALAD GREENS NEC	Lettuce	Cotton/40	0.08
394999	PEAS, EDIBLE POD (SNOW)	DryBeans	Cotton/20	0.17
395999	VEGETABLES, ORIENTAL, ALL	Vegetables	Cotton/40	0.08
396999	SPROUTS, ALFALFA & BEAN	Lettuce	Cotton/40	0.08
398199	CUCUMBERS, GREENHOUSE	No Land Prep.	Zero/1	0

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
398299	TOMATOES, GREENHOUSE	No Land Prep.	Zero/1	0
398399	TOMATOES, CHERRY	Tomatoes	Cotton/40	0.08
398499	TOMATILLO	Tomatoes	Cotton/40	0.08
398559	CILANTRO	Lettuce	Cotton/40	0.08
398599	SPICES AND HERBS	Lettuce	Cotton/40	0.08
398899	VEGETABLES, BABY	Vegetables	Cotton/40	0.08
398999	VEGETABLES, UNSPECIFIED	Vegetables	Cotton/20	0.17
832919	POTATOES SEED	Sugar Beets	Cotton/2	1.68
892999	NURSERY TURF	No Land Prep.	Zero 1	0

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproccresfarmop.htm>.

Windblown Dust - Agricultural Lands

Table 90. Windblown Dust - Agricultural Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.020478	279,178.00	5,717.07
	San Benito	0.015936	50,009.00	796.96
	Santa Cruz	0.002485	14,873.00	36.97
SCC	San Luis Obispo	0.006876	109,694.00	754.2
	Santa Barbara	0.00319	80,732.00	257.56
	Ventura	0.018418	54,568.00	1,005.02
SED	Imperial	0.141666	490,409.00	69,474.43
SV	Fresno	0.013761	864,164.00	11,891.35
	Kern	0.008662	408,313.48	3,536.73
	Kings	0.012856	473,817.00	6,091.62
	Madera	0.008032	141,617.00	1,137.47
	Merced	0.013659	364,804.00	4,982.86
	San Joaquin	0.003527	387,278.00	1,365.96
	Stanislaus	0.009052	229,805.00	2,080.26
	Tulare	0.004693	471,664.00	2,213.29
SV	Butte	0.001154	116,869.00	134.87
	Colusa	0.004702	229,747.00	1,080.31
	Glenn	0.004957	186,067.00	922.39
	Placer	0.002172	6,962.90	15.12
	Sacramento	0.002479	117,770.00	291.92

Note:

Fraction of PM10 (FRPM10): 0.50

(PM10 Emissions = PM x FRPM10)

Table 91. Windblown Dust - Pasture Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.00110562	1,108,000	1,225.03
	San Benito	0.00109336	512,000	559.8
	Santa Cruz	0.0001605	8,000	1.28
SCC	Santa Barbara	0.00021801	602,913	131.44
	San Luis Obispo	0.00046964	1,102,500	517.78
	Ventura	0.00050356	210,918	106.21
SED	Imperial	0.00867346	158,449	1,374.30
SV	Fresno	0.00149089	907,300	1,352.69
	Kern	0.00082834	1,527,603	1,265.37
	Kings	0.00146875	142,777	209.7
	Madera	0.00116178	421,000	489.11
	Merced	0.00155578	642,700	999.9
	San Joaquin	0.0005228	167,700	87.67
	Stanislaus	0.00107875	434,300	468.5
	Tulare	0.00063424	713,400	452.47
SV	Butte	0.00014292	288,500	41.23
	Colusa	0.00046444	181,900	84.48
	Glenn	0.00048846	256,575	125.33
	Placer	0.00026499	65,656	17.4
	Sacramento	0.00019538	118,000	23.05
	Shasta	0.00034146	459,000	156.73
	Solano	0.00039453	131,360	51.83
	Sutter	0.00037084	71,500	26.51
	Tehama	0.00035146	955,350	335.76
	Yolo	0.00061919	136,870	84.75
	Yuba	0.00023892	207,600	49.6

Note:

Fraction of PM10 (FRPM10): 0.50

(PM10 Emissions = PM x FRPM10)

Table 92. County Size

County	Area (acres)	
	Non-Pasture	Pasture
Butte	n/a	n/a
Colusa	n/a	n/a
Fresno	n/a	n/a
Glenn	n/a	n/a
Imperial	n/a	n/a
Kern	n/a	n/a
Kings	n/a	n/a
Madera	n/a	n/a
Merced	n/a	n/a
Monterey	n/a	n/a
Placer	n/a	n/a
Sacramento	n/a	n/a
San Benito	n/a	n/a
San Joaquin	n/a	n/a
San Luis Obispo	n/a	n/a
Santa Barbara	n/a	n/a
Santa Cruz	n/a	n/a
Shasta	n/a	n/a
Solano	n/a	n/a
Stanislaus	n/a	n/a
Sutter	n/a	n/a
Tehama	n/a	n/a
Tulare	n/a	n/a
Ventura	n/a	n/a
Yolo	n/a	n/a
Yuba	n/a	n/a
Total	0	0

Source:

CARB. 1997. *Emission Inventory Documentation, Section 7.12: Windblown Dust - Agricultural Lands*. July.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproc/fugwbdst.htm>.

Appendix E

Greenhouse Gas Emission Calculations

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Summary of Annual Greenhouse Gas Emissions

Table 1. GHG Emissions from Groundwater Substitution

Water Agency	Emissions (MTCO ₂ e/year)			
	CO ₂	CH ₄	N ₂ O	Total
Anderson-Cottonwood Irrigation District	146	0	1	147
Burroughs Farms	123	0	0	124
Canal Farms	35	0	0	35
Conaway Preservation Group	No Groundwater Substitution			0
Eastside Mutual Water Company	616	1	2	618
Guisti Farms	898	1	3	902
Glenn-Colusa Irrigation District	1,017	1	3	1,021
Lewis Ranch	No Groundwater Substitution			0
Maxwell Irrigation District	527	1	1	528
Natomas Central Mutual Water Company	1,907	3	6	1,915
Pelger Mutual Water Company	253	0	1	255
Pelger Road 1700 LLC	137	0	1	138
Pleasant Grove-Verona Mutual Water Company	1,317	2	4	1,323
Princeton-Cordora-Glenn Irrigation District	1,312	1	3	1,316
Provident Irrigation District	3,476	4	8	3,488
Reclamation District 108	620	1	2	624
Reclamation District 1004	998	1	3	1,002
River Garden Farms	387	1	2	389
Sutter Mutual Water Company	No Groundwater Substitution			0
Sycamore Mutual Water Company	179	0	1	180
T&P Farms	32	0	0	32
Te Velde Revocable Family Trust	195	0	1	196
Total	14,175	17	40	14,232

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Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

AgencyAnderson-Cottonwood Irrigation District

Transfer Volume4,800 acre-feet/year

Table 2. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Shasta	0	2	0	0	2
Tehama	0	0	0	0	0
Total	0	2	0	0	2

Table 3. Anderson-Cottonwood Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Barney Street	Shasta	Electric	2012	200	5,500	85%	4,062	4,010	598,578	n/a	117	0.0084	0.0015	117	0.21	0.46	117
Crowley Gulch	Shasta	Electric	2012	50	1,000	15%	738	4,010	149,645	n/a	29	0.0021	0.0004	29	0.05	0.11	29
Total					6,500	100%	4,800	8,021	748,223	0	146	0.0106	0.0019	146	0.26	0.57	147

Key:

AF = acre-feet

CH4 = methane

CO2 = carbon dioxide

gal/yr = gallons per year

GHG = greenhouse gas

gpm = gallons per minute

hp = horsepower

kW/yr = kilowatt hours per year

MTCO2e = metric tons carbon dioxide equivalent

N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g

1 tonne = 1,000 kg

1 tonne = 1,000,000 g

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 kW = 1.34 hp

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO21

CH425

N2O298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Burroughs Farms
Transfer Volume 2,000 acre-feet/year

Table 4. Burroughs Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	3	0	0	3
Total	0	3	0	0	3

Table 5. Burroughs Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Ag Well #1	Sutter	Electric	2013	200	3,200	42%	831	1,411	210,539	n/a	41	0.0030	0.0005	41	0.07	0.16	41
Ag Well #3	Sutter	Electric	unknown	200	2,500	32%	649	1,411	210,539	n/a	41	0.0030	0.0005	41	0.07	0.16	41
Ag Well #4	Sutter	Electric	unknown	200	2,000	26%	519	1,411	210,539	n/a	41	0.0030	0.0005	41	0.07	0.16	41
Total					7,700	100%	2,000	4,232	631,617	0	123	0.0089	0.0016	123	0.22	0.48	124

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Canal Farms
Transfer Volume 1,000 acre-feet/year

Table 6. Canal Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	1	3
Total	0	2	0	1	3

Table 7. Canal Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(MMBtu/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Dennis Well North	Colusa	Electric	unknown	125	3,500	29%	292	453	42,217	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Dennis Well South	Colusa	Electric	unknown	125	3,500	29%	292	453	42,217	n/a	8	0.0006	0.0001	8	0.01	0.03	8
East Well	Colusa	Propane	unknown	250	5,000	42%	417	453	n/a	288	18	0.0009	0.0002	18	0.02	0.05	18
Total					12,000	100%	1,000	1,358	84,435	288	35	0.0021	0.0004	35	0.05	0.12	35

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Eastside Mutual Water Company
Transfer Volume 2,230 acre-feet/year

Table 8. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 9. Eastside Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
ATW-1	Colusa	Diesel	2006	215	2,500	45%	1,014	2,202	n/a	26,559	270	0.011	0.0022	270	0.28	0.66	271
ATW-2	Colusa	Diesel	2002	275	3,000	55%	1,216	2,202	n/a	33,971	346	0.014	0.0028	346	0.35	0.84	347
Total					5,500	100%	2,230	4,404	0	60,531	616	0.025	0.0050	616	0.63	1.50	618

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Glenn-Colusa Irrigation District
Transfer Volume 11,300 acre-feet/year

Table 10. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	6	0	0	7
Colusa	4	6	0	0	10
Total	5	12	0	0	17

Table 11. Glenn-Colusa Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate		Transfer Volume (AF/year)	Operation		Fuel Consumption (gal/yr)	GHG Emissions						
					(gpm)	(% of Total)		(hours/year)	(kWh/yr)		(tonnes per year)			(MTCO2e per year)			
15-3-22H-3	Colusa	Diesel	unknown	121	800	2%	269	1,826	n/a	12,398	CO2	CH4	N2O	CO2	CH4	N2O	Total
17-2-6B-1	Colusa	Electric	unknown	121	3,000	9%	1,009	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
GRS-22H-1	Glenn	Electric	unknown	121	2,300	7%	774	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
GRS-34N-1	Glenn	Diesel	unknown	121	2,500	7%	841	1,826	n/a	12,398	126	0.0052	0.0010	126	0.13	0.31	127
GRS-35A-2	Glenn	Electric	unknown	121	4,300	13%	1,446	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
GRS-84A-1	Glenn	Electric	unknown	121	2,500	7%	841	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Haymen	Colusa	Diesel	unknown	121	2,250	7%	757	1,826	n/a	12,398	126	0.0052	0.0010	126	0.13	0.31	127
LaCroix 1	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
LaCroix 2	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
LaCroix 3	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Lagrande	Colusa	Diesel	unknown	121	3,000	9%	1,009	1,826	n/a	12,398	126	0.0052	0.0010	126	0.13	0.31	127
Reister 1	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Reister 2	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Reister 3	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Reister 4	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Vann 1	Colusa	Diesel	unknown	121	3,000	9%	1,009	1,826	n/a	12,398	126	0.0052	0.0010	126	0.13	0.31	127
Vann 2	Colusa	Electric	unknown	121	4,000	12%	1,345	1,826	164,925	n/a	32	0.0023	0.0004	32	0.06	0.13	32
Total					33,600	100%	11,300	31,050	1,979,105	61,992	1,017	0.0538	0.0103	1,017	1.34	3.06	1,021

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Guisti Farms
Transfer Volume 1,000 acre-feet/year

Table 12. Guisti Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	0	0	2	2
Total	0	0	0	2	2

Table 13. Guisti Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Guisti Well 1	Sutter	Propane	2015	150	3,200	50%	500	849	n/a	7,141	449	0.0214	0.0043	449	0.54	1.28	451
Guisti Well 2	Sutter	Propane	2015	150	3,200	50%	500	849	n/a	7,141	449	0.0214	0.0043	449	0.54	1.28	451
Total					6,400	100%	1,000	1,697	0	14,282	898	0.0428	0.0086	898	1.07	2.55	902

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Maxwell Irrigation District
Transfer Volume 3,000 acre-feet/year

Table 14. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 15. Maxwell Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
MainWell	Colusa	Diesel	2006	215	3,800	50%	1,500	2,144	n/a	25,857	263	0.0108	0.0022	263	0.27	0.64	264
TuttleWell	Colusa	Diesel	2006	215	3,800	50%	1,500	2,144	n/a	25,857	263	0.0108	0.0022	263	0.27	0.64	264
				Total	7,600	100%	3,000	4,288	0	51,715	527	0.0216	0.0043	527	0.54	1.29	528

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

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Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Natomas Central Mutual Water Company
Transfer Volume 20,000 acre-feet/year

Table 16. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	3	6	0	0	9
Sutter	1	14	0	0	15
Total	4	20	0	0	24

Table 17. Natomas Central Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate		Transfer Volume (AF/year)	Operation (hours/year)	(kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
											CO2	CH4	N2O	CO2	CH4	N2O	Total
L-1	Sutter	Diesel	2013	120	1,600	4%	748	2,538	n/a	17,085	174	0.0071	0.0014	174	0.18	0.42	175
L-2	Sutter	Electric	unknown	30	1,900	4%	888	2,538	56,816	n/a	11	0.0008	0.0001	11	0.02	0.04	11
L-3	Sutter	Electric	unknown	125	1,300	3%	607	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-4	Sutter	Electric	unknown	125	1,300	3%	607	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-6	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-7	Sutter	Electric	unknown	125	1,200	3%	561	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-8	Sutter	Electric	unknown	125	2,800	7%	1,308	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-9	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-10	Sutter	Electric	unknown	125	1,000	2%	467	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-11	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
L-12	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
MAP	Sacramento	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	60	0.0033	0.0006	60	0.08	0.18	61
Ose-1	Sacramento	Diesel	2013	200	1,800	4%	841	2,538	n/a	28,474	290	0.0119	0.0024	290	0.30	0.71	291
Ose-2	Sacramento	Electric	unknown	150	1,600	4%	748	2,538	284,080	n/a	72	0.0040	0.0007	72	0.10	0.22	73
Perry	Sacramento	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	60	0.0033	0.0006	60	0.08	0.18	61
Spangler	Sutter	Electric	unknown	80	2,400	6%	1,121	2,538	151,509	n/a	30	0.0021	0.0004	30	0.05	0.12	30
TNBC Frazer	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
TNBC Bennett North	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
TNBC Atkinson	Sutter	Electric	unknown	125	1,800	4%	841	2,538	236,733	n/a	46	0.0033	0.0006	46	0.08	0.18	46
TNBC Fisherman's Lake	Sacramento	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	60	0.0033	0.0006	60	0.08	0.18	61
TNBC Silva Dairy	Sacramento	Electric	unknown	125	1,100	3%	514	2,538	236,733	n/a	60	0.0033	0.0006	60	0.08	0.18	61
TNBC Betts	Sacramento	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	60	0.0033	0.0006	60	0.08	0.18	61
Dhaliwal	Sacramento	Diesel	2013	180	2,500	6%	1,168	2,538	n/a	25,627	261	0.0107	0.0021	261	0.27	0.64	262
Wiley	Sacramento	Diesel	2012	148	3,000	7%	1,402	2,538	n/a	21,071	215	0.0088	0.0018	215	0.22	0.52	215
Total					42,800	100%	20,000	60,907	4,516,870	92,257	1,907	0.1022	0.0193	1,907	2.56	5.75	1,915

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to max horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency

Pelger Mutual Water Company

Transfer Volume

4,670 acre-feet/year

Table 18. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	1	3	0	0	4
Total	1	3	0	0	4

Table 19. Pelger Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
PMWC#1	Sutter	Electric	unknown	150	3,100	25%	1,149	2,013	225,320	n/a	44	0.0032	0.0006	44	0.08	0.17	44
Well 1 Tucker	Sutter	Electric	unknown	75	3,100	25%	1,149	2,013	112,660	n/a	22	0.0016	0.0003	22	0.04	0.09	22
Well 2 Flopet	Sutter	Diesel	2008	125	2,100	17%	778	2,013	n/a	14,115	144	0.0059	0.0012	144	0.15	0.35	144
Well 3 Klein	Sutter	Electric	unknown	150	4,300	34%	1,594	2,013	225,320	n/a	44	0.0032	0.0006	44	0.08	0.17	44
Total					12,600	100%	4,670	8,051	563,301	14,115	253	0.0138	0.0026	253	0.35	0.78	255

Key:

AF = acre-feet

CH4 = methane

CO2 = carbon dioxide

gal/yr = gallons per year

GHG = greenhouse gas

gpm = gallons per minute

hp = horsepower

kW/yr = kilowatt hours per year

MTCO2e = metric tons carbon dioxide equivalent

N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g

1 tonne = 1,000 kg

1 tonne = 1,000,000 g

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 kW = 1.34 hp

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO21

CH425

N2O298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr

0.855 g/mL

7.13 lb/gal

(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

(Based on MSDS for Hess Diesel Fuel All Types)

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Road 1700 LLC
Transfer Volume 4,400 acre-feet/year

Table 20. Pelger Road 1700 LLC Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	4	0	0	4
Total	0	4	0	0	4

Table 21. Pelger Road 1700 LLC GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
North Well	Sutter	Electric	unknown	125	3,500	28%	1,213	1,882	175,518	n/a	34	0.0025	0.0005	34	0.06	0.13	34
South Well	Sutter	Electric	unknown	125	3,000	24%	1,039	1,882	175,518	n/a	34	0.0025	0.0005	34	0.06	0.13	34
Well #3	Sutter	Electric	unknown	125	3,100	24%	1,074	1,882	175,518	n/a	34	0.0025	0.0005	34	0.06	0.13	34
Well #4	Sutter	Electric	unknown	125	3,100	24%	1,074	1,882	175,518	n/a	34	0.0025	0.0005	34	0.06	0.13	34
Total					12,700	100%	4,400	7,526	702,073	0	137	0.0099	0.0018	137	0.25	0.54	138

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
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Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pleasant Grove-Verona Mutual Water Company
Transfer Volume 15,000 acre-feet/year

Table 22. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 23. Pleasant Grove-Verona Mutual Water Company GHG Emissions

Well	Well Location			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions									
	(County)				Fuel Type	Model Year	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr) - diesel (MMBtu/yr) - propane	(tonnes per year)			(MTCO2e per year)			
														CO2	CH4	N2O	CO2	CH4	N2O	Total
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	2,000	2%	348	946	21,182	n/a	4	0.0003	0.0001	4	0.01	0.02	4			
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	2,000	2%	348	946	43,847	n/a	9	0.0006	0.0001	9	0.02	0.03	9			
Kelly Windmill North Field Well	Sutter	Propane	2014	133	1,750	2%	305	946	n/a	320	20	0.0010	0.0002	20	0.02	0.06	20			
Kelly306	Sutter	Electric	unknown	60	2,600	3%	453	946	42,365	n/a	8	0.0006	0.0001	8	0.01	0.03	8			
MLF Clubhouse B Well	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	41	0.0030	0.0005	41	0.07	0.16	42			
MLF Marsh Well	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	41	0.0030	0.0005	41	0.07	0.16	42			
MLF Monster Well	Sutter	Electric	unknown	60	3,100	4%	540	946	42,365	n/a	8	0.0006	0.0001	8	0.01	0.03	8			
MLF Well #1	Sutter	Electric	unknown	30	2,000	2%	348	946	21,182	n/a	4	0.0003	0.0001	4	0.01	0.02	4			
MLF Well #16	Sutter	Electric	unknown	50	1,700	2%	296	946	35,304	n/a	7	0.0005	0.0001	7	0.01	0.03	7			
MLF Well#11	Sutter	Diesel	2004	250	4,200	5%	732	946	n/a	13,270	135	0.0055	0.0011	135	0.14	0.33	136			
MLF Well#12/17	Sutter	Electric	unknown	50	1,500	2%	261	946	35,304	n/a	7	0.0005	0.0001	7	0.01	0.03	7			
MLF Well#13	Sutter	Electric	2000	215	4,800	6%	836	946	151,806	n/a	30	0.0021	0.0004	30	0.05	0.12	30			
MLF Well#2B	Sutter	Electric	2000	300	2,500	3%	436	946	211,823	n/a	41	0.0030	0.0005	41	0.07	0.16	42			
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	5,000	6%	871	946	28,243	n/a	6	0.0004	0.0001	6	0.01	0.02	6			
Nicholas 72-Acree Field South	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34			
Nicholas BBC Well	Sutter	Electric	unknown	30	2,500	3%	436	946	21,182	n/a	4	0.0003	0.0001	4	0.01	0.02	4			
Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34			
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	2,000	2%	348	946	28,243	n/a	6	0.0004	0.0001	6	0.01	0.02	6			
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	2,000	2%	348	946	28,243	n/a	6	0.0004	0.0001	6	0.01	0.02	6			
Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34			
RiverRanch#19	Sutter	Diesel	2008	99	2,500	3%	436	946	n/a	5,255	54	0.0022	0.0004	54	0.05	0.13	54			
S&O#16	Sutter	Electric	2014	159	2,000	2%	348	946	112,266	n/a	22	0.0016	0.0003	22	0.04	0.09	22			
S&O#17	Sutter	Diesel	1999	101	3,000	3%	523	946	n/a	5,361	55	0.0022	0.0004	55	0.06	0.13	55			
S&O#18A	Sutter	Diesel	1999	101	2,250	3%	392	946	n/a	5,361	55	0.0022	0.0004	55	0.06	0.13	55			
S&O#19	Sutter	Diesel	2007	215	1,800	2%	314	946	n/a	11,412	116	0.0048	0.0010	116	0.12	0.28	117			
S&O#20	Sutter	Propane	2014	154	2,150	2%	375	946	n/a	370	23	0.0011	0.0002	23	0.03	0.07	23			
Willey#1	Sutter	Diesel	2000	168	2,250	3%	392	946	n/a	8,917	91	0.0037	0.0007	91	0.09	0.22	91			
Willey#2	Sutter	Diesel	unknown	250	3,000	3%	523	946	n/a	13,270	135	0.0055	0.0011	135	0.14	0.33	136			
Willey#3	Sutter	Electric	unknown	75	3,000	3%	523	946	52,956	n/a	10	0.0007	0.0001	10	0.02	0.04	10			
Willey#4	Sutter	Diesel	1974	150	2,000	2%	348	946	n/a	7,962	81	0.0033	0.0007	81	0.08	0.20	81			
Will-Lee Well#30	Sutter	Diesel	2000	100	2,500	3%	436	946	n/a	5,308	54	0.0022	0.0004	54	0.06	0.13	54			
Will-Lee Well#31	Sutter	Electric	unknown	50	2,500	3%	436	946	35,304	n/a	7	0.0005	0.0001	7	0.01	0.03	7			
Will-Lee Well#32	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	41	0.0030	0.0005	41	0.07	0.16	42			
Will-Lee Well#33	Sutter	Electric	unknown	75	2,500	3%	436	946	52,956	n/a	10	0.0007	0.0001	10	0.02	0.04	10			
Will-Lee Well#4A	Sutter	Diesel	2000	160	1,500	2%	261	946	n/a	8,493	86	0.0035	0.0007	86	0.09	0.21	87			
Total					86,100	100%	15,000	33,115	1,600,038	n/a	1,317	0.0641	0.0124	1,317	1.60	3.70	1,323			

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Princeton-Codora-Glenn Irrigation District
Transfer Volume 5,500 acre-feet/year

Table 24. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	4	0	0	0	4
Colusa	0	0	0	0	0
Total	4	0	0	0	4

Table 25. Princeton-Codora-Glenn Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Joel Mann	Glenn	Diesel	unknown	170	2,211	25%	1,375	3,377	n/a	32,211	328	0.0134	0.0027	328	0.34	0.80	329
D.Withrow	Glenn	Diesel	unknown	170	2,211	25%	1,375	3,377	n/a	32,211	328	0.0134	0.0027	328	0.34	0.80	329
Chrisman	Glenn	Diesel	unknown	170	2,211	25%	1,375	3,377	n/a	32,211	328	0.0134	0.0027	328	0.34	0.80	329
D.Schmidt	Glenn	Diesel	2013	170	2,211	25%	1,375	3,377	n/a	32,211	328	0.0134	0.0027	328	0.34	0.80	329
Total					8,844	100%	5,500	13,510	0	128,843	1,312	0.0537	0.0107	1,312	1.34	3.20	1,316

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency

Provident Irrigation District

Transfer Volume

7,000 acre-feet/year

Table 26. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	7	0	0	0	7
Colusa	0	0	0	0	0
Total	7	0	0	0	7

Table 27. Provident Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Weller62V	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
L Hansen#1	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
L Hansen#2	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
K Hansen#1	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
K Hansen#2	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
E Weller	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
Weller#4	Glenn	Diesel	unknown	170	1,062	14%	1,000	5,113	n/a	48,765	497	0.0203	0.0041	497	0.51	1.21	498
Total					7,435	100%	7,000	35,792	0	341,354	3,476	0.1423	0.0285	3,476	3.56	8.48	3,488

Key:

AF = acre-feet

CH4 = methane

CO2 = carbon dioxide

gal/yr = gallons per year

GHG = greenhouse gas

gpm = gallons per minute

hp = horsepower

kW/yr = kilowatt hours per year

MTCO2e = metric tons carbon dioxide equivalent

N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g

1 tonne = 1,000 kg

1 tonne = 1,000,000 g

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 kW = 1.34 hp

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1

CH4 25

N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)

7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Reclamation District 108
Transfer Volume 15,000 acre-feet/year

Table 28. Reclamation District 108 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	3	0	0	3
Yolo	0	2	0	0	2
Total	0	5	0	0	5

Table 29. Reclamation District 108 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate		Transfer Volume (AF/year)	Operation		Fuel Consumption (gal/yr)	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
					(gpm)	(% of Total)		(hours/year)	(kWh/yr)		CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #4 Huff	Colusa	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	155	0.0112	0.0020	155	0.28	0.61	156
Well #5 RiggsRanch	Colusa	Electric	unknown	150	1,700	9%	1,335	4,265	477,433	n/a	93	0.0067	0.0012	93	0.17	0.37	94
Well #6 CountyLine	Yolo	Electric	unknown	250	5,900	31%	4,634	4,265	795,721	n/a	155	0.0112	0.0020	155	0.28	0.61	156
Well#1 Heidrick	Colusa	Electric	unknown	100	3,500	18%	2,749	4,265	318,288	n/a	62	0.0045	0.0008	62	0.11	0.24	62
Well#7 Tract 6	Yolo	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	155	0.0112	0.0020	155	0.28	0.61	156
Total					19,100	100%	15,000	21,325	3,182,885	0	620	0.0449	0.0082	620	1.12	2.44	624

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency	Reclamation District 1004
Transfer Volume	7,175 acre-feet/year

Table 30. Reclamation District 1004 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	5	0	0	6
Colusa	17	5	0	0	22
Sutter	0	0	0	0	0
Total	18	10	0	0	28

Table 31. Reclamation District 1004 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate		Transfer Volume (AF/year)	Operation (hours/year)	(kWh/yr)	Consumption (gal/yr)	GHG Emissions						
					CO2	CH4					N2O	(MTCO2e per year)					
												CO2	CH4	N2O	Total		
Barale Well	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	5,800	6%	453	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	3,400	4%	266	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	1,000	1%	78	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch West Well No.97863	Colusa	Electric	unknown	125	2,300	3%	180	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Drumheller Well No.7	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	2,600	3%	203	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	1,300	1%	102	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Gardener No. 374672	Colusa	Diesel	2008	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52
Gardener No. 498178	Colusa	Diesel	2009	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52
Hall Well No. X	Glenn	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Hall Well No.369428	Glenn	Electric	2011	125	4,500	5%	352	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Myers Well #1 No.3457	Glenn	Electric	2006	40	2,200	2%	172	424	12,671	n/a	2	0.0002	0.0000	2	0.00	0.01	2
Myers Well #2 No. 340884	Glenn	Electric	1982	100	4,100	4%	320	424	31,677	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Rancho Caleta No. 726883	Colusa	Diesel	2004	170	4,500	5%	352	424	n/a	4,048	41	0.0017	0.0003	41	0.04	0.10	41
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	4,000	4%	313	424	n/a	4,120	42	0.0017	0.0003	42	0.04	0.10	42
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	4,000	4%	313	424	n/a	3,572	36	0.0015	0.0003	36	0.04	0.09	36
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	4,800	5%	375	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Stone Well #6 No.11334	Colusa	Electric	2006	40	1,800	2%	141	424	12,671	n/a	2	0.0002	0.0000	2	0.00	0.01	2
Wilder Farms Well	Glenn	Electric	unknown	125	2,500	3%	195	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Dan Charter Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Dan Charter Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
GVL Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Well	Colusa	Electric	unknown	125	4,000	4%	313	424	39,596	n/a	8	0.0006	0.0001	8	0.01	0.03	8
Claudia Charter	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
GVL Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
				Total	91,800	100%	7,175	11,885	334,191	91,633	998	0.0429	0.0085	998	1.07	2.53	1,002

Key:
AF = acre-feet
CH₄ = methane
CO₂ = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO₂e = metric tons carbon dioxide equivalent
N₂O = nitrous oxide

Conversion Factors

1 lb =	453.6 g
1 tonne =	1,000 kg
1 tonne =	1,000,000 g
1 MWh =	1,000 kWh
1 GWh =	1,000,000 kWh
1 kW =	1.34 hp
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency River Garden Farms
Transfer Volume 10,000 acre-feet/year

Table 32. River Garden Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	8	0	0	8
Total	0	8	0	0	8

Table 33. River Garden Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Field 65 PW	Yolo	Electric	2008	125	2500	12%	1,226	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 71 PW	Yolo	Electric	2001	125	1700	8%	834	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 98 PW	Yolo	Electric	1963	125	2900	14%	1,422	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 104 PW	Yolo	Electric	2008	125	2500	12%	1,226	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 104-09 PW	Yolo	Electric	2009	125	2990	15%	1,466	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 91-09 PW	Yolo	Electric	2009	125	2840	14%	1,392	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Field 117 PW	Yolo	Electric	2009	125	1965	10%	963	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Shop PW	Yolo	Electric	2009	125	3000	15%	1,471	2,663	248,399	n/a	48	0.0035	0.0006	48	0.09	0.19	49
Total					20,395	100%	10,000	21,303	1,987,190	0	387	0.0281	0.0051	387	0.70	1.52	389

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend	
	Information on engine not available; engine assumed to be electric based on other engines used by water agency.
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Sycamore Mutual Water Company
Transfer Volume 8,000 acre-feet/year

Table 34. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	5	0	0	5
Total	0	5	0	0	5

Table 35. Sycamore Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #15	Colusa	Electric	unknown	125	3,270	15%	1,183	1,966	183,356	n/a	36	0.0026	0.0005	36	0.06	0.14	36
Well #14	Colusa	Electric	unknown	125	3,270	15%	1,183	1,966	183,356	n/a	36	0.0026	0.0005	36	0.06	0.14	36
Well #11	Colusa	Electric	unknown	125	6,409	29%	2,320	1,966	183,356	n/a	36	0.0026	0.0005	36	0.06	0.14	36
Well #2b	Colusa	Electric	unknown	125	4,578	21%	1,657	1,966	183,356	n/a	36	0.0026	0.0005	36	0.06	0.14	36
Well #2a	Colusa	Electric	unknown	125	4,578	21%	1,657	1,966	183,356	n/a	36	0.0026	0.0005	36	0.06	0.14	36
Total					22,104	100%	8,000	9,828	916,778	0	179	0.0129	0.0024	179	0.32	0.70	180

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency T&P Farms
Transfer Volume 1,200 acre-feet/year

Table 36. T&P Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 37. T&P Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
NW-3	Colusa	Electric	unknown	125	3,500	47%	560	869	81,057	n/a	16	0.0011	0.0002	16	0.03	0.06	16
NW-4	Colusa	Electric	unknown	125	4,000	53%	640	869	81,057	n/a	16	0.0011	0.0002	16	0.03	0.06	16
Total					7,500	100%	1,200	1,738	162,115	0	32	0.0023	0.0004	32	0.06	0.12	32

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Te Velde Revocable Family Trust
Transfer Volume 7,094 acre-feet/year

Table 38. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	5	0	0	5
Total	0	5	0	0	5

Table 39. Te Velde Revocable Family Trust GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
GW1	Yolo	Electric	unknown	127	4,656	29%	2,090	2,438	231,042	n/a	45	0.0033	0.0006	45	0.08	0.18	45
GW10	Yolo	Electric	unknown	143	2,833	18%	1,272	2,438	260,150	n/a	51	0.0037	0.0007	51	0.09	0.20	51
GW9	Yolo	Electric	unknown	104	2,400	15%	1,077	2,438	189,200	n/a	37	0.0027	0.0005	37	0.07	0.15	37
GW3	Yolo	Electric	unknown	52	3,715	24%	1,668	2,438	94,600	n/a	18	0.0013	0.0002	18	0.03	0.07	19
GW4	Yolo	Electric	unknown	125	2,200	14%	988	2,438	227,404	n/a	44	0.0032	0.0006	44	0.08	0.17	45
Total					15,804	100%	7,094	12,189	1,002,395	0	195	0.0141	0.0026	195	0.35	0.77	196

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

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Engine Size Summary

Table 40. Engine Power Rating Summary by Fuel Type

Fuel Type	No. Engines	Avg. HP	Max HP	Min HP
Diesel	23	170	250	60
Electric	47	125	300	30
Natural Gas	0	n/a	0	0
Propane	3	180	250	135

GHG Emission Factors

Table 41. GHG Emission Factors for Electric Pumps

County	Utility Company	Emission Factors		
		CO2 (lbs/MWh)	CH4 (lbs/GWh)	N2O (lbs/GWh)
Colusa	Pacific Gas & Electric	429.638	31.12	5.67
Glenn	Pacific Gas & Electric	429.638	31.12	5.67
Sacramento	Sacramento Municipal Utility District	561.08	31.12	5.67
Shasta	Pacific Gas & Electric	429.638	31.12	5.67
Sutter	Pacific Gas & Electric	429.638	31.12	5.67
Tehama	Pacific Gas & Electric	429.638	31.12	5.67
Yolo	Pacific Gas & Electric	429.638	31.12	5.67

Table 42. Utility-Specific CO2 Emission Factors

2012 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO ₂ /MWh)
Sacramento Municipal Utility District	Retail Power	561.08
	Special Power	0.00
	Wholesale Power	803.58
Pacific Gas & Electric	System average	429.64

Source:

The Climate Registry. 2015. *Utility-Specific Emission Factors*. Accessed on: January 07, 2016. Available at:
<http://www.theclimateregistry.org/tools-resources/reporting-protocols/general-reporting-protocol/>

Table 43. Diesel Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	10.18175	kg/gallon	Table 12.1, Distillate Fuel Oil No. 2
CH4	0.003	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
Heat Content	0.139	MMBtu/gallon	Table 12.1, Distillate Fuel Oil No. 2

Source: The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Accessed on: January 7, 2016. Available at:
<http://www.theclimateregistry.org/wp-content/uploads/2015/04/2015-TCR-Default-EF-April-2015-FINAL.pdf>.

Table 44. Natural Gas Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	53.06	kg/MMBtu	Table 12.1, US Weighted Average
CH4	0.001	kg/MMBtu	Table 12.9.1, Natural Gas, Industrial
N2O	0.0001	kg/MMBtu	Table 12.9.1, Natural Gas, Industrial
Heat Content	1,026	Btu/scf	Table 12.1, US Weighted Average

Source: The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Accessed on: January 7, 2016. Available at:
<http://www.theclimateregistry.org/wp-content/uploads/2015/04/2015-TCR-Default-EF-April-2015-FINAL.pdf>.

Table 45. Propane Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	62.87	kg/MMBtu	Table 12.1, Propane (liquid)
CH4	0.003	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
Heat Content	0.091	MMBtu/gal	Table 12.1, Propane (liquid)

Source: The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Accessed on: January 7, 2016. Available at:
<http://www.theclimateregistry.org/wp-content/uploads/2015/04/2015-TCR-Default-EF-April-2015-FINAL.pdf>.

Table 46. Year 2012 eGRID Subregion Emissions - Greenhouse Gases

eGRID subregion acronym	eGRID subregion name	Carbon dioxide (CO2)		Methane (CH4)		Nitrous oxide (N2O)		Carbon dioxide equivalent (CO2e)	
		Emissions (tons)	Total output emission rate (lb/MWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/MWh)
AKGD	ASCC Alaska Grid	3,382,037.0	1,268.73	140,402.7	26.34	40,490.5	7.59	3,389,787.2	1,271.64
AKMS	ASCC Miscellaneous	384,195.8	481.17	29,787.0	18.65	5,666.3	3.55	385,386.8	482.66
AZNM	WECC Southwest	102,534,225.3	1,152.89	3,317,864.6	18.65	2,686,986.1	15.11	102,985,545.7	1,157.96
CAMX	WECC California	67,187,988.1	650.31	6,429,630.8	31.12	1,172,434.9	5.67	67,437,084.4	652.72
ERCT	ERCOT All	205,873,315.5	1,143.04	6,015,952.8	16.7	4,443,235.0	12.33	206,625,056.6	1,147.21
FRCC	FRCC All	118,861,947.3	1,125.35	8,459,346.4	40.05	2,503,826.1	11.85	119,338,507.3	1,129.86
HIMS	HICC Miscellaneous	1,760,031.8	1,200.10	199,673.8	68.08	37,202.0	12.68	1,767,894.6	1,205.46
HIOA	HICC Oahu	5,939,881.8	1,576.38	681,311.9	90.41	162,405.3	21.55	5,972,208.4	1,584.95
MROE	MRO East	21,794,875.8	1,522.57	695,782.7	24.3	731,606.9	25.55	21,915,580.6	1,531.00
MROW	MRO West	145,305,369.2	1,425.15	5,627,262.8	27.6	4,947,215.7	24.26	146,130,871.2	1,433.25
NEWE	NPCC New England New England	38,377,520.5	637.9	8,764,225.4	72.84	1,288,397.3	10.71	38,669,246.4	642.75
NWPP	WECC Northwest	95,734,309.7	665.75	3,622,959.4	12.6	2,983,818.8	10.38	96,234,699.4	669.23
NYCW	NPCC NYC/Westchester	15,851,201.7	696.7	1,160,747.0	25.51	133,430.3	2.93	15,882,764.1	698.08
NYLI	NPCC Long Island	7,280,232.8	1,201.20	947,931.1	78.2	119,618.7	9.87	7,308,726.9	1,205.90
NYUP	NPCC Upstate NY	16,873,346.4	408.8	1,287,300.2	15.59	315,913.7	3.83	16,935,829.7	410.31
RFCE	RFC East	112,888,707.9	858.56	6,954,055.7	26.44	3,020,840.1	11.49	113,429,807.1	862.68
RFCM	RFC Michigan	68,119,780.7	1,569.23	2,635,889.2	30.36	2,093,696.0	24.12	68,471,962.7	1,577.34
RFCW	RFC West	391,126,291.4	1,379.48	9,701,816.8	17.11	12,286,300.3	21.67	393,132,519.0	1,386.55
RMPA	WECC Rockies	57,993,856.1	1,822.65	1,378,226.1	21.66	1,790,072.3	28.13	58,285,775.9	1,831.82
SPNO	SPP North	59,782,627.7	1,721.65	1,403,934.9	20.22	1,885,096.3	27.14	60,089,349.8	1,730.49
SPSO	SPP South	117,500,299.0	1,538.63	3,627,540.2	23.75	3,050,862.7	19.98	118,011,271.9	1,545.32
SRMV	SERC Mississippi Valley	95,886,176.4	1,052.92	3,816,210.1	20.95	1,931,912.9	10.61	96,225,693.1	1,056.65
SRMW	SERC Midwest	113,709,694.8	1,710.75	2,603,196.3	19.58	3,655,614.1	27.5	114,303,633.0	1,719.68
SRSO	SERC South	146,477,427.2	1,149.05	5,777,614.3	22.66	3,948,687.2	15.49	147,150,138.6	1,154.32
SRTV	SERC Tennessee Valley	153,167,116.4	1,337.15	3,982,959.3	17.39	4,761,521.4	20.78	153,946,973.3	1,343.96
SRVC	SERC Virginia/Carolina	135,132,027.1	932.87	6,937,947.2	23.95	4,229,617.5	14.6	135,860,466.3	937.90

Source: U.S. Environmental Protection Agency. 2015. eGRID2012, Summary Tables. October 8. Available online at: http://www.epa.gov/sites/production/files/2015-10/documents/eGRID2012_summarytables_0.pdf [Accessed on January 7, 2016].

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Table 47. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution	Cropland Idling/ Crop Shifting	GW Pumping Equivalent	Annual Emission (MT/year)			Annual Emissions (MTCO2e/year)			
	(acre-feet/year)	(acre-feet/year)	(acre-feet/year)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Anderson-Cottonwood Irrigation District	4,800	--	--	--	--	--	--	--	--	--
Burroughs Farms	2,000	--	--	--	--	--	--	--	--	--
Canal Farms	1,000	635	149	63	0.0035	0.00066	63	0.1	0.2	64
Conaway Preservation Group	--	21,350	5,024	2,133	0.12	0.022	2,133	2.9	6.6	2,143
Pelger Road 1700 LLC	4,400	--	--	--	--	--	--	--	--	--
Eastside Mutual Water Company	2,230	1,846	434	184	0.010	0.0019	184	0.3	0.6	185
Guisti Farms	1,000	--	--	--	--	--	--	--	--	--
Glenn-Colusa Irrigation District	11,300	33,000	7,765	3,297	0.18	0.034	3,297	4.5	10.2	3,312
Lewis Ranch	--	2,310	544	231	0.013	0.0024	231	0.3	0.7	232
Maxwell Irrigation District	3,000	5,000	1,176	499	0.027	0.0052	499	0.7	1.5	502
Natomas Central Mutual Water Company	20,000	--	--	--	--	--	--	--	--	--
Pelger Mutual Water Company	4,670	2,538	597	253	0.014	0.0026	253	0.3	0.8	255
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	899	0.049	0.0093	899	1.2	2.8	903
Princeton-Codora-Glenn Irrigation District	5,500	6,600	1,553	659	0.036	0.0068	659	0.9	2.0	662
Provident Irrigation District	7,000	9,900	2,329	989	0.054	0.010	989	1.3	3.1	993
Reclamation District 108	15,000	20,000	4,706	1,998	0.11	0.021	1,998	2.7	6.2	2,007
Reclamation District 1004	7,175	12,500	2,941	1,249	0.068	0.013	1,249	1.7	3.9	1,254
River Garden Farms	10,000	10,000	2,353	999	0.055	0.010	999	1.4	3.1	1,004
Sutter Mutual Water Company	--	18,000	4,235	1,798	0.098	0.019	1,798	2.5	5.6	1,806
Sycamore Mutual Water Company	8,000	7,000	1,647	699	0.038	0.0072	699	1.0	2.2	702
T&P Farms	1,200	890	209	89	0.0048	0.00092	89	0.1	0.3	89
Te Velde Revocable Family Trust	7,094	6,975	1,641	697	0.038	0.0072	697	1.0	2.2	700
Total	130,369	167,544	39,421	16,739	0.91	0.17	16,739	22.8	51.7	16,813

Notes:
Reclamation District 108 used to estimate emissions for other water agencies.
Engine power rating equal to 140 hp for RD-108 engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
RD-108 engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing
Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

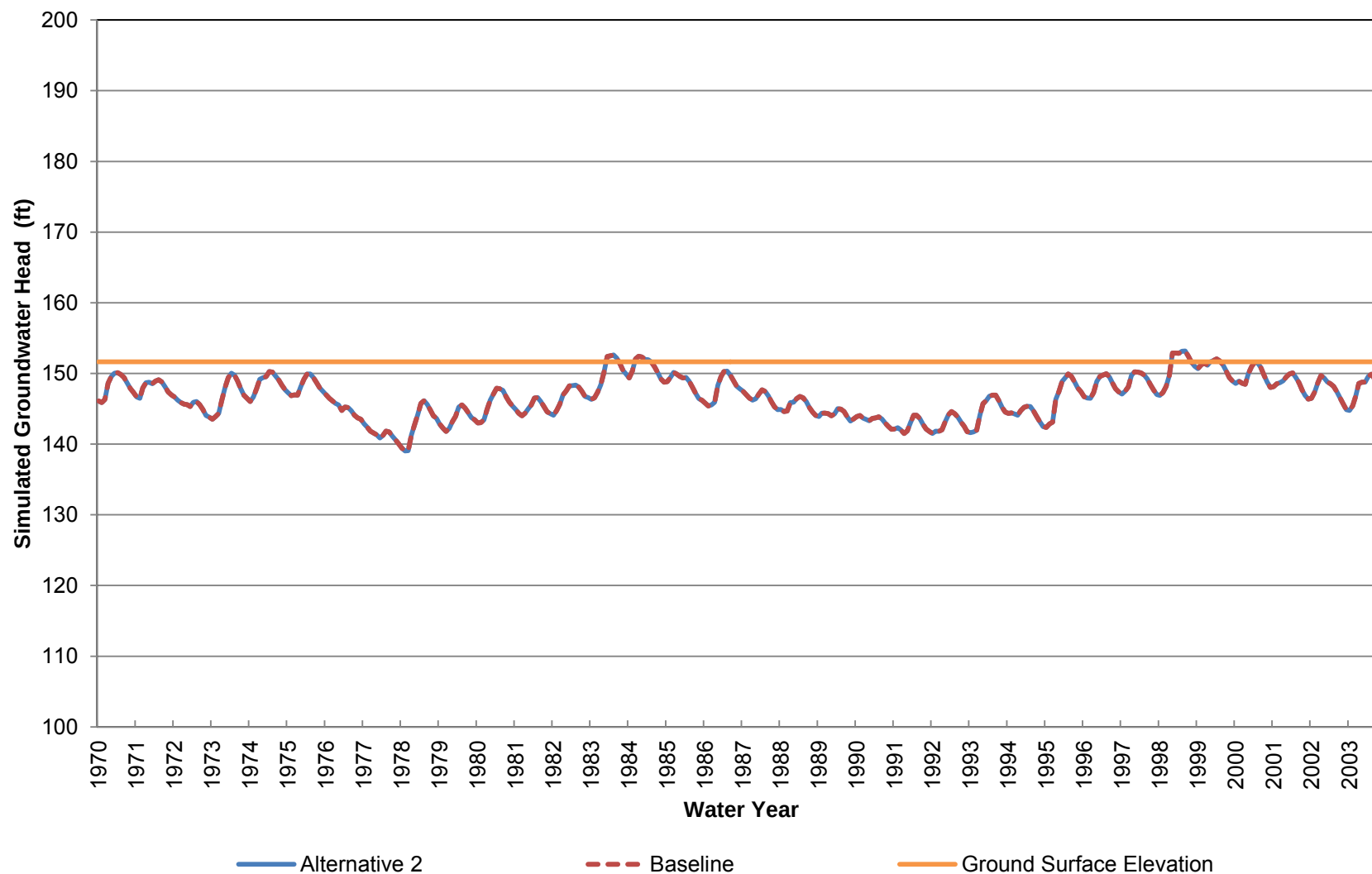
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Appendix F

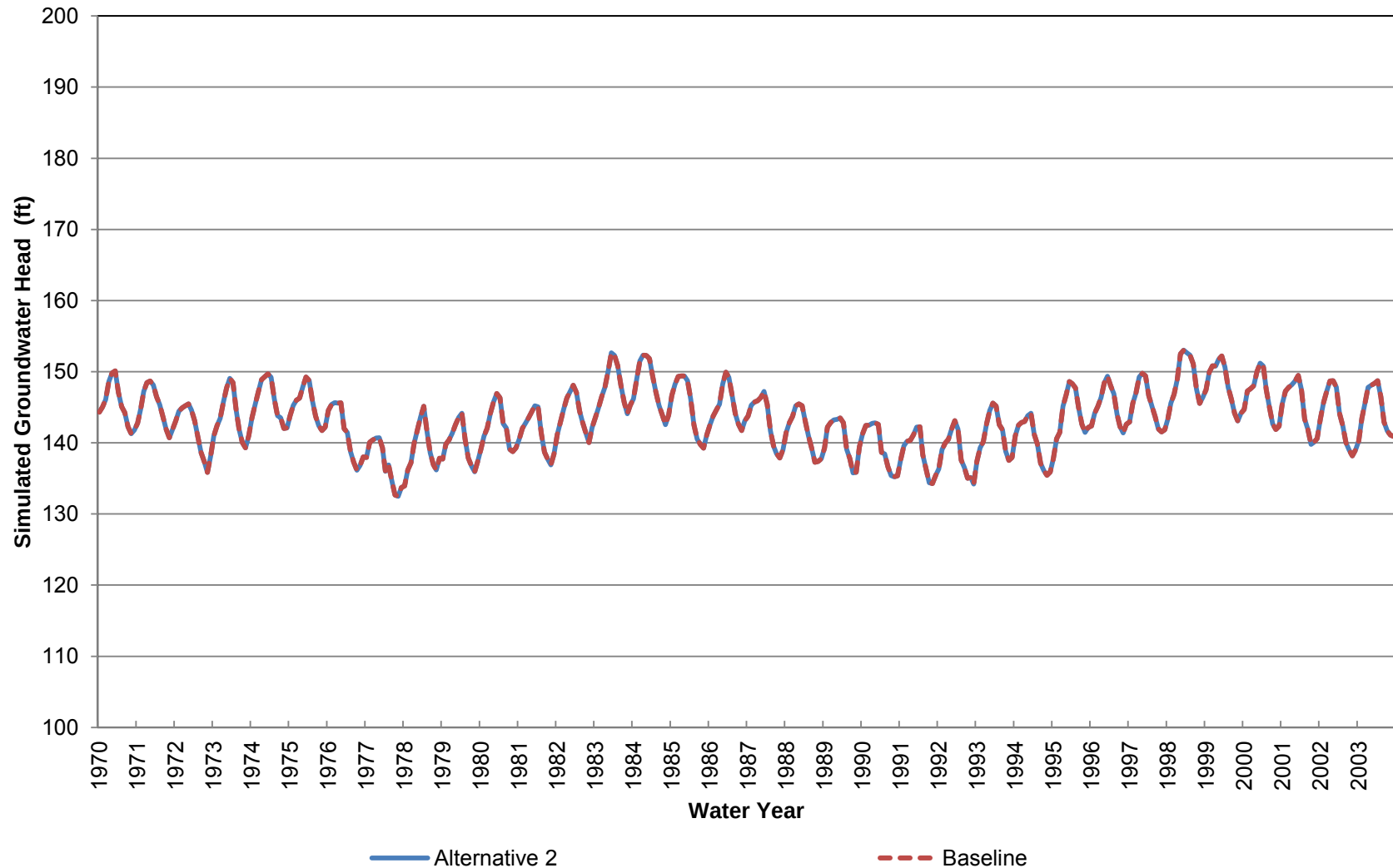
Groundwater Modeling Results

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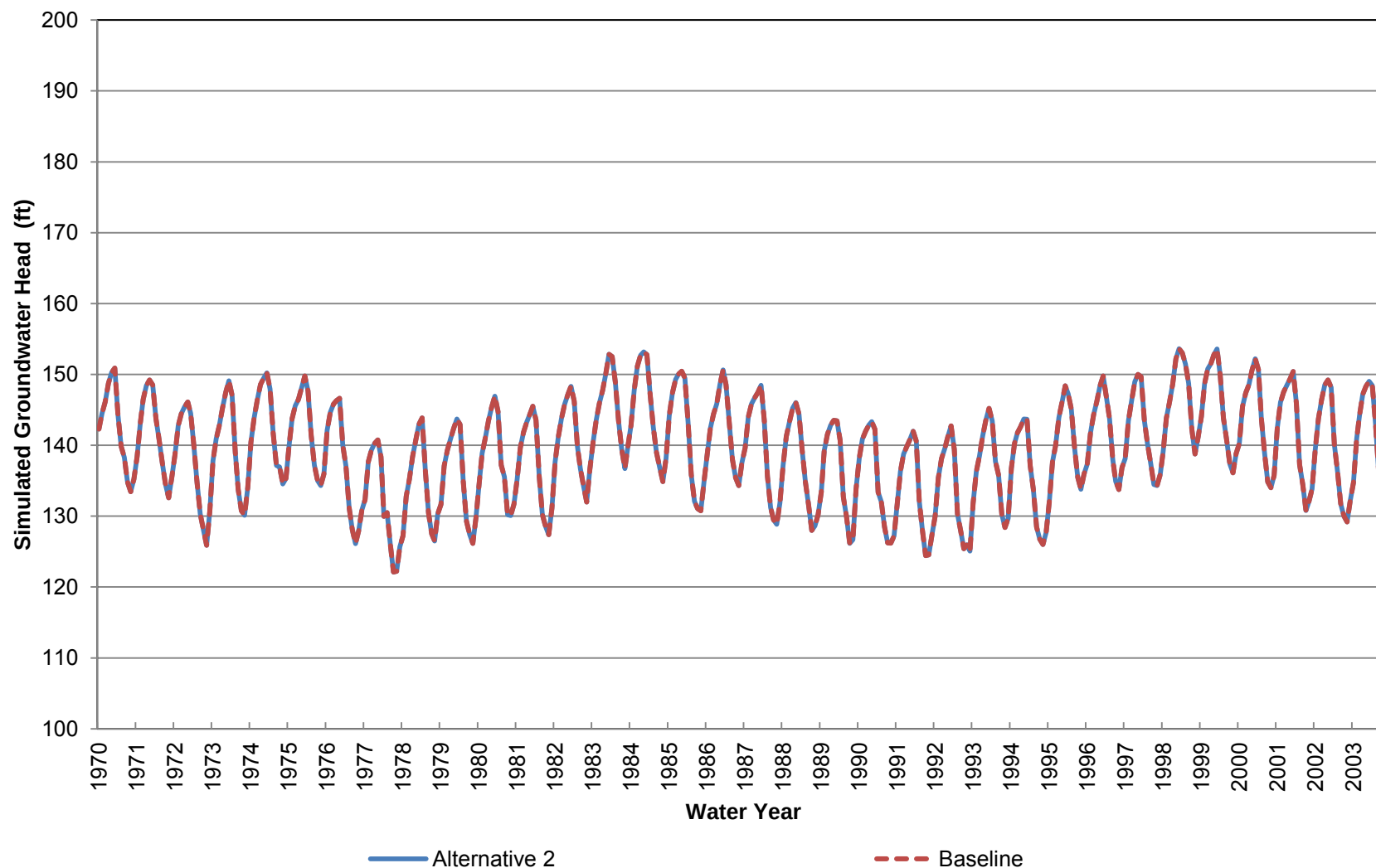
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 1 (Approximately 0-70 ft bgs)



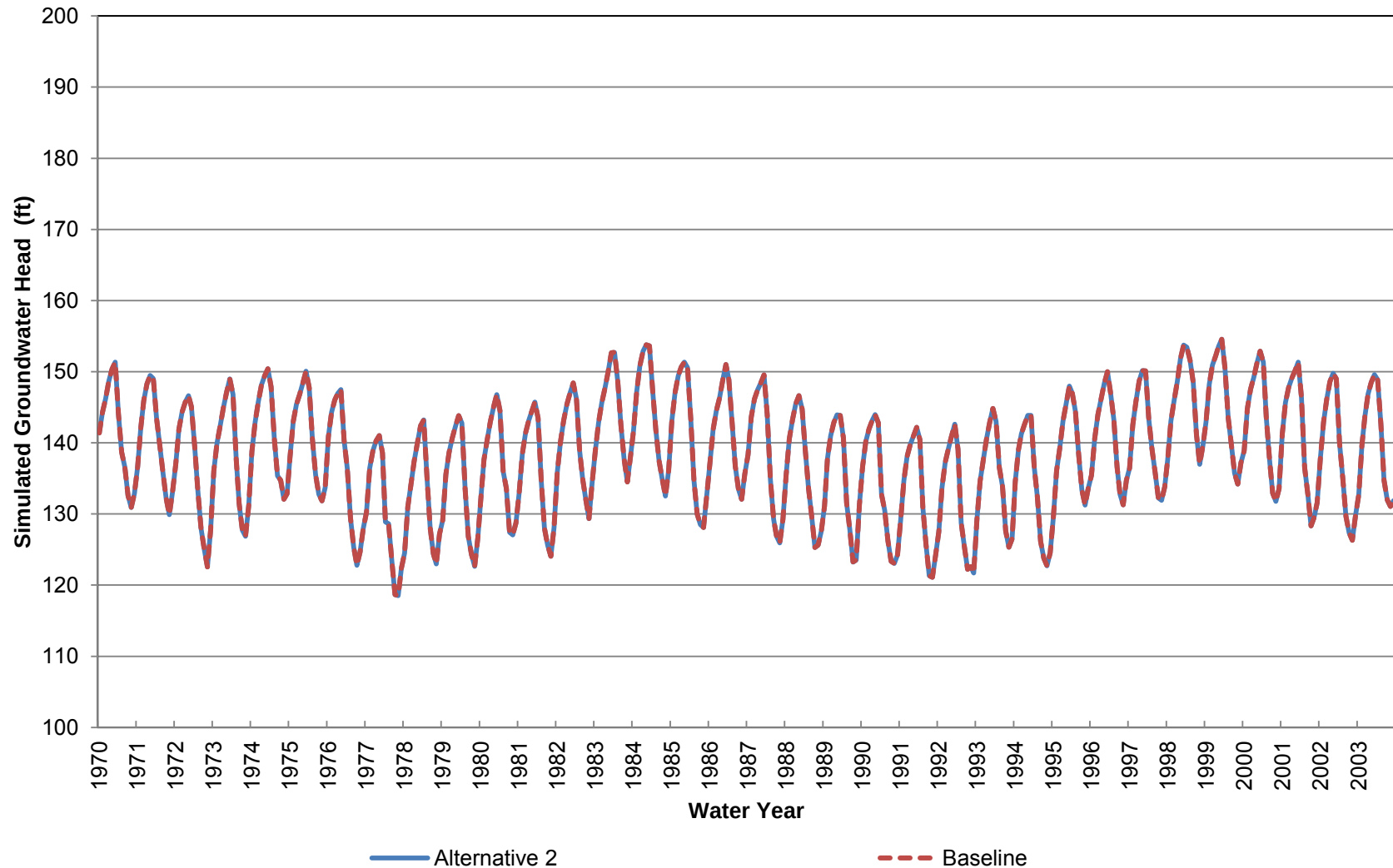
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 70-200 ft bgs)



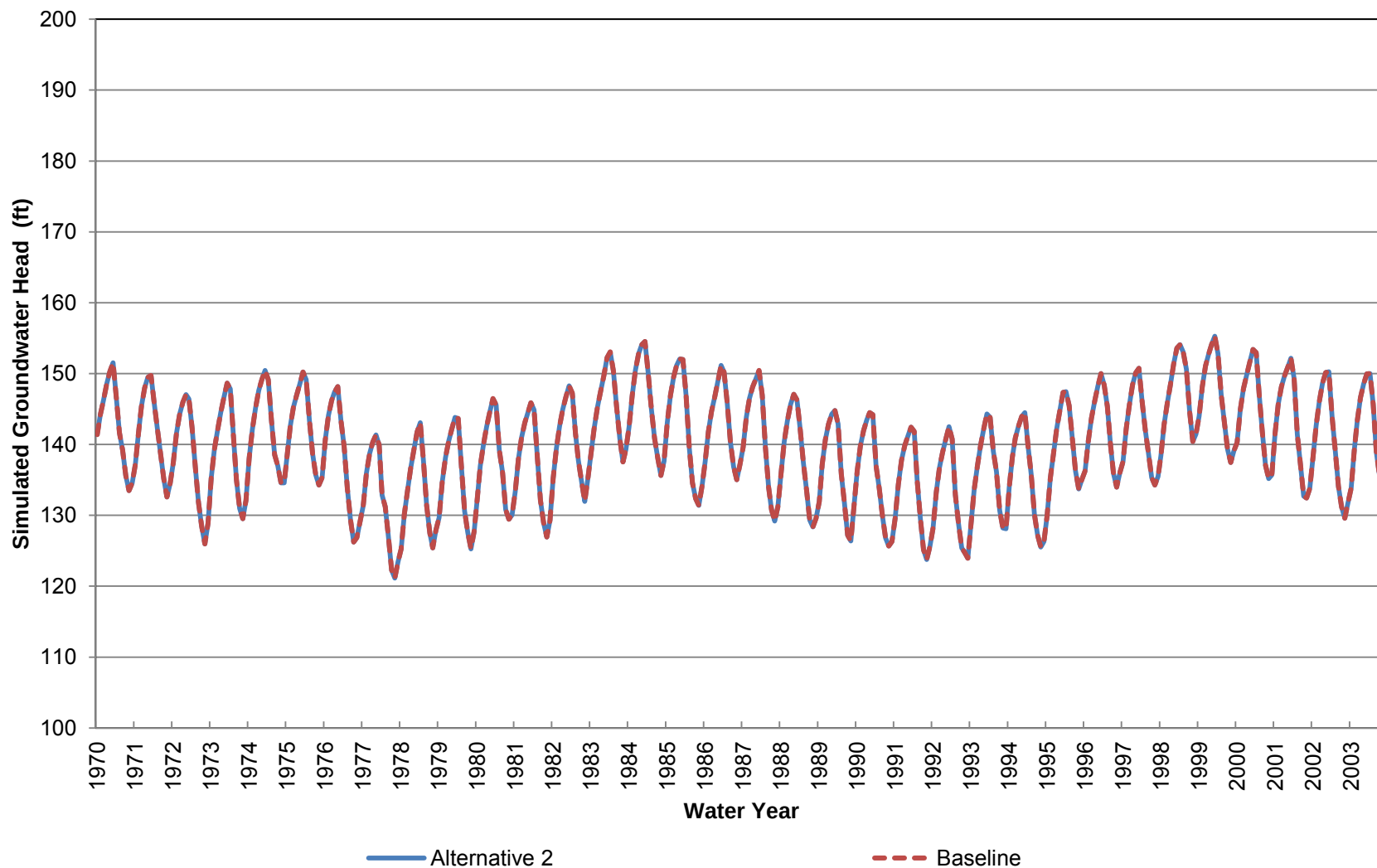
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 200-330 ft bgs)



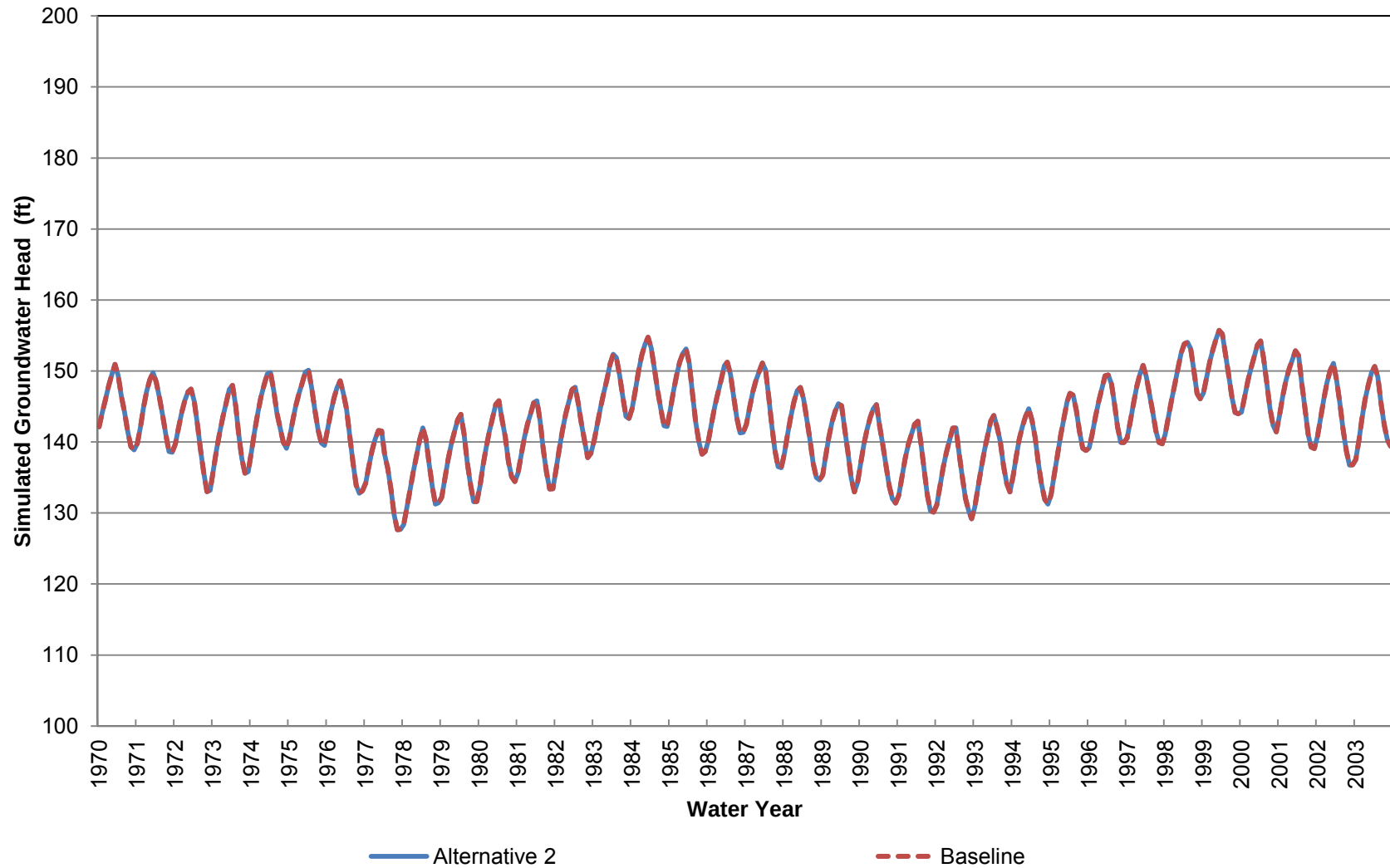
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 330-450 ft bgs)



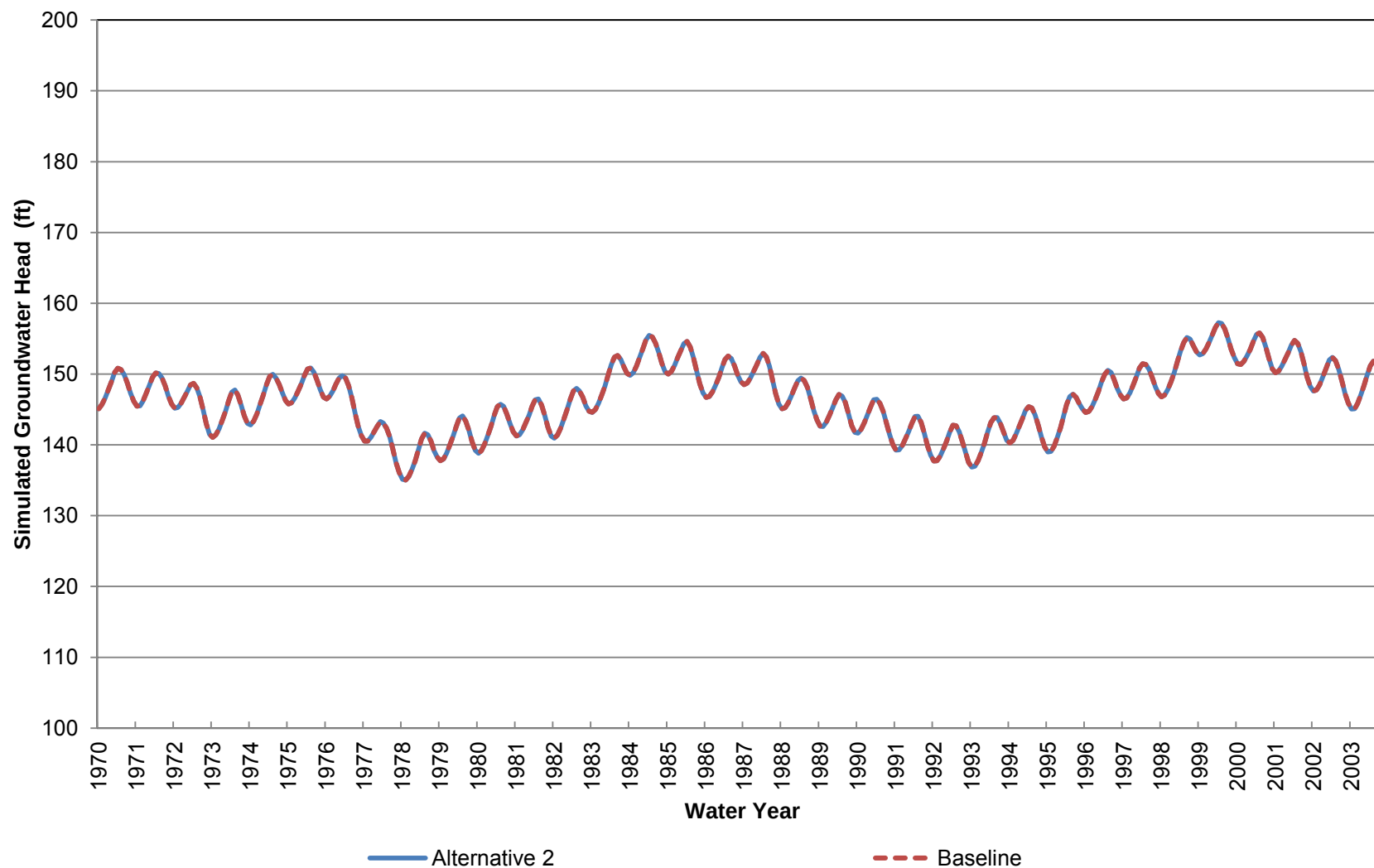
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 450-640 ft bgs)



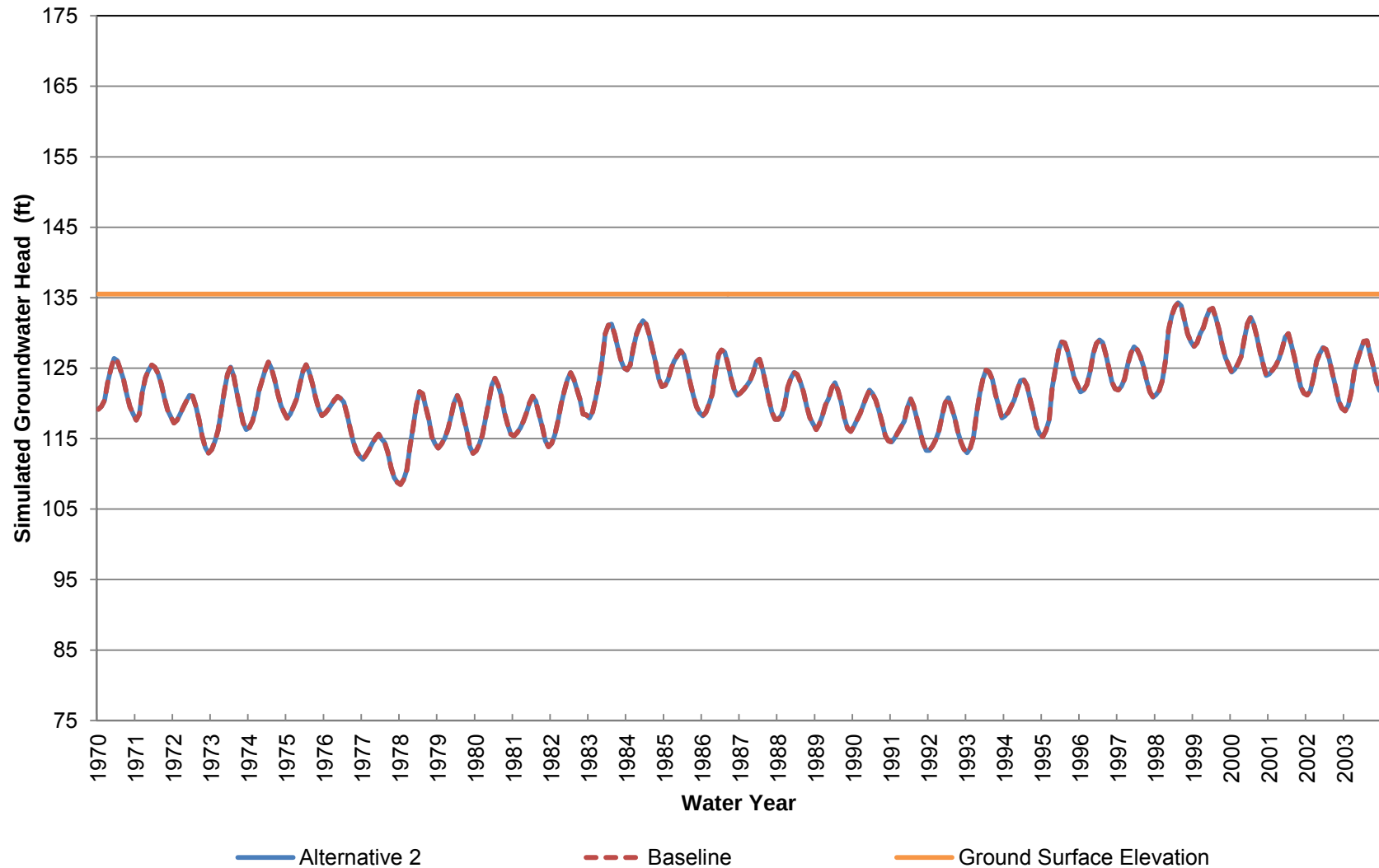
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 640-890 ft bgs)



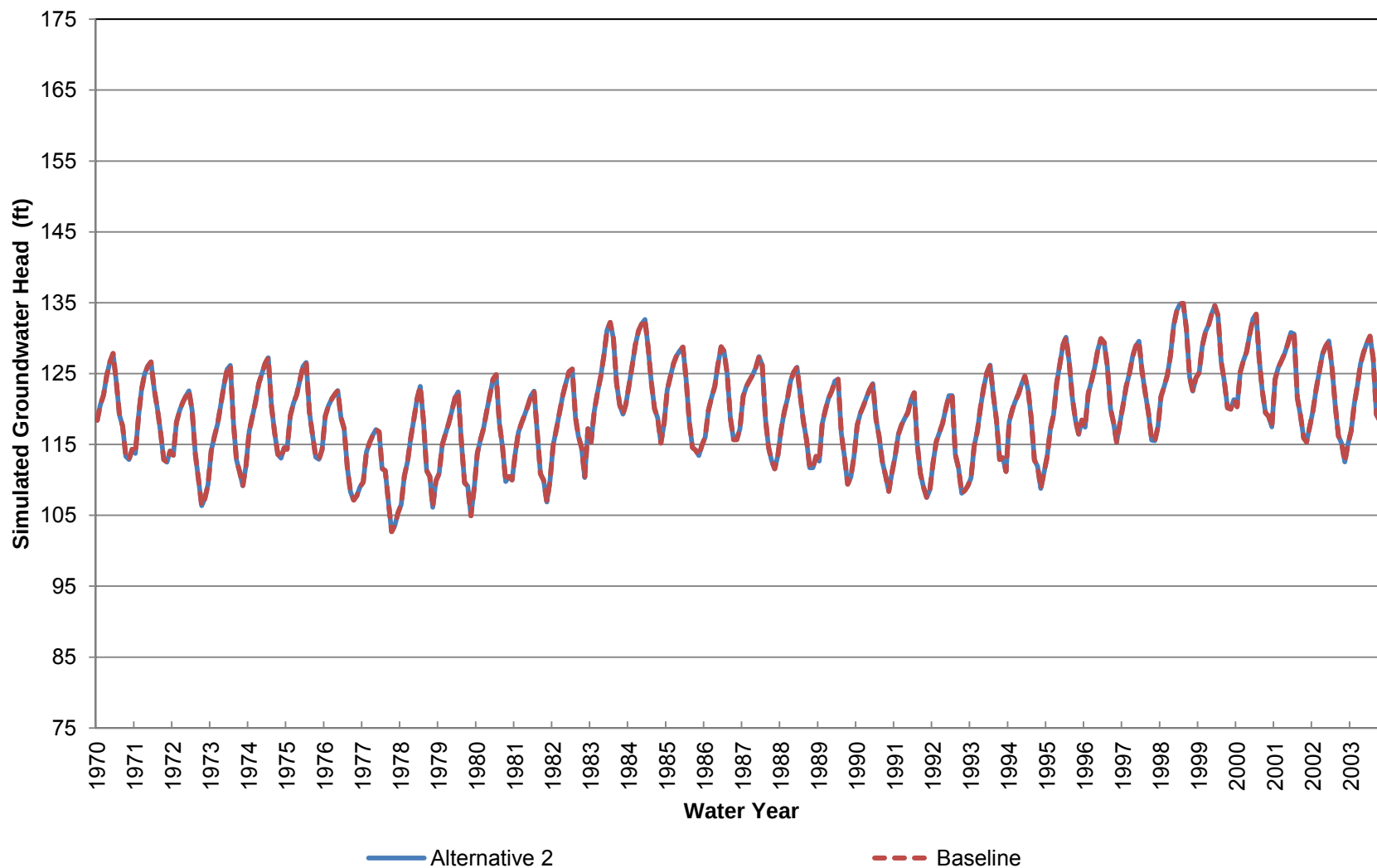
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 890-1360 ft bgs)



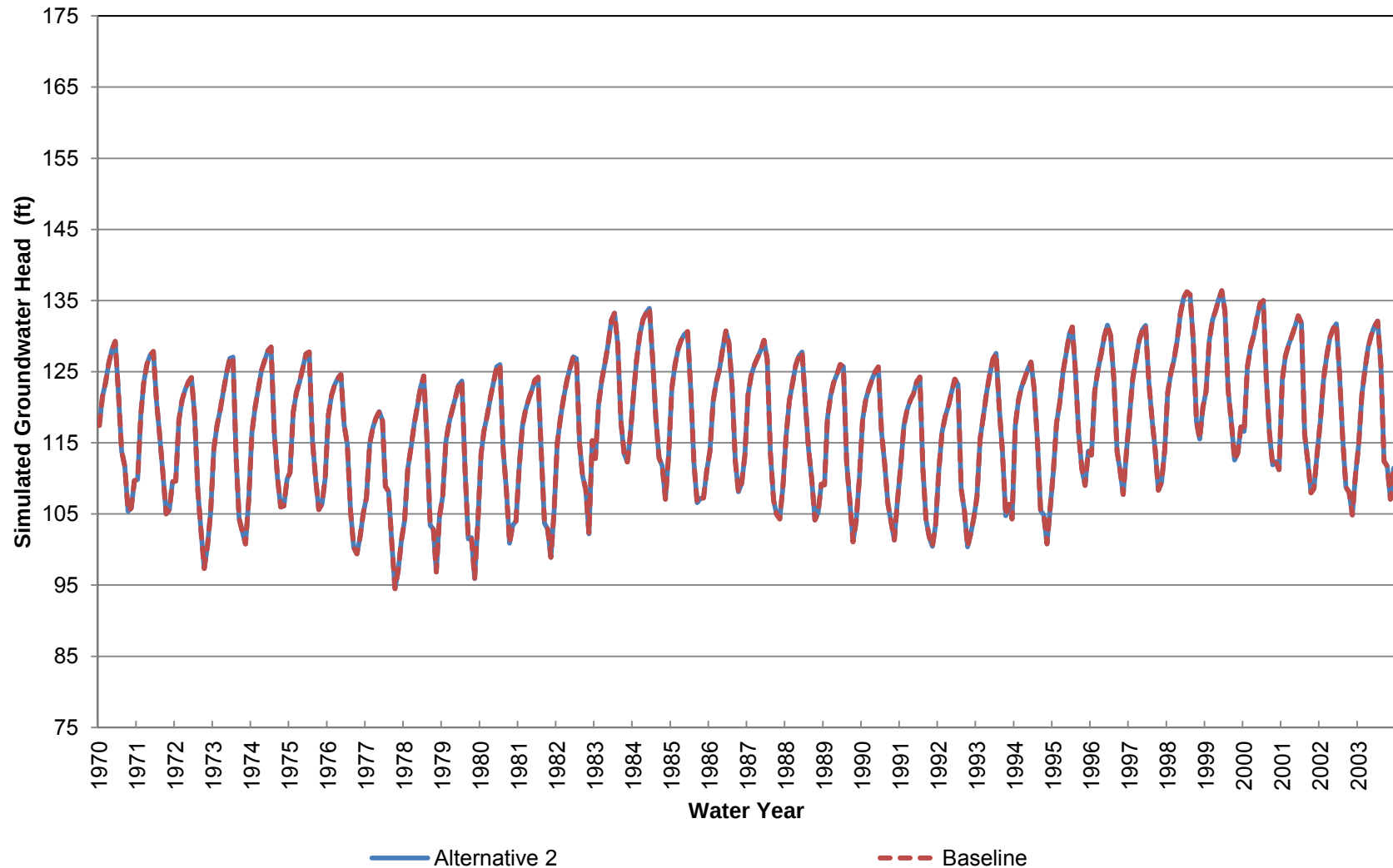
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 2 (Approximately 0-70 ft bgs)



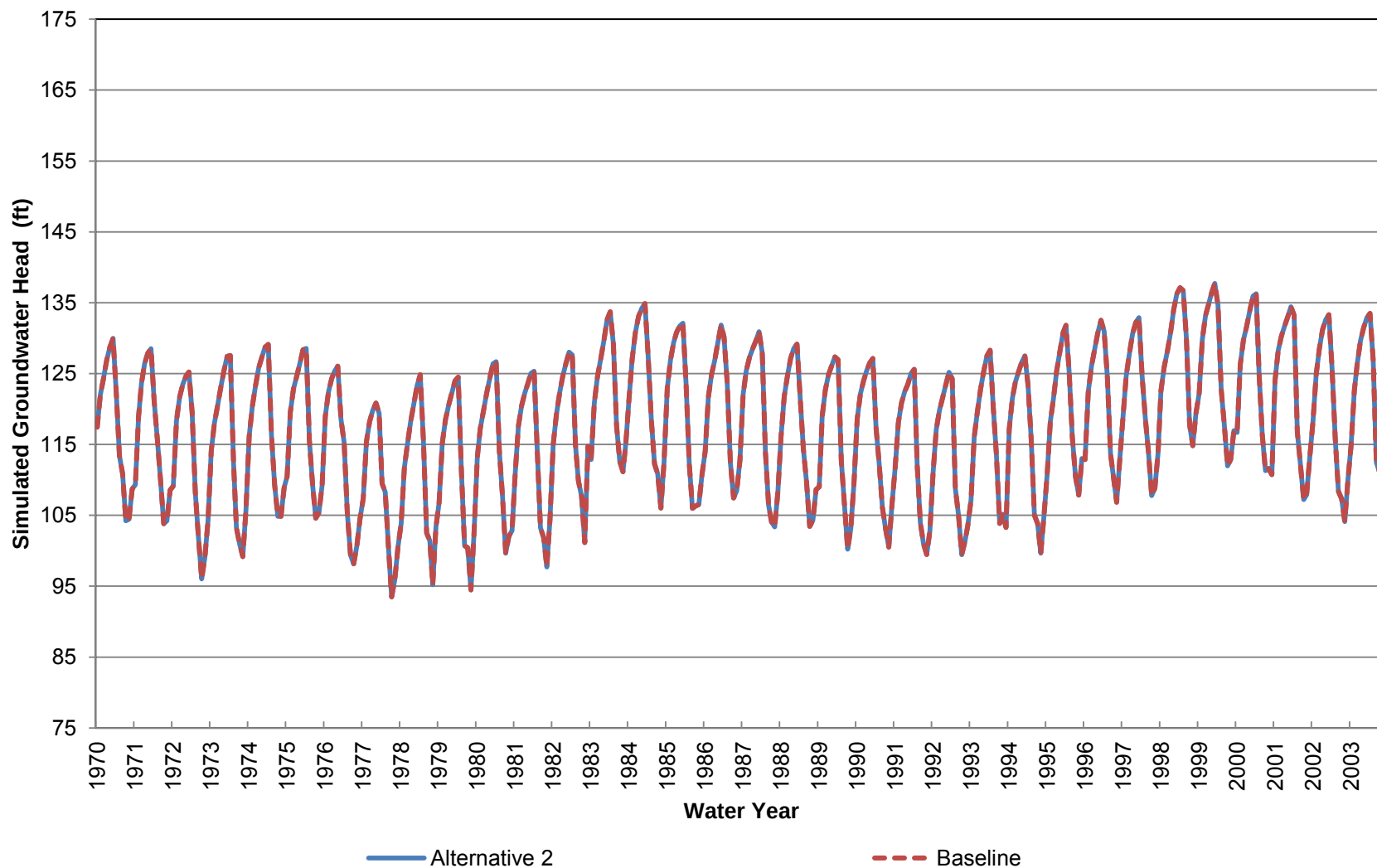
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 70-190 ft bgs)



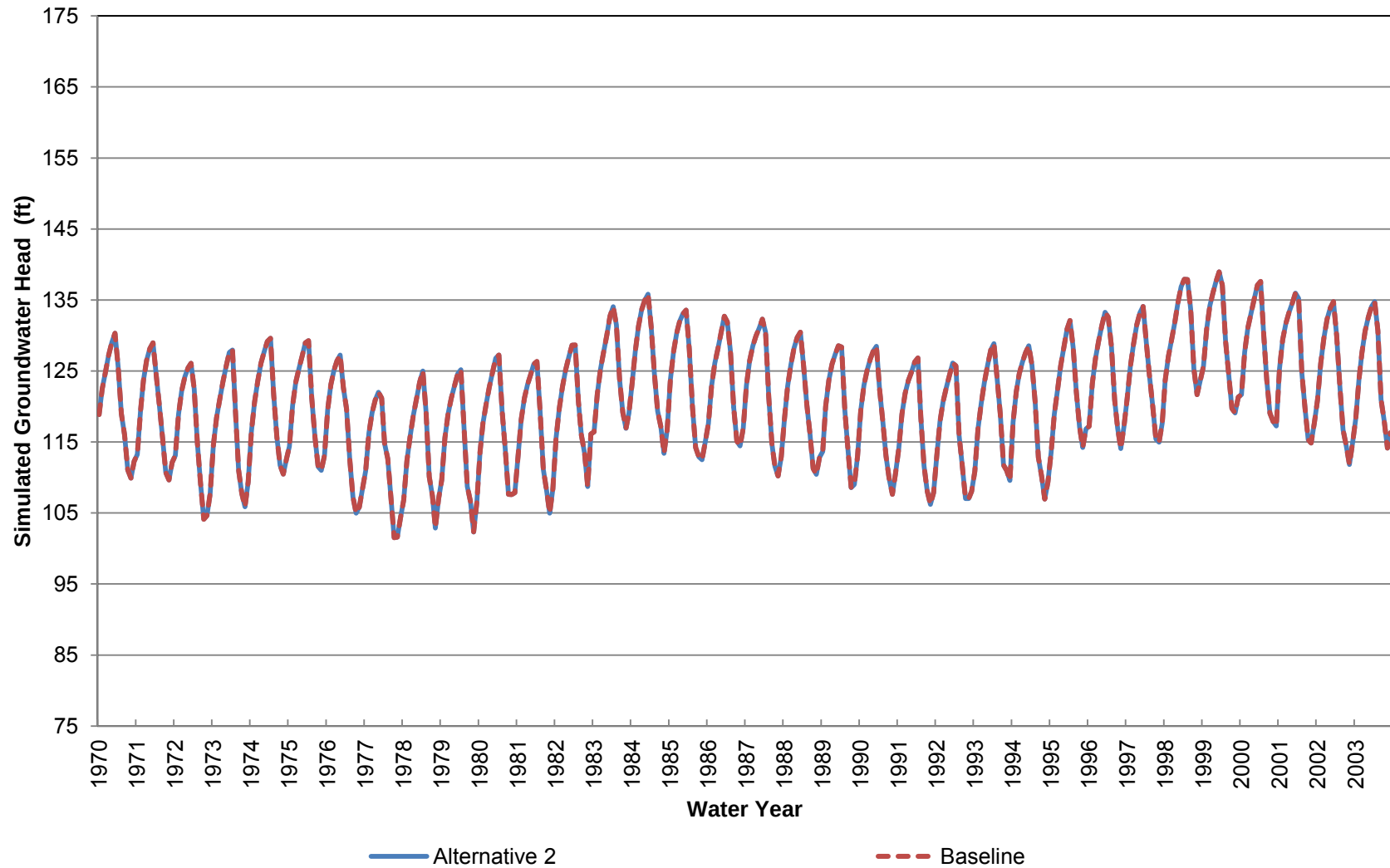
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 190-300 ft bgs)



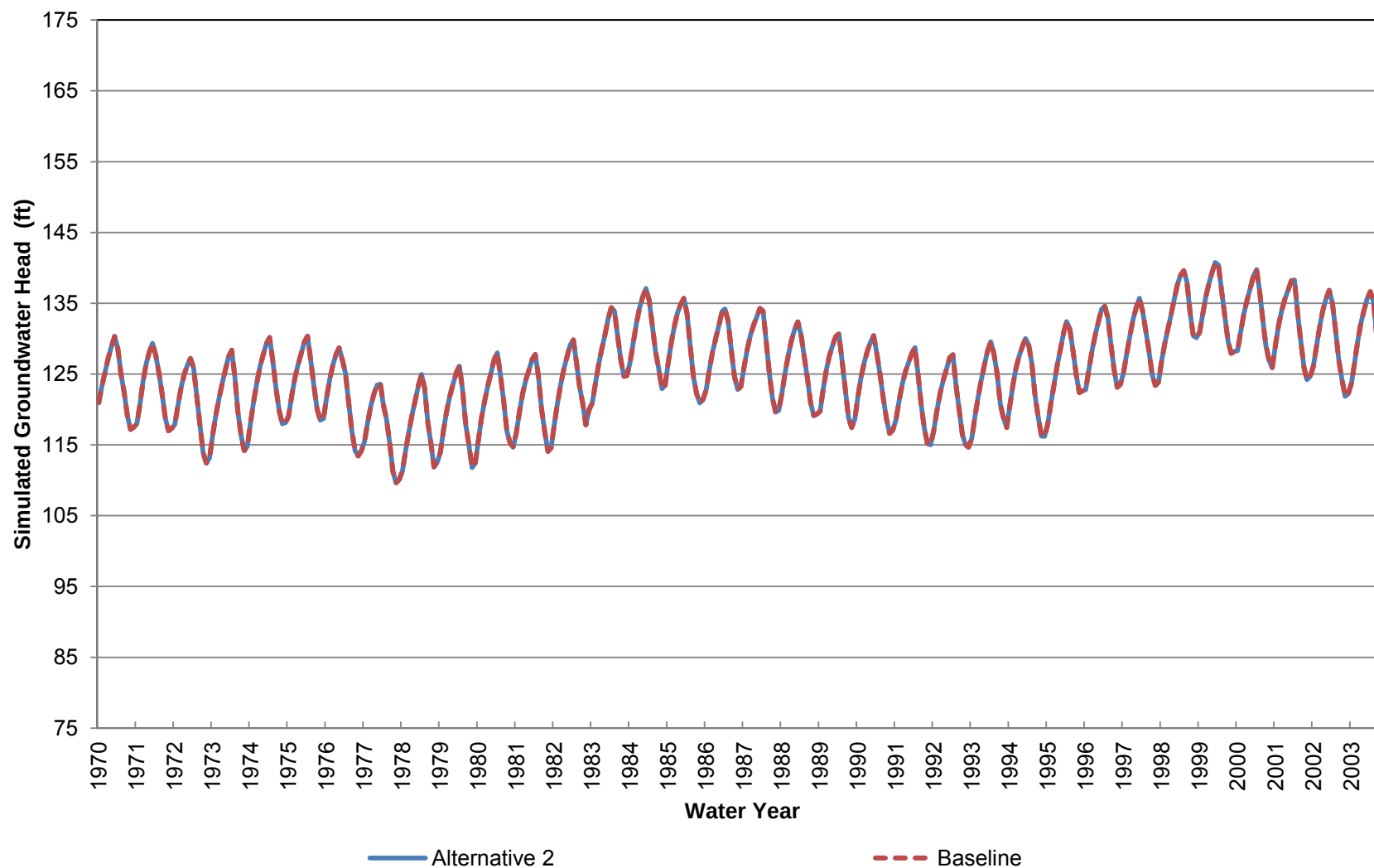
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 300-420 ft bgs)



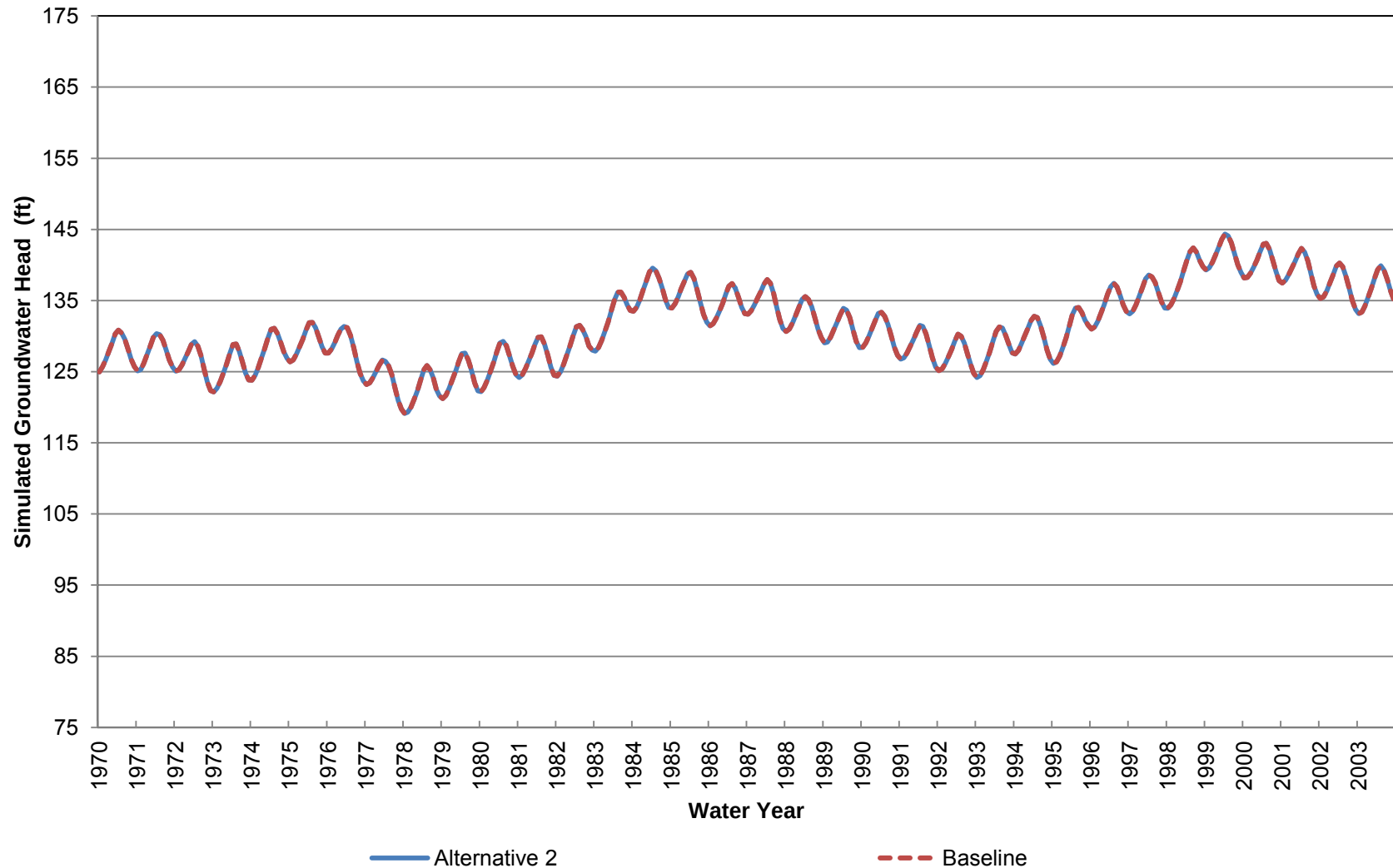
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 420-580 ft bgs)



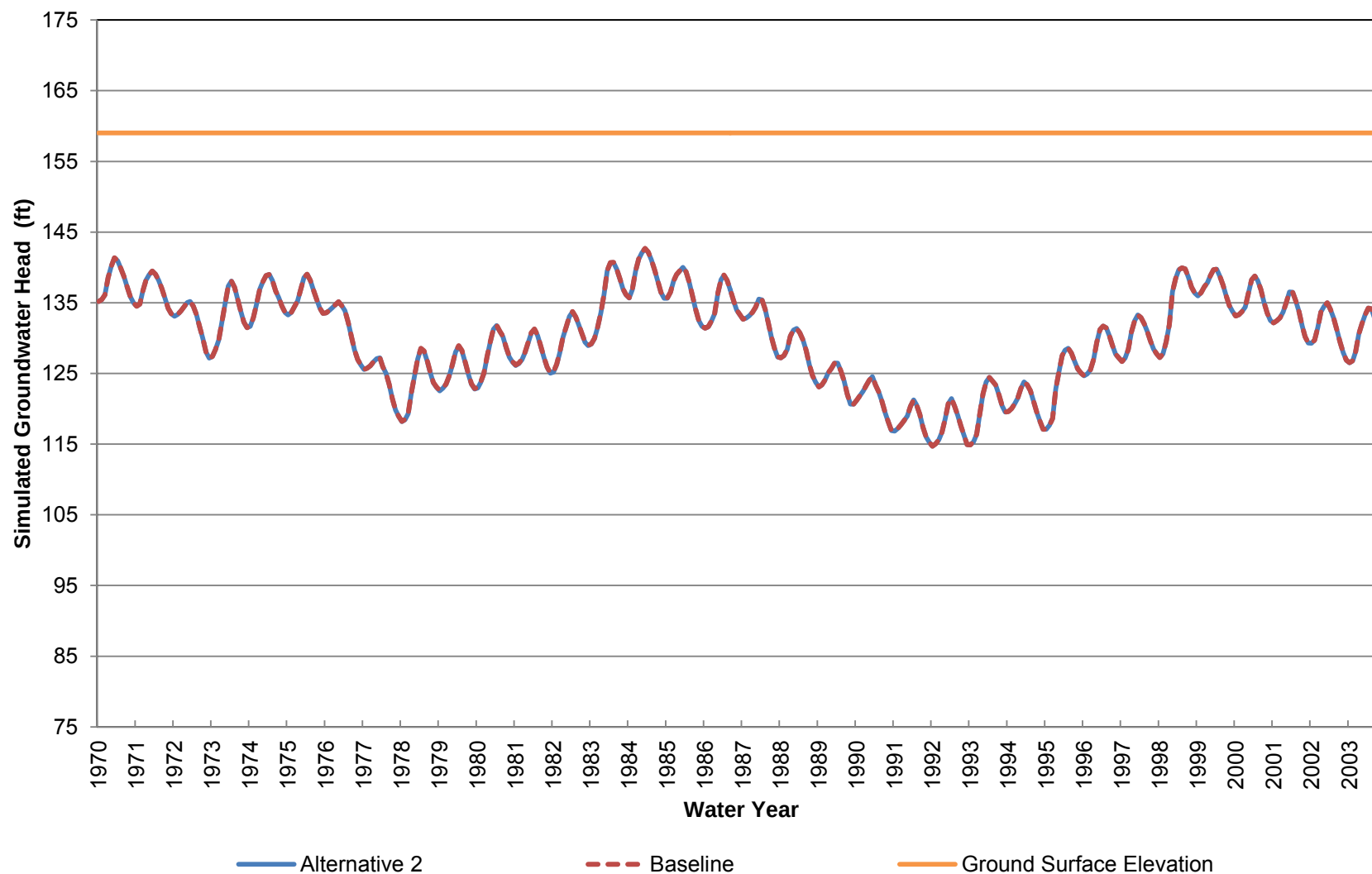
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 580-830 ft bgs)



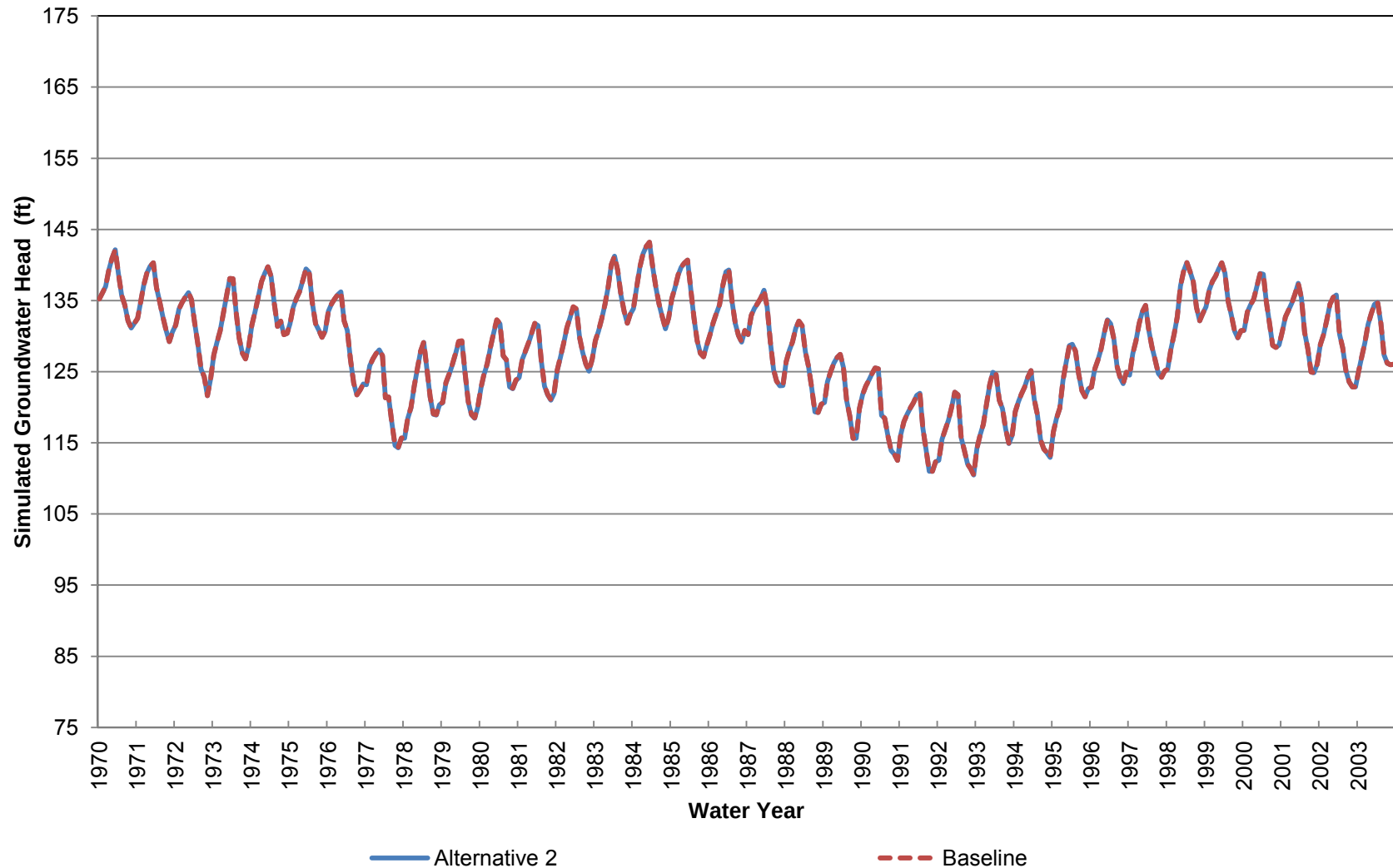
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 830-1330 ft bgs)



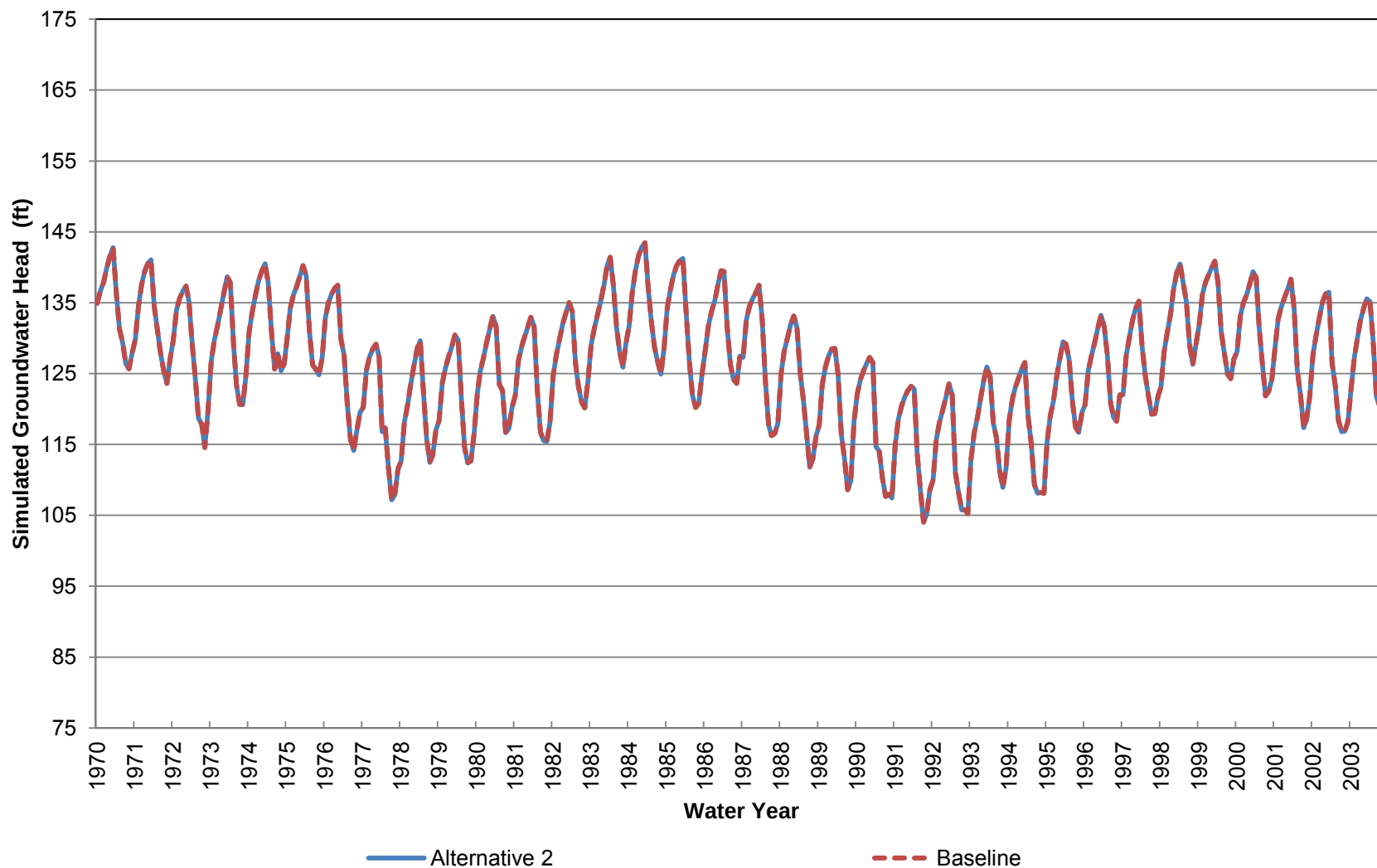
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 3 (Approximately 0-70 ft bgs)



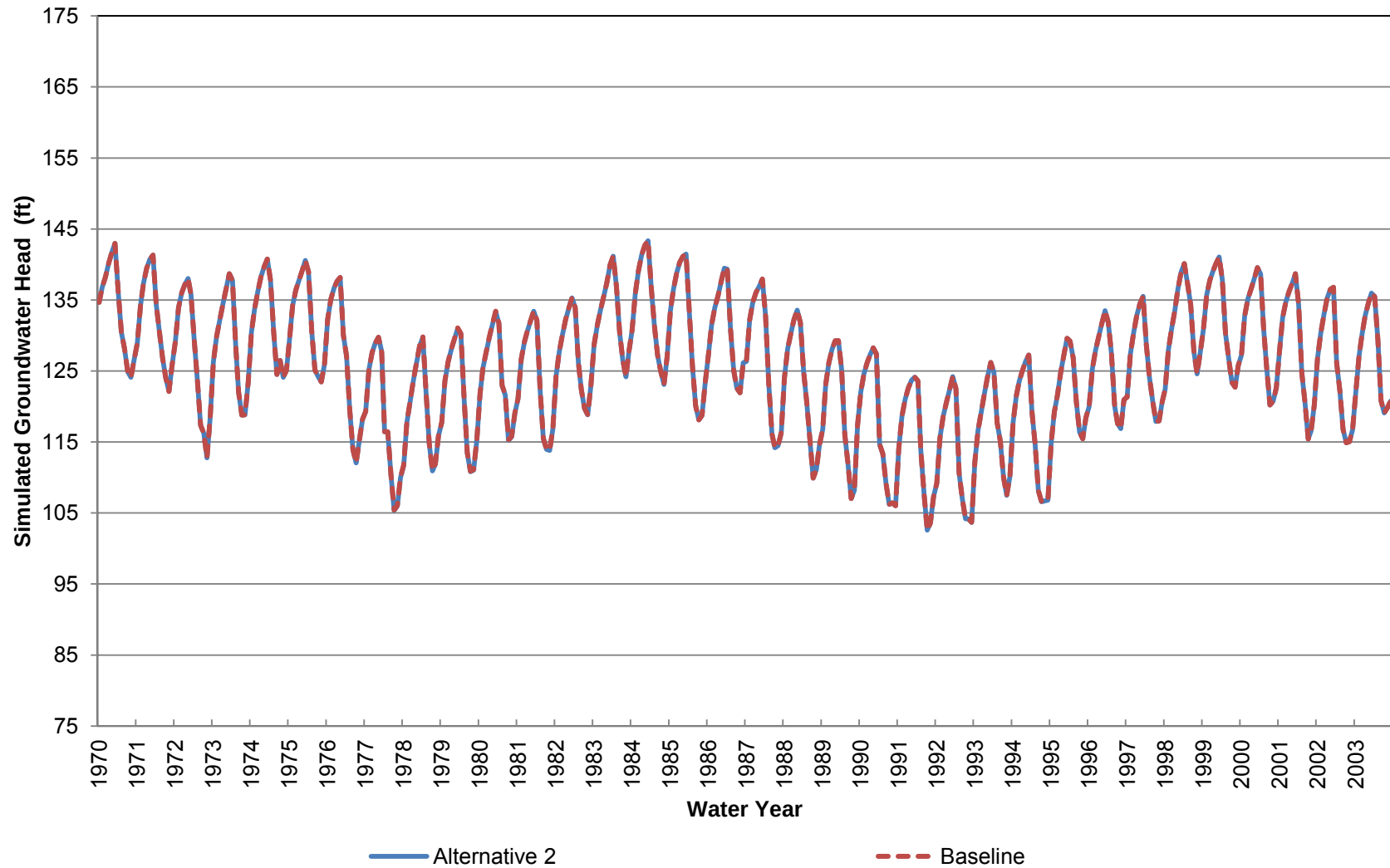
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 70-210 ft bgs)



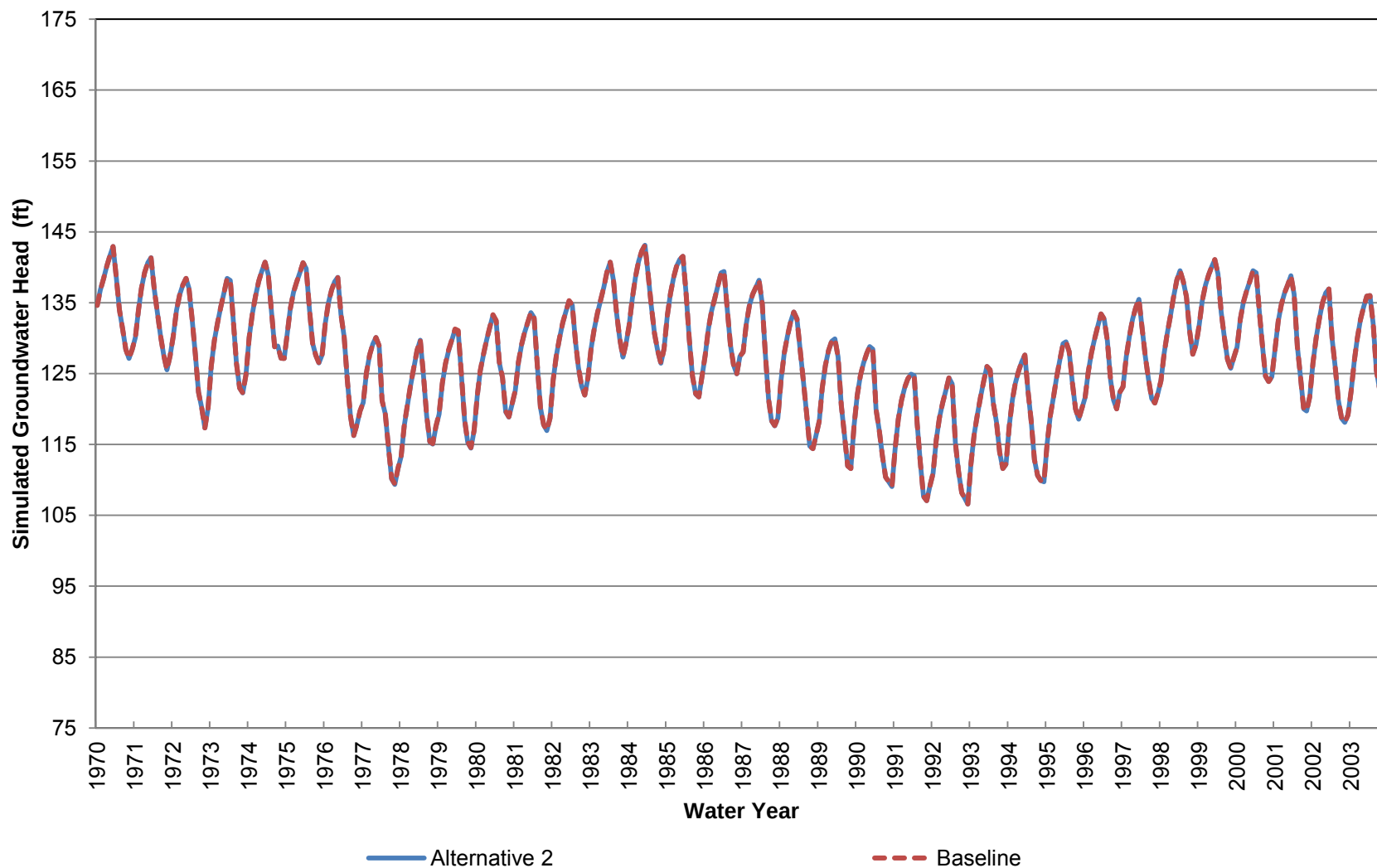
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 210-350 ft bgs)



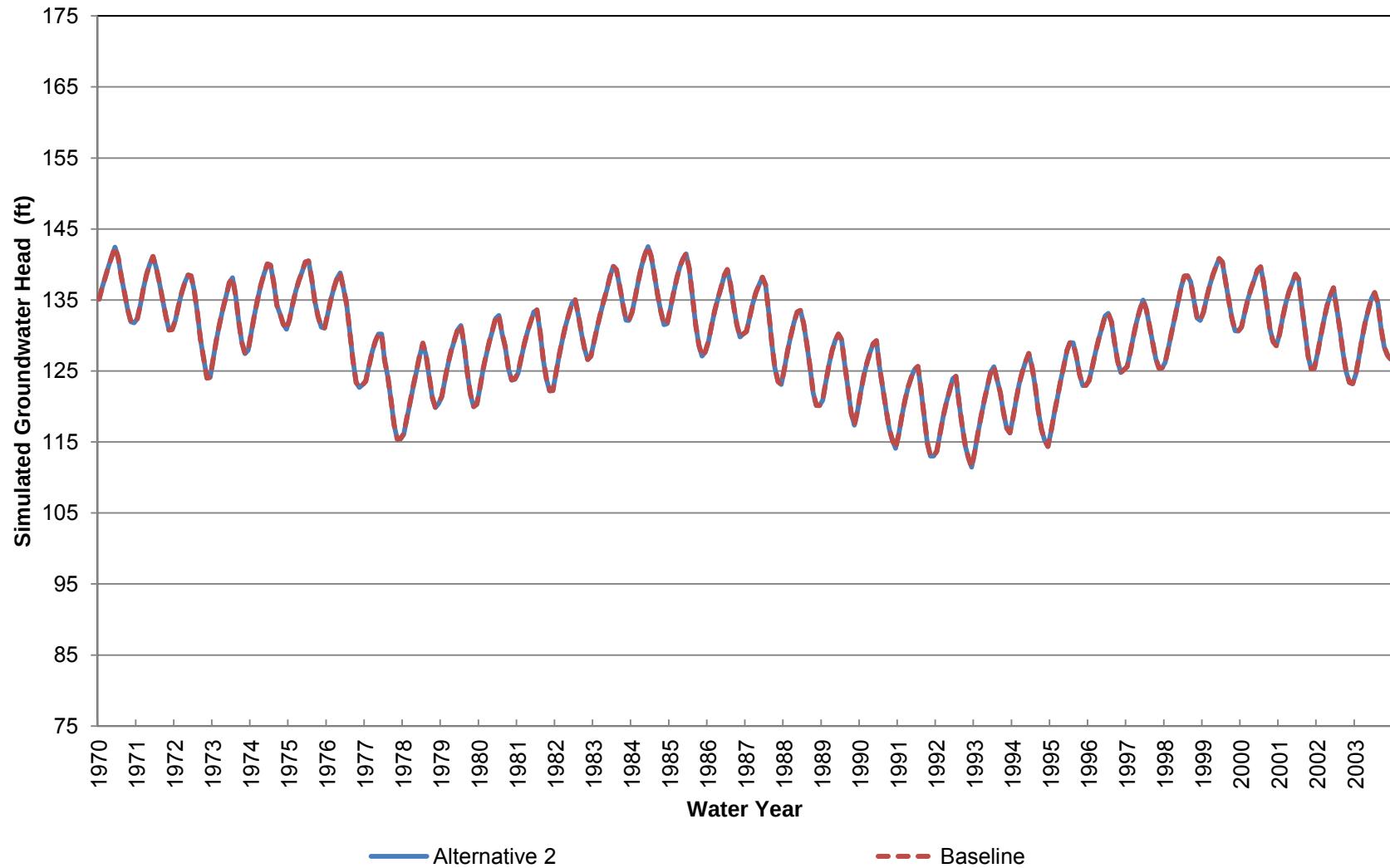
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 350-480 ft bgs)



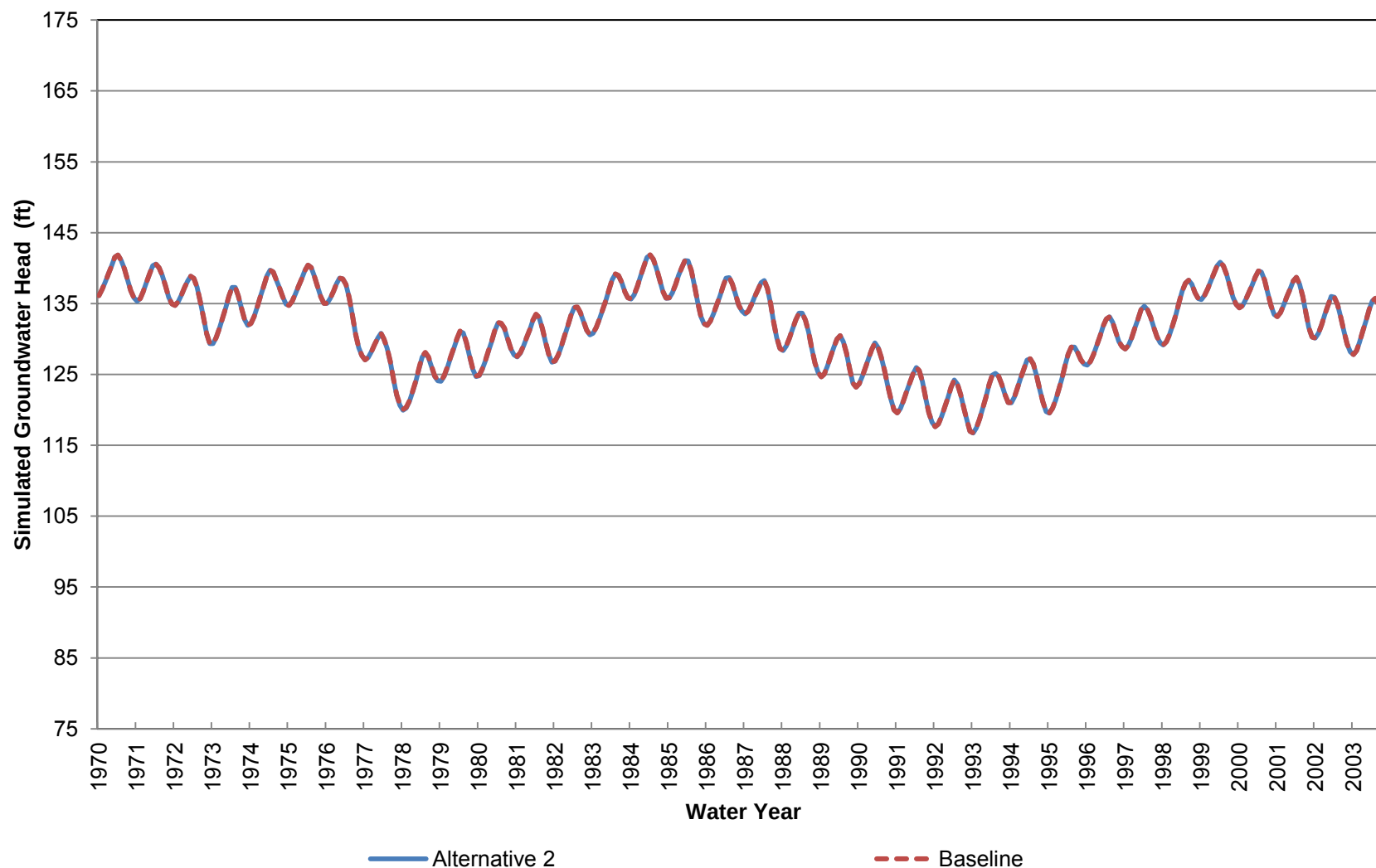
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 480-700 ft bgs)



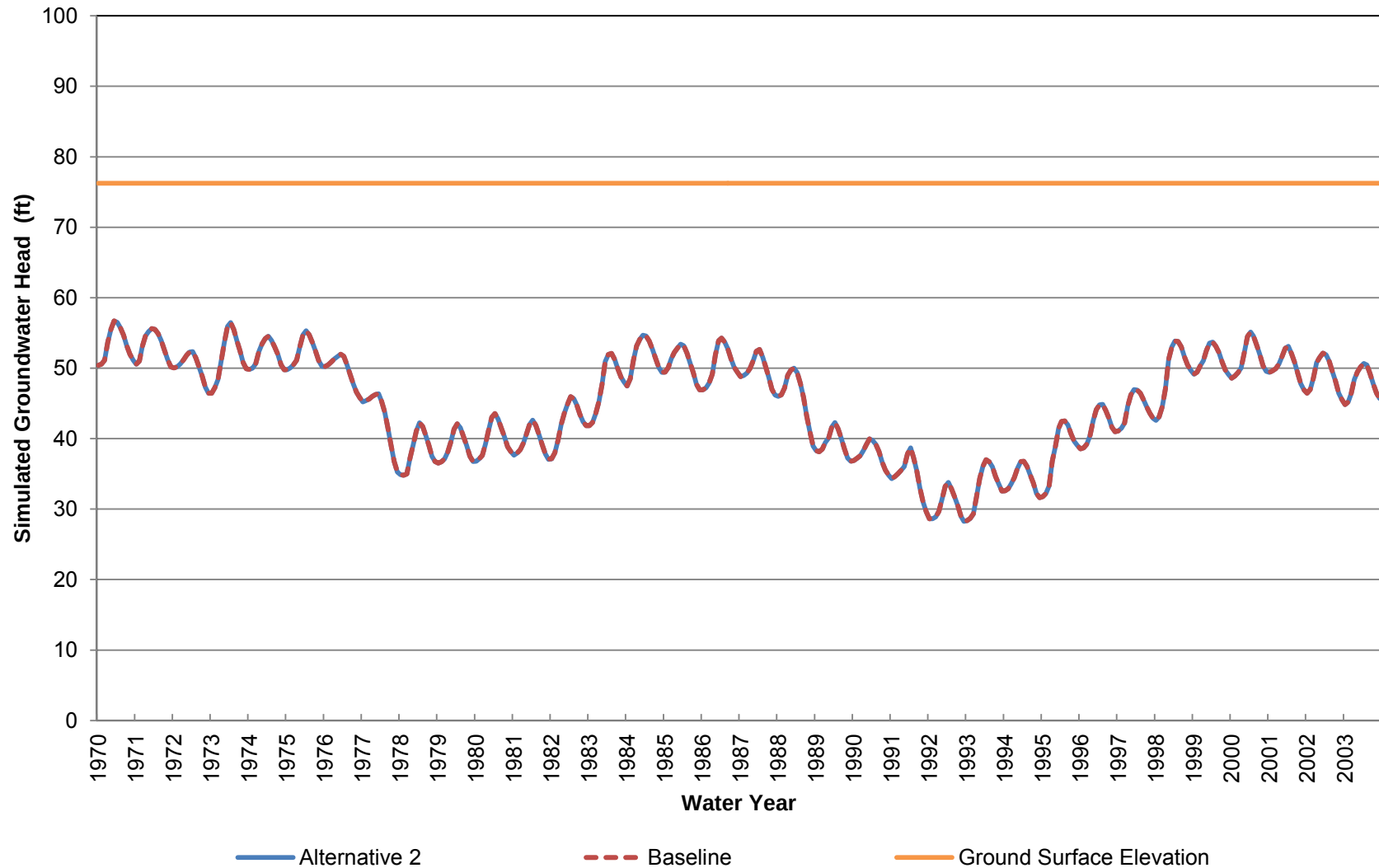
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 700-930 ft bgs)



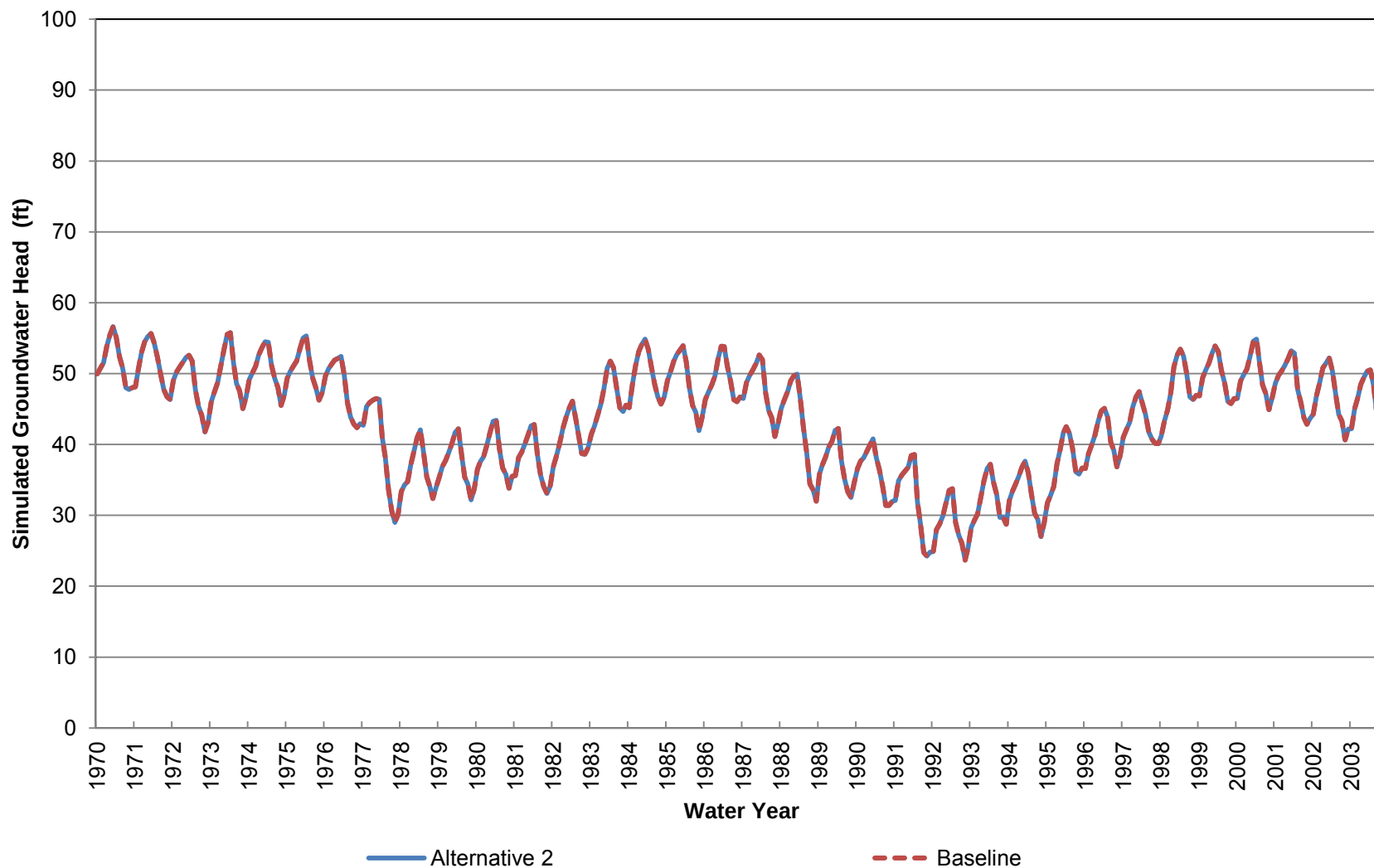
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 930-1290 ft bgs)



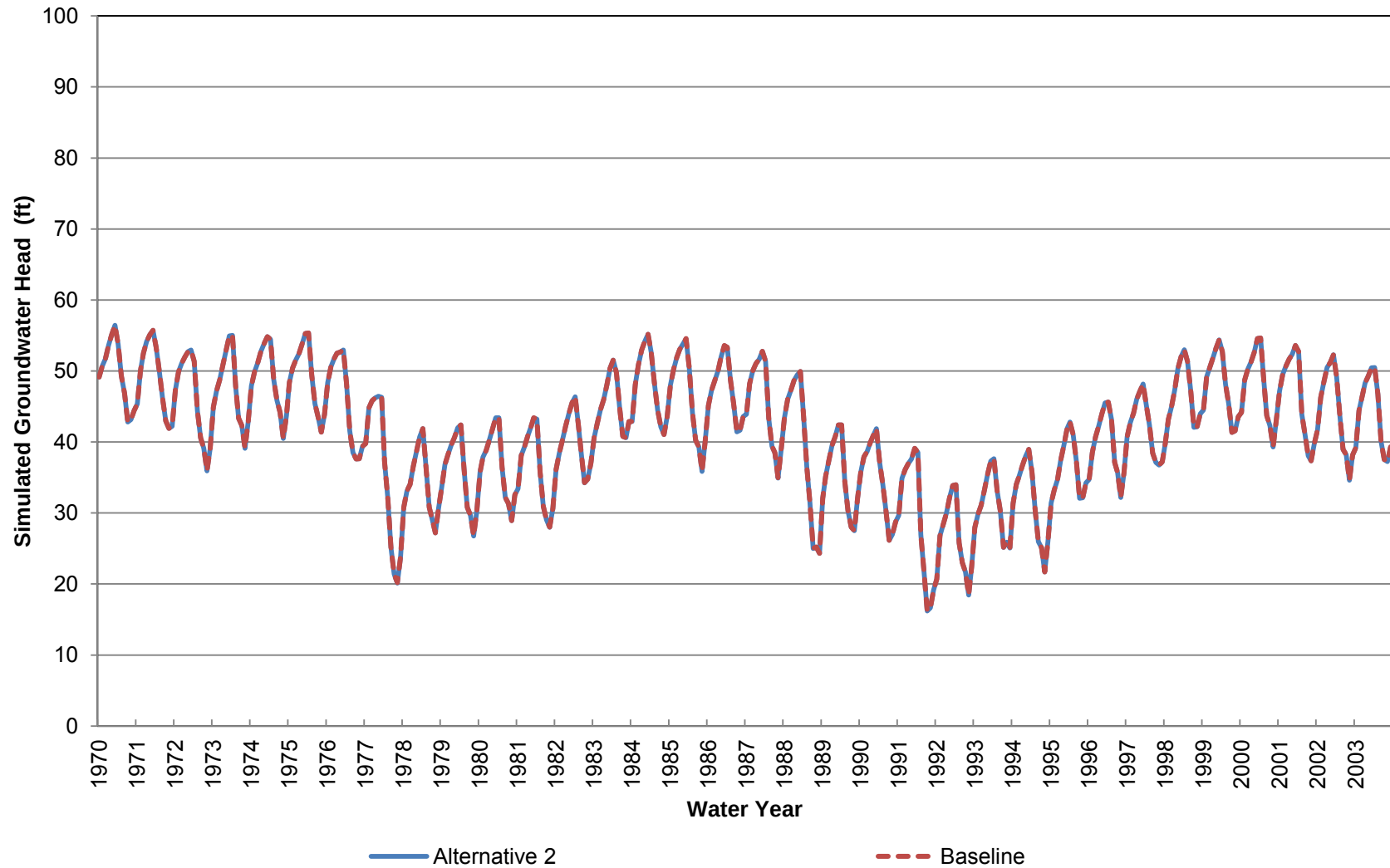
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 4 (Approximately 0-70 ft bgs)



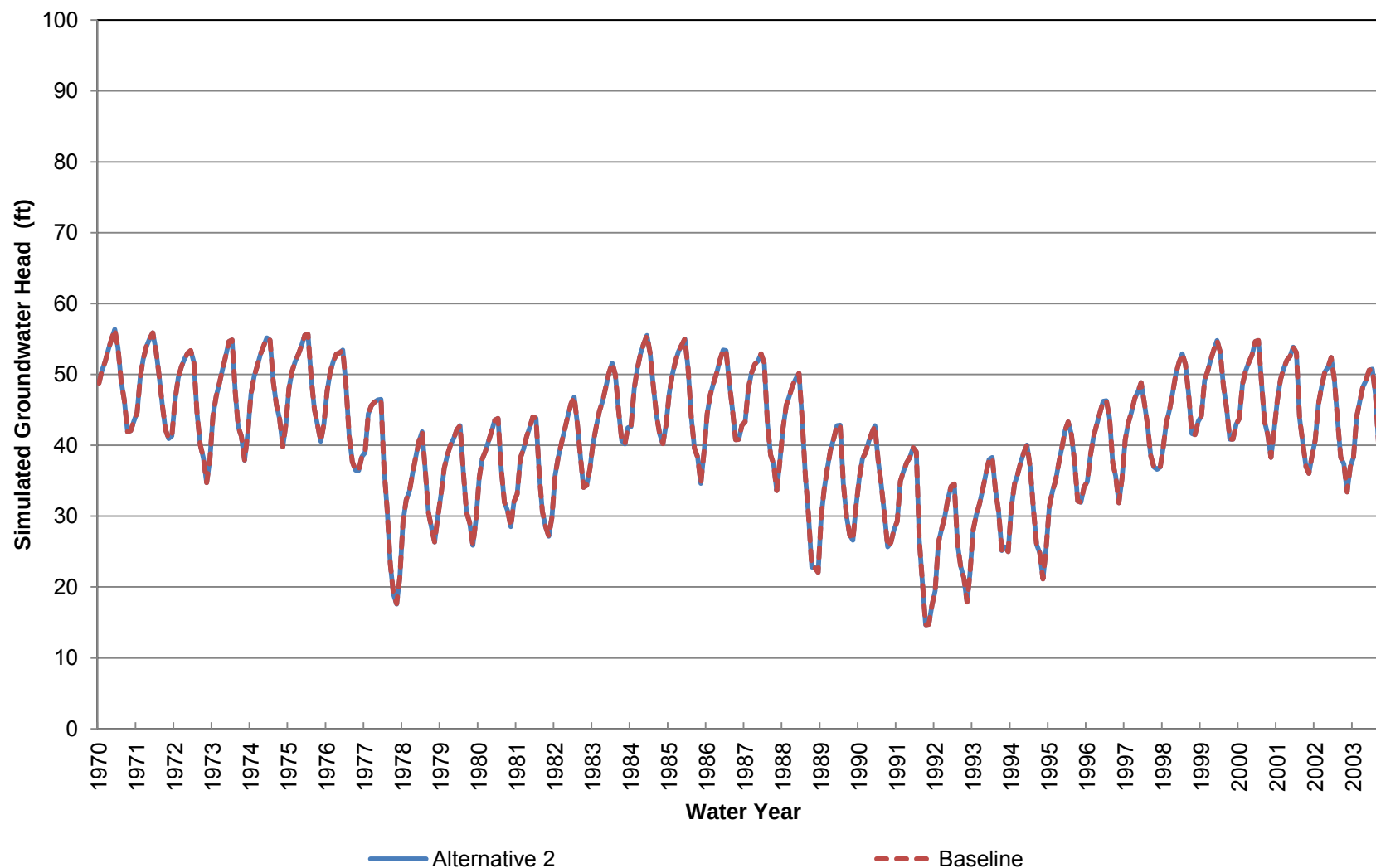
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 70-190 ft bgs)



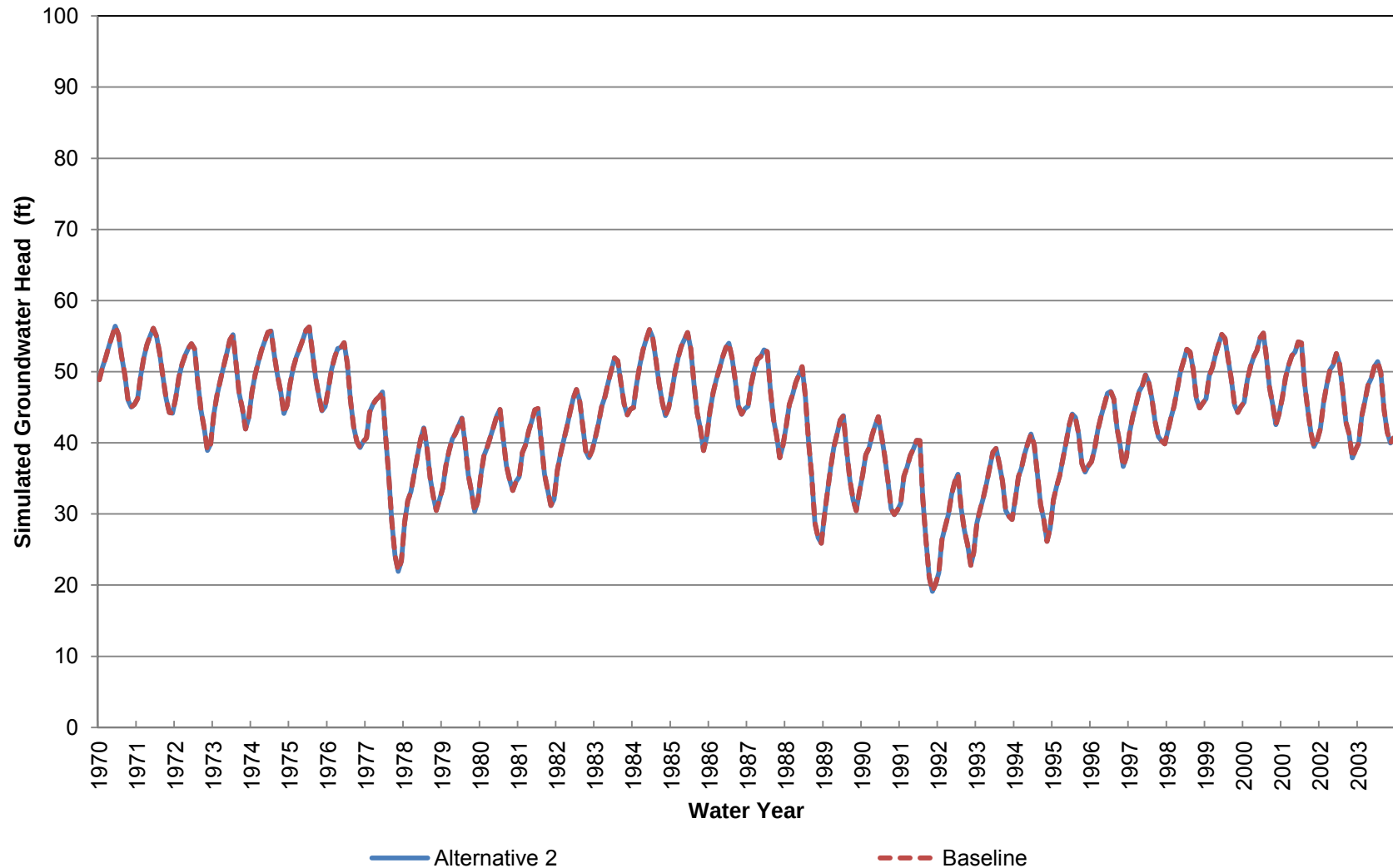
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 190-300 ft bgs)



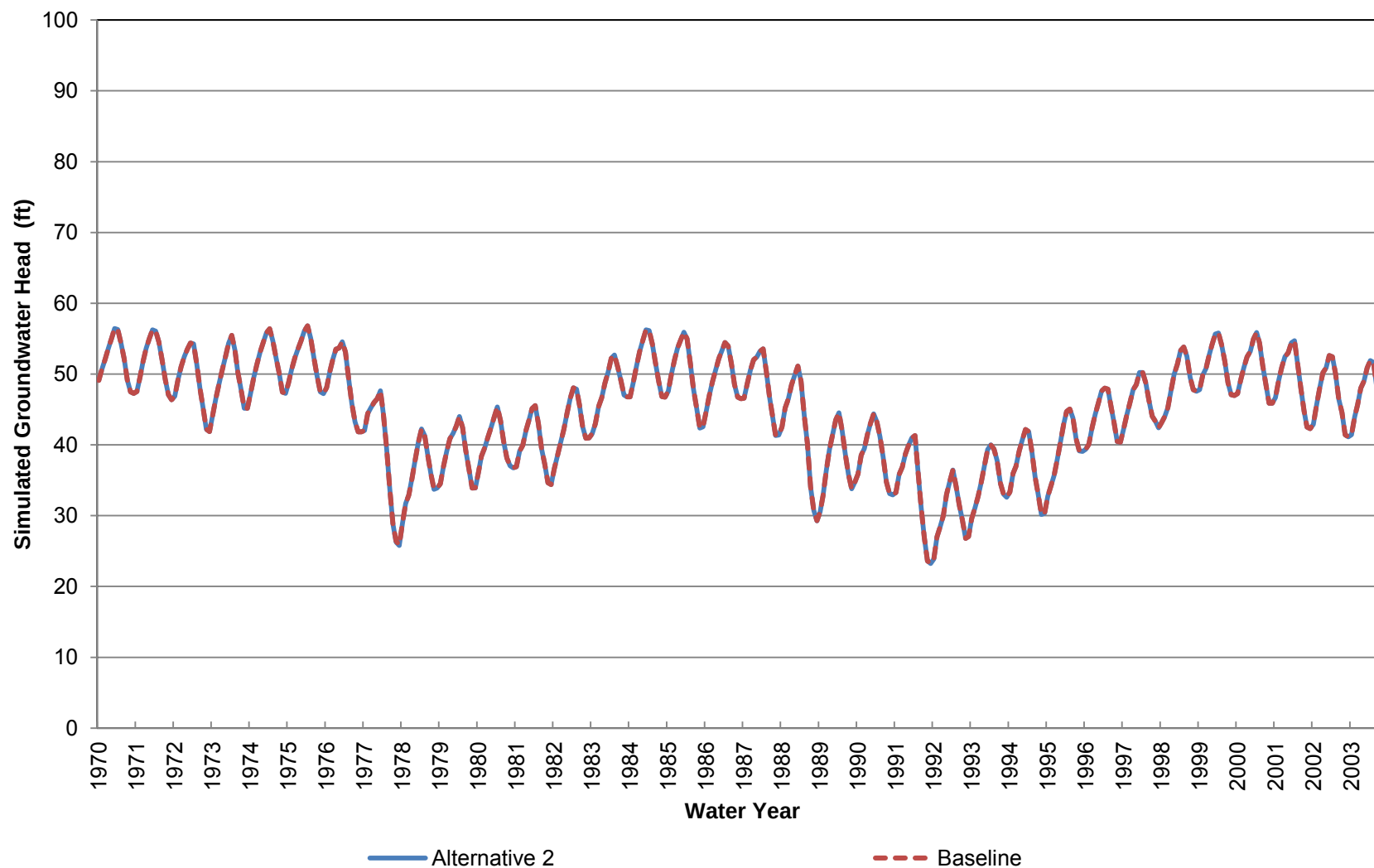
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 300-420 ft bgs)



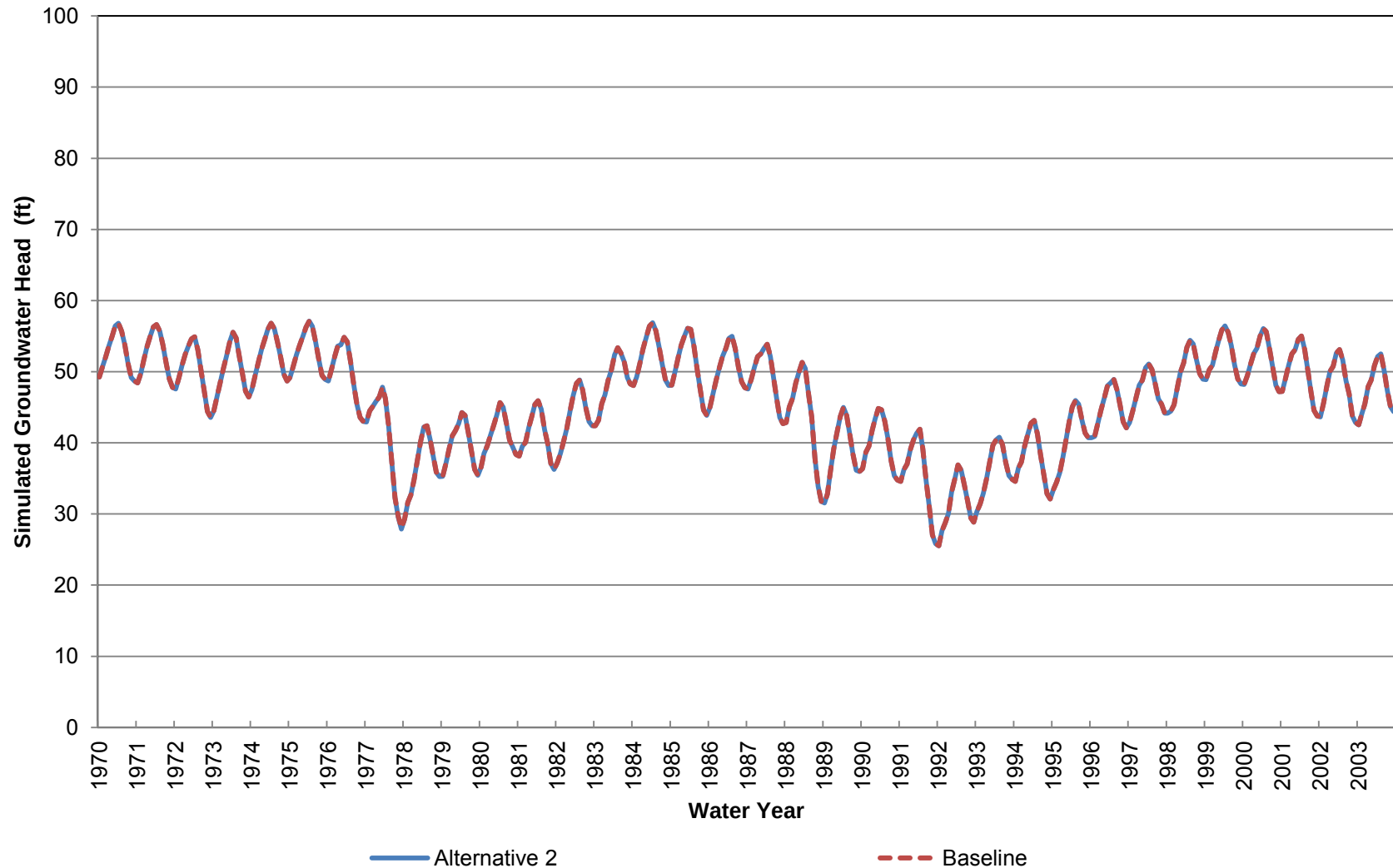
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 420-580 ft bgs)



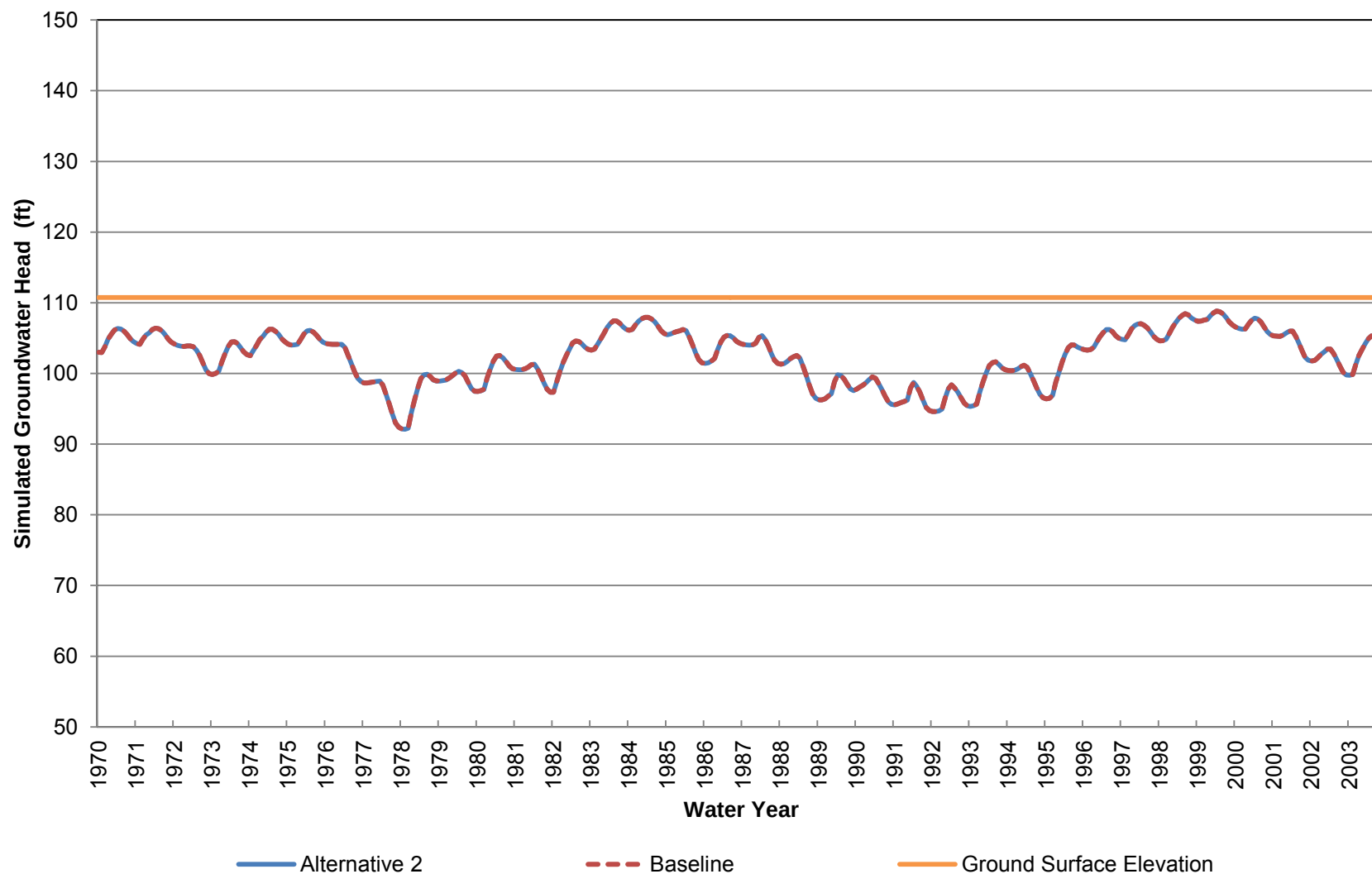
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 580-780 ft bgs)



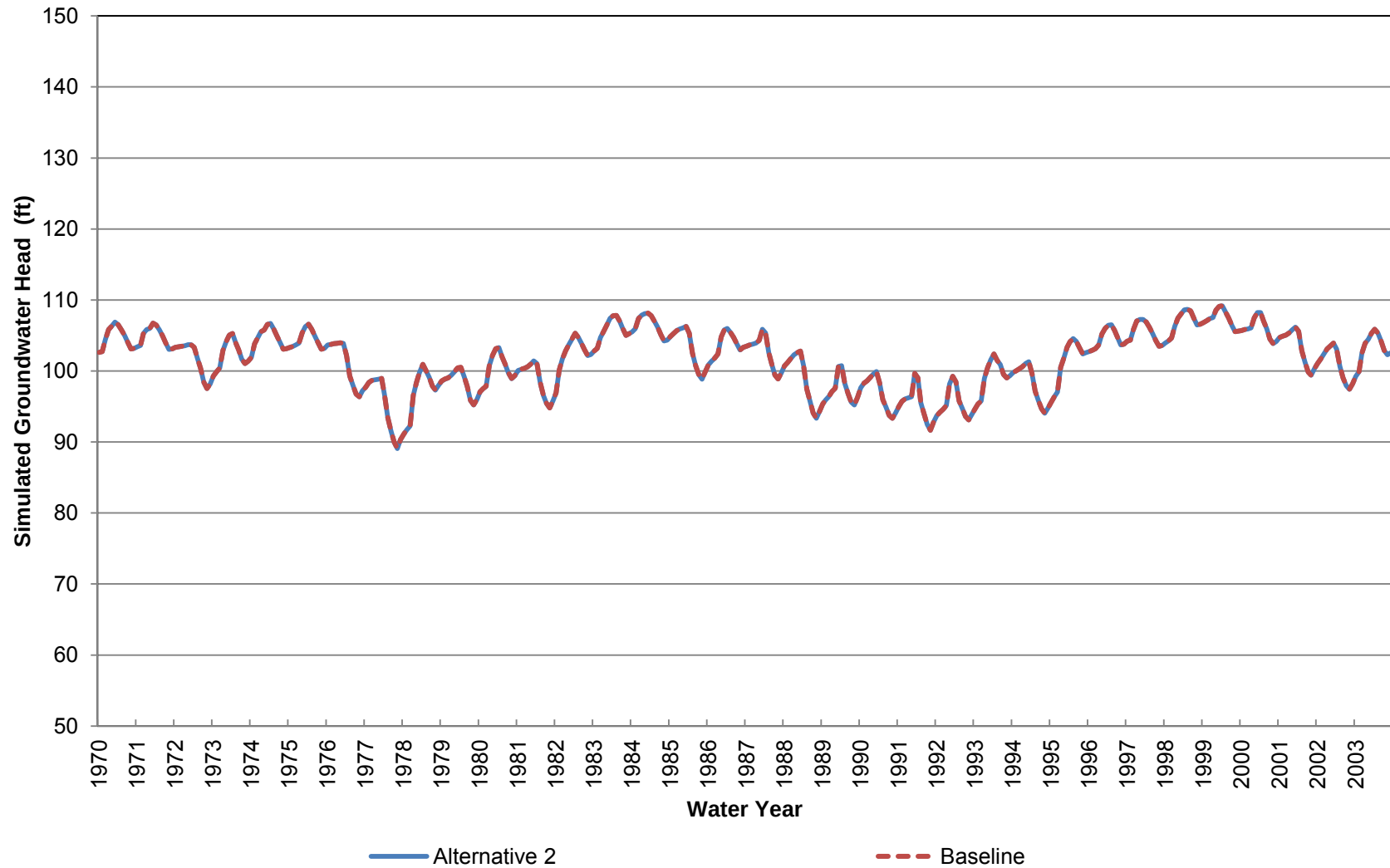
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 780-1060 ft bgs)



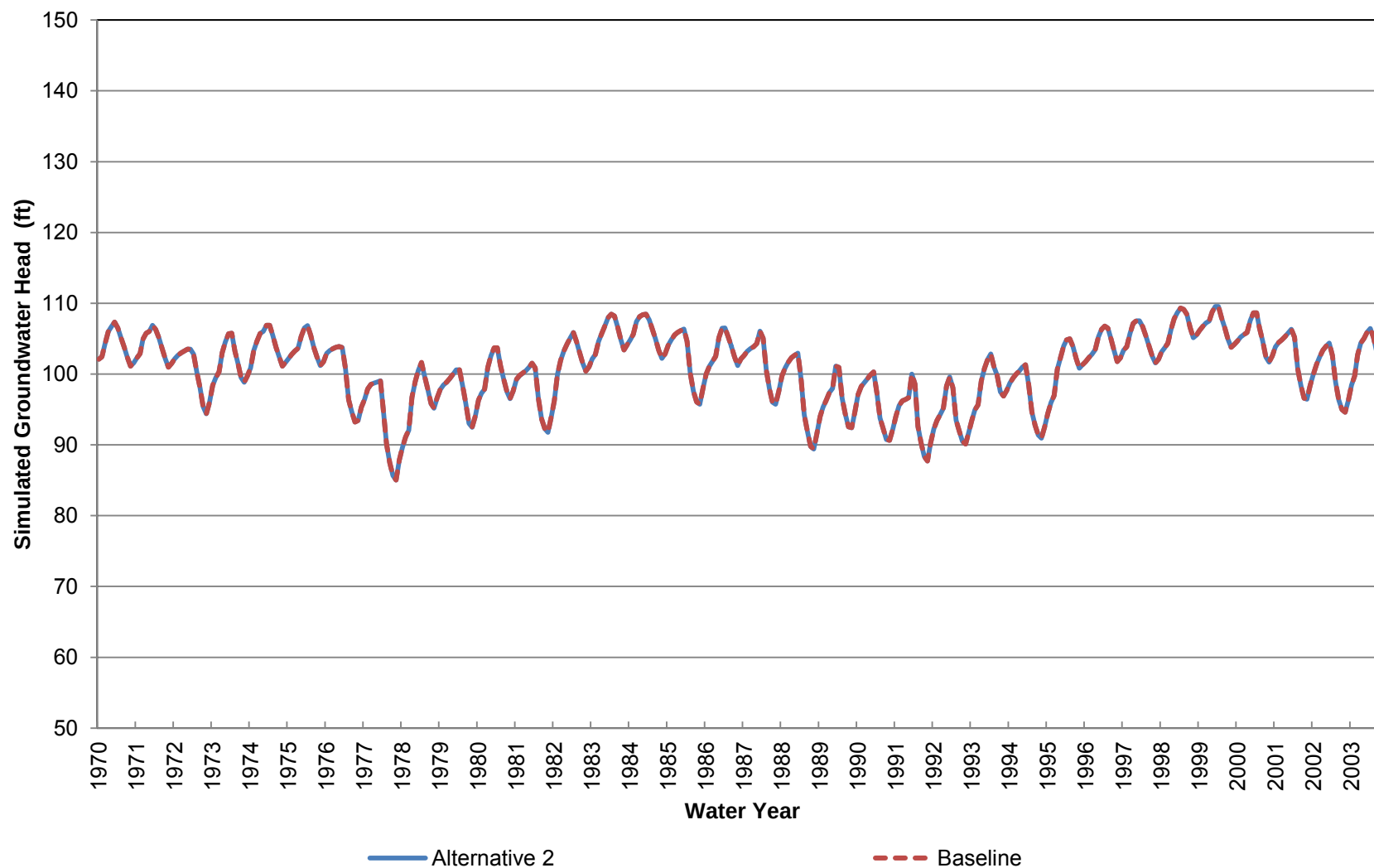
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 5 (Approximately 0-70 ft bgs)



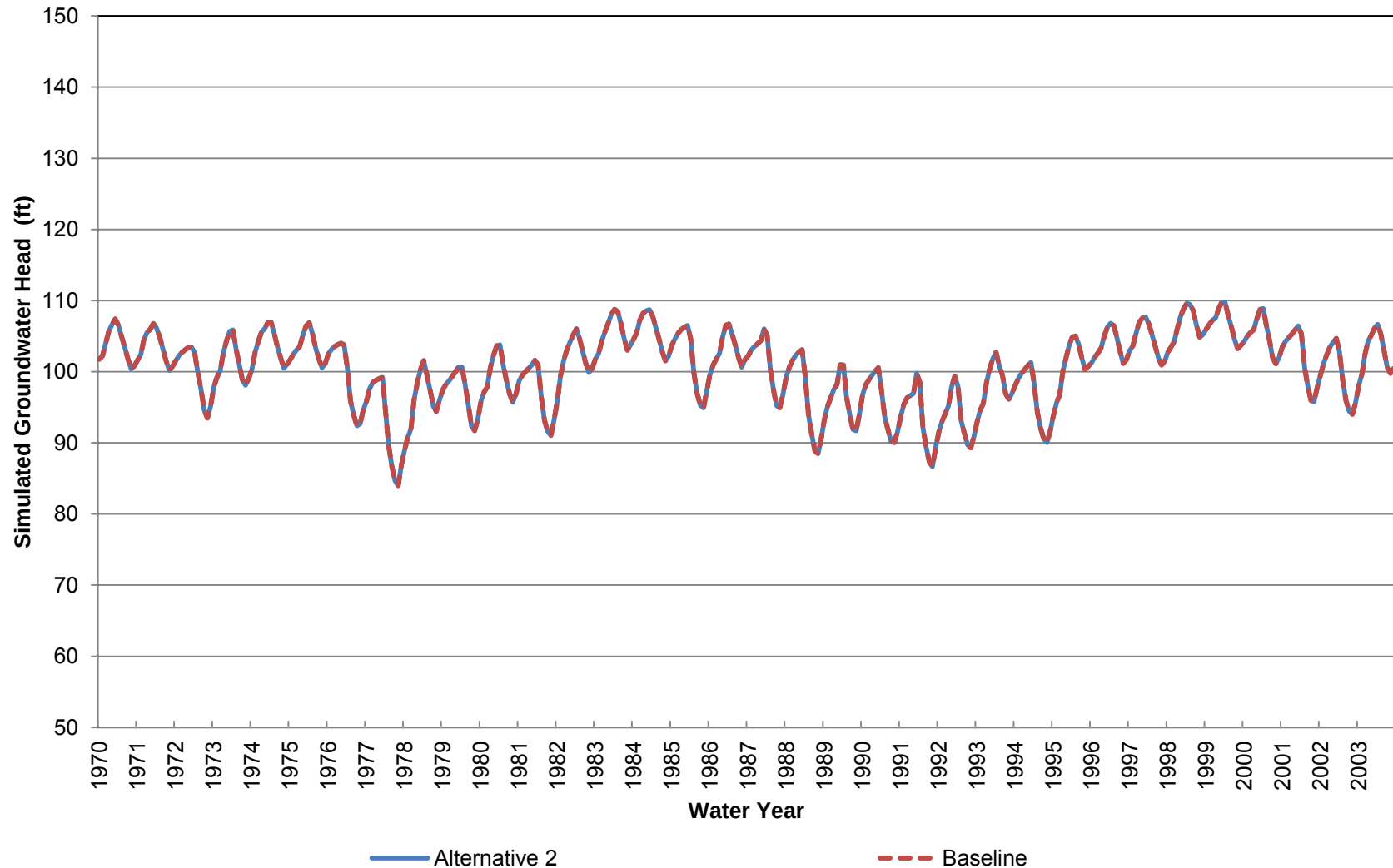
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 70-200 ft bgs)



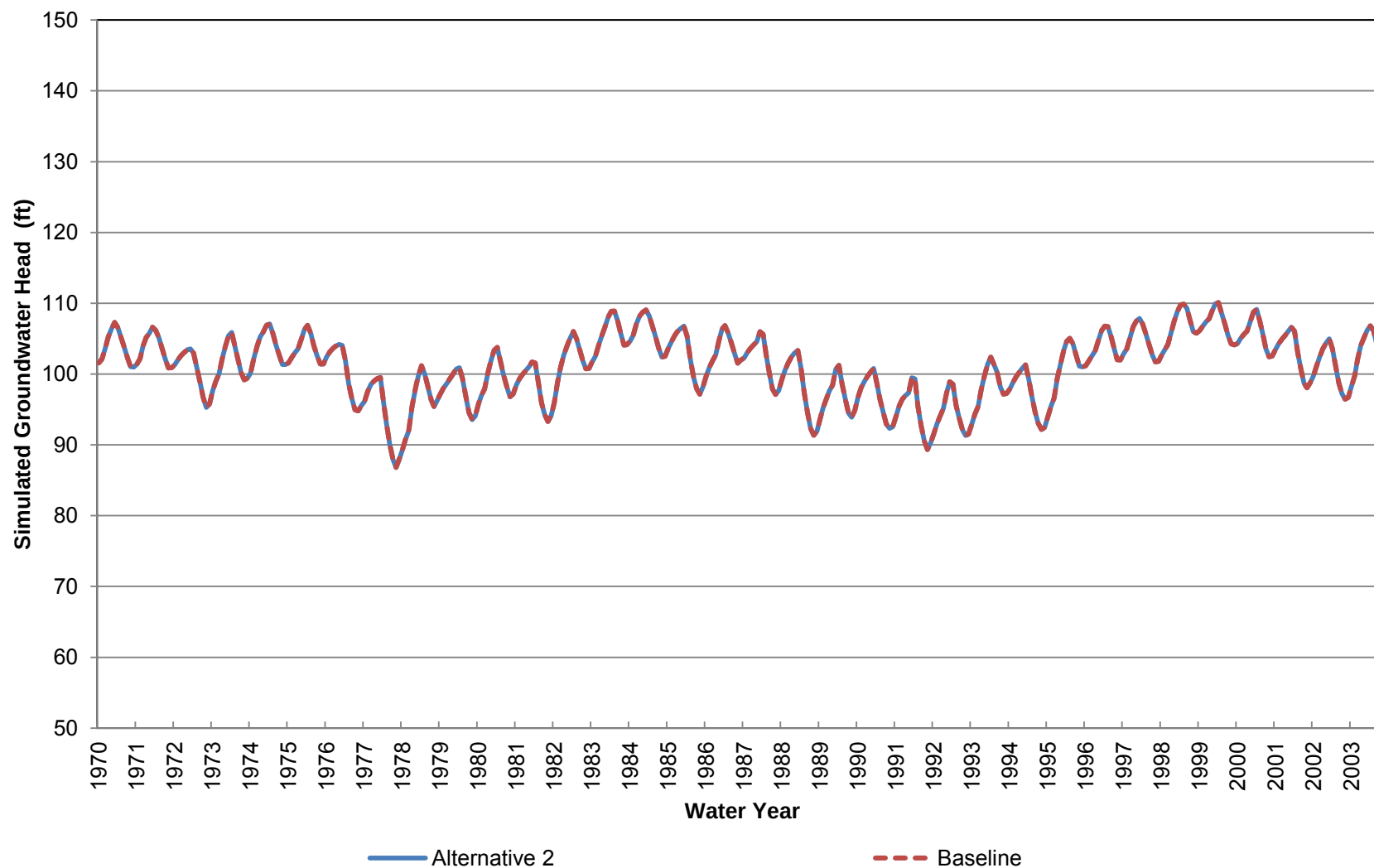
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 200-340 ft bgs)



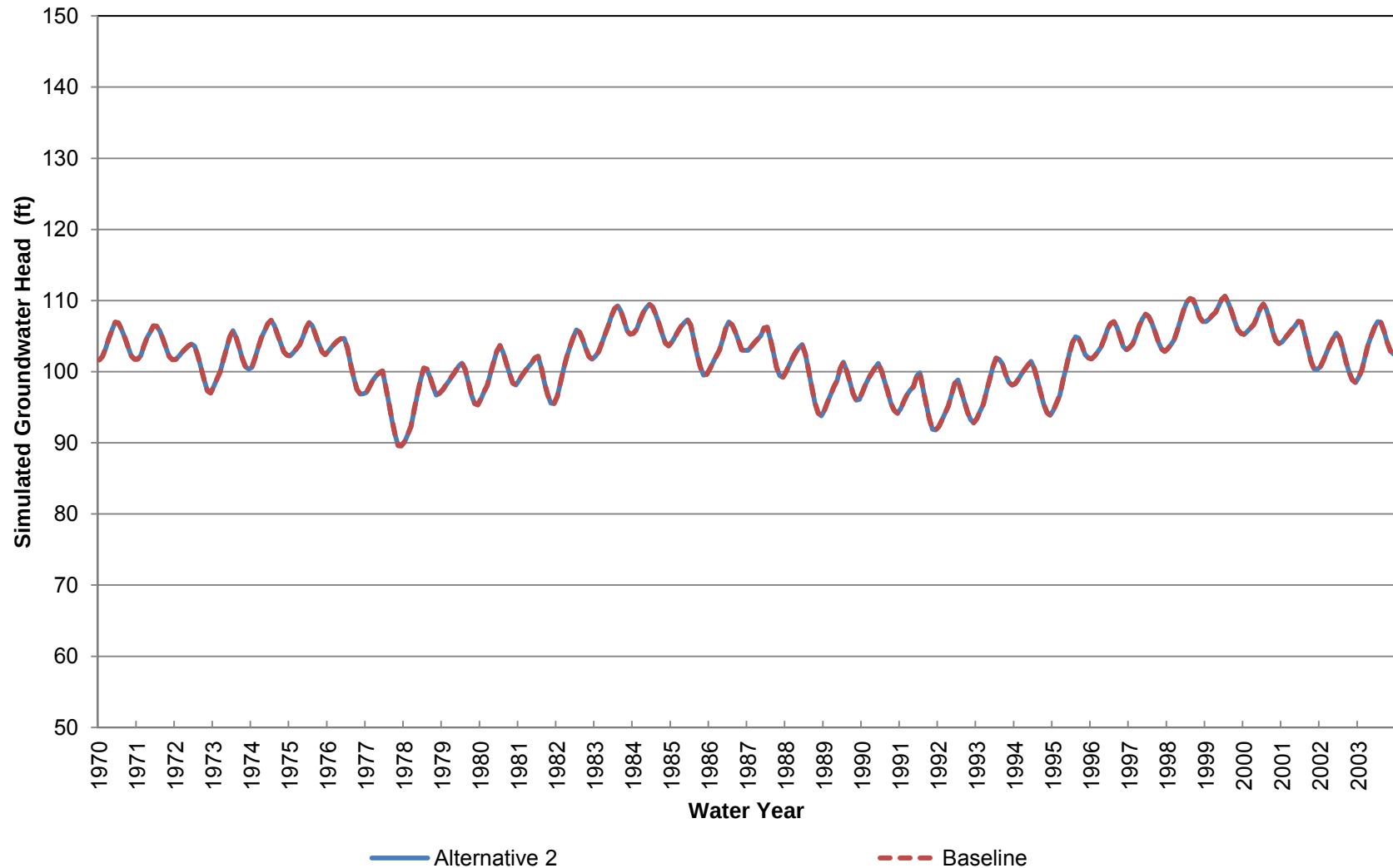
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 340-470 ft bgs)



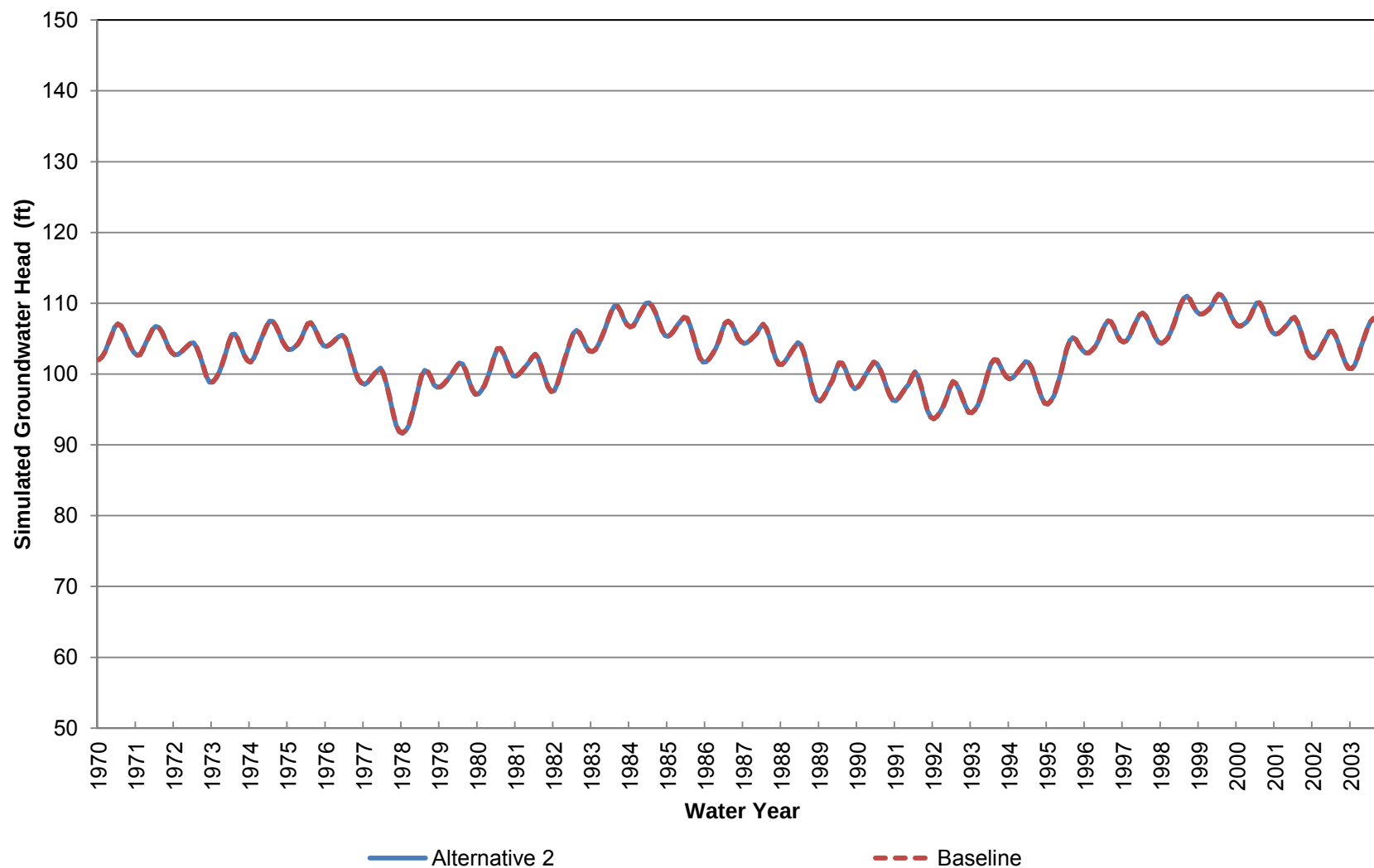
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 470-670 ft bgs)



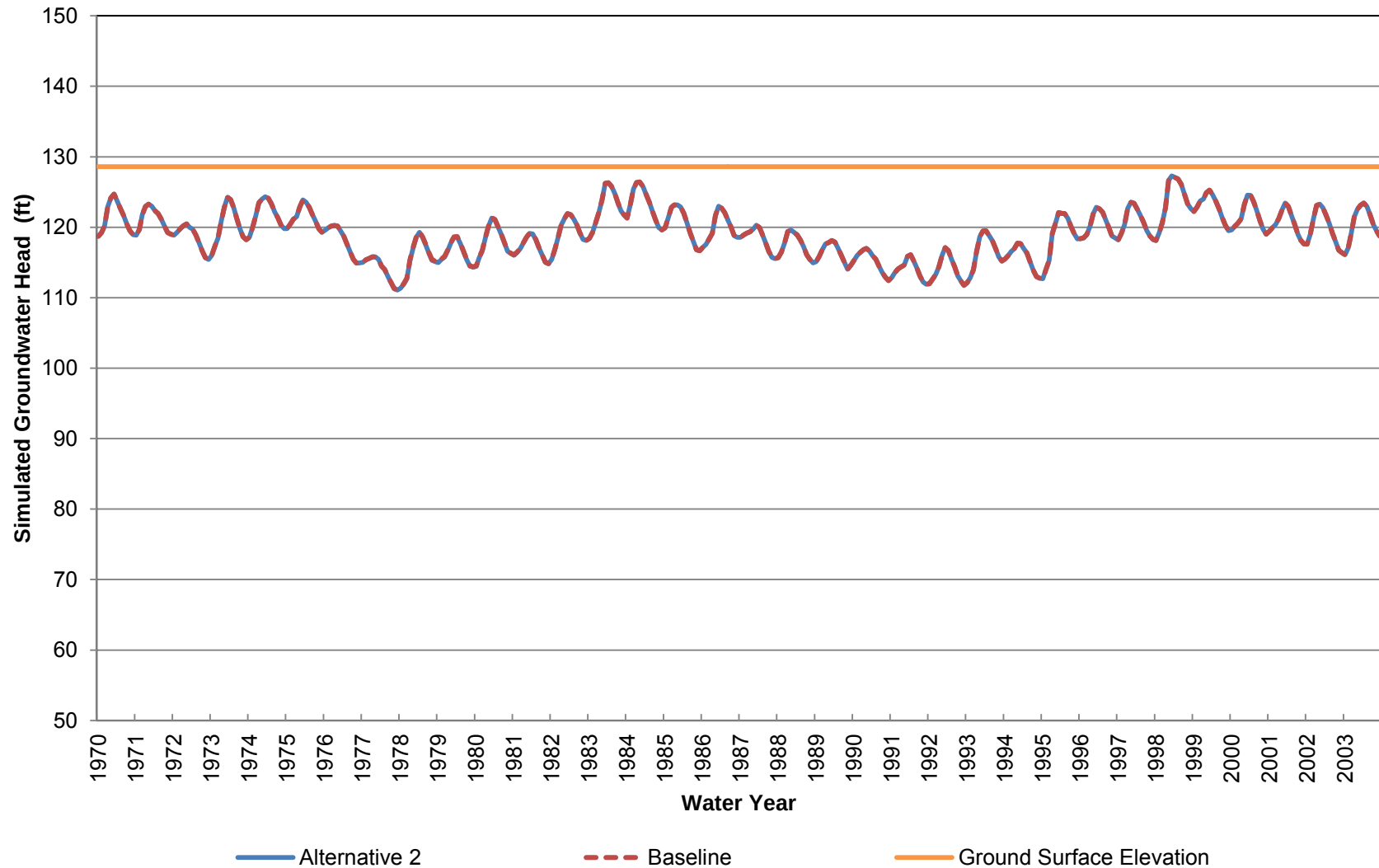
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 670-910 ft bgs)



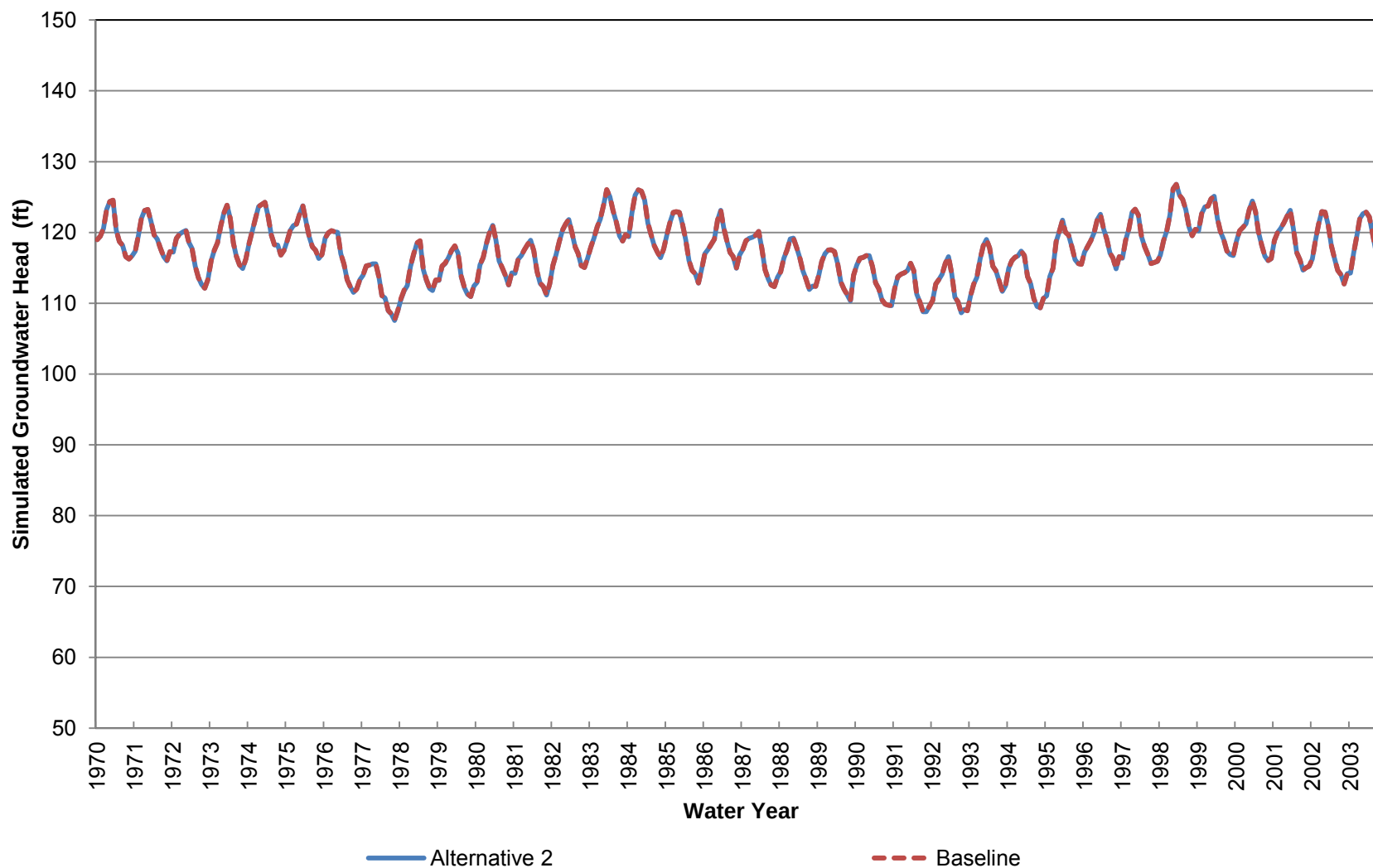
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 910-1310 ft bgs)



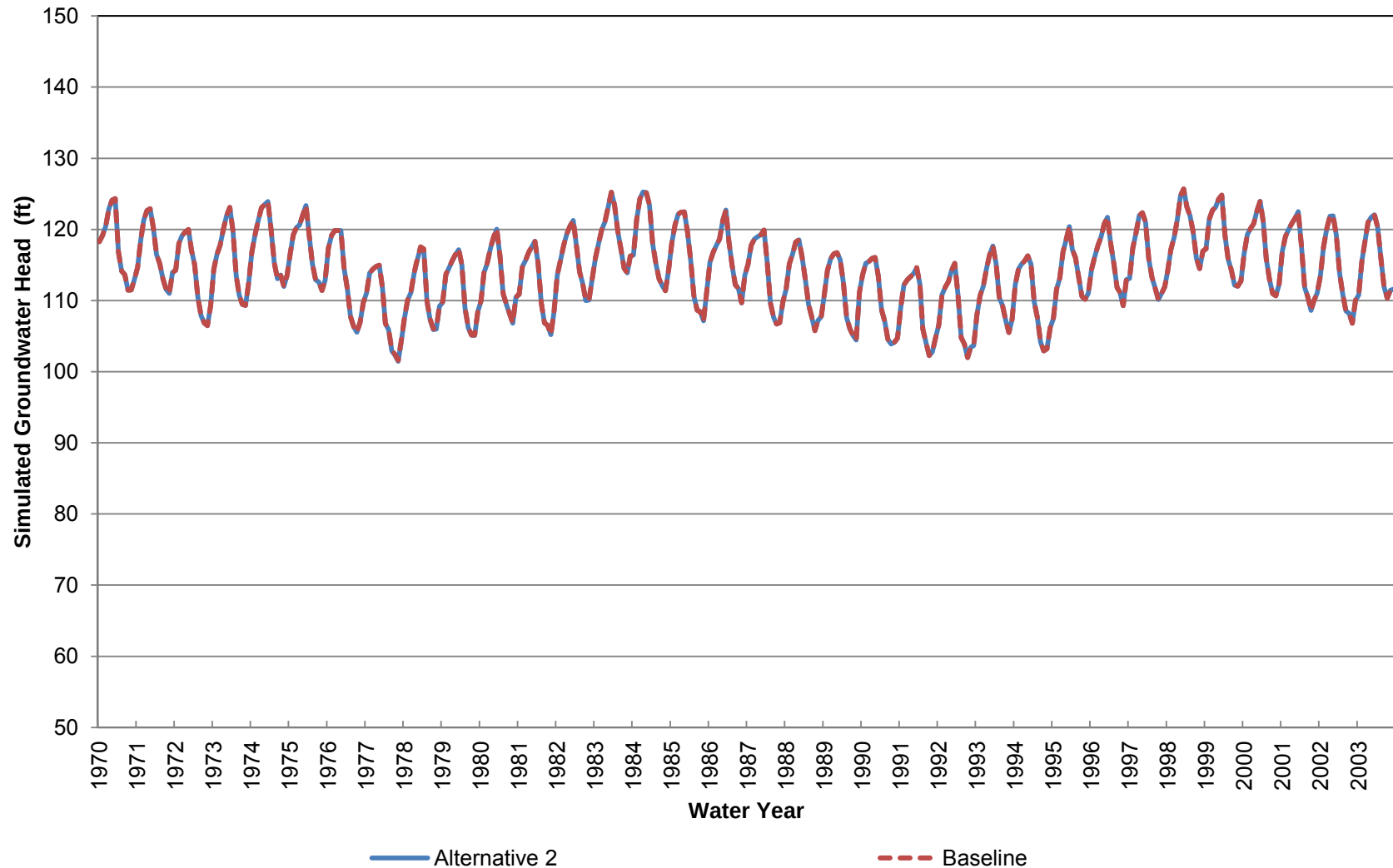
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 6 (Approximately 0-70 ft bgs)



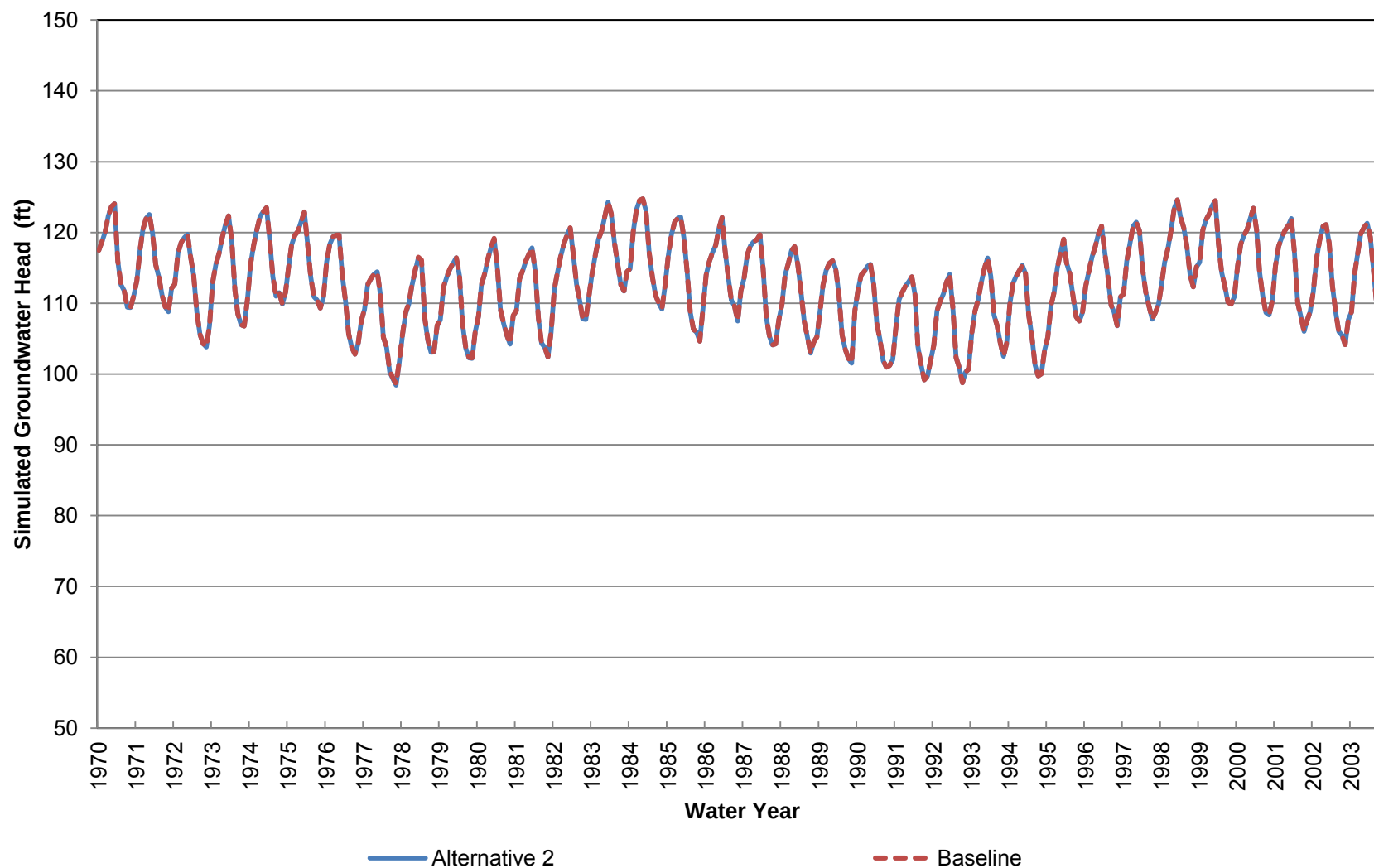
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 70-200 ft bgs)



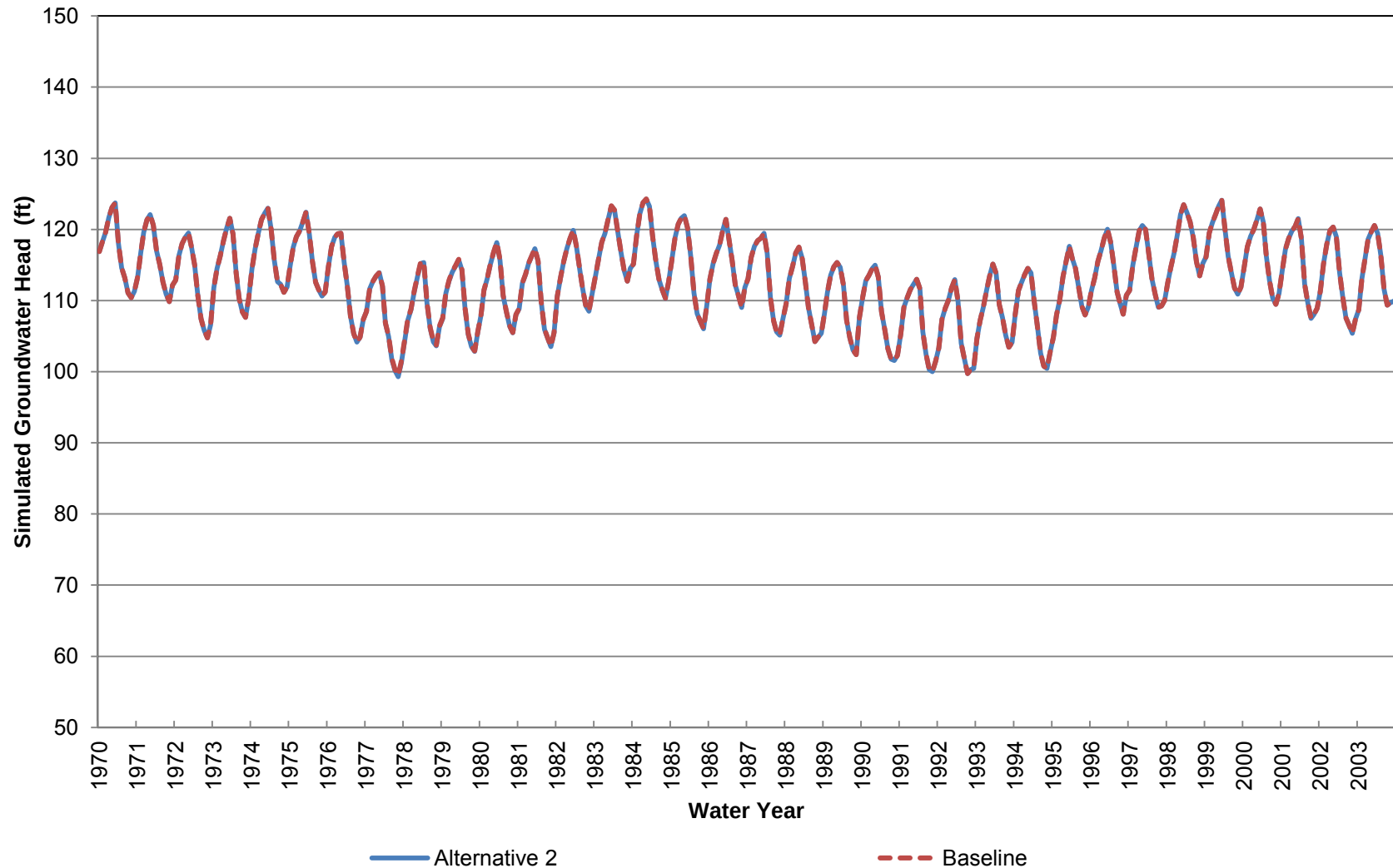
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 200-320 ft bgs)



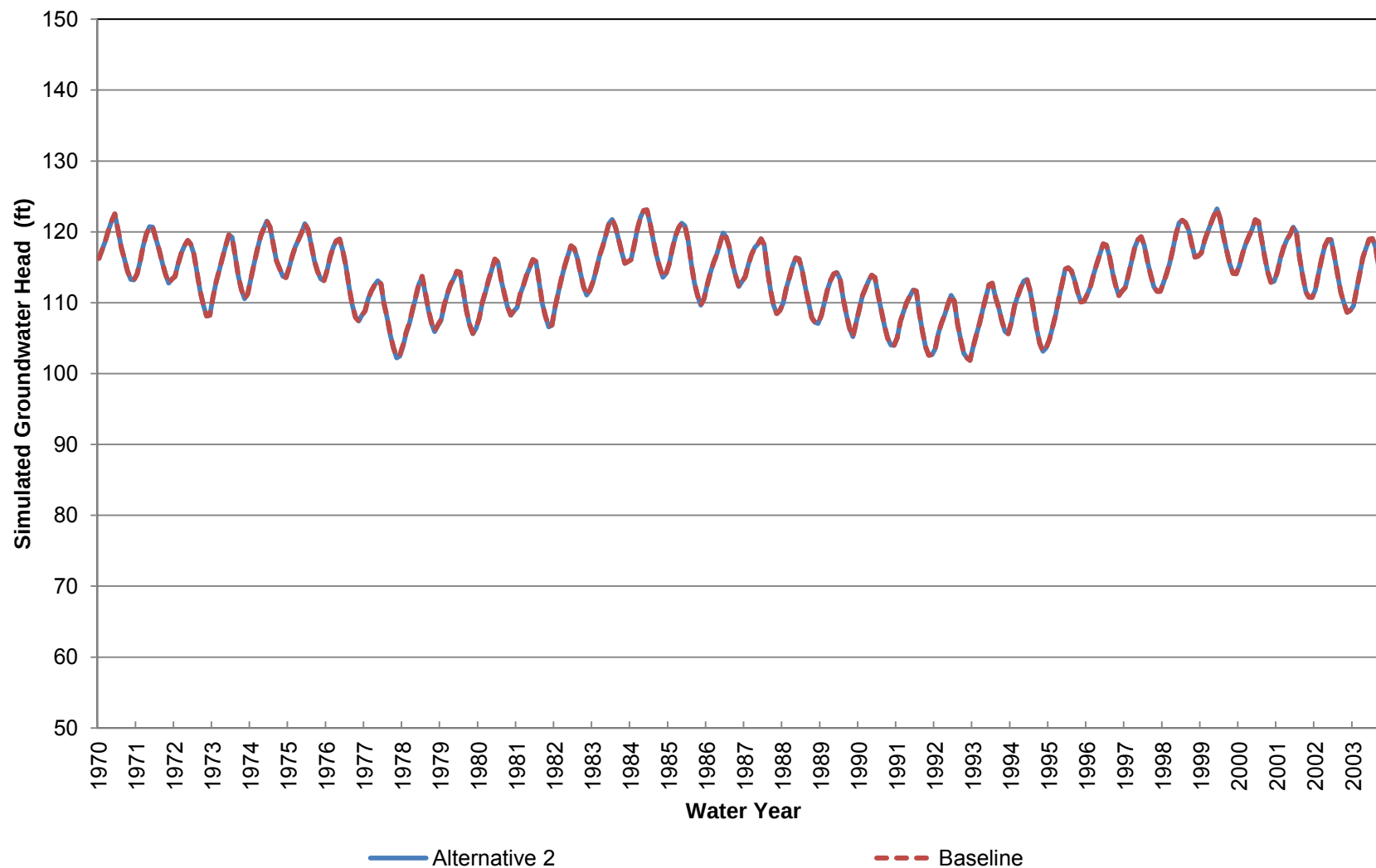
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 320-440 ft bgs)



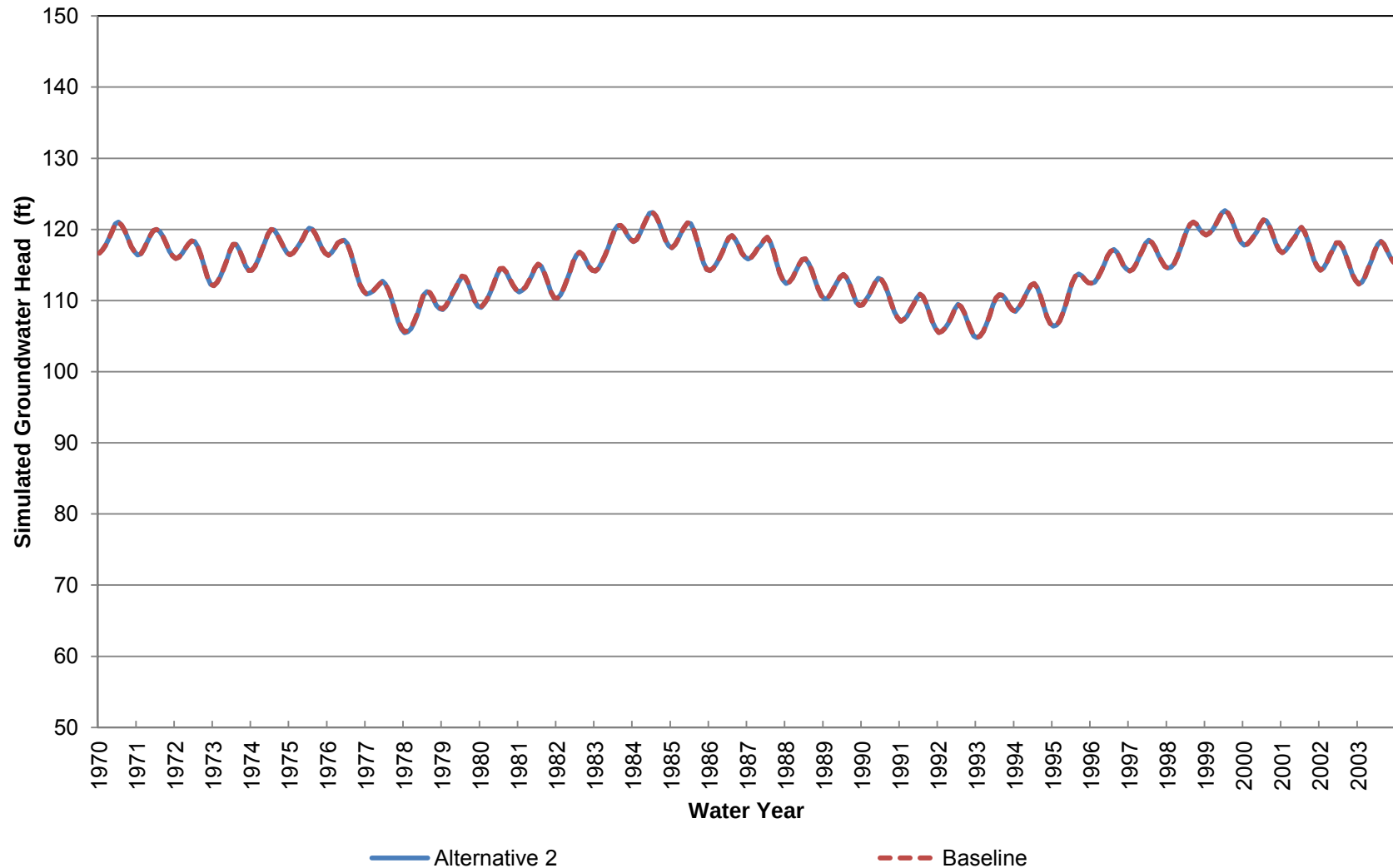
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 440-630 ft bgs)



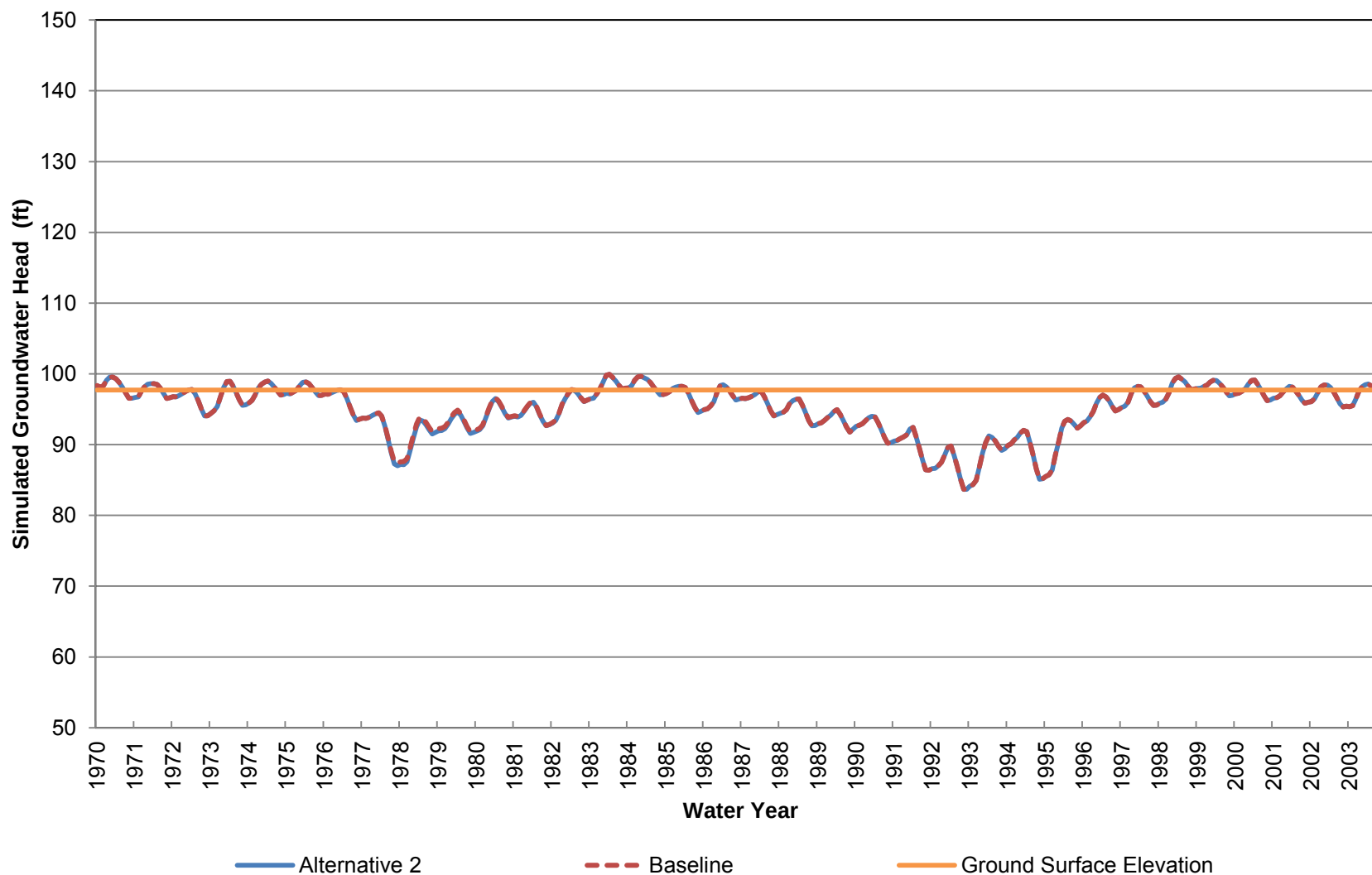
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 630-860 ft bgs)



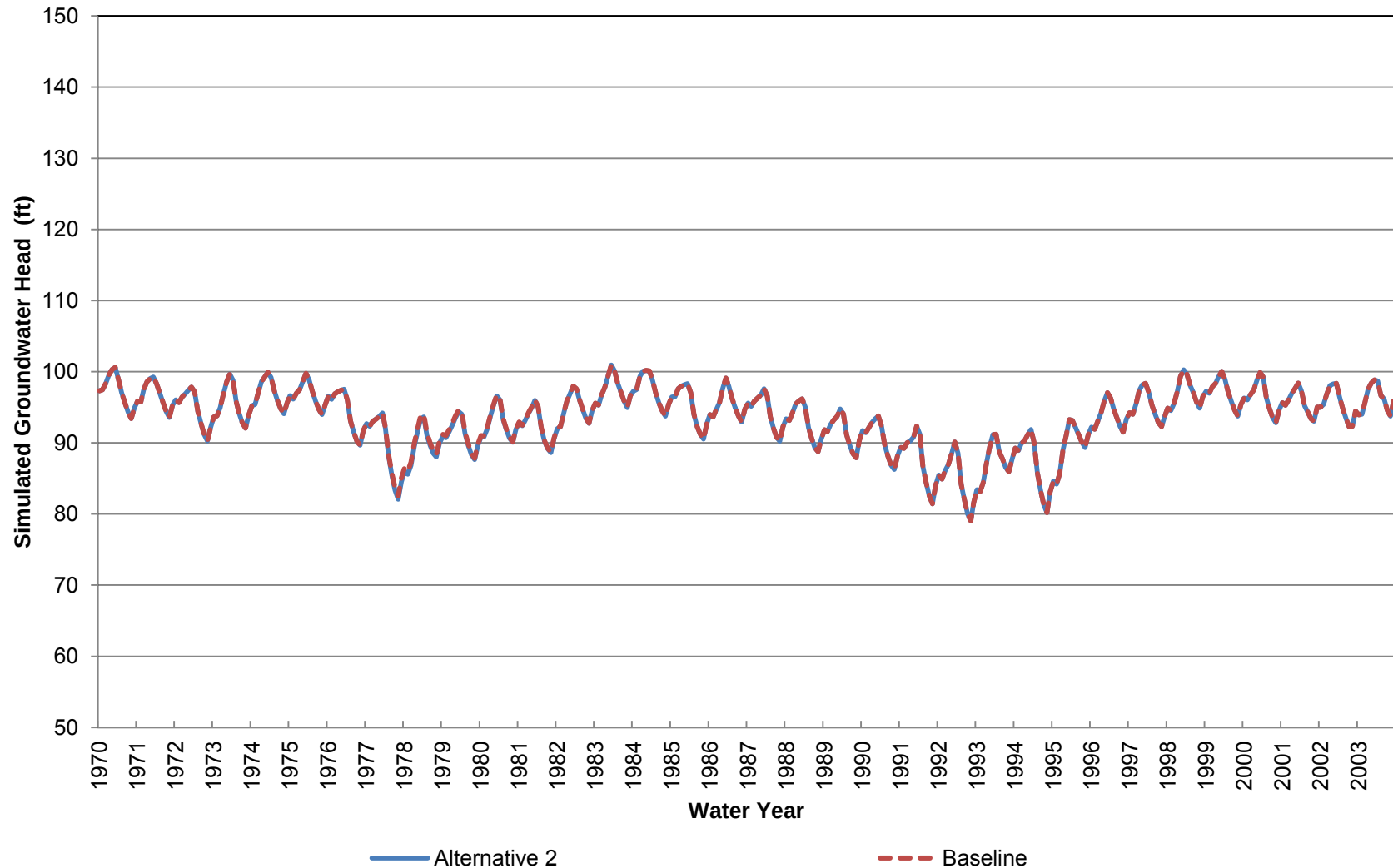
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 860-1290 ft bgs)



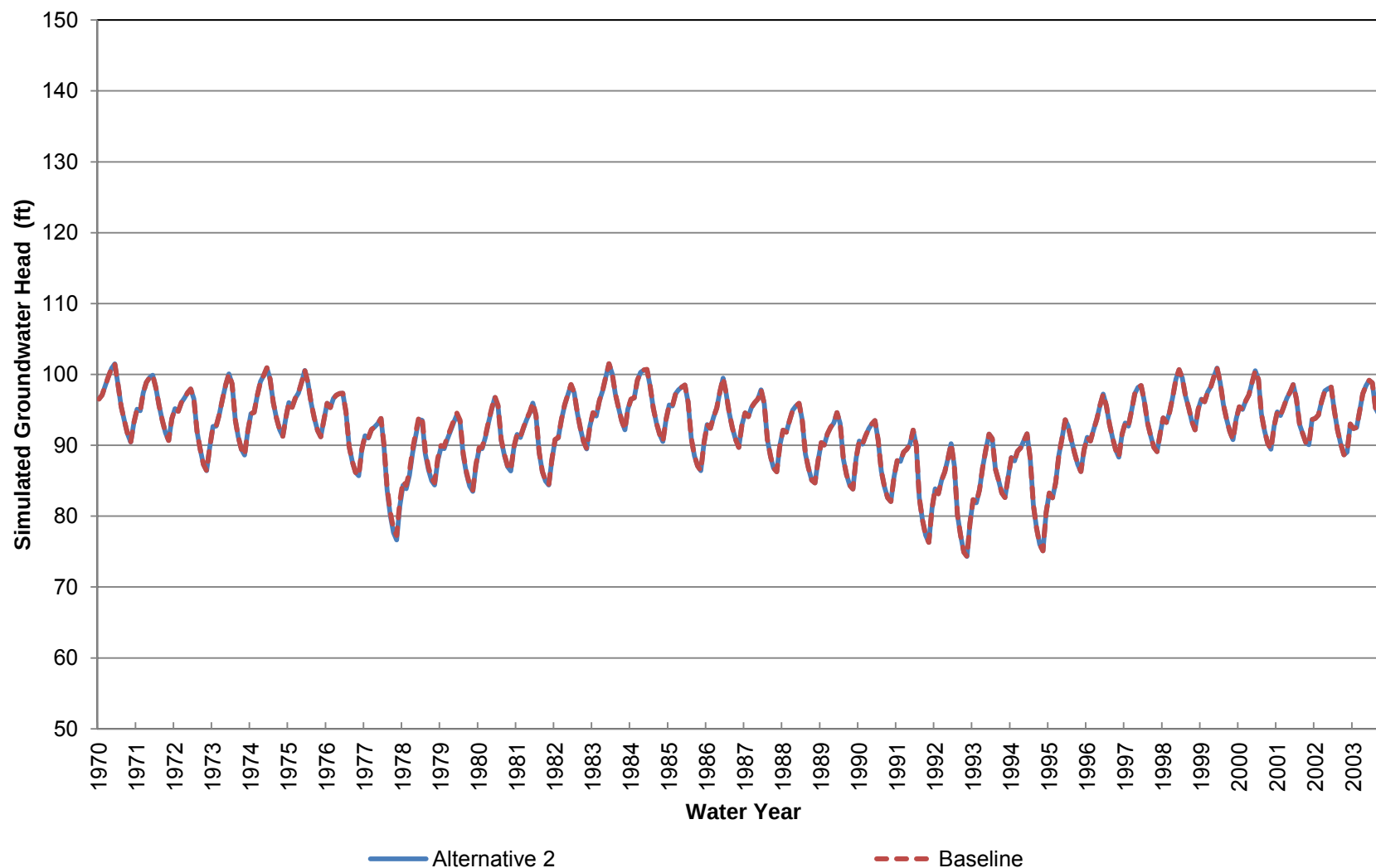
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 7 (Approximately 0-70 ft bgs)



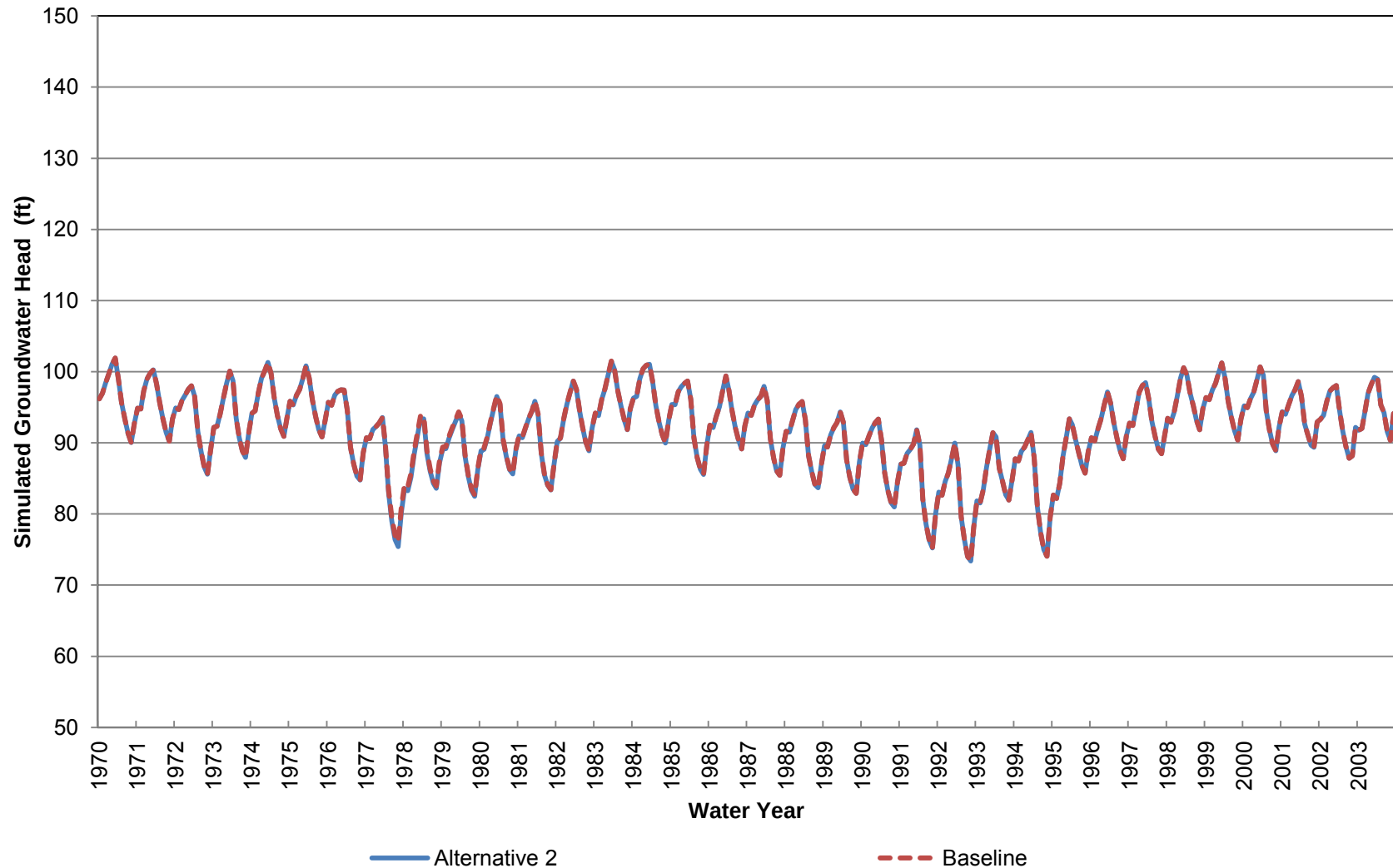
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 70-220 ft bgs)



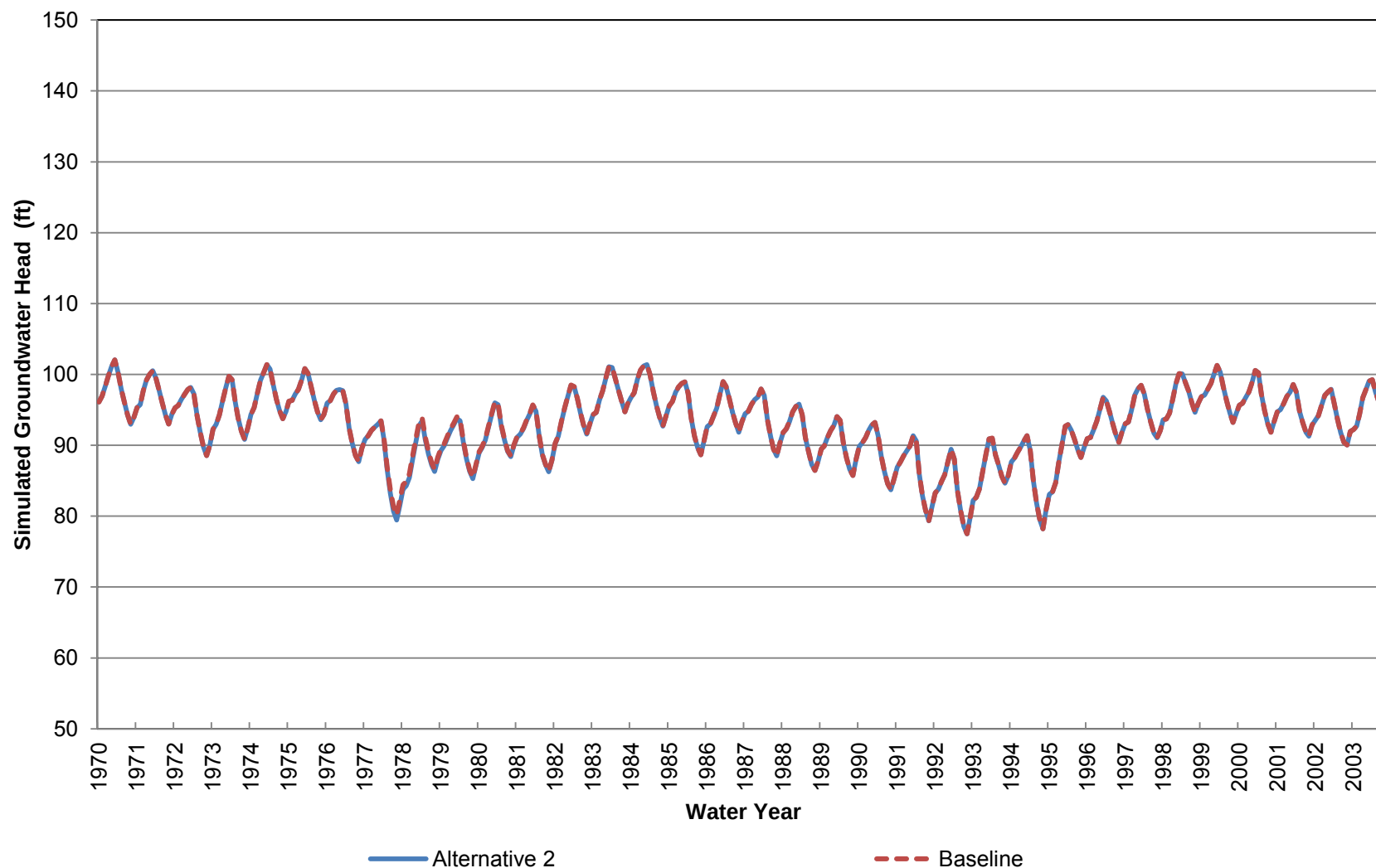
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 220-370 ft bgs)



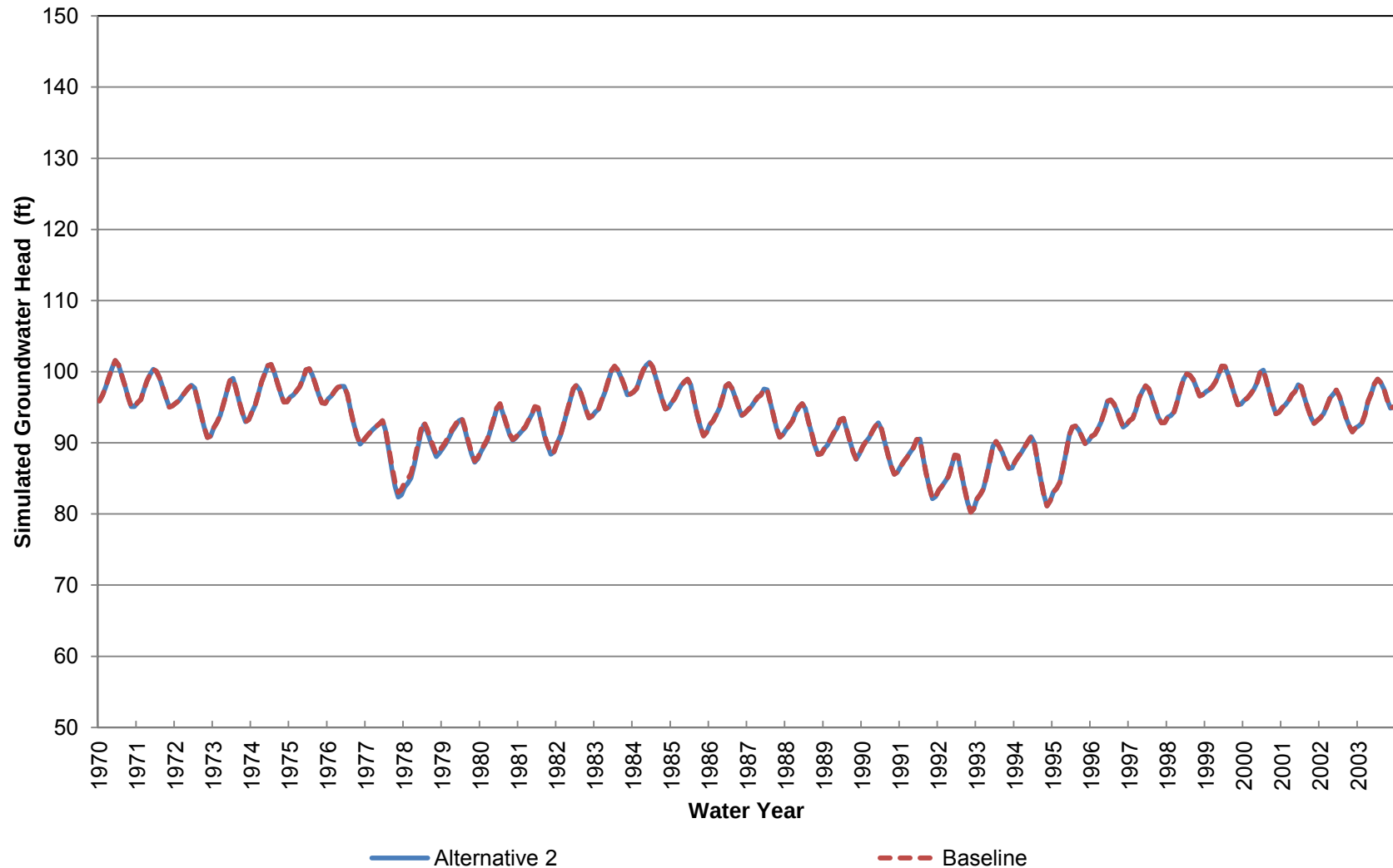
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 370-520 ft bgs)



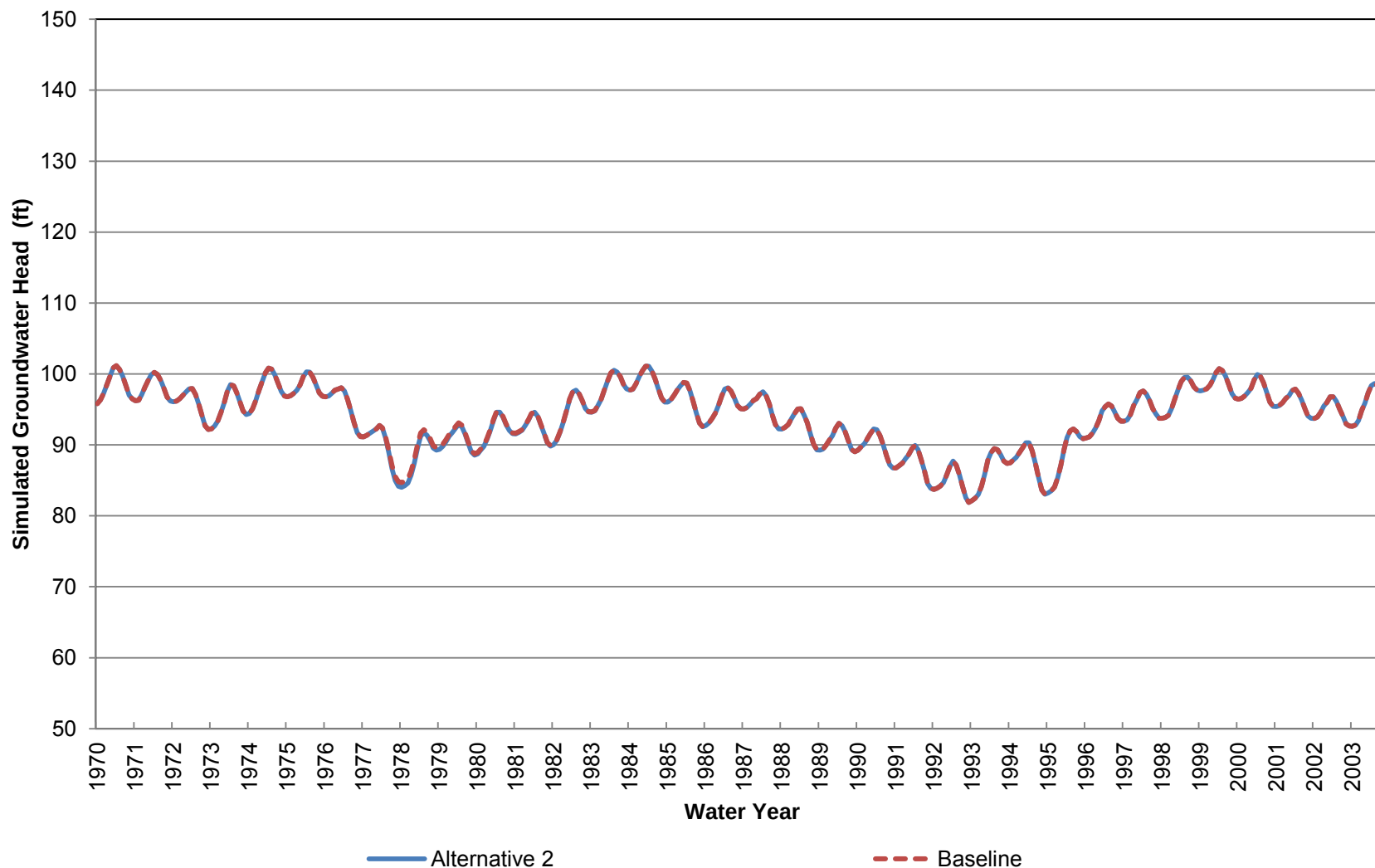
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 520-760 ft bgs)



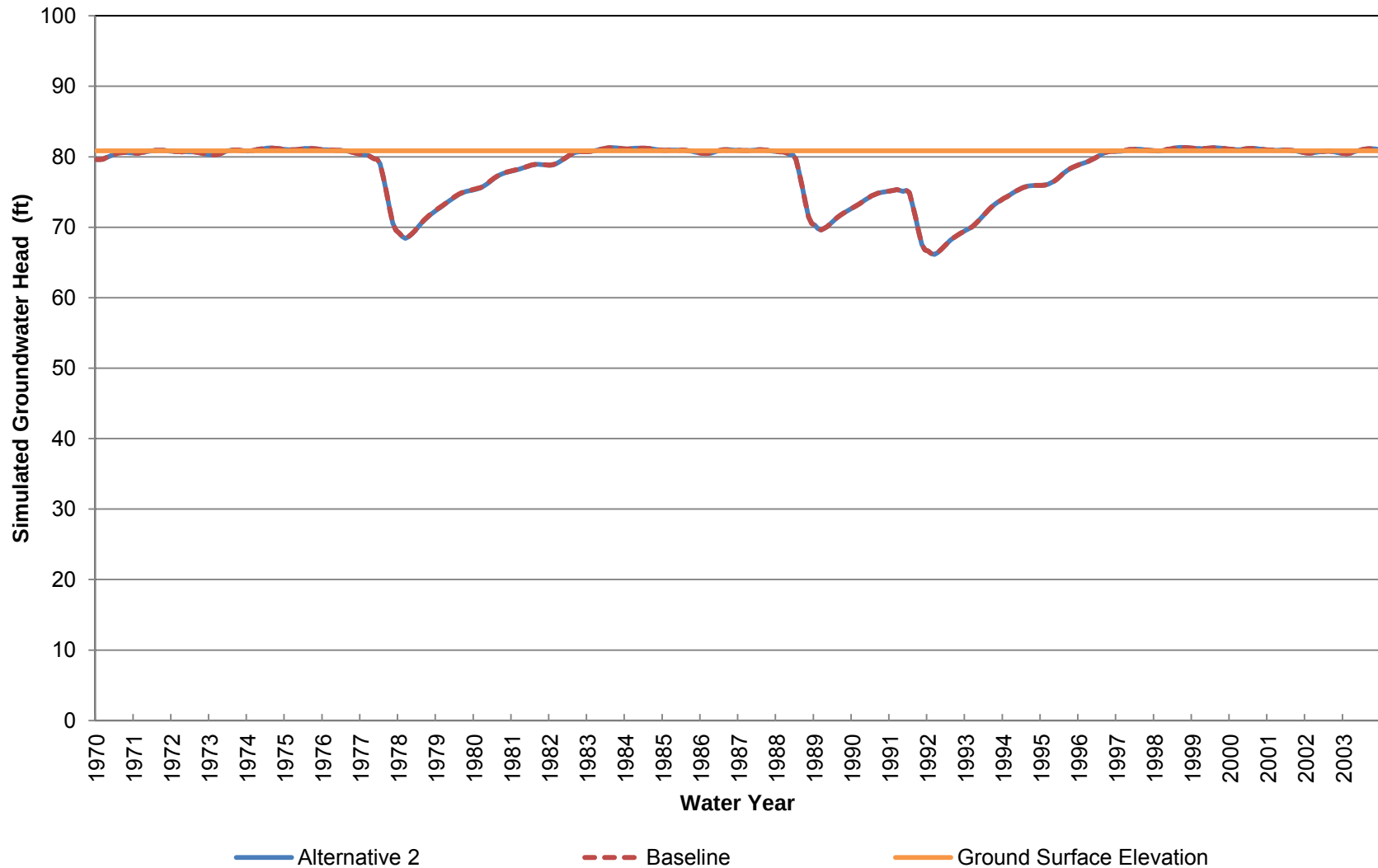
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 760-1030 ft bgs)



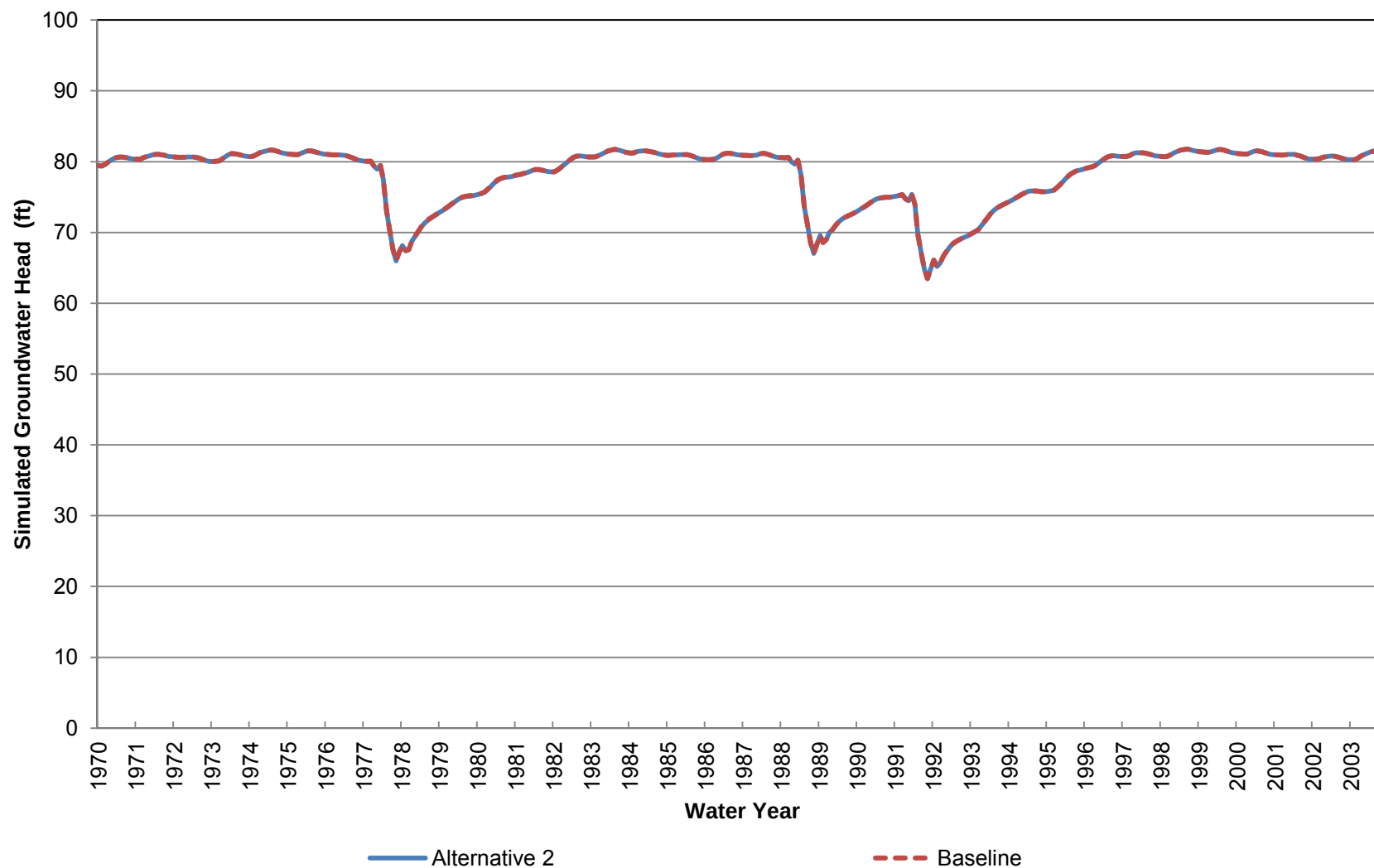
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 1030-1520 ft bgs)



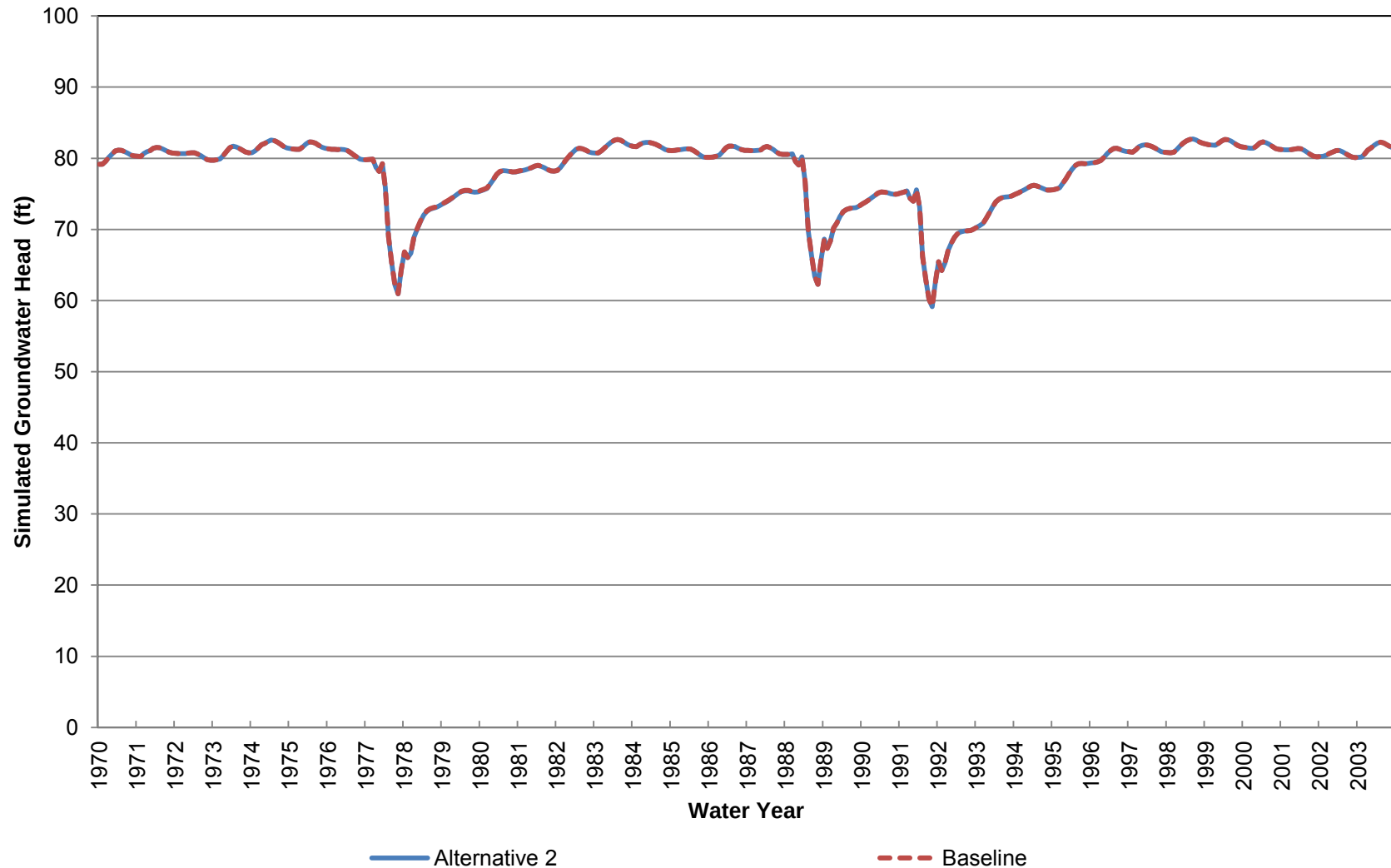
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 8 (Approximately 0-70 ft bgs)



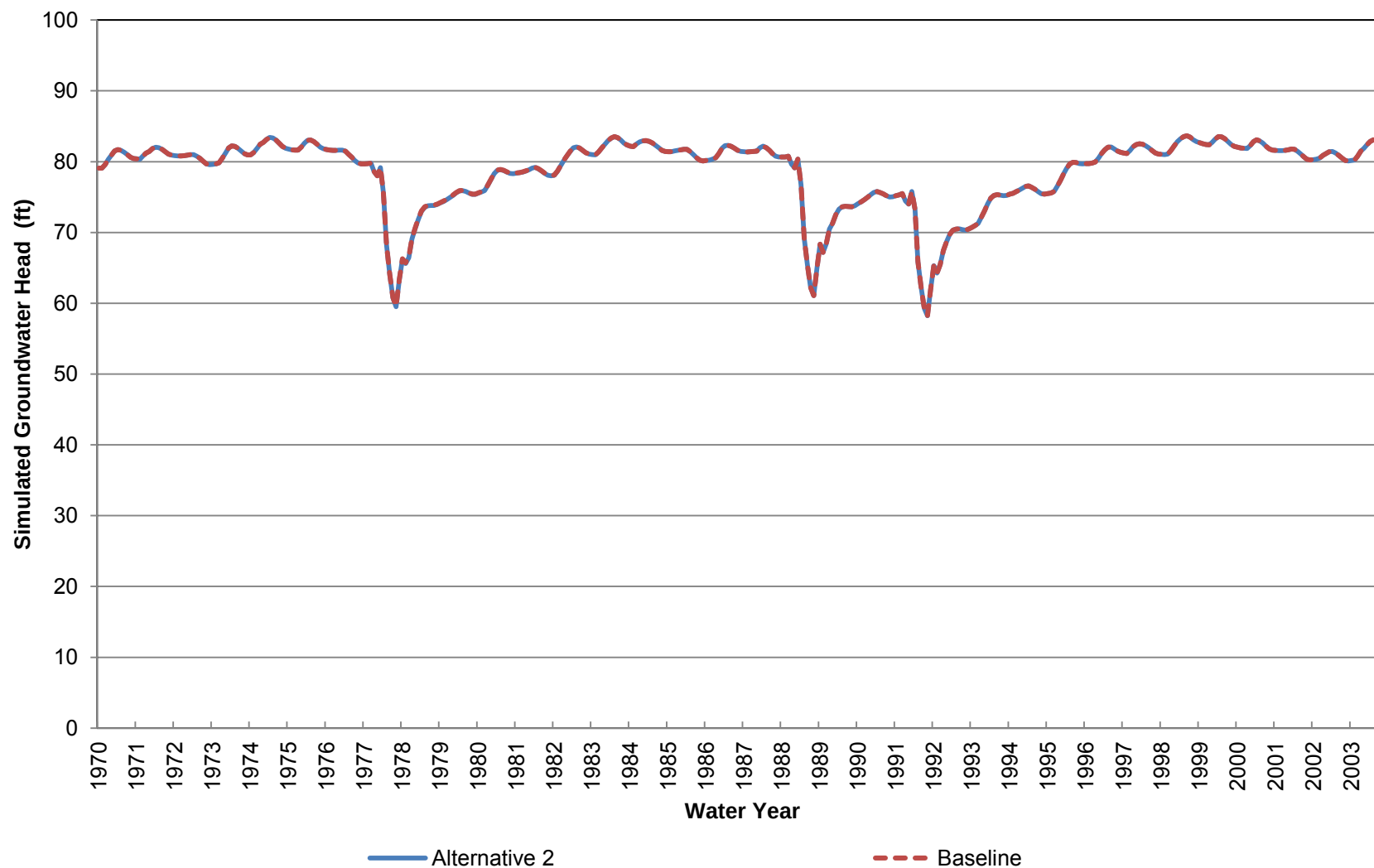
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 70-200 ft bgs)



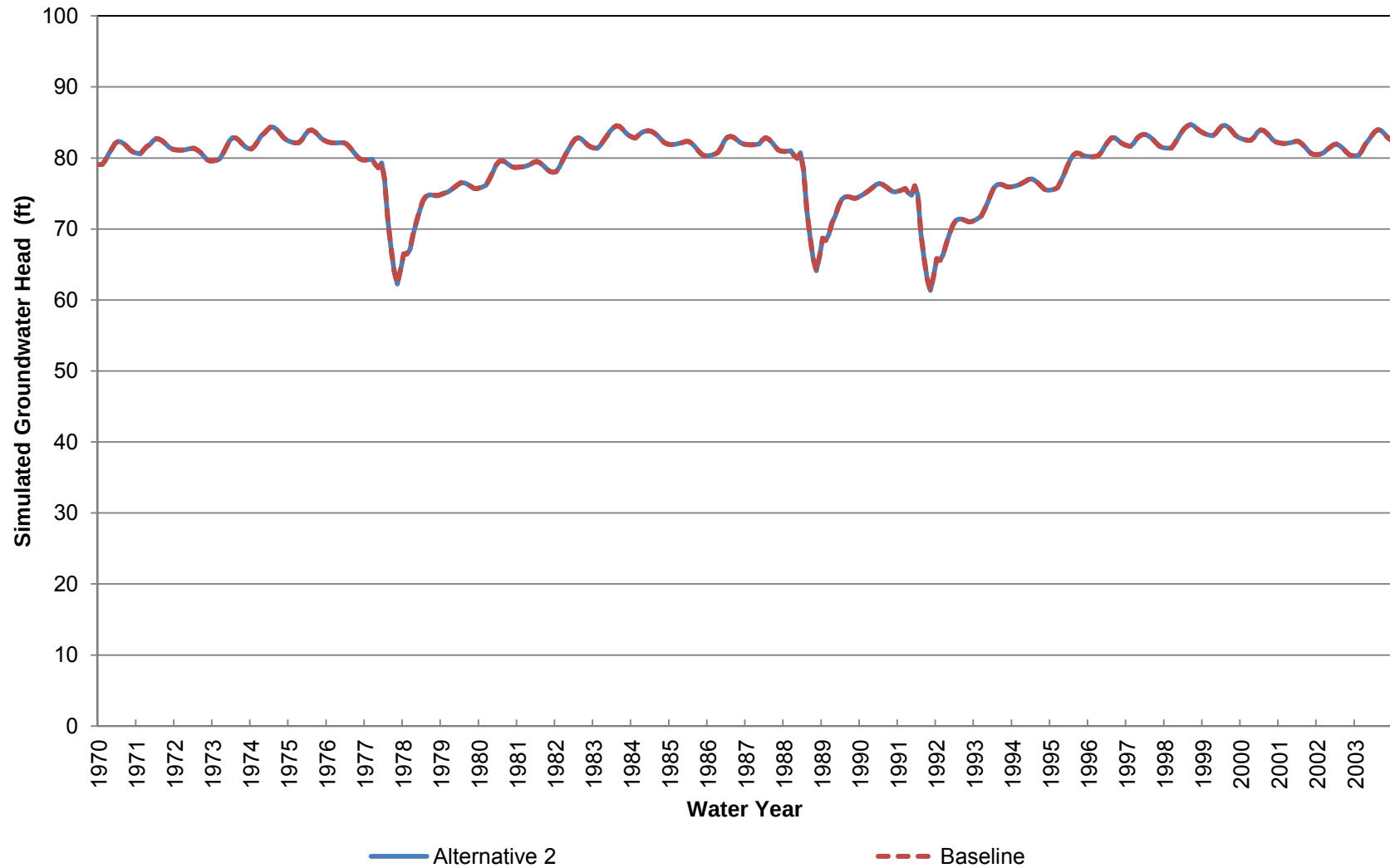
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 200-330 ft bgs)



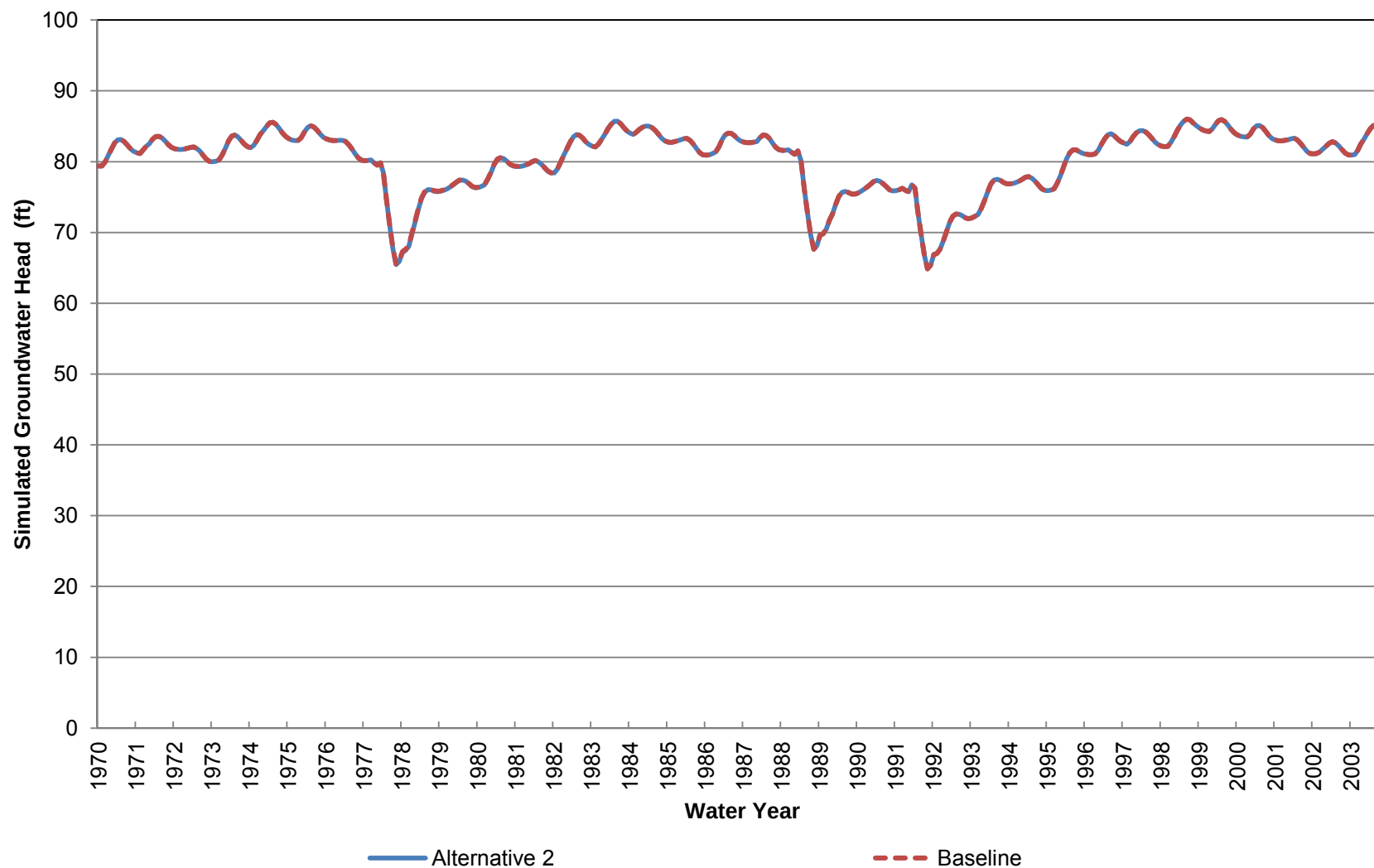
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 330-450 ft bgs)



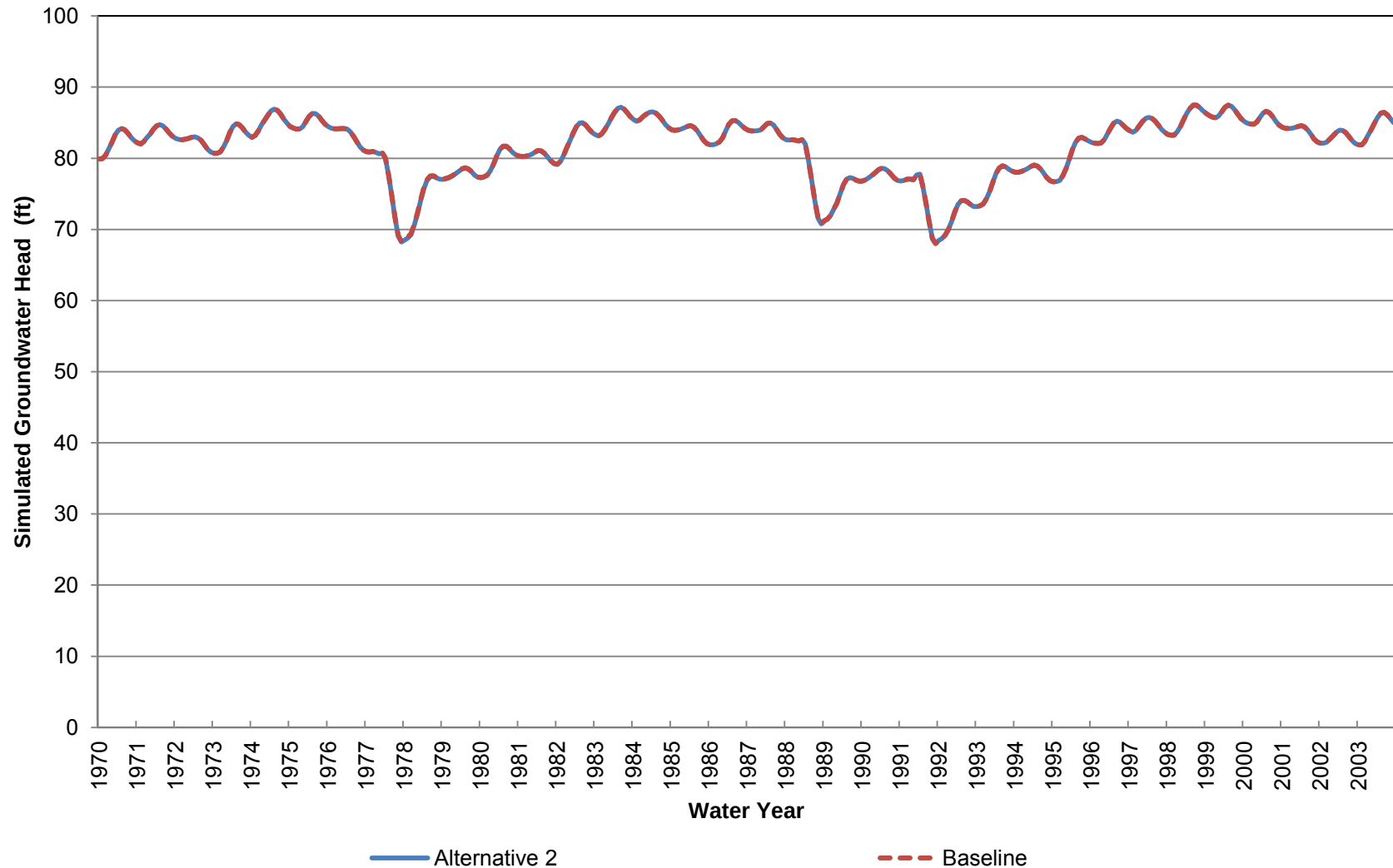
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 450-650 ft bgs)



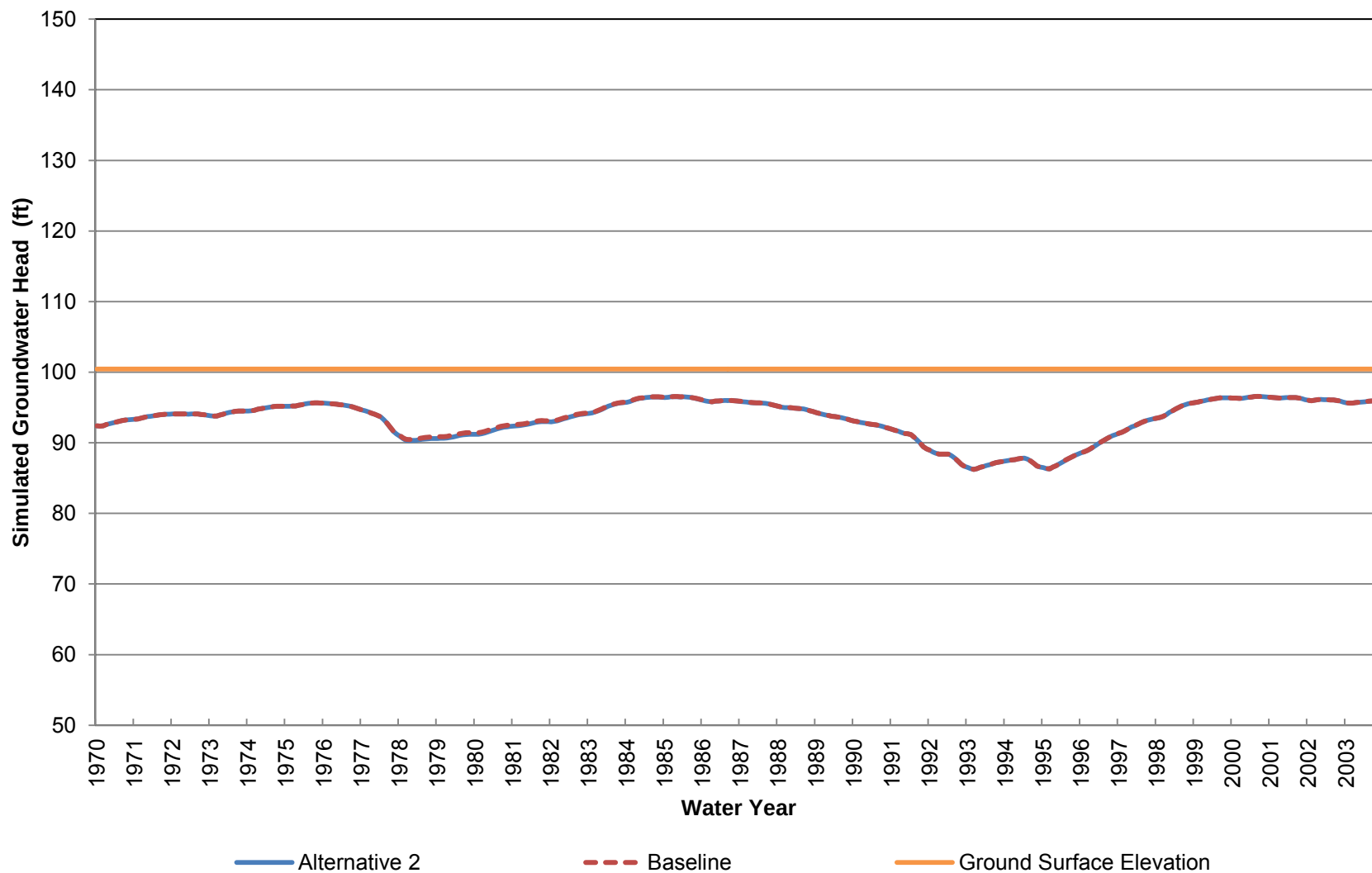
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 650-890 ft bgs)



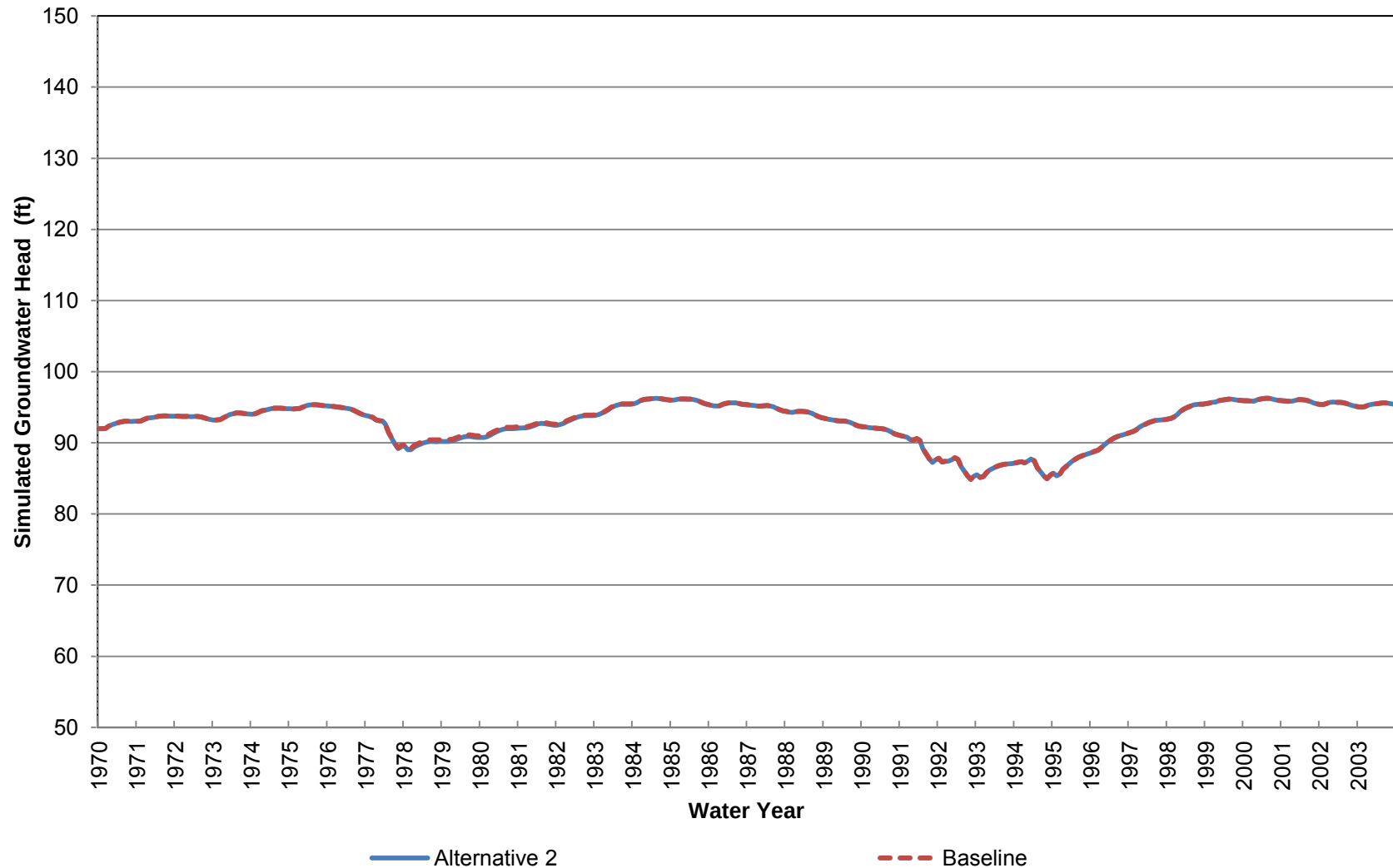
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 890-1330 ft bgs)



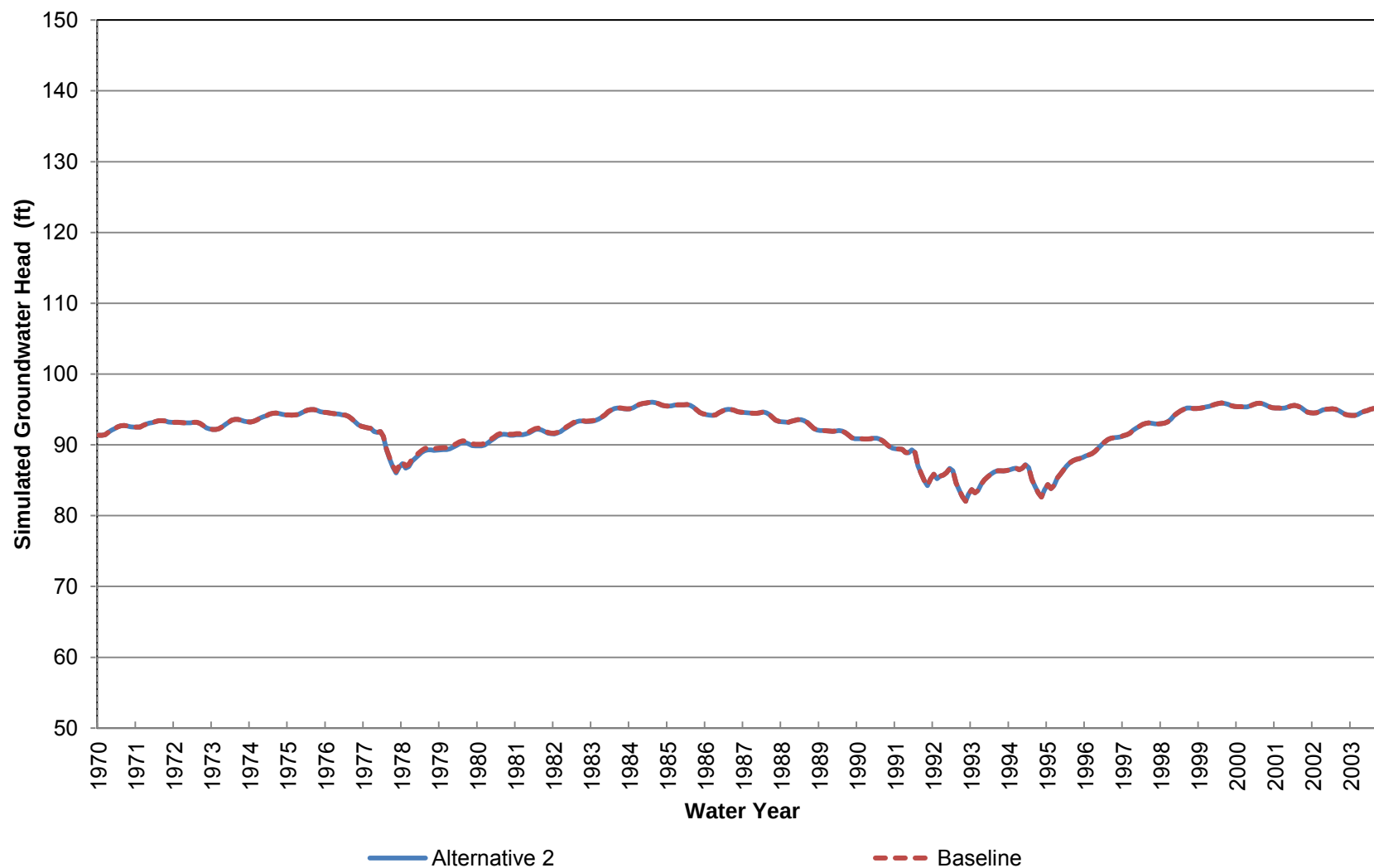
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 9 (Approximately 0-70 ft bgs)



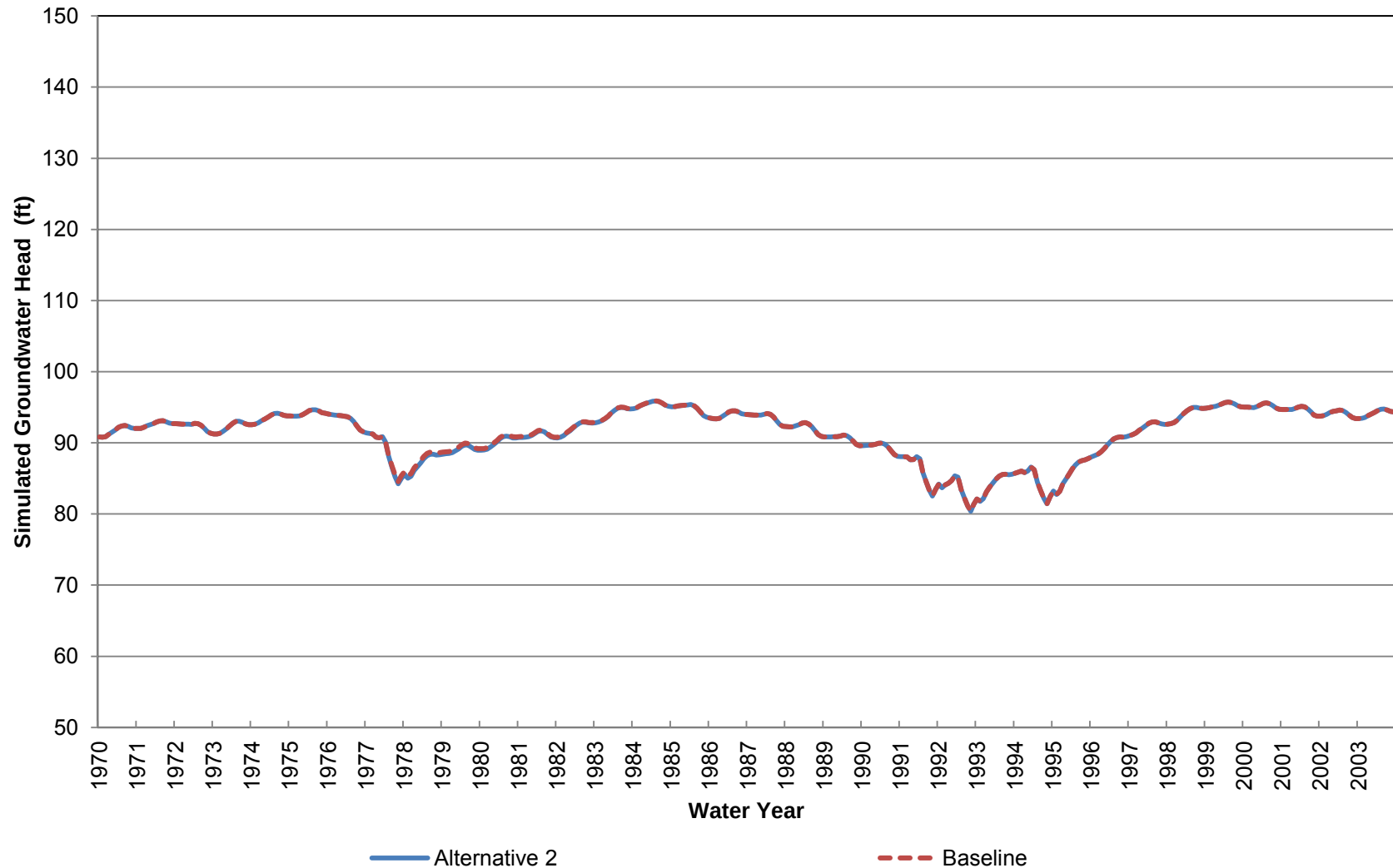
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 70-210 ft bgs)



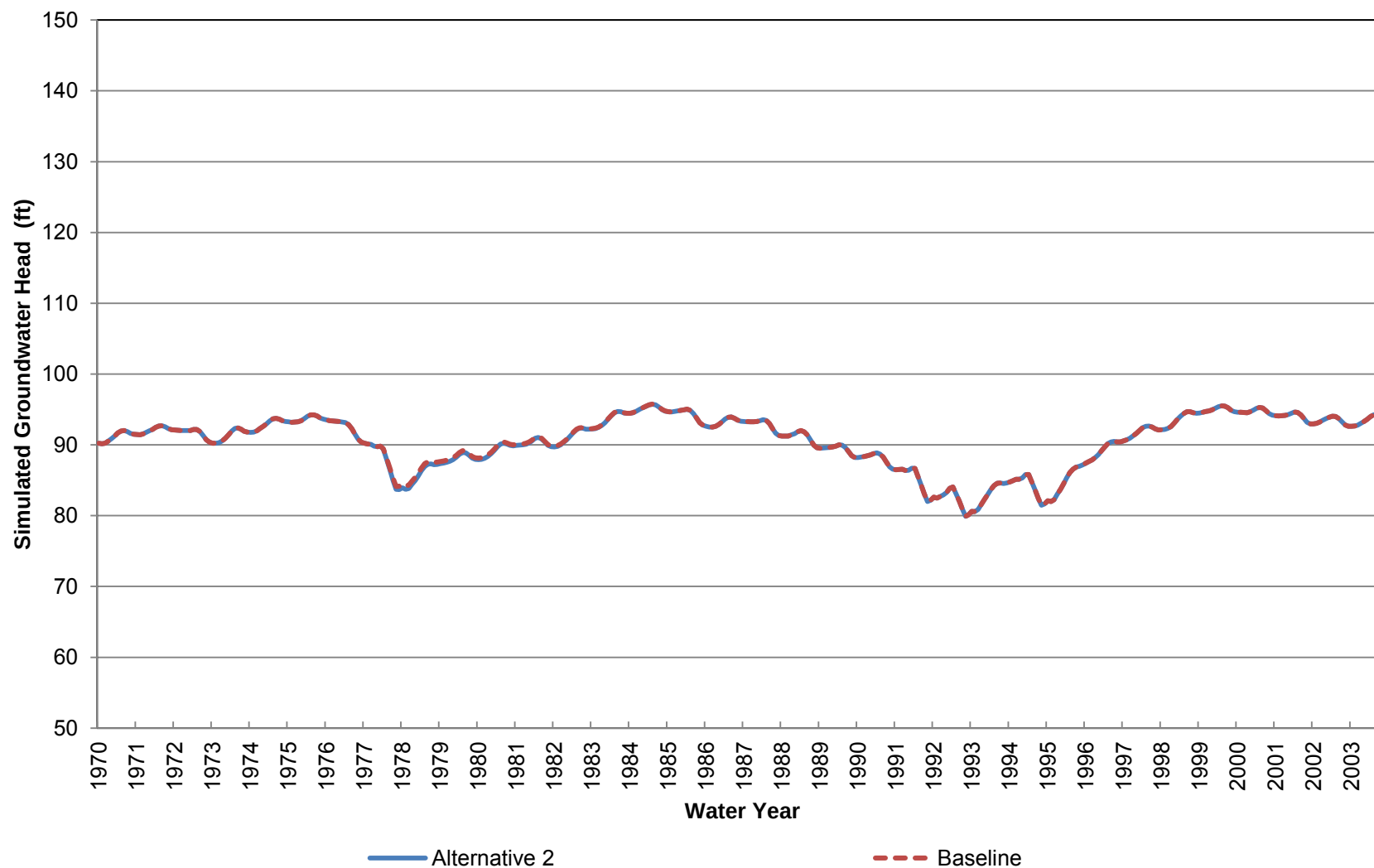
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 210-340 ft bgs)



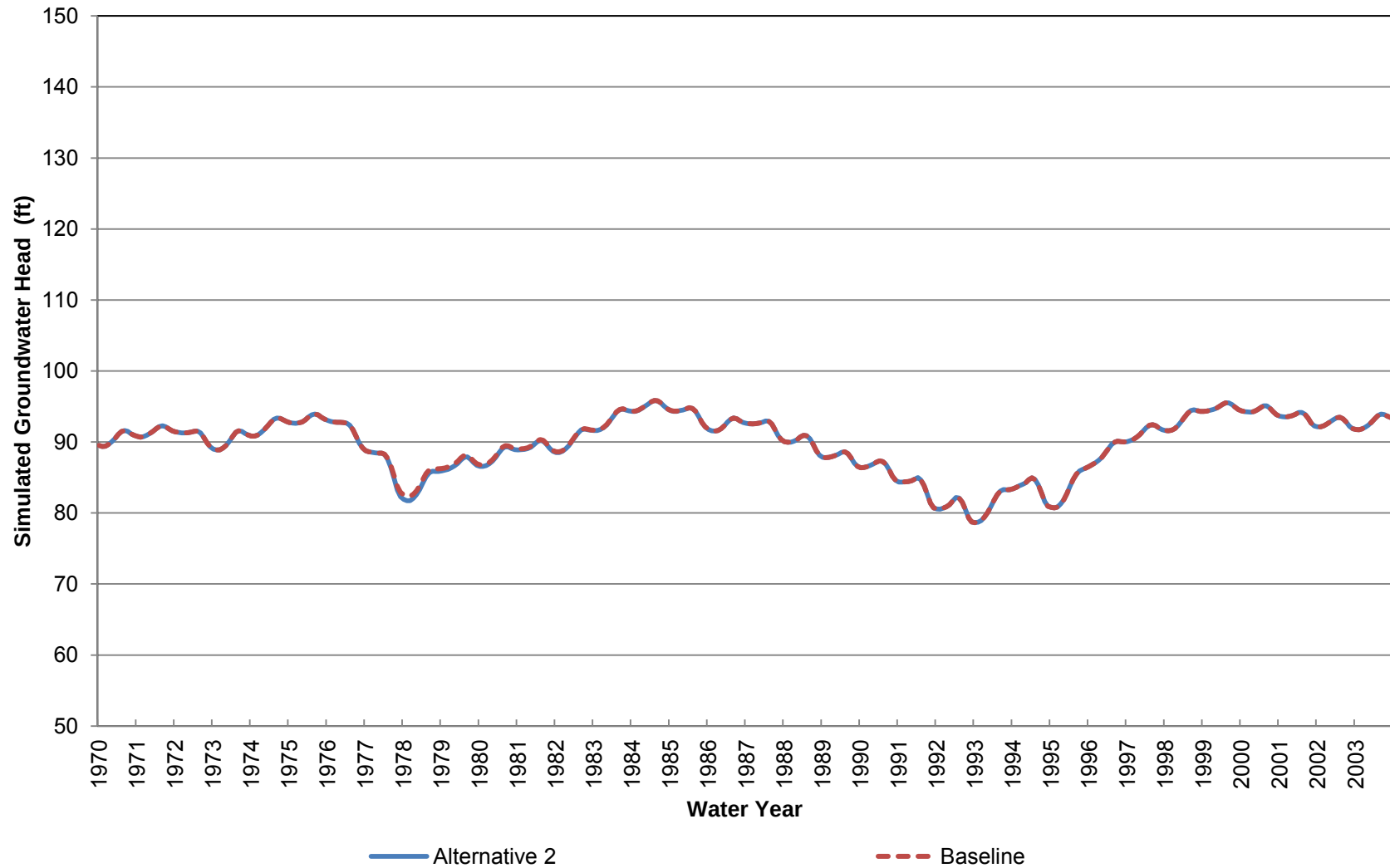
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 340-480 ft bgs)



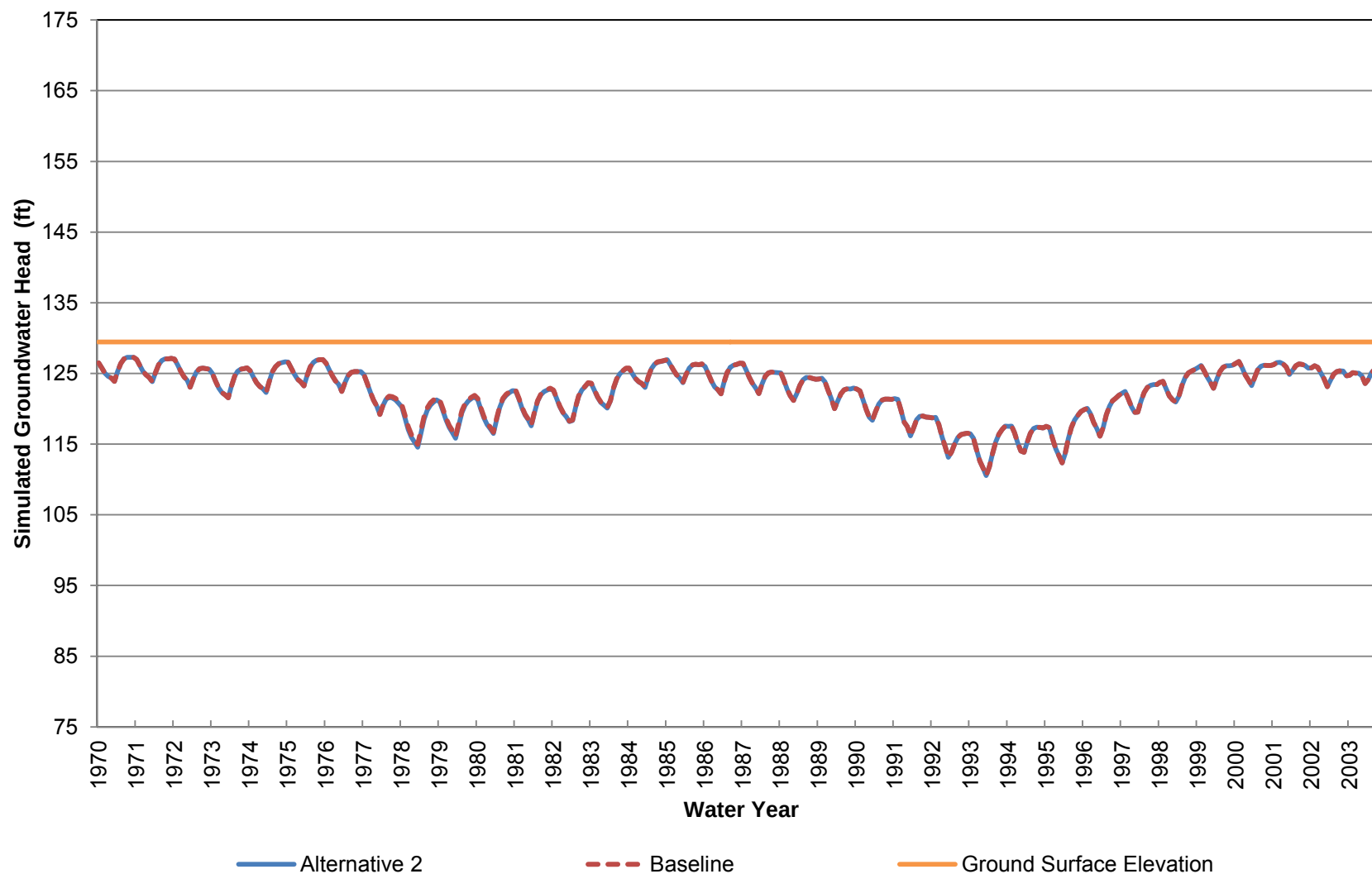
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 480-690 ft bgs)



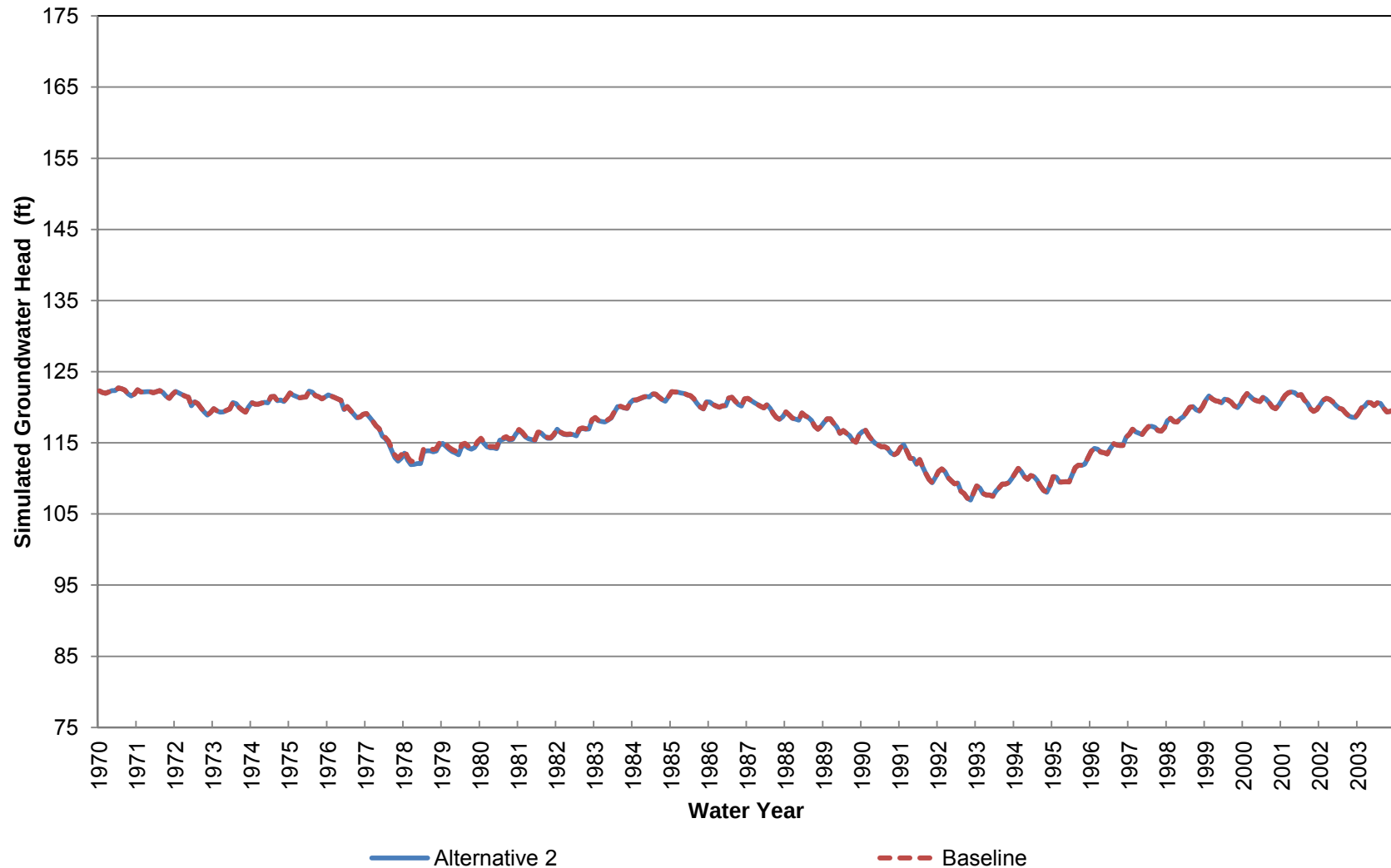
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 910-1250 ft bgs)



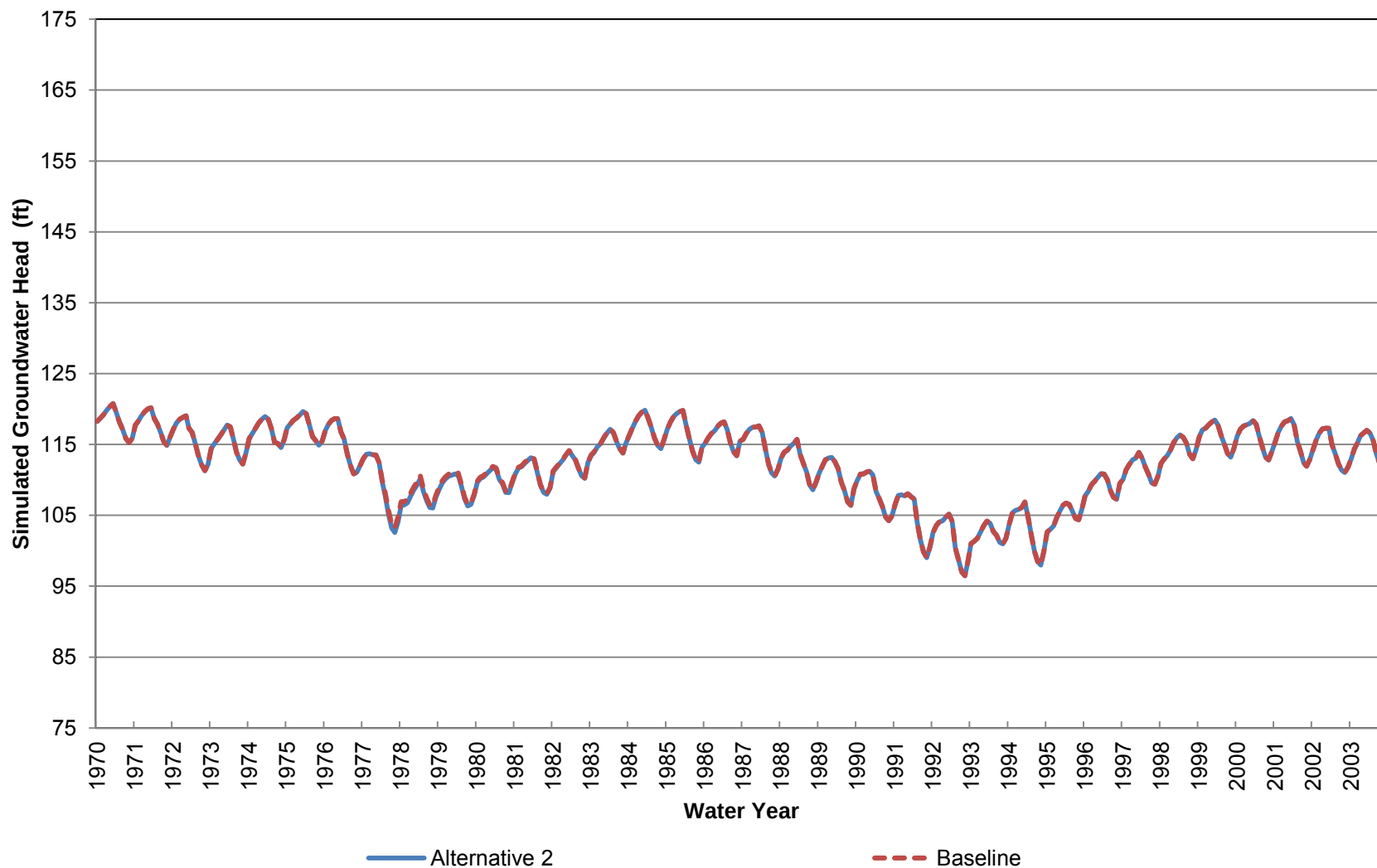
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 10 (Approximately 0-70 ft bgs)



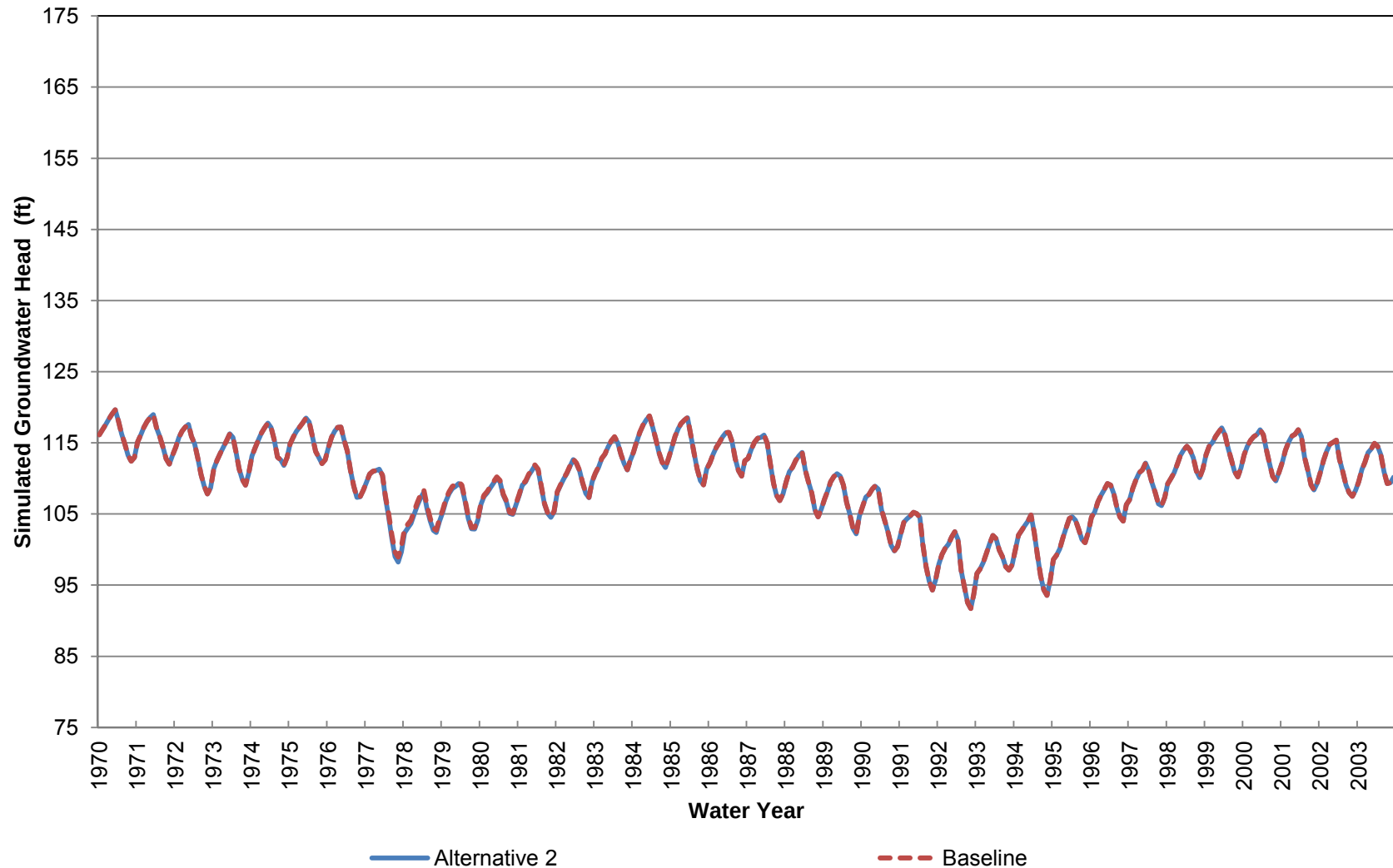
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 70-240 ft bgs)



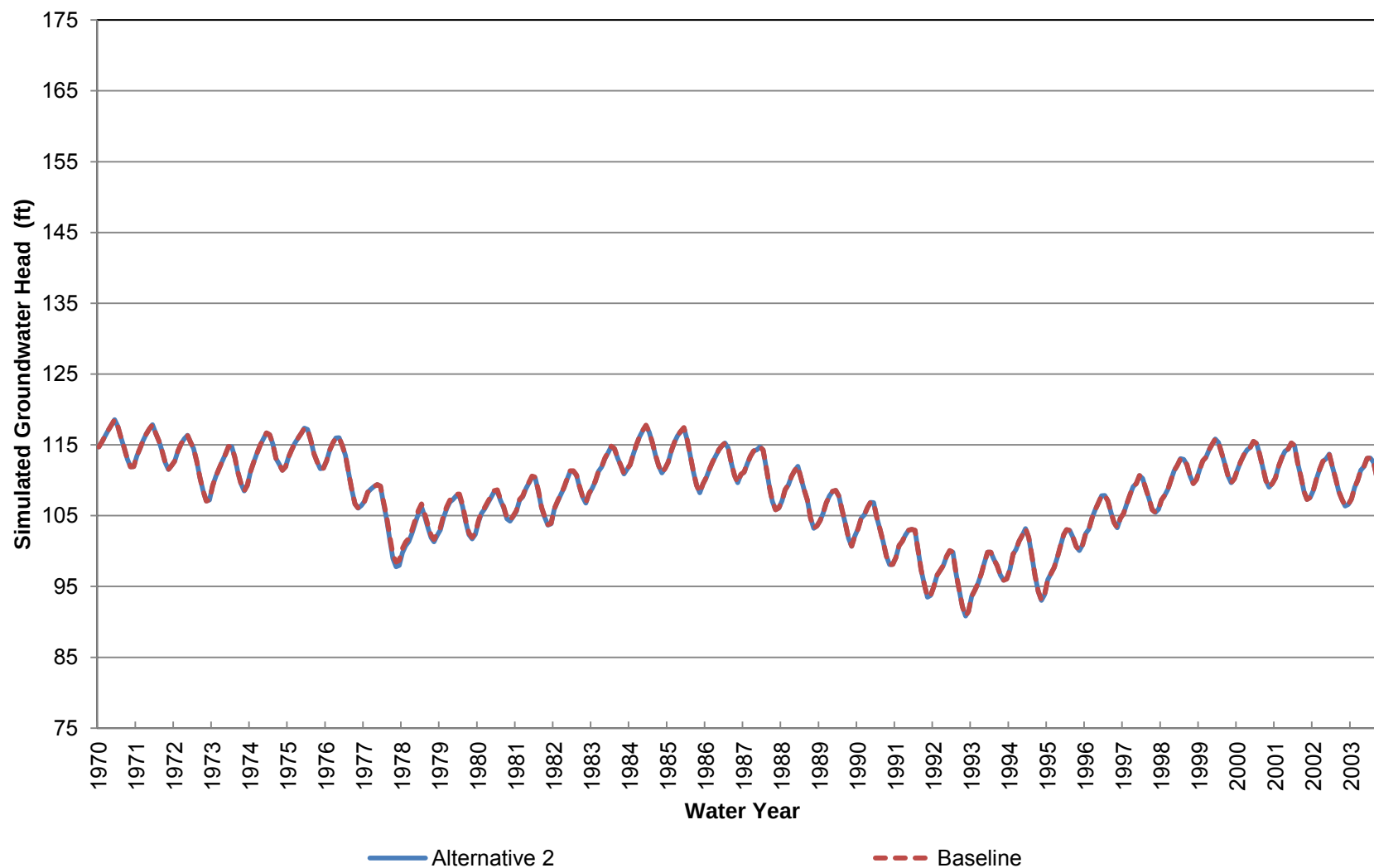
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 240-420 ft bgs)



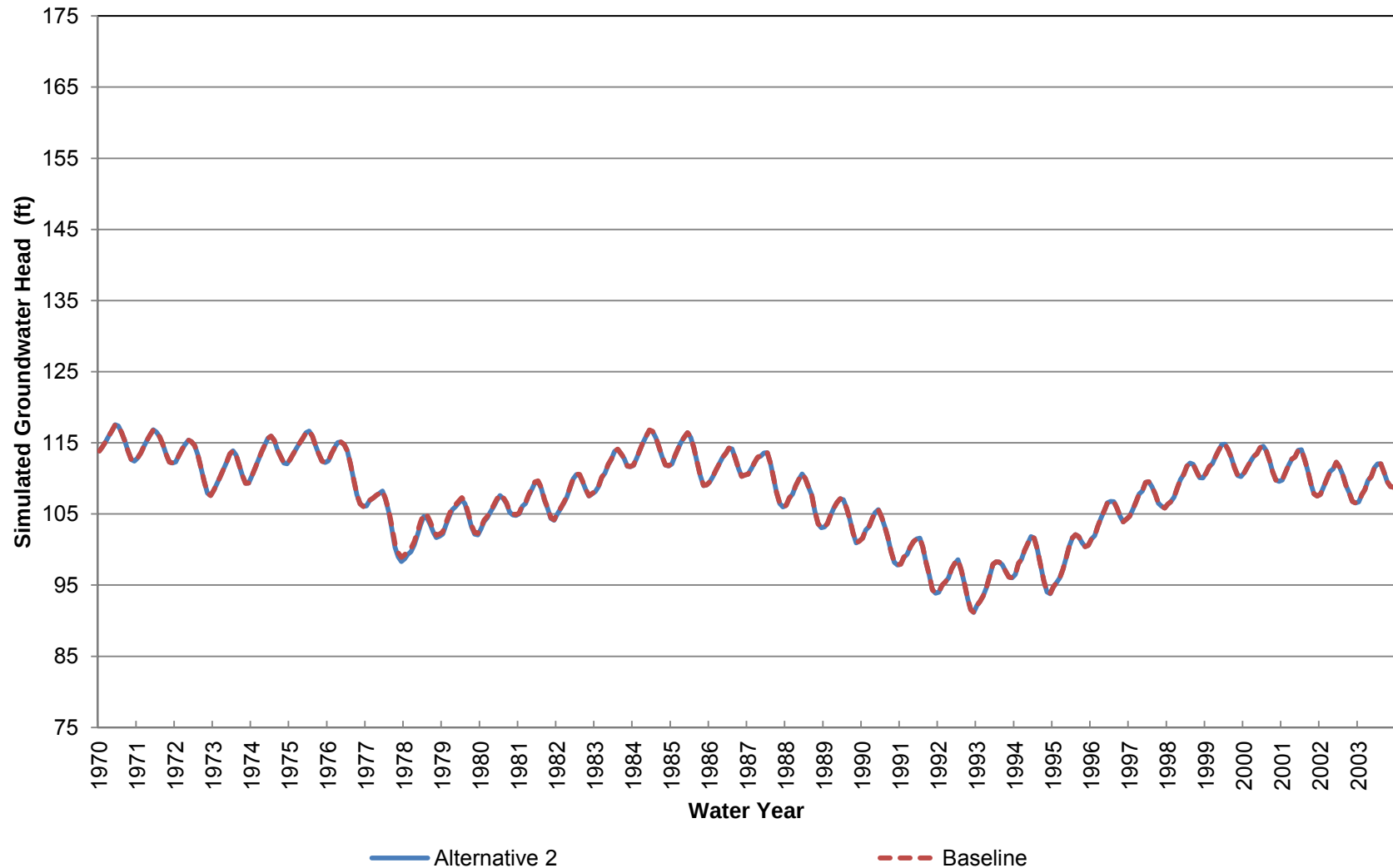
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 420-590 ft bgs)



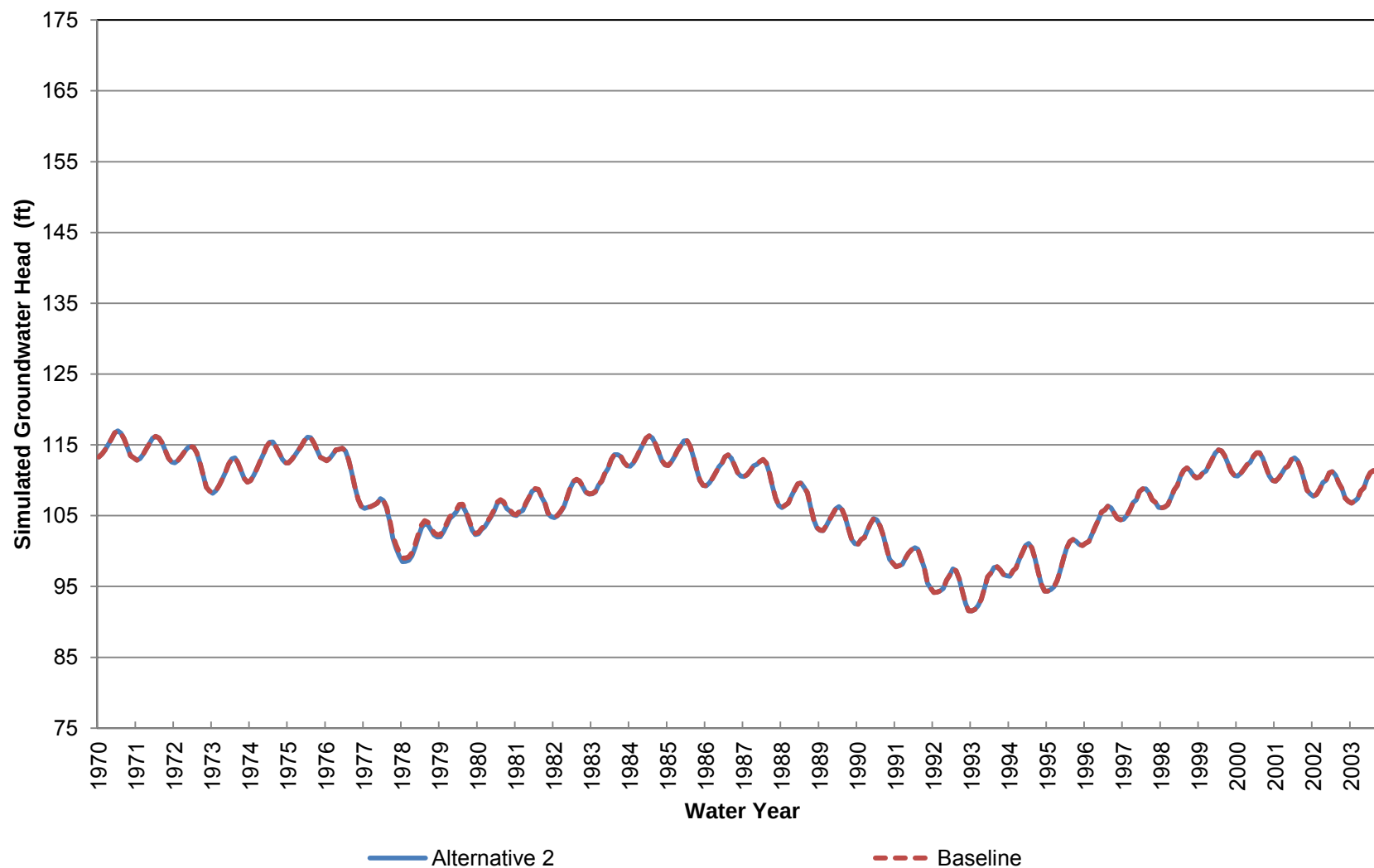
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 590-870 ft bgs)



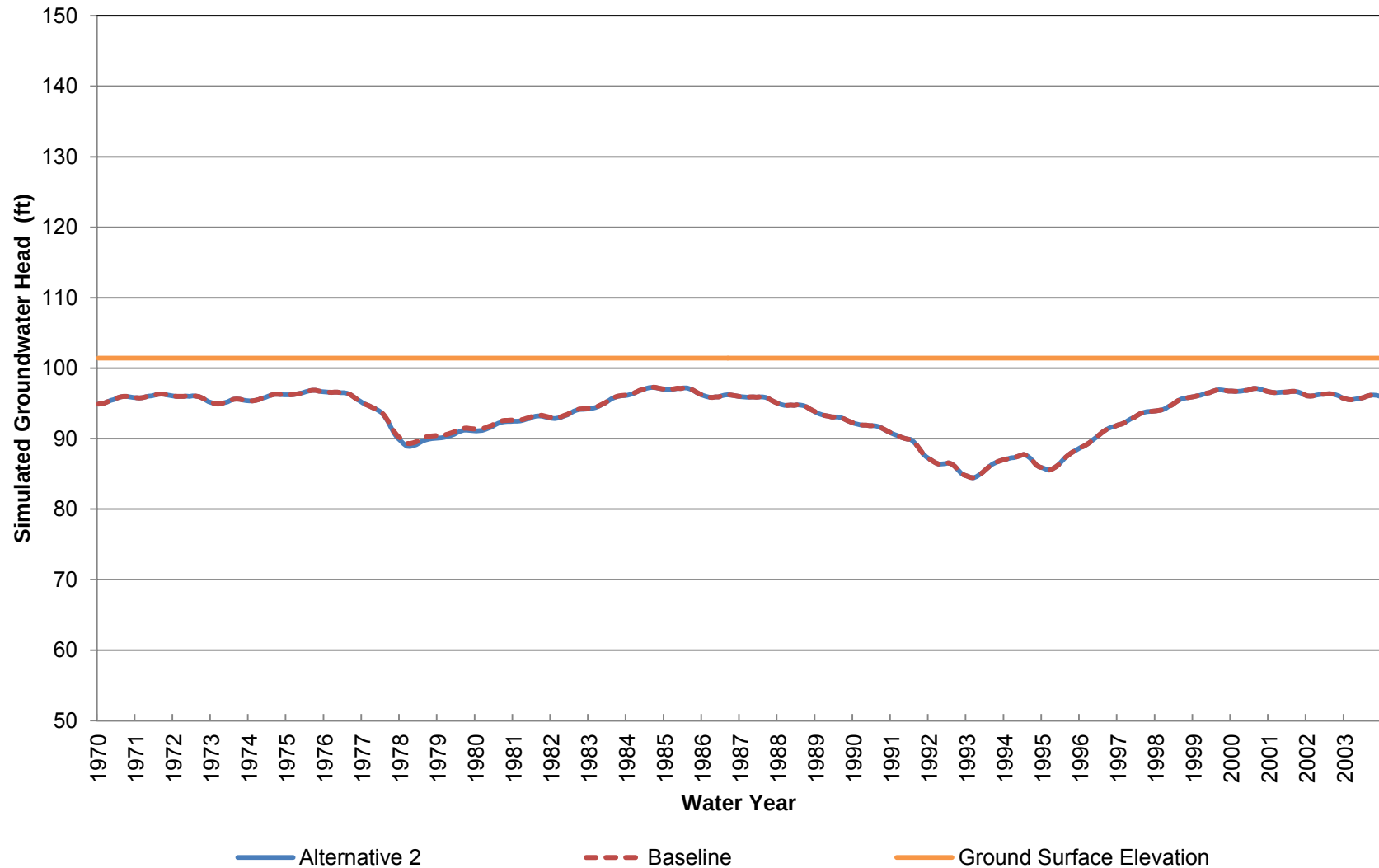
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 870-1160 ft bgs)



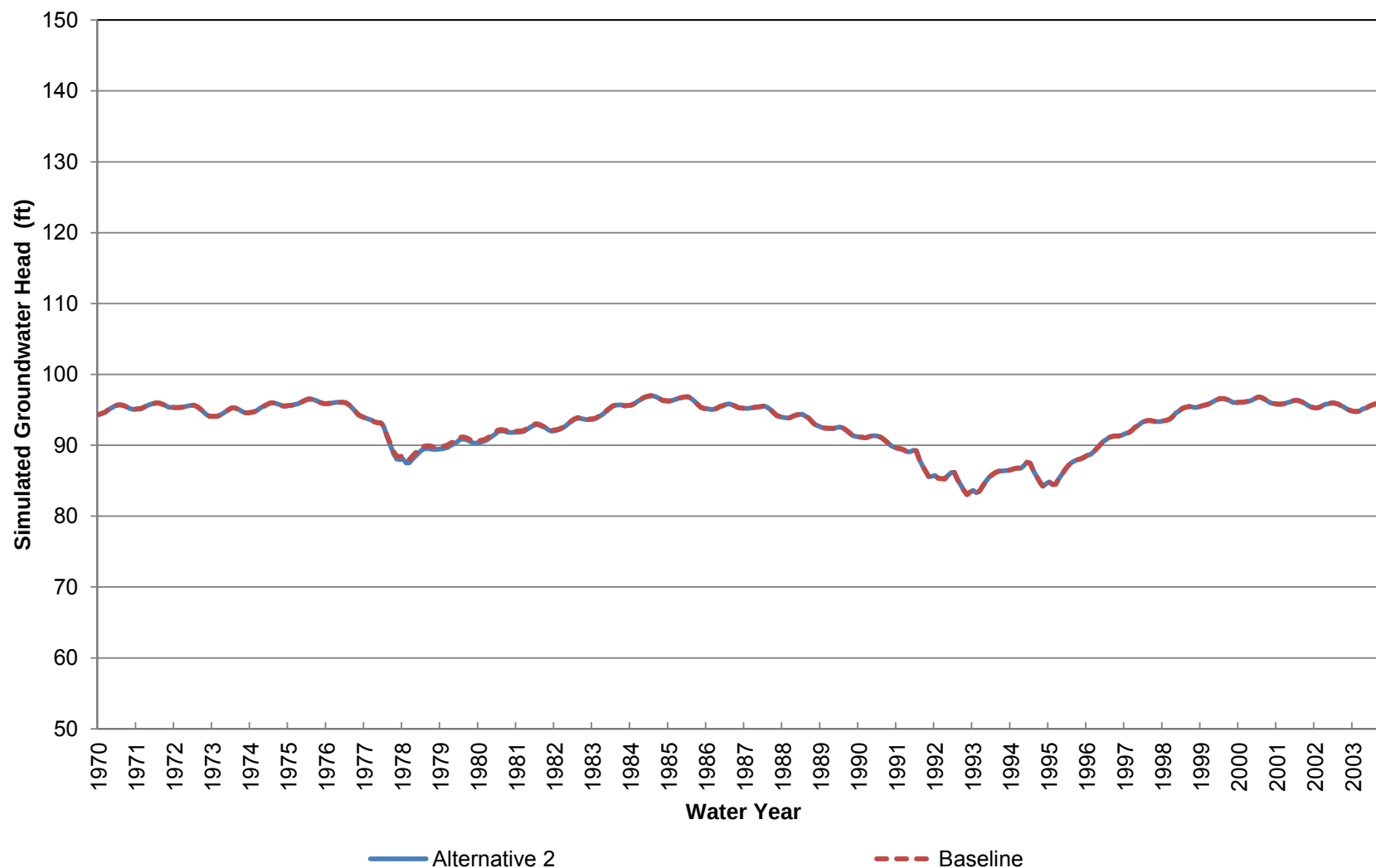
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 1160-1590 ft bgs)



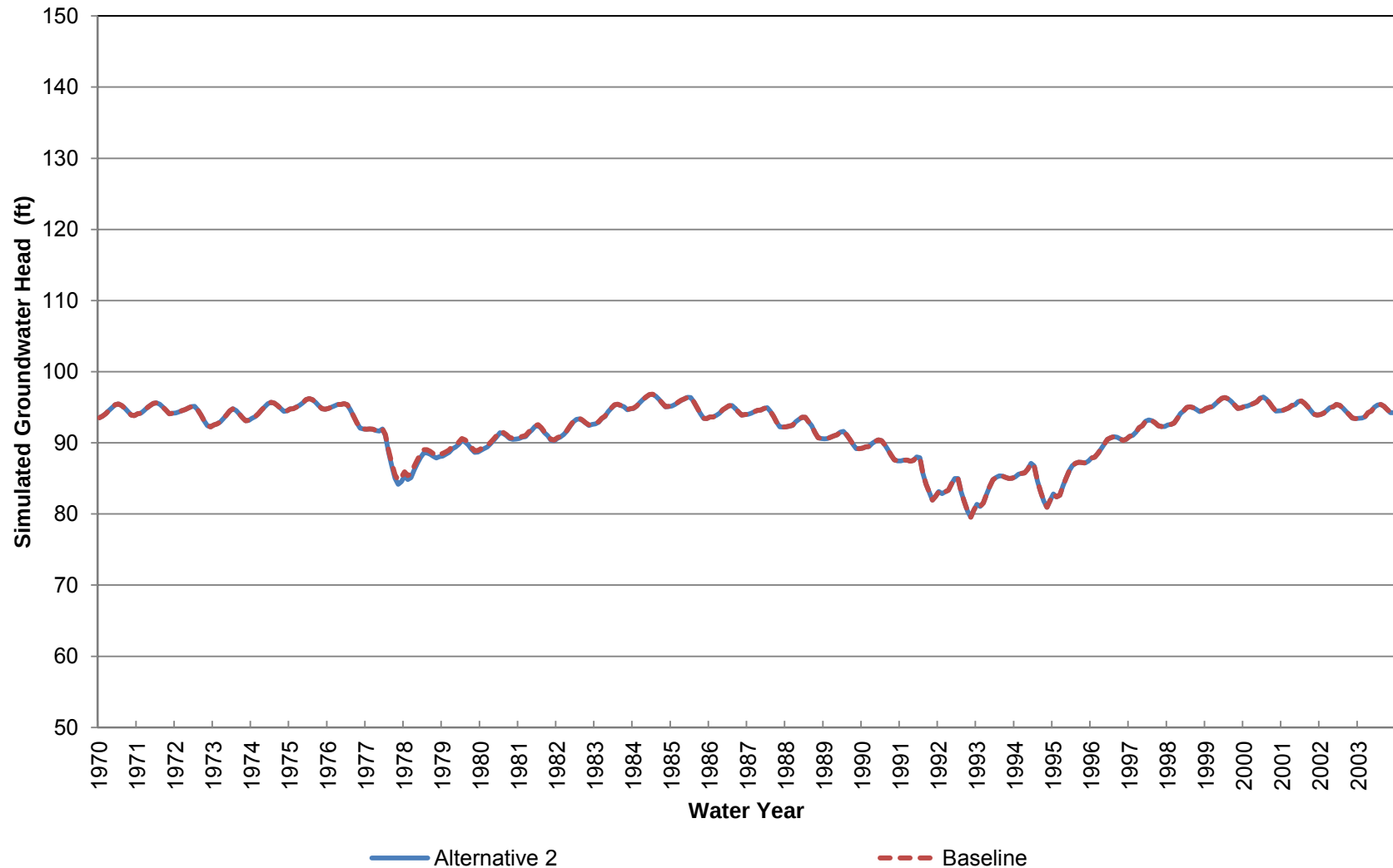
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 11 (Approximately 0-70 ft bgs)



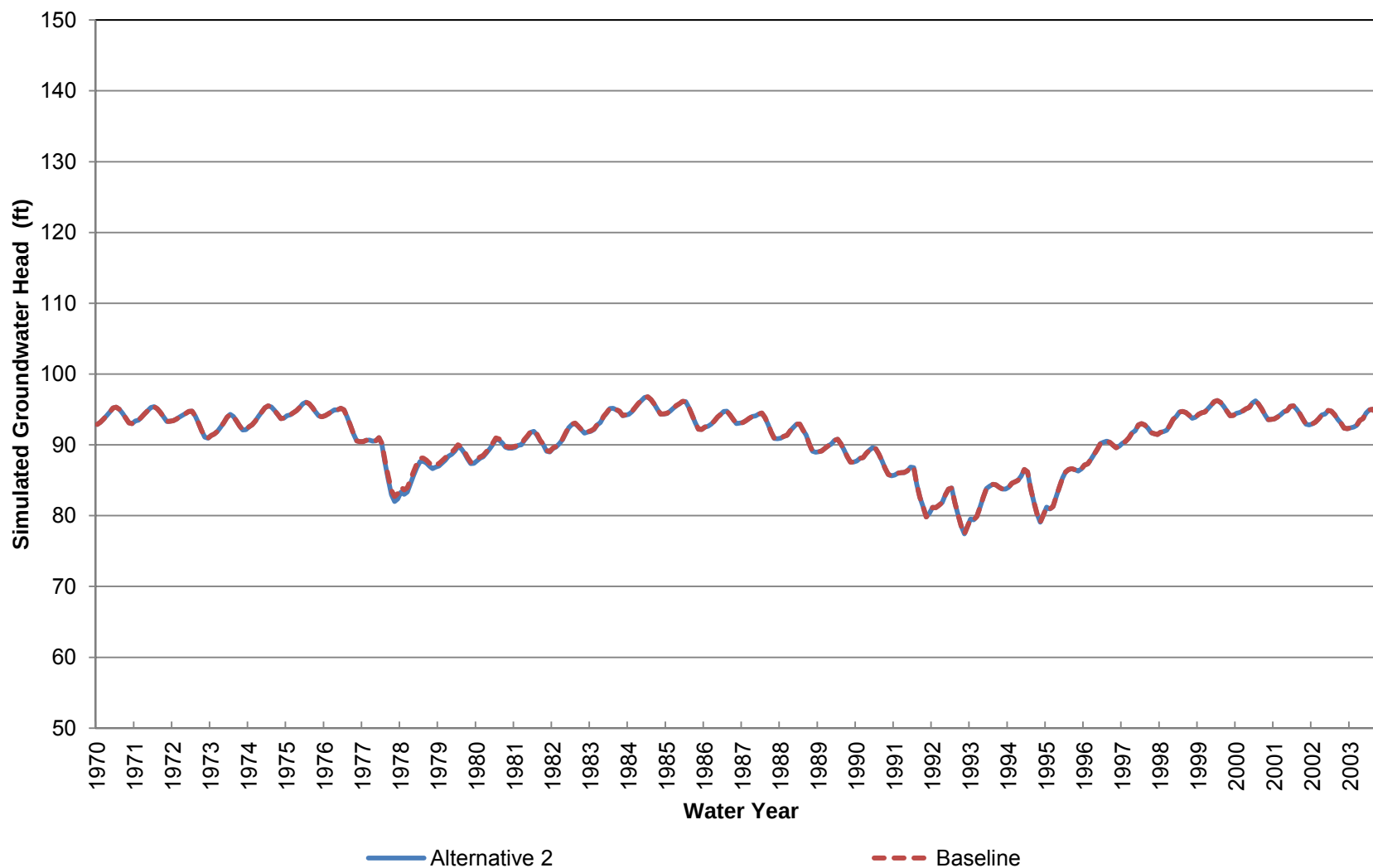
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 70-260 ft bgs)



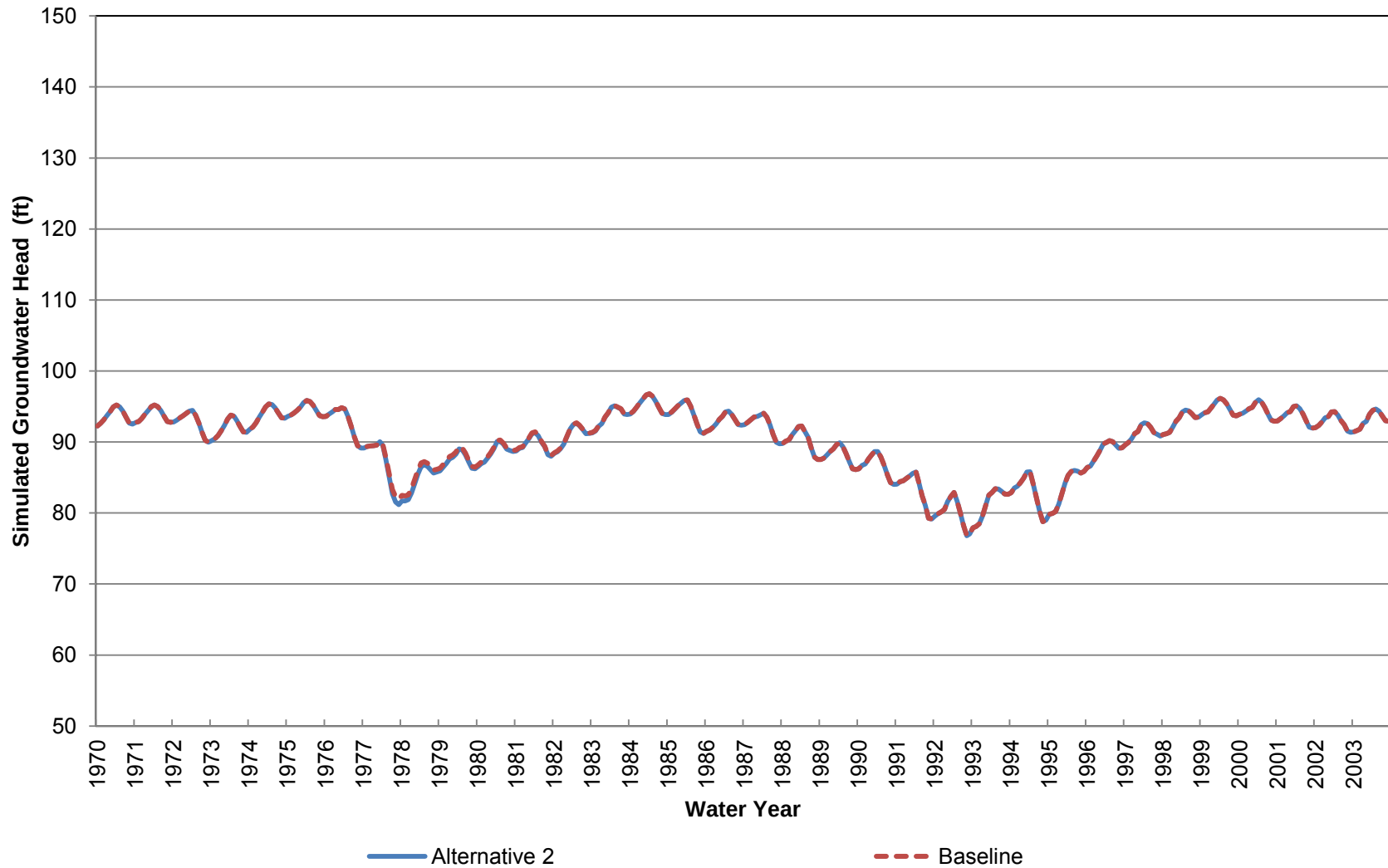
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 260-450 ft bgs)



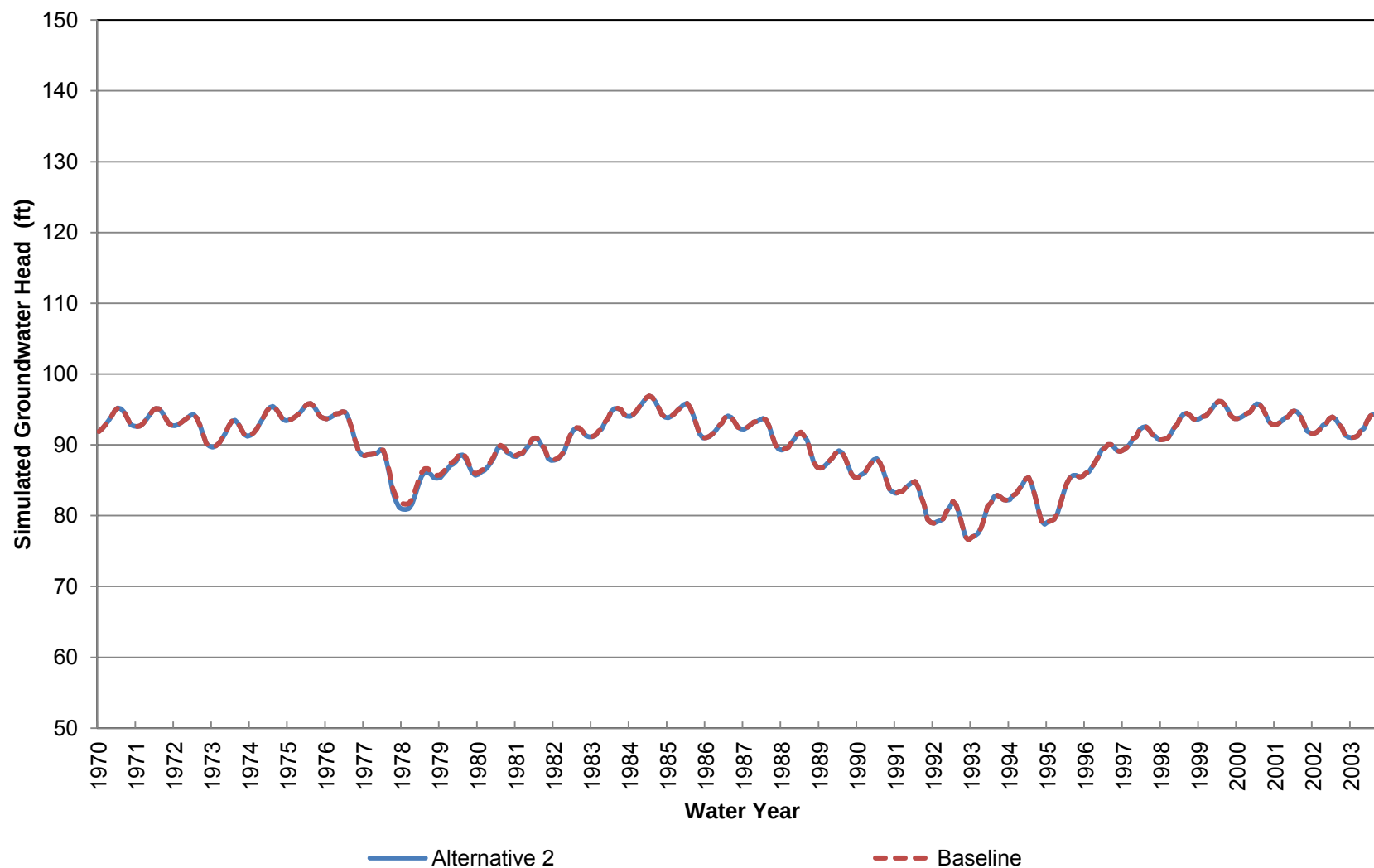
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 450-640 ft bgs)



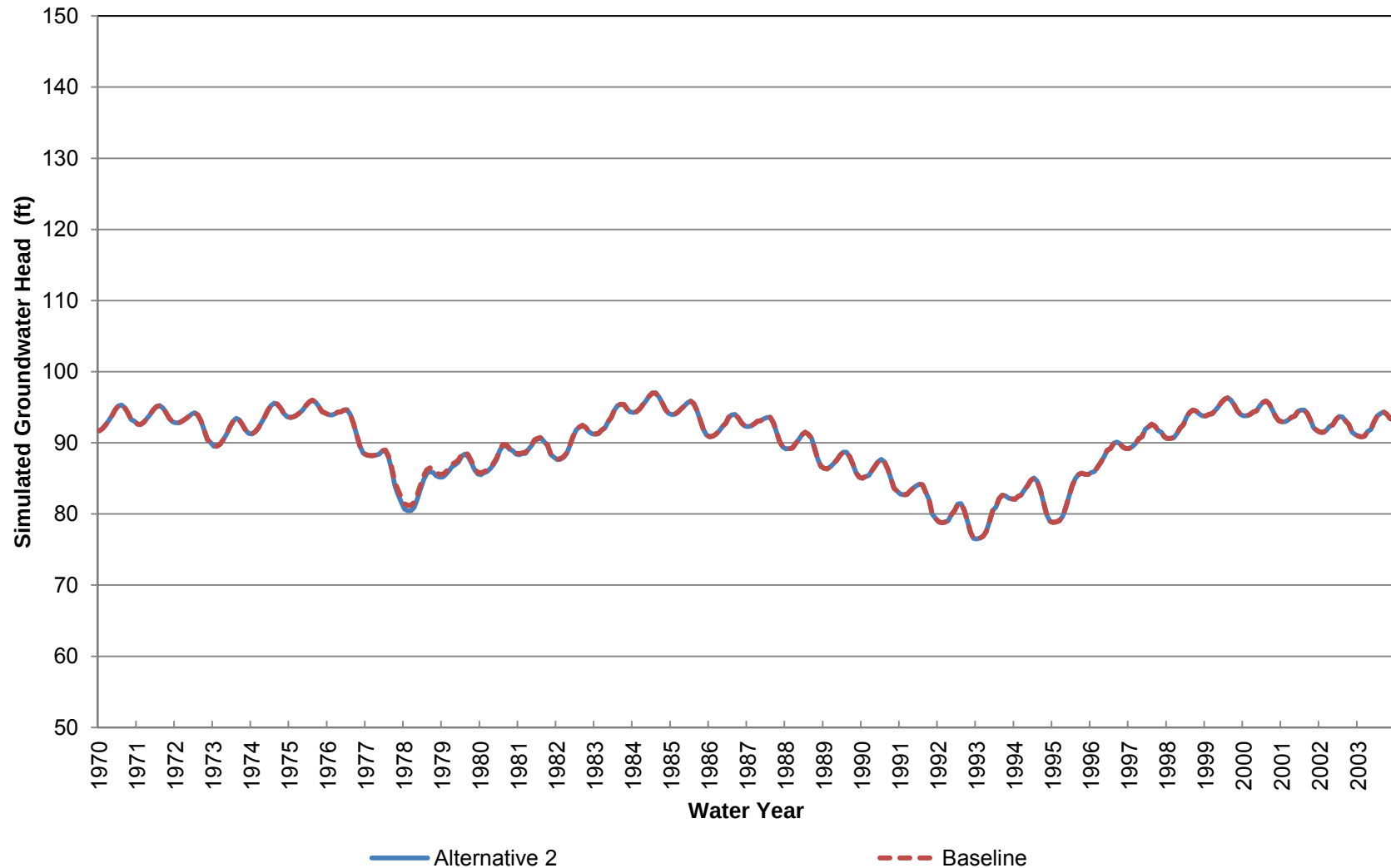
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 640-950 ft bgs)



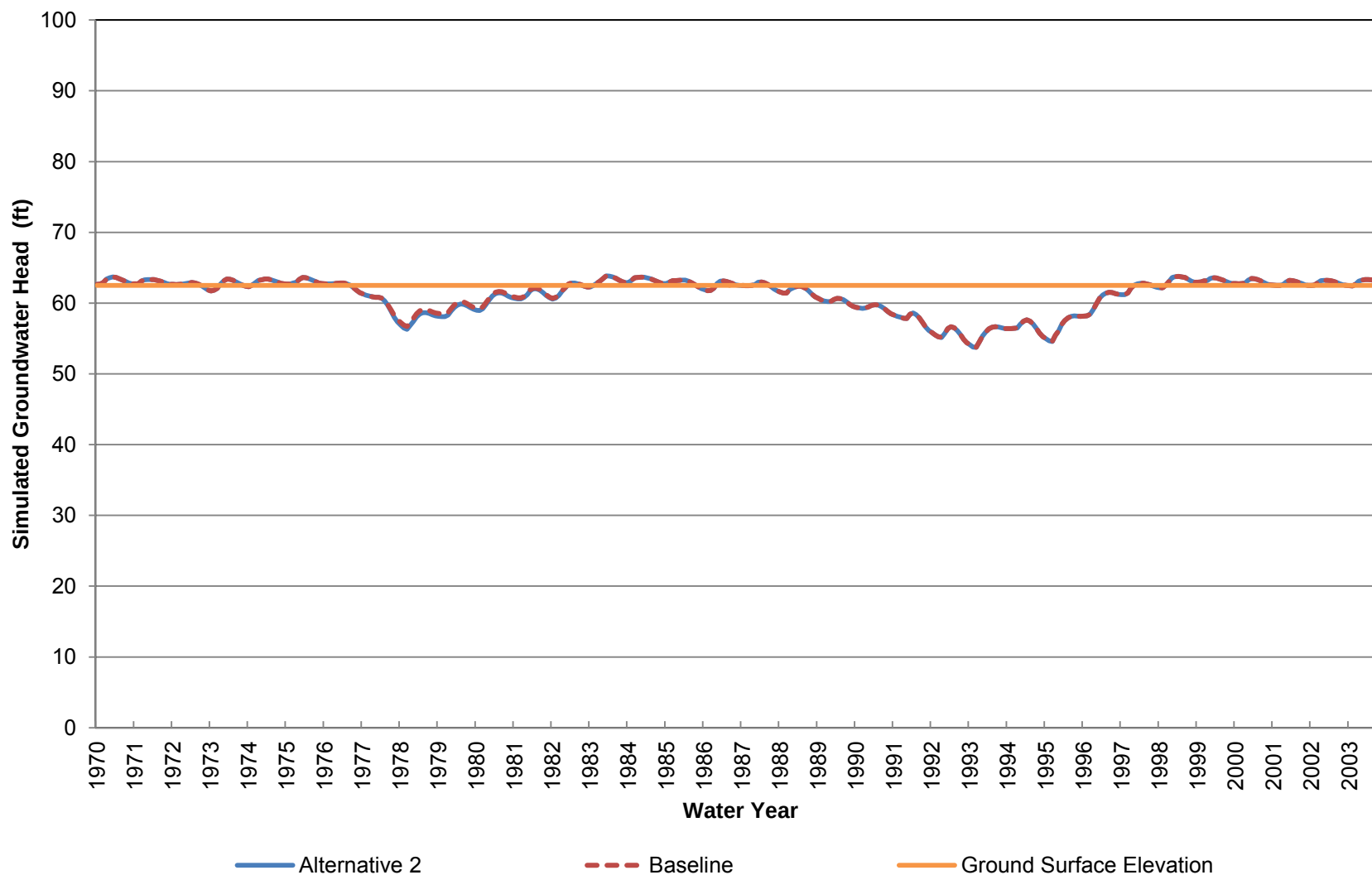
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 950-1260 ft bgs)



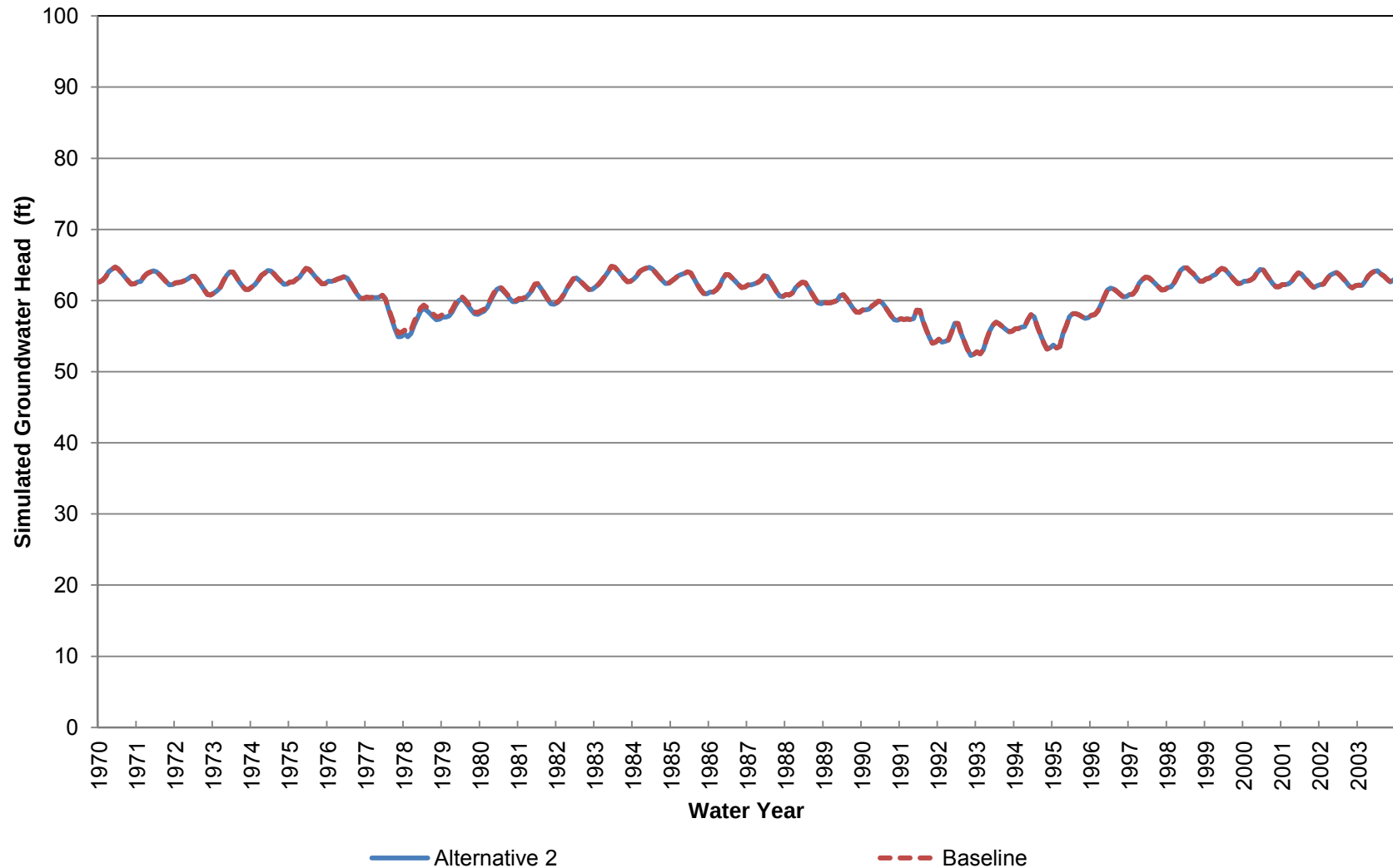
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 1260-1740 ft bgs)



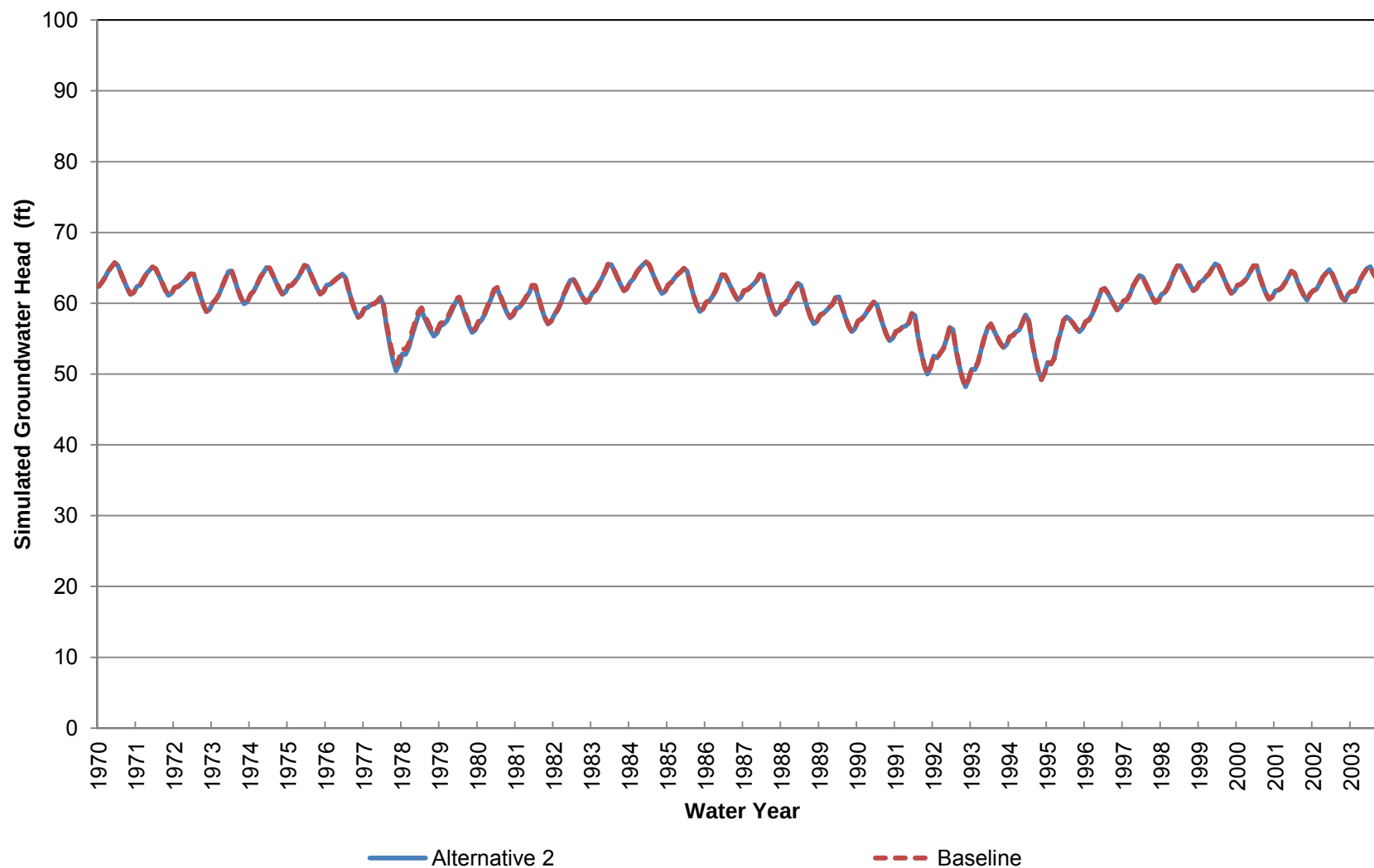
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 12 (Approximately 0-70 ft bgs)



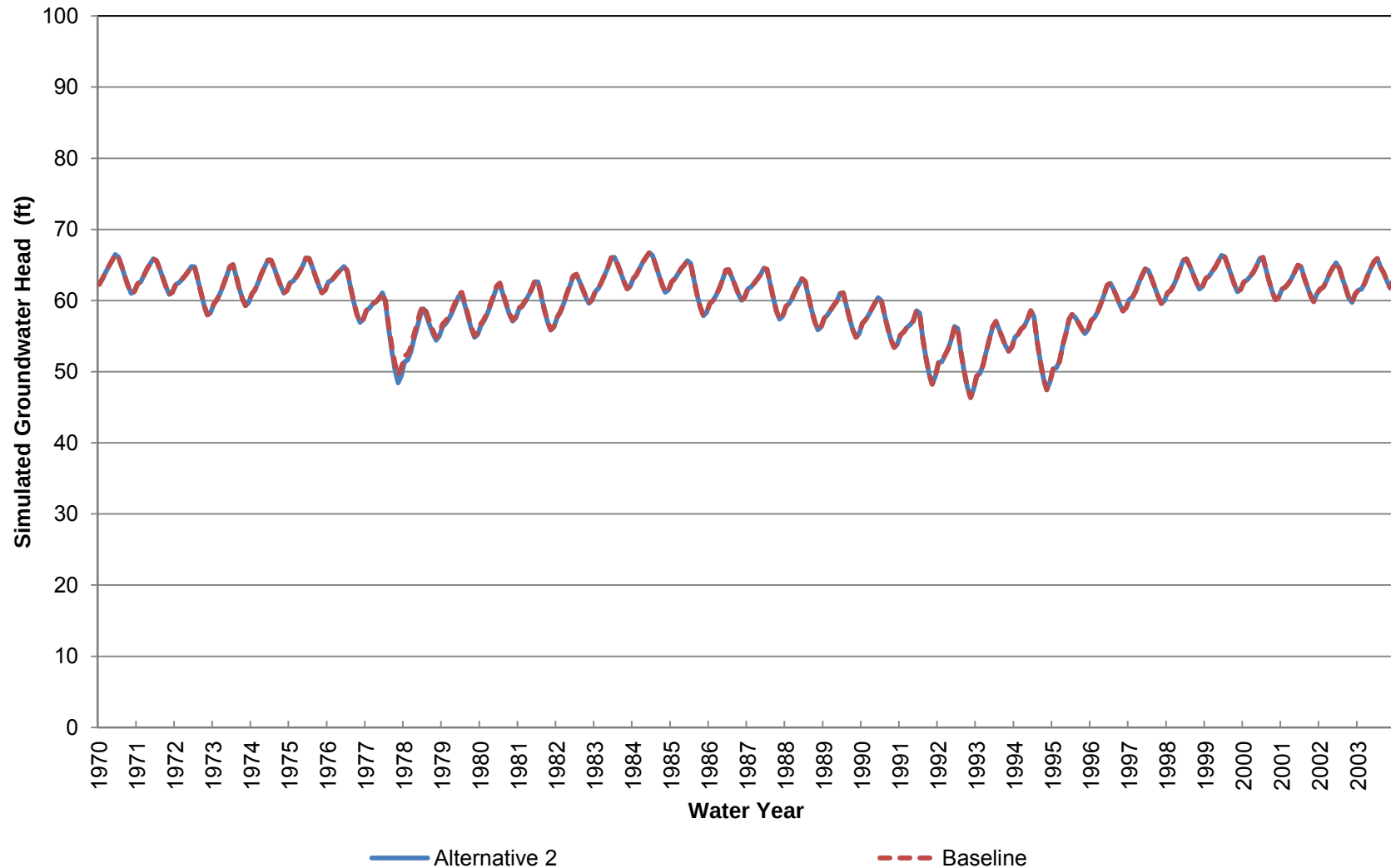
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 70-260 ft bgs)



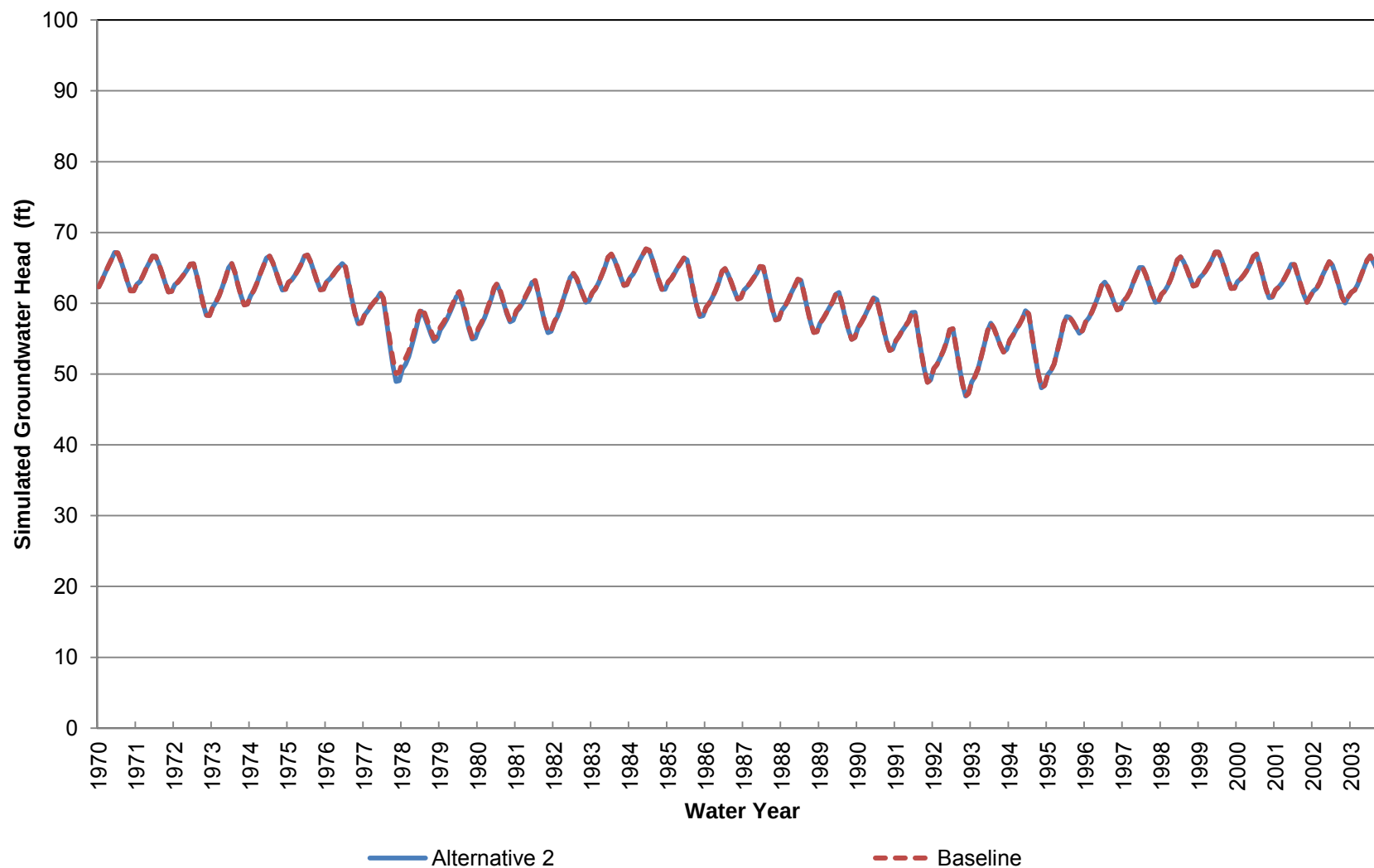
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 260-440 ft bgs)



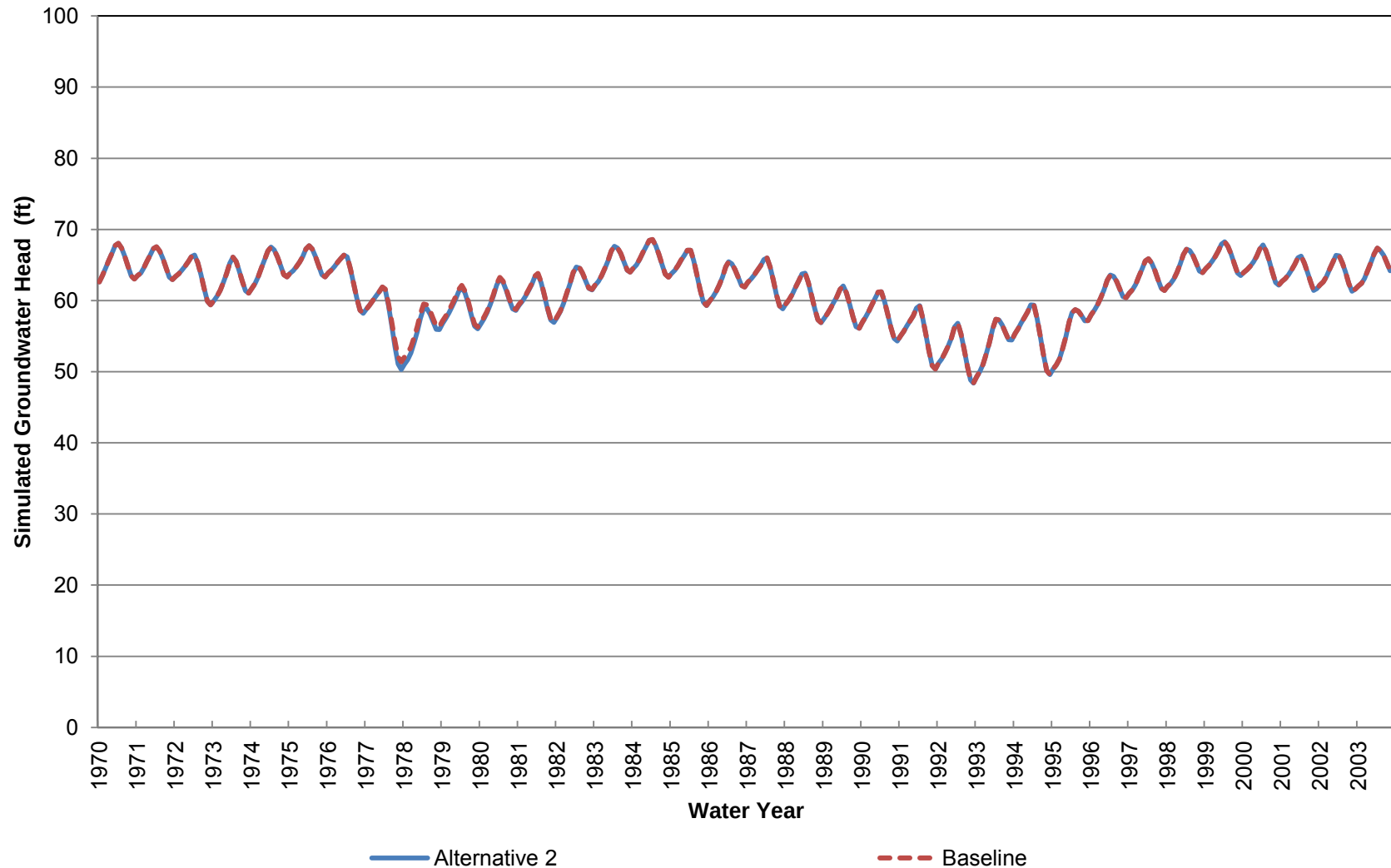
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 440-630 ft bgs)



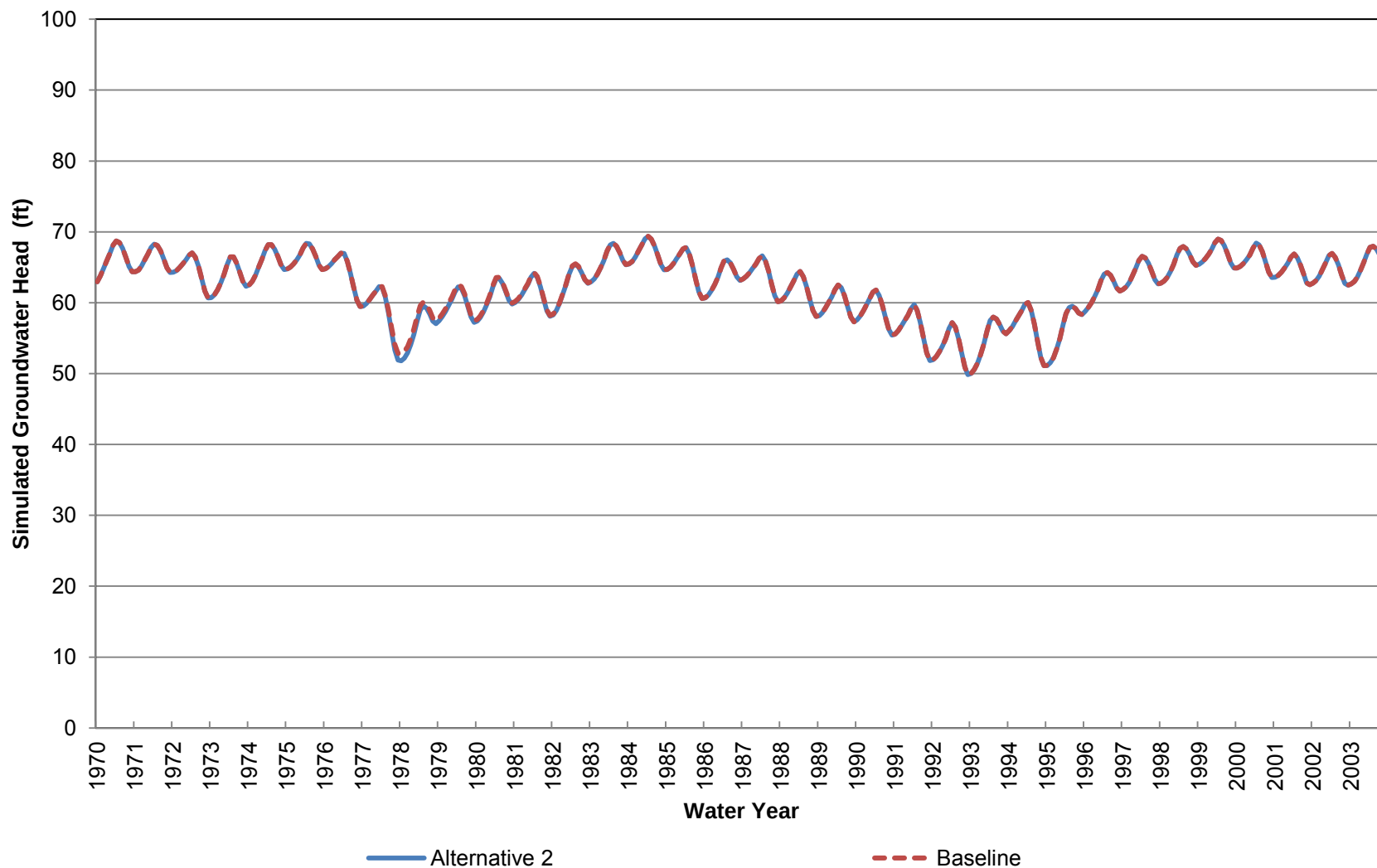
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 630-930 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 930-1240 ft bgs)



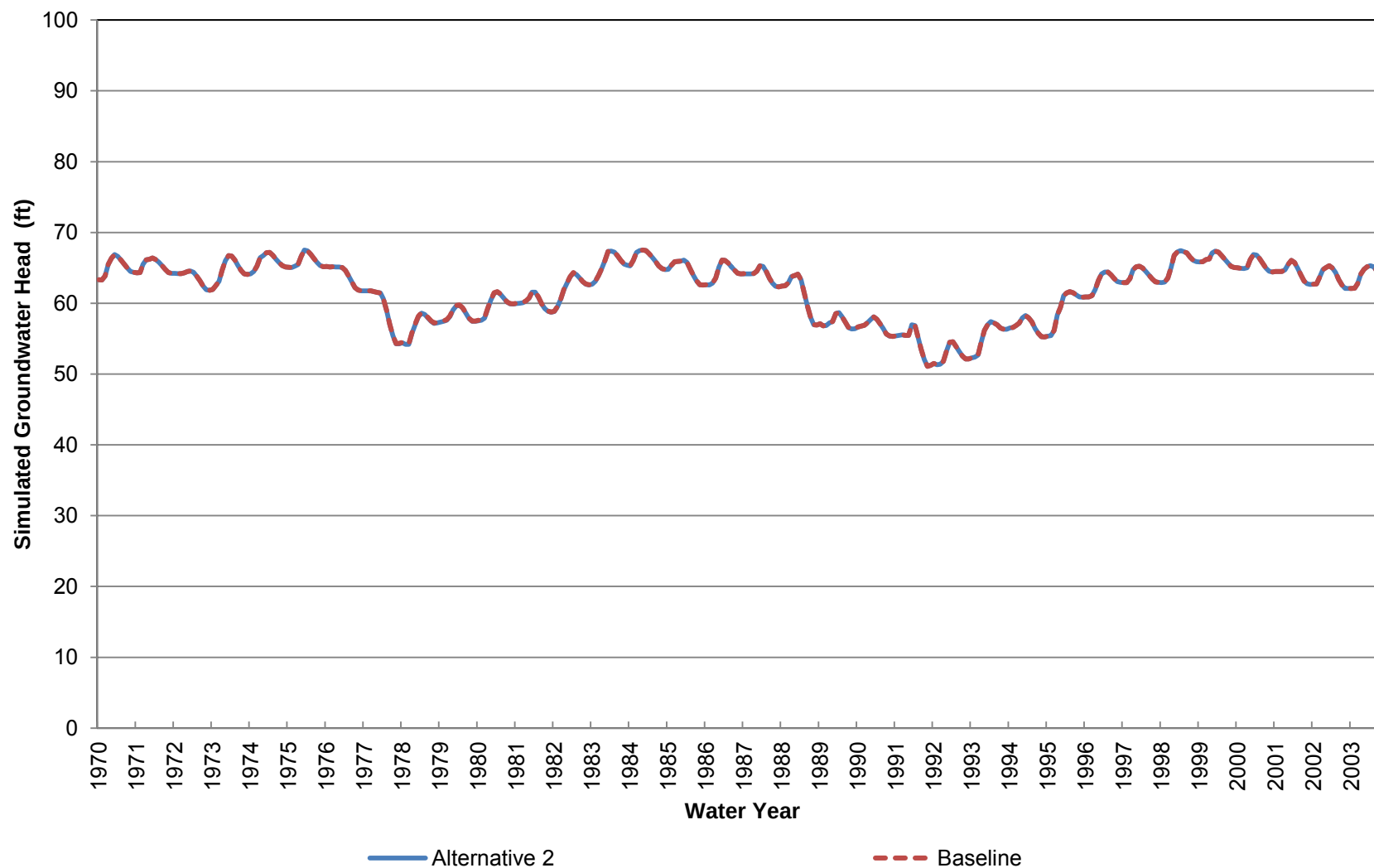
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 1240-1700 ft bgs)



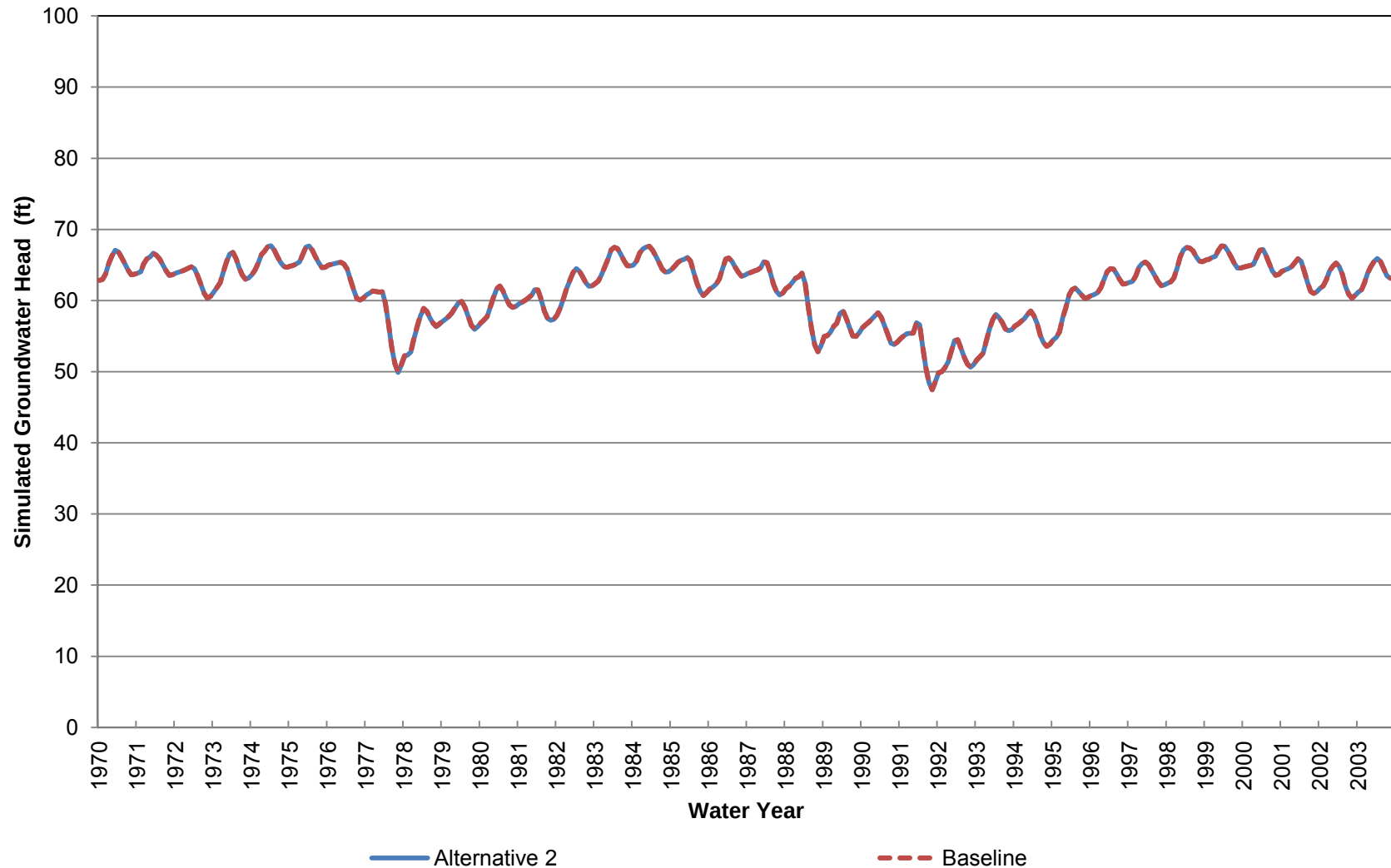
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 13 (Approximately 0-70 ft bgs)



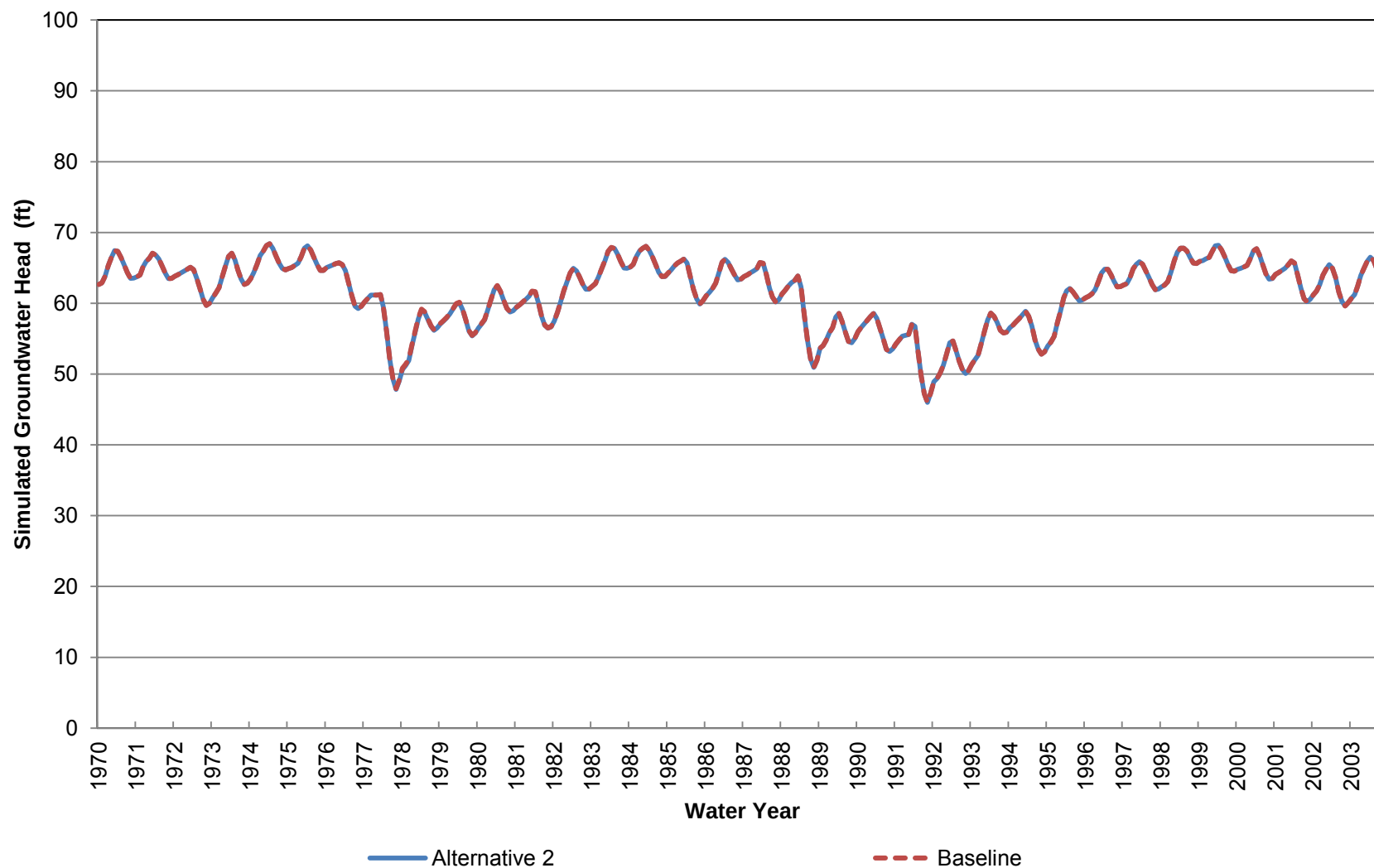
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 70-210 ft bgs)



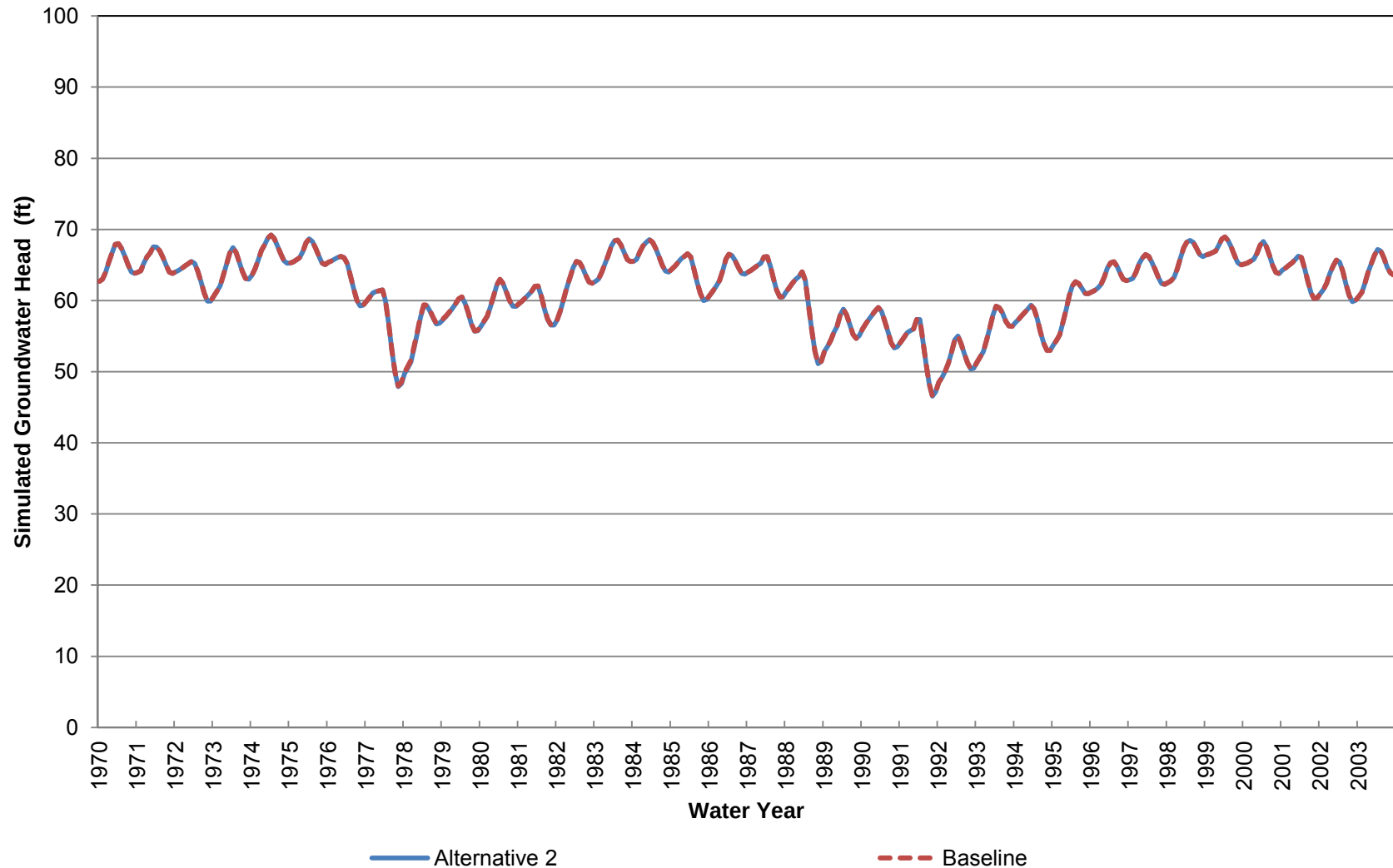
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 210-350 ft bgs)



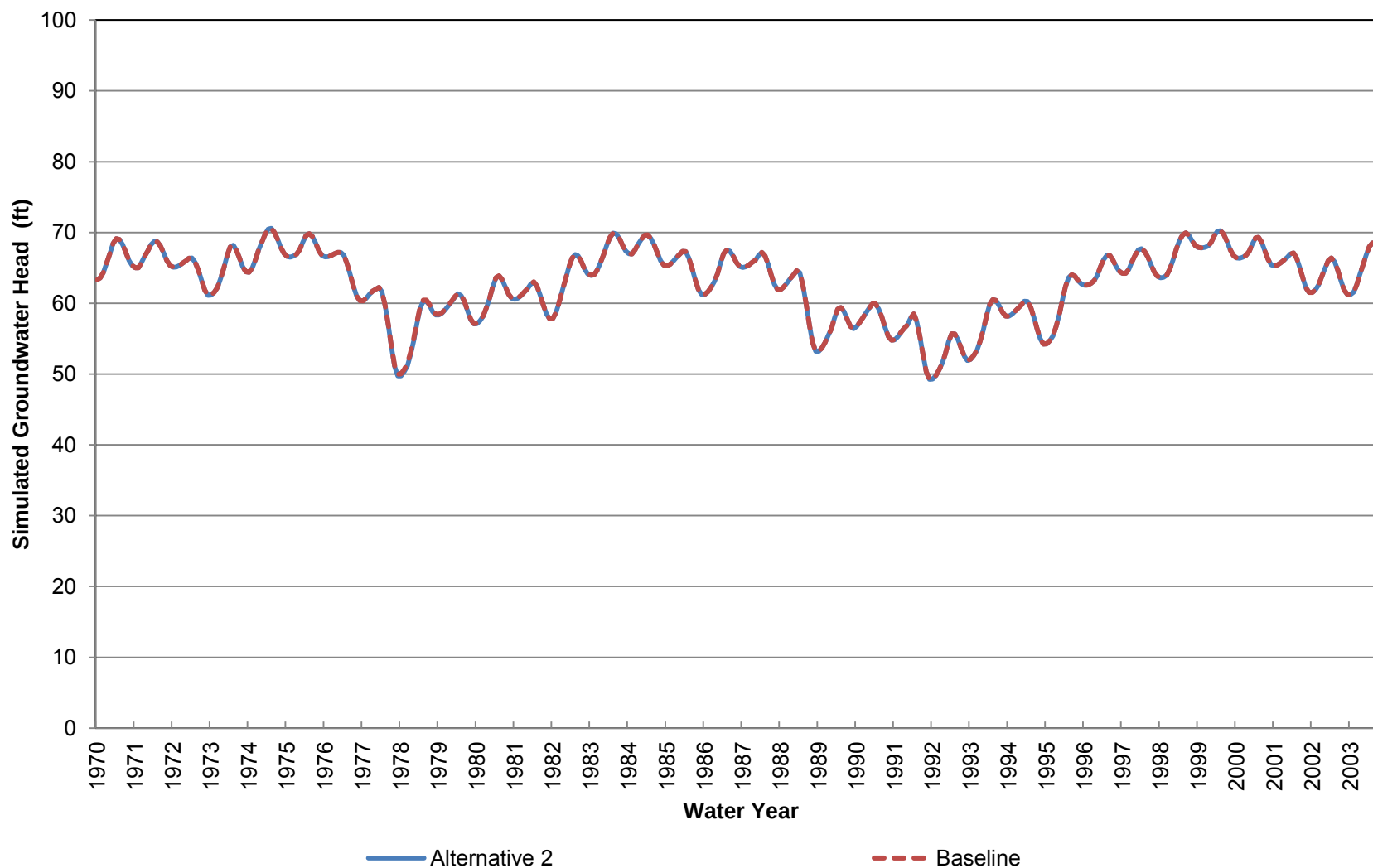
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 350-490 ft bgs)



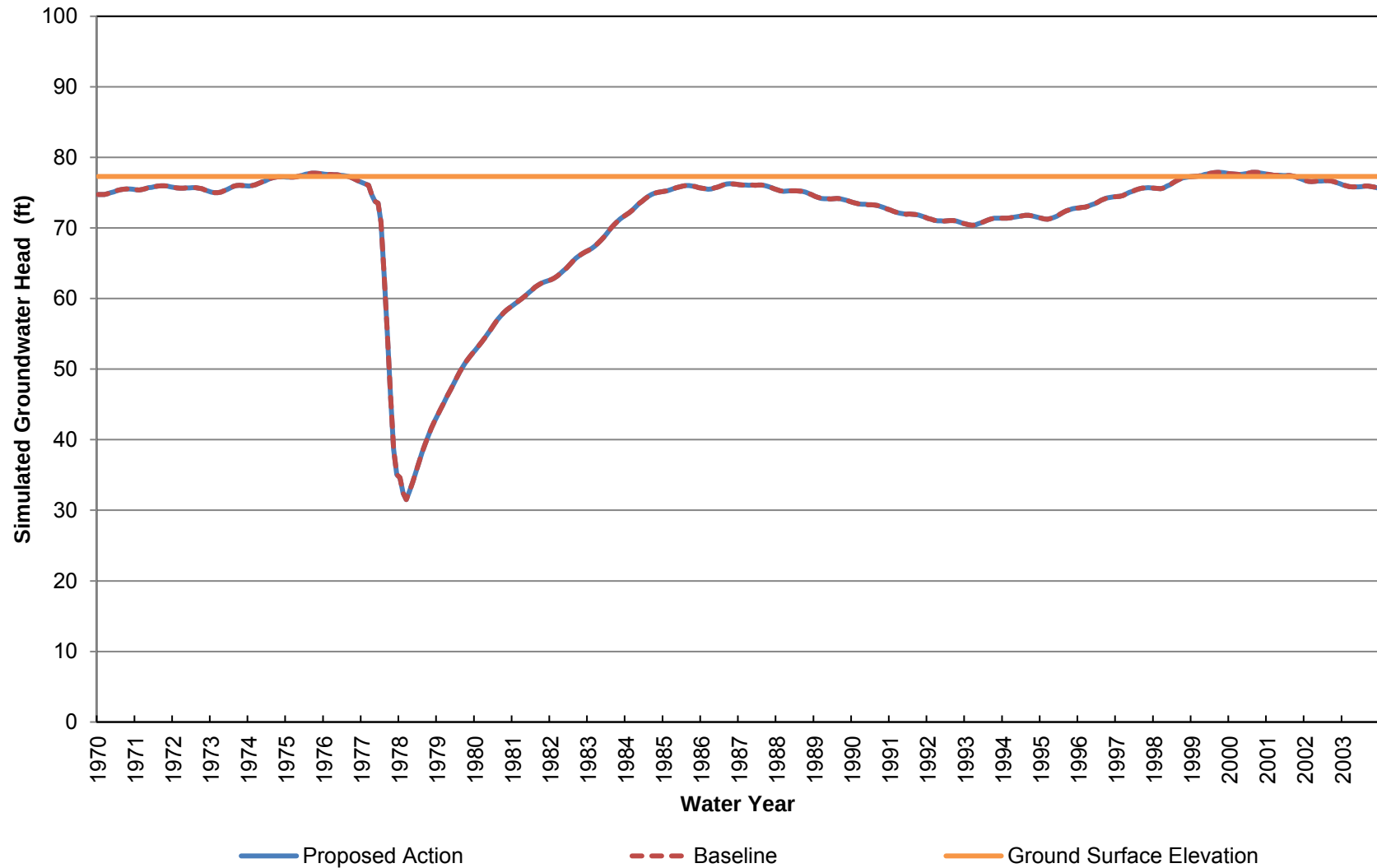
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 490-700 ft bgs)



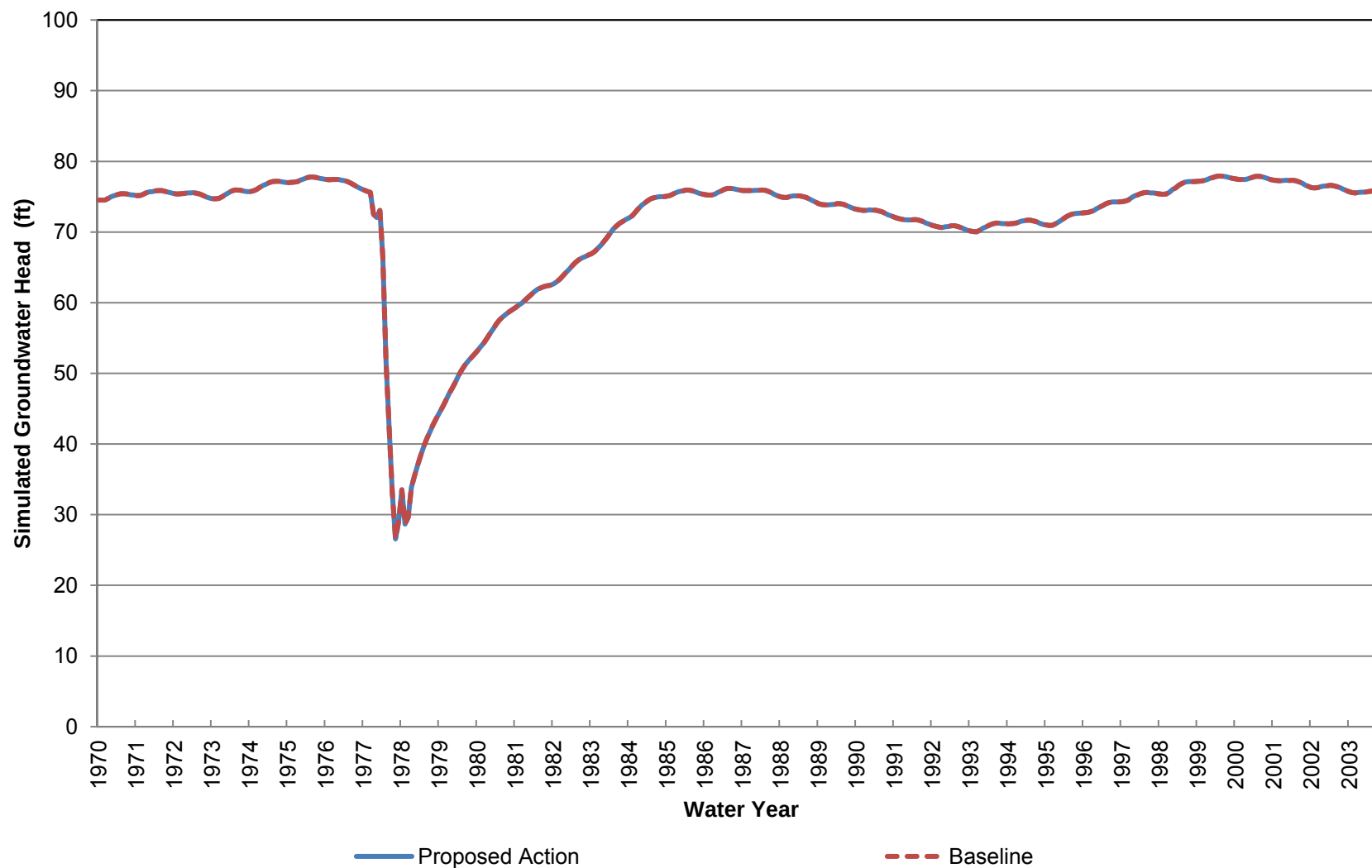
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 930-1280 ft bgs)



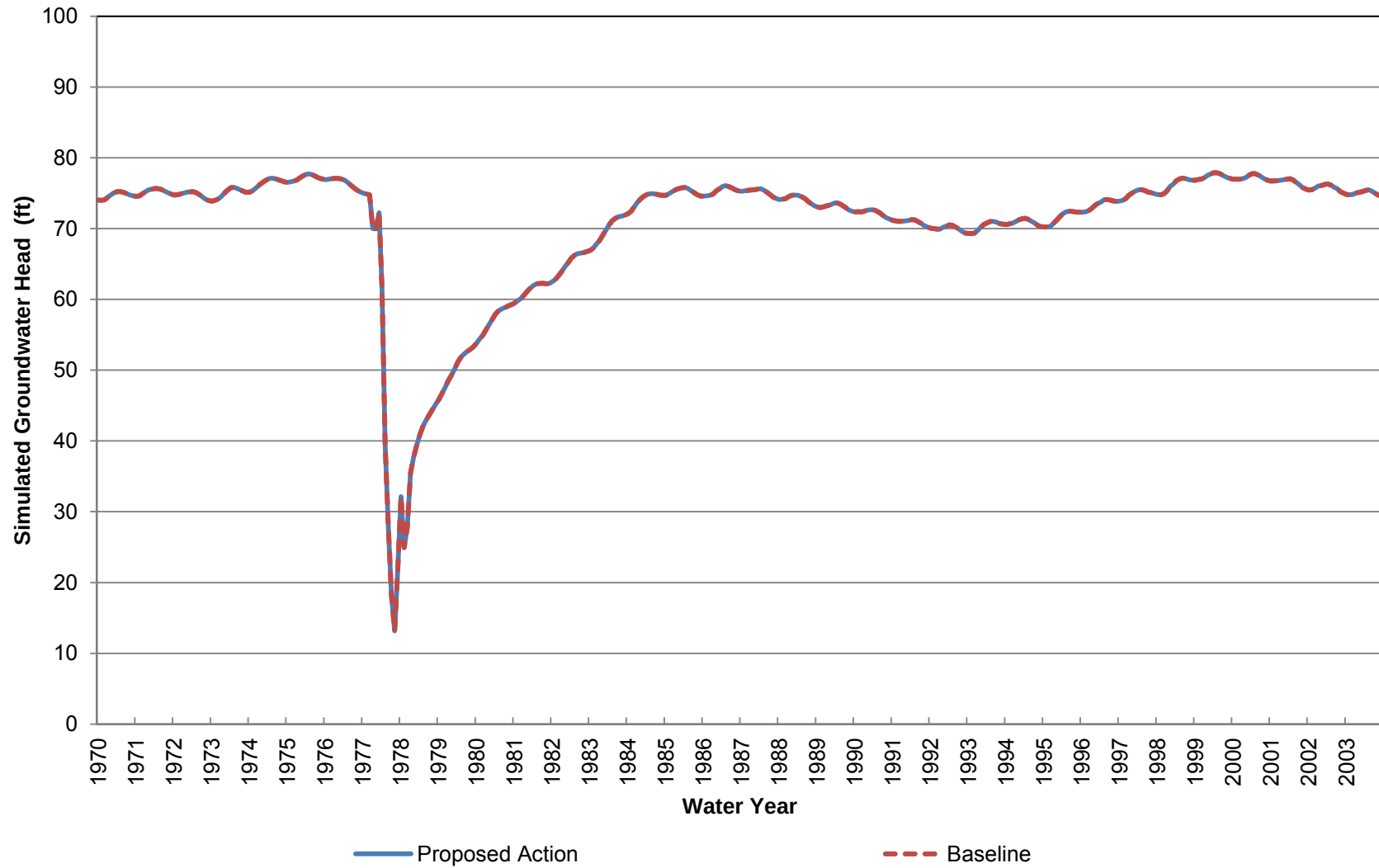
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 14 (Approximately 0-40 ft bgs)



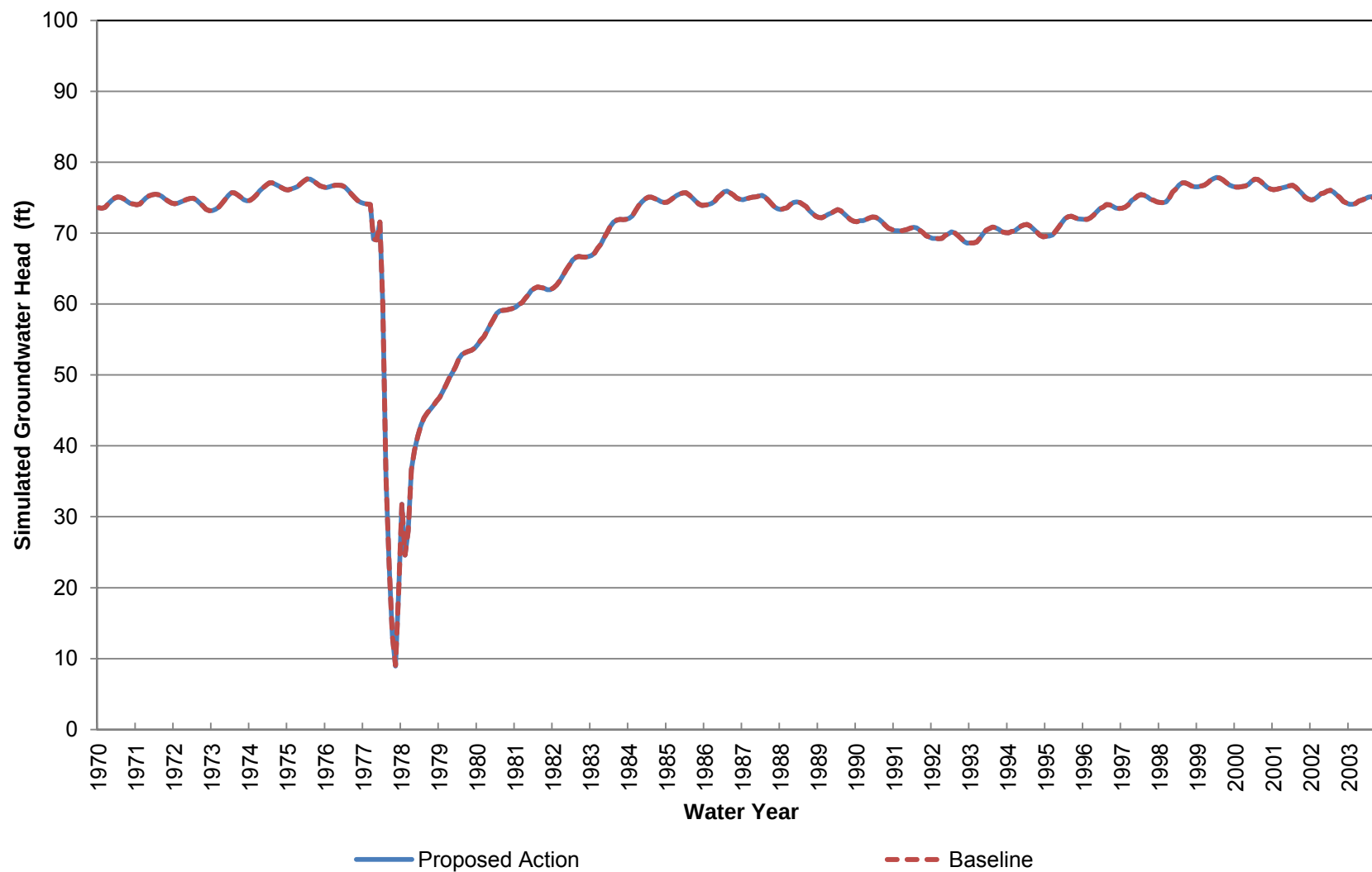
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 40-110 ft bgs)



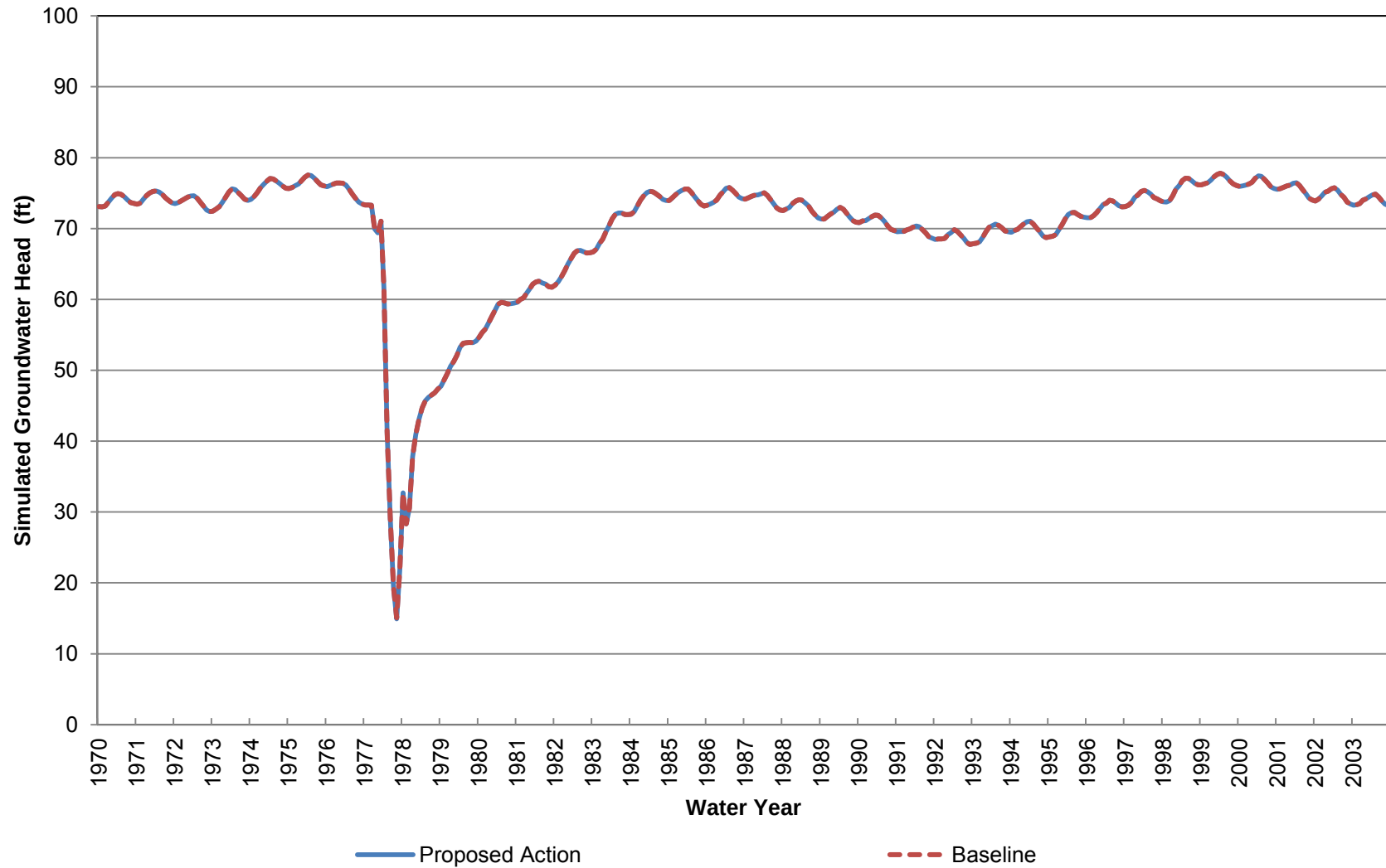
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 110-170 ft bgs)



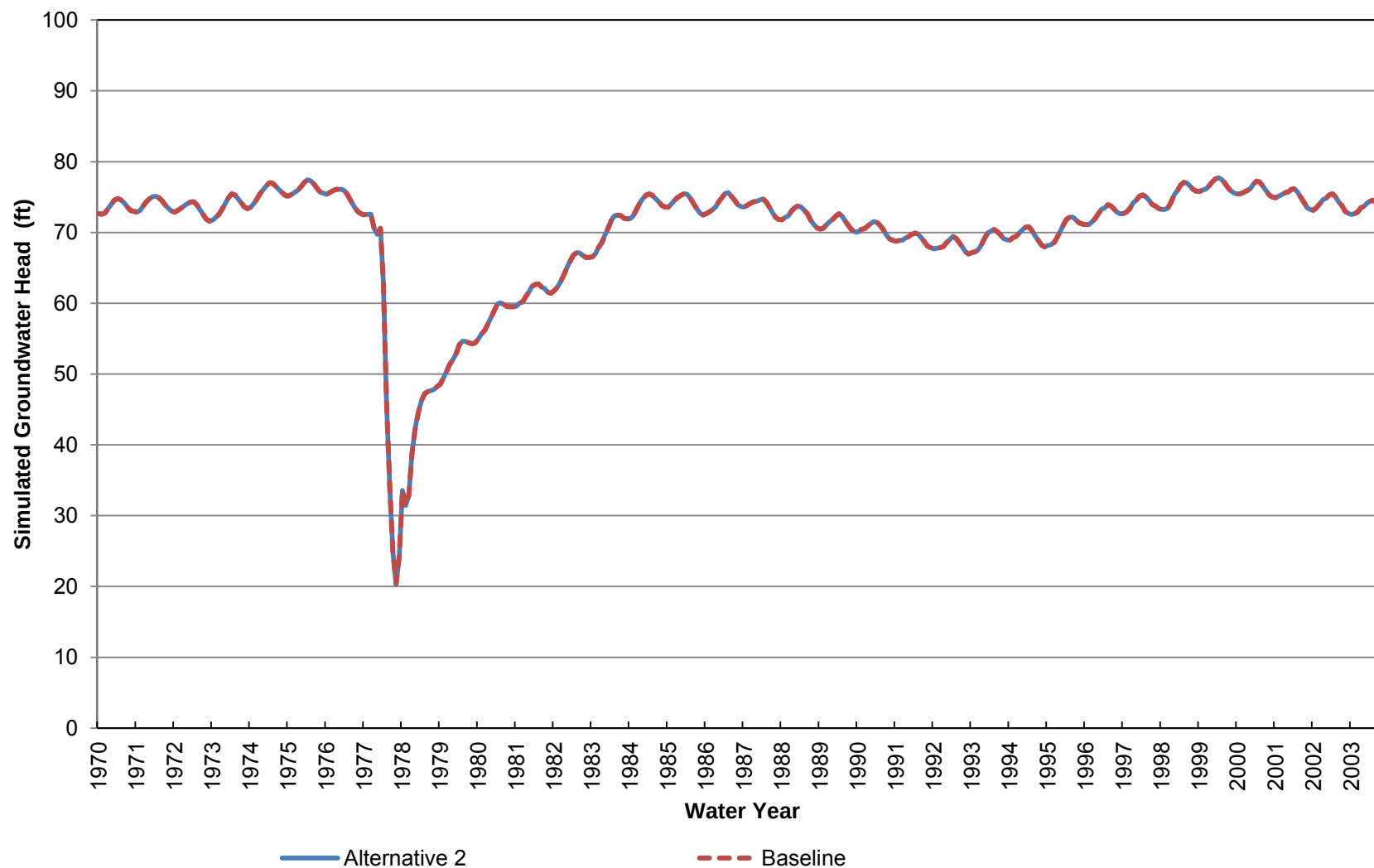
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 170-230 ft bgs)



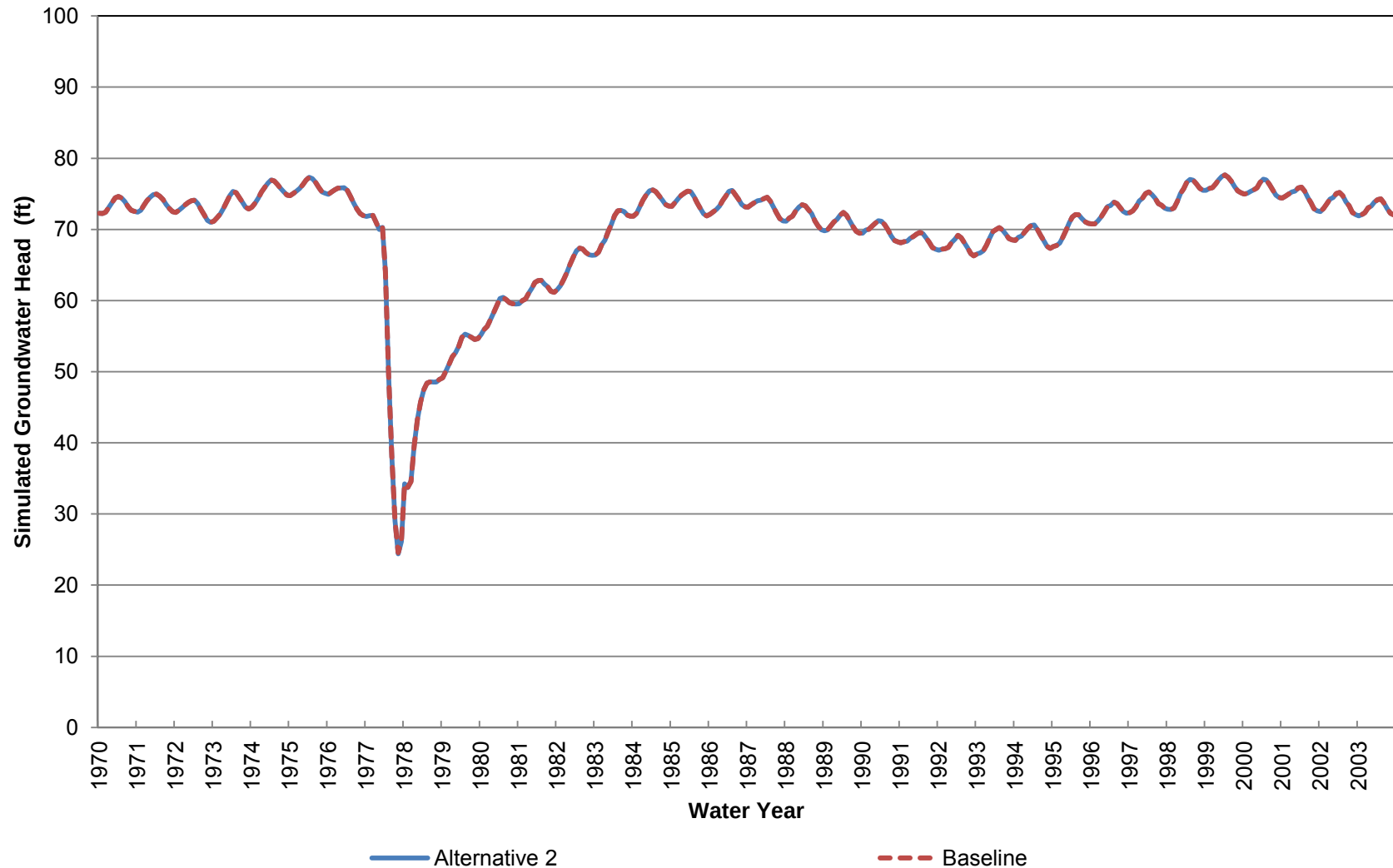
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 230-310 ft bgs)



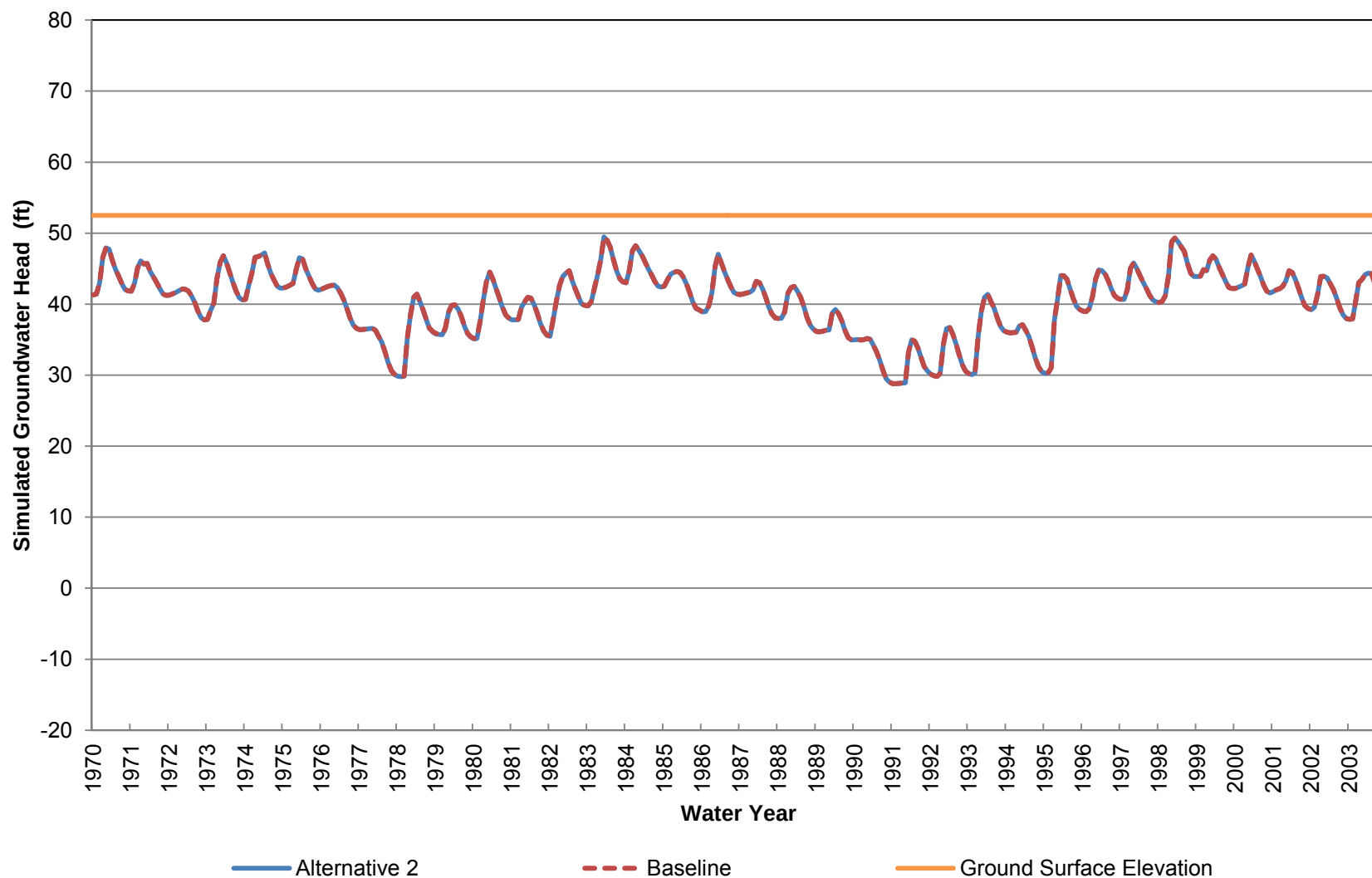
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 310-420 ft bgs)



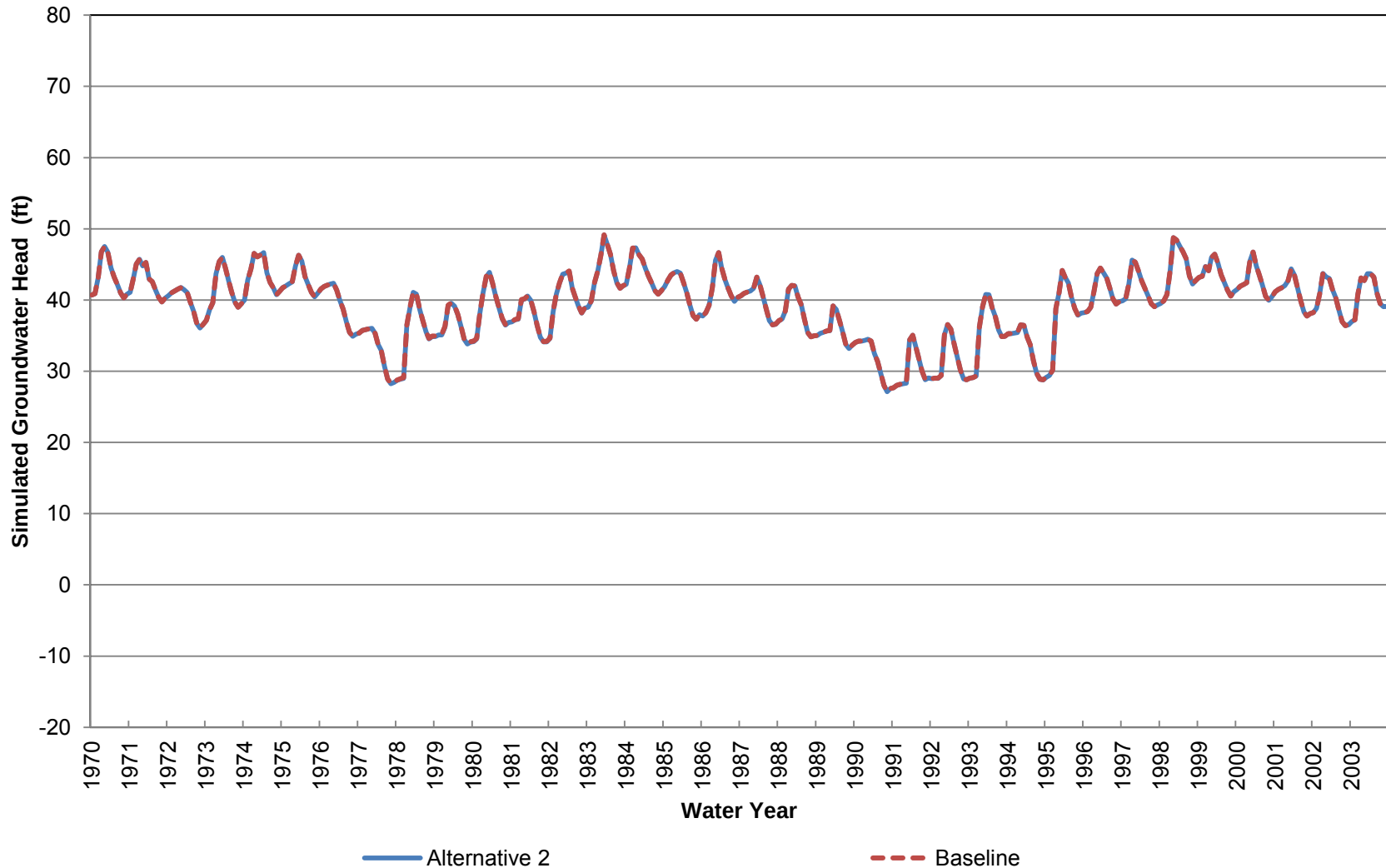
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 420-570 ft bgs)



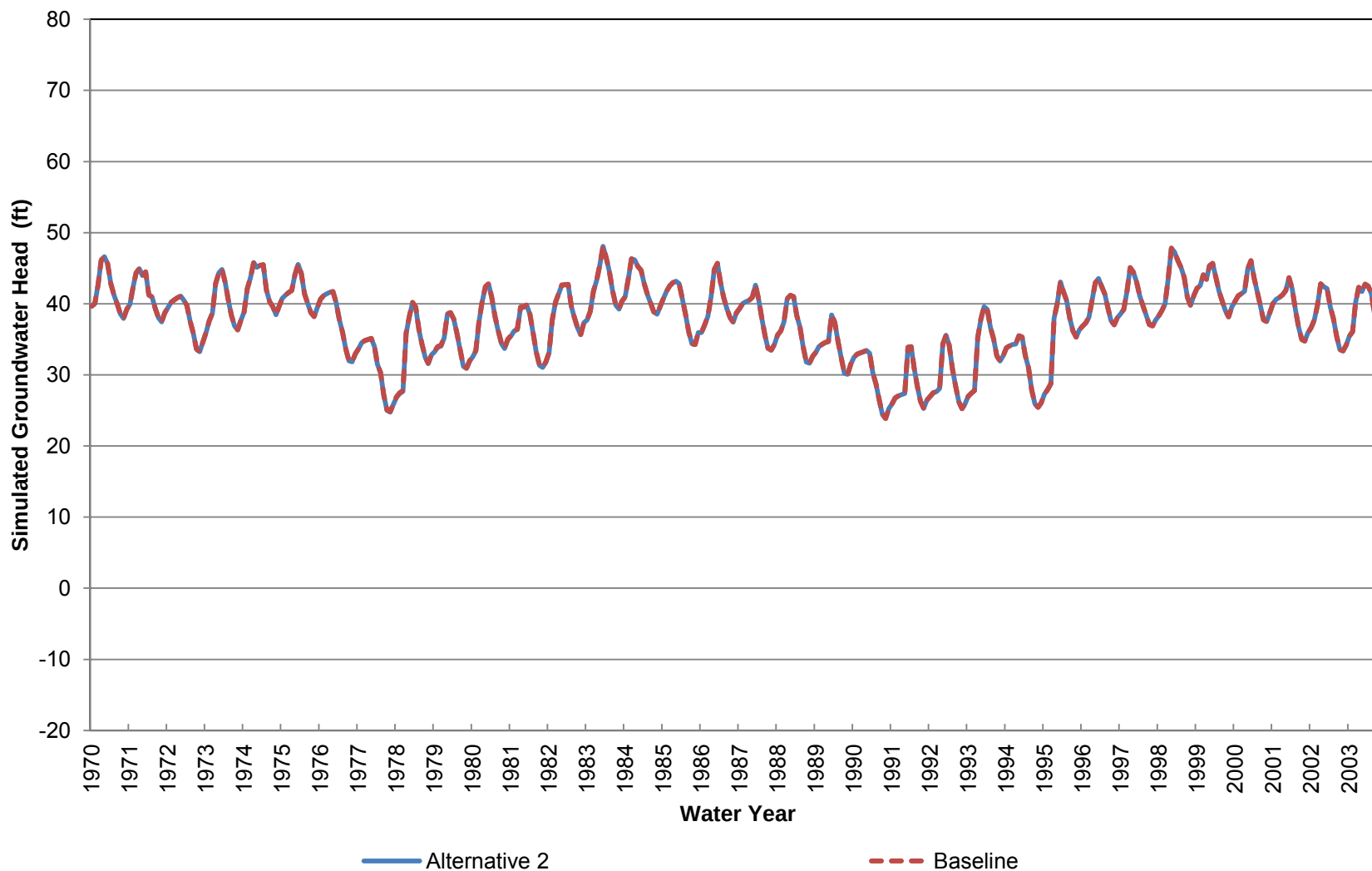
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 15 (Approximately 0-30 ft bgs)



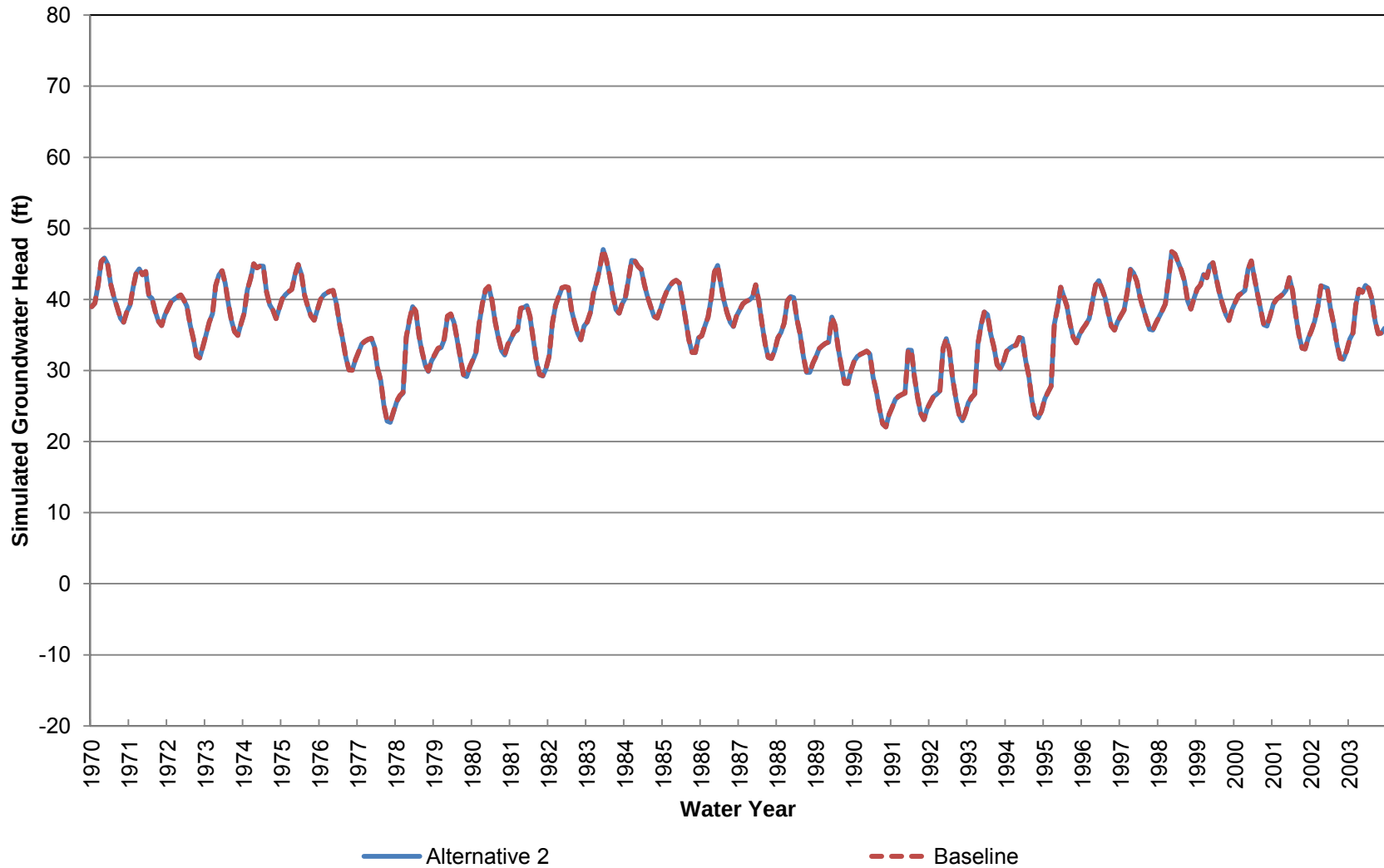
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 30-70 ft bgs)



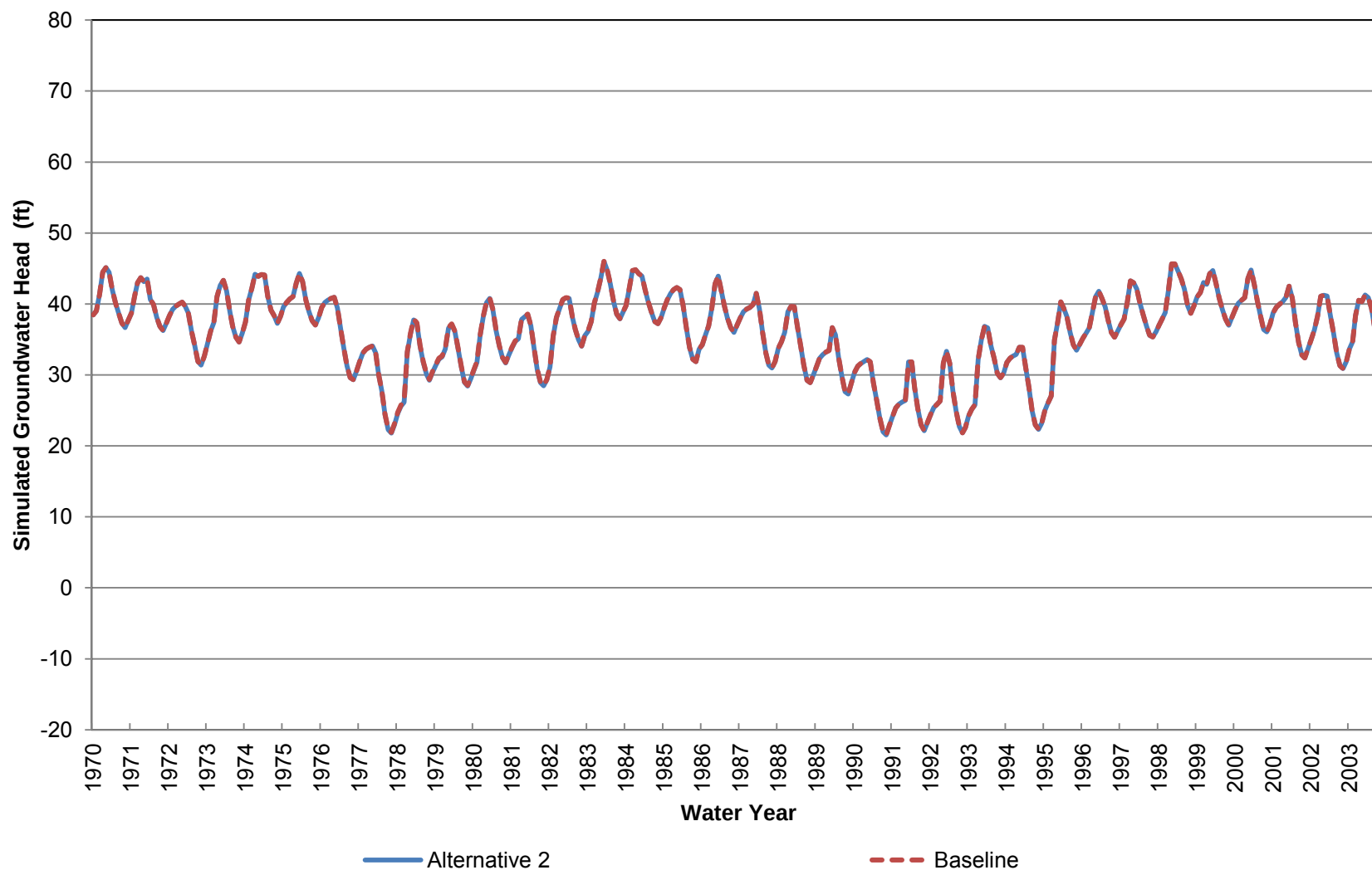
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 70-110 ft bgs)



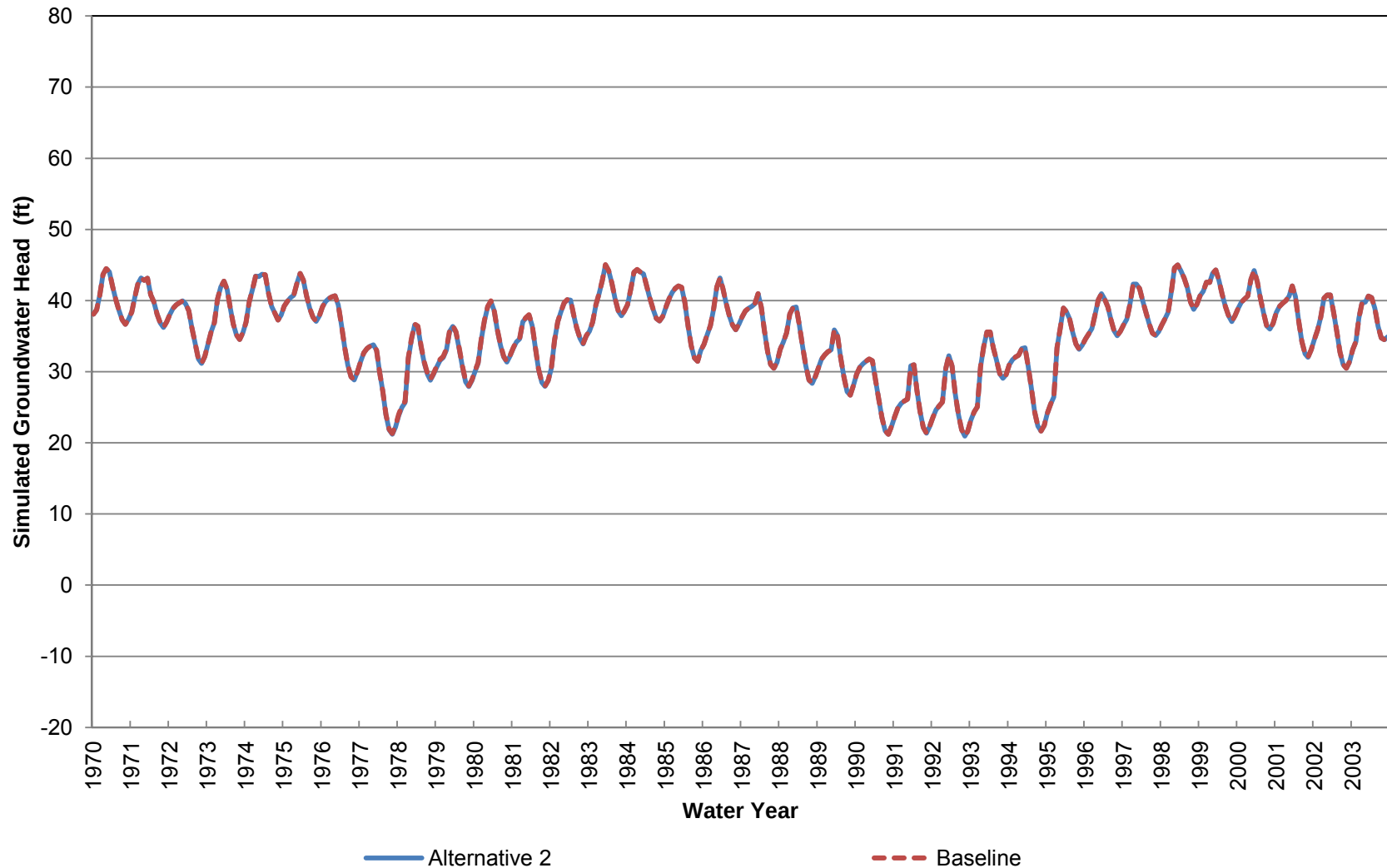
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 110-150 ft bgs)



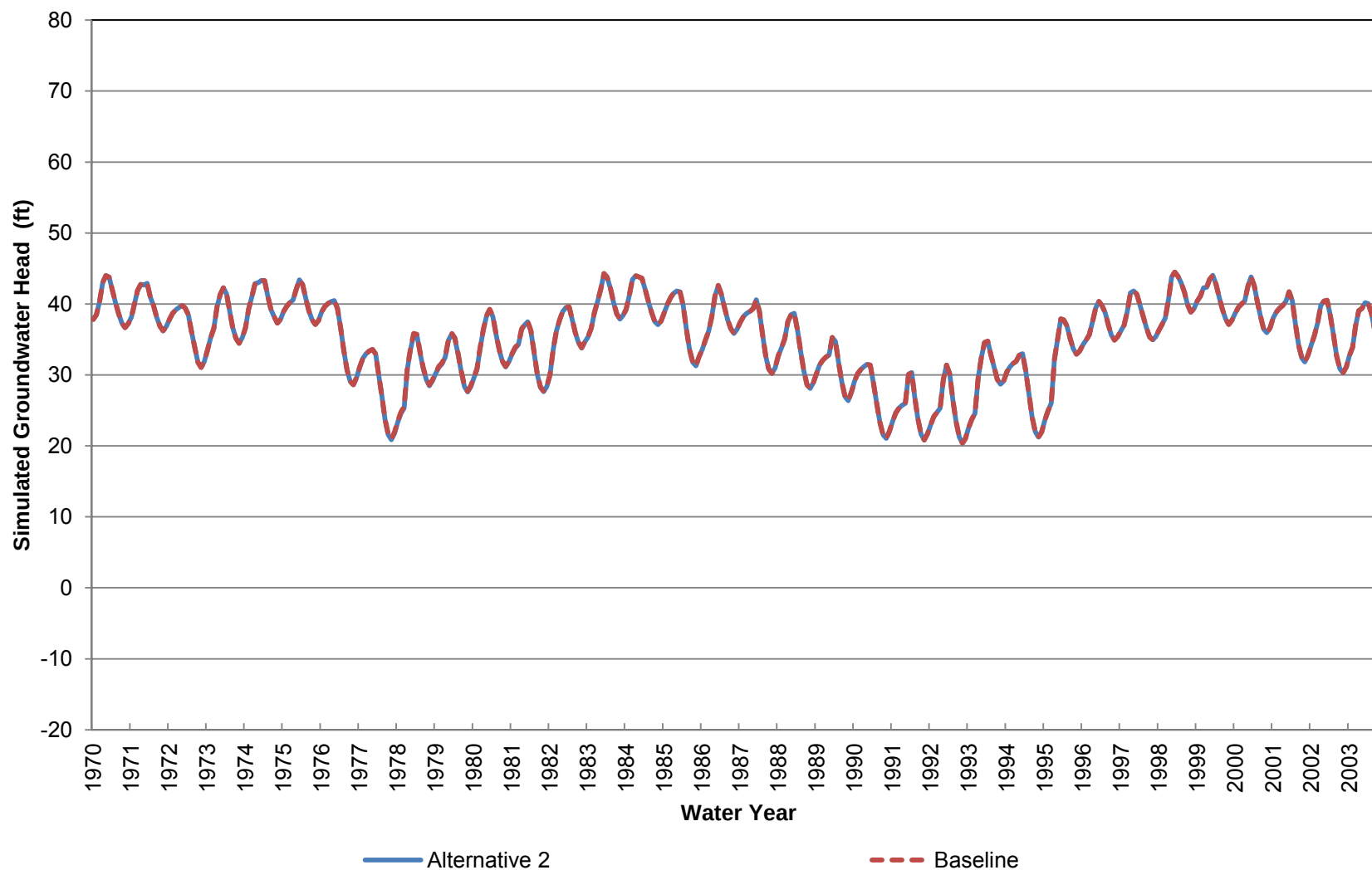
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 150-200 ft bgs)



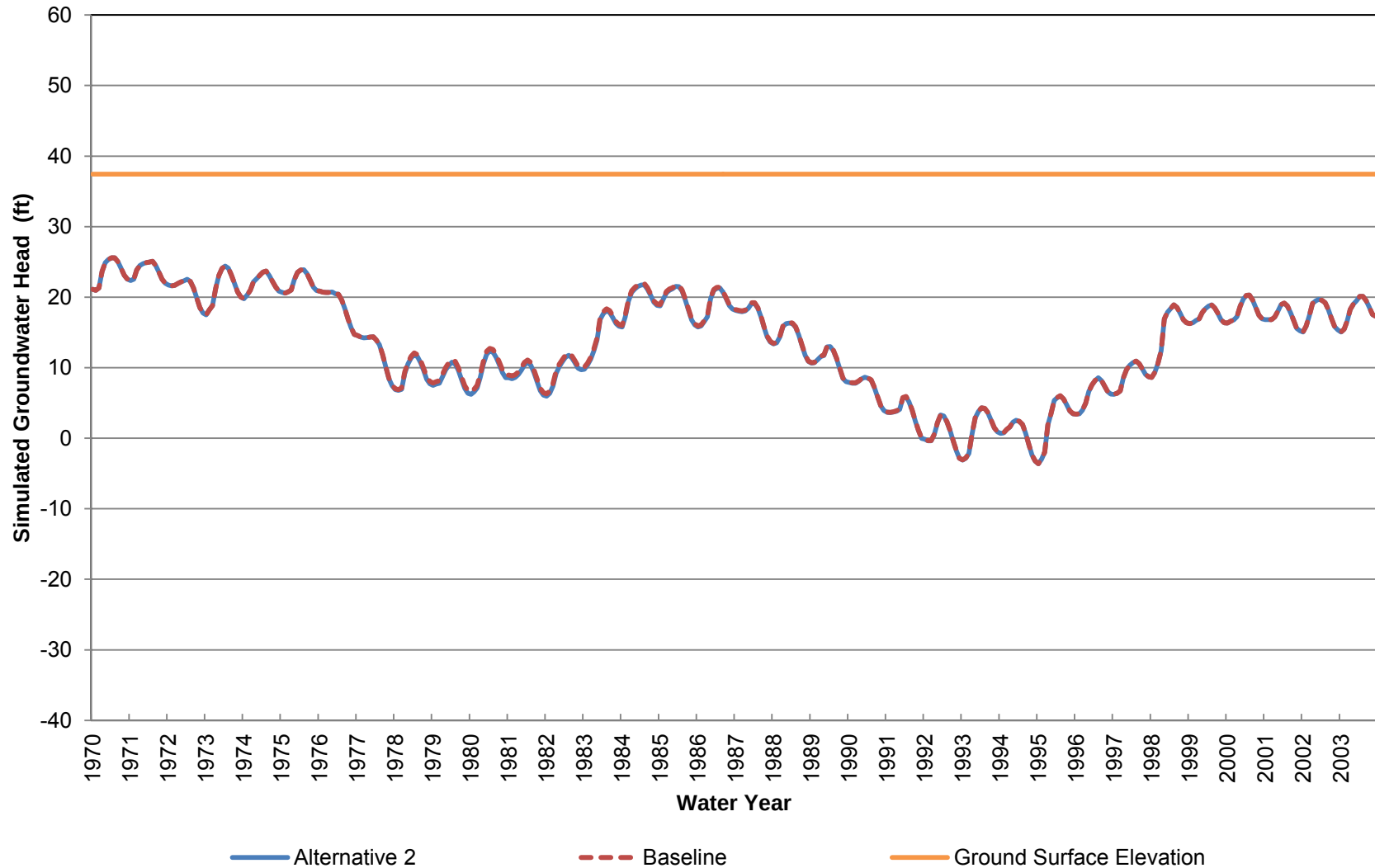
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 200-270 ft bgs)



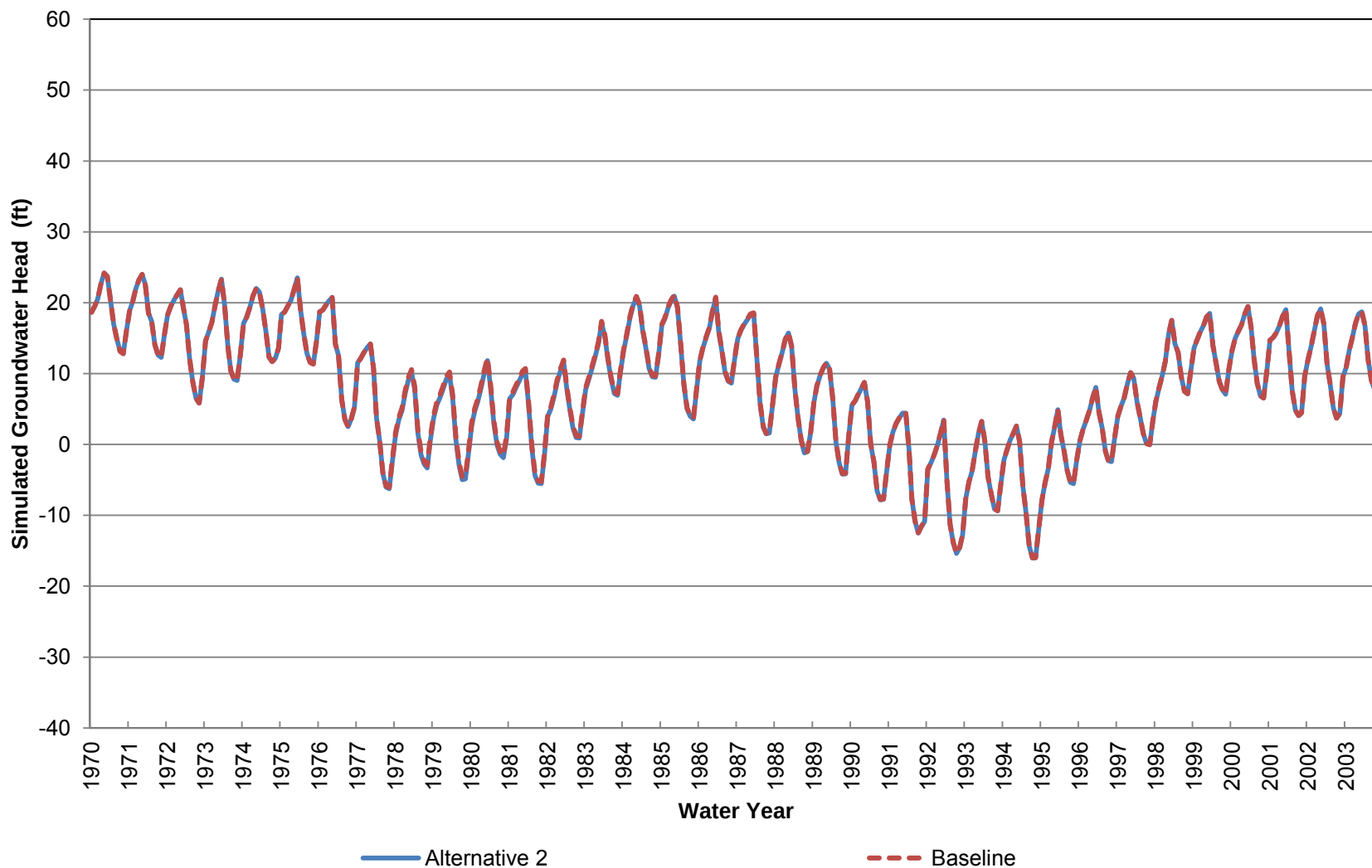
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 270-360 ft bgs)



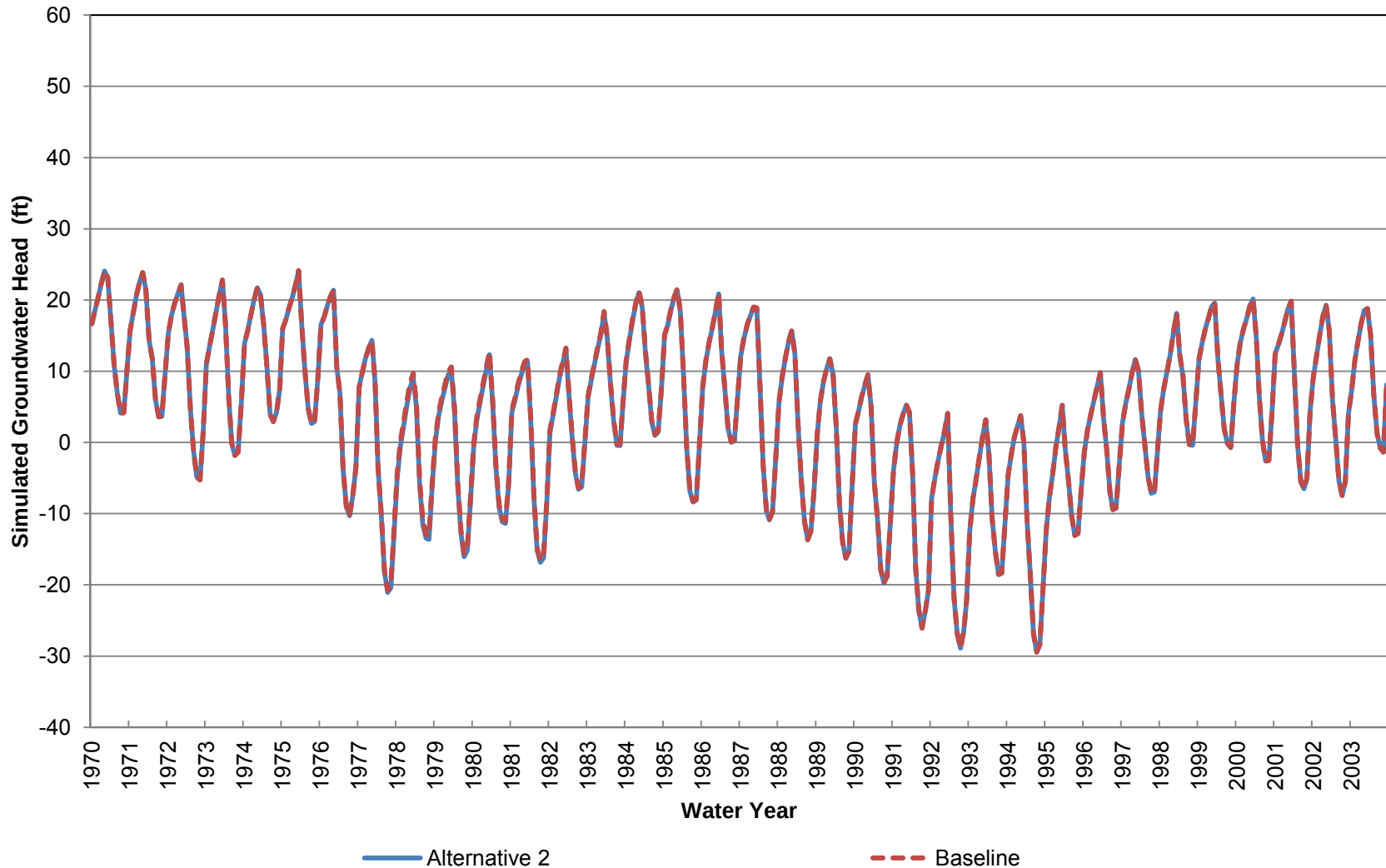
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 16 (Approximately 0-70 ft bgs)



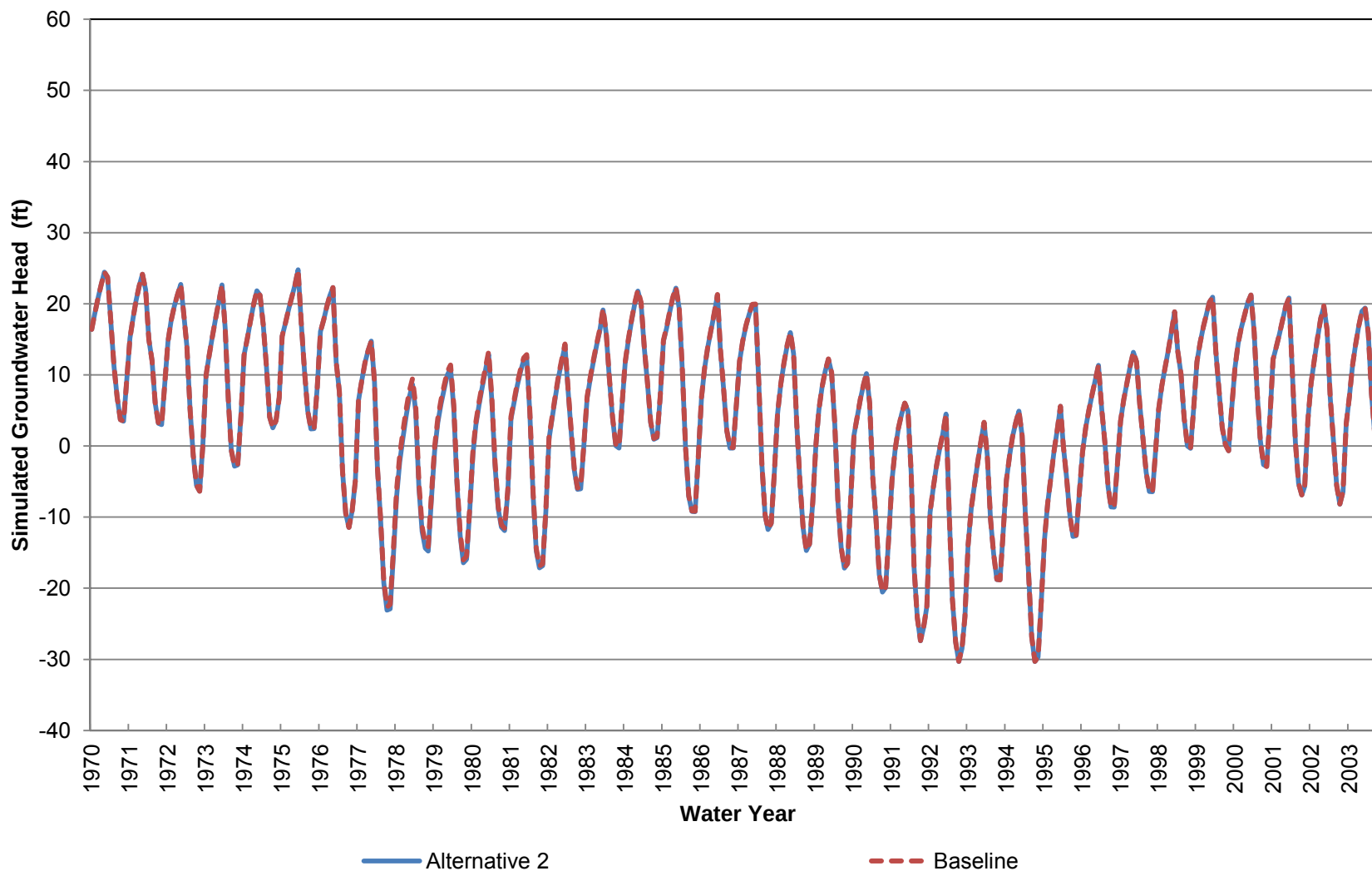
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 70-220 ft bgs)



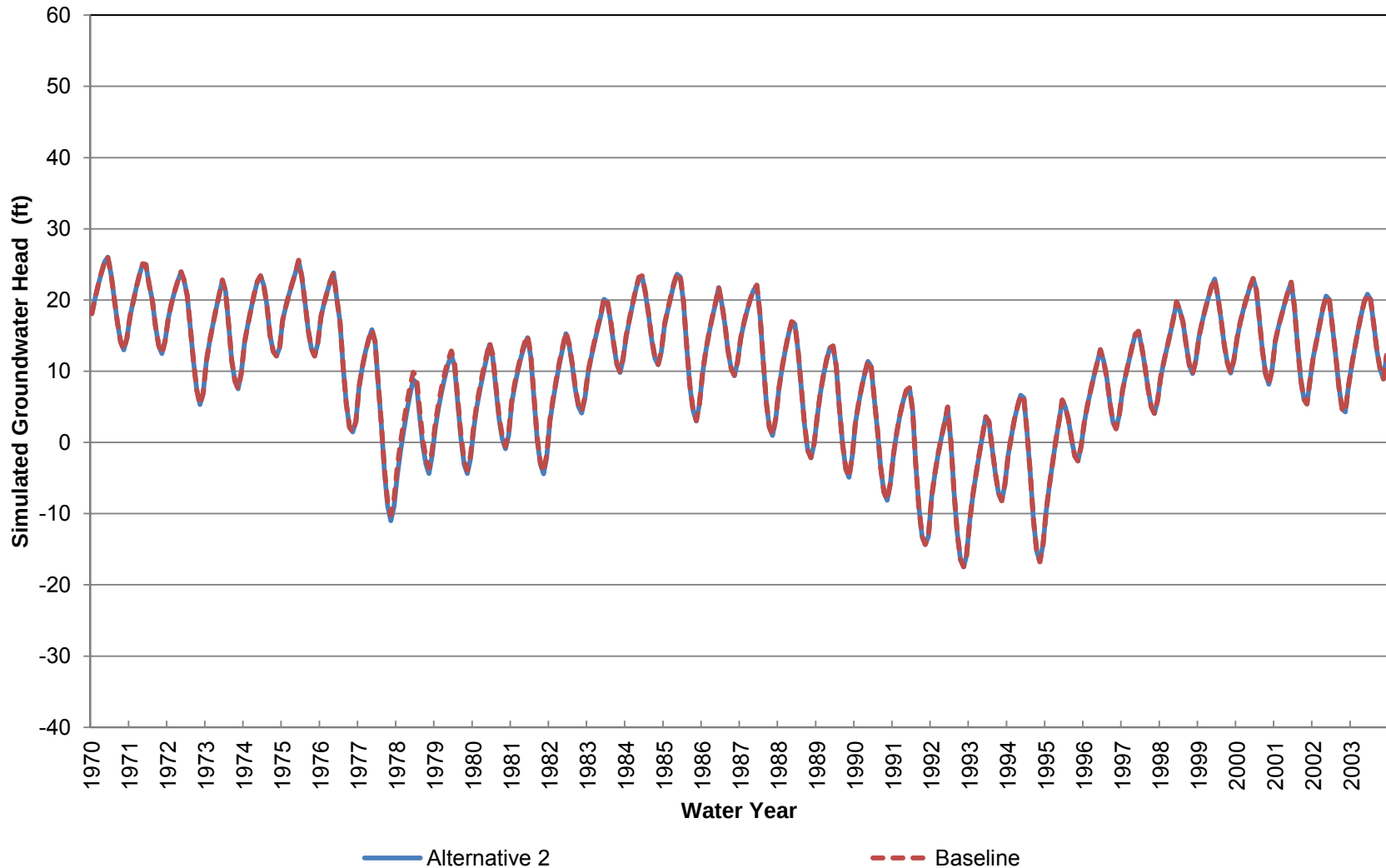
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 220-370 ft bgs)



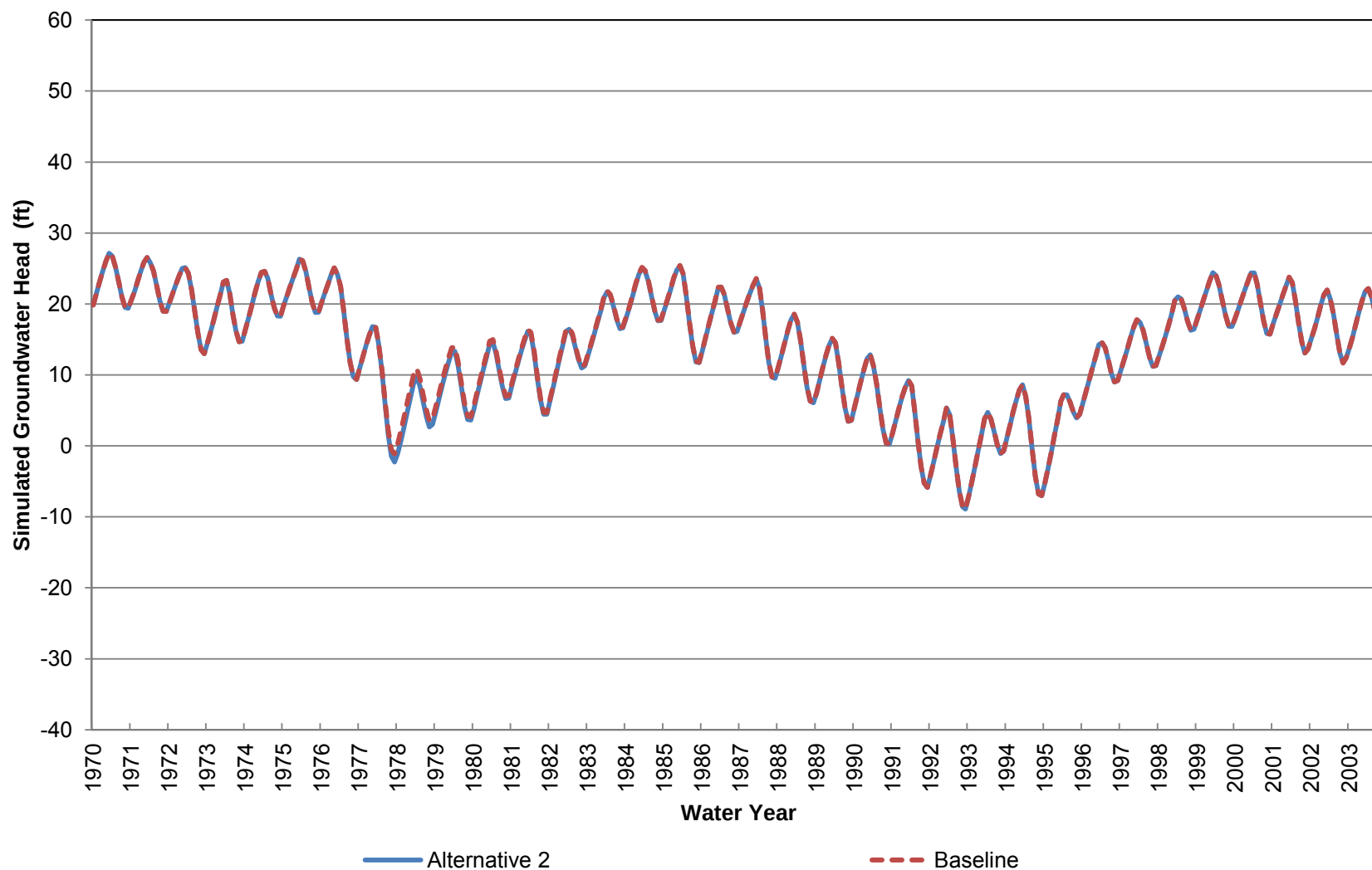
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 370-530 ft bgs)



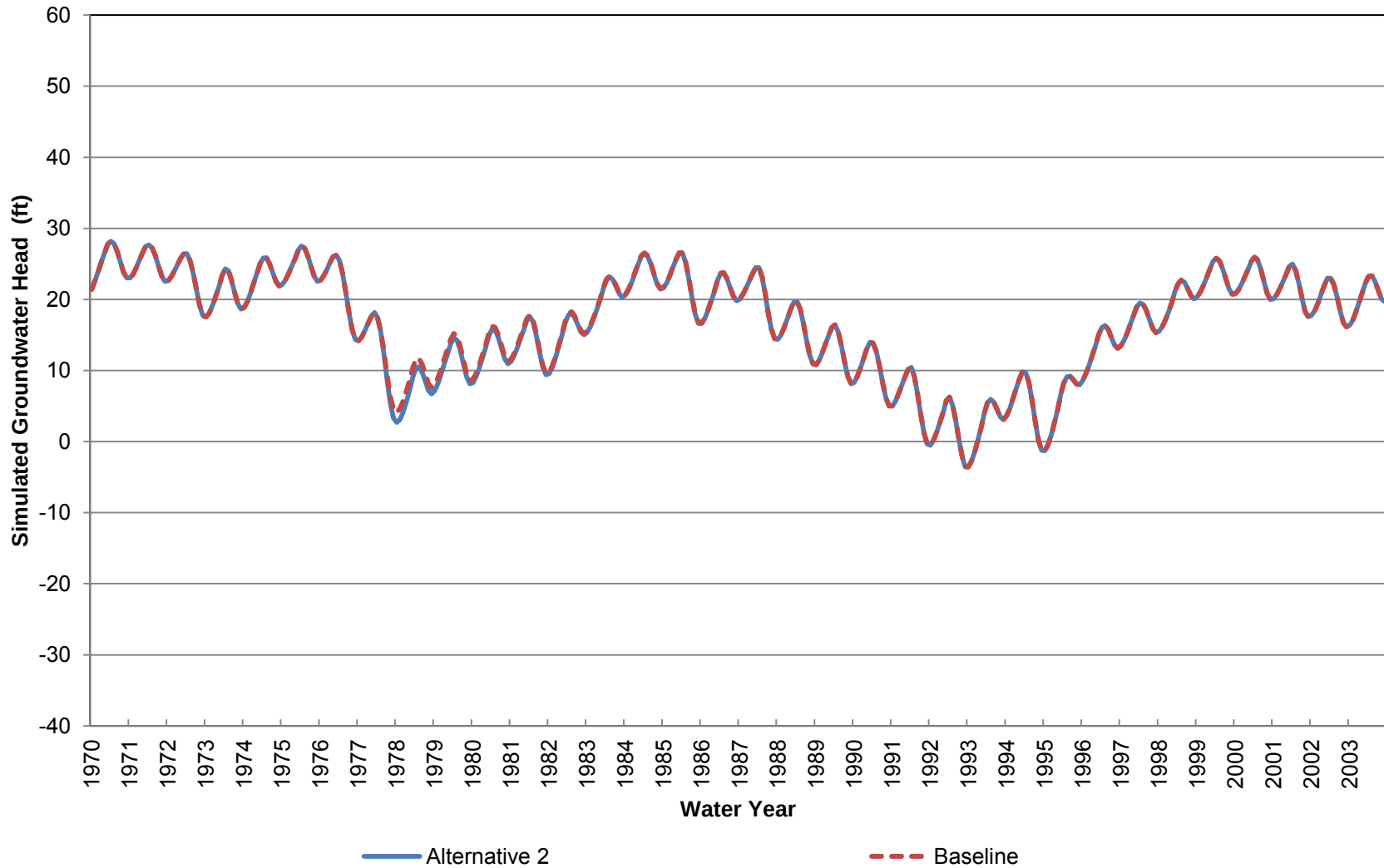
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 530-760 ft bgs)



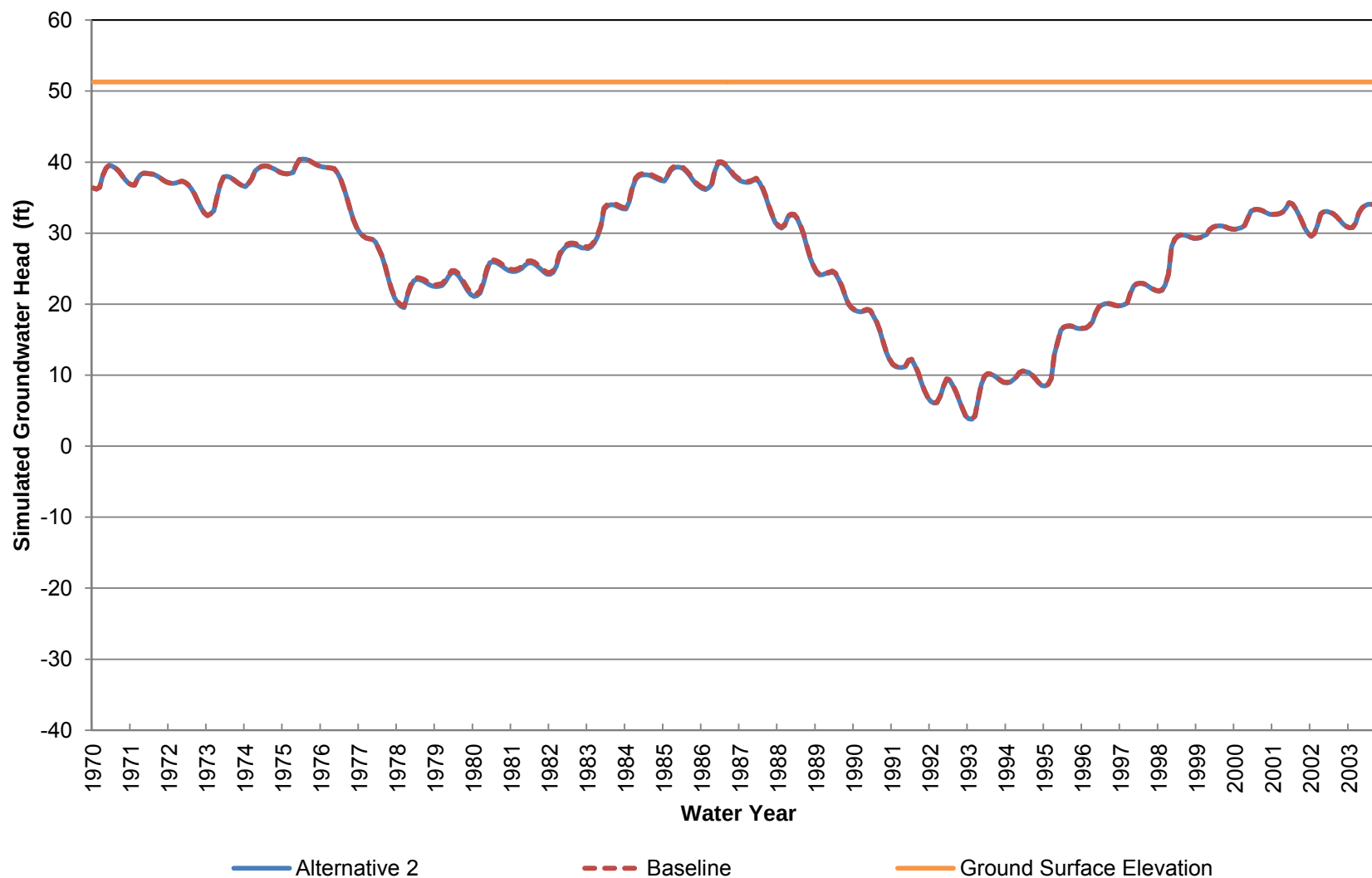
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 760-1020 ft bgs)



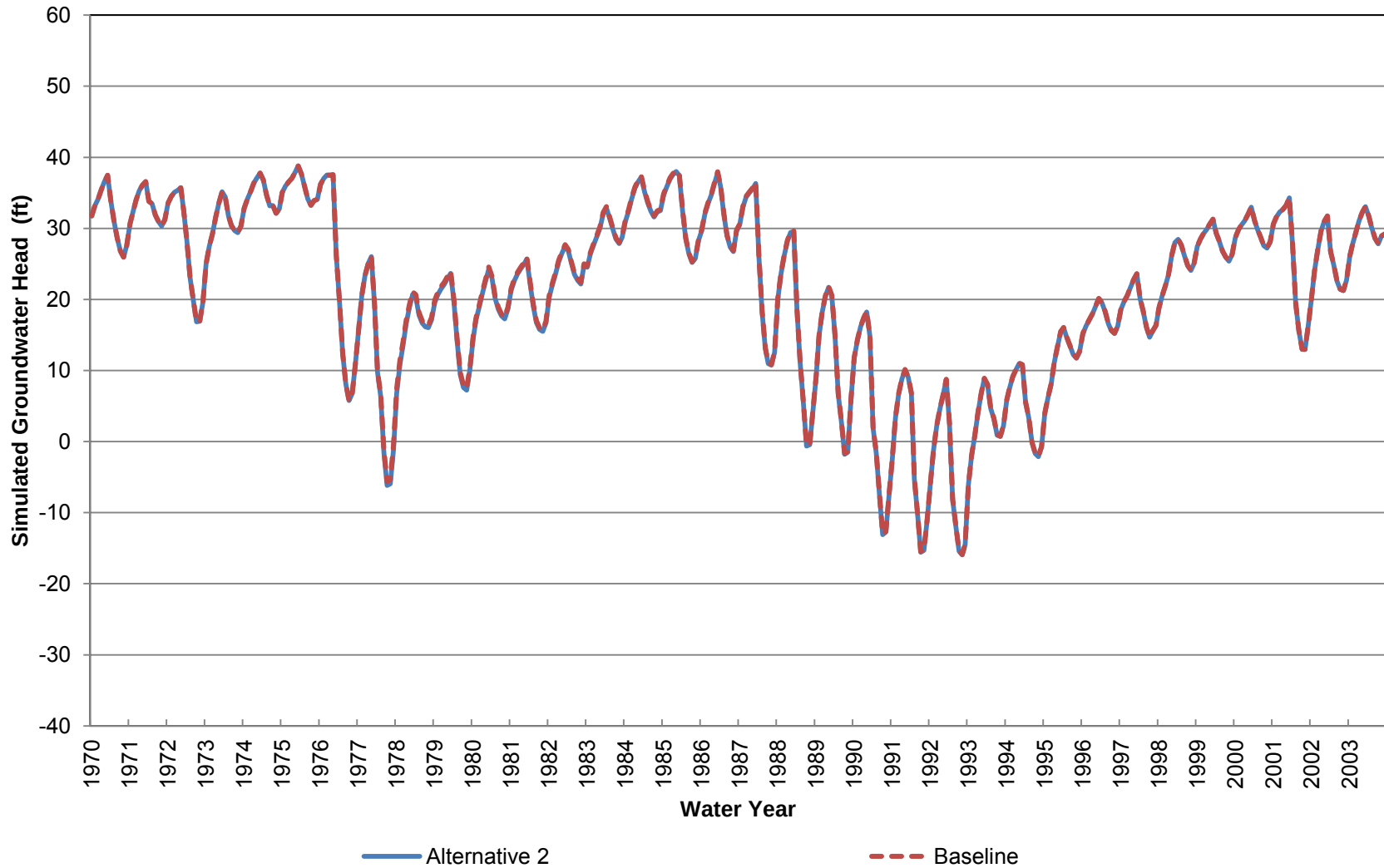
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 1020-1390 ft bgs)



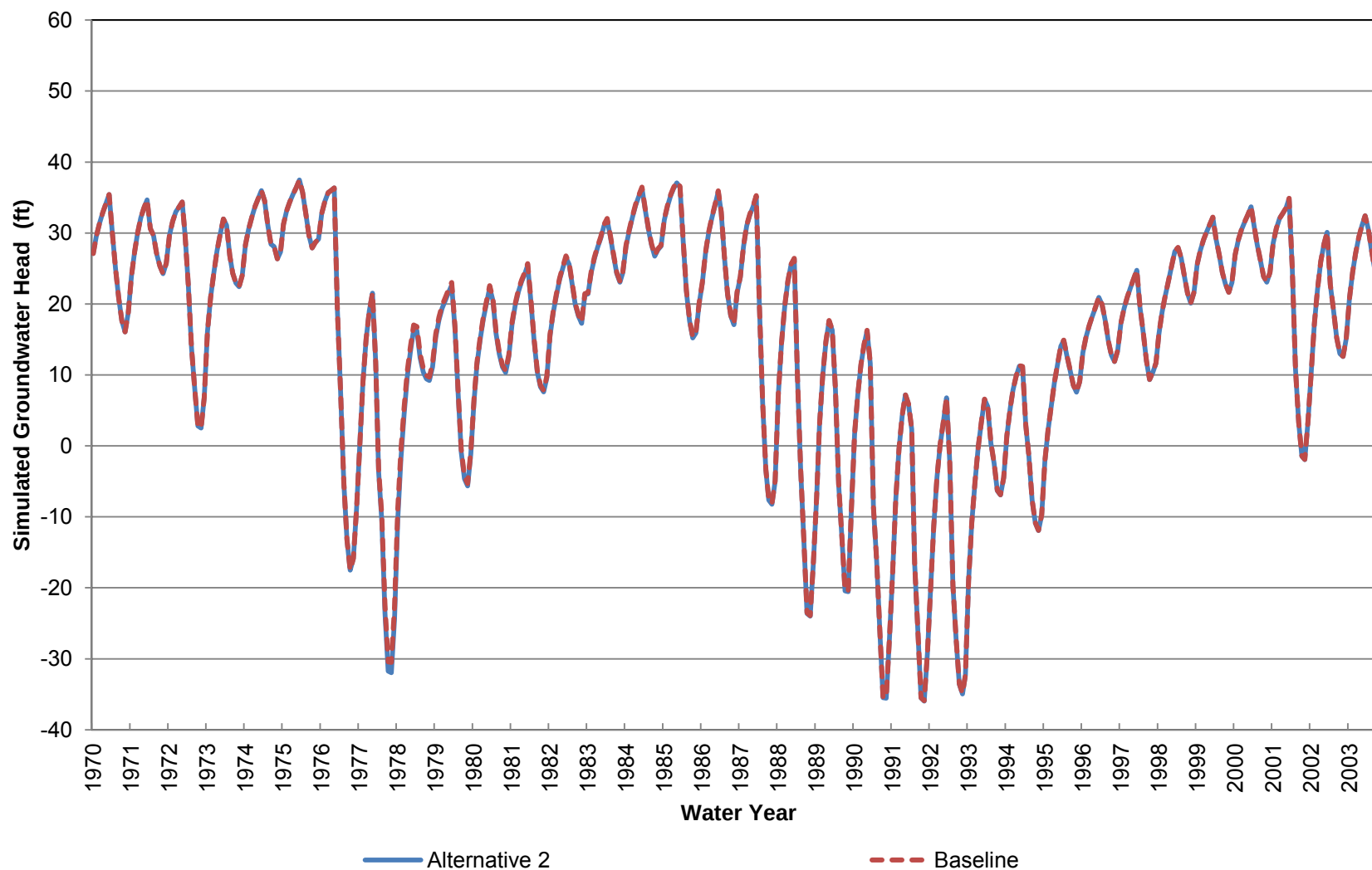
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 17 (Approximately 0-70 ft bgs)



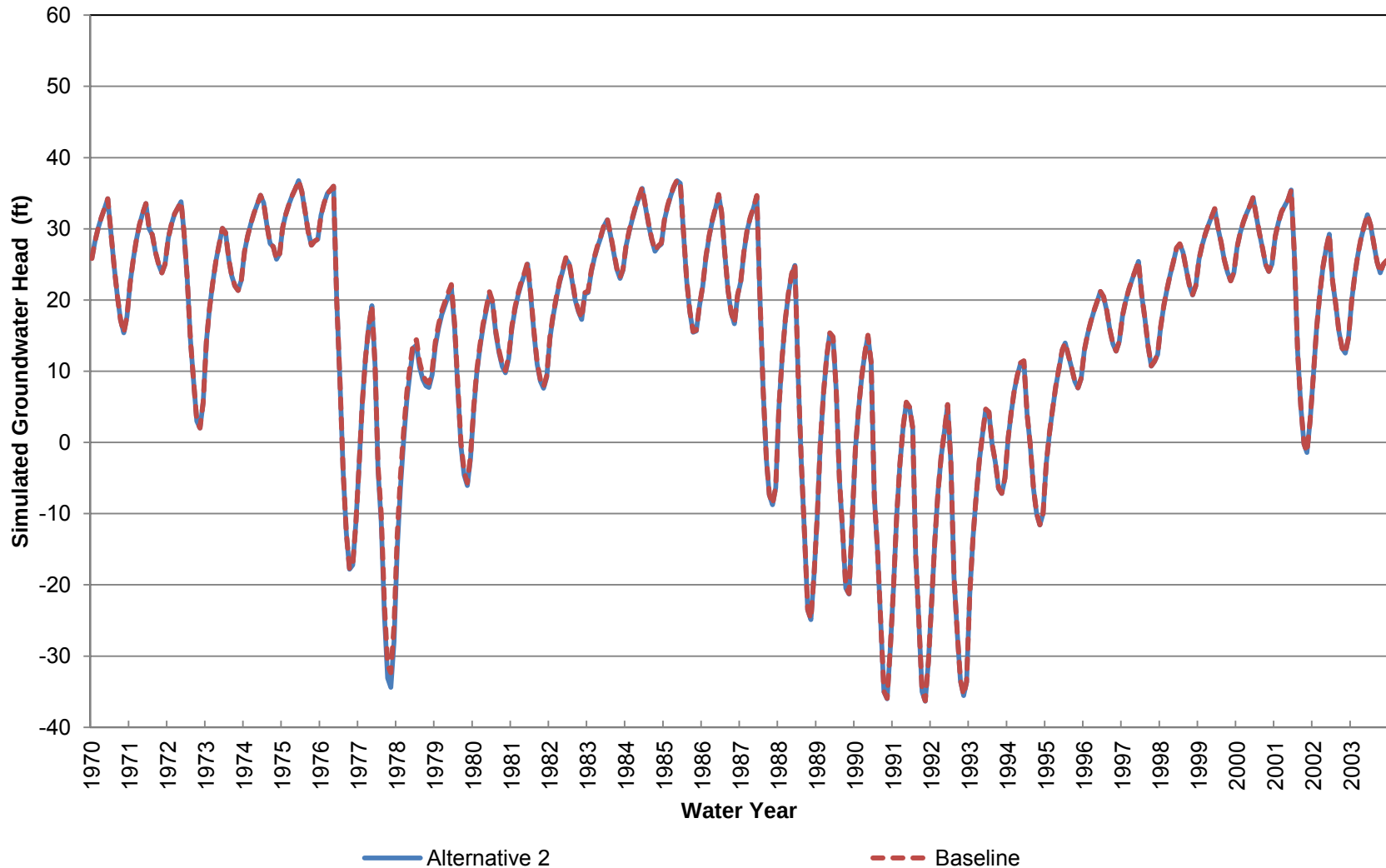
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 70-250 ft bgs)



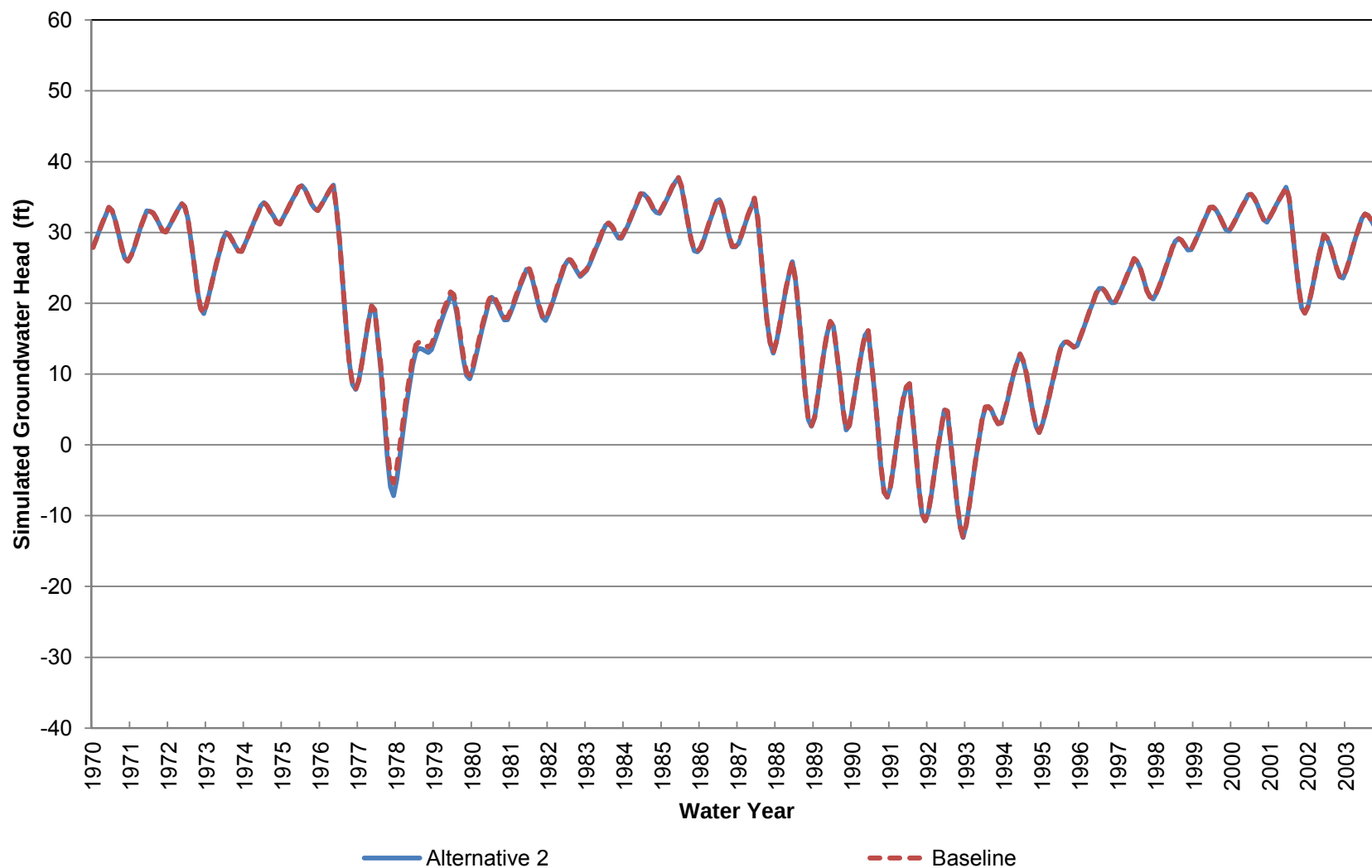
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 250-440 ft bgs)



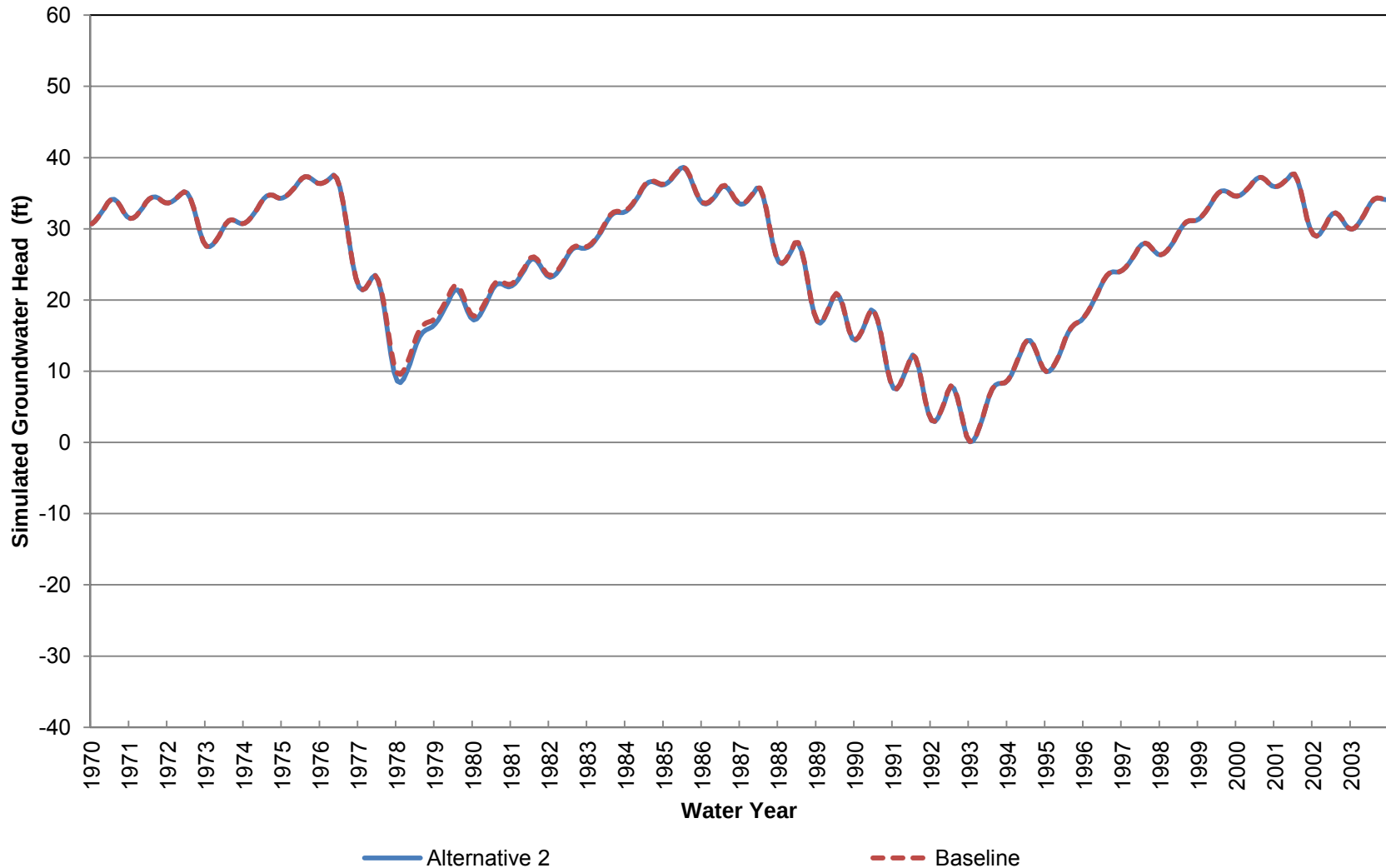
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 440-620 ft bgs)



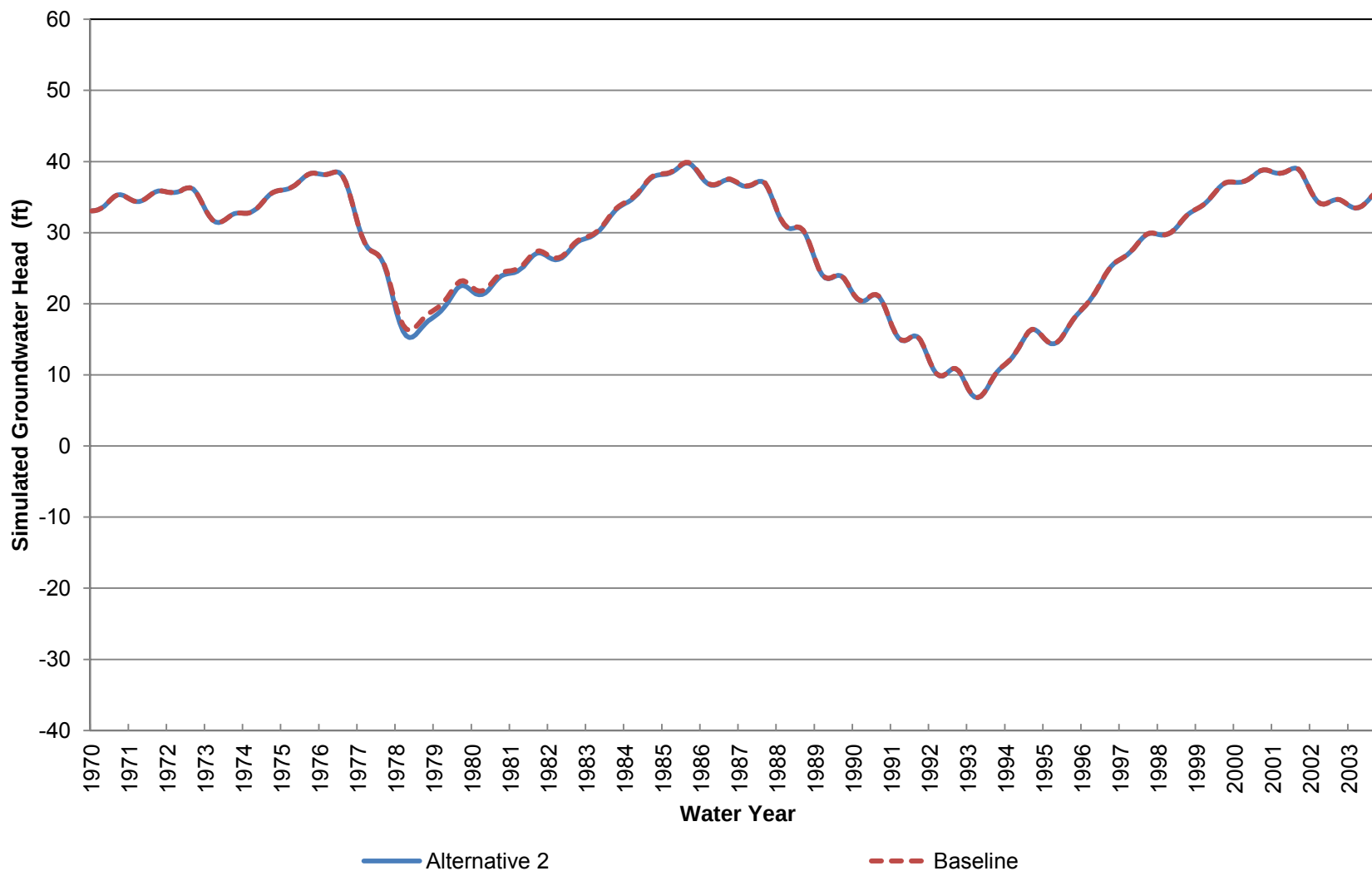
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 620-920 ft bgs)



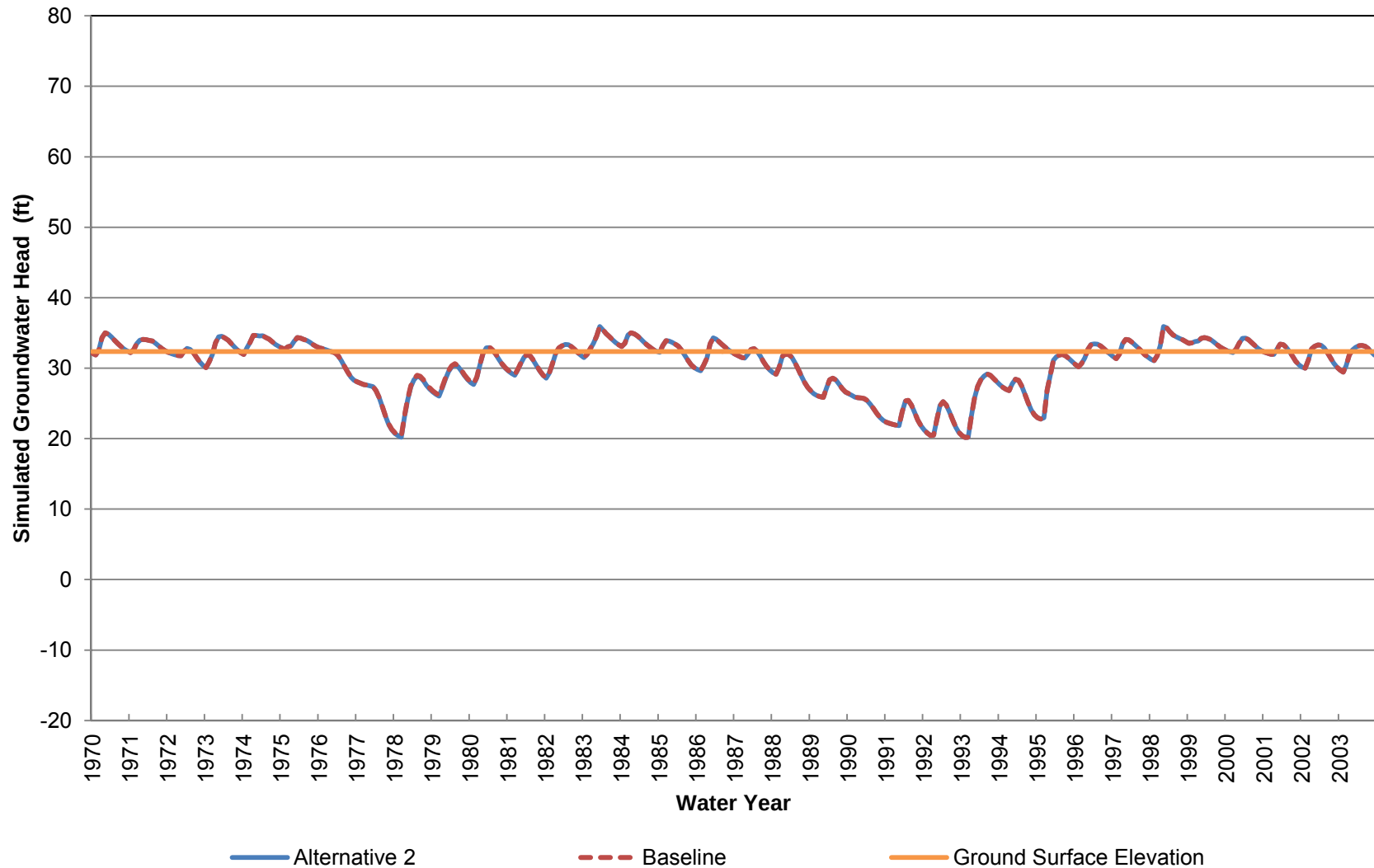
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 920-1220 ft bgs)



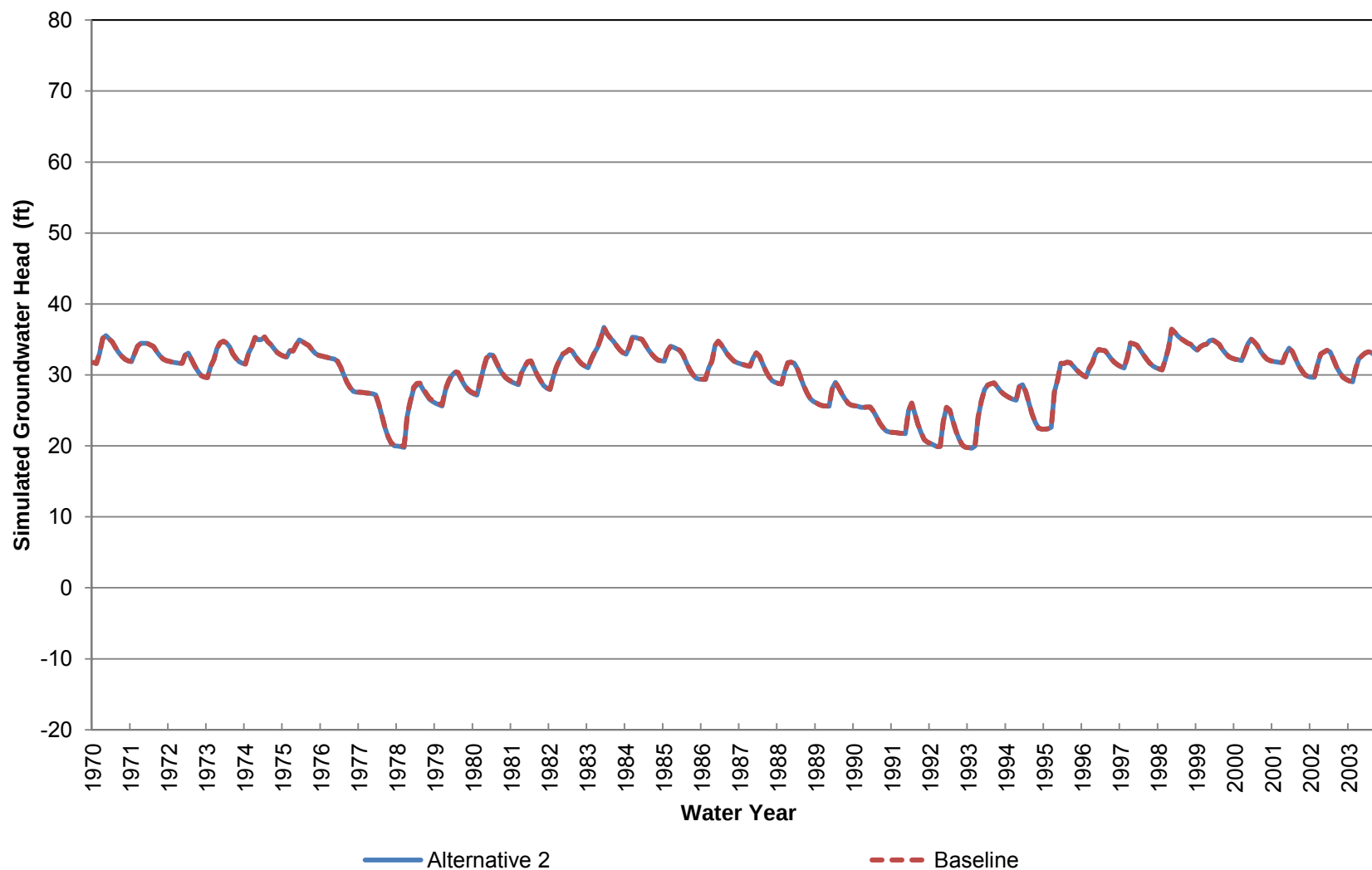
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 1220-1680 ft bgs)



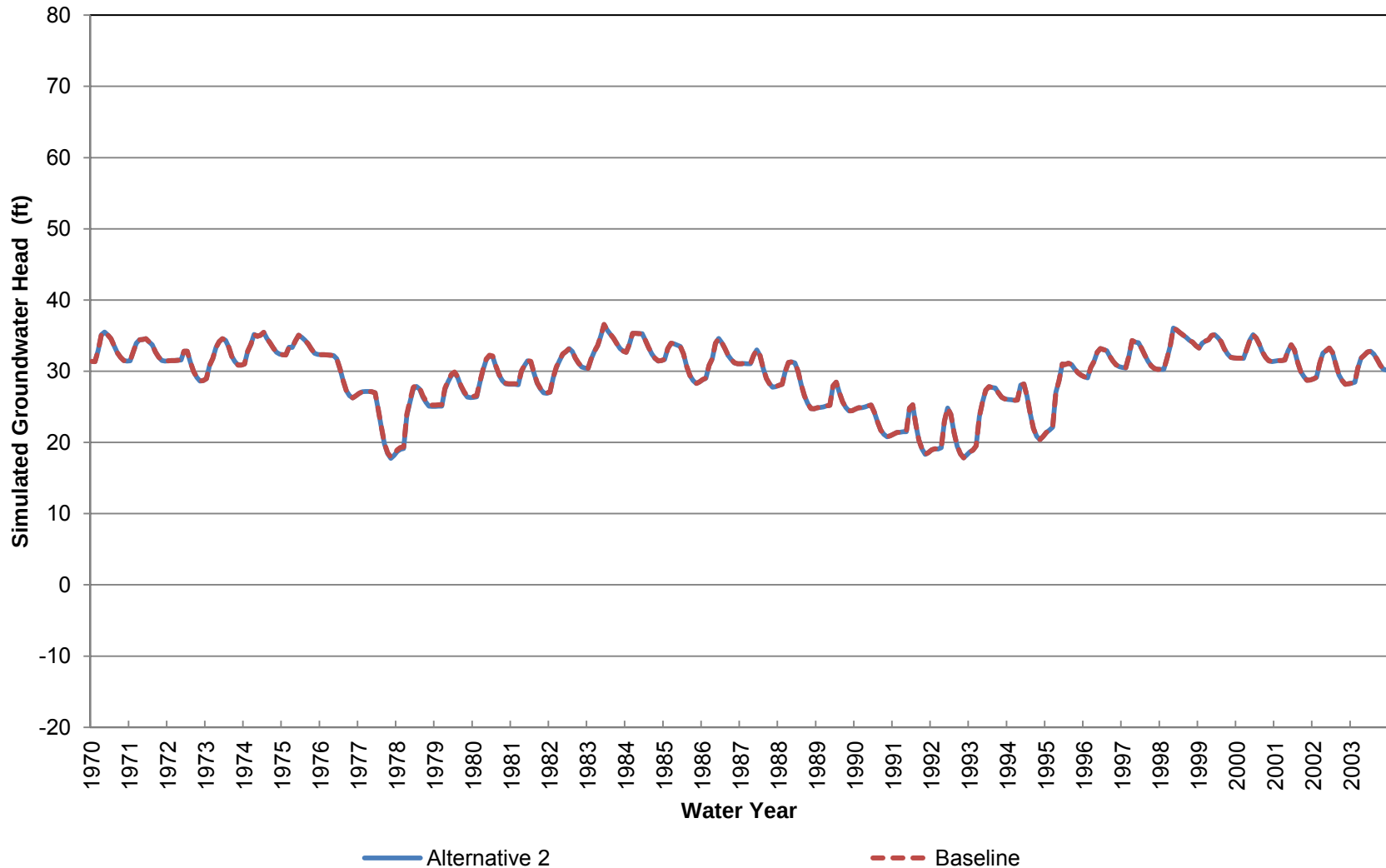
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 18 (Approximately 0-60 ft bgs)



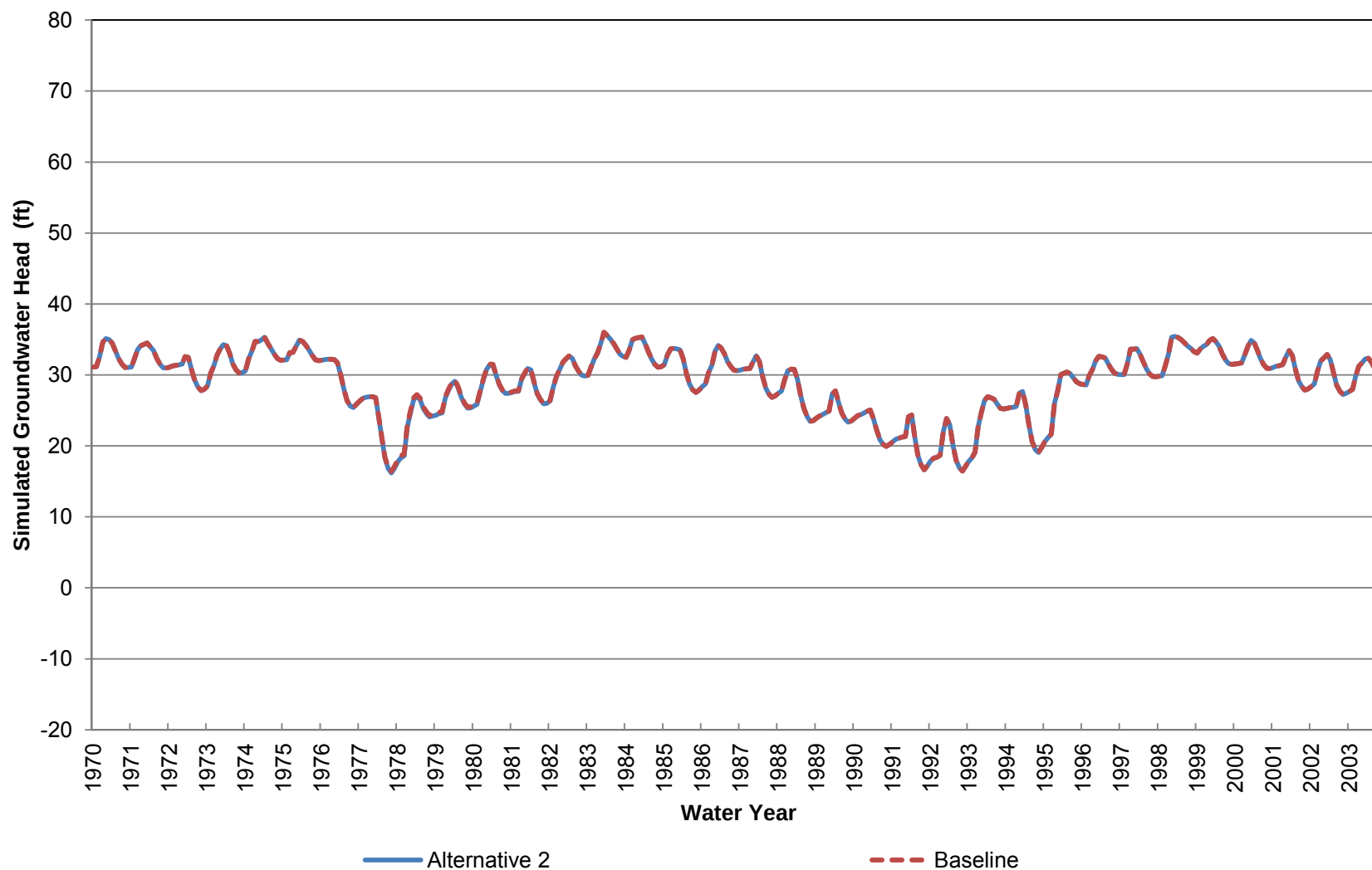
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 60-150 ft bgs)



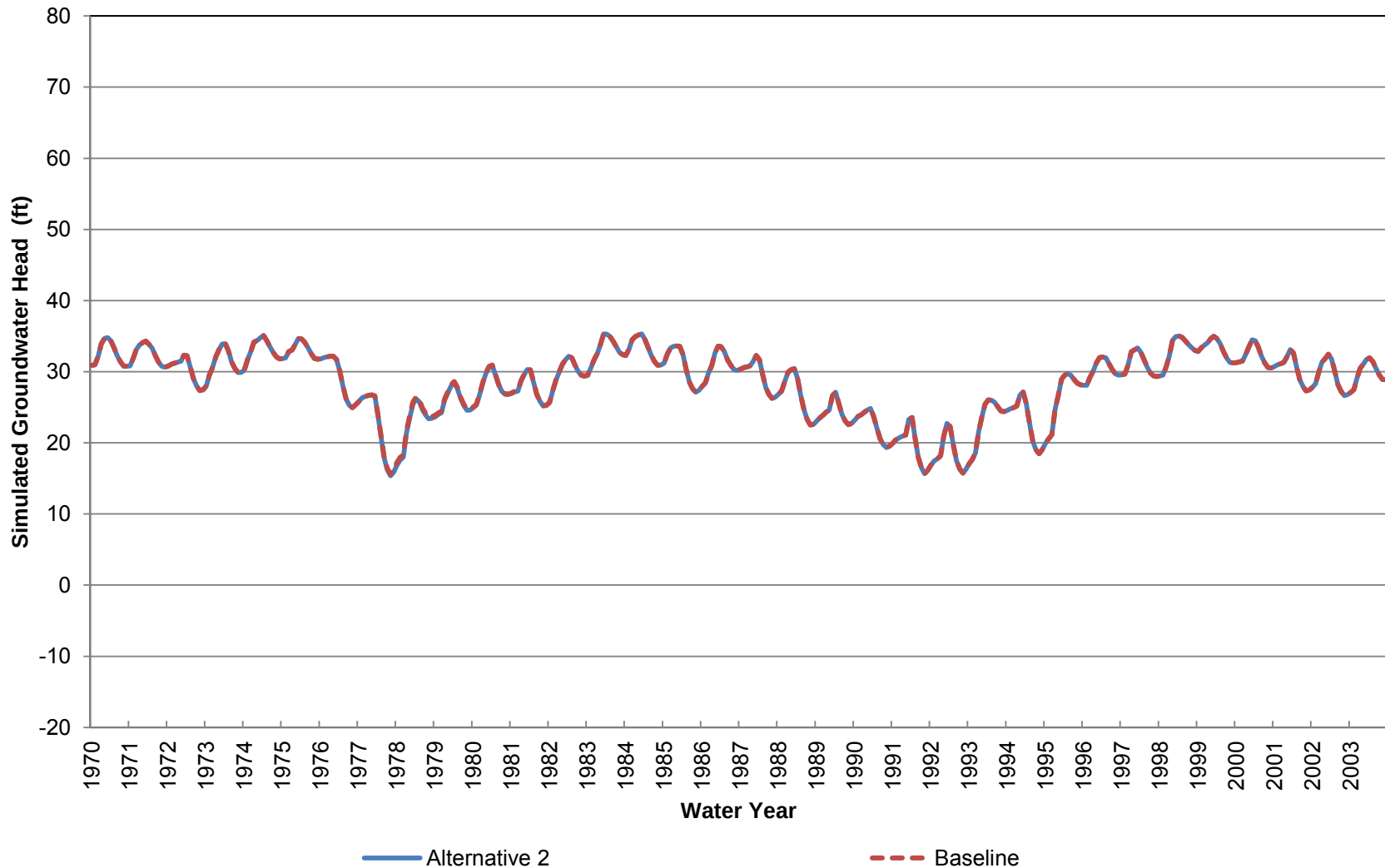
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 150-240 ft bgs)



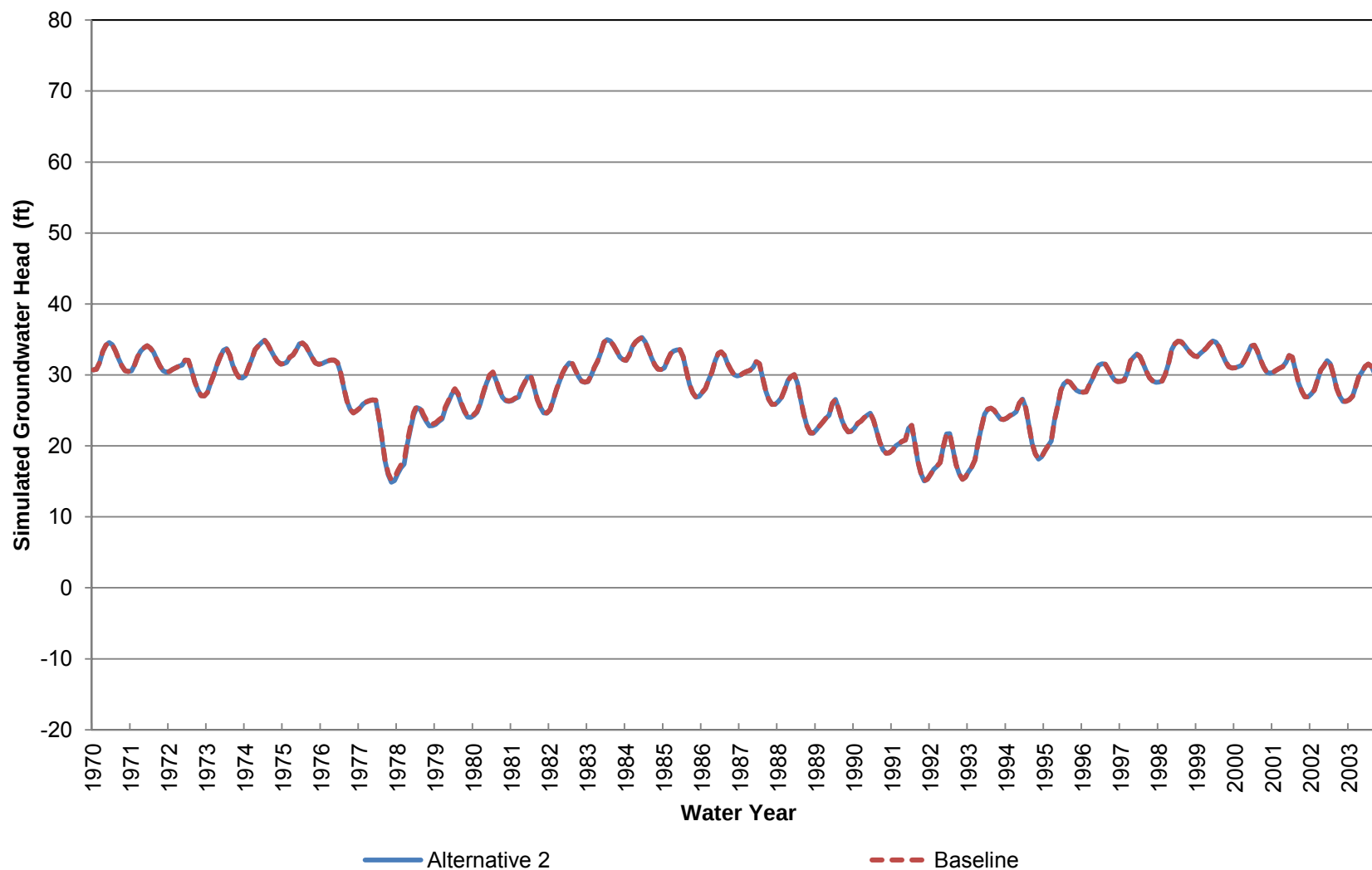
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 240-330 ft bgs)



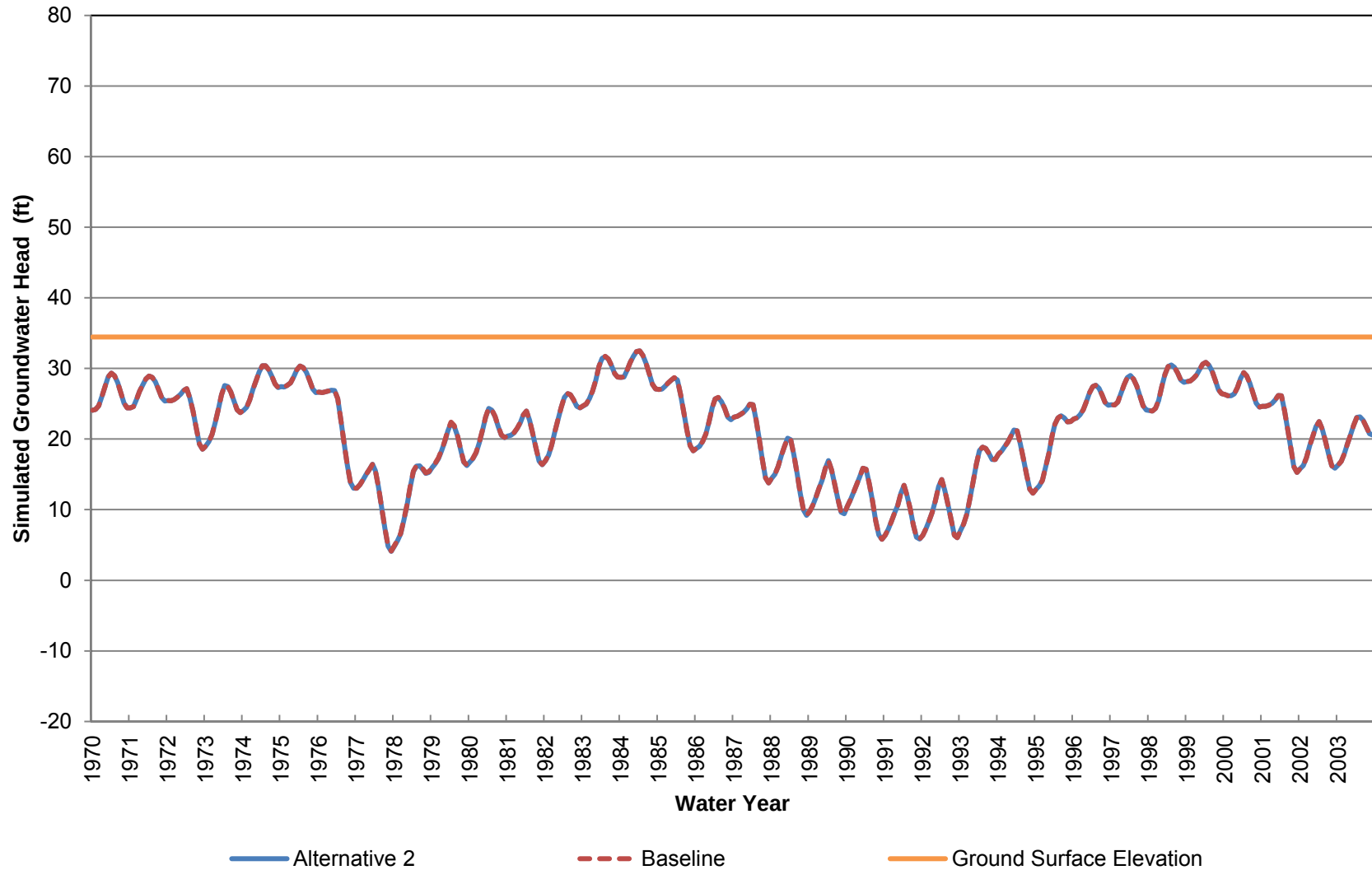
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 330-450 ft bgs)



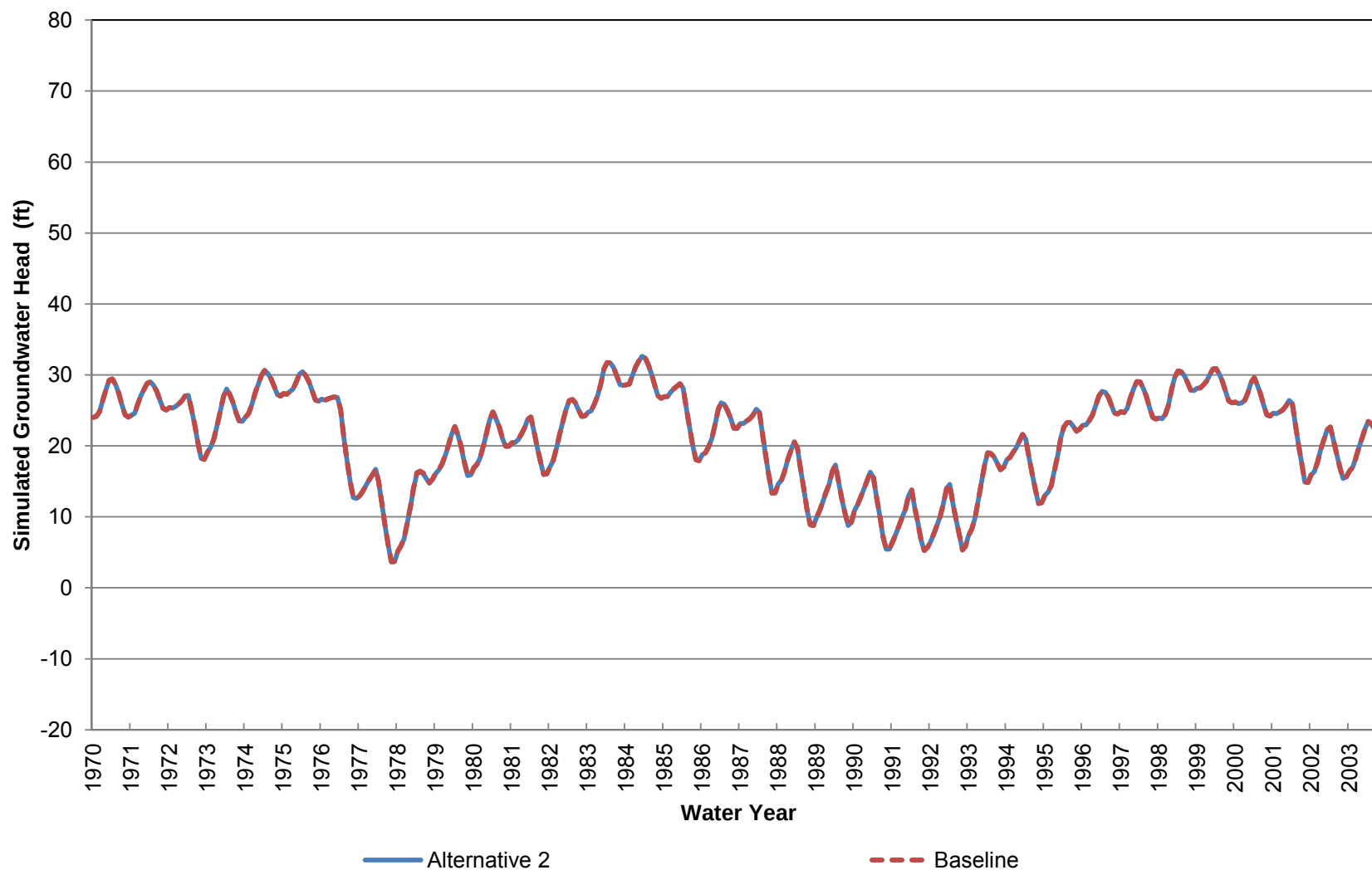
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 450-600 ft bgs)



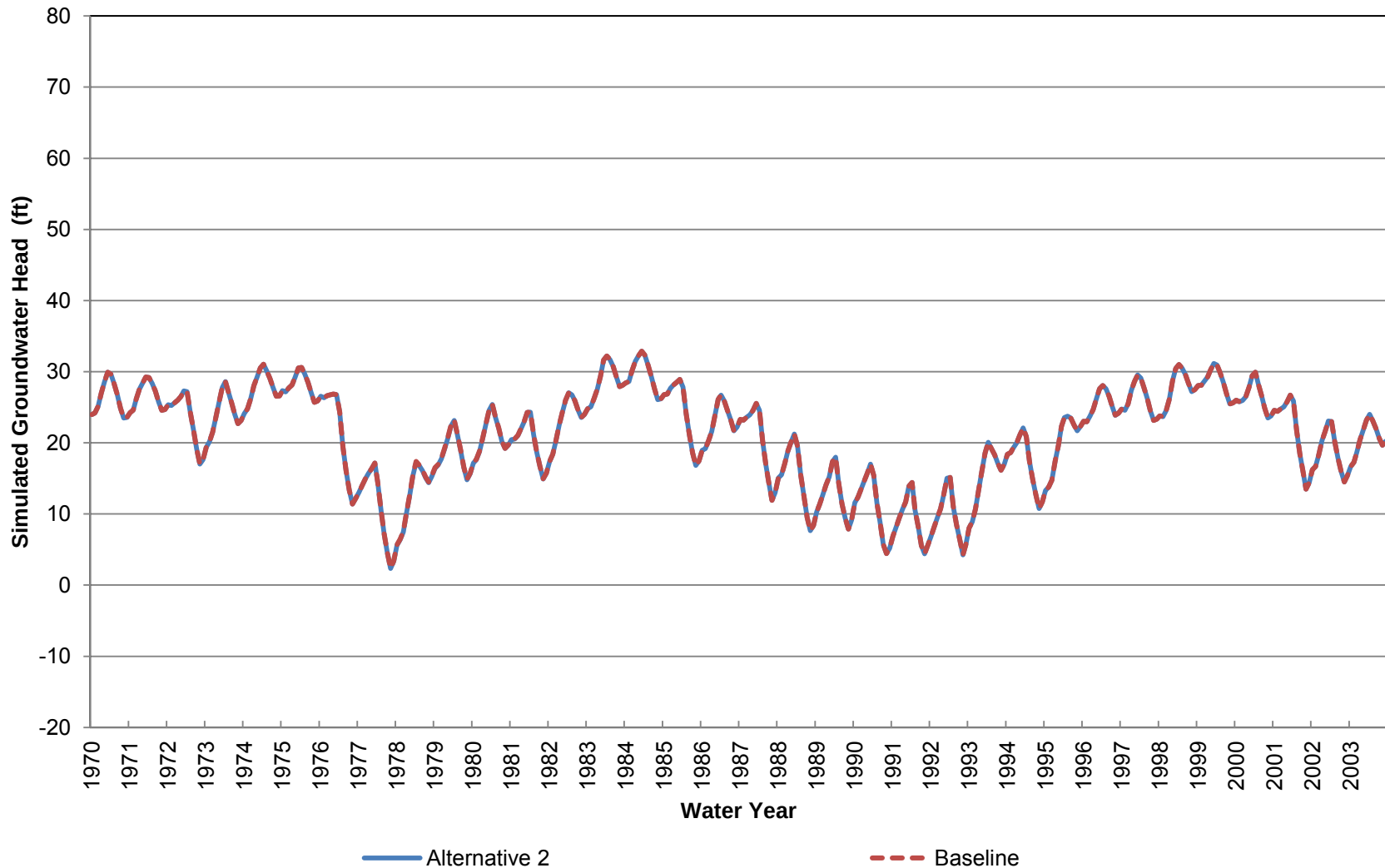
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 19 (Approximately 0-30 ft bgs)



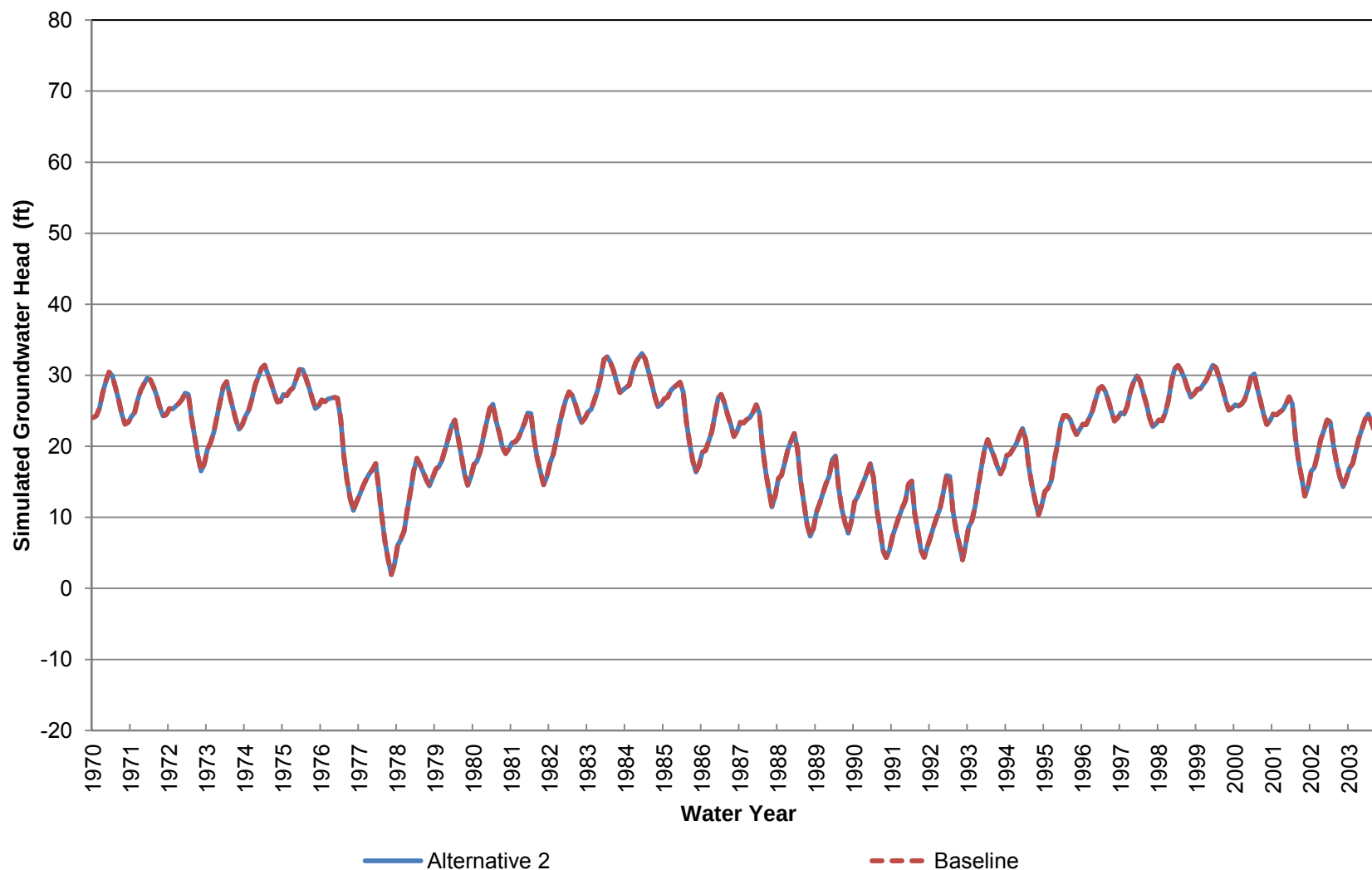
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 30-70 ft bgs)



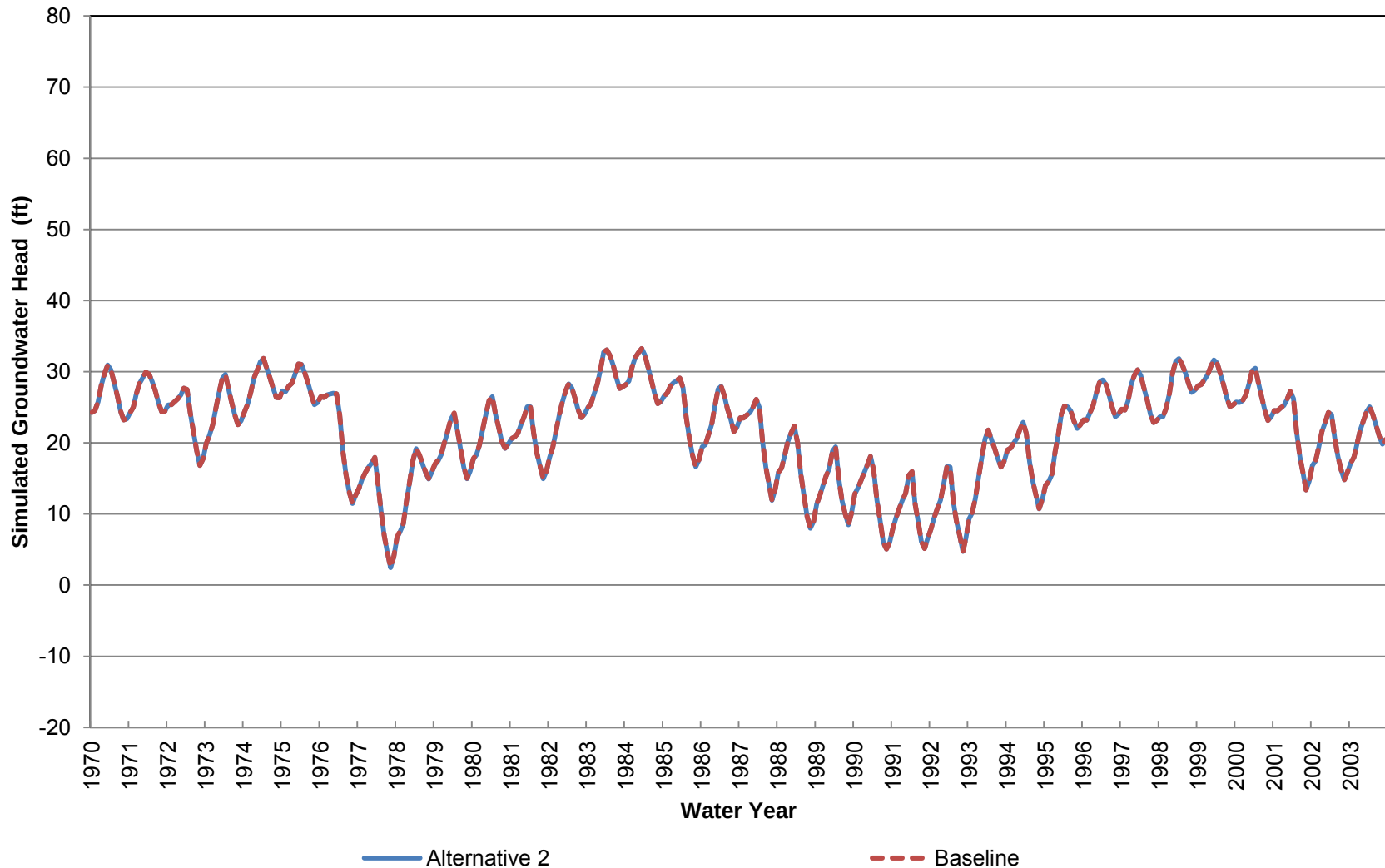
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 70-120 ft bgs)



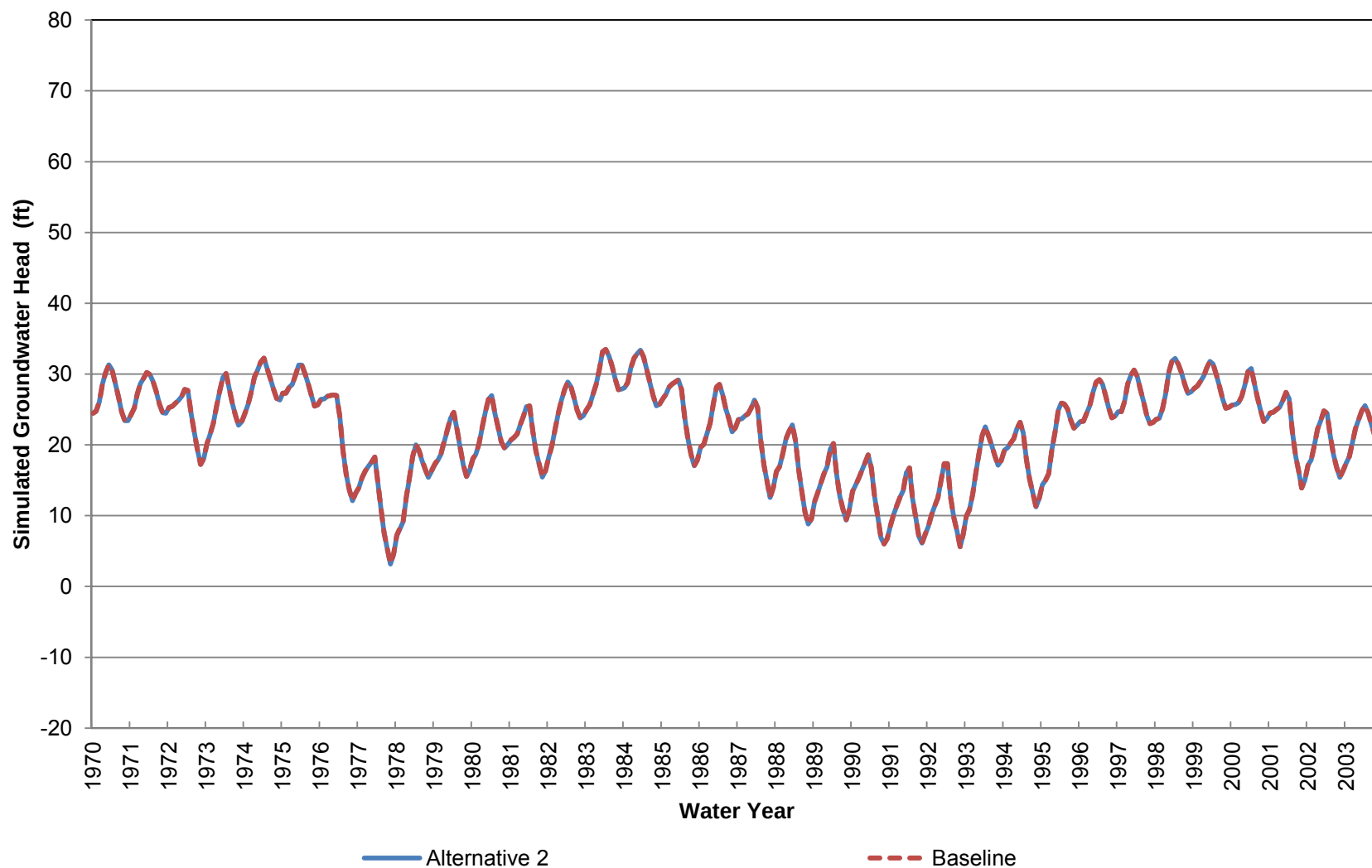
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 120-160 ft bgs)



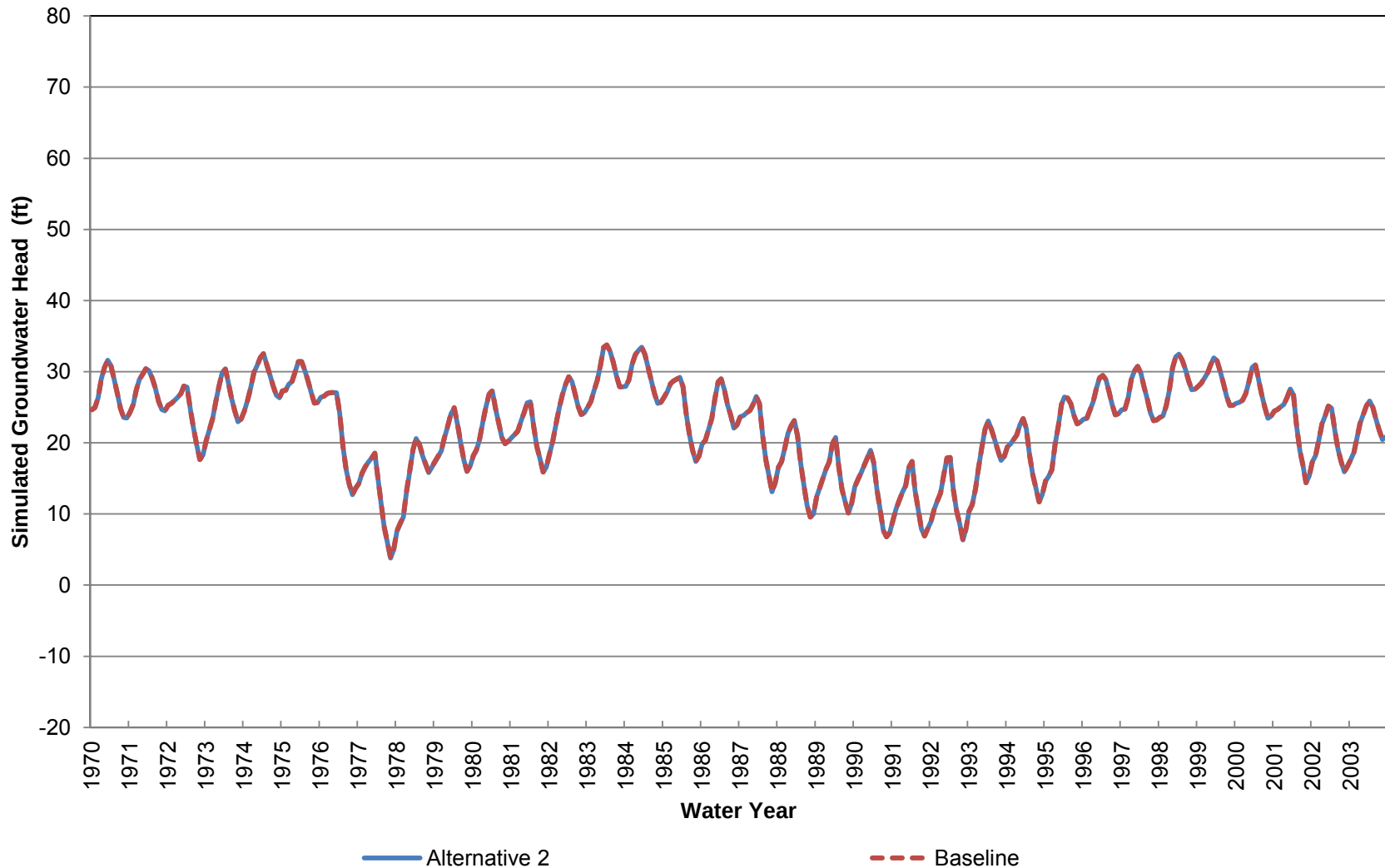
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 160-220 ft bgs)



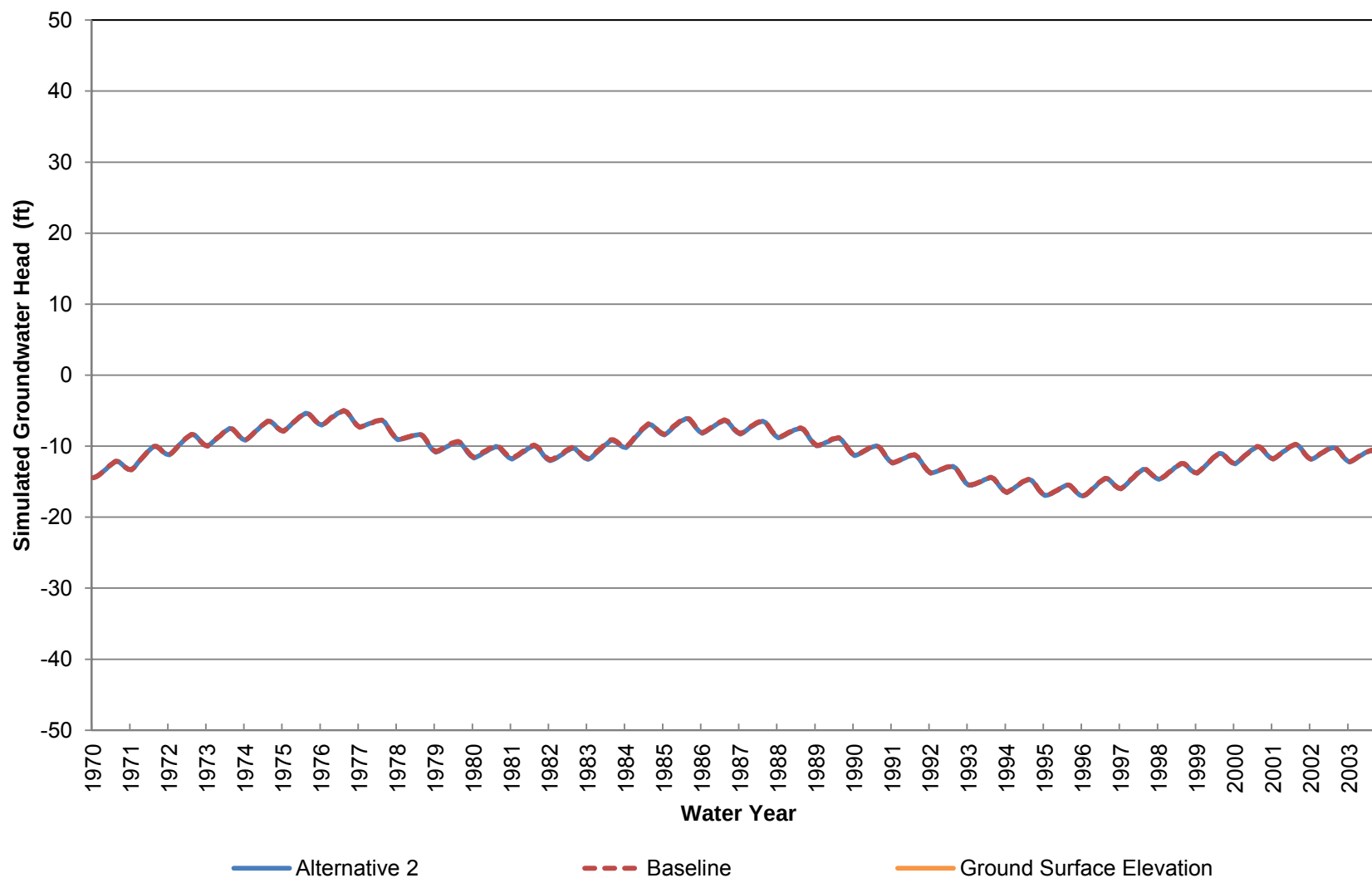
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 220-290 ft bgs)



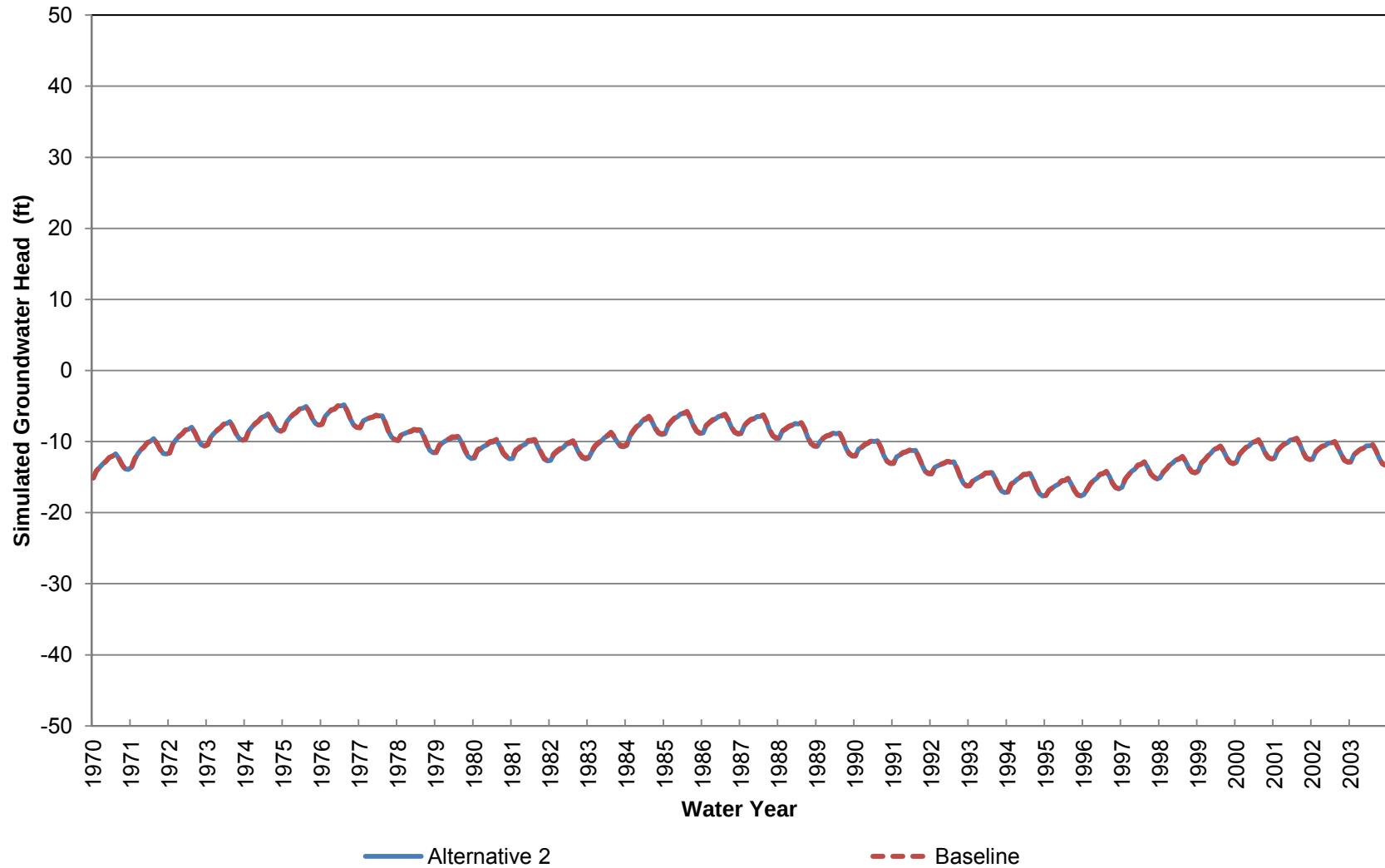
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 290-400 ft bgs)



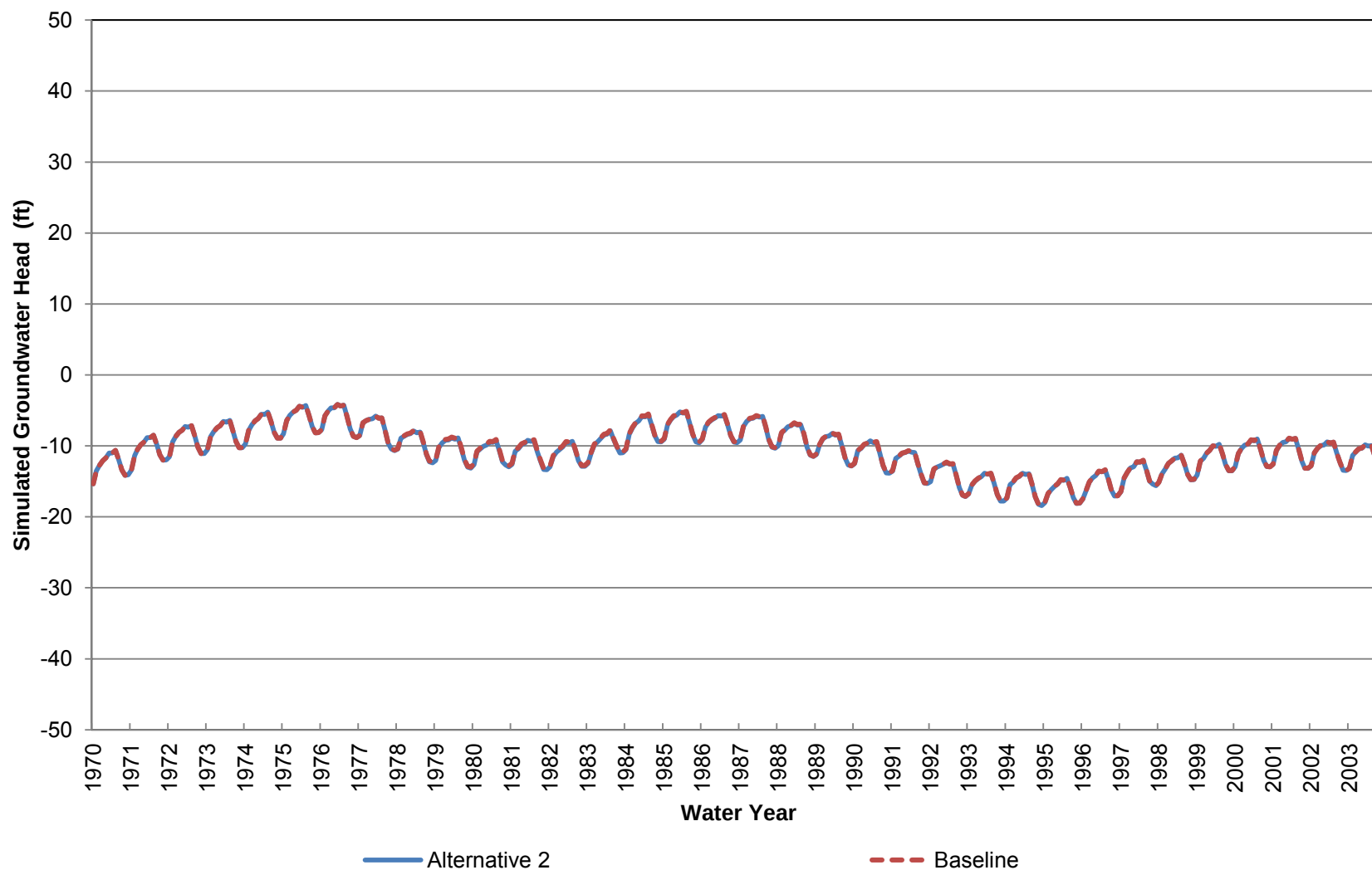
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 20 (Approximately 0-70 ft bgs)



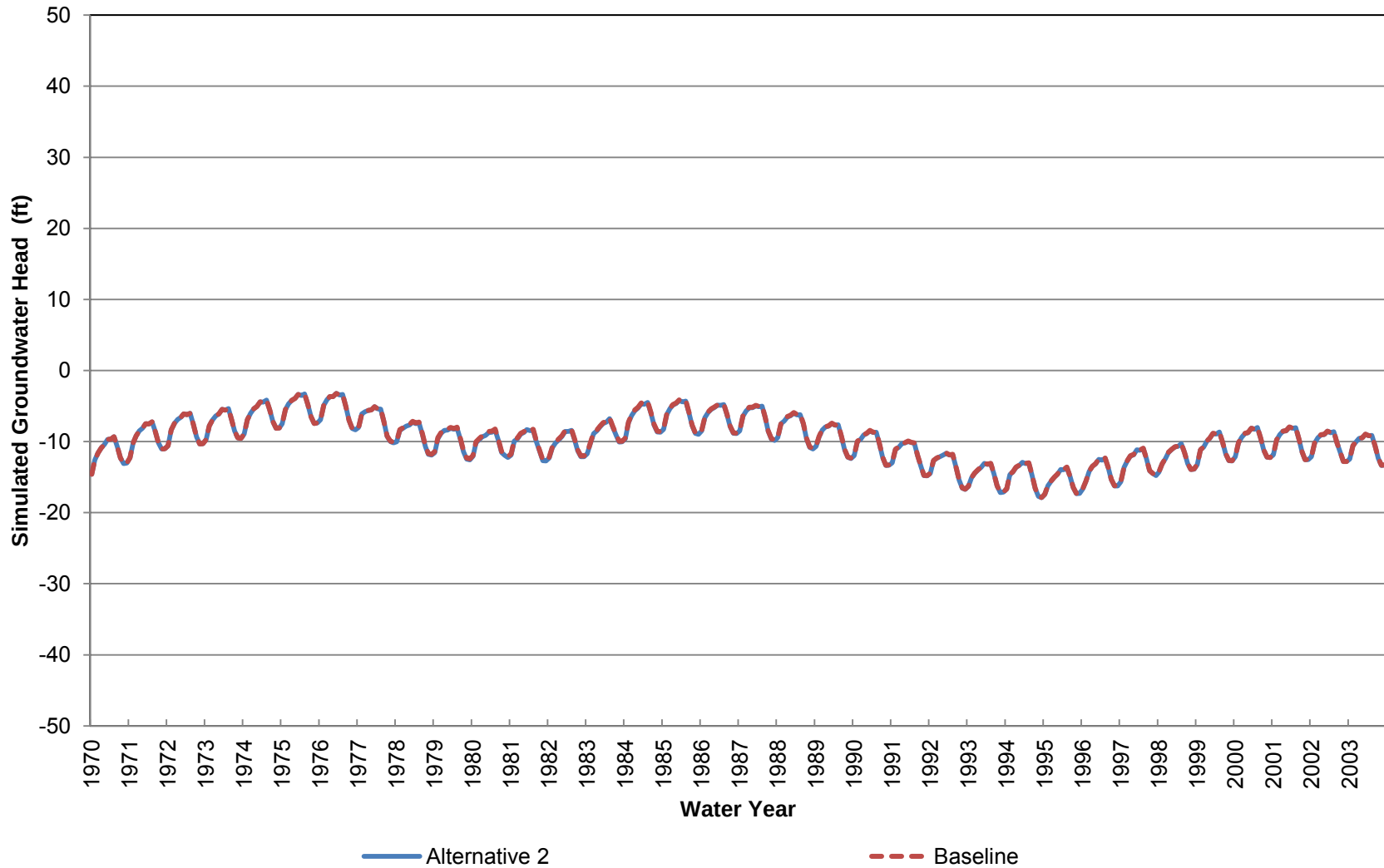
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 70-230 ft bgs)



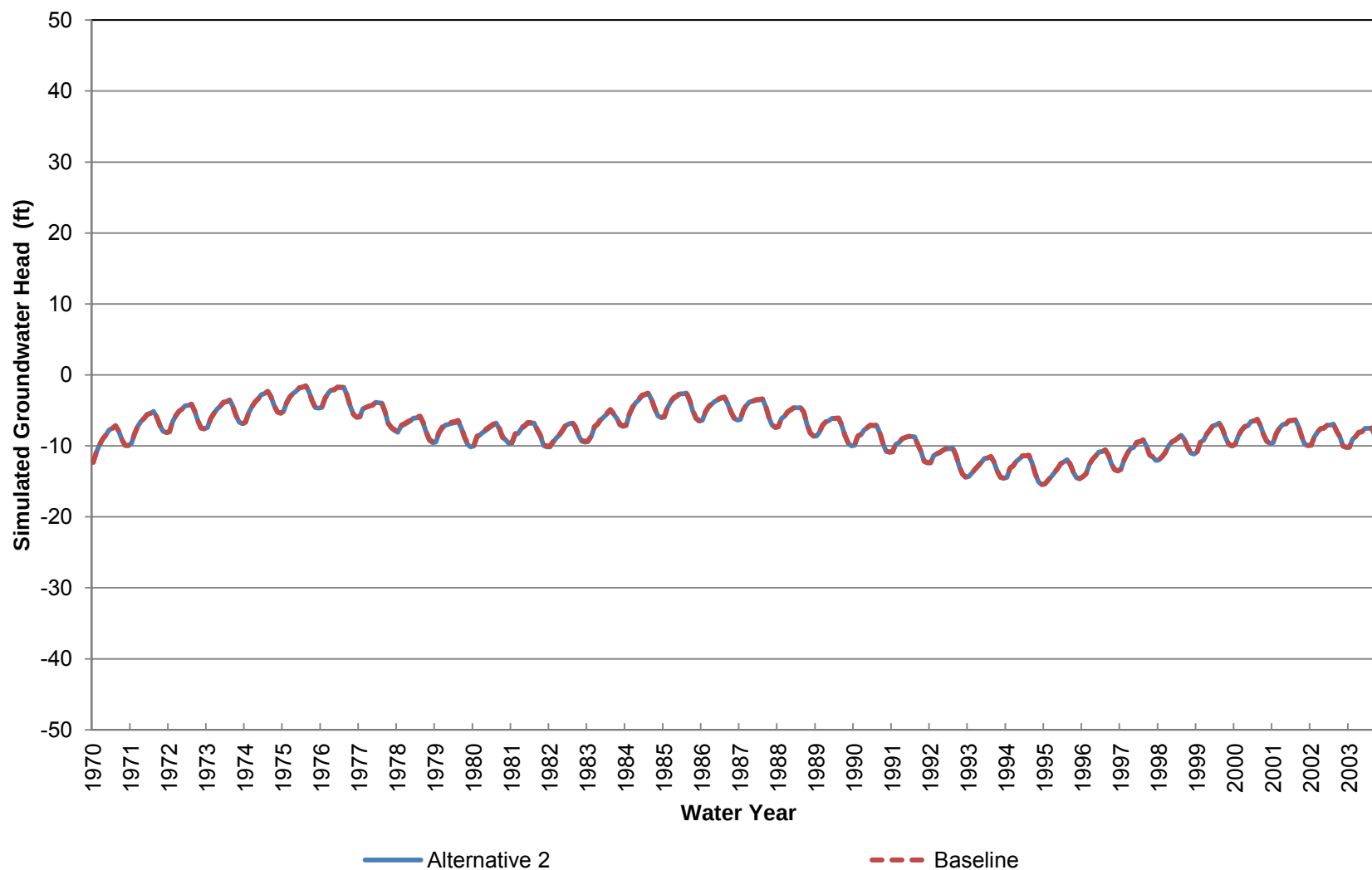
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 230-380 ft bgs)



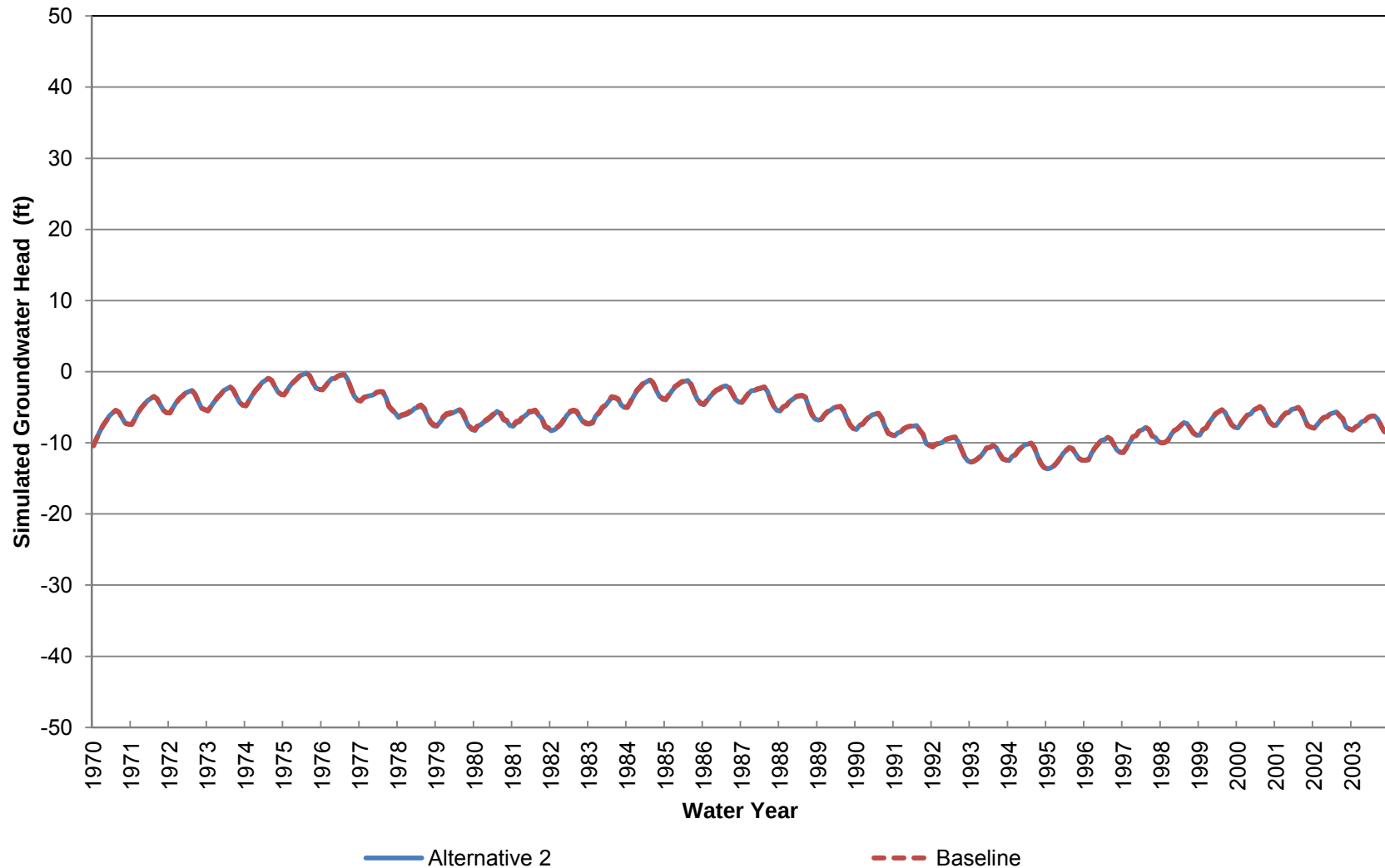
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 380-530 ft bgs)



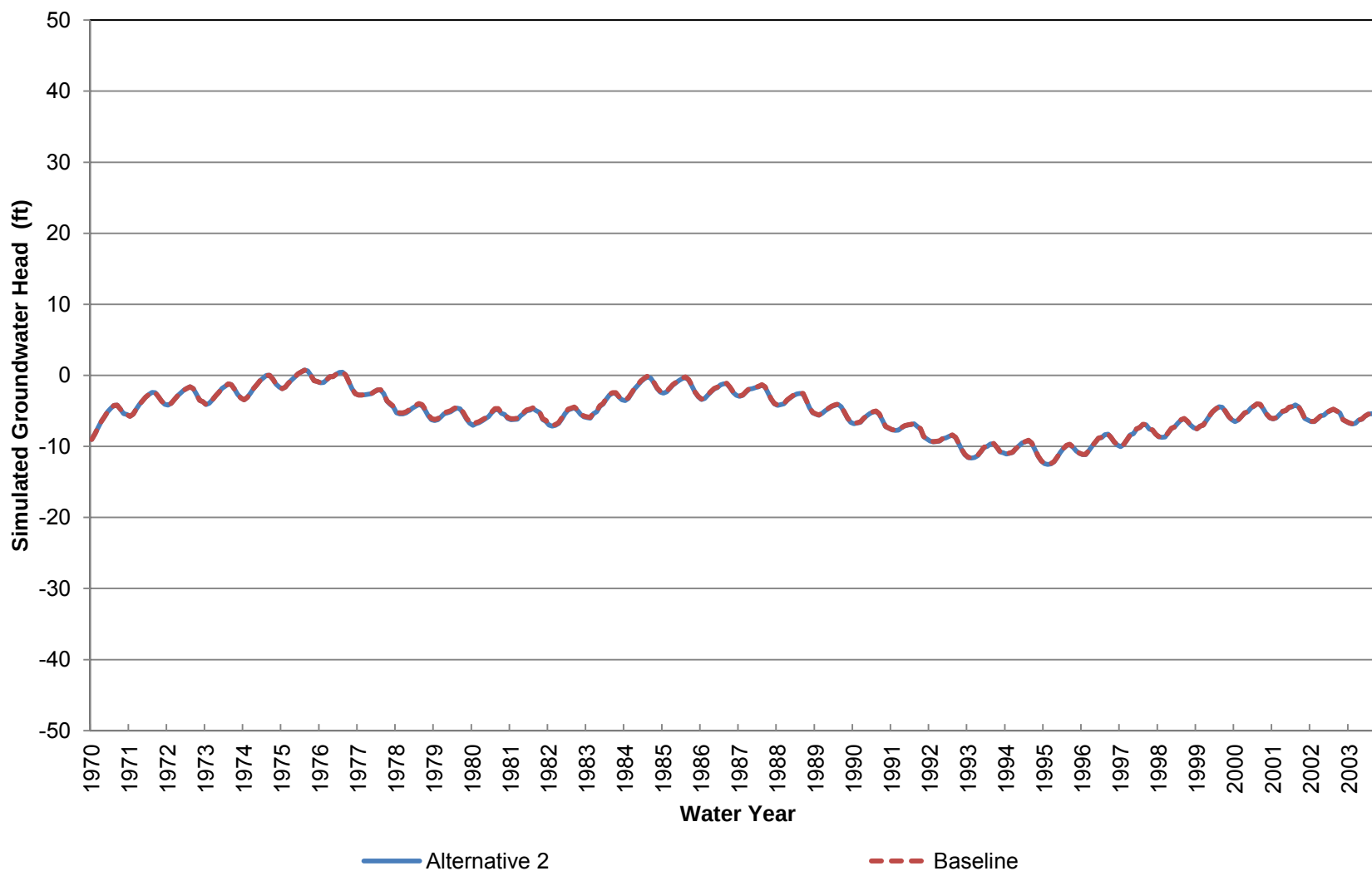
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 530-780 ft bgs)



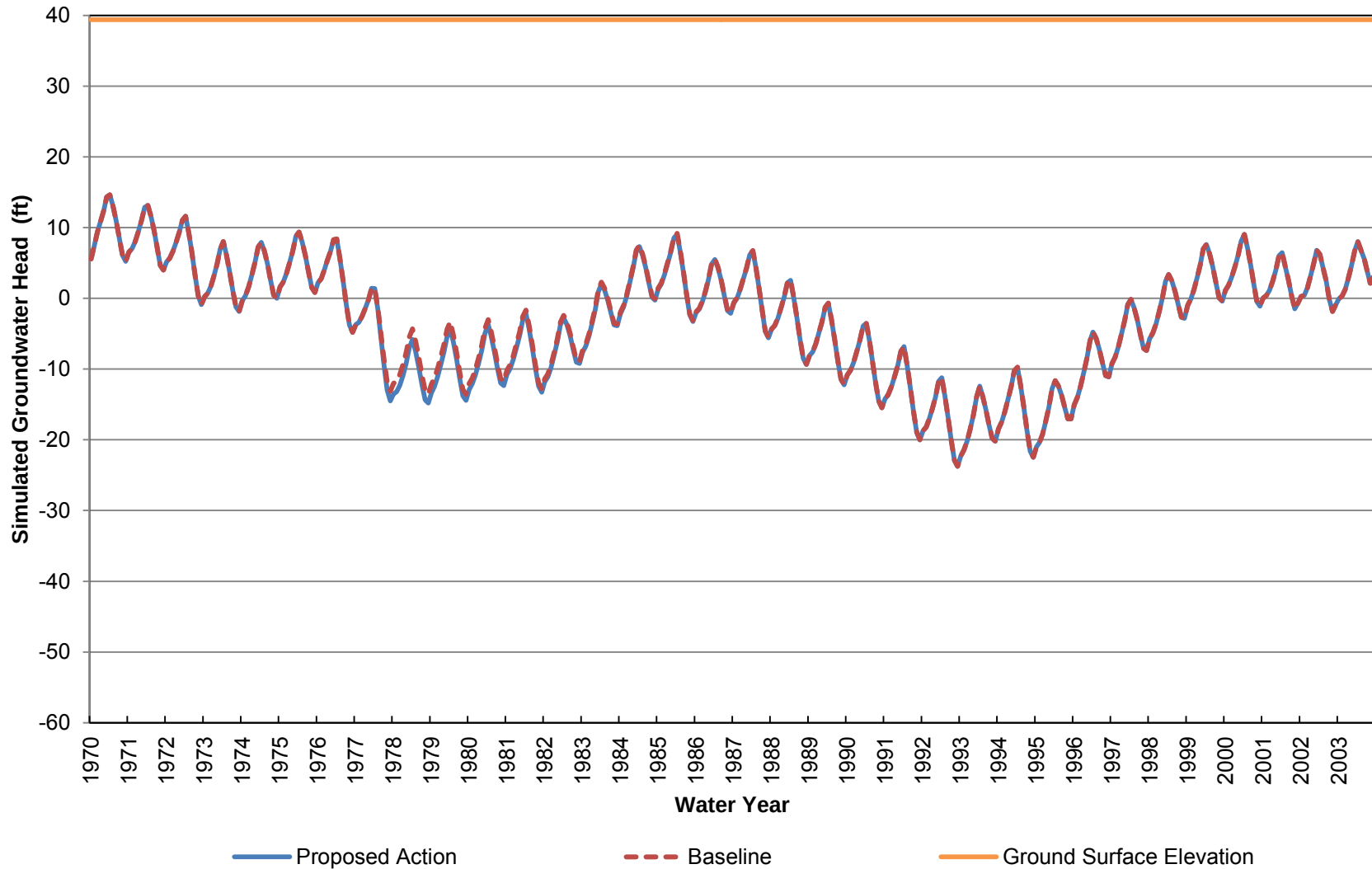
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 780-1030 ft bgs)



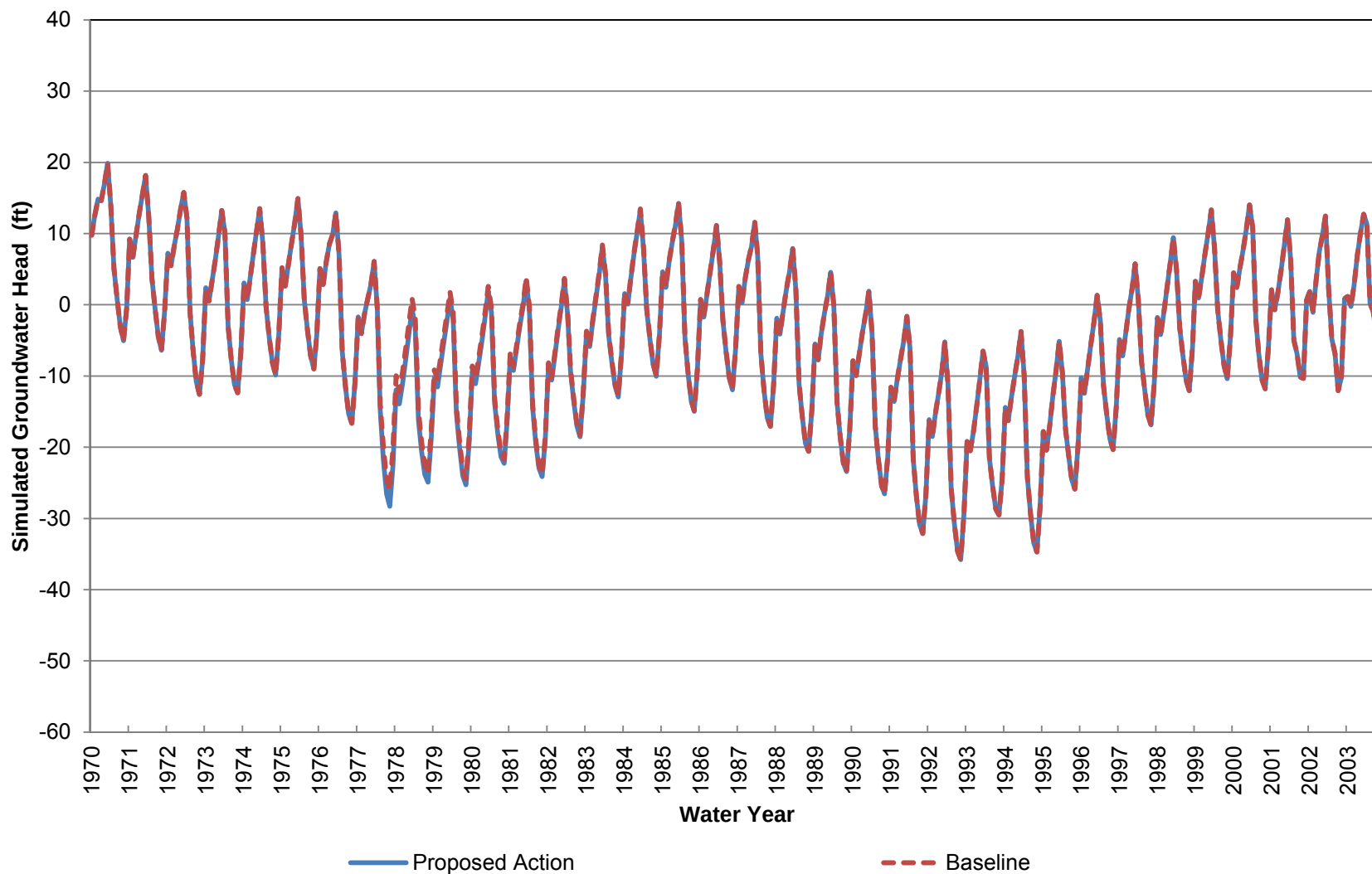
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 1030-1420 ft bgs)



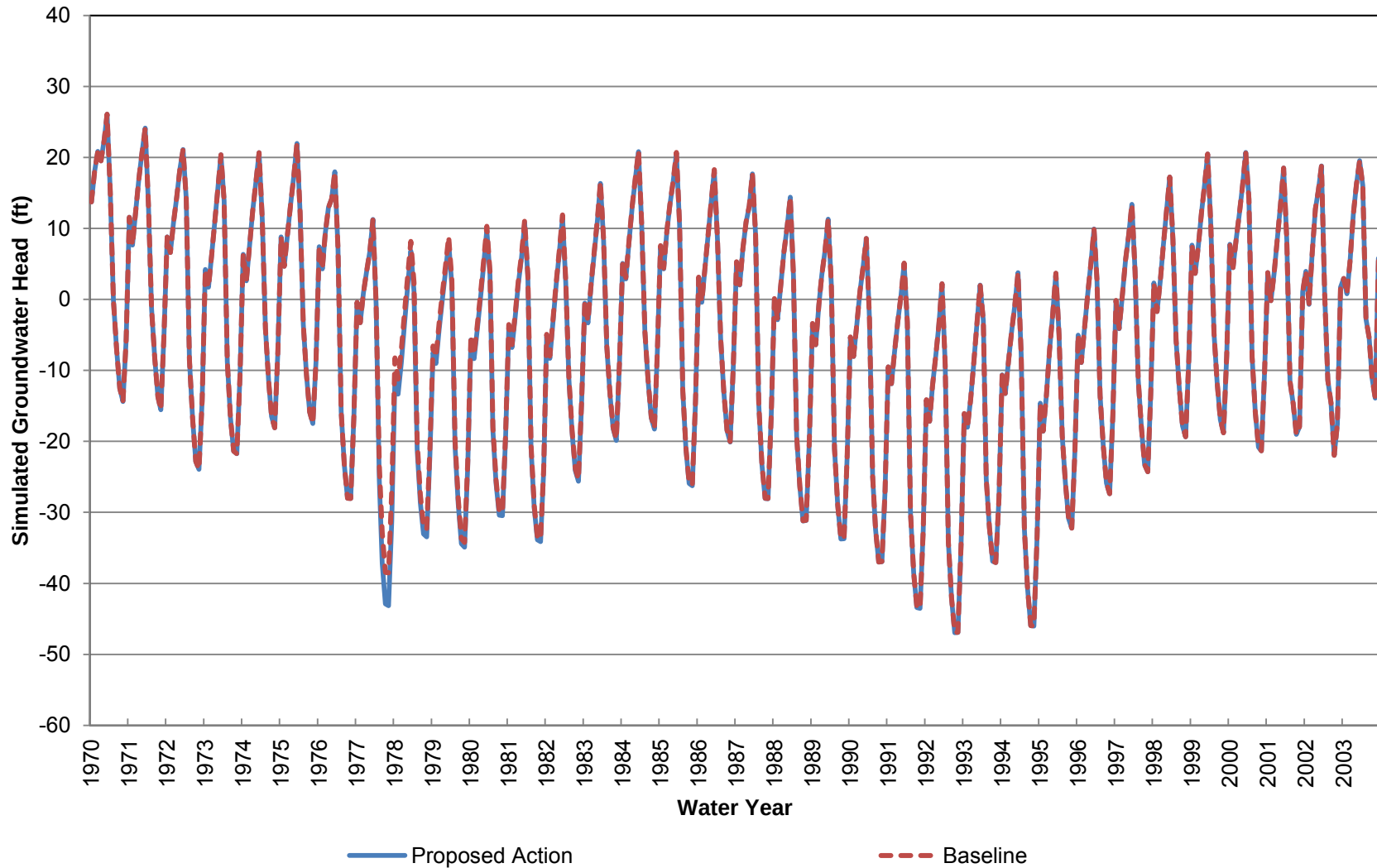
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 21 (Approximately 0-70 ft bgs)



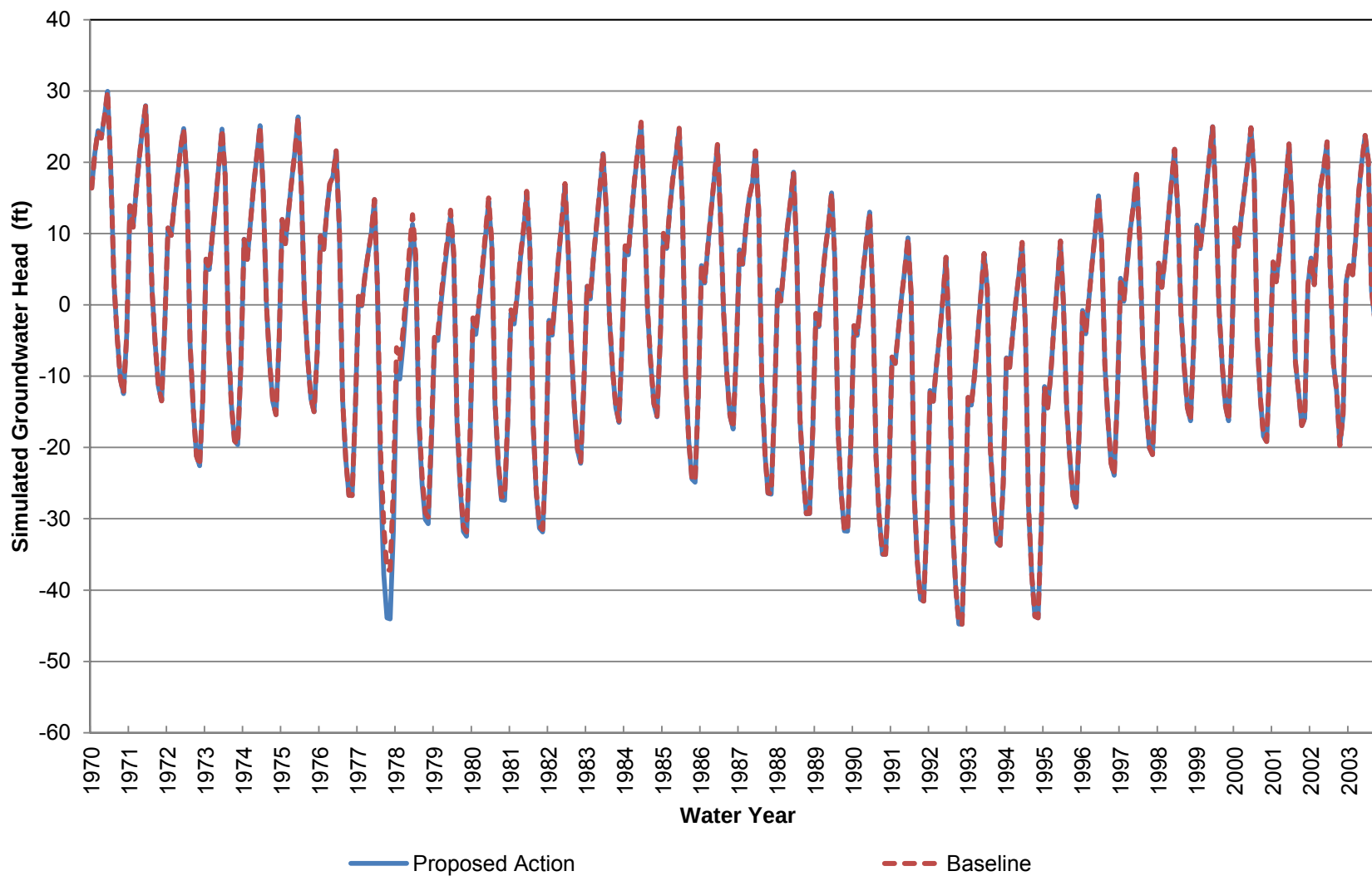
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 70-210 ft bgs)



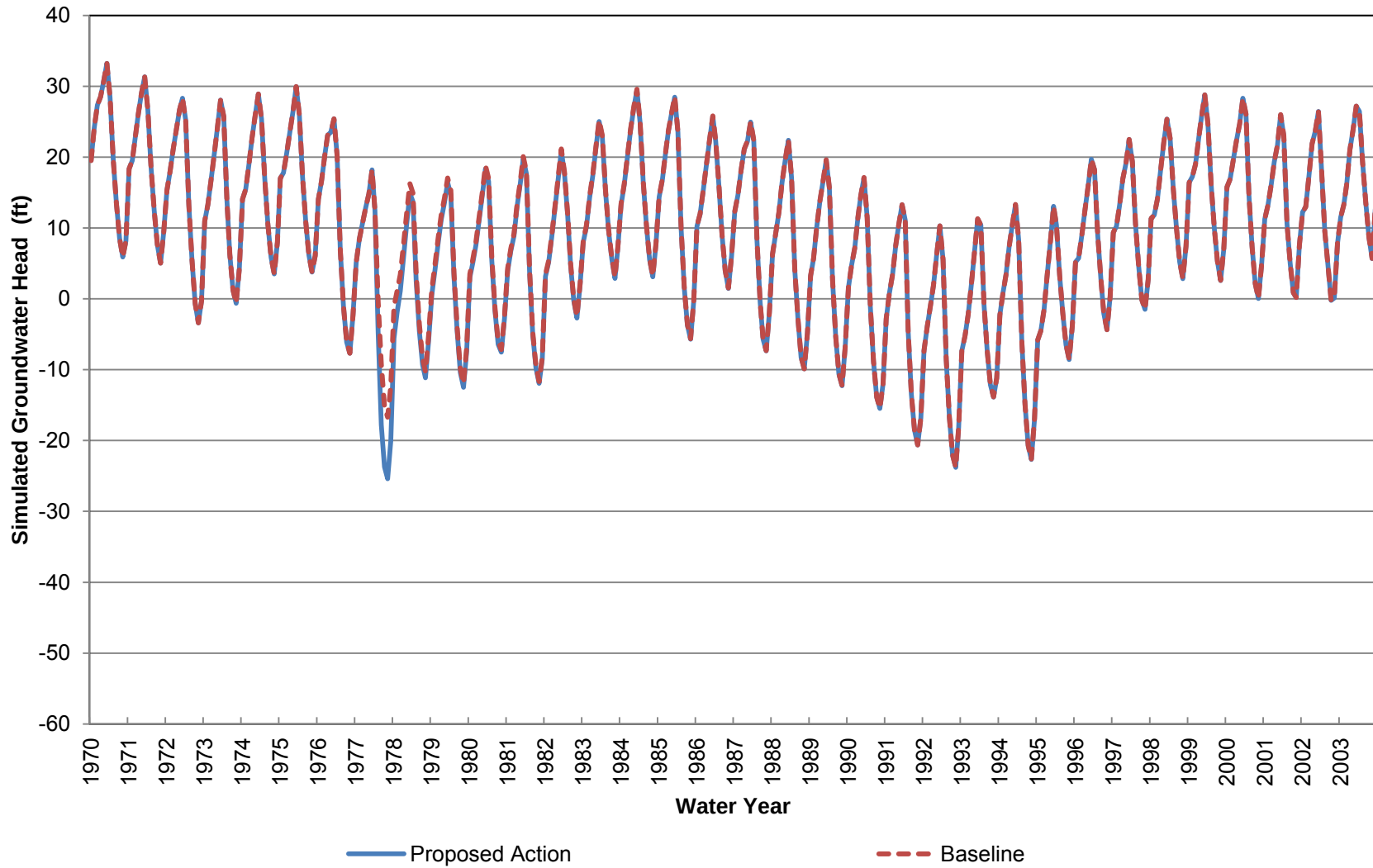
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 210-340 ft bgs)



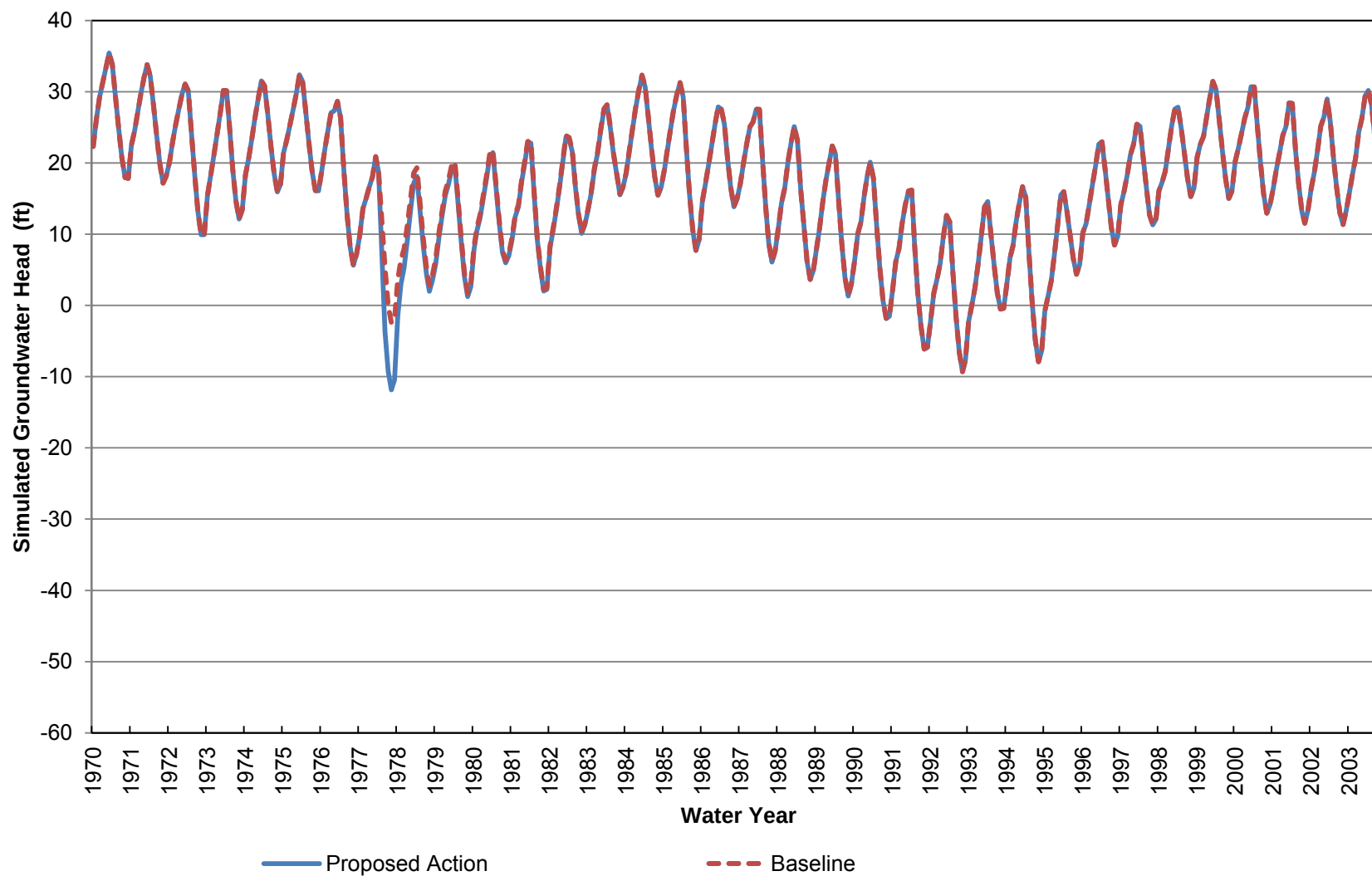
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 340-480 ft bgs)



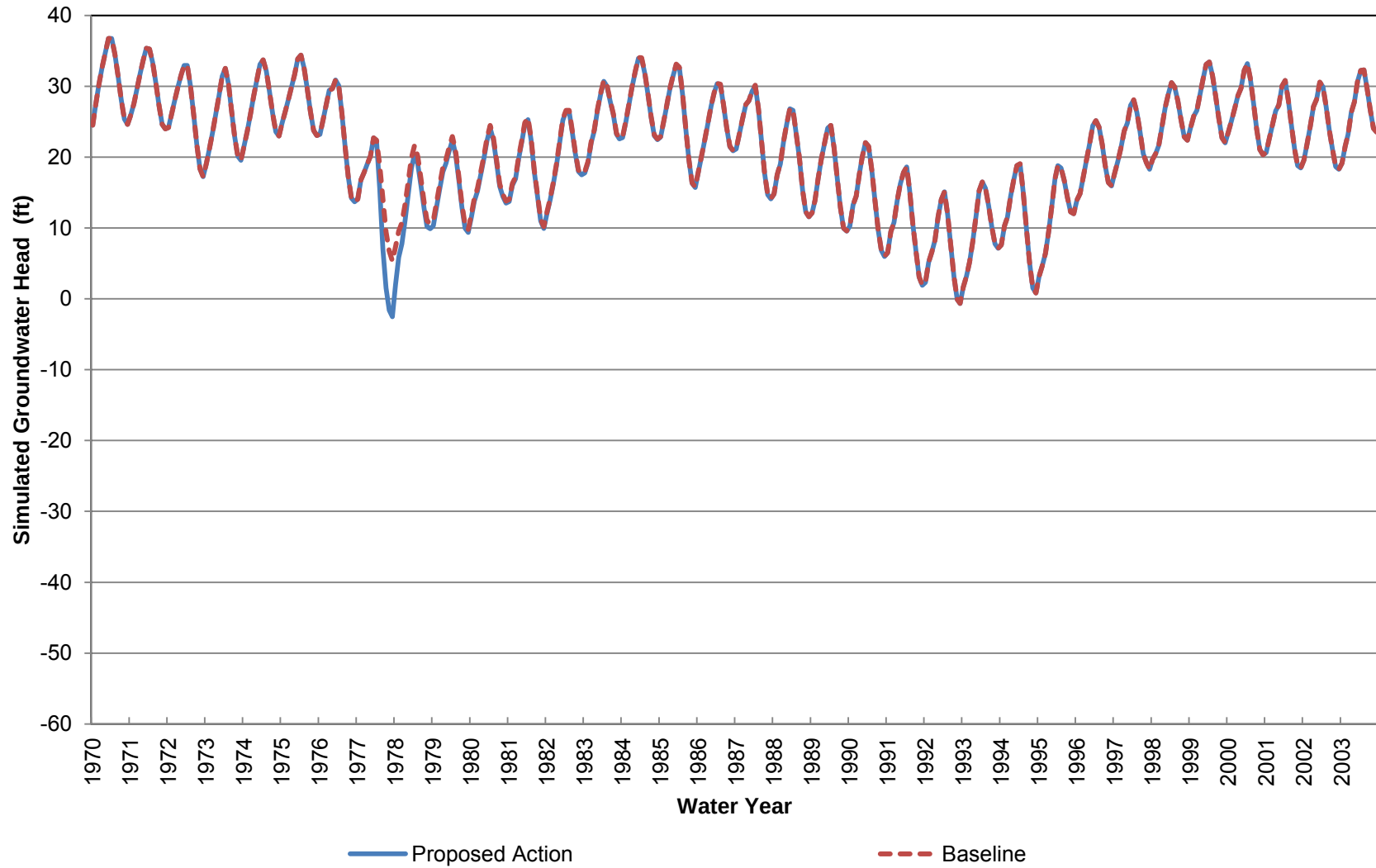
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 480-690 ft bgs)



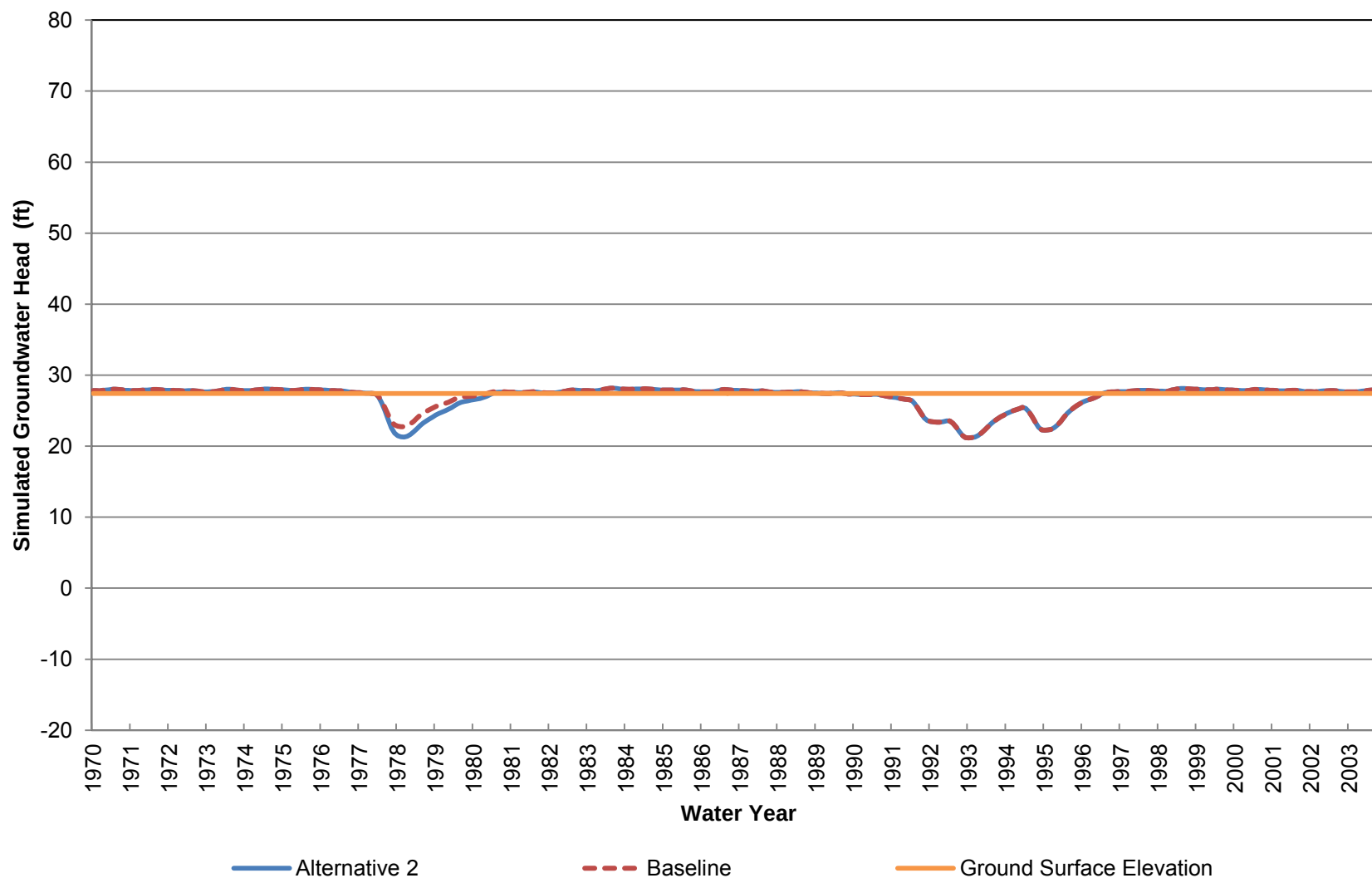
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 690-910 ft bgs)



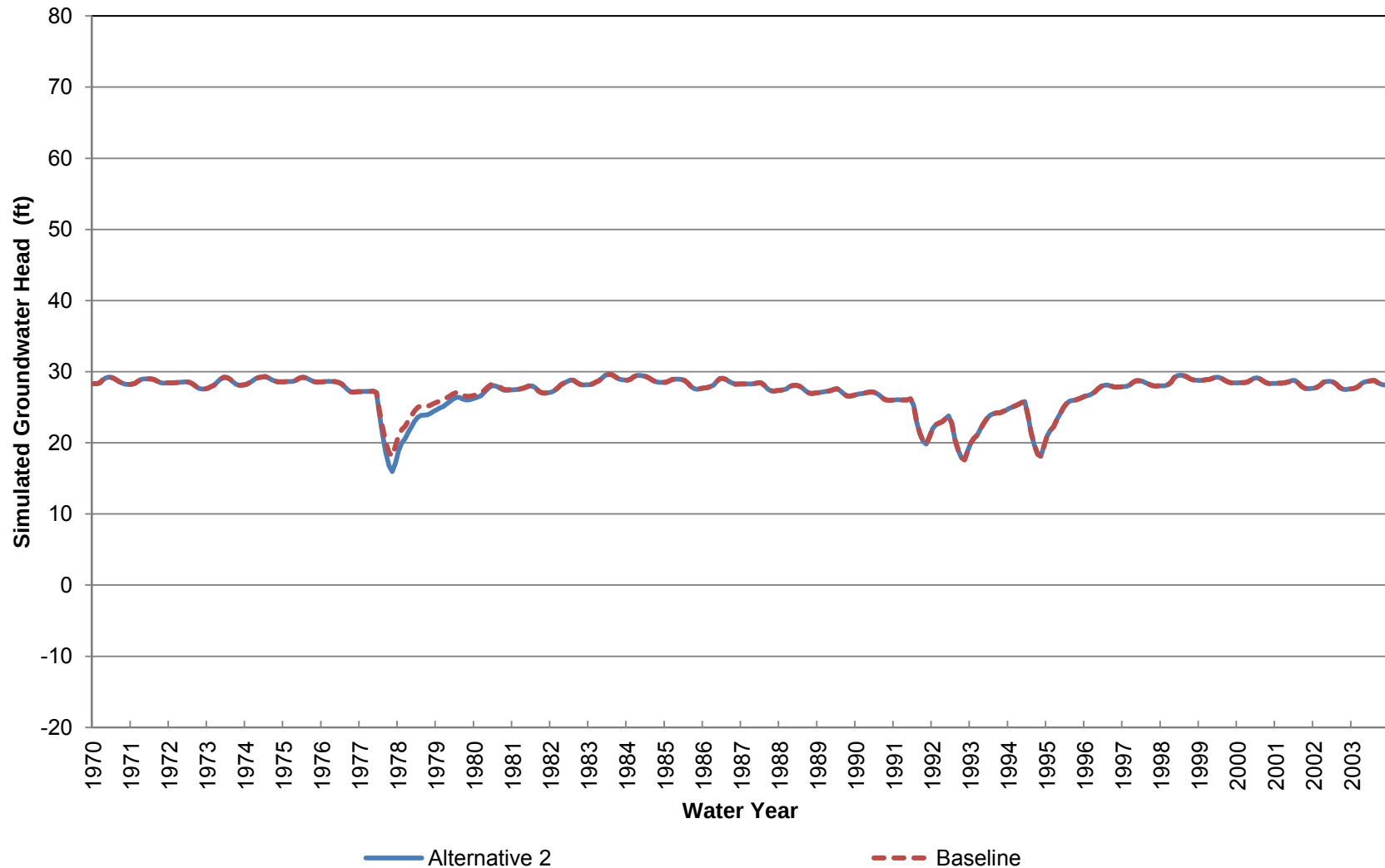
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 910-1250 ft bgs)



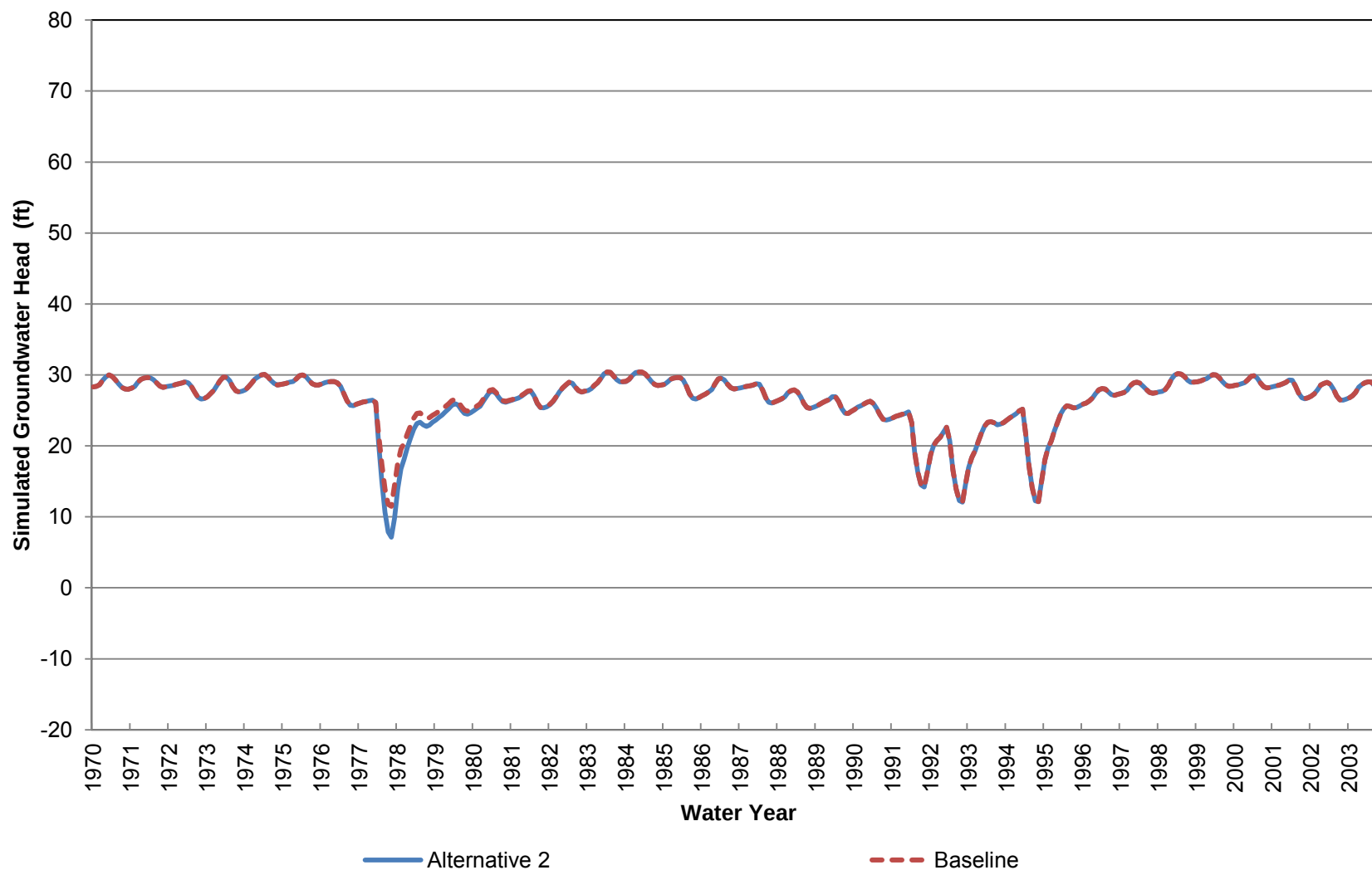
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 22 (Approximately 0-70 ft bgs)



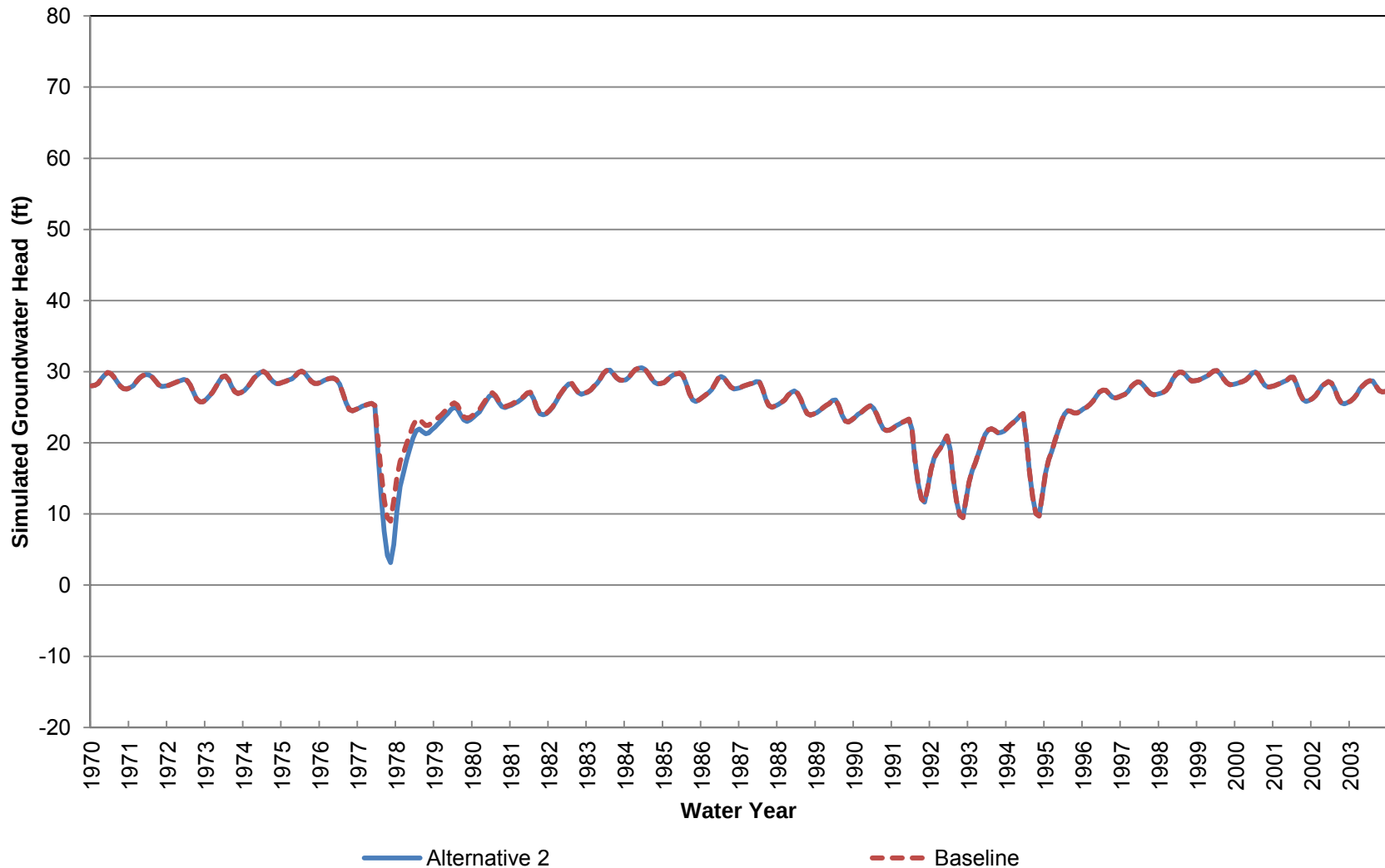
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 70-230 ft bgs)



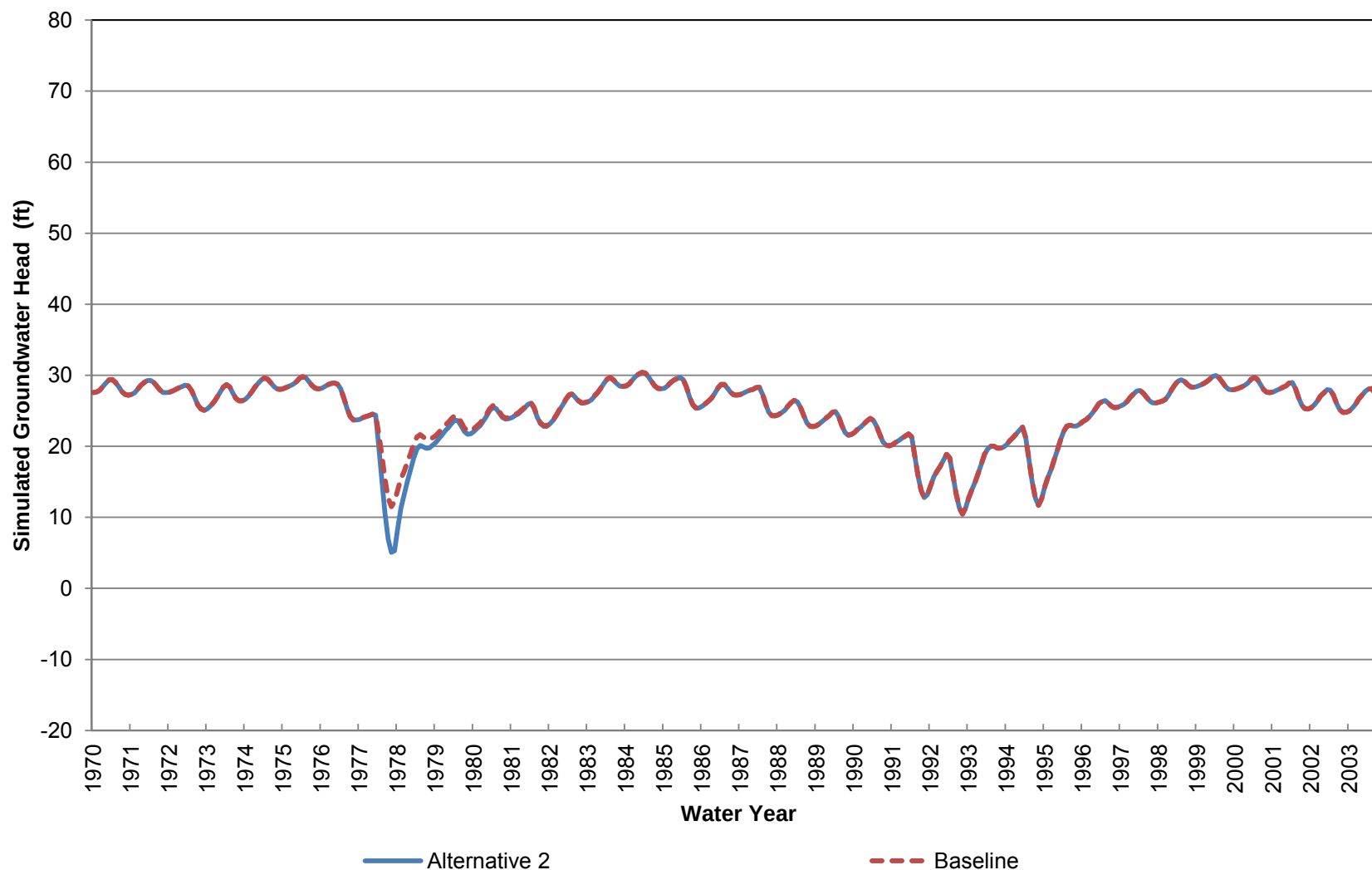
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 230-390 ft bgs)



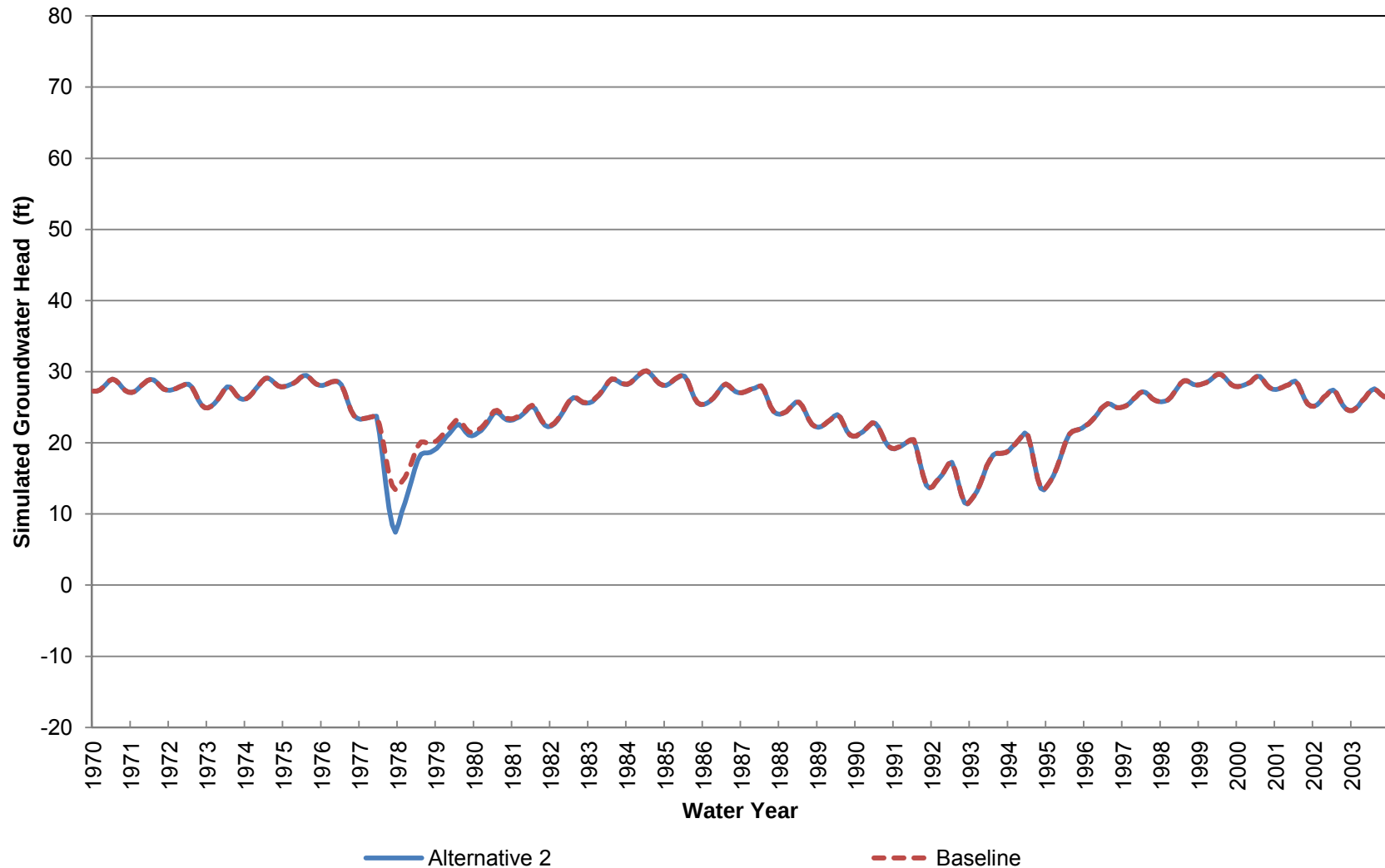
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 390-550 ft bgs)



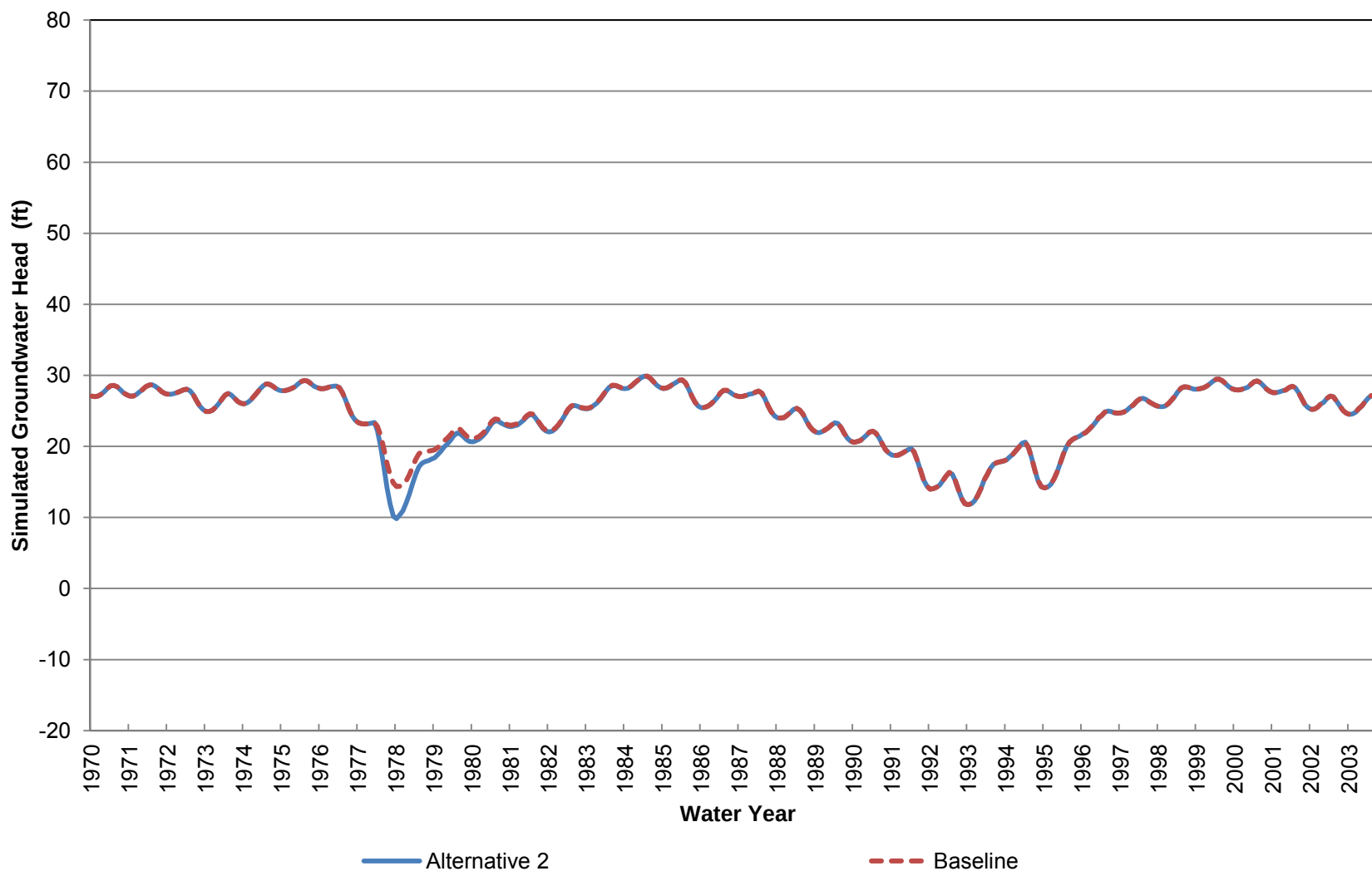
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 550-810 ft bgs)



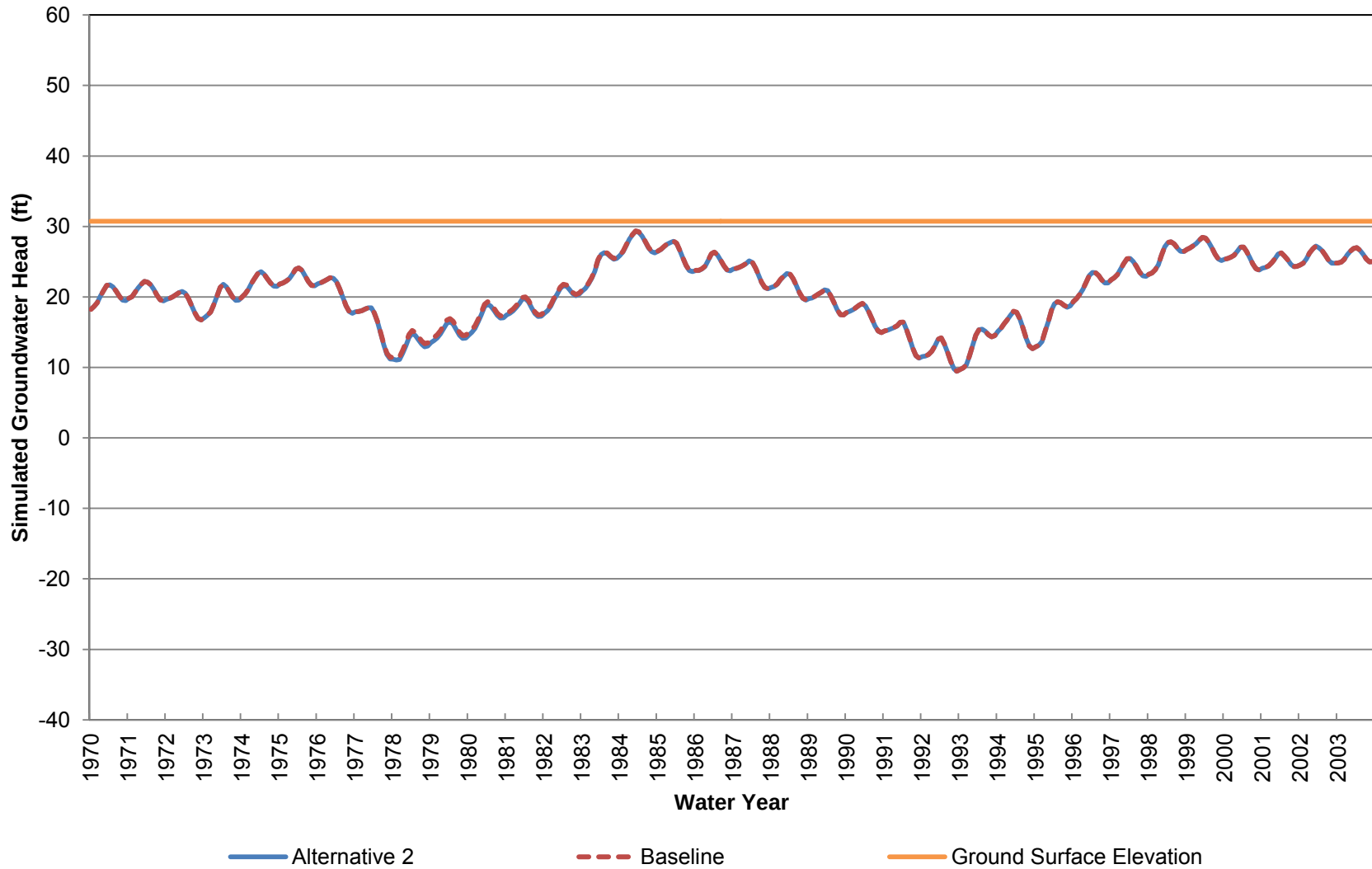
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 810-1080 ft bgs)



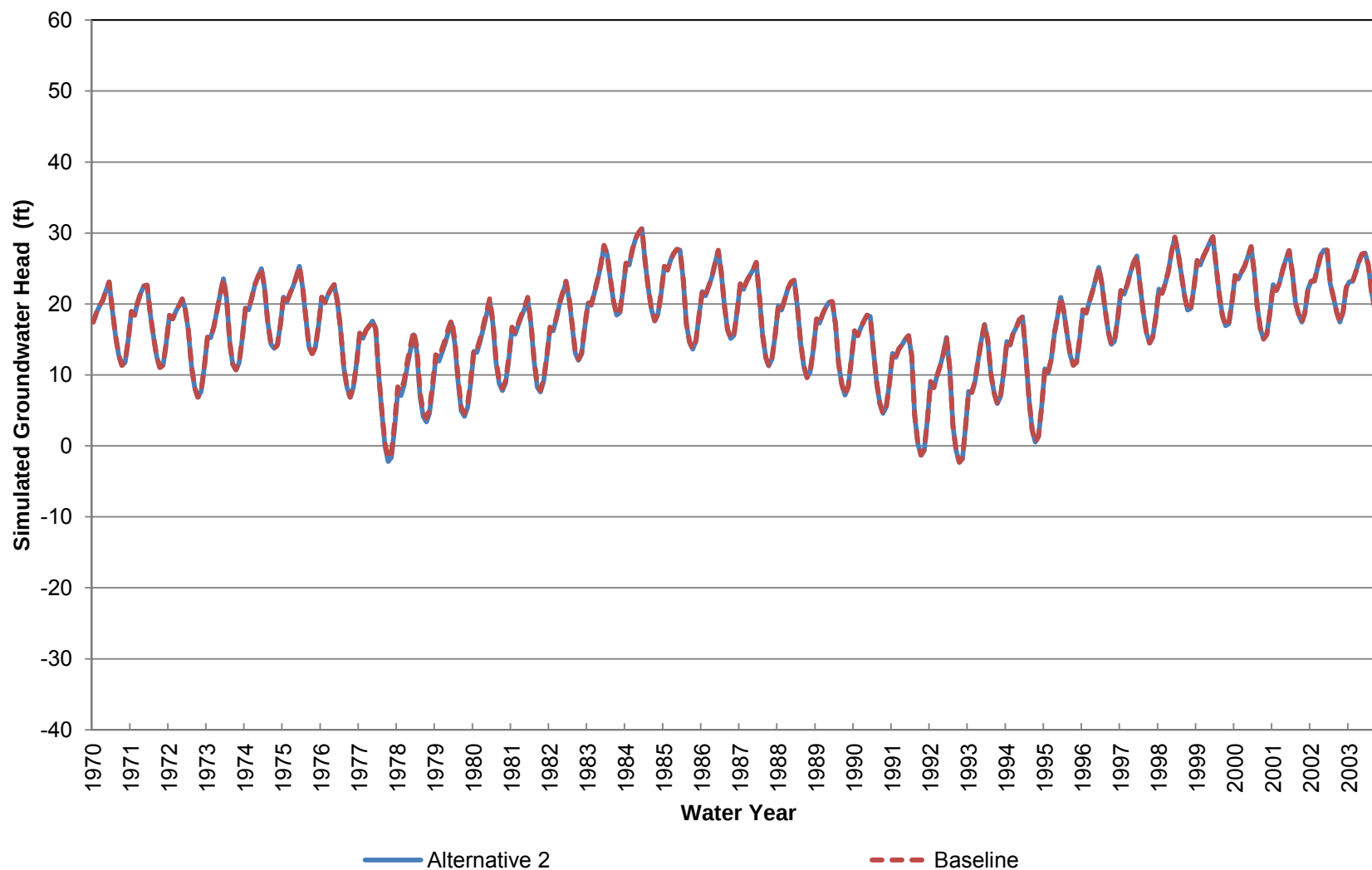
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 1080-1480 ft bgs)



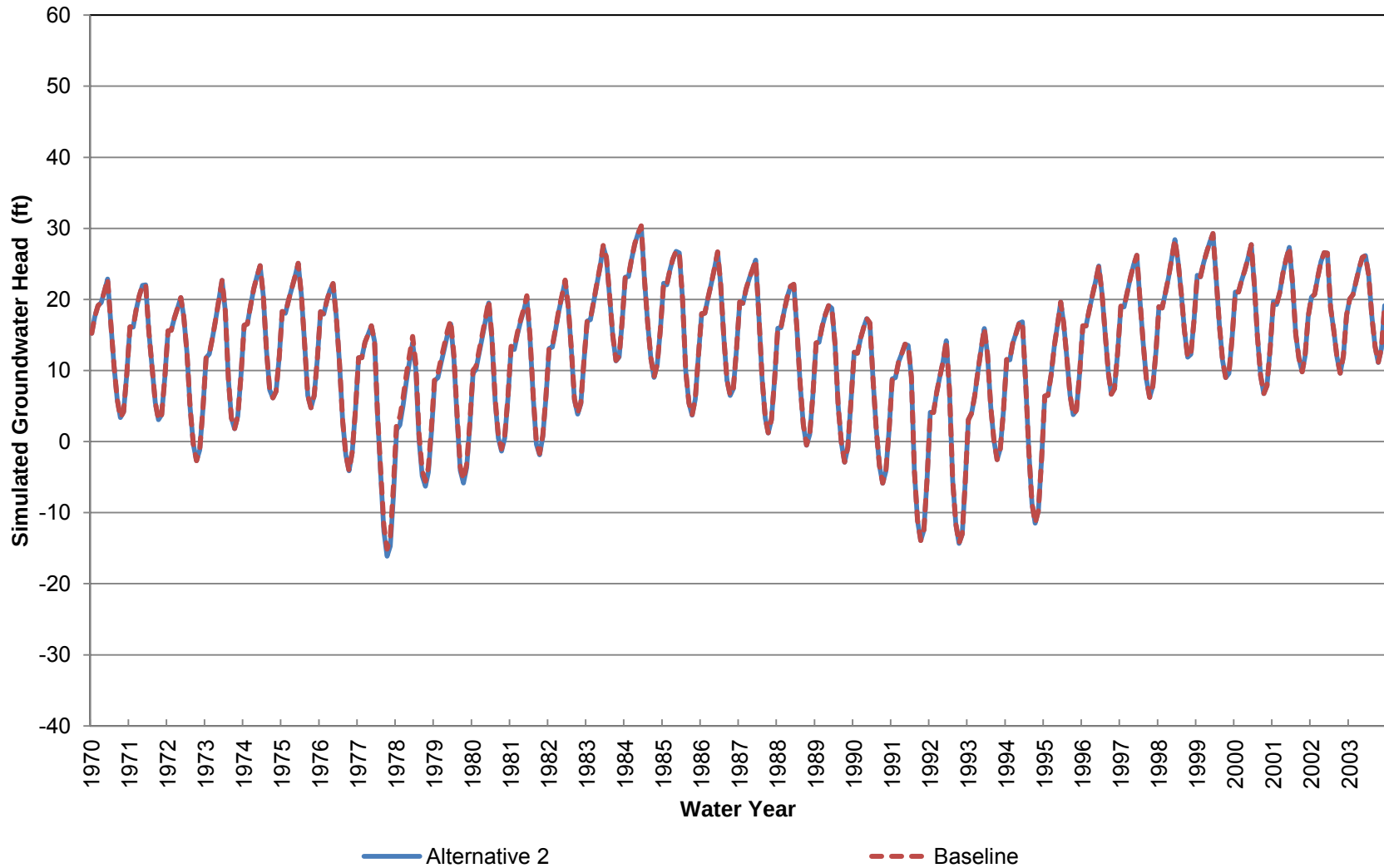
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 23 (Approximately 0-70 ft bgs)



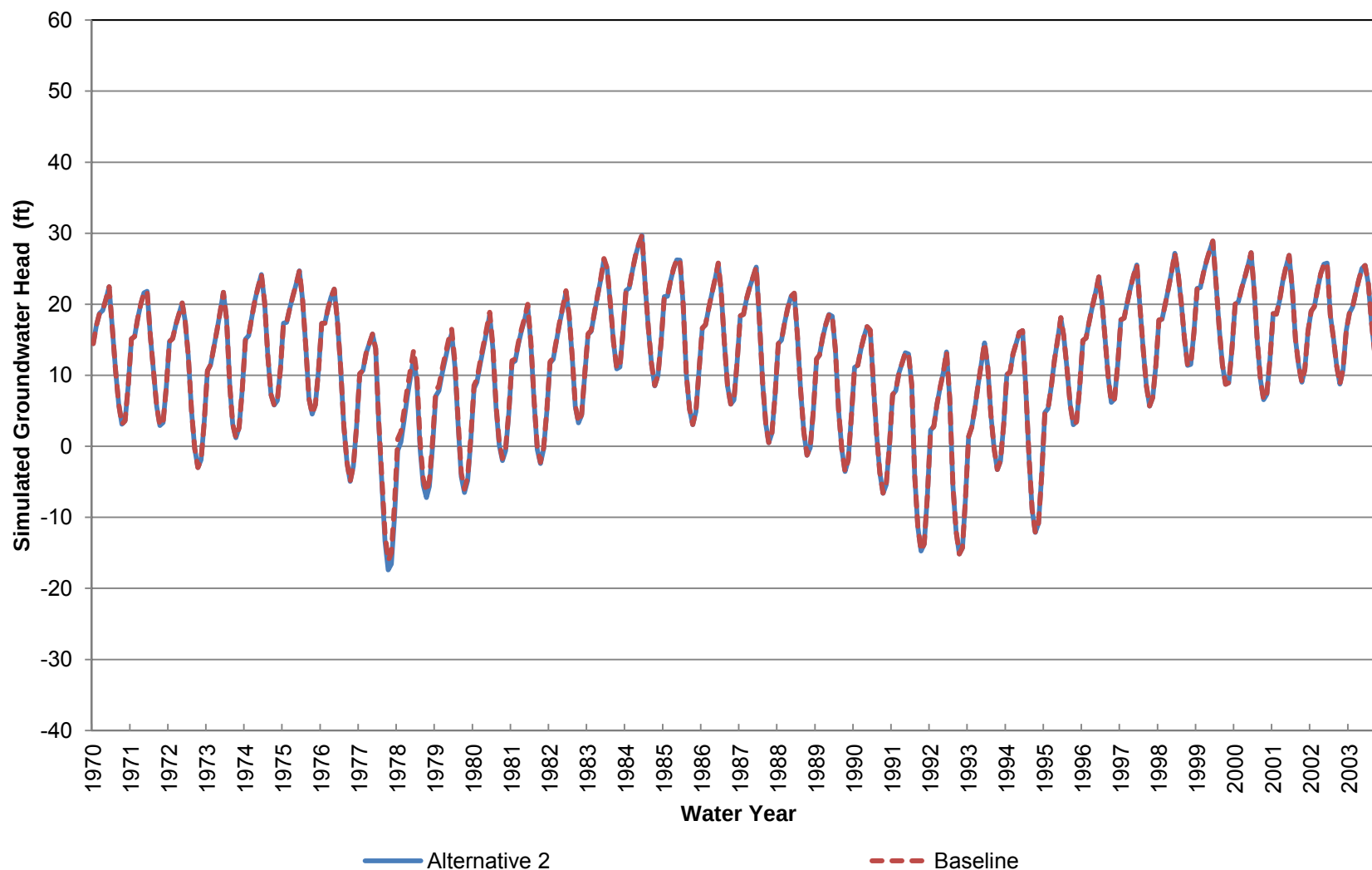
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 70-290 ft bgs)



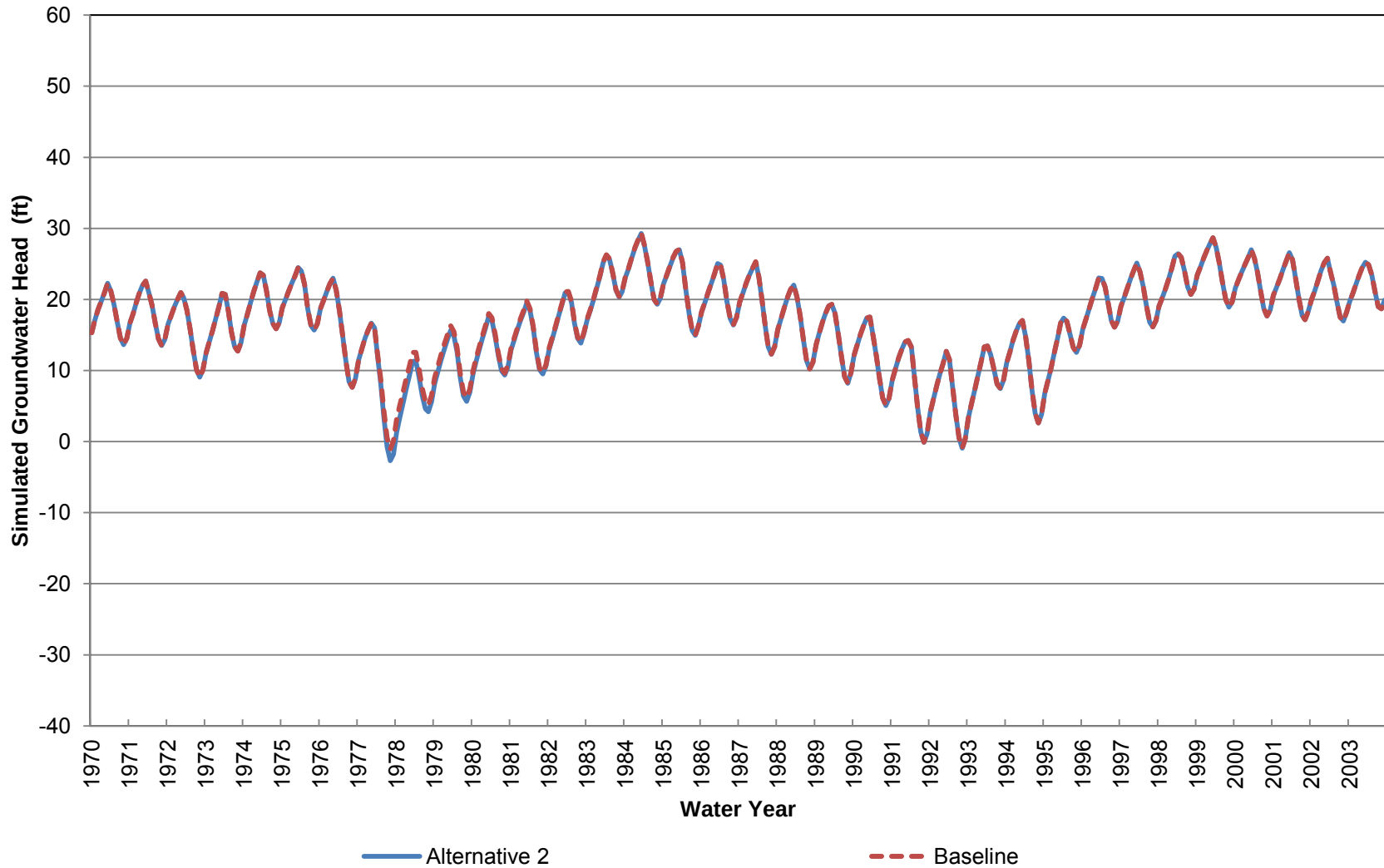
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 290-520 ft bgs)



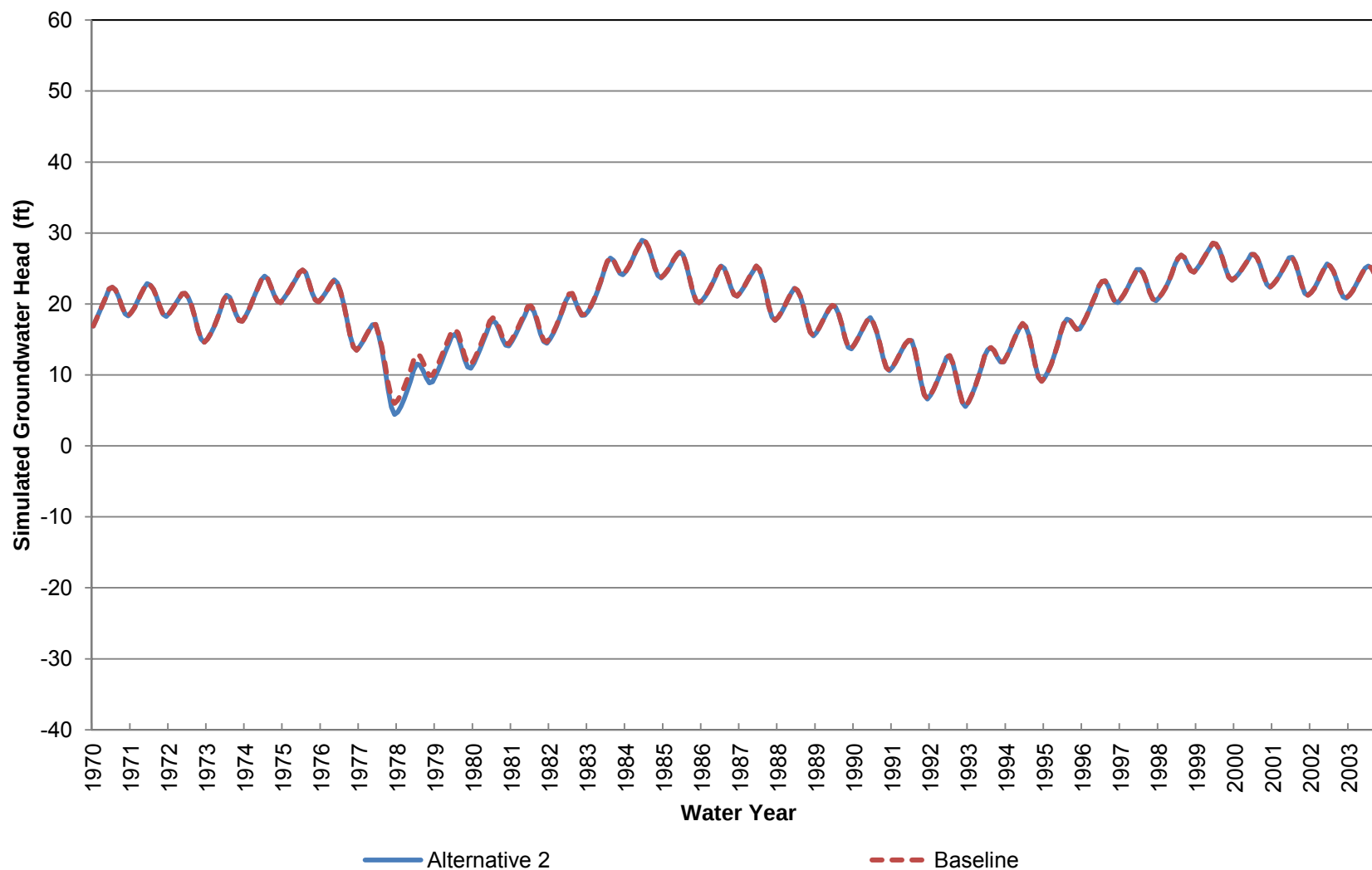
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 520-740 ft bgs)



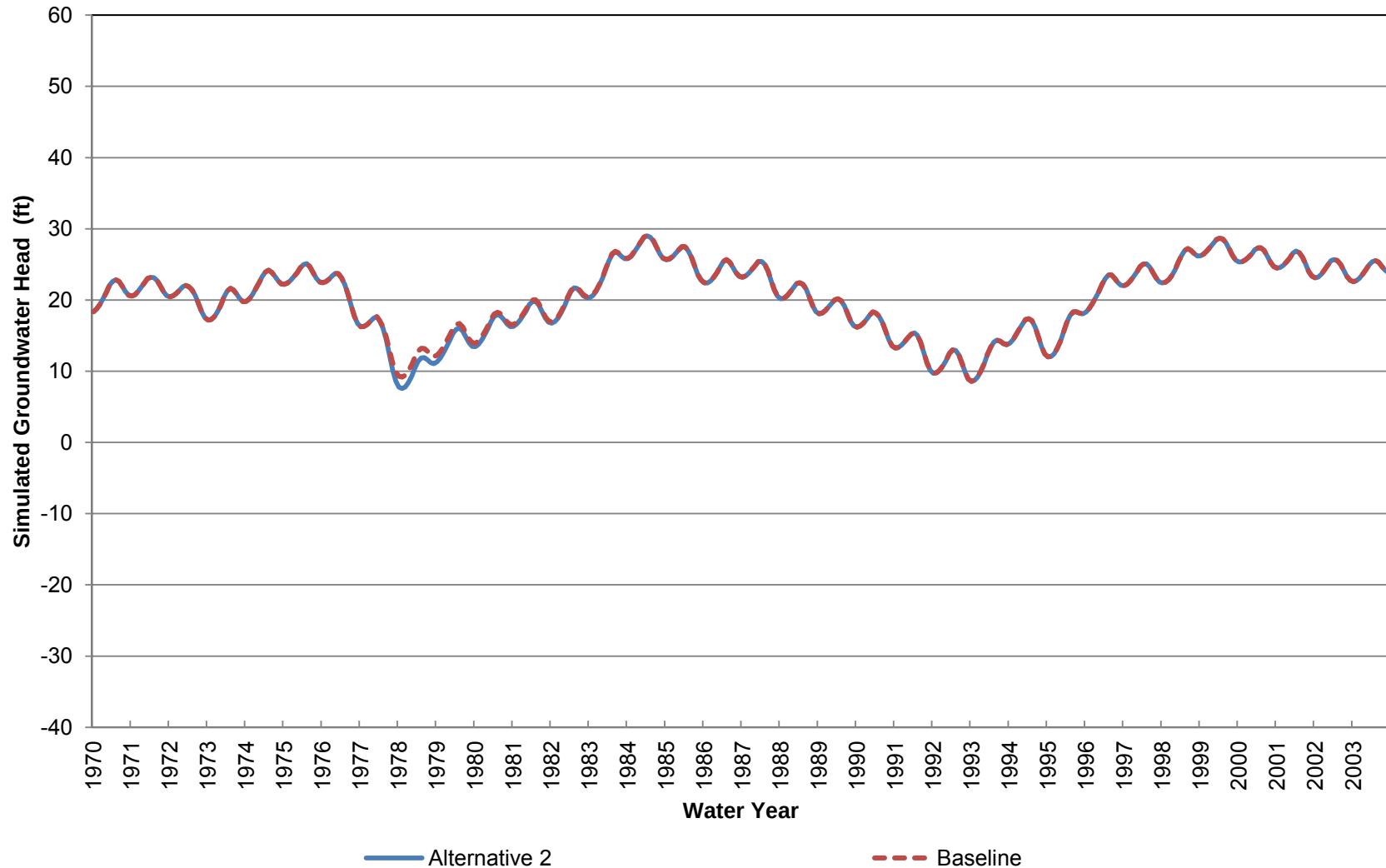
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 740-1120 ft bgs)



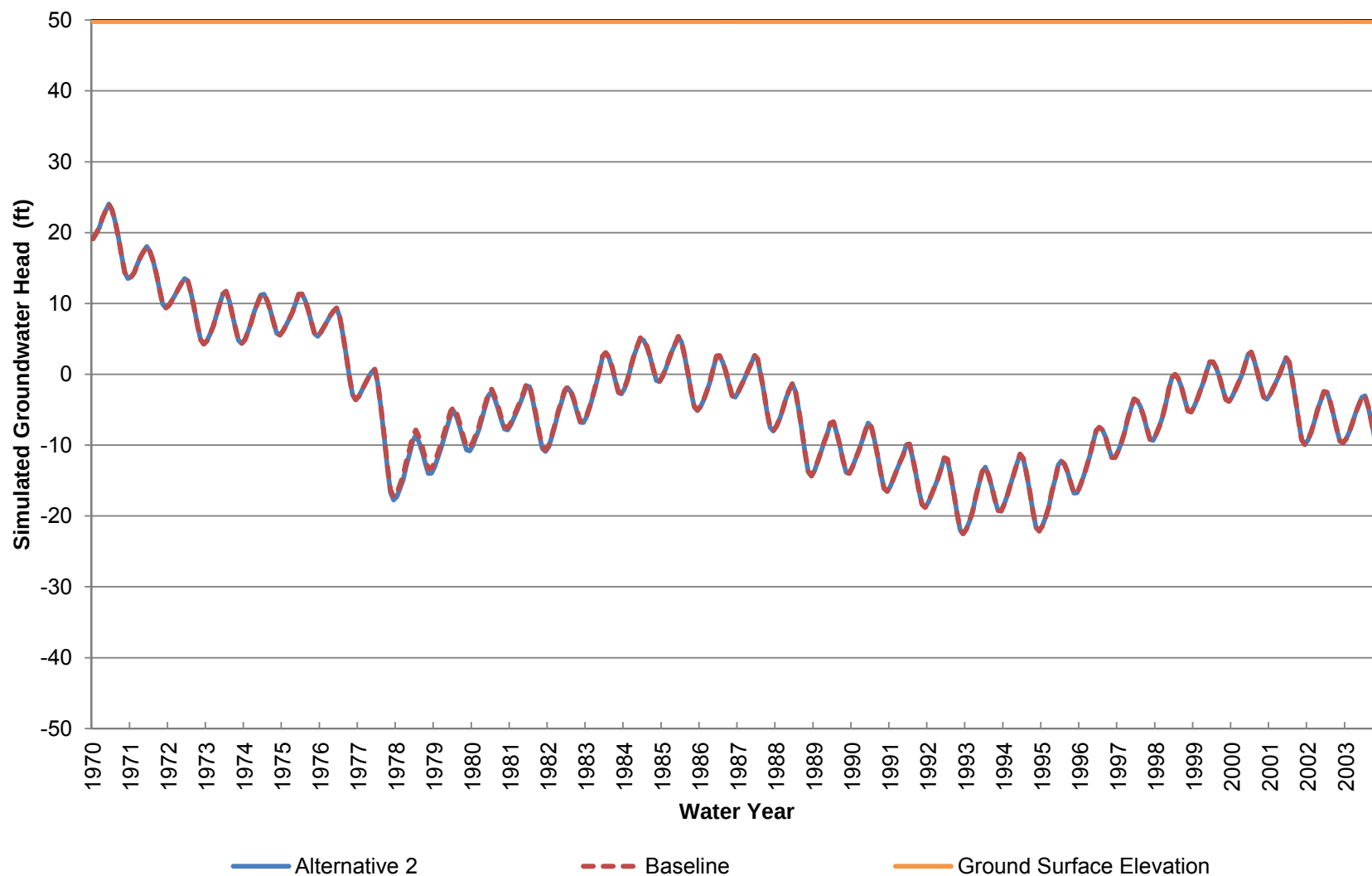
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 1120-1500 ft bgs)



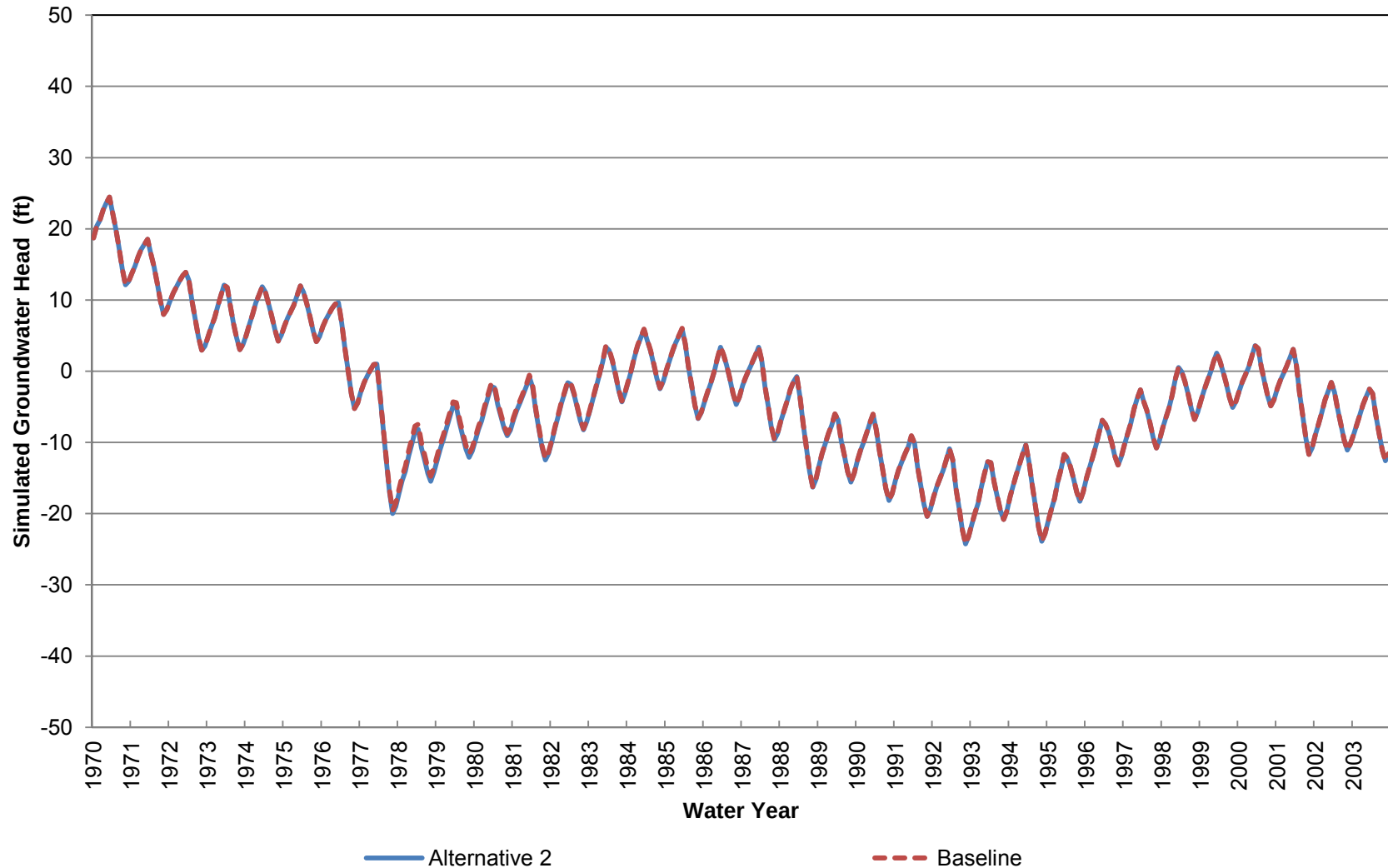
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 1500-2050 ft bgs)



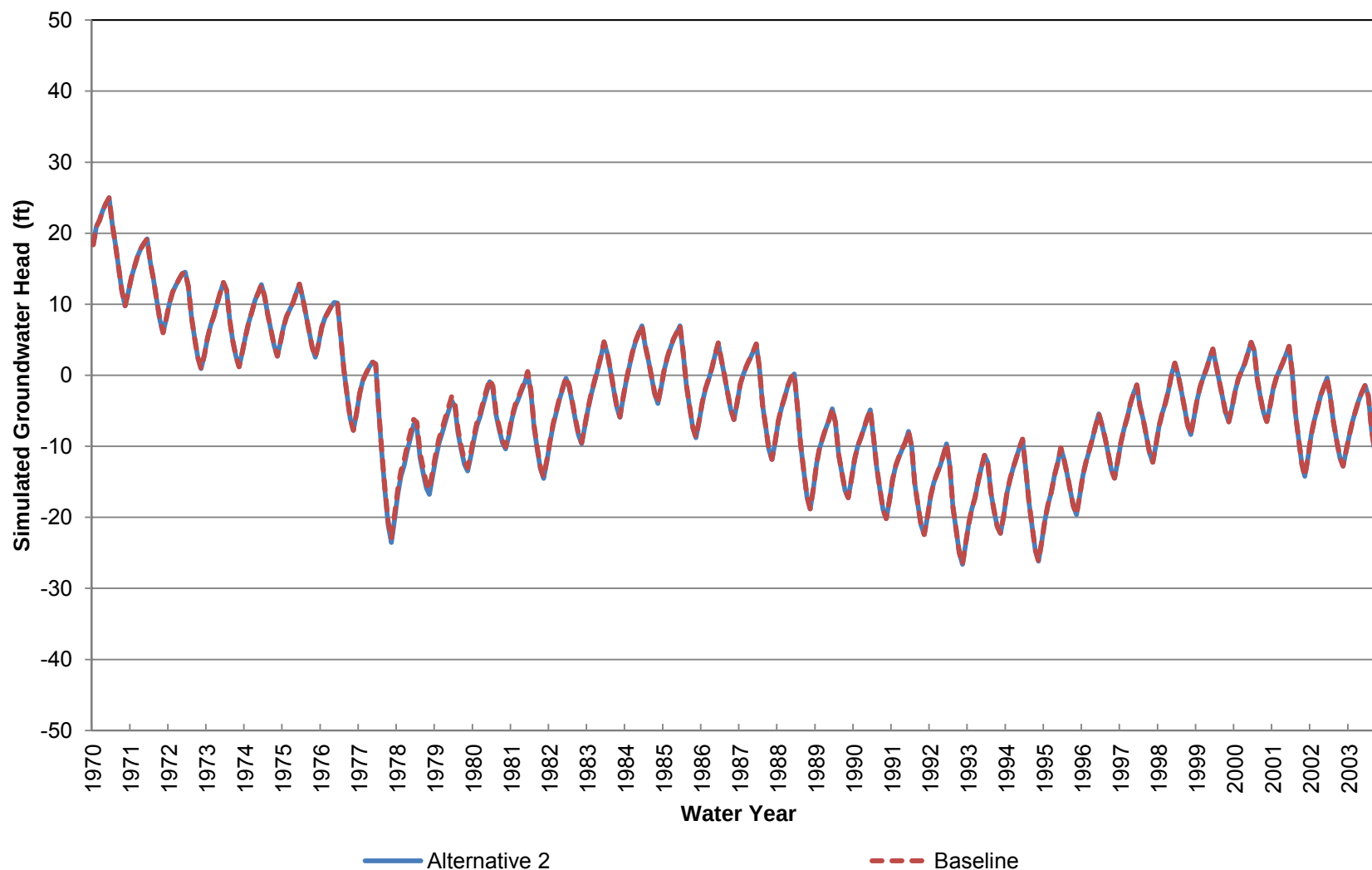
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 24 (Approximately 0-60 ft bgs)



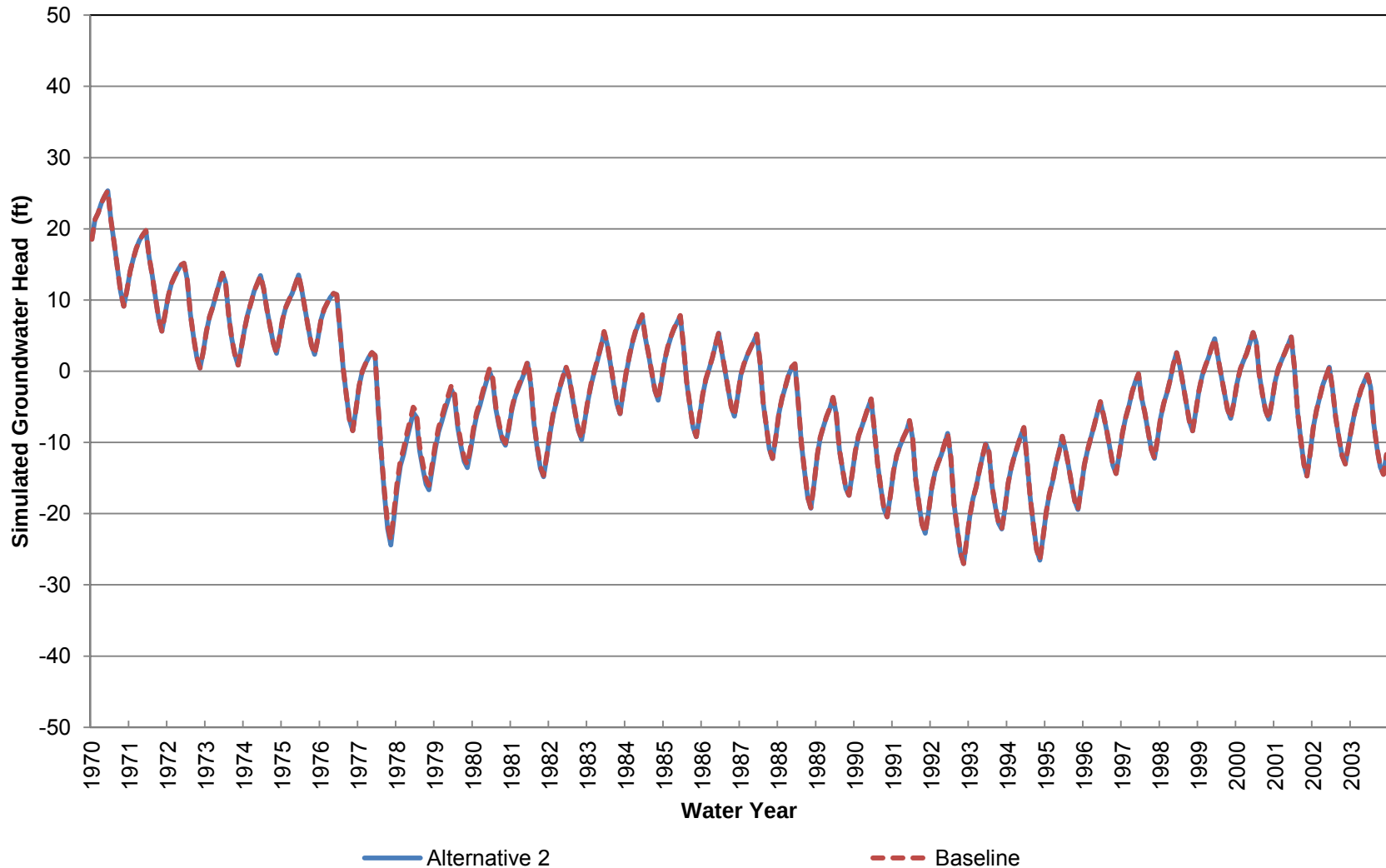
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 60-140 ft bgs)



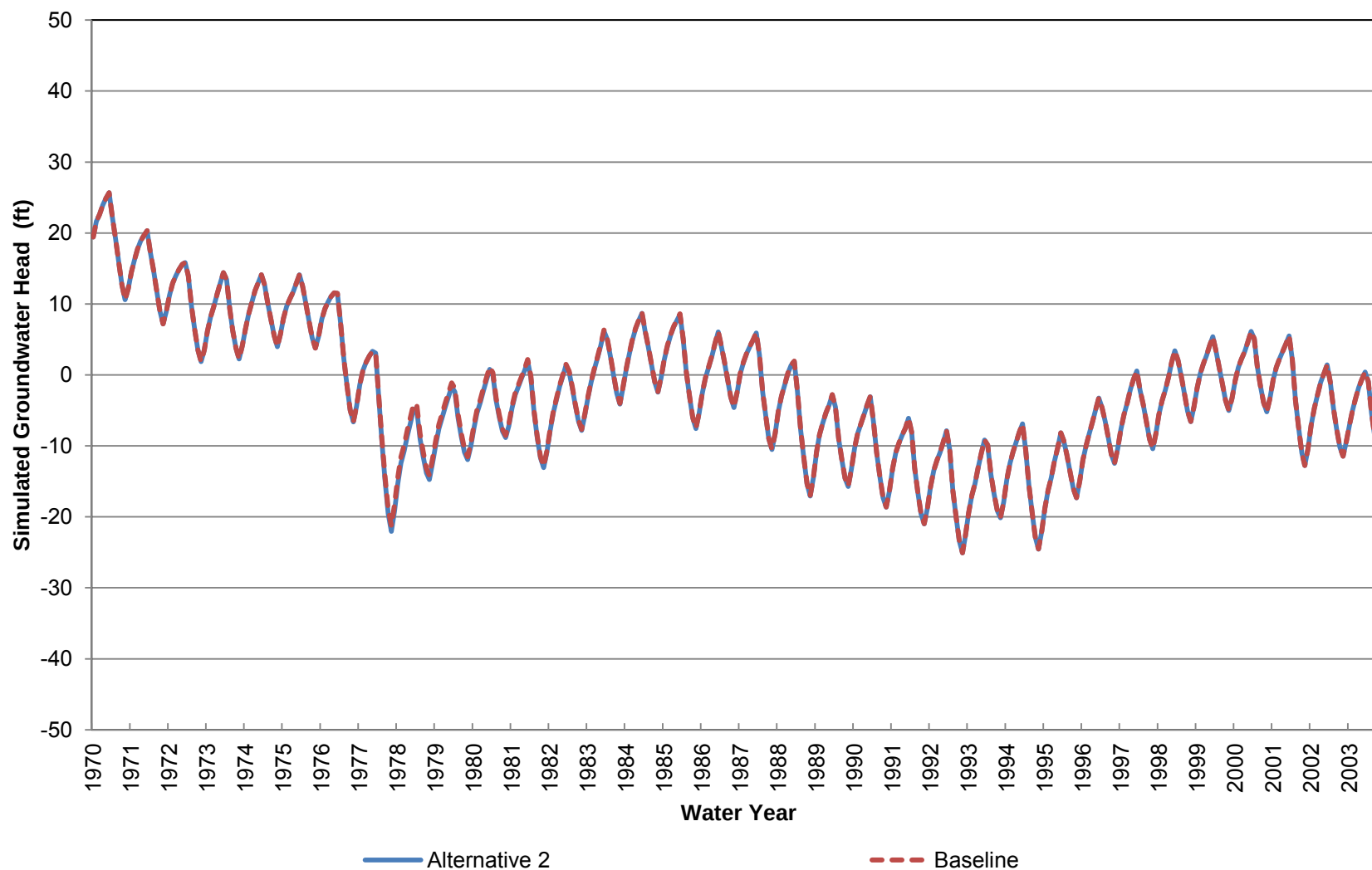
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 140-220 ft bgs)



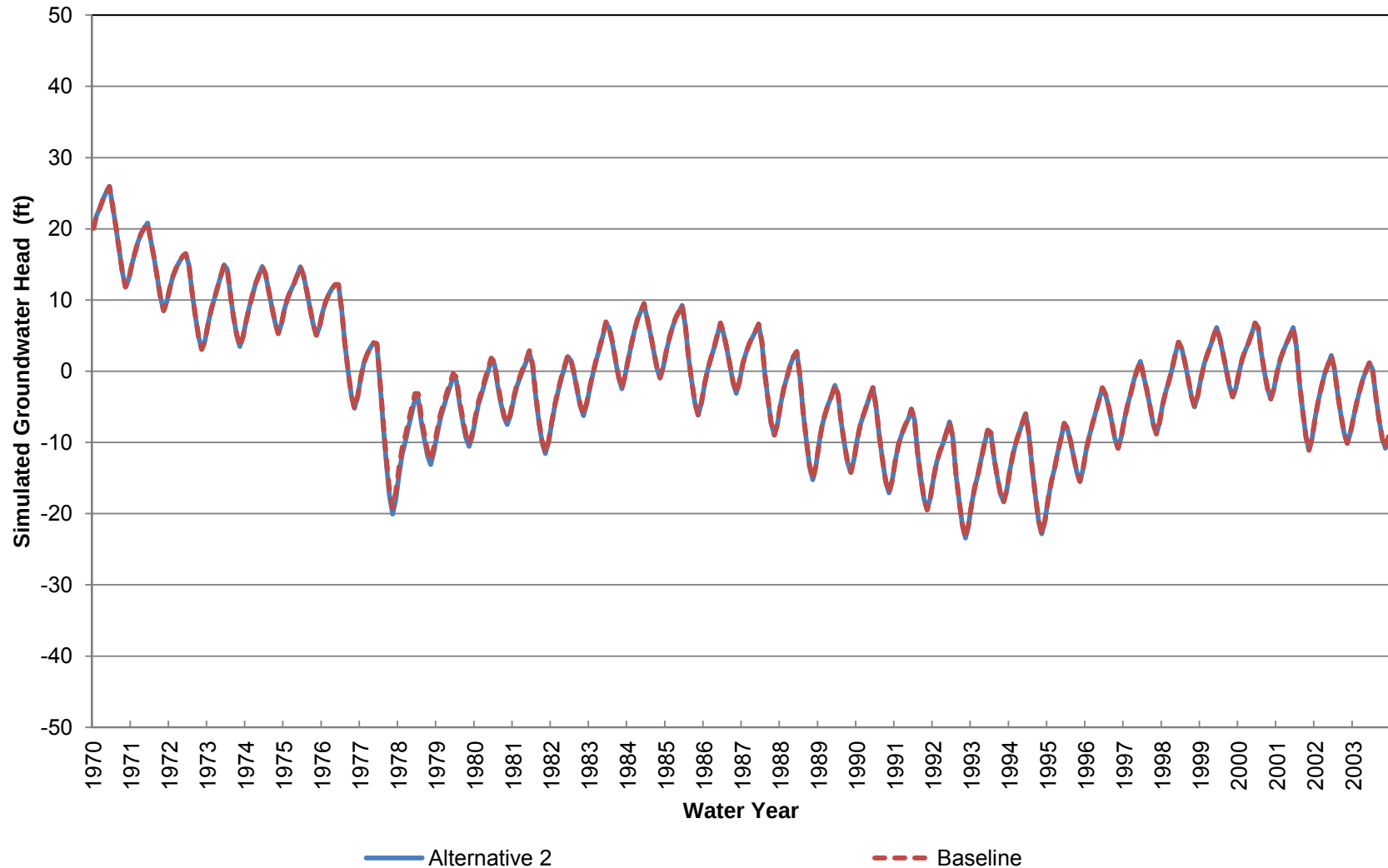
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 220-300 ft bgs)



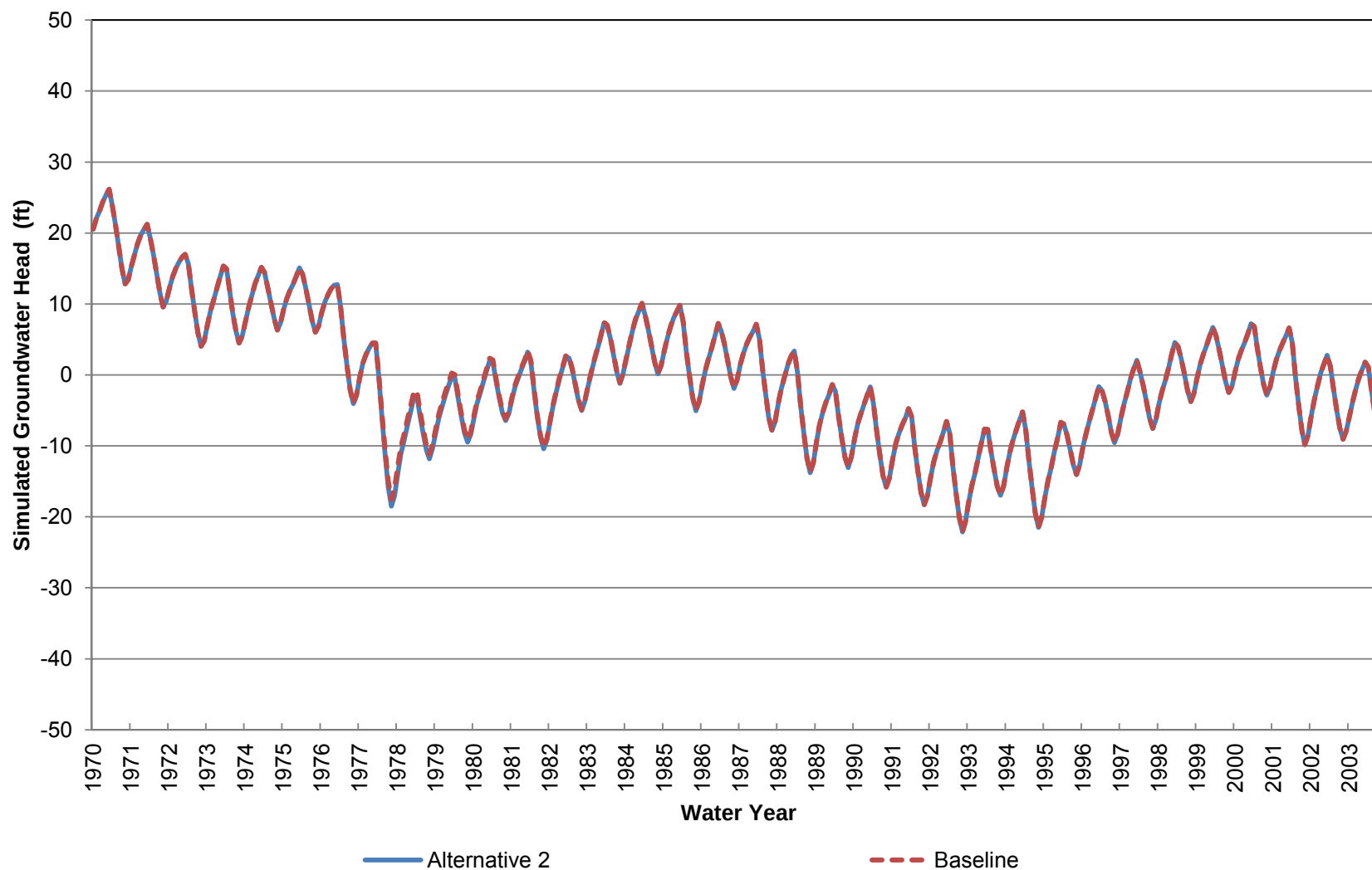
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 300-410 ft bgs)



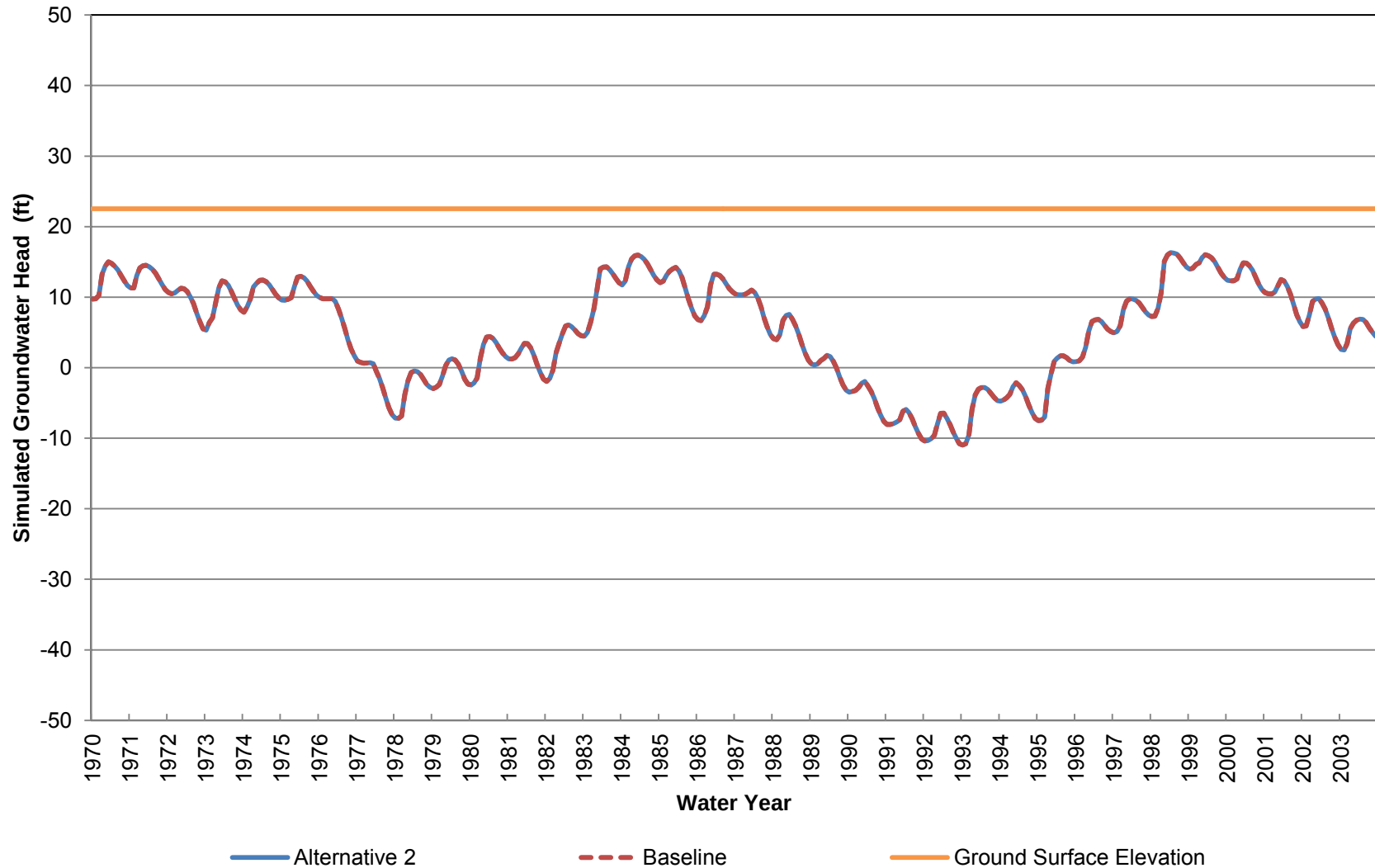
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 410-550 ft bgs)



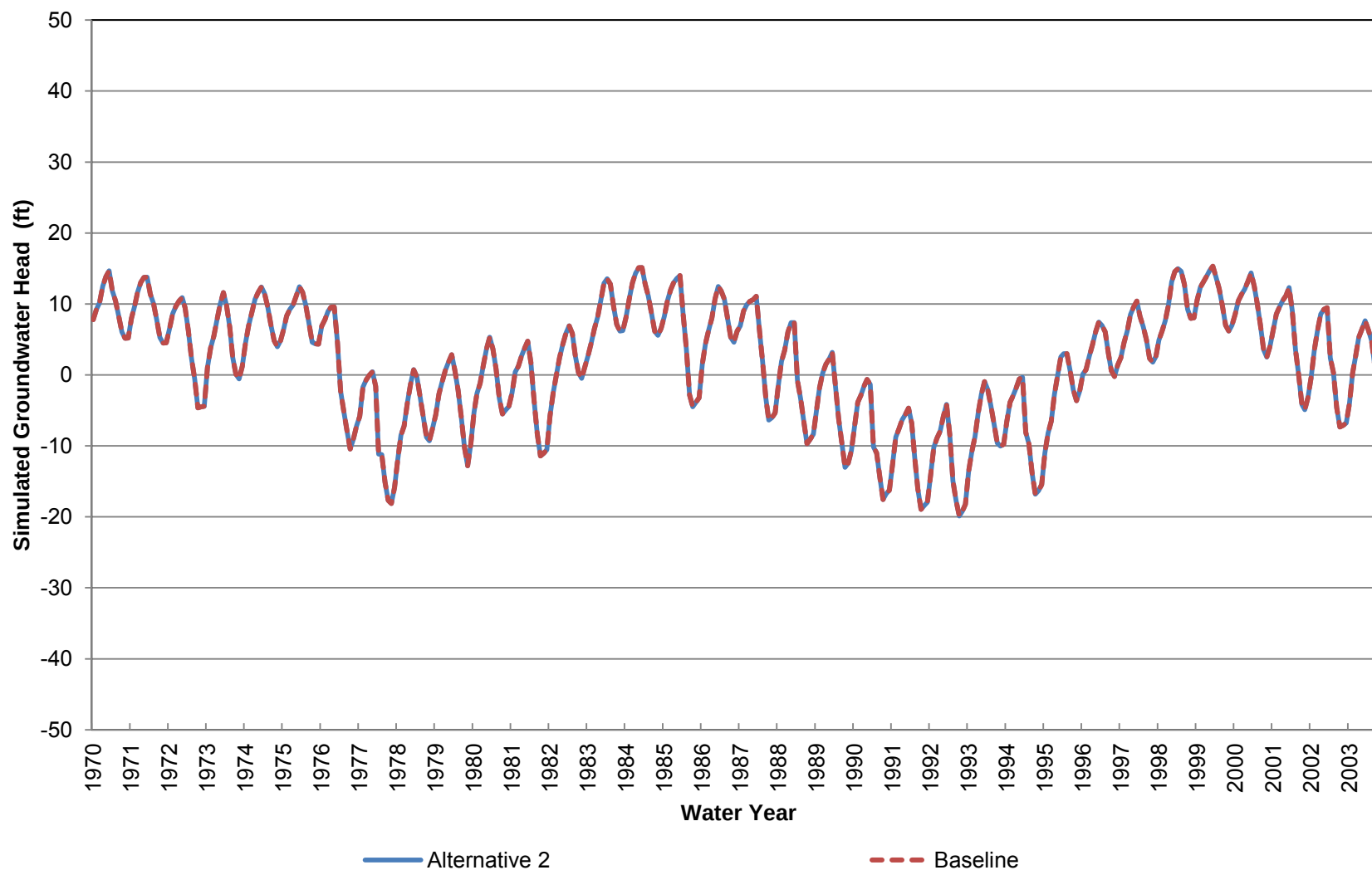
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 550-750 ft bgs)



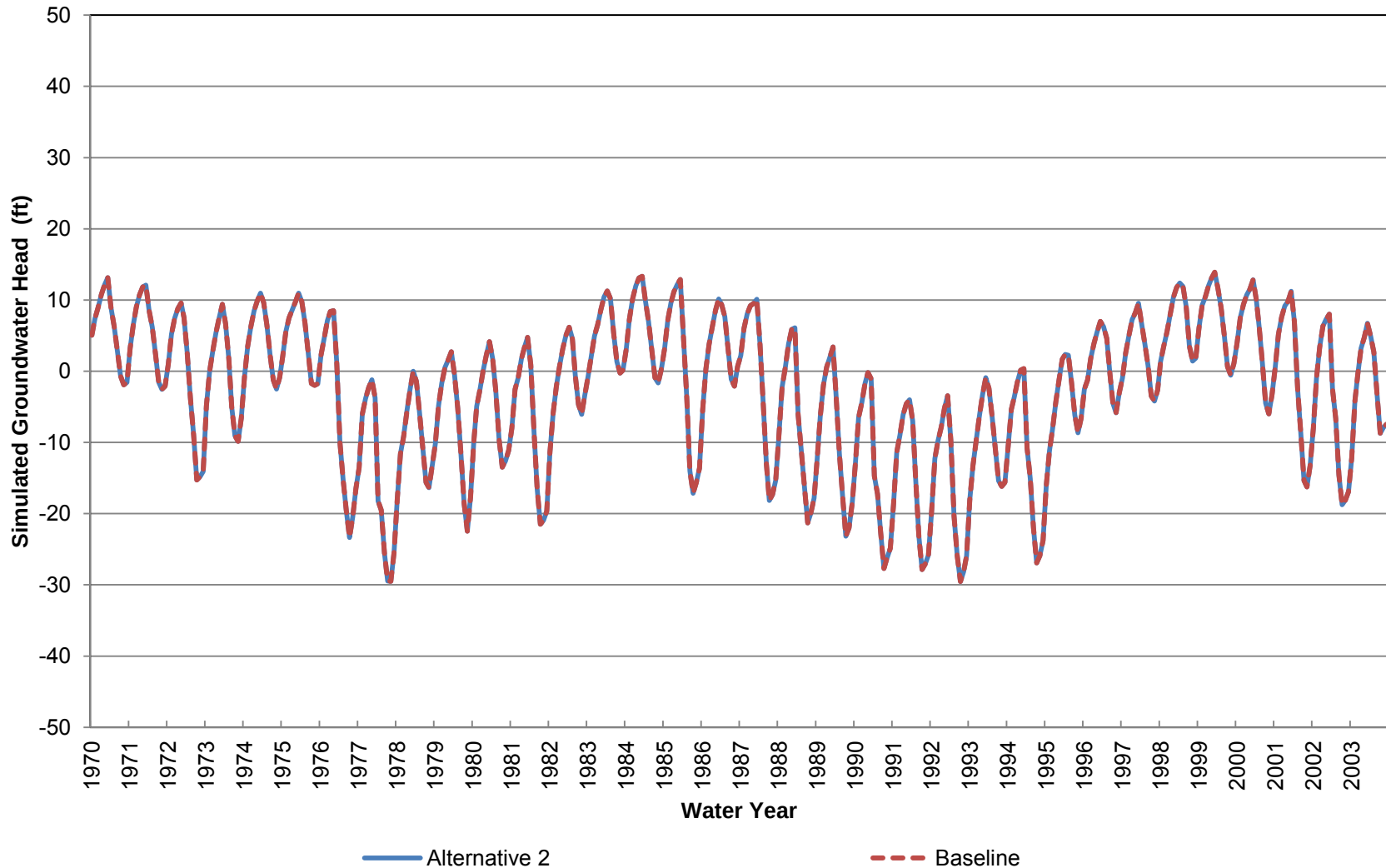
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 25 (Approximately 0-70 ft bgs)



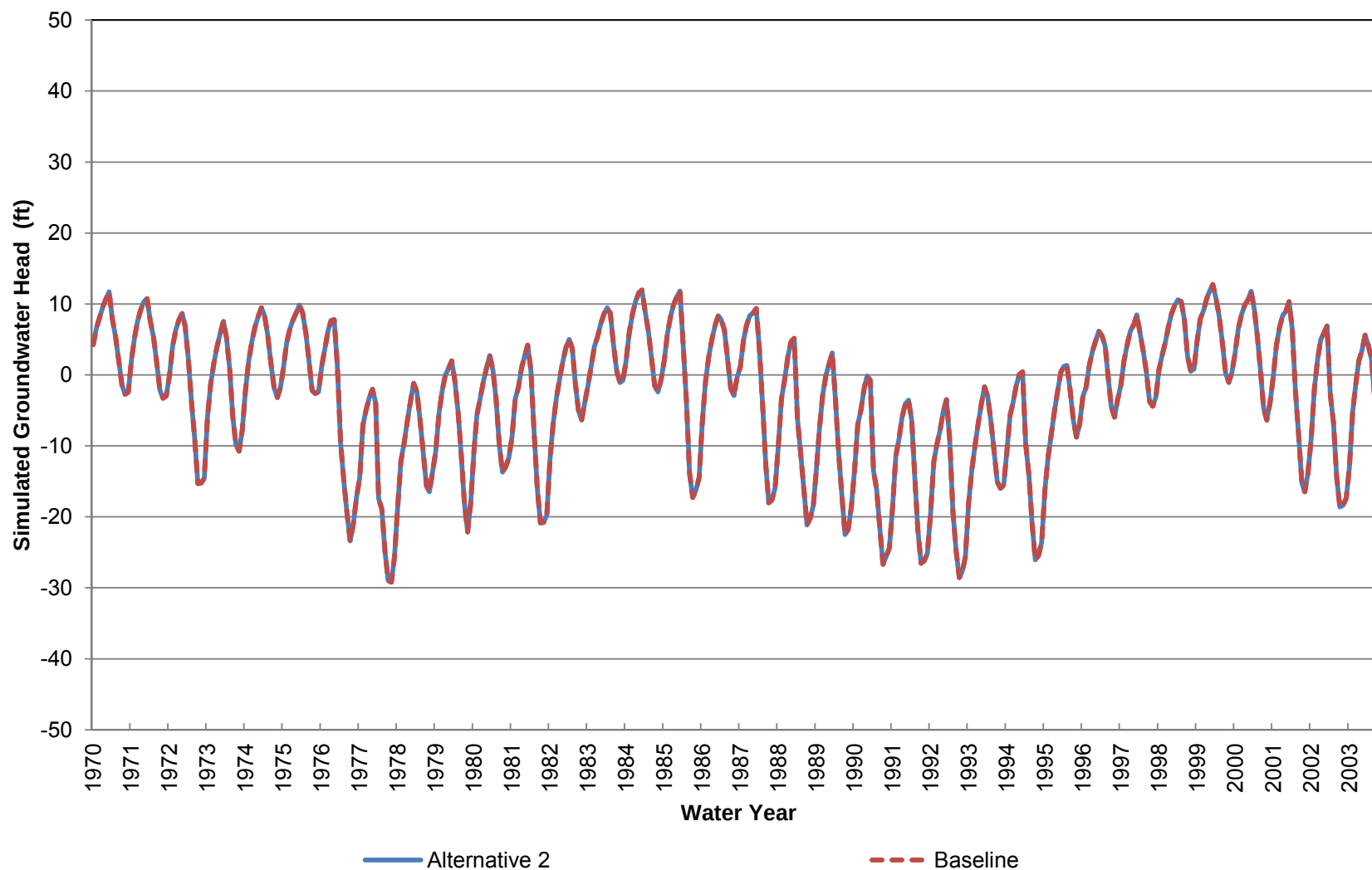
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 70-380 ft bgs)



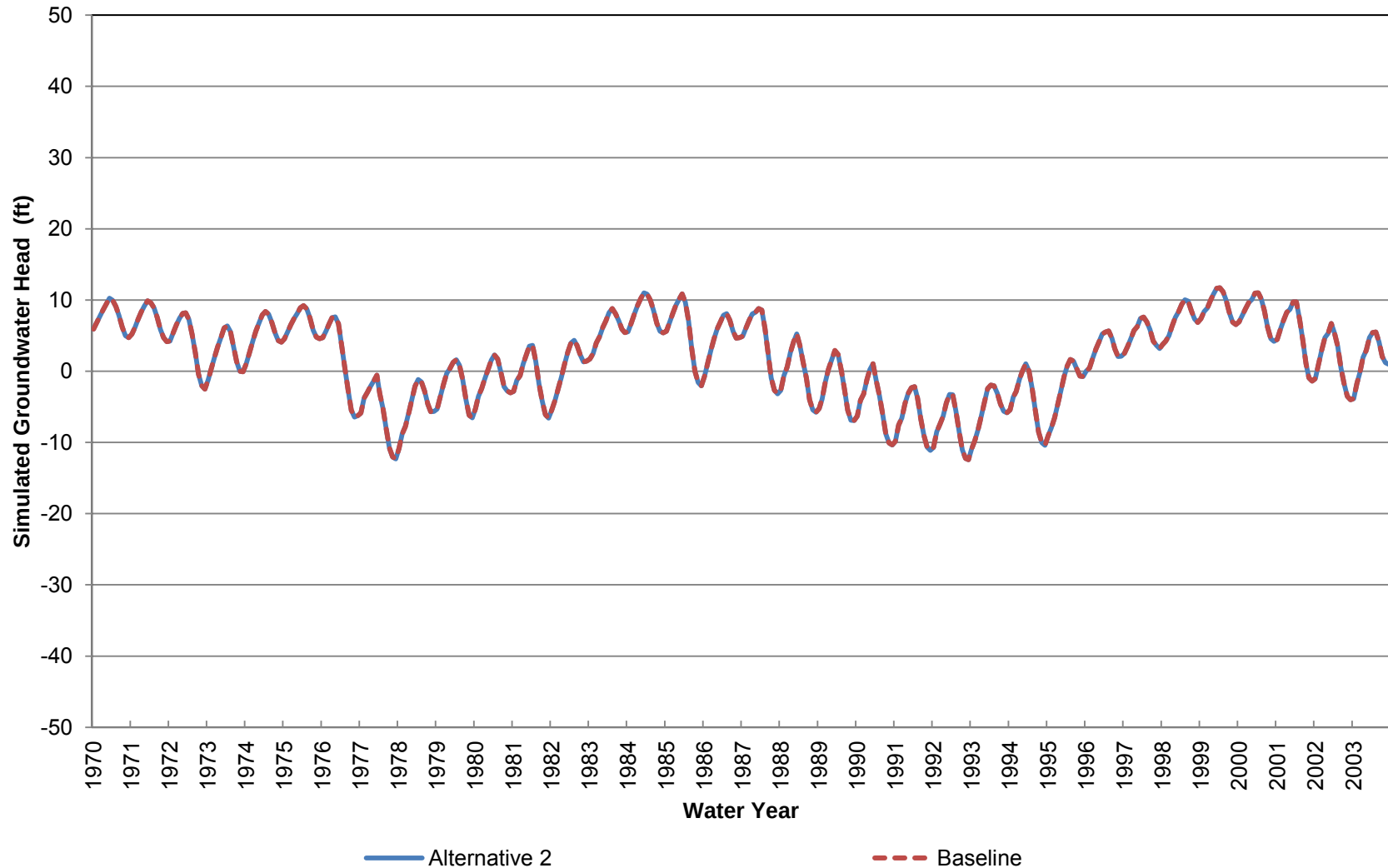
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 380-680 ft bgs)



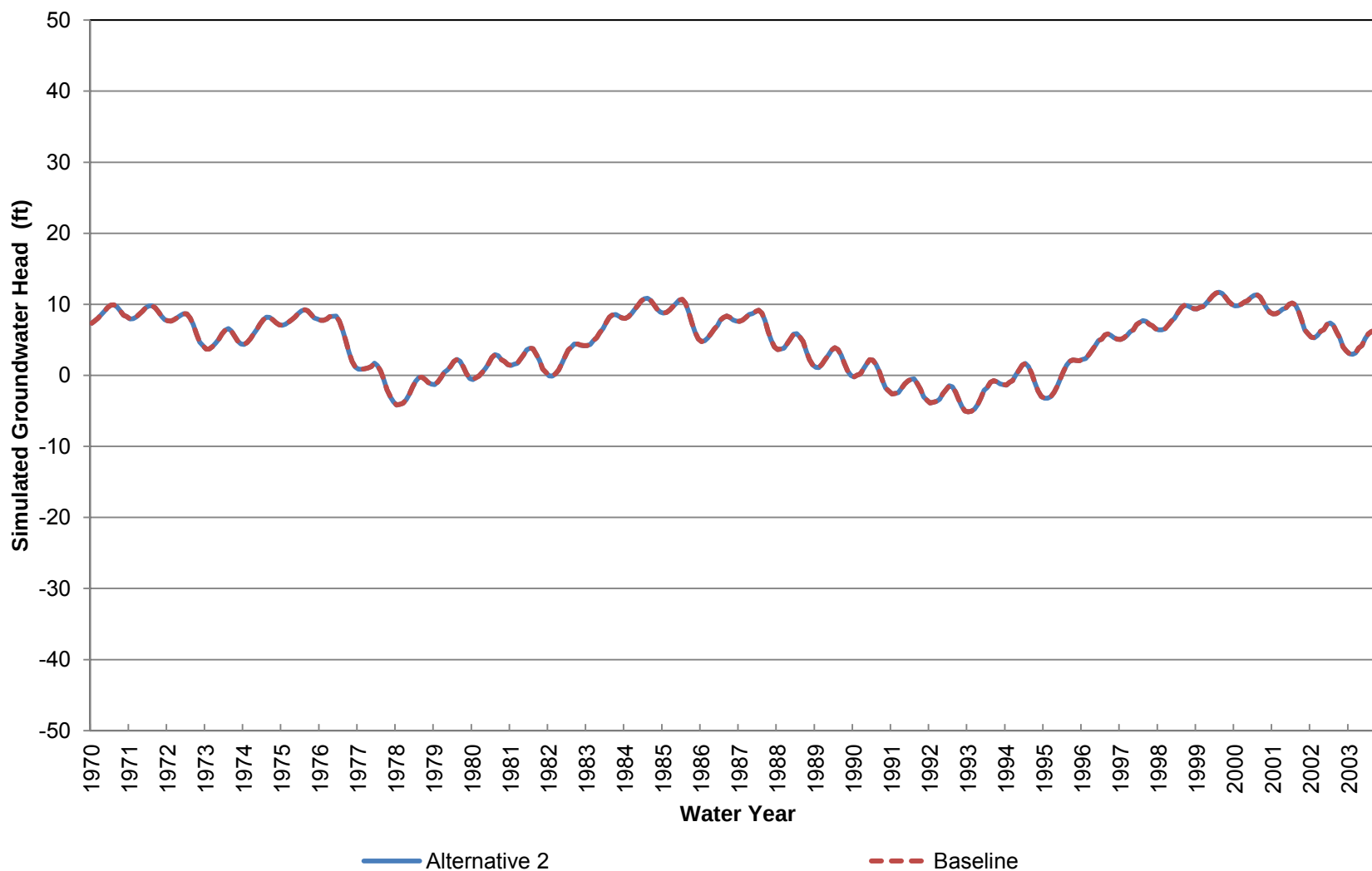
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 680-990 ft bgs)



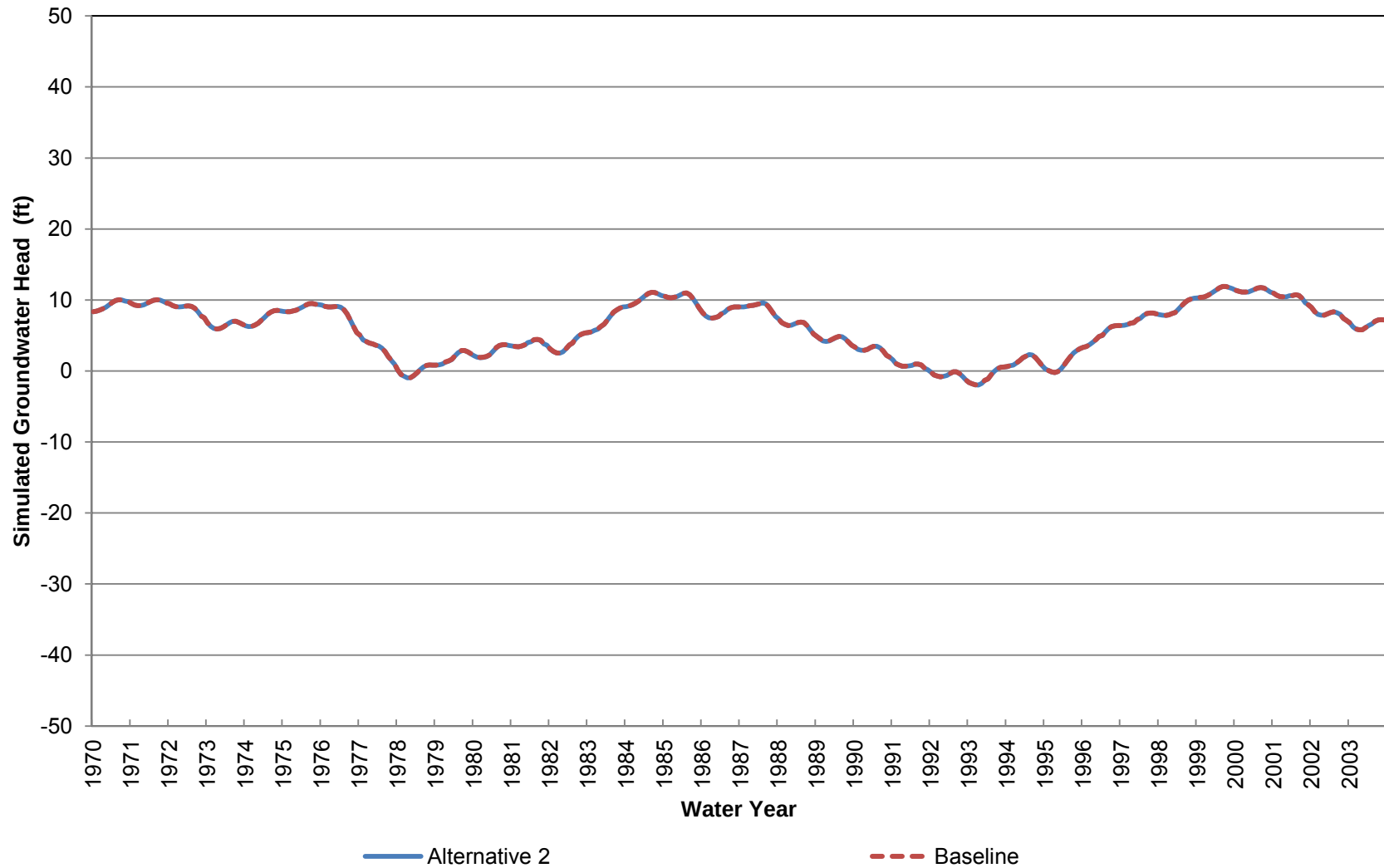
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 990-1530 ft bgs)



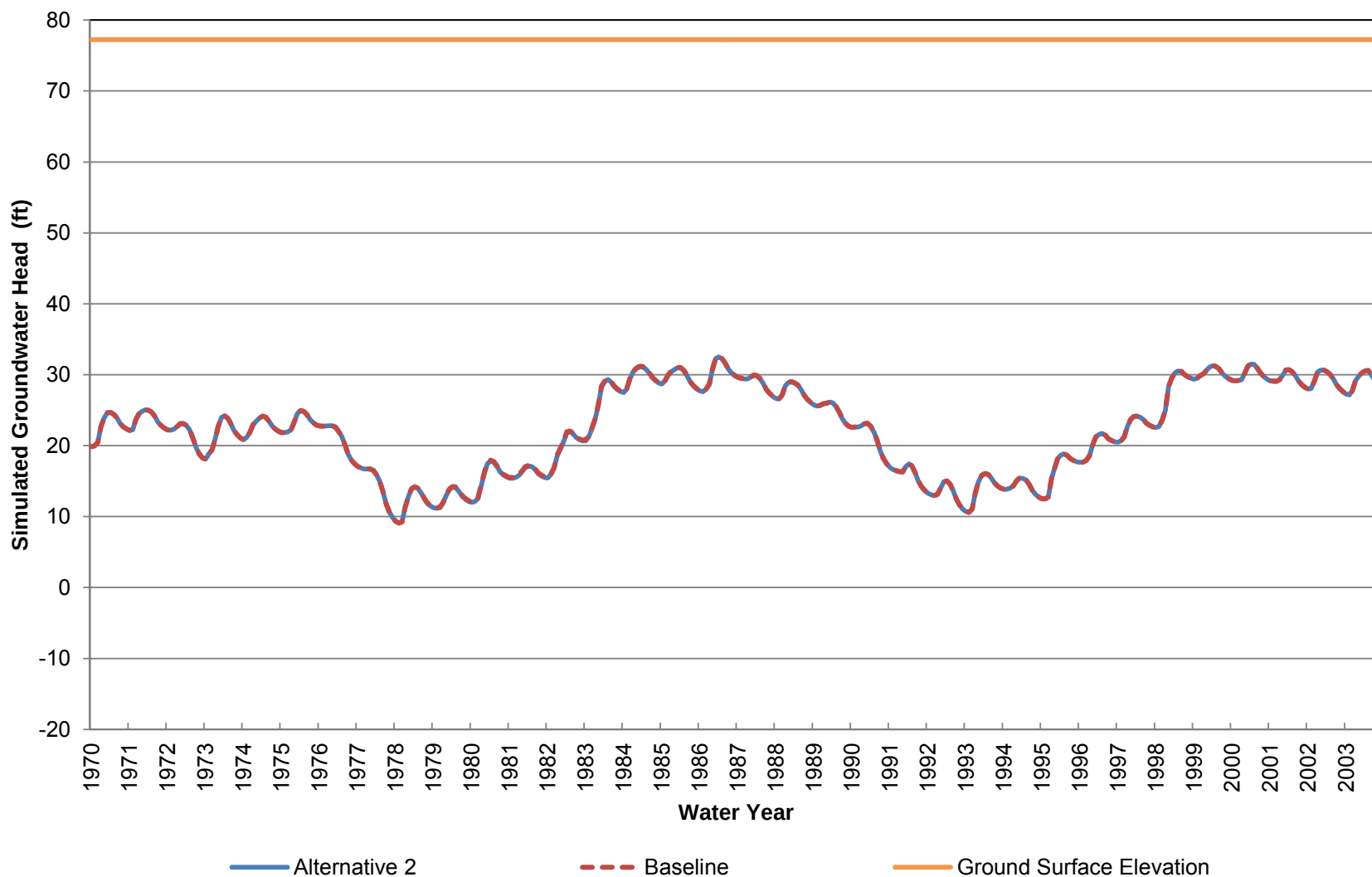
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 1530-2040 ft bgs)



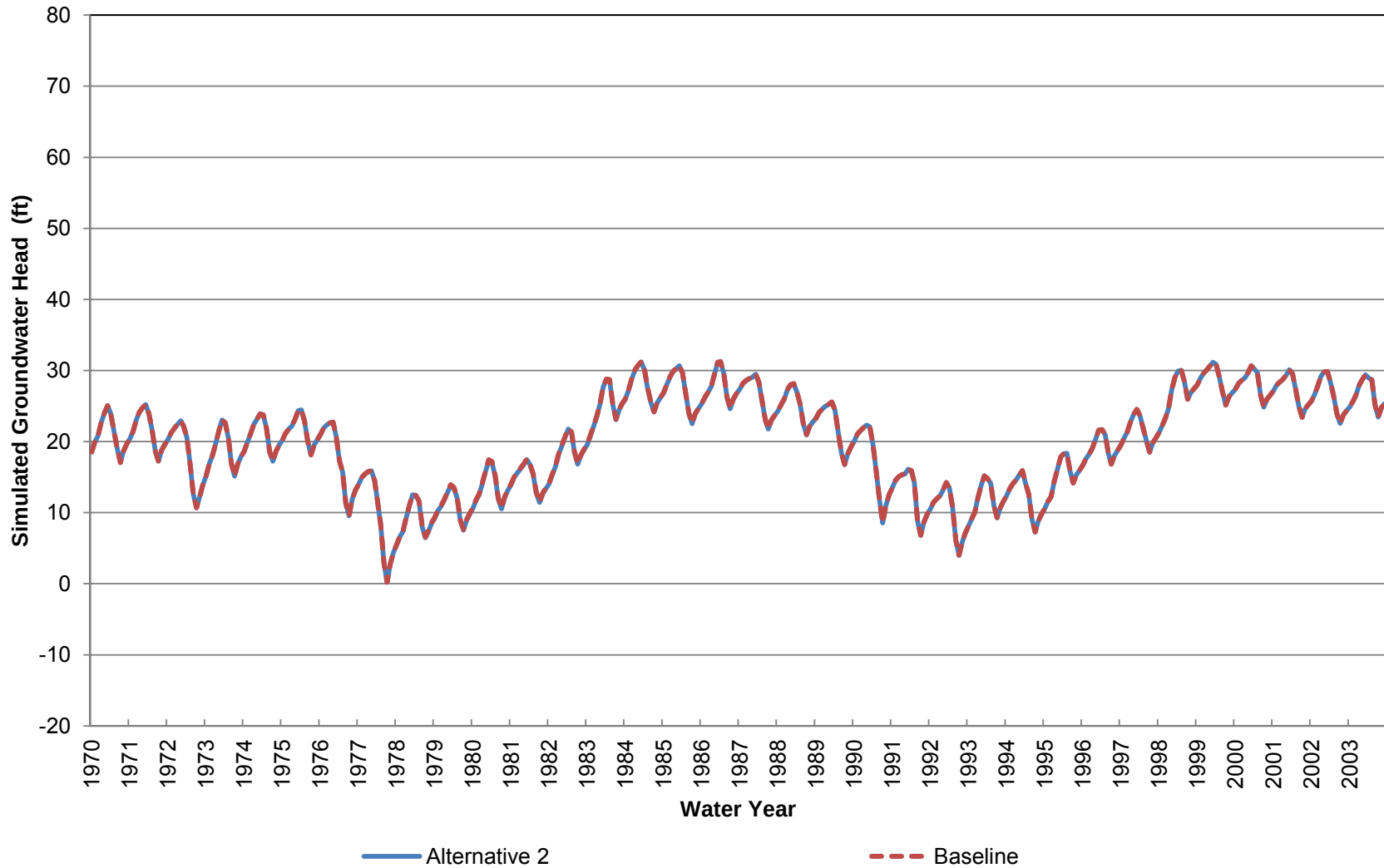
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 2040-2800 ft bgs)



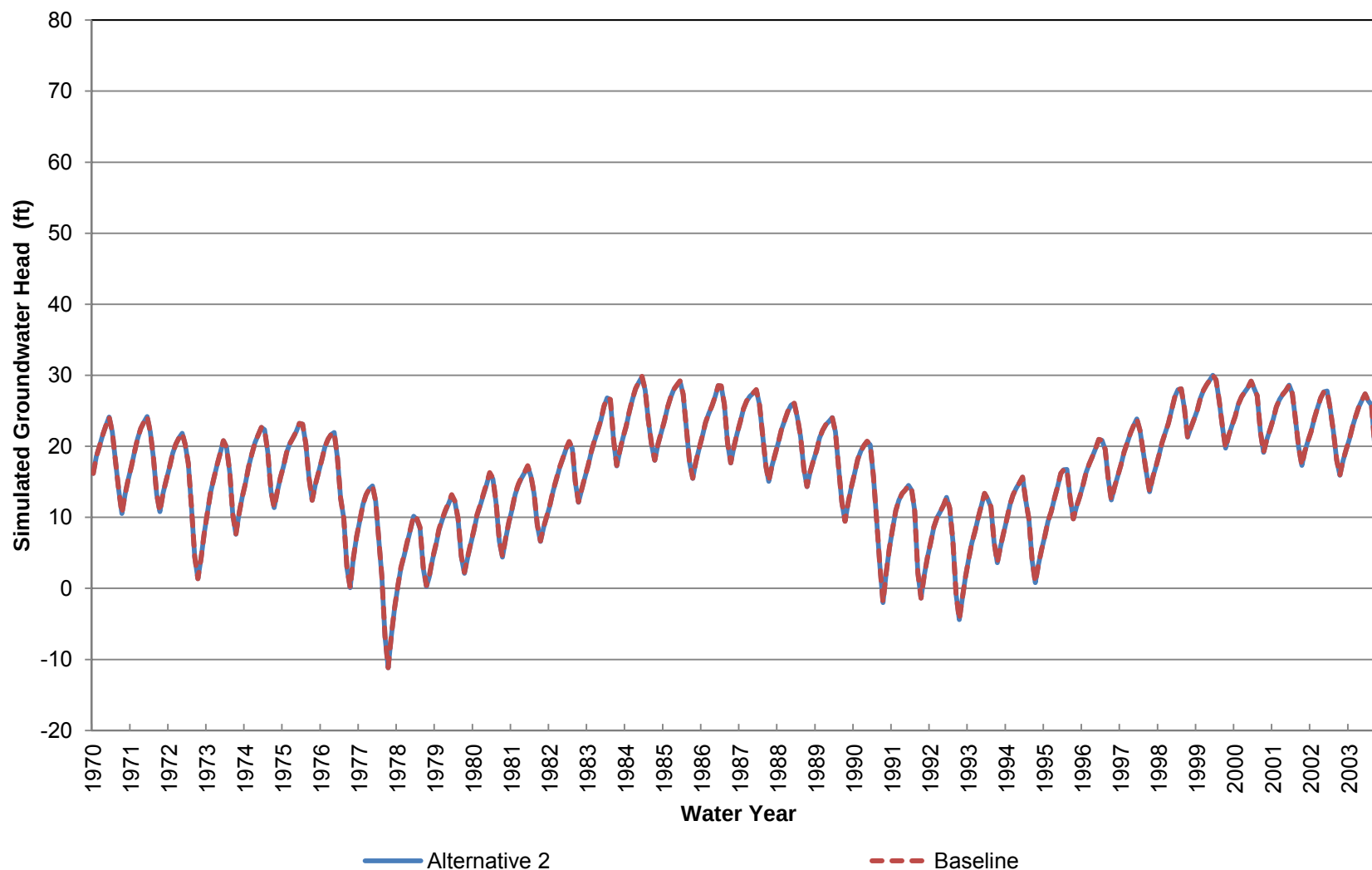
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 26 (Approximately 0-70 ft bgs)



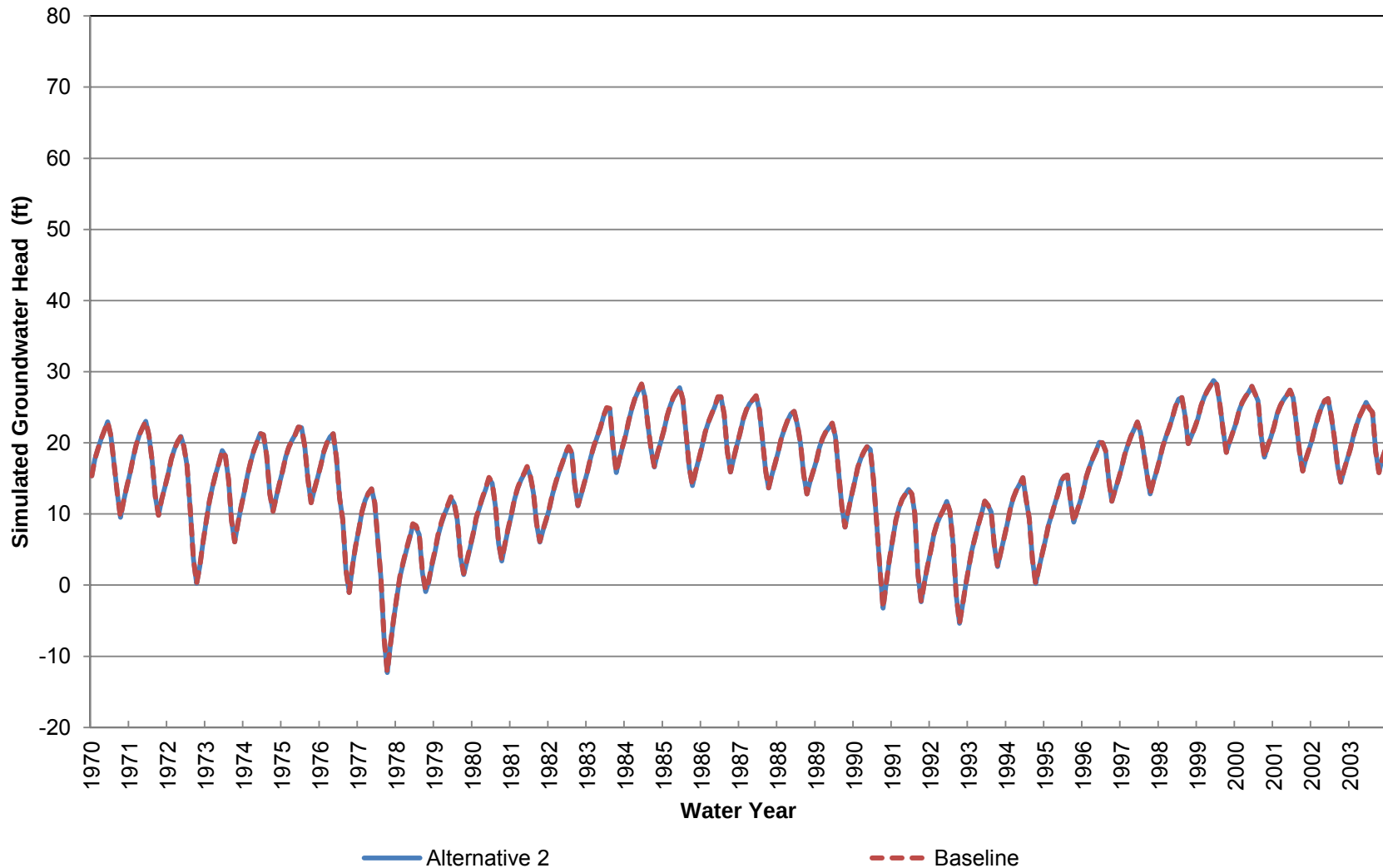
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 70-380 ft bgs)



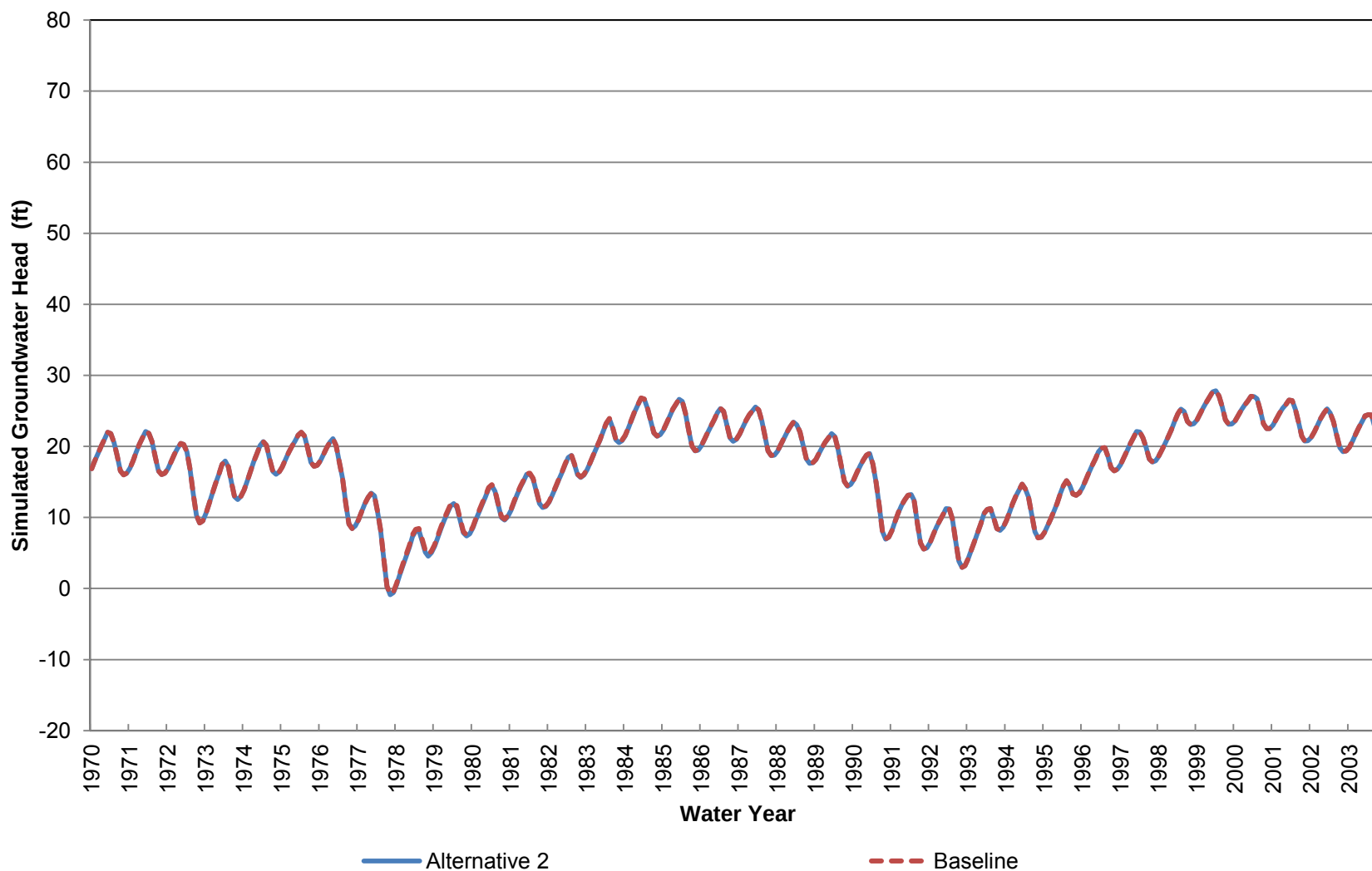
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 380-690 ft bgs)



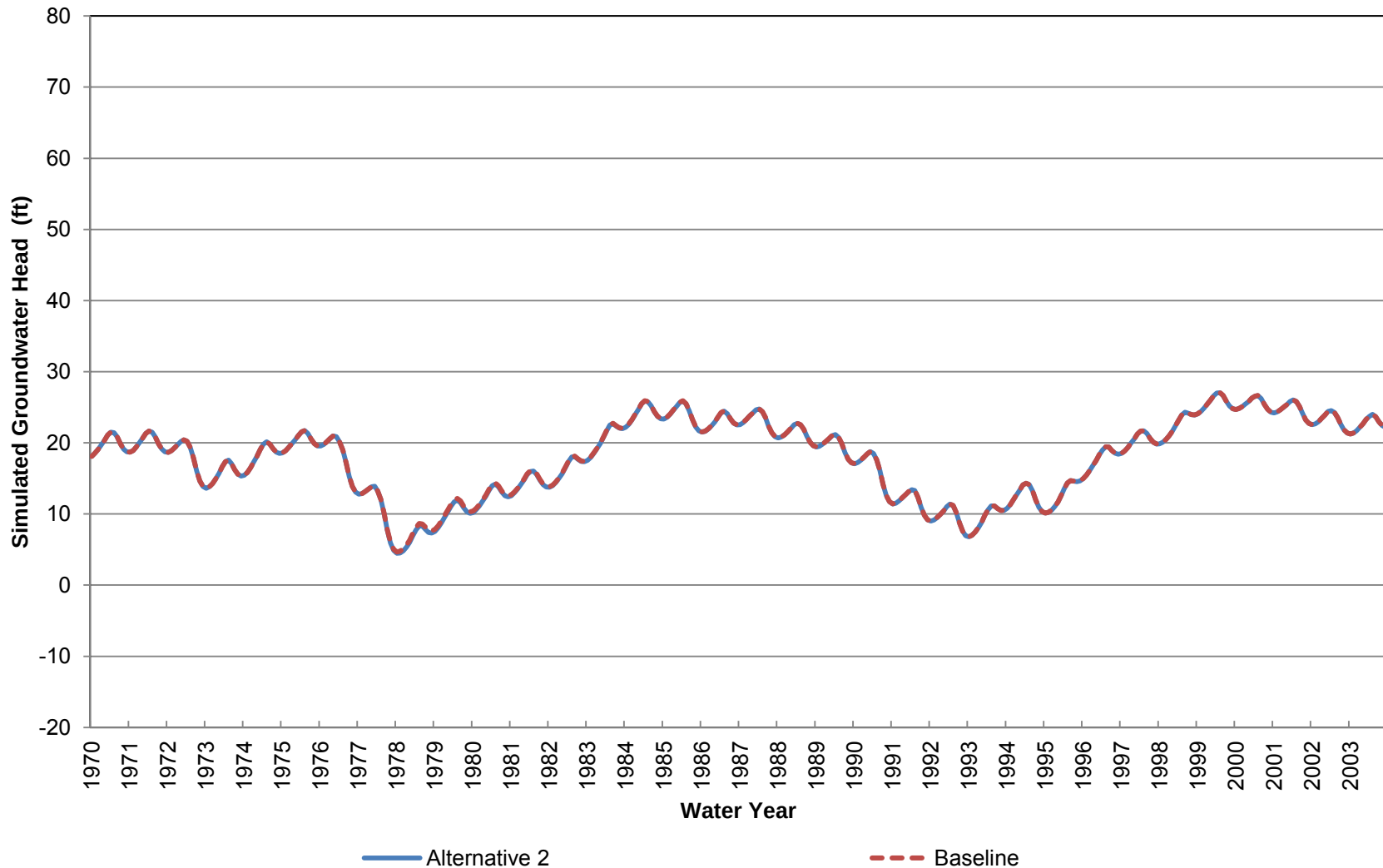
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 690-1000 ft bgs)



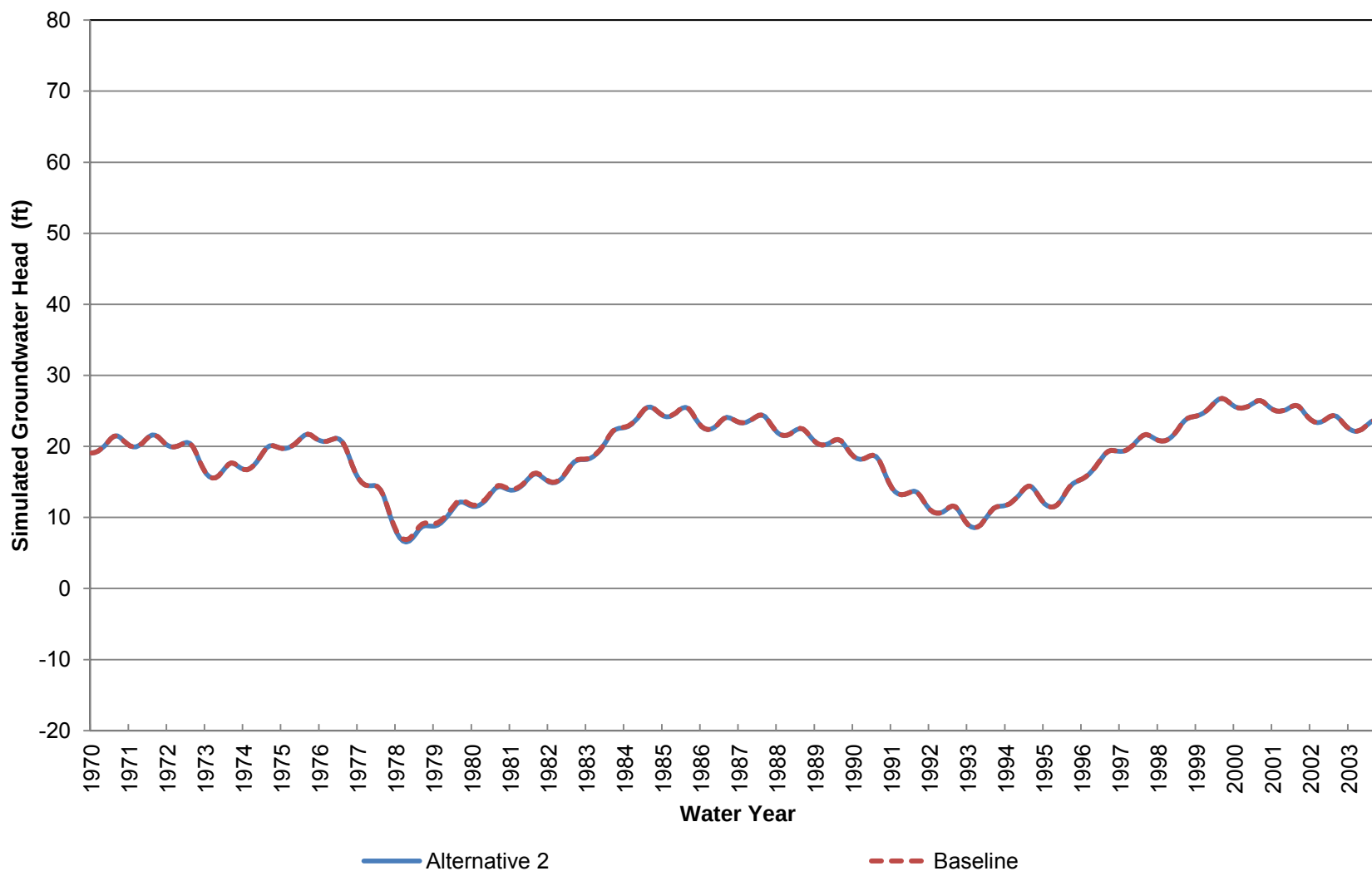
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 1000-1550 ft bgs)



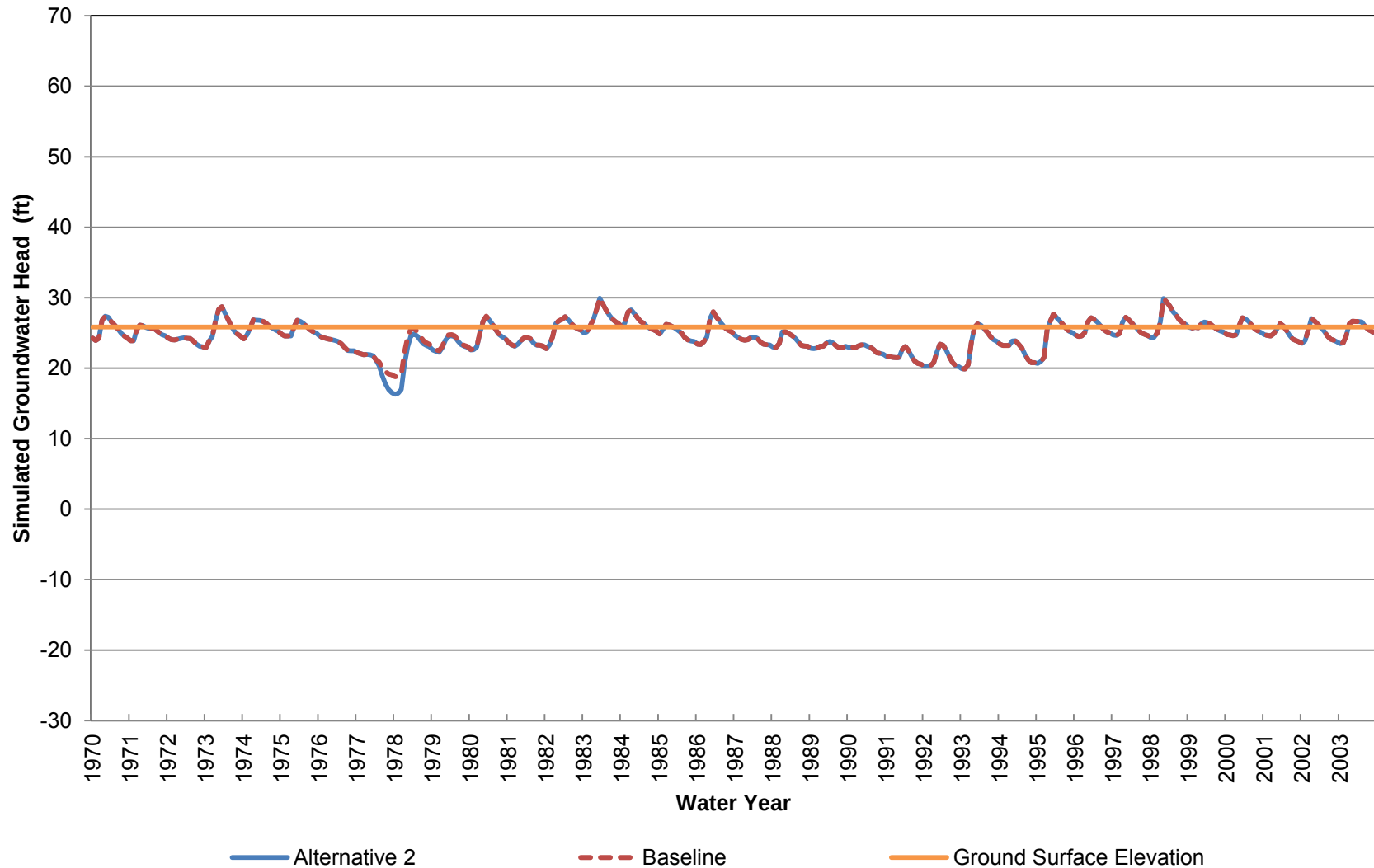
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 1550-2070 ft bgs)



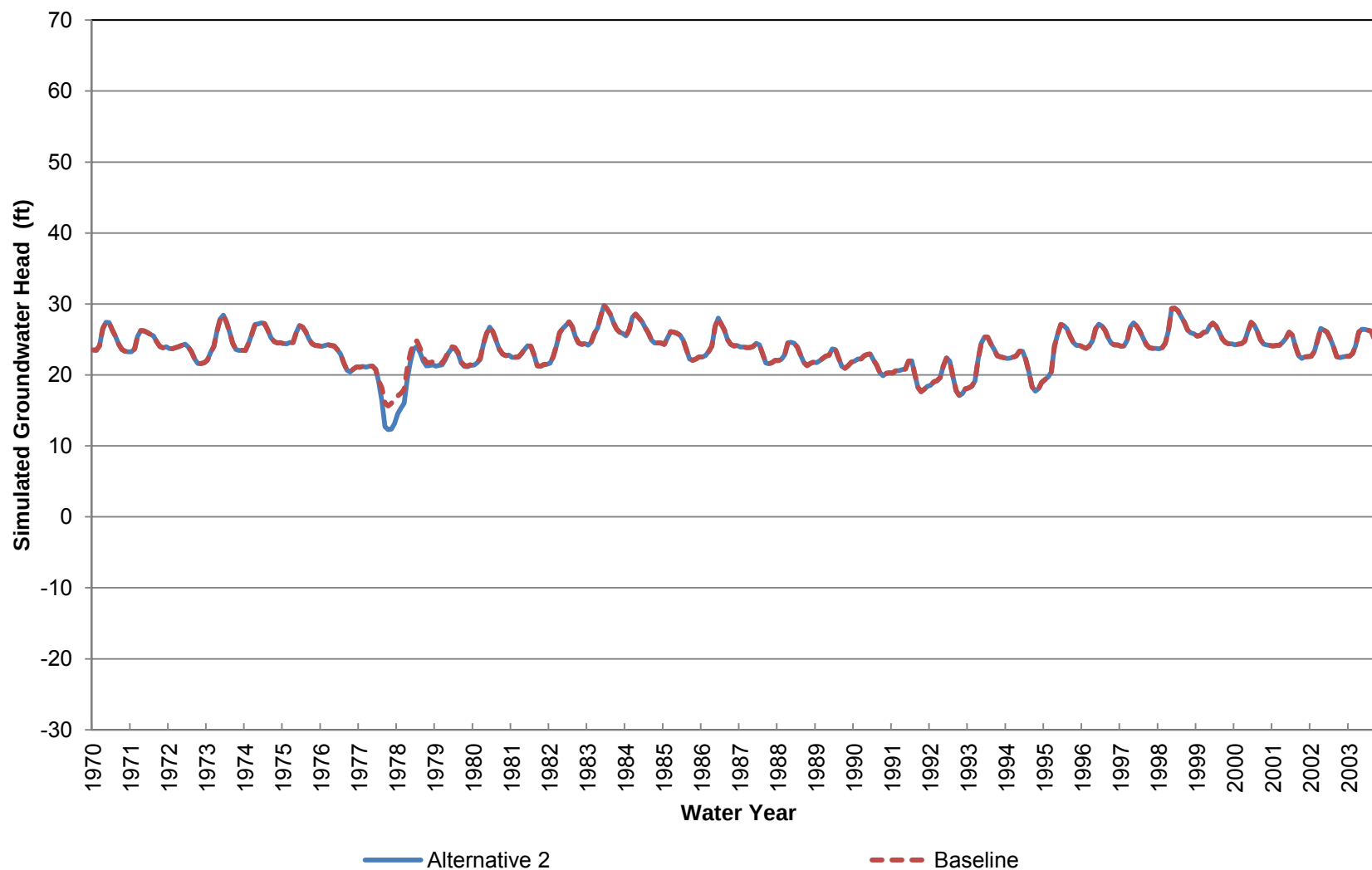
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 2070-2840 ft bgs)



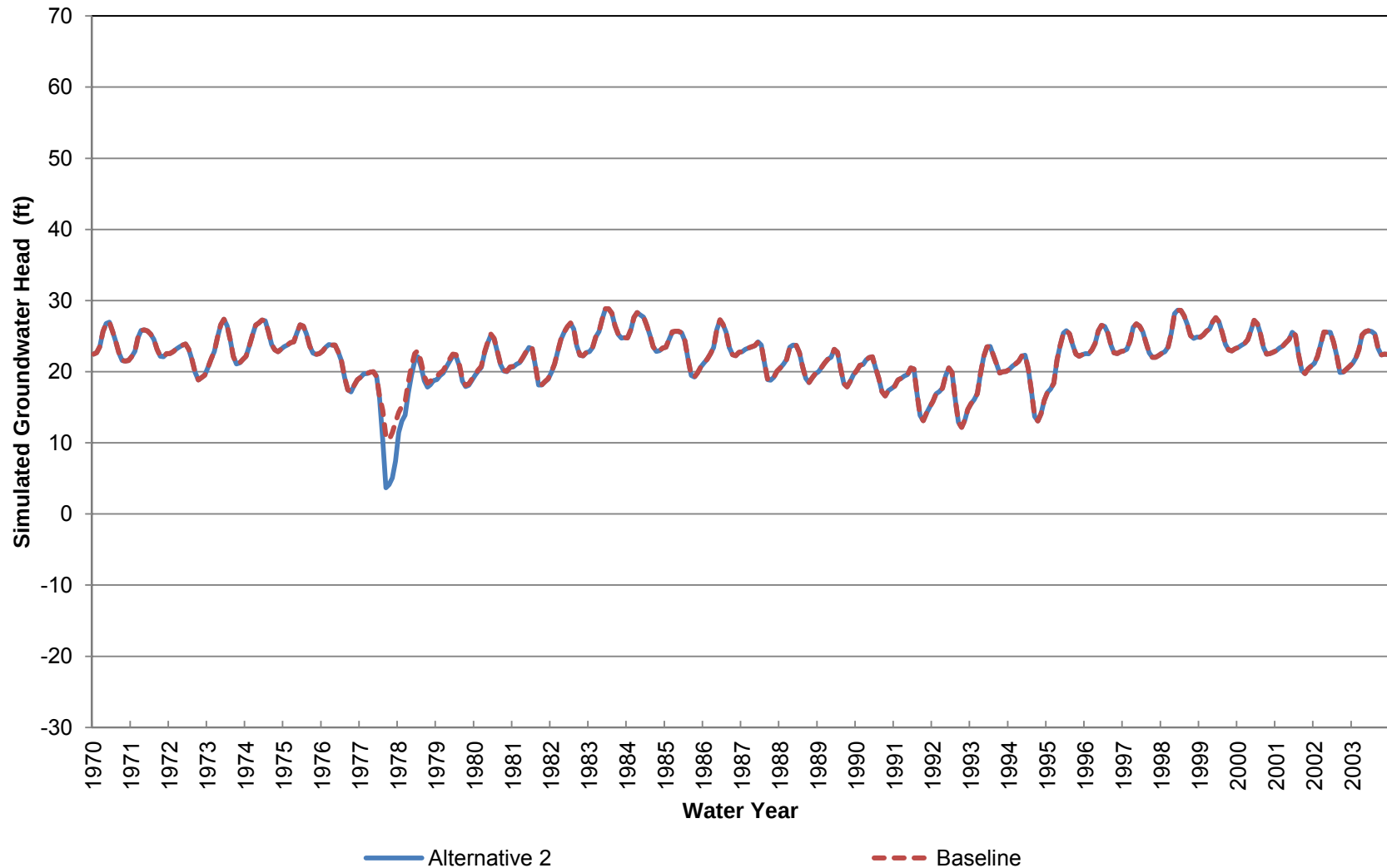
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 27 (Approximately 0-70 ft bgs)



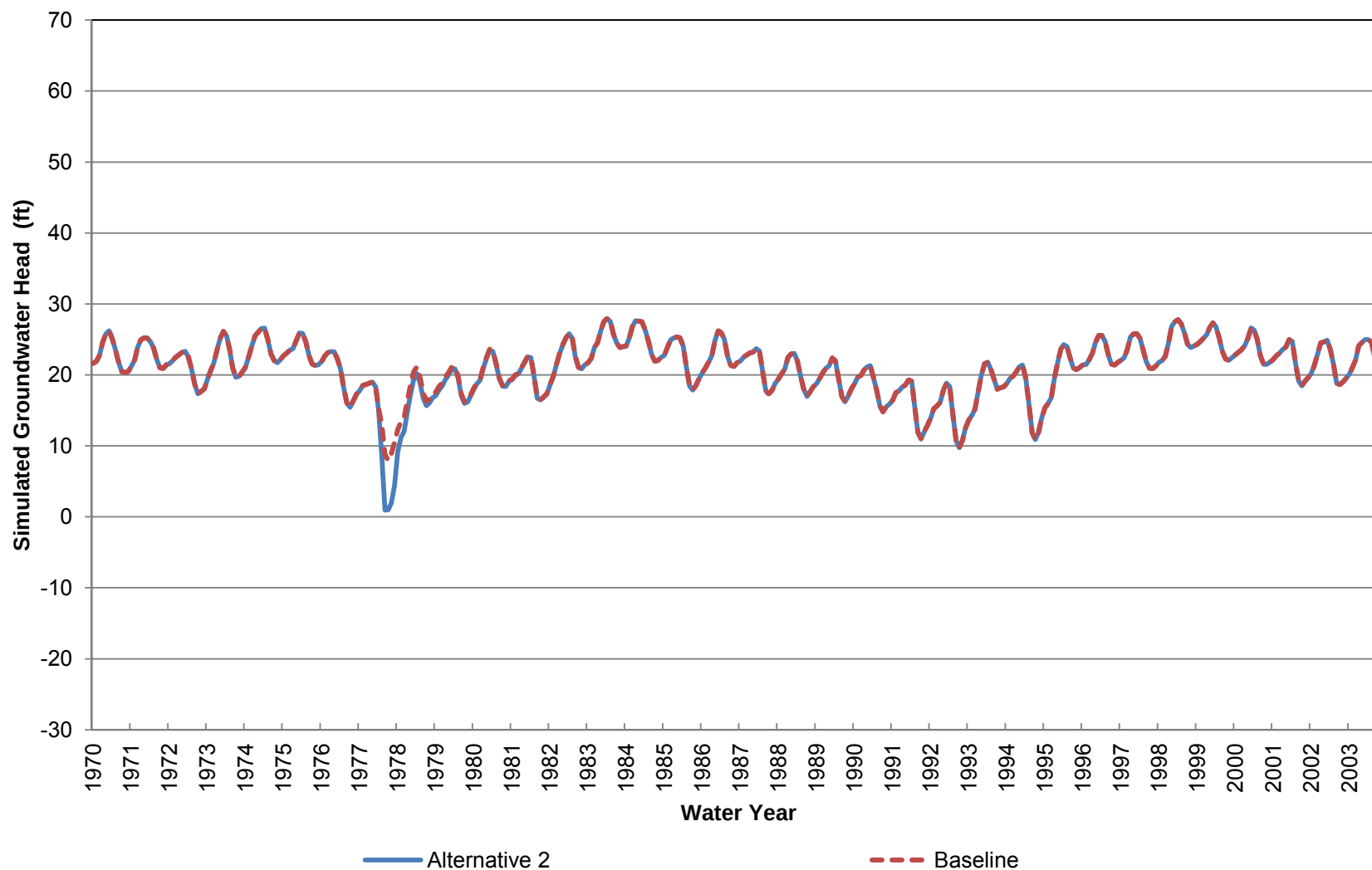
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 70-220 ft bgs)



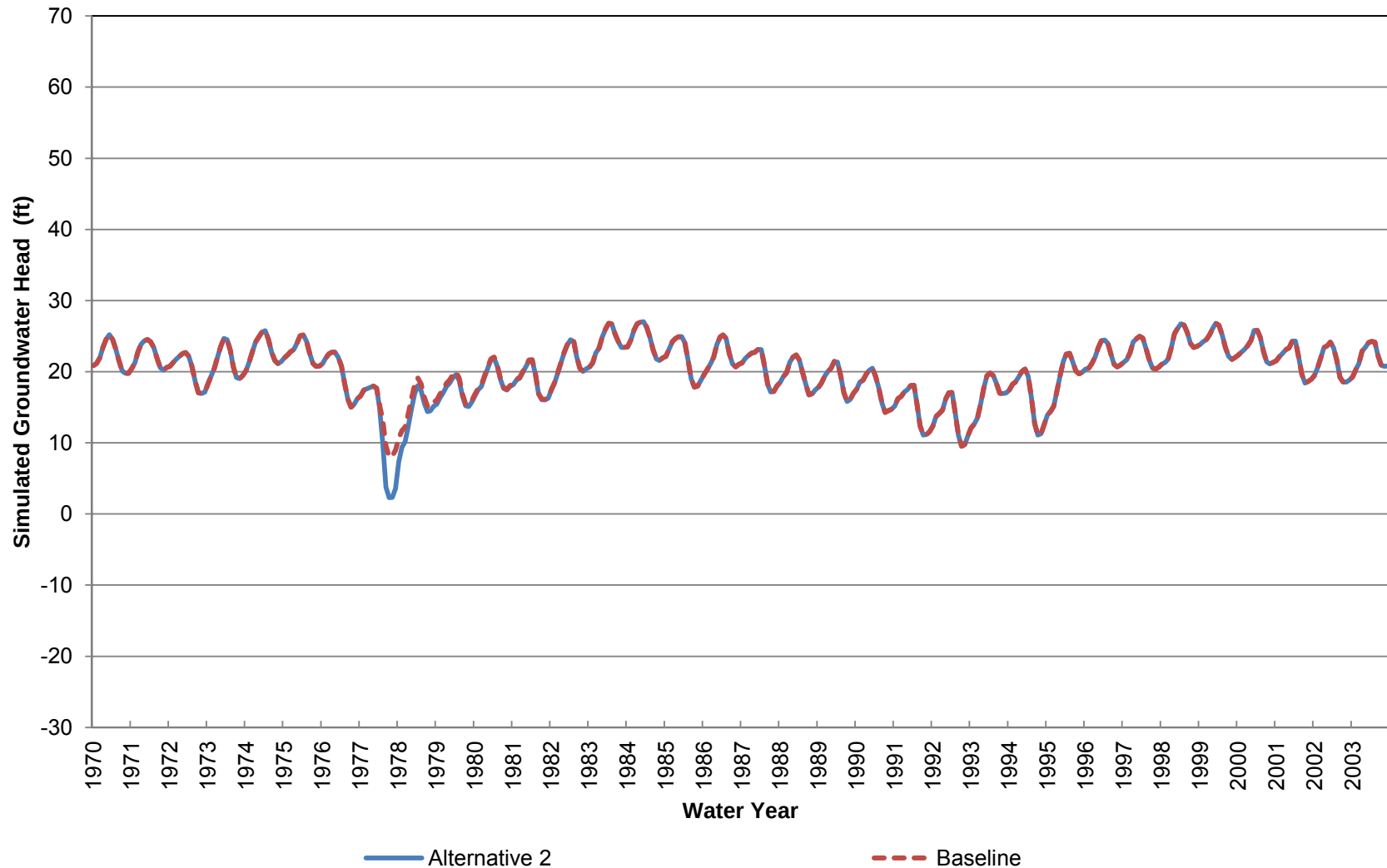
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 220-380 ft bgs)



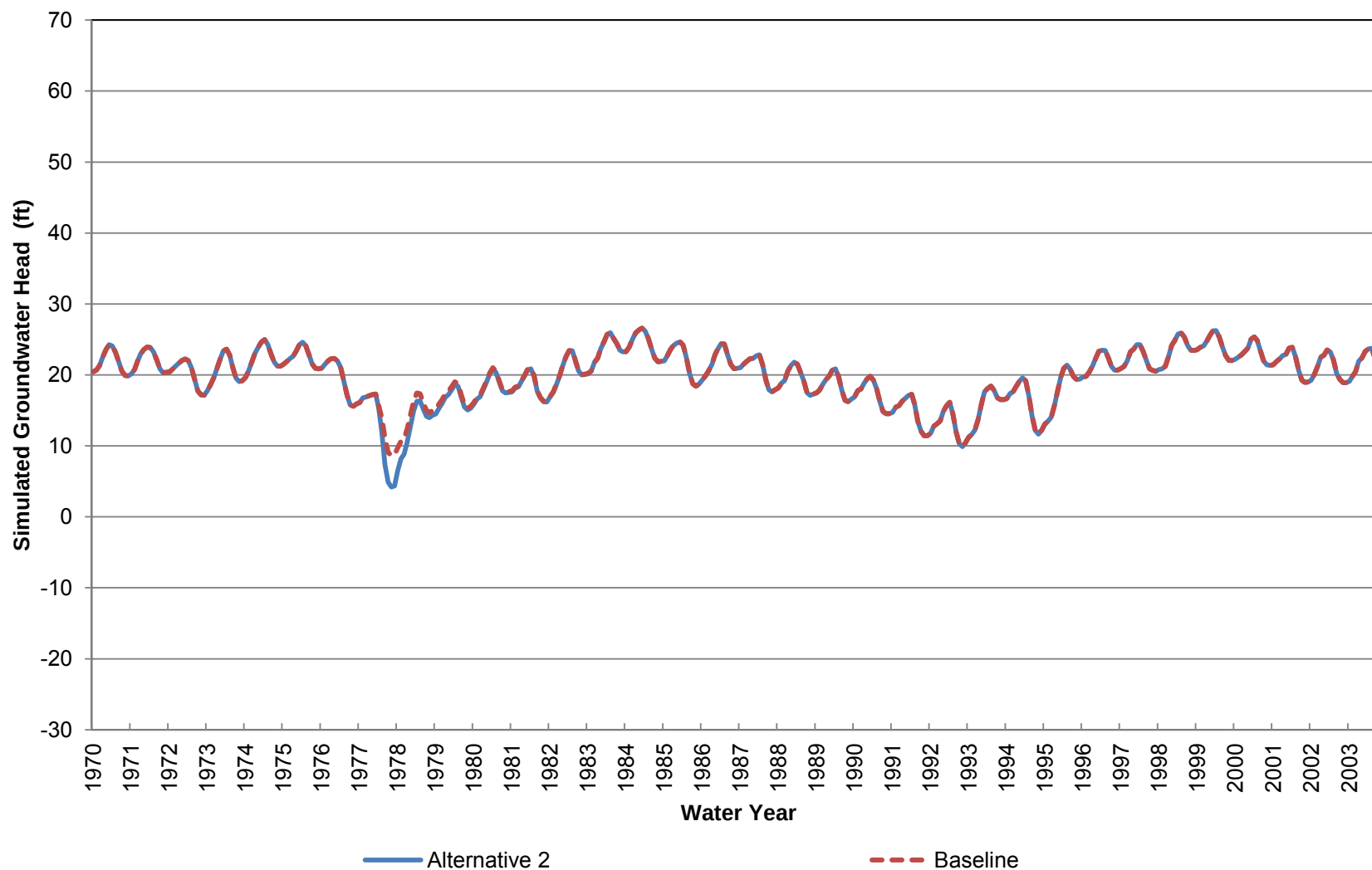
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 380-530 ft bgs)



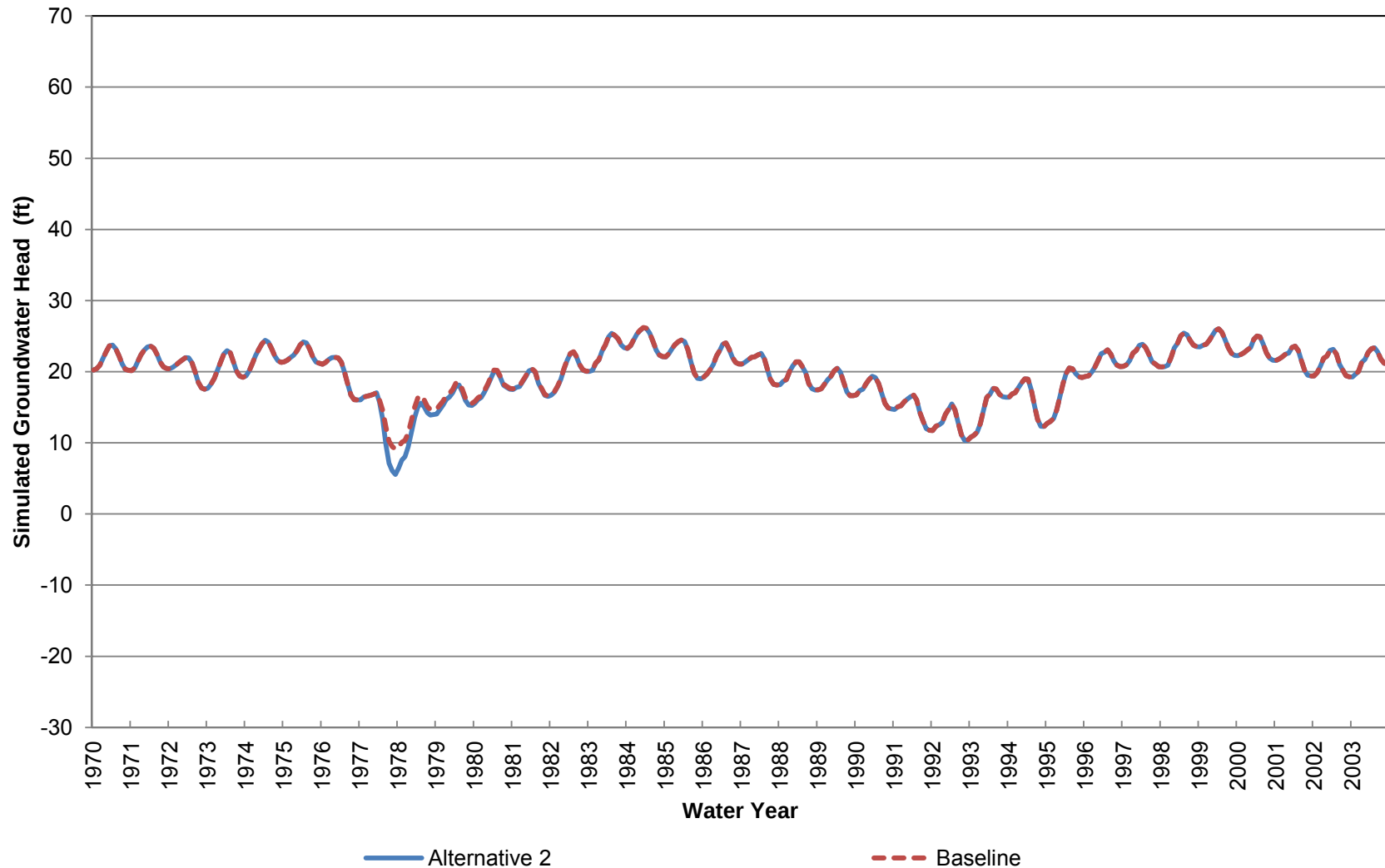
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 530-770 ft bgs)



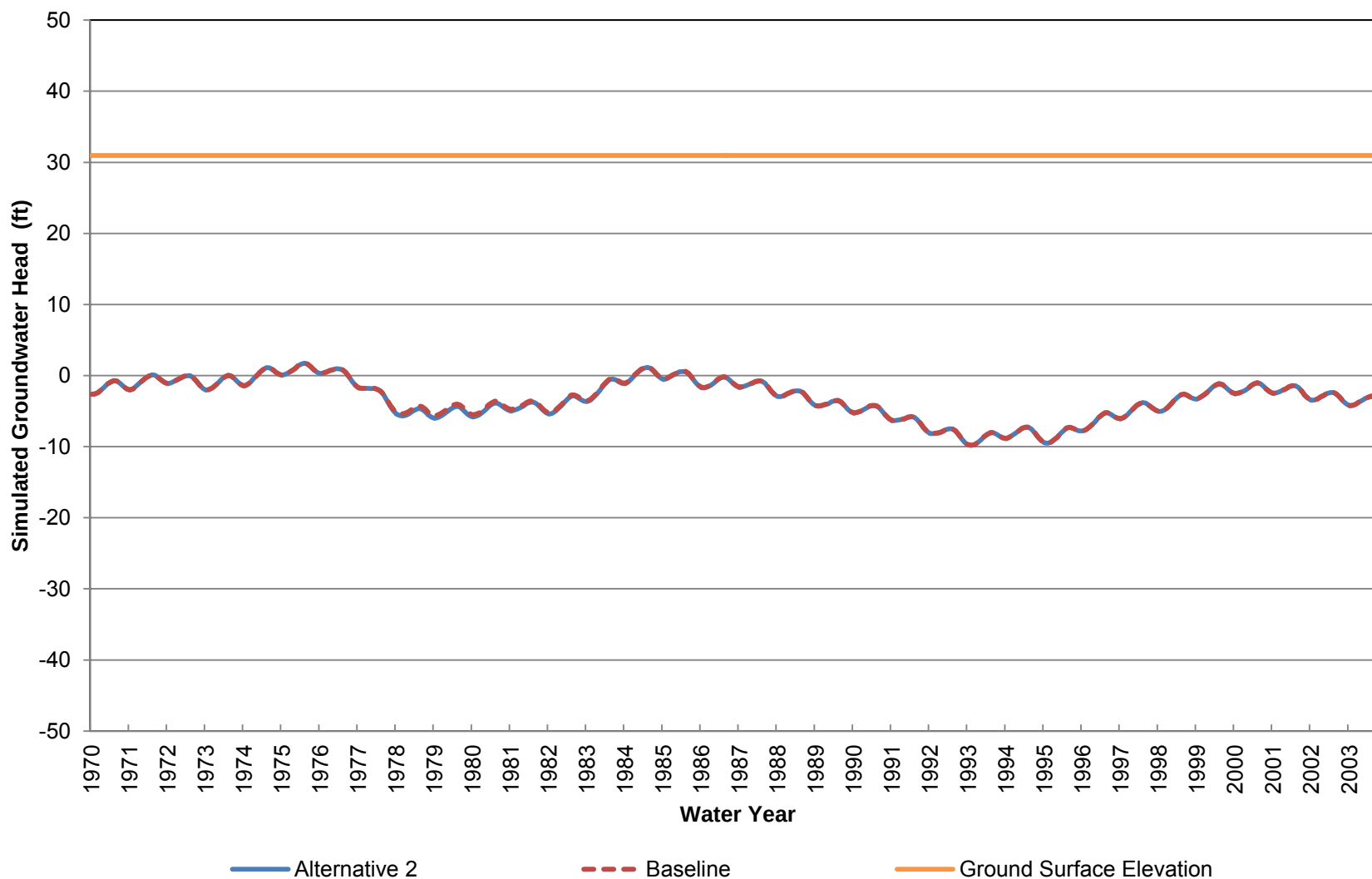
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 770-1030 ft bgs)



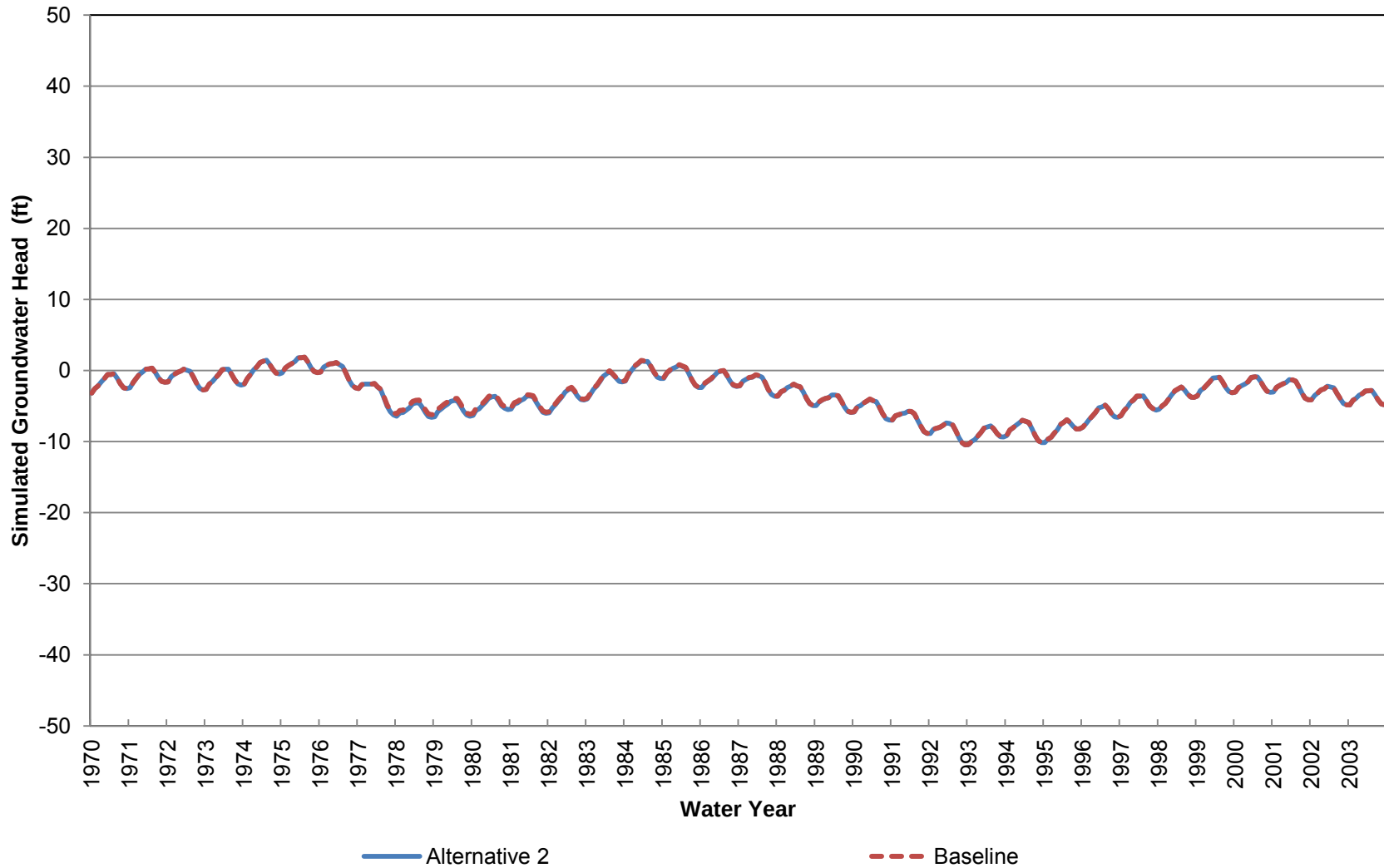
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 1030-1410 ft bgs)



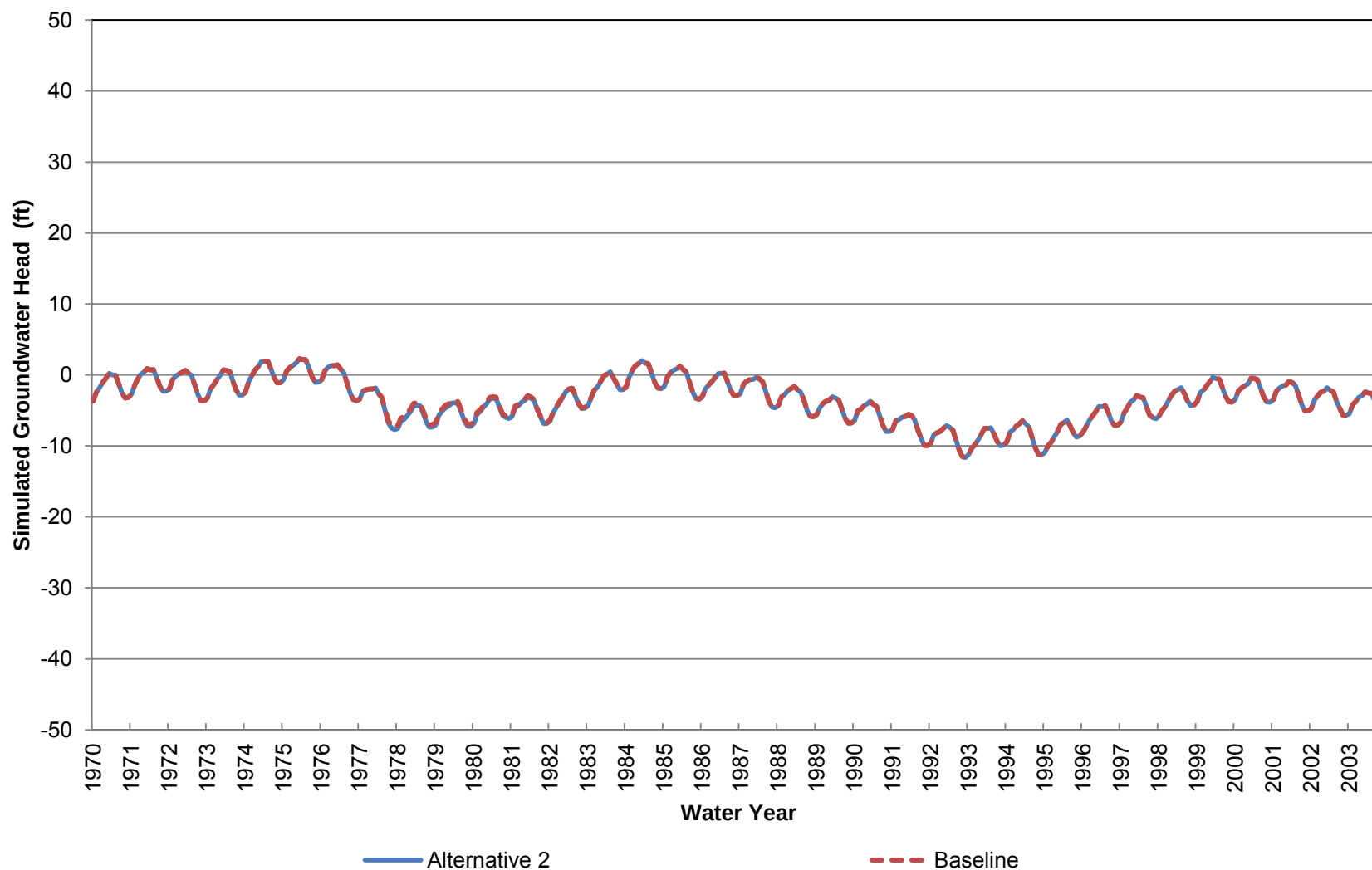
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 28 (Approximately 0-70 ft bgs)



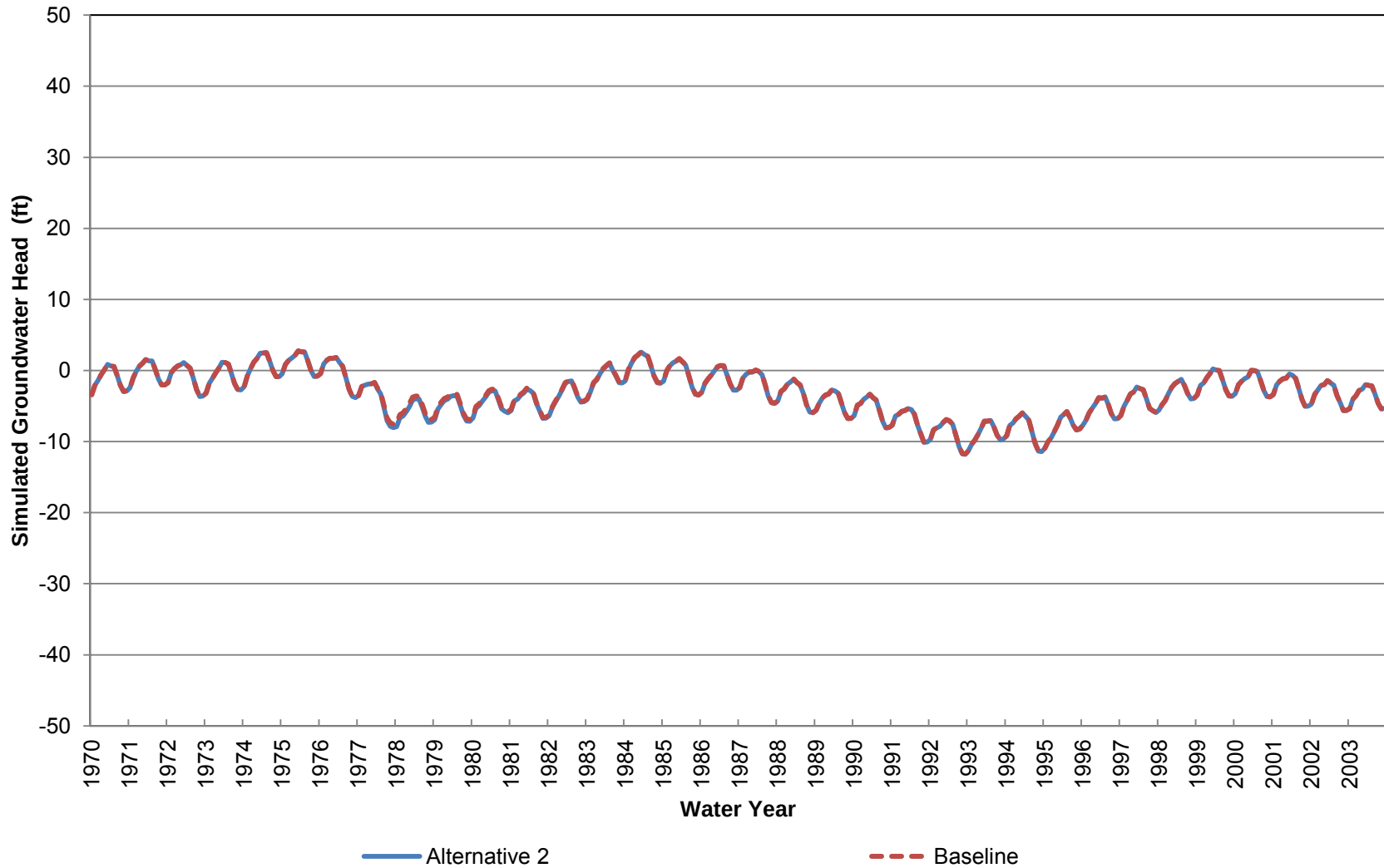
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 70-250 ft bgs)



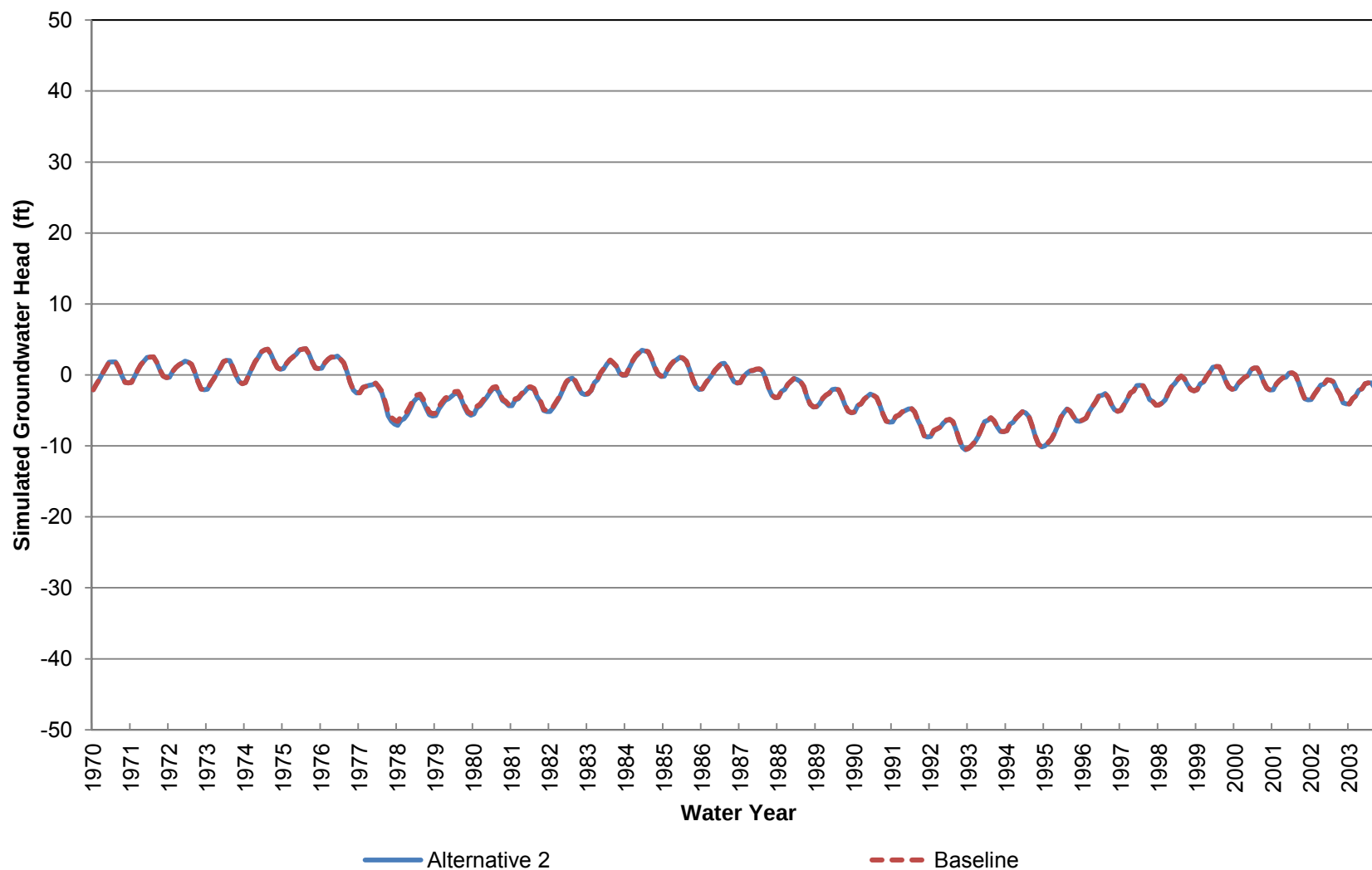
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 250-440 ft bgs)



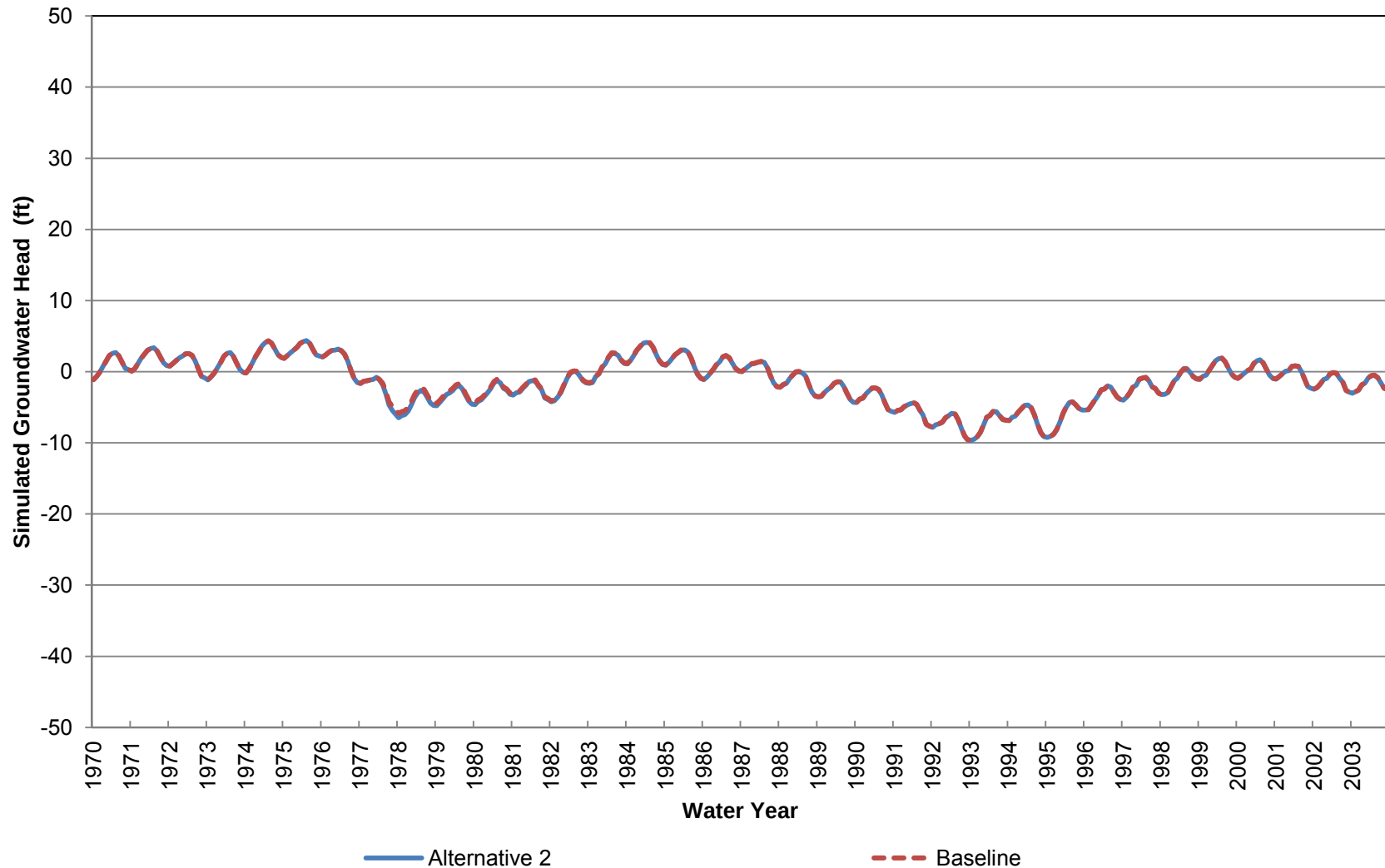
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 440-620 ft bgs)



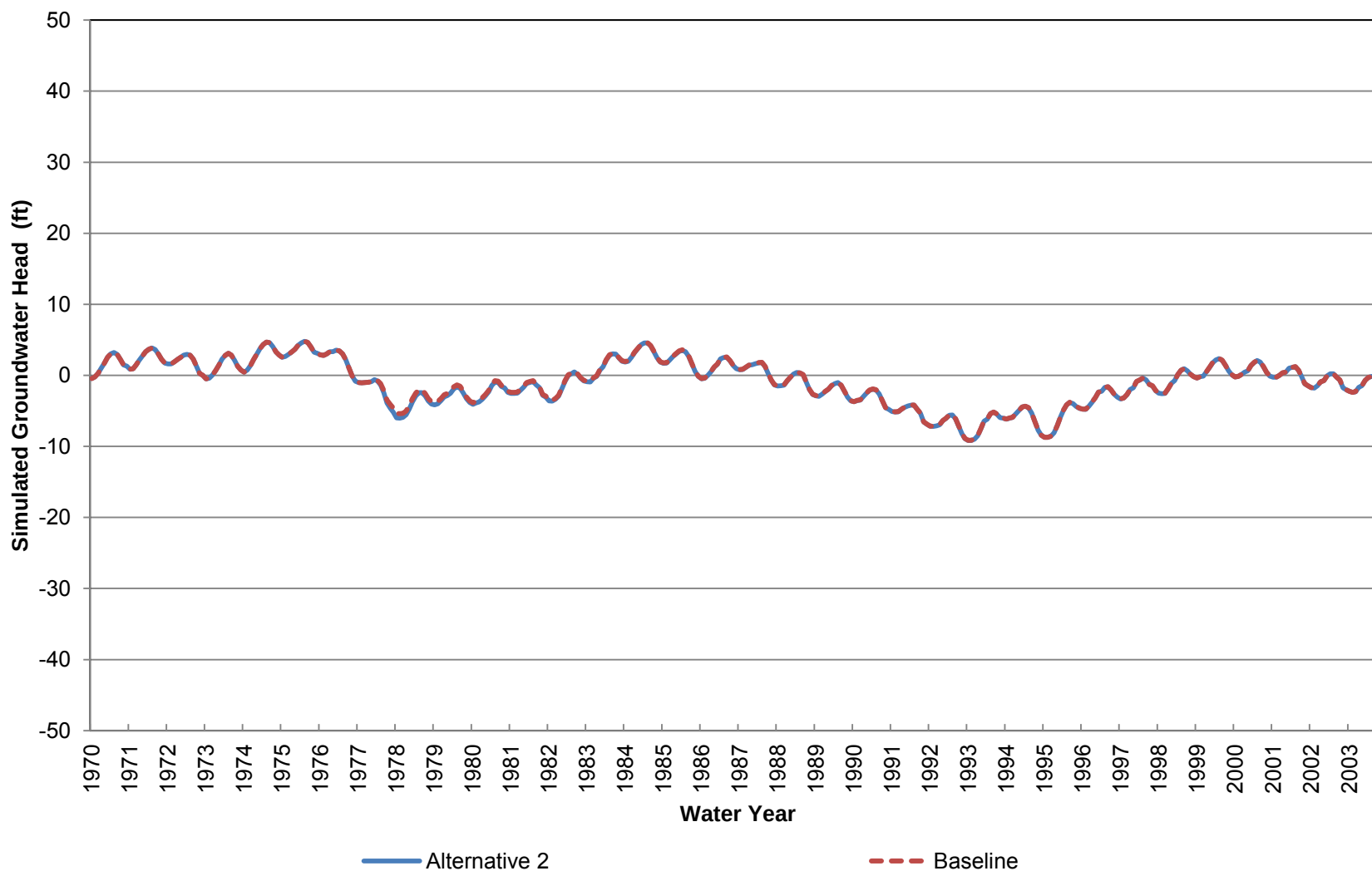
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 620-920 ft bgs)



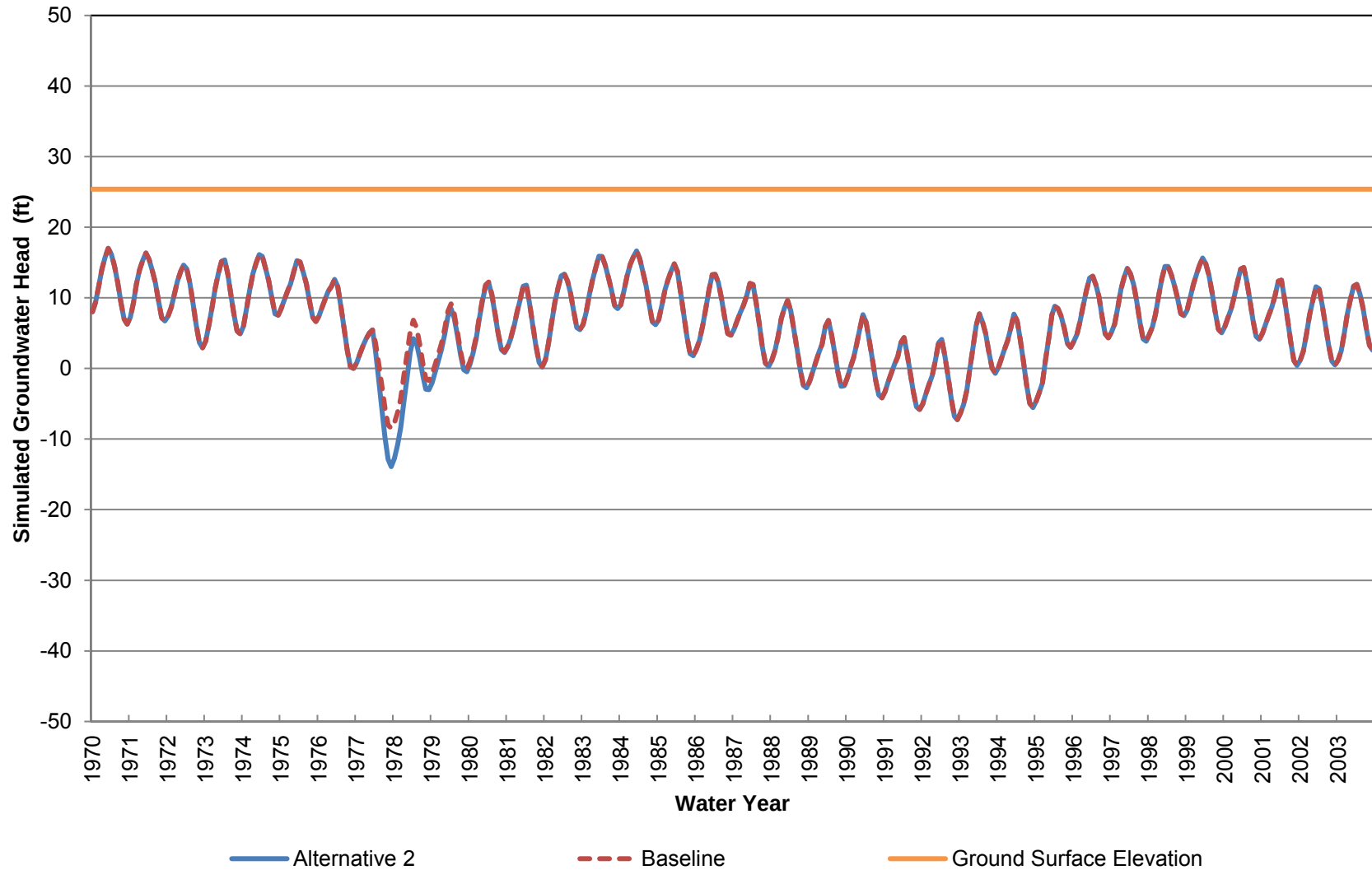
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 920-1220 ft bgs)



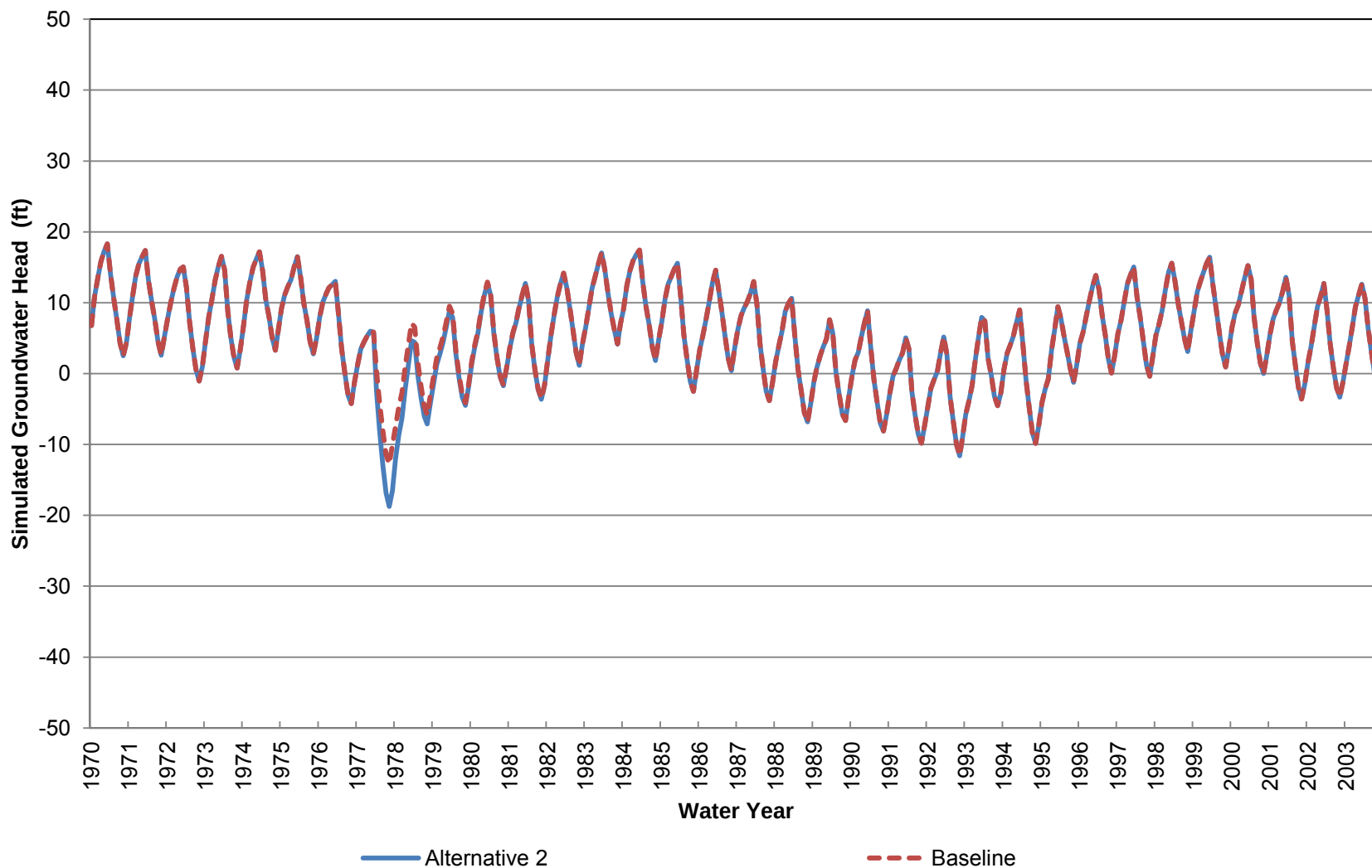
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 1220-1680 ft bgs)



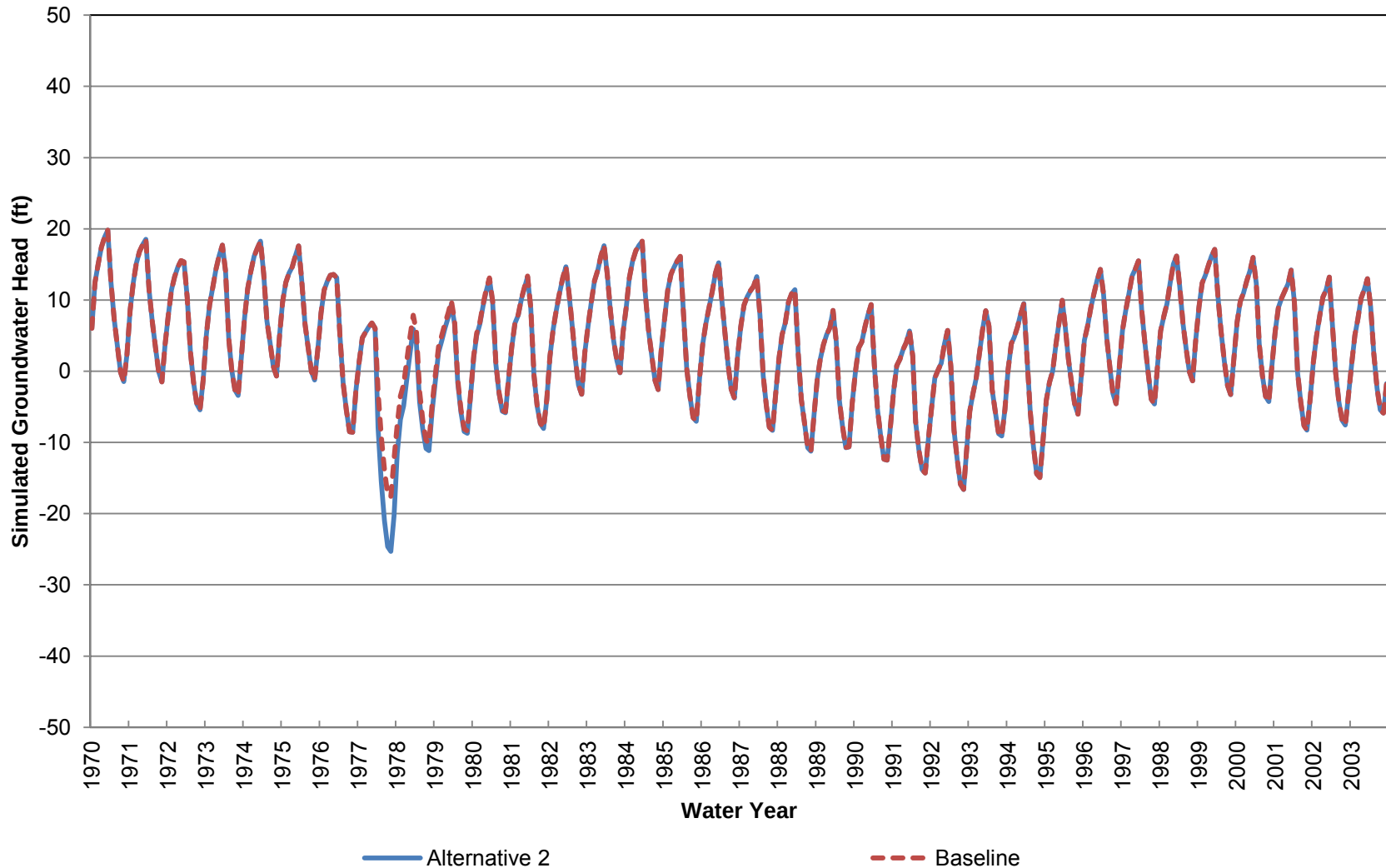
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 29 (Approximately 0-70 ft bgs)



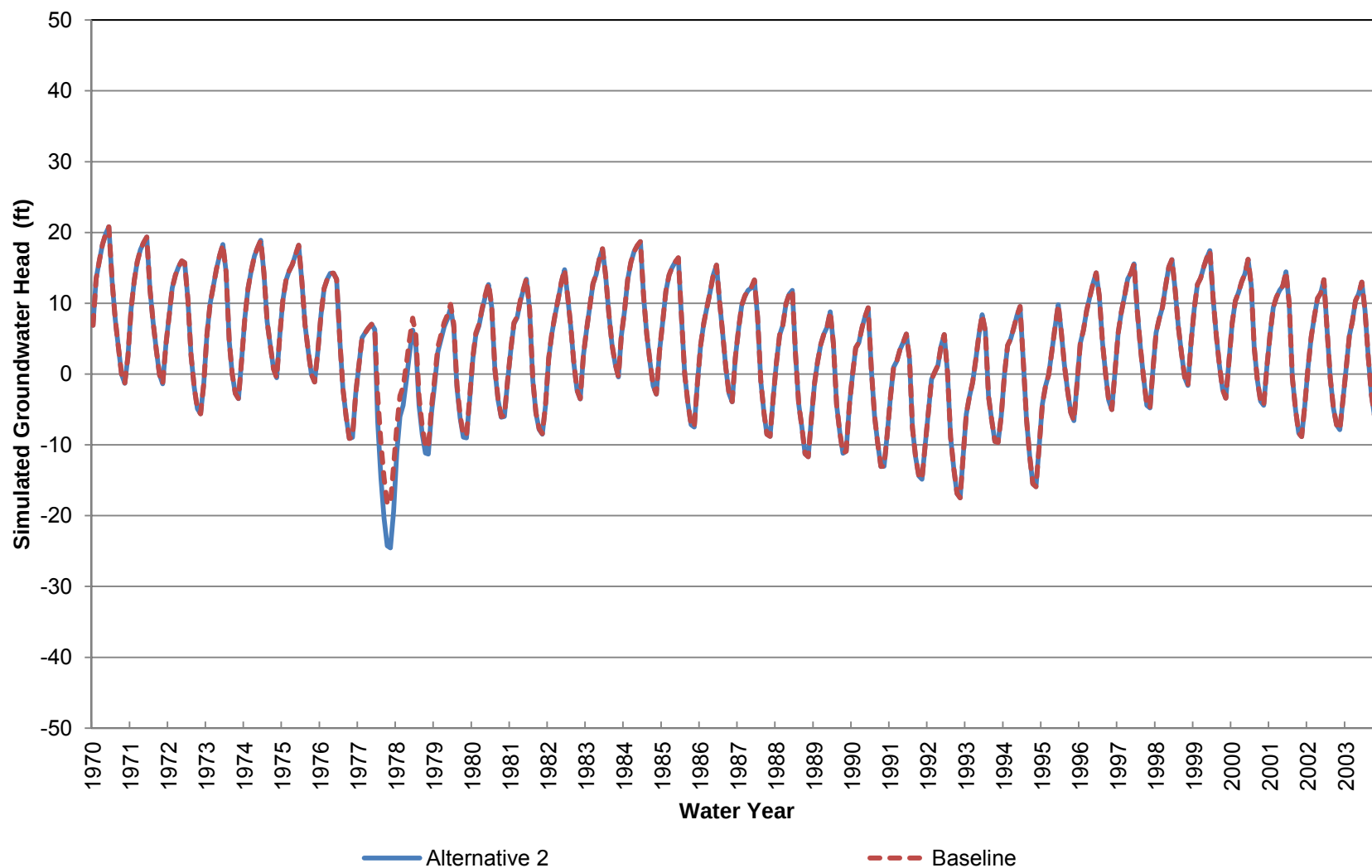
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 70-200 ft bgs)



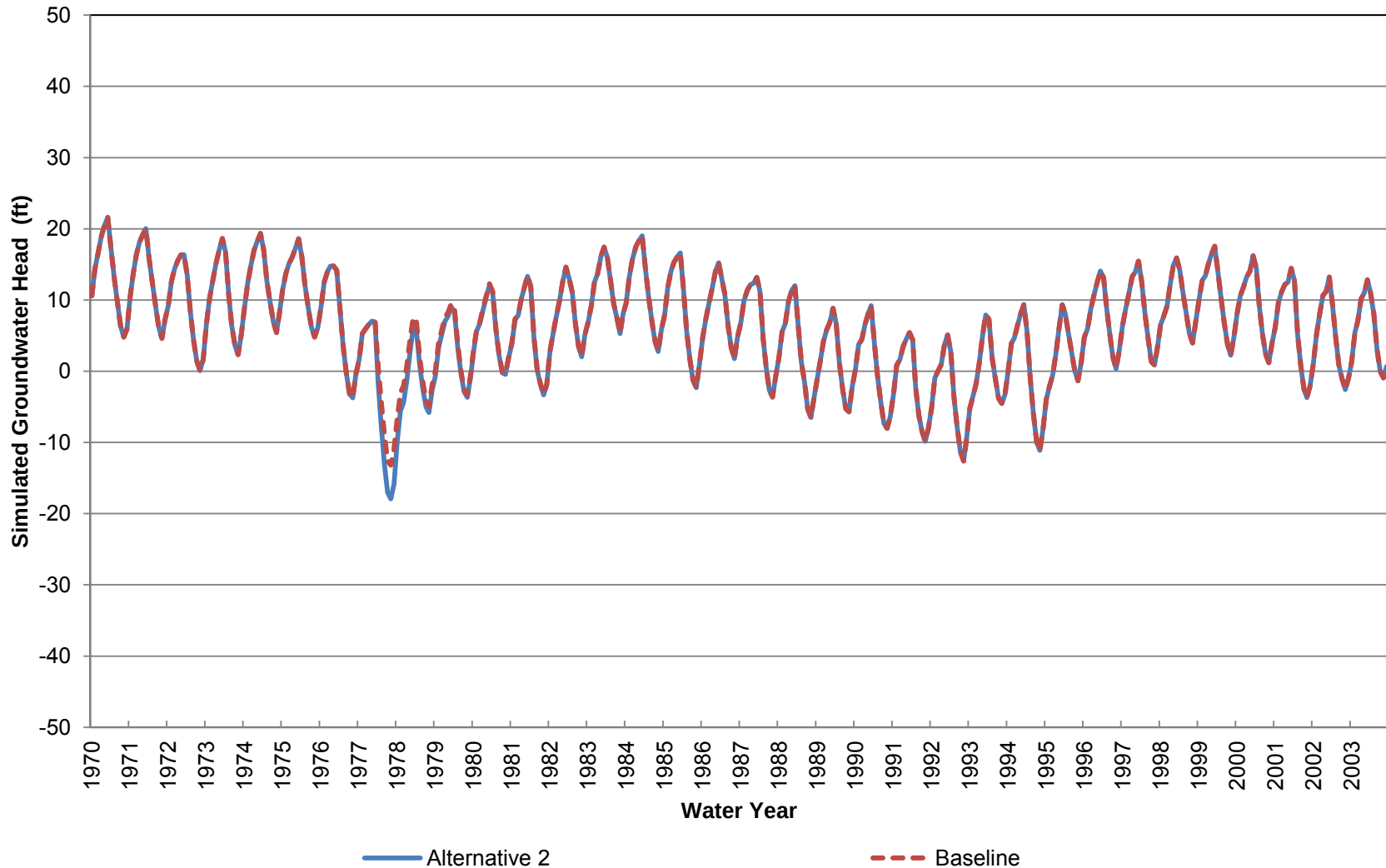
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 200-330 ft bgs)



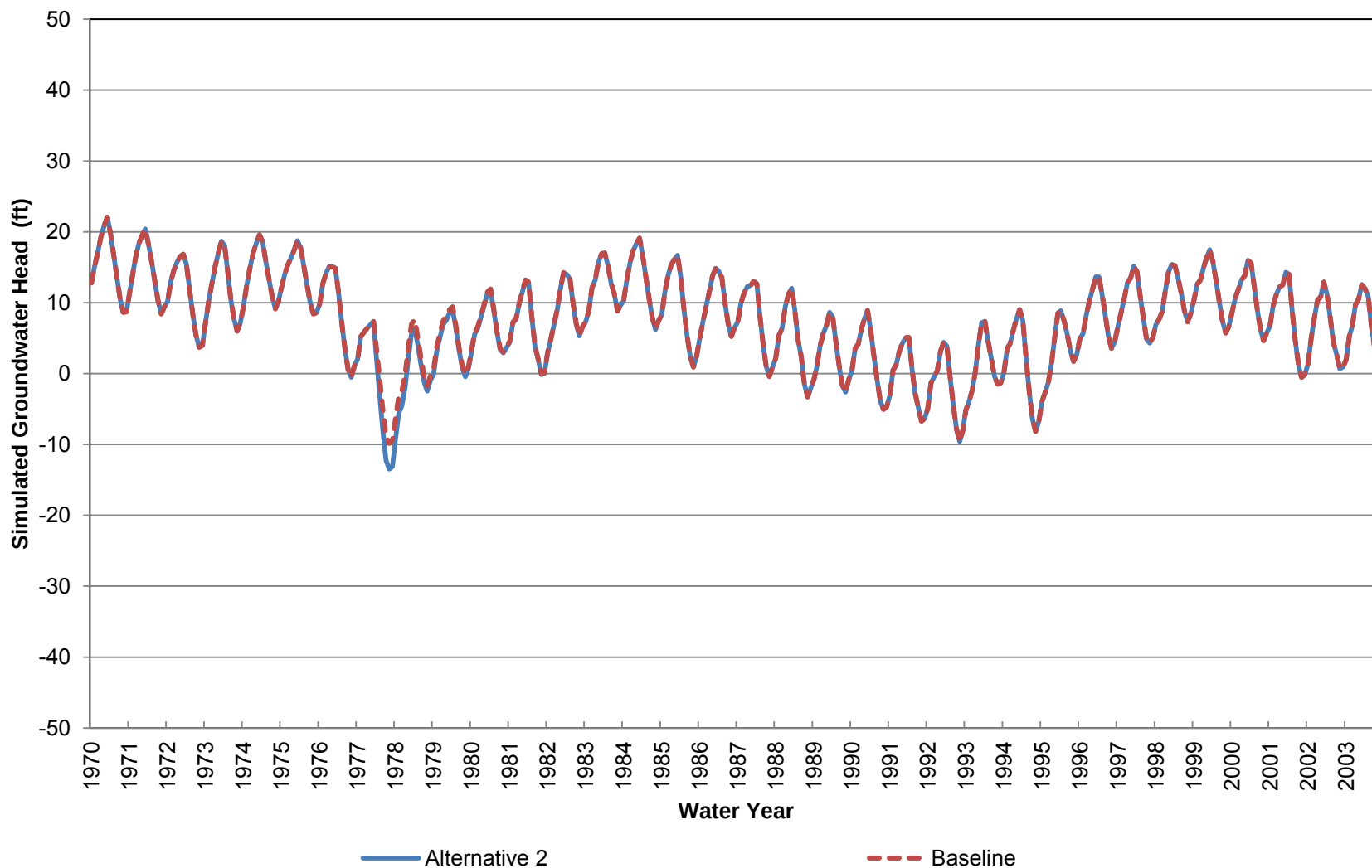
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 330-470 ft bgs)



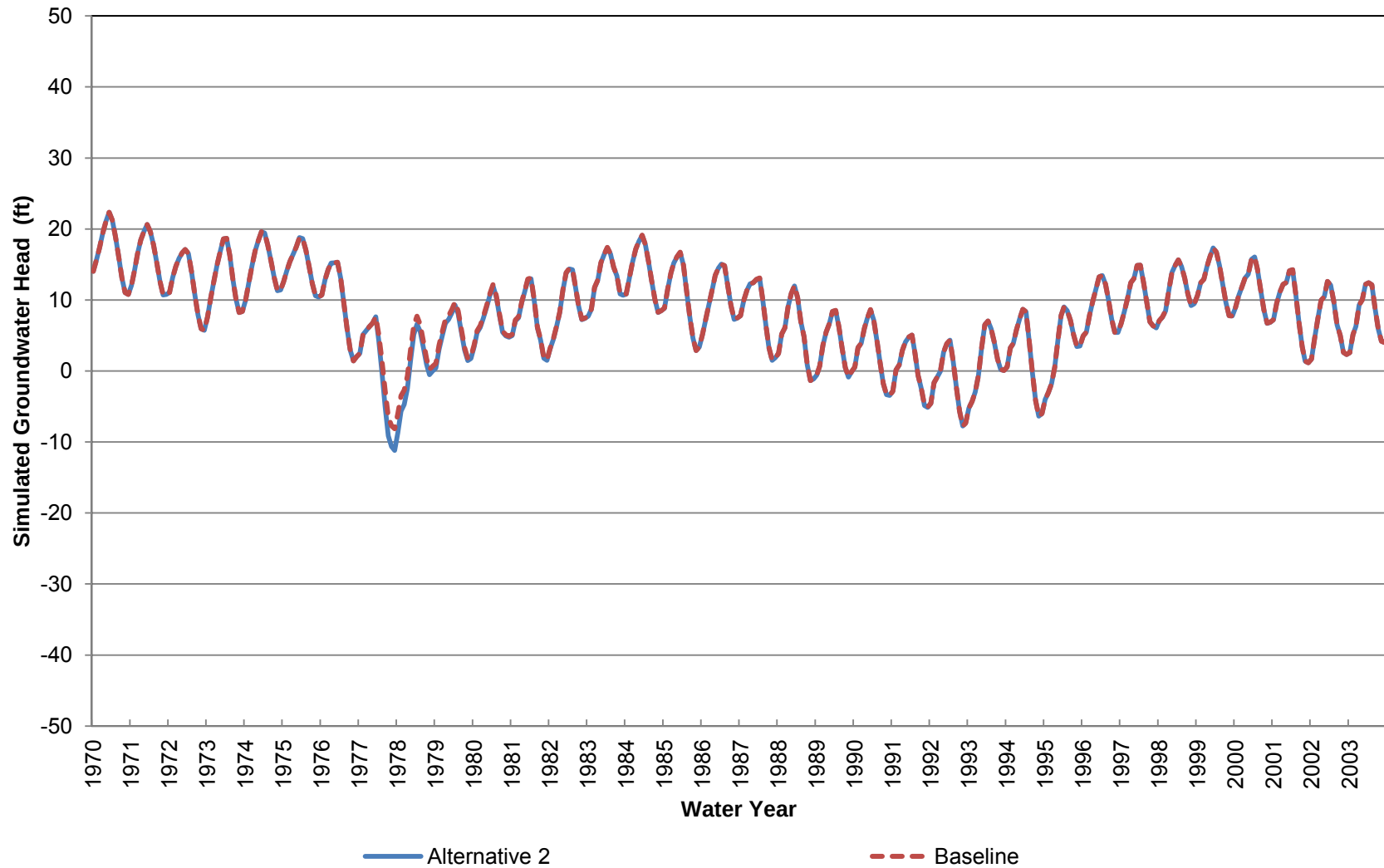
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 470-660 ft bgs)



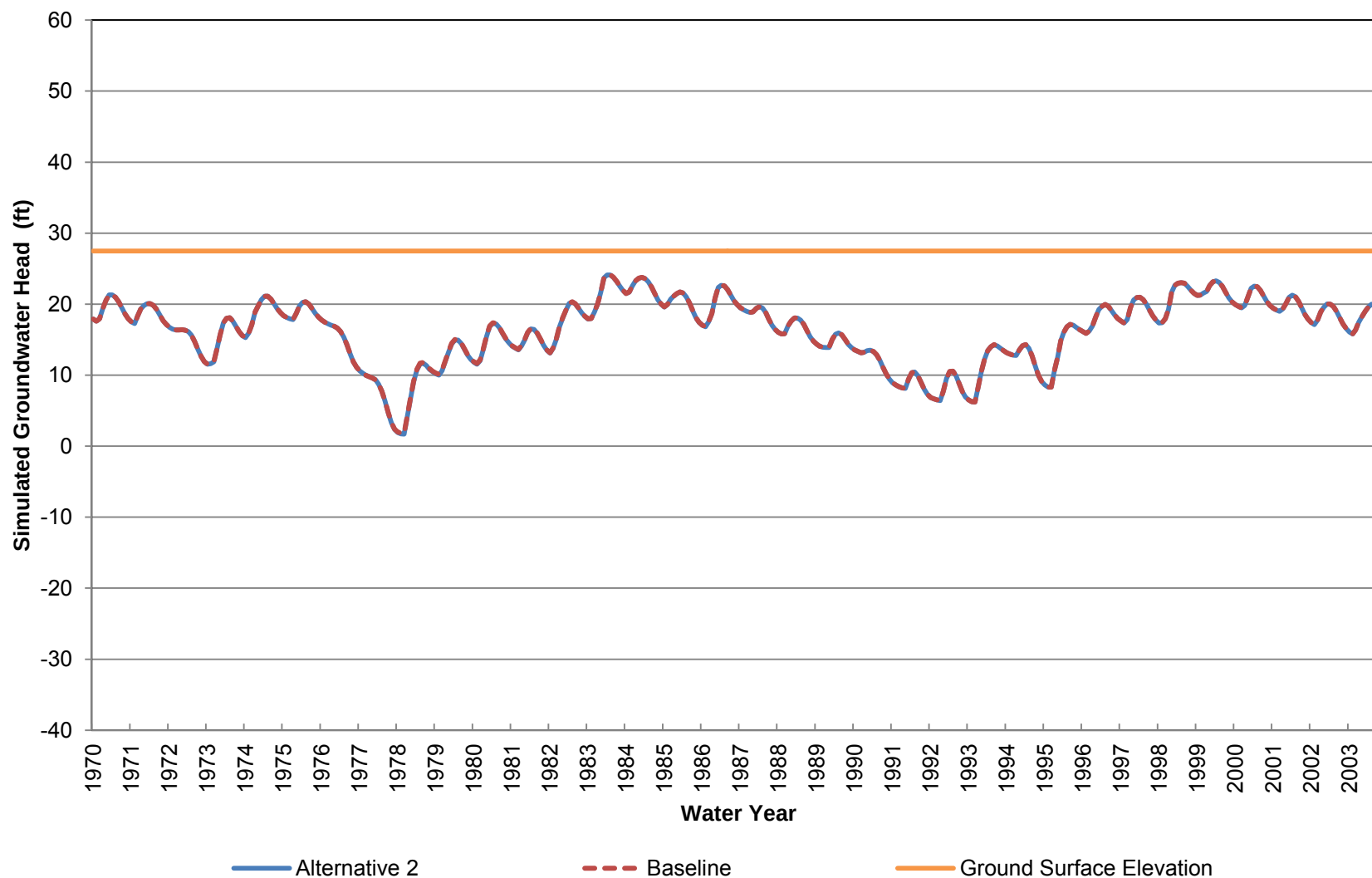
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 660-880 ft bgs)



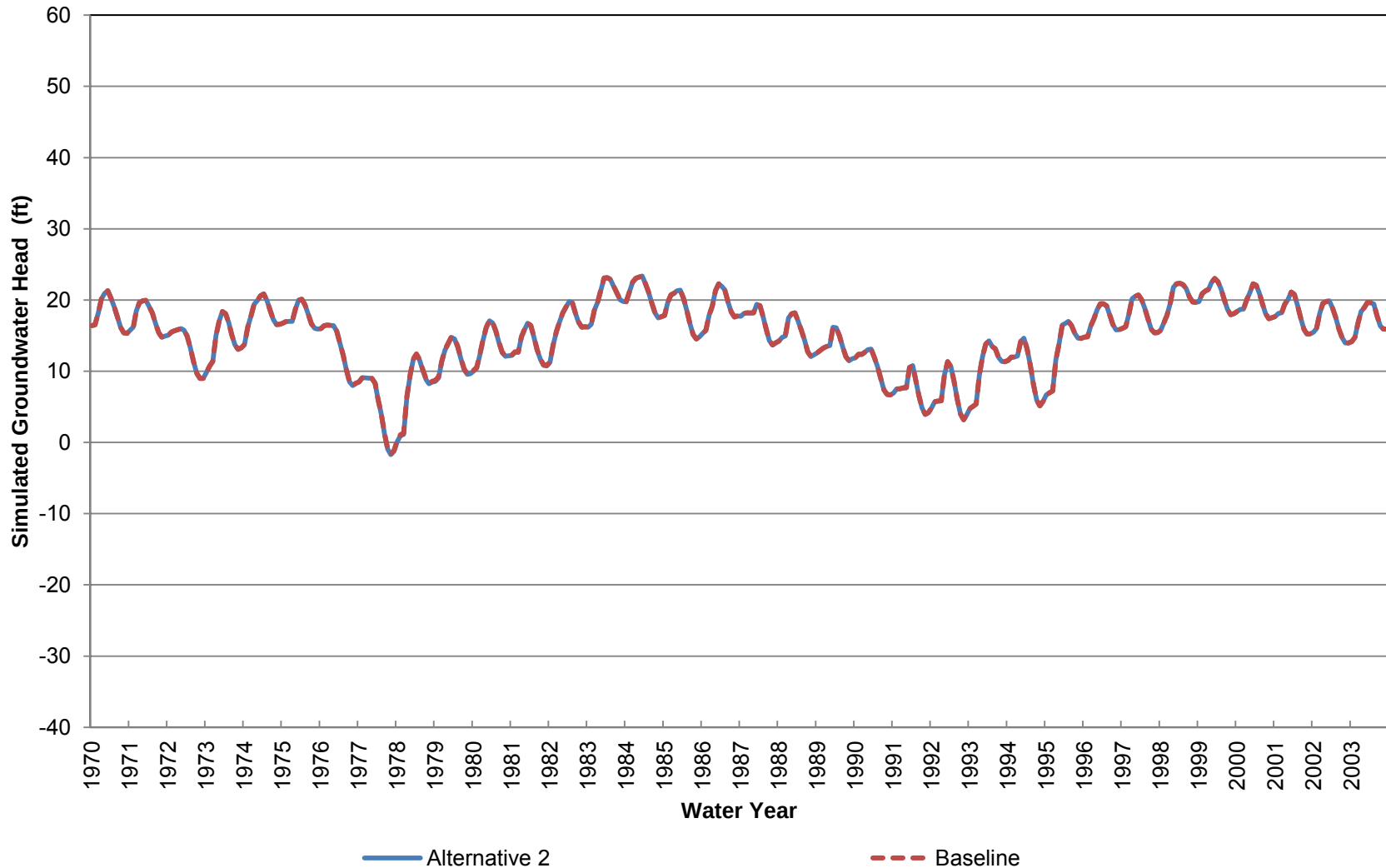
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 880-1210 ft bgs)



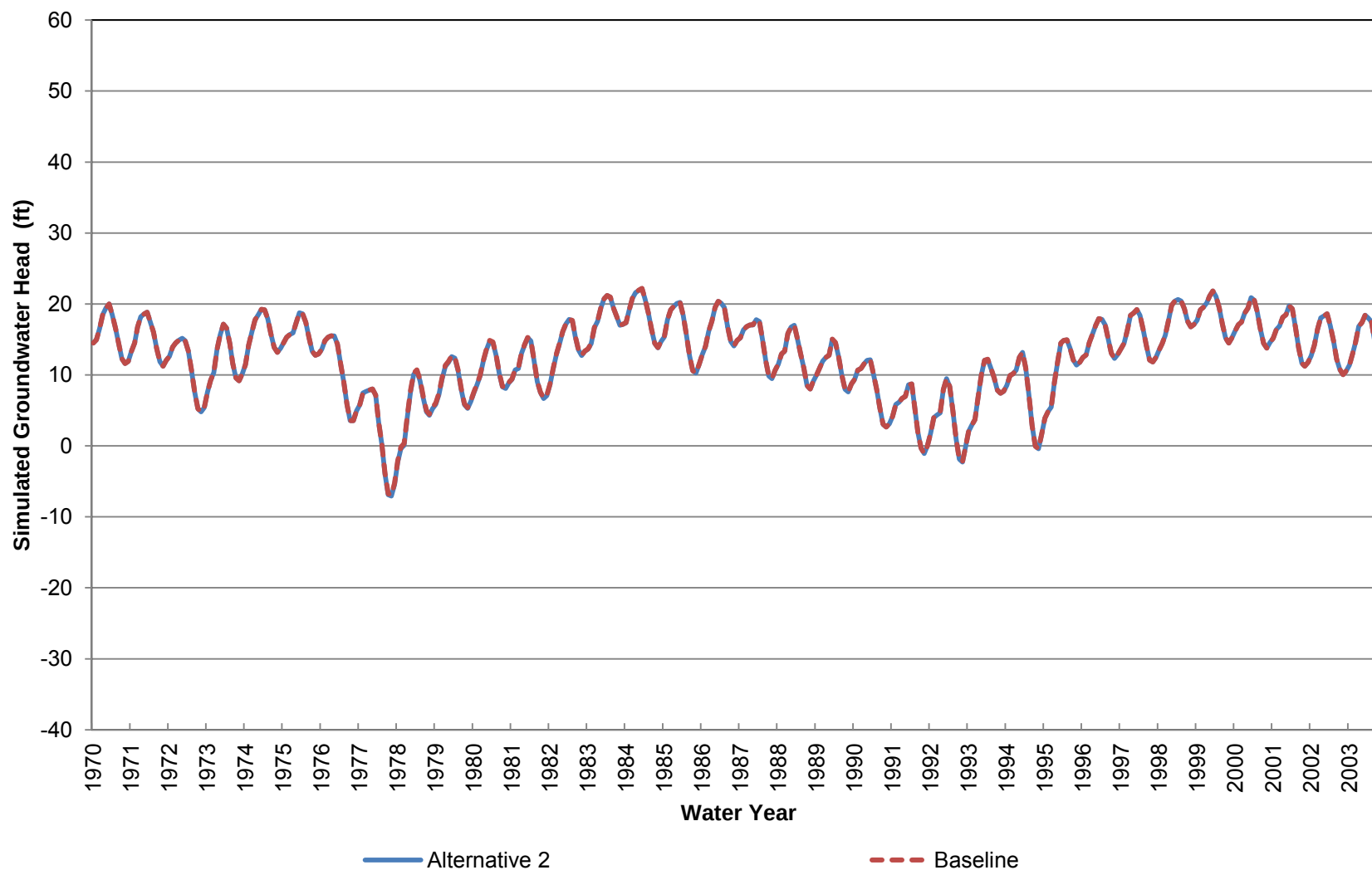
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 30 (Approximately 0-70 ft bgs)



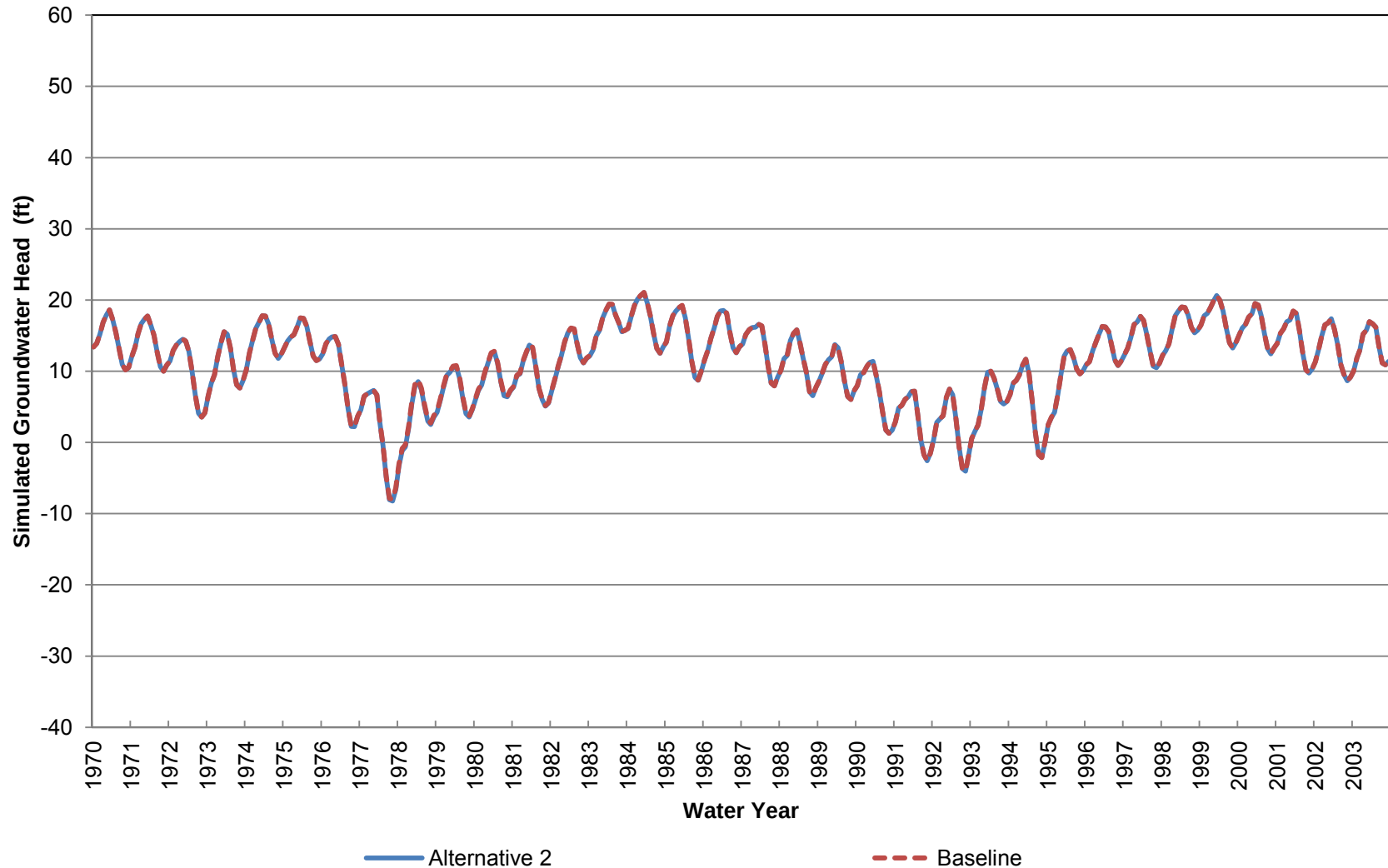
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 70-340 ft bgs)



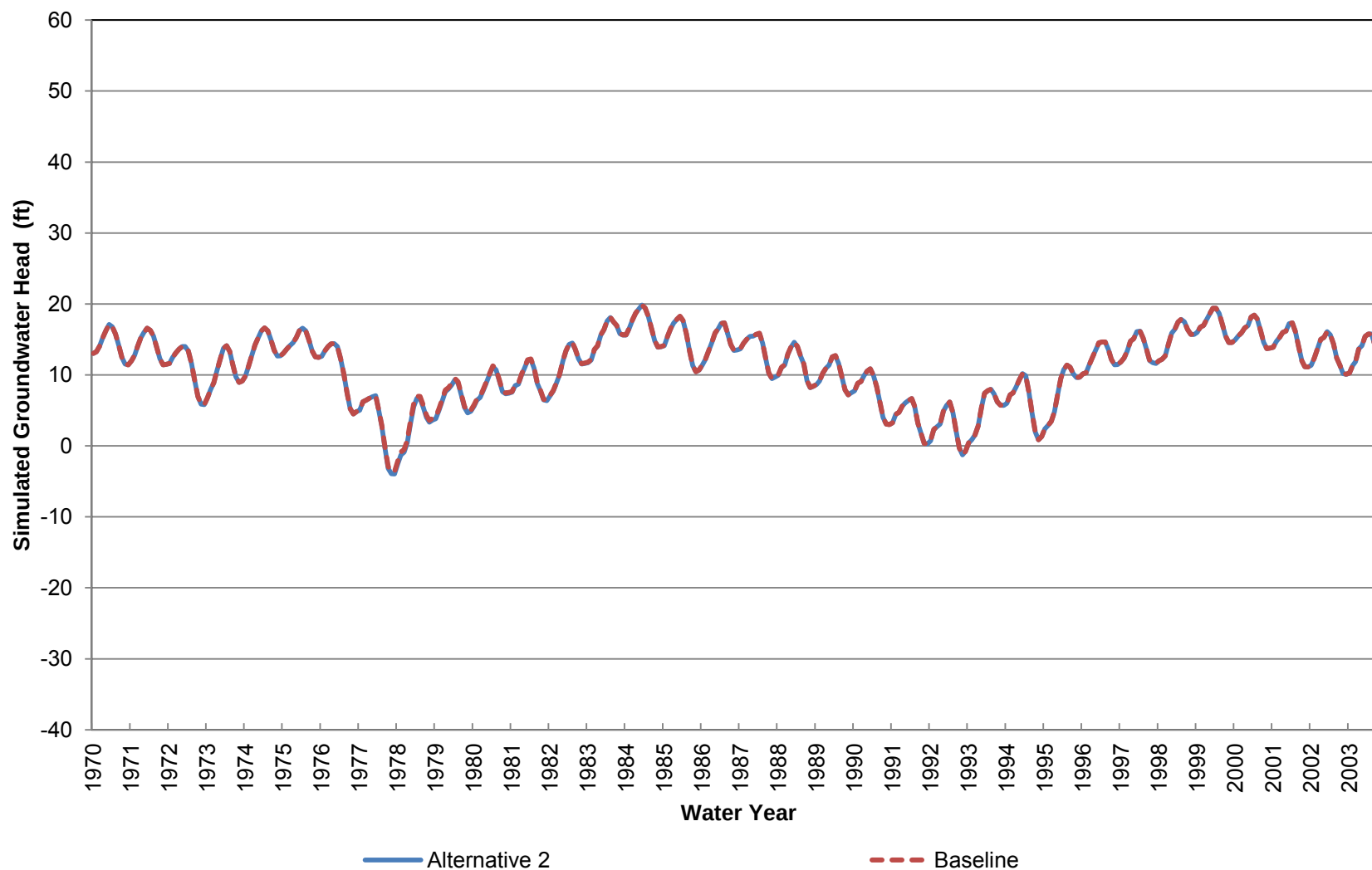
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 340-600 ft bgs)



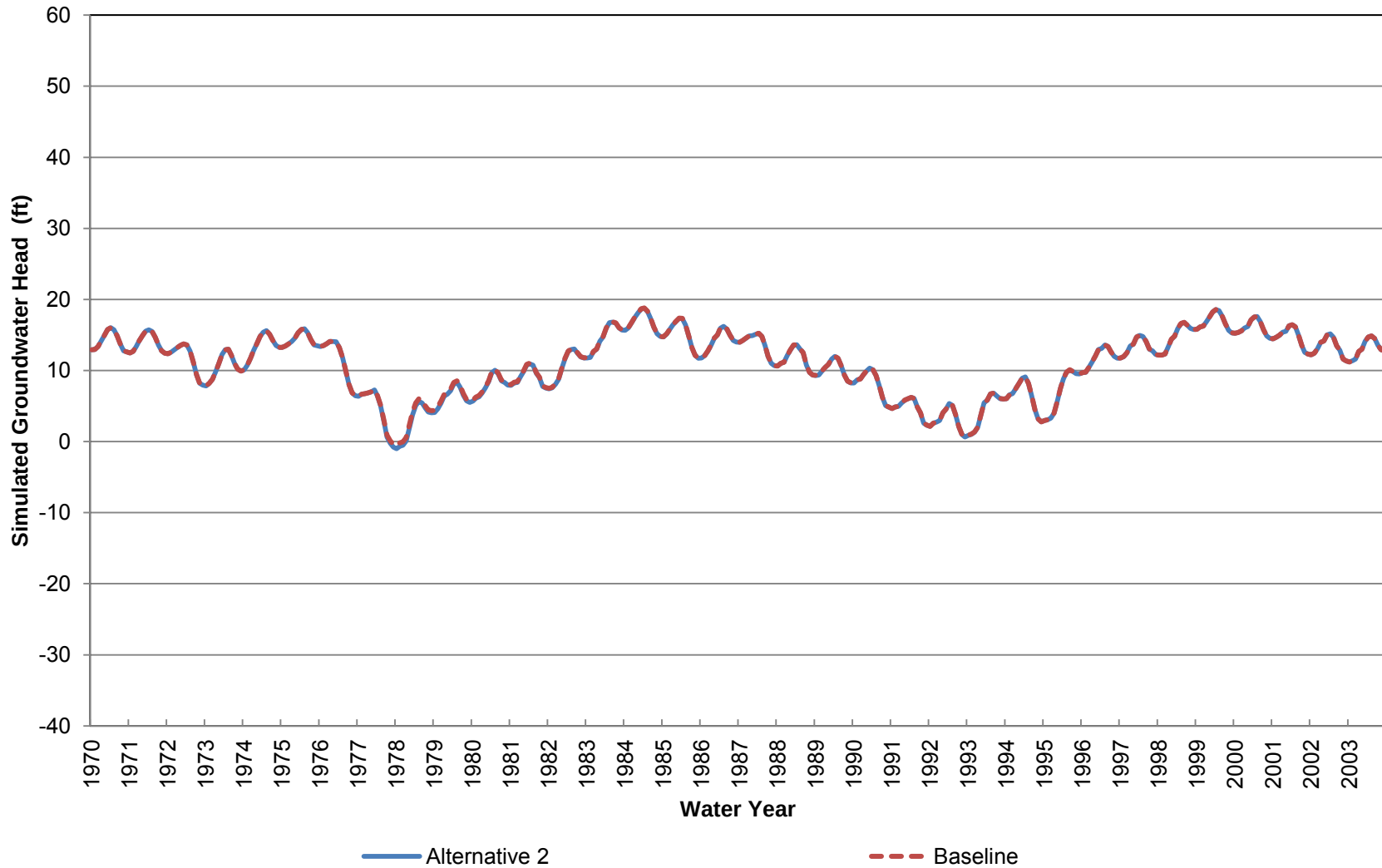
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 600-860 ft bgs)



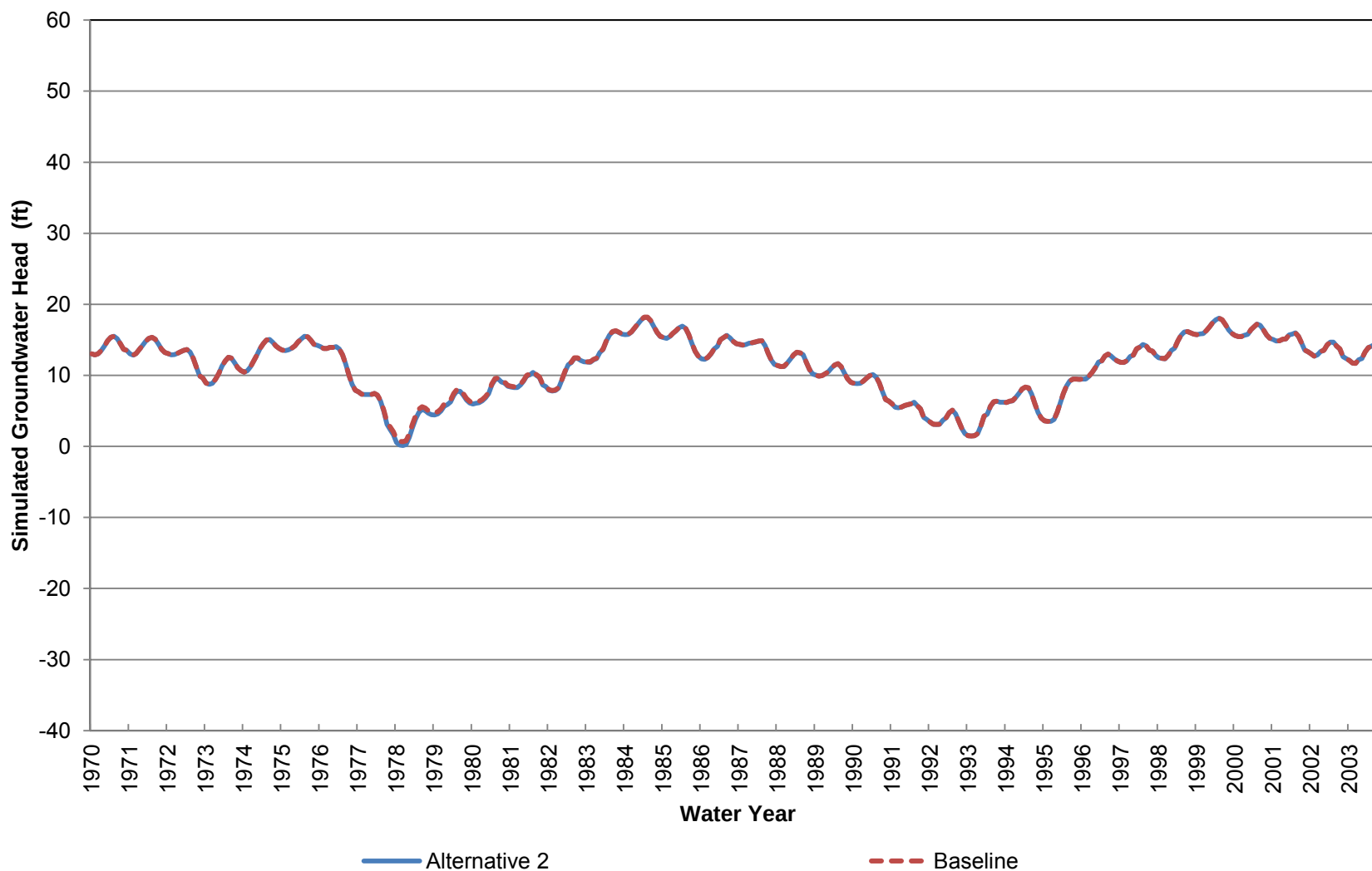
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 860-1330 ft bgs)



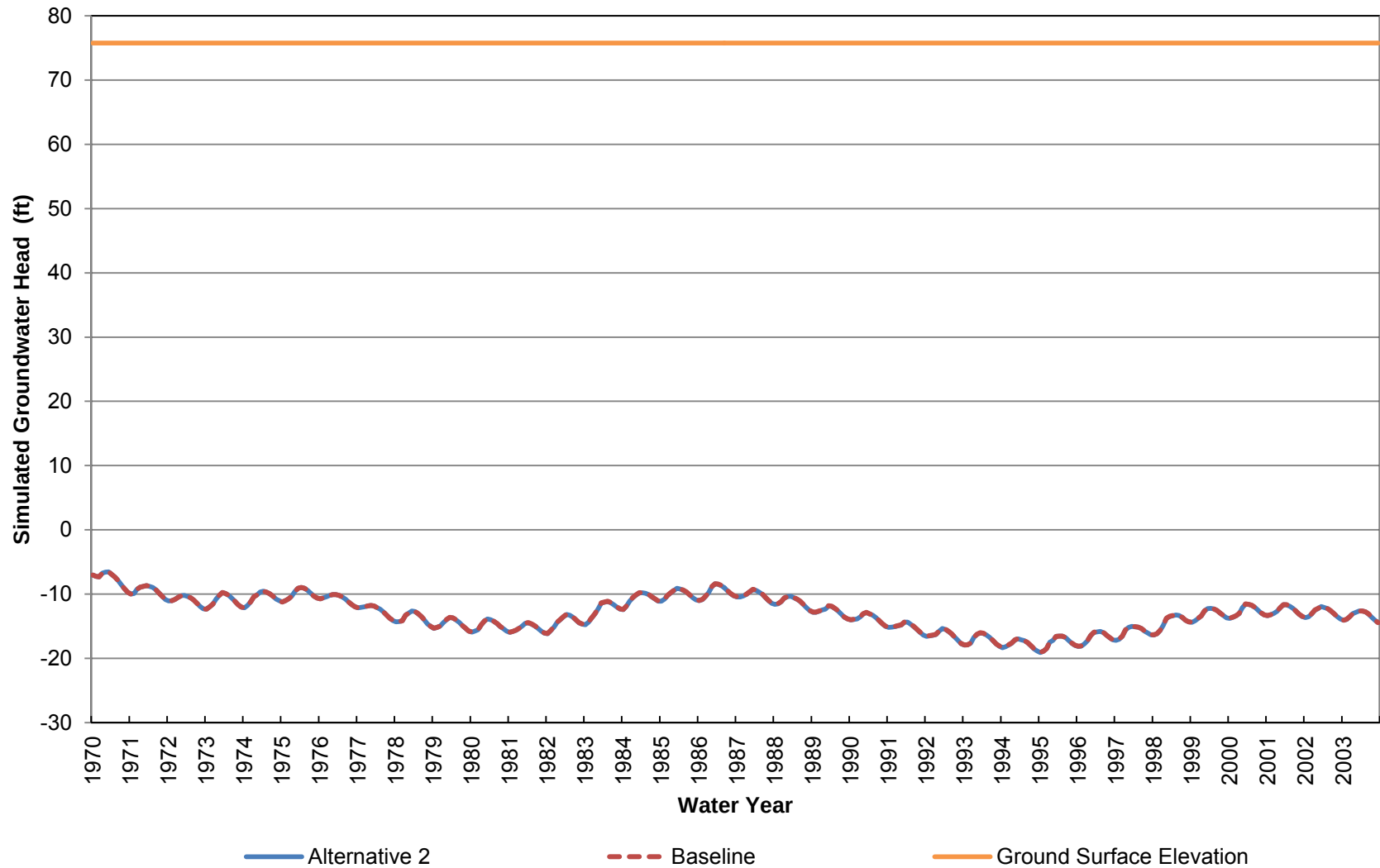
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 1330-1770 ft bgs)



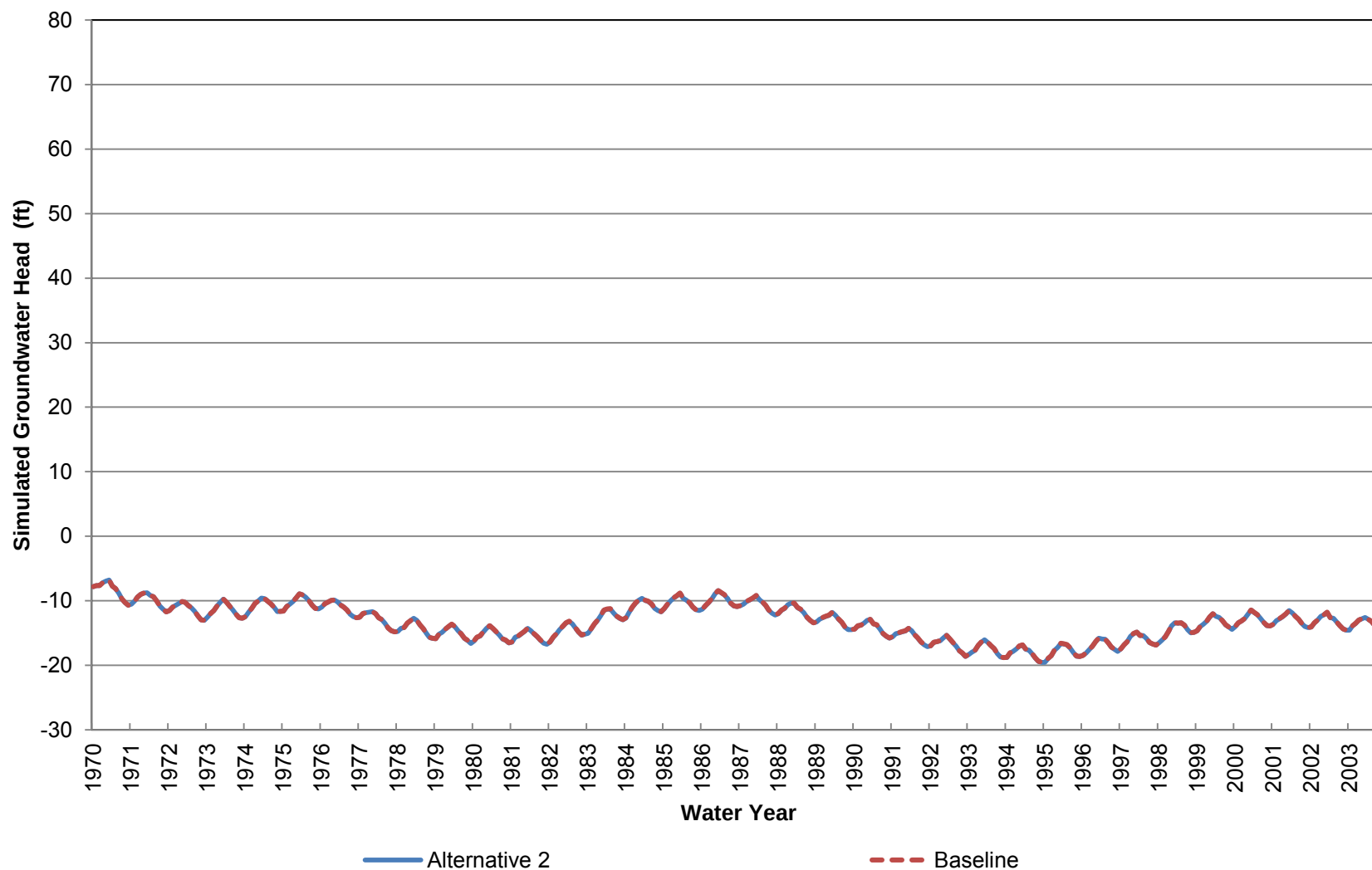
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 1770-2430 ft bgs)



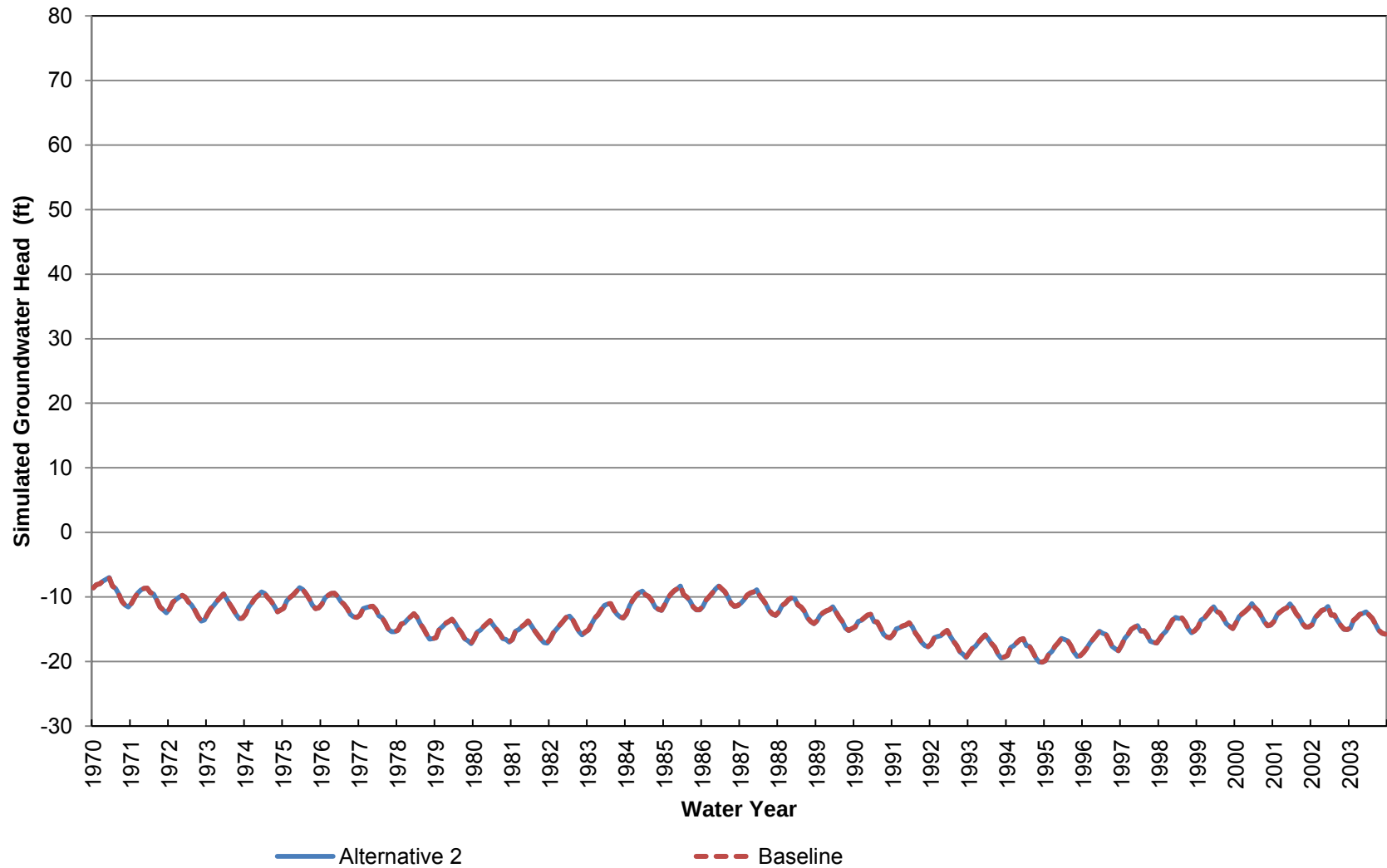
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 31 (Approximately 0-70 ft bgs)



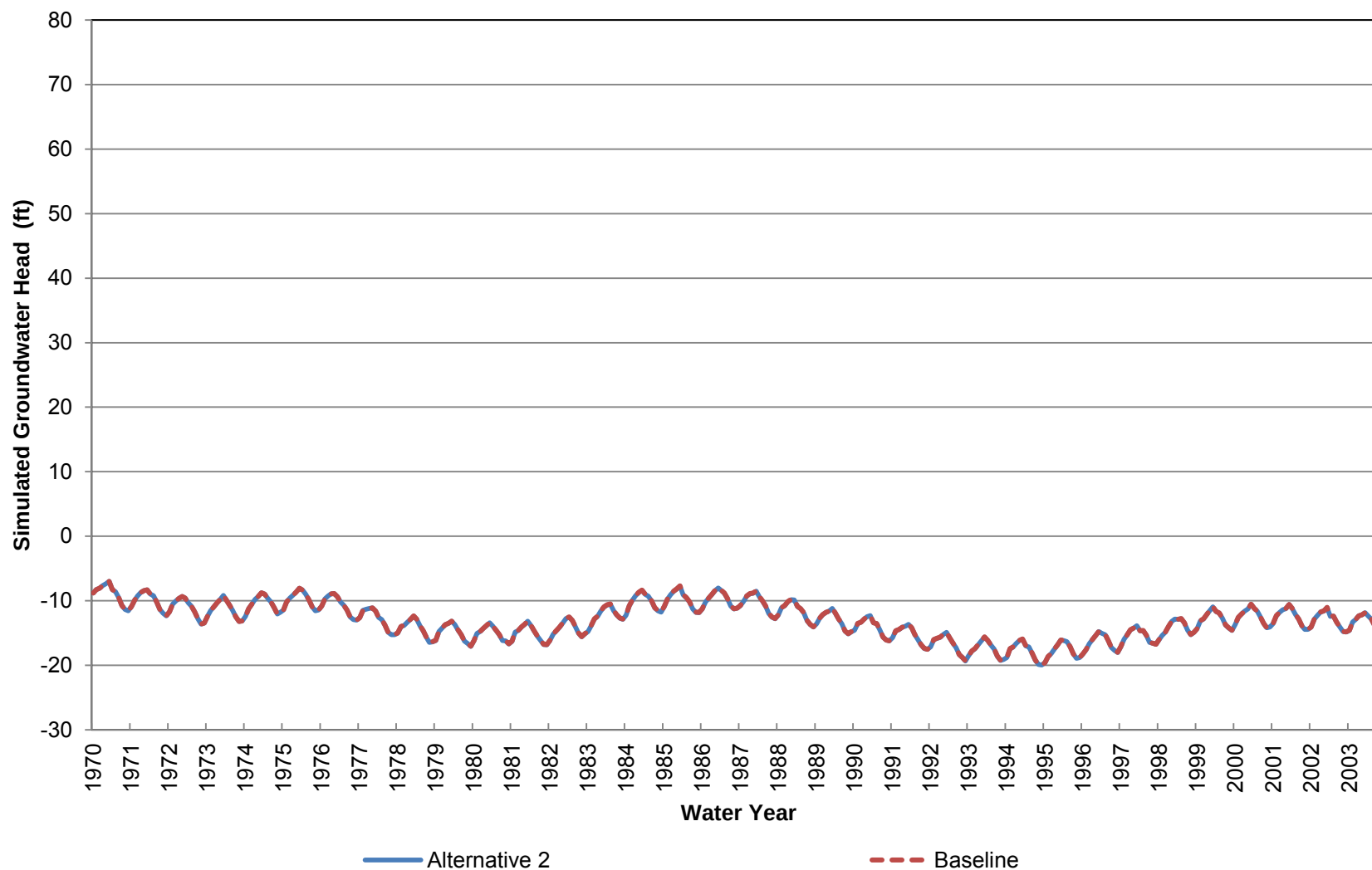
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 70-200 ft bgs)



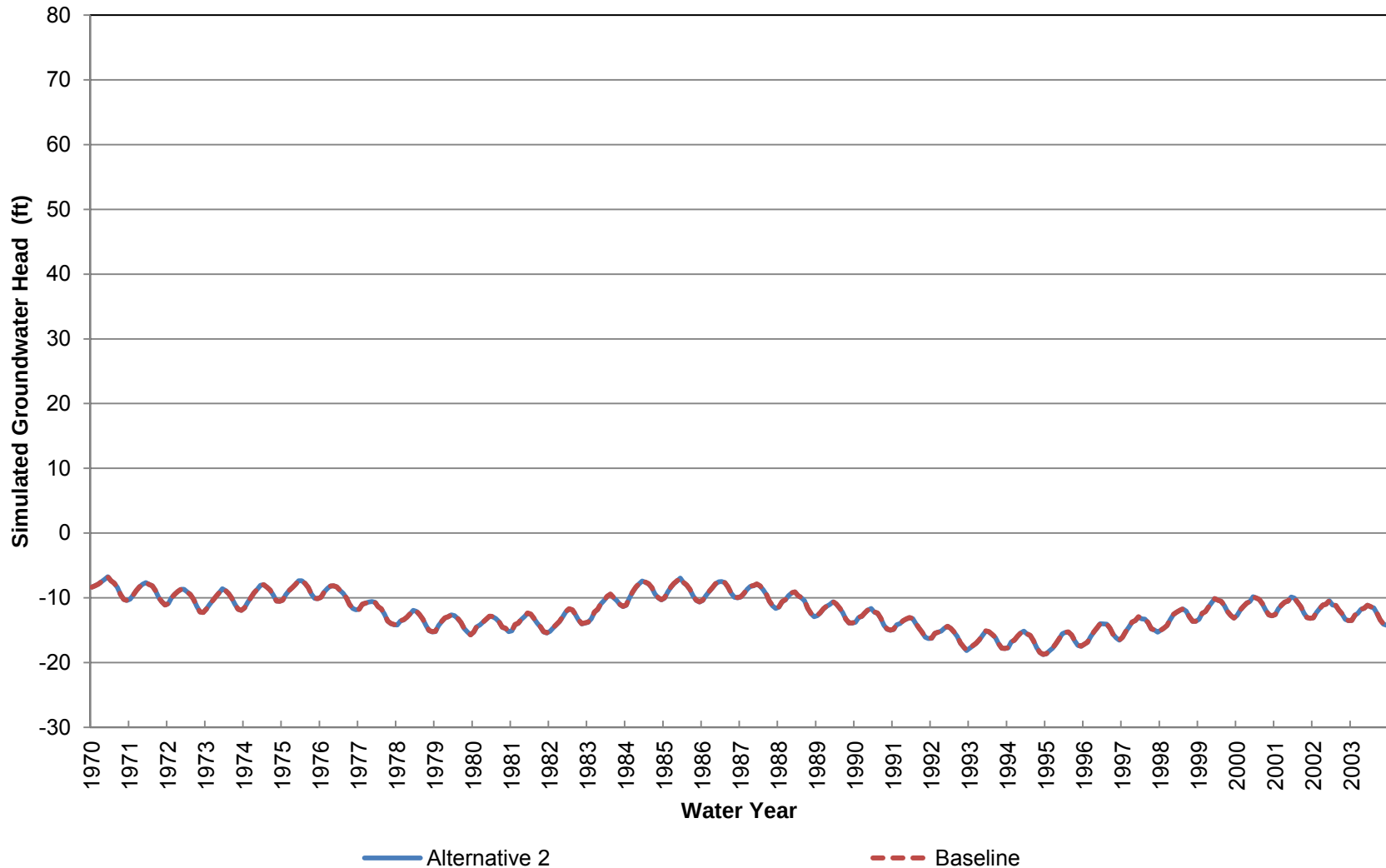
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 200-330 ft bgs)



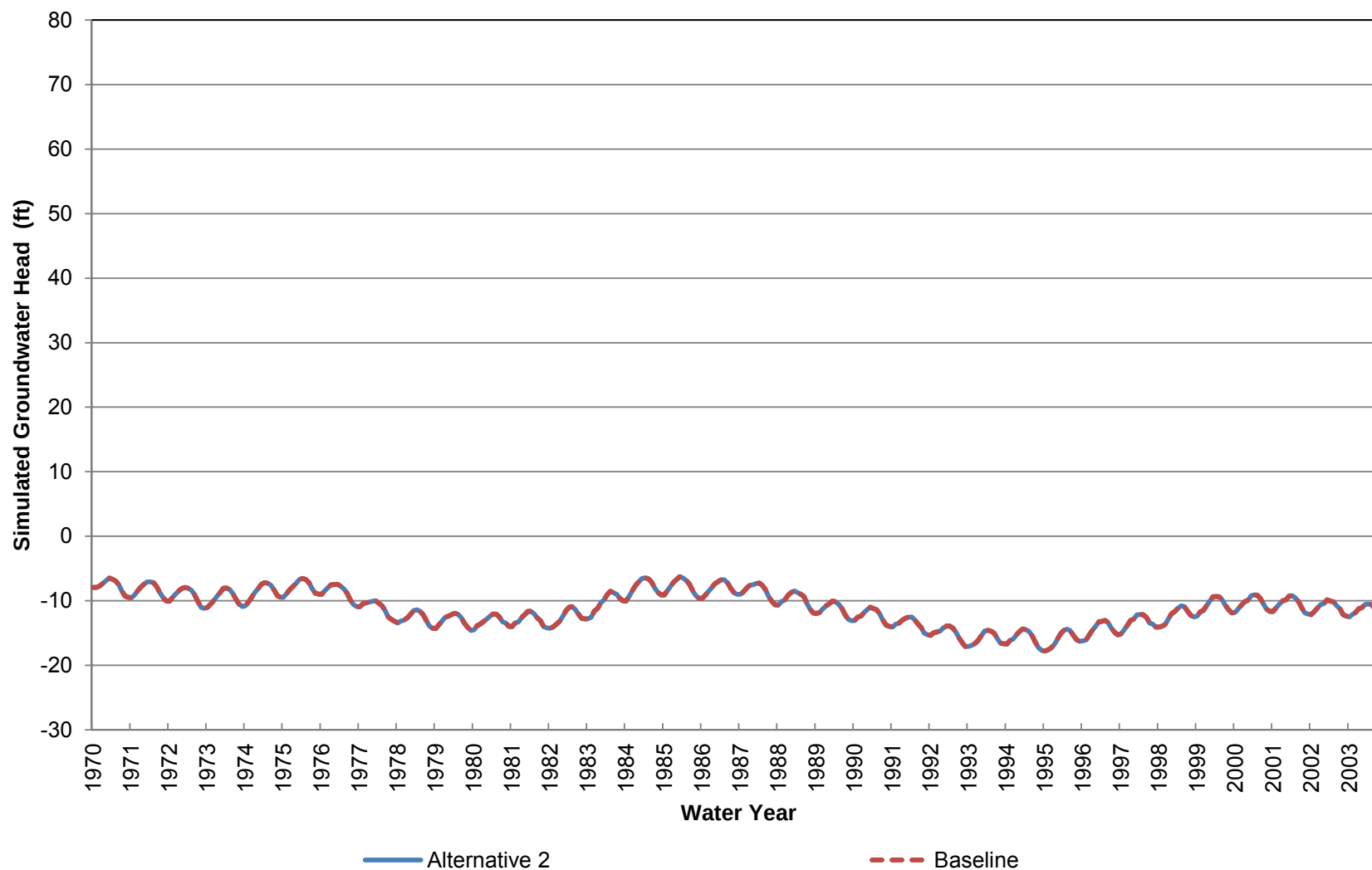
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 330-460 ft bgs)



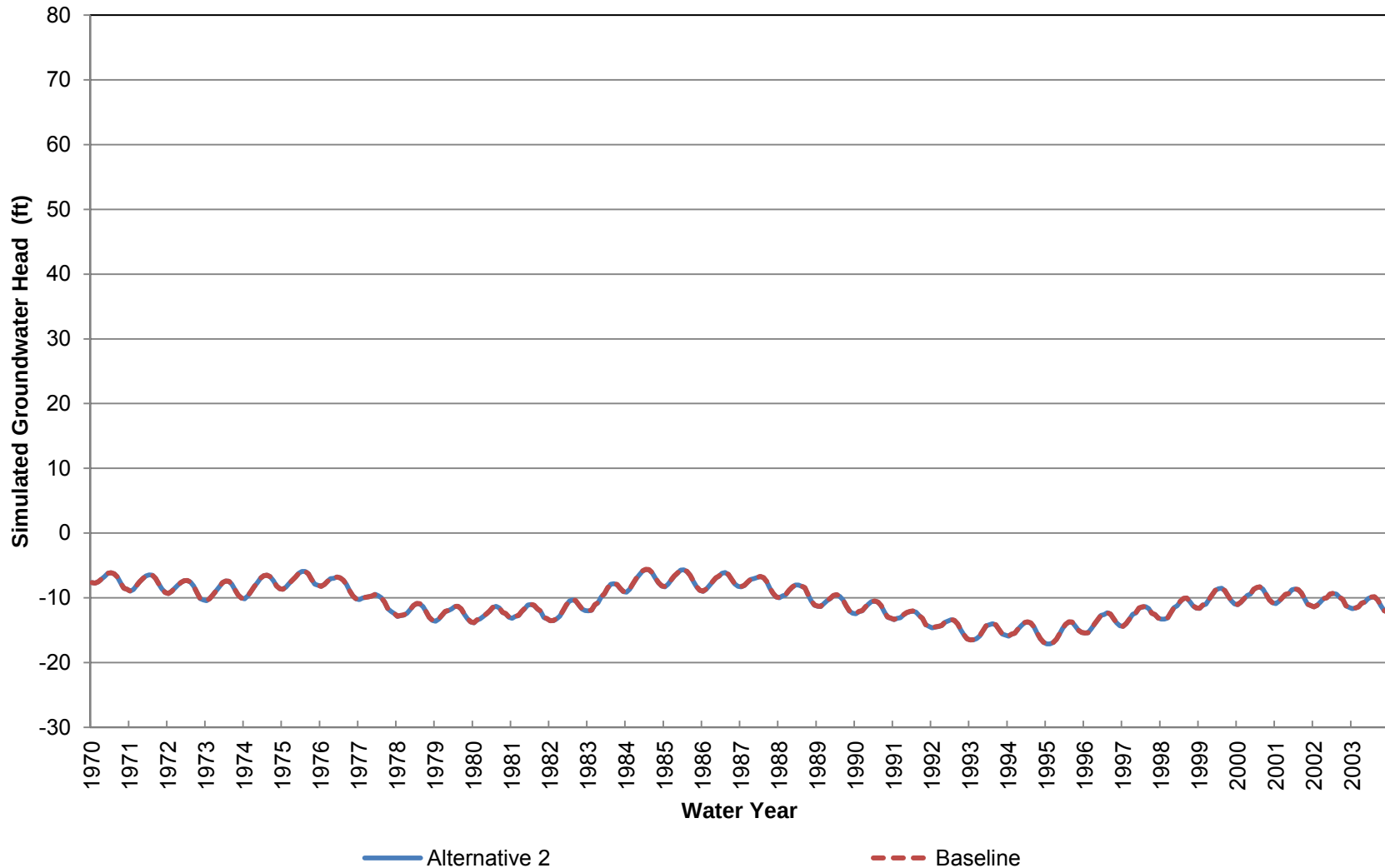
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 460-650 ft bgs)



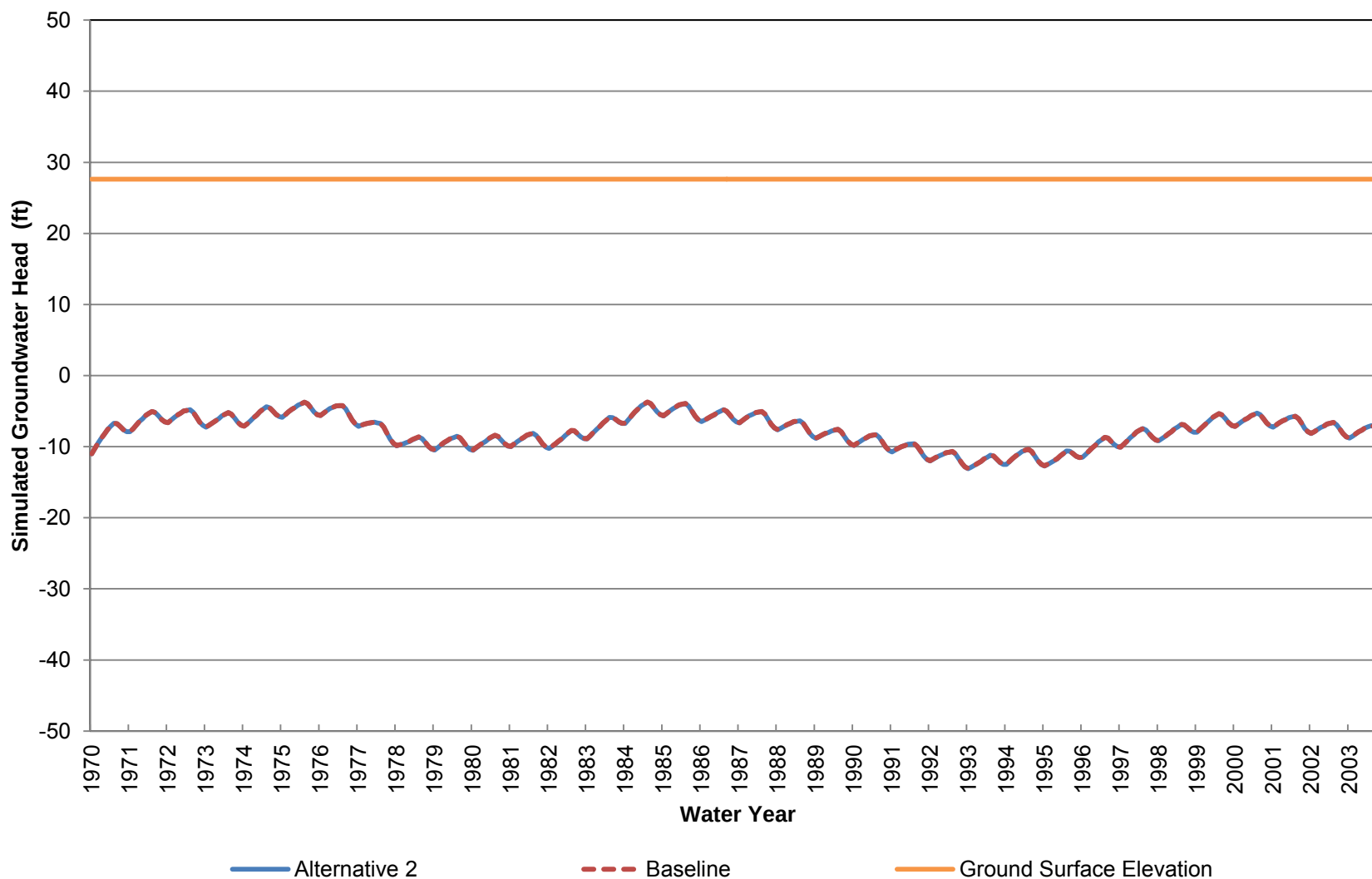
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 650-870 ft bgs)



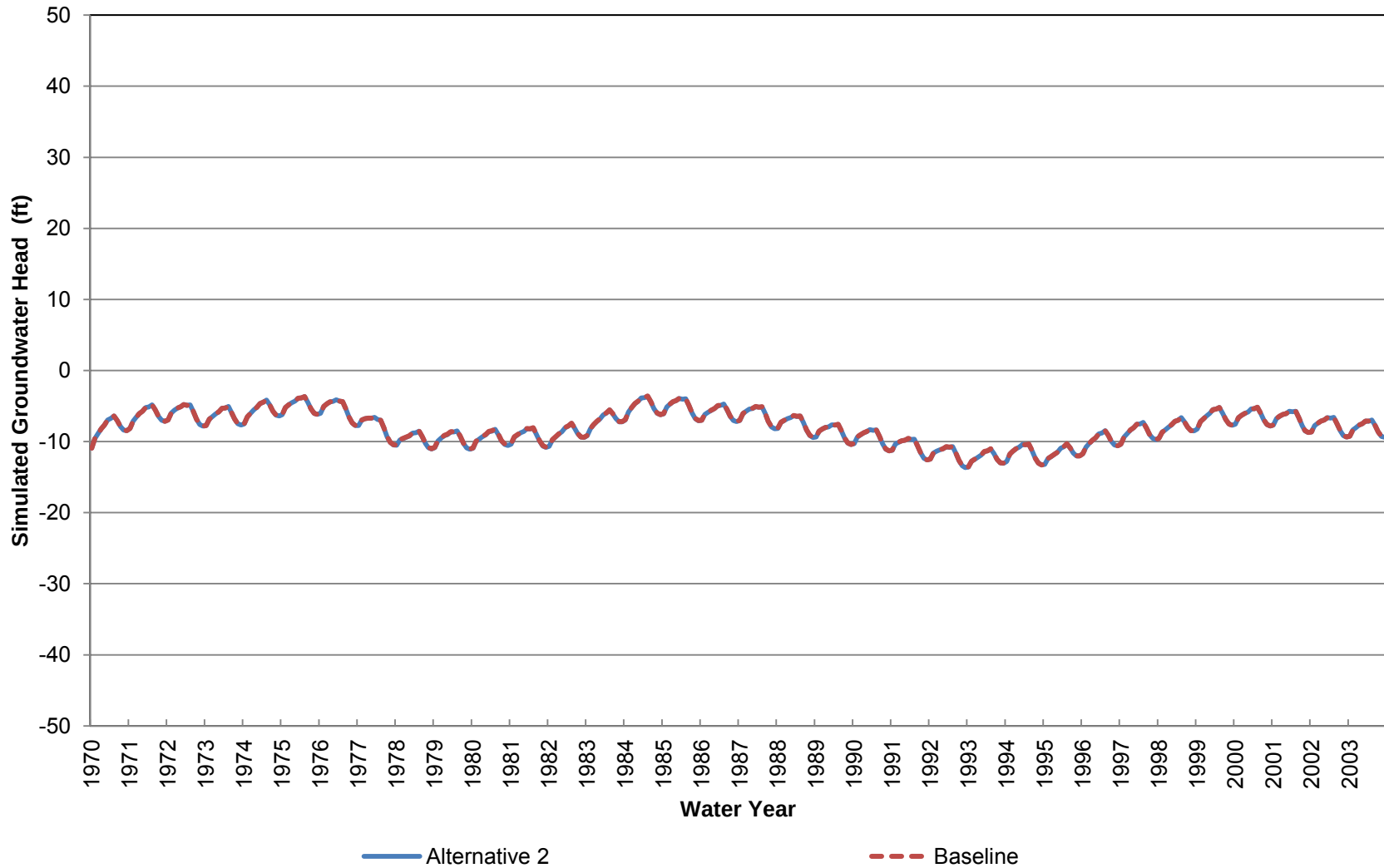
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 870-1190 ft bgs)



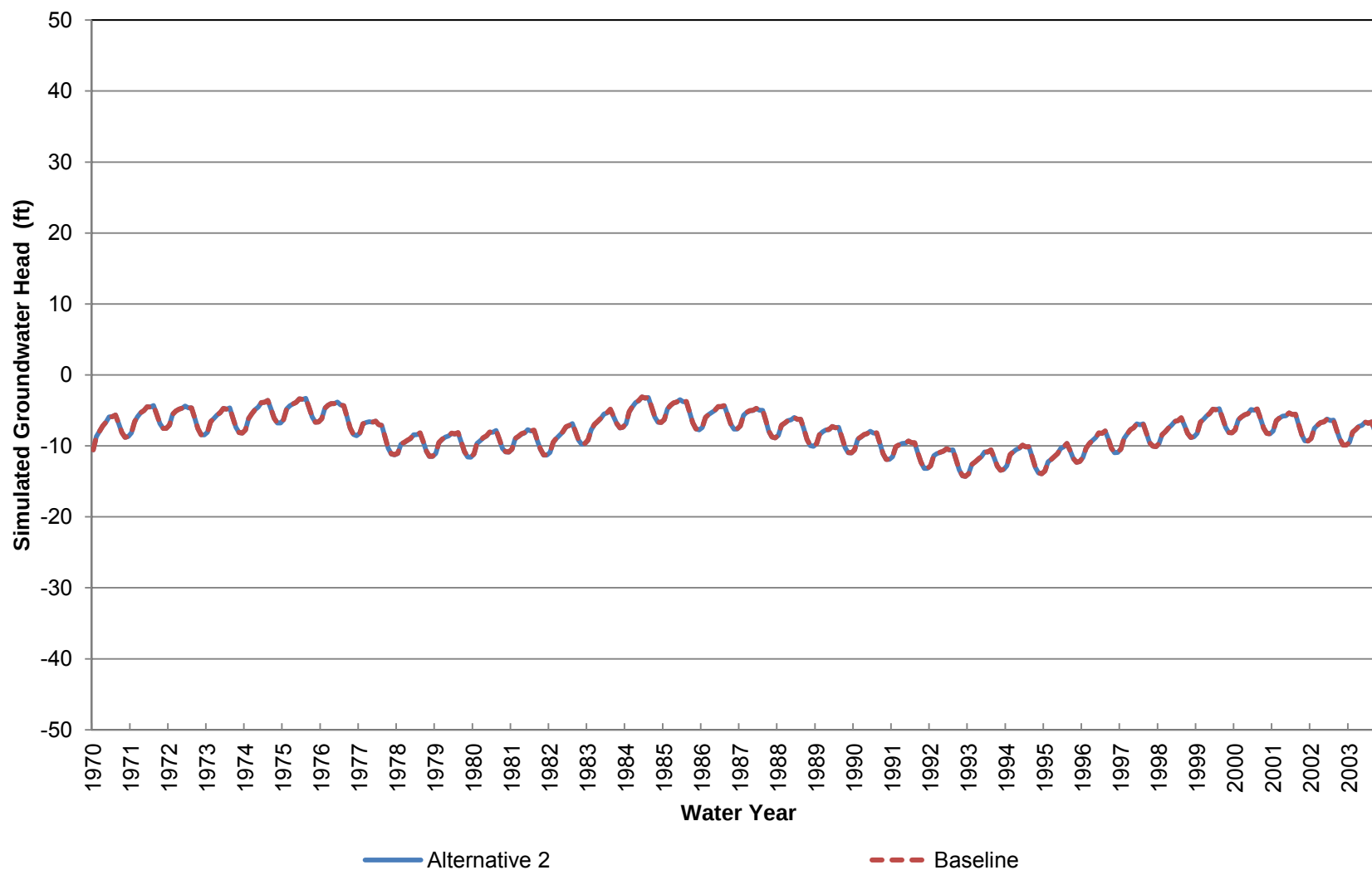
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 32 (Approximately 0-70 ft bgs)



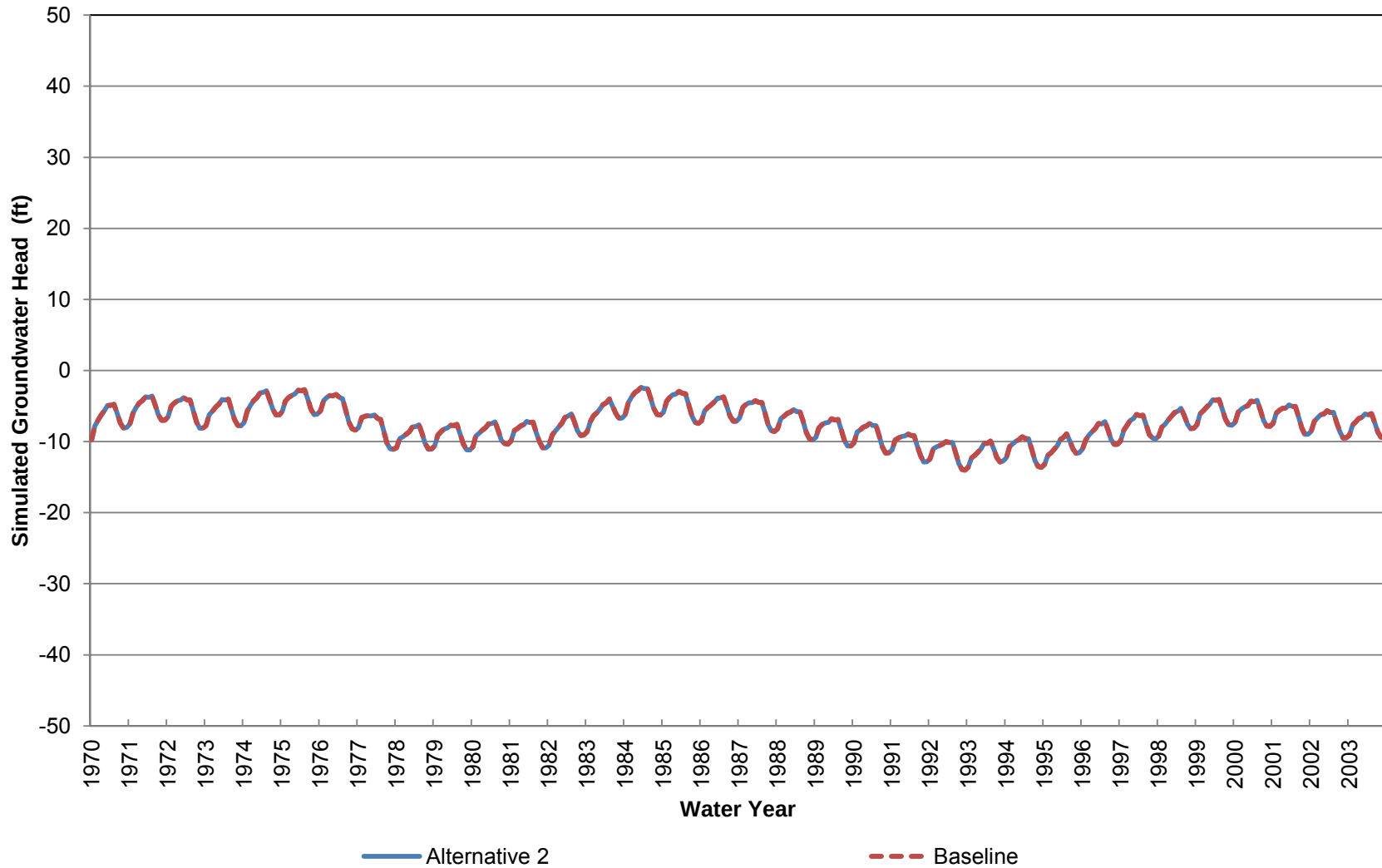
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 70-240 ft bgs)



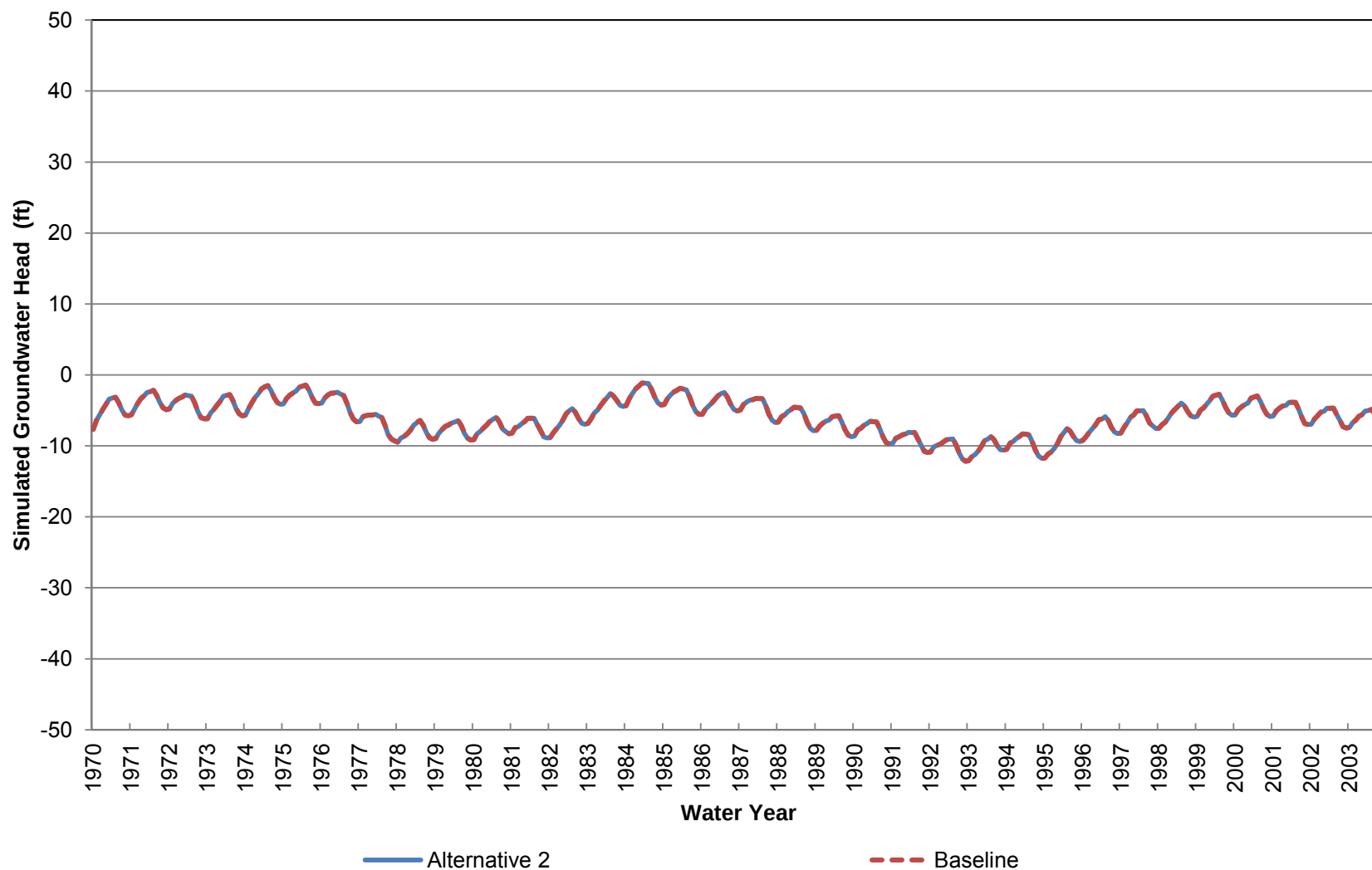
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 240-410 ft bgs)



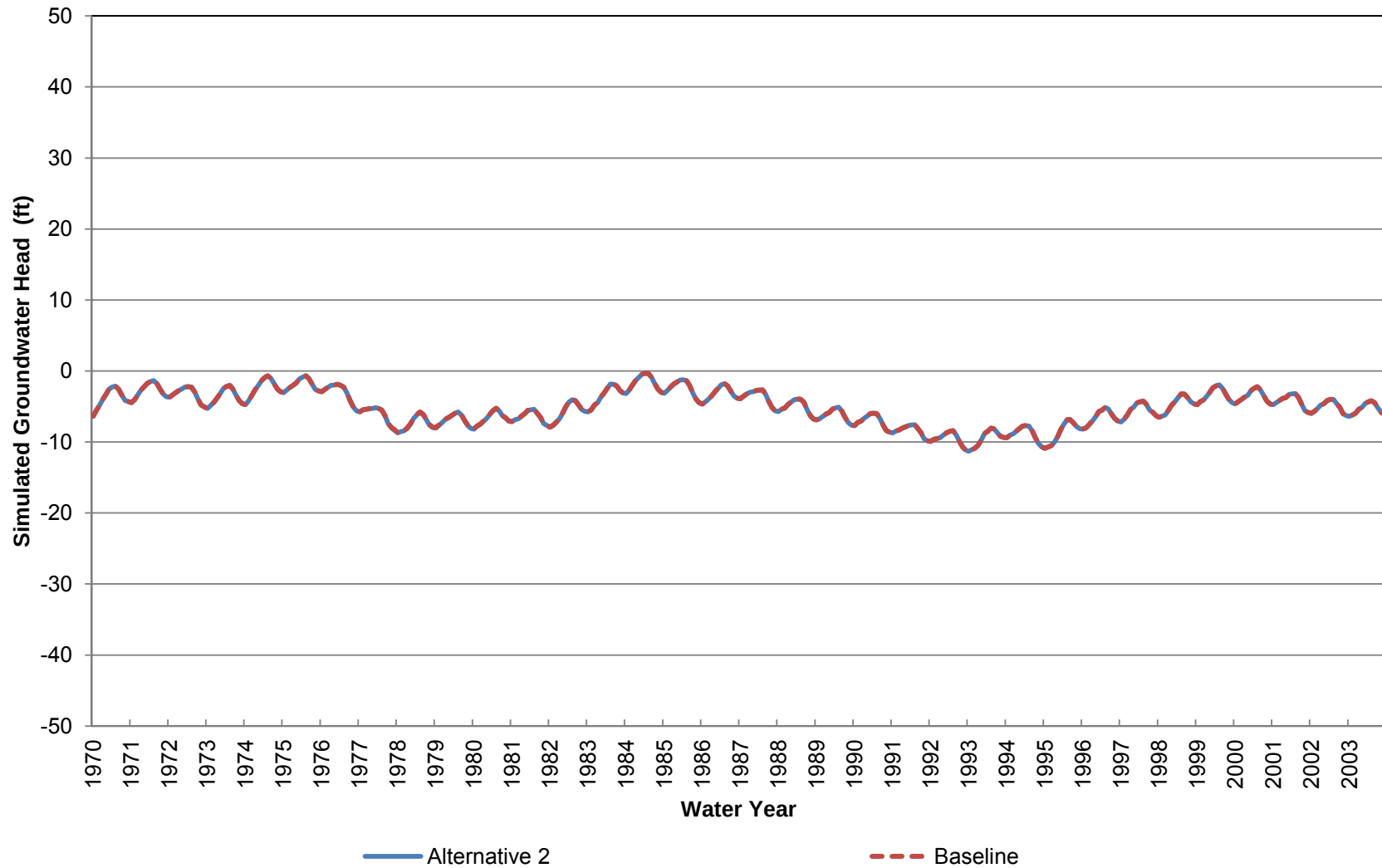
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 410-580 ft bgs)



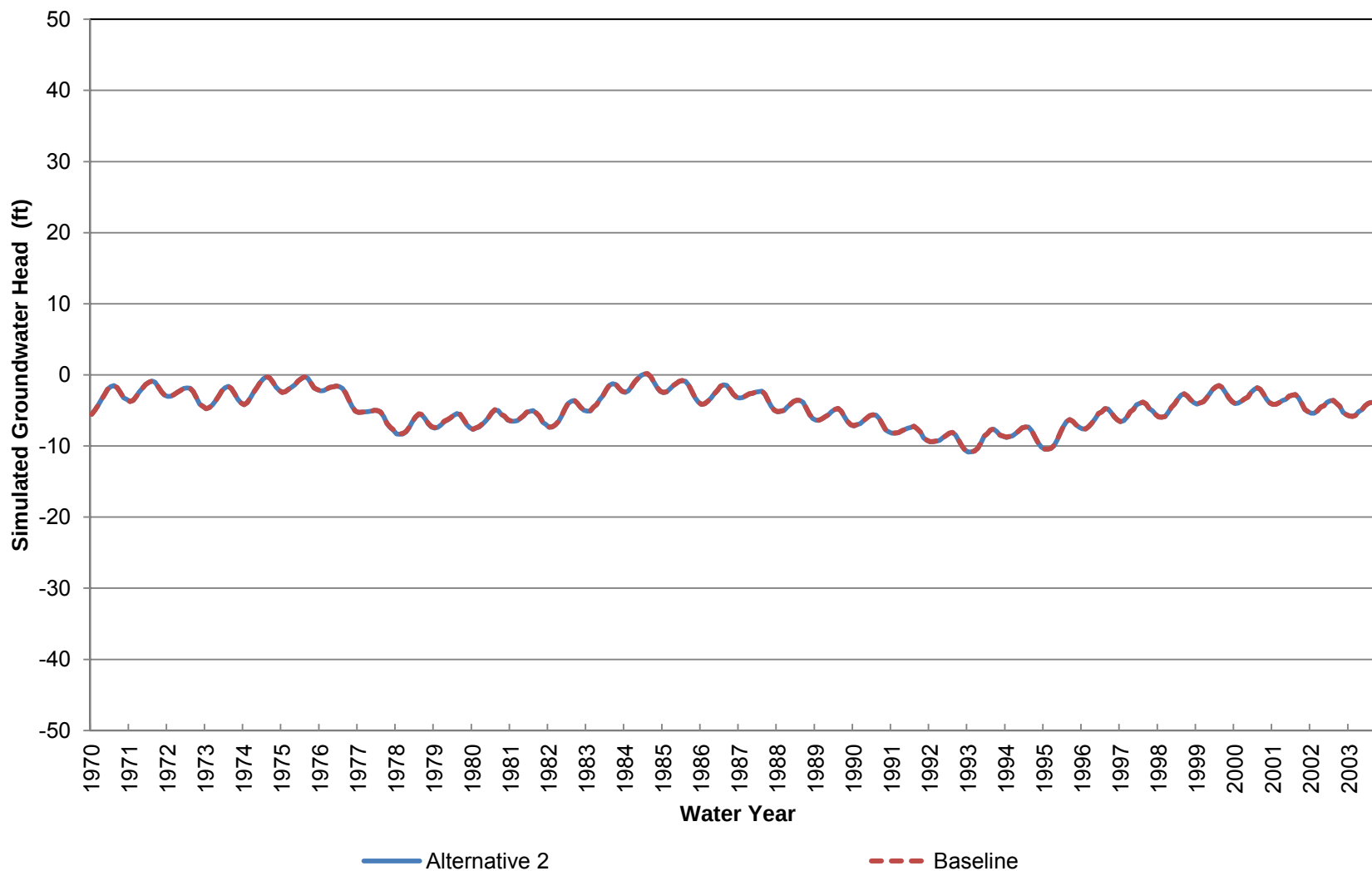
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 580-850 ft bgs)



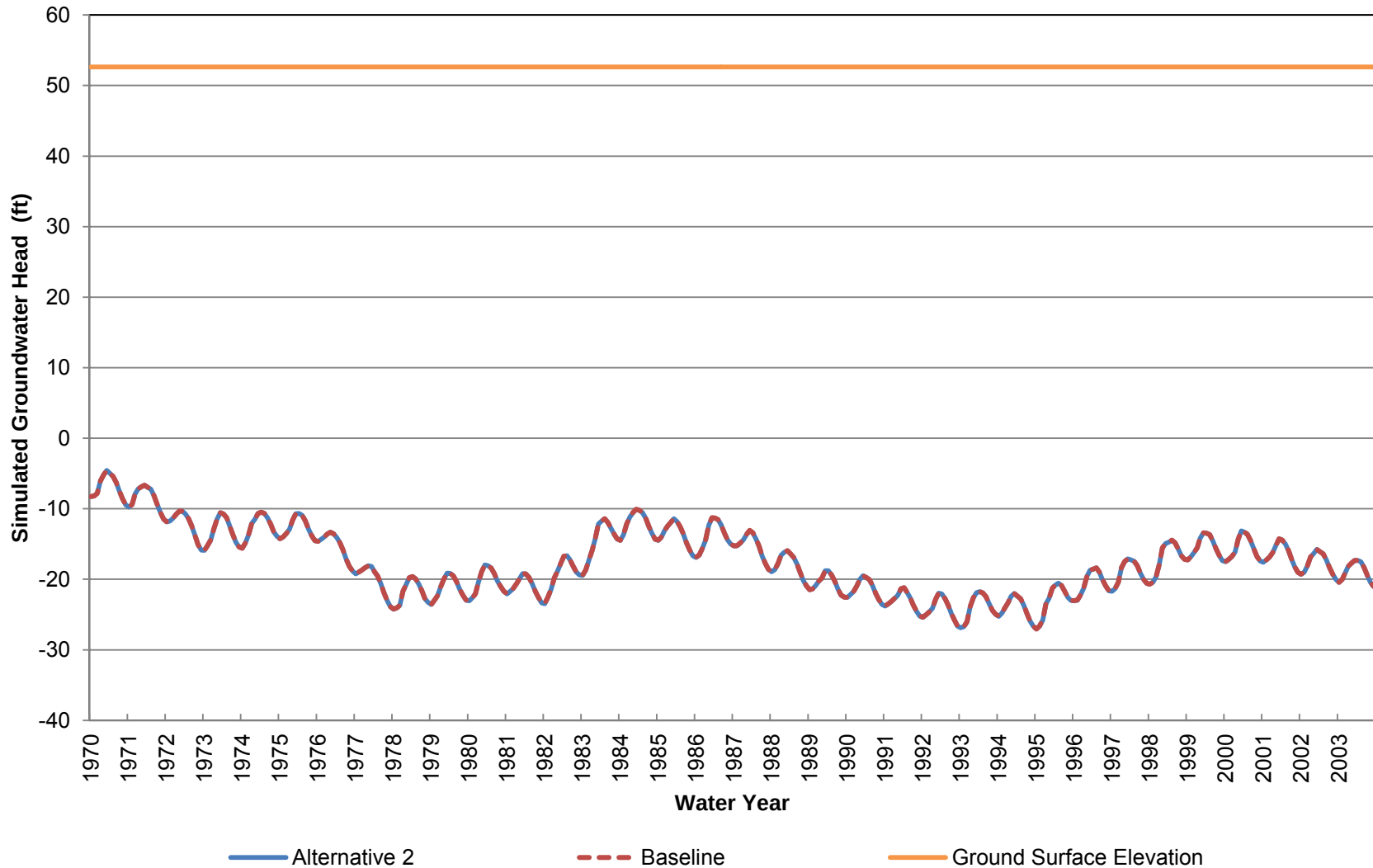
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 850-1140 ft bgs)



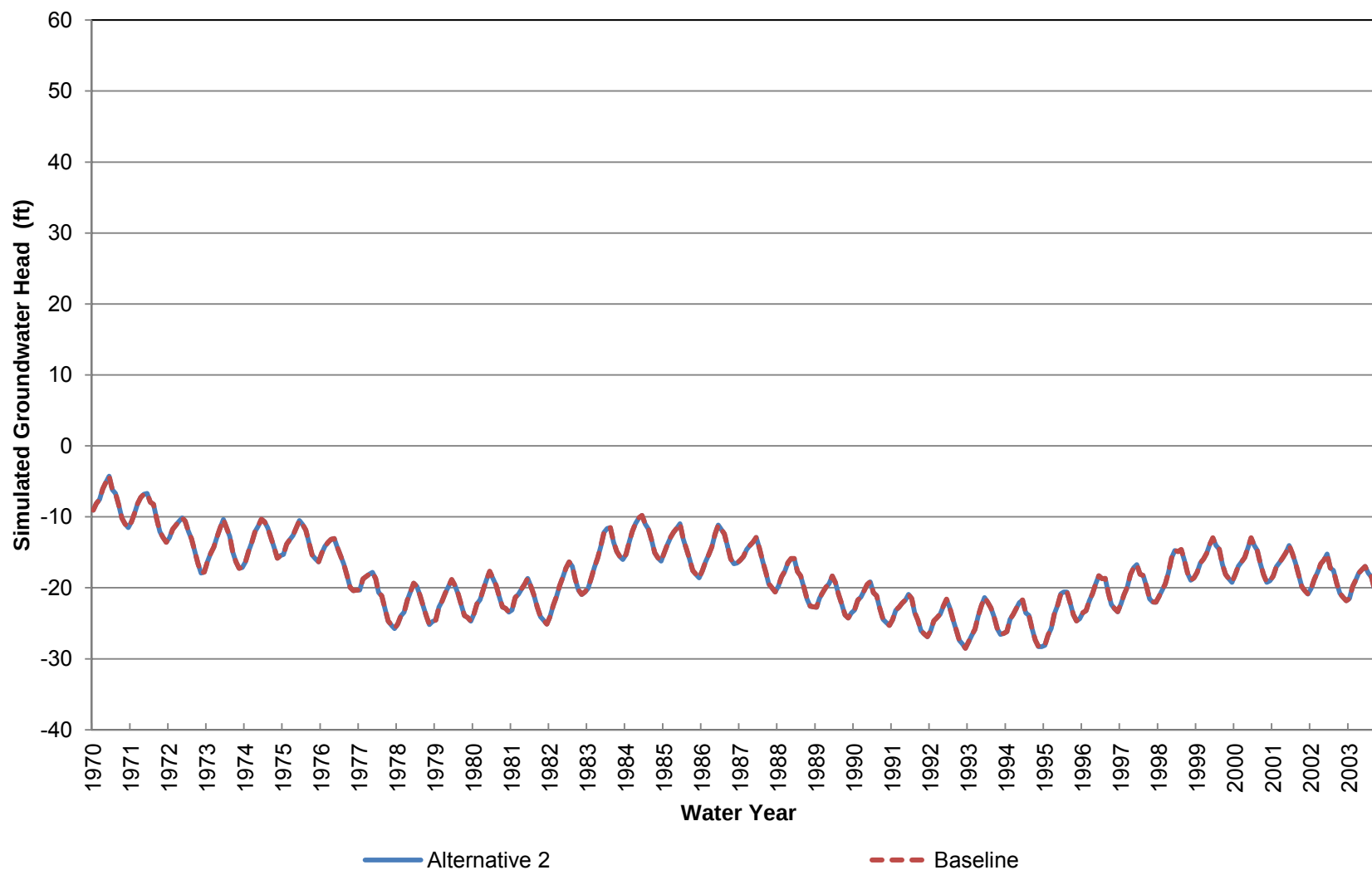
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 1140-1560 ft bgs)



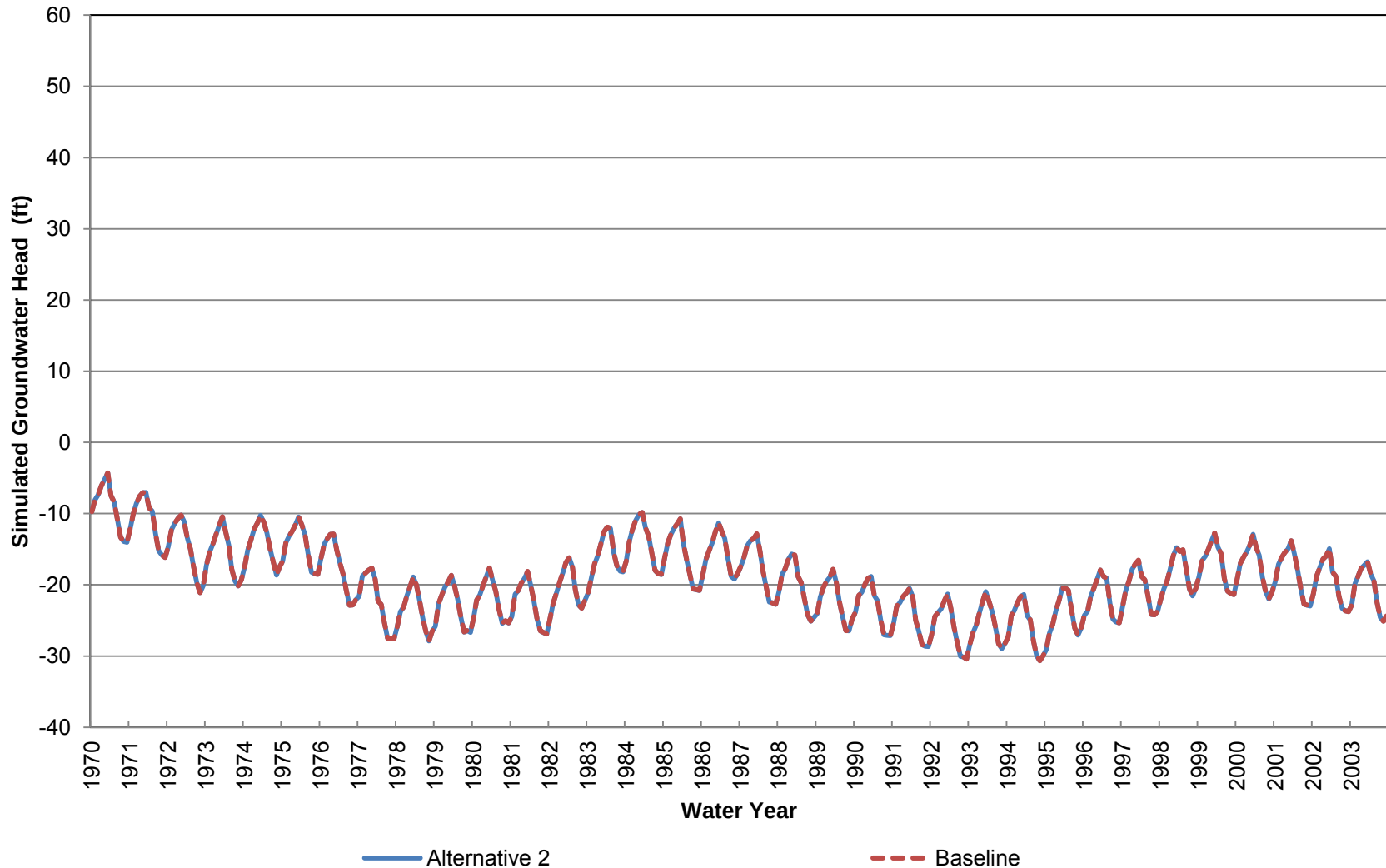
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 33 (Approximately 0-70 ft bgs)



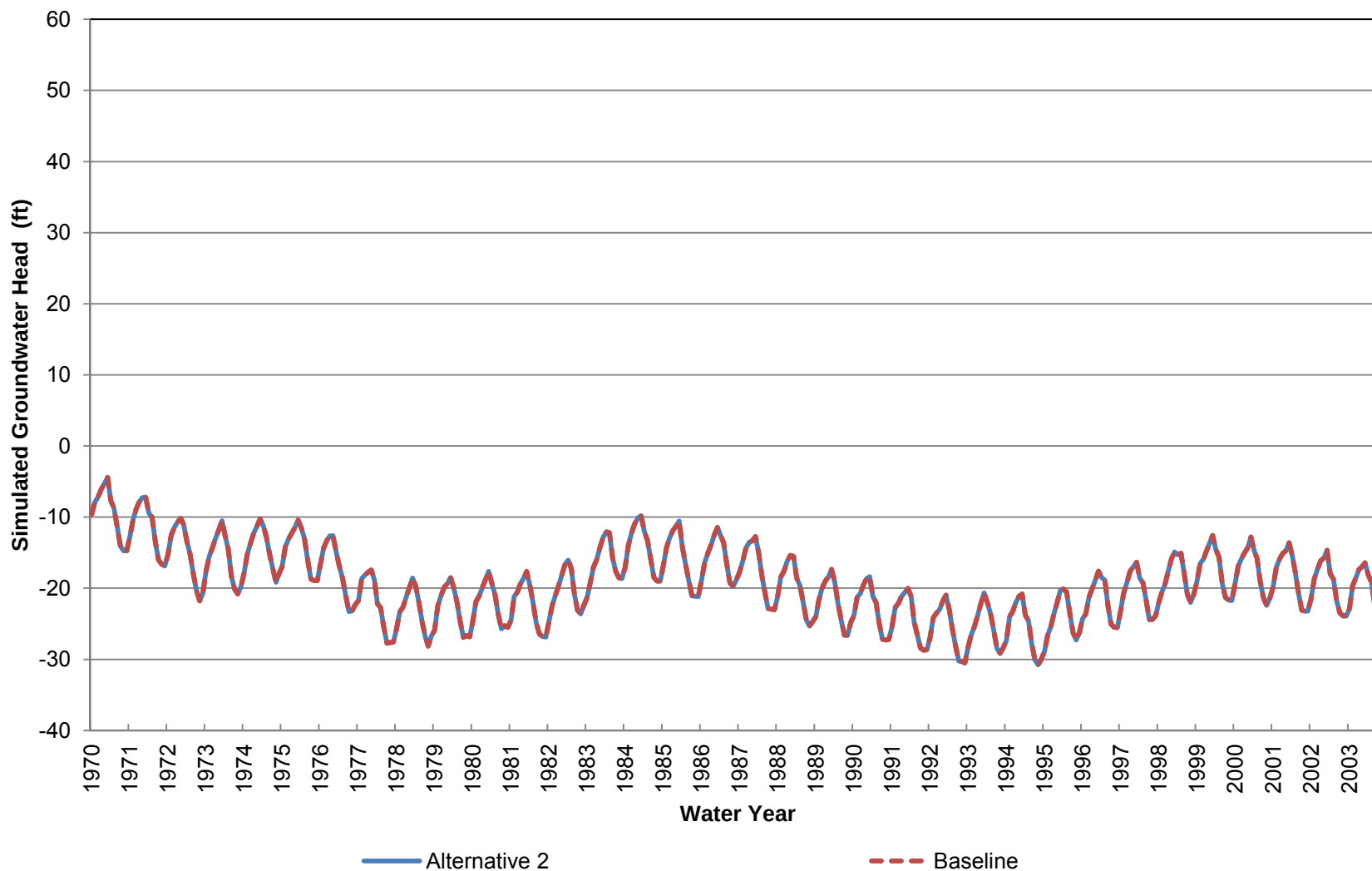
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 70-240 ft bgs)



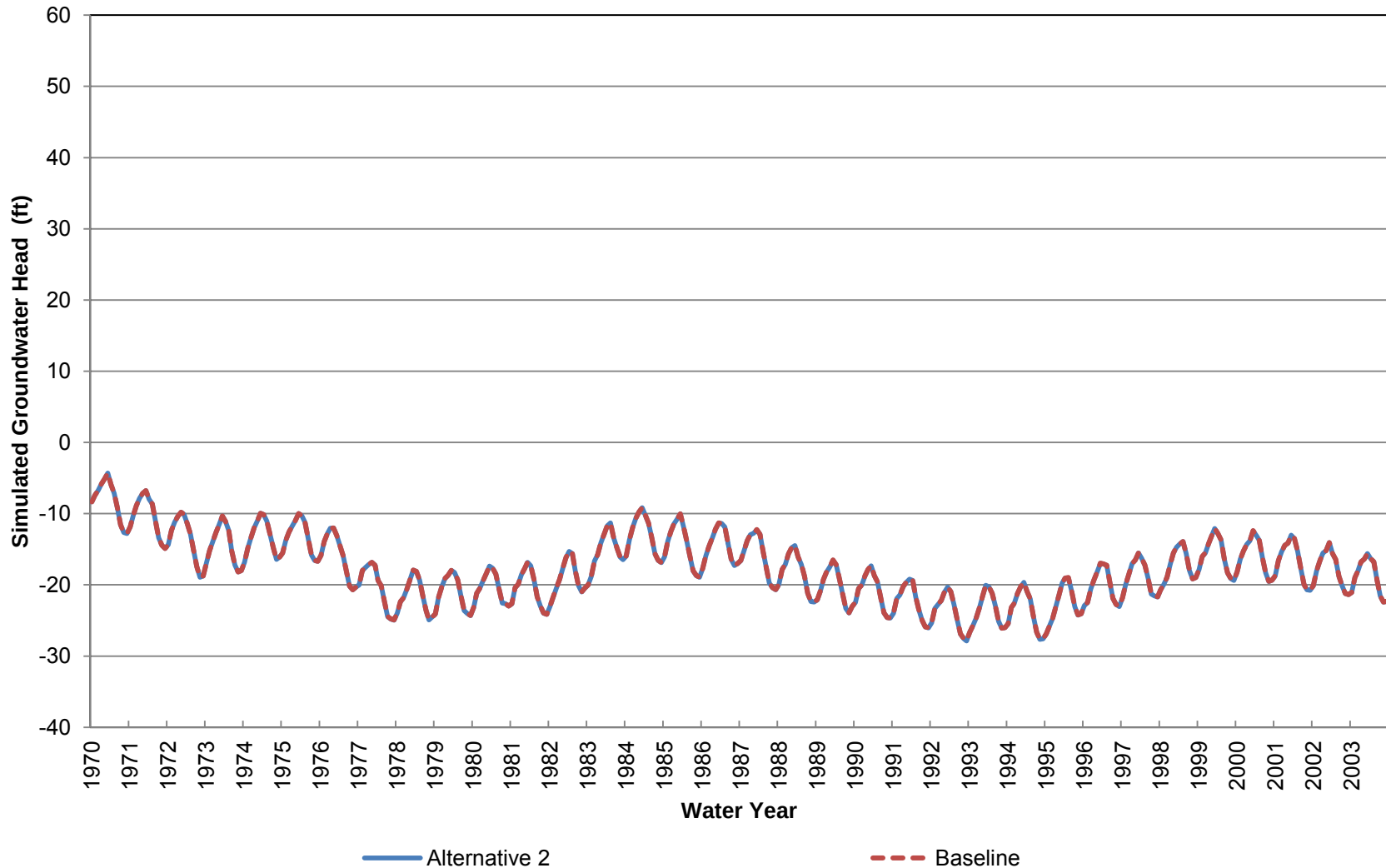
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 240-410 ft bgs)



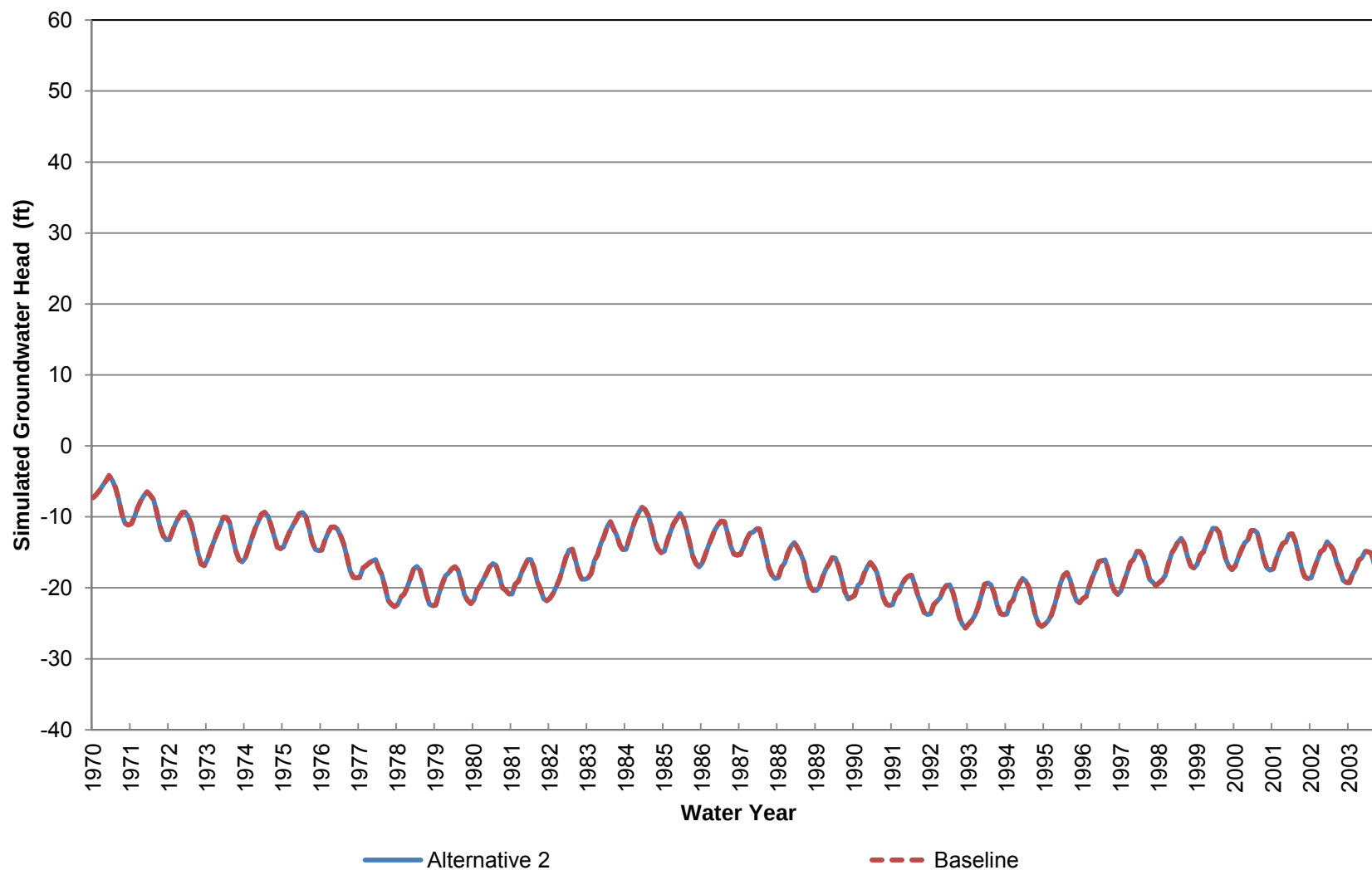
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 410-570 ft bgs)



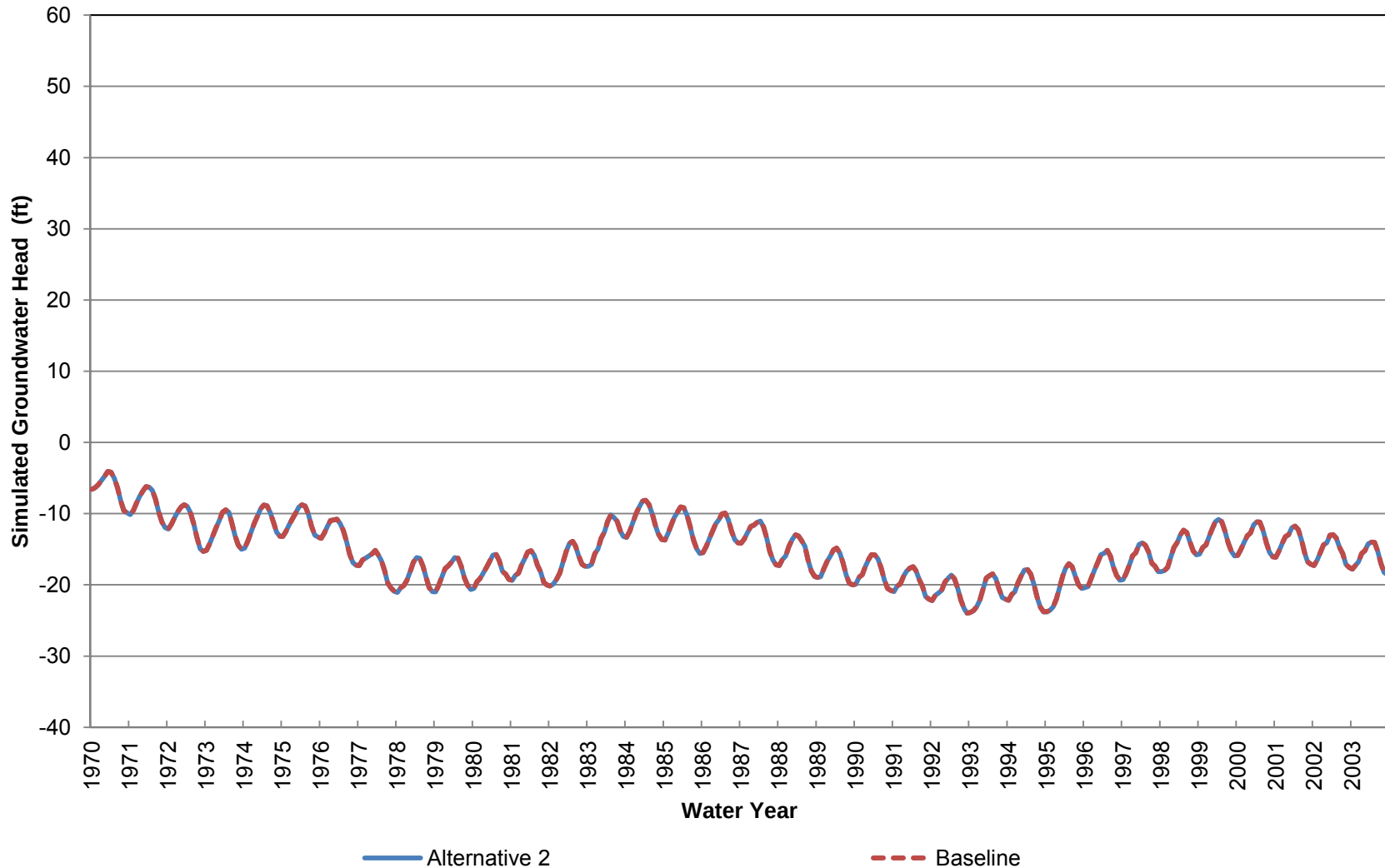
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 570-840 ft bgs)



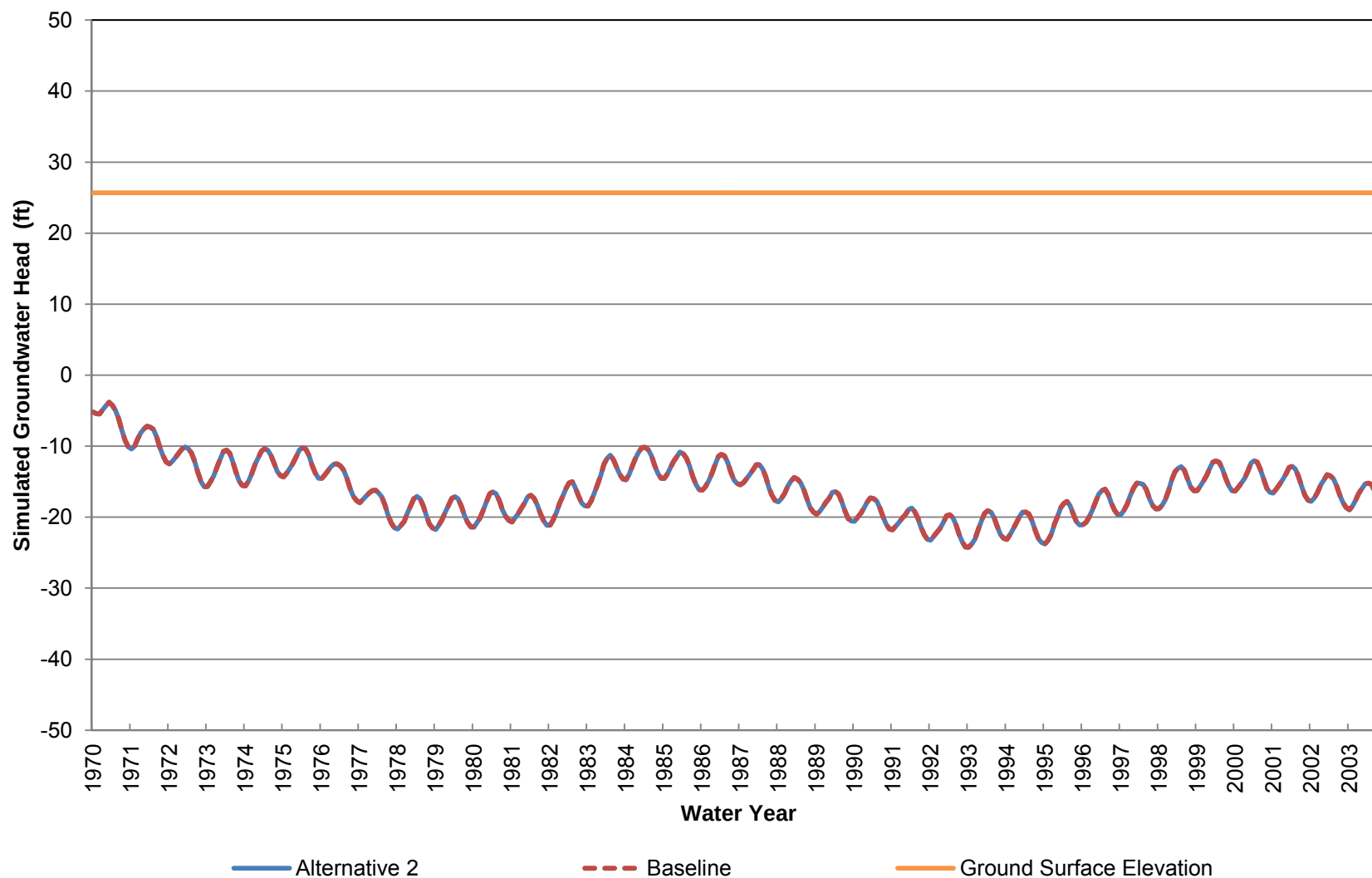
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 840-1120 ft bgs)



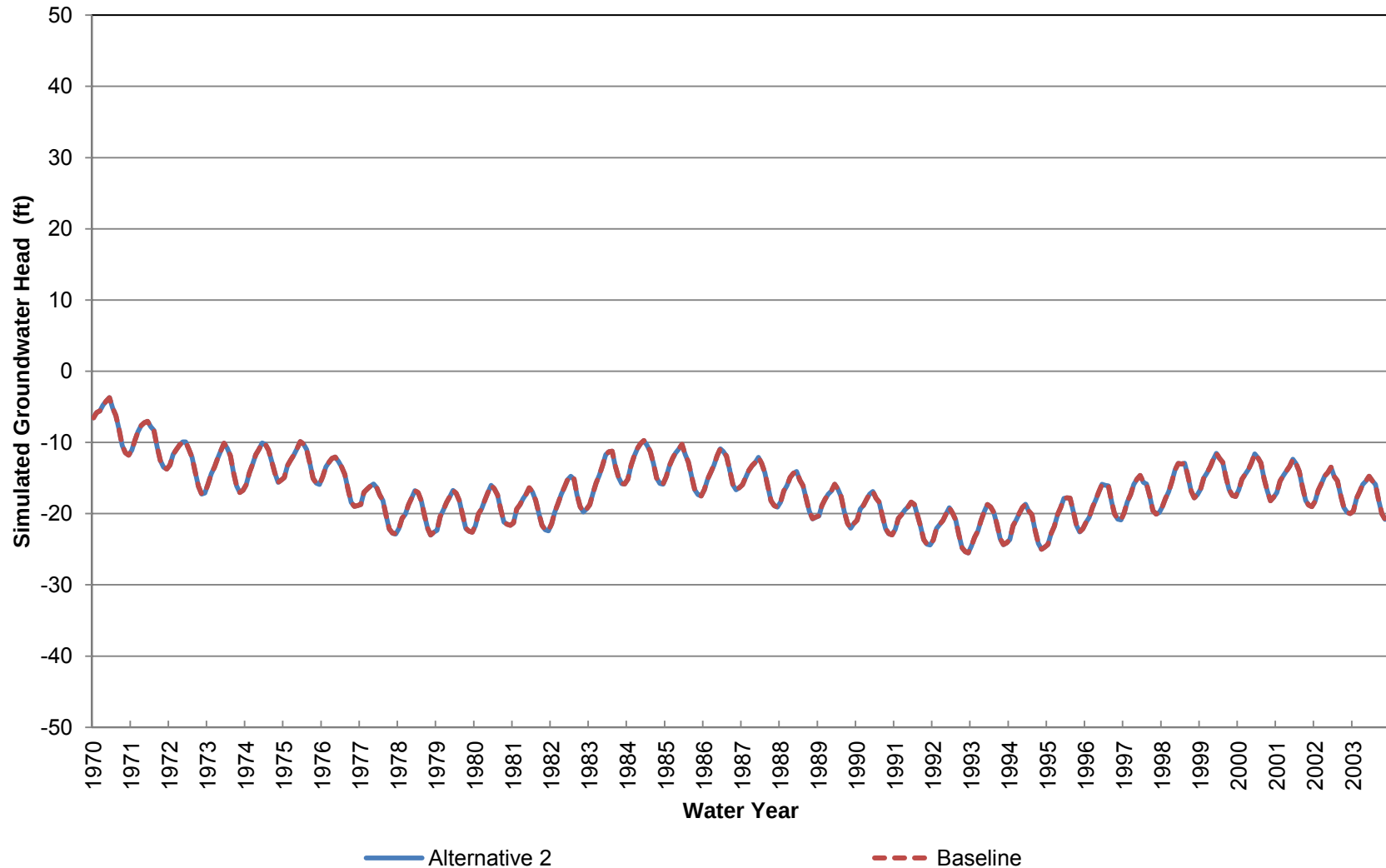
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 1120-1540 ft bgs)



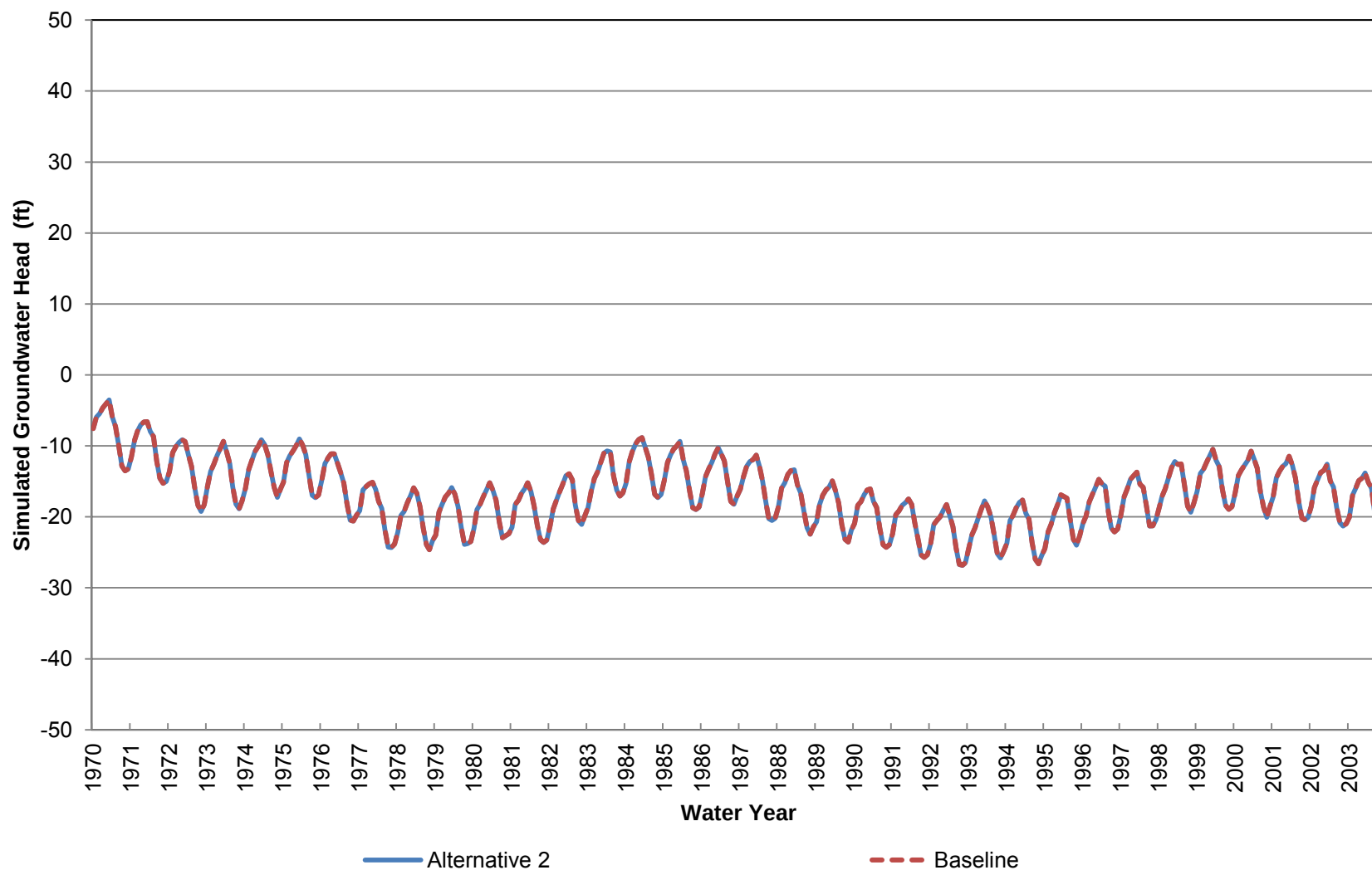
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 34 (Approximately 0-70 ft bgs)



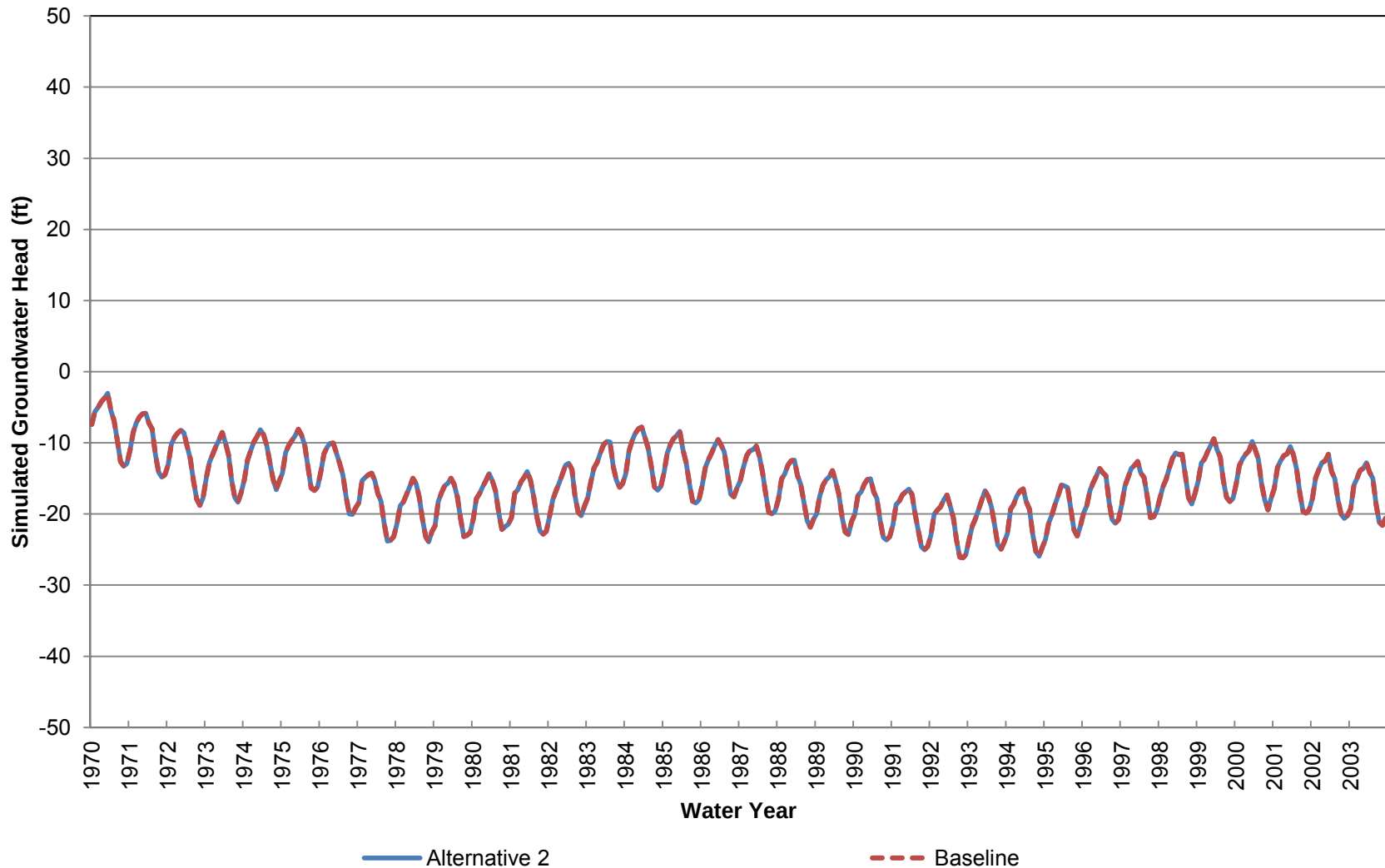
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 70-230 ft bgs)



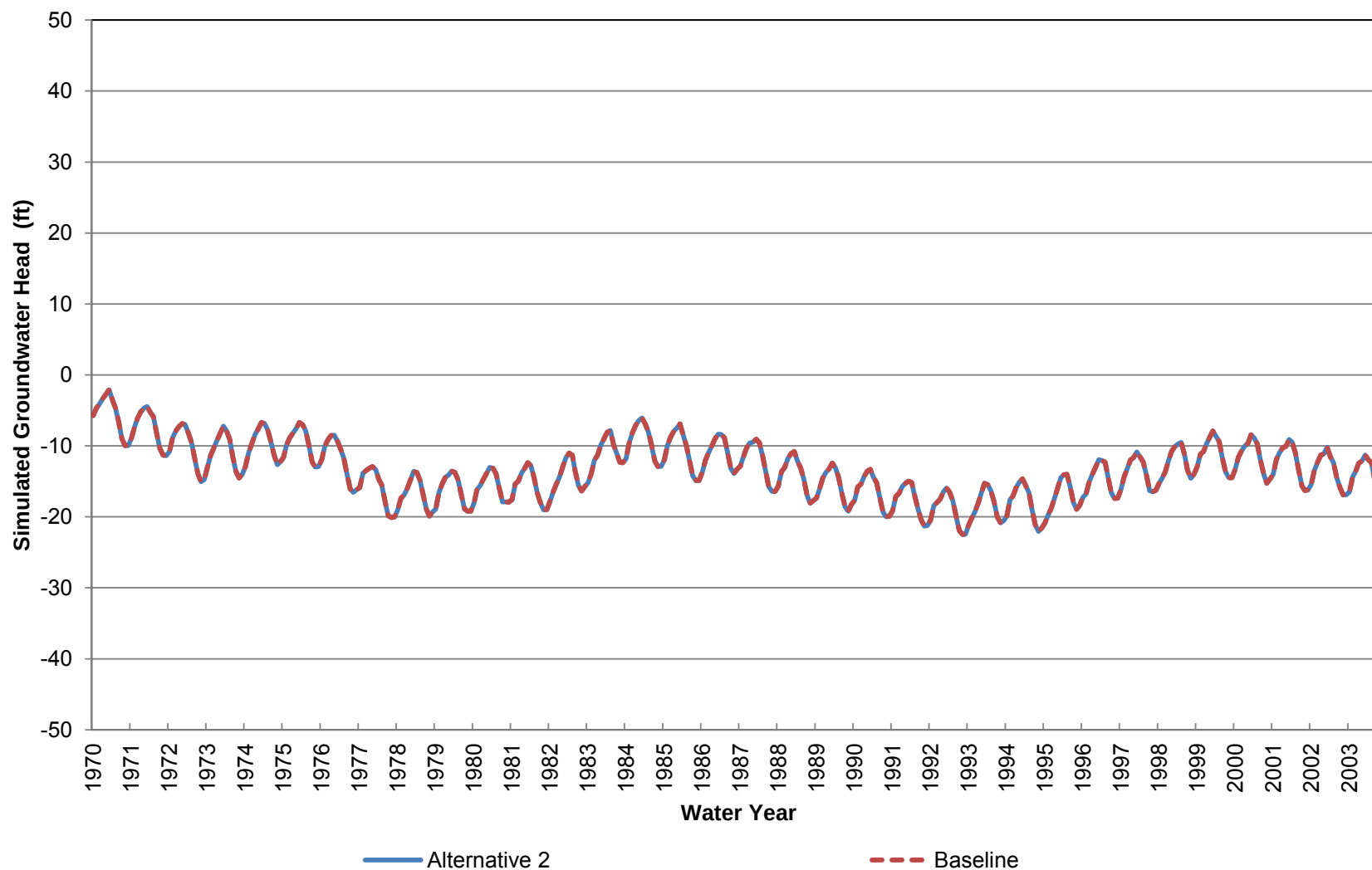
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 230-380 ft bgs)



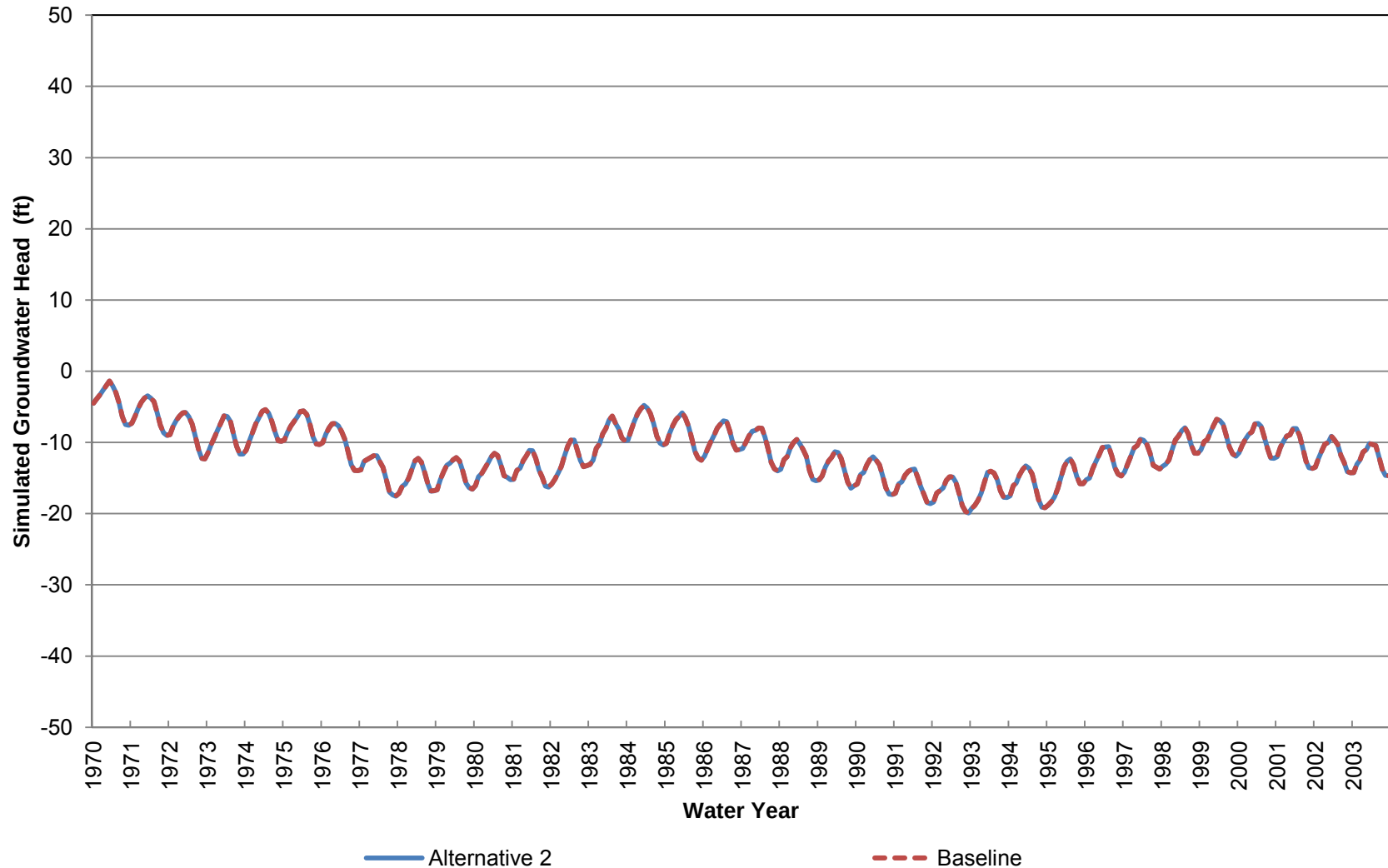
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 380-540 ft bgs)



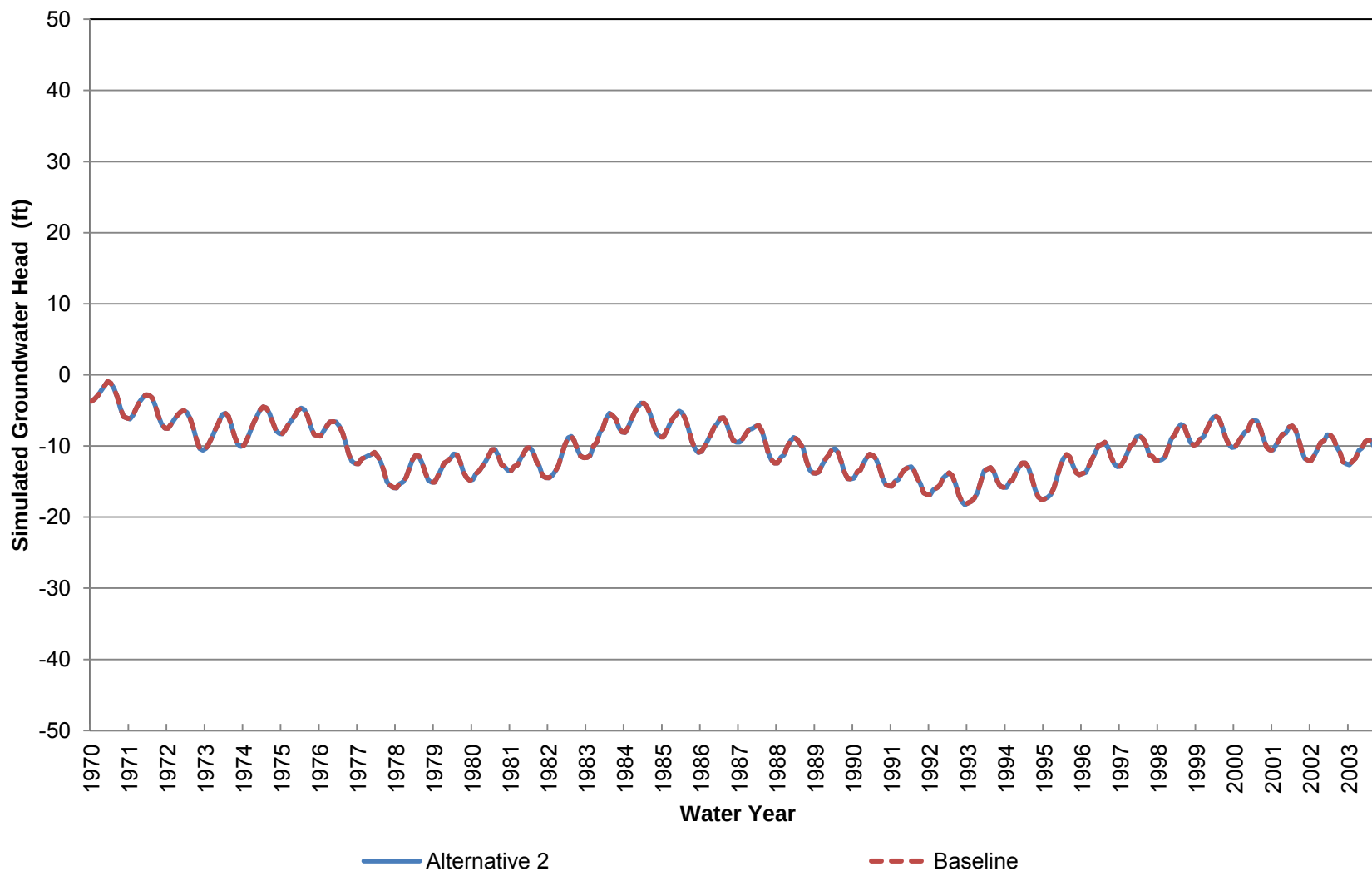
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 540-780 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 780-1040 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 1040-1430 ft bgs)



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