Chapter 2 Appendices

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Chapter 2
Appendix A

Cuyama Valley Groundwater Basin Hydrographs

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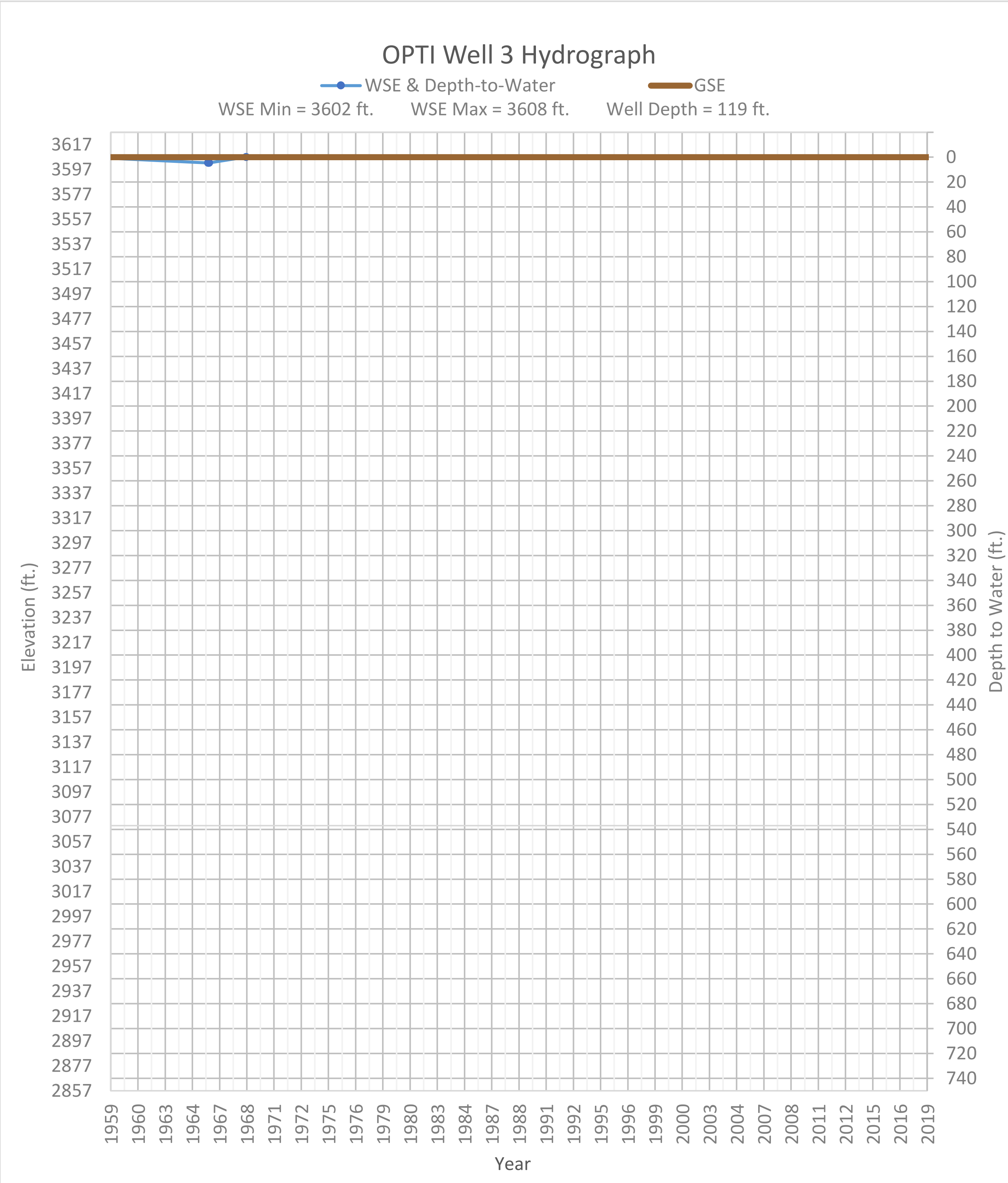
OPTI Well 2 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3659 ft.
WSE Max = 3692 ft.
Well Depth = 73 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 3 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3602 ft.
WSE Max = 3608 ft.
Well Depth = 119 ft.
Elevation (ft.)
3617
3597
3577
3557
3537
3517
3497
3477
3457
3437
3417
3397
3377
3357
3337
3317
3297
3277
3257
3237
3217
3197
3177
3157
3137
3117
3097
3077
3057
3037
3017
2997
2977
2957
2937
2917
2897
2877
2857
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
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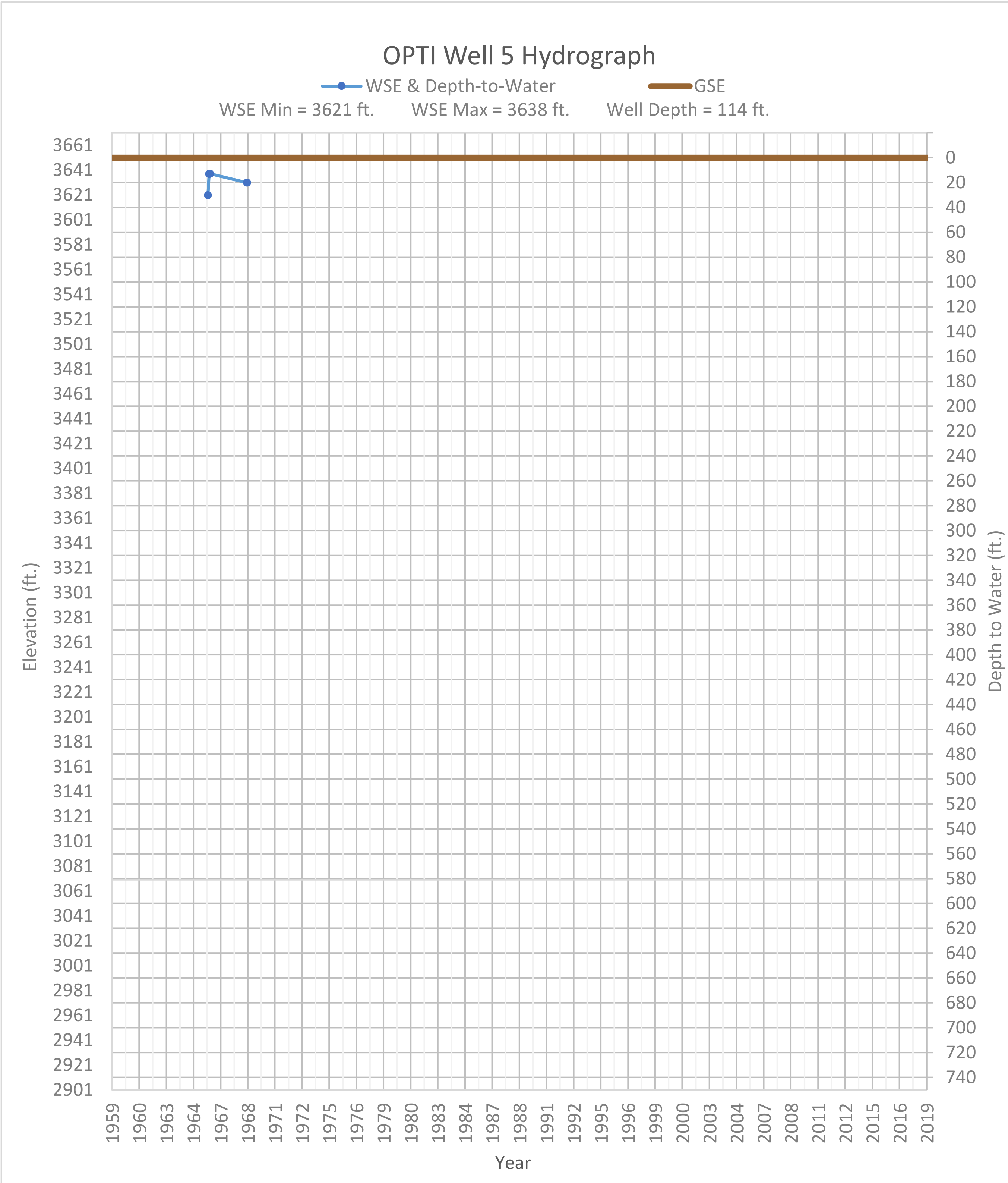
OPTI Well 5 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3621 ft.
WSE Max = 3638 ft.
Well Depth = 114 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 6 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3778 ft.
WSE Max = 3808 ft.
Well Depth = 96 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3852
3832
3812
3792
3772
3752
3732
3712
3692
3672
3652
3632
3612
3592
3572
3552
3532
3512
3492
3472
3452
3432
3412
3392
3372
3352
3332
3312
3292
3272
3252
3232
3212
3192
3172
3152
3132
3112
3092
0
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120
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160
180
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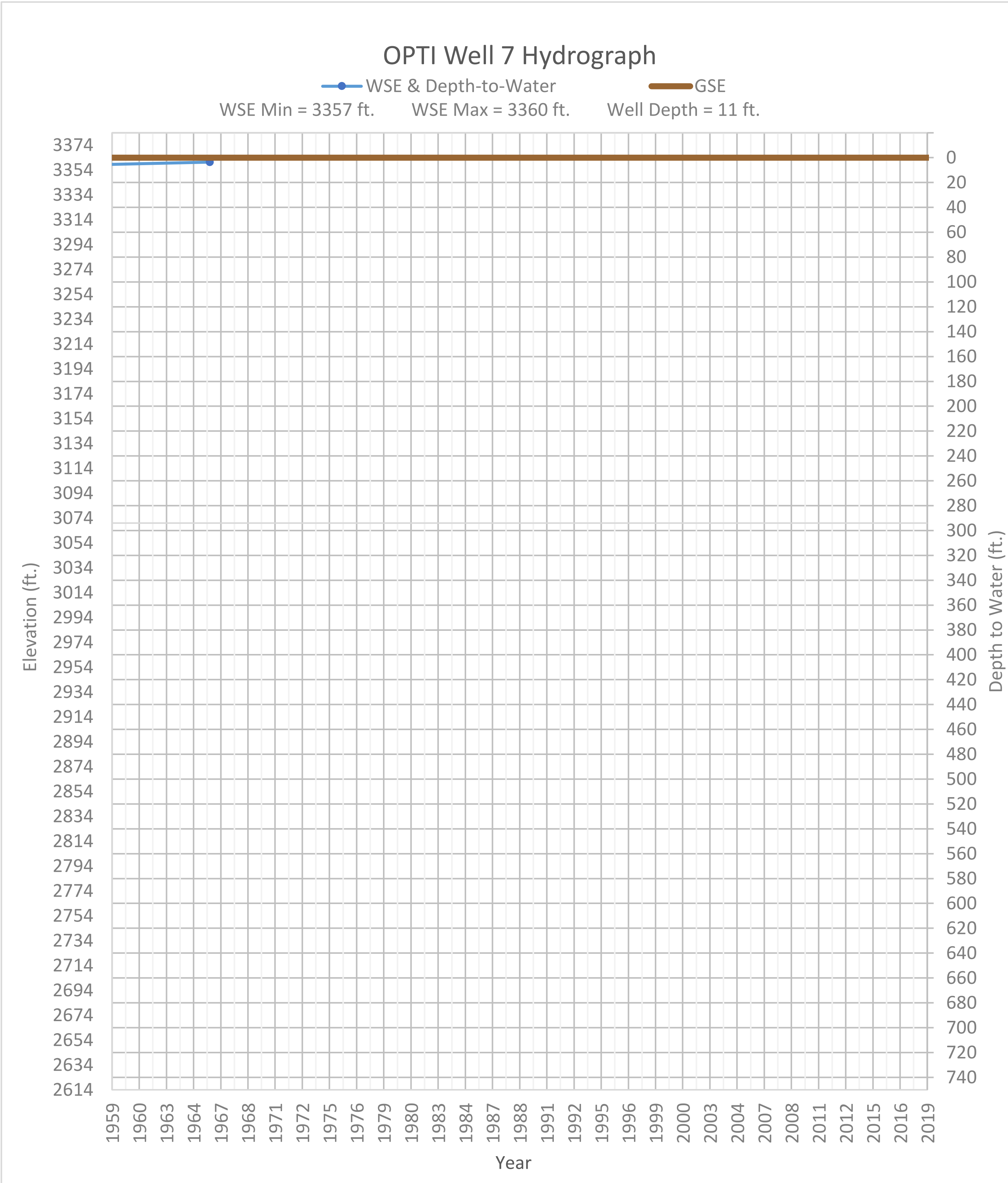
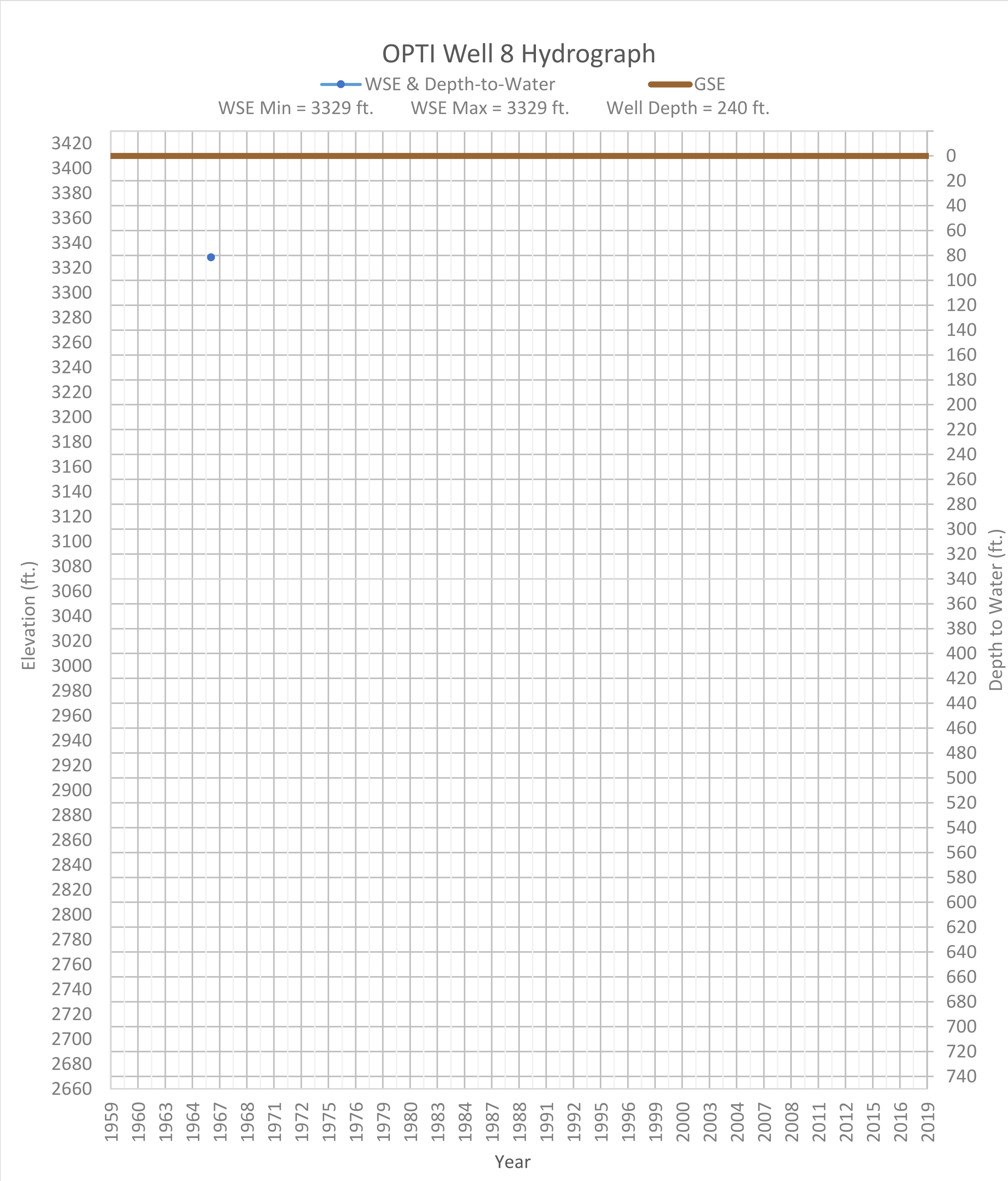

OPTI Well 7 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3357 ft.
WSE Max = 3360 ft.
Well Depth = 11 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 8 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3329 ft.
WSE Max = 3329 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3420
3400
3380
3360
3340
3320
3300
3280
3260
3240
3220
3200
3180
3160
3140
3120
3100
3080
3060
3040
3020
3000
2980
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2880
2860
2840
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2780
2760
2740
2720
2700
2680
2660
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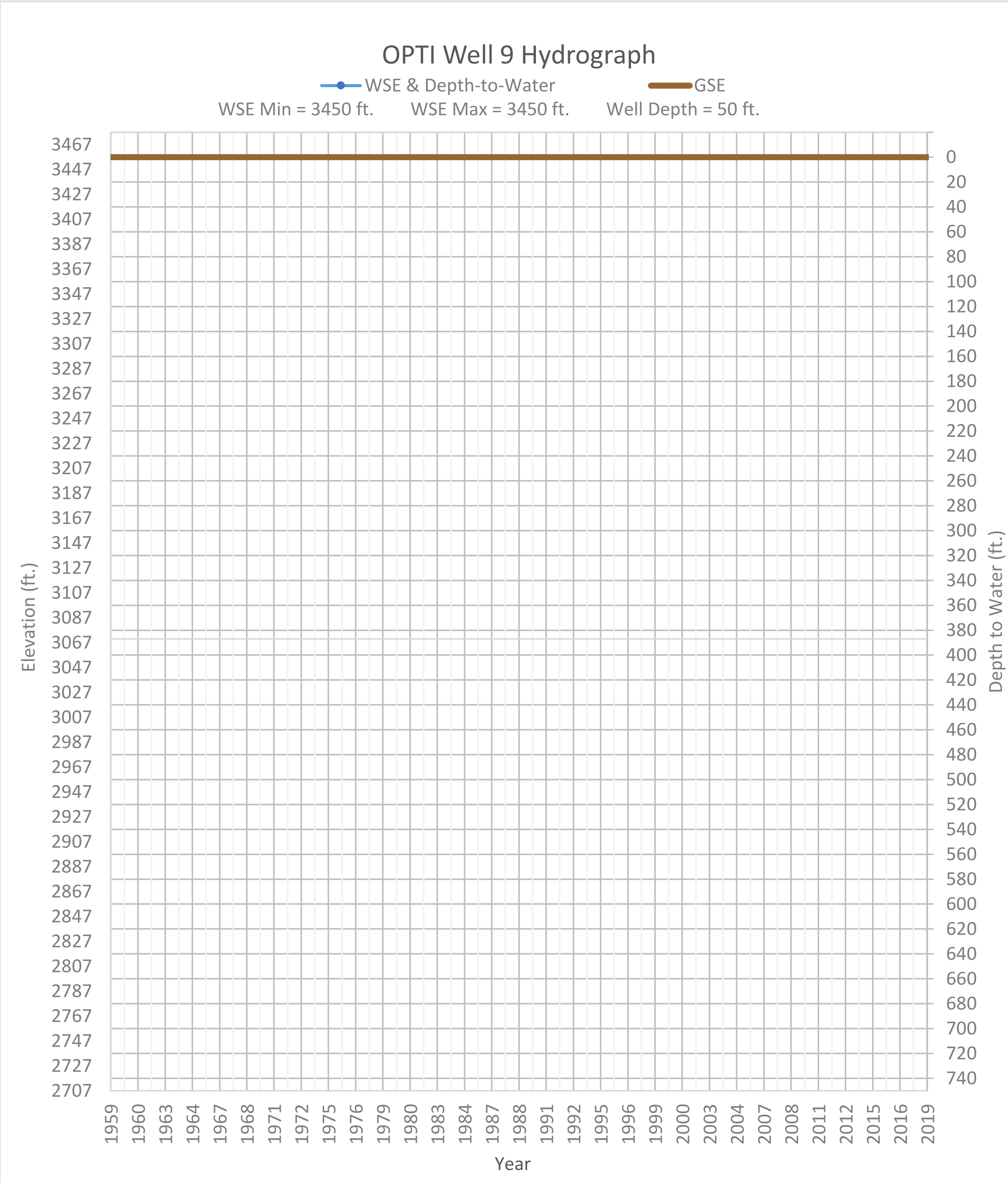
OPTI Well 9 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3450 ft.
WSE Max = 3450 ft.
Well Depth = 50 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3467
3447
3427
3407
3387
3367
3347
3327
3307
3287
3267
3247
3227
3207
3187
3167
3147
3127
3107
3087
3067
3047
3027
3007
2987
2967
2947
2927
2907
2887
2867
2847
2827
2807
2787
2767
2747
2727
2707
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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380
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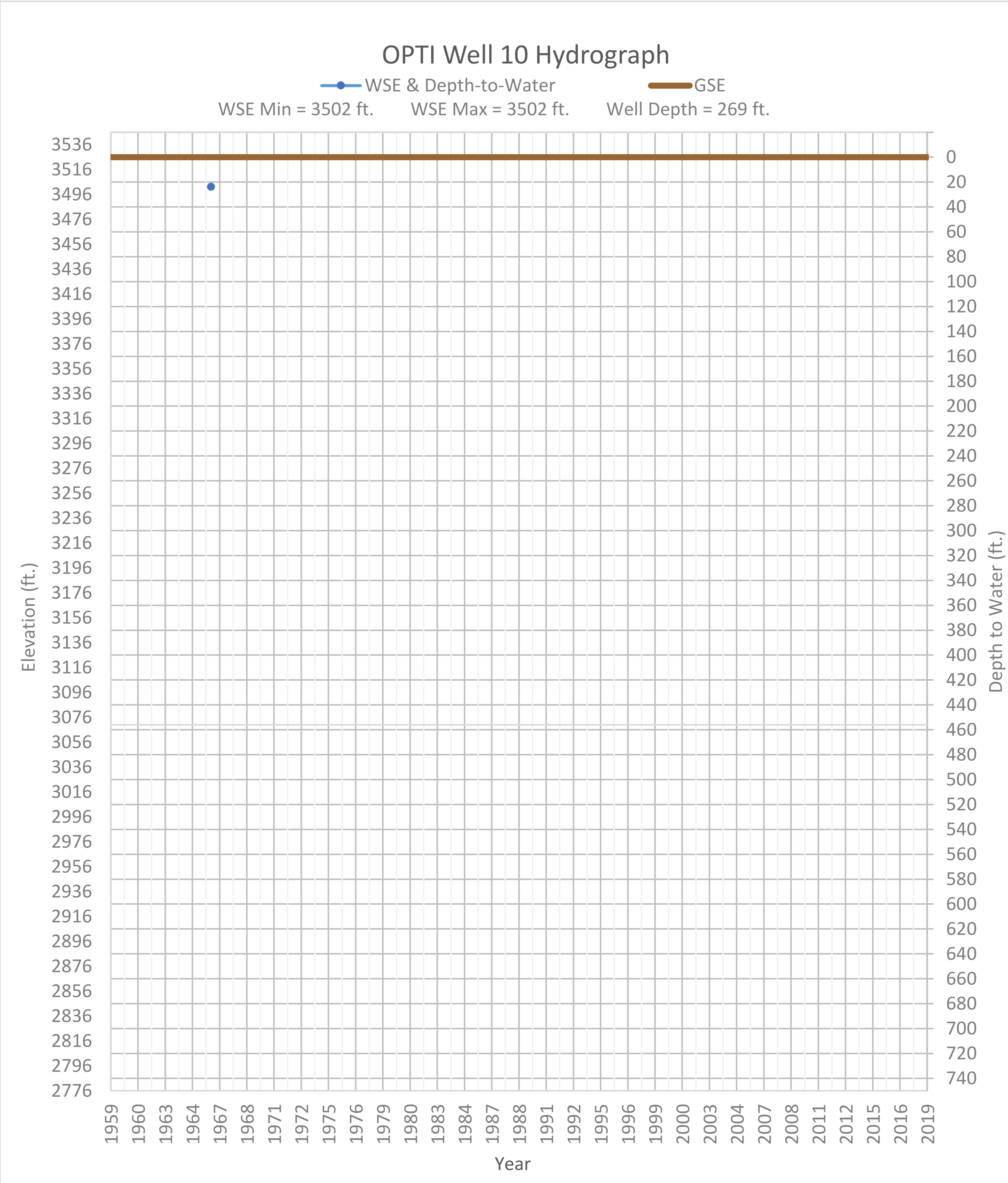
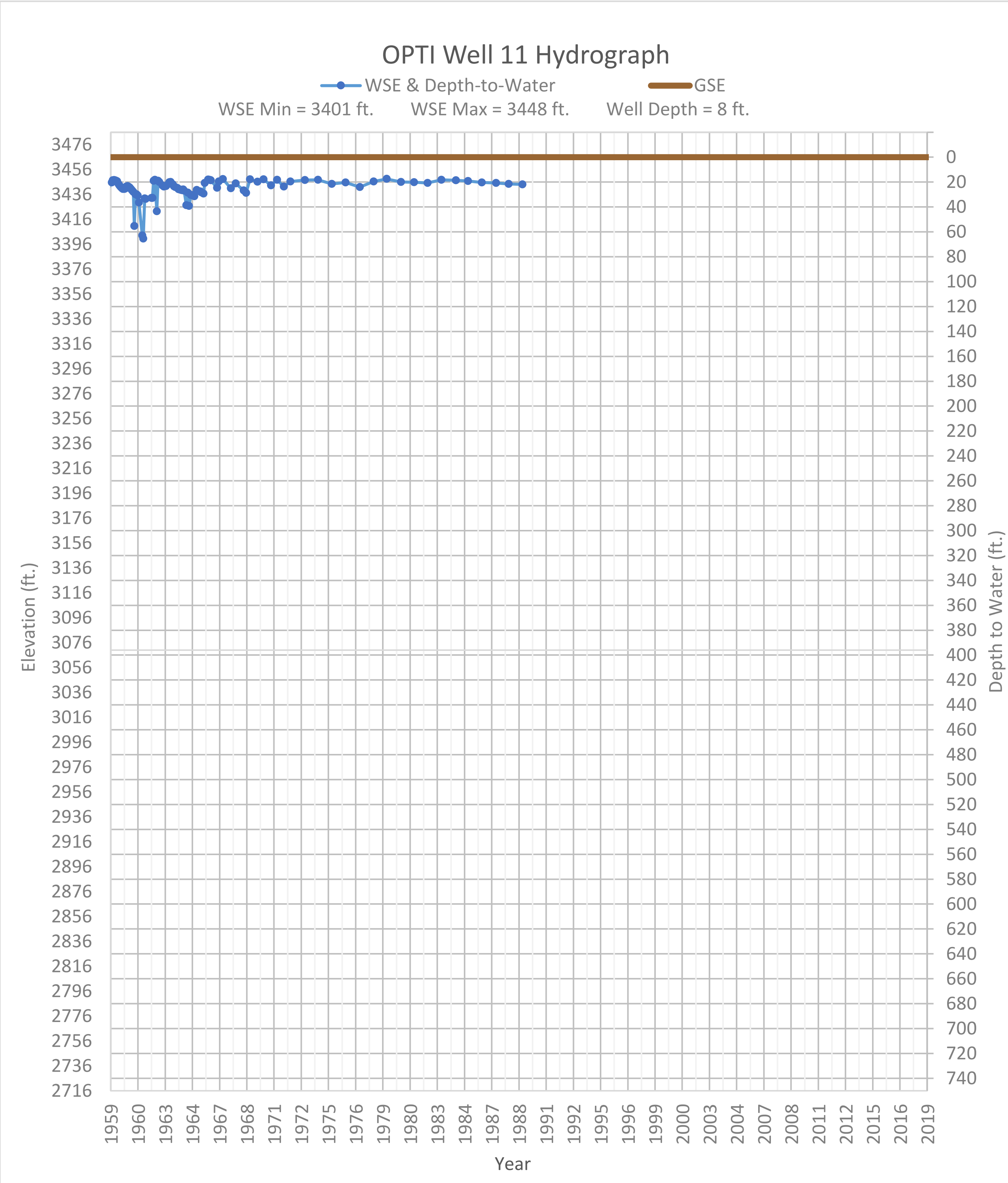
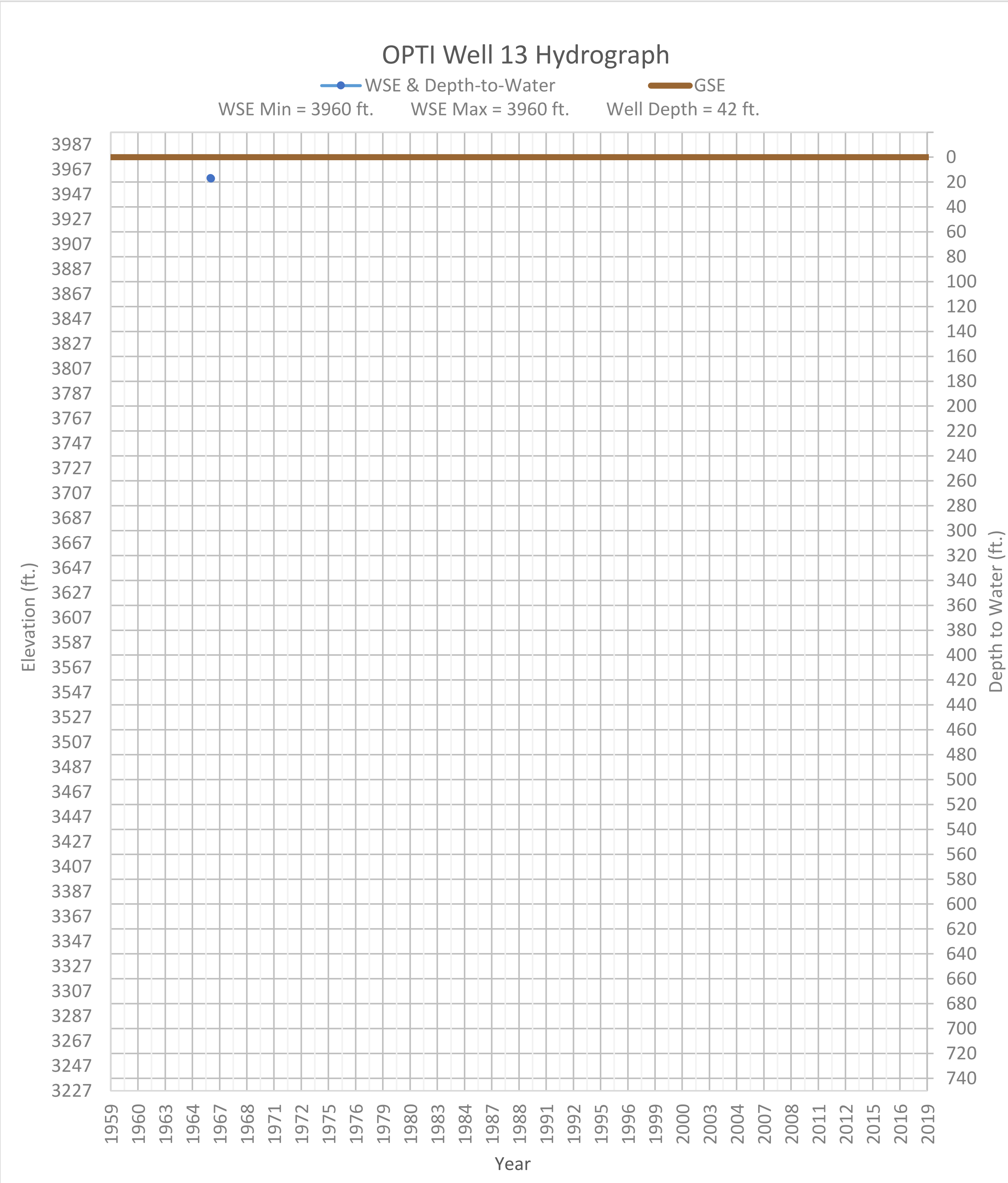


OPTI Well 10 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3502 ft.
WSE Max = 3502 ft.
Well Depth = 269 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 11 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3401 ft.
WSE Max = 3448 ft.
Well Depth = 8 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 13 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3960 ft.
WSE Max = 3960 ft.
Well Depth = 42 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3987
3967
3947
3927
3907
3887
3867
3847
3827
3807
3787
3767
3747
3727
3707
3687
3667
3647
3627
3607
3587
3567
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3527
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3407
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3367
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3327
3307
3287
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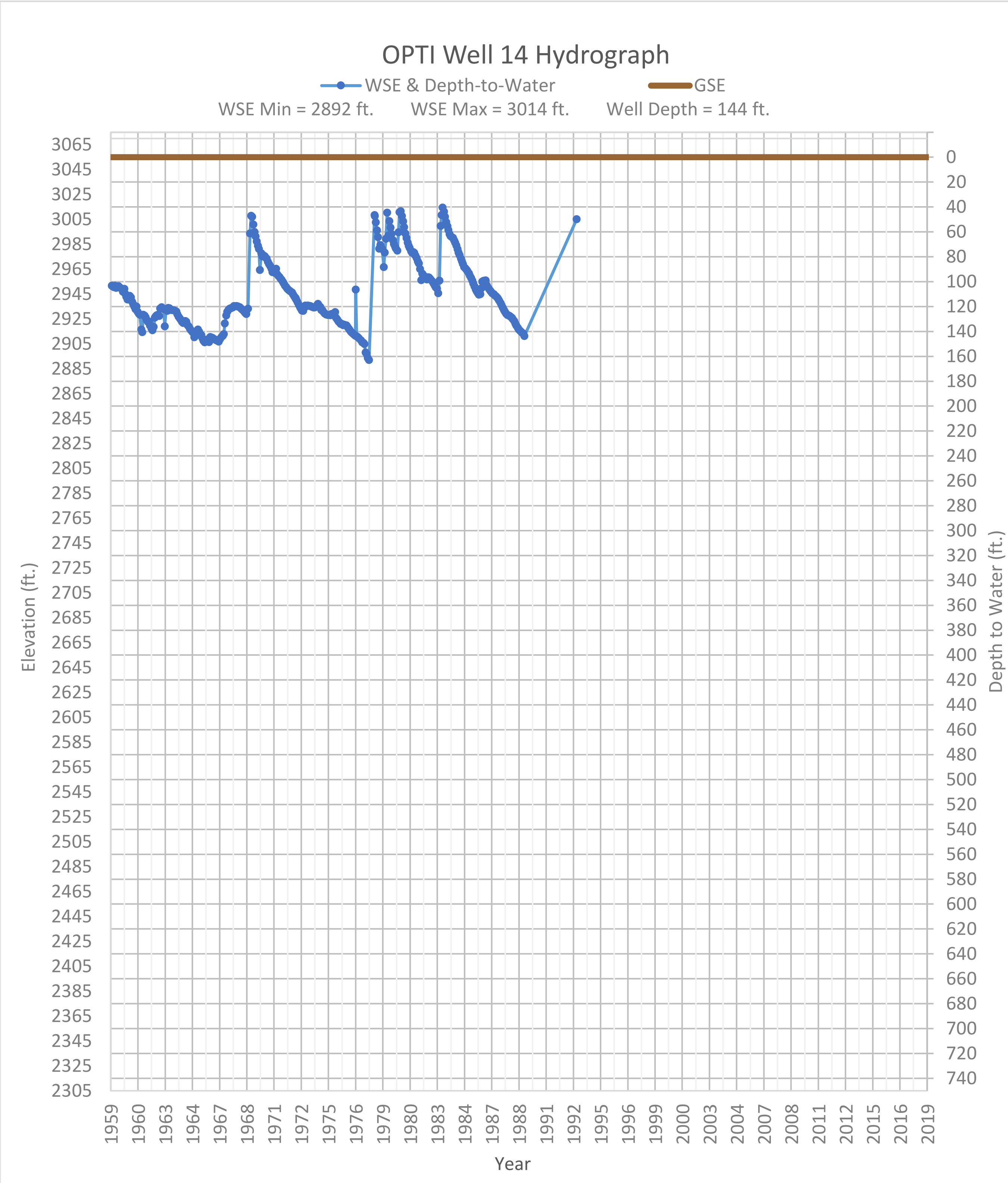
OPTI Well 14 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2892 ft.
WSE Max = 3014 ft.
Well Depth = 144 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3065
3045
3025
3005
2985
2965
2945
2925
2905
2885
2865
2845
2825
2805
2785
2765
2745
2725
2705
2685
2665
2645
2625
2605
2585
2565
2545
2525
2505
2485
2465
2445
2425
2405
2385
2365
2345
2325
2305
0
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200
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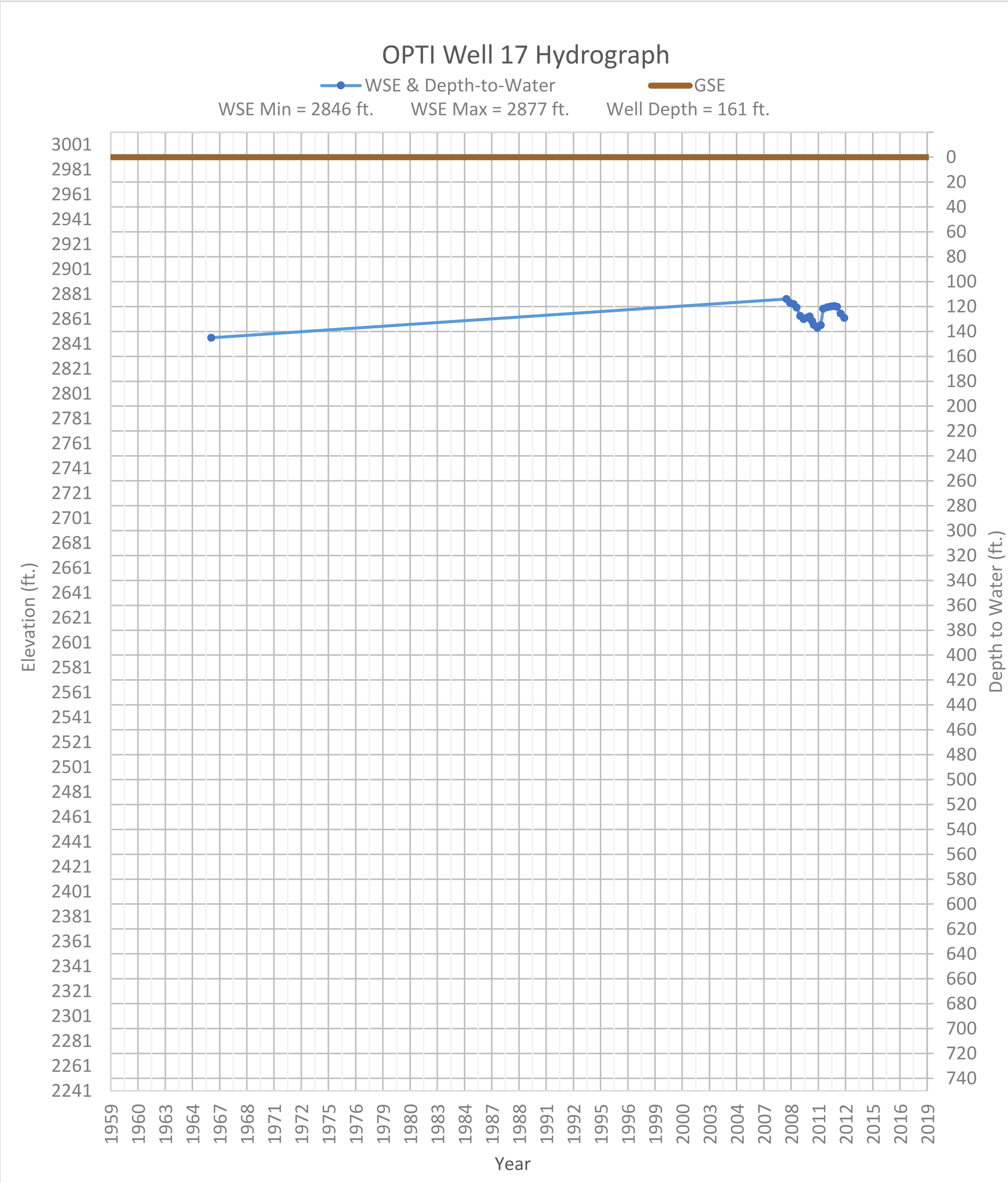
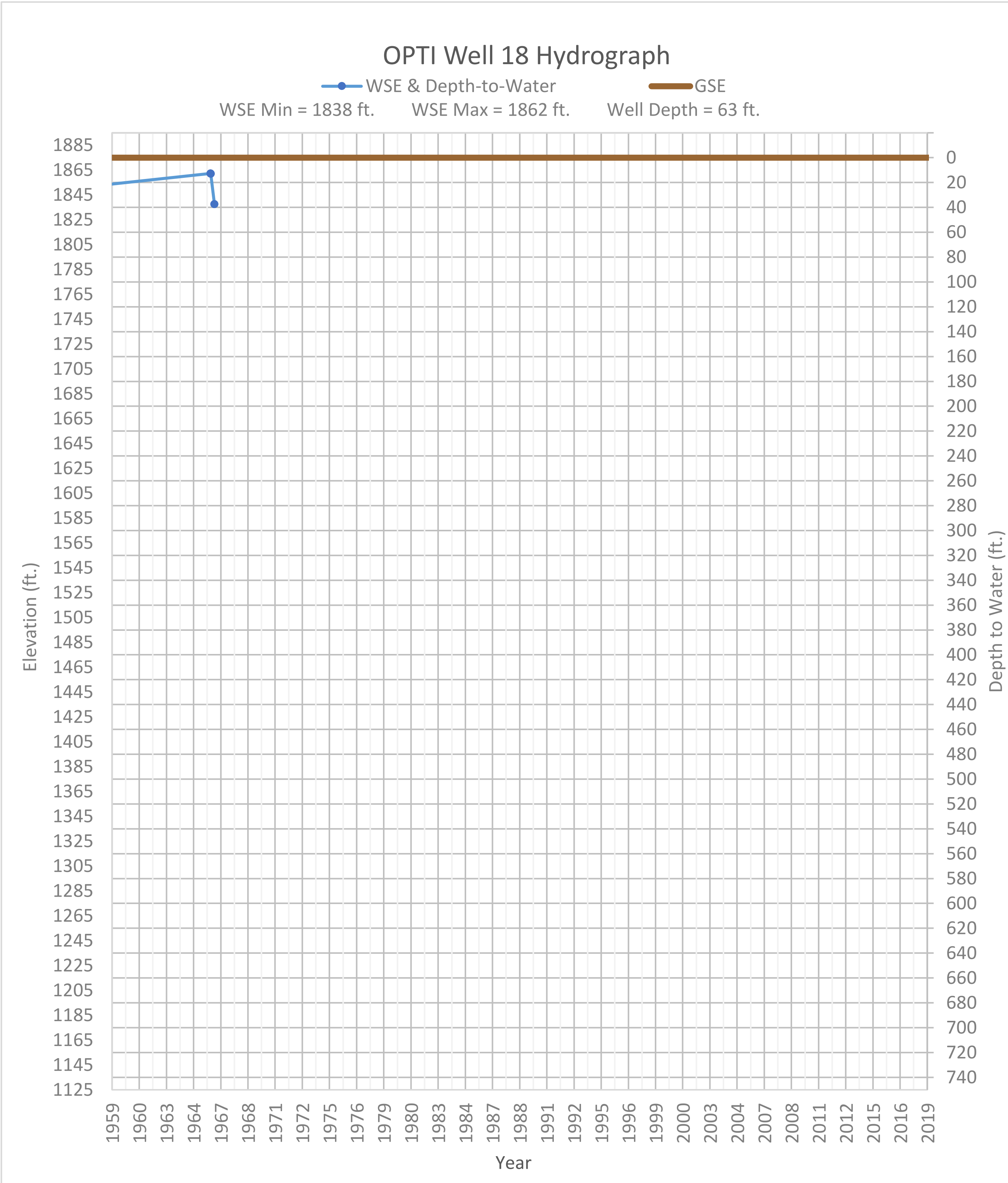
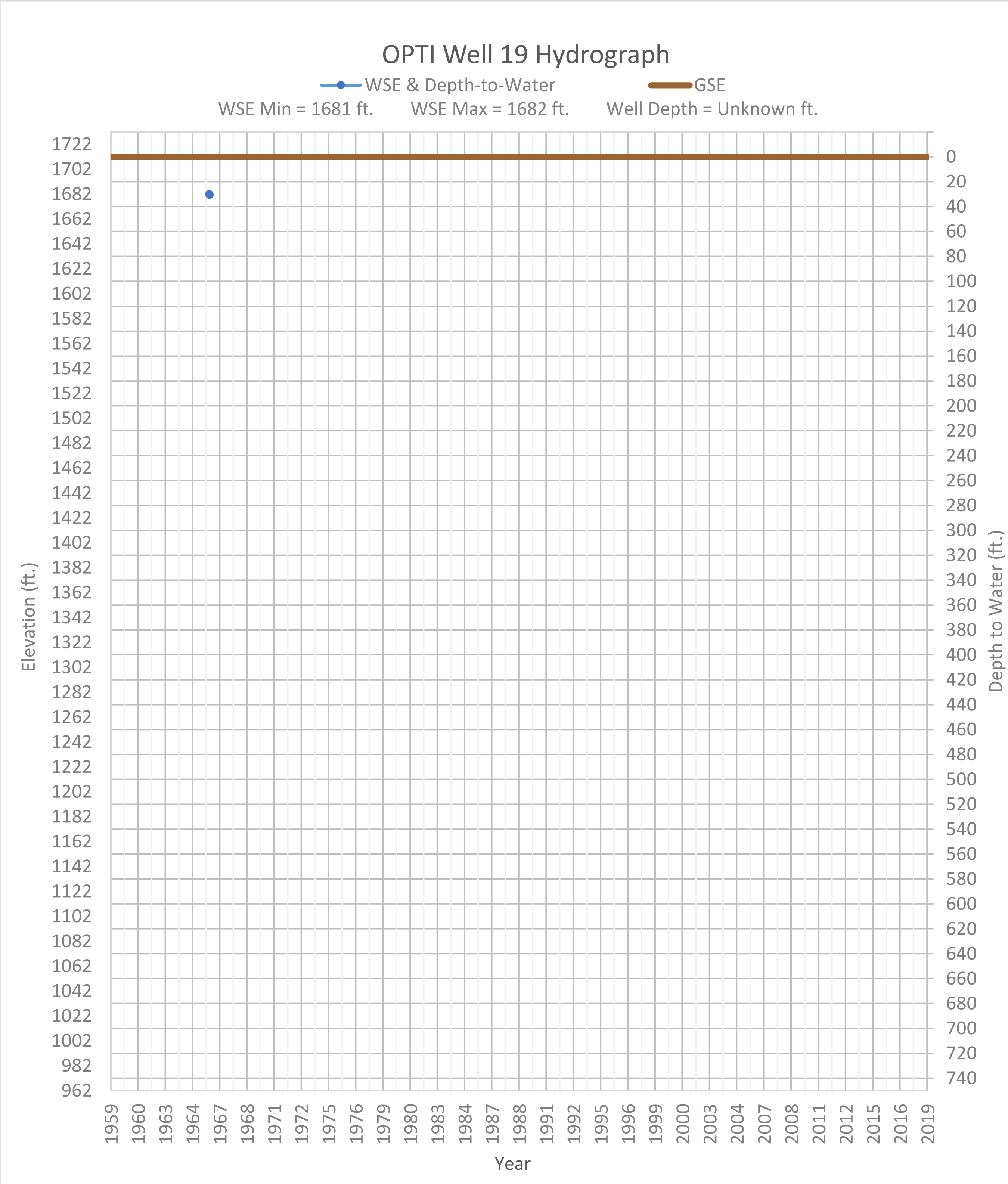
2016
2019

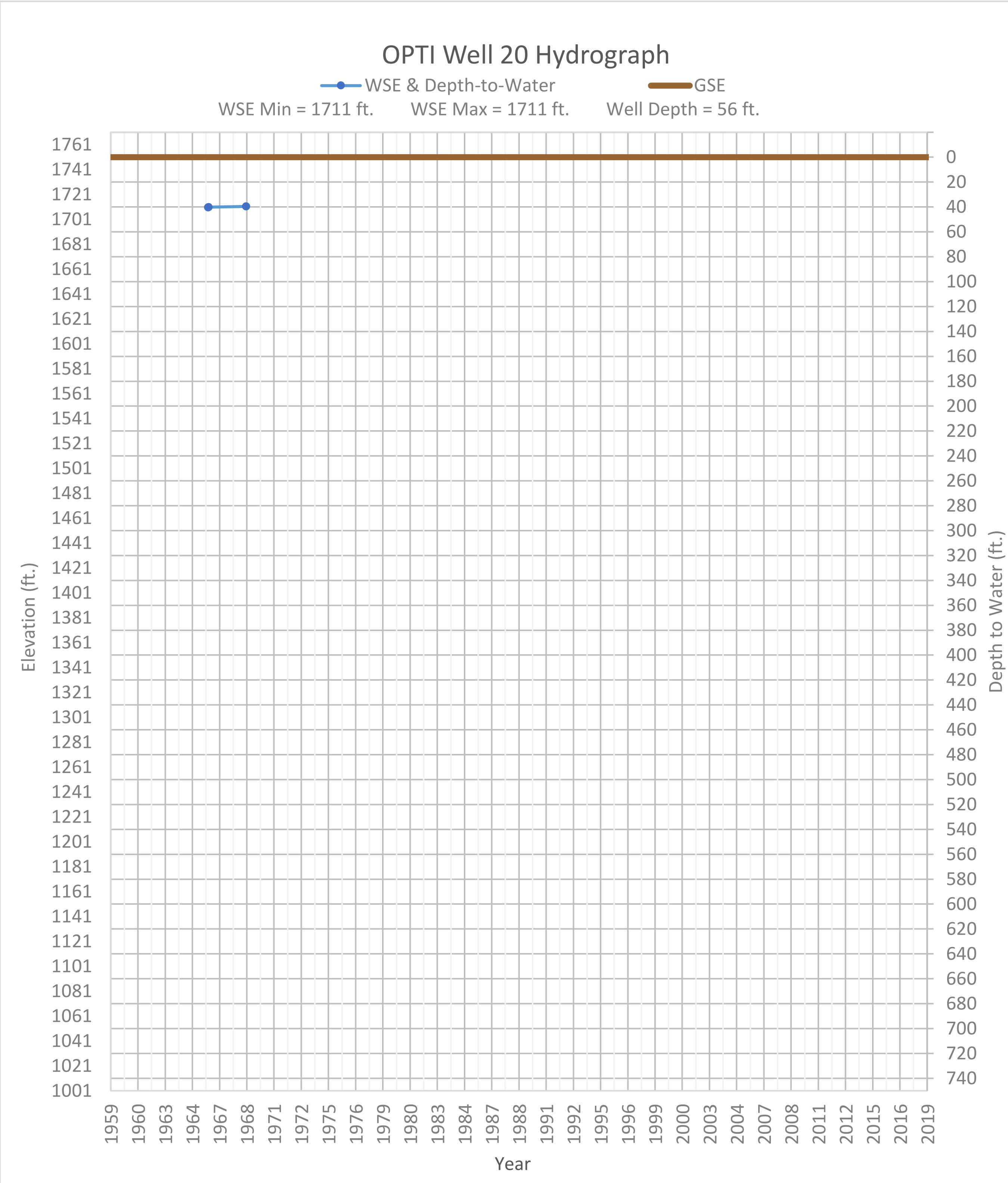

OPTI Well 17 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2846 ft.
WSE Max = 2877 ft.
Well Depth = 161 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

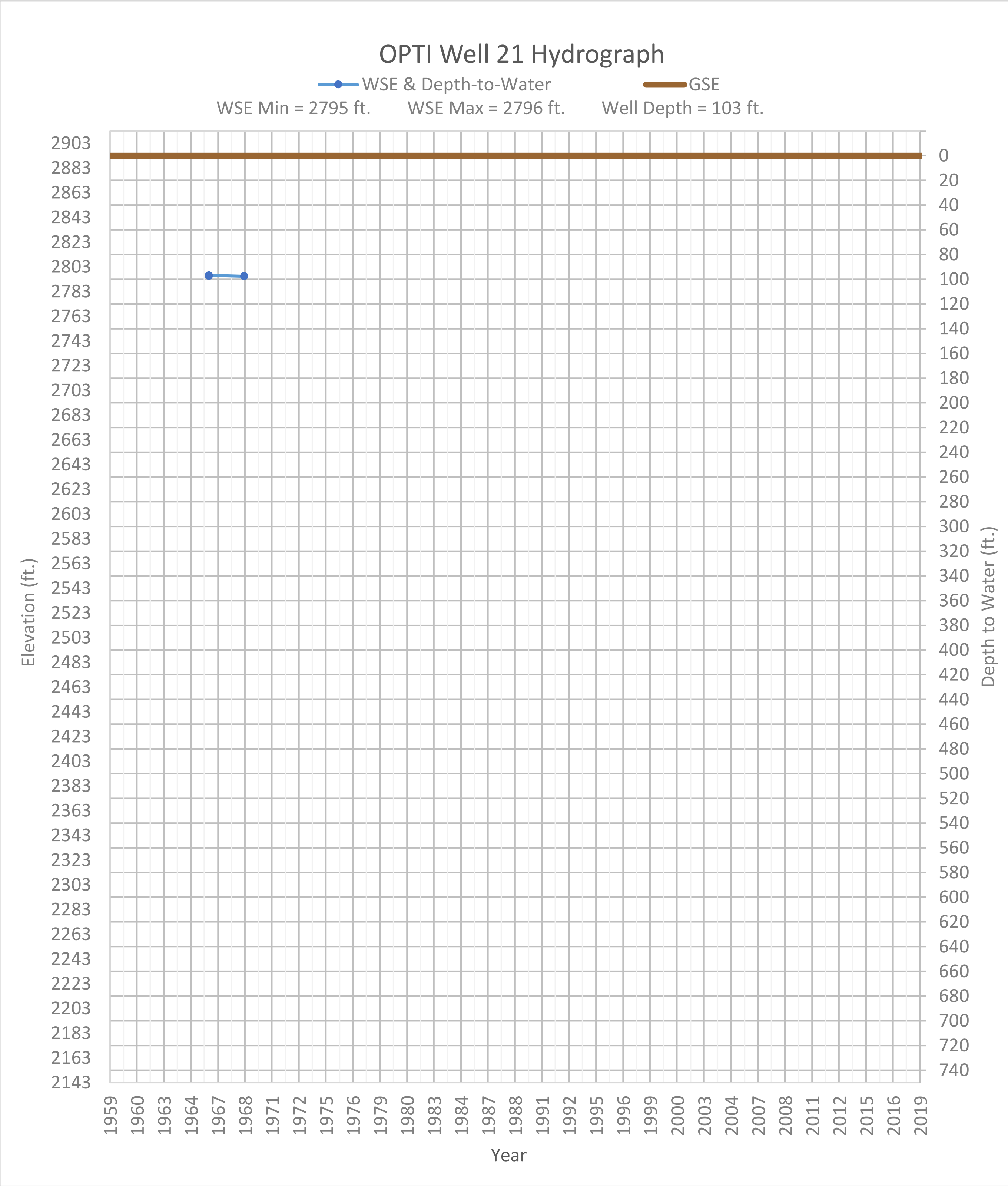


OPTI Well 18 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1838 ft.
WSE Max = 1862 ft.
Well Depth = 63 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

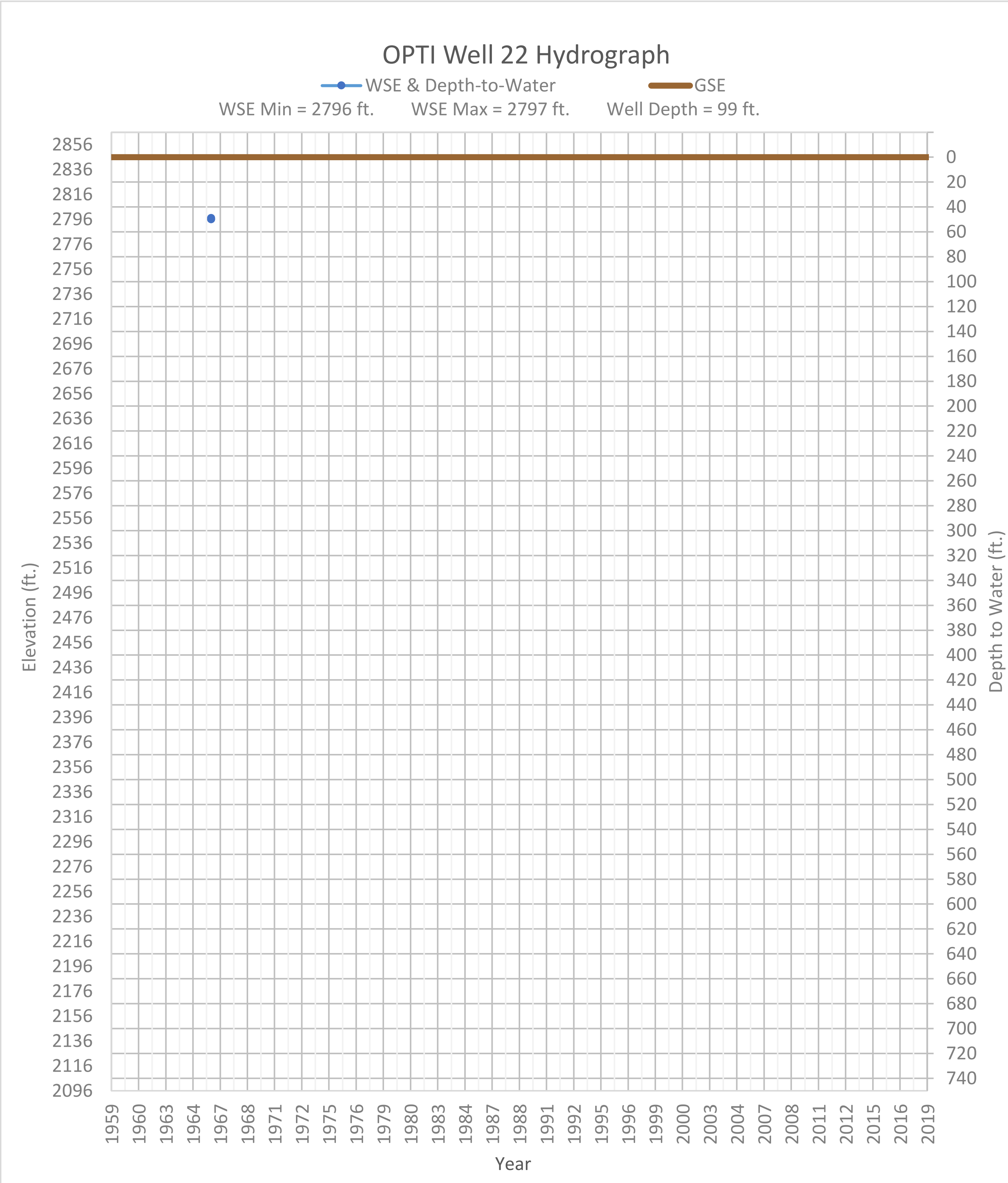


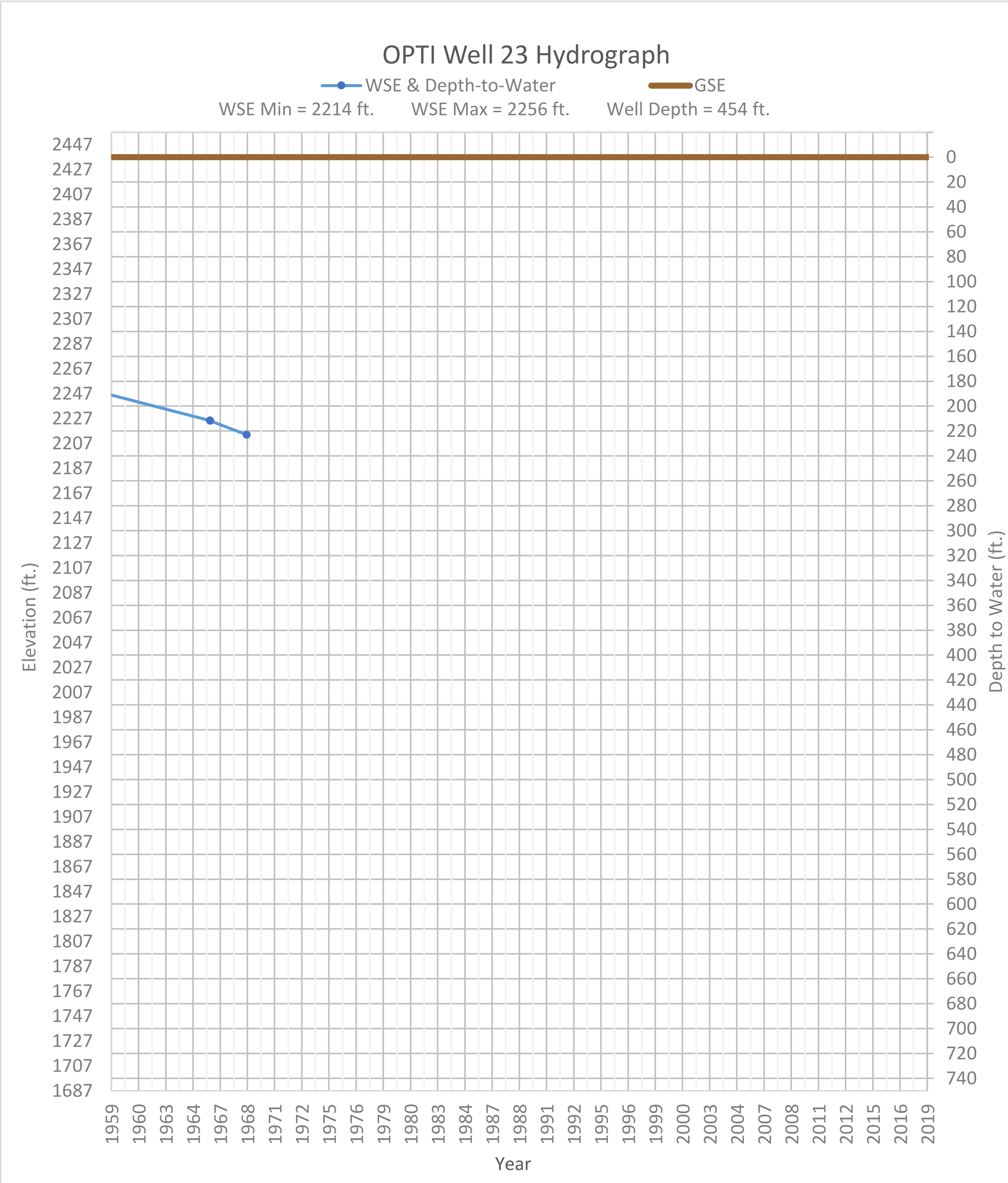
OPTI Well 19 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1681 ft.
WSE Max = 1682 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

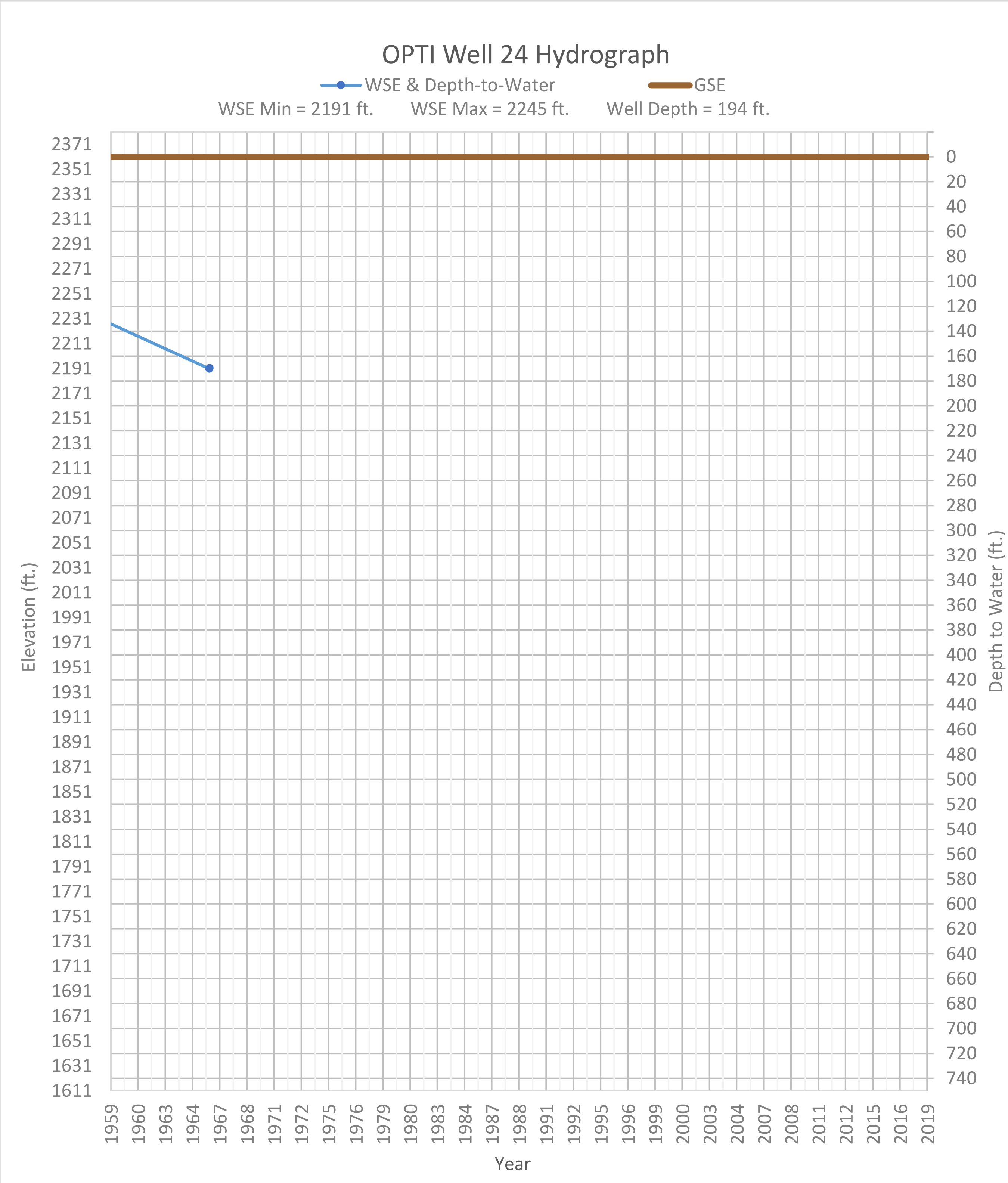

OPTI Well 20 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1711 ft.
WSE Max = 1711 ft.
Well Depth = 56 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

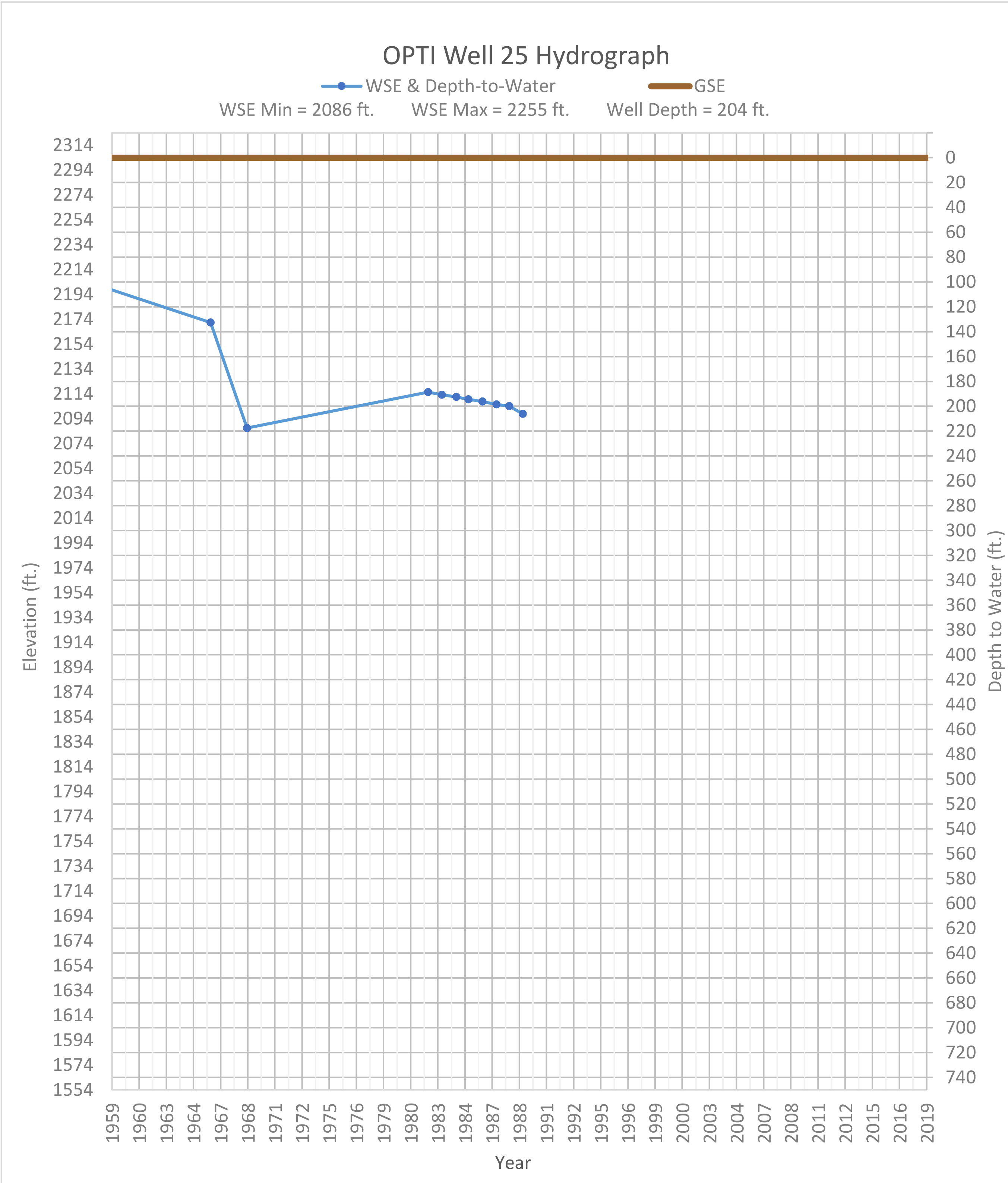


OPTI Well 21 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2795 ft.
WSE Max = 2796 ft.
Well Depth = 103 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

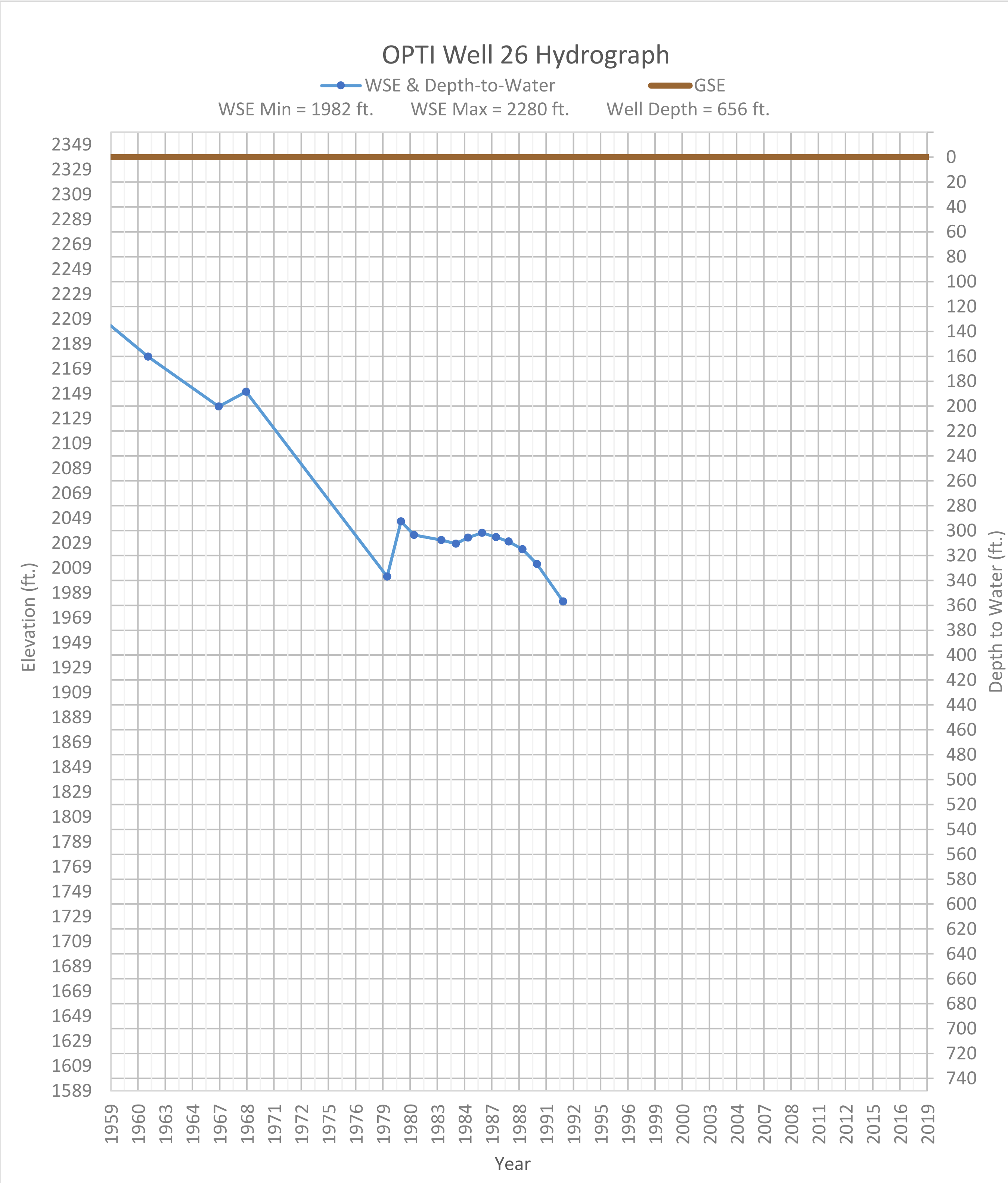

OPTI Well 22 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2796 ft.
WSE Max = 2797 ft.
Well Depth = 99 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 23 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2214 ft.
WSE Max = 2256 ft.
Well Depth = 454 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

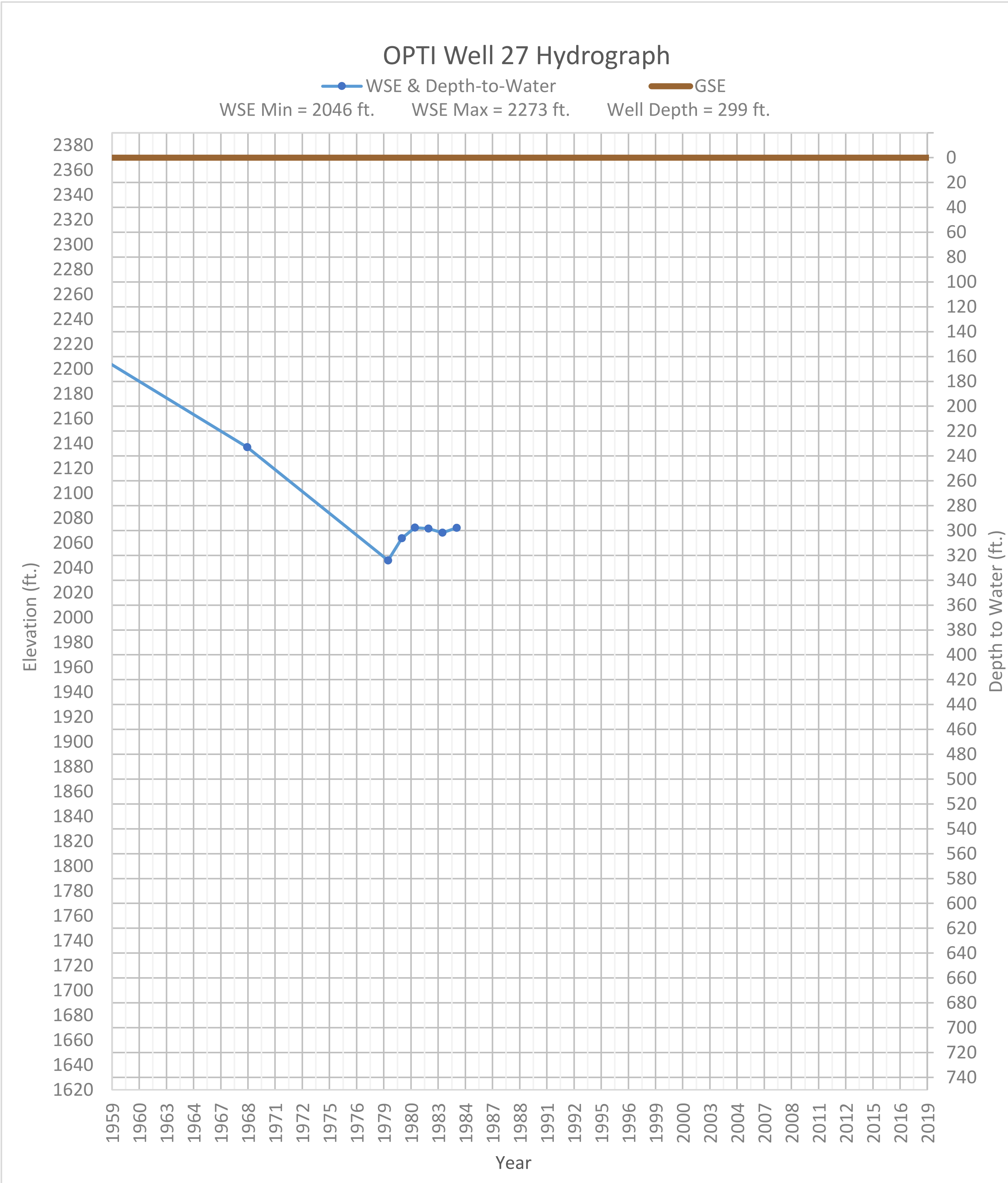

OPTI Well 24 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2191 ft.
WSE Max = 2245 ft.
Well Depth = 194 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



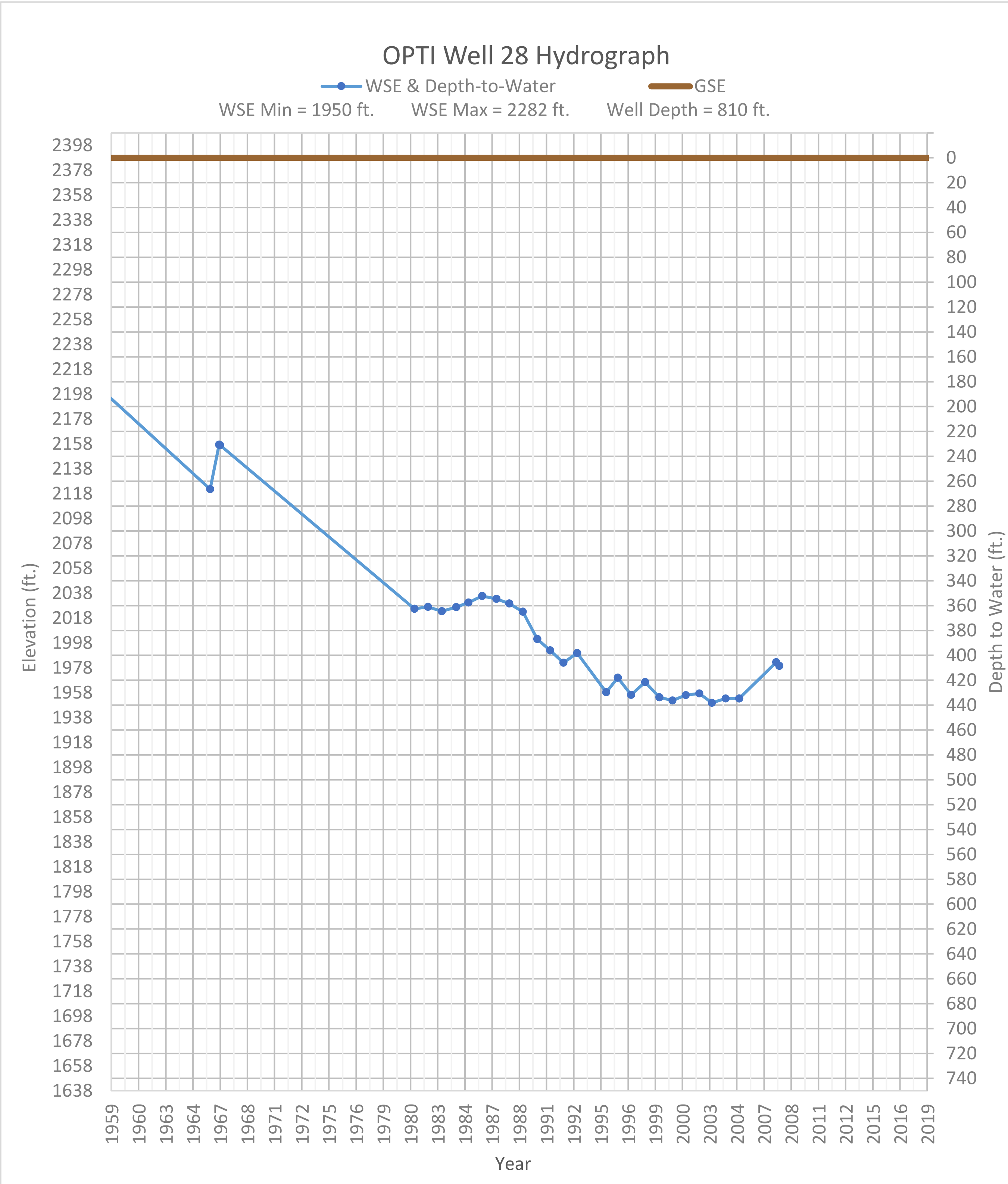
OPTI Well 25 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2086 ft.
WSE Max = 2255 ft.
Well Depth = 204 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 26 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1982 ft.
WSE Max = 2280 ft.
Well Depth = 656 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 27 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2046 ft.
WSE Max = 2273 ft.
Well Depth = 299 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 28 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1950 ft.
WSE Max = 2282 ft.
Well Depth = 810 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2398
2378
2358
2338
2318
2298
2278
2258
2238
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
1918
1898
1878
1858
1838
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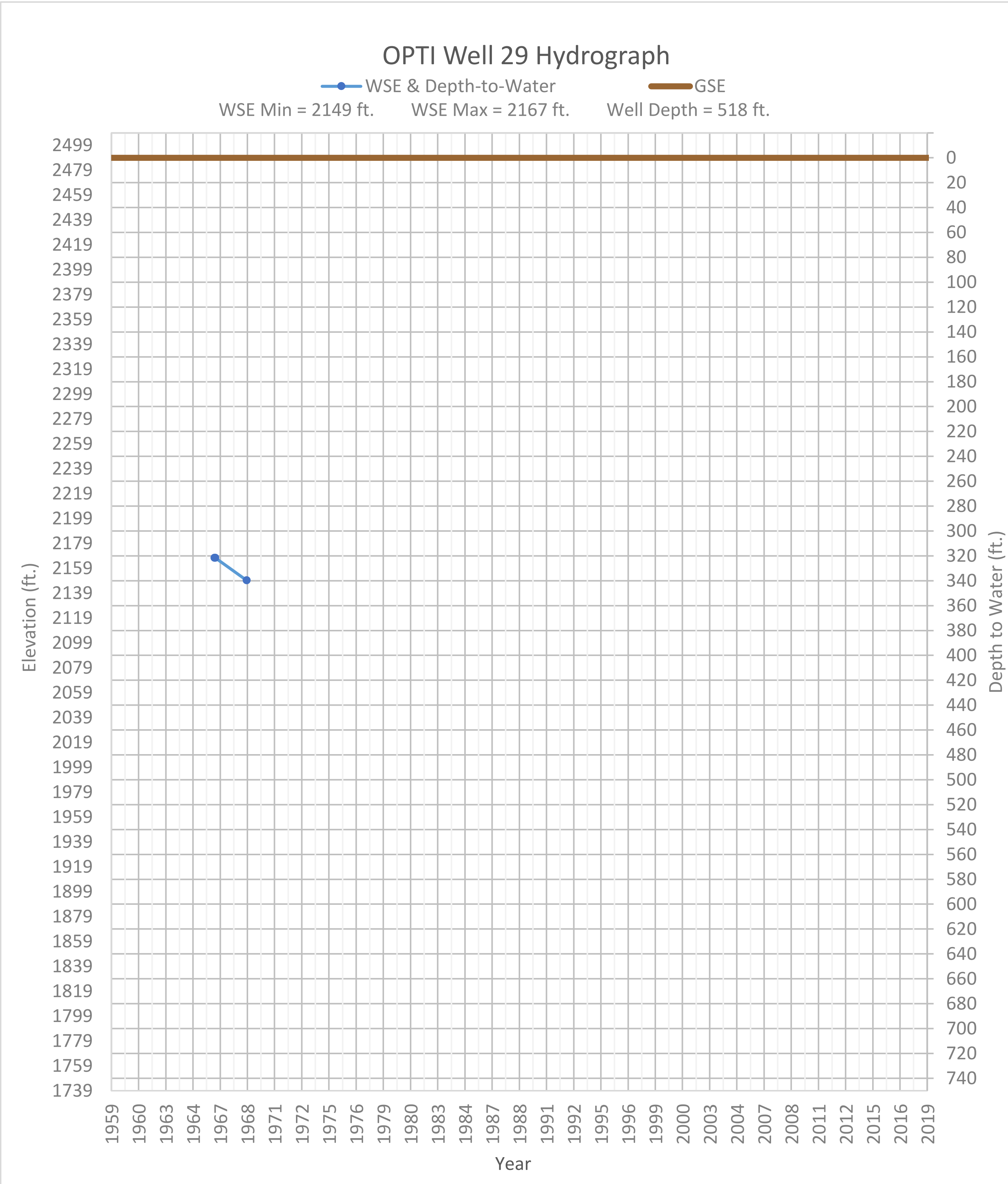
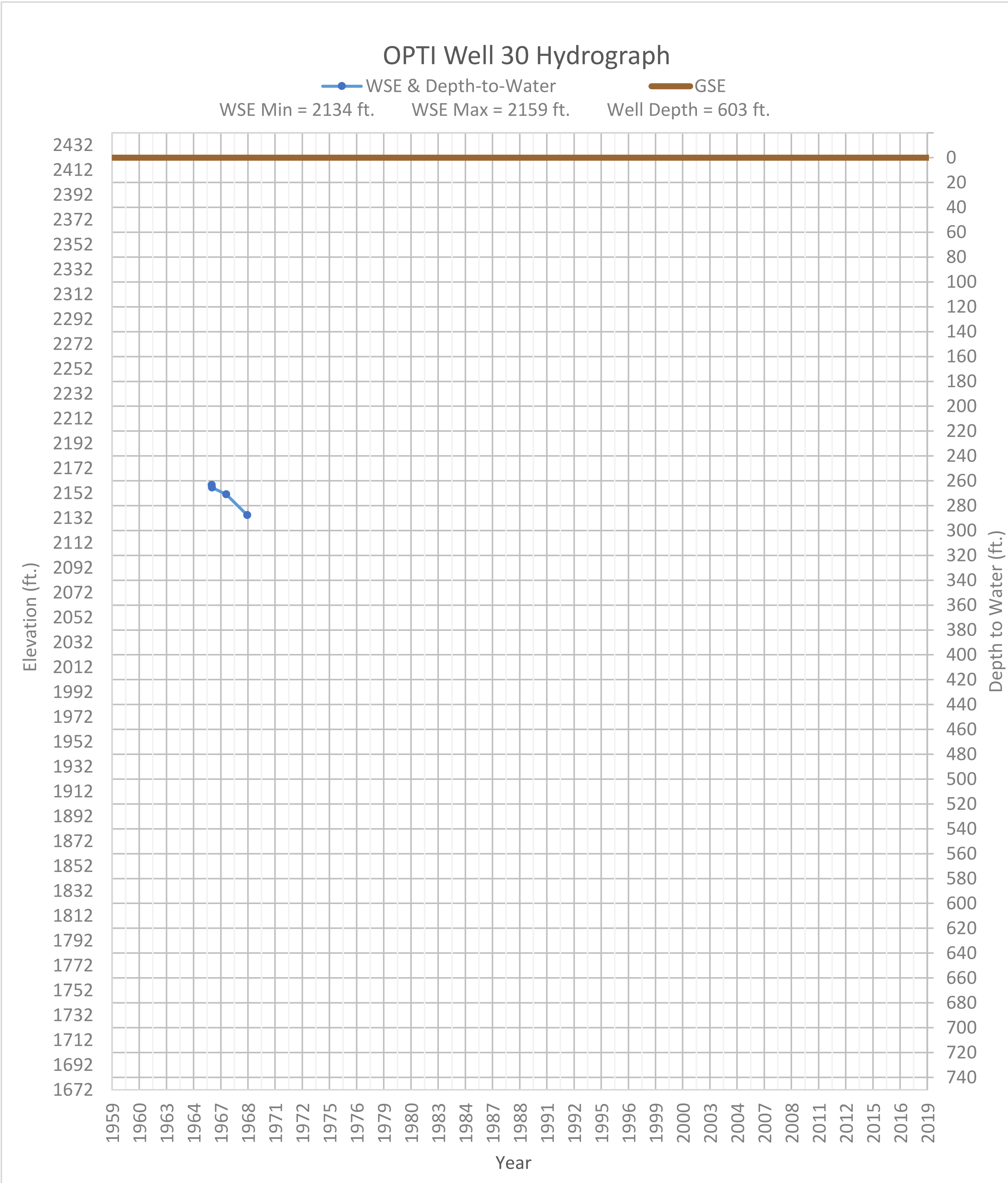
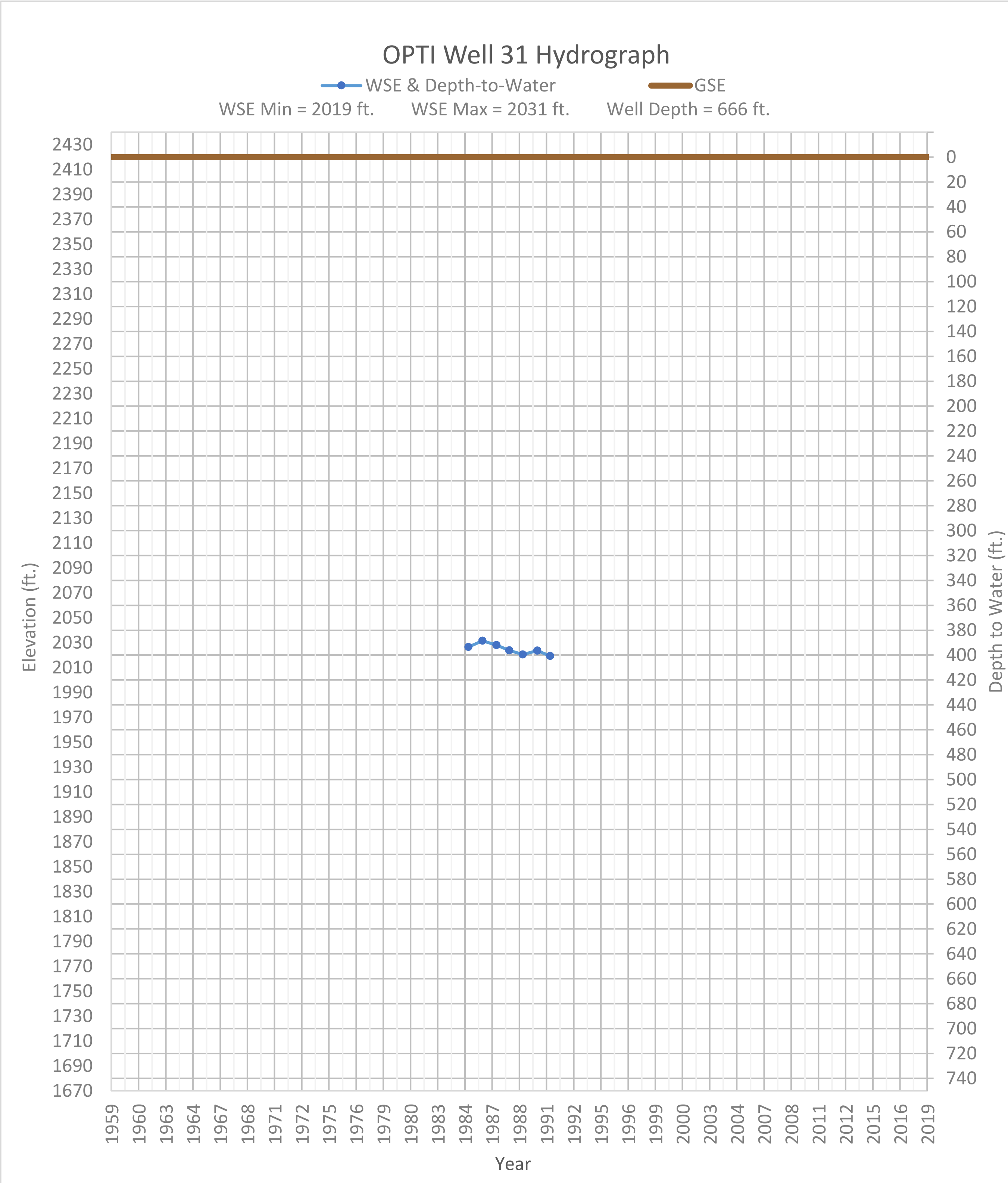


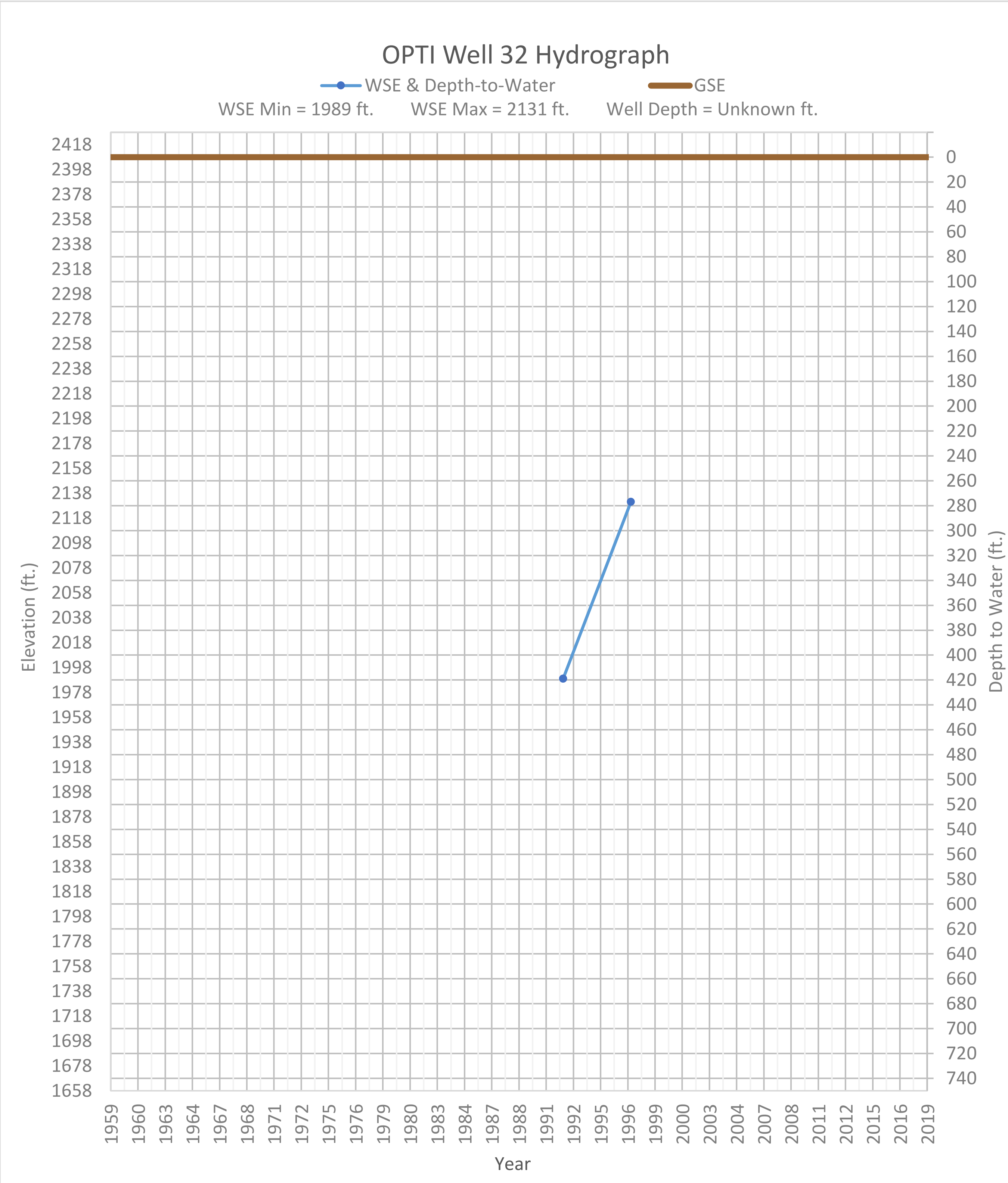
OPTI Well 29 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2149 ft.
WSE Max = 2167 ft.
Well Depth = 518 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



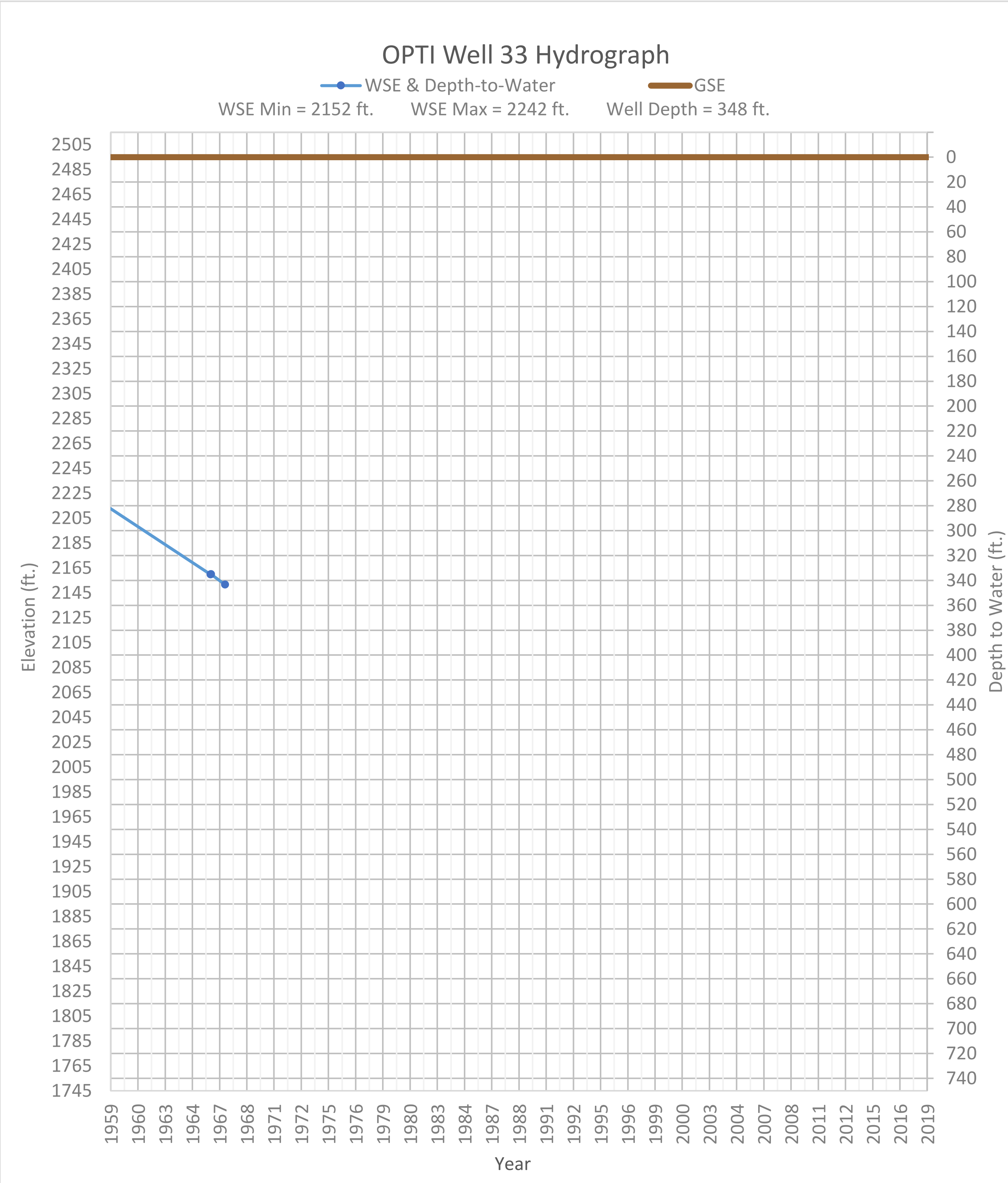
OPTI Well 30 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2134 ft.
WSE Max = 2159 ft.
Well Depth = 603 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



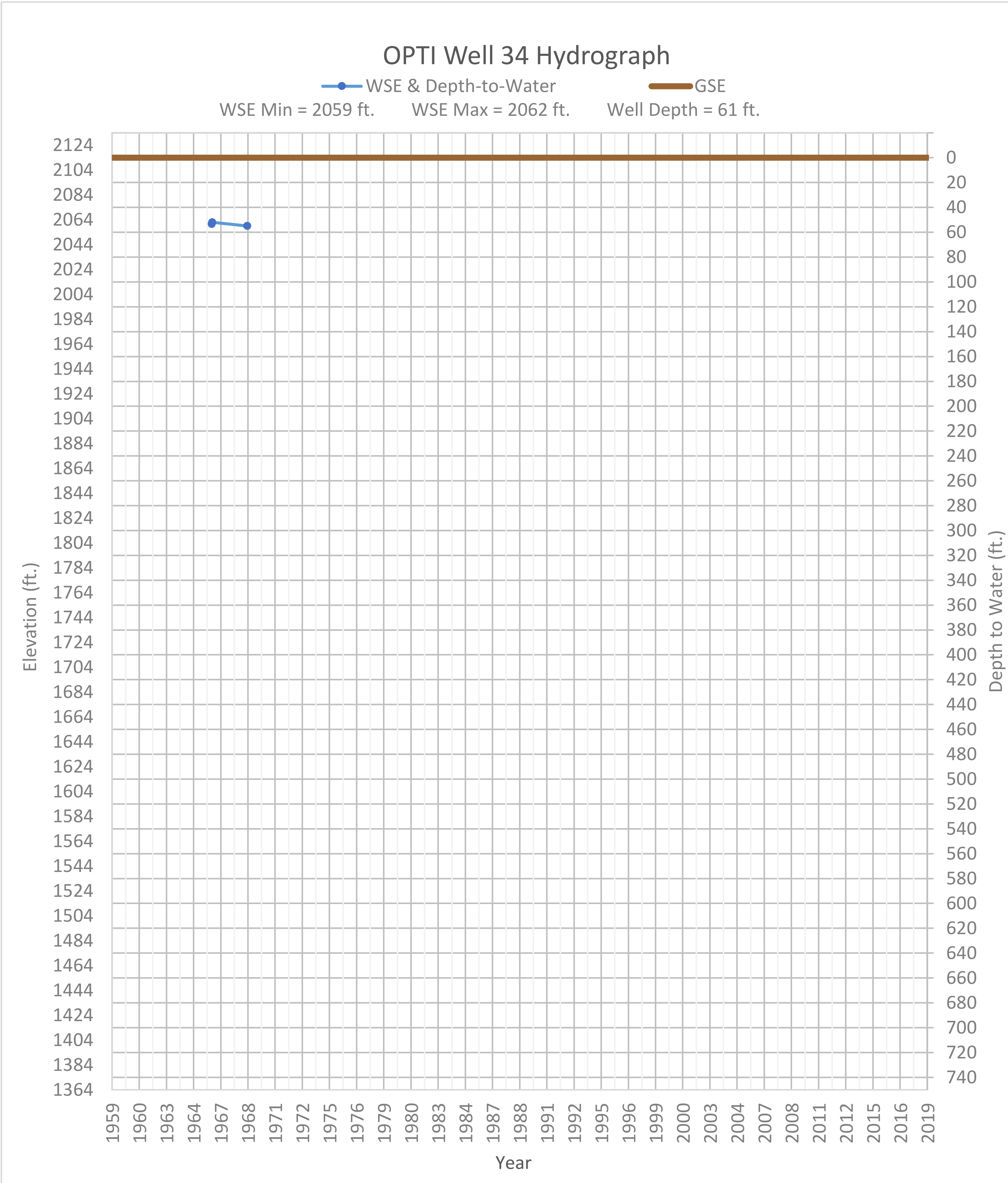
OPTI Well 31 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2019 ft.
WSE Max = 2031 ft.
Well Depth = 666 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



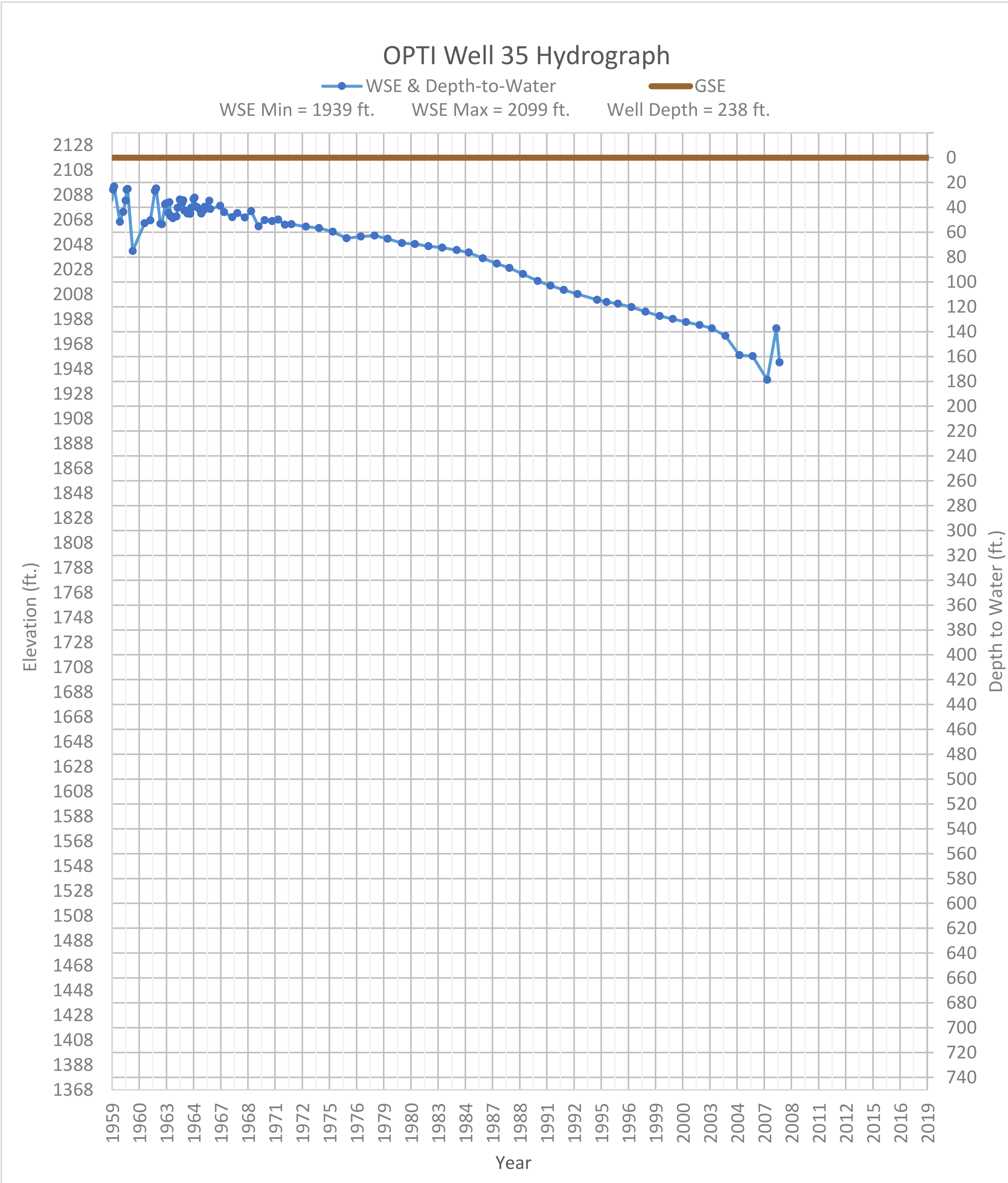
OPTI Well 32 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1989 ft.
WSE Max = 2131 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



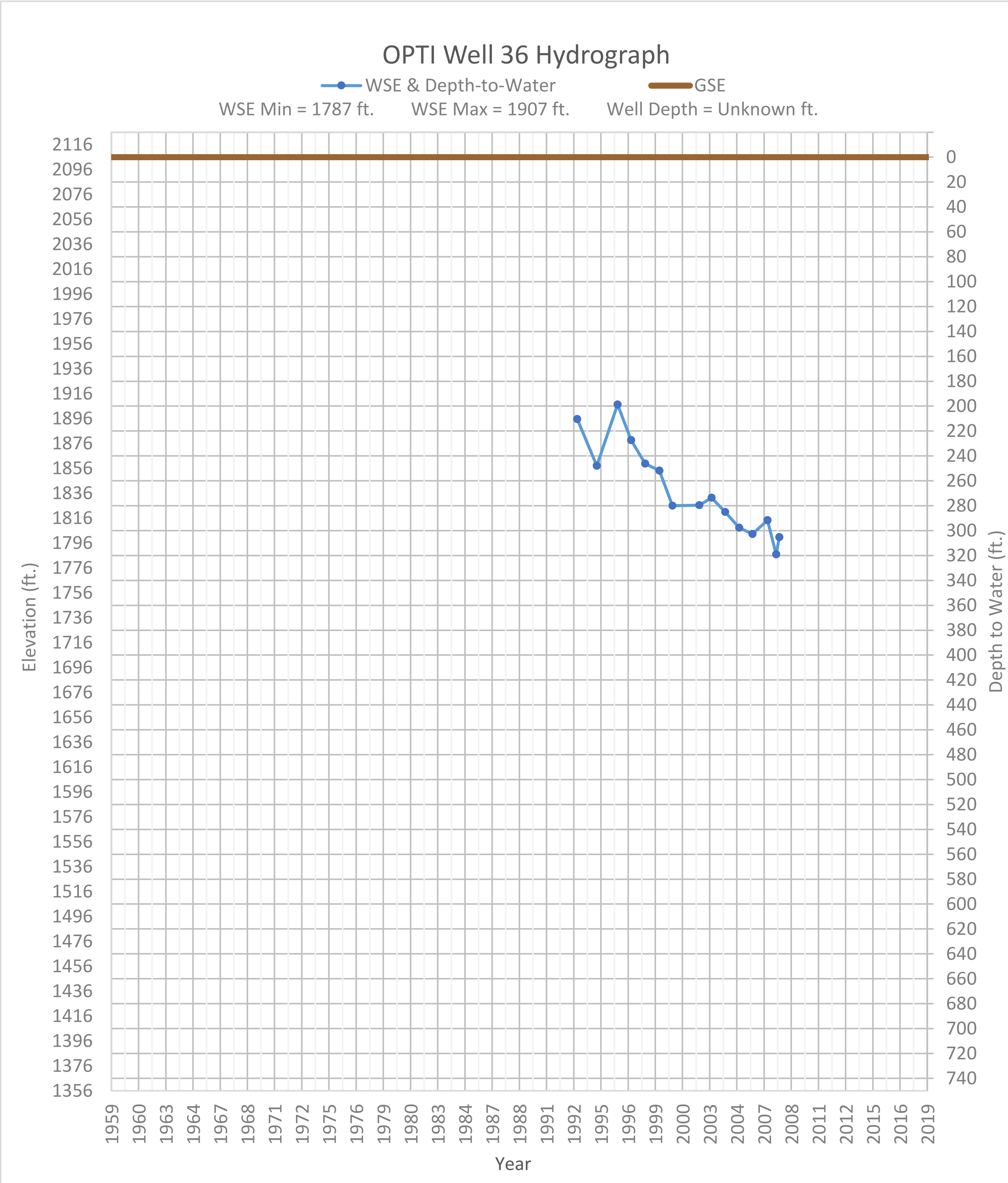
OPTI Well 33 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2152 ft.
WSE Max = 2242 ft.
Well Depth = 348 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

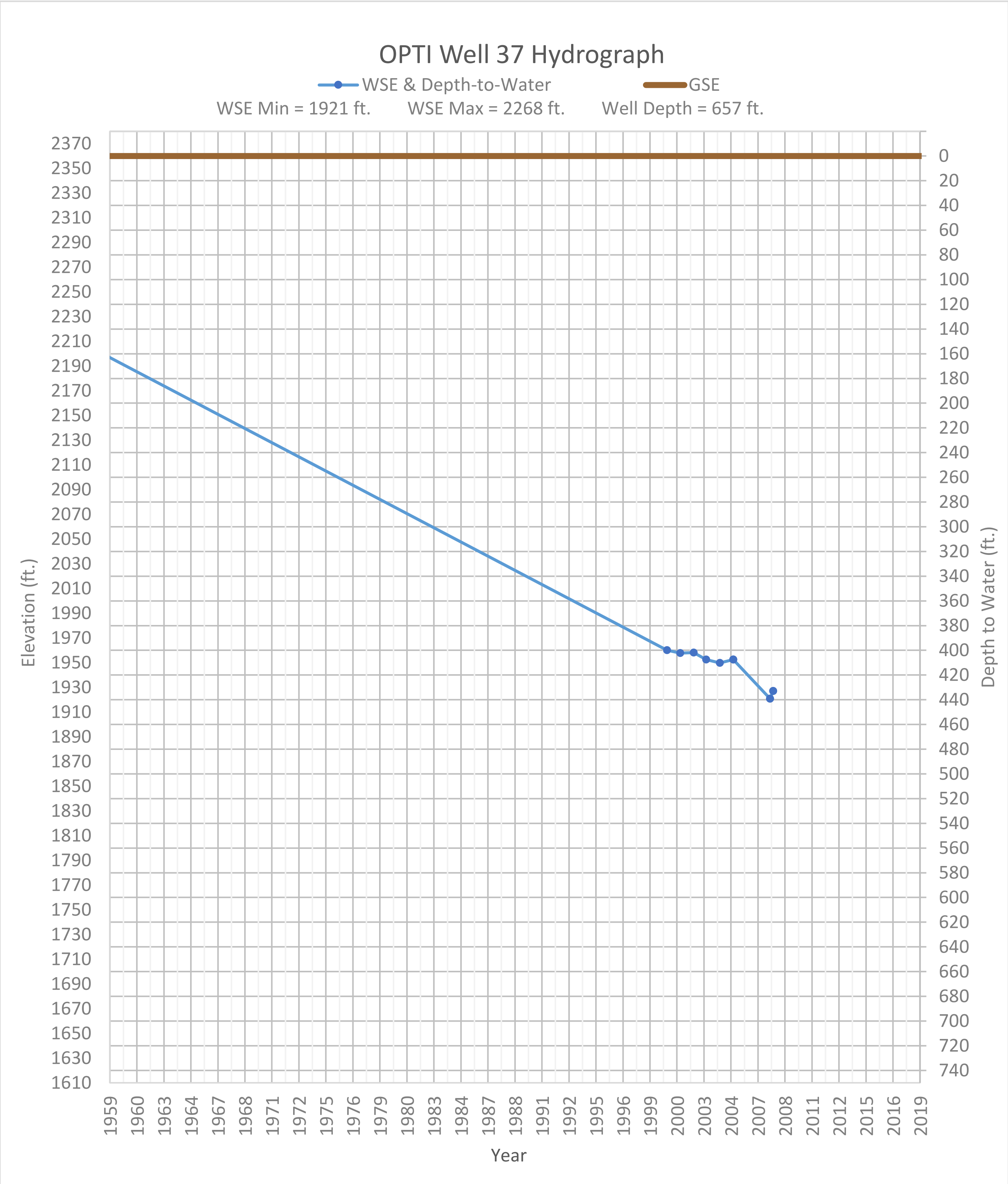


OPTI Well 34 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2059 ft.
WSE Max = 2062 ft.
Well Depth = 61 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



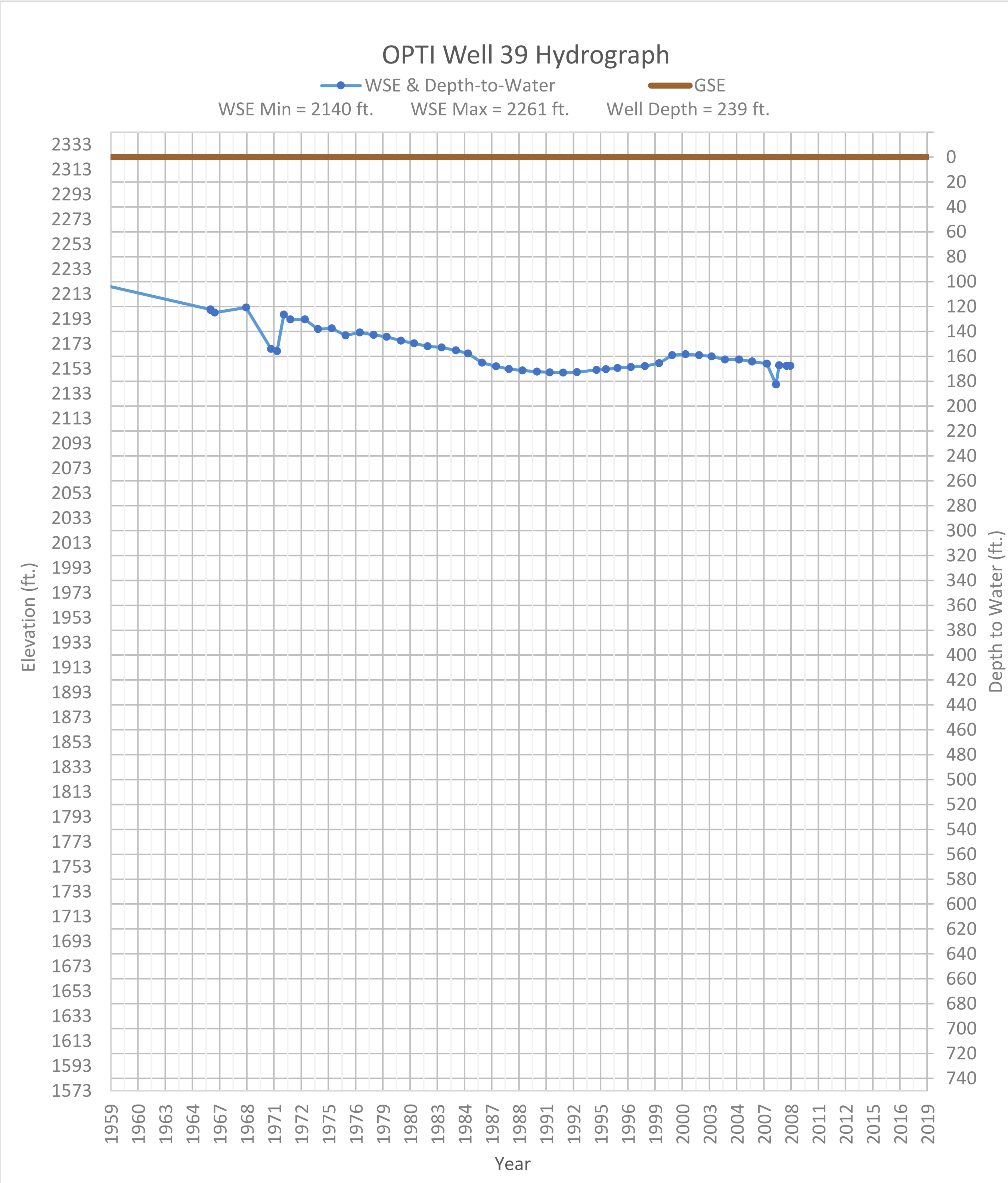
OPTI Well 35 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1939 ft.
WSE Max = 2099 ft.
Well Depth = 238 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 36 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1787 ft.
WSE Max = 1907 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

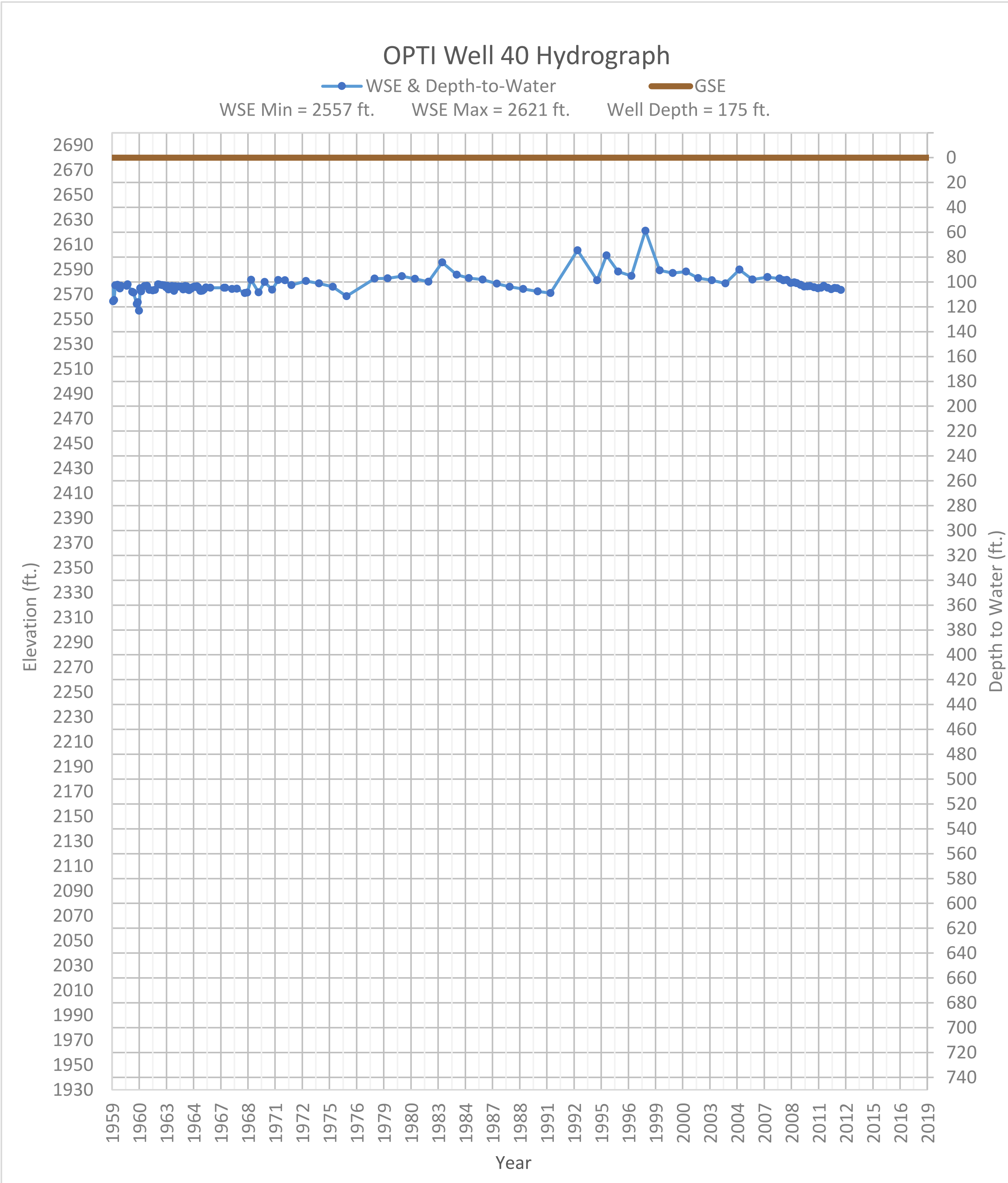


OPTI Well 37 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1921 ft.
WSE Max = 2268 ft.
Well Depth = 657 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 38 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1917 ft.
WSE Max = 2239 ft.
Well Depth = 450 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019
2370 2350 2330 2310 2290 2270 2250 2230 2210 2190 2170 2150 2130 2110 2090 2070 2050 2030 2010 1990 1970 1950 1930 1910 1890 1870 1850 1830 1810 1790 1770 1750 1730 1710 1690 1670 1650 1630 1610
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740

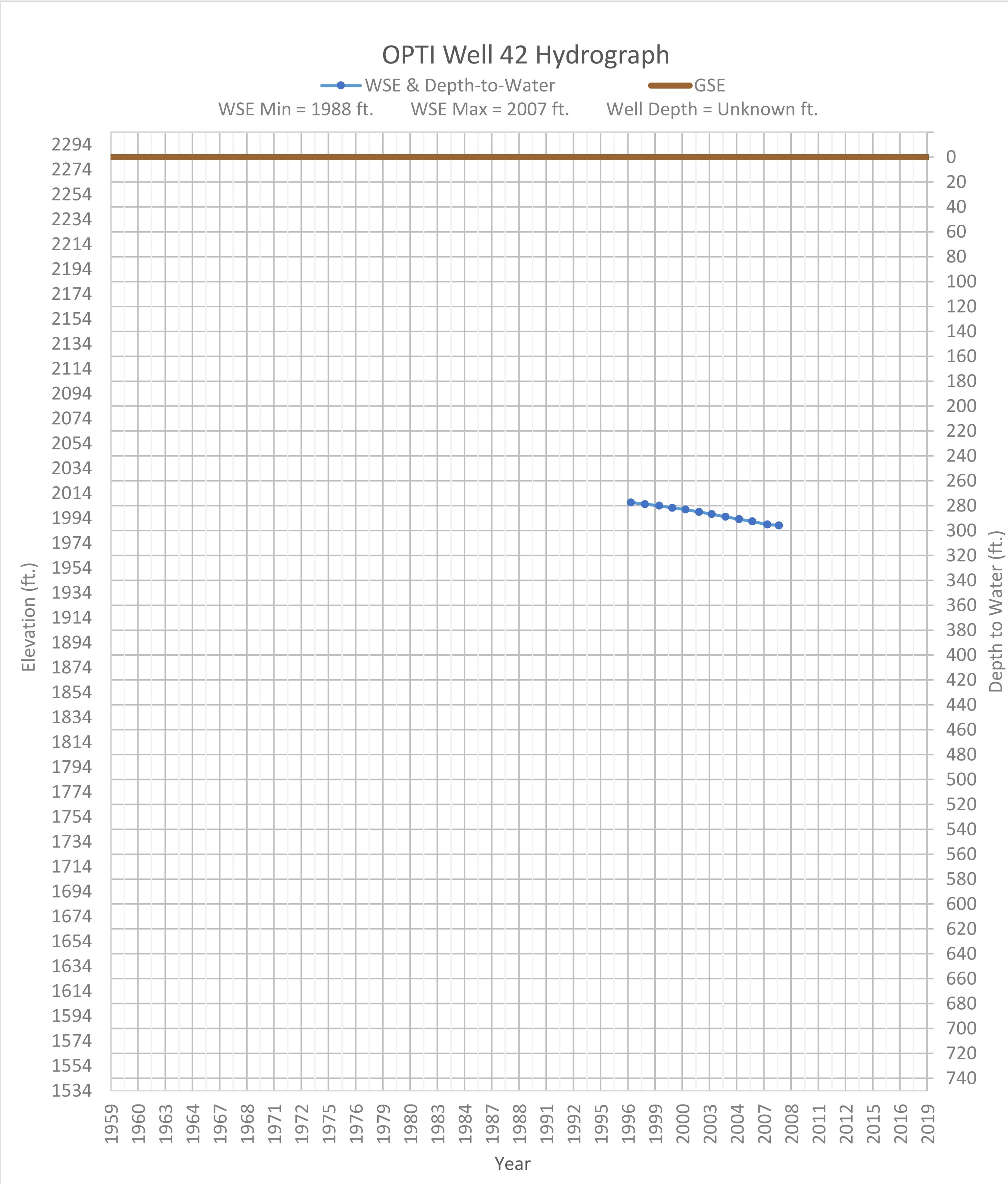


OPTI Well 39 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2140 ft.
WSE Max = 2261 ft.
Well Depth = 239 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 40 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2557 ft.
WSE Max = 2621 ft.
Well Depth = 175 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 41 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2743 ft.
WSE Max = 2799 ft.
Well Depth = 95 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 42 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1988 ft.
WSE Max = 2007 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2294
2274
2254
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
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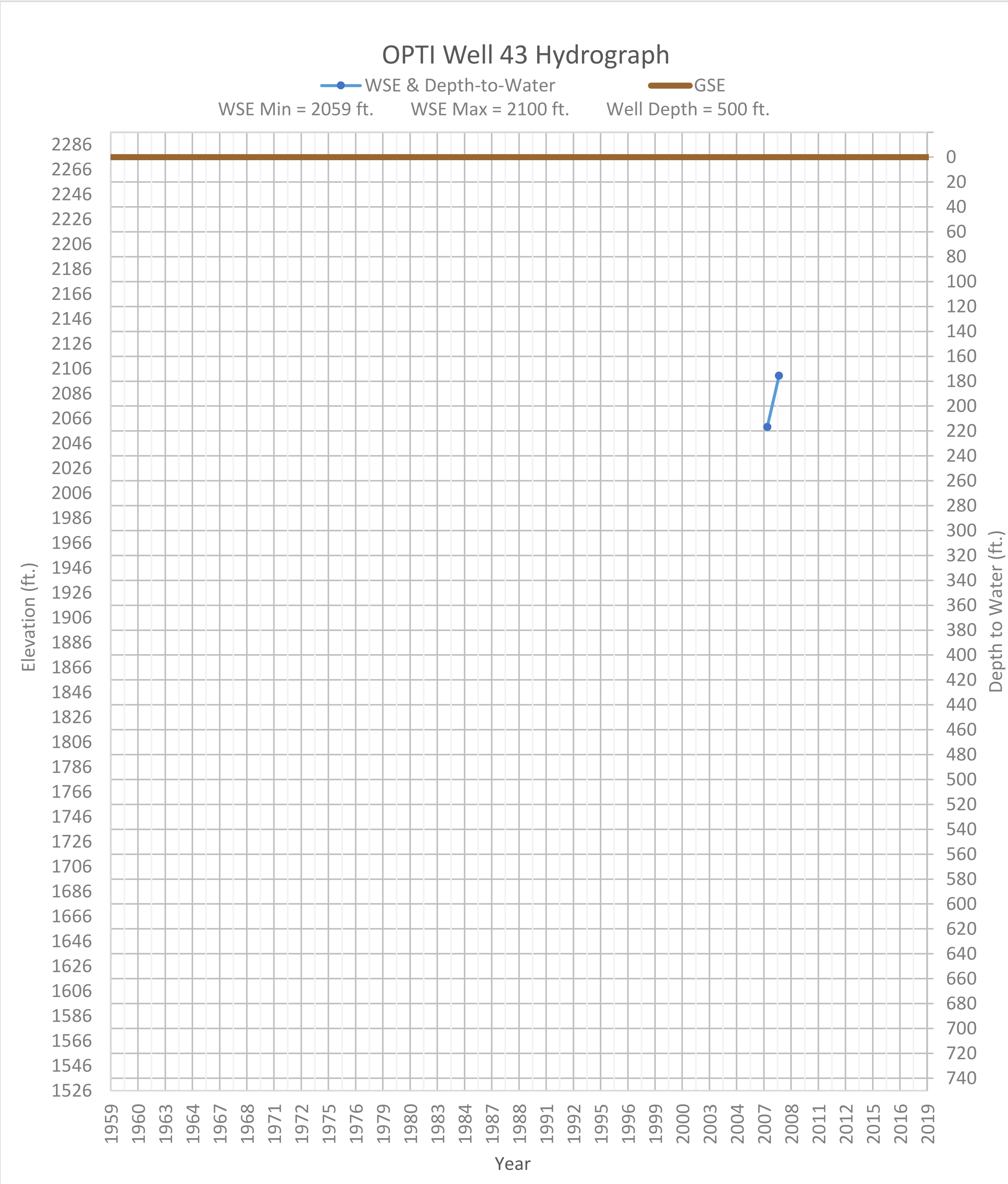
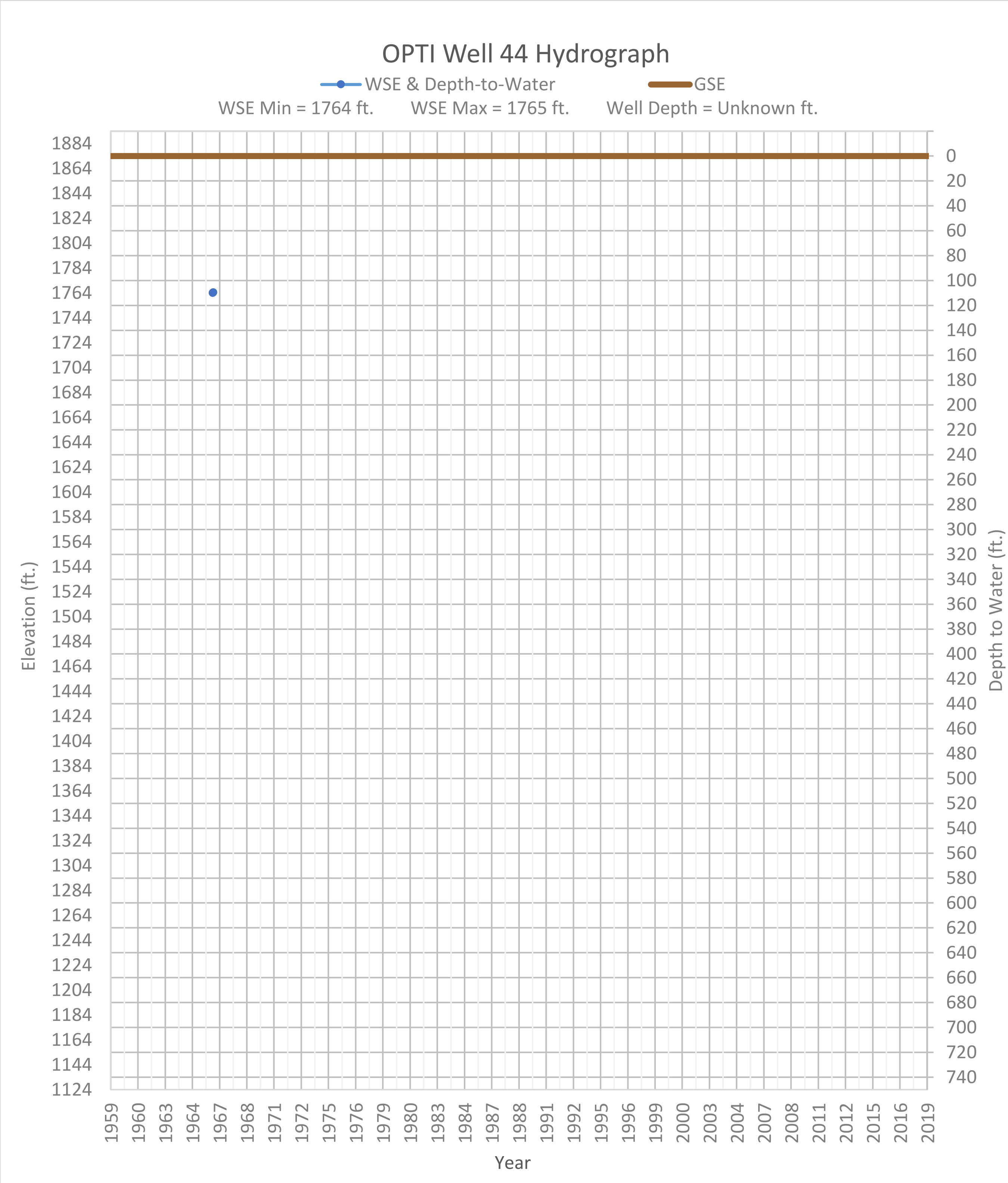


OPTI Well 43 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2059 ft.
WSE Max = 2100 ft.
Well Depth = 500 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 44 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1764 ft.
WSE Max = 1765 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1884
1864
1844
1824
1804
1784
1764
1744
1724
1704
1684
1664
1644
1624
1604
1584
1564
1544
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1424
1404
1384
1364
1344
1324
1304
1284
1264
1244
1224
1204
1184
1164
1144
1124
0
20
40
60
80
100
120
140
160
180
200
220
240
260
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320
340
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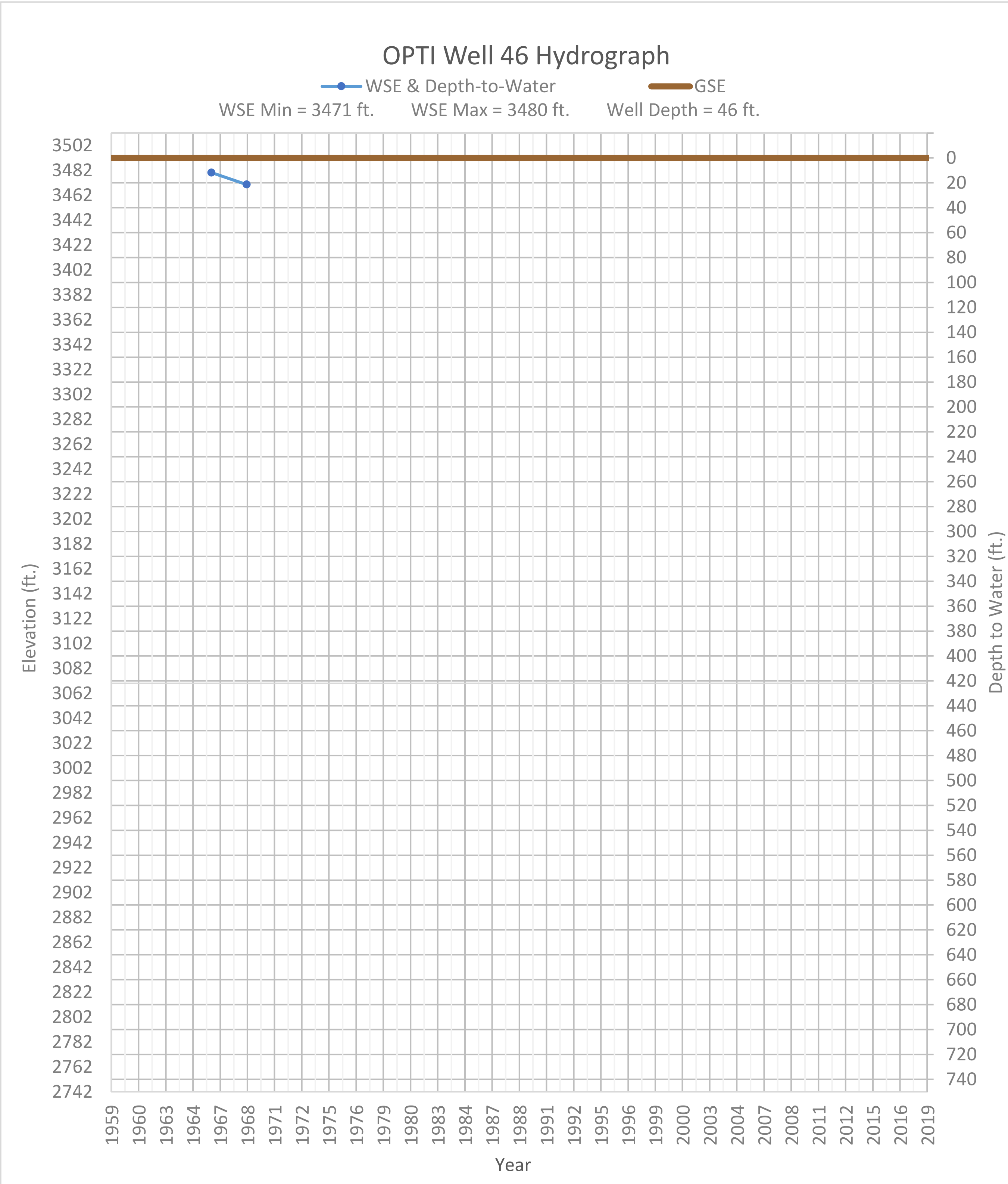
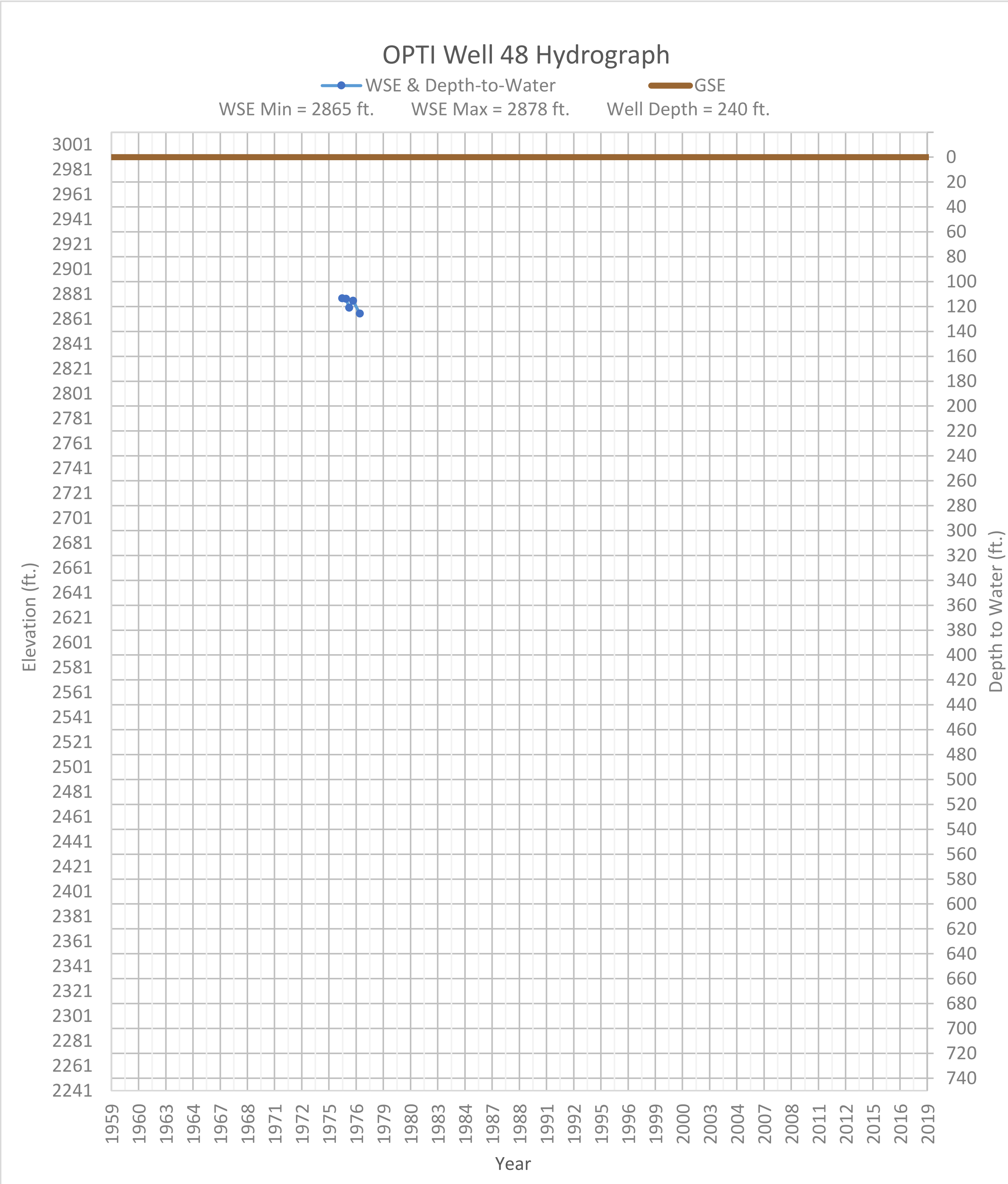
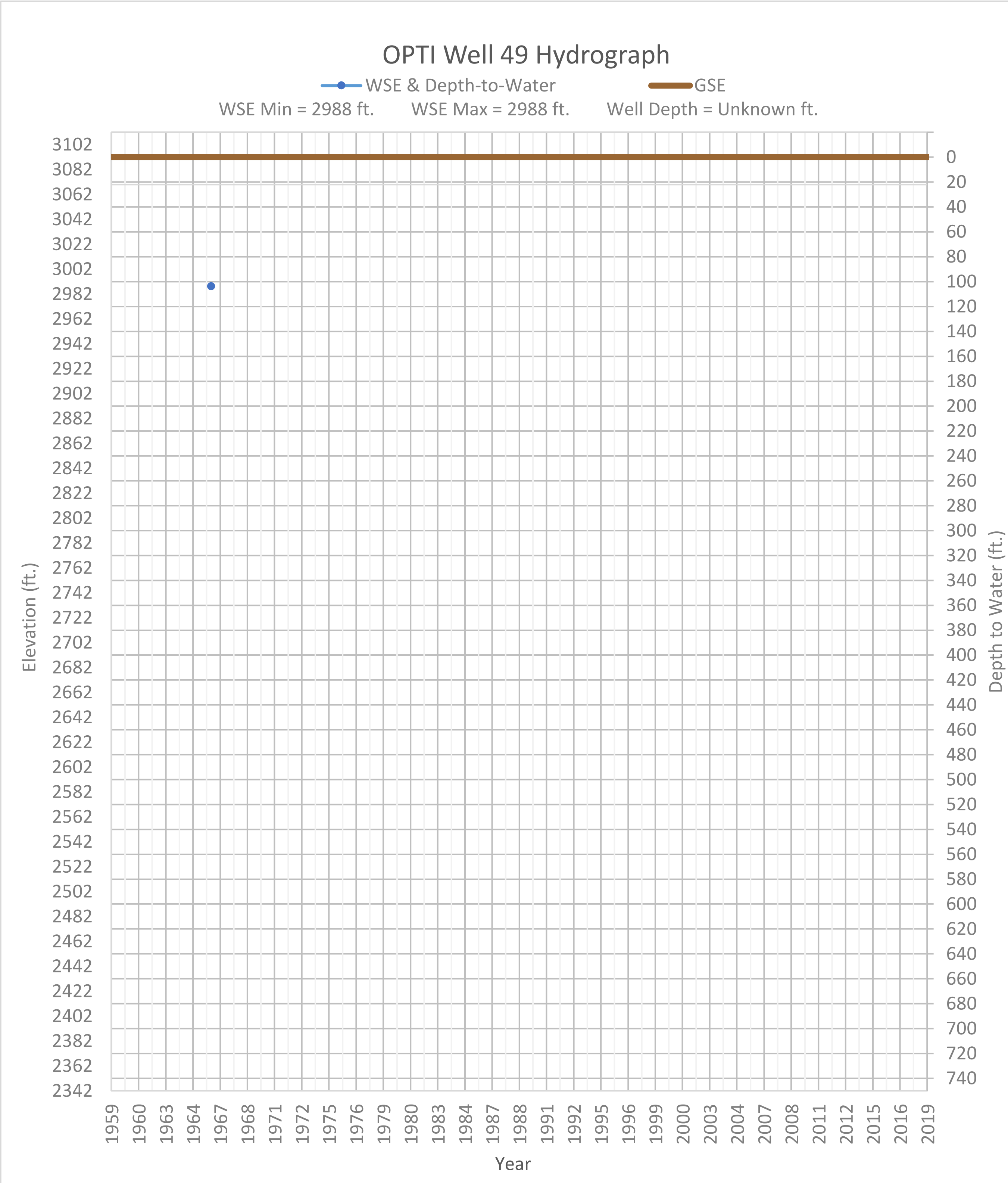


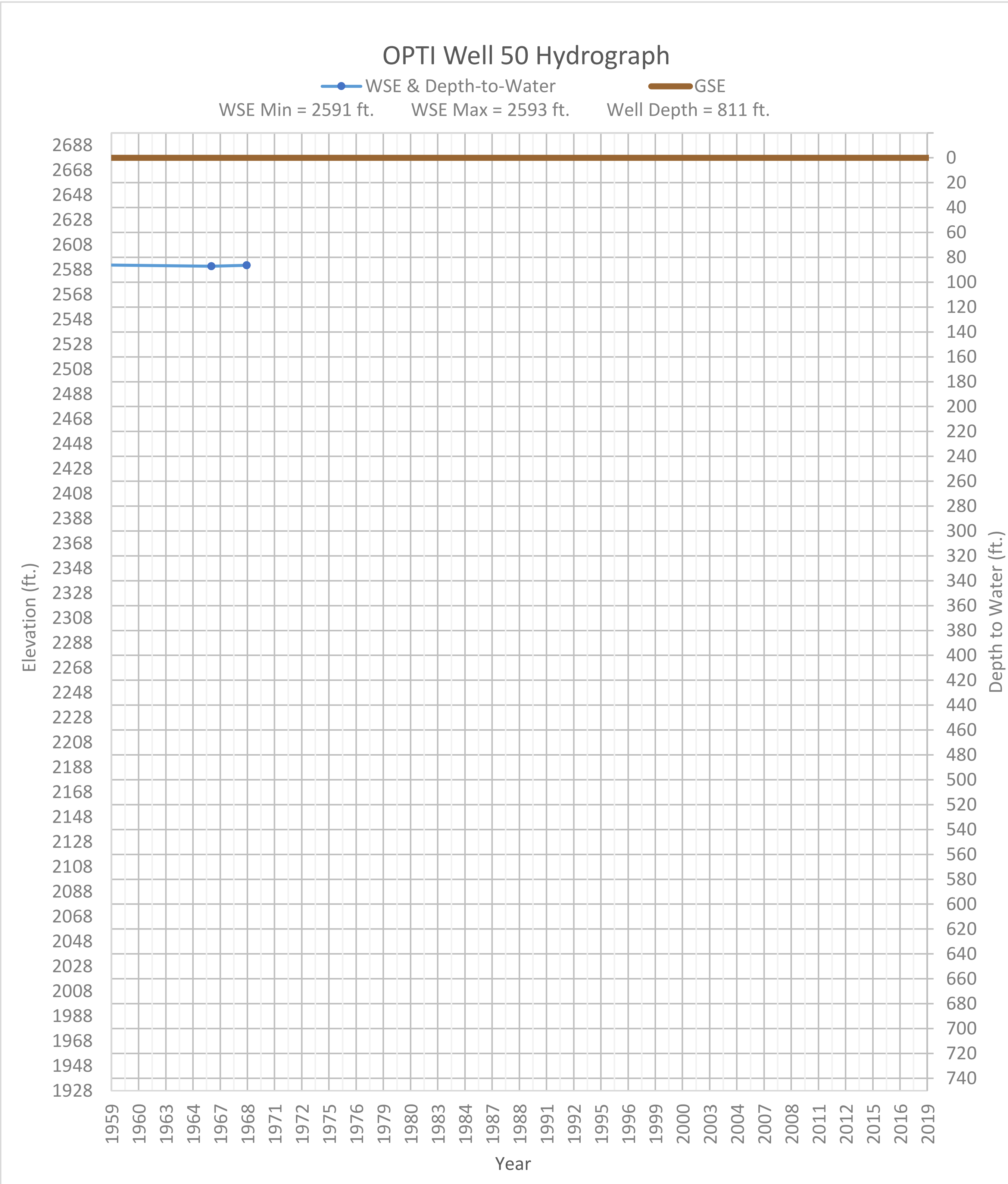
OPTI Well 46 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3471 ft.
WSE Max = 3480 ft.
Well Depth = 46 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



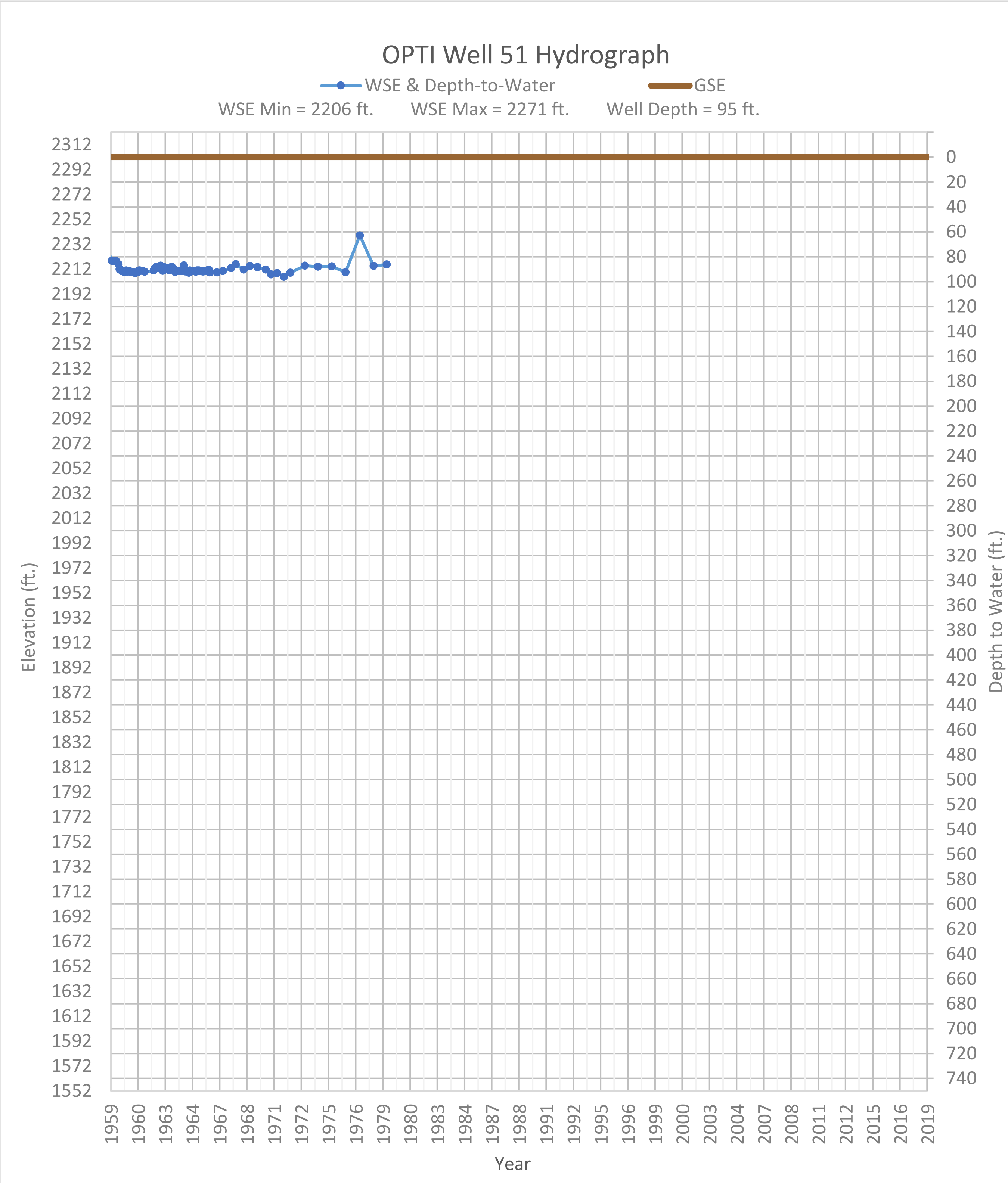
OPTI Well 48 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2865 ft.
WSE Max = 2878 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 49 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2988 ft.
WSE Max = 2988 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 50 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2591 ft.
WSE Max = 2593 ft.
Well Depth = 811 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 51 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2206 ft.
WSE Max = 2271 ft.
Well Depth = 95 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
1792
1772
1752
1732
1712
1692
1672
1652
1632
1612
1592
1572
1552
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
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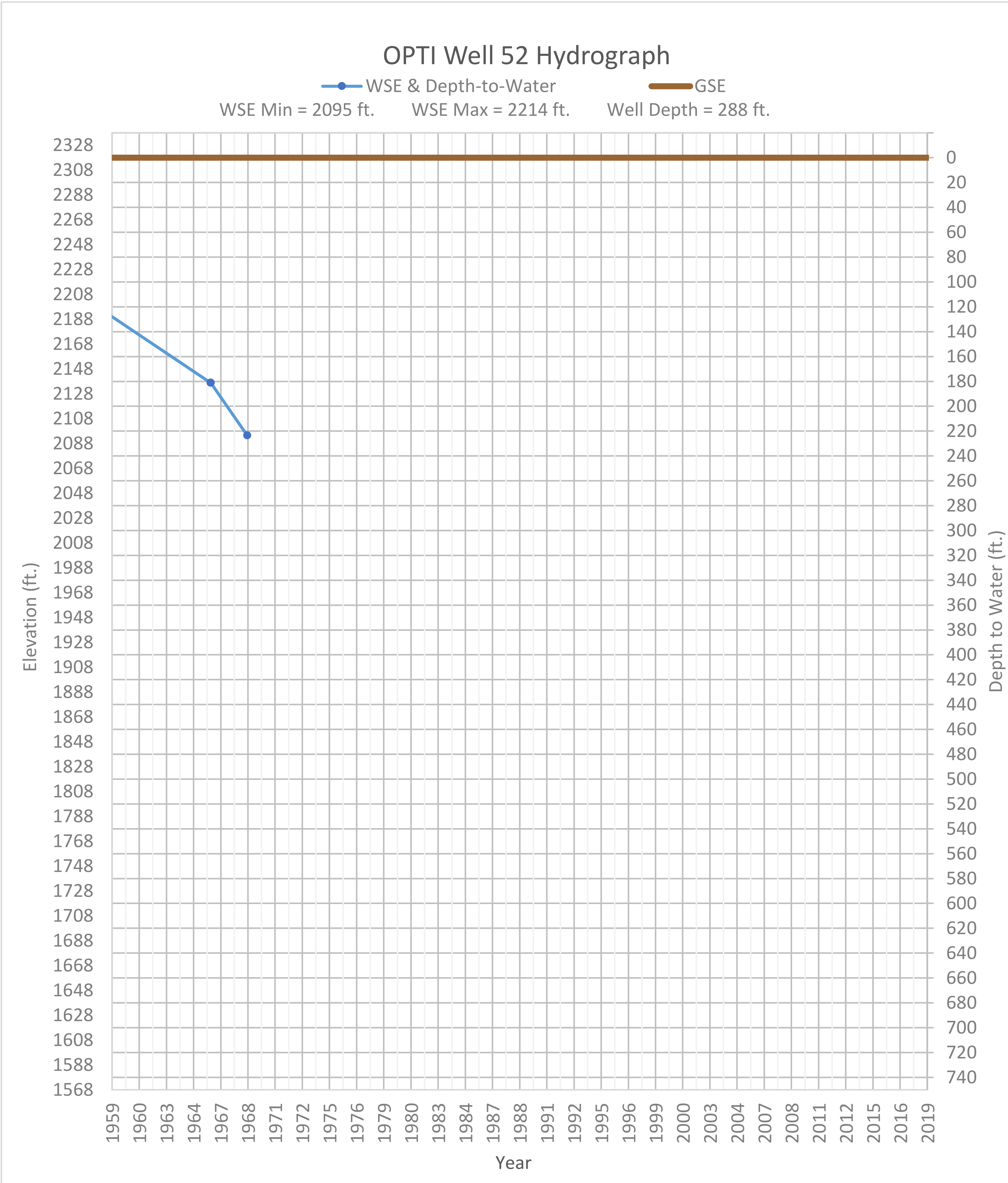
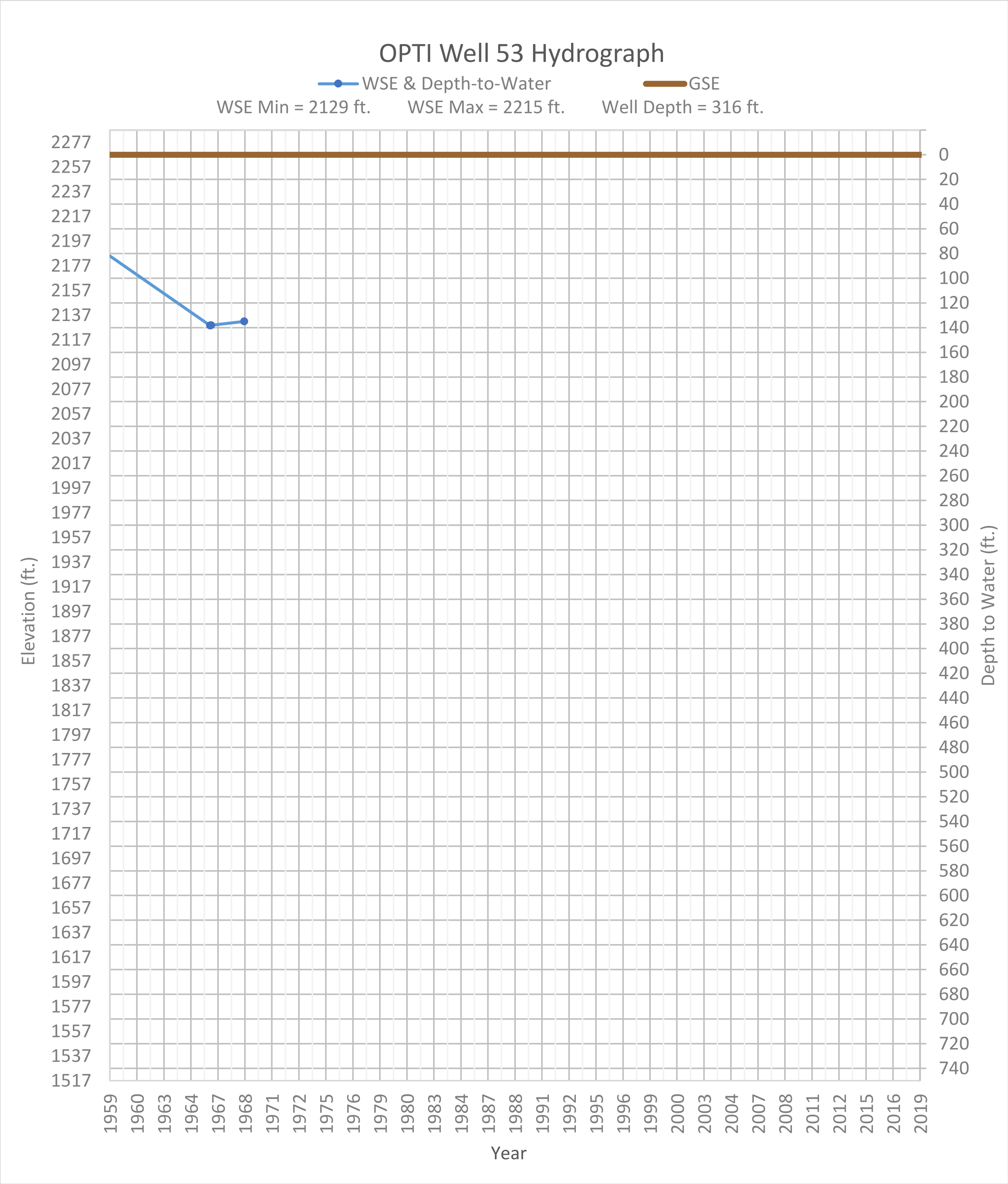
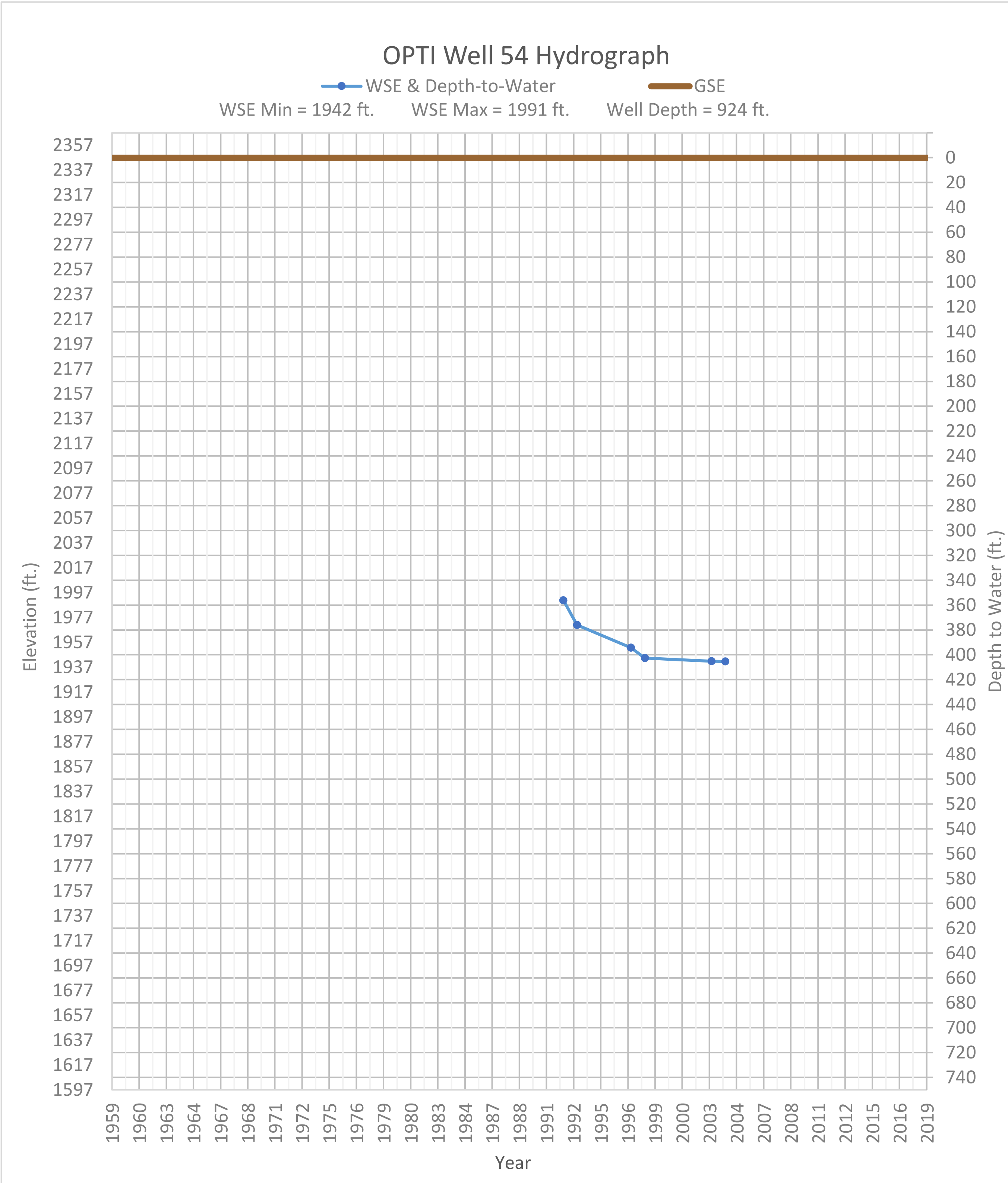
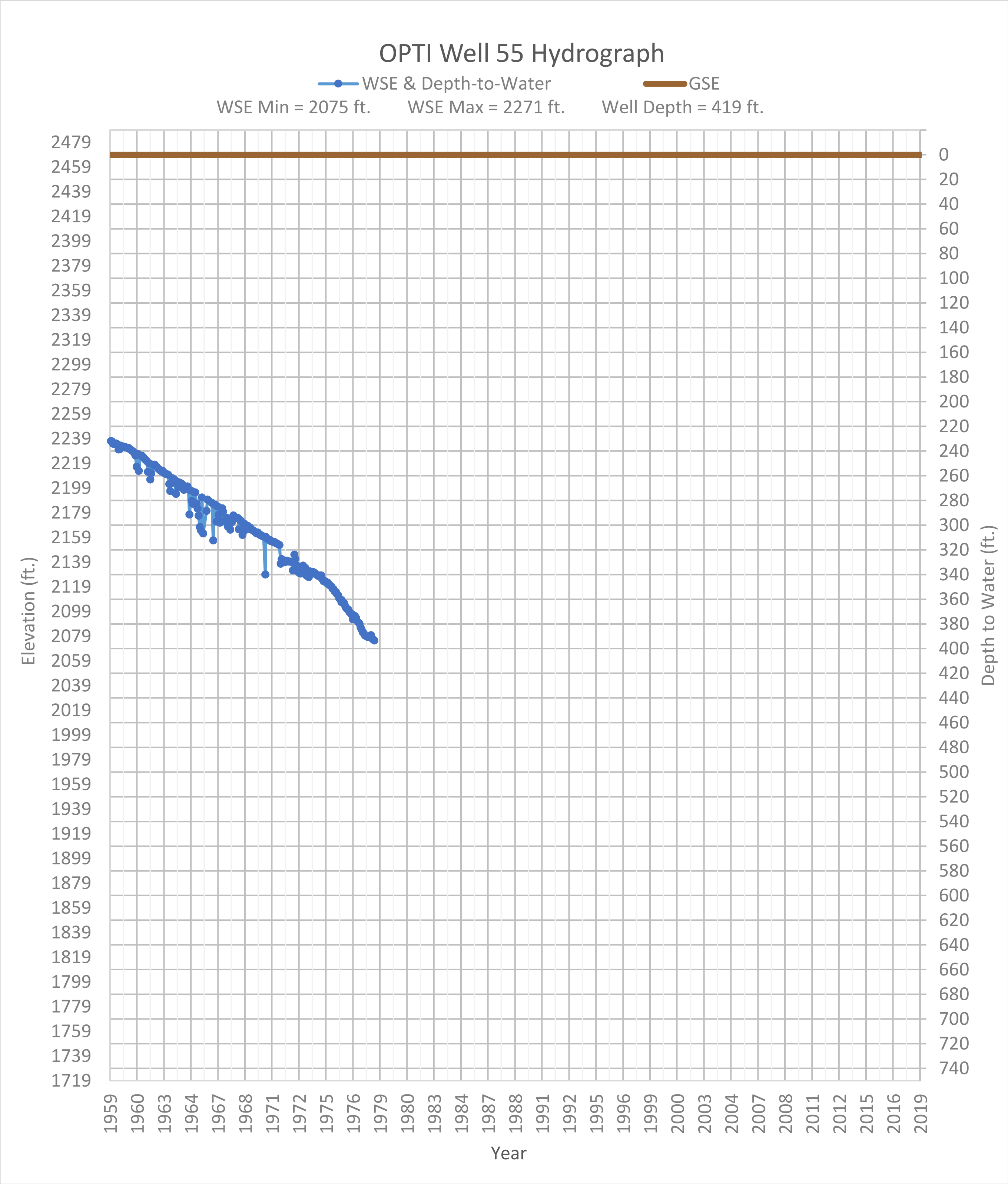


OPTI Well 52 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2095 ft.
WSE Max = 2214 ft.
Well Depth = 288 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

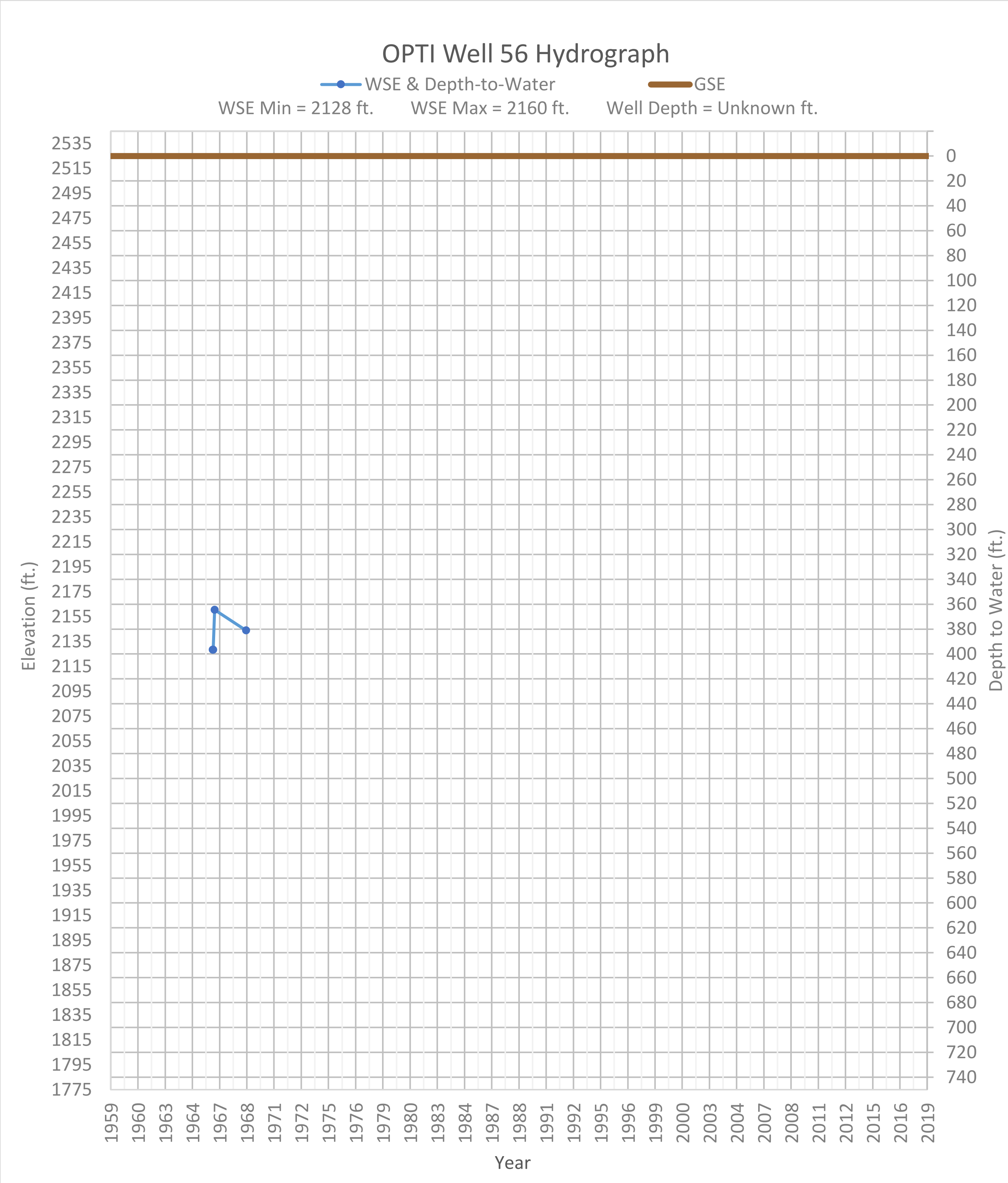


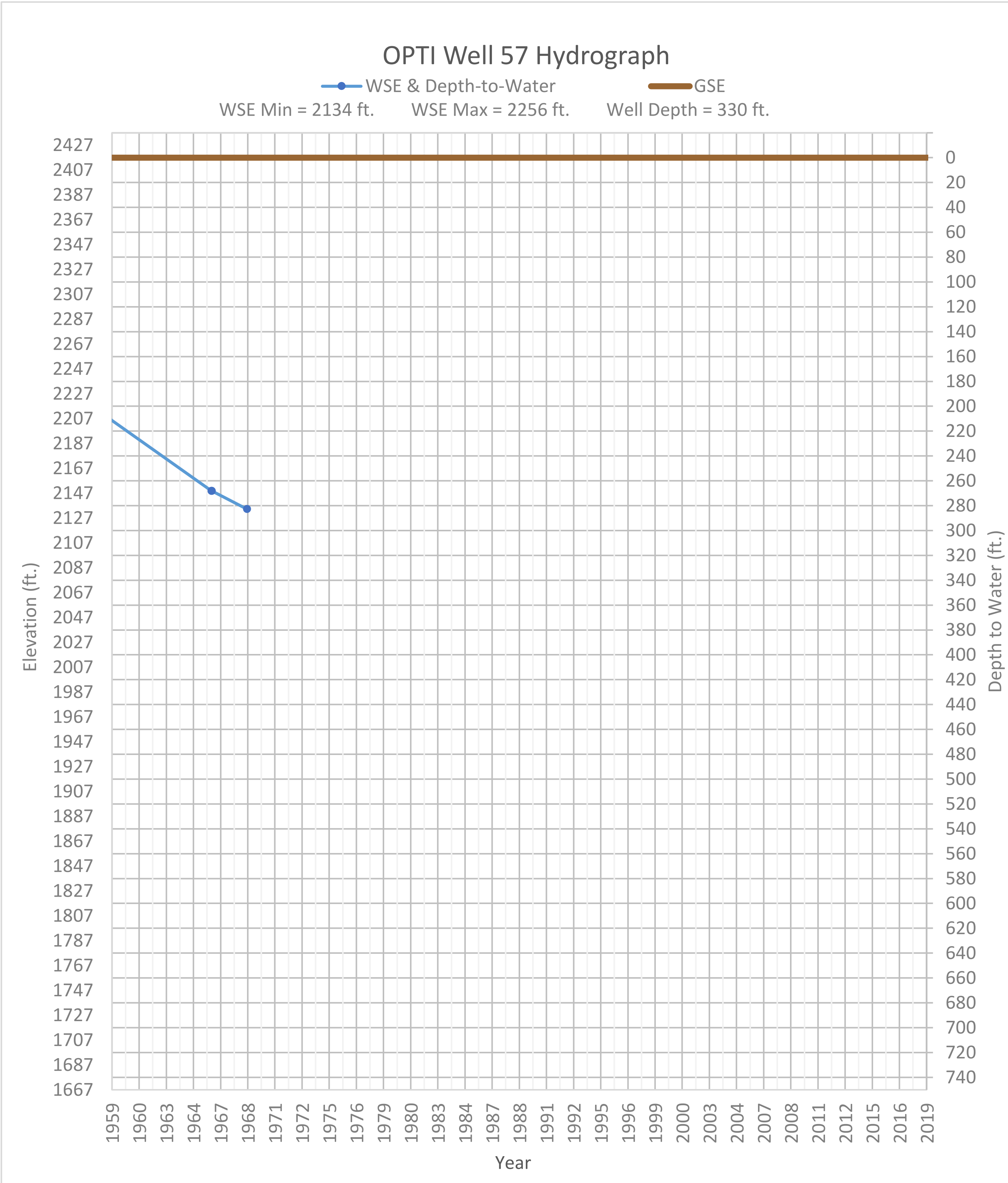
OPTI Well 53 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2129 ft.
WSE Max = 2215 ft.
Well Depth = 316 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 54 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1942 ft.
WSE Max = 1991 ft.
Well Depth = 924 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 55 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2075 ft.
WSE Max = 2271 ft.
Well Depth = 419 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 56 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2128 ft.
WSE Max = 2160 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 57 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2134 ft.
WSE Max = 2256 ft.
Well Depth = 330 ft.
Elevation (ft.)
2427
2407
2387
2367
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
1947
1927
1907
1887
1867
1847
1827
1807
1787
1767
1747
1727
1707
1687
1667
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
520
540
560
580
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620
640
660
680
700
720
740
Year
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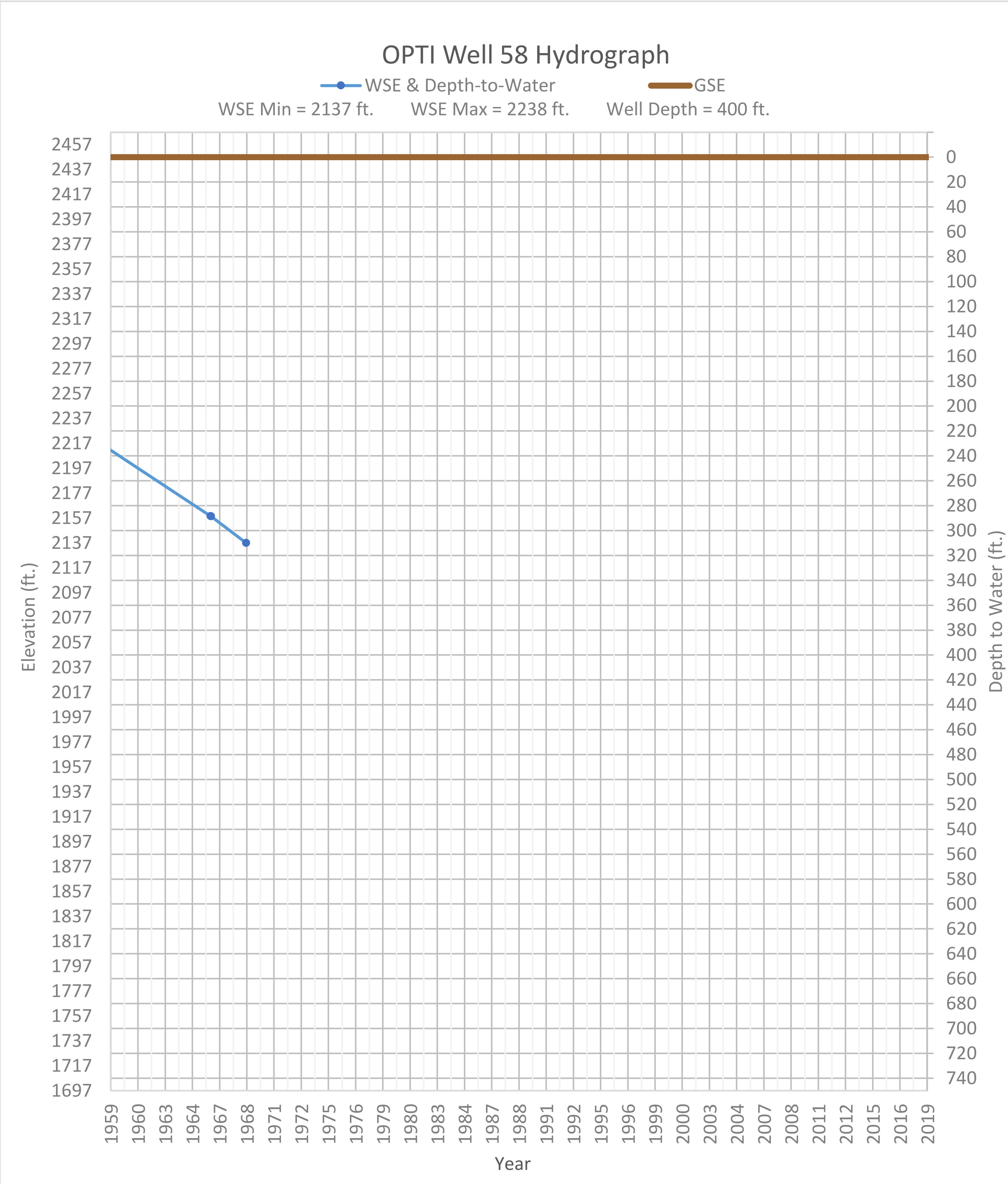
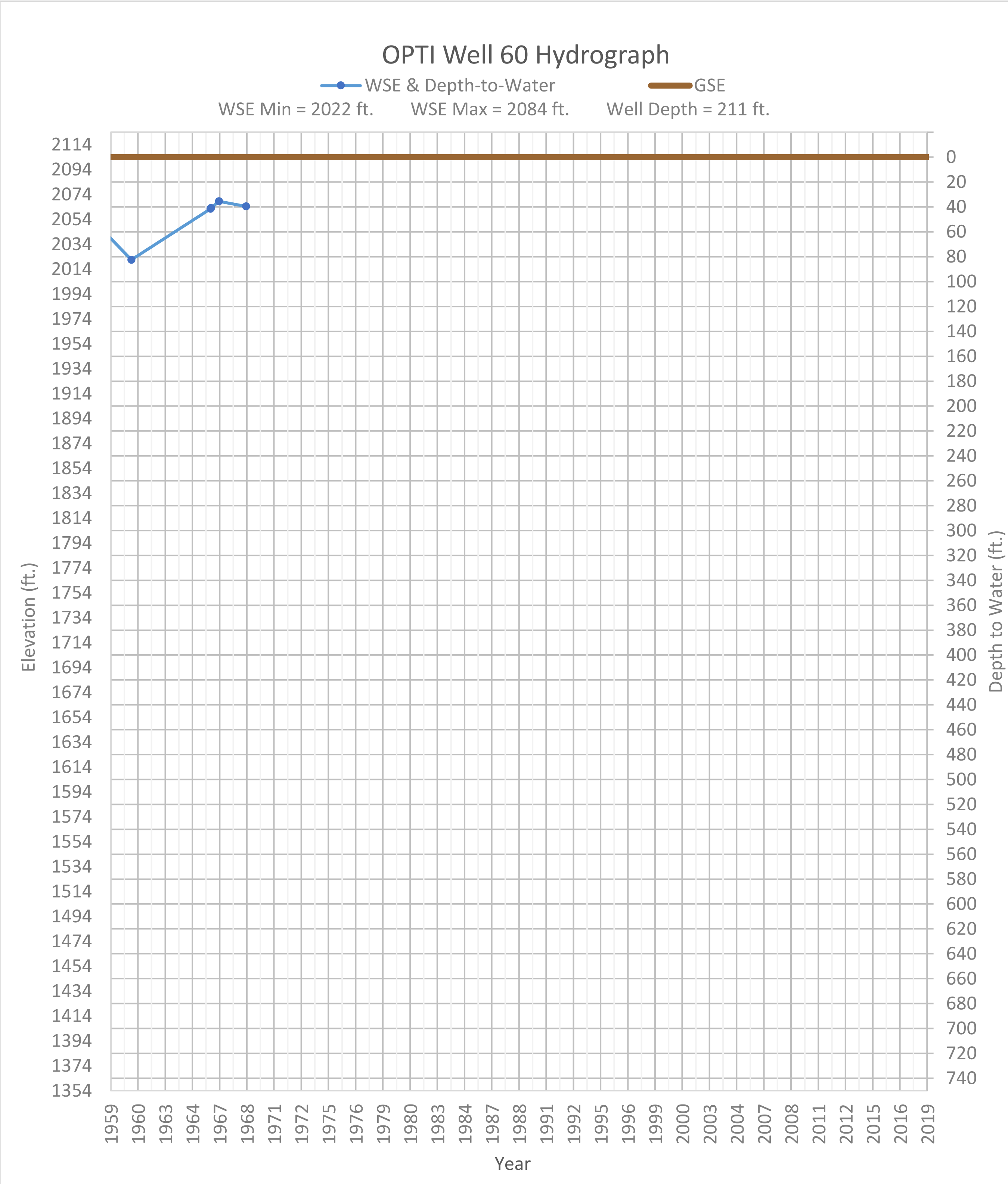

OPTI Well 58 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2137 ft.
WSE Max = 2238 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019
2457 2437 2417 2397 2377 2357 2337 2317 2297 2277 2257 2237 2217 2197 2177 2157 2137 2117 2097 2077 2057 2037 2017 1997 1977 1957 1937 1917 1897 1877 1857 1837 1817 1797 1777 1757 1737 1717 1697
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740

OPTI Well 59 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2087 ft.
WSE Max = 2095 ft.
Well Depth = 65 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 60 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2022 ft.
WSE Max = 2084 ft.
Well Depth = 211 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
1754
1734
1714
1694
1674
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1374
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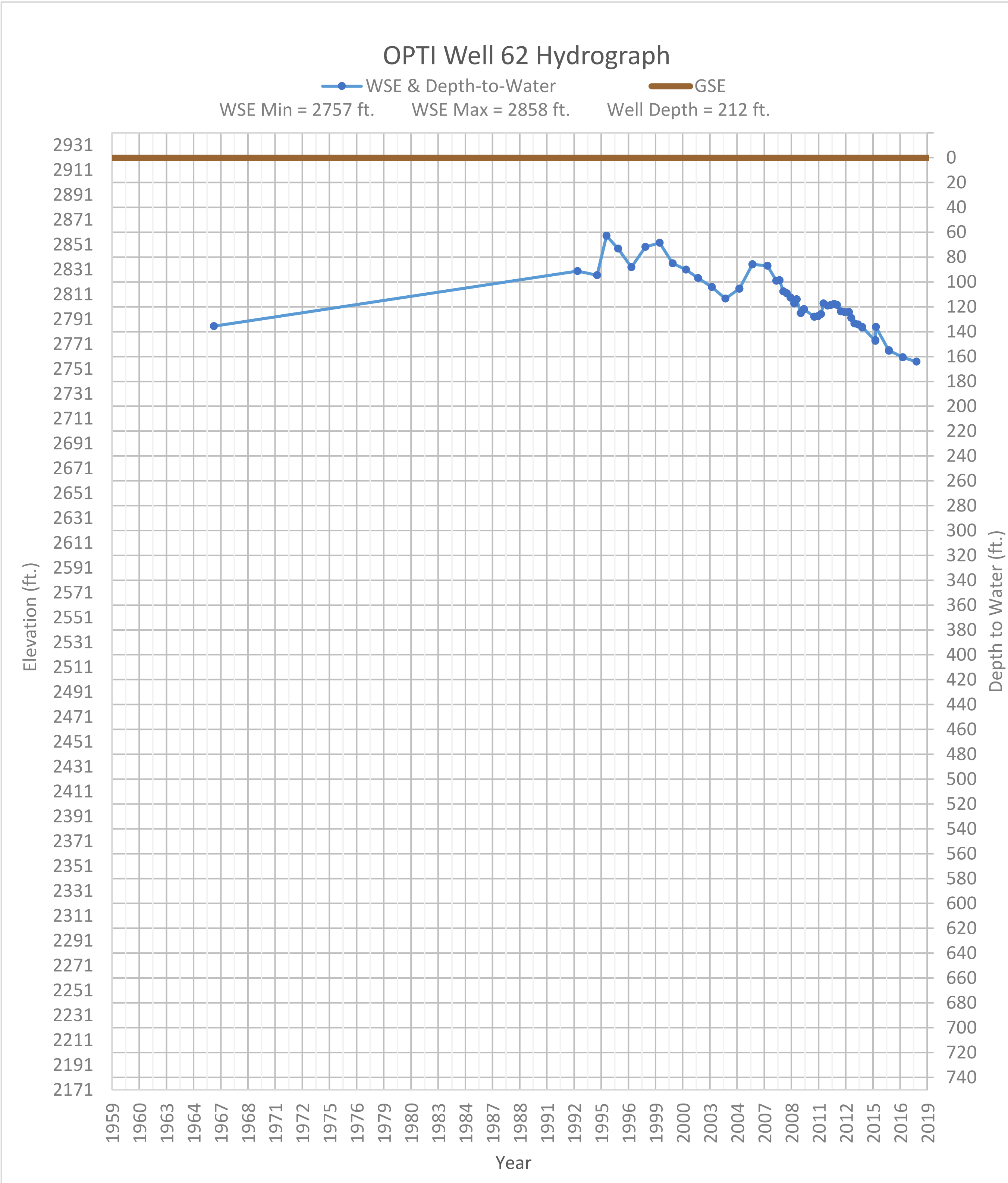
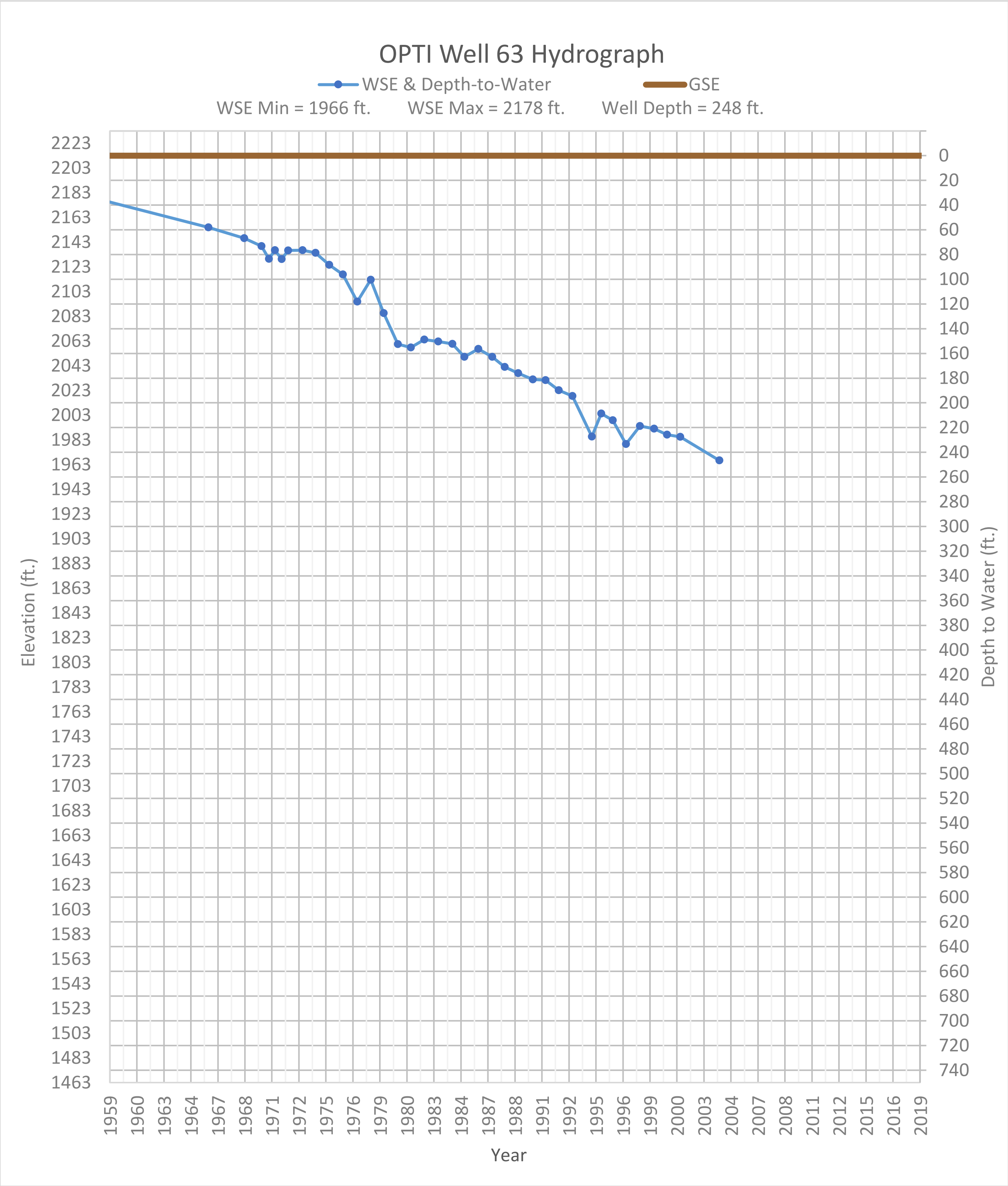
OPTI Well 61 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3593 ft.
WSE Max = 3664 ft.
Well Depth = 357 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 62 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2757 ft.
WSE Max = 2858 ft.
Well Depth = 212 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 63 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1966 ft.
WSE Max = 2178 ft.
Well Depth = 248 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2223
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
1923
1903
1883
1863
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1623
1603
1583
1563
1543
1523
1503
1483
1463
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120
140
160
180
200
220
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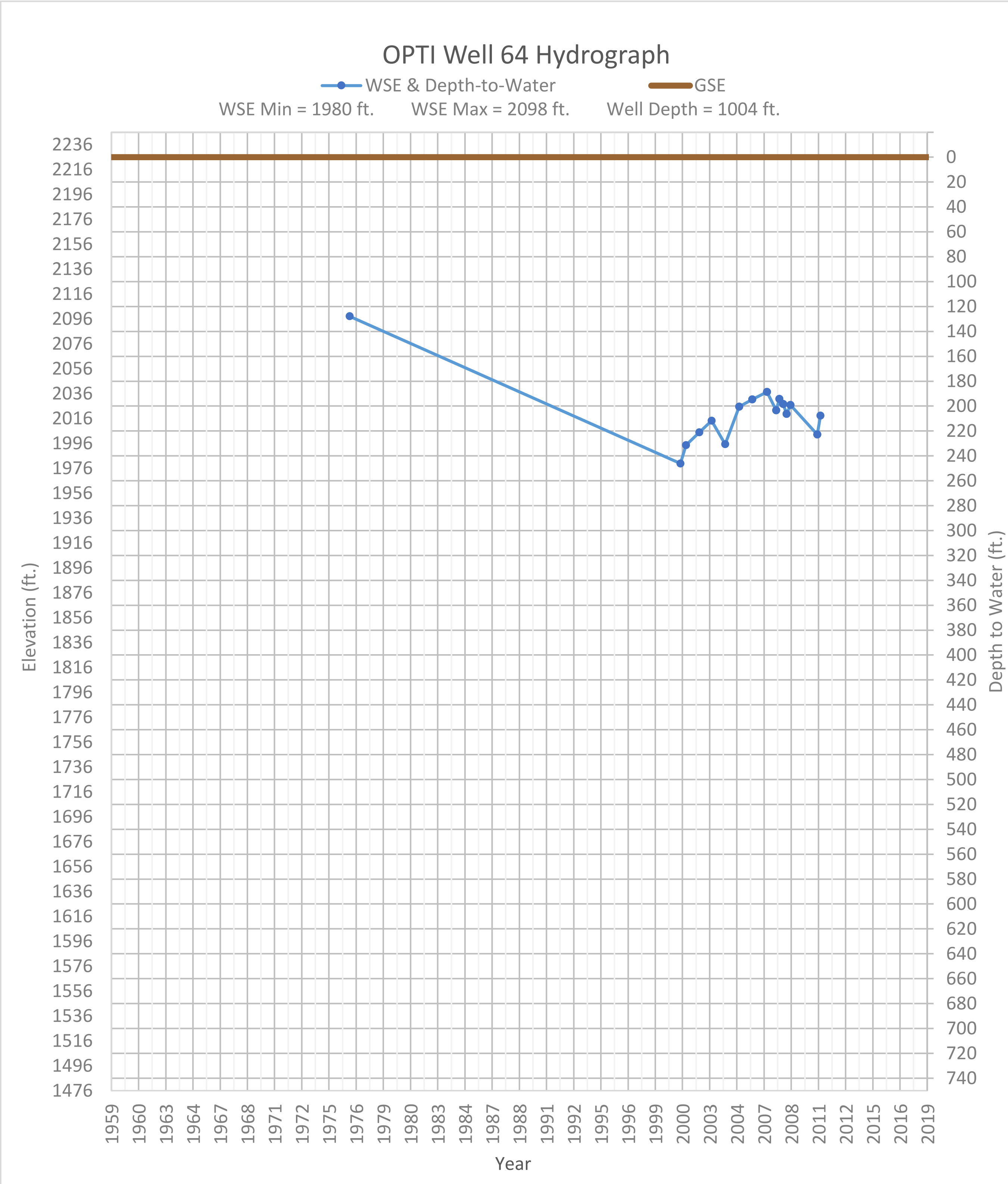
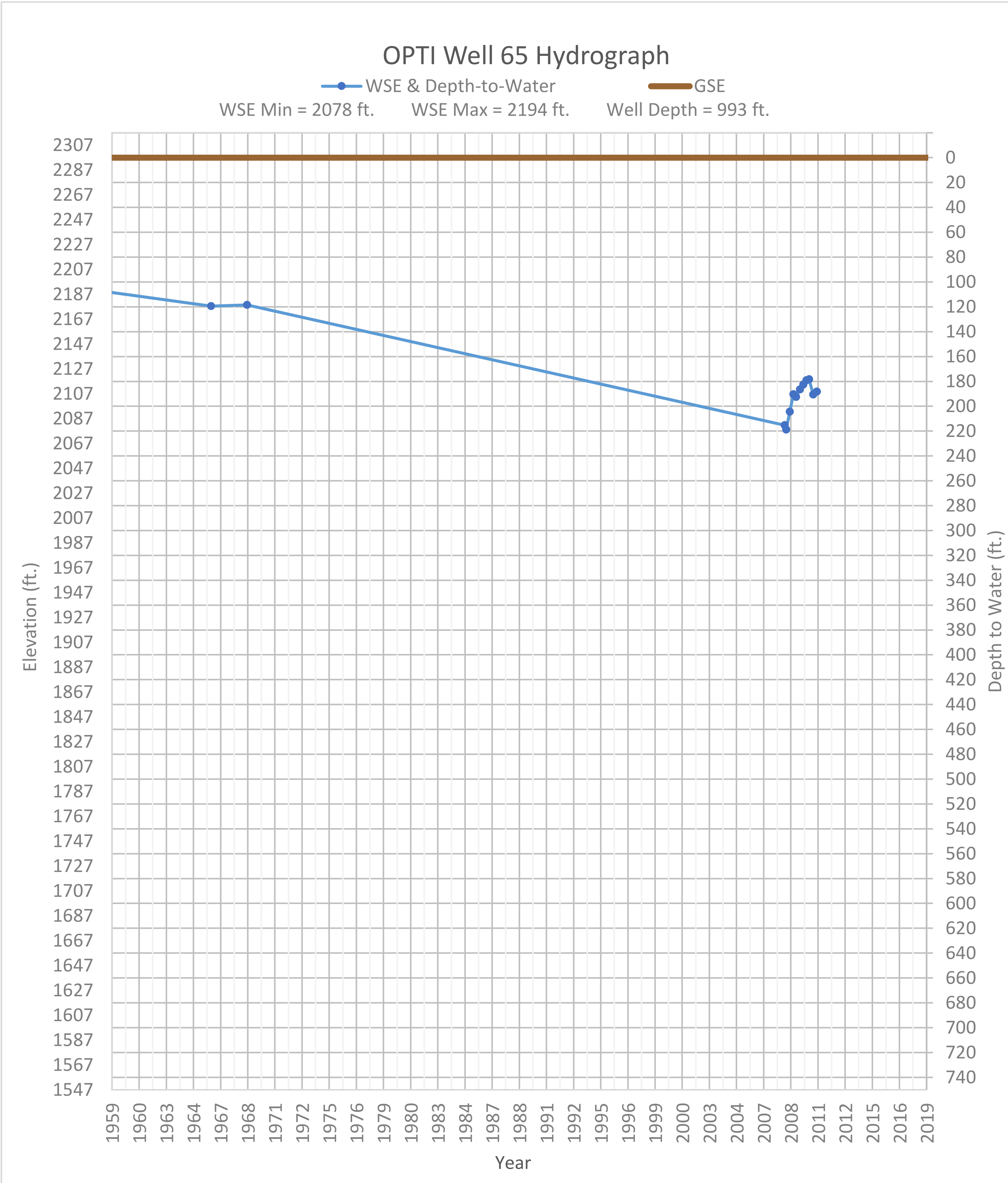
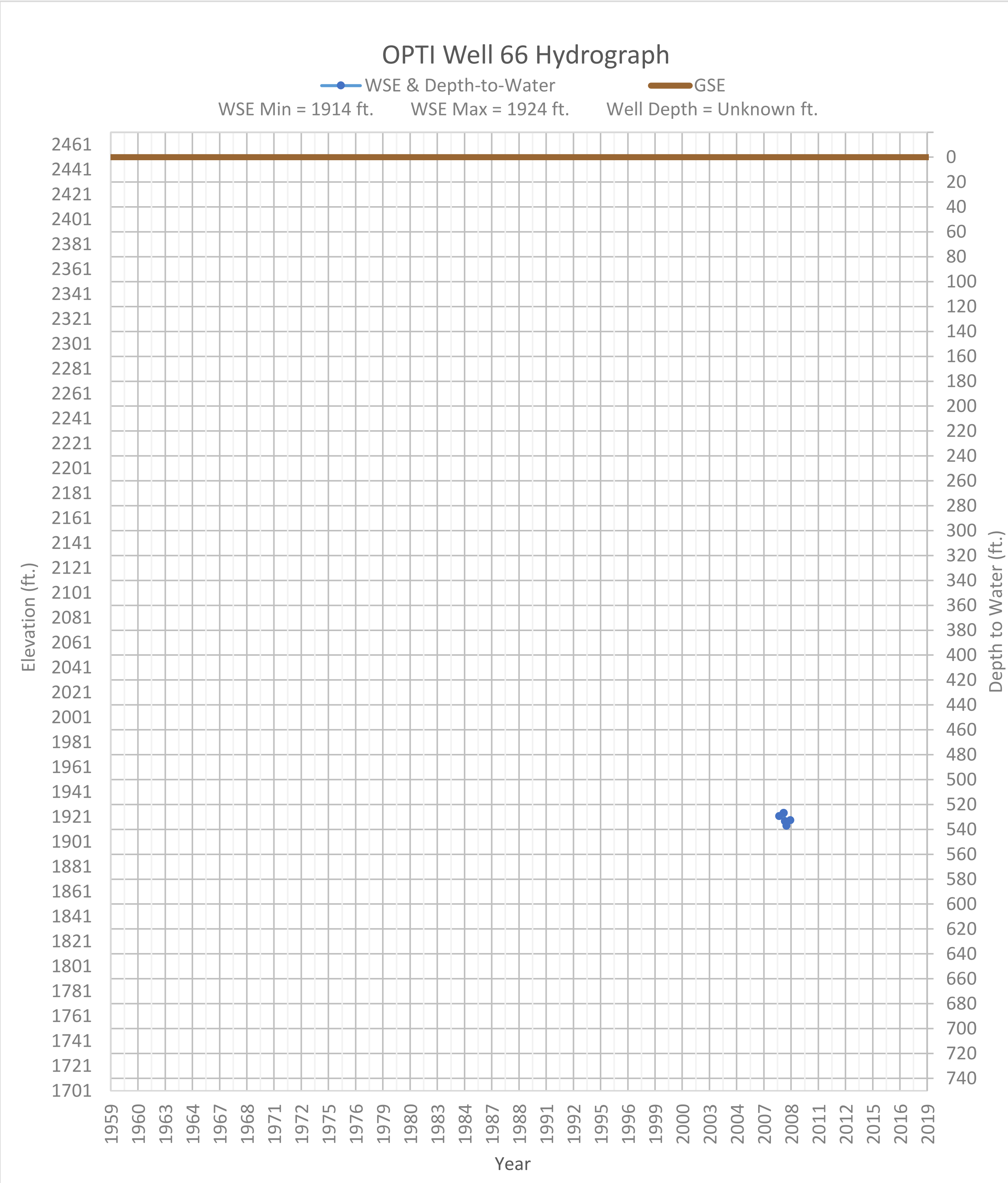
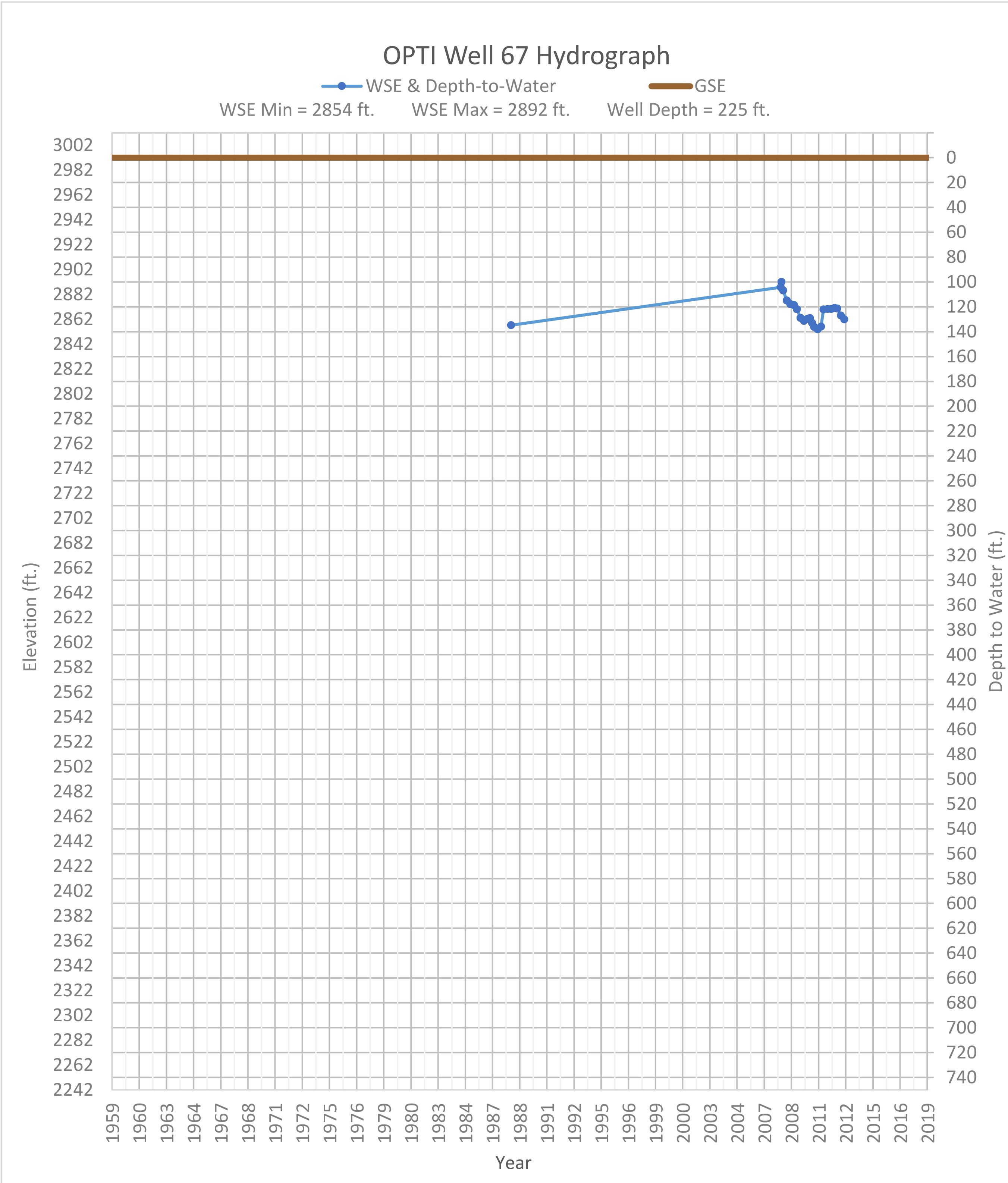


OPTI Well 64 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1980 ft.
WSE Max = 2098 ft.
Well Depth = 1004 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 65 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2078 ft.
WSE Max = 2194 ft.
Well Depth = 993 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 66 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1914 ft.
WSE Max = 1924 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 67 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2854 ft.
WSE Max = 2892 ft.
Well Depth = 225 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3002
2982
2962
2942
2922
2902
2882
2862
2842
2822
2802
2782
2762
2742
2722
2702
2682
2662
2642
2622
2602
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2542
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2362
2342
2322
2302
2282
2262
2242
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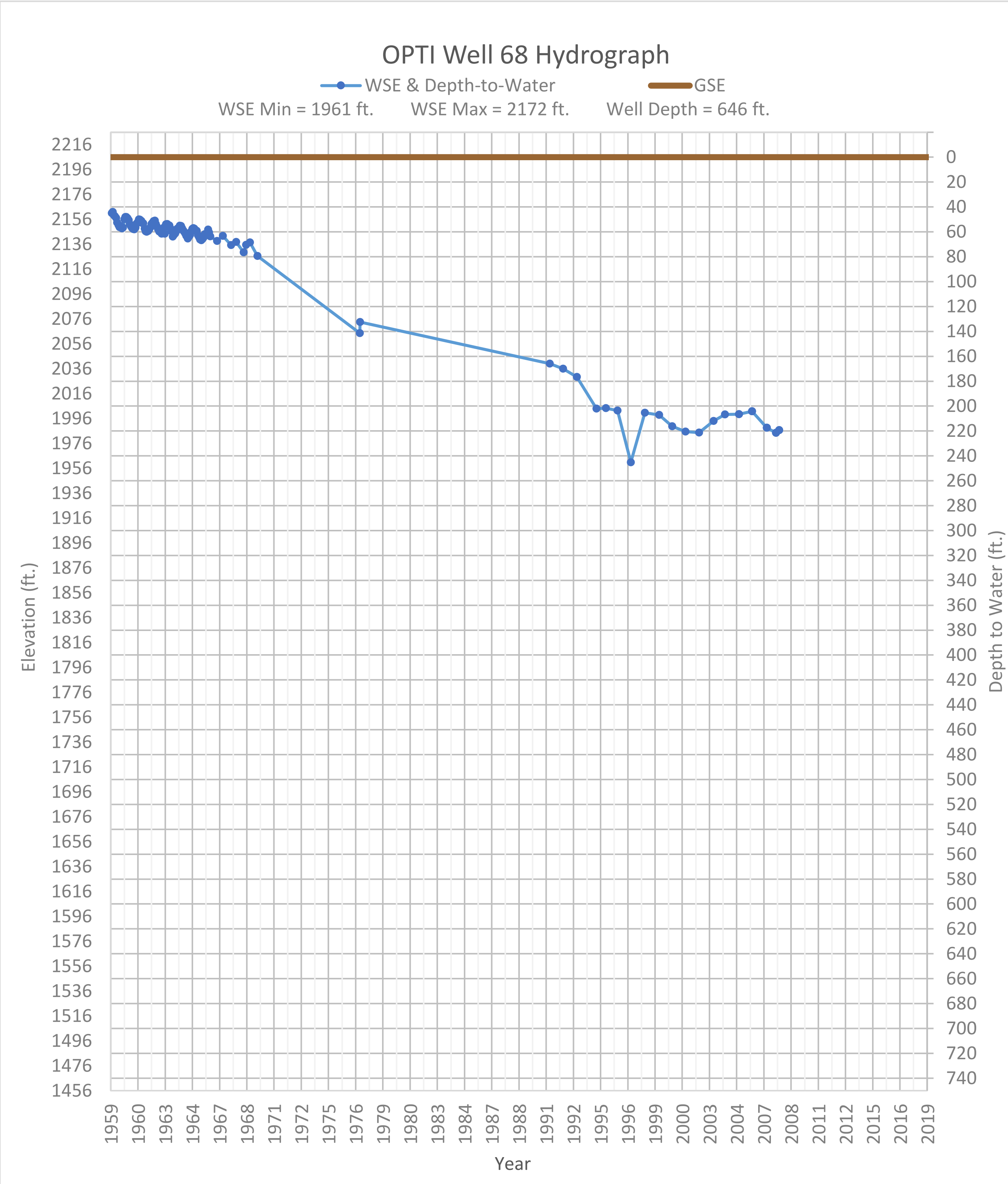
OPTI Well 68 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1961 ft.
WSE Max = 2172 ft.
Well Depth = 646 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2216
2196
2176
2156
2136
2116
2096
2076
2056
2036
2016
1996
1976
1956
1936
1916
1896
1876
1856
1836
1816
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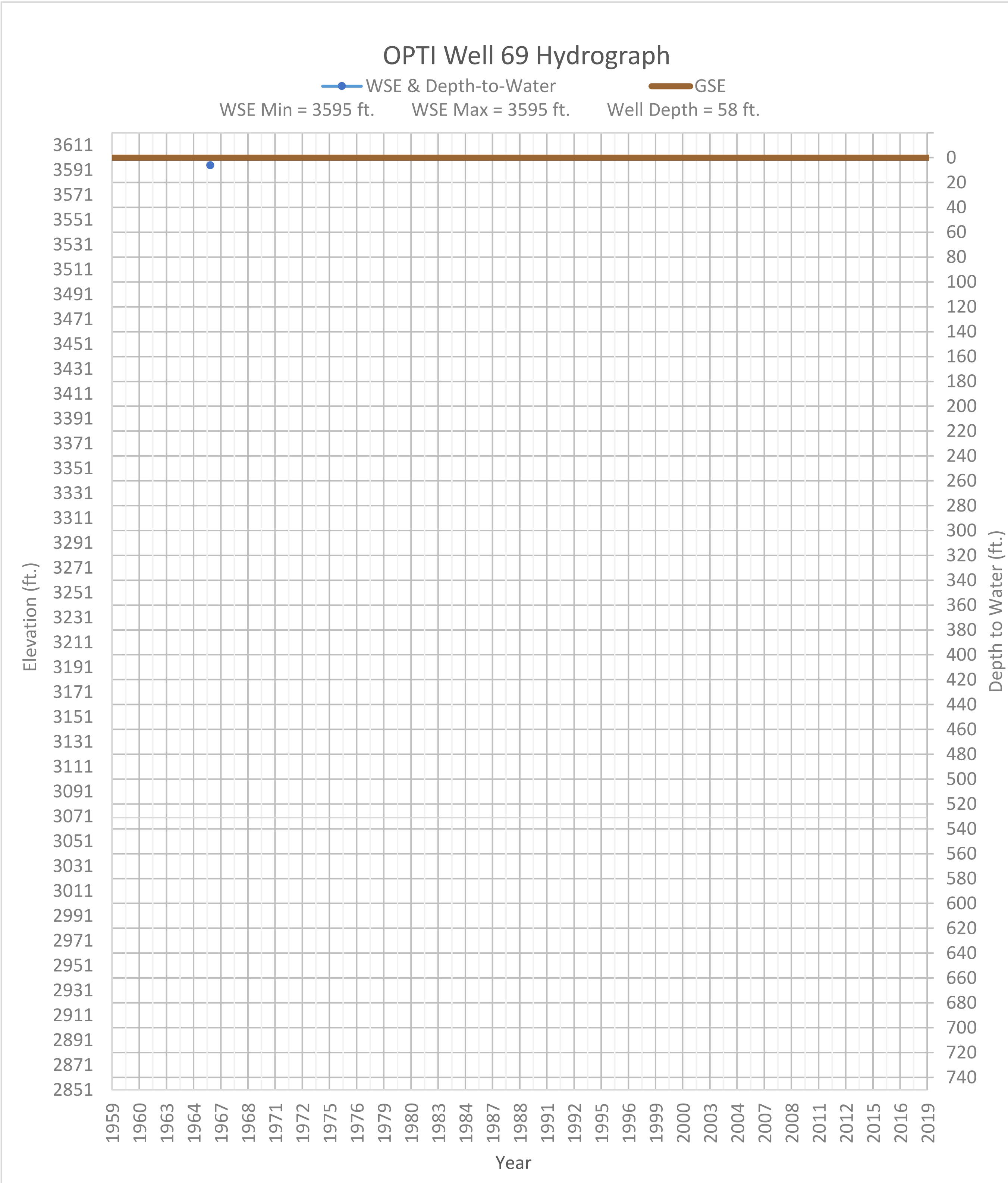
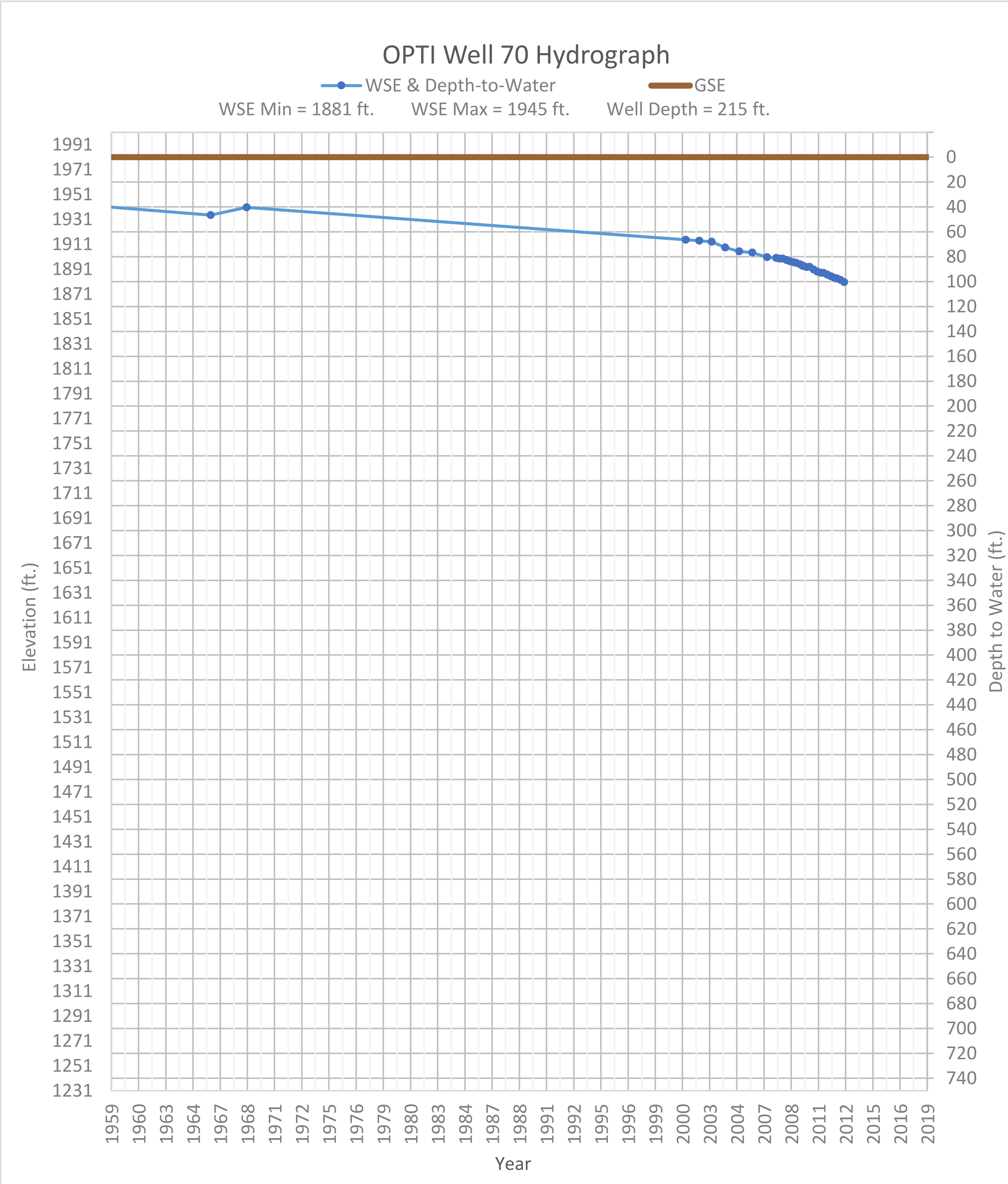
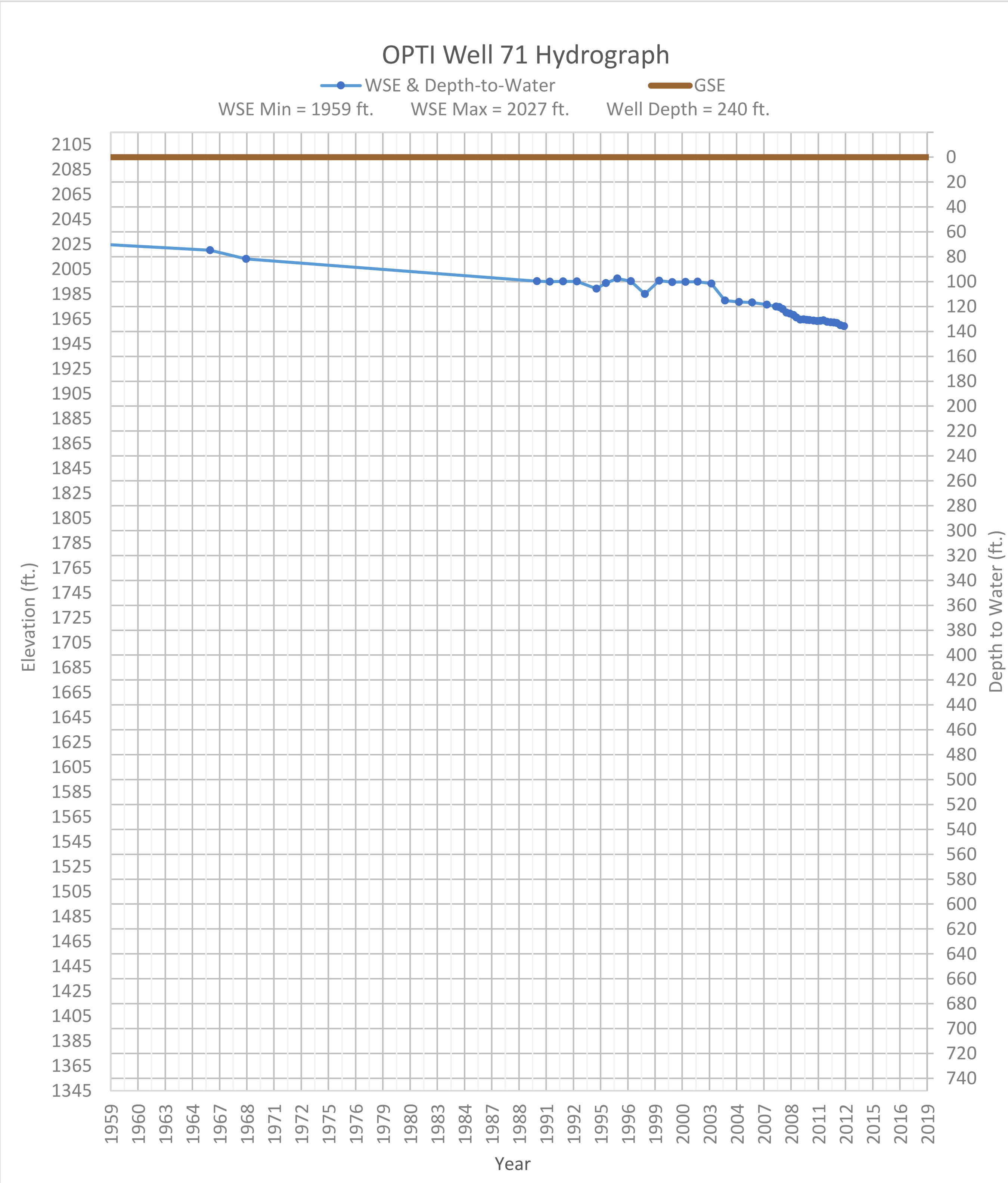
2019


OPTI Well 69 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3595 ft.
WSE Max = 3595 ft.
Well Depth = 58 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 70 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1881 ft.
WSE Max = 1945 ft.
Well Depth = 215 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 71 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1959 ft.
WSE Max = 2027 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2105
2085
2065
2045
2025
2005
1985
1965
1945
1925
1905
1885
1865
1845
1825
1805
1785
1765
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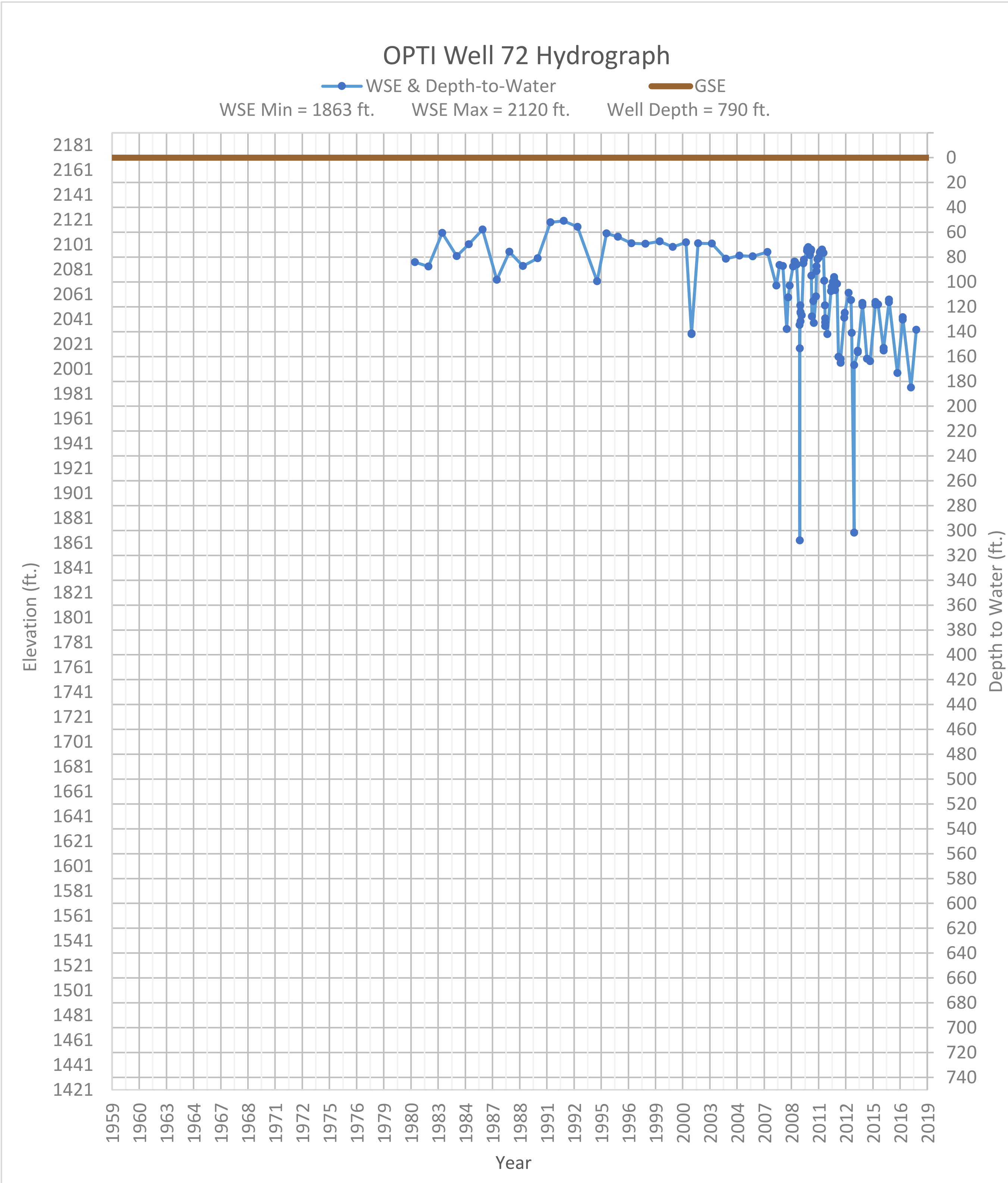
OPTI Well 72 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1863 ft.
WSE Max = 2120 ft.
Well Depth = 790 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2181
2161
2141
2121
2101
2081
2061
2041
2021
2001
1981
1961
1941
1921
1901
1881
1861
1841
1821
1801
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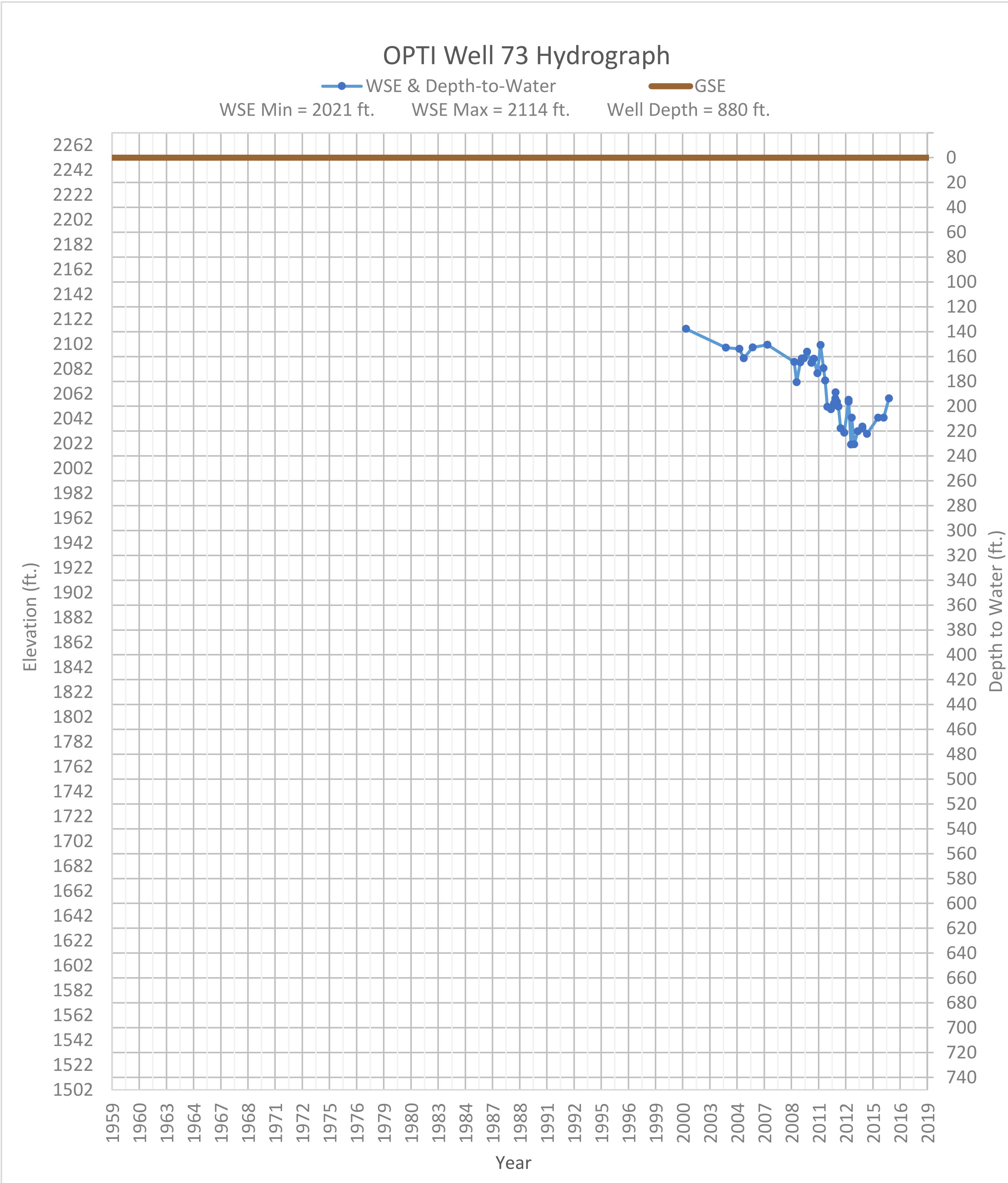
OPTI Well 73 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2021 ft.
WSE Max = 2114 ft.
Well Depth = 880 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 74 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1882 ft.
WSE Max = 1986 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
1923
1903
1883
1863
1843
1823
1803
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1623
1603
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1543
1523
1503
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1443
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OPTI Well 75 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1912 ft.
WSE Max = 2089 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2305
2285
2265
2245
2225
2205
2185
2165
2145
2125
2105
2085
2065
2045
2025
2005
1985
1965
1945
1925
1905
1885
1865
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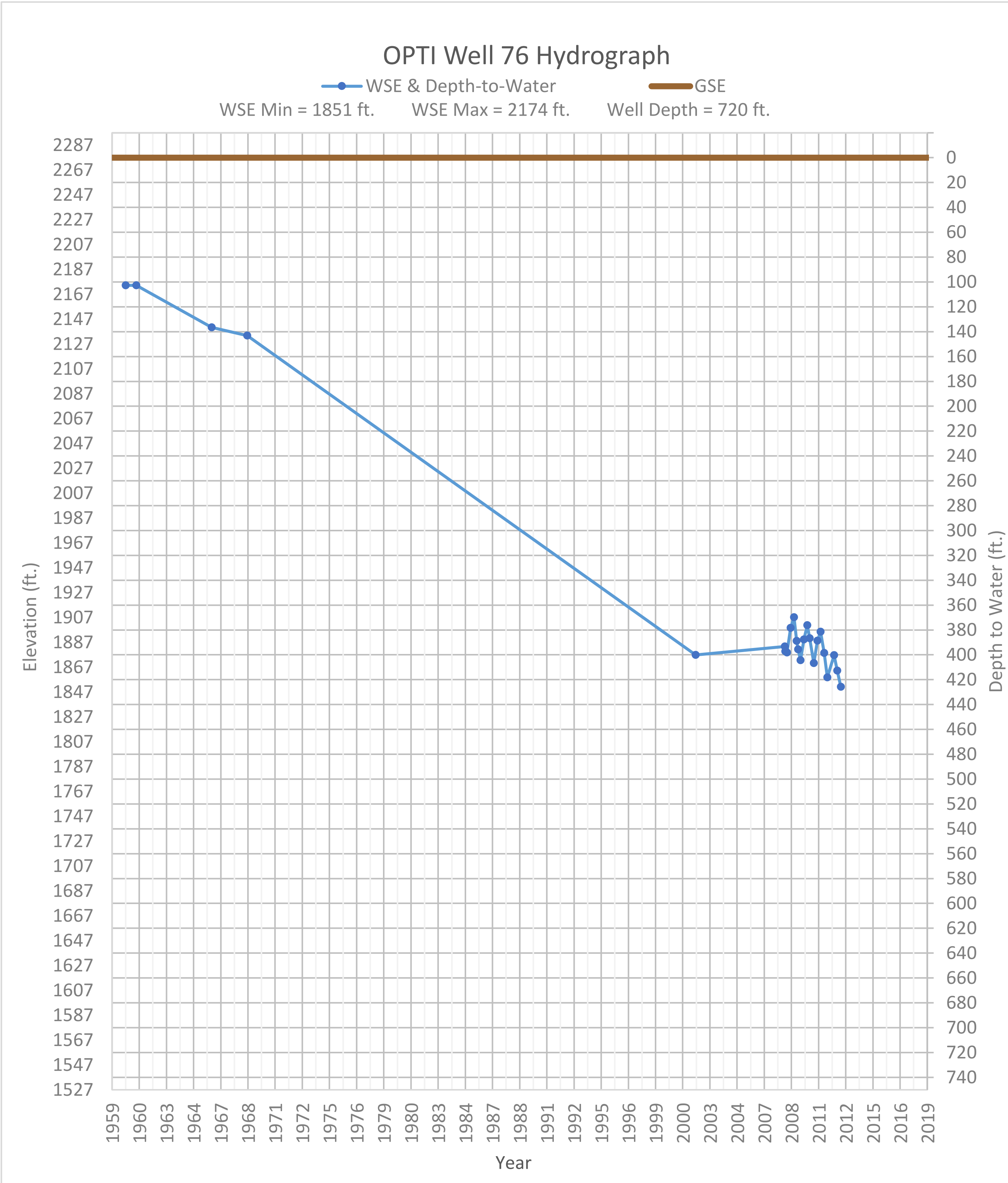
OPTI Well 76 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1851 ft.
WSE Max = 2174 ft.
Well Depth = 720 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
1947
1927
1907
1887
1867
1847
1827
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1627
1607
1587
1567
1547
1527
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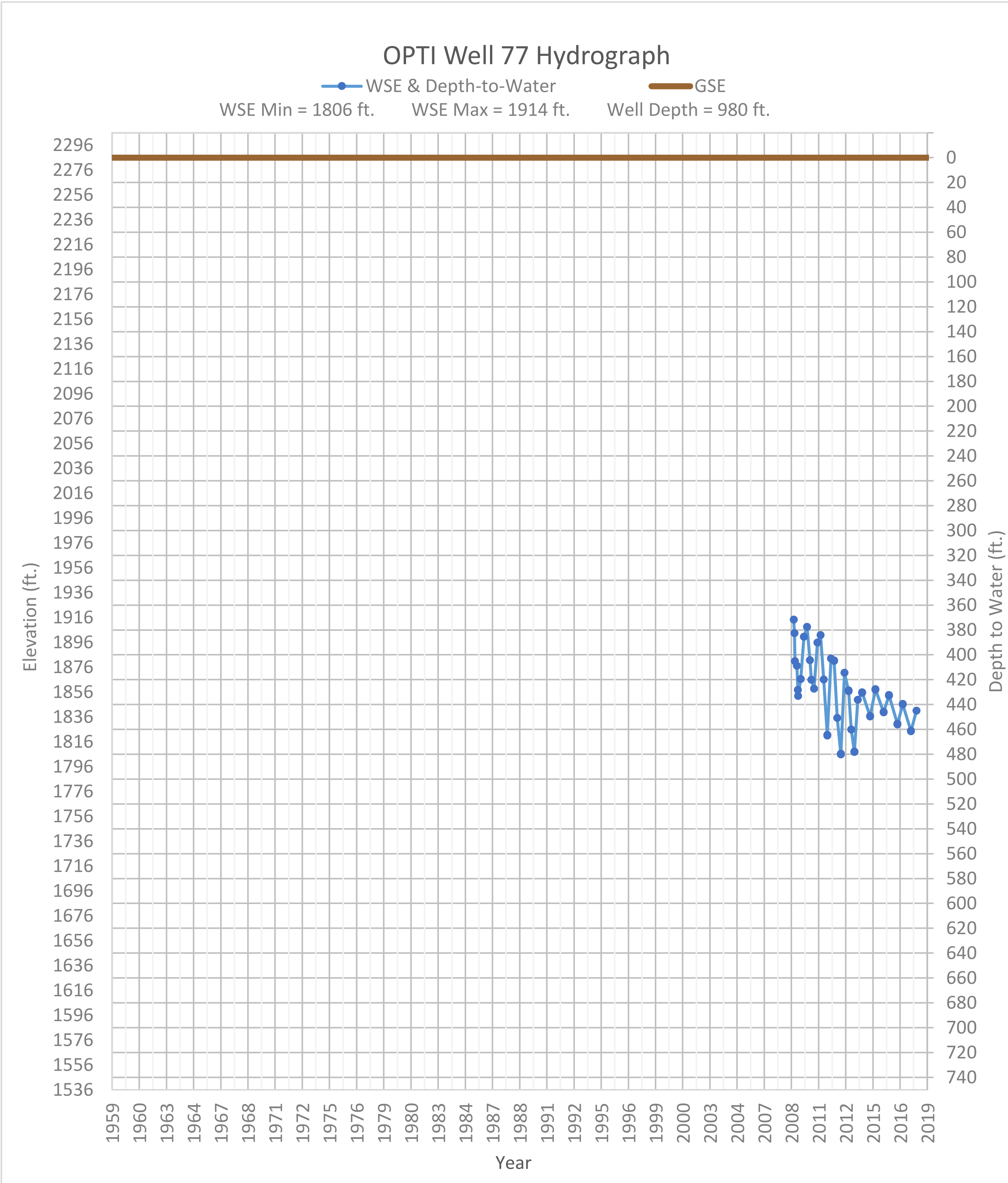
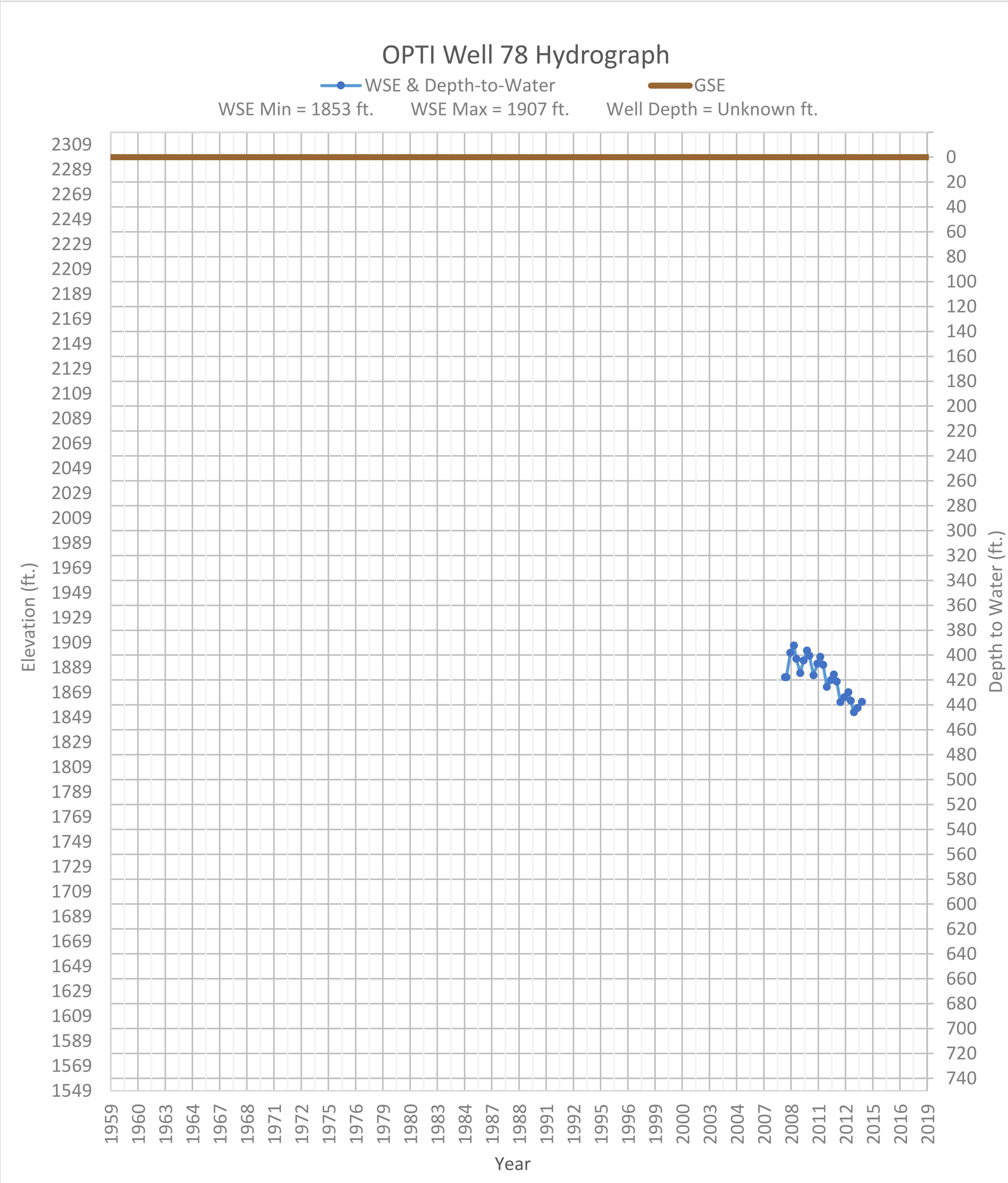
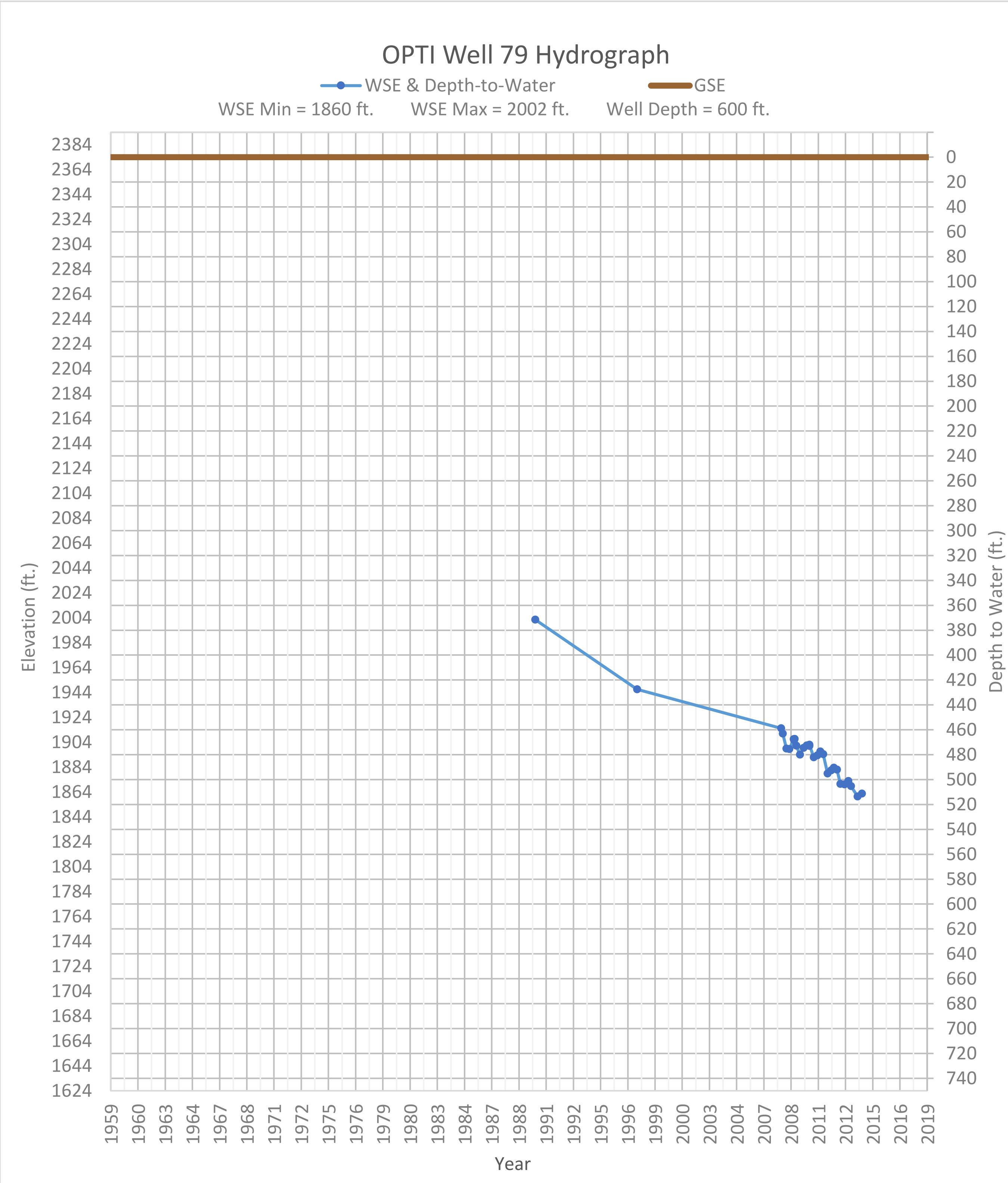


OPTI Well 77 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1806 ft.
WSE Max = 1914 ft.
Well Depth = 980 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 78 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1853 ft.
WSE Max = 1907 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 79 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1860 ft.
WSE Max = 2002 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
1764
1744
1724
1704
1684
1664
1644
1624
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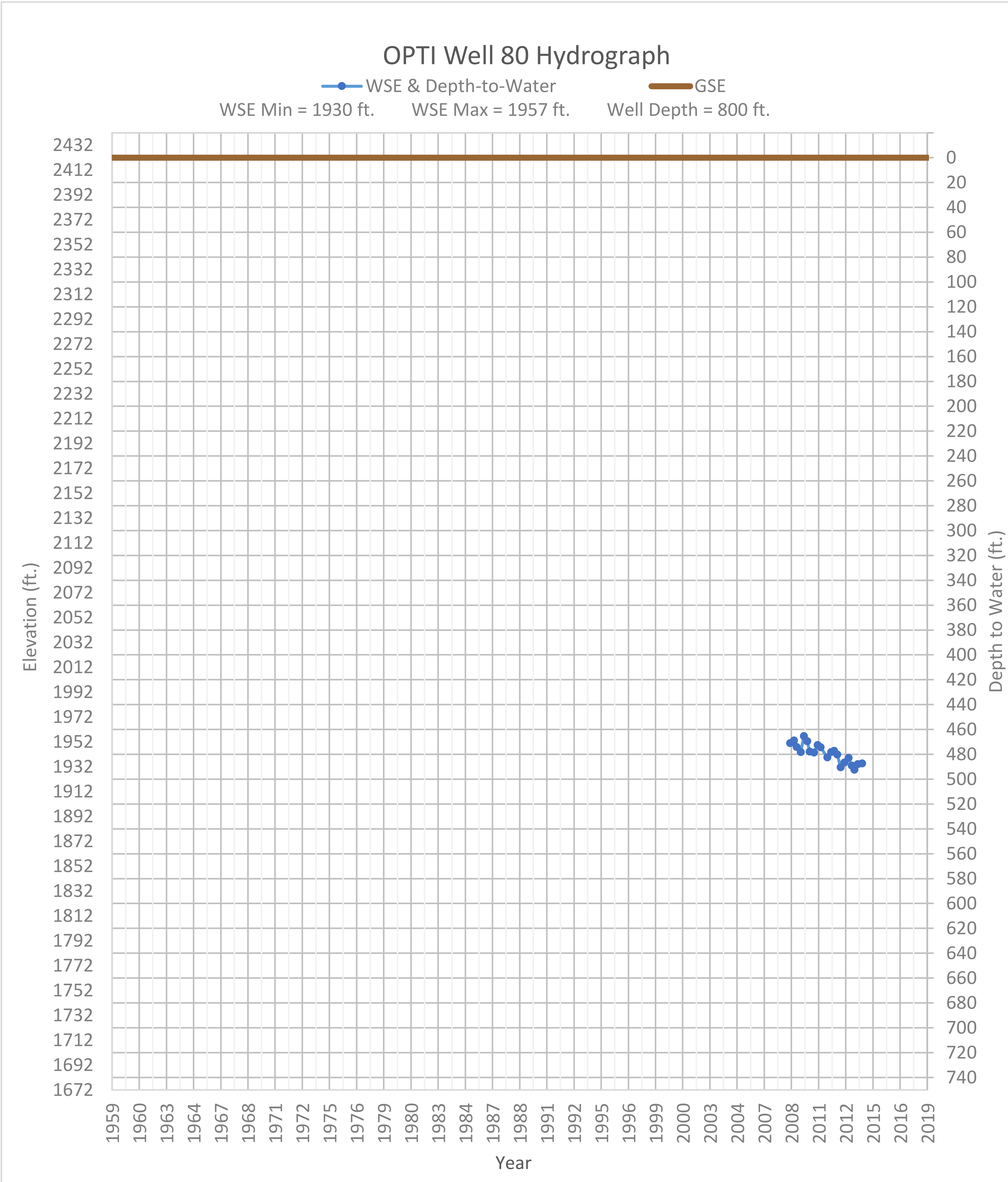
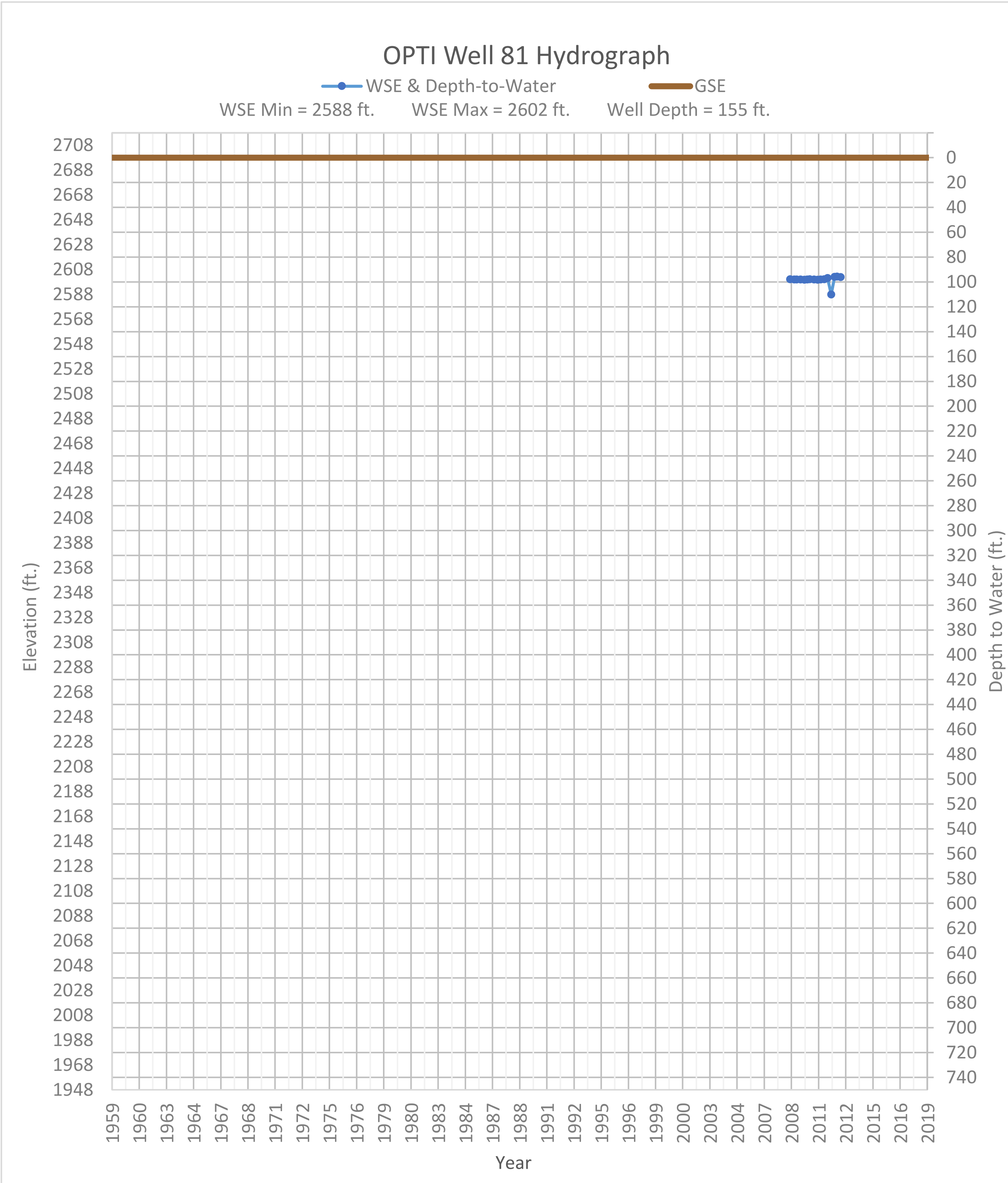
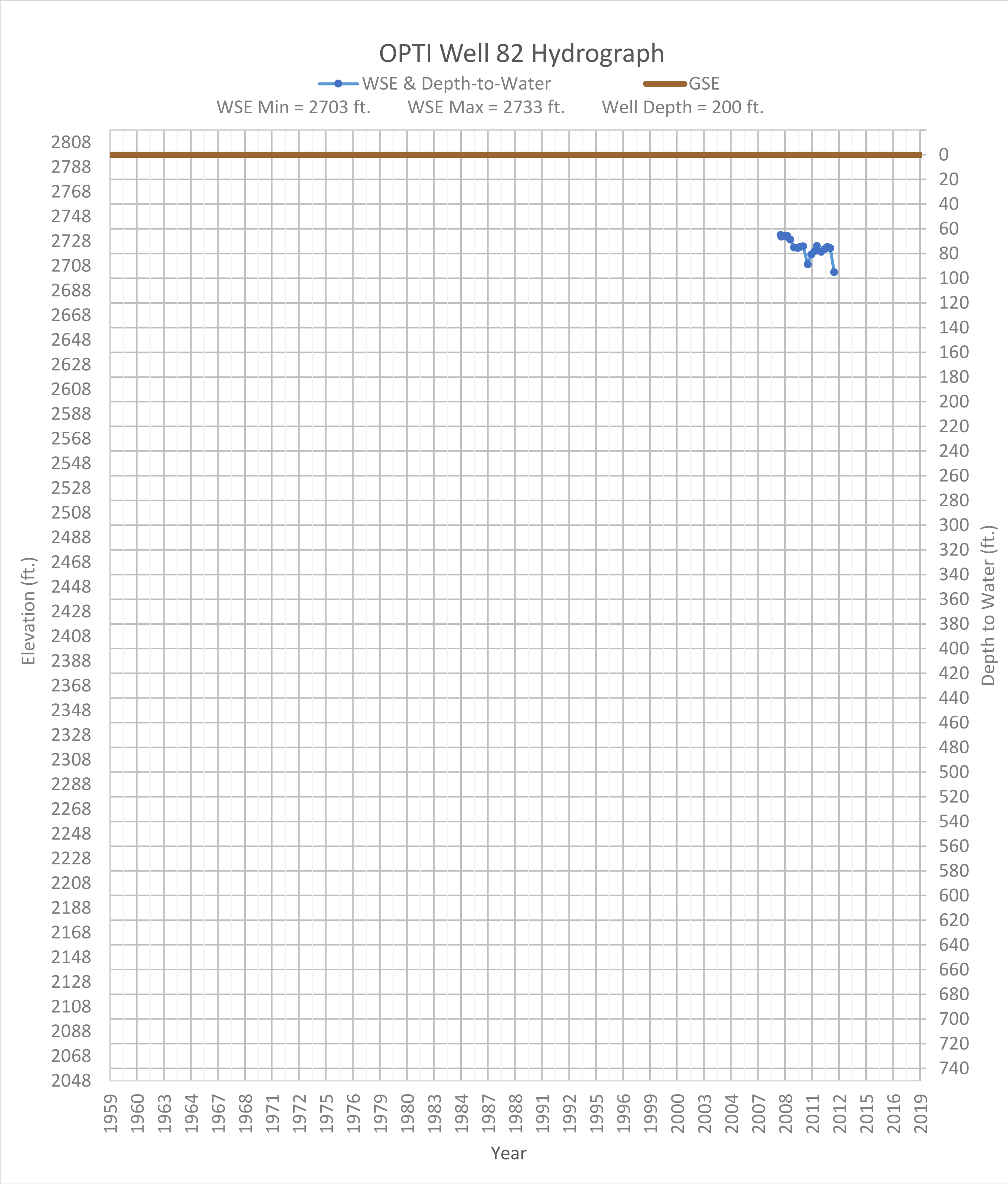
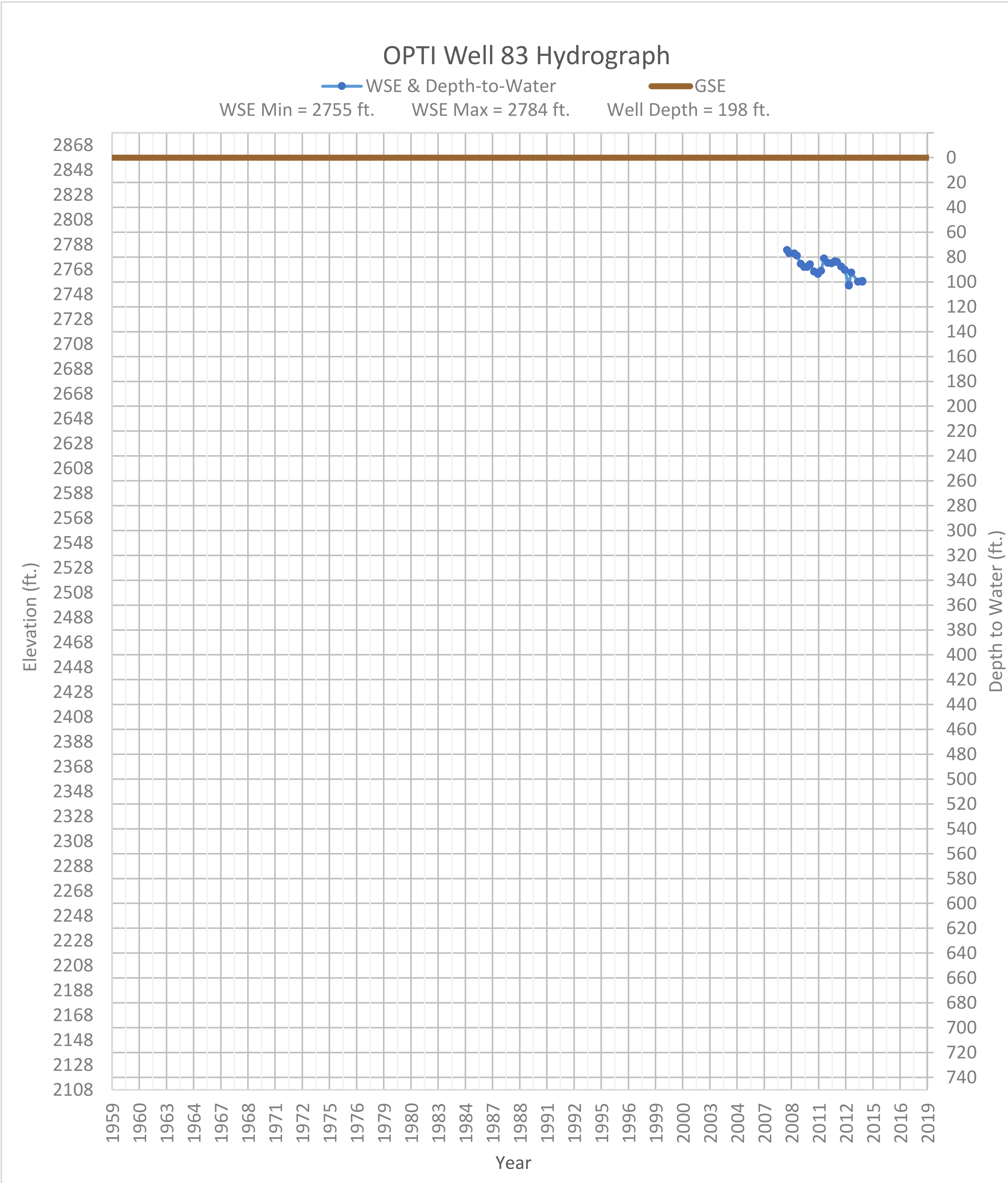


OPTI Well 80 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1930 ft.
WSE Max = 1957 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 81 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2588 ft.
WSE Max = 2602 ft.
Well Depth = 155 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 82 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2703 ft.
WSE Max = 2733 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 83 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2755 ft.
WSE Max = 2784 ft.
Well Depth = 198 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2868
2848
2828
2808
2788
2768
2748
2728
2708
2688
2668
2648
2628
2608
2588
2568
2548
2528
2508
2488
2468
2448
2428
2408
2388
2368
2348
2328
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
0
20
40
60
80
100
120
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160
180
200
220
240
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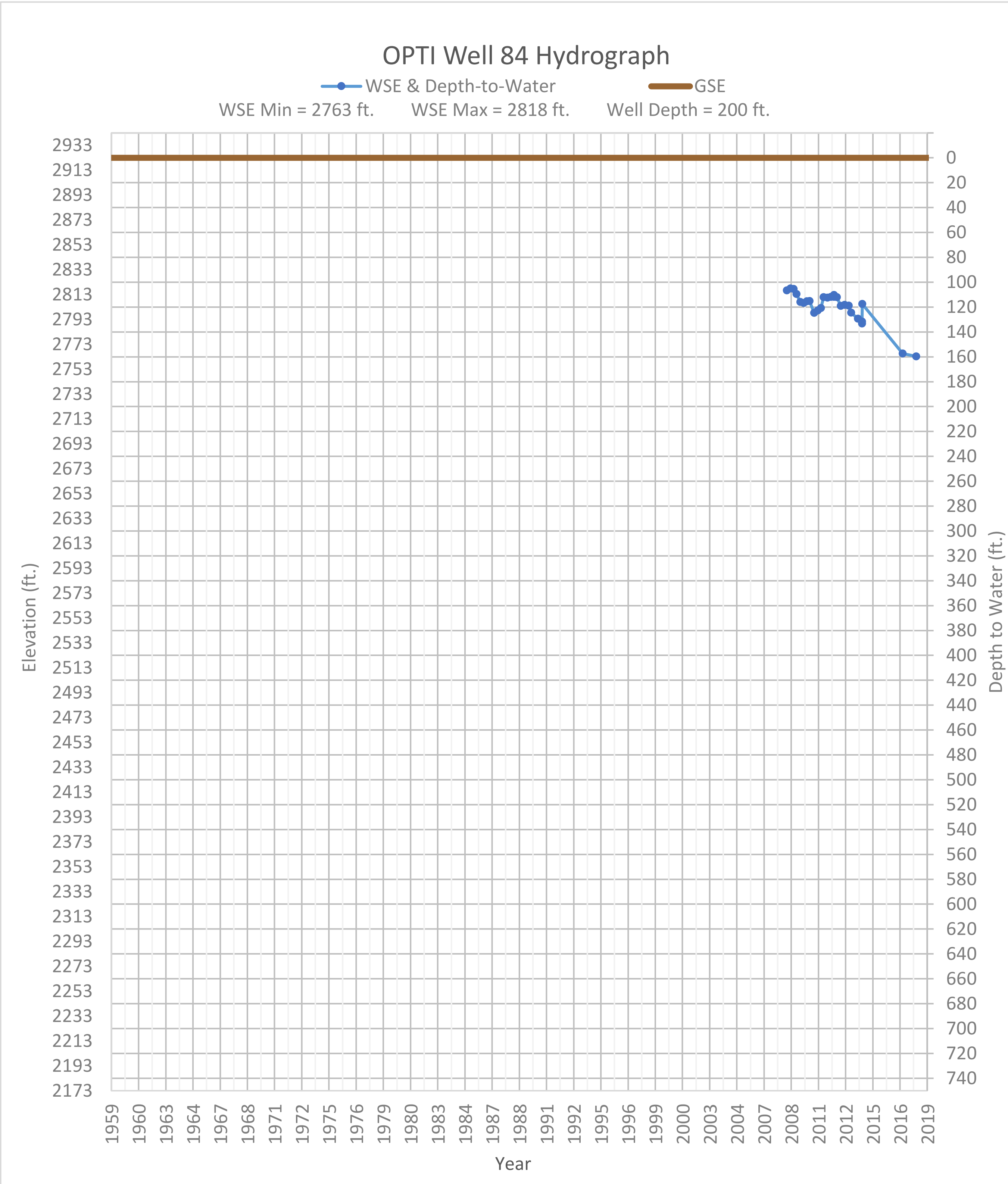
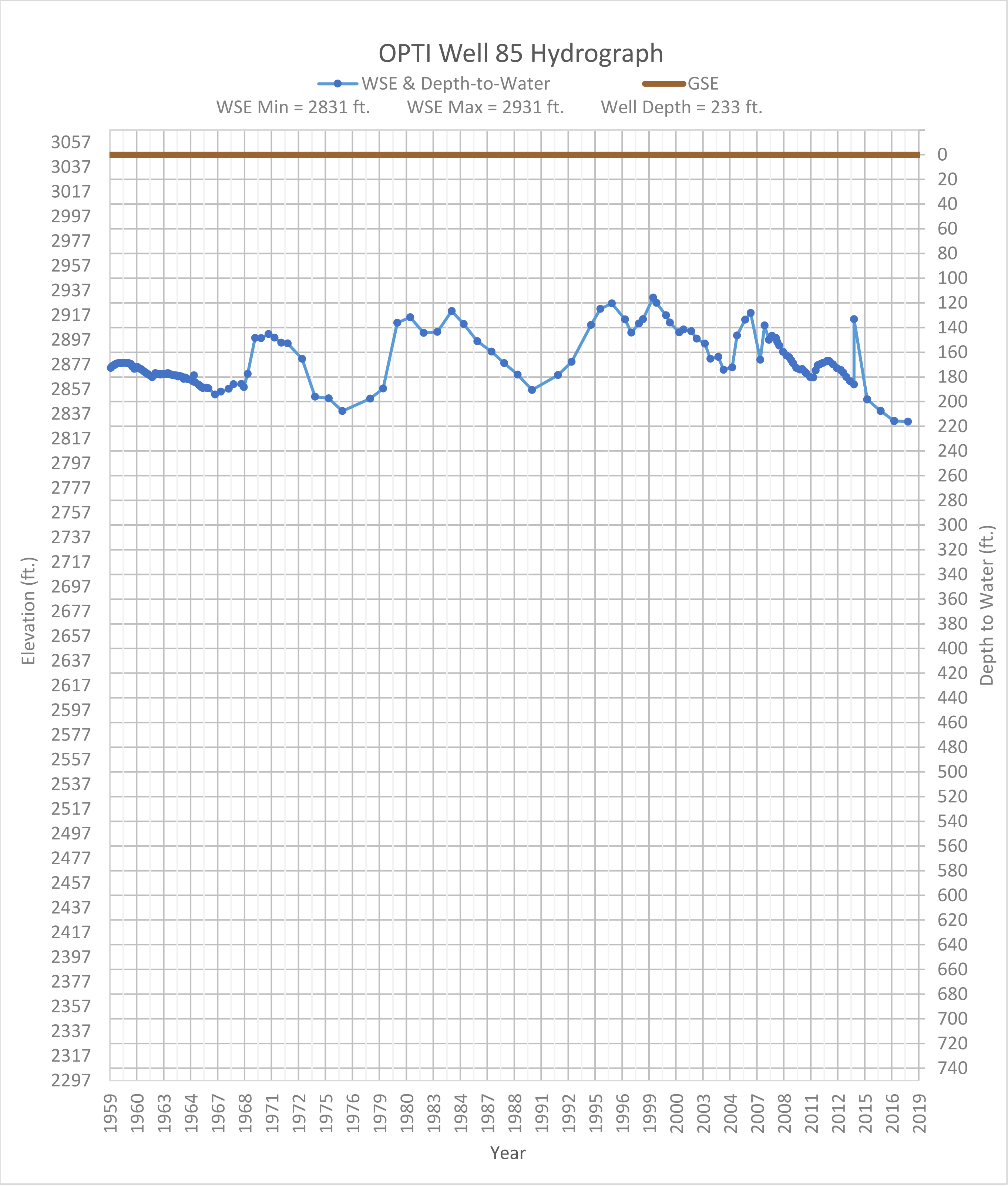
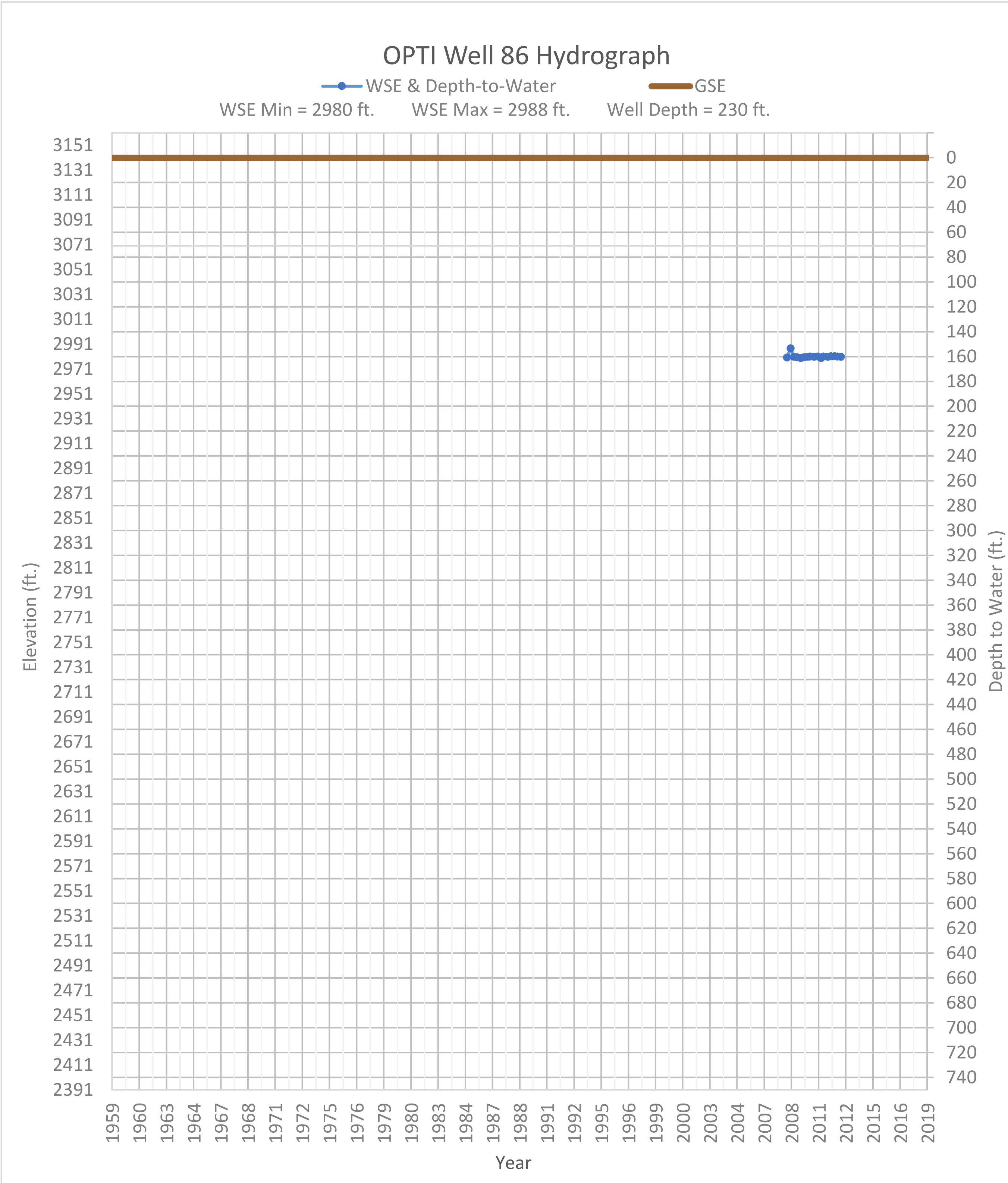


OPTI Well 84 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2763 ft.
WSE Max = 2818 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 85 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2831 ft.
WSE Max = 2931 ft.
Well Depth = 233 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 86 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2980 ft.
WSE Max = 2988 ft.
Well Depth = 230 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 87 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3358 ft.
WSE Max = 3378 ft.
Well Depth = 232 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 88 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3276 ft.
WSE Max = 3322 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3559
3539
3519
3499
3479
3459
3439
3419
3399
3379
3359
3339
3319
3299
3279
3259
3239
3219
3199
3179
3159
3139
3119
3099
3079
3059
3039
3019
2999
2979
2959
2939
2919
2899
2879
2859
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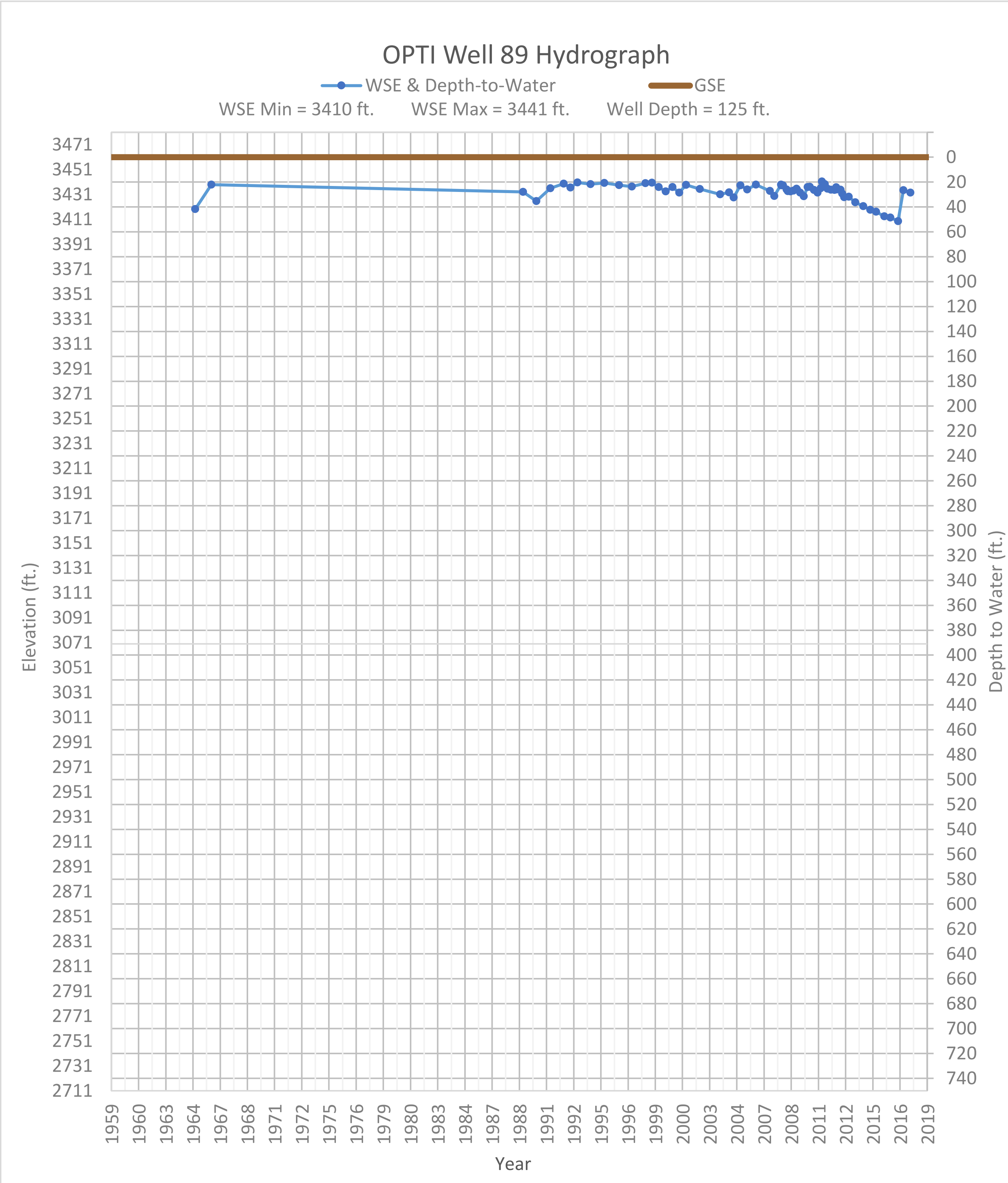
OPTI Well 89 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3410 ft.
WSE Max = 3441 ft.
Well Depth = 125 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3471
3451
3431
3411
3391
3371
3351
3331
3311
3291
3271
3251
3231
3211
3191
3171
3151
3131
3111
3091
3071
3051
3031
3011
2991
2971
2951
2931
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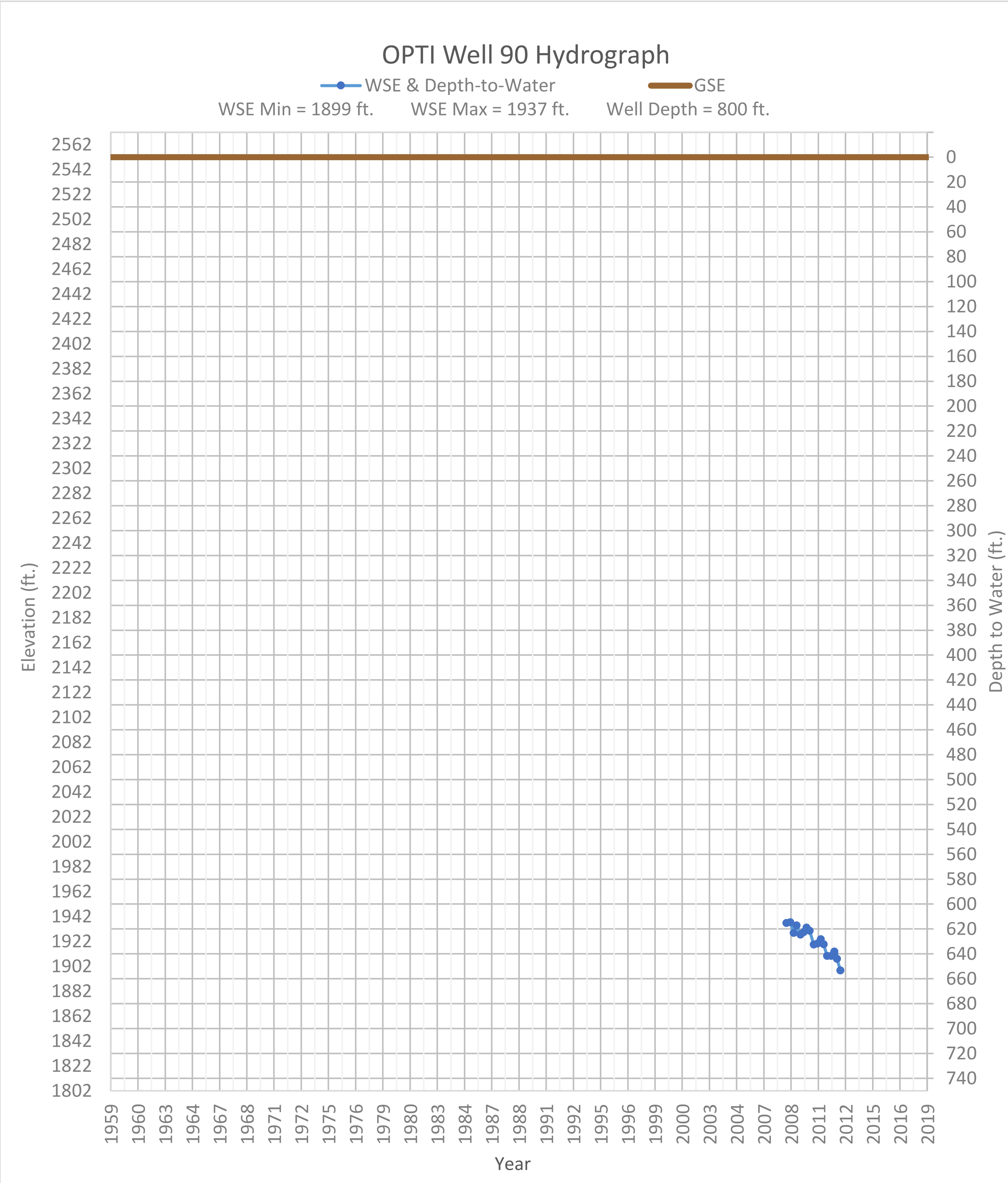
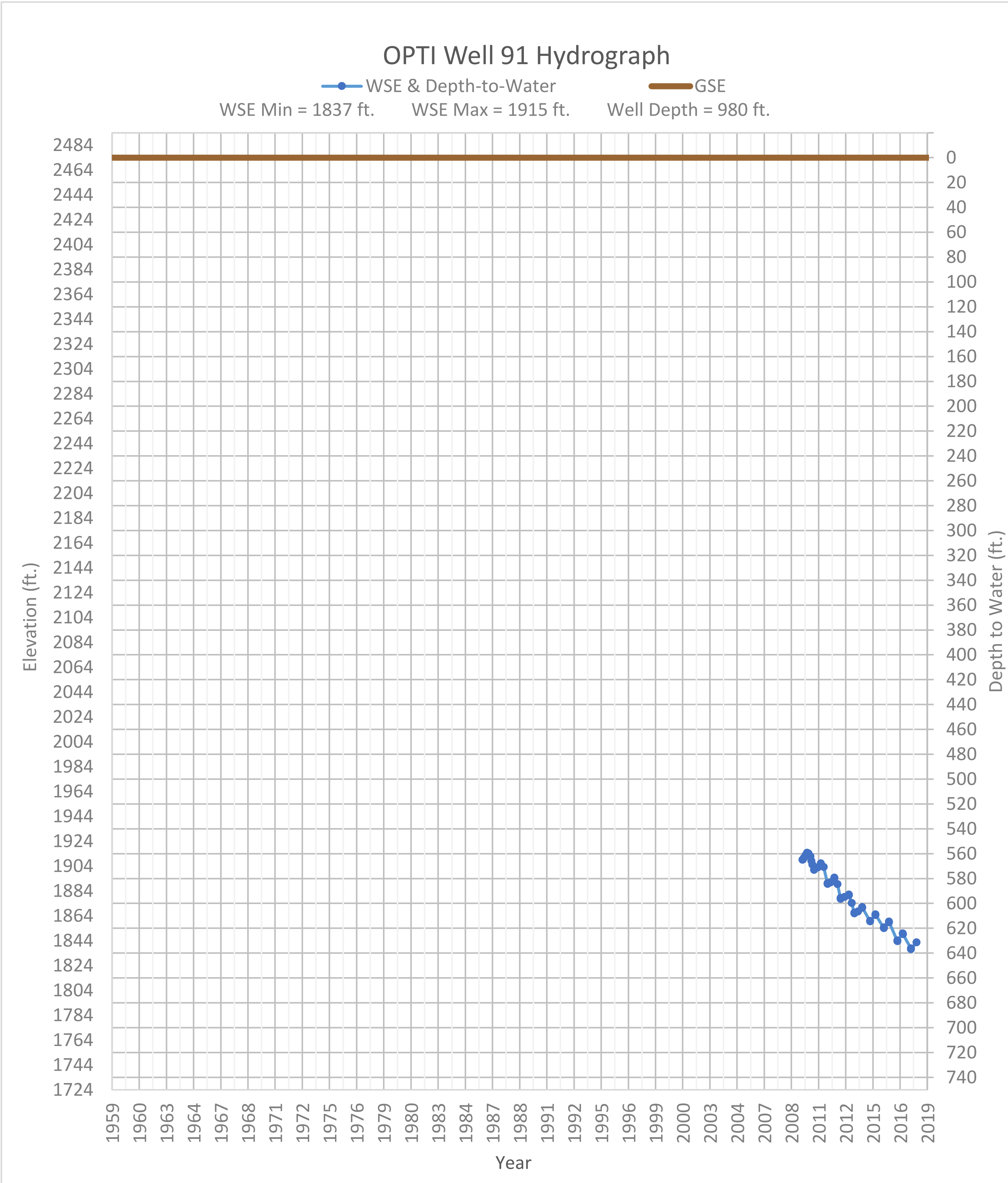


OPTI Well 90 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1899 ft.
WSE Max = 1937 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 91 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1837 ft.
WSE Max = 1915 ft.
Well Depth = 980 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2484
2464
2444
2424
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
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OPTI Well 92 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2530 ft.
WSE Max = 2577 ft.
Well Depth = 230 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 93 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2822 ft.
WSE Max = 2848 ft.
Well Depth = 151 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2938
2918
2898
2878
2858
2838
2818
2798
2778
2758
2738
2718
2698
2678
2658
2638
2618
2598
2578
2558
2538
2518
2498
2478
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2438
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2378
2358
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2298
2278
2258
2238
2218
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2178
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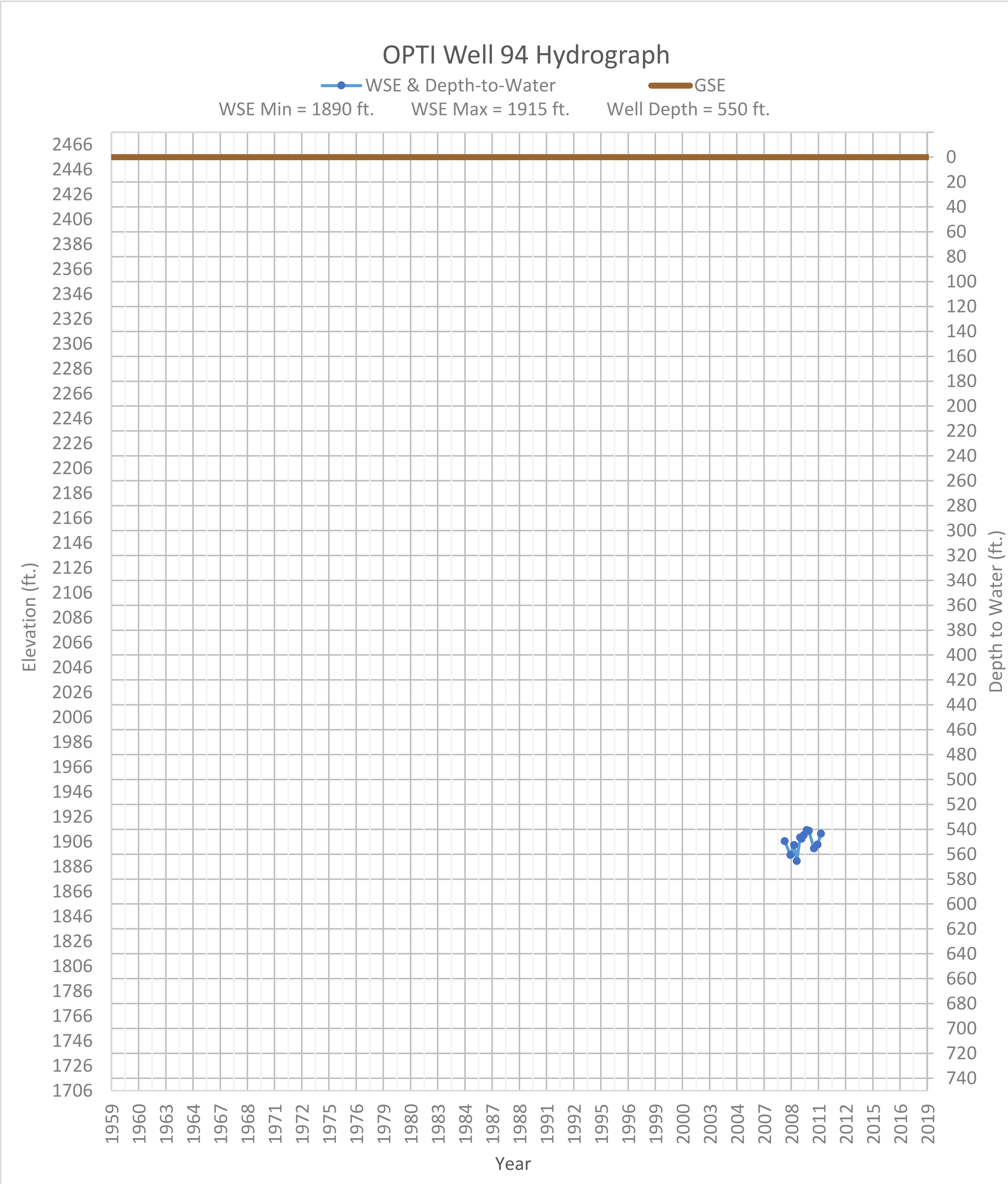
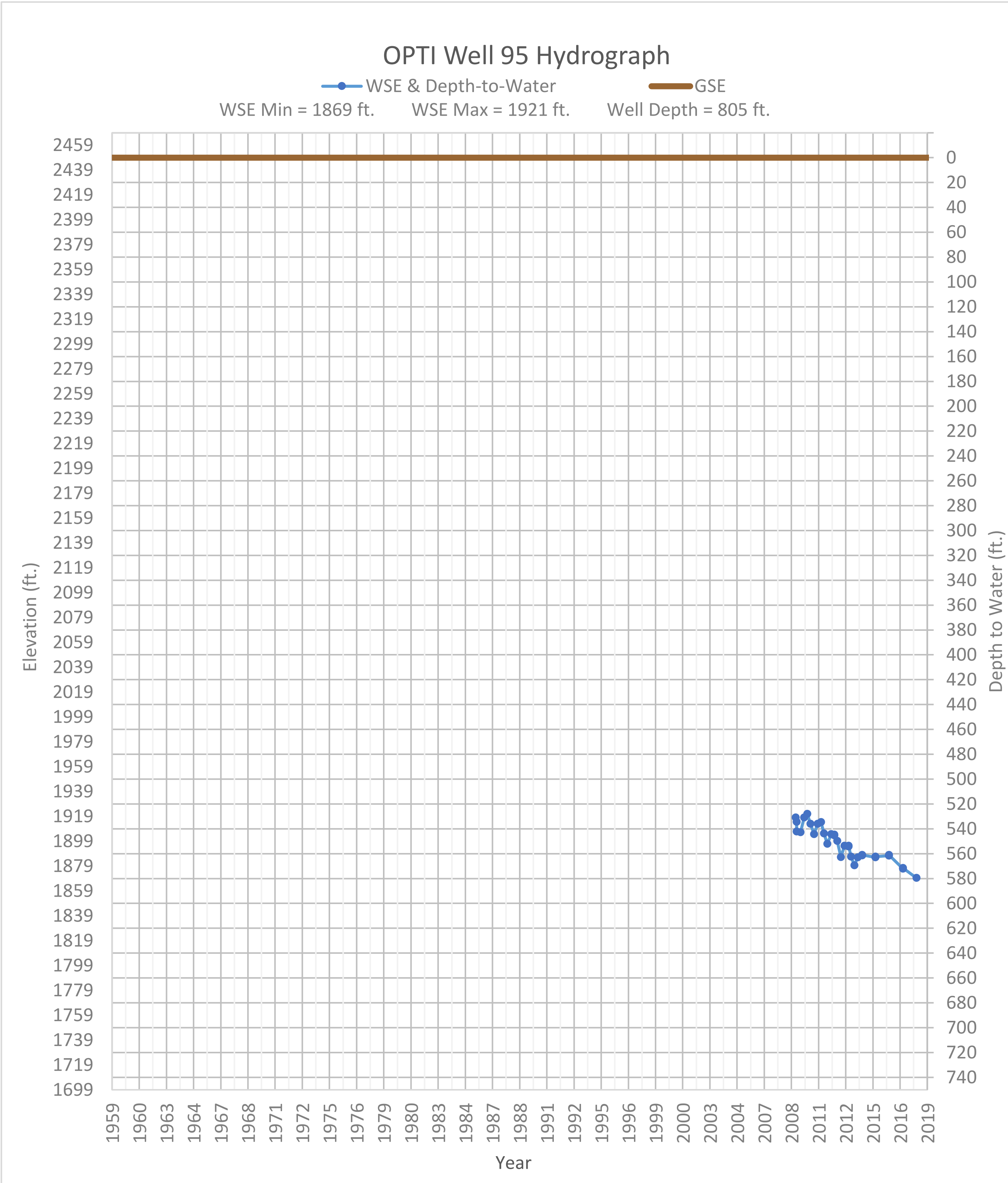


OPTI Well 94 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1890 ft.
WSE Max = 1915 ft.
Well Depth = 550 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 95 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1869 ft.
WSE Max = 1921 ft.
Well Depth = 805 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2459
2439
2419
2399
2379
2359
2339
2319
2299
2279
2259
2239
2219
2199
2179
2159
2139
2119
2099
2079
2059
2039
2019
1999
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1939
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1699
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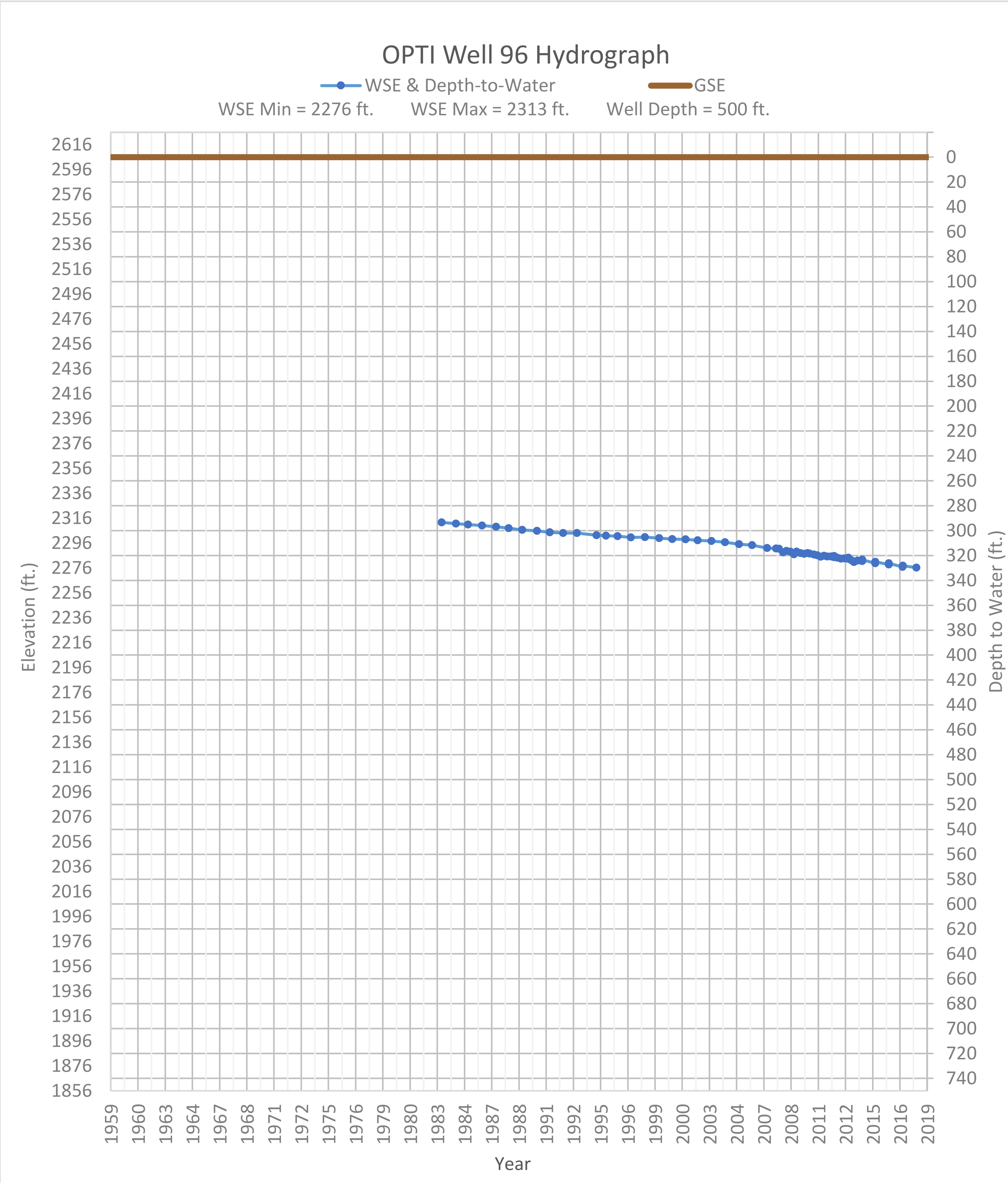
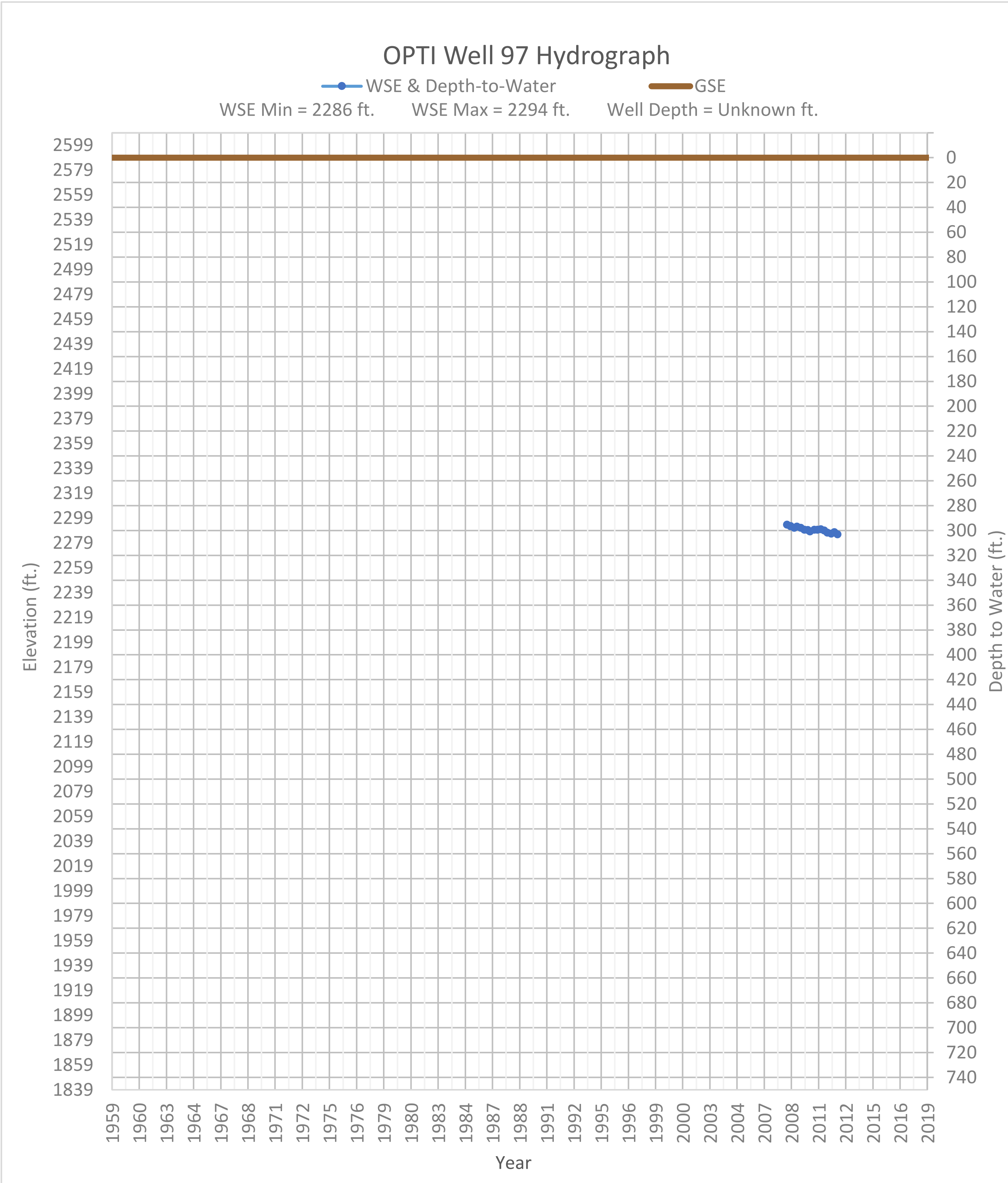
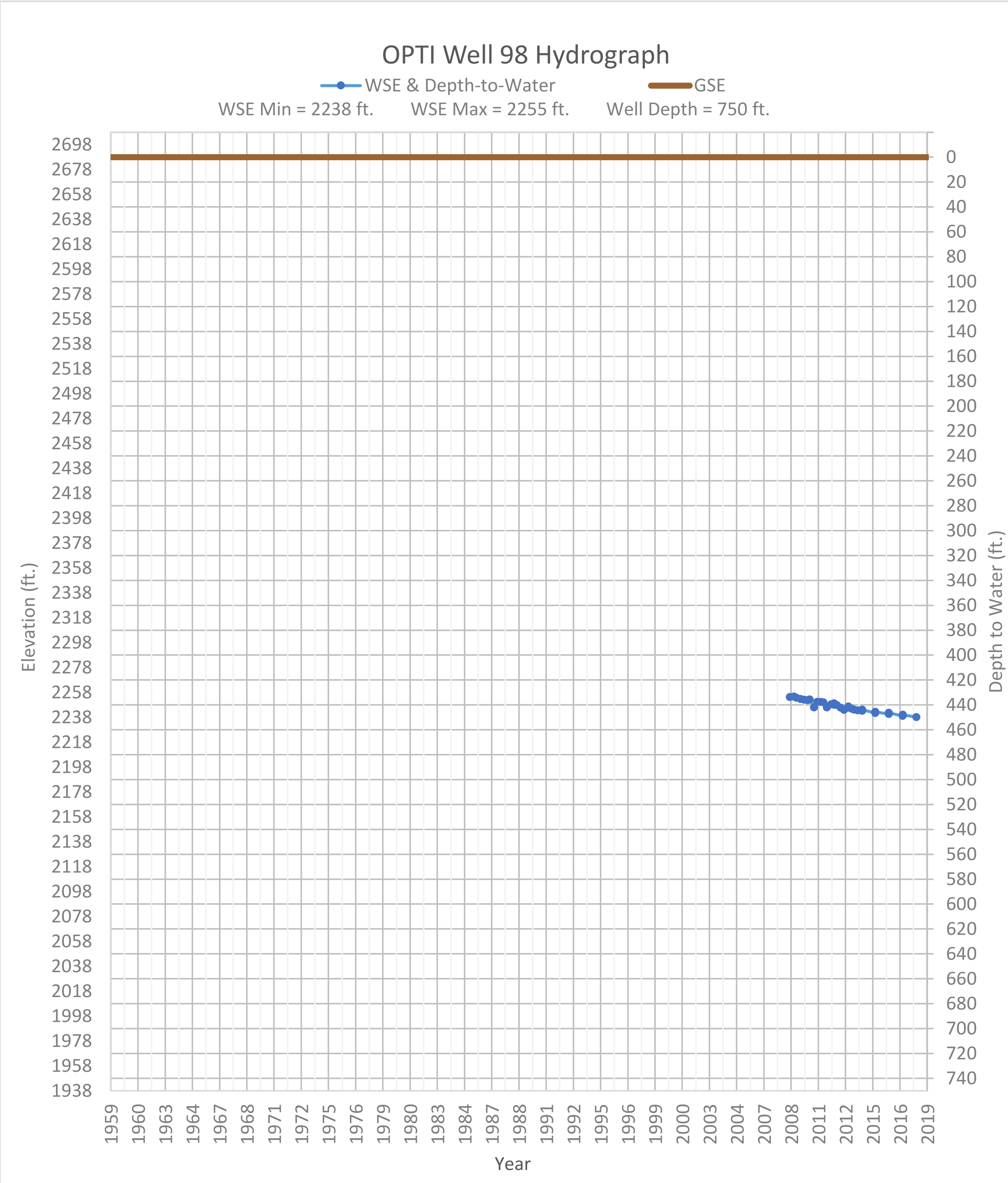

OPTI Well 96 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2276 ft.
WSE Max = 2313 ft.
Well Depth = 500 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 97 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2286 ft.
WSE Max = 2294 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 98 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2238 ft.
WSE Max = 2255 ft.
Well Depth = 750 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2698
2678
2658
2638
2618
2598
2578
2558
2538
2518
2498
2478
2458
2438
2418
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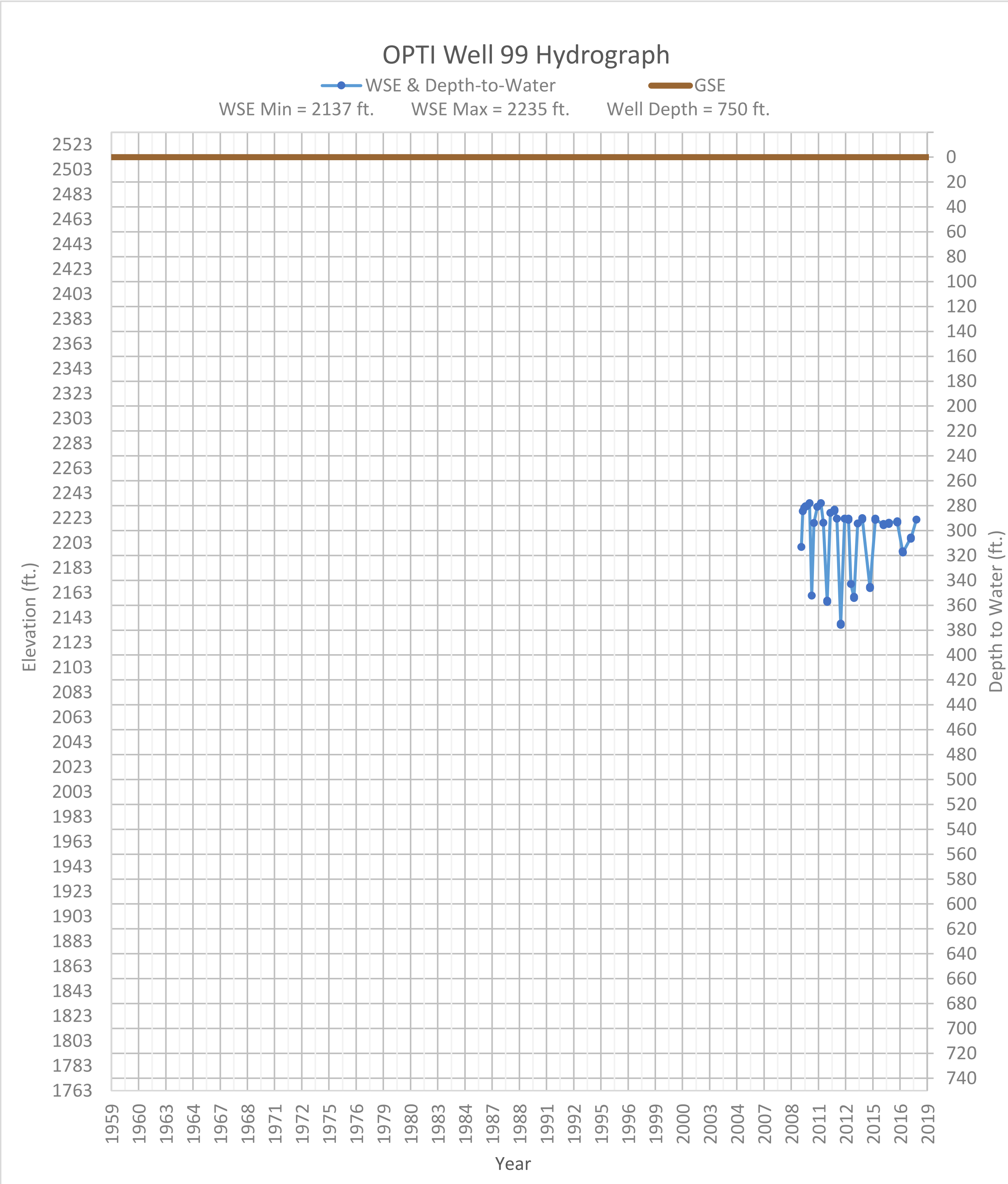

OPTI Well 99 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2137 ft.
WSE Max = 2235 ft.
Well Depth = 750 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2523
2503
2483
2463
2443
2423
2403
2383
2363
2343
2323
2303
2283
2263
2243
2223
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
1923
1903
1883
1863
1843
1823
1803
1783
1763
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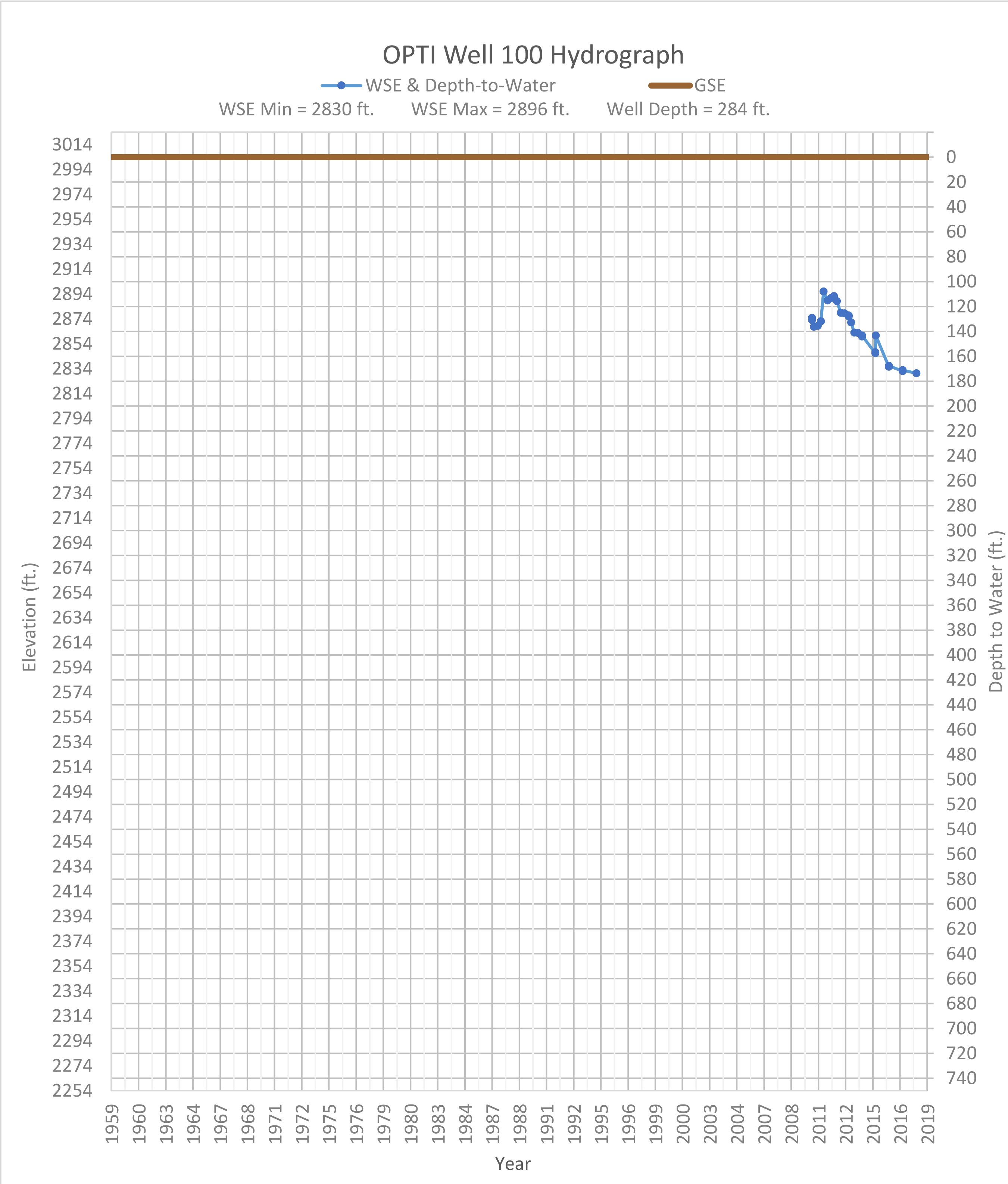
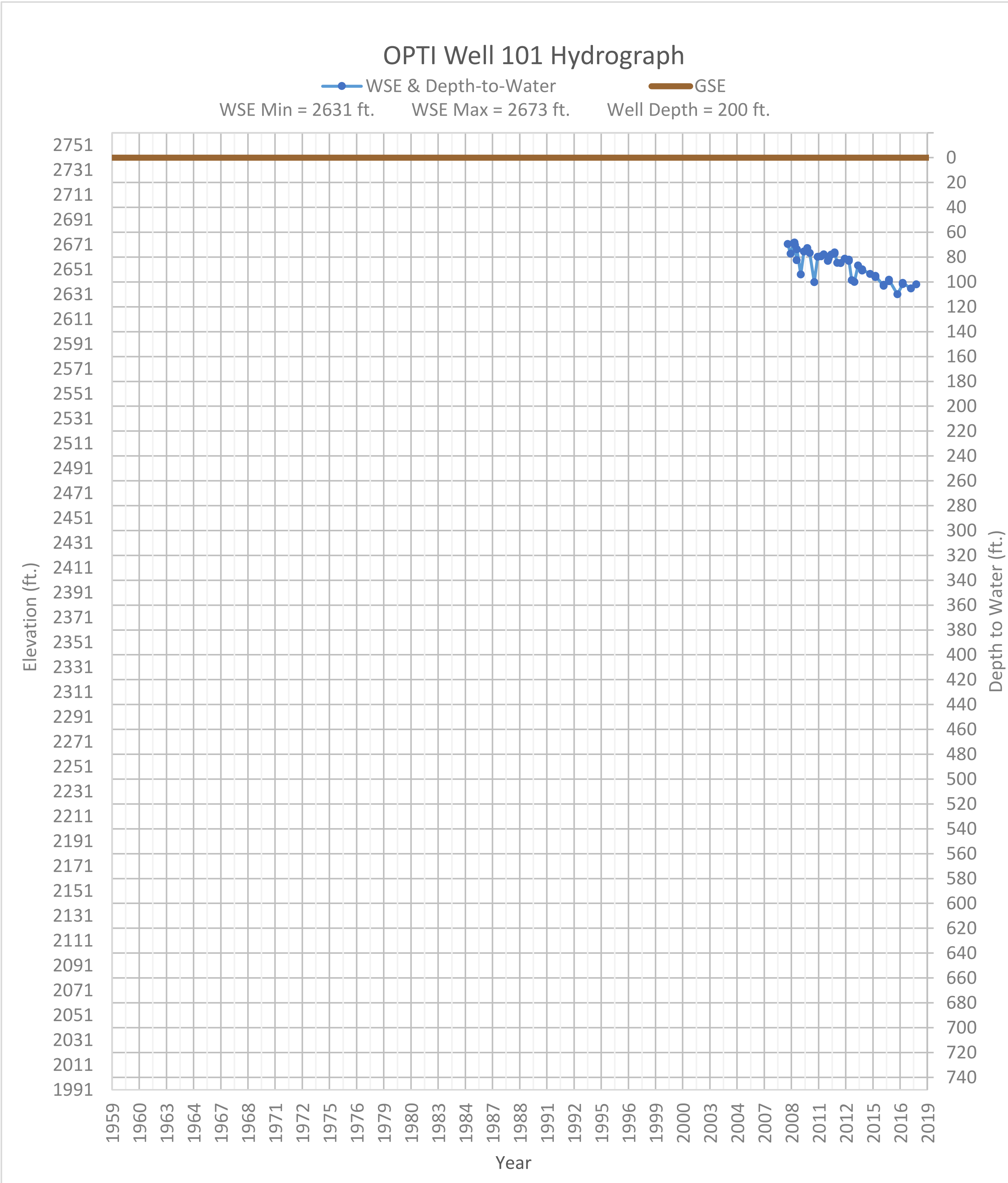
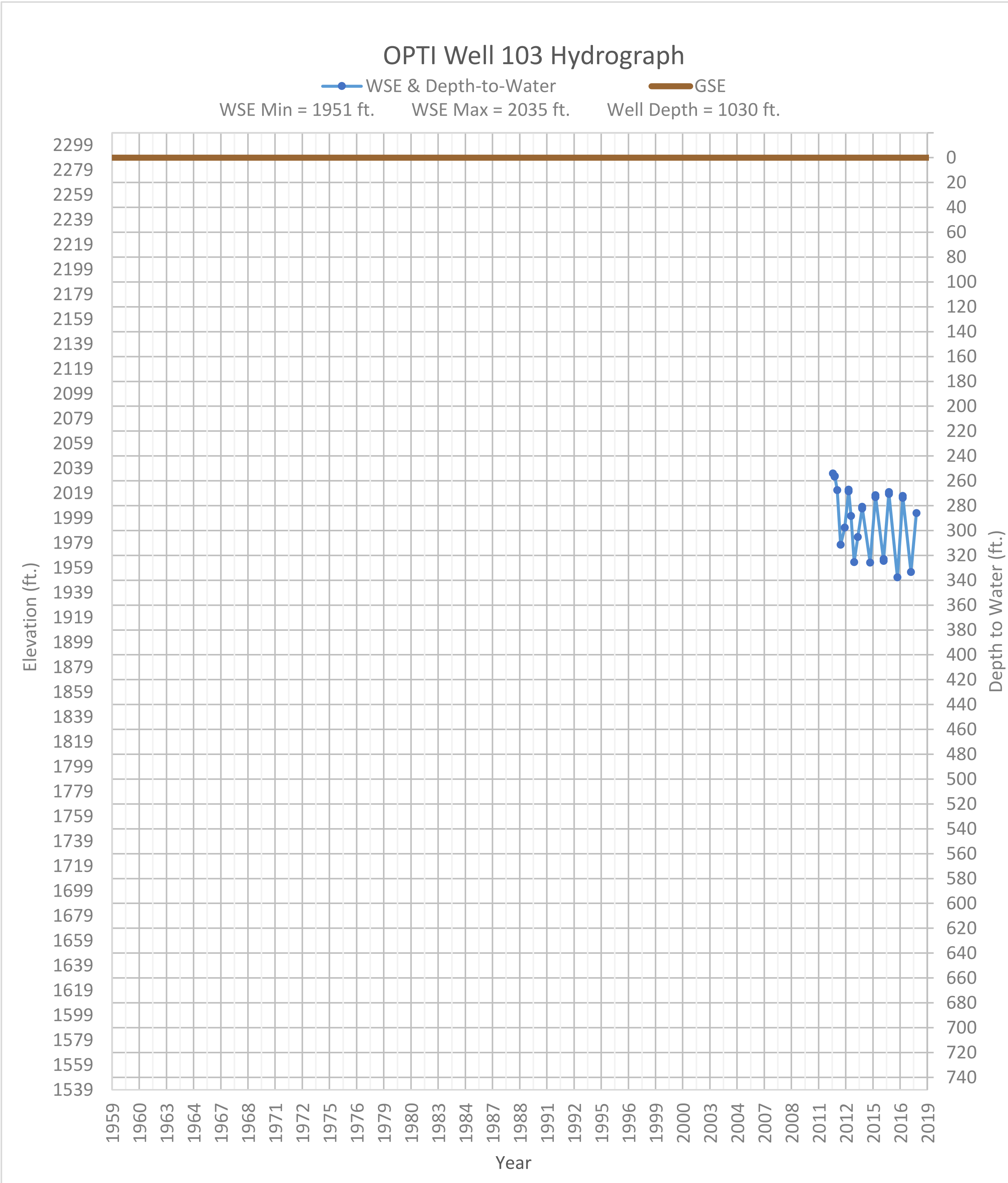


OPTI Well 100 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2830 ft.
WSE Max = 2896 ft.
Well Depth = 284 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

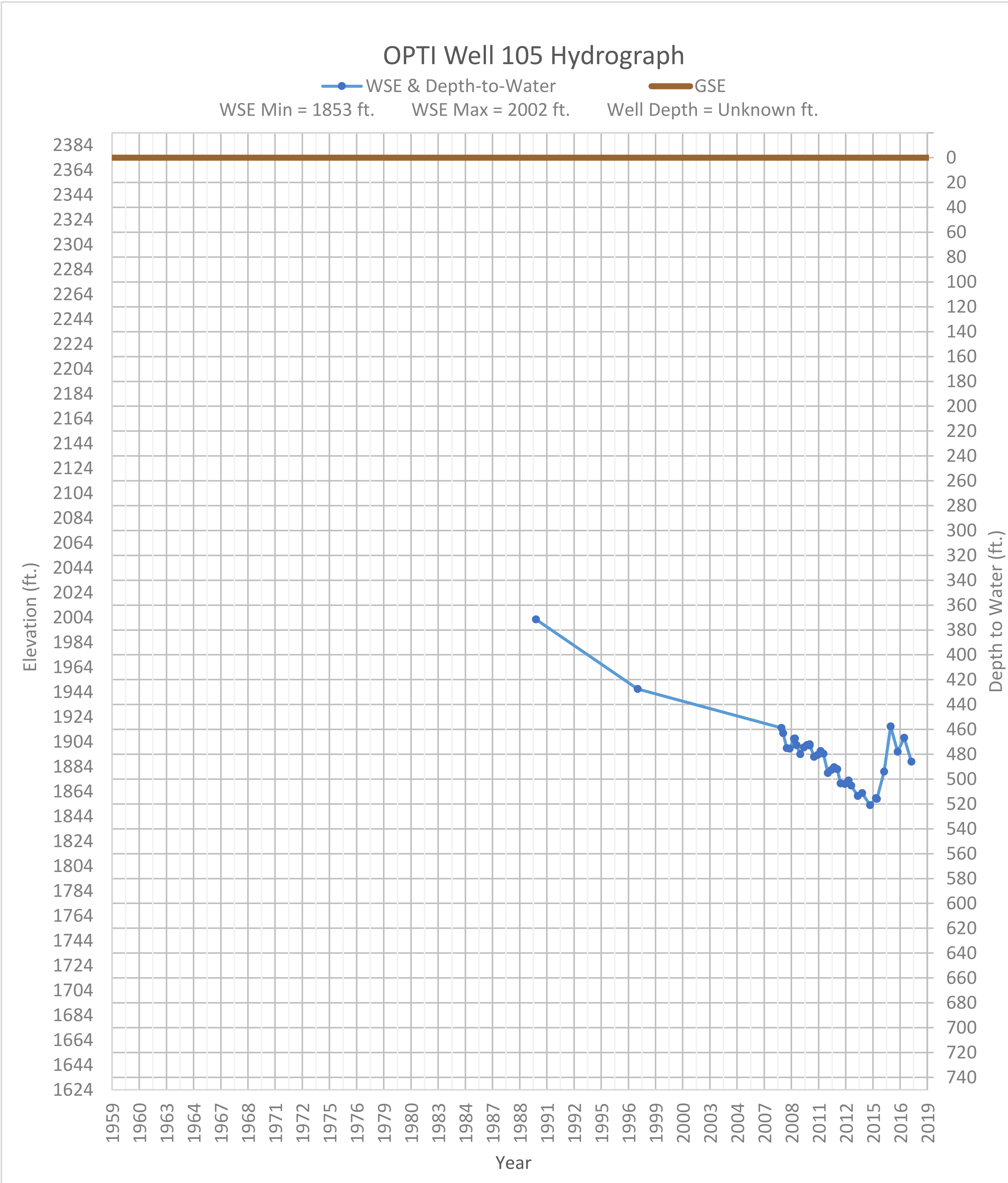

OPTI Well 101 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2631 ft.
WSE Max = 2673 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

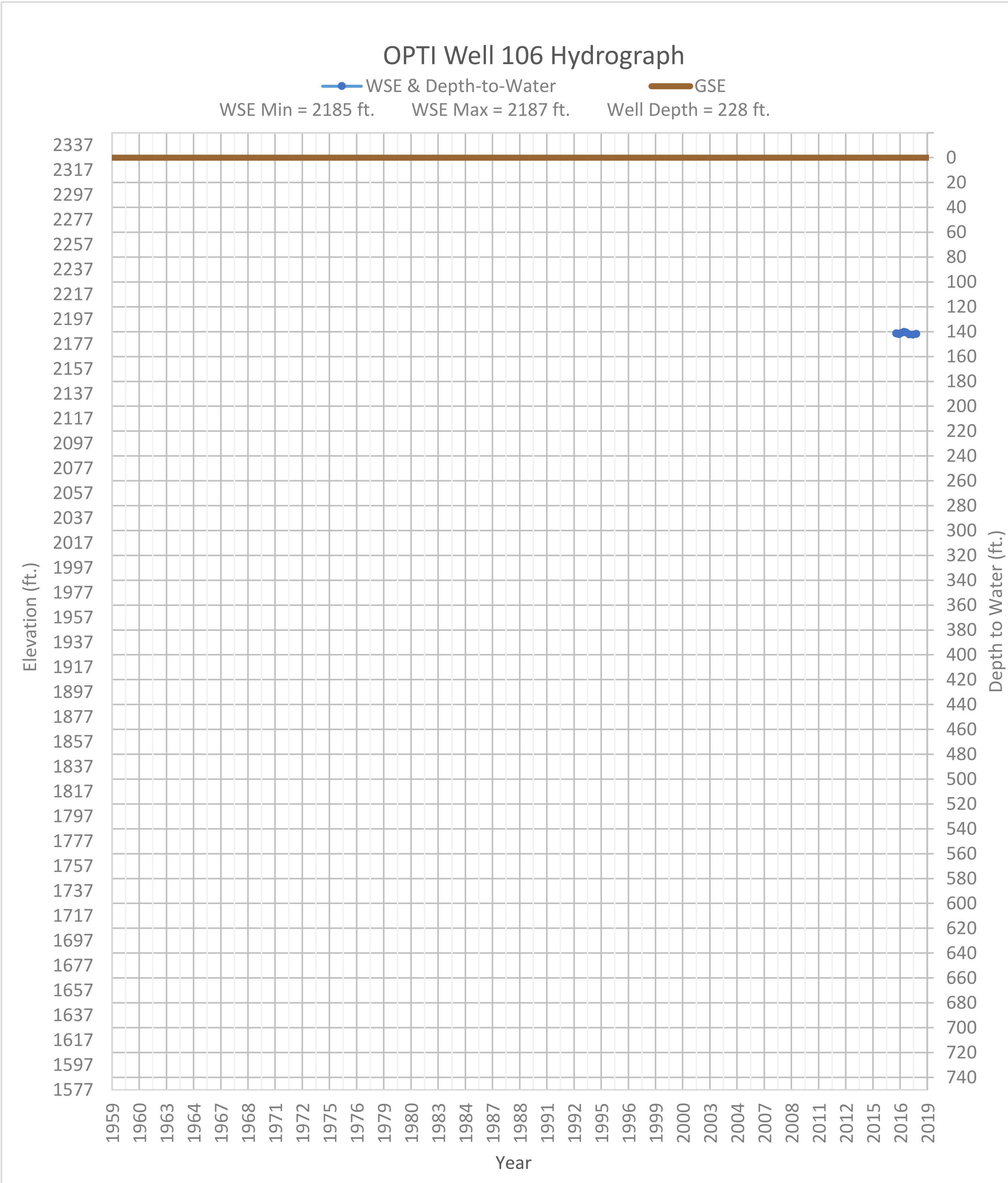

OPTI Well 102 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1802 ft.
WSE Max = 1861 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



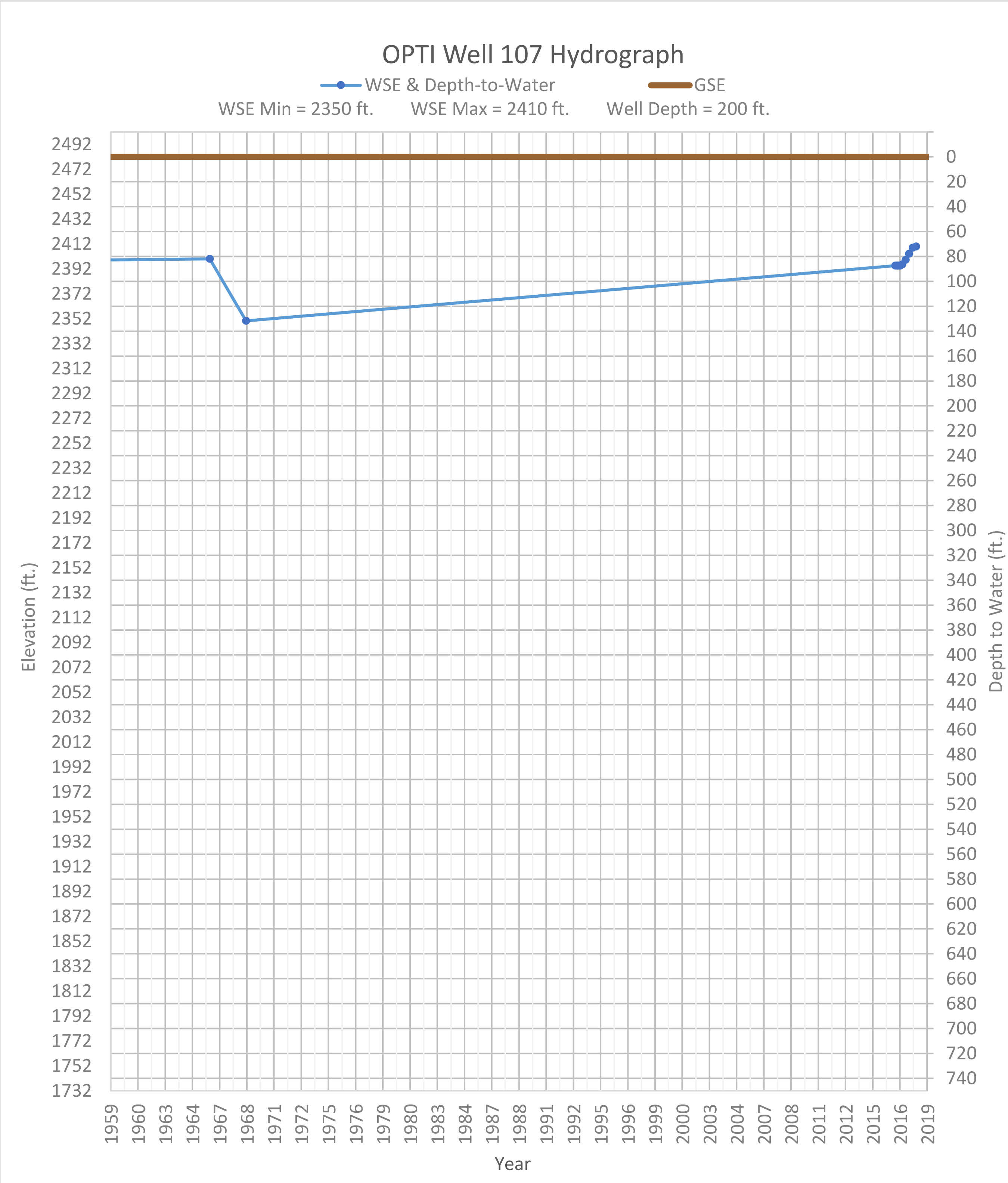
OPTI Well 103 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1951 ft.
WSE Max = 2035 ft.
Well Depth = 1030 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 104 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1837 ft.
WSE Max = 1907 ft.
Well Depth = 640 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 105 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1853 ft.
WSE Max = 2002 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 106 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2185 ft.
WSE Max = 2187 ft.
Well Depth = 228 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 107 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2350 ft.
WSE Max = 2410 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2492
2472
2452
2432
2412
2392
2372
2352
2332
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
1792
1772
1752
1732
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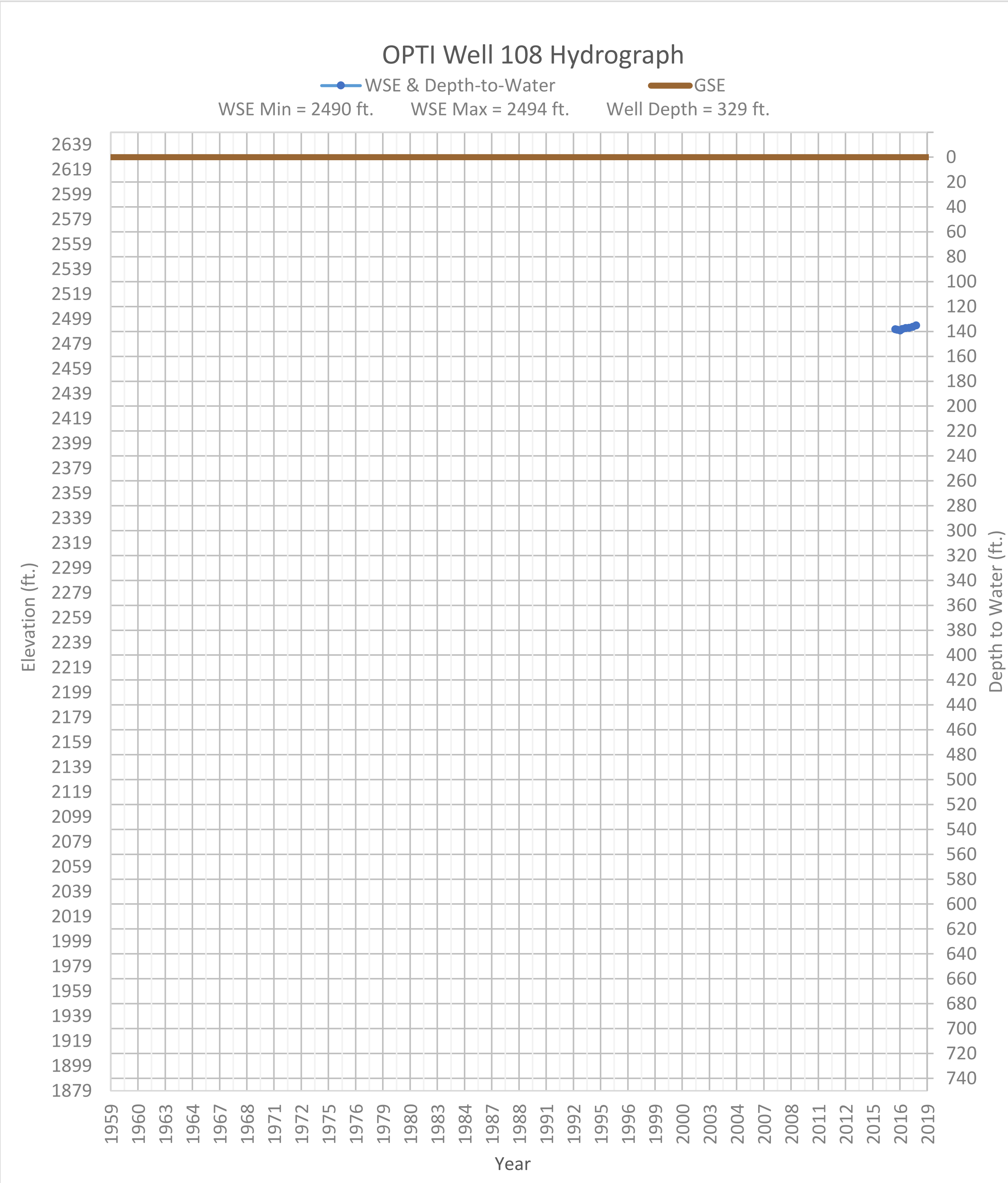
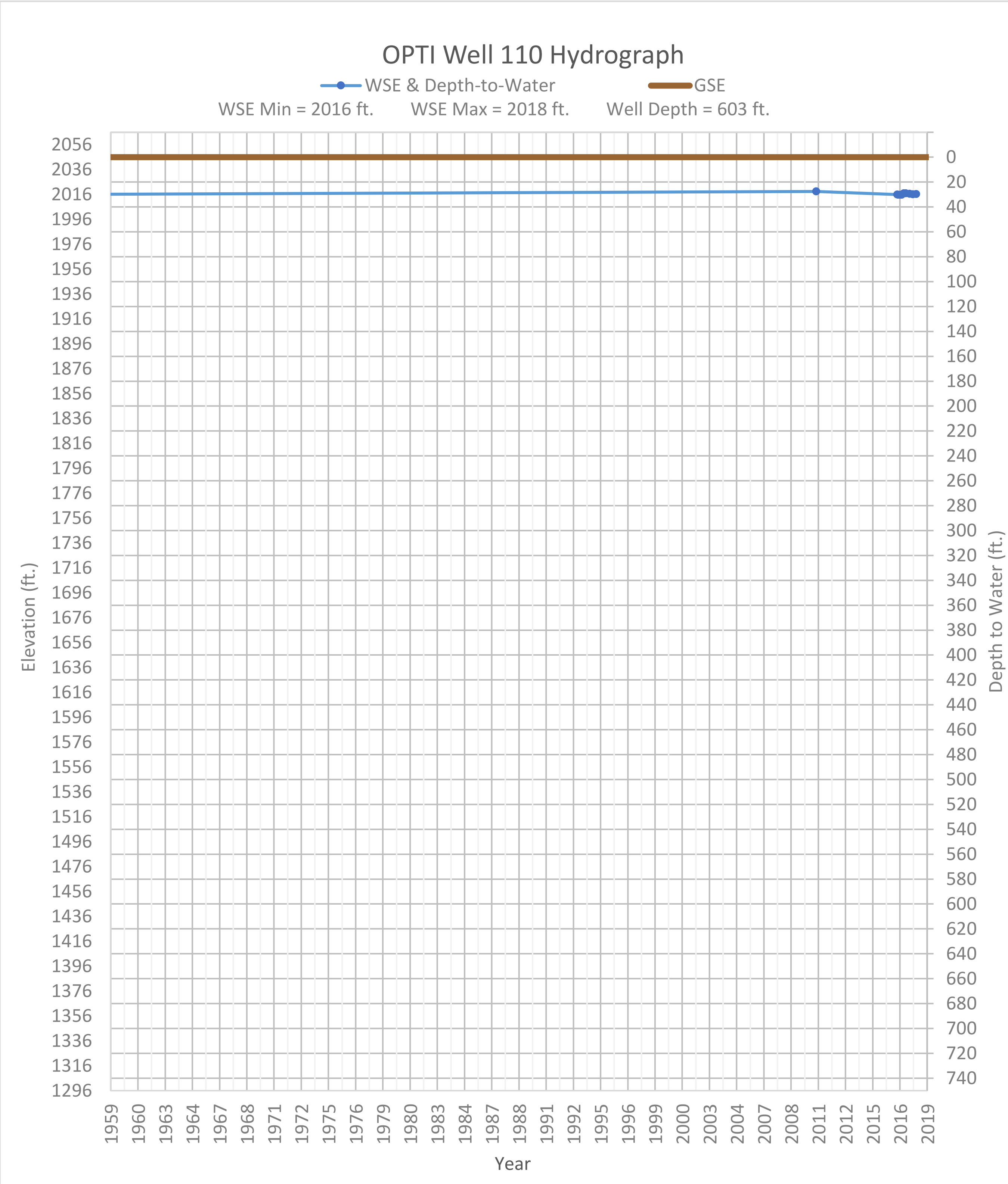

OPTI Well 108 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2490 ft.
WSE Max = 2494 ft.
Well Depth = 329 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 110 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2016 ft.
WSE Max = 2018 ft.
Well Depth = 603 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2056
2036
2016
1996
1976
1956
1936
1916
1896
1876
1856
1836
1816
1796
1776
1756
1736
1716
1696
1676
1656
1636
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1356
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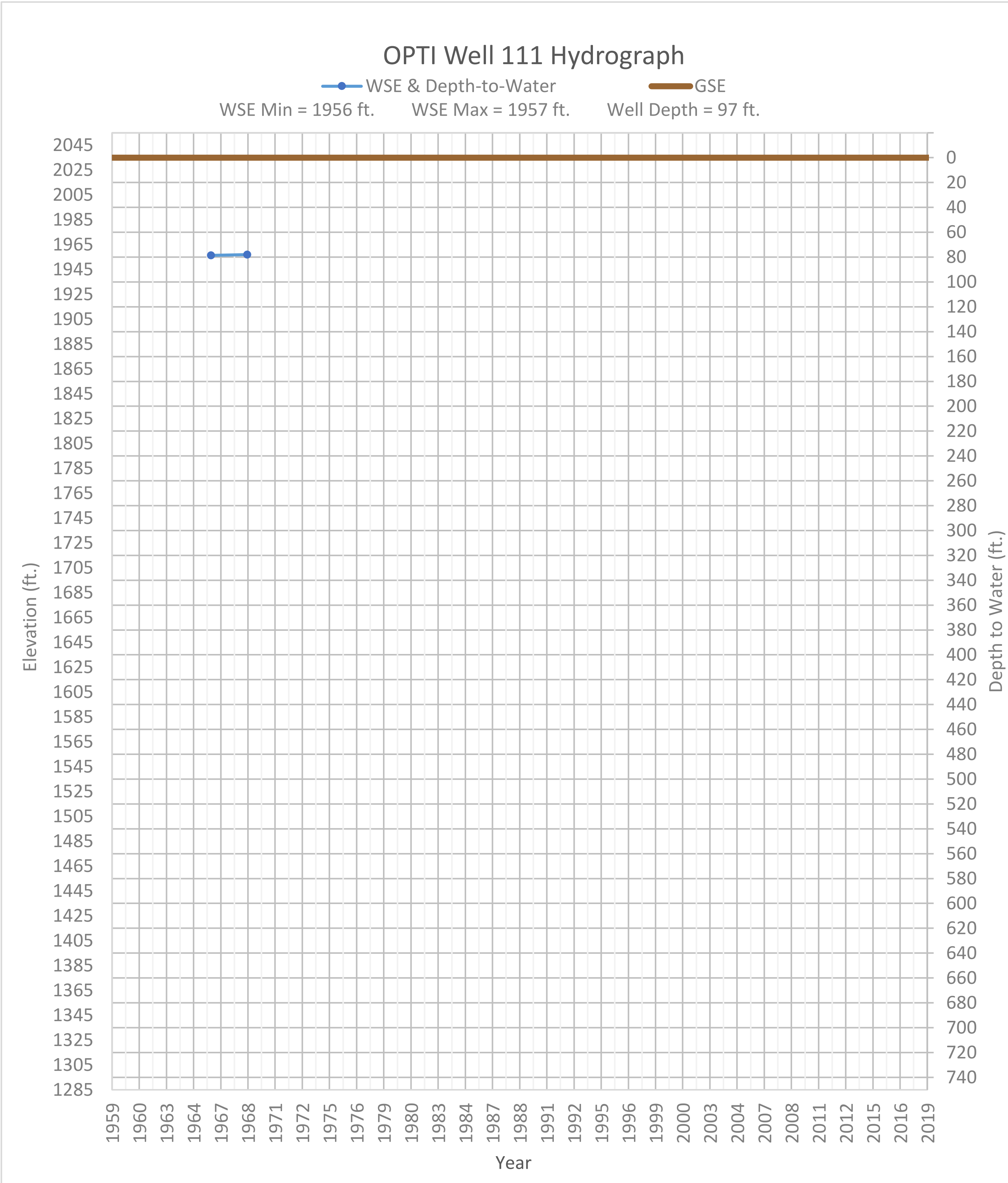
OPTI Well 111 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1956 ft.
WSE Max = 1957 ft.
Well Depth = 97 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2045
2025
2005
1985
1965
1945
1925
1905
1885
1865
1845
1825
1805
1785
1765
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1725
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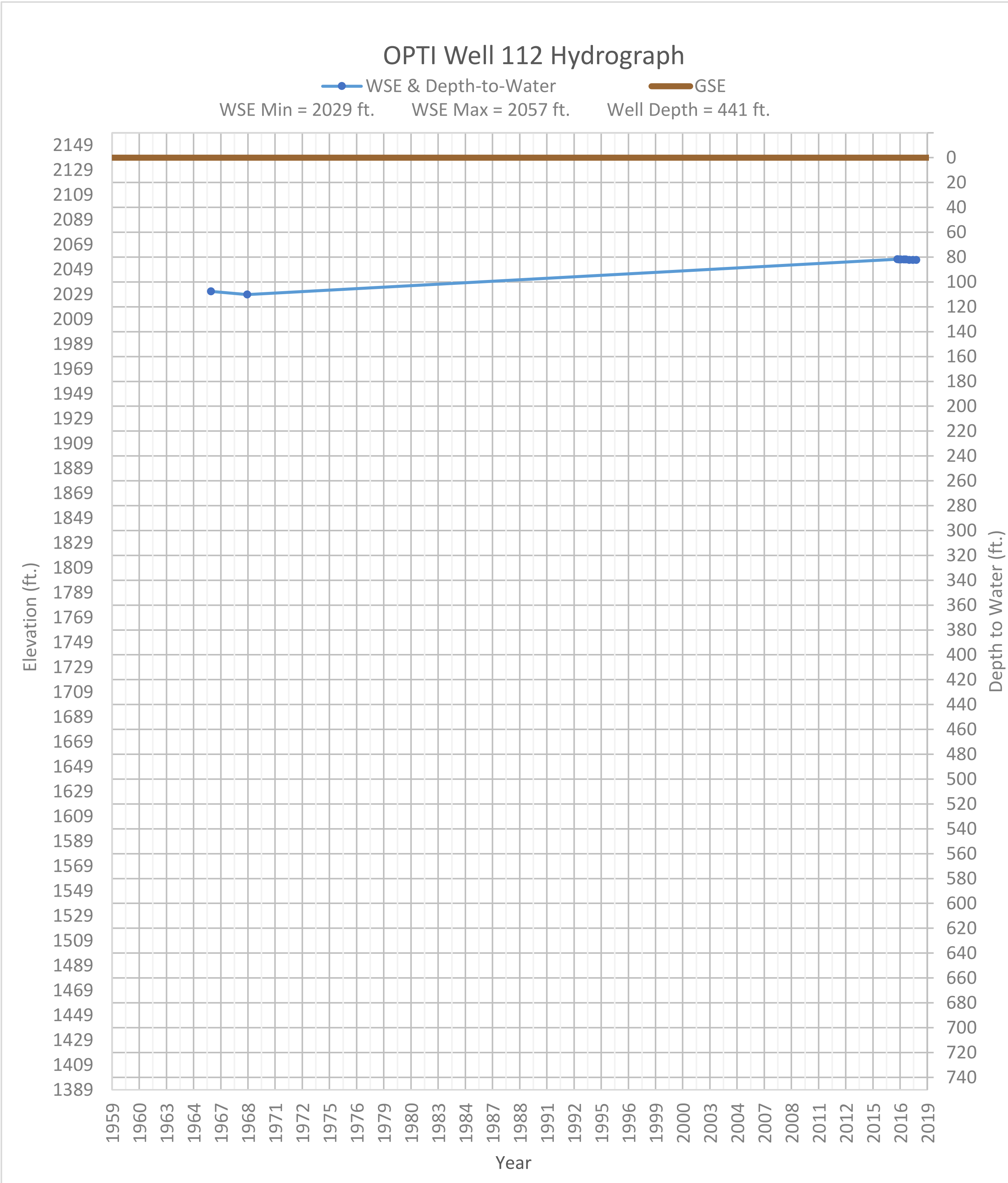
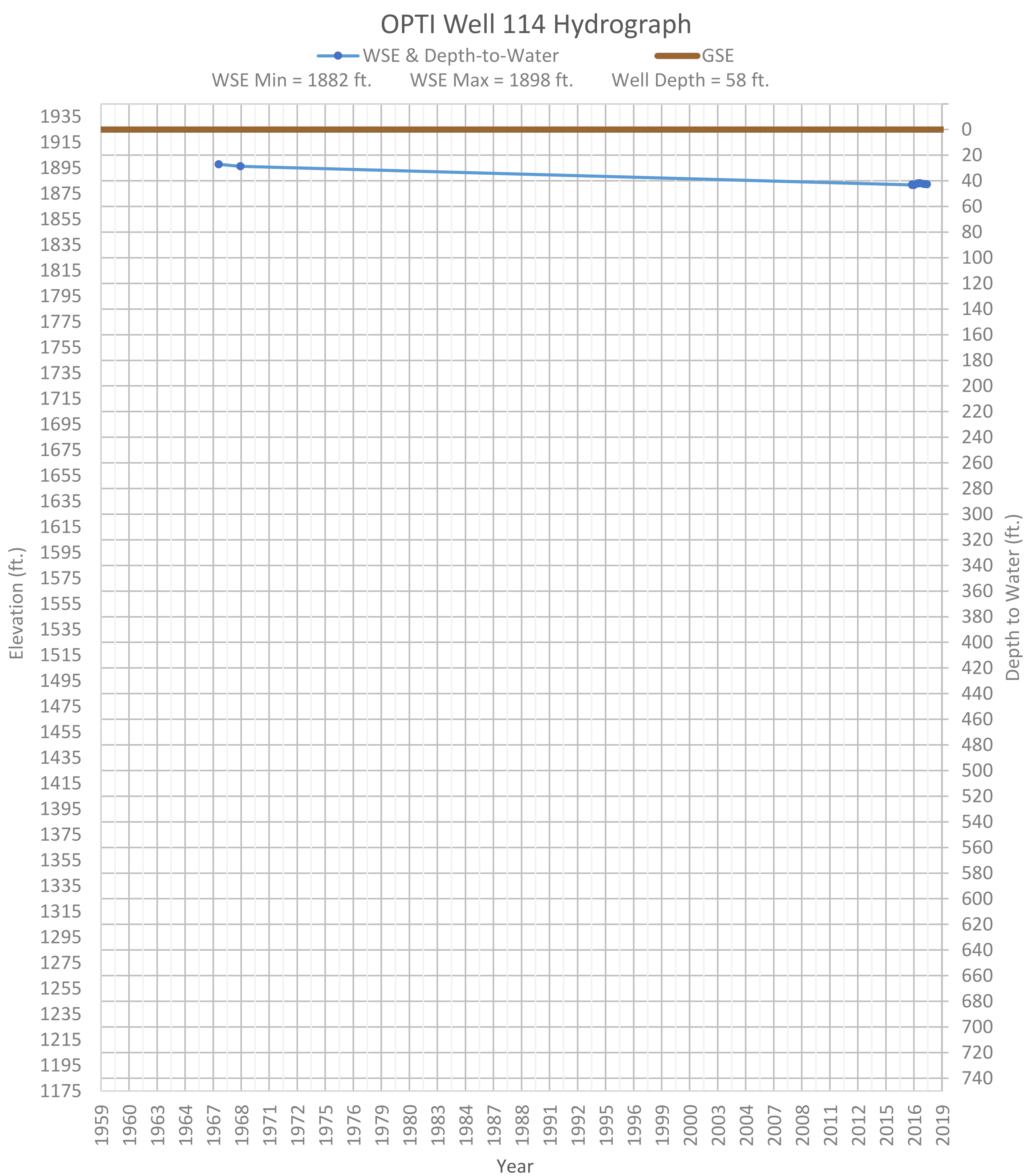


OPTI Well 112 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2029 ft.
WSE Max = 2057 ft.
Well Depth = 441 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 114 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1882 ft.
WSE Max = 1898 ft.
Well Depth = 58 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1935
1915
1895
1875
1855
1835
1815
1795
1775
1755
1735
1715
1695
1675
1655
1635
1615
1595
1575
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1195
1175
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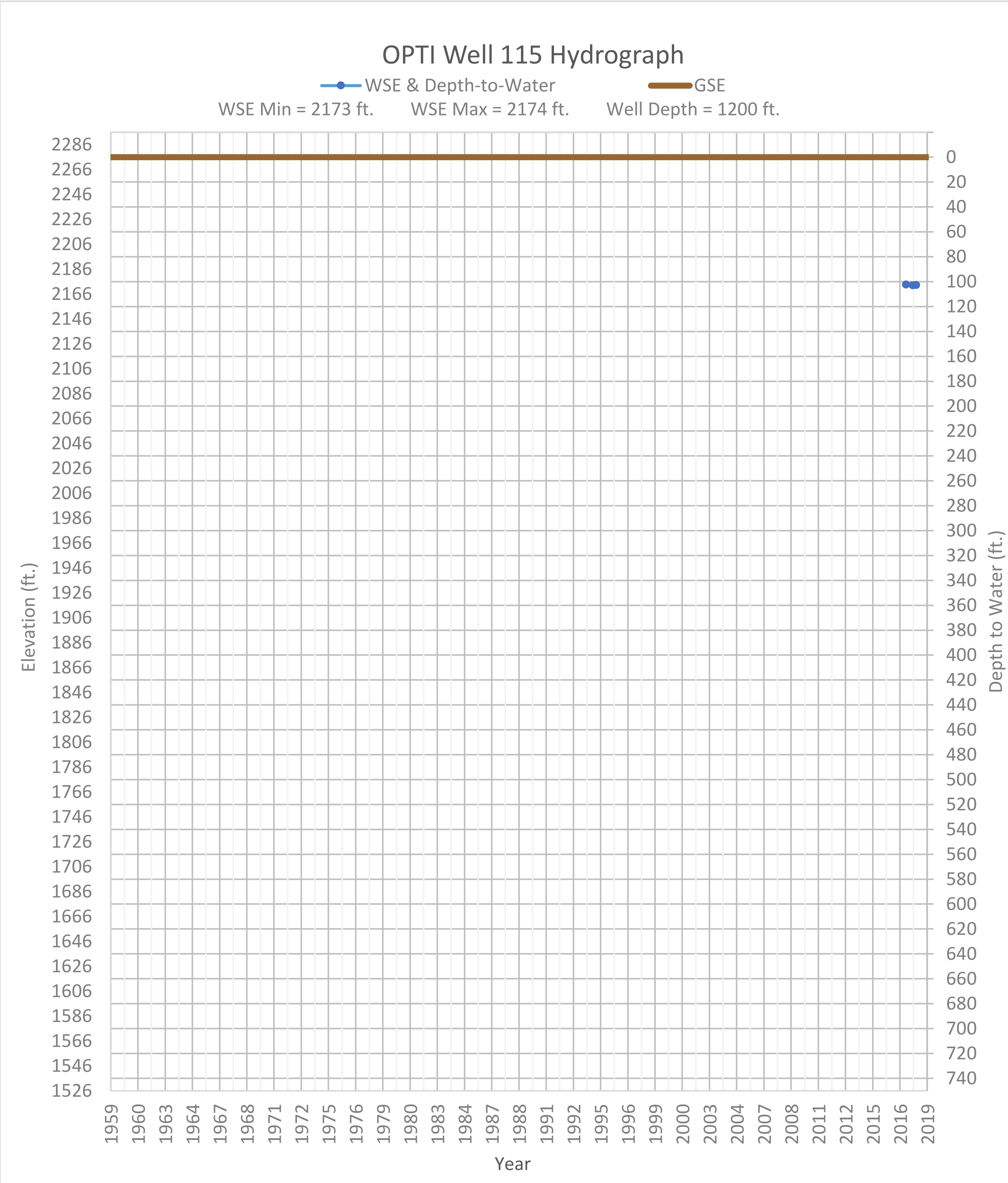
OPTI Well 115 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2173 ft.
WSE Max = 2174 ft.
Well Depth = 1200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
1966
1946
1926
1906
1886
1866
1846
1826
1806
1786
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1706
1686
1666
1646
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1606
1586
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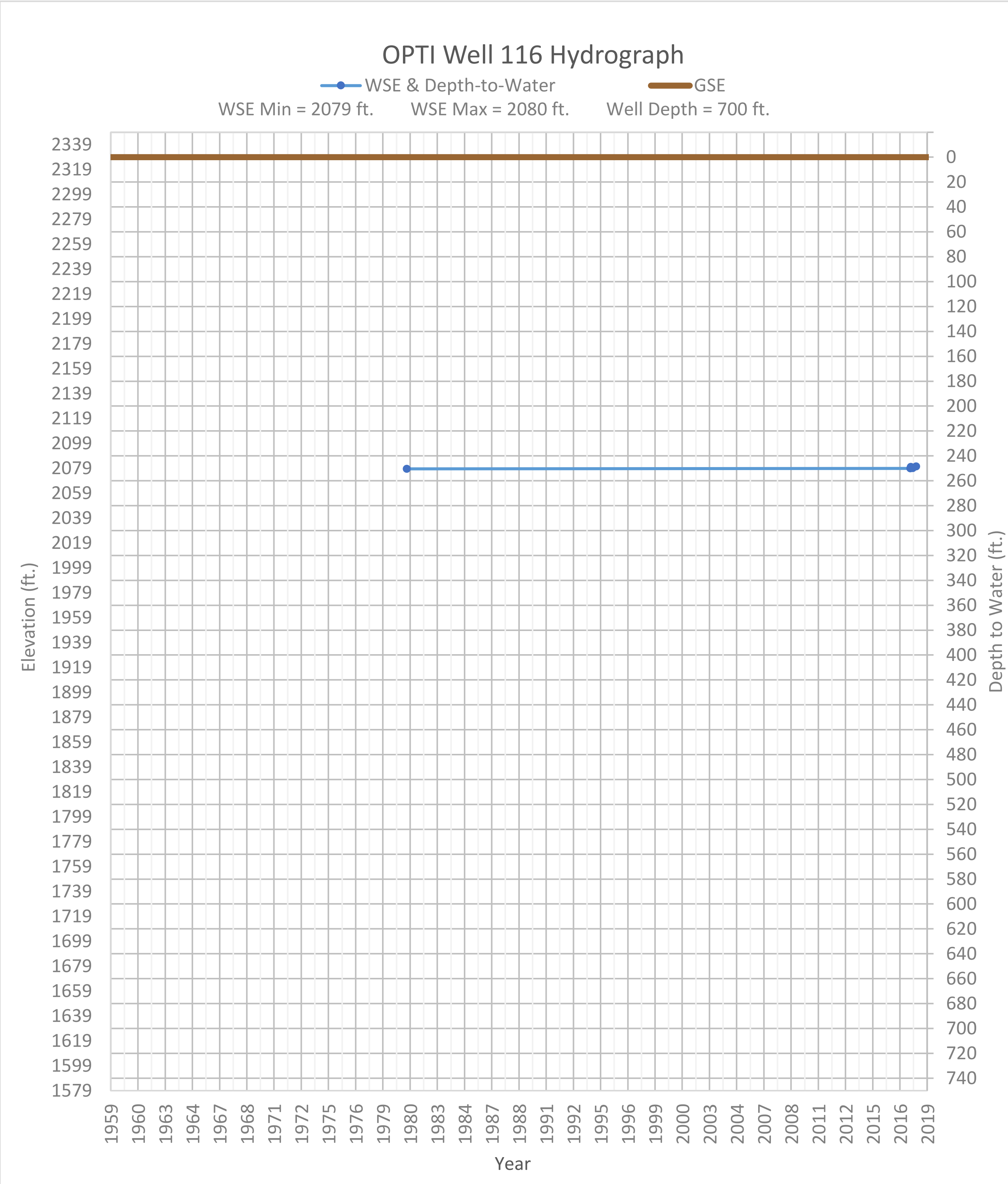
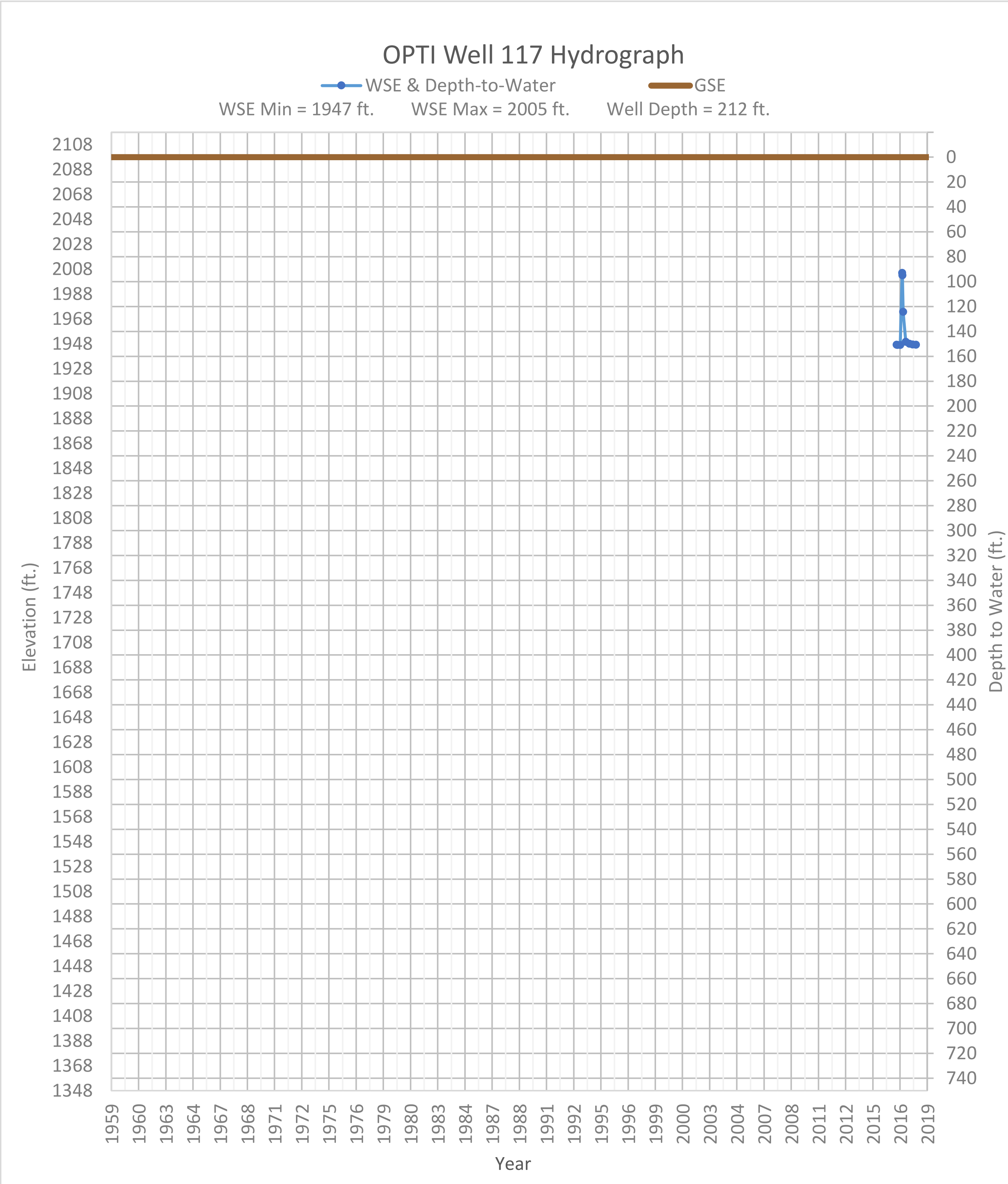
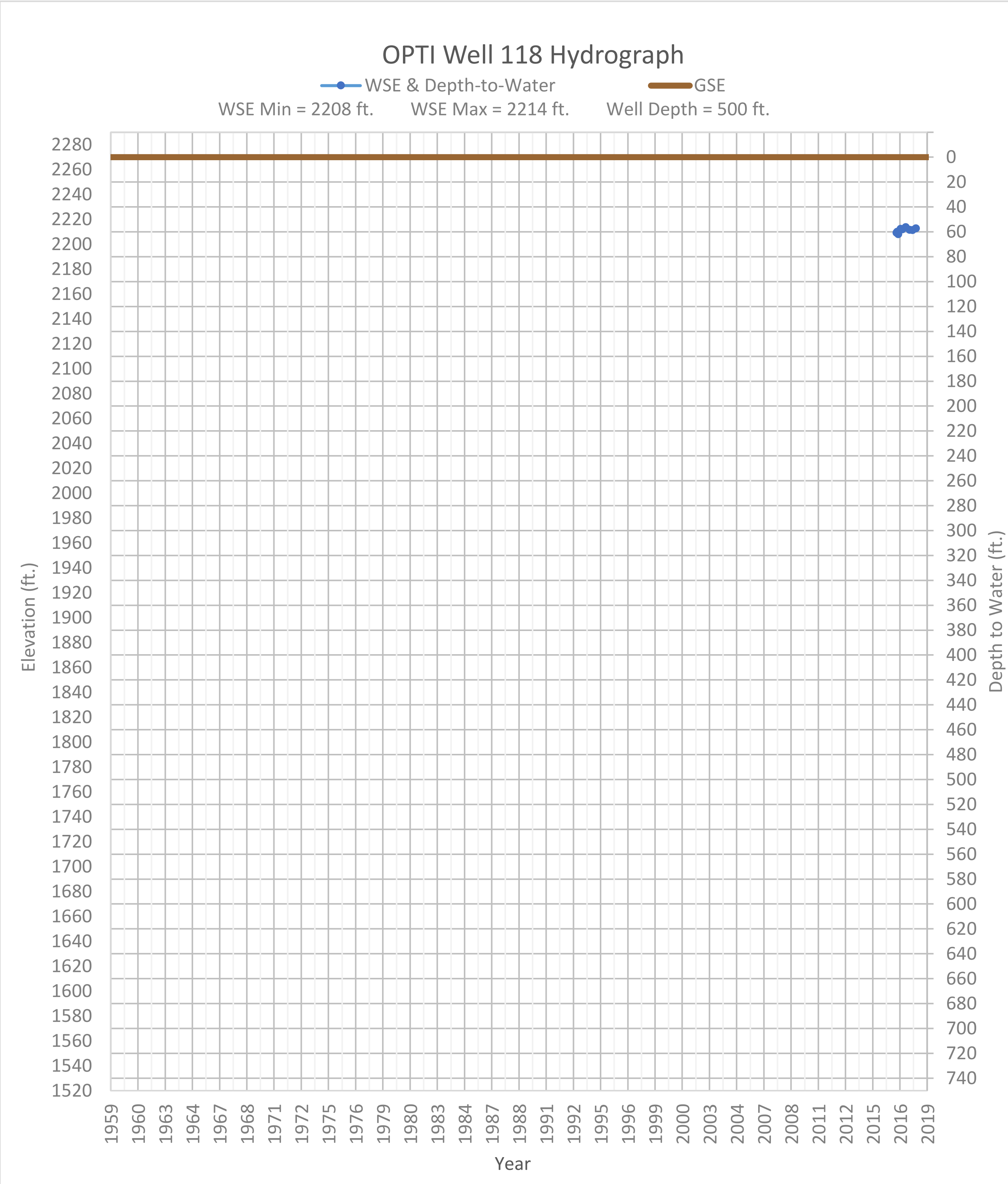

OPTI Well 116 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2079 ft.
WSE Max = 2080 ft.
Well Depth = 700 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 117 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1947 ft.
WSE Max = 2005 ft.
Well Depth = 212 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 118 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2208 ft.
WSE Max = 2214 ft.
Well Depth = 500 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
1900
1880
1860
1840
1820
1800
1780
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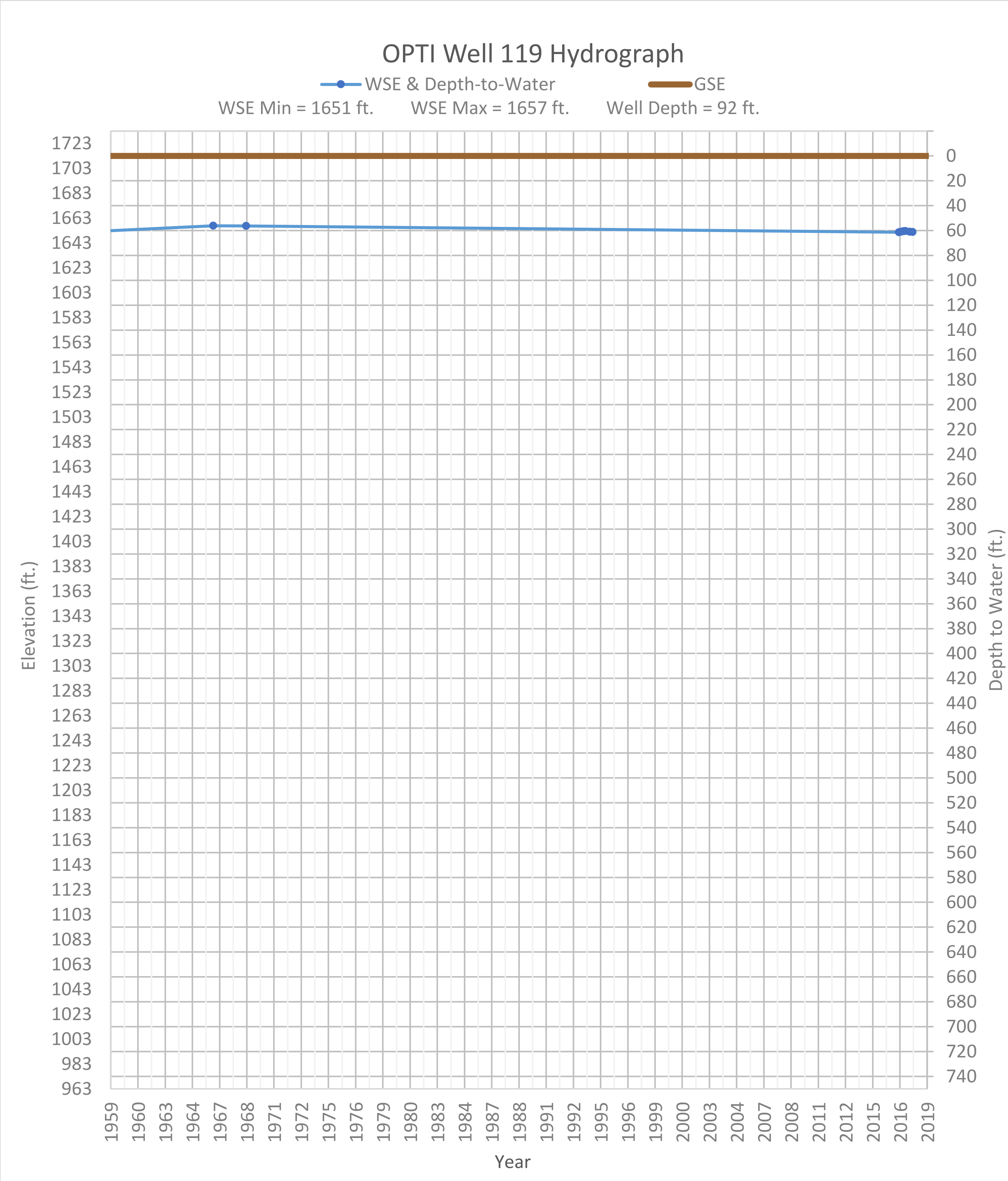
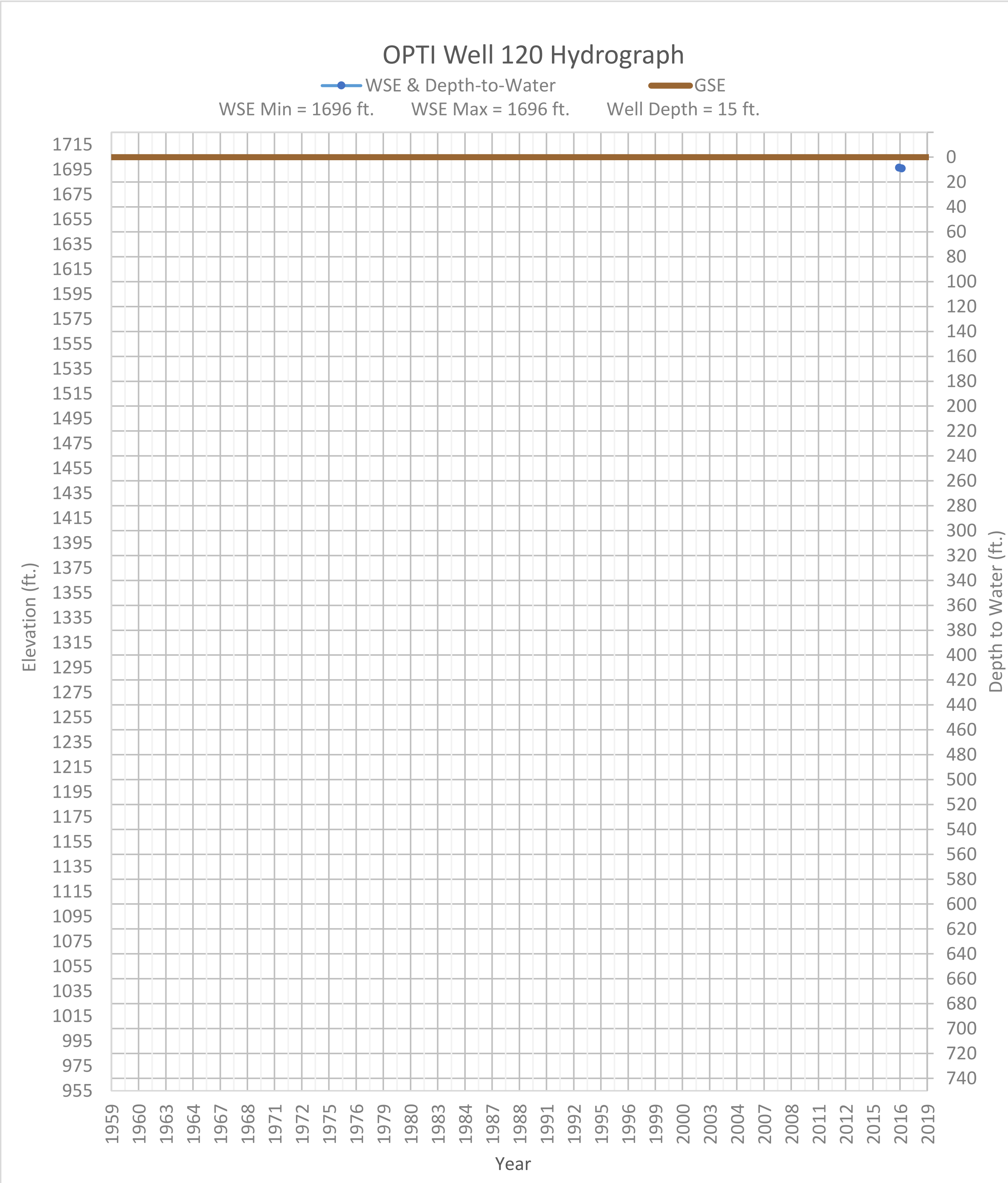

OPTI Well 119 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1651 ft.
WSE Max = 1657 ft.
Well Depth = 92 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 120 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1696 ft.
WSE Max = 1696 ft.
Well Depth = 15 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1715
1695
1675
1655
1635
1615
1595
1575
1555
1535
1515
1495
1475
1455
1435
1415
1395
1375
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995
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955
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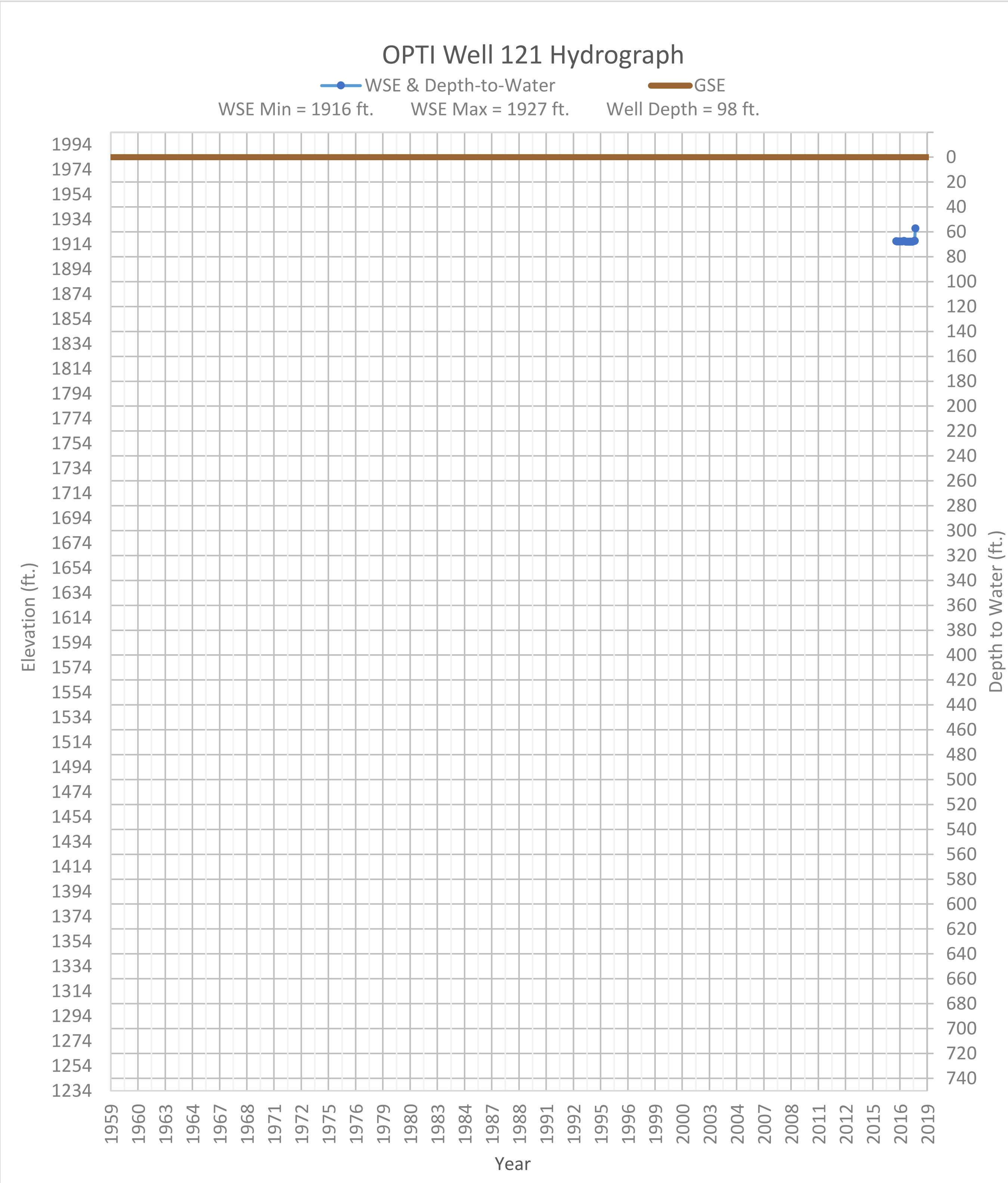
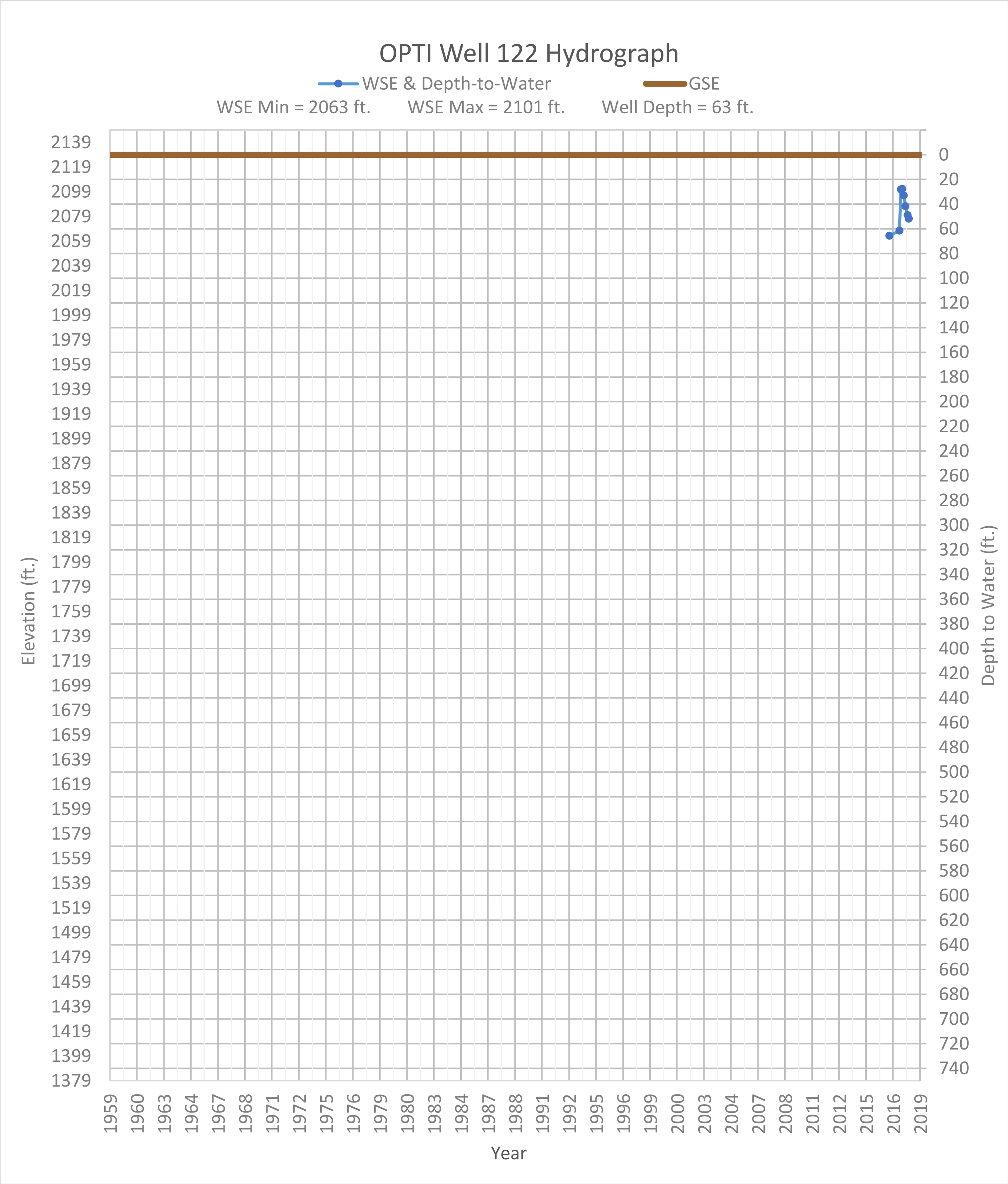
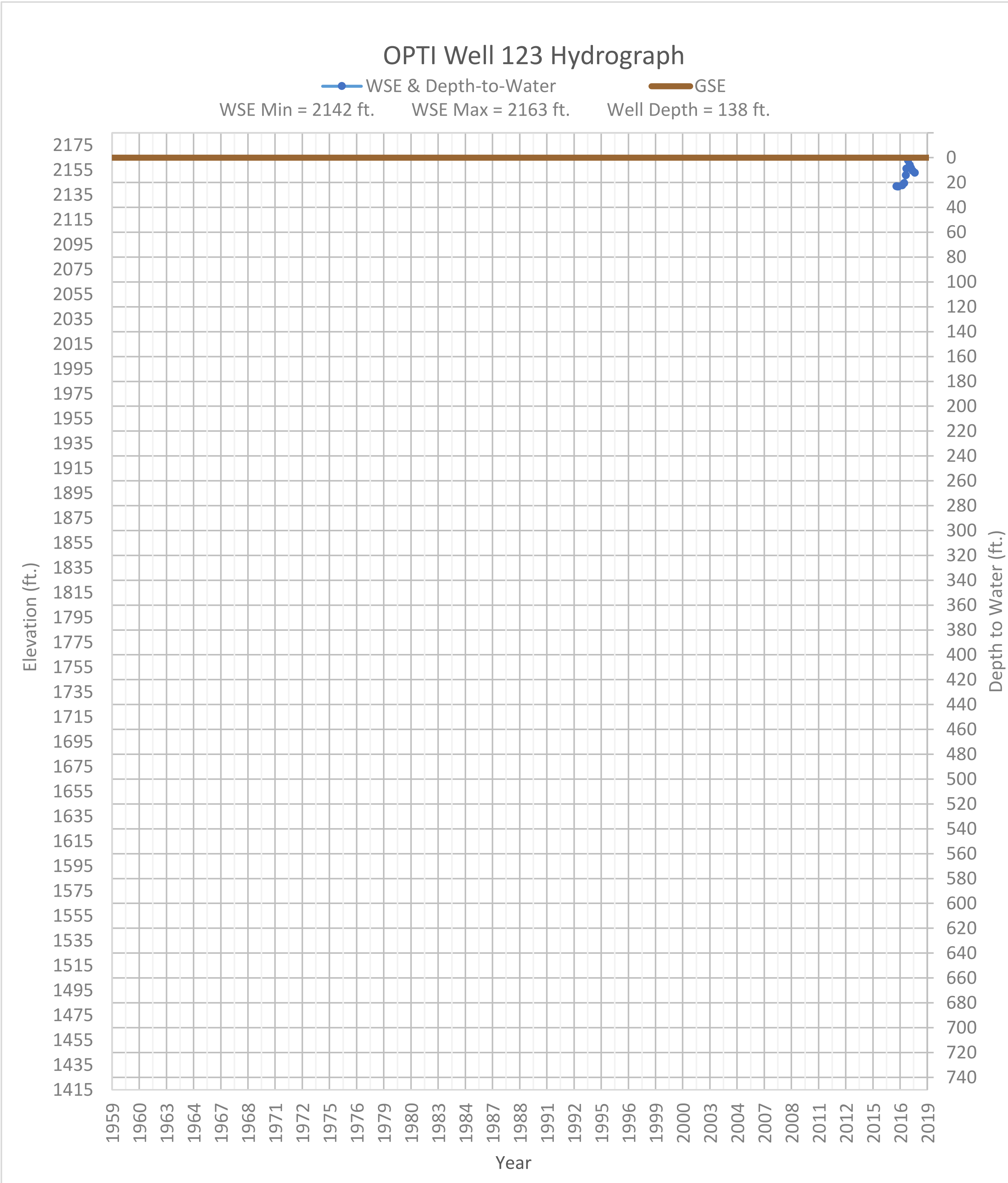


OPTI Well 121 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1916 ft.
WSE Max = 1927 ft.
Well Depth = 98 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 122 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2063 ft.
WSE Max = 2101 ft.
Well Depth = 63 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 123 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2142 ft.
WSE Max = 2163 ft.
Well Depth = 138 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2175
2155
2135
2115
2095
2075
2055
2035
2015
1995
1975
1955
1935
1915
1895
1875
1855
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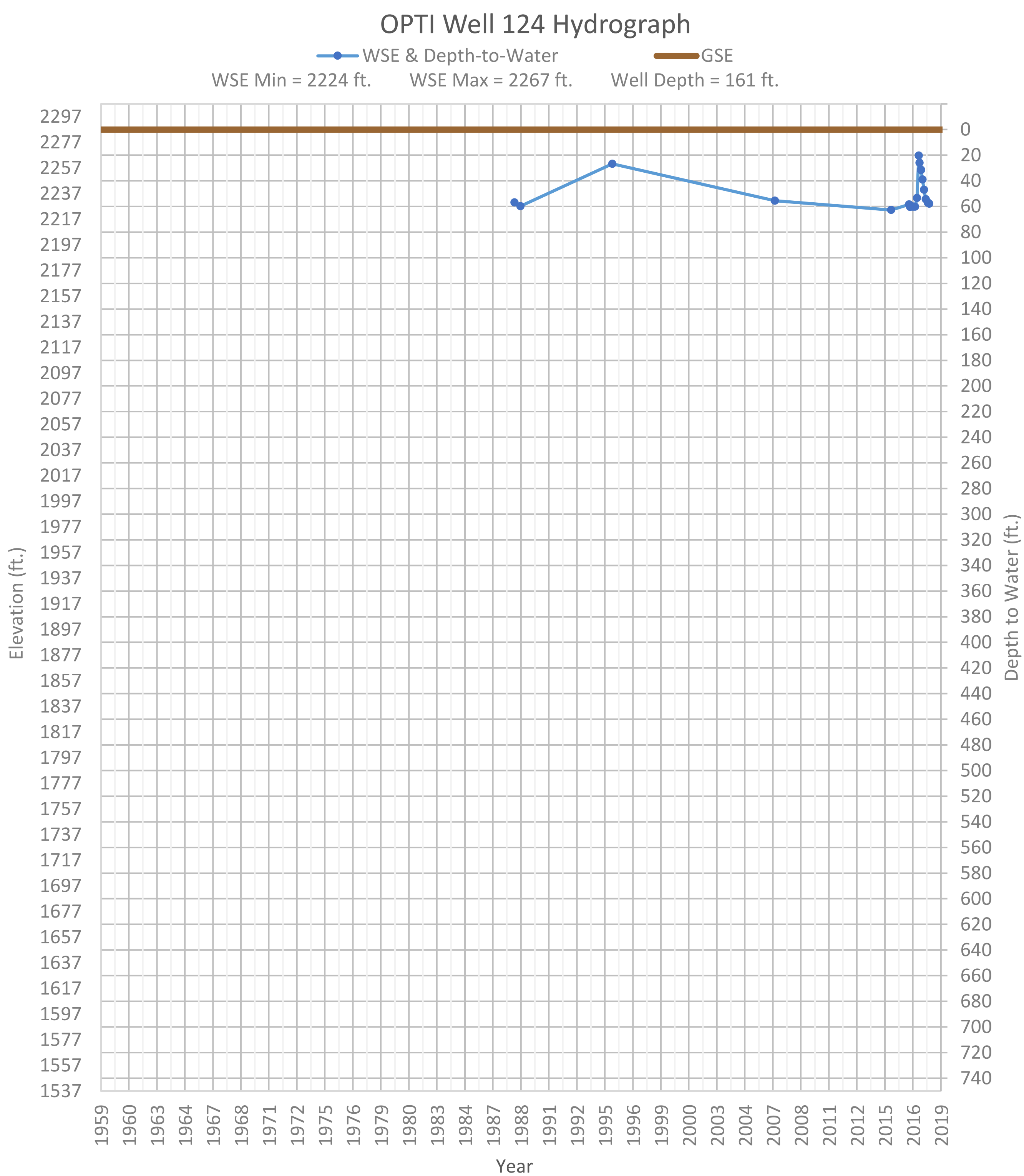
OPTI Well 124 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2224 ft.
WSE Max = 2267 ft.
Well Depth = 161 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
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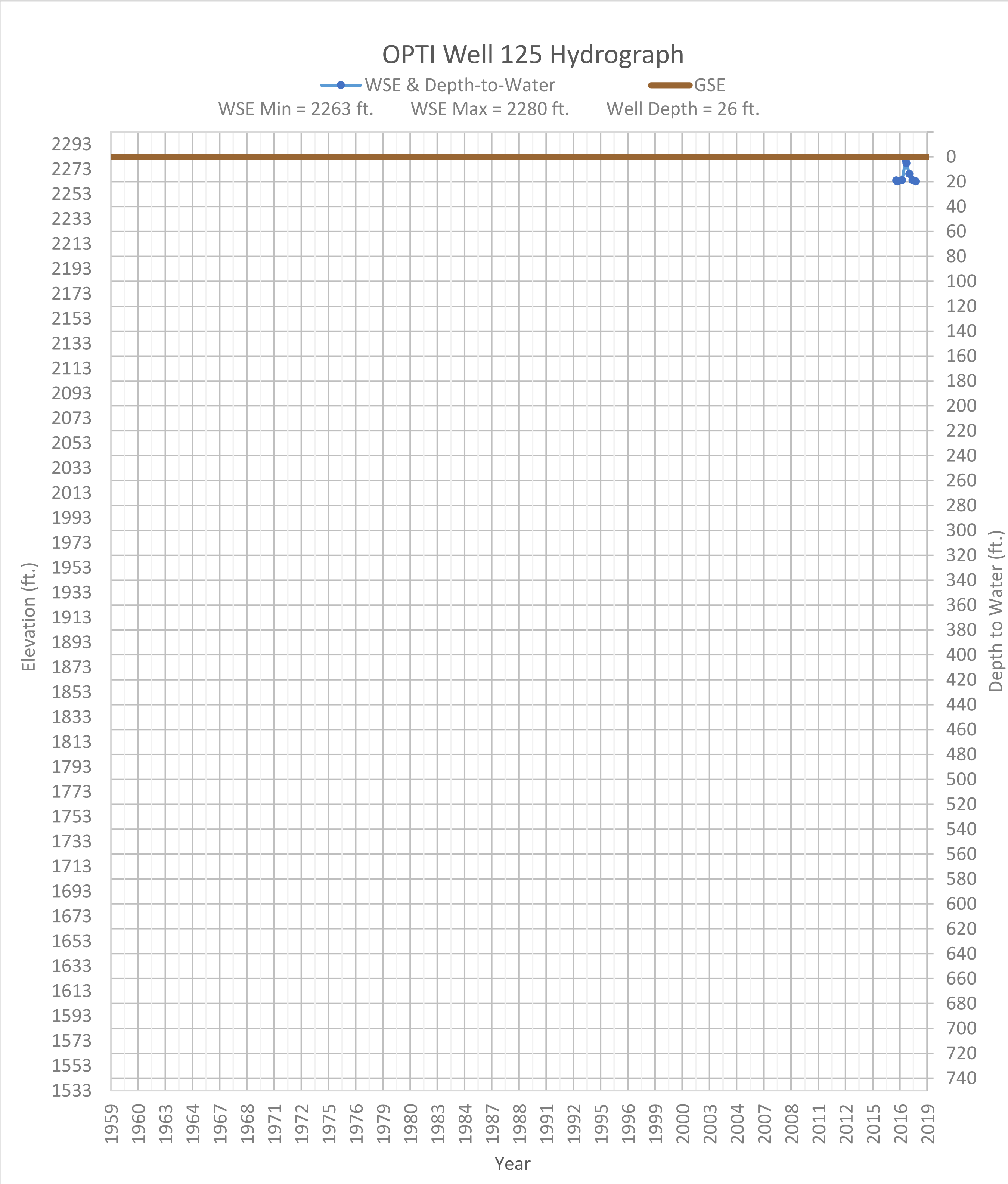
OPTI Well 125 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2263 ft.
WSE Max = 2280 ft.
Well Depth = 26 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2293
2273
2253
2233
2213
2193
2173
2153
2133
2113
2093
2073
2053
2033
2013
1993
1973
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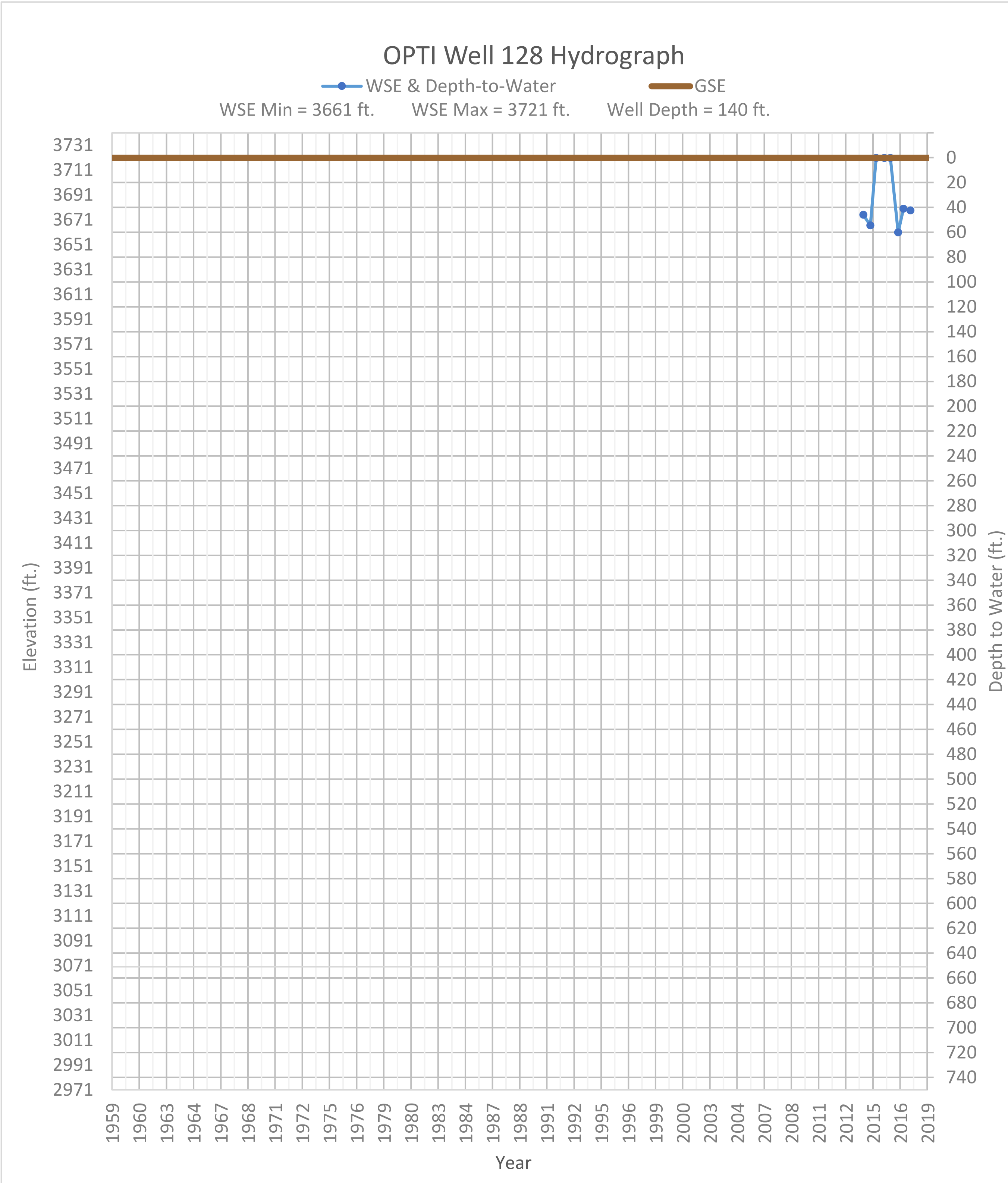
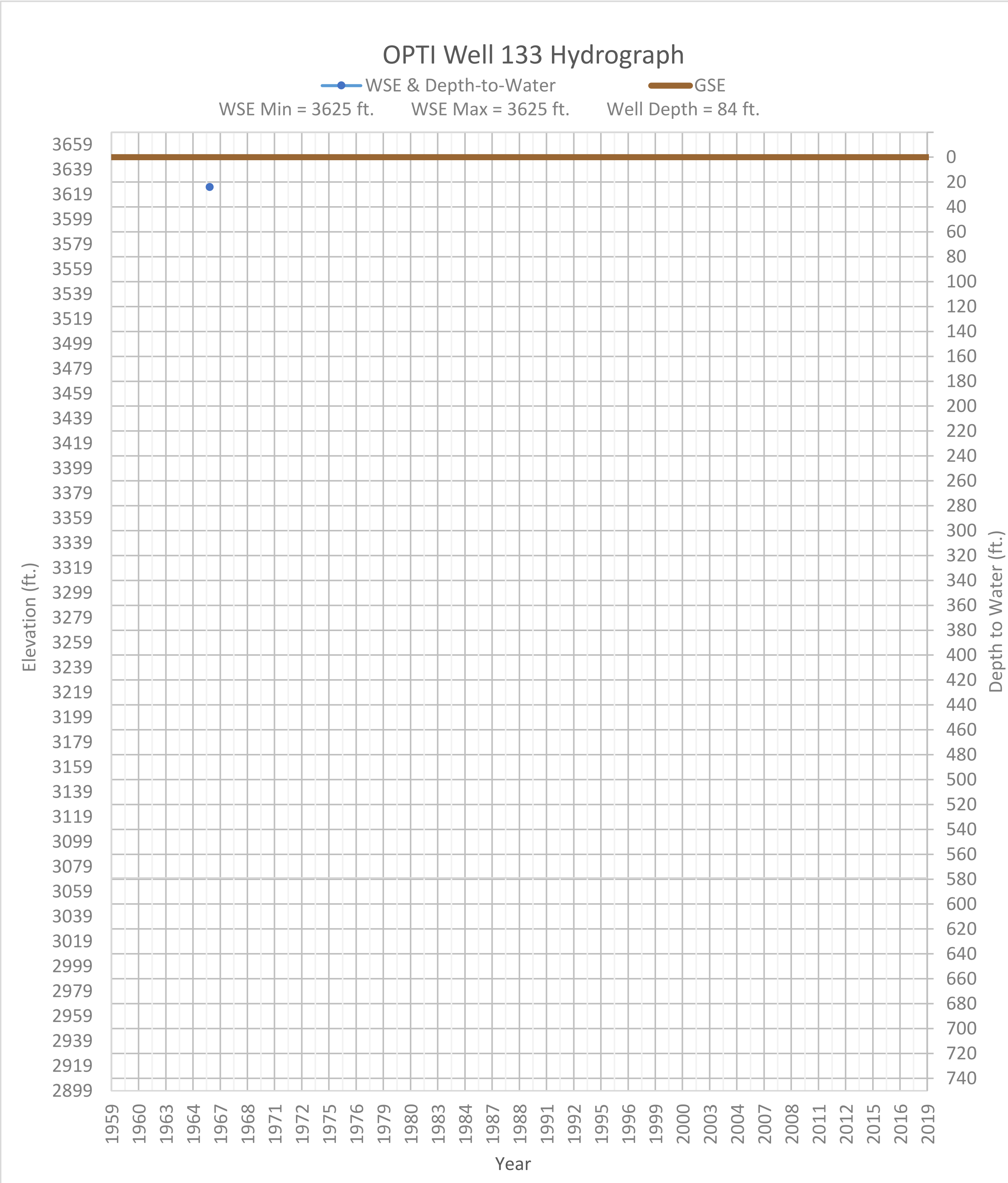
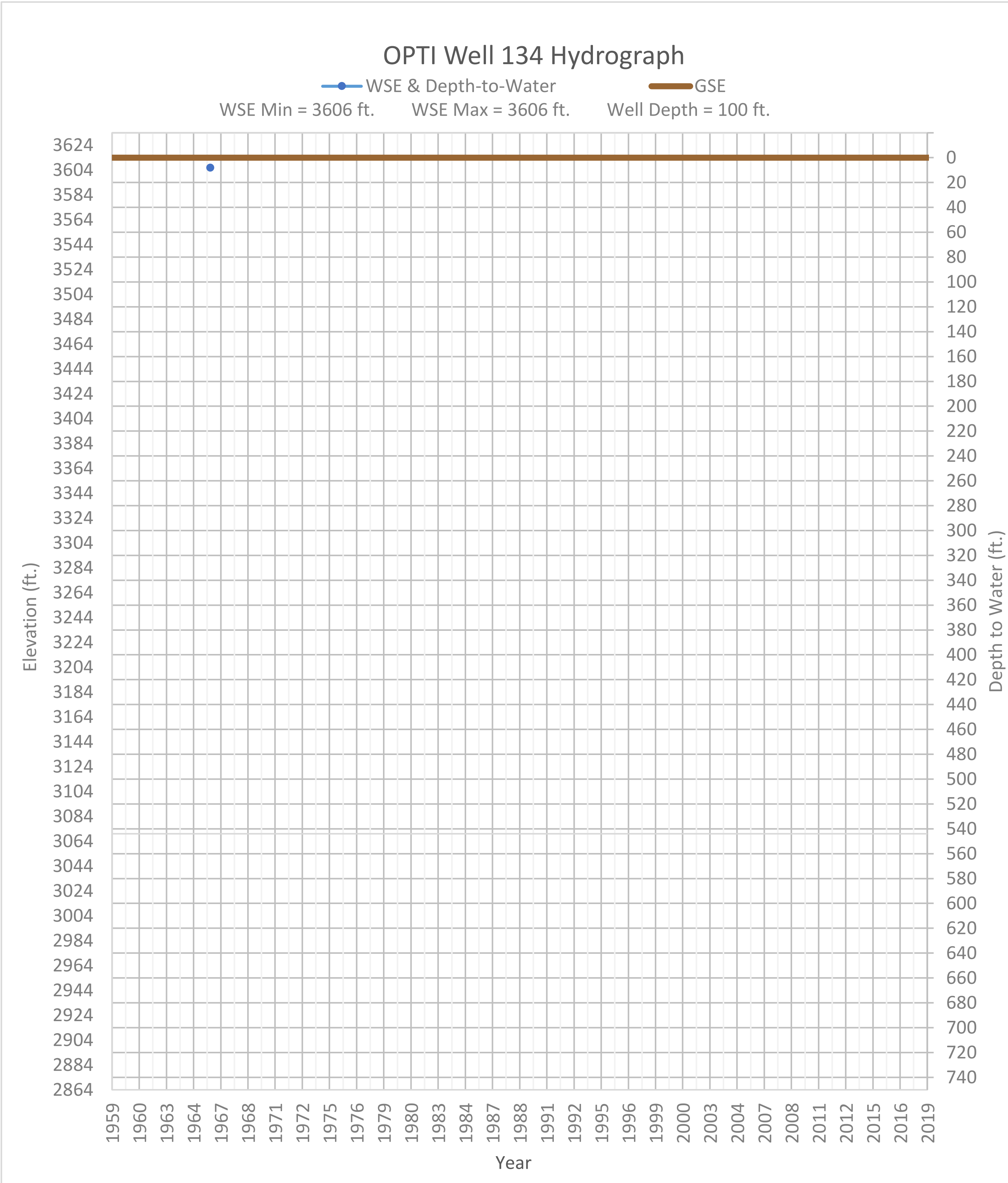
OPTI Well 127 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2328 ft.
WSE Max = 2345 ft.
Well Depth = 100 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



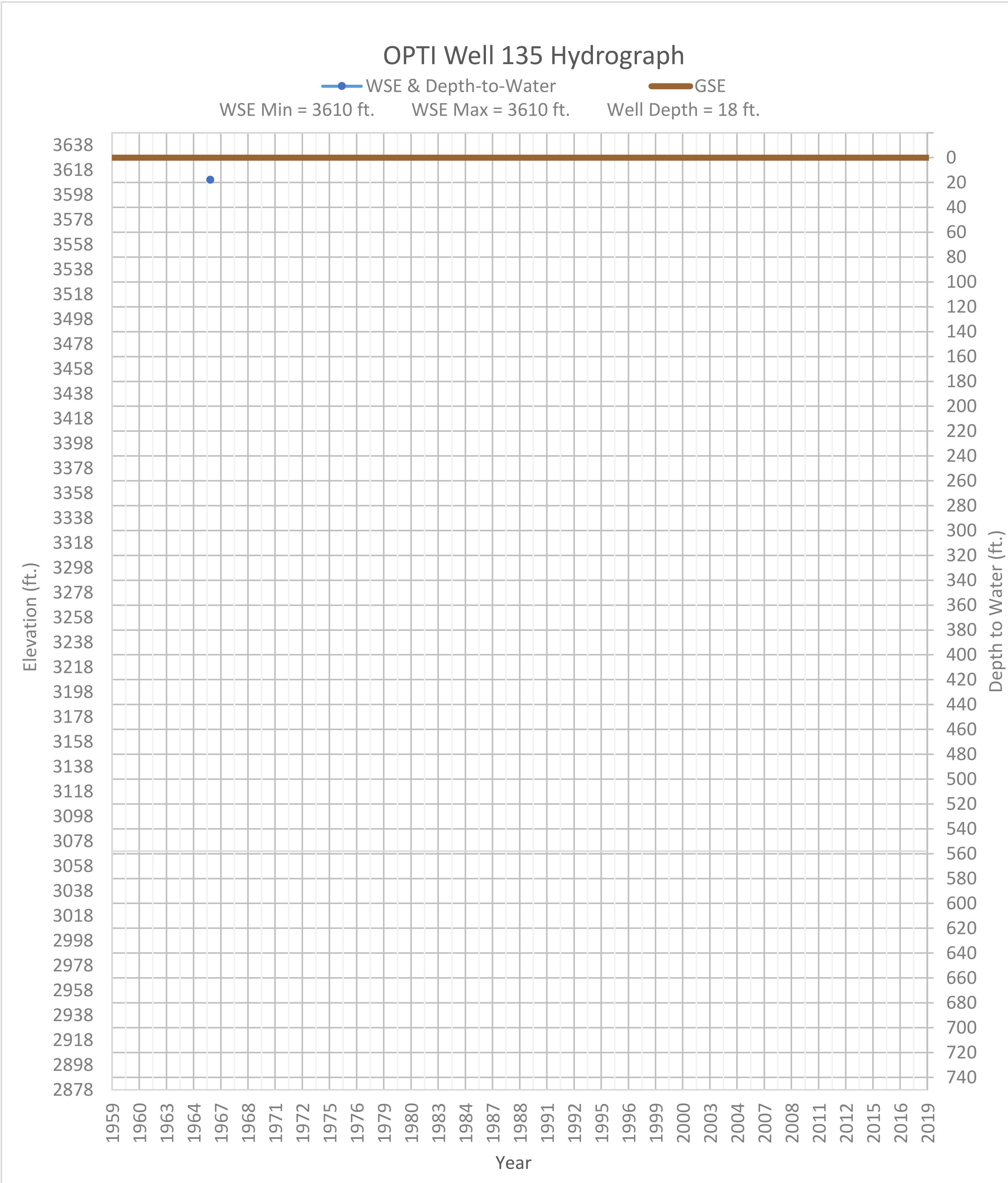
OPTI Well 128 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3661 ft.
WSE Max = 3721 ft.
Well Depth = 140 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



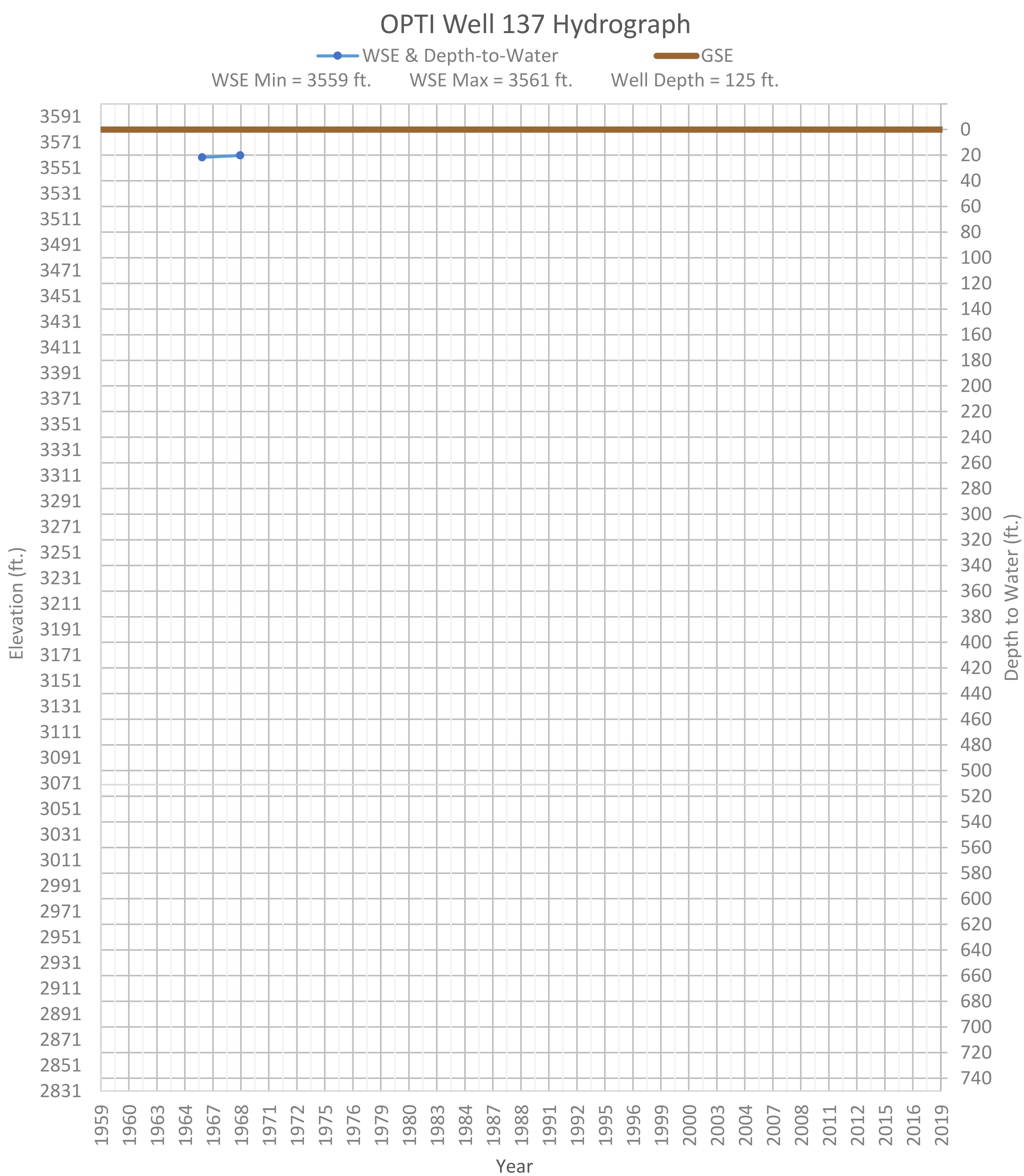
OPTI Well 133 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3625 ft.
WSE Max = 3625 ft.
Well Depth = 84 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 134 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3606 ft.
WSE Max = 3606 ft.
Well Depth = 100 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 135 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3610 ft.
WSE Max = 3610 ft.
Well Depth = 18 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 137 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3559 ft.
WSE Max = 3561 ft.
Well Depth = 125 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3591
3571
3551
3531
3511
3491
3471
3451
3431
3411
3391
3371
3351
3331
3311
3291
3271
3251
3231
3211
3191
3171
3151
3131
3111
3091
3071
3051
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3011
2991
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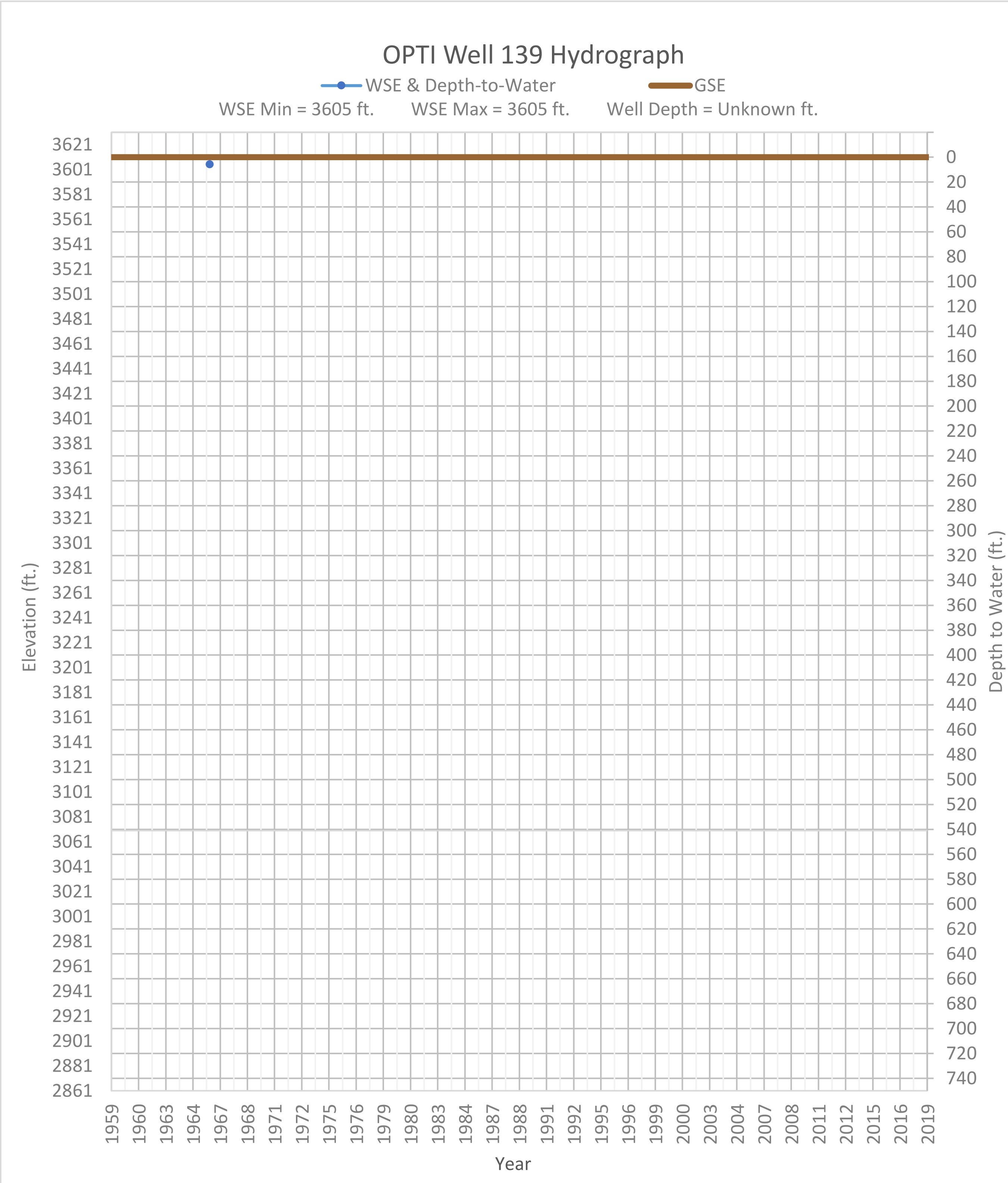
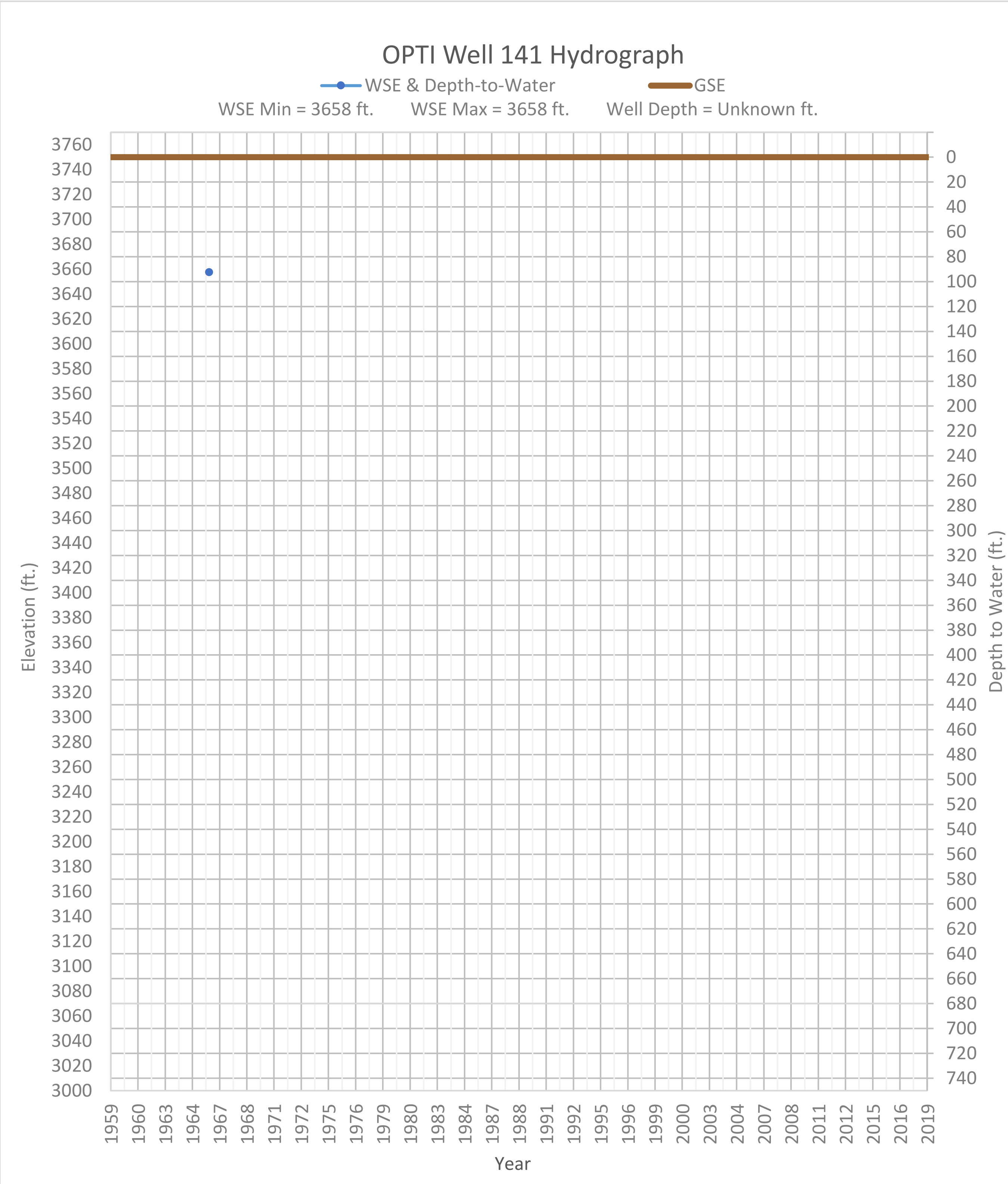
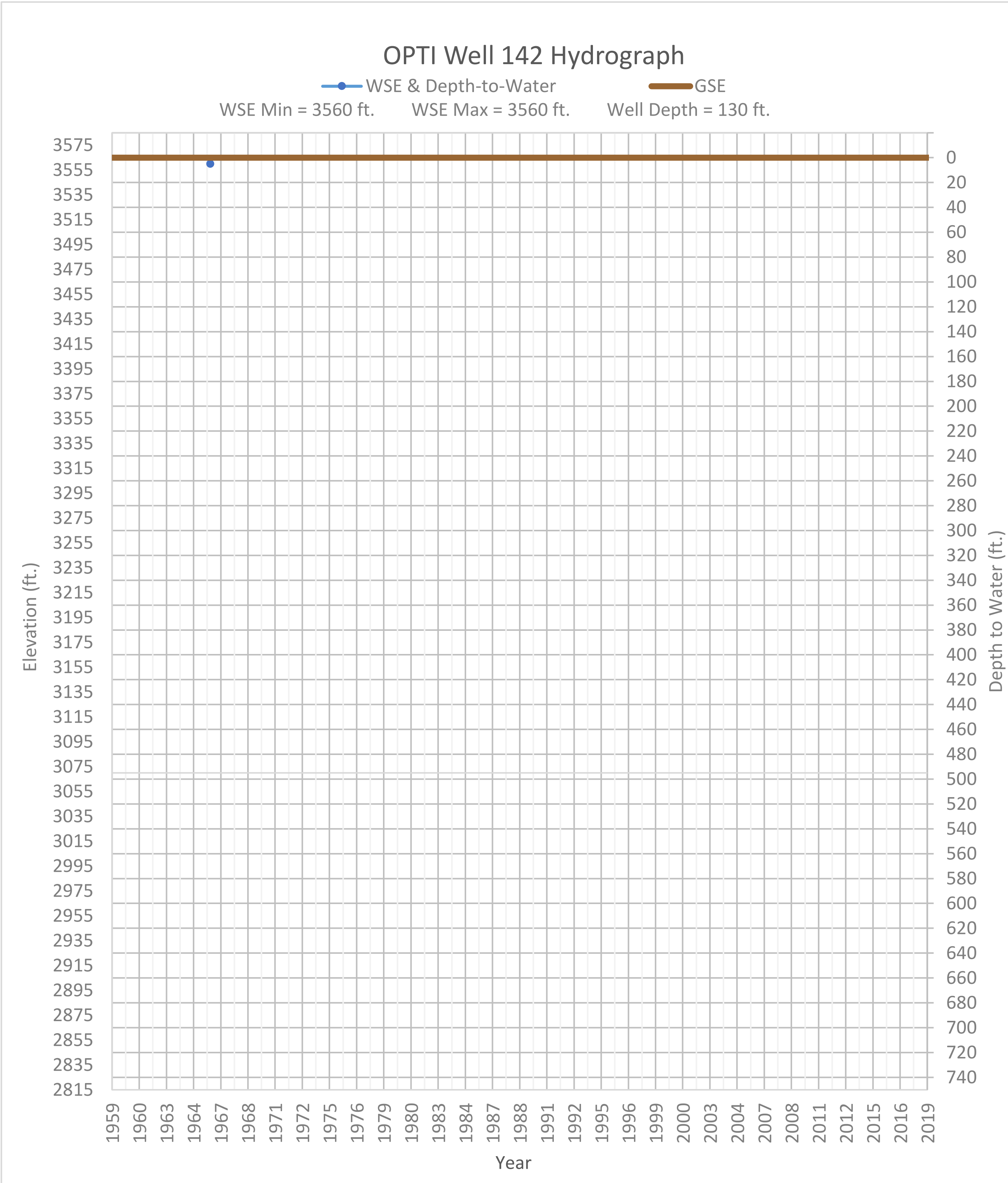


OPTI Well 139 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3605 ft.
WSE Max = 3605 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 141 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3658 ft.
WSE Max = 3658 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 142 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3560 ft.
WSE Max = 3560 ft.
Well Depth = 130 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3575
3555
3535
3515
3495
3475
3455
3435
3415
3395
3375
3355
3335
3315
3295
3275
3255
3235
3215
3195
3175
3155
3135
3115
3095
3075
3055
3035
3015
2995
2975
2955
2935
2915
2895
2875
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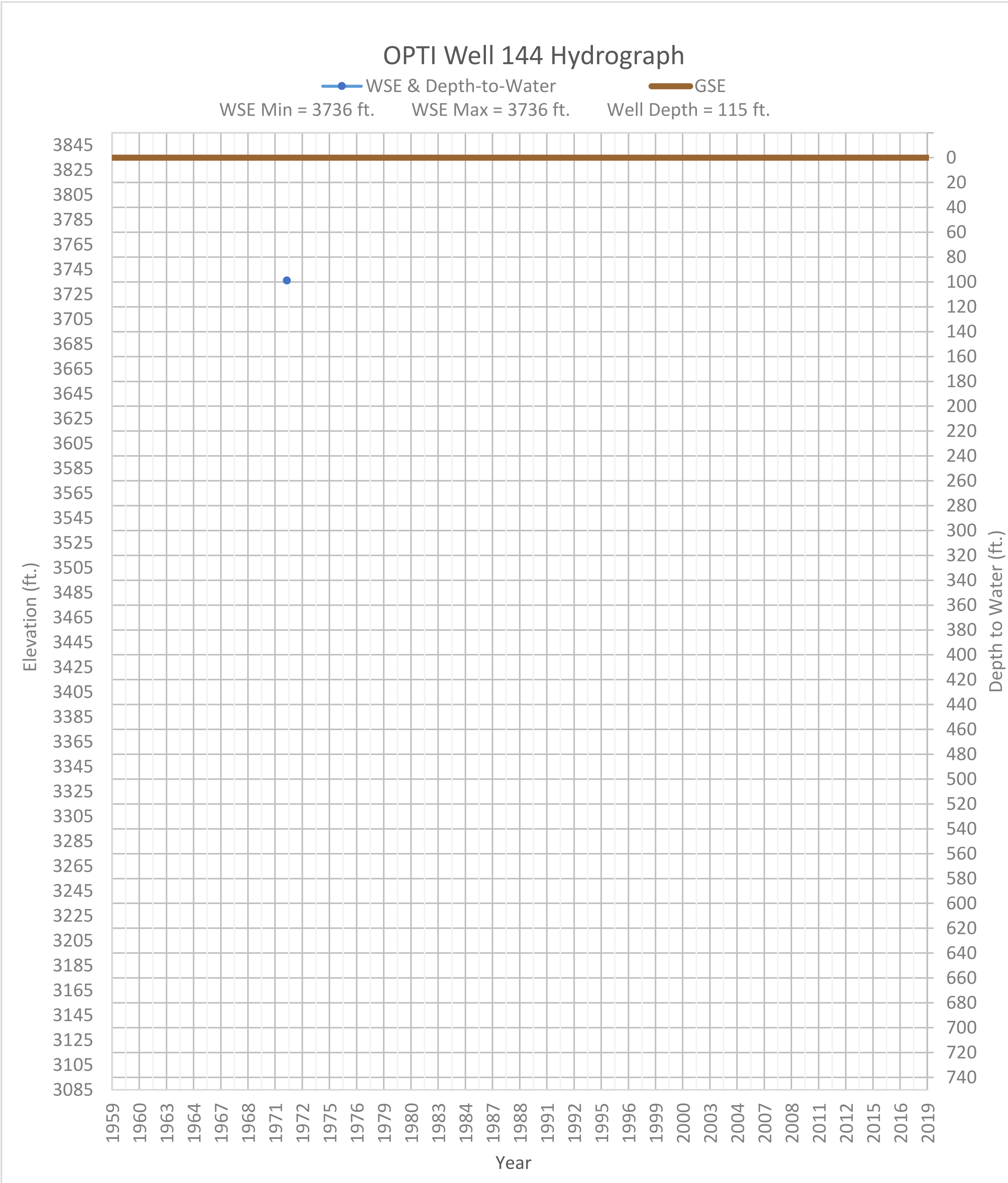
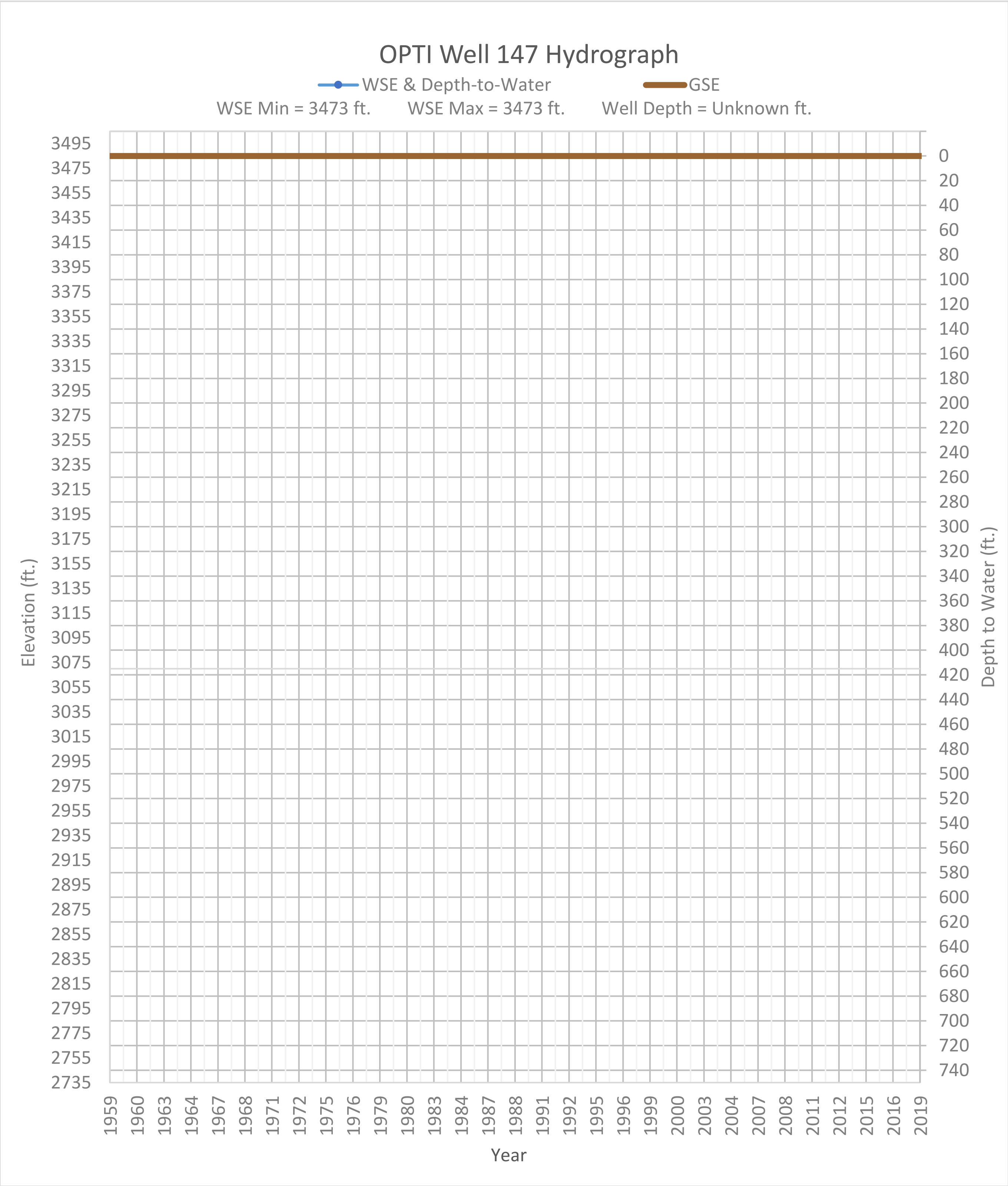
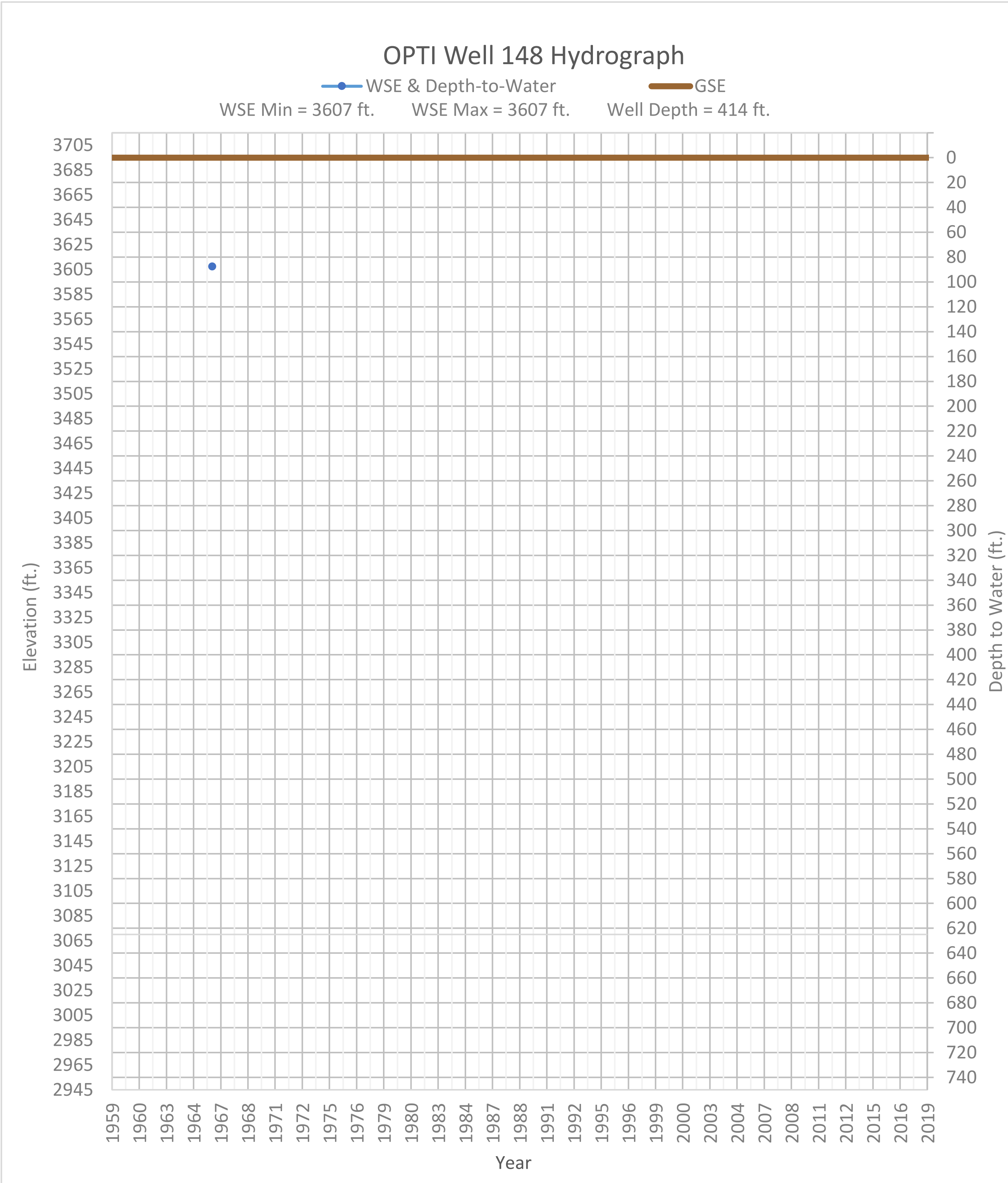


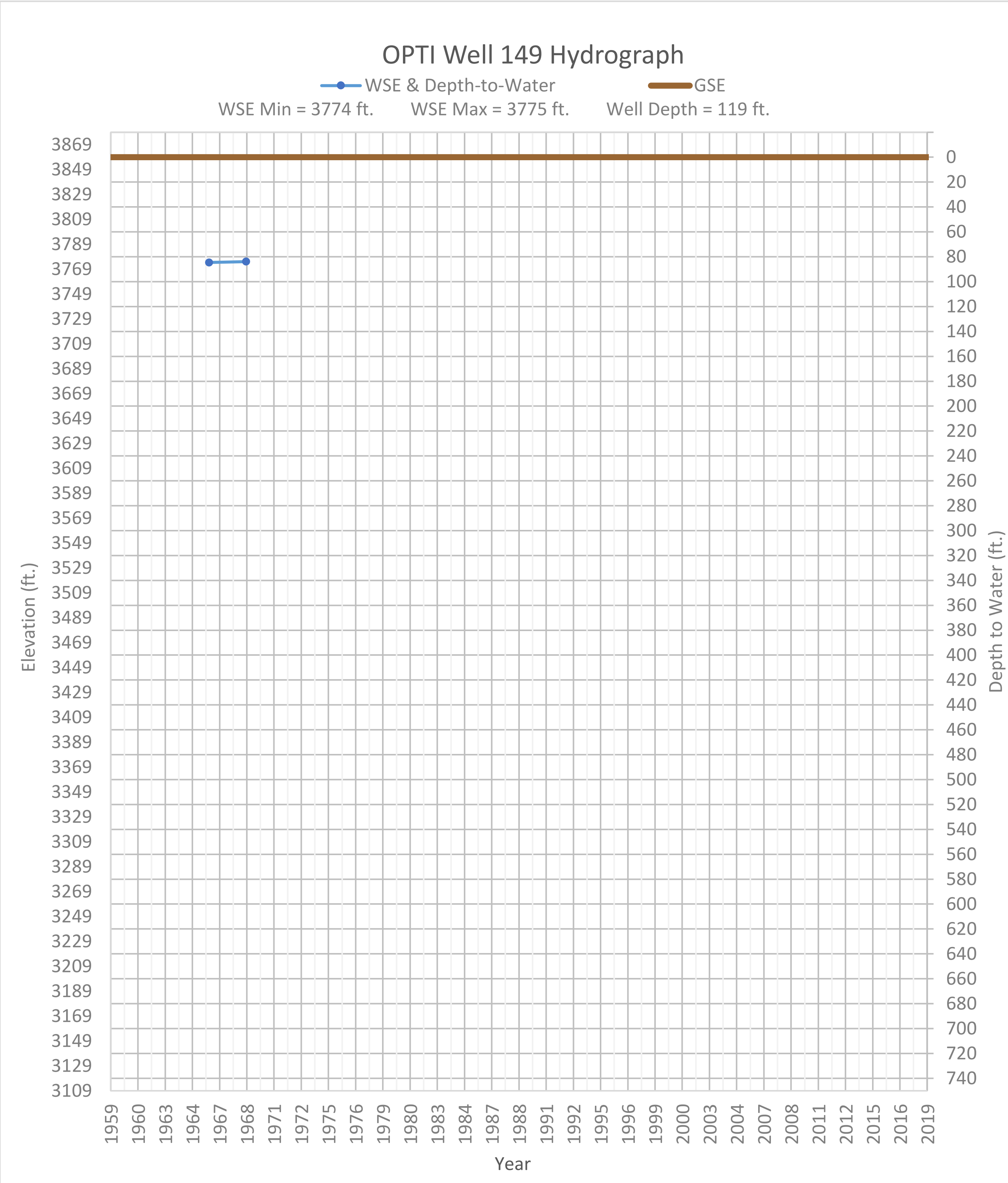
OPTI Well 144 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3736 ft.
WSE Max = 3736 ft.
Well Depth = 115 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

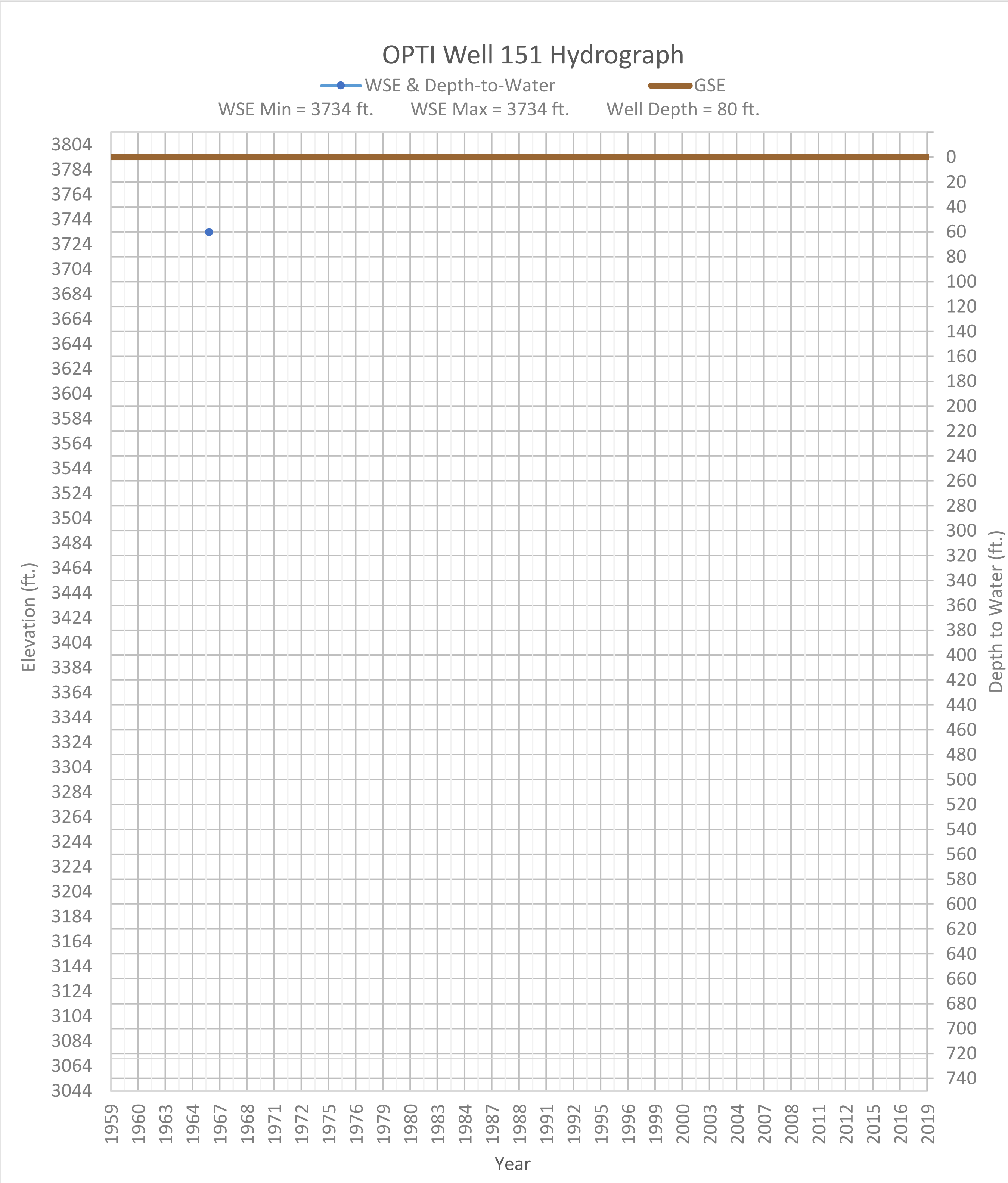


OPTI Well 147 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3473 ft.
WSE Max = 3473 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

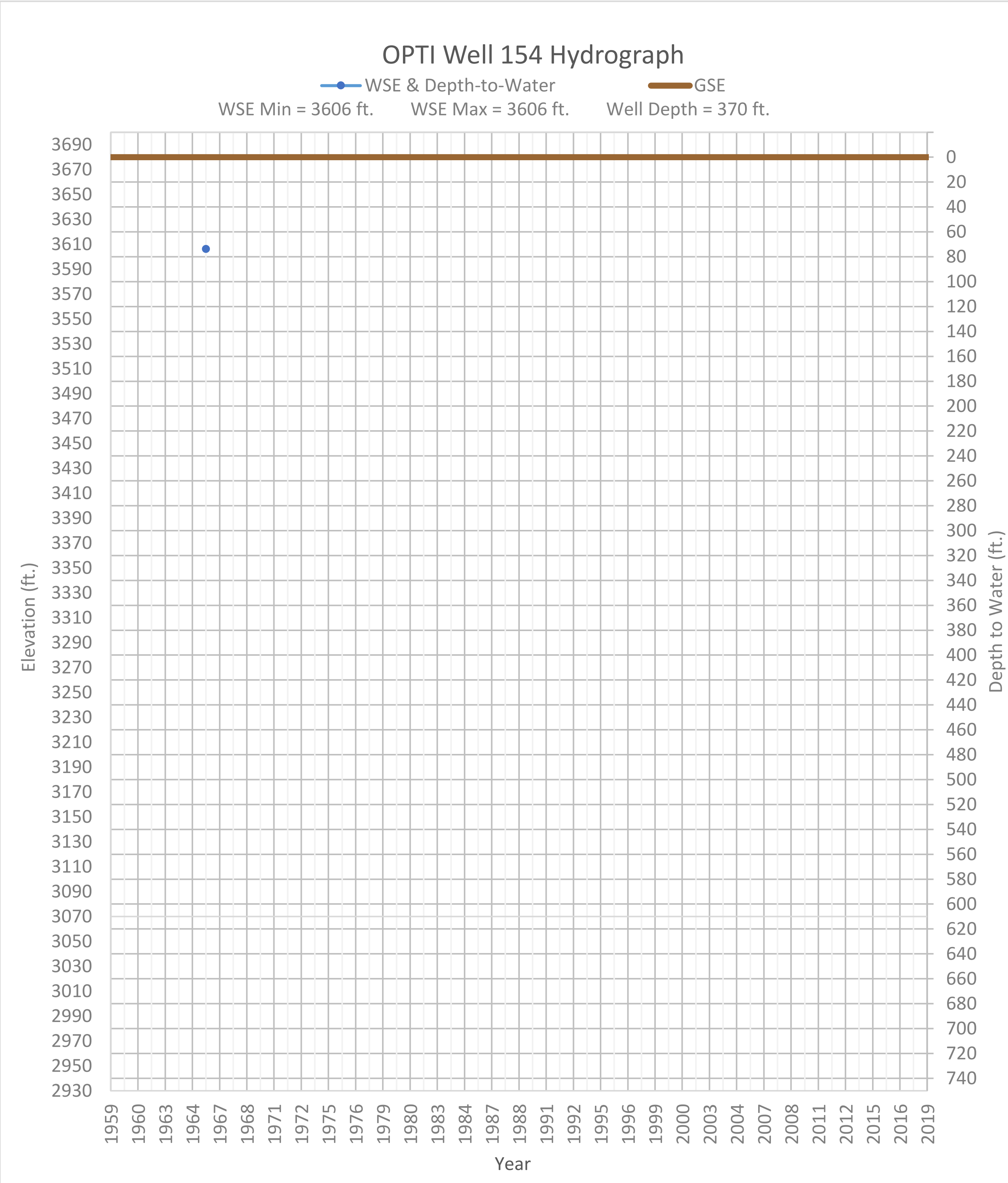


OPTI Well 148 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3607 ft.
WSE Max = 3607 ft.
Well Depth = 414 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 149 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3774 ft.
WSE Max = 3775 ft.
Well Depth = 119 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 151 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3734 ft.
WSE Max = 3734 ft.
Well Depth = 80 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 154 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3606 ft.
WSE Max = 3606 ft.
Well Depth = 370 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3690
3670
3650
3630
3610
3590
3570
3550
3530
3510
3490
3470
3450
3430
3410
3390
3370
3350
3330
3310
3290
3270
3250
3230
3210
3190
3170
3150
3130
3110
3090
3070
3050
3030
3010
2990
2970
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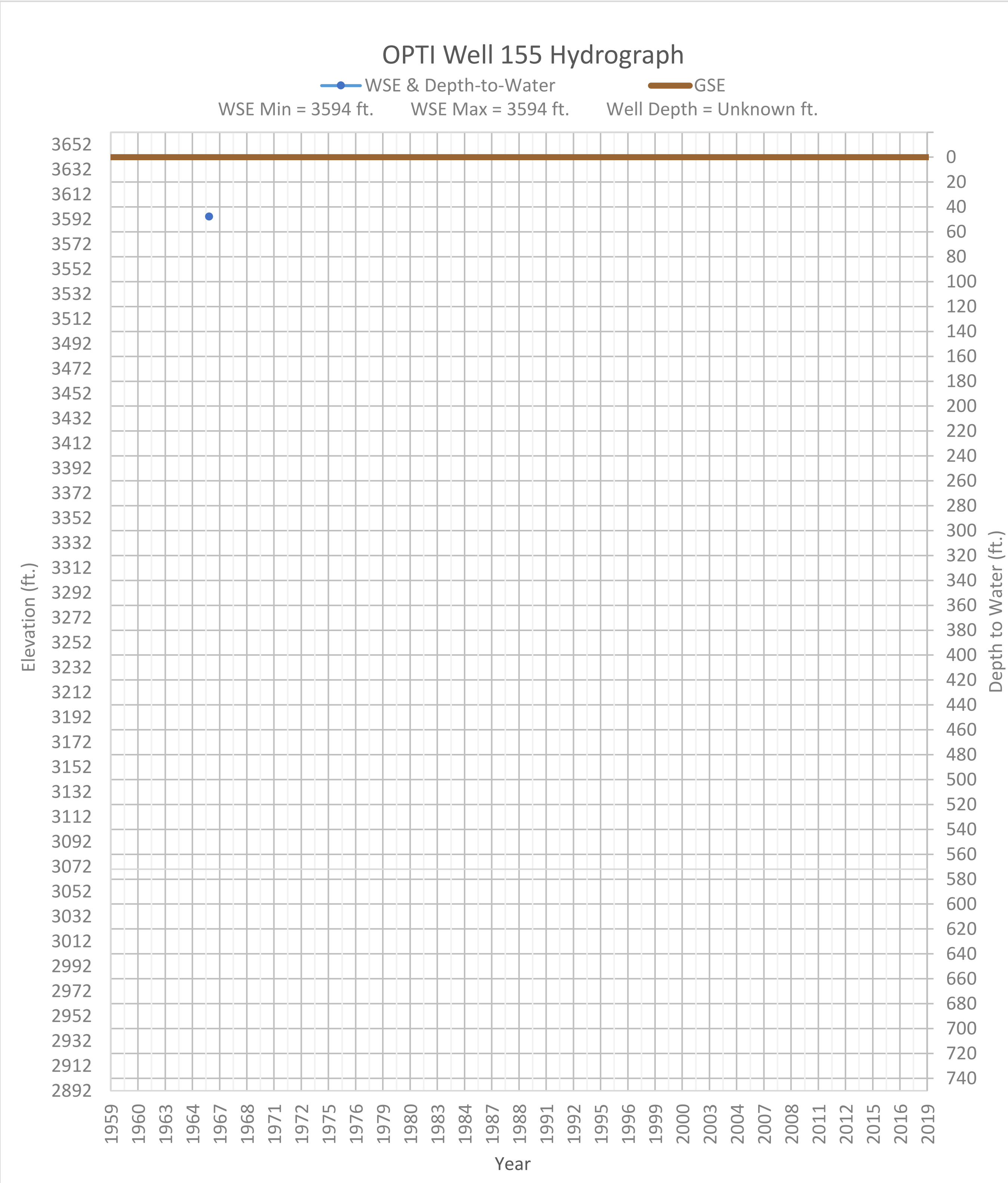
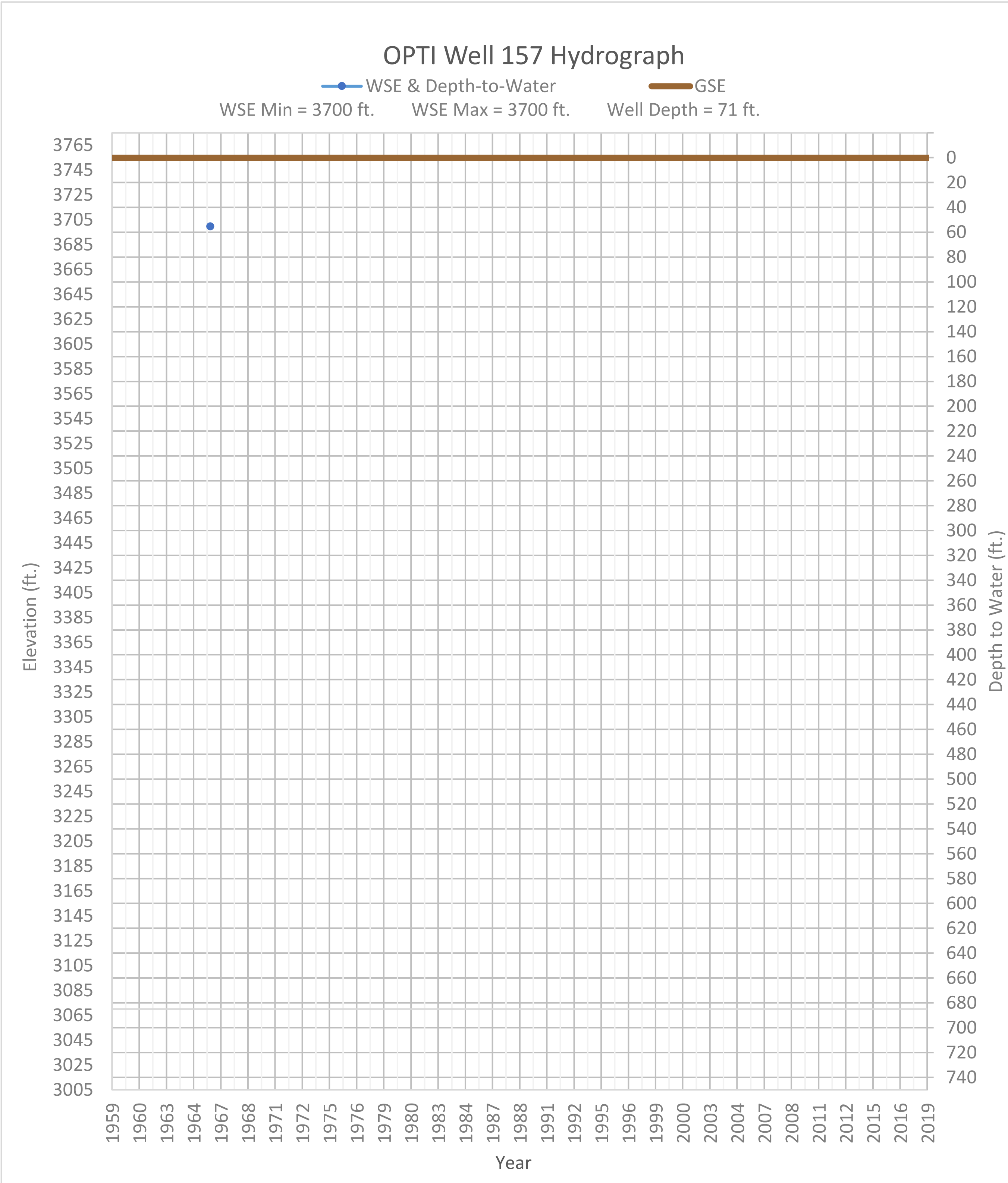

OPTI Well 155 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3594 ft.
WSE Max = 3594 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 157 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3700 ft.
WSE Max = 3700 ft.
Well Depth = 71 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3765
3745
3725
3705
3685
3665
3645
3625
3605
3585
3565
3545
3525
3505
3485
3465
3445
3425
3405
3385
3365
3345
3325
3305
3285
3265
3245
3225
3205
3185
3165
3145
3125
3105
3085
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3045
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3005
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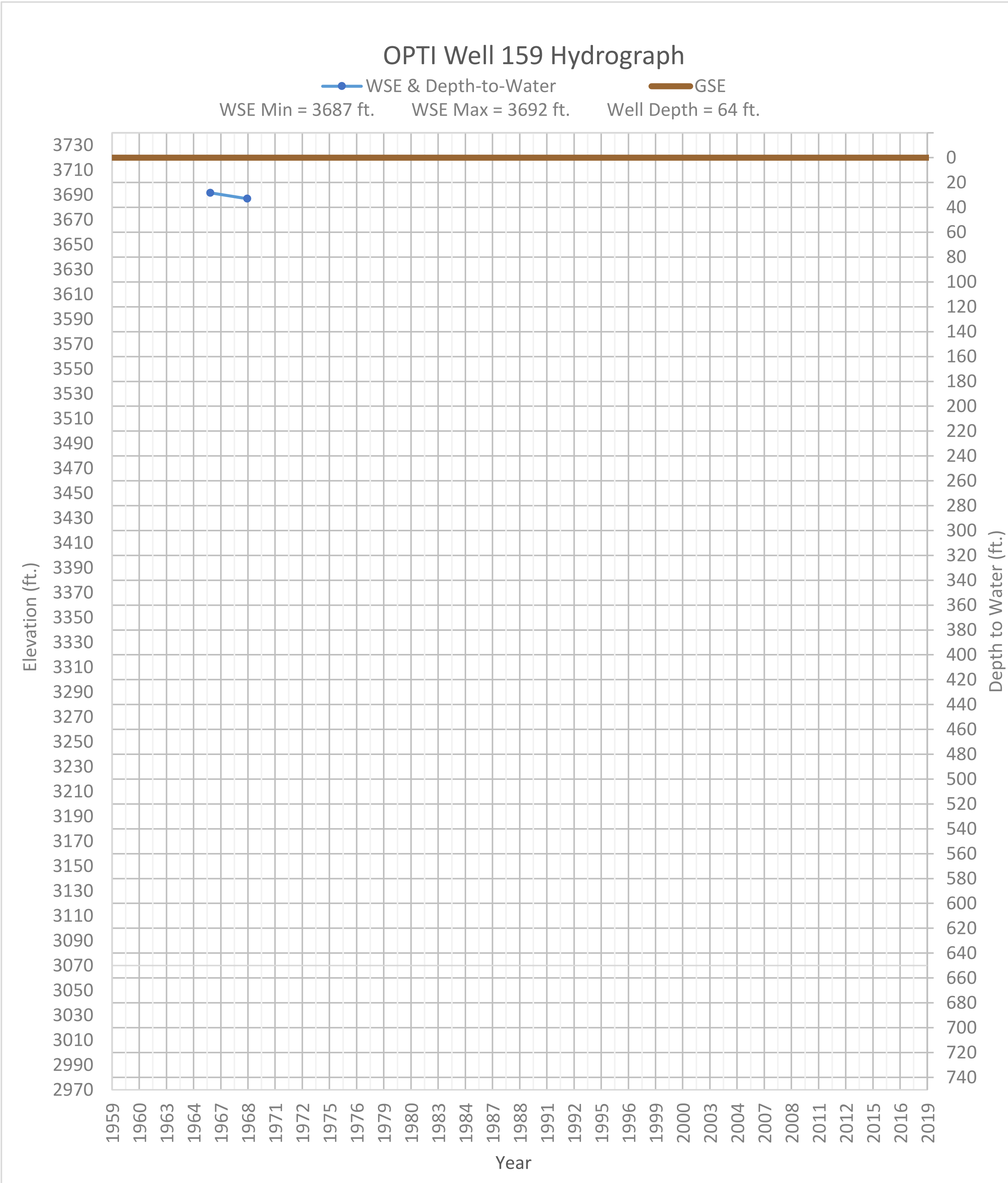
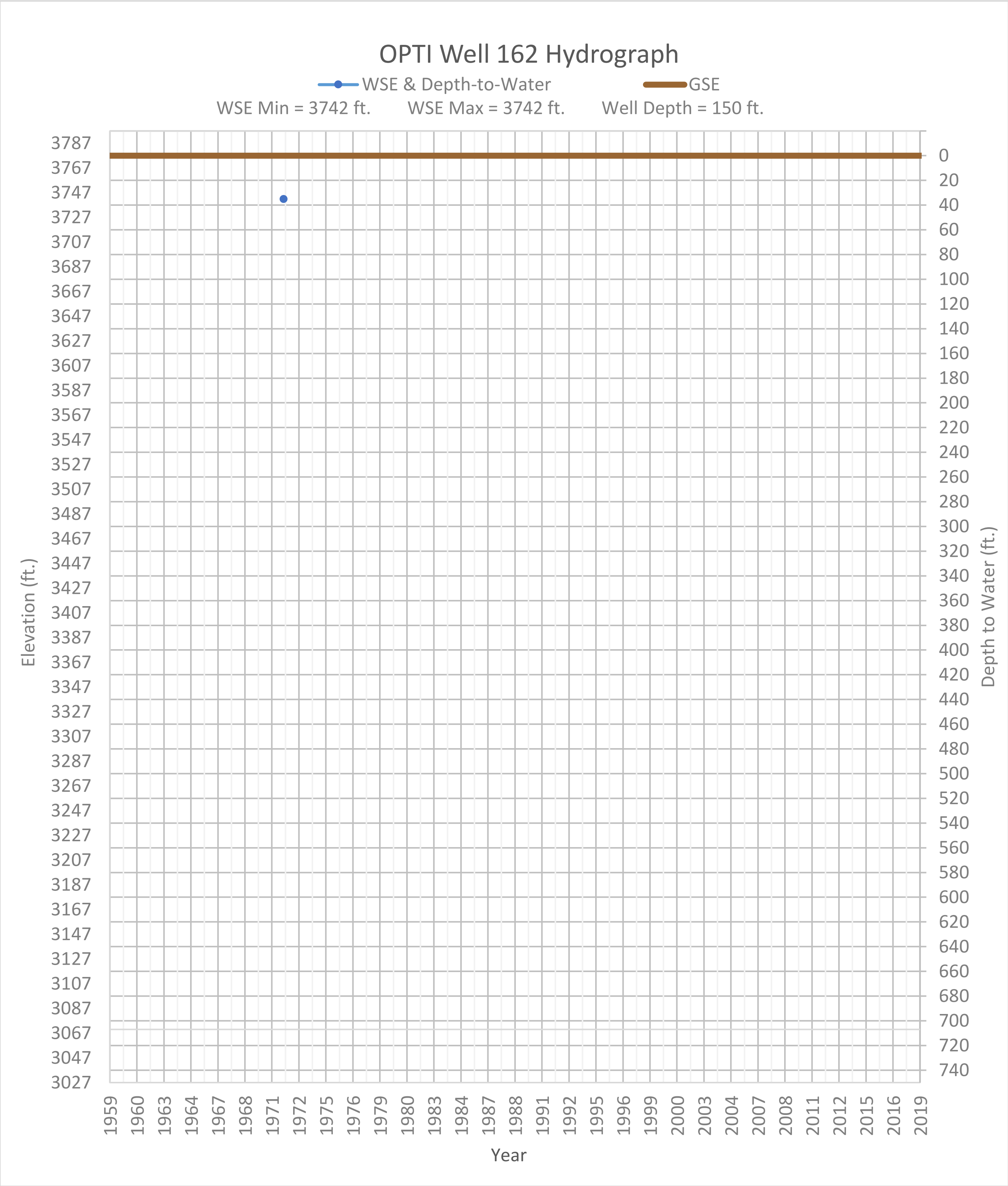
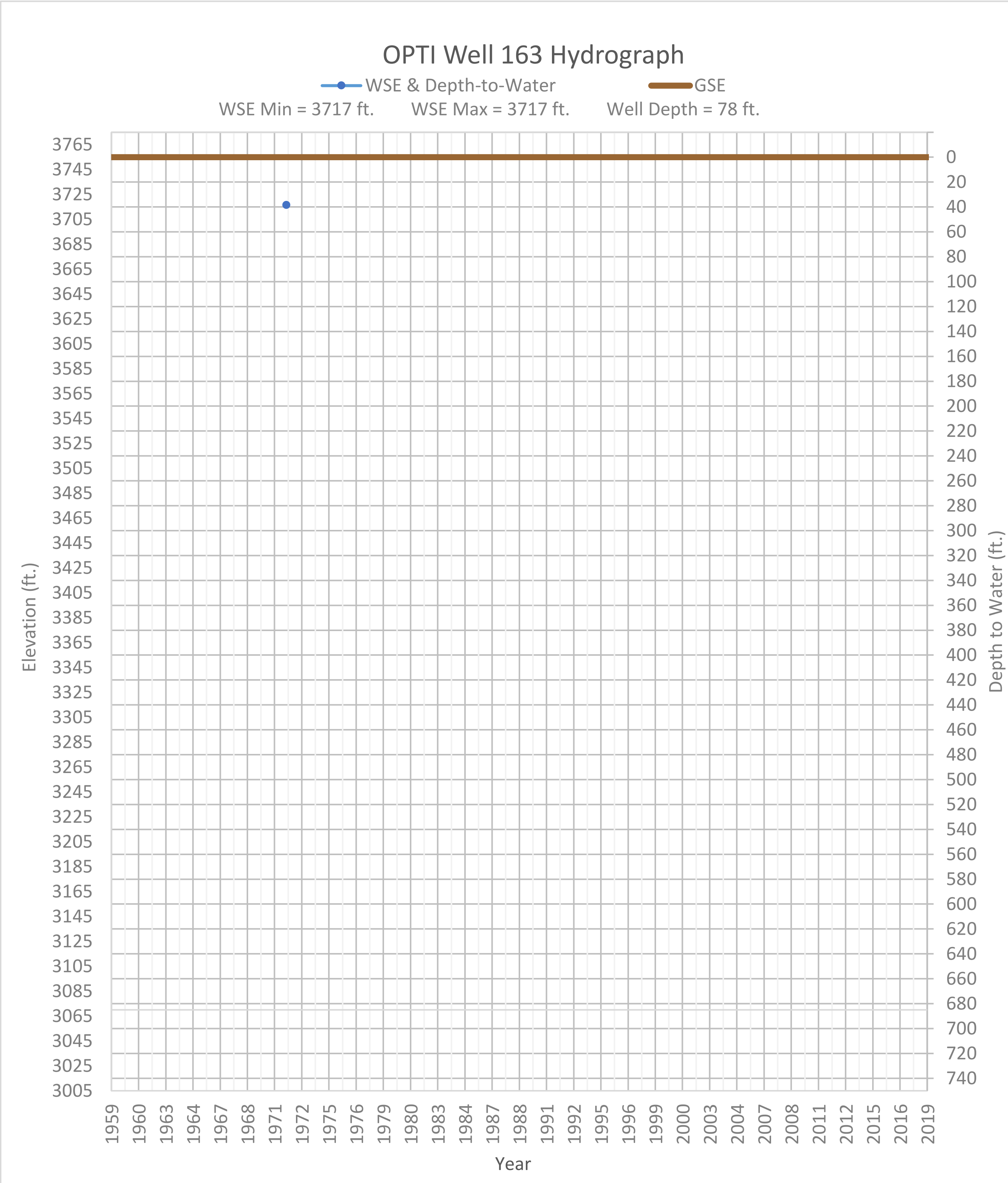
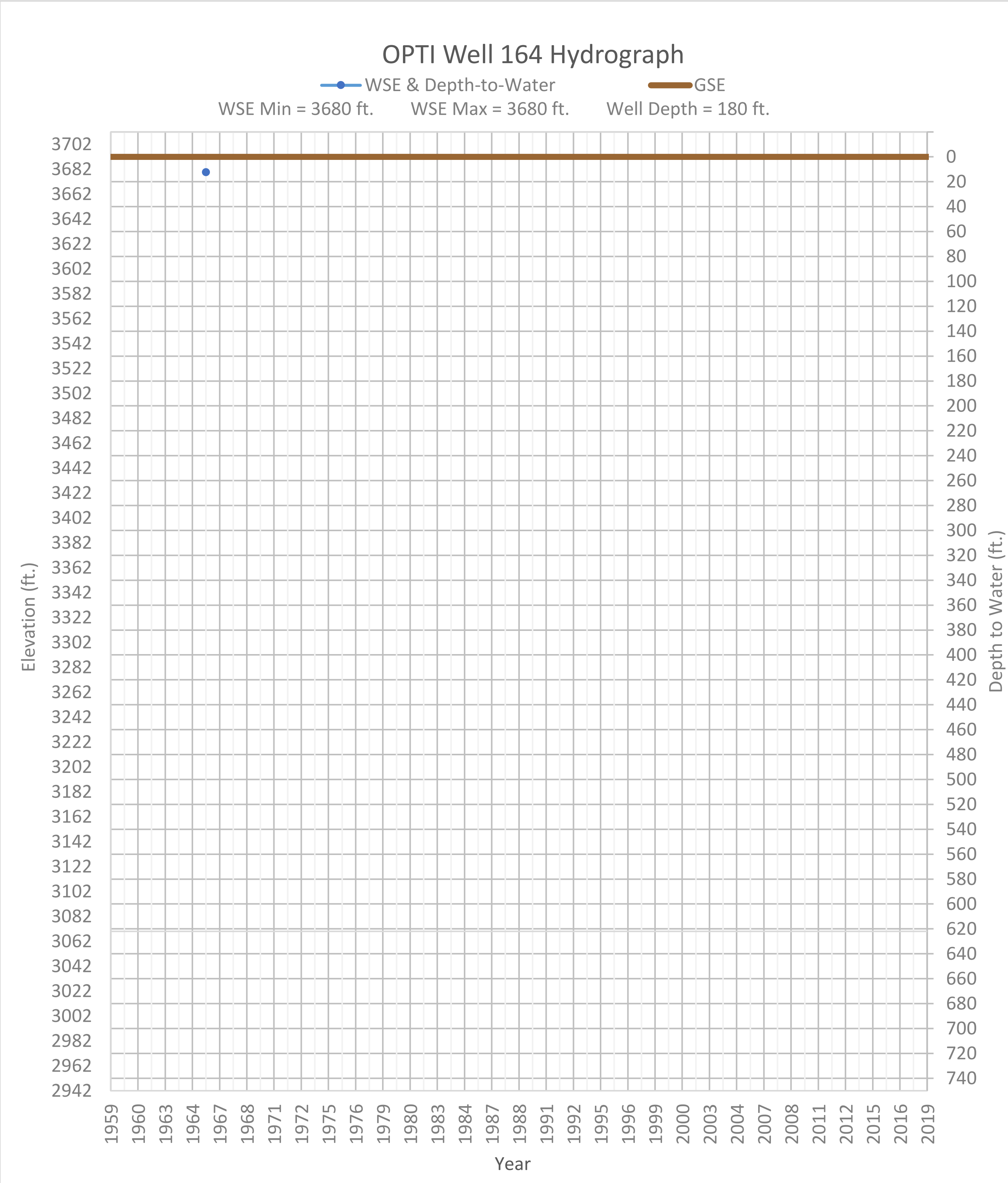
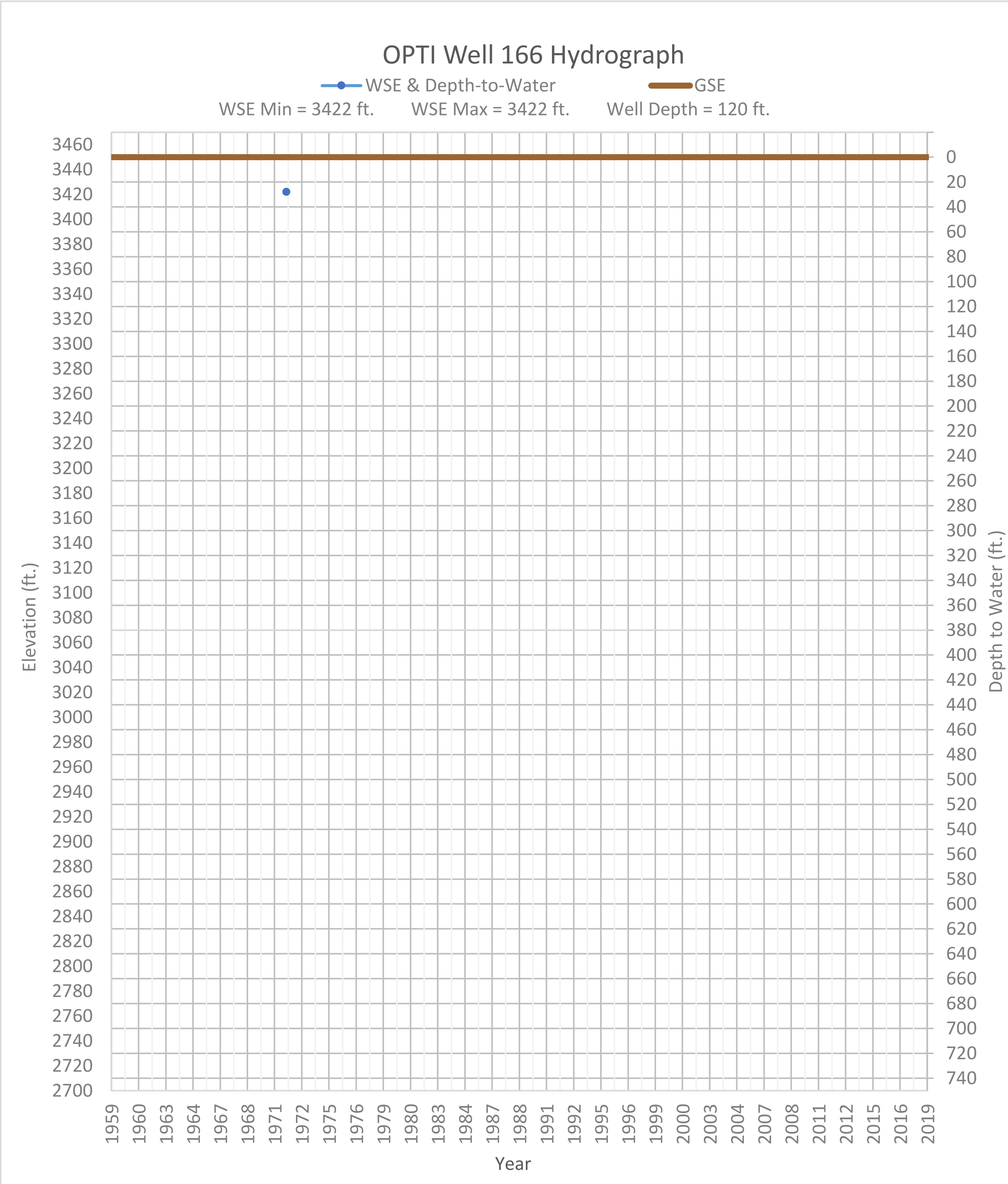

OPTI Well 159 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3687 ft.
WSE Max = 3692 ft.
Well Depth = 64 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



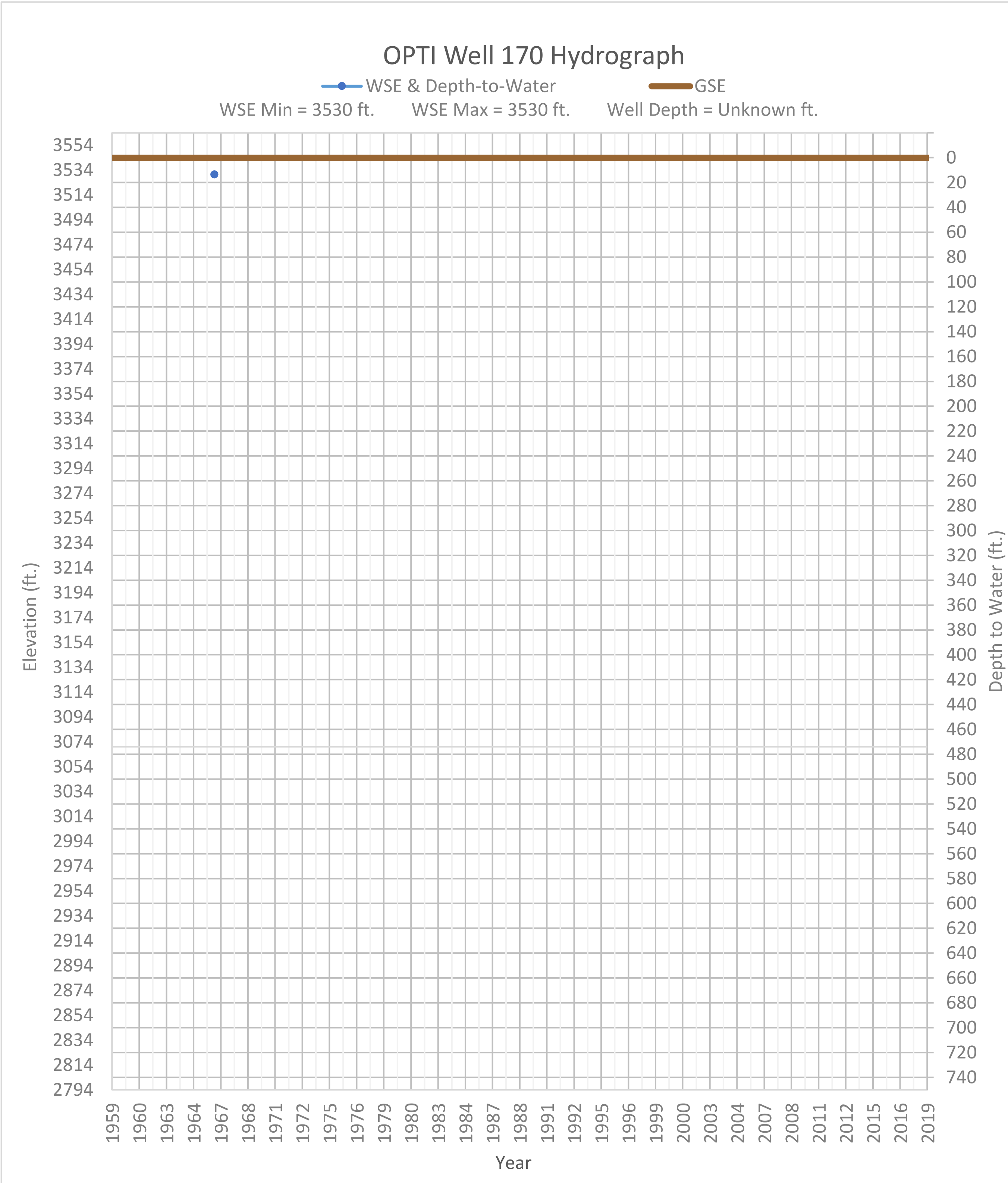
OPTI Well 162 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3742 ft.
WSE Max = 3742 ft.
Well Depth = 150 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 163 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3717 ft.
WSE Max = 3717 ft.
Well Depth = 78 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

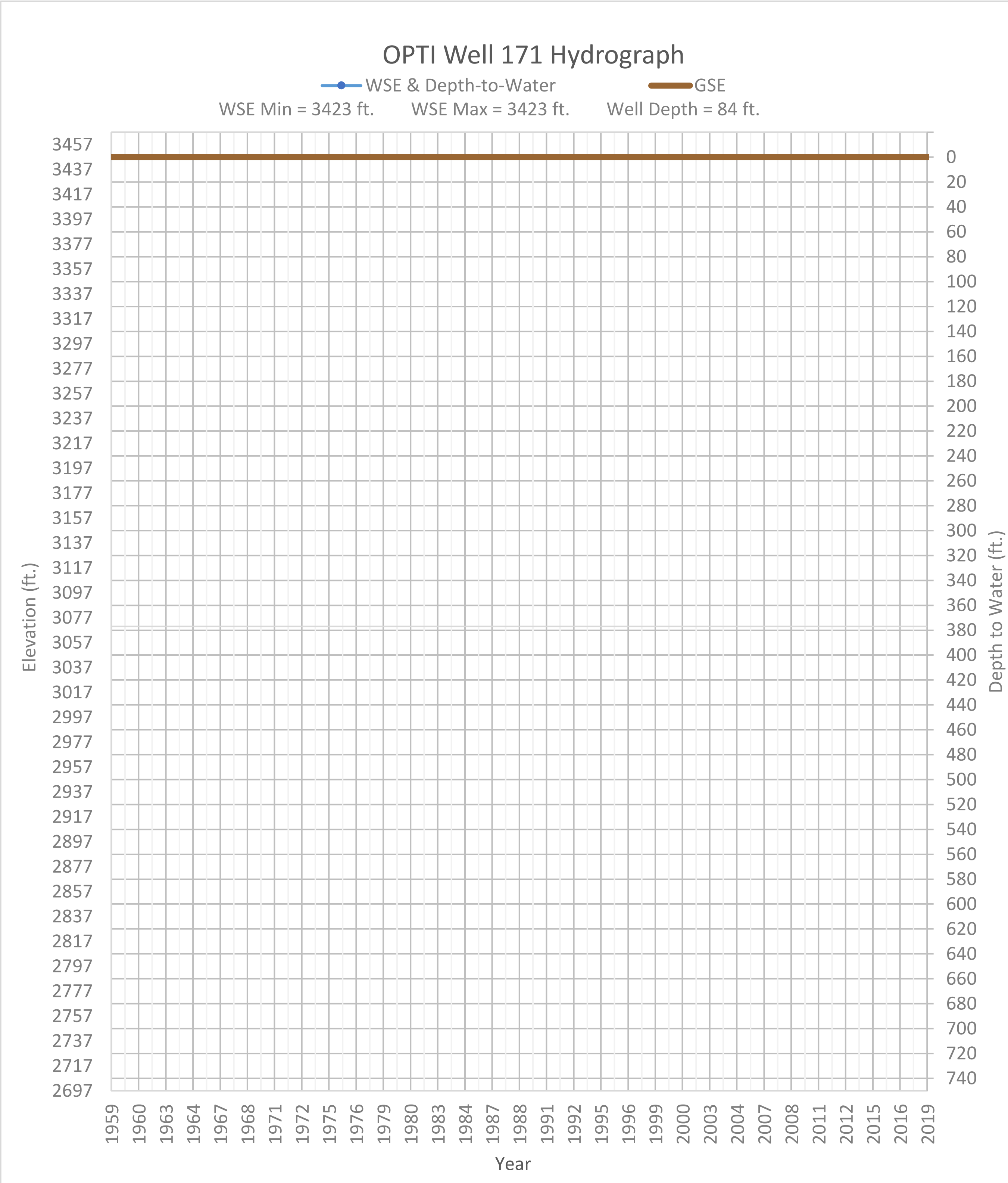

OPTI Well 164 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3680 ft.
WSE Max = 3680 ft.
Well Depth = 180 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3702 3682 3662 3642 3622 3602 3582 3562 3542 3522 3502 3482 3462 3442 3422 3402 3382 3362 3342 3322 3302 3282 3262 3242 3222 3202 3182 3162 3142 3122 3102 3082 3062 3042 3022 3002 2982 2962 2942
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019



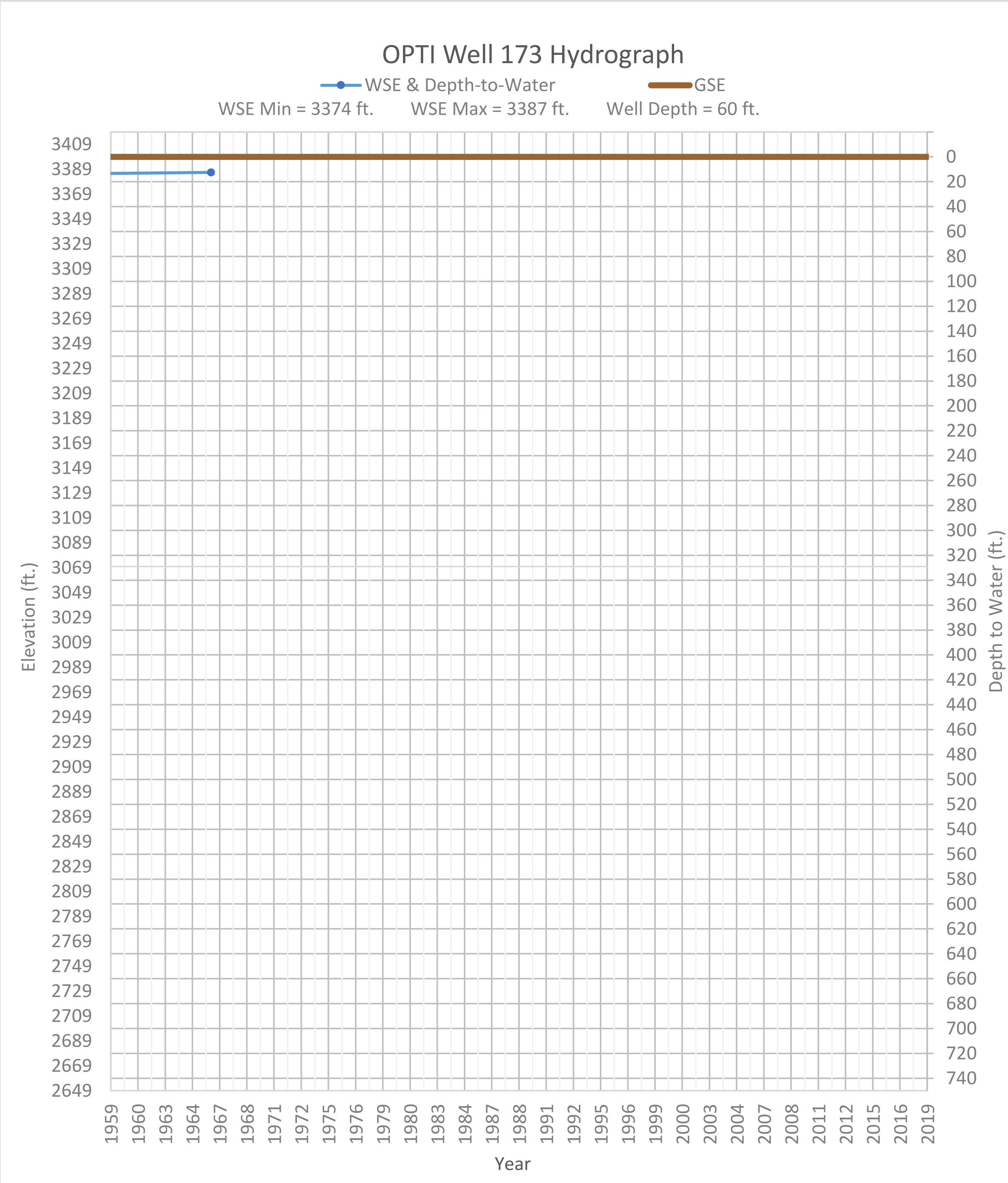
OPTI Well 166 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3422 ft.
WSE Max = 3422 ft.
Well Depth = 120 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 170 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3530 ft.
WSE Max = 3530 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 171 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3423 ft.
WSE Max = 3423 ft.
Well Depth = 84 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 173 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3374 ft.
WSE Max = 3387 ft.
Well Depth = 60 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3409
3389
3369
3349
3329
3309
3289
3269
3249
3229
3209
3189
3169
3149
3129
3109
3089
3069
3049
3029
3009
2989
2969
2949
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2649
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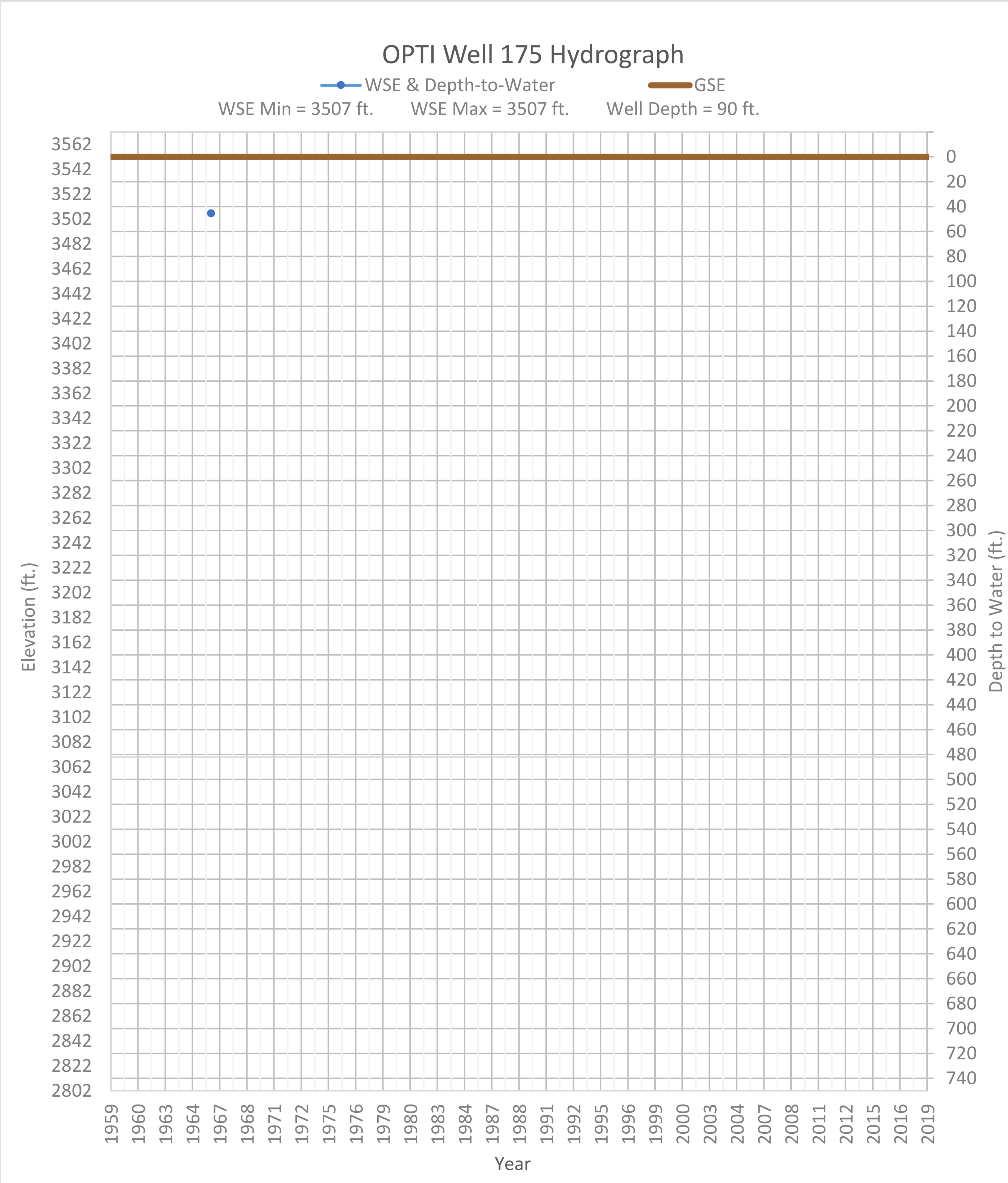
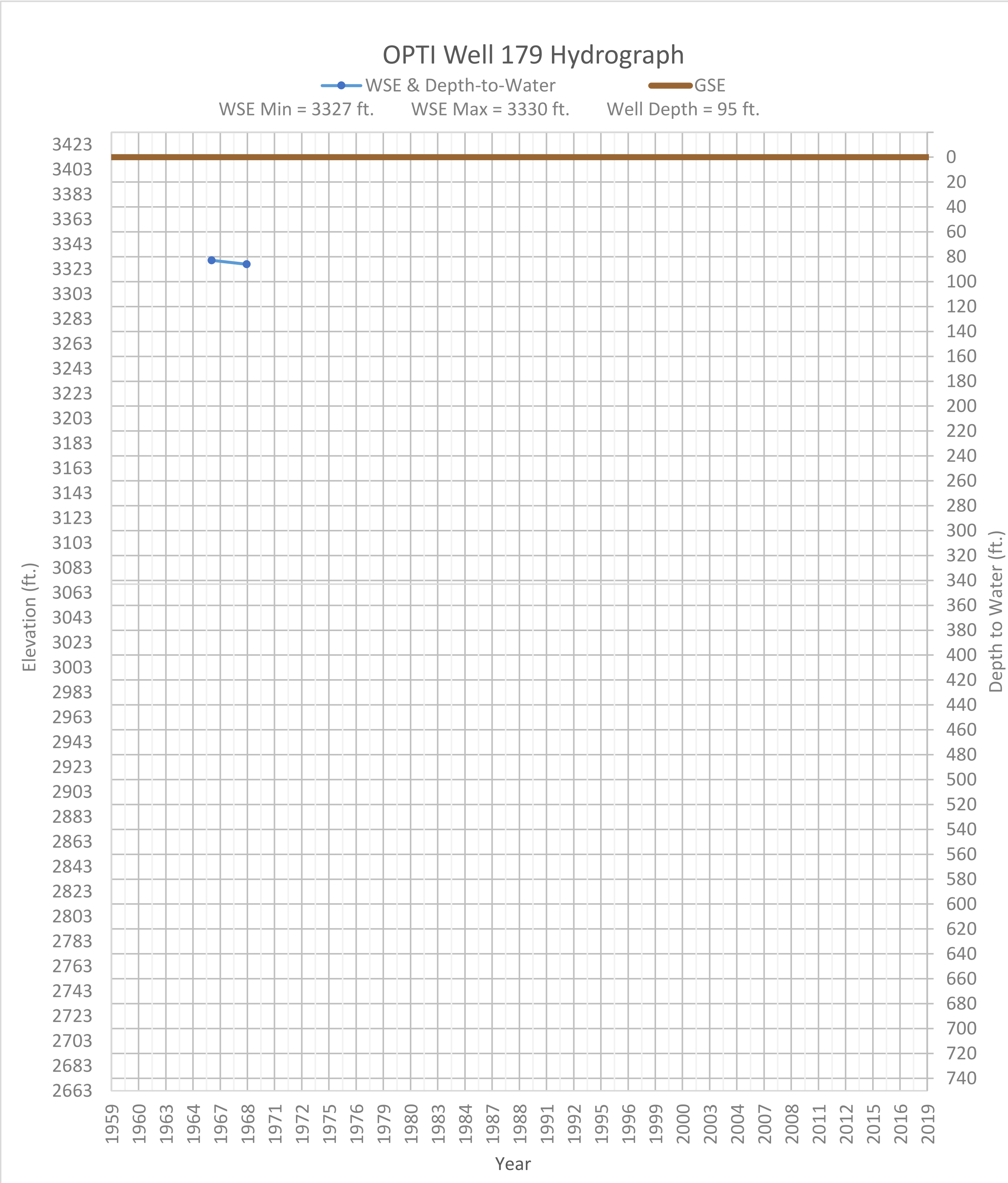
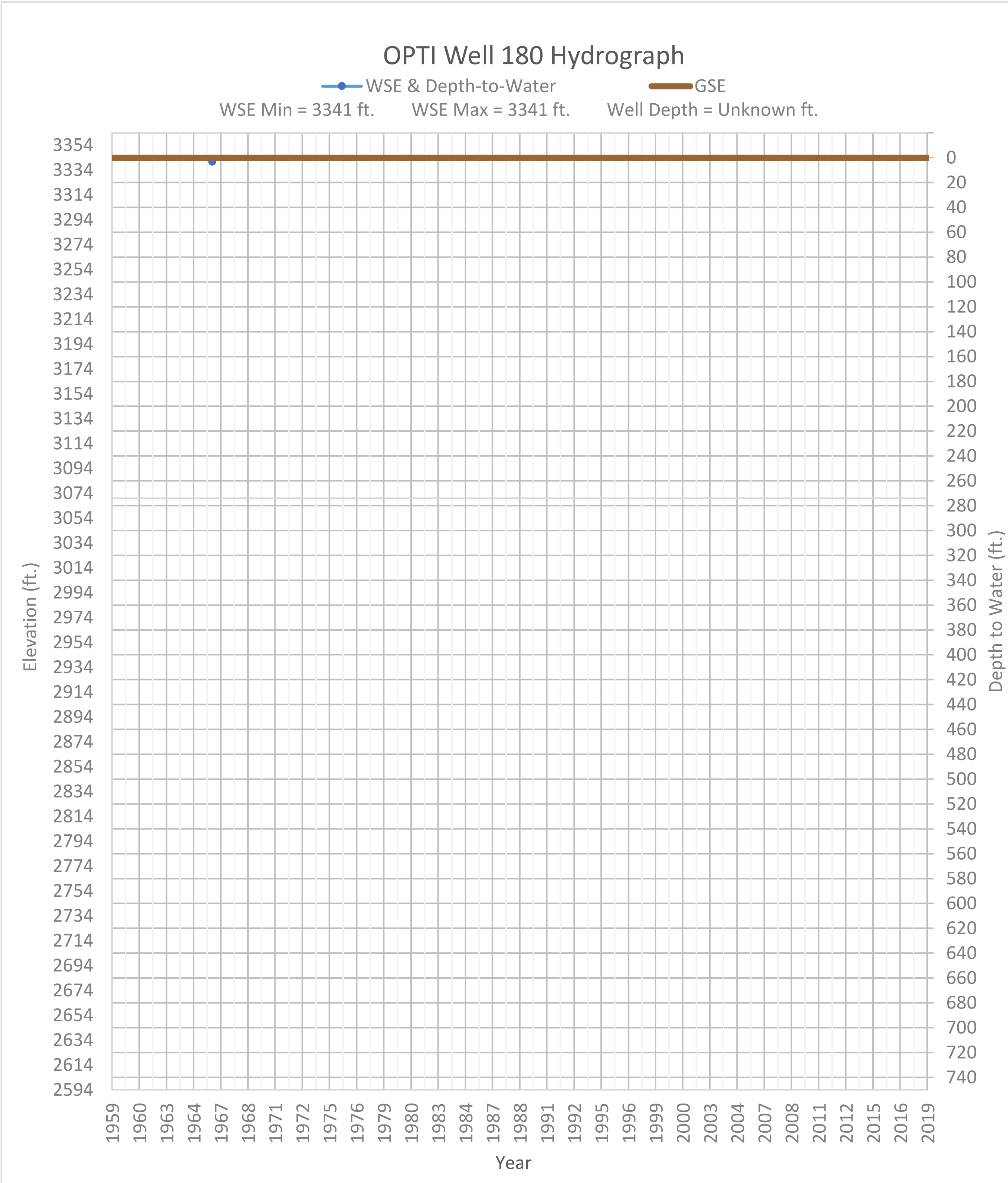


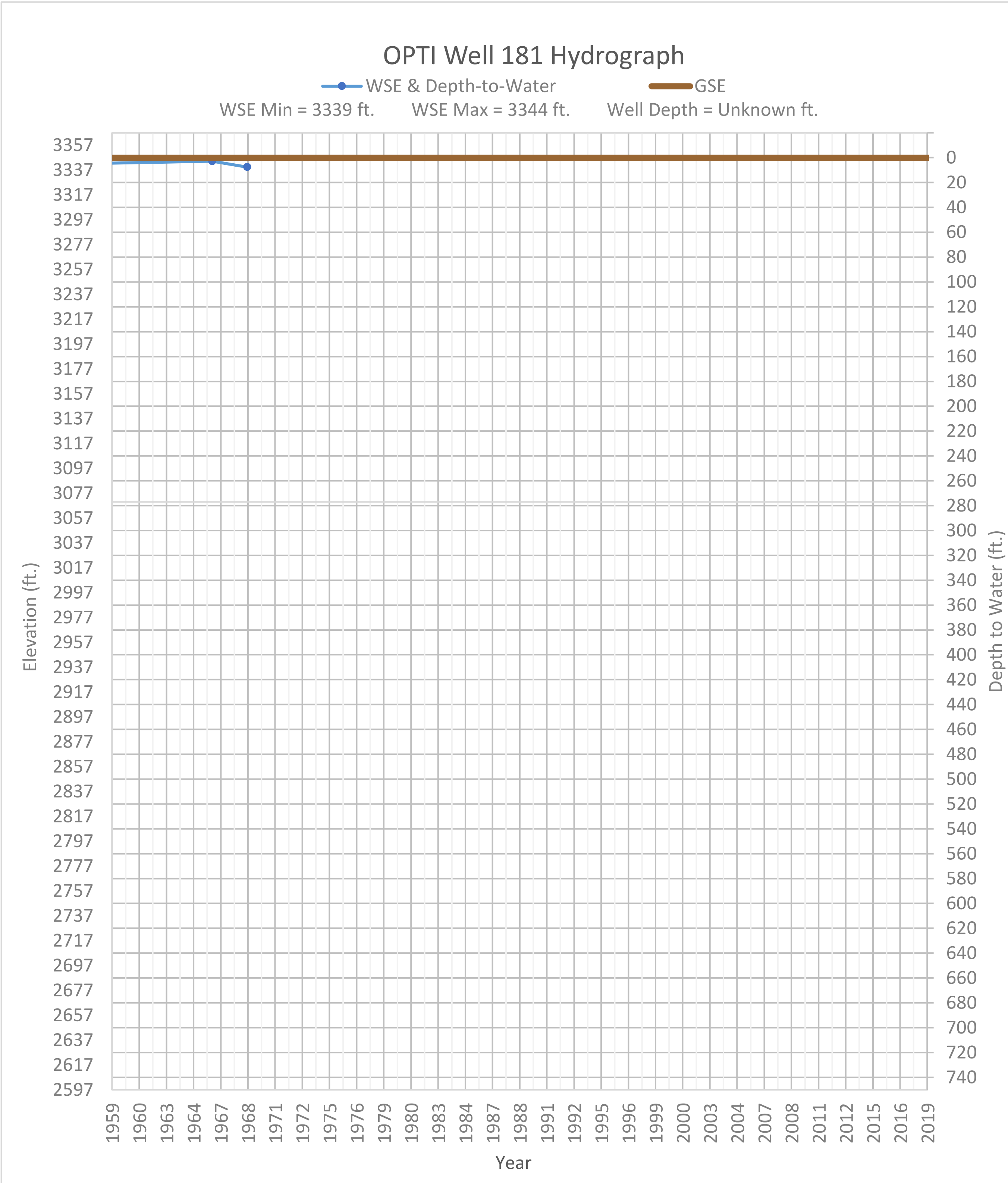
OPTI Well 175 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3507 ft.
WSE Max = 3507 ft.
Well Depth = 90 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



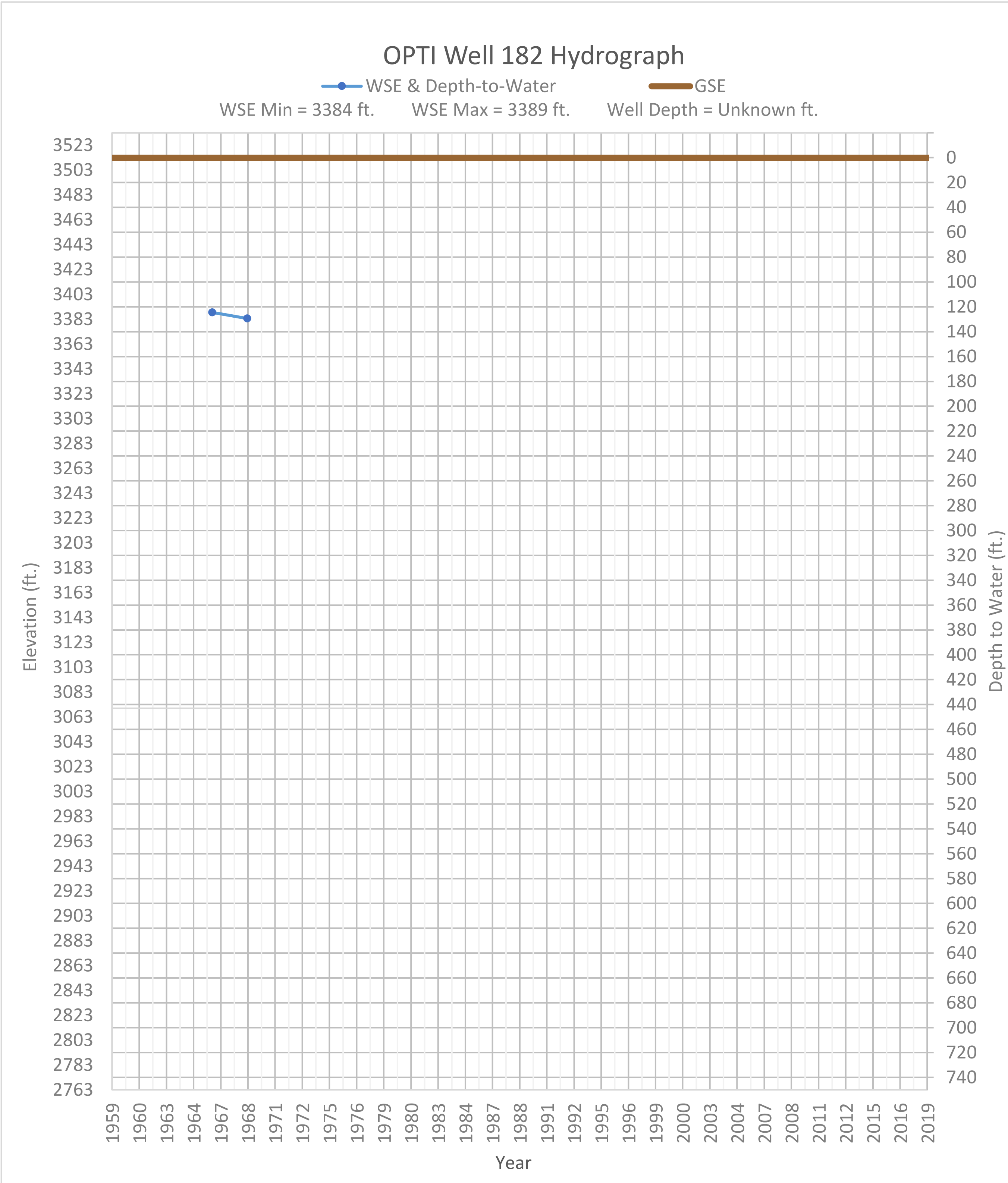
OPTI Well 179 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3327 ft.
WSE Max = 3330 ft.
Well Depth = 95 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

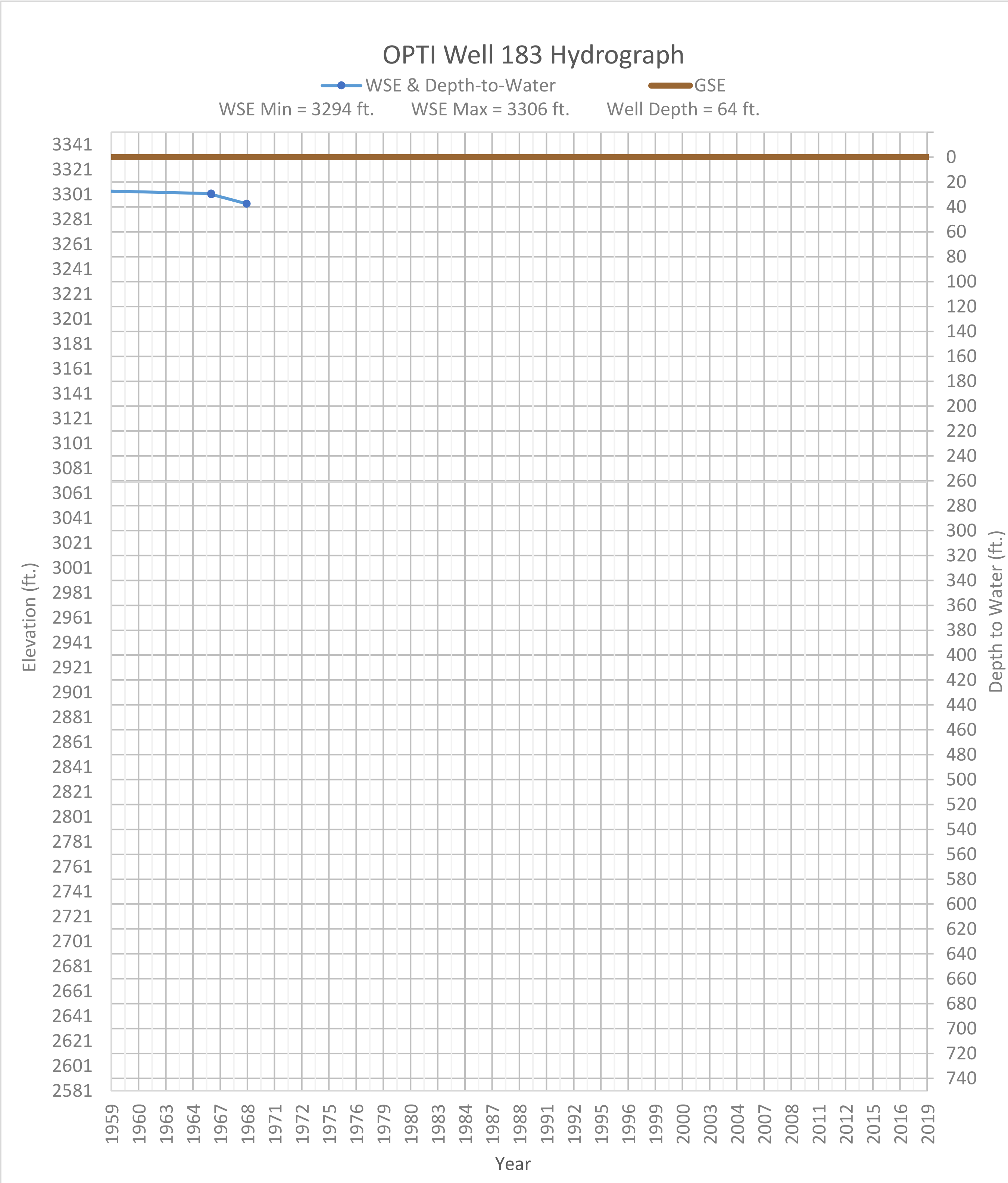


OPTI Well 180 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3341 ft.
WSE Max = 3341 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 181 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3339 ft.
WSE Max = 3344 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 182 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3384 ft.
WSE Max = 3389 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 183 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3294 ft.
WSE Max = 3306 ft.
Well Depth = 64 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3341
3321
3301
3281
3261
3241
3221
3201
3181
3161
3141
3121
3101
3081
3061
3041
3021
3001
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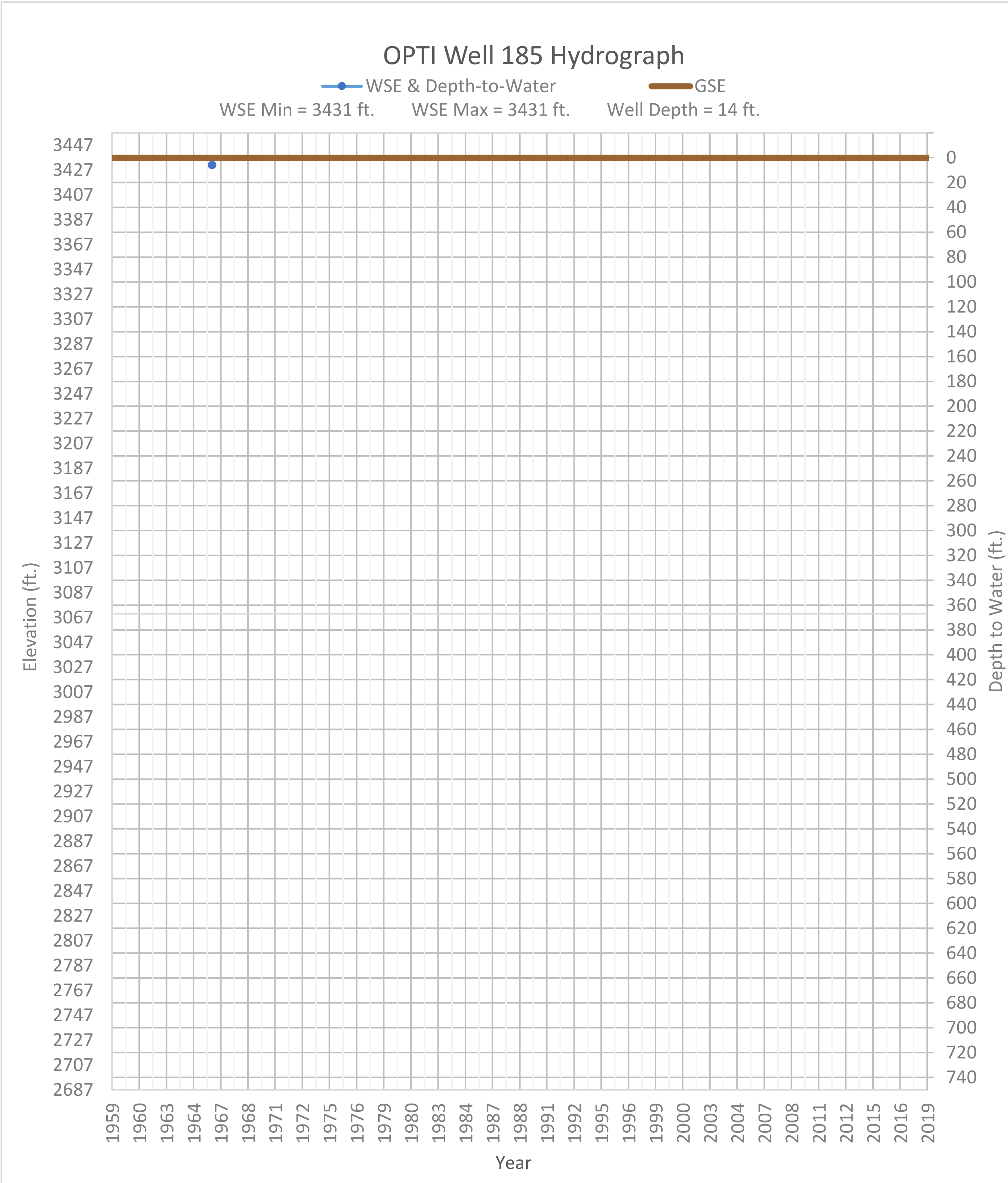
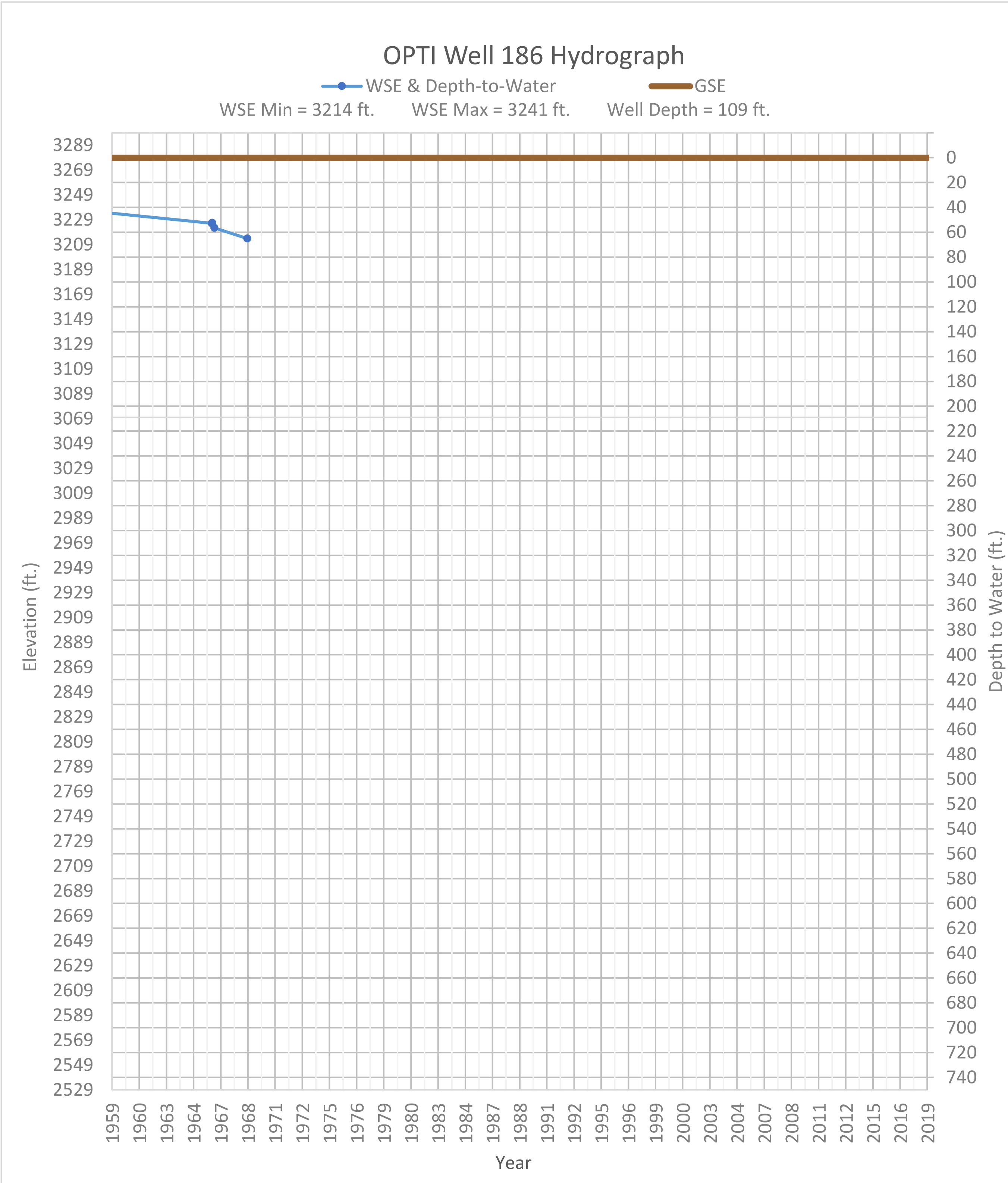

OPTI Well 185 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3431 ft.
WSE Max = 3431 ft.
Well Depth = 14 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 186 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3214 ft.
WSE Max = 3241 ft.
Well Depth = 109 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3289
3269
3249
3229
3209
3189
3169
3149
3129
3109
3089
3069
3049
3029
3009
2989
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2909
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2789
2769
2749
2729
2709
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2669
2649
2629
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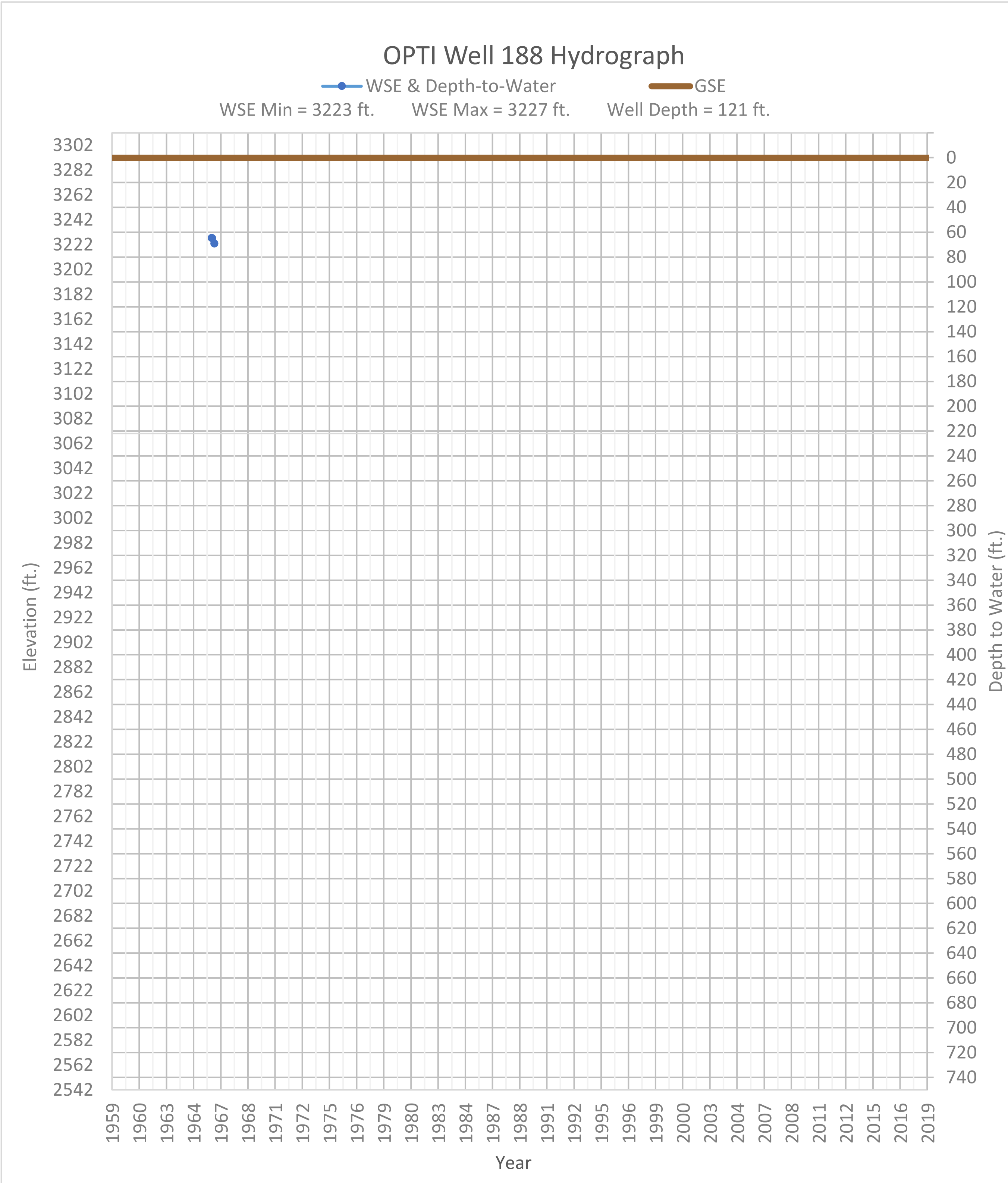
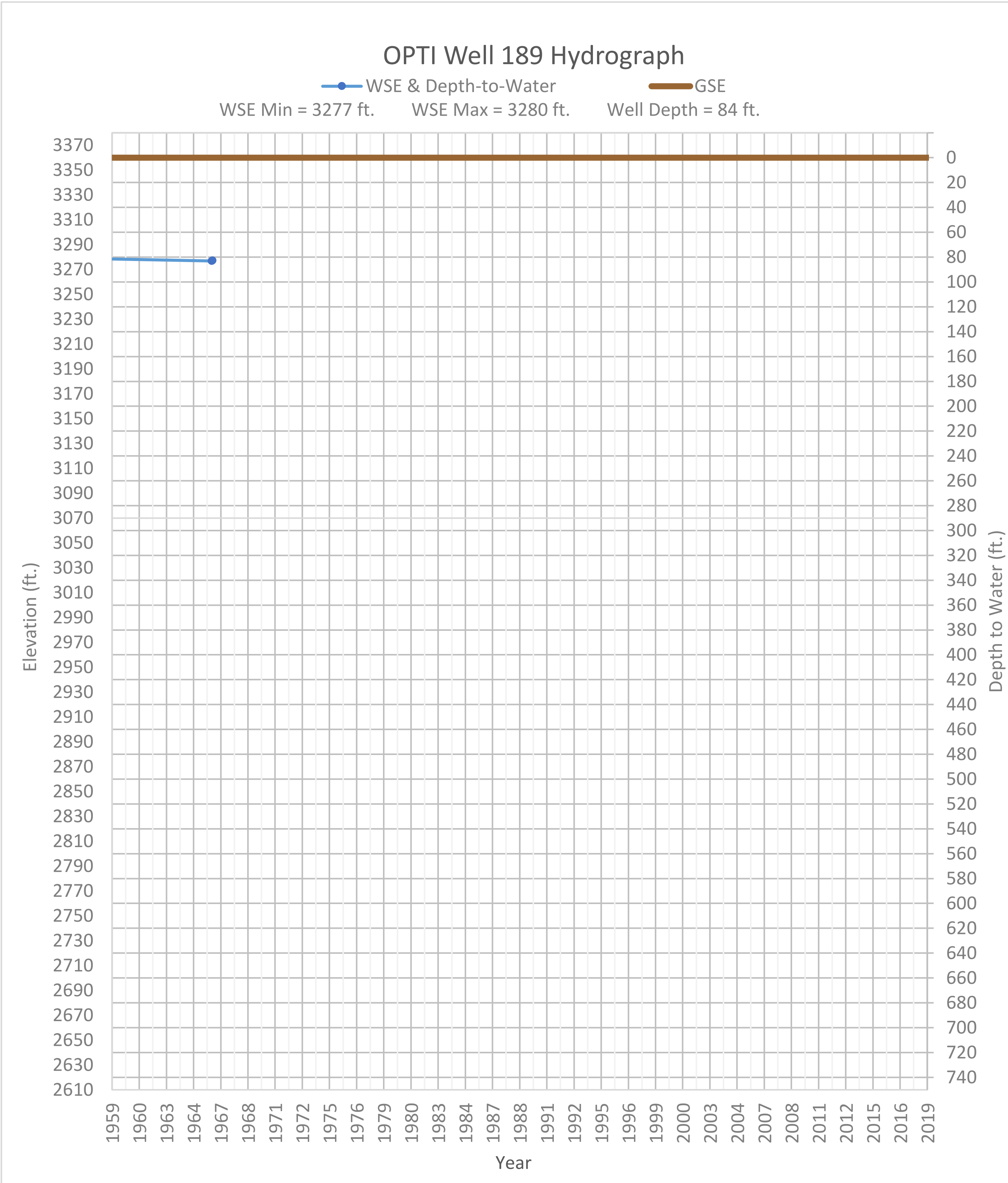
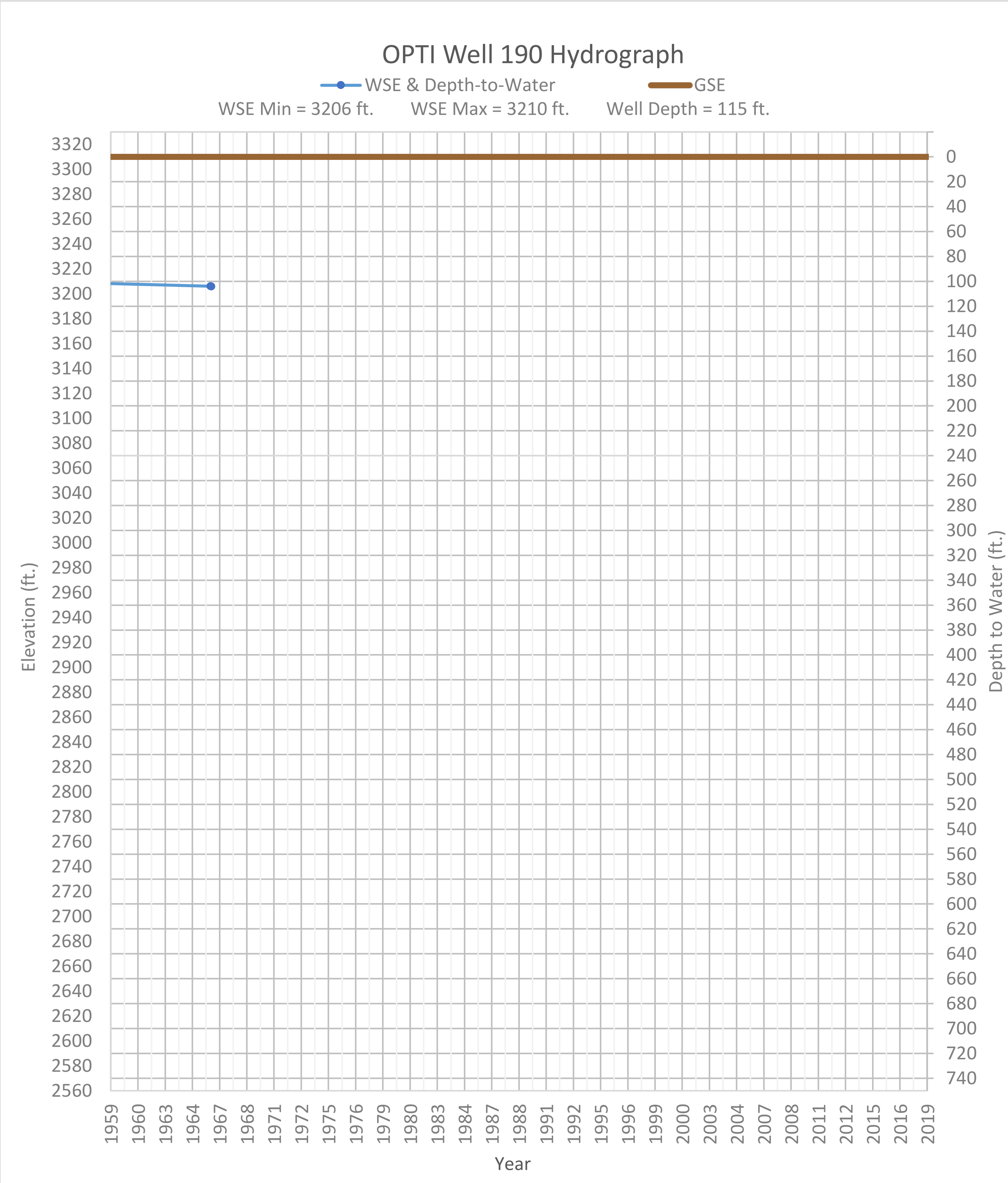
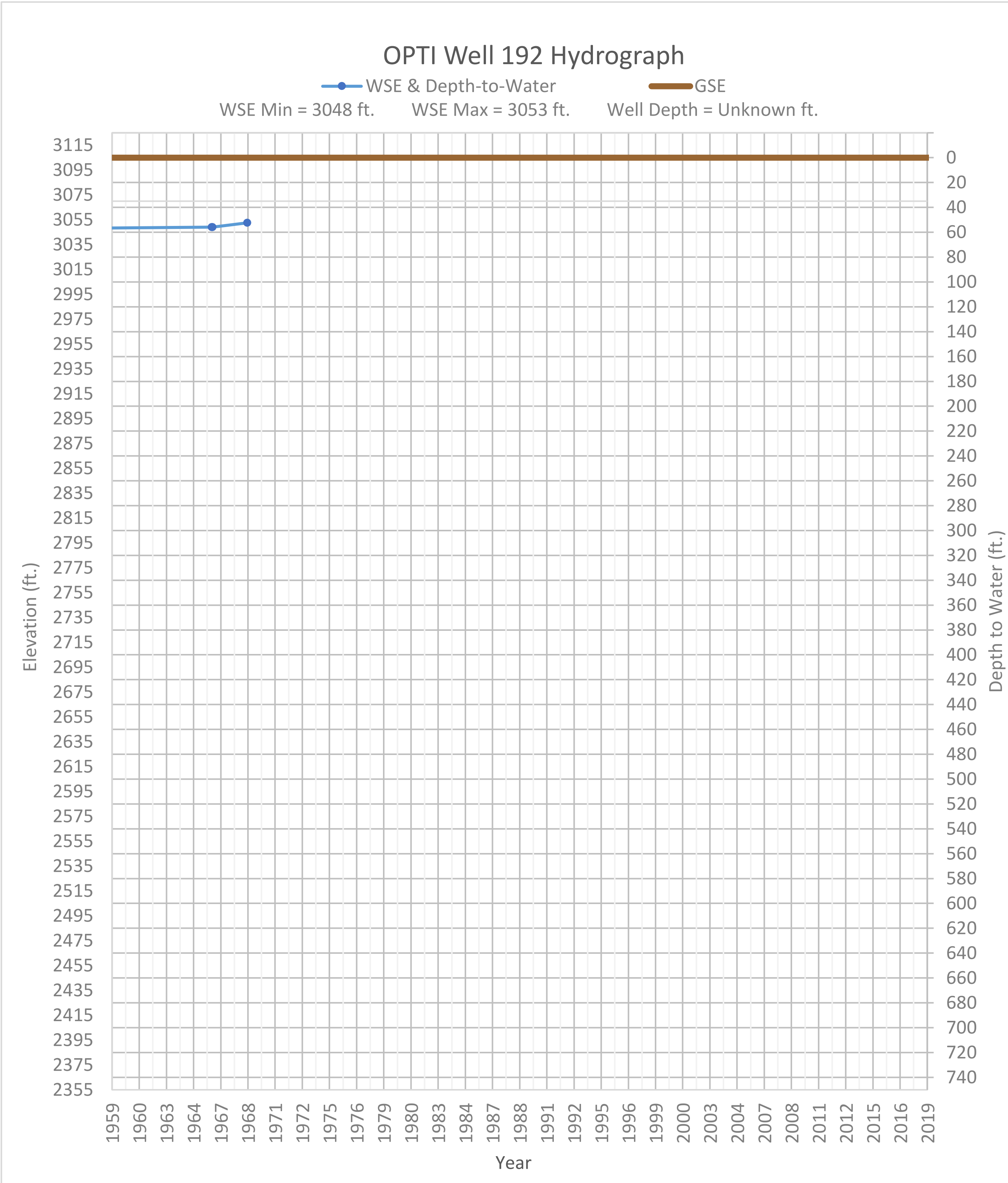


OPTI Well 188 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3223 ft.
WSE Max = 3227 ft.
Well Depth = 121 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 189 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3277 ft.
WSE Max = 3280 ft.
Well Depth = 84 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 190 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3206 ft.
WSE Max = 3210 ft.
Well Depth = 115 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

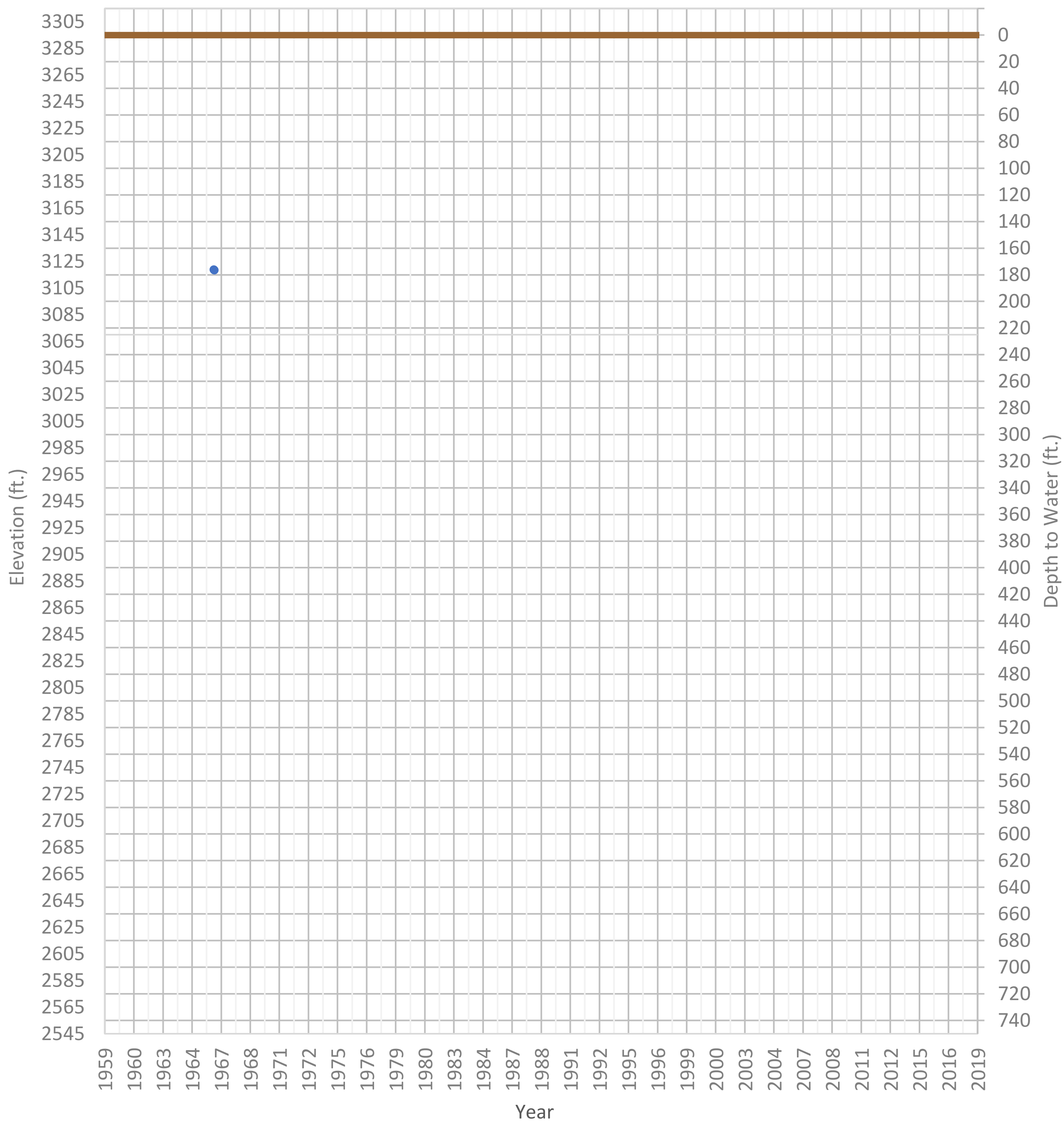


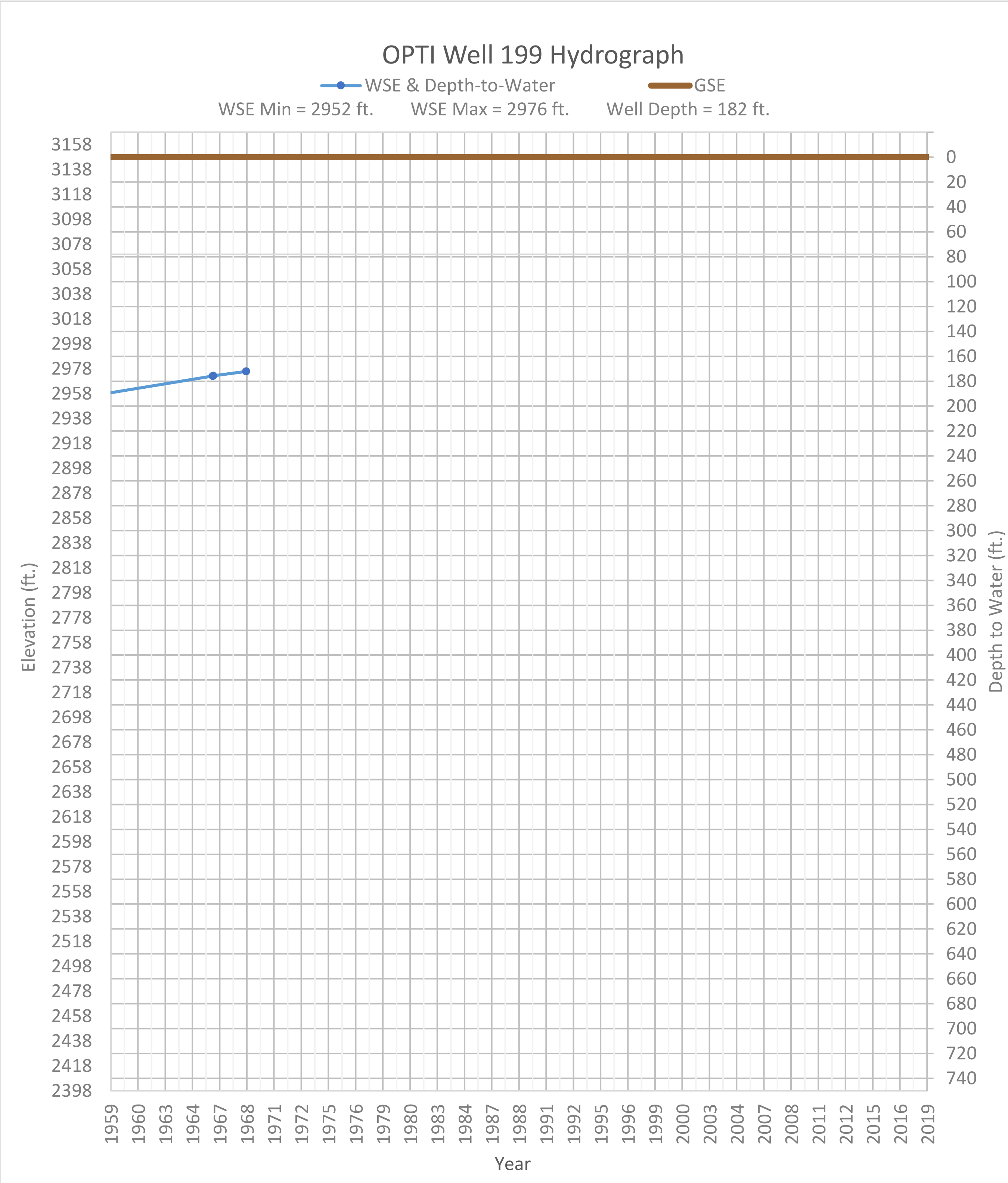
OPTI Well 192 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3048 ft.
WSE Max = 3053 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 198 Hydrograph

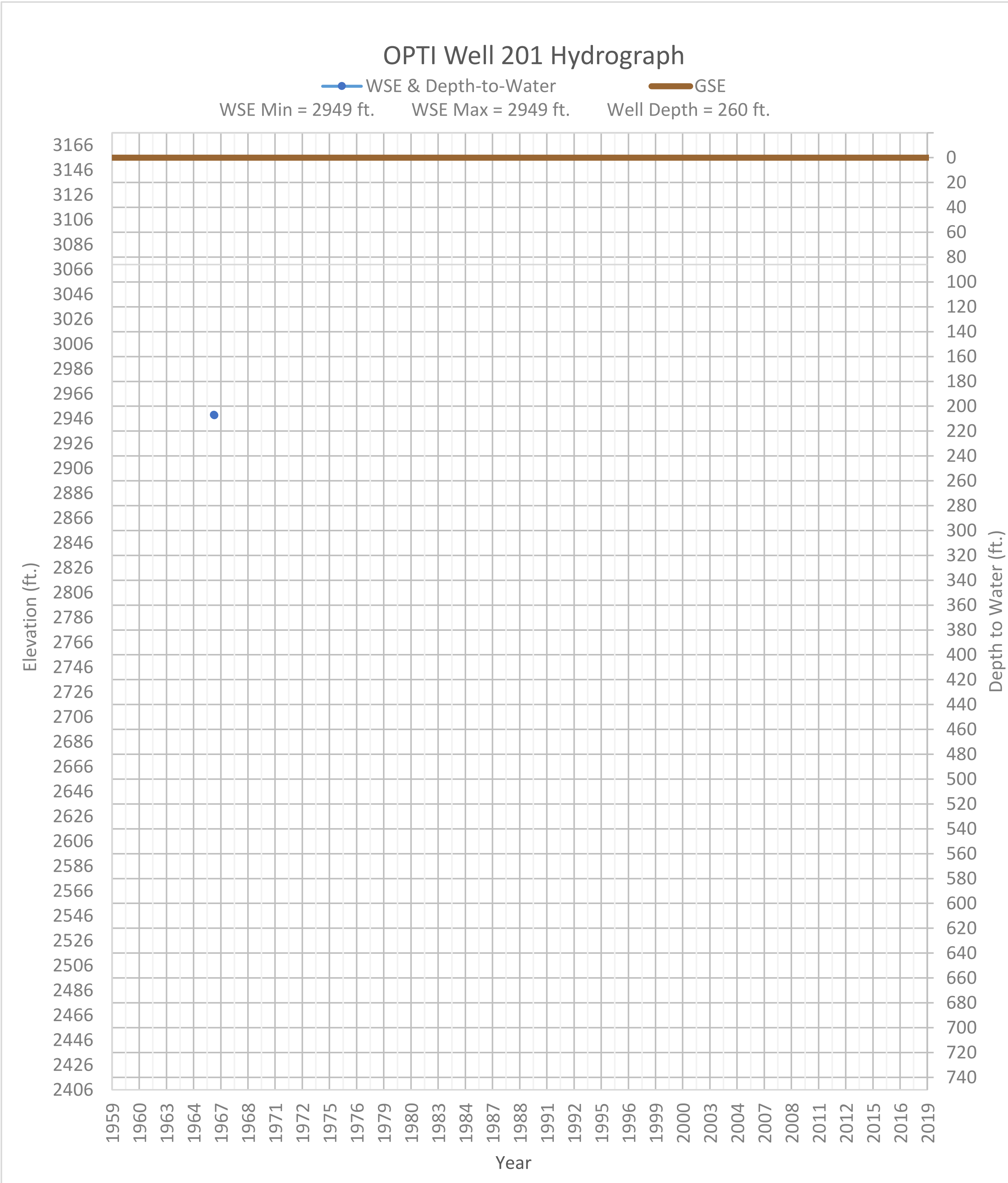
WSE & Depth-to-Water   GSE

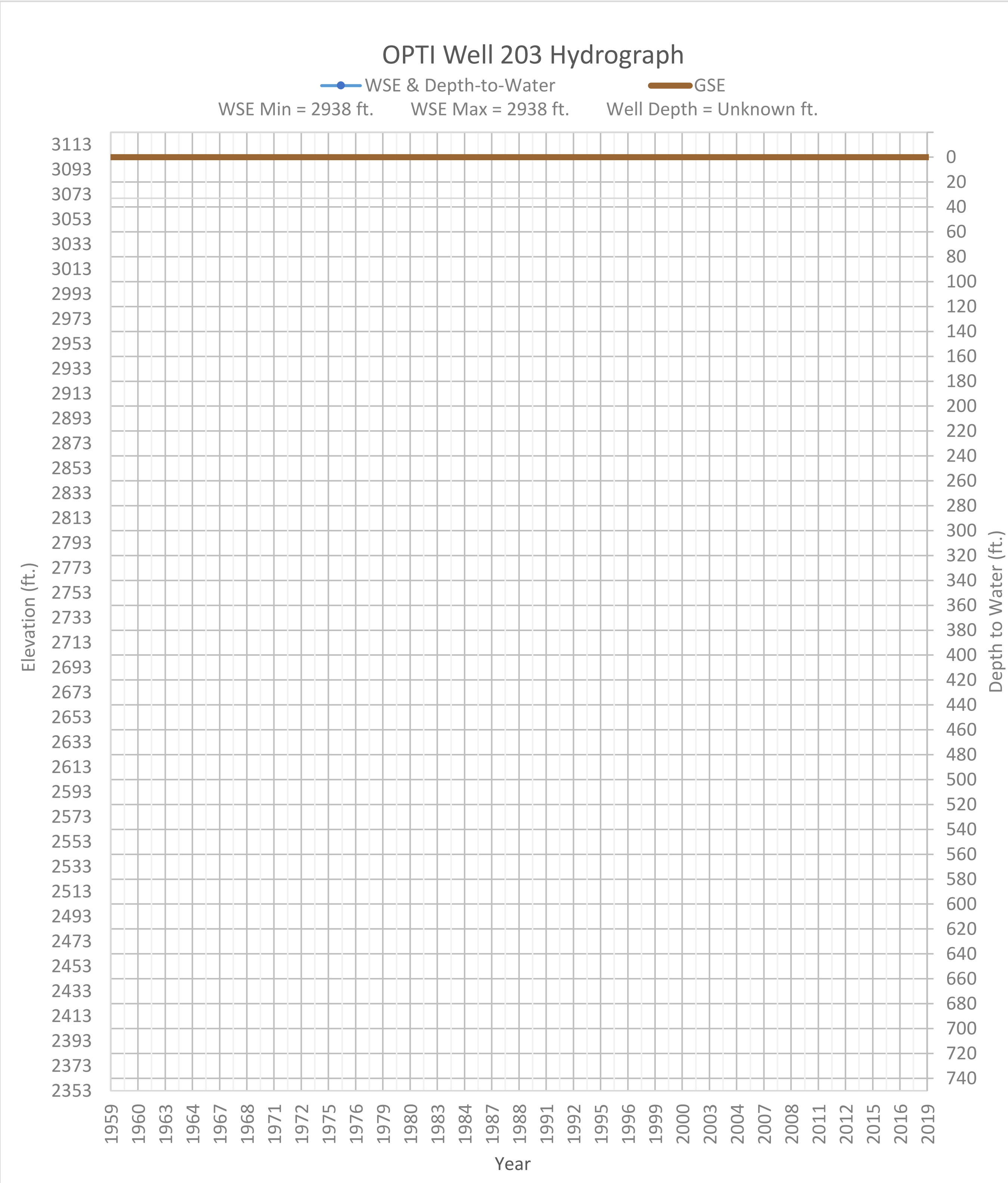
WSE Min = 3118 ft.   WSE Max = 3119 ft.   Well Depth = Unknown ft.





OPTI Well 199 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2952 ft.
WSE Max = 2976 ft.
Well Depth = 182 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 201 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2949 ft.
WSE Max = 2949 ft.
Well Depth = 260 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 203 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2938 ft.
WSE Max = 2938 ft.
Well Depth = Unknown ft.
Elevation (ft.)
3113
3093
3073
3053
3033
3013
2993
2973
2953
2933
2913
2893
2873
2853
2833
2813
2793
2773
2753
2733
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2673
2653
2633
2613
2593
2573
2553
2533
2513
2493
2473
2453
2433
2413
2393
2373
2353
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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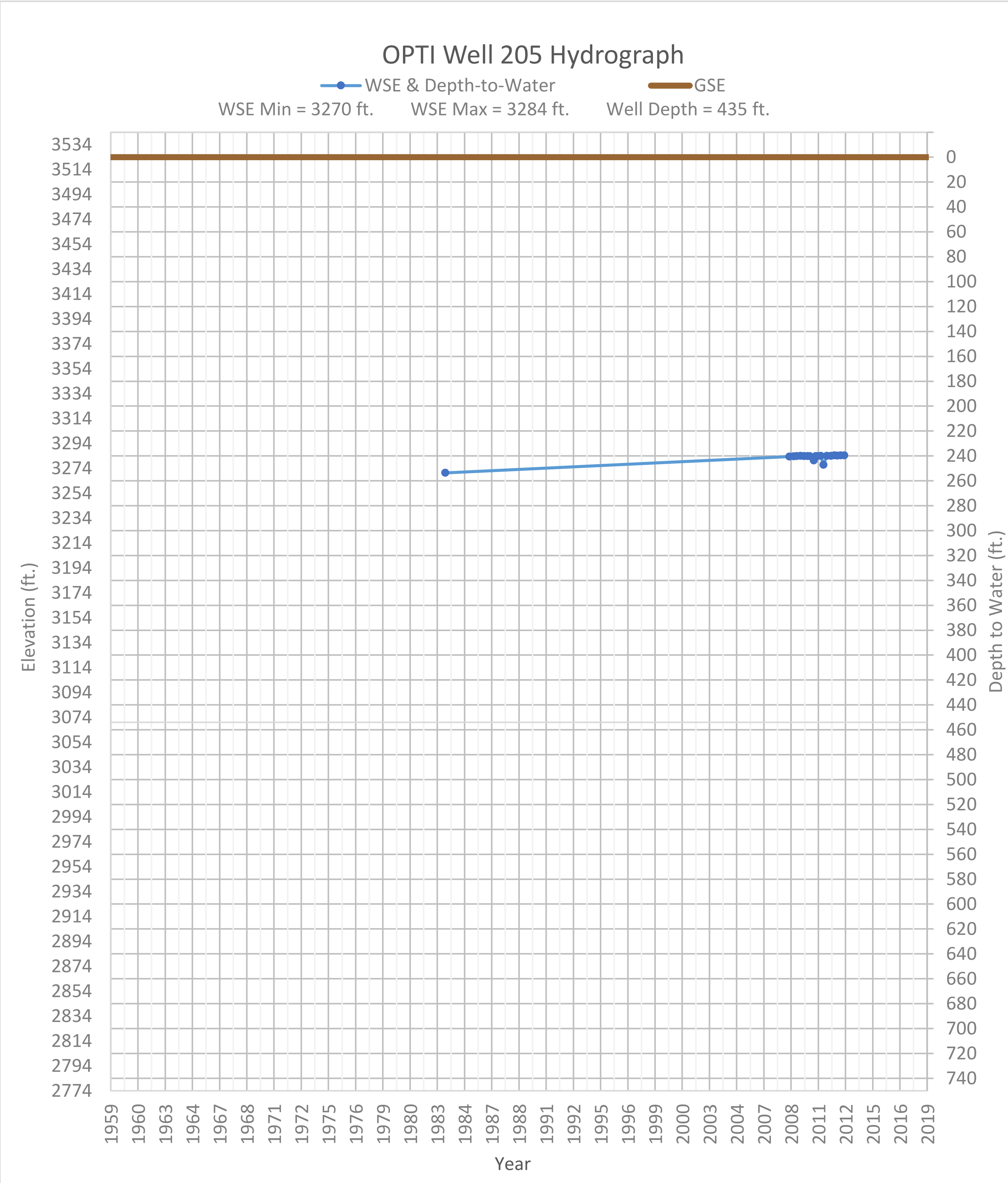
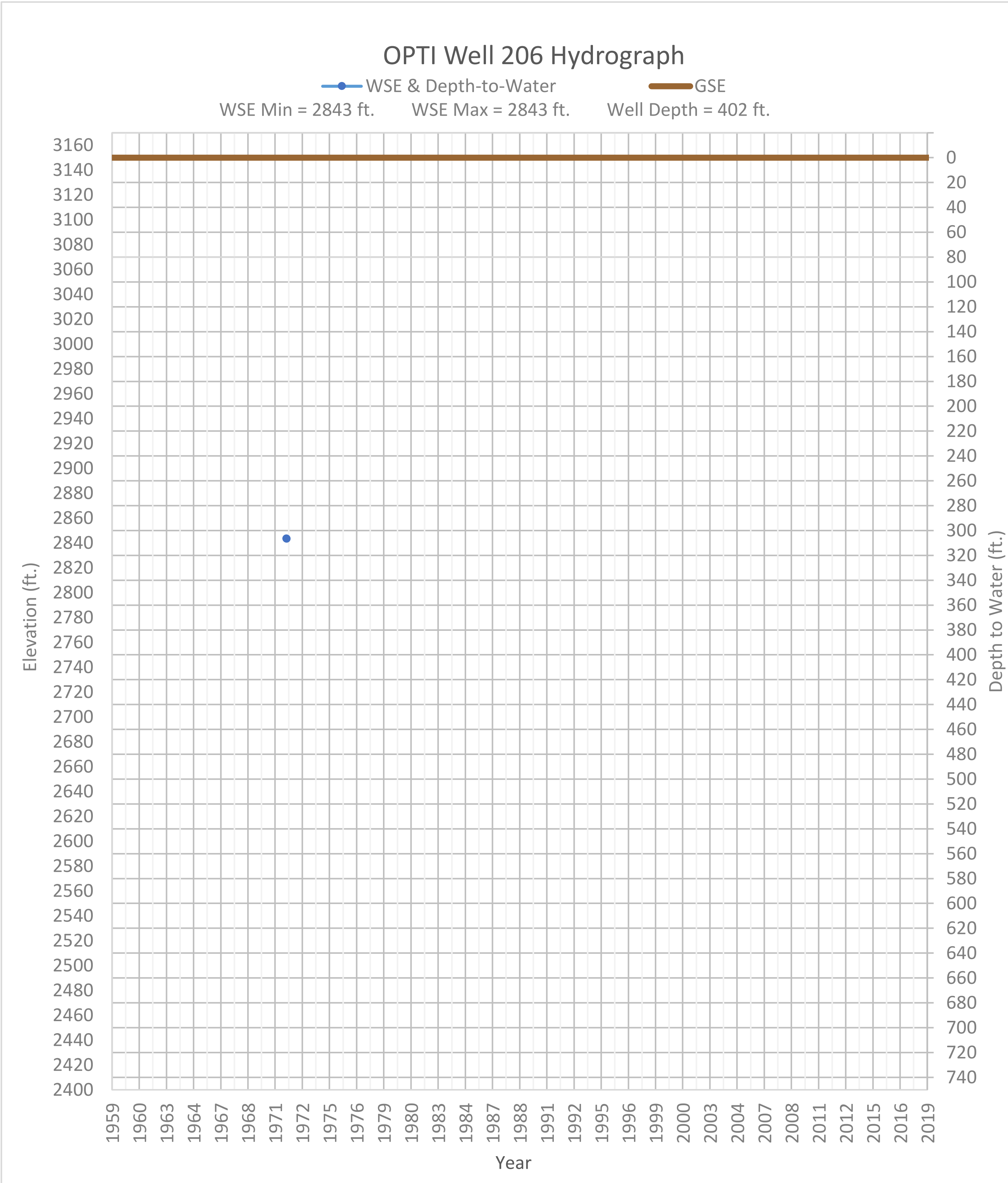
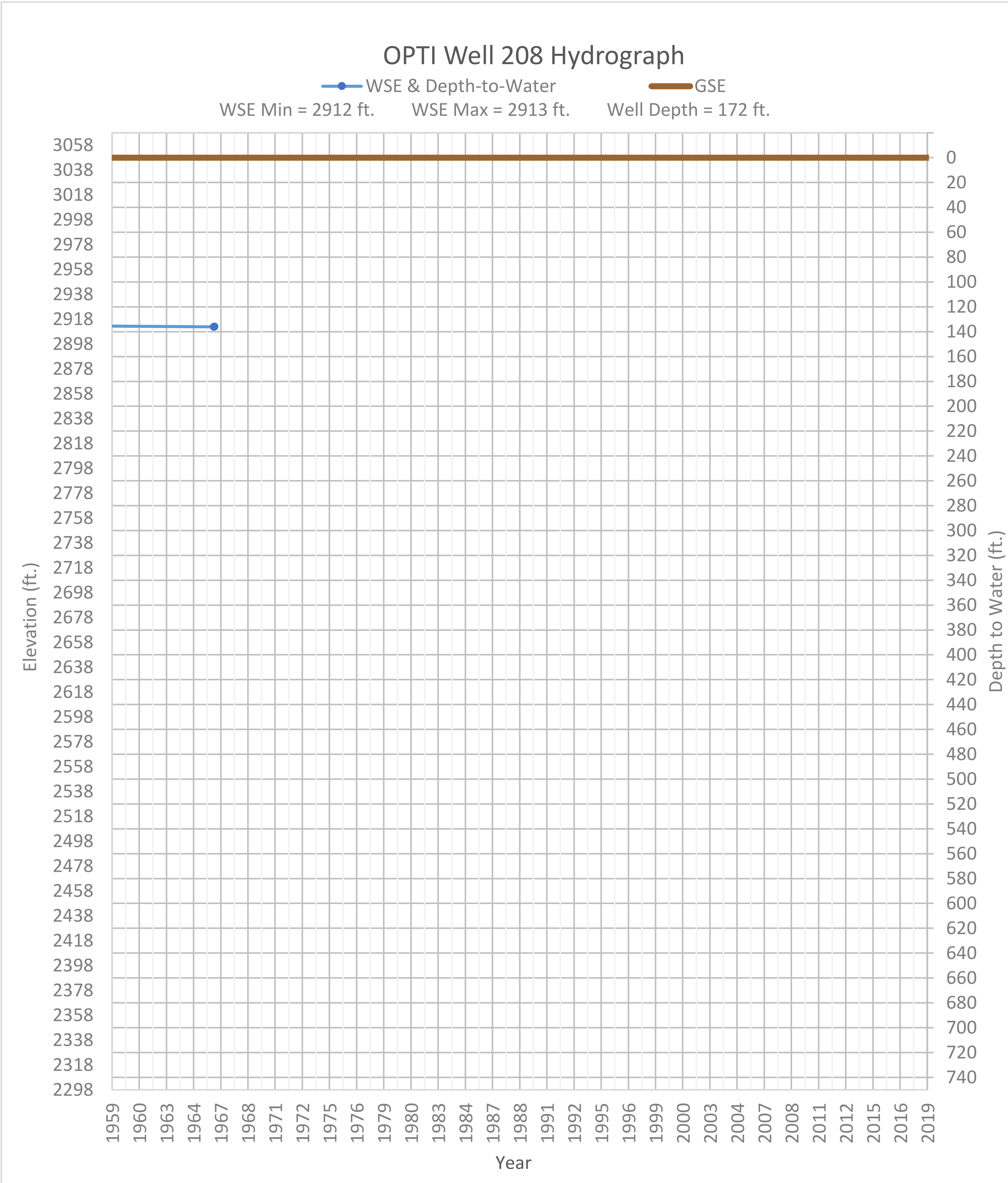


OPTI Well 205 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3270 ft.
WSE Max = 3284 ft.
Well Depth = 435 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 206 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2843 ft.
WSE Max = 2843 ft.
Well Depth = 402 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 208 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2912 ft.
WSE Max = 2913 ft.
Well Depth = 172 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3058
3038
3018
2998
2978
2958
2938
2918
2898
2878
2858
2838
2818
2798
2778
2758
2738
2718
2698
2678
2658
2638
2618
2598
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2398
2378
2358
2338
2318
2298
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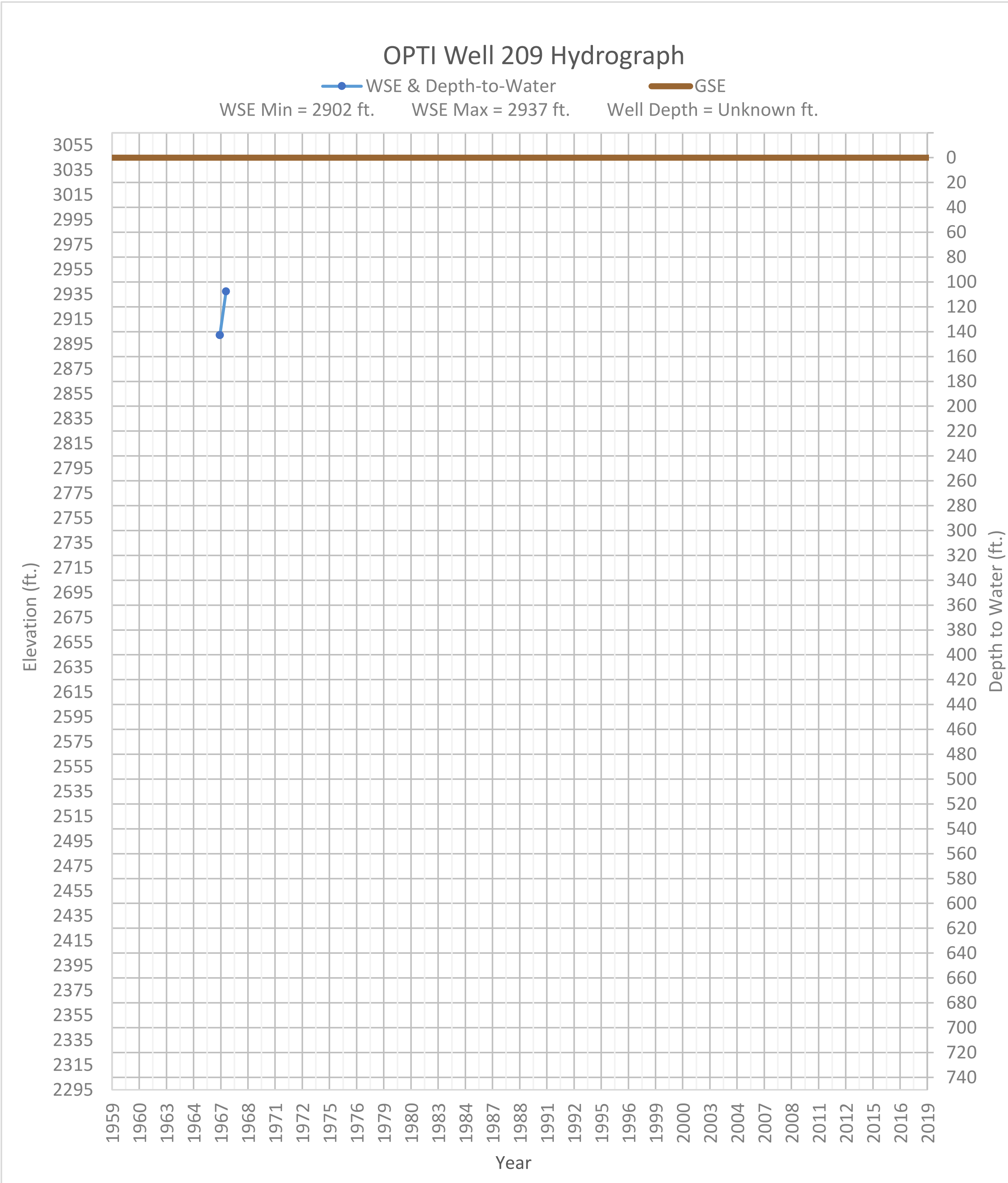
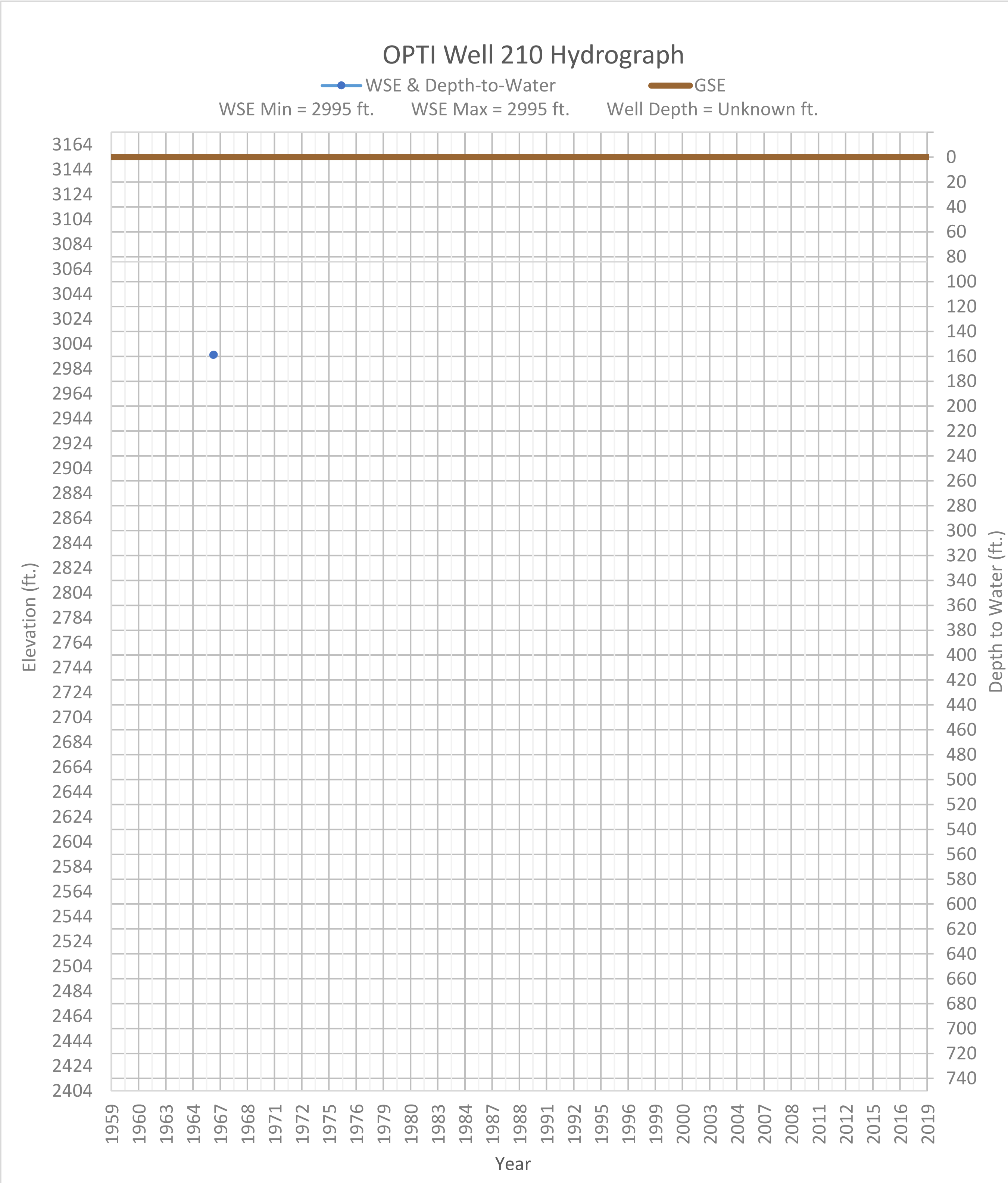
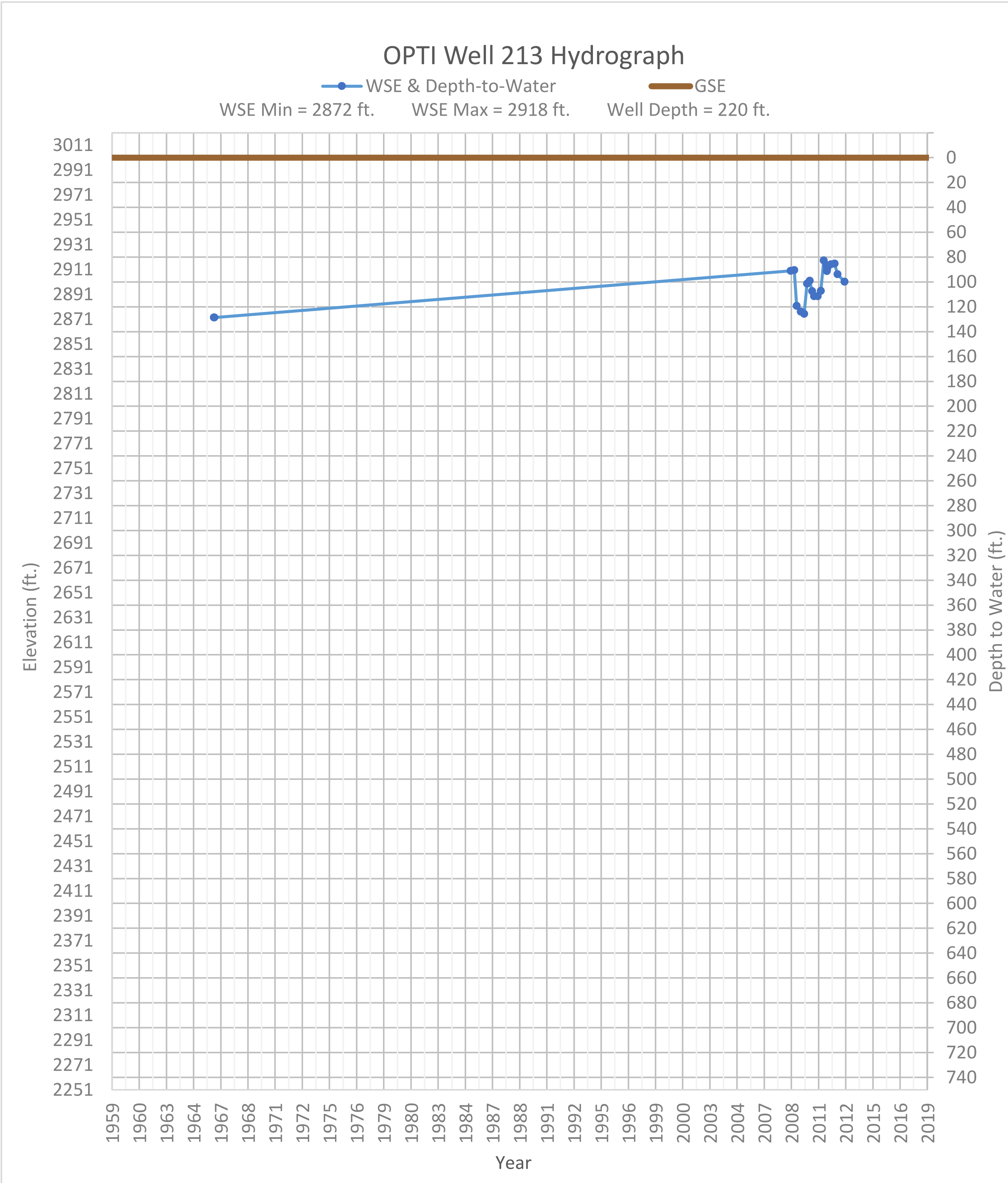


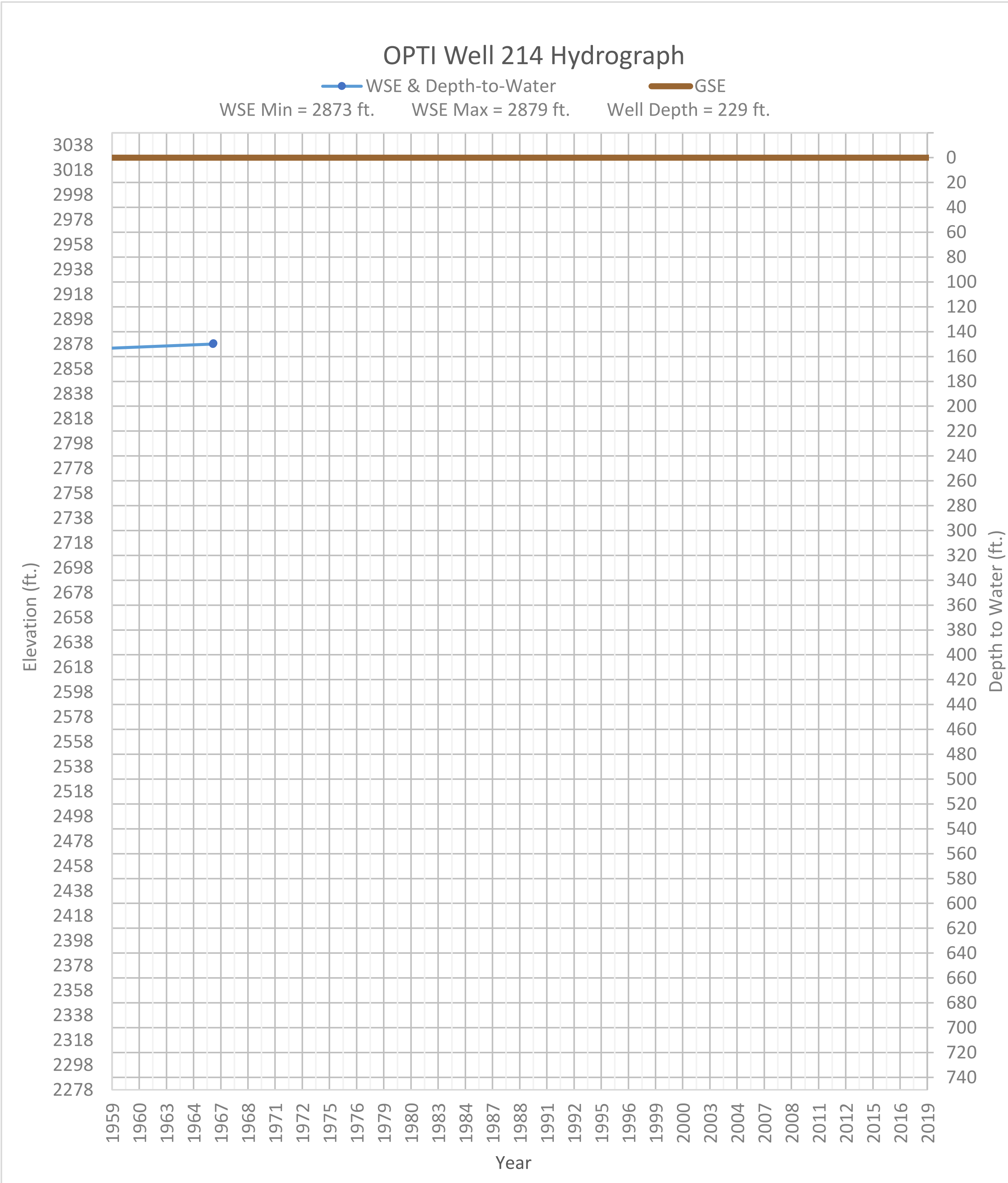
OPTI Well 209 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2902 ft.
WSE Max = 2937 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



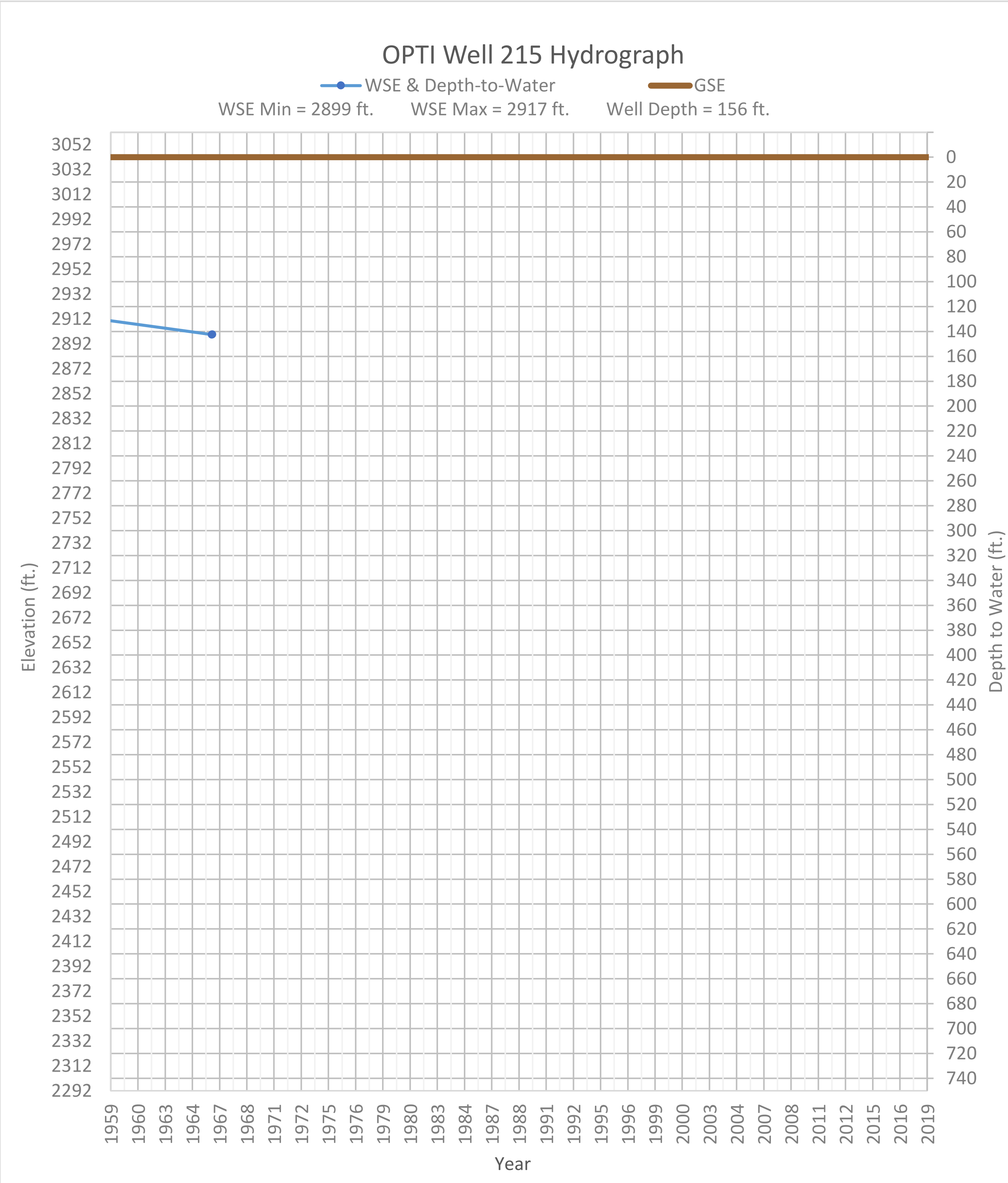
OPTI Well 210 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2995 ft.
WSE Max = 2995 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



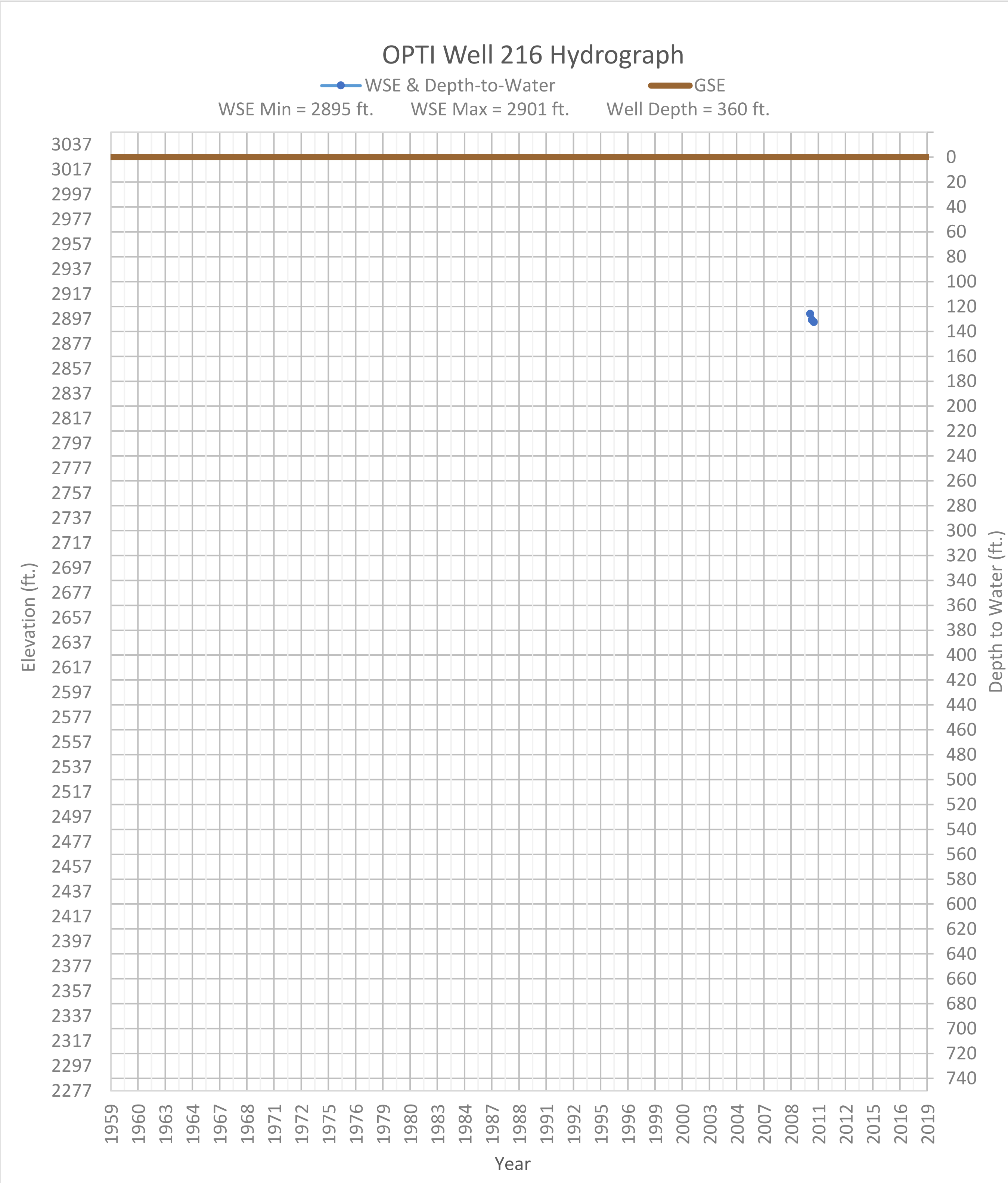
OPTI Well 213 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2872 ft.
WSE Max = 2918 ft.
Well Depth = 220 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



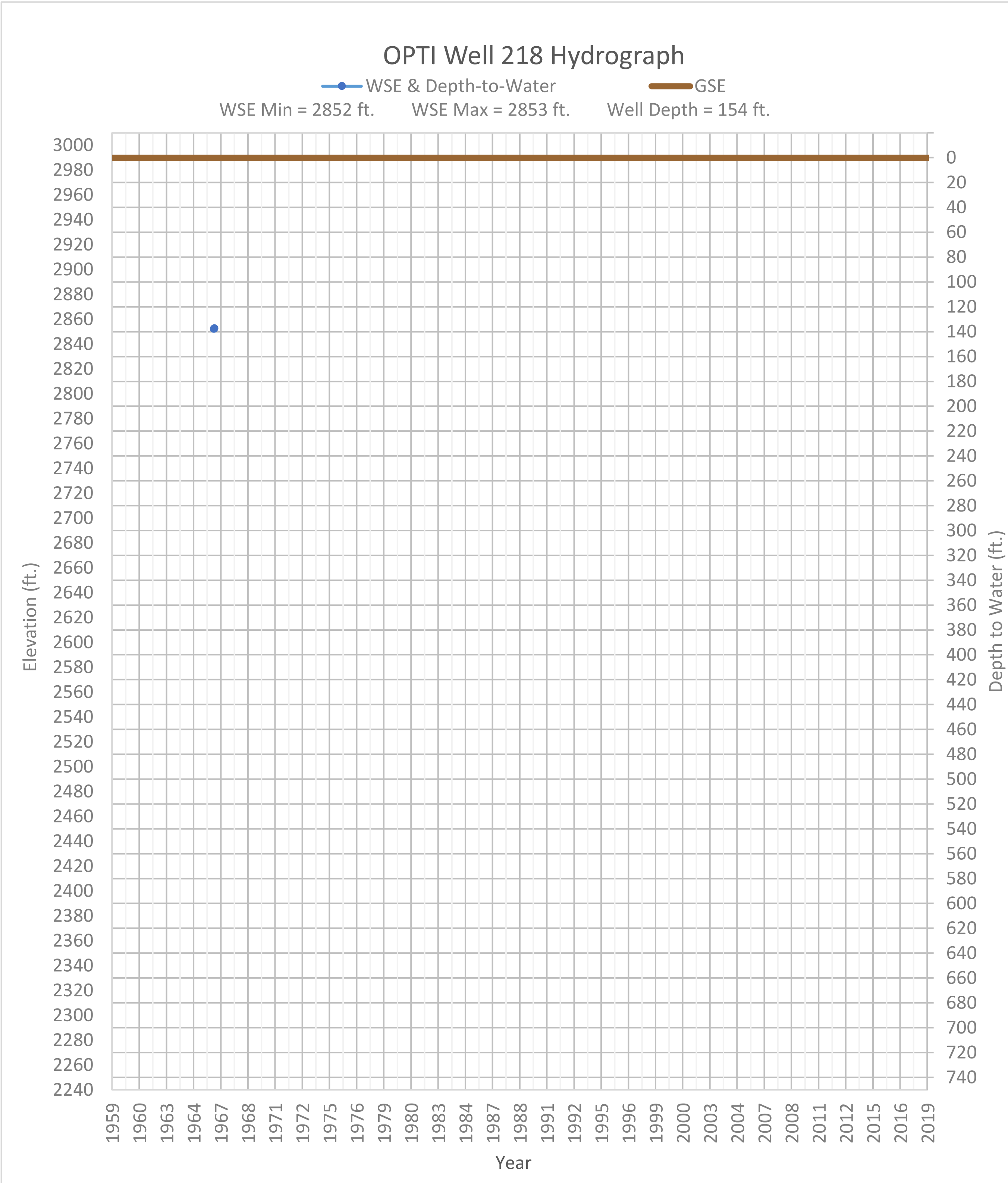
OPTI Well 214 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2873 ft.
WSE Max = 2879 ft.
Well Depth = 229 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 215 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2899 ft.
WSE Max = 2917 ft.
Well Depth = 156 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 216 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2895 ft.
WSE Max = 2901 ft.
Well Depth = 360 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 218 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2852 ft.
WSE Max = 2853 ft.
Well Depth = 154 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3000
2980
2960
2940
2920
2900
2880
2860
2840
2820
2800
2780
2760
2740
2720
2700
2680
2660
2640
2620
2600
2580
2560
2540
2520
2500
2480
2460
2440
2420
2400
2380
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2340
2320
2300
2280
2260
2240
0
20
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160
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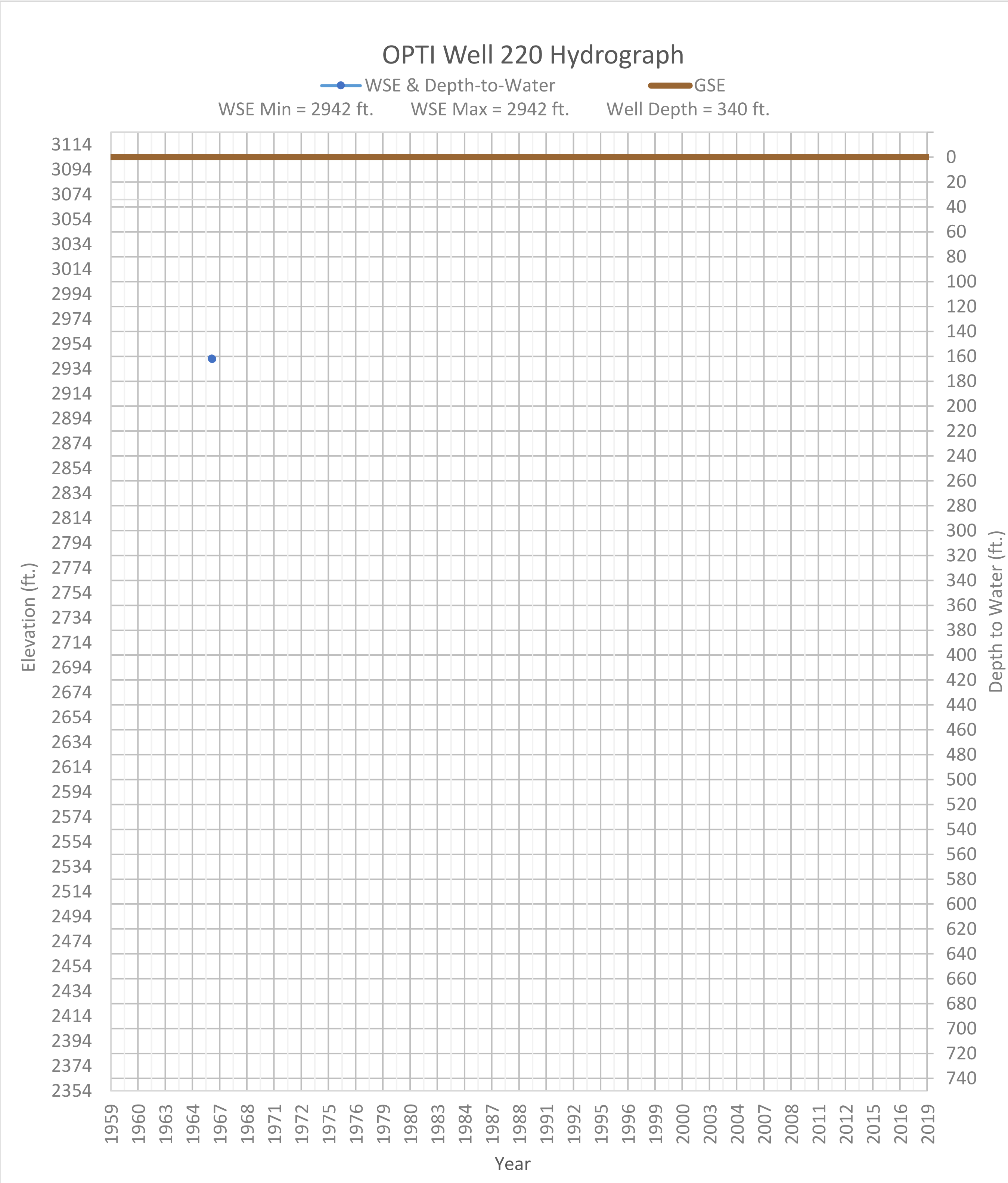

OPTI Well 220 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2942 ft.
WSE Max = 2942 ft.
Well Depth = 340 ft.
Elevation (ft.)
3114
3094
3074
3054
3034
3014
2994
2974
2954
2934
2914
2894
2874
2854
2834
2814
2794
2774
2754
2734
2714
2694
2674
2654
2634
2614
2594
2574
2554
2534
2514
2494
2474
2454
2434
2414
2394
2374
2354
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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Year
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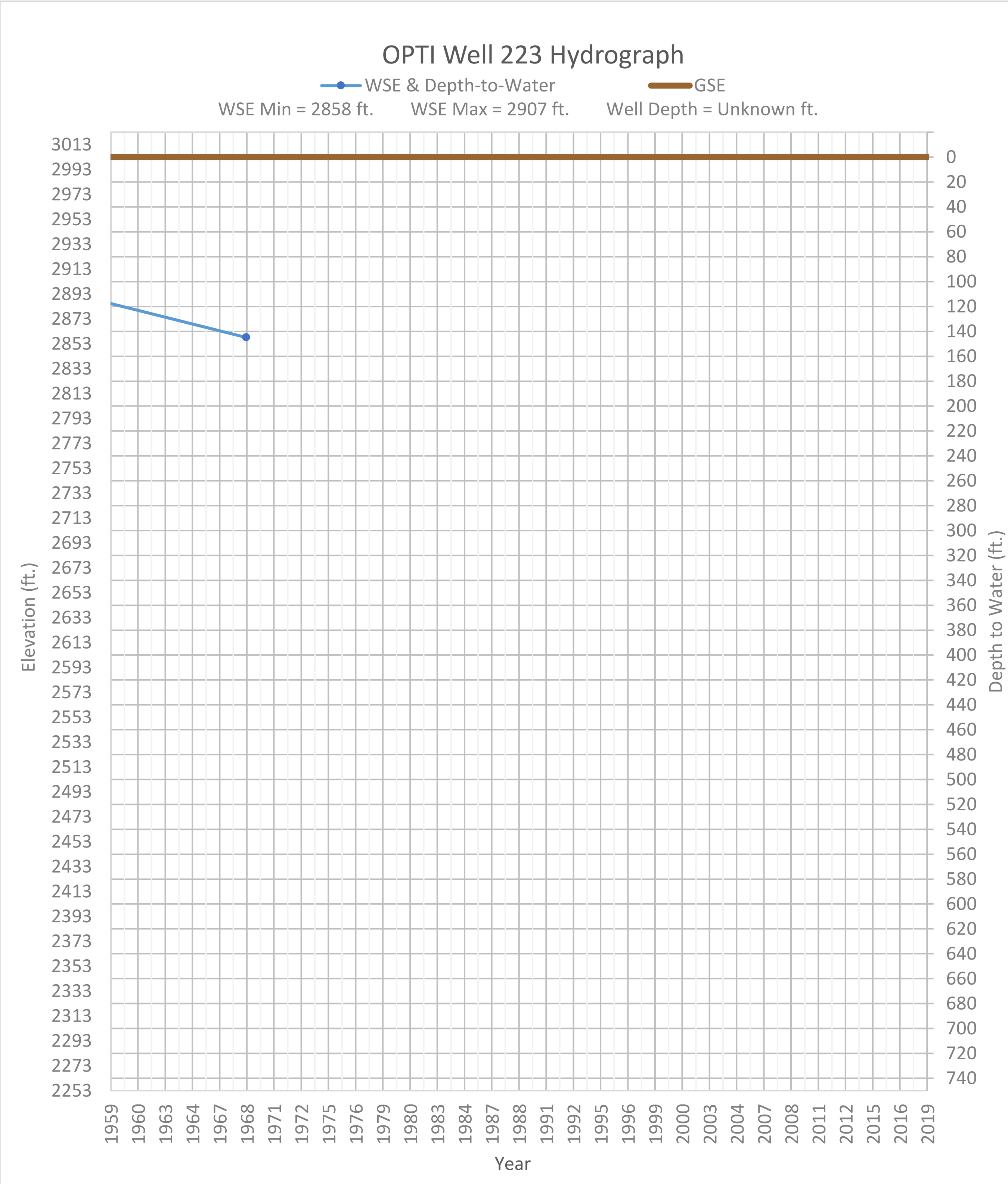
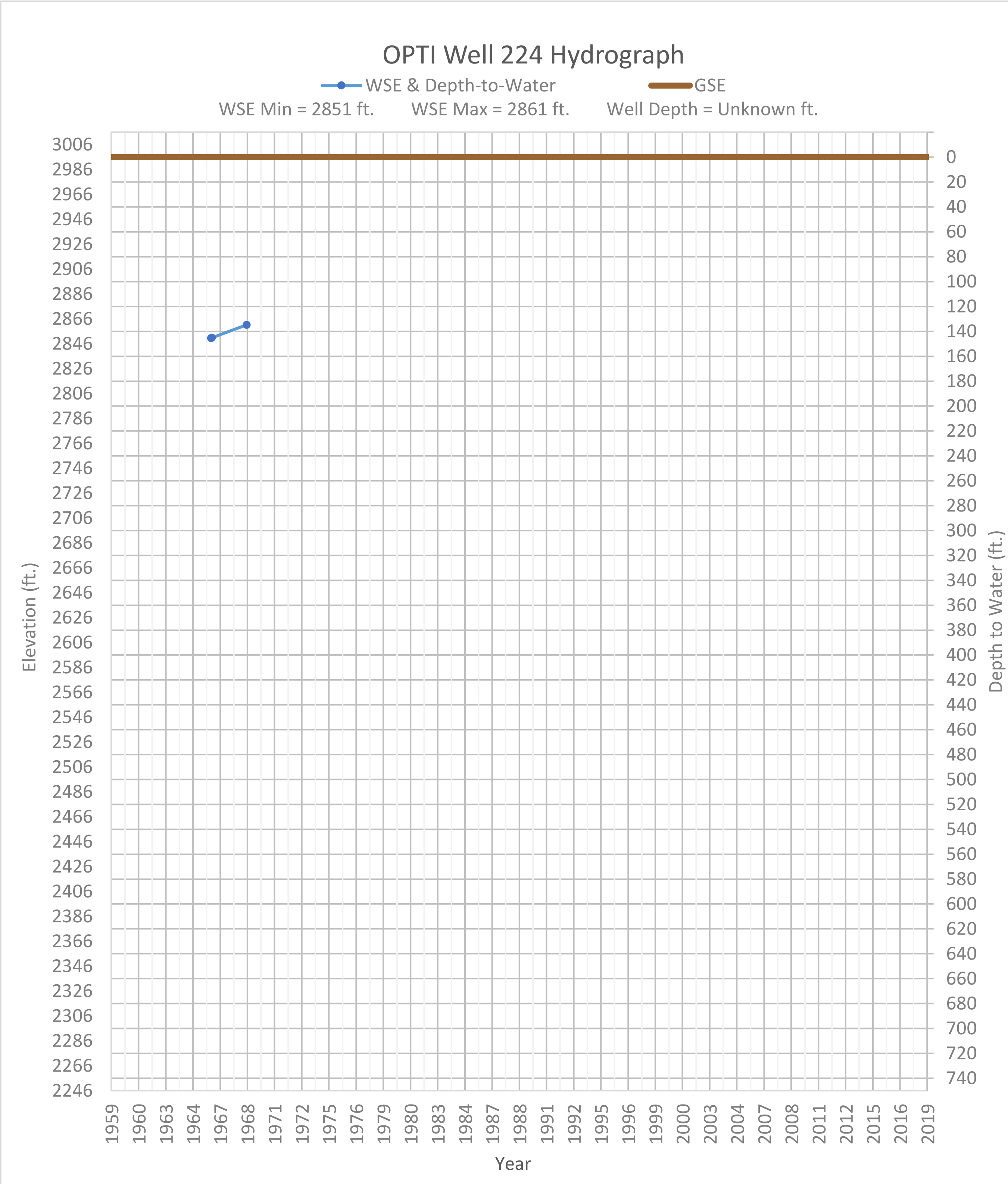


OPTI Well 223 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2858 ft.
WSE Max = 2907 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 224 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2851 ft.
WSE Max = 2861 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3006
2986
2966
2946
2926
2906
2886
2866
2846
2826
2806
2786
2766
2746
2726
2706
2686
2666
2646
2626
2606
2586
2566
2546
2526
2506
2486
2466
2446
2426
2406
2386
2366
2346
2326
2306
2286
2266
2246
0
20
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60
80
100
120
140
160
180
200
220
240
260
280
300
320
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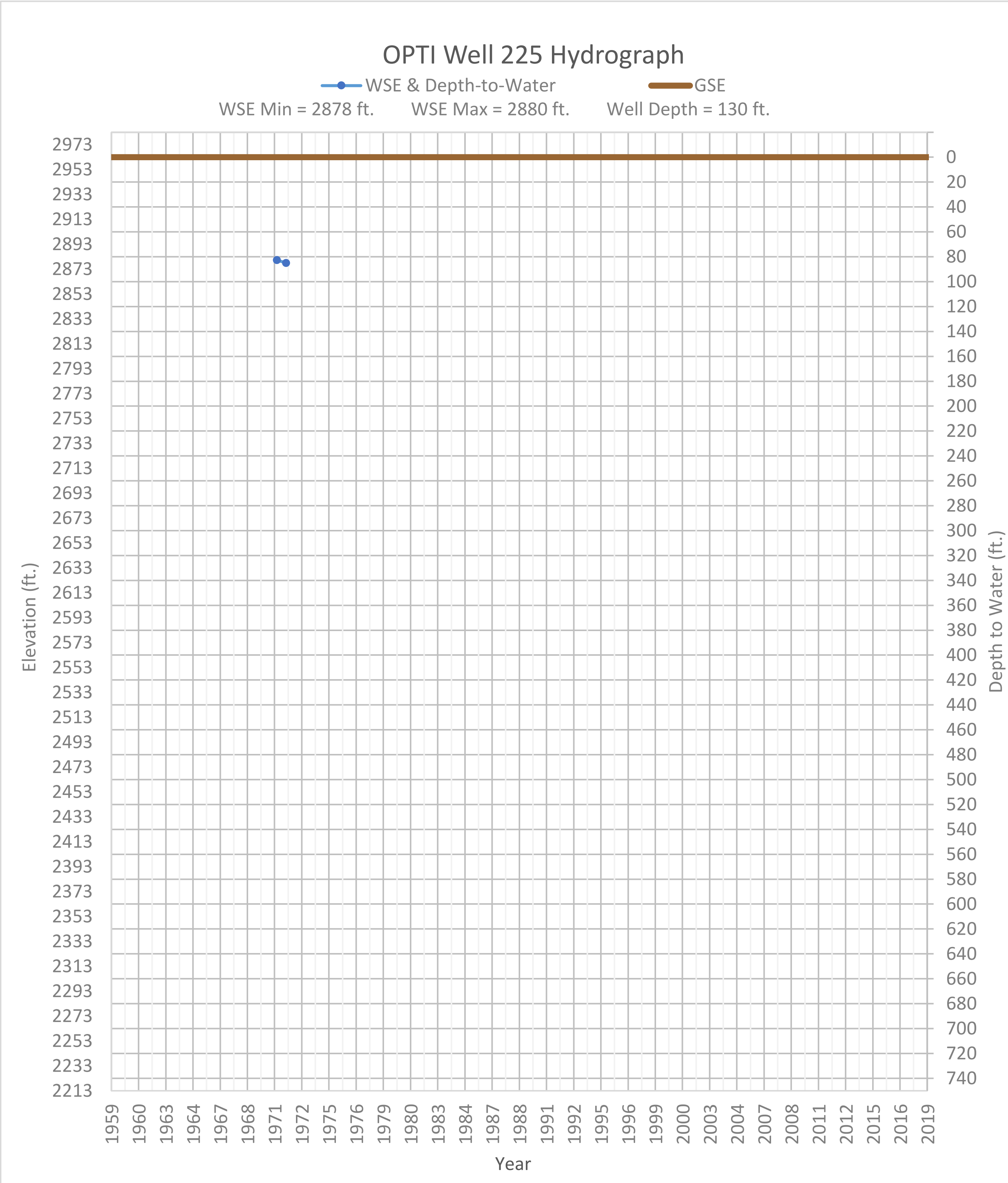
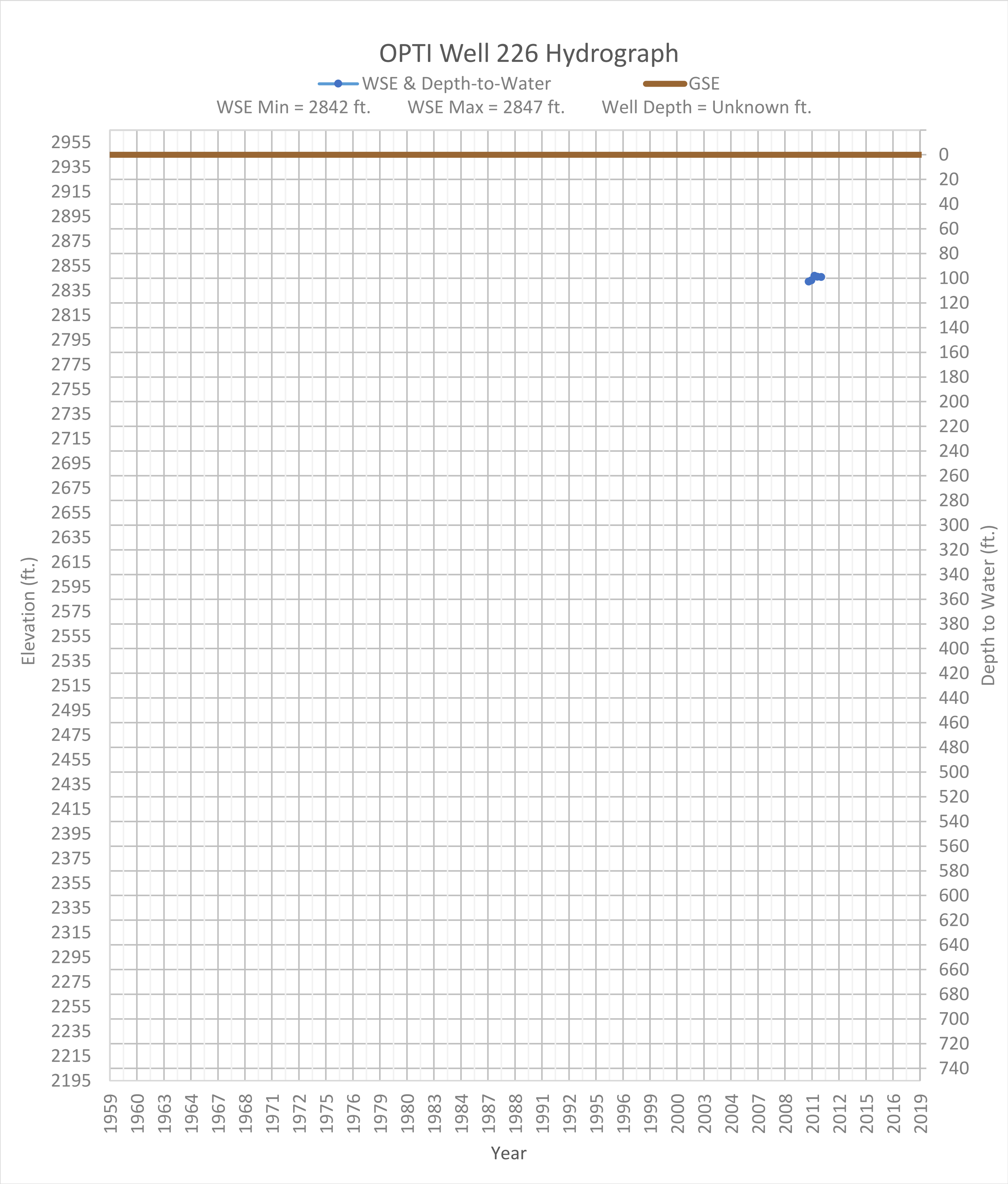
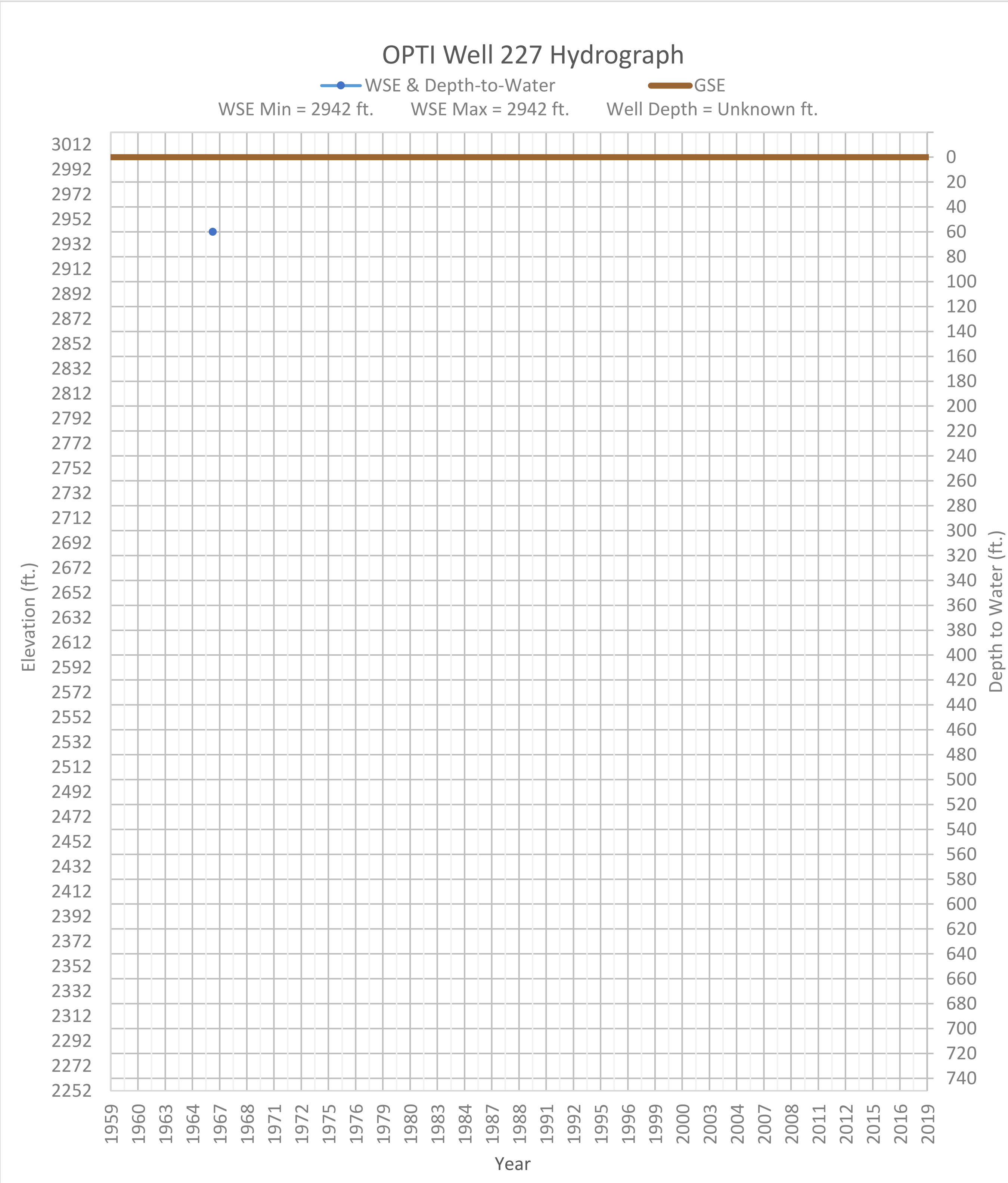
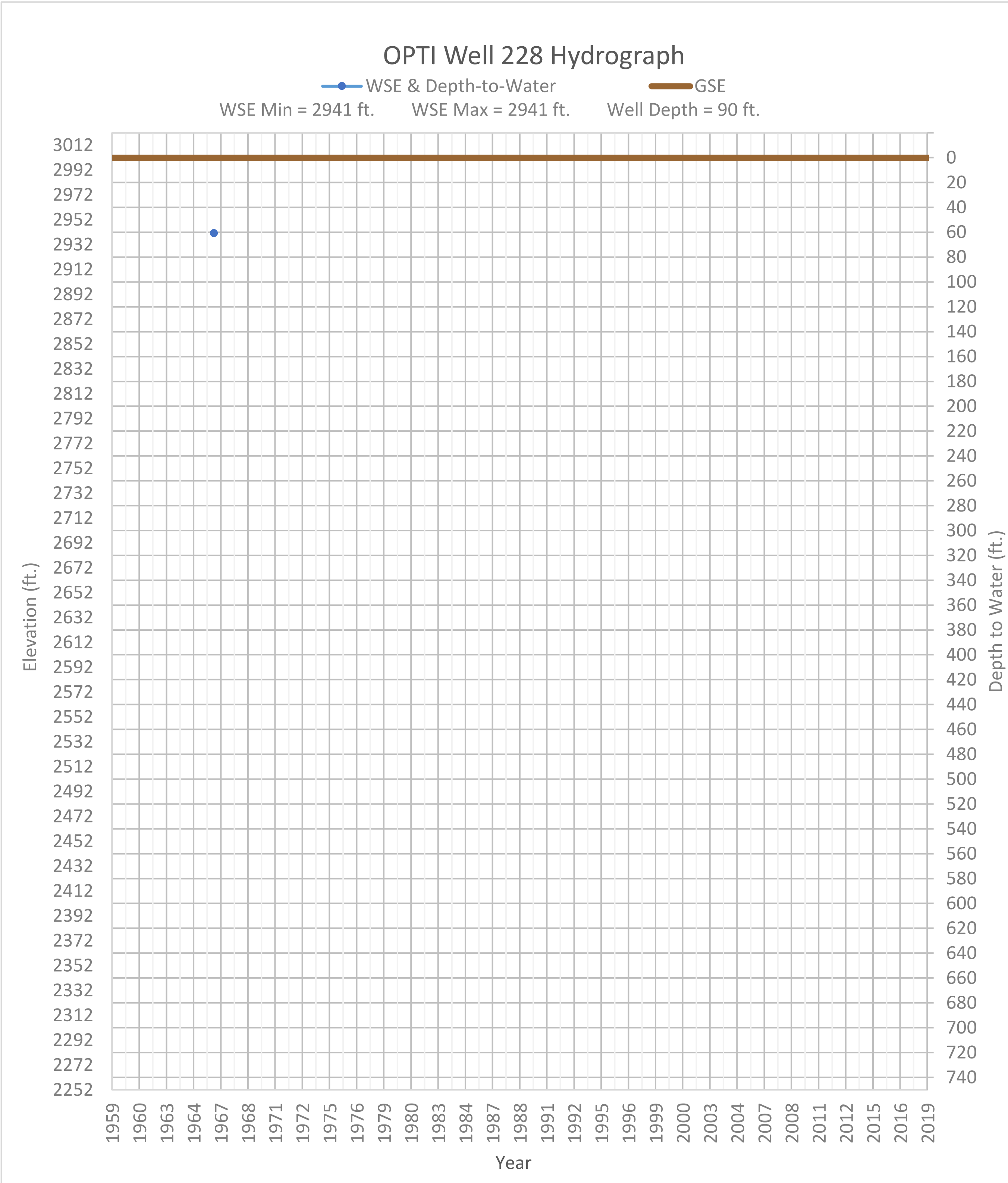


OPTI Well 225 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2878 ft.
WSE Max = 2880 ft.
Well Depth = 130 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 226 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2842 ft.
WSE Max = 2847 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 227 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2942 ft.
WSE Max = 2942 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 228 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2941 ft.
WSE Max = 2941 ft.
Well Depth = 90 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3012
2992
2972
2952
2932
2912
2892
2872
2852
2832
2812
2792
2772
2752
2732
2712
2692
2672
2652
2632
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2572
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2532
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2492
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2452
2432
2412
2392
2372
2352
2332
2312
2292
2272
2252
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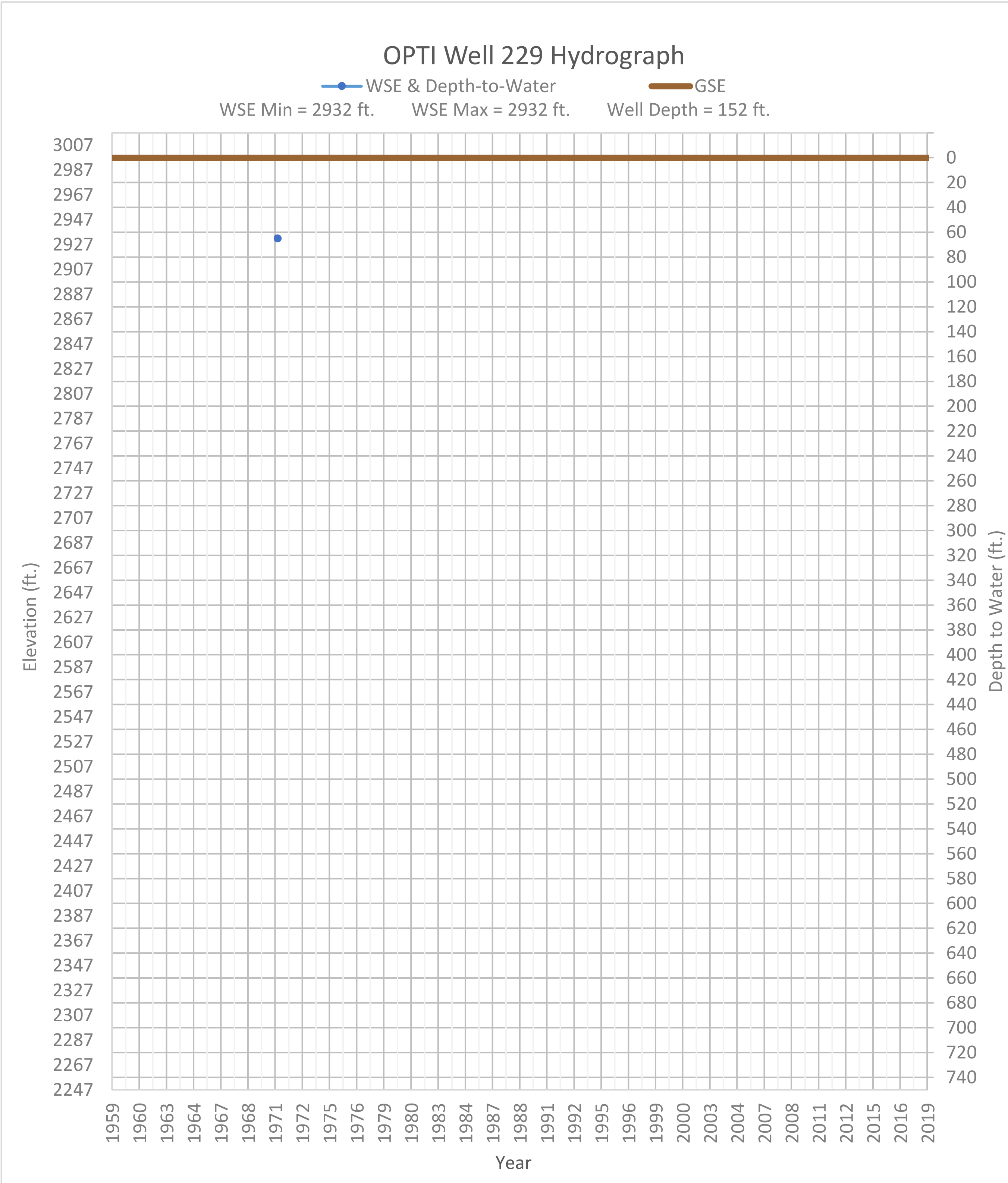
OPTI Well 229 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2932 ft.
WSE Max = 2932 ft.
Well Depth = 152 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3007
2987
2967
2947
2927
2907
2887
2867
2847
2827
2807
2787
2767
2747
2727
2707
2687
2667
2647
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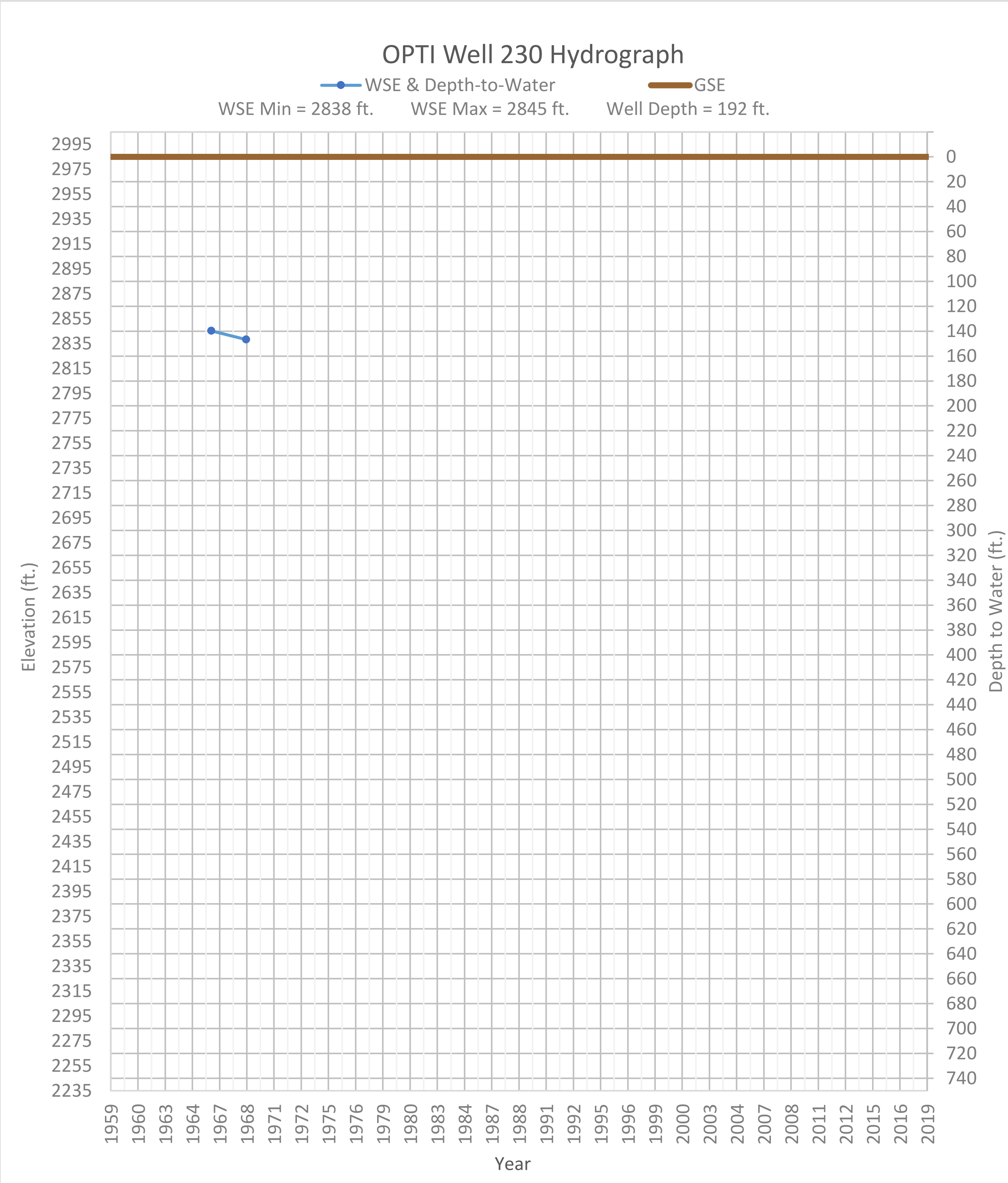
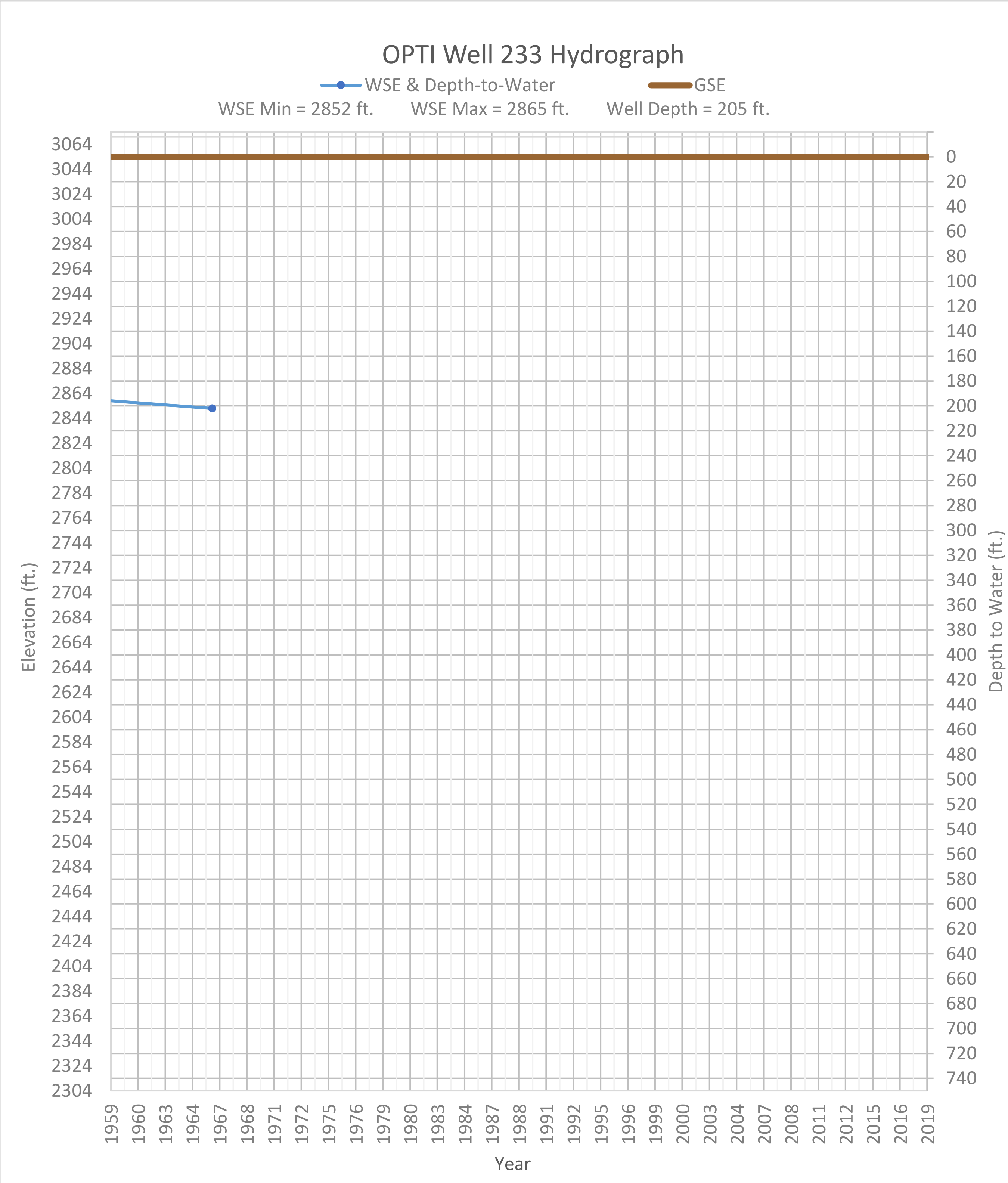
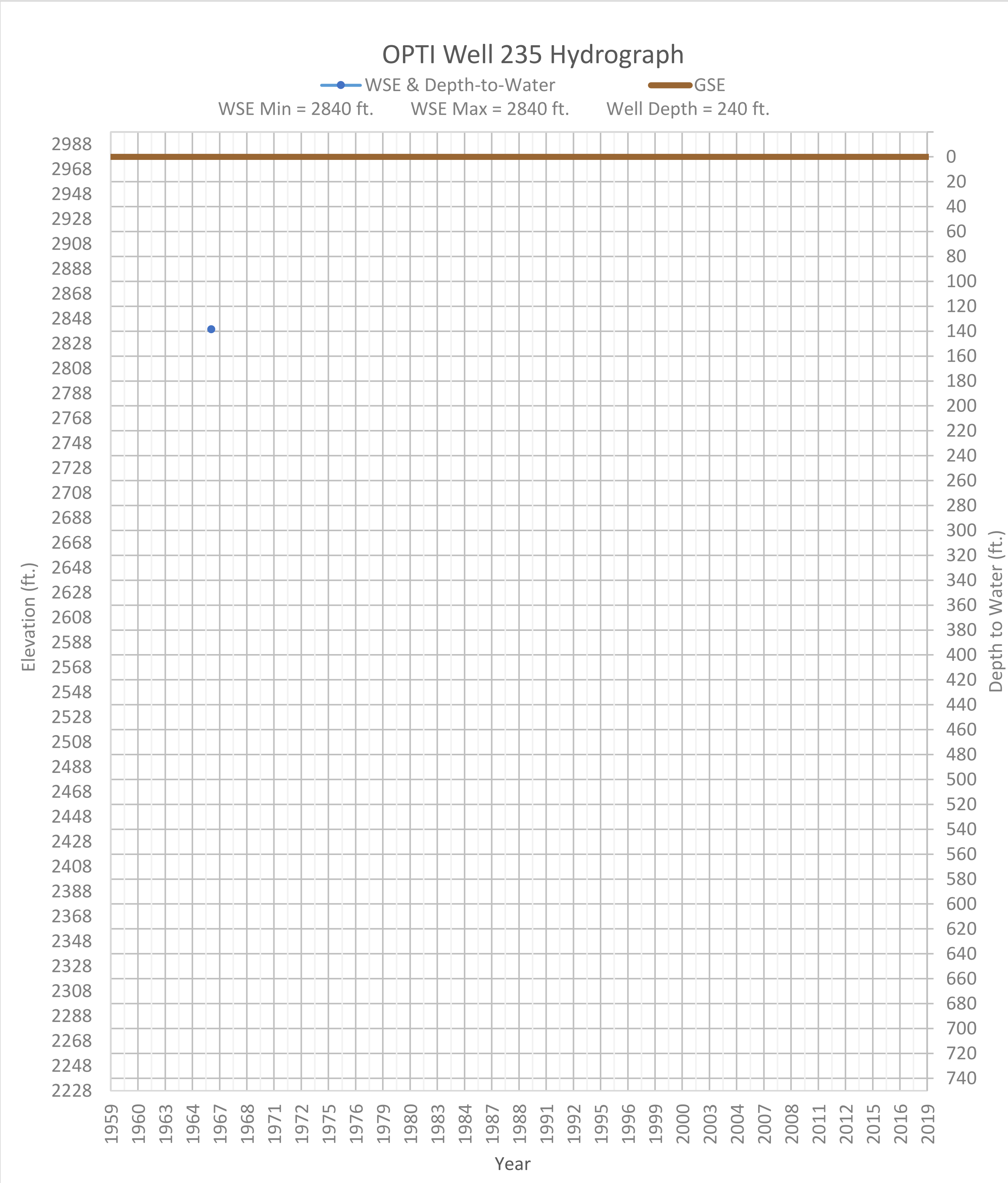
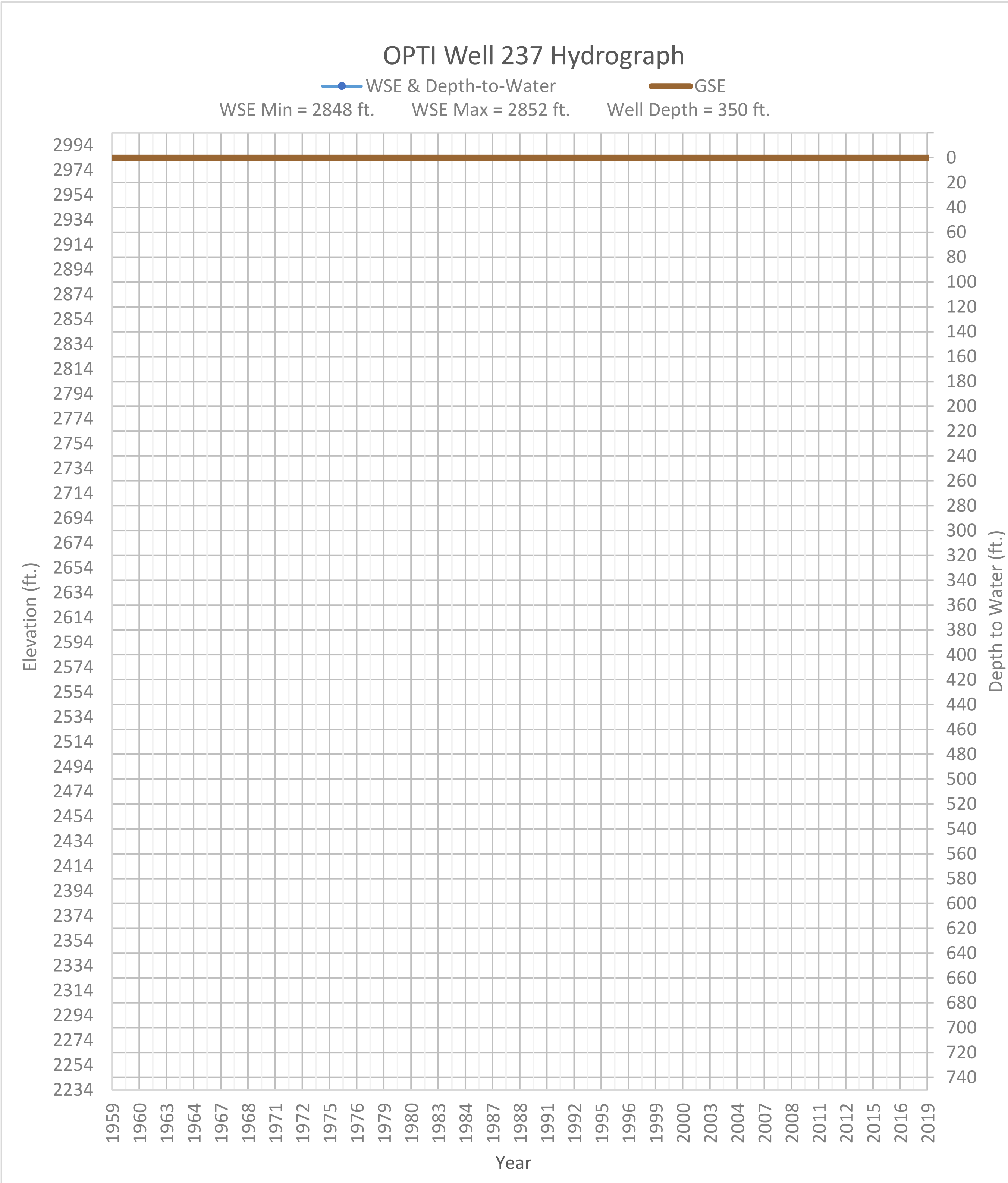

OPTI Well 230 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2838 ft.
WSE Max = 2845 ft.
Well Depth = 192 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

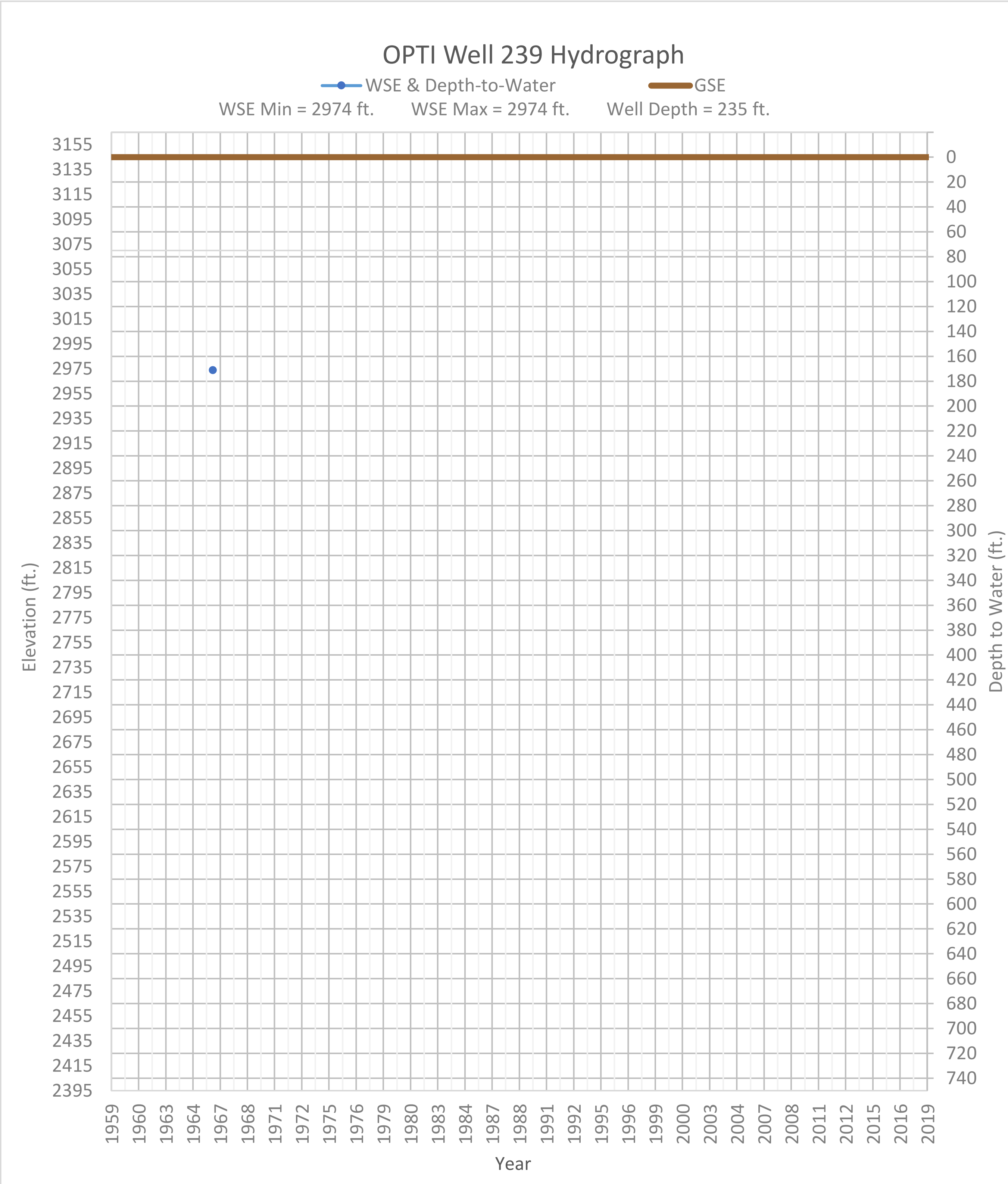


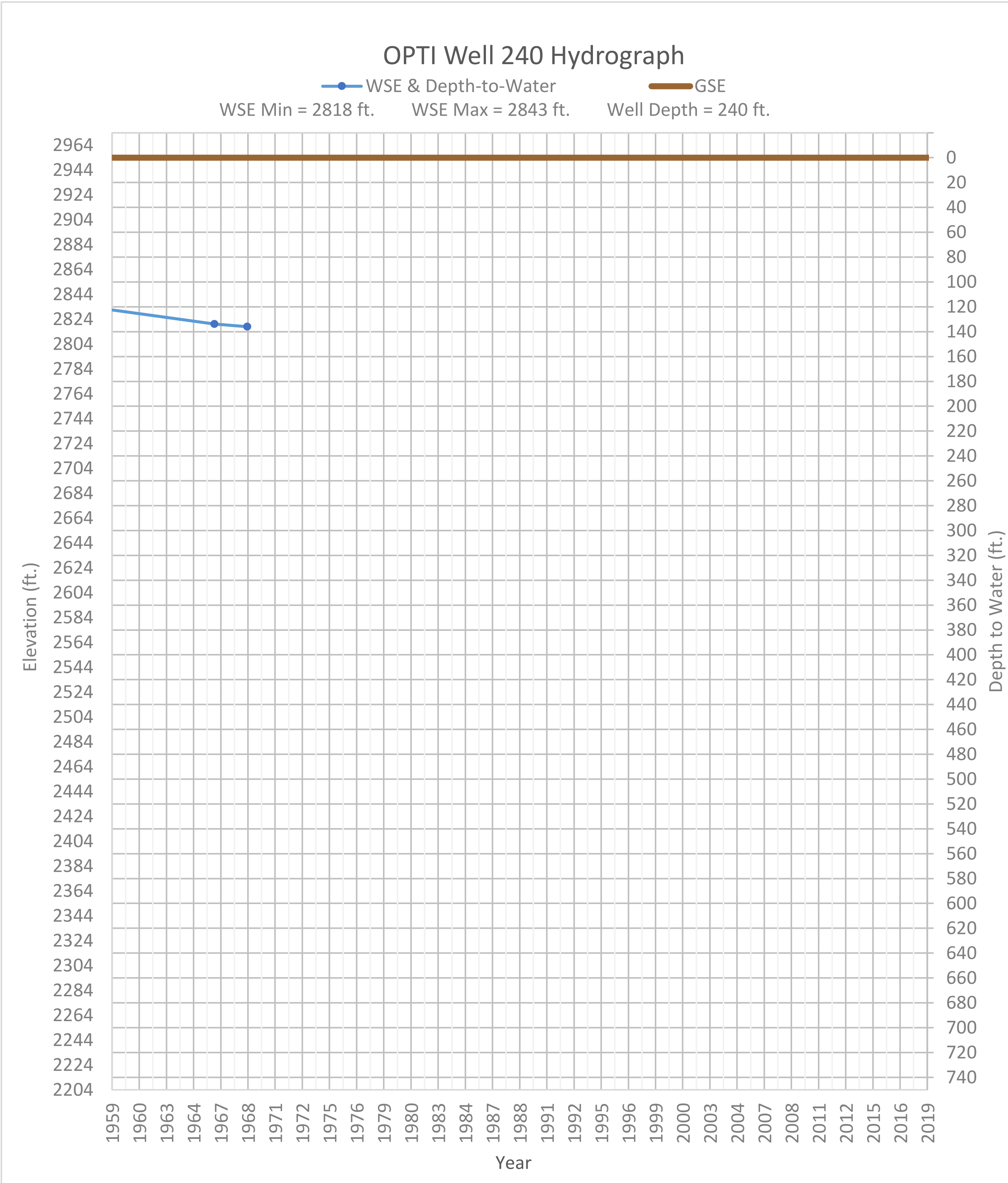
OPTI Well 233 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2852 ft.
WSE Max = 2865 ft.
Well Depth = 205 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 235 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2840 ft.
WSE Max = 2840 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 237 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2848 ft.
WSE Max = 2852 ft.
Well Depth = 350 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 239 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2974 ft.
WSE Max = 2974 ft.
Well Depth = 235 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 240 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2818 ft.
WSE Max = 2843 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2964
2944
2924
2904
2884
2864
2844
2824
2804
2784
2764
2744
2724
2704
2684
2664
2644
2624
2604
2584
2564
2544
2524
2504
2484
2464
2444
2424
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
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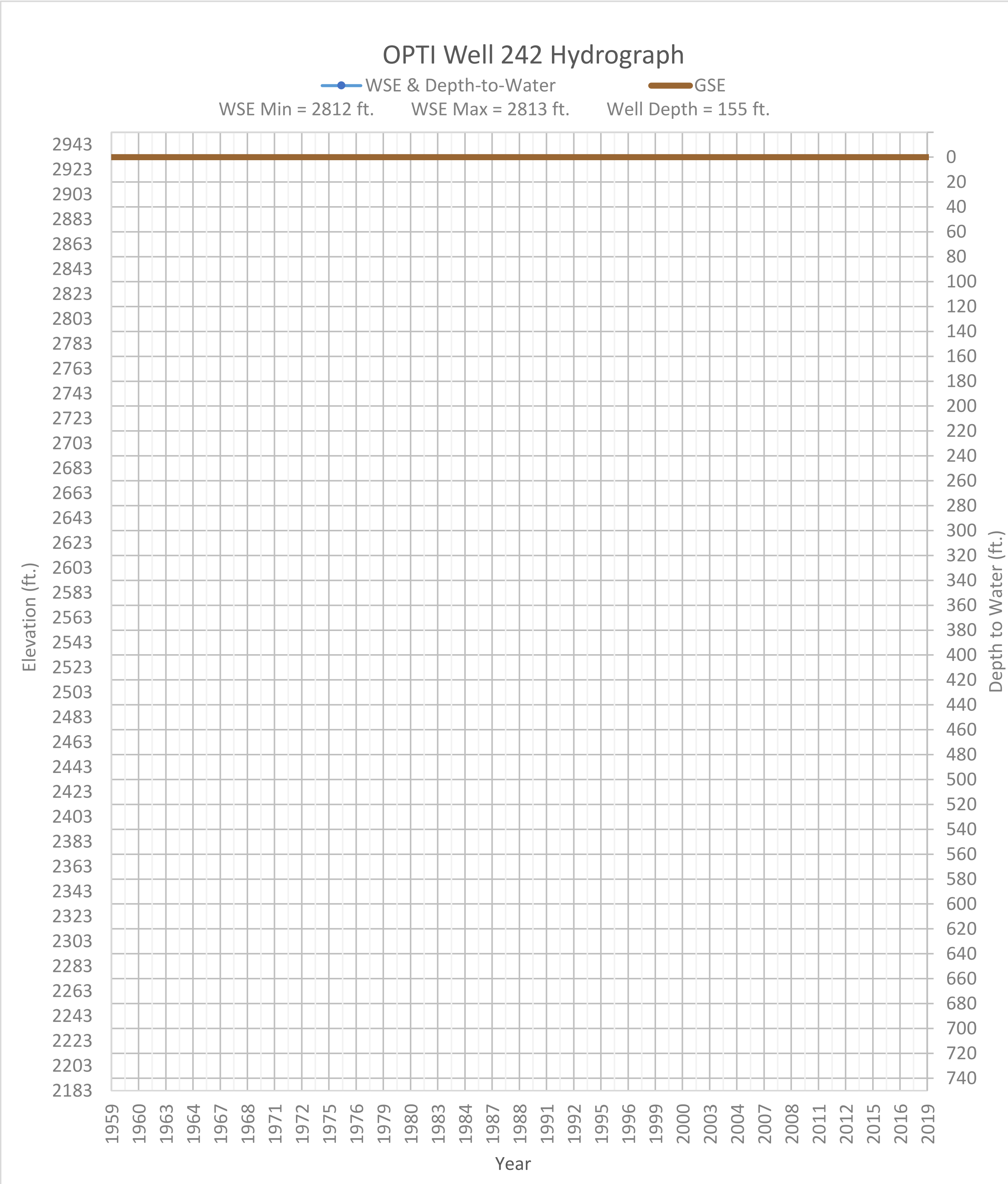
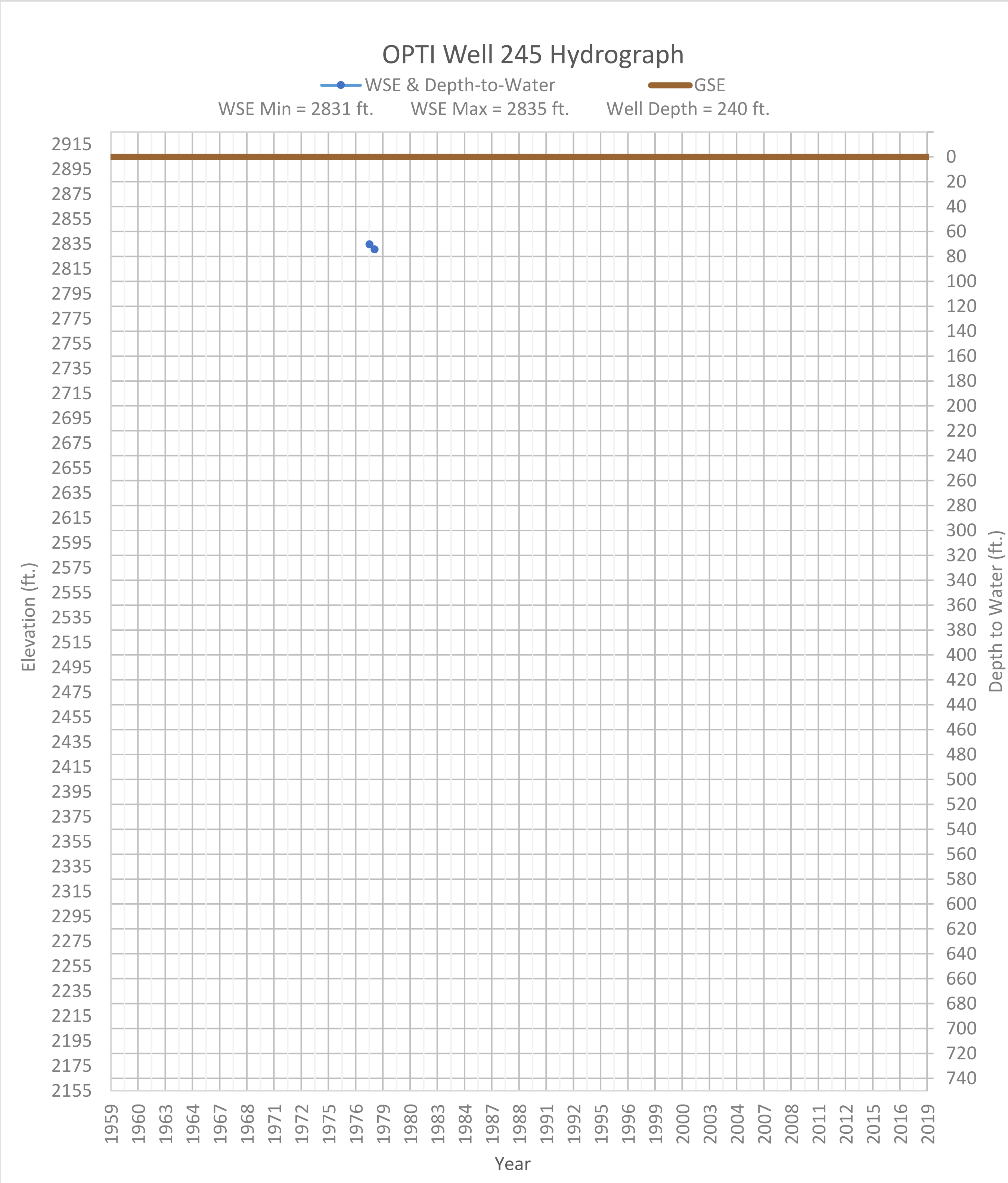
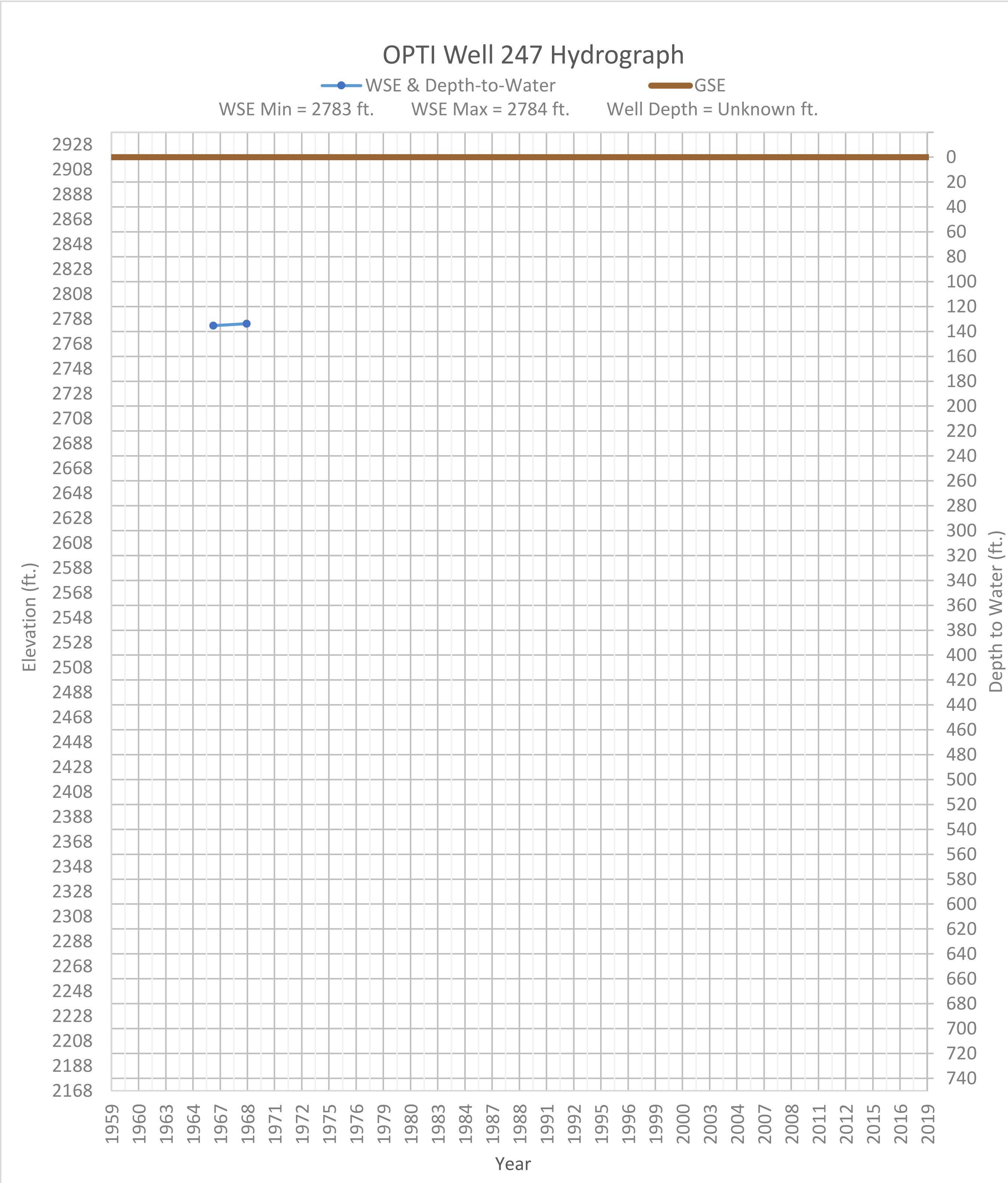
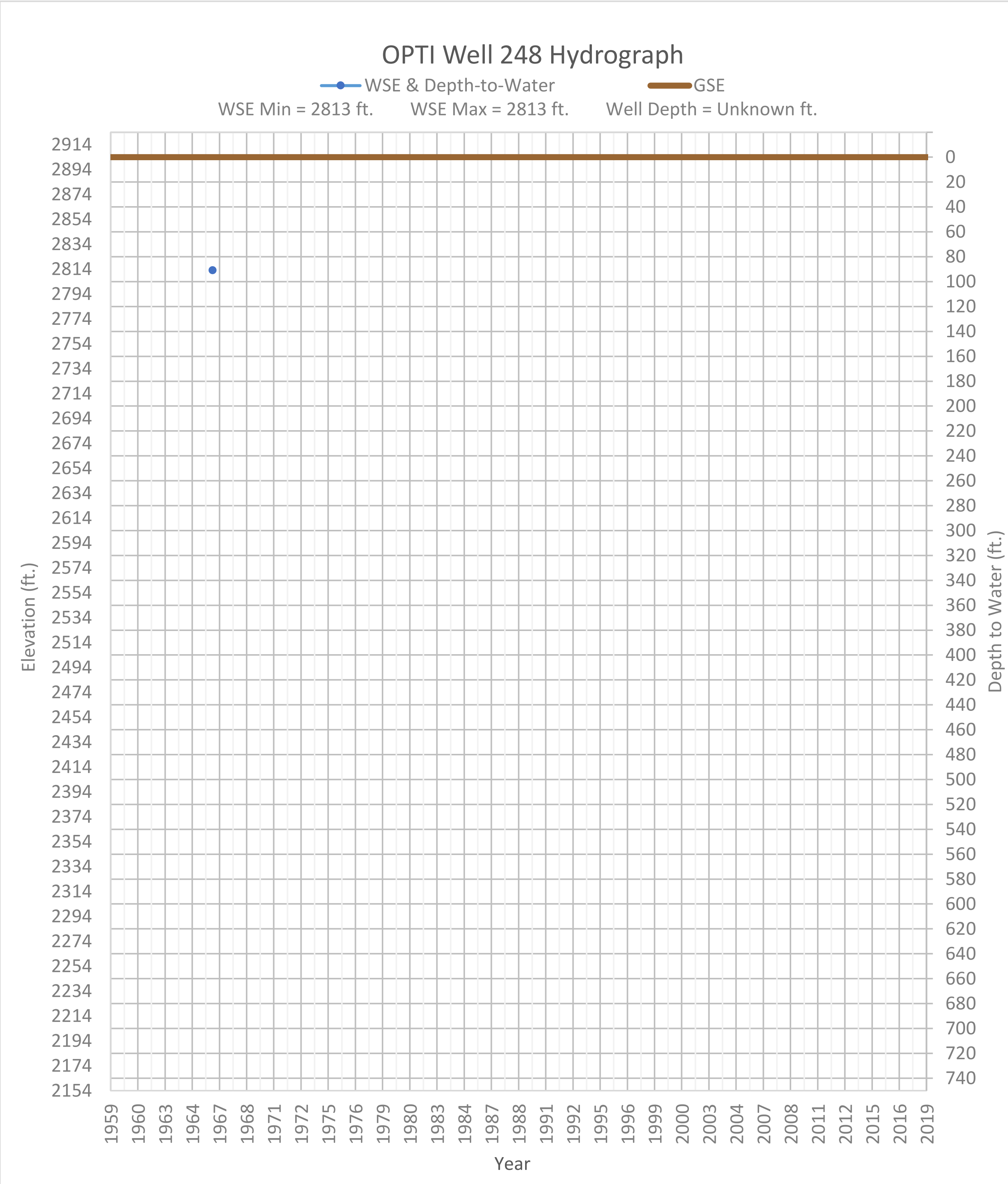
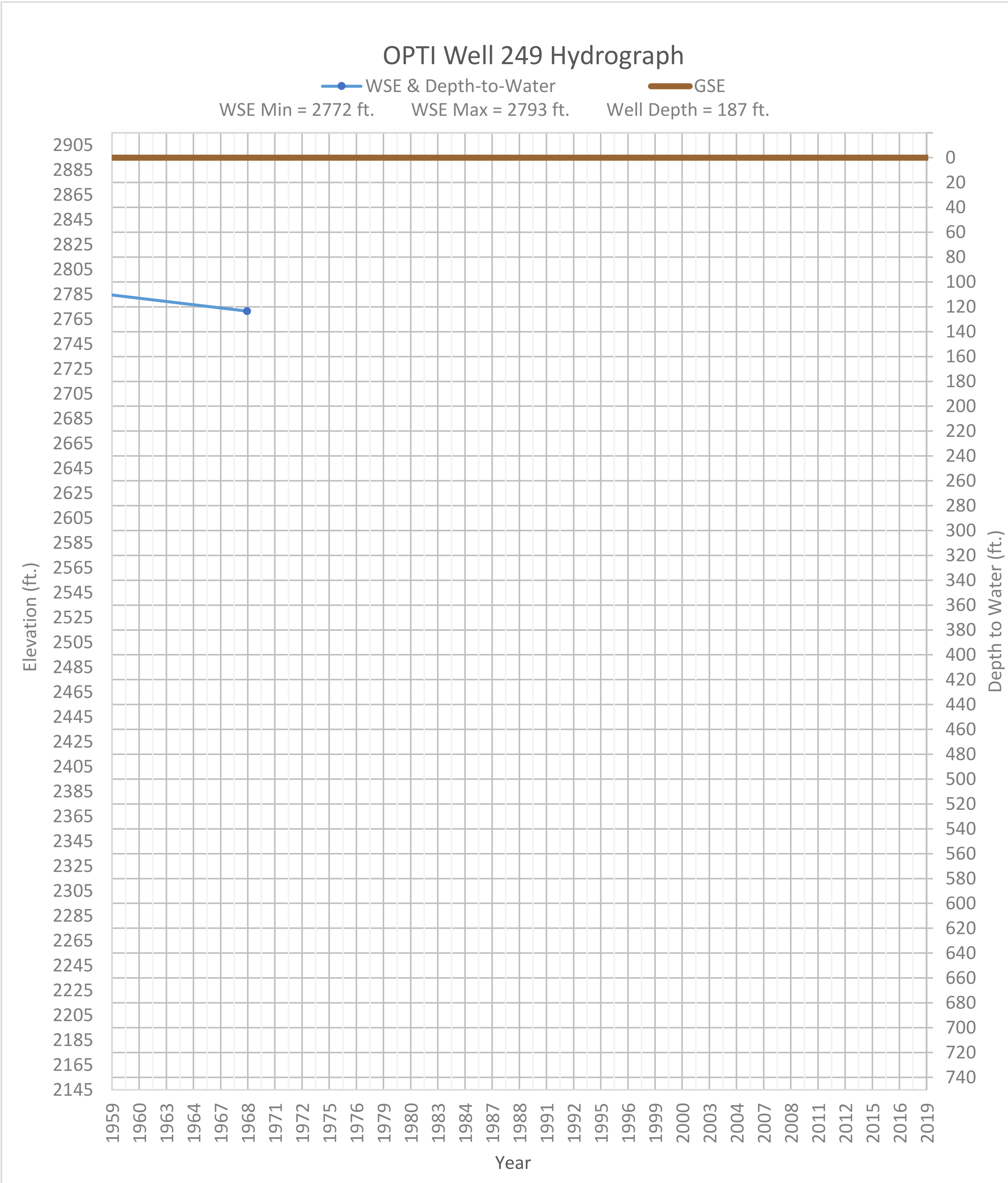

OPTI Well 242 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2812 ft.
WSE Max = 2813 ft.
Well Depth = 155 ft.
Elevation (ft.)
2943 2923 2903 2883 2863 2843 2823 2803 2783 2763 2743 2723 2703 2683 2663 2643 2623 2603 2583 2563 2543 2523 2503 2483 2463 2443 2423 2403 2383 2363 2343 2323 2303 2283 2263 2243 2223 2203 2183
Depth to Water (ft.)
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740
Year
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019


OPTI Well 245 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2831 ft.
WSE Max = 2835 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

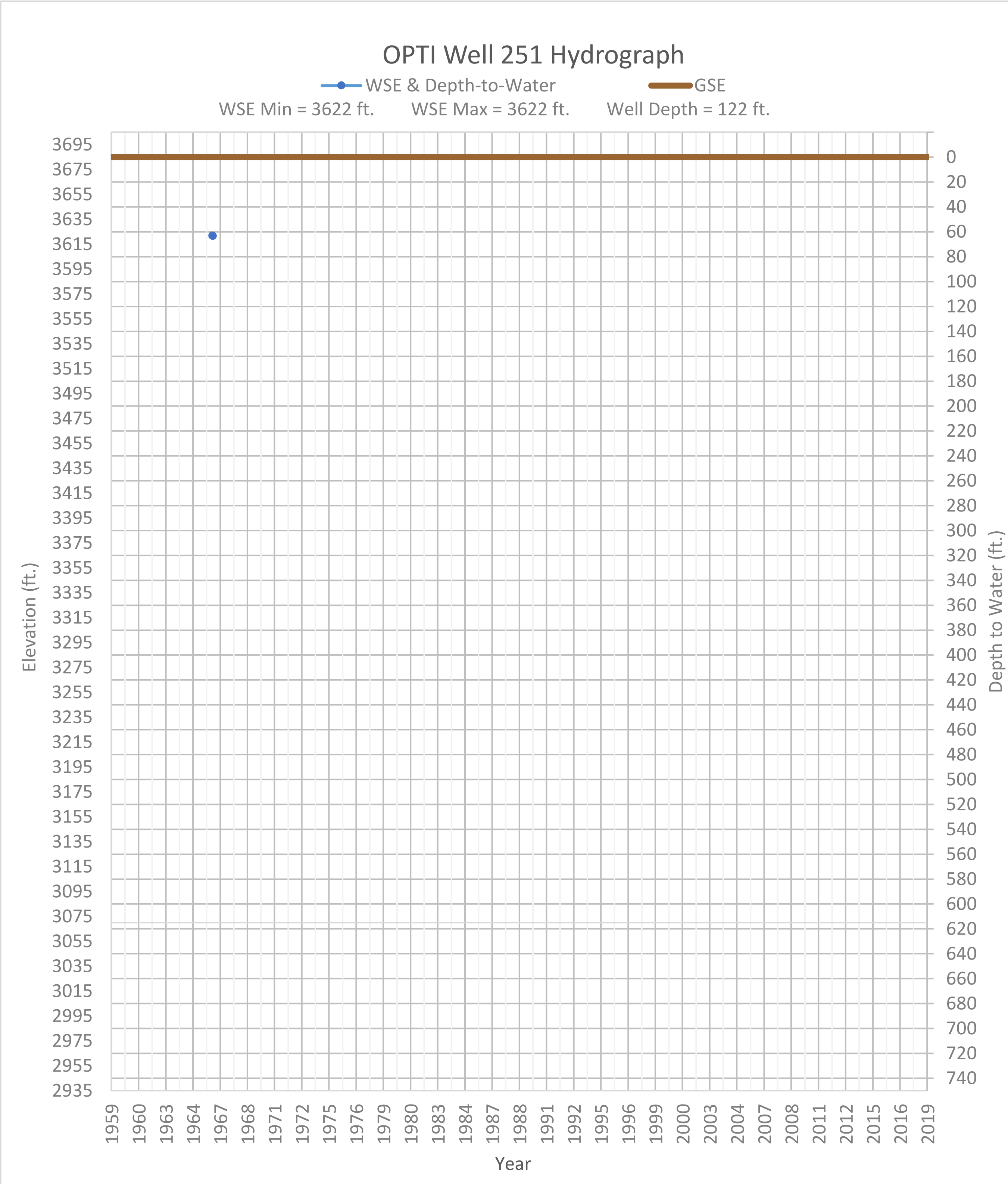


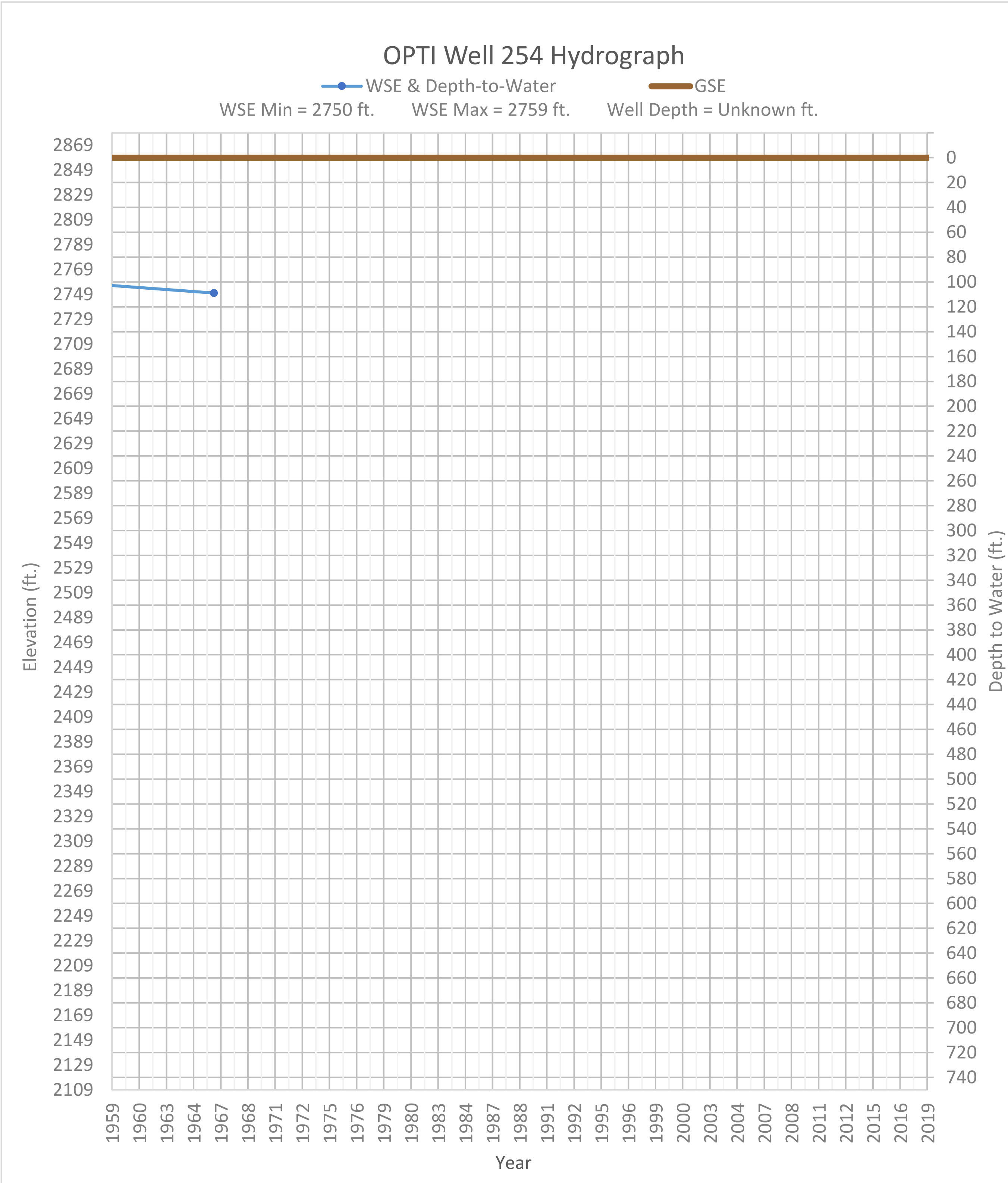
OPTI Well 247 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2783 ft.
WSE Max = 2784 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 248 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2813 ft.
WSE Max = 2813 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 249 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2772 ft.
WSE Max = 2793 ft.
Well Depth = 187 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 251 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3622 ft.
WSE Max = 3622 ft.
Well Depth = 122 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 254 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2750 ft.
WSE Max = 2759 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2869
2849
2829
2809
2789
2769
2749
2729
2709
2689
2669
2649
2629
2609
2589
2569
2549
2529
2509
2489
2469
2449
2429
2409
2389
2369
2349
2329
2309
2289
2269
2249
2229
2209
2189
2169
2149
2129
2109
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
520
540
560
580
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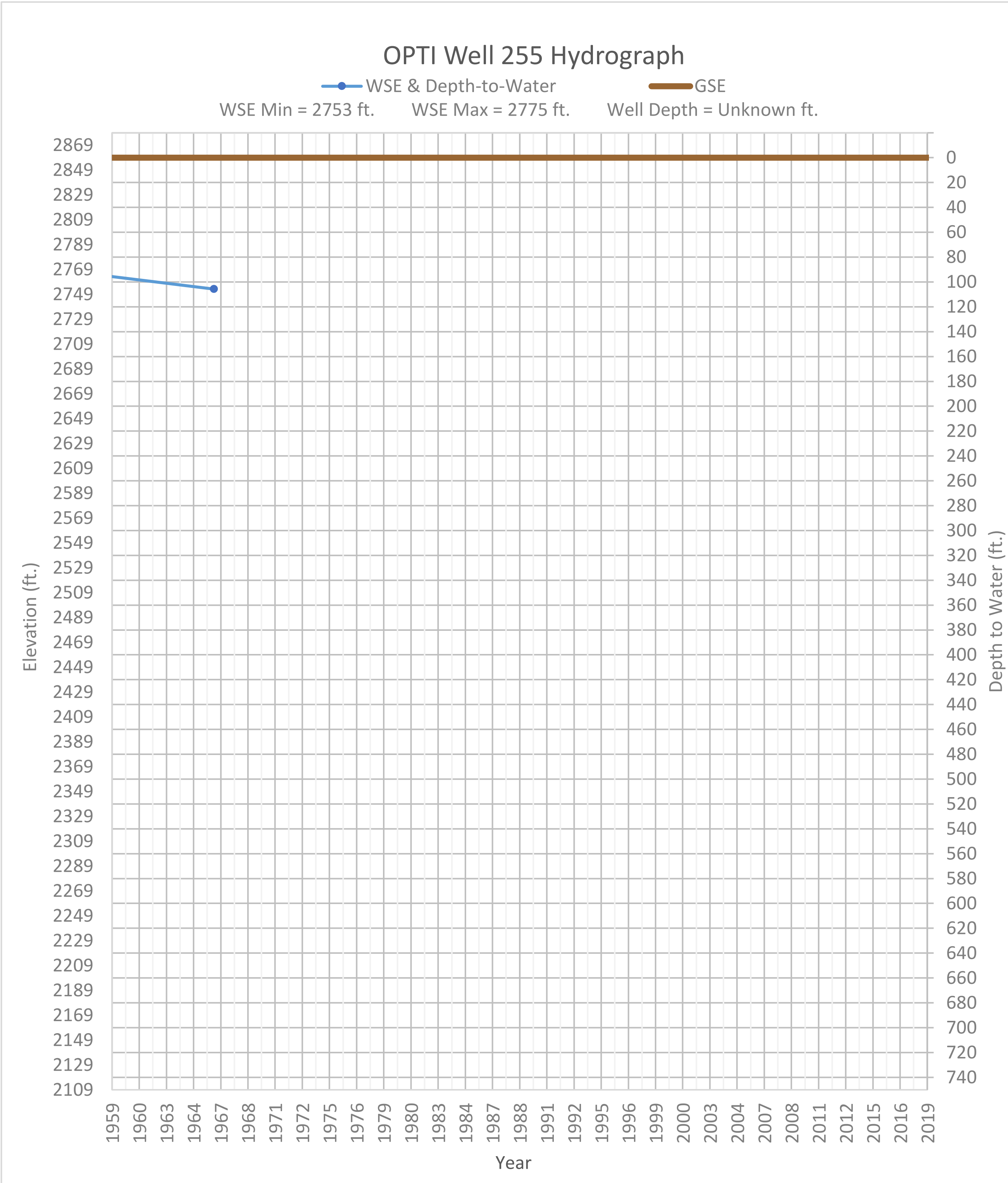
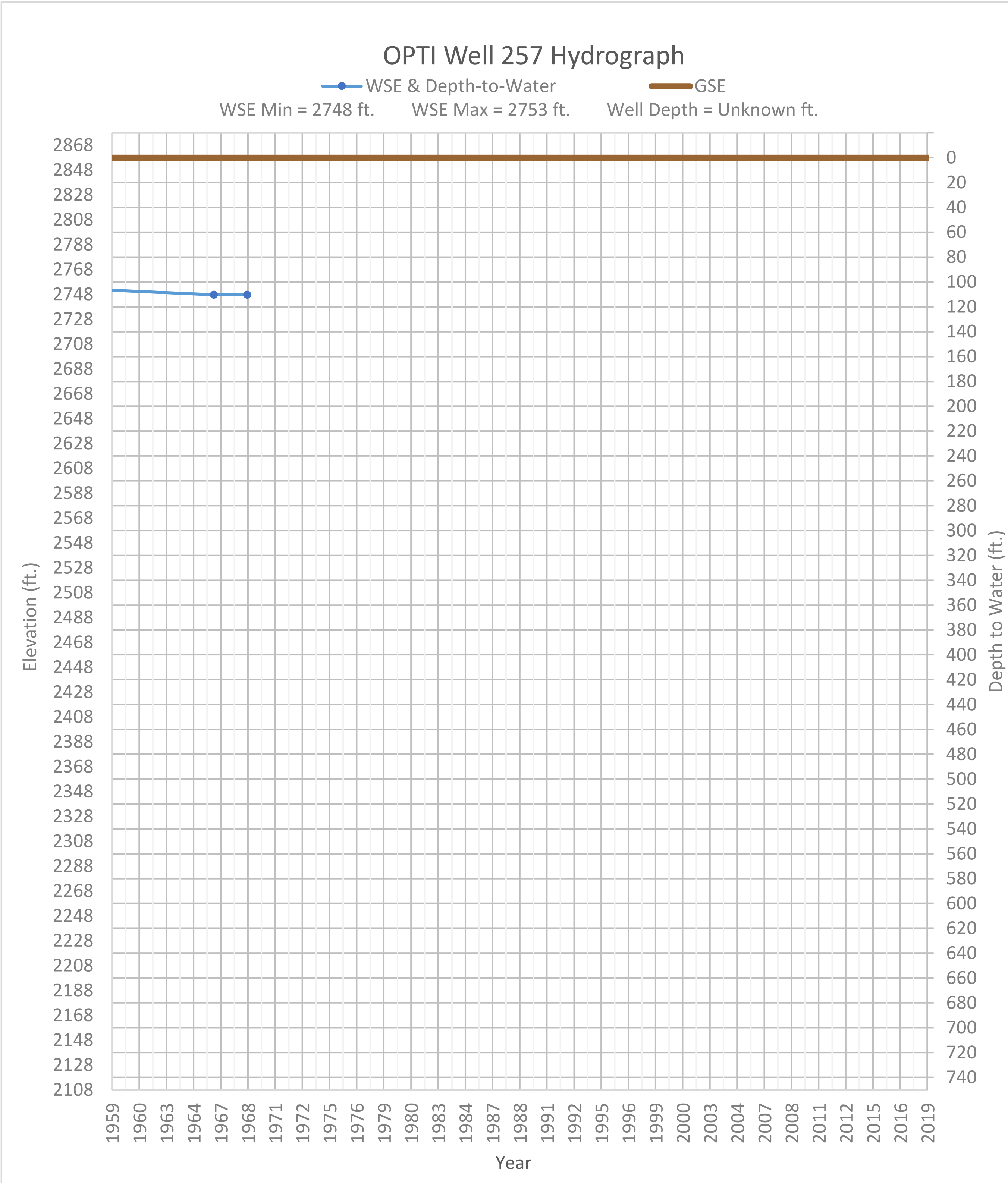
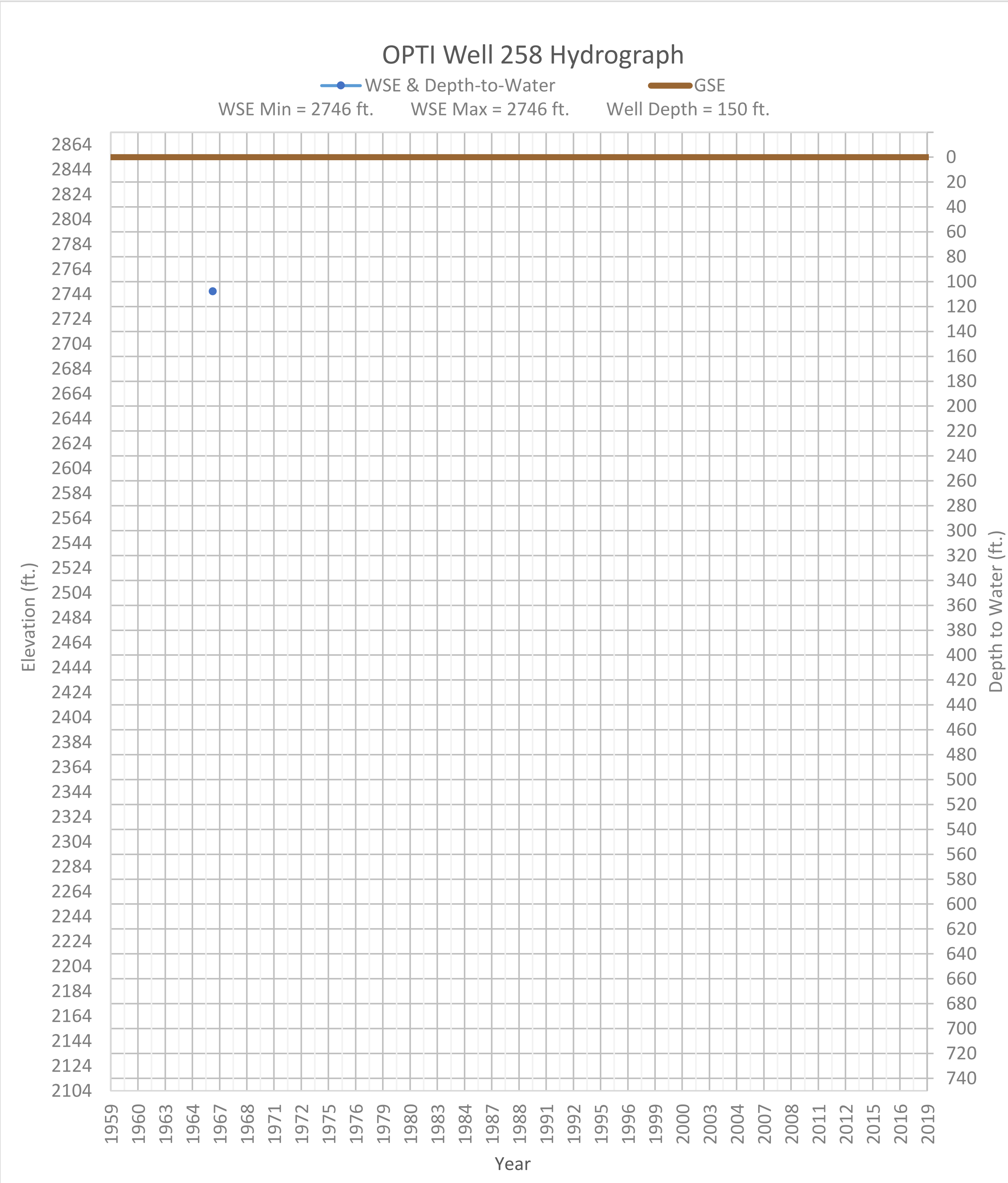


OPTI Well 255 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2753 ft.
WSE Max = 2775 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 257 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2748 ft.
WSE Max = 2753 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 258 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2746 ft.
WSE Max = 2746 ft.
Well Depth = 150 ft.
Elevation (ft.)
2864
2844
2824
2804
2784
2764
2744
2724
2704
2684
2664
2644
2624
2604
2584
2564
2544
2524
2504
2484
2464
2444
2424
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
520
540
560
580
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640
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680
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1959
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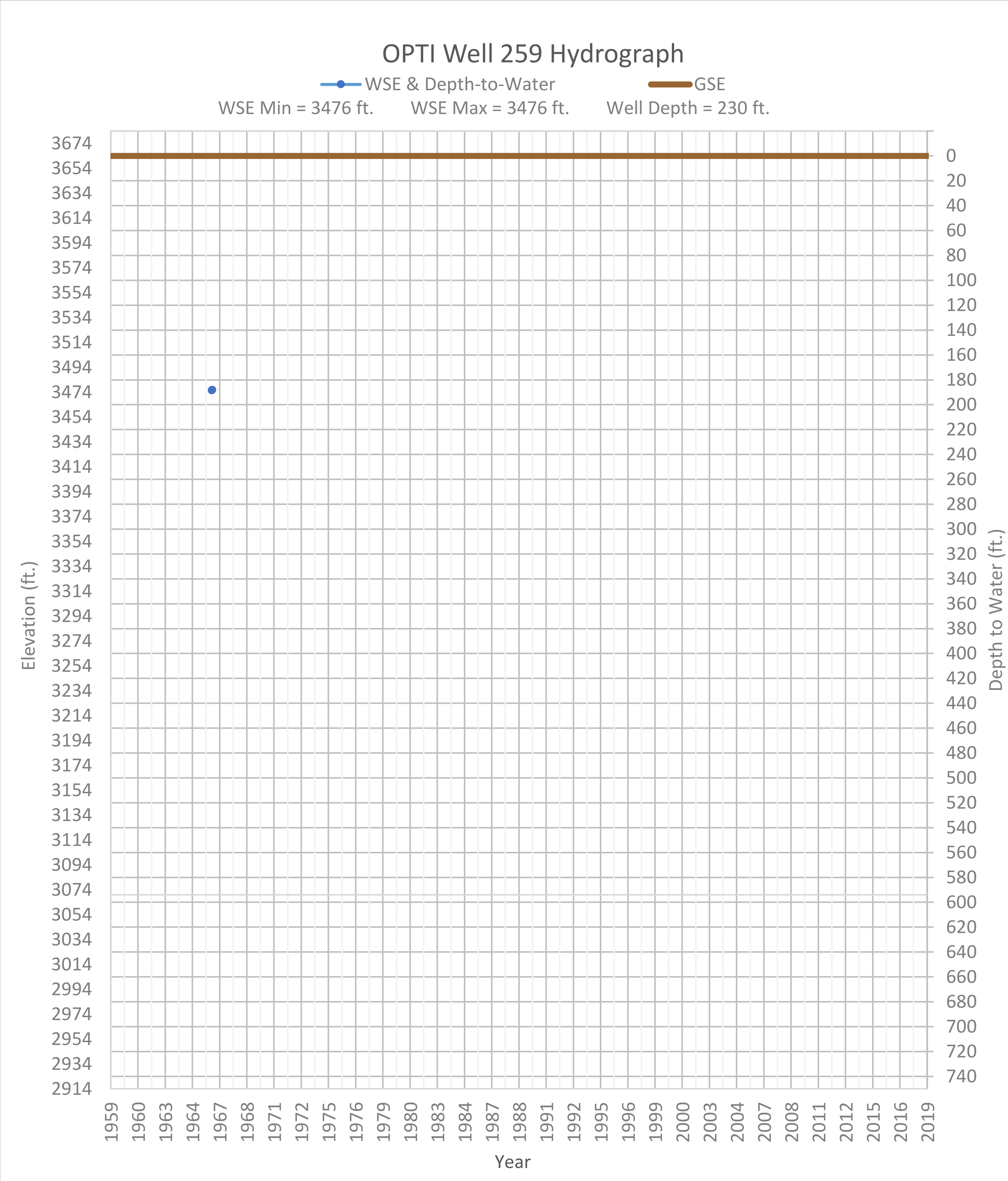
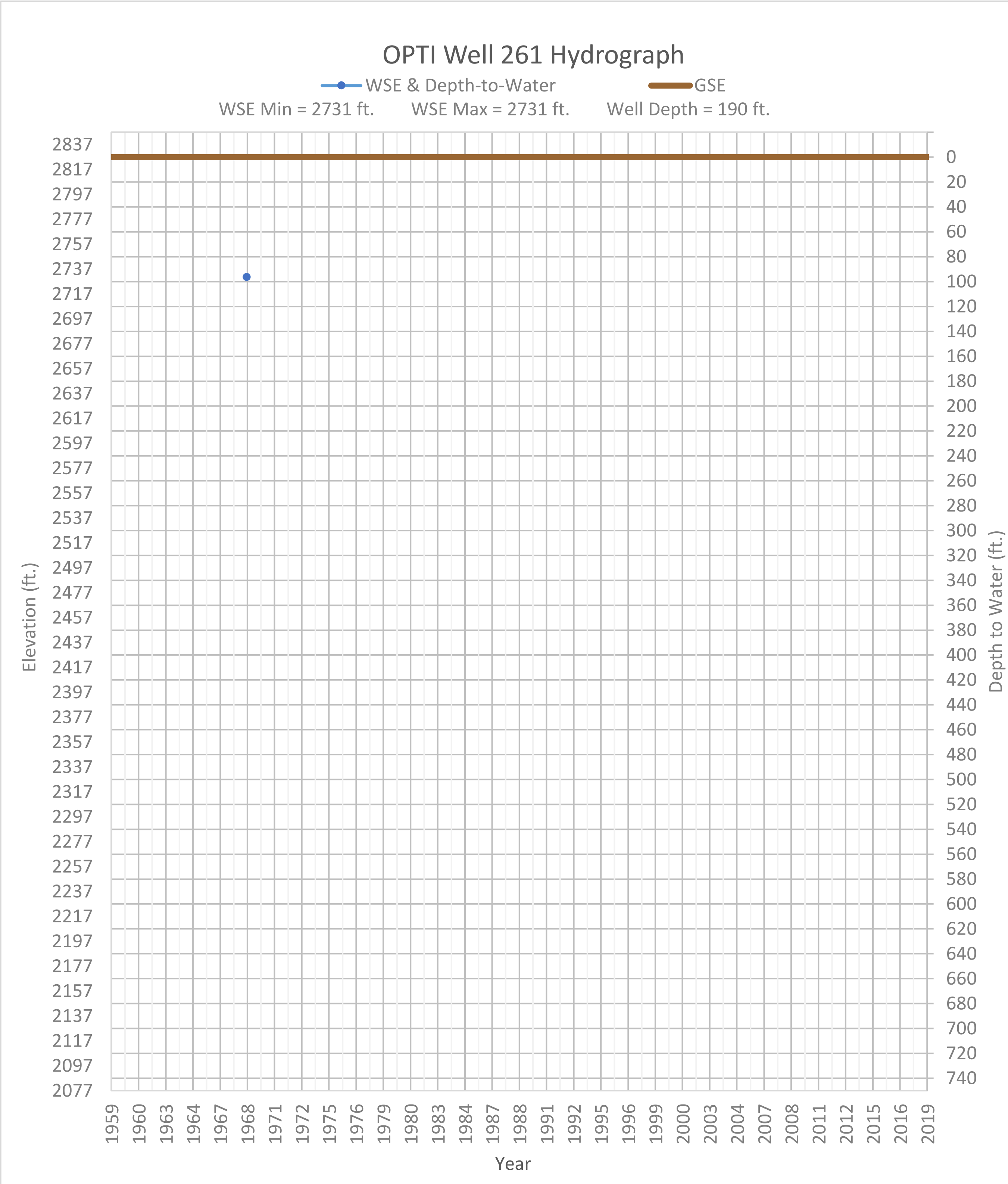
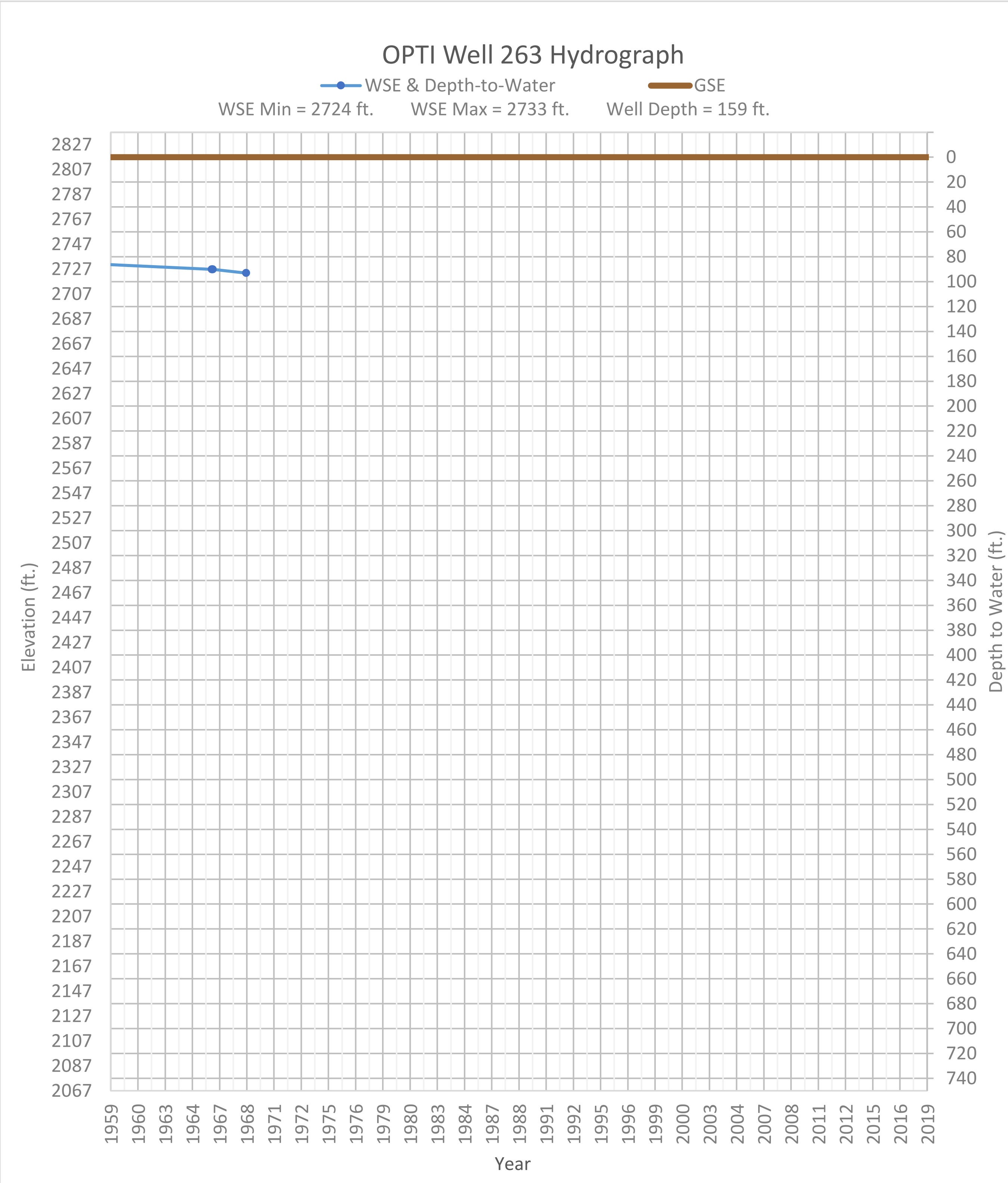
2015
2016
2019
Year



OPTI Well 259 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3476 ft.
WSE Max = 3476 ft.
Well Depth = 230 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 261 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2731 ft.
WSE Max = 2731 ft.
Well Depth = 190 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 263 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2724 ft.
WSE Max = 2733 ft.
Well Depth = 159 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2827
2807
2787
2767
2747
2727
2707
2687
2667
2647
2627
2607
2587
2567
2547
2527
2507
2487
2467
2447
2427
2407
2387
2367
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
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420
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560
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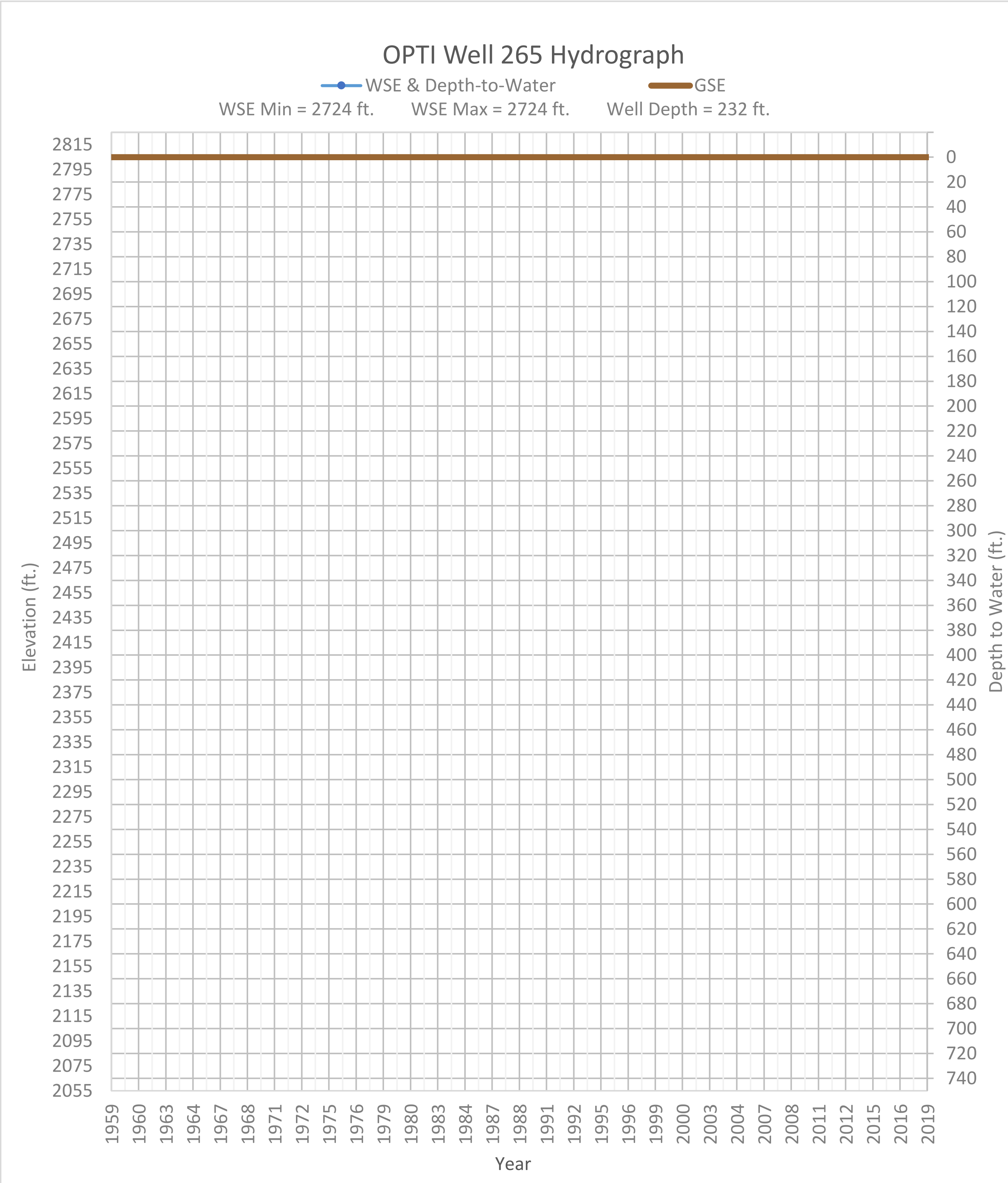
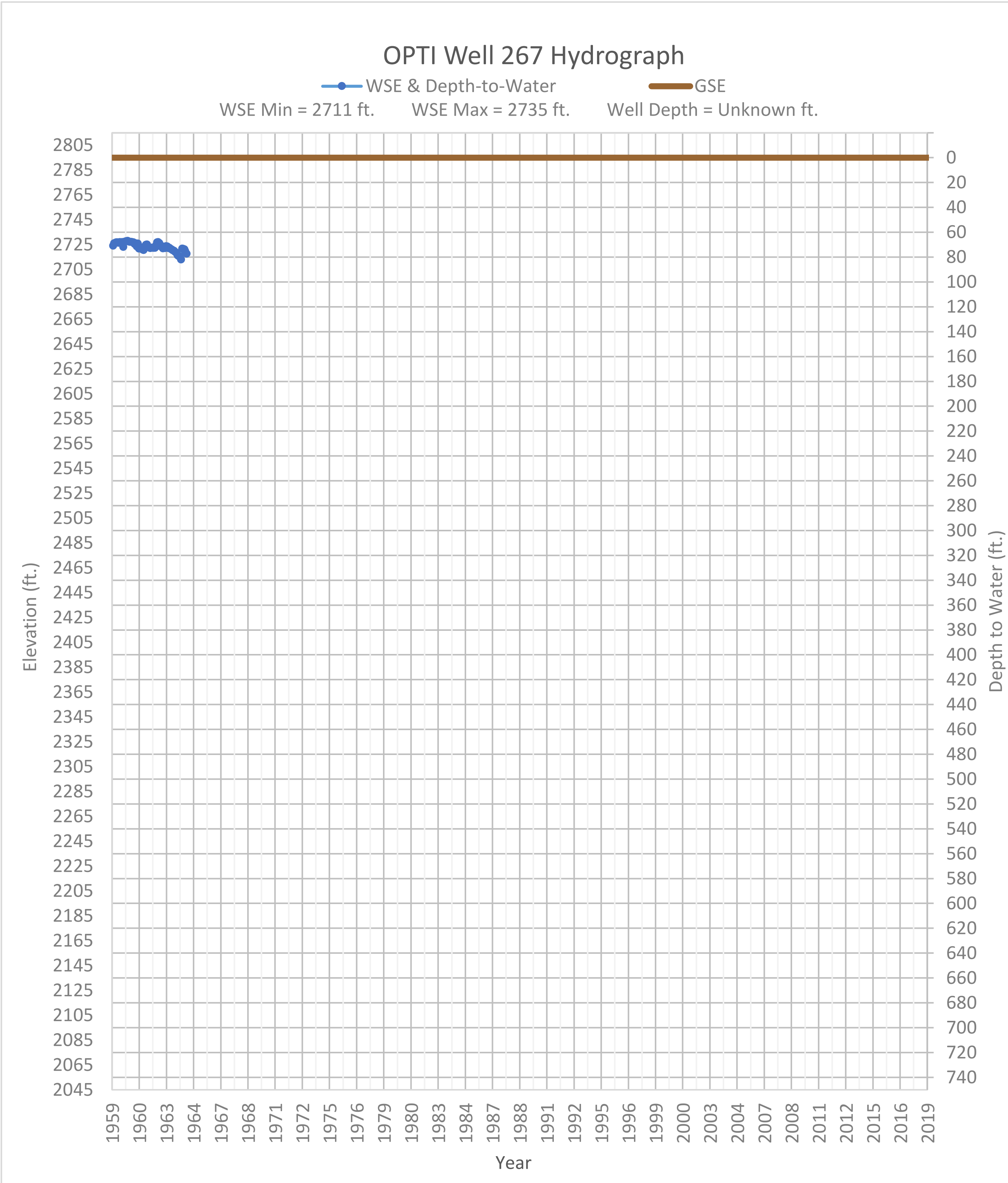


OPTI Well 265 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2724 ft.
WSE Max = 2724 ft.
Well Depth = 232 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 267 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2711 ft.
WSE Max = 2735 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2805
2785
2765
2745
2725
2705
2685
2665
2645
2625
2605
2585
2565
2545
2525
2505
2485
2465
2445
2425
2405
2385
2365
2345
2325
2305
2285
2265
2245
2225
2205
2185
2165
2145
2125
2105
2085
2065
2045
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
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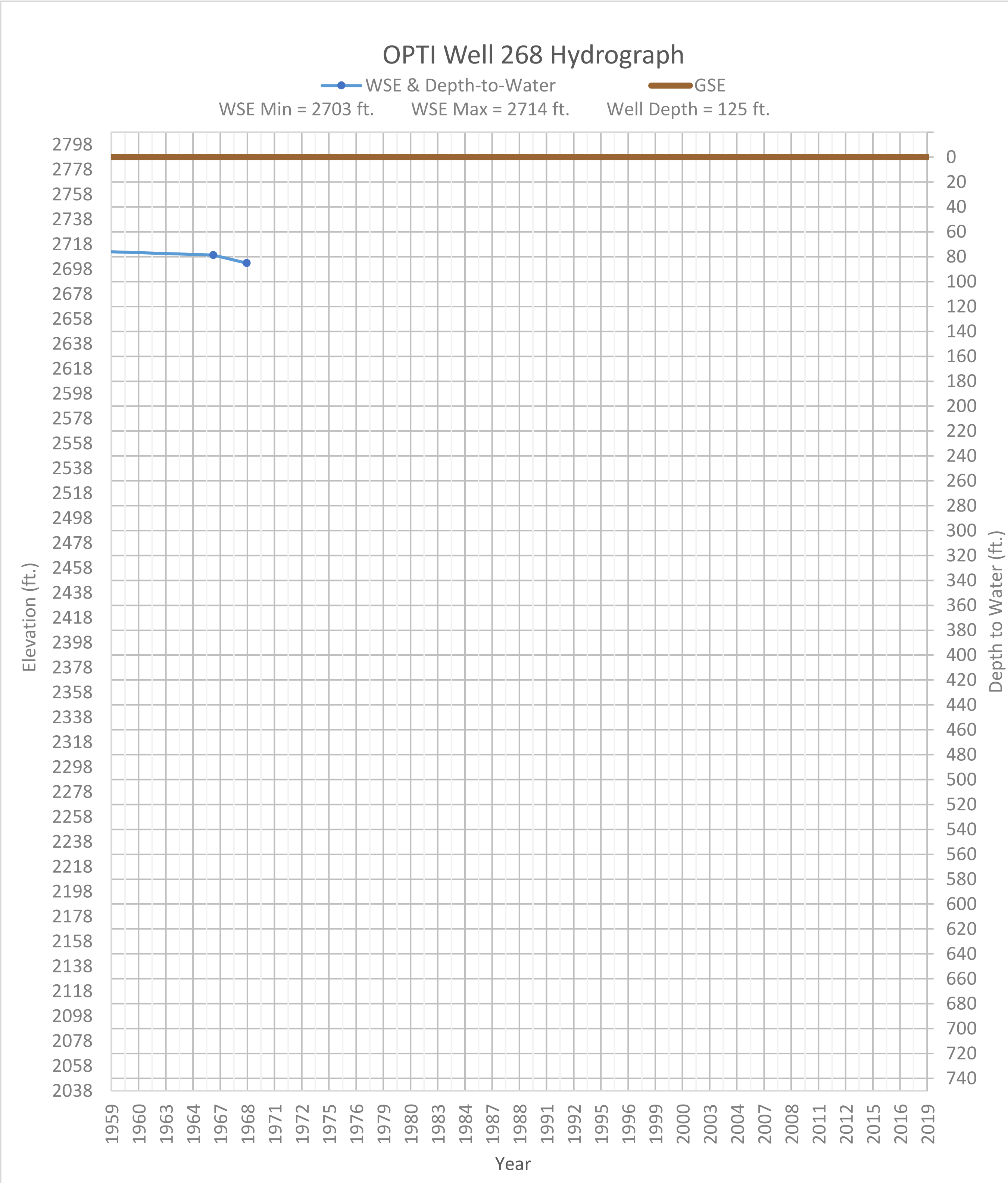
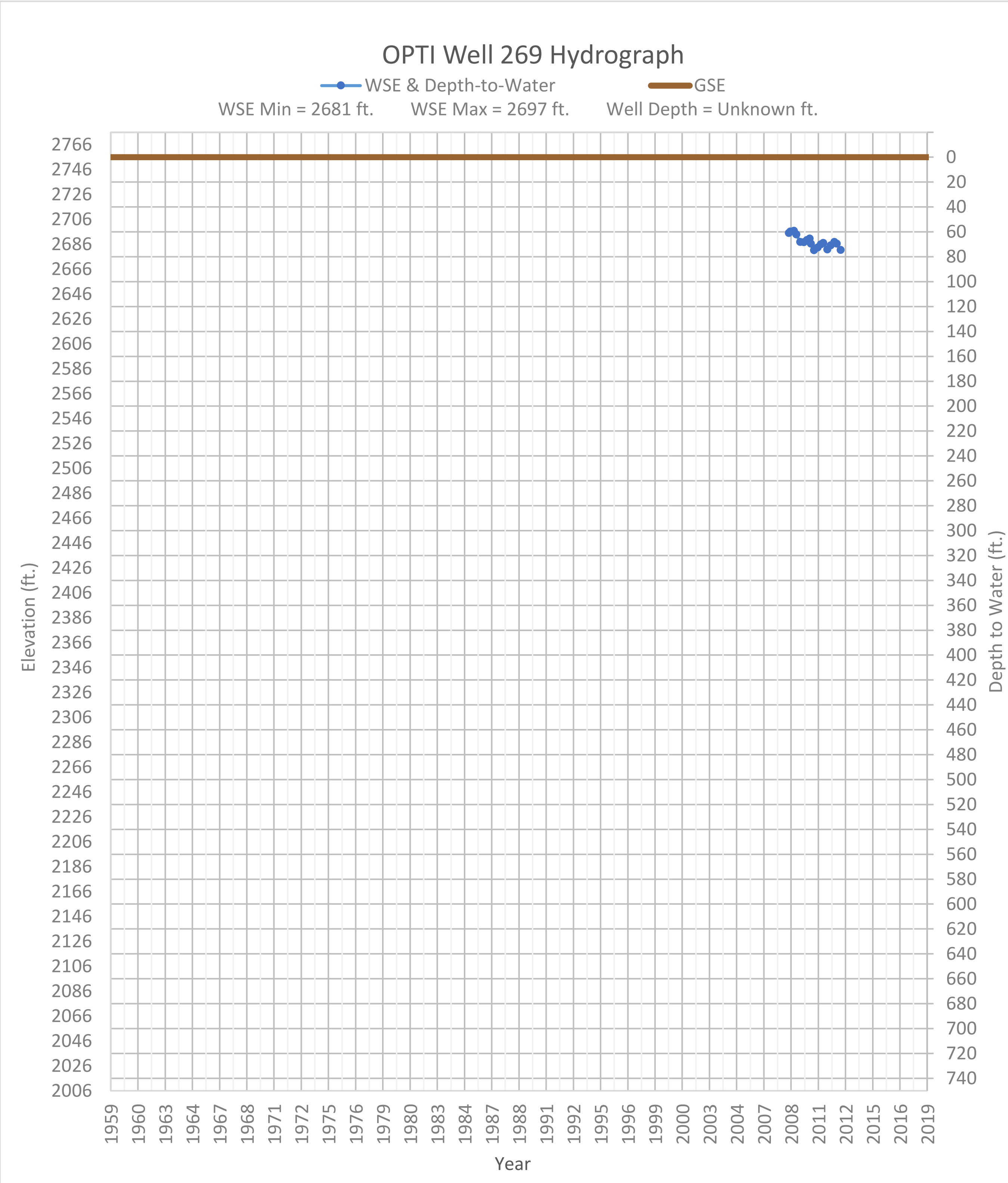


OPTI Well 268 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2703 ft.
WSE Max = 2714 ft.
Well Depth = 125 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 269 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2681 ft.
WSE Max = 2697 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2766
2746
2726
2706
2686
2666
2646
2626
2606
2586
2566
2546
2526
2506
2486
2466
2446
2426
2406
2386
2366
2346
2326
2306
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
0
20
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100
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140
160
180
200
220
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260
280
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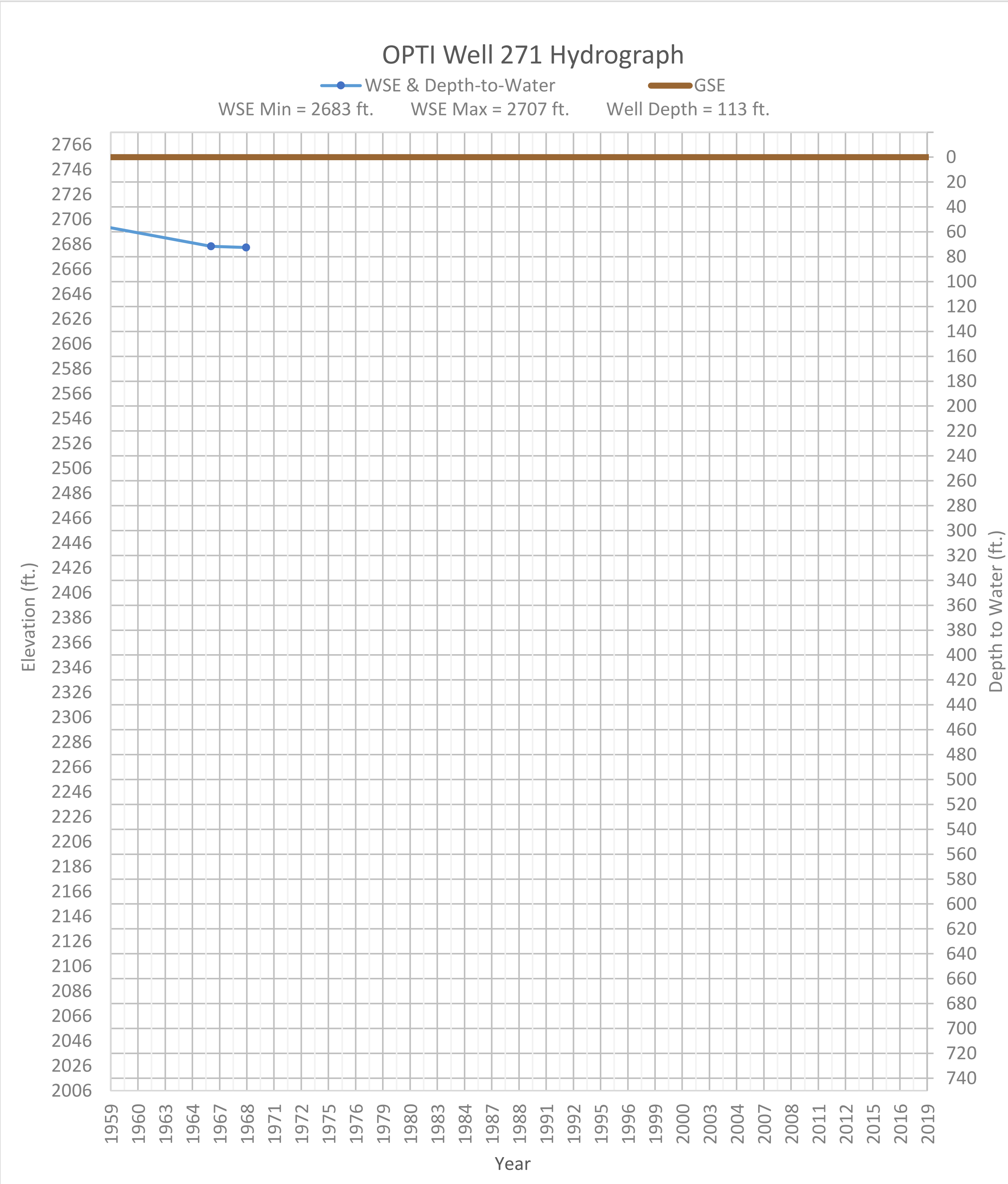
OPTI Well 271 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2683 ft.
WSE Max = 2707 ft.
Well Depth = 113 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2766
2746
2726
2706
2686
2666
2646
2626
2606
2586
2566
2546
2526
2506
2486
2466
2446
2426
2406
2386
2366
2346
2326
2306
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
0
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40
60
80
100
120
140
160
180
200
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360
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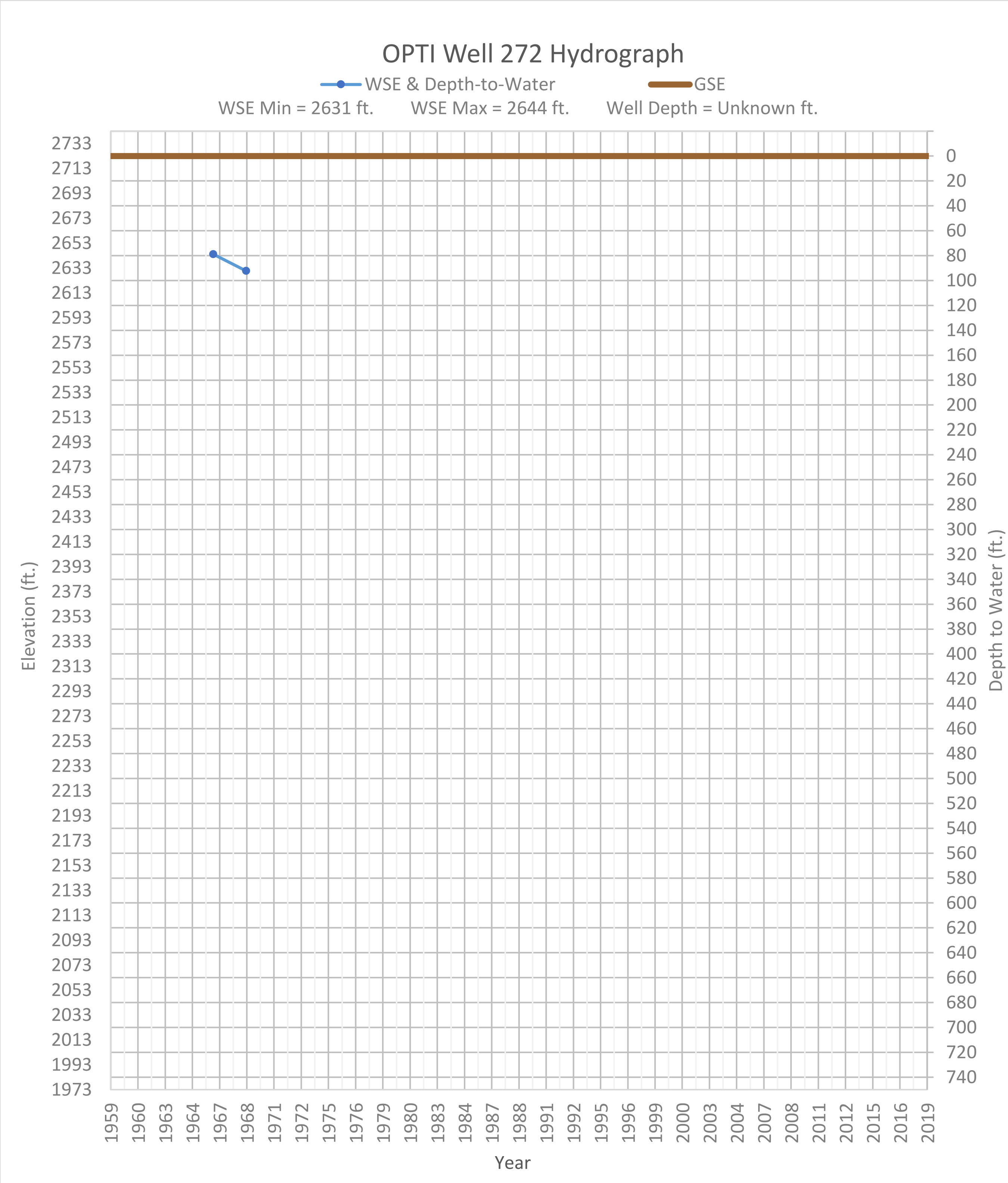
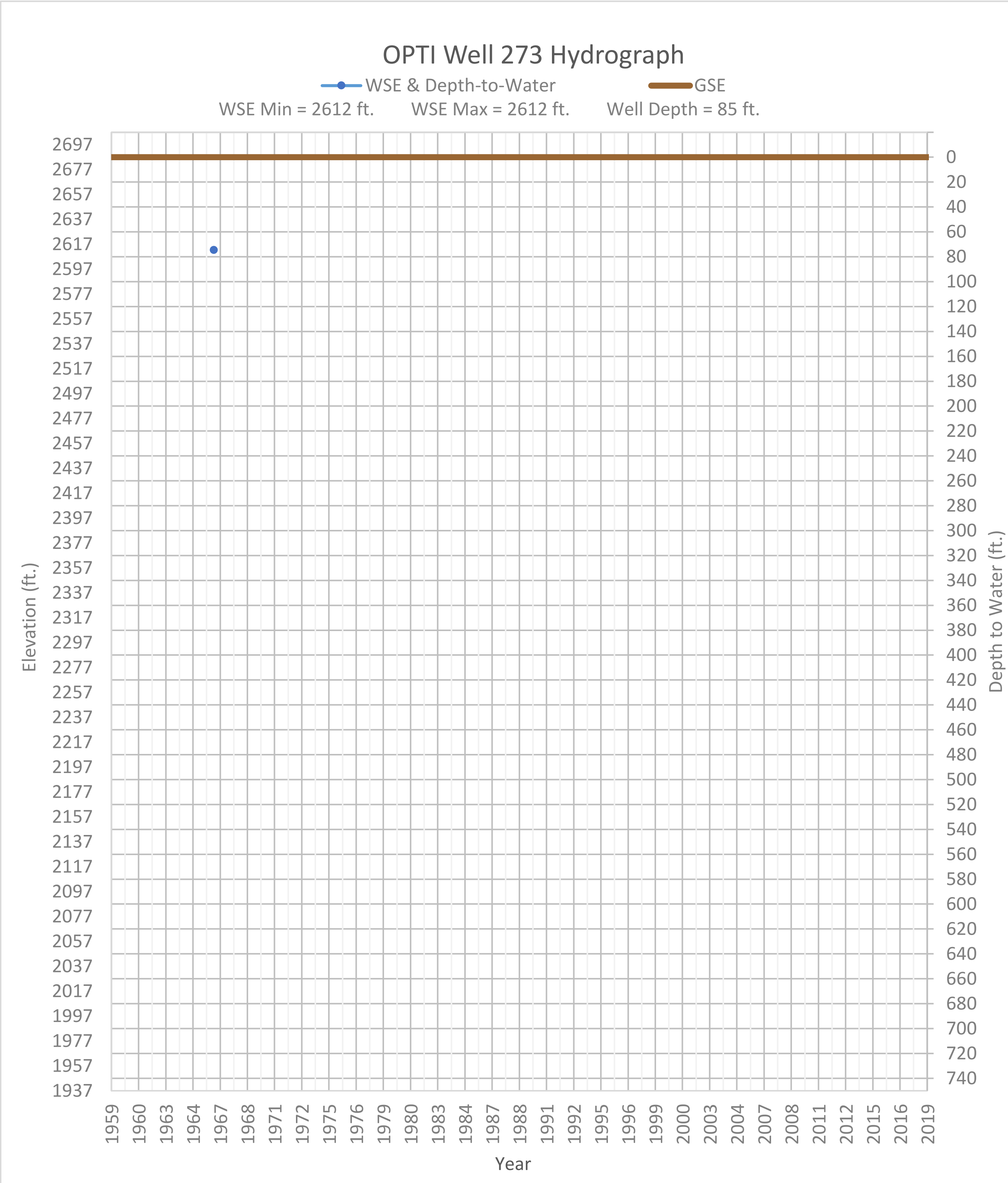
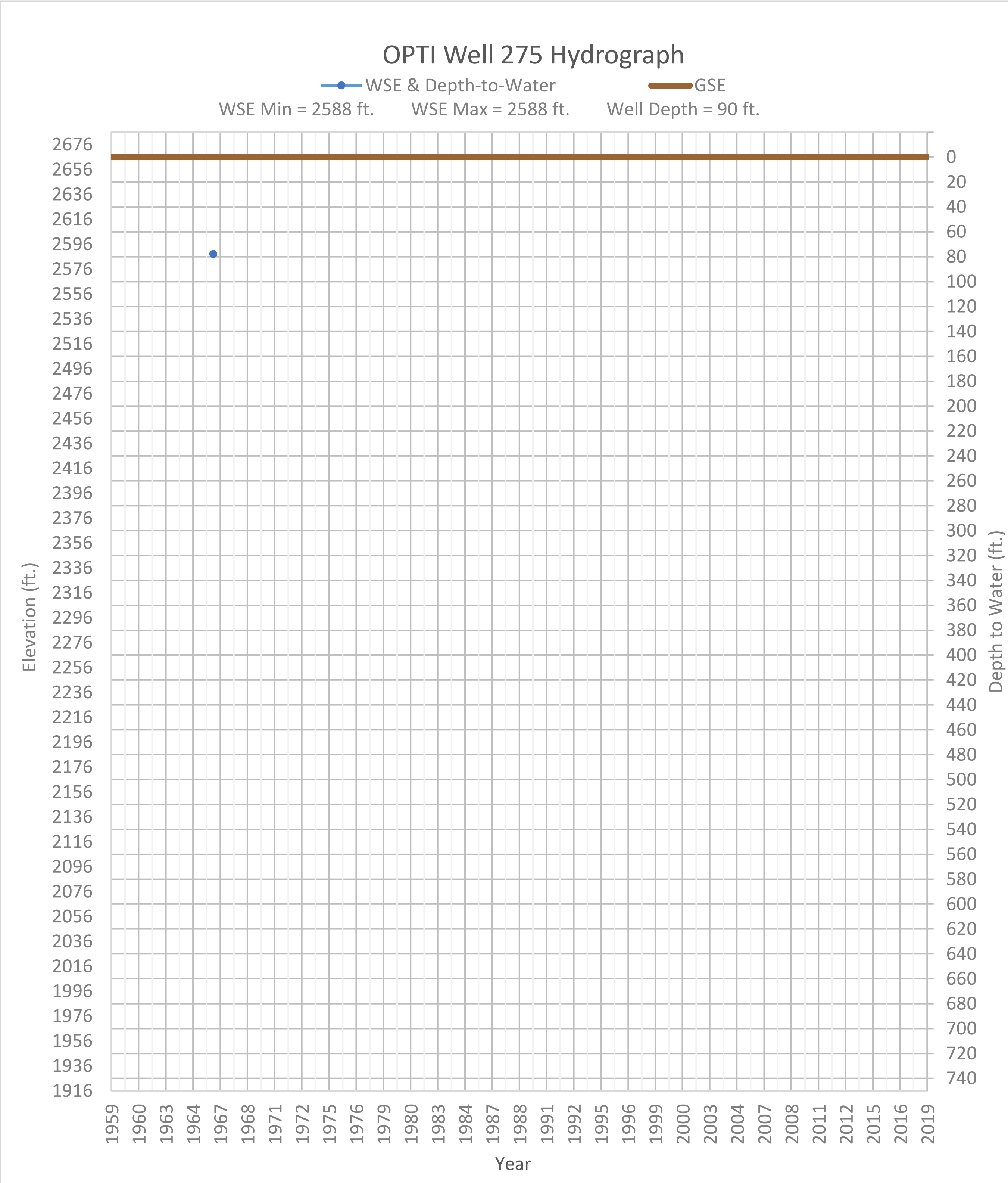
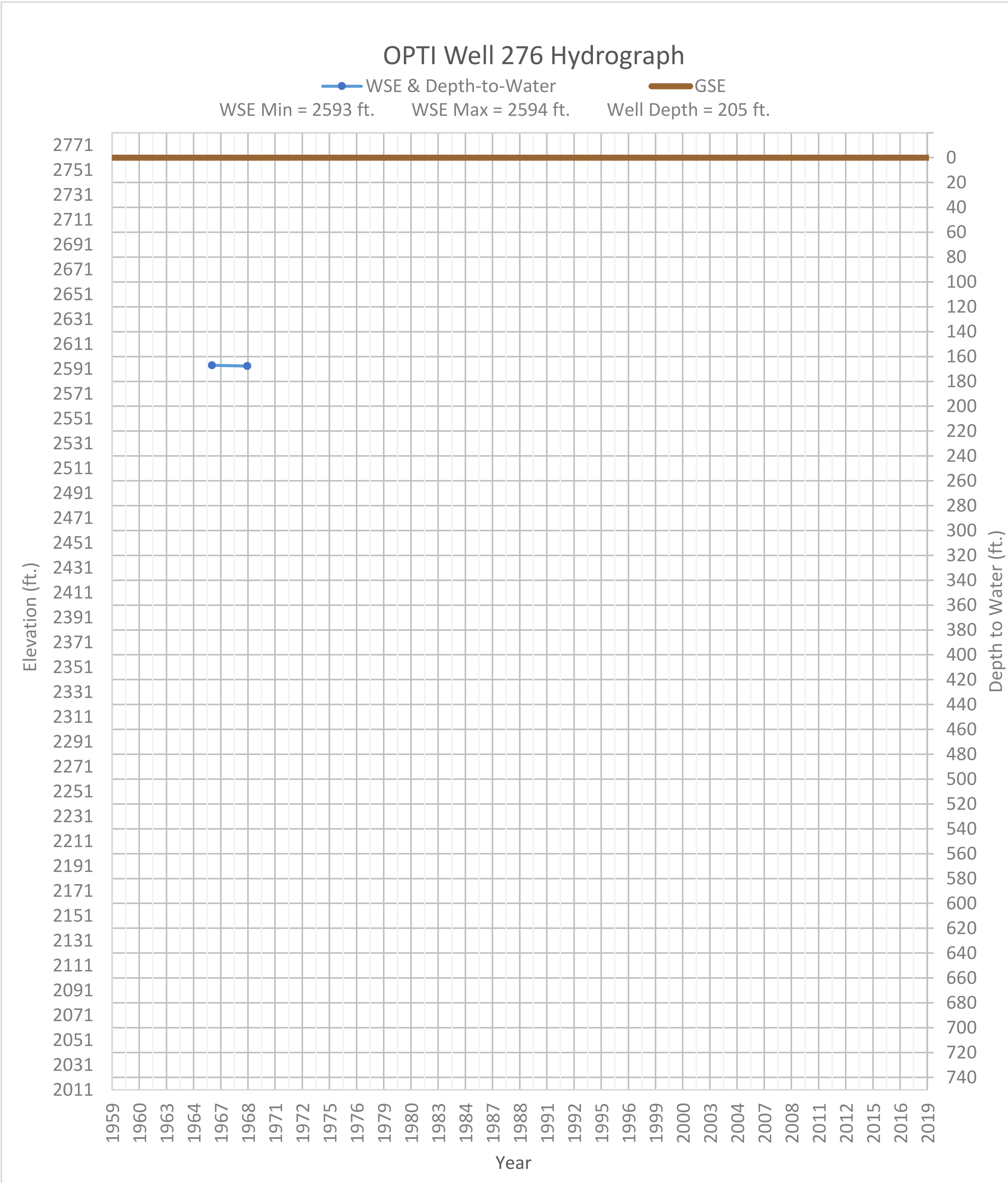

OPTI Well 272 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2631 ft.
WSE Max = 2644 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 273 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2612 ft.
WSE Max = 2612 ft.
Well Depth = 85 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 275 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2588 ft.
WSE Max = 2588 ft.
Well Depth = 90 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 276 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2593 ft.
WSE Max = 2594 ft.
Well Depth = 205 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2771
2751
2731
2711
2691
2671
2651
2631
2611
2591
2571
2551
2531
2511
2491
2471
2451
2431
2411
2391
2371
2351
2331
2311
2291
2271
2251
2231
2211
2191
2171
2151
2131
2111
2091
2071
2051
2031
2011
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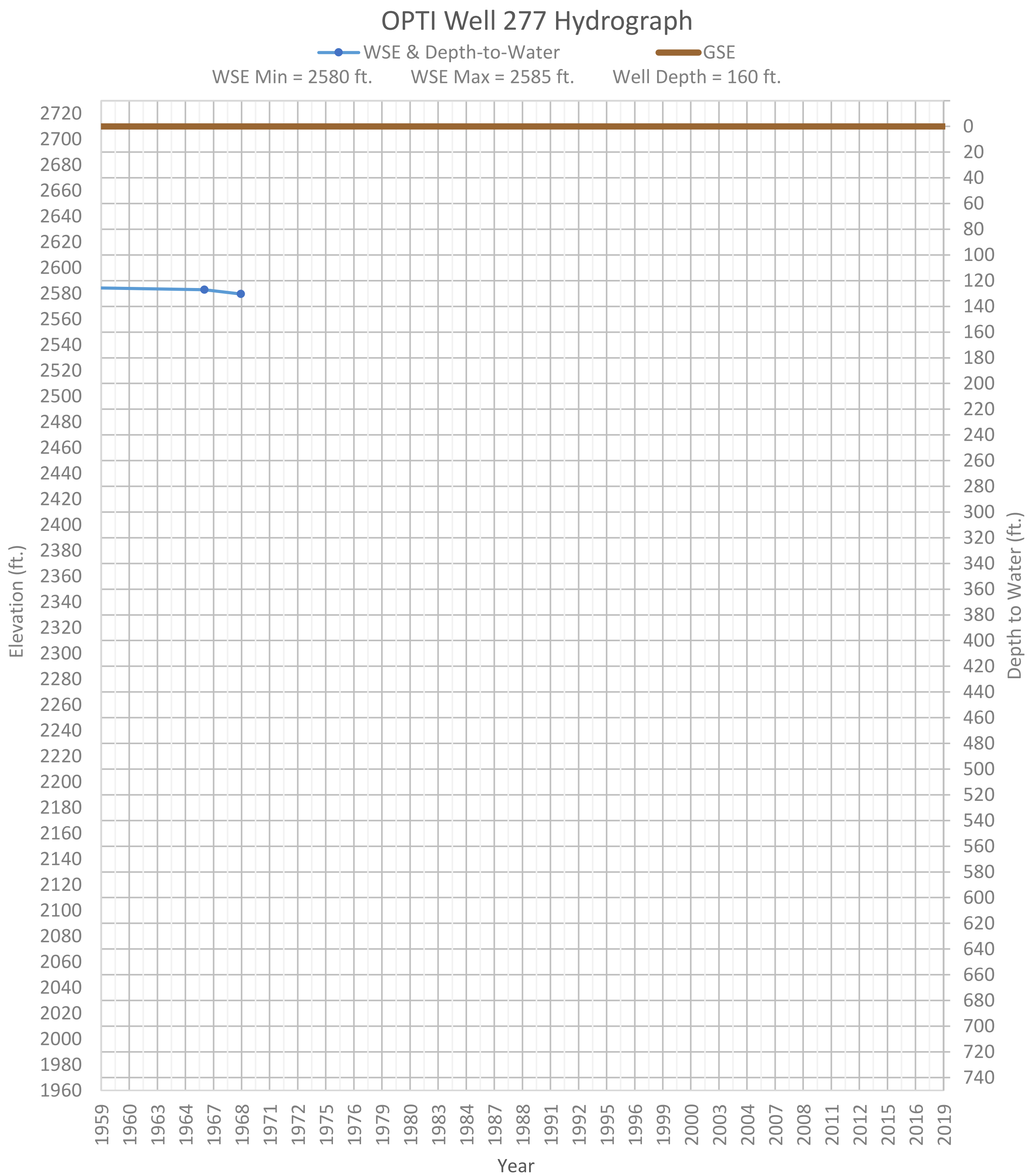
OPTI Well 277 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2580 ft.
WSE Max = 2585 ft.
Well Depth = 160 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2720
2700
2680
2660
2640
2620
2600
2580
2560
2540
2520
2500
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
0
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160
180
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220
240
260
280
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320
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360
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540
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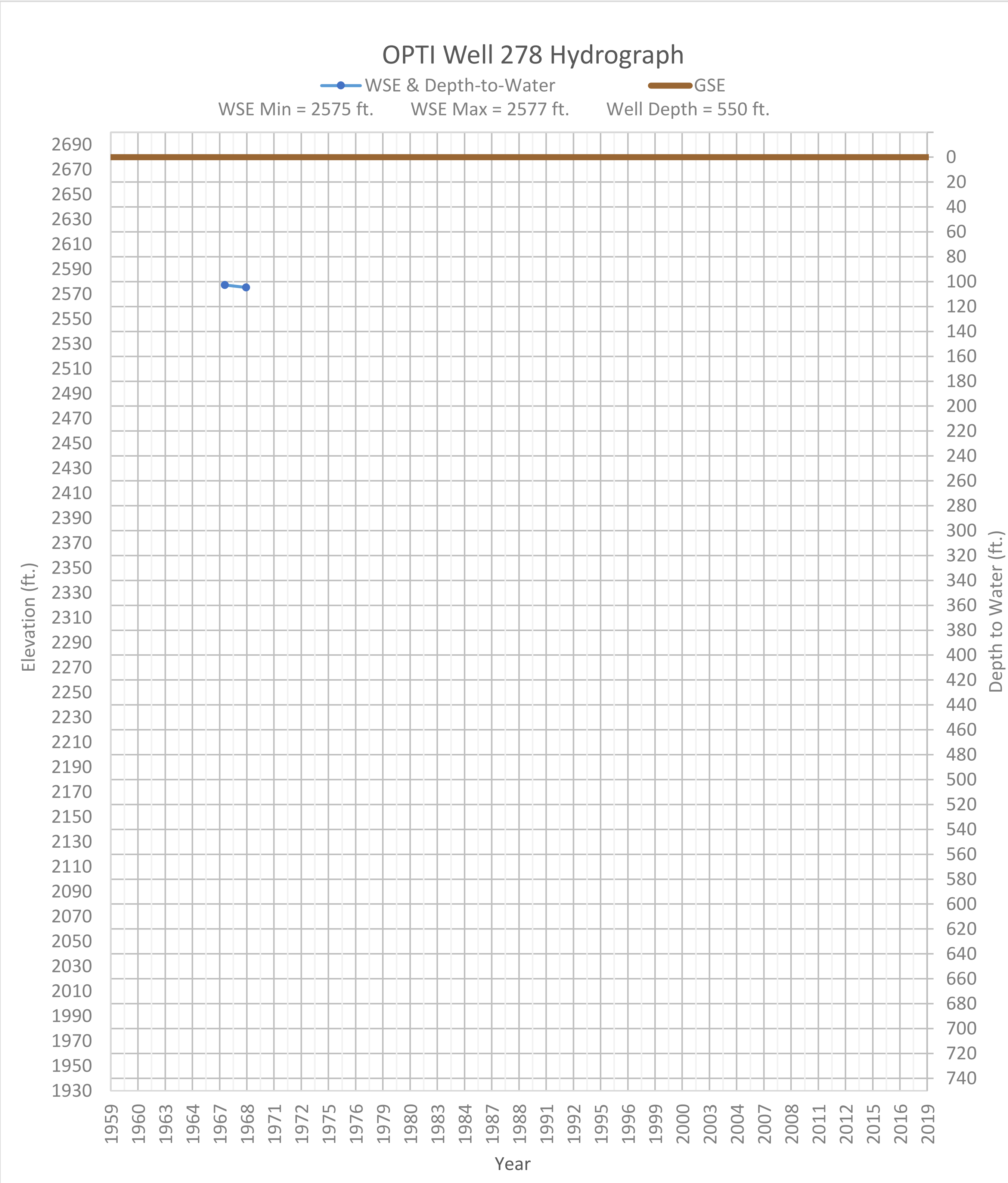
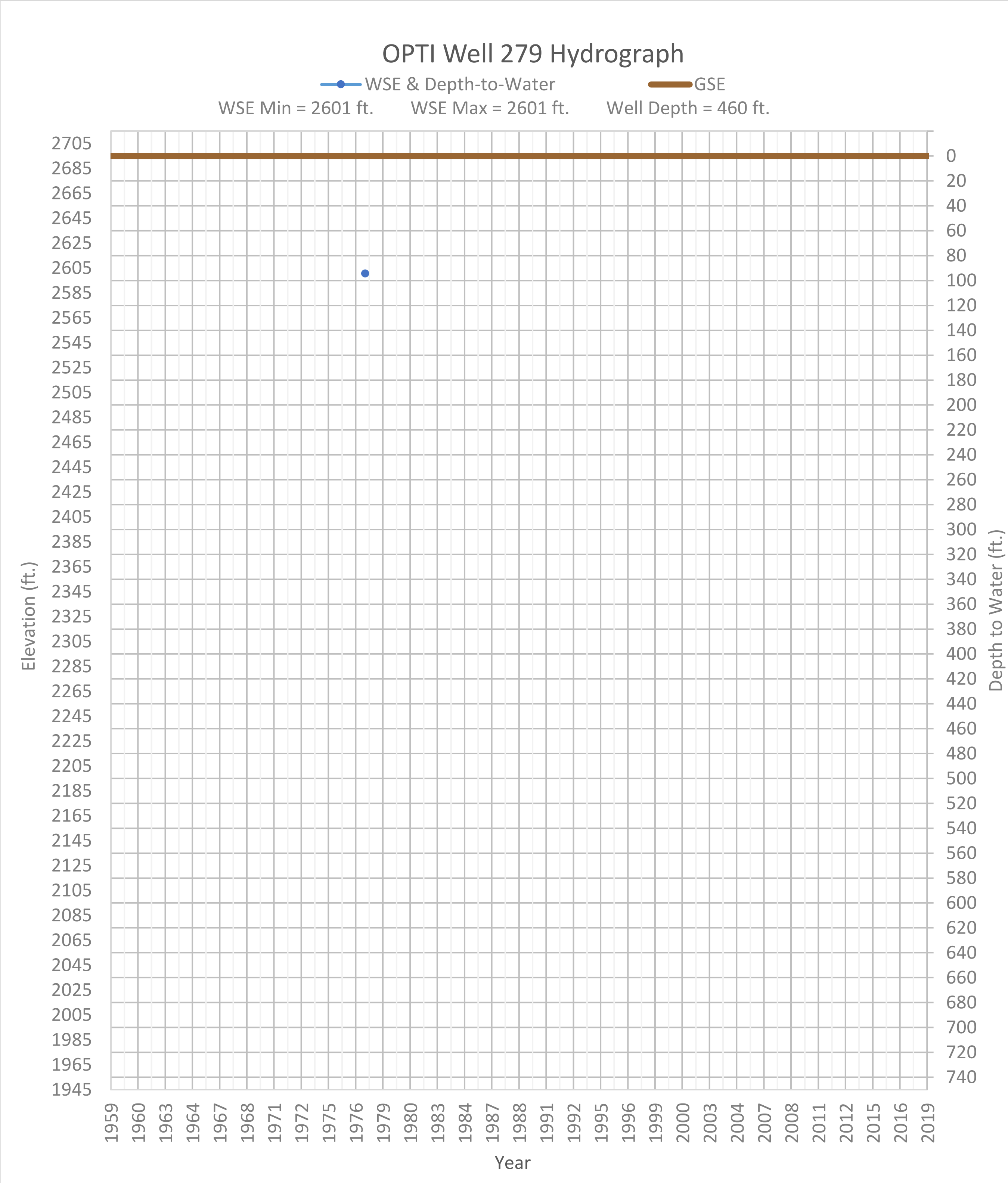
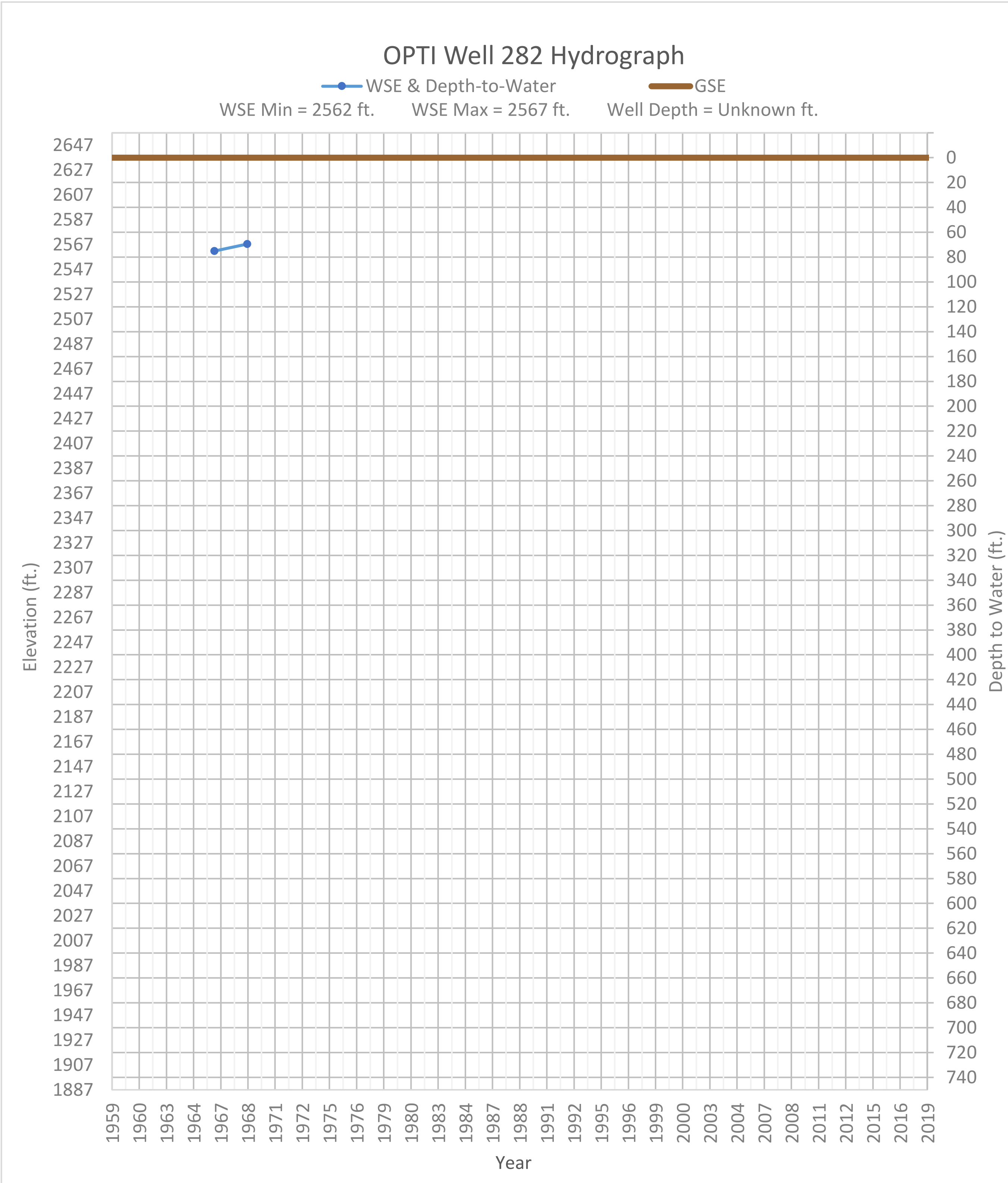
2011
2012
2015
2016
2019


OPTI Well 278 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2575 ft.
WSE Max = 2577 ft.
Well Depth = 550 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 279 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2601 ft.
WSE Max = 2601 ft.
Well Depth = 460 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 282 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2562 ft.
WSE Max = 2567 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2647
2627
2607
2587
2567
2547
2527
2507
2487
2467
2447
2427
2407
2387
2367
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
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1927
1907
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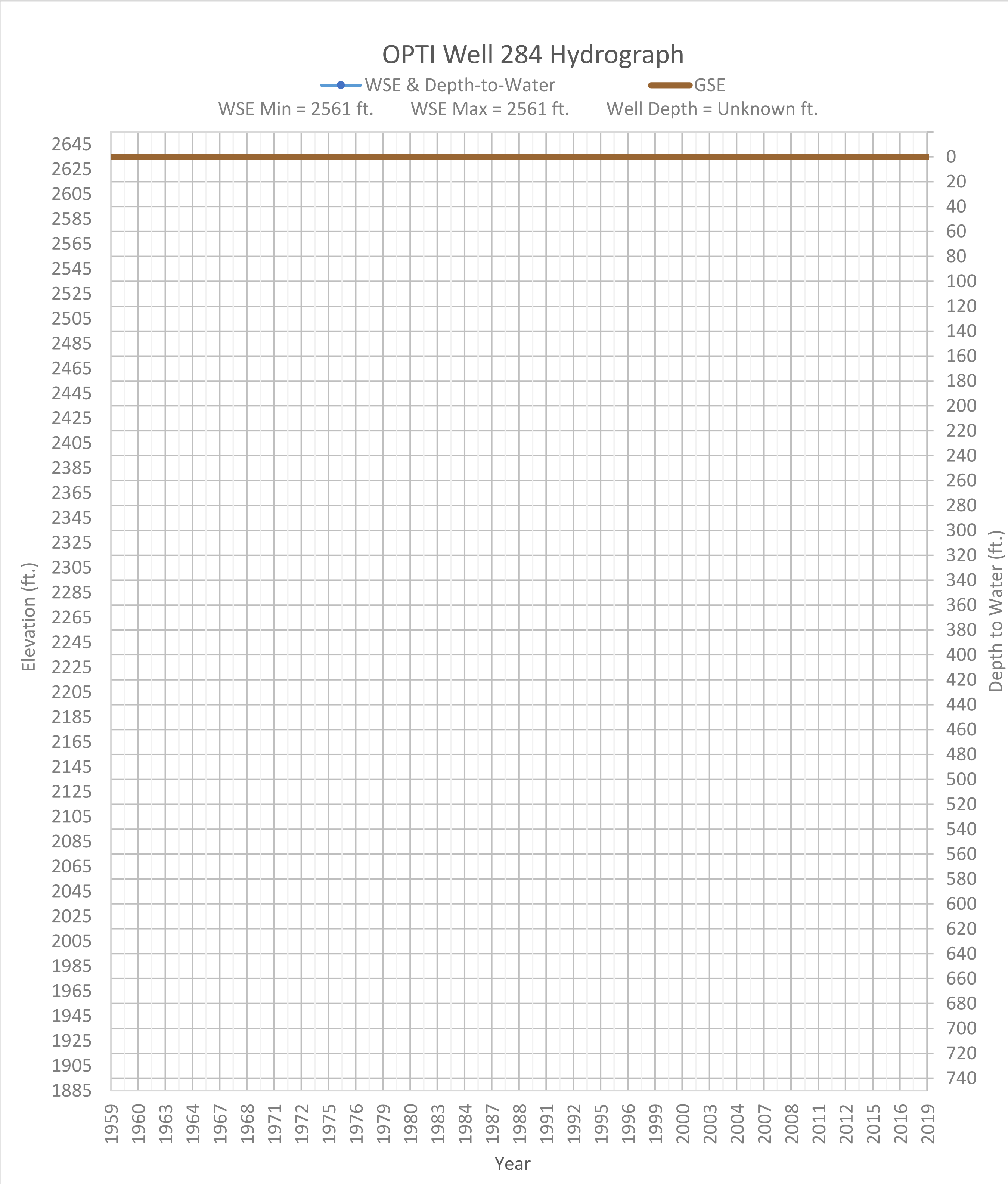
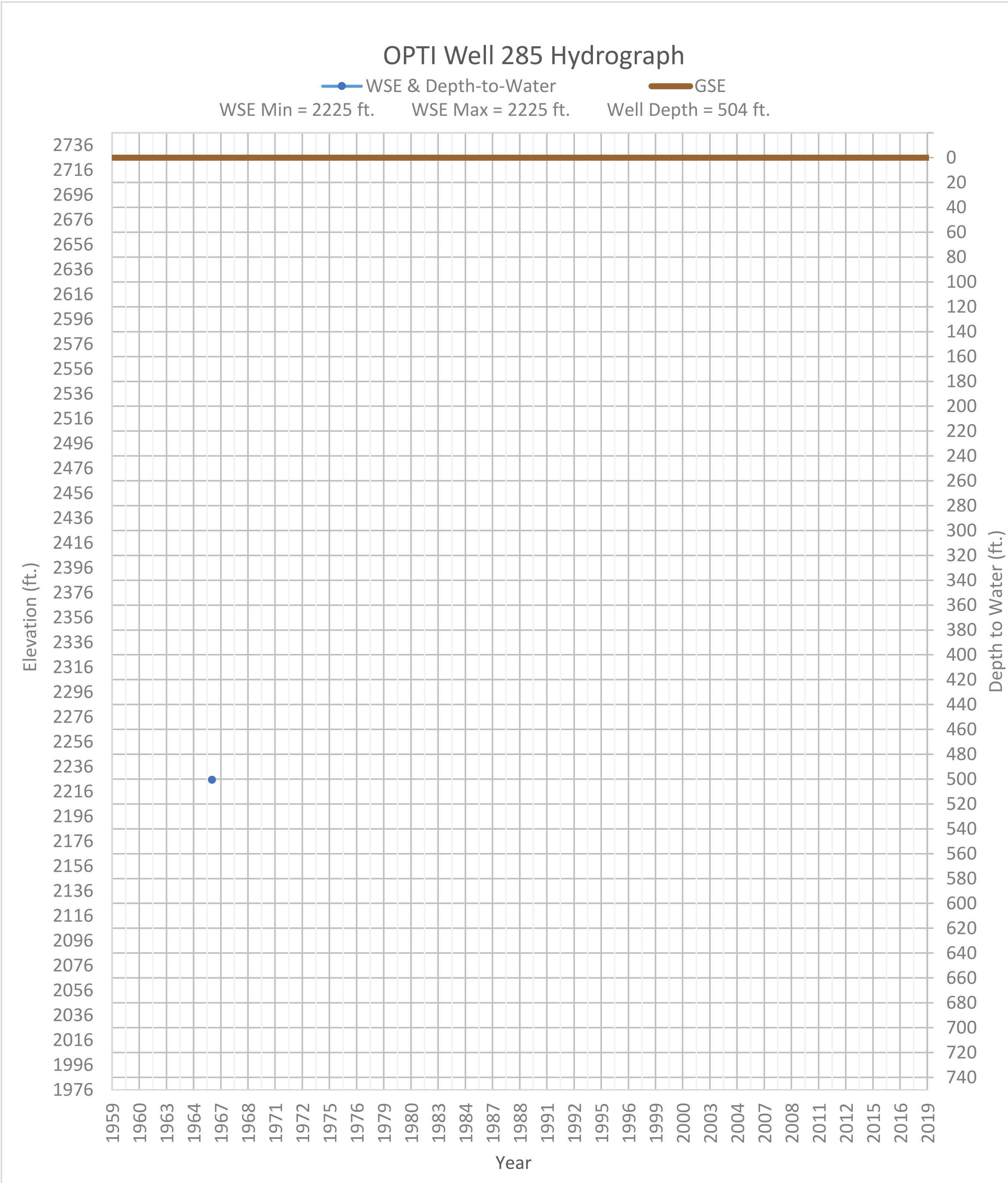

OPTI Well 284 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2561 ft.
WSE Max = 2561 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 285 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2225 ft.
WSE Max = 2225 ft.
Well Depth = 504 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2736
2716
2696
2676
2656
2636
2616
2596
2576
2556
2536
2516
2496
2476
2456
2436
2416
2396
2376
2356
2336
2316
2296
2276
2256
2236
2216
2196
2176
2156
2136
2116
2096
2076
2056
2036
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1996
1976
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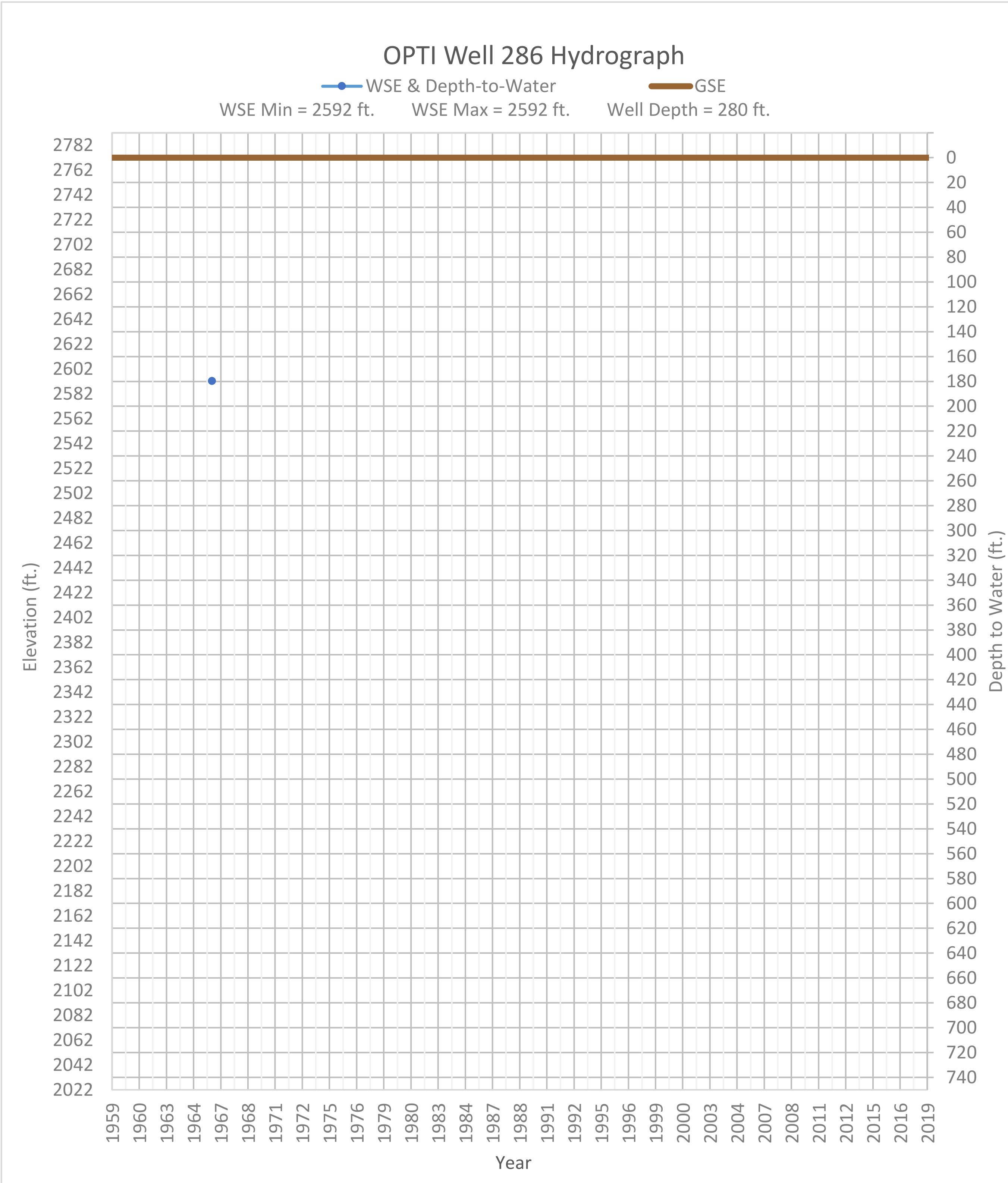
OPTI Well 286 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2592 ft.
WSE Max = 2592 ft.
Well Depth = 280 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2782
2762
2742
2722
2702
2682
2662
2642
2622
2602
2582
2562
2542
2522
2502
2482
2462
2442
2422
2402
2382
2362
2342
2322
2302
2282
2262
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
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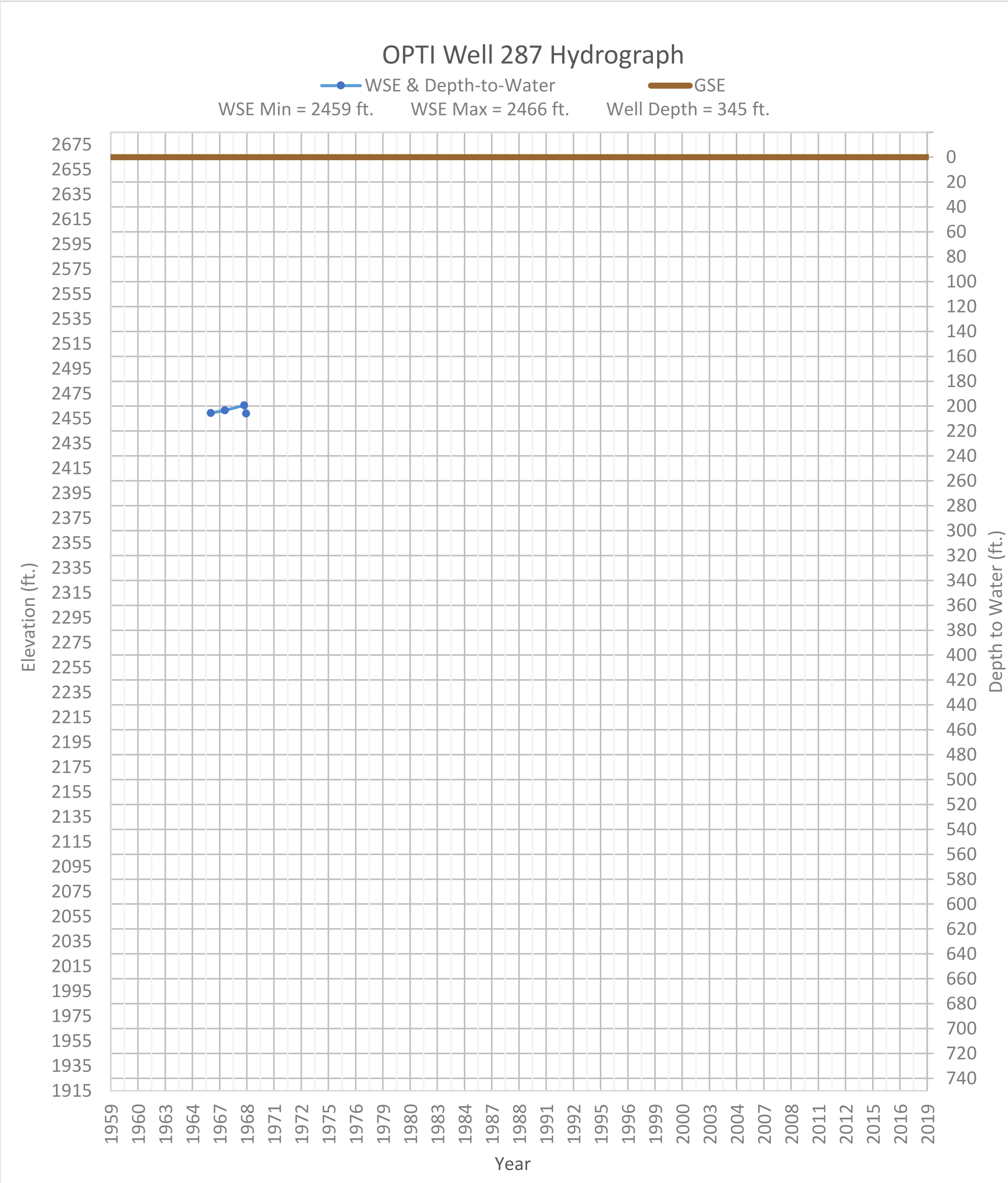
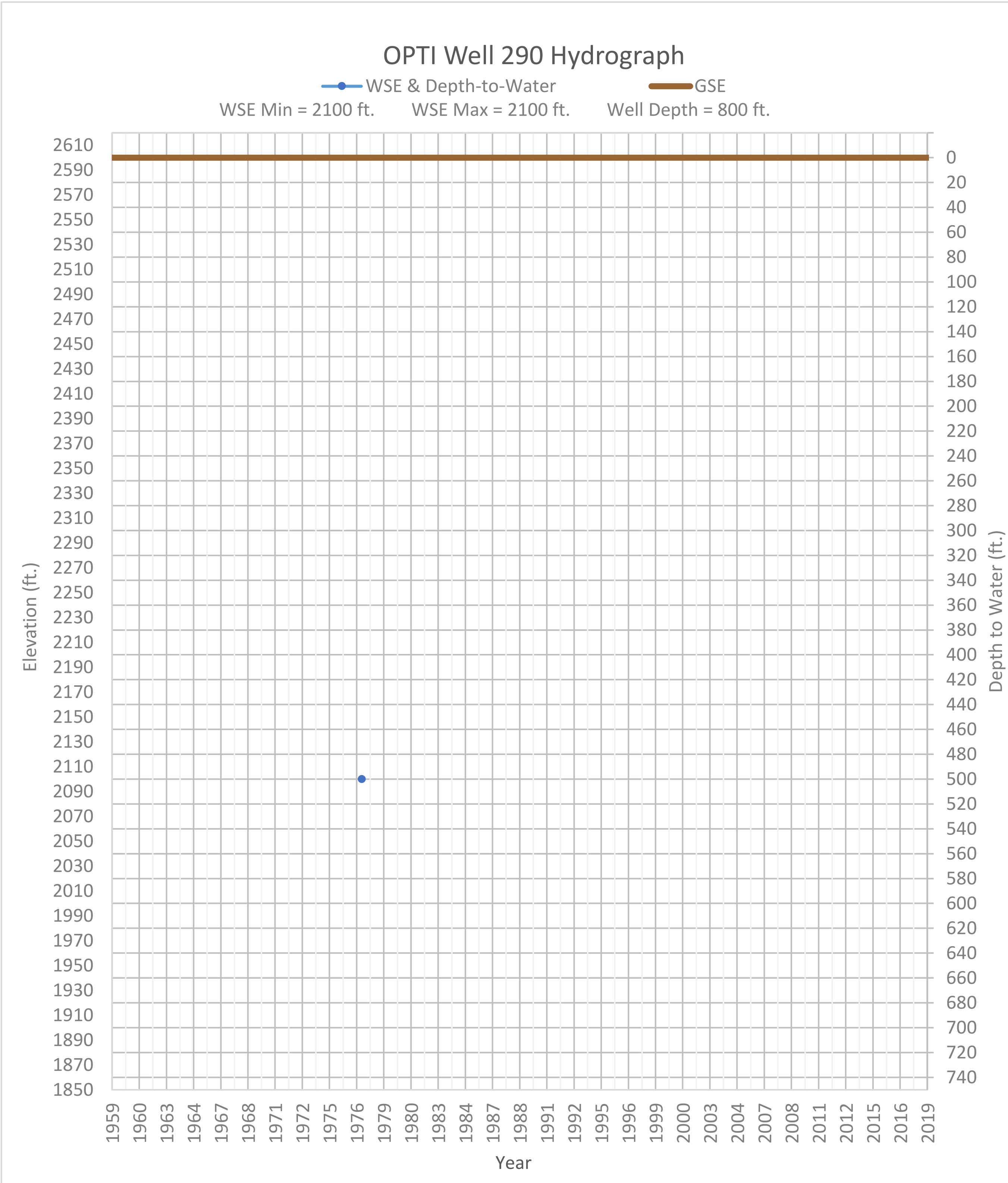


OPTI Well 287 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2459 ft.
WSE Max = 2466 ft.
Well Depth = 345 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 290 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2100 ft.
WSE Max = 2100 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2610
2590
2570
2550
2530
2510
2490
2470
2450
2430
2410
2390
2370
2350
2330
2310
2290
2270
2250
2230
2210
2190
2170
2150
2130
2110
2090
2070
2050
2030
2010
1990
1970
1950
1930
1910
1890
1870
1850
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240
260
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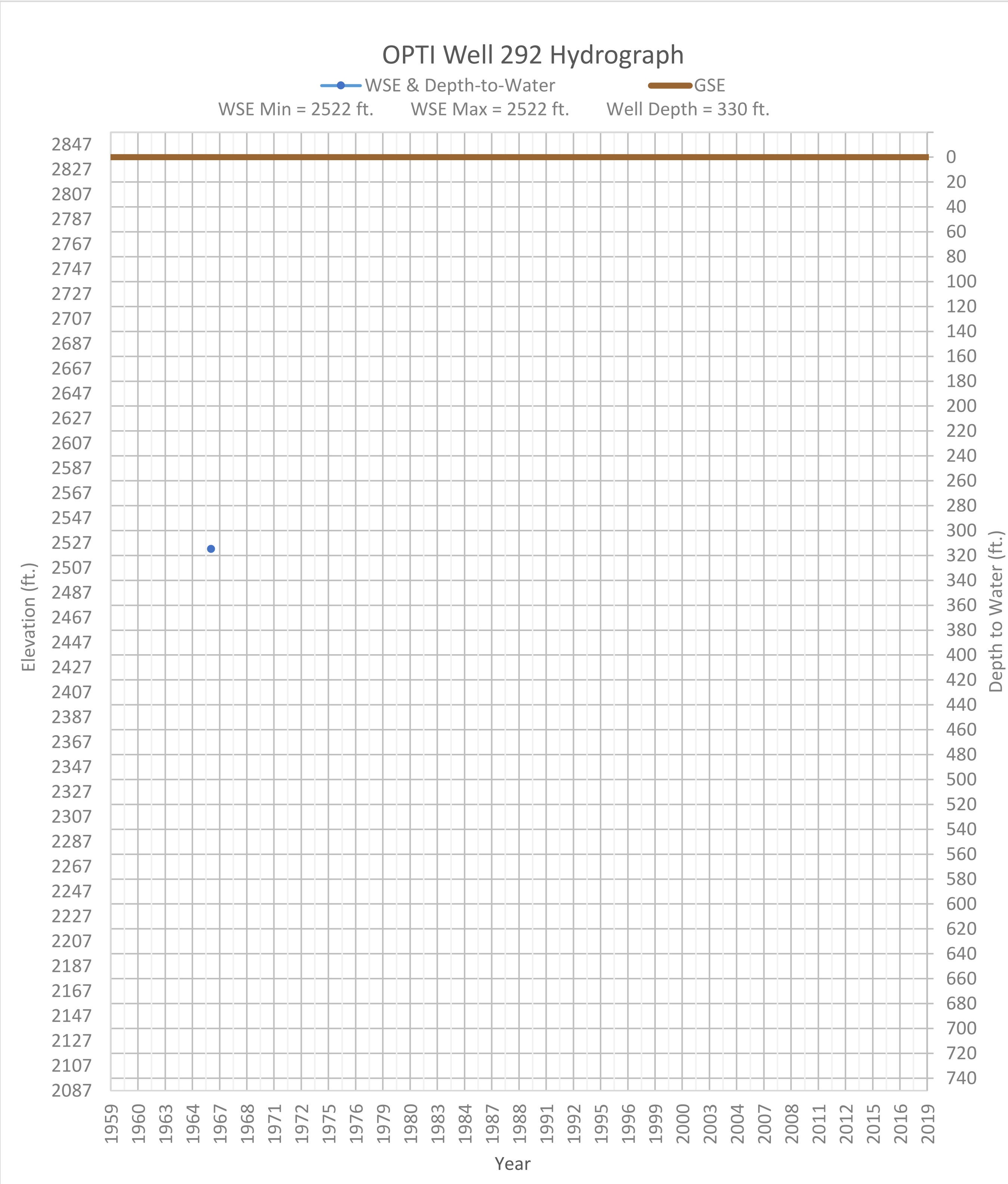
OPTI Well 292 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2522 ft.
WSE Max = 2522 ft.
Well Depth = 330 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2847
2827
2807
2787
2767
2747
2727
2707
2687
2667
2647
2627
2607
2587
2567
2547
2527
2507
2487
2467
2447
2427
2407
2387
2367
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
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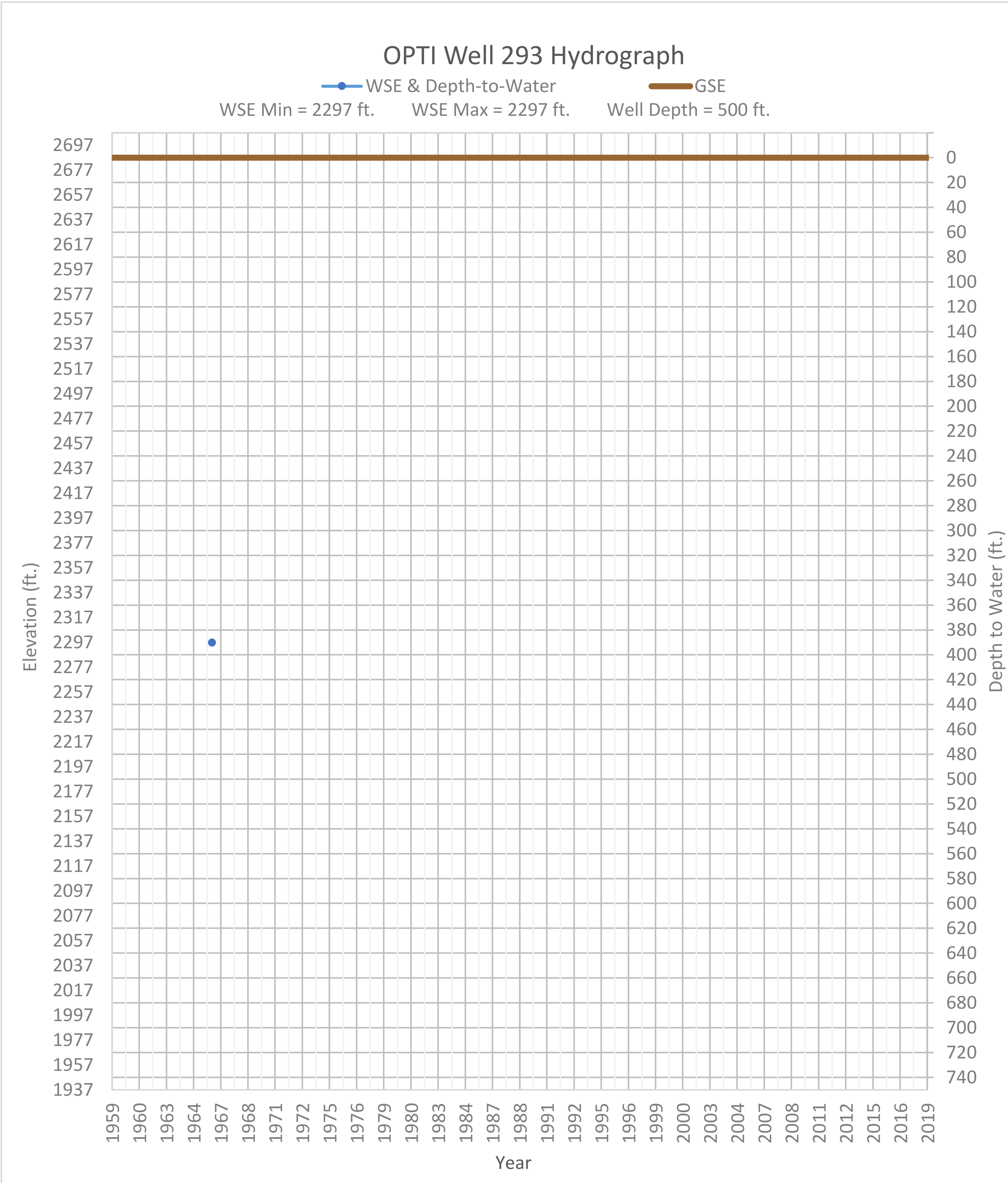
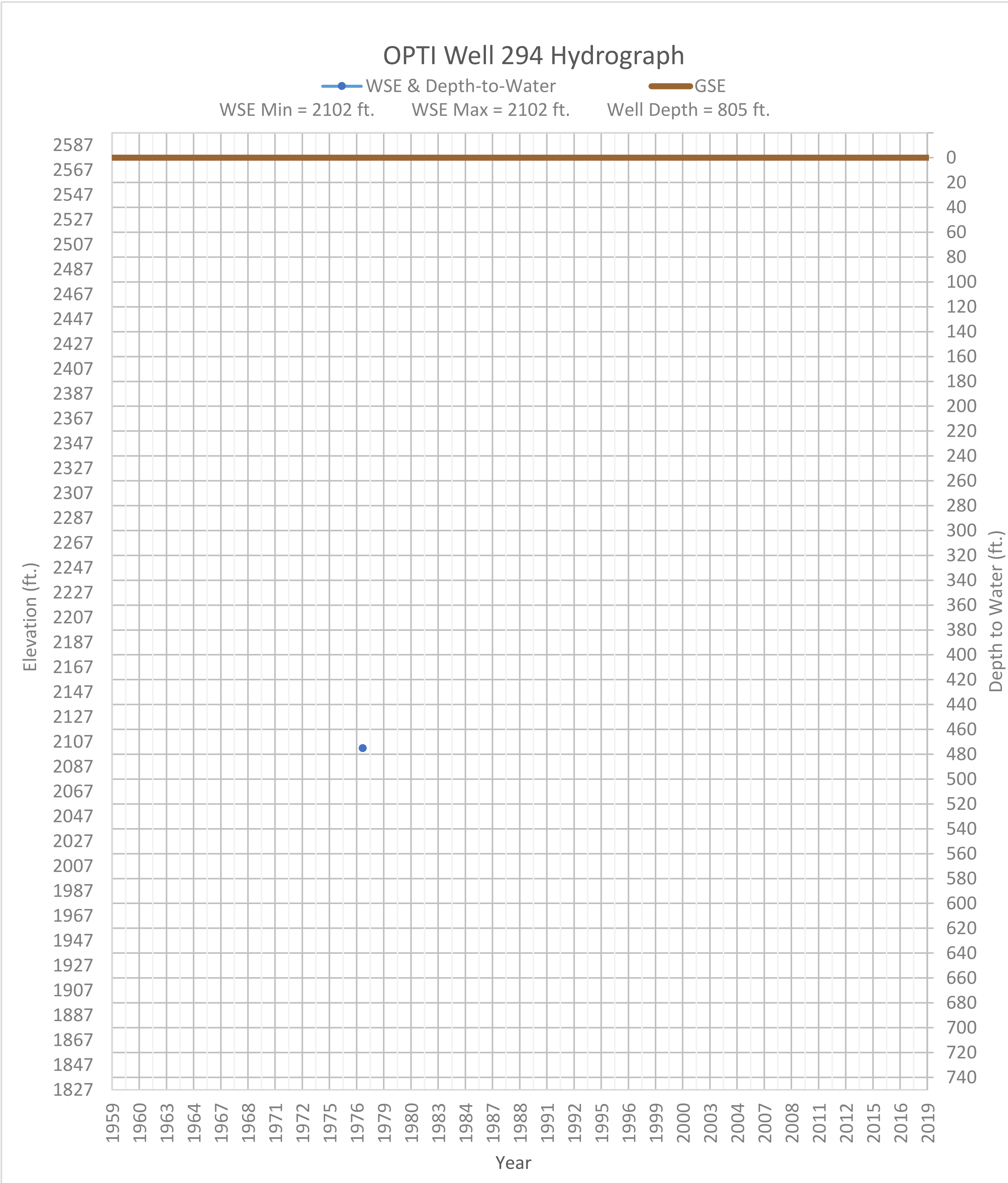
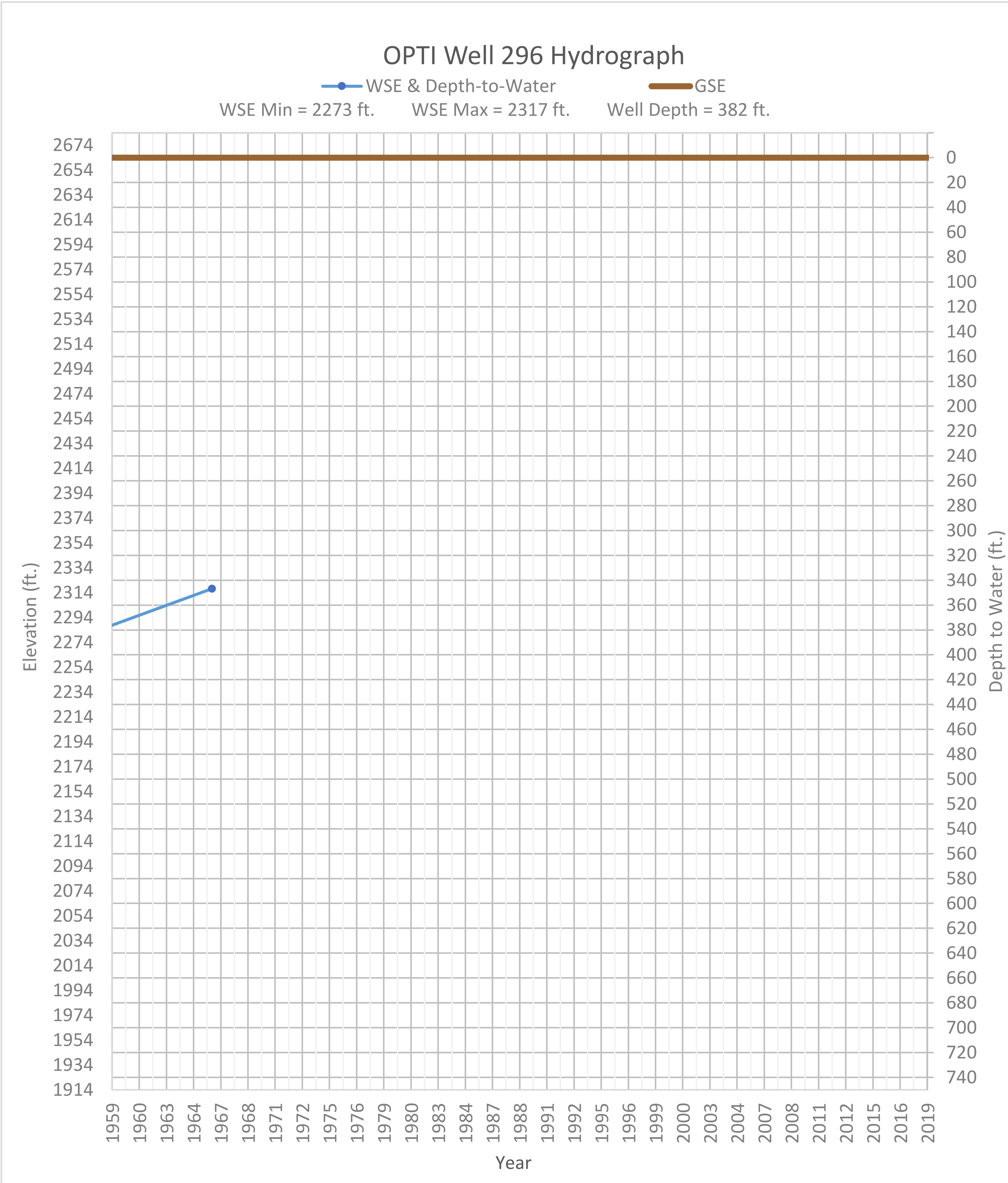
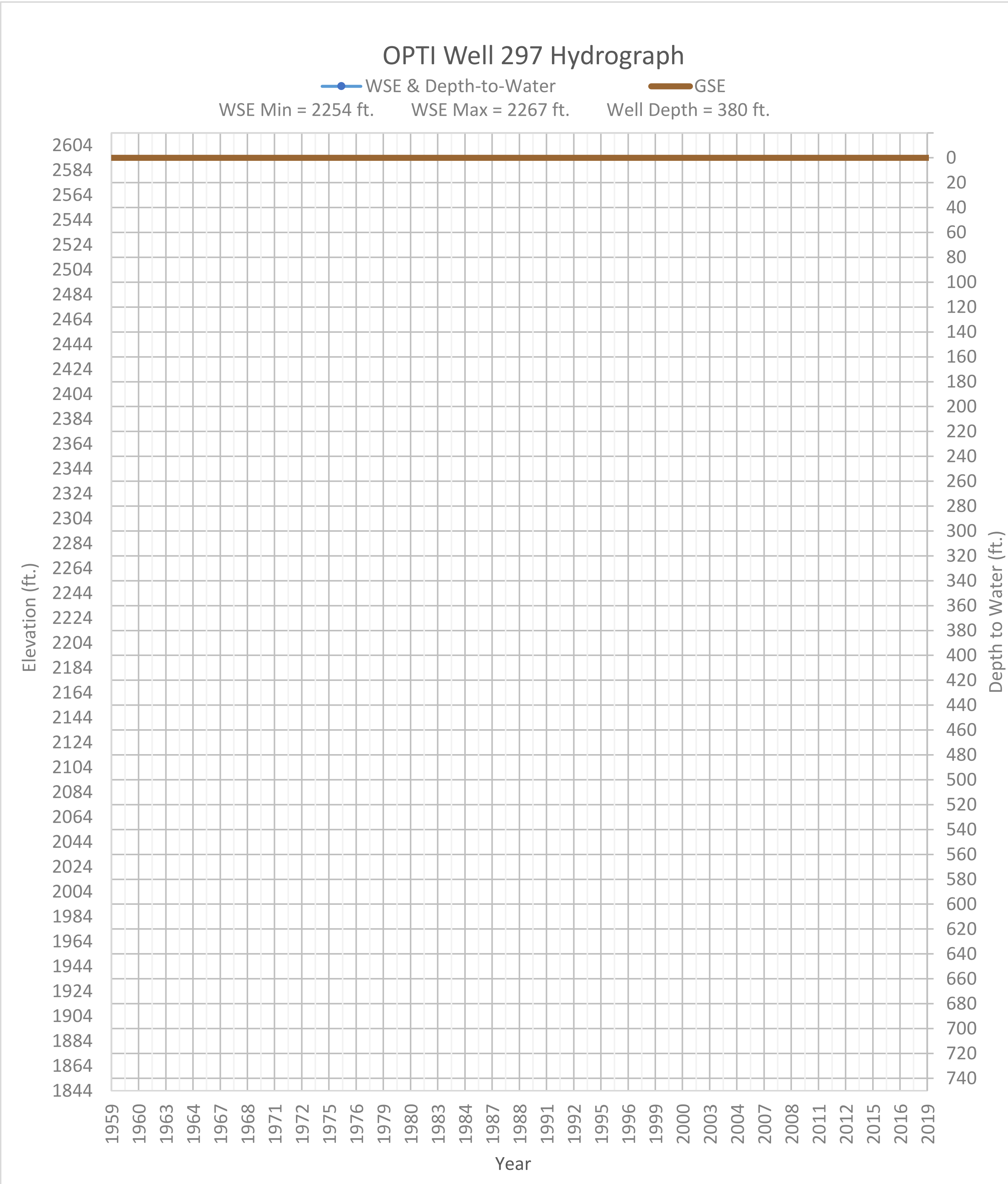

OPTI Well 293 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2297 ft.
WSE Max = 2297 ft.
Well Depth = 500 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

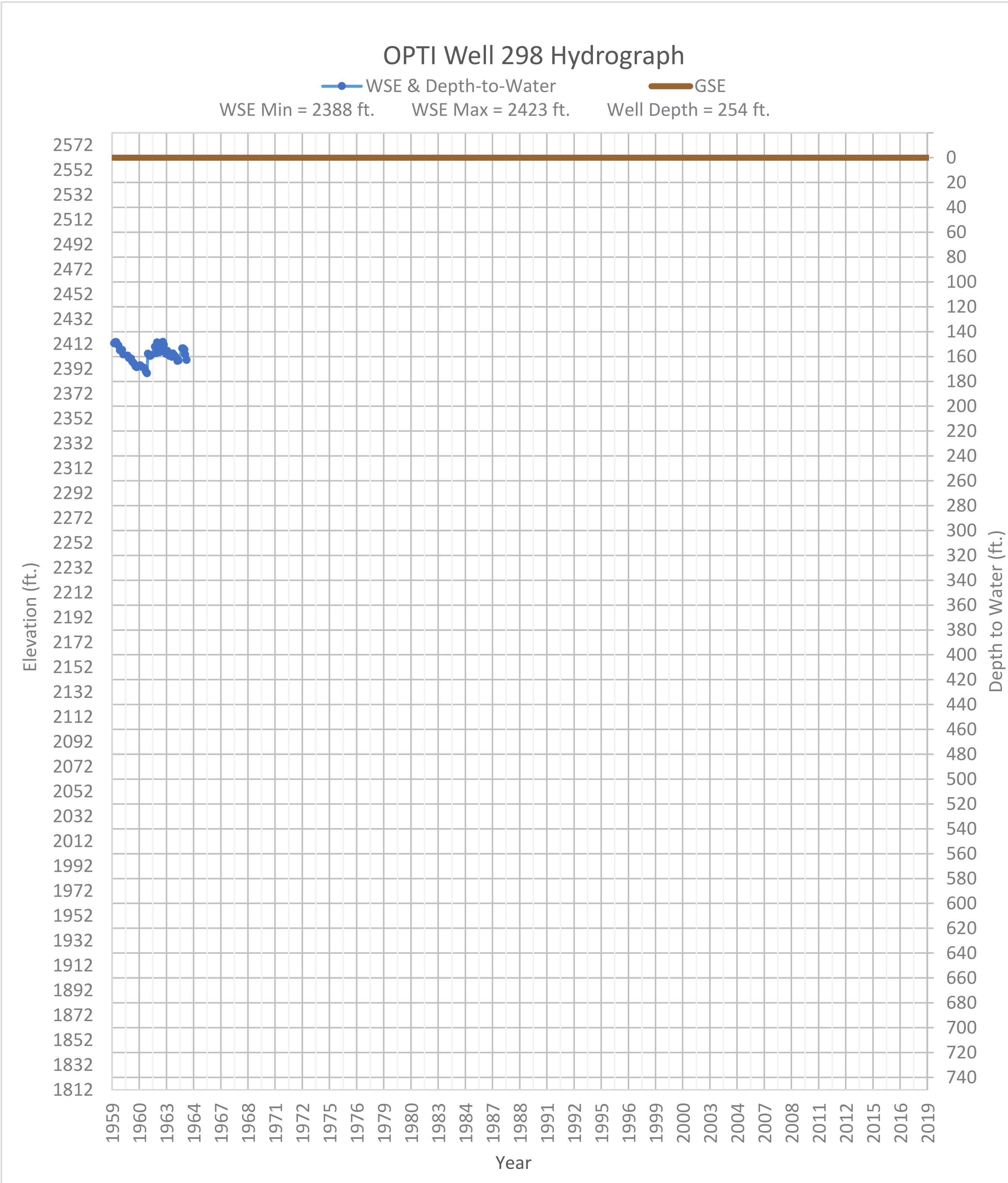


OPTI Well 294 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2102 ft.
WSE Max = 2102 ft.
Well Depth = 805 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

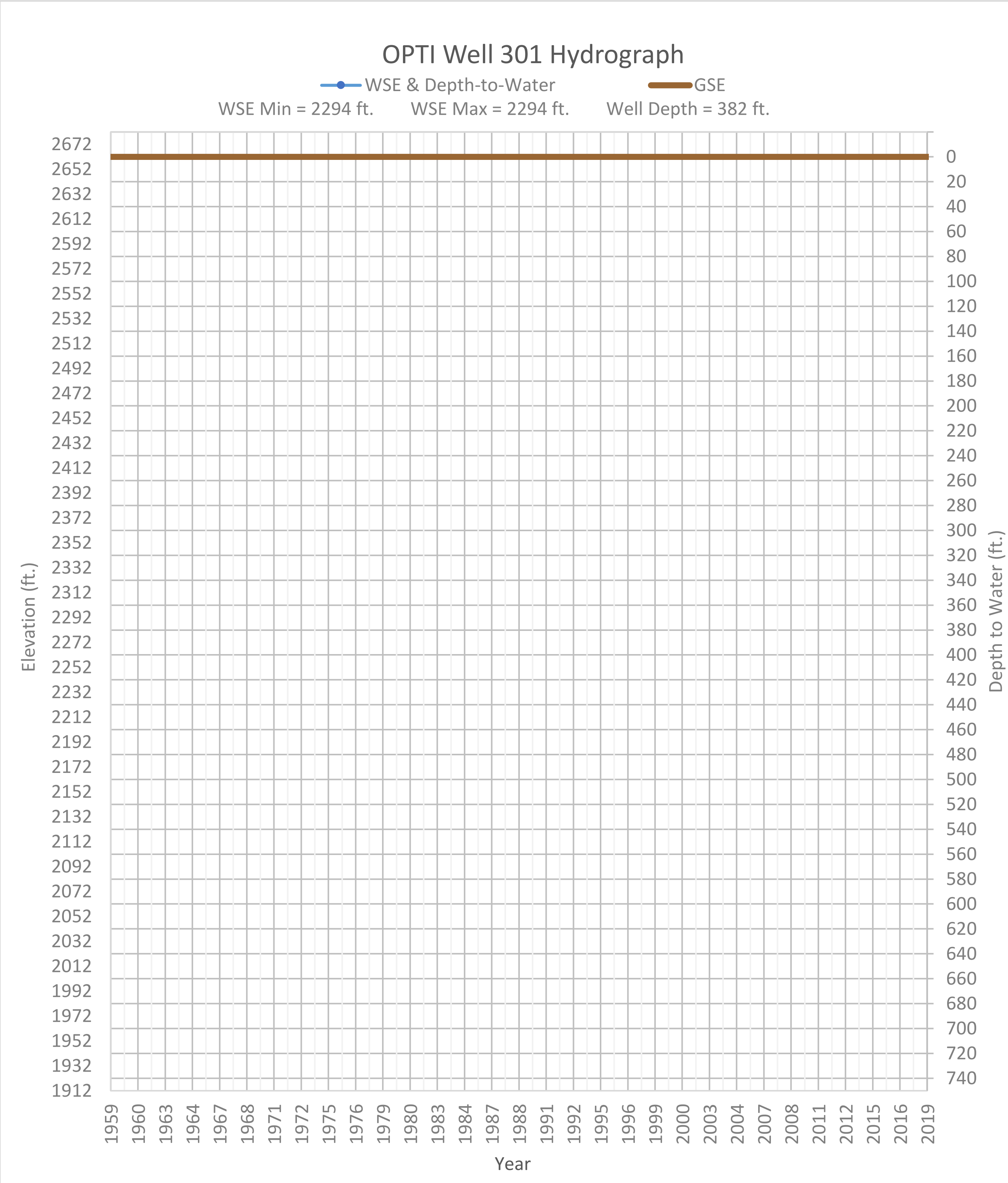


OPTI Well 296 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2273 ft.
WSE Max = 2317 ft.
Well Depth = 382 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

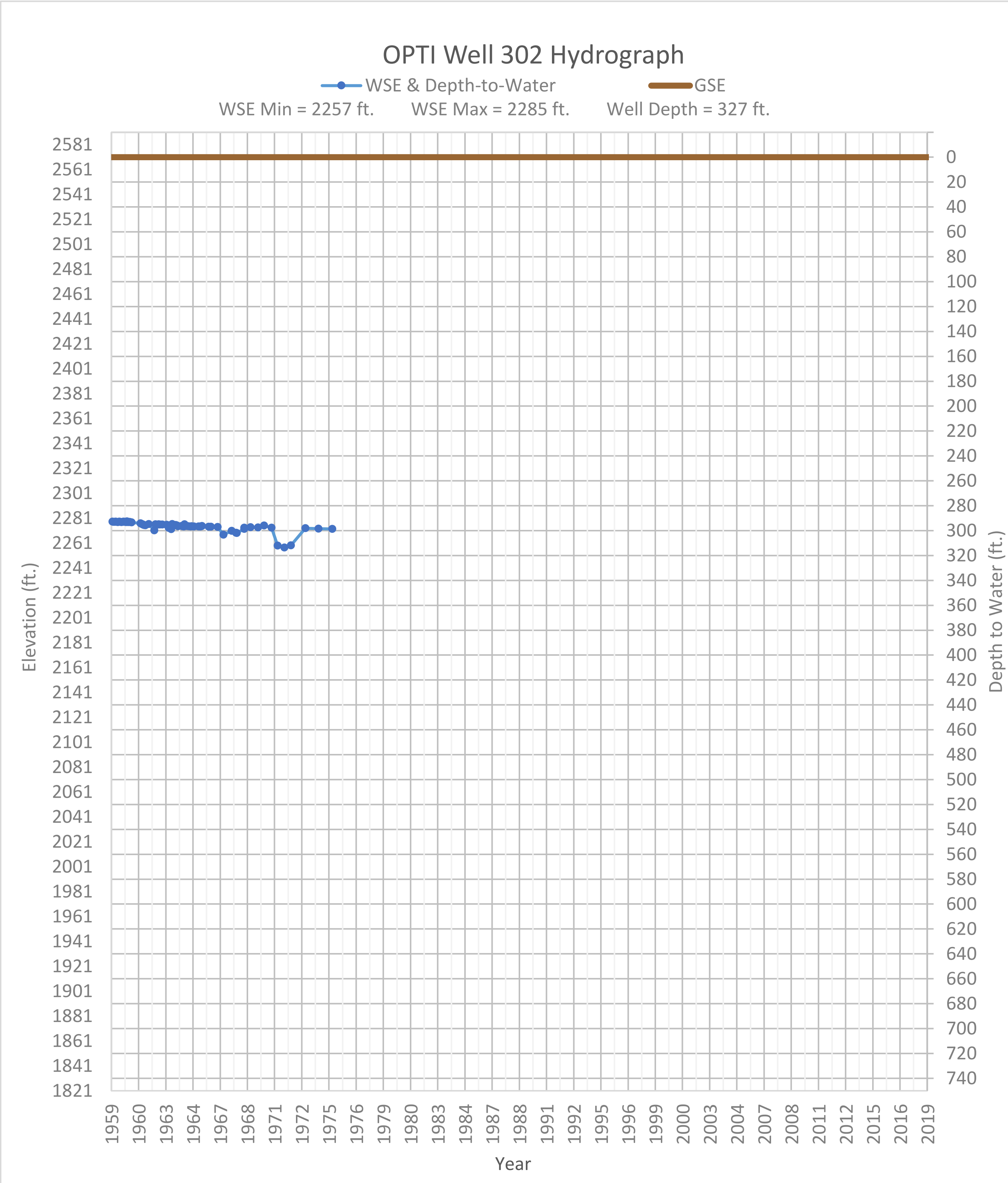

OPTI Well 297 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2254 ft.
WSE Max = 2267 ft.
Well Depth = 380 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 298 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2388 ft.
WSE Max = 2423 ft.
Well Depth = 254 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 301 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2294 ft.
WSE Max = 2294 ft.
Well Depth = 382 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 302 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2257 ft.
WSE Max = 2285 ft.
Well Depth = 327 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2581
2561
2541
2521
2501
2481
2461
2441
2421
2401
2381
2361
2341
2321
2301
2281
2261
2241
2221
2201
2181
2161
2141
2121
2101
2081
2061
2041
2021
2001
1981
1961
1941
1921
1901
1881
1861
1841
1821
0
20
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200
220
240
260
280
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320
340
360
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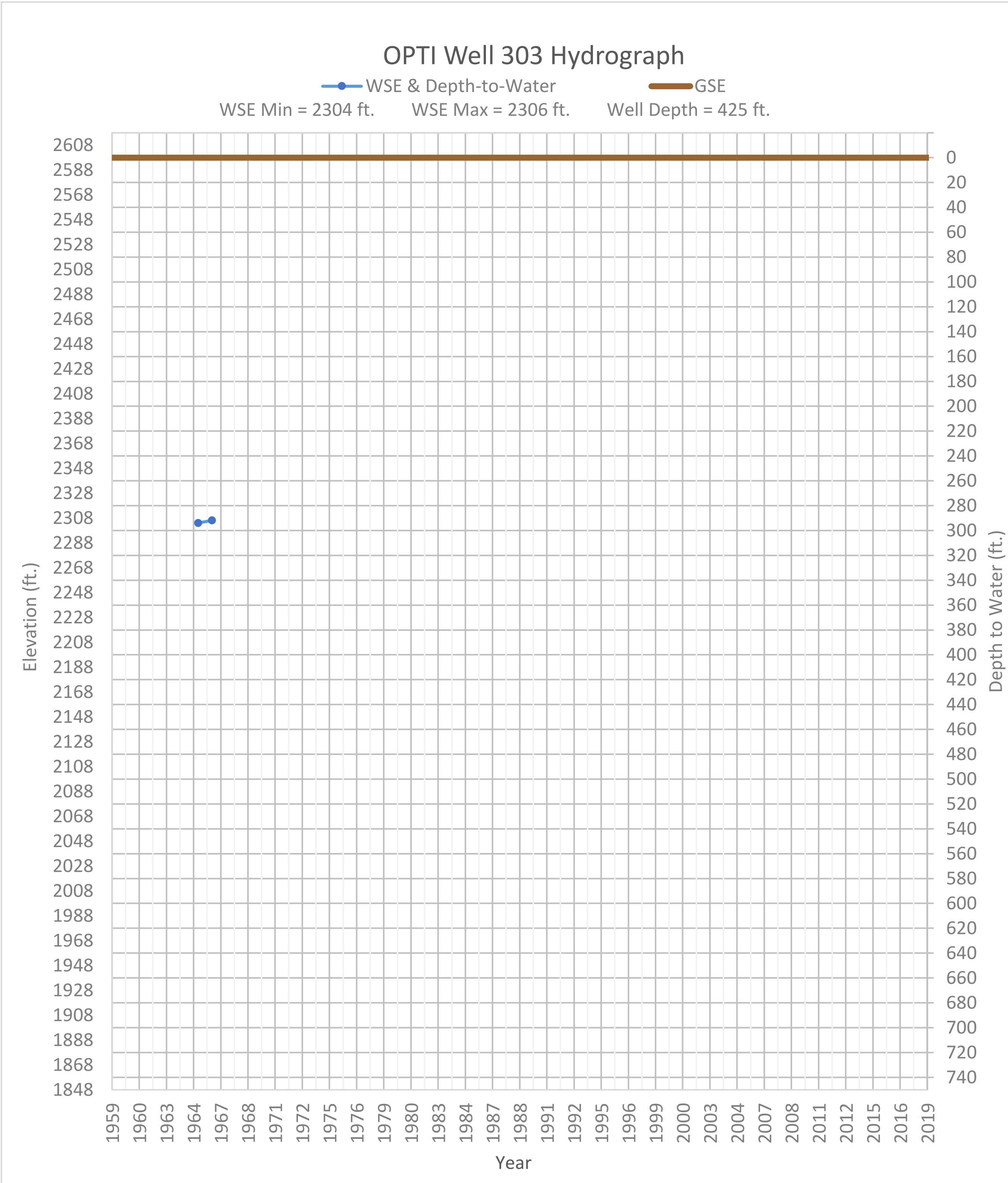
OPTI Well 303 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2304 ft.
WSE Max = 2306 ft.
Well Depth = 425 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2608
2588
2568
2548
2528
2508
2488
2468
2448
2428
2408
2388
2368
2348
2328
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
1888
1868
1848
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80
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180
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220
240
260
280
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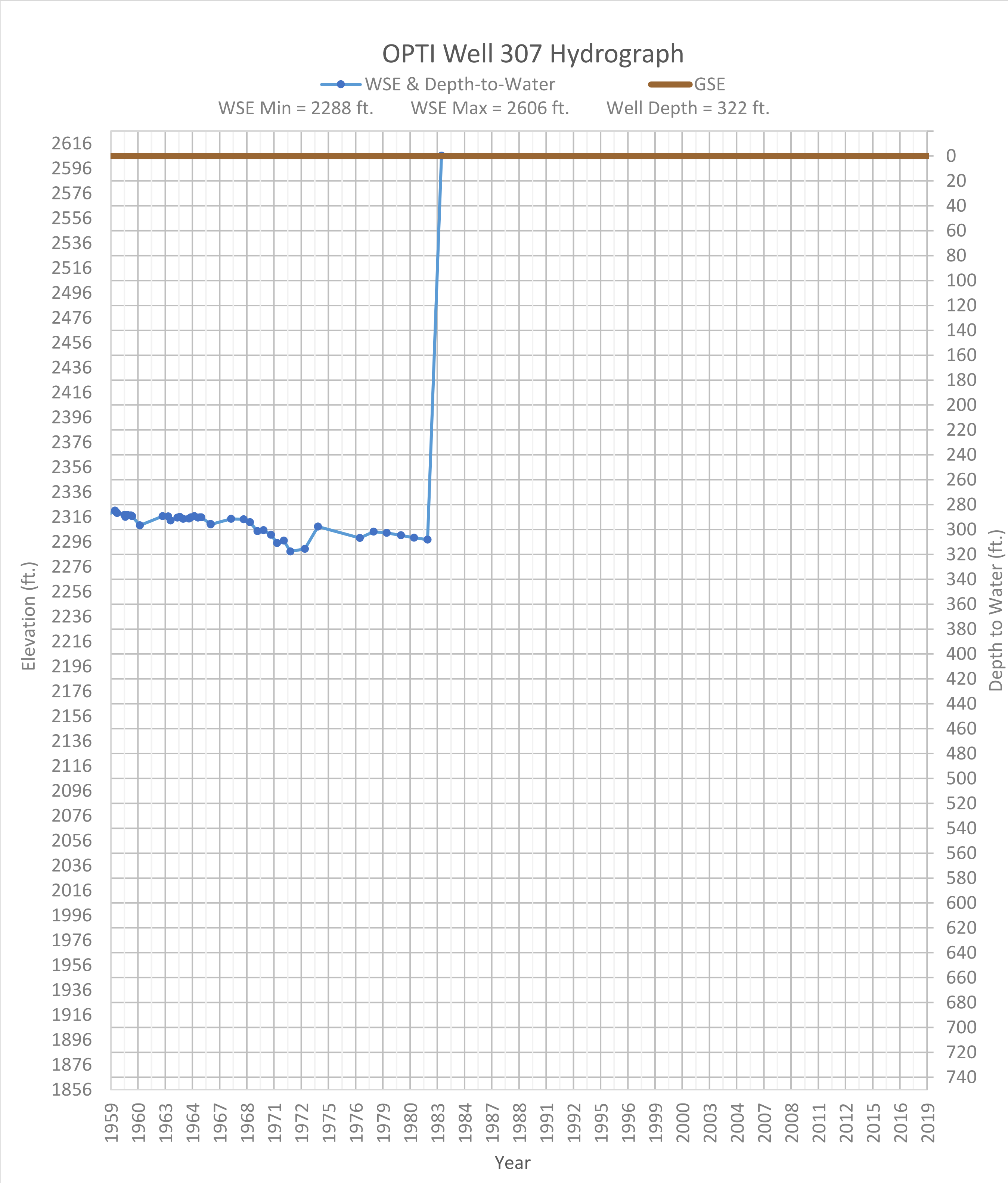
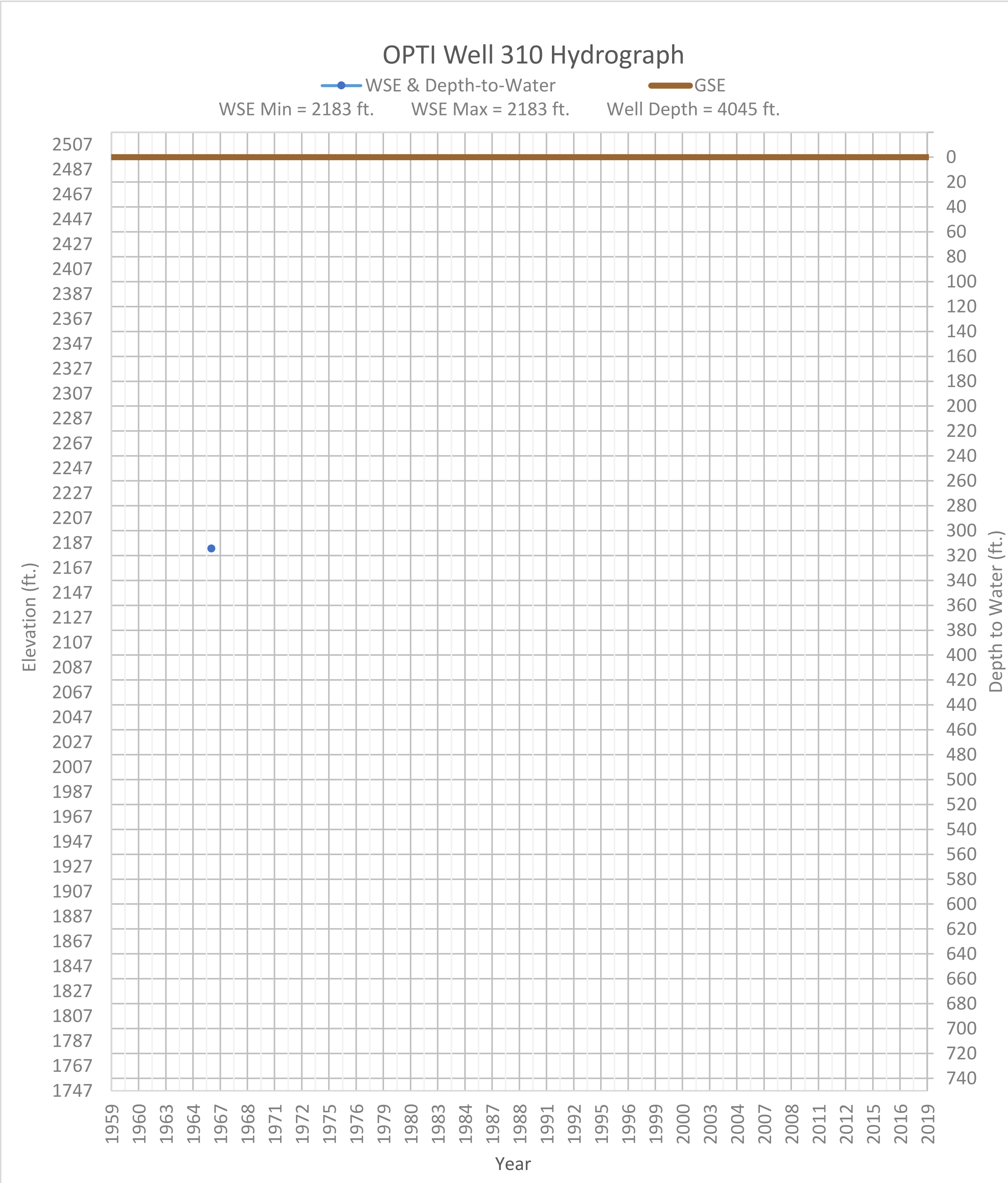
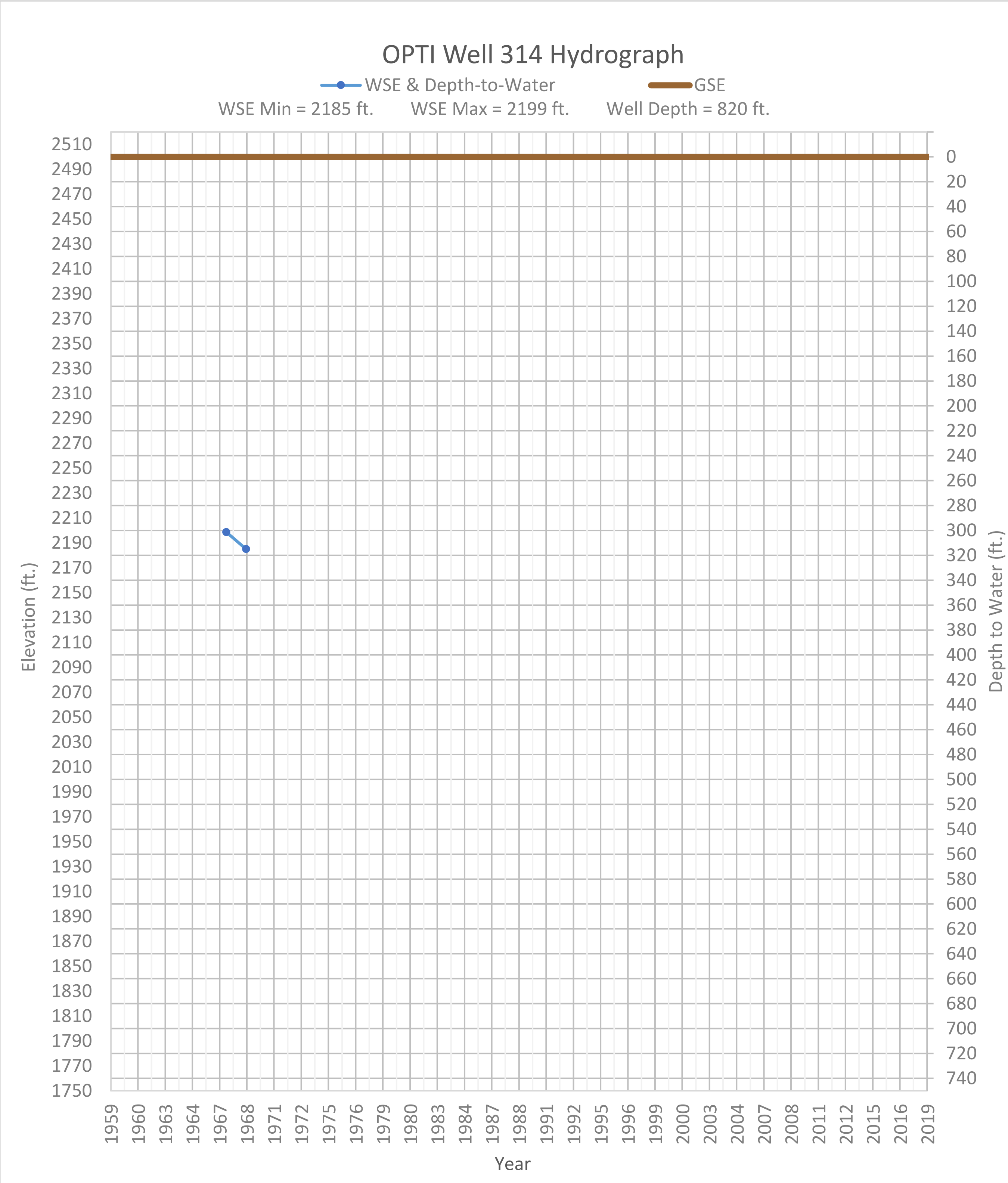


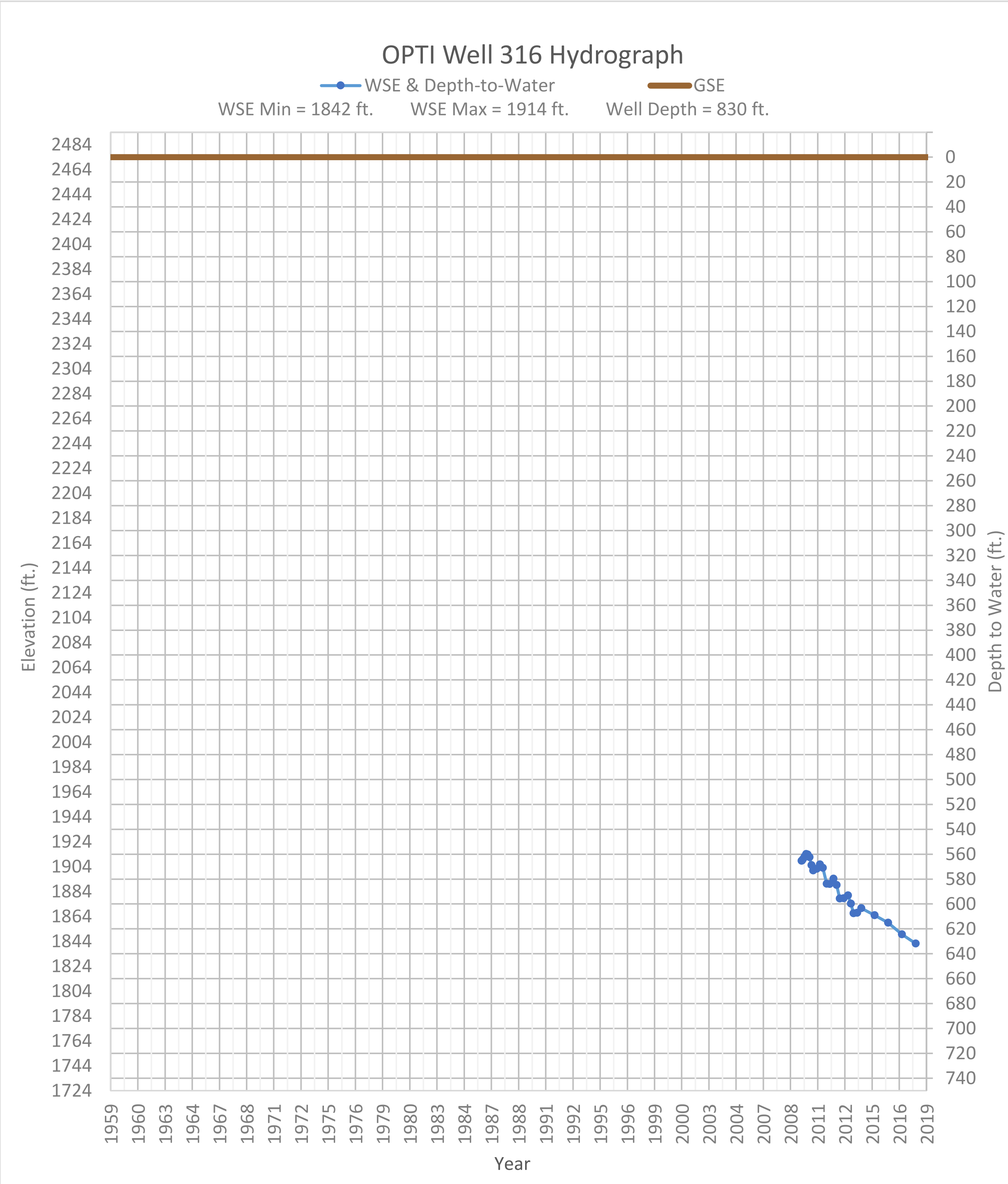
OPTI Well 307 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2288 ft.
WSE Max = 2606 ft.
Well Depth = 322 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 310 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2183 ft.
WSE Max = 2183 ft.
Well Depth = 4045 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 314 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2185 ft.
WSE Max = 2199 ft.
Well Depth = 820 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 316 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1842 ft.
WSE Max = 1914 ft.
Well Depth = 830 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2484
2464
2444
2424
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
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80
100
120
140
160
180
200
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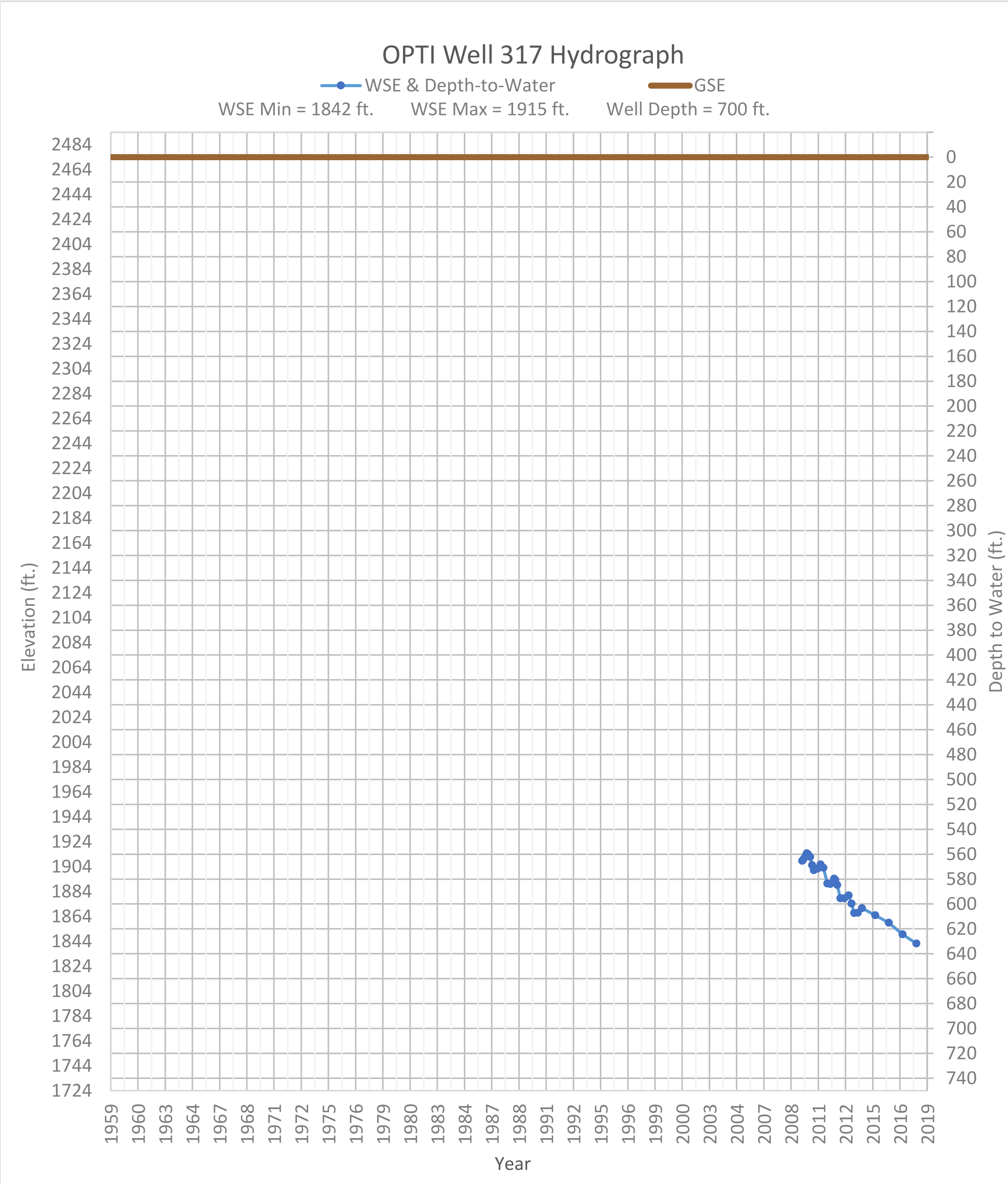

OPTI Well 317 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1842 ft.
WSE Max = 1915 ft.
Well Depth = 700 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2484
2464
2444
2424
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
1764
1744
1724
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100
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160
180
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220
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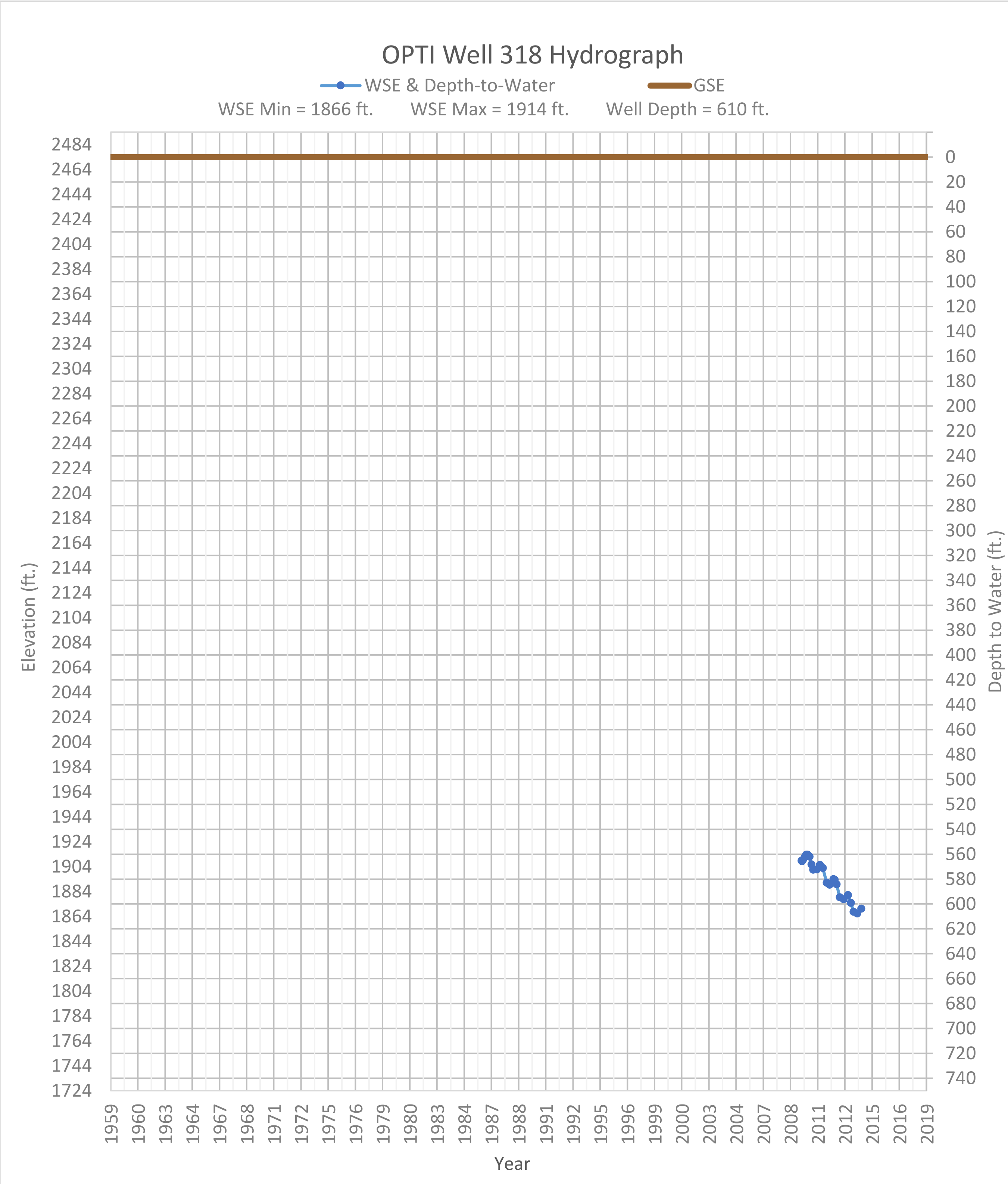
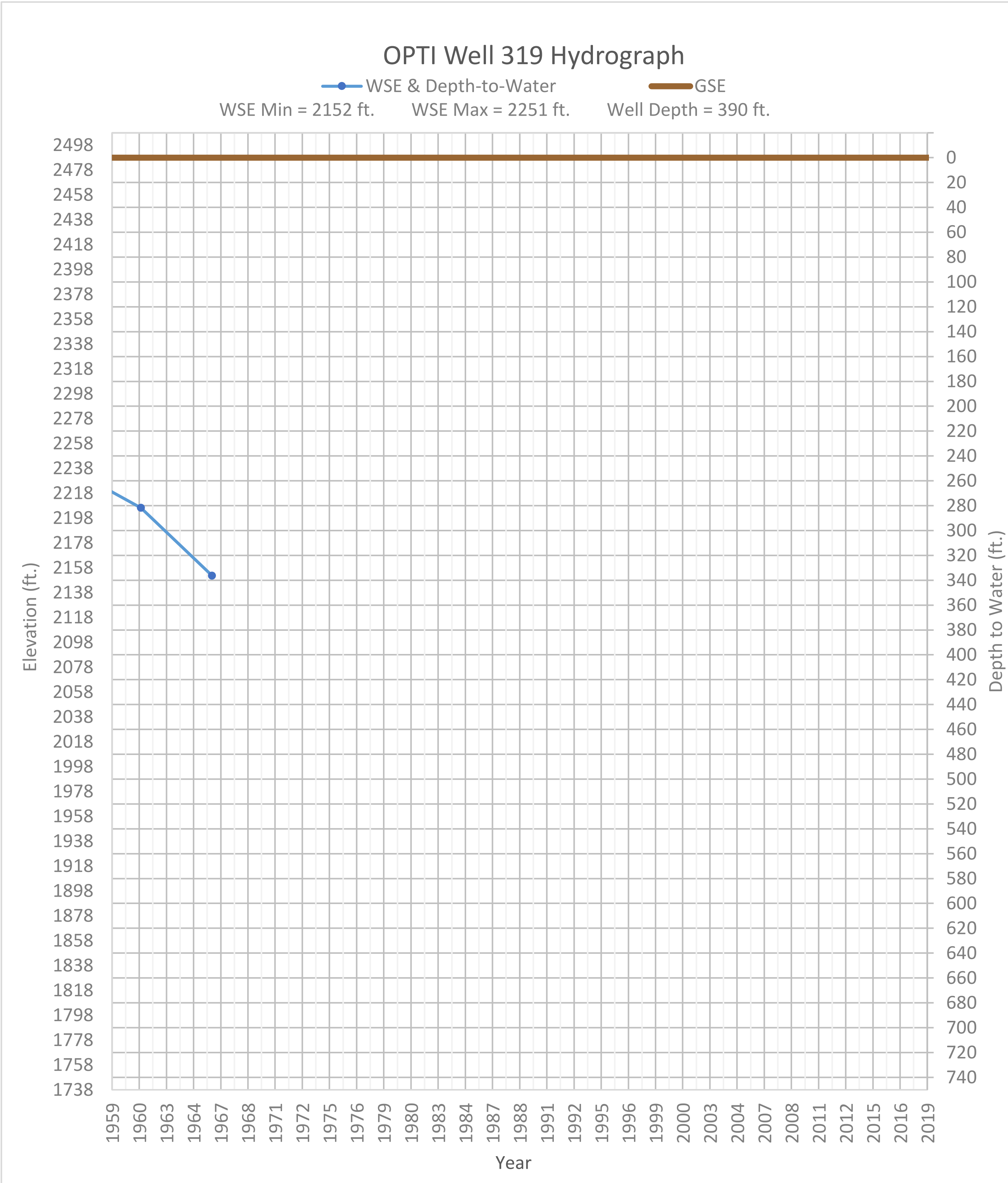
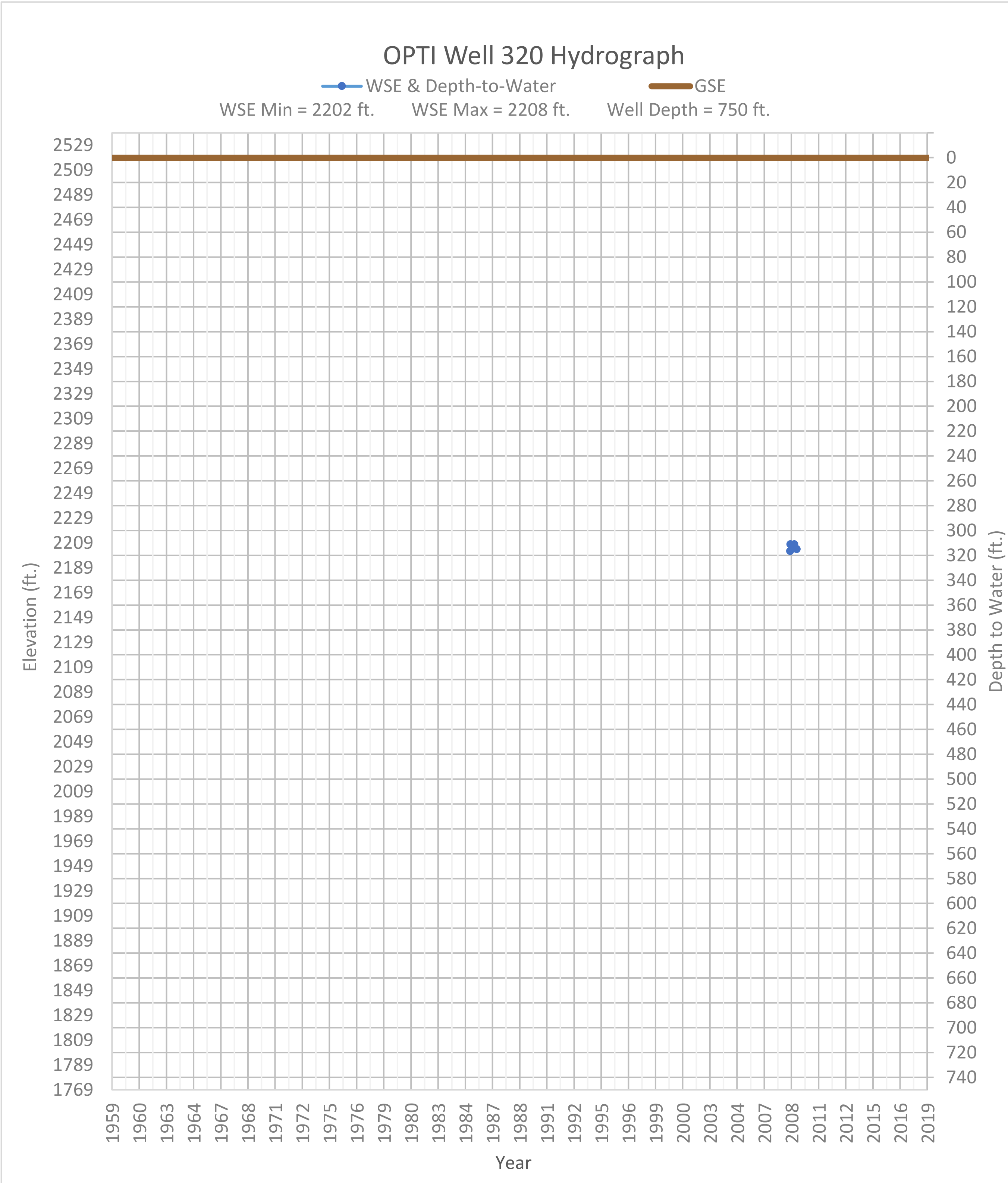
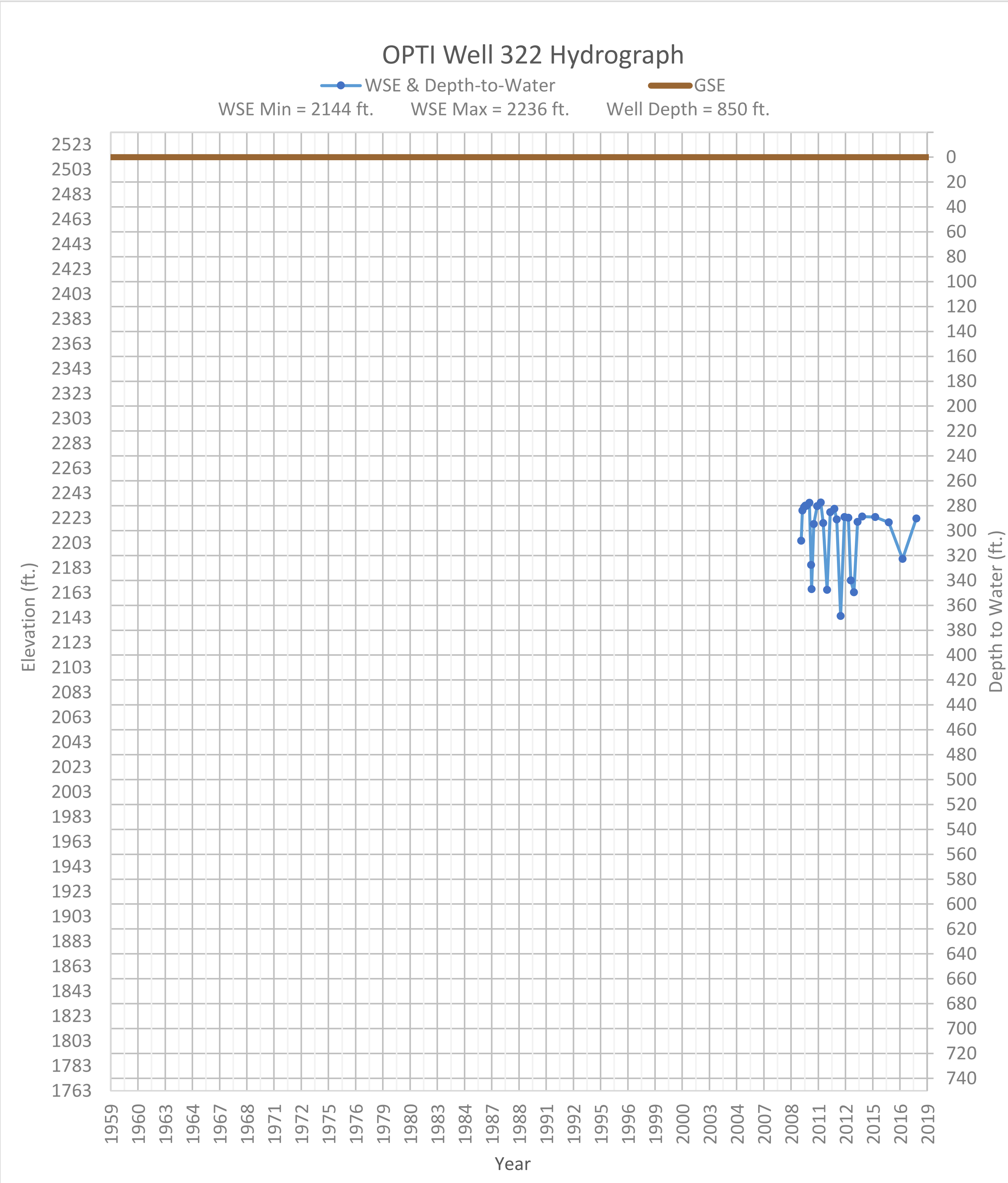

OPTI Well 318 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1866 ft.
WSE Max = 1914 ft.
Well Depth = 610 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



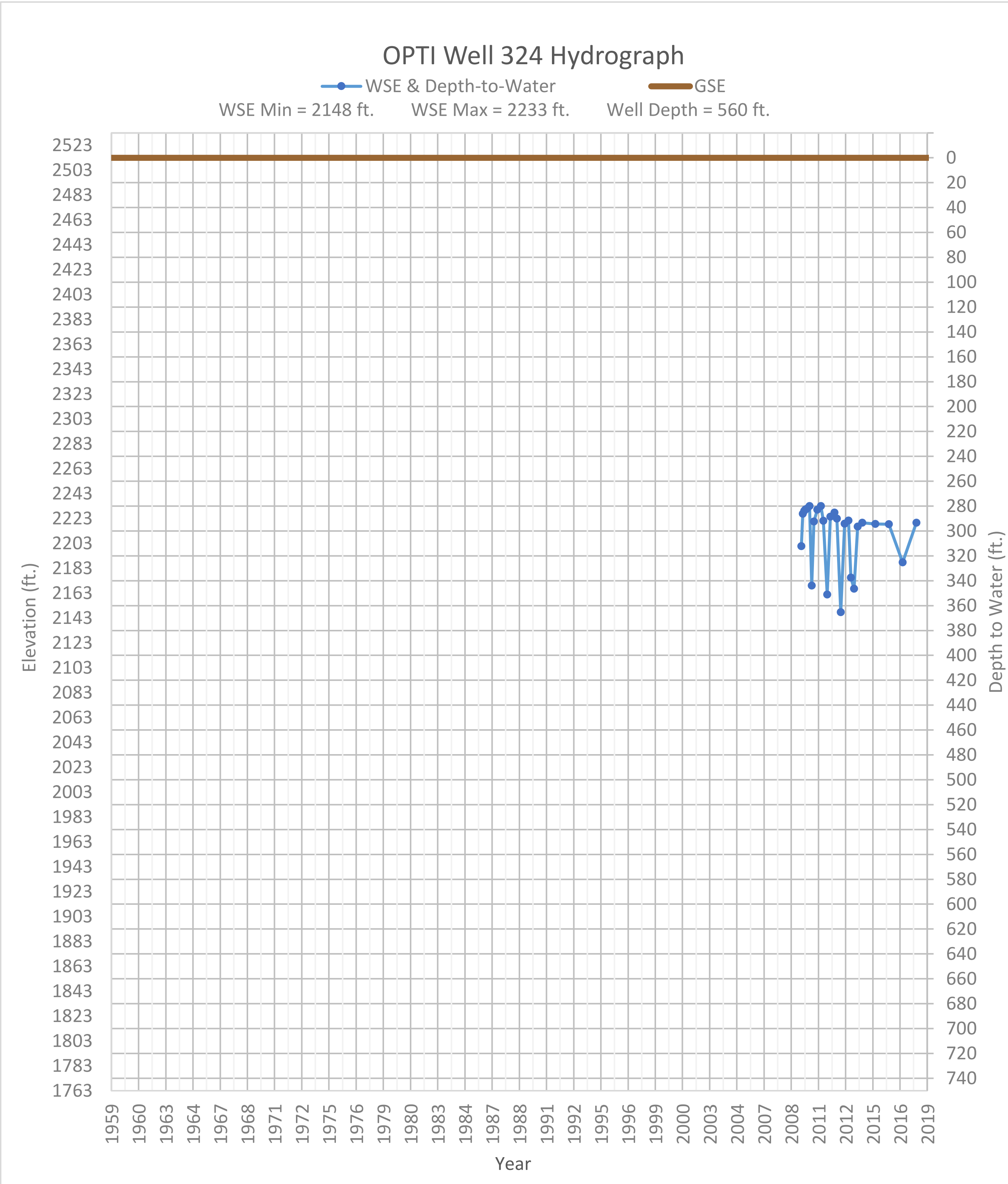
OPTI Well 319 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2152 ft.
WSE Max = 2251 ft.
Well Depth = 390 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



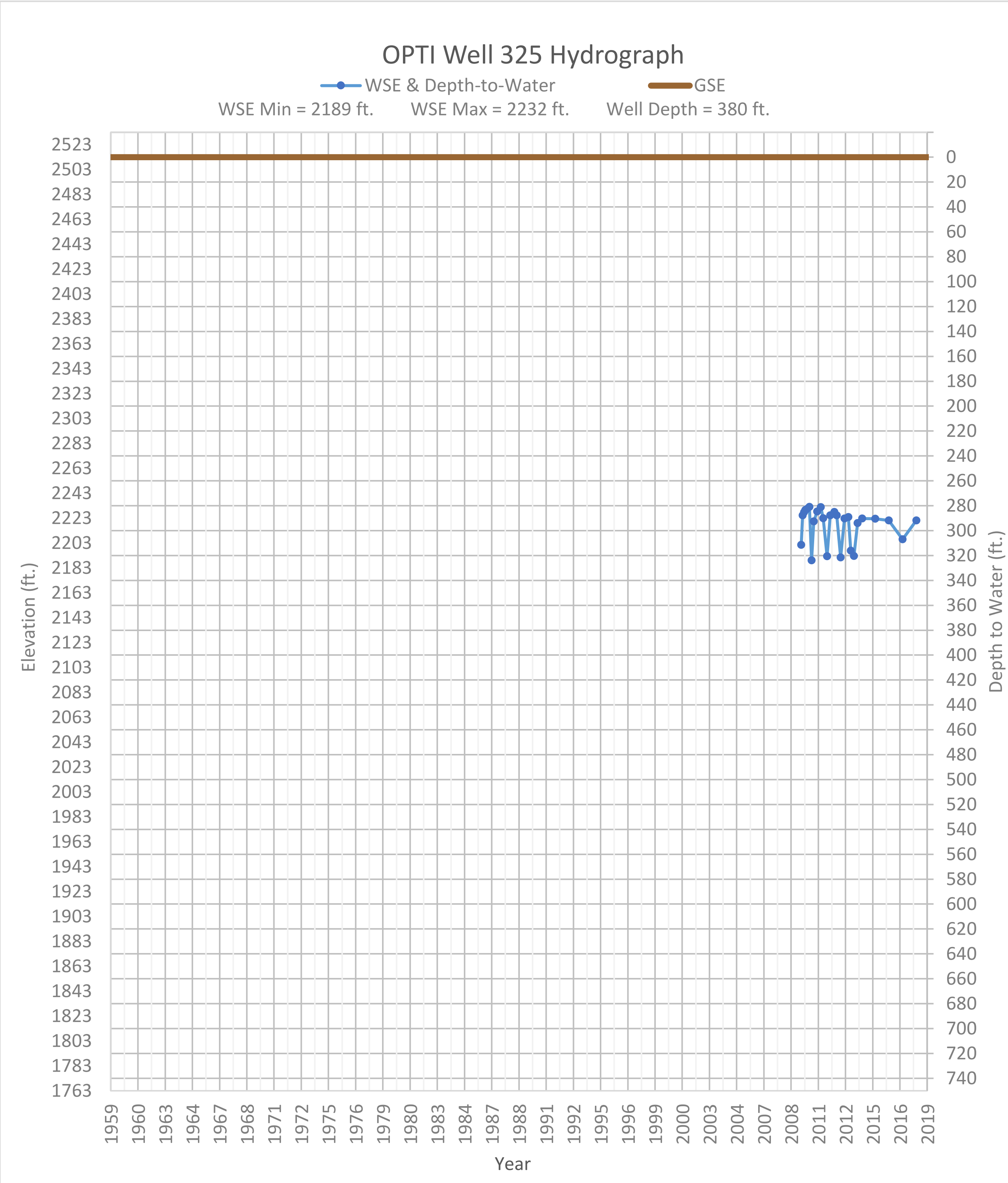
OPTI Well 320 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2202 ft.
WSE Max = 2208 ft.
Well Depth = 750 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



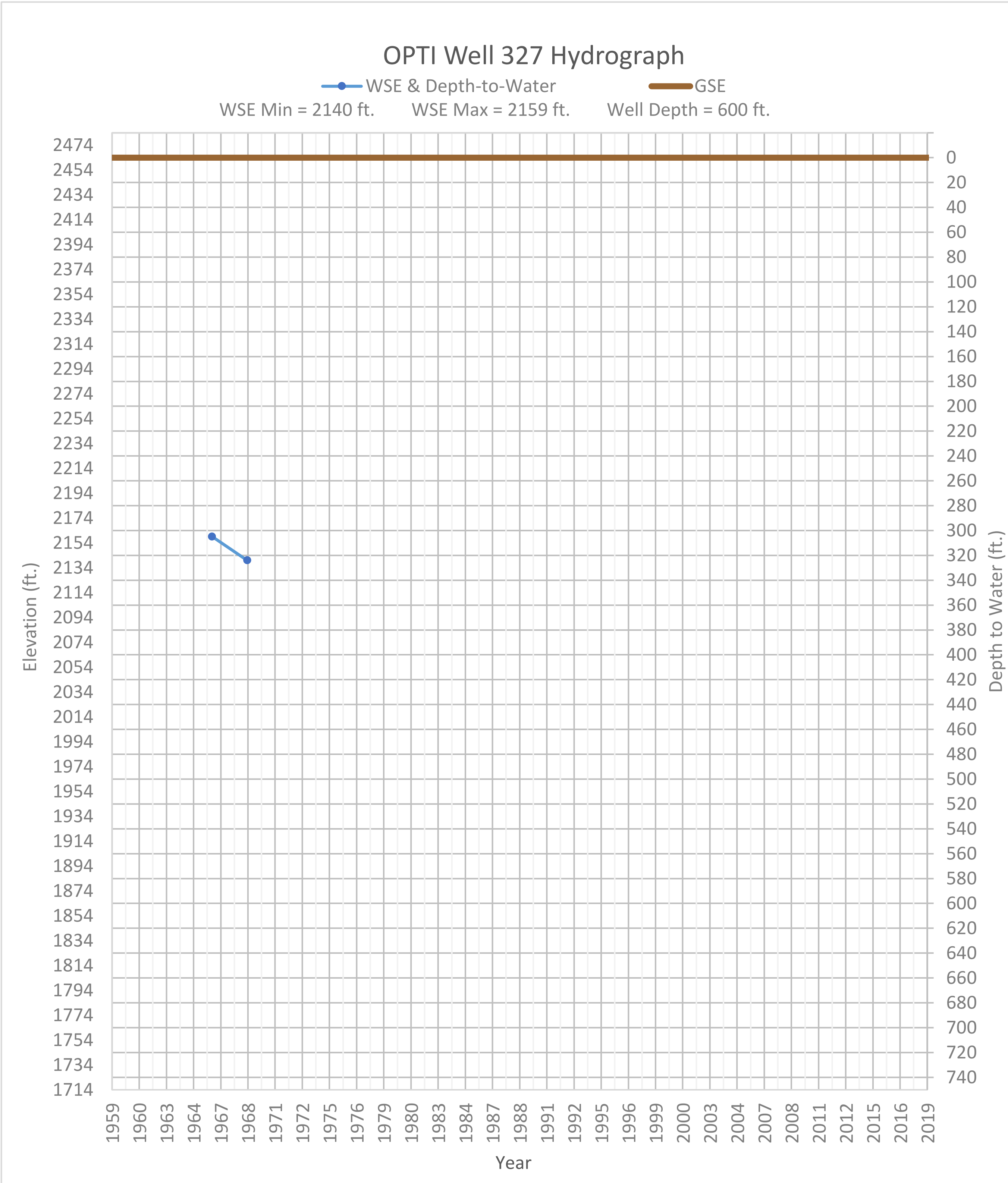
OPTI Well 322 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2144 ft.
WSE Max = 2236 ft.
Well Depth = 850 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

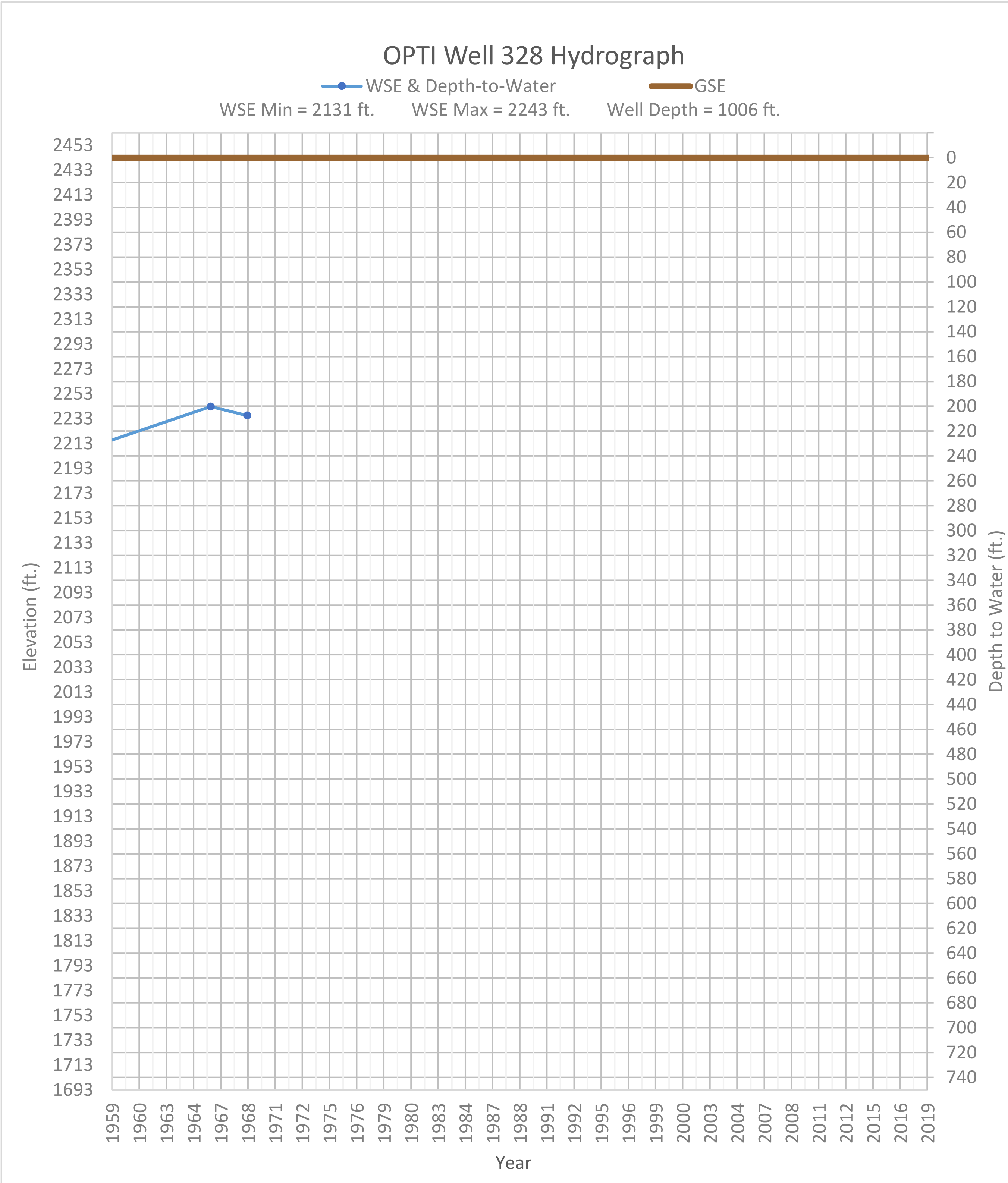


OPTI Well 324 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2148 ft.
WSE Max = 2233 ft.
Well Depth = 560 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 325 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2189 ft.
WSE Max = 2232 ft.
Well Depth = 380 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 327 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2140 ft.
WSE Max = 2159 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 328 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2131 ft.
WSE Max = 2243 ft.
Well Depth = 1006 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2453
2433
2413
2393
2373
2353
2333
2313
2293
2273
2253
2233
2213
2193
2173
2153
2133
2113
2093
2073
2053
2033
2013
1993
1973
1953
1933
1913
1893
1873
1853
1833
1813
1793
1773
1753
1733
1713
1693
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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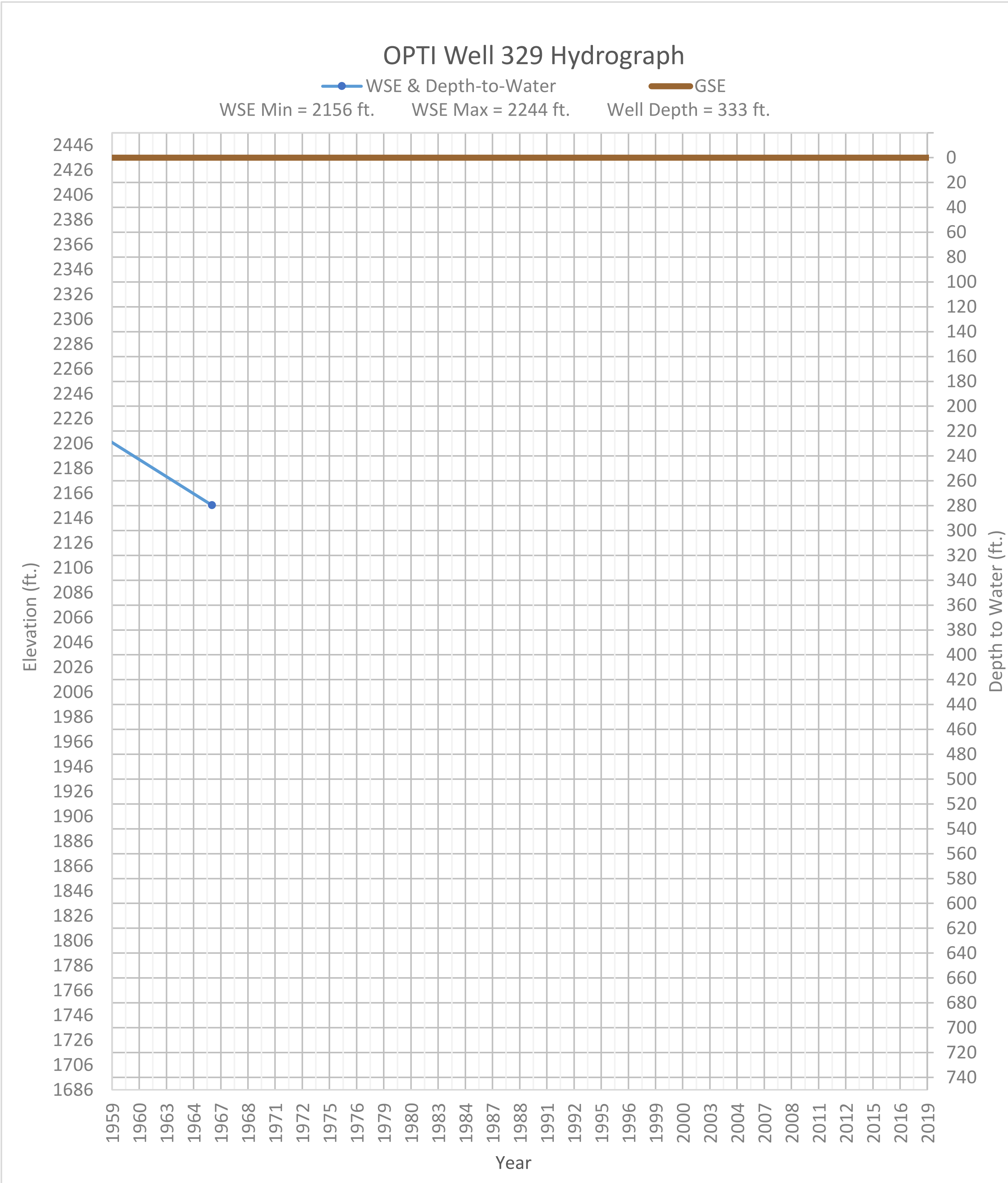
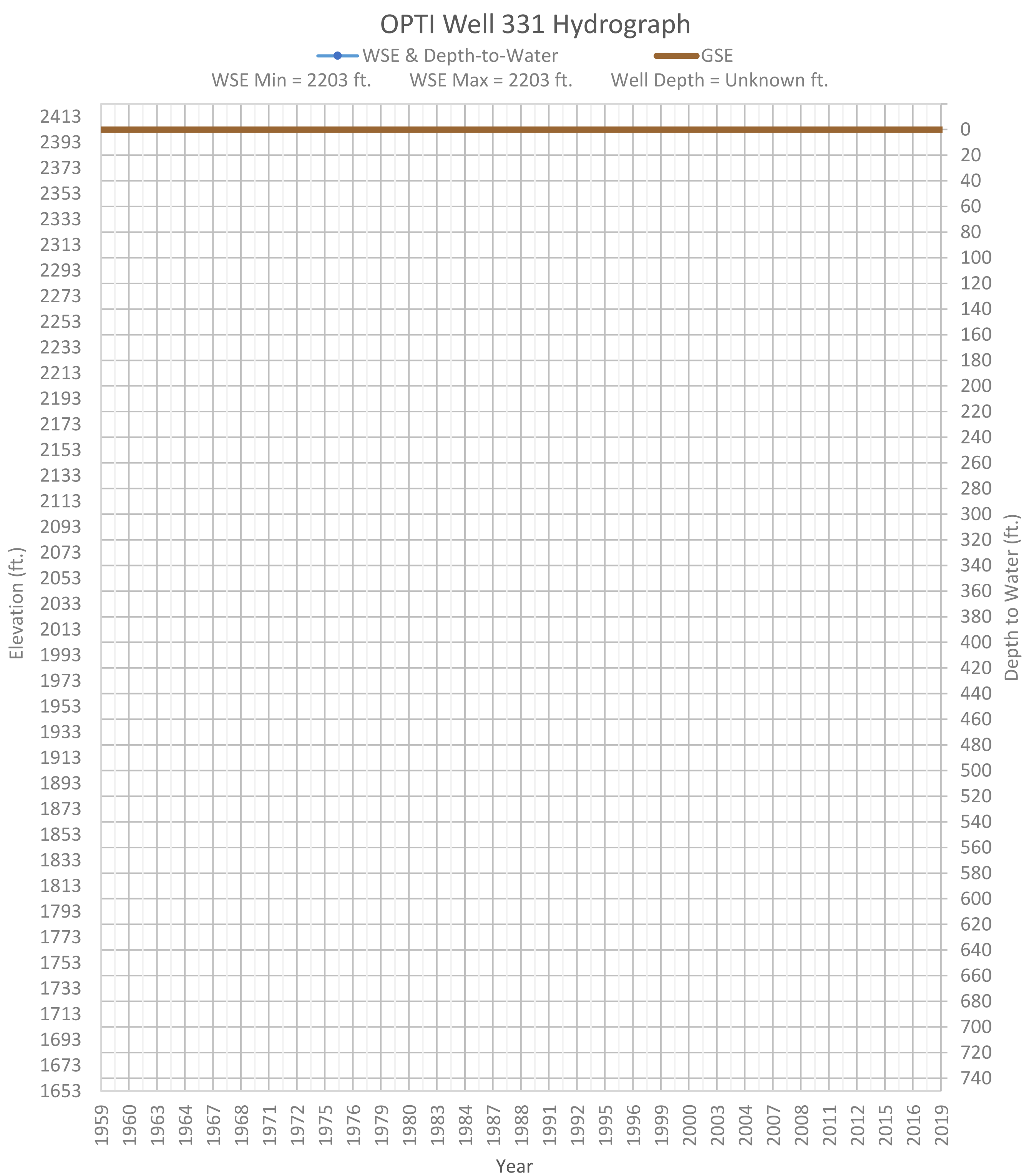


OPTI Well 329 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2156 ft.
WSE Max = 2244 ft.
Well Depth = 333 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 331 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2203 ft.
WSE Max = 2203 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2413
2393
2373
2353
2333
2313
2293
2273
2253
2233
2213
2193
2173
2153
2133
2113
2093
2073
2053
2033
2013
1993
1973
1953
1933
1913
1893
1873
1853
1833
1813
1793
1773
1753
1733
1713
1693
1673
1653
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
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540
560
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620
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660
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700
720
740
1959
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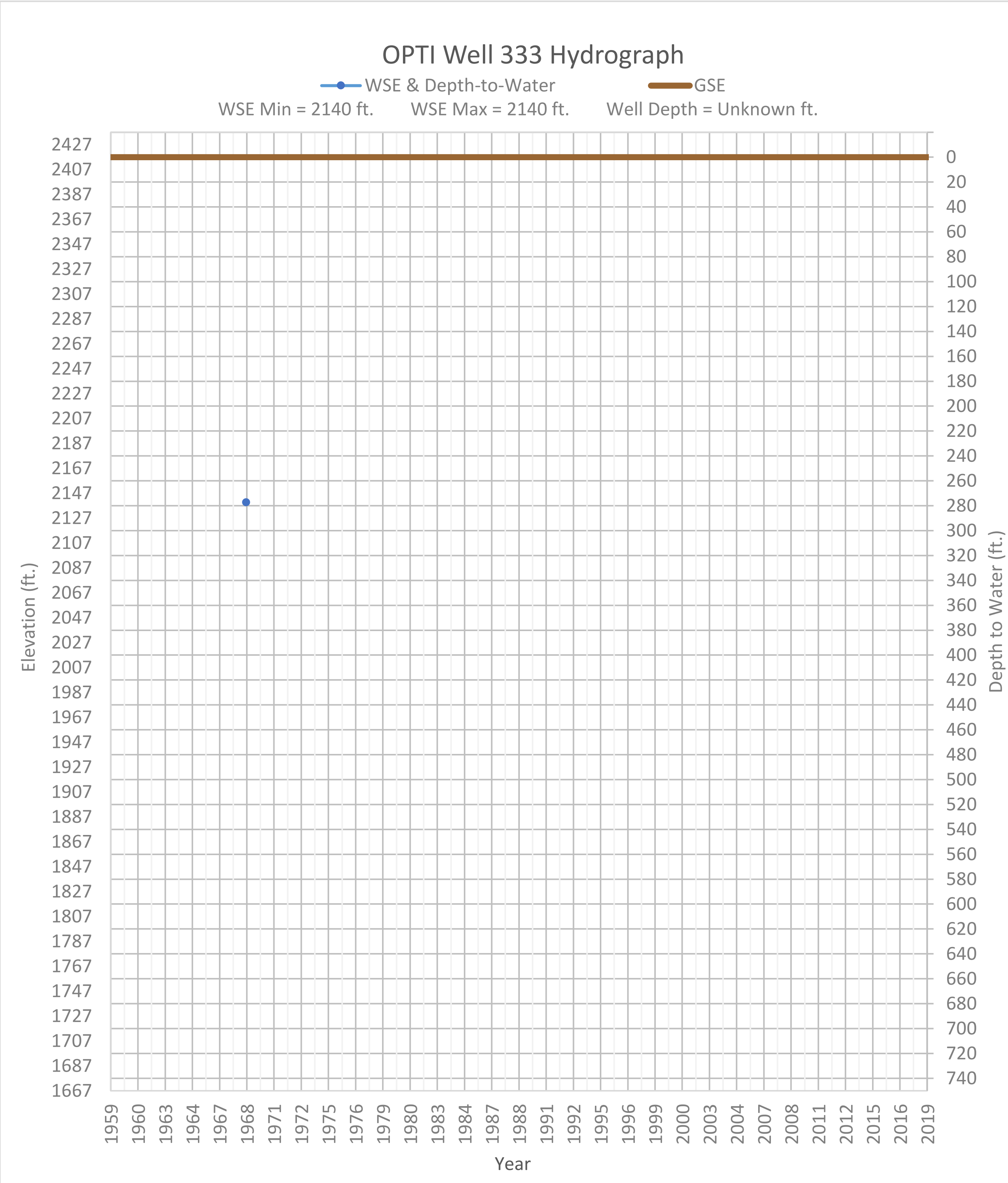
2016
2019


OPTI Well 333 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2140 ft.
WSE Max = 2140 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2427
2407
2387
2367
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
1947
1927
1907
1887
1867
1847
1827
1807
1787
1767
1747
1727
1707
1687
1667
0
20
40
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80
100
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180
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240
260
280
300
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2016
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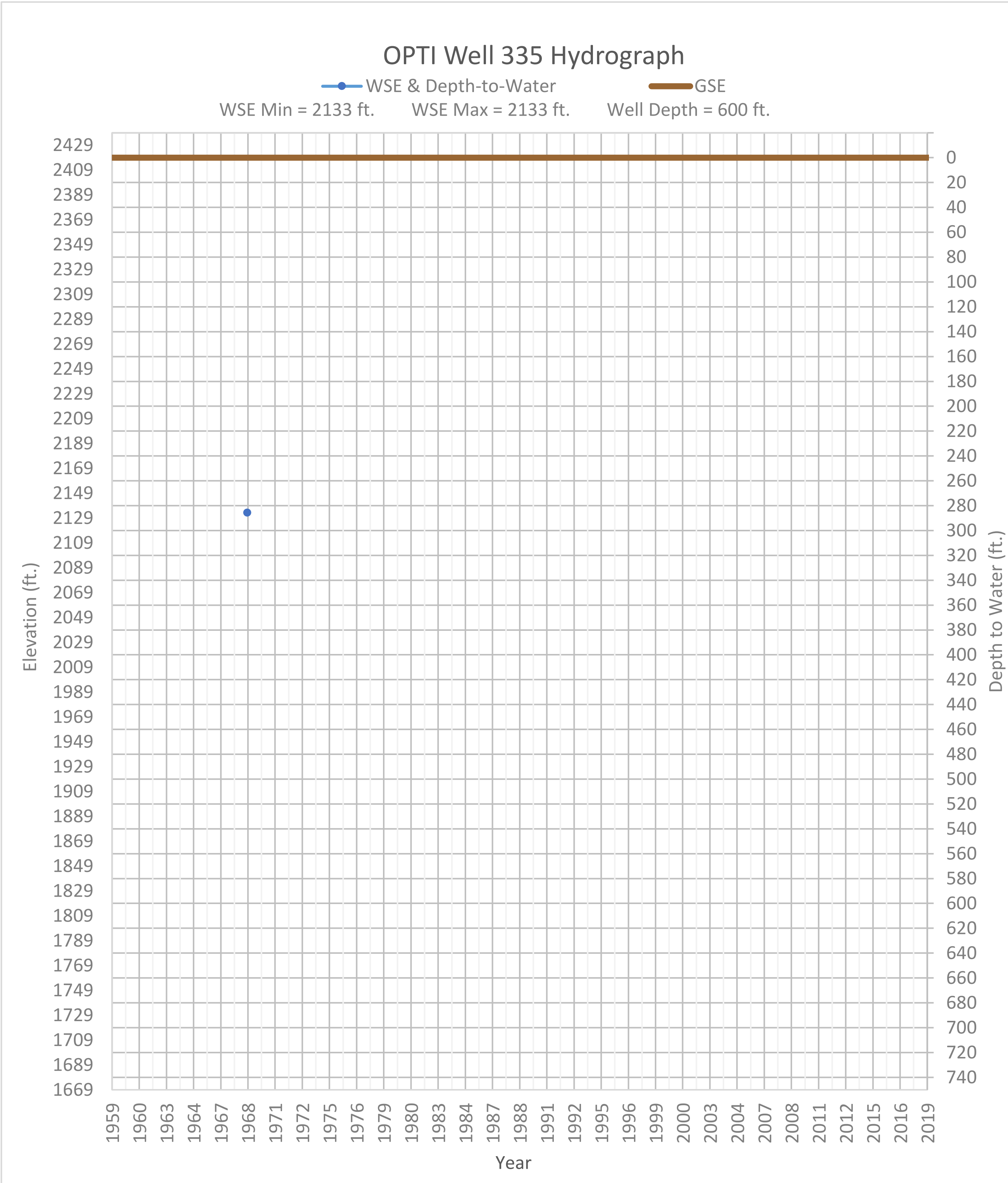
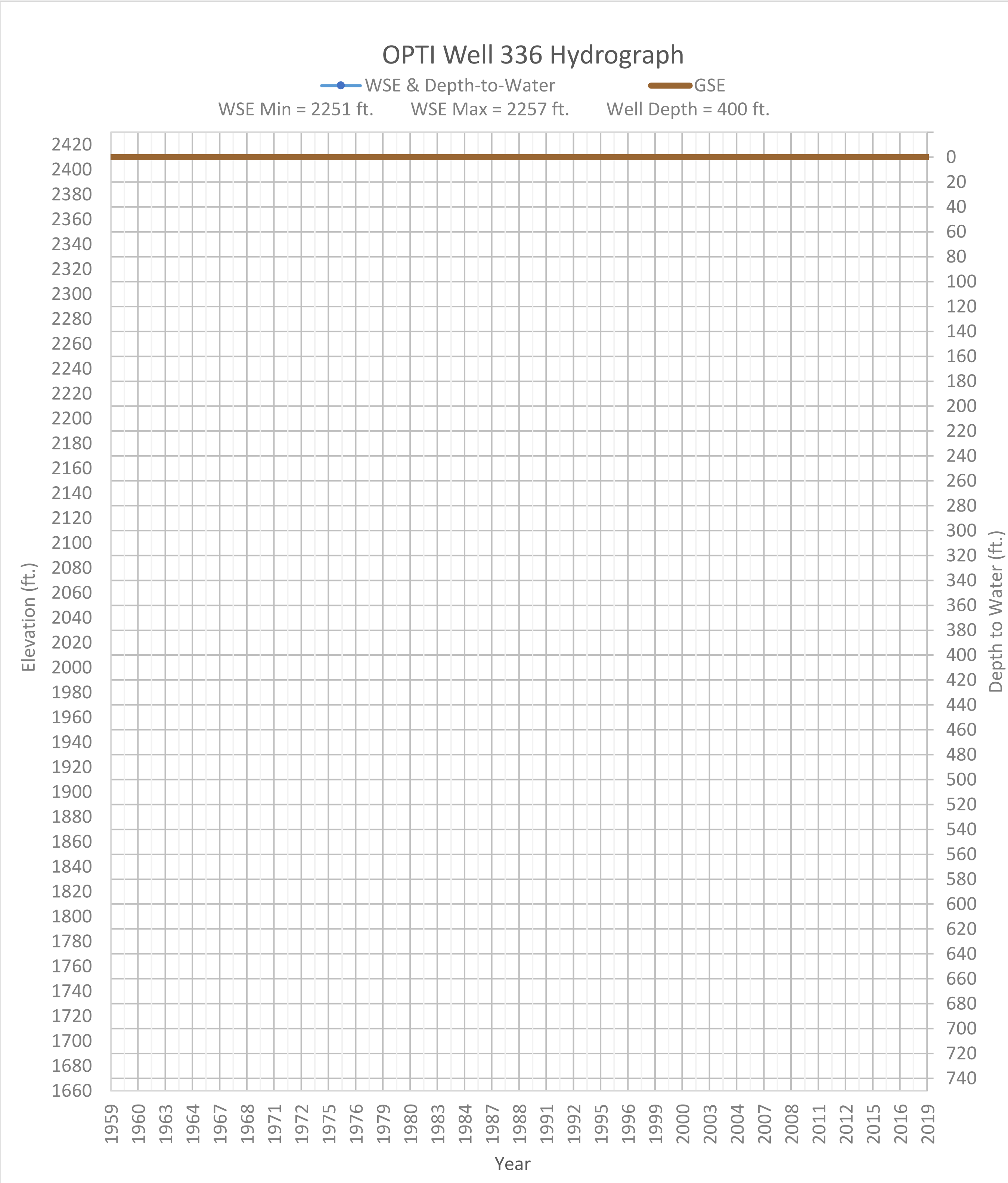


OPTI Well 335 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2133 ft.
WSE Max = 2133 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 336 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2251 ft.
WSE Max = 2257 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2420
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
1900
1880
1860
1840
1820
1800
1780
1760
1740
1720
1700
1680
1660
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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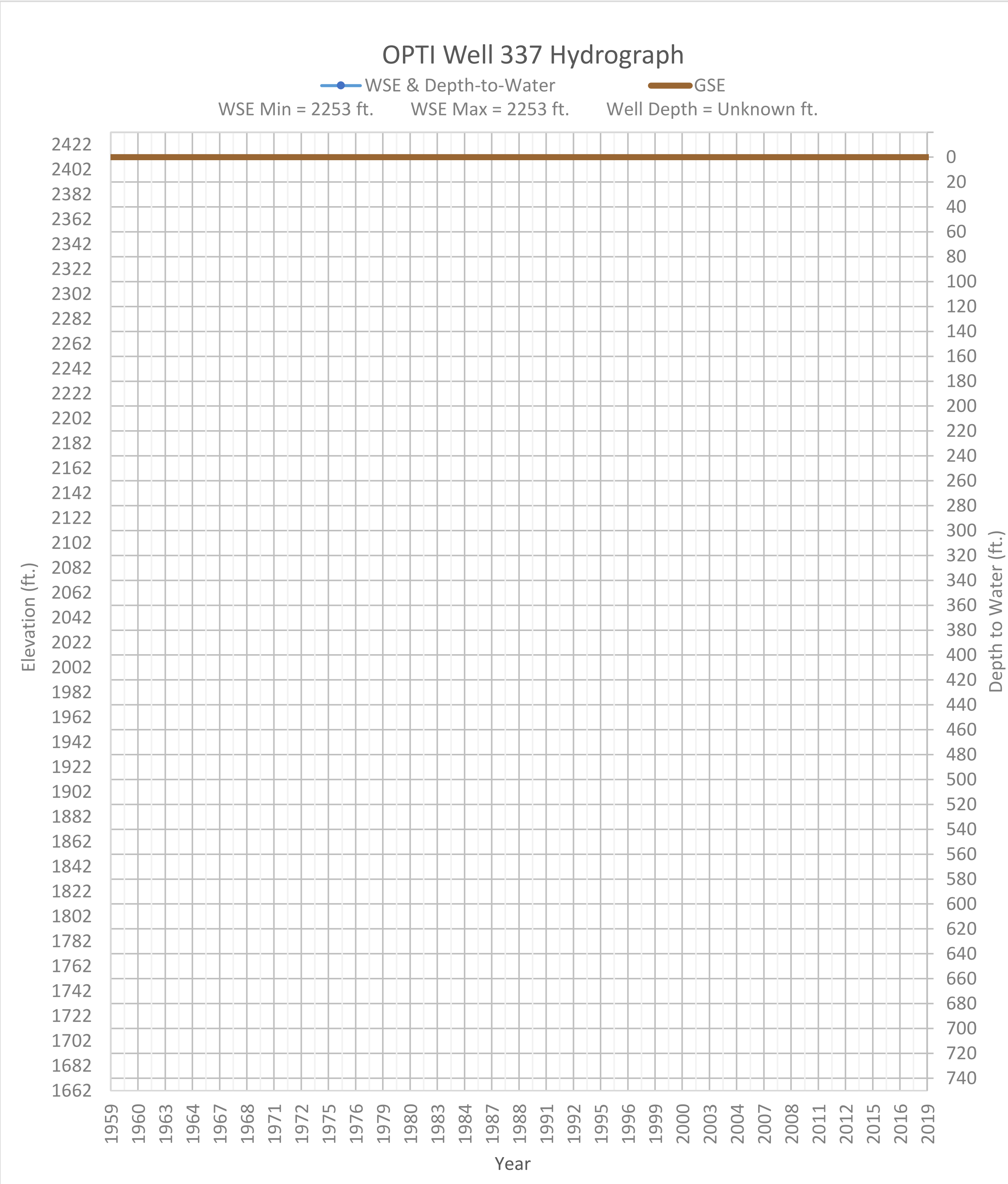

OPTI Well 337 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2253 ft.
WSE Max = 2253 ft.
Well Depth = Unknown ft.
Elevation (ft.)
2422
2402
2382
2362
2342
2322
2302
2282
2262
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
2002
1982
1962
1942
1922
1902
1882
1862
1842
1822
1802
1782
1762
1742
1722
1702
1682
1662
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
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380
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Year
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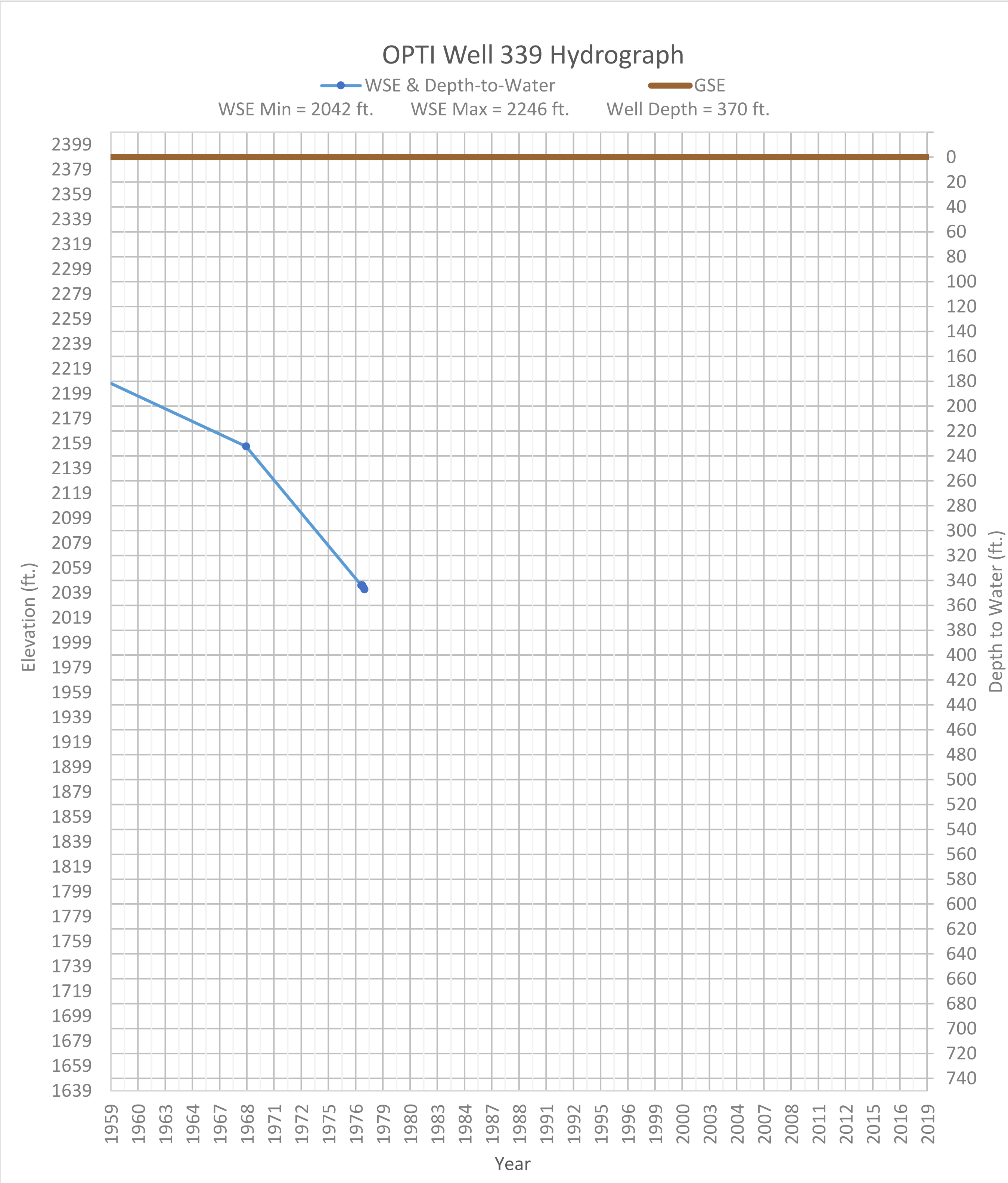

OPTI Well 339 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2042 ft.
WSE Max = 2246 ft.
Well Depth = 370 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2399
2379
2359
2339
2319
2299
2279
2259
2239
2219
2199
2179
2159
2139
2119
2099
2079
2059
2039
2019
1999
1979
1959
1939
1919
1899
1879
1859
1839
1819
1799
1779
1759
1739
1719
1699
1679
1659
1639
0
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160
180
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220
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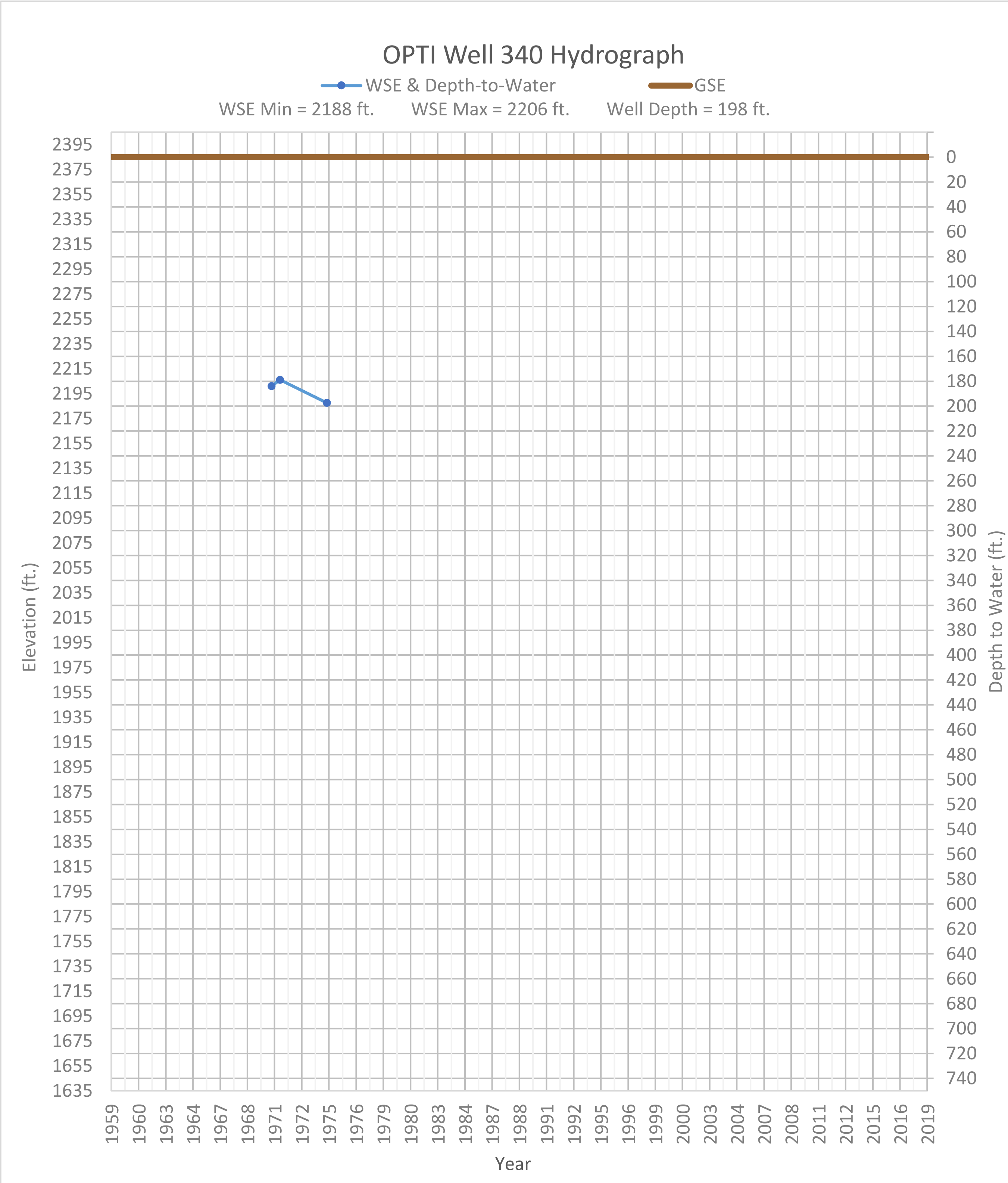
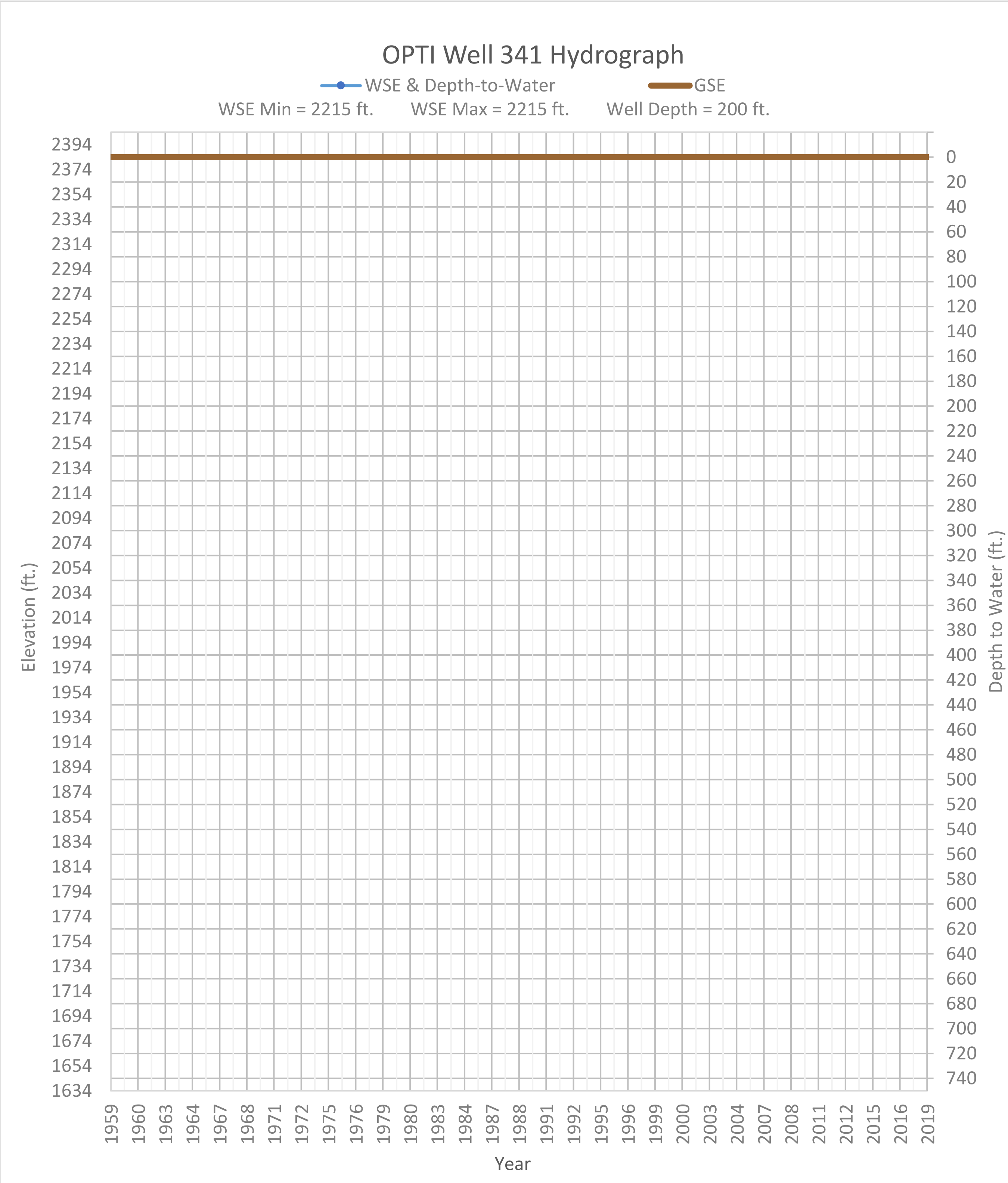


OPTI Well 340 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2188 ft.
WSE Max = 2206 ft.
Well Depth = 198 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 341 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2215 ft.
WSE Max = 2215 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2394
2374
2354
2334
2314
2294
2274
2254
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
1754
1734
1714
1694
1674
1654
1634
0
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60
80
100
120
140
160
180
200
220
240
260
280
300
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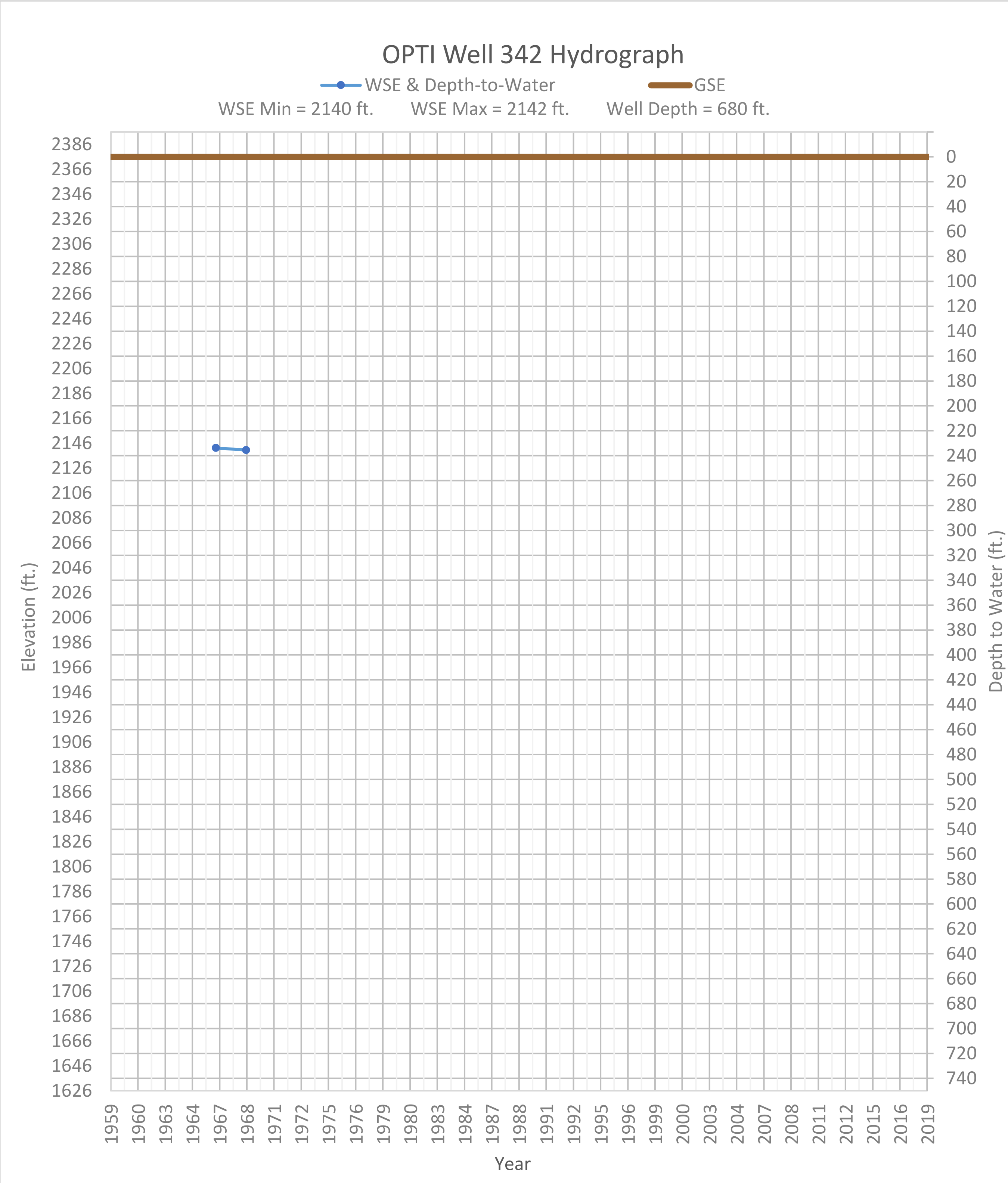
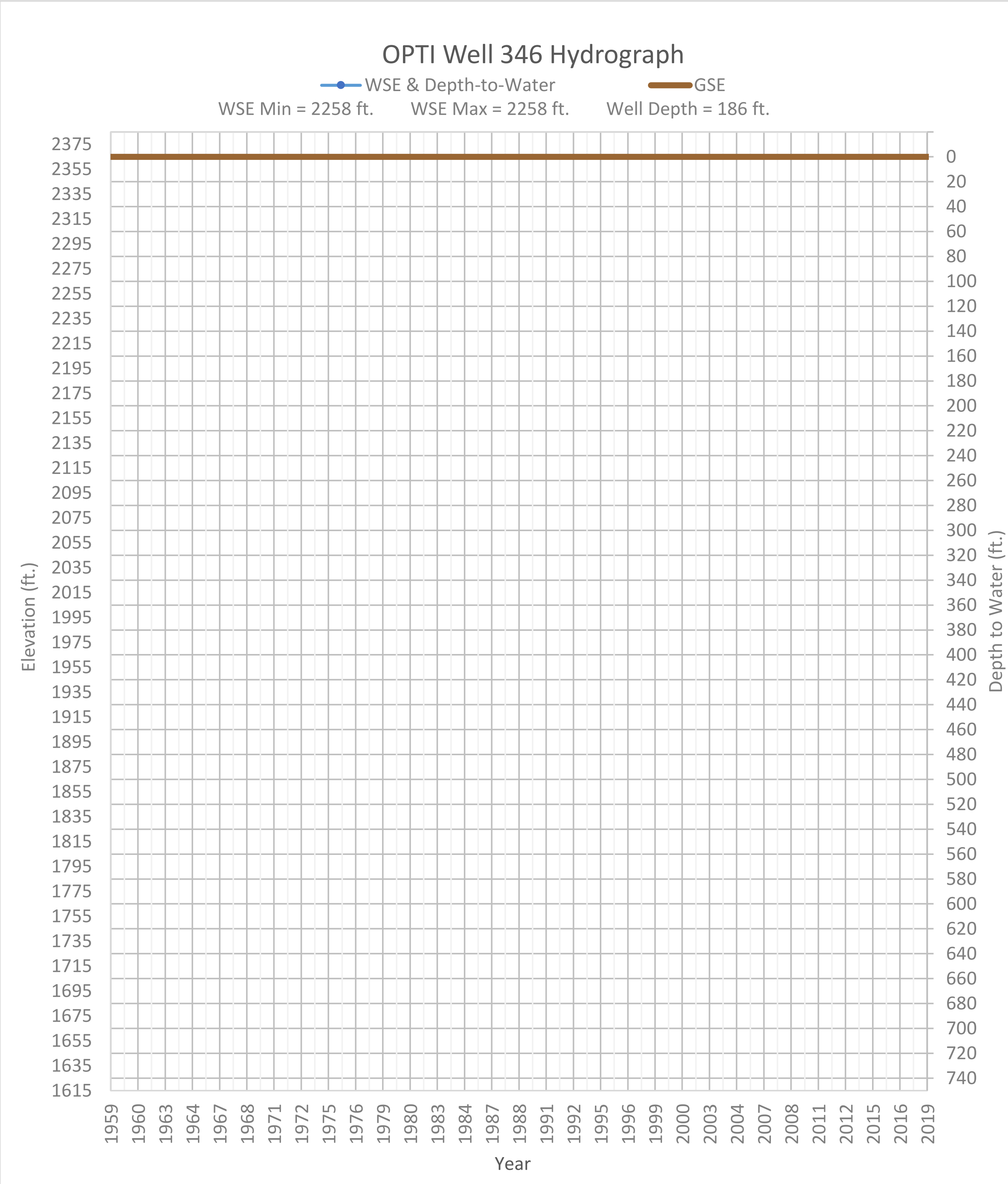
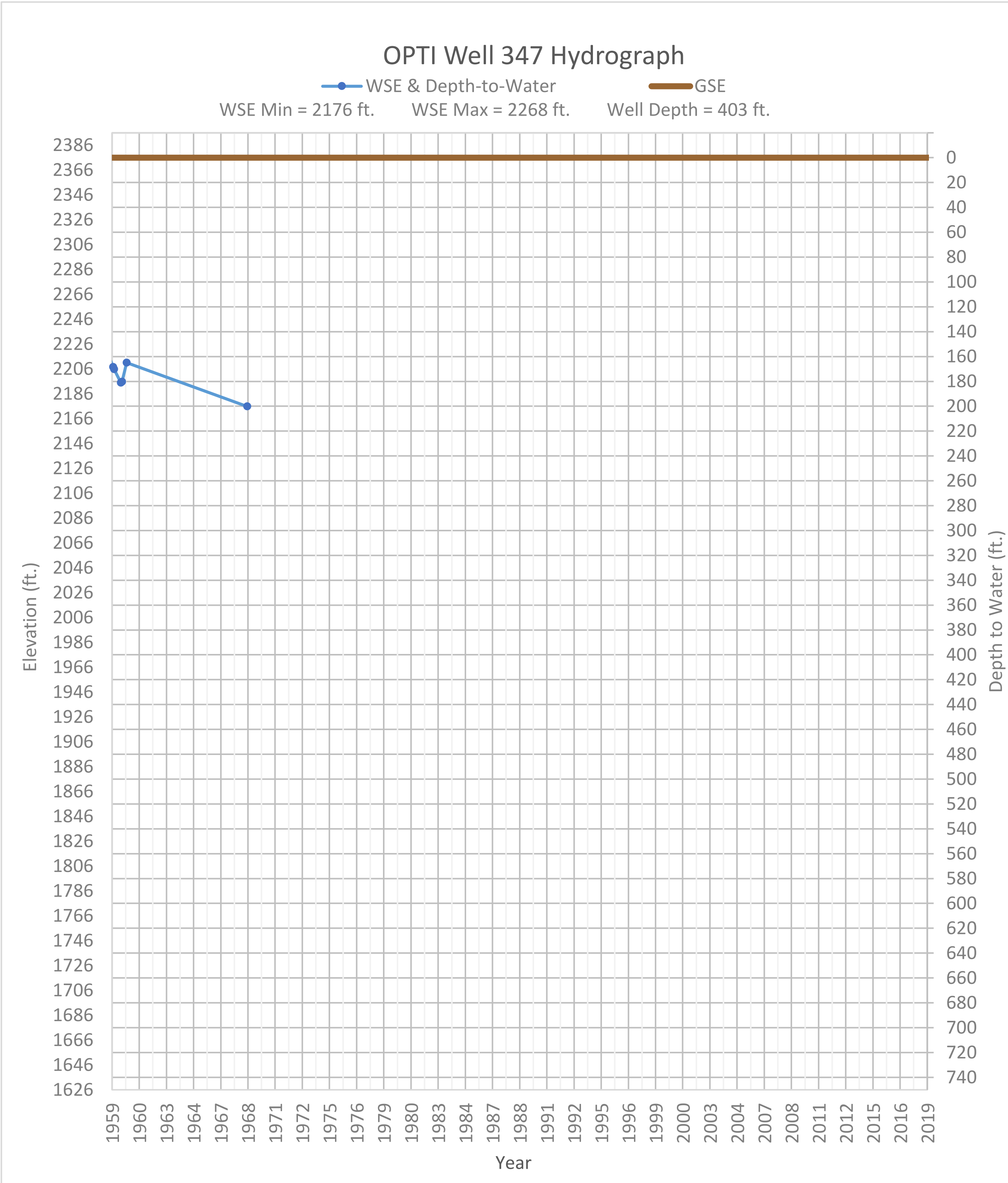
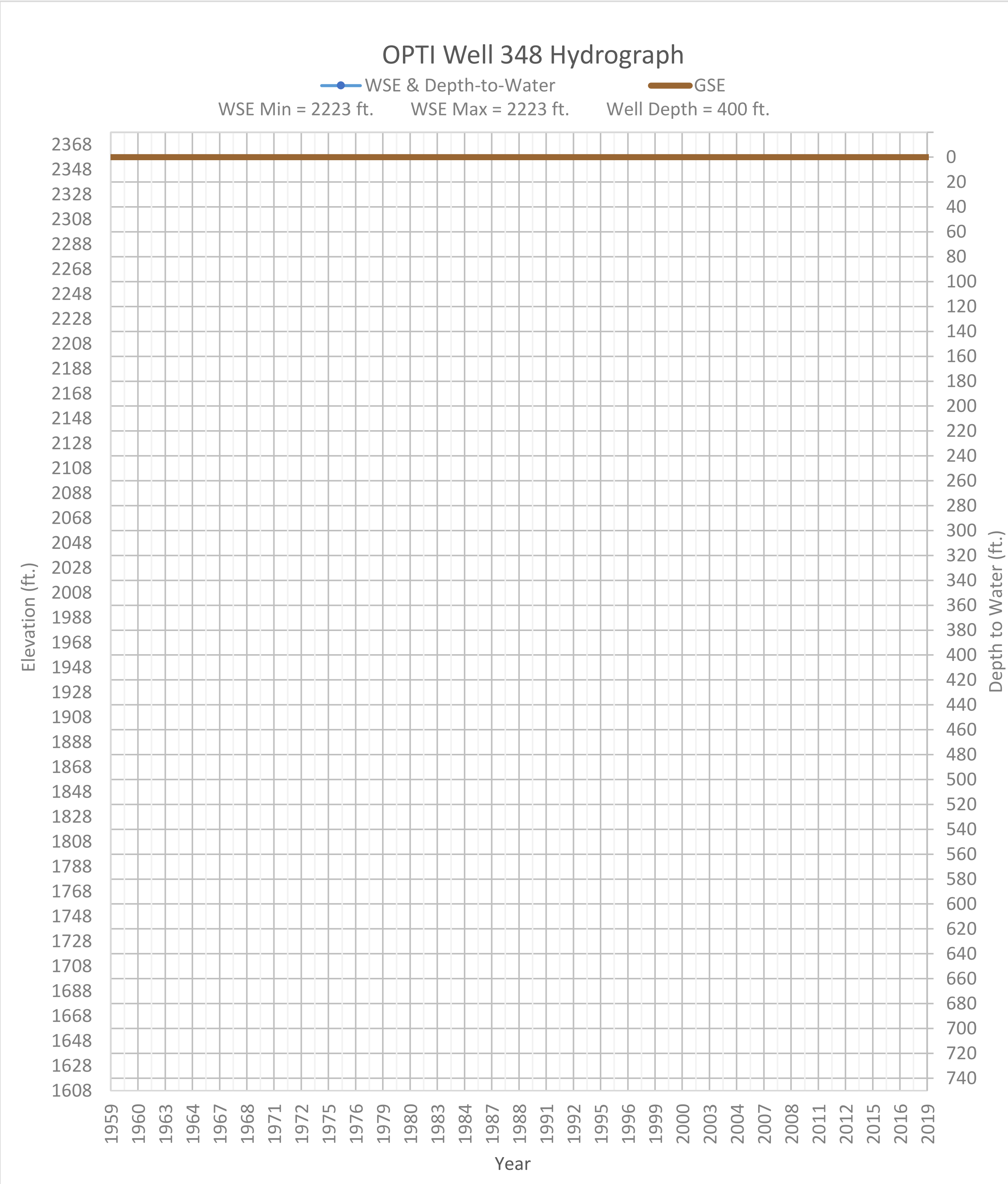


OPTI Well 342 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2140 ft.
WSE Max = 2142 ft.
Well Depth = 680 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 346 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2258 ft.
WSE Max = 2258 ft.
Well Depth = 186 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2375 2355 2335 2315 2295 2275 2255 2235 2215 2195 2175 2155 2135 2115 2095 2075 2055 2035 2015 1995 1975 1955 1935 1915 1895 1875 1855 1835 1815 1795 1775 1755 1735 1715 1695 1675 1655 1635 1615
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019



OPTI Well 347 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2176 ft.
WSE Max = 2268 ft.
Well Depth = 403 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 348 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2223 ft.
WSE Max = 2223 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2368
2348
2328
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
1888
1868
1848
1828
1808
1788
1768
1748
1728
1708
1688
1668
1648
1628
1608
0
20
40
60
80
100
120
140
160
180
200
220
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260
280
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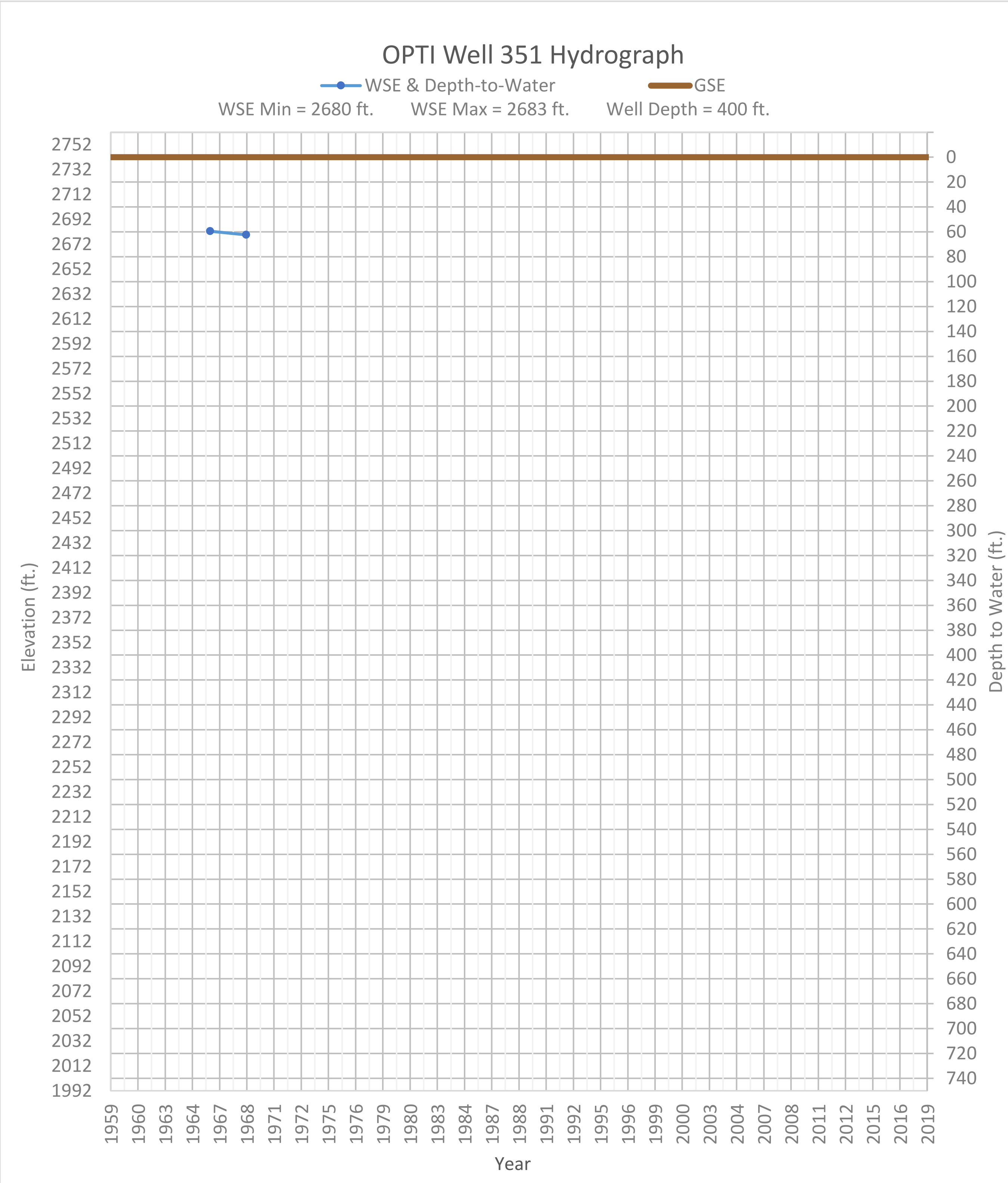
OPTI Well 351 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2680 ft.
WSE Max = 2683 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2752
2732
2712
2692
2672
2652
2632
2612
2592
2572
2552
2532
2512
2492
2472
2452
2432
2412
2392
2372
2352
2332
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
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1959
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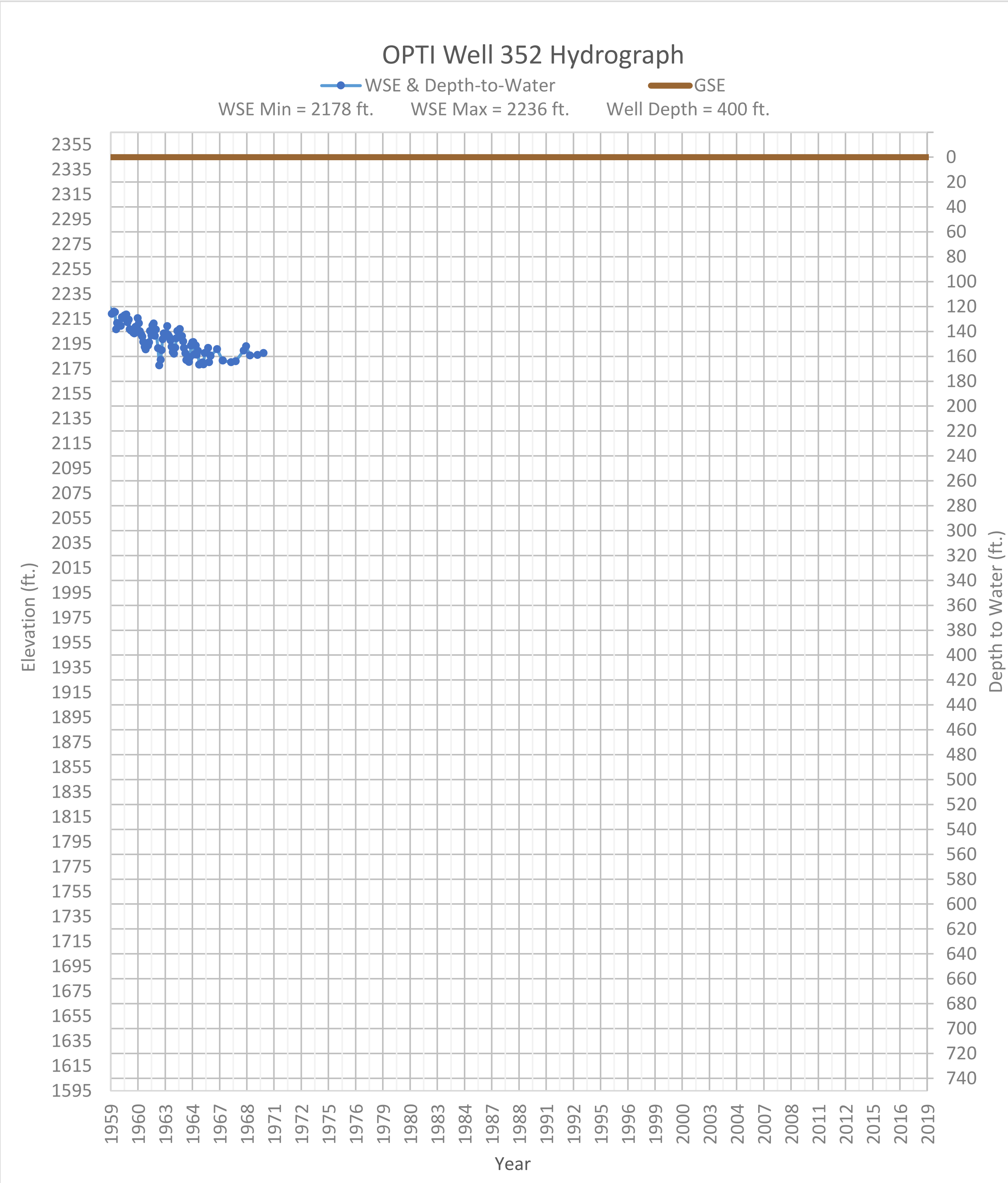
2012
2015
2016
2019


OPTI Well 352 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2178 ft.
WSE Max = 2236 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2355
2335
2315
2295
2275
2255
2235
2215
2195
2175
2155
2135
2115
2095
2075
2055
2035
2015
1995
1975
1955
1935
1915
1895
1875
1855
1835
1815
1795
1775
1755
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1715
1695
1675
1655
1635
1615
1595
0
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160
180
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520
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1959
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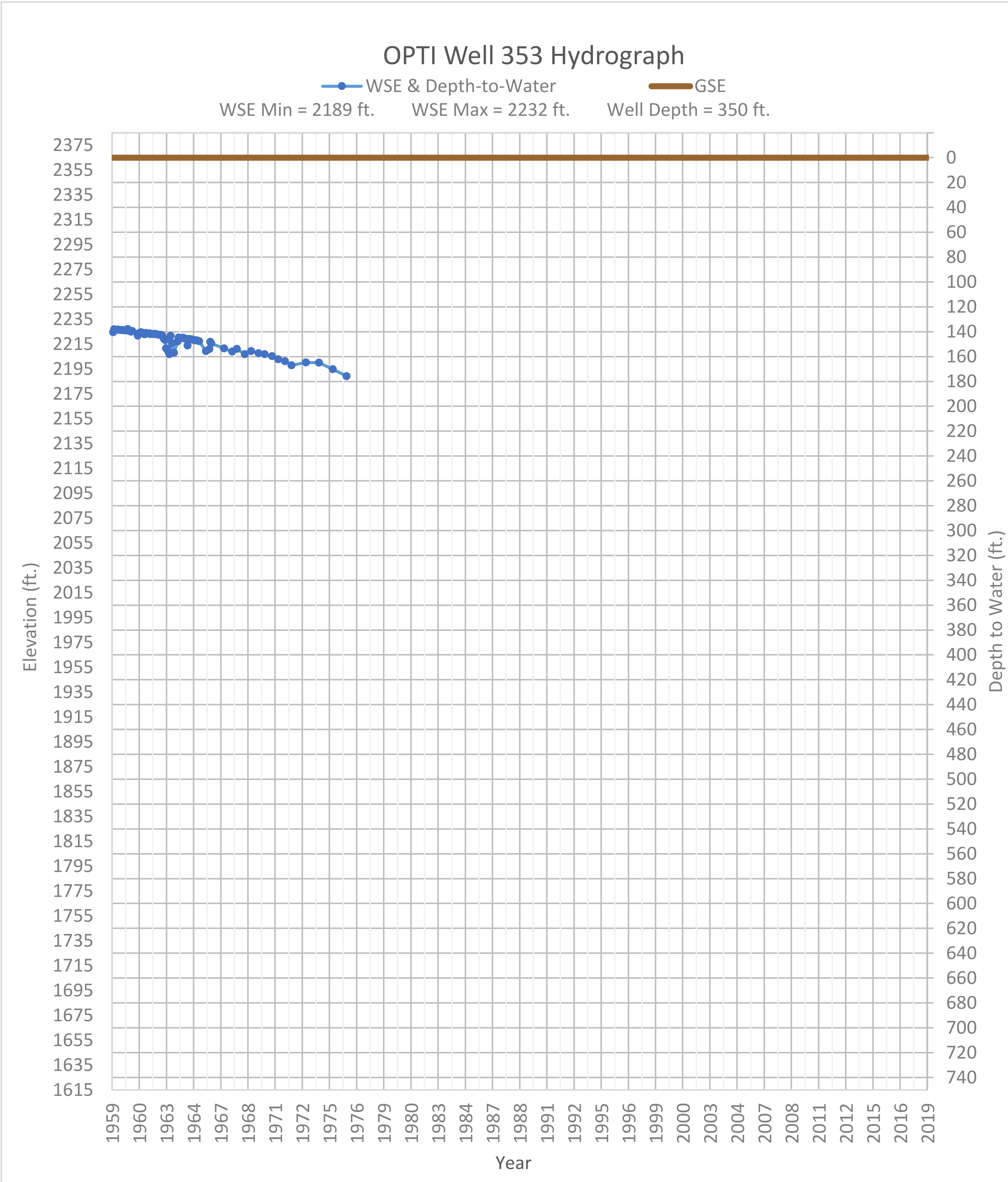
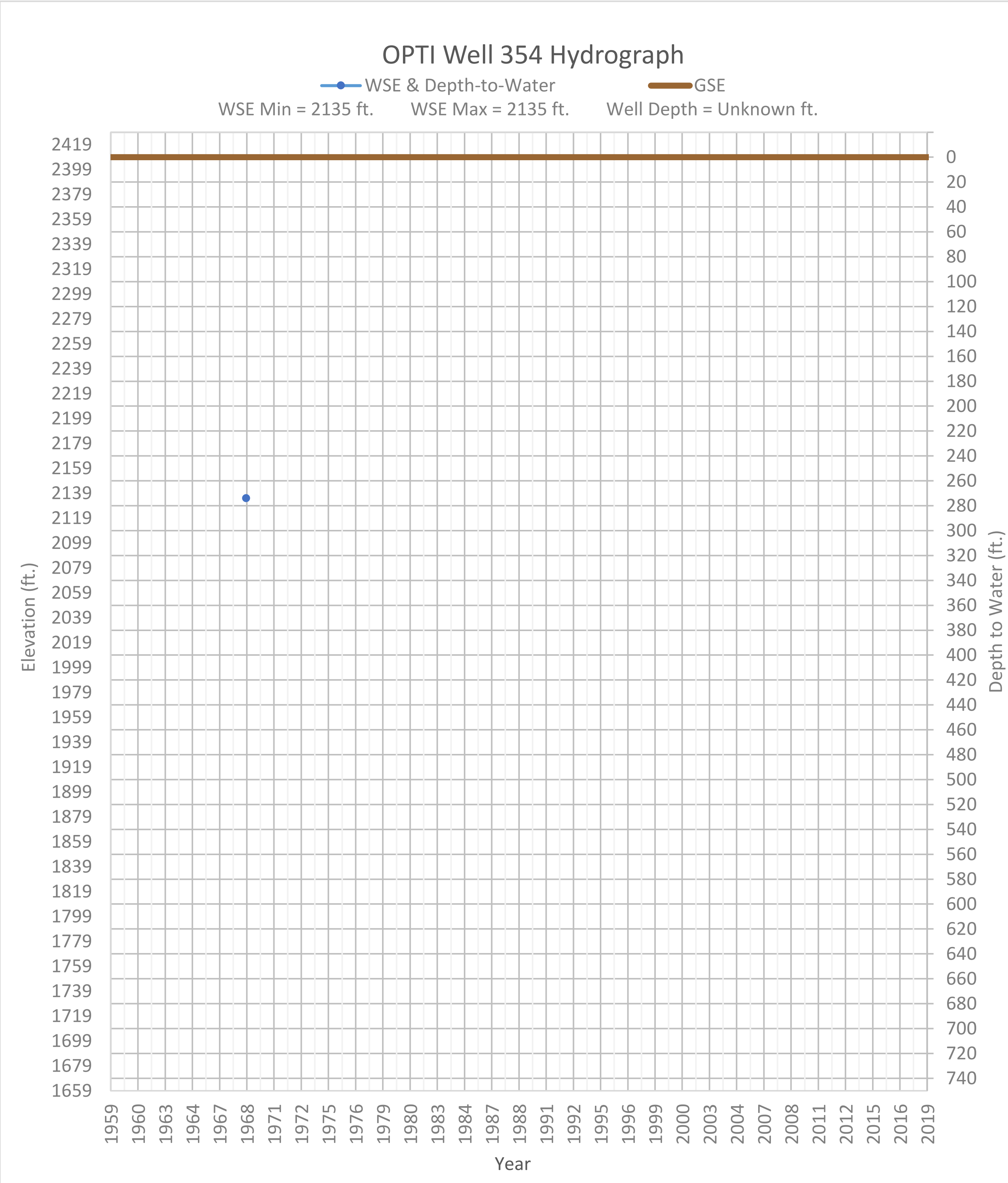
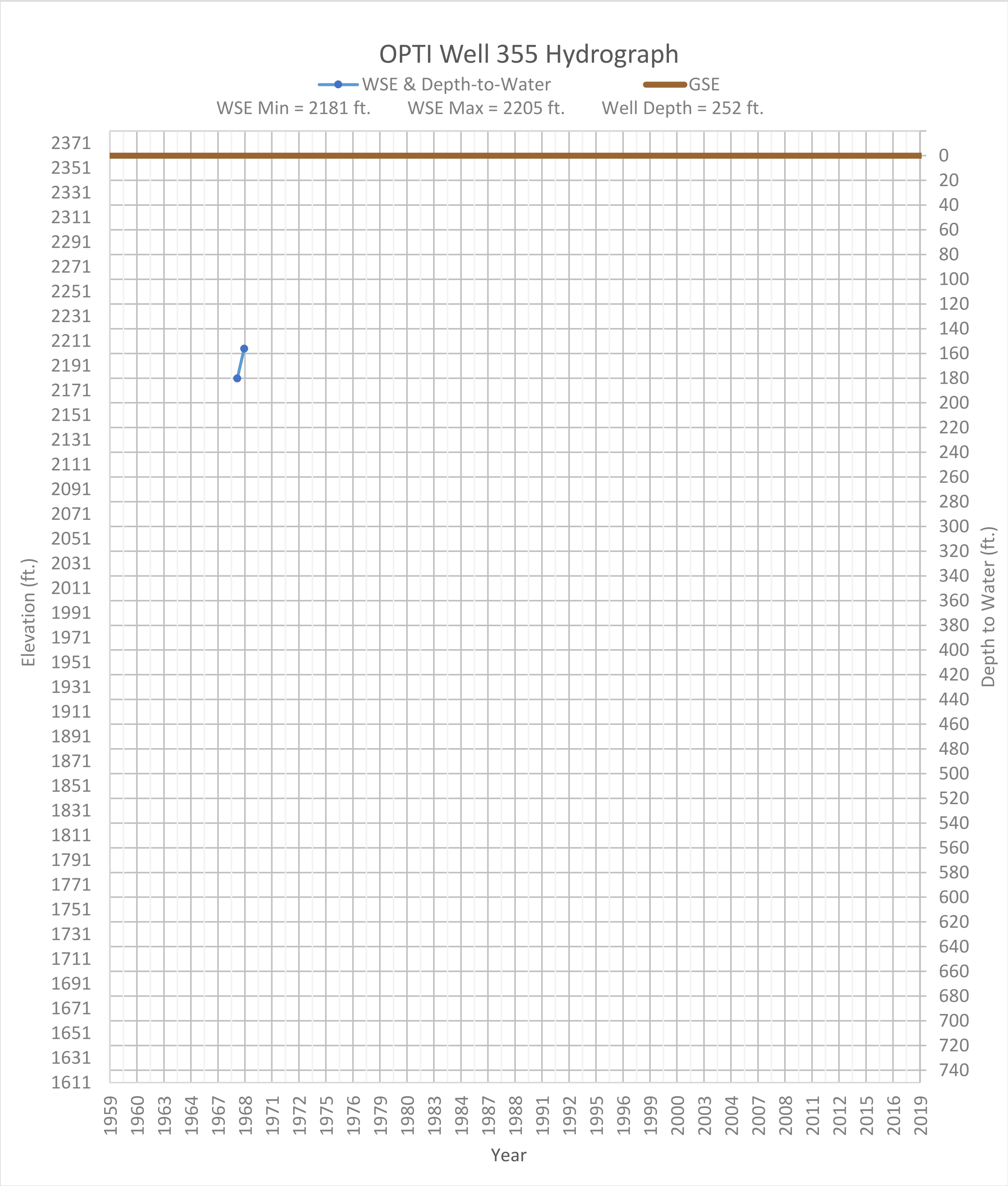

OPTI Well 353 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2189 ft.
WSE Max = 2232 ft.
Well Depth = 350 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 354 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2135 ft.
WSE Max = 2135 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 355 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2181 ft.
WSE Max = 2205 ft.
Well Depth = 252 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2371
2351
2331
2311
2291
2271
2251
2231
2211
2191
2171
2151
2131
2111
2091
2071
2051
2031
2011
1991
1971
1951
1931
1911
1891
1871
1851
1831
1811
1791
1771
1751
1731
1711
1691
1671
1651
1631
1611
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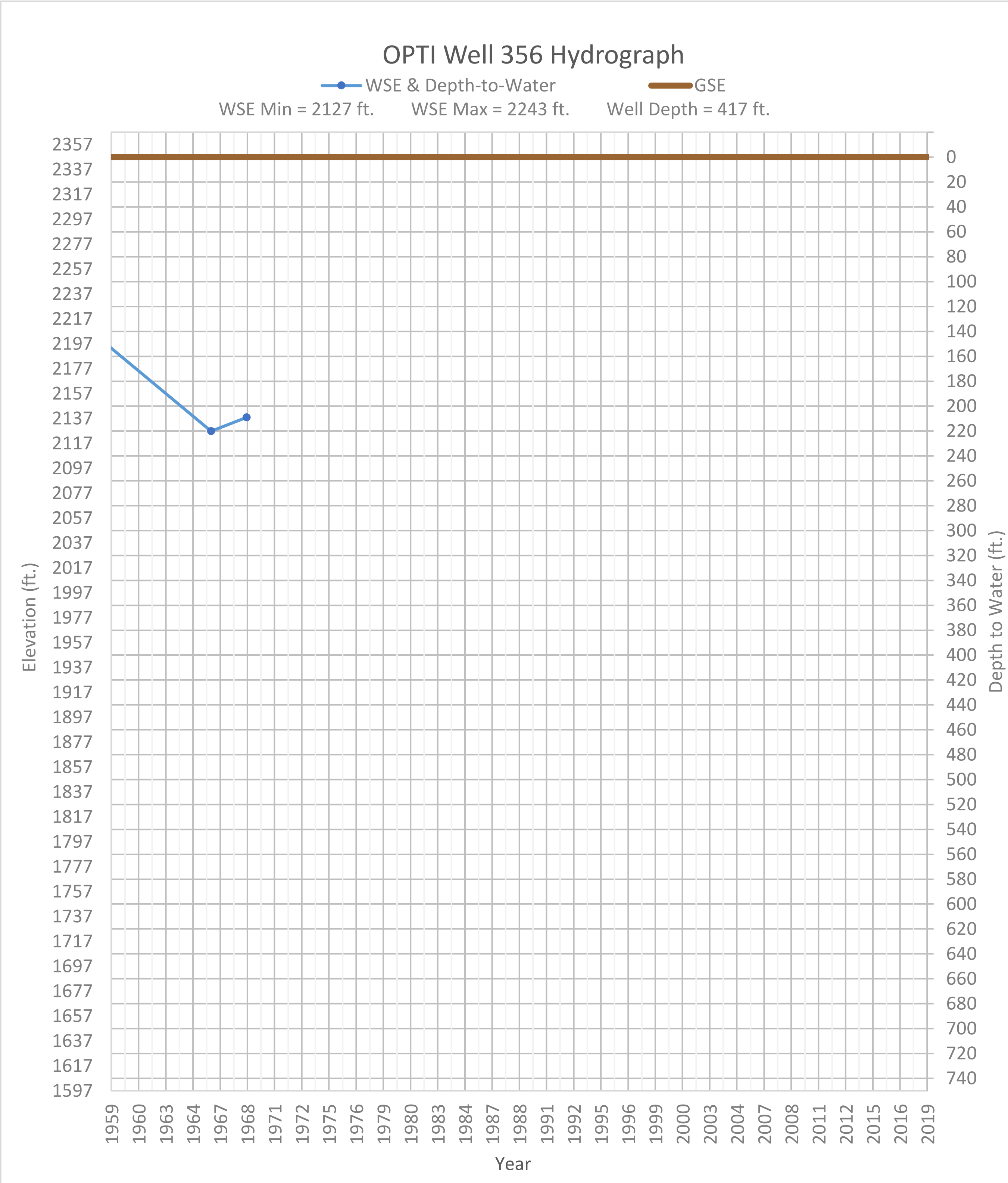
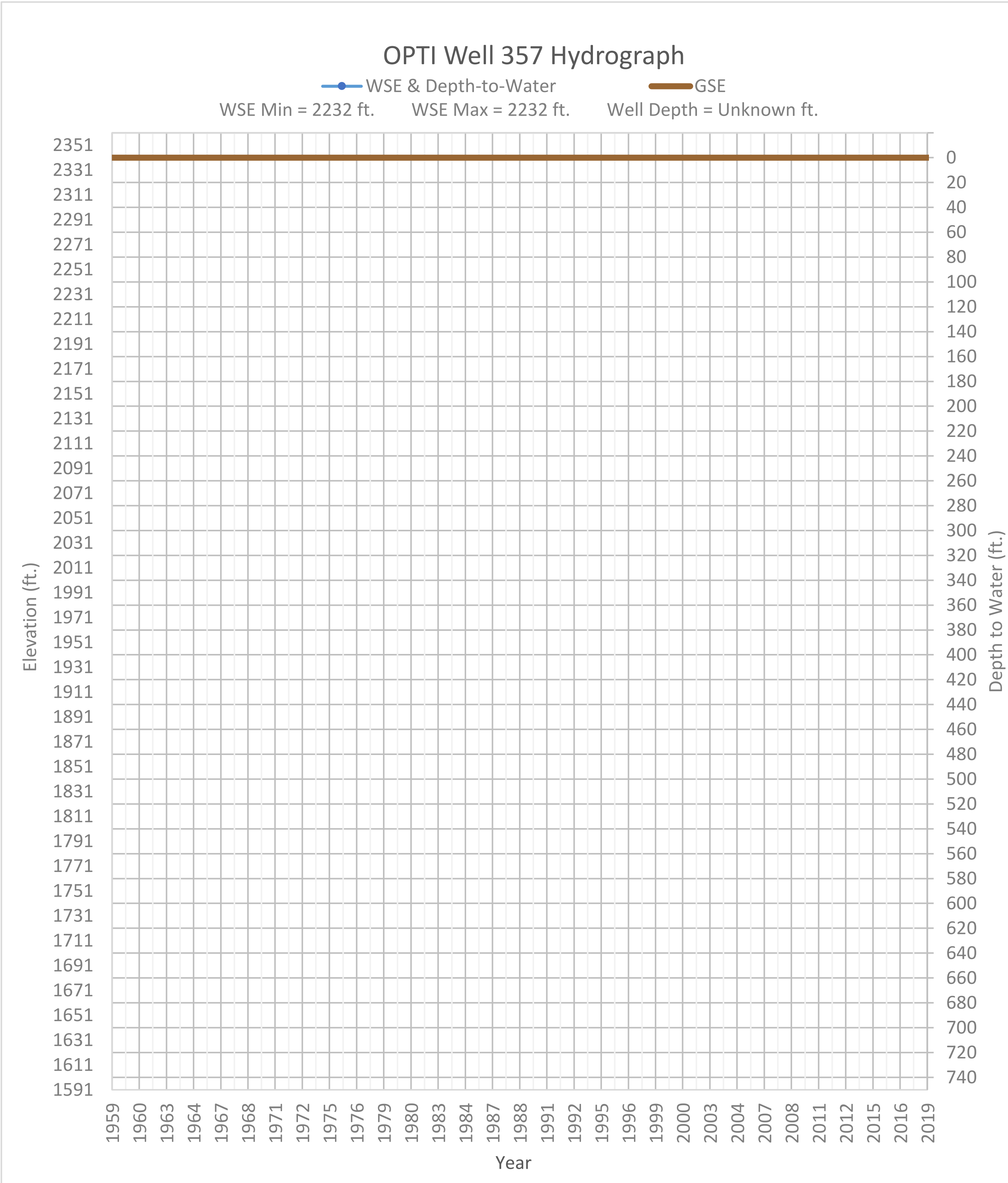


OPTI Well 356 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2127 ft.
WSE Max = 2243 ft.
Well Depth = 417 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 357 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2232 ft.
WSE Max = 2232 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2351
2331
2311
2291
2271
2251
2231
2211
2191
2171
2151
2131
2111
2091
2071
2051
2031
2011
1991
1971
1951
1931
1911
1891
1871
1851
1831
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1711
1691
1671
1651
1631
1611
1591
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180
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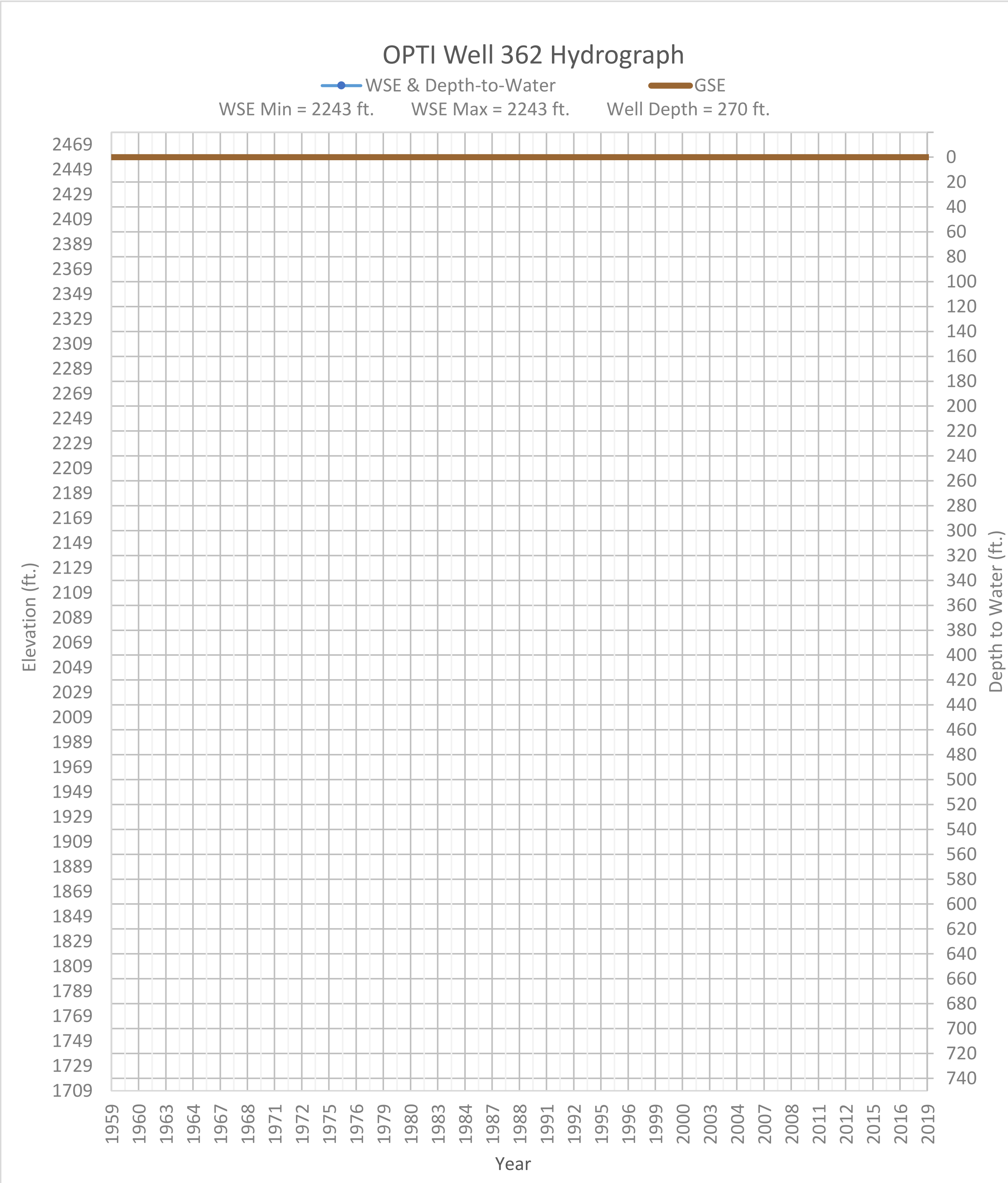

OPTI Well 362 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2243 ft.
WSE Max = 2243 ft.
Well Depth = 270 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2469
2449
2429
2409
2389
2369
2349
2329
2309
2289
2269
2249
2229
2209
2189
2169
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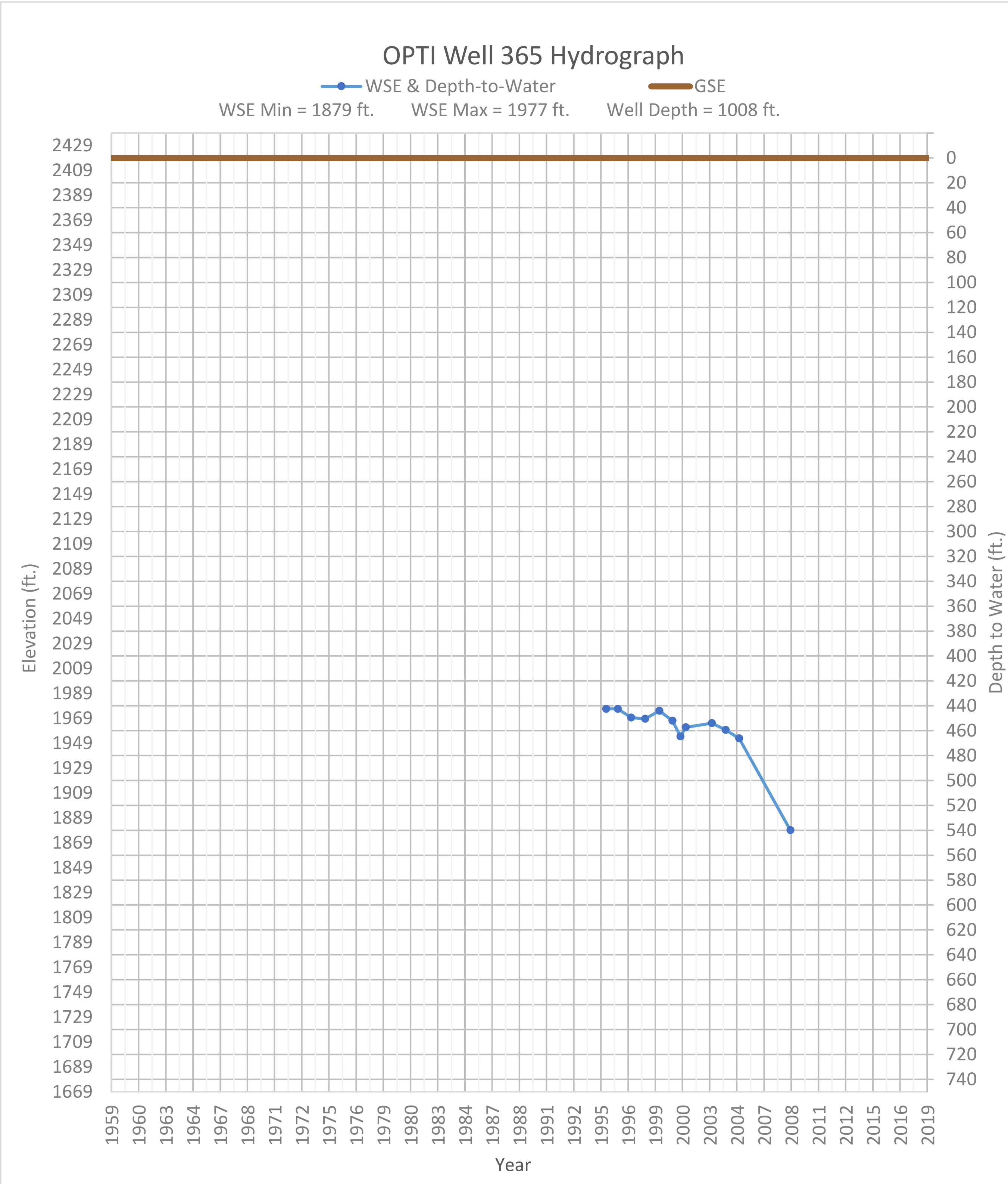
OPTI Well 365 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1879 ft.
WSE Max = 1977 ft.
Well Depth = 1008 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2429
2409
2389
2369
2349
2329
2309
2289
2269
2249
2229
2209
2189
2169
2149
2129
2109
2089
2069
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2029
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1989
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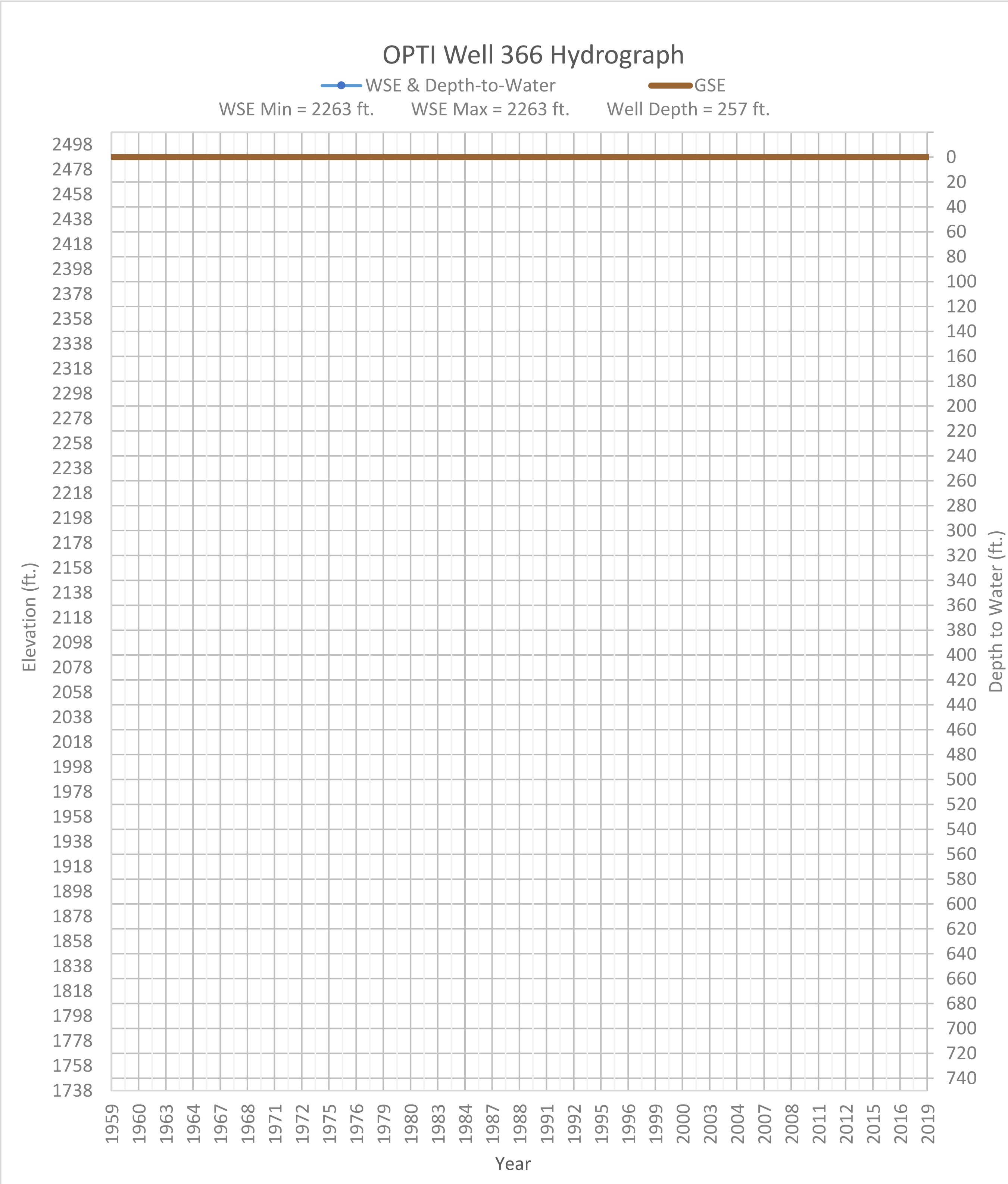
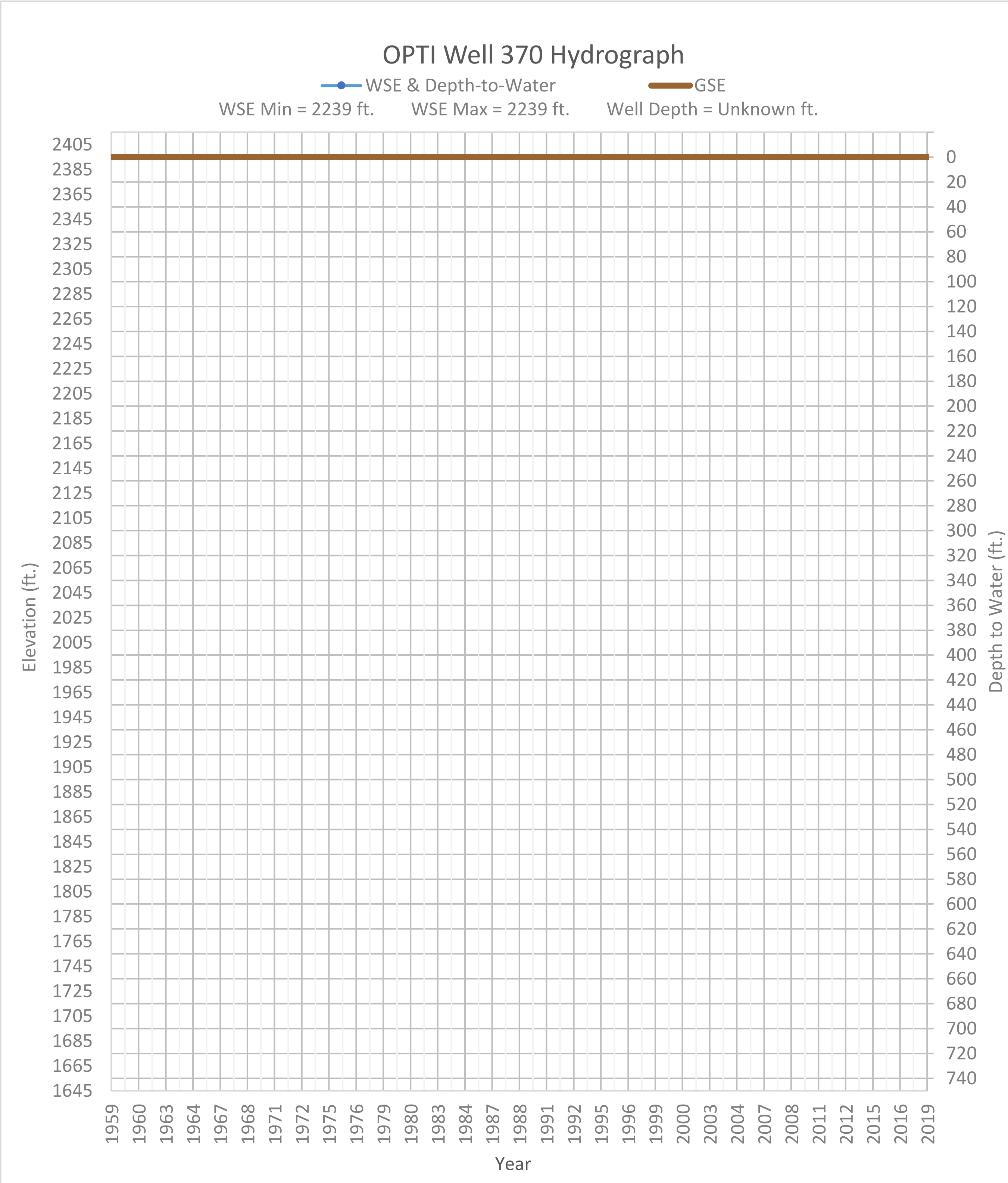
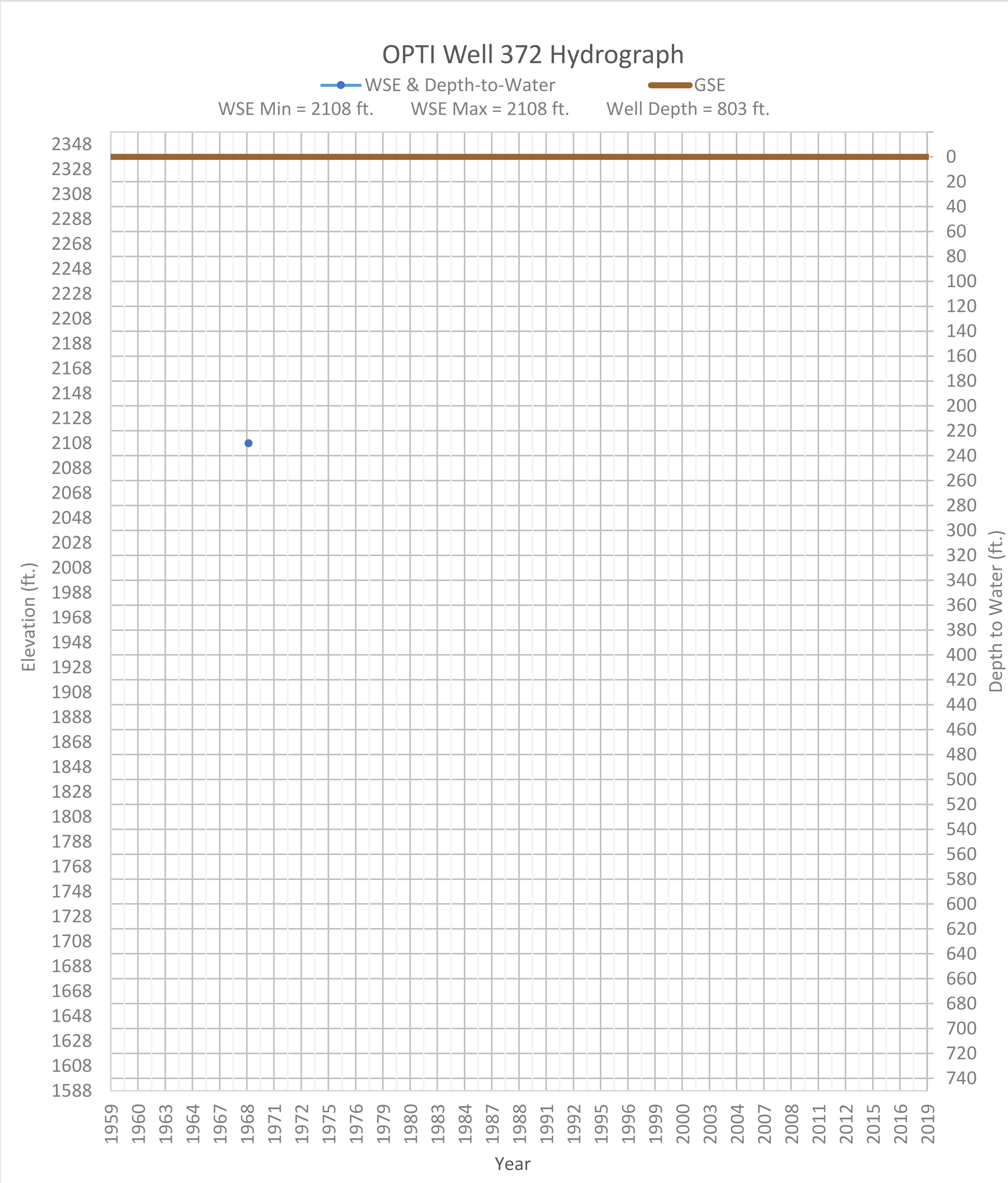
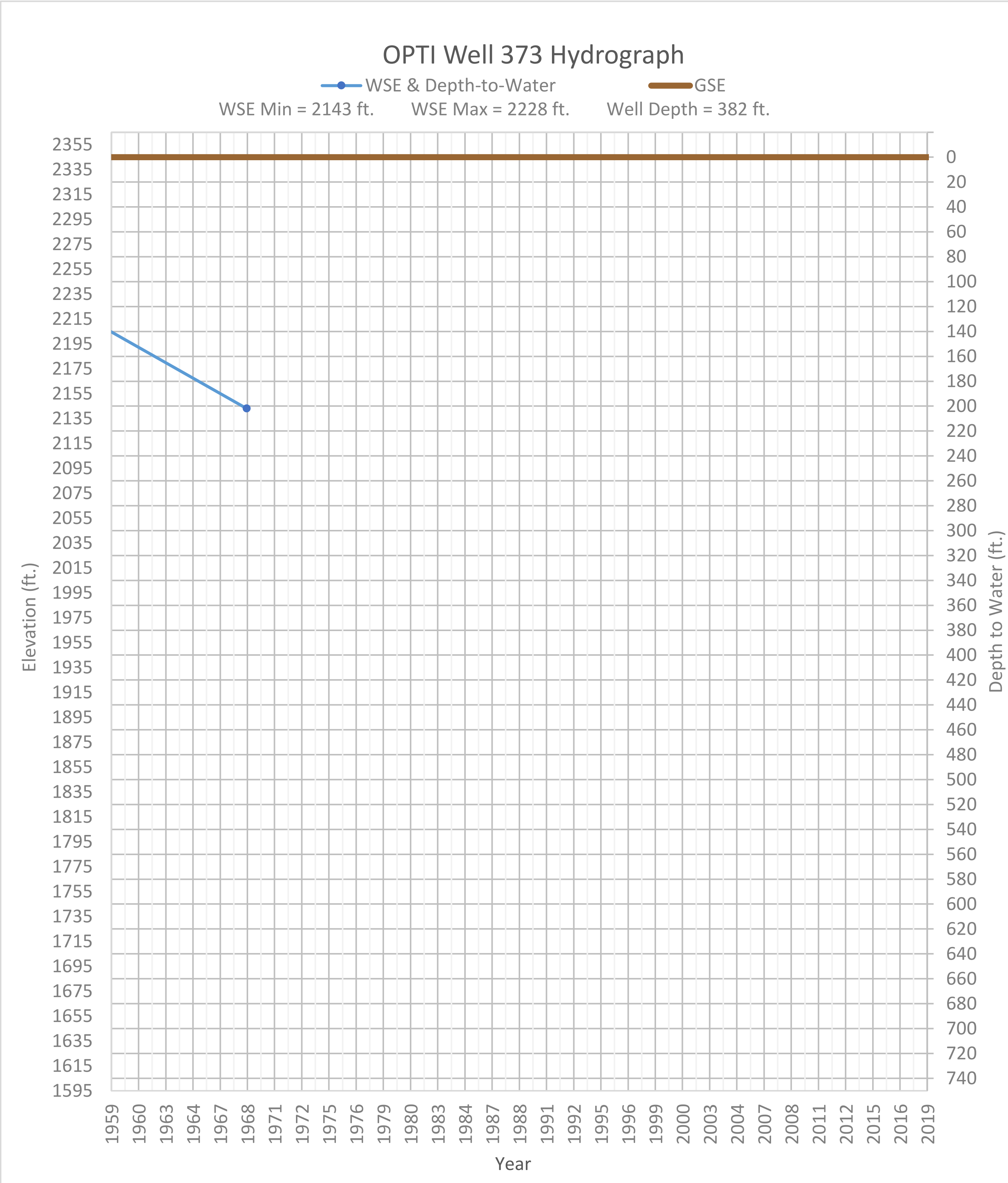
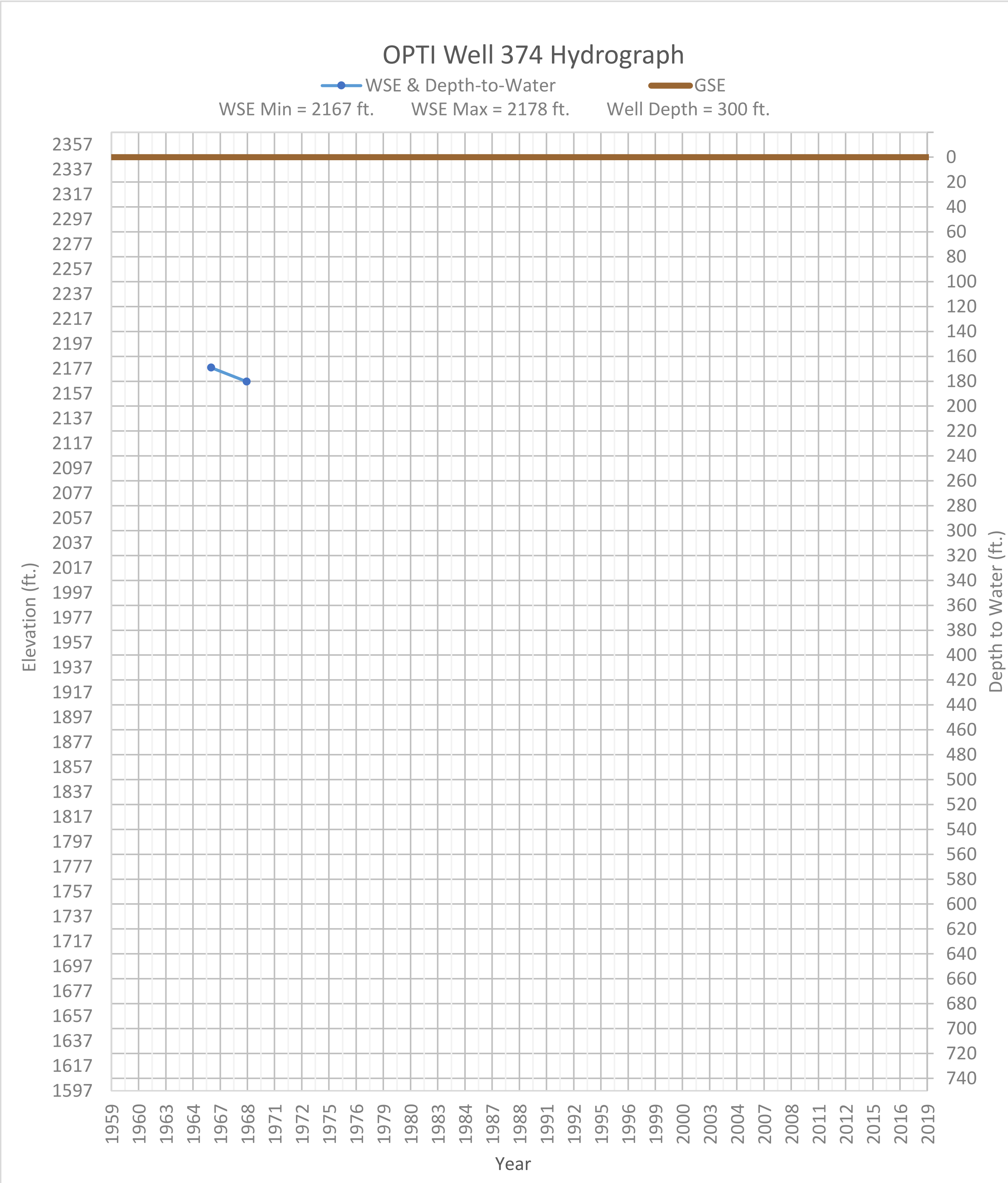

OPTI Well 366 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2263 ft.
WSE Max = 2263 ft.
Well Depth = 257 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 370 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2239 ft.
WSE Max = 2239 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2405 2385 2365 2345 2325 2305 2285 2265 2245 2225 2205 2185 2165 2145 2125 2105 2085 2065 2045 2025 2005 1985 1965 1945 1925 1905 1885 1865 1845 1825 1805 1785 1765 1745 1725 1705 1685 1665 1645
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019


OPTI Well 372 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2108 ft.
WSE Max = 2108 ft.
Well Depth = 803 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 373 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2143 ft.
WSE Max = 2228 ft.
Well Depth = 382 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 374 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2167 ft.
WSE Max = 2178 ft.
Well Depth = 300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2357
2337
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
1837
1817
1797
1777
1757
1737
1717
1697
1677
1657
1637
1617
1597
0
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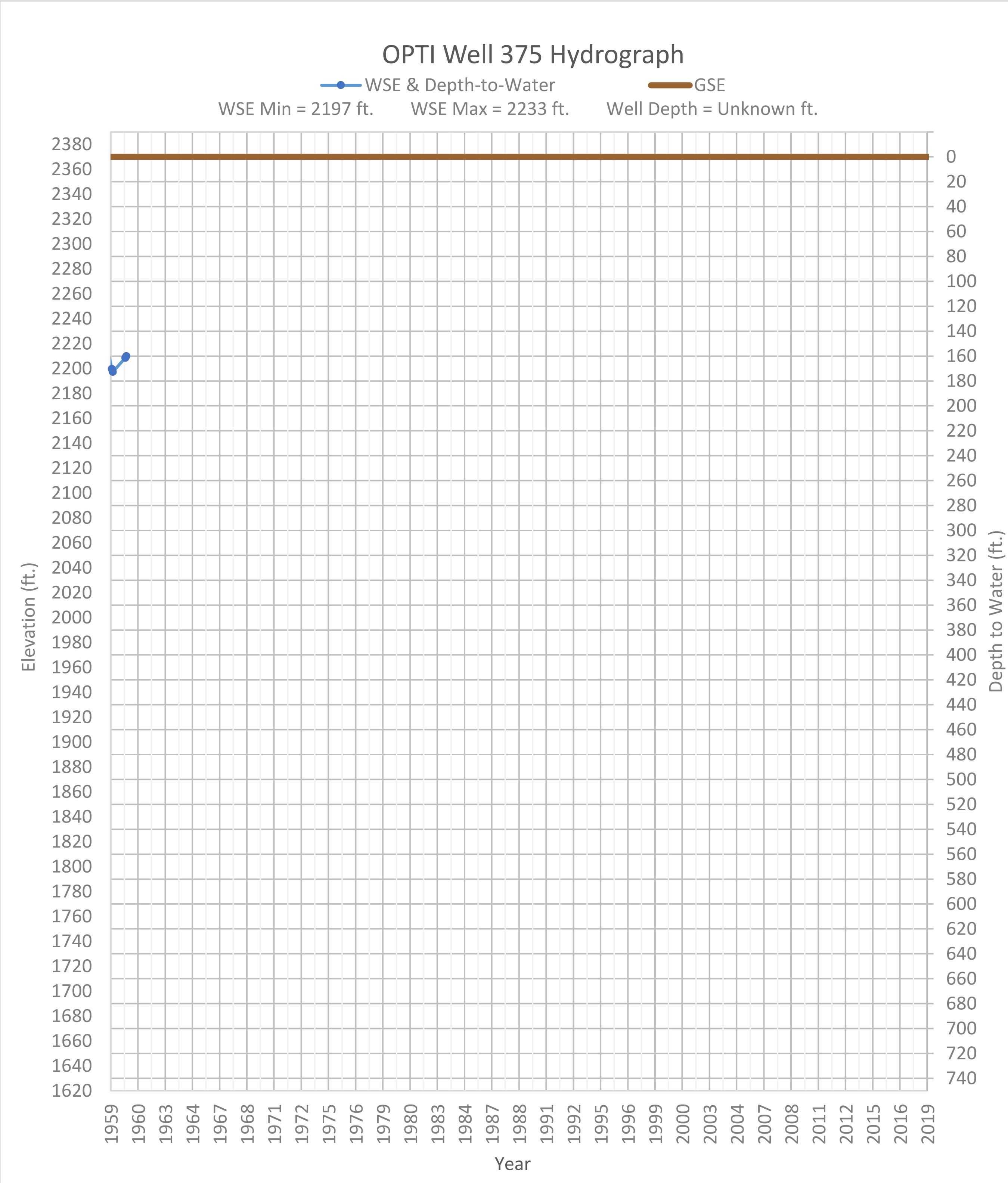
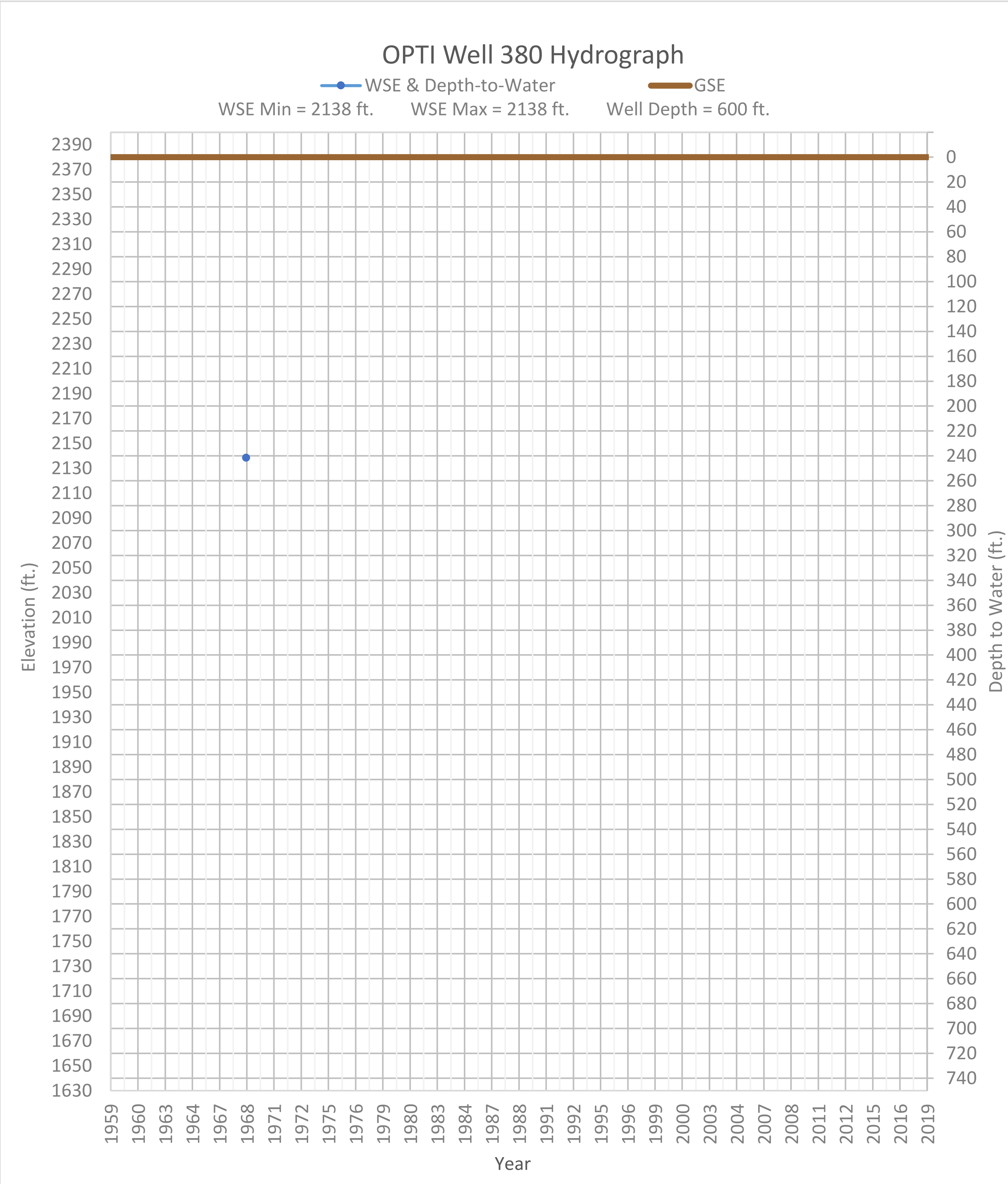


OPTI Well 375 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2197 ft.
WSE Max = 2233 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 380 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2138 ft.
WSE Max = 2138 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2390
2370
2350
2330
2310
2290
2270
2250
2230
2210
2190
2170
2150
2130
2110
2090
2070
2050
2030
2010
1990
1970
1950
1930
1910
1890
1870
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1770
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1730
1710
1690
1670
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220
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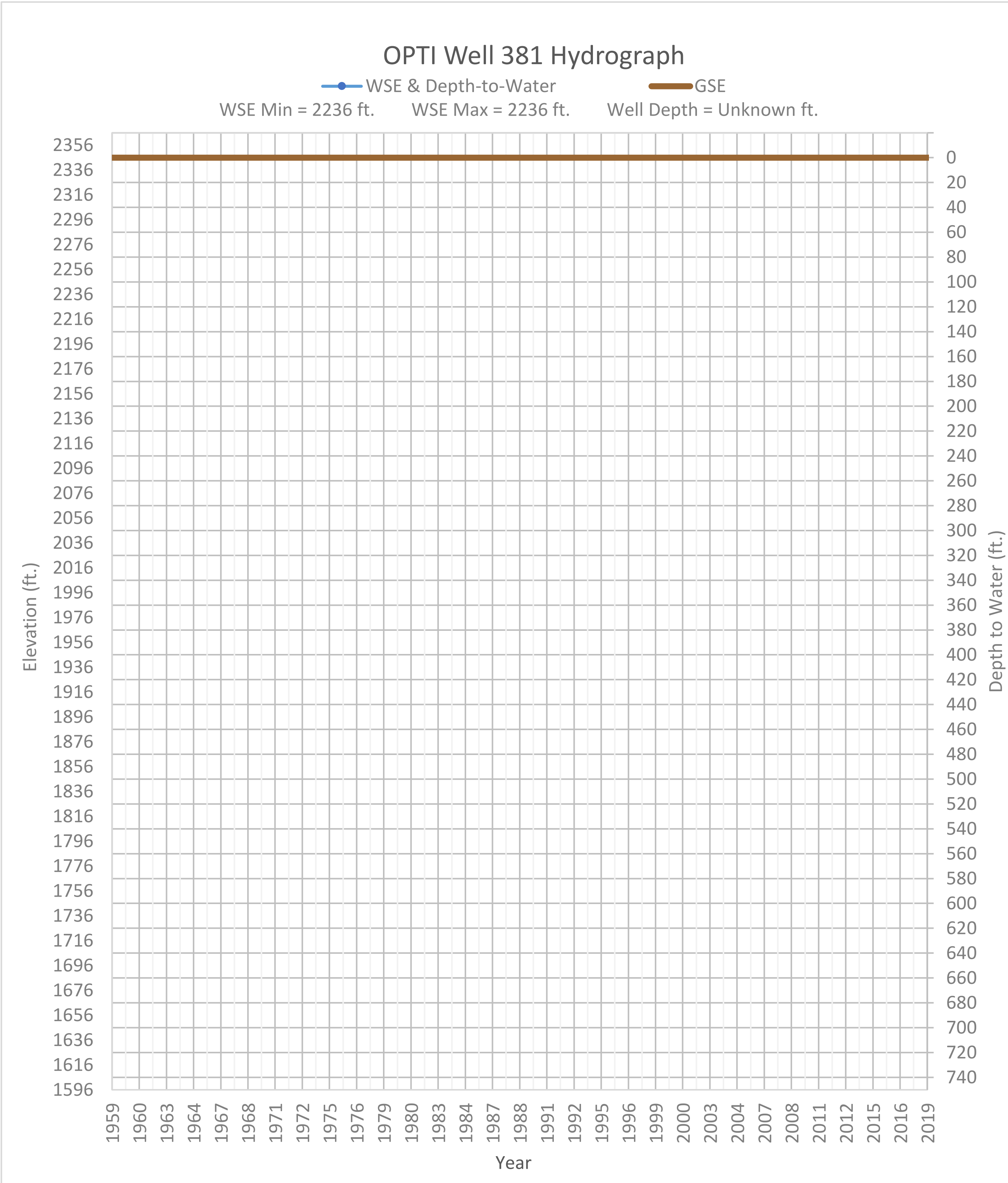
OPTI Well 381 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2236 ft.
WSE Max = 2236 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2356
2336
2316
2296
2276
2256
2236
2216
2196
2176
2156
2136
2116
2096
2076
2056
2036
2016
1996
1976
1956
1936
1916
1896
1876
1856
1836
1816
1796
1776
1756
1736
1716
1696
1676
1656
1636
1616
1596
0
20
40
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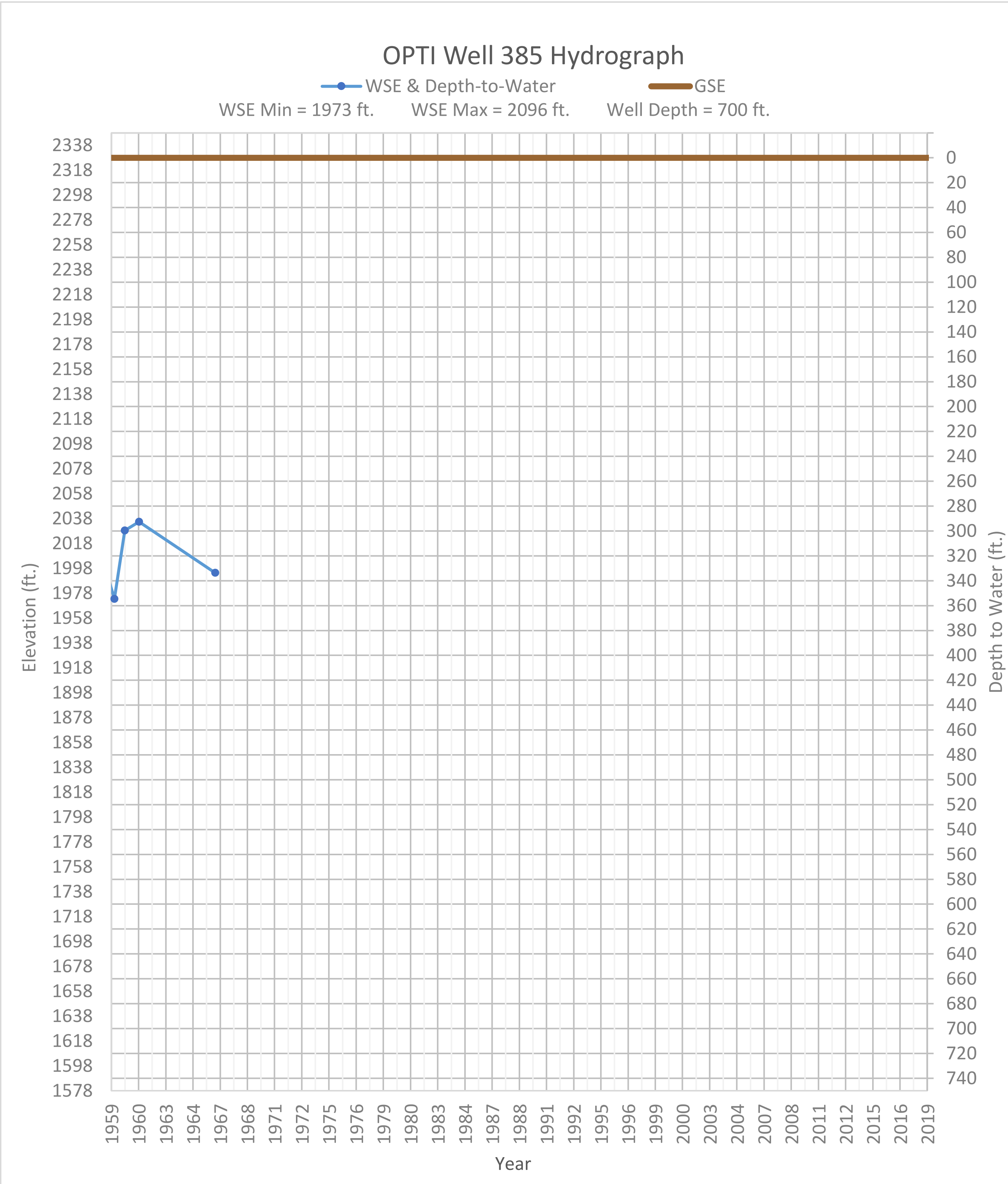
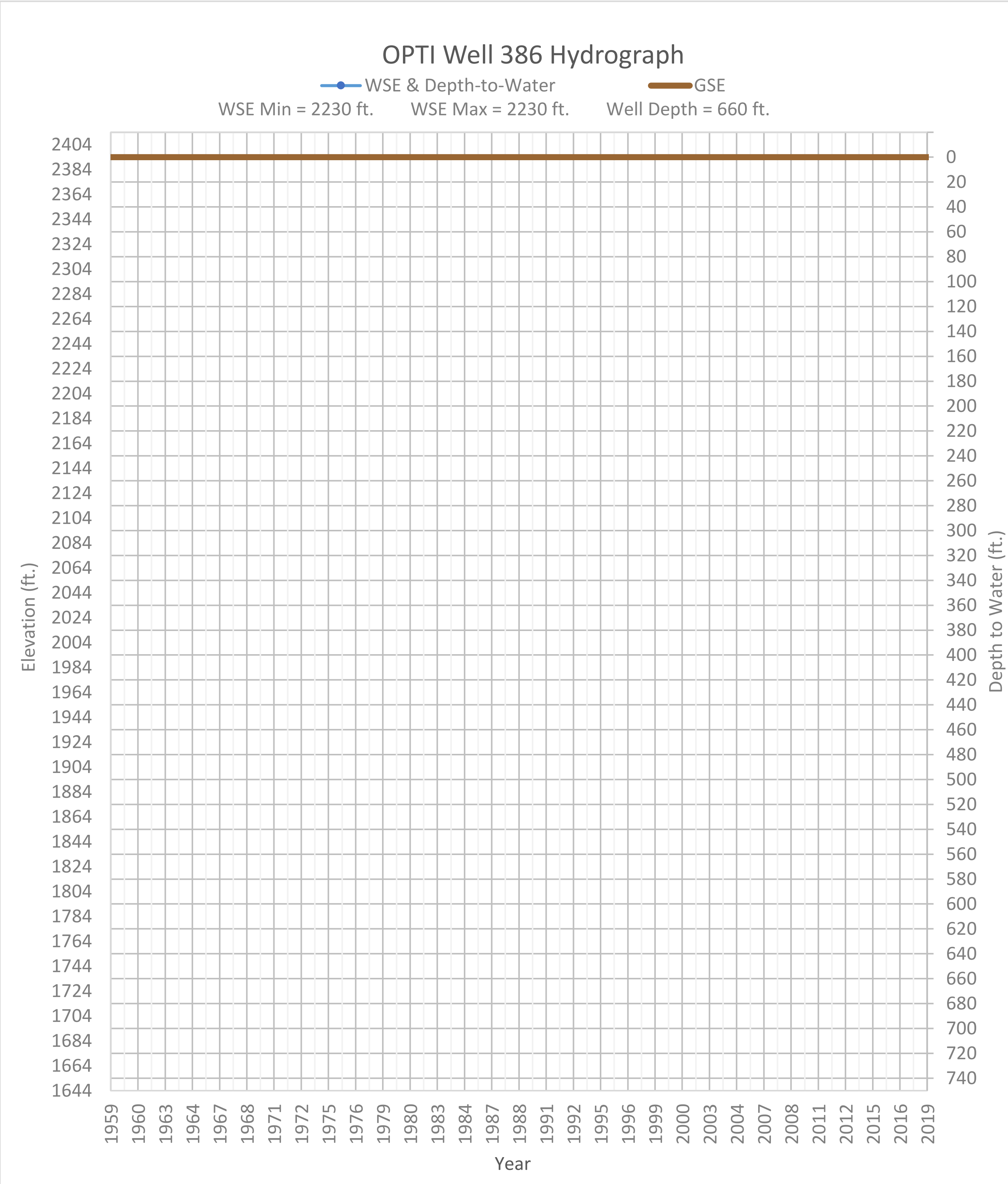


OPTI Well 385 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1973 ft.
WSE Max = 2096 ft.
Well Depth = 700 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 386 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2230 ft.
WSE Max = 2230 ft.
Well Depth = 660 ft.
Elevation (ft.)
2404
2384
2364
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
1764
1744
1724
1704
1684
1664
1644
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
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580
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620
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660
680
700
720
740
Year
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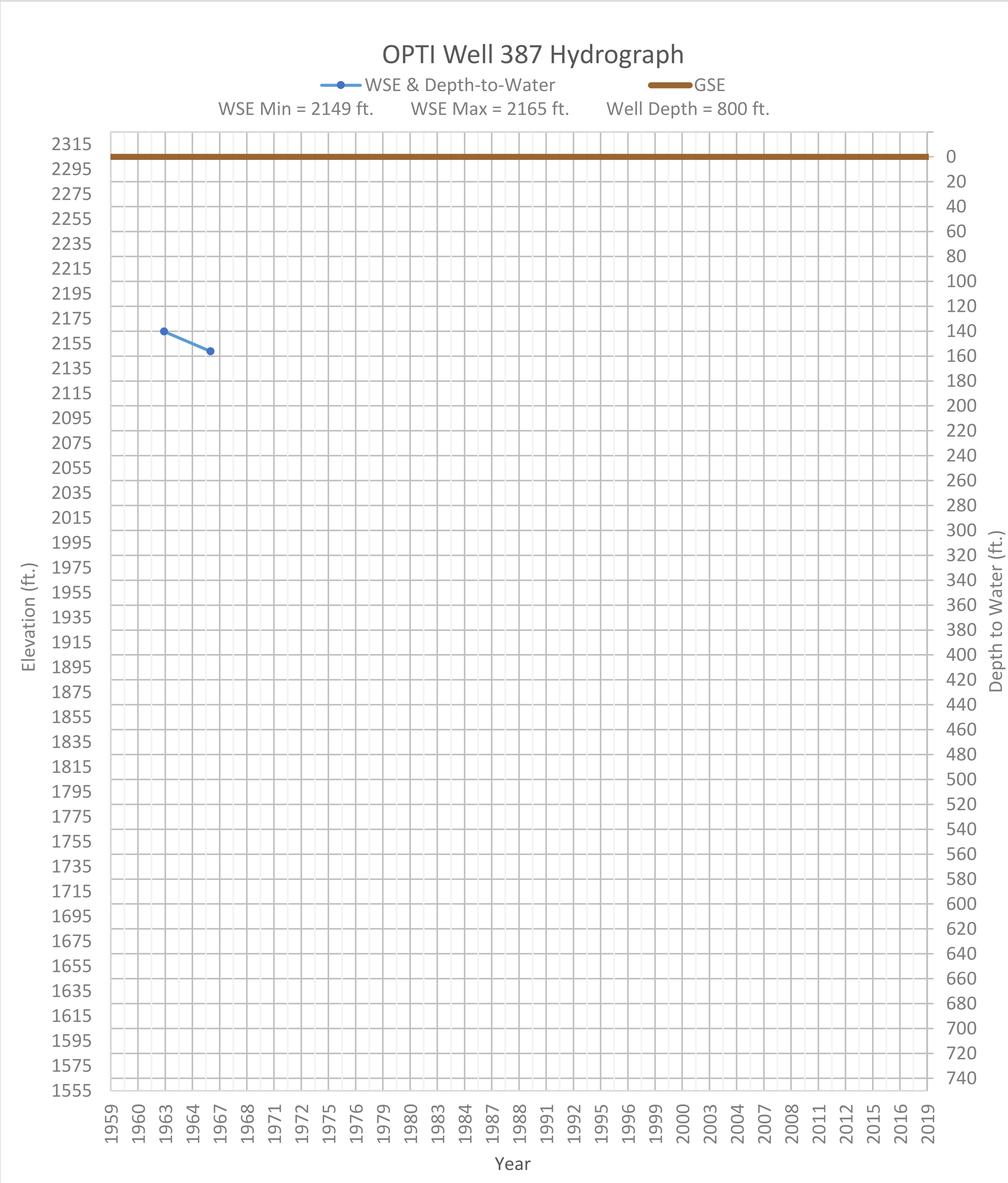
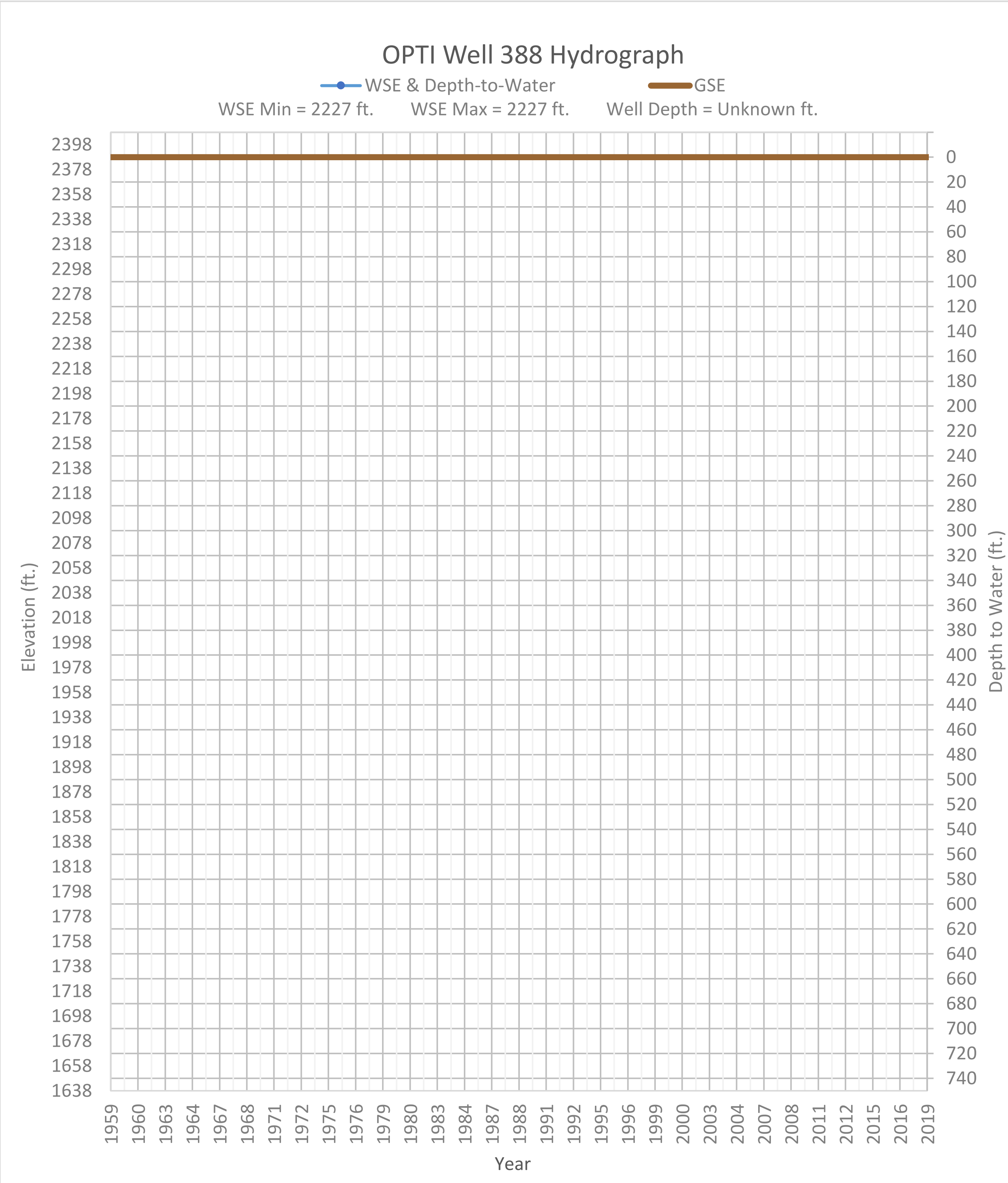
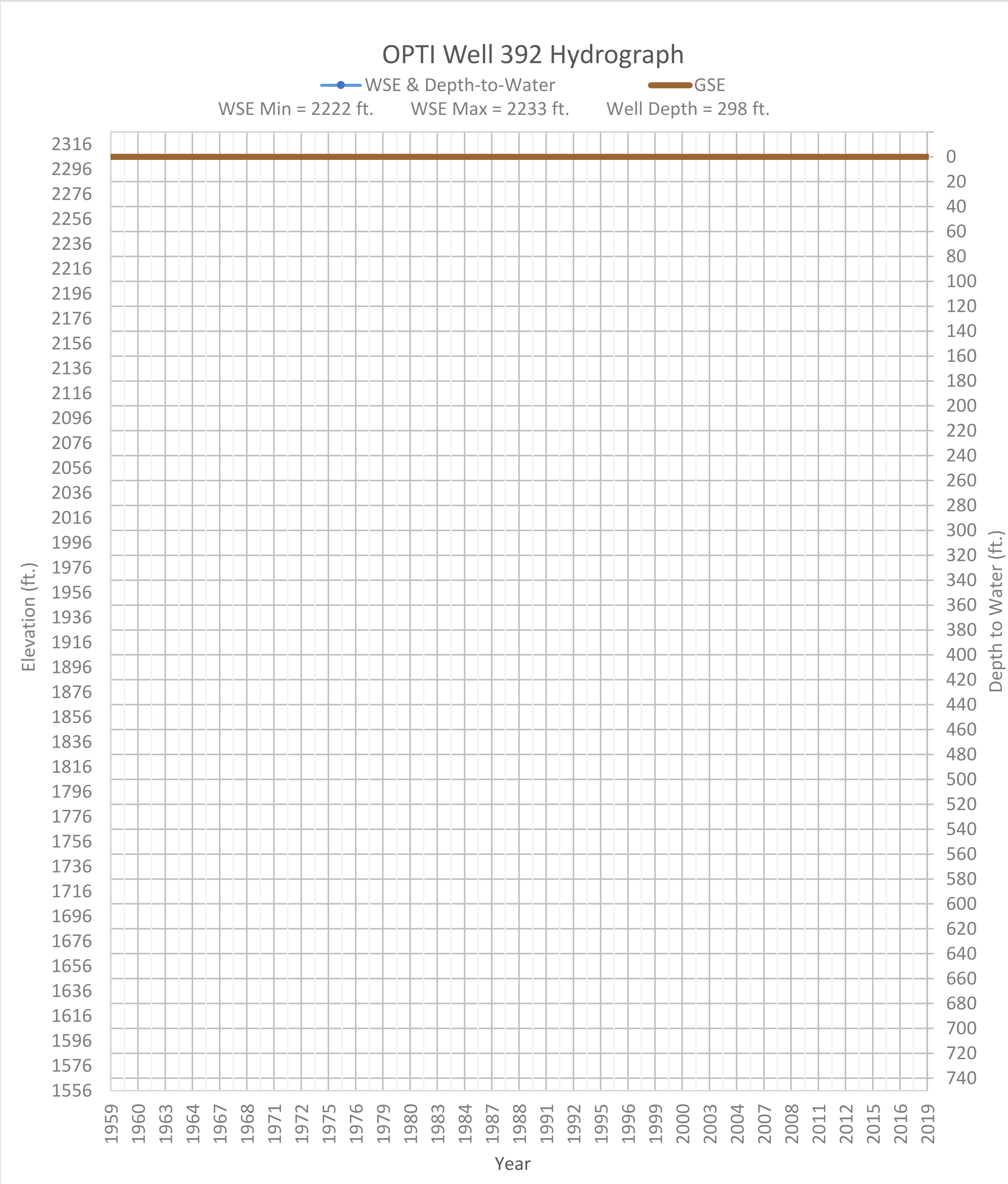
2016
2019

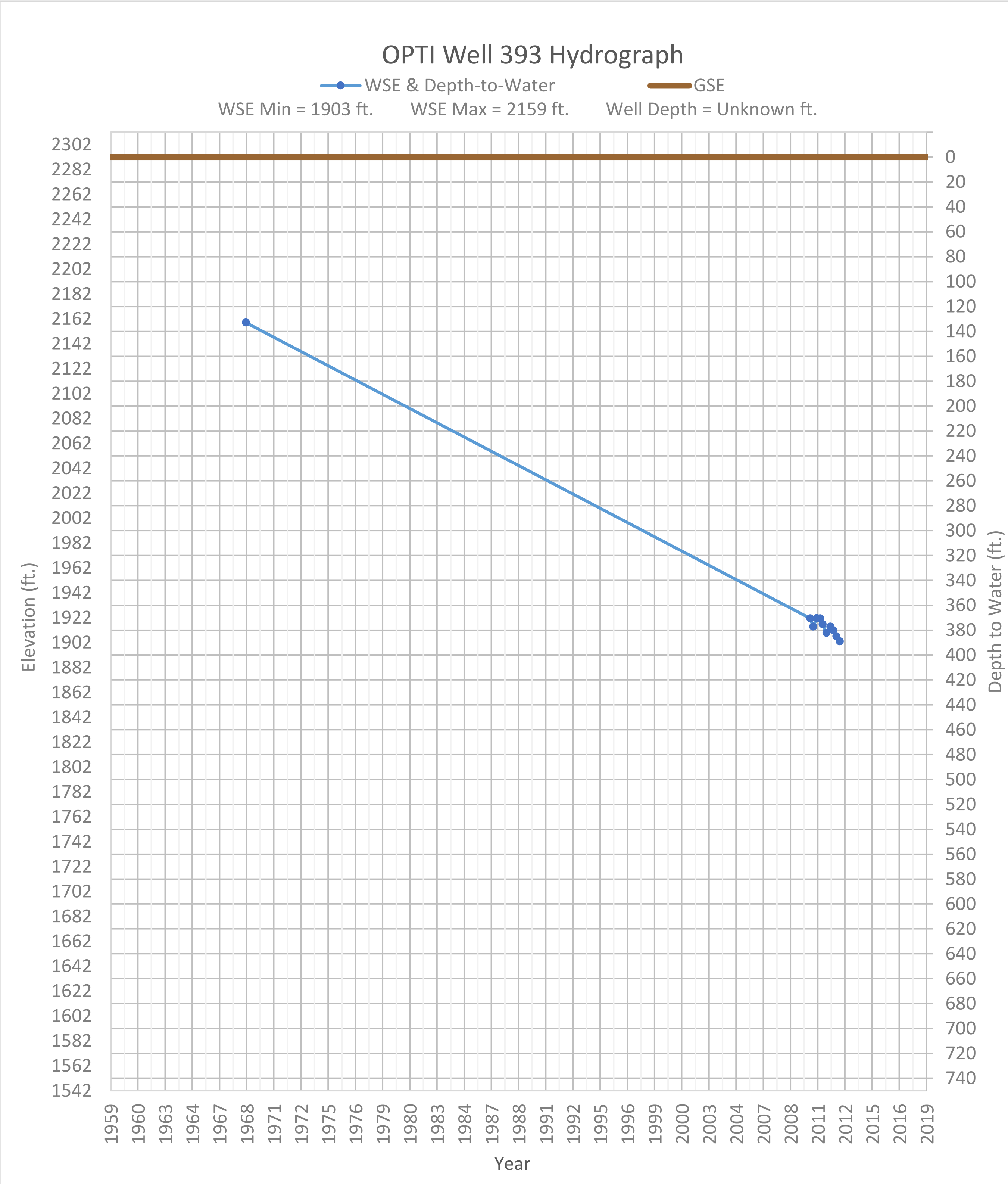

OPTI Well 387 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2149 ft.
WSE Max = 2165 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 388 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2227 ft.
WSE Max = 2227 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 392 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2222 ft.
WSE Max = 2233 ft.
Well Depth = 298 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 393 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1903 ft.
WSE Max = 2159 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2302
2282
2262
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
2002
1982
1962
1942
1922
1902
1882
1862
1842
1822
1802
1782
1762
1742
1722
1702
1682
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1642
1622
1602
1582
1562
1542
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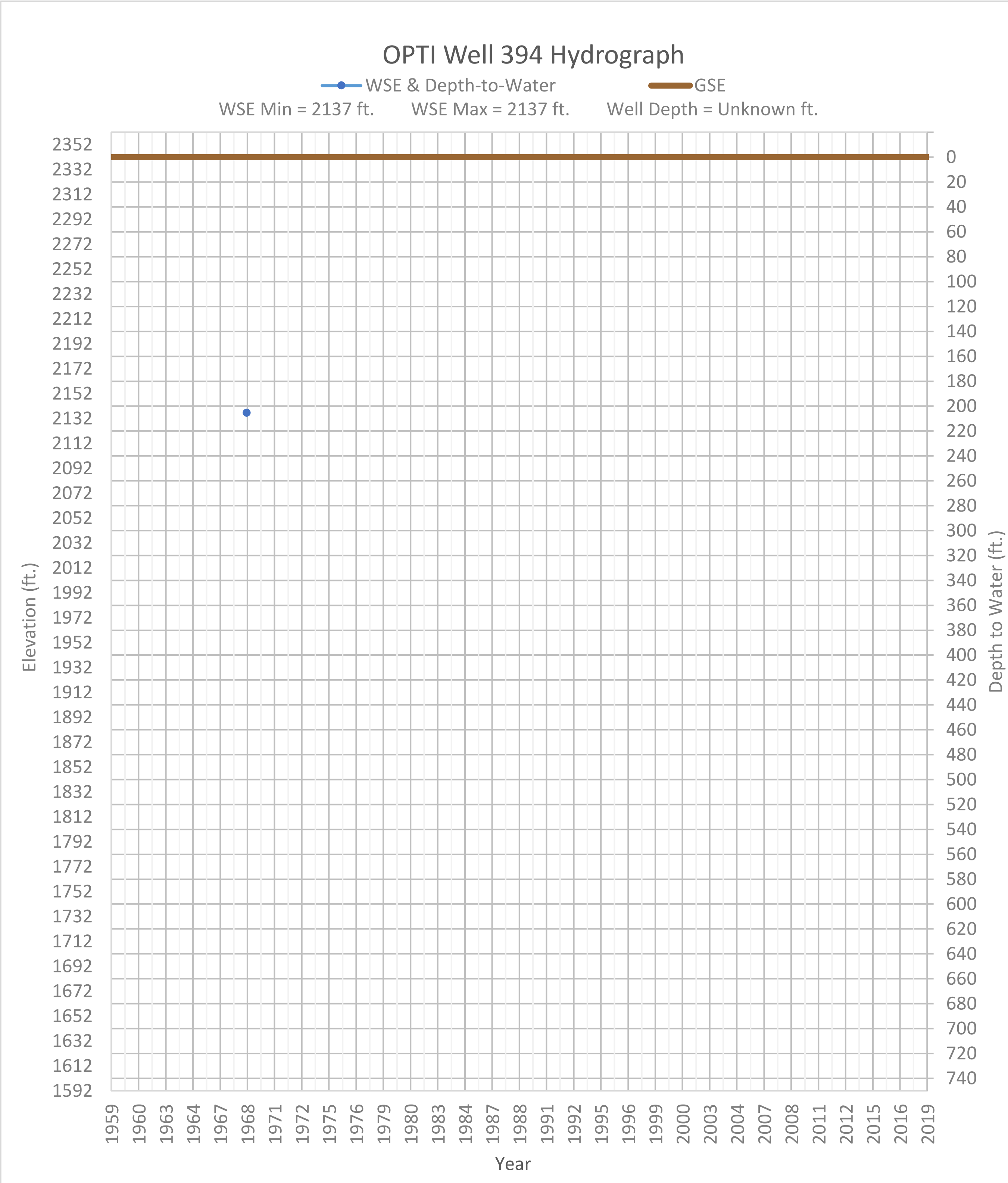
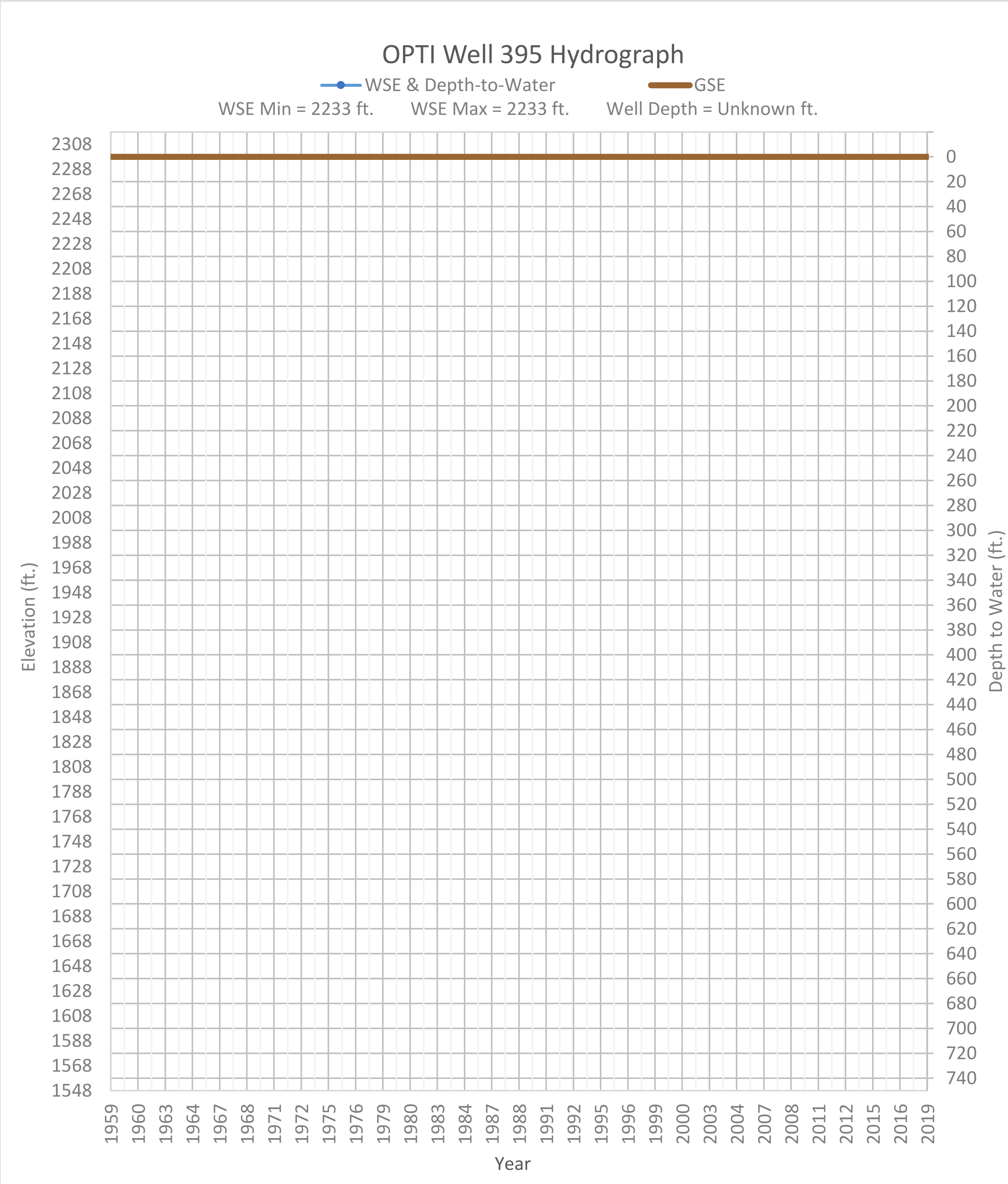

OPTI Well 394 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2137 ft.
WSE Max = 2137 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 395 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2233 ft.
WSE Max = 2233 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
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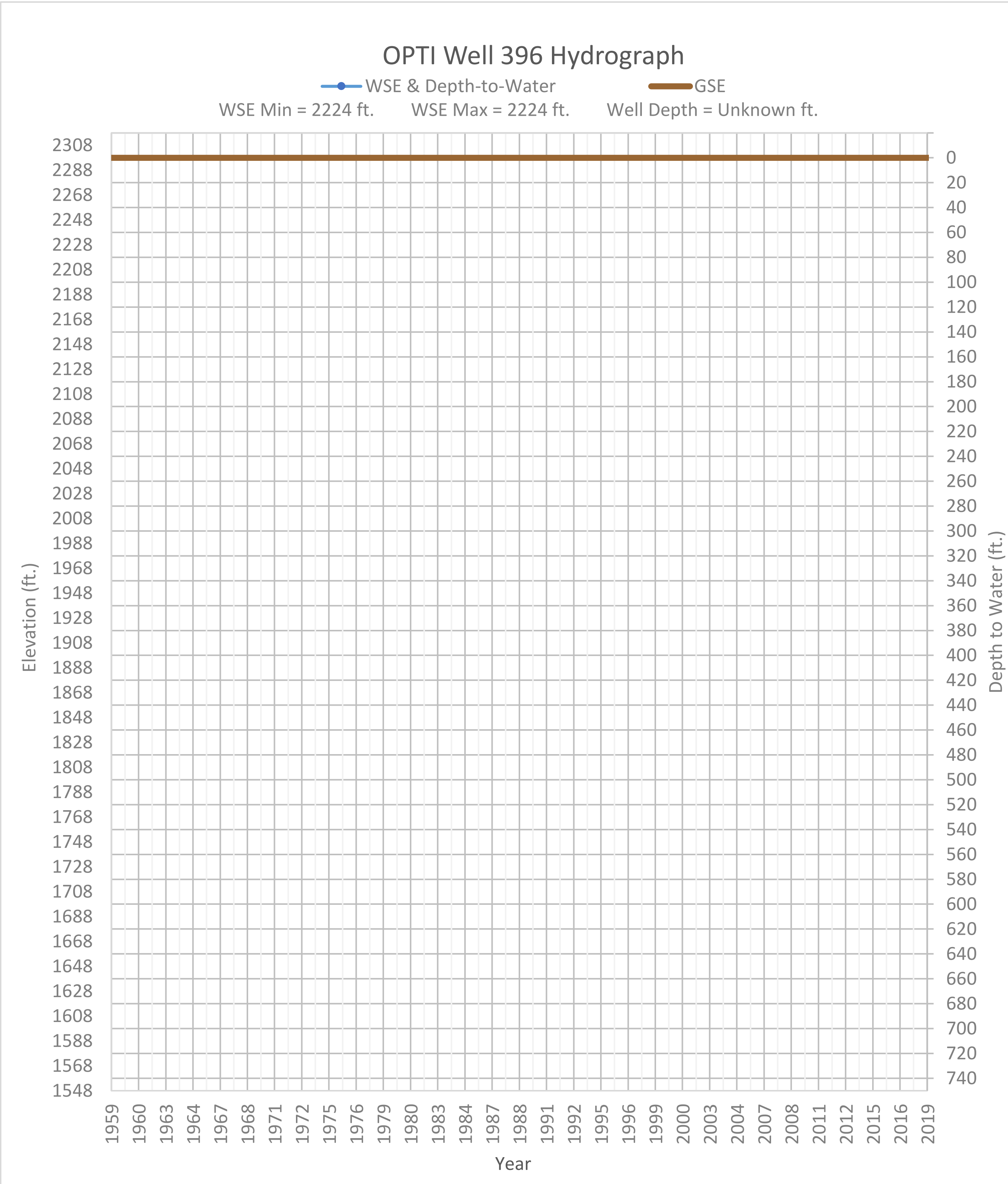
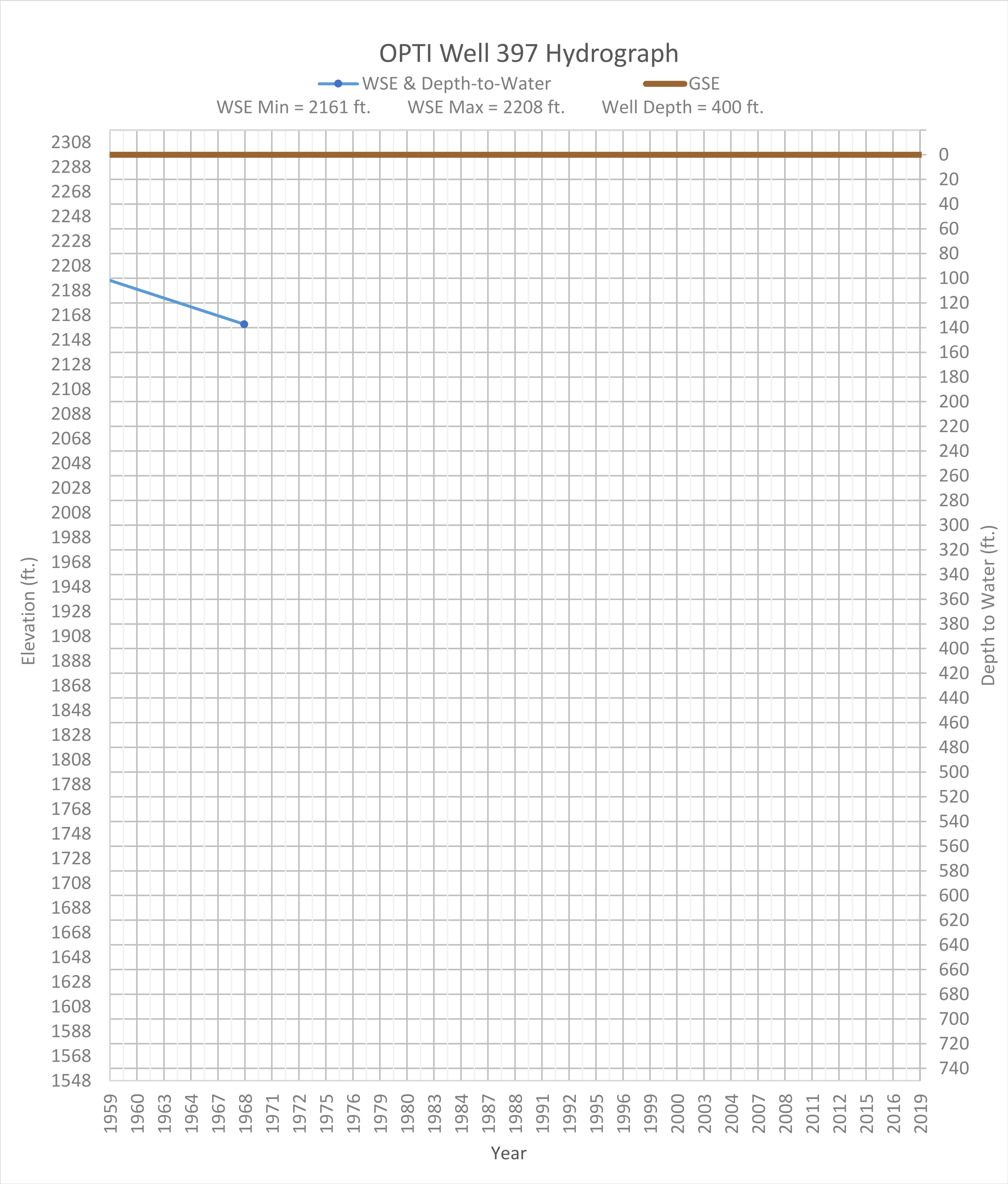
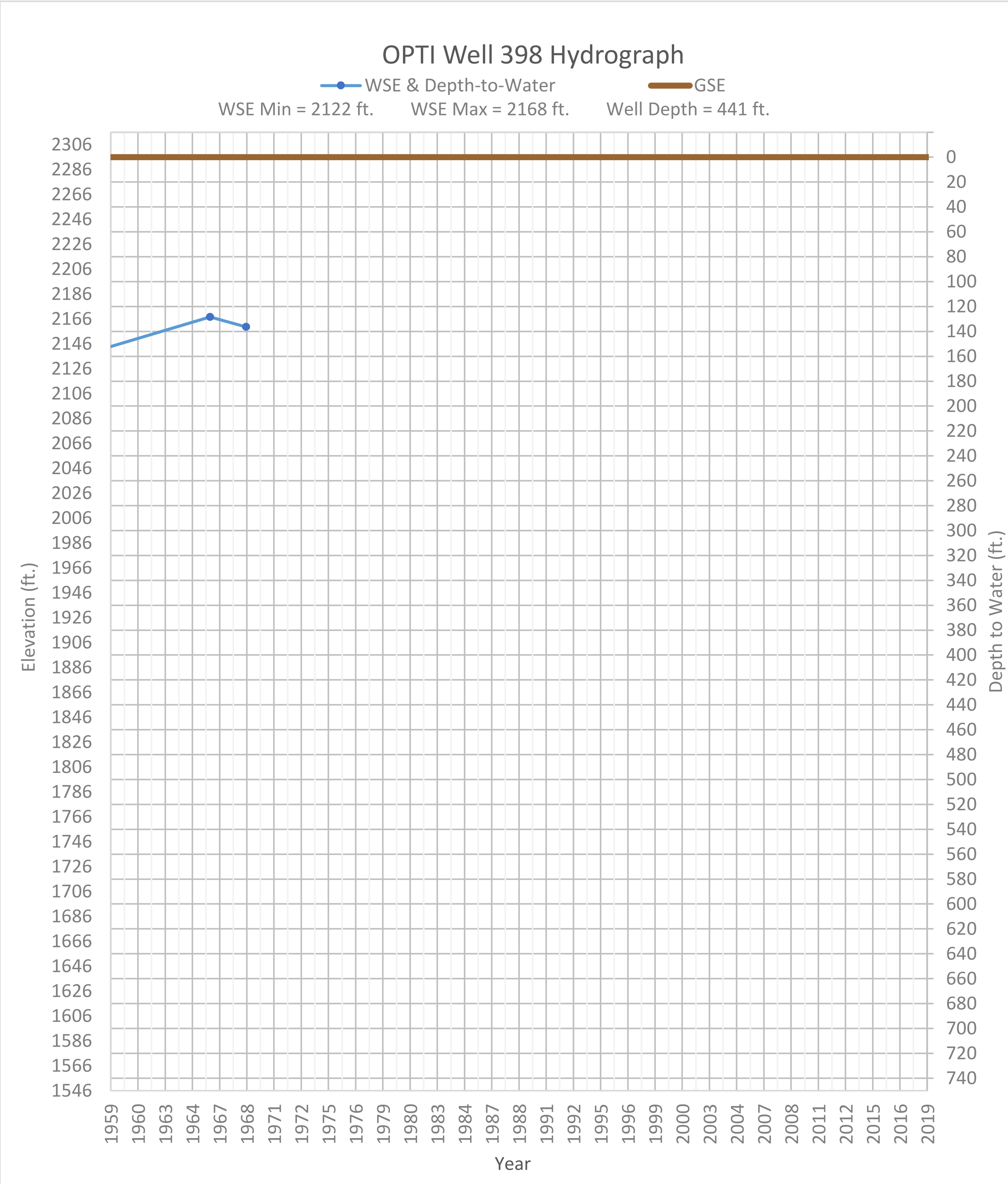
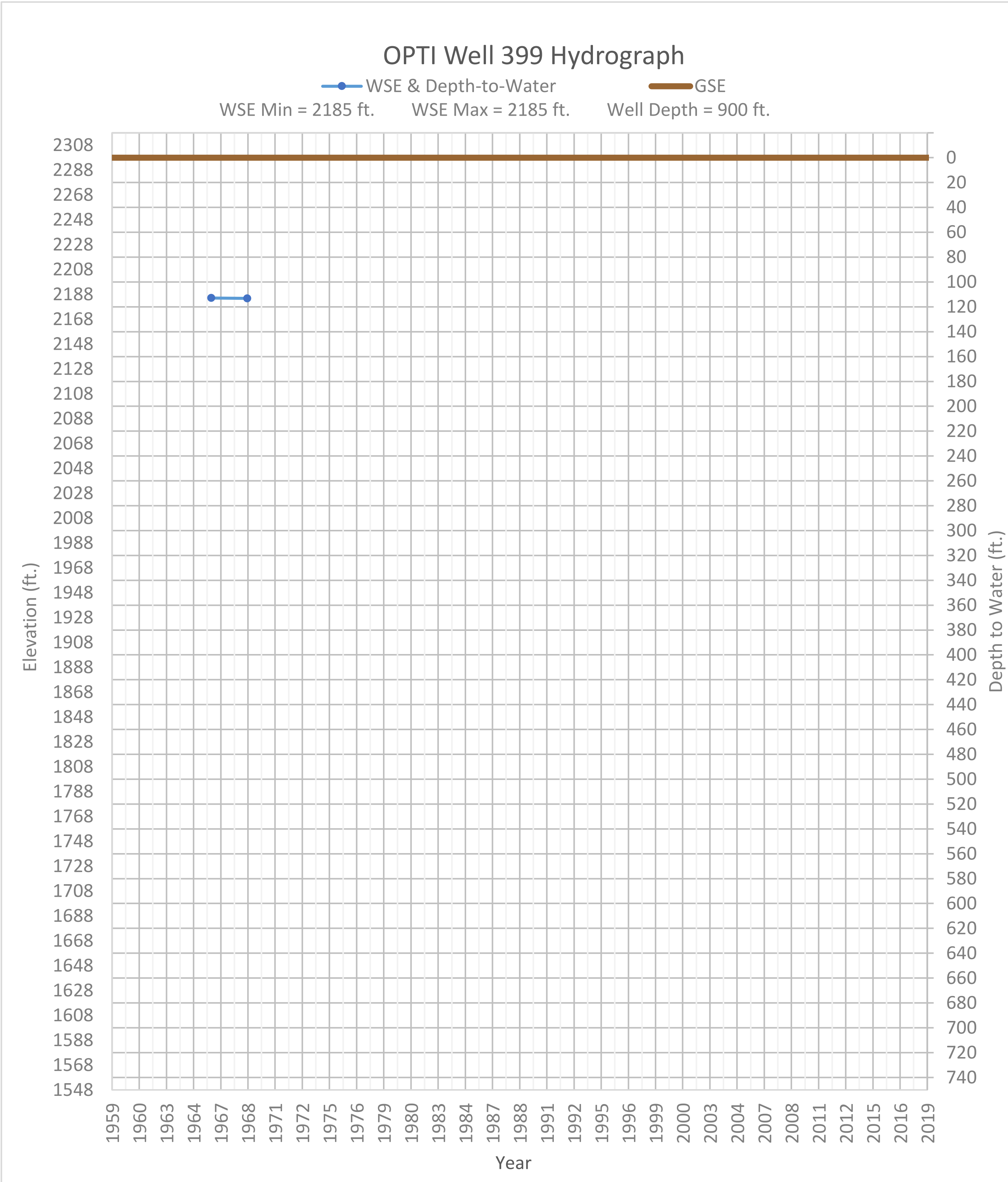
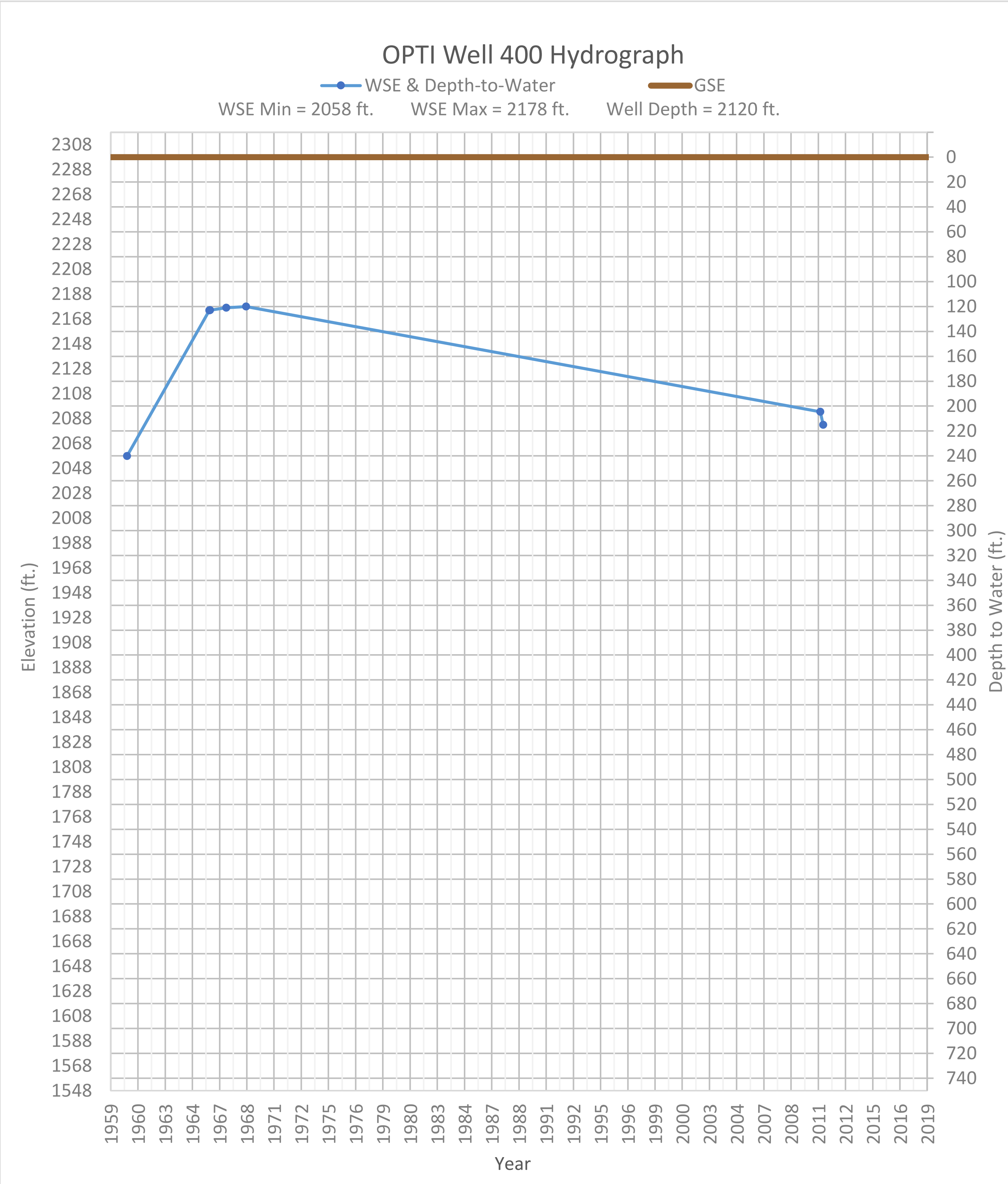

OPTI Well 396 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2224 ft.
WSE Max = 2224 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 397 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2161 ft.
WSE Max = 2208 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 398 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2122 ft.
WSE Max = 2168 ft.
Well Depth = 441 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 399 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2185 ft.
WSE Max = 2185 ft.
Well Depth = 900 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 400 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2058 ft.
WSE Max = 2178 ft.
Well Depth = 2120 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
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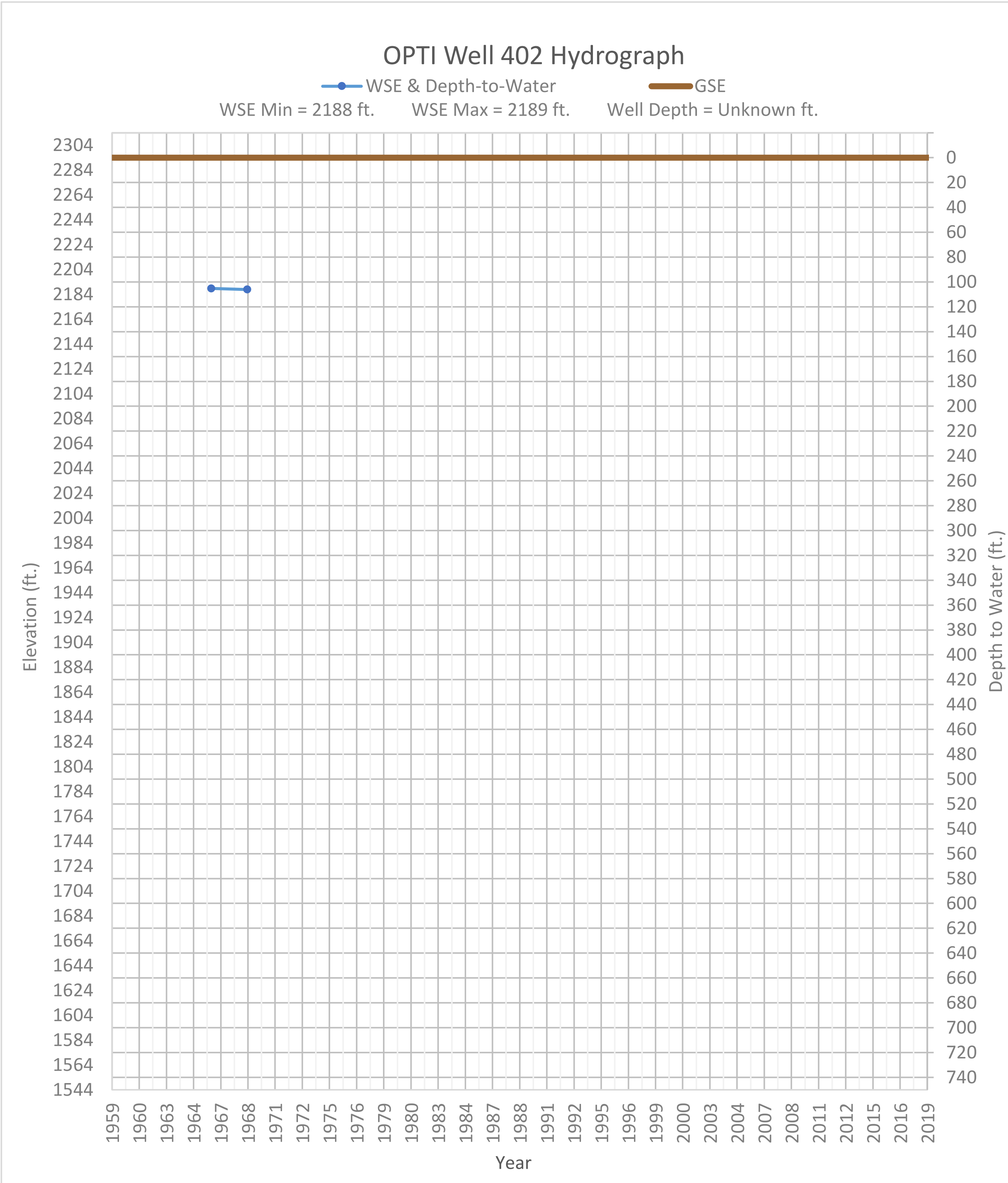
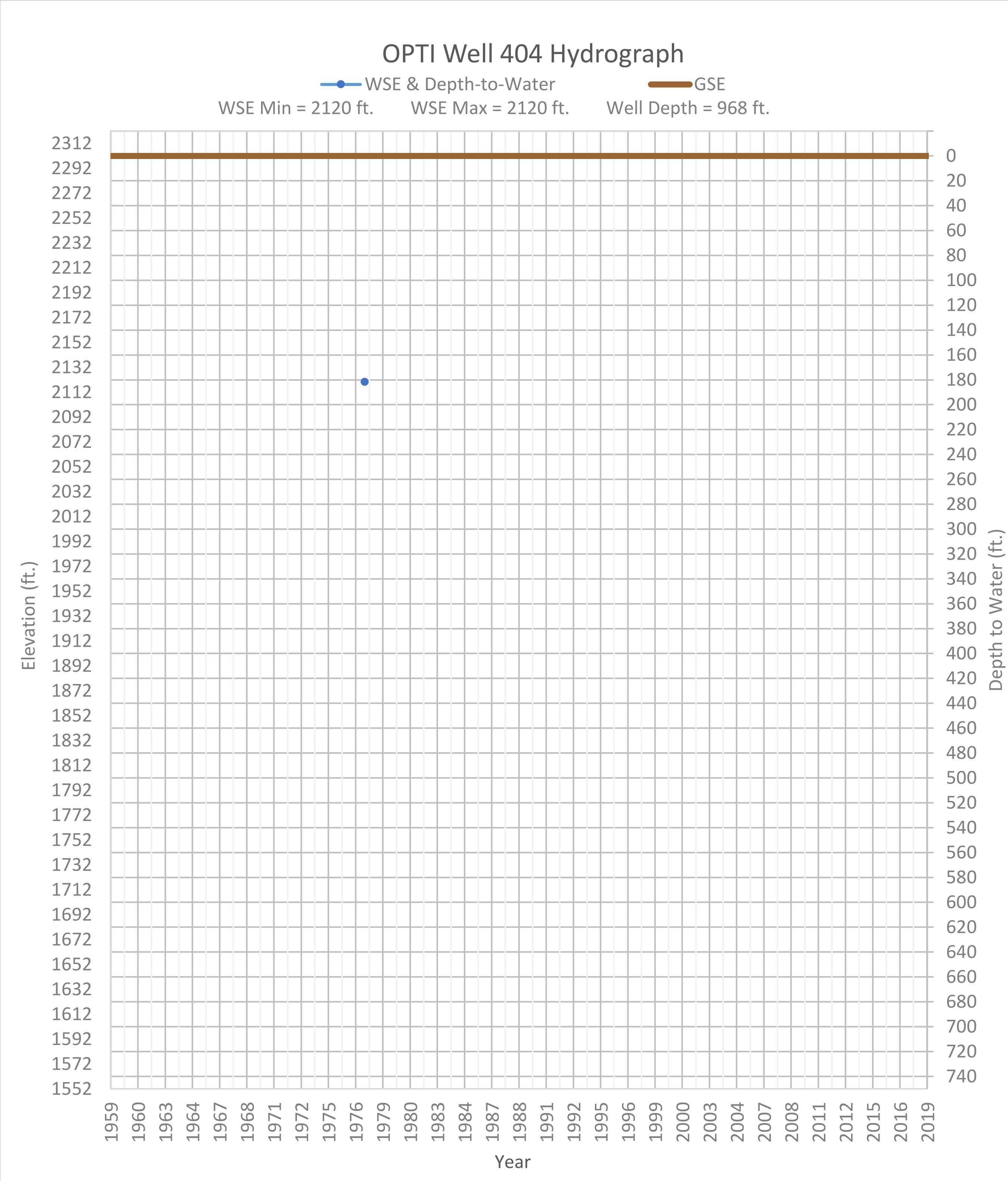


OPTI Well 402 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2188 ft.
WSE Max = 2189 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 404 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2120 ft.
WSE Max = 2120 ft.
Well Depth = 968 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
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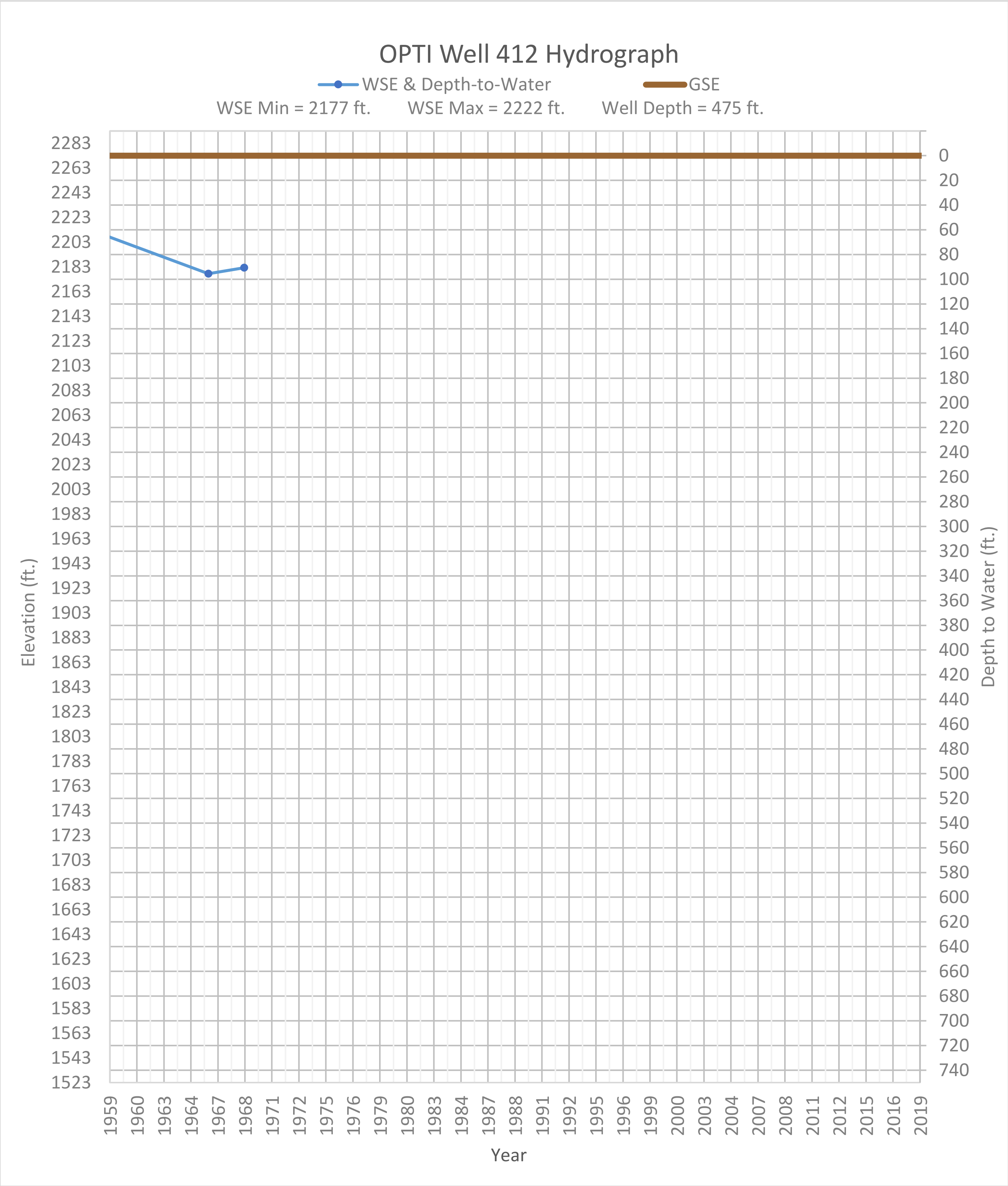
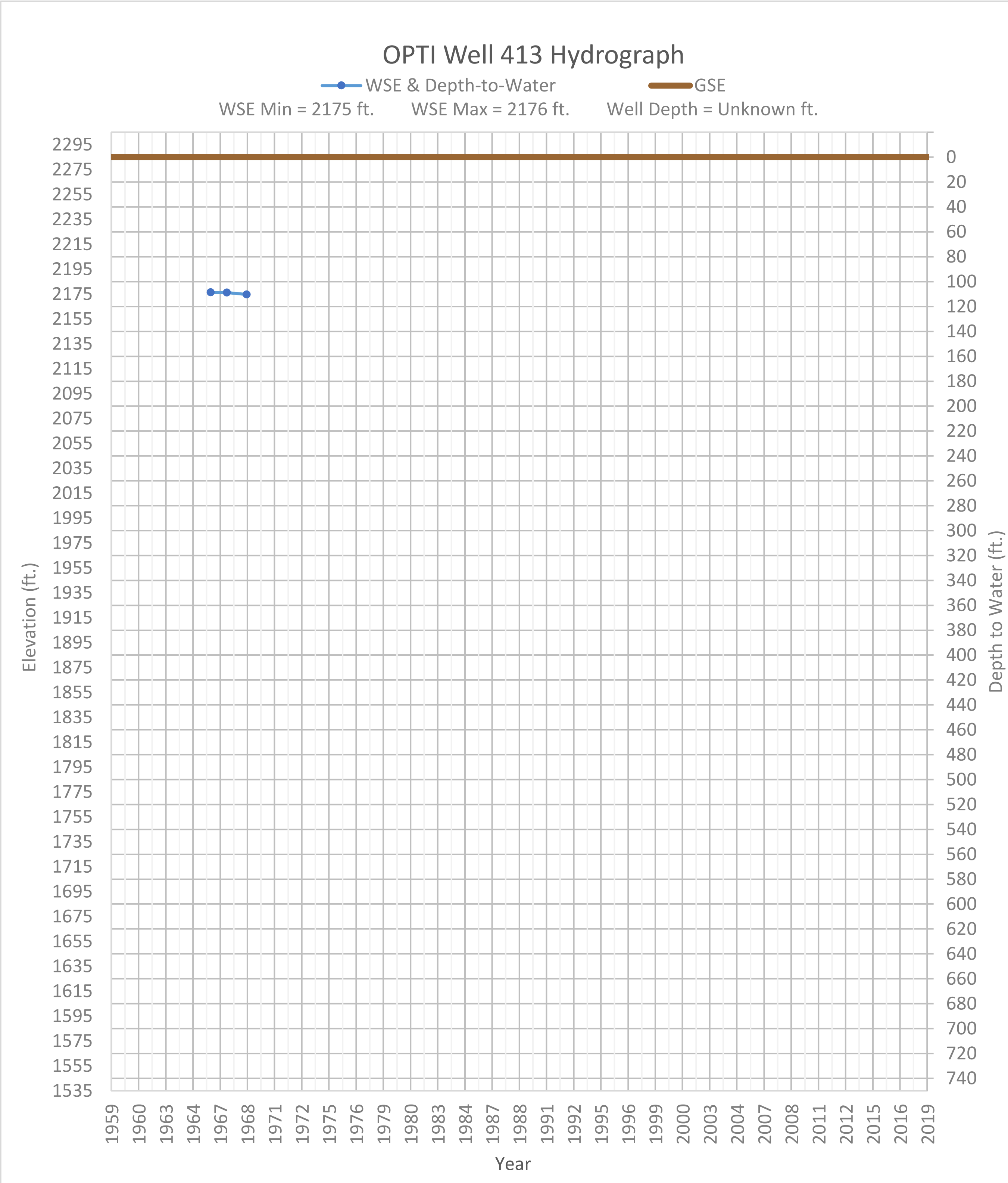
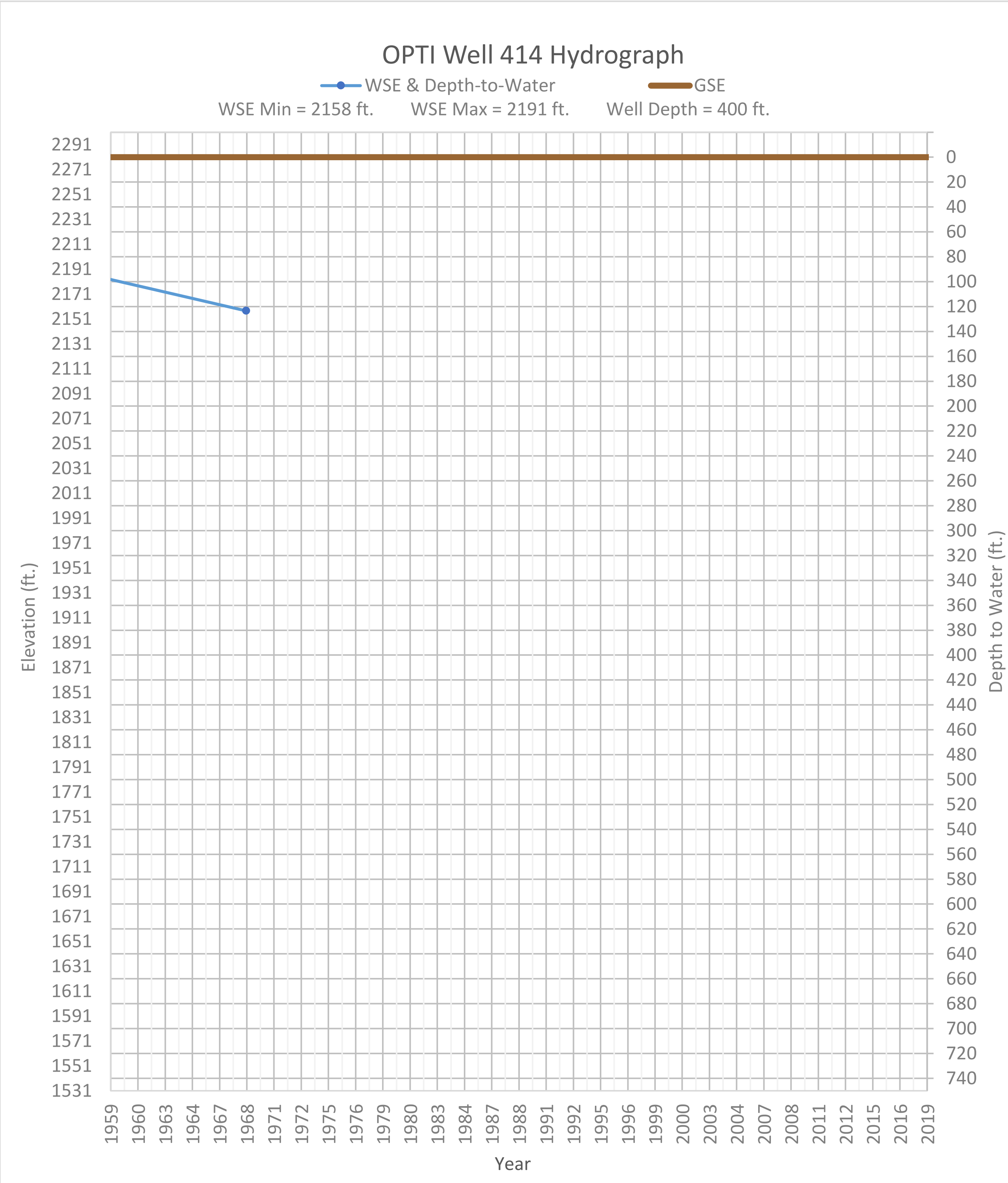
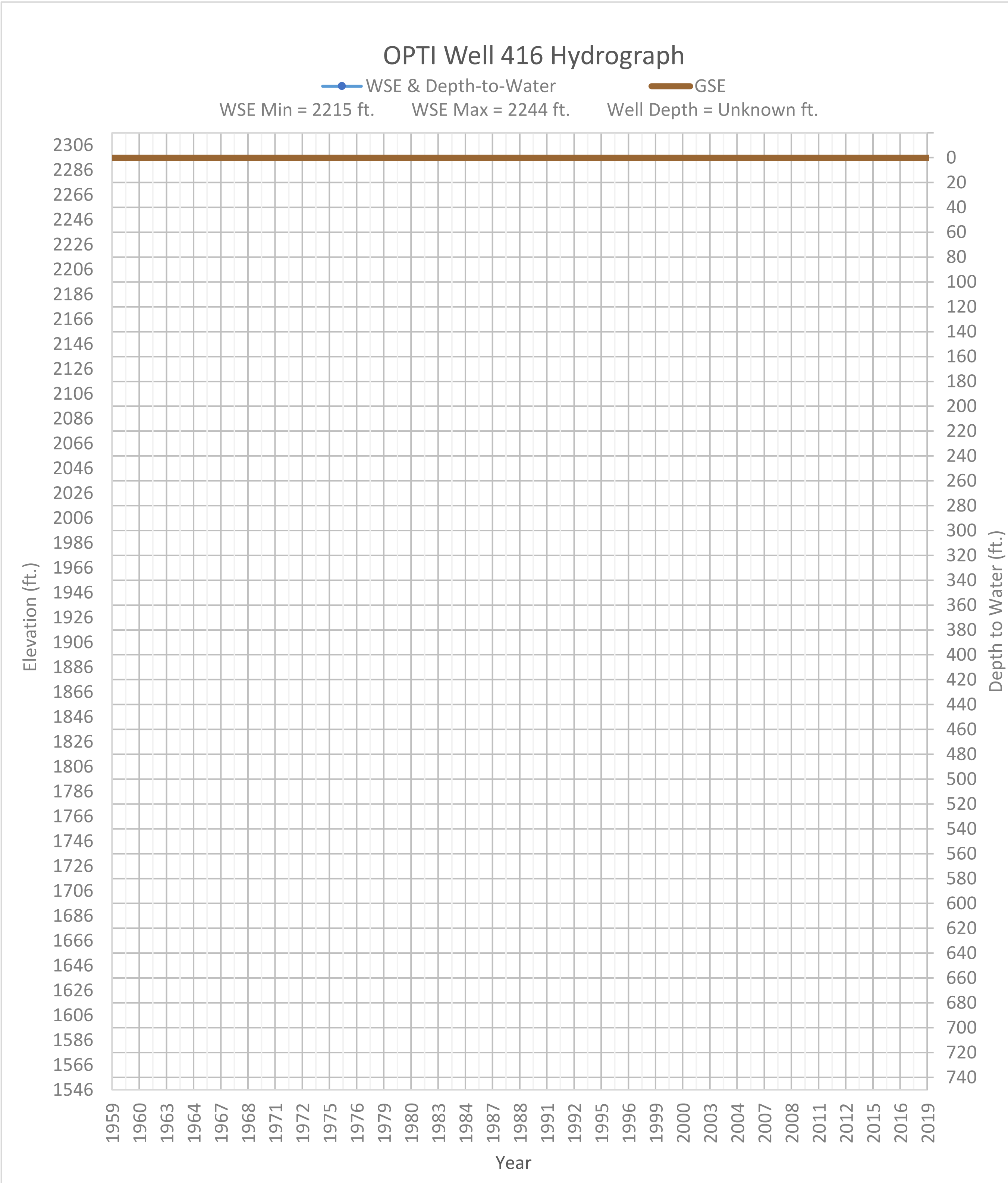
2015
2016
2019



OPTI Well 412 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2177 ft.
WSE Max = 2222 ft.
Well Depth = 475 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 413 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2175 ft.
WSE Max = 2176 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 414 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2158 ft.
WSE Max = 2191 ft.
Well Depth = 400 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 416 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2215 ft.
WSE Max = 2244 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2306
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
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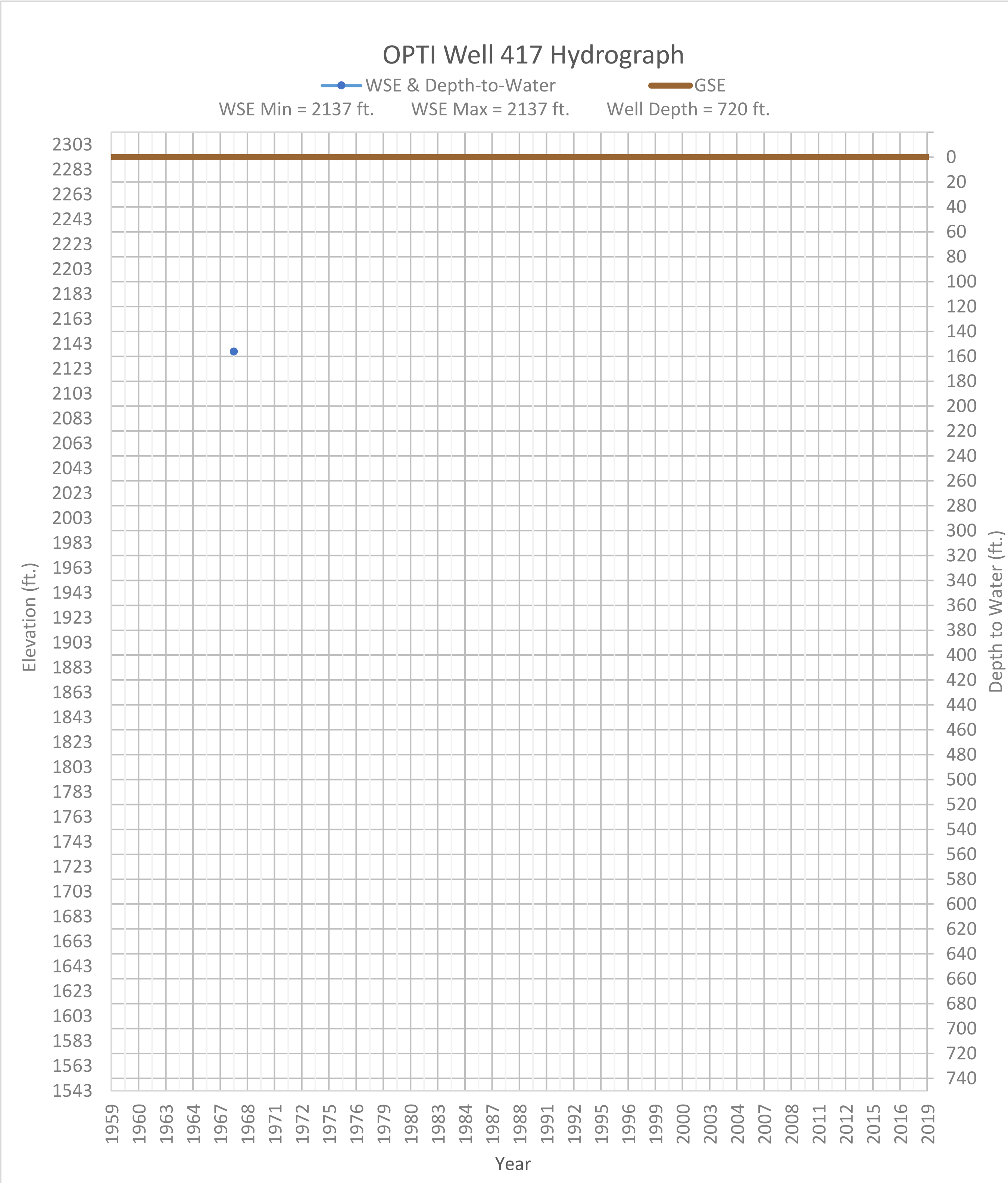
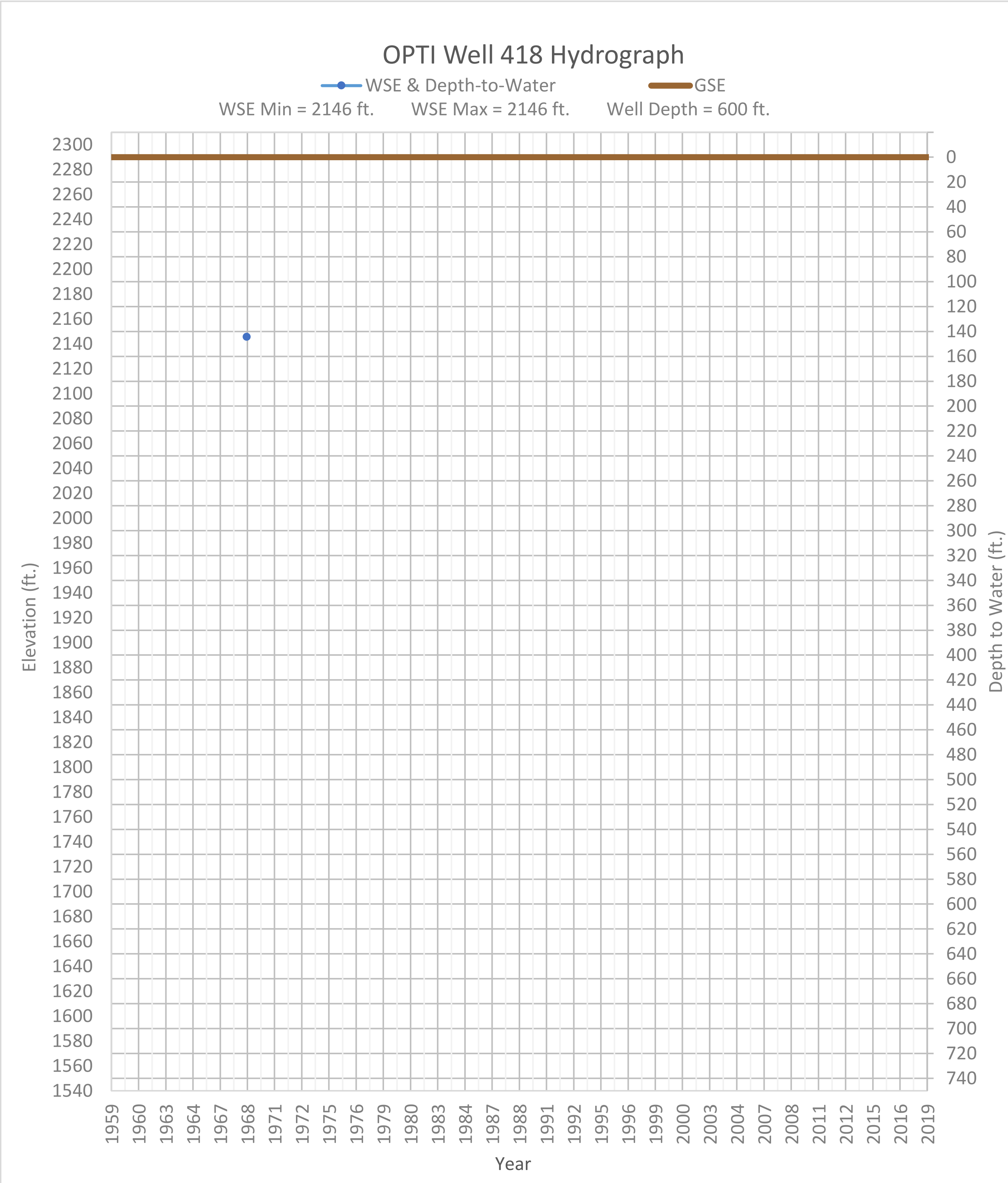
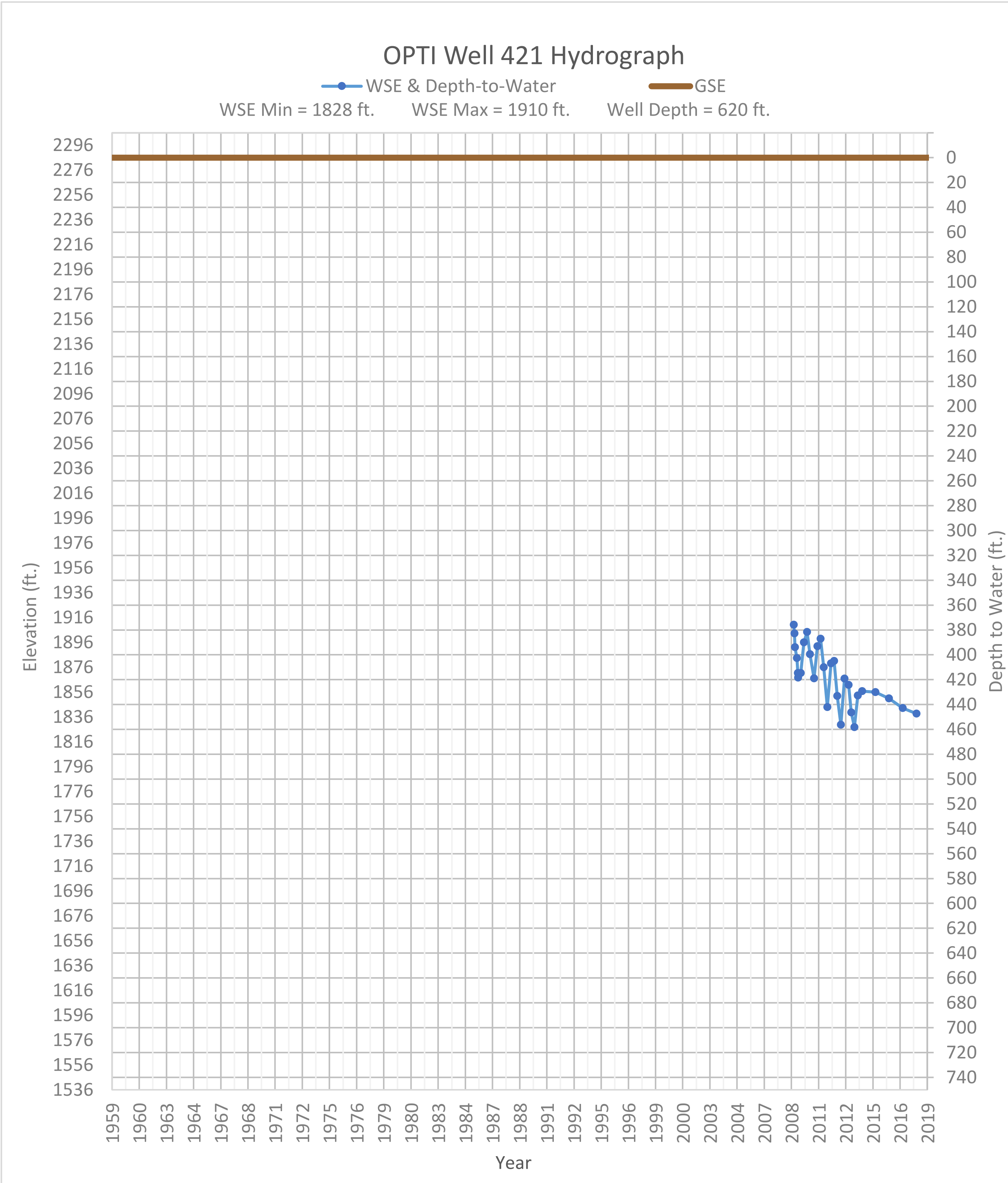

OPTI Well 417 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2137 ft.
WSE Max = 2137 ft.
Well Depth = 720 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



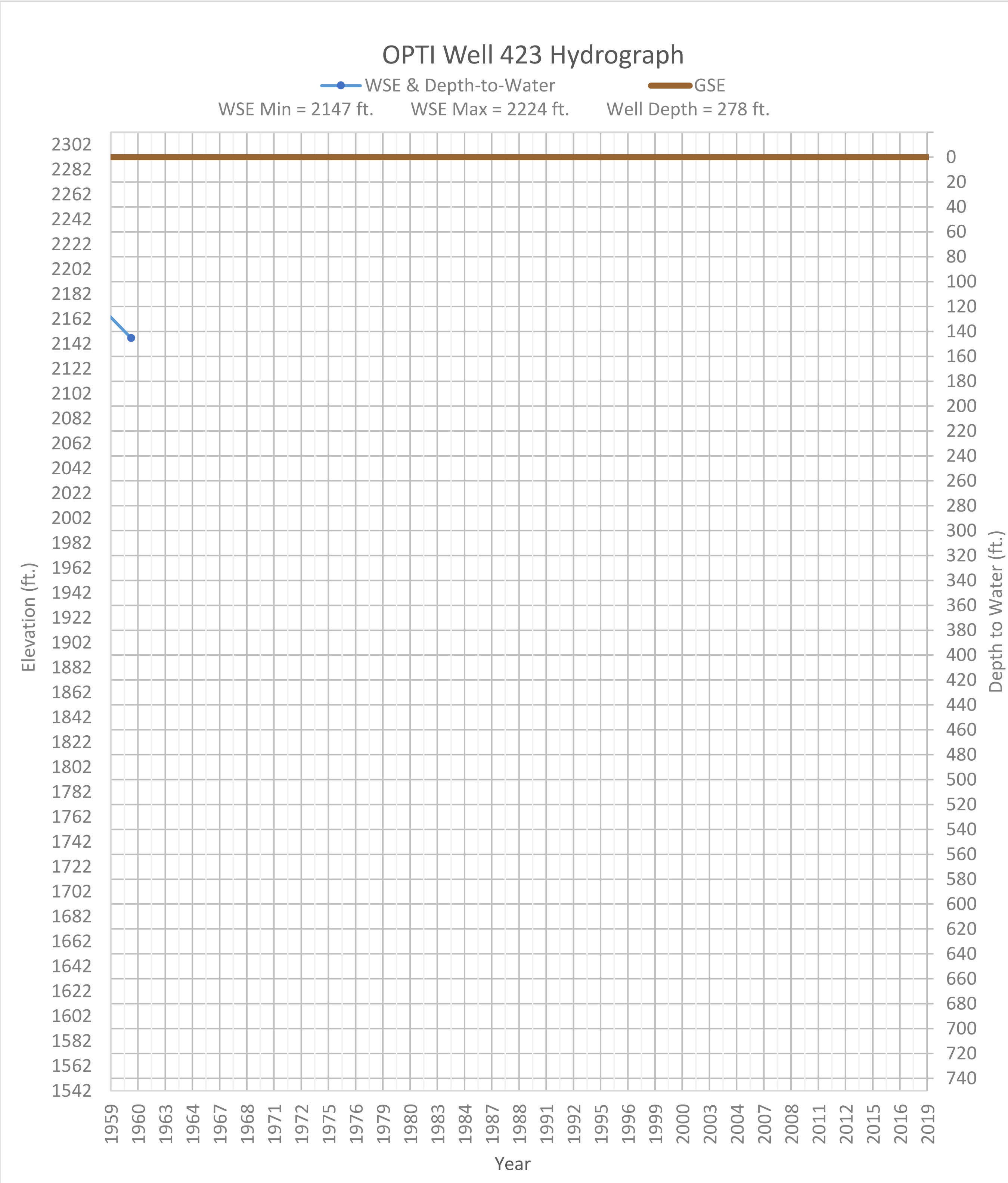
OPTI Well 418 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2146 ft.
WSE Max = 2146 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 420 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1809 ft.
WSE Max = 1913 ft.
Well Depth = 780 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

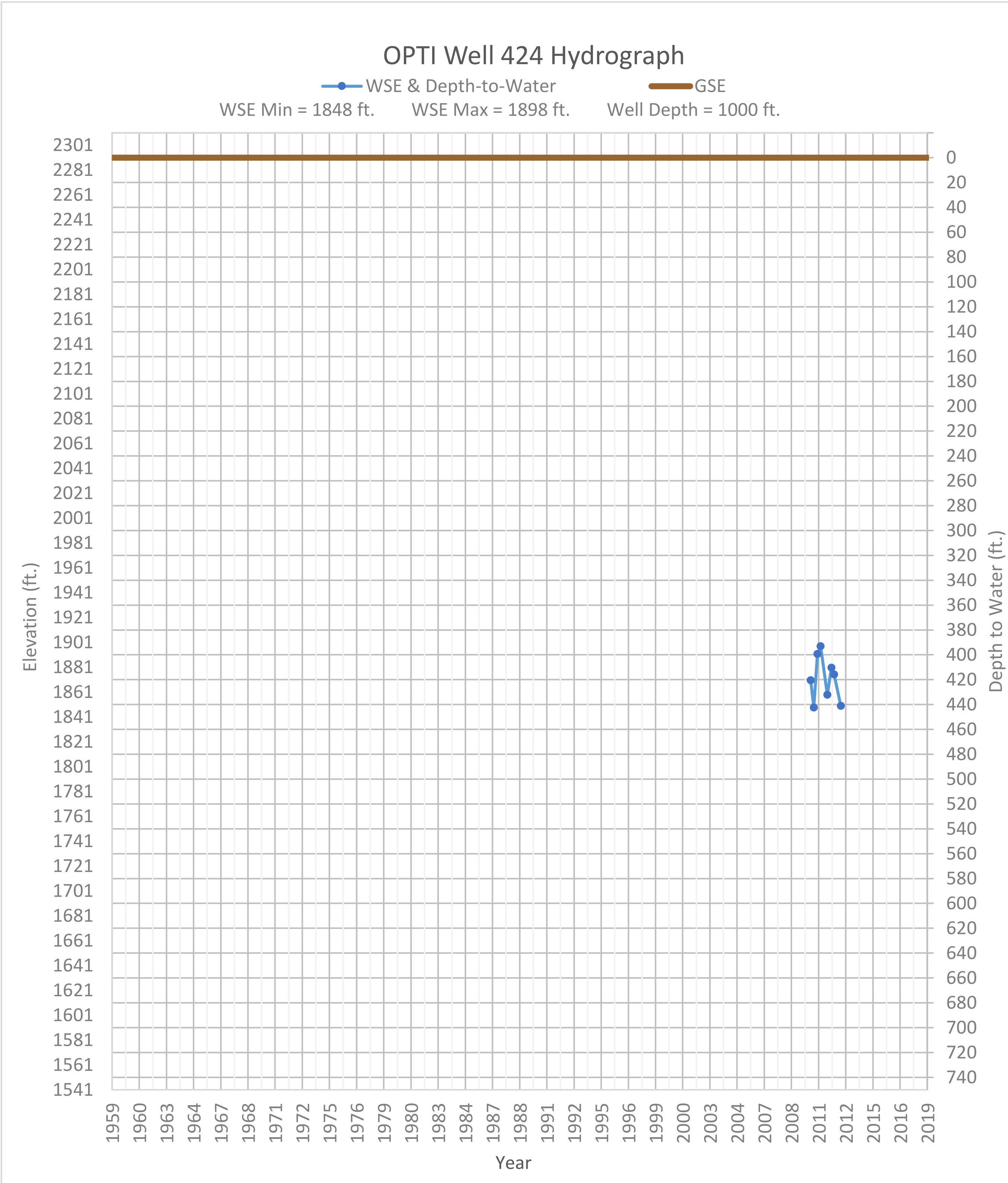


OPTI Well 421 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1828 ft.
WSE Max = 1910 ft.
Well Depth = 620 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

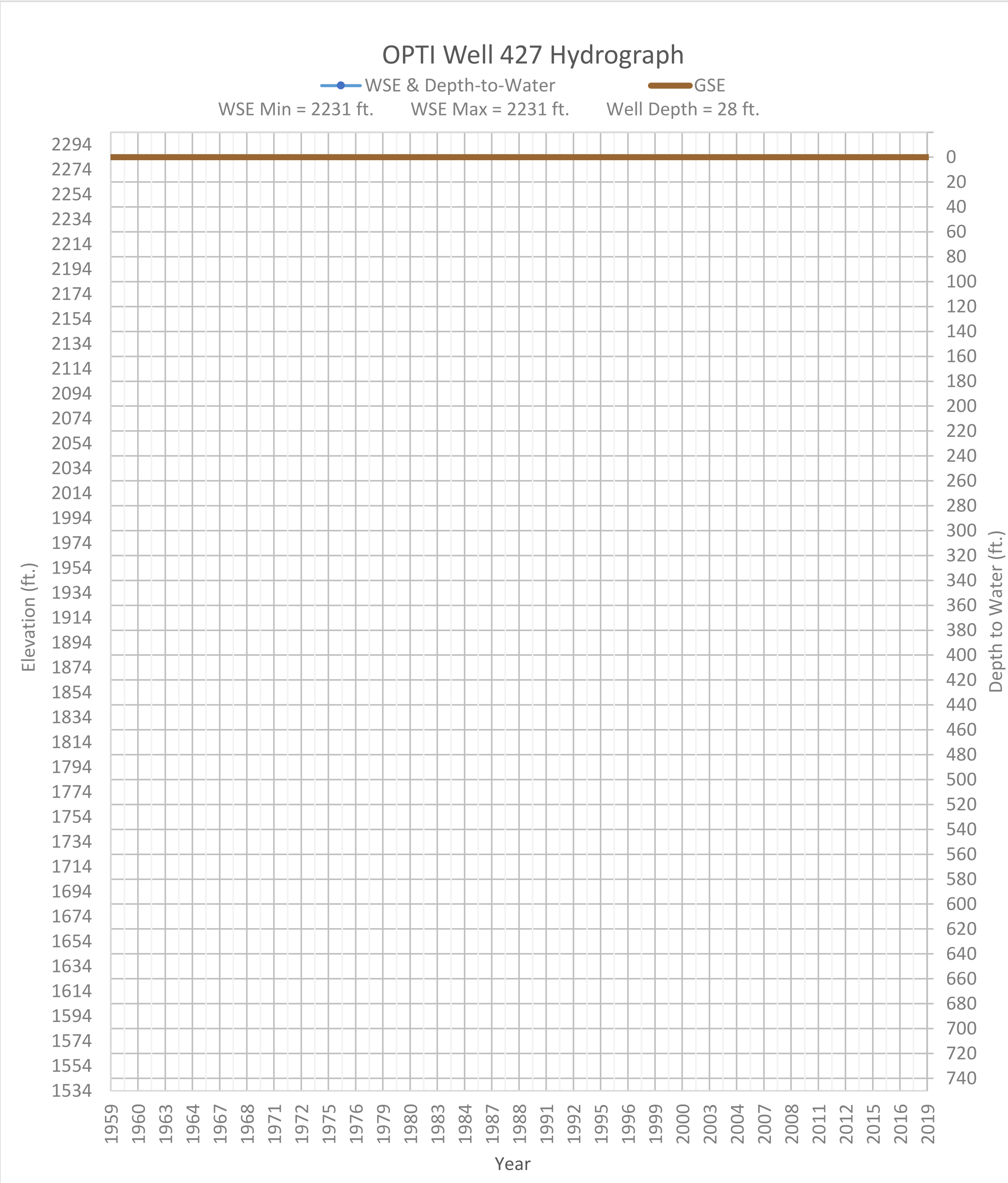

OPTI Well 422 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1838 ft.
WSE Max = 1909 ft.
Well Depth = 460 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 423 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2147 ft.
WSE Max = 2224 ft.
Well Depth = 278 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 424 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1848 ft.
WSE Max = 1898 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 427 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2231 ft.
WSE Max = 2231 ft.
Well Depth = 28 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2294
2274
2254
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
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1694
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1654
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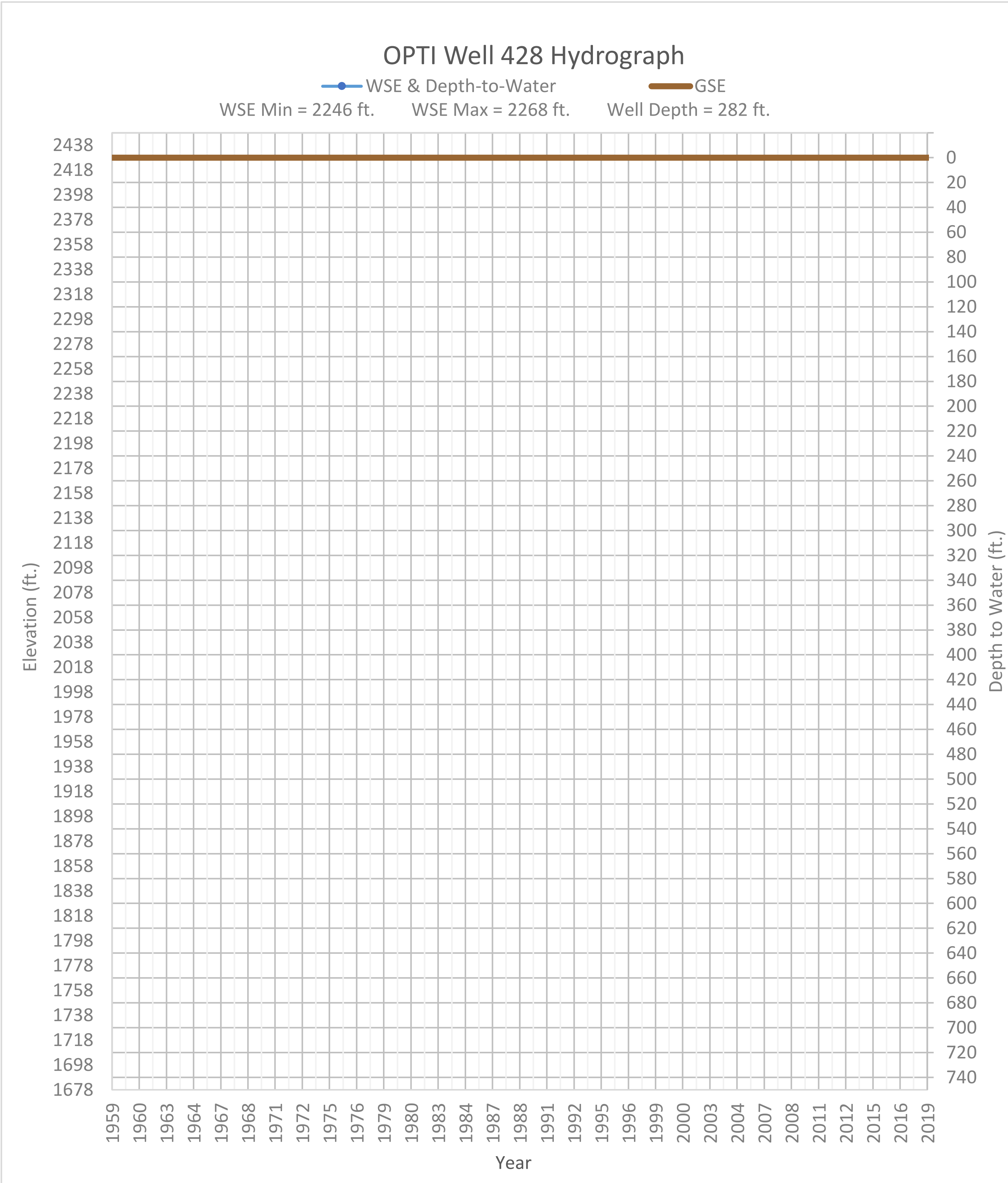
OPTI Well 428 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2246 ft.
WSE Max = 2268 ft.
Well Depth = 282 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2438
2418
2398
2378
2358
2338
2318
2298
2278
2258
2238
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
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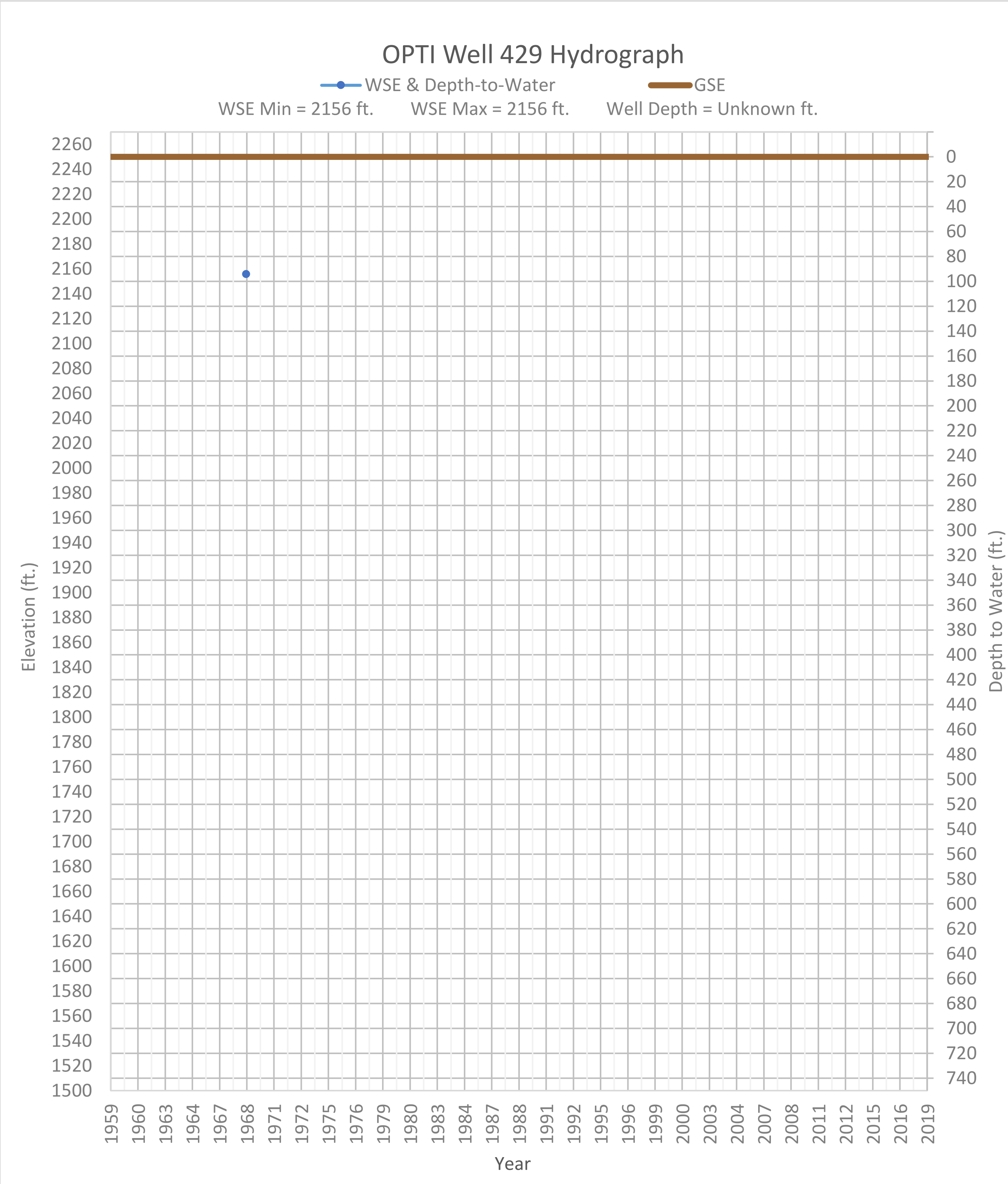
OPTI Well 429 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2156 ft.
WSE Max = 2156 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
1900
1880
1860
1840
1820
1800
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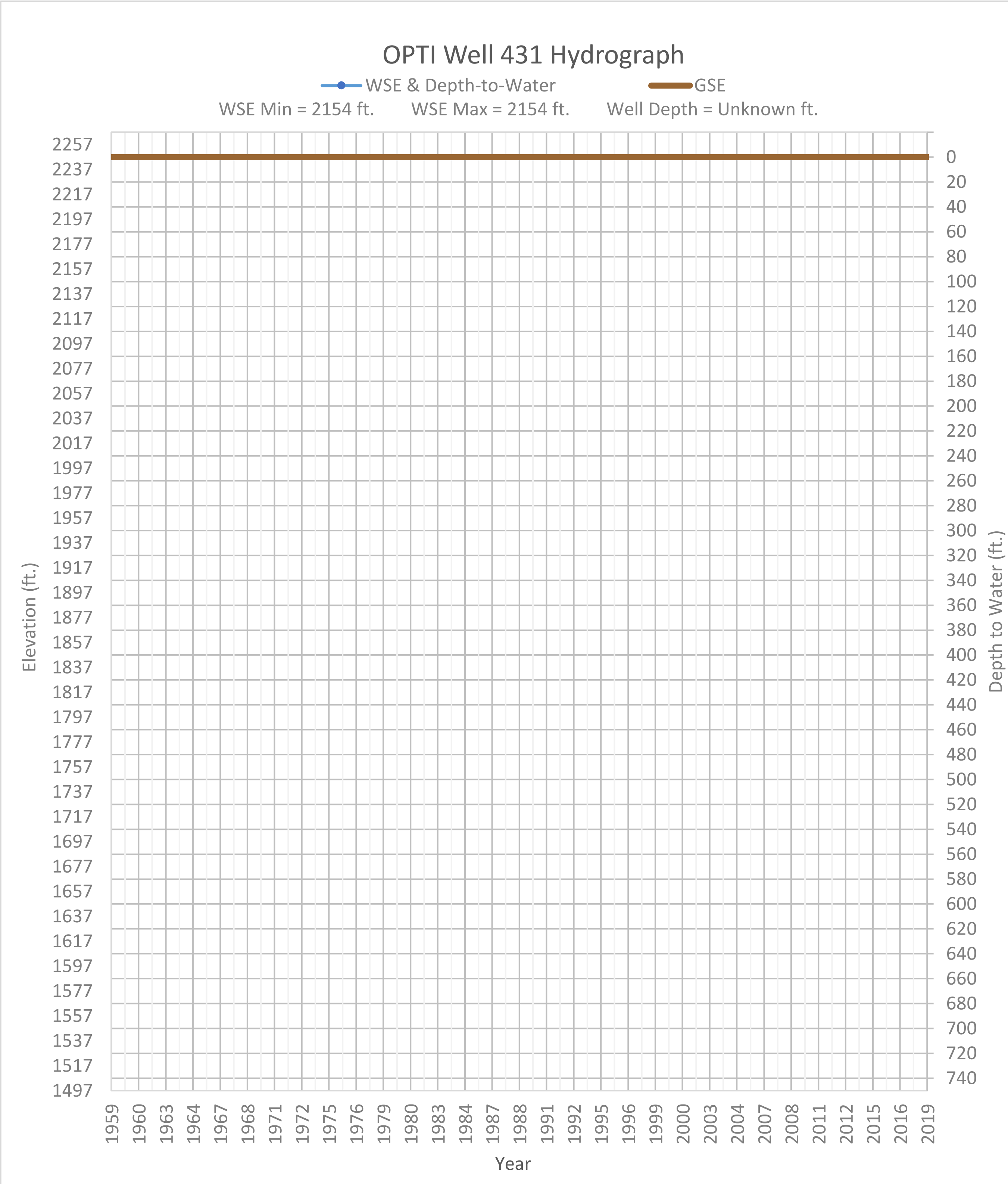
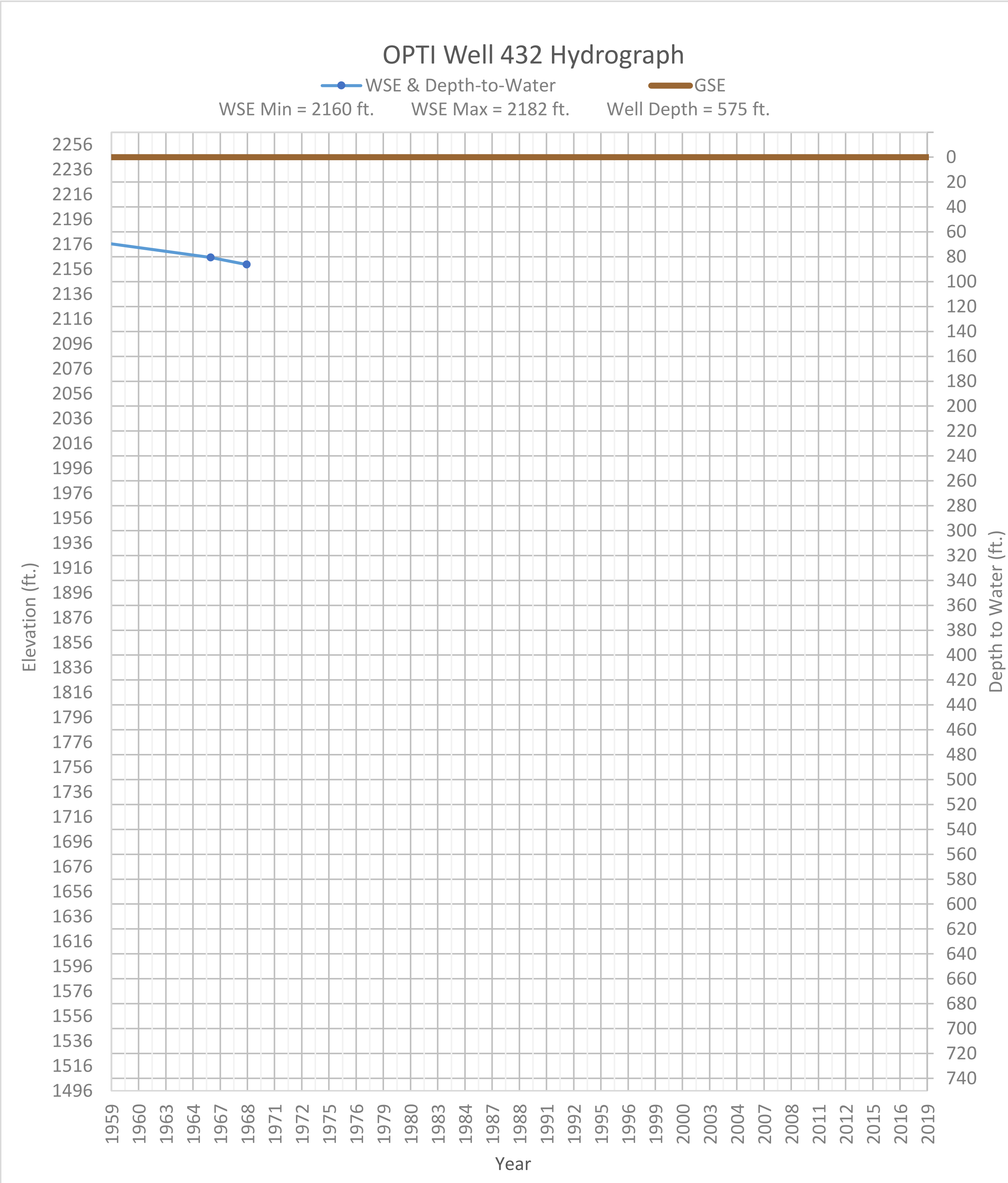
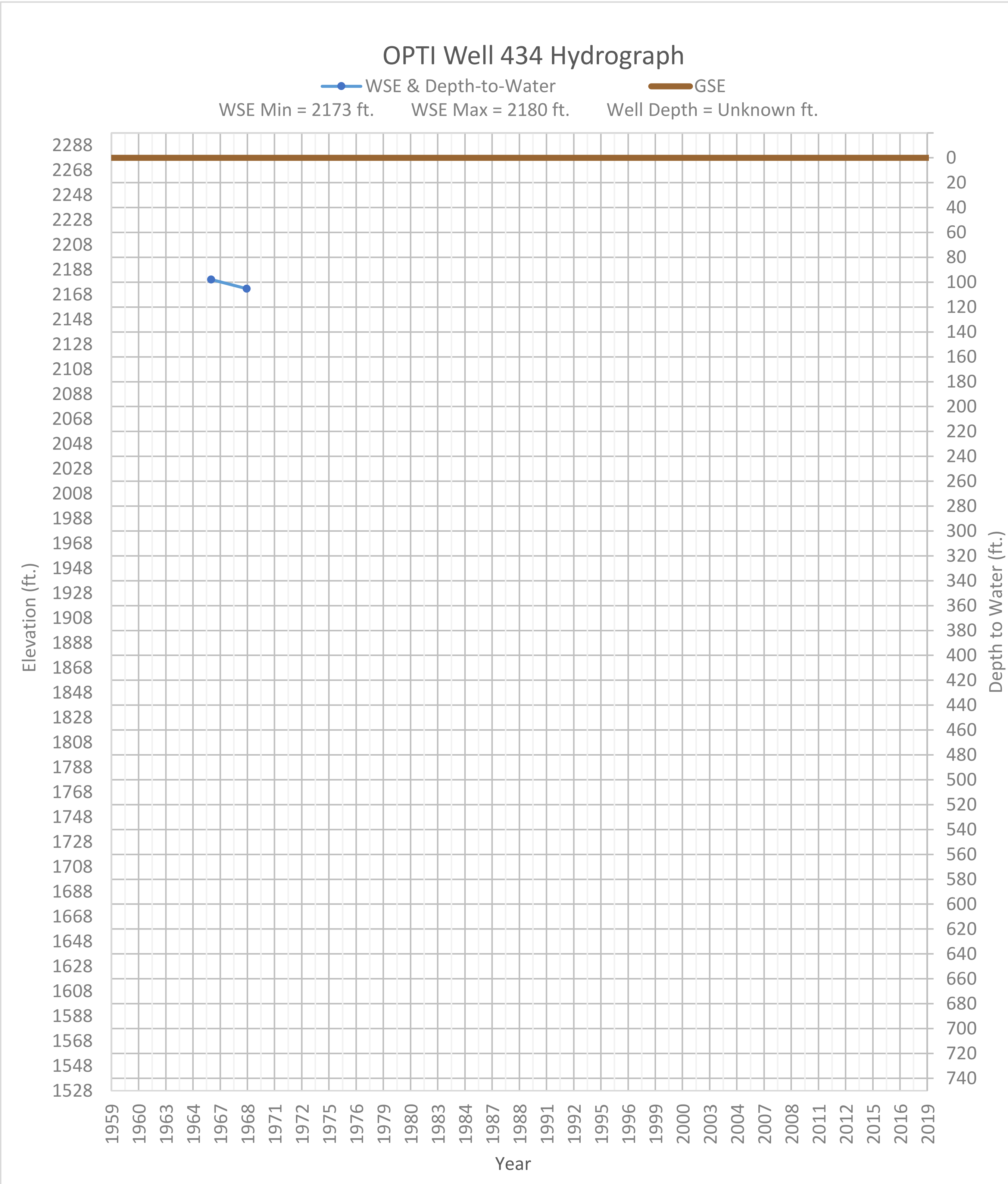


OPTI Well 431 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2154 ft.
WSE Max = 2154 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 432 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2160 ft.
WSE Max = 2182 ft.
Well Depth = 575 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 434 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2173 ft.
WSE Max = 2180 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
1888
1868
1848
1828
1808
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1768
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1708
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1668
1648
1628
1608
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1568
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1528
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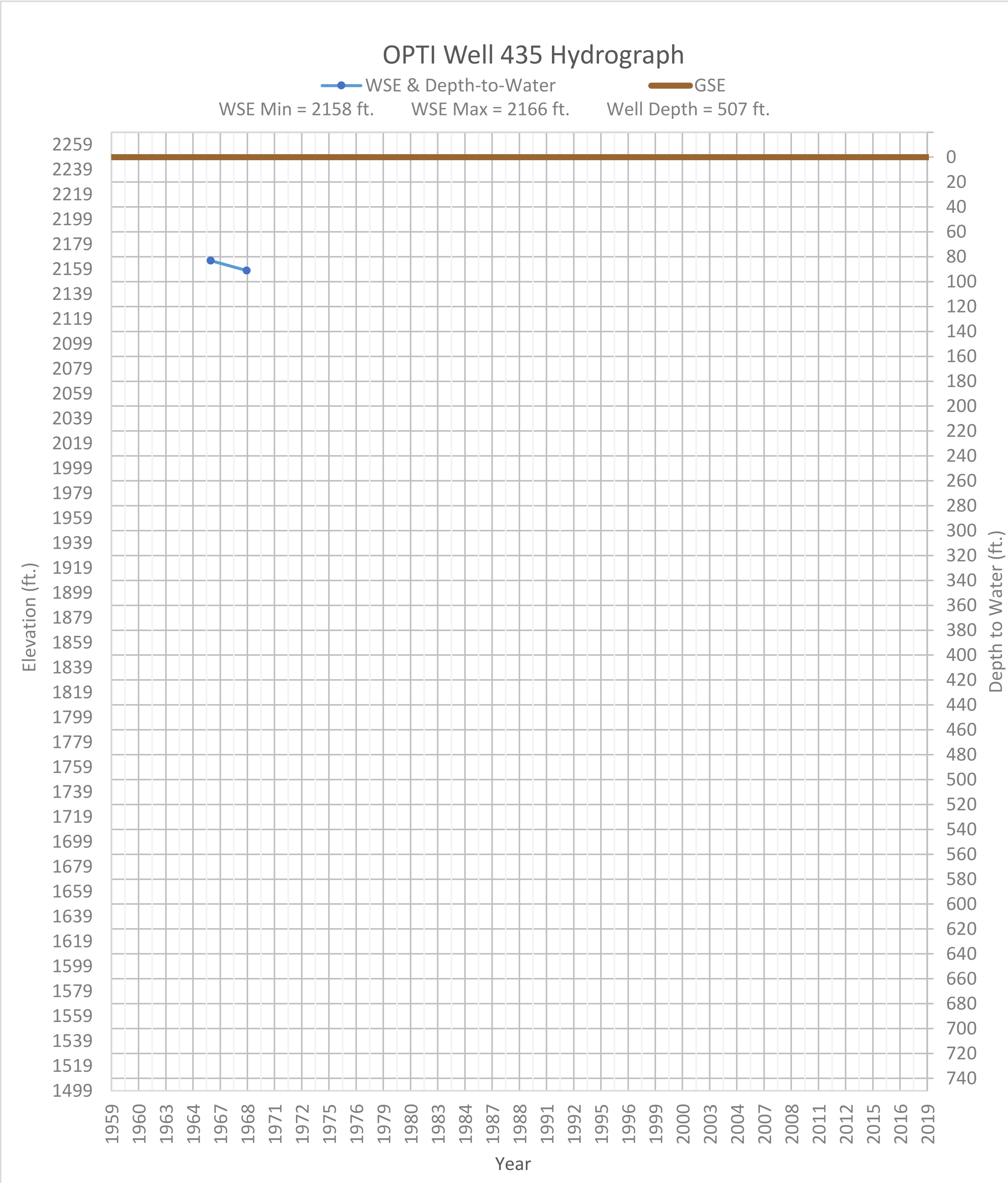

OPTI Well 435 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2158 ft.
WSE Max = 2166 ft.
Well Depth = 507 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2259
2239
2219
2199
2179
2159
2139
2119
2099
2079
2059
2039
2019
1999
1979
1959
1939
1919
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1579
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1539
1519
1499
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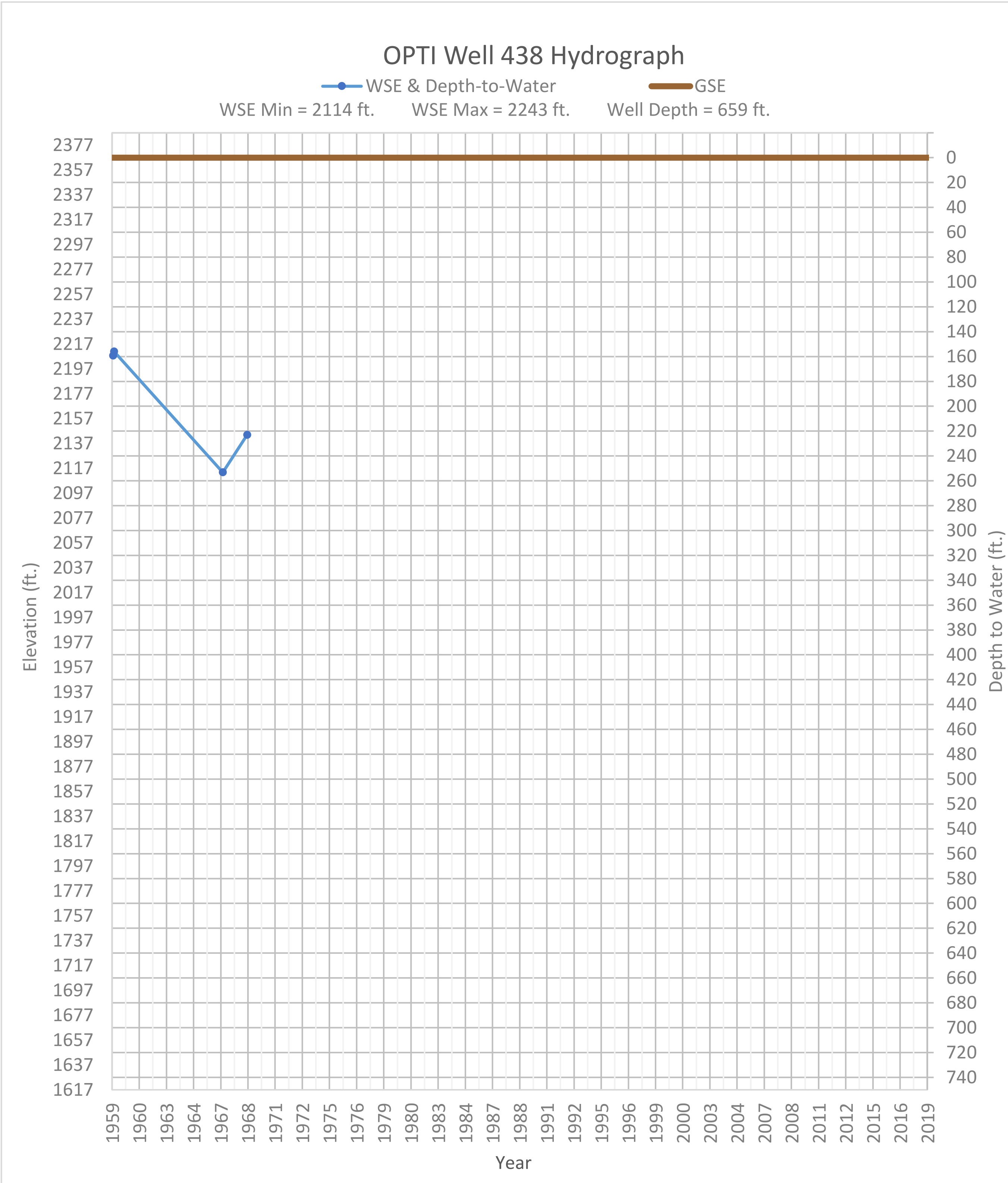

OPTI Well 438 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2114 ft.
WSE Max = 2243 ft.
Well Depth = 659 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2377
2357
2337
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
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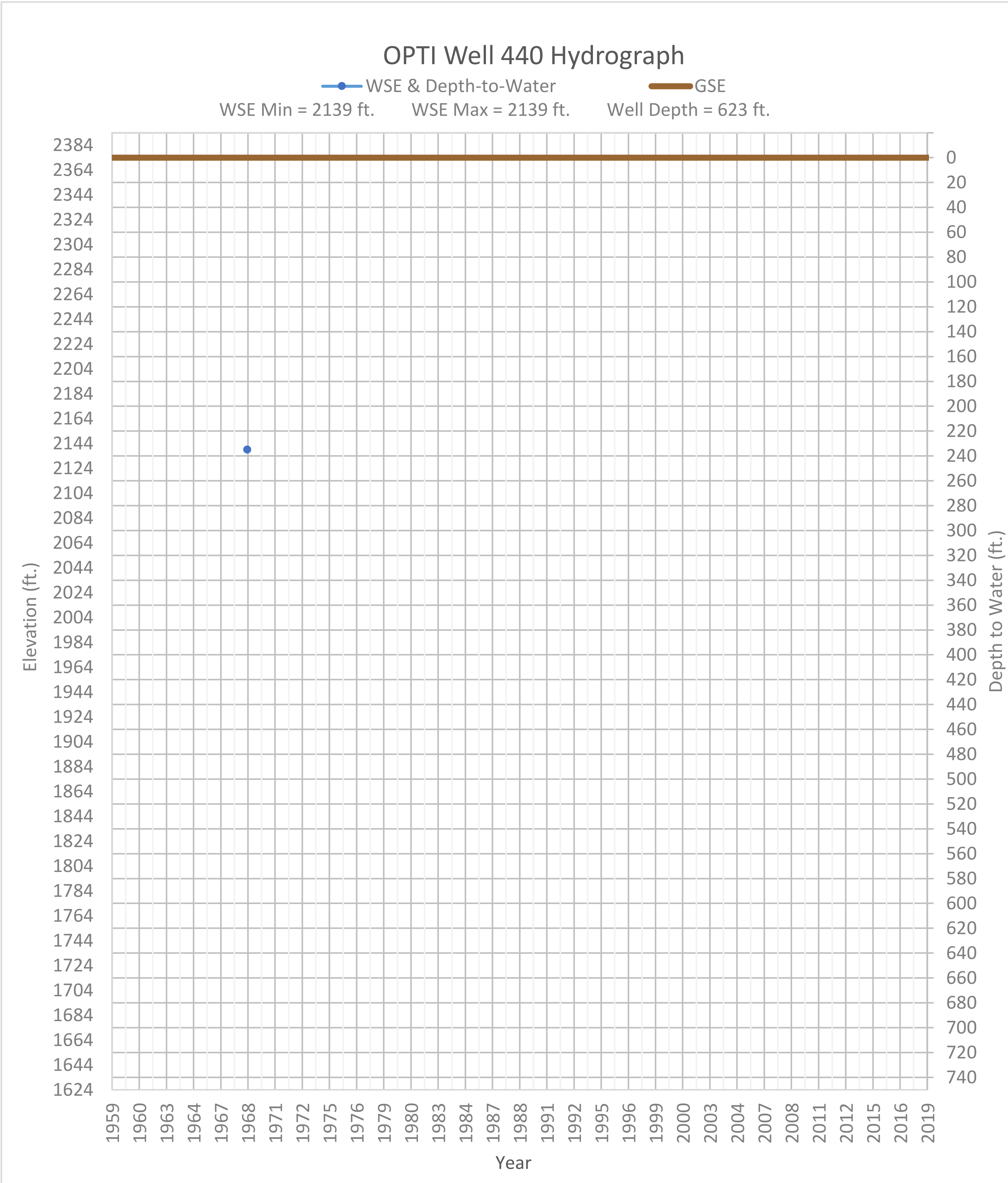
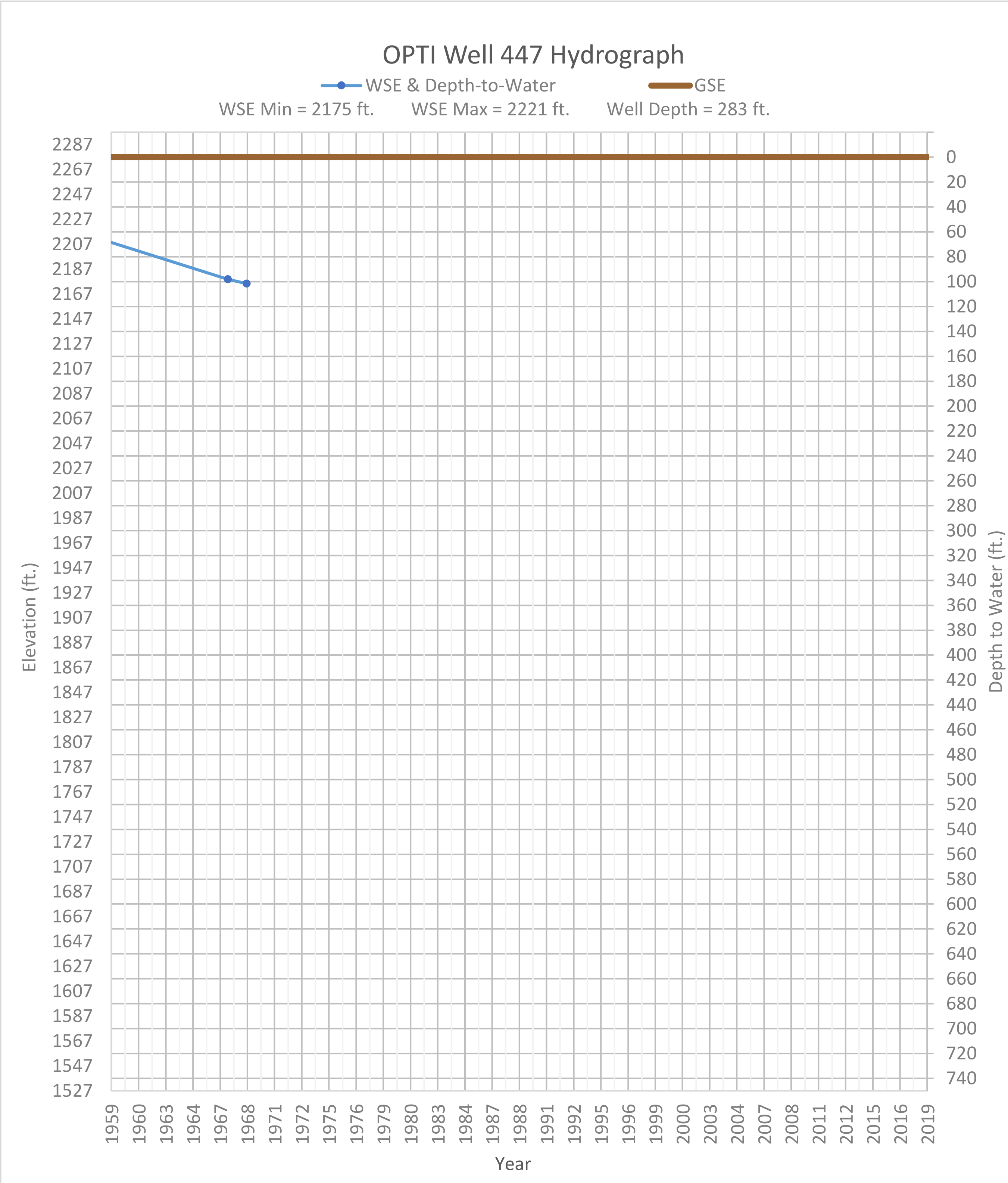


OPTI Well 440 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2139 ft.
WSE Max = 2139 ft.
Well Depth = 623 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 447 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2175 ft.
WSE Max = 2221 ft.
Well Depth = 283 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
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1927
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1607
1587
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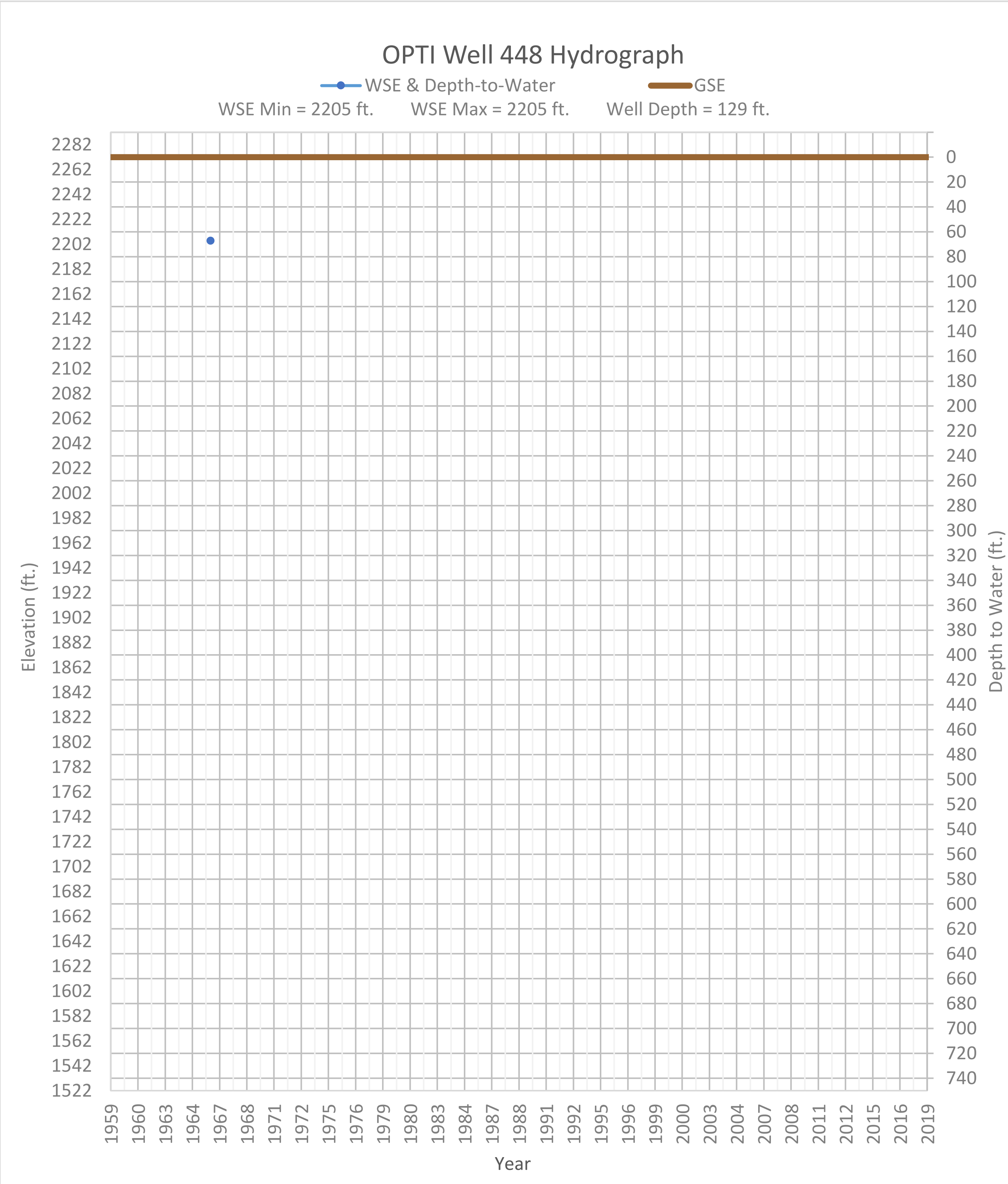
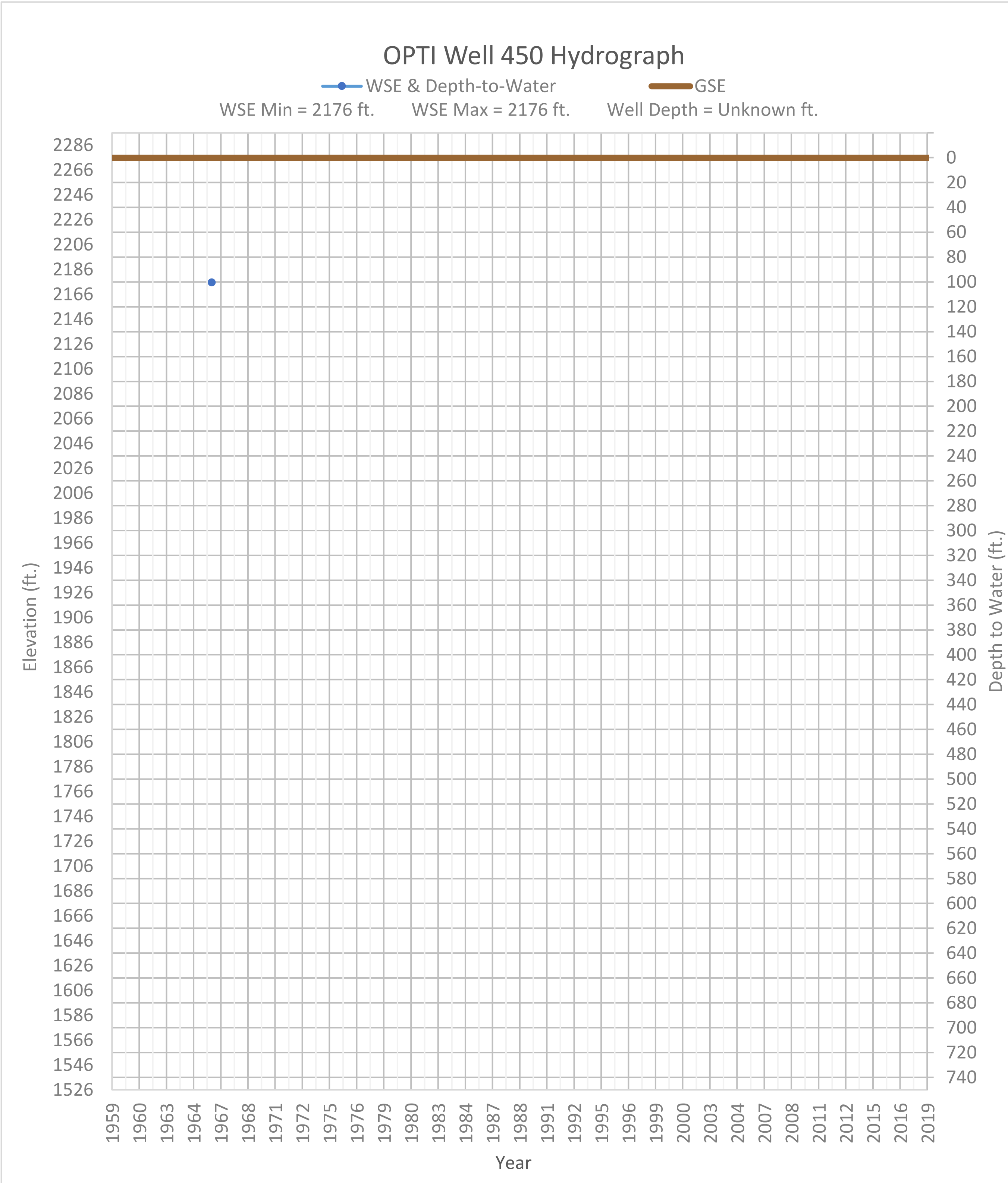


OPTI Well 448 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2205 ft.
WSE Max = 2205 ft.
Well Depth = 129 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 450 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2176 ft.
WSE Max = 2176 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
1966
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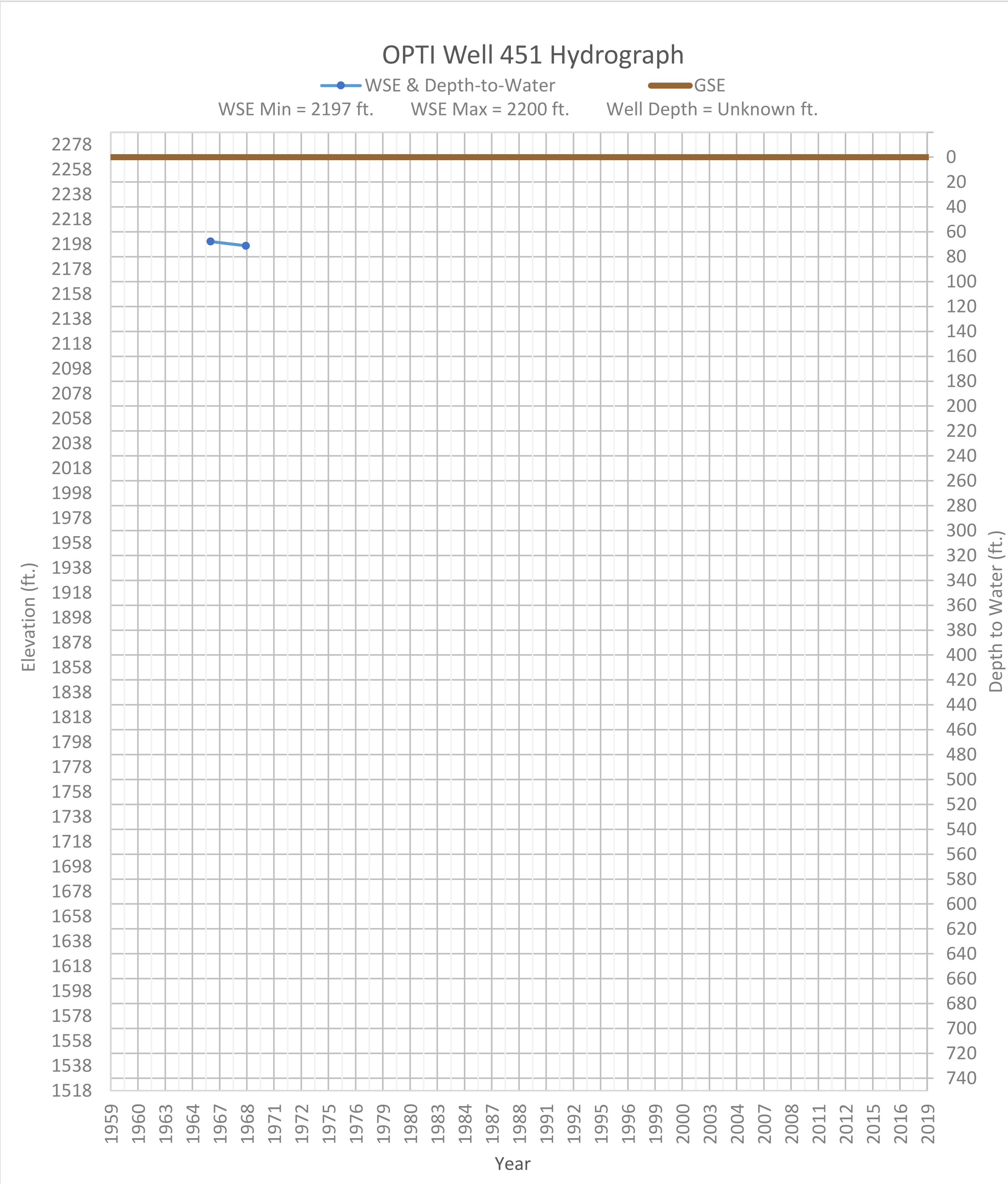
OPTI Well 451 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2197 ft.
WSE Max = 2200 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2278
2258
2238
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
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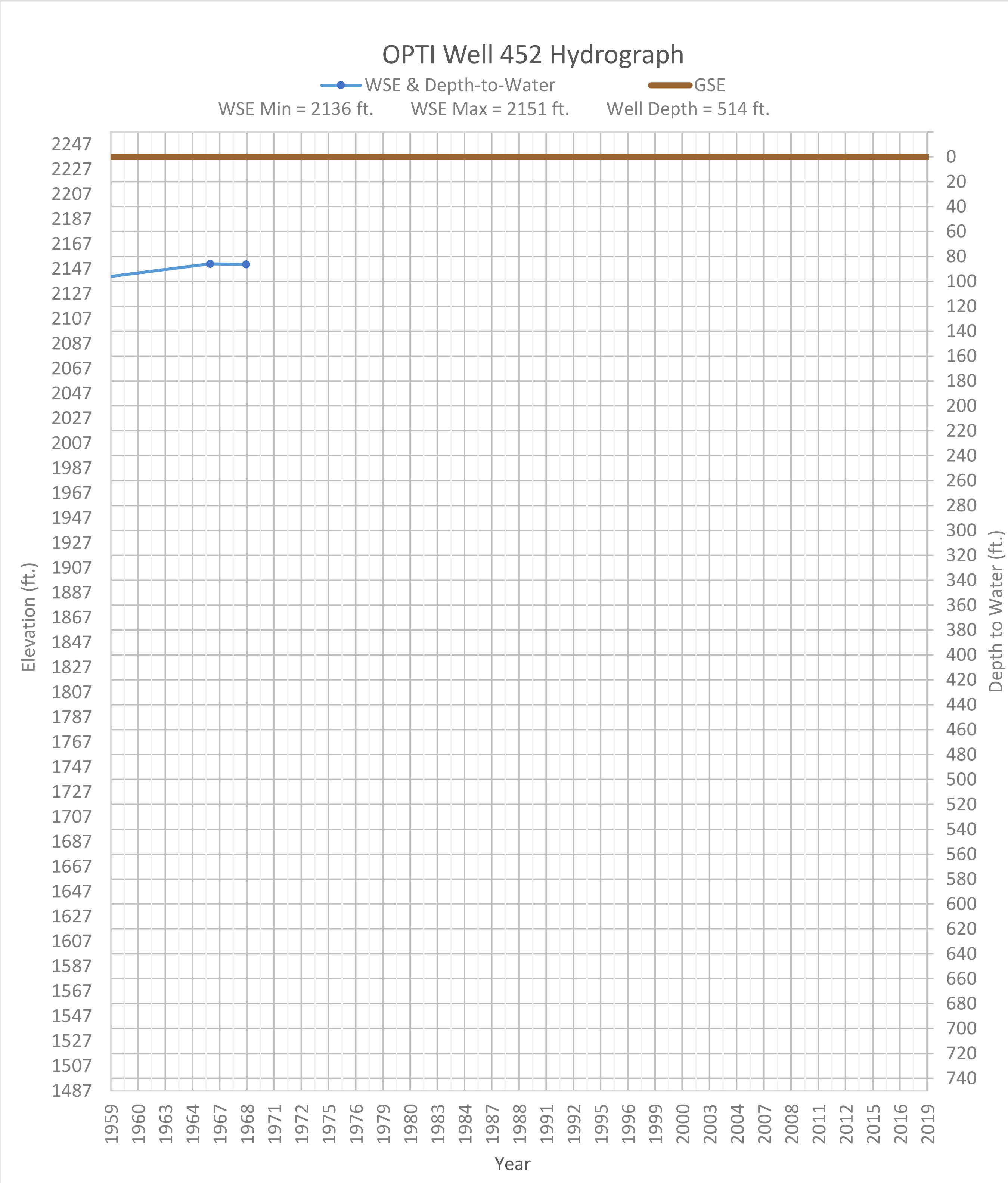
OPTI Well 452 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2136 ft.
WSE Max = 2151 ft.
Well Depth = 514 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
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2007
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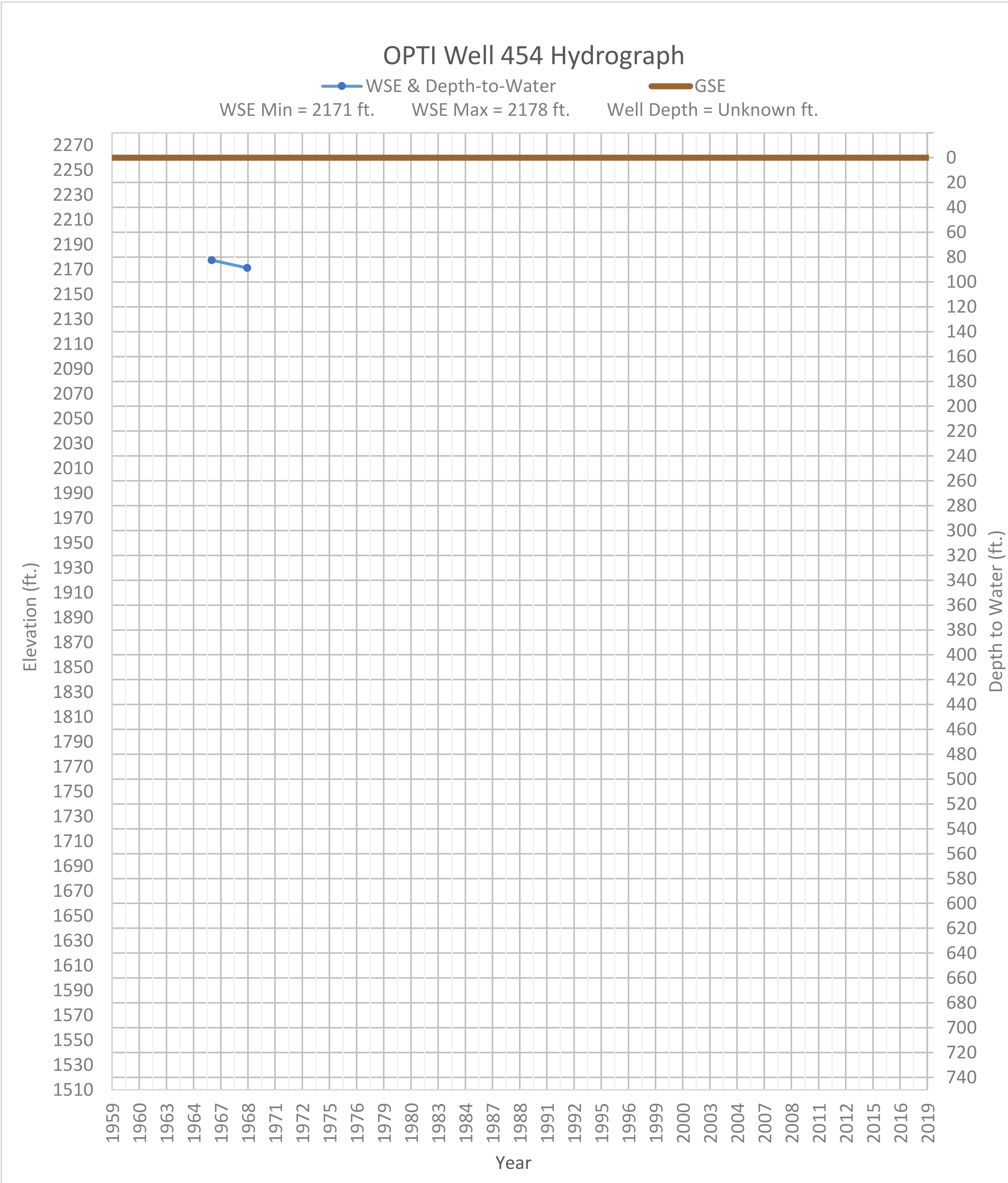
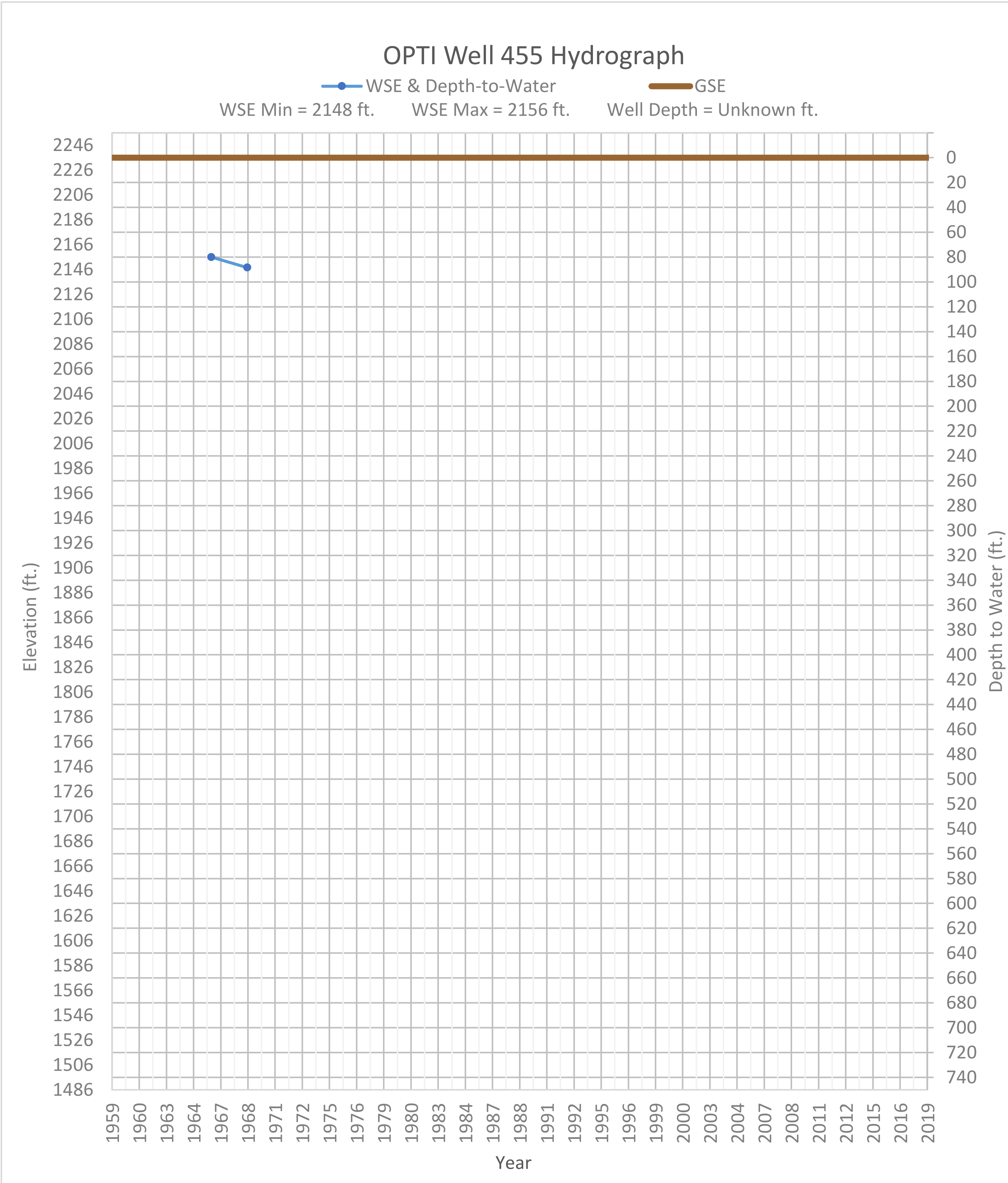


OPTI Well 454 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2171 ft.
WSE Max = 2178 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 455 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2148 ft.
WSE Max = 2156 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2246
2226
2206
2186
2166
2146
2126
2106
2086
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2006
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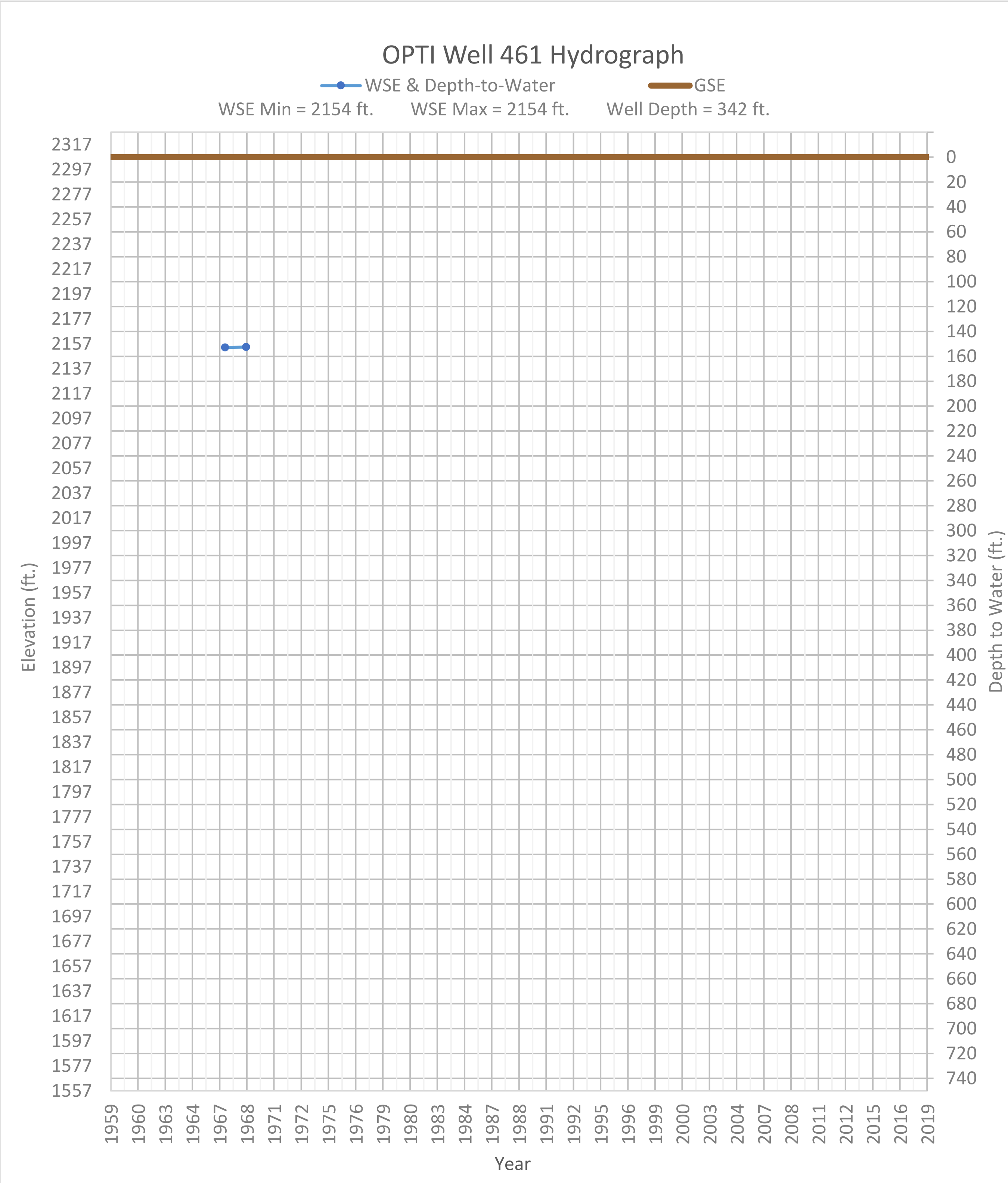
OPTI Well 461 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2154 ft.
WSE Max = 2154 ft.
Well Depth = 342 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
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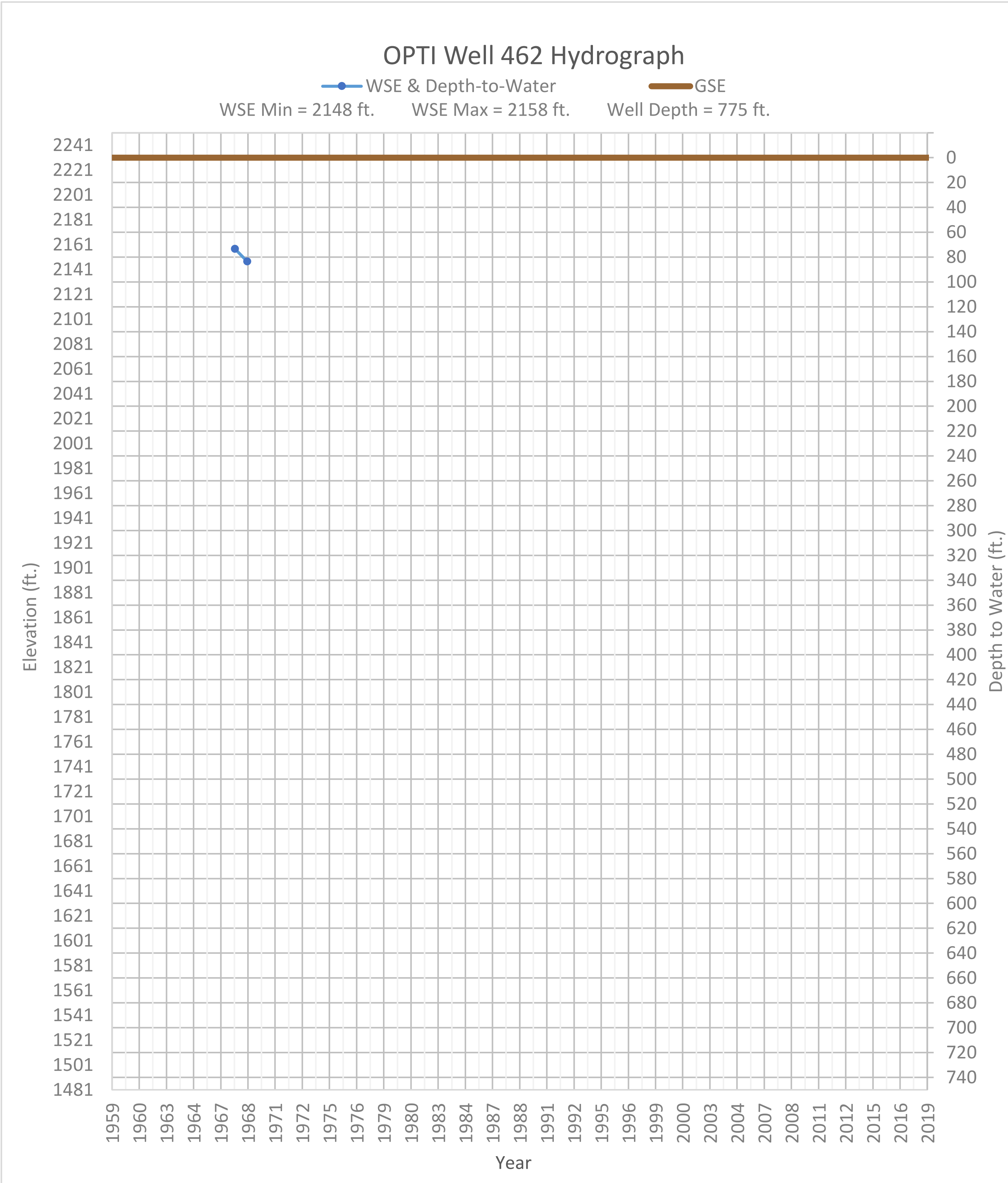
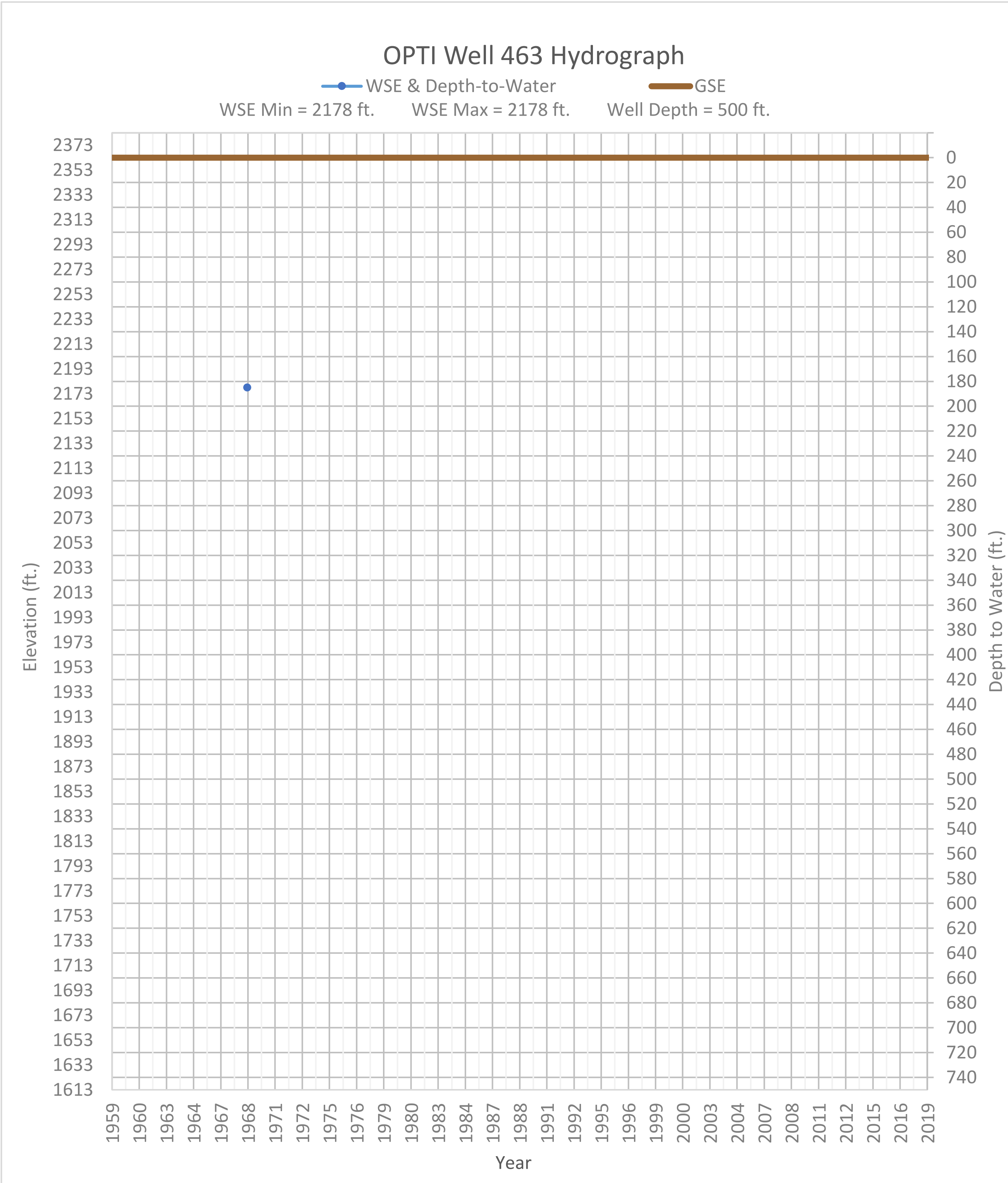
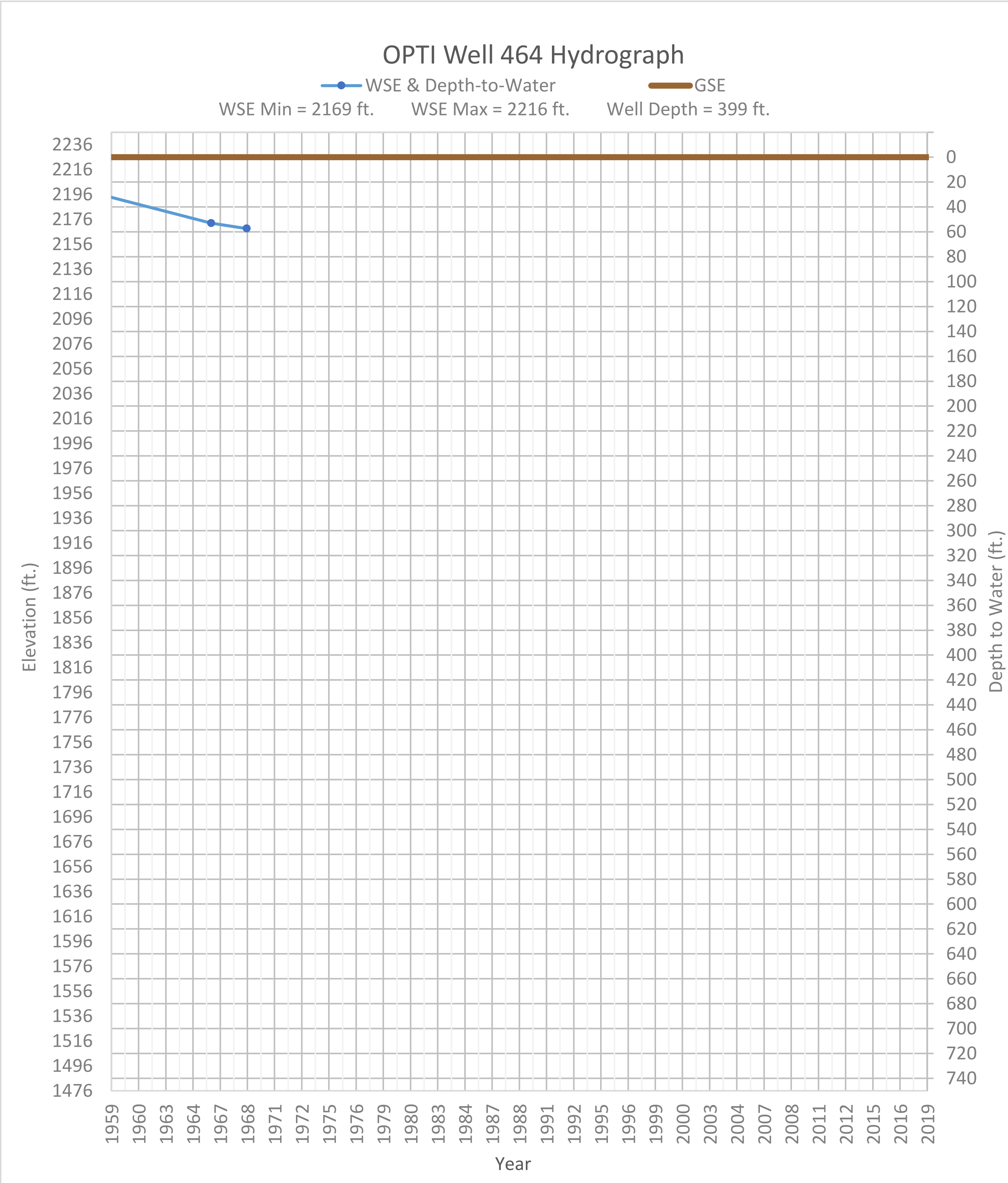
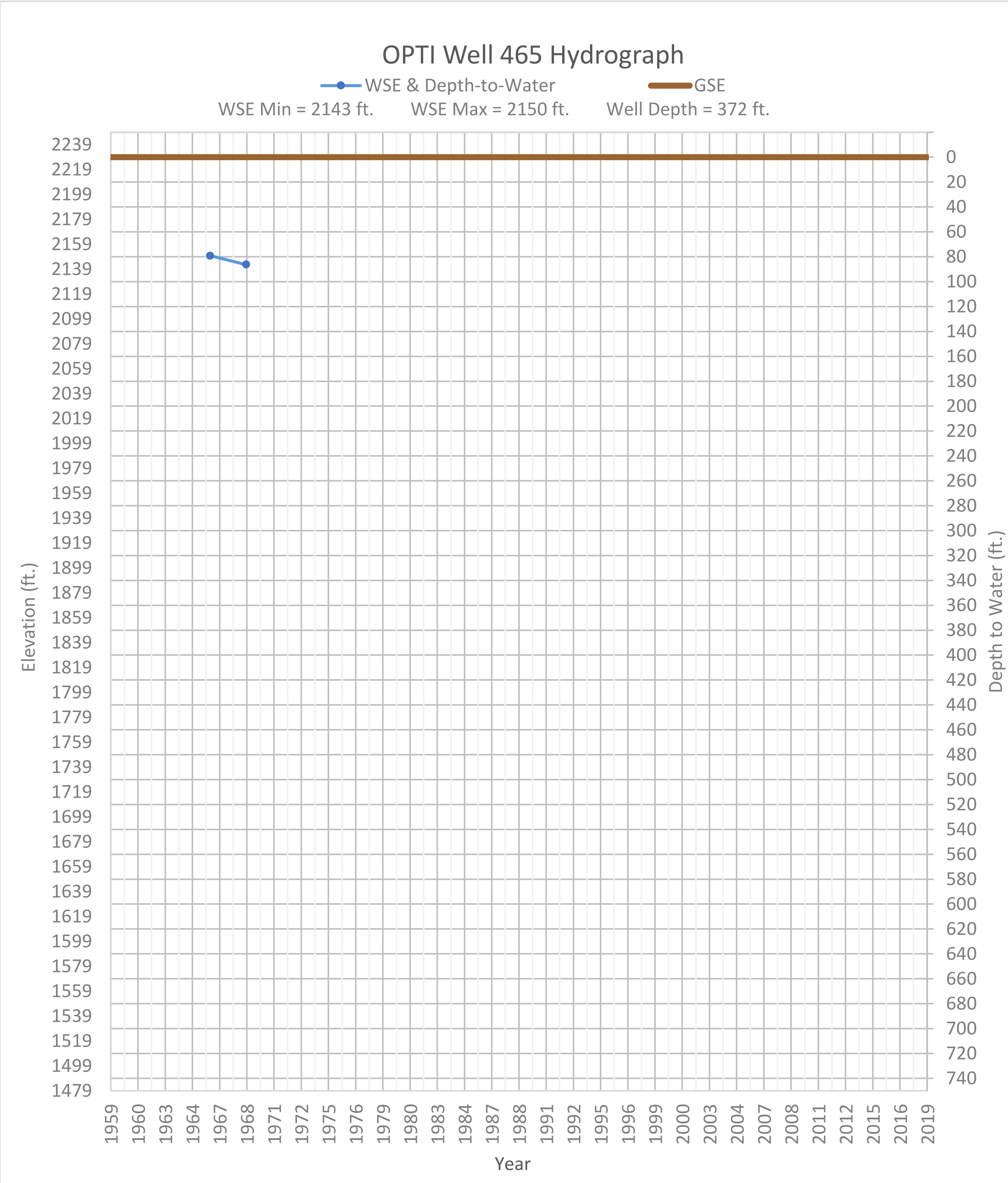


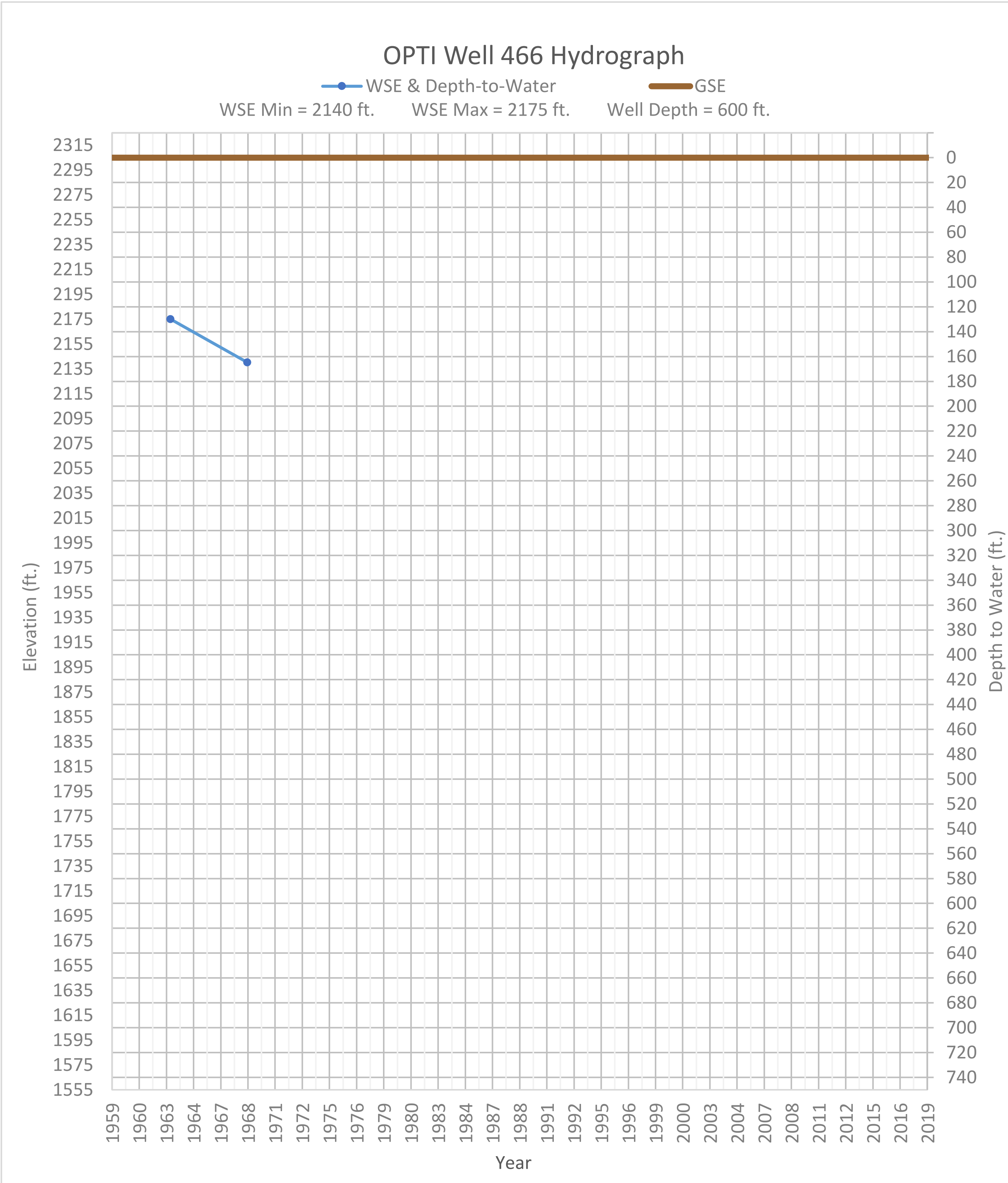
OPTI Well 462 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2148 ft.
WSE Max = 2158 ft.
Well Depth = 775 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 463 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2178 ft.
WSE Max = 2178 ft.
Well Depth = 500 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

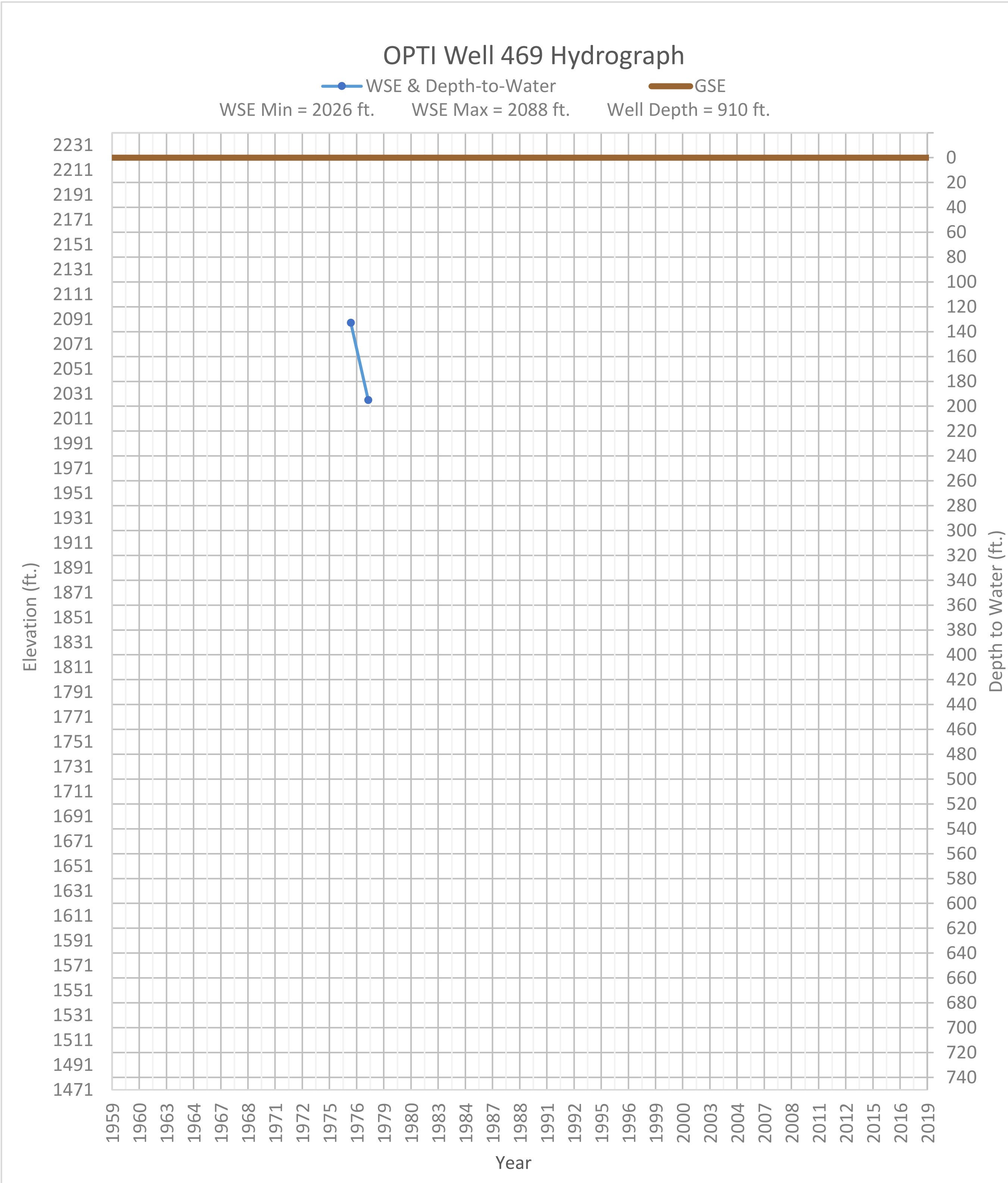

OPTI Well 464 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2169 ft.
WSE Max = 2216 ft.
Well Depth = 399 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



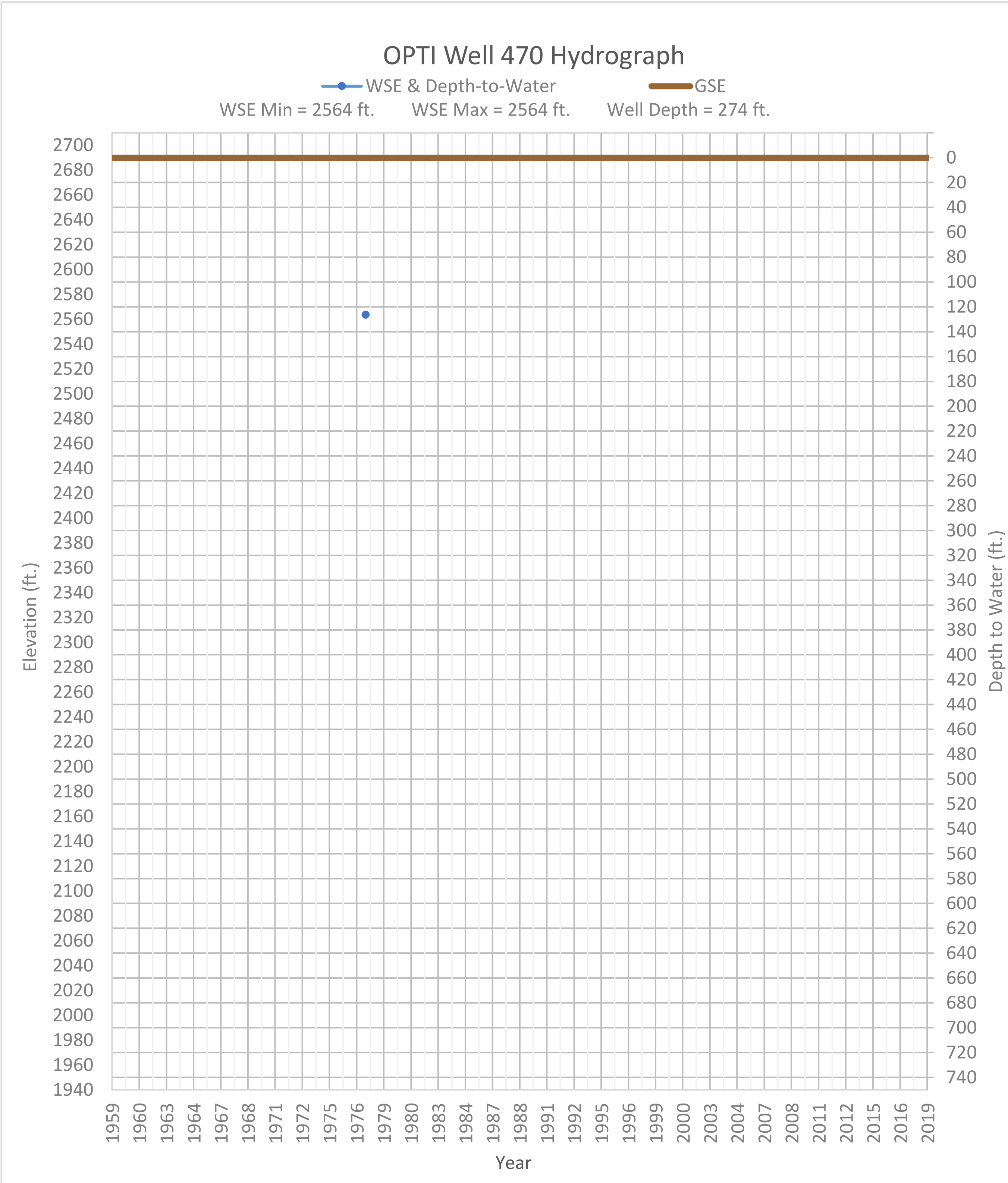
OPTI Well 465 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2143 ft.
WSE Max = 2150 ft.
Well Depth = 372 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



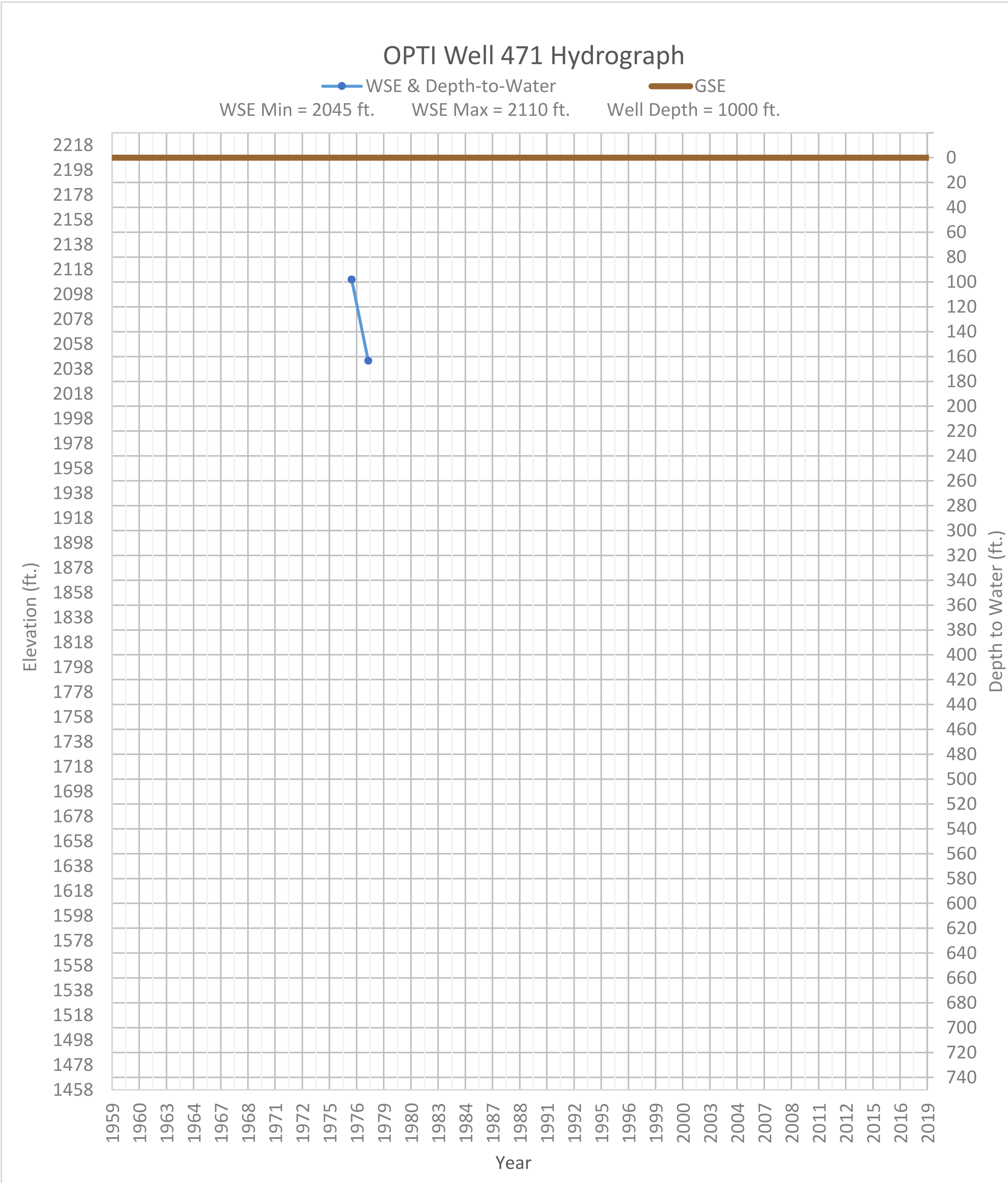
OPTI Well 466 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2140 ft.
WSE Max = 2175 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 469 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2026 ft.
WSE Max = 2088 ft.
Well Depth = 910 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 470 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2564 ft.
WSE Max = 2564 ft.
Well Depth = 274 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 471 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2045 ft.
WSE Max = 2110 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
1918
1898
1878
1858
1838
1818
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1638
1618
1598
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1558
1538
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1498
1478
1458
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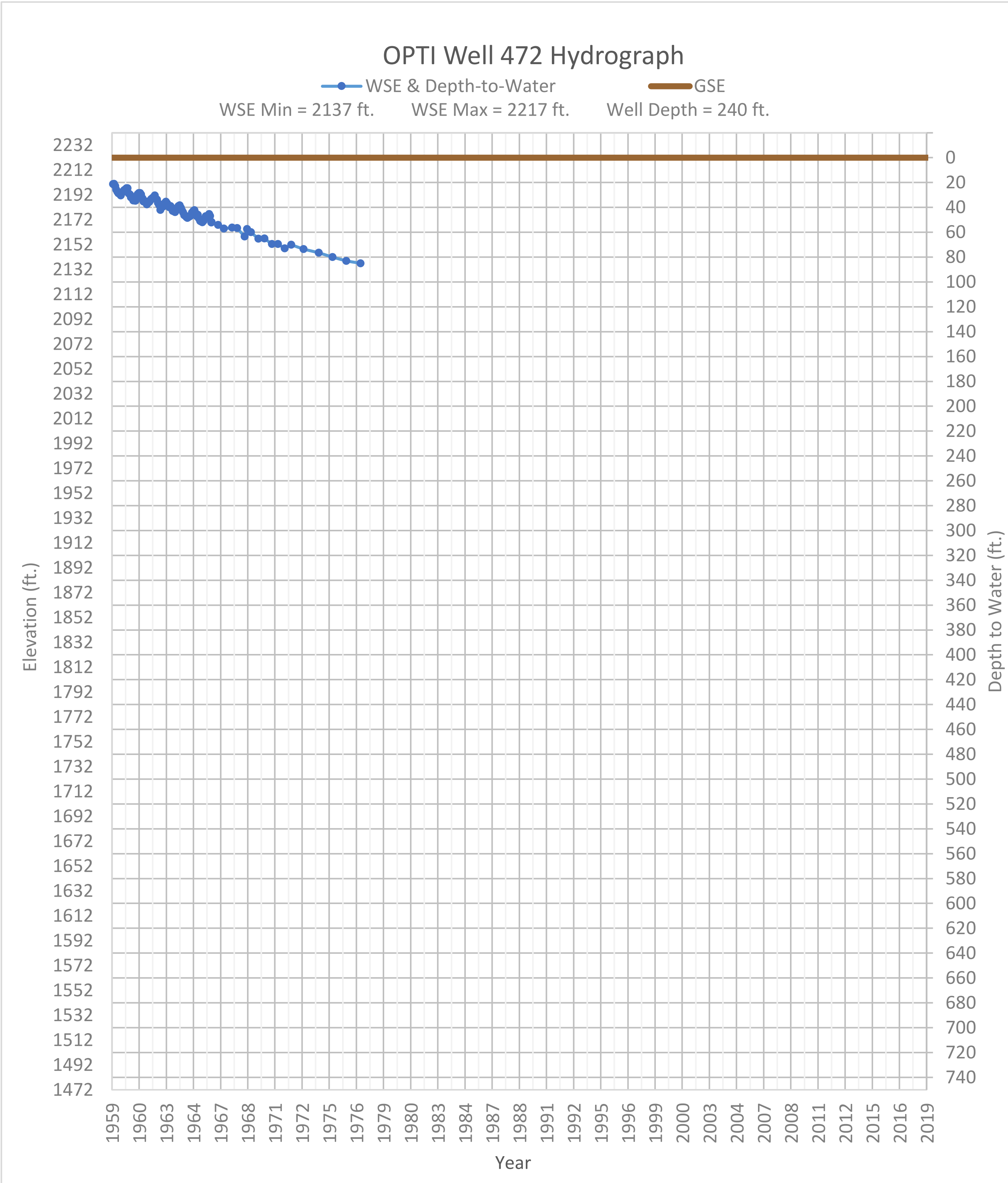
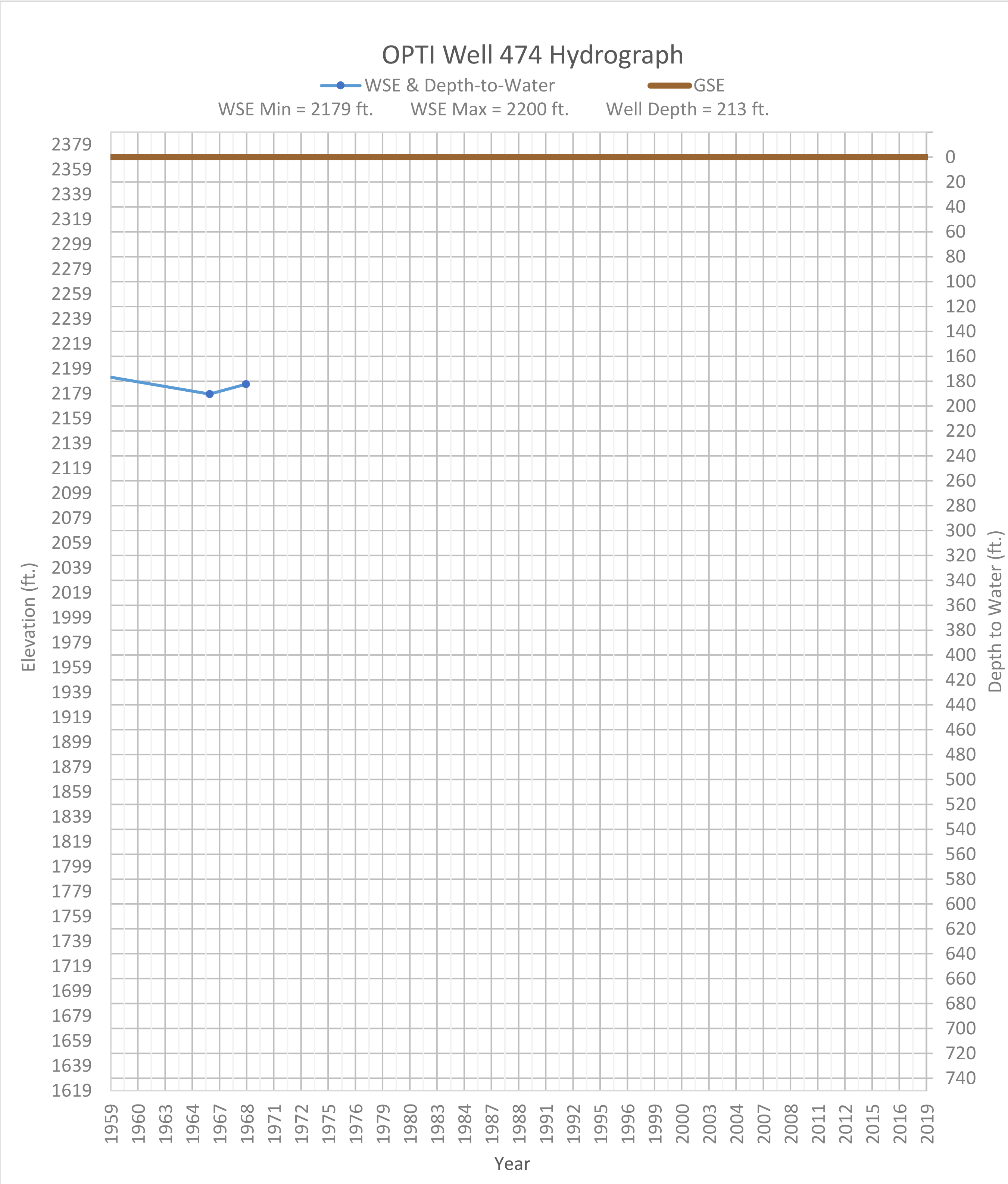
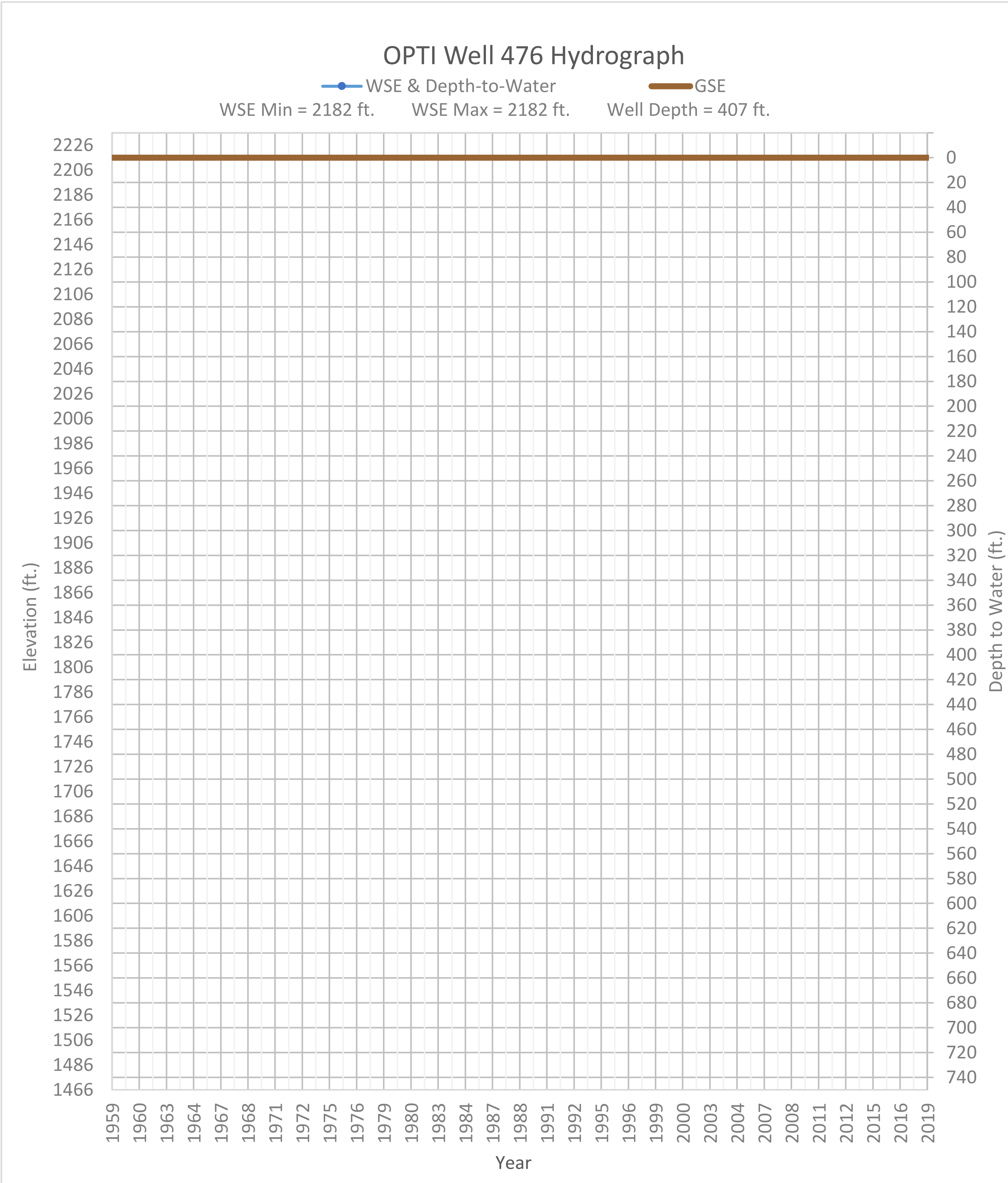


OPTI Well 472 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2137 ft.
WSE Max = 2217 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 474 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2179 ft.
WSE Max = 2200 ft.
Well Depth = 213 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 476 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2182 ft.
WSE Max = 2182 ft.
Well Depth = 407 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
1966
1946
1926
1906
1886
1866
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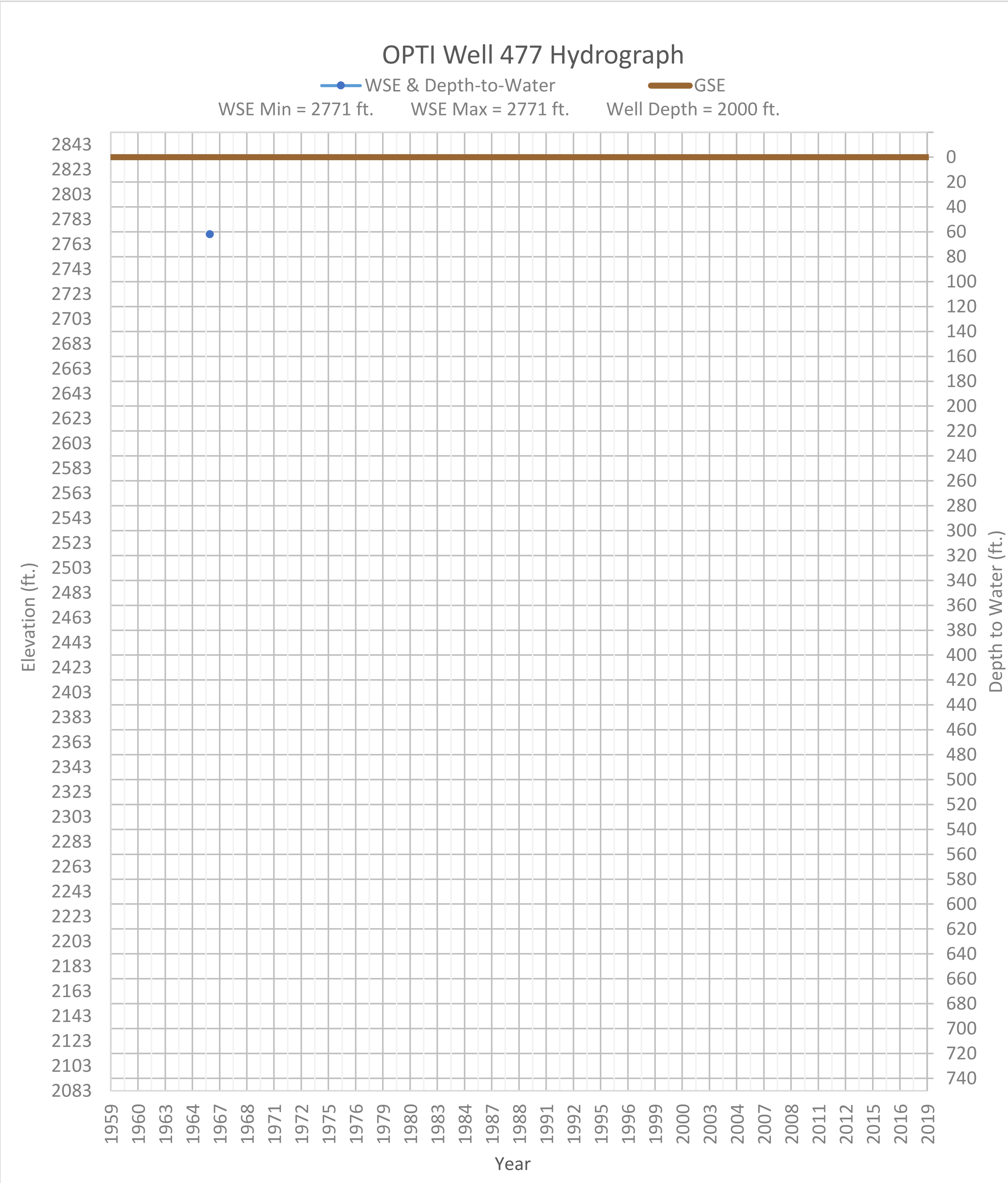

OPTI Well 477 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2771 ft.
WSE Max = 2771 ft.
Well Depth = 2000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 478 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2046 ft.
WSE Max = 2100 ft.
Well Depth = 350 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
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1918
1898
1878
1858
1838
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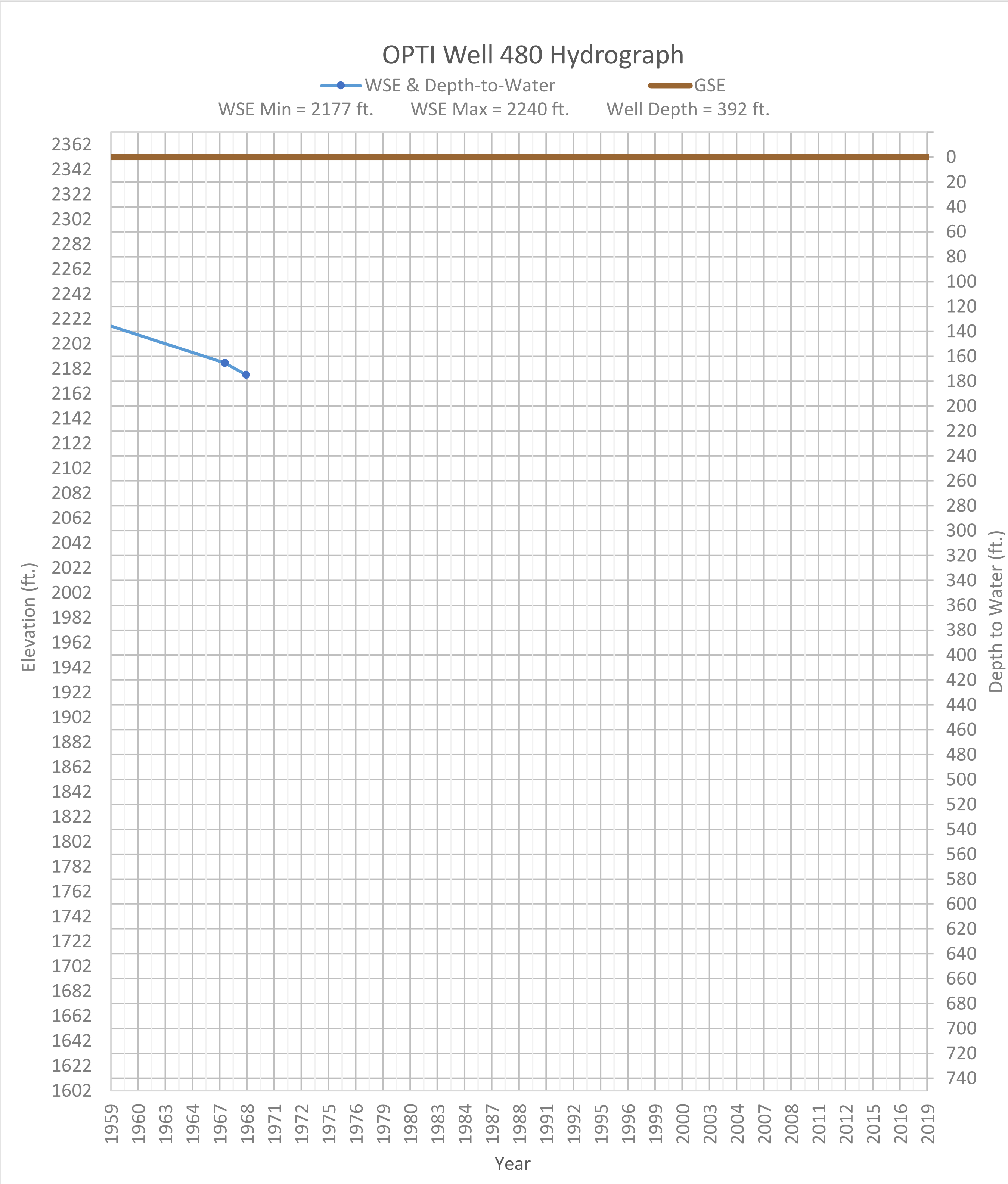
OPTI Well 480 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2177 ft.
WSE Max = 2240 ft.
Well Depth = 392 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2362
2342
2322
2302
2282
2262
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
2002
1982
1962
1942
1922
1902
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OPTI Well 482 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2037 ft.
WSE Max = 2123 ft.
Well Depth = 508 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2209
2189
2169
2149
2129
2109
2089
2069
2049
2029
2009
1989
1969
1949
1929
1909
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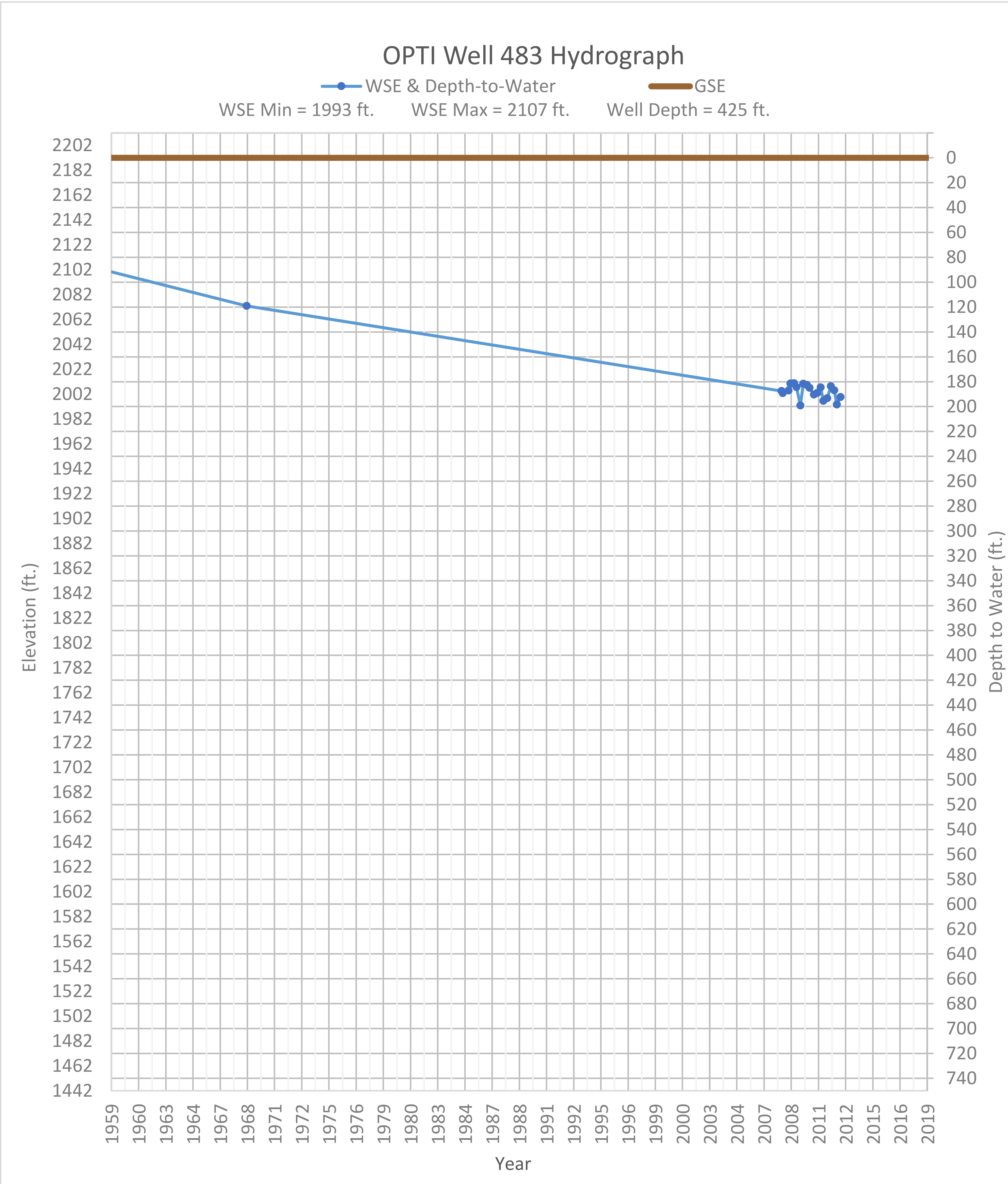
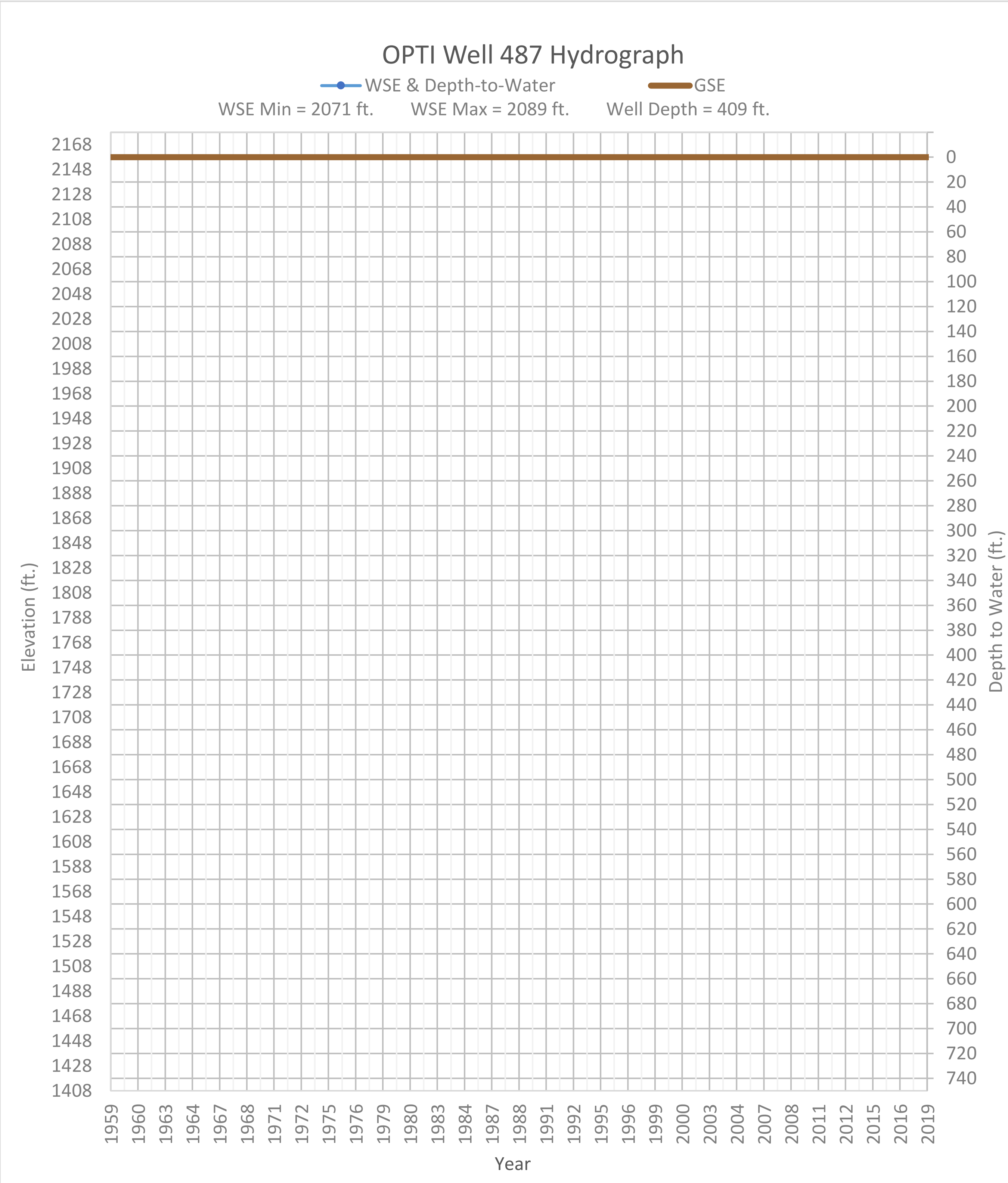
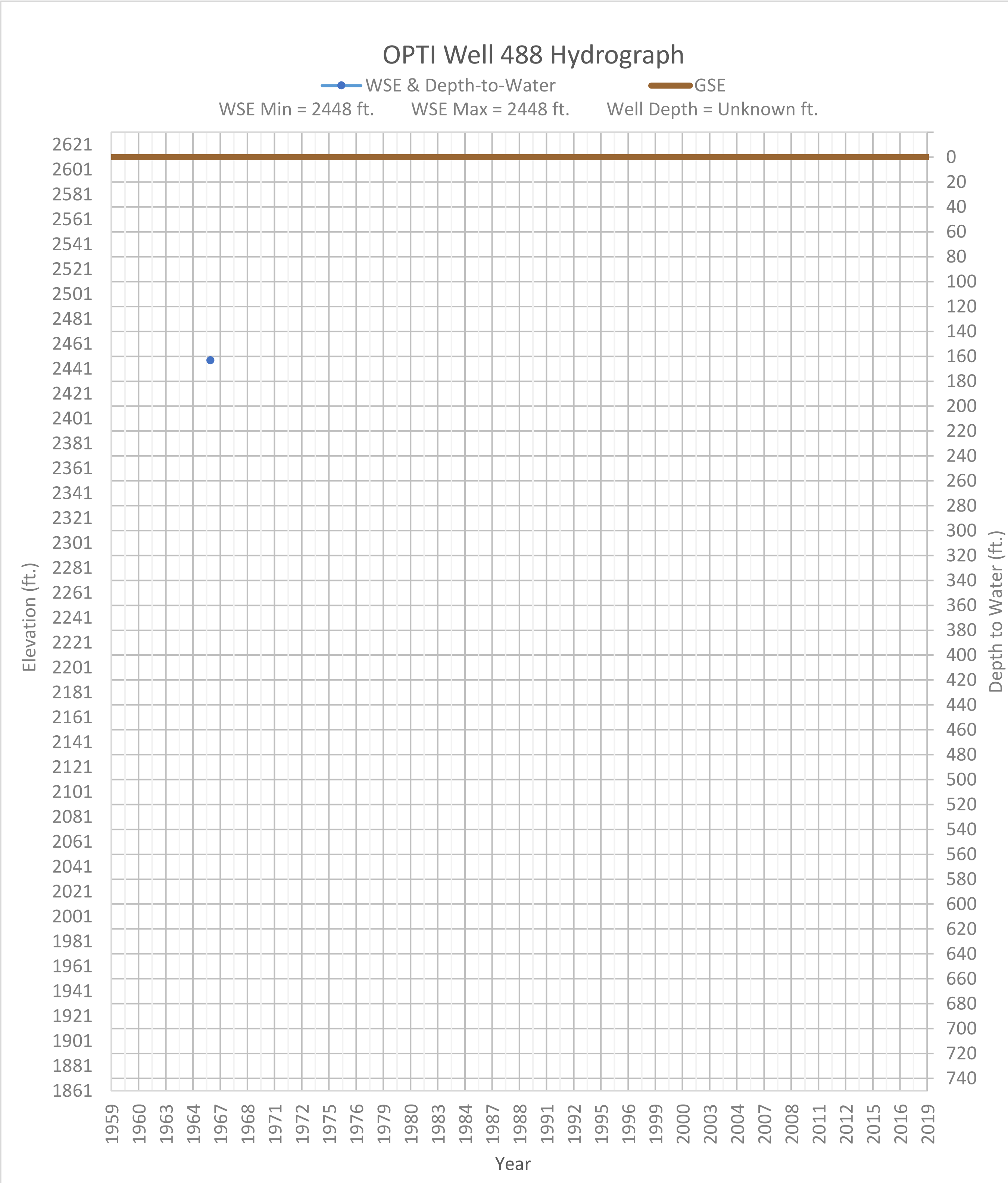


OPTI Well 483 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1993 ft.
WSE Max = 2107 ft.
Well Depth = 425 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 484 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2027 ft.
WSE Max = 2122 ft.
Well Depth = 465 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 487 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2071 ft.
WSE Max = 2089 ft.
Well Depth = 409 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 488 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2448 ft.
WSE Max = 2448 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2621
2601
2581
2561
2541
2521
2501
2481
2461
2441
2421
2401
2381
2361
2341
2321
2301
2281
2261
2241
2221
2201
2181
2161
2141
2121
2101
2081
2061
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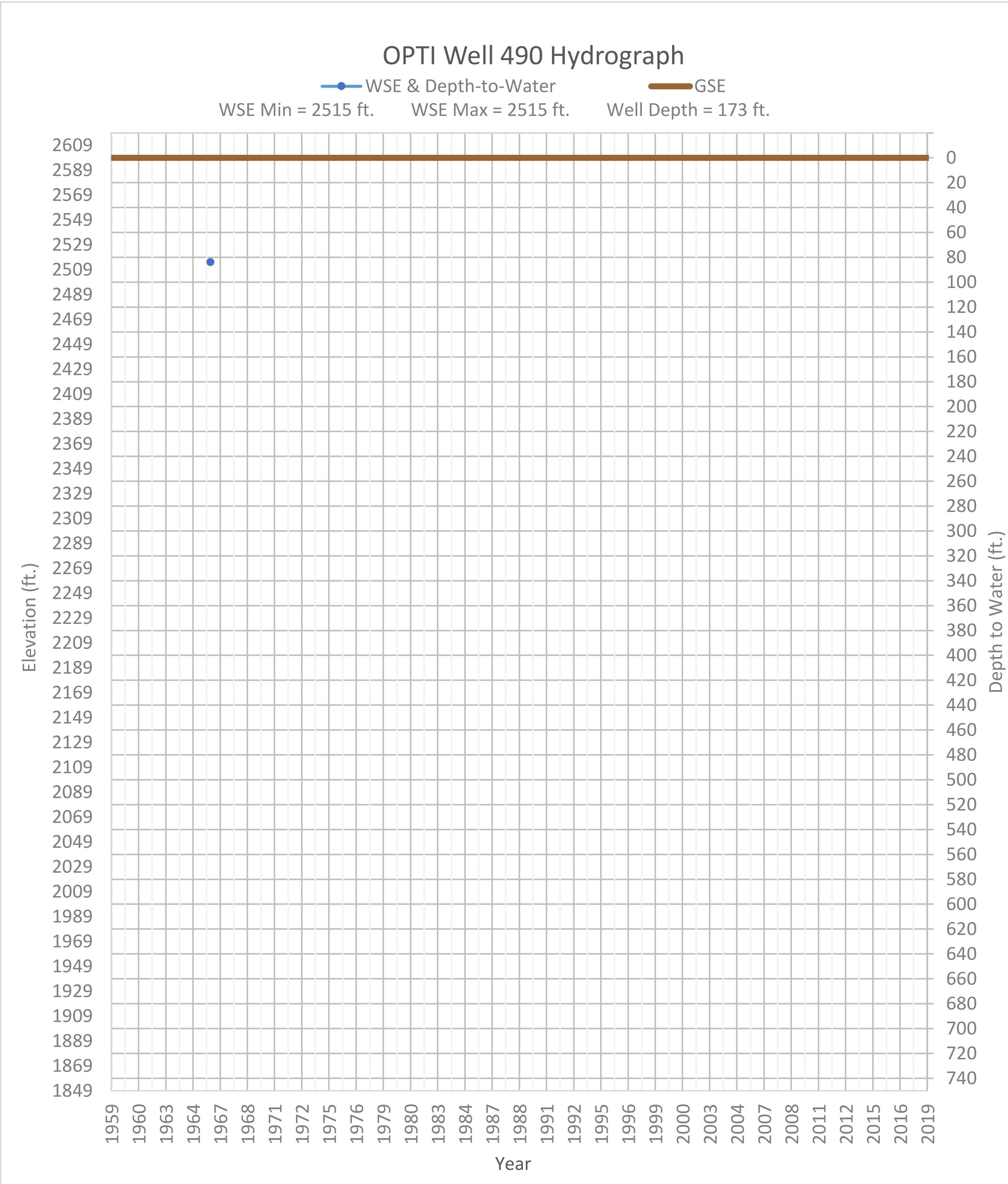
OPTI Well 490 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2515 ft.
WSE Max = 2515 ft.
Well Depth = 173 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2609
2589
2569
2549
2529
2509
2489
2469
2449
2429
2409
2389
2369
2349
2329
2309
2289
2269
2249
2229
2209
2189
2169
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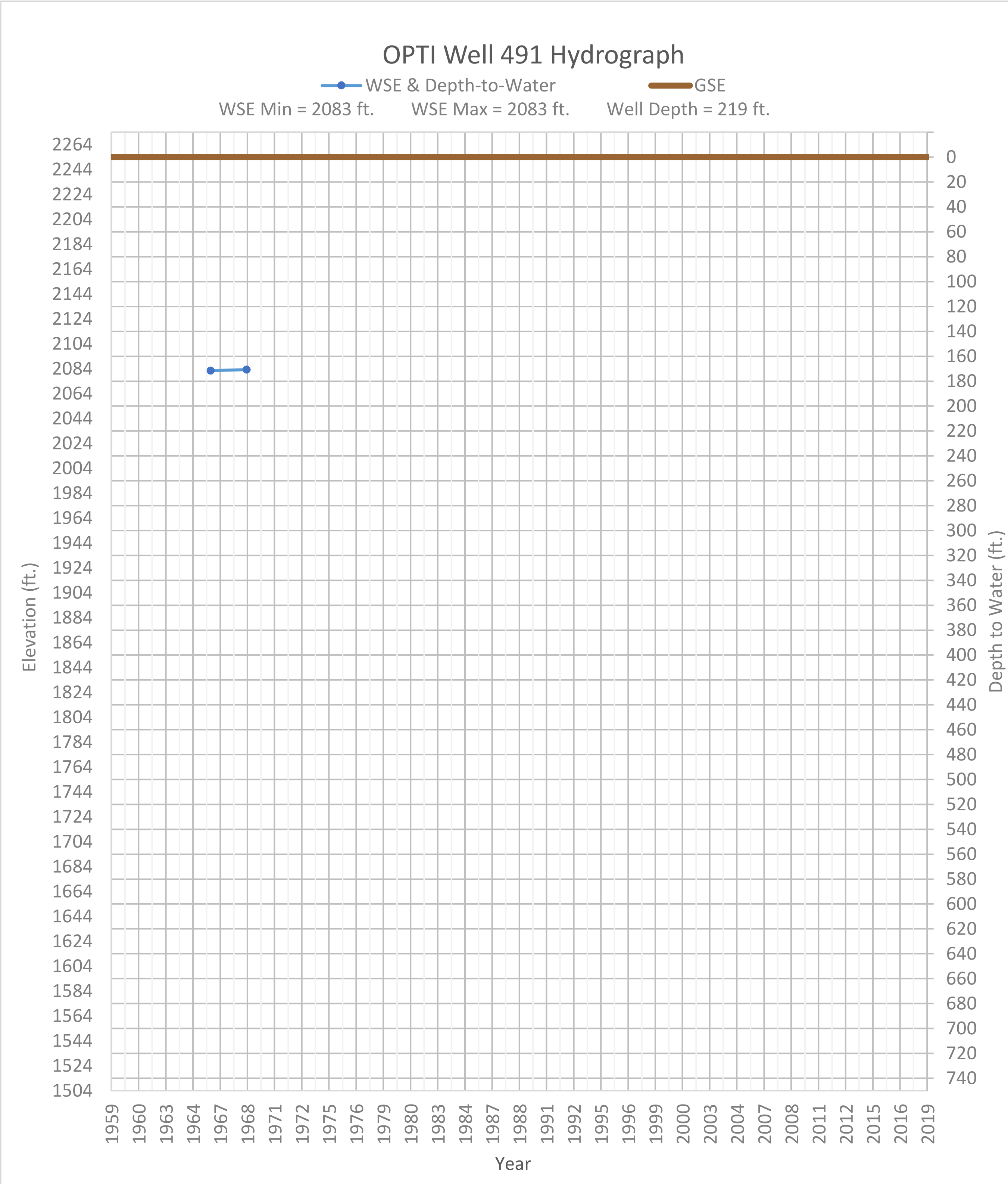
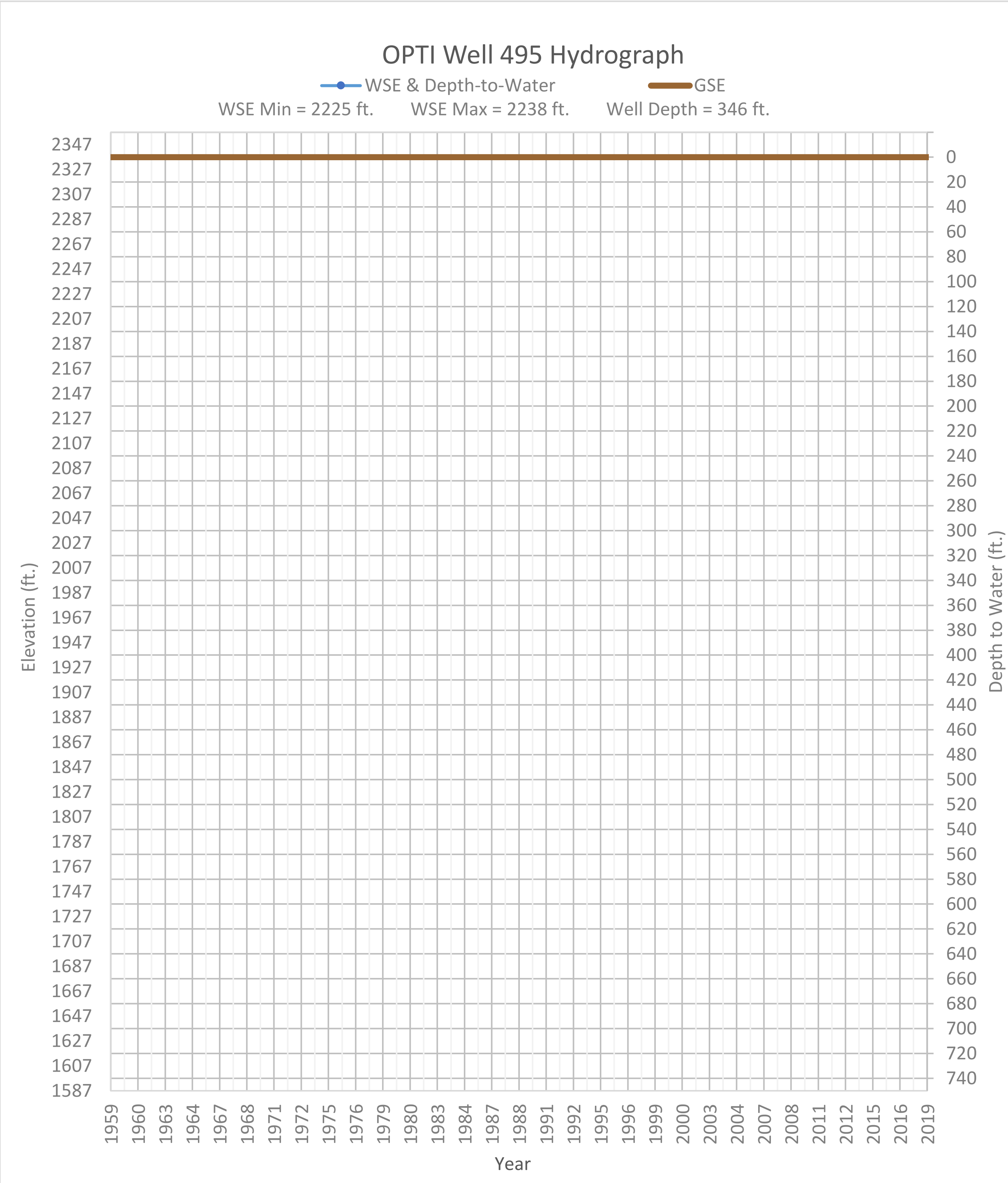


OPTI Well 491 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2083 ft.
WSE Max = 2083 ft.
Well Depth = 219 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 495 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2225 ft.
WSE Max = 2238 ft.
Well Depth = 346 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2347
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
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1927
1907
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1687
1667
1647
1627
1607
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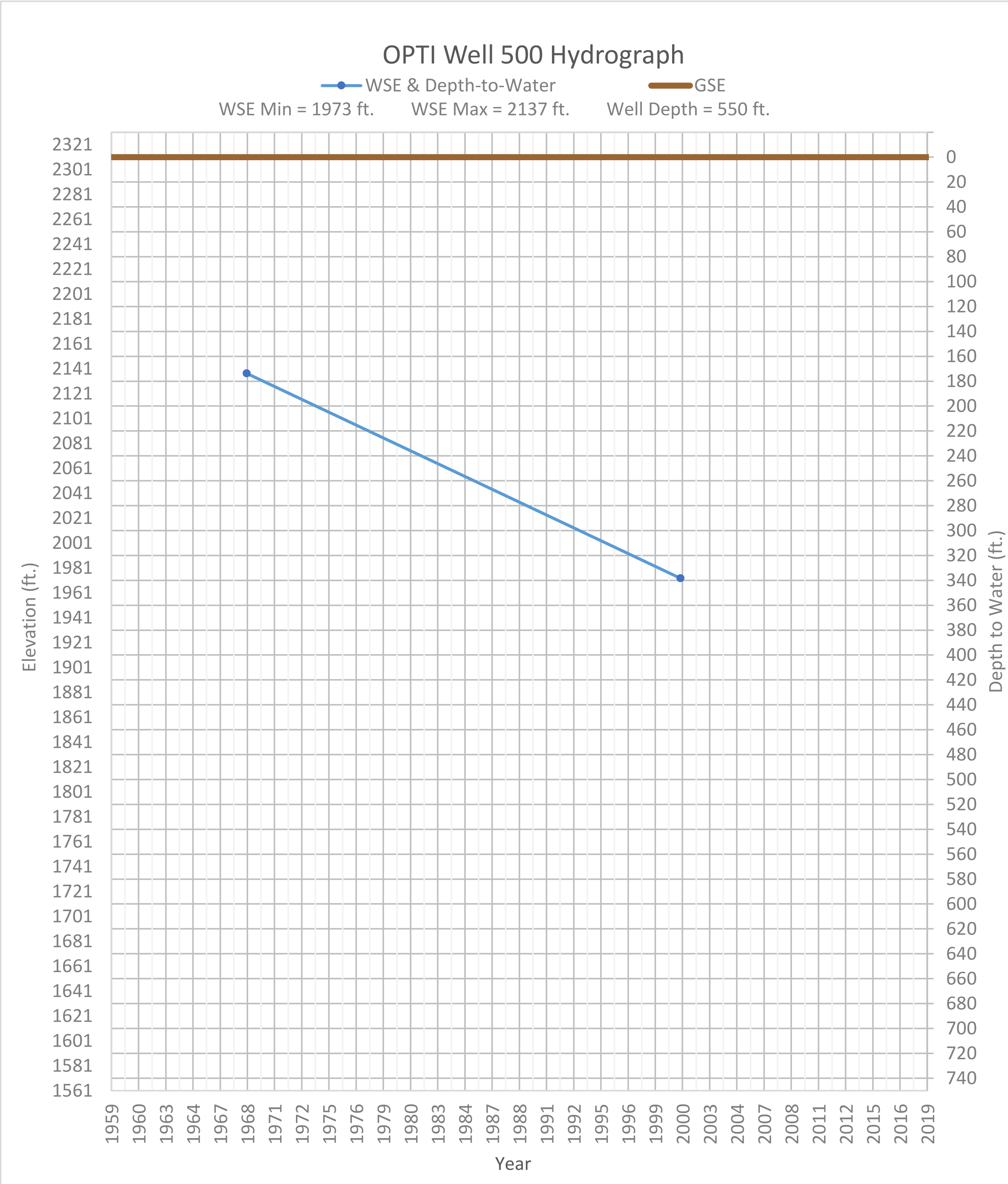
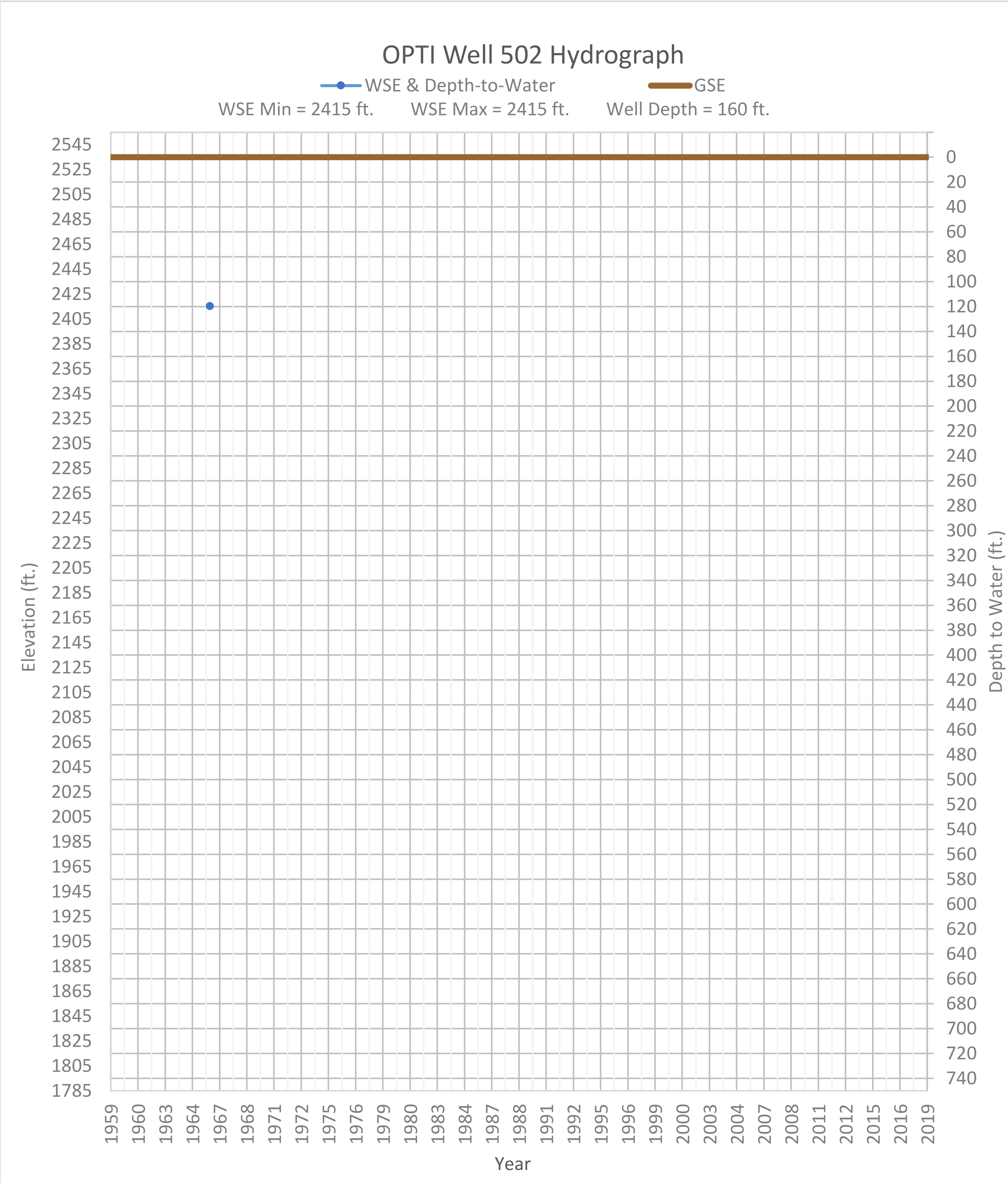
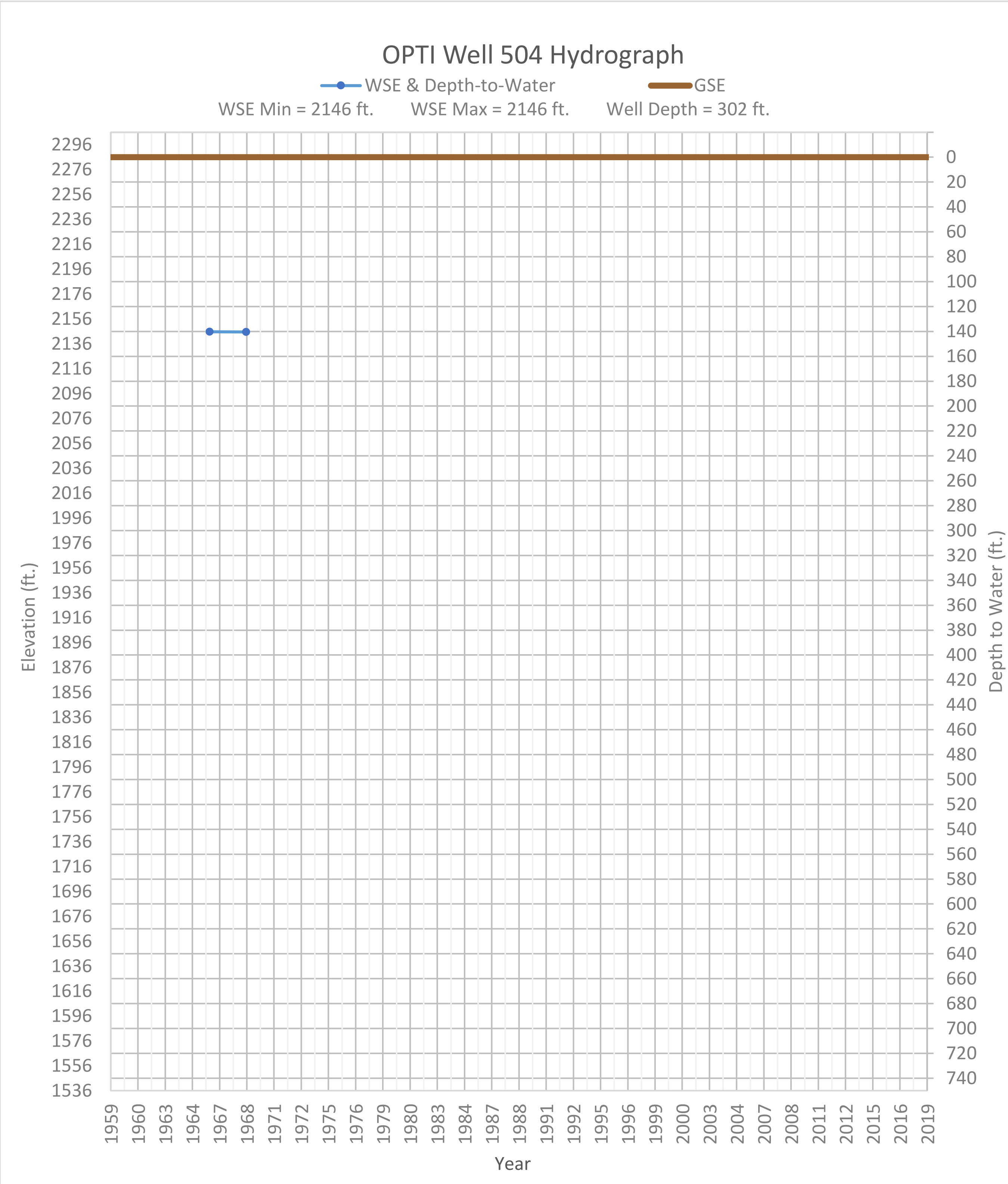
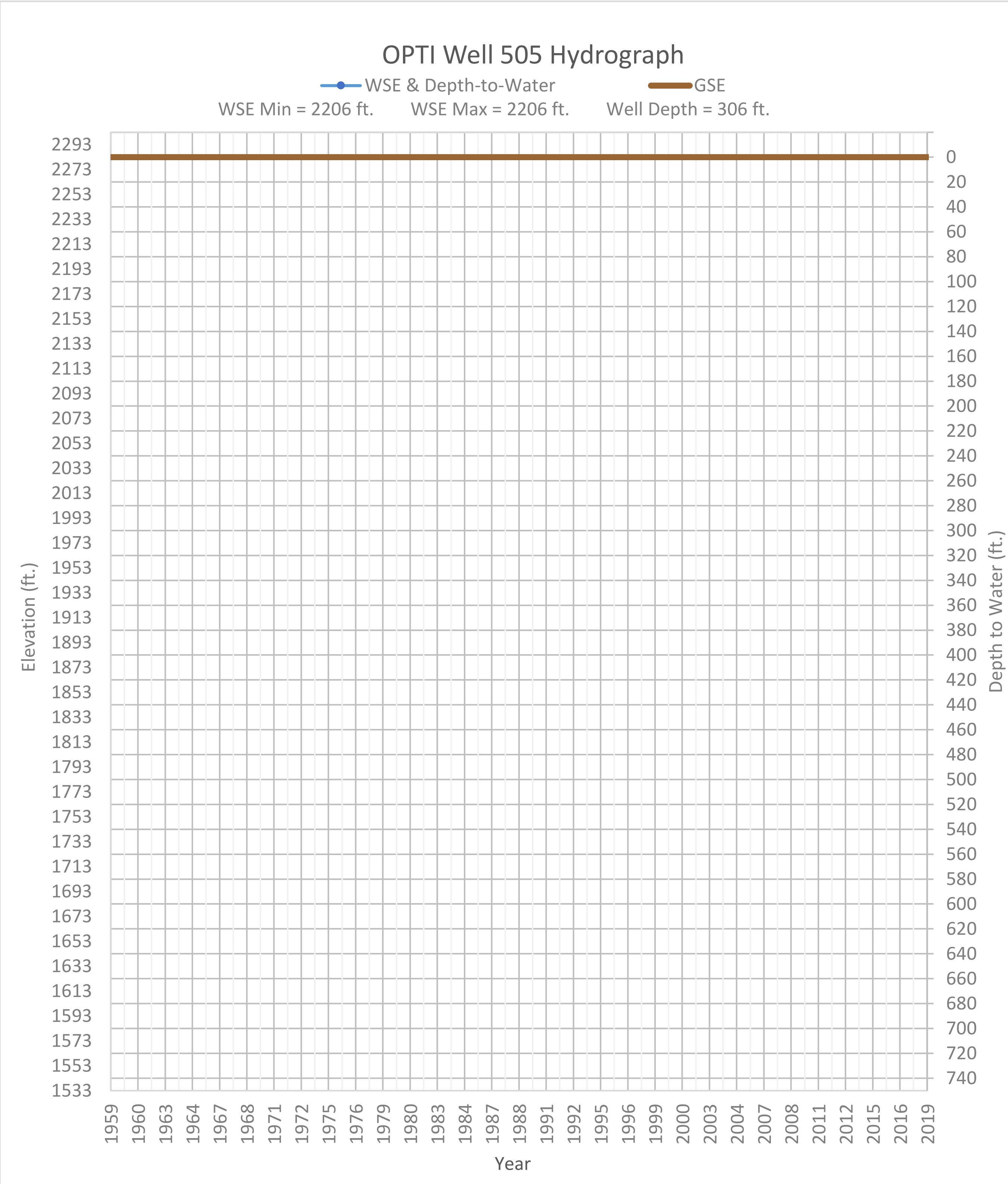

OPTI Well 500 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1973 ft.
WSE Max = 2137 ft.
Well Depth = 550 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 502 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2415 ft.
WSE Max = 2415 ft.
Well Depth = 160 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 504 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2146 ft.
WSE Max = 2146 ft.
Well Depth = 302 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 505 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2206 ft.
WSE Max = 2206 ft.
Well Depth = 306 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2293
2273
2253
2233
2213
2193
2173
2153
2133
2113
2093
2073
2053
2033
2013
1993
1973
1953
1933
1913
1893
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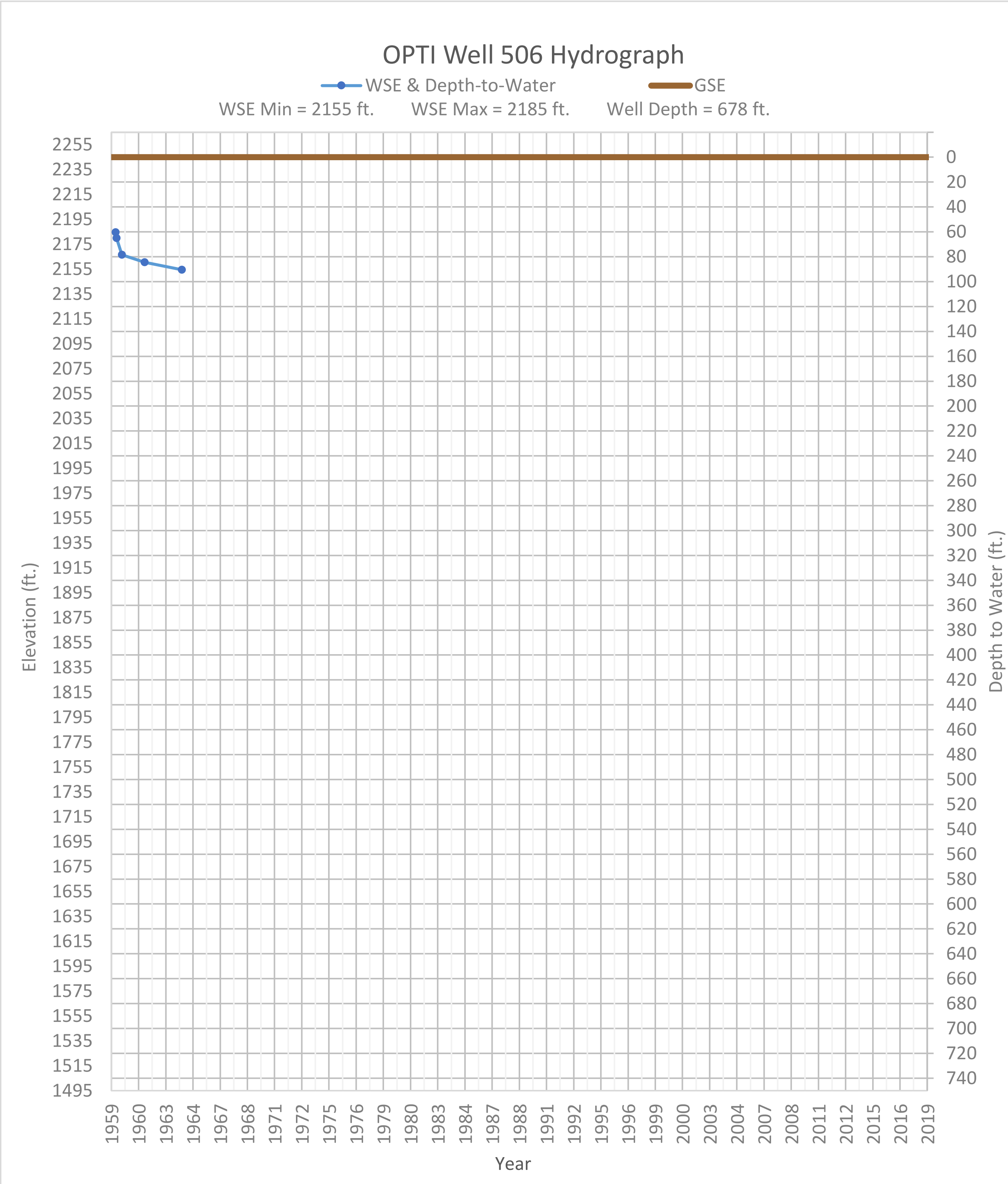
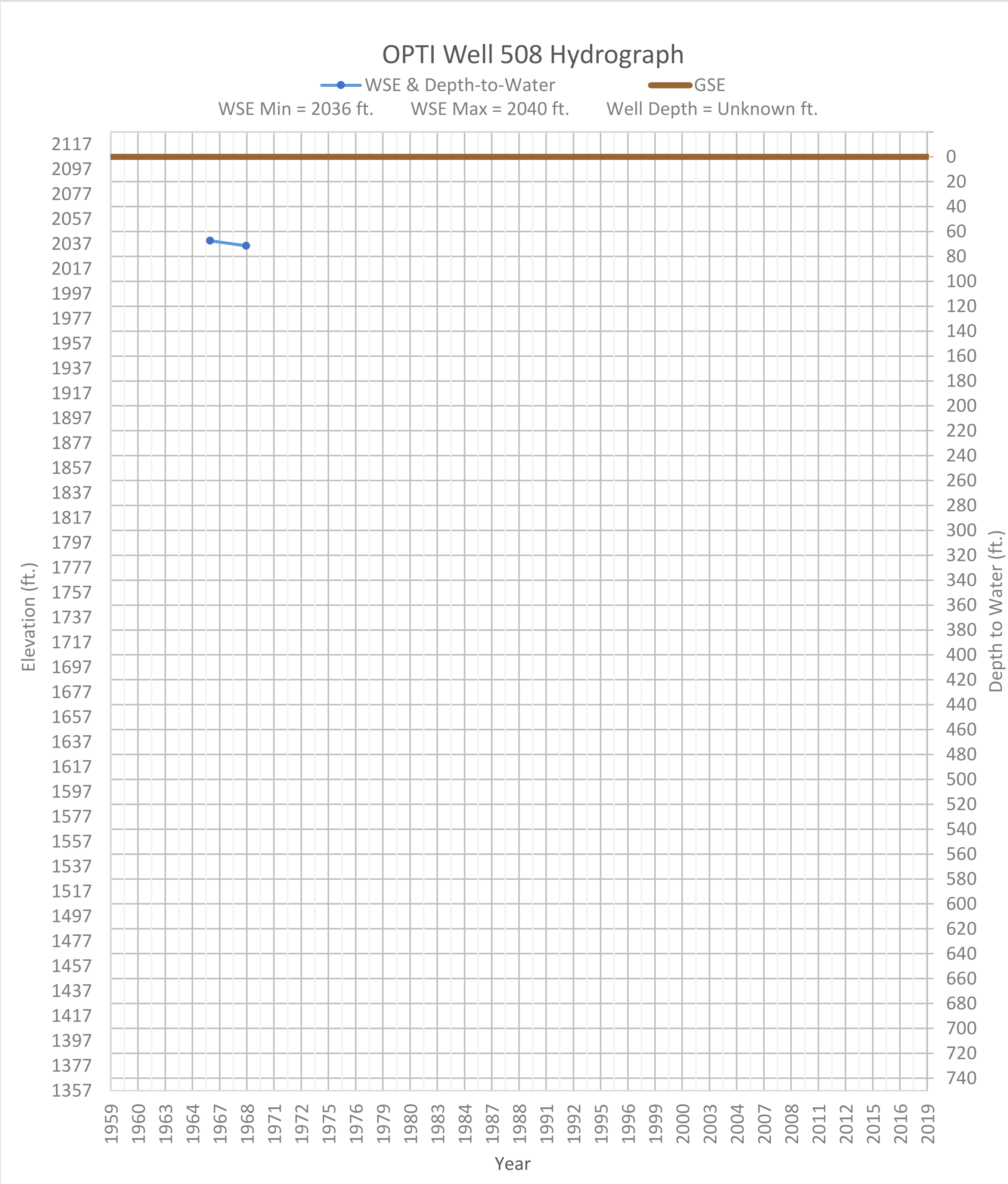
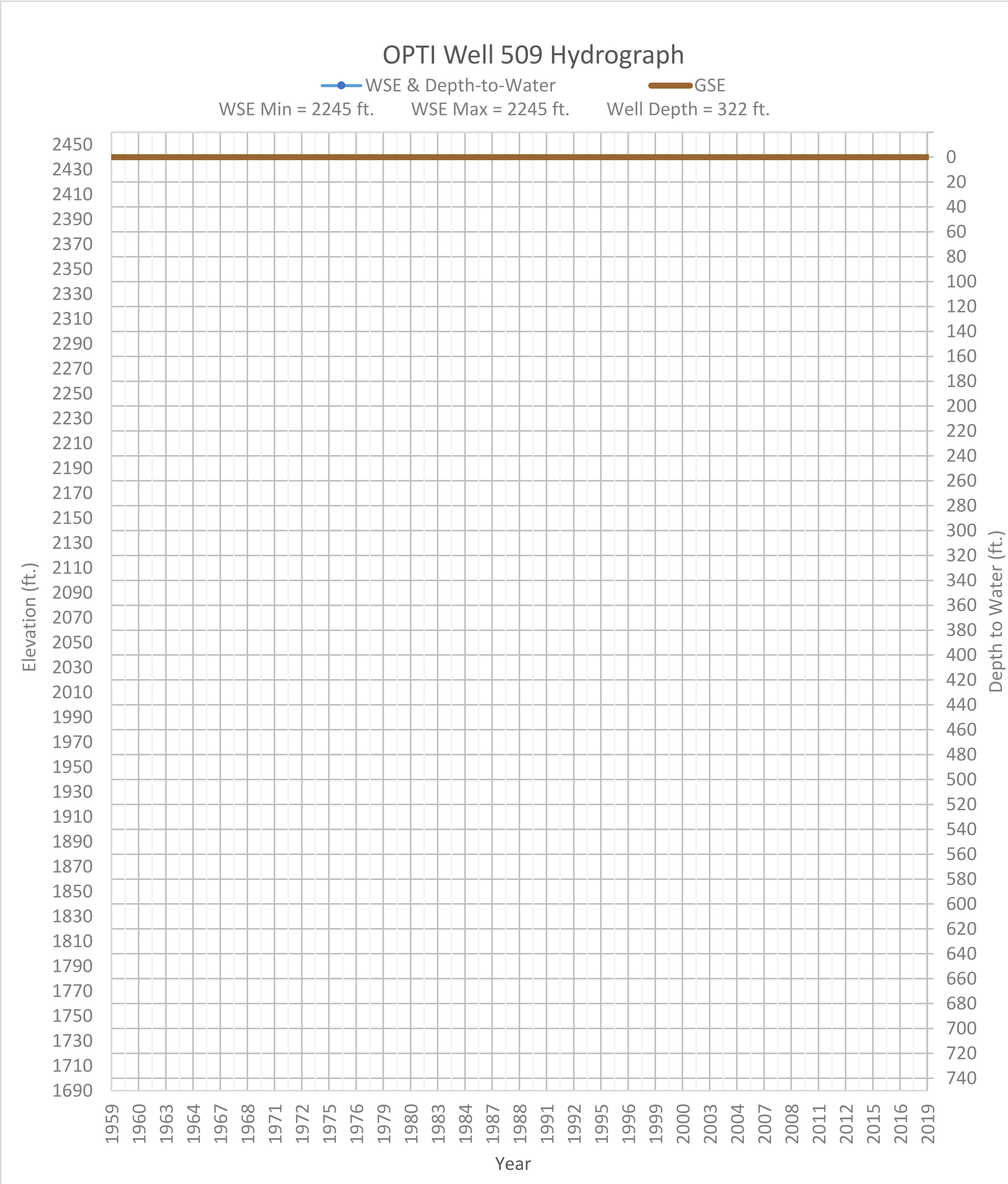


OPTI Well 506 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2155 ft.
WSE Max = 2185 ft.
Well Depth = 678 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 508 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2036 ft.
WSE Max = 2040 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 509 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2245 ft.
WSE Max = 2245 ft.
Well Depth = 322 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2450
2430
2410
2390
2370
2350
2330
2310
2290
2270
2250
2230
2210
2190
2170
2150
2130
2110
2090
2070
2050
2030
2010
1990
1970
1950
1930
1910
1890
1870
1850
1830
1810
1790
1770
1750
1730
1710
1690
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80
100
120
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160
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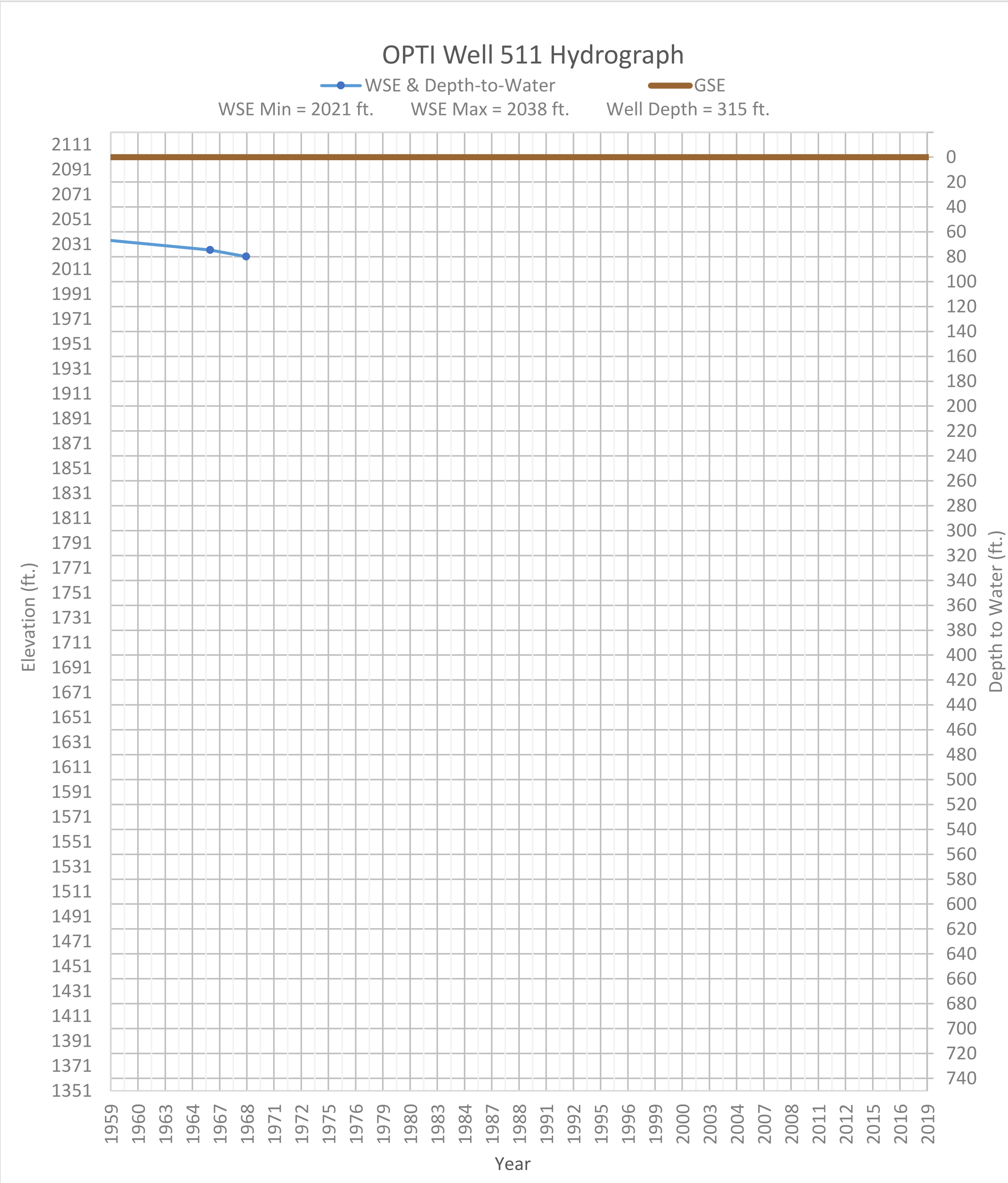
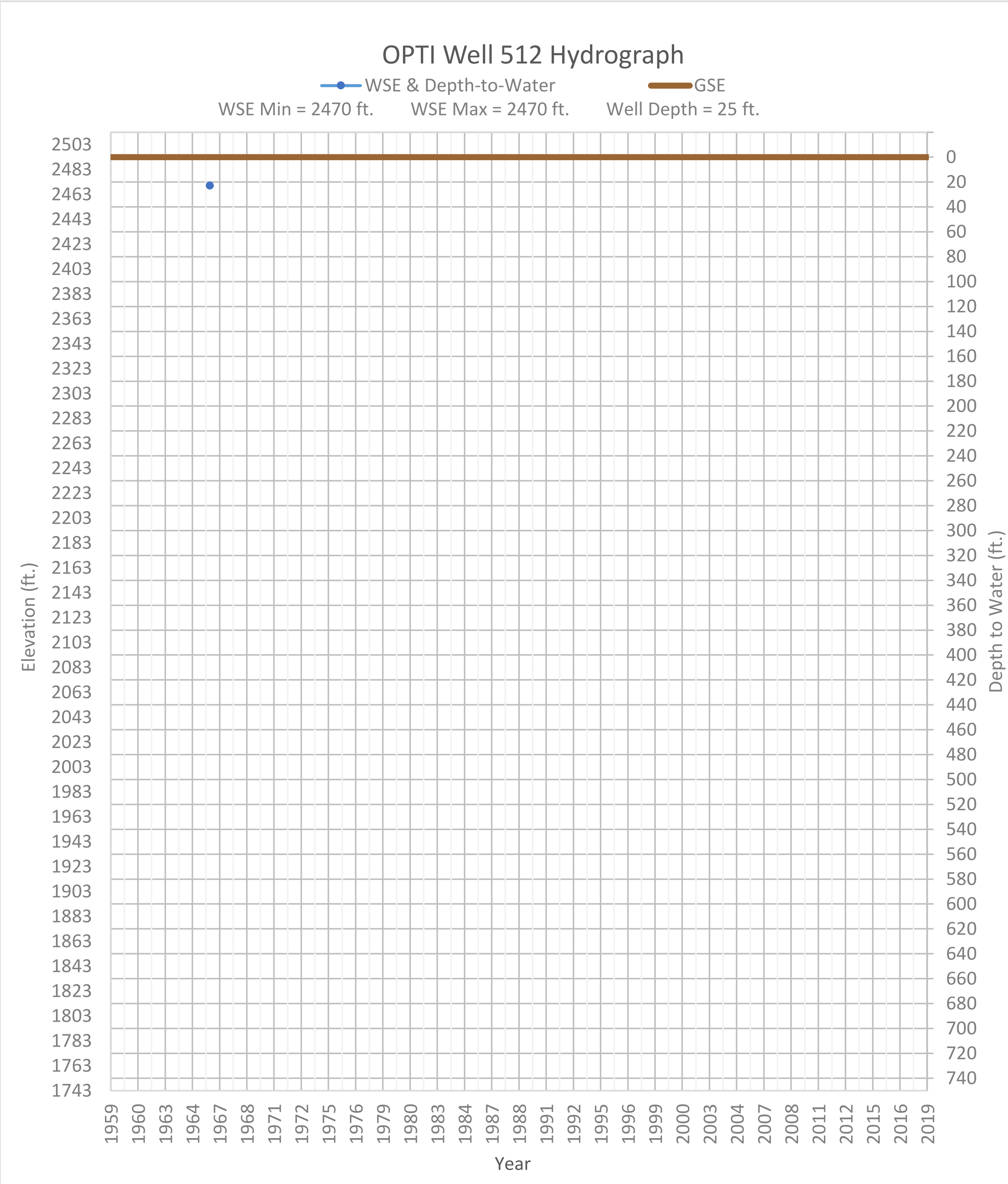


OPTI Well 511 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2021 ft.
WSE Max = 2038 ft.
Well Depth = 315 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 512 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2470 ft.
WSE Max = 2470 ft.
Well Depth = 25 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2503
2483
2463
2443
2423
2403
2383
2363
2343
2323
2303
2283
2263
2243
2223
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
1923
1903
1883
1863
1843
1823
1803
1783
1763
1743
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20
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80
100
120
140
160
180
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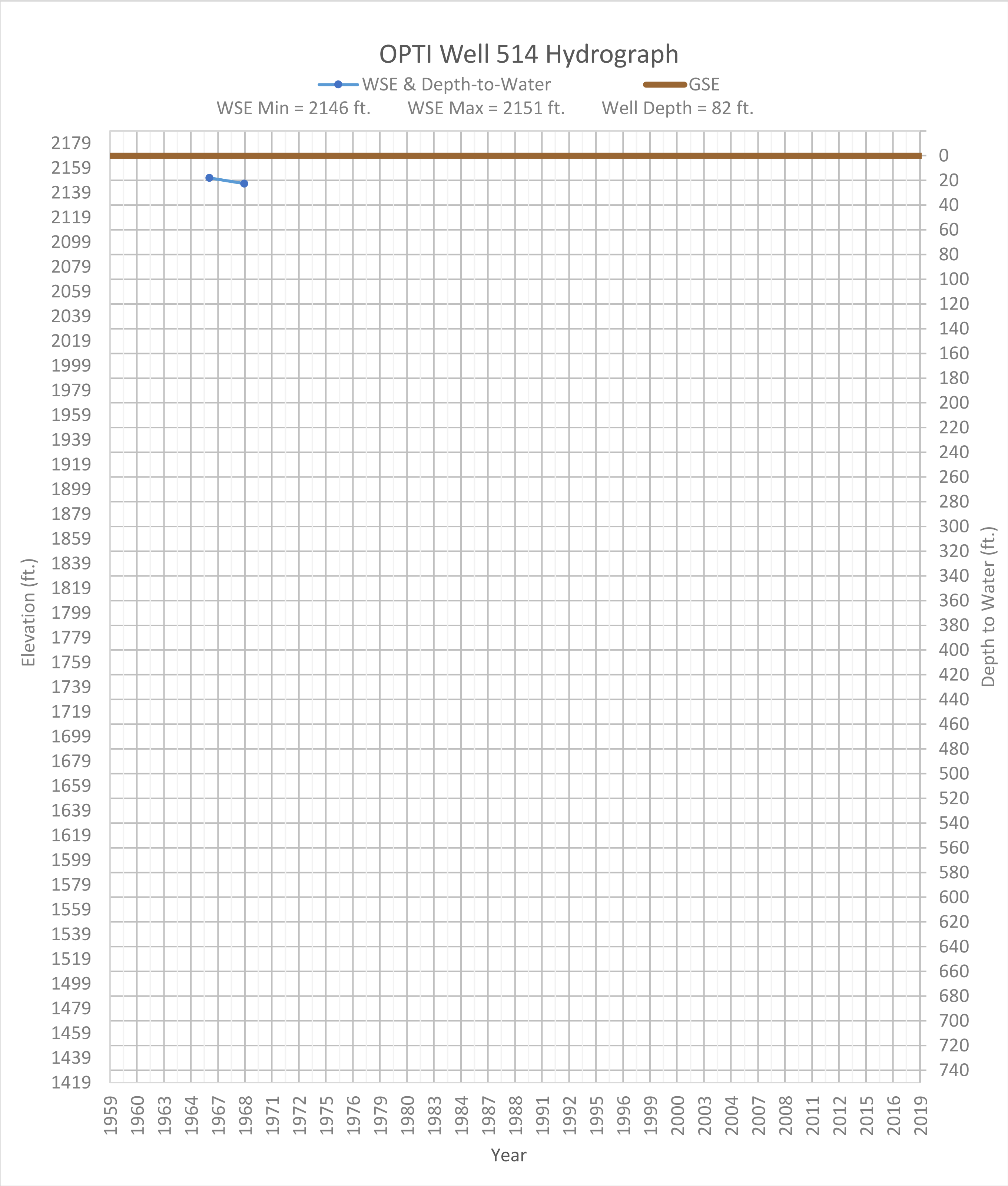
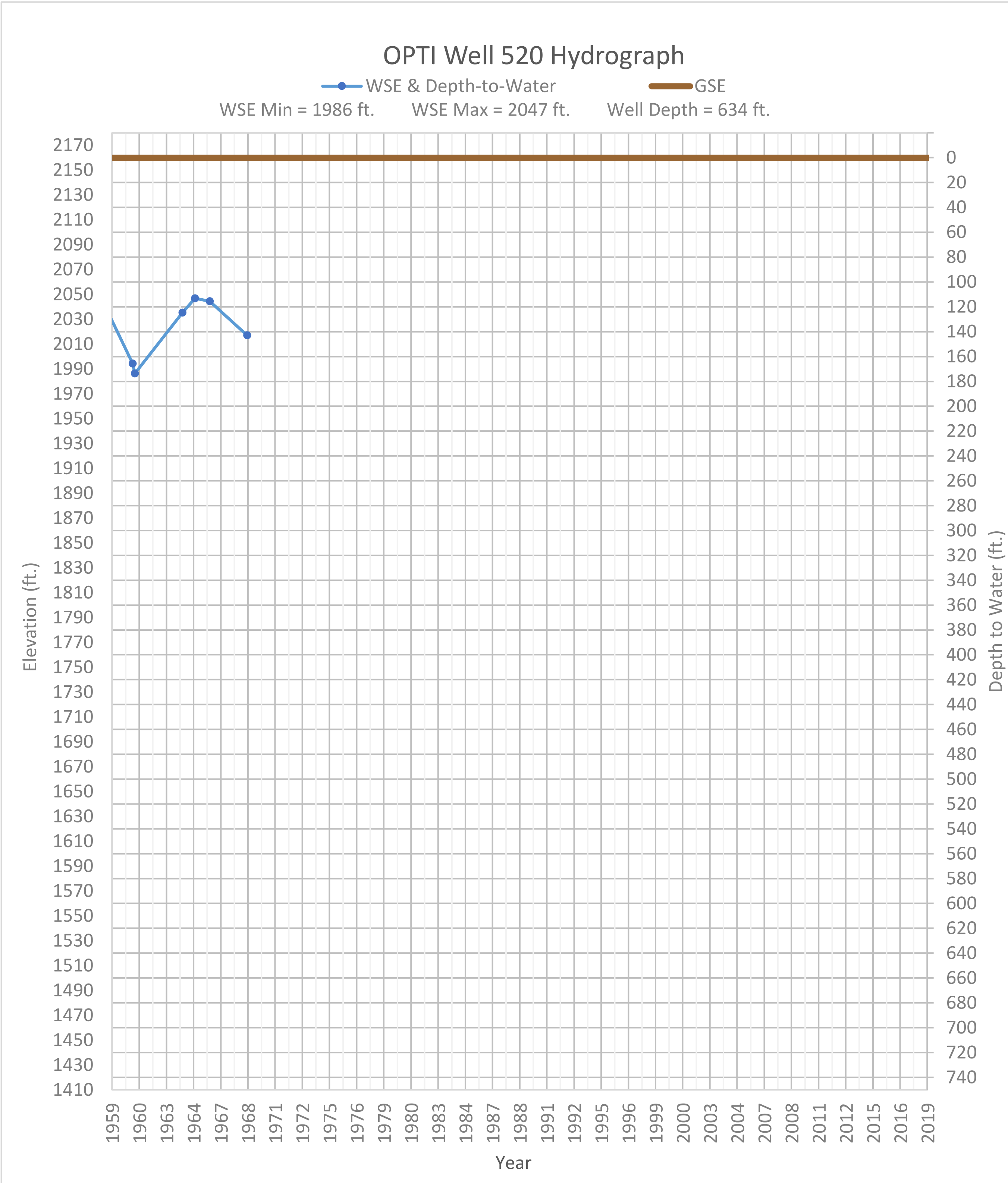
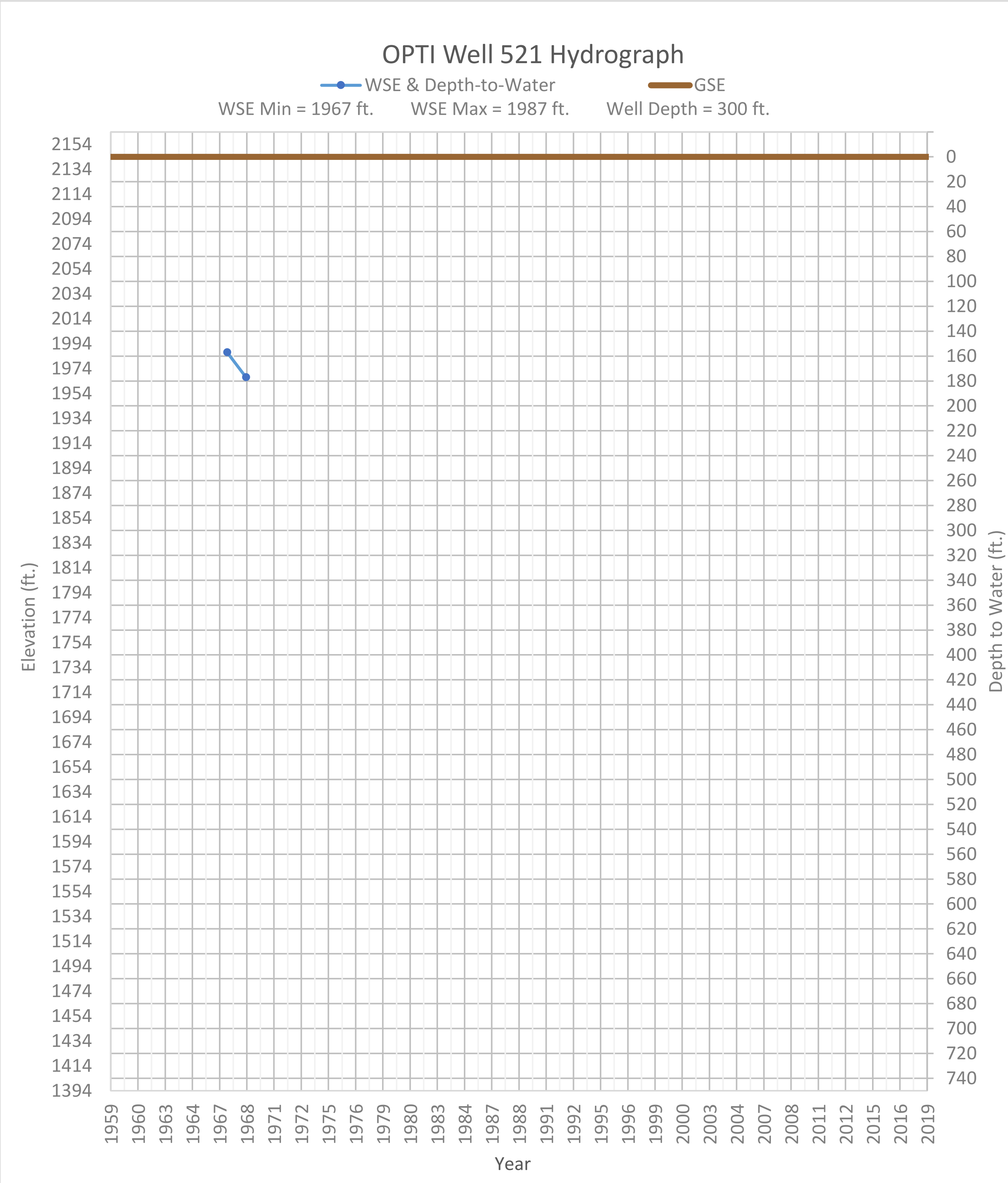
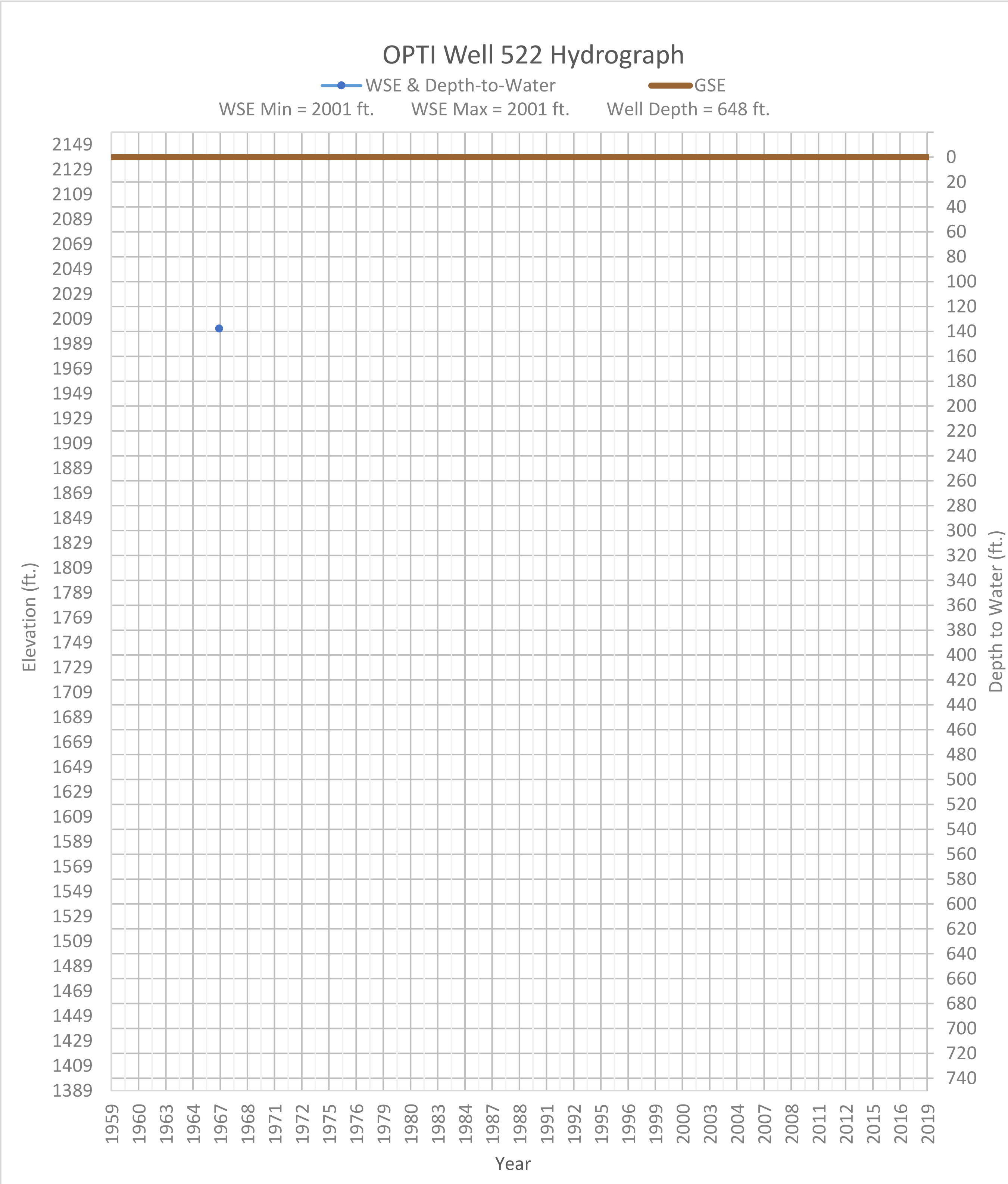

OPTI Well 514 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2146 ft.
WSE Max = 2151 ft.
Well Depth = 82 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 520 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1986 ft.
WSE Max = 2047 ft.
Well Depth = 634 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 521 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1967 ft.
WSE Max = 1987 ft.
Well Depth = 300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 522 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2001 ft.
WSE Max = 2001 ft.
Well Depth = 648 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2149
2129
2109
2089
2069
2049
2029
2009
1989
1969
1949
1929
1909
1889
1869
1849
1829
1809
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1769
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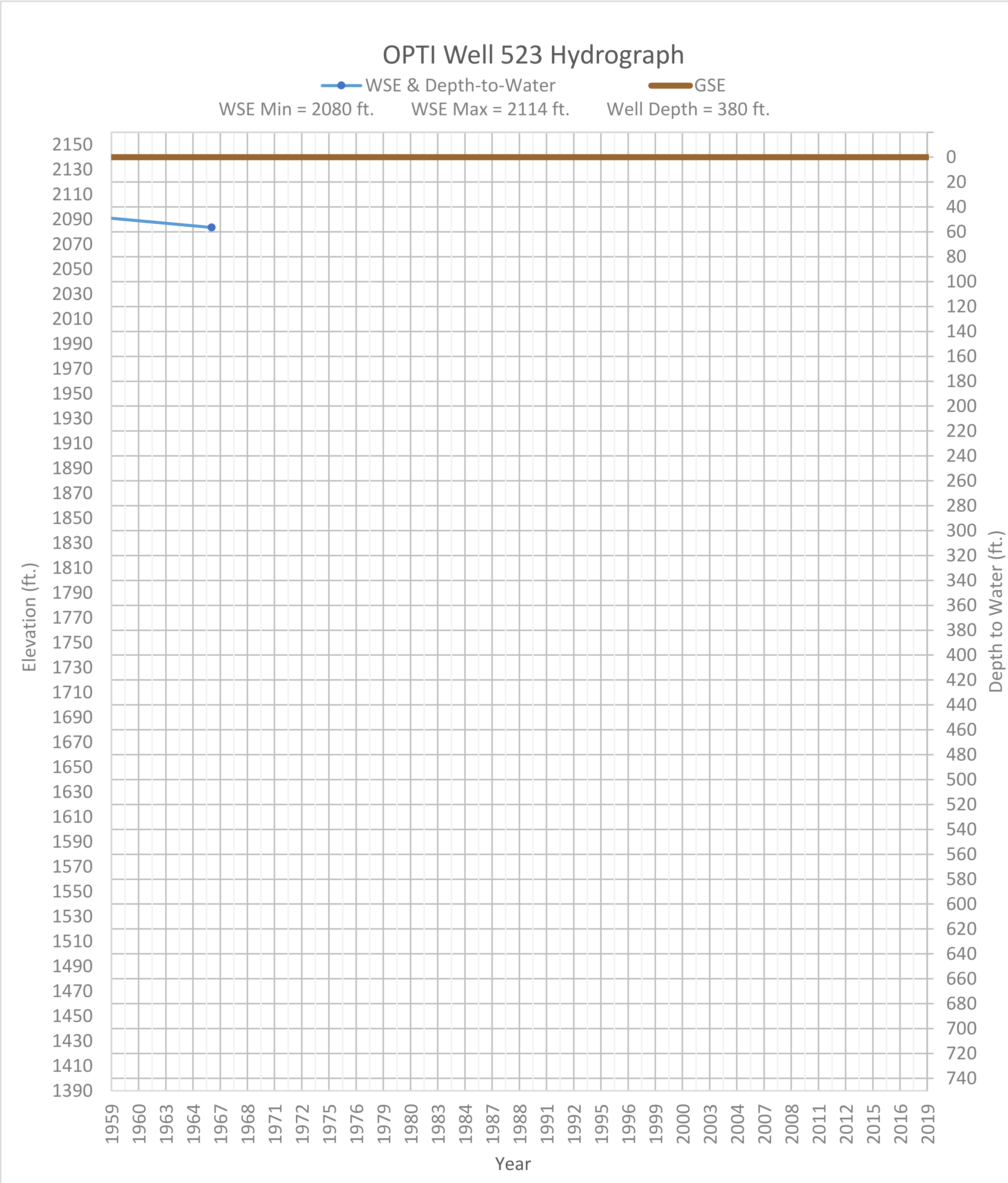
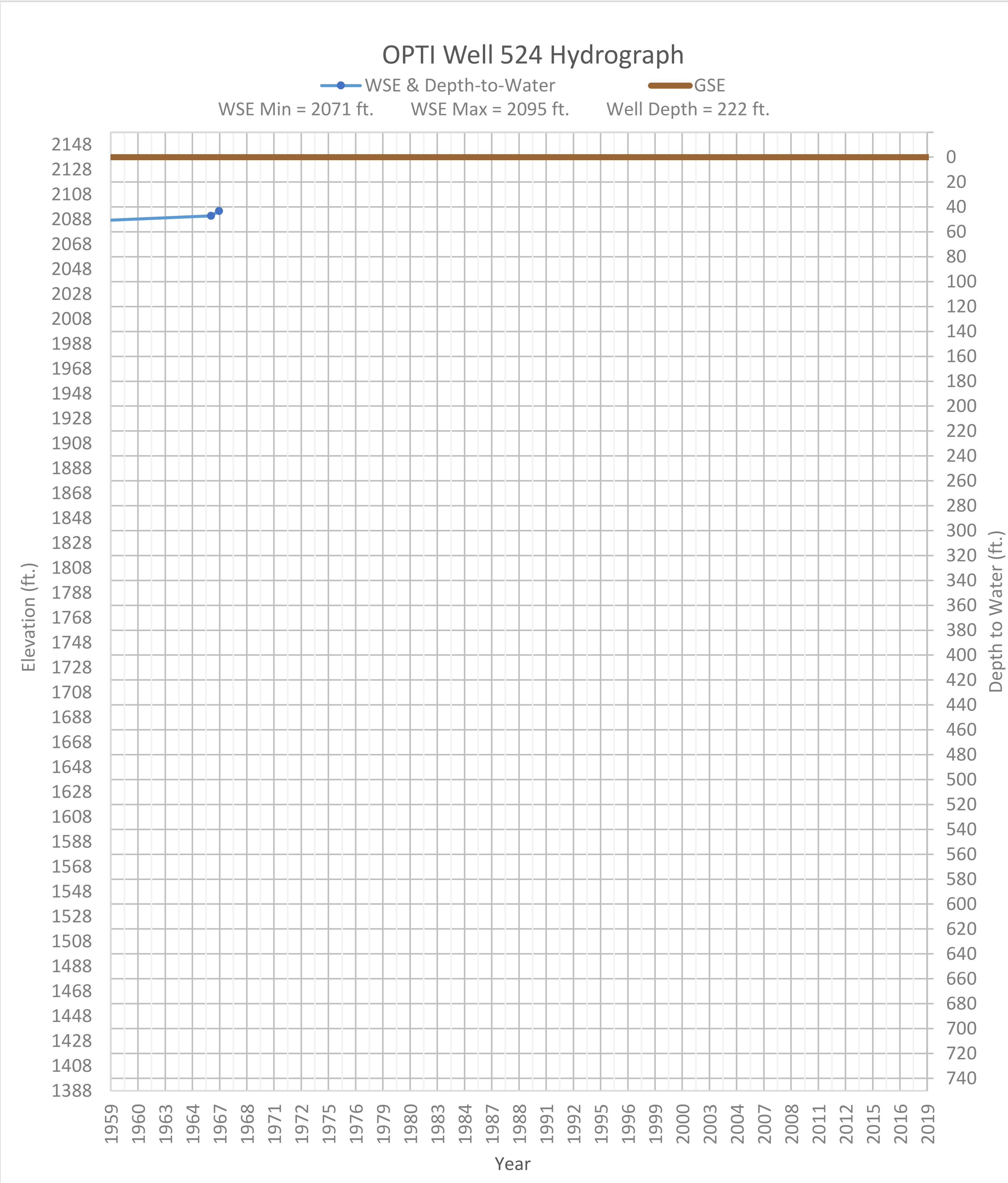

OPTI Well 523 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2080 ft.
WSE Max = 2114 ft.
Well Depth = 380 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 524 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2071 ft.
WSE Max = 2095 ft.
Well Depth = 222 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
1888
1868
1848
1828
1808
1788
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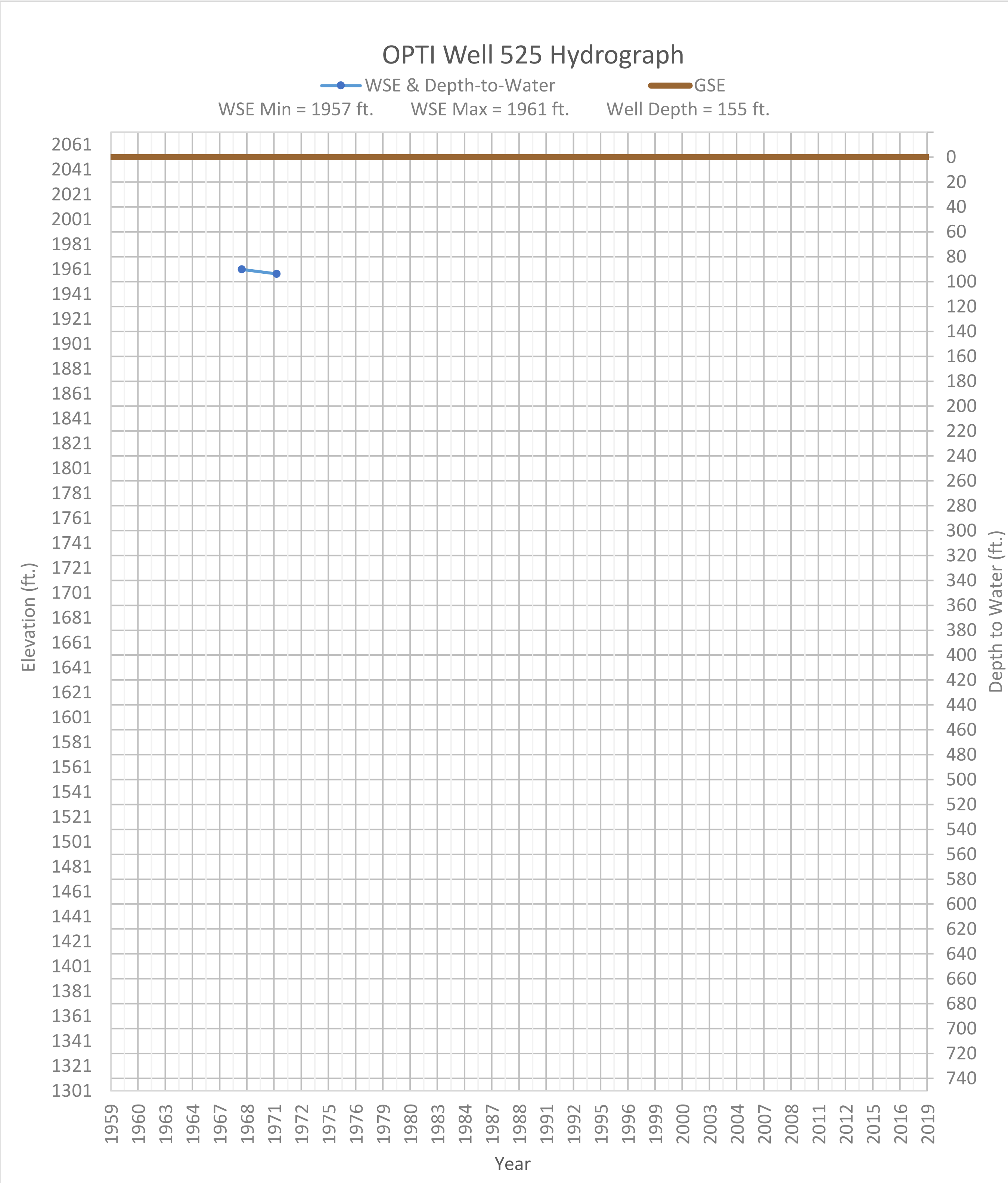

OPTI Well 525 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1957 ft.
WSE Max = 1961 ft.
Well Depth = 155 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2061
2041
2021
2001
1981
1961
1941
1921
1901
1881
1861
1841
1821
1801
1781
1761
1741
1721
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1681
1661
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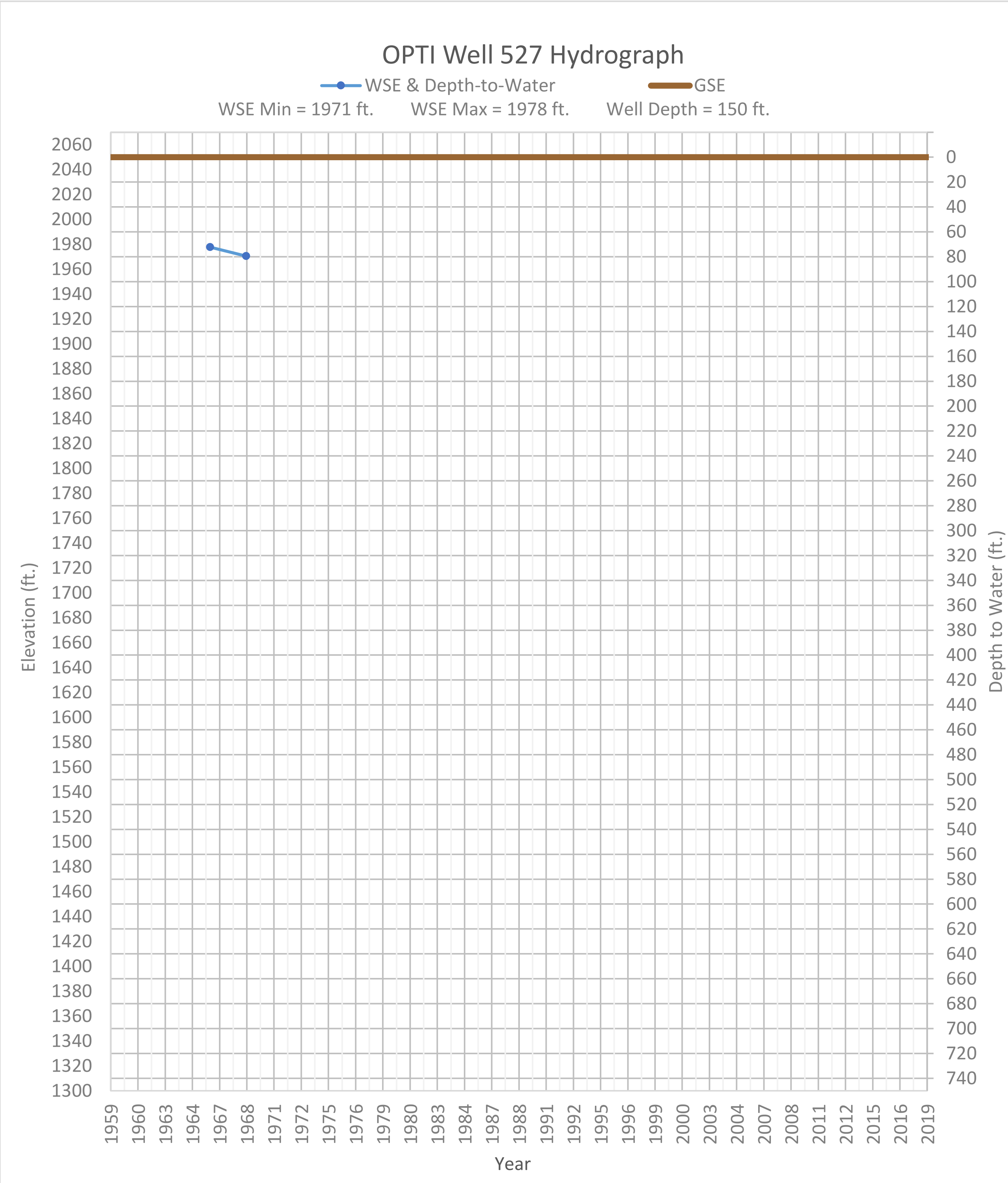
OPTI Well 527 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1971 ft.
WSE Max = 1978 ft.
Well Depth = 150 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2060
2040
2020
2000
1980
1960
1940
1920
1900
1880
1860
1840
1820
1800
1780
1760
1740
1720
1700
1680
1660
1640
1620
1600
1580
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1520
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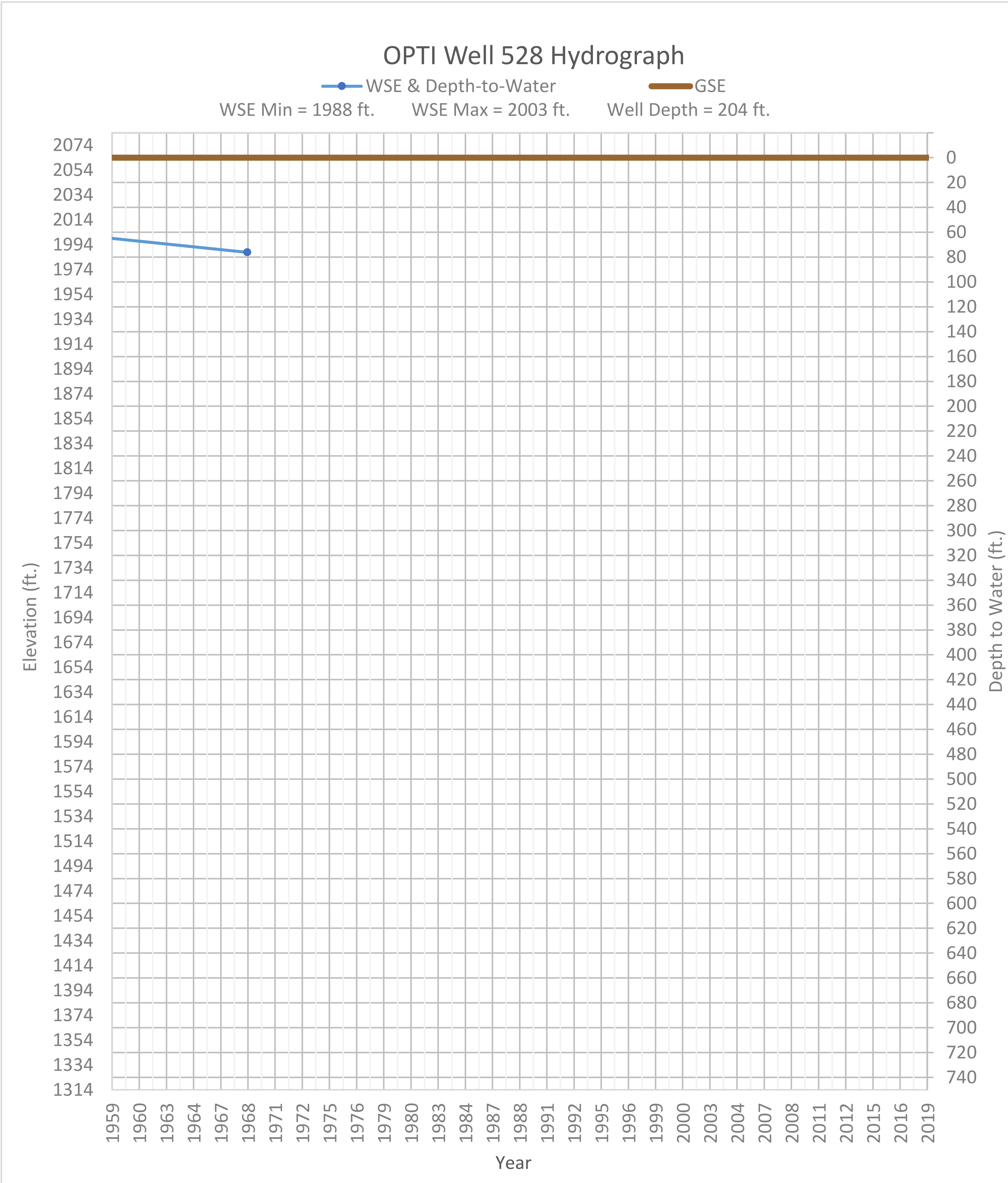
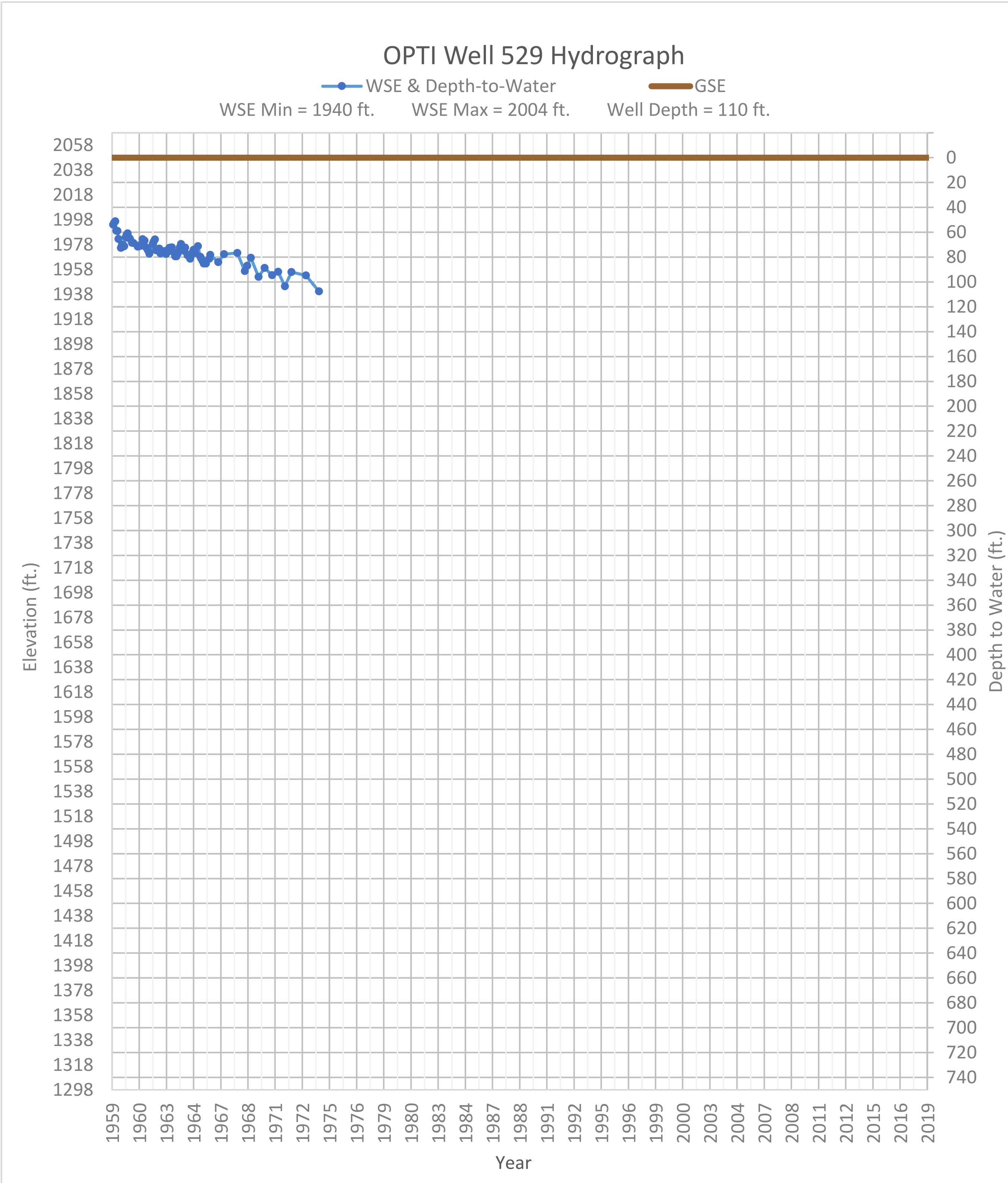
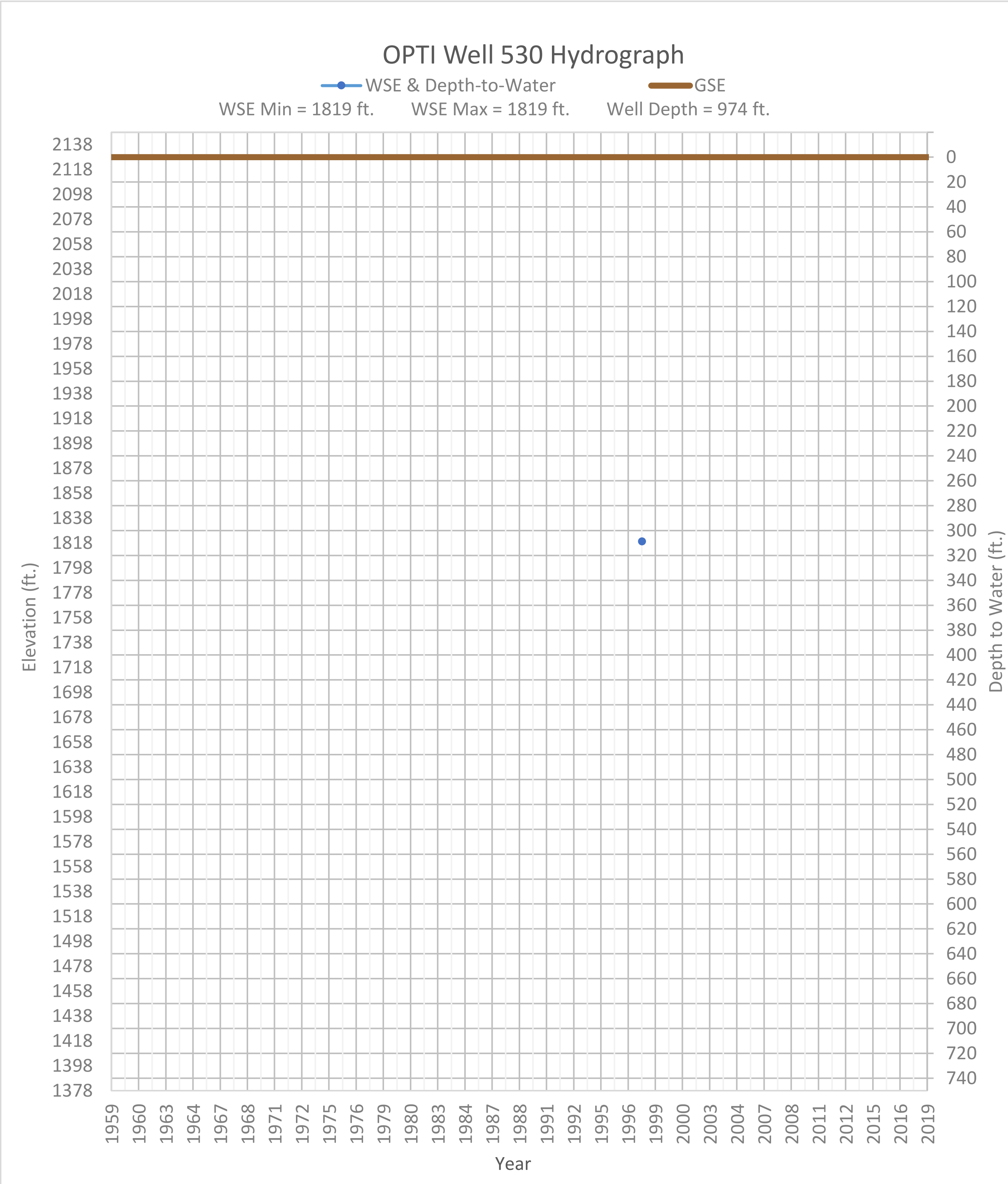


OPTI Well 528 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1988 ft.
WSE Max = 2003 ft.
Well Depth = 204 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 529 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1940 ft.
WSE Max = 2004 ft.
Well Depth = 110 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 530 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1819 ft.
WSE Max = 1819 ft.
Well Depth = 974 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
1918
1898
1878
1858
1838
1818
1798
1778
1758
1738
1718
1698
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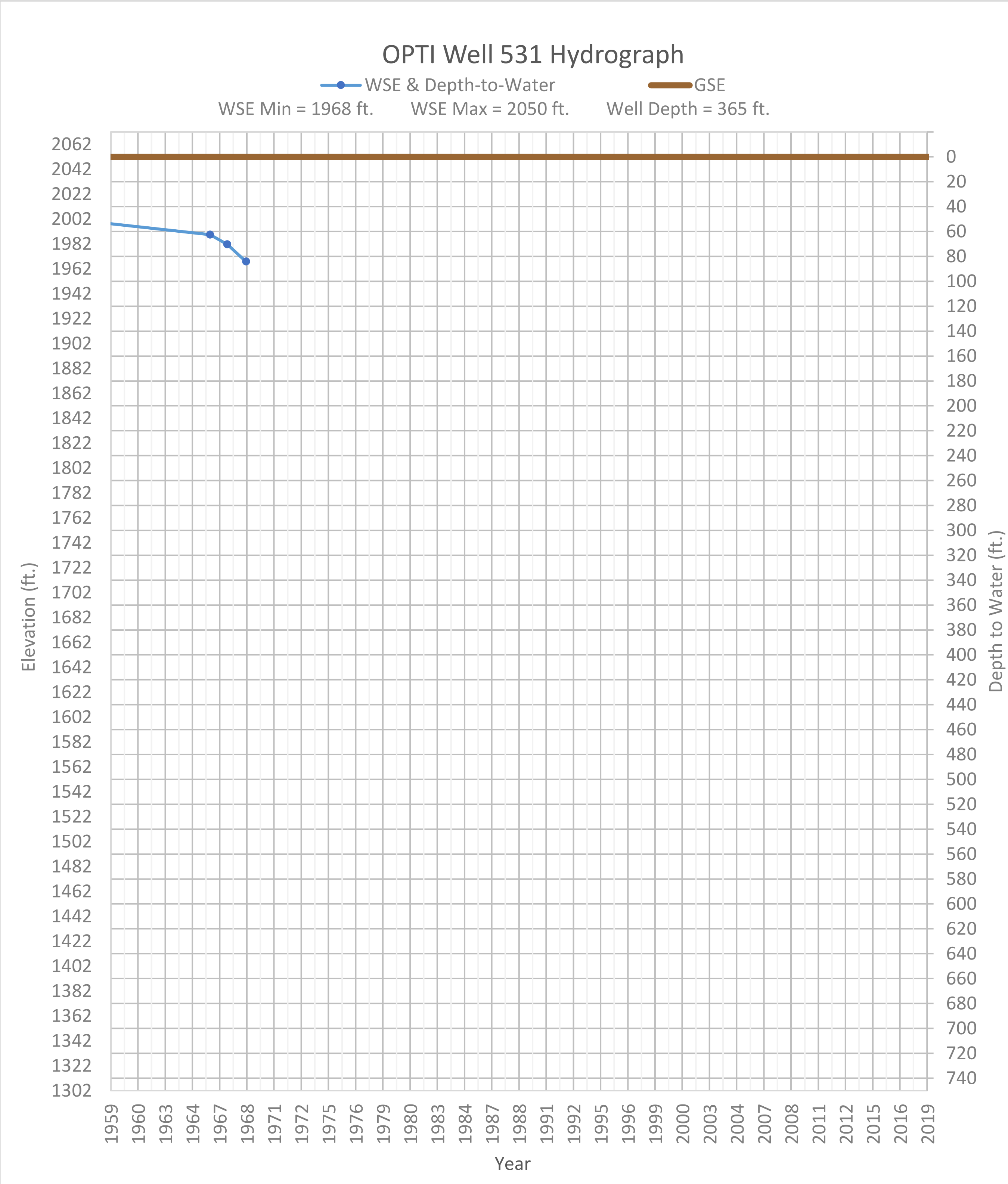

OPTI Well 531 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1968 ft.
WSE Max = 2050 ft.
Well Depth = 365 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2062
2042
2022
2002
1982
1962
1942
1922
1902
1882
1862
1842
1822
1802
1782
1762
1742
1722
1702
1682
1662
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1622
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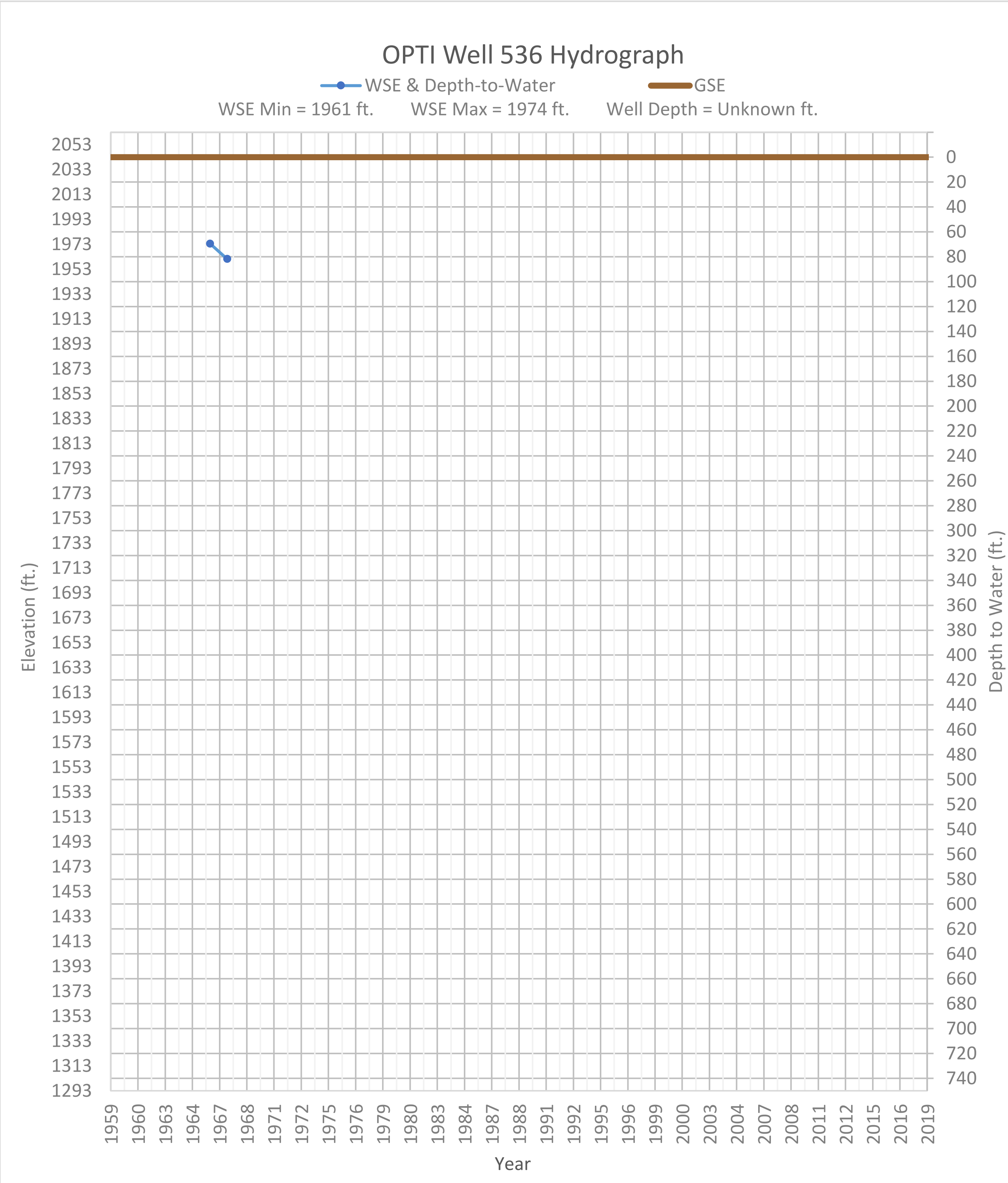
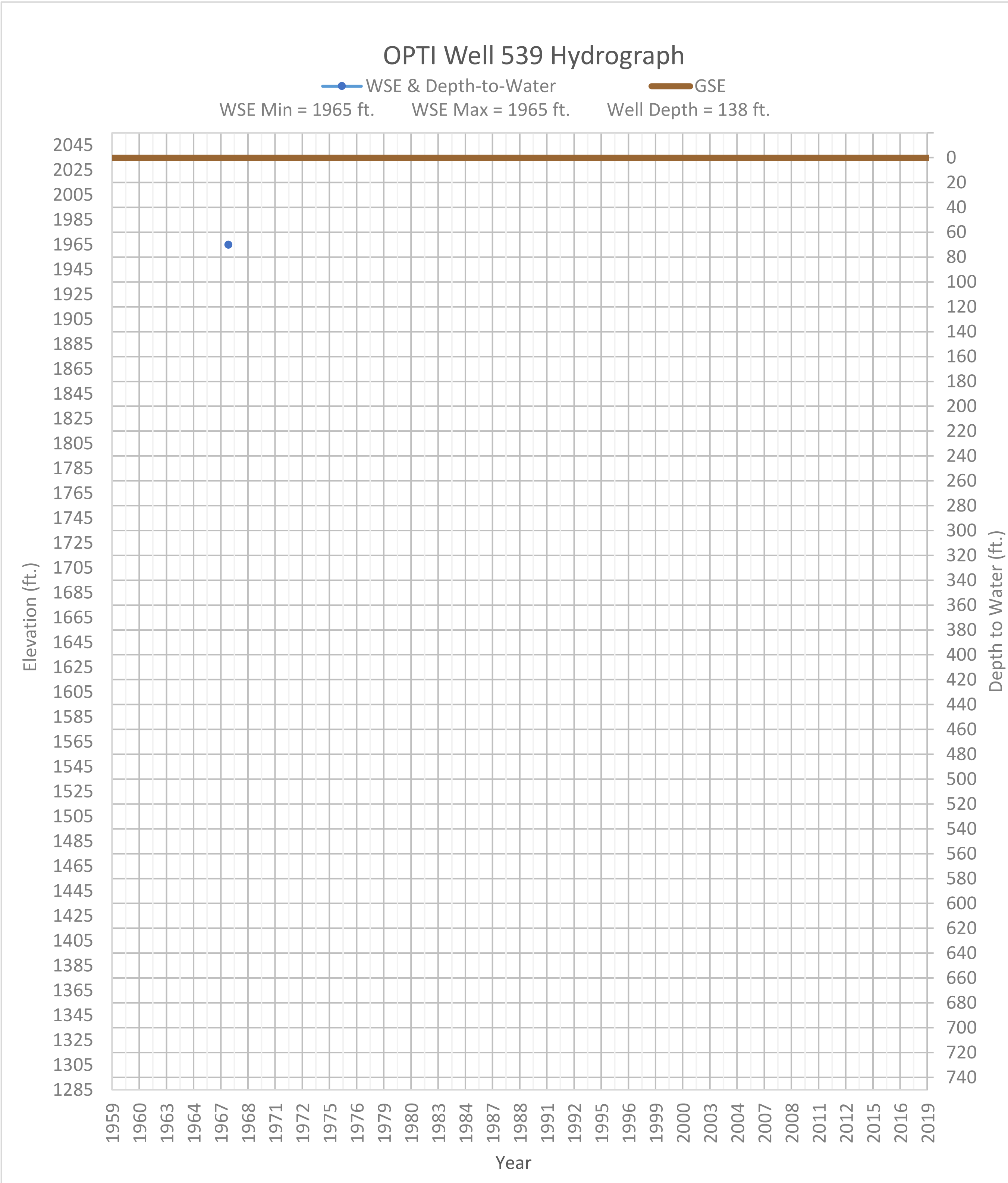
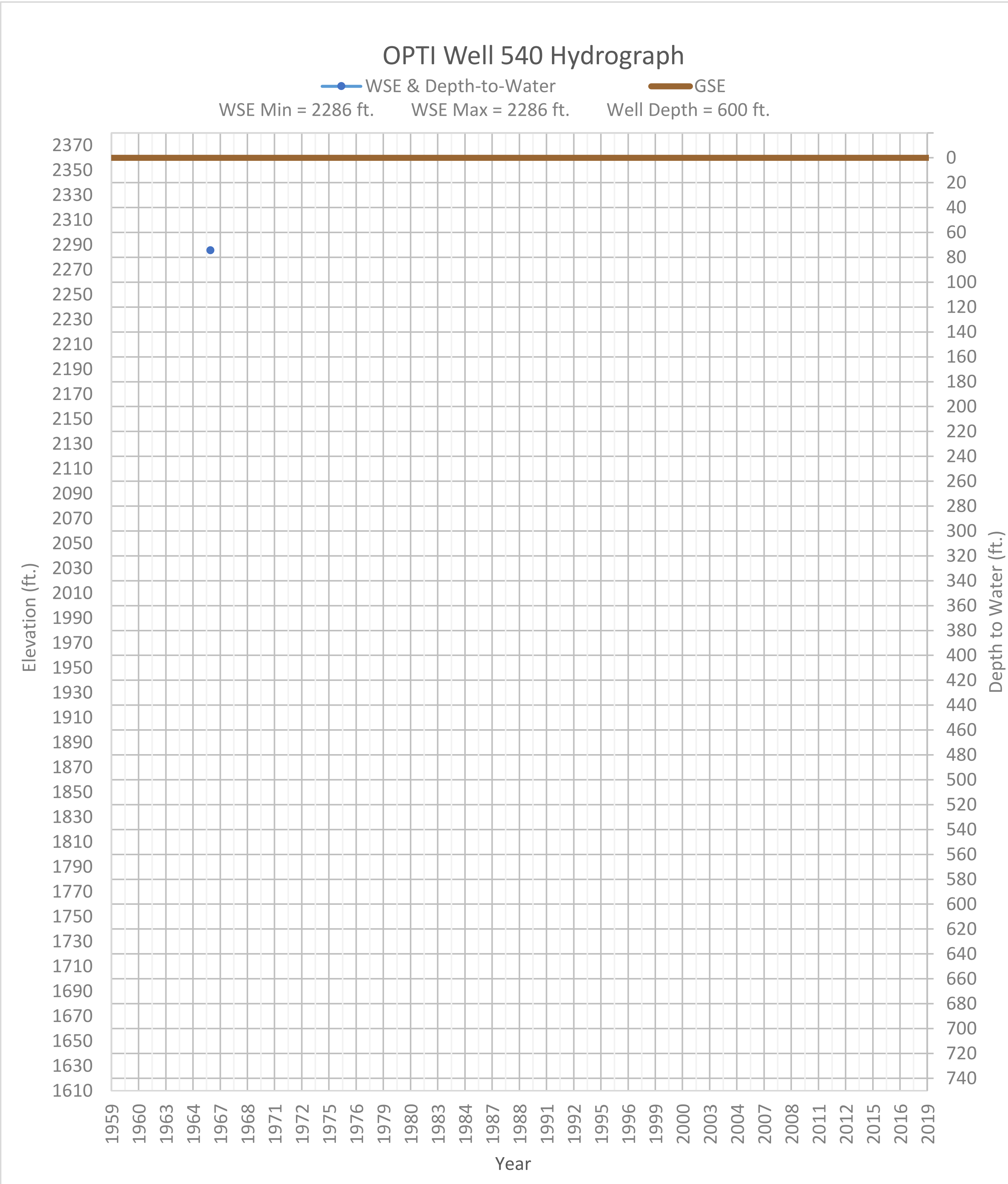
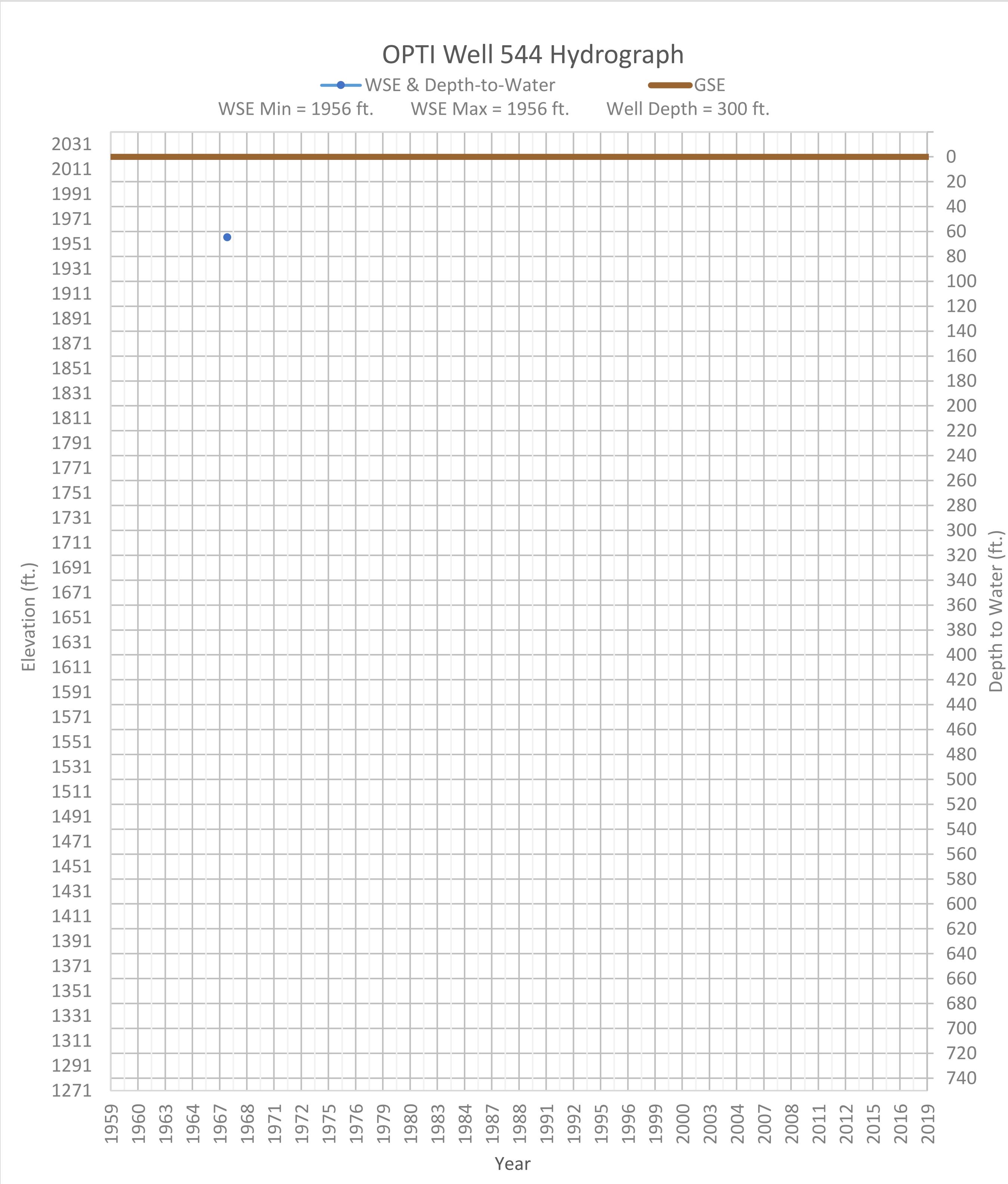

OPTI Well 536 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1961 ft.
WSE Max = 1974 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

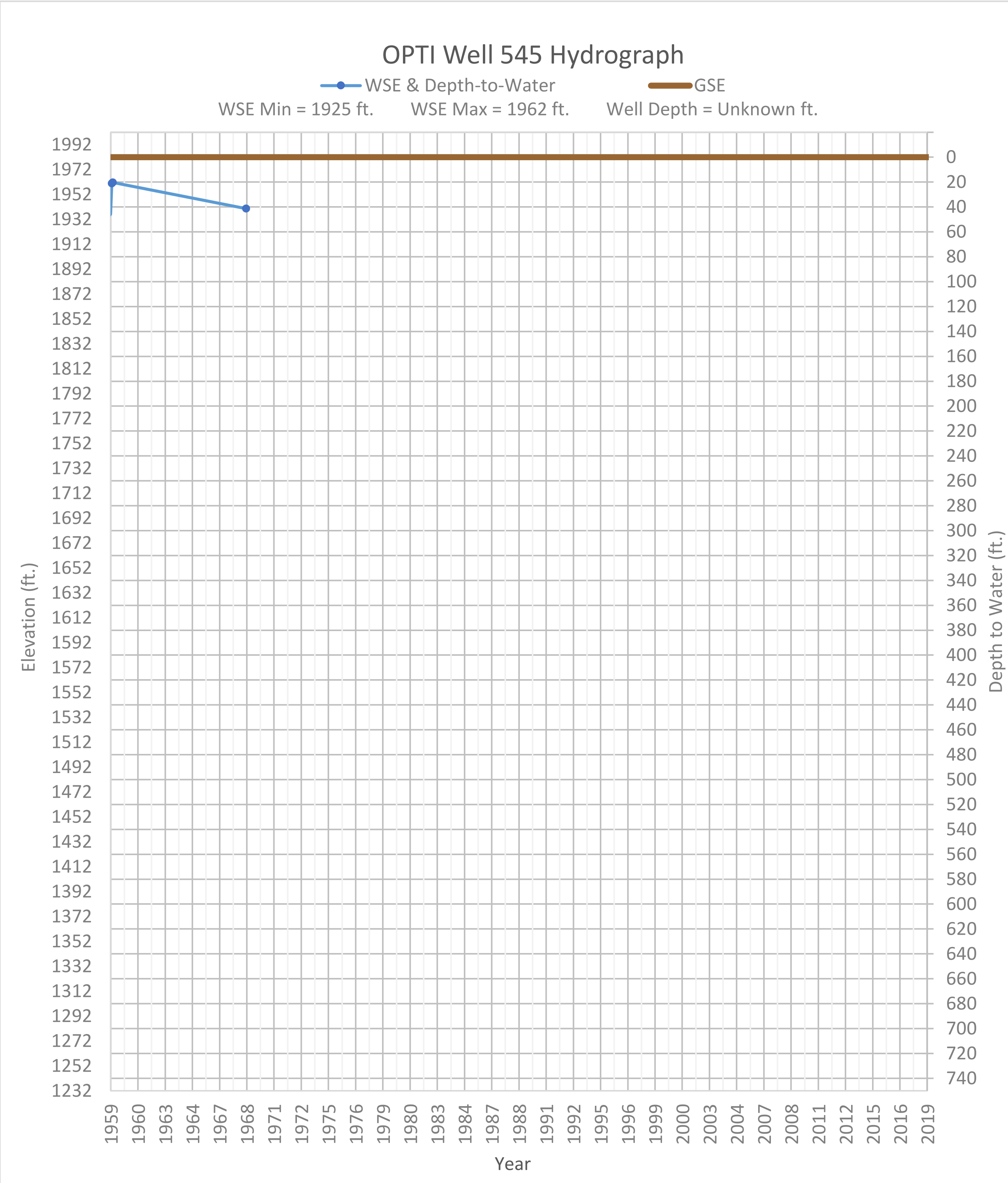


OPTI Well 539 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1965 ft.
WSE Max = 1965 ft.
Well Depth = 138 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 540 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2286 ft.
WSE Max = 2286 ft.
Well Depth = 600 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 544 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1956 ft.
WSE Max = 1956 ft.
Well Depth = 300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 545 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1925 ft.
WSE Max = 1962 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
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1732
1712
1692
1672
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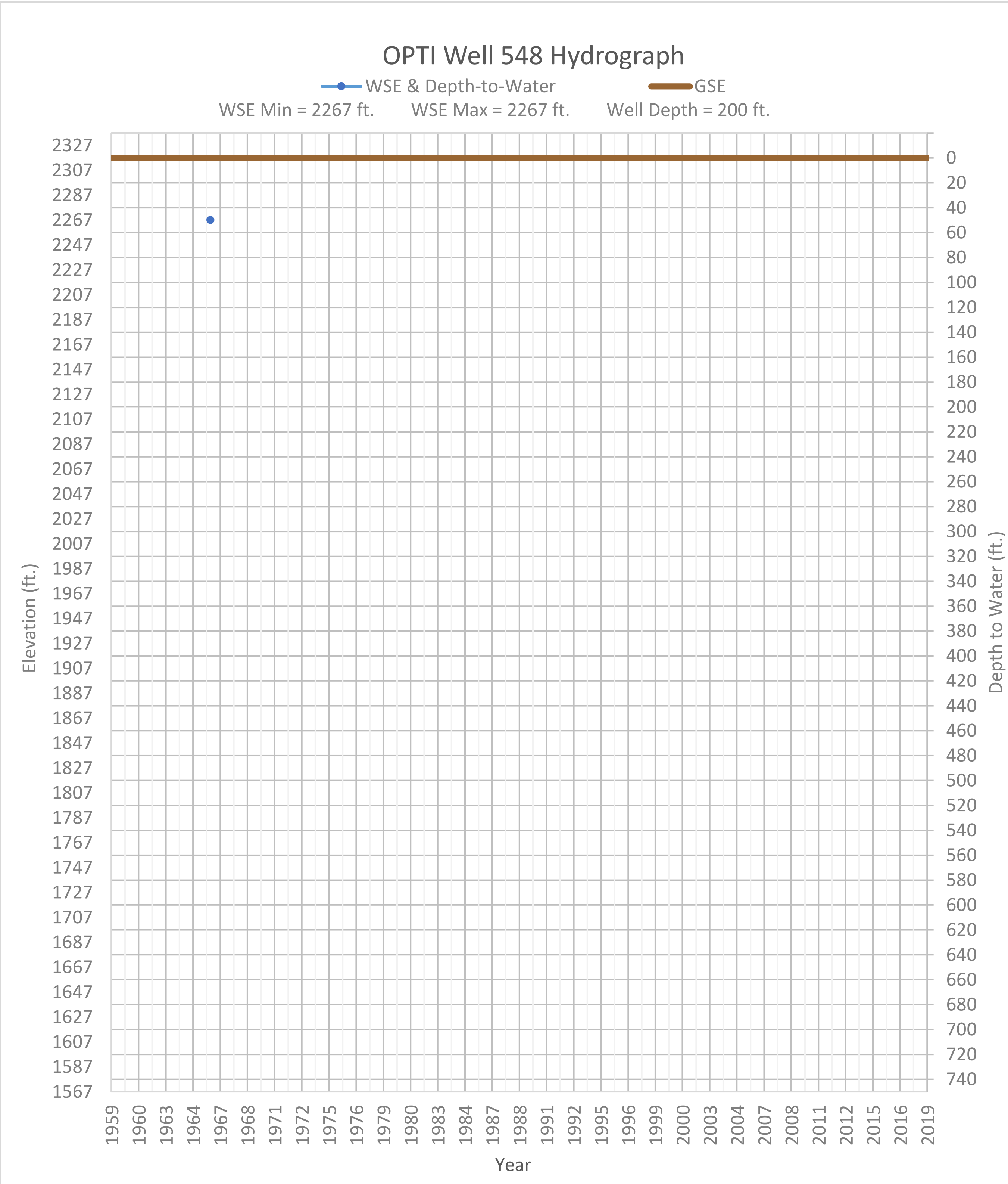
OPTI Well 548 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2267 ft.
WSE Max = 2267 ft.
Well Depth = 200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2327
2307
2287
2267
2247
2227
2207
2187
2167
2147
2127
2107
2087
2067
2047
2027
2007
1987
1967
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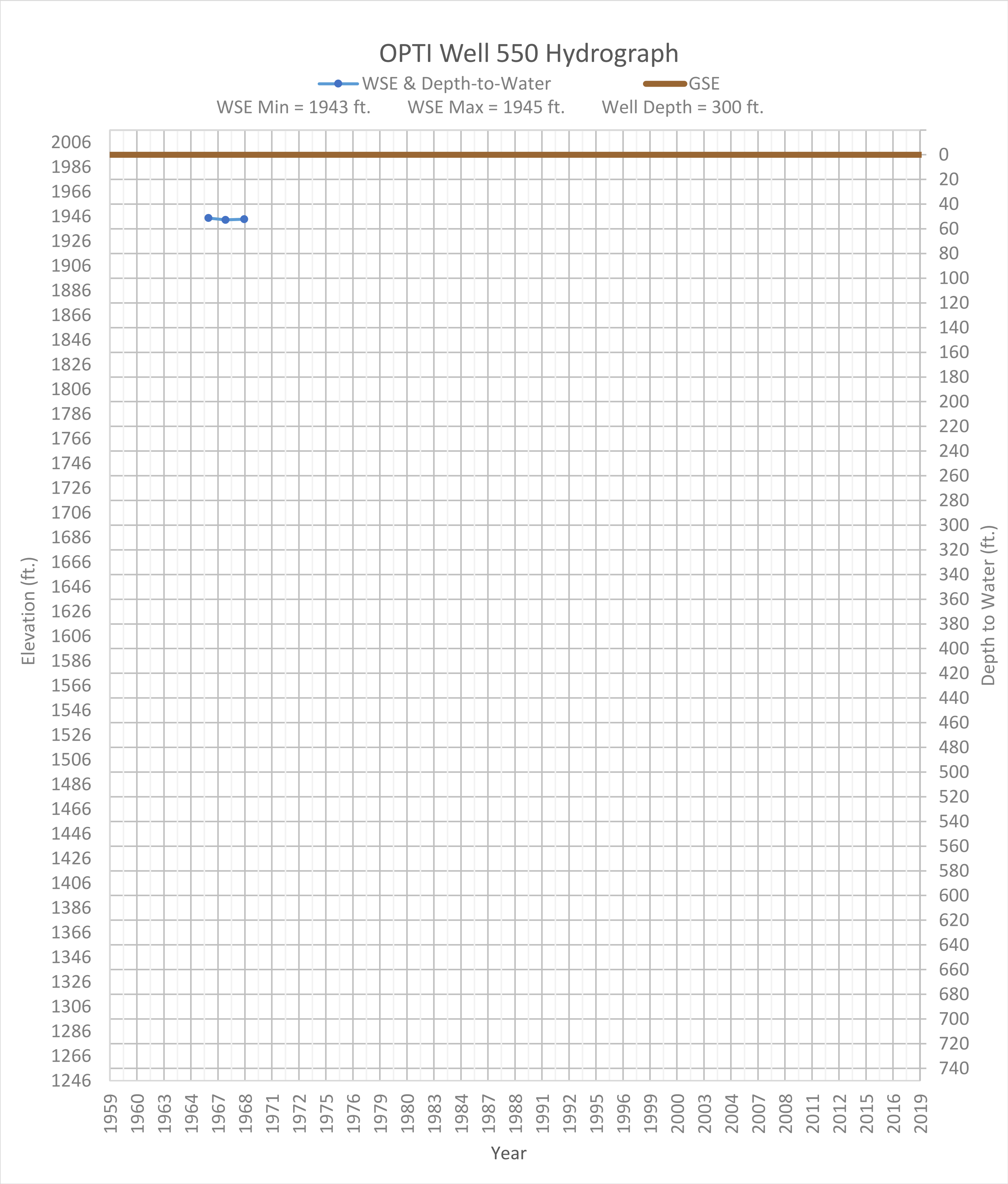
OPTI Well 550 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1943 ft.
WSE Max = 1945 ft.
Well Depth = 300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2006
1986
1966
1946
1926
1906
1886
1866
1846
1826
1806
1786
1766
1746
1726
1706
1686
1666
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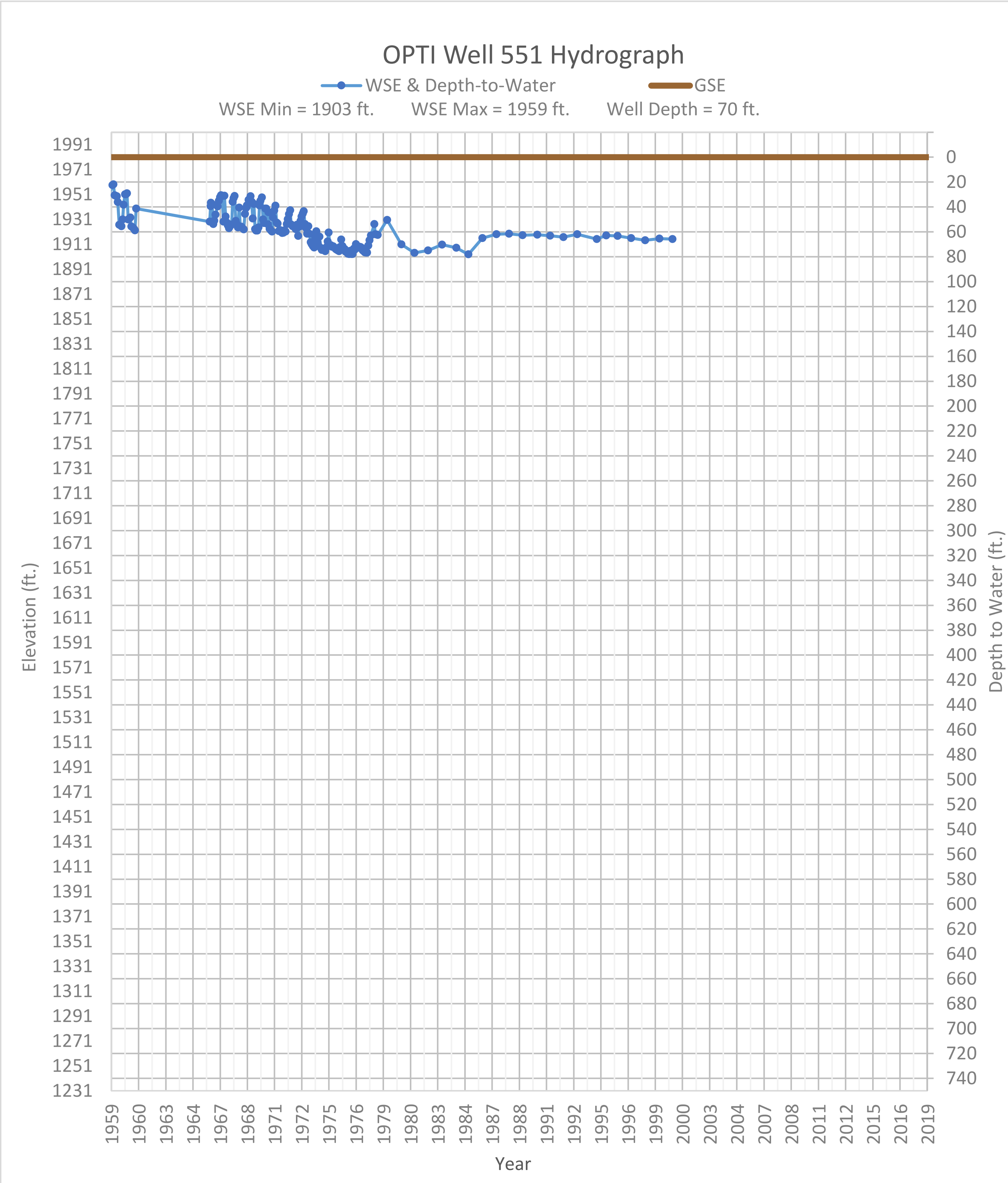
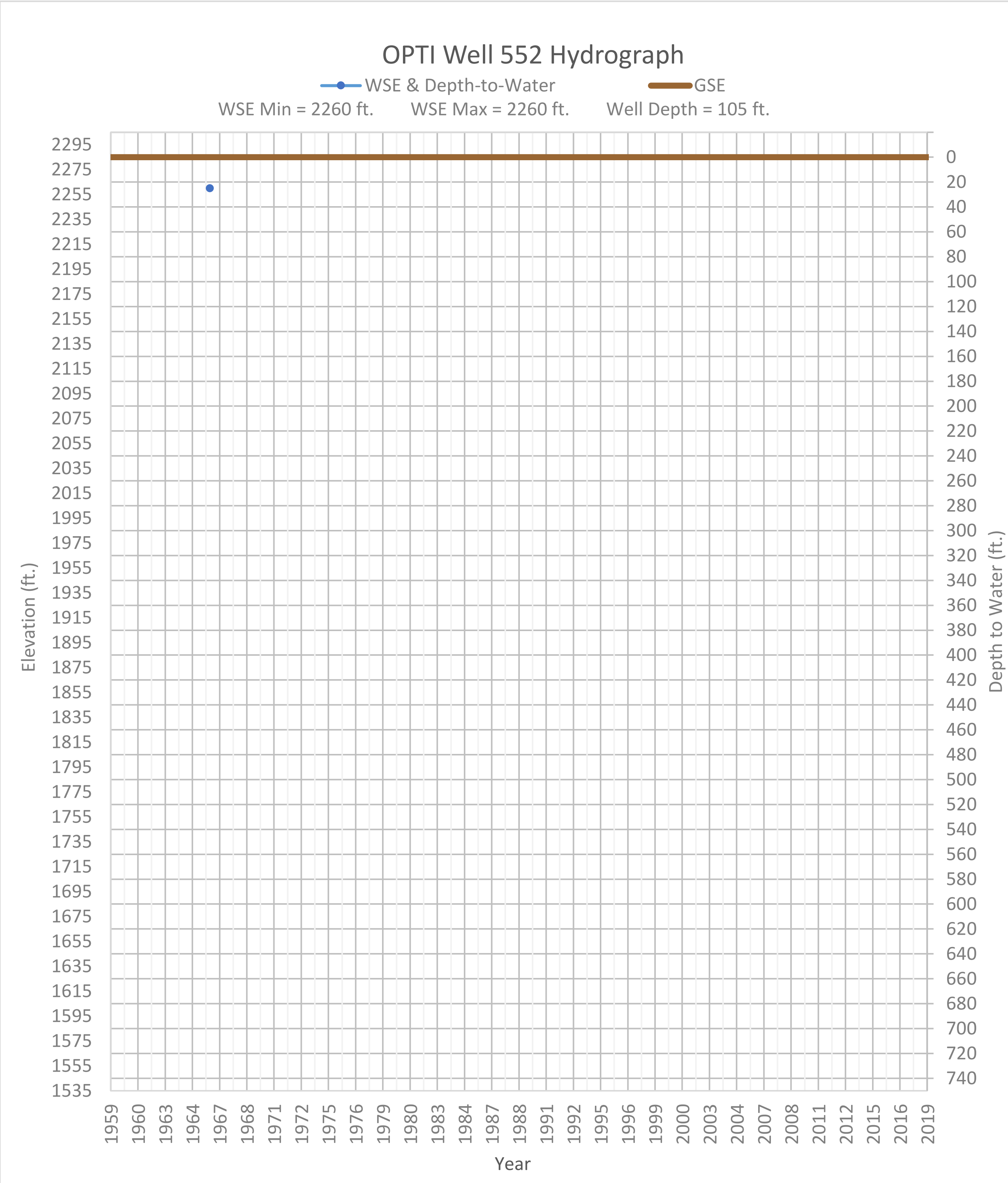

OPTI Well 551 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1903 ft.
WSE Max = 1959 ft.
Well Depth = 70 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 552 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2260 ft.
WSE Max = 2260 ft.
Well Depth = 105 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 554 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1879 ft.
WSE Max = 1947 ft.
Well Depth = 378 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 557 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1939 ft.
WSE Max = 1942 ft.
Well Depth = 300 ft.
Elevation (ft.)
1996
1976
1956
1936
1916
1896
1876
1856
1836
1816
1796
1776
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1736
1716
1696
1676
1656
1636
1616
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1536
1516
1496
1476
1456
1436
1416
1396
1376
1356
1336
1316
1296
1276
1256
1236
Depth to Water (ft.)
0
20
40
60
80
100
120
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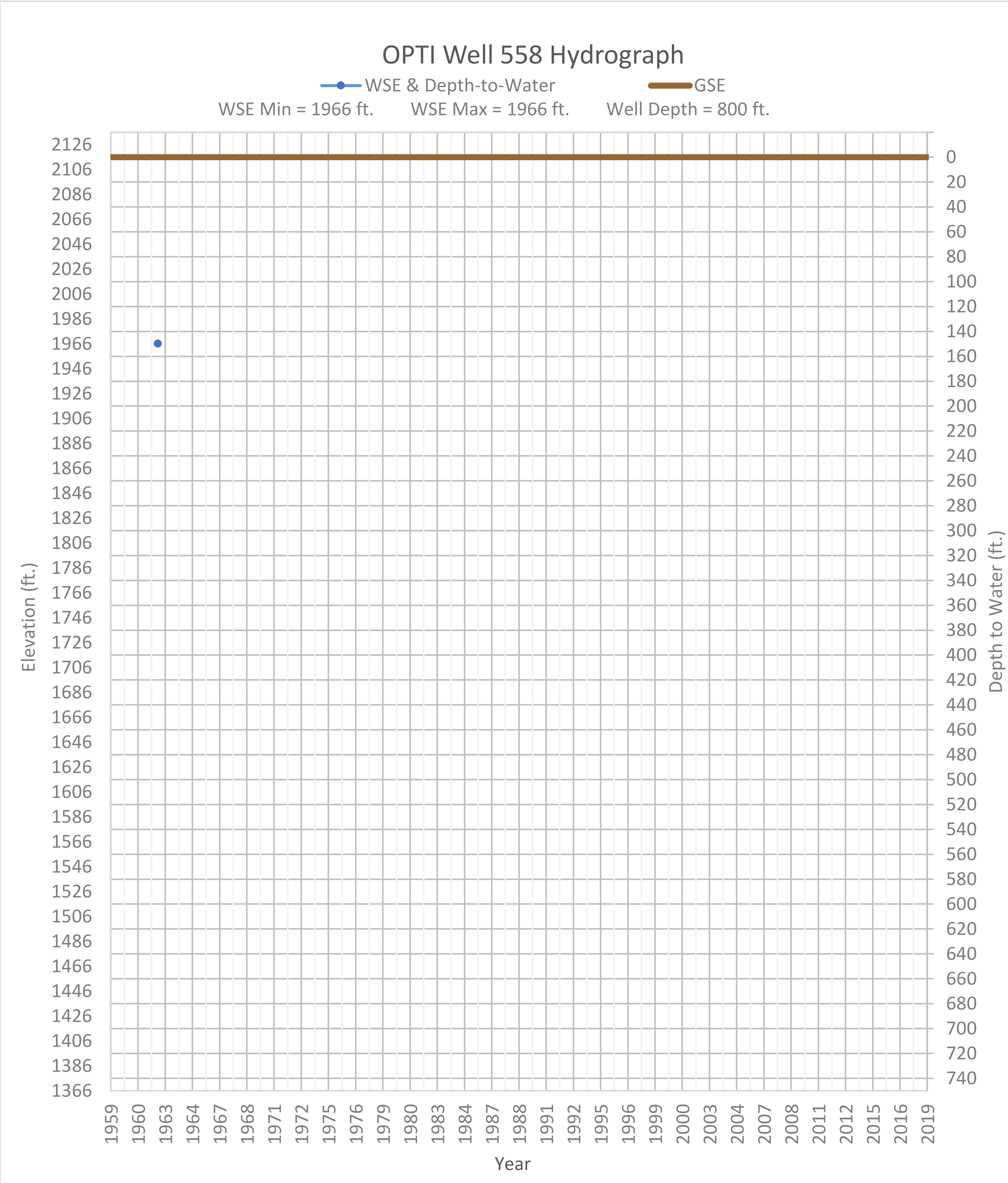
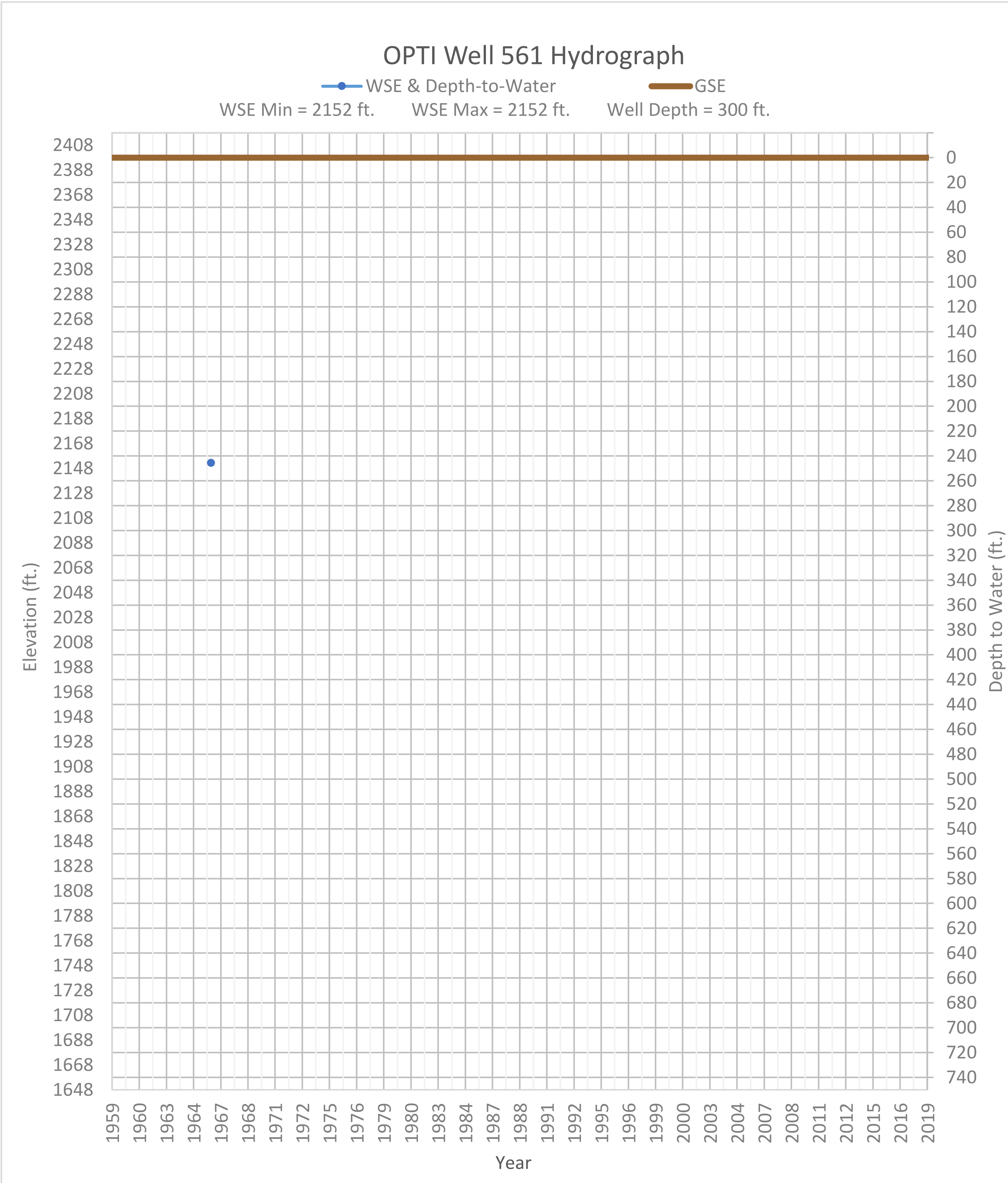


OPTI Well 558 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1966 ft.
WSE Max = 1966 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 561 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2152 ft.
WSE Max = 2152 ft.
Well Depth = 300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2408
2388
2368
2348
2328
2308
2288
2268
2248
2228
2208
2188
2168
2148
2128
2108
2088
2068
2048
2028
2008
1988
1968
1948
1928
1908
1888
1868
1848
1828
1808
1788
1768
1748
1728
1708
1688
1668
1648
0
20
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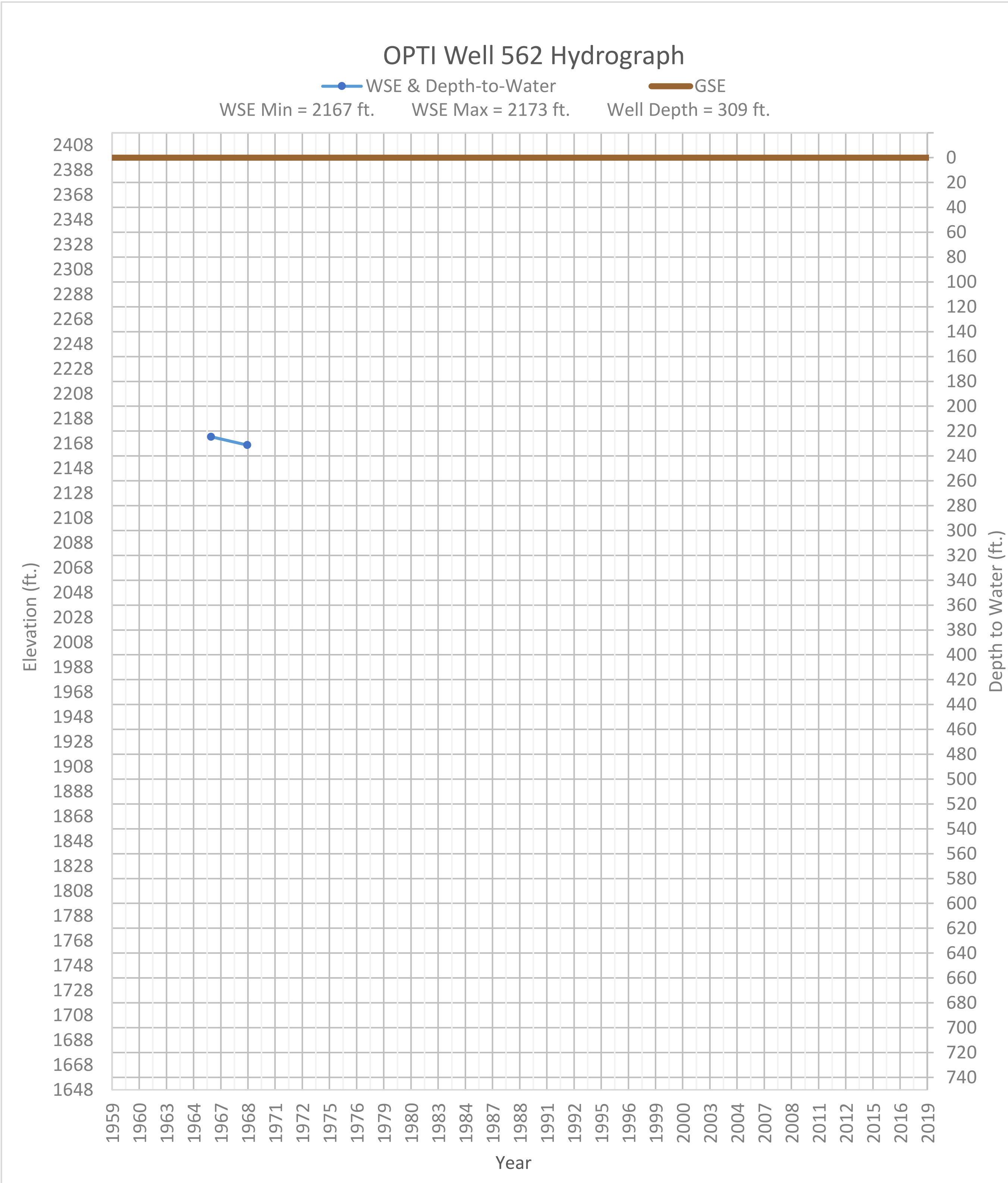
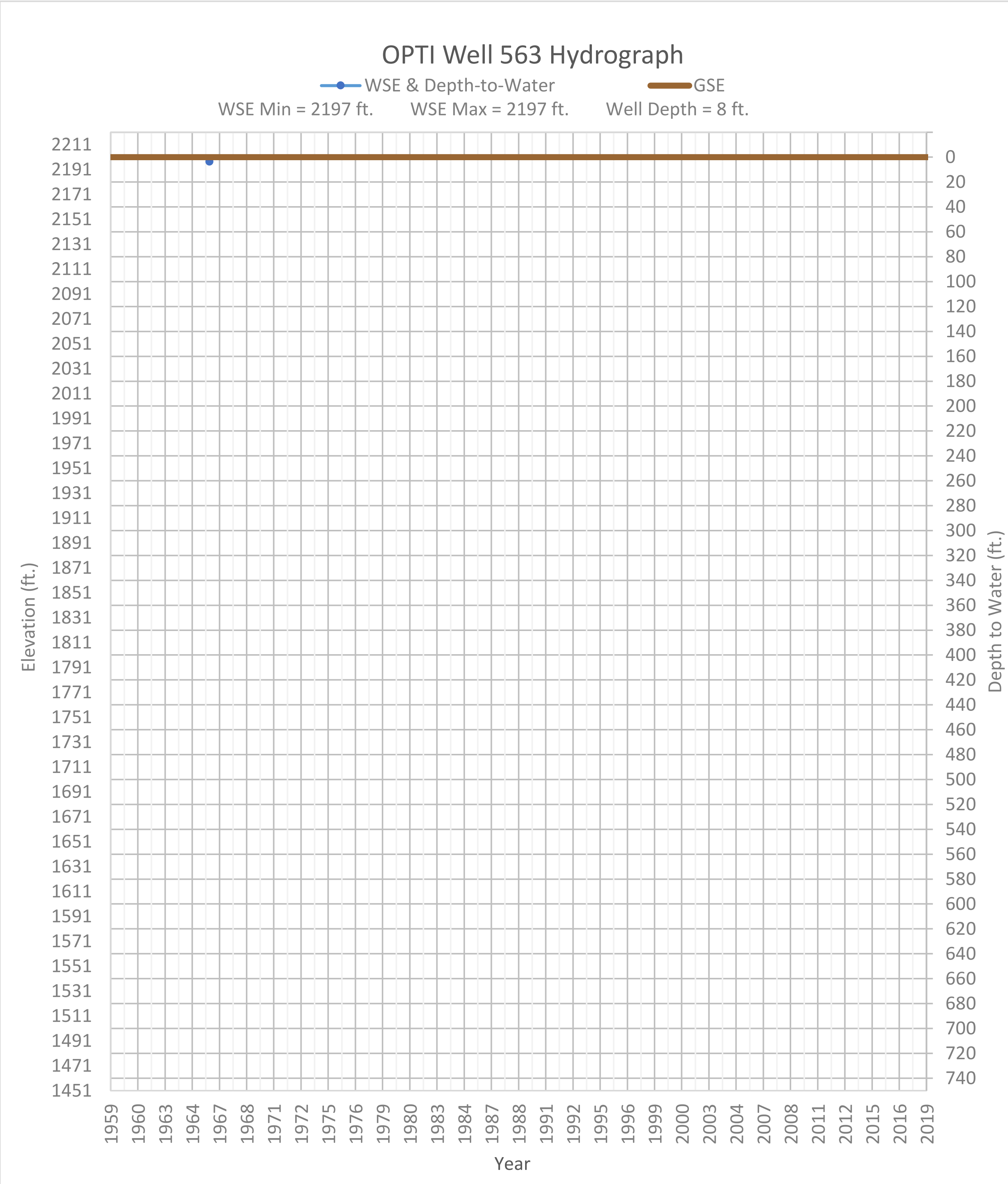
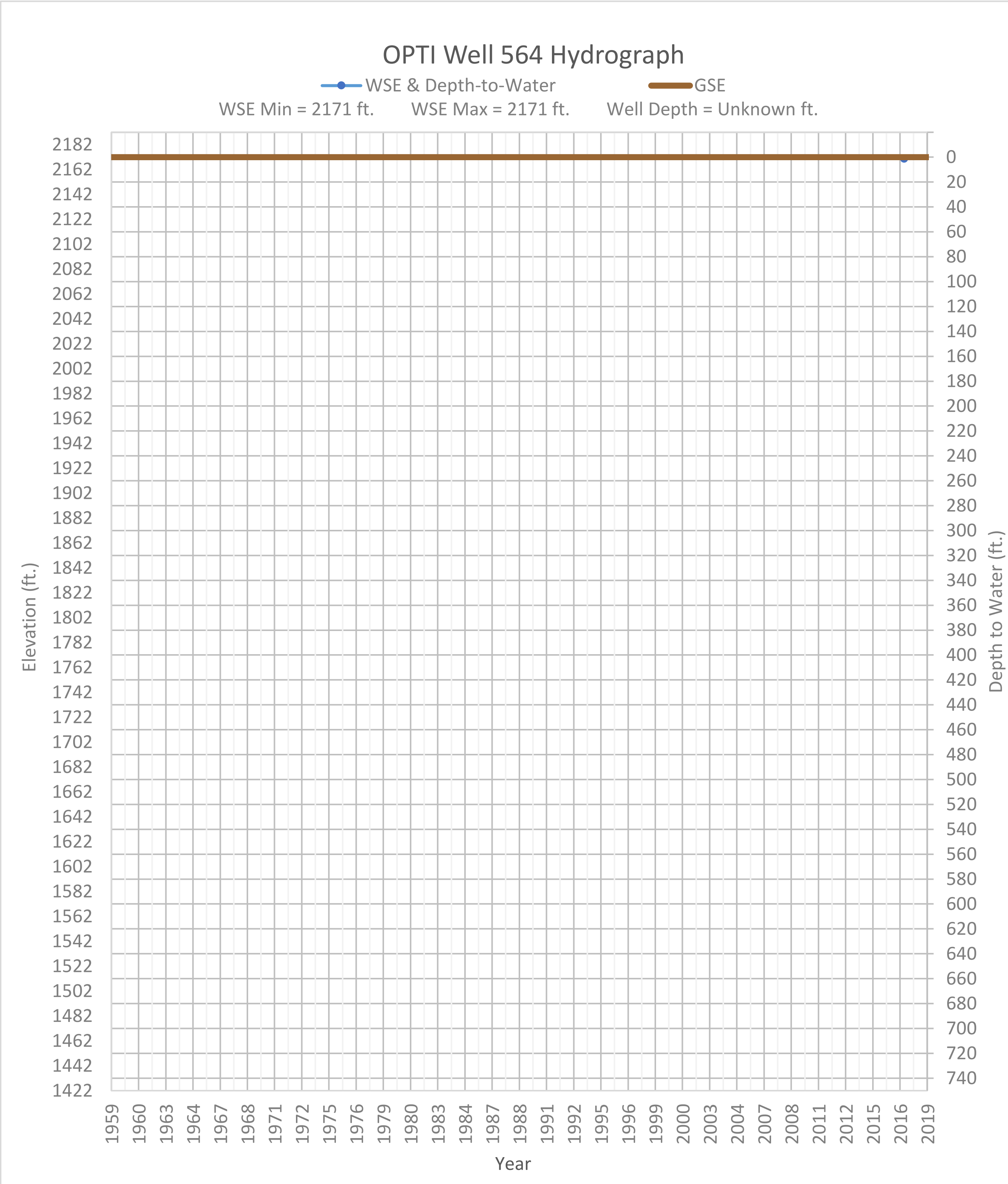
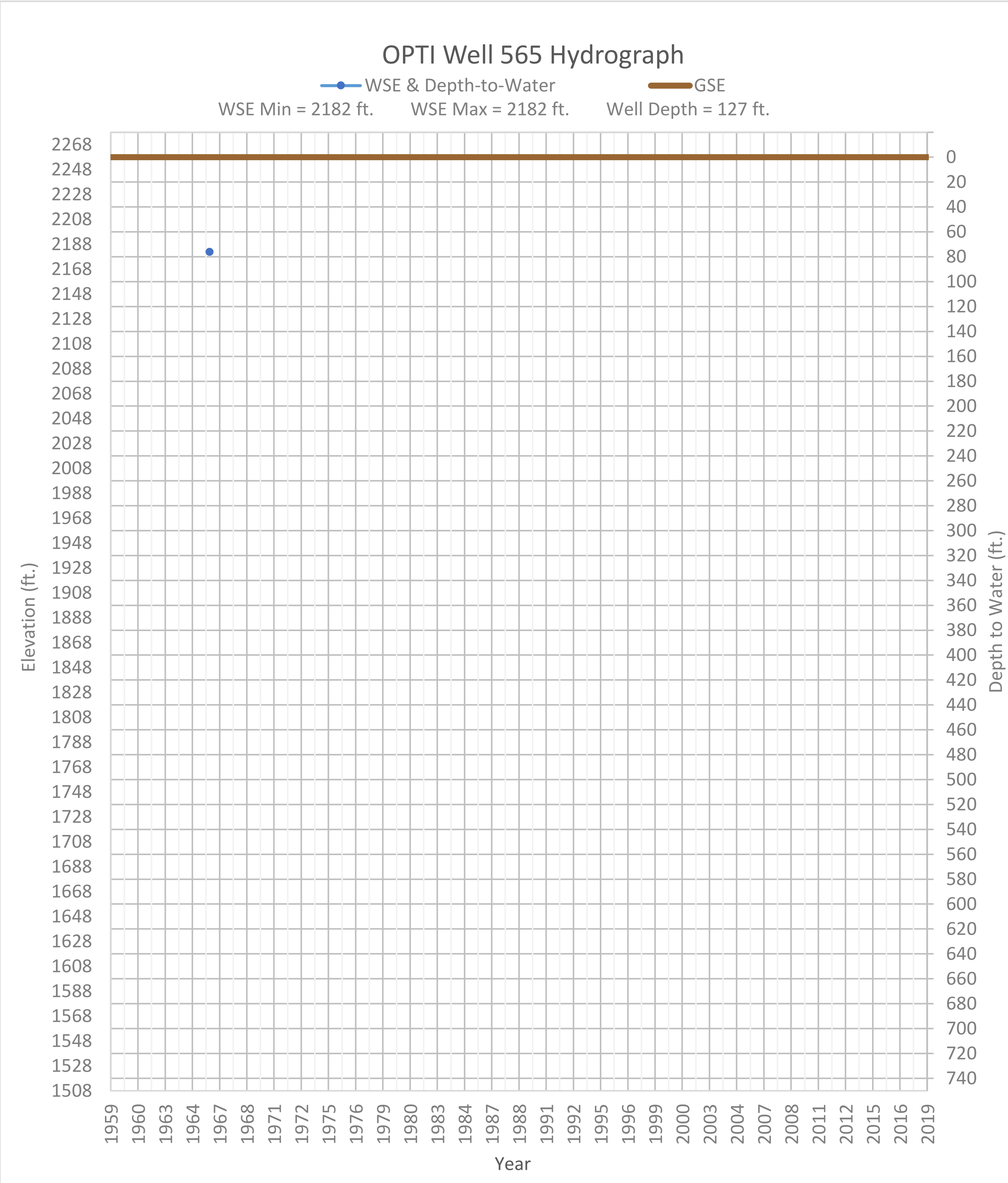

OPTI Well 562 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2167 ft.
WSE Max = 2173 ft.
Well Depth = 309 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

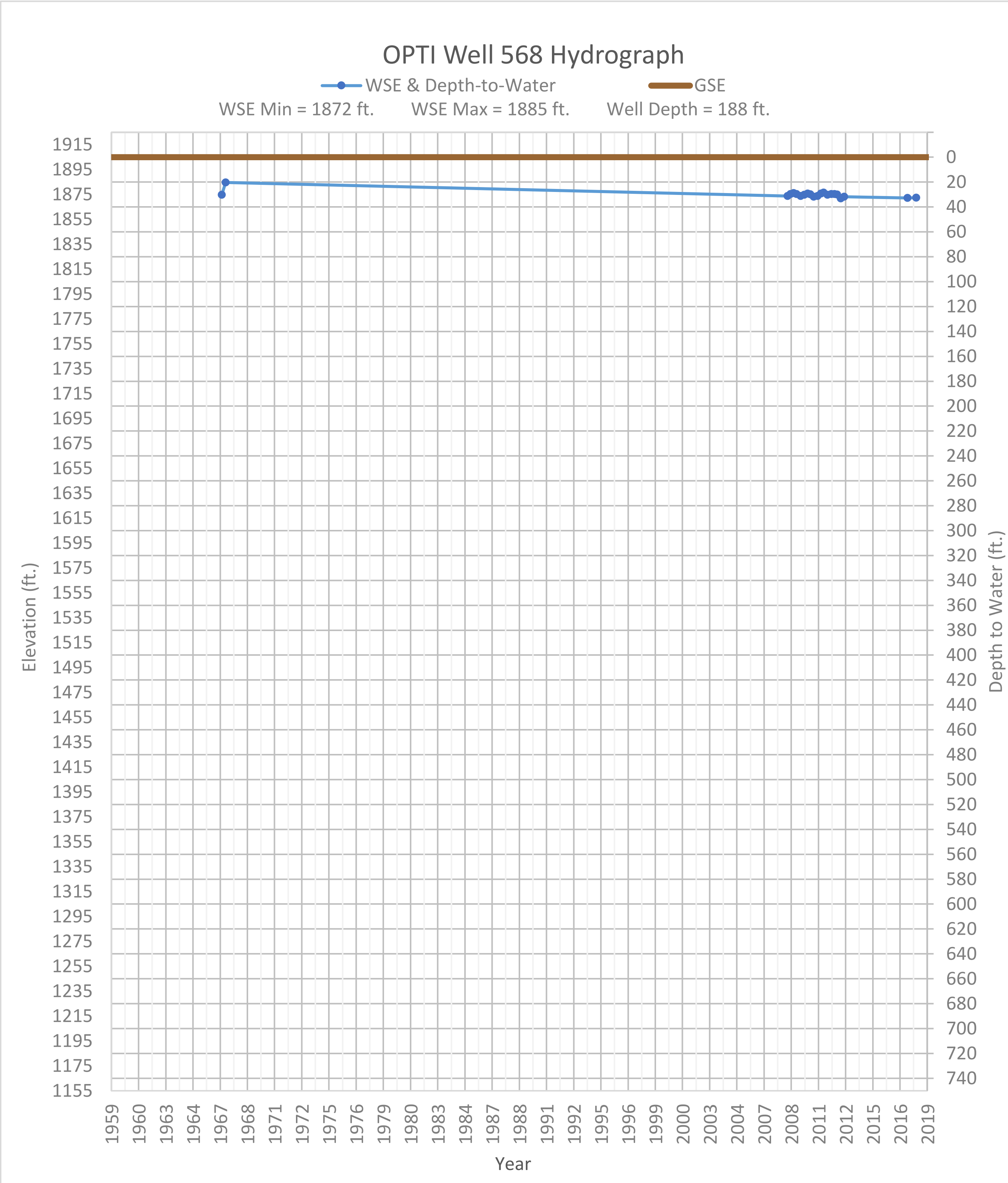

OPTI Well 563 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2197 ft.
WSE Max = 2197 ft.
Well Depth = 8 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



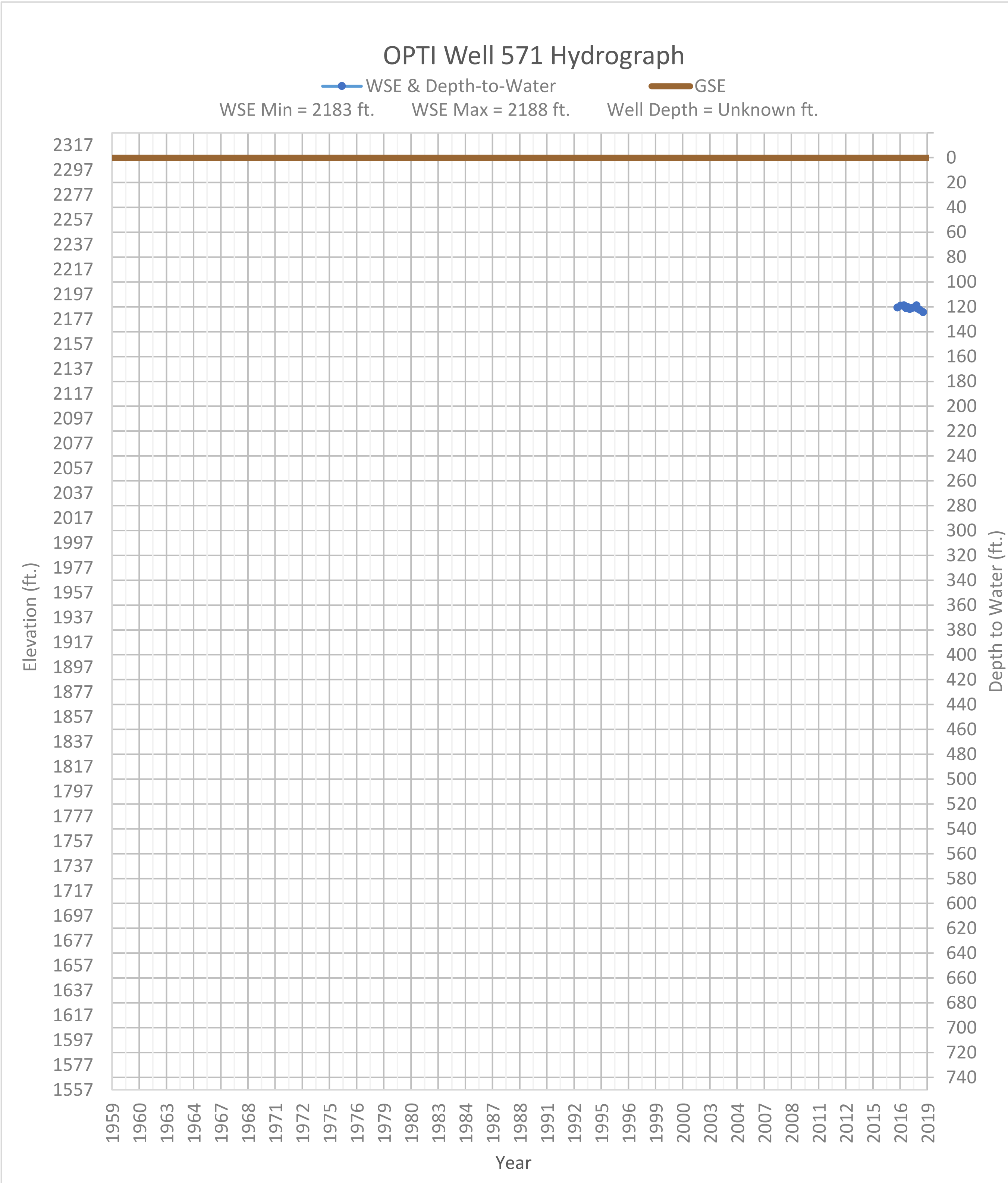
OPTI Well 564 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2171 ft.
WSE Max = 2171 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 565 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2182 ft.
WSE Max = 2182 ft.
Well Depth = 127 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 568 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1872 ft.
WSE Max = 1885 ft.
Well Depth = 188 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 571 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2183 ft.
WSE Max = 2188 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
1837
1817
1797
1777
1757
1737
1717
1697
1677
1657
1637
1617
1597
1577
1557
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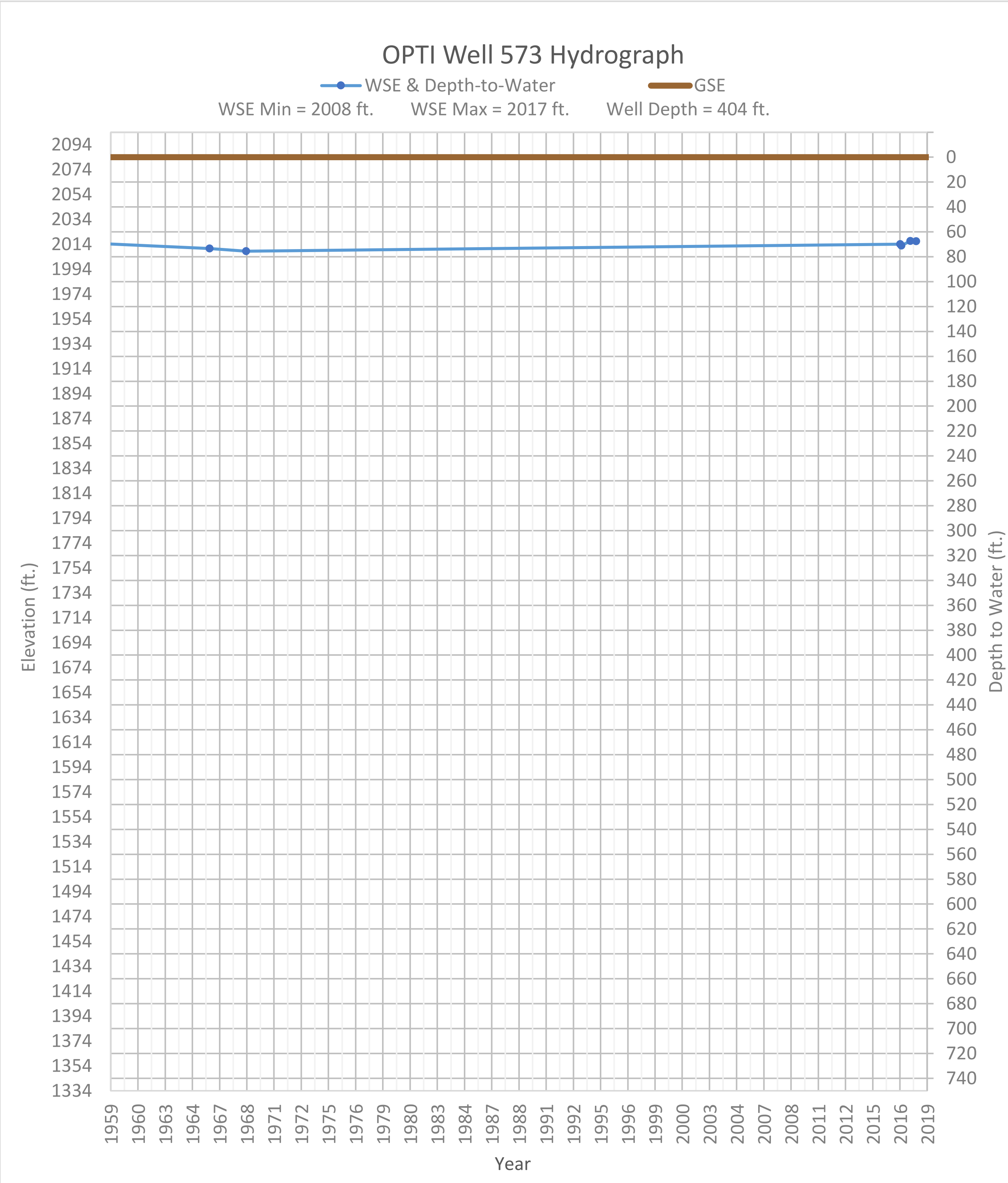
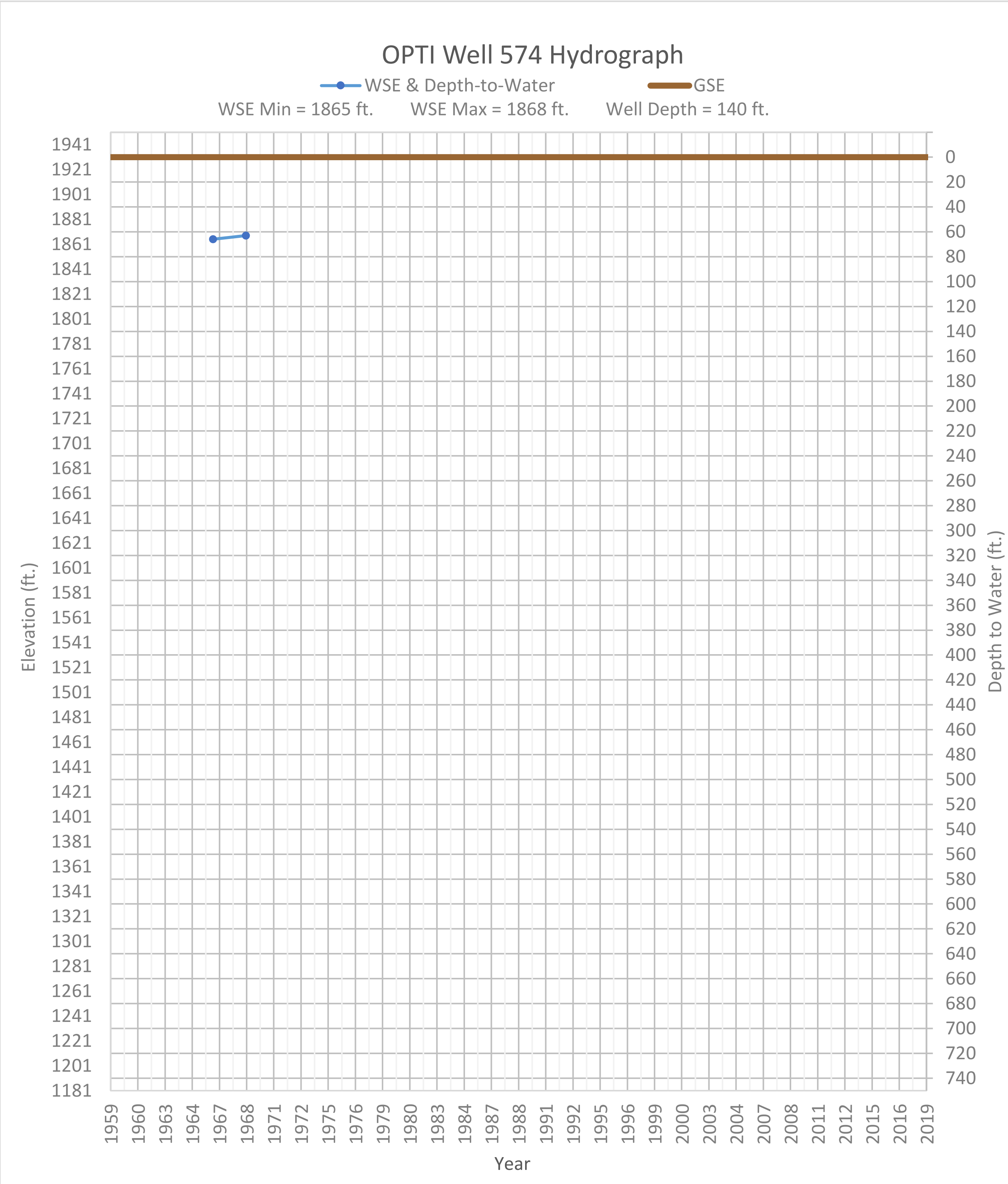
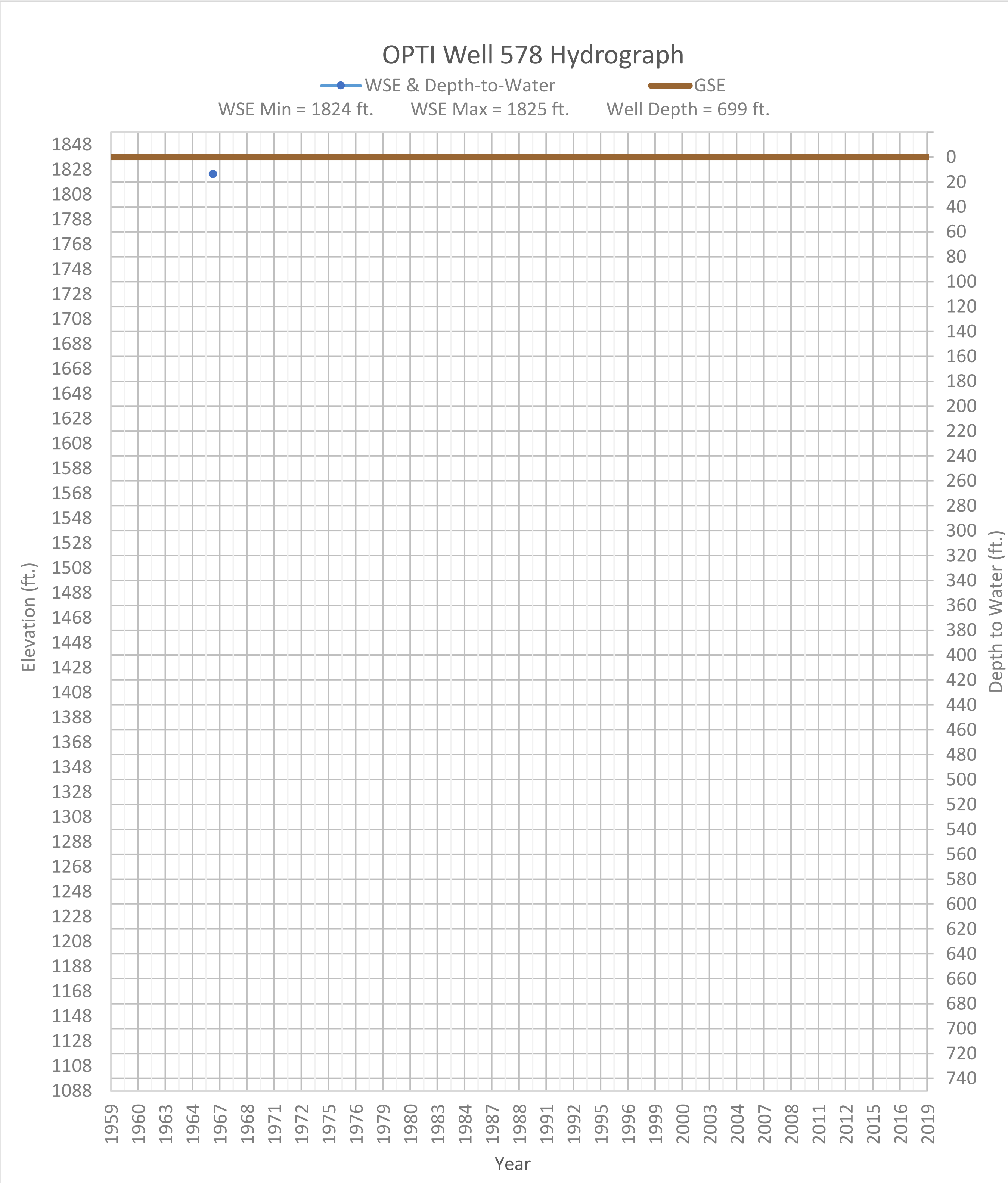

OPTI Well 573 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2008 ft.
WSE Max = 2017 ft.
Well Depth = 404 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 574 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1865 ft.
WSE Max = 1868 ft.
Well Depth = 140 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 578 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1824 ft.
WSE Max = 1825 ft.
Well Depth = 699 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1848
1828
1808
1788
1768
1748
1728
1708
1688
1668
1648
1628
1608
1588
1568
1548
1528
1508
1488
1468
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1208
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1148
1128
1108
1088
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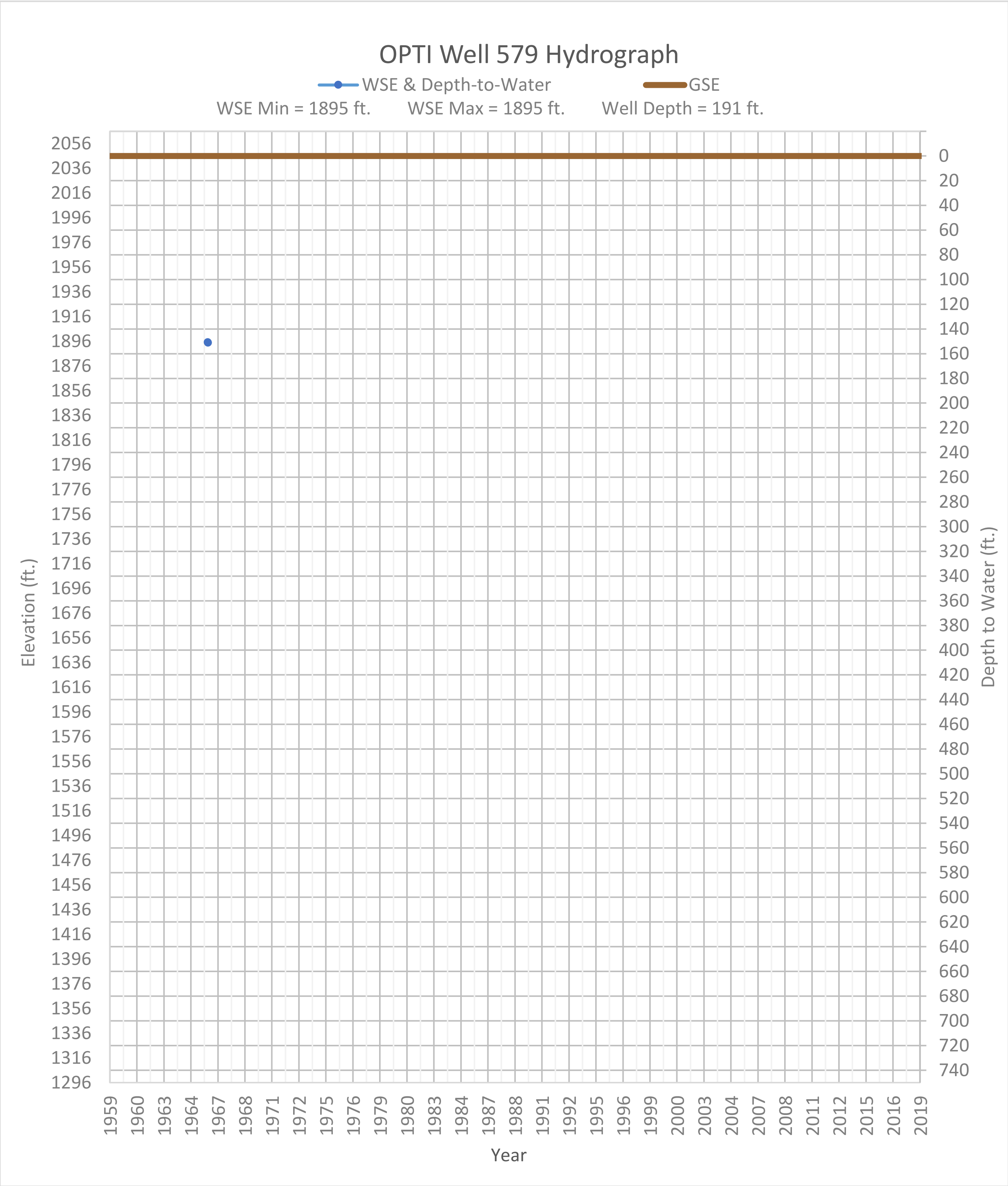
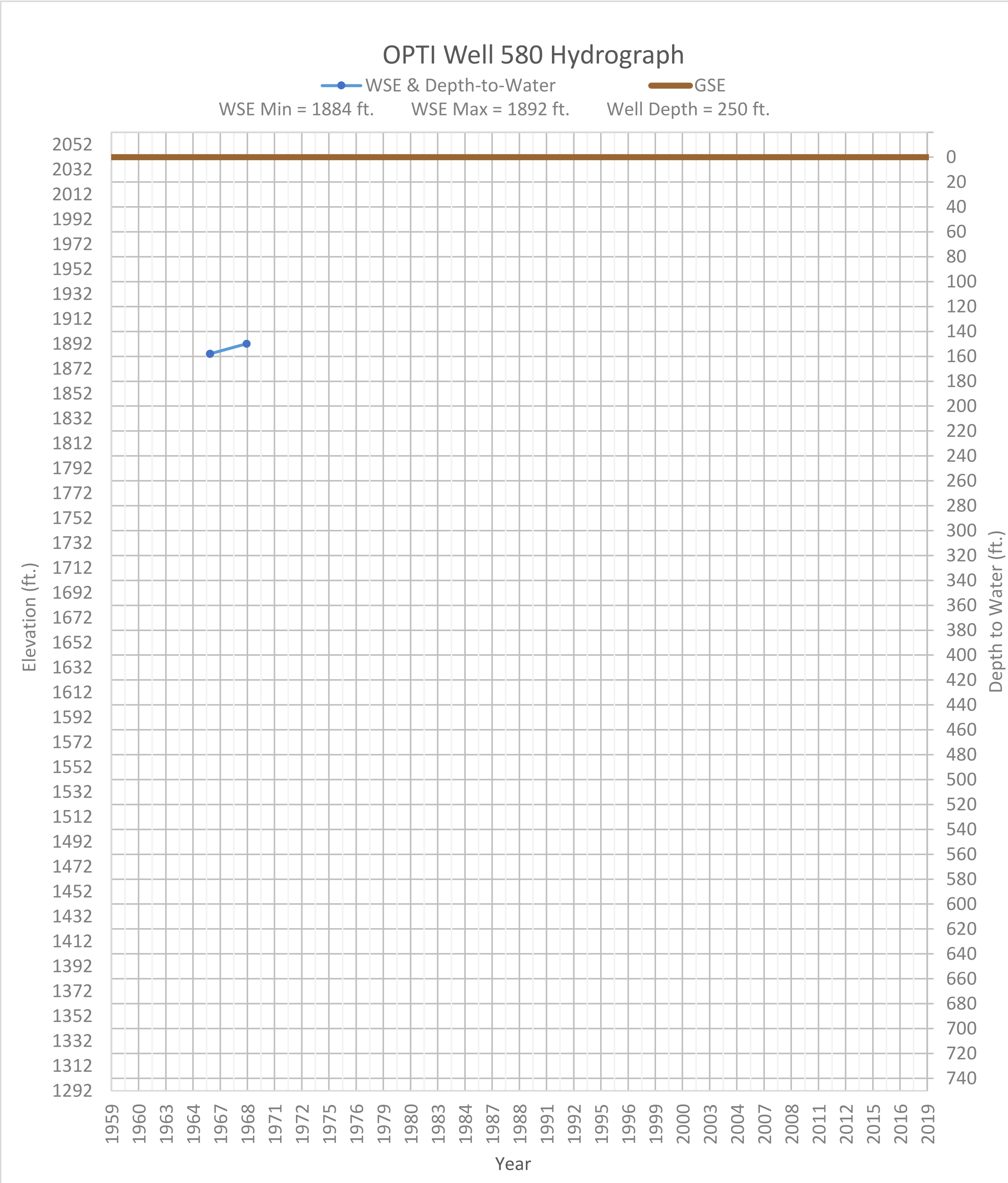

OPTI Well 579 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1895 ft.
WSE Max = 1895 ft.
Well Depth = 191 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 580 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1884 ft.
WSE Max = 1892 ft.
Well Depth = 250 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
1792
1772
1752
1732
1712
1692
1672
1652
1632
1612
1592
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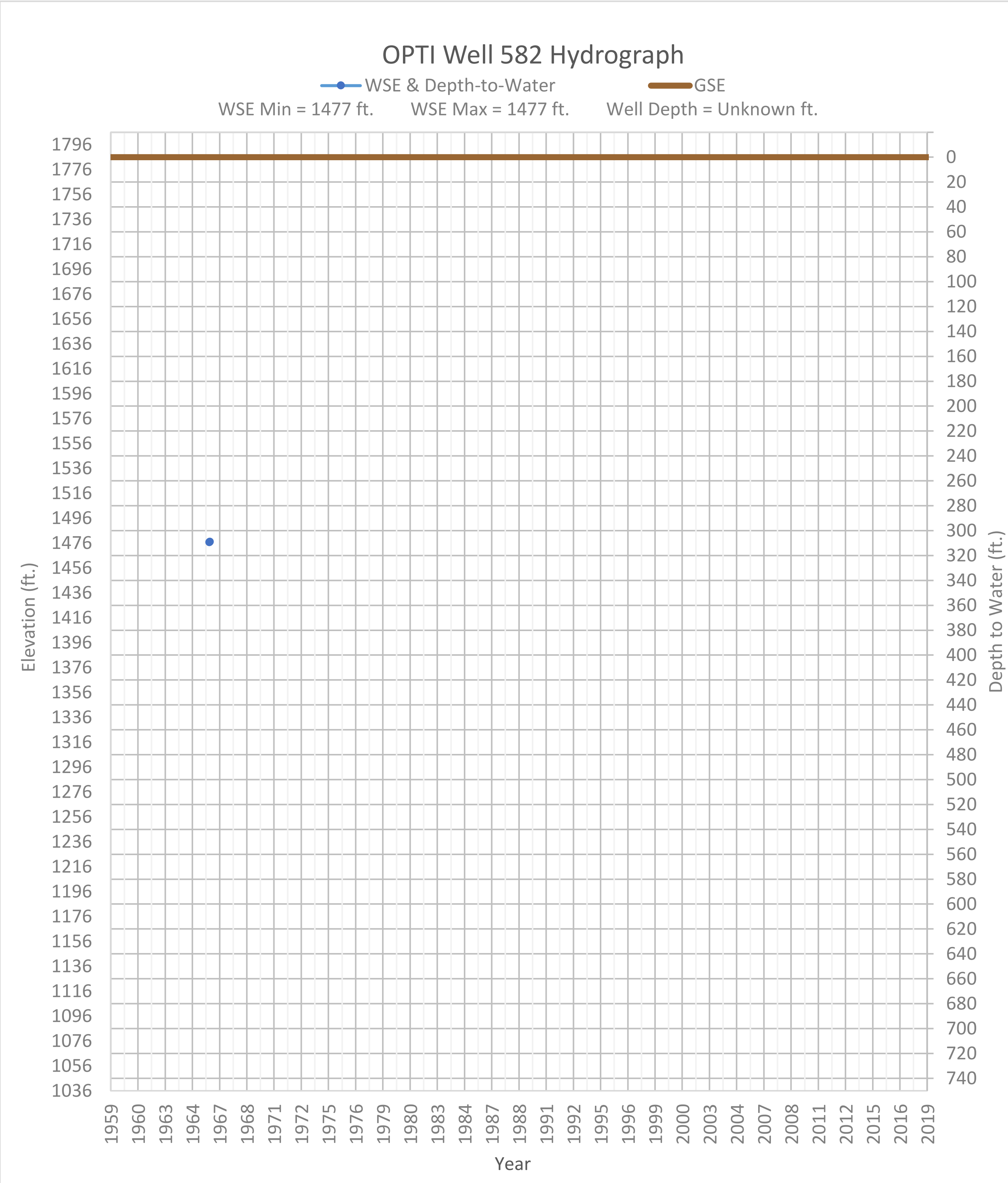
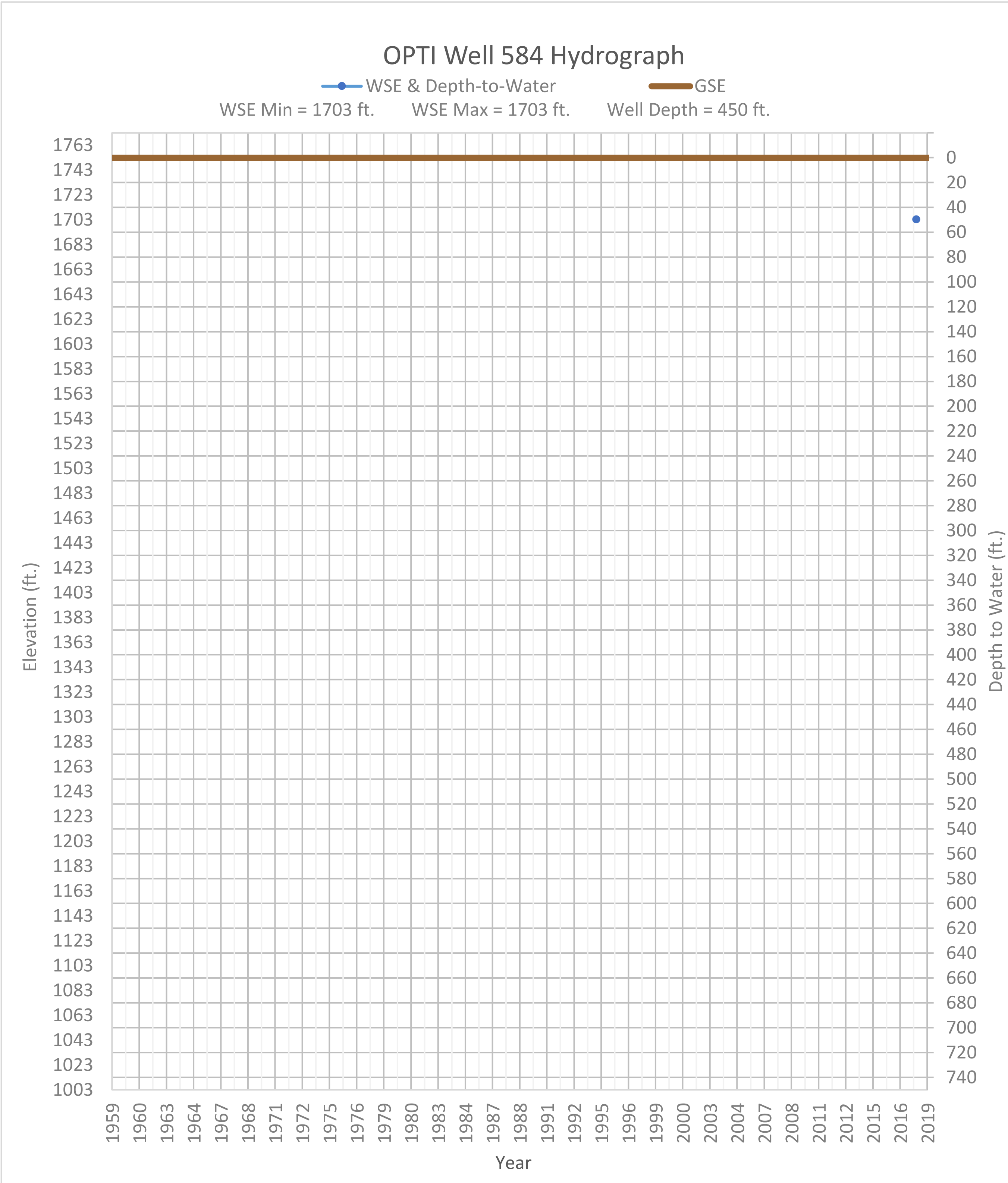


OPTI Well 582 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1477 ft.
WSE Max = 1477 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 584 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1703 ft.
WSE Max = 1703 ft.
Well Depth = 450 ft.
Elevation (ft.)
1763
1743
1723
1703
1683
1663
1643
1623
1603
1583
1563
1543
1523
1503
1483
1463
1443
1423
1403
1383
1363
1343
1323
1303
1283
1263
1243
1223
1203
1183
1163
1143
1123
1103
1083
1063
1043
1023
1003
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
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400
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Year
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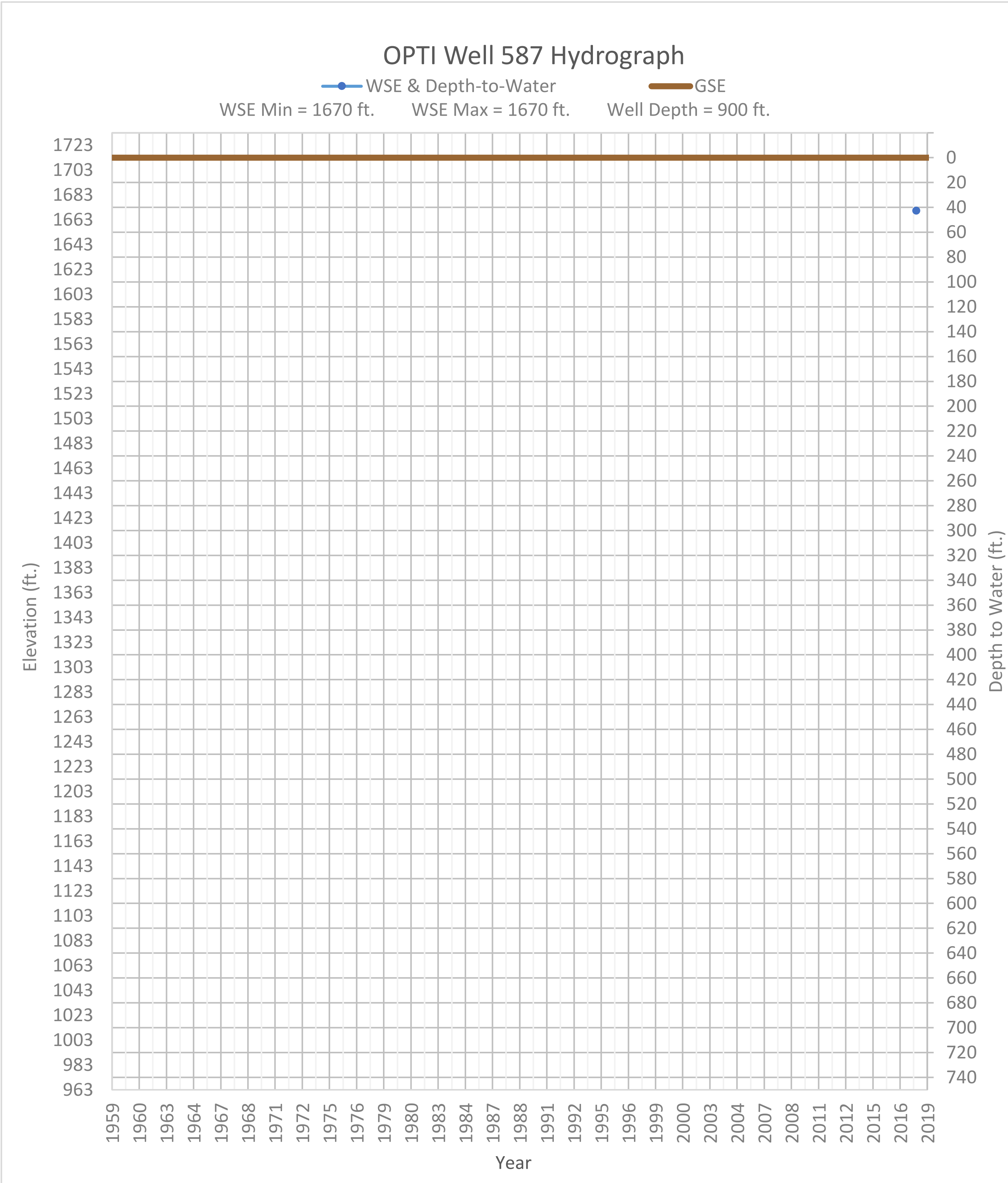
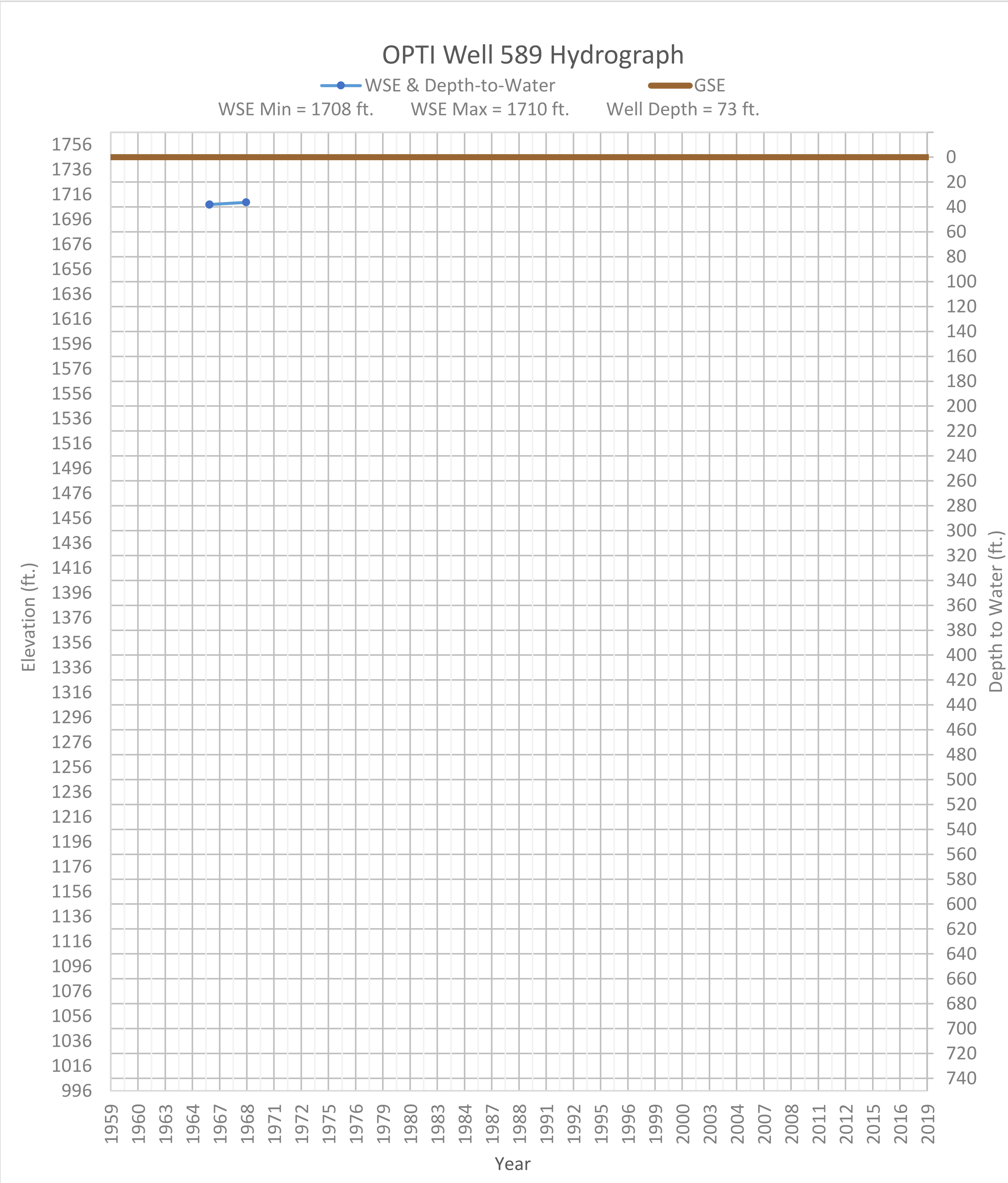


OPTI Well 587 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1670 ft.
WSE Max = 1670 ft.
Well Depth = 900 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 589 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1708 ft.
WSE Max = 1710 ft.
Well Depth = 73 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1756
1736
1716
1696
1676
1656
1636
1616
1596
1576
1556
1536
1516
1496
1476
1456
1436
1416
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1196
1176
1156
1136
1116
1096
1076
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1016
996
0
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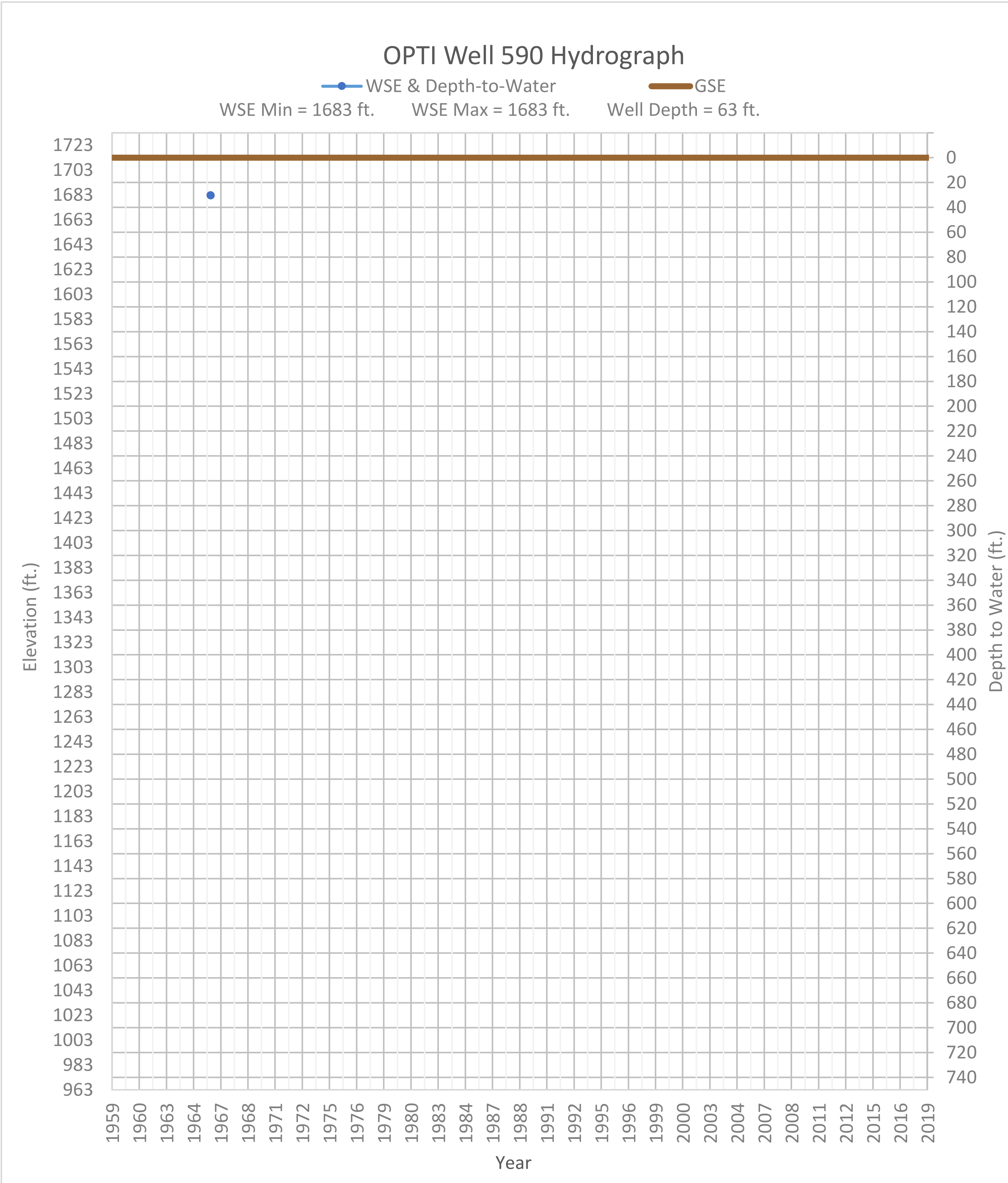
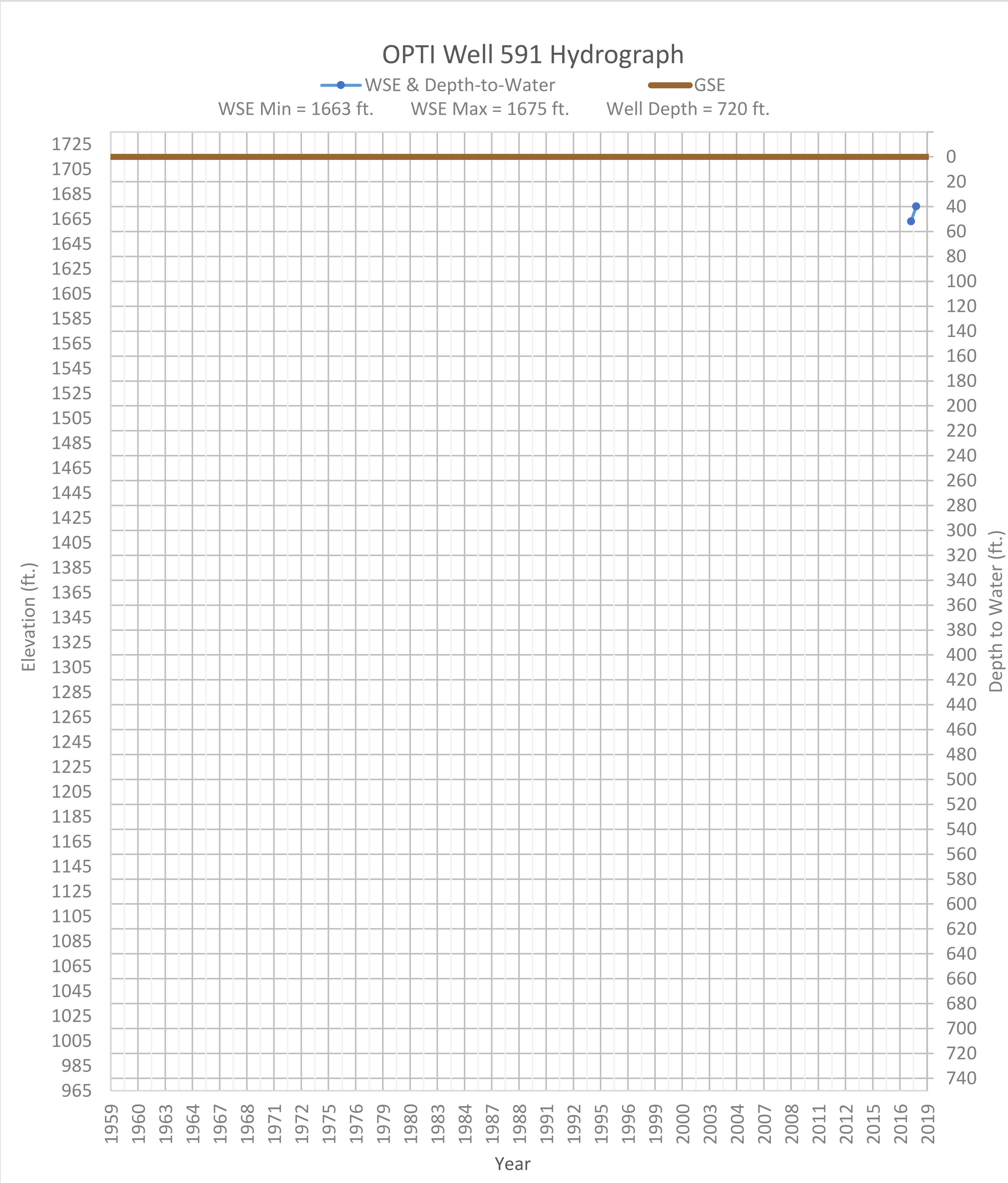

OPTI Well 590 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1683 ft.
WSE Max = 1683 ft.
Well Depth = 63 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 591 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1663 ft.
WSE Max = 1675 ft.
Well Depth = 720 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1725
1705
1685
1665
1645
1625
1605
1585
1565
1545
1525
1505
1485
1465
1445
1425
1405
1385
1365
1345
1325
1305
1285
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1125
1105
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1005
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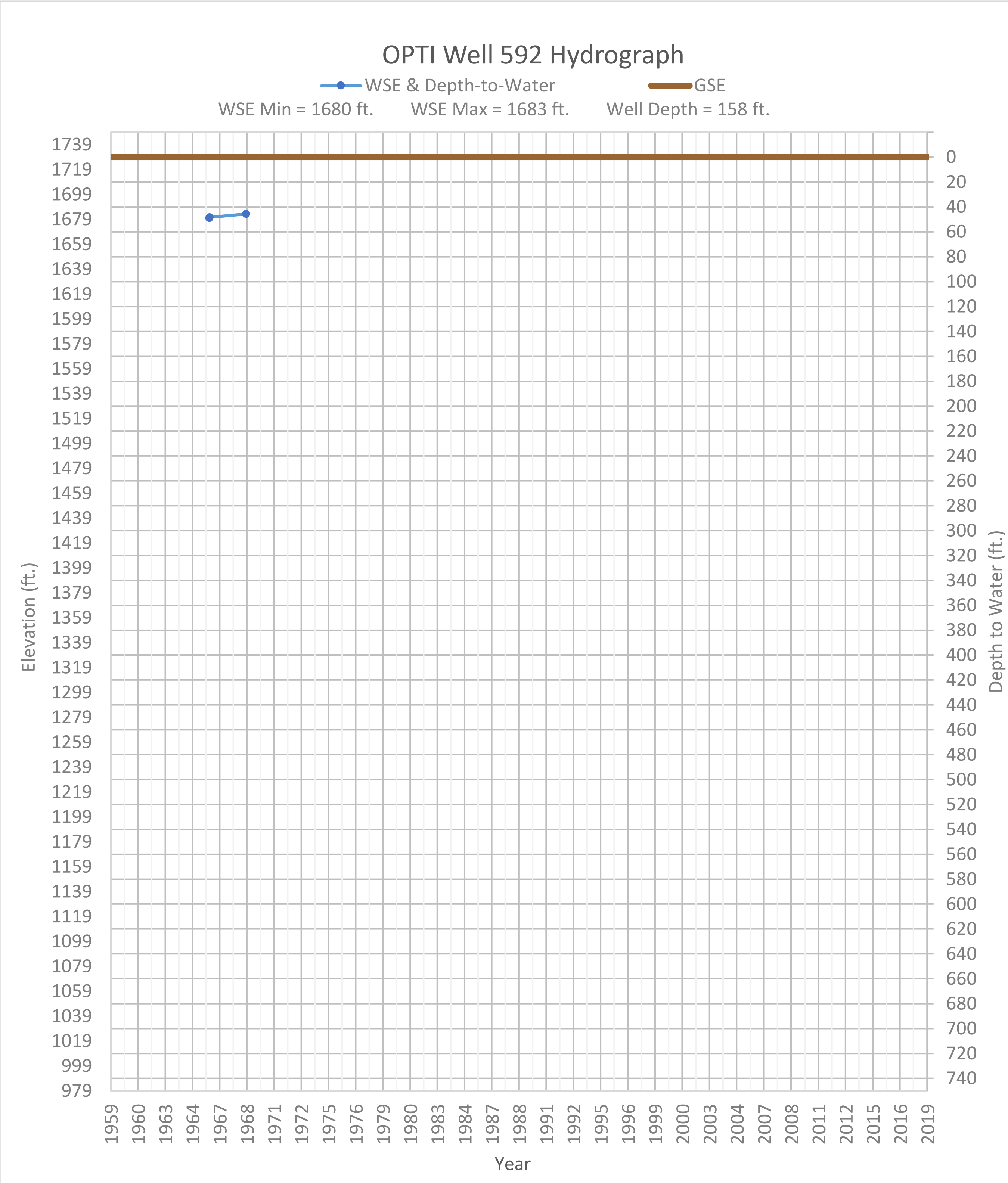
OPTI Well 592 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1680 ft.
WSE Max = 1683 ft.
Well Depth = 158 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1739
1719
1699
1679
1659
1639
1619
1599
1579
1559
1539
1519
1499
1479
1459
1439
1419
1399
1379
1359
1339
1319
1299
1279
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1019
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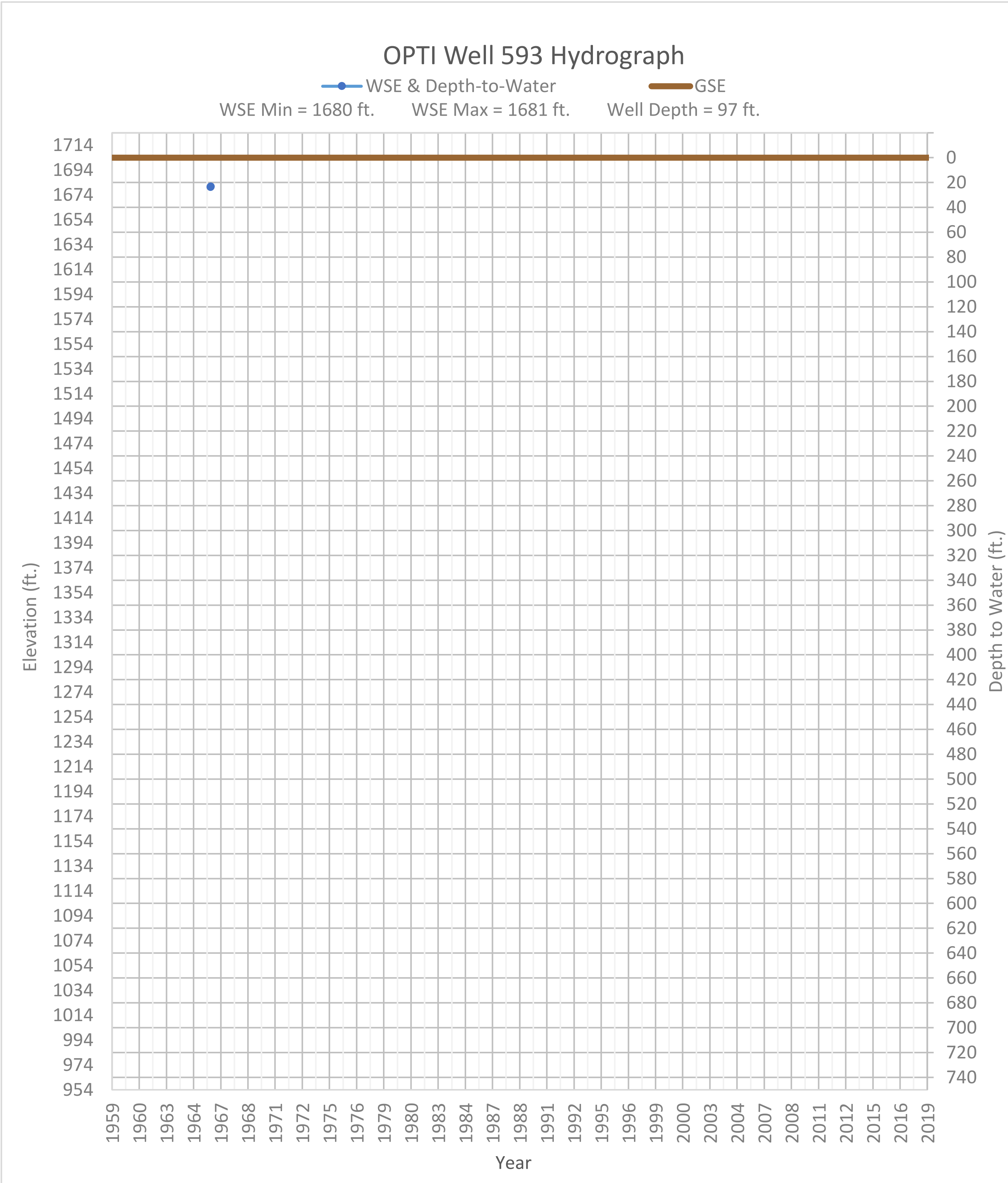
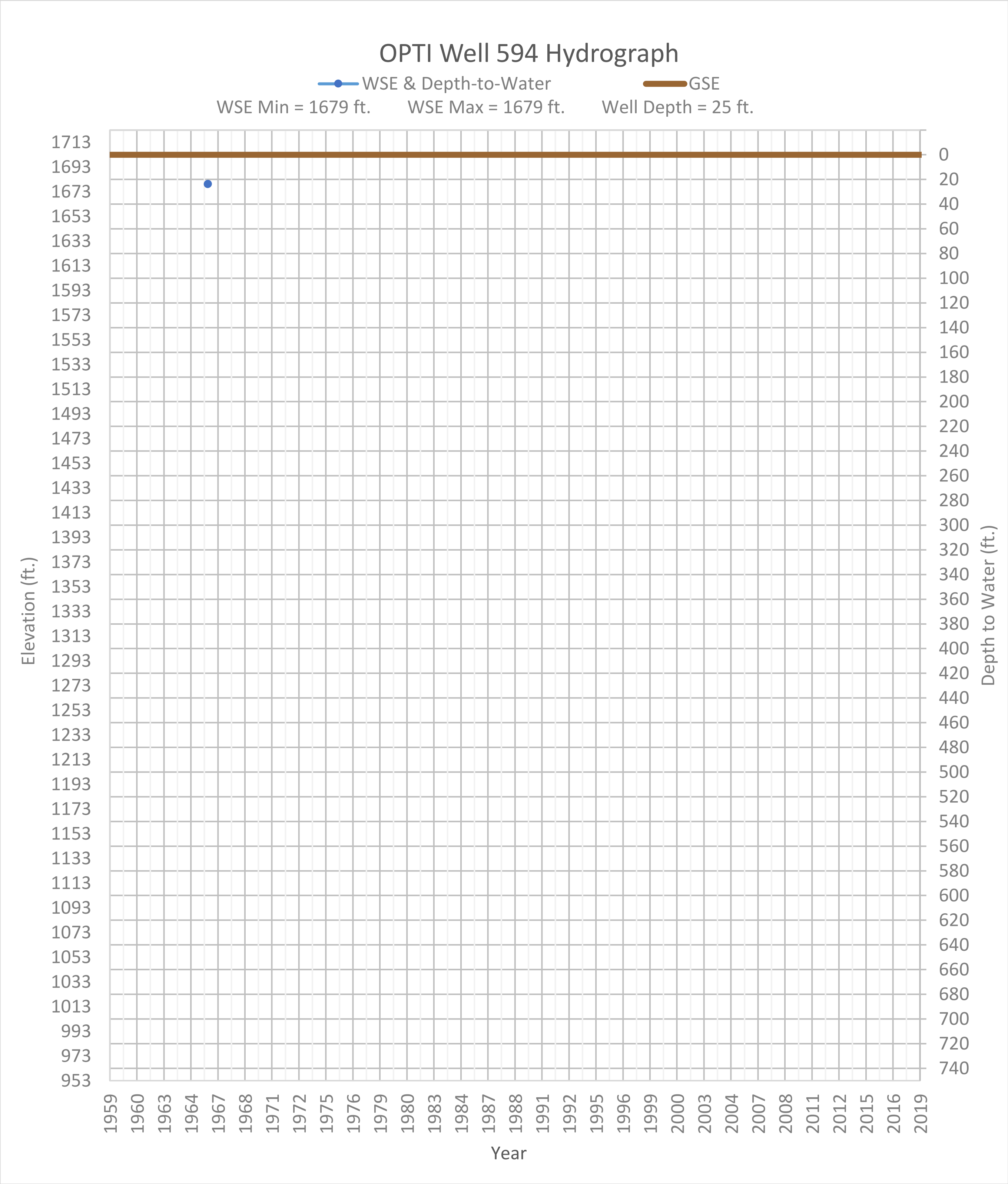
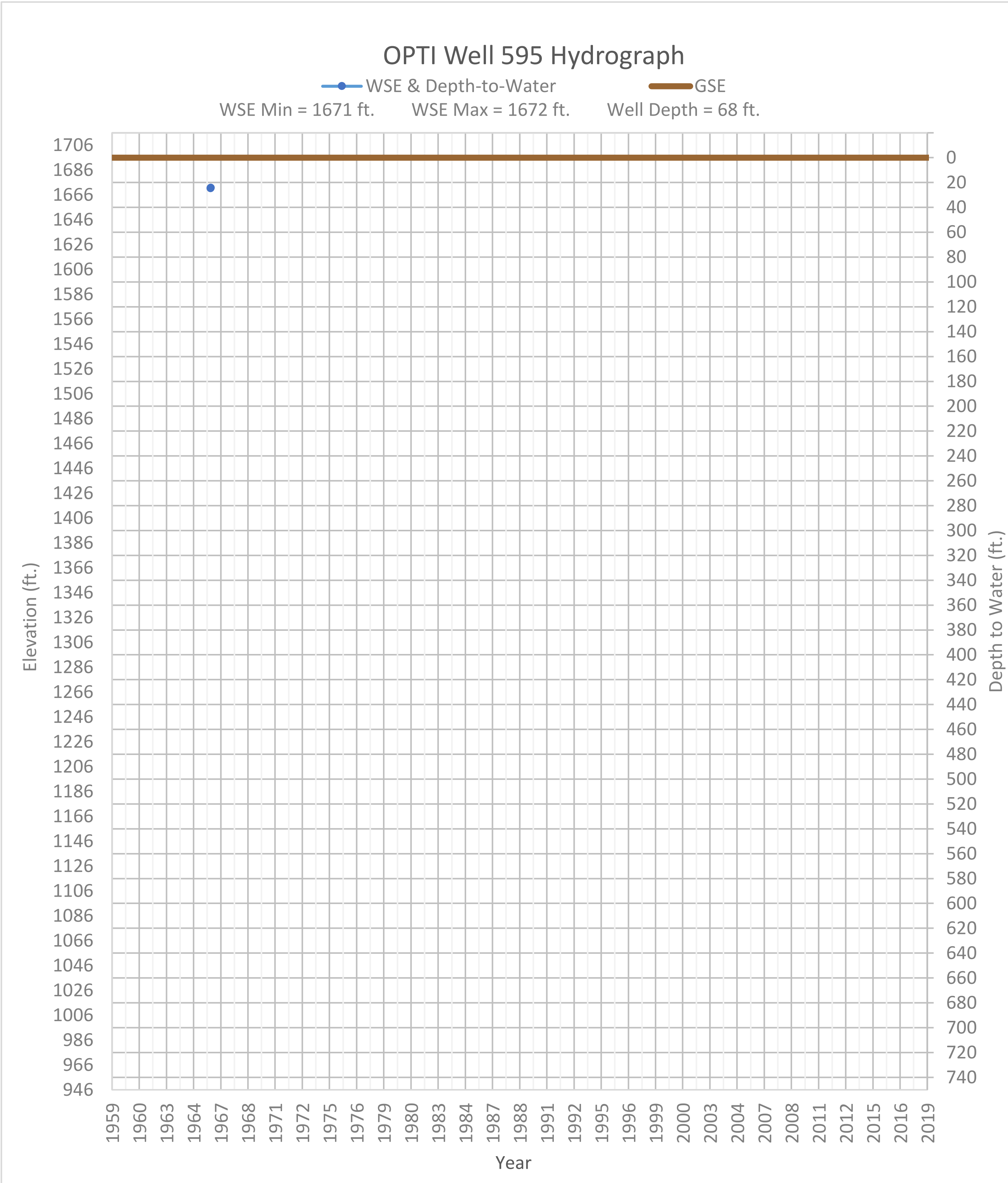
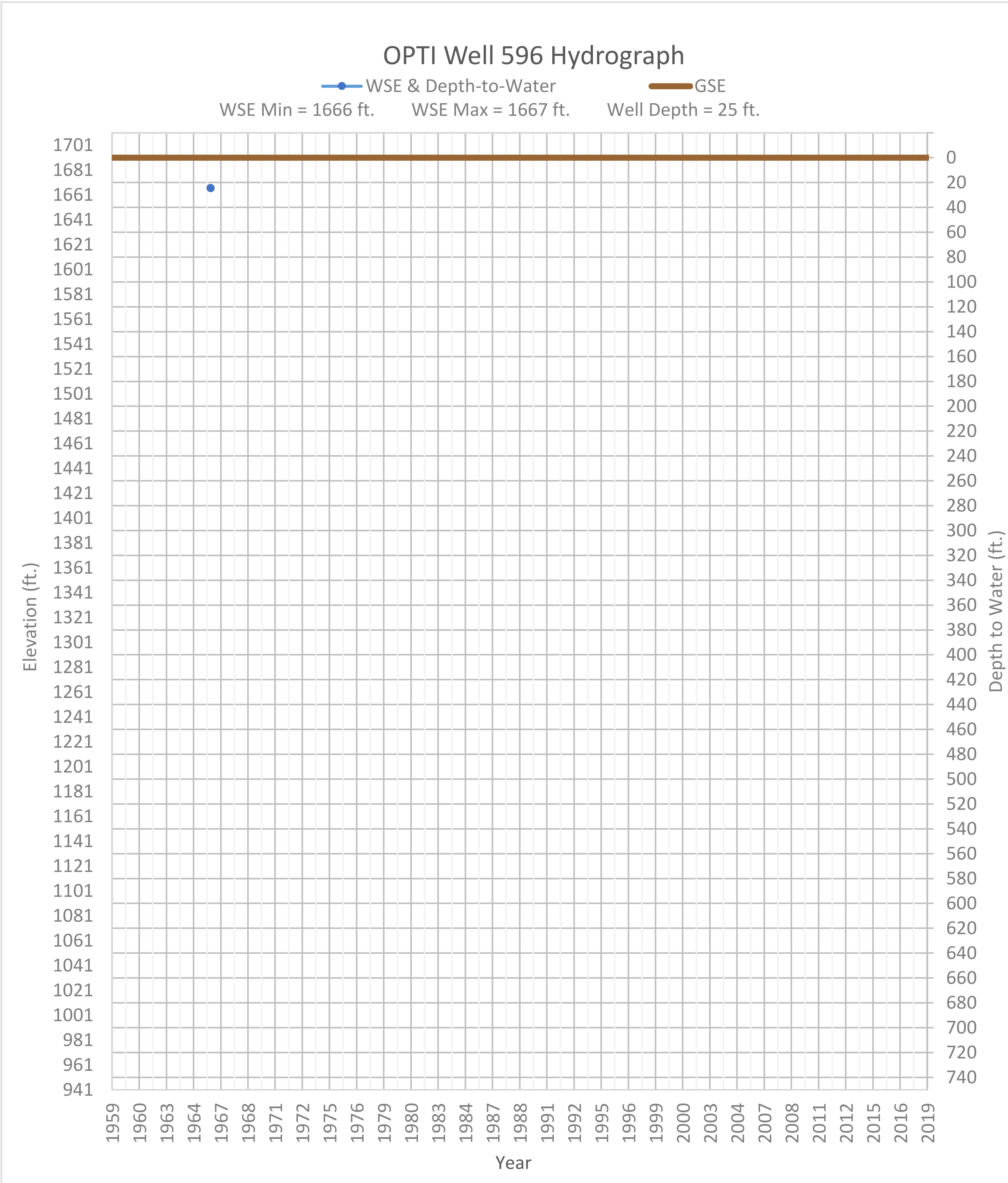


OPTI Well 593 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1680 ft.
WSE Max = 1681 ft.
Well Depth = 97 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 594 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1679 ft.
WSE Max = 1679 ft.
Well Depth = 25 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 595 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1671 ft.
WSE Max = 1672 ft.
Well Depth = 68 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 596 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1666 ft.
WSE Max = 1667 ft.
Well Depth = 25 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1701
1681
1661
1641
1621
1601
1581
1561
1541
1521
1501
1481
1461
1441
1421
1401
1381
1361
1341
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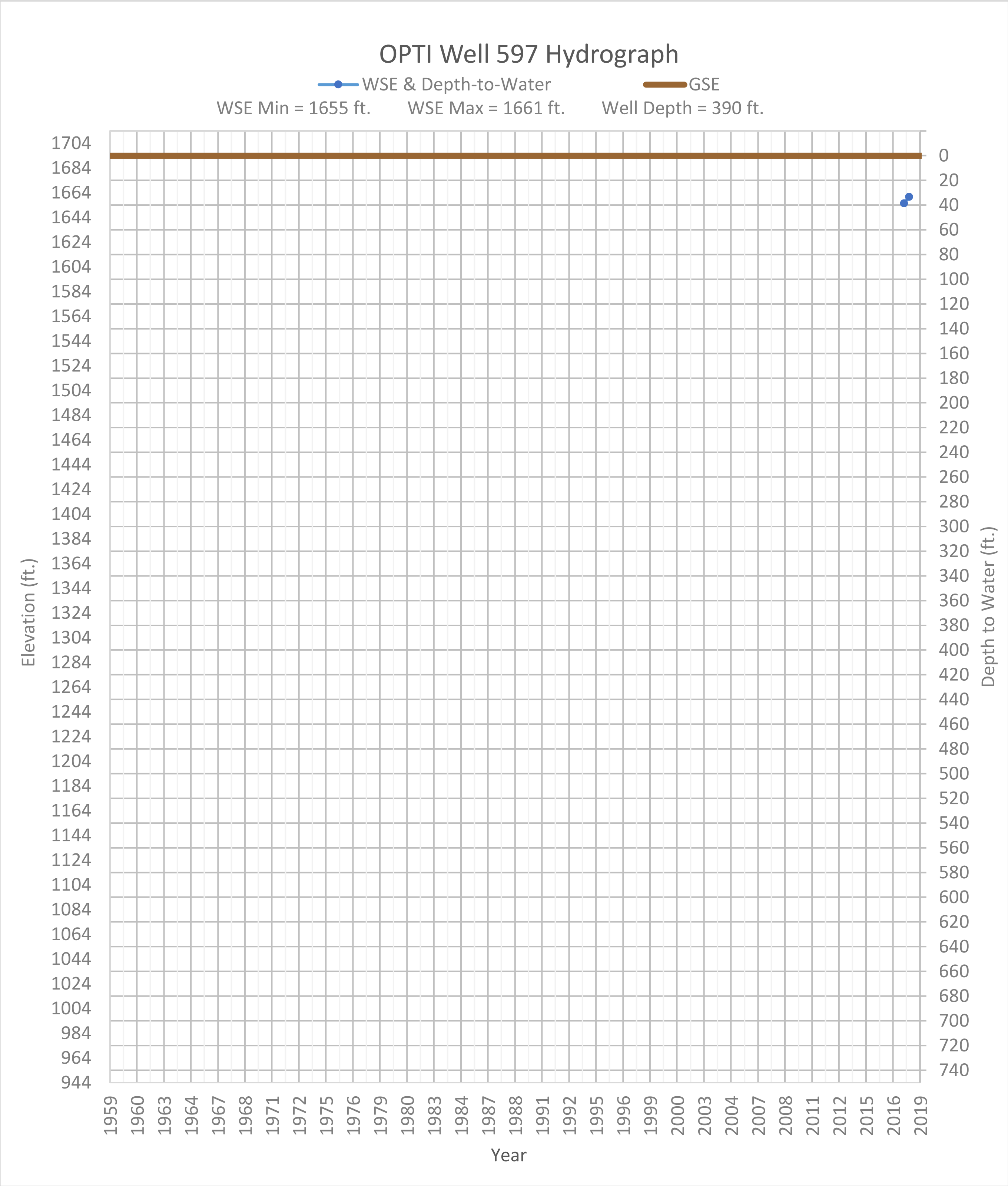

OPTI Well 597 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1655 ft.
WSE Max = 1661 ft.
Well Depth = 390 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 601 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1640 ft.
WSE Max = 2056 ft.
Well Depth = 723 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
1764
1744
1724
1704
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1564
1544
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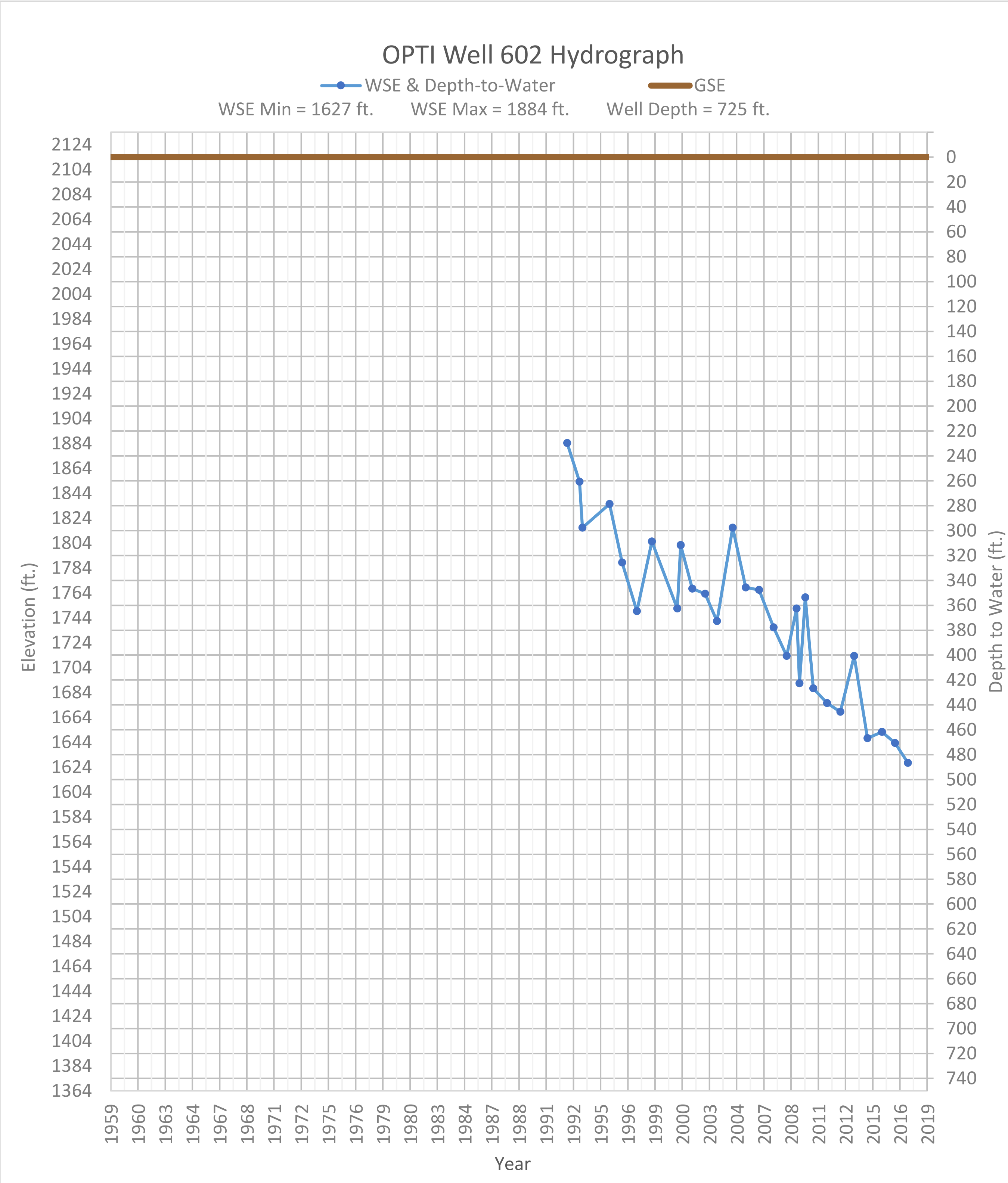
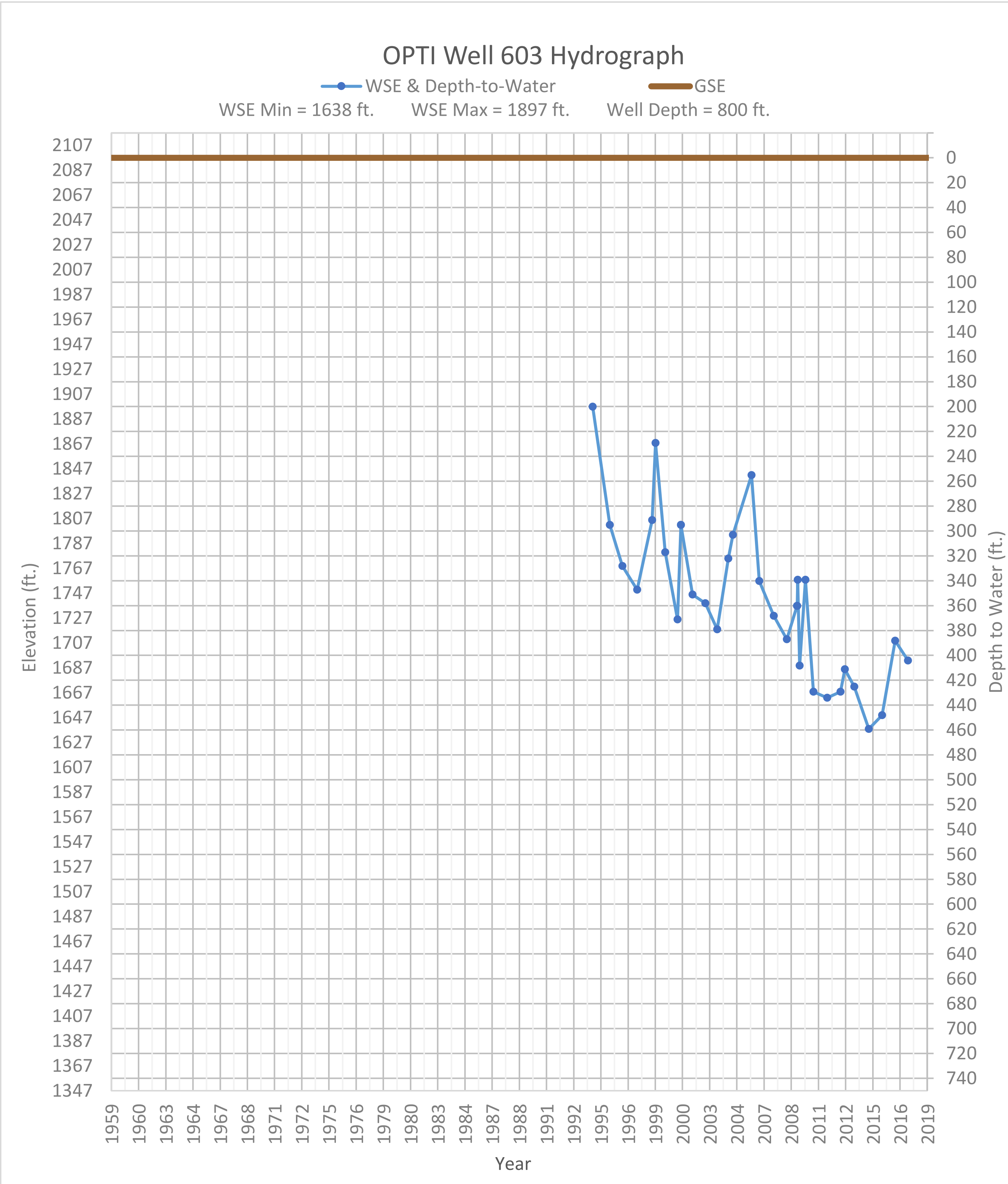


OPTI Well 602 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1627 ft.
WSE Max = 1884 ft.
Well Depth = 725 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 603 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1638 ft.
WSE Max = 1897 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2107
2087
2067
2047
2027
2007
1987
1967
1947
1927
1907
1887
1867
1847
1827
1807
1787
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2016
2019

OPTI Well 604 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1607 ft.
WSE Max = 1844 ft.
Well Depth = 924 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2135
2115
2095
2075
2055
2035
2015
1995
1975
1955
1935
1915
1895
1875
1855
1835
1815
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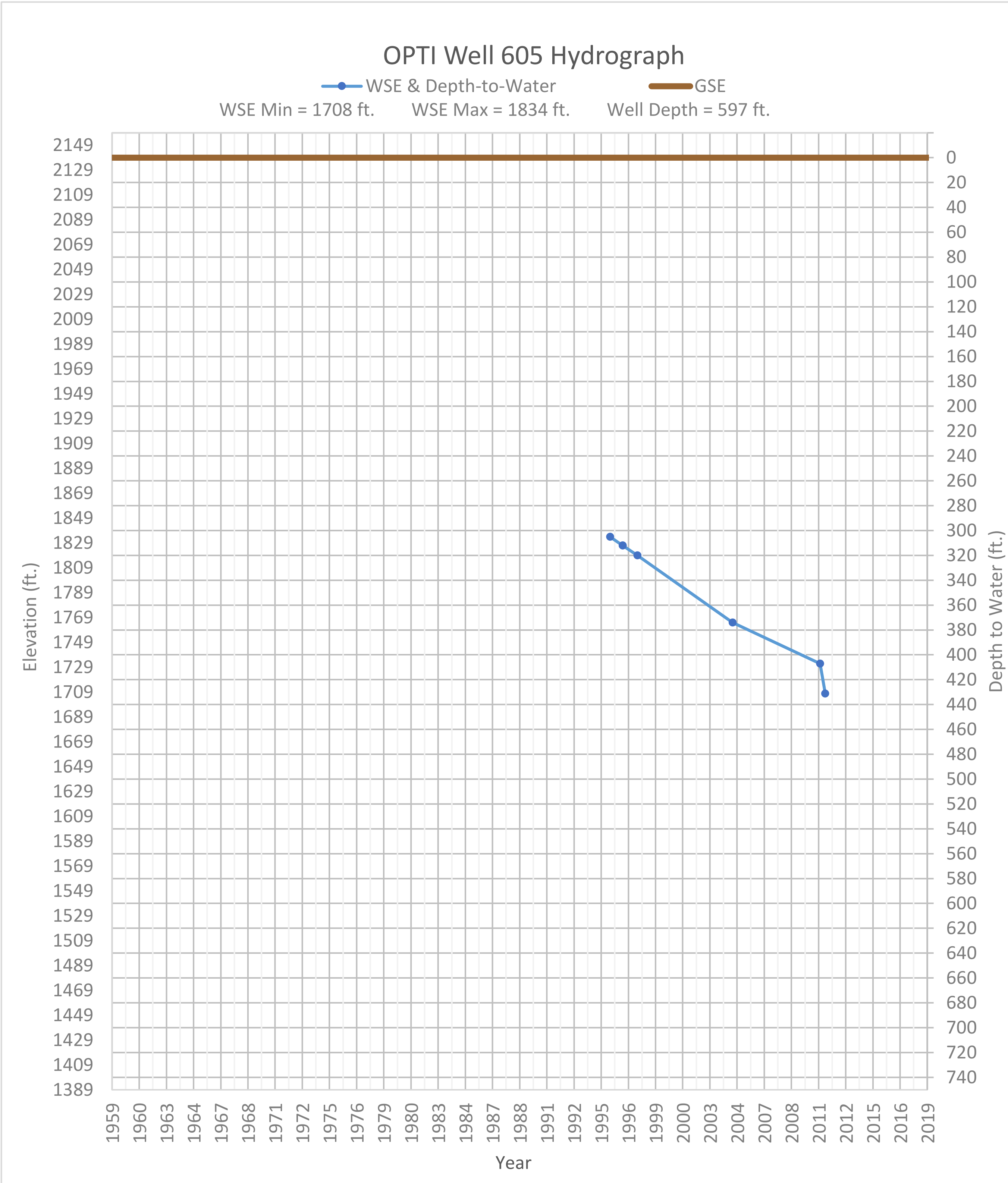
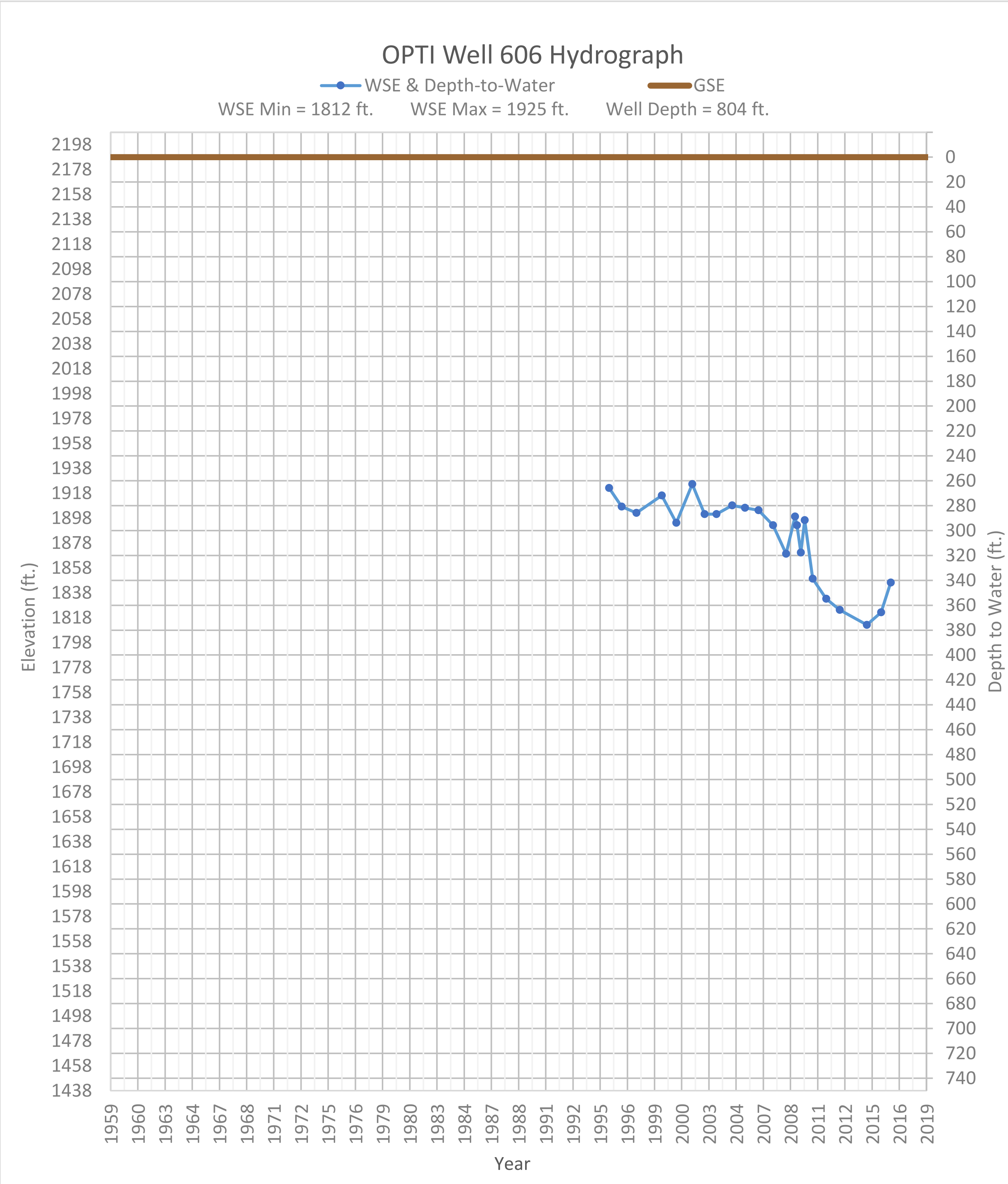


OPTI Well 605 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1708 ft.
WSE Max = 1834 ft.
Well Depth = 597 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 606 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1812 ft.
WSE Max = 1925 ft.
Well Depth = 804 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 607 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1751 ft.
WSE Max = 1925 ft.
Well Depth = 775 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019


OPTI Well 608 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1789 ft.
WSE Max = 1954 ft.
Well Depth = 745 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
1754
1734
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OPTI Well 609 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1721 ft.
WSE Max = 1937 ft.
Well Depth = 970 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
1837
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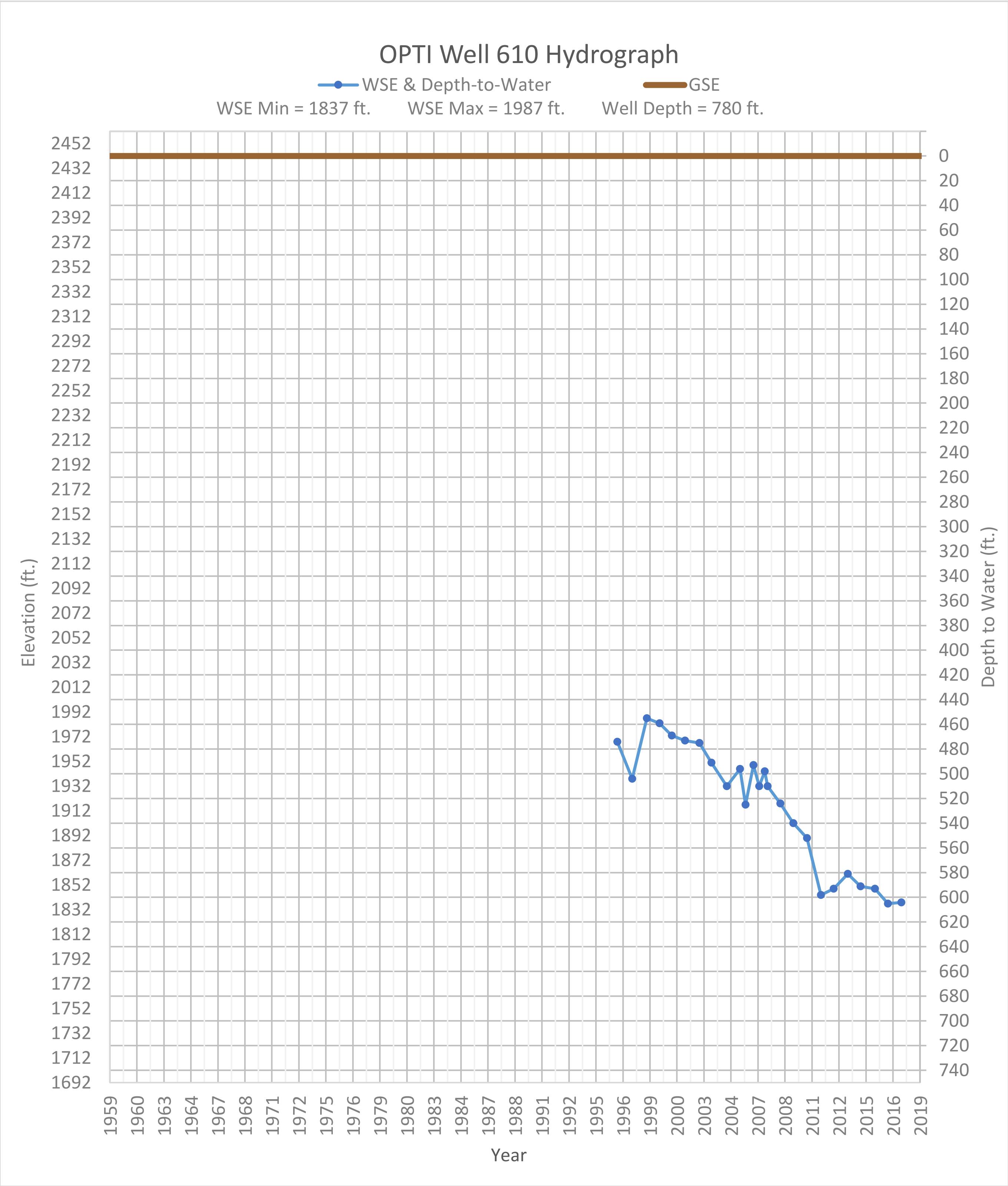
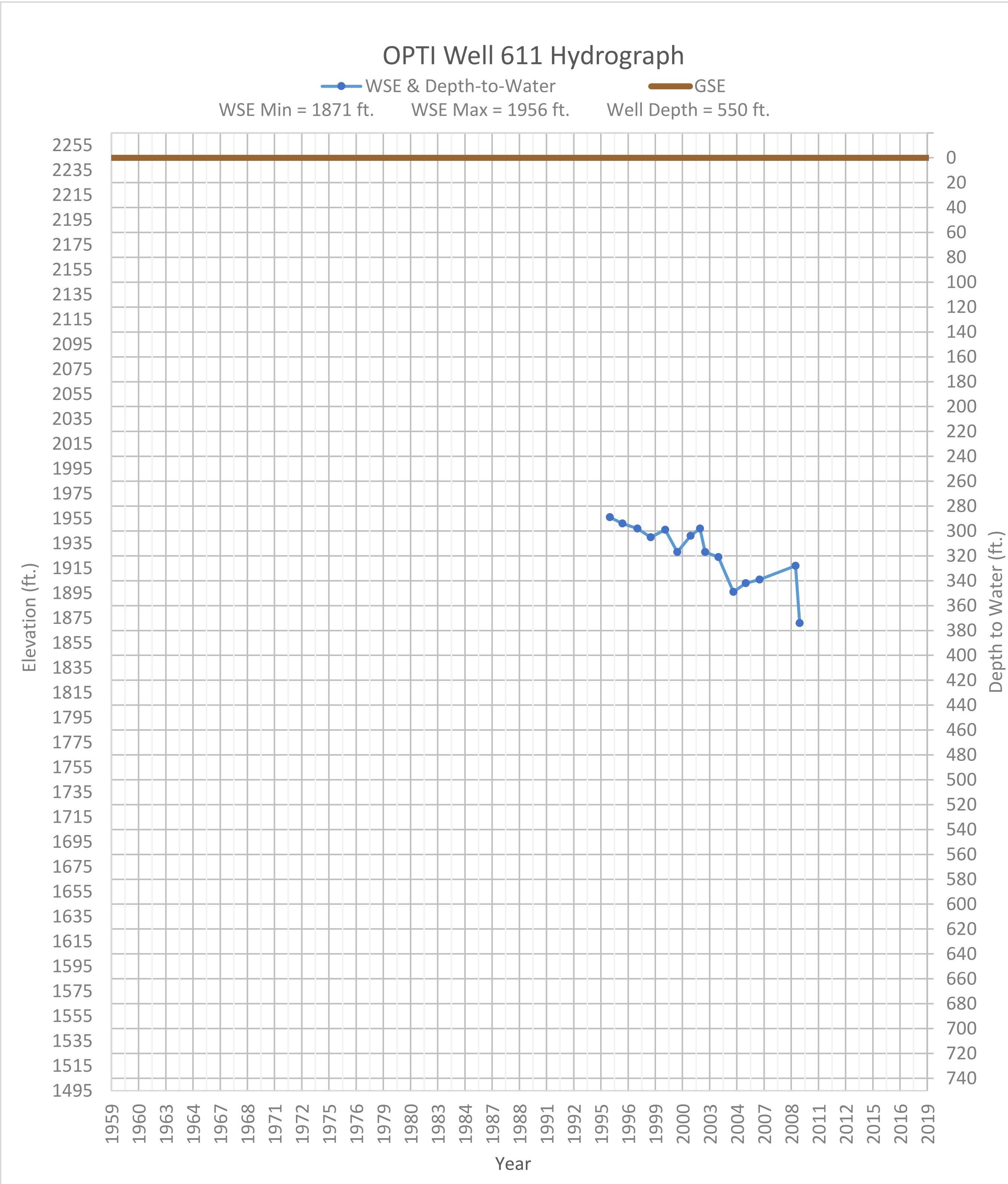
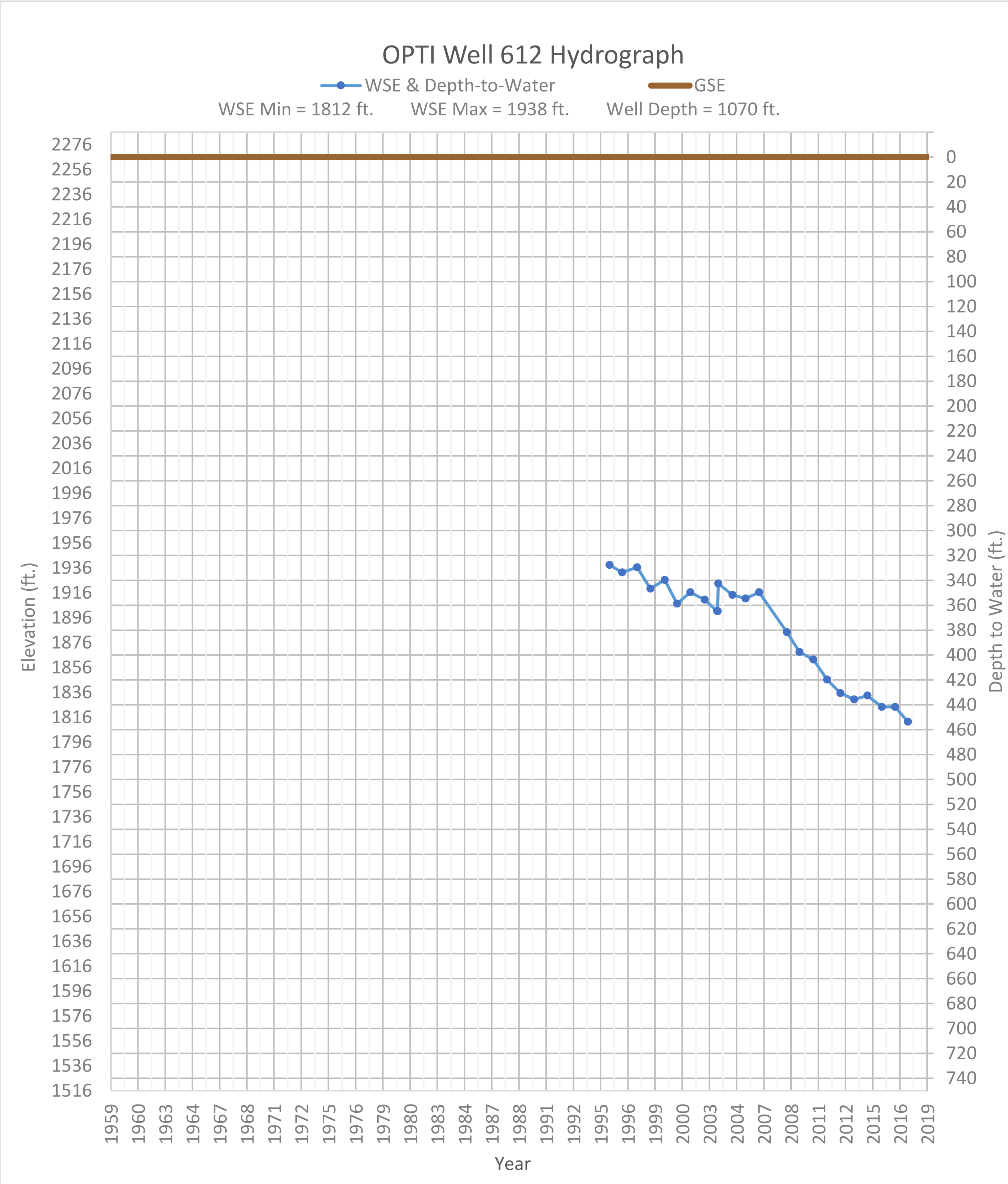


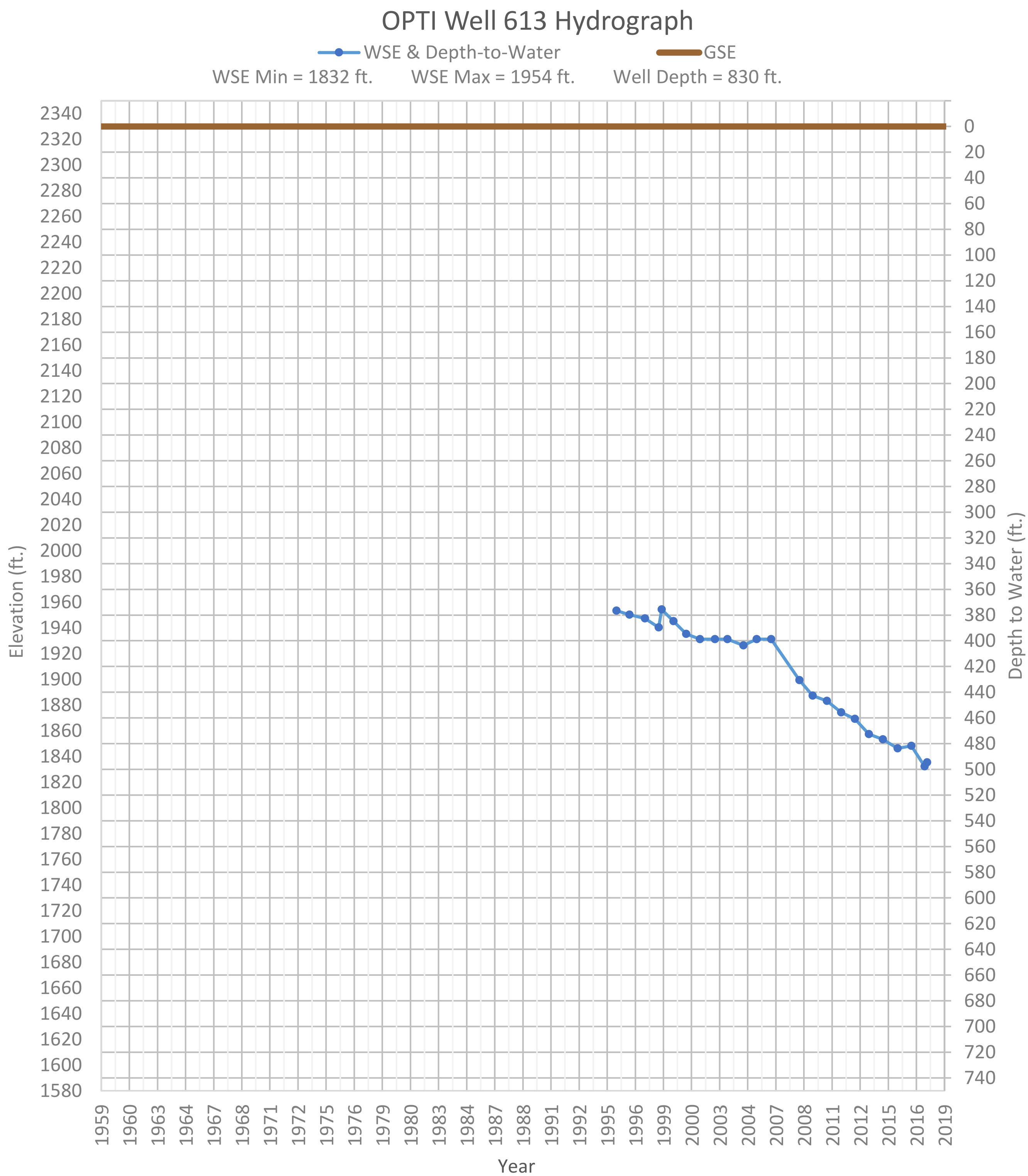
OPTI Well 610 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1837 ft.
WSE Max = 1987 ft.
Well Depth = 780 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 611 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1871 ft.
WSE Max = 1956 ft.
Well Depth = 550 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 612 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1812 ft.
WSE Max = 1938 ft.
Well Depth = 1070 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 613 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1832 ft.
WSE Max = 1954 ft.
Well Depth = 830 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
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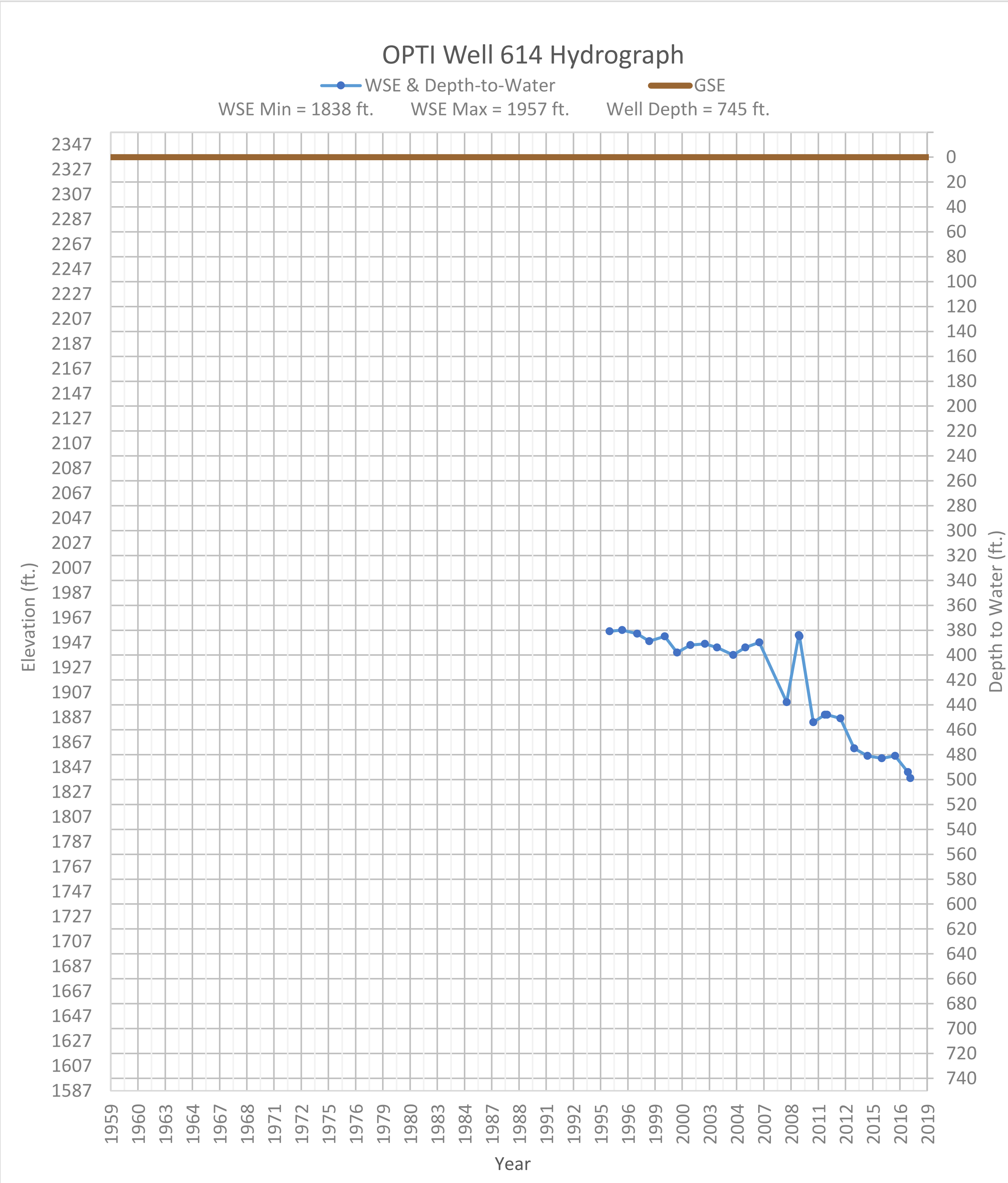
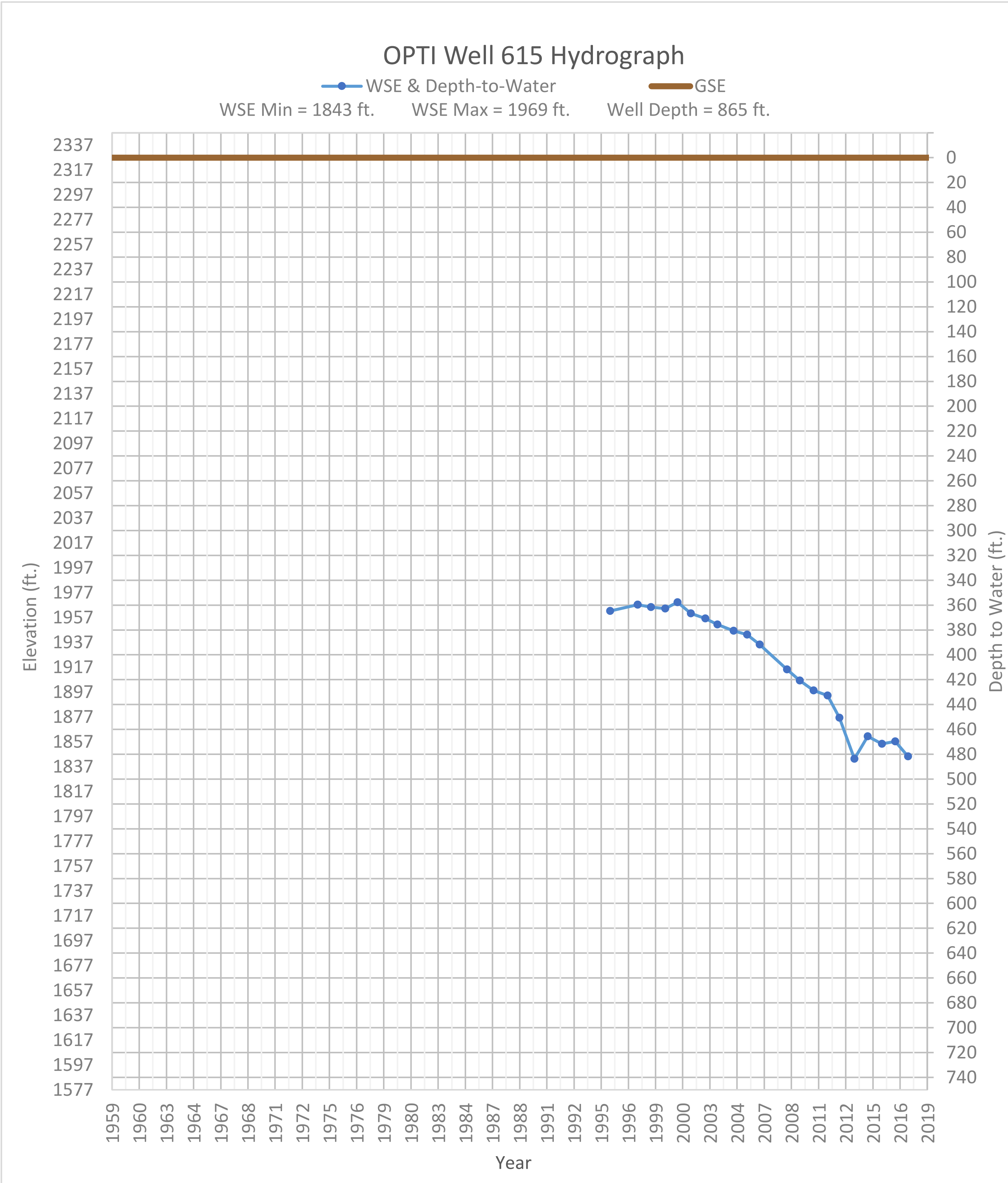


OPTI Well 614 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1838 ft.
WSE Max = 1957 ft.
Well Depth = 745 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 615 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1843 ft.
WSE Max = 1969 ft.
Well Depth = 865 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 616 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1929 ft.
WSE Max = 2139 ft.
Well Depth = 780 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2600
2580
2560
2540
2520
2500
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
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1980
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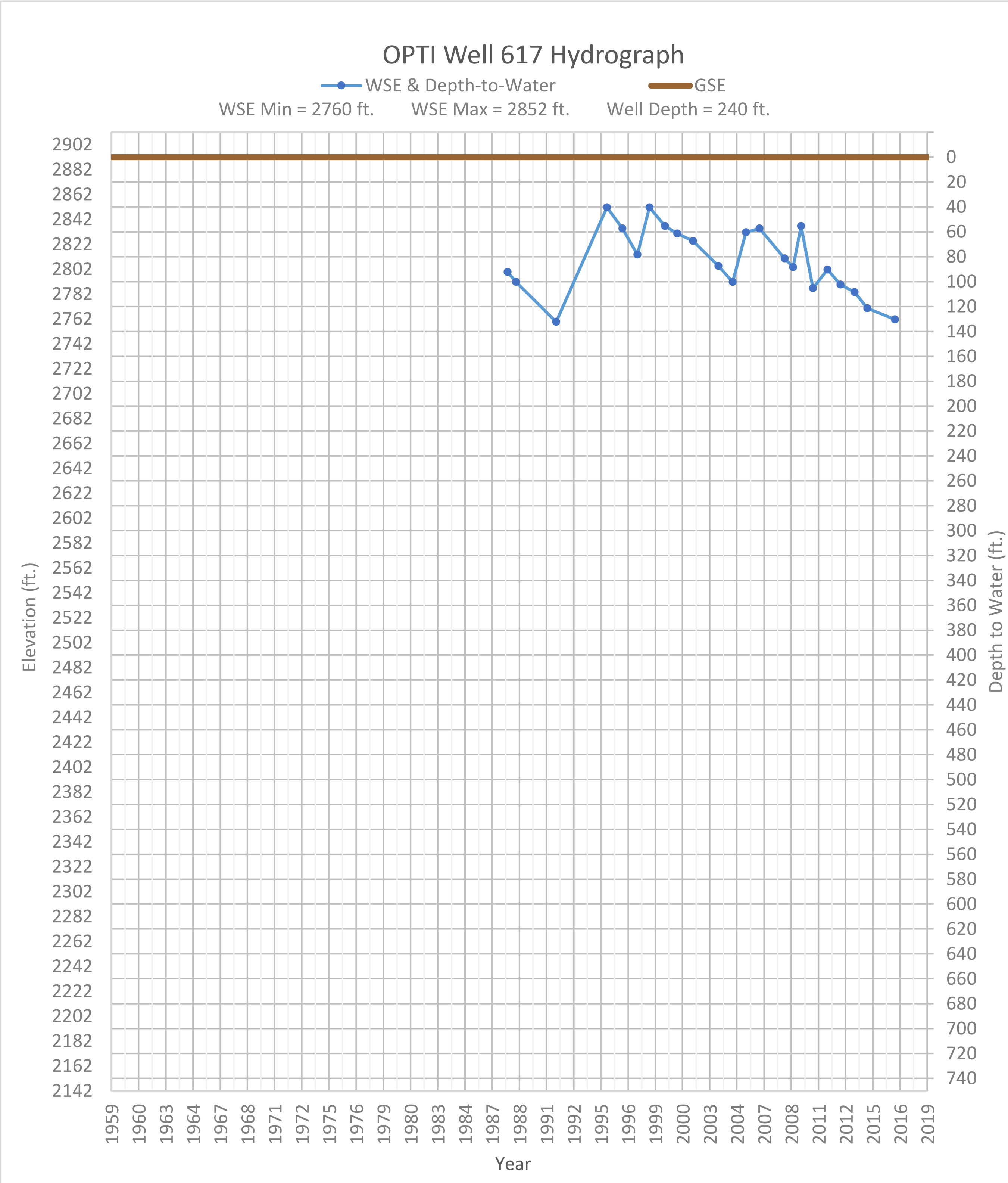
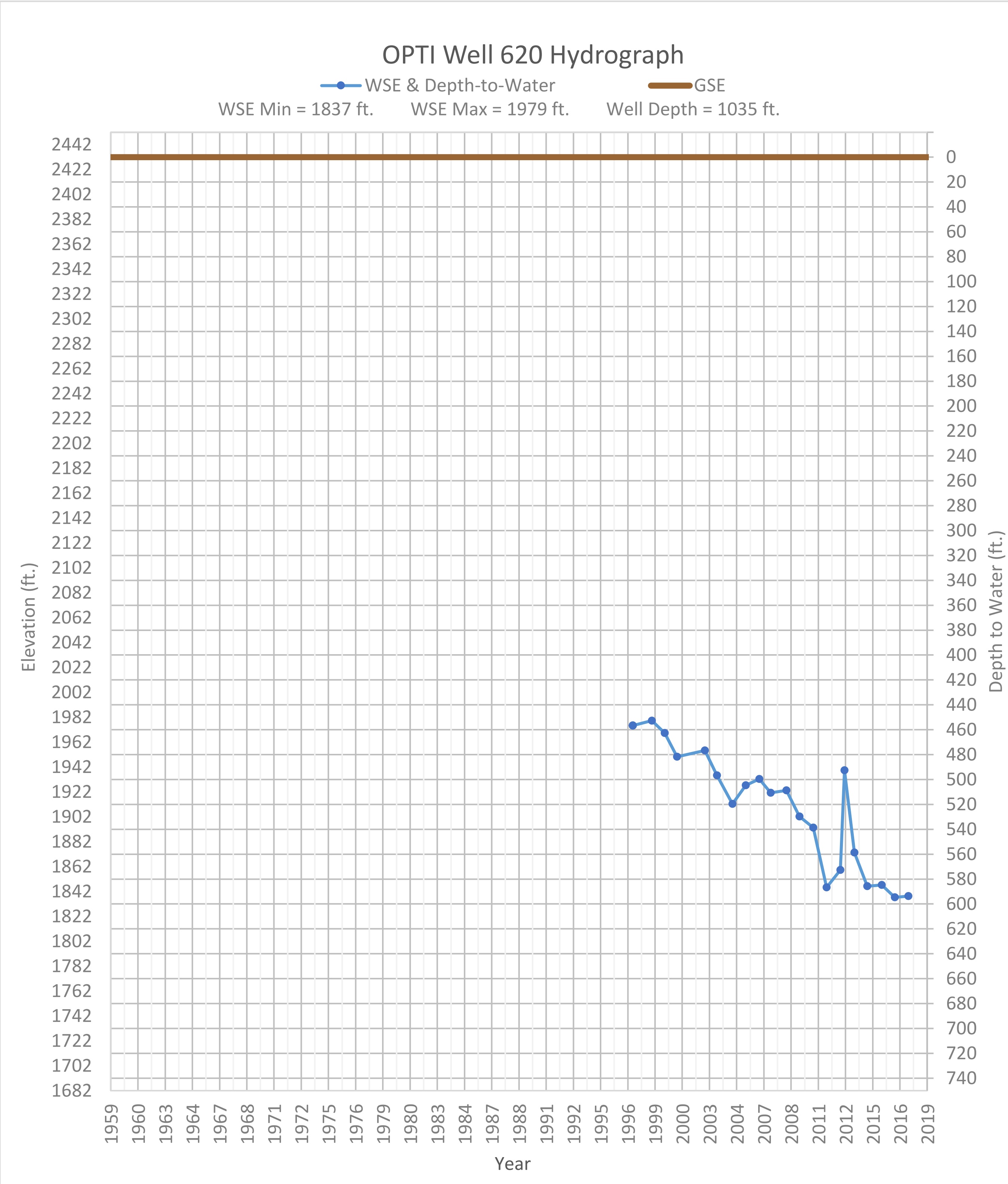


OPTI Well 617 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2760 ft.
WSE Max = 2852 ft.
Well Depth = 240 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 618 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1613 ft.
WSE Max = 1894 ft.
Well Depth = 927 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 619 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1826 ft.
WSE Max = 1977 ft.
Well Depth = 1040 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 620 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1837 ft.
WSE Max = 1979 ft.
Well Depth = 1035 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2442
2422
2402
2382
2362
2342
2322
2302
2282
2262
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
2002
1982
1962
1942
1922
1902
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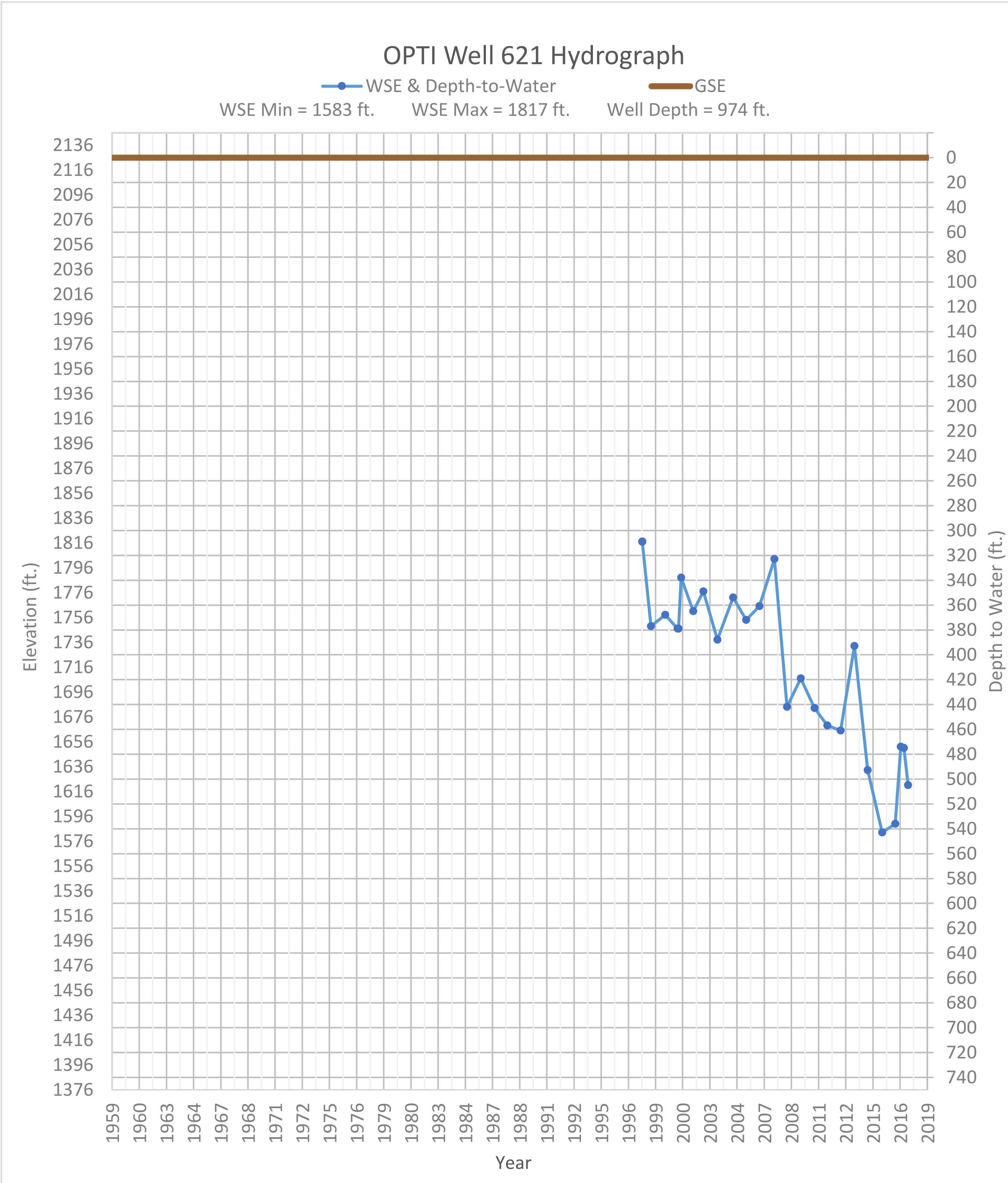
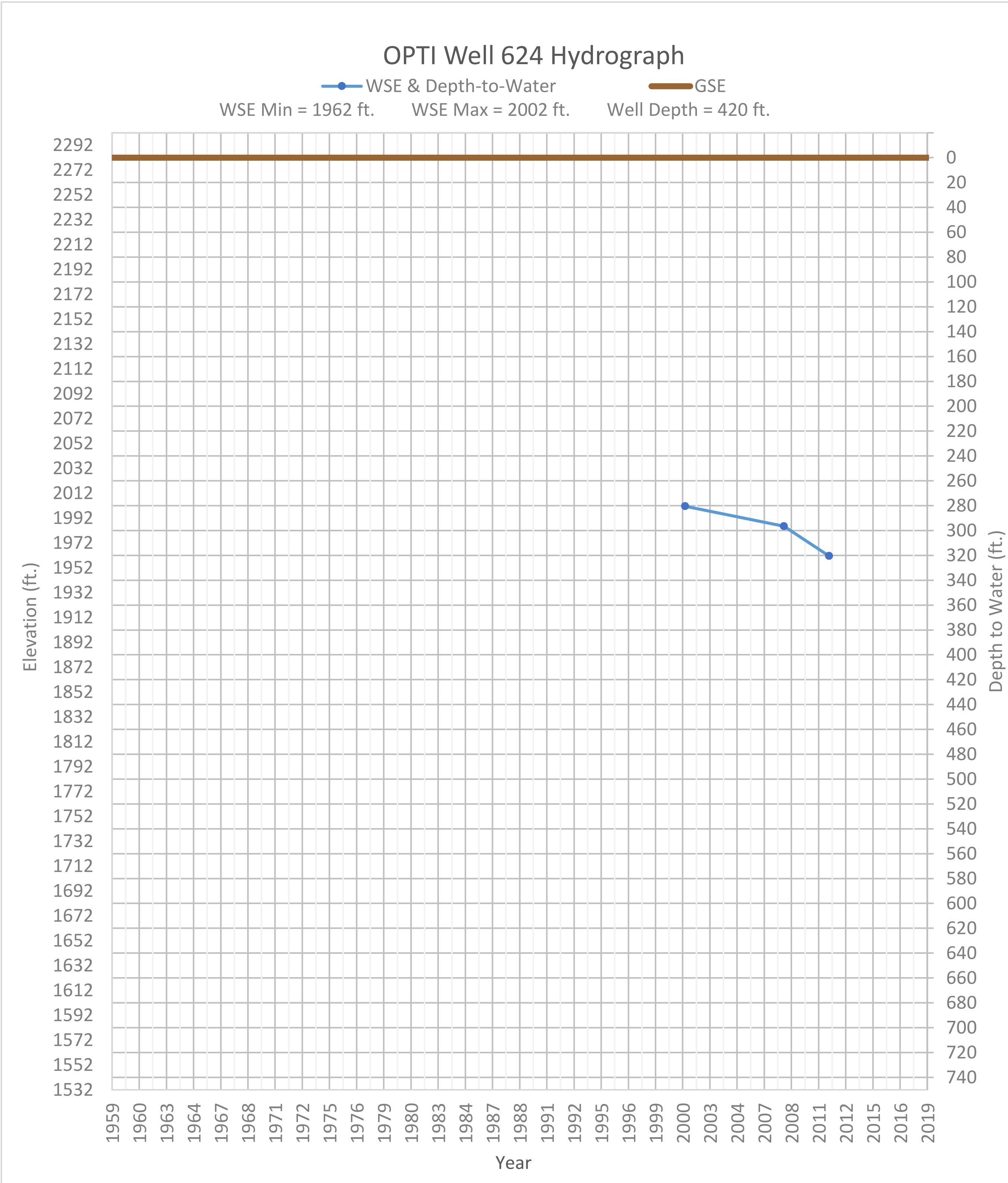


OPTI Well 621 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1583 ft.
WSE Max = 1817 ft.
Well Depth = 974 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 622 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1794 ft.
WSE Max = 1952 ft.
Well Depth = 1200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 623 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1797 ft.
WSE Max = 1954 ft.
Well Depth = 1040 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 624 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1962 ft.
WSE Max = 2002 ft.
Well Depth = 420 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
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2019


OPTI Well 625 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3590 ft.
WSE Max = 3611 ft.
Well Depth = 250 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 626 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 3636 ft.
WSE Max = 3652 ft.
Well Depth = 120 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
3685
3665
3645
3625
3605
3585
3565
3545
3525
3505
3485
3465
3445
3425
3405
3385
3365
3345
3325
3305
3285
3265
3245
3225
3205
3185
3165
3145
3125
3105
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3005
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2019

OPTI Well 627 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1730 ft.
WSE Max = 2076 ft.
Well Depth = 960 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2289
2269
2249
2229
2209
2189
2169
2149
2129
2109
2089
2069
2049
2029
2009
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2011
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2019

OPTI Well 628 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1792 ft.
WSE Max = 2078 ft.
Well Depth = 941 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2398
2378
2358
2338
2318
2298
2278
2258
2238
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
1918
1898
1878
1858
1838
1818
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1738
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1698
1678
1658
1638
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2016
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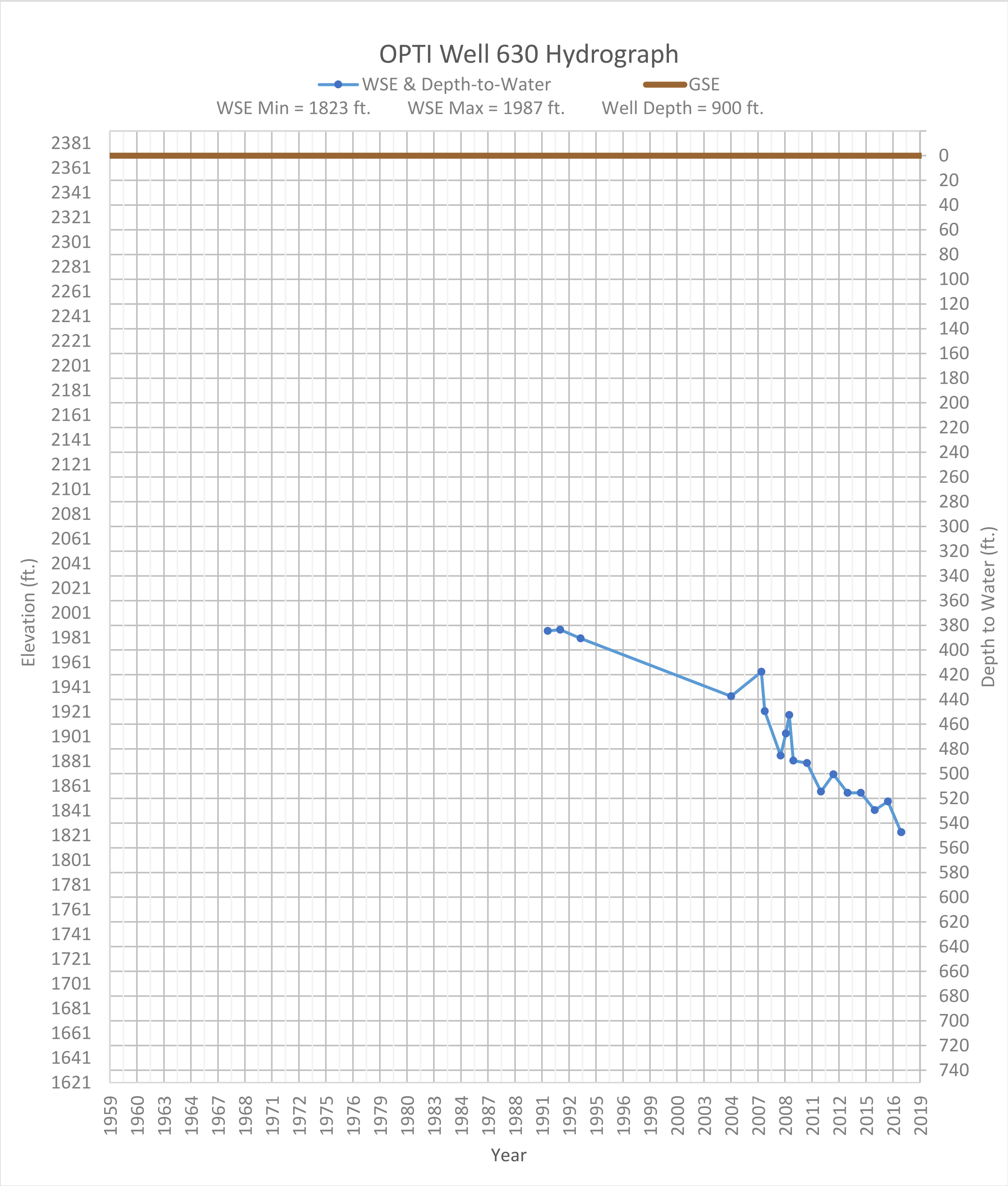
OPTI Well 629 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1826 ft.
WSE Max = 1970 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 630 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1823 ft.
WSE Max = 1987 ft.
Well Depth = 900 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 631 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1830 ft.
WSE Max = 2033 ft.
Well Depth = 960 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2377
2357
2337
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
1837
1817
1797
1777
1757
1737
1717
1697
1677
1657
1637
1617
0
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40
60
80
100
120
140
160
180
200
220
240
260
280
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2008
2011
2012
2015
2016
2019

OPTI Well 632 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1837 ft.
WSE Max = 2252 ft.
Well Depth = 960 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2371
2351
2331
2311
2291
2271
2251
2231
2211
2191
2171
2151
2131
2111
2091
2071
2051
2031
2011
1991
1971
1951
1931
1911
1891
1871
1851
1831
1811
1791
1771
1751
1731
1711
1691
1671
1651
1631
1611
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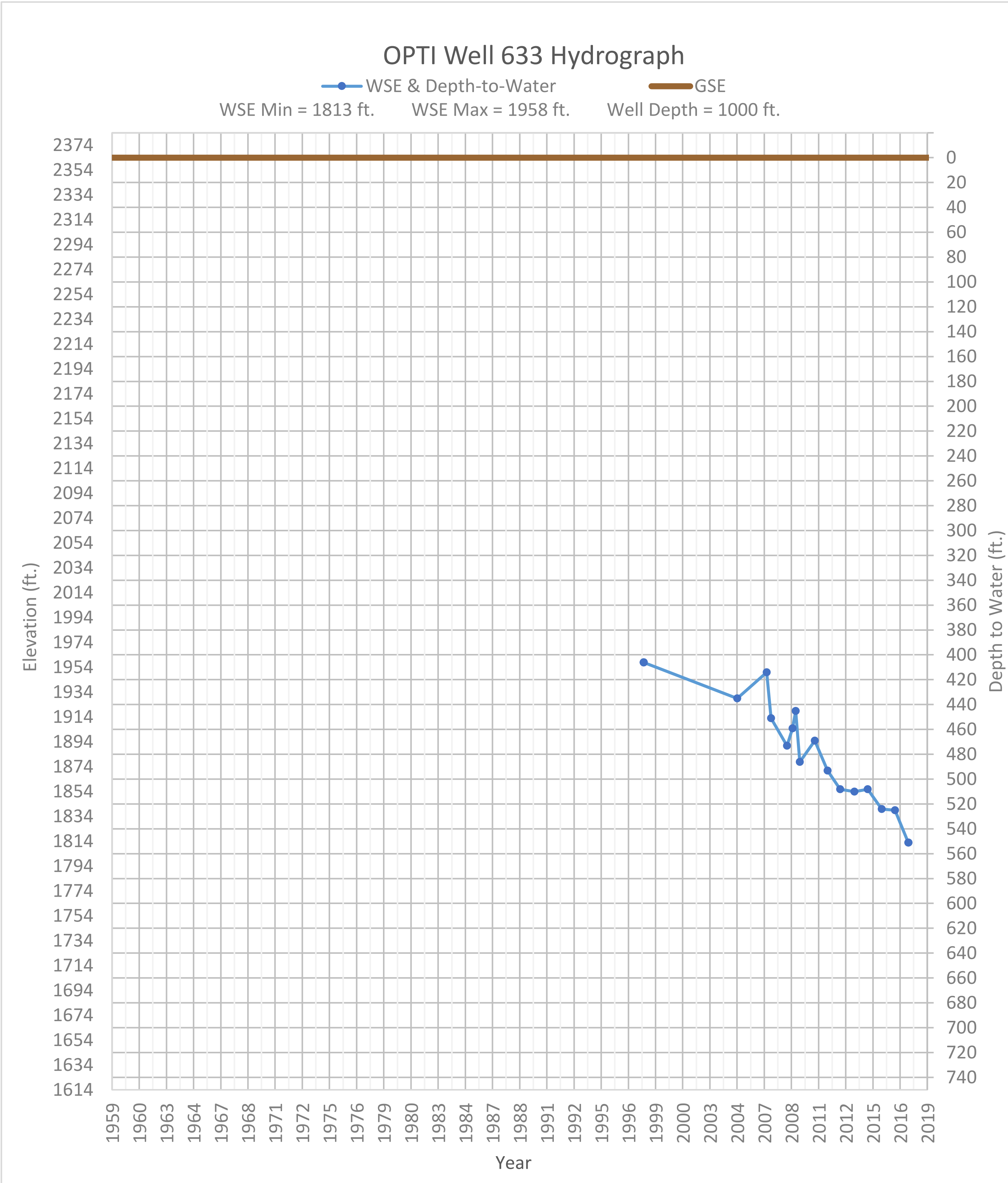

OPTI Well 633 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1813 ft.
WSE Max = 1958 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2374
2354
2334
2314
2294
2274
2254
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
1754
1734
1714
1694
1674
1654
1634
1614
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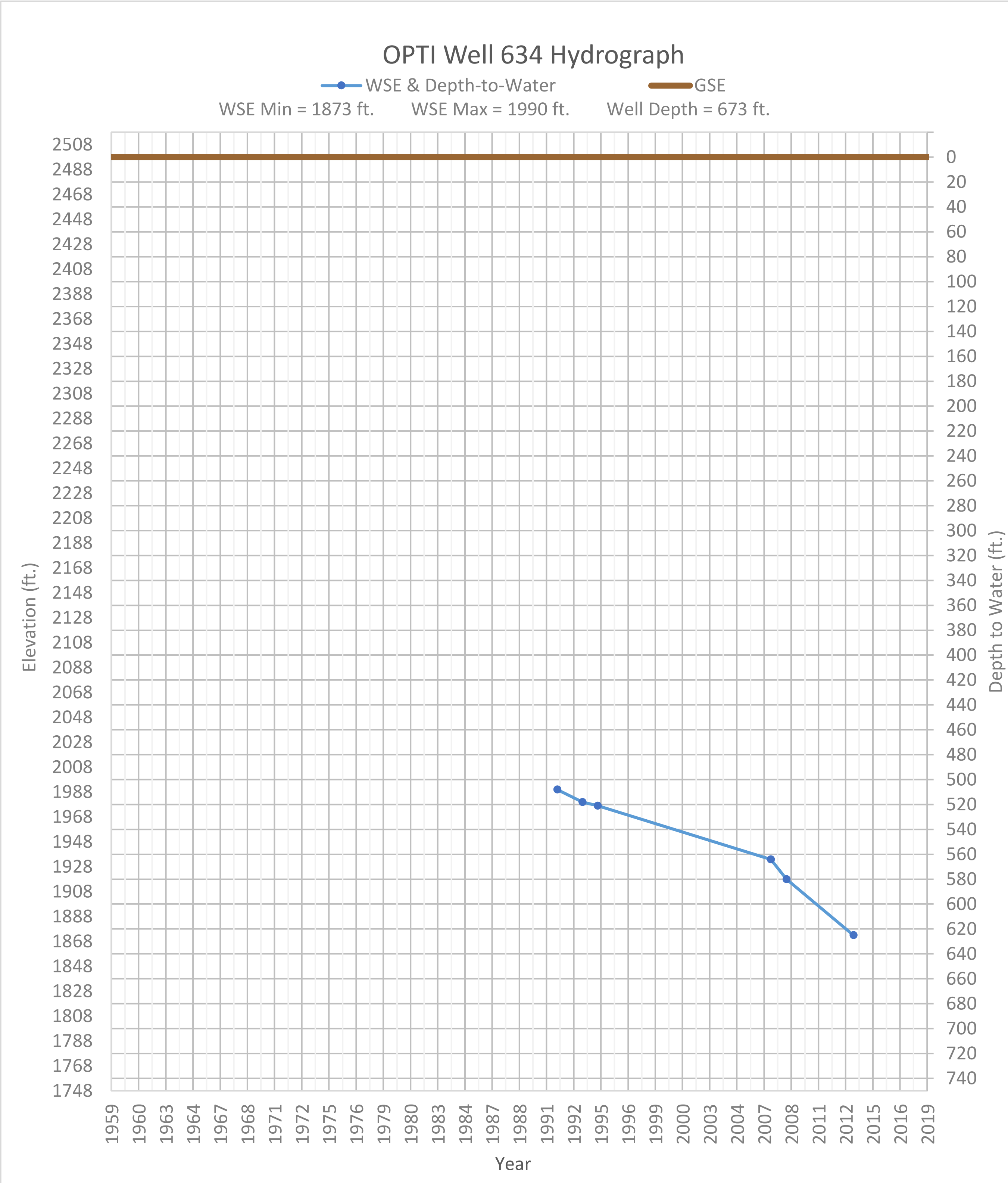
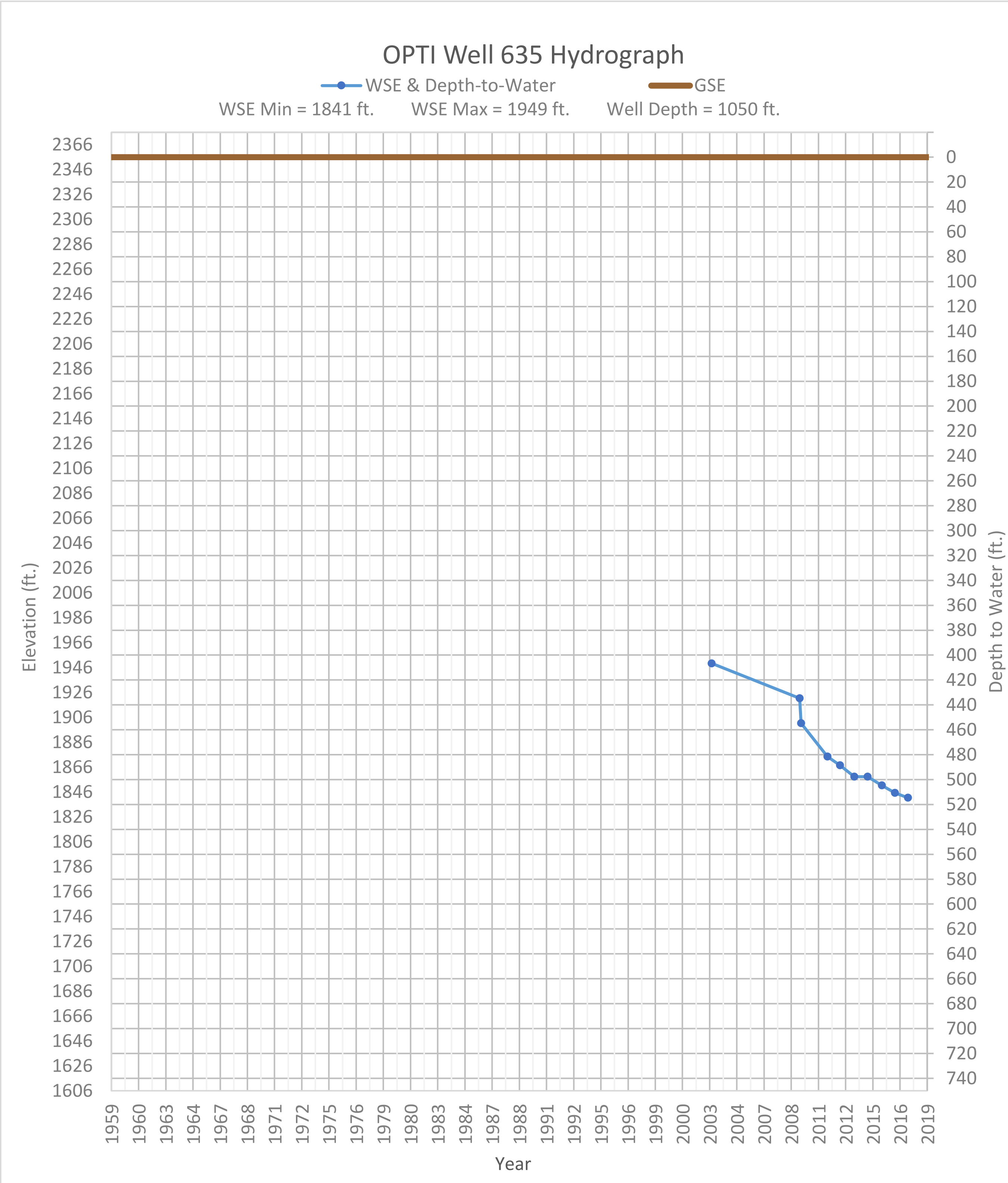

OPTI Well 634 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1873 ft.
WSE Max = 1990 ft.
Well Depth = 673 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 635 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1841 ft.
WSE Max = 1949 ft.
Well Depth = 1050 ft.
Elevation (ft.)
2366
2346
2326
2306
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
1966
1946
1926
1906
1886
1866
1846
1826
1806
1786
1766
1746
1726
1706
1686
1666
1646
1626
1606
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
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460
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520
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560
580
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640
660
680
700
720
740
Year
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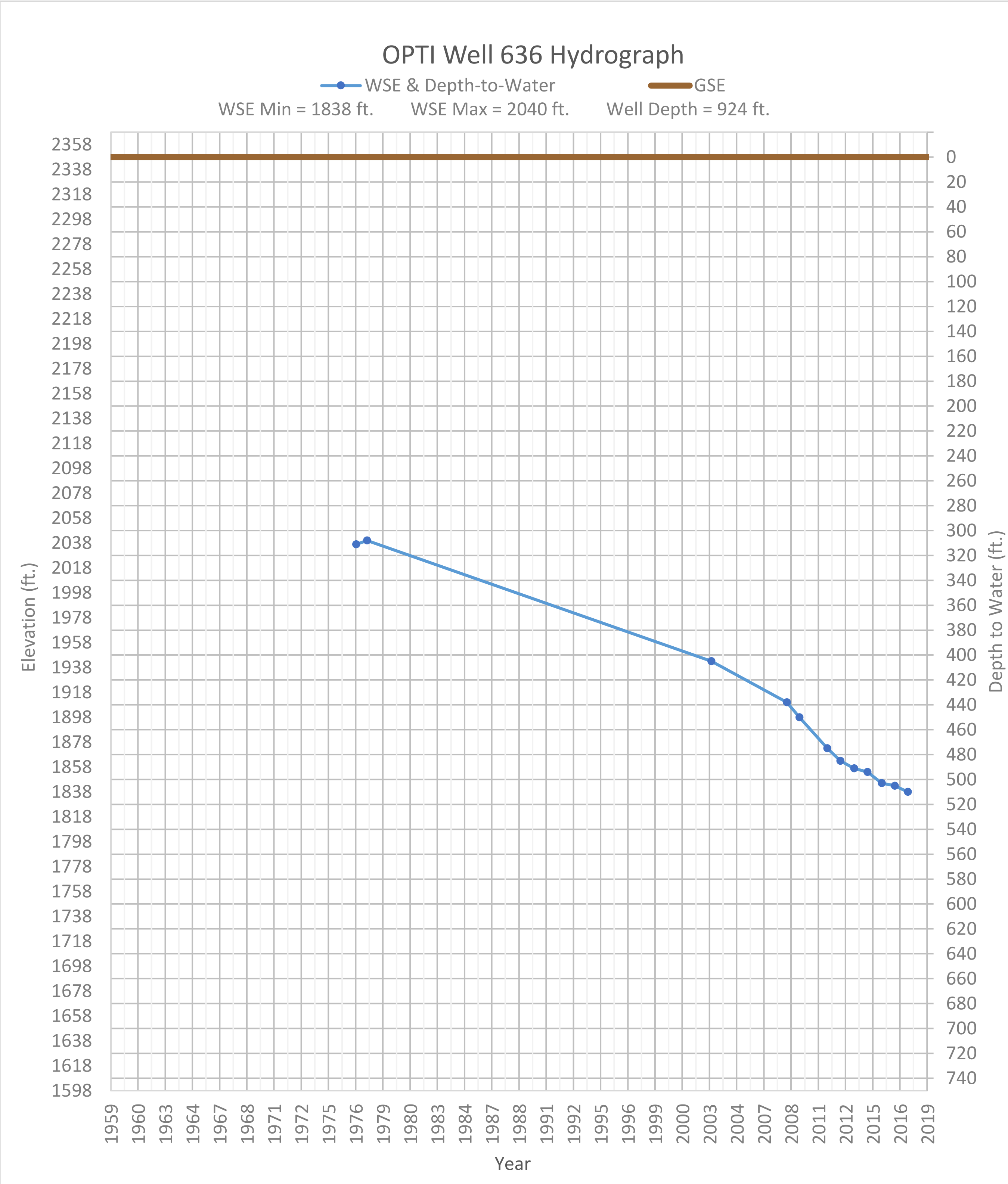
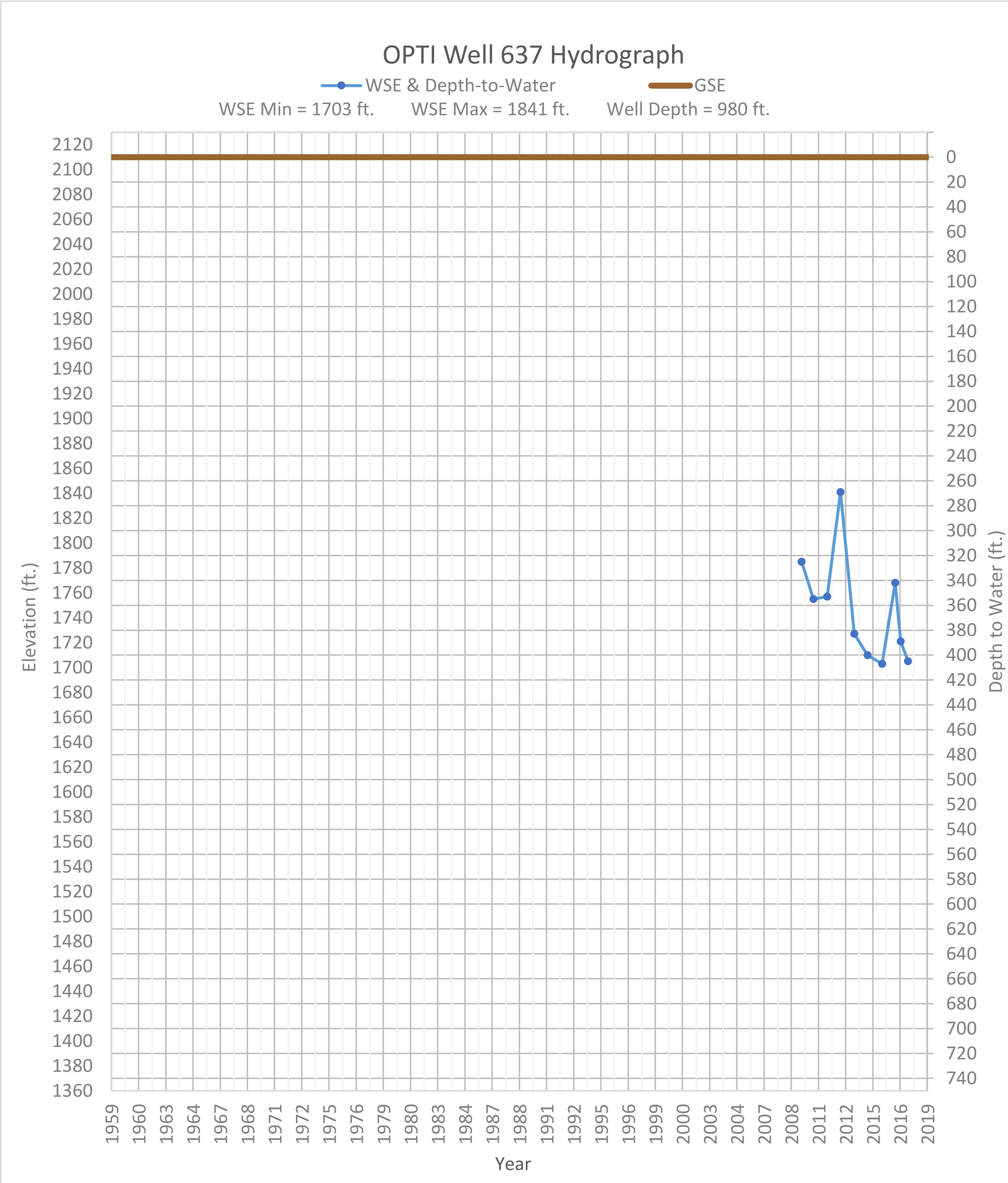
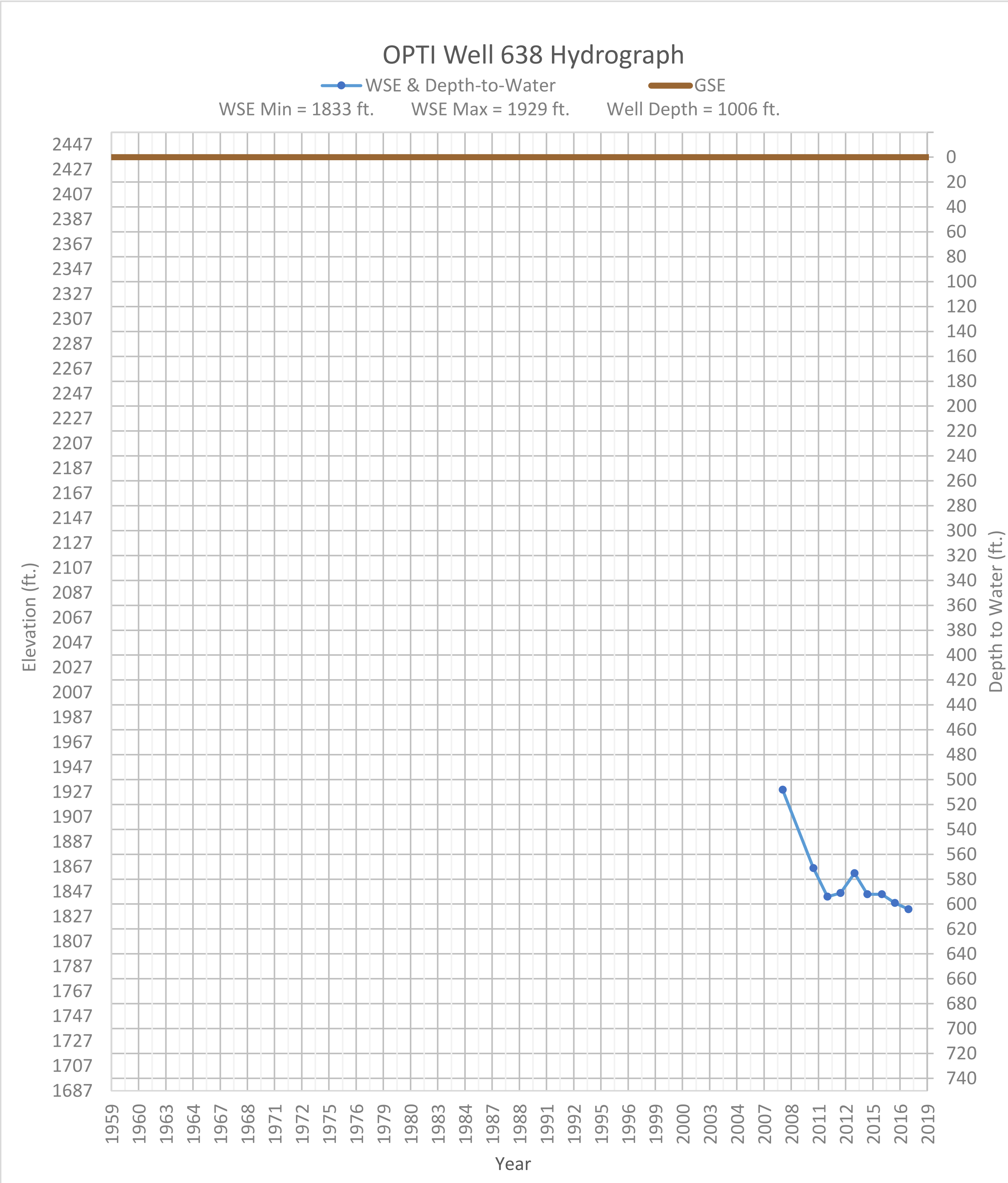
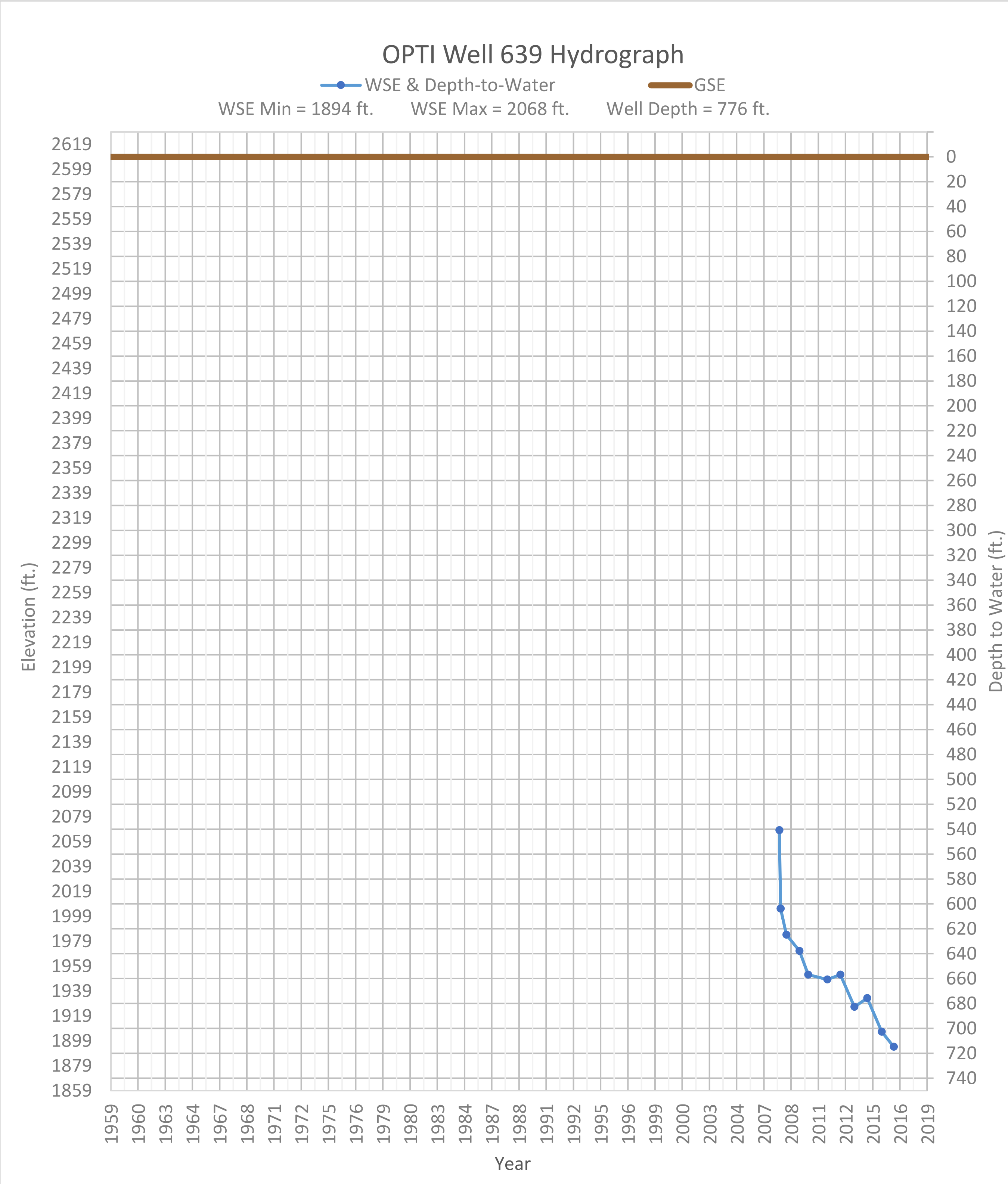

OPTI Well 636 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1838 ft.
WSE Max = 2040 ft.
Well Depth = 924 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

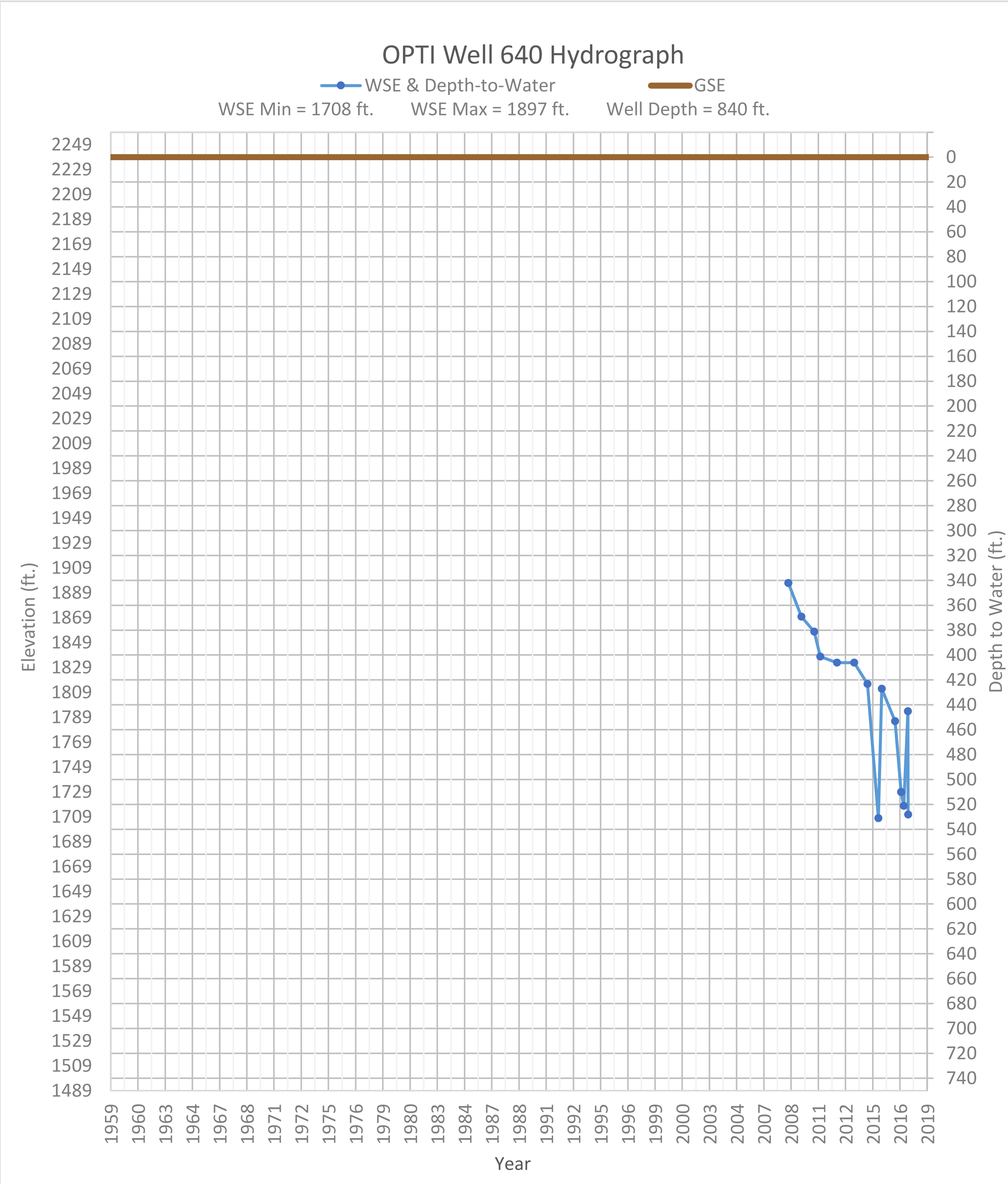


OPTI Well 637 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1703 ft.
WSE Max = 1841 ft.
Well Depth = 980 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 638 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1833 ft.
WSE Max = 1929 ft.
Well Depth = 1006 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 639 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1894 ft.
WSE Max = 2068 ft.
Well Depth = 776 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 640 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1708 ft.
WSE Max = 1897 ft.
Well Depth = 840 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2249
2229
2209
2189
2169
2149
2129
2109
2089
2069
2049
2029
2009
1989
1969
1949
1929
1909
1889
1869
1849
1829
1809
1789
1769
1749
1729
1709
1689
1669
1649
1629
1609
1589
1569
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1489
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OPTI Well 641 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1762 ft.
WSE Max = 1864 ft.
Well Depth = 800 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2214 2194 2174 2154 2134 2114 2094 2074 2054 2034 2014 1994 1974 1954 1934 1914 1894 1874 1854 1834 1814 1794 1774 1754 1734 1714 1694 1674 1654 1634 1614 1594 1574 1554 1534 1514 1494 1474 1454
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740
1959 1960 1963 1964 1967 1968 1971 1972 1975 1976 1979 1980 1983 1984 1987 1988 1991 1992 1995 1996 1999 2000 2003 2004 2007 2008 2011 2012 2015 2016 2019

OPTI Well 642 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1745 ft.
WSE Max = 1907 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2242
2222
2202
2182
2162
2142
2122
2102
2082
2062
2042
2022
2002
1982
1962
1942
1922
1902
1882
1862
1842
1822
1802
1782
1762
1742
1722
1702
1682
1662
1642
1622
1602
1582
1562
1542
1522
1502
1482
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
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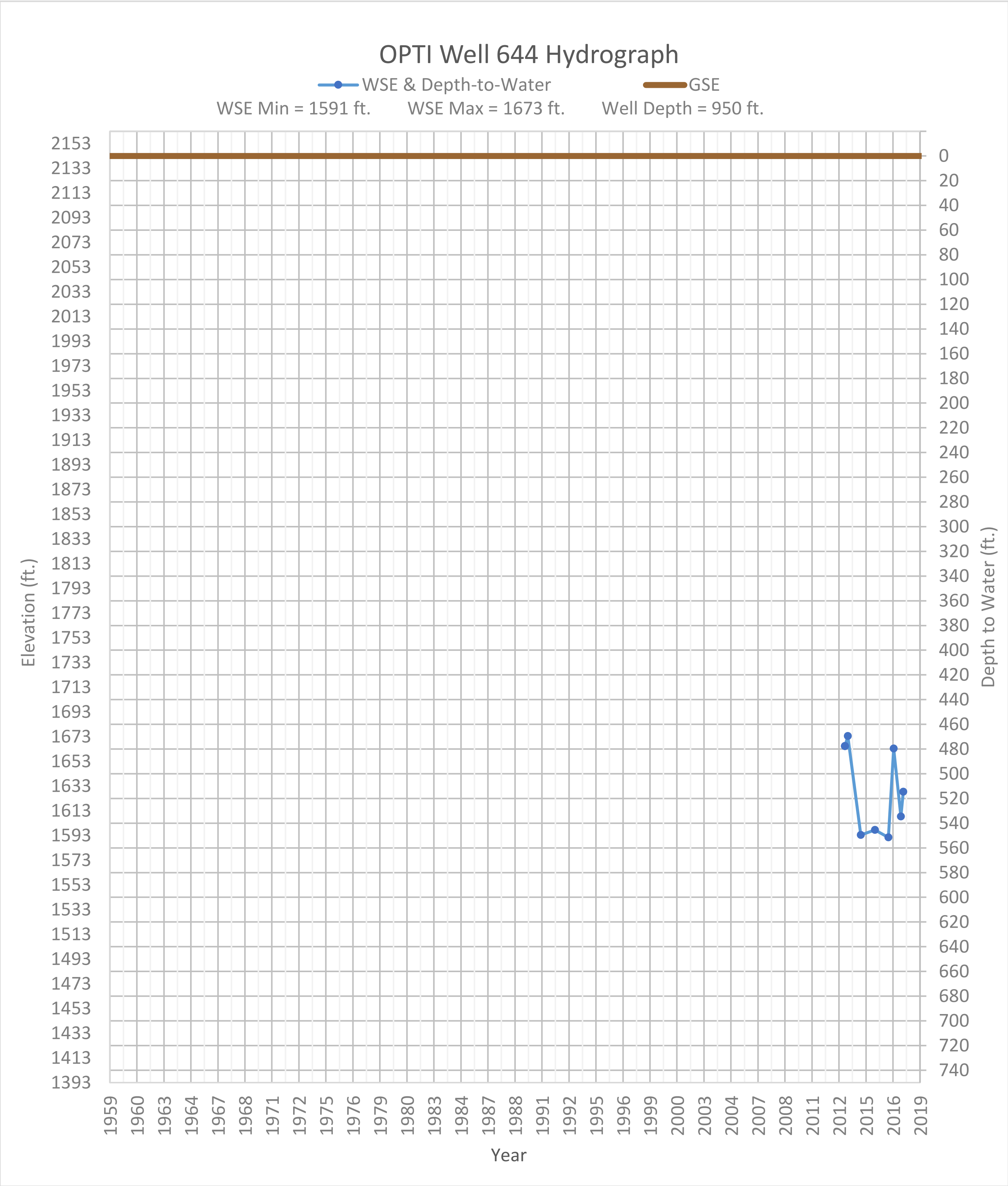
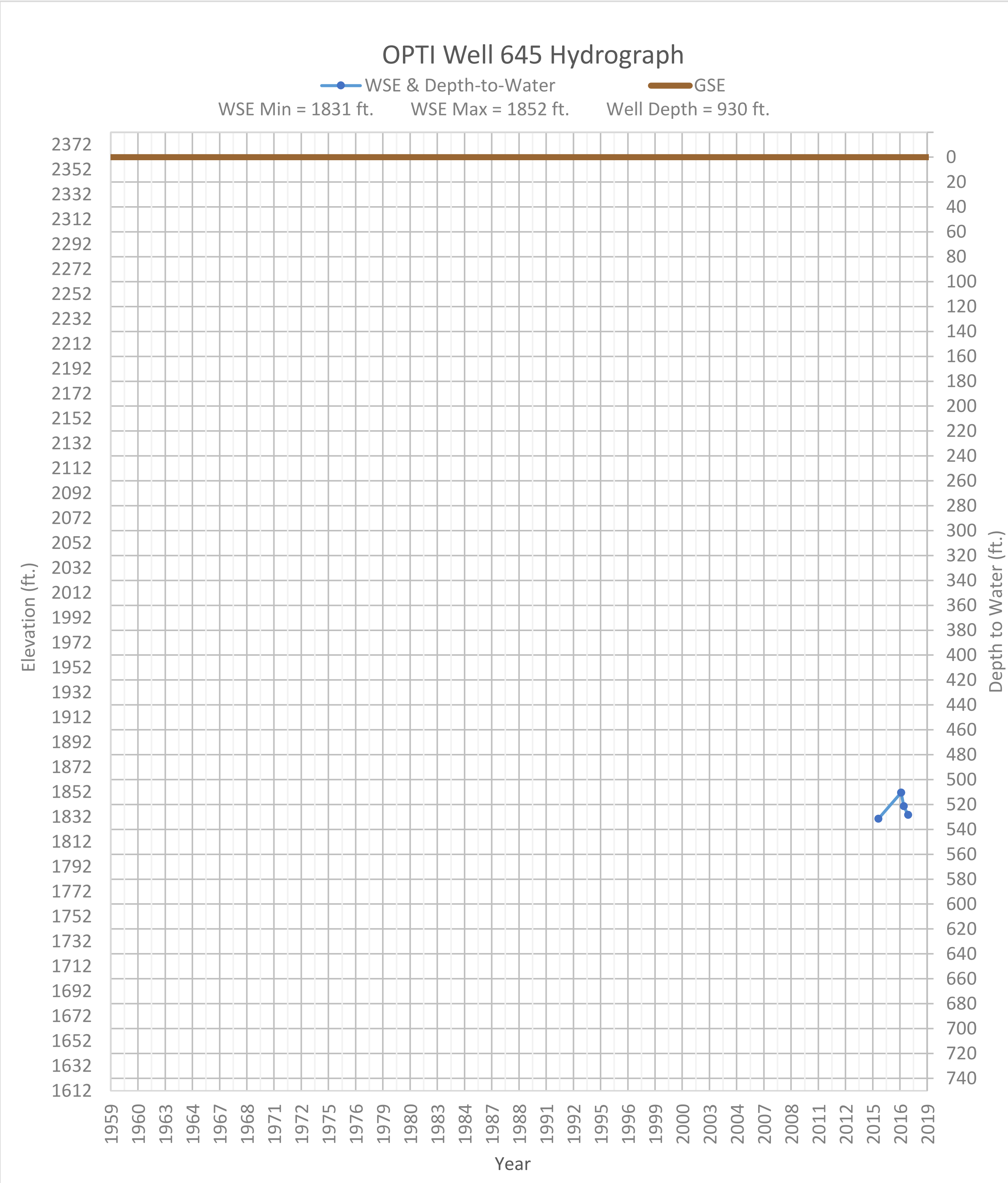


OPTI Well 644 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1591 ft.
WSE Max = 1673 ft.
Well Depth = 950 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 645 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1831 ft.
WSE Max = 1852 ft.
Well Depth = 930 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2372
2352
2332
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
1792
1772
1752
1732
1712
1692
1672
1652
1632
1612
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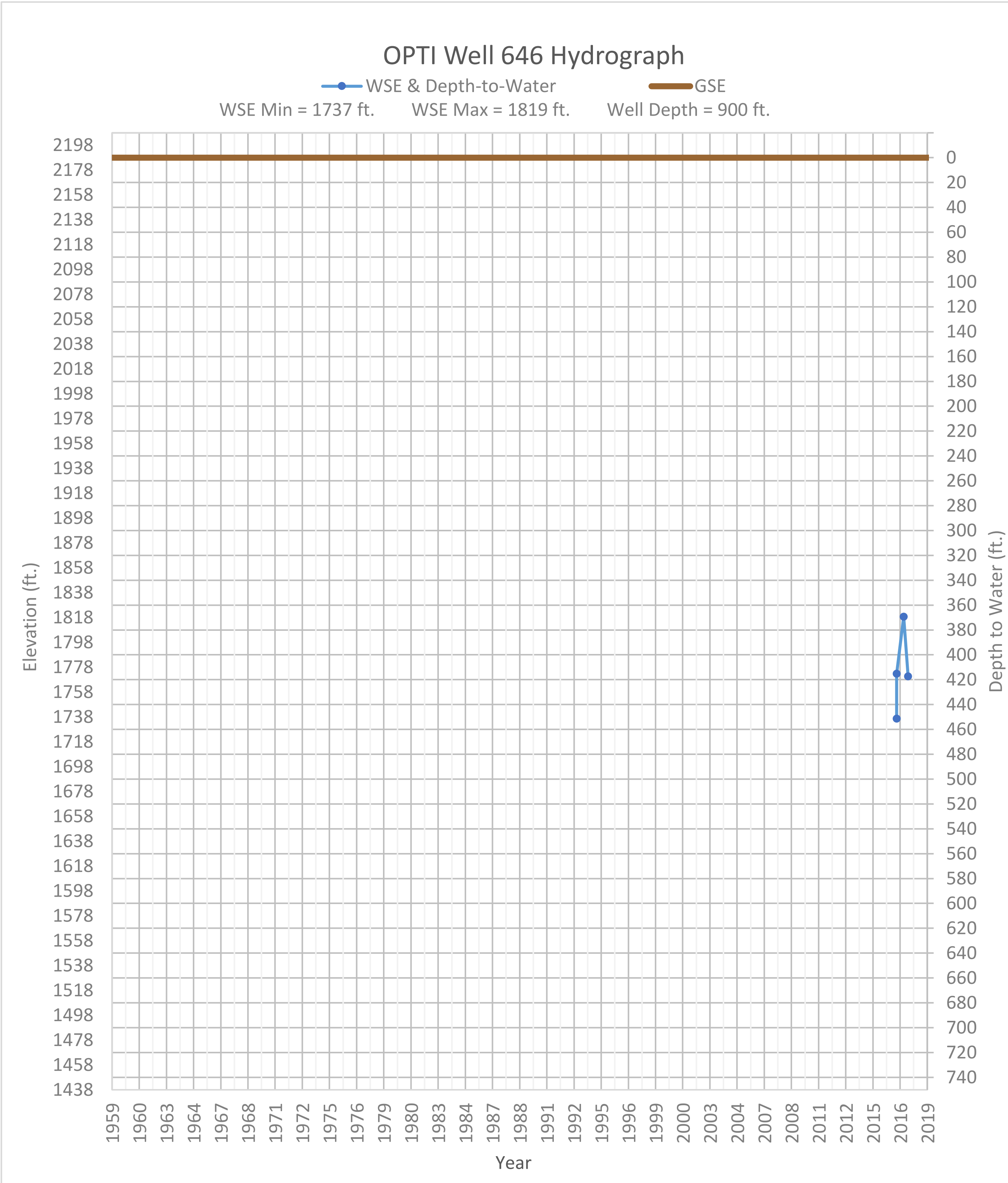
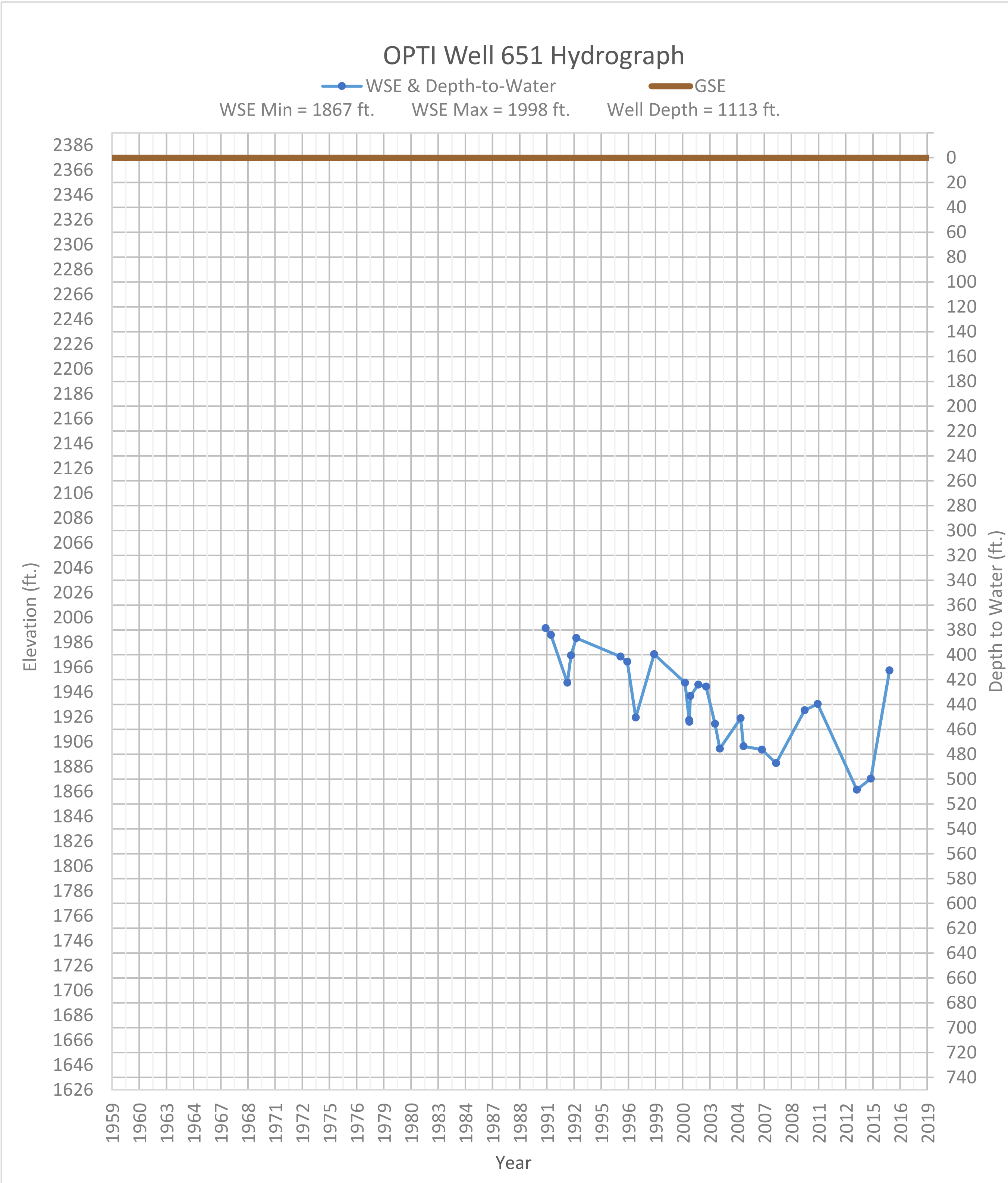
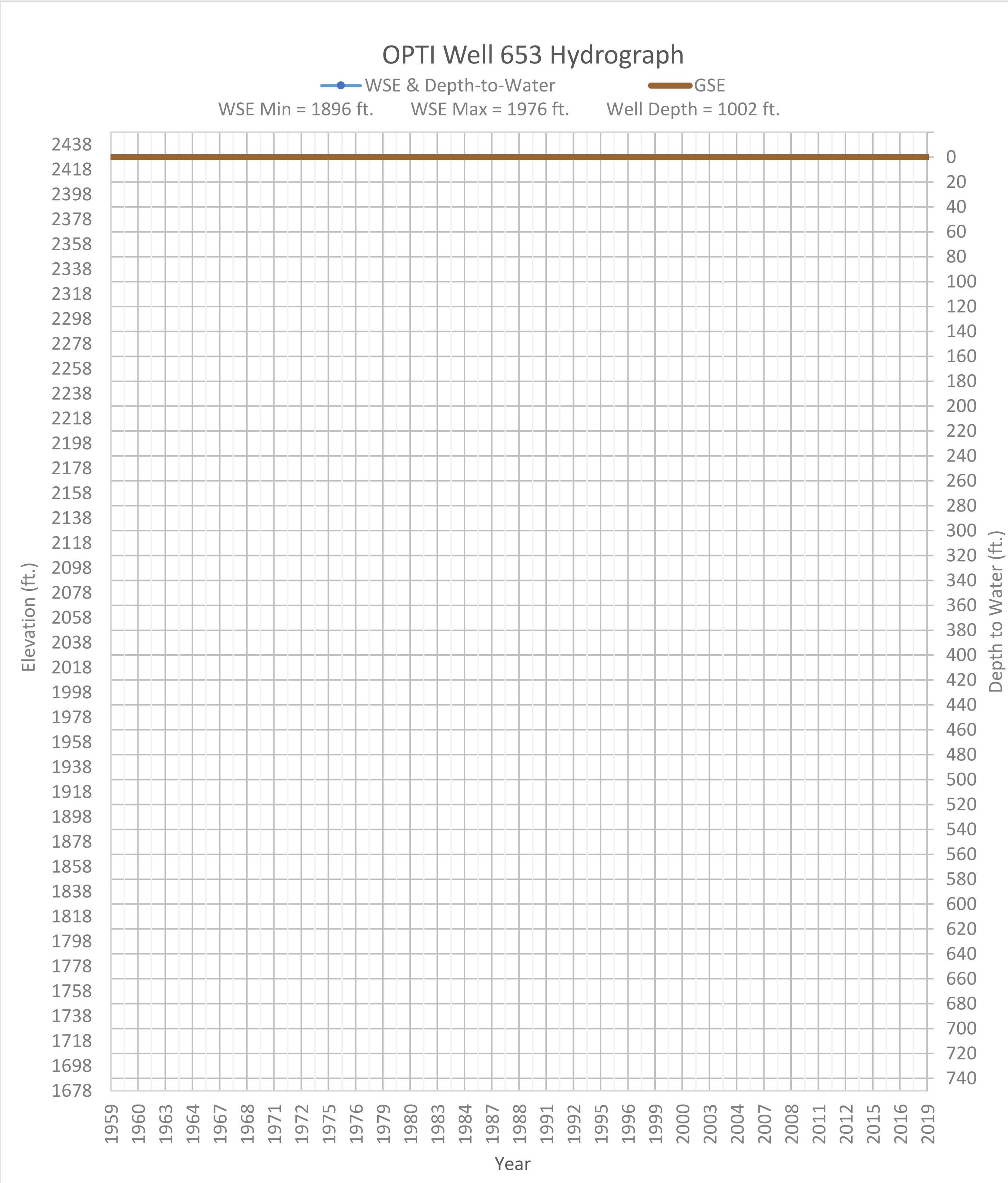
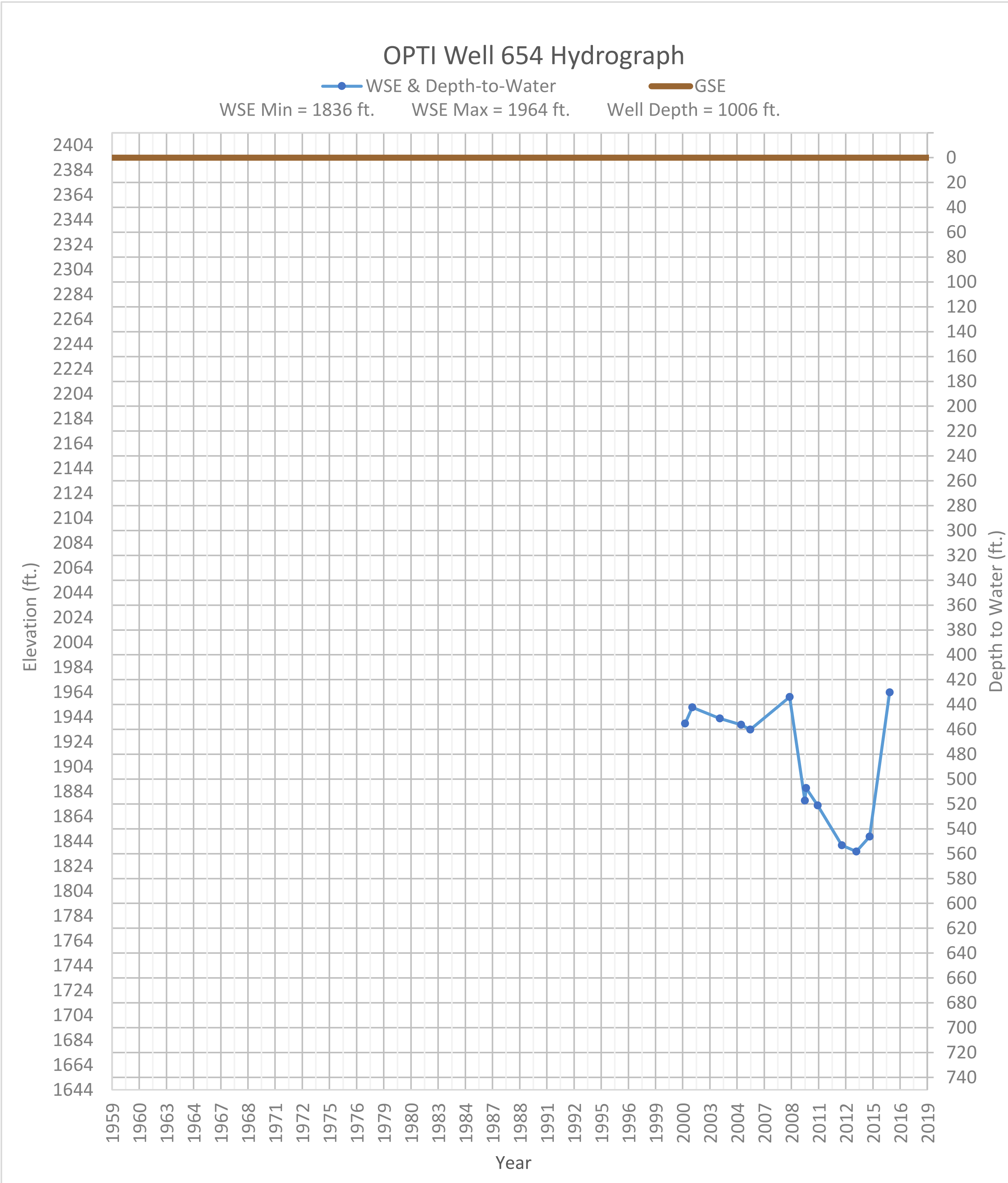


OPTI Well 646 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1737 ft.
WSE Max = 1819 ft.
Well Depth = 900 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

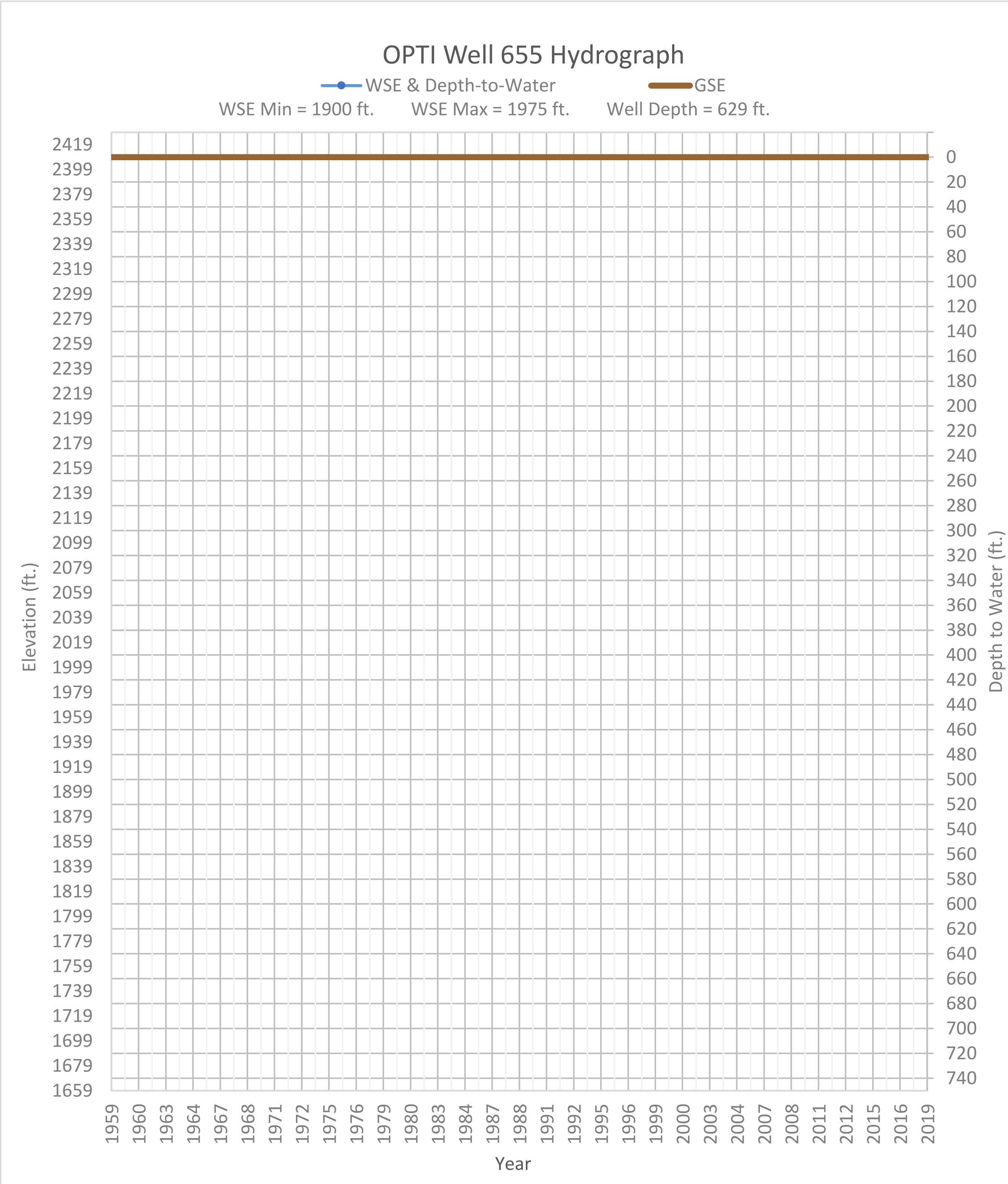


OPTI Well 651 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1867 ft.
WSE Max = 1998 ft.
Well Depth = 1113 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 653 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1896 ft.
WSE Max = 1976 ft.
Well Depth = 1002 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 654 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1836 ft.
WSE Max = 1964 ft.
Well Depth = 1006 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 655 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1900 ft.
WSE Max = 1975 ft.
Well Depth = 629 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2419
2399
2379
2359
2339
2319
2299
2279
2259
2239
2219
2199
2179
2159
2139
2119
2099
2079
2059
2039
2019
1999
1979
1959
1939
1919
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1719
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1679
1659
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2016
2019

OPTI Well 656 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1916 ft.
WSE Max = 1979 ft.
Well Depth = 930 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 657 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1804 ft.
WSE Max = 2000 ft.
Well Depth = 932 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2355
2335
2315
2295
2275
2255
2235
2215
2195
2175
2155
2135
2115
2095
2075
2055
2035
2015
1995
1975
1955
1935
1915
1895
1875
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1835
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1695
1675
1655
1635
1615
1595
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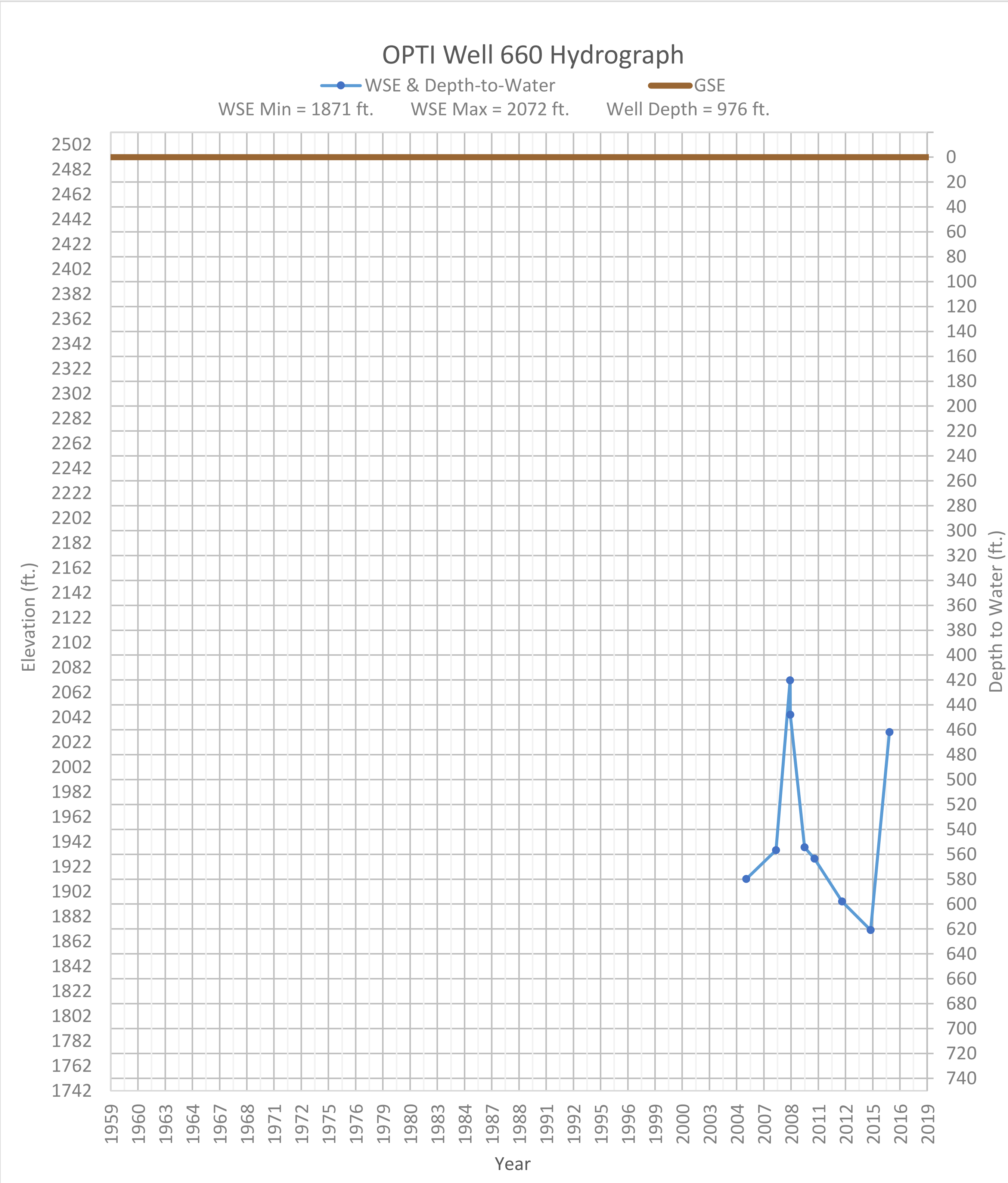
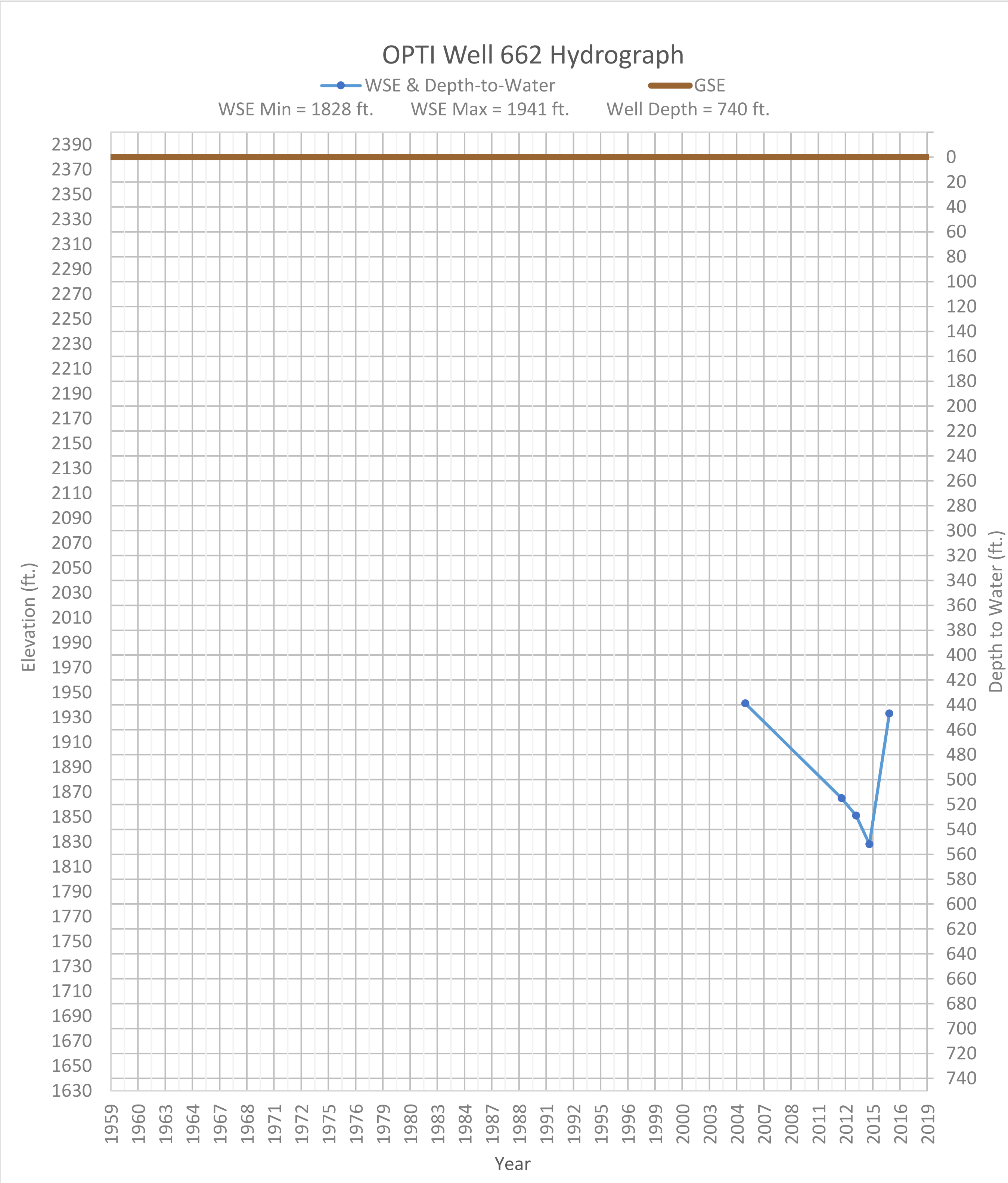
2011
2012
2015
2016
2019

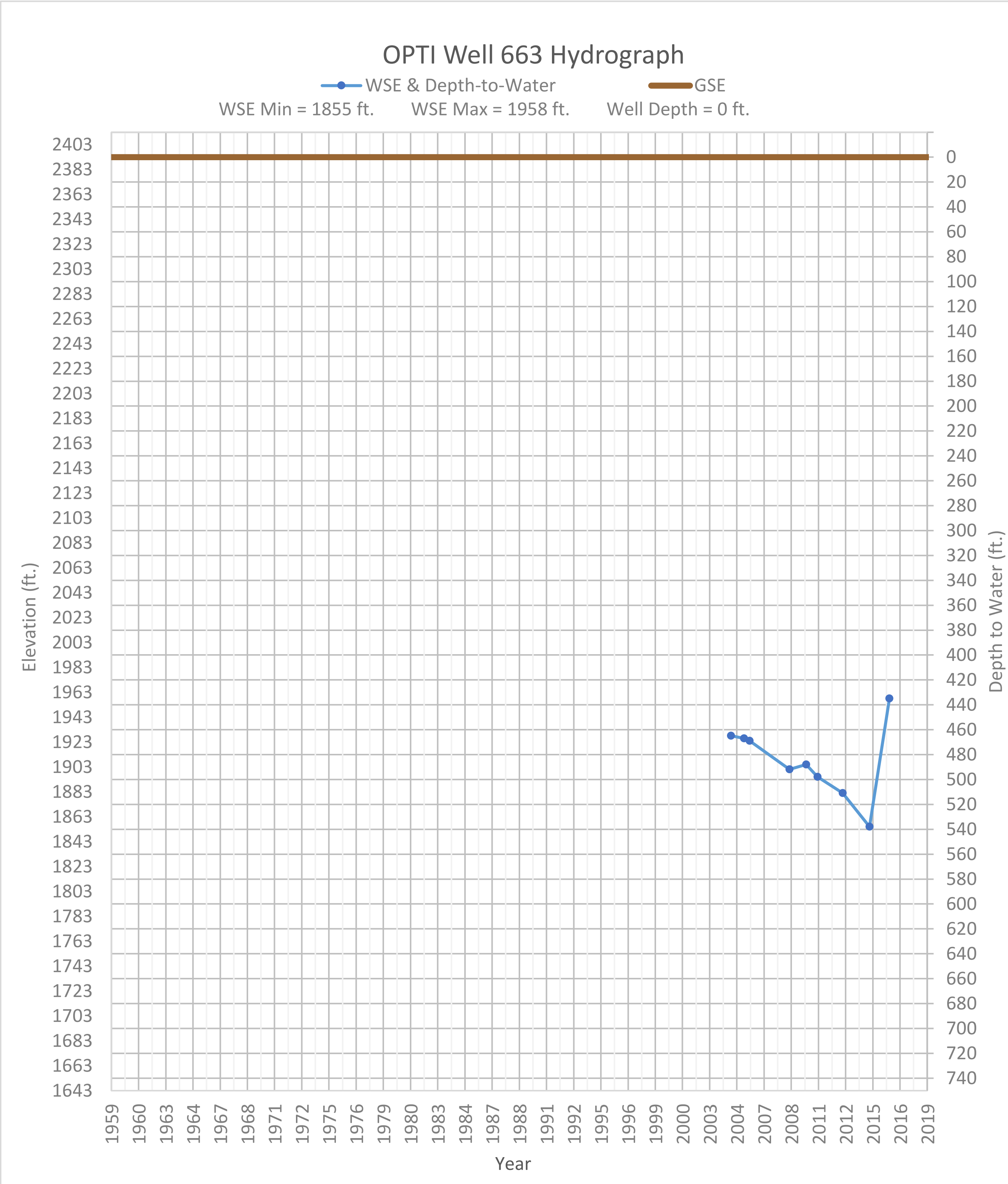

OPTI Well 659 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1861 ft.
WSE Max = 1962 ft.
Well Depth = 869 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 660 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1871 ft.
WSE Max = 2072 ft.
Well Depth = 976 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 661 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1875 ft.
WSE Max = 2002 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 662 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1828 ft.
WSE Max = 1941 ft.
Well Depth = 740 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 663 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1855 ft.
WSE Max = 1958 ft.
Well Depth = 0 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2403
2383
2363
2343
2323
2303
2283
2263
2243
2223
2203
2183
2163
2143
2123
2103
2083
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2043
2023
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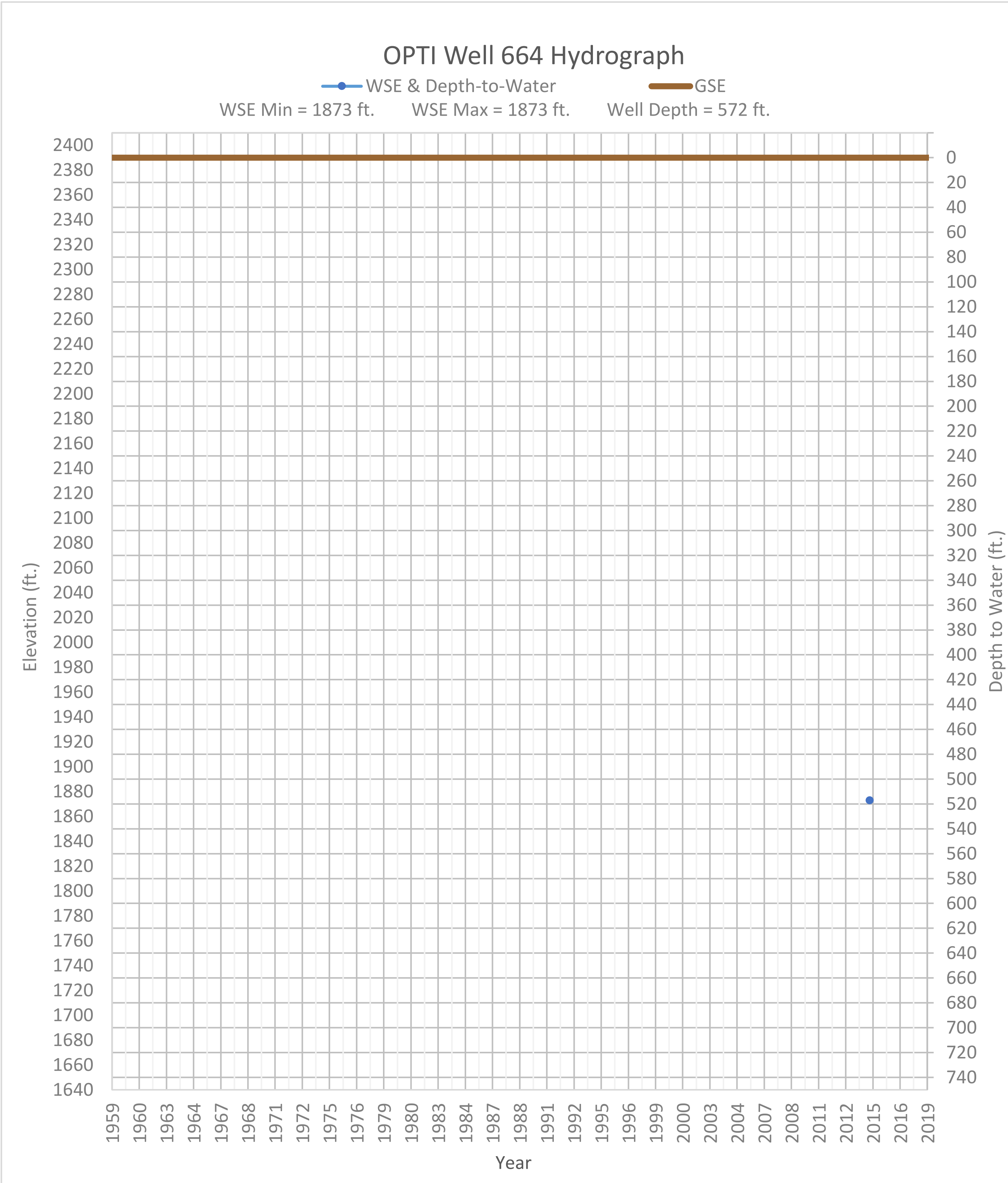
2019


OPTI Well 664 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1873 ft.
WSE Max = 1873 ft.
Well Depth = 572 ft.
Elevation (ft.)
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
1900
1880
1860
1840
1820
1800
1780
1760
1740
1720
1700
1680
1660
1640
Depth to Water (ft.)
0
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40
60
80
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120
140
160
180
200
220
240
260
280
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320
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Year
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2012
2015
2016
2019


OPTI Well 665 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1821 ft.
WSE Max = 1975 ft.
Well Depth = 1200 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 666 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1910 ft.
WSE Max = 1972 ft.
Well Depth = 1157 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2344
2324
2304
2284
2264
2244
2224
2204
2184
2164
2144
2124
2104
2084
2064
2044
2024
2004
1984
1964
1944
1924
1904
1884
1864
1844
1824
1804
1784
1764
1744
1724
1704
1684
1664
1644
1624
1604
1584
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2011
2012
2015
2016
2019


OPTI Well 667 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1829 ft.
WSE Max = 2219 ft.
Well Depth = 1083 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2326
2306
2286
2266
2246
2226
2206
2186
2166
2146
2126
2106
2086
2066
2046
2026
2006
1986
1966
1946
1926
1906
1886
1866
1846
1826
1806
1786
1766
1746
1726
1706
1686
1666
1646
1626
1606
1586
1566
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2019


OPTI Well 668 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1764 ft.
WSE Max = 1925 ft.
Well Depth = 1002 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2323
2303
2283
2263
2243
2223
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
1923
1903
1883
1863
1843
1823
1803
1783
1763
1743
1723
1703
1683
1663
1643
1623
1603
1583
1563
0
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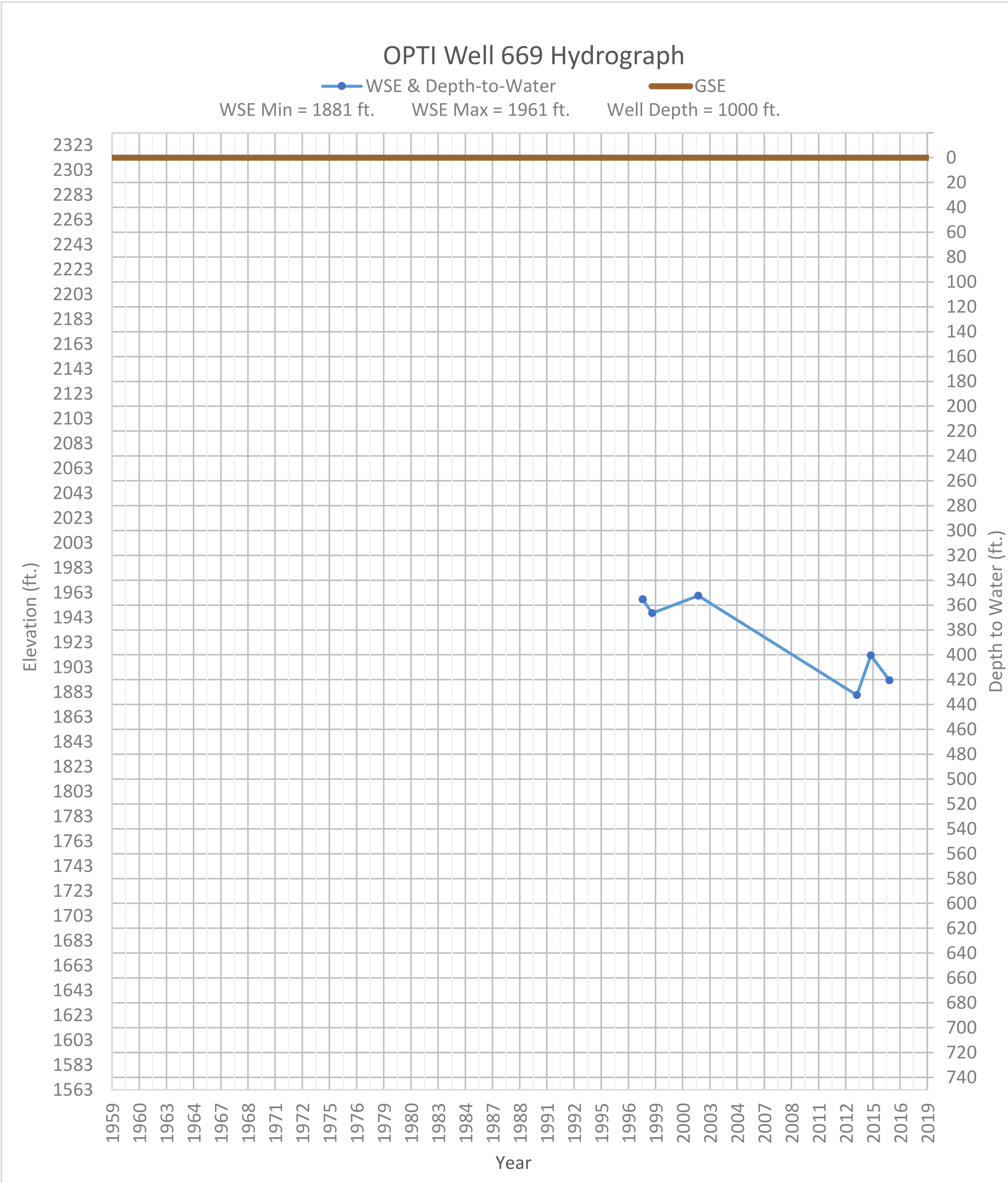

OPTI Well 669 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1881 ft.
WSE Max = 1961 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2323
2303
2283
2263
2243
2223
2203
2183
2163
2143
2123
2103
2083
2063
2043
2023
2003
1983
1963
1943
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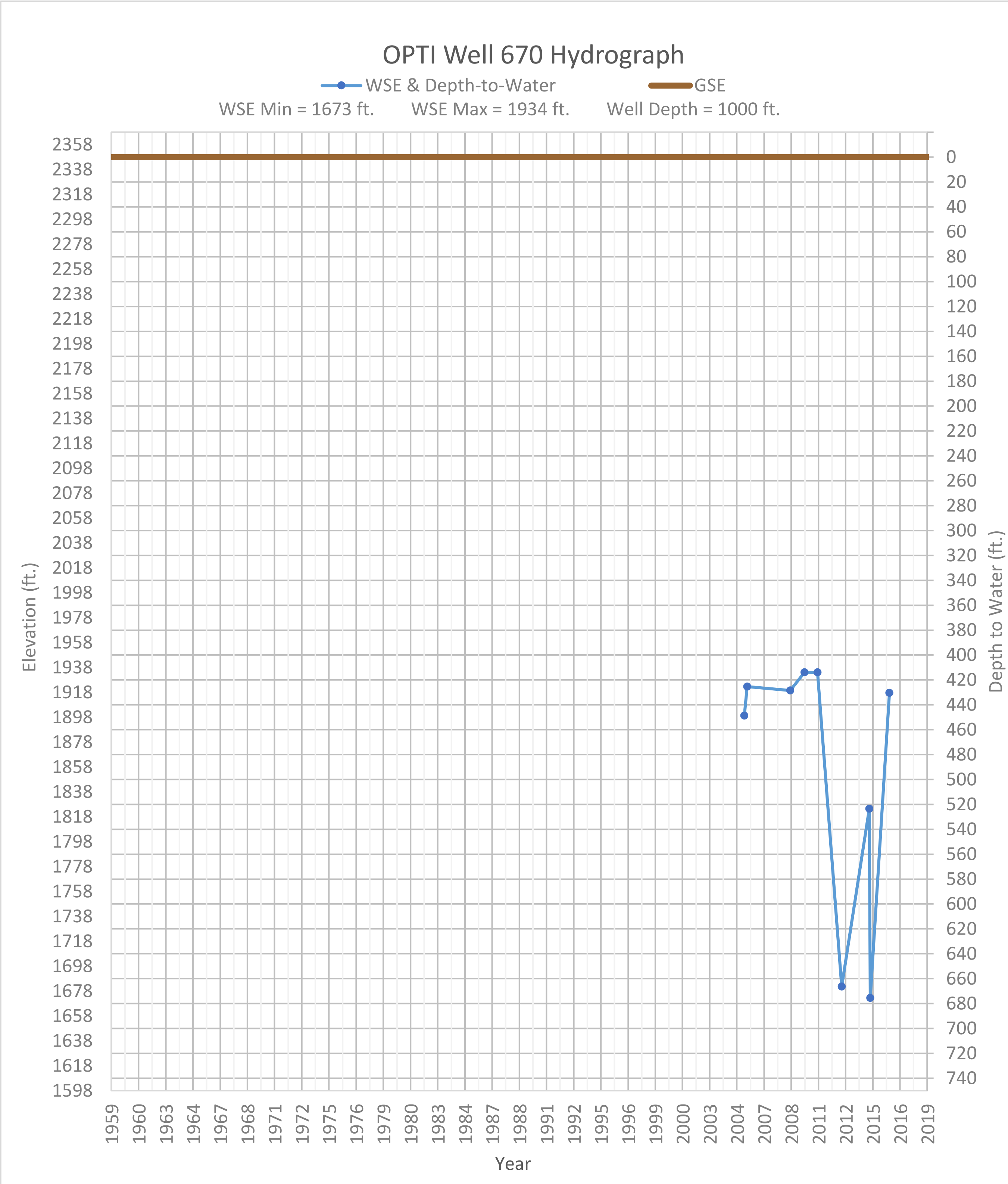
OPTI Well 670 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1673 ft.
WSE Max = 1934 ft.
Well Depth = 1000 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2358
2338
2318
2298
2278
2258
2238
2218
2198
2178
2158
2138
2118
2098
2078
2058
2038
2018
1998
1978
1958
1938
1918
1898
1878
1858
1838
1818
1798
1778
1758
1738
1718
1698
1678
1658
1638
1618
1598
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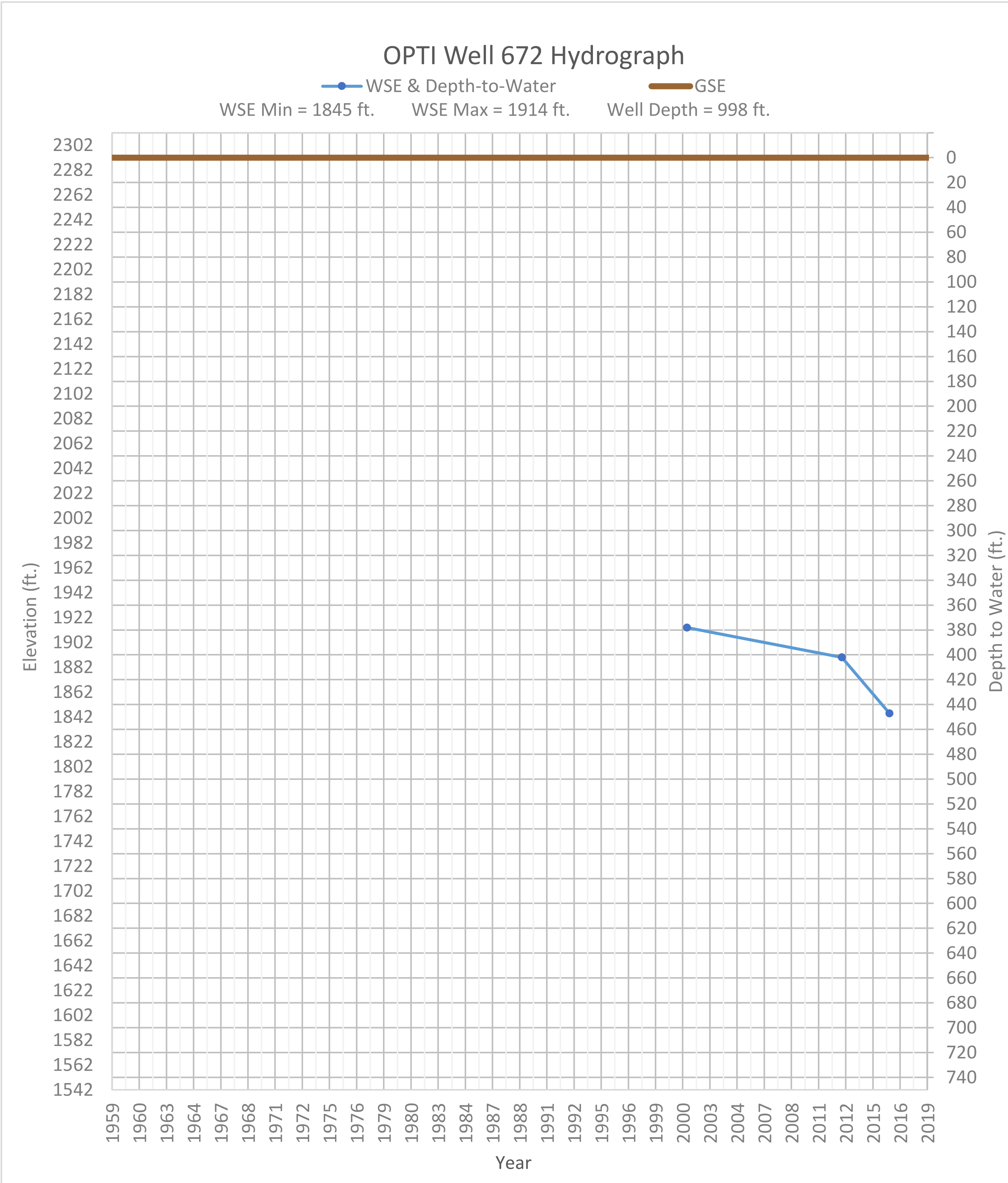
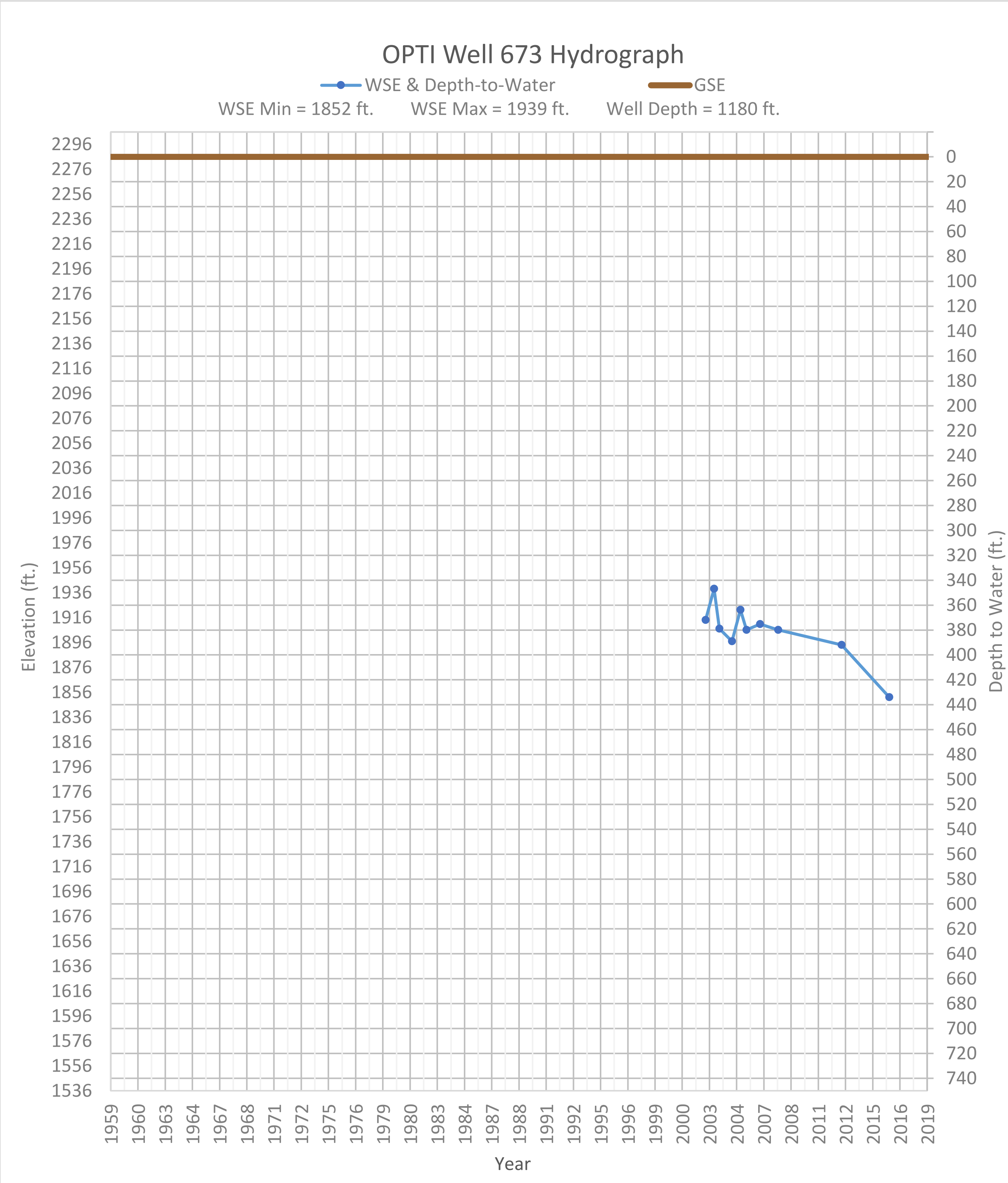
OPTI Well 671 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1852 ft.
WSE Max = 1992 ft.
Well Depth = 1002 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 672 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1845 ft.
WSE Max = 1914 ft.
Well Depth = 998 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 673 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1852 ft.
WSE Max = 1939 ft.
Well Depth = 1180 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2296
2276
2256
2236
2216
2196
2176
2156
2136
2116
2096
2076
2056
2036
2016
1996
1976
1956
1936
1916
1896
1876
1856
1836
1816
1796
1776
1756
1736
1716
1696
1676
1656
1636
1616
1596
1576
1556
1536
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OPTI Well 674 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1809 ft.
WSE Max = 1960 ft.
Well Depth = 1100 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 675 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1859 ft.
WSE Max = 1951 ft.
Well Depth = 1203 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 676 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1740 ft.
WSE Max = 1960 ft.
Well Depth = 735 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 677 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1890 ft.
WSE Max = 1949 ft.
Well Depth = 941 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2309
2289
2269
2249
2229
2209
2189
2169
2149
2129
2109
2089
2069
2049
2029
2009
1989
1969
1949
1929
1909
1889
1869
1849
1829
1809
1789
1769
1749
1729
1709
1689
1669
1649
1629
1609
1589
1569
1549
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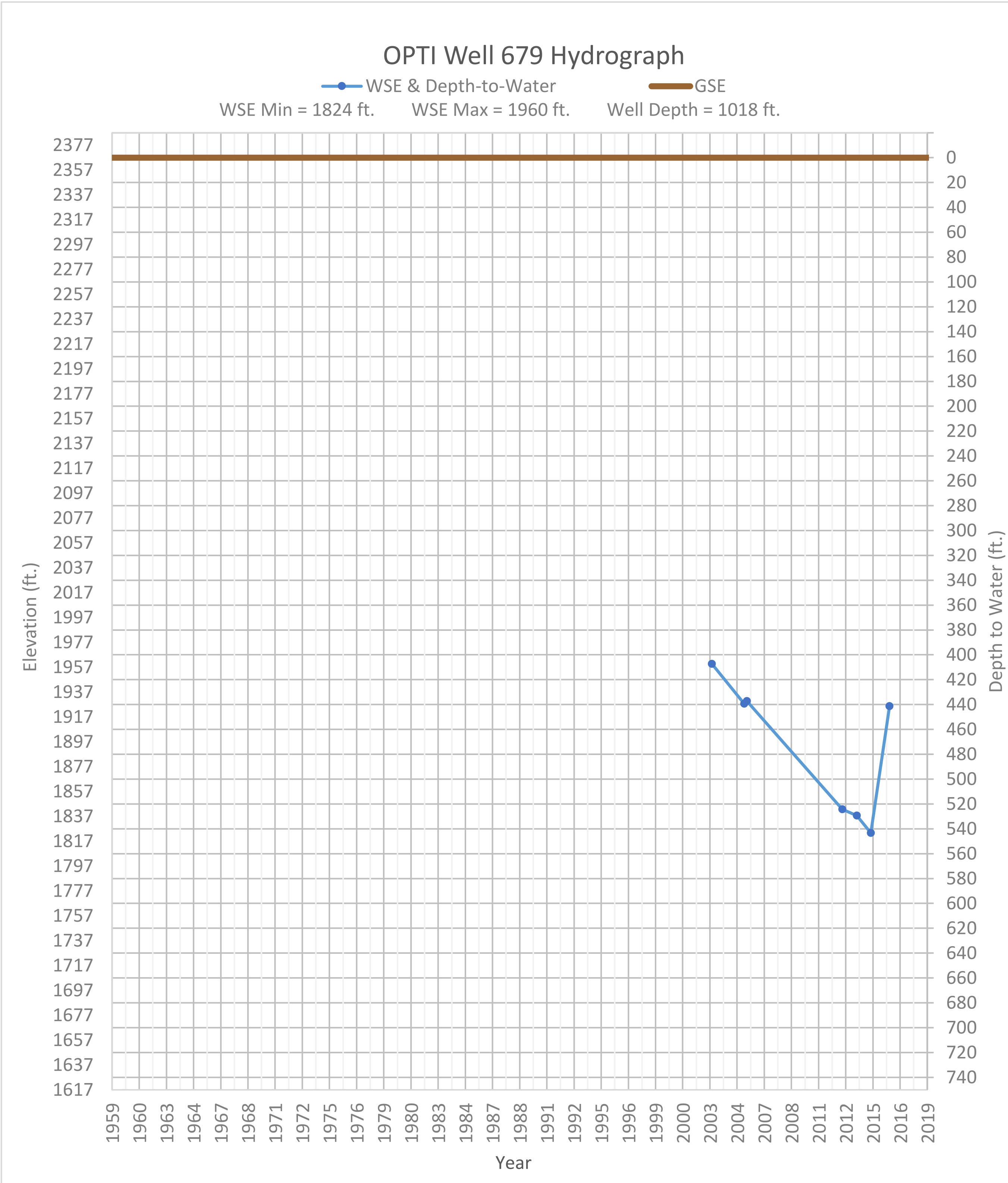
2016
2019


OPTI Well 678 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1881 ft.
WSE Max = 2167 ft.
Well Depth = 881 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 679 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1824 ft.
WSE Max = 1960 ft.
Well Depth = 1018 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2377
2357
2337
2317
2297
2277
2257
2237
2217
2197
2177
2157
2137
2117
2097
2077
2057
2037
2017
1997
1977
1957
1937
1917
1897
1877
1857
1837
1817
1797
1777
1757
1737
1717
1697
1677
1657
1637
1617
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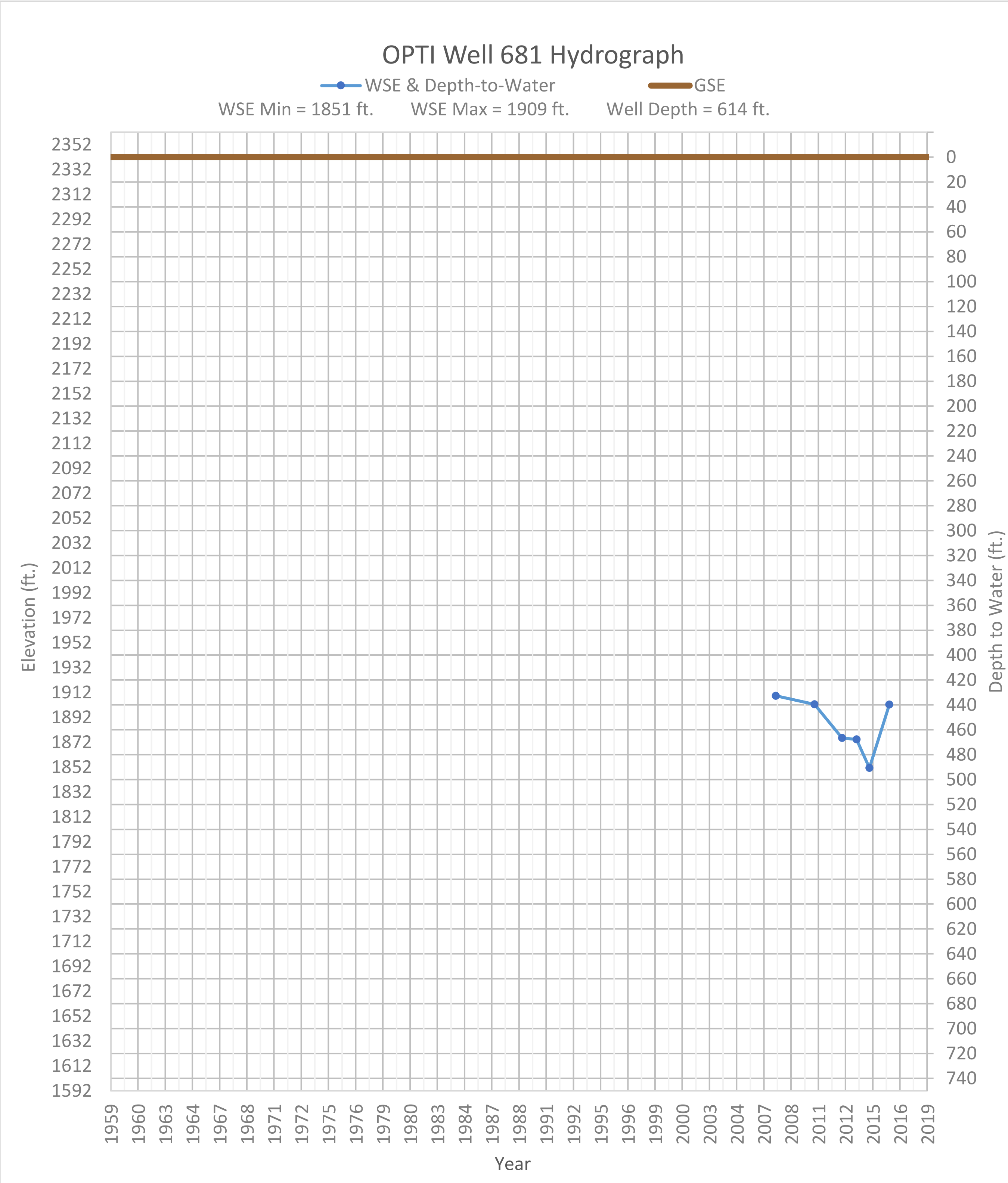

OPTI Well 681 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1851 ft.
WSE Max = 1909 ft.
Well Depth = 614 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2352
2332
2312
2292
2272
2252
2232
2212
2192
2172
2152
2132
2112
2092
2072
2052
2032
2012
1992
1972
1952
1932
1912
1892
1872
1852
1832
1812
1792
1772
1752
1732
1712
1692
1672
1652
1632
1612
1592
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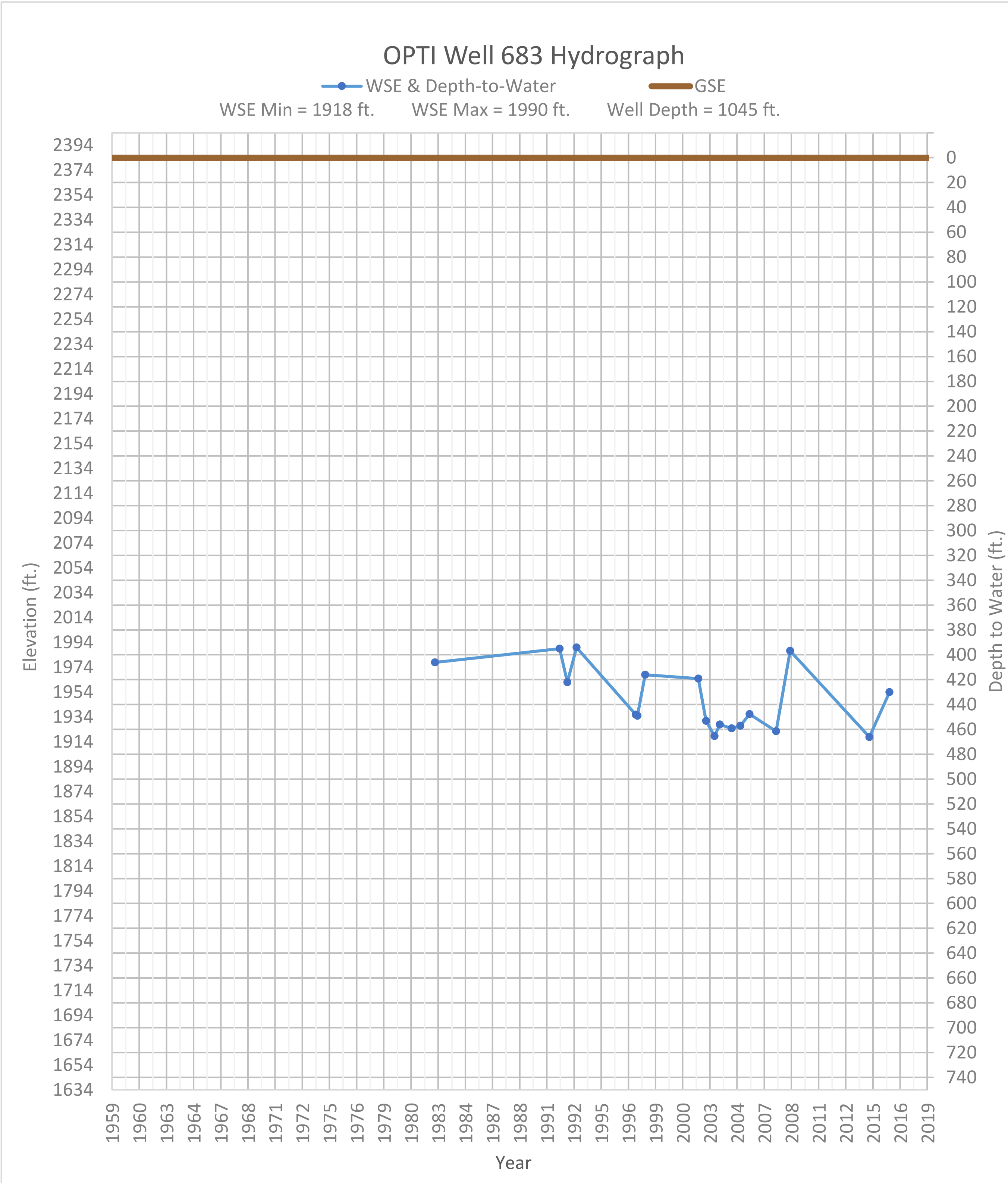
2011
2012
2015
2016
2019

OPTI Well 682 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1934 ft.
WSE Max = 1993 ft.
Well Depth = 1300 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 683 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1918 ft.
WSE Max = 1990 ft.
Well Depth = 1045 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2394
2374
2354
2334
2314
2294
2274
2254
2234
2214
2194
2174
2154
2134
2114
2094
2074
2054
2034
2014
1994
1974
1954
1934
1914
1894
1874
1854
1834
1814
1794
1774
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1734
1714
1694
1674
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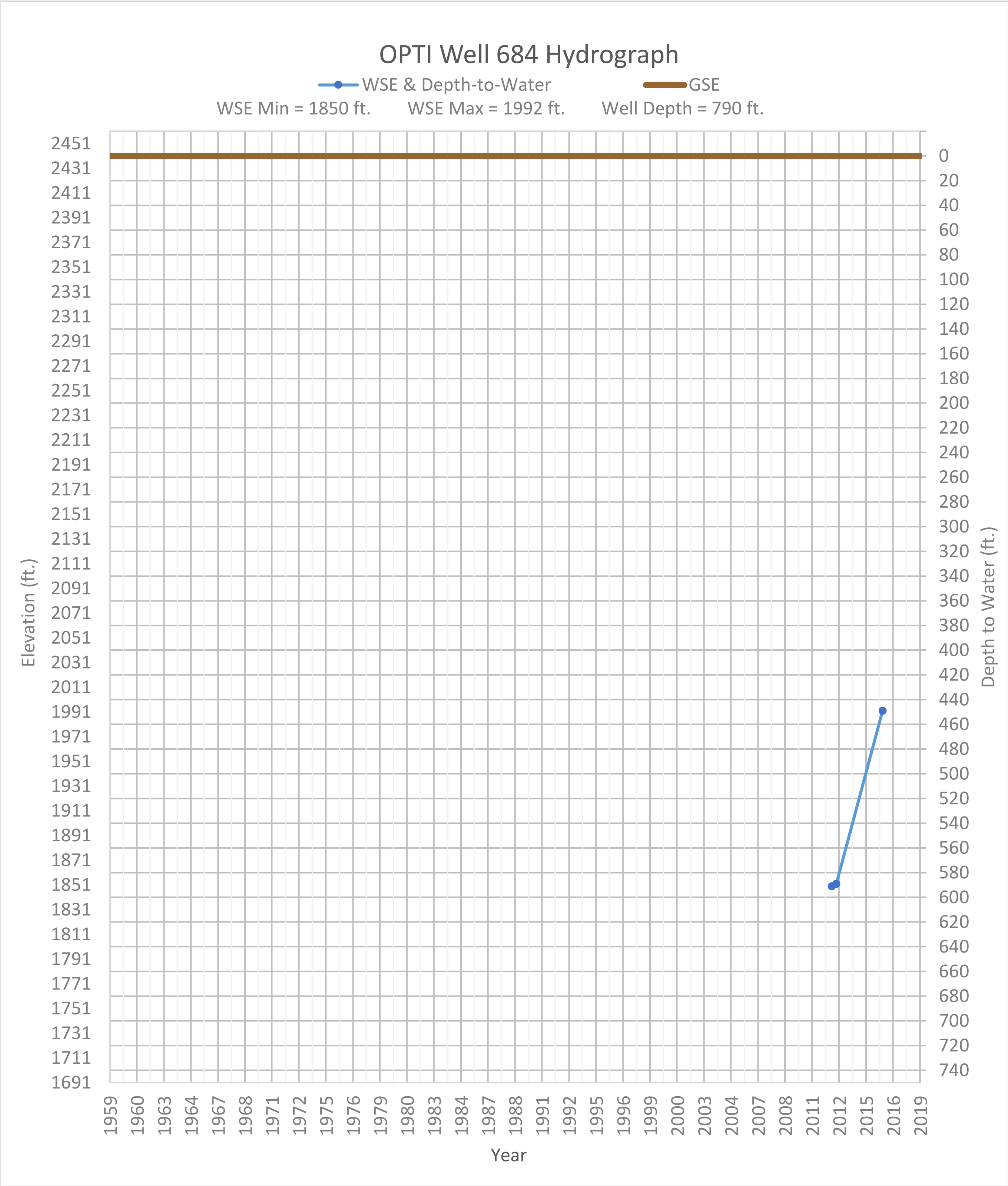
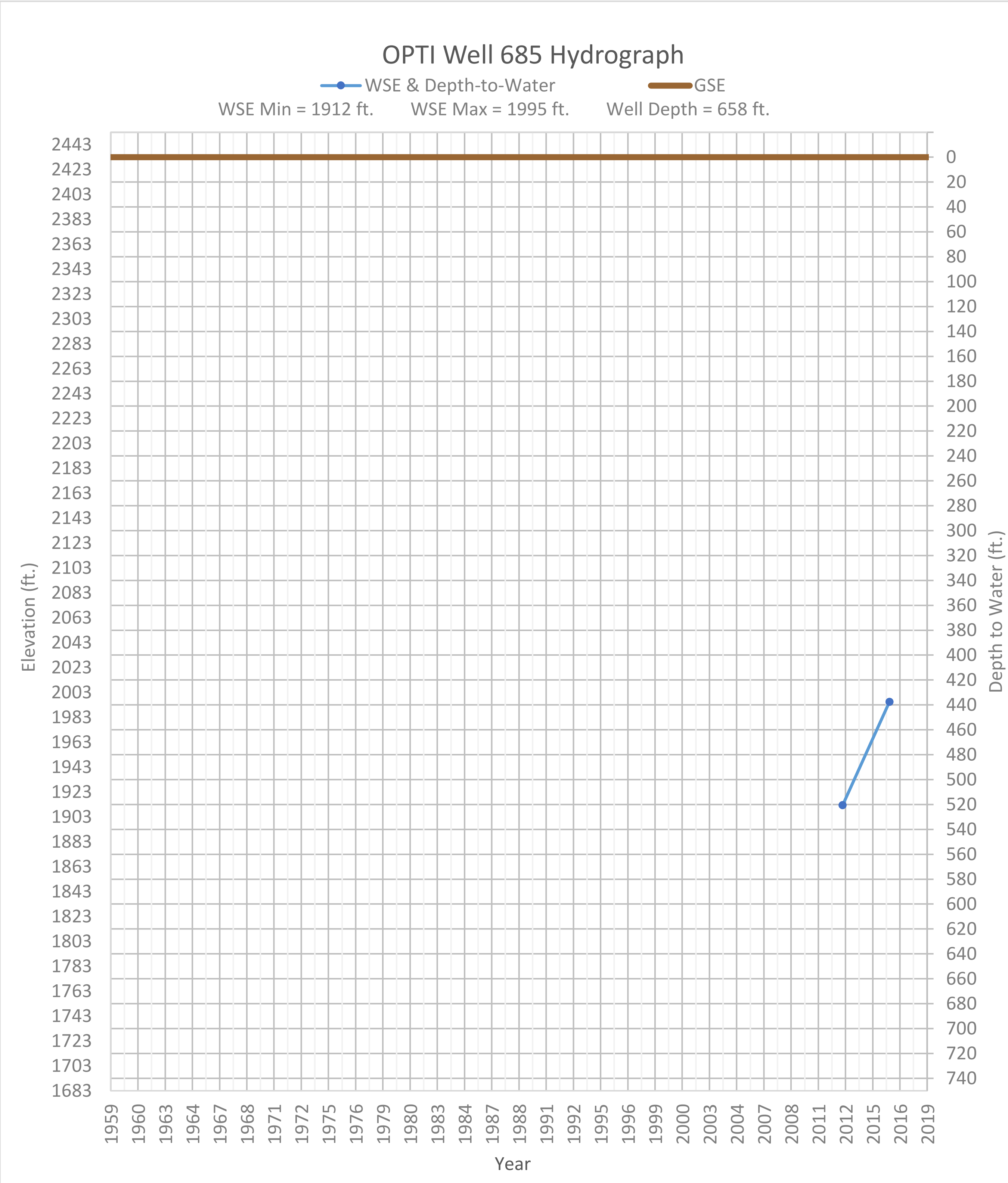
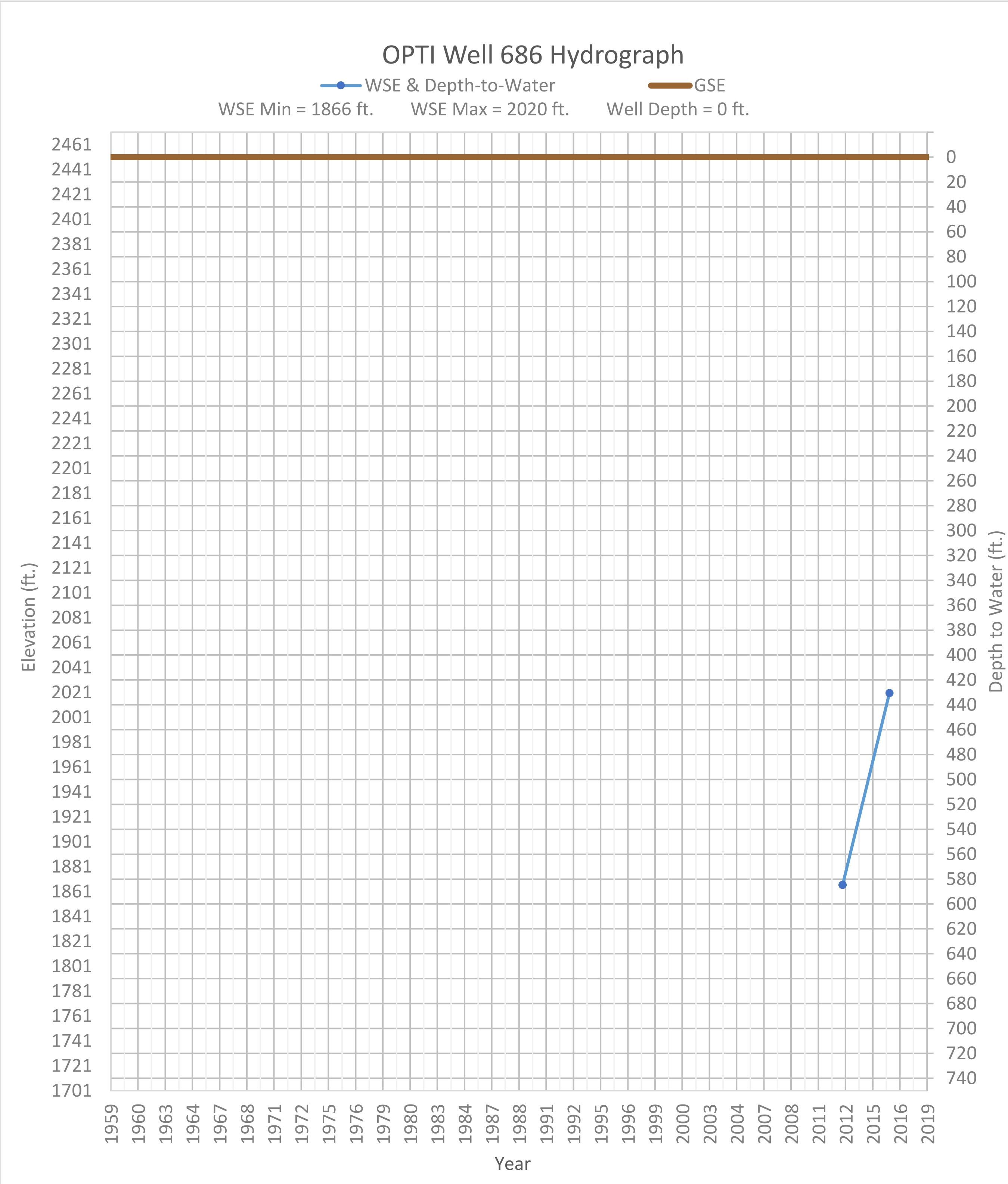


OPTI Well 684 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1850 ft.
WSE Max = 1992 ft.
Well Depth = 790 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

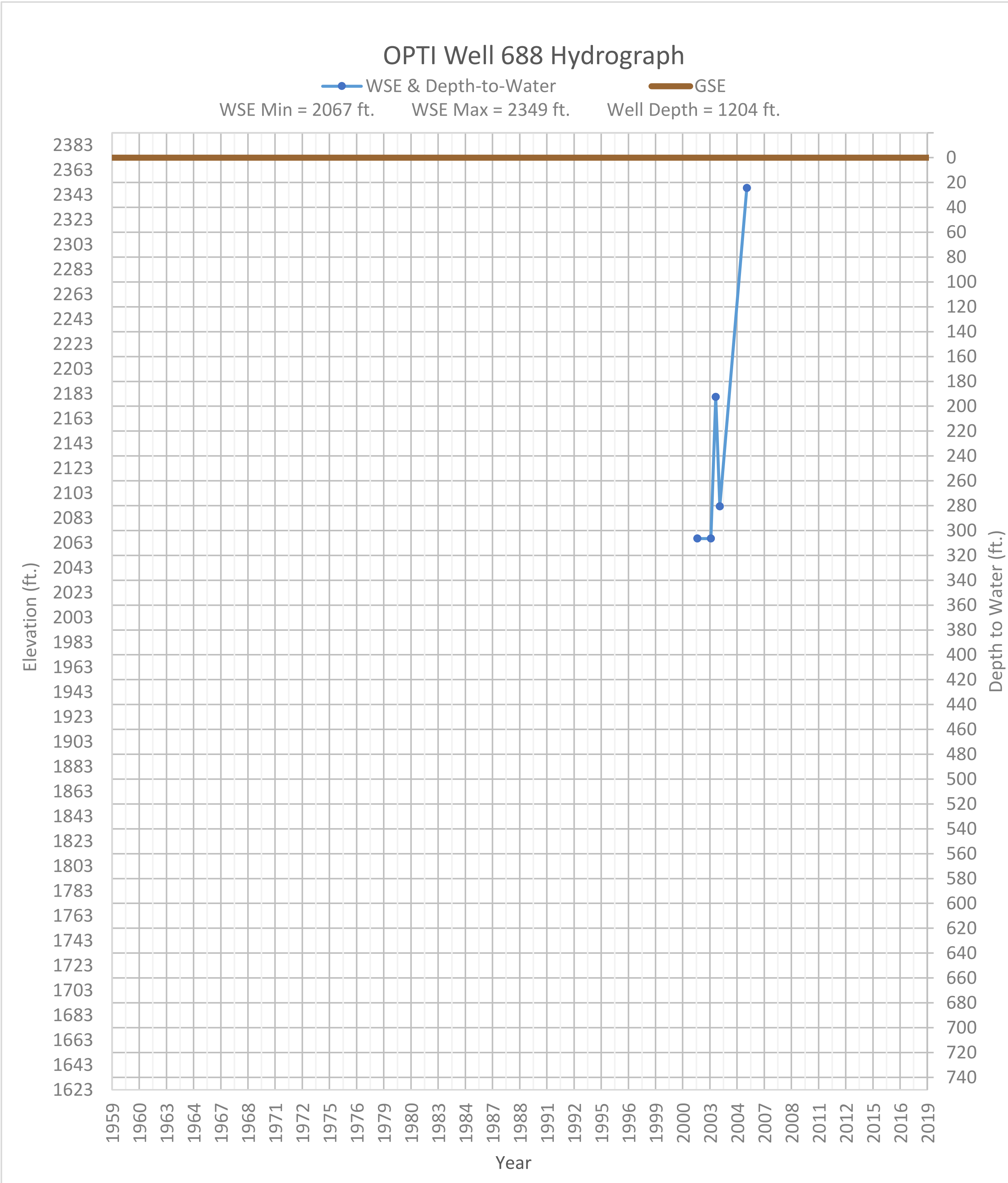


OPTI Well 685 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1912 ft.
WSE Max = 1995 ft.
Well Depth = 658 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

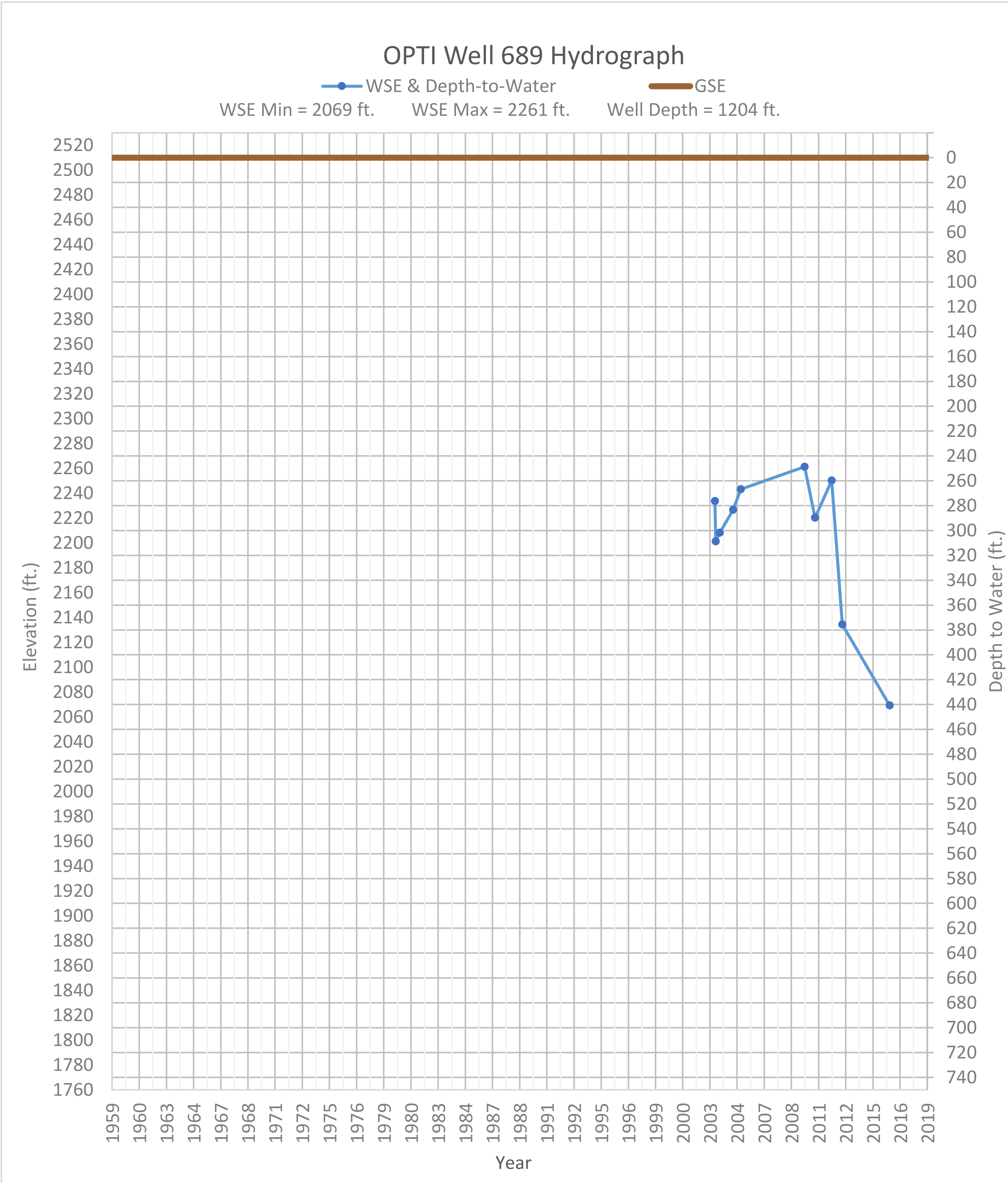


OPTI Well 686 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1866 ft.
WSE Max = 2020 ft.
Well Depth = 0 ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 687 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1781 ft.
WSE Max = 2101 ft.
Well Depth = 1195 ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 688 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2067 ft.
WSE Max = 2349 ft.
Well Depth = 1204 ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 689 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 2069 ft.
WSE Max = 2261 ft.
Well Depth = 1204 ft.
Elevation (ft.)
Depth to Water (ft.)
Year
2520
2500
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
2180
2160
2140
2120
2100
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2040
2020
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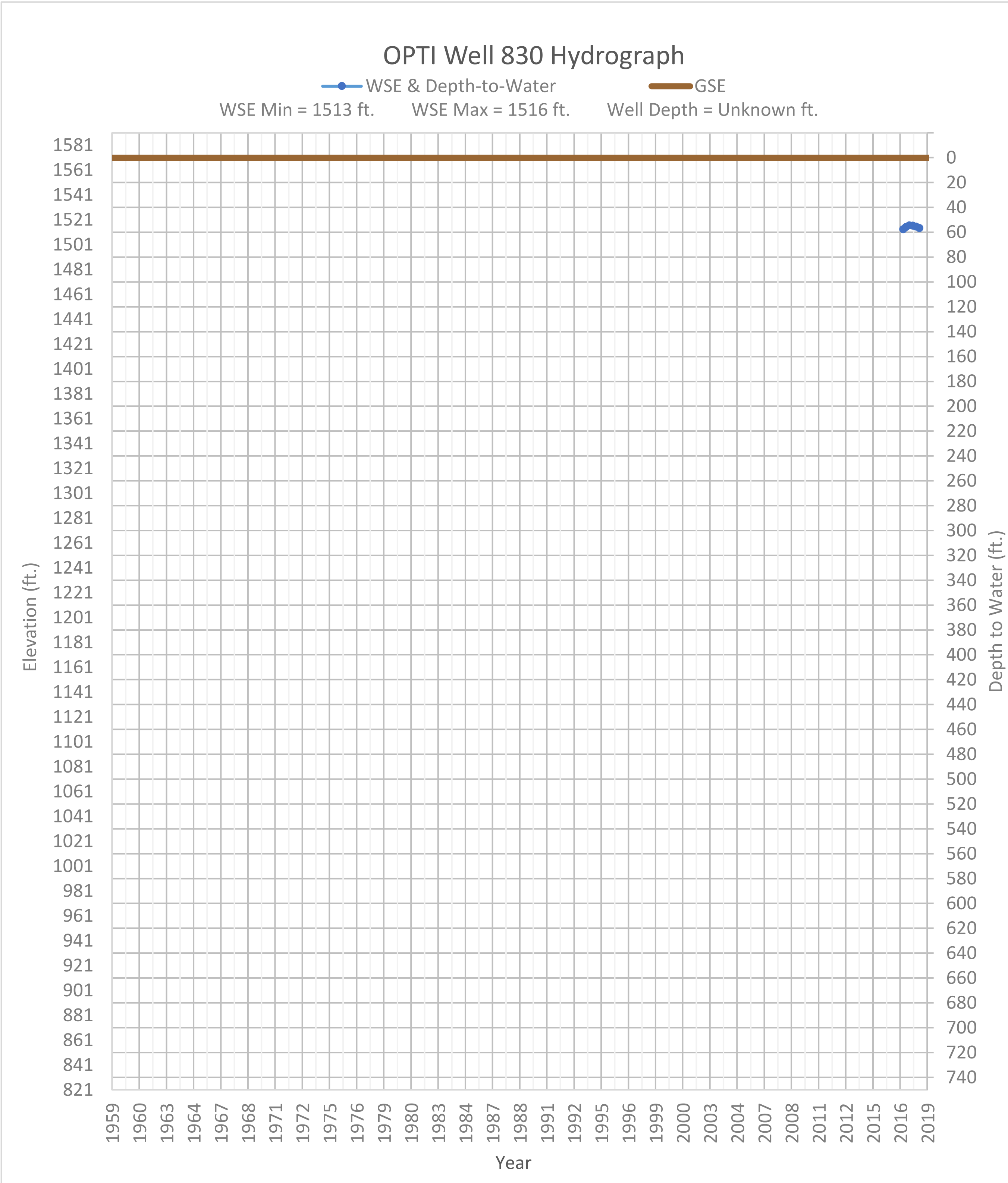

OPTI Well 830 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1513 ft.
WSE Max = 1516 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1581
1561
1541
1521
1501
1481
1461
1441
1421
1401
1381
1361
1341
1321
1301
1281
1261
1241
1221
1201
1181
1161
1141
1121
1101
1081
1061
1041
1021
1001
981
961
941
921
901
881
861
841
821
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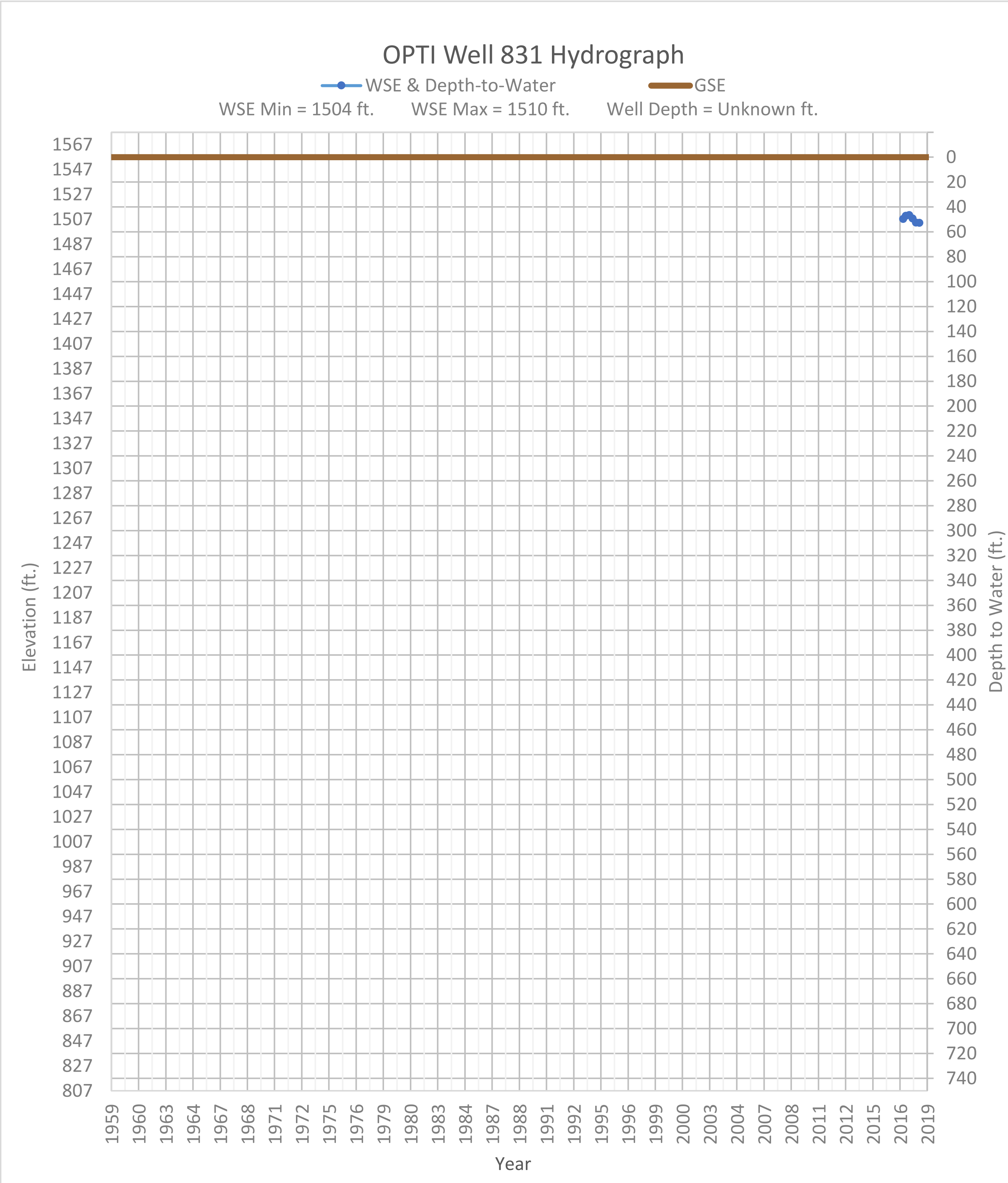
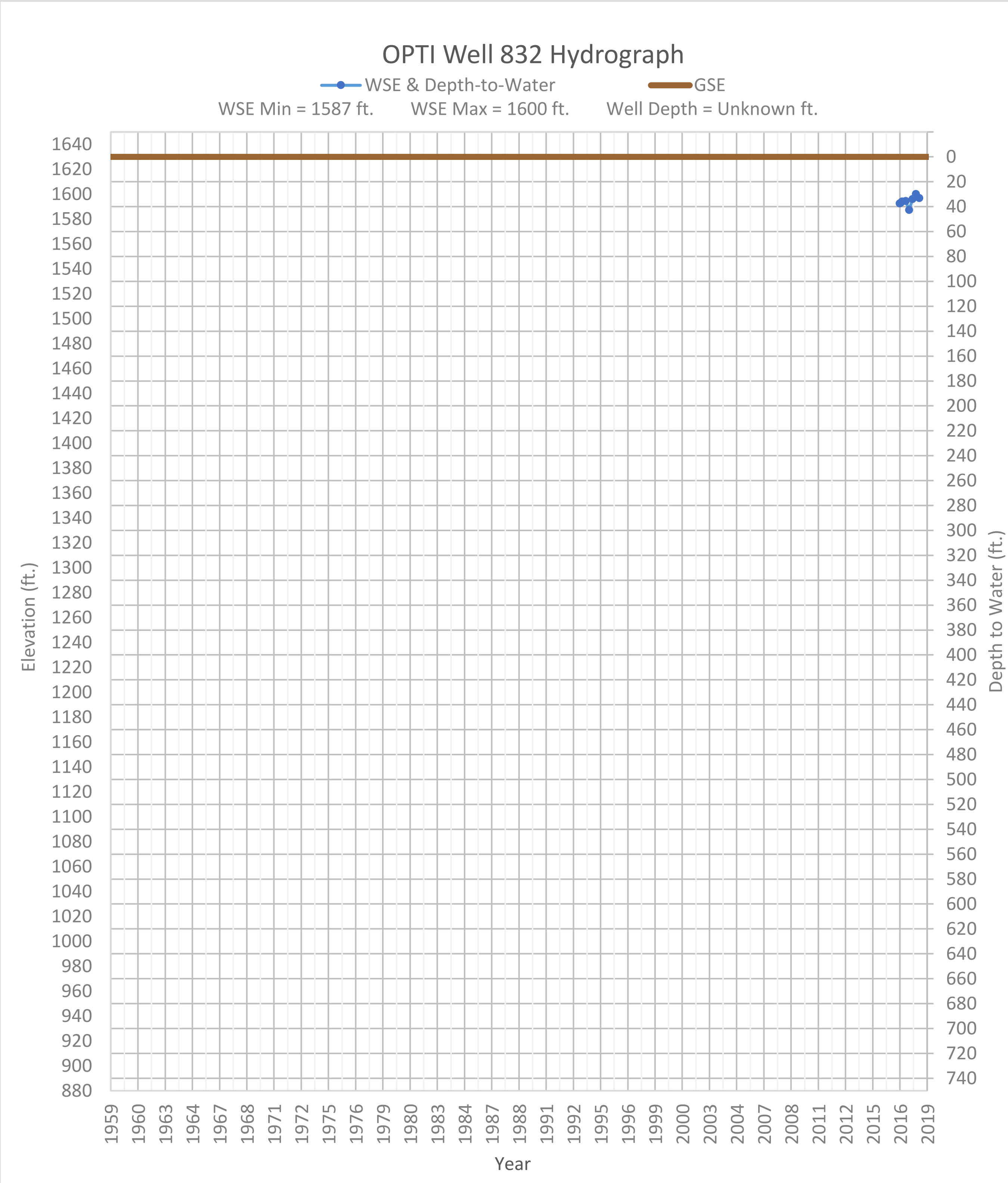


OPTI Well 831 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1504 ft.
WSE Max = 1510 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 832 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1587 ft.
WSE Max = 1600 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1640
1620
1600
1580
1560
1540
1520
1500
1480
1460
1440
1420
1400
1380
1360
1340
1320
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1200
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1120
1100
1080
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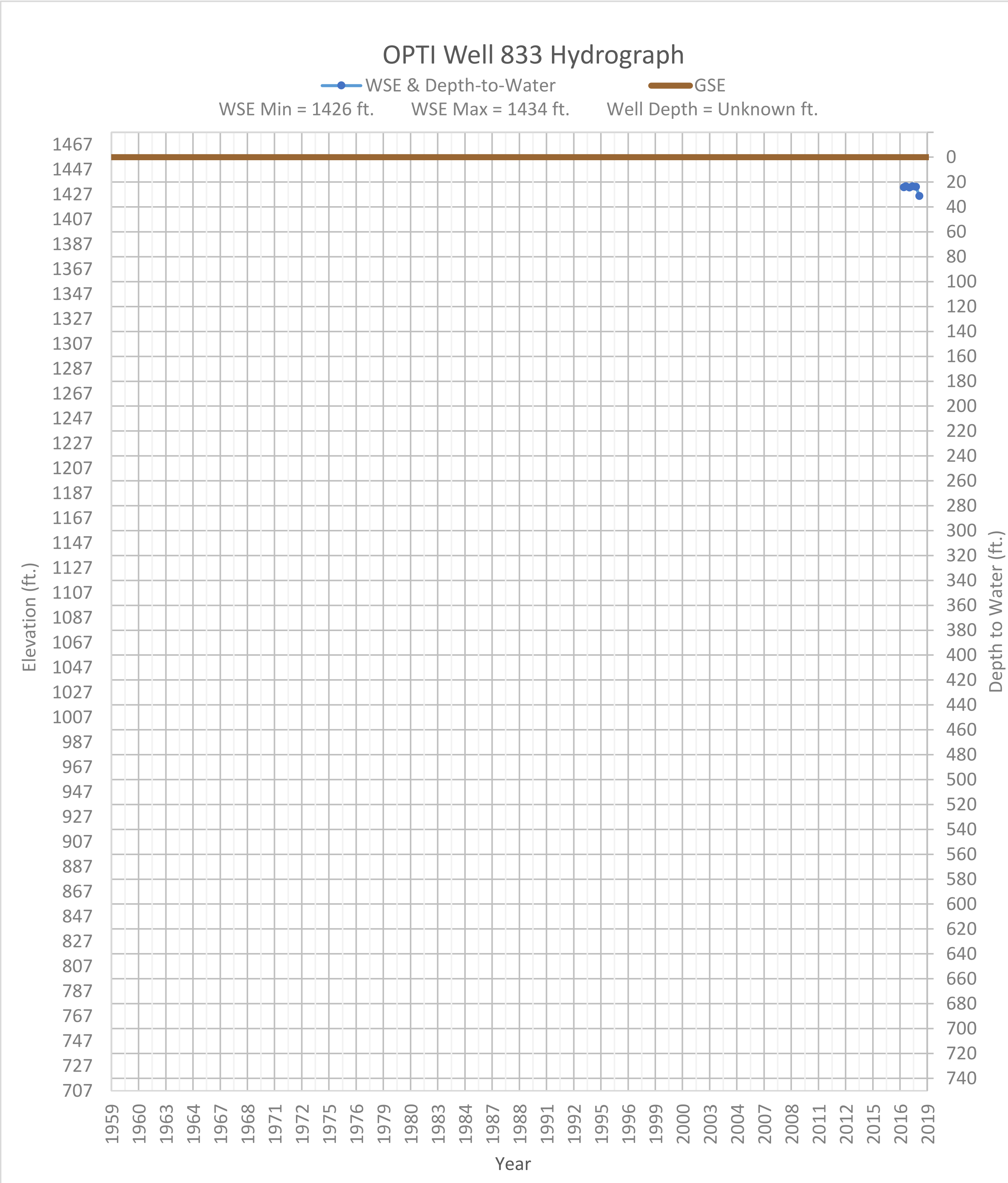

OPTI Well 833 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1426 ft.
WSE Max = 1434 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1467
1447
1427
1407
1387
1367
1347
1327
1307
1287
1267
1247
1227
1207
1187
1167
1147
1127
1107
1087
1067
1047
1027
1007
987
967
947
927
907
887
867
847
827
807
787
767
747
727
707
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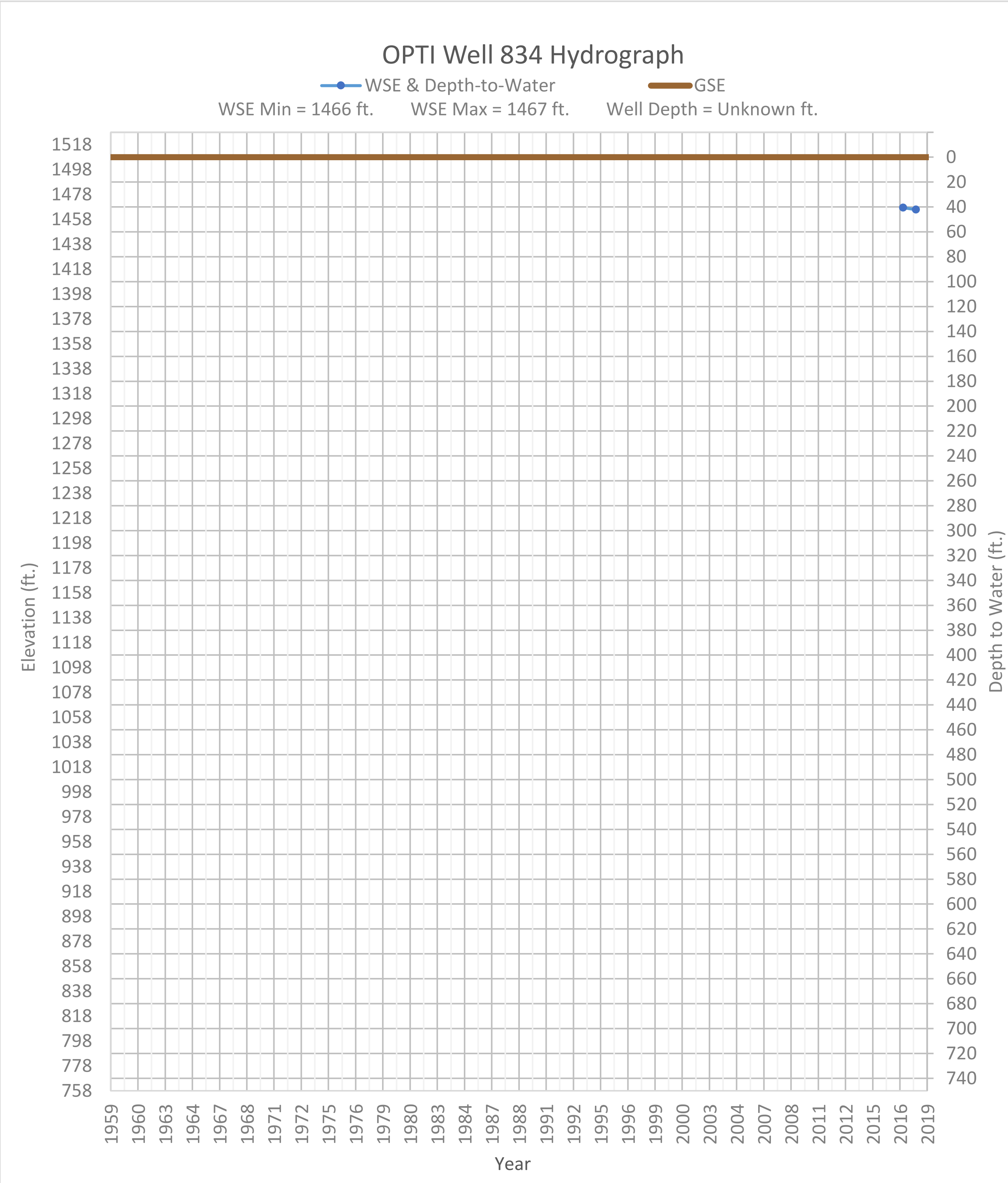

OPTI Well 834 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1466 ft.
WSE Max = 1467 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 835 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1518 ft.
WSE Max = 1533 ft.
Well Depth = Unknown ft.
Elevation (ft.)
1565
1545
1525
1505
1485
1465
1445
1425
1405
1385
1365
1345
1325
1305
1285
1265
1245
1225
1205
1185
1165
1145
1125
1105
1085
1065
1045
1025
1005
985
965
945
925
905
885
865
845
825
805
Depth to Water (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
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460
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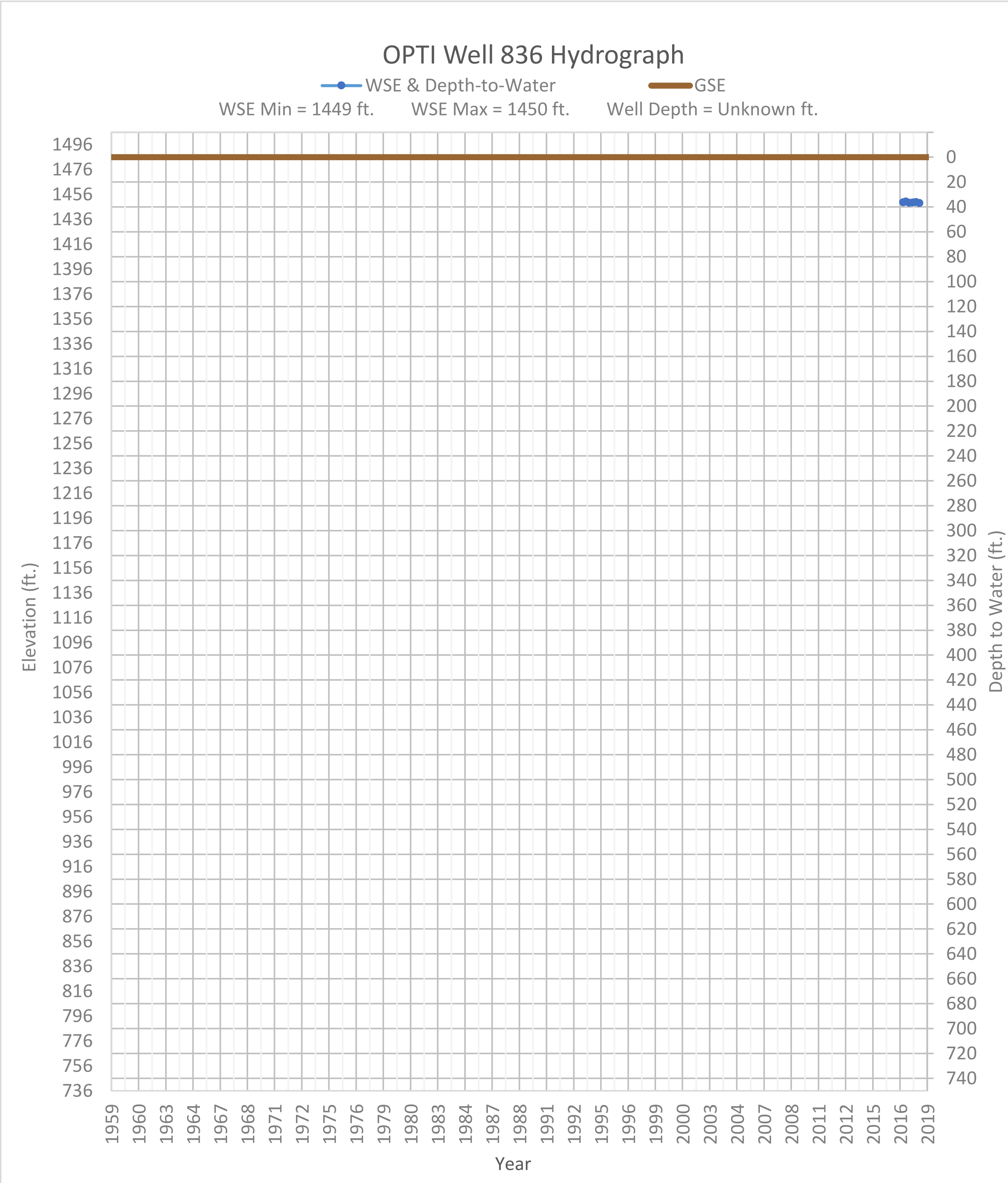
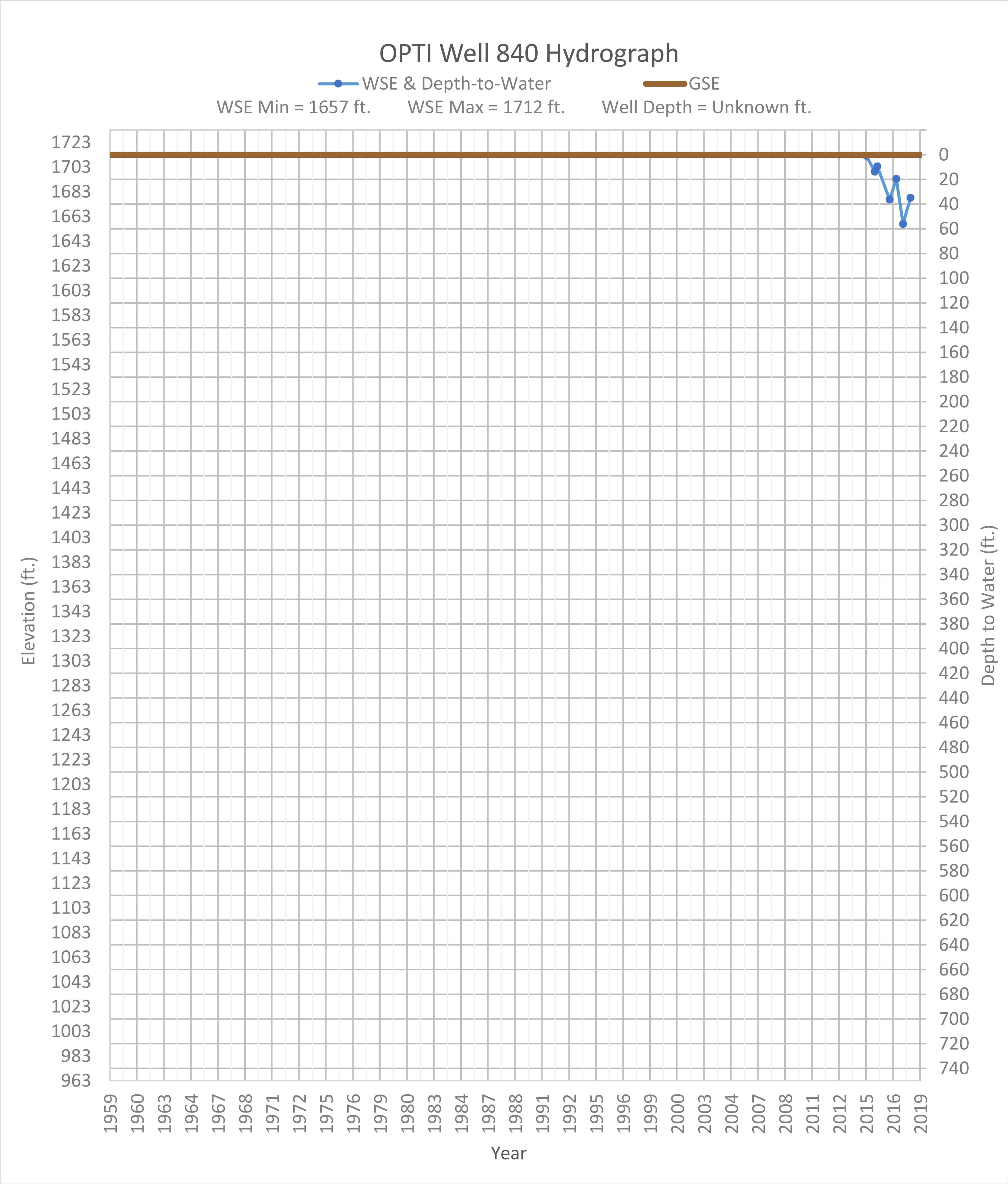
Year

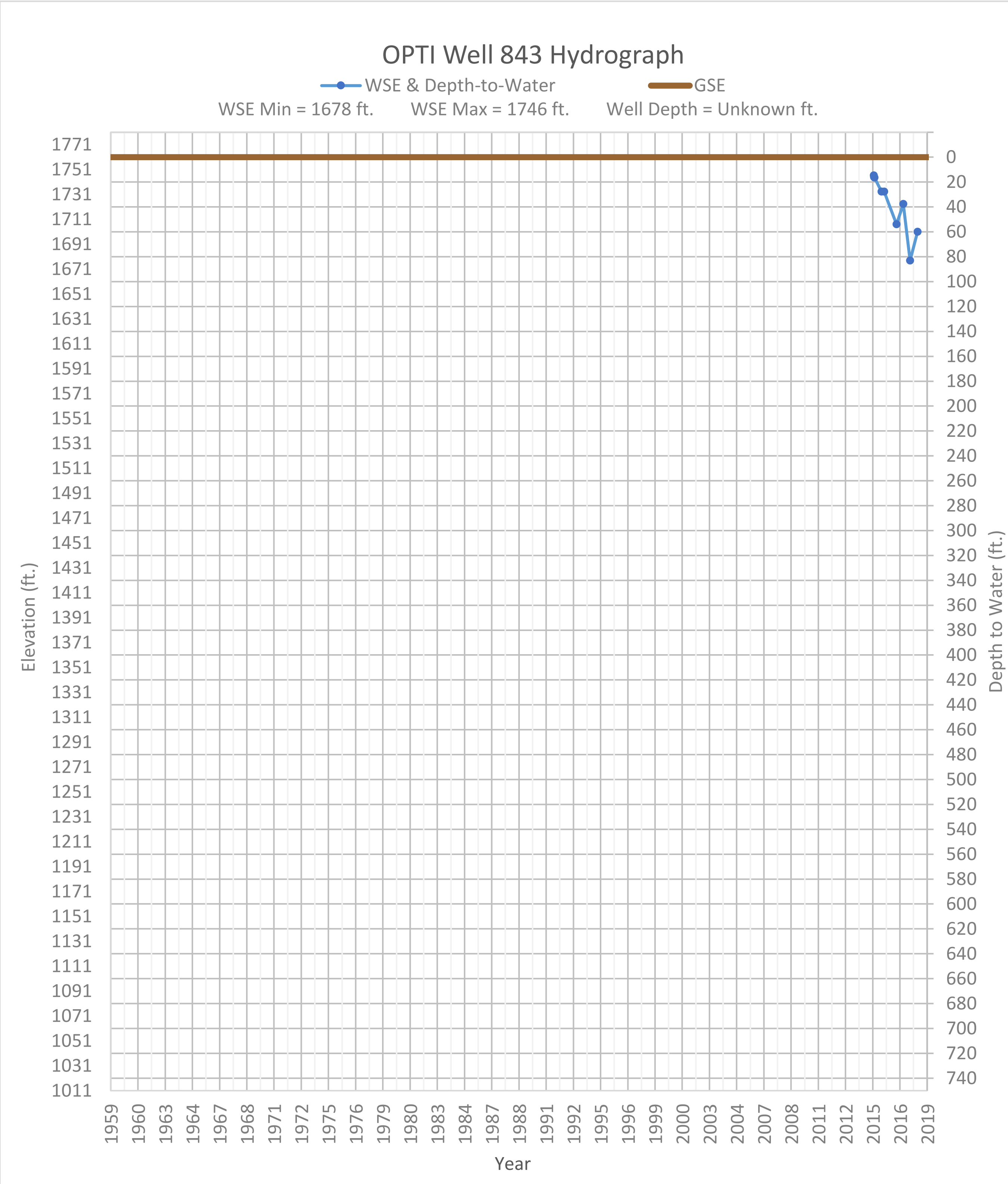


OPTI Well 836 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1449 ft.
WSE Max = 1450 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

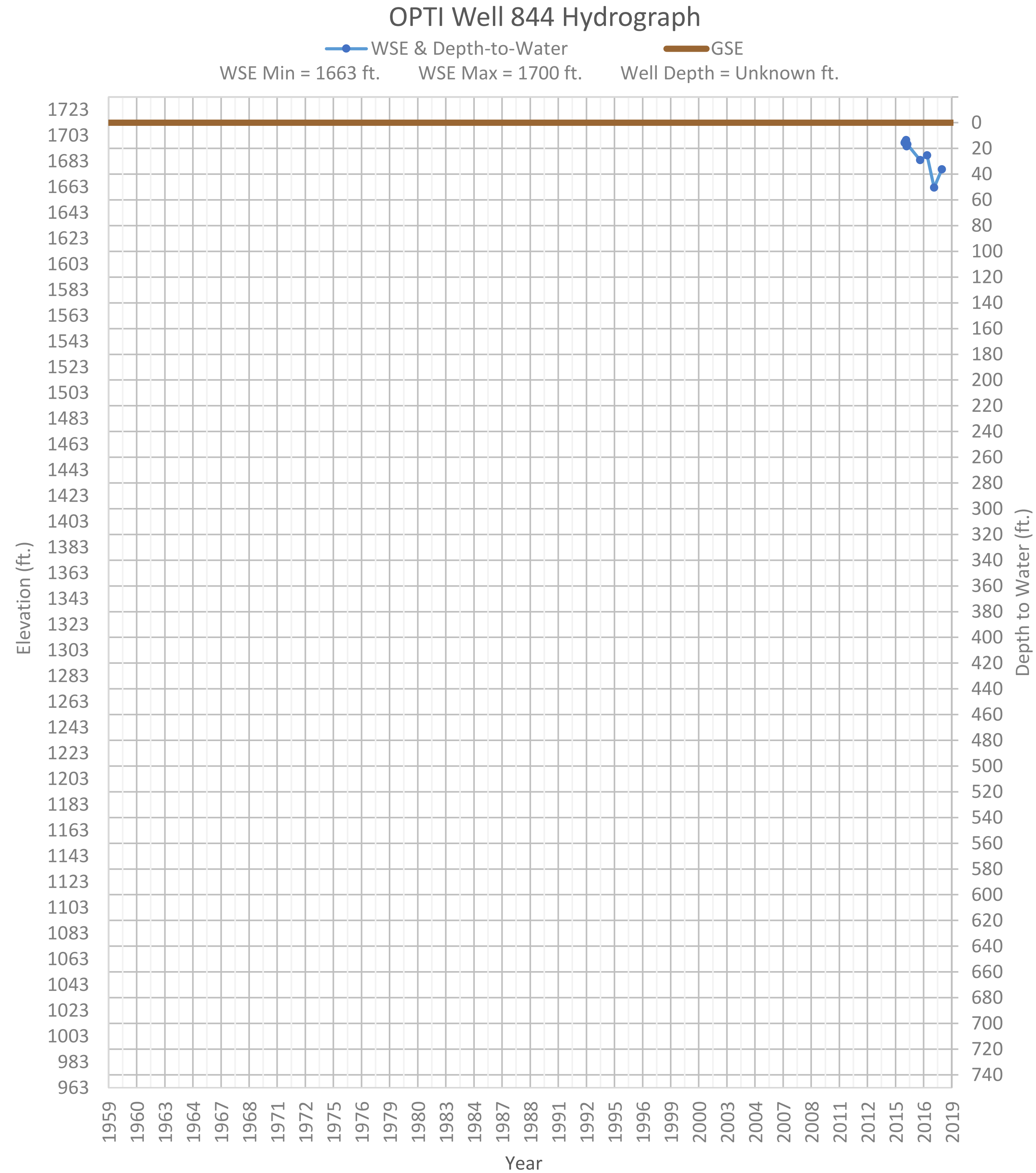

OPTI Well 840 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1657 ft.
WSE Max = 1712 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

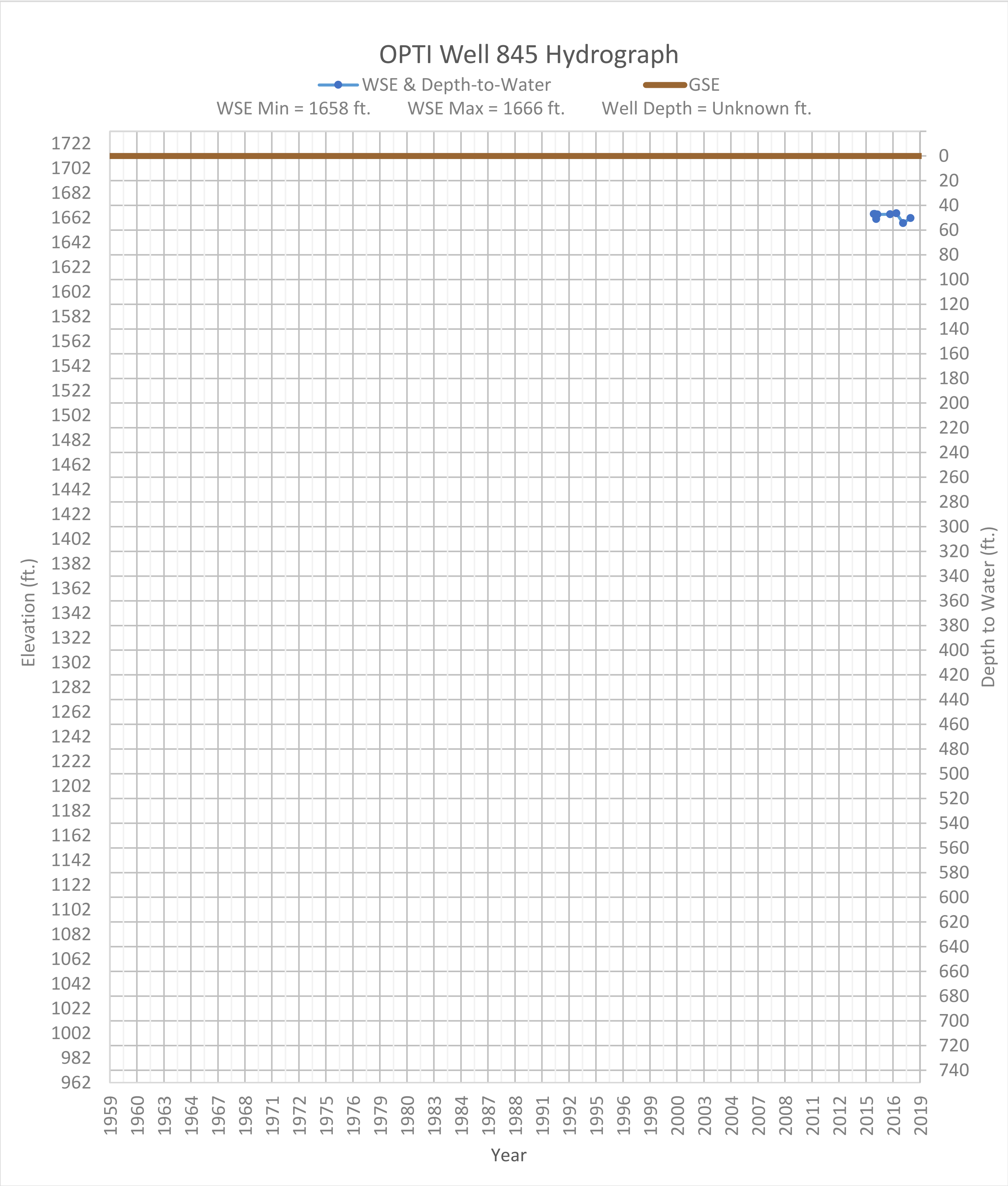
OPTI Well 841 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1701 ft.
WSE Max = 1740 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 842 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1698 ft.
WSE Max = 1751 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 843 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1678 ft.
WSE Max = 1746 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 844 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1663 ft.
WSE Max = 1700 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year



OPTI Well 845 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1658 ft.
WSE Max = 1666 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1722
1702
1682
1662
1642
1622
1602
1582
1562
1542
1522
1502
1482
1462
1442
1422
1402
1382
1362
1342
1322
1302
1282
1262
1242
1222
1202
1182
1162
1142
1122
1102
1082
1062
1042
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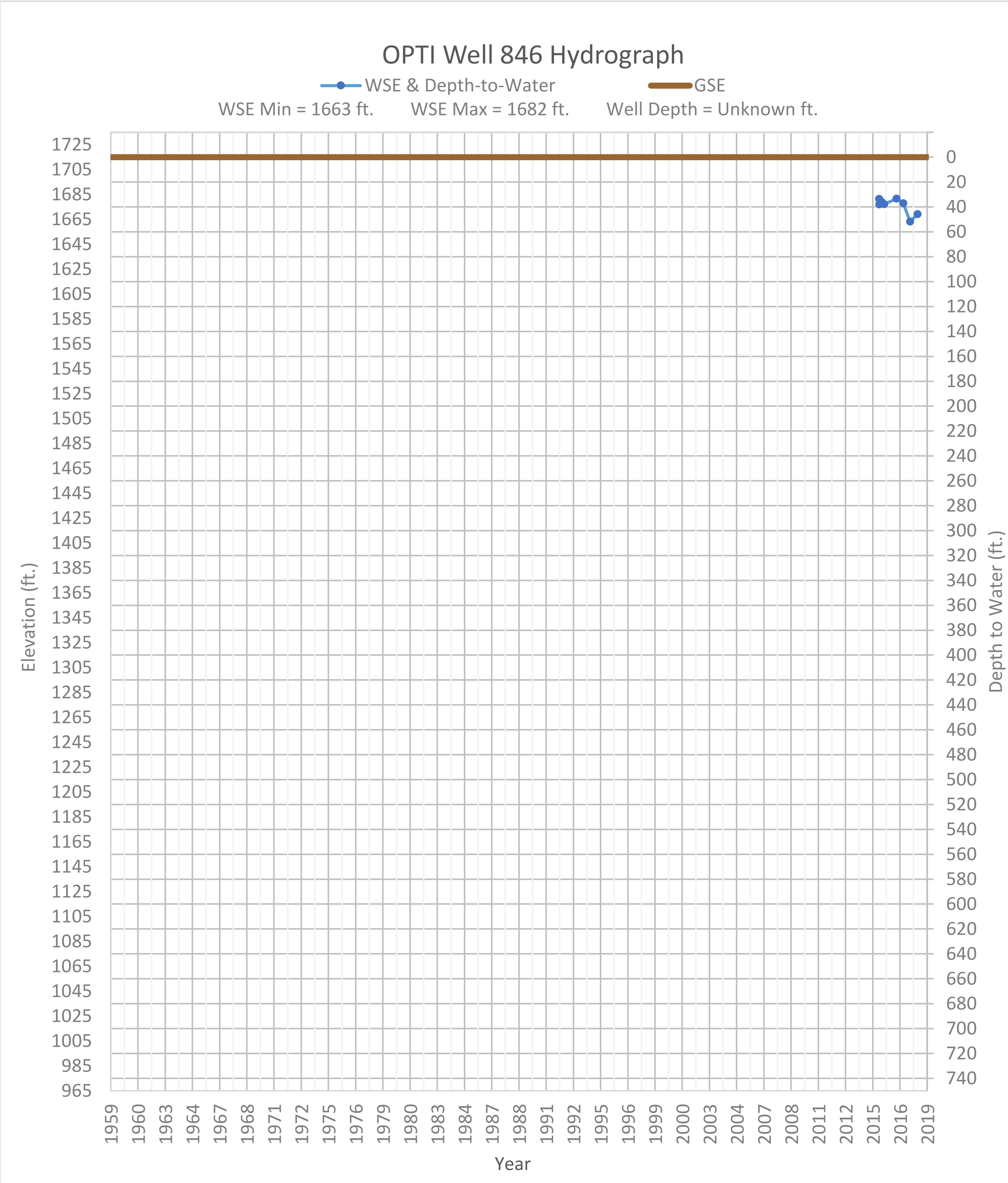
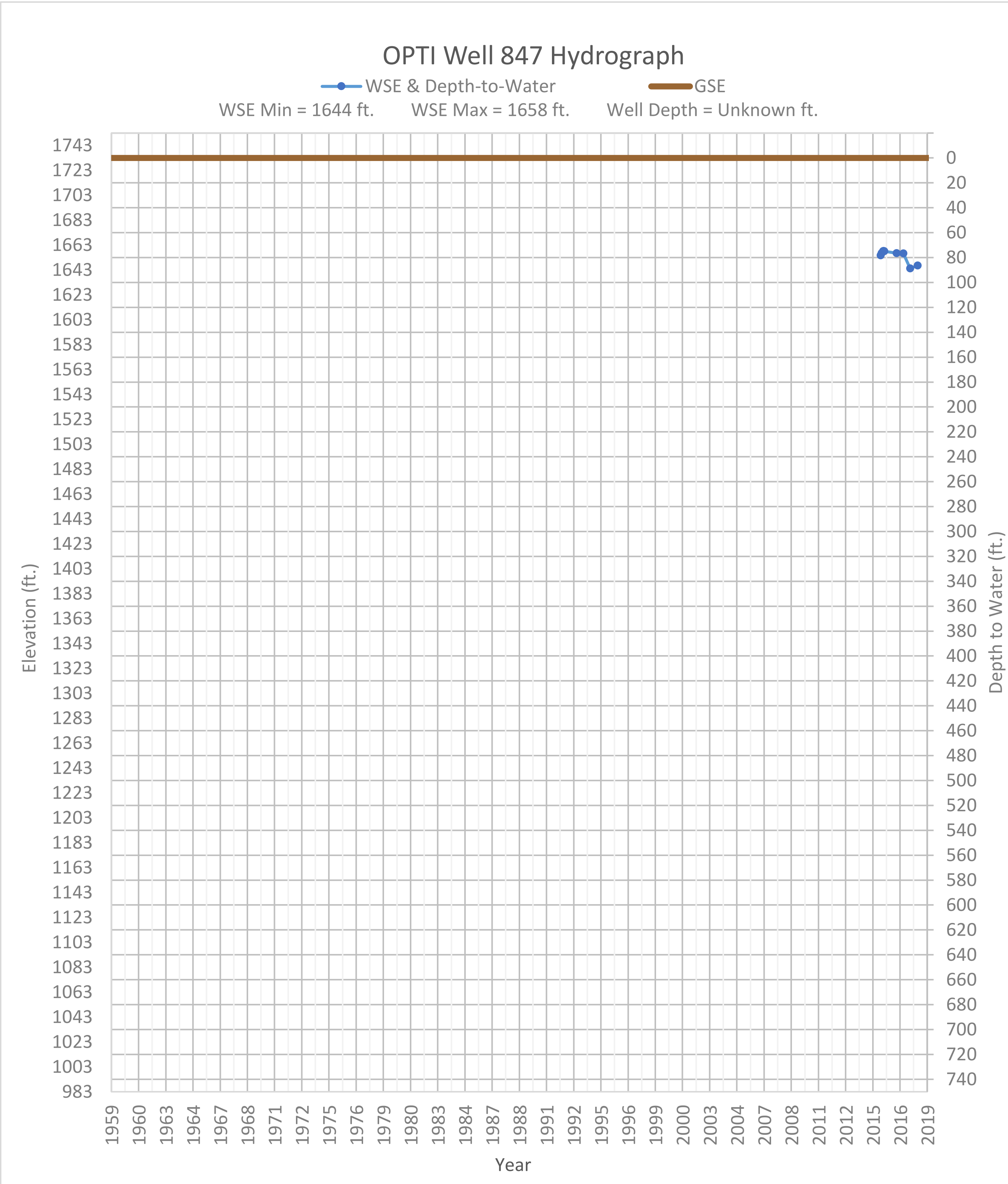


OPTI Well 846 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1663 ft.
WSE Max = 1682 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 847 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1644 ft.
WSE Max = 1658 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1743
1723
1703
1683
1663
1643
1623
1603
1583
1563
1543
1523
1503
1483
1463
1443
1423
1403
1383
1363
1343
1323
1303
1283
1263
1243
1223
1203
1183
1163
1143
1123
1103
1083
1063
1043
1023
1003
983
0
20
40
60
80
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160
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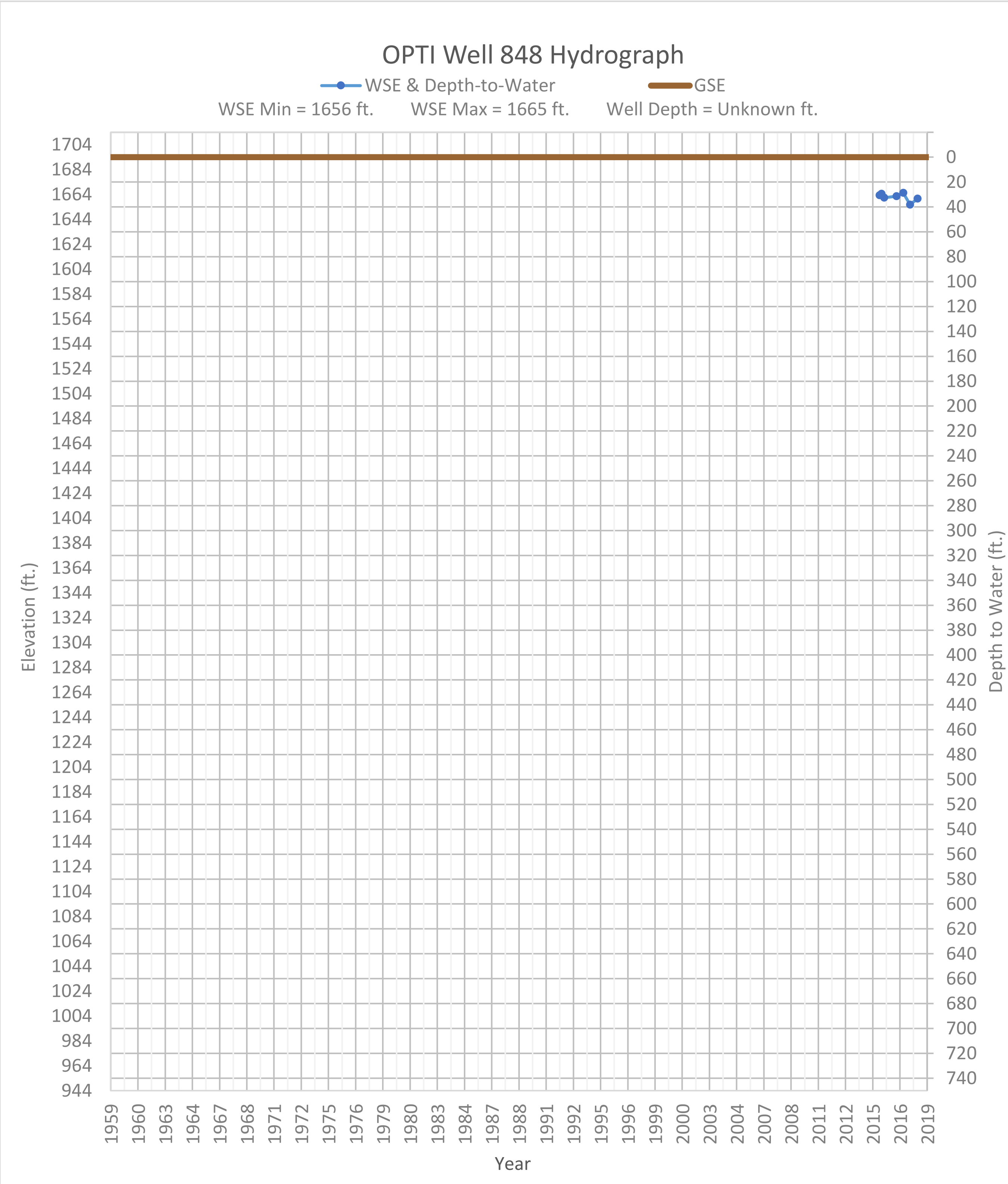
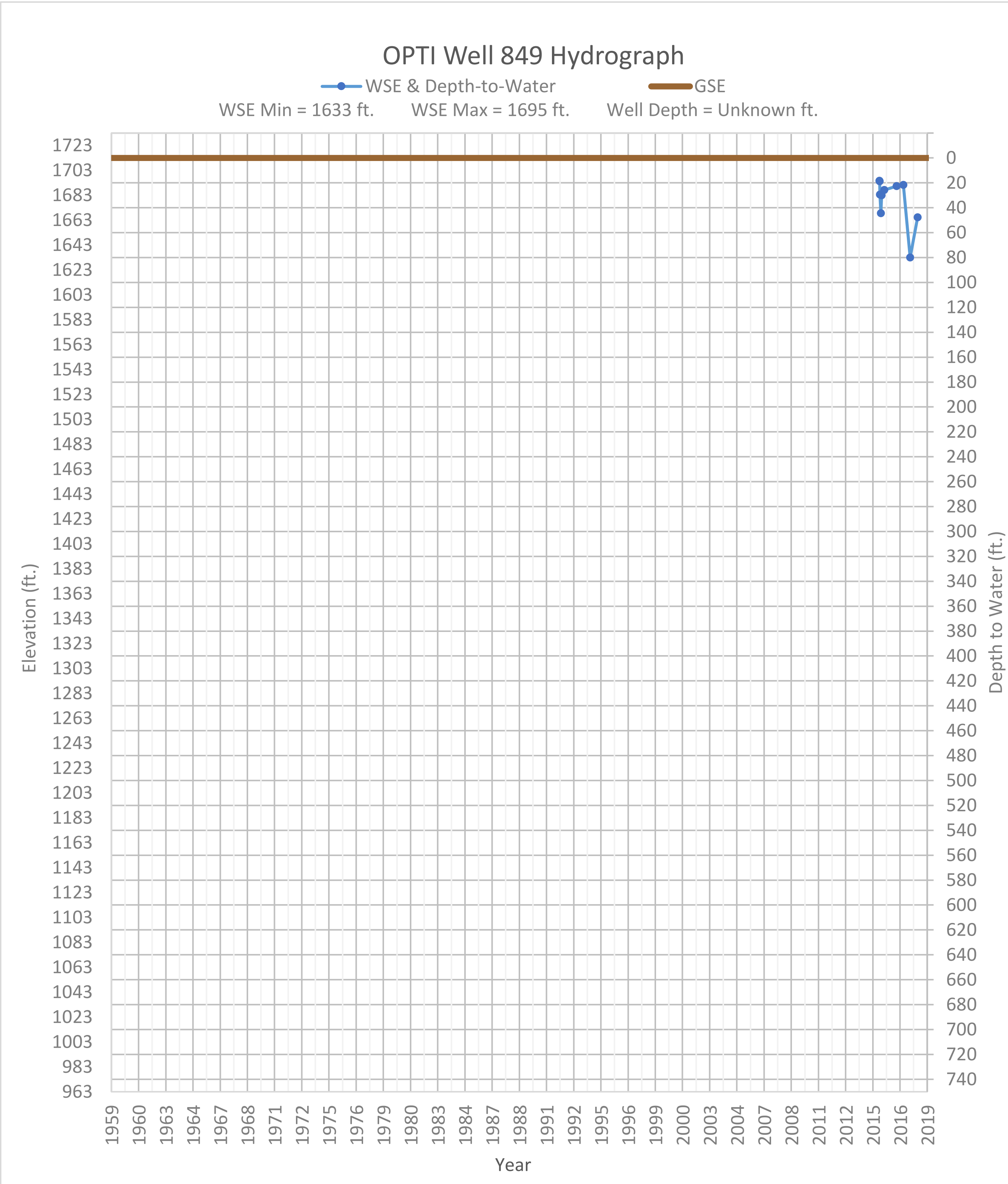


OPTI Well 848 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1656 ft.
WSE Max = 1665 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year


OPTI Well 849 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1633 ft.
WSE Max = 1695 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year

OPTI Well 850 Hydrograph
WSE & Depth-to-Water
GSE
WSE Min = 1654 ft.
WSE Max = 1701 ft.
Well Depth = Unknown ft.
Elevation (ft.)
Depth to Water (ft.)
Year
1769
1749
1729
1709
1689
1669
1649
1629
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1529
1509
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1469
1449
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1129
1109
1089
1069
1049
1029
1009
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Chapter 2
Appendix B

White Paper: Subsidence and Subsidence Monitoring Techniques

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Subsidence White Paper

Author: C. Micah Eggleton - *Environmental Planner* at Woodard & Curran, September 19, 2017.
meggleton@woodardcurran.com

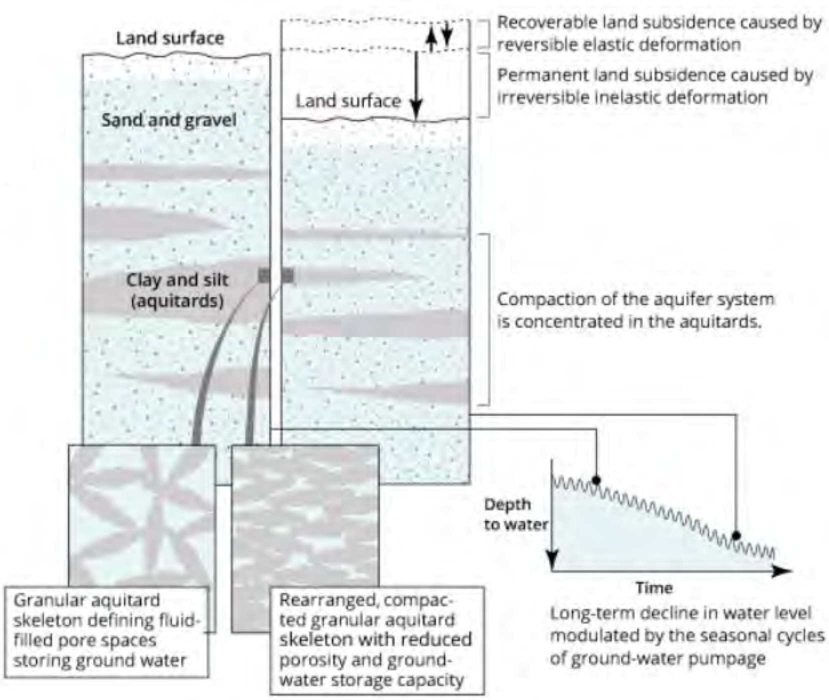
What is Subsidence?

Land subsidence is the sinking or downward settling of the earth's surface, not restricted in rate, magnitude, or area involved. Subsidence is often a result of over-extraction of subsurface water. In these cases, subsidence generally occurs over a large to very large area (10's to 100's of km^2) and may happen over several years.

How Subsidence Occurs

Groundwater saturates the sediments in the subsurface where groundwater is present. Sediments in water bearing units are commonly made up of sands, gravels, silts, and clays. Aquitards are composed of clay materials, and may have multiple thin layers or larger extensive, and/or thicker layers. Groundwater in these materials fills the pore spaces and supports the material's structure. As groundwater levels decline, the sands, gravels, silts, and clays in water bearing units are dewatered, and the water's support of the structure of the materials is removed. Clays in particular rearrange when dewatered and clay grains orient in a similar direction, which reduces the amount of pore space and thus, the clay compacts. As the clays compact, ground surface elevation begins to drop.

Figure 1: Subsidence and Compaction Process



Source: USGS, Ladn Subsidence: Cause and Effect. 9/17/2017. https://ca.water.usgs.gov/land_subsidence/california-subsidence-cause-effect.html#pumping

This is problematic all over the world but is of particular concern in California agricultural communities such as the Cuyama Basin. Cuyama Basin subsidence may have effects on agriculture in a few ways.

1. Water delivery systems that may deliver irrigation water can be affected by land subsidence. Surface canals or gravity lines may not have enough elevation gradient to transport water or may even have reverse flows due to changes in ground surface elevation.
2. Infrastructure such as buildings and roads may be de-leveled and need repair

Figure 2: Subsidence Visualized

Source: USGS, https://ca.water.usgs.gov/land_subsidence/

Not all groundwater pumping results in permanent subsidence. Groundwater reservoirs have an *elastic* and *inelastic* range of stress. Within the elastic range of stress, water levels in a groundwater storage unit can fluctuate without damaging the storage unit's ability to recharge to its original capacity. If water levels in a storage system dip into the inelastic range, the clays compact and cause inelastic land subsidence.

Clays and silts, such as those present in the Younger Alluvium, Older Alluvium, and Upper Morales Formations, generally have lower elastic capabilities, meaning they are not able to recover to their original volume once water has been removed. Once clays and silts are heavily compacted, they often cannot return to their previous saturation capacity even if groundwater levels are increased; this permanently reduces the storage capacity of the aquifer. This loss of aquifer is limited to the water that was stored in the compressed clays, and storage capacity lost is limited to the water that was stored in clays that were compressed, which is reflected in the amount of subsidence measured. Water stored in clay materials is generally not available for use by wells.

Methods of Measuring Land Subsidence

Measurements of elevations, aquifer-system compaction, and water levels are used to improve our understanding of the processes responsible for land-surface elevation changes. Elevation or elevation-change measurements are fundamental to monitoring land subsidence and have been measured by using interferometric synthetic aperture radar (InSAR), continuous GPS (CGPS) measurements, extensometers, and spirit-leveling surveying.

Interferometric Synthetic Aperture Radar (InSAR)

InSAR is a method and product of remote sensing imagery that measure changes in land-surface altitude by sending radar signals (historically C-band but new equipment often uses L- or X-band) to the land surface and measuring the return time of that signal. Changes in land surface elevation are calculated by taking the difference between two SAR images of the same area taken at different times. The difference between the two shows the ground-surface displacement (range change) between the two time periods.

The spatial resolution of InSAR is dependent on the location and resolution of the remote imagery, and whether it is taken from a plane or by orbiting satellite. At its finest resolution, InSAR has a sampling pixel of approximately 25’ by 25’ from satellites. The resolution of vertical displacement is dependent upon meteorological, observational, and other conditions, but is typically within a few centimeters to millimeters.

Raw InSAR data requires specialized computer programs to process and view. Some agencies and organizations, such as the California Water Science Center, provide InSAR imagery online. Direct data downloads are possible, but require registration approved with UNAVCO as an affiliate with an institution engaged in SAR research to download data. Data is available for anyone to browse online, and there are several agencies/institutes that publish data for specific regions.

Currently, InSAR imagery is obtained via specialized radar equipment on an aircraft and managed by NASA’s Jet Propulsion Laboratory (JPL). In December 2021, the satellite NISAR is scheduled to launch; NISAR will provide coverage every 12 days and all NASA data will be free.

Continuous Global Positing System (CGPS)

CGPS stations continuously measure the three-dimensional position of a sensor. There are more than 1,000 sensors in Western North America, with hundreds in California. Most sensors are managed by the Plate Boundary Observatory/UNAVCO and by Scripps Orbit and Permanent Arrary Center (SOPAC), but other groups such as Caltrans also operate sensors. These monitoring stations help measure tectonic movements as well as subsidence, which means data is taken in the X, Y, and Z axis.

Measurements are typically taken every 15 seconds and are processed to produce a daily position. The CGPS system has data/information published online, however, some use is limited and registration is required for certain data access.

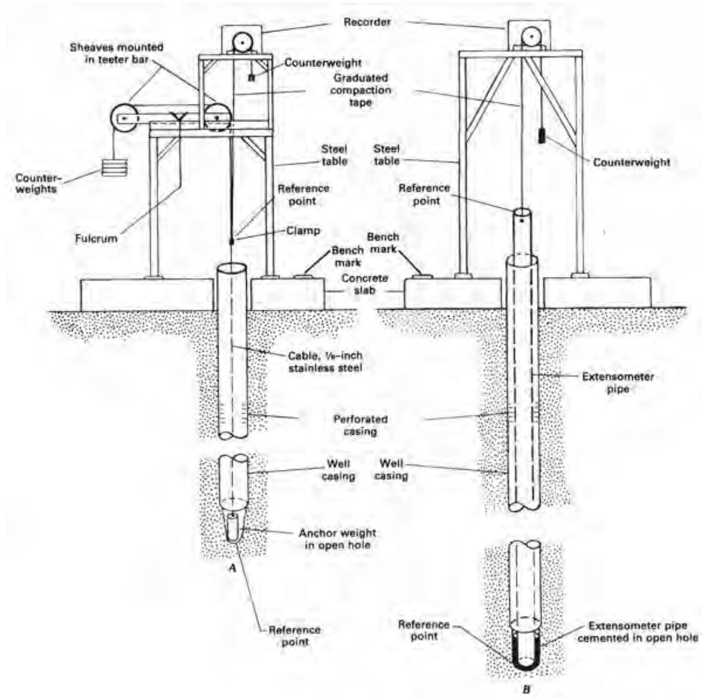
Currently, subsidence measurements in and immediately around the Cuyama Basin are taken through CGPS instrumentation.

Spirit Leveling

This is the oldest method of measuring subsidence and was used long before electronic aids such as GPS. The primary tool is a Spirit Level in combination with a telescope and graduated vertical rods. Measurements are based on one reference point. This technique is best used for smaller survey areas (5 miles or less) and areas where high spatial density is desired. This is a good option for localized surveying and where cost is a priority.

Extensometers

Extensometers are *one dimensional* indicators of change in a specified depth. In regards to land subsidence, they often measure the change in an aquifer system within a specific depth range – that is to say, if the extensometer extends 20 meters into the ground, it can only measure the change in compaction (or expansion) within those 20m. It is also important to understand that extensometers measure compaction/expansion, *not* elevation.



Between the 1950s and 1970s, more than two dozen extensometers were installed in California's Central Valley by the USGS, with additional units installed since then.

Most extensometers are constructed as cable or pipe borehole extensometers (see the figure to the right above). They function by having a cable or pipe extend to the bottom of a drilled hole to the measuring depth at a specific reference point. At the top of this cable or pipe is a reference point, and attached to the reference point is another cable that extends to the top of a platform near the ground surface, around a wheel, and to a counter weight which maintains tension on all cables. As the ground elevation and bottom reference point change in relation to one another, the wheel turns as the counter weight either drops or rises. This change in the position of the counter weight is equal to the amount of compaction between the two reference points.

Although simple in theory, extensometers can be costly to install due to the drilling that is required and robust equipment needed. In addition, multiple extensometers are often needed to measure compaction across a range of depths and to determine which portion of the subsurface is compacting.

Piezometers

Piezometers measure the hydraulic pressure in a groundwater system. Piezometers are paired with extensometers or CGPS data to analyze stress-strain characteristics of a groundwater system. These systems allow for the calculation of the *skeletal storage coefficient*, which is the standard measure of an aquifer's storage directly related to the compressibility of the soil/storage system. This is what largely controls how "recoverable" an aquifer system is when it is recharged with water.

If water levels continue to decline into the inelastic range of stress, it can become possible to compute the *inelastic storage coefficient* that governs the permanent compaction of the aquifer system. If water levels fluctuate into both of these ranges seasonally or annually, it may be possible to calculate both.

Chapter 2
Appendix C

Cuyama Basin Water Resources
Model Documentation

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Figures

Attachments

Appendix C — Cuyama Basin Water Resources Model Documentation

Introduction

Goals of Model Development

The Cuyama Basin Water Resources Model (CBWRM) was developed to evaluate the recent historical, current, and projected surface water and groundwater conditions in the Cuyama Groundwater Basin (Basin), and simulate various scenarios as part of the Basin's *Groundwater Sustainability Plan* (GSP). The fine temporal and spatial scale of the CBRWM allows the Cuyama Basin Groundwater Sustainability Agency (CBGSA) and its stakeholders to evaluate the effect of changing groundwater conditions in different parts of the Basin.

The CBWRM was developed in consultation with members of the Technical Forum, which includes technical staff and consultants representing a range of public and private entities in the Basin. Technical Forum members are listed in Chapter 1, Section 1.3. The Technical Forum held 14 monthly conference calls over the course of CBWRM development, and model data and outputs were provided to Technical Forum members to facilitate review and feedback on model development. This allowed Technical Forum members to review and comment on all major aspects of CBWRM development.

Basin Overview

The Basin encompasses an area of approximately 378 square miles, and includes the communities of New Cuyama and Cuyama, which are located along State Route (SR) 166 and Ventucopa, which is located along SR 33. Figure C-1 shows the Cuyama Basin and its key geographic features. The Basin encompasses an approximately 55-mile stretch of the Cuyama River, which runs through the Basin for much of its extent before leaving the Basin to the northwest and flowing toward the Pacific Ocean. The Basin also encompasses reaches of Wells Creek in its north-central area, Santa Barbara Creek in the south-central area, and the Quatal Canyon drainage and Cuyama Creek in the southern area of the Basin. Primary land use and development in the Basin is agricultural use, which mostly occurs in the central portion east of New Cuyama, and along the Cuyama River near SR 33 through Ventucopa. Additionally, there has recently been new agricultural development in the western part of the Basin.

CBRWM Platform

The CBWRM was developed based on the Integrated Water Flow Model (IWFM) software platform. The IWFM is an open-source, finite element simulation code that supports triangular and quadrilateral elements (Dogrul et al., 2017b). IWFM was specifically designated in the Sustainable Groundwater Management Act (SGMA) regulations as a model supported by the California Department of Water Resources (DWR) for evaluation of the integrated surface water and groundwater resources a basin, including detailed water budget development that meets SGMA requirements. IWFM has been used throughout California for planning and management of water resources, including GSP development. IWFM is also used for DWR's California Central Valley Groundwater-Surface Water Simulation Model

(C2VSim), which is the fine-grid version that is being refined and enhanced by DWR to support SGMA activities throughout the Central Valley at the regional scale (DWR, 2018).

The IWFM Demand Calculator (IDC) is the stand-alone root zone component of IWFM that simulates land surface and root zone flow processes (Dogrul et al., 2017b). It calculates agricultural and urban water demands using inputs including climatic conditions, soil hydrologic conditions, and land use types and cropping patterns. The IDC can be used as a stand-alone model, or it can be combined with IWFM. When combined, the full IWFM model simulates the integrated system of land surface processes and groundwater system and the stream system, as well as interaction among these systems.

CBWRM Development

Model Input Data

The CBWRM historical model simulates Basin hydrologic conditions on a daily time step from water year 1995 through water year 2017 (i.e., October 1, 1994 through September 30, 2017). Table C-1 lists CBWRM files and corresponding major data sources.

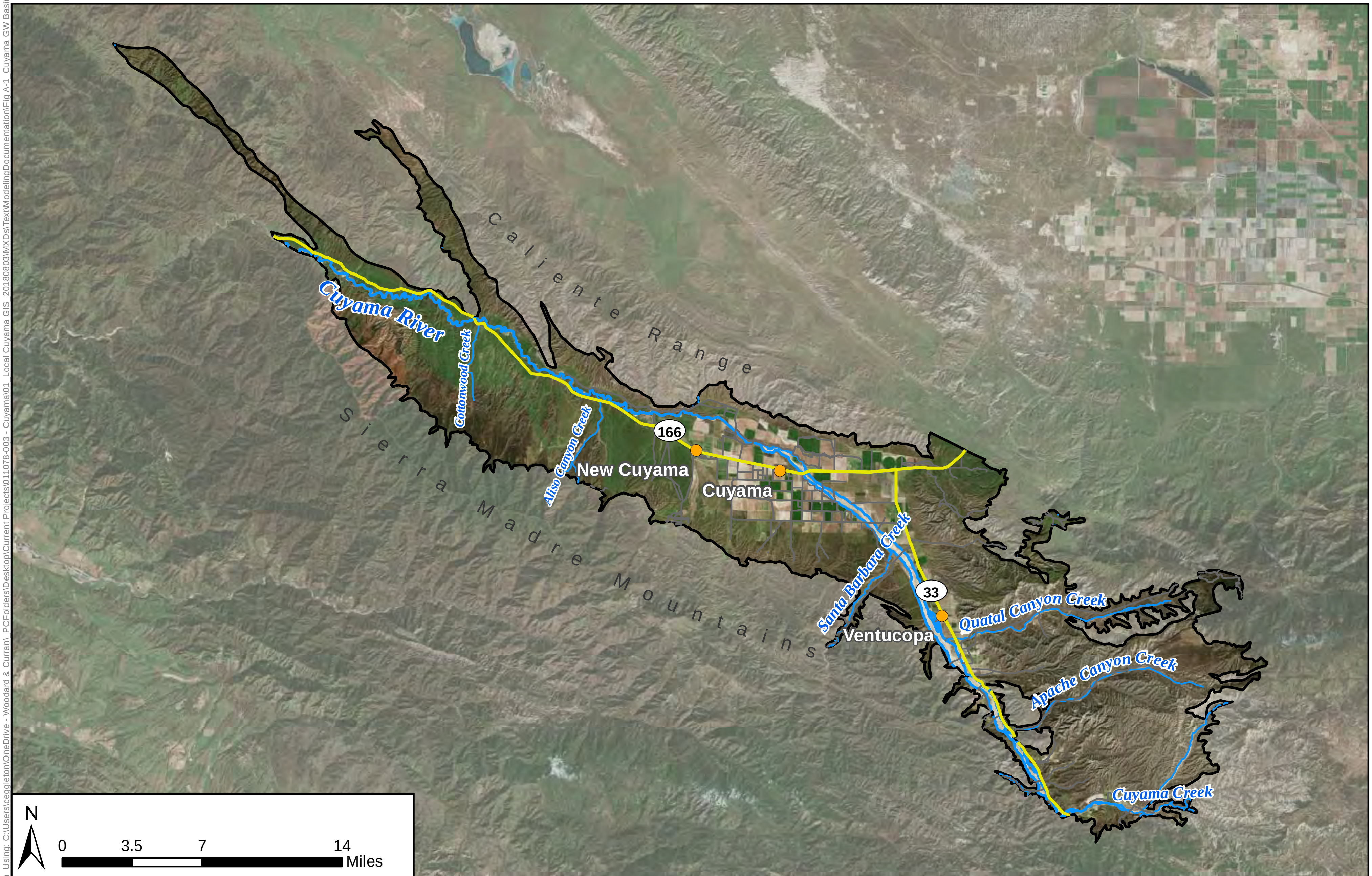

Figure C-1 - Cuyama Valley Groundwater Basin

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

April 2019

WOODARD & CURRAN

Legend

Towns	Local Roads
Cuyama Basin	Cuyama River
Highways	Streams/Creeks

Table C-1: CBWRM Major Model Data

Major Data Category	Minor Data Category	Data Source
Hydrogeological Data	Geologic Stratification	Diblee Maps and Cuyama Valley Hydrologic Model (CUVHM)
Stream Data	Stream Configuration	National Hydrography Dataset (NHD)
	Streamflow Records	United States Geological Survey (USGS) and California Data Exchange Center (CDEC) Stream Gages
Hydrological Data	Precipitation	Parameter-Elevation Relationships on Independent Slopes Model (PRISM)
Agricultural Water Demand	Land Use and Cropping Patterns	• DWR • Private Landowners • CBGSA-developed data
	Evapotranspiration	California Irrigation Management Information System (CIMIS)
	Soil Properties	Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO)
Urban Water Demand	Population	United States Census Bureau
	Per Capita Water Use	Cuyama Community Services District (CCSD) Local Information
Water Supply	Groundwater Pumping	CCSD
Other	Initial GW Level Conditions	• DWR Water Data Library • Private landowners
	Small Watersheds	NHD
	GW Level Records for Calibration Wells	• DWR Water Data Library • Private landowners

Analysts developed the 50-year hydrologic period of water years 1968 through 2017 for use in CBWRM to meet SGMA requirements for long-term water budget representation for current and projected Basin conditions.

CBWRM Grid

Analysts developed the finite element grid using the Groundwater Modeling System (GMS) software' the grid development module. The model grid network is composed of a combination of quadrilateral and triangular elements, which allows a detailed representation of various hydrologic, geologic, and jurisdictional features required for development of information about land and water use, water supply, groundwater conditions, and water budget. The CBWRM grid and the specific features used in grid development are shown in Figure C-2. These features include the following:

- The Basin boundary as defined in DWR's Bulletin 118 (DWR, 2004)
- Hydrologic and hydrogeologic features (i.e., Cuyama River and minor streams, faults, and outcroppings)
- The Cuyama Community Services District (CCSD) boundary
- Cuyama Water District boundary

The CBWRM grid contains 6,582 elements with an average element area of 36.8 acres. Primary objectives during grid development were to maintain a manageable number of elements and nodes for model computational performance, to optimize resolution for data analysis, and to contain relatively finer resolution along rivers, which allows for better simulation of stream-aquifer interaction to optimize the model run time and to streamline model output.

Stream Configuration and Watersheds

The CBWRM surface hydrology is represented by nine model stream reaches, representing the Cuyama River. The USGS has two active gages that record flows in the Cuyama River watershed upstream of Lake Twitchell. These include one gage on the Cuyama River downstream of the Basin (ID 11136800), which is located just upstream of Lake Twitchell. This gage has 58 recorded years of streamflow measurements from 1959 to 2017. The other active gage is south of the city of Ventucopa along Santa Barbara Canyon Creek (ID 11136600), and this partial record is limited to seven years (i.e., from 2010 to 2017). In addition, limited data are available from four deactivated gages, as shown in Chapter 1.

The inflow from upper watershed areas originates from ungaged watersheds. Figure C-3 shows the upper watershed areas included in the model. Flows from ungaged watersheds surrounding the Basin are estimated using a simplified rainfall runoff module incorporated in the small watersheds module of the CBWRM. This module simulates the surface water and groundwater contributions from the small watersheds using daily precipitation rates and runoff and infiltration characteristics assigned to each ungaged watershed. The portion of flow from the small watershed that enters the model domain as surface runoff is directed to drain into simulated streams. The portion of flow from small watersheds that infiltrates to ground contributes to the main groundwater system as boundary flows.

All subsurface inflows from these small watersheds are routed to the top model layer in each watershed (Layer 3 in most watersheds) along specified groundwater nodes, with a user-defined maximum percolation rate at each node. Excess flows that do not infiltrate to groundwater enter the simulated streams at user-specified locations. The hydrologic conditions of these small watersheds used to estimate the subsurface and surface flows are represented using parameters (e.g., precipitation, surface layer soil parameters, runoff coefficient) for each watershed. The soil parameters and runoff coefficients were estimated using data from SSURGO (USDA, 2017a).

Precipitation

Rainfall data for the CBWRM area are derived from the PRISM database (PRISM Climate Group, 2018). The database contains monthly precipitation data starting from 1895 and daily precipitation data from December 1, 1981 on a 4-kilometer grid throughout the model area. To develop data for the daily time step of the CBWRM, monthly precipitation data for the 1968 to 1981 time period was downscaled to daily temporal resolution with a similar water year type analysis using the recorded Cuyama River flows. Each of the model elements was mapped to the nearest PRISM reference node, which are uniformly distributed across the model domain. The resulting average annual precipitation is shown in Figure C-4.

Figure C-5 shows the Basin averaged annual rainfall in the model area and the cumulative departure from mean, which is an indication of long-term rainfall trends in the area. The average annual precipitation during the 50-year hydrologic sequence from October 1967 to September 2017 was 13.1 inches, which ranges from an annual average of 11.4 inches in the valley floor to 14.8 inches in the upper watershed areas.

Attachment C-2 describes the climate change scenarios analyzed for projected future conditions, and the modifications made to the precipitation data to reflect the effects of climate change.

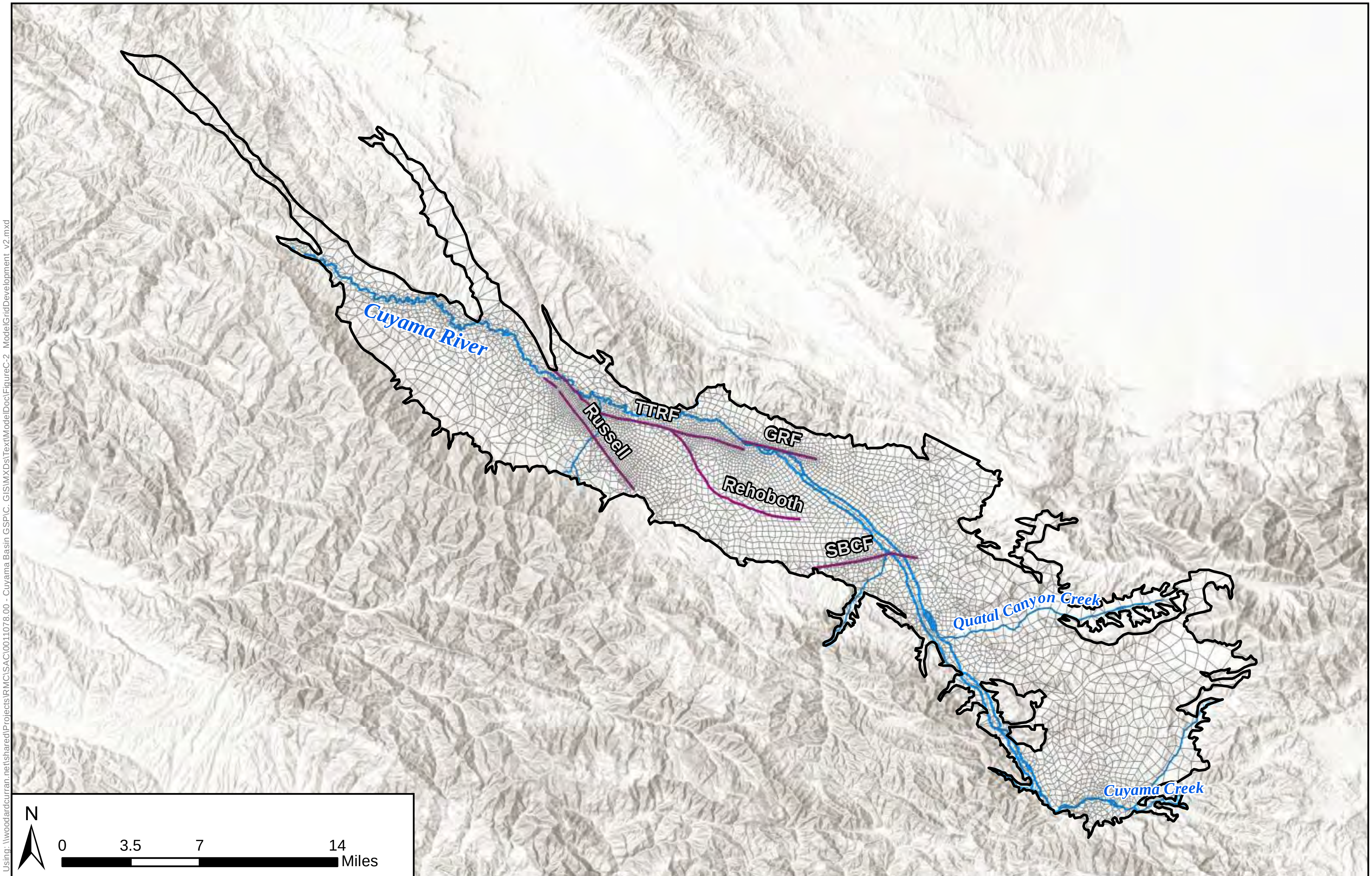

Figure C-2 - Cuyama Valley Groundwater Basin IWFM Grid Development Features

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Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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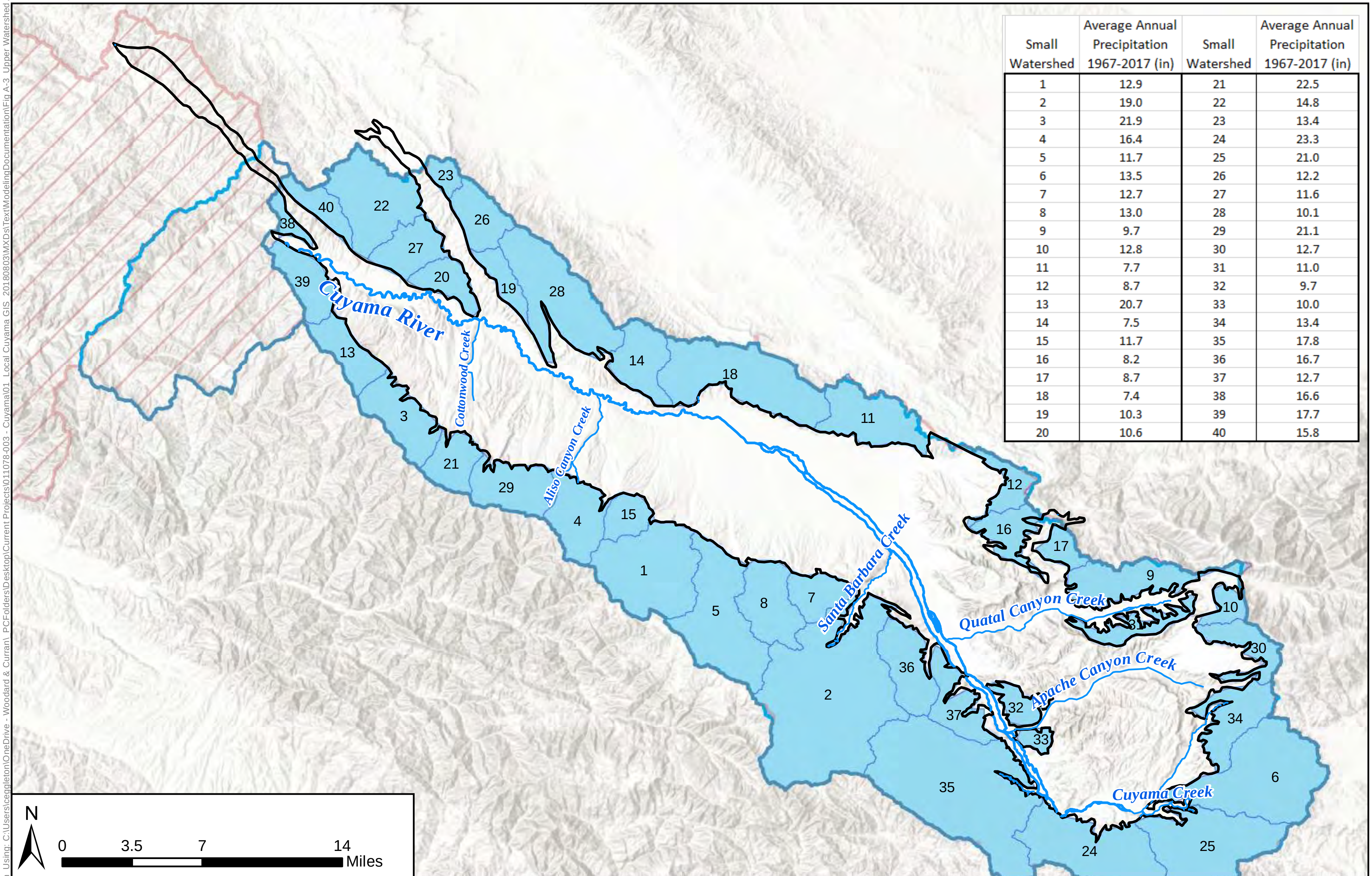
Legend

- Cuyama Basin
- Model Grid
- Faults in CBWRM
- Cuyama River
- Streams/Creeks



Small Watershed	Average Annual Precipitation 1967-2017 (in)	Small Watershed	Average Annual Precipitation 1967-2017 (in)
1	12.9	21	22.5
2	19.0	22	14.8
3	21.9	23	13.4
4	16.4	24	23.3
5	11.7	25	21.0
6	13.5	26	12.2
7	12.7	27	11.6
8	13.0	28	10.1
9	9.7	29	21.1
10	12.8	30	12.7
11	7.7	31	11.0
12	8.7	32	9.7
13	20.7	33	10.0
14	7.5	34	13.4
15	11.7	35	17.8
16	8.2	36	16.7
17	8.7	37	12.7
18	7.4	38	16.6
19	10.3	39	17.7
20	10.6	40	15.8

Figure C-3 - Cuyama Valley Groundwater Basin Upper Watershed Areas in the IWFM Model

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Legend

- Cuyama Basin
- Cuyama River
- Streams/Creeks
- Contributes to Cuyama GW Basin
- Does Not Contribute to Cuyama GW Basin
- Watershed
- Small Watersheds (HUC 12)

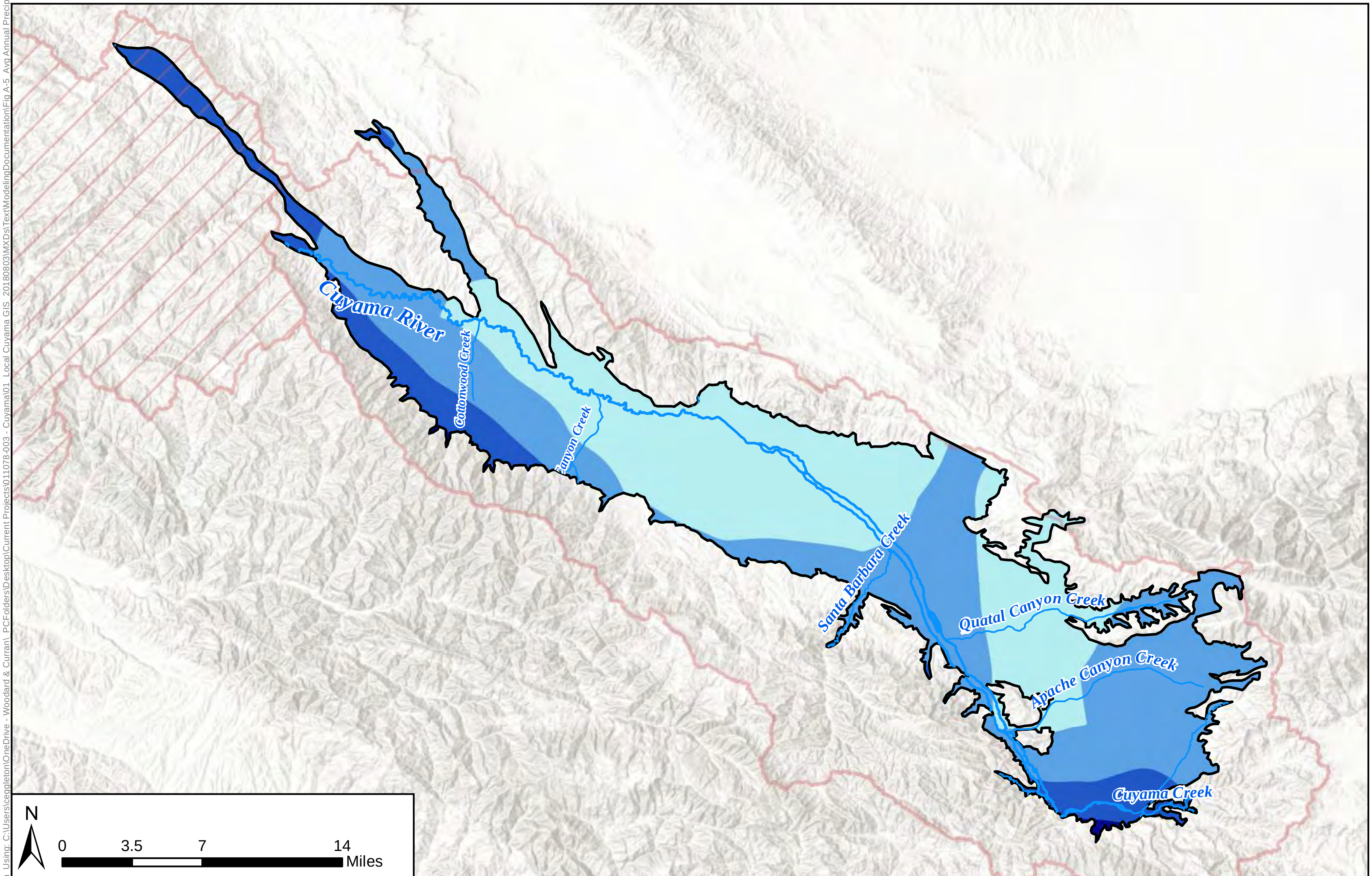

Figure C-4 - Cuyama Valley Groundwater Basin Average Annual Precipitation

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Legend

- Cuyama Basin
- Cuyama River
- Streams/Creeks
- Contributes to Cuyama GW Basin
- Does Not Contribute to Cuyama GW Basin

Average Annual Precipitation (.in)

- 5.1 - 10
- 11 - 15
- 16 - 20
- 21 - 25

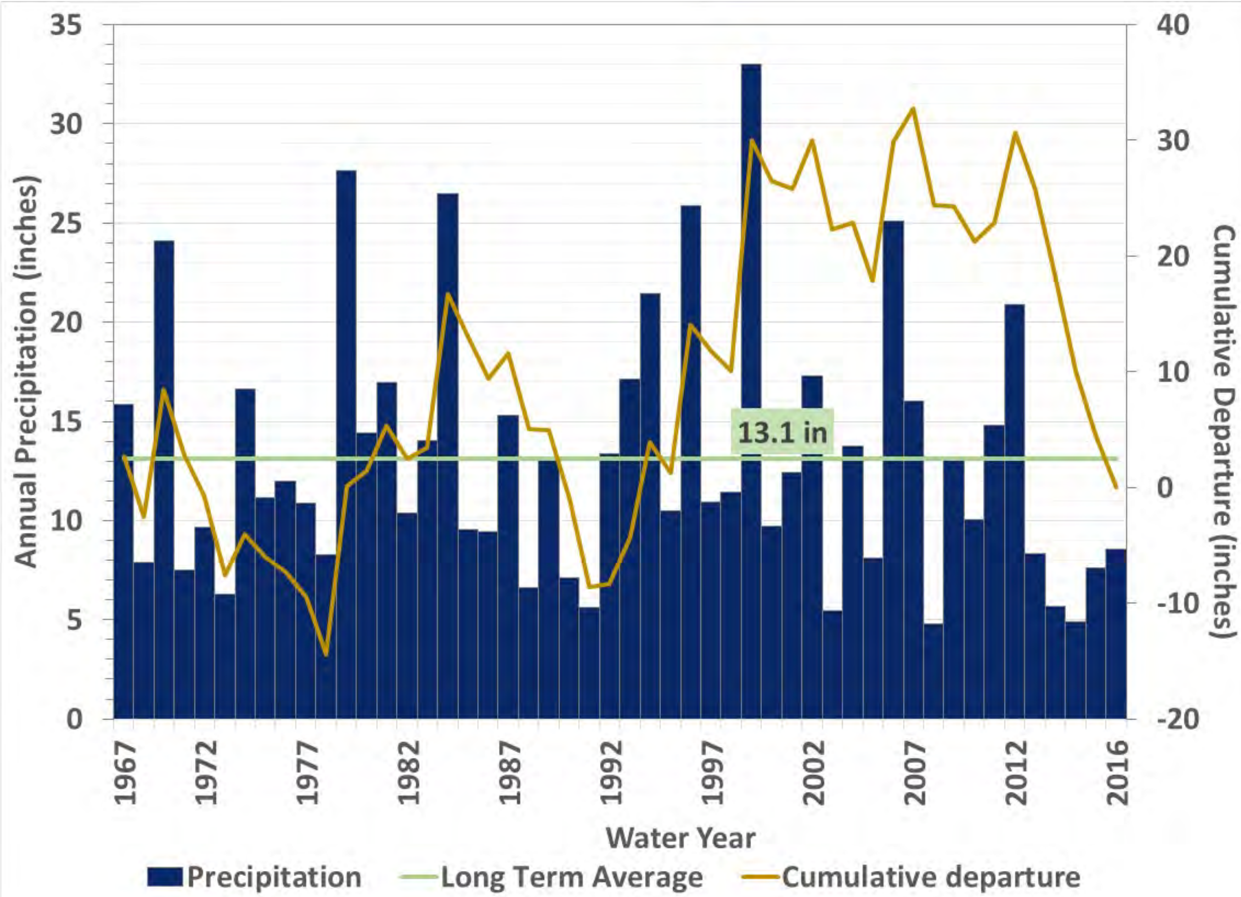

Figure C-5: 50-Year Historical Precipitation and Cumulative Departure from Mean Precipitation

Root Zone Soil Parameters

Soil properties specified in the CBWRM are field capacity, wilting point, total porosity, saturated hydraulic conductivity, and pore size distribution index. These soil properties are specified for each model element, and were used to calculate runoff and infiltration from both rainfall and applied water at each model time step.

DWR's IWFM Soil Data Builder (DWR, 2017) was used in conjunction with the SSURGO (USDA, 2017a) soil data to determine the five soil parameters for each model element. The IWFM Soil Data Builder extracts the SSURGO data relevant to the model area and associates it with each model grid element. For the elements where SSURGO data was incomplete, analysts used the USDA's Digital General Soil Map of the United States (STATSGO2) data (USDA, 2017b) to complement SSURGO parameters.

CBRWM elements are associated with the four hydrologic soil groups according to their runoff potential and infiltration characteristics. NRCS defines these hydrological soil groups as follows (NRCS, 2009):

- **Group A** – Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- **Group B** – Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 and 20 percent clay and 50 to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- **Group C** – Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- **Group D** – Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.

Land Use and Cropping Patterns

Land use and cropping patterns are key data sets that support estimation of monthly agricultural water requirements over the period of model simulation. Consistent with the DWR's C2VSim, the CBWRM includes 23 irrigated crop categories and four general land use categories. The general land use categories include urban landscape (e.g., residential areas, school fields, roads, etc.), water surface (e.g., streams, lakes, and reservoirs), riparian vegetation (e.g., native vegetation in the vicinity of surface water), and native vegetation. The 23 irrigated crop categories are combined into six summary-level crop group with similar water use and/or irrigation practices, which also provides a simpler representation of crop group types for planning and policy purposes. Table C-2 lists the land use categories.

Table C-2: Land Use Categories

Land Use Type	Model Category	Grouped Categories
Irrigated Crops	• Apple • Berry • Citrus • Olive • Pistachio • Misc. Deciduous • Misc. Subtropical Fruits	Fruit and Nut Trees
	Vineyards	Vineyards
	• Alfalfa • Mixed Pasture	Alfalfa and Irrigated Pasture
	• Misc. Grain • Misc. Grass • Wheat	Grain
	• Dry Beans • Corn • Misc. Field Crops • Safflowers	Field Crops
	• Carrot • Cole • Mixed Greens • Lettuce • Melons • Onion • Potatoes • Misc. Truck Crops	Truck Crops
	Idle and Fallow Lands	Idle
Other Land Use	• Urban Landscape • Water Surface • Riparian Vegetation • Native Vegetation	

Spatial land use data were used to specify land use types and crop acreages for each model element for each year of simulation. The following data sources were used:

- 1996 data from historical DWR county land use surveys[1]
- 2014 and 2016 data that were developed for DWR using remote sensing data by LandIQ[2]
- 2000, 2003, 2006, 2009, 2012 data that were developed for the CBGSA using remote sensing data; development of these datasets is documented in Attachment C-1.
- Data provided by private landowners for portions of the Basin between 1992 and 2017

Figure C-6 shows the spatial distribution of the major land use categories in the Basin for 2016.[3] Estimated land use in 2016 includes approximately 36,500 acres of irrigated land use. Figure C-7 shows the historical trend of land use categories in the Basin and the projected assumed annual land use pattern for the 50-year hydrologic period used for the projected condition model scenario. The projected annual land use categories are developed based on the 2017 crop categories and acreage values as the basis, with adjustments made for known acreage changes in 2018. Permanent crop acreages were assumed to remain unchanged from 2017-18 values, while annual crop acreages reflect annual variability that was developed based on an autoregressive moving average model that uses the historical land use data sets. The autoregressive moving average was developed such that long-term average acreage for each annual crop type remained unchanged from 2017 values.

[1] https://www.water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Land-Use-Surveys
[2] https://gis.water.ca.gov/app/CADWRLandUseViewer/
[3] Figures for other years can be found in Chapter 1

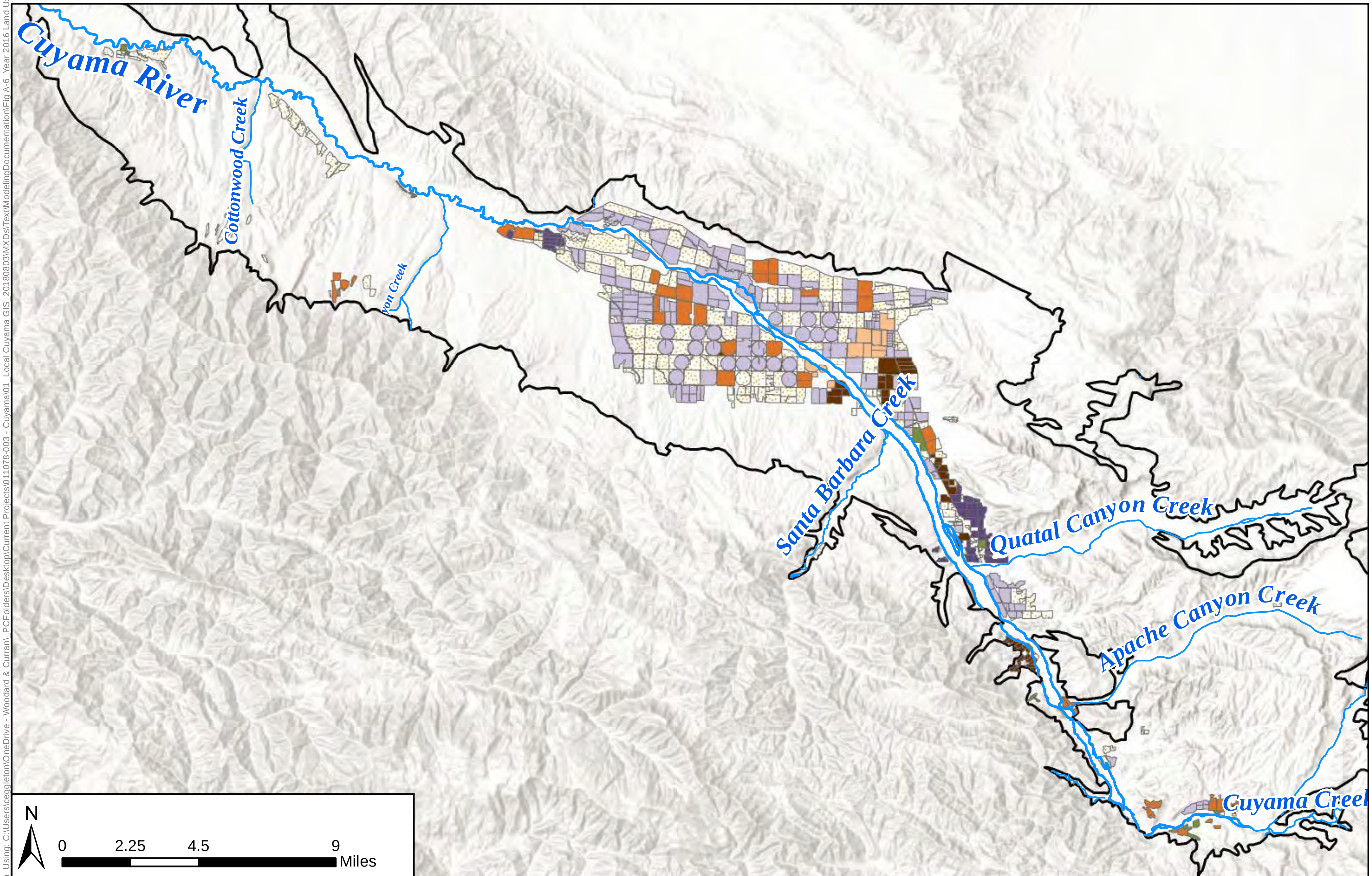

Figure C-6 - Cuyama Valley Groundwater Basin Year 2016 Land Use

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Legend

- Cuyama Basin
- Cuyama River
- Streams/Creeks

Land Use from 2016 Crop Mapping

- Alfalfa and Irrigated Pasture
- Fruit and Nut Trees
- Field Crops
- Truck Crops
- Vineyard
- Grain
- Idle

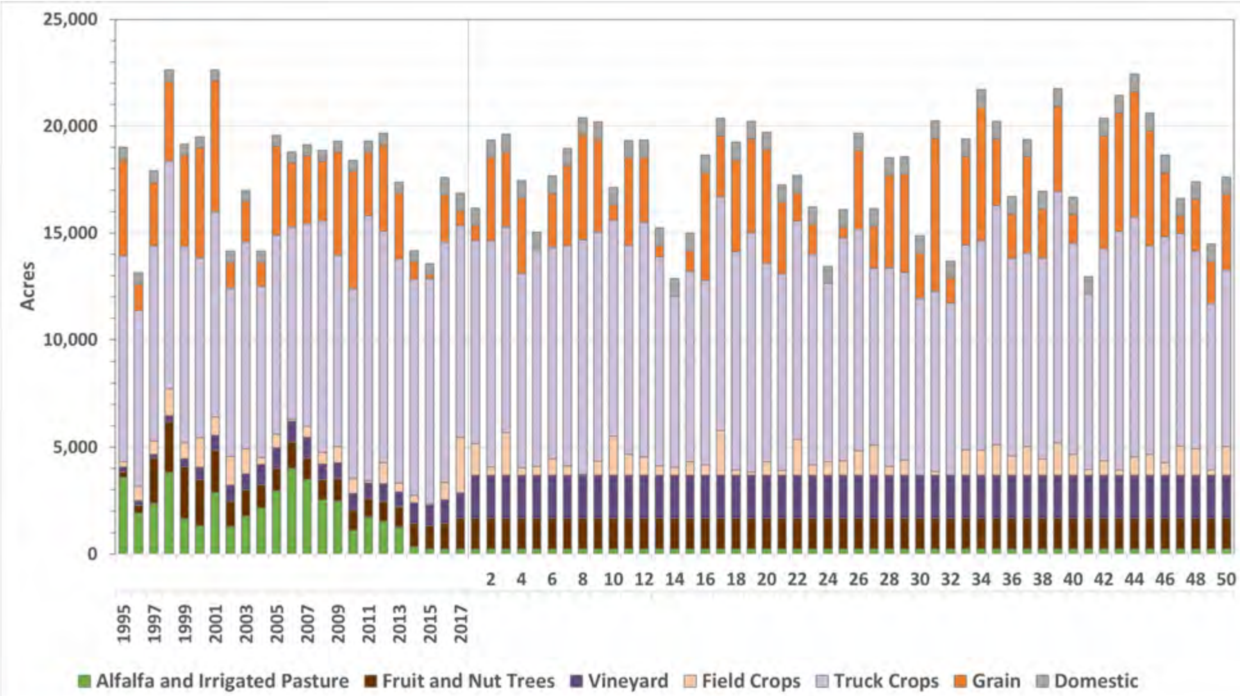


Figure C-7: Historical and Projected Land Use in the Basin

Evapotranspiration

The crop evapotranspiration (ET) requirement is an important factor in agricultural demand estimation. Every land use category must have evapotranspiration assigned for the simulation period. Due to changes in cropping patterns and irrigation practices over time during the historical calibration period, the ET data are specified as a time series during the entire calibration period. ET values are based on the reference evapotranspiration data from Cuyama CIMIS Station. The reference evapotranspiration was converted to crop evapotranspiration using crop coefficients, supplemented by information developed using the Mapping EvapoTranspiration at High Resolution with Internalized Calibration (METRIC) methodology (as described in Attachment C-3). Crop coefficients for each land use category were developed using a daily root zone water balance model (as described in Attachment C-4). This model is driven by the Landsat Normalized Difference Vegetation Index (NDVI) data set, which was originally developed for the Kaweah Delta Water Conservation District in Tulare and Kings counties. The model simulates the rootzone processes on a daily time step, and using remote sensing data, it can capture changes in the timing and intensity of cropping over time.

In the CBWRM, ET represents the net vertical water flux from the land surface and root zone through the upper model layer. Figure C-8 shows the range in annual evapotranspiration rates for each crop category. For climate change scenarios analyzed for projected future conditions, evapotranspiration rates were modified to reflect the effects of anticipated temperature change (Attachment C-2).

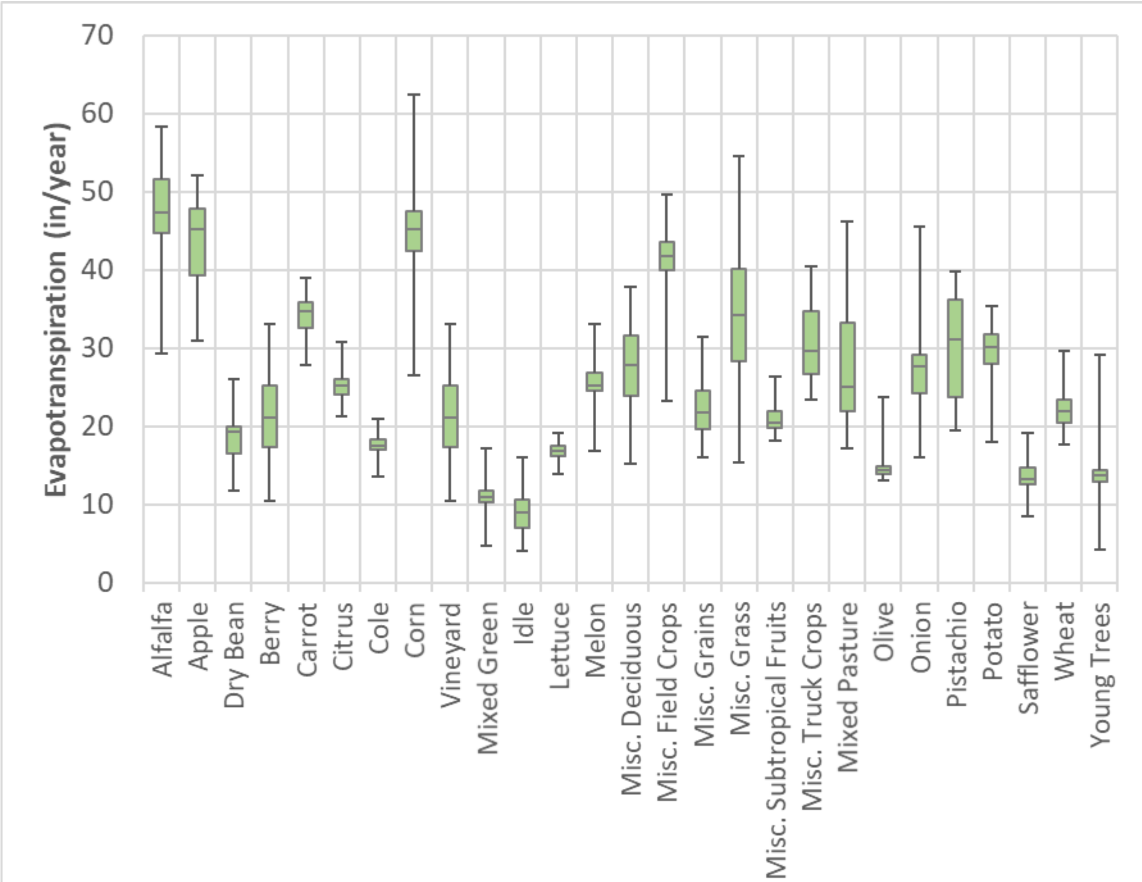


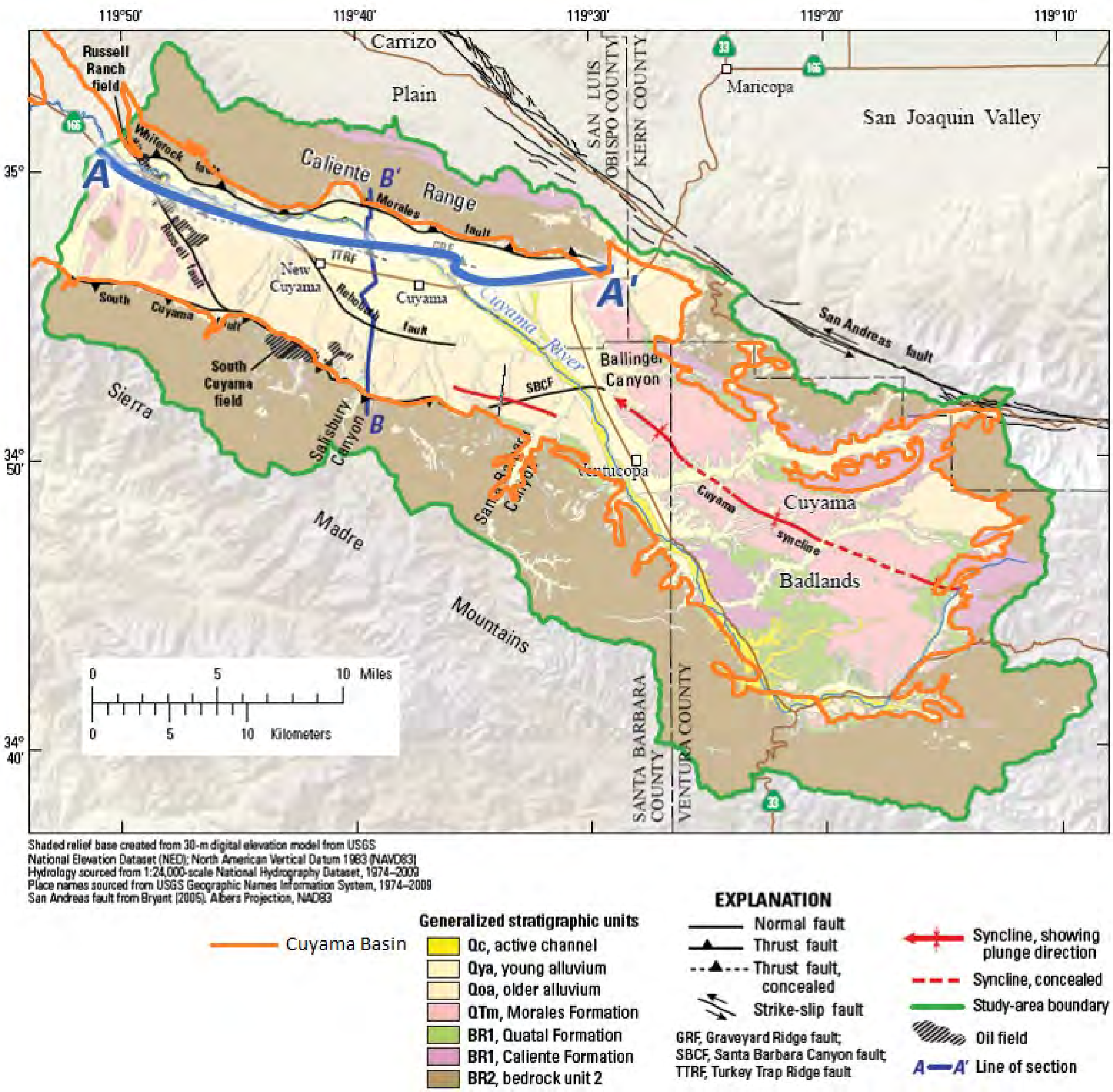
Figure C-8: Annual Evapotranspiration for Each Land Use Type

CBWRM Layering

The CBWRM subsurface zone is characterized by the following three model layers, representing geologic stratification from ground surface to bedrock (listed from top to bottom below) as follows:

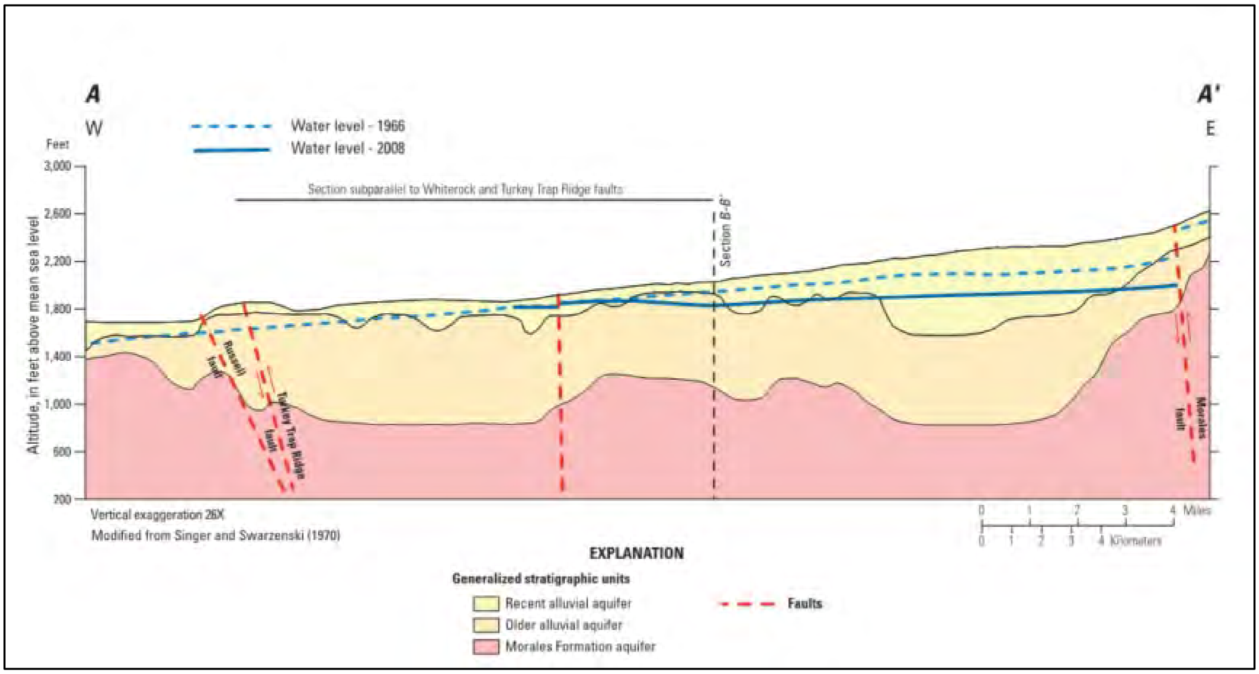
- Layer 1: Recent Alluvial aquifer
- Layer 2: Older Alluvial aquifer
- Layer 3: Morales Formation aquifer

These layers are primarily based on geologic stratification as defined by the USGS (USGS, 2015). They were refined using additional data sets as described in Chapter 2, Section 2.1 of the GSP. Figure C-9 shows the locations of cross sections across the central portion of the Basin as prepared by the USGS in 2013 (USGS, 2013). Figure C-10 shows a west-east cross section that runs near the towns of New Cuyama and Cuyama labeled A-A’, and Figure C-11 shows a south-north cross section labeled B-B’. Figures C-12 through C-14 show the extents and thicknesses of layers 1, 2 and 3 in the CBWRM model.



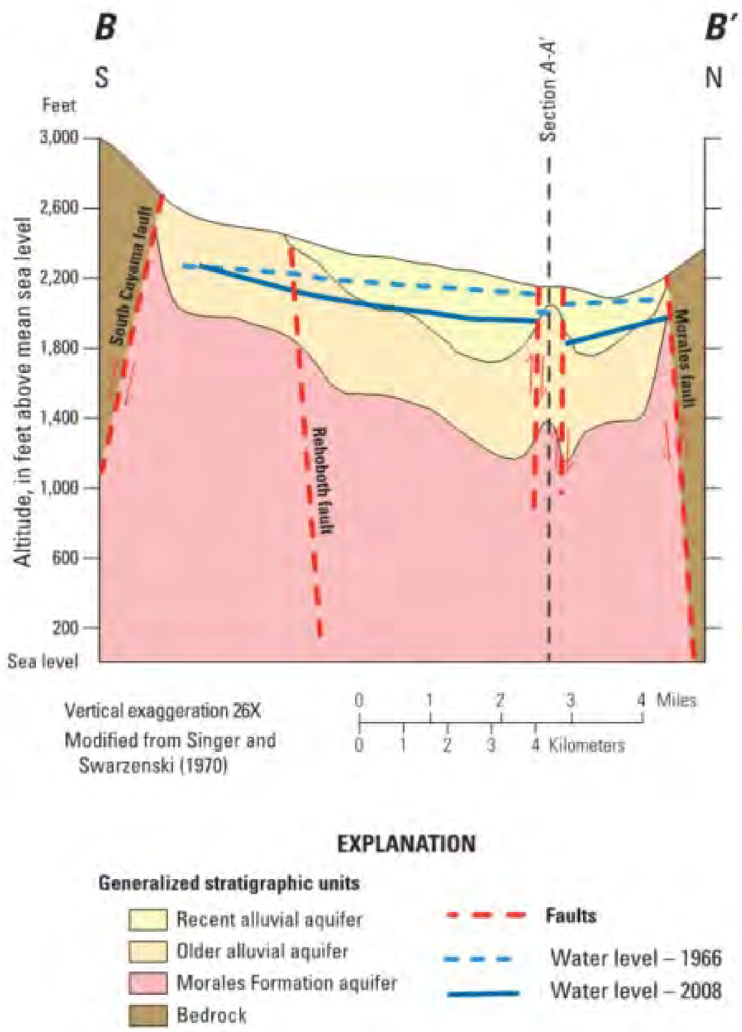
Source: USGS, 2015.

Figure C-9: Location of USGS 2015 Cross Sections



Source: USGS, 2015

Figure C-10: USGS Cross Section A-A'



Source: USGS, 2015

Figure C-11: USGS Cross Section B-B'

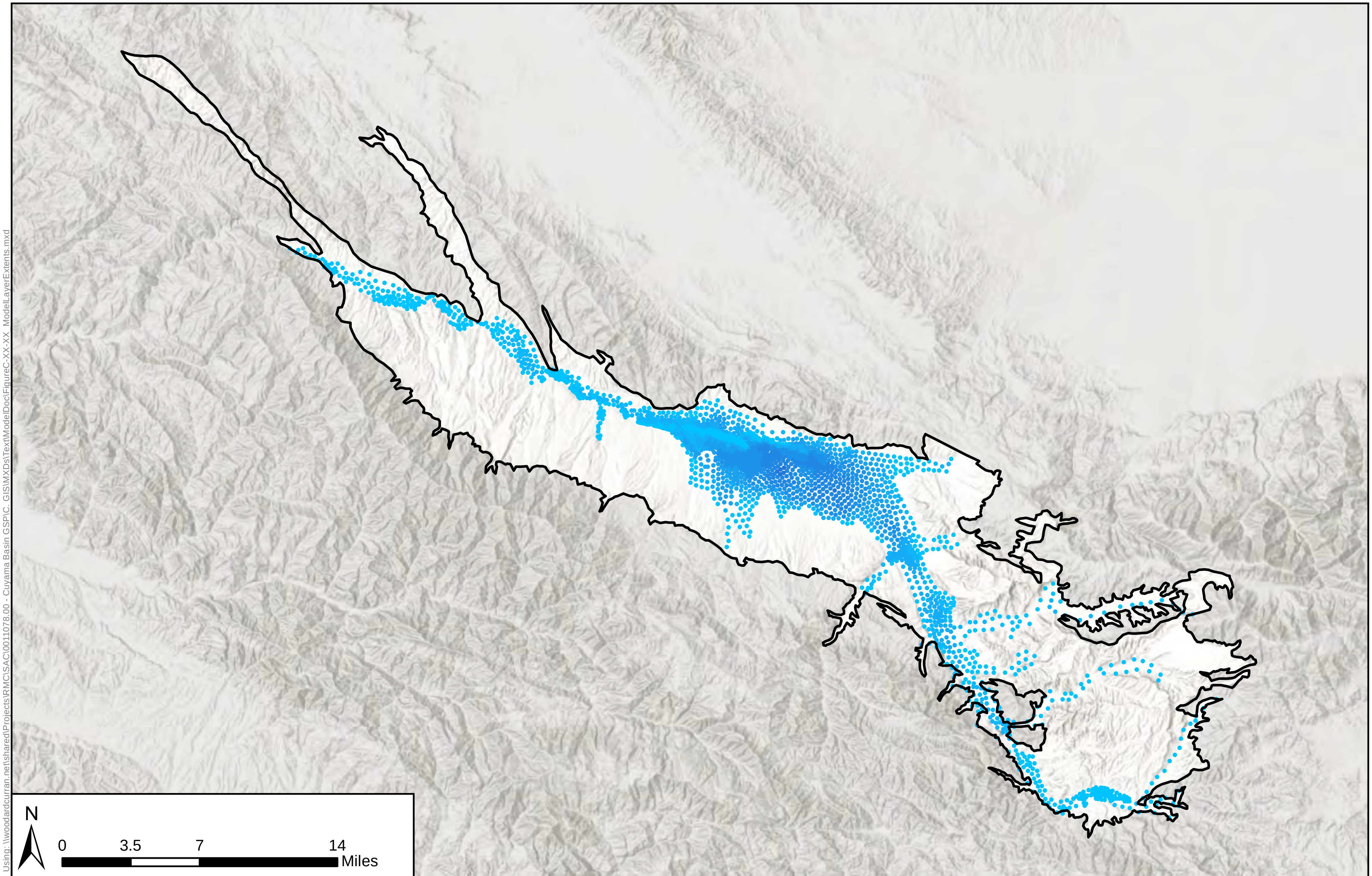


Figure C-12 - CBWRM Layer 1 Extent and Thickness

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Legend

Layer 1 Thickness (ft)

- 10 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1100
- 1101 - 1200

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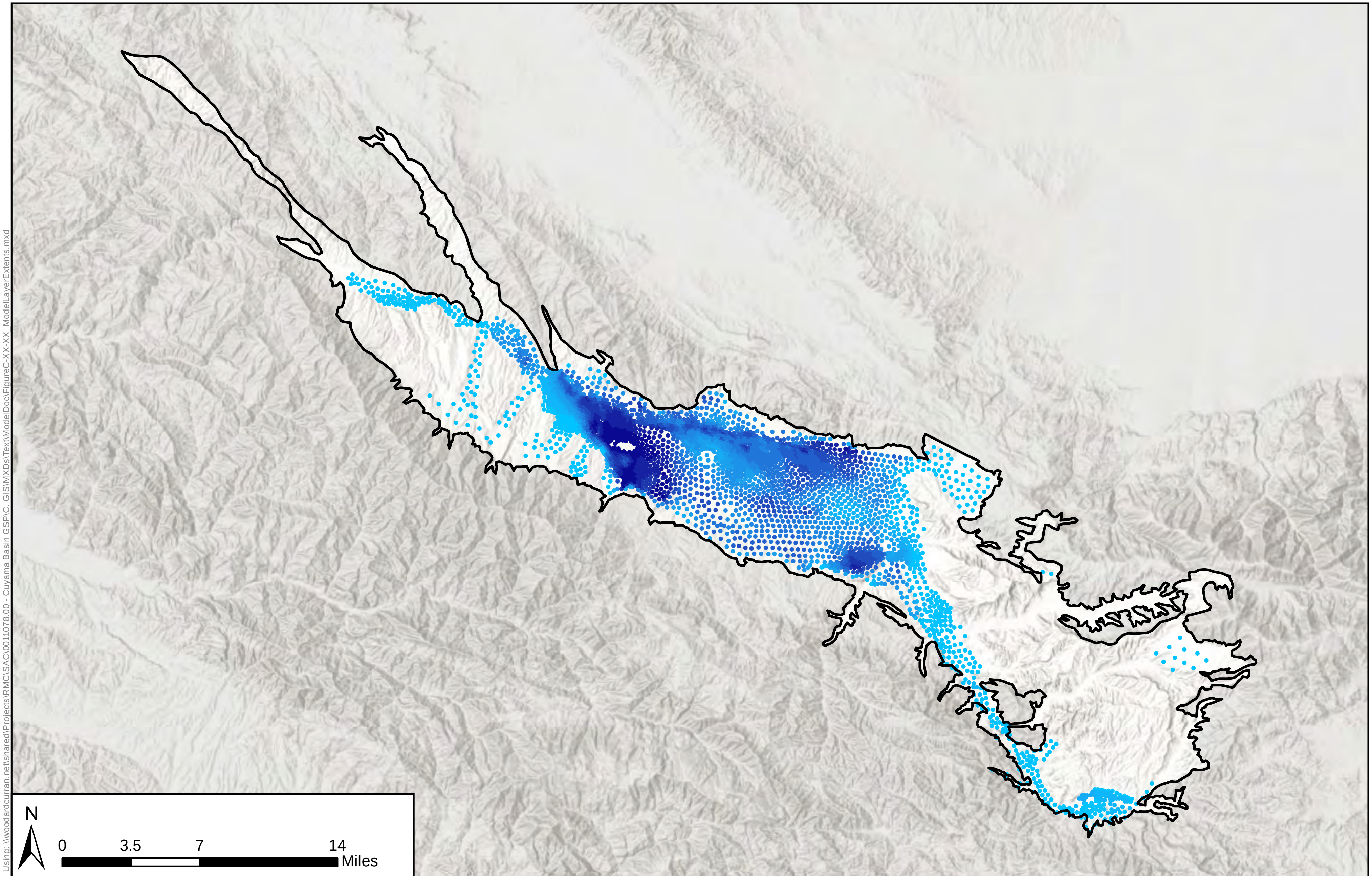

Figure C-13 - CBWRM Layer 2 Extent and Thickness

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Legend

Layer 2 Thickness (ft)

- 10 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1100
- 1101 - 1200

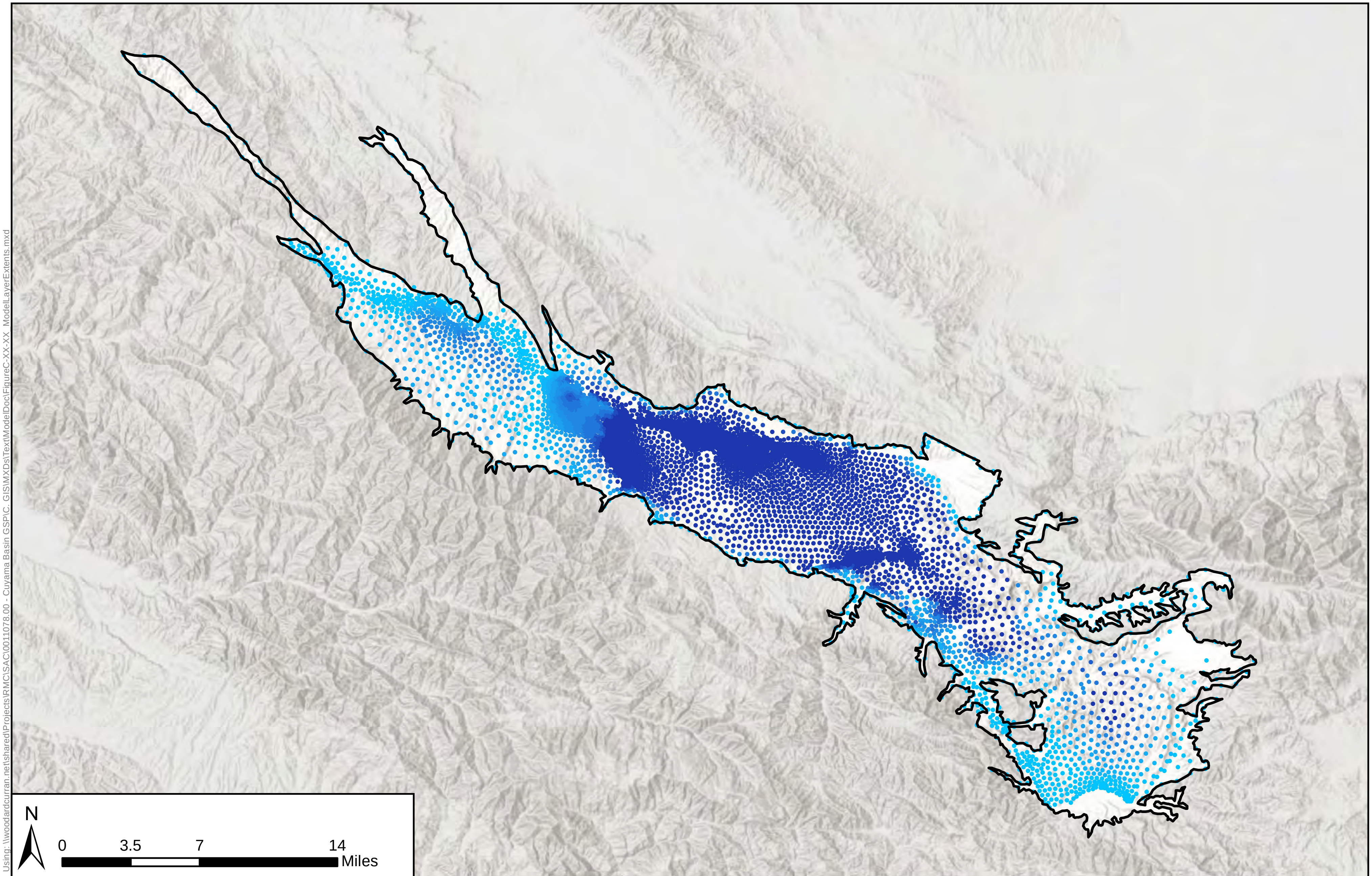

Figure C-14 - CBWRM Layer 3 Extent and Thickness

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Legend

Layer 3 Thickness (ft)

- 10 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1100
- 1101 - 1200

Boundary Conditions

As discussed in the previous section, both surface and subsurface inflows within the ungaged watershed areas tributary to the main Basin are simulated using small watersheds module of the CBWRM. No flow boundary conditions were assumed for the rest of the domain boundary.

Initial Conditions

Groundwater heads for each model node and each layer at the beginning of the historical simulation (i.e., October 1, 1994) were developed using groundwater level data described in Chapter 2, Section 2.2. Due to the lack of information on well depth and/or perforation for many of the wells used, groundwater heads for each model layer are assumed to be the same. During the calibration process, some refinements were made by layer, as needed. This assumption, however, results in the use of first few years of simulation for start-up period to stabilize the simulated groundwater levels. Therefore, the model calibration period effectively ends up to be the 20-year period of water years 1996 through 2015.

Water Supply and Demand Data

The following sections describe the data and methodology for the CBWRM water demand and supply calculations. Agricultural water demands were calculated in the IDC portion of IWFM. Agricultural and domestic supplies are specified in the CBWRM's groundwater pumping data.

Agricultural Water Demand

Agricultural water demand is the amount of irrigation water that is required to satisfy the crops' evapotranspiration requirement after rainfall. The IDC is designed to estimate the agricultural water demand for each model element through consumptive use methodology. The IDC calculations rely on model input data for historical crop acreage, irrigation practices, soil moisture requirements, effective rainfall (the portion of rainfall available for crop consumptive use), crop evapotranspiration, and localized soil parameters. This data was compiled, analyzed, synthesized, and processed for input into CBWRM.

Domestic Water Use

IDC calculates urban water demand based on population and per capita water use, and the breakdown of indoor versus outdoor water use by month. For the Basin, the per capita water use was estimated using historical pumping estimates provided by the CCSD (CCSD 2010 to 2017) and population records published for the CCSD service area. Domestic water use during the historical period ranges between 100 and 200 acre-feet per year (AFY).

CBRWM Calibration

The goals of CBRWM calibration were as follows:

- Achieve a reasonable water budget for each component of the hydrologic cycle modeled (i.e., land and water use, soil moisture, stream flow, and groundwater) that is acceptable by the stakeholders to support the development of the GSP
- Maximize the agreement between simulated and observed groundwater levels at select well locations, and simulated and observed streamflow hydrographs at select gaging stations

These objectives are achieved through verification of model input data and adjustment of model parameters.

CBRWM calibration begins after data analysis and input data file development are completed. The calibration effort can be broken down into subsets that align with packages within the IWFM platform. As an integrated surface water and groundwater model, the results of each part of the simulation are dependent on one another. The model calibration can be considered a systematic process that includes the following activities:

- Calibrate water demand estimates for agricultural and urban sectors
- Calibrate surface water features, including the small watershed runoff, boundary flows, and streamflows
- Calibrate overall water budgets for the model area, and model subregions
- Calibrate simulated groundwater levels to observed groundwater levels
- Compare calibration performance with the calibration targets
- Conduct additional refinements to model as necessary

The CBWRM was calibrated to historical groundwater elevation data, with the calibration informed by local data provided by private landowners and other stakeholders.

Due to uncertainty in the initial conditions, a one-year warm-up period was included to allow groundwater levels to stabilize. Thus, the model calibration period for the CBWRM is October 1995 through September 2015, or water years 1996 through 2015 (i.e., 20 years).

Calibration of IDC and Root-Zone Parameters

The goal of IDC calibration is to estimate a reasonable urban and agricultural demand and develop the components of a balanced root zone budget. IDC calibration serves as the foundation of IWFM calibration as demand estimates directly affect the estimates of groundwater pumping. This part of the calibration effort focused primarily on refining individual budget items, while maintaining reasonable root zone parameters.

The calibrated IDC was used to estimate monthly agricultural water demand at each model element during the model hydrologic period. To adjust agricultural demand, elemental root zone parameters were adjusted in accordance with the hydrologic soil group. Figure C-15 shows estimates of annual agricultural water demand in the Basin from water year 1998 to water year 2017. The average annual agricultural water demand during these years is estimated to be approximately 59,000 AFY. The year-to-year variability in estimated agricultural demand reflects the variabilities in land use, precipitation, and temperature experienced historically in the Basin.

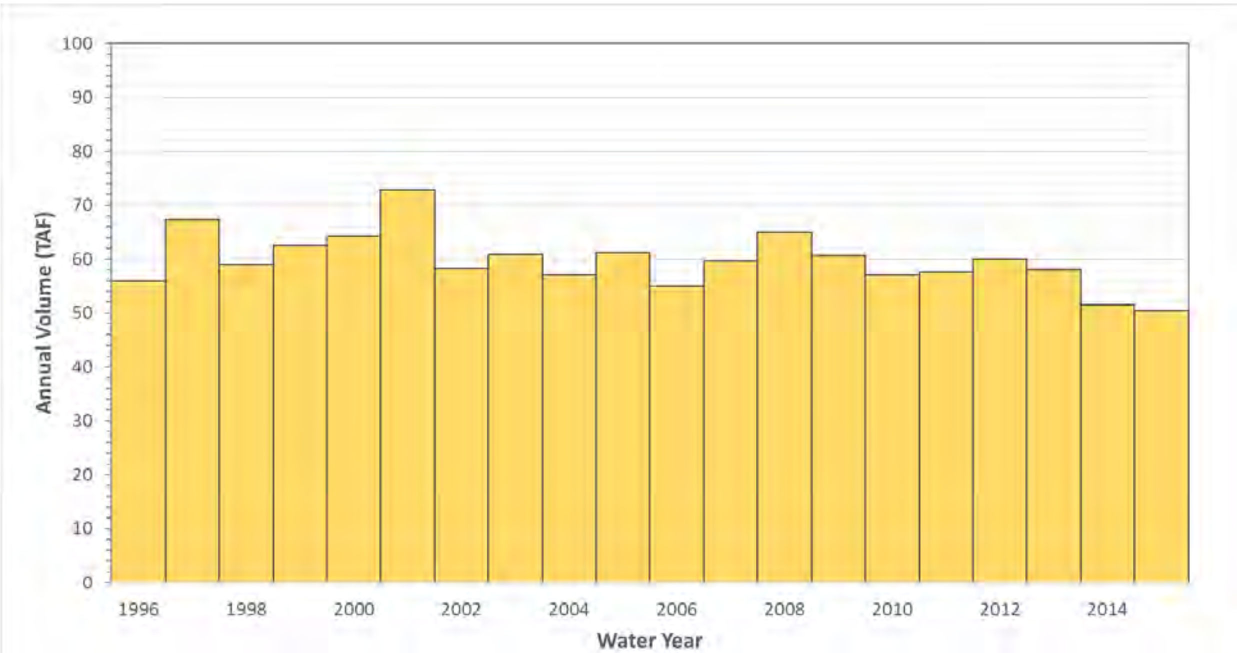

Figure C-15: Annual Agricultural Water Demand

Calibration of Surface Water Features

As discussed above, small watersheds were used to simulate inflows into the model from ungaged watersheds. The small watershed were split between surface water runoff that enters the stream system, percolation that occurs during transport to the streams, and baseflow entering the groundwater system at the model boundary.

In addition to the surface water flows coming from small watersheds, surface water runoff generated over the groundwater basin is collected in the stream network to simulate streamflows and stream-aquifer interaction. Stream-aquifer interaction is calculated based on stream stage, groundwater levels, and channel properties such as streambed hydraulic conductance.

As discussed above, limited streamflow data are available to perform calibration on surface water flows in the model. One USGS gage is available on the Cuyama River downstream of the Basin (ID 11136800), which is located just upstream of Lake Twitchell. The flows from this gage were adjusted to estimate flows at the downstream boundary of the Basin. These adjusted flows as well as available streamflow data from deactivated and active gages on small watersheds were then compared to the flows resulting from the model calibration process.

Calibration of Water Budgets

The aim of the calibration process is to ensure an accurate representation of the hydrologic characteristics of the Basin, confirmed through the analysis of the resulting water budgets. A water budget balances all supplies, demands, and any subsequent change in storage occurring within that specific portion of the hydrologic cycle. IWFM automatically outputs budgets at the subregion scale for processes involving groundwater, the surface layer, streams, the root zone, and small watersheds. IWFM can output select budget information down to a single element or any specific grouping of elements. This feature was used during the calibration process to prepare water budget information by certain geographic areas for planning and comparison purposes.

During this step of the calibration process, CBRWM results are reviewed and summarized into monthly and annual (by water year) budgets. Two key hydrologic components that were reviewed most frequently during the calibration process were the groundwater budget and the land and water use budget. During extensive analysis of water budgets, key model datasets and parameters were adjusted (including parameters related to soil and root zone, small watershed and boundary flows, stream system, and aquifer system), to better match the conceptual understanding of the Basin. CBWRM water budget results are summarized in the following sections.

Land Surface Water Budget

The following components are included in the land surface water budget:

- Inflows:
  - Precipitation
  - Applied Water
- Outflows:
  - Evapotranspiration (Agricultural and Native Vegetation)
  - Domestic Water Use
  - Deep Percolation
  - Runoff

Figure C-16 shows the annual time series of historical land surface inflows and outflows during the calibration period. The Basin experienced about 282,000 AF of inflows each year, of which 223,000 AF is from precipitation and the remainder is from applied water. About 223,000 AFY was consumed as evapotranspiration and domestic use, with the remainder either recharging the groundwater aquifer as deep percolation, stream seepage or leaving the Basin as river flow.

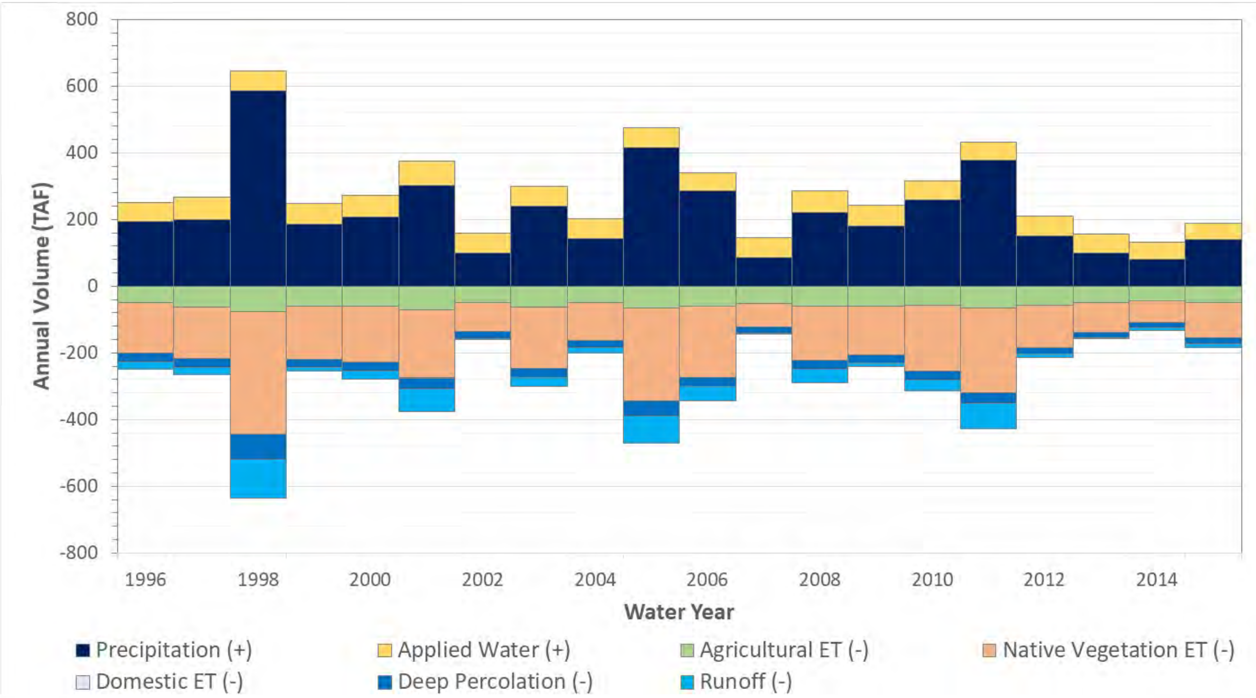

Figure C-16: Land Surface Water Budget Annual Time Series in the Calibration Period

Groundwater Budget

The following components are included in the groundwater water budget:

- Inflows:
  - Deep percolation
  - Gain from stream
  - Subsurface inflow
- Outflows:
  - Groundwater pumping

Figure C-17 shows the annual time series of groundwater inflows and outflows during the calibration period. The Basin average annual historical groundwater budget has greater outflows than inflows, leading to an average annual deficit in groundwater storage of 24,000 AF. The groundwater storage decreases consistently over time, despite year-to-year variability in groundwater inflows.

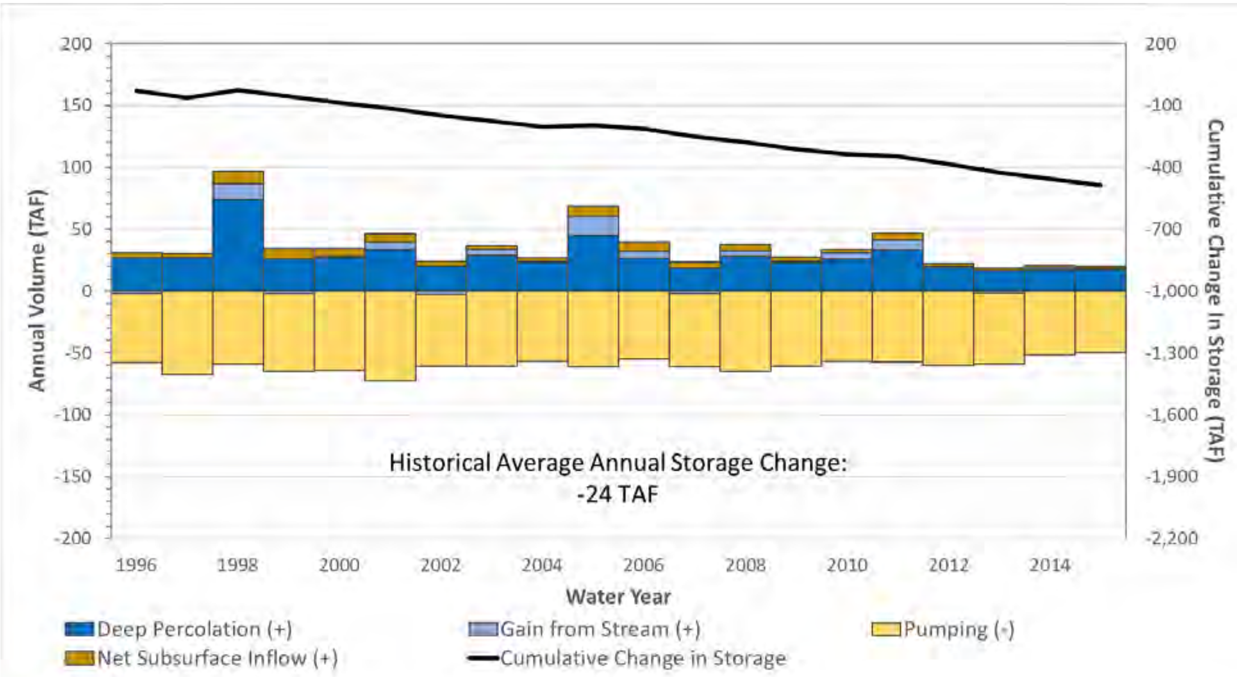

Figure C-17: Groundwater Budget Annual Time Series in the Calibration Period

Groundwater Level Calibration

The goal of groundwater level calibration is to achieve reasonable agreement between the simulated and observed values (in this case, groundwater levels at the calibration wells). Within the CBWRM, 65 wells were used to evaluate the model calibration at both a regional and local scale. These wells are included in the CBGSA's Opti data management system. The calibration wells were selected based on their period of record and availability of observation data, spatial distribution across the model, and trends of nearby wells. These calibration wells are shown in Figure C-18.

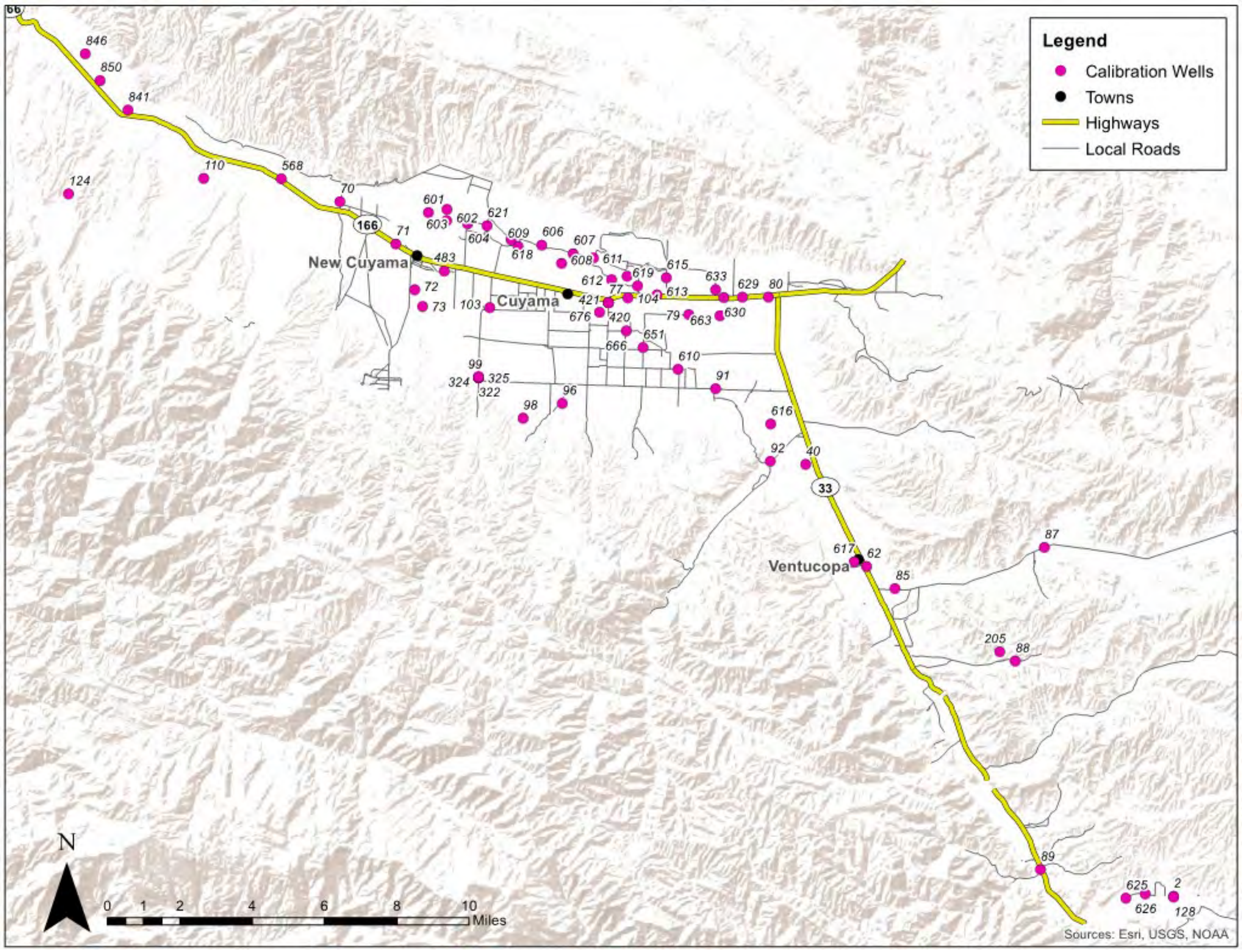

Figure C-18: Location of Calibration Wells

Simulated groundwater levels were calibrated to observed levels through systematic adjustments to aquifer parameters including hydraulic conductivity, specific storage, and specific yield. The goal of groundwater level calibration is to achieve the maximum agreement between simulated and observed groundwater elevations at calibration wells while maintaining aquifer parameters within reasonable range. The groundwater level calibration is performed in two stages as follows:

- The initial calibration effort is focused on the regional scale to verify hydrogeological assumptions made during model data development and confirm the accuracy of general groundwater flow directions. During this stage, simulated groundwater elevation trends, flow directions, and groundwater gradients are compared to those that can be synthesized form the reported data.
- The second stage of calibration of groundwater levels is to compare the simulated and observed groundwater levels at each calibration well. This comparison provides information on the overall model performance during the simulation period. The simulated groundwater elevations at the calibration wells were compared with corresponding observed values for concurrence in long-term trends as well as seasonal fluctuations.

The results of the groundwater level calibration indicate that CBWRM reasonably simulates long-term hydrologic responses under various hydrologic conditions, and the short-term monthly or seasonal fluctuations. Attachment 3 shows a selection of calibration wells with their resulting groundwater level hydrographs.

Figures C-19 and C-20 show a statistical comparison of the final simulated and observed groundwater levels across the entire Basin. As shown in these figures, the model results show a strong correlation with the observed data.

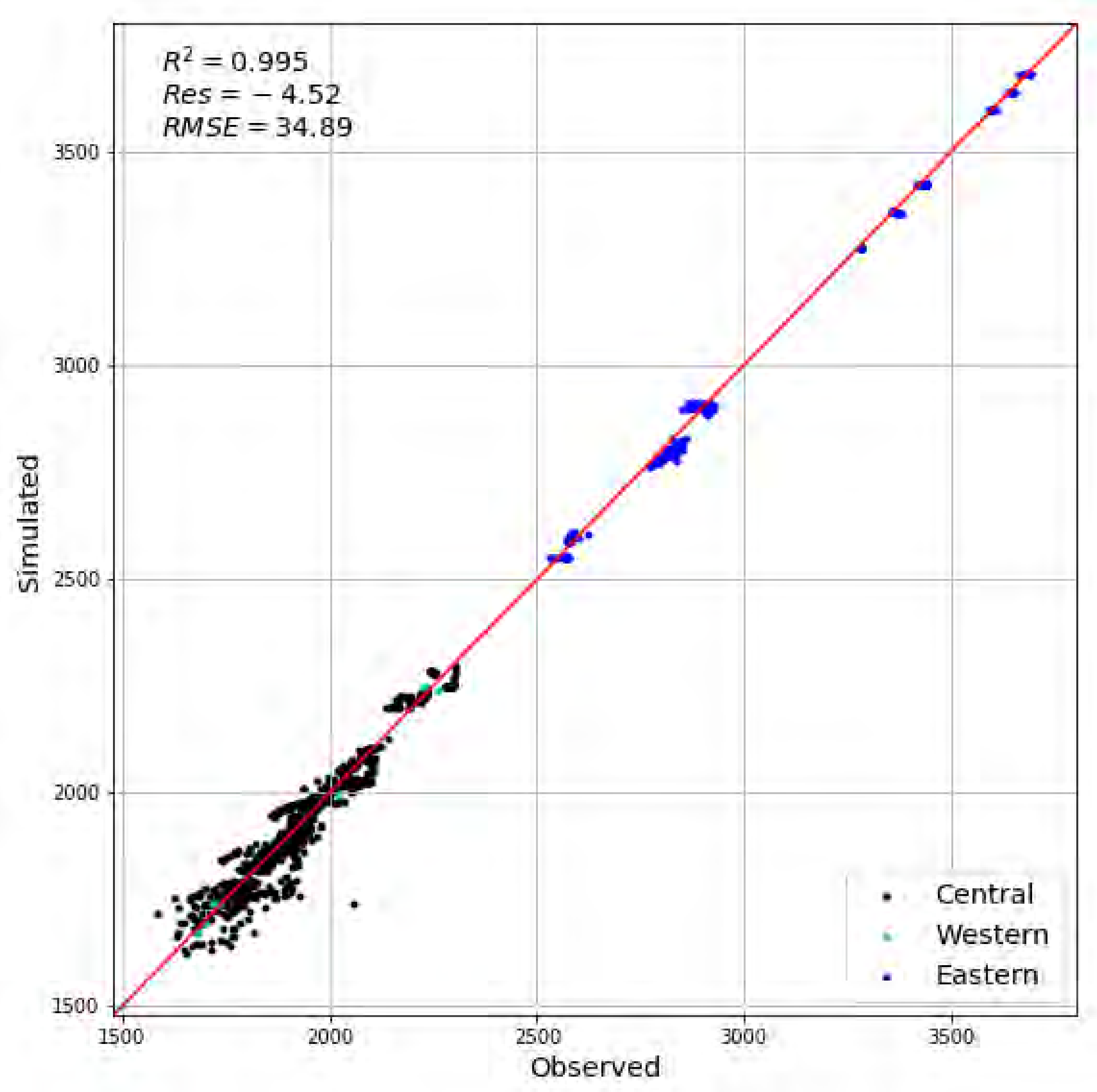

Figure C-19: Comparison of Simulated and Observed Groundwater Levels

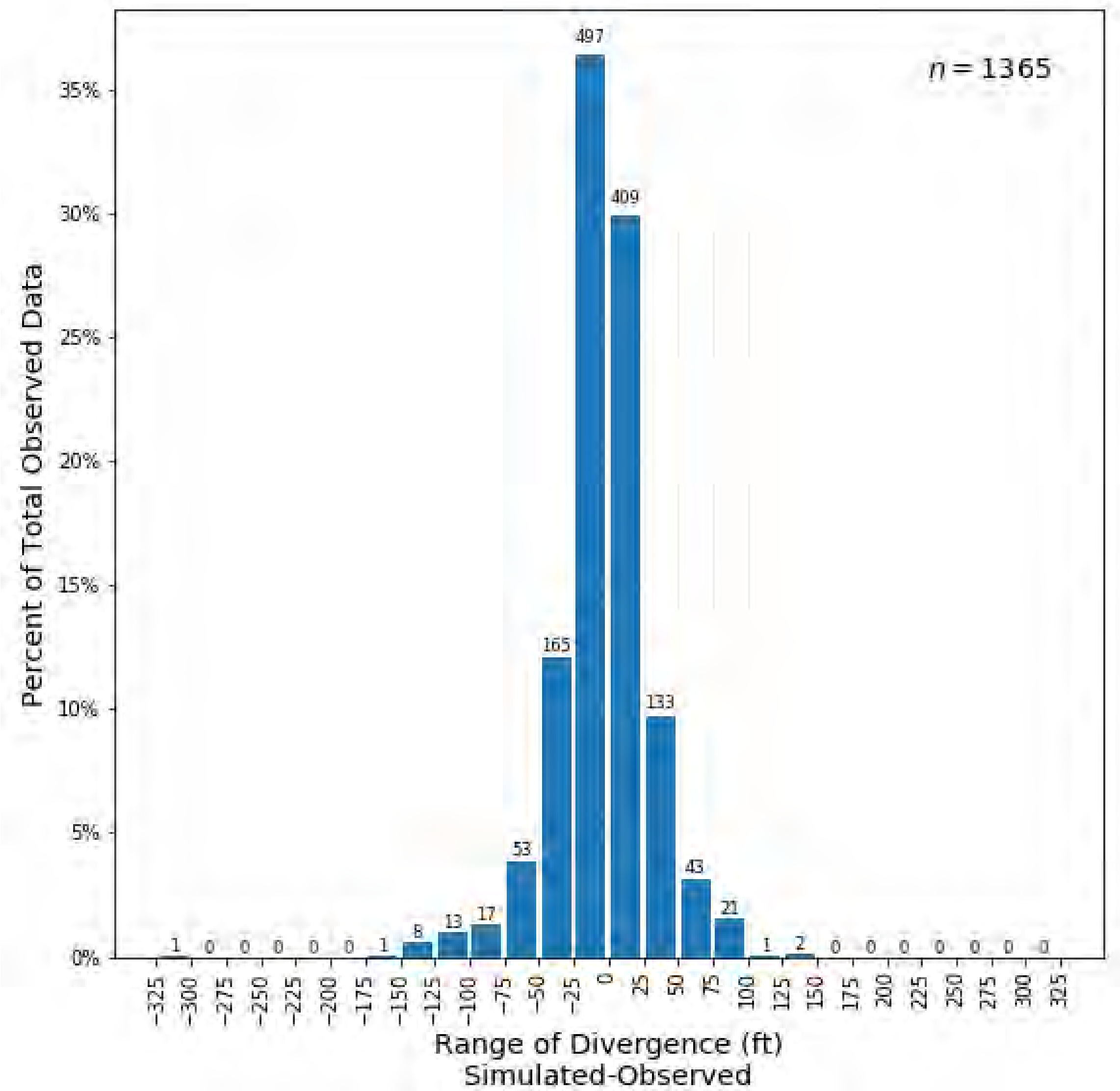

Figure C-20: Histogram of Divergence of Simulated Groundwater Levels from Observed Data

Uncertainty and Sensitivity Assessment

To incorporate the uncertainty that originates from various model inputs such as hydraulic parameters, land use, irrigation practices and agricultural demand, an ensemble of perturbed simulation results were analyzed to quantify the overall effect on the groundwater storage change over the historical simulation period.

Table C-3 shows the range of aquifer hydraulic parameters used in CBWRM as compared to reported values from historical USGS studies. The ranges of horizontal hydraulic conductivity used in CBWRM for layers 1 and 2 is similar to the USGS values. In layer 3, it was necessary to set CBWRM values lower than the reported USGS values in order to provide a good match with historical groundwater levels. The specific yield and specific storage values used in CBWRM are consistent with typical values used for similar geologic formations.

Table C-3: Range of Aquifer Parameters in CBWRM as Compared to Reported Values

Study	Horizontal Hydraulic Conductivity (feet/day)			Specific Yield	Specific Storage
	Layer 1	Layer 2	Layer 3		
CBWRM	$3.0x10^{-1}$ to $2.4x10^{1}$	$1.0x10^{-2}$ to $1.0x10^{1}$	$1.1x10^{-4}$ to $3.5x10^{-2}$	0.08 to 0.25	10-6 to 10-4
USGS Pumping Tests[a]	$1.9x10^{-1}$ to $5.3x10^{1}$	$5.3x10^{-2}$ to $2.6x10^{1}$	$6.6x10^{-2}$ to $2.7x10^{-1}$	N/A	N/A
USGS Slug Tests[a]	N/A	$1.5x10^{0}$ to $2.8x10^{1}$	$1.6x10^{0}$ to $9.9x10^{0}$	N/A	N/A

[a]USGS, 2013b

Table C-4 shows the sensitivity of Basin-wide storage change to various model parameters. Groundwater pumping was tested by simulating plus or minus 20 percent of the baseline value, while the other parameters were tested by multiplying the baseline values by 0.1 and 10 (for specific storage) or by 0.2 and 5 (for the other parameters). Basin-wide storage was found to be most sensitive to groundwater pumping, followed by soil percolation potential and streambed seepage potential.

Table C-4: Sensitivity of Basin-wide Storage Change to Different Parameters

Parameter	Change Factor	Maximum Range (AF)	Deviation of Maximum Range (percent)	Minimum Range (AF)	Deviation of Minimum Range (percent)	Range of Deviation (percent)
Groundwater Pumping	±20	34,945	+45	13,114	-46	91
Aquifer Hydraulic Conductivity	x0.2/x5.0	26,050	+8	23,103	-4	12
Specific Yield for Shallow Aquifer System	x0.2/x5.0	26,124	+8	23,384	-3	11
Specific Storage for Semi-confined Aquifer Systems	x0.1/x10.0	24,153	0	23,985	0	<1
Streambed Seepage Potential	x0.2/x5.0	29,368	+22	20,054	-17	39
Soil Percolation Potential	x0.2/x5.0	26,688	+11	17,118	-29	40
Tributary Watershed Flows	x0.2/x5.0	25,107	+4	24,103	0	4

Accounting for these uncertainties in combination with comparisons of observed and simulated groundwater elevations, the upper and lower bounds for the cumulative groundwater storage change are presented in Figure C-21 below. The upper and lower bounds for the average groundwater storage change that result in a similar correlation of observed and simulated groundwater elevations are estimated to range from 22,000 to 27,000 AFY.

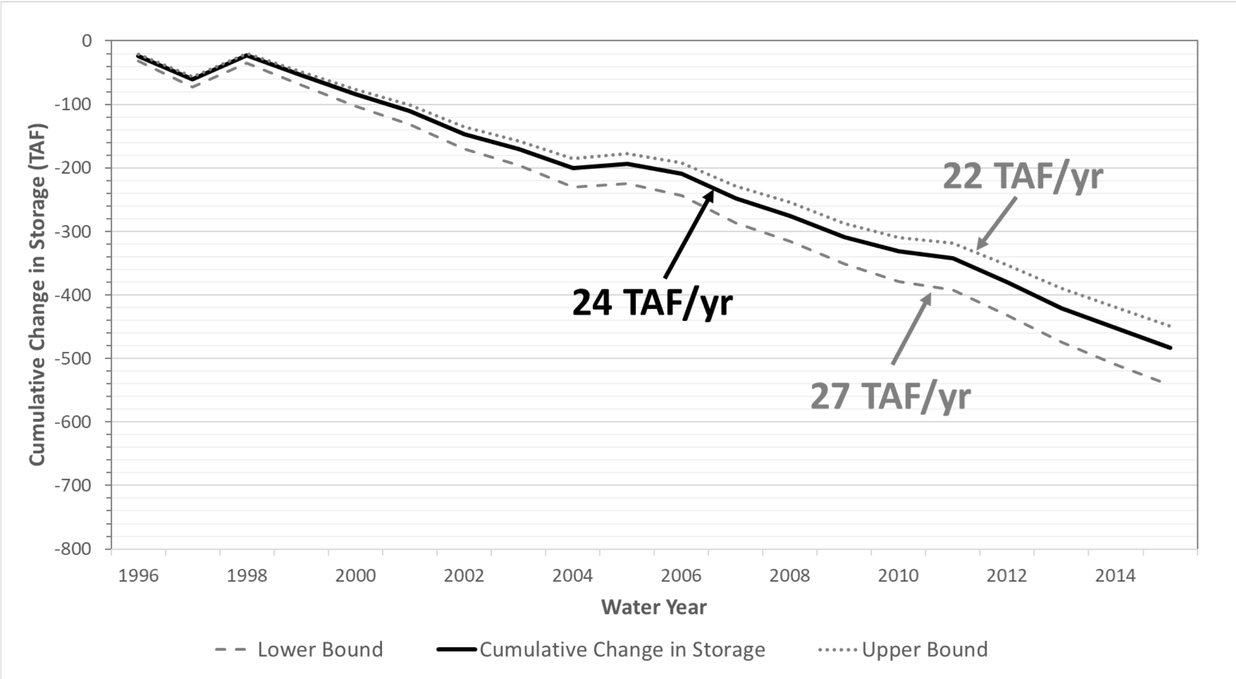

Figure C-21: Lower and Upper Bounds for the Groundwater Storage Change

Conclusions and Recommendations

The CBWRM is the latest analytical model based on DWR's state-of-the science modeling platform, IWFM. The CBWRM has relied on data sets from various sources, and was developed to support GSP development with the primary purpose of assessing hydrologic and groundwater conditions in the Basin during the recent historical period from water 1998 to water year 2017. CBWRM also assesses hydrologic and groundwater conditions under the Basin's current level of development and under projected conditions.

Based on analysis, the following conclusions are made:

1- CBRWM is reasonably calibrated, and reflects a reasonable representation of the Basin's hydrologic and hydrogeologic conditions

2- CBRWM calibration meets the intended need to support GSP development

3- GSP stakeholders and the Technical Forum have reviewed model development and calibration results, and have agreed that the CBWRM, as it stands, is an appropriate tool to be used for assessment of and planning for sustainable groundwater conditions in the Basin.

The following recommended actions would support future model updates:

- **Continue engagement with local stakeholders**. Continue working with local agencies and groundwater users in the Basin to further understand the local operations of the groundwater system and improve representation of groundwater users in the model by collecting additional data. Specific data to be considered are irrigation practices outside the main District areas, groundwater level data, information on the well profiles and characteristics.
- **Perform additional hydrogeological conceptualization.** Specific areas can benefit from additional hydrogeologic investigations. These include eastern part of the basin in the vicinity of the Ventucopa area, as well as the western part of the model, downgradient from the Russel Fault. In addition, data about effectiveness of the fault system in the area are very sparse. Additional targeted groundwater exploration and/or groundwater level monitoring should focus on the areas near the fault systems.
- **Improve streamflow record collection.** Currently, there are no long-term streamflow gaging stations within the CBWRM. As part of GSP implementation, at least two streamflow gaging stations should be installed and monitored regularly, so that Basin inflows and outflows are properly monitored.
- **Improve representation of small watersheds.** Surface water flow from and evapotranspiration losses in the ungaged watersheds represent a relatively large portion of the Basin water budgets. Additional investigations on the native vegetation ET, and runoff conditions in the ungaged watersheds can improve model representation of this feature.
- **Develop groundwater pumping estimates.** As groundwater pumping is the primary outflow from the groundwater system, an accurate representation of outflow significantly improve CBWRM performance. A pilot project is recommended to monitor and measure groundwater use and well discharge for select parcels based on cropping patterns and geographic location relative to the river and relative to other hydrologic features, such as faults.

  Incorporate future data into model calibration. Data will be collected using the CBGSA's groundwater monitoring network, and should be used to re-assess and improve the HCM, CBWRM parameter values and CBWRM calibration, especially in areas of the Basin where little or no data exist currently. In addition, model predictions should be compared to actual future climate and water availability conditions to provide insights into model performance.

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Attachment C-1

Land Use and Consumptive Water Use of Cuyama Groundwater Basin for Water Years 1996 Through 2016

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TECHNICAL MEMORANDUM – DRAFT

LAND USE AND CONSUMPTIVE WATER USE OF CUYAMA GROUNDWATER BASIN FOR WATER YEARS 1996 THROUGH 2016

To: Woodard & Curran

From: Land IQ

Date: June 19, 2018

INTRODUCTION

Accurate and current information on constantly changing consumptive water use for crops is critical not only to water rights administration, but also to sustainable groundwater management, agricultural irrigation management, and to environmental and water quality protection. Land IQ has been contracted by Woodard & Curran to analyze consumptive water use in the Cuyama Groundwater Basin for these purposes and overall Groundwater Sustainability Plan (GSP) development data resources.

This memorandum provides methods and results of crop type identification for selected water years (1996, 2000, 2003, 2006, 2009, 2012, 2014 & 2016) during the 20 year time period. Multiple sources of data are used in the identification of each field. These sources include aerial imagery, satellite photography, DWR land use surveys and ground survey information.

This documentation also provides estimates of crop evapotranspiration (ET) for the 1996 and 2016 water years (10/1/1995 – 9/30/1996, 10/1/2015 – 9/30/2016). The surface energy balance model, METRIC (Mapping Evapotranspiration with high Resolution and Internalized Calibration), is applied to estimate monthly and annual evapotranspiration. The input data include CIMIS weather station data and USGS Landsat 5 & 8 satellite images.

DETERMINING LAND USE

Land use is one of the most influential inputs to a consumptive use or groundwater model. This analysis was used to develop estimates of land uses associated with agricultural production in the Cuyama Groundwater Basin. Crop type information optimizes estimations of evapotranspiration, applied water, deep percolation return flows and other water balance input data requirements.

LAND USE DATA SOURCES

Available resources for crop mapping in recent years are more refined and accurate and in past years. Table 1 shows the types of aerial/satellite imagery as well as data availability for each year. Taking this into account, the accuracy and specifity of crop identification is greatest in the most recent mapping years (2014 & 2016). In more recent years, data allows individual crop types to be identified, instead of a more general category (e.g. Miscellaneous Truck Crops).

TABLE 1. SUMMARY OF DATA SOURCES AVAILABLE FOR EACH ANALYSIS YEAR

Year	Land Use Survey Data	Google Earth	NAIP Imagery	Landsat
2016	✔	✔	✔	✔
2014	✔	✔	✔	✔
2012	-	✔	✔	✔
2009	-	✔	✔	✔
2006	-	✔	✔	✔
2003	-	-	✔	✔
2000	-	-	-	✔
1996	✔	-	-	✔

LAND USE SURVEY DATA

The California Department of Water Resources (DWR) publishes land use data for regions on a rotating schedule for all or portions of each California County (DWR, 2018). The Cuyama Valley was last surveyed by DWR in 1996, including >90% of the fields in the Valley. Since then, Land IQ has completed statewide crop mapping for DWR in 2014 and 2016, encompassing the entire Cuyama Valley. In these three years, this data was used as a base layer and updated as needed.

GOOGLE EARTH

Google Earth provides high resolution satellite imagery with some temporal variation. Currently, most Google Earth data is provided by DigitalGlobe's WorldView-3 satellite, providing sub-meter resolution (Digital Globe, 2010). The street view function is also very helpful when identifying past years' crops. The street view in this area is very limited, however, and only available in 2008.

NAIP AERIAL IMAGERY

The National Agriculture Imagery Program (NAIP) captures aerial imagery during the growing season for public use (USDA, 2017). The imagery for the Cuyama Valley was available starting in 2003. NAIP imagery has a fairly high resolution of one meter. This imagery is used to update the field boundary layer for each year because the high resolution allows for the identification of fields that have split or have a different footprint. The drawback to NAIP imagery is that it is only a snapshot in time, with no temporal variation. Figure 1 shows 2009 NAIP imagery of the Cuyama Valley at two different scales to show detail.

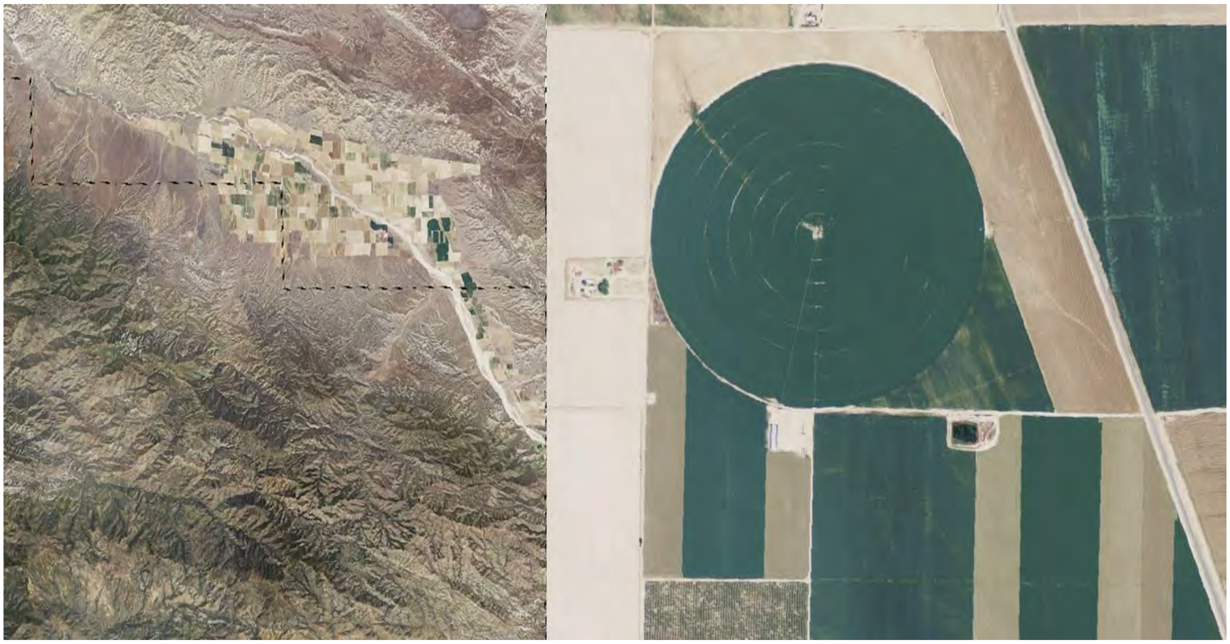

FIGURE 1. NATURAL COLOR COMPOSITE OF NAIP IMAGE, FOR 05/05/2012; 1:300,000 SCALE ON LEFT; 1:9,000 SCALE ON RIGHT.

LANDSAT SATELLITE IMAGERY

Landsat satellite imagery is a joint project between the USGS and NASA that collects imagery for public use. Landsat provides lower resolution imagery (30 x 30 meter pixels) but at a much higher frequency than NAIP (USGS, 2007). Depending on year and cloud cover, imagery for an area could be as frequent as every 8 days. This frequency allows for the observation of the crop in all stages of development. All imagery dates during the growing season are used to identify the color and texture changes, to support the crop type identification.

The Cuyama Valley is within Landsat reference system path 42 and row 36. Landsat 5, 7, and 8 were used for appropriate years. All available growing season images were utilized, except those that had cloud contamination. Figure 2 is an example of the agriculture area in Landsat 5 on June 26, 2009.

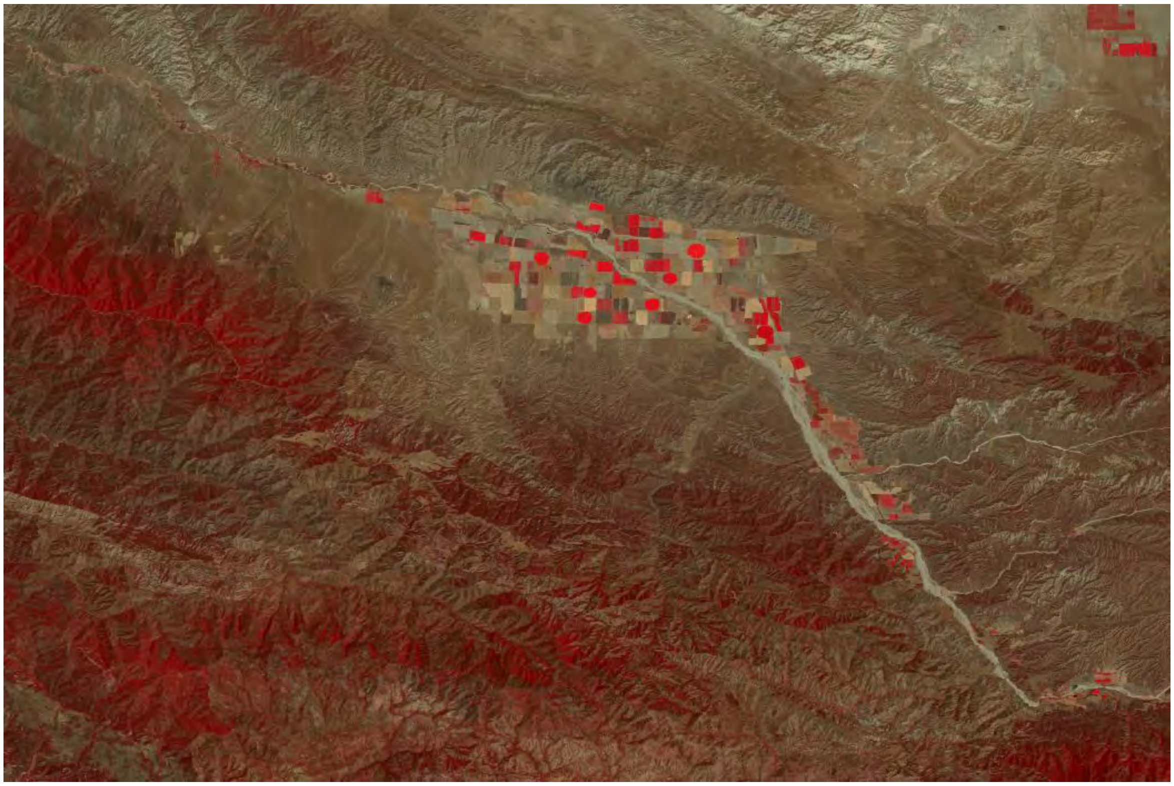

FIGURE 2. FALSE COLOR COMPOSITE OF LANDSAT 5 IMAGE, PATH 42 ROW 36, FOR 06/26/2009. AGRICULTURE IS IN THE MIDDLE OF THE IMAGE.

LAND USE RESULTS

Classification and field boundary updates were completed for each year, using the data sources available. Table 2 summarizes the results of the classification and boundaries. The top 5 crop classes during the 20 year period (excluding idle) were miscellaneous truck, miscellaneous grain and hay, carrots, alfalfa and alfalfa mixtures, and apples.

TABLE 2. SUMMARY OF CROP MAPPING RESULTS

DWR Crop	1996	2000	2003	2006	2009	2012	2014	2016
Alfalfa & alfalfa mixtures	3,574	2,586	1,950	2,201	935	1,356	168	235
Apples	2,475	2,478	1,417	773	518	282	307	331
Beans (dry)	-	259	-	-	-	-	1,064	-
Bush berries	-	-	-	-	-	-	-	21
Carrots	4,698	843	307	566	5,582	6,654	2,302	5,572
Citrus	-	2	2	2	4	4	2	2
Cole crops	-	-	107	137	292	236	182	383
Corn, sorghum and sudan	-	185	209	-	74	-	32	173
Grapes	357	794	768	768	765	853	1,303	1,241
Greenhouses	-	-	-	-	-	-	-	5
Idle	-	8,286	9,971	12,247	9,139	8,449	15,352	13,572
Lettuce/leafy greens	-	-	-	271	212	171	-	612
Melons, squash, and cucumbers	12	-	-	-	-	-	562	50
Miscellaneous deciduous	12	10	10	16	41	35	10	6
Miscellaneous field crops	114	-	-	-	-	-	-	-
Miscellaneous grain and hay	7,462	5,756	5,580	4,712	8,767	6,367	851	3,198
Miscellaneous grasses	-	192	485	192	111	14	22	-
Miscellaneous subtropical fruit and nut	-	-	-	-	-	-	-	7
Miscellaneous truck	3,723	6,842	8,083	9,380	3,451	4,078	6,100	3,322
Mixed pasture	737	104	91	398	273	392	97	142
Native	-	-	-	-	-	166	-	-
Olives	-	4	4	4	4	4	4	517
Onions and garlic	313	10	315	527	983	1,231	615	2,190
Peaches/nectarines	413	348	284	213	75	-	-	-
Pistachios	676	604	604	757	757	722	802	722

DETERMINING CONSUMPTIVE USE

Traditional methods of calculating evapotranspiration can be done quite accurately using weighing lysimeters and eddy correlation monitoring techniques. These methods are limited, however, because they provide point values of ET for a specific location and fail to provide the ET on a regional scale. This limitation has motivated the development of using remotely sensed (RS) data from satellites to evaluate ET over vast areas. Satellite data are ideally suited for deriving spatially continuous ET surfaces that can be pared down to the field scale because of their temporal and spatial characteristics. However, the most accurate use of RS models require calibration to surface measurements.

SURFACE ENERGY BALANCE CONSUMPTIVE USE ANALYSIS – METRIC MODEL

METRIC estimates surface evapotranspiration (ET) based on the evaluation of the energy balance at the earth's surface. METRIC model processes instantaneous remotely-sensed images and weather data, and estimates the partitioning of energy into net incoming radiation (R_n), heat flux into the ground (G), sensible heat flux to the air (H), and latent heat flux (LE). The latent heat flux is computed as a residual in the energy balance, representing the energy consumed by ET. The main advantage of using the energy balance is that the actual ET is computed, rather than a potential ET. A disadvantage of the energy balance approach is in the complexity of calculations and the need for human oversight during calibration. Figure 3 shows a general workflow of the METRIC process.

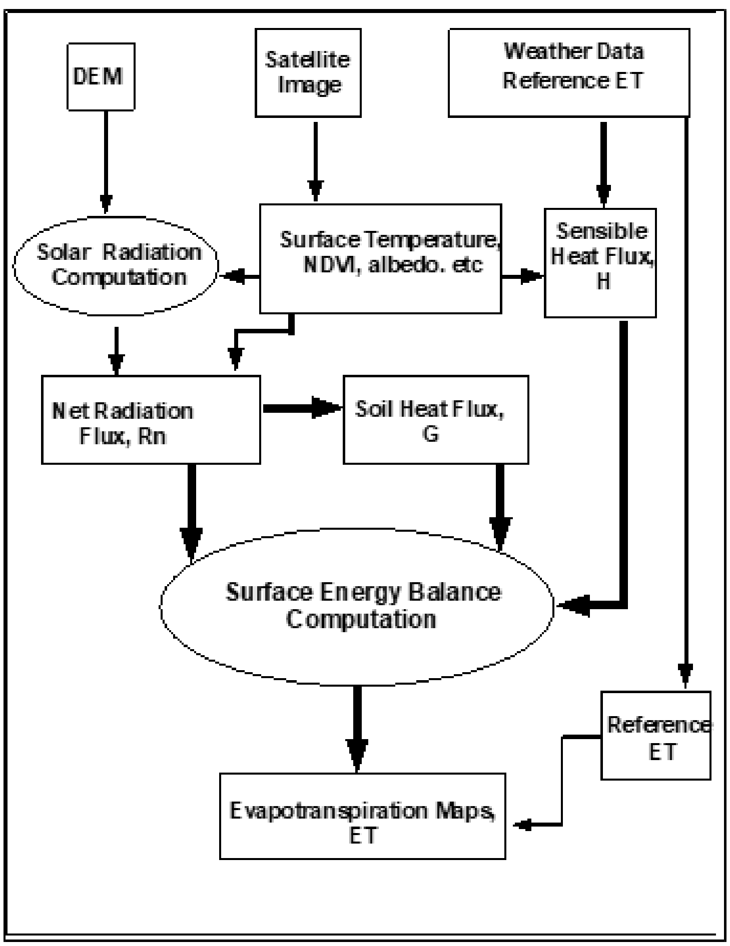

FIGURE 3. GENERAL WORKFLOW OF THE METRIC PROCESS

For the Cuyama Groundwater Basin METRIC application, the Cuyama station (CIMIS station #88) was selected to produce the reference ET (ETo) during calibration. During the internal calibration of sensible heat flux in METRIC, multiple pairs of hot and cold pixels are selected for the model, the one with relative stable result is selected for final calibration. A detailed description of METRIC can be found in Allen et al. (2007a, b; 2008).

METRIC Input Data – Satellite Images

The Cuyama Groundwater Basin is within Landsat reference system path 42 and row 36. For the 1996 water year, Landsat 5 images were used, and for the 2016 water year, Landsat 8 images were used. All available images were utilized, except those that had cloud contamination.

Tables 3 and 4 provide a list of the images used for each water year. A total of 14 Landsat 5 images were modeled by METRIC for the 1996 water year, and a total of 17 Landsat 8 images were modeled for the 2016 water year. For each image, the METRIC model was used to estimate actual daily ET. Linear interpolation was then used to calculate monthly and annual ET.

TABLE 3. DATES OF THE LANDSAT 5 SATELLITE IMAGES USED FOR METRIC PROCESSING IN 1996 WATER YEAR

#	Date of Landsat	Image Type
1	9/24/1995	Landsat 5
2	10/10/1995	Landsat 5
3	11/11/1995	Landsat 5
4	11/27/1995	Landsat 5
5	1/14/1996	Landsat 5
6	5/21/1996	Landsat 5
7	6/6/1996	Landsat 5
8	6/22/1996	Landsat 5
9	7/8/1996	Landsat 5
10	7/24/1996	Landsat 5
11	8/9/1996	Landsat 5
12	8/25/1996	Landsat 5
13	9/10/1996	Landsat 5
14	9/26/1996	Landsat 5

TABLE 4. DATES OF THE LANDSAT 8 SATELLITE IMAGES USED FOR METRIC PROCESSING IN 2016 WATER YEAR

#	Date of Landsat	Image Type
1	10/1/2015	Landsat 8
2	11/18/2015	Landsat 8
3	1/21/2016	Landsat 8
4	2/6/2016	Landsat 8
5	3/9/2016	Landsat 8
6	3/25/2016	Landsat 8
7	4/26/2016	Landsat 8
8	5/12/2016	Landsat 8
9	5/28/2016	Landsat 8
10	6/13/2016	Landsat 8
11	6/29/2016	Landsat 8
12	7/15/2016	Landsat 8
13	7/31/2016	Landsat 8
14	8/16/2016	Landsat 8
15	9/1/2016	Landsat 8
16	9/17/2016	Landsat 8
17	10/3/2016	Landsat 8

METRIC INPUT DATA – WEATHER DATA

METRIC utilizes reference ET as calculated by the ASCE standardized Penman-Monteith equation (ASCE-EWRI 2005) for calibration of the energy balance process. For our study, grass reference ET (ETo) is used in the modeling process. Hourly weather data time steps are needed to represent ETo at the time of the Landsat overpass for calibration of the METRIC energy balance estimation process. ETo was calculated using the RefET software from the University of Idaho (Allen, 2013). California Irrigation Management Information System (CIMIS) weather station #88 at Cuyama was used to provide hourly weather data for ETo calculation. Figure 4 is an example of weather data for May 21st, 1996. Figure 5 shows the annual reference ETo for 1996 and 2016 water years calculated from the CIMIS Cuyama weather station using RefET software.

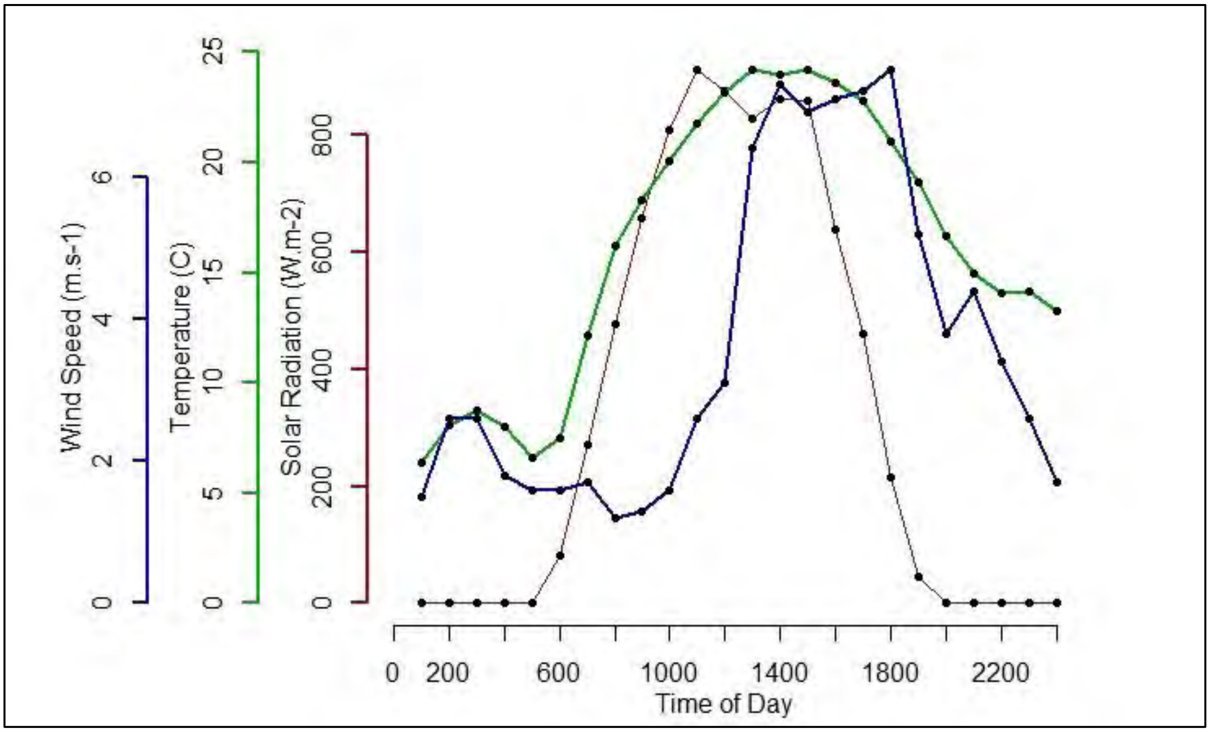

FIGURE 4. CIMIS CUYAMA #88 STATION WEATHER DATA ON MAY 21ST, 1996.

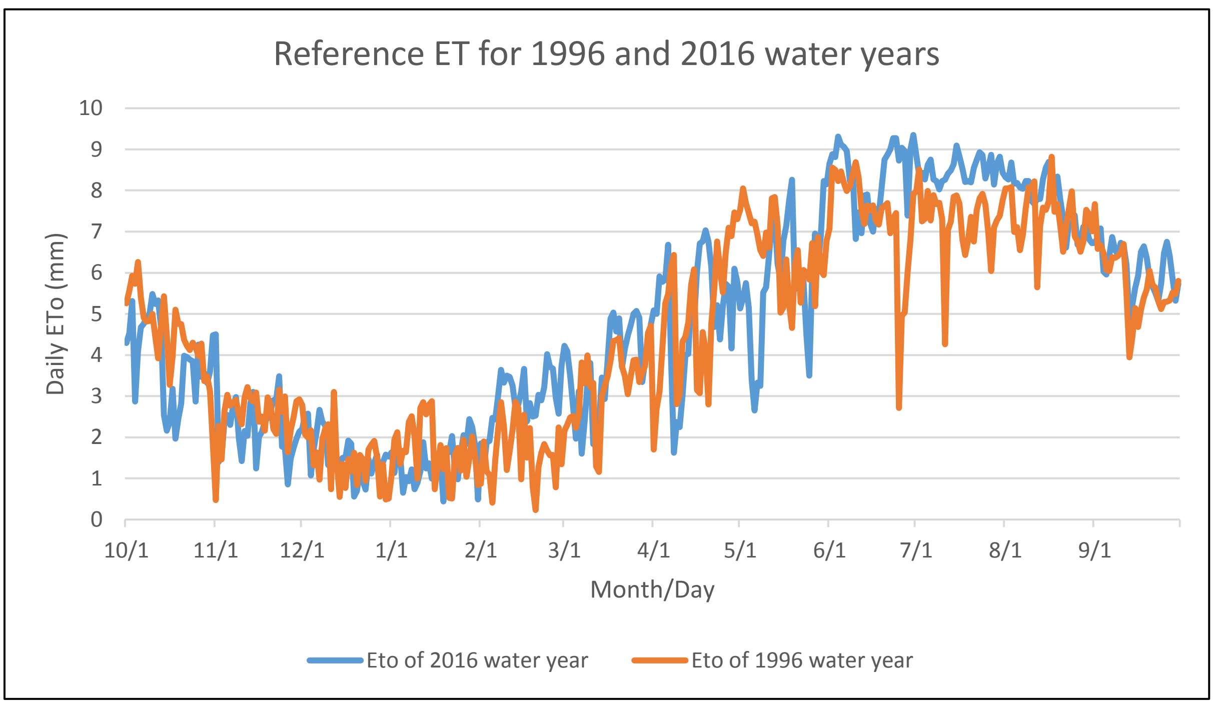

FIGURE 5. REFERENCE EVAPOTRANSPIRATION FOR 1996 AND 2016 WATER YEARS.

CONSUMPTIVE USE RESULTS

The annual ET data for the 1996 and 2016 water years are summarized by major crop types within each year. Tables 5 and 6 show the results of average crop actual ET. Major crops, such as alfalfa, apples, and carrots, have relative higher annual ET in 2016 than 1996, and these could be attributed to a number of factors:

- ➔ 2016 total annual ETo is higher than 1996 total annual ETo. As shown in Figure 5, during the month of June and July, ETo is consistently higher in 2016.
- ➔ The underlying crop layers used for generating the statistics are created differently. 2016 crop layer is created by Land IQ while 1996 crop layer is created by DWR.
- ➔ The field boundary of 2016 is more accurate, compared with 1996 field boundary. And this could cause differences in ET stats.
- ➔ Crop variety and irrigation methods are different in those 2 years, making crops evaporate more water in 2016.

Figure 6 shows the overview of 2016 water year ET over the whole Cuyama Basin. The focus and calibration area for METRIC ET evaluations was the agricultural growing region (valley floor) itself. The surrounding mountains with different elevations and aspects may have differing results.

TABLE 5. SUMMARY OF CROP EVAPOTRANSPIRATION OF 1996 WATER YEAR

Crop Types	1996 Water Year ET (mm)	1996 Crop Acres
Alfalfa and Alfalfa Mixtures	1163	3579
Apples	905	2478
Carrots	800	4705
Grapes	846	357
Miscellaneous Grain and Hay	590	7474
Miscellaneous Truck Crops	618	3729
Mixed Pasture	807	738
Onions and Garlic	591	313
Peaches/nectarines	819	414
Pistachios	683	677

TABLE 6. SUMMARY OF CROP EVAPOTRANSPIRATION OF 2016 WATER YEAR

Crop Types	2016 Water Year ET (mm)	2016 Crop Acres
Alfalfa and Alfalfa Mixtures	1365	235
Apples	1204	331
Carrots	1077	5576
Grapes	822	1242
Miscellaneous Grain and Hay	824	3201
Miscellaneous Truck Crops	818	3324
Mixed Pasture	633	142
Onions and Garlic	986	2192
Pistachios	1266	722
Lettuce/Leafy Greens	789	613
Olives	737	517
Safflower	714	810

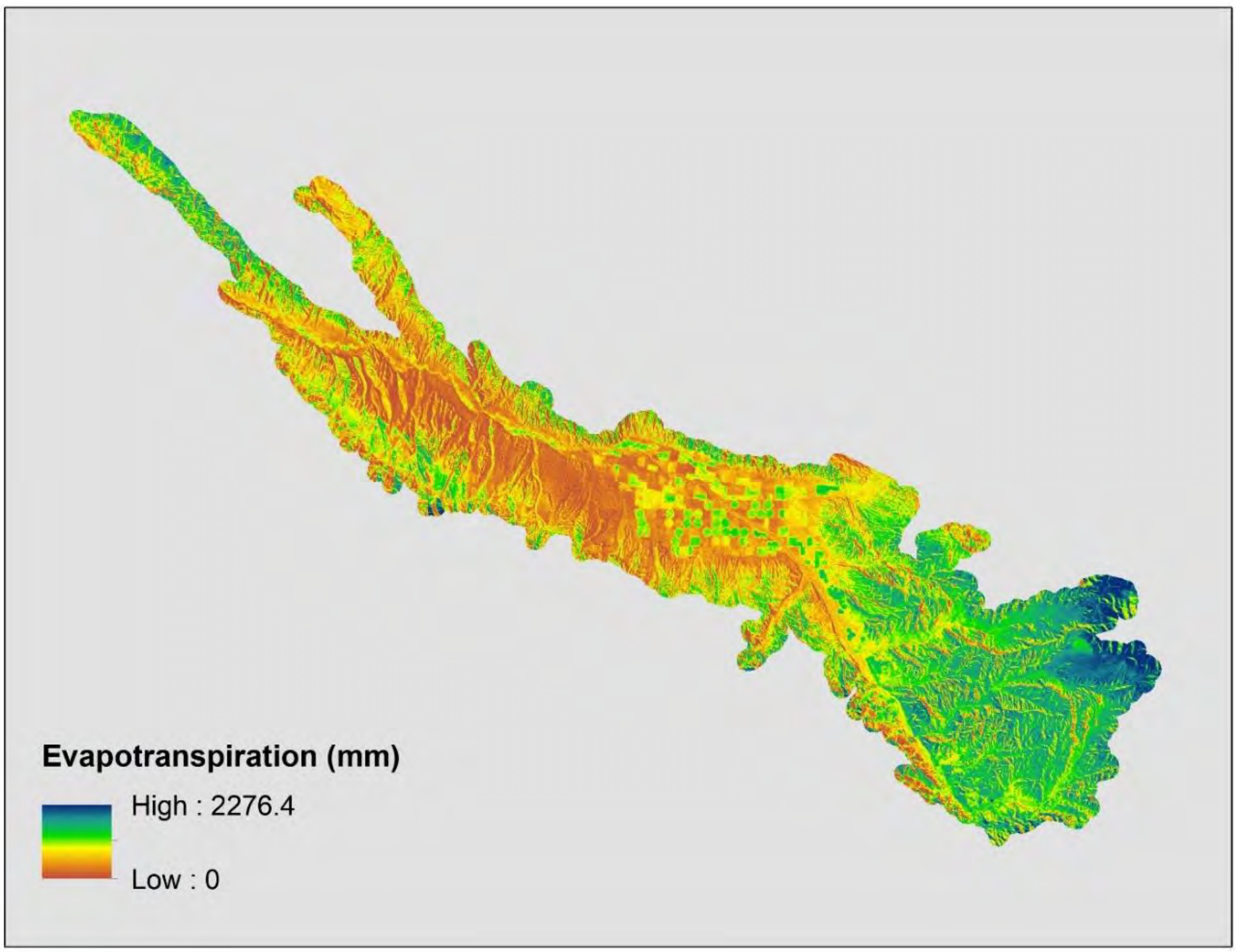

FIGURE 6. 2016 WATER YEAR EVAPOTRANSPIRATION OF THE CUYMA BASIN.

DATA DELIVERABLES

Data delivered as part of the consumptive water analysis efforts are summarized in Table 7.

TABLE 7. SUMMARY OF CROP MAPPING DATA DELIVERABLES

#	File Name	Description
1	CuyamaValley_2016_LandUse_Classification.shp	Crop classification for 2016 water year (attribute: Crop2016)
2	CuyamaValley_2014_LandUse_Classification.shp	Crop classification for 2014 water year (attribute: Crop2014)
3	CuyamaValley_2012_LandUse_Classification.shp	Crop classification for 2012 water year (attribute: Crop2012)
4	CuyamaValley_2009_LandUse.shp	Crop classification for 2009 water year (attribute: Crop2009)
5	CuyamaValley_2006_LandUse.shp	Crop classification for 2006 water year (attribute: Crop2006)
6	CuyamaValley_2003_LandUse.shp	Crop classification for 2003 water year (attribute: Crop2003)
7	CuyamaValley_2000_LandUse.shp	Crop classification for 2000 water year (attribute: Crop2000)
8	CuyamaValley_1996_LandUse.shp	Crop classification for 1996 water year (attribute: Crop1996)
9	1995-10_ETa.tif	Raster image of total evapotranspiration (unit: mm) for October 1995
10	1995-11_ETa.tif	Raster image of total evapotranspiration (unit: mm) for November 1995
11	1995-12_ETa.tif	Raster image of total evapotranspiration (unit: mm) for December 1995
12	1996-01_ETa.tif	Raster image of total evapotranspiration (unit: mm) for January 1996
13	1996-02_ETa.tif	Raster image of total evapotranspiration (unit: mm) for February 1996
14	1996-03_ETa.tif	Raster image of total evapotranspiration (unit: mm) for March 1996
15	1996-04_ETa.tif	Raster image of total evapotranspiration (unit: mm) for April 1996
16	1996-05_ETa.tif	Raster image of total evapotranspiration (unit: mm) for May 1996
17	1996-06_ETa.tif	Raster image of total evapotranspiration (unit: mm) for June 1996
18	1996-07_ETa.tif	Raster image of total evapotranspiration (unit: mm) for July 1996
19	1996-08_ETa.tif	Raster image of total evapotranspiration (unit: mm) for August 1996
20	1996-09_ETa.tif	Raster image of total evapotranspiration (unit: mm) for September 1996
21	1996_total_ETa_mm.tif	Raster image of total evapotranspiration (unit: mm) for 1996 water year

22	2015-10_ETa.tif	Raster image of total evapotranspiration (unit: mm) for October 2015
23	2015-11_ETa.tif	Raster image of total evapotranspiration (unit: mm) for November 2015
24	2015-12_ETa.tif	Raster image of total evapotranspiration (unit: mm) for December 2015
25	2016-01_ETa.tif	Raster image of total evapotranspiration (unit: mm) for January 2016
26	2016-02_ETa.tif	Raster image of total evapotranspiration (unit: mm) for February 2016
27	2016-03_ETa.tif	Raster image of total evapotranspiration (unit: mm) for March 2016
28	2016-04_ETa.tif	Raster image of total evapotranspiration (unit: mm) for April 2016
29	2016-05_ETa.tif	Raster image of total evapotranspiration (unit: mm) for May 2016
30	2016-06_ETa.tif	Raster image of total evapotranspiration (unit: mm) for June 2016
31	2016-07_ETa.tif	Raster image of total evapotranspiration (unit: mm) for July 2016
32	2016-08_ETa.tif	Raster image of total evapotranspiration (unit: mm) for August 2016
33	2016-09_ETa.tif	Raster image of total evapotranspiration (unit: mm) for September 2016
34	2016_total_ETa_mm.tif	Raster image of total evapotranspiration (unit: mm) for 2016 water year
35	Reference_ETo	Reference ET for 1996 and 2016 water years
36	Cuyama Consumptive Use Report	Memorandum summarizing consumptive use efforts (this document)

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Attachment C-2

Climate Change Scenario Development

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1. CLIMATE CHANGE SCENARIO DEVELOPMENT

1.1 Regulatory Background

As prescribed in Section 354.18(d)(3) and Section 354.18(e) of the SGMA regulations, climate change conditions were incorporated into the projected water budgets for the Cuyama Valley Groundwater Basin *Groundwater Sustainability Plan*.

Section 354.18(d)(3) of the SGMA regulations state:

> *"(d) The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:*
>
> *(1) Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.*
>
> *(2) Current water budget information for temperature, water year type, evapotranspiration, and land use.*
>
> *(3) Projected water budget information for population, population growth,* ***climate change****, and sea level rise."*

Section 354.18(e) of the SGMA regulations state:

> *"(e) Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population,* ***climate change****, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions."*

Climate change analysis is an area with continued evolution in terms of methods, tools, forecasted datasets, and the predictions of actual greenhouse gas concentrations in the atmosphere. There is a large number of available combinations of these elements that result in many potential ways to evaluate climate change impacts. For the purposes of this GSP, the method proposed by the California Department of Water Resources (DWR) as a valid method of evaluation in its guidance document was considered adequate (DWR, 2018). Similarly, the "best available information" was deemed the information provided by DWR, customized for the method proposed.

The following resources from DWR were used to carry out the climate change analysis:

- SGMA Data Viewer
- Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development
- Sustainability Plan Development and Appendices (Guidance Document)
- Water Budget BMP
- Desktop IWFM Tools

SGMA Data Viewer provides the location for which the climate change forecasts datasets[1] were downloaded for the Cuyama subbasin (DWR, 2019). The guidance document details the approach, development, applications, and limitations of the datasets available from the SGMA Data Viewer (DWR, 2018). The Water Budget BMP describes in more granular detail how projected water budgets should be computed (DWR, 2016). The Desktop IWFM Tools are available to calculate the projected precipitation and evapotranspiration inputs under climate change conditions (DWR, 2018).

Generally, the methods suggested by DWR in the above resources were used, with a few exceptions to ensure the resolution and scale matched that of the historical and current water budgets. Figure C-2-1 shows the overall process consistent with the Climate Change Resource Guide (DWR, 2018) that describes workflow beginning with baseline historical conditions to perturbed 2070 conditions for the projected model run.

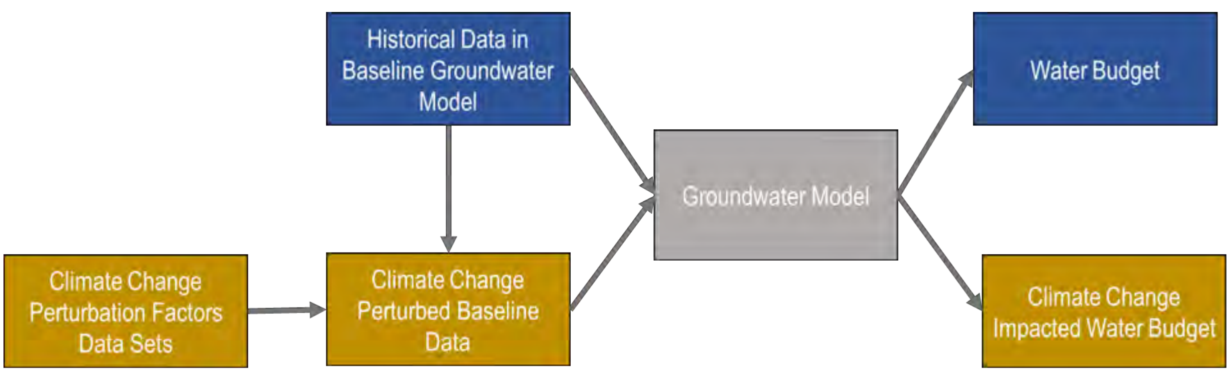

Figure C-2-1: Model Process

[1] In the industry, climate change impacted variable forecasts are sometimes referred to as "data" and their collections are called "datasets." Calling forecasted variable values "data" can be misleading, so this document tries to be explicit about data (i.e., historical data) versus forecasts or model outputs.

Table C-2-1 below summarizes the forecasted variable datasets provided by DWR that were used to carry out the climate change analysis (DWR, 2019).

Table C-2-1. DWR Forecasted Datasets

Input Variable	DWR-provided dataset
Precipitation	Change factors: VIC model-generated GIS grid with associated change factor time series for each cell
Reference ET	Change factors: VIC model-generated GIS grid with associated change factor time series for each cell

1.2 Climate Change Analysis Methodology

For climate change impacts on groundwater, accepted methods include the assessment of the impacts on the individual water resource system elements that are impacted and directly link to groundwater. These elements include precipitation, streamflow, evapotranspiration and, for coastal aquifers, sea level rise as a boundary condition. For Cuyama, sea level is not relevant. Additionally, in the Cuyama model does not have any stream inflows. For this reason, streamflow under climate change was not perturbed in this analysis.

The methods for perturbing the precipitation and evapotranspiration input files is described in the following sections. Two future scenarios were evaluated in this analysis, according to DWR guidance (DWR, 2018):

- Water Budget under 2030 central tendency conditions to assess near-future impacts of climate change.
- Water Budget under 2070 central tendency conditions to assess impacts of climate change over the long-term planning and implementation period.

1.2.1 Perturbed Precipitation under Climate Change

Projected precipitation change (perturbation) factors are provided by DWR, calculated using a climate period analysis based on historical precipitation from January 1915 to December 2011 (DWR, 2018). Change factors provided by DWR were calculated as a ratio of the value of a variable under a "future scenario" divided by a baseline. DWR used a macroscale hydrologic model that solves the full water and balance in a watershed, called the Variable Infiltration Capacity (VIC) Model. The baseline data corresponds to the 1995 historical template detrended scenario by the VIC model through global circulation model (GCM) downscaling. The "future scenario" corresponds to VIC outputs of the simulation of future conditions using GCM forecasted hydroclimatic variables as inputs. These change factors are thus a simple perturbation factor that corresponds to the ratio of a future with climate change divided by the past without it. Change factors are available on a monthly time step and spatially defined by the VIC model grid. Supplemental tables with the time series of perturbation factors are available by DWR for each grid cell.

Because the Cuyama model has a daily time step, the historical baseline time series (water year 1960 to water year 2017) was aggregated monthly. DWR change factors, or perturbation factors, were then multiplied by historical baseline precipitation to generate projected precipitation under 2030 and 2070 central tendency future scenarios using the Desktop IWFM GIS tool (DWR, 2018). The tool calculates an area weighted precipitation change factor for each model grid geometry. This model grid geometry was generated based on polygons generated around the PRISM nodes that are within the model region.

However, the DWR tool only includes change factors through 2011. The remaining five years of the time series were synthesized according to historically comparable water years. The perturbation factor from the corresponding month of the comparable year was applied to the baseline of the missing years (i.e., 2012 to 2017) to generate projected values. Months with no precipitation in the baseline were assumed a monthly precipitation of 1 millimeter under climate change to account for increased precipitation that cannot be calculated from a baseline of 0 millimeter for these synthesized years. Table C-2-2 below shows the comparable water years assigned for each missing year.

Table C-2-2. Water Years Assigned for Missing Years

Water Year with Missing Change Factors	Comparable Water Year on Record	
	April to September	October to March
2012	1987	2009
2013	1990	1990
2014	1990	1989
2015	2001	1990
2016	1990	1989
2017	1990	1990

Applying Change Factors to Precipitation and ET

DWR datasets include scenarios for 2030 and 2070 timeframes and for conditions similar to historical in terms of precipitation forecasted (central tendency) and conditions wetter and drier. All scenarios available present higher future temperatures. The team selected the 2070 central tendency forecasted conditions for the analysis.

After applying the change factor to the model simulation period (baseline) analysts obtained the precipitation and evapotranspiration under climate change. The resulting perturbed precipitation values and the baseline precipitation values can be found in Figure C-2-2 below. The exceedance plot for these two times series can be found in Figure C-2-3.

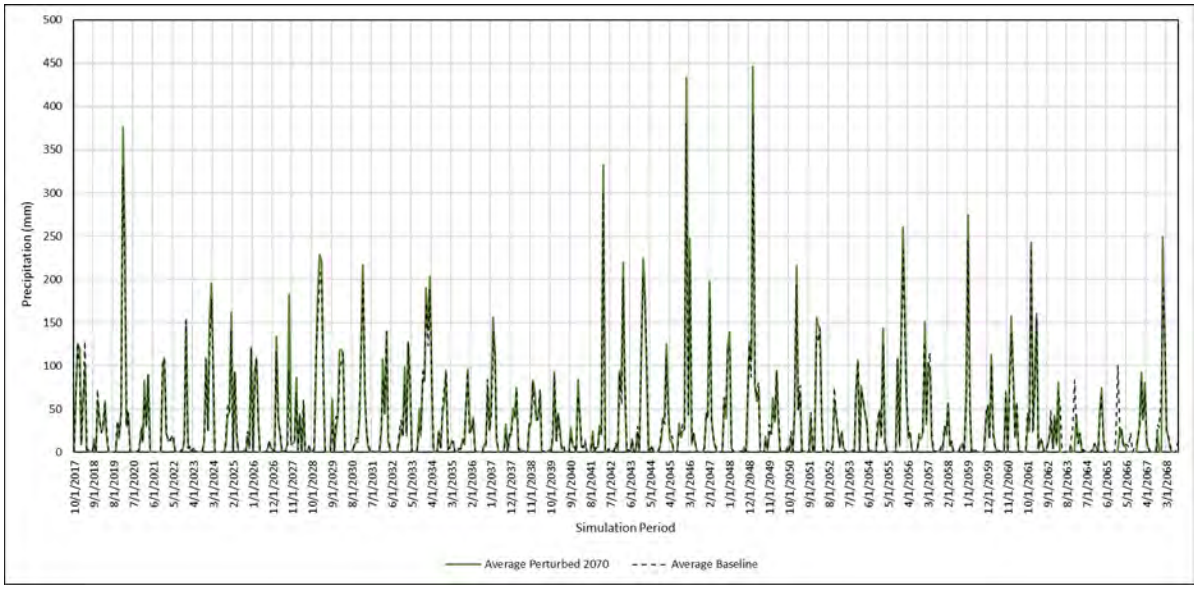

Figure C-2-2. Precipitation Perturbation Factors as Compared to Baseline Values

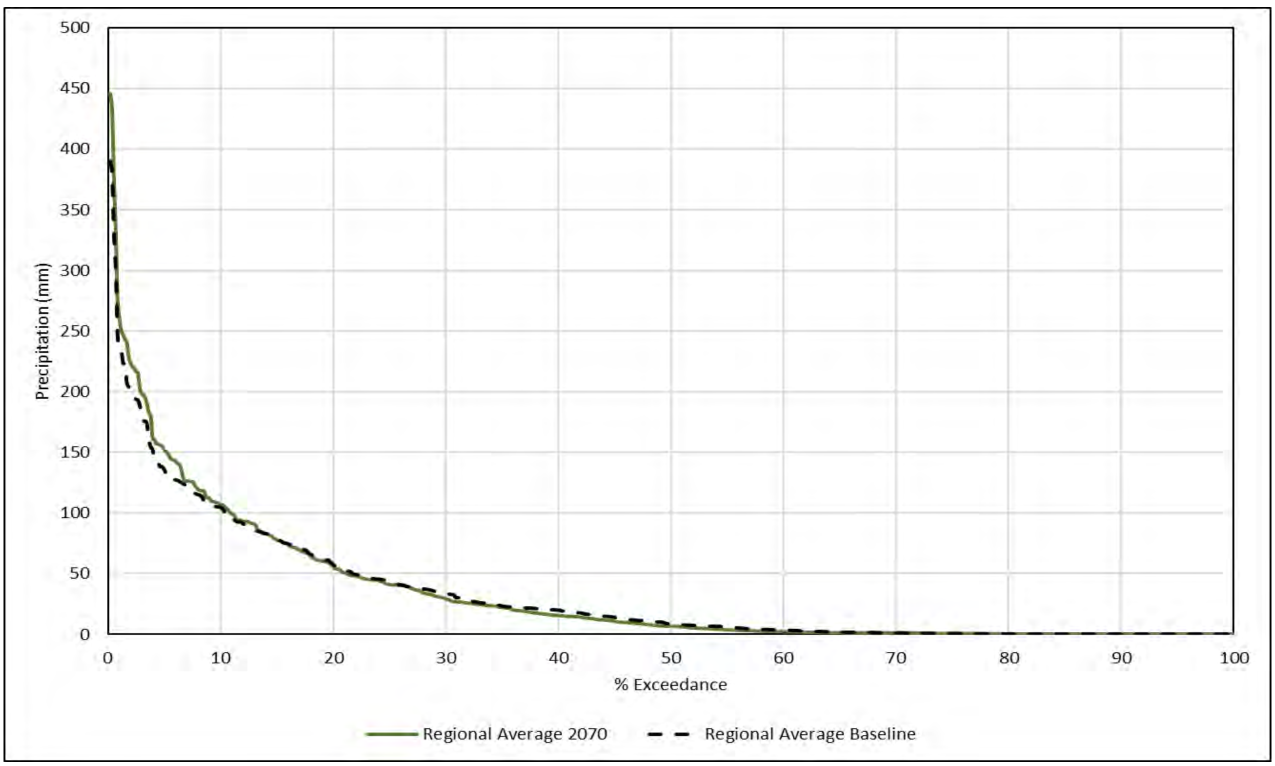

Figure C-2-3. Exceedance of Precipitation Perturbation Factors as Compared to Baseline Values

Figure C-2-4 shows the difference between the regional average under 2070 climate change conditions and the regional average under historical baseline conditions plotted against different amounts of projected monthly precipitation.

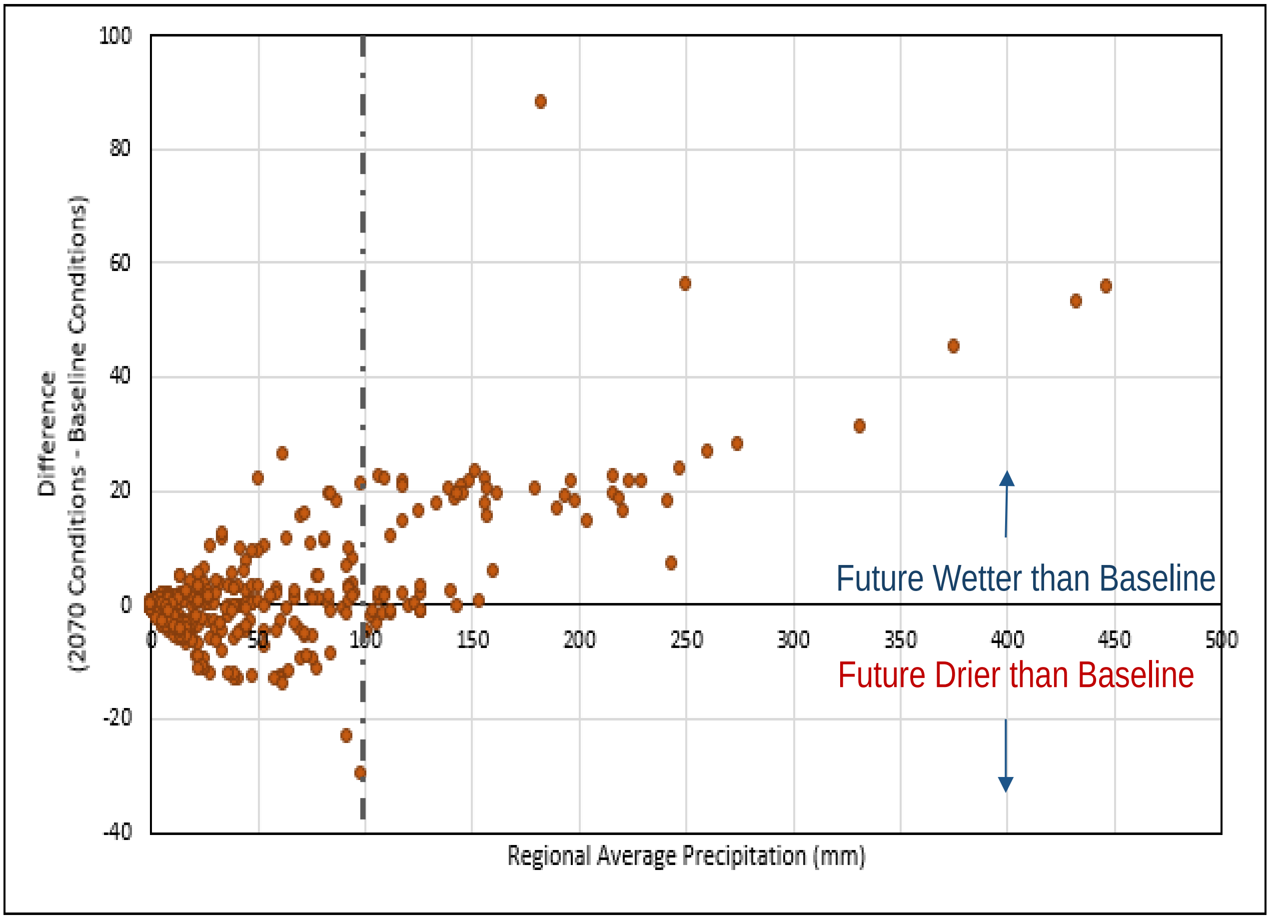

Figure C-2-4. Difference in Monthly Precipitation Estimates as Compared to Baseline Values

This plot demonstrates that in 2070 with climate change added, in low precipitation months, there is approximately equal probability that the month will be wetter or drier than historical conditions. However, under climate change, the 2070 conditions will be always wetter on average in months with precipitation above approximately 100mm. Therefore, under climate change conditions, the occurrence of low precipitation months will likely not change, but the higher precipitation months will be wetter overall than the baseline.

It is important to note that, while the central tendency scenario shows limited changes in future precipitation compared to historical record, the drier and wetter scenarios do show more variability. Figure C-2-5 shows the exceedance curve for the wet scenario and it shows a larger difference to baseline compared to the central tendency. The use of other scenarios can be explored in future GSP updates.

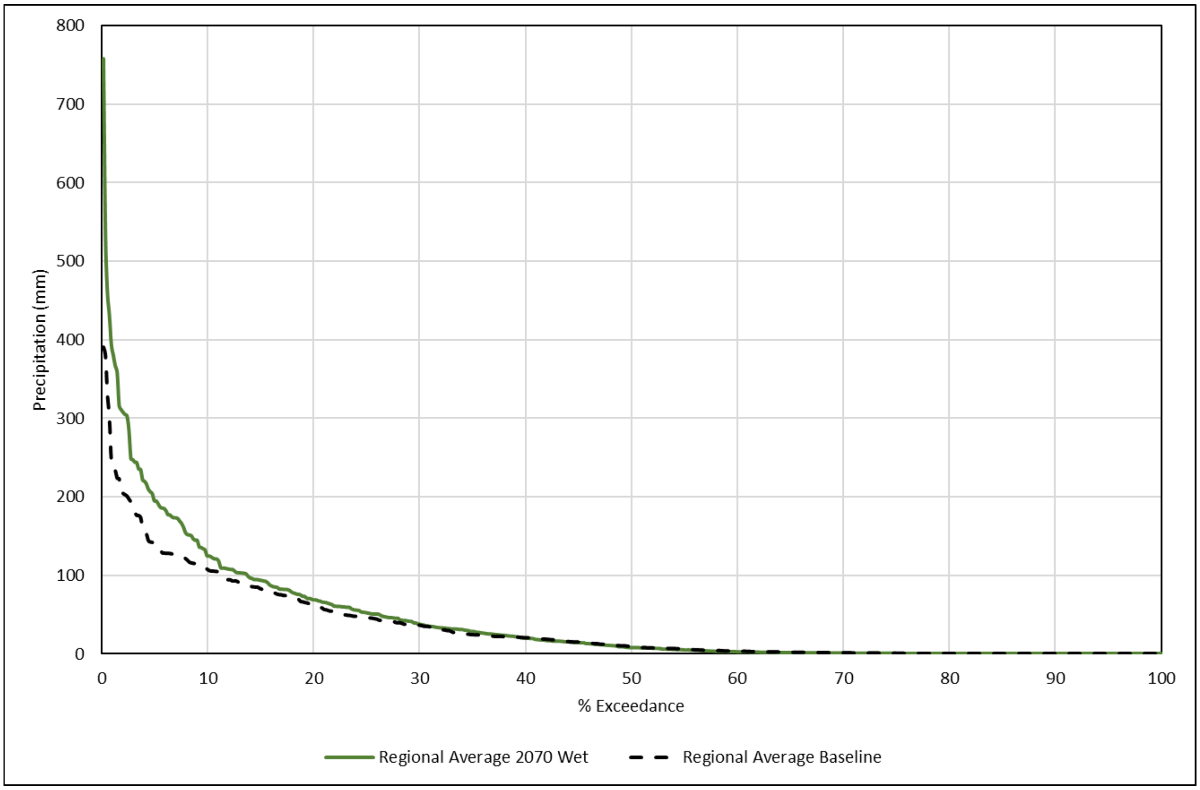

Figure C-2- 5. Exceedance of Wet Scemario Precipitation Estimates as Compared to Baseline Values

Perturbed Evapotranspiration under Climate Change

Reference evapotranspiration (ET) is differentiated only by crop in the Cuyama model. However, because there is no spatial component to ET, the same crop in a different part of the basin is modeled with the same ET. Change factors for ET are available in the same spatially distributed manner as precipitation, as described above. However, to match the level of discretization with the Cuyama model, an average ET change factor was calculated across all VIC grid cells within the Cuyama Subbasin boundary. Therefore, the tool to process ET provided by DWR was not needed or used. Change factors provided by DWR for water year 1964 through December 1, 2011 were averaged. This average ET change factor was then applied to the baseline ET time series for each crop type. Because the same ET change factor was applied over the entire baseline time series, no synthesis was required in this analysis.

- For 2030, average change factor is: **1.03**
- For 2070, average change factor is: **1.07**

To better show the impact of climate change, a sample of years (1994 and 1995) for one crop (melons) is included in Figure C-2-6. Figure C-2-7 shows the exceedance curve for these estimates.

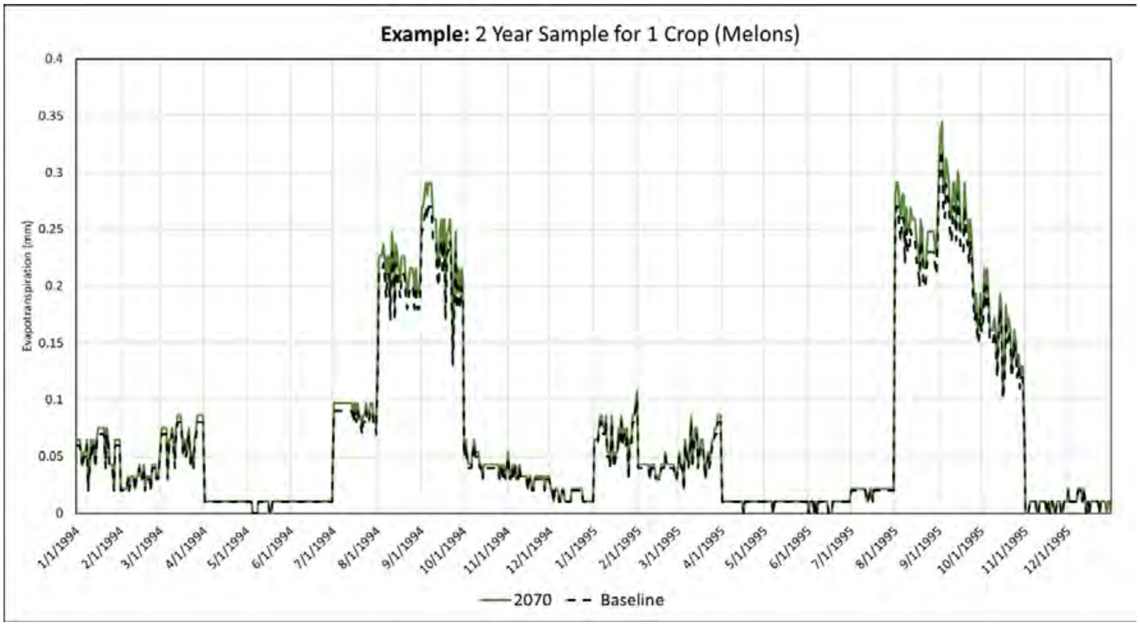

Figure C-2-6. Changes in Melon Evapotranspiration in 1994 and 1995 as Compared to Baseline Values

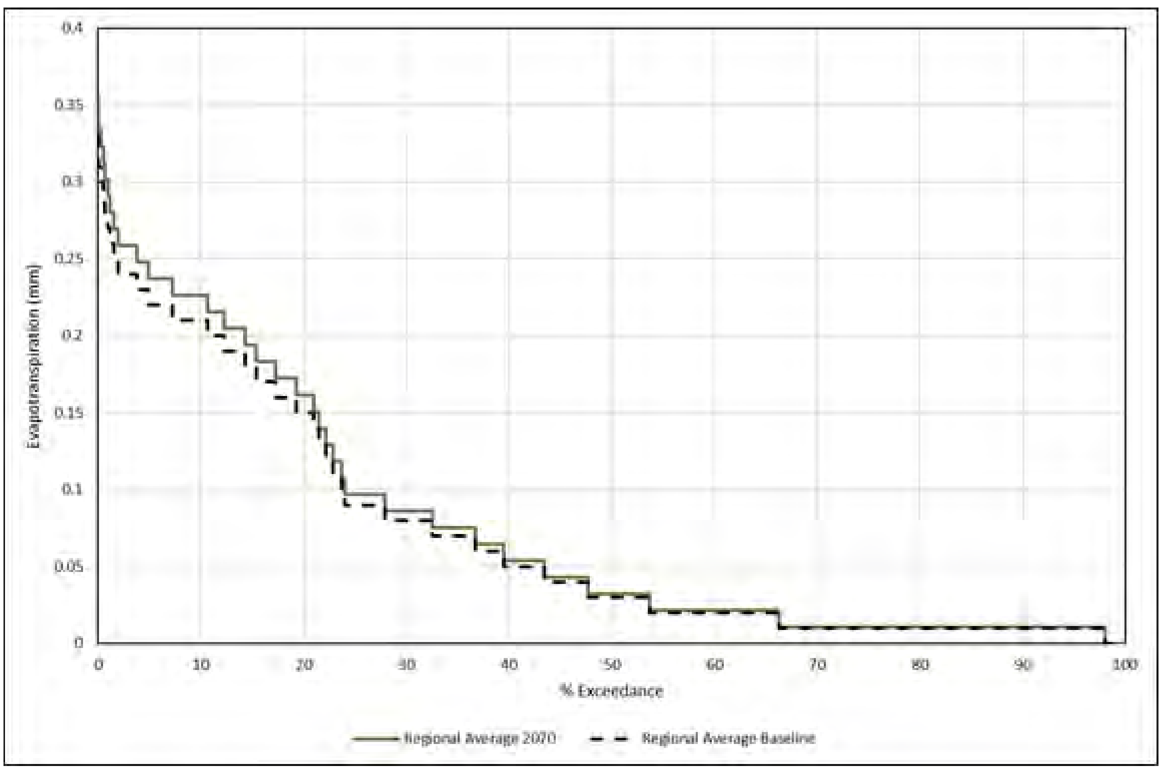

Figure C-2-7. Exceedance of Melon Evapotranspiration in 1994 and 1995 as Compared to Baseline Values

Considerations for this Analysis

By using DWR's climate change datasets, this GSP has chosen to use a climate period analysis. A "period of analysis" method is what DWR proposes since it provides an intuitive way to compare the past and future conditions, preserving historical temporal trends. Under a period of analysis (sometimes referred to as the "delta method") precipitation and Crop ET patterns from the past are mirrored into the future and shifted either higher or lower in magnitude (DWR, 2018). When using a period of analysis method, any difference between the baseline historical conditions and the projected conditions can be attributed only to climate change.

Using a climate period analysis in contrast to a transient analysis, however, brings also some disadvantages. While a significant advantage of this method is that the climate change signal can be isolated from signals of other impacts, temporal changes in the water resources system are ignored in favor of adopting the temporal trends of the past. In a continuously changing and variable climate in California, this approach incurs significant disadvantages. Inter-annual variability in the climate period analysis follows the exact patterns of the historical period it references. Shifting seasonality of precipitation, peak snowmelt, and temperature, are important climate impacts expected through the GSP planning horizon that are not captured in the projected water budget (Langridge, Sepaniak, Fencl, & Mendez, 2018) (PPIC, 2019). Longer drought period than have been recorded historically are also expected according to many climate experts (PPIC, 2019). These changes are also not captured.

Opportunities for Future Refinement

The regulations dictate that GSPs reflect the best available science to make climate change projections. For future GSP updates, climate change analysis incorporation should build off of this baseline work to continually improve projections into the future. Some refinements or modifications may include:

- Use other scenarios (dry and wet) in addition to the central tendency scenario
- Use a transient method as opposed to a period of record method
- Incorporate paleohydrology observations and make inferences about the impacts of longer droughts captured in the paleorecord

1.3 References

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Attachment C-3

Groundwater Level Hydrographs for Calibration Wells

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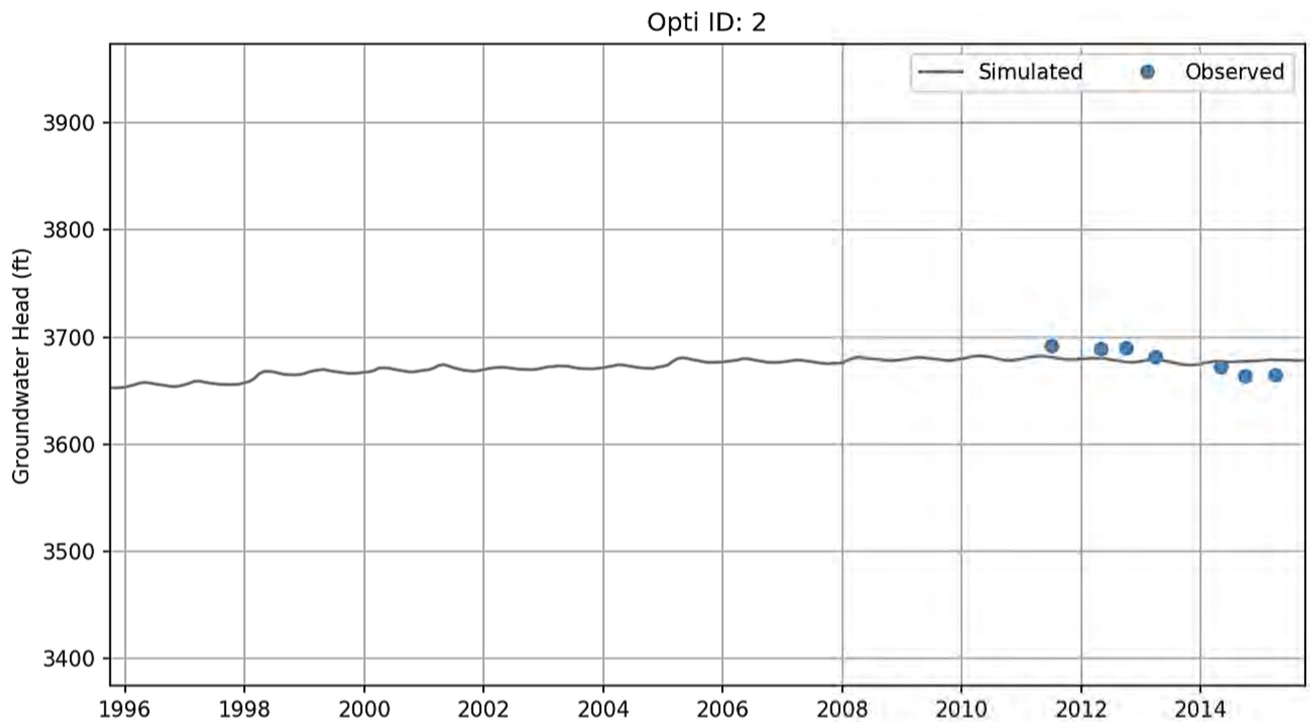
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2000
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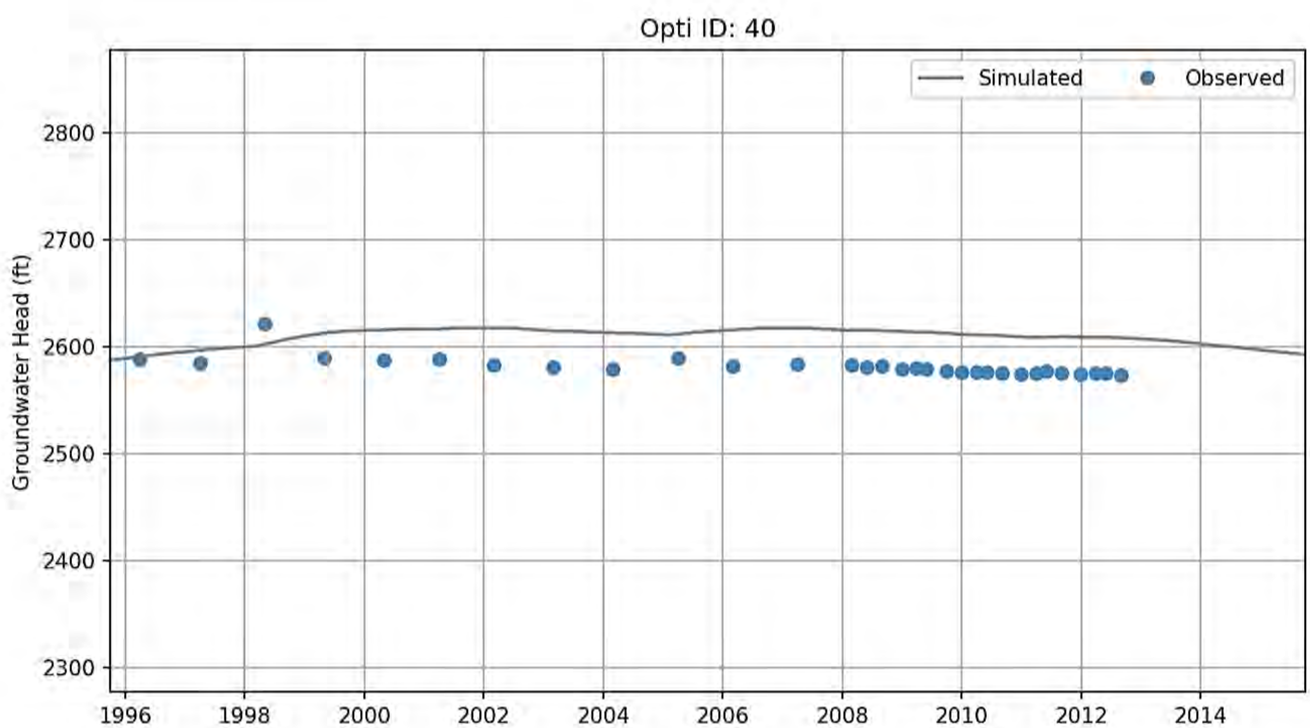
2006
2008
2010
2012
2014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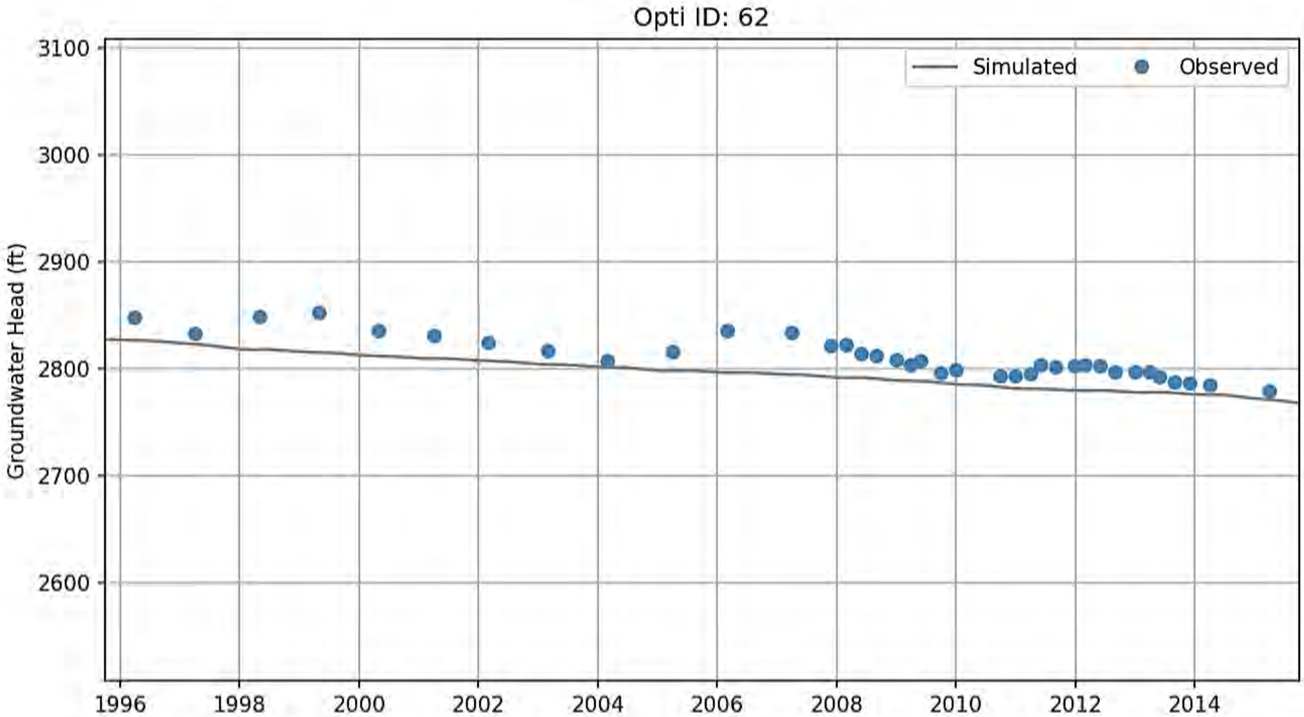
2012
2014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2006
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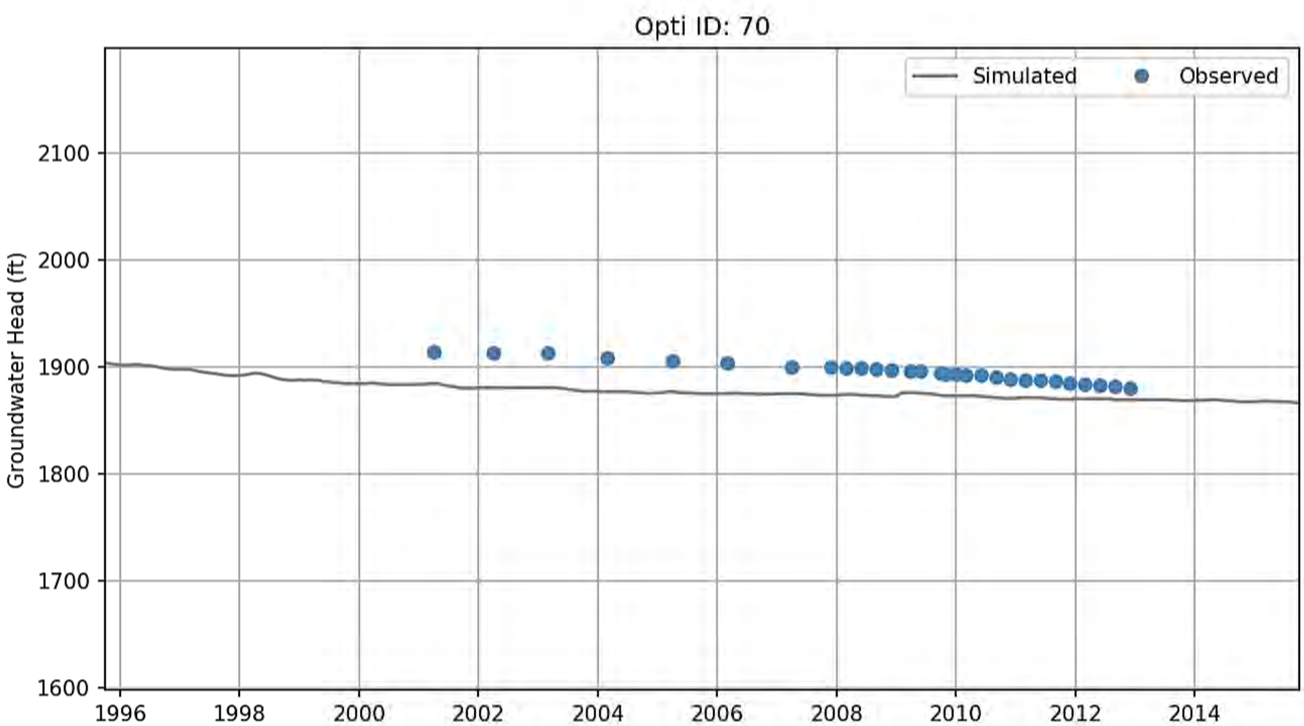
2012
2014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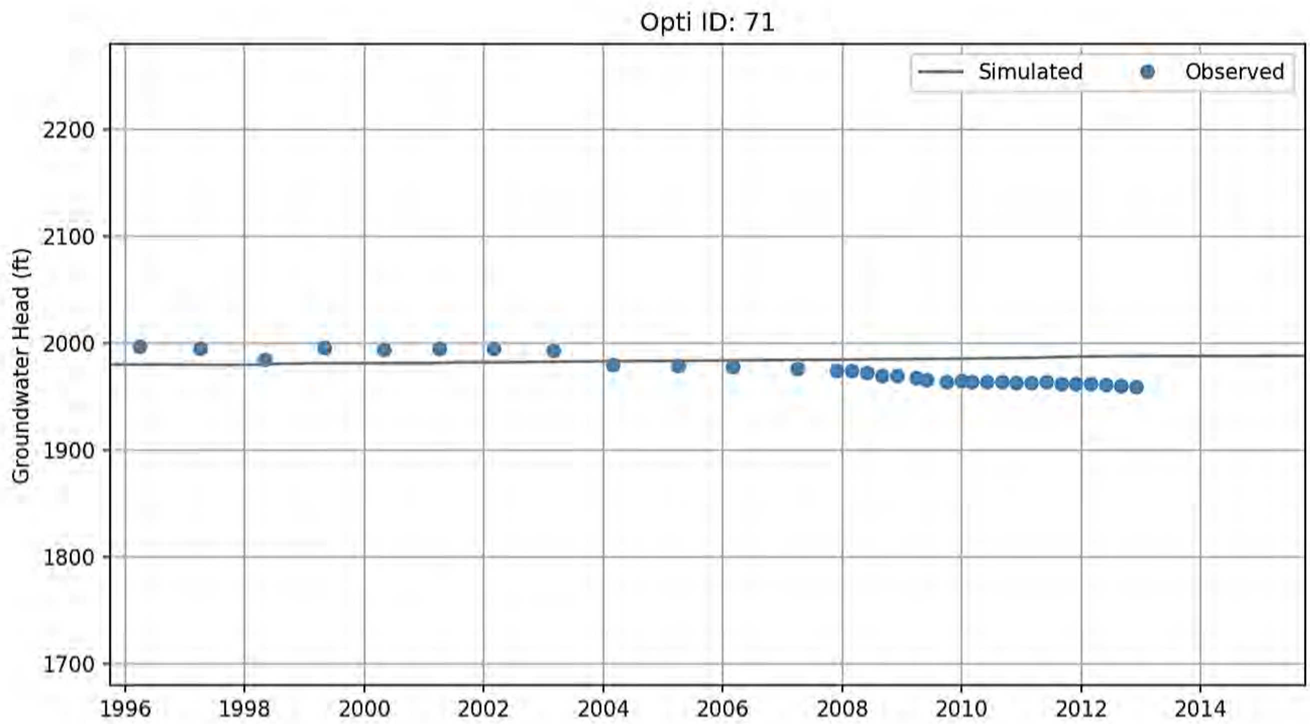
2014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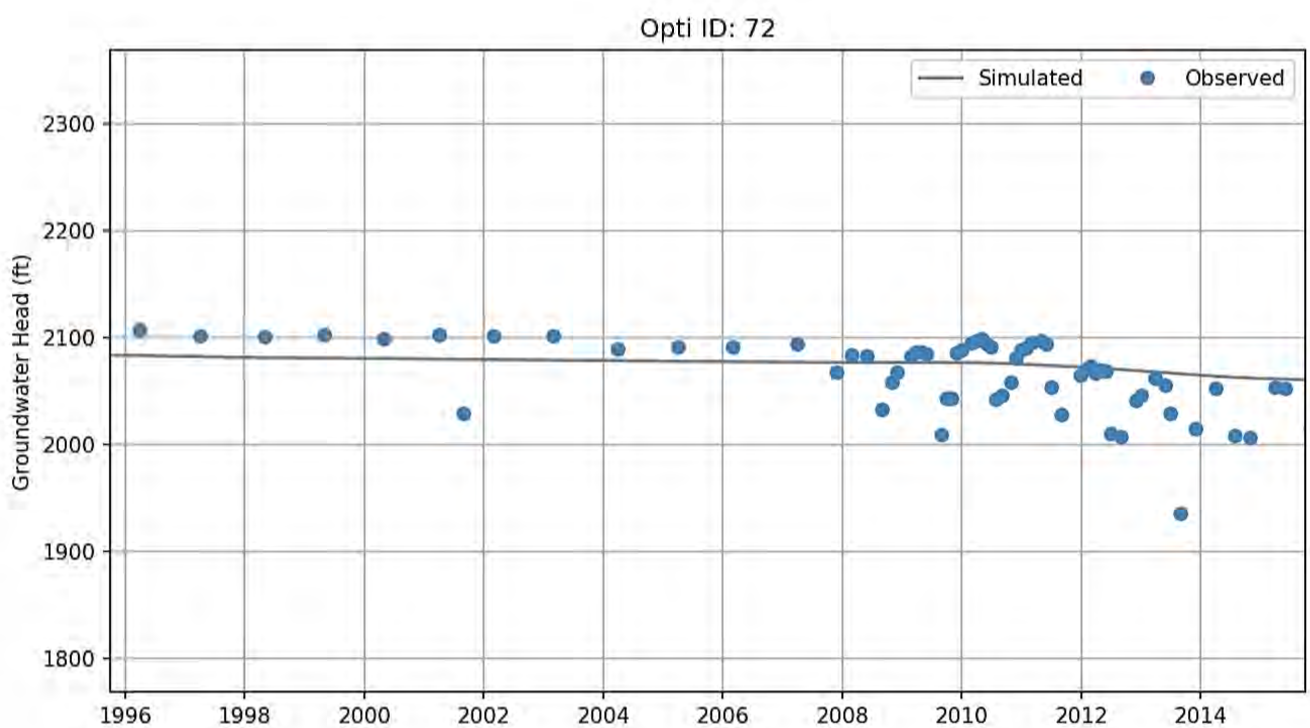
2012
2014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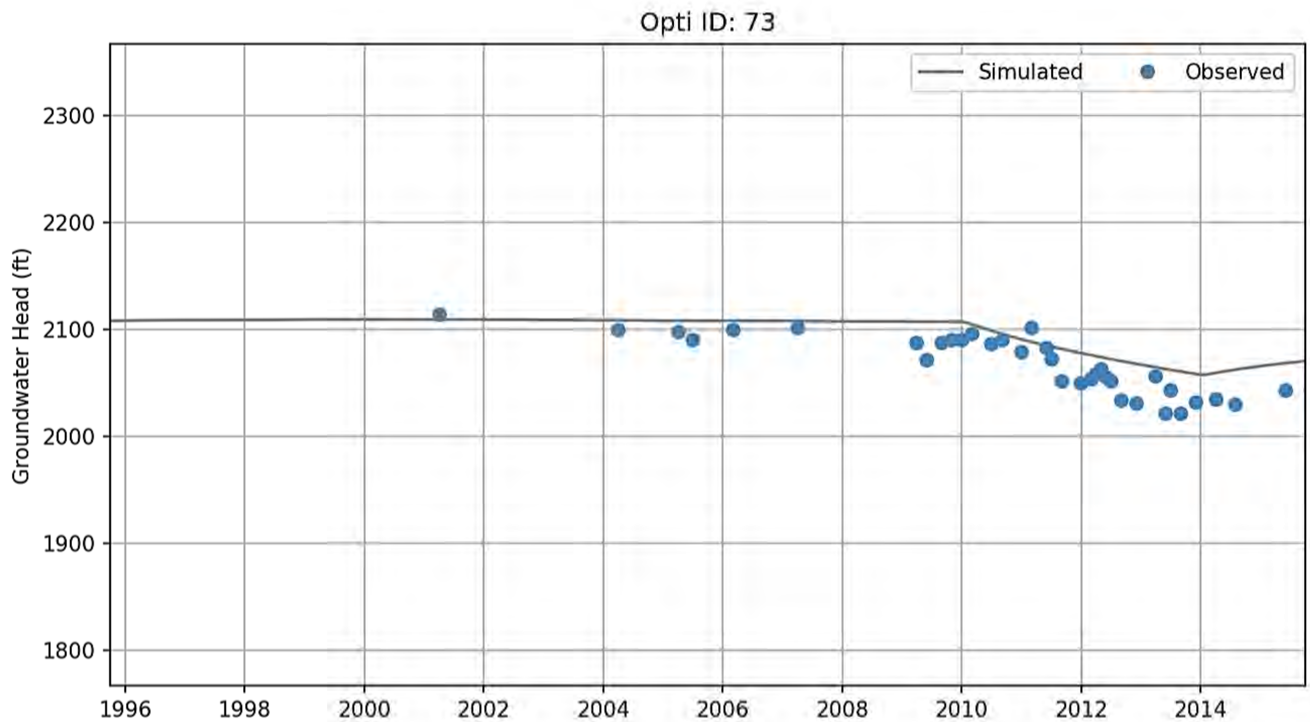
2012
2014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2008
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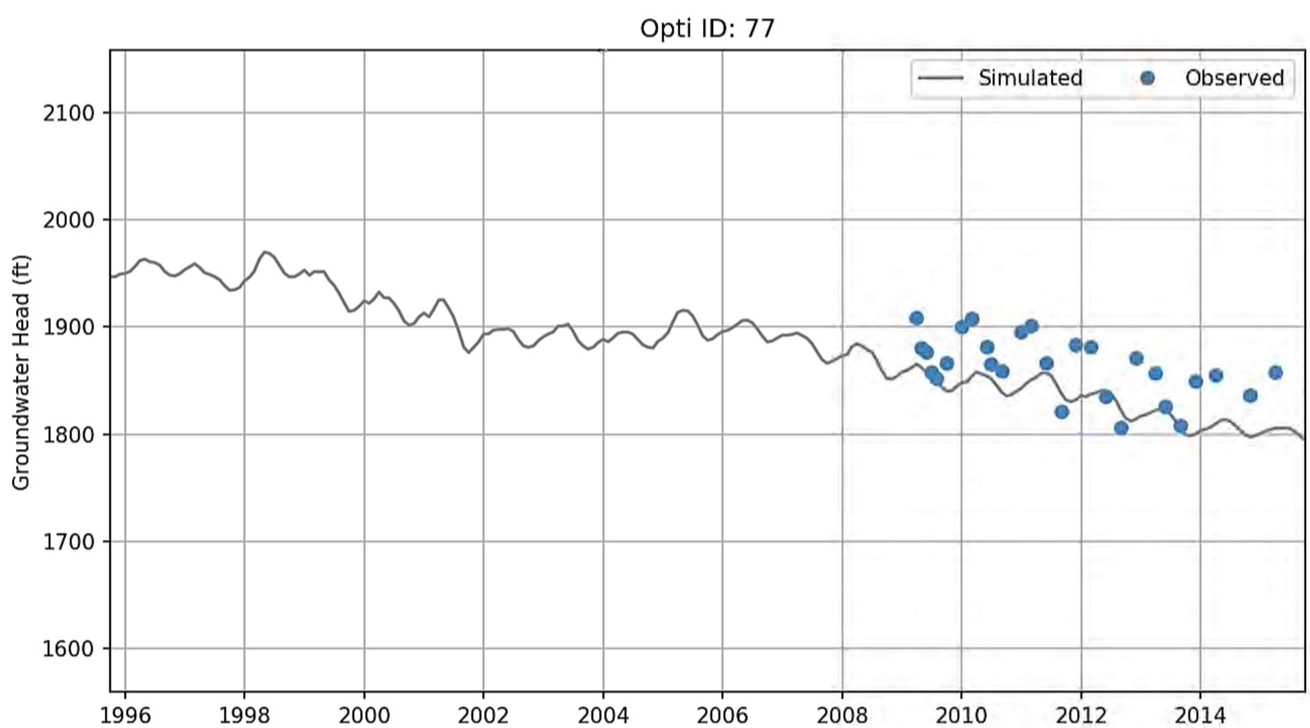
2012
2014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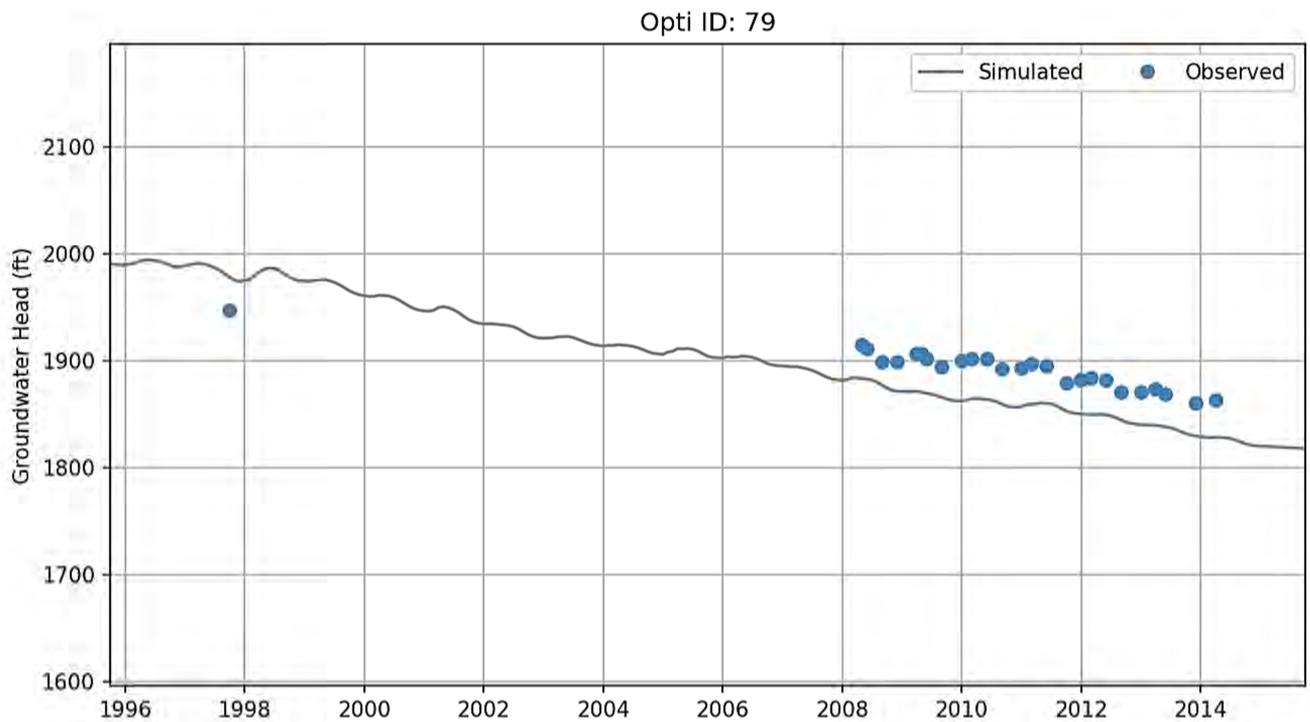

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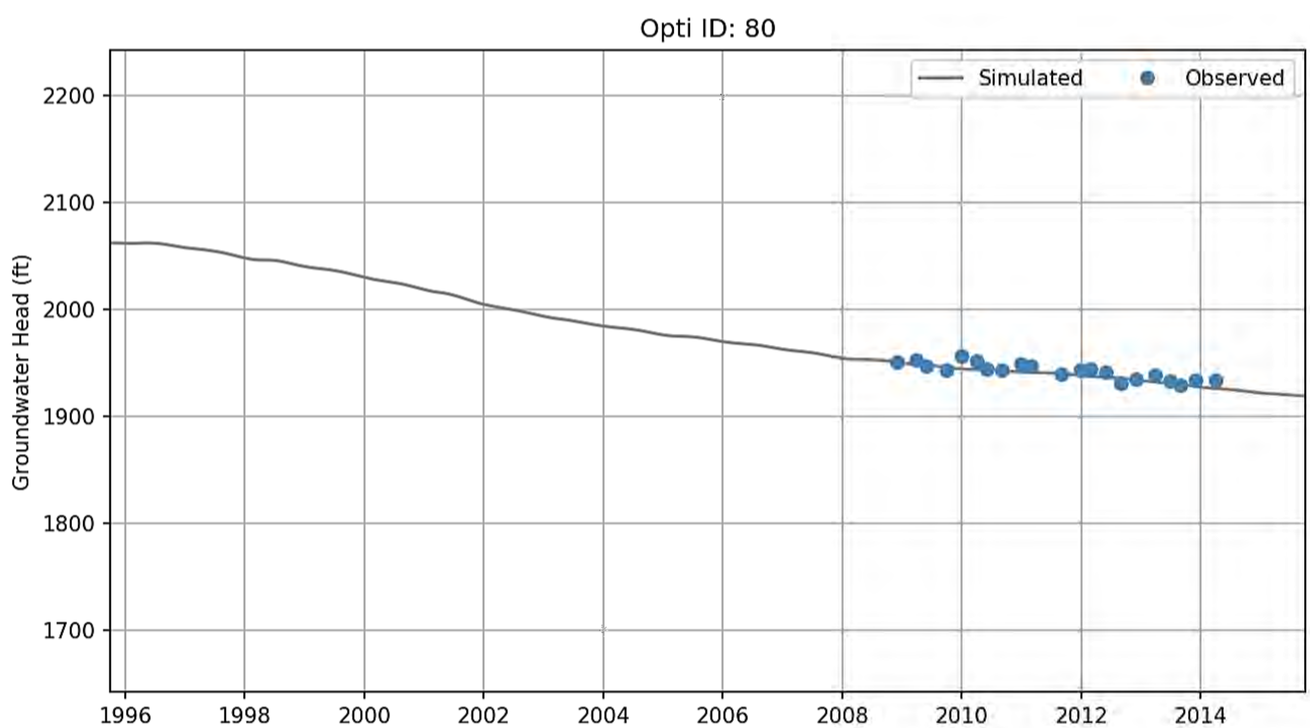
2014



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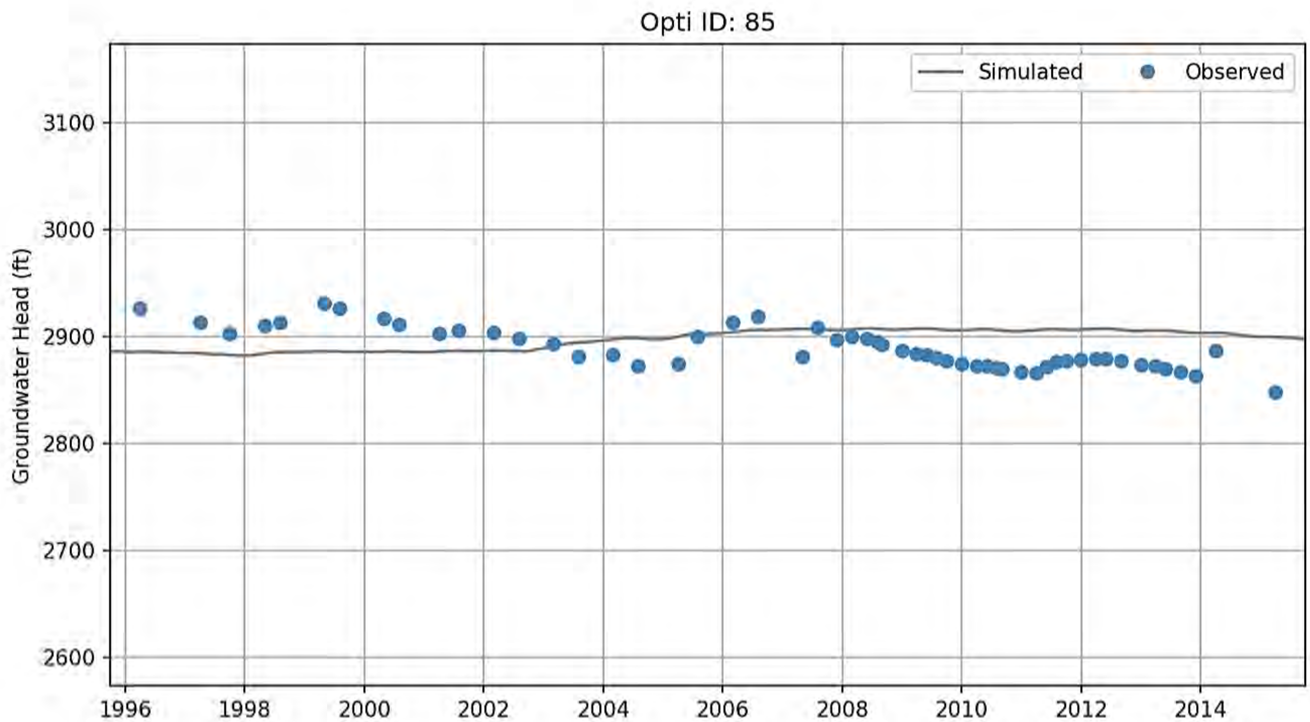
2012
2014



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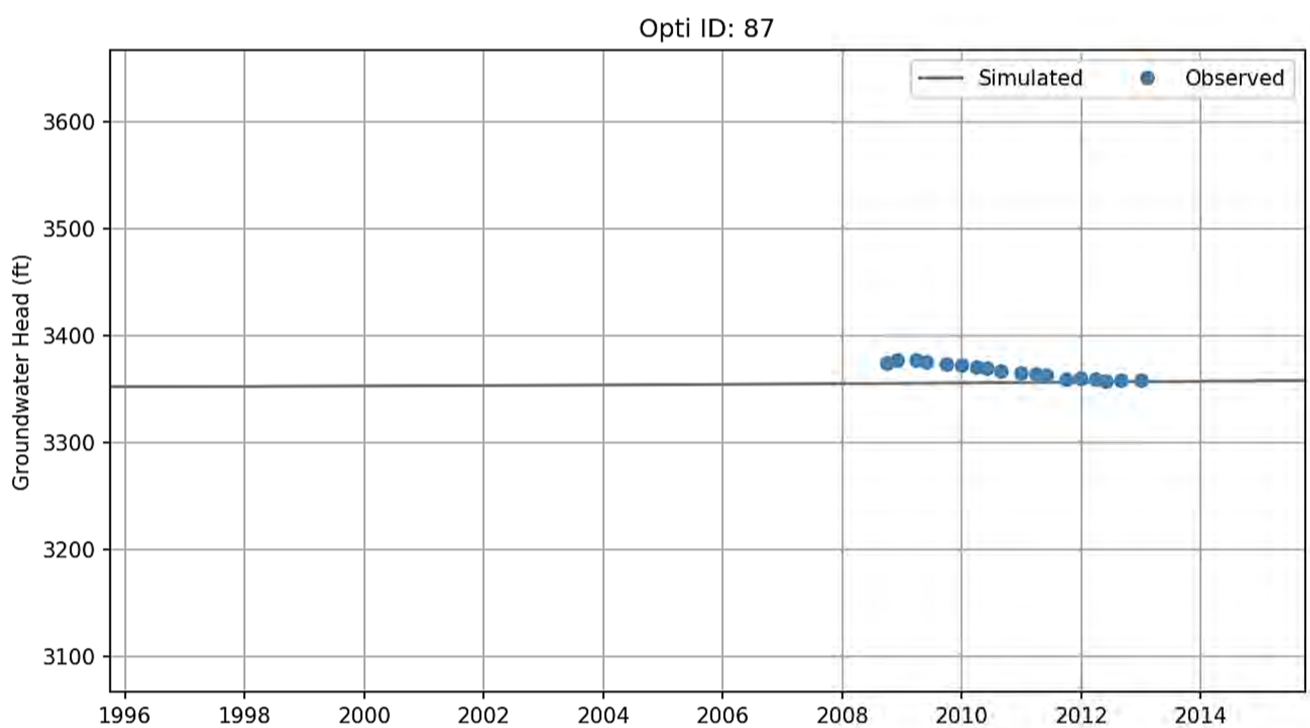

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3400
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1998
2000
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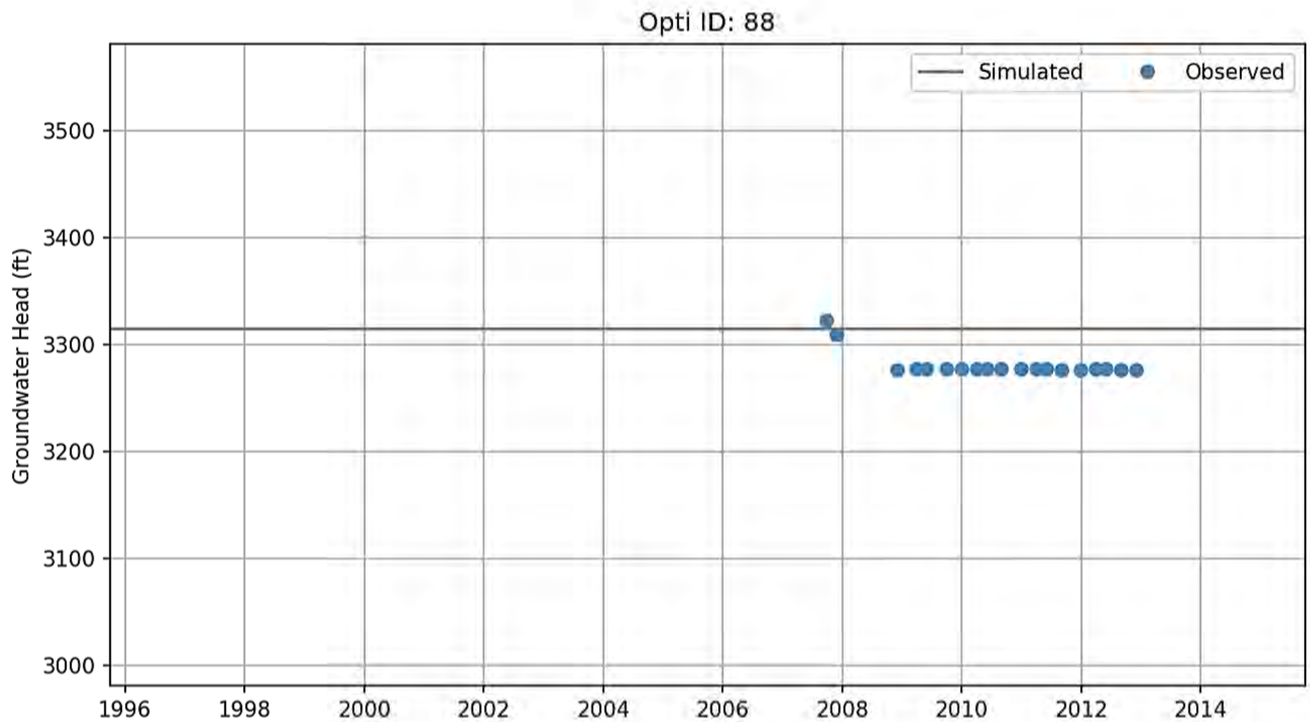
2006
2008
2010
2012
2014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Groundwater Head (ft)
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3400
3300
3200
3100
3000
1996
1998
2000
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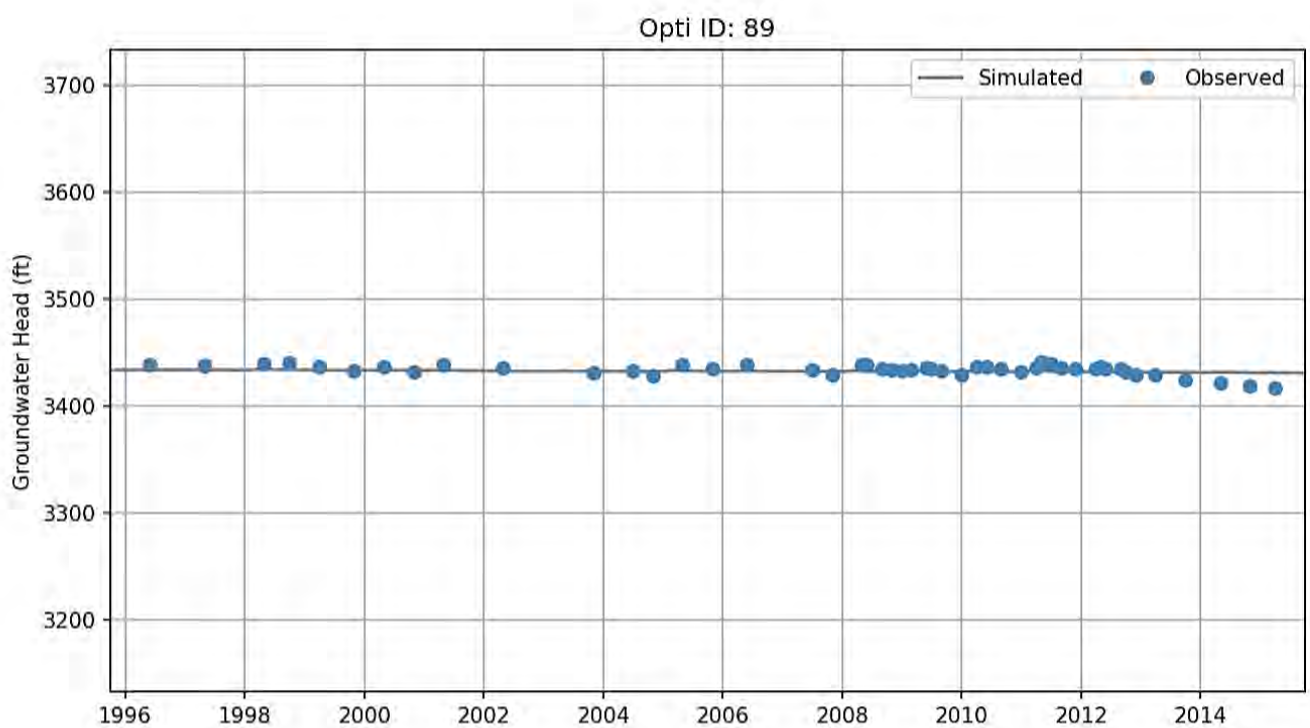
2006
2008
2010
2012
2014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Observed
Groundwater Head (ft)
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3600
3500
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3200
1996
1998
2000
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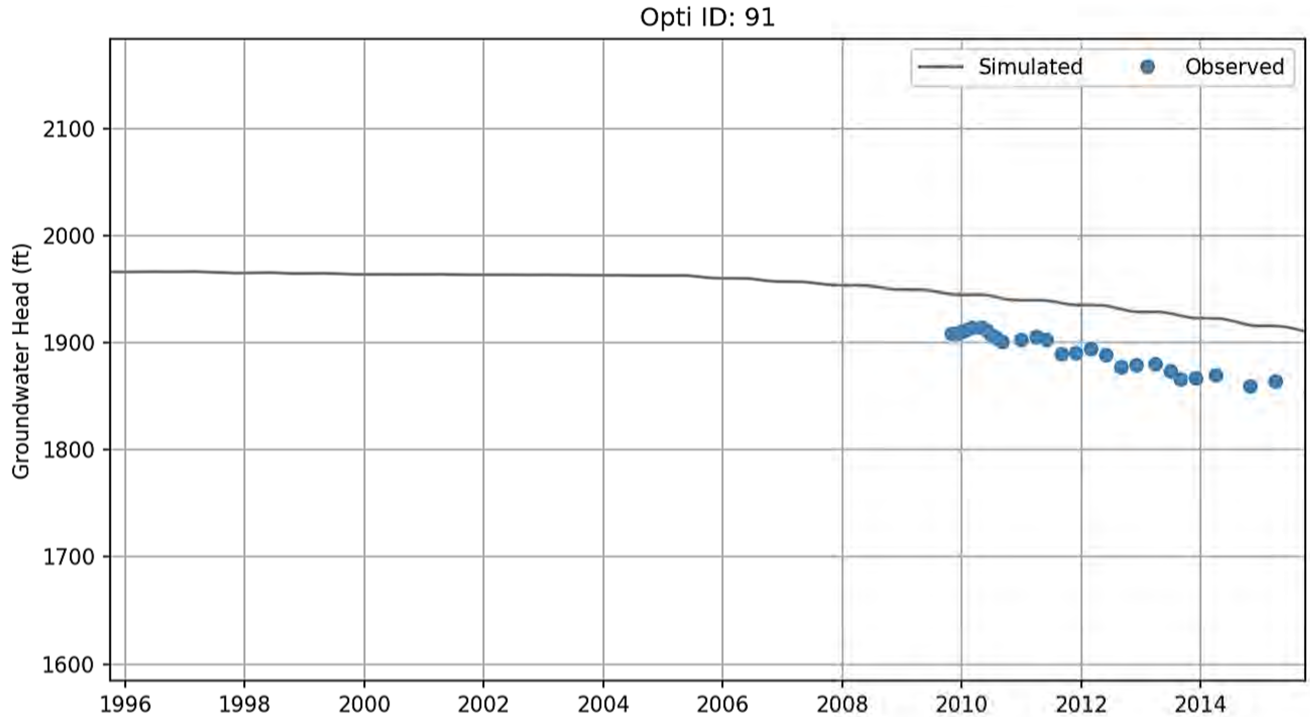
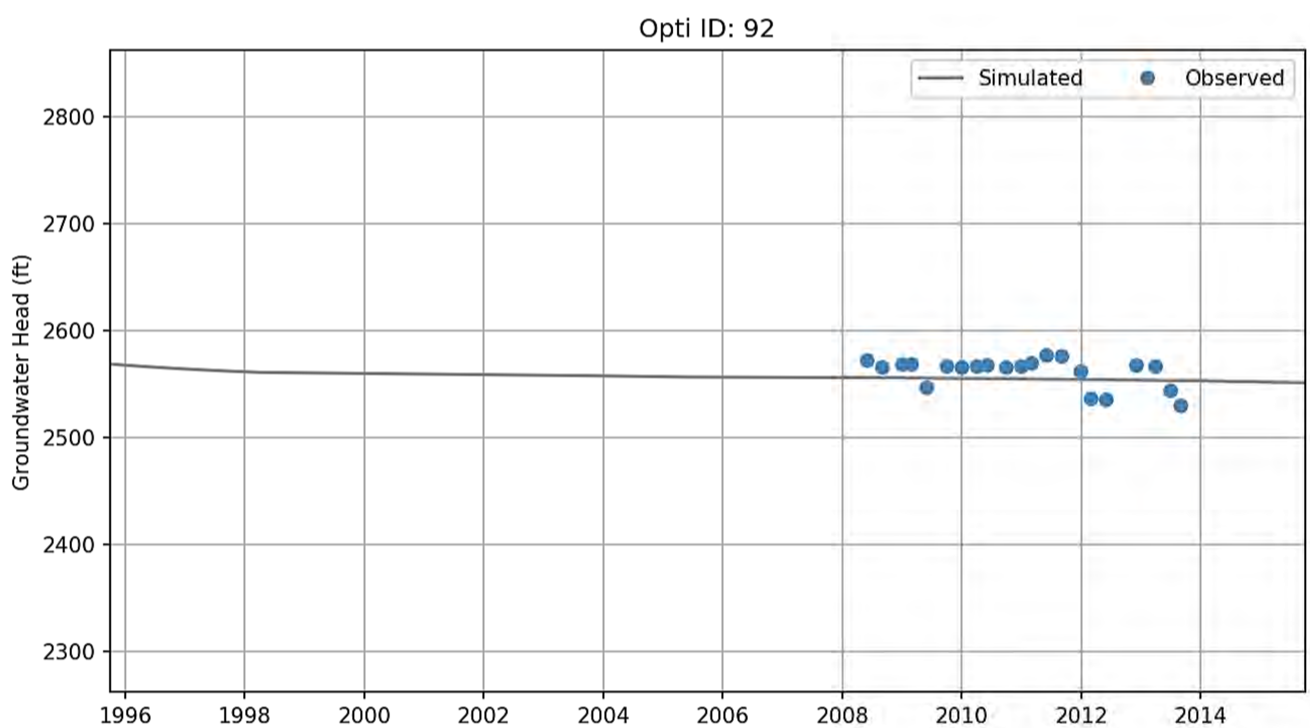
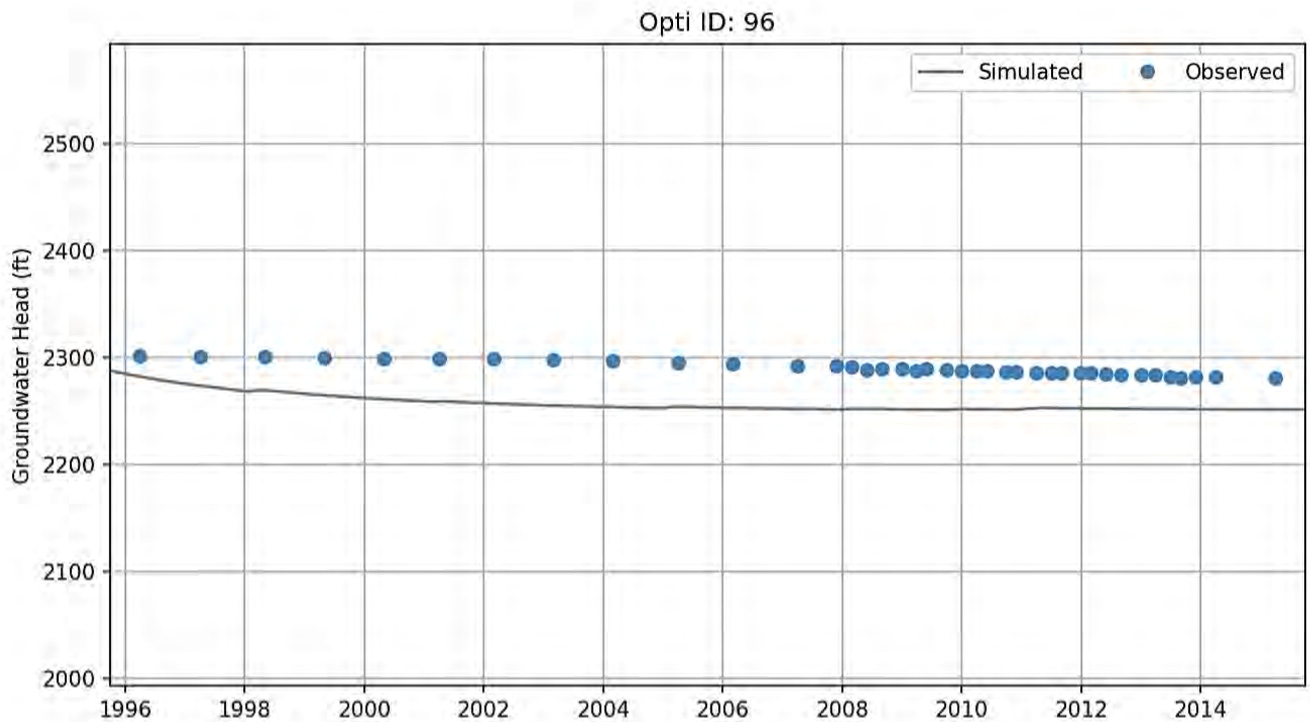
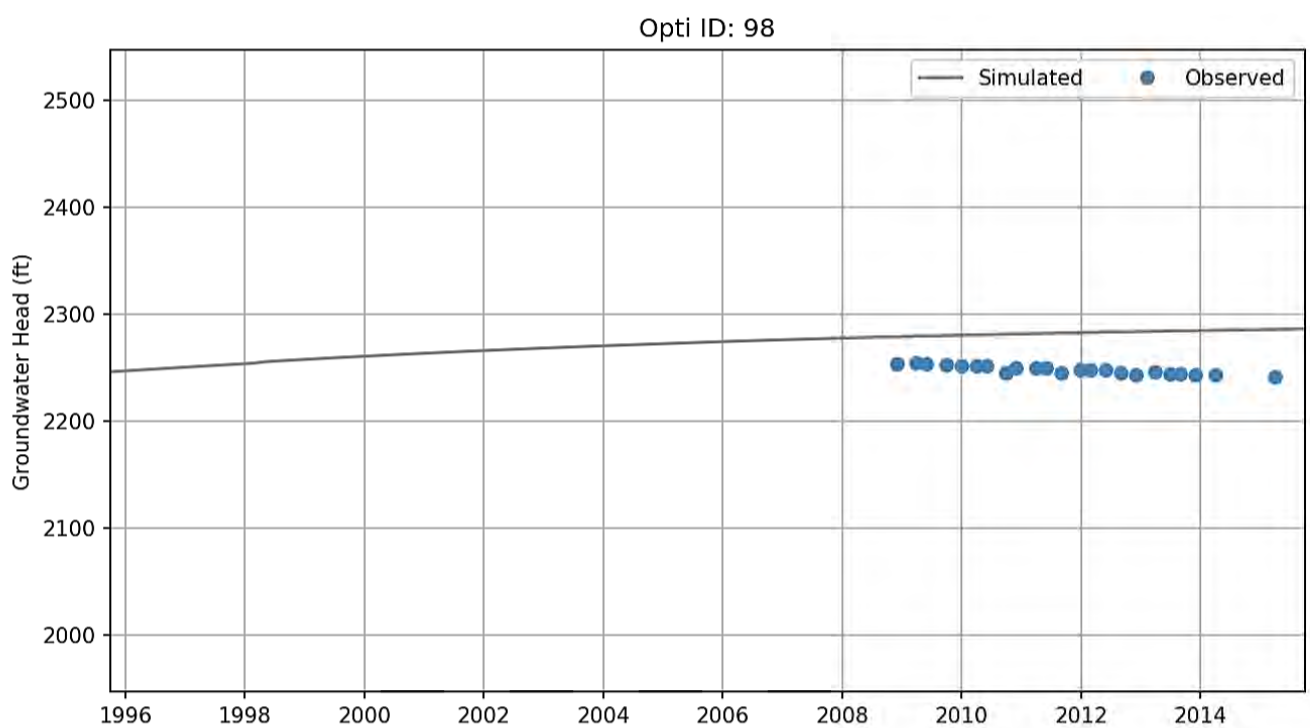
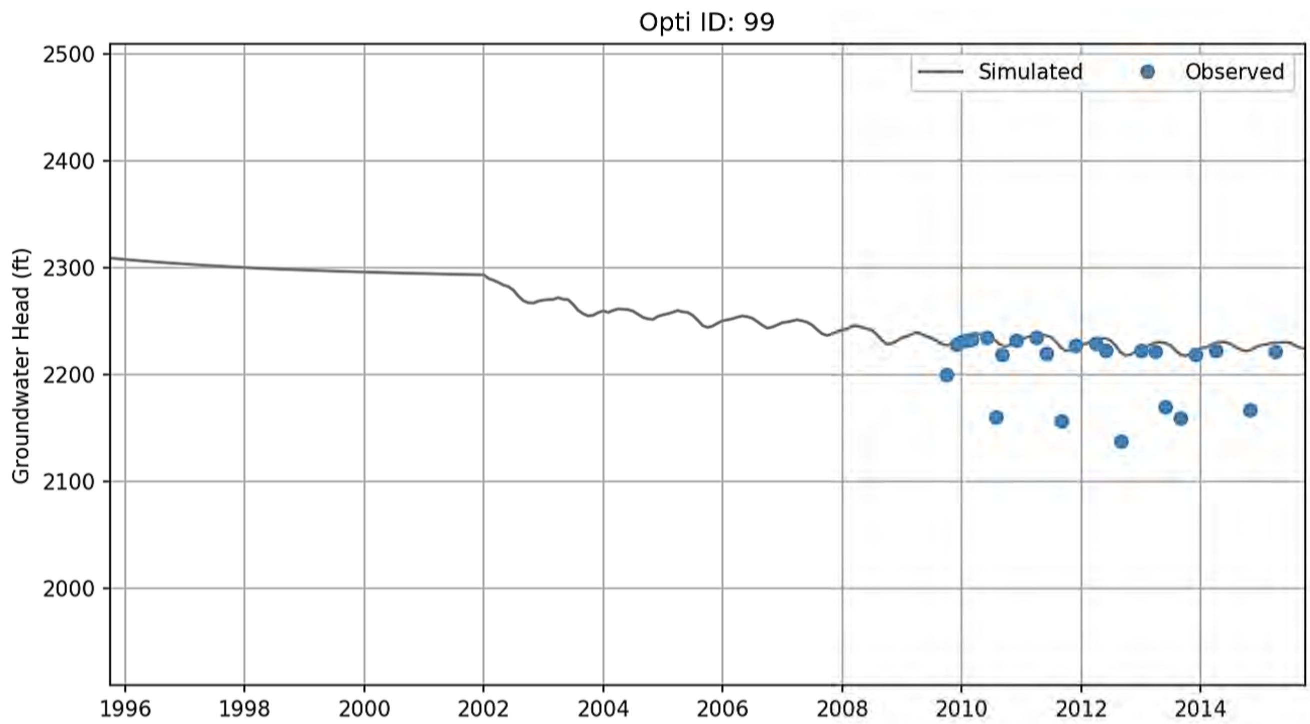
2004
2006
2008
2010
2012
2014

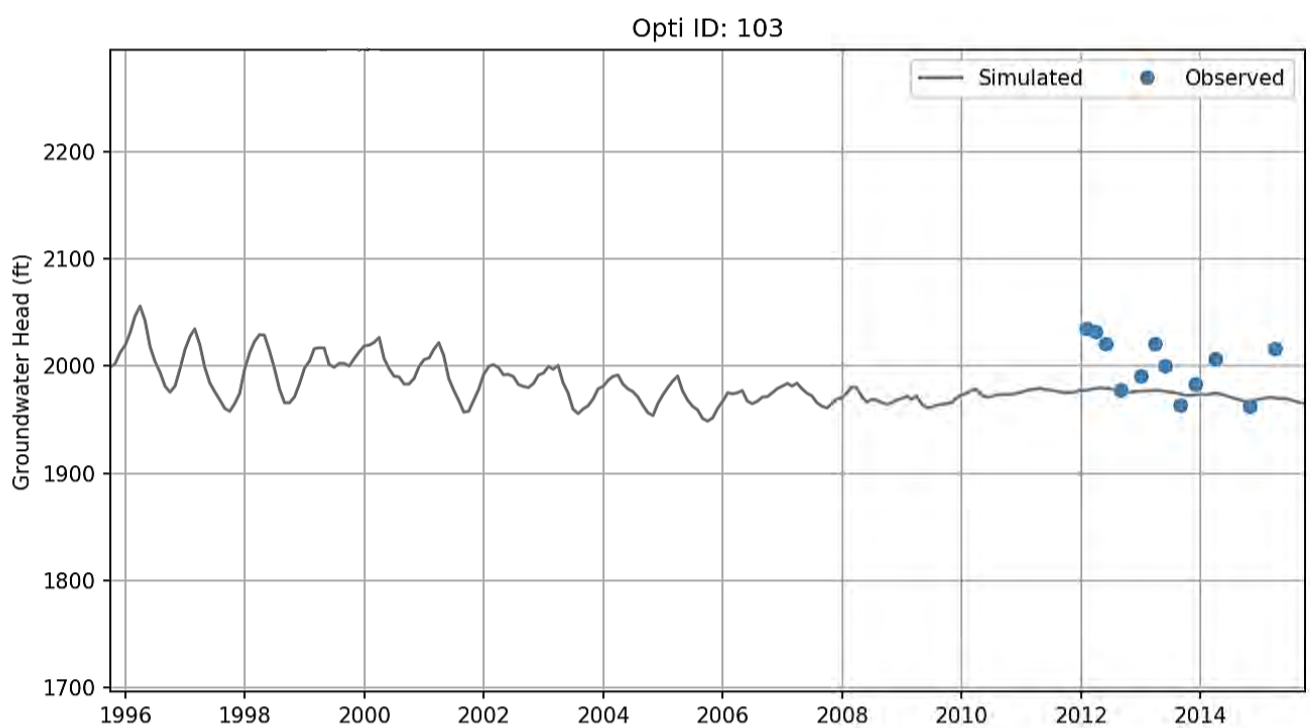

Opti ID: 91
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

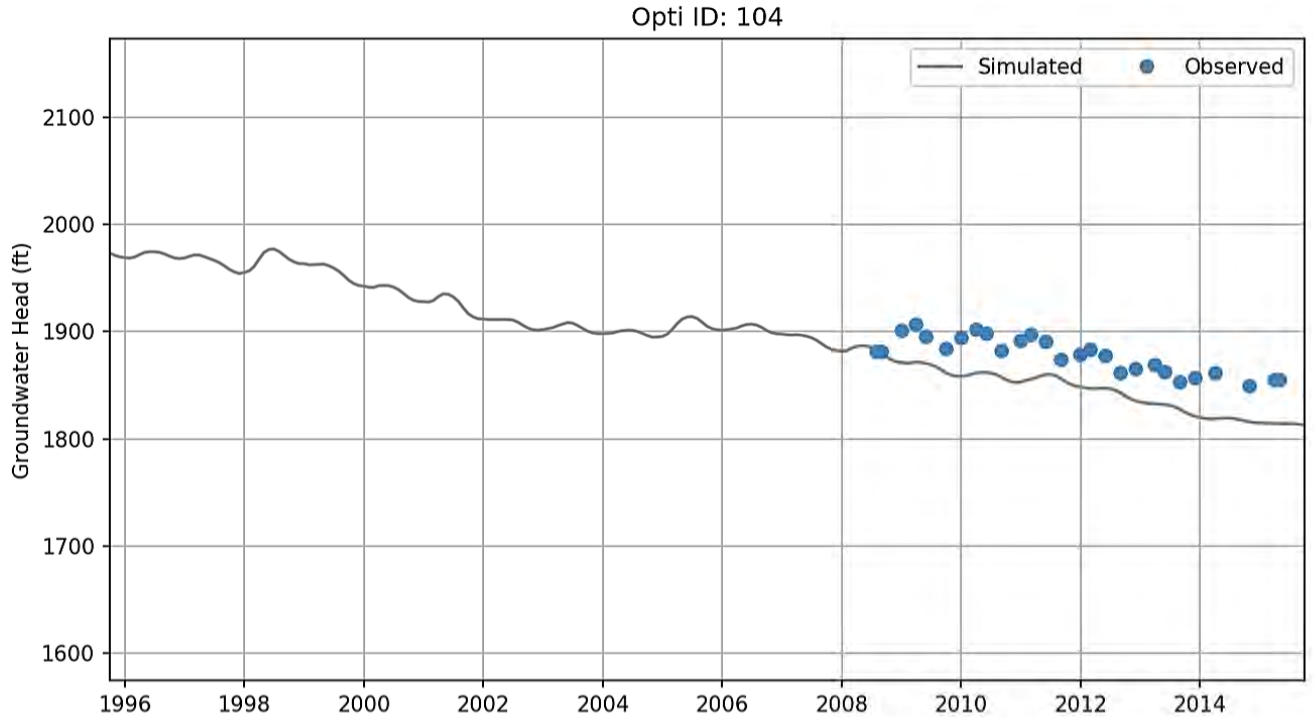

Opti ID: 92
Simulated
Observed
Groundwater Head (ft)
2800
2700
2600
2500
2400
2300
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

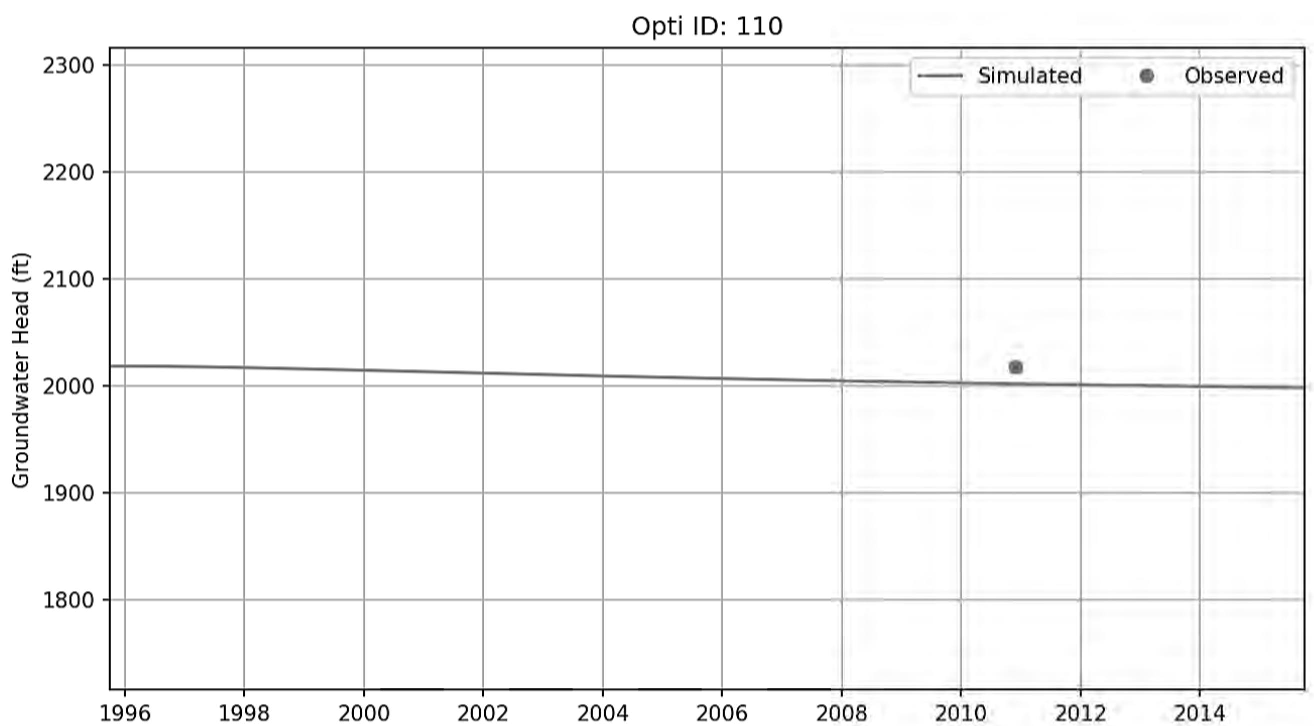

Opti ID: 96
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

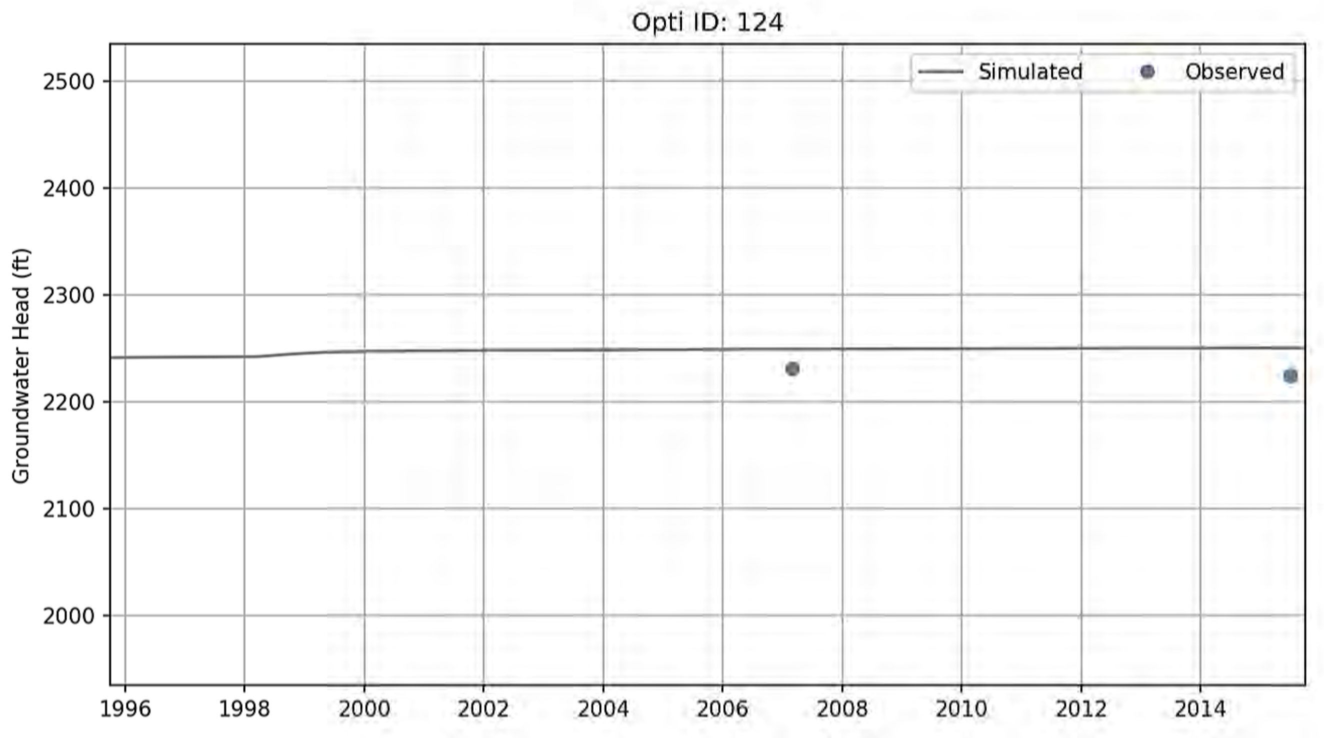

Opti ID: 98
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

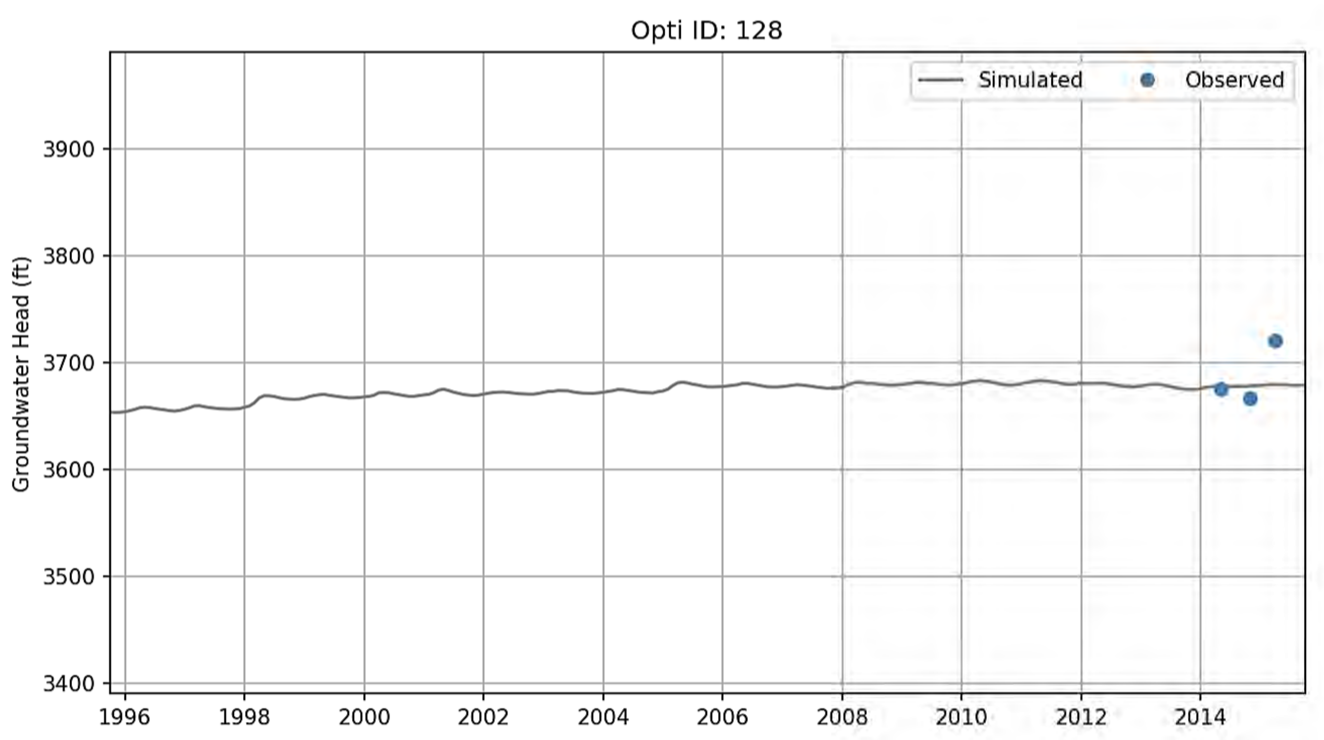

Opti ID: 99
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

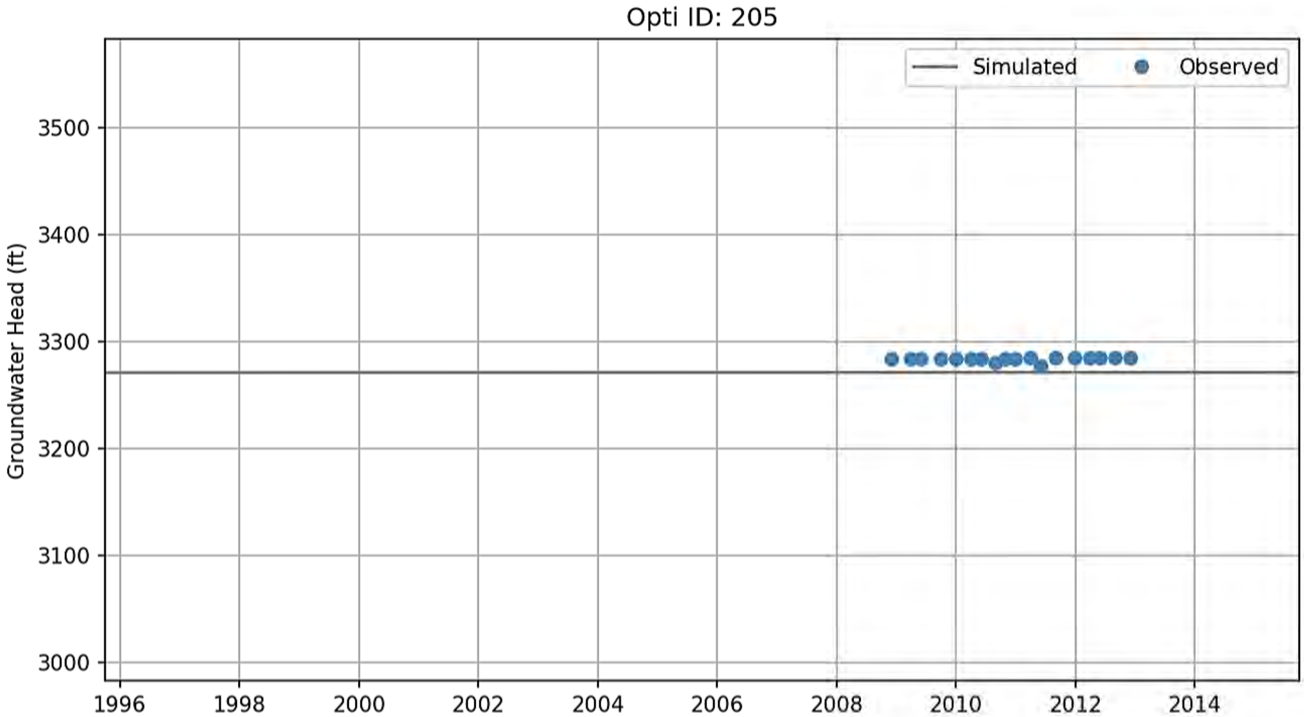

Opti ID: 103
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

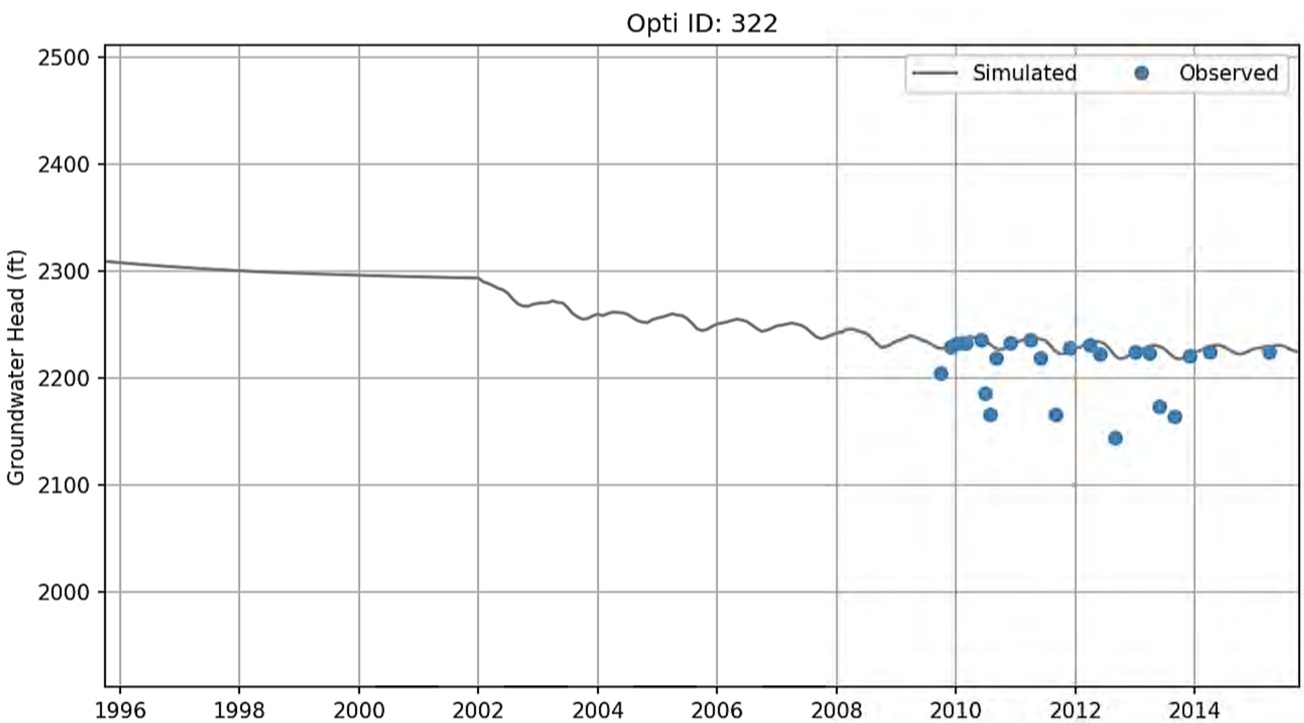

Opti ID: 104
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

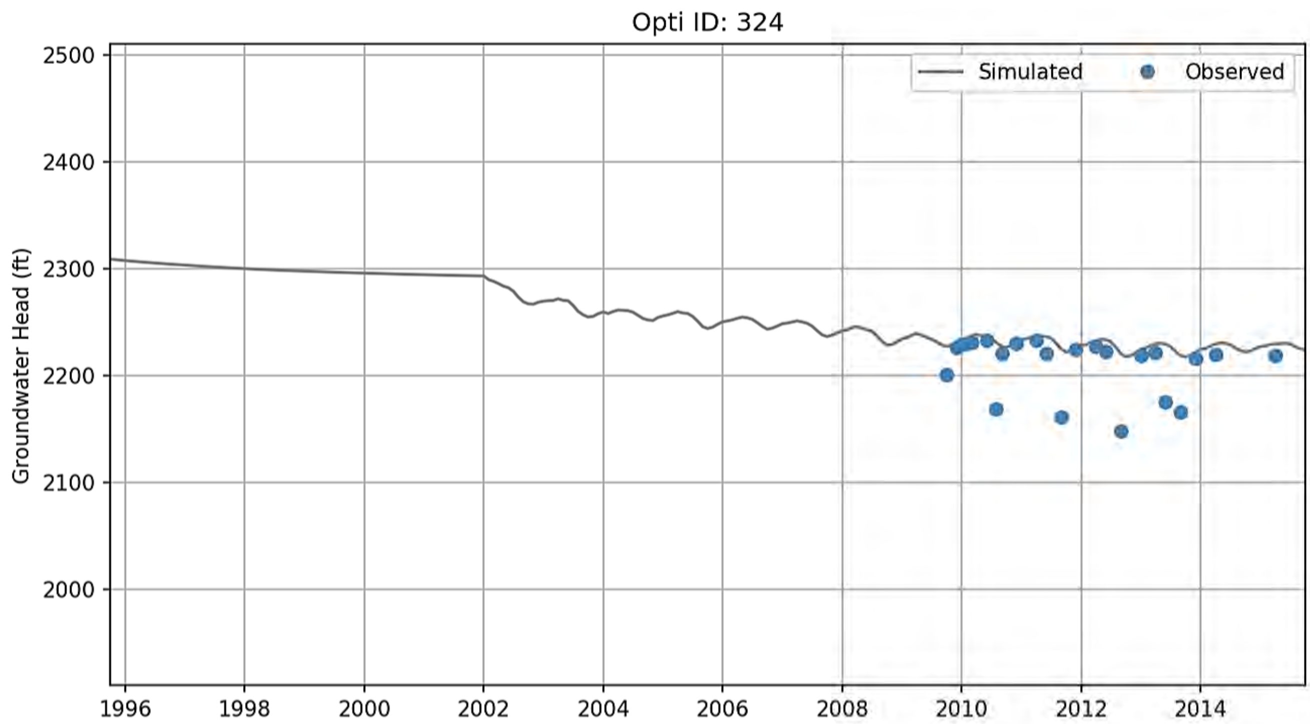

Opti ID: 110
Simulated
Observed
Groundwater Head (ft)
2300
2200
2100
2000
1900
1800
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

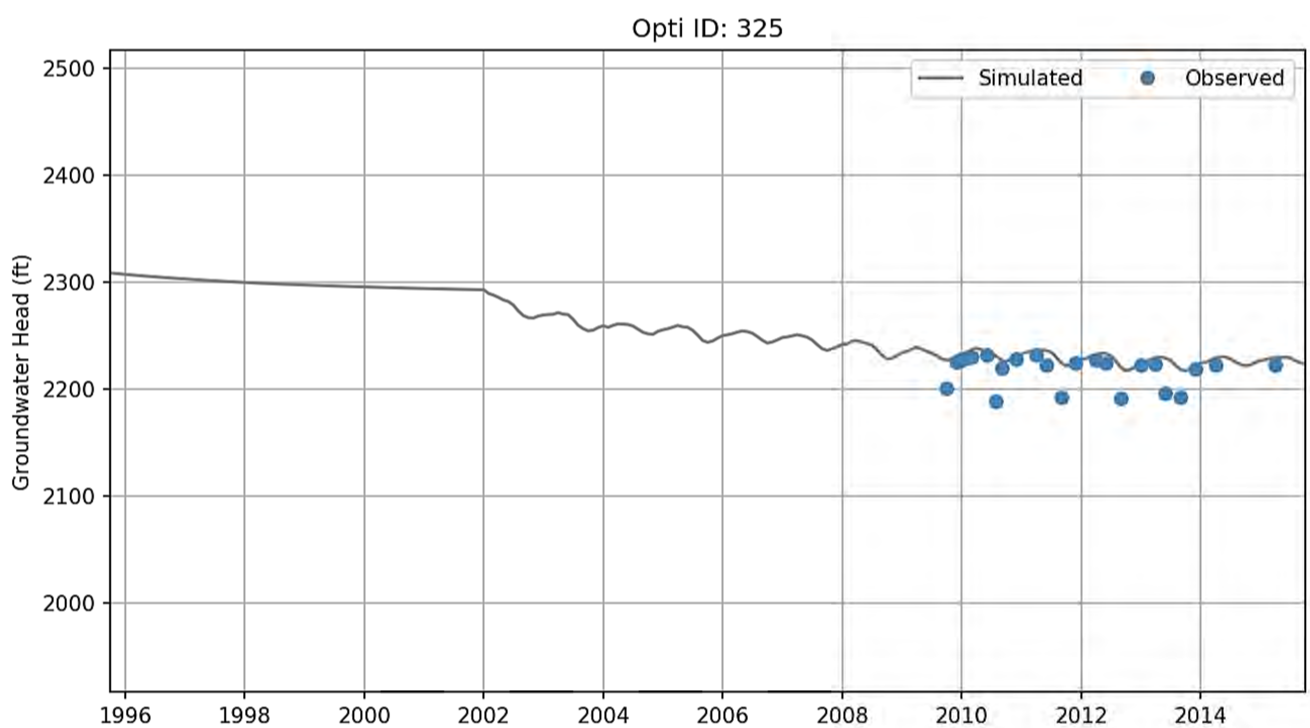

Opti ID: 124
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

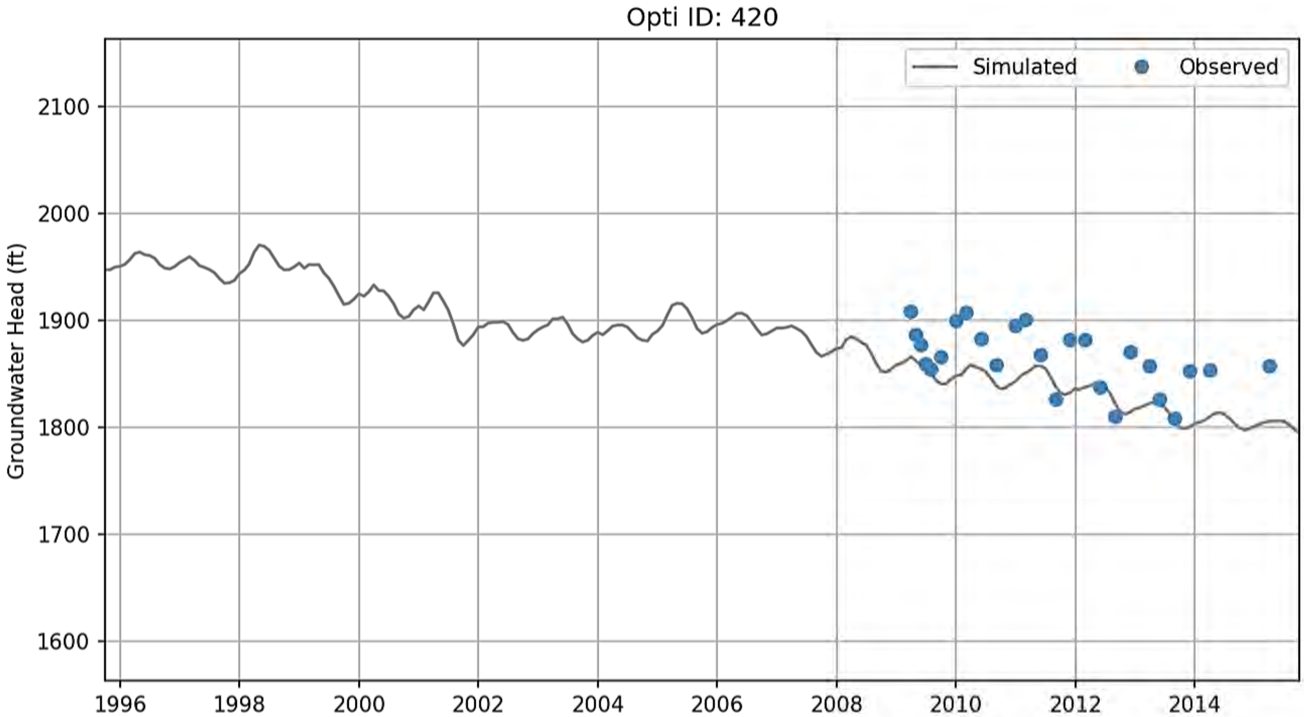

Opti ID: 128
Simulated
Observed
Groundwater Head (ft)
3900
3800
3700
3600
3500
3400
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 205
Simulated
Observed
Groundwater Head (ft)
3500
3400
3300
3200
3100
3000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

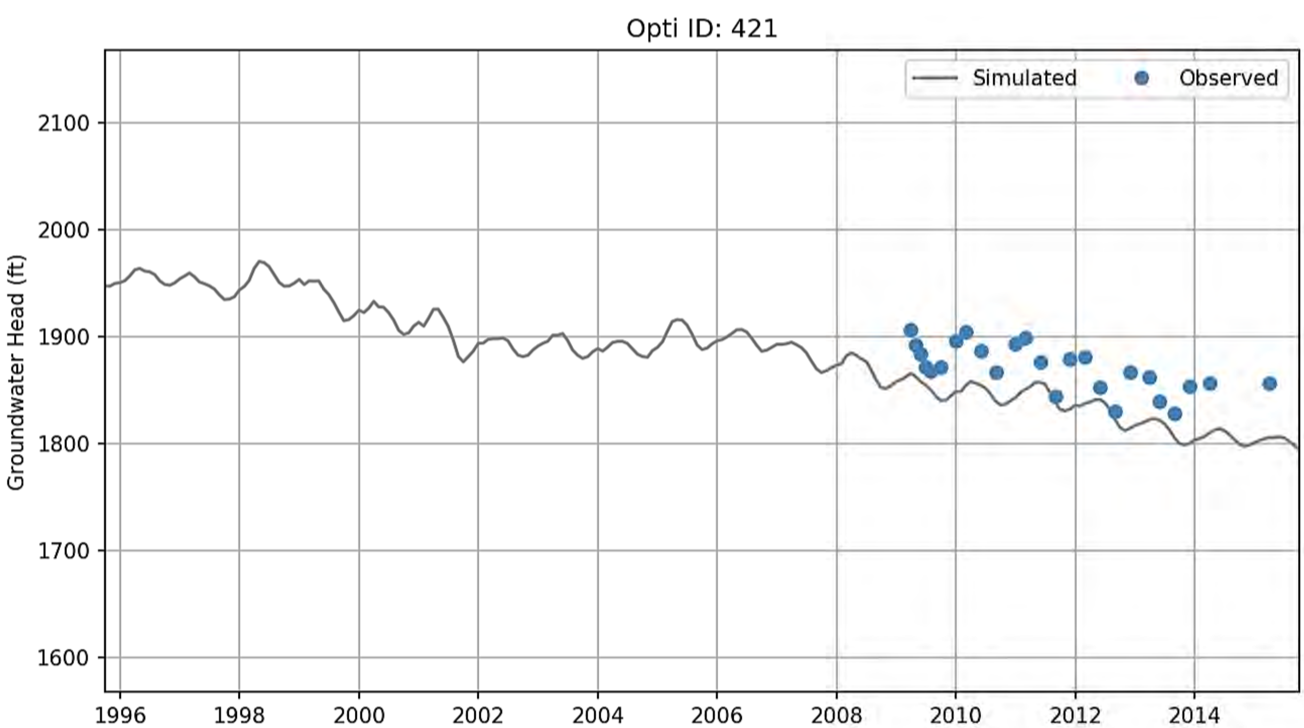

Opti ID: 322
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 324
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

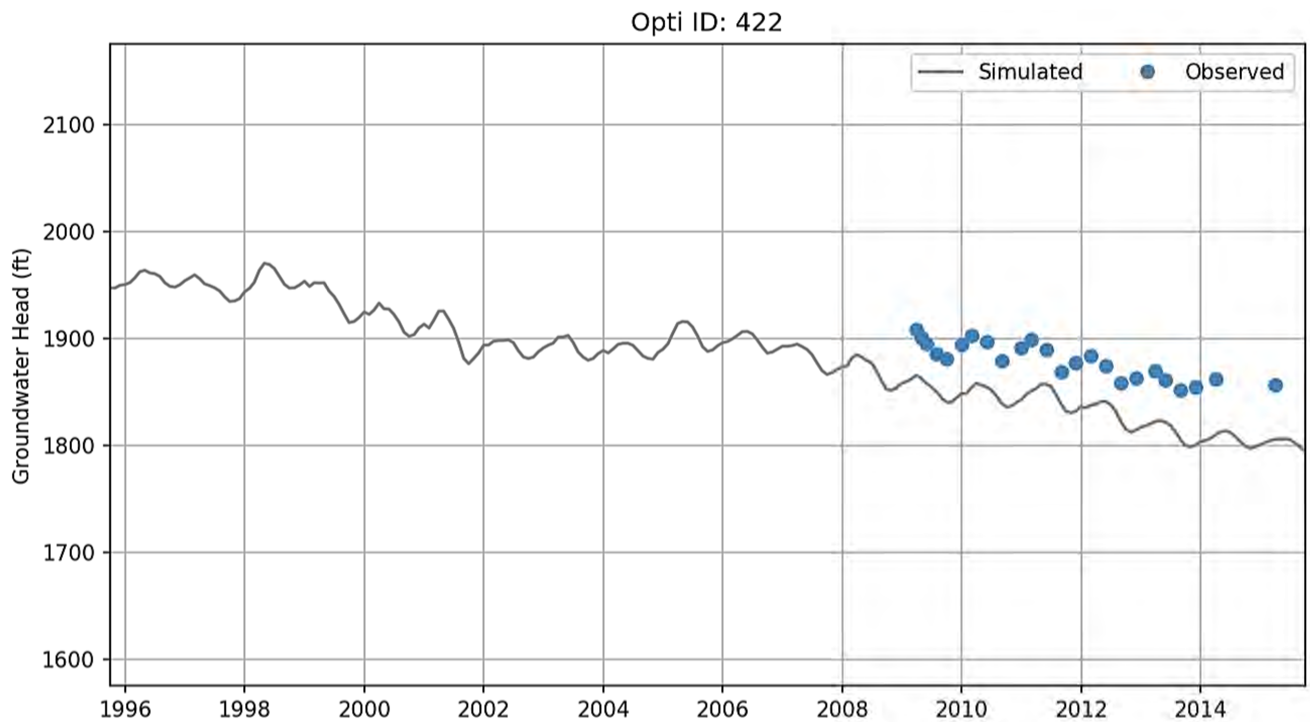

Opti ID: 325
Simulated
Observed
Groundwater Head (ft)
2500
2400
2300
2200
2100
2000
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014



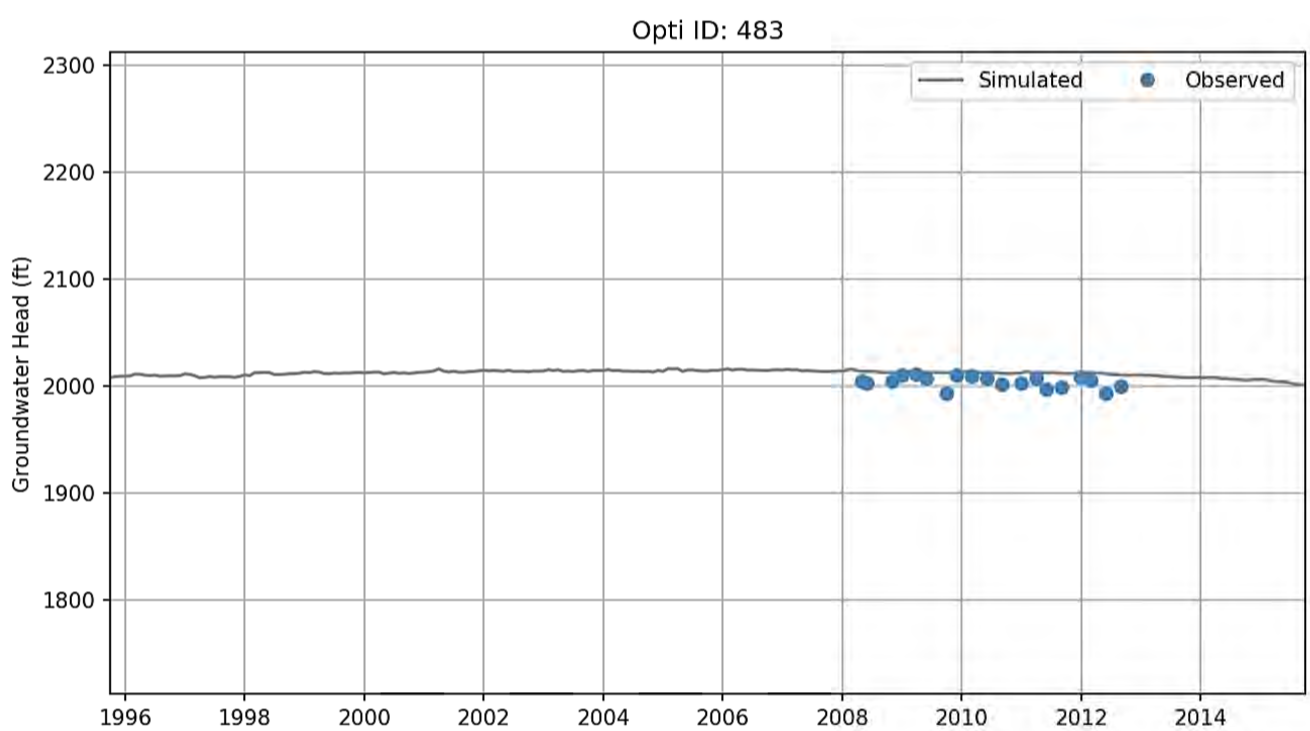
Opti ID: 420
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014



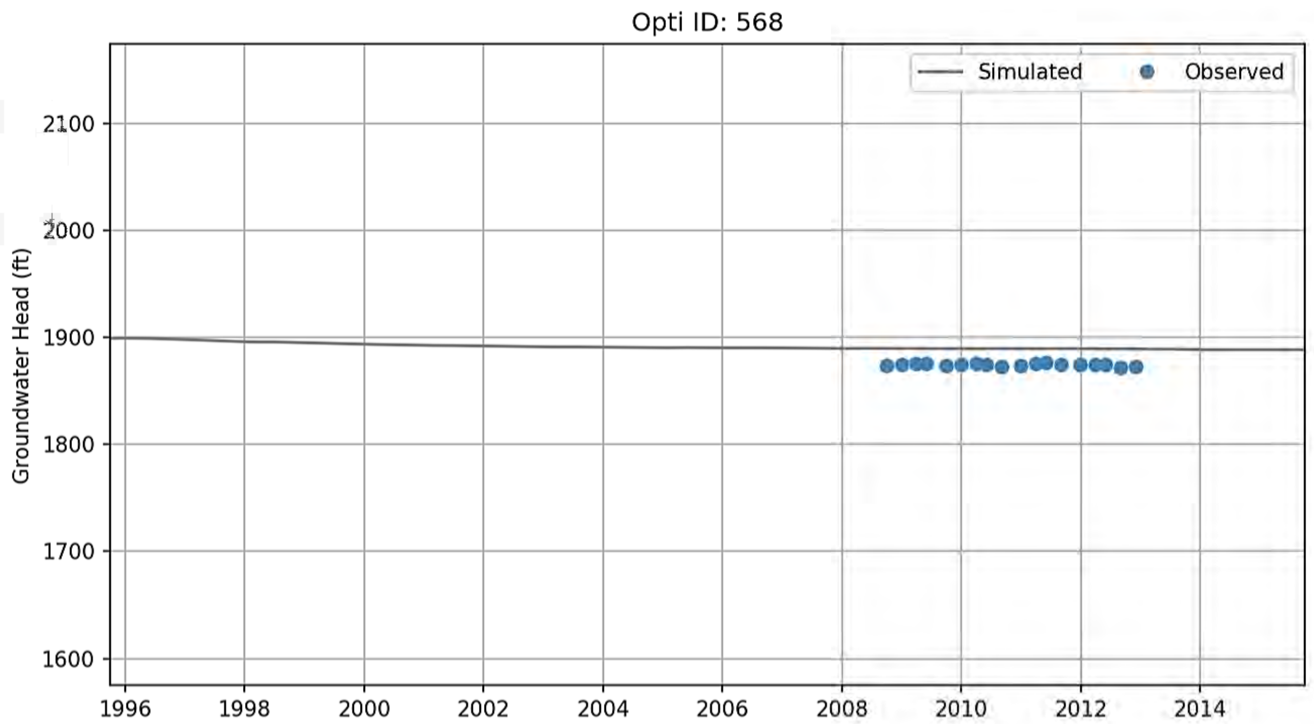
Opti ID: 421
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

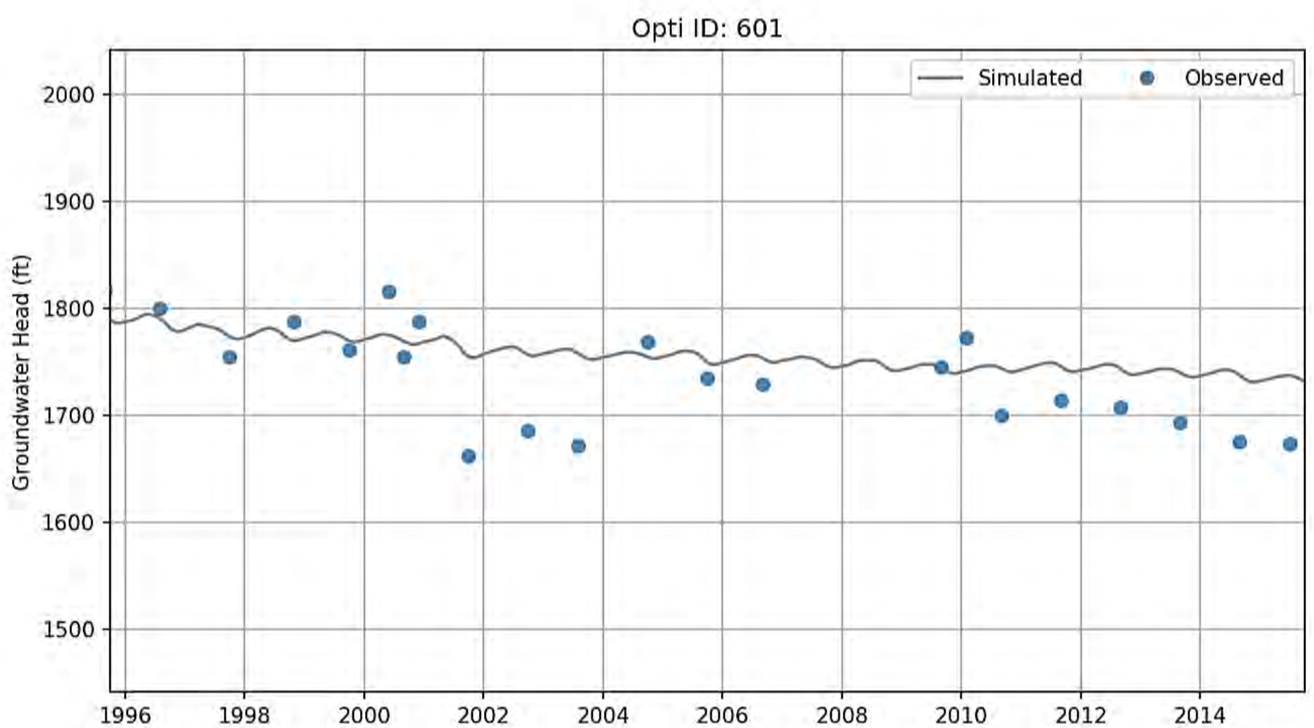


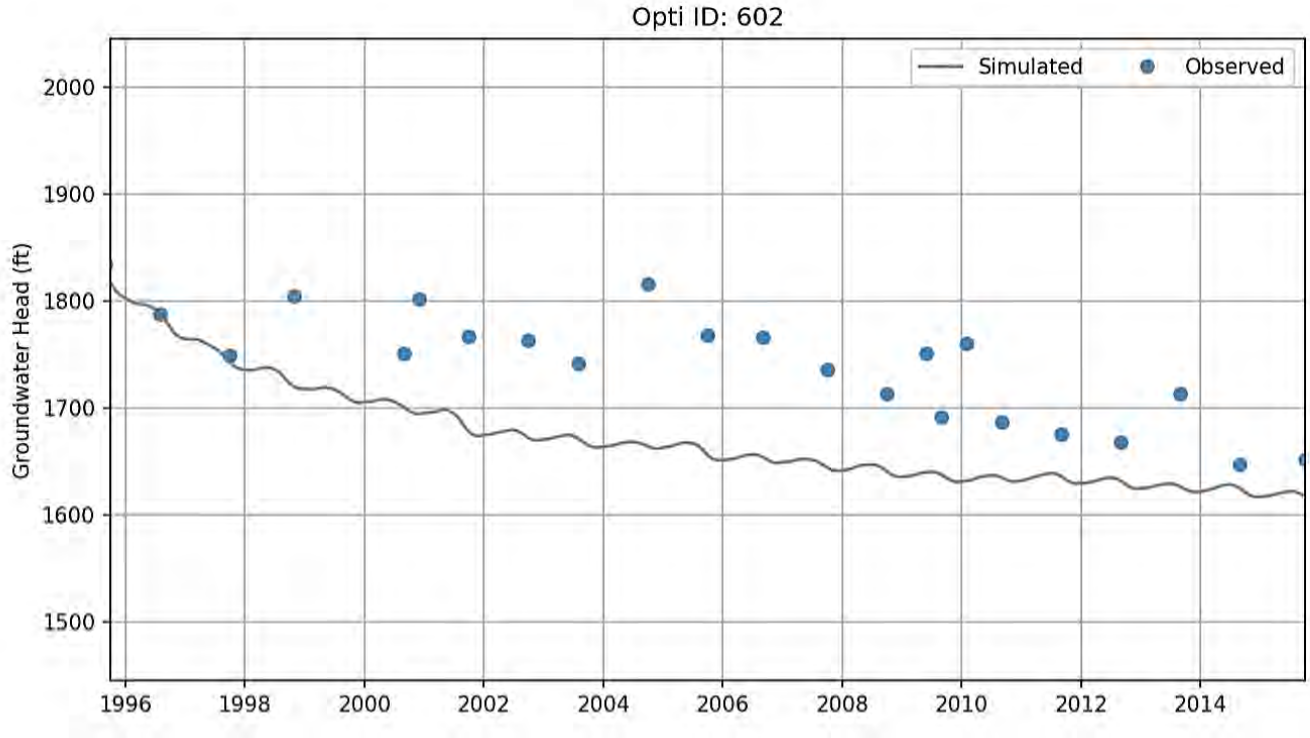
Opti ID: 422
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

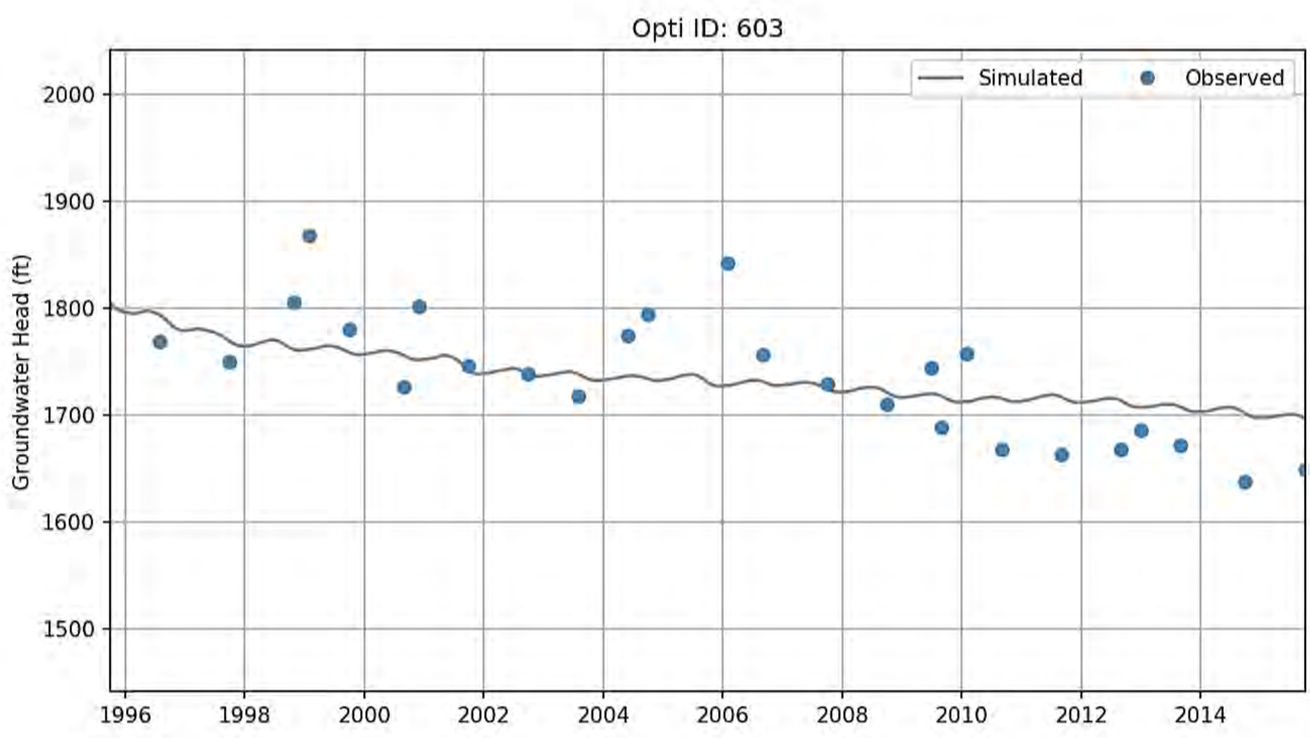


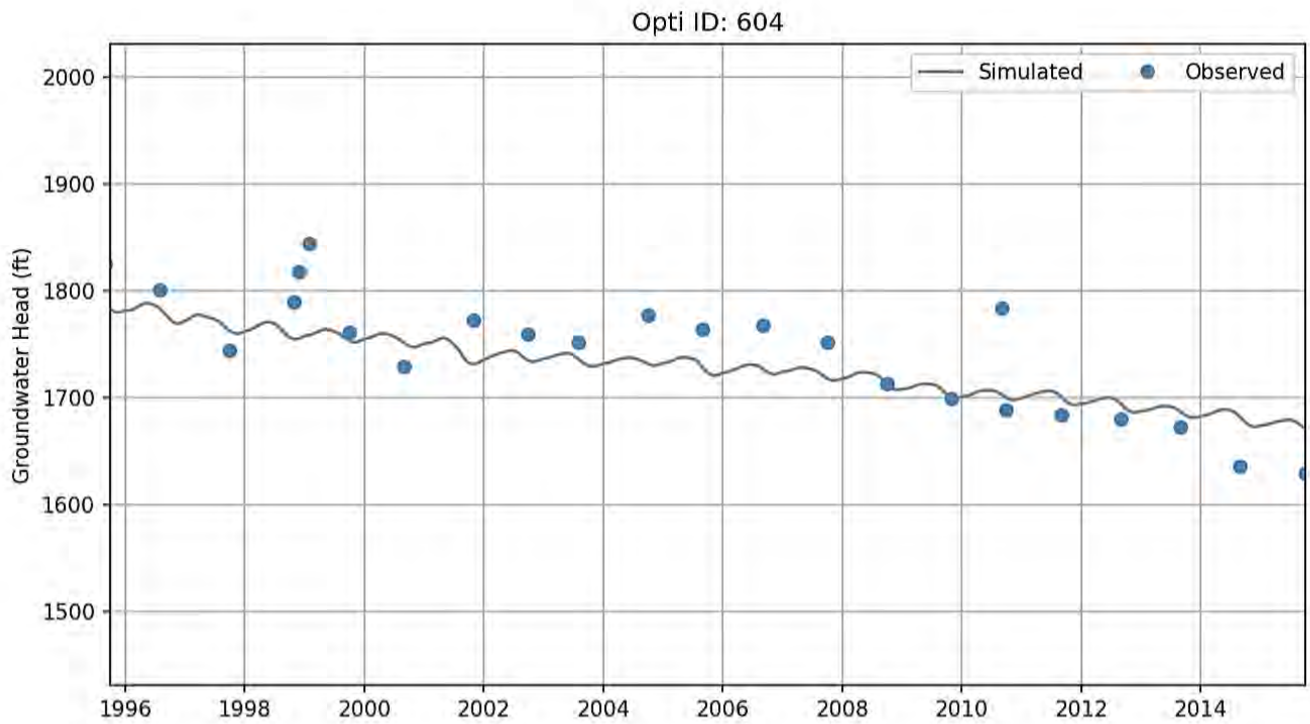
Opti ID: 483
Simulated
Observed
Groundwater Head (ft)
2300
2200
2100
2000
1900
1800
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

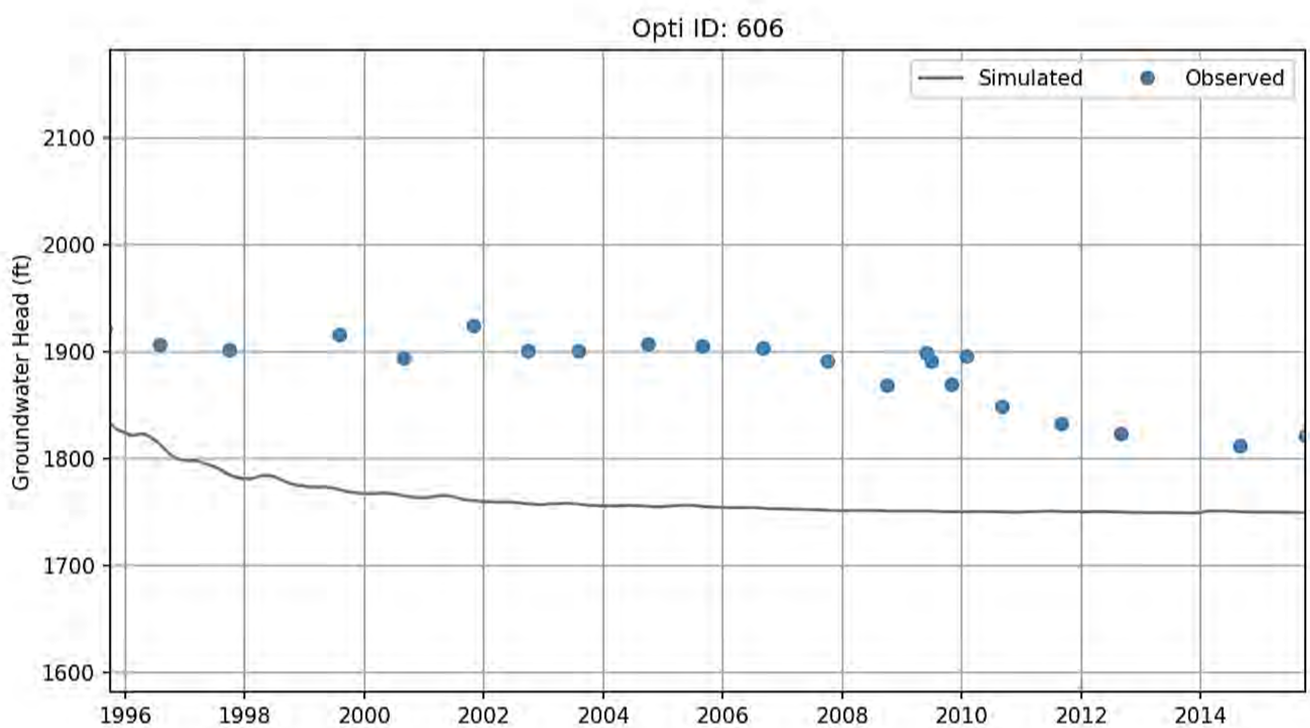

Opti ID: 568
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

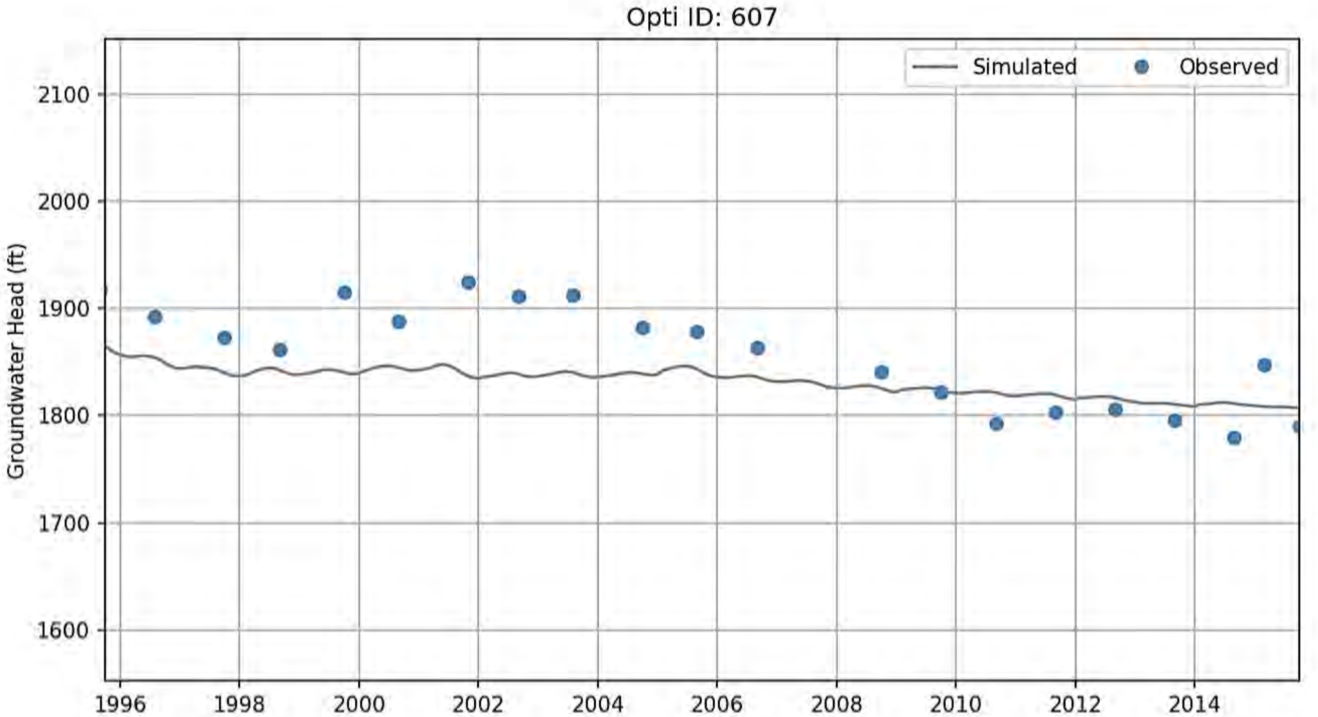

Opti ID: 601
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

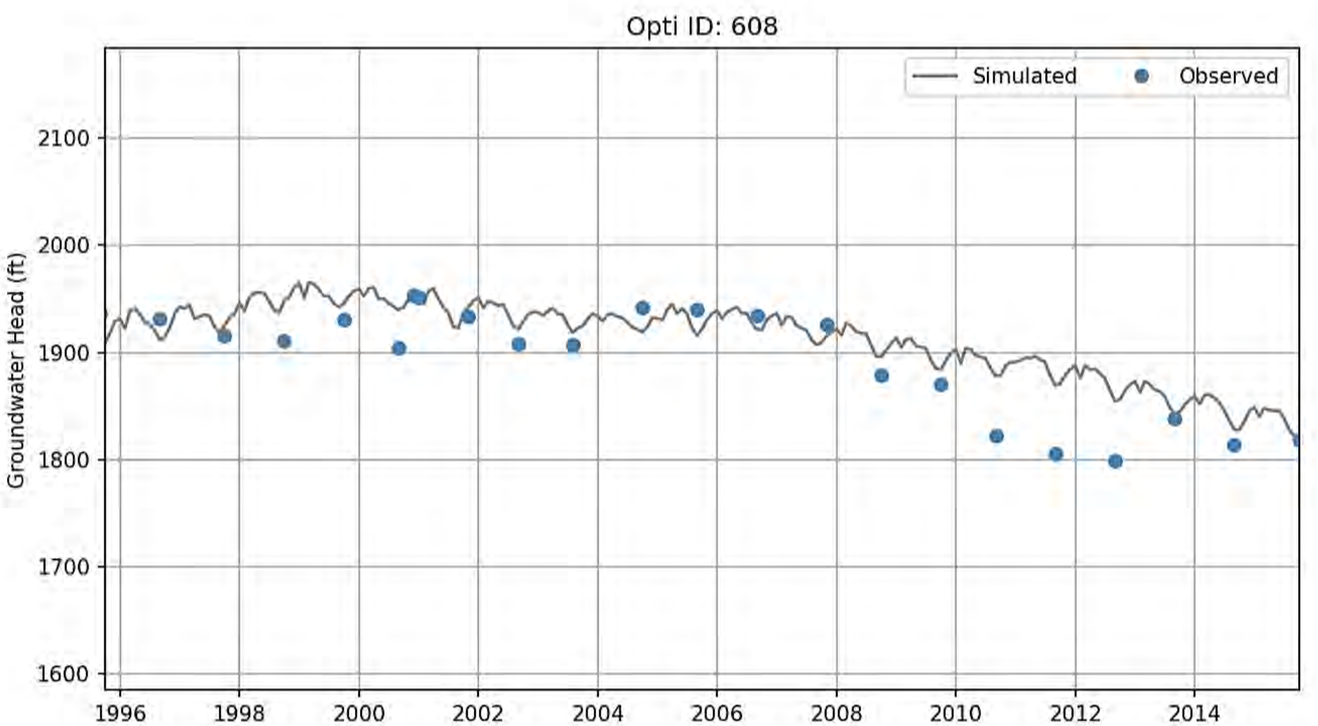

Opti ID: 602
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

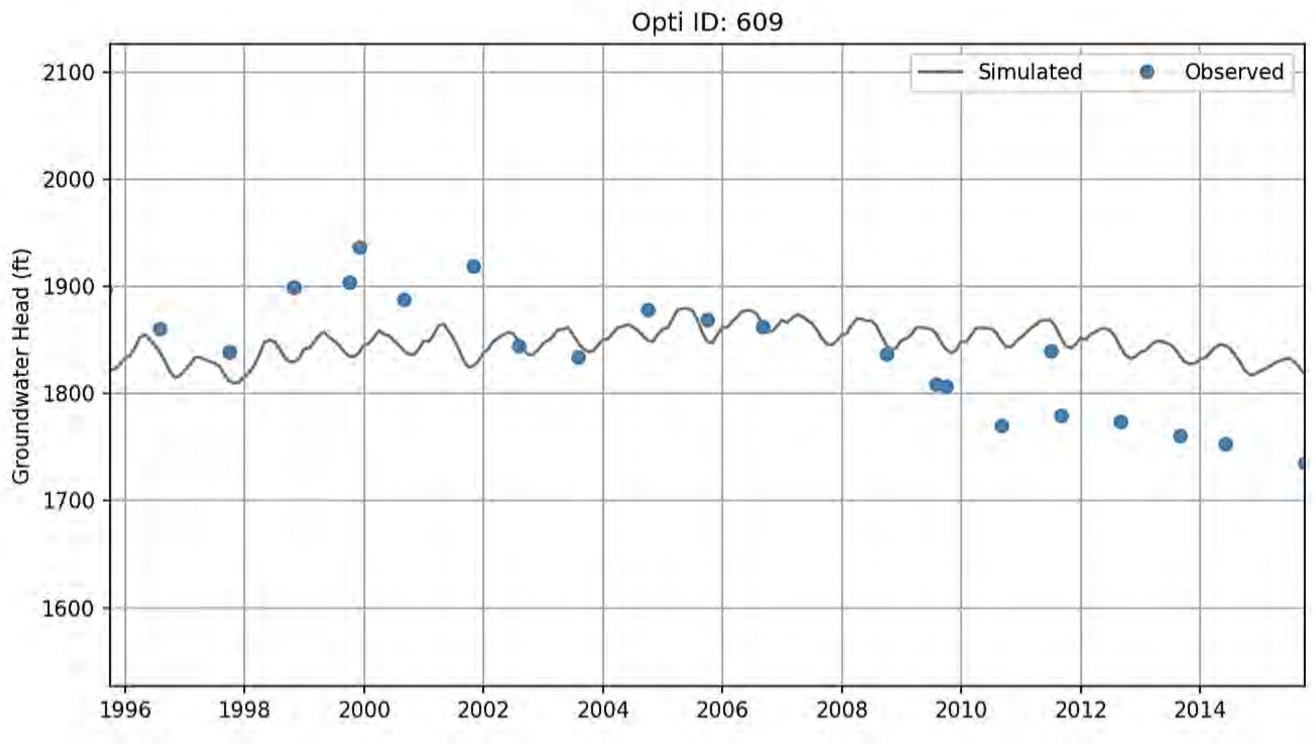

Opti ID: 603
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

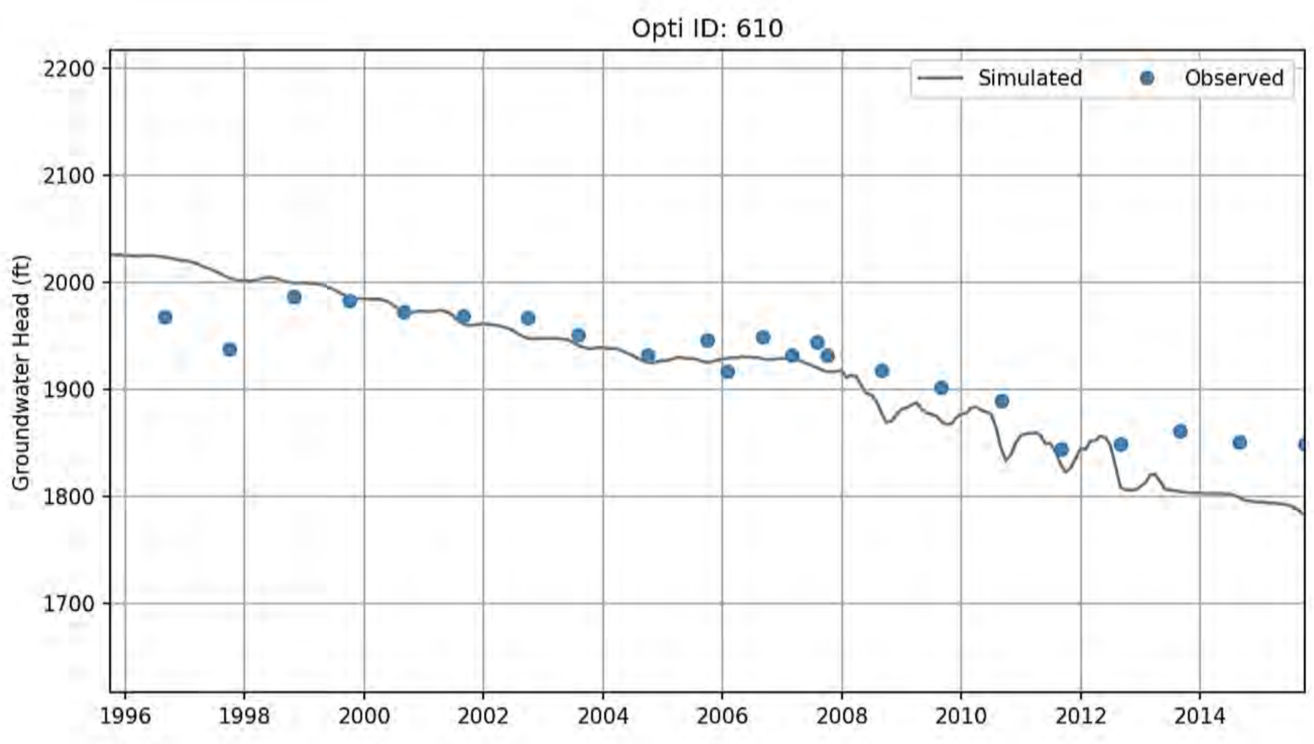

Opti ID: 604
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

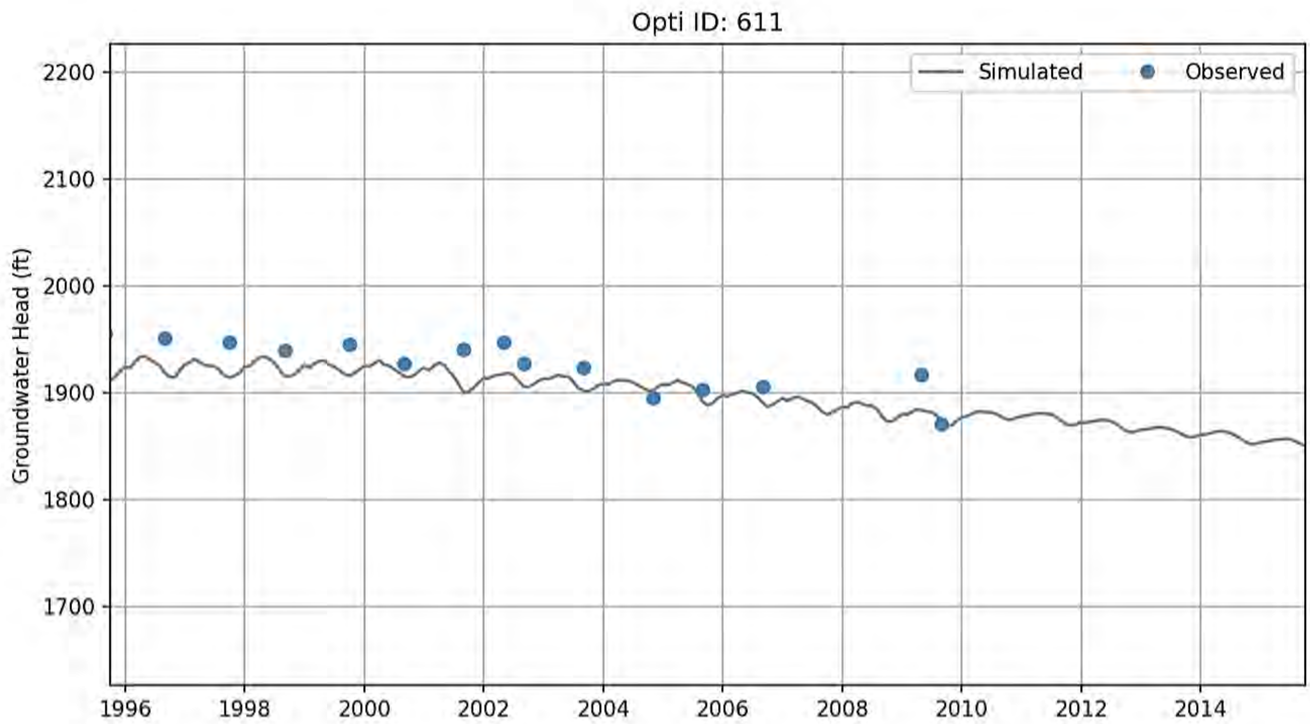

Opti ID: 606
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

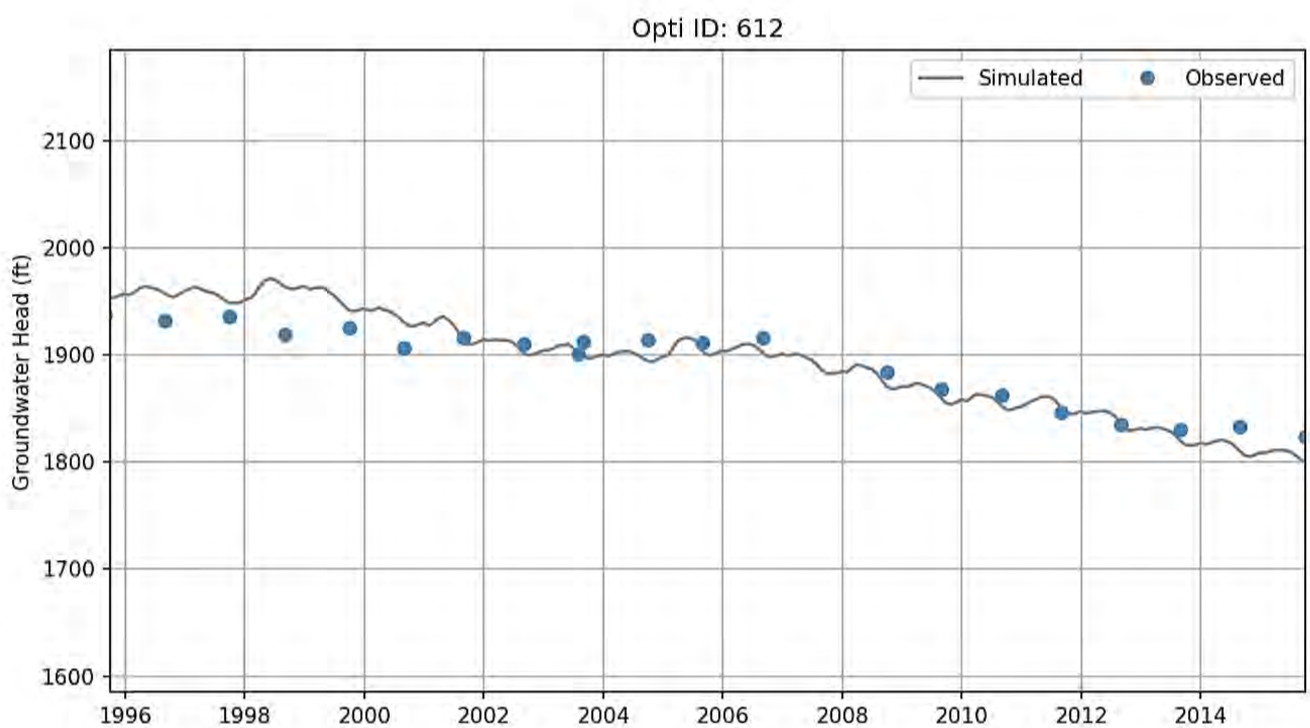

Opti ID: 607
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

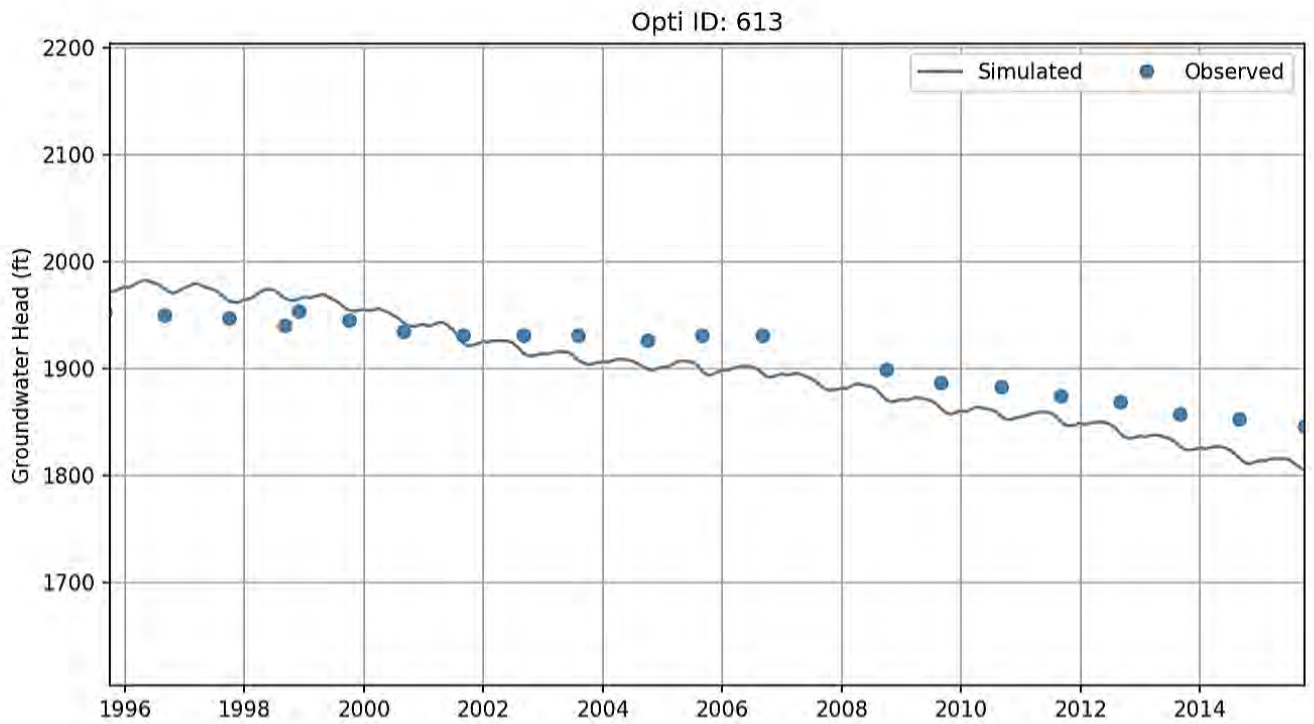

Opti ID: 608
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

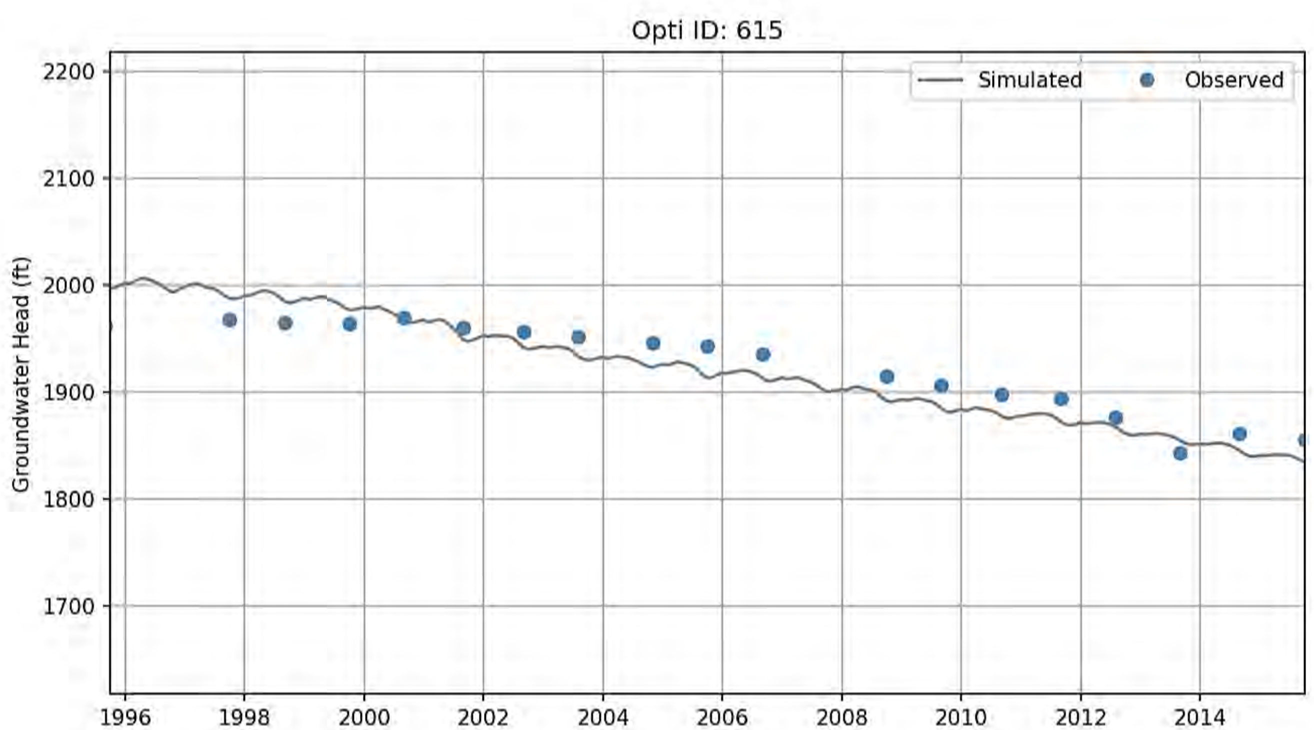

Opti ID: 609
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

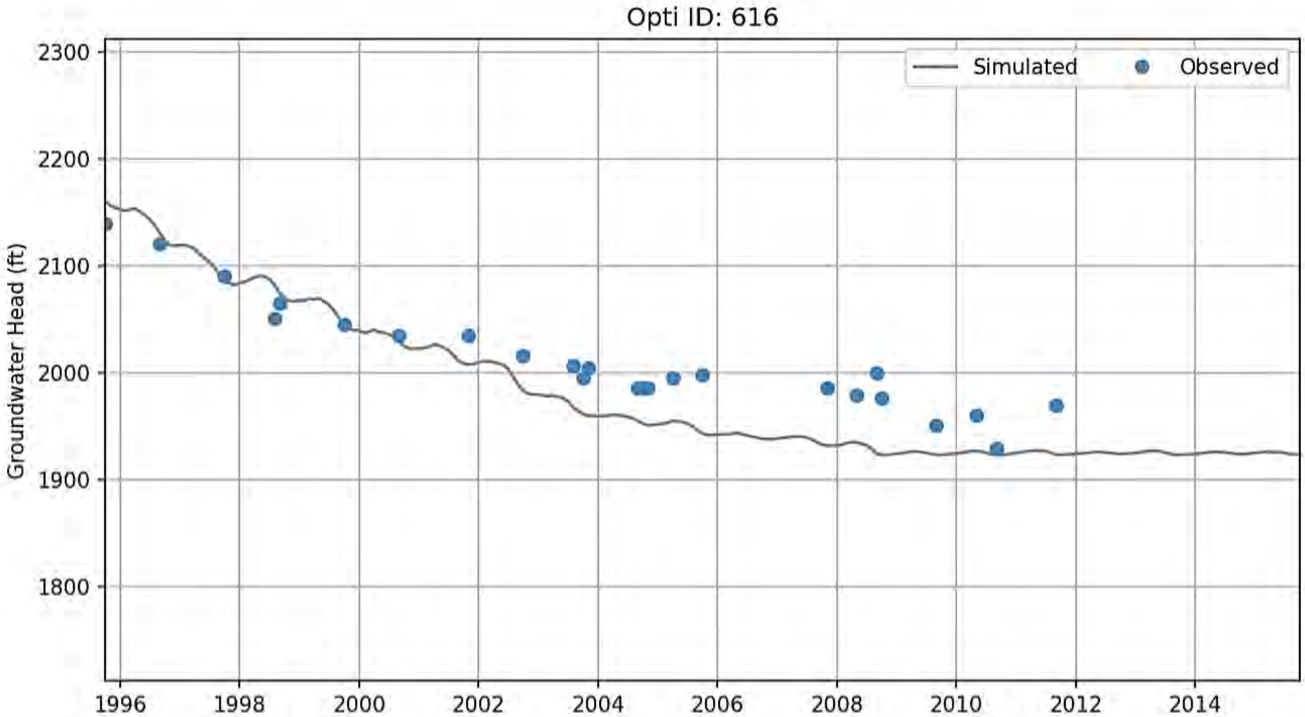

Opti ID: 610
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

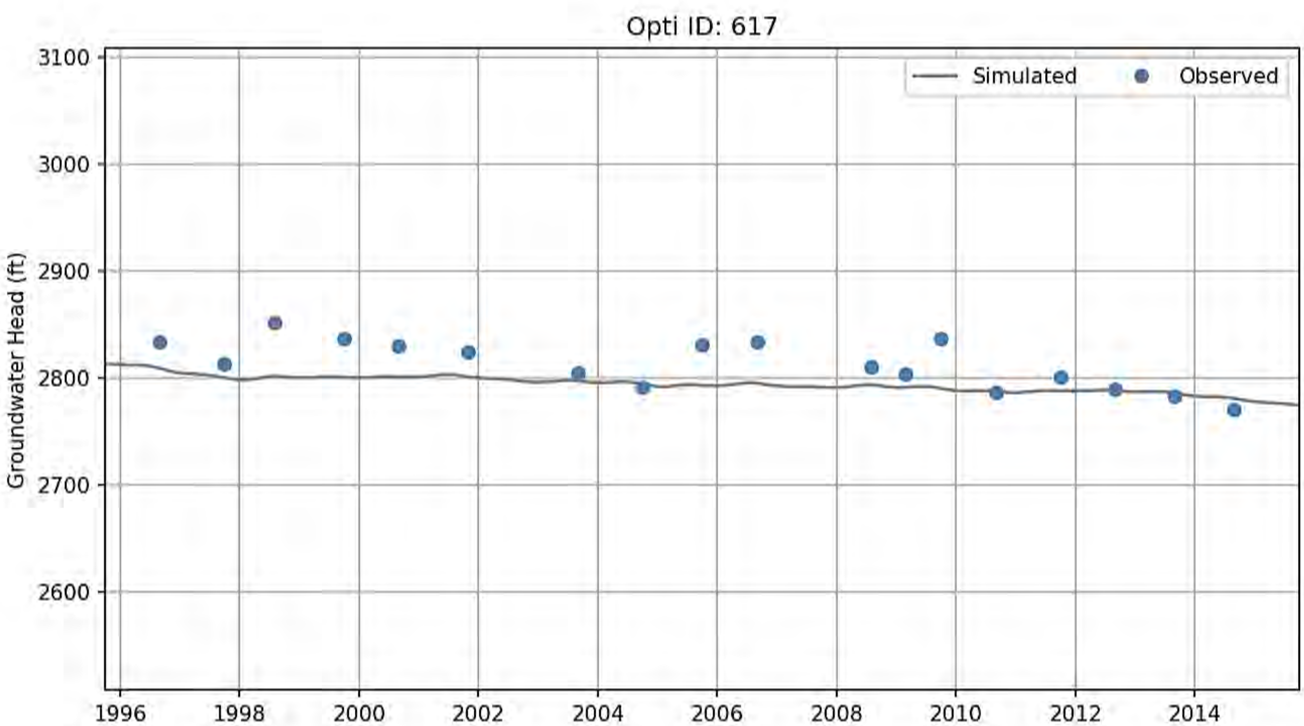

Opti ID: 611
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

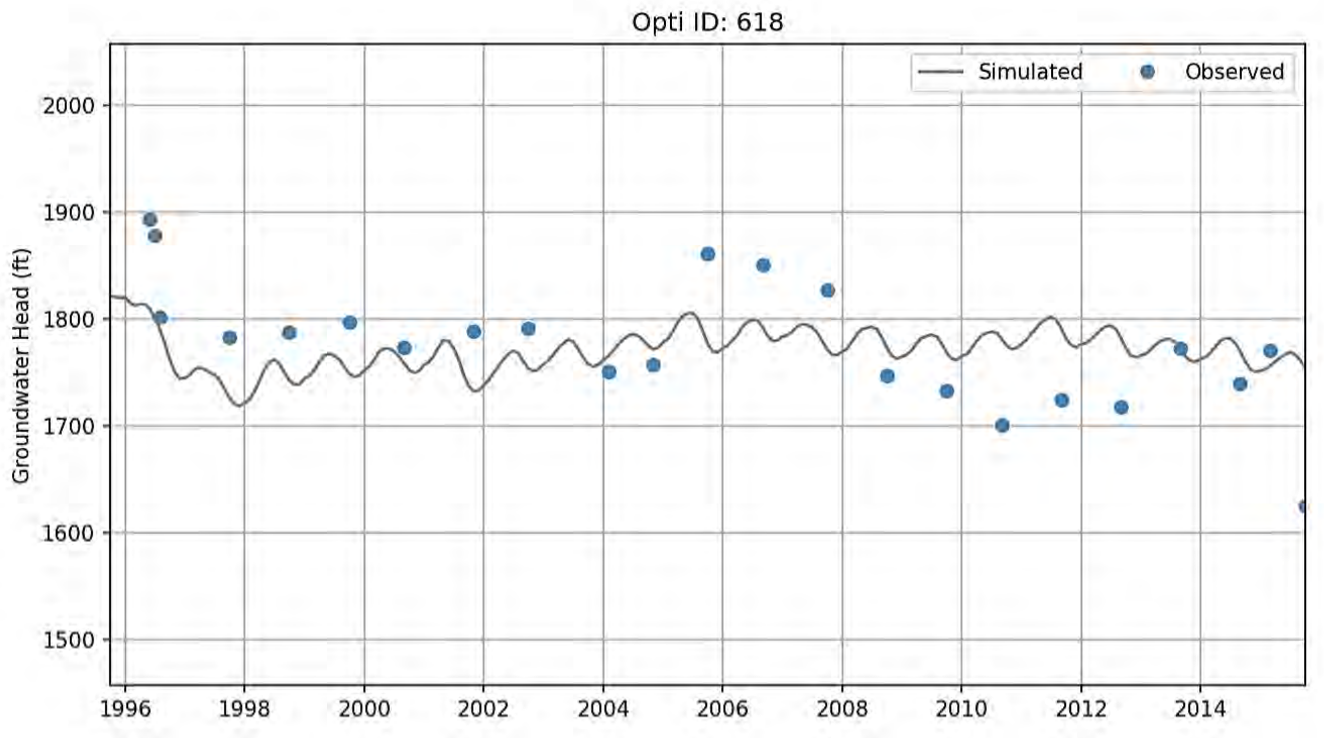

Opti ID: 612
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

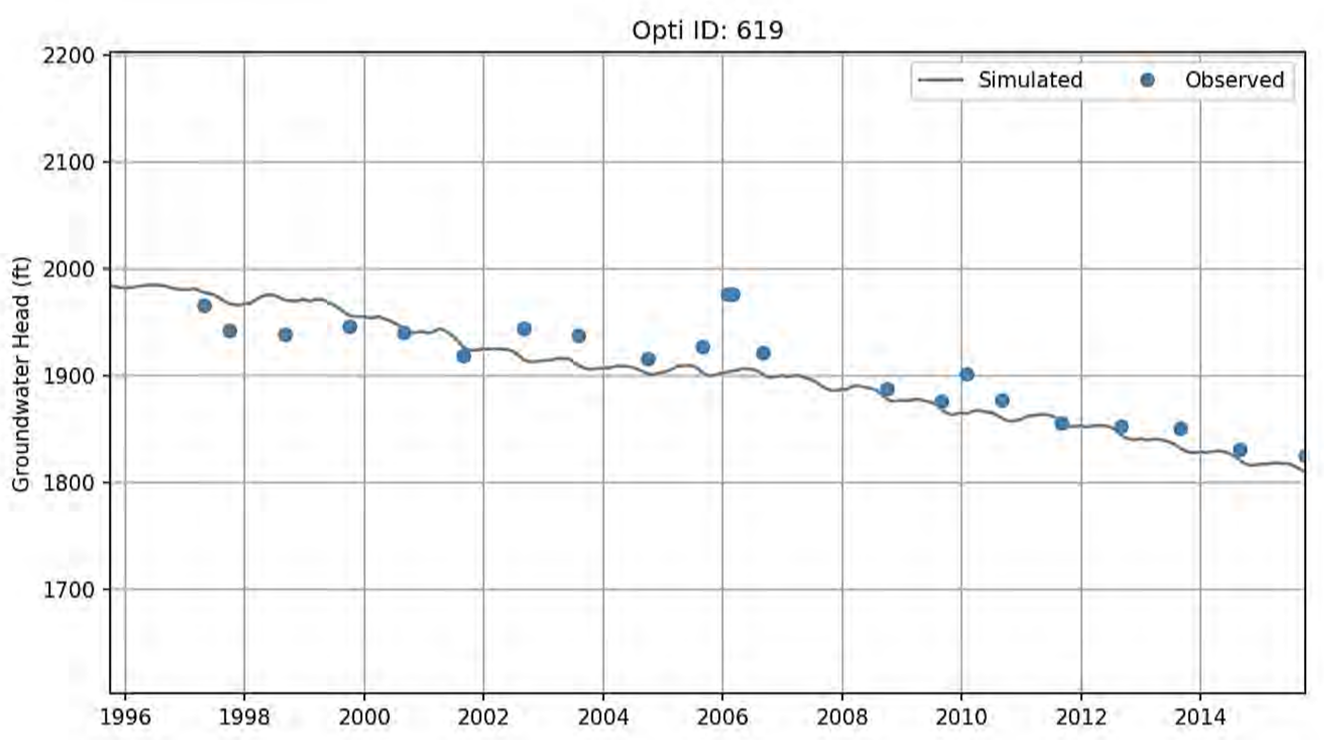

Opti ID: 613
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

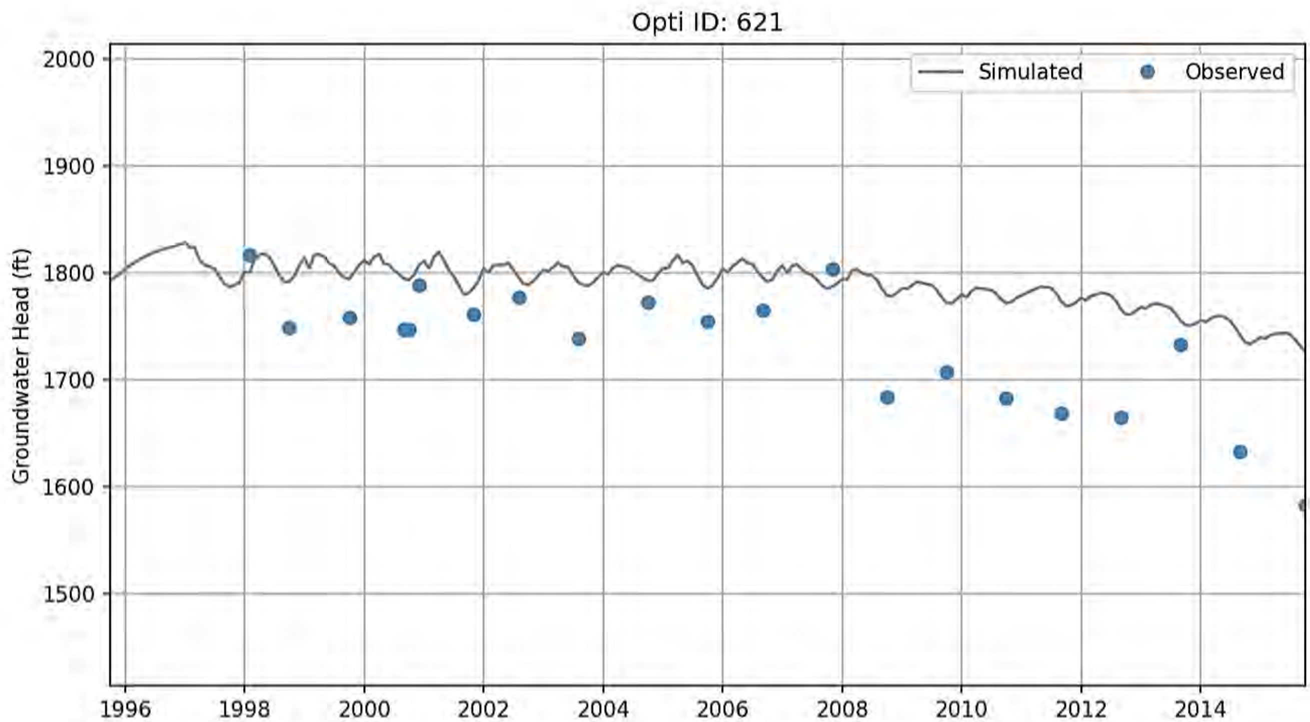

Opti ID: 615
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

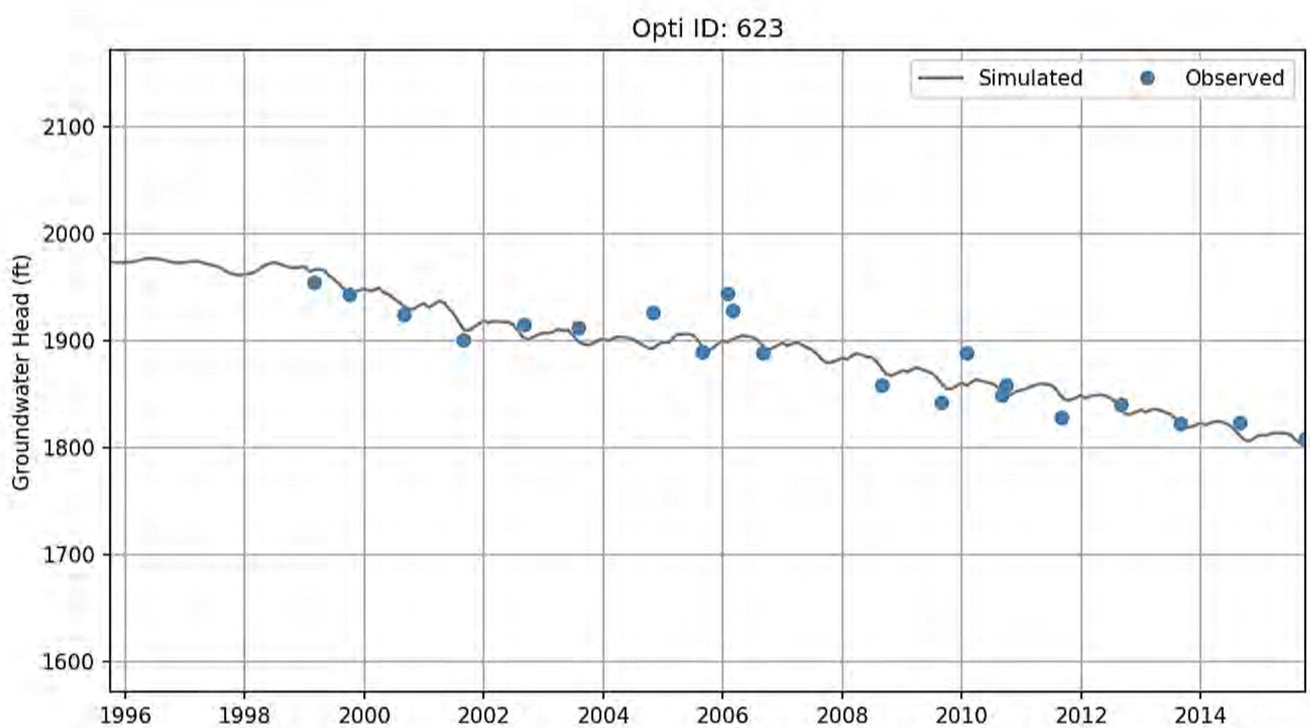

Opti ID: 616
Simulated
Observed
Groundwater Head (ft)
2300
2200
2100
2000
1900
1800
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

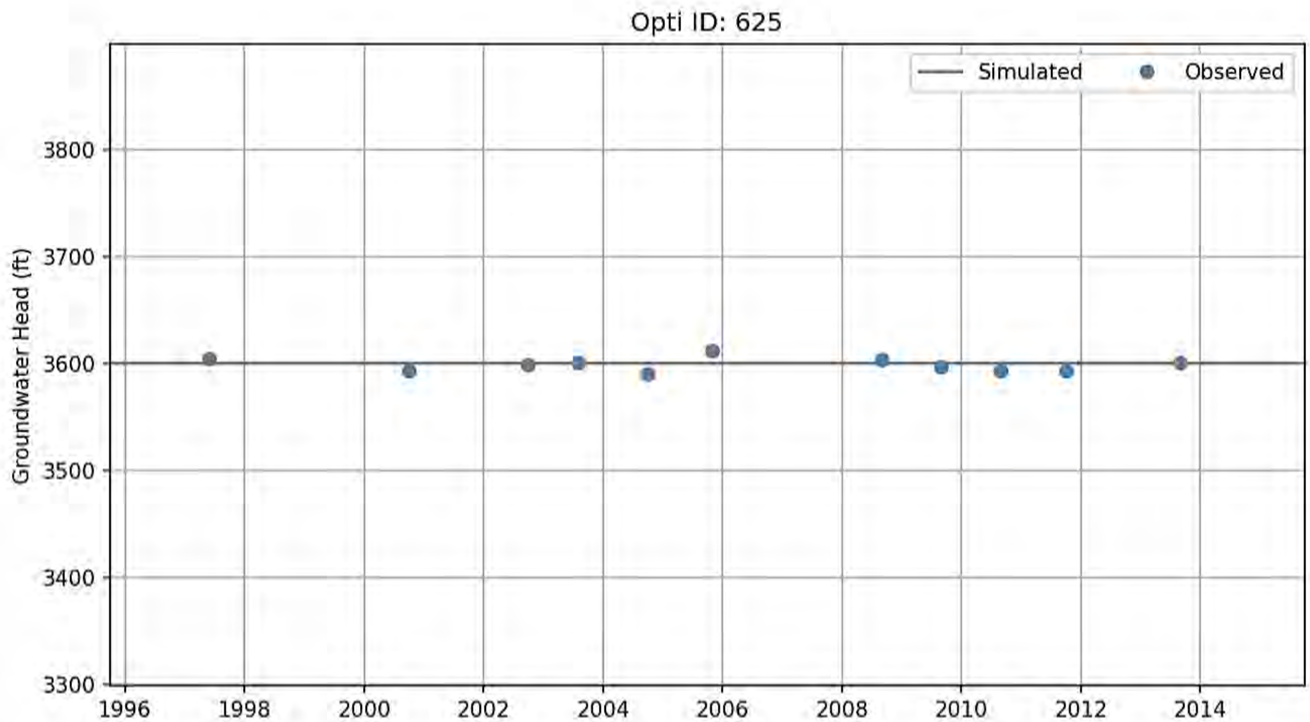

Opti ID: 617
Simulated
Observed
Groundwater Head (ft)
3100
3000
2900
2800
2700
2600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

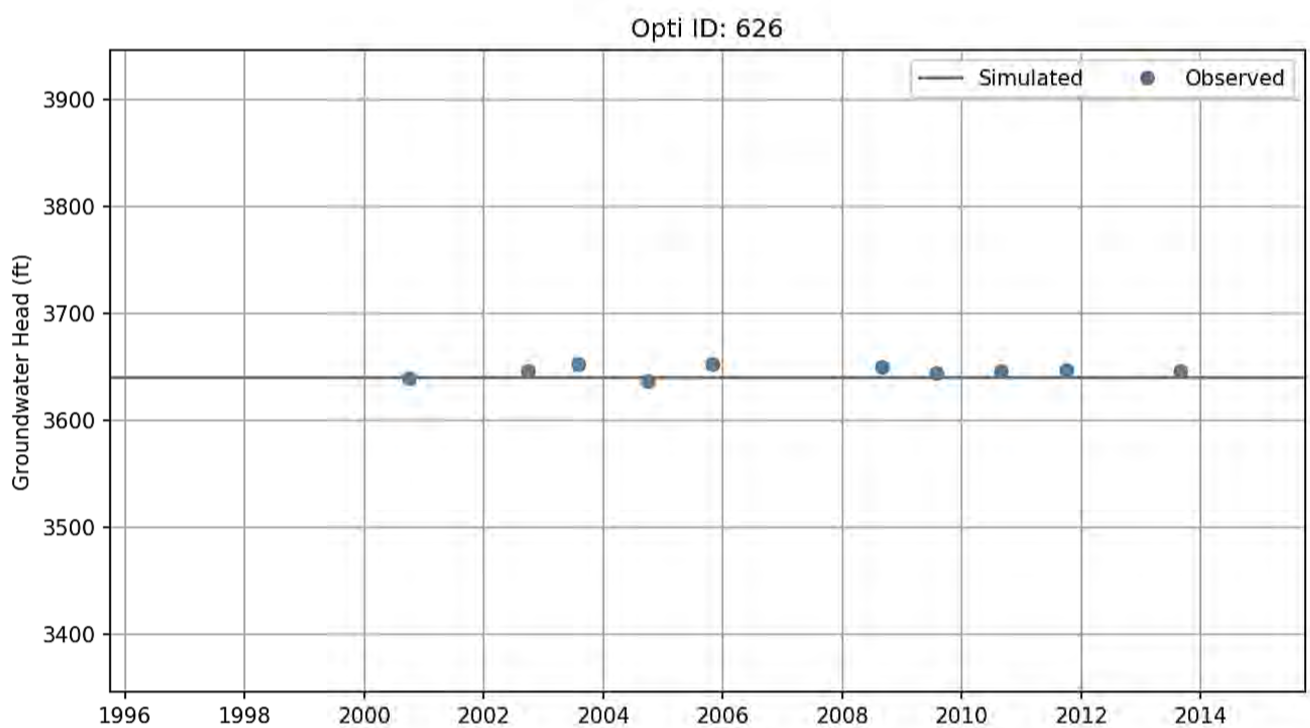

Opti ID: 618
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

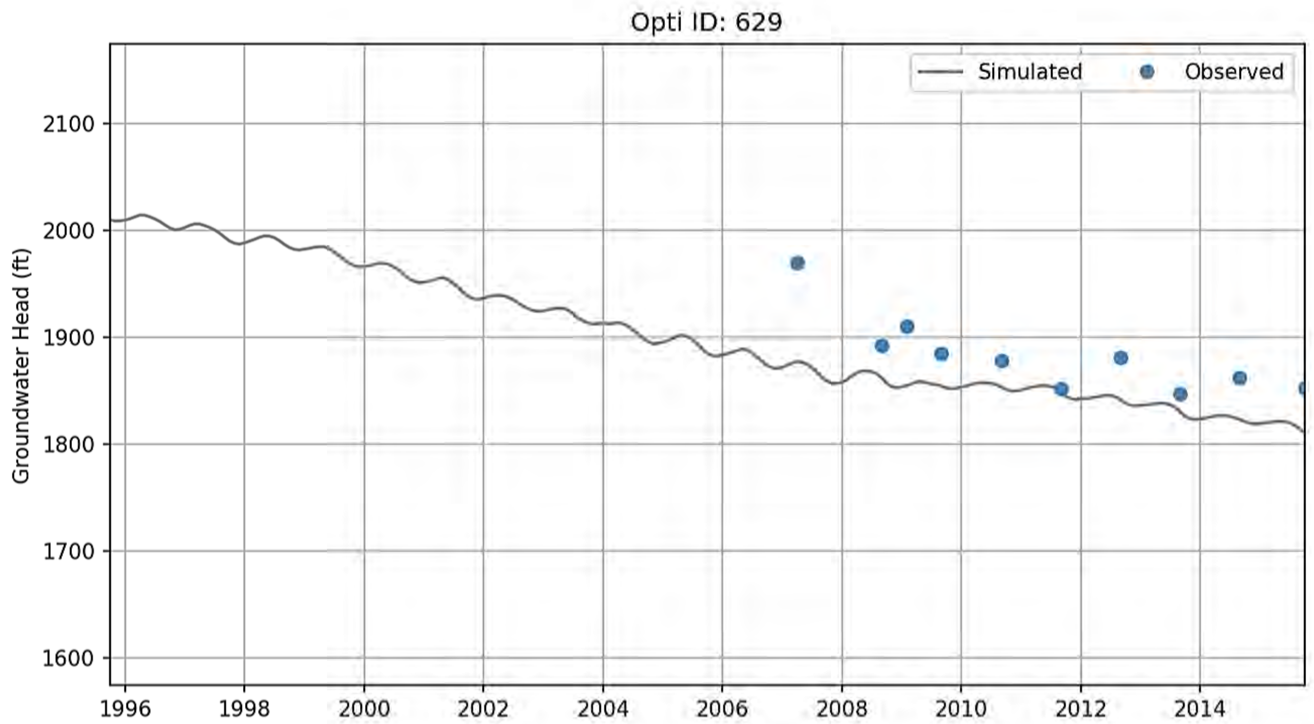

Opti ID: 619
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

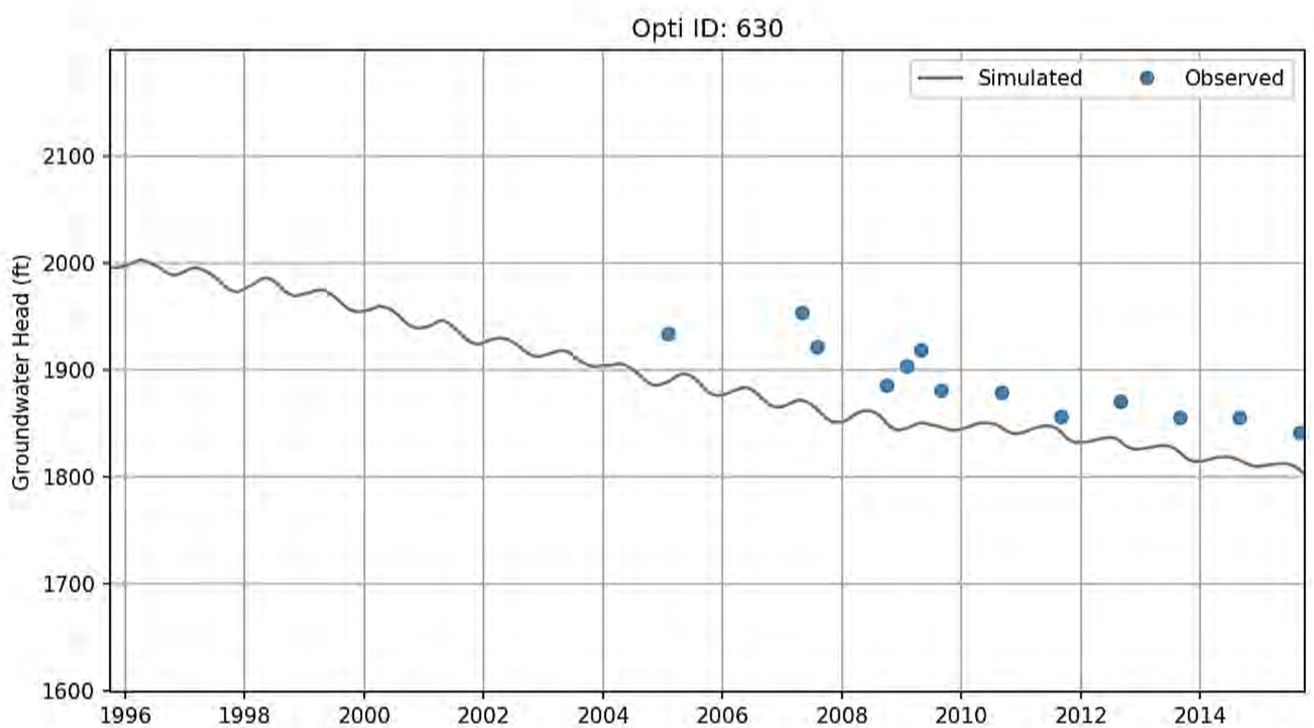

Opti ID: 621
Simulated
Observed
Groundwater Head (ft)
2000
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

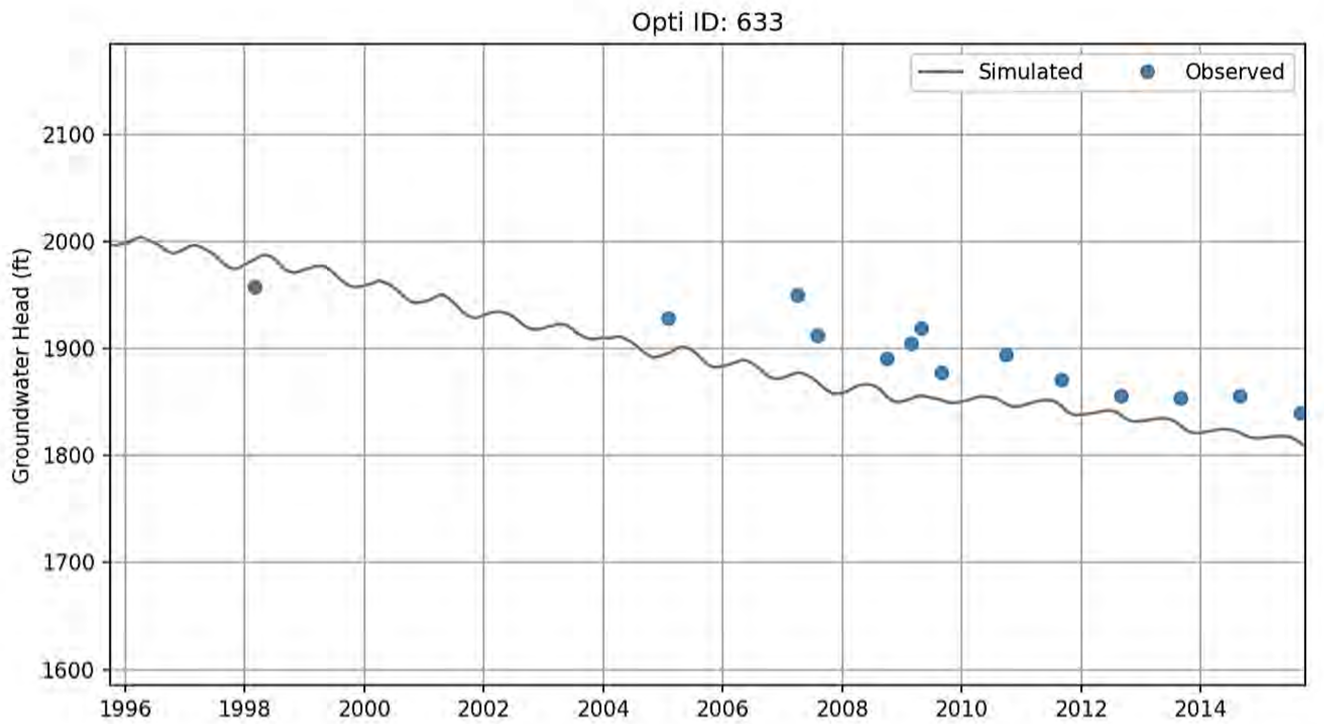

Opti ID: 623
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 625
Simulated
Observed
Groundwater Head (ft)
3800
3700
3600
3500
3400
3300
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

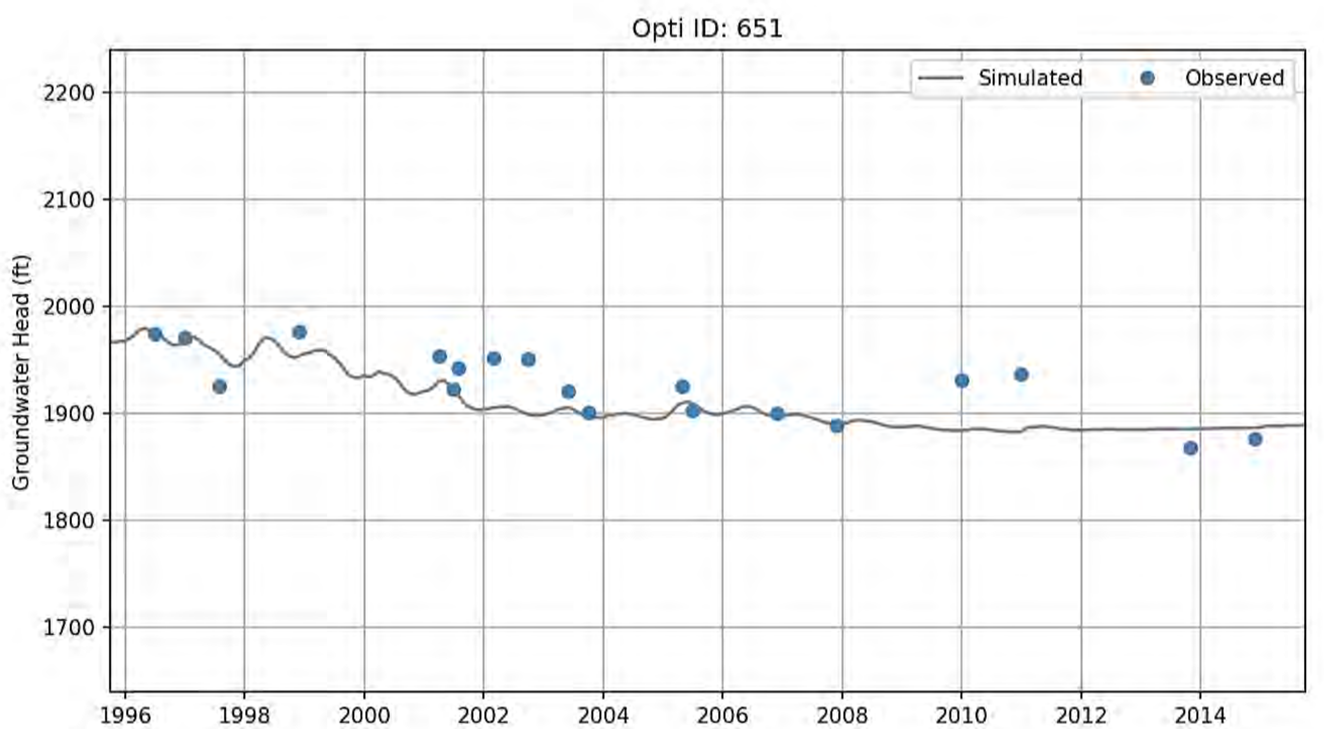

Opti ID: 626
Simulated
Observed
Groundwater Head (ft)
3900
3800
3700
3600
3500
3400
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 629
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

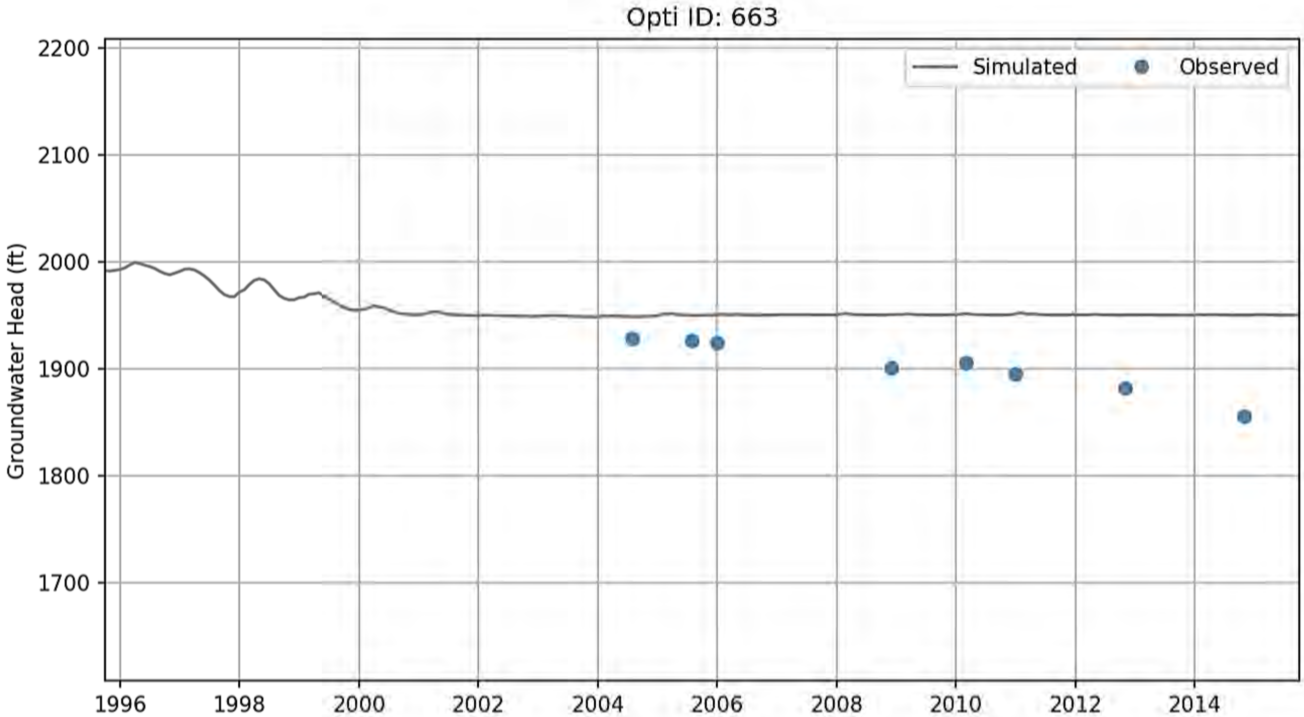

Opti ID: 630
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

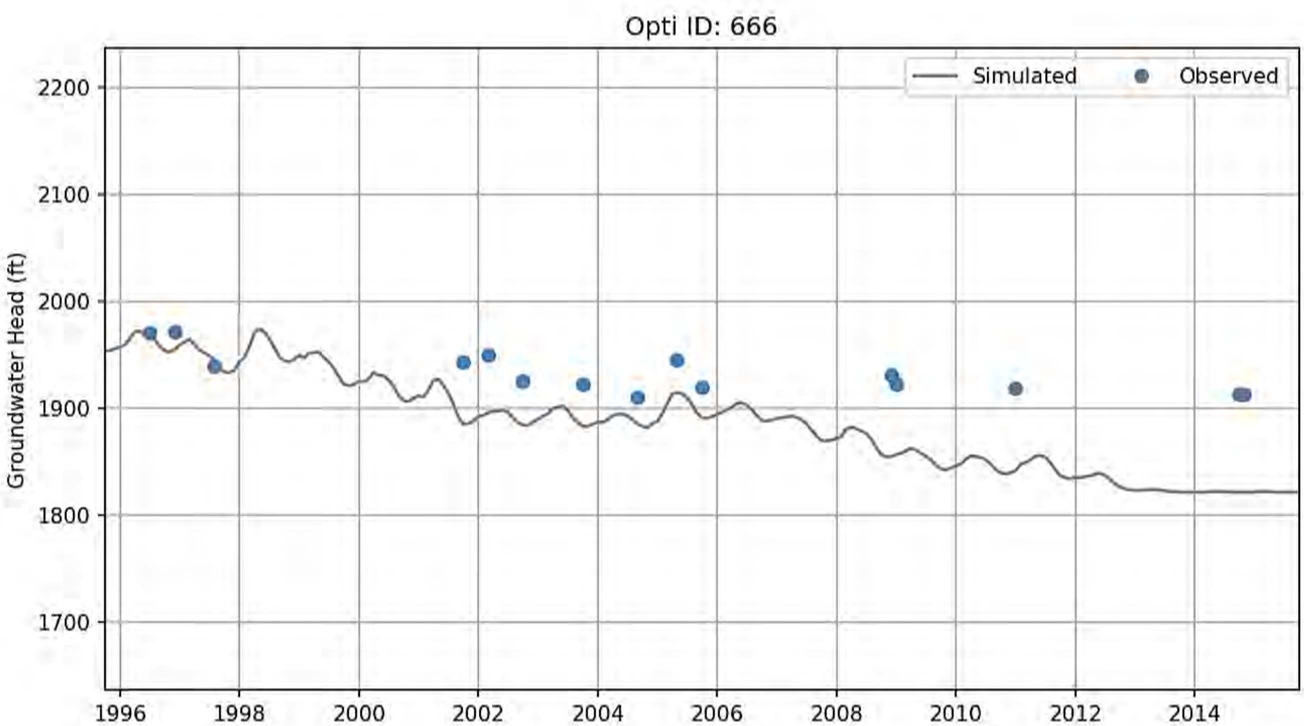


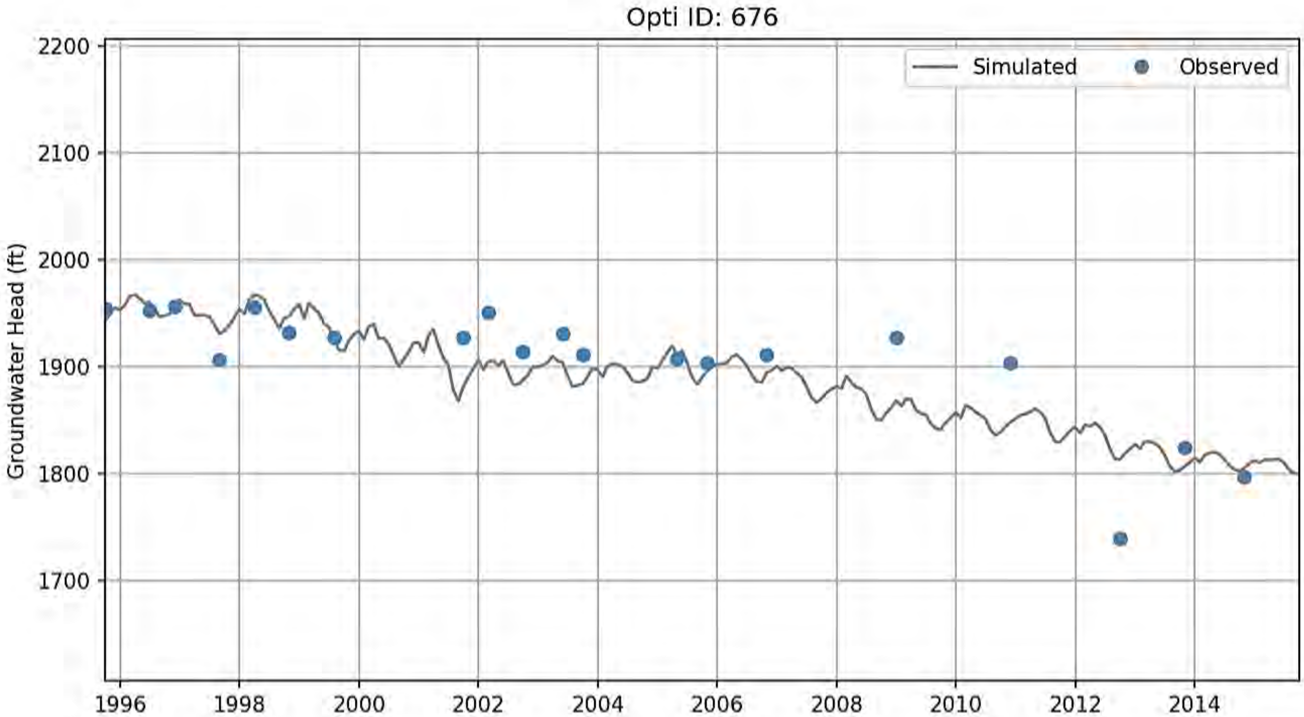
Opti ID: 633
Simulated
Observed
Groundwater Head (ft)
2100
2000
1900
1800
1700
1600
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014



Opti ID: 651
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 663
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 666
Simulated
Observed
Groundwater Head (ft)
2200
2100
2000
1900
1800
1700
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014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Observed
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2100
2000
1900
1800
1700
1996
1998
2000
2002
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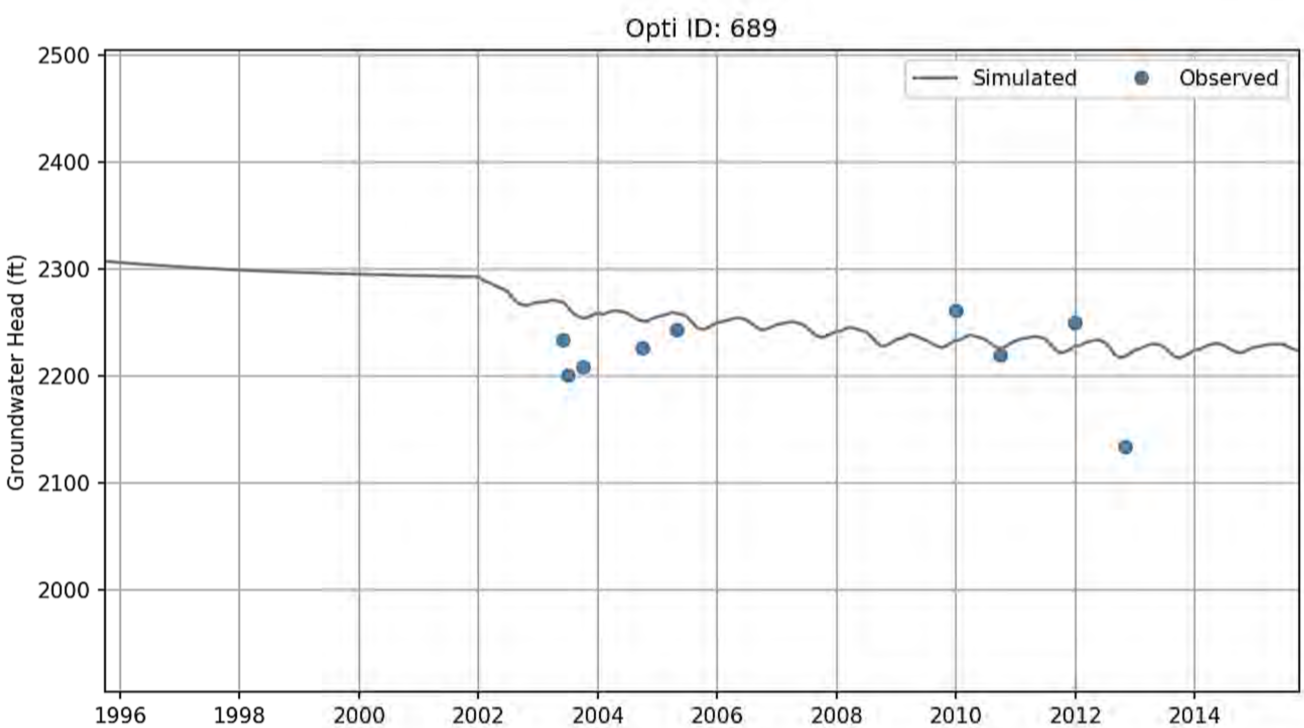
2006
2008
2010
2012
2014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Observed
Groundwater Head (ft)
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2400
2300
2200
2100
2000
1996
1998
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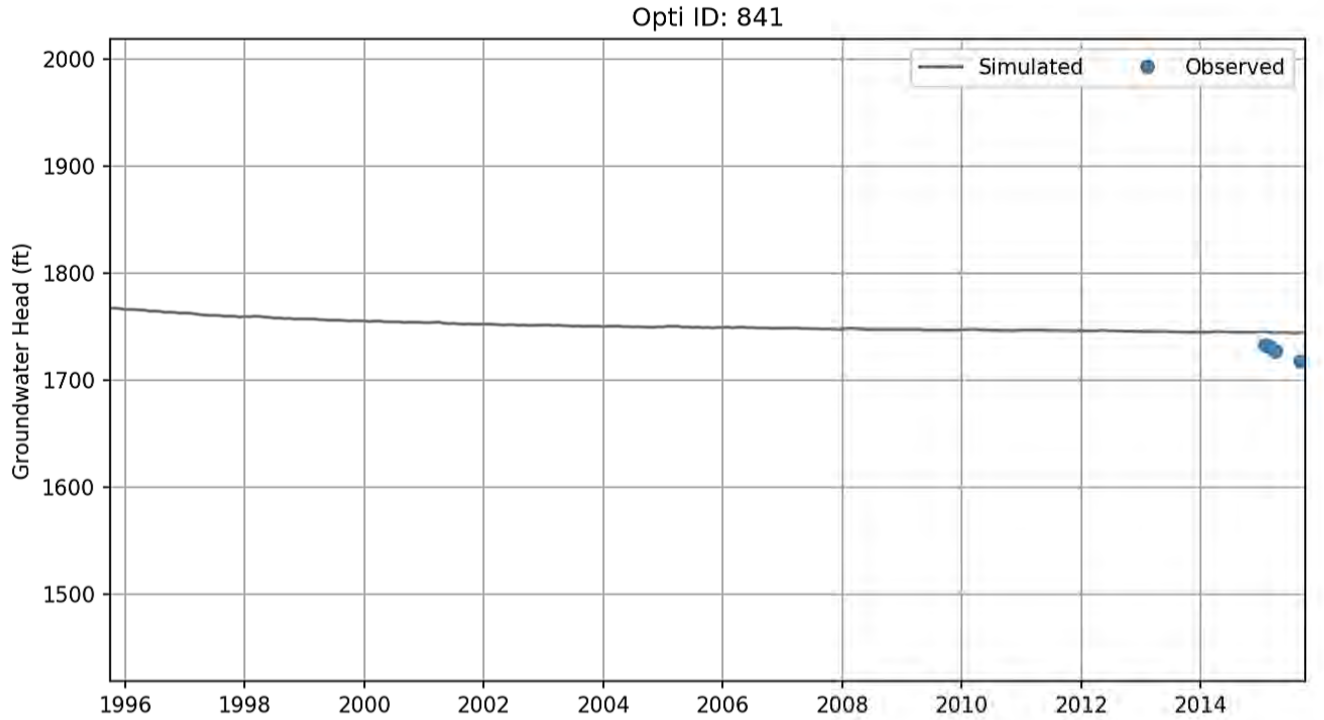
2006
2008
2010
2012
2014



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Observed
Groundwater Head (ft)
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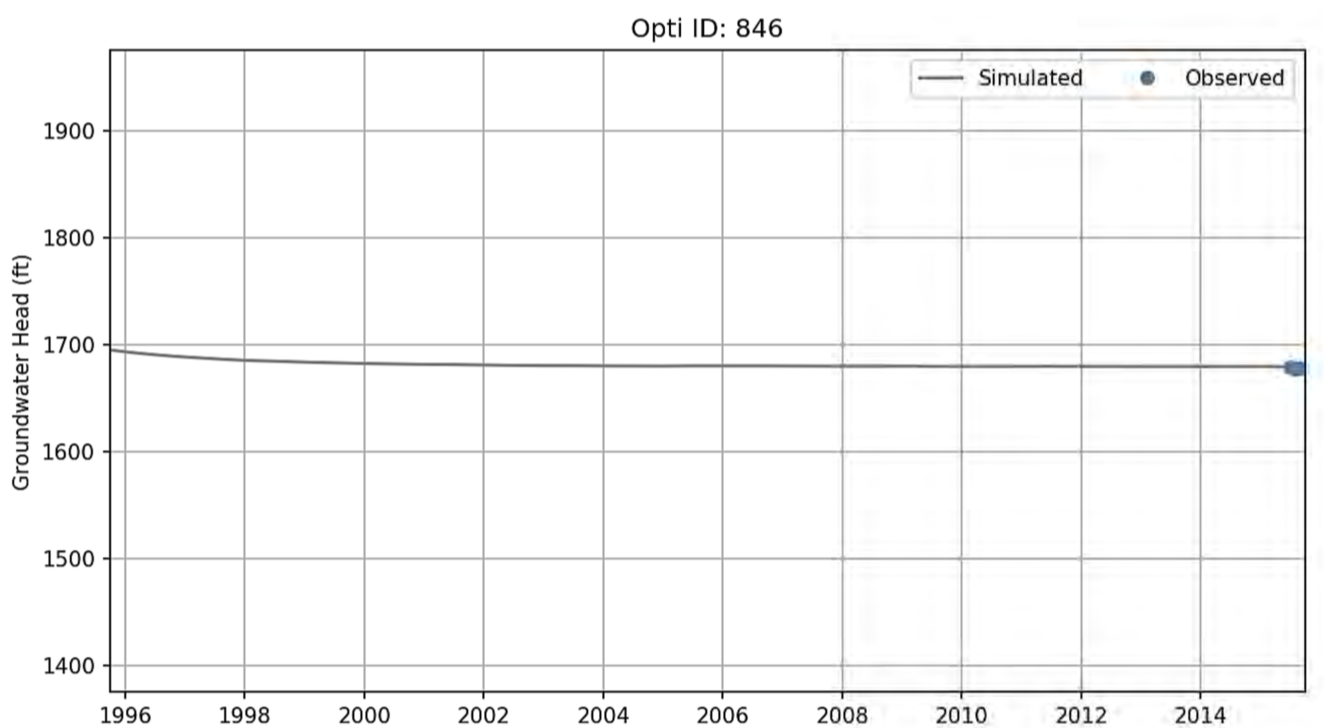
1900
1800
1700
1600
1500
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014



Opti ID: 846
Simulated
Observed
Groundwater Head (ft)
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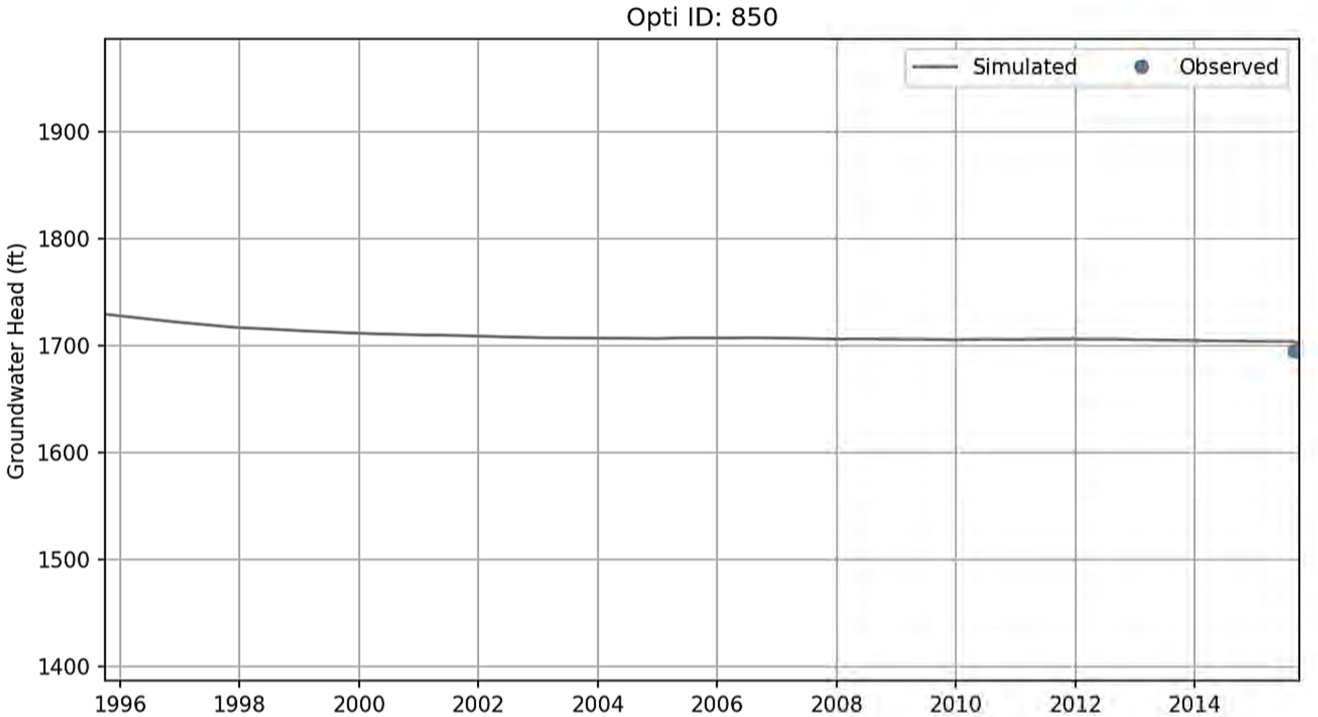
1800
1700
1600
1500
1400
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Opti ID: 850
Simulated
Observed
Groundwater Head (ft)
1900
1800
1700
1600
1500
1400
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

Attachment C-4

Evapotranspiration and Applied Water Estimates

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Specialists in Agricultural Water Management
Serving Stewards of Western Water since 1993

Technical Memorandum

To: Woodard & Curran

From: Davids Engineering

Date: January 7, 2018

Subject: **Cuyama Basin Development of Evapotranspiration and Applied Water Estimates Using Remote Sensing**

1 Summary

The purpose of this effort is to develop time series estimates of agricultural water use for the Cuyama Basin from October 1994 through December 2017. The approach builds upon estimates of actual evapotranspiration (ETa) developed using remotely sensed information from the Landsat satellite.

The consumptive use of water (i.e., evapotranspiration) is the primary destination of infiltrated precipitation and applied irrigation water within the Cuyama Basin. Quantification of consumptive use was achieved by performing daily calculations of evapotranspiration (ET) for individual fields from October 1996 through December 2017. ET was separated into its evaporation (E) and transpiration (T) components. Transpiration was quantified using a remote sensing approach where Landsat satellite images acquired from USGS were used to calculate the Normalized Difference Vegetation Index (NDVI), which was subsequently translated to a basal crop coefficient and combined with reference ET to calculate transpiration over time.

A spatial coverage of field boundaries was developed for the Cuyama Basin, and individual field polygons were assigned cropping and irrigation method information over time based on available data. Field boundaries were delineated by combining polygon coverages in GIS format from Bolthouse Farms, Grimmway Farms, LandIQ, and the California Department of Water Resources (DWR). The area encompassed by the field boundary GIS coverage includes only the Cuyama Basin.

Crop ET was calculated based on a combination of remote sensing data and simulation of irrigation events in a daily root zone water balance model. Due to the remote sensing approach crop ET estimates are relatively insensitive to crop type and irrigation method so detailed, accurate assignment of crop types and irrigation methods to each field is not critical to developing relatively reliable estimates of crop ET. The amount of green vegetation present over time was estimated for each field polygon based on NDVI, which is calculated using a combination of red and near infrared reflectances as measured using multispectral satellite sensors onboard Landsat satellites. Following the preparation of NDVI imagery spanning the analysis period all images were quality controlled to remove pixels affected by clouds.

Mean daily NDVI values for each field were converted to basal crop coefficients. Daily precipitation was estimated based on assembly and review of data from the PRISM Climate Group at Oregon State

University[1]. Daily reference evapotranspiration (ET_o) was estimated based on information from California Irrigation Management Information System (CIMIS) weather stations. Root zone parameters that influence the amount of available soil moisture storage were estimated based on crops and soils present in the Cuyama Basin.

A summary for the 1994 to 2017 analysis period of the annual ET of applied water (ET_{AW}), ET_c (synonymous with ET_a), applied water (AW), deep percolation of applied water (DP_{AW}) and deep percolation of precipitation (DP_{pr}) estimates based on the root zone water balance model is given in the Results section.

Application of remote sensing combined with daily root zone water balance modeling (RS-RZ model) provides an improved methodology for estimation of surface interactions with the groundwater system including net groundwater depletion through estimation of ET of applied water and other fluxes.

2 Introduction

The purpose of this effort is to develop time series estimates of agricultural, urban, and native vegetation water use for the Cuyama Basin from 1996 through 2017. Demand has been quantified at the field scale using a remote-sensing based daily root zone water balance model. Results from this model were used to parameterize an IWFM Demand Calculator (IDC) application that will be incorporated into an IWFM application for the Basin to support GSP development.

3 Methodology

3.1 Daily Root Zone Simulation Model

A conceptual diagram of the various surface layer fluxes of water into and out of the crop root zone is provided in Figure 3.1. The consumptive use of water (i.e., evapotranspiration or ET) is the primary destination of infiltrated precipitation and applied irrigation water within the Cuyama Basin. Quantification of consumptive use was achieved by performing daily calculations of ET for individual fields from October 1994 through December 2017. Evapotranspiration was separated into its evaporation (E) and transpiration (T) components. Additionally, each component was separated into the amount of E or T derived from precipitation or applied water.

[1] PRISM website: http://prism.oregonstate.edu/

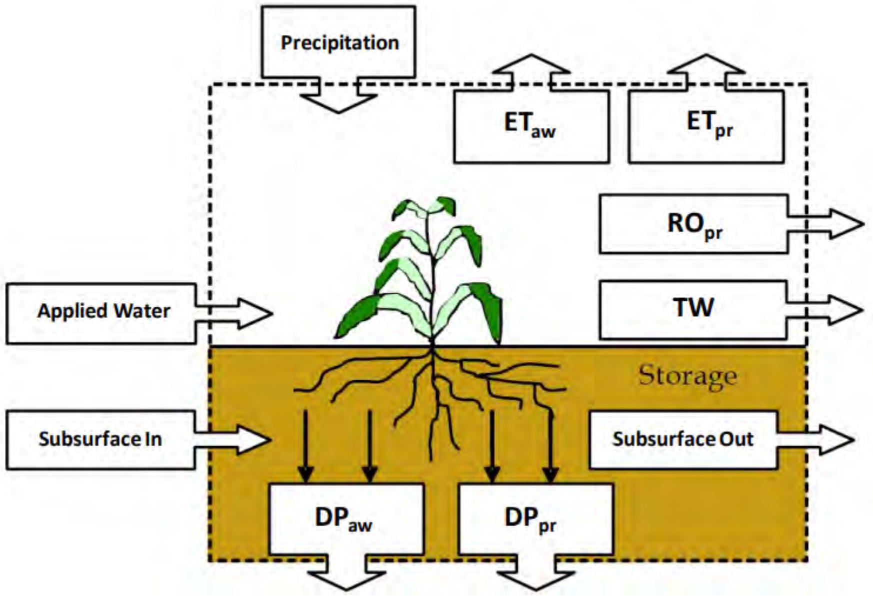

Figure 3.1. Conceptualization of Fluxes of Water Into and Out of the Crop Root Zone

Transpiration was quantified using a remote sensing approach whereby Landsat satellite images acquired from USGS were used to calculate the Normalized Difference Vegetation Index (NDVI), a measure of the amount of green vegetation present. NDVI values were calculated and interpolated for each field over time. NDVI values were then converted to transpiration coefficients that were used to calculate transpiration over time by multiplying daily NDVI by daily reference evapotranspiration (ET_o). Evaporation was quantified by performing a surface layer water balance for the soil based on the dual crop coefficient approach described in FAO Irrigation and Drainage Paper 56 (Allen et al. 1998). On a daily basis, evaporation was calculated based on the most recent wetting event (precipitation or irrigation) and the evaporative demand for the day (ET_o). This methodology is described in greater detail in the Davids Engineering report for the Kaweah Delta Water Conservation District (Davids Engineering 2013).

3.2 Development of Field Boundaries

A spatial coverage of field boundaries was developed for the Cuyama Basin, and individual field polygons were assigned cropping and irrigation method information. For each field polygon, daily water balance calculations were performed for the 1994 to 2017 analysis period, and irrigation events were simulated to estimate the amount of water applied to meet crop irrigation demands. This section describes the development of the field polygon coverage and assignment of cropping and irrigation method attributes.

3.2.1 Development of Field Boundaries

Field boundaries were delineated by combining polygon coverages in GIS format from Bolthouse Farms, Grimmway Farms, LandIQ, and the California Department of Water Resources (DWR). The area encompassed by the field boundary GIS coverage includes only the Cuyama Basin.

3.3 Assignment of Cropping and Irrigation Method

As described previously, crop evapotranspiration (ET) was calculated based on a combination of remote sensing data and simulation of irrigation events in a daily root zone water balance model. A result of the remote sensing approach is that crop transpiration was estimated with little influence from the assigned crop type for each field. Additionally, crop transpiration is the dominant component of ET, meaning that ET estimates are likewise largely independent of the assigned crop type.

Crop evapotranspiration is driven to some extent by the characteristics of the irrigation method and its management, including the area wetted during each irrigation event and the frequency of irrigation. Surface irrigation methods typically wet more of the soil surface than micro-irrigation methods; however, surface irrigated fields are typically irrigated less frequently than their micro-irrigated counterparts. As a result, evaporation rates can be similar among surface and micro-irrigated fields and estimates of evaporation are likewise somewhat independent of the assigned irrigation method. Parameters related to irrigation method were assigned based the predominant irrigation method for each crop, as described by recent historical DWR land and water use surveys.

A key result of the relative insensitivity of the crop ET estimates to crop type or irrigation method (due to the remote sensing approach), is that detailed, accurate assignment of crop types and irrigation methods to each field is not critical to developing reliable estimates of crop ET at the field scale and, more importantly, at coarser scales due to the cancellation of errors in individual field estimates as they are aggregated.

Crop types were assigned to each field based on a combination of data from Bolthouse Farms, Grimmway Farms, LandIQ, and DWR. For fields farmed by Bolthouse or Grimmway, the local data were used. For other fields, available data from LandIQ and DWR were used.

3.4 NDVI Analysis

The amount of green vegetation present over time was estimated for each field polygon based on the Normalized Difference Vegetation Index (NDVI), which is calculated using a combination of red and near infrared reflectances, as measured using multispectral satellite sensors onboard Landsat satellites. NDVI can vary from -1 to 1 and typically varies from approximately 0.15 to 0.2 for bare soil to 0.8 for green vegetation with full cover. Negative NDVI values typically represent water surfaces.

3.4.1 Image Selection

Landsat images are preferred due to their relatively high spatial resolution (30-meter pixels, approx. 0.2 acres in size). A total of 671 raw satellite images were selected and converted to NDVI spanning the period from July 1994 to April 2018. Of the images selected, 207 were from the Landsat 5 satellite, 364 were from the Landsat 7 satellite (first available in 2001), and 100 were from the Landsat 8 satellite (first available in 2013). These images were used to process and download surface reflectance (SR) NDVI from the USGS Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA)[2].

There was sufficient cloud-free Landsat imagery available that no cloud gap filling was necessary. The number of days between image dates ranged from 8 to 96, with an average of 13 days. Generally, there was at least one image selected for each month.

3.4.2 Extraction of NDVI Values by Field and Development of Time Series NDVI Results

Following the preparation of NDVI imagery spanning the analysis period, all images were masked using the Quality Assessment Band (BQA) provided by ESPA to remove pixels affected by clouds and cloud shadows. Then, mean NDVI was extracted from the imagery for each field for each image date. These NDVI values were interpolated across the full analysis period from October 1, 1994 to December 31, 2017 to provide a daily time series of mean NDVI values for each field.

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[2] USGS ESPA website: https://espa.cr.usgs.gov/

Landsat satellite 5 and 7 bandwidths were adjusted to be consistent with bandwidths from Landsat 8 using the following empirical relationship:

$$\text{(Equivalent L8 mean NDVI)} = 0.984*\text{(L5/7 mean NDVI)} - 0.0421 \quad [3.1]$$

3.4.3 Development of Relationships to Estimate Basal Crop Coefficient from NDVI

Basal crop coefficients (K_{cb}) describe the ratio of crop transpiration to reference evapotranspiration (ET_o) as estimated from a ground-based agronomic weather station. By combining K_{cb}, estimated from NDVI, with an evaporation coefficient (K_e), it is possible to calculate a combined crop coefficient ($K_c = K_{cb} + K_e$) over time[3]. By multiplying K_c by ET_o, crop evapotranspiration (ET_c) can be calculated. For this analysis, ET_o, K_{cb}, K_e, and ET_c (synonymous to actual ET, ET_a) were estimated for each field on a daily time step from October 1, 1994 to December 31, 2017.

Mean daily NDVI values for each field were converted to basal crop coefficients using the relationship based on cropping information from the 2007 Tulare County crop survey conducted by DWR, combined with an analysis of actual evapotranspiration (ET_a) by crop conducted using the Surface Energy Balance Algorithm for Land (SEBAL®) for 2007 (Bastiaanssen et al., 2005; SNA, 2009). Specifically, a relationship between actual basal crop coefficients estimated using SEBAL and field-scale mean NDVI values developed by Davids Engineering (2013) was applied using NDVI data from Landsat to calculate daily basal crop coefficients for each field over time[4].

3.5 Precipitation

Daily precipitation was estimated based on assembly and review of data from the PRISM Climate Group at Oregon State University. Specifically, each field was assigned estimated precipitation from the 4km PRISM grid cell within which its centroid fell.

Annual precipitation totals, averaged over the study area for water years 1995 to 2017, are shown in Figure 3.1. Water year precipitation over the study period varied from 2.7 inches in 2014 to 25.0 inches in 1998, with an annual average of 9.3 inches.

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[3] The estimation of Ke is based on a daily 2-stage evaporation model presented in FAO Irrigation and Drainage Paper No. 56 (Allen et al. 1998).

[4] This relationship is developed based on comparison of the combined crop coefficient to NDVI for individual fields but represents only the transpiration component of ET. Thus, the relationship developed predicts the basal crop coefficient, Kcb.

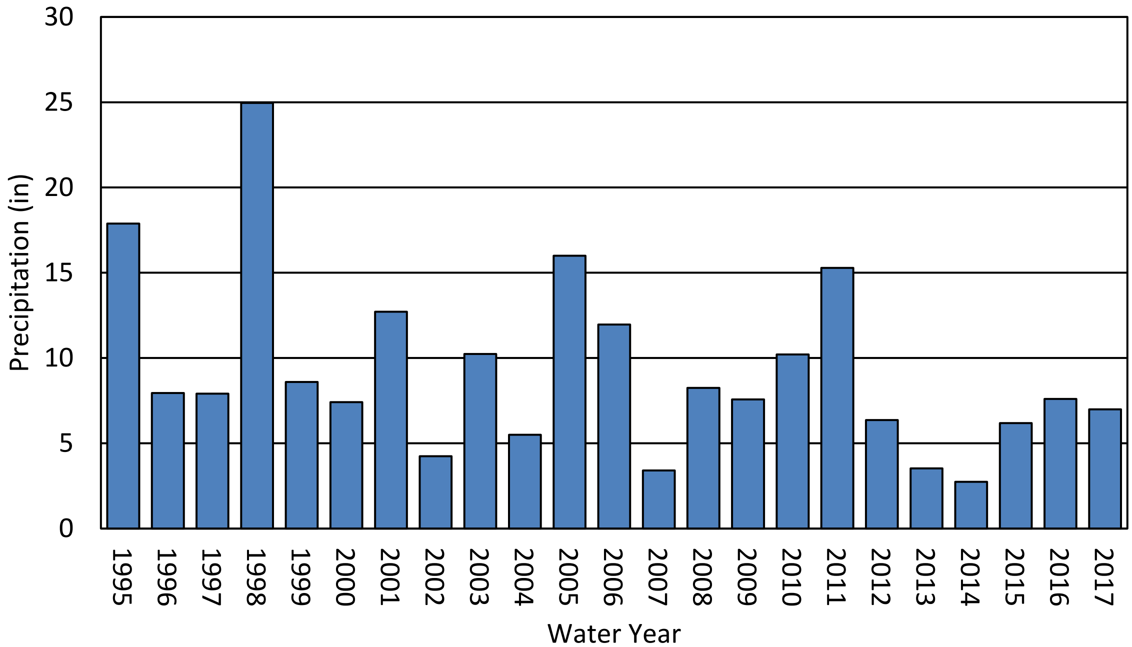

Figure 3.2. Annual Precipitation Totals

3.6 Estimation of Daily Reference Evapotranspiration

Daily reference evapotranspiration (ET_o) was estimated based on information from the California Irrigation Management Information System (CIMIS) weather station at Cuyama. ET_o provides a means of estimating actual crop evapotranspiration over time for each field. Based on review of nearby weather stations with data available during the period of analysis, the Cuyama station (88) was selected based on it being located within the Cuyama Basin, having relatively good fetch, and having available data during the analysis period.

Individual parameters from the available data including incoming solar radiation, air temperature, relative humidity, and wind speed were quality-controlled according to the procedures of Allen et al. (2005). The quality-controlled data were then used to calculate daily ET_o for the available period of record.

3.7 Estimation of Root Zone Water Balance Parameters

Root zone parameters that influence the amount of available soil moisture storage were estimated based on crops and soils present in the Cuyama Basin. Crop parameters of interest include root depth, NRCS curve number[5], and management allowable depletion (MAD). Root depth was estimated by crop group based on published values and a representative mix of individual crops within each crop group for the Cuyama Basin. Curve numbers were estimated based on values published in the NRCS National Engineering Handbook, which provides estimates based on crop type and condition. MAD values by crop were estimated based on values published in FAO Irrigation and Drainage Paper No. 56 (Allen et al., 1998).

[5] The curve number runoff estimation method developed the Natural Resources Conservation Service (NRCS) was used to estimate runoff from precipitation in the model. For additional information, see NRCS NEH Chapter 2 (NRCS, 1993).

Soil hydraulic parameters of interest include field capacity (% by vol.), wilting point (% by vol.), saturated hydraulic conductivity (ft/day), total porosity (% by vol.), and the pore size distribution index (λ, dimensionless). These parameters were estimated by first determining the depth-weighted average soil texture (sand, silt, clay, etc.) based on available NRCS soil surveys. Then, the hydraulic parameters were estimated using hydraulic pedotransfer functions developed by Saxton and Rawls (2006). Next, hydraulic parameters were adjusted within reasonable physical ranges for each soil texture so that the modeled time required for water to drain by gravity from saturation to field capacity agreed with typically accepted agronomic values. Unsaturated hydraulic conductivity (e.g. deep percolation) within the root zone was modeled based on the equation developed by Campbell (1974) for unsaturated flow.

4 Results

4.1 Crop Evapotranspiration

Estimated annual crop evapotranspiration volumes for fields with their centroid within the Cuyama Basin are shown in Figure 4.1. Estimated volumes of ET derived from applied water (ETaw) and precipitation (ETpr) are shown in thousands of acre-feet (taf). Annual ETaw ranged from 38 taf to 53 taf, with an average of 44 taf. Annual ETpr ranged from 4 taf to 33 taf, with an average of 15 taf. Total crop ET ranged from 43 taf to 76 taf, with an average of 58 taf.

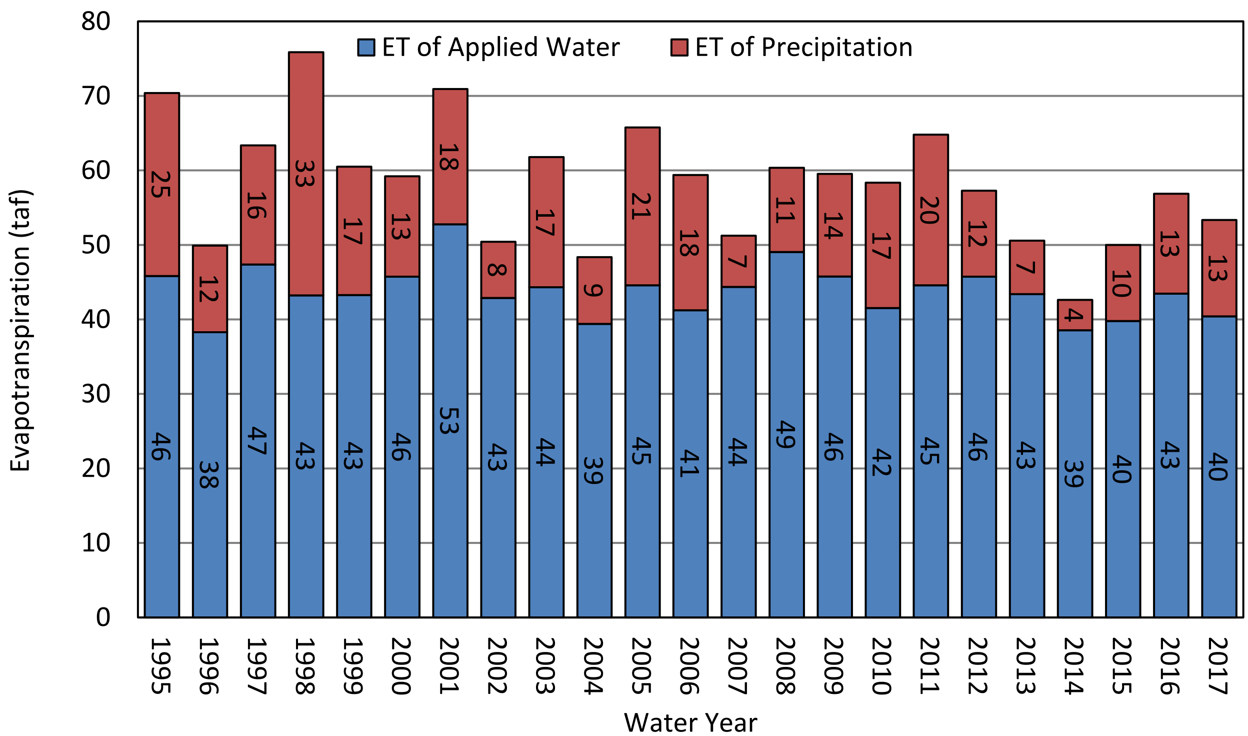

Figure 4.1. Cuyama Basin Crop ET by Water Year

4.2 Irrigation Demands

Annual estimated irrigation demands for fields with their centroid within the Cuyama Basin are shown in Figure 4.2 in thousands of acre feet. Annual demands ranged from 52 taf to 73 taf, with an average of 60 taf.

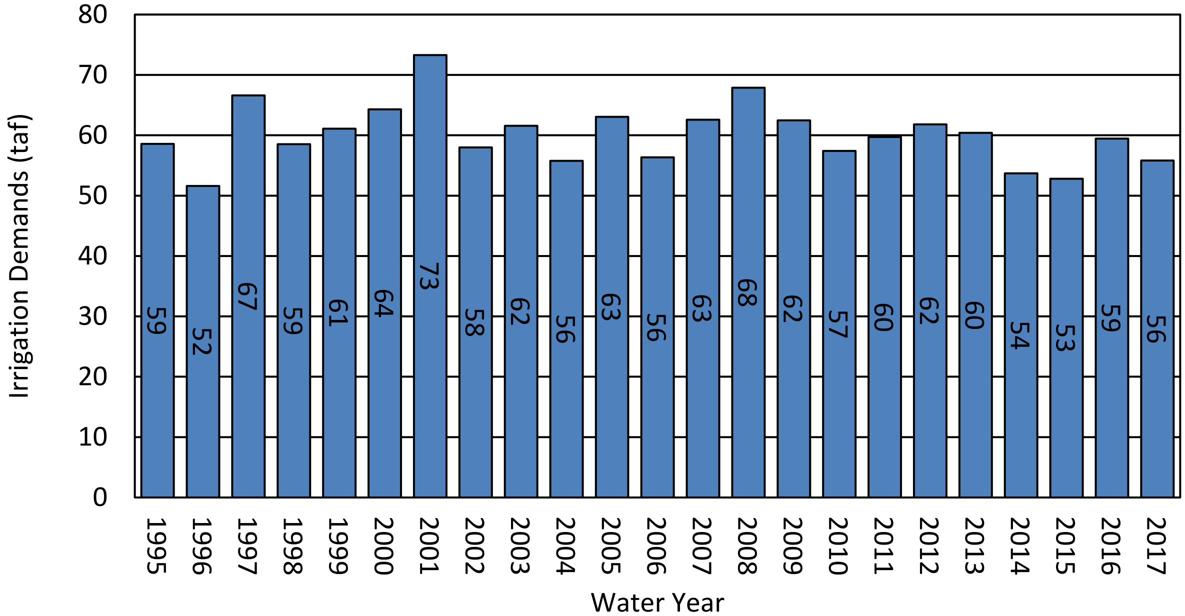

Figure 4.2. Cuyama Basin Irrigation Demands by Water Year

4.3 Deep Percolation

Estimated annual deep percolation volumes for fields with their centroid within the Cuyama Basin are shown in Figure 4.3. Estimated volumes of deep percolation derived from applied water (DPaw) and precipitation (DPpr) are shown in thousands of acre-feet. Annual DPaw ranged from 15 taf to 19 taf, with an average of 17 taf. Annual DPpr ranged from 4 taf to 28 taf, with an average of 10 taf. Total deep percolation ranged from 20 taf to 47 taf, with an average of 27 taf.

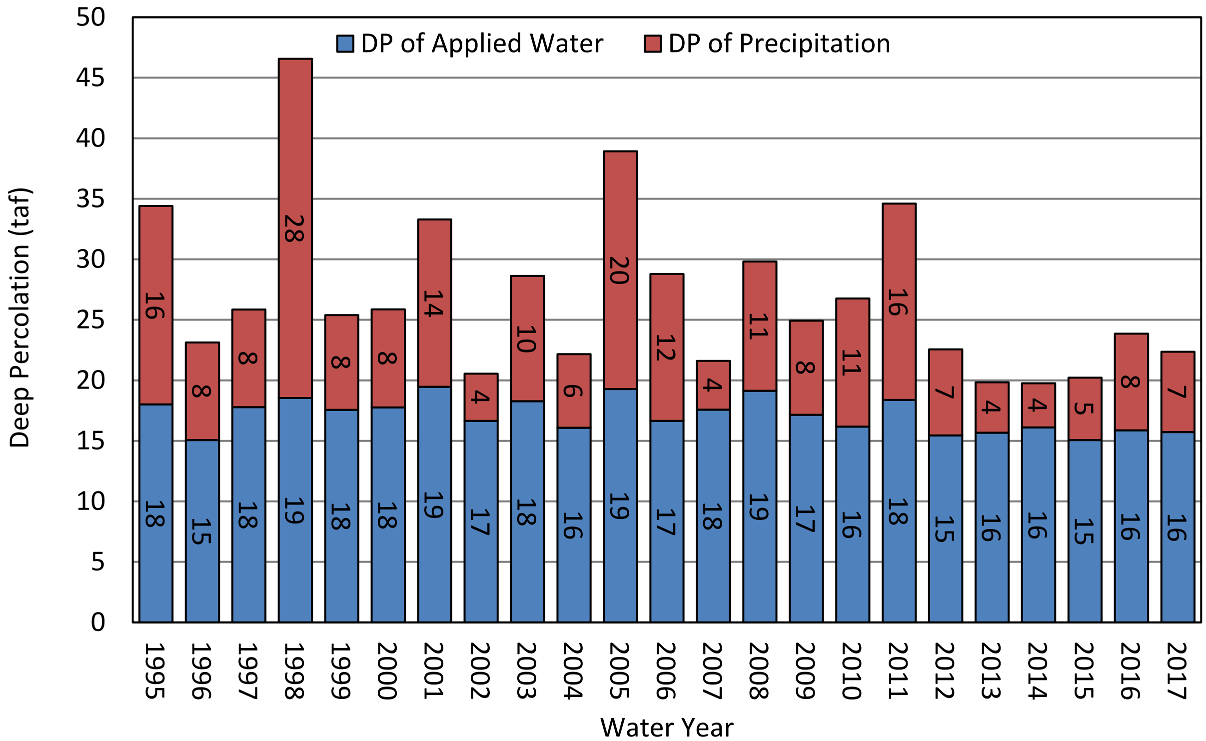

Figure 4.3. Cuyama Basin Deep Percolation by Water Year

4.4 Annual Evapotranspiration by Crop for 2014

Estimated annual evapotranspiration by crop is shown in Figure 4.4, along with the estimated acreage for each crop. Figure 4.4 shows the estimated total ET by crop in inches in 2014. Annual ET ranges from 5 inches for young perennials to 59 inches for alfalfa. The primary crops are carrots, representing 5,500 acres. Grapes, miscellaneous truck crops, pistachios, potatoes and onions and garlic are also significant, representing 948, 838, 761, 668 and 646 acres, respectively.

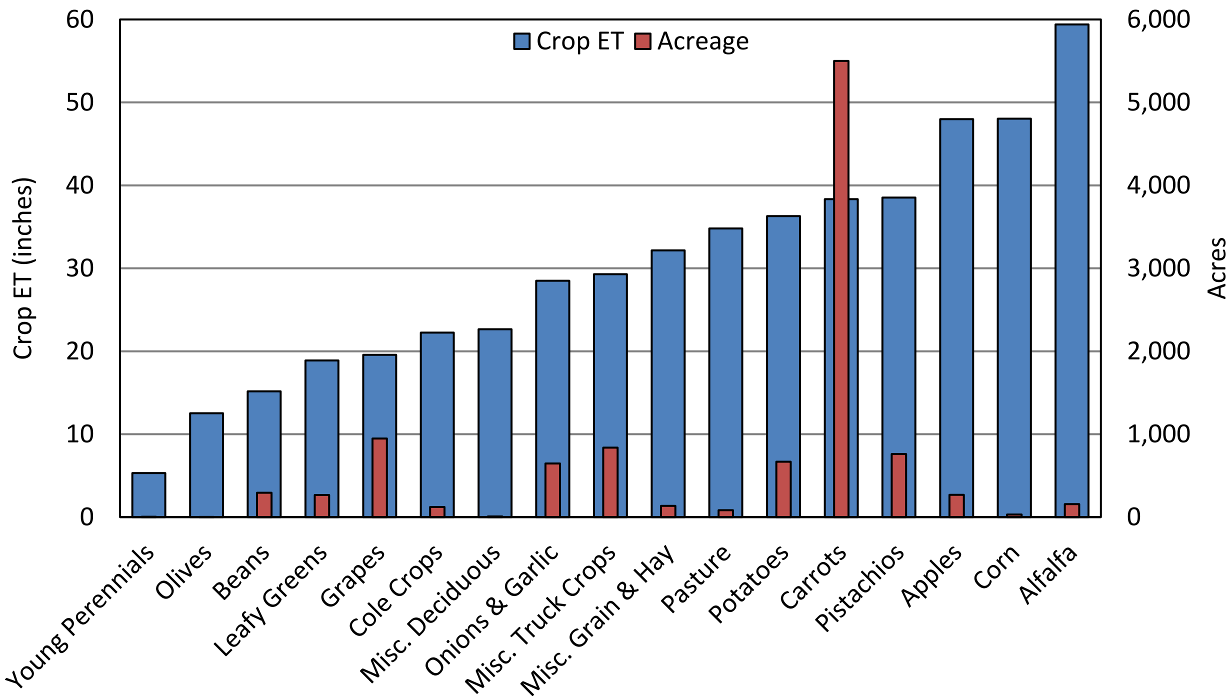

Figure 4.4. Cuyama Basin 2014 ET by Crop and Crop Acreage

Additional monthly plots of the "fraction of reference ET" (ET_{oF}), ET_a and AW by crop for 2014 can be found in the appendix.

5 References

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Allen, R.G., Walter, I.A., Elliott, R.L., Howell, T.A., Itenfisu, D., Jensen, M.E., and R.L. Snyder. 2005. The ASCE Standardized Reference Evapotranspiration Equation. Technical Committee on Standardization of Reference Evapotranspiration. American Society of Civil Engineers. Reston, VA.

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NRCS. 1993. Chapter 2 - Watershed Project Evaluation Procedures. National Engineering Handbook Part 630, Hydrology.

Saxton, K.E. and W.J. Rawls. 2006. Soil Water Characteristic Estimates by Texture and Organic Matter for Hydrologic Solutions. Soil Sci. Soc. Am. J. 70:1569–1578.

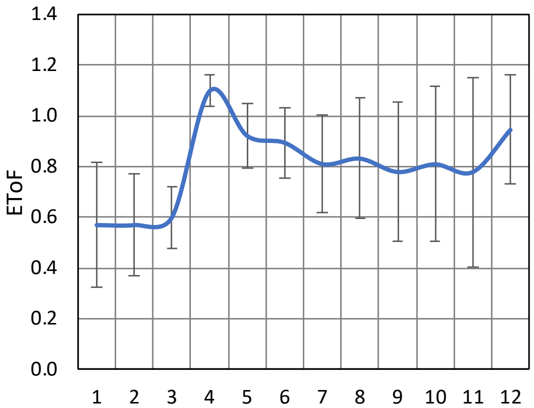
6 Appendix

This appendix includes the following figures:

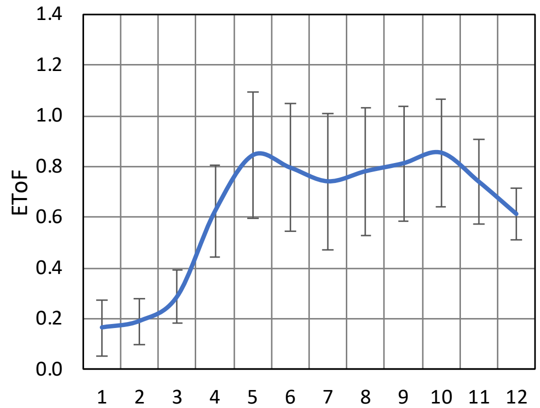
- Average monthly crop water use coefficients or “fraction of reference ET” (EToF) by crop, along with error bars depicting the standard deviation among fields.
- Average monthly crop ET by crop, along with error bars depicting the standard deviation among fields.
- Average monthly applied water by crop, along with error bars depicting the standard deviation among fields.

EToF 2014

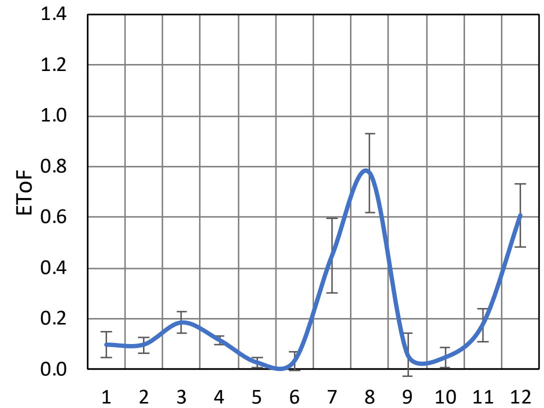
Alfalfa



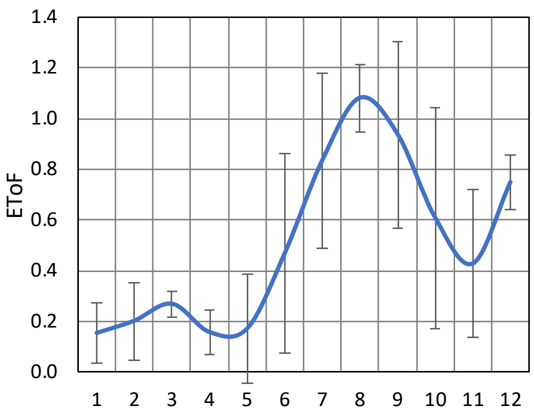
Apples



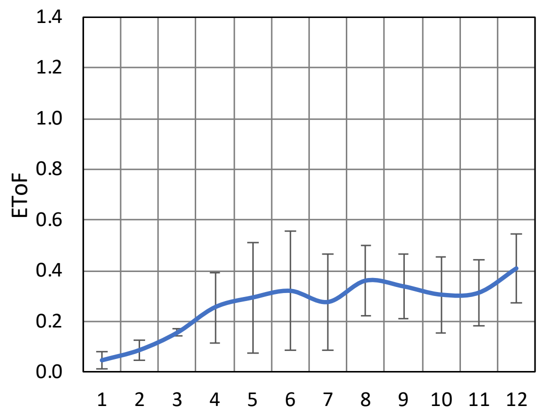
Beans



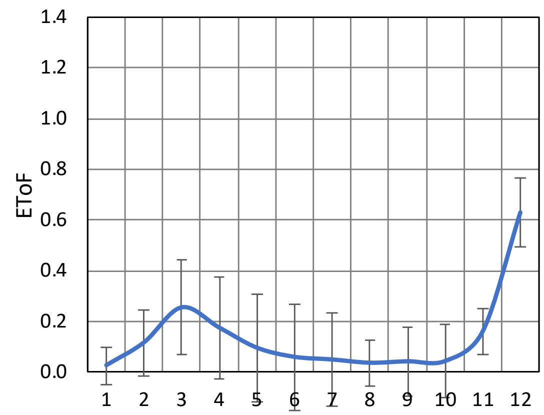
Carrots

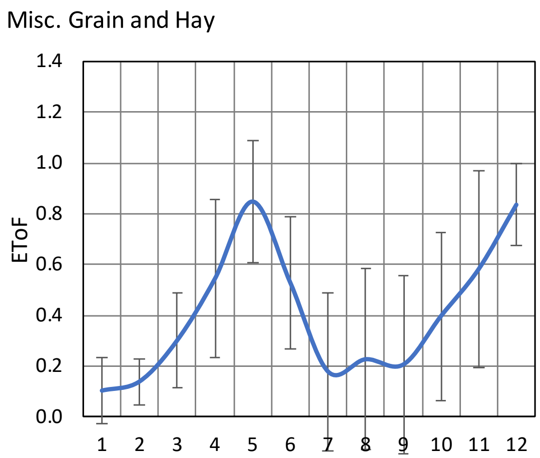


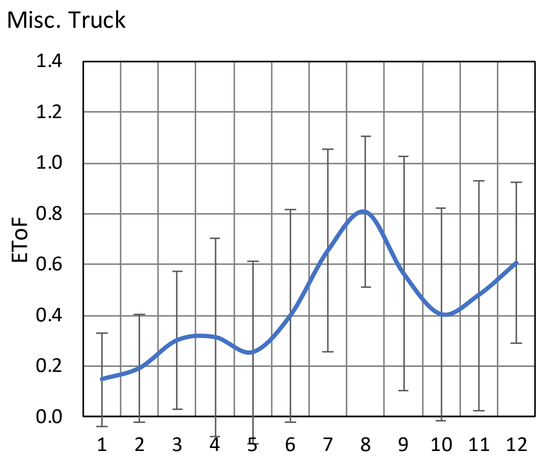
Grapes

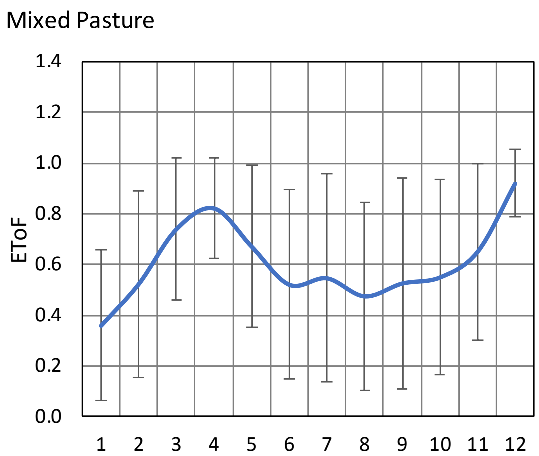


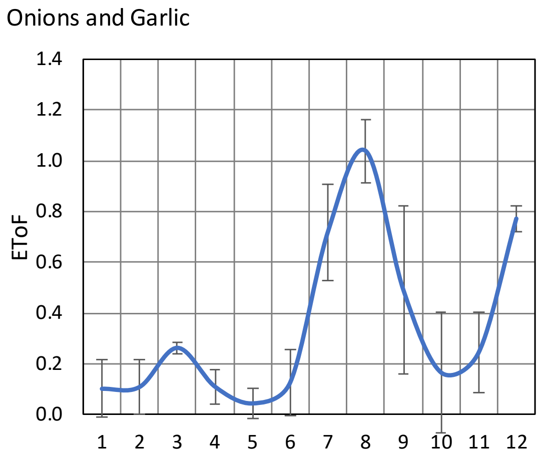
Idle

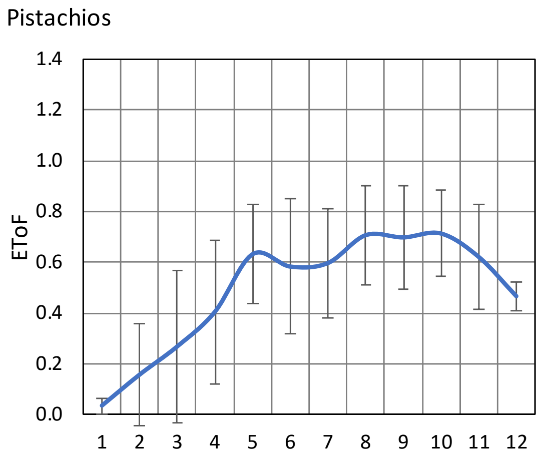


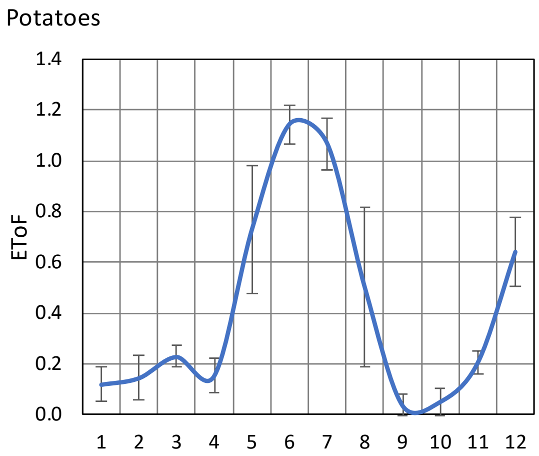

Misc. Grain and Hay
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12


Misc. Truck
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12


Mixed Pasture
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12

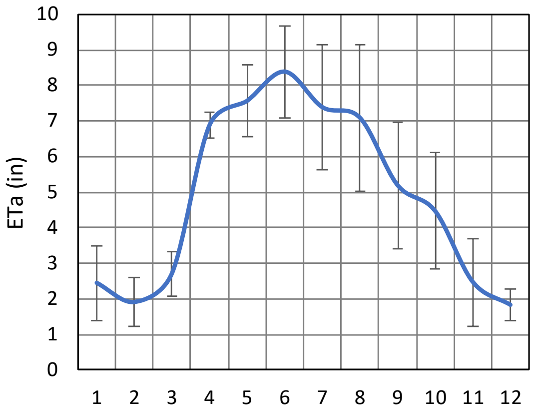

Onions and Garlic
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12


Pistachios
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12

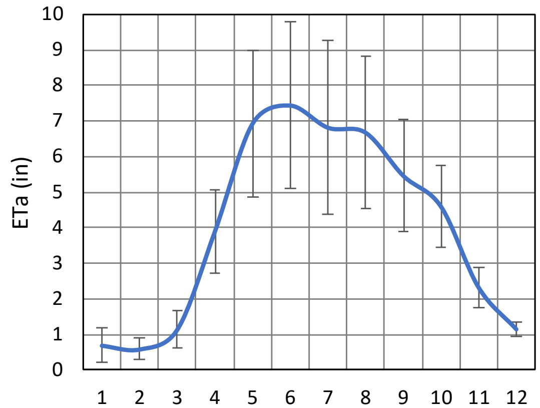

Potatoes
EToF
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12

ETc 2014

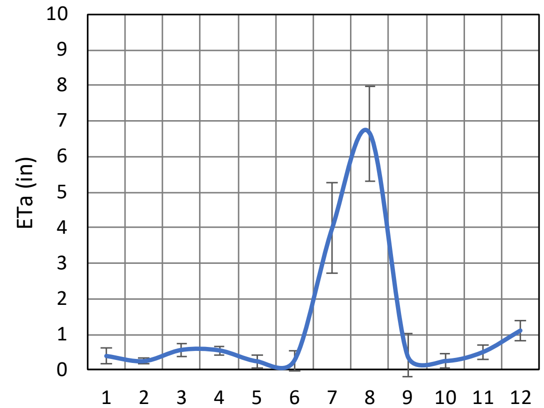
Alfalfa



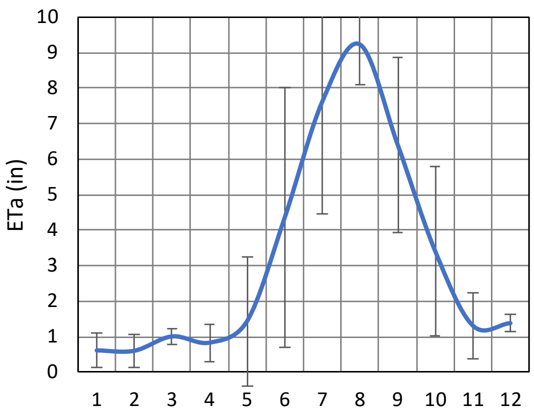
Apples



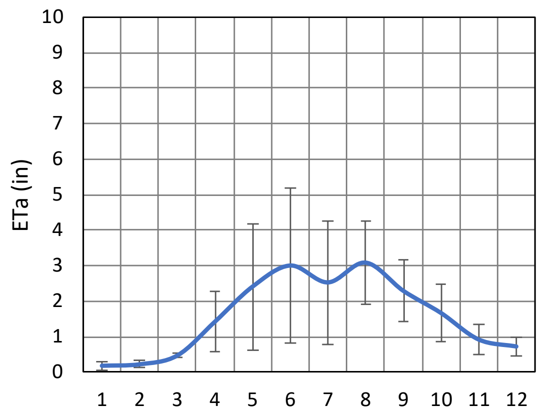
Beans



Carrots



Grapes



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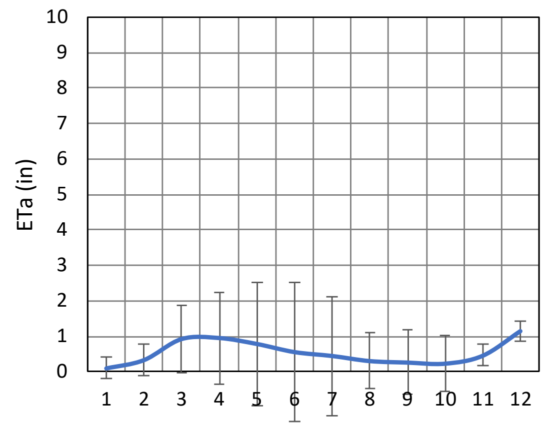

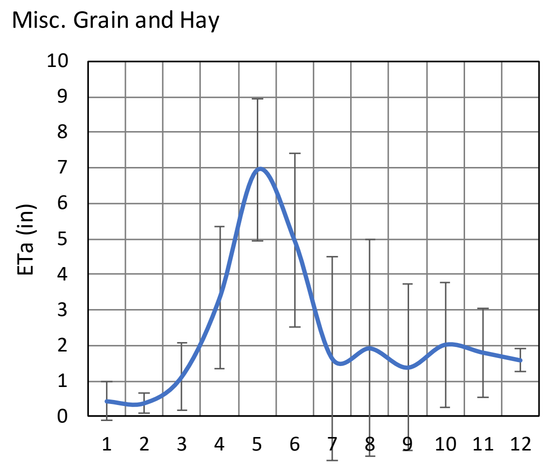
Misc. Grain and Hay
ETa (in)
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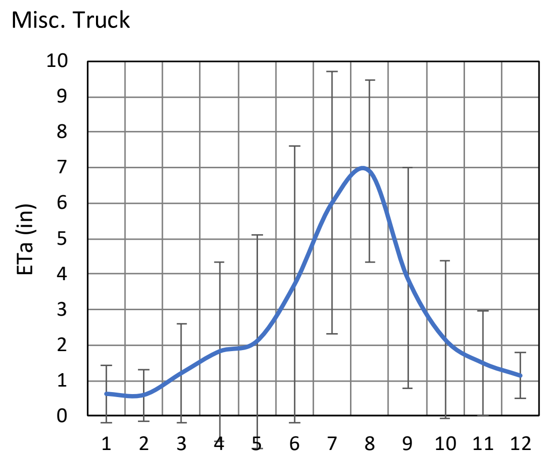
1 2 3 4 5 6 7 8 9 10 11 12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ETa (in)
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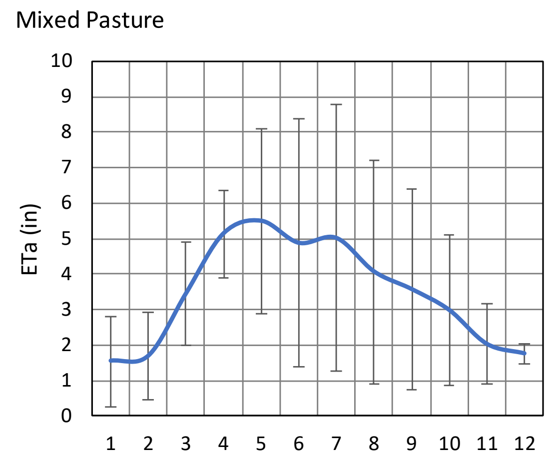
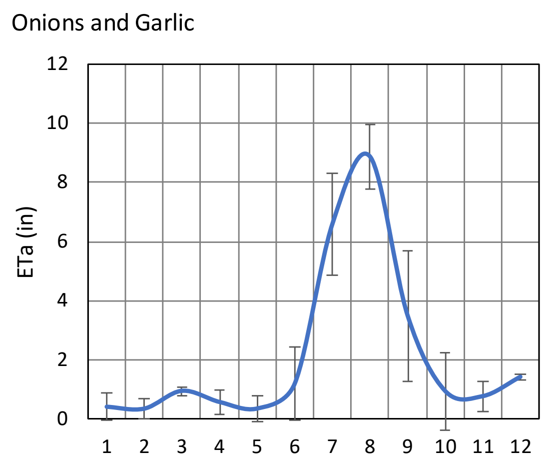
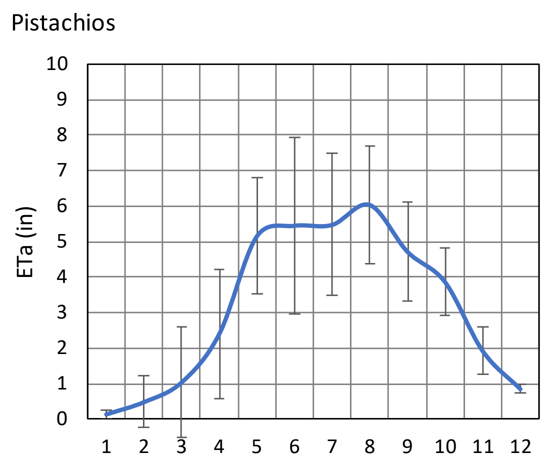

Mixed Pasture
ETa (in)
0 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10 11 12


Onions and Garlic
ETa (in)
0 2 4 6 8 10 12
1 2 3 4 5 6 7 8 9 10 11 12


Pistachios
ETa (in)
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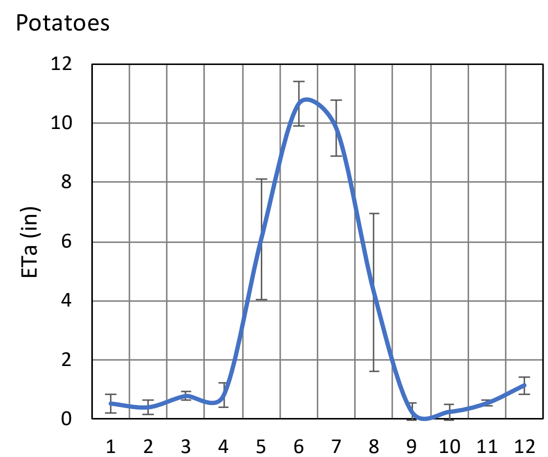
Potatoes
ETa (in)
0 2 4 6 8 10 12
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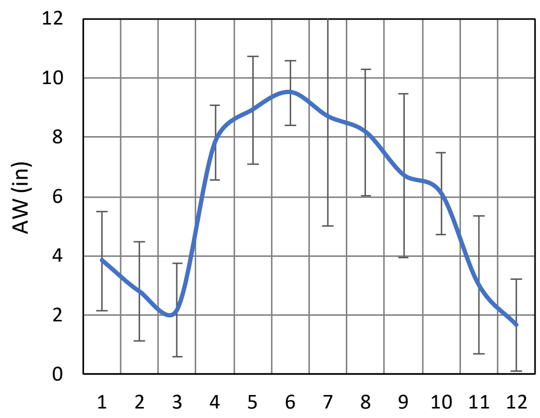
AW 2014

Alfalfa



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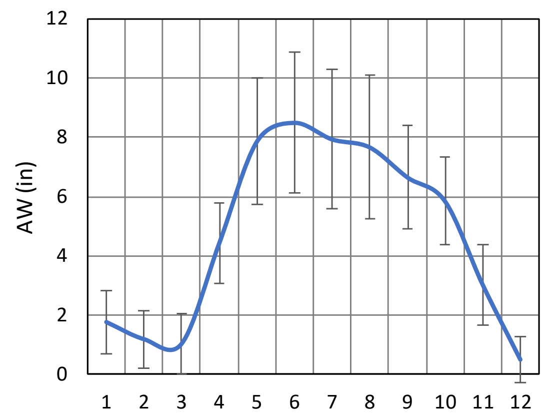
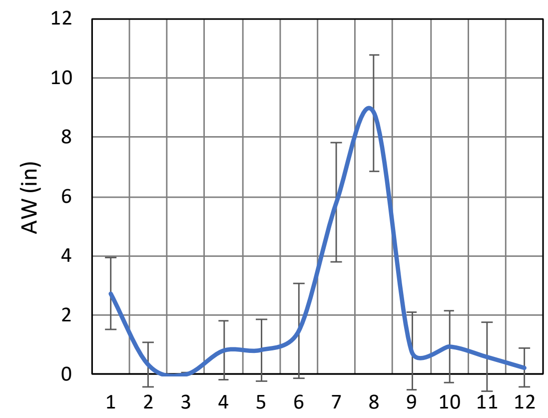


Beans



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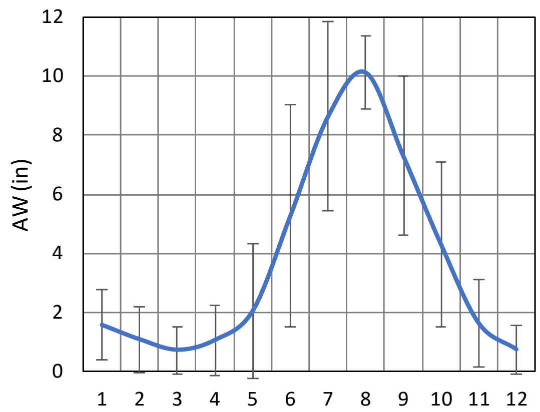

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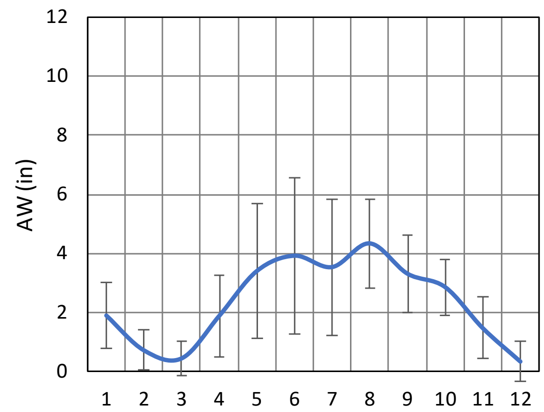

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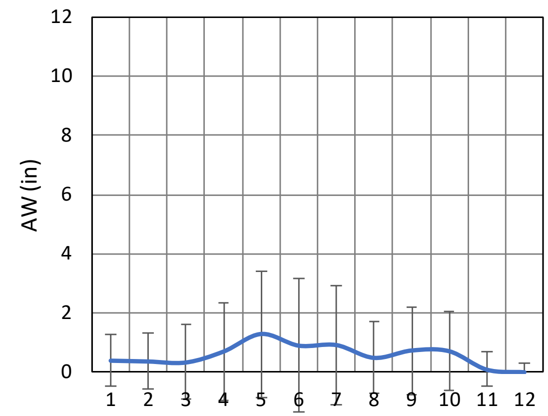
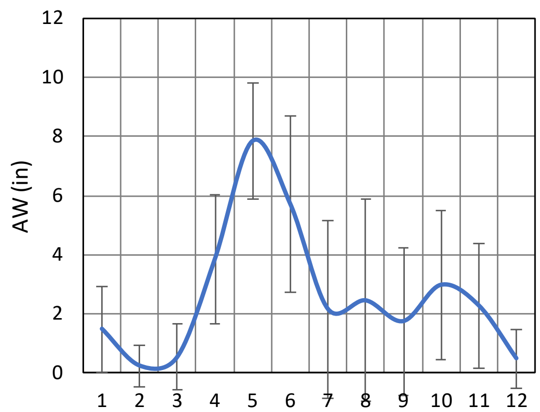
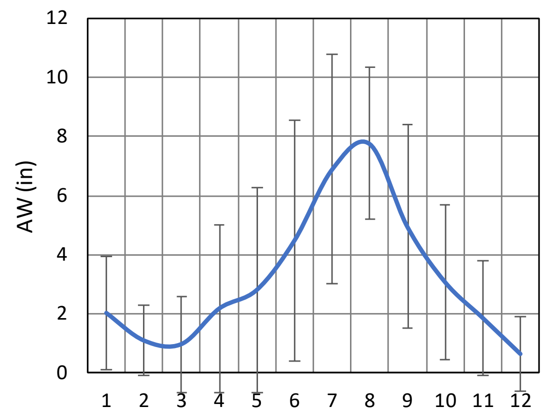


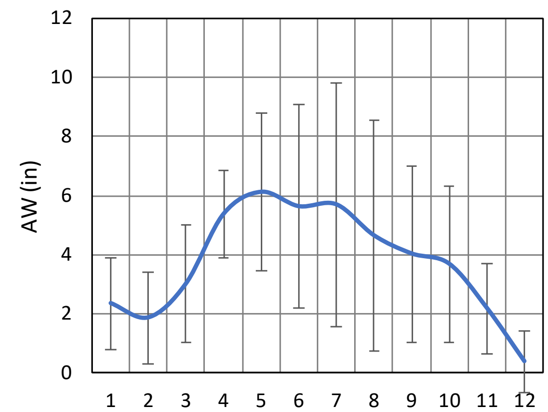
Misc. Grain and Hay



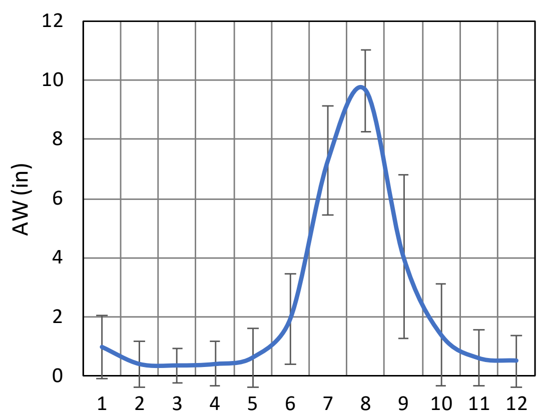
Misc. Truck



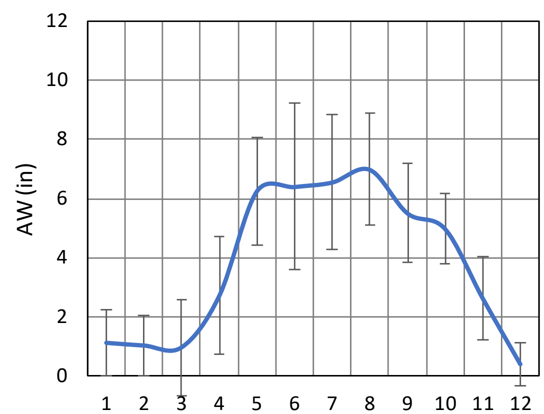
Mixed Pasture



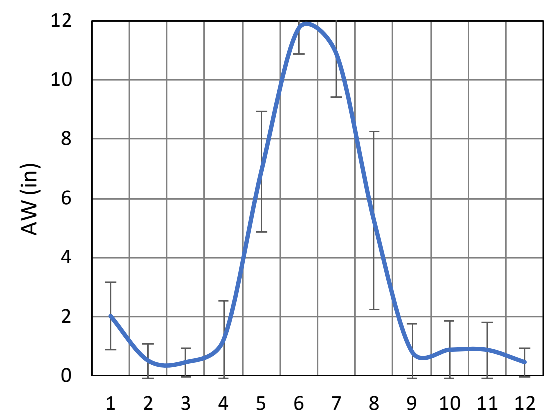
Onions and Garlic



Pistachios



Potatoes



Chapter 2
Appendix D

Technical Memorandum:
Verification of NCCAG-Identified Locations

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TECHNICAL MEMORANDUM

TO: Cuyama Groundwater Sustainability Agency

CC: Brian Van Lienden, Woodard & Curran PM

PREPARED BY: William L. Medlin, PWS, ENV SP

REVIEWED BY: John Ayres and Micah Eggleton

DATE: February 15, 2019

RE: Cuyama GSP Groundwater Dependent Ecosystems Study

As part of the California Sustainable Groundwater Management Act (SGMA), Groundwater Sustainability Agencies (GSAs) are required to develop a Groundwater Sustainability Plan (GSP) to help ensure that groundwater is available for long-term, reliable water supply uses. SGMA was put into place and is enforced by the California Department of Water Resources (DWR). Once implemented, each GSP must address certain key elements such as a baseline groundwater assessment, monitoring, establishing best management practices (BMPs), and setting new regulations with the goal of defining a pathway to achieve sustainable groundwater management within 20 years (DWR 2018).

Within the GSP, a baseline assessment of groundwater conditions must be completed, and part of that assessment includes identification of groundwater dependent ecosystems (GDEs) and an assessment of potential impacts on GDEs. SGMA defines GDEs as “ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.” The identification and determination of GDEs within a groundwater basin is the responsibility of the GSA that governs the basin. This study specifically focuses on GDEs identified within the Cuyama Valley groundwater basin.

1. CUYAMA VALLEY GROUNDWATER BASIN ECOLOGICAL SETTING

The Cuyama Valley groundwater basin encompasses multiple California ecoregions (Griffith et al. 2016). In terms of land area, the dominant ecoregion is the Central California Foothills and Coastal Mountains (6), sub-ecoregion Cuyama Valley (6am). This ecoregion is characterized by its Mediterranean climate with hot, dry summers and cool, moist winters. Typical vegetative communities consist of chaparral and oak woodlands; grasslands are present at some lower elevations and pine forests are observed at high elevations. Most of the region is comprised of open, low mountains and foothills with some irregular plains and narrow valleys in certain locations. More specifically, the Cuyama Valley is a narrow valley with significant agricultural production. The mainstem Cuyama River flows through the center of the valley from southeast to northwest.

A minor part of the Cuyama Valley ground water basin is in the Southern California Mountains (8) ecoregion, in the Northern Transverse Range (8g) sub-ecoregion. This ecoregion, like other California ecoregions, is characterized by a Mediterranean climate of hot, dry summers and cool, moist winters. Chaparral and oak woodland vegetative communities are still ever-present, however the elevations in this ecoregion are higher generally leading to cooler summers and greater rainfall which result in denser vegetation and large areas of coniferous forests. There is a slope effect that causes some significant ecological differences in the Transverse Range. South-facing slopes receive more annual precipitation (30-40 inches) than the northern-facing slopes (15-20 inches), yet evaporation rates contribute to the development of chaparral communities. While on the northern-facing side of parts of the ecoregion, lower temperatures and evaporation coupled with slow snow melt allow for a coniferous forest that transitions to desert montane habitat. Some areas of severe erosion are common where vegetation has been removed via fire, overgrazing, or other land clearing practices. Many areas in this ecoregion are National Forest public land (Griffith et al. 2016). The Cuyama River headwaters (Quatal Canyon Creek, Apache Canyon Creek, and Cuyama Creek) flow through this ecoregion. Figure 1 (Attachment A) illustrates the general location of the Cuyama Valley groundwater basin in the context of the Ecoregions of California.

2. GDE ASSESSMENT AND FIELD VALIDATION

Using Geographic Information Systems (GIS), Woodard & Curran completed a preliminary desktop analysis of the California DWR *Natural Communities Commonly Associated with Groundwater* (NCCAG) geospatial data set. Woodard & Curran attempted to identify NCCAG polygons that appeared to be "probable GDEs" based on the following observations:

- Presence of a mapped USGS spring or seep
- Inundation visible on aerial imagery
- Saturation visible on aerial imagery
- Dense riparian and/or wetland vegetation visible on aerial imagery

Areas that did not exhibit the above characteristics (or similar) were considered "probable non-GDEs" for purposes of this study. Reference Figure 2 (Attachment A) for geospatial representation of our basin-wide GDE desktop assessment.

In addition to the preliminary desktop analysis of the NCCAG data set, Woodard & Curran also completed a preliminary GDE field validation study throughout portions of the Cuyama Valley groundwater basin. The field study was conducted only on publicly accessible lands (including the Los Padres National Forest) where the NCCAG data set indicated potential presence of GDEs. Field observations were made at NCCAG-mapped seeps, springs, and at other riparian habitats to document plant communities, aquatic or semi-aquatic wildlife, indicators of surface and subsurface hydrology, presence of hydric soils, and other relevant ecological and hydrological data. Photographs were taken in the four cardinal directions (north, east, south, west) at each field validation assessment location, and additional photographs were taken of plant species and other relevant ecological data. Global Positioning System (GPS) points were also collected using a sub-meter Trimble Geo 7x GPS unit at the field validation assessment locations. Preliminary determinations were made at these field assessment locations as to whether an area would be classified as a GDE. Figure 3 (Attachment A) shows the locations of GDE field validation assessment data collection points.

3. RESULTS

Out of 486 NCCAG-mapped polygons (128 GDE_wetland and 358 GDE_vegetation), the preliminary desktop analysis yielded 123 "probable GDEs" and 275 "probable non-GDEs" based on the above-described methodology. Individual polygons were not assessed due to time constraints, but rather groupings of similarly-situated riparian areas or clusters of polygons were assessed via GIS for probability of GDE classification.

The preliminary GDE field validation study assessed six (6) locations in the field on publicly accessible lands. All field assessment sites were in the Los Padres National Forest public lands. One (1) location was along the upper mainstem of the Cuyama River, and the other five (5) locations were in the Apache Canyon Creek watershed. Table 1 below describes each of the field assessment sites in more detail.

Table 1: GDE Field Validation Data Collection Sites

GPS Data Point Name	Latitude / Longitude	NCCAG-Mapped Polygon?	NCCAG Vegetation / Wetland Type	Dominant Plant Species Observed	Other Notes
probable Non-GDE 1	34.760116 N, 119.419661 W	Yes	Vegetation - Riversidean Alluvial Scrub	*Hesperoyucca whipplei, Arctostaphylos glauca, Lepidospartum squamatum, Ericameria nauseosa, Eriogonum fasiculatum, Bromus carinatus*	Soils at data point are sandy, dry and friable; would not stay in soil auger. This location does not appear to be a GDE.
probable Non-GDE 2	34.761994 N 119.375711 W	Yes	Vegetation - Scalebroom	*Lepidospartum squamatum, Ericameria nauseosa, Eriogonum fasiculatum*	Soils at data point are dry and friable; Some pines and junipers are growing in the riparian zone adjacent to river bed; no evidence of hydrology that persists beyond flashy storm events. This location does not appear to be a GDE.
GDE 1	34.778902 N 119.341961 W	No	N/A	*Juncus xiphoides, Juncus patens, Typha domingensis, Scirpus microcarpus, Salix exigua, Salix laevigata, Castilleja sp., Isoetes howellii*	A small stream is flowing at this location and hydrophytic vegetation is present throughout the channel; brown algae observed in flowing stream; crystallized salt or other calcic material observed on stream channel sediments; soils are saturated to the surface in this area. This location appears to be a GDE.
GDE 2	34.801748 N 119.293979 W	Yes	Wetland - Palustrine, Scrub-Shrub, Seasonally Saturated	*Clematis ligusticifolia, Juncus effusus, Salix laevigata, Urtica dioica*	Data point is located at US Forest Service Nettle Springs Campground; USGS mapped spring indicated at data point; groundwater is seeping out of the hillside at this data point; soils sampled on hillslope are hydric and saturated at the surface; water flows in a small channel for approximately 300-500 feet downstream of the spring before drying up. This location appears to be a GDE.
GDE 3	34.772312 N 119.346965 W	No	N/A	*Salix lasiolepis, Baccharis salicifolia, Baccharis pilularis Distichlis spicata, Artemisia californica,*	Data point is located within a small floodplain depression willow thicket. Hydrophytes are present and soils are saturated at

				Juncus patens, Anemopsis californica, Leymus triticoides	the surface by what appears to be groundwater. Soils are hydric. This location appears to be a GDE.
GDE 4	34.773548 N 119.346732 W	Yes	Vegetation - Riparian Mixed Shrub	*Salix laevigata, Juncus patens, Leymus triticoides, Anemopsis californica, Melilotus sp., Isoetes howellii*	A small stream is flowing at this location and hydrophytic vegetation is present throughout the channel; crystallized salt or other calcic material observed on stream channel sediments; soils are saturated to the surface in this area. This location appears to be a GDE.

4. CONCLUSIONS

The Cuyama Valley groundwater basin is a significantly stressed aquifer due to several factors including climate, industrial-scale agriculture, oil and gas exploration and production, ranching, and other land uses. The combination of these factors has drawn the groundwater down to greater than 600 feet below the ground surface in some locations, and this affects GDEs by limiting the amount of groundwater available to ecological communities living at the surface. Especially affected is the Cuyama River mainstem which was observed to be dry throughout much of its reach that was visible during our preliminary GDE field validation study.

However, there do appear to be some GDEs present within the Cuyama Valley groundwater basin as indicated in Table 1. All these areas (GDE 1 – 4) were located within the headwaters of the Cuyama River along Apache Canyon Creek and its floodplain. Areas mapped by the NCCAG data set as seeps and/or springs and the immediately downstream riparian corridors were among the GDEs that were assessed in the field. These locations had hydrophytic vegetation and other near-surface hydrologic indicators that would suggest that the ecological community is dependent on groundwater being present for significant durations during the growing season each year.

Due to access limitations because of private property restrictions, further study should be done along the mainstem of the Cuyama River (and other select tributaries) to determine if GDEs are present within the channel or riparian area.

5. REFERENCES

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Griffith, G.E., Omernik, J.M., Smith, D.W., Cook, T.D., Tallyn, E., Moseley, K., and Johnson, C.B., 2016, Ecoregions of California (poster): U.S. Geological Survey Open-File Report 2016–1021, with map, scale 1:1,100,000, http://dx.doi.org/10.3133/ofr20161021.

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ATTACHMENT A: FIGURES

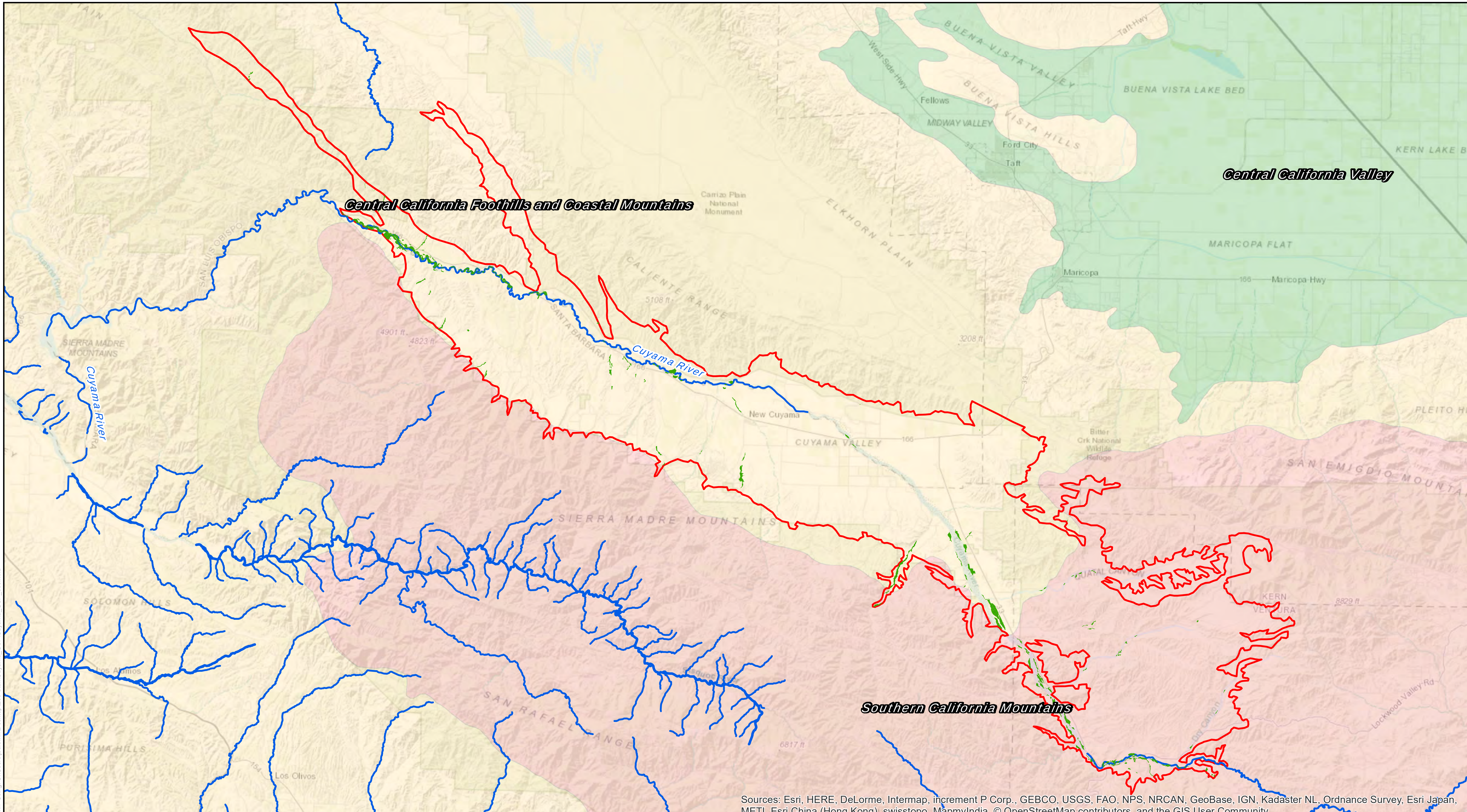

Figure 1:
California Ecoregions
Cuyama Valley Groundwater Basin

Kern, San Luis Obispo, Santa Monica, and Ventura Counties, CA

Legend
- NCCAG Groundwater Dependent Ecosystem
- USGS NHD Streams
- Cuyama Valley Groundwater Basin
- Central California Foothills and Coastal Mountains
- Central California Valley
- Southern California Mountains

0 1.25 2.5 5 Miles

N

WOODARD & CURRAN

Project #: 0011078.01
Map Created: February 2019

Figure Exported: 02/14/2019 By: jbaldwin Using: C:\Users\jbaldwin\Desktop\Eco Stuff\Cuyama_GSP\Cuyama_GSP_eco.mxd

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: USEPA Level III Ecoregions of California(2016), USGS NHD**

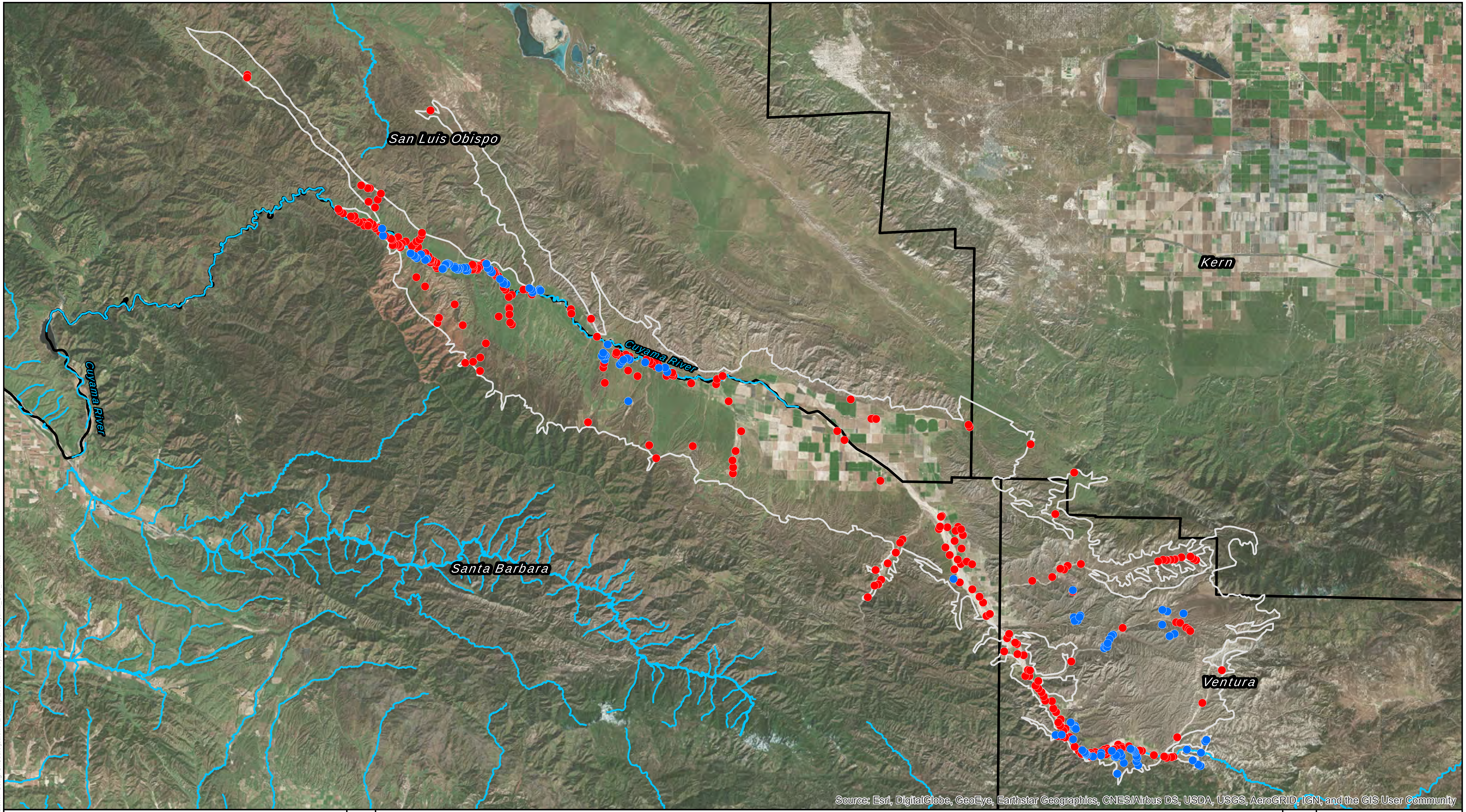

Figure 2: Basin-Wide Groundwater Dependent Ecosystem (GDE) Desktop Assessment

Cuyama Valley Groundwater Basin

Kern, San Luis Obispo, Santa Monica, and Ventura Counties, CA

Legend

- Probable GDE
- Probable Non-GDE
- Streams
- Cuyama Valley Groundwater Basin
- County Boundary

0 1.25 2.5 5 Miles

N

WOODARD & CURRAN

Project #: 0011078.01
Map Created: February 2019

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: USGS NHD**

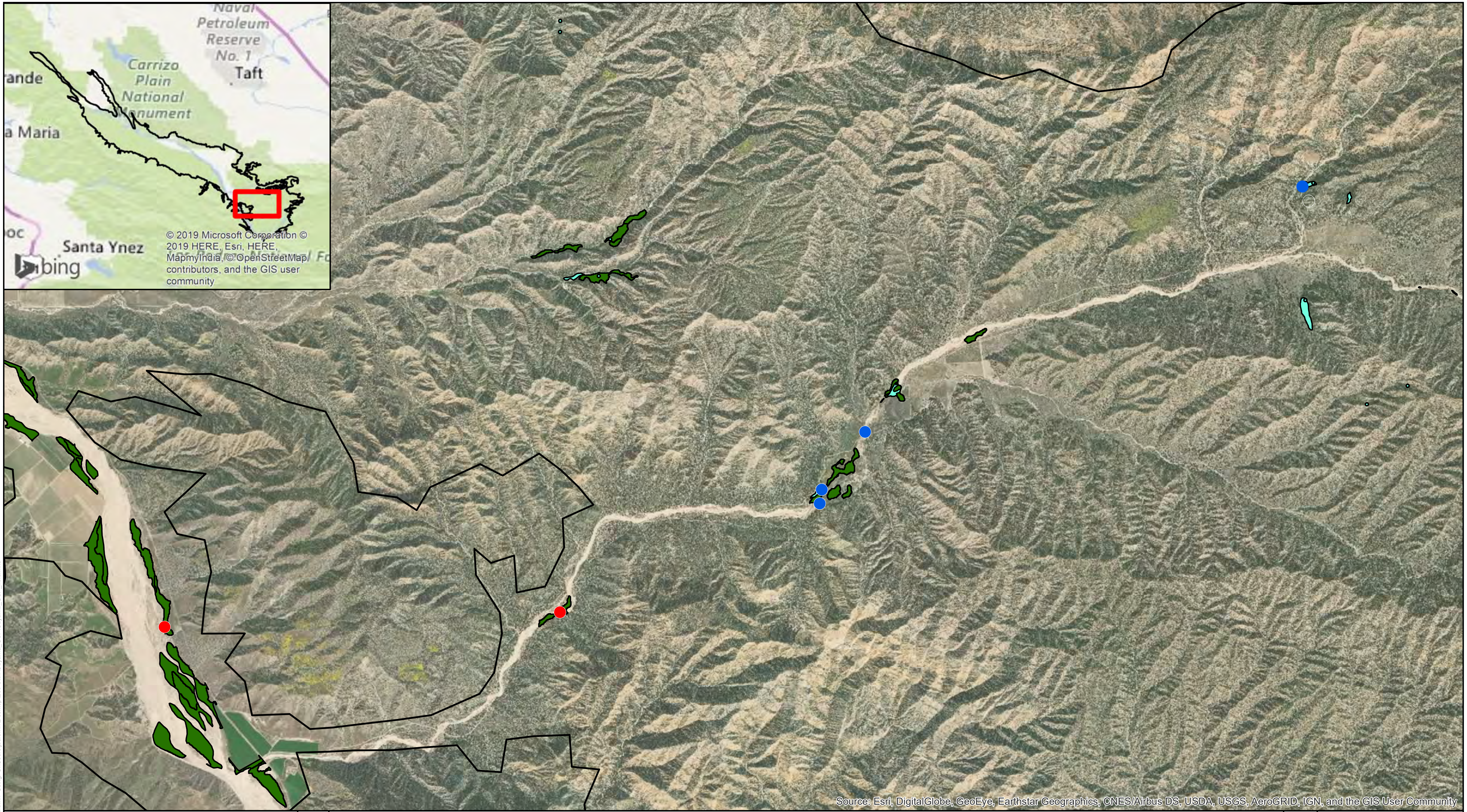

Figure 3: Groundwater Dependent Ecosystem (GDE) Field Validation Sites

Cuyama Valley Groundwater Basin

Kern, San Luis Obispo, Santa Monica, and Ventura Counties, CA

Legend

- Confirmed GDE Data Point
- Probable Non-GDE Data Point
- NCCAG GDE Wetland
- NCCAG GDE Vegetation
- Cuyama Valley Groundwater Basin

1 inch = 3,000 feet

0 1,500 3,000 6,000 Feet

N

WOODARD & CURRAN

Project #: 0011078.01

Map Created: February 2019

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: CADWR - Natural Communities Commonly Associated with Groundwater(2018)**

ATTACHMENT B: PHOTOGRAPHS

Photo Number: 1 | **View Direction: North** | **Date: October 23, 2018**

Description: Representative photograph taken of potential incorrectly mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "probable non-GDE 1".

Photo Number: 2 | **View Direction: South** | **Date: October 23, 2018**

Description: Representative photograph taken of potential incorrectly mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "probable non-GDE 1".

Photo Number: 3 | View Direction: North | Date: October 23, 2018

Description: Representative photograph taken of potential incorrectly mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "probable non-GDE 2".

Photo Number: 4 | View Direction: South | Date: October 23, 2018

Description: Representative photograph taken of potential incorrectly mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "probable non-GDE 2".

Photo Number: 5 | **View Direction: North** | **Date: October 23, 2018**

Description: Representative photograph taken of unmapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 1".

Photo Number: 6 | **View Direction: South** | **Date: July 26, 2018**

Description: Representative photograph taken of unmapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 1".

Photo Number: 7 | **View Direction: North** | **Date: October 23, 2018**

Description: Representative photograph taken of field-verified mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 2".

Photo Number: 8 | **View Direction: South** | **Date: July 26, 2018**

Description: Representative photograph taken of field-verified mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 2".

Photo Number: 9 | **View Direction: North** | **Date: October 23, 2018**

Description: **Representative photograph taken of unmapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 3".**

Photo Number: 10 | **View Direction: South** | **Date: October 23, 2018**

Description: **Representative photograph taken of unmapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 3".**

Photo Number: 11 | **View Direction: East** | **Date: October 23, 2018**

Description: Representative photograph taken of field-verified mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 4".

Photo Number: 12 | **View Direction: South** | **Date: October 23, 2018**

Description: Representative photograph taken of field-verified mapped groundwater dependent ecosystem (CA DWR NCAG dataset 2018). Photo taken a GPS point "GDE 4".