TECHNICAL MEMORANDUM

TO: Mario Iglesias, General Manager NCSD

FROM: Brad Newton, Ph.D., P.G.

RE: Technical Memorandum #39 – Fall 2019 Ground Water Index

DATE: December 18, 2019

INTRODUCTION

Groundwater surface elevations (GSE) underlying the Nipomo Mesa are regularly measured at many places (wells) across the mesa. The Fall 2019 Ground Water Index (GWI) has been computed from GSE measurements collected during fall across the Nipomo Mesa and presented herein along with historical GWI from 1975 to present. Limited measurements of GSE were available for the years 1978, 1982, 1983, 1984, 1994 and 1997, precluding a reliable calculation of GWI for those years.

The Nipomo Mesa Management Area (NMMA) Technical Group (TG) has not reviewed this technical memorandum, its findings, or any presentation of this evaluation.

RESULTS

The Fall 2019 GWI is 40,000 AF (Table 1, Figure 1), a decrease from last year (56,000 AF). The estimated rainfall for this year is approximately 16 inches, approximately 98 percent of the 1975 to present average annual rainfall of 16.2 inches. The GWI has been in decline since the turn of the century, with a severe decline from year 2011 to 2015 related to the drought. However, GWI has been increasing since 2015 despite continued drought conditions, which is likely attributable to the conservation of groundwater production and the above average rainfall of 2017 (29.41 inches). Average annual rainfall for year 2012 to 2019 (12.55 inches) is approximately 77 percent of the 1975 to present average annual rainfall (16.2 inches).

Generally, the GWI has been in decline since the turn of the century, even while rainfall was slightly above average from 1998 to 2012 (Figure 2). Consumptive use of ground water produced is certainly a contributing factor to the GWI (Technical Memorandum #30 - Fall 2014 Ground Water Index and Hydrologic Inventory Analysis, December 10, 2014). Consumptive use of ground water produced is the only significant component of the hydrologic inventory that is currently being managed through conservation and the new water brought to the Nipomo Mesa through the Nipomo Supplemental Water Project (NSWP). An additional benefit

Newton Geo-Hydrology Consulting Services
P.O. Box 2081, Santa Barbara, CA 93120 • (805) 636-6619 • bnewton@NGHcorp.com

of new NSWP water brought to the Nipomo Mesa is that the return flow increases the amount of groundwater available for future production.

The 2019 Key Well Index (KWI) value (15.9 ft msl) has slightly increased from the previous year (13.8 ft msl), and remains in the Severe Water Shortage Condition (see Methodology for KWI explanation). The KWI generally follows the same historical trends as the GWI (Figure 1).

METHODOLOGY

The calculation of spring and fall GWI are based on GSE measurements regularly made by San Luis Obispo County Department of Public Works (SLO DPW), NCSD, USGS, and Woodlands. The integration of GSE data is accomplished by using computer software to interpolate between measurements and calculate GWI within the principal production aquifer assuming an unconfined aquifer and a specific yield of 11.7 percent. Limited measurements of GSE were available for the years 1982, 1983, 1984, 1994 and 1997, precluding a reliable calculation of GWI for those years.

Groundwater Surface Elevation Measurements

Groundwater surface elevation data were obtained from SLO DPW, NCSD, USGS, and Woodlands. SLO DPW measures GSE in monitoring wells during the spring (April) and the fall (October) of each year. Woodlands and NCSD measures GSE in their monitoring wells monthly. For the years 1975 to 1999, available representative GSE data were used to compute GWI. For the years 2000 to 2017, only GSE data from the same 45 wells were used to compute GWI.

The GSE data was reviewed in combination with well completion reports and historical hydrographic records in order to exclude measurements that likely do not accurately represent static water levels within the principal production aquifer. Wells that do not access the principal production aquifer or were otherwise determined to not accurately represent static water levels within the aquifer were not included in analysis.

Groundwater Surface Interpolation

The individual GSE measurements from each year were used to produce a GSE field by interpolation using the inverse distance weighting method.

Ground Water Index

The GWI is defined as the annually normalized value of the saturated volume above sea level and bedrock multiplied by the specific yield of 11.7 percent. The GWI is comprised from approximately 45 ground water elevation measurements made by the County of San Luis

Obispo each April and October. The value of the Ground Water Index was computed for an area approximately similar to the NMMA Boundary. The base of the saturated volume is mean sea level surface (elevation equals zero) or the bedrock, whichever is higher. The bedrock surface elevation is based on Figure 11: Base of Potential Water-Bearing Sediments, presented in the report, Water Resources of the Arroyo Grande – Nipomo Mesa Area (DWR 2002). The bedrock surface elevation was preliminarily verified by reviewing driller reports obtained from DWR. The specific yield is based on the average weighted specific yield measurement made at wells within the Nipomo Mesa Hydrologic Sub-Area (DWR 2002, pg. 86). The GWI is similar to the Key Well Index presented in the Nipomo Mesa Management Area Technical Group annual report to the Court, but is not directly comparable.

Key Well Index

The Key Well Index (KWI) was developed by the NMMA Technical Group from eight inland wells representing the whole of the groundwater basin within the NMMA. The Key Well Index was defined for each year from 1975 to present as the average of the normalized spring groundwater data from each well. The lowest value of the Key Well Index could be considered the "historical low" within the NMMA.

REFERENCES

Department of Water Resources (DWR). 2002. Water Resources of the Arroyo Grande – Nipomo Mesa Area, Southern District Report. 2002.

Spring and Fall Groundwater Index (GWI)

Year	Rainfall Water Year (inches)	Spring GWI (Acre-Feet)	Number of Wells	Fall GWI (Acre-Feet)	Number of Wells	Spring to Fall Difference (Acre-Feet)
1975	17.29	99,000	54	91,000	54	8,000
1976	13.45	82,000	45	76,000	65	6,000
1977	10.23	64,000	59	54,000	63	10,000
1978	30.00	84,000	62	---	35	---
1979	15.80	72,000	57	77,000	63	(5,000)
1980	16.57	88,000	55	89,000	46	(1,000)
1981	14.32	97,000	46	75,000	47	22,000
1982	18.58	123,000	42	---	31	---
1983	33.09	---	35	95,000	42	---
1984	10.38	---	14	76,000	37	---
1985	12.20	106,000	37	82,000	41	24,000
1986	16.85	98,000	51	67,000	51	31,000
1987	11.29	83,000	48	71,000	52	12,000
1988	12.66	80,000	51	66,000	49	14,000
1989	12.25	59,000	47	47,000	57	12,000
1990	7.12	62,000	55	49,000	53	13,000
1991	13.18	62,000	52	55,000	54	7,000
1992	15.66	61,000	52	35,000	48	26,000
1993	20.17	72,000	54	52,000	61	20,000
1994	12.15	60,000	54	---	36	---
1995	25.87	87,000	35	74,000	52	13,000
1996	16.54	76,000	45	62,000	57	14,000
1997	20.50	---	20	91,000	48	---
1998	33.67	105,000	41	93,000	44	12,000
1999	12.98	106,000	56	88,000	49	18,000
2000	14.47	108,000	44	84,000	41	24,000
2001	21.62	118,000	43	85,000	35	33,000
2002	10.25	96,000	29	79,000	41	17,000
2003	11.39	94,000	37	66,000	42	28,000
2004	12.57	89,000	42	81,000	35	8,000
2005	22.23	98,000	38	79,000	39	19,000
2006	20.83	107,000	44	78,000	41	29,000
2007	7.11	93,000	44	66,000	42	27,000
2008	15.18	83,000	43	65,000	42	18,000
2009	10.31	76,000	44	65,000	43	11,000
2010	20.07	80,000	45	67,000	42	13,000
2011	34.05	87,000	43	81,000	43	6,000
2012	15.35	89,000	45	65,000	44	24,000
2013	8.07	67,000	45	42,000	43	25,000
2014	4.72	57,000	45	47,000	42	10,000
2015	8.65	52,000	42	45,000	39	7,000
2016	11.48	62,000	39	50,000	41	12,000
2017	29.41	70,000	36	52,000	43	18,000
2018	10.16	58,000	42	56,000	38	2,000
2019	16*	57,000	42	40,000	42	17,000

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*: Preliminary value

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Table 1: Spring and Fall GWI computed from Spring 1975 to Spring 2019.

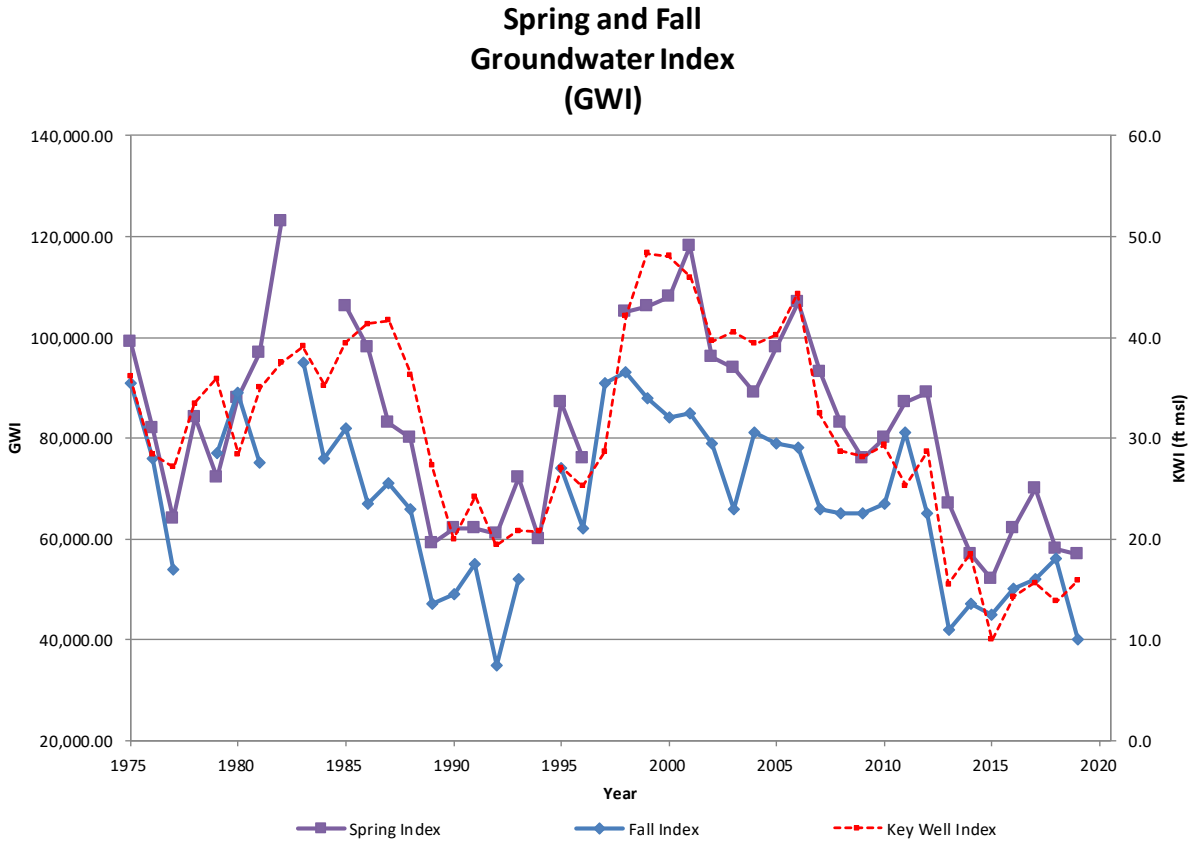

Figure 1: Spring and Fall GWI, and KWI (Spring only) from 1975 to present.

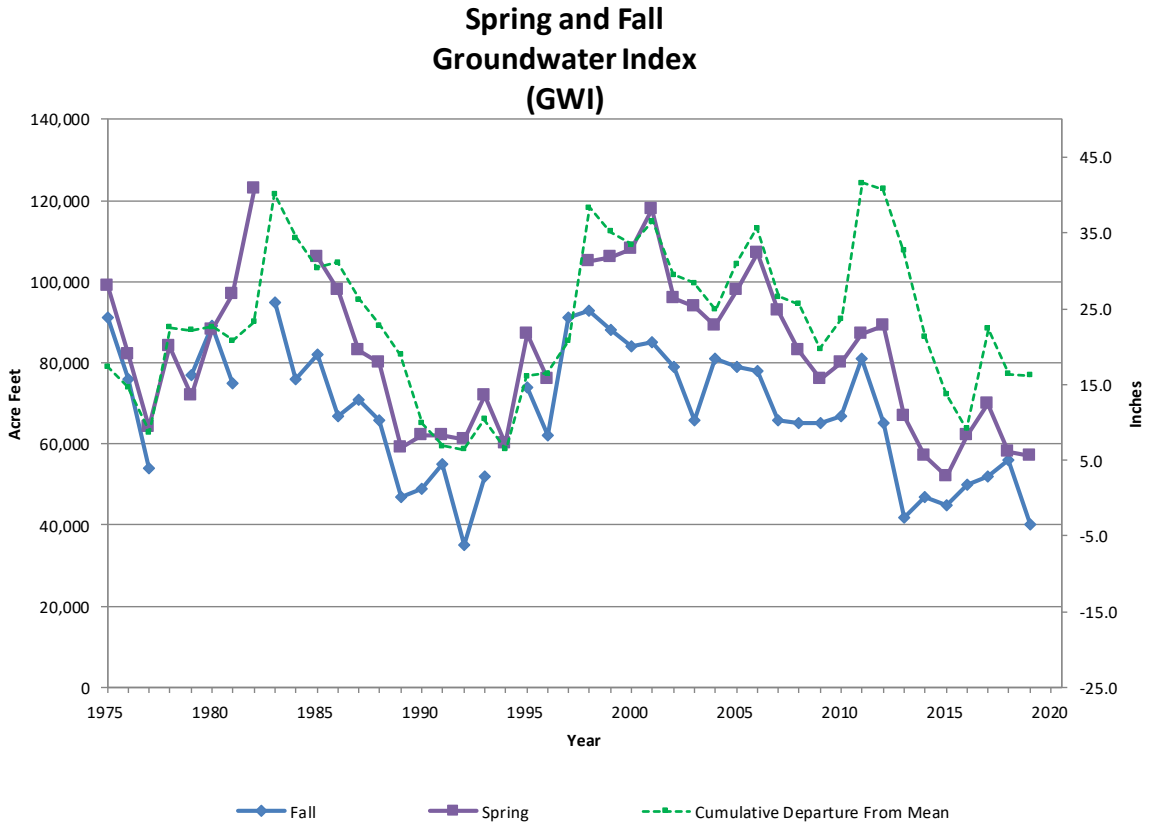

Figure 2: Spring and Fall GWI, and Cumulative Departure of Annual Rainfall from the Mean Rainfall, 1975 to present.