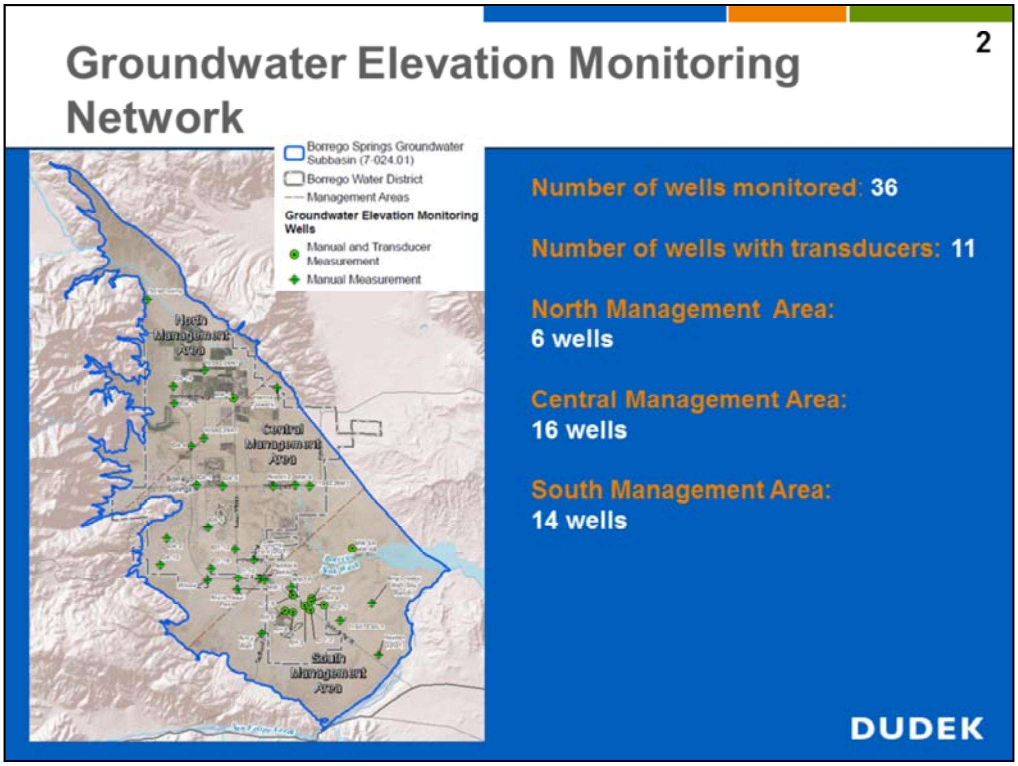

As per Agenda Packet Item IV.A: Informational Items this part of the presentation presents Draft Fall 2017 Groundwater Monitoring Results for Groundwater Levels and Water Quality.

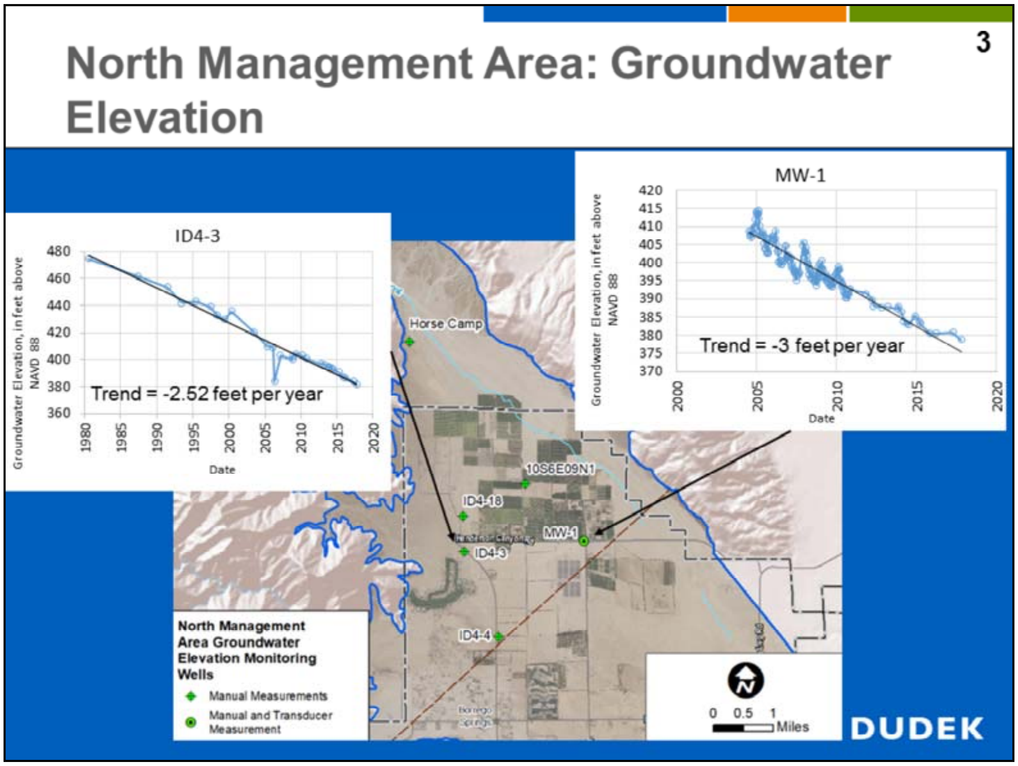



The Borrego Valley Groundwater Sustainability Agency (GSA) groundwater elevation monitoring network currently consists of 36 wells in the Borrego Springs Subbasin. An additional 4 wells are monitored for groundwater levels in the Ocotillo Wells Subbasin. This presentation is focused on the results of the Borrego Springs Subbasin (Subbasin).

Of the 36 wells monitored, 11 of the wells have pressure transducers installed that record groundwater levels at a frequency of every 15 minutes.

Results of groundwater elevation monitoring are presented in the following slides by Subbasin management area, which includes the North Management Area (NMA), Central Management Area (CMA) and South Management Area (SMA). The distribution of wells by management area are 6 wells in the NMA, 16 wells in the CMA and 14 wells in the SMA. As the Borrego Water District (BWD) has included all of their production wells into the GSA network and they predominantly pump form the CMA, there are more wells located in the CMA.

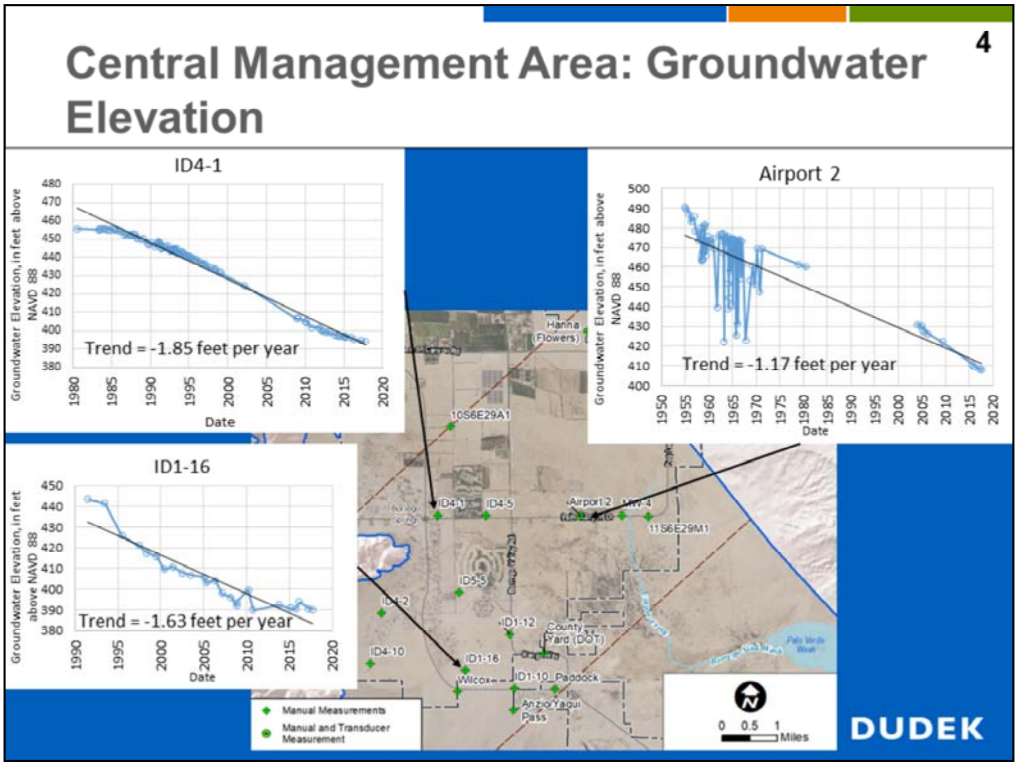
The Borrego Valley GSA monitored groundwater elevations in the spring and fall of 2017. Historical groundwater level data were previously collected by the U.S. Geological Survey (USGS), Department of Water Resources (DWR), BWD and County of San Diego (County).




Historical groundwater levels in wells ID4-3 and MW-1 indicate a declining trend of 2.5 to 3 feet per year in the NMA. Each well hydrograph has a distinct period of record and number of data points based on when the well was originally drilled, lifespan of the well and frequency of data collection.

Proximity of groundwater elevation monitoring wells to pumping centers located in the area of agricultural irrigation will influence overall trend of groundwater level elevations.

Thus, groundwater elevations should be monitored at multiple wells during Groundwater Sustainability Plan (GSP) implementation to track trends and progress toward GSP goals.




Historical groundwater levels in wells ID4-1, ID1-16 and Airport 2 indicate a declining trend of 1.85, 1.63 and 1.17 feet per year, respectively in the in the CMA.

The historical rate of decline is the CMA is less than the NMA. This is likely because less overall groundwater extraction occurs in the CMA. However, groundwater levels will likely continue to decline in the CMA at the current rate of groundwater extraction regardless of future agricultural land fallowing in the NMA.

Thus, declining groundwater levels are not limited to areas where agricultural extraction is predominantly occurring (i.e. NMA).[1] Reduction in groundwater extraction will likely also need to occur in the CMA in order to reach Subbasin sustainability.

1. Recreation pumping also occurs in the NMA for the De Anza Country Club.

## South Management Area: Groundwater Elevation

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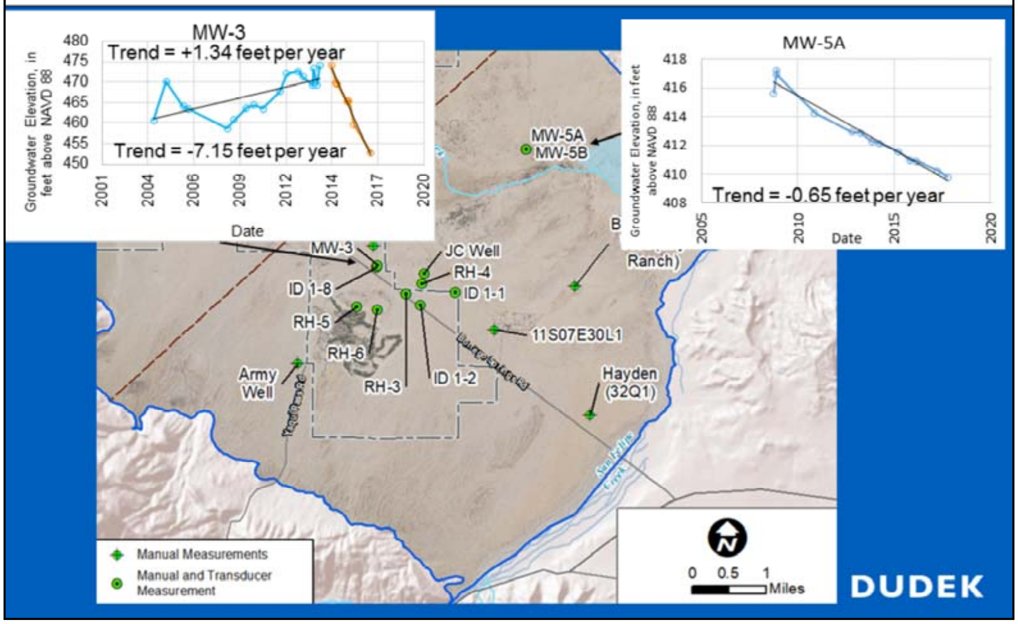
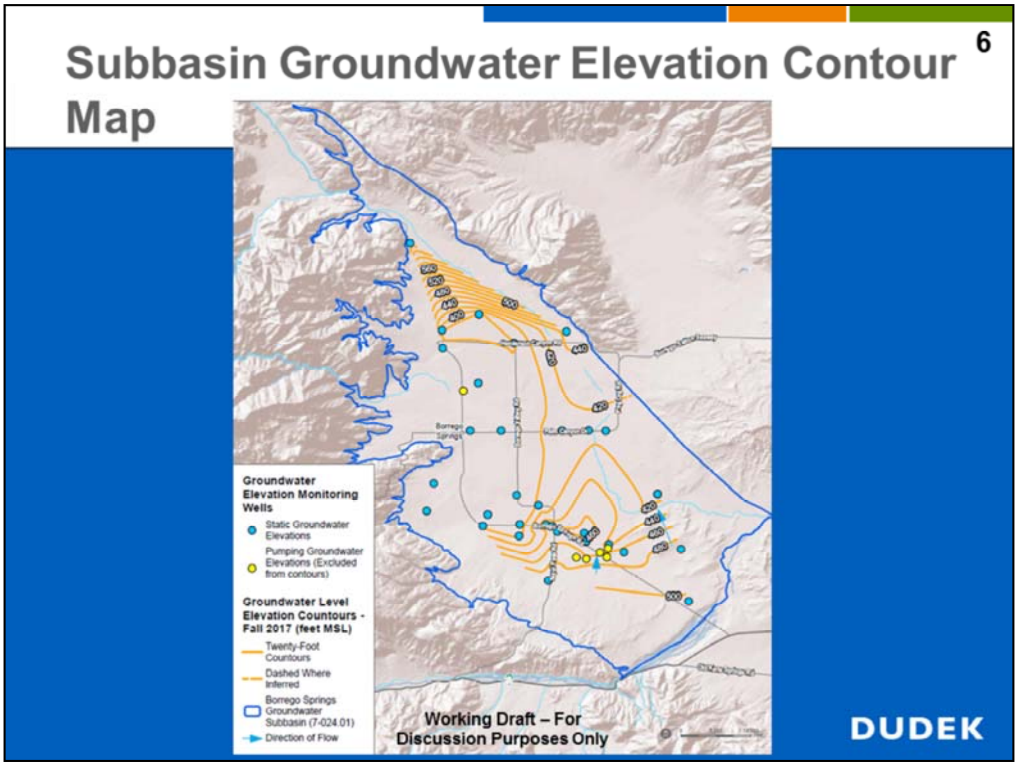



Well MW-5A located in the Borrego Sink in the SMA indicates a declining groundwater trend of 0.65 feet per year. This well is located far from large pumping centers.

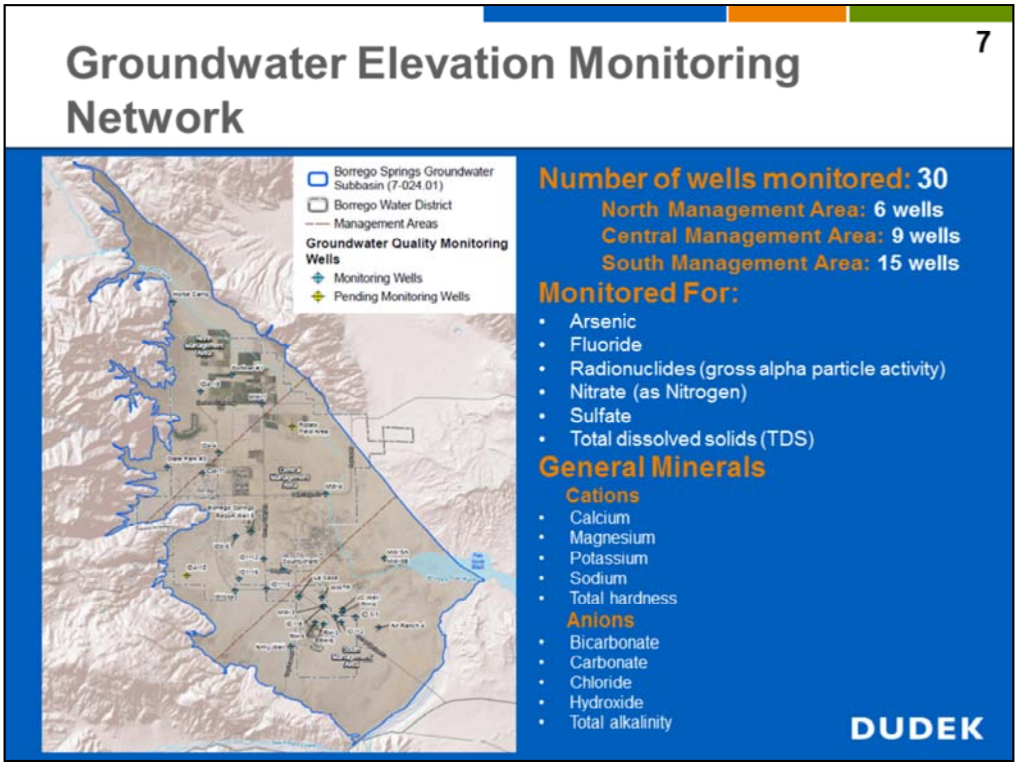
The groundwater trend at Well MW-3 in the SMA reflects the change in water supply for the Rams Hill Golf Course. Prior to 2013 the Rams Hill Golf Course was predominantly supplied from wells located in the CMA. Groundwater levels are observed to be recovering at a rate of 1.34 feet per year in well MW-3 over the 10-year period from 2004 to 2014. This likely was a result of recharge from applied irrigation water at the Rams Hill Golf Course and lack of appreciable groundwater pumping in the SMA during this timeframe.

When the Rams Hill Golf Course reopened in 2014/2015, the water supply was provided by new wells primarily located in the SMA. Pumping from Rams Hill wells in combination with some Borrego Water District (BWD) pumping from well ID1-8 has resulted in a declining groundwater level trend of 7.15 feet per year over the 3 year period from 2015 to 2017. Reduction in groundwater extraction will need to occur in the SMA in order to reach Subbasin sustainability.




Groundwater elevation contours shown in the figure represent groundwater elevations measured in the fall of 2017. Groundwater elevations decrease from the north end (at Coyote Creek), and south end (near Rams Hill) of the Subbasin towards the center of the Subbasin near the town of Borrego Springs, where the current groundwater elevation is approximately 400 feet above the NAVD 88 datum.

Steep groundwater gradients, represented by the closely spaced groundwater contours, and a groundwater elevation depression in the NMA are due to groundwater extraction for agriculture. The lowest groundwater contour elevation in the Subbasin of 380 feet above the NAVD 88 datum is located north of Henderson Canyon Road in the NMA.

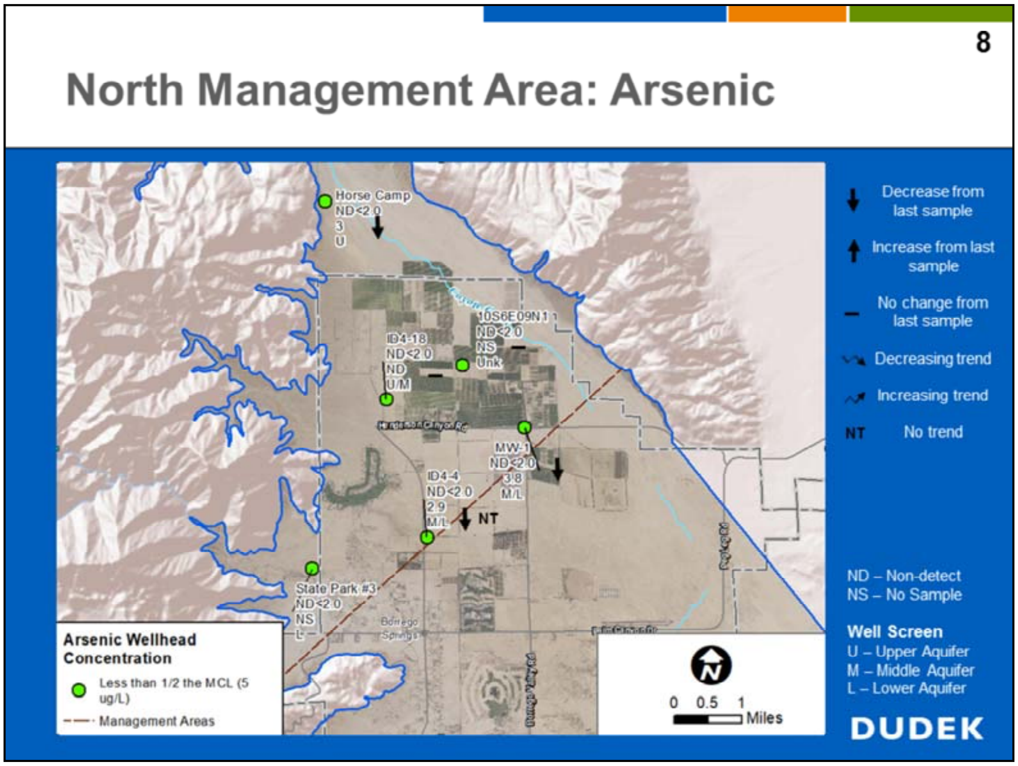



In the fall of 2017, the Borrego Valley Groundwater Sustainability Agency (GSA) performed baseline groundwater quality sampling in order to establish baseline water quality and track water quality trends.

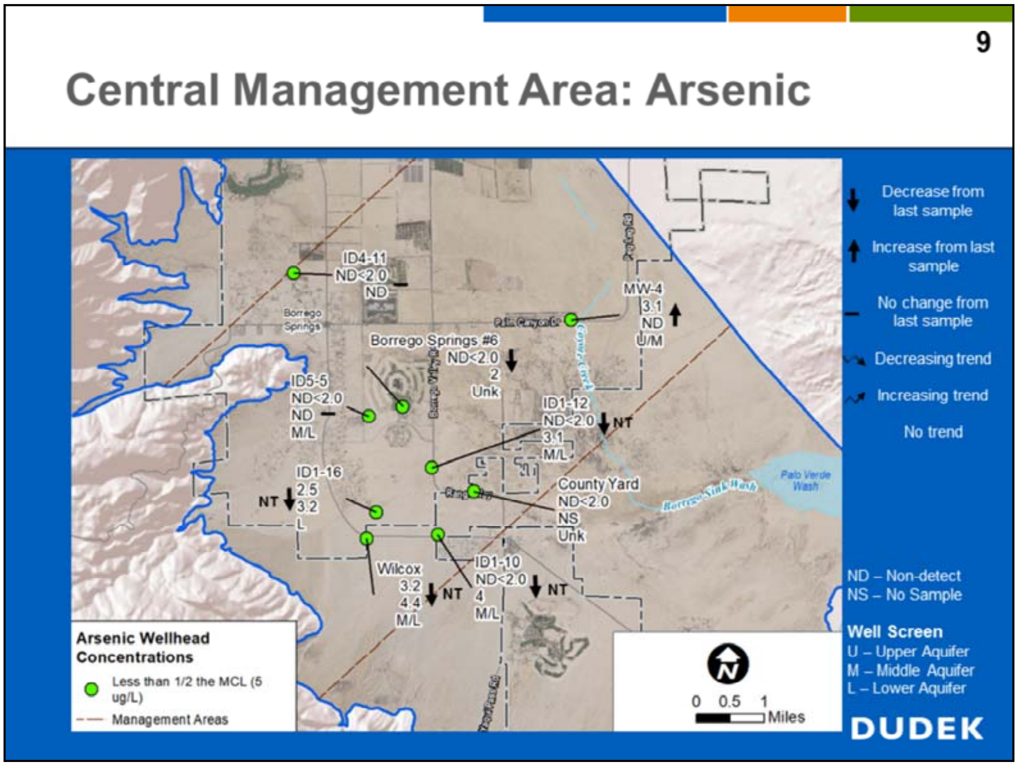
Wells were monitored for potential constituents of concern (COCs) that were previously identified in part by the U.S. Geological Survey (USGS) and Department of Water Resources (DWR), and a review of the historical data by the GSA Consultant team.

The COCs include arsenic, fluoride, radionuclides, nitrate, sulfate and total dissolved solids (TDS). Additionally, general minerals were analyzed to establish baseline water quality and for comparison of water quality type for all wells monitored.

Results of groundwater quality are presented in the following slides by Subbasin Management Area and by constituent of concern.




Groundwater quality results are color coded by concentration relative to their respective California drinking water maximum contaminant level (MCL). Green dots represent concentrations less than one-half the MCL. Yellow dots represent concentrations less than the MCL and red dots indicate concentrations above the MCL. Symbology is used to indicate concentration change since the last sample. The downward arrow represents a decrease, the upward arrow represents an increase and dash indicates no change since the last sample. Additionally, water quality trends over time are indicated by the decreasing wave symbol, increasing wave symbol and “NT” abbreviation. Aquifers intercepted by the well are indicated by the abbreviations “U”, “M”, and “L” to designate the upper, middle and lower aquifers. Individual wells may intercept one or more aquifer units. Arsenic concentrations from the 6 wells sampled in the NMA were all less than one-half the drinking water MCL. The primary MCL for arsenic is 10 micrograms per liter. The fall 2017 results indicate decreasing or stable arsenic concentrations from the previous groundwater sample collected for each of the wells with historical data (indicated by the downward arrow or dash symbol). No historical data were available for the State Park #3 well and well 10S6E09N1. No statistically significant arsenic trend is observed for well ID4-4 (indicated by “NT” abbreviation). A minimum of four samples is required to determine a significant trend. Only well ID4-4 has a sufficient number of historical results to analyze trend. As additional data is collected by the GSA, wells will be continuously tracked to determine water quality trend on a semi-annual basis.



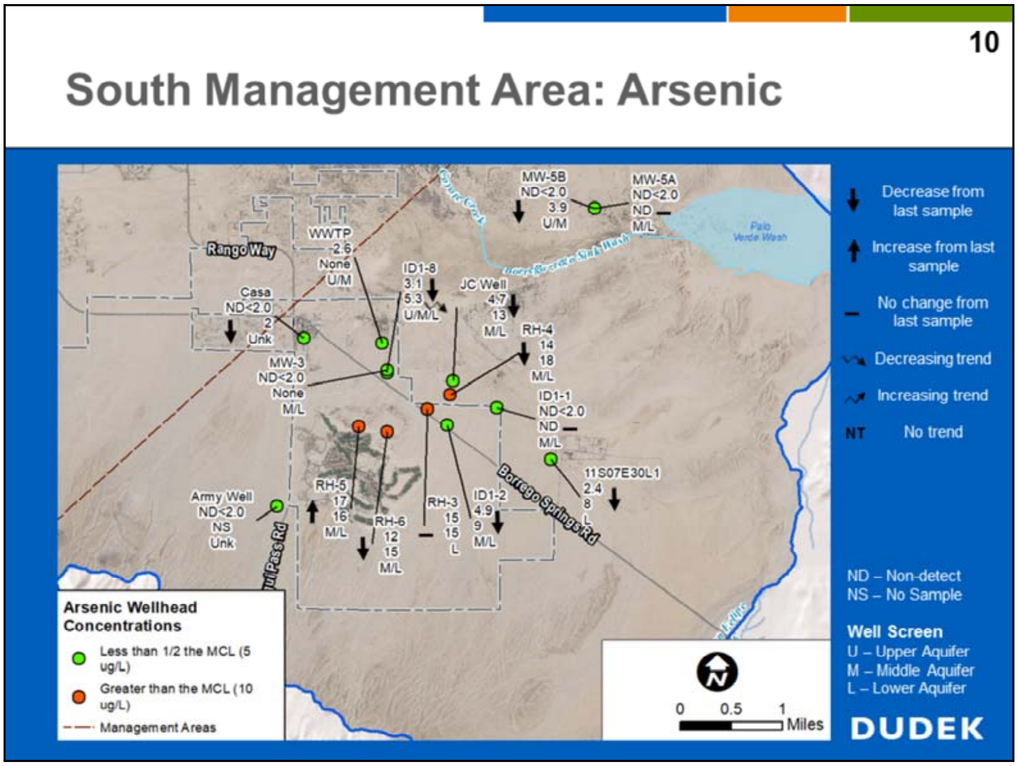

Arsenic concentrations from the 9 wells sampled in the CMA were all less than one-half the drinking water maximum contaminant level (MCL). The primary MCL for arsenic is 10 micrograms per liter.

The fall 2017 results indicate decreasing or stable arsenic concentrations (indicated by the downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except well MW-4 (indicated by the upward arrow).

No historical data were available for the County Yard well.

Upward and downward moving concentrations do not represent a trend in water quality. As indicated in the previous slide, a minimum of 4 historical results are required to determine a significant trend.

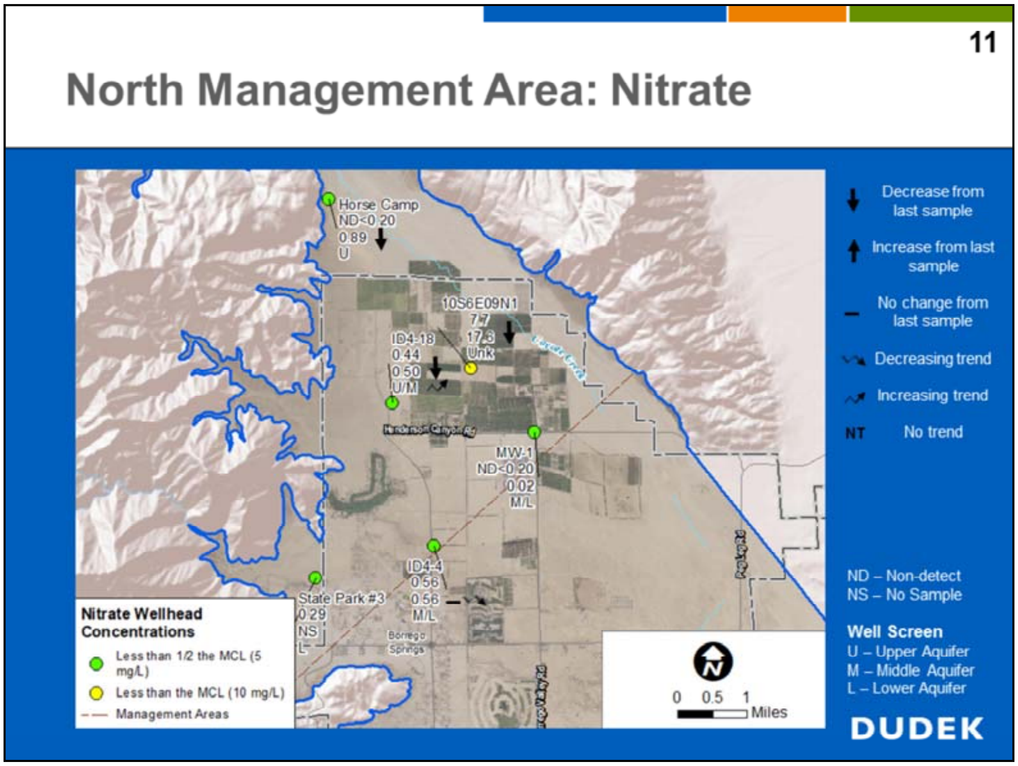
No statistically significant trend is observed for arsenic in the CMA wells. Borrego Water District (BWD) wells ID1-10, ID1-12 ID1-16, and Wilcox have sufficient number of historical results to analyze trend. No trend is indicated for these wells (as indicated by the “NT” abbreviation).




Arsenic concentrations from 4 of the 15 wells sampled in the SMA exceeded the drinking water maximum contaminant level (MCL). The primary MCL for arsenic is 10 micrograms per liter. The other 11 wells sampled had arsenic concentrations less than one-half the drinking water MCL.

The fall 2017 results indicate decreasing or stable arsenic concentrations (indicated by the downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except well RH-5 (indicated by the upward arrow). No historical data were available for the Army and WWTP wells.

Only BWD well ID1-8 has sufficient historical data to statistically determine a trend. Interestingly, with the latest two data points, well ID1-8 has a decreasing trend (indicated by downward pointing wave arrow) whereas it previously had an increasing trend if the latest data are ignored. It is uncertain why the trend in ID1-8 is now decreasing (e.g. potentially due to less pumping of the well) and uncertain why many of the wells sampled decreased in concentration from when they were last sampled. Additional data and analysis are required to evaluate potential pumping effects and seasonal effects on arsenic concentration in the SMA. The source of arsenic in the wells is naturally occurring and common in semi-arid and arid groundwater basins in the western United States.

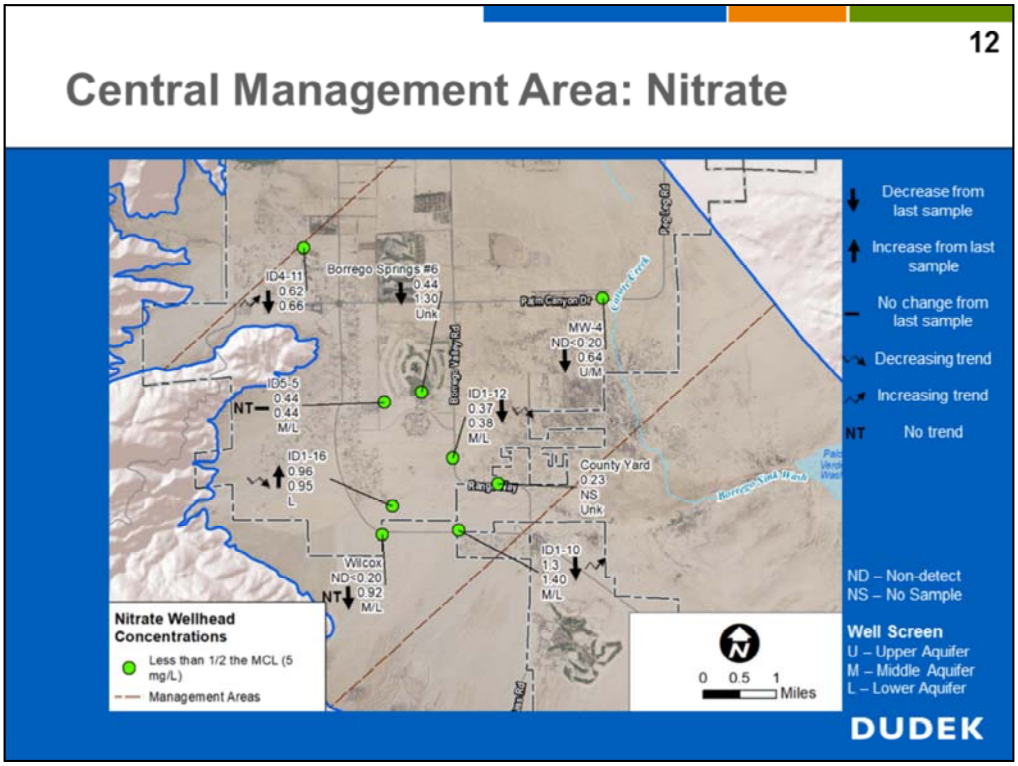



Nitrate concentrations from the 5 of the 6 wells sampled in the NMA were all less than one-half the drinking water maximum contaminant level (MCL). Well 10S6E09N1 was less than the MCL. The primary MCL for nitrate as nitrogen (as N) is 10 milligrams per liter.

The fall 2017 results indicate decreasing or stable nitrate concentrations (indicated by downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data (indicated by the downward arrow or dash symbol).

Well ID4-18 indicates an increasing trend for nitrate (indicated by the upward wave symbol). However, the nitrate concentration in well ID4-18 is less than one-tenth the MCL. Well ID4-4 indicates a decreasing trend for nitrate (indicated by the downward wave symbol). ID4-4 has similar nitrate concentrations to ID4-18. Well 10S6E09N1 has decreased since the previous sample.

The source of nitrate in these wells in unknown. Potential sources of nitrate include septic recharge, fertilizer applications and/or leaching of natural nitrogen deposition in desert soils. Additional wells screened in the upper aquifer of the NMA are likely required to determine nitrate concentrations in the upper aquifer underlying areas of historical agricultural fertilizer applications.

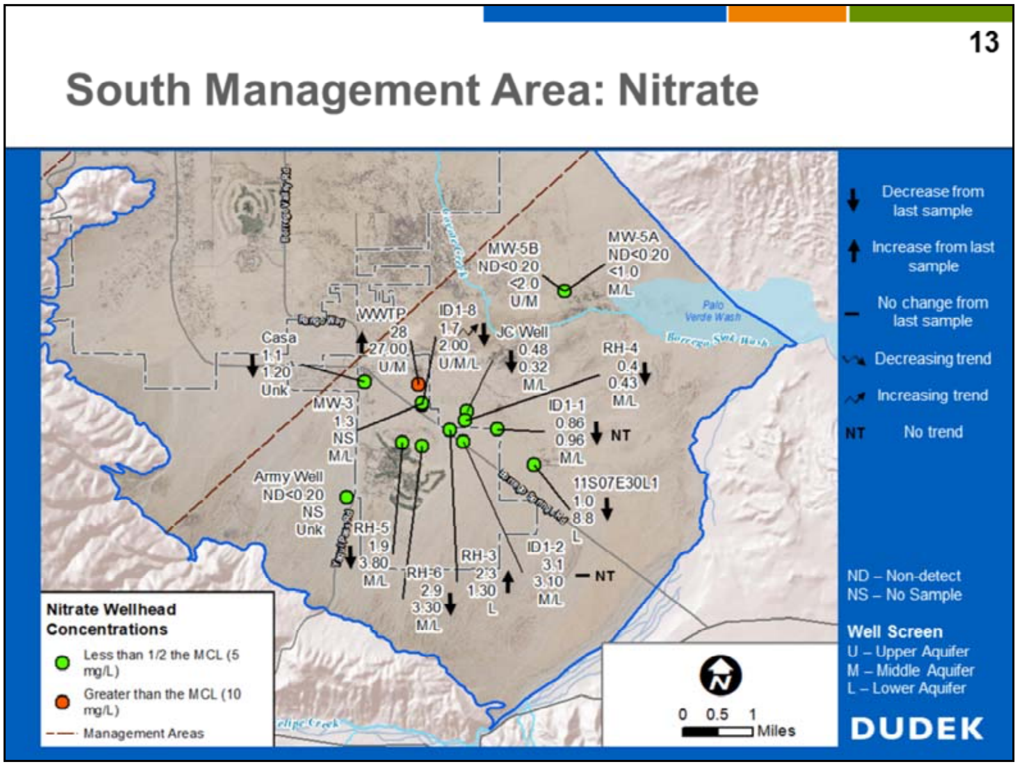



Nitrate concentrations from the 9 wells sampled in the CMA were all less than one-half the drinking water maximum contaminant level (MCL). The primary MCL for nitrate as nitrogen (as N) is 10 milligrams per liter.

The fall 2017 results indicate decreasing or stable nitrate concentrations (indicated by downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except for well ID1-16, which displays a slightly increased concentration (indicated by the upward arrow).

Wells ID4-11 and ID1-10 indicate increasing trends for nitrate (indicated by the upward wave symbol). However, the nitrate concentration in well ID4-11 is less than one-tenth the MCL and ID1-10 is less than two-tenths the MCL. Wells ID1-12 and ID1-16 indicate decreasing trends for nitrate (indicated by the downward wave symbol).

The source of nitrate in these wells in unknown. Potential sources of nitrate include septic recharge, fertilizer applications and/or leaching of natural nitrogen deposition in desert soils.

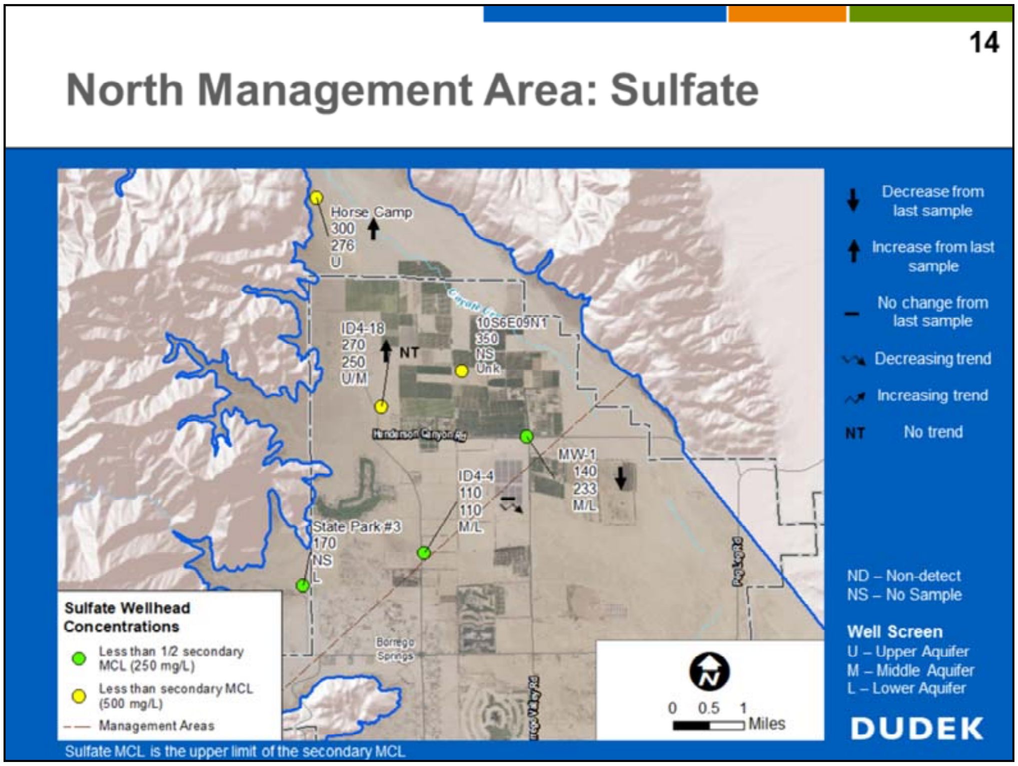



Nitrate concentrations from the 14 wells sampled in the SMA were all less than one-half the drinking water maximum contaminant level (MCL) except for the WWTP well, which exceeded the MCL with a nitrate (as N) concentration of 28 micrograms per liter. The primary MCL for nitrate (as N) is 10 milligrams per liter.

The fall 2017 results indicate decreasing or stable nitrate concentrations (indicated by the downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except for the WWTP well and well RH-3 with slightly increased concentrations (indicated by the upward arrow).

Wells ID1-8 indicates an increasing trend for nitrate (indicated by the upward wave symbol). However, the nitrate concentration in well ID1-8 is less than two-tenths the MCL. Wells ID1-1 and ID1-2 indicate no trend for nitrate (indicated by the "NT" abbreviation). None of the other wells have a sufficient number of samples to significantly determine trend.

The source of elevated nitrate in the WWTP well is likely the adjacent percolation ponds for the Rams Hill Wastewater Treatment Facility (WWTF). Review of the effluent data for the WWTF indicated total nitrogen effluent concentrations ranging from 4.2 mg/L to 48.0 mg/L. Dissolved concentrations of nitrate may increase at the percolation ponds as result of evaporation. The elevated nitrate detected in the wells in the vicinity of Rams Hill Golf Course may be from fertilizer application on the golf course or septic recharge.

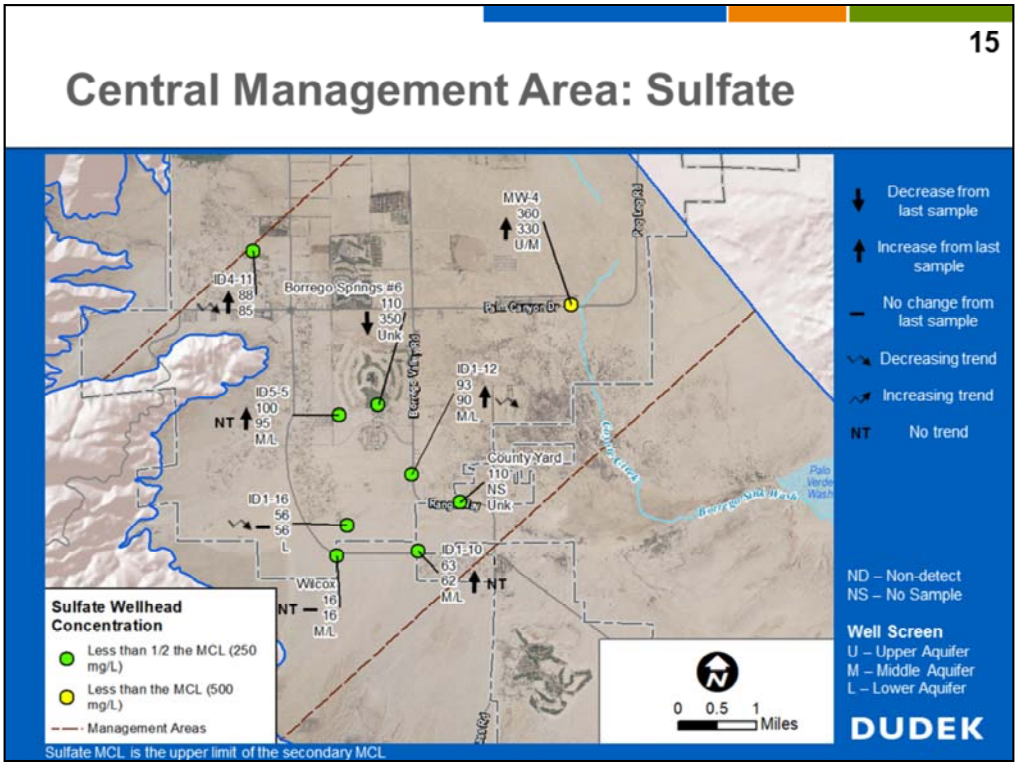



Sulfate concentrations from the 3 of the 6 wells sampled in the NMA were less than one-half the secondary upper drinking water maximum contaminant level (MCL).[1] The Horse Camp well, Well 10S6E09N1, and ID4-18 were less than the secondary MCL. The upper limit secondary MCL for sulfate is 500 milligrams per liter. The fall 2017 results indicate decreasing or stable sulfate concentrations from the previous groundwater sample collected for wells MW-1 and ID4-4 (indicated by the downward arrow or dash symbol). Well ID4-18 and the Horse Camp well indicate an increasing concentration from the last sample collected (indicated by upward arrow). No historical data were available for the State Park #3 well and Well 10S6E09N1.

ID4-4 indicates decreasing trend for sulfate (indicated by the downward wave symbol). Well ID4-18 indicates no trend for sulfate (indicated by the "NT" abbreviation).

The elevated source of sulfate is unknown but may coincide with variable groundwater quality at the edge of the Subbasin near the contact of unconsolidated sediments with metamorphic and igneous fractured rock.

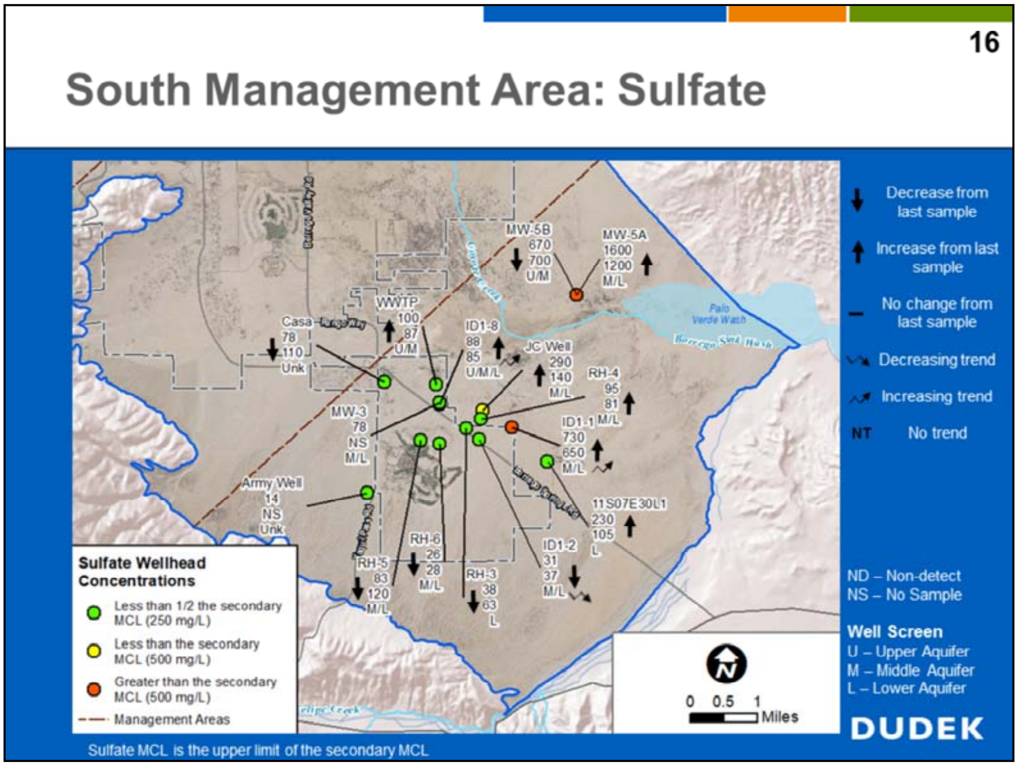
[1.] Sulfate has a secondary MCL ranges of recommended (250 mg/L), upper (500 mg/L) and a short term limit of 600 mg/L.




Sulfate concentrations from the 9 wells sampled were all less than one-half the upper limit secondary drinking water maximum contaminant level (MCL) except MW-4, which is less than the secondary upper MCL of 500 milligrams per liter at a concentration of 360 milligrams per liter.

The fall 2017 results indicate increasing or stable sulfate concentrations from the previous groundwater sample collected for each of the wells with historical data (indicated by the upward arrow or dash symbol) except for Borrego Springs #6 with a decreasing concentration (indicated by the downward arrow). No historical data were available for the County Yard well.

Wells ID4-11, ID1-12 and ID1-16 indicate decreasing trends for sulfate (indicated by the downward wave symbol). Wells ID5-5, ID1-10 and Wilcox indicate no trend for sulfate (indicated by the “NT” abbreviation).

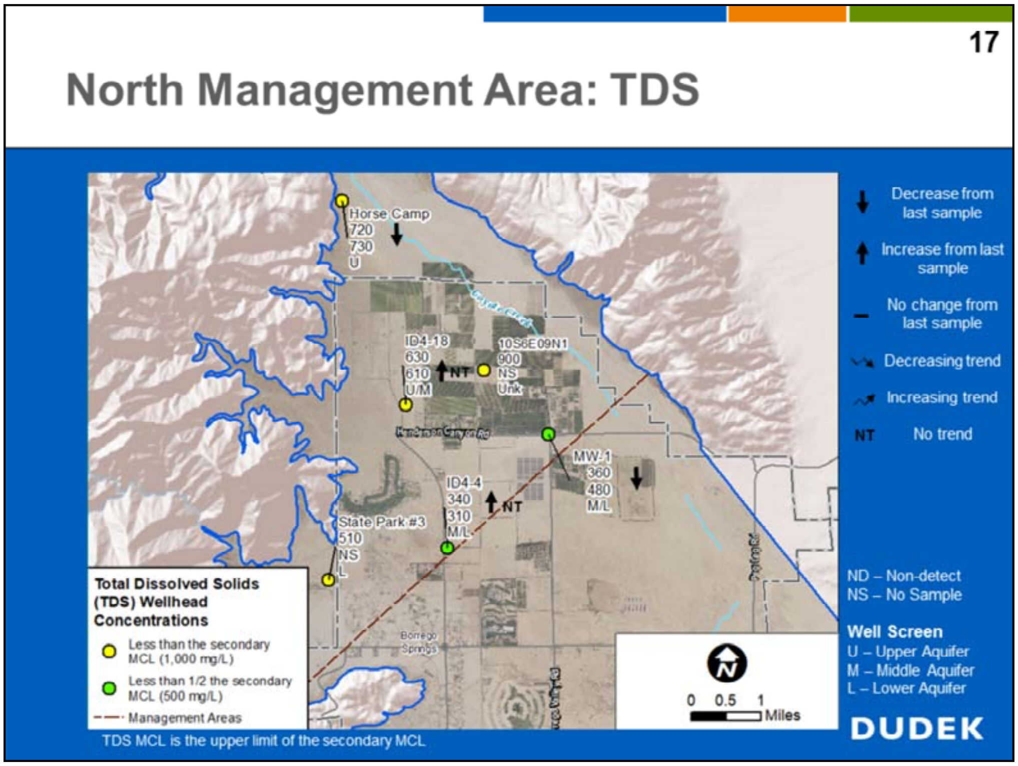



Sulfate concentrations from the 15 wells sampled in the SMA were all less than one-half drinking water upper maximum contaminant level (MCL) except for the JC Well, ID1-1, MW-5A, and MW-5B. The JC Well is less than the secondary upper MCL for sulfate of 500 milligrams per liter. ID1-1, MW-5A, and MW-5B all exceed the secondary upper MCL for sulfate.

The fall 2017 results indicate decreasing or stable sulfate concentrations (indicated by the downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except well ID1-1, ID1-8, RH-4, JC well, Well 11S07E30L1, Well-5B, and MW-5A (indicated by the upward arrow).

Wells ID1-1 and ID1-8 indicate increasing trend for sulfate (indicated by the upward wave symbol). Well ID1-2 indicates a decreasing tend for sulfate (indicated by downward wave symbol). None of the other wells have a sufficient number of samples to significantly determine trend.

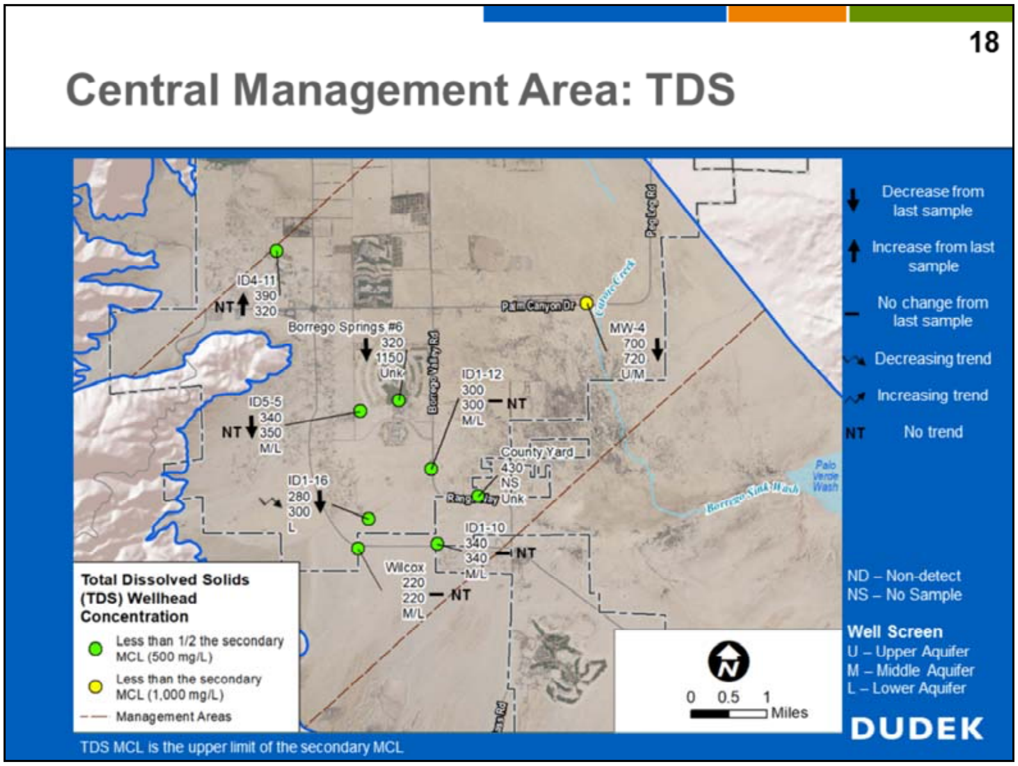
Elevated sulfate appears to be associated with poorer water quality near the Borrego Sink likely due to concentration of dissolved solids as a result of evaporation of water in the Borrego Sink and later leaching of evaporites (sediments formed by the evaporation of water).




Total dissolved solids (TDS) concentrations from the 6 wells sampled in the NMA were all less than one-half the drinking water upper maximum contaminant level (MCL) except the Horse Camp well, State Park #3, Well 10S6E09N1, and ID4-18. The secondary upper MCL for sulfate is 1,000 milligrams per liter.[1]

The fall 2017 results indicate increasing and decreasing TDS concentrations from the previous groundwater sample collected (indicated by the downward/upward arrows). Wells ID4-4 and ID4-18 indicate no trend for TDS (indicated by the “NT” abbreviation).

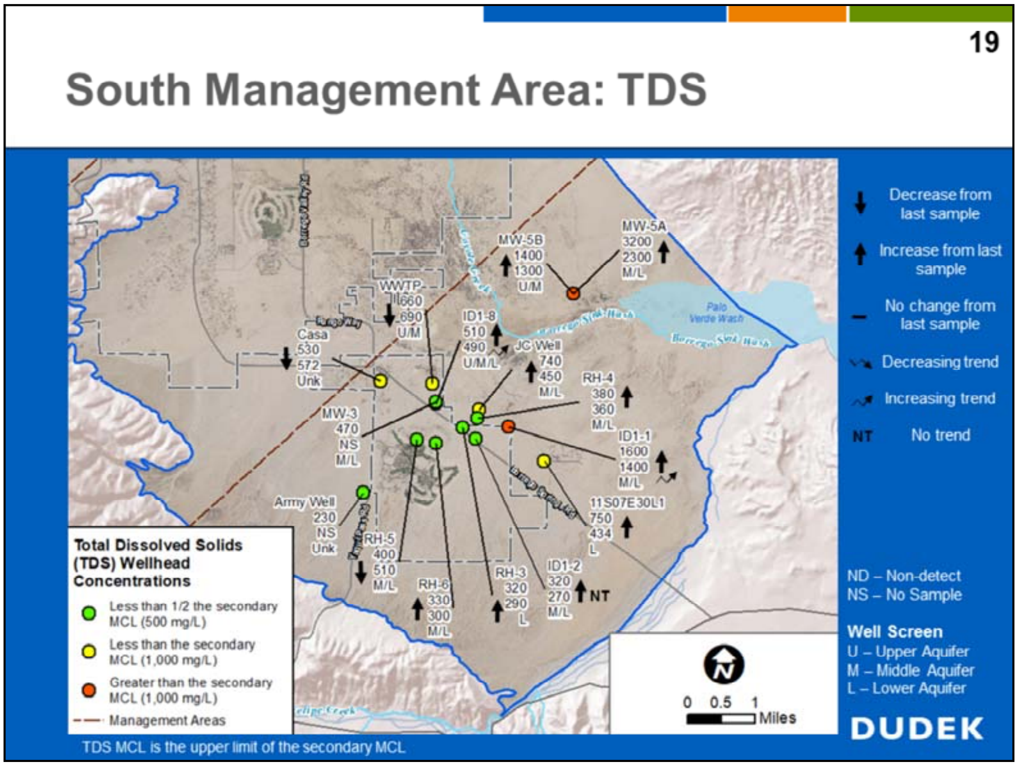
[1.] Total Dissolved Solids (TDS) has a secondary MCL ranges of recommended (500 mg/L), upper (1,000 mg/L) and short-term.(1,500 mg/L).




Total dissolved solids (TDS) concentrations from the 9 wells sampled in the CMA were all less than one-half the drinking water upper maximum contaminant level (MCL) except MW-4, which is less than the secondary MCL of 1,000 milligrams per liter at a concentration of 700 milligrams per liter.

The fall 2017 results indicate decreasing or stable TDS concentrations (indicated by the downward arrow or dash symbol) from the previous groundwater sample collected for each of the wells with historical data except for ID4-11 with an increasing concentration (indicated by the upward arrow).

Well ID1-16 indicates a decreasing trend for TDS (indicated by the downward wave symbol). Wells ID1-10, ID1-12, ID4-11 ID5-5 and Wilcox indicate no trend for TDS (indicated by the “NT” abbreviation).



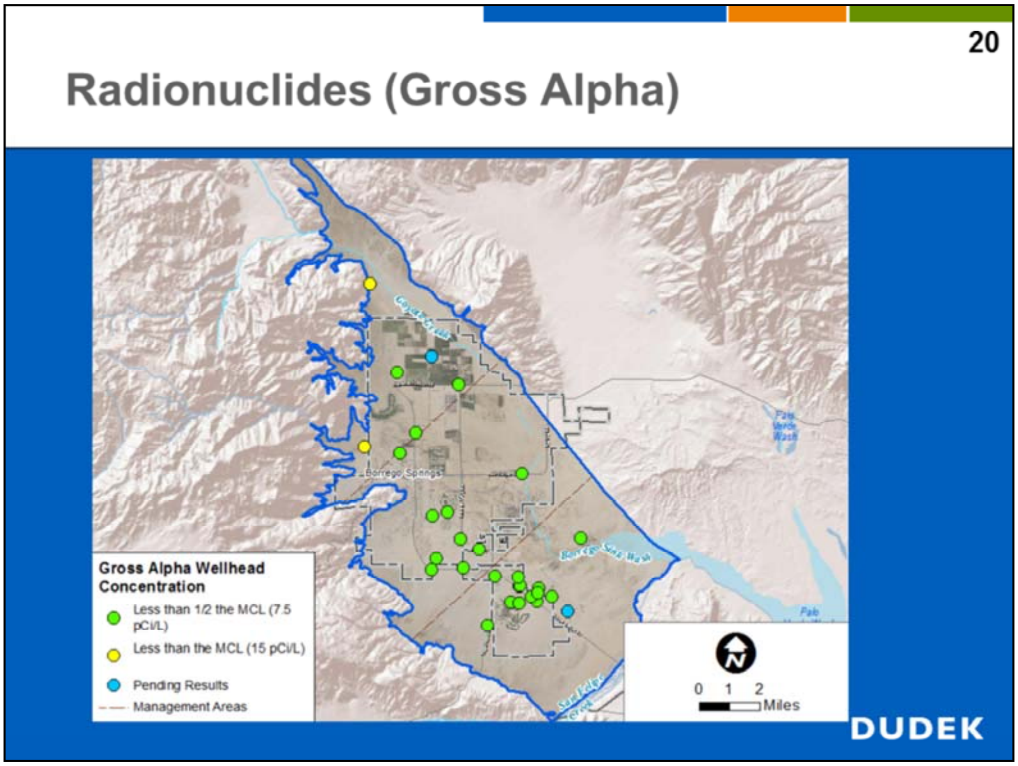

Total dissolved solids (TDS) concentrations from the 15 wells sampled in the SMA were all less than one-half the drinking water upper maximum contaminant level (MCL) except for WWTP well, JC well, Casa well, ID1-1, ID1-8, Well 11S07E30L1, MW-5A, and MW-5B.

The JC well, ID1-8, WWTP well and Casa well are less than the secondary upper MCL for TDS of 1,000 milligrams per liter. ID1-1, MW-5A and MW-5B all exceed the secondary upper MCL for TDS.

The fall 2017 results indicate increasing TDS concentrations (indicated by the upward arrows) from the previous groundwater sample collected for each of the wells with historical data except well WWTP well, Casa well, and RH-5 (indicated by the downward arrows).

Wells ID1-1 and ID1-8 indicate increasing trend for TDS (indicated by the upward wave symbol). Well ID1-2 indicates no trend for TDS (indicated by the “NT” abbreviation). None of the other wells have a sufficient number of samples to significantly determine trend.

Elevated TDS appears to be correlated with poorer water quality near the Borrego Sink as previously explained for sulfates.




Radionuclides were screened in the Borrego Springs Subbasin by analyzing for gross alpha particle activity. Radionuclides are naturally occurring in groundwater as a result of trace levels of radioactive isotopes. Gross alpha measurement is a common screening tool to track general radioactivity in groundwater, and the primary California drinking water maximum contaminant level (MCL) is 15 picocuries per liter.

Gross alpha concentrations from the 30 wells sampled in the Subbasin were all less than one-half the primary drinking water MCL except for two wells that were less than the MCL. The mixed metamorphic and igneous rocks which make up the mountain range to the west of the Subbasin may contribute to elevated gross alpha in the two wells with higher than one half the MCL for gross alpha.

Further evaluation will be conducted to determine if radionuclides will continue to be monitored in the Subbasin as a constituent of concern.


Questions and Discussion