IN THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF NEVADA

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IN THE MATTER OF APPLICATIONS 53987 THROUGH 53992, INCLUSIVE, AND 54003 THROUGH 54021, INCLUSIVE, FILED TO APPROPRIATE THE UNDERGROUND WATERS OF CAVE VALLEY, DRY LAKE VALLEY, DELAMAR VALLEY AND SPRING VALLEY(HYDROGRAPHIC BASINS 180, 181, 182, AND 184), LINCOLN COUNTY AND WHITE PINE COUNTY, NEVADA.	**DECLARATION OF JUDITH M. BRANDT**

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DECLARATION OF JUDITH M. BRANDT

I, Judith M. Brandt, do hereby declare under penalty of perjury that the following is true and correct:

1. I am over the age of 18, and not a party within this administrative hearing. I am submitting this Declaration for the purpose of documenting my anticipated testimony that might be considered to be expert opinions, within the applicable statutes, rules and regulations and which may be expressed during hearing testimony. This declaration and the related and referenced documents also provides a summary of the basis for those opinions and a summary of the data and information I considered in forming my opinions.
2. I am a Senior Remote Sensing Analyst with the Southern Nevada Water Authority (SNWA). For over 10 years I have employed remote sensing methods to classify and quantify vegetation cover from high resolution imagery. A copy of my curriculum vitae is an SNWA exhibit for these proceedings.
3. SNWA is using remote sensing in the Spring Valley Hydrographic Area to monitor shrubland habitat vegetation as part of its Clark, Lincoln, and White Pine Counties Groundwater Development Project (GDP) monitoring, management and mitigation (3M) program.
4. SNWA is using data derived from satellite imagery to quantify changes in vegetation over time in order to establish baseline conditions and conduct long-term monitoring.
5. Huntington Hydrologic provided me the following datasets for the Spring Valley Hydrographic Area for 1985-2015: Landsat images, cloud masks and cloud score datasets, cross-sensor calibrated at-surface reflectance NDVI raster datasets, and gridMET precipitation raster datasets.
6. Huntington Hydrologic also provided me with a Python software script for the purpose of producing NDVI and precipitation zonal statistics for polygons within the analysis areas.
7. I used the Python script to produce NDVI and precipitation zonal statistics datasets for the shrubland habitat vegetation analysis.
8. Cloud cover in the NDVI raster datasets will cause erroneous data. To avoid this error, I filtered this data out of the NDVI zonal statistics datasets using clouds masks and cloud scores. I visually examined the Landsat imagery and confirmed that the NDVI data were free of the influence of clouds or clouds shadows.

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9. SNWA is also using remote sensing in the Spring Valley Hydrographic Area to monitor terrestrial woodland habitat vegetation as part of its GDP 3M program.

10. The methods described in Paragraphs #7-8 were also applied to sample areas within the terrestrial woodland habitat in the Swamp Cedar Area of Critical Environmental Concern (ACEC) to quantify baseline percent range in NDVI from 1985-2015.

11. National Agricultural Imagery Program (NAIP) high-resolution imagery was used to identify juniper trees within the ACEC terrestrial woodland habitat for the purpose of calculating tree cover area.

12. NDVI data were derived from the 2015 NAIP imagery.

13. Through visual interpretation of the NAIP and NDVI imagery, a range of NDVI values were determined to be indicative of juniper trees within the ACEC terrestrial woodland habitat. To conduct the visual image interpretation, I relied on professional judgement and my past field experience which included spectral measurements, observations and identification of vegetation in shrublands of Spring Valley, as well as thousands of hours spent on high resolution photo interpretation of urban, sub-urban, riparian, and shrubland areas.

14. The range of NDVI values that were determined to be indicative of juniper trees were converted into digital polygons (areas) that encircled trees and tree clusters in the ACEC so that I could calculate total tree cover area. Digital polygons void of trees were removed from the dataset.

15. Through visual interpretation of the NAIP imagery and with the aid of very high resolution imagery collected by SNWA in 2016, I performed a quality check.

16. Juniper trees with canopy greater than 1-1.5 meters in diameter were positively identified and included in the GIS dataset.

17. Tree cover area in the Swamp Cedar ACEC was quantified reliably and can be compared over time for long-term monitoring for purposes of SNWA's GDP 3M program.

18. This work, data and resulting opinions have been incorporated into the Remote Sensing Analysis portion of the report entitled *Technical Analysis Report Supporting the Spring Valley and Delamar, Dry Lake, and Cave Valleys, Nevada, 3M Plans.* The majority of my contribution can be found in Appendix "D" to that report.

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19. I am prepared to testify and respond to any questions or examination within the scope of the work as described herein.

FURTHER YOUR DECLARANT SAYETH NAUGHT.

Dated this 19th day of June, 2017 in Las Vegas, Nevada.

JUDITH M. BRANDT

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