STERLING RANCH

1805 Shea Center Dr., Suite 210
Highlands Ranch, CO 80129
(303) 202-6800
www.sterlingranchcolorado.com

July 1, 2016

Ms. Rebecca Mitchell
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
Denver, CO 80203

Mr. Kevin Rein
Colorado Division of Water Resources
1313 Sherman Street, Suite 818
Denver, CO 80203

RE: 2016 Sterling Ranch Precipitation Harvesting Pilot Study Annual Report

Dear Ms. Mitchell and Mr. Rein,

The enclosed letter report is the sixth annual report submitted by Leonard Rice Engineers, Inc. on behalf of the Sterling Ranch Development for the Precipitation Harvesting Pilot Study.

The 2016 Sterling Ranch Precipitation Harvesting Pilot Study Annual Report documents the progress that was made in the 2015/2016 study year including: tasks accomplished during the study year, presentation the data collected, planned tasks for the 2016/2017 study year, and variances to the application that was originally submitted on May 1, 2010.

Tasks accomplished in the 2015/2016 study year for the Pilot Project include:

- Climate data has continued to be collected, extending the record for site specific data from March 2010 to May 2016.
- Continued monitoring and collection of data from the surface water station located on Upper Sterling Gulch. A total of ten surface water events were observed with the largest measurable event of 4.06 cfs occurring on August 16, 2015.
- Continued use of trail cameras on Sterling Gulch to document hydrologic events in real-time.
- The 2015/2016 project year was the first full year of data collection at the new lysimeter site.

- Continued water level data collection at the ground water monitoring wells located within Sterling Gulch.

The 2015/2016 project year was an above average year to date with a total of 19.98 inches of recorded precipitation at the climate station. The largest rainfall event occurred August 16, 2016 at 1:20 am totaling 1.03 inches.

In addition to the data collection efforts, Sterling Ranch has begun the transition from planning and data collection to implementation of rainwater harvesting by working towards an SWSP based on the updated Criteria and Guidelines and considering rainwater harvesting in the design of regional stormwater system's and at proposed commercial sites located in Filing 1.

As the project progresses, we continue to broaden our understanding of precipitation harvesting as a reliable water supply. In the upcoming study year, we look forward to continuing our work with the Colorado Water Conservation Board and Colorado Division of Water Resources. Thank you for your continued support in developing harvested precipitation as a viable water supply.

Best Regards,

Mary Kay Provaznik
DWSD & Sterling Ranch Utilities Director

cc: DWSD Board

Encl: 2016 Sterling Ranch Precipitation Harvesting Pilot Study Annual Report

July 1, 2016

Ms. Rebecca Mitchell
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
Denver, CO 80203

Mr. Kevin Rein
Colorado Division of Water Resources
1313 Sherman Street, Suite 818
Denver, CO 80203

RE: 2016 Sterling Ranch Precipitation Harvesting Pilot Study Annual Report

Dear Ms. Mitchell and Mr. Rein,

This is the sixth annual report addressing the Precipitation Harvesting Pilot Study to be submitted by Leonard Rice Engineers, Inc. (LRE) on behalf of Dominion Water and Sanitation District and the Sterling Ranch Development.

Introduction

The proponents of the Sterling Ranch Development continue to work passionately towards a vision for the land that is in harmony with the area, the community, and the State, and that meets a significant need for housing and infrastructure in Douglas County. Sterling Ranch's participation in the Colorado Water Conservation Board's (CWCB) Rainwater Harvesting Pilot Project Program (Program) is a reflection of their goals for establishing sustainable, defensible, non-potable water supplies for their development, in addition to being a positive example of conservation and efficient resource management. During the 2015-2016 project year, Sterling Ranch has begun the transition from planning and data collection to implementation of rainwater harvesting by working towards an SWSP based on the updated Criteria and Guidelines and considering rainwater harvesting in the design of and at proposed commercial sites located in Filing 1.

Current Sterling Ranch Development Activity

With Douglas County zoning approval, development of the site is on the fast track. In the past six months the construction of a new water treatment facility has begun and portions of the site have been re-contoured to accommodate home building and commercial sites. The stormwater infrastructure designs are being finalized with some temporary/permanent ponds being developed to accommodate construction activity and the potable and non-potable water system infrastructure is being installed. With development fully underway the focus of the next year will be the planning and implementation of rainwater harvesting for commercial sites and regional stormwater systems.

Precipitation Harvesting Criteria and Guidelines Update

On January 26, 2016, the Colorado Water Conservation Board Members approved the updated Precipitation Harvesting Criteria and Guidelines based on provisions contained in HB 15-1016. HB 15-1016, among other provisions, directs the CWCB to establish regionally applicable factors that program sponsors can use for substitute water supply plans that specify the amount of evapotranspiration of preexisting natural vegetative cover. The updated criteria and guidelines clarify the development and use of regionally applicable factors as follows:

"Sponsors of projects in areas where Regionally Applicable Factors have been adopted by the Board may propose to use the Regionally Applicable Factor to claim an evapotranspiration credit for the preexisting vegetative cover that was made impermeable through development associated with the pilot project. The evapotranspiration credit may be used prior to the sponsor completing two years of data collection and/or the sponsor's application to the water court. Proposed use of the credit will be reviewed as a part of the State Engineer's SWSP approval process."

Sterling Ranch is excited about the opportunity to support the State in the development of regional factors applicable to the Dominion Water and Sanitation District service area and nearby communities.

Summary of Pilot Project Progress

Generally, the Sterling Ranch Precipitation Harvesting Pilot Study (Pilot Project) has proceeded on schedule. The variances to the Pilot Project, including the proposed schedule, are described herein. The following tasks were accomplished during the 2015-2016 monitoring season:

- Climate data collection from the Sterling Ranch Climate Station;
- Data collection from the Sterling Ranch Lysimeter;
- Surface water runoff data collection;
- Trail camera data collection of surface water runoff; and
- Data collection from two ground water monitoring wells and one shallow (Datum) well.

These tasks, associated costs, and variances to the overall Pilot Project are further discussed in this report.

CWCB Program and Reporting Requirements

On March 1, 2010, Sterling Ranch provided the "Sterling Ranch Precipitation Harvesting Pilot Study Application" (Application) based on the criteria and guidelines outlined by the CWCB that were established under House Bill 09-1129. The aim of the Program is to use natural conditions data to evaluate precipitation harvesting in Colorado as a legally obtainable water supply and as a water conservation enhancement when paired with advanced outdoor water demand management.

The Application described conceptual Sterling Ranch planning policies and requirements, including their current water conservation plan and the Pilot Project strategies to be implemented that assist in the overall precipitation harvesting design.

The Pilot Project is split into three phases; 1) Natural Conditions, 2) Experimental Precipitation Harvest Designs, and 3) New Precipitation Harvest Designs.

Annual Reporting Requirements

One of the requirements of the Program is to submit an annual progress report (Annual Report) by July 1st of every year that the Pilot Project is in operation. In accordance with Section 37-60-115(6)(a), C.R.S., the Report summarizes each component of the Pilot Project and indicates how the data and findings address Program goals. The CWCB Annual Report Requirements serve as an outline for this report and are included in **Attachment A**. The information required includes:

1. A **description of variances** from the Application including information on any data quality issues that may magnify if results are extrapolated to a larger scale project.
2. **Precipitation harvesting performance metrics**.
3. Pilot Project **implementation plan and estimated water conservation** achieved through pairing precipitation harvesting with advanced outdoor water management.
4. A **description of the climate and hydrologic data collected** to characterize the pre-existing, natural vegetation conditions.

Sterling Ranch Precipitation Harvesting Pilot Project – Progress and Variances

Four objectives were established in the Application that was designed to meet the guidelines and criteria provided by CWCB. They are:

1. Evaluate natural conditions (climate, hydrology, and ET) to quantify the amount of precipitation physically and legally available as a water supply;
2. Evaluate a variety of precipitation collection designs;
3. Evaluate precipitation harvesting paired with advanced outdoor water demand management as a water conservation practice; and
4. Create a baseline set of data to support:

a) An engineering report in support of a water court application for an augmentation plan to use harvested precipitation, and define a defensible water supply.

b) Develop sound, transferable, and scalable methodologies for use at other locations in the State of Colorado.

In 2010, the Pilot Project began with the installation of the measuring devices for natural conditions, collecting associated data, and implementation of an educational campaign. These efforts are further discussed in the sections below.

Phase 1: Natural Conditions

Originally, two study basins were proposed to evaluate natural conditions of Sterling Ranch as part of a comprehensive monitoring plan. Currently, monitoring is only occurring in Sterling Gulch basin. The integrated monitoring plan includes measuring climate, precipitation, surface runoff, native ET, deep percolation, and ground water data to provide the foundation for defining physical yield characteristics and return flow obligations.

Figure 1 shows the location of the Sterling Gulch watershed and the location of the implemented monitoring stations within the Sterling Ranch boundary to date. Sterling Gulch is being used to quantify the site-specific amount of precipitation that, under pre-existing natural vegetation conditions, accrues to the natural stream system via surface and ground water return flows. The sections below summarize the progress, variation, and data collected to date for each of the monitoring programs designed to characterize the natural hydrology at the site.

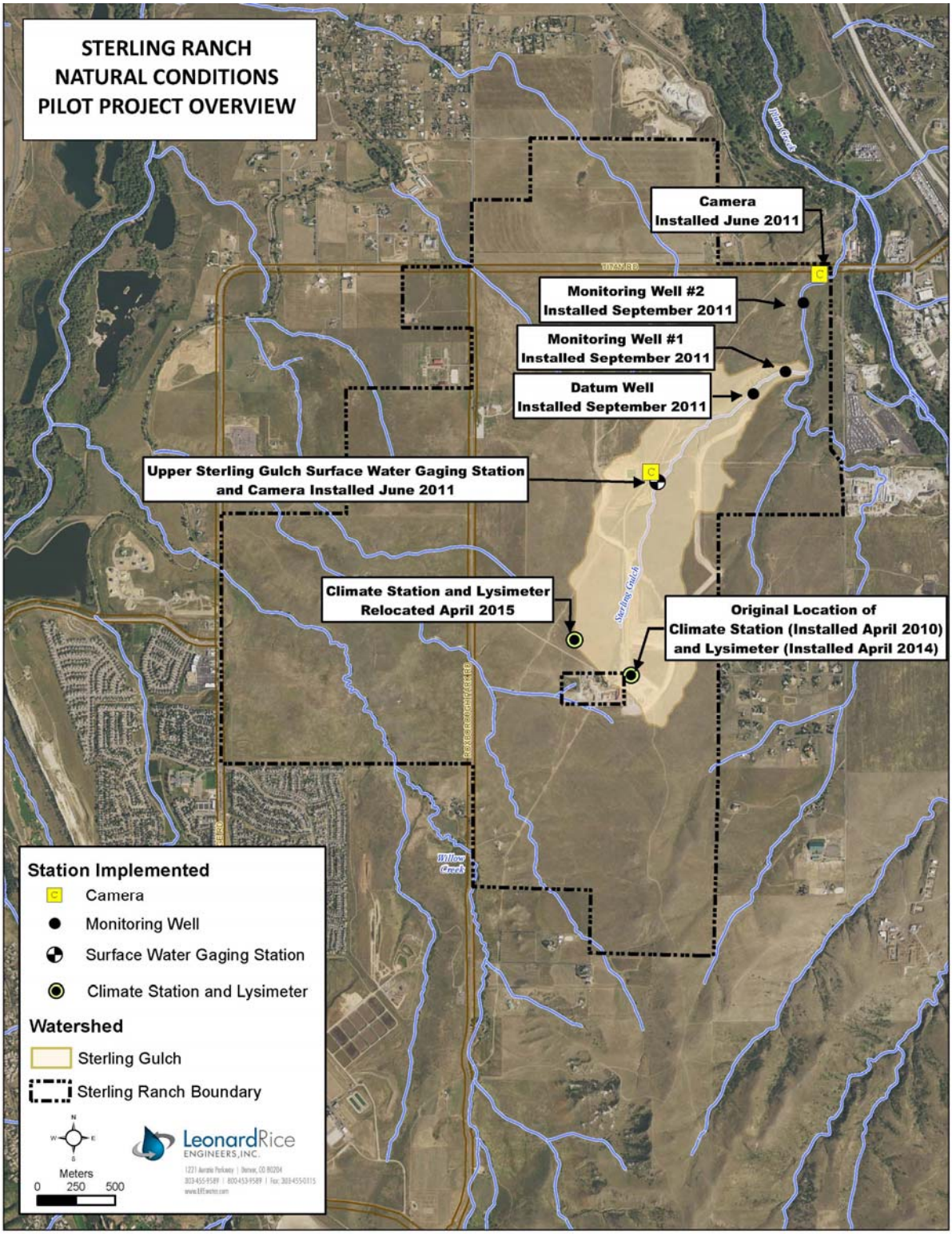

Figure 1 – Sterling Gulch Basin Map

Climate Monitoring Program

2015-2016 Variance from Application: None

The Sterling Ranch Climate Station was installed on March 29, 2010 and moved to new location in April 2015 (see **Figure 1 & Figure 2**). The station continues to collect data that is used to characterize local weather patterns, and will be used for the future estimates of native ET. The data collected at the Sterling Ranch site includes net solar radiation, air temperature, wind velocity and direction, relative humidity, and barometric pressure, and soil temperature at varying depths. Most data is recorded in 15-minute intervals, transmitted to the Sterling Ranch website, and archived in a centralized database. **Table 1** is a monthly summary of the data collected to date from the Sterling Ranch Climate Station. The original soil temperature sensors at the climate station have been discontinued, with this information being recorded at each of the soil moisture sensors associated with the lysimeter.

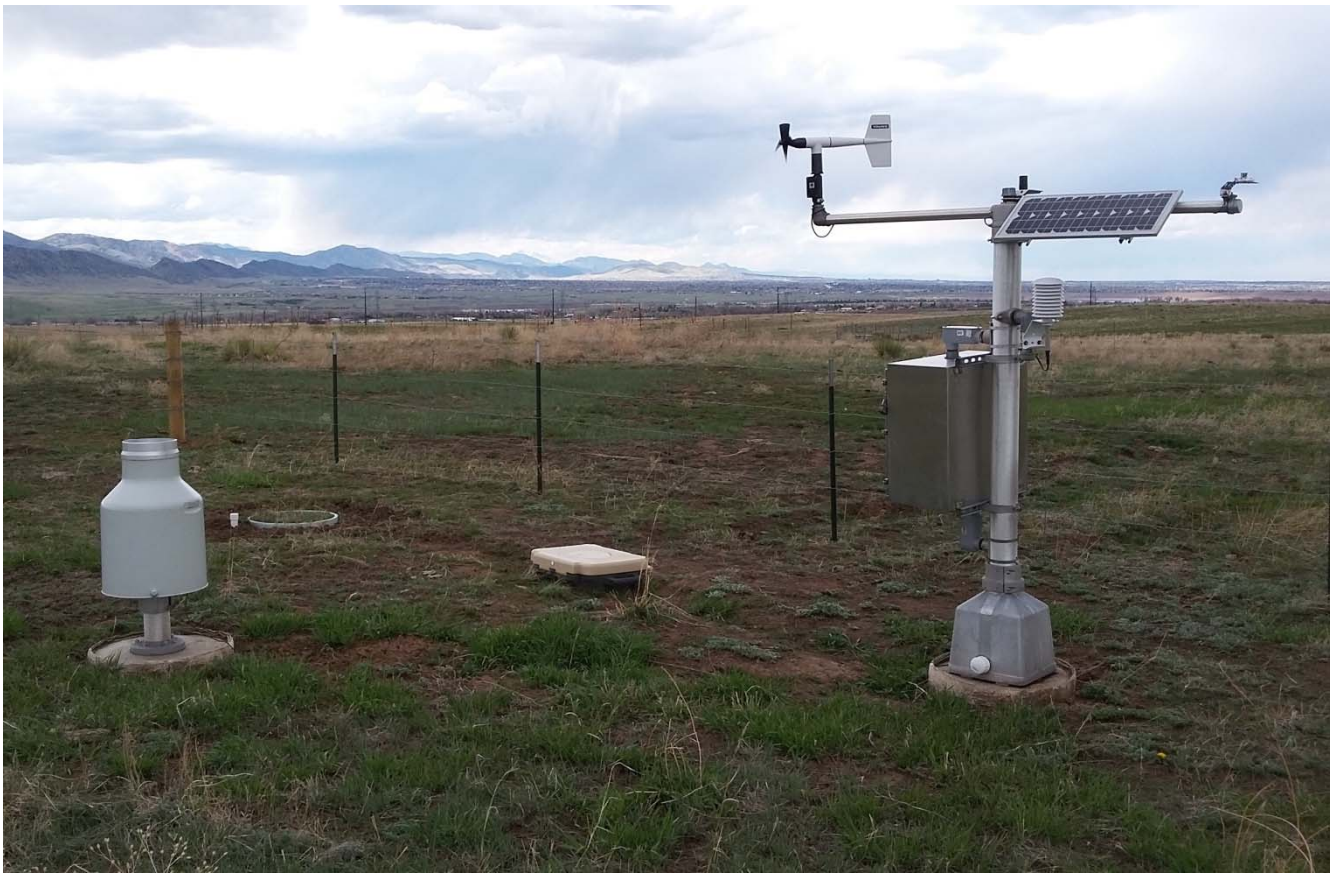

Figure 2 – Sterling Ranch Climate Station (April 2016)

Table 1 – Sterling Ranch Climate Station Monthly Summary

Year	2015							2016				
Month	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Temperature (F)												
Average Temperature*	60.17	61.11	62.01	60.43	53.22	45.81	40.13	41.32	44.24	45.27	48.22	51.95
Max Temperature*	73.24	74.51	75.42	71.48	69.64	63.43	58.09	59.08	60.38	62.22	64.61	66.87
Min Temperature*	48.33	51.13	48	47.84	40.14	28.32	25.46	28.6	25.77	30.66	34.17	36.56
Temp Range*	24.91	23.38	27.42	23.64	29.5	35.11	32.63	30.48	34.61	31.56	30.44	30.31
Wind (mph)												
Average Velocity	5.69	5.45	6.27	6.01	5.25	6.83	6.31	6.23	6.70	7.19	6.78	6.30
Max Velocity	27.12	30.67	37.31	27.73	22.69	32.01	32.54	33.80	39.56	40.11	38.14	26.00
Average Direction (Deg N)	187.3	181.27	175.30	178.75	192.01	188.16	190.72	186.04	191.74	182.54	188.91	185.48
Solar Radiation (MJ/m2 h)												
Average Radiation	1.03	0.94	0.88	0.80	0.53	0.46	0.34	0.42	0.56	0.71	0.82	0.93
Max Radiation	4.25	4.22	3.93	4.01	3.01	2.61	2.11	2.42	2.86	4.01	4.51	4.26
Barometric Pressure (mbar)												
Average BP	824.32	825.10	825.66	824.05	824.21	819.34	817.07	819.65	822.65	818.60	821.04	821.77
Max BP	830.95	832.21	831.33	832.42	834.12	832.06	834.67	831.45	832.73	830.84	831.01	830.97
Min BP	817.33	816.70	817.84	816.65	815.24	805.34	799.17	804.90	805.90	804.95	807.75	809.64
Humidity (%)												
Average Humidity	53.89	51.36	42.44	33.32	50.84	43.92	50.14	45.74	41.35	47.22	54.1	56.05
Max Humidity	95.23	94.73	92.13	87.09	96.19	98.36	96.21	97.55	96.97	98.05	98.09	96.94
Min Humidity	8.63	13.15	9.74	7.95	9.68	6.78	12.13	9.73	6.35	8.98	11.78	10.15

*Due to an issue with the temperature sensor, all temperature readings reported are provisional until further investigation can be completed.

Precipitation Monitoring Program

2015-2016 Variance from Application: None

An OTT Pluvio^2 weighing precipitation gage was installed on the site and began collecting data on March 29, 2010 (see **Figure 3**). The precipitation gage is located at the Sterling Ranch Climate Station and reports data in 15-minute intervals. The data collected at the site includes total accumulation and maximum rainfall intensity. This is the first of many proposed precipitation stations for the Pilot Project. As development continues the installation of several more stations is planned. The physical measurement of precipitation is important in characterizing the native water supply, native water demand, and other hydrologic processes. **Table 2** is a summary of the data collected from the Sterling Ranch precipitation station. During the 2015-2016 monitoring season there was a total of 19.98 inches of precipitation accumulated with the max intensity of 5.29 in/hr on August 10, 2015.

Figure 3 – OTT Pluvio^2

Table 2 – Sterling Ranch Precipitation Station Summary

Year	2015							2016				
Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Precipitation (in)												
Monthly Total	3.38	1.80	2.85	0.15	2.52	1.34	0.23	0.62	0.34	1.92	3.54	1.29
Max Intensity (in/hr)	2.72	2.76	5.29	0.60	2.63	4.49	0.33	0.0	0.29	1.66	0.82	0.73

Surface Water Monitoring Program

2015-2016 Variance from Application: None

The surface water monitoring program was continued during the 2015-2016 monitoring season to quantify the site-specific stream flow that accrues to the natural stream system through surface water flows. To document surface water events in real-time, trail cameras have been added to the plan at the surface monitoring sites within the Sterling Gulch basin.

Figure 1 shows the location of the Upper Sterling Gulch surface water station completed in June 2011 and the location of trail camera used to document surface water events. This surface water station includes a 9-inch Parshall Flume, shaft encoder water level sensor, and data logger.

Recorded Surface Water Events

In total there were ten events with greater than 0.25 cfs recorded at the surface water station during the 2015-2016 project year. **Figure 4** is the hydrograph for the 2015-2016 project year. In

total there were ten days with measurable surface water events recorded at the Upper Sterling Gulch flume. Upper Sterling Gulch flume is not maintained from November 1st to March 1st, but data is collected. During this period data was not unavailable from November 13, 2015 through December 9, 2015 due to a loss of digital data. The total rainfall accumulation during this period was 0.81 inches with the accumulation occurring as the result of one 19-hour duration, low intensity storm occurring on November 16 and November 17, 2015. Historically, long duration events with low rainfall intensities do not result in surface water events.

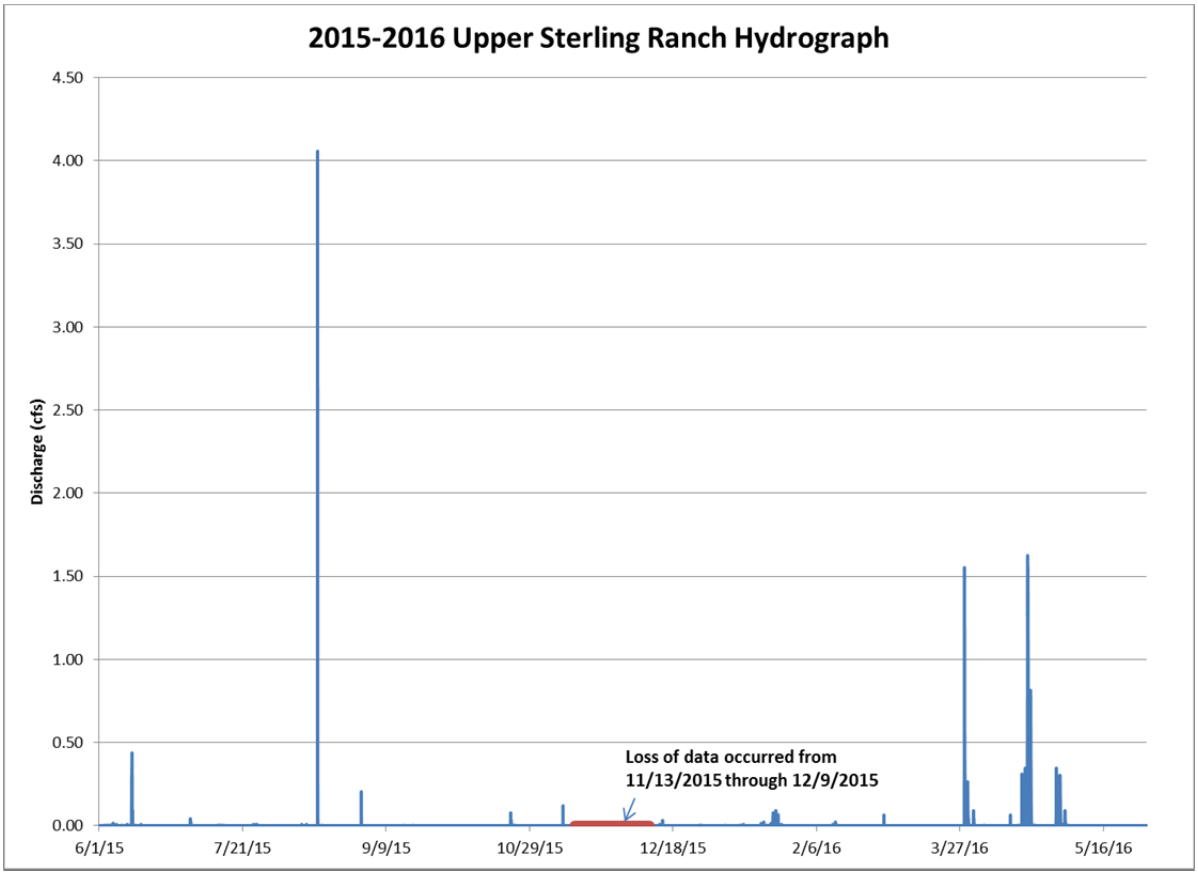

Figure 4 – 2015-2016 Upper Sterling Gulch Hydrograph

Table 3 - Summary of Surface Water Events during 2015-2016 Project Year

Year	2015		2016							
Month/Day	6/12	8/16	3/28	3/29	4/17	4/18	4/19	4/20	4/29	4/30
Duration										
Beginning Time	7:00	2:20	14:05	16:20	14:45	13:45	12:15	12:25	14:35	12:10
End Time	14:40	4:00	19:45	20:35	15:25	3:25	0:20	21:25	1:15	2:15
Duration (hrs)	7:40	1:40	5:40	4:15	0:40	13:40	12:05	9:00	10:40	14:05
Discharge										
Maximum 15-Minute Average Discharge (cfs)	0.43	4.06	1.39	0.21	0.25	0.35	1.55	0.81	0.35	0.30

While a trail camera is currently installed at the Sterling Gulch flume, no photographs were available for any of the recorded events during the 2015-2016 Project Year. Although photographs were taken, camera settings, battery issues, and general camera malfunctions resulted in the loss of data. All cameras were replaced and reprogrammed for the 2016-2017 Project Year.

Native Vegetation (ET) Monitoring Program

2015-2016 Variance from Application: None

The design and construction of a single weighing lysimeter began in January 2014. A representative single intact soil core was collected on April 8, 2014 in an area where future precipitation harvesting is planned. The lysimeter was completed and began transmitting data on April 11, 2014. The lysimeter is 24 inches in diameter, 42 inches tall and is equipped with three 500 lb load cells, 4 soil moisture sensors, and a tensiometer controlled vacuum system and tipping bucket. The lysimeter was constructed next to the climate station to take advantage of the existing sensors and telemetry infrastructure at the site. In April 2015 the lysimeter was moved along with the climate station to a new location. At that time the lysimeter load cells were recalibrated and the soil moisture sensors and vacuum system were tested.

The data collected at the lysimeter will be used to address two important aspects of the pilot study; the actual native vegetation ET and the amount of precipitation that percolates through the soil root zone to the ground water table known as ground water recharge or deep percolation. The lysimeters may also provide some insight on site-specific soil moisture storage and surface runoff. The 2015-2016 project year was the first full year of data collection at the lysimeter in its new location. Although data has been collected during the 2015-2016 monitoring season, the data is still under review and was not compiled for this report.

Ground Water Monitoring Program

2015-2016 Variance from Application: None

Understanding pre-existing ground water interactions on Sterling Ranch is another important component of the water budget. Quantifying the amount, timing, and location of ground water return flows that accrue to the local alluvial aquifer from precipitation events is important when determining augmentation requirements to local streams. The installation of two monitoring wells and one shallow (Datum) well located within Sterling Gulch was completed in September 2011 (see **Figure 1**). **Table 4** below summarizes the manual ground water level data collected at each of the monitoring wells with an M-scope.

Table 4 – Sterling Gulch Monitoring Well Recorded Depth to Ground Water

Date	Depth (ft)	2015			2016
		7/24/2015	8/31/2015	11/9/2015	2/29/2016
Manual Recorded Depth of Ground Water (ft)					
Datum Well	6.25	Dry	Dry	Dry	Dry
MW-1	15.30	Dry	Dry	Dry	Dry
MW-2	17.96	Wet*	Wet*	Wet*	Wet*

*Some condensation/dampness at the bottom of well

During the four site visits completed in the 2015-2016 project year all manual water levels measured at each of the three wells indicate wells were dry with no measurable alluvial ground water levels recorded. In July 2014, LRE installed a pressure transducer in MW-1 to provide continuous measurements of depth to water within the well. Since that time, the device has been measuring and recording water pressure/levels at the bottom of MW-1 every 15 minutes. LRE has reviewed the pressure transducer data from the 2015-2016 project year and have found the data recorded to be inconsistent with manual measurements. Therefore, data was not compiled for this report. As a result the pressure transducer will be recalibrated, reprogrammed, and reinstalled in the 2016/2017 project year and the monitoring of MW-1 will continue.

Monitoring Program Maintenance Plan

Since March 2010, OneRain has been the contractor assisting in the monitoring and maintenance of the Sterling Ranch climate station. The design of the monitoring plan is modular, and the maintenance requirement of each monitoring program element is different. Once installed, routine physical inspections of all instrumentation were conducted. Real-time sensors were remotely monitored to verify that they are operating correctly. The data-logging sensors were checked and maintained every time that the data was retrieved. During the 2015-2016 project year, the data

reports were reviewed and found the temperature sensor was not reporting values consistent with nearby stations. The temperature sensor is to be replaced by July 2016 and additional program checks implemented. All other data reports were reviewed and found to be consistent, with no major outliers resulting from measurement and program errors.

Beginning in July 2011, Leonard Rice Engineers, Inc. has been responsible for the data collection and maintenance of the Upper Sterling Gulch flume, trail cameras, and monitoring wells. The site has been visited a total of five times over the 2015-2016 monitoring season with maintenance and data collection occurring each time. During the 2015-2016 project year, data was recovered from all sensors and cameras during the March through October monitoring season. Flume data reports were reviewed and found to be consistent, with no major outliers resulting from measurement and program errors. While a trail camera is currently installed at the Sterling Gulch flume, no photographs were available for any of the recorded events during the 2015-2016 Project Year. Although photographs were taken, camera settings, battery issues, and general camera malfunctions resulted in the loss of data. All cameras were replaced and reprogrammed for the 2016-2017 Project Year. At each of the monitoring wells, water level data was collected manually using an M-scope and pressure transducer data has been collected from MW-1. Data collected at the monitoring wells are then reviewed for consistency.

Natural Consumptive Use, Return Flows to the River, Water Budgets, and Models

With most natural conditions monitoring programs in place, it is anticipated that future efforts will be focused on the development and integration of water budgets and modeling. With the Precipitation Harvesting Criteria and Guidelines Updated and Approved to contain HB 15-1016 provisions, Sterling Ranch anticipates that future modeling efforts maybe focused on the development of regional ET coefficients (factors) to support and SWSP.

Phase 2: Experimental Precipitation Harvesting Designs

Experimental precipitation harvesting designs is an ongoing planning and implementation effort that evaluates the feasibility of residential, commercial, and regional harvesting designs at the development. Sterling Ranch continues to evaluate and collect information about different types of precipitation harvesting designs, equipment, and materials. There is no data to report on Experimental Precipitation Harvesting Designs for the 2015-2016 project year.

Phase 3: New Precipitation Harvesting Designs

New construction and implementation of planned new precipitation harvesting designs is anticipated to begin within the year with the focus on regional capture designs. Sterling Ranch continues to evaluate and collect information about different regional precipitation harvesting systems, equipment, and materials. Implementation and monitoring of the new regional precipitation harvesting system is planned for the initial filing, Providence Village (**see Figure 5**). Providence Village is also the location where the majority of rainwater harvesting is currently

planned. Sterling Gulch Reservoir (aka Providence Lake) will be used to regulate stormwater flows to historic peak discharges, and used to manage rainwater captured for use in the non-potable water system. There is no data to report on New Precipitation Harvesting Designs for the 2015-2016 project year.

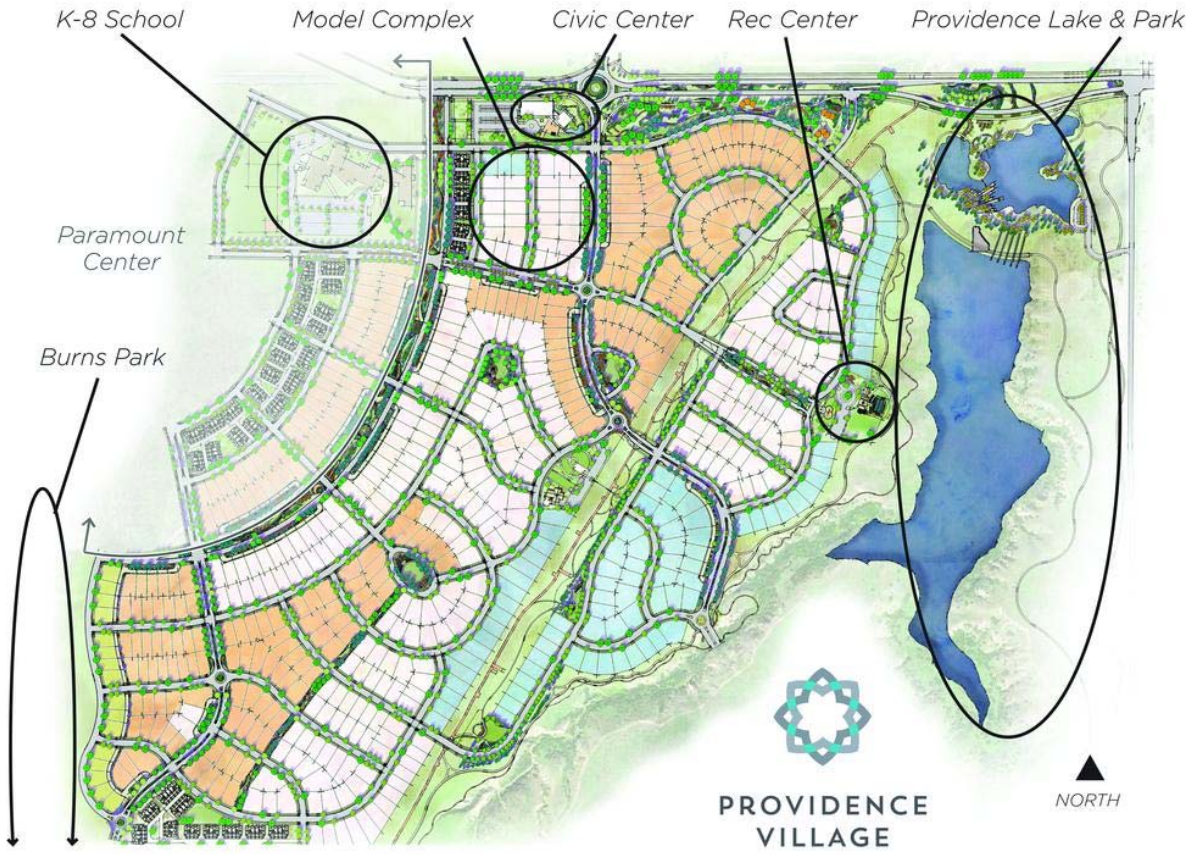

Figure 5 – Providence Village at Sterling Ranch (Filing 1)

Overall Pilot Project Schedule

With final zoning in place, the pilot project continues to progress, with only a slight deviation from schedule. The delay in development has caused some delays in the progress of the pilot project, especially for the developed conditions. With construction and home building starting this summer we expect the pilot program to be back on schedule by next year. Below is a summary of the variances from the original application:

2015-2016 Variance from Application:

- Climate and precipitation monitoring site was installed in March of 2010 and is collecting data. *On Schedule*
- The lysimeter was installed in April 2014 and ET and deep percolation monitoring has begun. *Delay = approx. 3 years*
- The first surface water monitoring site was installed in June 2011 and is collecting data. *Ahead of schedule = 6 months*
- Ground water monitoring started in September 2011. *Ahead of schedule = 1 year*
- All planning and implementation of Experimental Harvesting Designs has been delayed.
    - Residential Experimental Site - *Delay = approx. 5.5 years*
    - Commercial Experimental Monitoring Site - *Delay = approx. 5.5 years*
    - Regional Observation Site - *Delay = approx. 5.5 years*
- All New Precipitation Harvesting Designs are planned to begin within the next year.
    - Residential System - Delay = approx. 4 years
    - Commercial System – Delay = approx. 3.5 years
    - Regional System – Delay = approx. 3 years
- The proposed administration plan originally included a preliminary administration report developed for demonstration site as a test for the development of the new sites. Planning and development of administration is planned to begin in the next year with the development regional factors supported by HB- 15 1016 - *Delay = approx. 5.5 years*

Figure 6 shows the proposed timeline with the adjustments made due to the extended schedule as described above. As shown, the climate and precipitation monitoring programs were implemented and began monitoring in 2010. In 2015-2016 natural conditions data collection has resumed with the continuation of lysimeter and ET monitoring. Experimental precipitation harvesting designs is an ongoing planning and implementation effort that evaluates the feasibility of residential, commercial, and regional harvesting designs at the development. New construction and implementation of planned new precipitation harvesting designs is anticipated to begin within the year with the focus on regional capture designs.

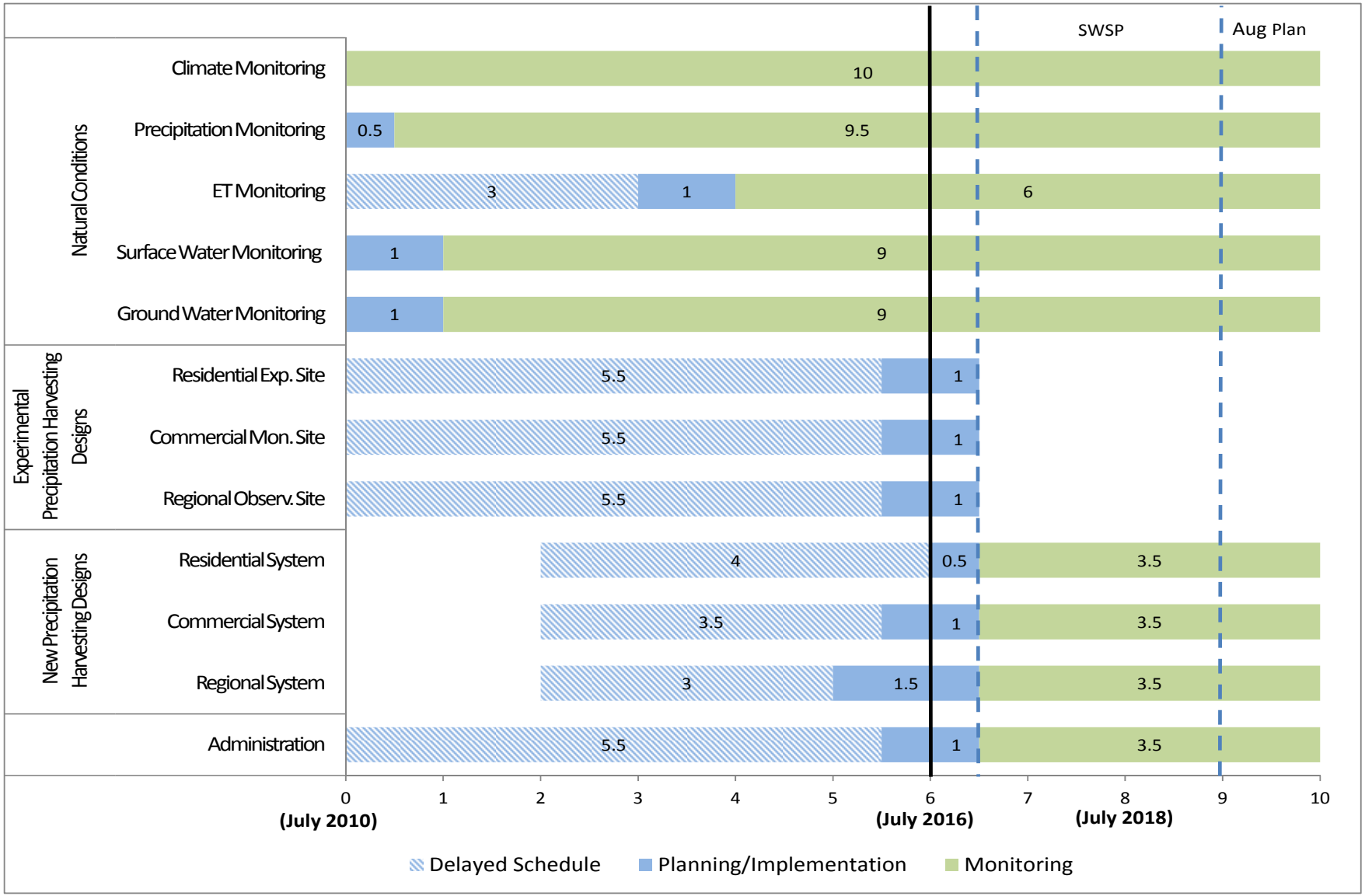

Figure 6 – Updated Pilot Project Schedule

Augmentation Requirements

The augmentation requirements that will be met under an approved Substitute Water Supply Plan are expected to begin within the next year. The updated Criteria and Guidelines help define development and use of regionally applicable factors for the Dominion Water and Sanitation District service area and the SWSP requirements associated with rainwater harvesting and captured stormwater.

Implementation

Collection and irrigation system design have not currently been finalized or implemented. Therefore, no data is yet available for describing operation and maintenance or for estimating collection efficiencies.

Estimated Water Savings, Landscape Plans, Metered Water Use, Consumptive Use and Estimated Water Conservation, and Estimated Unit Cost for Rainwater

Currently there is no new information to provide on the estimated water savings, landscape plans, metered water use, consumptive use, estimated water conservation, and estimate unit cost for rainwater capture and use.

Costs to date

Costs for the Pilot Project have occurred primarily in the efforts for the monitoring of natural conditions. These are summarized below:

Natural Conditions

In 2015-2016; climate station and lysimeter monitoring, station maintenance, data collection, data management and reporting were the primary costs. These costs were:

- Climate Station and Lysimeter Monitoring – $5,000
- Natural Conditions Monitoring and Maintenance – $8,000
- Data Management/Analysis/Reporting – $7,000

Partnerships and the Sharing of Information

The Colorado Legislature, Colorado Water Conservation Board, and Division of Water Resources are important partners that continue to support the development of rainwater as a viable non-potable water supply. In the 2015-2016 project year there are two primary examples of their support. The first example was the passing of HB 16-1005, also known as the rain barrel bill. Previously unsuccessful during the 2015 session, the Bill was revised to include additional language recognizing the doctrine of prior appropriation and the role of the State Engineer. These provisions among others, allowed the Bill to be successful, allowing rainwater capture for single family residents and utilizing no more than 110 gallons of storage. The passage of HB 16-1005 has provided several opportunities to engage the water community and educate them about the Sterling Ranch Pilot Program and the importance of pairing rainwater harvesting with water conservation practices.

The second example is the updated Criteria and Guidelines to include provisions in HB 15-1016. The updated Criteria and Guidelines provide a streamlined path forward for the development of an SWSP supporting rainwater as a viable and legal water supply.

Group tours of the site and natural conditions monitoring program continue to be provided to public visitors, other water districts, and water providers as an example of the process and steps required to utilizing rainwater as a reliable water supply. Information on how Sterling Ranch has developed these sites and the process used to quantify rainwater as a physical and legal supply continues to be discussed with interested parties throughout the state.

Closing

This letter report describes the sixth year of the Sterling Ranch Precipitation Harvesting Pilot Study. If you have any questions, please feel free to call at 303-455-9589.

Sincerely,

LEONARD RICE ENGINEERS, INC.

Mark Mitisek, P.H.
Senior Project Hydrologist

Greg Roush, P.E.
Chief Operating Officer

Sterling Ranch, Attachment A - CWCB Requirements for Annual Report

1. A description of variances from the Pilot Project application including information on any data quality issues that may magnify if results are extrapolated to a larger scale project.

2. Precipitation harvesting performance metrics, including:
    a) Description of final collection system design with plans and specifications of all system components.
    b) Operation and maintenance plans and any issues encountered.
    c) Meter data of water flowing into the precipitation collection device and estimated capture efficiency.

3. Pilot project implementation plan and estimated water conservation achieved through pairing precipitation harvesting with advanced outdoor water management, including:
    a) A description of the applied method used to capture precipitation and any potable water supply with plans and specifications for all system components including any technology utilized (system programmers, ET controllers, etc.).
    b) Landscaping plans including measured irrigated acres, plan descriptions, theoretical irrigation water requirement methods, results, and water budgets reflecting application efficiencies.
    c) Metered water use from precipitation collection system. Water use will be categorized by use if application varies.
    d) Metered water use from other potable water supplies if the precipitation collection is supplemented. Water use will be categorized by use if application varies.
    e) Comparison of actual consumptive use by category of use to estimated water budgets. Estimate amount of water conserved as a result of the precipitation harvesting.
    f) A landscape maintenance assessment of quality of the landscapes, maintenance issues encountered, and any necessary replacement of plantings. The results of the irrigation system audit and corresponding actions.
    g) Cost to date including design, infrastructure, operations, and maintenance costs. Estimated costs to implement precipitation harvesting system per acre-foot of water saved; and comparison of original projected and actual costs from implementing the precipitation harvesting systems. The cost comparison will include institutional, legal, technical/design, infrastructure, and augmentation water supplies.

4. A description of the climate and hydrologic data collected to characterize the preexisting, natural vegetation conditions including:
    a) A description of the methodology and analysis results toward providing information about the technical ability to reasonably quantify the site-specific amount of precipitation that, under preexisting natural conditions, accrues to the natural stream system via surface and ground water return flows.
    b) A description of the baseline set of data and sound, transferrable methodologies used for measuring local weather and precipitation patterns that account for variations in hydrology and precipitation event intensity, frequency, and duration.
    c) Descriptions of the methodology and analysis results quantifying preexisting natural vegetation consumption; measuring precipitation return flow amounts; identifying surface versus ground water return flow splits; and identifying delayed ground water return flow timing to receiving streams.

d) Quantification of the amount of precipitation that must be augmented to prevent injury to decreed water rights.
e) Description of the location and methods used to collect climate data measurements, with a summary of data including, at a minimum, temperature and precipitation