Memorandum

Date: July 26, 2016

To: Andrea Mackenzie, Santa Clara Valley Open Space Authority

Cc: Matt Freeman and Jake Smith, Santa Clara Valley Open Space Authority

From: Jim Robins, Senior Ecologist/Principal, Alnus Ecological

Subject: **Technical Memo Coyote Valley Water Resources Investment Strategy Phase 1 findings: Water-related Ecosystem Services**

Executive Summary

The Santa Clara Valley Open Space Authority (OSA) and the Santa Clara Valley Water District (District) established in 2015 an MOU outlining the agencies' shared commitment to support joint initiatives to promote watershed conservation in the Santa Clara Valley. As part of this partnership, the agencies have engaged Alnus Ecological to explore opportunities in the Coyote Valley to advance the goals of both agencies through collaborative projects. This memo reports the preliminary findings of Phase 1 of the Coyote Valley Water Resources Investment Strategy as a pilot project for protection of water resources.

Findings from Phase 1 indicate that the Coyote Valley offers significant opportunity for conservation, management, and restoration of open space lands that will enhance local water resources, wetlands, and wildlife habitat. Our findings describe the potential value of projects that promote long-term protection of water resources while also advancing conservation goals, particularly aquifer recharge for stable water supply, mitigation of flood risk through stormwater capture, and improved surface and groundwater quality, and that well-managed projects will have multiple water and other resource benefits. This work cues up Phase 2 of the project, in which we will identify specific types and locations of projects, conduct more granular modeling to forecast projected benefits, and conduct an economic cost-benefit analysis of individual green infrastructure projects.

Coyote Valley Water Resources Investment Strategy: Project background and phase 1

Natural landscapes are known to provide society with numerous benefits that go beyond recreational and aesthetic values, including a suite of ecosystem services. When planned and managed intentionally for optimizing ecological resilience, natural landscapes – including agricultural lands – can efficiently and effectively buffer communities against the effects of changing weather patterns due to climate change. Some of the most important benefits of such ecosystem services are those related to managing the quality and quantity of water, both surface water bodies as well as groundwater. This green infrastructure can be more effective – and less expensive – than built infrastructure, and can also provide a range of other co-benefits.

Santa Clara County is one of the fastest growing counties in California, with a current population of 1.8 million that is predicted to grow to 2.3 million by 2030.[1] With this growth, water demand for new households and businesses will continue to increase. The rural Coyote Valley in Santa Clara County is an ideal setting for a pilot project to quantify the benefits that conserving open space has for enhancing and managing water resources, and to identify how we might further enhance these benefits by employing land management and planning for green infrastructure.

With a focus on examining surface and groundwater, we set out to evaluate the current and future potential benefits that the Coyote Valley has on four related ecosystem services by asking the following questions:

1. Are there opportunities in the Coyote Valley to enhance **groundwater recharge** through improved land management to capture stormwater? If so, how much, and where could it be captured and percolated?
2. What will be the change in downstream **flood risk** if we increase stormwater capture in the Coyote Valley?
3. Where are the best opportunities for multiple benefit **ecological restoration** actions to improve aquifer recharge and flood attenuation?
4. Can green infrastructure within Coyote Valley improve and enhance **surface and groundwater quality**?

We investigated these questions by reviewing published reports and scientific literature, consulting with subject matter experts, modeling scenarios in collaboration with SCVWD hydrology staff, and analyzing stream gauge data. Our findings are detailed below.

Ecosystem Service #1: Groundwater Recharge

Groundwater, the single most important water source supplying Santa Clara County, is drawn primarily from the Santa Clara Plain Basin. The vast majority of this basin is urbanized, and due to the density of impervious surfaces, most of the groundwater recharge within the Santa Clara Plain occurs within stream channels or managed recharge ponds. The Coyote Valley sub-basin is the only sub-basin feeding the Santa Clara Plain Basin. It contains significant amounts of rural, undeveloped land overlying a large unconfined aquifer. Whether stormwater can be used to recharge groundwater via the open space of the Coyote Valley depends on a number of factors.

For several decades, the District has used managed recharge in streams and percolation ponds to maintain balance in Santa Clara and Coyote Valley basins in order to avoid land subsidence. Imported water accounts for more than 50% of Santa Clara County's water supplies, the

[1] https://www.sccgov.org/sites/dpd/AboutUs/CountyInfo/Pages/AboutCounty.aspx

majority which is used for managed aquifer recharge.[2] While the effort to keep the basins in balance has proven effective over a number of decades, the recent prolonged drought has highlighted the vulnerability of reliance on imported water. In 2013-2014, water imports were curtailed by 75%,[3] leading to overdraft conditions in the Santa Clara Plain Basin. This basin is currently experiencing significant groundwater declines, and is nearing emergency thresholds for subsidence.[4]

Declines in imports were exacerbated by an increase in groundwater pumping, resulting in average groundwater level declines of over 40% in the Santa Clara Plain Basin and 2%[5] in the Coyote Valley Sub-basin. While conditions in 2016 appear to have improved, allocations are still far below average, hampering the ability of the District to maintain these basins in a state of balance.[6] Pumping is expected to continue to increase over time,[7] and water demand will increase to keep pace with the rapid growth of our region. **Without additional supplies, by 2030 the demand for water in Santa Clara County is expected to exceed best-case water supply scenarios.[8] In short, continued reliance on imported water places our water supply in an increasingly vulnerable position.**

The relative stability of the Coyote Valley sub-basin water level is in part the result of natural recharge from rainfall on the existing permeable soils in the Coyote Valley.[9] Estimates of natural recharge in the Coyote Valley sub-basin can fluctuate drastically between years, as this basin shows rapid recharge to local precipitation.[10] In 2014, annual groundwater losses from this sub-basin were estimated to be in the range of 10,000-12,000 acre-feet from pumping, and 4,000 acre-feet of outflow to the Santa Clara Plain Basin.[11] Given that this estimate was for a year (2014) in which recharge from imported water was severely limited, it is very likely that a large portion of the outflow to Santa Clara Plain Basin came from local origins, *i.e.* deep percolation of rainfall in the Coyote Valley. It is likely that the Coyote Valley Basin functions as a kind of reservoir, both storing water locally and also providing a slow, constant flow of cool subsurface water (some of which is local, not imported water) to the larger Santa Clara Plain basin, Fisher Creek, and Coyote Creek.

District modeling suggests that if the Coyote Valley basin were in a state of prolonged overdraft, flow patterns between the two aquifers would reverse, “pulling” water from the Santa Clara Plain into the Coyote Valley.[12] Such a reverse flow could result in disastrous and costly consequences, including additional need for subsidence control, and movement of brackish and/or contaminated urban groundwater upstream into areas of high quality

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[2] Santa Clara Valley Water District, 2015
[3] Ibid
[4] Ibid
[5] While the average decline was measured as 2%, groundwater levels in the southern and central Coyote Valley appear to be much less stable and dropped as much as 40’ between spring and fall of 2014.
[6] Santa Clara Valley Water District, 2016
[7] Santa Clara Valley Water District, 2015
[8] SPUR, 2013.
[9] *Ibid*
[10] City of San Jose, 2007 asserts, “Water levels in the Coyote basin respond quickly to changes in circumstances and precipitation.” The District’s July 2016 Groundwater Conditions Report supports this assertion with managed recharge estimates of 5,800 acre-feet (121% of normal), corresponding to the Coyote index well being 29ft higher in June of 2016 than 2015 and 25ft above the 5-year running average (Santa Clara Valley Water District, 2016). Fluctuations in recharge are exemplified by the estimates of 500 acre-feet in 2013 and 2,400 acre-feet in 2014.
[11] Santa Clara Valley Water District, 2014 and 2015
[12] Santa Clara Valley Water District, 2015

groundwater. It is clear that it is of utmost importance that Coyote Valley sub-basin water levels remain high enough to maintain its natural flow relationship to the larger Santa Clara Plain basin.

Models by Russo *et al.*[13] concluded that, when compared to sites close to the coast, recharge projects placed farther inland were more effective in long-term reduction of sea-water intrusion, reduced groundwater loss to the ocean, and greater availability of groundwater for extraction. The Coyote Valley sub-basin position is the most inland extent of the Santa Clara Plain Basin.

With this in mind, we hypothesize that recharge projects sited in Coyote Valley itself will result in a sound long-term local strategy for subsidence prevention, salination prevention, groundwater conservation, and availability of freshwater supplies. We further hypothesize that the responsiveness of the Coyote Valley sub-basin following precipitation events presents a unique opportunity to achieve this goal by utilizing Coyote Valley's open space to optimize stormwater capture and percolation.

With these hypotheses in mind, we investigated the following questions: *Are there opportunities in Coyote Valley to enhance groundwater recharge by capturing stormwater? If so, how much water, and where could it be captured and percolated?*

Approaches

To answer the above questions, we used four approaches.

First, using the District's gauges on Fisher Creek at Monterey Blvd and at Laguna Avenue, we conducted a monthly water availability analysis. For Monterey Blvd, we converted gauge data to average monthly flow to better understand the total amount of water moving through the Fisher Creek system that could be available for groundwater recharge.

Second, to determine maximum volume of water available for stormwater capture, we utilized existing SCVWD Hydrologic Modeling System (HEC-HMS) modeling to quantify the total volume of runoff and recharge within each sub-basin in the Coyote Valley during 2-year, 5-year, and 10-year storm events.

Third, in consultation with experts at San Francisco Estuary Institute, we examined data from historic aerial imagery, historic soil maps, and review of soil borings from the 1950s to identify specific areas with the opportunity for increased recharge.

Finally, we consulted with experts at UC Santa Cruz's Recharge Initiative to review the results of the above models and other recharge suitability data including geologic and soil information, historic ecology data, stream channels and floodplains, and additional site suitability data to help determine areas with the best characteristics for stormwater capture and recharge.

Findings

Flow gauges on Fisher Creek:

Discharge data from the District's Monterey Highway gauge on Fisher Creek show that an

[13] Russo, et al. 2014

average of 815 acre-feet, 3,910 acre-feet, and 10,626 acre-feet flow through Fisher Creek between October and April during "dry," "normal," and "wet" years, respectively.[14] Appendix A shows the summarized monthly flow for these three categories of years. This flow represents a viable underutilized resource that could be optimized for recharge and/or aquatic habitats.

Both the Laguna Avenue and Monterey Highway stations show approximately 1,500 acre-feet of water flowing past both locations during an 11-day period before and after the storms on March 7 and March 14, 2016,[15] indicating that storms can create enormous spikes in runoff in relatively short periods of time.

Stormwater Modeling

After reviewing model results, 4 out of the 10 Fisher Creek sub-basins within the Coyote Valley (Fisher Creek sub-basins 3,4,6,7) provide relatively high amounts of runoff and recharge and are located in an area of relatively high suitability for stormwater capture (*e.g.*, rural or undeveloped land uses, low density of septic systems, overlying an unconfined groundwater aquifer, contain high percolation soils within stream channels or downslope from runoff source areas, etc.). As shown in Table 2, the District's modeling suggests a high volume of water that could be captured by the natural landscape in these during 2-, 5-, and 10-year storm events.

Results indicate that there is a significant amount of water generated during storm events that could be captured to increase the contribution of local water to the recharge of the Coyote Valley sub-basin and Santa Clara Plain basin.

Table 2: Fisher Creek sub-basin recharge and runoff volumes, indicating high volumes of recharge potentially occurring in these basins and large volumes of runoff that could potentially be capture for additional groundwater recharge.
* Basins of interest

	2-year storm		**5-year storm**		**10-year storm**	
Sub-Basin	Landscape recharge (acre-feet)	Runoff (acre-feet)	Landscape recharge (acre-feet)	Runoff (acre-feet)	Landscape recharge (acre-feet)	Runoff (acre-feet)
FISHER_1	121	73	161	55	181	31
FISHER_2	80	67	101	50	111	26
FISHER_3 *	250	196	322	151	357	82
FISHER_4 *	171	131	217	99	240	52
FISHER_5	147	102	192	78	216	44
FISHER_6 *	118	105	148	80	162	42
FISHER_7 *	152	120	194	91	213	48
FISHER_8	59	48	74	37	81	20
FISHER_9	52	37	68	28	76	15
FISHER_10	86	56	142	13	125	23
TOTAL	**1237**	**383**	**1620**	**684**	**1762**	**933**

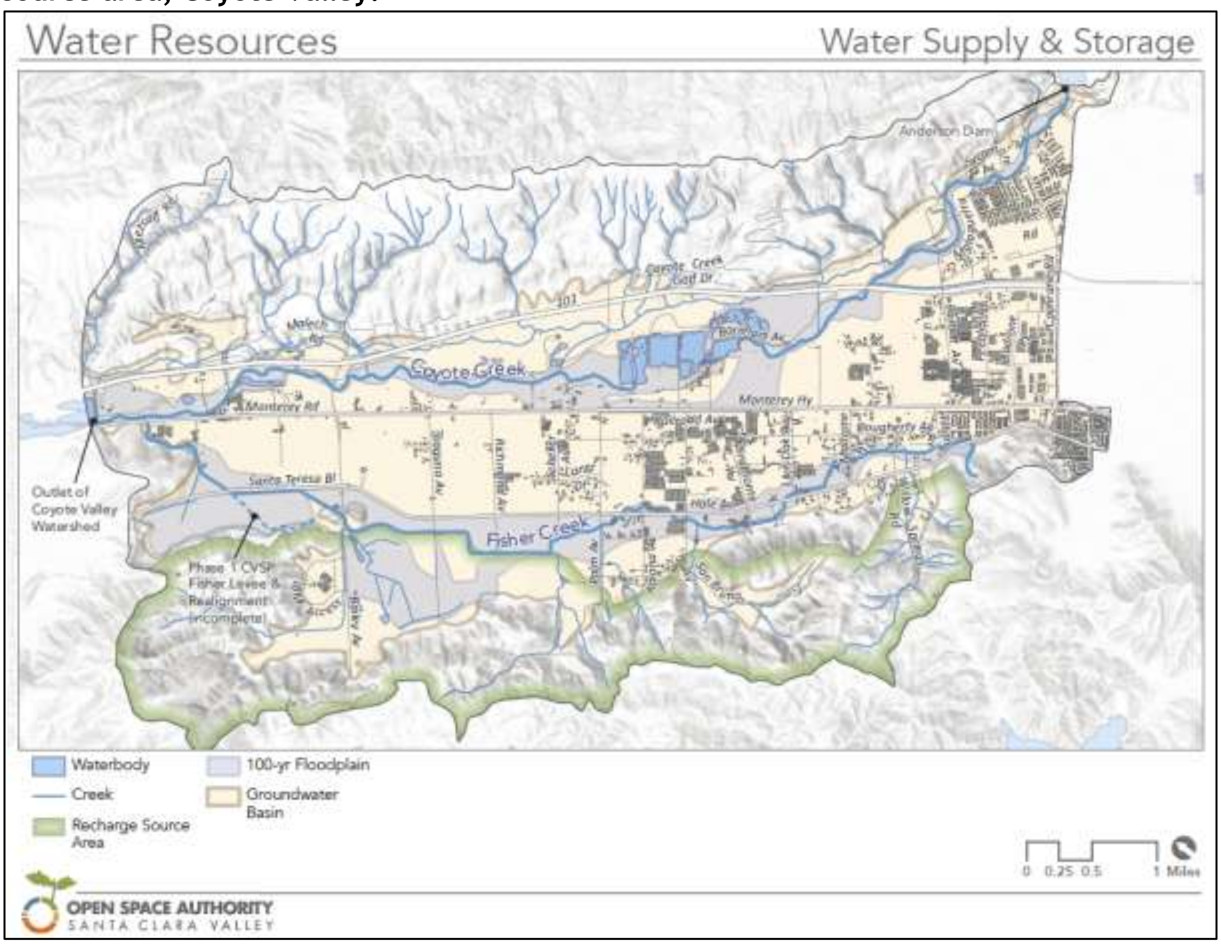
Source: Santa Clara Valley Water District

[14] Dry season flows (May-September) in Fisher Creek were removed from the analysis, since District data suggest these flows are primarily groundwater from Coyote Creek returning to the system in the lower reach, just upstream of the narrows.
[15] Paul Frank, FloWest, personal communication

SFEI and UC Santa Cruz Review

The current landscape can be managed and/or restored to improve recharge conditions and capture some of the water lost to shallow percolation and runoff. Key tributary valleys such as OSA's Coyote Valley Open Space Preserve North Meadow and the valley adjacent to IBM's campus appear to be particularly amenable to optimizing land management for groundwater recharge. Additionally, realigning Fisher Creek to flow through areas of gravelly, high percolation soils located at the western foothills of the Coyote Valley would increase the capture of stormwater, allowing it to recharge the groundwater instead of contributing to stormwater flows. The most effective and efficient locations for increased recharge in Coyote Valley are areas of gravelly soils, specifically at the mountain faces and within tributary valleys.

Figure 1: Areas of high percolation soils and recharge potential indicated as recharge source area, Coyote Valley.



<u>Conclusions</u>

Groundwater recharge from local rainfall and runoff is already significant in the Coyote Valley, and it provides a meaningful source of inflow to the Santa Clara Plain Basin.

Results from flow gauges following a short 11-day stormy period, as well as our modeling efforts of storm runoff, show that a substantial amount of water – close to 1,500 acre-feet in 2016, following just two storms – flushed into the Bay as stormwater. This stormwater runoff represents an important opportunity for capture and recharge.

A recent white paper by San Francisco Bay Area Planning and Urban Research (SPUR)[16] urges management of stormwater as a water supply source and a key strategy for improving water supply reliability in Silicon Valley. The incremental recharge offered by stormwater capture in Coyote Valley will help to buffer our water supply during drought, reduce impacts of future increased urban and agricultural demand, help maintain flow gradient and outflow to the Santa Clara Plain, support shallow groundwater wetlands, and protect against subsidence.

Climate models for the South Bay region predict prolonged droughts, thus necessitating diversity and redundancy in our water supplies, especially since – as we have observed in recent years – imports are likely to decrease in times of water stress. Climate models also predict drier, longer summers, and flashier, more intense winter rainfalls.

Our analyses suggest that conditions in Coyote Valley can maximize the benefits of these otherwise difficult climate changes. The contiguous open space and rapid responsiveness to intense rainfall of Coyote Valley sub-basin can help to provide flow to the Santa Clara Plain Basin, prevent subsidence, and manage the threat of reverse flow and saltwater intrusion into the larger aquifer. **While not a panacea for the region's water needs, maximizing natural recharge in the Coyote Valley sub-basin must be a critical tool in our resilience toolbox.**

Ecosystem Service #2: Flood Attenuation

Flooding in the City of San Jose along Coyote Creek is a known problem that presents a risk to health and safety, and places a major economic burden on local government. Flood risk reduction is a critical responsibility of both the District and the City, and requires significant ongoing investments to maintain.

According to the District's 2015 Draft Coyote Creek Hydrology Study[17], the current undeveloped landscape of the Coyote Valley provides significant flood attenuation benefits for downstream landowners and the city of San Jose. This benefit is provided by the existing permeable landscape – green infrastructure including natural floodplains, agricultural fields and historic wetland features that absorb and detain overflow from Fisher Creek, until after the storm peaks have passed.

Development of natural and agricultural lands in the Mid and North Coyote Valley is likely to result in reductions to the size, management, and effectiveness of these natural floodplains. Left unmitigated, development at the scale of the Coyote Valley Specific Plan would nearly triple peak flows in Fisher Creek, from 1,530 cfs to 4,210 cfs.[18] Flood control infrastructure as proposed in the Coyote Valley Specific Plan[19] could mitigate direct localized flood impacts of this development, but there are several technical, policy, and resource issues that could

[16] SPUR, 2016
[17] Santa Clara Valley Water District,2015
[18] Schaaf & Wheeler, 2006
[19] City of San Jose, 2006

reduce the effectiveness and feasibility of the proposed detention system.[20]

Furthermore, urbanization within the Coyote Valley and the loss of its natural floodplain will reduce natural aquifer recharge by approximately 25%, or enough water for 3,400 homes each year.[21] Finally, the hydro-modification analysis in the Specific Plan focuses on managing runoff from new urban development, but fails to account for lost opportunities for additional Valley floodplain storage via enhancement projects and the co-benefits provided by these green infrastructure alternatives for stormwater management.

Conversely, if we consider strategic conservation and improvement of floodplains within the Coyote Valley, we can quantify the benefits of increased flood attenuation, and manage them in a manner that maintains or enhances groundwater recharge, supports a more effective riparian corridor and Laguna Seca wetlands, and improves water quality.

With respect to potential flood attenuation benefits of Coyote Valley floodplains, we investigated the following question: *What is the maximum possible downstream flood risk reduction benefit possible by capturing stormwater in the Coyote Valley?*

Approaches

Working with District staff, we used existing District HEC-HMS models to determine the flood outcomes of 72-hour duration 10-year and 100-year storm events centered in Coyote Valley. We also examined change in peak flows at two downstream San Jose locations known to be prone to flooding - the Mobile Home Park at Old Oakland Road and the area surrounding Williams Street. To quantify the *maximum* flood benefit that could accrue from stormwater capture projects in the Coyote Valley, we modeled downstream peak flow reduction that would occur with the capture of *all* Fisher Creek stormwater. The modeled change in peak flow was then compared to peak flow flood thresholds known by District staff. Although capture of all storm flows from Fisher Creek would be infeasible (in part because this would likely decrease flows to Coyote Creek, impacting steelhead habitat), this approach gives us the absolute upper bounds estimate of downstream flood risk reduction potential by working on stormwater capture projects in the Coyote Valley.

Findings

We found that if all flows from Fisher Creek and its tributaries were removed from the downstream Coyote Creek system, peak flow rates at Mobile Home Park and Williams Street would be reduced by 3-4.5% (Table 3). This translates into a reduction of 438 cubic feet per second (cfs) for the 100-year event and 345 cfs for the 10-year event at Williams Street. District staff know that the Williams Street locations are 600 cfs under capacity during 10-year storm events. **This suggests that Fisher Creek stormwater retention projects could theoretically capture more than 57% of the flow that floods the Williams Street location during 10-year events.**

[20] Schaaf & Wheeler, 2006
[21] Schaaf & Wheeler, 2006

Table 3. Peak flow rate reduction from 72-hr Coyote Valley-centered storm, as modeled by HEC-HMS.

	COY11 - Mobile Home Park all measurements in cfs				COY8 - Williams St all measurements in cfs			
Storm event	With Fisher Ck flows	w/o Fisher Ck flows	Difference	% difference	With Fisher Ck flows	w/o Fisher Ck flows	Difference	% difference
100-year	14,849	14,395	454	3.06%	13,085	12,647	438	3.35%
10-year	9,030	8,683	347	3.84%	7,632	7,286	346	4.53%

Source: Santa Clara Valley Water District

<u>Conclusions</u>

Presently, without any interventions to improve green infrastructure, floodplains along Fisher Creek absorb substantial flows during storm events and attenuate downstream flooding in Coyote Creek. If this capacity were lost due to development in the region, downstream flooding would increase. The approaches proposed by the Coyote Valley Specific Plan to mitigate downstream impacts of floodplain reduction and urbanization will also result in a significant decline in natural groundwater recharge, and raise a number of questions regarding their effectiveness and feasibility. In addition, the approaches in the Coyote Valley Specific Plan primarily maintain the current level of downstream flood risk.

Well-planned stormwater capture enhancement projects in the Coyote Valley would reduce downstream flood risk while also providing a suite of co-benefits. Although capture of *all* flow from Fisher Creek is infeasible, our study indicates that there are measurable and potentially very valuable flood risk reduction benefits associated with stormwater capture in the Coyote Valley. These projects are not necessarily an either/or proposition, and could complement traditional flood infrastructure projects, lessening the human and financial toll of flooding in San Jose.

Ecosystem Service #3: Wetland Habitat Restoration/Enhancement

The Coyote Valley represents a unique opportunity to restore a number of unique and nationally rare habitat types that are vanishing rapidly, including the historic Laguna Seca wetland and the emergent wetlands and riparian forests within Fisher Creek's floodplain. The Laguna Seca wetland complex, the largest freshwater wetland in Santa Clara County, offers significant opportunities for restoration and enhancement. Historically, the Laguna Seca complex was approximately 1,000 acres in size with a gradient of perennial wetlands, seasonal wetlands, and meadows.[22] Fisher Creek is the primary drainage flowing through the western portion of the Coyote Valley. Prior to Fisher Creek's realignment (which has left it entrenched and incised), it supported the larger Laguna Seca wetland complex.

[22] Grossinger et al., 2006

The Coyote Valley Specific Plan EIR recognizes that realignment and enhancement of Fisher Creek is necessary to mitigate flood risk impacts of development and to enhance habitat and improve recreational opportunities.[23] Despite recognizing the value of these two landscape features, the Coyote Valley Specific Plan does not fully explore restoration approaches for Fisher Creek and Laguna Seca that increase co-benefits and performance from present-day conditions. Both Laguna Seca and Fisher Creek represent rare opportunities to restore aquatic function while also restoring habitat that benefits a much larger suite of our region's wildlife populations, including those species that rely on the Coyote Valley corridor to move between the Santa Cruz Mountains and Diablo Range.

Given the hydrological and ecological importance of Laguna Seca and Fisher Creek, and that these areas have yet to be conserved, we focused on these two areas and asked the question: *Where are there opportunities for enhancing water recharge and flood attenuation while restoring aquatic habitat and other biodiversity benefits?*

Analysis

To address this question, we reviewed several reports on Laguna Seca Wetland,[24] and consulted with San Francisco Estuary Institute (SFEI) experts on the historical ecology of Coyote Valley. We also used the analyses previously described for groundwater recharge to understand the potential availability of water to support perennial and seasonal aquatic habitats.

Findings and Conclusions

There is still an opportunity to restore a semblance of the natural hydrograph to Fisher Creek and its tributaries, and to restore native habitat in and around the Laguna Seca complex. Preliminary hydrologic and ecological analyses suggest that restoring a mosaic of habitat types spanning from the Santa Cruz Mountain drainages, through a realigned and greatly expanded Fisher Creek corridor, and into a portion of the historic Laguna Seca, is physically and technically possible, and does not necessarily preclude development within the Coyote Valley.

A realistic restoration scenario for Laguna Seca would focus on a portion of the historic footprint, not the entire Laguna Seca. **This large-scale restoration could result in thousands of linear feet of a restored Fisher Creek and riparian corridor and hundreds of acres of various types of wetlands, wet meadows, and valley oak savannah.** Further development of these restoration plans requires identification of specific ecological goals and specific actions on the landscape to reach these goals.

In 2012, the District concluded[25] that ecological restoration of Laguna Seca was infeasible due to uncertainty around maintaining groundwater levels in the northern Coyote Valley to support a perennial wetland. This conclusion was based in part on District projections of future groundwater pumping and lack of regulatory authority to control groundwater extraction in the Valley. Since this analysis, a critical change has occurred that may alleviate this concern. The Sustainable Groundwater Management Act, passed in 2014, may provide the District significant regulatory control over groundwater pumping and management into the

[23] City of San Jose, 2006
[24] Santa Clara Valley Water District,2012; Santa Clara Valley Water District, 2011; Aguilera, J.R., 1999/revised 2007; Woodward et al., 1959.
[25] Santa Clara Valley Water District, 2012

foreseeable future. This important regulatory change enables the District to pursue restoration of Laguna Seca with the authority it requires to ensure necessary water levels.

Reconnecting Fisher Creek directly to a portion of the historic Laguna Seca footprint (such as the terminal basin) will increase the inflow needed to support wetland restoration. In addition, the upstream actions to increase natural recharge (described earlier) should result in additional groundwater resources needed to restore a portion of Laguna Seca's diverse wetland types. While restoring a portion of Laguna Seca wetland complex and Fisher Creek's riparian habitats would require additional water, preliminary analysis suggests that this water usage may be offset by increased recharge and/or the savings in water demand due to the change from irrigated agriculture to native habitat.

Opportunities also exist to restore tributaries and alluvial fans flowing from the Santa Cruz Mountains into the Coyote Valley. These would result in multiple benefits including increased meadow and riparian habitat, increased groundwater storage capacity, reduced peak flows, and reduced sediment delivery to Fisher Creek. Several of these co-benefits of restoration of the Fisher Creek system will add value to the quantity and quality of water downstream of Coyote Narrows, assisting the District's efforts to recover Steelhead Salmon populations.

Ecosystem Service #4: Water Quality Improvement

Surface water monitoring has shown that suspended sediment, nitrate, and fecal coliform are known to be problems in runoff from tributaries within Coyote Valley.[26] Water draining into Coyote Creek from Fisher Creek appears to be so degraded that a CA Department of Fish and Wildlife (CDFW) fisheries biologist suggested that both winter and summer flows out of Fisher Creek could be detrimental to fish populations in Coyote Creek.[27] In South County (including Coyote Valley), domestic drinking water wells showed higher levels of nitrate (31% above the maximum contaminant level), and coliform bacteria were found in 27% of South County domestic wells.[28]

Given these concerns with water quality in streams and wells, we are investigating the following question. *Can green infrastructure in Coyote Valley be designed to improve surface and groundwater quality?*

A well monitoring program throughout the Coyote sub-basin provides valuable data on groundwater quality, summarized in the District's Annual Groundwater Monitoring Reports, and we continue to gather data from the District on surface water quality in the Fisher Creek system.

Increased urban development and pollutants from agricultural intensification could result in further degradation of surface and groundwater quality in the Coyote Valley Basin, Fisher Creek, and downstream in the Santa Clara Plain and Coyote Creek. Green infrastructure in the form of managed treatment wetlands or filtration wetlands can effectively reduce nitrate levels in the water through denitrification, and reduce suspended sediment loads through increased residence time and exposure to biogeochemical reactions. Treatment wetlands can be incorporated into the design of recharge and habitat restoration, and can increase the quality of water for human consumption and aquatic species habitat.

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[26] Melissa Moore, SCVWD, personal communication
[27] M. Leicester, CDFW, personal communication
[28] Santa Clara Valley Water District, 2014

Summary

Existing open space in the Coyote Valley already provides valuable ecosystem services that benefit water resources. In this time of water stress, changing climate, and rapid urban growth, we have the opportunity to better manage our water resources through open space conservation and land management practices. With some investment, this green infrastructure can provide a more resilient water supply for our region, and can help us meet multiple environmental objectives. **Improved management of open space and interventions that facilitate percolation of storm flows and runoff presents a significant opportunity to simultaneously attenuate floods and provide flows needed for restoring habitat. Habitat restoration, in turn, can further help to recharge groundwater, attenuate floods, and improve water quality.**

Next Steps

The Phase 2 of the Coyote Valley Water Resources Investment Strategy will focus on building and refining the analyses conducted to date and conducting more detailed quantification of ecosystem service benefits associated with green infrastructure projects. We anticipate two specific outcomes from this next round of analysis. First, we will be able to test a number of different scenarios for green infrastructure and understand the relative performance of various projects. Second, we will be able to establish the relative costs of each project to conduct a preliminary Benefit Cost Analysis of each scenario to inform future investment, restoration, and land use planning. Ultimately, this project will identify a suite of feasible and cost-effective restoration and enhancement projects in the Coyote Valley that will maintain and enhance the provision of essential ecosystem services provided by this landscape.

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Appendix A. Summary of Fisher Creek Flows at Monterey Highway

	Dry Years		Normal Years		Wet Years	
Month	Avg Daily Flow (cfs)	Avg Monthly Flow (Acre-Ft)	Avg Daily Flow (cfs)	Avg Monthly Flow (Acre-Ft)	Avg Daily Flow (cfs)	Avg Monthly Flow (Acre-Ft)
Jan	2.2	134	14.1	868	37.2	2285
Feb	3.6	199	14.5	803	47.2	2624
Mar	3.0	182	12.4	760	35.4	2174
Apr	1.8	106	8.7	515	26.7	1586
May	1.0	62	6.1	375	13.6	837
Jun	0.6	35	4.1	247	9.6	570
Jul	0.4	26	3.5	212	7.6	467
Aug	0.4	22	3.2	198	6.6	407
Sep	0.4	22	3.1	184	7.3	436
Oct	0.5	33	3.9	239	7.7	470
Nov	0.7	44	4.2	253	9.6	570
Dec	1.9	118	7.7	472	14.9	917

Source: Data from Santa Clara Valley Water District and Analysis by FlowWest