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City of San Luis Obispo, Open Space Survey

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1 Executive Summary

The City of San Luis Obispo (SLO) has eleven official public open spaces. Managing these places presents a challenge in providing top-tier environmental stewardship, while also accommodating passive recreational use and access, in an era of fiscal limitations and competing priorities. Given that reality and the changing population dynamics in the US, providing equal access to these facilities is of increasing importance, whether by car, bike, on foot or via public transit. These open spaces provide value (environmental, economic and social) primarily to residents, as well as visitors, and gaining a data-driven understanding of that value was a primary goal of this study.

Within this framework, team of undergraduate and graduate students from CalPoly, San Luis Obispo worked under the direction of Dr. William Riggs and Natural Resources Manager Robert Hill, to evaluate the conditions, characteristics-of, and visitors-to SLO open spaces. To accomplish this, the project team conducted an initial facilities assessment of the existing conditions at the entrances to SLO's open spaces. Following this, a survey was conducted to gather information about use, conditions and travel / access to local open spaces. This was complimented by use data gathered from electronic counters placed at open space entrances.

Figure 1: Natural Resources Manager Hill assists with an assessment of Bishop Peak.

In summary, the user survey indicated that SLO open space users were primarily white and affluent. Approximately 70% of all users have a degree from a four-year university, with

average age of 46 years old. Most come from the City of San Luis Obispo (63%), while thirty-seven percent (37%) of users come from outside the City of SLO and 6% from outside SLO County. San Luis Obispo's larger open spaces (Johnson Ranch, Bishop Peak, and Cerro San Luis) average between 400 and 600 users daily.

Based on this assessment, the most clear finding is the heavy use of open spaces, however data shows that use was more diffuse than anecdotal inference would suggest, with 40% of use volume occurring at Johnson Ranch, 22% at Bishop Peak, 17% at Cerro San Luis and 11% at Irish Hills. This issue of heavy use at 4 signature reserves underpins three key issues for improvement: 1) transportation access; 2) trash; and 3) education / wayfinding. Results clearly show a distinction between open spaces that were used by neighborhoods, and those that have a broader, regional usage base. This underscores the importance of travel since many open spaces have acute parking issues (particularly Johnson Ranch and Bishop Peak) and missed opportunities for transit connectivity. Facilitating their trips in a manner consistent with community goals of the Land Use and Circulation Element (LUCE), has the potential to contribute in helping manage demand at more crowded open spaces, while nourishing the economic multiplier effects that open space can have (a factor that is evident throughout our work but warrants further, in-depth study).

Likewise, of additional import is our observation and documentation of trash issues, and invariably the top issue related to dog feces. At one point in time our team observed as many as 7 bags of feces at one entrance. Pet control is an area of equal concern based on survey responses, and numerous off-leash animals were observed throughout the study period. The clearest solution to this is to provide tools for open space patrons to self-police, by providing trash bags and bins and trailheads. That said, this involves a maintenance and personnel burden. Additional policy opportunity resides in opportunities to reconsider pet policy and conduct higher levels of enforcement. Better education and signage might also work to help improve this, and offer the opportunity to tie in to conservation, educational, and wayfinding goals.

This aspect of signage and wayfinding provide a final area for suggested improvement and action. Our facilities inventories show an inconsistency in messaging across open spaces and sometimes within each open space. While some of this variability in messaging relates to directional signage for navigation, it also relates to differences in how signage connects to education kiosks and messaging on SLO's environmental values. We also noted very little integration of digital technology in this area and no bilingual serves for non-native English speakers. We hypothesize that there may be latent demand for such a resources, and based on this we recommend a follow-on signage and wayfinding plan that can take a comprehensive look at this subject. Clearly, improvement in this area could vastly enhance the quality and visual aesthetics of the open spaces – especially at their front door, the open space entrances.

While none of these issues are a fix-all, and a universal approach may not fit every specific open space, broad work on the issues of transportation, trash and wayfinding / education, could potentially help SLO in meeting its conservation goals. SLO open spaces will continue to provide social and economic value to new sets of users, while maintaining the ecological quality of its natural resources.

2 Introduction

The City of San Luis Obispo (SLO) has approximately 3,500 acres of open space for natural resource conservation purposes where community passive recreational use is also allowed. Per the Conservation and Open Space Element (COSE) of the City's General Plan the primary goal of these spaces is "to protect (open space) resources (such as air and water, wildlife habitat, scenic and agricultural lands, watershed and historic features) with a secondary goal of accommodating passive recreation where it will not harm the environment or interfere with agricultural operations." (COSE 6-9). The city also holds a goal that such community will not only be ecologically self-sustaining (6-36) with promotion of native trees, vegetation and wildlife (COSE 6-40 to 6-44) but that the City will "allow public access to open space that fosters knowledge and appreciation of open space resources without harming them and without exposing the public to unacceptable risk." (COSE 6-51)

As underscored by these community documents, these open spaces are important for SLO. This value of open space appreciation is consistent with a broad base of academic literature which shows benefits of integrating the natural environment in urban areas -- from the macro scale influences on local heat and climate conditions to the micro scale with a connection with active lifestyles, health and biophelia (Jonker, Lenthe, Donkers, Mackenbach, & Burdorf, 2014; Takano, Nakamura, & Watanabe, 2002; Ulrich, 1984; Ulrich et al., 1991; J. Wolch et al., 2011; J. R. Wolch, Byrne, & Newell, 2014). Studies illustrate the overlap of human and natural systems that come into play in urban areas. Green space and human interactions are sometimes dealt with separately, however in urban spaces the lines between the two become more blurred – one clearly impacting the other. Literature has also demonstrated that when comparing the value of open spaces there can be benefits (Boswell, Greve, & Seale, 2012; Dooling, Graybill, & Greve, 2007; Oleyar, Greve, Withey, & Bjorn, 2008) but also that when there is a lack of environmental quality, neighborhoods degrade (Gilderbloom, Meares, & Riggs, 2014.; Gilderbloom et al., 2014.; Knight & Riggs, 2010; Riggs, 2014)

It is in this context that this study assesses how people use and access SLO open spaces. To do this we first conducted a facilities assessment evaluating entrances to the open spaces and inquiring how more multi-modal access can be achieved to these spaces. After this, we surveyed approximately 400 individuals (both in-person and online) about their open space use. We balanced this survey with traffic-related use data from a pyro-electric counter. The results of both of these data points were then analyzed and the opportunities and constraints evaluated. With this information, recommendations were identified for potential policies or strategies that could improve use of and access-to open spaces in SLO.

3 Methods

Multiple methods were used to evaluate and understand how people use SLO's open spaces. First we began by visiting each of the eleven open spaces to assess and document the initial conditions of all the trailhead entrances. The next phase of the study was survey-based, in which we sought direct feedback from people that were already open space users. The survey was issued in-person to open spaces users as well as to those online participants. We balanced this survey with in-person and automated user counts to gather data about how and how much each open space was being used.

3.1 Initial Facilities Assessment

Our initial assessment of the existing conditions occurred in July 2014 and was completed over the course of a week. For each of the eleven open spaces, we visited all of the formal and known informal entrances into the space. Each entrance was evaluated using four general parameters: accessibility; biological, cultural, and geological factors; land use and environmental conditions; and transport. The parameter details are explained by:

> ***Accessibility:*** Is there bike, pedestrian or public transit access? Is it handicap accessible and/or are there any factors that would prevent some users from entering? Is the entrance easy to identify? Are bikes permitted on trails?
>
> ***Biological, Cultural, and Geological****:* What are the physical conditions and landscapes of the entrance? What is the historical background if known? Are there any sensitive habitat areas present?
>
> ***Land Use and Environmental:*** What are the surrounding environment and land uses around the open space? What is the lighting? Are there any educational amenities at the entrance?
>
> ***Transport****:* What are the car and bike parking conditions? What are the traffic conditions?

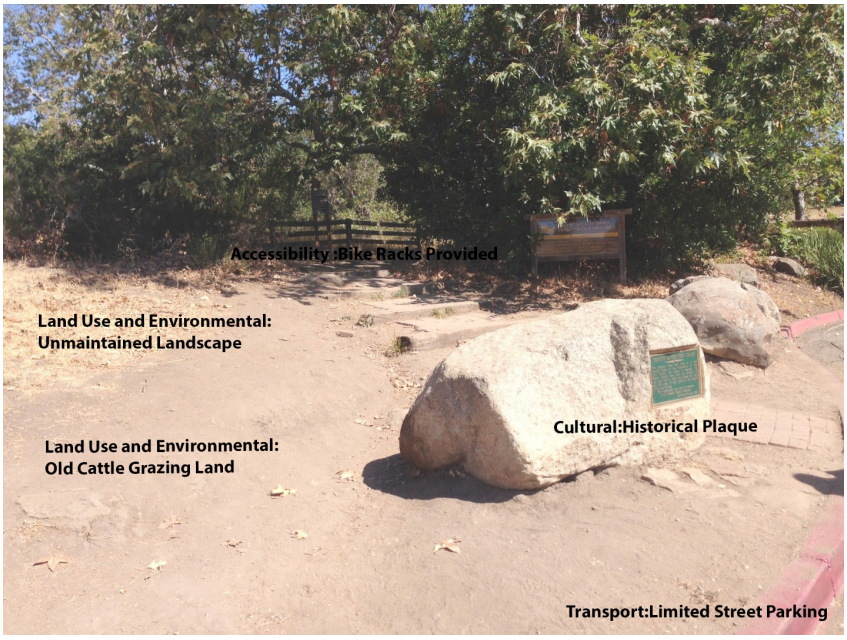

Figure 2: Example of factors observed during facilities assessment.

3.2 Survey

A survey was developed to further gain insights on how and why individuals are using San Luis Obispo's open spaces. The survey also sought to understand the demographics of open space users. The survey asked ten questions detailing how a user used the open space including: what type of transit the user uses to gain access to the open space, what activities they participated in at the open space, and any problems associated with the open space. The survey additionally asked nine questions about the user's background. Results were statistically significant at the 99% confidence interval with a margin of error of +/- 6 based on over 400 respondents. The survey complied with regulations regarding the protection of human subjects.

After the initial conditions were assessed and documented, a sign containing the online survey location (using both a QR code and website address) was posted visibly at every entrance. Approximately 20 signs were posted during the week of July 28, 2014. In order to gather information from users that may have not participated in the online survey option and to increase our sample size, the research team surveyed at the trailhead entrances of Johnson Ranch, Cerro San Luis Obispo, Bishop Peak, and Reservoir Canyon over the course of the study.

Figure 3: A flyer was posted at every open space entrance to inform users of the online survey they could participate in.

3.3 Automated Pedestrian Counts

The pyro compact bicycle and pedestrian counter (Eco-counter) was utilized at four open space trailhead locations in the City of San Luis Obispo to count user volumes over the course of several weeks. Data from the Eco-counter is useful for determining which trailheads are used most often and when peak hours of trailhead use are during the day. The Eco-counter was utilized at the Bowden Ranch Trailhead, Highland and Patricia Trailheads of Bishop Peak, Cerro San Luis, and Johnson Ranch. Real-life pedestrian counts were conducted at the Bishop Peak and Johnson Ranch locations to evaluate the standard error of the Eco-counter.

The Eco-counter sensor uses both passive infrared technology and a high precision lens to detect directional use and volume of use when a person passes in the range of the sensor. This technology allows for the counter to be sensitive enough to detect two different people with only a small gap between them. The Eco-counter is self-calibrating, adjusting to the environmental conditions on its own after its initial site installation (www.eco-compteur.com). Data confirms that the Eco-counter over counts by approximately 30%, especially when groups are involved and there is sensitivity to environment conditions (Kilambi, Ribnick, Joshi, Masoud, & Papanikolopoulos, 2008; Sidla, Lypetskyy, Brandle, & Seer, 2006).

Manual counting was performed at peak AM and peak PM hours for two sequential days. Peak hours were determined by data collected by the counter at each location, and kept consistent for the manual count times for both locations. The AM counts were conducted between 8AM and 10AM, and the PM counts were conducted between 5PM and 7PM. The manual counts keep track of pedestrian and cyclist users at each of the respective trailheads. The automated and manual counts are separated by “Ins” and “Outs” from the trailhead, and only tabulated manually when a person walks past the sensor in either direction. Counts are tabulated in 15-minute intervals. Table 2 shows a sample of both automated and observed manual counts at the Patricia Trailhead at Bishop Peak on Thursday October 23, 2014 from 5:00PM to 7:00PM.

Table 1: Patricia Trailhead at Bishop Peak PM Counts, October 23, 2014.

Date and Time	Counter			Manual		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Thu, Oct 23, 2014 05:00 PM	7	7	14	9	6	9
Thu, Oct 23, 2014 05:15 PM	2	9	11	3	0	3
Thu, Oct 23, 2014 05:30 PM	5	2	7	1	1	1
Thu, Oct 23, 2014 05:45 PM	3	0	3	4	0	4
Thu, Oct 23, 2014 06:00 PM	13	2	15	10	4	10
Thu, Oct 23, 2014 06:15 PM	0	4	4	1	1	1
Thu, Oct 23, 2014 06:30 PM	0	1	1	2	2	2
Thu, Oct 23, 2014 06:45 PM	0	4	4	5	5	5
TOTAL	30	29	59	35	19	35

The manual count samples are preliminary in the assessment of the accuracy of the Eco-counter. The data collected by both the automated counter and manually over the two-day period represent a small sample for analysis. For the purpose of determining the accuracy of the automated counter, it is assumed that the manual counts are 100 percent accurate.

Figure 4: A pedestrian eco-counter is compact device that can detect the direction that users are moving. It counts pedestrians as they cross an invisible infrared beam emitting from the device. An example is shown at the entrance of the Johnson Ranch open space.

4 Results

4.1 Facilities Assessment

The following section summarizes the initial conditions of the open space entrances. A summary of the assessment is provided in Table 1 and key data points from each assessment are found in the appendices.

4.1.1 Bishop Peak

Patricia Trailhead: This entrance is clearly marked and easy to find, with signs along Patricia Dr. pointing towards the trailhead. The entrance is located in a residential neighborhood with a significant amount street parking. Bike racks are located at the trailhead and the entrance is easily accessible by bike or foot. Although a transit stop is near the trail head, it is not in view. The trailhead is an uneven, wide, sloped path with a turnstile entry approximately 50m from the street. The trail is composed of loose dirt with some erosion and is lined with unmaintained, natural landscaping. There were no educational amenities or lighting fixtures. The entrance at the Patricia trailhead is not handicap or stroller accessible.

Highland Trailhead: This trailhead is not identified by any street directional signs and is located at the top of a steep hill in the same residential neighborhood. Access by bike and pedestrian is possible, but there is no reasonably close transit. The beginning of the trailhead is clearly marked at the top of a cul-de-sac, and street parking is extremely limited and congested. The trail entrance is long and narrow, with erosion at the beginning from continuous use. A turnstile entry is located 25m away from the street. This entrance is closer in proximity to houses which could cause trash and noise issues, and there are no educational amenities.

Unofficial Foothill Access: There is an informal lot that people use to park. Most people access this entrance by automobile and have to hop the fence to enter. Entrance is used for grazing and is on private property.

Figure 5: The entrance at the Patricia trailhead is eroded and has several narrow turnstiles.

Table 2: Facilities Assessment Summary

Open Space	*Acres*	*Transit*	*Parking*	*Trail heads*	*Illegal Trail heads*	*Cycling Access*	*Bike Racks*	*Amenities*	*Signage*	*Trash*	*Dog Feces*
Bishop Peak	360	Yes at Patricia only	Residential Street	2	1	Yes	Yes	Educational kiosk in the process of being constructed	Great signage for Patricia trailhead along Patricia drive and at immediate trailheads	Yes, nearby resident places trash bag at Highland trailhead everyday	Yes, some feces bags
Bowden Ranch	207	No	Residential Street	1	0	Yes	Yes		Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	Yes, anonymous individual places trashbag at trailhead	Yes, dog feces and feces bags scattered all over entrance
Cerro San Luis Obispo	121	No	12 spaces; high volume dirt lot	1	1	Yes but not safe	Yes	Bike bell box.	Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	No	No
Irish Hills	941	Yes at Madonna only	Residential Street at Madonna and 5-7 dirt lot at Perfumo entrance	2	0	Yes at Madonna only	No	Bike bell box and educational kiosk.	Poor signage on road to open space. Trailhead is marked.	No	No
Islay Hill	65	No	Residential Street	1	0	Yes	No		Poor signage on road to open space. Trailhead is marked.	No	No
Johnson Ranch	242	No	20 spaces, high volume dirt lot	1	0	Yes, but not safe	Yes	Bike bell box and educational kiosk.	Poor signage on road to open space. Trailhead is marked. Reasonable amount of trailmarkers on trail, however connection to Irish Hills is not marked.	Yes, anonymous individual places trashbag at trailhead	Yes, dog feces and feces bags near entrance
Laguna Lake	360	Yes	10 spaces, high volume paved lot	1	0	Yes	No		Poor signage on road to open space. Trailhead is marked.No obvious signage in actual open space.	No	No
Reservoir Canyon	487	No	5-7 low volume dirt lot	1	0	No	No		Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	No	No
South Hills	131	Yes, at Woodbridge	Residential Street	2	0	Yes	No	Educational kiosk.	Poor. No signage on road to open space. Trailhead is marked.	No	No
Stenner Springs	417	No	5 spaces, low volume dirt lot	2	0	No	No		No signage whatsover and trailhead is not marked at either entrance.	No	No
Terrace Hill	22	Yes, not in-sight	Residental Street	1	0	Yes	No		Poor. No signage on road to open space but trailhead is marked.	No	No

4.1.2 Cerro San Luis

Marsh Street Trailhead: There are no directional signs to the open space site, but the trailhead itself is clearly marked by a sign and turnstile entry. The entrance can be accessed by both foot and bike, but mainly accessed by automobile. Bike racks are available. There is a bike bath that connects from downtown to the trail head that requires crossing a highway on-ramp. The open space is near a transit stop, but not in view. There is a dirt parking lot that has a high volume of cars and congestion. The initial trail is wide and sloped, with no educational amenities. Someone unaffiliated with the City of SLO has hung a trash bag from the trailhead side, and there is some trash on the ground. Additionally, approximately five filled dog feces bags are sitting next to the trailhead entrance, along with some dog feces that were not picked up. Many of the individuals entering and exiting the trailhead have off-leash dogs.

Unofficial Access at Hill Street: Mainly used by locals, and accessed by foot and bike. To access, a private driveway is used and there is a small sign addressing public use.

Figure 6: Trash bags have been left at the Cerro San Luis Obispo Marsh Street entrance.

4.1.3 Irish Hills

Perfumo Trailhead: The entrance to the open space is not marked, but the immediate trailhead is clearly identified with signs and educational panel. The entrance is mainly accessed by automobile, although there is a bike lane leading to the entrance. Chorro Creek Bog Thistle is listed as an endangered species, and is located nearby. This open space entrance is not connected to the community and is slightly isolated and out of town. There is a small parking lot limited to about 5-7 spaces without traffic or congestion. There are no bike racks.

Madonna Trailhead: Located in a residential neighborhood, this entrance is easily accessible on foot, by bike, and transit. There is limited street parking and there are bike racks. The entrance is visible from the street but not clearly marked with signage. There is an initial concrete path with a trashcan and dog bags courtesy of the neighborhood association; it is noteworthy that this trailhead is relatively clean and free of litter and dog feces apparently due to the presence of these facilities. This path leads to a dirt path with an educational panel. Tangent to the educational panel is a box with bike bells that riders can borrow to identify themselves around corners with a little noise from the bell.

Figure 7: The Perfumo Trailhead entrance has an educational kiosk past the turnstiles.

4.1.4 Johnson Ranch

The entrance is mainly accessed by automobile and does not have clearly marked signage. The dirt parking lot is very congested. There are bike racks and the entrance is accessible by bike, although the bike route along Higuera is not the safest. There is no pedestrian or transit access. The trailhead entrance is extremely narrow, but a wide path once inside. There is a wide gate that is available for use for handicap access, but a ranger needs to unlock and open ahead of time. Someone unaffiliated with the city of SLO has posted a trash bag. This open space is off of the freeway and not connected to any communities. There is an educational kiosk available.

Figure 8: Trashbags are left at the Johnson Ranch open space entrance.

Figure 9: After the gate entrance, there is an educational kiosk and bike bell box.

4.1.5 Reservoir Canyon

Reservoir Canyon: The turnoff for the open space is directly off of US Highway 101 North, with no marked entrance or signage. Pedestrian, bike, and transit access are not available. The open space is somewhat isolated with no educational kiosks, no rules posted as to if mountain bikes are permitted, and no bike racks. There is a small dirt parking lot with 5-7 spots and three trailhead openings in the fence, but no clear signage.

Bowden Ranch Trailhead: The entrance is in a residential community with limited street parking. The open space has no directional signage, but the entrance itself is clearly labeled. Possibly near transit, but not in-site. Pedestrian and bikes can easily access the trailhead, and there are bike racks. An old adobe house and cultural heritage site are nearby the entrance.

Figure 10: The entrance to Reservoir Canyon has trash and feces bags.

Figure 11: The Bowden Ranch entrance has visible signage and bike racks.

4.1.6 Islay Hill

The entrance is not clearly marked, but the trailhead itself has great signage. Pedestrians can easily access, and transit is possibly accessible but not in-site. No bikes are permitted at the open space and there are no bike racks. We saw that someone had left a bike partially hidden in a bush near the trailhead. The entrance is in a residential community with street parking. Traffic and congestion are low. Someone unaffiliated with the city of SLO has left out a dog bowl and a gallon of water.

Figure 12: The Islay Hill entrance is a narrow dirt path to the left of the gate.

Figure 13: A bike was spotted in the bushes. There are no bike racks at Islay Hill but it appears there is definitely a demand for them.

4.1.7 Laguna Lake

This property is bike, pedestrian, and transit accessible with a marked trailhead once inside Laguna Lake Park that leads to Laguna Lake Natural Reserve. This open space is unique because it is connected to a city park with recreational amenities including trash cans, off leash dog area, restroom, benches, and picnic tables. The eastern border of the park has a small private property sign that marks the border between city and private property. The parking lot is shared with the park and is paved with ten spaces. Traffic and congestion are high and there are no bike racks

Figure 14: The Laguna Lake trailhead is wide and flat after the turnstile entrance. The entrance has visible signage.

4.1.8 South Hills

Bluerock Trailhead: There is no bike or transit, and only local pedestrian accessibility due to the entrance being far back in a neighborhood. The entrance is marked with a locked gate and a smaller unlocked gate and turnstile. There is residential street parking and traffic and congestion are low. There are no bike racks.

Woodbridge Trailhead : Bike, transit, and pedestrian accessibility is possible from South Street, but is not in sight. Entrance marked with a locked gate and a smaller unlocked gate with a turnstile. There is an educational kiosk with a bike rack located under the tree to the right. There is street parking with low traffic and congestion.

Figure 15: The Bluerock Trailhead entrance has a narrow turnstile and two sets of gates.

Figure 16: The Woodbridge Trailhead has an educational kiosk and narrow trail.

4.1.9 Stenner Springs

Stenner Springs Trailhead: The entrance is off Highway One via Stenner Creek Road, and there is no indication of a trail. There is a small dirt parking lot at the end of the road. Many hikers and walkers parked closer to the Cal Poly agricultural property and used the access road for recreation instead of hiking into the open space. Due to many private driveways, it was very unclear how to get to the trailhead. Pedestrian and transit access is impossible, and bike access is possible if the biker used Cal Poly roads. There is a bridge and path leading to an unmarked, dilapidated ropes course, but this is off-route. There are cattle grazing and a running spring, and no bike racks. After the dirt parking lot, the entrance gate for the actual trailhead appears to be on private property, but is actually on Cal Poly land. The gate leads to a bridge over Stenner Creek, followed by another trail along the creek that leads up into the City open space above the Union Pacific Railroad tracks and to The Eucs, a mountain bike skills course area.

West Cuesta Ridge Entrance (Shooters/Morning Glory): Bike, transit, and pedestrian accessibility not possible because the parking lot is directly off of the highway 101 grade. The dirt parking lot has 5 spaces with low traffic and congestion. There are no bike racks. There is a sign signifying the West Cuesta Ridge, but no entrance markers. There is a dirt parking lot and a vehicle-wide access road leading up the ridge, but it is unmaintained with many potholes currently present. Following this trail two miles, there is another parking lot that leads to an extremely steep trailhead. There are no markers. Once you go down the unmarked trail known locally as “Shooters” that begins in US Forest Service lands, you eventually end up at the “The Eucs” a bicycle-skills course that has its own educational kiosk. Further up West Cuesta Grade Road near the TV Towers and the Botanical Area in US Forest Service lands, there is a metal gate with pedestrian and bike side access that leads to the “Morning Glory Trail” which in turn leads into the City open space.

Figure 17: The entrance to Stenner Springs main trailhead does not have any signage and is hard to distinguish from surrounding private property.

4.1.10 Terrace Hill

The entrance is located in a residential neighborhood with limited street parking. The entrance is bike and pedestrian accessible and transit is possible, but not in sight. There is a locked gate and smaller turnstile leading to a wide, steep path. There is an open space sign hanging on the gate, but there is no directional street signage. There are no bike racks.

Figure 18: Terrace Hill Open Space has a very narrow turnstile entrance. The entrance is in a residential neighborhood but there is no street signage.

4.2 Survey Results

Following our initial assessment, we conducted a survey of over 430 individuals. This was done using two methods: 1) direct intercept of trail users; 2) emails to users through local mailing lists. The information gathered offered insight into the variables that made certain open spaces more desirable as well as constraints and problems. Results were statistically significant at the 99% confidence interval with a margin of error of +/- 6. The survey complied with regulations regarding the protection of human subjects promulgated by Cal Poly.

4.2.1 Open Space Most Frequently Visited

Johnson Ranch was the most frequented open space at 40%, with Bishop Peak and Cerro San Luis at 22% and 17% respectively. The number amount of Johnson Ranch users was strongly influenced by individuals using the Johnson Ranch/Irish Hills connector, a factor that is supported by the high number of users who frequent Irish Hills, where 11% of users claimed that it was their most frequented venue. Additionally many respondents state that they used "other" open spaces actually because they used multiple in one trip (e.g. Johnson and Irish Hills, Cerro San Luis and Laguna Lake).

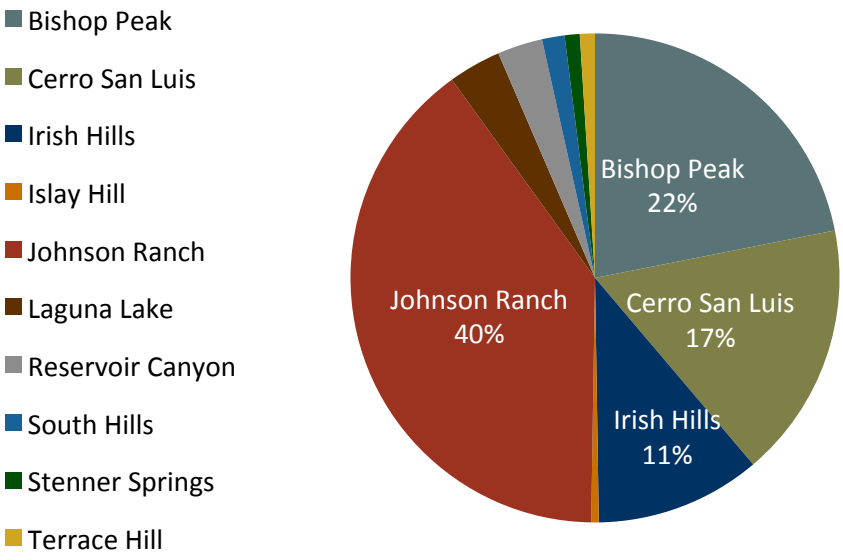

Figure 19: Users self-report the open space they most frequent.

The responses support the concept that SLO has 4 "signature" open space properties in Johnson Ranch, Bishop Peak, Cerro San Luis Obispo, and Irish hills. Stenner Springs was the least frequented open space, with only 1.2% of users claiming that it was their most frequented space, followed closely by Islay Hill at 1.8%. Laguna Lake, South Hills, Terrace Hill, and Reservoir Canyon also had low user rates

4.2.2 Days Per Month to Your Most Frequented Open Space

Users were asked to report the number of days per month that they visit their most frequented open space. 85% of users access SLO open spaces multiple times per week.

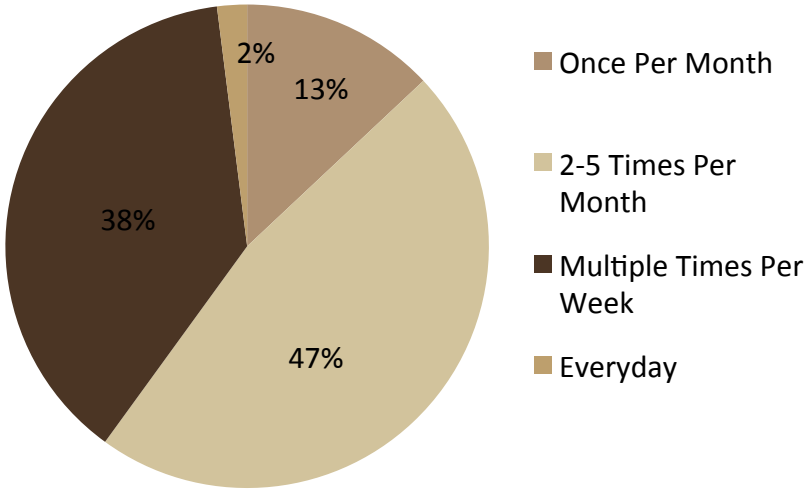

Figure 20: Users were asked how often they visit the open space they most frequent.

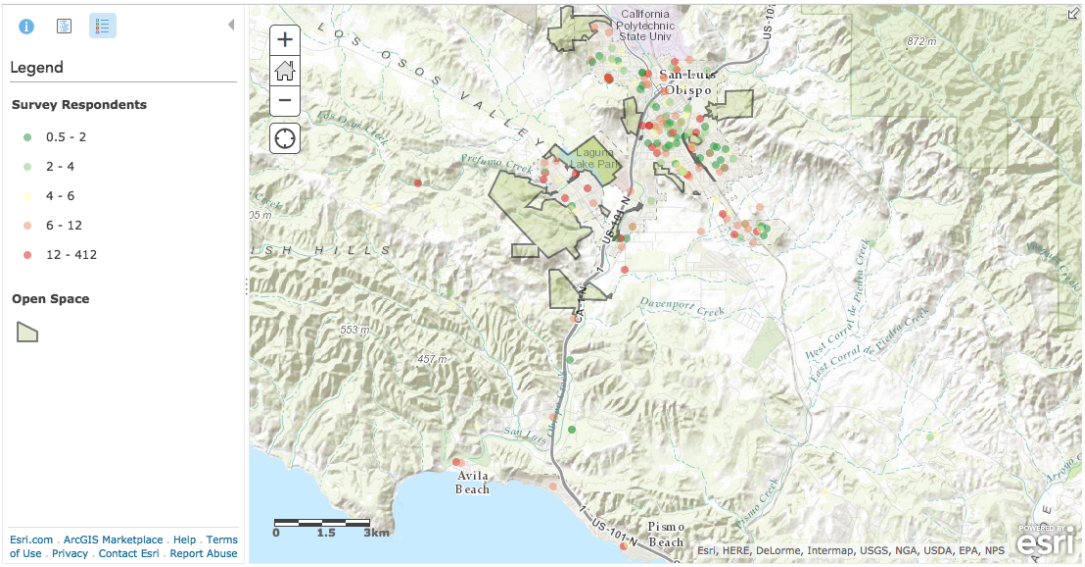

Figure 21: Map of how often users visit the one open space site that they most frequent.

4.2.3 Days Per Month to Any Open Space

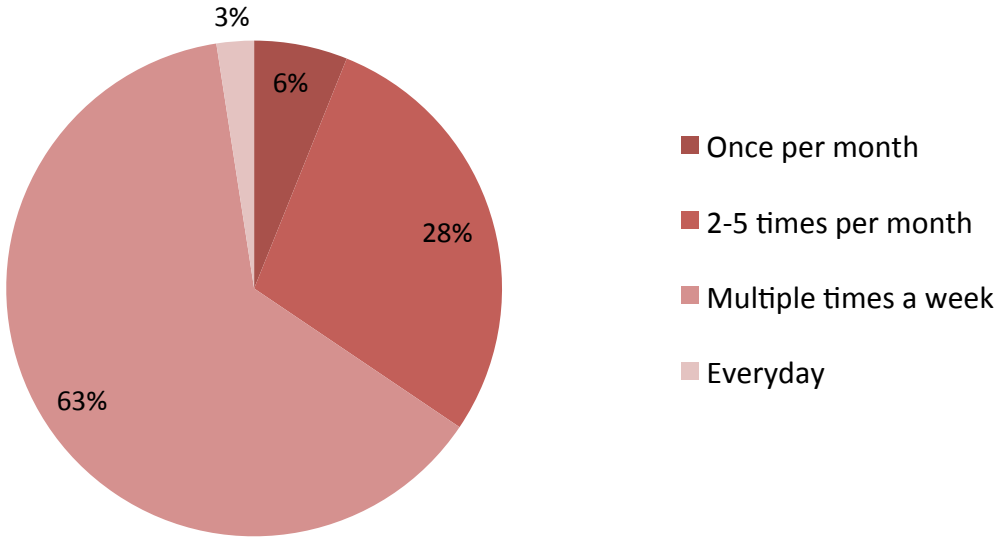

Figure 22: Total number of times users visit any of San Luis Obispo's open spaces.

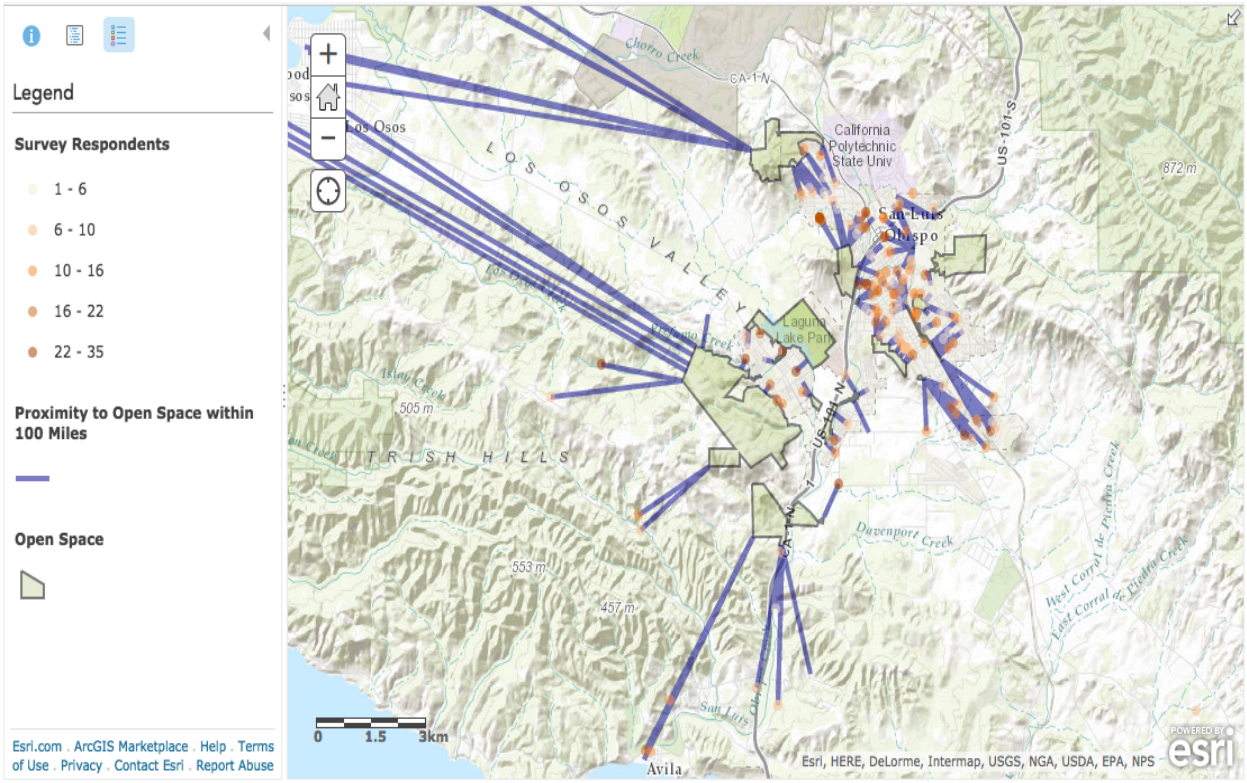

Figure 23: Map with total number of times users visit any of San Luis Obispo's open spaces and closest open space irrespective of use.

4.2.4 Reason Visited

A significant majority of users reported that exercise is their main reason for visiting an open space. 84% of users partake in exercise as their main activity, followed by 46.7% of users stating ‘recreation’ as their main reason, and 19.9% stated ‘sightseeing’ as their reason.

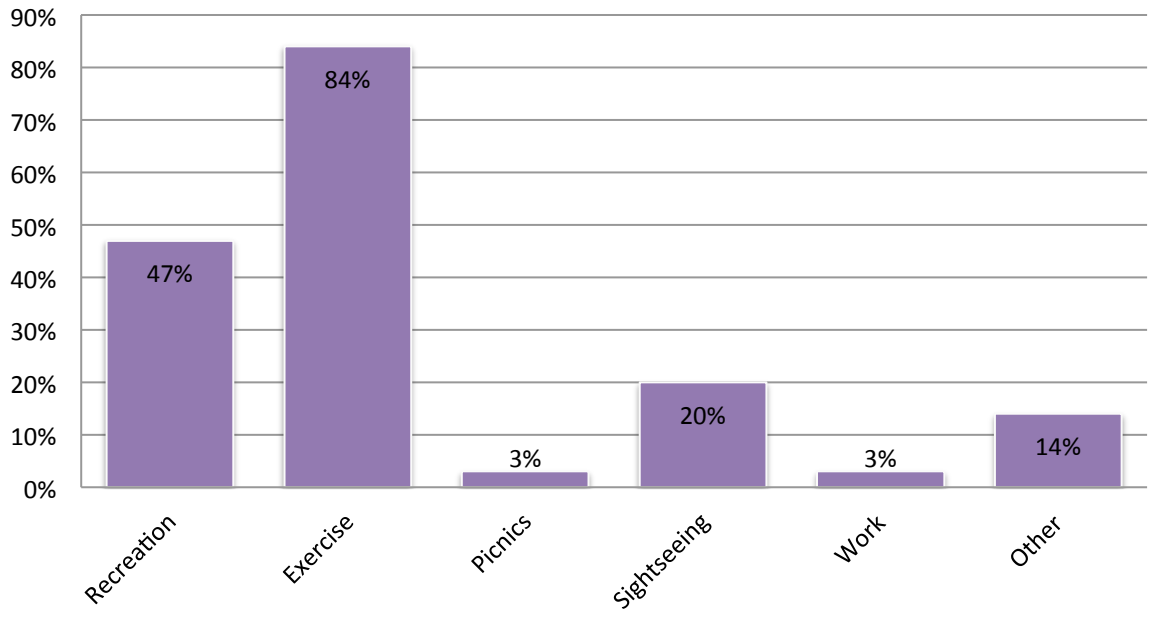

Figure 24: Reasons why users visit open spaces. Users could select multiple reasons for visiting.

The most common responses for when users selected ‘other’ was a tie between mountain biking and proximity. Users reported comments such as “Walking distance from my home” and “closest to work = convenient.” The second most common response was also a tie between dog walking and being outside in nature. Comments included “Get out into the open”, “To try to escape civilization” and “Hike with my dog.”

Table 3: Most common responses for "other" reasons why users visit open spaces.

Top Responses to "Other"	*Count*	*%*
Mountain Biking	8	17.4
Proximity/Location is close to home or work	8	17.4
Dog Walking	6	13
Be outside and experience nature	6	13

4.2.5 Things That Could Better the Experiences

When users were asked about what amenities or features that would improve their open space experience, 30.2% users asked for bathrooms, followed by drinking water and wayfinding at 25.3% and 23.4%. The lack of car parking is also a concern for users with almost 14% reporting that more car parking space would improve the open space.

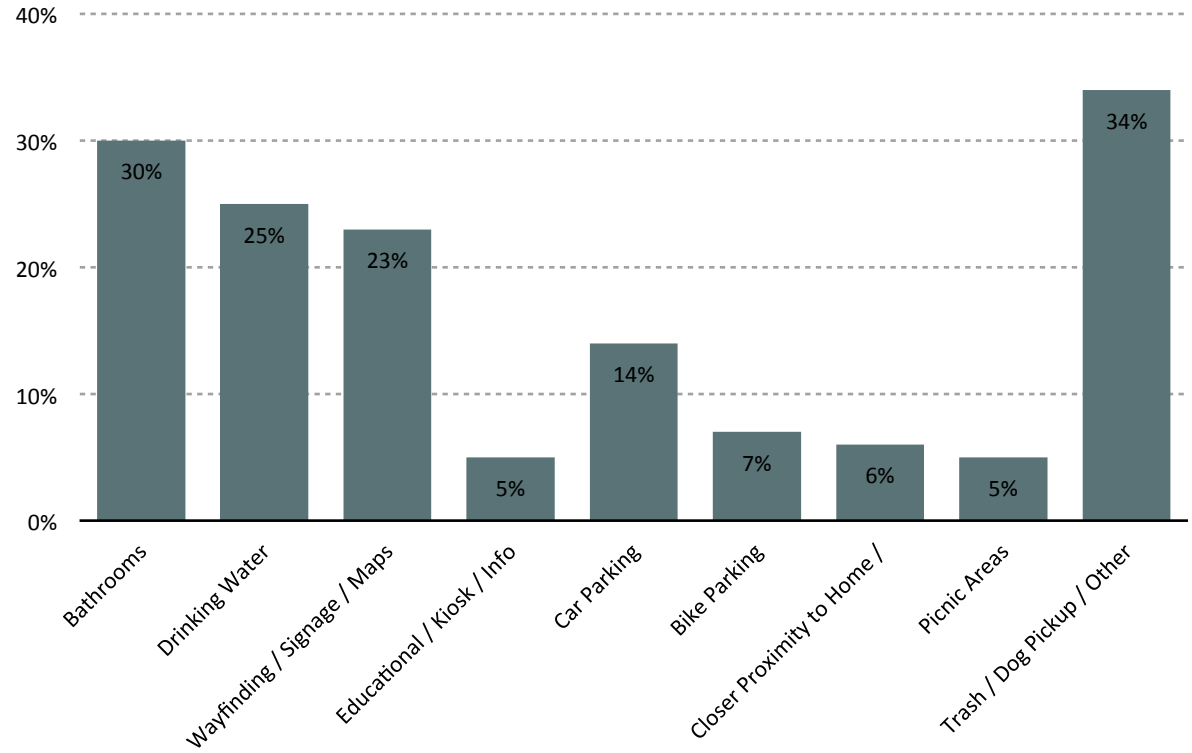

Figure 25: Factors and amenities that users felt would better their experience.

The option “other” was actually the most popular at 34.1%. Some prevalent themes for the “other reasons” that could improve open space include: more access to the open space, more trails, enforcement of dog leash laws, picking up dog waste, and the need for trash containers. Users reported comments such as “[Trails] Accessible to mountain bikes,” “Trash, dog feces removal,” and “Trail erosion.” There are also a significant number of responses that stated that the open spaces needed nothing and should be left in their natural state without adding amenities such as restrooms. Comments included “Keeping things natural and not adding man made features” and “Keep it natural; do not city-fy it.”

Table 4: Common responses for "other" ways open spaces could be improved.

Common "Other" Reasons that would improve open space	Count
Trash cans / feces disposal	39
Less development	18
More trails	9
Better trails (less erosion)	8
Separate bikers from hikers	5
Enforce dog leash laws	5
More benches	2

4.2.6 Who Users Visit Open Spaces With

The majority of users, 54.7%, reported that they visited the open spaces with their friends. 30.5% users go with their family, and 26.9% of users go alone.

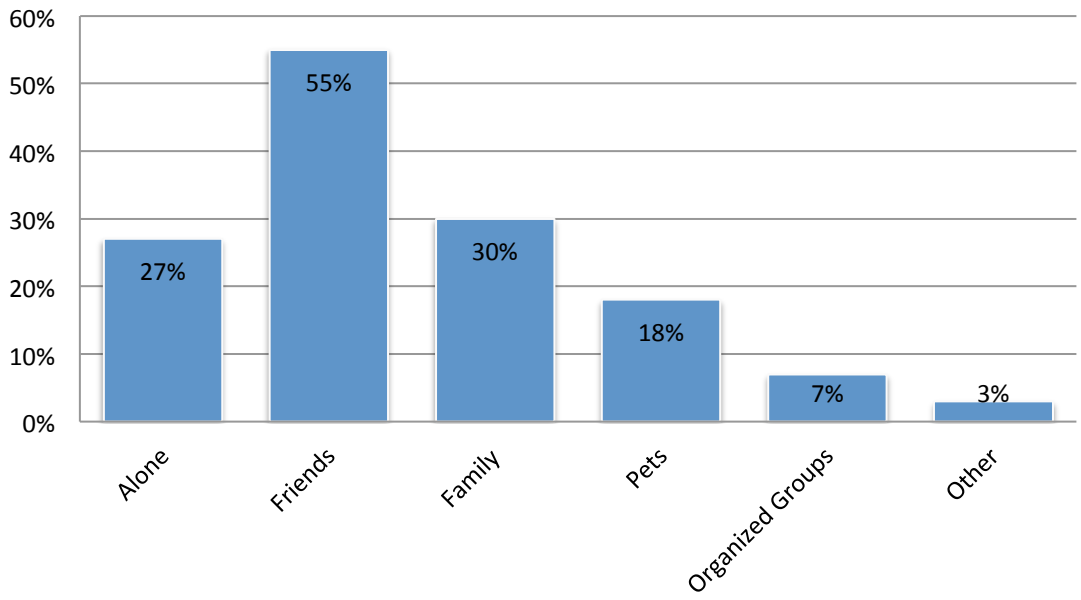

Figure 26: Who users usually visit open spaces with.

4.2.7 Getting to (Accessing) Open Spaces

The most popular method of transportation to open spaces is by car with 67.7% of users getting to open spaces through this method. 12.4% of users walk and 7.9% users bike. 7.6% of users stated that they walked or drove depending on the space, but the majority of responses were not specific of what open space they were referring to. Users that selected "other" also typically stated that it depended on the space. Examples include: "[I] live downtown so I can walk/bike to some, but drive to others" or "Walk to Terrace Hill." The high amount of users that drive to open spaces is most likely why users reported that car parking was an issue earlier in the survey results. This is notable because the 2014 SLO Land Use and Circulation Element targets a 20% cycling mode share – far more than the 8% that currently access open spaces via that mode.

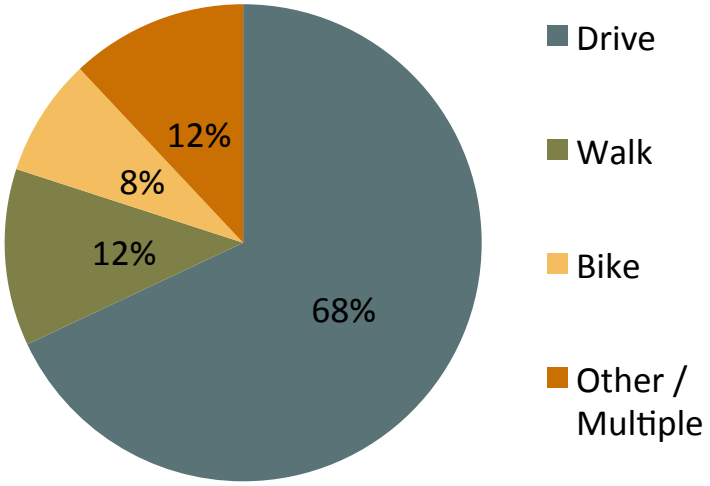

Figure 27: How users typically transport themselves to open spaces.

4.2.8 Getting Information About Open Spaces

64.5% of users get information about the open spaces through word of mouth, as opposed to city websites or guidebooks. While this may under-represent the power of the internet as a tool, since many responses were gathered in person, it does indicate the power of an active user base willing to share their experiences and favorite open spaces via word of mouth. It should also be noted that the detail responses within the category "other" representing 23% were highly fragmented.

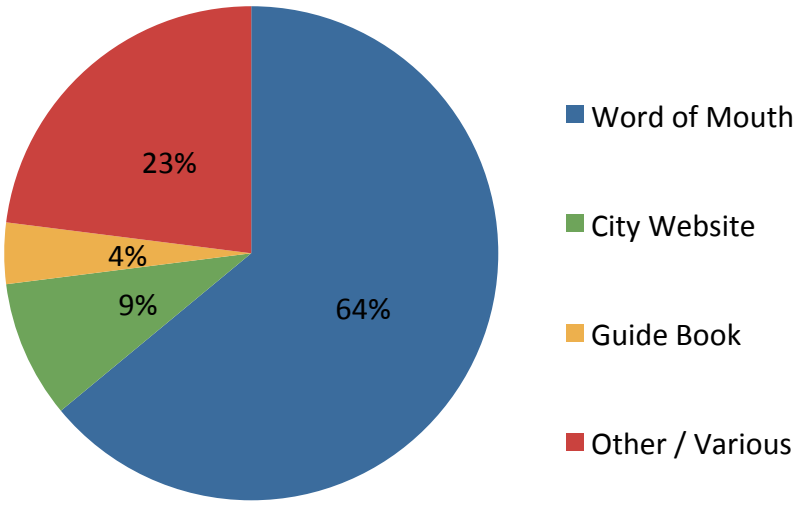

Figure 28: How users get information about open space.

4.2.9 Avoiding Open Spaces

Users were also asked to select which open spaces they did not visit and explain why. 15.4% of users avoided Reservoir Canyon, 14.2% avoided Bishop, 13.6% avoided Laguna Lake, and 10.7% avoided Johnson Ranch. 22.5% of users selected “other” as their option. That said, many users specified reasons why they avoided a particular open space. The two most popular reasons for avoiding certain open spaces were:

1) Distance from home or work (7.9%)
2) Lack of bathrooms (~5%)
3) Wayfinding (~5%)
4) Car parking (~5%)
5) Drinking water (~5%).

In dissecting some open ended comments in more depth, the common reason many users avoid Laguna Lake is that the landscape is too barren and windy with no hills (note: there is a hill / ridge hike available at Laguna Lake, but this responses tells us that many users may not ne aware of this trail option). Another commonly mentioned factor is that there are too many transients and “shady people” at Laguna Lake, along with off-leash dog concerns.

The biggest reason why users stated they avoided Bishop Peak was “overcrowding” and high volume of people on the trails. Users also stated that there was a lack of adequate car parking, too much poison oak, too much trash, disrespectful college students, drug and alcohol problems, and that mountain biking is not permitted. The reasons why users said they avoided Cerro San Luis Obispo were varied and included: perceived safety, highway noise, off-leash dogs, overcrowded trails, poorly designed trails, lack of parking, and a lack of wayfinding.

Johnson Ranch was avoided mostly because of the overcrowded trails, lack of car parking and bathrooms, off-leash dog problems, and lack of dog feces cleanup. The majority of users stated they avoided Reservoir Canyon because getting on and off Highway 101 was too dangerous and risky. Other popular responses were that Reservoir Canyon was too far from home, too isolated, or not possible to safely bike to. Users also did not like that mountain biking was not permitted and felt they there was a lack of wayfinding.

Stenner Springs was avoided because users felt it was inaccessible, too far from home, and had poor wayfinding. Islay Hill was avoided because users felt it was too far from their homes and too barren. Irish Hills was avoided due to a lack of wayfinding. South Hills was avoided because users felt it was too barren and that bikes were not allowed. Users stated that Terrace Hill was too small, too far, or inconvenient.

Table 5: Common reasons why users selected "other" to explain why they avoided a certain open space.

Open Space	Common reasons why space is avoided
Laguna Lake	Too barren and desolate. Too many transients and "shady" people. Issues with off-leash dogs.
Bishop Peak	Overcrowding and high volume of people on trails, lack of adequate car parking, too much poison oak, too much trash, disrespectful college students, drug and alcohol problems, and that mountain biking is not permitted.
Cerro SLO	Perceived safety, highway noise, off-leash dogs, overcrowded trails, poorly designed trails, lack of parking, and a lack of wayfinding.
Johnson Ranch	Overcrowded trails, lack of car parking and bathrooms, off-leash dog problems, and lack of dog feces cleanup.
Johnson/Irish Hills connector	High volume of users and inadequate wayfinding.
Reservoir Canyon	Getting on and off the 101 highway is too dangerous and risky, too far from home, too isolated, and is impossible to safely bike to, mountain biking is not permitted, lack of car parking, lack of wayfinding.
Stenner Springs	Inaccessible, a far proximity from user's homes, and has poor wayfinding.
Islay Hill	Too far from users' homes and is too barren.
Irish Hills	Lack of wayfinding.
South Hills	Too barren and bikes are not allowed.
Terrace Hill	Too small, too far or inconvenient to reach from home, and avoided because bikes are not allowed.

4.2.10 City of Residence

The majority of users were from San Luis Obispo although a substantial amount of users also traveled from surrounding San Luis Obispo County to access the open spaces. Some places that users in the "other" category include cities in other California counties such as Oceanside and Palo Alto. There was only one user from out of state and two international users.

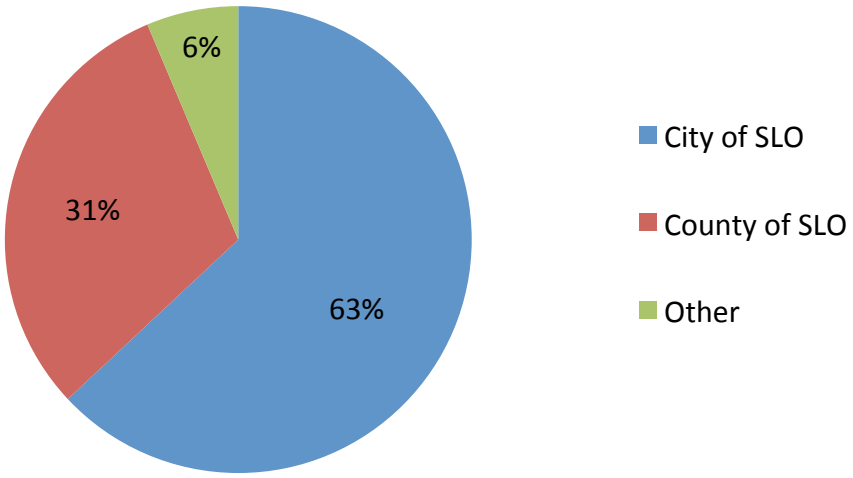

Figure 29: Open space users from the City of SLO, SLO County, or outside of the county.

4.2.11 Gender

There was a fairly even distribution of genders using the open space, but with slightly more males at 53.9% and females at 45.2%.

4.2.12 Race

84% of users identified themselves as white. The next common selected race was “other/multi-racial.” While this may be somewhat high as compared to the state, it is relatively consistent with the ethnic make up of the SLO City and County. However when looking at those who stated they are of Hispanic decent, fewer open space users are of Hispanic decent than one would expect. (Note that per Census definitions those of Hispanic origin can be of any race.) SLO City and County have 15% and 20% of the population that identify has Hispanic based on 2010 Census figures. For SLO open space users only 12 percent are Hispanic, indicating that open spaces may not be attracting or meeting of the needs of these individuals.

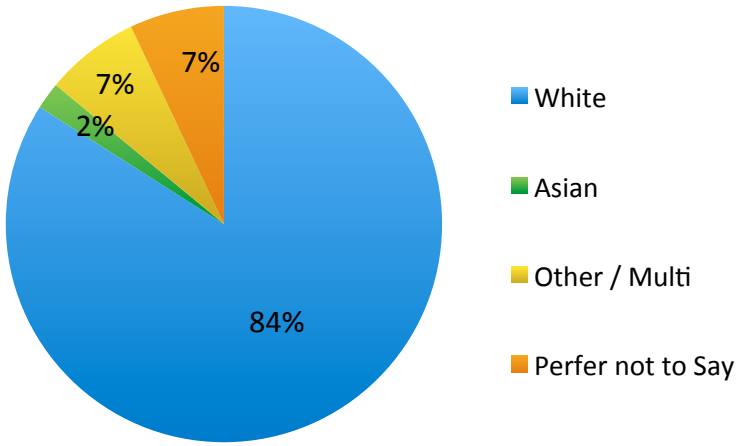

Figure 30: Race of users.

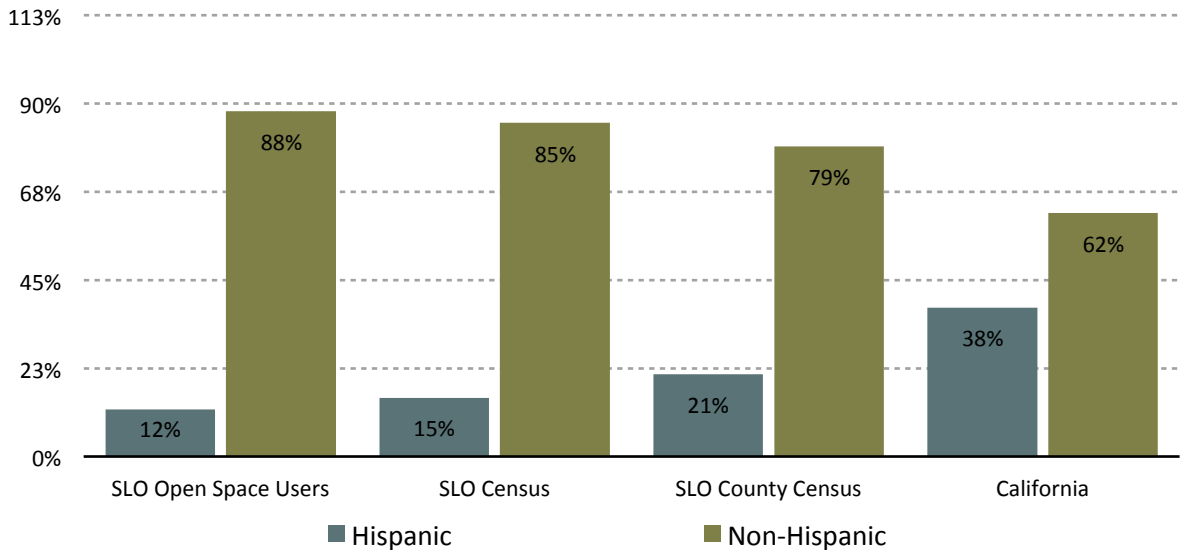

Figure 31: Hispanic users vs. City, County & State (2010 Census).

4.2.13 Education

The most common level of educational attainment of the sample of SLO open space users was a Bachelor's degree. Almost 49% of users stated they had a bachelor's degree and 30% of users reported they have a graduate degree. This means that approximately 79% of SLO open space users have graduated from a four-year university.

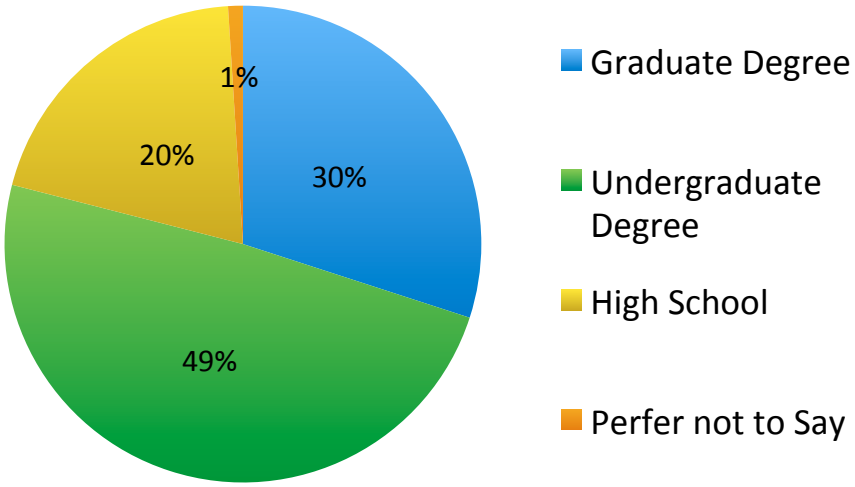

Figure 32: This graph depicts the highest level of educational attainment of SLO open space users.

4.2.14 What year were you born?

The average age of an open space user is 46 years old. The age distribution of open space users resembles a bell curve with the most common age range as 40 to 49 years old.

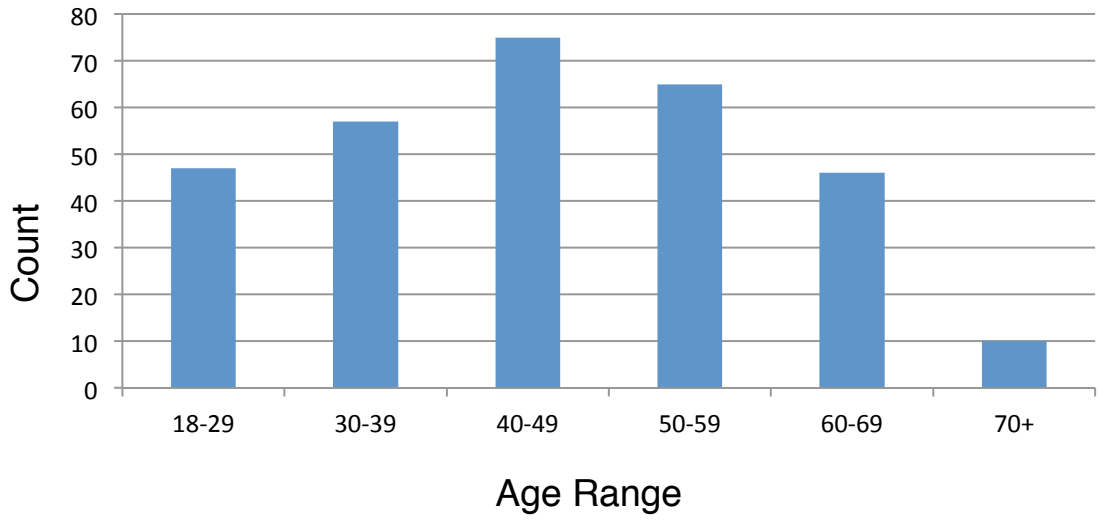

Figure 33: The age distribution of open space users.

4.2.15 Household Income

The most common household income was $50,000-$100,000 with 27% of users reporting being in this range. 24% of users reported of having a household income in-between $100,000-$150,000. 13% make more then $150,000.

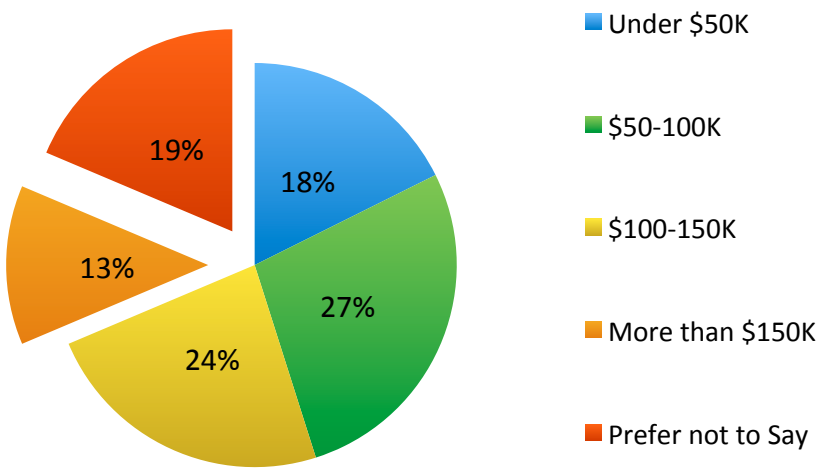

Figure 34: Users approximate household income.

4.2.16 Additional Comments

Users additionally provided more feedback in the “comment” section. Users commonly asked for garbage collection, regulation for off-leash dogs, dog feces collection, more trails for just mountain bikers, better signage, and poison oak clearance. There was a somewhat even distribution of users asking for drinking water and restroom facilities whereas the other half insisted that no facilities should be added since open spaces are not parks. A large amount of users thanked the city for the work they do in acquiring and maintaining open space usage.

4.3 Pedestrian Counting Results

4.3.1 Manual Counts vs. Automated Counts

Automated counts were conducted at various locations throughout the study period. These were balanced by manual counts taken during various peak periods. The variation between the two is discussed in the appendices; however, for the purposes of our reporting it is assumed that in general the counters over count by roughly 30% due to a number of different factors. This means that they are only about 70% accurate. The numbers from counts are used to test the validity of use stemming from the survey

4.3.2 Johnson Ranch

Johnson Ranch is clearly the most utilized open space with one clear entrance and exit. The daily number of ins and outs is 954 which equates to an average of 425 users. The peak during our assessment period was over 600 users a day over Labor Day weekend of 2014.

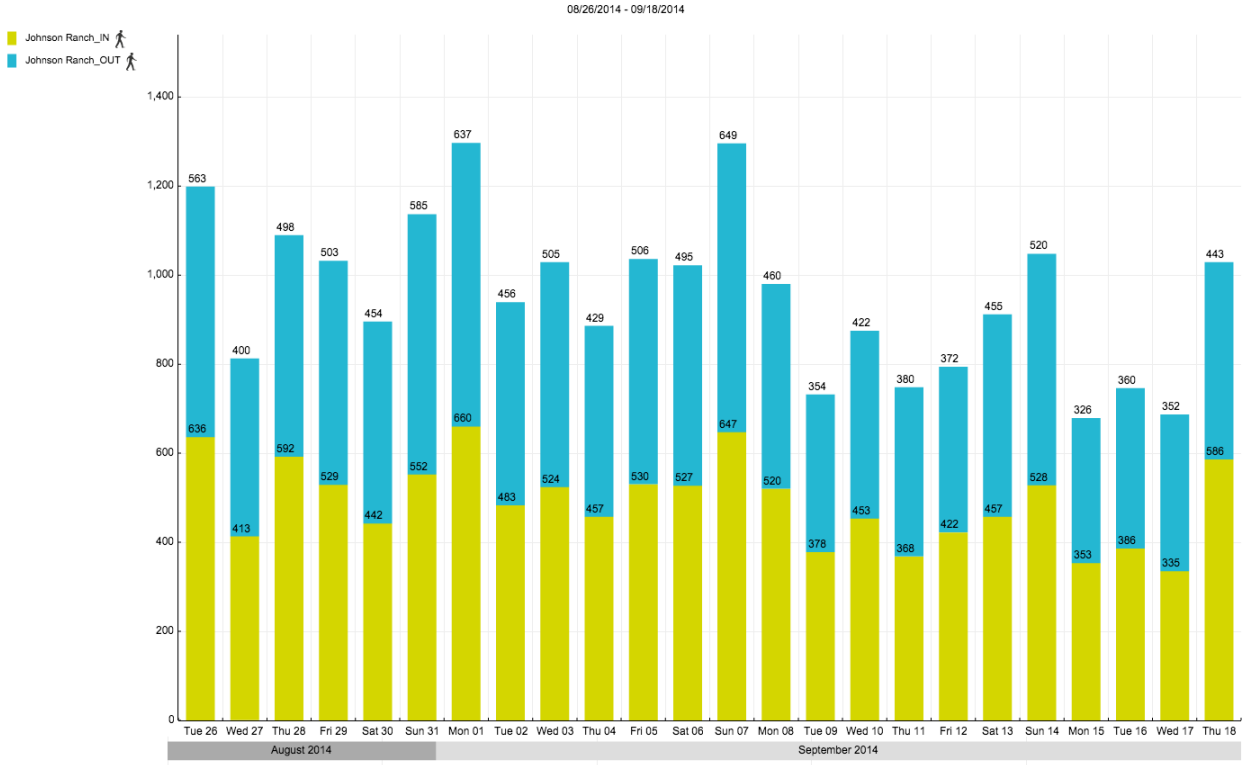

Figure 35: Daily traffic Johnson Ranch

There is heavy use all day, however on the weekdays there are clear AM and PM peaks, while on the weekends there are

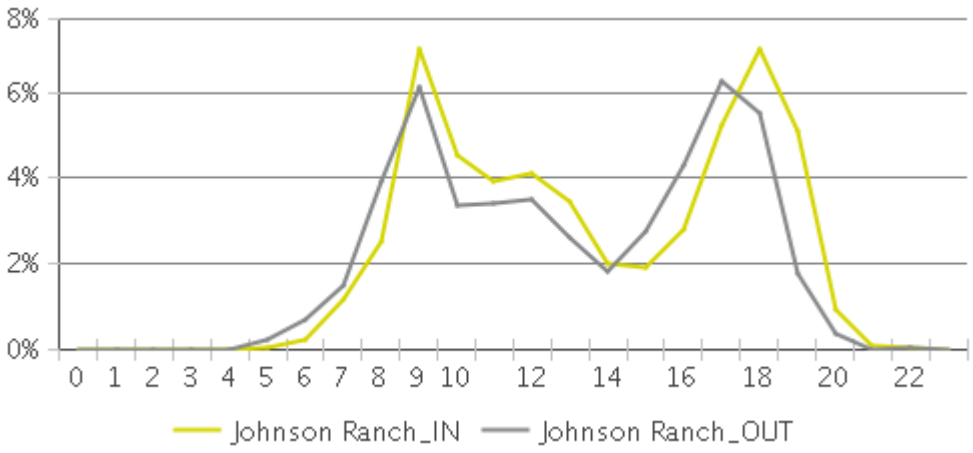

Figure 36: Johnson Ranch Weekday Profile

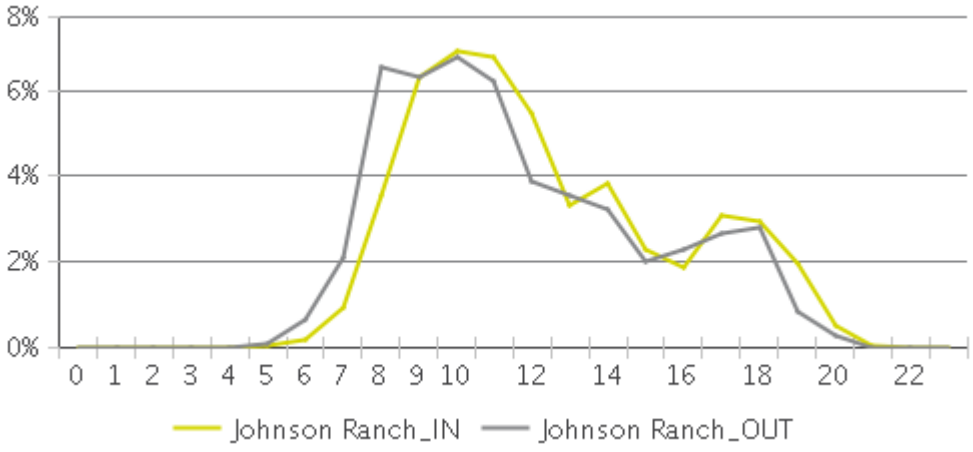

Figure 37: Johnson Ranch Weekend Profile

4.3.3 Bishop Peak

Similar to Johnson Ranch. Bishop Peak has heavy use, however it's primary use occurs on the weekends. While the average use hovers at 807 ins and outs, 504 or approximately 250 users at the Highland entrance and 303 or approximately 150 users at the Patricia entrance, this is skewed by dramatic weekend peaks. **In total, 56% of all traffic on Bishop Peak comes on the weekend.** As is indicated below which shows the Highland entrance, users on the weekends can equal that of Johnson Ranch but during the week use is more modest and indicative of other locations such as Reservoir Canyon (discussed later in this document).

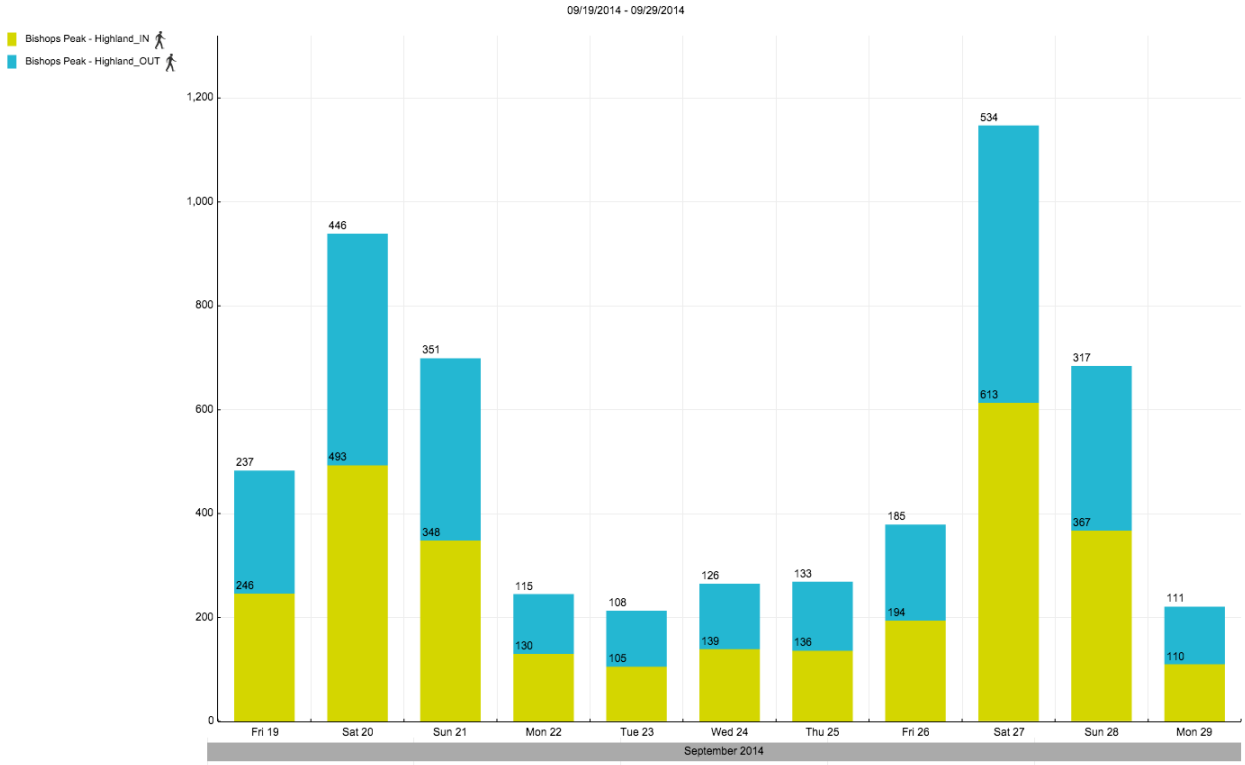

Figure 38: Daily Traffic Highland

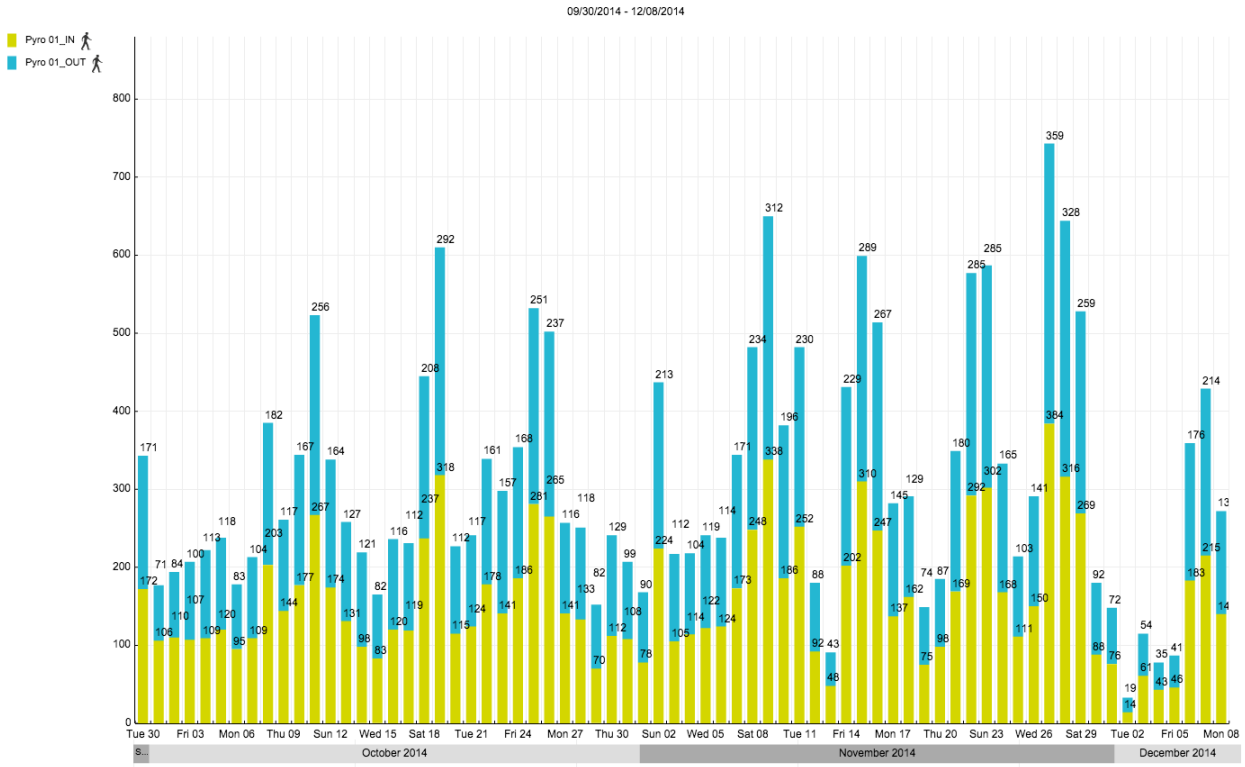

Figure 39: Daily Traffic Patricia

As shown in the subsequent figures, use is limited and diffuse during the week, but has a definitive peak around midday on the weekend, especially at the Highland Entrance.

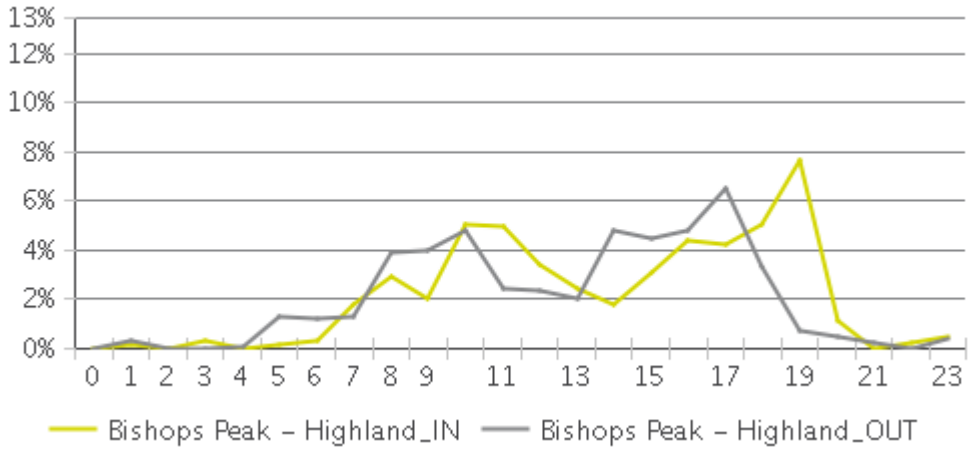

Figure 40: Bishop Peak (Highland) Weekday Profile

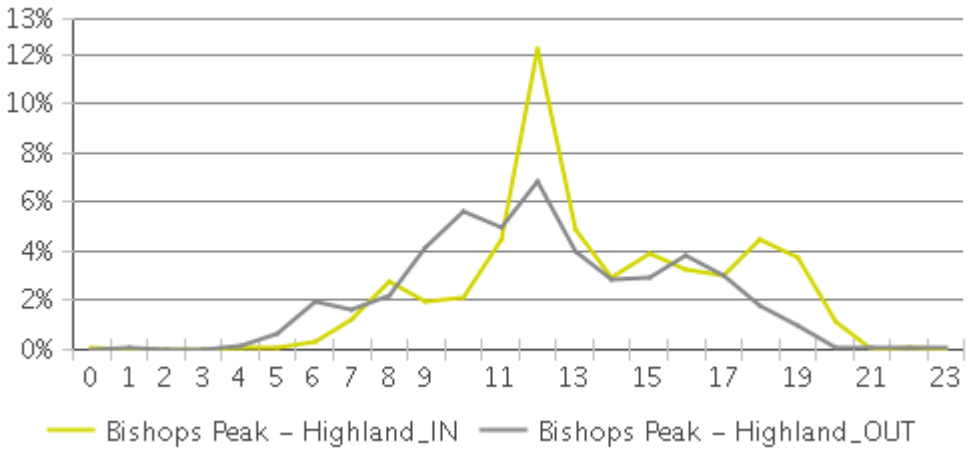

Figure 41: Bishop Peak (Highland) Weekend Profile

Figure 42: Patricia Trailhead at Bishop Peak Eco-counter installation.

4.3.4 Reservoir Canyon at Bowden Ranch

In contrast at a less utilized open space, the manual counts for the Bowden Ranch entrance to Reservoir Canyon yielded a daily average of 126 ins and outs with the busiest day being a Saturday.

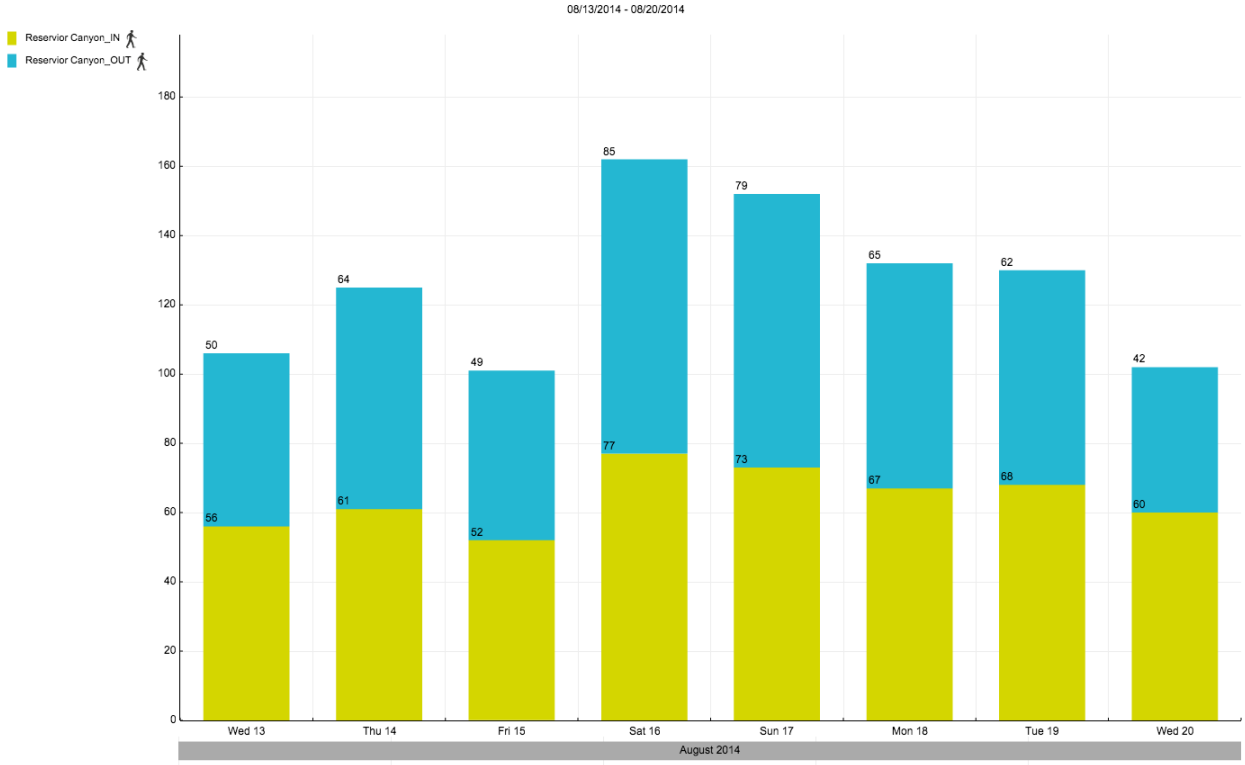

Figure 43: Daily traffic at Reservior Canyon

An hourly profile during the week showed individuals entering in the PM hours. On the weekends use was more diffuse with a peak around 10AM.

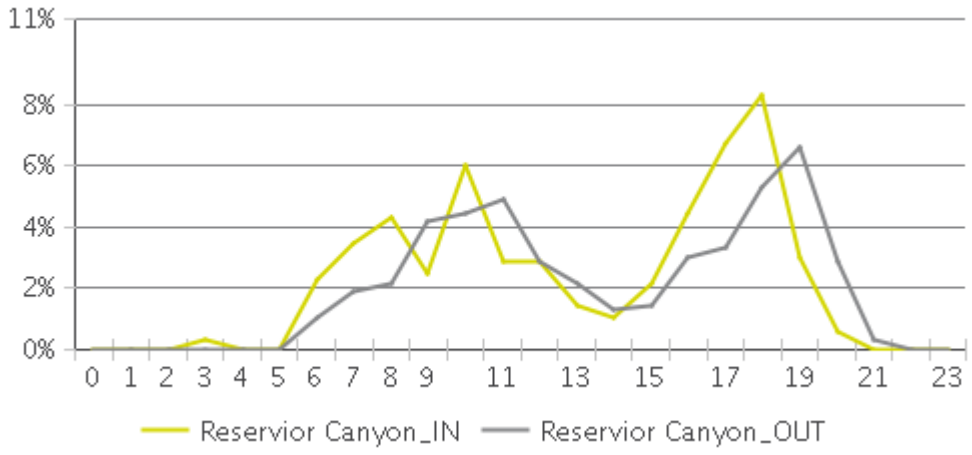

Figure 44: Reservoir Canyon Weekday Profile

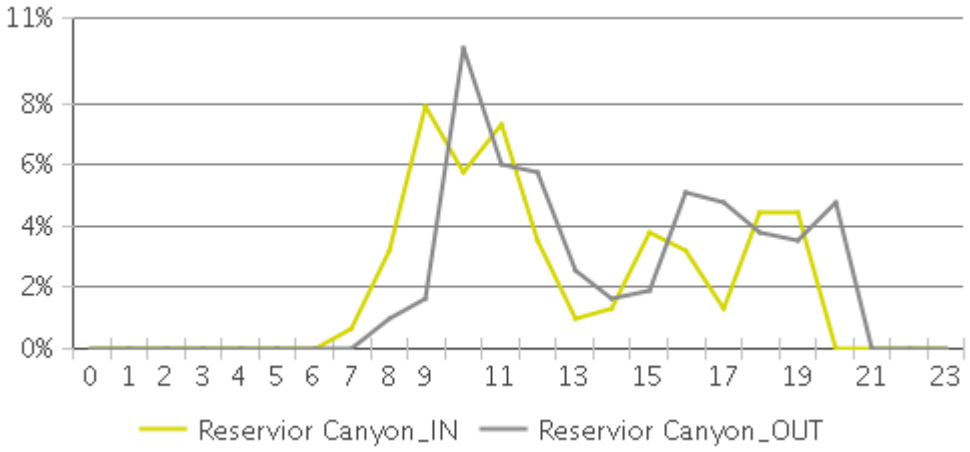

Figure 45: Reservoir Canyon Weekend Profile

4.3.5 Conclusion

In validating the data from the survey, it is clear that there are both regional and neighborhood serving open spaces. Just at the 3 open spaces evaluated on a typical day, as many as 875 users take advantage of these open spaces. Open Spaces like Johnson Ranch and Bishop Peak have a wide draw and heavy weekend use, however there is less intensive use at Bishop Peak on the weekday.

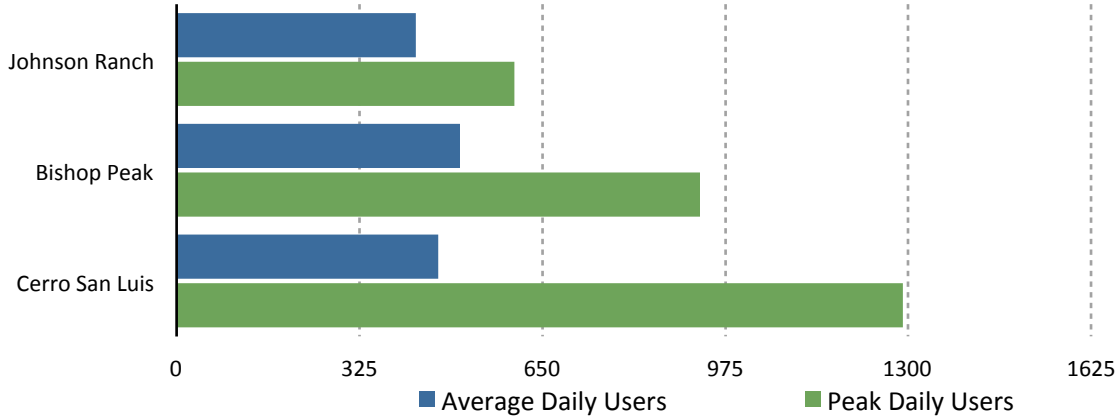

Table 6: Summary of user counts with average and peak users.

In sum, as illustrated in the table above, many of the prominent open spaces in San Luis Obispo average between 400 and 600 users per day. Assuming 500 users per day, one could extrapolate that open spaces like Johnson Ranch, Bishop Peak & Cerro San Luis each serve ~3500 individuals per week. That equates to 182,000 per year. Assuming that roughly 6% of these individuals are from outside of SLO County (as the survey indicates), it is probable that roughly 14,600 of these visits are made by those not residing in SLO or SLO County. While there are clear policy and fiscal ramifications that could stem from these numbers, more work is needed to validate them, truly uncovering how and how much SLO open spaces are utilized.

5 Discussion

The results of the surveys and initial assessments highlighted some clear trends in how users access and use open spaces, who these users are, and common issues associated with San Luis Obispo's open spaces. The assessment of the open space entrances showed that although there are many existing amenities in the system, there are also additional needs that clearly emerge. We noticed a lack of some important components, including 1) transportation accessibility, 2) issues with trash and feces and 3) the potential for additional or refreshed signage / educational materials.

5.1 Transportation

First, with regard to transportation accessibility, while most users access open space via cars, opportunities may exist to provide access via alternative modes of transportation. For example, most locations have bike parking, but some have none. Islay Hill and Stenner Springs have no bike parking. Furthermore trails that are close to transit have very to little connection to it. For example Bishop has a bus stop within 4 blocks but this is not legible to most individuals. Likewise, Johnson Ranch has RTA routes that run with easy access off 101 and Ontario Road, but there is no stop to serve the site.

The need for alternative forms of access is highlighted by apparent parking issues. At popular locations parking operates at over 95% occupancy – well over what would be acceptable in a public parking lot. Given that 68% of users state that they drive to open spaces this presents a dilemma – ***Can user-ship be increased (or even sustained) without increasing parking or alternative transportation access? Should it be, or would a more strategic alternative be to divert users to less heavily used open spaces?***

This issue presents an important policy issue that is underpinned by conservation goals. Our results clearly show a distinction between open spaces that are used by neighborhoods and those that have a broader regional (or even national / international) draw. It was clear from our survey work that while use was diffuse, Johnson Ranch, Bishop Peak, Cerro San Luis, and Irish Hills carry the bulk of users. They have high numbers of users and a broader base of 'customers' than other locations. This was evident from our on-site work, where we documented individuals from as far away as Australia. It was also underscored by our subsequent GIS analysis (as shown in the figures that follow) showing the large 'footprint' of these 3 regional open spaces based on the density of related residential locations. As Figure 47 shows, when flow lines are drawn the travel footprint of these three locations exceed the others, meaning that they draw from a regional user base, while the other locations have a more local draw.

Strategically, it may make sense for SLO to attempt to do a few things this including divert users to other locations through education and wayfinding but also exploring alternatives to address parking issues and encourage users to travel via other modes to local open spaces. These concepts are discussed in greater depth in the Policy Opportunities & Future Work section that follows.

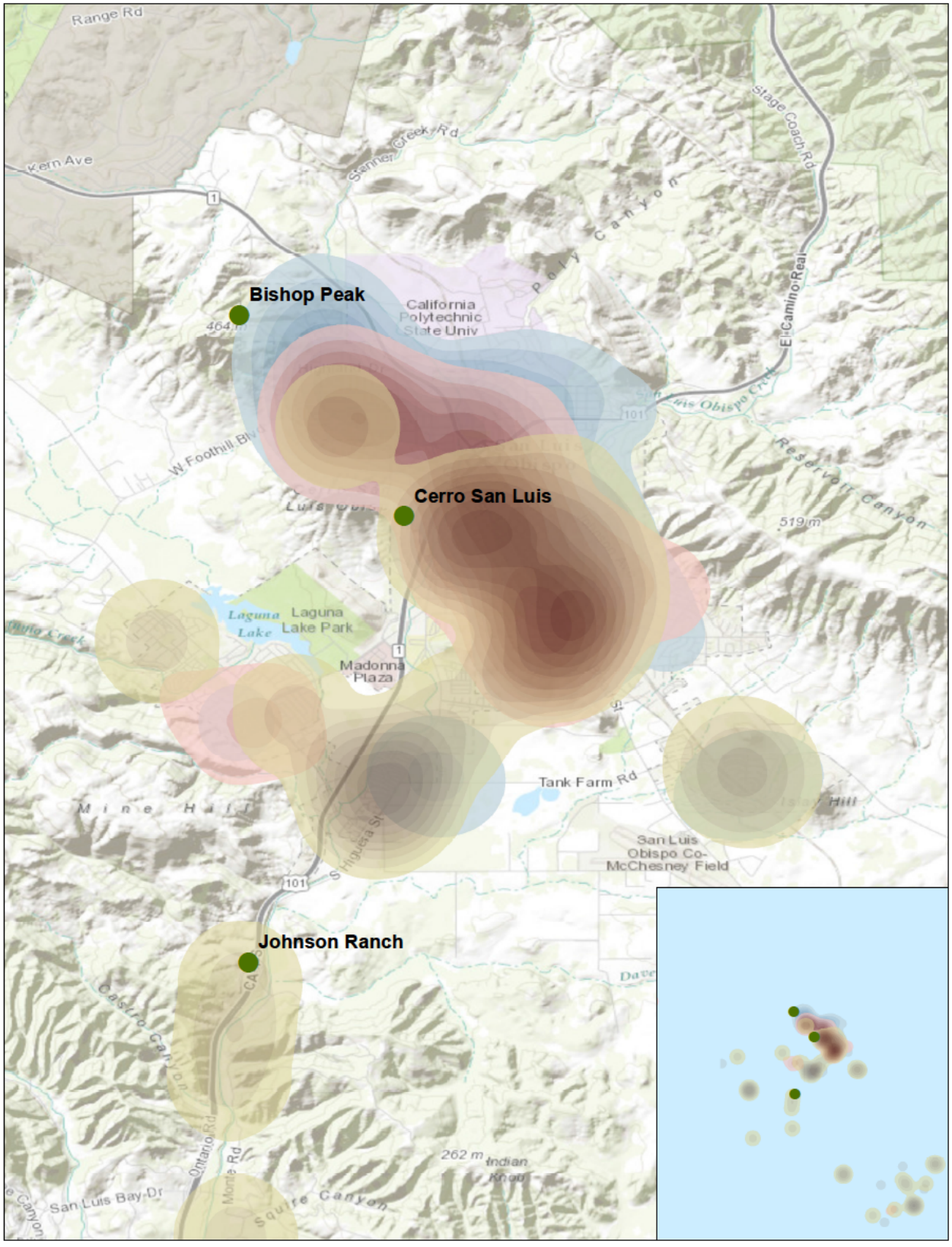

Figure 46: Total Open Space Use and Closest Open Space

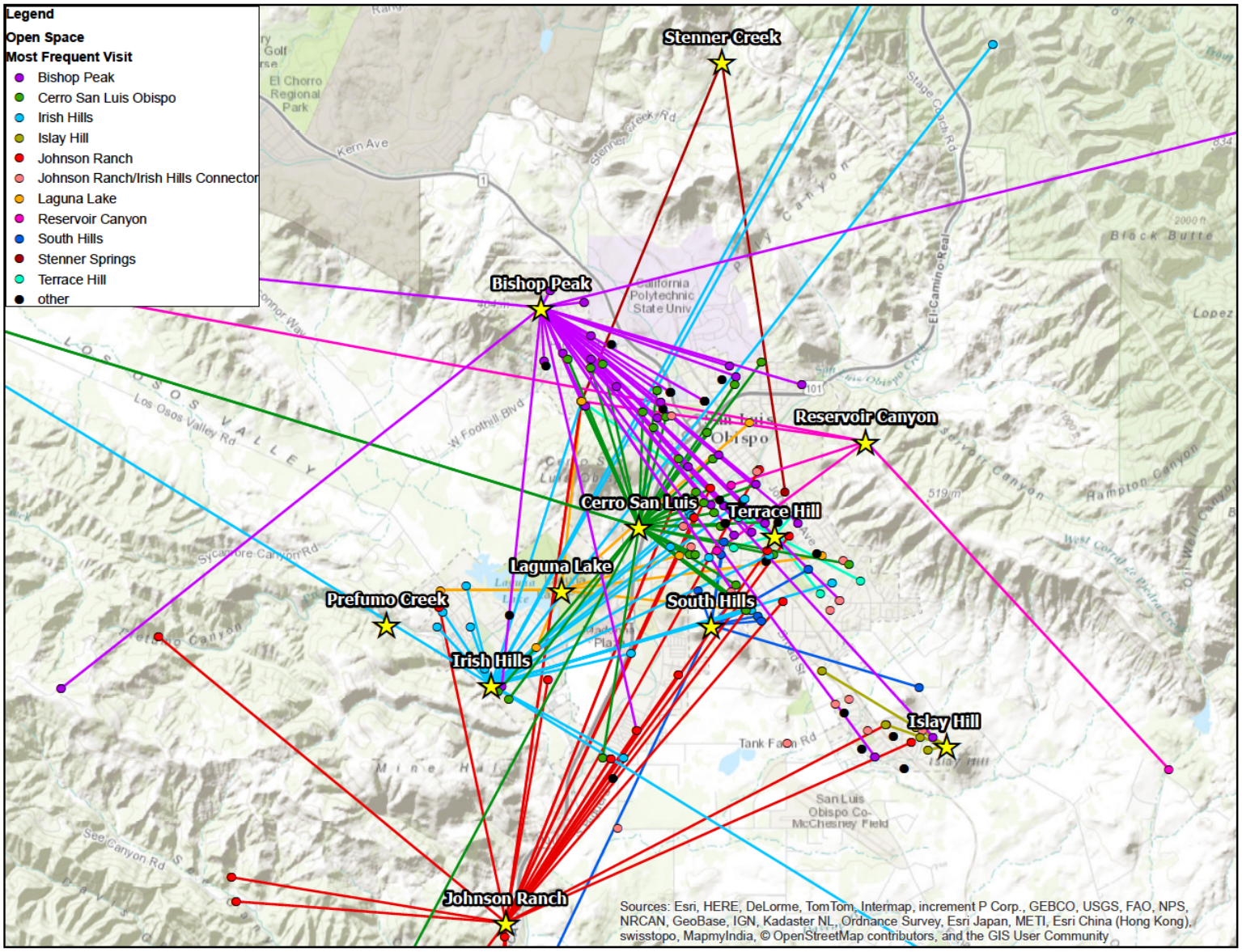

Figure 47: Flow diagram from residence to most frequently used open space.

These regional use dynamics are noteworthy because they heighten the importance of local policy in recognizing the value of both local and non-local open space users. 37% of users come from outside the City of SLO, contributing to an economic multiplier effect when they come to an open space and also then shop, dine, or engage in other economic transactions while in San Luis Obispo. They also present a management challenge in that the most ***popular open spaces are almost identical to the same open spaces that users reported as avoiding because of their popularity and crowds***. Cerro San Luis Obispo, Bishop Peak, and Johnson Ranch are both the most popular and some of the most avoided open spaces.

5.2 Trash

Secondly, while the reasons that people avoid open spaces are likely complex, they do underscore some of our other observations including issues with trash and dog feces. During the initial assessment and through the ongoing field surveying, all of these open spaces had trash bags posted at the entrances at one time or another. Since the City does not maintain garbage collection from these places we assume that locals are depositing these bags because of the demand and need.

This need is underscored by pet pickup problems. Trash and feces were two of the most frequent comments in our survey, and our team observed a significant amount of unpicked dog feces and pet clean-up bags that were left at several of the entrances. Cerro San Luis Obispo in particular had dog feces and trash issues – at one time having over seven feces bags left at the entrance alongside a few un-bagged piles of feces. Pet control is of equal concern based on the survey, and we observed numerous off-leash animals throughout the survey.

5.3 Wayfinding & Education

Third, of note is the clear need for improved wayfinding and educational materials. Navigating to open space is currently not easy as many open spaces are remote and primarily used by those with access to vehicles. Determining how to direct people better to open spaces and to provide relevant information could be of value to the City both socially and economically. As the city explores this, it may be important to consider multilingual messaging to encourage use by those whose primary language may not be English.

The homogenous user base evident in SLO open space was a key observation and something that the City may want to consider in helping to promote a more equitable future that reflects the diversity of California. As indicated previously, most current users of these spaces are white and affluent – possibly not representative of a diverse cross-section of society in SLO County, especially with regard to the Latino population. SLO may also want to consider offering a handicap accessible open space for those with special needs to experience the local environment.

5.4 Policy Opportunities & Future Work

These observations leave room for potential policy revisions and future work projects, especially in the area of transportation, dog control, trash policy, and wayfinding. Some ideas and parallel locations are discussed below.

5.4.1 Heavy Use, Parking and Accessibility

Clearly the question presented earlier presents a dilemma: how can SLO continue to meet conservation goals in open space with heavy use and unending parking demand? Strategically, it may make sense for SLO to attempt to address the issue on a few fronts.

First, with regard to use, it may make sense to work on education and outreach to attract users to other less congested open spaces. While this highlights the importance of a comprehensive education and wayfinding plan (discussed below), it also could tie in to SLO's multi-modal goals by facilitating more biking walking and transit access to trailheads. As mentioned previously, there are potential easy transit connections at both Johnson Ranch and Bishop Peak that are not being taken full advantage of.

Secondly, parking could be increased or strategies could be used to mitigate demand. One such strategy could be through on-street metering or pay boxes. While this policy might prove unpopular to some, it could be bundled with a pass / hangtag program for residents issued annually with water bills. Such a program is similar to what is used by East Bay Regional Parks in the San Francisco Bay Area which charges for parking at most of its locations and issues parking permits to Park Foundation members.

Finally, as a third strategy, SLO may want to consider providing more parking; however, given the inherent cost of providing this resource we would recommend this be done after pursing other options. That said, locations such as Johnson Ranch may already be over capacity and need additional parking supply. A supply and demand assessment should be completed as a next step to validate this and provide the appropriate supply of parking.

Pursuing these strategies might cause a momentary inconvenience to users but could further underscore the benefit of these and other pricing and revenue strategies. As a result, a first step could be a benefit-cost analysis that looked at the cost of implementing such a program alongside the benefit. Such a plan could also quantitatively model the potential economic benefit of open spaces to the City.

5.4.2 Dog Feces and Off-Leash Enforcement

Users reported that dog feces pickup and off-leash dogs were two significant problems within San Luis Obispo's open spaces. The dog waste issue was supported by the many leftover feces piles and full feces bags that were observed at the open space sites during the initial conditions examination as well as throughout the ongoing field visits for the study. Additionally during the field surveying many off-leash dogs were observed.

Dog waste is a significant public health hazard. Exposure to pet waste often means exposure to harmful microbes including *salmonella* and *e.coli* and waste can also have dangerous parasites such as roundworms. Dog waste that is not picked up is a leading source of contamination in water sources because run-off from rain events transports pathogens (U.S. EPA, 2001). Additionally when users bag their pet waste but leave full bags at the trail, plastic trash is left behind in addition to health risks. Off-leash dogs can have many negative consequences on the environment, as well as dog bites to humans, spreading of infectious diseases through contact, and aggression towards other dogs (Rock, Adams, Degeling, Massolo, & McCormack, 2014).

Additionally, dog bites are a leading cause of injury to children, even when leash protocol is followed, so it is imperative that the leash laws are strongly enforced (Rock et al., 2014) Despite the problems caused by dogs, banning them from the city's public open spaces is not a realistic solution. One of the most common activities users reported engaging in at the open spaces was walking and hiking with their dogs.

While many users of San Luis Obispo may have healthy dogs or believe that their dogs are well-behaved enough, the leash policy needs to be enforced. The City of Boulder, Colorado requires all pet owners to obtain city licensing of their pets with proof of rabies vaccination. Therefore all dogs that enter public open spaces are already licensed by the city. Pet owners can be cited for having aggressive dogs off leash or not following open space protocol. Since the pets are licensed, rangers can monitor repeat offenders and outlaw certain dogs from the open spaces (Meltzer, 2014). Another perk of dog licensing is that it could be a way to generate revenue to enhance and maintain the open space.

San Luis Obispo animal control officers or rangers could patrol trailheads and fine users for their off-leash dogs, failure to pick up dog feces, and for littering. A monetary fine could be effective for increasing the levels of policycompliance. One reoccurring theme during the ongoing research in San Luis Obispo was that many users do not want any change to their open space. When first applying new methods of dog regulation to San Luis Obispo, it may be helpful to post warnings or have rangers give warnings for the first couple of weeks because sudden enforcement and fines for dog owners may cause a lot of dissent.

The City of Boulder also tried a "Leave No Trace" educational program and found that there was already a high level of users with knowledge of "Leave No Trace" guidelines and that familiarity with regulation was predictive of whether an individual actually followed the guidelines. Users reported that fear from losing their dog walking privileges was the most influential reason for them to follow policy. Users also were more likely to change their behavior to following policy after hearing moral appeals of dogs harming or scarring wildlife (Jones, 2004). San Luis Obispo could implement a similar educational program. Permanent, visible, and informative signs should be posted that list the importance of following dog policy and leaving no trace. The signs could also warn that dog privileges could be taken away if there is no improvement in behavior. Trail volunteers could help to distribute brochures or talk to users directly.

Jacksonville National Park promotes a positive-based approach where visitors will strongly self-regulate themselves out of desire to promote environmental ethics. Rangers posted a bulletin board "Our Canine Visiting Friends" and asked visitors if they could take a picture of their dog while it was leashed. There are 200 fun pictures of various loved pets on the bulletin boards and the rangers talked to the owners about the leash laws while taking the pet pictures. By making friendly and welcoming contact with the dog owners and celebrating the animal companions on the bulletin board, rangers were able to educate owners about the important dog policy.

The benefits of this program are that owners can learn about policy imperatives in a positive way and increase their interactions with rangers. Rangers build up a good reputation with the users and people were more informed of the importance of leash laws. Rangers also reported that the special bulletin board program also led to more user dialogue and interest in other animal-related issues in the park and requests for ranger led hikes for people and their companion dogs (Tardona, 2012). This type of positive program could be very successful in San Luis Obispo since it encourages themes of positivity and makes users feel like they have a choice, instead of harsher policies that just tell users what they cannot do.

5.4.3 Alternative Dog Policy

Going further, if such policy proved unsuccessful to curtail abuse of pet waste and leash policy, an alternative could be to allow domestic animals only in certain locations. Although controversial, San Francisco has explored similar policy in recent years. In 2011 a new dog management plan was introduced for the Golden Gate National Recreation Area (GGNRA) including the popular Crissy Field (Dog Management in the GGNRA). Previously dogs had been regulated under the GGNRA 1979 Pet Policy guidelines that allowed dogs to be off-leash if they were under voice control. While these off-leash areas were said to constitute less than 1% of the entire GGNRA, they included sites such as: Ocean Beach, Fort Funston, Crissy Field, Baker Beach, Lands End, Fort Mason, Fort Miley in San Francisco, Rodeo Beach, Muir Beach, and various trails in Marin (SF Dog, 2014). Recently there have been attempts to completely ban dogs from the GGNRA because the 1979 regulations do not adequately protect people, habitat, and wildlife (Dog Management in the GGNRA). Banning dogs would also aid in attempts to restore native plants to the recreation area (SF Dog, 2014).

A proposal to ban dogs in the GGNRA was extremely disliked by the public and caused widespread complaint. Instead, a new proposal tried to just remove off-leash areas, and that also caused massive discontent (Dog Management in the GGNRA.). The new dog management draft will be finalized winter 2015 and ultimately is focused on keeping visitors safe and protecting habitat (National Park Service). The draft proposes 21 miles of on-leash dog paths as well as four designated off-leash areas (Dog Management in the GGNRA). Currently San Francisco has several dog-related health ordinances that can be enforced in the park. All dogs over four months old must have a license and rabies vaccination. Owners are required to pick up their dog feces (San Francisco Recreation and Parks).

5.4.4 Trash Enforcement

Trash was reported as a major problem at San Luis Obispo's open spaces. Currently, there are no trash cans or waste disposal services at the open spaces and users need to follow a "pack it in, pack it out" policy. However litter is frequently found at several open space trailheads including Cerro San Luis Obispo, Reservoir Canyon, Bishop Peak, and Johnson Ranch. Oftentimes, unknown individuals will place black trash bags at the trailheads to help with the amount of trash. Adding trash cans was a popular request from the survey participants, but San Luis Obispo doesn't have trash cans because of past issues with illegal dumping and the costs of continued, consistent maintenance.

Similarly to some of the "Leave No Trace" policies to help control dog feces problems, educational programs or educational opportunities could be used to encourage non-littering behavior. Utilizing social marketing is one suggestion to strengthen the educational message to the community and raise awareness (Campbell, Paterson de Heer, & Kinslow, 2014). For example, San Luis Obispo could utilize a Facebook or Twitter for a campaign that would explain the importance of not littering in the city's precious open spaces and being responsible for packing out what is brought in.

5.5 Wayfinding & Education

Finally, signage, wayfinding and information is a clear opportunity for SLO open spaces. The consistency of information throughout the open space system is currently not tied together in aesthetics or messaging. It also is limited in its capacity to meet the needs of digital users who may want interactive tools, maps or other mobile resources on-the-go at trailheads. Each of these tools needs to be an integrated piece of a whole, which is why we recommend a comprehensive signage, education and wayfinding plan that will pulls together all the different

branding and messaging strategies into a consistent visual and educational tone. Such a plan could be the next step meeting the needs of an increasingly diverse user base, while trying to beautify and support conservation of SLO's natural resources.

6 Conclusion

Clearly, the heavy use and passion for SLO open spaces is representative of a regional and national, if not multi-national, audience. These natural environments provide a resource not only to local citizens but to the region and beyond – with high demand both in and out of community. Our results illustrate this clearly, with 37% of users coming from outside SLO, representing a regional dynamic based on the travel footprint of active users. While this offers an opportunity from an economic development standpoint, it also presents a dilemma in how to best steward the ecological resources in the future, in both meeting ecosystem protection goals, but also given changing socio-demographics in California and the United States.

Key areas that SLO might have an interest in evaluating include: 1) transportation access; 2) trash; and 3) education / wayfinding. We recommend further investigation in these areas along with the social and economic capital that these open spaces can provide to SLO. By focusing on these items and working to encourage more disbursed use of open spaces, City of SLO will continue to provide additional social and economic value to new sets of users, while maintaining ecological quality.

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8 Appendix 1 – Facilities Assessments

8.1 Bishop Peak

Acres	*Transit*	*Parking*	*#Trailheads*	*# Illegal Trailheads*	*Cycling Access*
360	Yes at Patricia only	Residential Street	2	1	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
Yes	Educational Kiosk in process of being constructed	Great signage for Patricia trailhead along Patricia drive and at immediate trailheads	Yes, nearby resident places trash bag at Highland trailhead every day to deal with trash issues	Yes, some feces bags	

8.1.1 Patricia Trailhead

Accessibility There is bike and pedestrian access, but mainly by those living in the neighborhood. There is a transit stop is near the trail head it is not in view. The entrance was clearly marked, with signs along Patricia Dr. pointing you to the trailhead	***Transport*** There is no parking lot, but a lot of street parking (which is in front of some people's houses). There is a bike rack at entrance, but limited spots. Traffic is volume was medium, and not too much congestion(given the time of day we were there. 10:30am)
Biological/Cultural/Geological There is some slope at the entrance and the beginning of the trail. Some of the land is used for cattle grazing. There are no endangered species or historic site mentioned. The trail head was is made up of loose dirt, with some erosion on side banks of the trail. Used rolling beds to divert water off trail. Wide trail entrance	***Land Use/ Environmental*** The entrance is very connected to the community, with the entrance starting in a neighborhood. There was no major noise issues. Besides natural daylight, which was fine, there was no additional lighting at the entrance

Figure 48: The Patricia Trailhead entrance is offset from the residential road.

8.1.2 Highland Trailhead

Accessibility Can be access by bike, and pedestrians (mainly by those who live in neighborhood). No transit access. Entrance is clearly marked, but no maintained landscaping.	***Transport*** No parking lot, limited to street parking which is very limited due to the narrow street and it is a cul-de- sac. Traffic and congestion is relatively high. There are bike racks (not in plain sight).
Biological/Cultural/Geological Unknown endangered species, no major slope, some land use to be used for cattle. Long narrow trail entrance. Somewhat scenic view. Erosion at the base of the entrance due to human impact over time.	***Land Use/ Environmental*** Connected to the community, noise issues at night, lighting was ok, lots of shading/coverage, but no additional street lighting. No educational amenities.

Figure 49: The Highland Trailhead entrance is in a neighborhood cul-de-sac.

8.1.3 Illegal Access at Foothill

There is an informal lot that people use to park. Most people access this entrance by automobile. People have to hop/go under a fence to enter. Entrance is used for grazing.

8.2 Cerro San Luis Obispo

Acres	*Transit*	*Parking*	*#Trail-heads*	*# Illegal Trailheads*	*Cycling Access*
121	No	12 spaces; high volume dirt lot	1	1	Yes but not safe
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
Yes	Bike bell box	Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	No	No	

8.2.1 Marsh Street Trailhead

Accessibility Can be accessed by both foot and bike, but mainly accessed by automobile. There is a bike Path that connects from downtown to the trail head, but is not the safest. Near a transit stop, but not in view. Entrance from afar not clearly marked or seen, but at trail head sign is visible.	***Transport*** There is a parking lot, with about a dozen spaces. The traffic and congestion was not very high. There are bike racks (about 4 spaces)
Biological/Cultural/Geological Unknown endangered species, or historic site. There is some slope. Scenic view. People made their own trash/waste bags and left them there.	***Land Use/ Environmental*** Some connection to the community, but not as much as other open spaces. Only noise issue is that the trail head is right next to the freeway. Very good natural lighting, but no additional lighting in parking lot.

Figure 50: The entrance to the Marsh Street Trailhead.

8.2.2 Unofficial Access at Hillstreet

There is an unofficial entrance to the Cerro San Luis Obispo open space that is accessed through a private property. There is a posted sign that is says users are welcome to utilize their easement to access the open space. It appears that mostly locals and neighborhood residents use this entrance.

8.3 Irish Hills

Acres	*Transit*	*Parking*	*#Trail-heads*	*# Illegal Trailheads*	*Cycling Access*
941	Yes at Madonna only	Residential Street at Madonna and 5-7 dirt lot at Perfumo entrance	2	0	Yes at Madonna only
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	Bike bell box and educational kiosk	Poor signage on road to open space. Trailhead is marked.	No	No	

8.3.1 Perfumo Trailhead

Accessibility Mainly accessed by automobile, although there is a bike lane leading to the entrance. Entrances marked. Two trail heads, the main one had a wide entrance/path. The bog thistle trail is single lane trail.	***Transport*** Small parking lot limited to about 5-7 spaces, not street parking. Not a lot of traffic or congestion. There are no bike racks.
Biological/Cultural/Geological Bog thistle is an endangered species. There was a panel/board that had educational features about the site.	***Land Use/ Environmental*** Not connected to the community, a bit out from town. Not very good lighting on trail due to tree overhang/ density***.***

Figure 51: The Perfumo Canyon Trailhead does not have any signage visible from the road, but the immediate trailhead has a kiosk with historical information.

8.3.2 Madonna Trailhead

Accessibility Accessed by foot(mainly those in the community), bike, and transit. Entrance is visible from street but not clearly marked with signage at front.	***Transport*** No parking lot, limited to street parking(in front of peoples house). There was little to no traffic or congestion. There are bike racks.
Biological/Cultural/Geological Unknown endangered species or historical site. Educational panels/ boards, and bike bells.	***Land Use/ Environmental*** Connected to the community. No major noise issues. Natural lighting was ok, but no additional lighting

8.4 Johnson Ranch

Acres	*Transit*	*Parking*	*#Trail- heads*	*# Illegal Trailheads*	*Cycling Access*
242	No	20 spaces, high volume dirt lot	1	0	Yes, but not safe
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
Yes	Bike bell box and educational kiosk.	Poor signage on road to open space. Trailhead is marked. Reasonable amount of trailmarkers on trail, however connection to Irish Hills is not marked.	Yes, anonymous individual places trashbag at trailhead	Yes, dog feces and feces bags near entrance	

8.4.1 Main Trailhead

Accessibility Was handicap and bike accessible, but mainly automobile accessible. Entrance is not clearly marked, but entrance is very visible. Gated/fenced with narrow entrance, but very wide path.	***Transport*** Most parking was in the lot, with some that parked on frontage road. Traffic and congestion was low
Biological/Cultural/Geological Unknown endangered species. Some of the land is owned by someone who lives on the site. Fairly scenic. The is educational panels/boards at the entrance.	***Land Use/ Environmental*** Not very connected to the community, have to go a ways out. Only noise issue is that the entrance and part of the trail is right next to the freeway. Good natural lighting, but no additional lighting. People provided trashbags, and left it at the entrance.

Figure 52: The Johnson Ranch entrance has a wheelchair friendly entranced that can be opened by a ranger when you dial the number listed on the gate. The entrance also has bike racks and an educational kiosk.

8.5 Reservoir Canyon

Acres	Transit	Parking	#Trail- heads	# Illegal Trailheads	Cycling Access
487	No	5-7 low volume dirt lot	1	0	No
Bike Racks	**Amenities**	**Signage**	**Trash**	**Dog Feces**	
None	Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	No	Some, occasional trash left at entrance.	Some, left in bags at entrance.	

8.5.2 Main Trailhead

Accessibility Only accessibly by automobile. Not clear or marked entrance, and no signage. Narrow road to get to entrance.	***Transport*** Limited parking on side to road the let to entrance (5-7 spaces) No traffic, but bit of congestion due to the limited space/size at the entrance. No bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site.	***Land Use/ Environmental*** Not very connected to community, a bit far out. Natural lighting was okay, but a lot of shading from tree coverage/density. And there is no additional lighting. And there 3 different trails.

Figure 53: The entrance to Reservoir Canyon has no open space signage at the entrance.

8.5.3 Bowden Ranch

Acres	*Transit*	*Parking*	*#Trail- heads*	*# Illegal Trailheads*	*Cycling Access*
207	No	Residential Street	1	0	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
Yes	None	Poor. No signage on road to open space, and limited signs on actual trails. Trailhead is marked.	Yes, anonymous individual places trash bag at trailhead.	Yes, dog feces and feces bags scattered all over entrance	

Accessibility Bike and pedestrian accessible, mainly used by neighboring community. Possibly near transit, but not in site. Entrance marked.	***Transport*** Limited parking on street. Traffic and congestion are low. There are bike racks (about 4 spaces), and fence parking.
Biological/Cultural/Geological Some slope. Unknown endangered species or historic site, although an old Adobe house and cultural heritage site across entrance.	***Land Use/ Environmental*** Connected to community. No major noise issues. Not very good natural lighting due to tree coverage/ density, and no additional lighting.

Figure 54: The Bowden Ranch entrance has visible signage at the trailhead entrance. The entrance is located in a neighborhood cul-de-sac.

8.6 Islay Hill

Acres	*Transit*	*Parking*	*#Trail-heads*	*# Illegal Trailheads*	*Cycling Access*
65	No	Residential Street	1	0	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	None	Poor signage on road to open space. Trailhead is marked.	No	No	

8.6.1 Main Trailhead

Accessibility Bike and pedestrian accessible, probably mainly used by neighboring community. Possibly near transit, but not in site. Not handicap accessible. Entrance marked.	***Transport*** Parking on residential street. Traffic and congestion are low. There are no bike racks.
Biological/Cultural/Geological Some slope. Unknown endangered species or historic site.	***Land Use/ Environmental*** Connected to community. No major noise issues.

Figure 55: The entrance to Islay Hill is located in a neighborhood cul-de-sac.

8.7 Laguna Lake

Acres	*Transit*	*Parking*	*#Trail-heads*	*# Illegal Trailheads*	*Cycling Access*
360	Yes	10 spaces, high volume paved lot	1	0	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	Attached to the city park which features many amenities that technically aren't open space.	Poor signage on road to open space. Trailhead is marked. No obvious signage in actual open space.	No	No	

8.7.1 Main Trailhead

Accessibility Bike and pedestrian accessible, probably mainly used by neighboring community . Transit off Madonna, near entrance. Not handicap accessible. Entrance marked.	***Transport*** Parking lot with 10 spaces. Traffic and congestion are high. There are no bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site.	***Land Use/ Environmental*** Connected to city park with recreational amenities including trash cans, dog park, restroom, benches, and picnic tables. No major noise issues. No educational panels/board. The eastern border of the park has a small private property sign that marks the border between city and private property.

Figure 56: The entrance to the Laguna Lake open space is accessed through the city park.

Acres	Transit	Parking	#Trail-heads	# Illegal Trailheads	Cycling Access

131	Yes, at Woodbridge	Residential Street	2	0	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	Educational kiosk.	Poor. No signage on road to open space. Trailhead is marked.	No	No	

8.8 South Hills

8.8.1 Woodbridge Trailhead

Accessibility No bike, transit, or pedestrian accessibility due to the entrance being far back in a neighborhood, (entrance probably mainly used by neighboring community). Entrance marked with a locked gate and a smaller unlocked gate and turnstile. Not handicap accessible.	***Transport*** Residential street parking. Traffic and congestion are low. There are no bike racks
Biological/Cultural/Geological Unknown endangered species or historic site. No educational panels/board.	***Land Use/ Environmental*** No major noise issues.

Figure 57: The entrance to South Hills open space from Woodbridge.

8.8.2 Blue Rock Trailhead

Accessibility Bike, transit, and pedestrian accessibility is possible from South Street, but not in sight(entrance probably mainly used by neighboring community) . Entrance marked with a locked gate and a smaller unlocked gate and turnstyle. Not handicap accessible.	***Transport*** Residential street parking. Traffic and congestion are low. There are no bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site. Educational kiosk present detailing historical and geological background.	***Land Use/ Environmental*** No major noise issues.

Figure 58: The entrance to South Hills open space at Blue Rock.

8.9 Stenner Springs

Acres	*Transit*	*Parking*	*#Trail-heads*	*# Illegal Trailheads*	*Cycling Access*
417	No	5 spaces, low volume dirt lot	2	0	No
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	No	No signage. Trailhead is not marked at either entrance.	No	No	

8.9.1 Stenner Springs Main Entrance

Accessibility Bike, transit, and pedestrian accessibility not possible. There are no trail or entrance markers. Many hikers and walkers parked closer to the Cal Poly agricultural property and used the access road for recreation instead of hiking into the open space. Due to many private driveways, it was very unclear how to get to the trailhead. Handicap accessible.	***Transport*** Dirt parking lot with 5 spaces. Traffic and congestion are low. There are no bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site. No educational kiosk.	***Land Use/ Environmental*** No major noise issues. There is a bridge and path leading to an unmarked, dilapidated ropes course. Many cattle grazing and a running spring.

Figure 59: The Stenner Springs open space entrance has no signage. Through the gate is the same trail that connects to the West Cuesta entrance of the open space.

8.9.2 West Cuesta Ridge Entrance (Shooters/Moring Gory)

Accessibility Bike, transit, and pedestrian accessibility not possible because the parking lot is directly off of the grade. There is a sign signifying the West Cuesta Ridge, but no entrance markers.. Following this trail two miles, there is another parking lot that leads to an extremely steep trailhead. There are no markers. Handicap inaccessible.	***Transport*** Dirt parking lot with 5 spaces. Traffic and congestion are low. There are no bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site. Informational kiosk located at “The Eucs”, the location of the bicycle-skills course.	***Land Use/ Environmental*** No major noise issues.

8.10 Terrace Hill

Acres	*Transit*	*Parking*	*#Trail- heads*	*# Illegal Trailheads*	*Cycling Access*
22	Yes, not in-sight	Residental Street	1	0	Yes
Bike Racks	***Amenities***	***Signage***	***Trash***	***Dog Feces***	
No	No	Poor. No signage on road to open space but trailhead is marked.	No	No	

7.10.1 Main Trailhead

Accessibility Bike and pedestrian accessible. Transit possible, but not in sight. There is a locked gate and smaller turnstile leading to a wide, steep path. There is an open space sign hanging on the gate, but it is not very obvious or clear. Not handicap accessible.	***Transport*** Limited residential street parking. Traffic and congestion are low. There are no bike racks.
Biological/Cultural/Geological Unknown endangered species or historic site. No educational kiosks.	***Land Use/ Environmental*** No major noise issues.

Figure 60: Terrace Hill open space has no signage visible from the road. The open space entrance is just posted on the gate.

9 Appendix 2 – Entrepreneurial Ideas

In an era of fiscal scarcity additional funding streams may be needed to implement programs and practices as envisioned in planning processes. This presents a tension between the desired outcomes of open space protection and use, and the ebb and flow of the budgeting process. The goal of this document is to envision both policy and entrepreneurial opportunities that might mitigate the risk of neglecting environmental stewardship in times of economic hardship. This goal recognizes the essentiality of preservation and commitment to core principles (such as the Ahwahnee Principles and Bruntland Report) while seeing the intrinsic economic value and opportunity open space brings to the community as a whole.

Through brainstorming and in-depth research a list of prospective list of entrepreneurial activities was developed. Entrepreneurial activities are defined as revenue-generating ideas that take into account the available markets and capitalize on opportunities within these markets. These activities are drawn from a broad base, including models from domestic as well as international sources to provide the most diverse list possible. They have been broken up into categories based on similarities in ideology or implementation.

9.1 Real Property Entrepreneurial Initiatives

Real estate based entrepreneurial initiatives on owned, leased or adjacent land provides solid potential for increasing revenues. Because of the ability to leverage existing assets and plan for new cost-effective, high-revenue-generating facilities it offers the some of the return on investment for the open space or the most “bang for the buck.” In the current constrained budget environment for many governments agencies, land and fixed infrastructure become some of the most valuable assets. By harnessing and controlling both leasing and development activities the open space system or its’ partner can monitor such activities to ensure that tasteful and environmentally conscious development is done. Ownership, terms and conditions can all be negotiated per the desires of the agency. Three basic prongs to these real estate entrepreneurial activities are overnight accommodations, lease of underutilized facilities, and housing.

Eco-Lodging: Creating a Lodging Experience in a Sustainable Environment

Historic Structures	• Historic structures, lighthouses or other fixed assets can be used for overnight lodging. This can be done in coordination with historic preservation bodies and public land trusts. • A model for management could be taken from The Landmark Trust of the UK, which uses a combination lottery funding (Heritage Lottery Fund) , restoration grants, fundraising and charitable resources to restore and maintain historic structures for public use and lodging. They operate four facilities within the US that have specific cultural importance to the UK using the same model. • This could be done in parallel with cultural restoration projects at the historic La Loma Adobe on Lizzie Street
Tents and Cabins	• Traditional canvas tents and cabins can be modified to create more of a resort-like experience. Locations such as Costanoa, near Año Nuevo State Park and Treebones in Big Sur have specialized in providing such facilities, and recent project proposals in Avila hint at demand for this type of affordable lodging.
Yurts	• These rural housing huts have been used for centuries in Southeast Asia's nomadic culture and are being implemented as low cost and maintenance, high yield camping structures in places such as Oregon, Colorado and Washington. They are reserved for between $40 and $60 per night. Again, recent project proposals in Avila hint at demand for this type of affordable lodging.
Norwegian Rorbu	• These traditional fishing cottages are found in Fjord Norway, and other locations across Scandinavia and Northern Europe, used for shelter and food preparation on fishing or other expeditions. They sleep between 2 and 6 individuals and have a small bathroom and kitchen facility.
Cycling Terminals	• Cycling Terminals have developed in Japan that feature overnight accommodations, conference rooms and bike rentals at affordable rates for

	tourists. There are 57 cycling terminals across the country built by the Japan Bicycle Road Development Association with the cooperation of local government. They are subsidized by the Japan Keirin Association and administered by local governments. • Properties near abandoned railroad lines and areas with existing bike paths would support this type of development. This could be explored in coordination with non-profits such as the SLO Bicycle Coalition and the Rails-to-Trails Conservancy.
Agri-tourism	• In Italy alone the government has been promoting Agriturismo and 'Green Tousimo' (Turismo Verde) since 1965 through the Associazione Nazionale Agricoltura e Turismo and the Confederazione Italiana Agricoltori and now has over 1500 participating facilities throughout the country. • Harnessing this model at locations adjacent to open spaces and involved in agricultural production could provide additional partnerships and revenue for SLO. UC Davis operates a website and database to encourage small-farm agricultural tourism; a parallel open space tourism website could be a conduit to attacting these

Lease: Lease of Existing Land or Under-Utilized Structures

Lease of Existing Facilities	• Housing units on owned property could be leased out to the general public at fair market value rent (This is already being done to some extent at Johnson Ranch).
	• Other non-housing facilities could be leased for alternative uses including but not limited to:
	  ○ Farmer's Markets
	  ○ Children's Facilities and Museums
	  ○ Research Centers
	  ○ Educational Institutions
	  ○ Non-profits
	  ○ Conservation Organizations

Lease of Existing Land	• Land could be leased for alternative purposes or conservation-related commercial activities. For example, use of land or facilities for farmers market and natural/organic food sale and production would be consistent with the SLO food movement in addition to Agri-tourism concepts. • Other concepts might be workable with the appropriate structure and controls.

9.2 Resource Stewardship Initiatives

Conservation-based Initiatives: Initiatives based on resources stewardship and conservation can generate institutional savings and additional revenue for agencies. Reduction of energy and resources consumption cuts fixed sustainment costs, while encouraging reliance on independent renewable sources greatly reduces dependence on outside energy costs and sources.

Energy Resource Efficiency	• Taking advantage of tools available to cut down on resource consumption and improve efficiency can mean dramatic savings. Use of electricity can be minimized by changing to more energy efficient, longer-lasting bulbs, encourage ambient lighting or monitoring heating and cooling practices. Waterless urinals, smaller water heaters and toilets in addition to bio-composting utilities reduce wasted water.

Renewable Energy	• Integrating renewable energy sources and green infrastructure significantly reduces costs. This includes:
	  ○ Installation of turbines; wind or wave
	  ○ Solar power and collection
	  ○ Green infrastructure

Solid Waste Reduction	• Solid waste can be reduced by increasing the amount of non-disposable materials, re-using disposable items, recycling, and integration of techniques such as composting

Other Initiatives: While traditional conservation-based activities focus on preservation of existing resources, based on new technology and creativity other inherent resources have become available in recent years. Harnessing potential of resources related to digital, airwave frequencies, and other inherent geographic advantages can increase revenue.

Parking Pricing or Hangtags	• Charging for parking or requiring hangtag for parking could be a way to generate revenue while balancing use. • SLO Residents or Open Space Conservancy members could be given an annual hangtag while others would be required to purchase pay and display parking ○ Similar policies are in place and have been used by East Bay Regional Parks in the Bay Area

Telecommunications	• The integration of telecommunication agreements at sites close to highways and major metro areas could generate significant revenue and eliminate dependency on land-based phone service through:
	  ○ Cell tower placement
	  ○ Reception licensing
	  ○ Preferred carrier agreement

WiFi	• Increasing possibilities are coming about though local and regional WiFi towers and internet service providers. Models such as the one used by TMobile in airports and other facilities across the country, could provide internet 'hotspots' for access around open spaces that would generate revenue by access. • Use of the Earthlink/Google model for free WiFi in locations such as San Francisco in exchange for ad revenue could also generate profits. •
Global Positioning Systems (GPS)	• Many opportunities are arising with use of Global Positioning Systems or GPS. Agreements for habitat monitoring , with Geographic Information Systems (GIS) tie-ins could be established. • Using such technology might help reduce the costs of monitoring flora and fauna • Examples include potential companies like Trailhead Labs (http://www.trailheadlabs.com/), which used digitial information to enrich the open space experience.

9.3 Events/Special Uses

Traditional Special Uses: There are many special and/or event uses that can take place in an open space, be they media and filming or special uses such as weddings or outfitted excursions. Creative use of facilities and management of different types of concessionaire activity could bolster revenue.

Media/Filming	• Media & Filming rights • Commercial viability • Scale, budget & pricing
Boy or Girl Scout Camps	• Camps/Jamborees • Permitting and liability
Open-air Cemetery	• Open air/natural cemetery sites • Amount people willing to pay for open space burial • Trees or other memorials for each plot
Corporate Events/Training	• Packages for use and/or advertising • Could involve team building activities through items such ropes and/or COPE courses
Weddings	• Wedding and related special events
Guided Hikes	• Attract Eco-tourist through guided hikes/trips • Package Trips
Outdoor Outfitters	• Permitting for long visit or short duration • Extended Tour/hike of open spaces • BackRoads; National Geographic
Volunteer Travel	• There is opportunity to entice paying volunteers to work in open spaces. This possibility would provide volunteer work such as trail maintenance and removal of non-indigenous species at no cost, with a link to the possibility of any housing or agri-tourism-related activity.
GPS Related Activities	• A market has emerged for GPS location-based adventures. The company Groundspeak has developed a worldwide network of GeoCaching, a network of people who search for hidden treasures based on geographic coordinates.

Sporting Events: Sporting activities, events and competitions also offer special use opportunities. Although some of these activities may currently occur, they could be optimized to provide both a more pinpointed and consistent range of activities. Based on demand for certain types of activities the list could be broadened significantly. Event hosting and sponsorship are also potential sources of revenue, especially through the pursuit of new and/or fringe sporting activities.

Sporting and Outdoor Activities	• Backpacking • Extreme Sports • Kayaking/Canoeing • Rock Climbing • Running
Sporting Events and Competitions	• Tours & Events • Cyclocross • Triathlons • Extreme Sports • Running

9.4 Other Entrepreneurial Concepts

Although some may or may not be within the scope of the large-scale entrepreneurial activities developed in this document, there remain many other potential activities that could generate additional revenue for the open space system. These include potentially placing souvenir items in high-visibility, revenue generating locations such as Airport Gateway shops and programs such as a 'Passport' program suggested to the Chesapeake Bay Gateways Network.

Branded Merchandising	• Artists/Marketing of merchandise • Building identity • GGNRA example
Passport Program	• Bi-annual support program for benefits and easy access • Used by Chesapeake Bay Networks
TM/Banking Services	• Installation of ATM service providing facilities in locations around the system
Credit Cards	• SLO Open Space Credit Card
Vehicle Sponsorship	• Use of advertising on vehicles
Reaching Under-represented Market Segments	• Hispanics • Mentally, physically, or visually challenged • Schools and children • Adult and Juvenile Criminal Offenders, similar to programs offered by CA State Parks ○ Free Ventures Program
Charging for Maps/Brochures, Trash Bags, etc.	• Charging for otherwise free items such as park brochures and maps, using the 'Southwest' accounting model. • This could be a way to mitigate trash and feces issues.

10 Appendix 3 – IRB Forms & Survey Instrument

HUMAN SUBJECTS PROTOCOL APPROVAL FORM
Cal Poly, San Luis Obispo

All Cal Poly faculty, staff, and student research with human subjects, as well as other research involving human subjects that is conducted at Cal Poly, must be reviewed by the **Cal Poly Human Subjects Committee** for the protection of human subjects, the researchers, and the University. Human subjects research is defined as any systematic investigation of living human subjects that is designed to develop or contribute to generalizable knowledge. While the ethical guidelines for research are applicable to classroom activities, demonstrations, and assignments, the Human Subjects Committee does not review classroom activities unless data will be collected and used in a systematic investigation.

Researchers should complete all items on this approval form and submit ***three copies*** of it, along with ***three copies*** of a research protocol (containing the information detailed in Guidelines for Human Subjects Research Protocol), to the Office of Research and Industry Relations (Debbie Hart, Bldg. 38, Room 154). Please feel free to attach an additional page if your responses to any of the items require more space. Your answers to the items on this form, as well as the research protocol, should be typed. The Committee will make every effort to respond to your submission within two to four weeks. Committee approval should be received prior to contacting prospective subjects and collecting data. Please read carefully Cal Poly's Policy for the Use of Human Subjects in Research prior to completing this application.

If you require assistance in completing this form, contact the Office of Research and Industry Relations at (805) 756-1508.

1. Date: 18 July 2014

2. Title of Research Project:

Open Space Access Study

3. Type of Research:

- [ ] Senior project
- [ ] Master's thesis
- [x] Faculty research
- [ ] Other: *please explain*

4. Name(s) of Researcher(s)

Principal Investigator: William Riggs
Department or other affiliation: City & Regional Planning
Phone: 805-756-6317 Email: wriggs@calpoly.edu
Position: [x] Faculty [ ] Student
[ ] Other: *please explain*

Additional Researcher: Tessa Salzman
Department or other affiliation: City & Regional Planning Program graduate
Phone: 707 845 5846 Email: tessajsalzman@gmail.com
Position: [ ] Faculty [ ] Student
[x] Other: *Former student*
[ ] Other: *please explain*
[ ]

Additional Researcher: Megyn Rugh
Department or other affiliation: UCLA Student
Phone: Email: megyn@sustinere.co
Position: [ ] Faculty [x] Student
[ ] Other: *Please explain*
[ ] Other: *please explain*

Additional Researcher: Camille Jackson
Department or other affiliation: City & Regional Planning student, Cal Poly
Phone: Email: camille.g.jackson@gmail.com
Position: [ ] Faculty [x] Student
[ ] Other: *Please explain*
[ ] Other: *please explain*

5. Faculty Advisor (if applicable)
NA

6. Is there an *external* funding source for the project:
[ ] Yes, and the source is:
[x] No,

7. Is this a modification of a project previously reviewed by Cal Poly's Human Subjects Committee?
[ ] Yes, and the approximate date of the last review was:
[x] No

8. Estimated duration of the project:
Starting date: July 2014 Completion date: Dec 2014

9. Describe *any* risks (physical, psychological, social, or economic) that may be involved.
*See **Specific Ethical Criterion #1** in Policy for the Use of Human Subjects in Research for a description of the types of risks.*

Nominal risks participation populations could experience include potential feelings of vulnerability or social risk of embarrassment based on the public travel data they may submit as a part of the survey or mobile tools. All data will be anonymous so even if disclosed outside of this research, it would not reasonably place the subjects at risk or discomfort.

10. Indicate what measures will be taken to minimize risks. *See **Specific Ethical Criterion #1** in Policy for the Use of Human Subjects in Research for a discussion of strategies for minimizing risks.*

Anticipated risks are extremely minimal. To reduce risks no questions within the survey are required in order to move on to the next question. To account for location based information, only secure / encrypted data will be used and mobile travel data will be sent using secure data protocols that ensure anonymity.

11. Explain how subjects' *confidentiality* will be protected. *See **Specific Ethical Criterion #5** in Policy for the Use of Human Subjects in Research for a discussion of strategies for minimizing risks.*

Survey questions will be anonymous and random identifiers will be used to preserve the anonymity of mobile participants. All data will be kept in a secure location and kept confidential unless it involves illegal or inappropriate actions or activities.

12. Describe any *incentives* for participation that will be used. *See **Specific Ethical Criterion #2** in Policy for the Use of Human Subjects in Research for a discussion of the use of incentives in research.*

None.

13. Will *deception* of subjects be involved in the research procedures?

[ ] Yes* [x] No

If so, explain the deception and how it will be handled.* *See **Specific Ethical Criterion #3 in Policy for the Use of Human Subjects in Research for a discussion of the use of deception in research:*

14. Type of review requested:

[ ] Exempt from further review* [x] Expedited review [ ] Full review

See ***Types of Review*** in Policy for the Use of Human Subjects in Research for a discussion of the criteria for exempt, expedited, and full reviews.

**The research protocol submitted for a project presumed to be exempt may be abbreviated but should contain sufficient information to support the conclusion that the project meets the criteria for exemption.*

15. Signatures:

Your signature below indicates that the information presented in this application (the approval form and

research protocol) is accurate and that you have read, understand, and agree to follow the Policy for the Use of Human Subjects in Research.

Name of Primary Researcher: William Riggs

Signature: _____

Title of the Research:
City of San Luis Obispo, Open Space Access Study

Name and department/affiliation:
William Riggs
City & Regional Planning

Statement of purpose, benefits, and hypotheses:
The goal of this study is to assess and report on opportunities and constraints of how people travel to San Luis Obispo open spaces, and to begin a process on how more multi-modal access can be achieved. Once we understand how people currently get to open spaces and use them once they have arrived, we can identify appropriate transportation and streetscape enhancements to increase safe, equitable access to SLO's open spaces.

Methods:
To conduct the study we will complete three tasks:
1) data analysis & kickoff;
2) field analysis training & counts;
3) a strategic plan / assessment.
These three tasks are outlined below.

TASK 1: EXISTIND DATA, KICKOFF, AND ONGOING MANAGEMENT
This task will begin with a kickoff meeting with the City Open Space Manager and key Cal Poly team members to discuss goals for the project. We will review all data and documents and summarize available gaps and preliminary existing conditions in a brief memo. The existing conditions will be assessed through physical site visits to each of the 11 open spaces we are conducting surveys at.

TASK 2: FIELD ANALYSIS, TRAINGING & COUNTS
A student team will refine methods to conduct field review of the study area through in person and passive surveying. Students and trained volunteers will spend time doing in person surveys of open space visitors They will also do bicycle and pedestrian counts. Cal Poly students will be available to cover up to 3 locations, however it is assumed that other locations will be staffed by volunteers from the SLO County Land Conservancy trained by the Cal Poly team.

For the bicycle and pedestrian counts we will use a standard intercept survey with enhanced questions. Counts will collect pedestrian, bicycle, and other traffic on 6-8 distinct days at locations decided on mutually in coordination with the City Open Space Manager. If available we will compliment manual data collection by temporarily installing a manual infrared counter at key locations.

Additionally as a part of the counts volunteers will conduct a field review to assess constraints and opportunities for improving the multi-modal environment throughout the natural resource system. In

particular, we will observe potential constraints related to bike / ped infrastructure, topography, transit stops / service, and parking supply.

We will document the results of the assessment in a technical report with conditions and potential recommended treatments as a part of Task 3.

TASK 3: STREETSCAPE ASSESSMENT
Using data collected as a part of Task 2, we will develop an existing conditions summary and strategic access study. The study will identify potential opportunities and suggested treatments based on the data collected. These may warrant further study in the future masterplan. One revision of the report will be made based on client review.

Details on Analysis:
There will be no follow up questions or research on individual participants. The research will be analyzed as a set.

There will be no incentives offered to participants.

Subjects:
Subjects will be reached through in person, active survey collection at the open space trail heads. Survey responses will be captured passively through flyers posted at trail heads which lead people to the online survey via QR code. The link to the online survey may also be sent out through the City's mailing list. In all instances, subjects actively decide whether or not they wish to participate.

City of San Luis Obispo, Open Space Study

Please help us by filling out this survey. It will take a few minutes to answer the 9 questions about **How You Use SLO Open Spaces** and the 8 questions **About You**. The City of San Luis Obispo (SLO) has **11 official public open spaces**. However, many of them are inconvenient to access by foot, bike or public transit. This presents a challenge to our community members and SLO visitors who like to explore without personal vehicles. Working with Cal Poly, the City of SLO would like to evaluate how people travel to SLO open spaces and to explore more multi-modal access to these places.

You are not required to participate in this research and you may discontinue your participation at any time without penalty. All of your answers will be confidential and you may omit any items you prefer not to answer. If you have questions regarding this study or would like to be informed of the results when the study is completed, please feel free to contact Dr. William Riggs via email at wriggs@calpoly.edu. If you have concerns regarding the manner in which the study is conducted, you may contact Dr. Steve Davis, Chair of the Cal Poly Human Subjects Committee, at (805) 756-2754, sdavis@calpoly.edu, or Dr. Dean Wendt, Interim Dean of Research, at (805) 756-1508, dwendt@calpoly.edu.

1. Are you over 18 and do you agree to participate in this research? (Circle answer)
Yes No

2. What open space do you most frequent? (Circle answer)
Bishop Peak | Cerro San Luis (Madonna) | Irish Hills | Islay Hill | Johnson Ranch | Johnson Ranch / Irish Hills Connector | Laguna Lake | Reservoir Canyon | South Hills | Stenner Springs | Terrace Hill
Other _____
3. How often do you visit the location you marked above? (Fill in blanks)

_____(# days)/ _____ (week or month)

4. How often do you visit ANY of the open spaces listed above? (Fill in blanks)
_____(# days)/ _____ (week or month)

5. Why do you usually go there? (Circle answer)
Recreation/ Site seeing | Exercise | Picnics | Work/ Education
Other _____

6. What would improve your experience at these open spaces? (Circle answer)
Bathrooms | Drinking Water | Wayfinding (Signage, maps, etc) | Educational Kiosk/ Info Car Parking | Bike Parking | Picnic/ Gathering areas
Other _____

7. Who do you visit the spaces with? (Circle answer)
Alone | Friends | Family | Pets | Organized groups
Other _____

8. How do you usually get there? (Circle answer)
Drive (personal vehicle/ carpool) | Public Transit | Walk | Bike
Other_____
It depends on the space (please clarify) _____

9. Is there a reason you avoid a certain open space? The lack of:
Bathrooms | Drinking Water | Wayfinding (Signage, maps, etc) | Educational Kiosk/ Info Car Parking | Bike Parking | Picnic/ Gathering areas
Other _____

10. What is the most common way you have found out about the open spaces you visit? (Circle answer)
City Website | Guide Book | Word of Mouth
Other _____

11. What is your current street address? (Feel free to round to the nearest hundred block)

12. What city do you currently live in?

13. What is your current zip code?

14. What is your gender? (Circle answer)
Male | Female | Other/ prefer not to say

15. How would you describe your ethnic background? (Circle answer)
Asian/ Pacific Islander | Black/ African-American | Caucasian | Hispanic |
Native American/ Alaska Native | Other/ Multi-Racial | Prefer not to say

16. What is your highest level of educational attainment? (Circle answer)
12th grade or less | Graduated high school or equivalent | Some college, no degree | Associate degree | Bachelor's degree | Post-graduate degree | Prefer not to say

17. What is your age? (Circle answer)
under 18 | 18-24 | 25-34 | 35-54 | 55+ | Prefer not to say

18. What is your approximate household income? (Circle answer)
Less than $25,000 | $25,000 to $34,999 | $35,000 to $49,999 | $50,000 to $74,999 | $75,000 to $99,999 | $100,000 to $124,999 | $125,000 to $149,999 | $150,000 or more | Prefer not to say

19. Do you have other comments about public open space that this survey doesn't cover?

11 Appendix 4 – Eco-Counter Assessment

11.1 Introduction

The pyro compact bicycle and pedestrian counter (Eco-counter) was utilized at four open space trailhead locations in the City of San Luis Obispo to count user volumes over the course of several weeks. The Eco-counter sensor uses both passive infrared technology and a high precision lens to detect directional use and volume of use when a person passes in the range of the sensor. This technology allows for the counter to be sensitive enough to detect two different people with only a small gap between them. The Eco-counter is self-calibrating, adjusting to the environmental conditions on its own after its initial site installation (www.eco-compteur.com). Data confirms that the Eco-counter over counts by approximately 30%, especially when groups are involved and sensitivity to environment conditions (Kilambi, Ribnick, Joshi, Masoud, & Papanikolopoulos, 2008; Sidla, Lypetskyy, Brandle, & Seer, 2006).

The counter was installed at the Bowden Ranch Trailhead, the Highland and Patricia Trailheads at Bishop Peak, and the Johnson Ranch Trailhead. Data from the Eco-counter is useful for determining which trailheads are used most often and when peak hours of trailhead use are during the day. Manual counts were performed at the Patricia Trailhead at Bishop Peak, and the Johnson Ranch trailhead in order to evaluate the accuracy of the automated counter.

11.2 Manual Counts

Manual counting was performed at peak AM and peak PM hours for two sequential days. Peak hours were determined by data collected by the counter at each location, and kept consistent for the manual count times for both locations. The AM counts were conducted between 8AM and 10AM, and the PM counts were conducted between 5PM and 7PM. The manual counts keep track of pedestrian and cyclist users at each of the respective trailheads. The automated and manual counts are separated by “Ins” and “Outs” from the trailhead, and only tabulated manually when a person walks past the sensor in either direction. Counts are tabulated in 15-minute intervals. Table 8 shows a sample of both automated and observed manual counts at the Patricia Trailhead at Bishop Peak on Thursday October 23, 2014 from 5:00PM to 7:00PM.

Table 7: Patricia Trailhead at Bishop Peak PM Counts, October 23, 2014

Date and Time	Counter			Manual		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Thu, Oct 23, 2014 05:00 PM	7	7	14	9	6	9
Thu, Oct 23, 2014 05:15 PM	2	9	11	3	0	3
Thu, Oct 23, 2014 05:30 PM	5	2	7	1	1	1
Thu, Oct 23, 2014 05:45 PM	3	0	3	4	0	4
Thu, Oct 23, 2014 06:00 PM	13	2	15	10	4	10
Thu, Oct 23, 2014 06:15 PM	0	4	4	1	1	1
Thu, Oct 23, 2014 06:30 PM	0	1	1	2:	2	2
Thu, Oct 23, 2014 06:45 PM	0	4	4	5	5	5
TOTAL	30	29	59	35	19	35

The manual count samples are preliminary in the assessment of the accuracy of the Eco-counter. The data collected by both the automated counter and manually over the two-day period represent a small sample for analysis. For the purpose of determining the accuracy of the automated counter, it is assumed that the manual counts are 100 percent accurate.

11.3 Johnson Ranch Setting

The manual counts for Johnson Ranch were completed on Wednesday September 10, 2014 and Thursday September 11, 2014. The morning weather for both days was overcast between the hours of 8AM and 9AM, and sunny from 9AM to 10AM. The afternoon weather on both days was sunny, until just before 7PM when the sun began to set.

The automated counter was installed on a post at the trailhead for Johnson Ranch. The post served as one of the entry posts, where trail users must enter, as the rest of the area is gated. The counter was placed to avoid collision form people and bicycles moving through the small trail opening. The counter was placed at a slight angle to accommodate users, pointing the sensor at a slight angle from the entrance as well.

Figure 61: Johnson Ranch Trailhead Eco-counter Installation

11.4 Manual Counts vs. Automated Counts

Recorded counts of the automated Eco-counter over the eight-peak usage hours on September 10, 2014 and September 11, 2011 are compared the manual counts taken during the same date and time. Figure X.X displays the counts recorded manually and by the counter for “Ins”, “Outs” and the total “Ins” and “Outs” over the testing period. The data reveals that the counter was 59 percent accurate in comparison to the manual counts for the total counts collected over the two-day period, with a 41 percent error.

Table 8: Johnson Ranch Trailhead Peak Hour %Counter Error for Total Counts

Date and Time	Counter TOTAL	MANUAL TOTAL	% Accuracy (Manual/Counter)	% Counter Error
Johnson Ranch 9.10 AM 8AM-10AM	84	53	63%	37%
Johnson Ranch 9.11 PM 8AM-10AM	113	63	56%	44%
Johnson Ranch 9.10 AM 5PM-7PM	251	136	54%	46%
Johnson Ranch 9.11 AM 5PM-7PM	186	120	65%	35%
TOTAL	634	372	59%	41%

The level of accuracy for each fifteen minute time period ranges throughout the two observed days, from anywhere between 25 percent and 100 percent accuracy .The average accuracy for each 2-hour time period over the two-recorded days was 59%. As shown in Table 9 the counter over counts in comparison to the manual counts. This is consistent with current data. A closer analysis of this trend revealed that at the Johnson Ranch Trailhead that the Eco-counter over counted users 86 percent of the time, and undercounted users 5 percent of the time for the total counts recorded, including “Ins”, “Outs”, and total “Ins” and “Outs”. It counted accurately according the manual record 8 percent of the time. Manual counts also allowed for observed constraints to the accuracy of the counter, including people’s behaviors at each of the trailheads.

11.5 Observations of Constraints

Constraints to the accuracy of the counter were observed during the manual counting process. Many trail users paused just past the threshold for the trail, and directly located next to the parking area. The area past the entrance is flat and open, where many paused to rest before or after using the trail. The angle of the sensor may have counted users that were standing within its range, even though they had already or not yet passed the entrance threshold. The gate is a place where people took a rest or stretched. People with dogs, paused in this general area to take their dogs on or off their leashes on multiple occasions. The location of the counter was obvious to users as well. Many people paused in front of the sensor to see what the counter was, and in a few cases waved their hands in front of the sensor.

Key contributors based on observations include:

- Close proximity to parking, with flat open area
- Narrow threshold and the angle of the Eco-counter
- Obvious placement/location of the counter

11.6 Patricia Trailhead at Bishop Peak Setting

The manual counts for the Patricia Trailhead at Bishop Peak were completed on Thursday October 23, 2014 and Friday October 24, 2014. The morning weather for both days was overcast between the hours of 8AM and 9AM, and sunny from 9AM to 10AM. The afternoon weather on both days was sunny, until 6:30PM when the sun was setting. The last fifteen minute count for each afternoon, 6:45PM-7:00PM was completely dark after sunset.

The Eco-counter was placed on a gate at the entrance for the Patricia Trailhead. Trail users must pass through the gate in order to enter the Bishop Peak open space area.

Figure 62: Patricia Trailhead at Bishop Peak Eco-counter Installation

11.7 Manual Counts vs. Automated Counts

The second sample of manual counts was taken over two peak hour time intervals on October 23, 2014 and October 24, 2014. The recorded automated counts are compared to the manually observed counts over this period of time. Table 10 displays the counts recorded manually and by the counter for “Ins”, “Outs” and the total “Ins” and “Outs over the testing period. The data reveals that the counter was 76 percent accurate in comparison to the manual counts for the total counts collected over the two-day period, with a 24 percent error.

Table 9: Patricia Trailhead at Bishop Peak, Peak Hour %Counter Error for Total Counts

Date and Time	Counter TOTAL	MANUAL TOTAL	% Accuracy TOTAL (Manual/Counter)	% Counter Error
10/23/2014 8:00 AM-10:00 AM	61	39	64%	36%
10/24/2014 8:00 AM-10:00 AM	59	35	59%	41%
10/23/2014 5:00:00 PM-7:00 PM	67	46	69%	31%
10/24/2014 5:00:00 PM-7:00 PM	30	46	65%	35%
Total	217	166	76%	24%

The level of accuracy for each fifteen minute time period ranges throughout the two observed days, ranging from anywhere between 0 percent and 100 percent. The average accuracy for

each 2-hour time period over the two-recorded days was 68. The Bishop Peak sample reveals that the counter over counts consistently. Further analysis of the data shows that the counter over counted 58 percent of the time and undercounted thirty six percent of the time for the total counts recorded, including “Ins”, “Outs”, and total “Ins” and “Outs”. It counted accurately according to the manual observations 7 percent of the time. One exception in is the PM counts for October 24, 2014. Under counting during this time increment is most likely due to the period after dark, and will be examined as a constraint to accuracy.

11.8 Observations of Constraints

The manual counting process helped identify constraints to the counter accuracy based upon the location and placement of the counter as well as the behaviors of the Trailhead users. The accuracy of the Eco-counter at this location was higher in comparison to the Johnson Ranch Trailhead. The space to walk past the sensor through the entrance gate is very narrow, and only allowed for one person at a time to pass the counter. The entrance is also located at an incline, and several hundred feet past the parking area for the trailhead. People had already rested, waited on friends, or stretched closer to the street area, and continuously moved past the counter. The automated counter was in an obvious location as well. Many people stopped to look at the counter, and waved their hands in front of the sensor.

The poorest accuracy recordings of the counter in comparison to the manual counts occurred in the last fifteen-minute interval of the PM counts. This time period was completely dark, and no outside lighting was present. There were many users after dark on the trail, and there were people recorded as passing through the sensor threshold during this time period as observed during the monitoring period.

Key contributors based on observations include:

- Distance from parking area
- Narrow entrance threshold
- Incline of site
- No lights after dark

11.9 Conclusion

Over a period of time, the Eco-counter can provide valuable data for recording volumes of pedestrian and bicycle use. The two samples taken at the two trailheads provide preliminary insight into the accuracy and versatility of use of the Eco-counter. Some key observations from these two cases include:

- The placement of the counter on entrance posts allows for the counter to capture all trail users
- A discreet location of the counter could prevent inaccuracy of curious people
- Placing the counter toward a flat or open area where people may linger can interfere with accurate readings
- A passive location for the counter can prevent trail users from stopping in the range of the sensor

- Lighting has an effect on the accuracy, after dark on the trailhead resulted in no automated recorded counts in comparison to the observed people counts after dark
- Small sample size may limit the accuracy recorded
- Peak hours with heavier volumes of users may be less accurate than other time periods

12 Appendix 5 – Eco-Counter & Manual Counter Comparison Data Reports

Table 10: Johnson Ranch Peak Hour % Error of Counter For All Recorded Counts

Johnson Ranch 9.10 AM	Counter IN	Manual IN	% Accurate (Manual / Counter)	% Counter Error	Counter OUT	Manual OUT	% Accurate (Manual/Counter)	% Counter Error	Counter TOTAL	Manual TOTAL	% Accurate	% Counter Error
Wed, Sep 10, 2014 08:00 AM	1	1	100%	0%	3	2	67%	33%	4	3	75%	25%
Wed, Sep 10, 2014 08:15 AM	6	4	67%	33%	0	0	100%	0%	6	4	67%	33%
Wed, Sep 10, 2014 08:30 AM	7	5	71%	29%	10	7	70%	30%	17	12	71%	29%
Wed, Sep 10, 2014 08:45 AM	5	4	80%	20%	6	3	50%	50%	11	7	64%	36%
Wed, Sep 10, 2014 09:00 AM	14	6	43%	57%	3	2	67%	33%	17	8	47%	53%
Wed, Sep 10, 2014 09:15 AM	2	2	100%	0%	3	2	67%	33%	5	4	80%	20%
Wed, Sep 10, 2014 09:30 AM	3	2	67%	33%	15	8	53%	47%	18	10	56%	44%
Wed, Sep 10, 2014 09:45 AM	4	3	75%	25%	2	2	100%	0%	6	5	83%	17%
Time Period 1	42	27	64%	36%	42	26	62%	38%	84	53	63%	37%
Johnson Ranch 9.11 AM	Counter IN	Manual IN	% Accurate (Manual / Counter)	% Counter Error	Counter OUT	Manual OUT	% Accurate (Manual / Counter)	% Counter Error	Counter TOTAL	Manual TOTAL	% Accurate (Manual / Counter)	% Counter Error
Thu, Sep 11, 2014 08:00 AM	6	3	50%	50%	6	4	67%	33%	12	7	58%	42%
Thu, Sep 11, 2014 08:15 AM	5	3	60%	40%	0	0	100%	0%	5	3	60%	40%
Thu, Sep 11, 2014 08:30 AM	8	3	38%	63%	5	2	40%	60%	13	5	38%	62%
Thu, Sep 11, 2014 08:45 AM	5	6	83%	17%	5	2	40%	60%	10	8	80%	20%
Thu, Sep 11, 2014 09:00 AM	3	4	75%	25%	3	1	33%	67%	6	5	83%	17%
Thu, Sep 11, 2014 09:15 AM	7	4	57%	43%	2	2	100%	0%	9	6	67%	33%
Thu, Sep 11, 2014 09:30 AM	14	11	79%	21%	10	6	60%	40%	24	17	71%	29%
Thu, Sep 11, 2014 09:45 AM	26	7	27%	73%	8	5	63%	38%	34	12	35%	65%
Time Period 2	74	41	55%	45%	39	22	56%	44%	113	63	56%	44%
Johnson Ranch 9.10 PM	Counter IN	Manual IN	% Accurate (Manual / Counter)	% Counter Error	Counter OUT	Manual OUT	% Accurate (Manual / Counter)	% Counter Error	Counter TOTAL	Manual TOTAL	% Accurate (Manual / Counter)	% Counter Error
Wed, Sep 10, 2014 05:00 PM	43	21	49%	51%	17	5	29%	71%	60	26	43%	57%
Wed, Sep 10, 2014 05:15 PM	20	10	50%	50%	12	6	50%	50%	32	16	50%	50%
Wed, Sep 10, 2014 05:30 PM	7	5	71%	29%	13	6	46%	54%	20	11	55%	45%
Wed, Sep 10, 2014 05:45 PM	13	7	54%	46%	3	6	50%	50%	16	13	81%	19%
Wed, Sep 10, 2014 06:00 PM	16	14	88%	13%	25	9	36%	64%	41	23	56%	44%
Wed, Sep 10, 2014 06:15 PM	16	9	56%	44%	20	14	70%	30%	36	23	64%	36%
Wed, Sep 10, 2014 06:30 PM	7	5	71%	29%	7	2	29%	71%	14	7	50%	50%
Wed, Sep 10, 2014 06:45 PM	15	7	47%	53%	17	10	59%	41%	32	17	53%	47%
Time Period 3	137	78	57%	43%	114	58	51%	49%	251	136	54%	46%
Johnson Ranch 9.11 PM	Counter IN	Manual IN	% Accurate (Manual / Counter)	% Counter Error	Counter OUT	Manual OUT	% Accurate (Manual / Counter)	% Counter Error	Counter TOTAL	Manual TOTAL	% Accurate (Manual / Counter)	% Counter Error
Thu, Sep 11, 2014 05:00 PM	7	7	100%	0%	2	4	50%	50%	9	11	82%	18%
Thu, Sep 11, 2014 05:15 PM	16	9	56%	44%	12	3	25%	75%	28	12	43%	57%
Thu, Sep 11, 2014 05:30 PM	13	10	77%	23%	4	3	75%	25%	17	13	76%	24%
Thu, Sep 11, 2014 05:45 PM	12	7	58%	42%	17	9	53%	47%	29	16	55%	45%
Thu, Sep 11, 2014 06:00 PM	15	9	60%	40%	11	6	55%	45%	26	15	58%	42%
Thu, Sep 11, 2014 06:15 PM	7	7	100%	0%	23	14	61%	39%	30	21	70%	30%
Thu, Sep 11, 2014 06:30 PM	8	5	63%	38%	11	8	73%	27%	19	13	68%	32%
Thu, Sep 11, 2014 06:45 PM	4	1	25%	75%	24	18	75%	25%	28	19	68%	32%
Time Period 4	82	55	67%	33%	104	65	63%	38%	186	120	65%	35%
TOTAL	335	201	60%	40%	299	171	57%	43%	634	372	59%	41%

Table 11: Patricia Trailhead at Bishop Peak Peak Hour % Error of Counter For All Recorded Counts

Date and Time	Counter IN	Manual IN	% Accurate (Manual/Counter)	% Counter Error	Counter OUT	Manual OUT	% Accurate (Manual/Counter)	% Counter Error	Counter TOTAL	Manual TOTAL	% Accurate (Manual/Counter)	% Counter Error
Thu, Oct 23, 2014 08:00 AM												
Thu, Oct 23, 2014 08:15 AM												
Thu, Oct 23, 2014 08:30 AM	2	4	50%	50%	4	5	80%	20%	6	9	67%	33%
Thu, Oct 23, 2014 08:45 AM	4	3	75%	25%	6	1	17%	83%	10	4	40%	60%
Thu, Oct 23, 2014 09:00 AM	6	3	50%	50%	3	1	33%	67%	9	4	44%	56%
Thu, Oct 23, 2014 09:15 AM	14	6	43%	57%	4	4	100%	0%	18	10	56%	44%
Thu, Oct 23, 2014 09:30 AM	6	3	50%	50%	5	3	60%	40%	11	6	55%	45%
Thu, Oct 23, 2014 09:45 AM	3	2	67%	33%	4	4	100%	0%	7	6	86%	14%
Time Period 1	35	21	60%	40%	26	18	69%	31%	61	39	64%	36%
Thu, Oct 23, 2014 05:00 PM	7	9	78%	22%	7	6	86%	14%	14	9	64%	36%
Thu, Oct 23, 2014 05:15 PM	2	3	67%	33%	9	0	0%	100%	11	3	27%	73%
Thu, Oct 23, 2014 05:30 PM	5	1	20%	80%	2	1	50%	50%	7	1	14%	86%
Thu, Oct 23, 2014 05:45 PM	3	4	75%	25%	0	0	100%	0%	3	4	75%	25%
Thu, Oct 23, 2014 06:00 PM	13	10	77%	23%	2	4	50%	50%	15	10	67%	33%
Thu, Oct 23, 2014 06:15 PM	0	1	0%	100%	4	1	25%	75%	4	1	25%	75%
Thu, Oct 23, 2014 06:30 PM	0	2	0%	100%	1	2	50%	50%	1	2	50%	50%
Thu, Oct 23, 2014 06:45 PM	0	5	0%	100%	4	5	80%	20%	4	5	80%	20%
Time Period 2	30	35	86%	14%	29	19	66%	34%	59	35	59%	41%
Fri, Oct 24, 2014 08:00 AM	0	1	0%	100%	0	2	0%	100%	0	3	0%	100%
Fri, Oct 24, 2014 08:15 AM	10	6	60%	40%	9	6	67%	33%	19	12	63%	37%
Fri, Oct 24, 2014 08:30 AM	3	2	67%	33%	2	1	50%	50%	5	3	60%	40%
Fri, Oct 24, 2014 08:45 AM	3	2	67%	33%	2	2	100%	0%	5	4	80%	20%
Fri, Oct 24, 2014 09:00 AM	2	2	100%	0%	1	0	0%	100%	3	2	67%	33%
Fri, Oct 24, 2014 09:15 AM	7	5	71%	29%	0	0	100%	0%	7	5	71%	29%
Fri, Oct 24, 2014 09:30 AM	12	6	50%	50%	3	3	100%	0%	15	9	60%	40%
Fri, Oct 24, 2014 09:45 AM	7	4	57%	43%	6	4	67%	33%	13	8	62%	38%
Time Period 3	44	28	64%	36%	23	18	78%	22%	67	46	69%	31%
Fri, Oct 24, 2014 05:00 PM	2	1	50%	50%	5	2	33%	67%	7	3	43%	57%
Fri, Oct 24, 2014 05:15 PM	3	6	50%	50%	1	6	17%	83%	4	12	33%	67%
Fri, Oct 24, 2014 05:30 PM	7	2	29%	71%	2	1	50%	50%	9	3	33%	67%
Fri, Oct 24, 2014 05:45 PM	1	2	50%	50%	3	2	67%	33%	4	4	100%	0%
Fri, Oct 24, 2014 06:00 PM	0	2	0%	100%	1	0	0%	100%	1	2	50%	50%
Fri, Oct 24, 2014 06:15 PM	0	5	0%	100%	3	0	0%	100%	3	5	60%	40%
Fri, Oct 24, 2014 06:30 PM	0	6	0%	100%	2	3	67%	33%	2	9	22%	78%
Fri, Oct 24, 2014 06:45 PM	0	4	0%	100%	0	4	0%	100%	0	8	0%	100%
Time Period 4	13	28	46%	54%	17	18	94%	6%	30	46	65%	35%
Total	122	112	92%	8%	95	73	77%	23%	217	166	76%	24%

Table 12: Johnson Ranch Trail Head Automated Over Counts

Date and Time	Automated Counts			Manual Counts			Difference of Counts (Counter/Manual)			% Overcounted or Undercountd (Total)
	IN	OUT	TOTAL	IN	OUT	Total	IN	OUT	TOTAL	
Wed, Sep 10, 2014 08:00 AM	1	3	4	1	2	3	0	1	1	33%
Wed, Sep 10, 2014 08:15 AM	6	0	6	4	0	4	2	0	2	50%
Wed, Sep 10, 2014 08:30 AM	7	10	17	5	7	12	2	3	5	42%
Wed, Sep 10, 2014 08:45 AM	5	6	11	4	3	7	1	3	4	57%
Wed, Sep 10, 2014 09:00 AM	14	3	17	6	2	8	8	1	9	113%
Wed, Sep 10, 2014 09:15 AM	2	3	5	2	2	4	0	1	1	25%
Wed, Sep 10, 2014 09:30 AM	3	15	18	2	8	10	1	7	8	80%
Wed, Sep 10, 2014 09:45 AM	4	2	6	3	2	5	1	0	1	20%
Wed, Sep 10, 2014 05:00 PM	43	17	60	21	5	26	22	12	34	131%
Wed, Sep 10, 2014 05:15 PM	20	12	32	10	6	16	10	6	16	100%
Wed, Sep 10, 2014 05:30 PM	7	13	20	5	6	11	2	7	9	82%
Wed, Sep 10, 2014 05:45 PM	13	3	16	7	6	13	6	-3	3	23%
Wed, Sep 10, 2014 06:00 PM	16	25	41	14	9	23	2	16	18	78%
Wed, Sep 10, 2014 06:15 PM	16	20	36	9	14	23	7	6	13	57%
Wed, Sep 10, 2014 06:30 PM	7	7	14	5	2	7	2	5	7	100%
Wed, Sep 10, 2014 06:45 PM	15	17	32	7	10	17	8	7	15	88%
Thu, Sep 11, 2014 08:00 AM	6	6	12	3	4	7	3	2	5	71%
Thu, Sep 11, 2014 08:15 AM	5	0	5	3	0	3	2	0	2	67%
Thu, Sep 11, 2014 08:30 AM	8	5	13	3	2	5	5	3	8	160%
Thu, Sep 11, 2014 08:45 AM	5	5	10	6	2	8	-1	3	2	25%
Thu, Sep 11, 2014 09:00 AM	3	3	6	4	1	5	-1	2	1	20%
Thu, Sep 11, 2014 09:15 AM	7	2	9	4	2	6	3	0	3	50%
Thu, Sep 11, 2014 09:30 AM	14	10	24	11	6	17	3	4	7	41%
Thu, Sep 11, 2014 09:45 AM	26	8	34	7	5	12	19	3	22	183%
Thu, Sep 11, 2014 05:00 PM	7	2	9	7	4	11	0	-2	-2	-18%
Thu, Sep 11, 2014 05:15 PM	16	12	28	9	3	12	7	9	16	133%
Thu, Sep 11, 2014 05:30 PM	13	4	17	10	3	13	3	1	4	31%
Thu, Sep 11, 2014 05:45 PM	12	17	29	7	9	16	5	8	13	81%
Thu, Sep 11, 2014 06:00 PM	15	11	26	9	6	15	6	5	11	73%
Thu, Sep 11, 2014 06:15 PM	7	23	30	7	14	21	0	9	9	43%
Thu, Sep 11, 2014 06:30 PM	8	11	19	5	8	13	3	3	6	46%
Thu, Sep 11, 2014 06:45 PM	4	24	28	1	18	19	3	6	9	47%
TOTAL	335	299	634	201	171	372	134	128	262	70%

	Inicates Overcounting
	Indicates Under Counting
	Indicates Accurate Count

Table 13: Patricia Trailhead at Bishop Peak Automated Over Counts

Date and Time	Automated Counts			Manual Counts			Difference of Counts (Counter/Manual)			% Overcounted or Undercountd
	IN	OUT	TOTAL	IN	OUT	Total	IN	OUT	TOTAL	
Thu, Oct 23, 2014 08:00 AM										
Thu, Oct 23, 2014 08:15 AM										
Thu, Oct 23, 2014 08:30 AM	2	4	6	4	5	9	-2	-1	-3	-33%
Thu, Oct 23, 2014 08:45 AM	4	6	10	3	1	4	1	5	6	150%
Thu, Oct 23, 2014 09:00 AM	6	3	9	3	1	4	3	2	5	125%
Thu, Oct 23, 2014 09:15 AM	14	4	18	6	4	10	8	0	8	80%
Thu, Oct 23, 2014 09:30 AM	6	5	11	3	3	6	3	2	5	83%
Thu, Oct 23, 2014 09:45 AM	3	4	7	2	4	6	1	0	1	17%
Thu, Oct 23, 2014 05:00 PM	7	7	14	9	6	9	-2	1	5	56%
Thu, Oct 23, 2014 05:15 PM	2	9	11	3	0	3	-1	9	8	267%
Thu, Oct 23, 2014 05:30 PM	5	2	7	1	1	1	4	1	6	600%
Thu, Oct 23, 2014 05:45 PM	3	0	3	4	0	4	-1	0	-1	-25%
Thu, Oct 23, 2014 06:00 PM	13	2	15	10	4	10	3	-2	5	50%
Thu, Oct 23, 2014 06:15 PM	0	4	4	1	1	1	-1	3	3	300%
Thu, Oct 23, 2014 06:30 PM	0	1	1	2	2	2	-2	-1	-1	-50%
Thu, Oct 23, 2014 06:45 PM	0	4	4	5	5	5	-5	-1	-1	-20%
Fri, Oct 24, 2014 08:00 AM	0	0	0	1	2	3	-1	-2	-3	-100%
Fri, Oct 24, 2014 08:15 AM	10	9	19	6	6	12	4	3	7	58%
Fri, Oct 24, 2014 08:30 AM	3	2	5	2	1	3	1	1	2	67%
Fri, Oct 24, 2014 08:45 AM	3	2	5	2	2	4	1	0	1	25%
Fri, Oct 24, 2014 09:00 AM	2	1	3	2	0	2	0	1	1	50%
Fri, Oct 24, 2014 09:15 AM	7	0	7	5	0	5	2	0	2	40%
Fri, Oct 24, 2014 09:30 AM	12	3	15	6	3	9	6	0	6	67%
Fri, Oct 24, 2014 09:45 AM	7	6	13	4	4	8	3	2	5	63%
Fri, Oct 24, 2014 08:00 AM	2	5	7	1	2	3	1	3	4	133%
Fri, Oct 24, 2014 08:15 AM	3	1	4	6	6	12	-3	-5	-8	-67%
Fri, Oct 24, 2014 08:30 AM	7	2	9	2	1	3	5	1	6	200%
Fri, Oct 24, 2014 08:45 AM	1	3	4	2	2	4	-1	1	0	0%
Fri, Oct 24, 2014 09:00 AM	0	1	1	2	0	2	-2	1	-1	-50%
Fri, Oct 24, 2014 09:15 AM	0	3	3	5	0	5	-5	3	-2	-40%
Fri, Oct 24, 2014 09:30 AM	0	2	2	6	3	9	-6	-1	-7	-78%
Fri, Oct 24, 2014 09:45 AM	0	0	0	4	4	8	-4	-4	-8	-100%

	Inicates Overcounting
	Indicates Under Counting
	Indicates Accurate Count