ATTACHMENT 1

Purisima Multimodal Access Implementation Project

Prepared for
Midpeninsula Regional Open Space District

November 2024

Parametrix

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Prepared for

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act
District	Midpeninsula Regional Open Space District
DMS	Dynamic Message Signs
Preserve	Purisima Creek Redwoods Open Space Preserve
SamTrans	San Mateo County Transit District
SR	State Route
TDM	Transportation Demand Management

ATTACHMENT 1

1. Introduction

This report summarizes the initial findings of the Purisima Multimodal Access Implementation Project, which is developing program scenarios and implementation details for potential transit shuttle service and parking management strategies for the Purisima Creek Redwoods Open Space Preserve (Preserve). The project is being conducted by the Midpeninsula Regional Open Space District (District) with support from consultant Parametrix.

This report is organized into the following sections:

- Transit Shuttle Concepts
- Transit Shuttle Recommendations
- Parking Management Concepts and Recommendations
  - → Reservation Parking
  - → Real-Time Parking Information
  - → Carpool and Vanpool Parking

2. Transit Shuttle Concepts

The Purisima Creek Trailhead accessed by the Purisima Creek Road parking area is a popular recreational destination constrained by limited parking and constrained roadways. The parking area frequently reaches capacity at peak times, resulting in traffic and parking impacts on the narrow Purisima Creek Road.

To increase recreational access to the Preserve, the District is currently designing a new trail called the Purisima-to-the-Sea trail connecting the Purisima Creek trailhead to coastal resources, along with a new parking area on Verde Road near Highway 1. The Purisima-to-the-Sea (Verde Road) parking area is over 4 miles from the Purisima Creek trailhead, and if visitors are directed to use the new parking area instead of the small parking area at the trailhead, a shuttle service would be needed to make the connection.

Implementing shuttle service in this context—from a parking area to a recreational facility—requires balancing demand for service with the cost to provide service. As such, the shuttle strategies are organized into two broad concepts:

- Concept 1 – Core Service. This concept would connect the Purisima Creek Road parking area to the Verde Road parking area. This concept most directly addresses District goals.
- Concept 2 – Expanded Service Area. This concept would connect the Purisima Creek Road parking area and/or the Verde Road parking area to additional destinations such as Half Moon Bay.

The feasibility of each concept is a function of two critical factors: the high cost of providing transit services and facilities, and the realities of procuring those services and facilities which limit the universe of viable options. As discussed in detail in the sections that follow, contracted equipment or services (which are likely to be required) would require a well-designed scope of services to attract potential bidders.

2.1 Concept 1 – Core Service

A simple bi-directional route would maximize the number of trips a single bus could make in an hour. This would help keep operating costs as low as feasible and would also be easy for visitors to understand.

A direct, point-to-point route between the Purisima Creek Road parking area and the new Verde Road parking area would travel along Purisima Creek Road and Verde Road as shown in Figure 1. There would be two stops:

- Verde Road parking area
- Purisima Creek Road parking area

The route is approximately 4.5 miles one way, or 9 miles round trip. As discussed in Section 3, Transit Shuttle Recommendations, this concept assumes that buses have room to turn around at the Purisima Creek parking area that is currently open to cars for general public parking.

If buses cannot turn around in the Purisima Creek parking area, a one-way loop traveling over a greater distance would be the operational solution, or capital improvements of the roadway or parking area would be needed to avoid a less direct and more costly route.

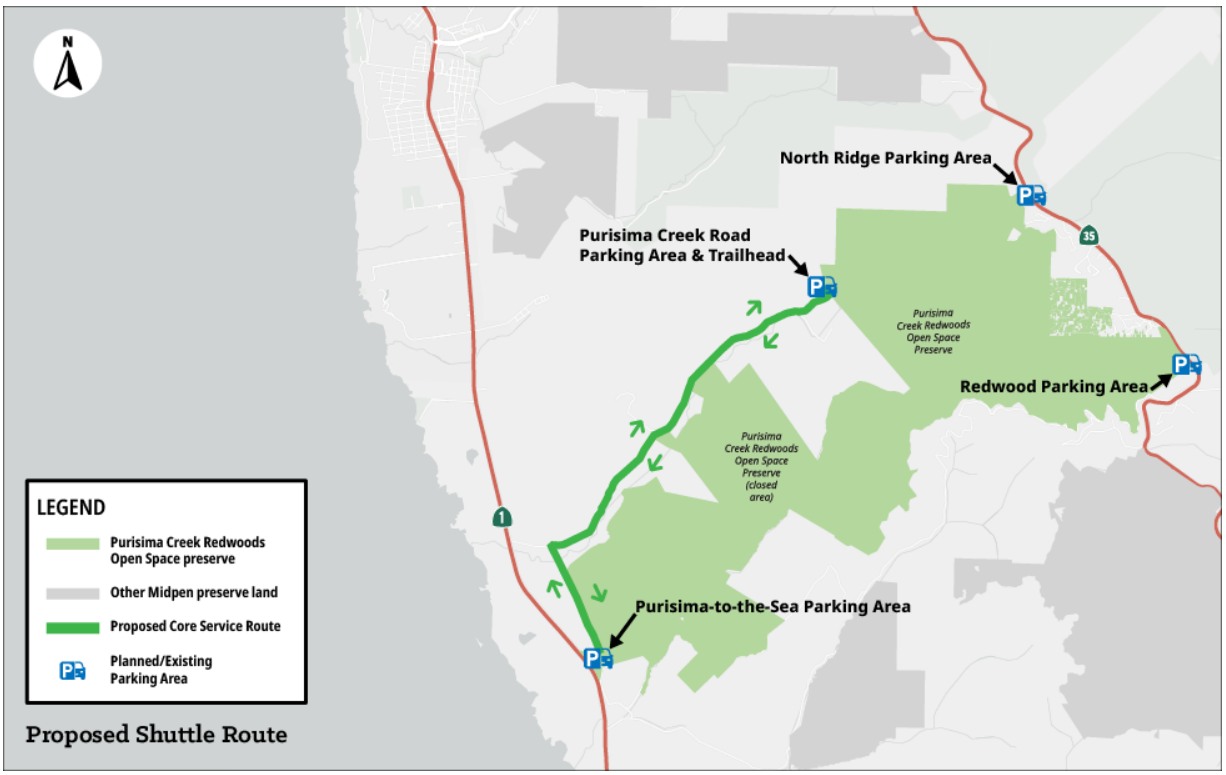

Figure 1. Proposed Route for Transit Shuttle Concept 1 – Core Service

Table 1 lists the proposed stops including potential amenities and implementation considerations.

Table 1. Proposed Amenities and Capital Requirements for Concept 1 – Core Service

Stop	Proposed Amenities	Implementation Considerations
Verde Road parking area	ADA landing pad; bench with shelter; informational signage.	▪ Draft design plans from June 2024 include shuttle stop with amenities described at left. ▪ Turnaround may require travel through parking area and associated congestion in drive aisles. Potential for bus charging infrastructure could be needed.
Purisima Creek Road parking area	ADA landing pad; bench with shelter; informational signage.	▪ Amenities at left would require capital improvements. ▪ Turnaround could require a three-point turn in the existing parking area.

ADA = Americans with Disabilities Act

2.2 Concept 2 – Expanded Service Area

A shuttle serving an expanded service area could enhance the catchment area of those wishing to visit the trails at Purisima Creek and the Preserve more broadly. It could connect to the SamTrans bus system and improve access for those without a car, thus improving equitable access to the Preserve. Because the main goal of the transit shuttle is to reduce congestion, particularly at the trailhead, consideration for an expanded service area would likely be the most feasible with the cooperation of other partners since the costs to provide the service could be considered cost prohibitive.

Potential shuttle destinations include the following:

- **Half Moon Bay.** City approximately five miles north of the Preserve with over 11,000 residents and substantial tourism, including a cluster of local businesses near the intersection of State Route (SR) 1 and SR 92.
- **Hotels or Shopping Centers.** Nearby hotels, shopping centers, or other businesses that may wish to partner with the District. For example, the nearby Ritz-Carlton resort previously operated a recreational shuttle to the Preserve for resort guests.
- **Cowell-Purisima Trailhead and Parking Area.** Coastal trail west of SR 1 whose southern terminus will be connected to the Preserve by the new Purisima-to-the-Sea trail.
- **James Johnston House.** Local historic landmark and community activity center and the site of a future parking improvement and trailhead project.
- **Moon Ridge Apartments.** Affordable housing development, largely for farm workers, that is the closest multifamily housing to the Preserve and one of the last stops for existing SamTrans service near the Preserve.
- **Pescadero.** Unincorporated San Mateo County community approximately ten miles south of the Preserve near SR 1, characterized by agricultural land uses and recreational tourism.
- **SR 35 Destinations.** Destinations on the east side of the Preserve include the North Ridge and Redwood Roadside parking areas, and a future connection to the Bay Area Ridge trail and Bay to Sea trail east of SR 35.

Potential locations for expanded service are shown in Figure 2. The stops should focus on activity hubs, transportation junctions, or tourism destinations to best align with where Preserve visitors may be traveling from.

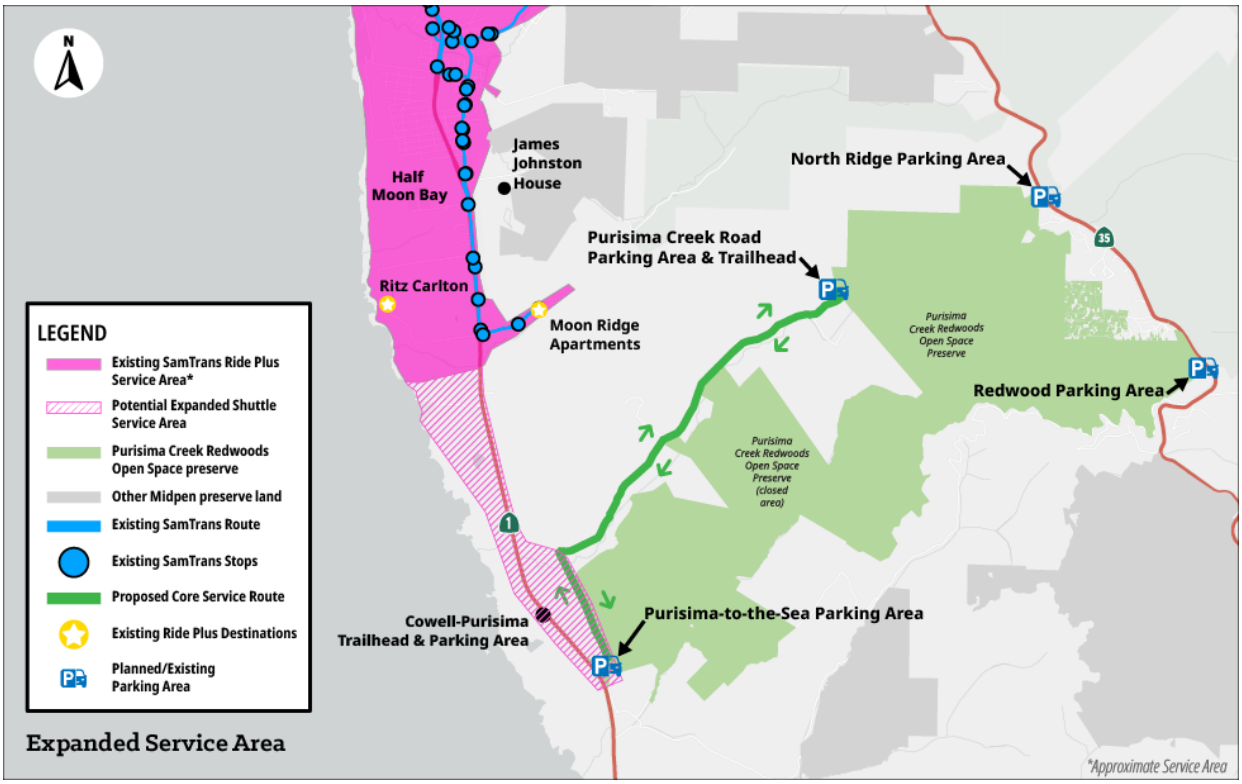

Figure 2. Potential Service Area for Transit Shuttle Concept 2 – Expanded Service

3. Transit Shuttle Recommendations

This section describes a base level of shuttle service that addresses the core project goals. Recommendations for the level of service address how to successfully move people between the Verde Road and Purisima Creek Road parking areas. Costs and service delivery methods associated with the recommendations follow.

This shuttle is intended, at least initially, as a first-last mile connector between two destinations—similar to an airport shuttle—which is different from traditional transit service that connects population centers to major destinations and serves multiple trip purposes. In this setting, the key questions to answer are the following:

- What is the minimum amount of service that can carry visitors at normal and peak times?
- How frequent must service be to be considered useful to visitors?

3.1 Methodology to Set Service Levels

To analyze the appropriate amount of transit service to provide, two key components are the level of demand and the availability of sustainable funding to operate the service. When funding is constrained, service is designed to meet the needs of as many people as possible. Performance metrics such as ridership by time-of-day help set and monitor service levels, and efficiency metrics such as cost per trip help monitor whether the service is meeting the goals with the resources available.

Demand Estimates: The project team evaluated overall annual visitation data for the Preserve, as well as more granular visitation data pulled from automated counters at the Purisima Creek trailhead as a proxy to estimate demand and potential shuttle ridership. Hourly visitation data from 2022 was used due to the completeness of the dataset. Weekend visitation was grouped to include Fridays. The automated counters track people traveling in and out and therefore all people are counted twice, but the specific direction is unknown. The ambiguity in this dataset required the project team to make assumptions about the direction of demand. Counts earlier than 9:00 AM were assumed to be entering the park, counts after 7:00 PM were assumed to be leaving the park, and all counts between these hours were halved to avoid double-counting inbound and outbound trips. The project team evaluated both average levels of demand and maximum (peak) counts by hour, day of week, and month.

Vehicle Capacity: The number of people each vehicle can carry per trip is the core factor in meeting visitor demand. Calculating how quickly one vehicle can be available for a second trip dictates how many people can be moved over the course of an hour or day. Calculations assumed each vehicle can seat between 18 to 25 passengers, based on the physical constraints at the proposed shuttle turnaround location at the Purisima Creek Road parking area.

These initial estimates allow the project team to determine the level of service that one vehicle could provide, and then compare that to the estimated demand to identify any potential gaps in service. The next steps were to determine the factors at play that were likely to increase or decrease demand over time and to make assumptions about peak demand by time of day.

3.2 Minimum Service Levels

The Concept 1 – Core Service described above assumes the 9-mile round trip can be completed in 30 minutes. This includes a short recovery period to account for traffic, passenger loading delays, or a driver break. Table 2 illustrates the range of passengers that could be carried in a day depending on the frequency of service, hours of the day the service operates, and vehicle size. On the low end, one 18-passenger vehicle running for 10 hours per day can accommodate 720 riders per day. On the high end, two 25-passenger vehicles operating for 14 hours per day can carry 2,800 people per day.

Table 2. Maximum Shuttle Capacity, 18- to 25-Passenger Vehicle

Vehicles and Frequency	Seats	Hourly Capacity (Passengers)		Daily Capacity (Passengers)
		One Way	Round Trip	Round Trip
Two vehicles: 15-Minute Service	18	72	144	10-hour day: 1,440 14-hour day: 2,016
	25	100	200	10-hour day: 2,000 14-hour day: 2,800
One vehicle: 30-Minute Service	18	36	72	10-hour day: 720 14-hour day: 1,000
	25	50	100	10-hour day: 1,008 14-hour day: 1,400

3.2.1 Supply Versus Demand: Average Visitors

Figure 3 shows the average visitors to the Purisima Creek trailhead per day, by month in 2022. Figure 4 shows the maximum number of daily visitors by month. Weekends are consistently higher ridership days, and are relatively consistent for 9 months of the year. The 3 months with the highest average daily weekend visitation were February, July, and August. Weekday visitation ranged from a low of 56 in December to a high of 116 in July. Average visitation Friday through Sunday ranged from a low of 77 in December (which was an outlier) to a high of 214 in August.

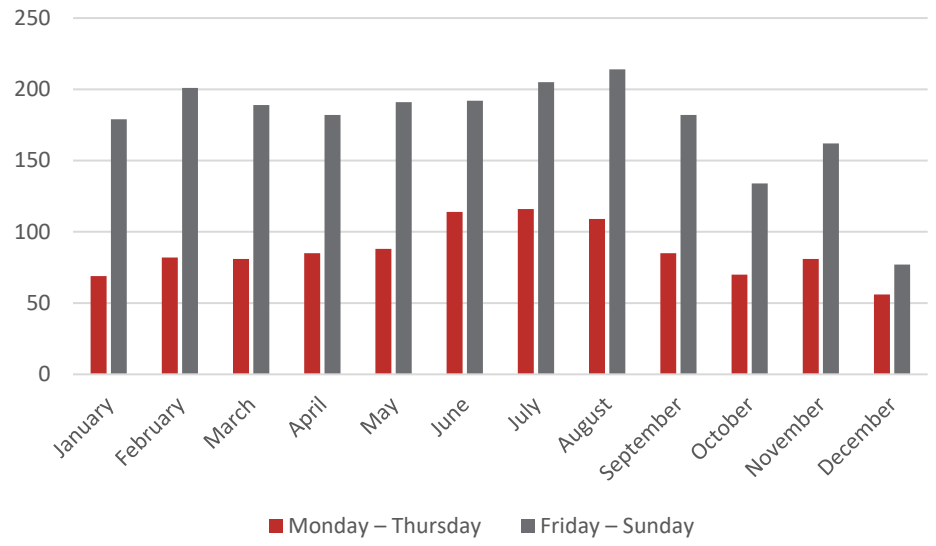

Figure 3. Average Daily Visitors by Month – 2022

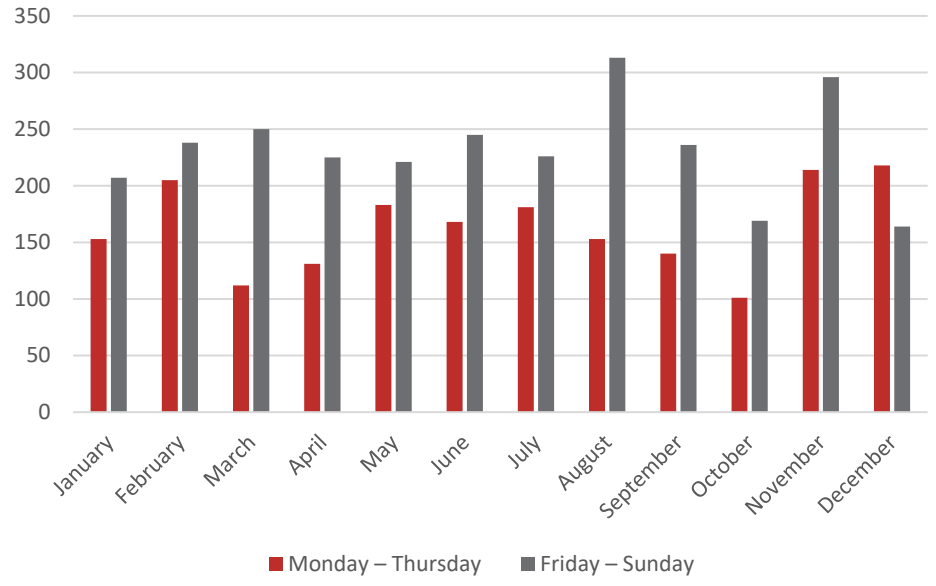

Figure 4. Maximum Daily Visitors by Month – 2022

Table 3 shows hourly visitation rates measured by the Purisima Creek trailhead pedestrian counter. With most hourly counts below 30 and a peak average counts of 34, one 25-passenger vehicle with two trips per hour would be capable of carrying the demand on an average day.

Table 3. Average Visitors by Hour and Month, 2022

Friday	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM
Jan	0	0	4	5	7	7	9	9	15	12	7	8	5	1	0	0	0
Feb	0	0	3	7	6	15	12	9	14	10	10	8	4	1	0	0	0
Mar	0	2	2	7	7	8	11	13	15	10	8	9	8	2	1	0	0
Apr	0	1	2	6	10	15	14	14	12	11	10	7	5	4	5	5	0
May	0	1	2	10	9	10	11	11	10	7	14	9	8	6	5	2	1
Jun	0	2	5	12	5	11	13	19	10	13	12	9	7	3	5	2	1
Jul	1	1	6	8	8	11	13	13	16	13	11	12	7	3	3	2	0
Aug	0	1	4	11	6	13	13	14	11	13	15	8	8	6	5	5	1
Sep	0	0	4	8	8	14	12	12	10	10	8	15	10	4	2	0	0
Oct	0	0	2	11	6	6	11	13	10	11	8	8	6	3	3	0	0
Nov	0	2	3	6	10	16	17	20	15	16	13	11	4	2	0	0	0
Dec	0	0	1	4	3	7	8	7	7	5	7	4	1	0	0	0	0
Saturday	**5:00 AM**	**6:00 AM**	**7:00 AM**	**8:00 AM**	**9:00 AM**	**10:00 AM**	**11:00 AM**	**12:00 PM**	**1:00 PM**	**2:00 PM**	**3:00 PM**	**4:00 PM**	**5:00 PM**	**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**
Jan	1	1	12	18	12	19	21	25	24	22	21	15	8	1	0	0	0
Feb	0	1	17	30	20	20	24	24	24	23	17	15	9	2	0	0	2
Mar	0	3	15	18	11	18	27	27	20	20	22	13	8	4	0	0	0
Apr	0	3	9	24	15	11	20	19	19	26	16	16	11	6	5	0	0
May	0	1	10	21	18	17	19	17	19	21	22	15	10	7	6	1	1
Jun	1	3	12	27	14	23	17	19	18	18	20	16	15	7	5	5	1
Jul	1	1	18	30	15	17	20	27	23	19	24	16	8	7	6	1	0
Aug	1	4	15	30	17	22	22	22	34	30	19	17	13	9	9	0	0
Sep	1	5	18	26	15	19	21	23	22	16	17	14	14	11	6	1	0
Oct	0	2	10	17	11	16	19	17	13	14	14	10	5	4	1	0	0
Nov	1	0	3	16	9	14	19	33	29	26	16	14	7	2	0	0	0
Dec	0	1	5	9	4	9	9	7	8	8	7	3	1	0	0	0	0
Sunday	**5:00 AM**	**6:00 AM**	**7:00 AM**	**8:00 AM**	**9:00 AM**	**10:00 AM**	**11:00 AM**	**12:00 PM**	**1:00 PM**	**2:00 PM**	**3:00 PM**	**4:00 PM**	**5:00 PM**	**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**
Jan	0	1	8	21	15	15	22	24	25	23	20	11	6	0	0	0	0
Feb	0	2	13	25	15	19	27	25	18	23	22	20	7	2	0	0	0
Mar	1	2	19	19	23	24	23	19	23	18	13	14	9	4	1	0	0
Apr	0	3	9	33	15	17	25	19	24	17	19	15	10	6	2	1	0
May	0	2	16	26	14	21	19	21	22	21	19	14	13	8	7	1	0
Jun	1	2	11	20	17	17	19	17	20	21	22	14	10	10	12	5	0
Jul	0	2	14	19	20	19	19	23	27	21	22	14	12	6	6	1	0
Aug	0	5	18	27	14	19	23	22	19	20	15	16	13	5	3	1	1
Sep	1	3	11	26	18	16	23	21	17	15	16	11	9	5	4	1	0
Oct	1	1	6	18	13	16	13	15	12	14	14	11	5	4	1	0	0
Nov	0	1	5	13	10	15	23	21	19	17	16	13	7	1	0	0	0
Dec	0	0	4	5	6	8	15	11	13	16	12	6	1	0	0	0	0

** Counts between 9:00 am and 6:59 pm are halved to avoid double-counting inbound and outbound trips.*

3.2.2 Supply Versus Demand: Maximum Visitors

After evaluating average visitation rates to determine typical demand, the project team also examined maximum observed visitation rates. This enables an understanding of demand on peak days and whether any additional vehicles may be needed for those times.

Table 4 shows the maximum counts by hour, day of week, and month in 2022. Most hourly maximum counts remain in the 10-40 range and could be accommodated with a single vehicle. However, there are a handful of days each year (highlighted in green) where two buses likely would be needed to accommodate visitor demand with minimal waiting time. Providing a second vehicle during these times, likely with more limited hours, would provide sufficient coverage, and these provisions could be incorporated into an agreement with the shuttle operator.

Table 4: 2022 Maximum Visitor Counts by Hour, Day of Week, and Month

Friday	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM
Jan	0	1	9	8	10	10	10.5	15	21	19	11.5	10.5	9	1.5	0	0	0
Feb	0	1	5	12	9	34	15	12.5	18	11.5	11	9.5	5	1.5	1	0	0
Mar	0	2	3	9	10.5	11	14	16.5	22.5	13	12.5	13.5	10.5	2	3	0	0
Apr	0	2	5	8	15	23.5	21.5	18	15	18.5	15	10	7.5	7	11	10	0
May	1	3	3	19	13	12	13	15.5	17.5	11	26.5	14.5	15.5	8.5	9	3	2
Jun	0	3	7	27	7	17	14	38.5	12	18	19	14	11.5	7	8	4	3
Jul	2	3	10	13	10.5	14	18	18	22	18.5	16.5	19	9.5	4	4	6	1
Aug	0	2	5	16	7	15	17	17.5	14.5	14.5	23	13	11	8.5	6	8	2
Sep	0	1	8	12	15	23.5	19.5	16.5	15.5	14	11.5	19.5	18.5	8	4	2	0
Oct	0	0	2	17	9	8.5	13.5	18	11.5	12.5	11.5	11	7.5	4.5	6	0	0
Nov	0	6	7	11	18.5	28.5	30.5	38.5	23	26	25	16.5	7	4.5	0	0	0
Dec	0	0	3	10	7	20.5	16	15	14	10	12	9	2	1.5	2	1	0
Saturday	**5:00 AM**	**6:00 AM**	**7:00 AM**	**8:00 AM**	**9:00 AM**	**10:00 AM**	**11:00 AM**	**12:00 PM**	**1:00 PM**	**2:00 PM**	**3:00 PM**	**4:00 PM**	**5:00 PM**	**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**
Jan	7	3	21	26	21.5	25	29	29.5	30.5	29	27	19	12.5	1	0	0	0
Feb	0	2	22	33	28.5	29.5	30	27	32.5	25.5	21.5	21.5	15.5	5	1	0	6
Mar	0	7	22	24	19.5	24	33.5	40.5	35	25	23.5	18	15.5	5.5	1	0	0
Apr	0	9	14	43	23	15	27	25.5	24	55.5	23	24.5	15.5	8.5	13	1	0
May	0	3	14	33	31.5	23.5	24.5	19.5	22.5	29.5	26.5	16.5	12	9.5	8	2	2
Jun	5	5	18	42	20	33	20	25.5	23	19	25	18.5	34.5	9	8	8	1
Jul	2	3	34	48	25.5	23	26.5	30.5	31	25.5	33.5	24	12.5	9	10	3	0
Aug	2	8	23	50	21	34	30	23.5	74.5	55.5	22.5	18	20	16.5	13	1	0
Sep	3	7	27	30	18	25.5	27	27	31	21	24	19	16.5	19	11	3	0
Oct	1	5	23	28	12.5	23	27.5	30	18	17	21	15.5	12.5	8.5	1	2	0
Nov	2	0	5	32	11	20	23.5	72.5	54.5	61.5	21.5	19	19	3.5	1	0	0
Dec	0	3	13	18	7	24	16	19	17	17.5	14.5	7	2.5	0.5	0	0	0
Sunday	**5:00 AM**	**6:00 AM**	**7:00 AM**	**8:00 AM**	**9:00 AM**	**10:00 AM**	**11:00 AM**	**12:00 PM**	**1:00 PM**	**2:00 PM**	**3:00 PM**	**4:00 PM**	**5:00 PM**	**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**
Jan	0	4	13	34	29	21	26	27.5	32.5	31	25.5	13.5	12	0.5	0	0	0
Feb	0	2	17	33	18.5	28	38.5	32	26.5	33	24	29	8	3.5	1	0	0
Mar	3	5	25	31	54	45	29	23.5	28	21.5	17	20	14	5	4	0	0
Apr	1	4	12	53	19	22.5	32.5	28	33	23	25.5	16	13	8	3	1	0
May	1	4	32	35	20	26	24	26.5	32	24	24	21	17	10	16	4	0
Jun	2	4	17	33	28	22.5	25.5	25.5	27.5	31	27.5	24.5	18.5	21	20	8	0
Jul	1	3	25	29	37	25.5	25.5	28	33.5	24.5	31	18	15	8.5	7	2	2
Aug	1	8	30	35	18	24.5	26.5	29.5	25	25.5	18.5	17.5	19.5	6.5	6	3	1
Sep	2	4	18	49	29.5	22.5	30.5	23.5	28.5	18.5	22.5	14	15	14.5	9	2	0
Oct	4	3	11	22	26.5	23.5	16.5	24	16.5	23	21	20	8.5	6	6	0	0
Nov	0	2	7	20	14.5	20	29	27.5	22	19.5	22	18	15.5	4.5	0	0	0
Dec	0	0	8	6	8.5	10	36.5	22	24	31	17	9	2.5	0	0	0	0

** Counts between 9:00 am and 6:59 pm are halved to avoid double-counting inbound and outbound trips.*

3.3 Estimating Ridership

Projecting ridership for a service that does not exist, where comparable routes are not nearby, where more disaggregated visitor data are unavailable, and where there may be latent demand due to parking constraints requires a bit of art and iteration. Based on 2022 visitation patterns, the capacity of one shuttle vehicle running every 30 minutes would accommodate Preserve visitors most days of the year.

However, 30 minutes is not generally considered a high level of service and people may seek alternative recreational opportunities. In a previous Preserve visitor survey, 75% of respondents reported being willing to wait up to 10 minutes for a shuttle; the majority of these (66%) were only willing to wait up to 20 minutes. Transit opinion surveys are known for having positive views of transit, but they do not often translate into similar usage patterns because there are so many variables that make transit service useful to riders. In a park setting, biases among survey respondents, as well as the frequency with which people visit the park can skew results. As a result, surveys can be important in understanding park support but are not often used as predictors of ridership. A service frequency of 30 minutes, which results in an expected wait time of 15 minutes for each trip, is unlikely to provide a strongly positive experience for many visitors.

To analyze how introducing a shuttle service between the Verde Road and Purisima Creek Road parking areas could impact visitation to the Preserve and shuttle demand, the following are key factors to consider:

- Service Characteristics
  - → Level of service: Can people travel where they want, when they want?
  - → Preserve access: What travel mode options are available to get to the Preserve? What trails are accessible to people based on the mode they have available to them?
  - → Ease of use: How easy is it for someone to take a trip? This includes the journey to the bus and from the bus to the final destination.
  - → Directness: How much time passes between parking and shuttle drop-off at the trailhead and between the trailhead and the parking lot?
  - → Fares and payment options: Is there a fare to ride? How do people pay if there is a fare?
- Population Factors
  - → Population: How close are the shuttle stops to major population centers?
  - → Catchment area: How big is the draw to the destination?
  - → Demand to Purisima Creek trailhead: Among the population in the catchment area, how many people would be interested in visiting this location? How often do people visit?

Table 5 describes how visitation might be expected to change based on the service characteristics and population factors listed above.

Table 5. Shuttle Design Considerations that Impact Ridership

		Positive Effect on Ridership	Negative Effect on Ridership
Service Characteristics	Level of service	More service is more appealing as less trip planning is necessary to complete the trip.	Infrequent service requires people to plan their trip and when to turn around on a trail to ensure shorter wait times.
	Ease of use	The easier it is to get on the shuttle and find the bus after visiting the Preserve, the more confident people will feel to try it and use it again.	The more people are required to plan their trip in advance, the less appealing the visit may become. Variation in schedules and levels of service can be confusing for people who do not visit often.
	Directness	A route with limited stops would better be able to travel at speeds comparable to a car. A stop near the trailhead and one at the parking area gets people where they are going the fastest.	A route with many stops would slow service down and require longer time on the bus.
	Fares and payment options	Free rides would encourage ridership.	Shuttle fares may incentivize people to use other trailheads. Complicated or limited payment options—such as book in advance only or exact change only—can reduce ease of use and disincentivize riders.
Population Factors	Population	More people who could access the shuttle would increase the number of people who might use the shuttle to visit the Preserve.	The more rural areas directly adjacent to the Preserve have fewer people and lower population densities compared to more urban areas.
	Catchment area	People visiting parks with regional or national draw due to factors at the destination such as views, type of terrain, trail characteristics, or amenities that fit with the experience visitors are looking for are more likely to plan the visit ahead of time and know to expect off-site parking with a dedicated shuttle to access the destination.	Visitors to parks that draw primarily from the local population may be more likely to consider multiple trailheads and parking locations and less likely to plan for the visit. One negative experience could negatively impact potential return visitation.
	Demand	Simple and straightforward information to help people plan and execute visits would increase the likelihood of repeat visits. A shuttle that serves destinations that appeal to more people would have higher demand.	The more specialized a service is, the less demand there would be for the service. The trails, terrain, and amenities at Purisima Creek will appeal to certain groups of people in the population and catchment area and not others. Shuttle service that requires people to access the park by first arriving at a parking lot may preclude those who do not drive.

3.4 Proposed Service

Based on the existing visitation patterns, hours of daylight throughout the year, and the service characteristics that influence park visitation and potential shuttle ridership, eight service options were considered that ranged from minimal service requiring one bus operating at 30-minute headways year-round, with limited days of service in the winter, up through 15-minute headways year-round. Cost estimates are detailed in Section 3.6, Estimated Costs.

Service Scenario 1 – Emphasis on Meeting Visitor Demand

- **Spring, Summer, and Fall Months (March–October).** 30-minute service, 7 days a week between 8:00 AM and 8:00 PM, with an overlay of 30-minute service to create 15-minute service on Saturdays and Sundays between 9:00 AM and 4:00 PM.
- **Winter Months (November–February).** 30-minute service Saturday – Sunday between the hours of 8:00 AM to 5:00 PM.

Scenario 1 represents the lowest level of service needed to be responsive to weekend visitor patterns. However, a higher level of service would improve the visitor experience by reducing waiting time and was recommended for consideration by the Planning and Natural Resources Committee:

Service Scenario 2 – Emphasis on Visitor Experience

- **Spring and Fall Months (March–April, September–October).** 15-minute service, 7 days a week between 8:00 AM and 5:00 PM, and 30-minute service between 7:00 AM and 8:00 AM, and between 5:00 PM and 8:00 PM.
- **Summer Months (May–August).** 15-minute service, 7 days a week between 8:00 AM and 5:00 PM, and 30-minute service between 6:30 AM and 8:00 AM, and between 5:00 PM and 8:30 PM.
- **Winter Months (November–February).** 30-minute service Saturday – Sunday between 8:00 AM and 5:00 PM.

The higher level of service envisioned in Scenario 2 carries substantially higher cost as detailed in Section 3.6, Estimated Costs. However, as emphasized by the Planning and Natural Resources Committee, a program goal should be to provide as much service as funding allows to make the shuttle experience positive and encourage visitation. Service Scenario 2 provides that higher level of service and is expected to meet all visitor needs throughout the year, even at peak times.

Major factors in selecting appropriate level of shuttle service includes the following considerations:

Frequency of Service. The frequency of service is the most important component of shuttle ridership for visitors. It impacts ease of use, stress, and uncertainty. The more frequent a service, the less a Preserve visitor needs to pre-plan their trip or understand how to use the shuttle. Service every 30 minutes is generally considered a low level of service and would require visitors to time their trips to minimize wait time in the parking area and again at the trail waiting to return to their cars. Operating every 15 minutes would be advantageous for visitors, but based on existing visitation it would reduce the performance metrics of riders per trip or hour and significantly increase costs. Because the goal of building a parking lot on Verde Road and implementing shuttle service is to reduce congestion and parking constraints, the performance metric should be viewed as less important than that of improving access to the trailhead. Funding limitations and costs to provide a high level of service would be the main reason why service should run at a base level of 30 minutes.

Days of Operation. A higher level of service between March and October and weekend-only service between November and February puts service on the road when traffic is most congested and demand is highest while being mindful of costs.

Span of Service. The Preserve is open from sunrise to sunset, the times of which change drastically depending on the season. The year can be divided into three seasons based on daylight hours. Calculations for hours and costs included the following parameters:

- **Summer Months (May–August).** 14 hours of daylight
- **Spring/Fall Months (March, April, September, and October).** 12 hours of daylight
- **Winter Months (November–February).** 9 hours of daylight

Three service changes per year are common and can be done with minimum disruption to the overall schedule or confusion to the public because schedules can be published in a way that clearly shows when the earliest and latest trips run.

Fares. Consistent with District policy and the recommendation of the Planning and Natural Resources Committee, fares are not recommended for this shuttle service. If an agency such as SamTrans operates the service, the general fare policy of that agency would govern, though fares could be paid directly by the District or another funding source to make rides free to users.

3.5 Implementation Considerations and Recommendations

This section explores further details and recommendations for service delivery options including staffing, vehicles, vehicle maintenance, parking policies and enforcement, funding and partnerships, and marketing and outreach.

3.5.1 Service Delivery Options

There are three primary service operators with various options to connect people between the Verde Road and Purisima Creek Road parking areas.

Private Operator. Contracting with a private operator could provide a dedicated service, and it could handle all staffing, maintenance, and administrative requirements. Private contracting can scale as service demand or operating conditions change. This option would be the quickest to implement effectively. Most private operators expect a contract with a term of 3 years, and most contracts are written to allow an extension of up to 2 additional years.

Directly Operate In-House. With the lease or purchase of shuttle vehicles, District staff could operate the shuttle service. When considering immediate operating costs such as vehicles, fuel, and driver time, this may have a lower cost than a contracted operator. However, capturing all costs including ongoing maintenance and vehicle obligations, plus District staff time required to manage operations and oversight (see Section 3.5.2) – all of which would be wrapped into the overall rate of a contracted operator – the overall savings from direct District operation are expected to be negligible. Direct operation would create ongoing administrative obligations; introduce the risk of cost overruns that otherwise would be borne by a contractor; and require the District to build institutional expertise as a transportation service provider, which may distract from the District's core mission and could be delivered more efficiently by a specialized operator.

Public Agency (SamTrans) as the Operator. The public transit agency in San Mateo County–San Mateo County Transit District (SamTrans)–directly operates and contracts out bus service. A transit-to-trails concept may be viable, but because one does not exist today, it would take time to create

and implement. Costs per revenue hour may be slightly higher than a private operator, but other efficiencies may be realized that offset those costs. There are three options for a partnership with SamTrans:

- Fixed Route Service. While local transit provider SamTrans can provide economies of scale with its current bus operations, the agency is not likely to provide the type of focused, point-to-point service envisioned in Concept 1. New fixed routes have typically been identified in short- and long-range planning efforts that include extensive outreach; the identified routes are then phased in as funding becomes available or as warranted by demand. All existing fixed routes are connected in some way to the local or regional transit network, which would not be the case for Concept 1 without other substantial network changes that are not part of the agency's current needs or goals. In addition, a new fixed route serving only the Preserve also could trigger equity concerns under Title VI. Furthermore, routes that do not meet performance goals may have funds reallocated where need is greater, making the reliability of a long-term service unpredictable.
- Ride Plus On-Demand Service. The existing SamTrans on-demand service zone could be expanded to include the Preserve. This model could be best suited for weekday and off-season trips when demand is low. Because cell service is not reliable in the Preserve, visitors would need to book their return trip in advance, which is not ideal. SamTrans could extend on-demand service to the Verde Road parking area with no additional cost to the District, but riders would need to transfer to another shuttle to get to the trailhead.
- Dedicated Shuttle. A longer-term option suggested by SamTrans staff would be to access the shuttle contract to develop a dedicated shuttle. This new type of service would require a memorandum of understanding and a change to the current shuttle program eligibility. More research and collaboration with SamTrans would be needed to understand whether this is a viable option. Overall, there are efficiencies that could be realized with this model, but the potential cost savings are unknown without more detail. Under current policy, this shuttle would not be eligible for San Mateo County Transportation Authority or City/County Association of Governments of San Mateo County grants and would likely need to be fully funded unless other grants become available.

3.5.1.1 Recommendation

A private operator is likely the most efficient way to provide this shuttle service, and it would offer flexibility as the service changes to meet demand or funding availability. The benefit of contracting this type of service is that the Contractor would handle vehicle storage, staffing, driver training and schedules, fleet management and maintenance, and because their core competency is providing this type of service, they would have policies and procedures in place for unforeseen circumstances that arise. They would also be the most likely to be able to find economies of scale by having other contracts that allow them to spread costs across multiple projects.

Over the next year, conversations with SamTrans should continue to understand the conditions to make a dedicated shuttle viable in its program. The District should also continue to engage partners involved in the Midcoastside Transportation Demand Management (TDM) Plan that is sponsored by San Mateo County (in partnership with Half Moon Bay) to ensure planning efforts that involve TDM measures or transit changes keep travel demand to recreational facilities in the conversation.

3.5.2 Staffing

There is a base level of staffing needed regardless of the size of a shuttle program. For a small service such as Concept 1, the following staffing positions typically would be provided by a private operator, or would need to be fulfilled by District staff if operated in-house:

- A general manager or project manager who may handle the contracts.
- One administrative staff for invoicing and contract support.
- A pool of two to five drivers (typically two on duty at any given time).
- A pool of two to four dispatchers (typically one on duty at any given time).

Economies of scale are realized by companies that can share staff among multiple small contracts. A contractor of a very small service often does not use full-time employees for non-driver positions. This means staff typically manage multiple contracts at the same time to keep costs lower. The staffing levels above do not account for a role that could track ridership, recommend service adjustments, or track and report on operator performance, which are services District staff may be able to provide on a limited basis.

Drivers. The cost of hiring and training operators would be included in contractor cost proposals. Private companies that already have procedures in place, which ensures that the full financial burden of hiring and training operators would not fall on the District. The base level of service identified assumes one bus is out on the road Monday through Thursday. Drivers need bathroom and lunch breaks. To avoid service disruptions, slack can be built into the schedule for bathroom breaks but not for lunch breaks. While individual contracts vary based on labor negotiations, transit agencies and contracted operators typically have minimum pay blocks of 4 hours, and drivers working longer than 5 hours are often required to take a 15- to 30-minute meal break.

The distance from the yard (where vehicles are stored) to the shuttle route impacts how long drivers are behind the wheel and how many drivers are needed each day. Drivers would be paid overtime for more than 8 hours of work. With service recommended for 10 to 14 hours per day, two operators would be required to cover the span of service, with another two operators required when 15-minute service is operated. With seven-day-a-week service, there are often two additional staff—part time or full-time—so that drivers work 3, 4, or 5 days a week. When companies bid on this work, it is useful to be open to their suggestions on how to maximize their drivers' staff time. In some cases, they may offer more 4-hour work blocks so that meal breaks are not required. This requires more drivers on staff but may be more efficient for the operator.

In California, a commercial motor vehicle license is required for any driver carrying more than 10 passengers, which includes the driver, if the vehicle is used for transporting people for compensation, profit, or used by any nonprofit organization or group. Any driver carrying more than 15 people including the driver needs a commercial driver's license for any reason. A private company would ensure all drivers are adequately trained and licensed.

When contracting, it is important to check driver pay rates and escalation. Companies whose drivers are not in labor unions are often able to pay lower wages that reduce the overall cost of the contract but may come at the cost of higher driver turnover.

Dispatchers. Similarly, one dispatcher would be on duty at a time, but seven-day-a-week service often corresponds with two dispatchers scheduled per day. This role may require up to four people working part-time shifts, which could be distributed as two people working four days per week and two working three days per week.

Maintenance Staff. Maintenance staff needs should be quite low for this contract, and it is therefore recommended to have the private company also manage maintenance needs. When a contractor is not in charge of maintenance, it can cause a delay in a vehicle getting back on the road if it has been pulled out of service.

3.5.2.1 Recommendation

A private contractor can suggest key staff roles and estimate staff hours. They would also be best equipped to handle the intricacies of driver staffing. District staff would need to manage the contract and monitor performance. Customer service calls should go to the contractor first, but there should be a mechanism in place to ensure District staff are aware of the issues and how they are to be resolved.

3.5.3 Vehicles

Table 6 provides three examples of vehicles that could be used for this service. A number of considerations should be made when choosing a shuttle vehicle; these are outlined below.

Turnaround Requirements. The most efficient implementation of Concept 1 requires shuttles to turn around in the Purisima Creek Road parking area. Initial field measurements indicate the lot can accommodate at least a 24-foot vehicle—any of the examples listed in Table 6—using a three-point turn in the trailhead/restroom area. However, additional field measurements would be necessary to confirm maximum allowable dimensions per vehicle turn templates.

Vehicle Quantity. Assuming each vehicle can make a round trip in 30 minutes in Concept 1, one bus would be needed. However, if drivers stay with their vehicles, which is likely the case for a service like this, up to two buses per day would be needed to cover the hours of service during the day. When service is increased to 15-minute frequencies, four buses would be needed if drivers stay with their buses.

The significance of a driver staying with their bus is that in more urban areas, or where a system has many other routes nearby, a driver may be relieved for breaks or shifts and another driver begins service on the same vehicle. Staff relief at the Verde Road parking area would require another staff person driving there to pick up the driver on break or done with their shift, which is not efficient scheduling, and so vehicle road time is likely to coincide with driver shifts. In some cases, an additional vehicle may be deployed to operate a limited number of trips to give the operator a meal break meaning that for some set number of hours, during 30-minute service two buses could be operating, and during 15-minute service three buses could be operating.

For Concept 2 – Expanded Service Area, additional vehicle needs can be calculated based on distance, headways, and service span. Language can be added to a request for proposals and negotiated during contracting to be clear about what service expansion looks like and would cost. Specific examples of additional routes could be used as optional add-ons.

Spare Vehicles. In both service concepts, at least one spare vehicle should be available to accommodate maintenance needs or fill in during unexpected situations. This is another case where a private operator with multiple contracts may be able to achieve economies of scale by not having a spare vehicle that does not need to be purchased or leased as part of this specific contract.

Bicycles. Vehicles should have bicycle racks. Most vehicles would be able to handle between two and three bicycles per trip. Bicycle racks that can fit the wider tires and heavier weight of electric vehicles should be assumed in accordance with the District's Other Power-Driven Mobility Devices policy.

Wheelchairs. During contracting, it should be scoped for how many wheelchair or mobility device positions should be made available. Most vehicles should be able to carry two wheelchairs per trip as indicated in Table 6.

Bus Yard or Vehicle Storage. For contracted operators, the distance between the route and the nearest available bus yard is a major consideration when bidding on the work. Transit service contracts are commonly written to only pay for what is known as revenue service and not the time spent traveling between the yard and the route. As such, the distance a yard is from service directly impacts the bottom line for the company bidding on the work. This can result in low interest from potential operators or the inclusion of higher overhead costs into the ultimate contract.

Table 6. Key Characteristics of Typical Transit Shuttle Vehicles

Vehicle	Typical Capacity	Typical Length
Ford Transit E-350 	Up to 15 passengers, or up to 4 wheelchair passengers.	18–22 feet
Ford E-450 	Up to 25 passengers.	22–24 feet
3500 El Dorado National Minibus 	Up to 16 passengers, plus 2 wheelchair passengers.	24 feet

Zero-Emission Considerations. As California moves to zero-emission vehicles, electric vehicles are replacing diesel and hybrid-diesel fleets. The number of vehicles would increase to account for charging times. There are fewer smaller electric transit vehicles on the market, but the options are growing. The distance vehicles can travel between charges varies based on weather, age of the battery, and operating conditions. The ranges between charges advertised by vendors are often more than what operators report. Assuming an operator can make 14 round trips on a 7-hour shift, the bus will have traveled 126 miles, which does not include the distance to and from the bus yard; this exceeds the recommended distance between charges, which is usually closer to 100 miles in average conditions. More research should be conducted to analyze how much charging time between trips could recharge the battery enough to maintain 7-hour shifts.

If partial charging between trips is possible, but the time needed causes the next trip on each vehicle to be longer than every 30 minutes, an additional bus would be required. Partial charging between trips may also allow for a better than 30-minute cycle time. More analysis is needed here.

The California Air Resources Board requires vehicles with a gross weight rating of 10,000 or more (which includes most transit shuttles) to shut off vehicles whenever the expected idling time will exceed five minutes. If the Preserve prefers a more stringent idling policy, that also can be written into the contract.

Vehicle Branding. This can range from minimal signage on the side or front of a vehicle to full vehicle wraps. Figure 5 shows examples of vehicle branding for several recreation-focused shuttle services. Specific branding needs for the Preserve could be included in an agreement with a private operator.

Figure 5. Sample Vehicle Branding Schemes *(Clockwise from top left: King County Metro Trailhead Direct; Columbia Area Transit Columbia Gorge Express [2 photos]; Marin Transit Muir Woods Shuttle)*

Real-Time or Static Vehicle Tracking. Vehicle location tracking apps can let riders use their mobile phones to see how close a vehicle is in real time. To implement this, hardware called Automatic Vehicle Location that gives accurate global positioning system (GPS)-based location information would be installed on each vehicle. This hardware is common and adaptable to all vehicles that would be considered for this type of service. Landscapes with canyons can make the accuracy of GPS data less reliable in some areas, and it would be useful to perform tests to see if they work at the trailhead.

Publishing real-time vehicle location data for riders also would require staff time to download and publish General Transit Feed Specification (GTFS) data. This data is open-source and commonly used by transit agencies and third-party mobile apps. Alternatively, "static" GTFS data allows transit schedule information to be published but does not provide real-time tracking. There is still value to the schedule-only information, as it provides information about when the service is operating by day of the week and time of day.

Private operators may already have procedures in place to work with this data or have vehicles that are equipped with Automatic Vehicle Location devices. Expectations about how to handle ridership and vehicle-tracking data would be made clear in the contract.

3.5.3.1 Recommendation

In the initial implementation, the request for proposals for a private operator could be agnostic of fuel type and let the vendors offer what they have locally and can operate effectively and efficiently. There are excess vehicles on the peninsula due to technology companies downsizing their employee bussing programs since the pandemic. Plans for conversion to zero- or low-emission vehicles could be researched and vetted as a future program goal that would align with the District's 2018 Climate Action Plan and 2024 Fleet Electrification Transition Plan. Private operators may need to comply with zero-emission fleet requirements as soon as 2027 per regulations by the California Air Resources Board. Any such requirement would be specified in the District's contract solicitation language.

For bus storage, the request for proposals should be flexible regarding available properties, as it may make or break a company bidding on the work.

3.5.4 Vehicle Maintenance

Maintenance can be separately contracted or attached to the service contract. Separating the two is not usually in the favor of the operator who cannot control how soon a vehicle is repaired and available for service again. For small contracts, which includes the level service envisioned here, operators often contract out the maintenance, but they would still be responsible for having vehicles available for service. This is often more economical for the operator than having maintenance staff on payroll and needing to have a yard with maintenance bays, which would limit options for storage yards.

3.5.4.1 Recommendation

Keep the vehicle maintenance contract with the service contract. This also allows a company to swap in a vehicle as a replacement to keep service running, if needed. For small contracts, a private provider can contract out maintenance or have staff in-house.

3.5.5 Parking Policies and Enforcement

It is recommended that the Purisima Creek Road parking area is closed to non-shuttle vehicles while the shuttle is in operation, which is critical to shuttle operations. The direct bi-directional route can only operate if it turns around at the Purisima Road parking area. If cars parked in the lot prevent a bus from turning around, the shuttle would have to continue to Higgins Canyon Road along a 14-mile loop to return to the Verde Road parking area. This would negatively impact the schedule, and delays would be compounded over the day. Additionally, Higgins Canyon Road is at risk for washouts during rainy seasons, which could shut the service down completely if a bus cannot turn around.

Because a shuttle is expensive to operate, early implementation calls for weekend-only service in the off-peak season. If the parking lot is open Monday through Thursday for 6 months of the year, enforcement and signage to help people understand the hours would be crucial.

When designing the turnaround lot at Purisima Creek, parking stalls for rangers or other officials would still be needed. This may be possible past the vehicle gate.

The least capital-intensive option for closing the parking area during shuttle operation hours is using clear signage and enforcement. Prevention of parking infractions is preferred over punitive outcomes that reduce the likelihood of repeat visitation. Helping people do the right thing may involve in-person monitoring for the first few months of opening and particularly when service levels are going to change such as from peak season to the off-season. Physical barriers could also be considered, although these would need to be passable by shuttle vehicles and District staff.

Physical barriers to prevent access at night should be considered for weekends, in particular. An agreement giving the private operator access to open the gate on the first trip and lock the gates on the last trip of the evening should be expected.

Policies and procedures would need to be developed to let the transit operator know who to contact if they cannot pass on the road or turn around at the Purisima Creek Road parking area.

3.5.5.1 Recommendation

Staff should develop clear messaging around when the Purisima Creek Road parking area is available and when to park at the Verde Road parking area. Policies and procedures should be developed for what to do in case a vehicle cannot drive the route as scheduled.

3.5.6 Funding and Partnerships

Partnerships with entities such as San Mateo County, SamTrans, the City of Half Moon Bay, City/County Association of Governments of San Mateo County, and local businesses can help the District to leverage its existing funds such as the General Fund and Measure AA. These partnerships can also be used to secure local, regional, state, or nationally competitive grants.

The Route to Parks grant program is a potential grant funding opportunity, providing funding to local organizations in overcoming transportation challenges to recreational and environmental experiences.

In-kind funding by partners may also include the provision of services or capital. Examples of in-kind partnerships could include:

- Working with local private or governmental partners to negotiate storage at existing bus yards.
- Collaborating with other governmental partners on vehicle purchases.
- Locking in fuel prices to ensure favorable rates.
- Partnering with SamTrans to explore potential operating contract opportunities.
- Coordinating with the City of Half Moon Bay during their current planning efforts to take advantage of any possible synergies.
- Partnering with the County of San Mateo and the City/County Association of Governments of San Mateo County to identify future grant opportunities.

- Participating in local community events and other public outreach opportunities to raise awareness of the shuttle and the Preserve.

3.5.6.1 Recommendation

Staff should continue to develop relationships with local and regional agencies, potential local business partners, and agencies outside of the region that operate similar park shuttles.

3.5.7 Marketing and Outreach

Effective marketing for a new shuttle service requires using multiple channels to reach diverse audiences, especially for a new service where education is critical to user acceptance. The initial marketing campaign could begin up to one year prior to shuttle operations, with a heavy investment during that pre-launch year and the first full year of operation. Once those two years are complete, the marking budget could be reduced gradually as the service becomes more familiar to visitors.

The elements of a typical marketing campaign include vehicle branding (discussed above), digital and social media advertising, print advertising, local mailers, community events, branded merchandise, and signage. Potential costs are outlined in Section 3.6, Estimated Costs.

3.6 Estimated Costs

Operating costs to run the shuttle are separated from the capital costs the District would incur related to the shuttle service. Some of the capital costs can be wrapped into other construction packages, such as signs, shelters, or paving. Labor costs incurred by the District to support the shuttle program are not included.

3.6.1 District Capital Costs

Capital costs the District can expect are shown in Table 7 and are broken out by the number of each item and when the District could expect to spend the money. Gaps between each year would not impact the overall project, in case it extends past 3 years. Cost range assumptions are based on bids from cost estimates and bid results for projects in the Bay Area.

Capital improvements include the following:

- **Design, technical studies, and permitting** for all site improvements described below.
- **Bus stop improvements** such as a paved landing pad at the bus stop, bench, shelter, and attached signage to indicate where people should wait for the bus.
- **Additional signage** at the Purisima Creek Road parking area (included in estimated costs below) and Verde Road parking area (costs accounted for separately as part of Verde Road parking area project).
- **Automatic gate** at the Purisima Creek Road parking area to control access for non-shuttle vehicles.

Table 7. Capital Costs

Cost Element	Base Cost Range by Year of Expenditure*	Year of Expenditure	Total Cost Range by Year of Expenditure*
Design (Year 1)	$23,000 - $34,500	Year 1	$46,000 - $69,000
Technical Studies (Year 1)	$23,000 - $34,500		
Design (Year 2)	$23,700 - $35,500	Year 2	$77,700 - $130,200
Technical Studies (Year 2)	$23,700 - $35,500		
Permitting (Year 2)	$29,600 - $59,200		
Materials & Construction (Year 3):		Year 3	$159,200 - $216,600
Bus Stop ADA* Landing Pad	$6,100 - $18,300		
Bus Stop Shelter, Bench & Attached Signs	$54,900 - $73,200		
Additional Signage	$600 - $3,100		
Automatic Gate	$97,600 - $122,000		
Total			**$282,200 - $415,800**

* All activities in Years 2-3 escalated by 3% per year to account for inflation. ADA = Americans with Disabilities Act.

3.6.2 Shuttle Operating Costs

The cost of a shuttle pilot can vary significantly depending on the level of service provided. The range of estimated costs for the two service scenarios presented in Section 3.4, Proposed Service are shown in Table 8 and Table 9 and summarized below:

- **Service Scenario 1 – Meeting Visitor Demand.** Estimated annual operating cost of $572,550 to $763,400
- **Service Scenario 2 – Emphasizing Visitor Experience.** Estimated annual operating cost of $866,700 to $1,155,600 (51% increase over Scenario 1)

As discussed above and emphasized by the Planning and Natural Resources Committee, a program goal should be to provide as much service as funding allows to make the shuttle experience positive and encourage visitation. Service Scenario 2 provides that higher level of service and is expected to meet all visitor needs throughout the year, even at the peak times identified in Section 3.2, Minimum Service Levels.

If the District opts for the lower costs of Service Scenario 1, it could work with the shuttle operator to program additional service at selected peak times when the highest visitation rates are expected; this cost could be built into the contract terms and would fall between the estimated costs of the two scenarios above. However, this generally is not recommended as it effectively would create more fluctuations in service throughout the year, which can confuse users and create an inconsistent experience. Generally it would be better to program the service envisioned in Service Scenario 2, which is already tailored to accommodate all visitor pattens while providing a high-quality user experience that minimizes waiting time.

Initial baseline operating costs included the assumption that the shuttle would operate closely to the hours the Preserve is open. However, hourly visitor demand data indicates that most visitors are there between the hours of 7:00 AM and 7:00 PM, and even earlier during winter months when it is dark earlier, and cost assumptions have been updated to better reflect visitor travel patterns.

Table 8. Projected Annual Operating Costs for Service Scenario 1 – Visitor Demand

Season	Hours of Service Per Day	Vehicle	Days of Operation per Week	Number of Days per Year	$150/Hour	$200/Hour
Winter	9	Bus #1	Sat - Sun	43	$58,050	$77,400
Spring/Fall	12	Bus #1	All days	122	$219,600	$292,800
	7	Bus #2	Sat – Sun	35	$36,750	$49,000
Summer	12	Bus #1	All days	123	$221,400	$295,200
	7	Bus #2	Sat – Sun	35	$36,750	$49,000
Total					**$572,550**	**$763,400**

Table 9. Projected Annual Operating Costs for Service Scenario 2 – Visitor Experience

Season	Hours of Service Per Day	Vehicle	Days of Operation per Week	Number of Days per Year	$150/Hour	$200/Hour
Winter	9	Bus #1	Sat - Sun	43	$58,050	$77,400
Spring/Fall	12	Bus #1	All days	122	$219,600	$292,800
	9	Bus #2			$164,700	$219,600
Summer	14	Bus #1	All days	123	$258,300	$344,400
	9	Bus #2			$166,050	$221,400
Total					**$866,700**	**$1,155,600**

The primary factors that affect the estimated shuttle operating costs are discussed below.

Labor Costs. The main operating expense in transit delivery is the cost of labor. The project team used a range of $150 to $200 per hour which is a realistic estimate of current operating costs. Negotiating a rate closer to or even slightly under $150 per hour is possible, but this higher range recognizes that the Verde Road parking area may open in 2027, and operator wages have grown nationwide since the COVID-19 pandemic. Operators are also generally paid higher wages in the Bay Area compared to other cities in the United States due to competition among tech sector transportation shuttle jobs. Hourly costs include contractor fees, profit, labor including benefits attributable to payroll, overhead, utilities, and other administrative expenses.

Startup Costs. Start-up costs can range from $15,000 to over $75,000. These expenditures would occur in the years leading up to the first year of shuttle operations. The District is encouraged to work with private contractors to understand the time implications of contract requirements, such as the time required for certain vehicle procurements. Implementing a new shuttle program requires significant work by the contractor before service begins. Start-up tasks include confirming policies and procedures with the District, hiring drivers, training drivers, procuring vehicles for service and branding them, implementing software or other technology used in vehicles, confirming vehicle storage locations, and securing contracts for vehicle maintenance, washing, and fueling.

Technology-related startup costs are another fixed cost that can vary significantly depending on needs. Costs to boost cell signal near the Purisima Creek Trailhead so drivers can communicate with

dispatchers can be included in the cost of vehicles since hardware is involved or as its own line item. Software needed to run a service of this size is minimal, but if the service grows to require advance reservations, or to track riders electronically through automatic passenger counters, this would be added to the operating cost of the service. The pilot can start with a basic hardware solution for driver-to-dispatcher communication to keep costs low and assume ridership is tracked manually by the driver with clickers or devices already preinstalled on the bus. These costs are included in the estimate below.

Vehicle Costs. Three vehicles are assumed for the proposed levels of service. Two vehicles would be needed for regular service, and one spare vehicle should be available. For an order-of-magnitude cost estimate, a range of $50,000 to $500,000 per vehicle was used, representing small used vehicles to larger standard vehicles that would likely be used for this type of service.

Contractors often lease vehicles for a seven-year term, and costs are passed through for the years of the contract. They or the District may also purchase new or used vehicles outright. The variation in cost per vehicle can be large, and it is recommended the District work with the contractor to find a solution that works within a given budget and set of operating criteria, as contractors often can recommend vehicle lease or purchase options to suit the specific service needs. There may be additional savings a contractor is able to provide based on fleet availability from other contracts.

At this time, zero-emission vehicles are less reliable and less tested for the sizes needed for this service. In the future, vehicle charging infrastructure for the shuttles may be considered at the Verde Road parking area. Costs are not included here for future vehicle charging needs because zero-emission vehicles are not currently a viable solution for the Preserve and there are too many variables that may be out of date in the next few years.

Marketing Costs. Marketing costs can vary widely depending on how much District staff want to take on in-house and how much of the messaging is created internally. The elements of a typical marketing campaign are listed below along with rough estimated costs:

- **Campaign Management and Content Development.** $2,000 - $8,000 per month, typically paid to a public relations consultant (could be performed in-house)
- **Digital and Social Media Advertising.** $10,000 - $40,000 per year
- **Local Print Advertising.** $5,000 - $30,000 per year
- **Local Mailers.** $2,000 - $10,000 per year
- **Community Events.** $3,000 - $20,000 per year
- **Branded Merchandise.** $2,000 - $10,000 per year
- **Signage.** Included in capital costs for installation near the Purisima Creek Road and Verde Road parking areas.

The cost estimate assumed the marketing campaign would begin one year prior to shuttle operations, with a heavy investment during that pre-launch year and the first full year of operation. The estimate assumes 75% of the initial annual marketing budget is allocated in the second year of operation, tapering down to 50% of the initial budget in the third year.

3.6.3 Combined Six-Year Shuttle Pilot Costs

As shown in Table 10 and Table 11, considering all capital and operating costs, a three-year pilot program including infrastructure improvements and other start-up expenses could range from $2.0 million to $4.5 million over six years. The capital costs shown in Table 7 are assumed to take place in years 1 through 3, and the operating costs shown in Table 8 and Table 9 would begin in year 4 with a 3% escalation each year to account for inflation, though that often can be negotiated in the contract. Potential vehicle costs are based on typical lease/financing rates and shown as capital costs in years 4 through 6; however, if vehicles are leased via the shuttle contractor rather than purchased, those costs would be reflected as higher operating costs paid to the contractor, rather than as capital costs paid by the District.

Table 10. Estimated Range of Cost Estimates, Service Scenario 1 (Meeting Visitor Demand), Excluding District Staff Hours

		Capital & Vehicle Cost	Operations & Marketing Cost	Total Cost
Phase	Year	Range	Range	Range
Design	1	$46,000 - $69,000	-	$46,000 - $69,000
Permitting	2	$77,000 - $130,200	-	$77,000 - $130,200
Site Improvements & Shuttle Start Up	3	$159,200 - $216,600	Operations: $15,000 - $75,000 Marketing: $46,000 - $206,000	$220,200 - $497,600
Shuttle Pilot Operation	4	$21,400 - $214,300	Operations: $572,550 - $763,400 Marketing: $47,400 - $212,000	$641,350 - $1,189,900
	5	$21,400 - $214,300	Operations: $589,700 - $786,300 Marketing: $36,600 - $163,900	$647,700 - $1,164,500
	6	$21,400 - $214,300	Operations: $607,400 - $809,900 Marketing: $18,800 - $84,400	$647,600 - $1,108,600
6-Year Total				**$2,279,850 - $4,159,800**

Table 11. Estimated Range of Cost Estimates, Service Scenario 2 (Emphasizing Visitor Experience), Excluding District Staff Hours

		Capital & Vehicle Cost	Operations & Marketing Cost	Total Cost
Phase	Year	Range	Range	Range
Design	1	$60,000 - $69,000	-	$46,000 - $69,000
Permitting	2	$77,000 - $130,200	-	$77,000 - $130,200
Site Improvements & Shuttle Start Up	3	$159,200 - $216,600	Operations: $15,000 - $75,000 Marketing: $46,000 - $206,000	$220,200 - $497,600
Shuttle Pilot Operation	4	$21,400 - $214,300	Operations: $866,700 - $1,155,600 Marketing: $47,400 - $212,200	$888,100 - $1,369,900
	5	$21,400 - $214,300	Operations: $892,700 - $1,190,300 Marketing: $36,600 - $163,900	$914,100 - $1,404,600
	6	$21,400 - $214,300	Operations: $919,500 - $1,226,000 Marketing: $18,800 - $84,400	$940,900 - $1,440,300
6-Year Total				**$3,086,300 - $4,911,600**

3.6.4 District Staff Considerations

Additional operating expenses include District staff time for the following:

- Updating websites and social media content with new instructions.
- Providing ongoing messaging.
- Providing enforcement in-house.
- Connecting with enforcement agencies as needed.
- Monitoring the shuttle program and working with the contractor for any needed changes.

Early stages of planning will likely require group meetings, and messaging should be tested with visitors through social media engagement, in-person events, or other methods, led by the District's public affairs specialist. Multiple staff should be involved to ensure that messaging reaches diverse audiences, but the task would not require a new full-time position.

In-field work to ensure compliance with parking policies, and to help people with changes to parking procedures would likely be necessary for a minimum of 3 months. These could be roaming full-time positions, that can be worked in to other in-field duties, or as dedicated staff. For the first year of service, the District should plan on having staff at the Verde Road parking area and near the Purisima Creek Road parking area during holiday weekends where visitation is highest and visitors may not be familiar with changes.

The District's management analyst could be the primary program manager. This person would be responsible for monitoring on-time performance, customer satisfaction, maintaining a relationship with the contractor, serving as the point of contact for visitor and neighbor concerns, and working out issues with the appropriate departments (e.g. Visitor Services, Legal, General Manager's Office, etc.) as they arise. It is advised that the contract is set up in such a way that only metrics that are easy to collect and analyze are tracked, and that these metrics are also actionable. For example, if trips are running late at a particular time of day on a for more than a month, the management analyst should work with the contractor to track the issue, and if the results are the same after a specified amount of time, such as a quarter, then an outcome may be to realize that trips take longer and should be published to reflect that, or that boarding and unloading can be improved to keep trips leaving on time. Problem solving with the contractor should be expected to be a larger part of the day for the first 3 to 6 months of the contract, and for the first month of any service change, where schedules change.

Before service is implemented, the District would need to work with the contractor to develop and agree to policies that would keep service running when issues arise. This includes policies around drivers calling out sick, a vehicle going out of service for something such as a flat tire, operating during inclement weather, or if the road gets washed out. Policies about who contacts whom and the line of command will be important to the success of the program.

As the program gets running, the management analyst might expect to spend anywhere from five to 20 hours per week on the contract, with fluctuations throughout the month. More hours may be added as staff time allows.

3.6.5 Performance Measures

Performance measures are necessary to ensure the service maintains quality standards and remains financially sustainable. They also should reflect the overall goals of the shuttle service – recognizing the core tradeoff between service efficiency (moving riders at the lowest cost possible) and service quality (minimizing waiting time for a better user experience).

Table 12 lists potential performance measures for shuttle service, including their purpose and potential targets. Given the goals of the District to provide a shuttle service that alleviates current access issues and provides a positive visitor experience, the District should look for positive results in quality-focused metrics such as ridership, on-time performance, and visitor feedback. Efficiency-focused metrics such as cost per rider will necessarily lag the quality-focused metrics given the goals of the program and should be used mainly to monitor fiscal sustainability.

Evaluating these measures over the three-year pilot program can provide actionable information for the District to use in decision-making going forward. For example, if the District chooses to provide a high level of service in the pilot (such as that envisioned in Service Scenario 2) but then finds that ridership is consistently lower than expected, this could be justification to reduce future service to a level closer to Service Scenario 1.

Table 12. Potential Shuttle Performance Measures

Measure	Purpose	Potential Target
Total Cost	Ensure financial sustainability	No cost overruns
On-Time Performance	Ensure operator maintains service reliability (typically a contract provision)	>90% on-time performance; schedule changes if not feasible
Ridership	Monitor overall usage, peak visitor flows, and growth trends (all by month, day of week, and hour)	Daily and peak-hour rider counts not exceeding shuttle capacity
Cost per Rider	Assess overall efficiency of service	To be determined; balance with goals for quality of service
Shuttle Feedback	Assess Preserve visitors' experience with shuttle system, overall access, and likelihood to return; and preserve neighbor experience with parking and traffic conditions.	Sustained average ratings of "satisfied" or better

3.7 Next Steps

The following next steps should be considered in developing shuttle service at the Preserve:

- With so many factors impacting capital and operating costs, work with relevant internal parties to get feedback on the costs and initial service levels.
- Reach out to vendors to ask what they would advise for this type of service, what services and equipment they would provide as part of their vendor contract, and what their experience is with similar contracts.
- Develop a scope of services, performance expectations, and a monitoring program that is in line with the size of the proposed program. Monitoring operator performance should focus on reliability and safety more than ridership, although ridership should be tracked to make sure the program is operating at a scale that is appropriate for its ridership.
- Research fleet electrification for future implementation.
- Develop and foster partnerships with potential partners for future phases.
- Research future funding and partnership opportunities.

4. Parking Management Concepts and Recommendations

This section reviews the overall benefits, costs, and challenges of several parking management concepts in achieving the study's goals to reduce parking demand, manage parking resources, improve multimodal access and visitor circulation, and enhance visitor safety and overall experience at the Preserve. The three parking management concepts discussed here are reservation parking, real-time parking information, and carpool and vanpool parking.

4.1 Key Findings

4.1.1 Site Feasibility

Implementation of these strategies generally requires formalized parking (via marked stalls, signs, and/or curbs) making the Purisima Creek and Redwood Roadside parking areas generally unsuitable for implementation without substantial physical improvements. Additionally, these strategies are most effective when implemented in larger parking areas that can yield greater economies of scale for the investments and more substantial TDM benefits. As such, the expanded North Ridge and new Verde Road parking areas are the most feasible candidates for these strategies.

4.1.2 Expected Demand

The District's recent investments in new parking capacity at both the North Ridge and Verde Road parking areas are expected to accommodate parking demand in the near to medium term. Over the medium to long term, visitation to both sites is likely to increase through a combination of induced demand from the new capacity and the natural growth of the regional population. This is likely to occur first at North Ridge, given its known demand levels and smaller capacity compared to Verde Road.

4.1.3 Enforcement

Enforcement is key to the successful implementation of the parking strategies discussed below. Without the compliance generated from robust enforcement, the strategies will not be able to effectively manage transportation demand to the Preserve. As such, enforcement represents one of the most significant costs to implementation of parking management concepts. It also has the potential to be a significant point of friction for both the District and user; robust and continuous education—particularly accompanying the rollout of the strategies—is key to reducing this friction and lessening the need for punitive enforcement.

4.1.4 Concept Evaluation and Recommendations

Given the cost to implement any of these parking strategies — not just their initial startup costs, but also the ongoing costs of staffing and technology systems — they are not recommended for implementation until parking shortages are observed in the expanded North Ridge and new Verde Road parking areas. This additional parking capacity in which the District is already investing should be the primary strategy to address current shortages. However, once these sites consistently begin to approach capacity at peak times, the strategies evaluated below can be useful tools to further manage demand. A good indicator to begin planning for this is when demand regularly starts exceeding 80% of capacity during peak periods.

Table 13 summarizes the benefits, costs, and challenges of the three parking management concepts evaluated. The sections that follow contain additional details and considerations for each strategy, including potential operations scenarios for the Preserve and case studies from peer facilities.

Table 13. Summary of Parking Management Concepts

Concept	Summary of Benefits	Summary of Costs and Challenges	Summary of Recommendations
Reservation Parking	**HIGH.** Flexible strategy to directly manage the flow of vehicles to the Preserve, accomplishing the study's goal while also improving the user experience by creating certainty for their visit.	**HIGH.** Imposes administrative and financial requirements on users, and also requires substantial investment in technology infrastructure, enforcement services, and educational campaigns for successful implementation.	Once the expanded North Ridge and new Verde Road parking areas begin to consistently approach capacity at peak times, which is expected in the medium to long term, reservations are likely the most effective tool to further manage demand. Based on overall value provided by the available system options, the recommended system is an online booking portal with enforcement provided by periodic staff checks of license plates. This reduces the need for physical improvements on-site and should be paired with consistent enforcement and education.
Real-Time Parking Information	**MODERATE.** Limited benefits to managing transportation demand, mostly affecting "go/no-go" decisions by visitors from closer communities, but also improves the overall user experience by providing more certainty and tools for trip planning.	**LOW TO MODERATE.** Online-only system similar to Rancho San Antonio Preserve carries relatively low cost for both capital improvements and ongoing operations, and does not impose administrative or financial requirements on users.	While benefits to managing transportation demand are limited, an online-only real-time information system still can provide useful information at a relatively low cost to both users and the District. Given the success of a similar system at the Rancho San Antonio Preserve, this strategy may be worth pursuing in coordination with ongoing improvements at the expanded North Ridge and new Verde Road parking areas.
Carpool and Vanpool Parking	**MODERATE.** Flexible to accommodate current and future needs but may have limited practicality given the high number of visitors already traveling in groups.	**HIGH.** Frequent staff presence and high enforcement are needed to make this strategy effective, which negates the benefits of relatively low-cost capital improvements.	Once the expanded North Ridge and new Verde Road parking areas begin to consistently approach capacity at peak times, which is expected in the medium to long term, carpool and vanpool parking may provide moderate benefits, particularly if paired with a reservation system offering guaranteed parking to enhance the incentive to carpool or vanpool. However, the high costs required to verify and enforce carpool policies are likely to exceed the potential benefits.

4.2 Reservation Parking

Reservation parking is a popular parking management strategy to provide an improved visitor experience while also allowing facilities to manage the flow of vehicles into their property. As shown in sample photos in Figure 6, reservations are typically made through an online website, app, or over the phone, and can be time-based to ensure that visitors have a parking spot upon arrival.

A reservation parking system can yield high benefits and is likely the most promising parking strategy to accomplish District goals, but it also carries high costs and challenges.

- **Summary of Benefits. HIGH.** Flexible strategy to directly manage the flow of vehicles to the Preserve, accomplishing the study's goal while also improving the user experience by creating certainty for their visit.
- **Summary of Costs and Challenges. HIGH.** Imposes administrative and financial requirements on users, and also requires substantial investment in technology infrastructure, enforcement services, and educational campaigns for successful implementation.
- **Summary of Recommendations.** Once the expanded North Ridge and new Verde Road parking areas begin to consistently approach capacity at peak times, which is expected in the medium to long term, reservations are likely the most effective tool to further manage demand. Based on overall value provided by the available system options, the recommended system is an online booking portal with enforcement provided by periodic staff checks of license plates. This reduces the need for physical improvements on-site and should be paired with consistent enforcement and education.

Figure 6. Sample App-Based Reservation System *(ParkMobile)*

4.2.1 Effectiveness in Managing Transportation Demand

Core Benefits. Compared to the other parking strategies evaluated in this report, a reservation parking system is the most effective tool to directly manage the flow of vehicles to the Preserve and accomplish the study goal of reducing parking and traffic impacts. A reservation system also provides flexibility for implementation across a variety of scenarios as conditions evolve, allowing for ongoing optimization of program rules and space allocation based on collected data and visitor feedback.

User Fees. As seen in the case studies below, reservation systems work best when they include a nominal user fee to reduce the occurrence of "no-shows" that waste valuable parking capacity during peak periods. Nearly all parking systems reviewed by the project team charge some fees for reservations, even as low as $2-$3 (see case studies below). However, user fees also can depress visitation rates and may require a change in District policy, which the Planning and Natural Resources Committee did not recommend pursuing at this time.

In some cases, the administrative requirements for users to reserve parking – going online, often in advance, and securing the reservation via a user account or other contact information – can provide a sufficient incentive to prevent most "no-show" occurrences. The project team found one example of this, at Heavenly Lake Tahoe Ski Resort, which requires no-fee reservations for carpool and disabled parking (see case studies in Section 4.4, Carpool and Vanpool Parking). Following this model, the District could choose to begin implementation of a reservation parking system without user fees, monitor its success in preventing "no-show" occurrences, and consider fees in the future only if needed.

Ancillary Benefits. A reservation system can enhance the visitor experience during peak times by providing certainty that parking will be available upon arrival. Reservations also would serve as an indicator of expected visitor demand to help District staff anticipate and plan for peak days.

Potential Strategy Combination. Parking reservations may be combined with other strategies, such as carpool and vanpool parking (discussed separately in this report) to increase potential effectiveness in managing transportation demand by creating additional incentives.

Potential Sites. As discussed earlier in this report, formalized parking is required for effective TDM strategy implementation, while implementation in larger lots yields the most benefit. Based on these criteria, the Purisima Creek and Redwood Roadside parking areas are generally unsuitable for reservation parking in their current states. Additionally, the District's ongoing investment in new parking capacity at the North Ridge and Verde Road parking areas should be the primary strategy to address current parking shortages. Once those sites begin to consistently approach capacity at peak times, reservations are likely the most effective tool to further manage demand. A good indicator to begin planning for this is when demand regularly starts exceeding 80% of capacity during peak periods.

4.2.2 Implementation Considerations and Challenges

The "three E's" of mobility planning—enforcement, engineering, and education—provide a useful framework for evaluating the considerations and challenges of implementing a reservation parking program at the Preserve.

4.2.2.1 Enforcement

A baseline level of enforcement—specifically, the ability to check reservations and follow through with citations and towing for violators—is required for successful implementation. Regular enforcement is

particularly important for a reservation system that reserves parking stalls for specific time blocks throughout the day, as these stalls must be available when new visitors arrive. This type of reservation system would maximize capacity, but it presents many challenges for enforcement. As noted in the case studies below, many high-demand recreation areas instead have a policy that reservations do not guarantee parking, and stalls are allocated on a first-come, first-served basis. While easier to enforce, this method may strain capacity on particularly popular days and lead to visitor frustration.

Enforcing a reservation parking system requires some combination of capital and technology costs and staffing costs. In general, there is a tradeoff between these types of enforcement systems:

- Technology-based enforcement with moderate staffing costs, such as a fully online reservation system that requires staff to check license plates once every 2 to 4 hours, generally carries the lowest cost and is the recommended enforcement method for the North Ridge and Verde Road parking areas.
- Technology-intensive enforcement with lower staffing costs, such as requiring visitors to scan proof of reservations to access a secured parking area via gate arm, would require physical modification to the parking areas. This system is less flexible in terms of adjusting the number of parking stalls available for reservation.
- Staff-intensive enforcement with lower capital and technology costs, such as a full-time parking attendant at the facility entrance, is typically the most expensive method of enforcement. This method would only be recommended in areas such as the Purisima Creek parking area where poor wireless connectivity would limit the effectiveness of technology systems. However, as discussed above, a reservation system is not recommended at Purisima Creek given its current lack of formalized parking and the primary recommendation for closure and operating shuttle service during peak times.

4.2.2.2 Engineering

- Many reservation parking systems rely on wireless connectivity for enforcement and for booking walk-up reservations at lots without parking attendants. Connectivity is available at both the North Ridge and Verde Road parking areas. Potential equity concerns around people who do not have smartphones could be solved by a digital kiosk, which would require wireless connectivity.
- In the absence of wireless cellular connectivity to allow on-site reservations via phone or text message, power would also be needed to implement an on-site, same-day reservation system that does not rely on a parking attendant, such as a digital kiosk. Assuming visitors would be able to make same-day reservations on their phones, this system would largely be used by people without smartphones or individuals who are less tech savvy. Power is expected to be included in the expanded North Ridge and new Verde Road parking areas.

4.2.2.3 Education

- Parking and entry reservation systems have become a best practice at popular recreational areas across the nation in recent years, accelerated by a combination of technology advancements, increasing visitation rates, and the widespread use of digital reservation systems during the COVID pandemic. Many people have become accustomed to these systems and are familiar with the process.
- Selecting a system that offers on-site, same-day reservations via kiosk or reservations via phone or text message may help users who do not have app-enabled smartphones or who are uncomfortable with these latest systems.

- As with any new change to access policies, a marketing campaign is recommended to inform visitors of the new requirements and process. This should include print and online advertisements targeted to communities located both east and west of the Preserve.
- Signage is recommended on-site and along roadway approaches to help educate visitors on the requirements and provide instructions for making reservations upon arrival (if available).
- For regular visitors who may be less familiar with new technology, having pre-trip planning information on site can help prepare people on how to use the system for their future trips.

4.2.3 Potential Operations at Purisima

Table 14 summarizes how a parking reservation system could work at the Preserve, including potential sites, operating scenarios, and an overview of the user experience.

Table 14. Potential Operations for Reservation Parking

Potential Sites	Potential Operating Scenario	Potential User Experience
Recommended in Medium to Long Term as Demand Begins to Exceed New Capacity: ▪ Expanded North Ridge parking area ▪ New Verde Road parking area **Not Recommended Due to Low Benefits and High Cost:** ▪ Purisima Creek Road parking area ▪ Redwood Roadside parking area	▪ Reservations available year-round, required for reservation spaces during holidays and weekends from June to early September. ▪ 60% of the lot designated for reserved spaces. ▪ 20% of reserved spaces available for day-of and in-person reservations. ▪ Staff scan license plates every 2–4 hours to ensure that only visitors with reservations park in designated spaces.	▪ Reservations made through online platform, over the phone, or in-person starting 1 month ahead of desired date. ▪ Visitors input vehicle information, including license plate number, when making a reservation. ▪ $3 fee per vehicle; potential for reduced rates for carpools/vanpools of 3+ people (see carpool and vanpool parking description below). ▪ Visitors can arrive within a 2-hour window of their reservation time. ▪ Upon arrival, visitors follow signage to park in spaces designated for reserved parking.

4.2.4 Costs and Capital Requirements

Key to any parking reservation system is the software that allows visitors to reserve parking spaces. While much of the functionality is built into the software package, some staff time is needed to manage back-end web and software needs. On-site requirements include signage to raise awareness of the reservation requirements. A successful reservation system requires staff enforcement, which would take the form of staff periodically scanning license plates to ensure that only visitors who reserved a parking space are parked in the designated areas.

Table 15 lists the estimated costs to implement a parking reservation system.

Major vendors for reservation parking systems include:

- **ParkMobile:** https://parkmobile.io/parking-solutions/transient-parking-reservations/
- **VEVS:** https://www.vevs.com/parking-reservation-software/
- **ParkHub:** https://parkhub.com/
- **HONK:** https://www.honkmobile.com/

Table 15. Reservation Parking System Estimated Costs

System Component	Estimated Cost	Considerations
Implementation (Software, Signage, Gate arm)	▪ $15,000 per year for web platform/software application. ▪ $15,000 for signage.	▪ Software system is needed to allow for reservations to be made ahead of time.
Staff	▪ One to two full-time employees.	▪ Staff time needed for enforcement and to manage back-end web and software needs.

The project team conducted initial research for vendors ParkMobile and VEVS to identify specific system designs and other implementation details. However, technology and market conditions continue to evolve rapidly in the parking management industry and, as discussed above, this type of demand-management system is not expected to be needed at the Preserve for several years (following not just construction of the new Verde Road and expanded North Ridge parking areas, but also their consistently reaching 80% of capacity at peak times). Therefore while the information below provides a starting point to understand typical vendor systems, it likely will be outdated once the District actually begins its procurement process, and at that time the District should obtain fresh information from all active vendors.

ParkMobile. Founded in the U.S. and now part of European conglomerate EasyPark Group, ParkMobile is a major vendor of parking reservation and payment systems worldwide. Its implementations in the U.S. include many college campuses and other institutional settings, and its relatively wide adoption means that many drivers have already used ParkMobile systems and are familiar with the process and user interface.

ParkMobile's "transient parking" reservation systems are its core offerings that would meet the reservation-parking needs at the Preserve. With a typical example shown in Figure 6, the systems allow visitors to make reservations in advance and upon arrival via website, mobile app, text messaging, and kiosk. If the District chooses to implement a reservation fee, ParkMobile integrates with major payment systems as a registered merchant, with payment processing fees around 2%-4% commensurate with industry standard.

On the back end, a dashboard-style interface would allow the District to manage parking inventory, including the ability to designate special parking types, such as carpool and ADA, for specific reservations. The reservation system integrates with ParkMobile's Insights platform, which provides data analysis capabilities to allow the District to monitor day-to-day parking usage as well as longer-term visitor trends.

VEVS. Similar to ParkMobile, VEVS is a Europe-based company that provides technology systems for parking and other mobility programs. The VEVS parking reservation system offers web- and app-based reservations, with a typical visitor interface shown in Figure 7. However, the typical VEVS implementation requires users to scan a QR code upon entry, which may be displayed via mobile app (requiring staffing and/or gate infrastructure) or may be printed and left on a visitor's car dashboard (requiring printing capabilities in advance or on site). Once the District is ready to begin procuring a reservation system, communication with VEVS sales associates would be required to determine the availability of other methods (such as license plate scanning) to monitor reservations.

The VEVS user dashboard, shown in Figure 8, would allow the District to manage and monitor its parking capacity, including the designation of special parking types, and is integrated with a payment system if the District choses to implement a fee. Similar to ParkMobile's Insights platform, the VEVS dashboard also provides visitor data in various formats to assist the District in understanding and predicting long-term trends.

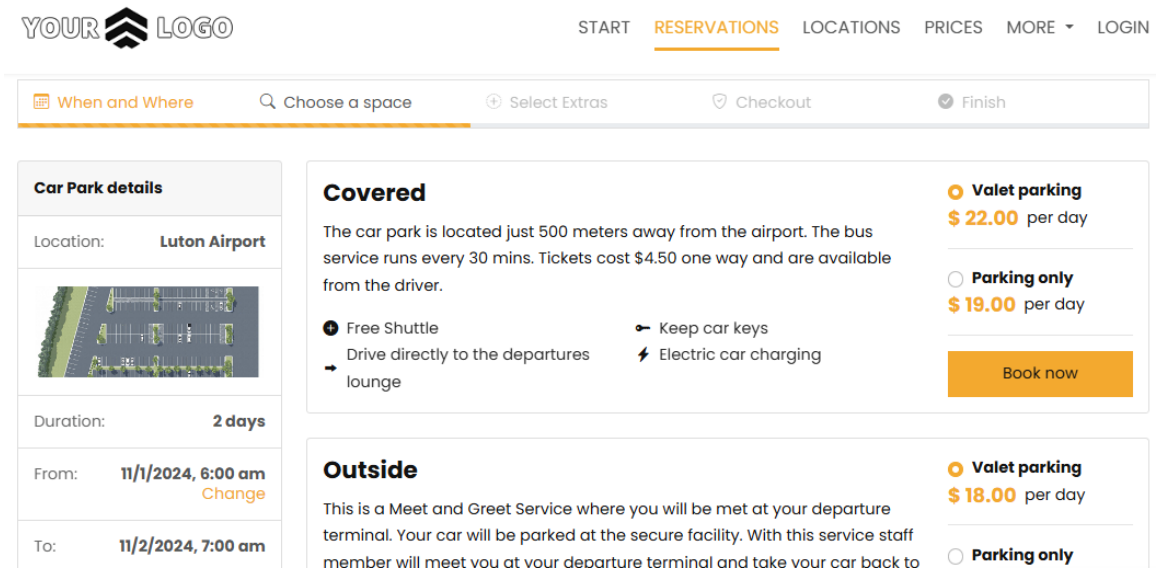

Figure 7. Typical Reservation Parking System User Interface *(VEVS)*

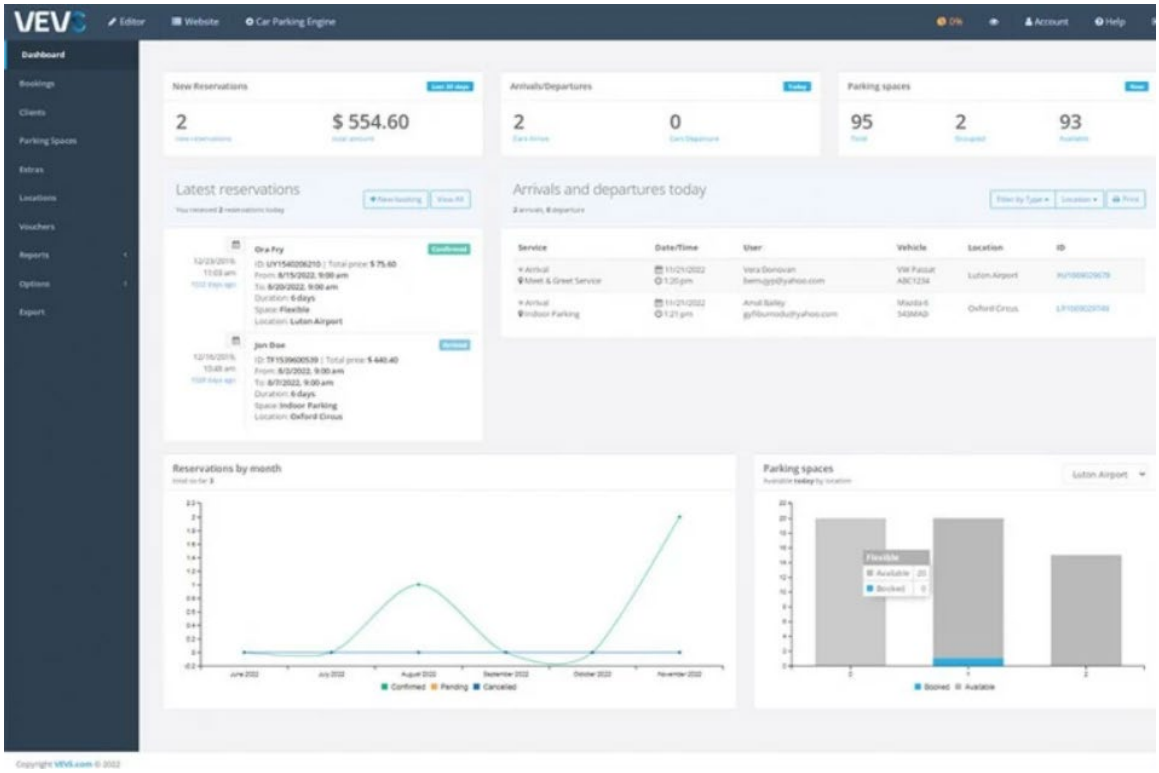

Figure 8. Typical Reservation Parking System Management Dashboard *(VEVS)*

4.2.5 Case Studies

This section provides an overview of existing parking reservation programs that can provide useful guidance as the District develops its own potential program.

4.2.5.1 Hanauma Bay, Hawaii

- **Reservation Time Frame:** Reservations required year-round.
- **Fee:** $3 parking fee per vehicle for nonresidents, $1 for Hawaii residents.
- **Reservation Process:** Online reservations can be made 2 days in advance starting at 7 a.m.
- **Parking Availability:** Reservation does not guarantee parking; stalls are still first-come, first-served.

4.2.5.2 Yosemite National Park, California

- **Reservation Time Frame:** Entrance reservations required on varying frequencies throughout the busy season of April 13 through October 27 between 5 a.m. and 4 p.m. Reservations required from 5 a.m. to 4 p.m. every day July 1 through August 16. Otherwise required only on weekends and holidays.
- **Fee:** $2 reservation fee (does not include $35 per car park entrance fee).
- **Reservation Process:** Online reservations can be made 1 week in advance starting at 8 a.m. each day.
- **Parking Availability:** Reservation does not guarantee parking, but those without reservations must arrive outside of the 5 a.m. to 4 p.m. time frame (peak hours).

4.2.5.3 Big Basin State Park, California

- **Reservation Time Frame:** Reservations not required, but encouraged due to limited first-come, first-served parking availability.
- **Fee:** $6 plus $2 reservation fee for regular-sized autos, $10 per vehicle without a reservation.
- **Reservation Process:** Online and over the phone reservations are available 2 months in advance with a limited number of spots also available 3 days in advance. Reservations need to be made by 6 a.m. on the day of the visit.
- **Parking Availability:** Reservation does guarantee parking, and the number of available spots are shown on an online calendar during the reservation process.

4.3 Real-Time Parking Information

Real-time parking information systems use sensors to track the number of available parking spaces in a parking area. This information can then be relayed to the public using dynamic message signs (DMS) or online tools as shown in Figure 7 and Figure 8, helping visitors more easily find available parking spaces. From a demand-management perspective, real-time information systems are most effective at distributing demand across multiple parking areas that serve the same destination, such as a shopping mall or stadium.

Given the remote nature of the Preserve—with a relatively low level of infrastructure and connectivity, and visitor travel times averaging 30-60 minutes or more—an online-only system like that at Rancho San Antiono Preserve is likely to provide the highest value and is the primary focus of this evaluation.

- **Summary of Benefits:** MODERATE. Limited benefits to managing transportation demand, mostly affecting "go/no-go" decisions by visitors from closer communities, but also improves the overall user experience by providing more certainty and tools for trip planning.
- **Summary of Costs and Challenges:** LOW TO MODERATE. Online-only system similar to Rancho San Antonio Preserve carries relatively low cost for both capital improvements and ongoing operations, and does not impose administrative or financial requirements on users.
- **Summary of Recommendations:** While benefits to managing transportation demand are limited, an online-only real-time information system still can provide useful information at a relatively low cost to both users and the District. Given the success of a similar system at the Rancho San Antonio Preserve, this strategy may be worth pursuing in coordination with ongoing improvements at the expanded North Ridge and new Verde Road parking areas.

4.3.1 Effectiveness in Managing Transportation Demand

Core Benefits. The expected effectiveness of a real-time information system in managing demand is lower than the other parking strategies evaluated in this report, particularly given the specific geography of the Preserve—with parking areas that are miles apart, each providing access to different areas and trails. These parking areas at the Preserve are significantly less "interchangeable" than the typical satellite parking areas that would surround a shopping mall or stadium. Combined with the long distances that many visitors travel to reach the Preserve, many are unlikely to want to change destinations to a different parking area and trailhead. As such, installing DMS on roadways approaching the Preserve are not recommended. However, the online system still may provide benefits for some users' "go/no-go" decisions, especially for people coming from closer communities.

Potential Strategy Combination. Real-time parking information also can be layered with other parking and TDM strategies, which is beneficial given the ongoing parking capacity improvement efforts at the North Ridge and new Verde Road parking areas. For example, a real-time parking information system could provide data on the number of carpool/vanpool stalls (or other specially designated stalls such as disabled or ranger uses) available at any given time. However, this typically would require a more expensive system with individual sensors at each stall, or clearly separated entry/exit points for each type of parking with sensors at each point (further details in engineering section below).

Figure 9. Sample Real-Time Parking Information Signage and Equipment *(Rancho San Antonio)*

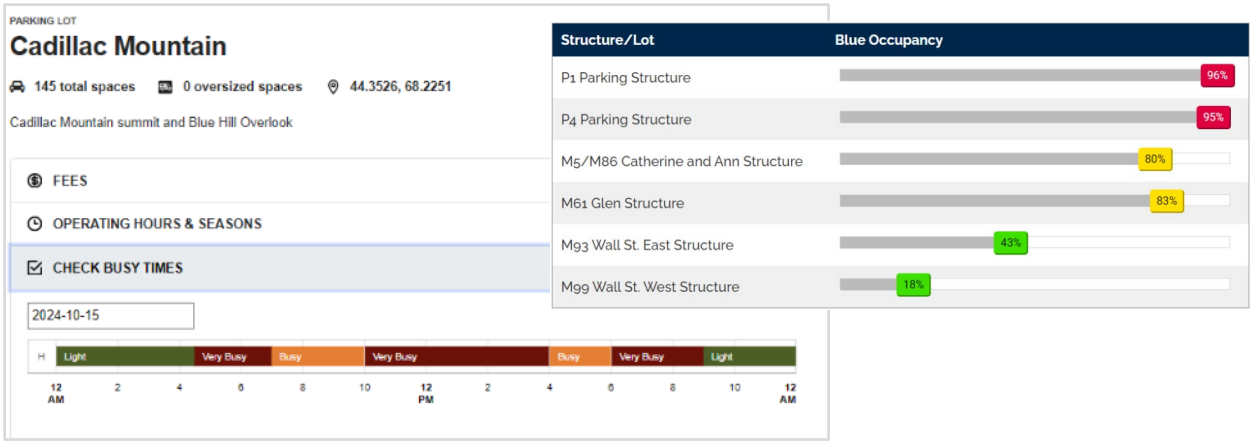

Figure 10. Sample Real-Time Parking Information Online Interfaces *(Acadia National Park; University of Michigan)*

4.3.2 Implementation Considerations and Challenges

While enforcement and education considerations are minimal for this parking management concept, several engineering challenges would need to be addressed prior to implementation at the Preserve.

4.3.2.1 Enforcement

- Minimal enforcement would be needed for a real-time information system. Key considerations may include traffic calming to slow vehicles as they pass sensors and signage to ensure that drivers use the correct lot entrance and exit points to ensure accurate counts.

4.3.2.2 Engineering

- Typical system architecture for a real-time parking system includes parking sensors—radar or magnetic loops—at either the parking area entry/exit points or in individual stalls (the latter being a much costlier option). These sensors are relatively easy to install and can withstand adverse weather conditions. They require little maintenance aside from replacement

approximately every 3 to 5 years. Repeaters, which are installed within 1,000 feet of the sensors, receive data from the sensors and communicate to the DMS and the cloud.

- The systems typically use wireless technology to communicate data. Without a wireless data signal, options would include underground wiring (carrying high capital cost) or the use of staff to manually update the DMS. DMS can be rented for busy seasons instead of purchasing, lowering initial costs and providing additional flexibility.
- A power source would be needed to run the DMS. Without power, staff would be needed to manually change signs as needed, which would be labor intensive and would reduce the signs' accuracy. Power is expected to be included in the expanded North Ridge and new Verde Road parking areas.

4.3.2.3 Education

- Little education is needed compared to other strategies. The real-time system is informational in nature and does not require advance reservations or other user processes.

4.3.3 Potential Operations at Purisima

Table 16 summarizes key characteristics of typical real-time parking information systems and how they could operate if implemented at the Preserve.

Table 16. Potential Operations for Real-Time Parking Information

Potential Sites	Potential Operating Scenario	User Experience
▪ Real-time parking counts available on District webpage and counting sensors to be installed at ▪ Expanded North Ridge parking area ▪ New Verde Road parking area	▪ Sensors installed at parking area entry/exit or at each parking stall. ▪ If tied to a carpool and vanpool strategy (see next section), sensors could capture restricted vs. unrestricted supply separately. ▪ Over time, trend information can be posted on the District's website to aid in visitor decision-making.	▪ Visitors approaching the preserve get real-time parking supply information at key decision points to facilitate making alternate plans, if necessary. ▪ Online information helps visitors plan to visit the park at less busy times.

4.3.4 Costs and Capital Requirements

This system has lower implementation and maintenance costs compared to other parking strategies. Estimated costs for a real-time parking system using entry/exit sensors are presented in Table 17. Implementing a system with individual parking stall sensors is estimated to cost over 3.5 times more, but it has not been seen to provide more accurate counts and is therefore not considered here.

Vendors for real-time parking availability systems include:

- **Parking Logix:** https://parkinglogix.com/
- **Scheidt & Bachmann:** https://www.scheidt-bachmann.de/en/
- **TCS International:** https://www.tcsintl.com/

Table 17. Real-Time Parking System Estimated Costs

System Component	Estimated Cost	Considerations
Installation	$20,000 to $30,000 per parking area.	Cost does not include underground wiring for wireless connectivity.
Implementation (sensors, repeaters, dynamic sign)	$20,000 to $30,000 per parking area.	N/A
Maintenance	Up to $2,000 per year per parking area.	Some systems do not require maintenance costs aside from occasional battery replacement.
Staff	0.25 new staff person time.	Staff time needed to manage and administer the system.

4.3.5 Case Studies

Several case studies from national parks and preserves can provide guidance if the District chooses to implement a real-time parking information system at the Preserve.

4.3.5.1 Rocky Mountain National Park, Colorado

- **Infrastructure:** DMS and Highway Advisory Radio.
- **Locations:** At highway junctions facing incoming traffic flow.
- **Effects:** Park staff have noticed a positive change in traffic flow since the implementation of DMS technology and other ITS solutions.

4.3.5.2 Acadia National Park, Maine

- **Infrastructure:** Static signs, online portal with accompanying app, and in-person information at the visitor center.
- **Locations:** Static signs at two of the most popular parking lots.
- **Effects:** Real-time parking information signs reduced excess parking demand, and website-based parking information is well used and was found useful by visitors.

4.3.5.3 Rancho San Antonio Open Space Preserve, California

- **Infrastructure:** Sensors, repeaters, and dynamic signs; trenching to run power to the sign from a fuse box; traffic calming features (bollards and speed bumps).
- **Locations:** Sign located at the preserve entrance and sensors installed at strategic access locations for the parking areas.
- **Effects:** Website-based information is well used and was found useful by visitors. District staff recommend local vendor to reduce maintenance costs.

4.4 Carpool and Vanpool Parking

Designating parking stalls for carpools and vanpools—or high-occupancy vehicles of any type—is a best practice in parking management. This can be accomplished with signage and striping or paired with an online reservation system for additional functionality (Figure 9). Like high-occupancy lanes on freeways, this strategy encourages people to make trips in larger groups and can reduce the total number of cars traveling to the Preserve.

With relatively low benefits, carpool and vanpool parking is unlikely to provide significant value to the District, especially given its high levels of costs and challenges.

- **Summary of Benefits.** MODERATE. Carpool and vanpool parking is flexible to accommodate current and future needs, but it may have limited practicality given the high number of visitors already traveling in groups.
- **Summary of Costs and Challenges.** HIGH. Frequent staff presence and consistent enforcement are needed to make this strategy effective, which negates the benefits of relatively low-cost capital improvements.
- **Summary of Recommendations.** Once the expanded North Ridge and new Verde Road parking areas begin to consistently approach capacity at peak times, which is expected in the medium to long term, carpool and vanpool parking may provide moderate benefits, particularly if paired with a reservation system offering guaranteed parking to enhance the incentive to carpool or vanpool. However, the high costs required to verify and enforce carpool policies are likely to exceed the potential benefits.

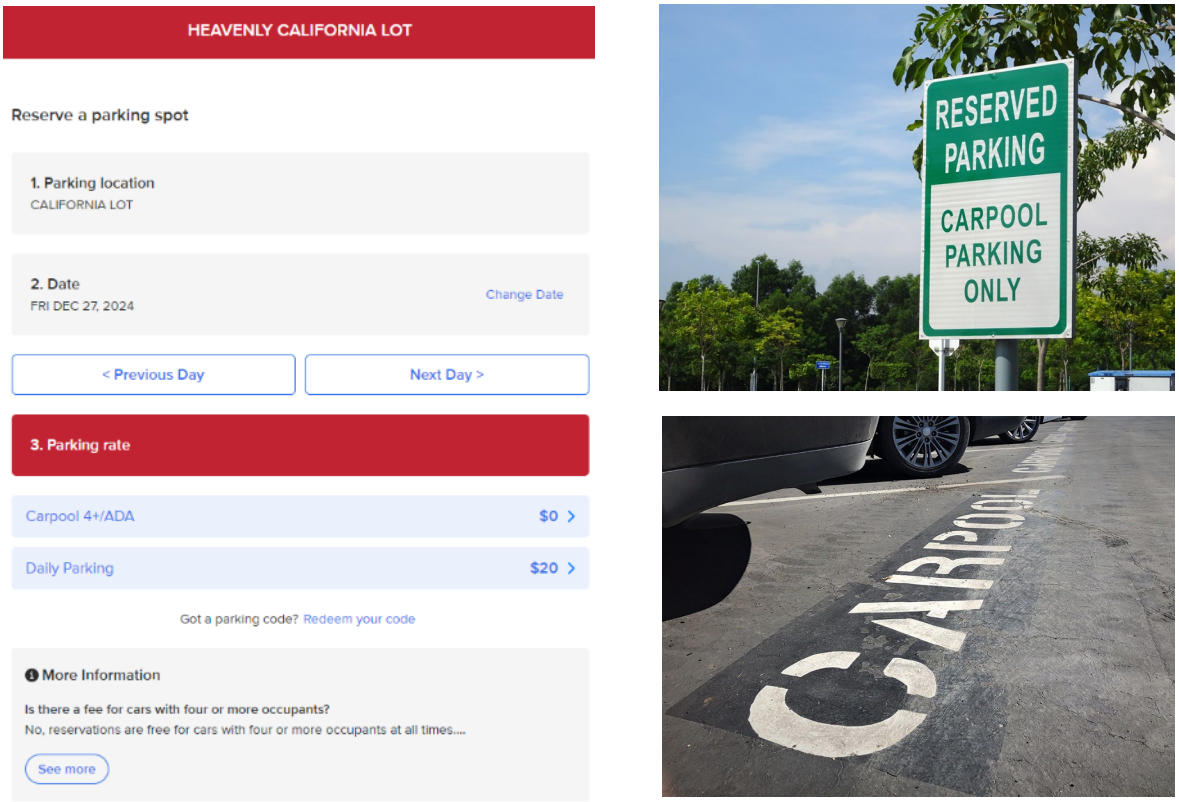

Figure 11. Sample Carpool Parking System and Signage *(Park Heavenly; CommutePA; California State University)*

4.4.1 Effectiveness in Managing Transportation Demand

Core Benefits. The primary benefit of carpool and vanpool parking occurs in parking areas that regularly reach capacity, such as the Purisima Creek and North Ridge parking areas. Setting aside space for the highest-occupancy vehicles increases the likelihood that these users will find parking when they arrive, thus creating an incentive for people to pool trips. The program also provides flexibility to adjust the allocation of space to carpools and vanpools on certain days or over time as conditions evolve, based collected data and visitor feedback.

Carpool and Vanpool Definition. Given the large number of visitors who already travel in groups to recreational activities such as hiking, to be effective this strategy likely would require defining carpools and vanpools as containing a minimum of three, or potentially even four, passengers per vehicle. While data on vehicle passenger counts is very limited, District staff have indicated that, like most hiking areas, solo trips to the Preserve are rare, and party sizes of two and three are very common. Previous field observations noted that approximately 20% to 35% of weekend visitors to the Preserve arrived in vehicles with three or more people.

Potential Strategy Combination. The incentive to travel in carpools and vanpools can be enhanced significantly through a reservation system that guarantees parking for these vehicles when booking in advance. (A reservation system is discussed separately in this report and could be paired with a carpool/vanpool parking program.) As shown in Figure 9 and discussed below, Heavenly Lake Tahoe Ski Resort allows free parking for carpools through its reservation system; however, effective enforcement of carpool rules requires staffed entry gates which is very costly.

4.4.2 Implementation Considerations and Challenges

The three E's of mobility planning—enforcement, engineering, and education—provide a useful framework for evaluating the considerations and challenges of implementing a carpool and vanpool parking program at the Preserve:.

4.4.2.1 Enforcement

- Carpool and vanpool parking has more intensive enforcement needs than other parking strategies because the verification of high-occupancy status must occur before users leave their vehicles. Unless relying on an "honor system"—which is not recommended due to frequent compliance issues in high-demand locations—this likely would require full-time staffing during peak visitation hours.

4.4.2.2 Engineering

- The most basic implementation requires a relatively low level of infrastructure, which can be as simple as signage, paint, and striping. Ideally all stalls can remain flexible to be redesignated as needed to best serve demand.
- A more complete implementation could include improvements to parking area driveways such as gates and a staffed kiosk to support enforcement and verification upon entry.

4.4.2.3 Education

- Signage is recommended on-site and along roadway approaches to inform visitors about carpool and vanpool parking and guide them to the designated stalls.

4.4.3 Potential Operations at Purisima

Given the considerations above, Table 18 summarizes how a carpool and vanpool parking system could work at the Preserve, including potential sites, operating scenarios, and an overview of the user experience.

Table 18. Potential Operations for Carpool and Vanpool Parking

Potential Sites	Potential Operating Scenario	Potential User Experience
Feasible and may Provide Moderate Benefits: ▪ Expanded North Ridge parking area ▪ New Verde Road parking area **Not Recommended due to Low Benefits and High Cost:** ▪ Purisima Creek Road parking area ▪ Redwood Roadside parking area	▪ Signage, pavement striping, and curb paint at driveway entrance, at all turn/diverge points in the parking area, and at each stall. ▪ Initial allocation of 35% of stalls, to be adjusted based on data and feedback. ▪ Additional signage on adjacent roadway approaches if possible, to allow drivers to prepare. ▪ Entry gates and staffed kiosk at driveway entrance to regulate and enforce high-occupancy policies. ▪ Could pair with online reservation system (discussed separately) to add advance booking capabilities.	▪ While driving to the Preserve, signs indicate the availability of carpool/vanpool parking while approaching the parking area. ▪ Upon entry, visitors check in with kiosk attendant to verify number of passengers and receive pass for carpool and vanpool parking. ▪ Visitors follow signs and pavement striping to appropriate parking area.

4.4.4 Costs and Capital Requirements

Carpool and vanpool parking requires a minimum of capital requirements compared to the other concepts: signage is essentially the only physical addition that would be needed to implement the concept, and signage would require minimal maintenance and only occasional replacement. Rather, staff time accounts for the largest share of this concept's costs. Staff would be required to verify occupancy for carpools and vanpools and would be needed as long as these parking regulations are in effect.

Table 19 lists the estimated costs to implement a carpool signage vanpool parking system.

Table 19. Carpool signage Vanpool Parking System Estimated Costs

System Component	Estimated Cost	Considerations
Signage	$100 - $1,000 per sign, and $5,000 - $10,000 depending on size, style and foundation.	One-time cost, changed as needed if damaged.
Staff	One to two staff per parking area (more required during longer summer hours).	Staff needed to verify vehicle occupancy during days/times when carpool/vanpool parking is in effects.

4.4.5 Case Study

The following case study can provide guidance if the District chooses to develop a carpool signage vanpool parking system at the Preserve.

4.4.5.1 Heavenly Lake Tahoe Ski Resort, California

- Reservation Time Frame: Reservations required on weekends and holiday/peak periods at popular lots. Lots are free after 12:00 p.m. and no reservations are required.
- Fee: Carpool reservations are free for cars with four or more occupants, verified by parking attendants upon entry. Flat fee of $20 per car otherwise.
- Reservation Process: Online reservations available at the start of the season, for the entire season.

5. Glossary

Table 20. Glossary

Term	Description
Activity Hub	Area with a high level of commercial activity.
Capital Improvements	Physical improvements made to a site, such as benches or signage.
Catchment Area	The area from which a population draws to get to a destination or use a service
Dispatcher	Individual coordinating and managing the logistics of a transit system including routing, service scheduling, and driver scheduling.
First-Last Mile Connector	The beginning/ending connection a rider makes to a transportation service.
Headway	The time between consecutive transit vehicles serving the same stop.
Highway Advisory Radio	Communication tool utilized by government organizations to broadcast traffic and travel information to motorists.
Intelligent Transportation Systems (ITS)	Electronics, communications, or information processing used to improve the efficiency of a transportation system.
Latent Demand	Service demand desired but unrealized due to constraints (i.e., lack of service).
Level of Service	Performance of a transit service from a traveler's perspective, typically measured by a variety of factors including convenience, capacity, reliability, and more.
On-Demand Service	A type of transit service where people book trips by phone, online, or mobile app, and are picked up at an agreed-upon location. Trips may be shared with other passengers but the vehicle does not travel along a set route.
Operating Costs	Ongoing expenses needed to administer and maintain transit service, such as wages, rent, insurance, and fuel. Operating costs can be fixed, meaning they do not change regardless of activity or performance, such as the cost of rent, or variable, which can include changes to cost in fuel.
Peak Demand	Demand for service at its highest point, typically described by time of day.
Transportation Junction	Area where multiple transportation services, routes, or roadways intersect.
Variable Messaging Board or Dynamic Message Sign (DMS)	Electronic message sign often used on roadways to inform the public about road traffic congestion, incidents, or other helpful information.