

December 28, 2018

Mr. Joe Powell, General Manager
Pine Mountain Lake Association
19228 Pine Mountain Drive
Groveland, CA 95321

RE: CIRCULATION ASSESSMENT RELATING TO TRAFFIC MANAGEMENT PLAN FOR PINE MOUNTAIN LAKE, TUOLUMNE COUNTY.

Dear Mr. Powell:

Thank you for contacting our firm regarding traffic circulation at Pine Mountain Lake. As we have discussed, issues have been raised as to the best approach for dealing with traffic conditions on the community's private streets. The issues of concern generally deal with the speed of traffic through the community, potential conflicts between motor vehicles, pedestrians and bicyclists on community streets and safety at key intersections. While various "solutions" have been suggested by residents in the past, our investigation, conclusions and recommendations are intended to provide you with an unbiased, professional look at the overall situation in order to provide you with options for best addressing community circulation.

Overview of Our Approach. The work we have completed is similar to the services we have provided for other private gated communities and combines new traffic data collection with consideration of best traffic management practices endorsed by the engineering profession. The materials which follow:

- Summarize the new traffic volume counts and speed surveys conducted at locations throughout the community.
- Describe the evaluation standards and guidelines we have employed to characterize the quality of traffic flow in Pine Mountain Lake and to isolate problem locations.
- Discuss the results of our on-site review of key problem locations identified in consultation with PMLA staff.
- Catalog the range of traffic management options that could be considered in Pine Mountain Lake based on the characteristics of your roads and the selection criteria that are commonly employed in other rural communities.
- Identify recommended actions as well as those issues and/or locations that may require subsequent study.

Background Information

Access to Pine Mountain Lake. Regional Access to the South Tuolumne County area is provided by **State Route 120** (SR 120), a two-lane highway that links the Central Valley in Stanislaus County with Yosemite National Park. The primary access to Pine Mountain Lake is provided by **Ferretti Road**, a Tuolumne County maintained road that links SR 120 at the east end of Groveland with another

connection to SR 120 roughly 8 miles to the east. Ferretti Road is designated a Major Collector road in the Tuolumne County General Plan Circulation Element and is generally a two-lane road with a posted speed limit of 40 mph. Locally, portions of Pine Mountain Drive, Mueller Drive, Hemlock Street, Clements Road and Elderberry Way are publicly maintained roads that link Ferretti Road with Pine Mountain Lake's gated private circulation system. However, some Pine Mountain Lake residences are located outside the gated circulation system and have direct access to public streets.

Street Classification. The community's circulation system includes a variety of privately maintained roadways. While Pine Mountain Lake's circulation system does not have an adopted classification system it is possible to categorize the streets by their function into *Collector Streets* and *Local Streets*. While both classes of streets typically allow direct residential driveway connections, Collector Streets are primarily intended to link various units within the community while local streets provide access within each unit.

For the purpose of this assessment, the following streets have been identified as Collectors from field review:

TABLE 1 COLLECTOR STREETS	
Street	Location
Pine Mountain Drive	From West Ferretti Road entrance (gate 2) to east Ferretti Road (gate 8)
Mueller Drive	From West Ferretti Road entrance to north Ferretti Road (gate 4)
Hemlock Street	From Ferretti Road (gate 9) to Clements Road (gate 11)
Pleasant View Drive	From Mueller Drive (S) to Mueller Drive (N)

Typically, Collector Streets may be wider than Local Streets providing two travel lanes, limited shoulders and centerline striping. Both Collector and Local Streets are currently signed with 25 mph speed limits.

Traffic Flow Data Collection

Traffic volume and speed information was gathered at locations throughout Pine Mountain Lake in order to help guide development of the traffic management plan. Two types of data were collected. **Daily traffic volume data** was collected using pneumatic tube traffic counters that record the number of sets of vehicle axels that cross the hoses in 24 hr period and convert those impulses to estimated vehicles by direction. Concurrently the hoses at some locations were positioned so as to determine the speed of vehicles as they cross the hoses, and this data is used to identify the range of **vehicle speeds** occurring on the road over a 24 hr period.

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For this assessment traffic flow information was collected on **Tuesday October 2, 2018**. Based on discussions with PMLA staff we understand that the volume of traffic occurring on the community's streets varies greatly throughout the year, primarily due to variations in the occupancy of rental and second homes. Highest occupancy occurs on summer weekends and traffic volumes would be highest at that time. Occupancy levels drop in the fall and winter, and traffic volumes would be reduced accordingly. We would expect that our midweek counts made in October would represent low to moderate traffic volume levels.

Our traffic volume counts were also conducted at a time when temporary traffic controls were in effect and a portion of the community's private road system was employed as a detour. Because the culvert on Ferretti Road north of Pine Mountain Drive was under repair, public traffic was routed onto Pine Mountain Drive and then north on Tannehill Drive and back to Ferretti Road via Mueller Drive. Temporary traffic calming measures (i.e., undulations) were installed on Tannehill Drive. This detour would have the effect of increasing the traffic volume on those roads but would not be expected to alter traffic volumes at locations in Pine Mountain Lake to the east.

Traffic Volumes. Figure 1 (attached) illustrates the location of 32 traffic volume counts conducted for this assessment. Traffic volumes only were collected at 8 locations where speed information would be irrelevant (i.e., locations near gates or intersections) while volume and speeds were recorded at another 24 locations.

Table 2 below identified the 24 hr volume recorded at each location and ranks the volume from highest to lowest. To a degree the high traffic volumes on streets in the west end of the community result from the detour. As indicated the highest volume was observed at the Pine Mountain Drive gate, where more than 4,000 vehicles per day (vpd) were observed with the detour in place. A great share of that traffic turned onto Tannehill Drive, as indicated by the volume on that route (i.e., nearly 3,000 vpd) and the reduced volume on Pine Mountain Drive in the area just west of Grizzly Circle (i.e., 2,048 vpd). Mueller Drive was also affected with more than 1,700 vpd west of Tannehill Drive and 656 vpd between that intersection and Oak Grove Circle.

Elsewhere the daily volume on Pine Mountain Drive ranged from 737 vpd to 1,709 vpd, while Mueller Drive carried 598 to 656 vpd. The volumes on Local Streets ranged from 41 to 149 vpd.

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**TABLE 2
 PINE MOUNTAIN LAKE COMMUNITY
 DAILY TRAFFIC VOLUMES**

#	Street	Location	Classification	Daily Volume (vpd)
1	Pine Mountain Drive	East of Elder Lane	Collector	4,056
S23	Tannahill Drive	South of Salvador Court	Collector	2,996
S1	Pine Mountain Drive	West of Grizzly Circle	Collector	2,048
2	Mueller Drive	West of Tannahill Drive	Collector	1,710
S2	Pine Mountain Drive	West of Mills Street	Collector	1,709
S3	Pine Mountain Drive	West of Lower Skyridge Drive	Collector	1,582
S4	Pine Mountain Drive	West of Ridgecrest Way (West)	Collector	1,383
S5	Pine Mountain Drive	West of Ridgecrest Way (east)	Collector	1,292
S7	Pine Mountain Drive	South of Longridge Court	Collector	1,142
S10	Pine Mountain Drive	West of Boitano Road	Collector	769
7	Pine Mountain Drive	South of Ferretti Road	Collector	766
S11	Pine Mountain Drive	North of Longview Street	Collector	737
S19	Mueller Drive	West of Oak Grove Circle	Collector	656
S18	Mueller Drive	West of Pleasant View Drive	Collector	598
S22	Pleasant View Drive	West of Chaffee Circle	Collector	503
S17	Mueller Drive	West of Jackson Mill Drive	Collector	398
3	Mueller Drive	South of Ferretti Road	Collector	389
S13	Clements Road	North of Beaver Court	Public	385
S21	Pleasant View Drive	West of Mt Jefferson Street	Collector	344
S16	Mueller Drive	South of Raboul Court	Collector	313
S20	Pleasant View Drive	West of Moonlight Court	Collector	291
9	Hemlock Street	North of Chaparral Court	Collector	266
S8	Cresthaven Drive	West of Eagle Court	Local	149
5	Rocky Point Drive	North of Ferretti Road	Local	143
S24	Hemlock Street	West of Woodside Way	Local	139
S12	Cresthaven Drive	East of Rising Hill Circle	Local	128
S6	Nonpareil Way	Point View Drive to Point View Drive	Local	119
S9	Rock Canyon Way	West of Crescent Way	Local	103
6	Cottonwood Street	South of Ferretti Road	Local	102
4	Cottonwood Street	South of Ferretti Road	Local	100
S15	Wells Fargo Drive	East of James Circle (east)	Local	53
S14	Cottonwood Street	South of Ferretti Road	Local	41

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Travel Speeds. The methods for collecting travel speed data yield a broad range of statistics that might be considered but which may also confuse the issue. Speed data is available by hour of day and by direction, and the results can be categorized in terms of the share of the observations that fall within specific ranges. The most common range is the speed that is not exceeded by 85 percent of the drivers. This 85th percentile speed is the initial basis for selection of speed zones under the California Vehicle Code (CVC) and is therefore commonly reported. The median speed (50th percentile) that is exceeded by ½ of the drivers has also been identified. The method can also identify the highest observed speeds over the 24 hr period, and this data is grouped within 5 mph ranges.

Table 3 summarizes our speed survey results. The highest speeds on Local Streets occurred on Cresthaven Drive where the 85th percentile speed was 34 mph.

The speeds on Collector Streets varied. As shown, the highest speeds were observed on Hemlock Street. This street follows a straight alignment with a relatively long distance between driveways, and the 85th percentile speed reached 44 mph. The 85th percentile speeds on Pine Mountain Drive ranged from a low of 31 mph to a high of 37 mph. On Mueller Drive the 85th percentile speed ranged from a low of 26 mph to a high of 35 mph. The 85th percentile speeds on Pleasant View Drive ranged from 32 mph to 37 mph.

Traffic Controls. In addition to centerline striping on Collector streets, stop signs are the most common form of traffic controls in Pine Mountain Lake. Typically side-street stop signs control the minor street approach and traffic on the major street proceeds without stopping, however, there are All-Way Stop controlled intersections at these locations:

- Pine Mountain Drive / Cassaretto Court (Marina)
- Pine Mountain Drive / Cresthaven Drive / Lake Lodge Access
- Pleasant View Drive / Dunn Court (Beach)

TABLE 3
PINE MOUNTAIN LAKE COMMUNITY
TRAVEL SPEED SURVEY RESULTS
(10/2/2018)

#	Street	Location	Classification	50 th Percentile Speed (mph)	85th Percentile Speed (mph)	Maximum Observed Speed # of Vehicles - (mph range)
S24	Hemlock Street	West of Woodside Way	Collector	35	44	2 – (50-54)
S1	Pine Mountain Drive	West of Grizzly Circle	Collector	32	37	10 - (45- 49)
S22	Pleasant View Drive	West of Chaffee Circle	Collector	31	37	7 – (45 – 49)
S20	Pleasant View Drive	West of Moonlight Court	Collector	30	37	15 – (40 – 44)
S2	Pine Mountain Drive	West of Mills Street	Collector	31	36	9 – (45- 49)
S13	Clements Road	North of Beaver Court	Public	30	36	3 – (45-49)
S3	Pine Mountain Drive	West of Lower Skyridge Drive	Collector	30	35	28 – (40 – 44)
S5	Pine Mountain Drive	West of Ridgecrest Way (east)	Collector	31	35	5 – (45- 49)
S18	Mueller Drive	West of Pleasant View Drive	Collector	29	35	4 – (45- 49)
S7	Pine Mountain Drive	South of Longridge Court	Collector	30	34	11 – (40 – 44)
S12	Cresthaven Drive	East of Rising Hill Circle	Local	27	34	11 – (35-39)
S4	Pine Mountain Drive	West of Ridgecrest Way (West)	Collector	28	33	5 – (40-44)
S9	Rock Canyon Way	West of Crescent Way	Local	27	33	7 – (35 – 39)
S23	Tannahill Drive	South of Salvador Court	Collector	27	32	3 – (45 – 49)
S11	Pine Mountain Drive	North of Longview Street	Collector	27	32	18 – (35 – 39)
S21	Pleasant View Drive	West of Mt Jefferson Street	Collector	27	32	4 – (40 – 44)
S10	Pine Mountain Drive	West of Boitano Road	Collector	27	31	3 – (35 – 39)
S6	Nonpareil Way	Point View Drive to Point View Drive	Local	26	31	3 – (35 – 39)
S16	Mueller Drive	South of Raboul Court	Collector	26	29	26 – (30 - 34)
S19	Mueller Drive	West of Oak Grove Circle	Collector	23	28	6 – (35 – 39)
S8	Cresthaven Drive	West of Eagle Court	Local	23	28	7 – (30 – 34)
S15	Wells Fargo Drive	East of James Circle (east)	Local	20	27	2 – 30 – 34)
S14	Cottonwood Street	South of Ferretti Road	Local	22	27	9 – (25 – 29)
S17	Mueller Drive	West of Jackson Mill Drive	Collector	22	26	7 – (30 – 34)

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Evaluation Criteria

Our assessment of the Pine Mountain Lake Circulation System is intended to address issues which relate to safety, quality of traffic flow, PMLA liability, convenience for residents and guests and general quality of life. The methods and guidelines used to evaluate these issues are discussed in the sections which follow.

Safety. We primarily considered the issues of intersection sight distance, pedestrian / bicycle / vehicular conflicts and roadway alignment. Sight distance requirements are governed by the Caltrans Highway Design Manual and deal with the minimum stopping sight distance (Table 201.1) and corner sight distance (Table 503.2b). Minimum Stopping Sight Distance is the view needed to identify an obstacle and to then bring a vehicle to a stop. Corner Sight Distance is the view needed for a waiting motorist to enter an intersection by turning left and get up to speed without requiring an approaching vehicle to maneuver to avoid a conflict. Caltrans guidelines indicate that while corner sight distance requirements should be met at public road intersections, the stopping sight distance requirement is the minimum for private intersections.

TABLE 4 SIGHT DISTANCE GUIDELINES		
Design Speed (mph)	Stopping Sight Distance ¹ (feet)	Corner Sight Distance ² (feet)
25	150	275
30	200	330
35	250	385
40	300	440
45	360	495
50	430	550
¹ HDM Table 201.1		
² based on HDM section 405.1 (2) a.		

Quality of Traffic Flow. Local agencies typically evaluate the flow of traffic at intersections and on roadway segments in terms of the operating *Level of Service*. Level of Service (i.e., LOS) is a quantitative measure where by a letter grade (i.e., A-F) can be assigned to a facility in response to progressively worsening traffic flow conditions. Agencies typically adopt minimum Level of Service standards for public roads in order to plan circulation system improvements or to evaluate the impacts of new development. For example, Tuolumne County’s General Plan identifies Level of Service for local and residential roads at LOS C, while the minimum standard for Minor/Major Collectors, Arterial and Urban Streets is LOS D.

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Methods exist to determine the Level of Service at intersections and on roadway segments. The most commonly used methods are contained in the Highway Capacity Manual. At intersections, LOS methods determine the average delay associated with waiting vehicles based on the hourly capacity of various traffic controls. On roadway segments the Level of Service can be calculated based on many factors such as hourly volume, roadway alignment, passing opportunities, truck percentage, etc. However, to simplify planning level evaluation many agencies adopted general guidelines for Level of Service based on daily traffic volumes. For example, the Tuolumne County Transportation Council (TCTC) has adopted such thresholds for the most recent Regional Transportation Plan (RTP) update. These guidelines suggest that a “local road” in rolling rural terrain could carry 5,760 vpd at their minimum LOS C, while a Major/Minor collector 20 to 23 feet wide could handle 7,770 vpd at LOS C and 11,008 vpd at LOS D.

These thresholds have been contrasted to the results of Pine Mountain Lake traffic volume counts to determine whether this metric is a useful tool for this assessment. Because the minimum volume thresholds far exceed current October traffic volumes, unless the PMLA decides to pursue subsequent analysis of seasonal peak conditions at intersections, Level of Service is not an important issue during the time periods we gathered data. We understand that traffic conditions are different in the summer, and the PMLA may wish to revisit this issue using summer data.

PMLA Liability. Agencies typically make decisions regarding its roadway system in response to best engineering practices in order to ensure public safety and to minimize its liability when collisions inevitably occur. In addition to the direction contained in the Caltrans Highway Design Manual, guidance for installing various traffic control devices is found in the *Manual of Uniform Traffic Control Devices (MUTCD)*. Agencies typically consider the MUTCD when deciding to install traffic control devices including signs, pavement markings, stop or yield controls and traffic signals.

Speed limits in California are governed by the *California Vehicle Code (CVC)*, and the California Manual on Uniform Traffic Control Devices (CA MUTCD) outlines Standards, Guidance and Options for establishing speed limits which can be enforced using radar. CVC Section 22352 sets the prima facie speed limits in California and these speed limits apply when no other specific speed limit is posted. A 25 mph speed limit is applicable to business and residential districts without other posted speed limits and to school zones. CVC Section 22349 sets a maximum speed limit for all California roadways which is 55 mph on 2-lane undivided roadways. Any deviation of speed limits upwards or downwards from these limits must be justified by an Engineer & Traffic Survey (E&TS). When an E&TS shows that the statutory or prima facie speed limits are not applicable for the existing conditions, the speed limits can be altered by posting a different limit based upon the findings of the E&TS.

Speed limits set by the findings of an E&TS are normally set near the 85th percentile speed. This is the speed at or below which 85% of the free-flowing traffic is moving. Use of the measured 85th percentile speed for posting speed limits is based upon the premise that the majority of drivers comply with the basic speed law and consider this speed reasonable and prudent for given conditions. Speed limits set at or near the 85th percentile speed provide law enforcement officers with a limit to cite drivers who do not conform to what the majority considers reasonable and prudent.

Convenience for Residents and Guests / Quality of Life. Persons residing along streets and roads often perceive issues that affect their “quality of life” when streets carry traffic volumes that are far below the Level of Service capacity of a road. For example, accessing streets from private driveways can become

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increasingly problematic as the traffic volume rises, particularly when backing maneuvers are required. Traffic noise can also be objectionable.

Although no formal guidelines exist to define traffic volumes or speeds that are “acceptable”, many communities pursue “traffic calming” measures that attempt to slow traffic through neighborhoods or to divert traffic to other streets. In turn, best practices have been created to identify the conditions that best support installation of traffic calming devices in terms of traffic volumes and speeds. The Institute of Transportation Engineers (ITE) has assembled guidelines for these features and many agencies have customized these guidelines into a “toolbox” of potential actions. Because the roadway characteristics of Placer County are similar to those of the south Tuolumne County its Neighborhood Traffic Management Program has been used a reference materials for this assessment.

Evaluation

We considered several issues in evaluating the adequacy of the Pine Mountain Lake circulation system and subsequently considering management improvements.

Are the Speed Limits on Pine Mountain Lake roads applicable and should the PMLA consider adopting new limits that could be enforced?

We considered two issues with regard to speeds. First, is there a safety issue associated with the layout of the streets that is remedied or exacerbated by the 25 mph limit? Second, were observed speeds themselves consistent with the current limit?

As noted earlier, sight distance along Pine Mountain Lake’s streets is an issue. As part of our review we drove the collector streets and key local streets and identified those locations where it appeared that sight distance might be limited, either due to the alignment of the road or due to adjoining topography or landscaping. As is noted in the discussion of specific intersections that follows later in this report, most intersections were probably intended to provide 275 feet of sight distance which would have satisfied the corner sight distance requirement at 25 mph and the minimum sight distance at more than 35 mph.

The speed survey results provide a general indication of the speed zones that could be enforceable in Pine Mountain Lake should the PMLA elect to enter into an agreement for enforcement under the CVC, as noted in Table 5. These initial indications are not indicative of the results of an E&TS, as enforceable limits require individual radar speed surveys as well as consideration of the collision history and physical features in each area. It is also important to note that the radar speed surveys conducted for a short duration in the midday may be different from the results of 24-hour data collection. A change in 85th percentile speed of 1 mph in either direction could alter the allowable speed limit.

CVC requirements allow the 85th percentile speed to be rounded up or down to the nearest 5 mph increment. Subsequently the engineer is allowed to further reduce the limit by 5 mph in response to conditions on the roadway that are not readily apparent to motorists. While the presence of such conditions has not been established, Table 5 indicates the range of possible speed limits under these procedures. This information is also shown in Figure 2. The lowest speed limit would be allowed based on this reduction assuming the 85th percentile speed does not change and that justification for the 5 mph reduction exists. When a range is presented, the higher value results from the assumption that the radar

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results may be 1-2 mph greater. It is important to note that the actual speed zones that may eventually be adopted will consolidate the individual segments in a consistent manner. For example, the three areas along Pleasant View Drive would have the same limit even though the speed on one individual segment may be lower than the rest.

As noted earlier, the CVC allows establishment of a 25 mph prima facie limit in “residential zones”. The mere presence of a house does not qualify an area as a “residential zone”, and the CVC defines a “residential zone” based on the relative density of dwellings. A minimum of 13 dwellings on one side of a ¼ mile long segment or 16 dwellings along two sides is required. This density is generally equivalent to a dwelling every 100 feet (two sides) or 125 feet (one side), and this density can be difficult to achieve in rural communities. Because Pine Mountain Lake is not fully built out, the number of dwellings is not equal to the number of lots in many areas. The CVC also disqualifies streets classified as arterials or collectors from the residential zone definition. While Pine Mountain Lake does not have a formal street classification system to guide that decision, it is reasonable to expect that a court would interpret streets such as Pine Mountain Drive as being collectors.

We reached the following initial conclusions about possible speed zones.

- If the final radar speed studies are consistent with the results of our pneumatic tube measurements, then many locations on collector streets could not be set with limits any lower than 30 mph.
- There were locations on Pine Mountain Drive north of Big Creek where the 85th percentile speed would justify a 25 mph limit, which is generally consistent with the sight distance limitations we observed at some intersections in that area.
- Many local streets experienced 85th percentile speeds that will support 25 mph limits.
- However, of the local streets that were surveyed, two had 85th percentile speeds that would require setting limits above 25 mph.
- Of those two local streets, only one (Cresthaven Drive) appears to have the residential density needed to support a 25 mph prima facia limit.

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**TABLE 5
PINE MOUNTAIN LAKE COMMUNITY
POTENTIAL SPEED LIMIT UNDER CALIFORNIA VEHICLE CODE REQUIREMENTS**

#	Street	Location	Classification	Daily Traffic (vpd)	85th Percentile Speed (mph)	Range of possible posted speed limit (mph)
S24	Hemlock Street	West of Woodside Way	Collector	139	44	40
S1	Pine Mountain Drive	West of Grizzly Circle	Collector	2,048	37	35-30
S22	Pleasant View Drive	West of Chaffee Circle	Collector	503	37	35-30
S20	Pleasant View Drive	West of Moonlight Court	Collector	291	37	35-30
S2	Pine Mountain Drive	West of Mills Street	Collector	1,709	36	35-30
S13	Clements Road	North of Beaver Court	Public	385	36	35-30
S3	Pine Mountain Drive	West of Lower Skyridge Drive	Collector	1,582	35	30
S5	Pine Mountain Drive	West of Ridgecrest Way (east)	Collector	1,292	35	30
S18	Mueller Drive	West of Pleasant View Drive	Collector	598	35	30
S7	Pine Mountain Drive	South of Longridge Court	Collector	1,142	34	30
S12	Cresthaven Drive	East of Rising Hill Circle	Local	128	34	30 (25 PF)
S4	Pine Mountain Drive	West of Ridgecrest Way (West)	Collector	1,383	33	30
S9	Rock Canyon Way	West of Crescent Way	Local	103	33	30
S23	Tannahill Drive	South of Salvador Court	Collector	2,996	32	30-25
S11	Pine Mountain Drive	North of Longview Street	Collector	737	32	30-25
S21	Pleasant View Drive	West of Mt Jefferson Street	Local	344	32	30-25
S10	Pine Mountain Drive	West of Boitano Road	Collector	769	31	25
S6	Nonpareil Way	Point View Dr to Point View Dr	Local	119	31	25
S16	Mueller Drive	South of Raboul Court	Collector	313	29	25
S19	Mueller Drive	West of Oak Grove Circle	Collector	656	28	25
S8	Cresthaven Drive	West of Eagle Court	Local	149	28	25
S15	Wells Fargo Drive	East of James Circle (east)	Local	53	27	25
S14	Cottonwood Street	South of Ferretti Road	Local	41	27	25
S17	Mueller Drive	West of Jackson Mill Drive	Collector	398	26	25

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What should the Pine Mountain Lake community's expectations be for speeds on its streets?

Typically, local streets operating under the prima facie 25 mph limit carry most traffic in the range of 20 mph to 30 mph. Thus, 85th percentile speeds that approach 30 mph on local streets are not uncommon. The expectation that everyone will drive within the 25 mph limit is unreasonable.

Anticipated speeds increase as the functional classification of the street increases, typically as the result of higher design standards for alignment or width, as well as the greater distance traveled. The speeds of most drivers on Pine Mountain Lake collector streets are not unusual.

However, as was noted in Table 5, there are isolated instances of motorists traveling at high rates of speed. These "outliers" would be the target of any program that was implemented to better manage traffic flow.

Could traffic calming measures be considered?

"Traffic calming" involves physical measures, programs or information to drivers that is intended to slow traffic. A broad range of options has been created over the years, although most are more suitable for urban rather than rural areas due to the shorter distances involved and the presence of urban edge of pavement features (i.e., curbs).

The "toolbox" of traffic management devices can be grouped into three categories, and not every option is suitable for a rural area. Illustrations of these methods are attached to this report and include:

- Non-Physical Devices
 - Target Speed Enforcement
 - Speed Radar Trailers
 - Speed Feedback Signs
 - Centerline / Edgeline Lane Striping
 - Optical Speed Bars
 - Signage
 - Speed Pavement Legend
 - Centerline Botts Dots
 - High Visibility Crosswalks
 - Angled Parking

- Speed Control
 - Narrowing Devices
 - Neckdown/Bulbout
 - Center Island Narrowing
 - Two-lane Choker
 - One-lane Choker
 - Horizontal Devices
 - Traffic Circle
 - Roundabouts
 - Chicane

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- Lateral Shift
- Realigned Intersection
- Vertical Devices
 - Speed Hump
 - Speed Lump
 - Speed Cushion
 - Speed Table
 - Raised Crosswalk
 - Rumble Stripe
 - Raised Intersection
 - Textured Pavement
- Volume Control Devices
 - Full Closure
 - Partial Closure
 - Diagonal Diverter
 - Median Barrier
 - Forced Turn Island
 - Turn Movement Restriction

It is important to note that installation of all-way stop controls is not included in the list of traffic calming treatments. The engineering profession recognizes that these traffic control devices are applicable based on traffic volume requirements noted in the MUTCD warrants or as determined in response to specific safety concerns. Installation of unwarranted all-way stops where motorists do not recognize the need for this treatment can lead drivers to ignore the specific control and eventually to create a general disregard for traffic controls elsewhere.

Of these features, standard practice has identified options that can be suitable within various volume and speed ranges within collector and local classifications, as well as those elements that are not practical at higher elevations due to snow and ice. Non-physical features are acceptable on both local and collector streets. Most physical speed control measures are not applicable to collector streets due to the need to ensure adequate emergency response. Similarly, installation of physical treatments at elevations above 2,000 feet is often not acceptable due to potential safety concerns and snow removal.

Public agencies that administer traffic calming programs have determined that a high degree of community and neighborhood support is necessary for successful implementation. For example, at the local level, the residents directly affected by any inconvenience caused by the calming measures often need to publicly declare their support.

For Pine Mountain Lake's collector streets, the most effective action would be enforcement of legal speed limits. To be effective this would require establishing legal speed limits and entering into an enforcement agreement with a public agency capable of enforcing the limits and administering a process to penalize violators. Tuolumne County currently contracts with the CHP for enforcement of speed limits on public roads, and the County could be asked to expand the program to include Pine Mountain Lake in such a program. The costs associated with the program and the level of commitment that could be made to Pine Mountain Lake's streets would need to be determined.

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Alternative methods for enforcing speed limits were considered. In some locations in the U.S. “speed cameras” are used to identify violations and simultaneously record the vehicle license number. In concept, this mechanism would allow violators to be ticketed without the regular presence of an officer. However, the number of states where this enforcement method is permitted is limited. Nationwide 146 communities have speed camera programs. However, while California has permitted red light cameras at intersections, no state law or ordinance permits speed camera enforcement.

Within the context of legal actions, radar speed feedback signs that inform the driver of his speed along with speed zone pavement markings would appear to be the most logical solutions for collector streets.

Pine Mountain Lake could consider implementing traffic calming measures on local streets, although with limited exceptions the speed we have observed would not warrant traffic calming. All Non-physical alternatives are available as they are not constrained by speed, volume or elevation. However, measures to control speed by narrowing roadway width, horizontally shifting lanes or installing vertical features may be infeasible if snow removal is an issue.

The local streets providing access to the less dense portions of Pine Mountain Lake north of Ferretti Road carry traffic at the highest speeds. Review of traffic calming guidelines reveals that physical measures are typically unacceptable on streets with speed limits that are greater than 35 mph. Thus streets such as Hemlock Street with high 85th percentile speeds would not be candidates for these types of actions.

What localized safety issues need to be considered by PMLA?

Locally, there are intersections in Pine Mountain Lake where sight distance is limited either because of the vertical/horizontal alignment of approaching streets or due to obstructions. These locations were identified in response to comments from PMLA staff as well as from our field review. Information regarding each location is noted Table 6.

As indicated, while the view may be somewhat limited the available sight distance appears for the most part to satisfy minimum sight distance requirements for speed limits of 25 mph (150 feet) or 30 mph (200 feet). As noted earlier, because corner sight distance requirements are greater than the minimum (i.e., 275 feet at 25 mph and 330 feet at 30 mph) it is very likely the residents waiting to turn could be “uncomfortable” entering the street when a shorter gap is available.

Two locations did exhibit sight distances which fell below the minimum sight distance standard. At these locations PMLA could face liability if a collision occurred. A pair of above ground electrical vaults exists on the southeast corner of the **Pine Mountain Drive / Big Foot Circle (N)** intersection and reduces the view for westbound drivers entering the intersection to about 90 feet. While it is possible to increase the distance by creeping into the intersection, the view does not satisfy the minimum standard for 25 mph or 30 mph.

In this case the remedy would involve removing the obstructions or installing alternative traffic control. While the volume of traffic at the intersection falls below MUTCD guidance for an All-Way stop, the MUTCD allows use of an all-way stop to remedy sight distance problems, and this action could be applicable if the obstructions cannot be moved. Advance warning signs would also be needed with an All-Way stop because of the curve in the alignment of Pine Mountain Drive through this area.

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The second location with deficient sight distance is on **Pleasant View Drive at Chaffee Circle (W)**. At this location a waiting motorist's view is obstructed by junipers on the northwest corner. The sight distance is about 120 feet which falls below the 150 foot minimum at 25 mph. Reconstructing the corner to increase the sight distance would be preferable in lieu of an all-way stop. In this case the traffic volume is so low that motorists could be inclined to disregard the all-way stop.

The extent to which measures to improve conditions at other locations was considered. Ideally the intersection of a collector street and another collector street should satisfy corner sight distance requirements, although the HDM indicates that only minimum stopping sight distance needs to be met on private streets. At the **Mueller Road / Pleasant View Drive** intersection the location within a relatively tight curve could justify the need for corner sight distance and would justify an all-way stop.

Pedestrian Crossing. Under the CVC legal pedestrian crossings exist at all intersections whether marked or unmarked. In Pine Mountain Lake a marked crosswalk exists on Pine Mountain Drive near the Rock Canyon Drive (N) intersection. This crosswalk is associated with the multipurpose trail that traverses the area of the tennis courts between Fisherman's Cove and the park area along Rock Canyon Drive.

The layout of the crosswalk is intended to provide a relatively direct extension of the trail. As a result the crosswalk is not necessarily aligned with the edge of the intersecting roadway at the intersection. In a location where formal curb returns were present the crosswalk might be moved to be more closely aligned with the intersection, but there is no legal requirement to do so under the CVC. The sight distance from the crosswalk satisfies the minimum stopping distance requirement and would not be appreciably changed by moving the crosswalk slightly. We do not recommend moving the crosswalk.

Conditions on Pine Mountain Drive bridge over Big Creek. We understand from discussion with PMLA staff that the bridge regularly becomes icy in the winter. A pavement overlay intended to deal with that issue has been installed, and a warning sign noting the presence of ice on the bridge has been installed. PMLA staff have asked whether additional measures are needed and whether the vertical alignment of Pine Mountain Drive on a downhill grade as it approaches the bridge should be a factor in the consideration of speed limits on Pine Mountain Drive.

As noted earlier, if an enforceable speed limit is to be installed on Pine Mountain Drive it would likely be 30 mph in the general area from the western Ferretti Road gate across Big Creek to a point between Boitano Road and Longridge Court. We believe that with warning signs the conditions on the bridge would not be a factor that required further reduction between the 30 mph limit.

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**TABLE 6
SIGHT DISTANCE DEFICIENCY SUMMARY**

Street	Street	Approach Direction	Available Sight Distance (feet)	Minimum Standard (feet)	Cause / Remedy
Pine Mtn Drive	Big Foot Circle (N)	Westbound	90	200	Electrical box - curve / install all-way stop
Pine Mtn Drive	Cresthaven Drive	Southbound	200	150	
Pine Mtn Drive	Rock Canyon Way (S)		225	150	Junipers along ROW
Pine Mtn Drive	Rock Canyon Way (N)	Eastbound	200	200	Vertical curve
Pine Mtn Drive	Longview Street	Eastbound	225	200	Embankment / vertical curve
Pleasant View Drive	Chaffee Circle (W)	Southbound	120	150	Junipers / remove obstruction
Mueller Drive	Pleasant View Drive	Westbound	200	200	Tight curve / install all-way stop
Mueller Drive	Jackson Mill Drive (S)	Eastbound	220	200	Embankment
Mueller Drive	Wells Fargo Drive	Westbound	200	150	Embankment

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Next Steps / Recommendations

PMLA shows:

1. Consider the ramifications of implementing enforceable speed zones and determine whether that is a course of action the PMLA wishes to pursue.
2. If PMLA elects to pursue enforceable speed limits, then conduct applicable Engineering and Traffic Survey to confirm the speed limits.
3. Approach Tuolumne County regarding implementation of speed enforcement in Pine Mountain Lake, and if acceptable enter into an agreement.
4. If PMLA does not elect to pursue enforceable limits then consider using radar feedback signs to inform motorists of their speed, along with speed limit pavement markings.
5. Address identified sight distance problems where the available sight distance does not meet minimum standards.
6. Consider addressing corner sight distance limitations at collector street / collector street intersections.
7. Evaluate the results of local street survey results to determine where there is community interest in traffic calming.

Thank you for considering our firm for this assignment. Please feel free to contact me if you have any questions.

Sincerely,

KD Anderson & Associates, Inc.



Kenneth D. Anderson, P.E.
President

Attachments: Figures, Traffic Volume and Speed Data,
Traffic Calming Information, Study Intersections

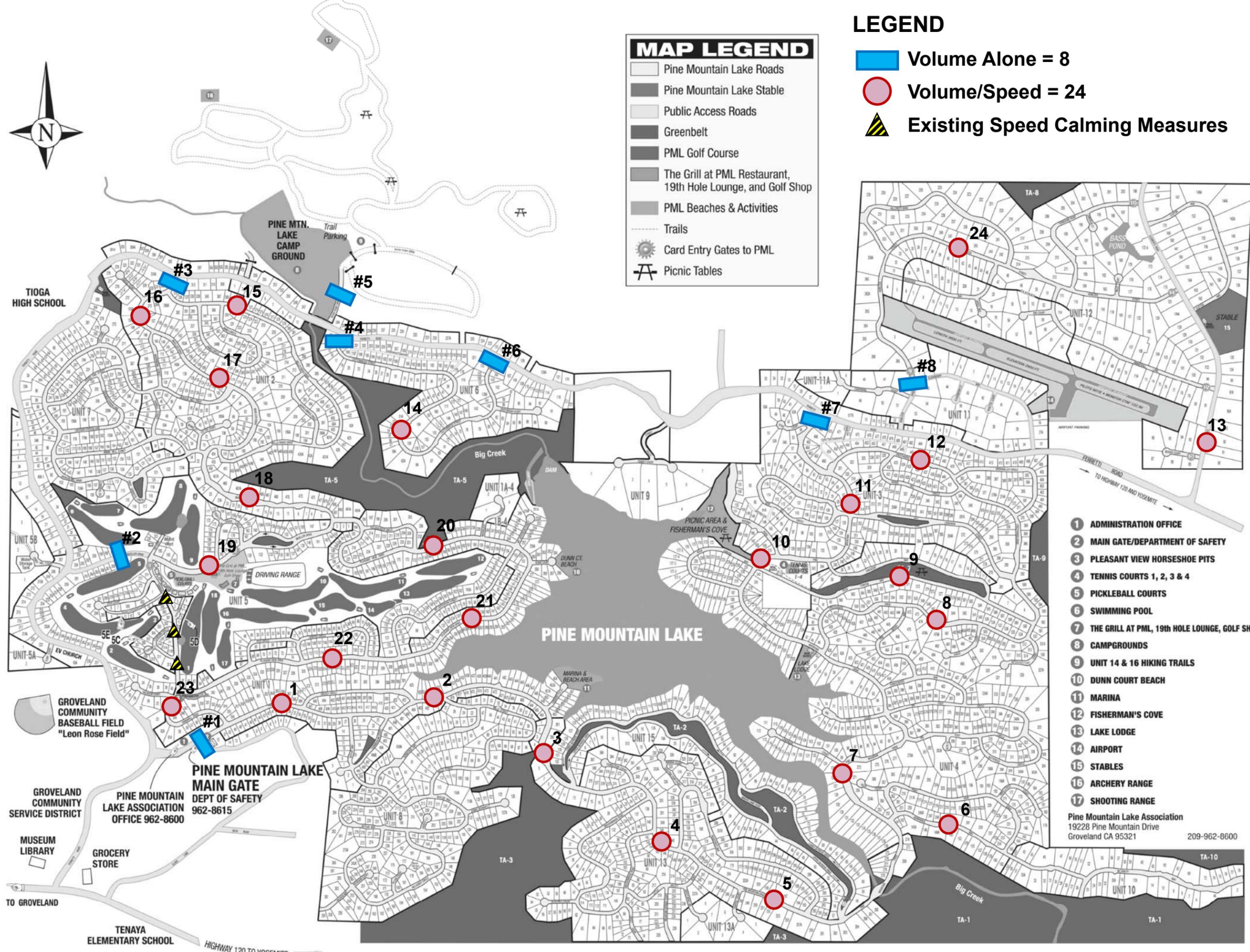


LEGEND

- Volume Alone = 8
- Volume/Speed = 24
- Existing Speed Calming Measures

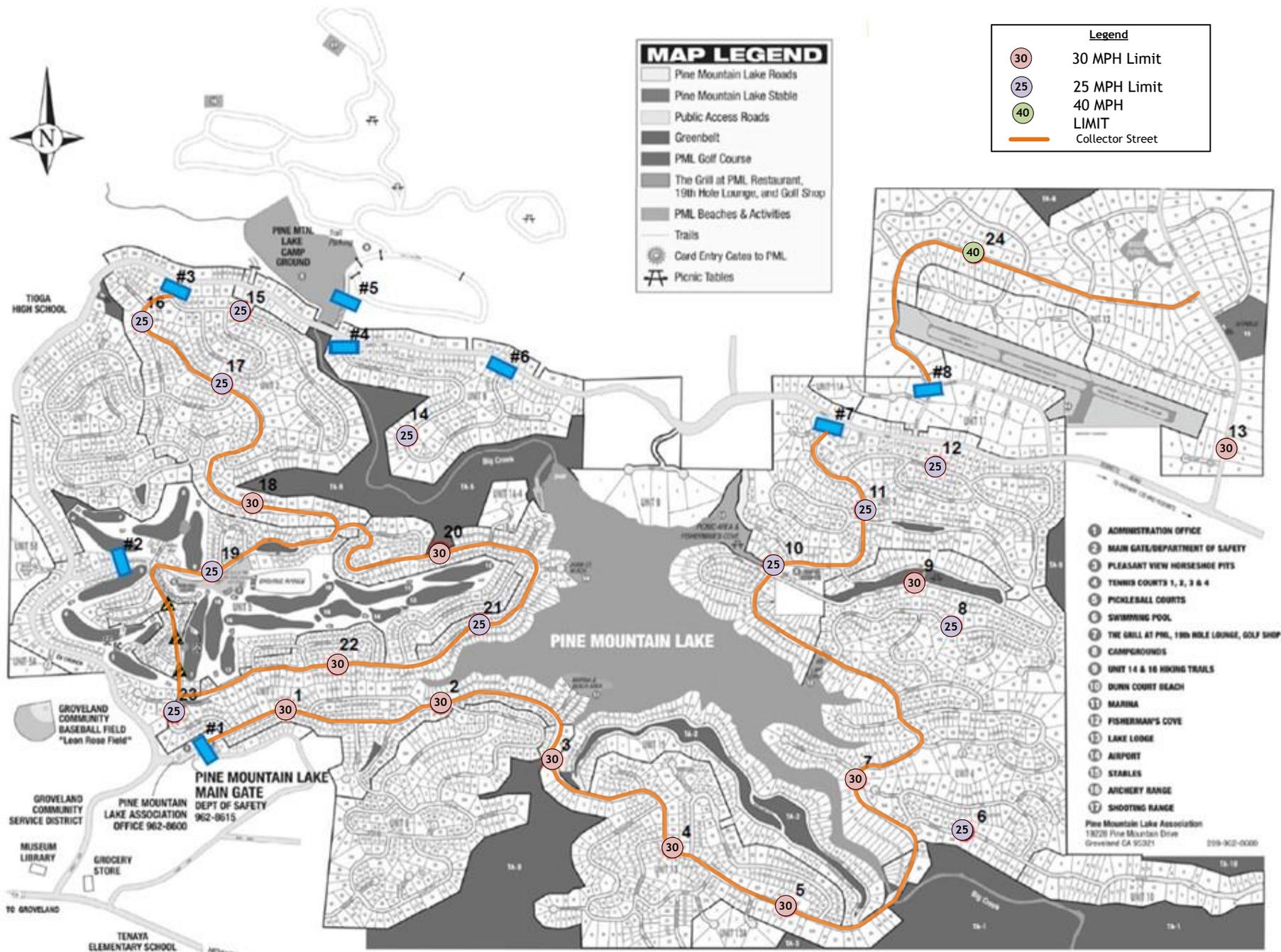
MAP LEGEND

- Pine Mountain Lake Roads
- Pine Mountain Lake Stable
- Public Access Roads
- Greenbelt
- PML Golf Course
- The Grill at PML Restaurant, 19th Hole Lounge, and Golf Shop
- PML Beaches & Activities
- Trails
- Card Entry Gates to PML
- Picnic Tables



- 1** ADMINISTRATION OFFICE
- 2** MAIN GATE/DEPARTMENT OF SAFETY
- 3** PLEASANT VIEW HORSESHOE PITS
- 4** TENNIS COURTS 1, 2, 3 & 4
- 5** PICKLEBALL COURTS
- 6** SWIMMING POOL
- 7** THE GRILL AT PML, 19th HOLE LOUNGE, GOLF SHOP
- 8** CAMPGROUNDS
- 9** UNIT 14 & 16 HIKING TRAILS
- 10** DUNN COURT BEACH
- 11** MARINA
- 12** FISHERMAN'S COVE
- 13** LAKE LODGE
- 14** AIRPORT
- 15** STABLES
- 16** ARCHERY RANGE
- 17** SHOOTING RANGE

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LOWEST POSSIBLE SPEED LIMITS