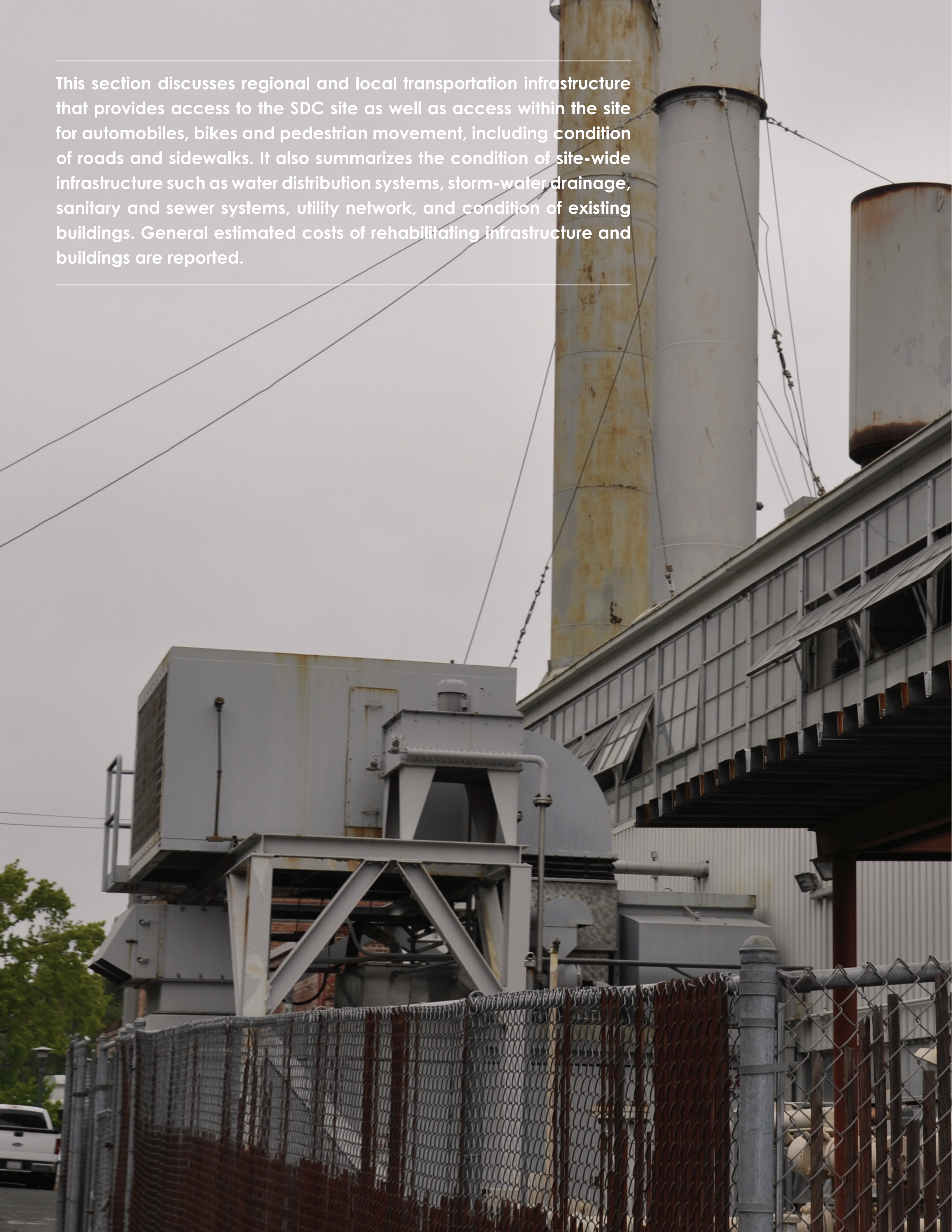
7. BUILDINGS + INFRASTRUCTURE

This section discusses regional and local transportation infrastructure that provides access to the SDC site as well as access within the site for automobiles, bikes and pedestrian movement, including condition of roads and sidewalks. It also summarizes the condition of site-wide infrastructure such as water distribution systems, storm-water drainage, sanitary and sewer systems, utility network, and condition of existing buildings. General estimated costs of rehabilitating infrastructure and buildings are reported.



7.1 Regional Transportation Context

Sections 7.1 and 7.2 provide an overview of the existing transportation environment in and around the Sonoma Developmental Center (SDC) site. The analysis will serve as a basis for identifying constraints and opportunities to improve access and circulation. The information is based on multiple site visits conducted by Nelson\Nygaard, and on review of existing and available plans, studies, and data, including the Sonoma County General Plan 2020, the Sonoma County Transportation Plan, and the Sonoma County Bicycle Plan. These sections draw on the more detailed Sonoma Developmental Center Mobility Assessment: Existing Conditions (Nelson\Nygaard, May 2018), included as Appendix E.

ROADWAYS AND TRAVEL PATTERNS

SDC is located on Arnold Drive, immediately south of Glen Ellen and just over six miles north of the town of Sonoma. This rural location, in the north end of the Sonoma Valley, is surrounded by open space, agricultural land, and sparse residential and commercial development scattered around a few town centers to the north and south. The city of Santa Rosa is 15 miles northwest of the SDC site, and the rest of the more densely developed Highway 101 corridor is on the other side of Sonoma Mountain. With fewer regional employment and commercial destinations nearby, and with a much smaller local population than the cities along the Highway 101 corridor, this area generates very few trips relative to the rest of Sonoma County. Most of the commute trip activity is located in cities along the Highway 101 corridor. Based on the county's projected 2035 trip volumes for the town of Sonoma, the nearest incorporated area to the SDC site, we can infer that Sonoma Valley trips make up a small portion of total regional travel.

Figure 7-1 illustrates forecasted commute patterns for trips originating in Sonoma County cities and towns, using Sonoma County Travel Model 2035 projections.

Figure 7-2 shows the destinations of trips that originate in the SDC area.

Figure 7-3 shows the origins of trips whose destination is the SDC area.

The intersection of Highways 121 and 37, south of the town of Sonoma, provides a connection to Napa and Marin counties, and is a known pinch point for commute traffic within the regional highway network. However, travel patterns illustrated by the travel model suggest that SDC does not make a significant contribution to regional commute trips at the Highway 121/Highway 37 intersection. This aligns with expectations based on the local population and land development density – the existing land uses on and around the SDC project site do not generate a high volume of trips relative to the other population and employment centers connected to the surrounding regional road network in Sonoma, Marin and Napa counties.

Regional travel behavior and traffic conditions are discussed in detail in the Sonoma Developmental Center Mobility Assessment Report. (reference to appendix)

SDC AREA ROADWAYS

Roads in the vicinity of the SDC site include Arnold Drive, Warm Springs Road, Madrone Road, and Agua Caliente Road West, all two-lane streets. In the Sonoma County General Plan 2020, these roads are classified as follows:

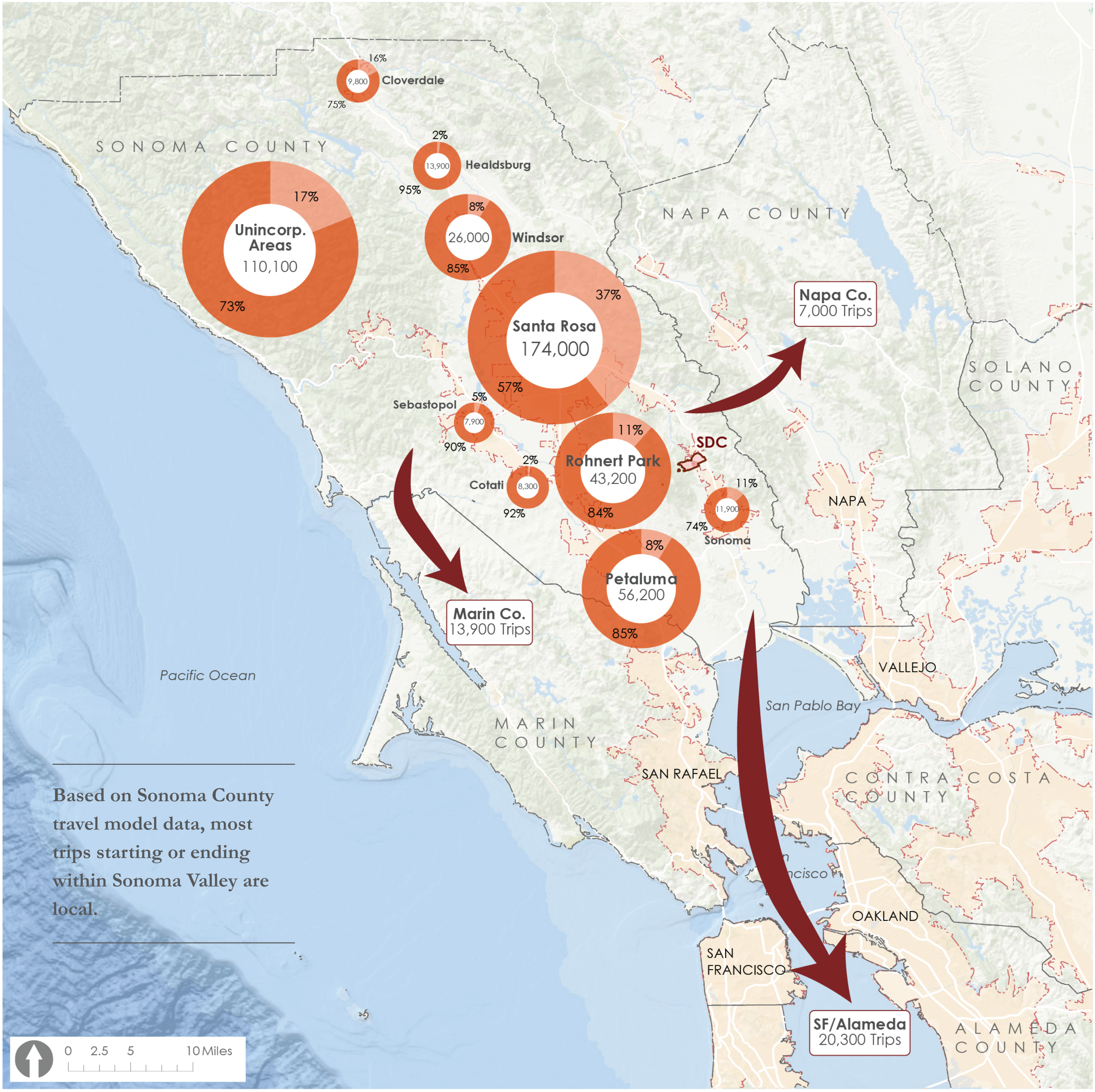
- Arnold Drive – Urban Major Collector between Warm Springs Road and Madrone Road, Urban Minor Arterial between Madrone Road and Petaluma Avenue
- Warm Springs Road – Rural Major Collector
- Madrone Road – Urban Minor Arterial
- Agua Caliente Road West – Urban Minor Arterial

Other roadways in the SDC area are not classified in the General Plan 2020 and are considered "local streets" that connect to these collector and arterial roadways. Most of these roadways do not include bicycle routes, with the exception of Madrone Road, which includes Class II striped bike lanes between Arnold Drive and Maplewood Drive.

The intersection of Harney and Arnold Drive provides direct access to the SDC site and is an All-Way STOP-Controlled (AWSC) intersection with a flashing red

Figure 7-1

SDC SONOMA COUNTY COMMUTE TRIP PATTERNS (2035)



SDC Property

County Boundary

Urbanized Areas

Commute Trip Patterns - 2035

Out of City Work Trips (within Sonoma County)

Internal City Work Trips

Out of County Work Trips (summarized for all Sonoma Co.)

xx,xxx *Total Number of Trips from Origin City (circles sized by total trips)*

xx% *Percent of Trip Type from Origin City*

Sources:
USGS, US Census Bureau, California Geoportal, GreenInfo Network, Sonoma Ecology Center

traffic signal. Directly north and south of Harney and Arnold Drive, the intersections of Holt Road/Arnold Drive and Wilson/Arnold Drive, respectively, provide additional access to SDC. Both of these T-intersections have side-street stops (Arnold Drive is free flow with no STOP signs or signals at these intersections).

TRAFFIC CONDITIONS

Existing vehicle traffic conditions were evaluated along select intersections on Arnold Drive near the SDC property, and along mainline segments of Arnold Drive adjacent to the site. This traffic operations analysis provides a picture of intersection capacity and current vehicle traffic conditions around the SDC site. Level of service (LOS) is a quantitative measure of traffic operating conditions, whereby a letter grade (LOS “A” – LOS “F”) is assigned to an intersection or roadway segment representing average delay based on vehicle volumes during peak periods [1].

Intersection Operations Analysis

Intersection vehicle turning movement counts were collected during weekday peak commute periods, and on a weekend. Because SDC’s location in the Sonoma Valley is surrounded by parks, trails, and wineries, the weekend traffic generated by recreation and tourist visitors is of interest, in addition to the standard weekday peak commute periods.

During both the weekday and weekend AM and PM peak hours, all of the study intersections operate at LOS A, B, or C, indicating very low vehicle delays and significant additional capacity. While weekend AM peak volumes are higher than weekday AM peak volumes at the sample intersections, the weekday PM peak volumes are consistently higher than both AM and PM peak volumes on weekends. Please refer to the Nelson/Nygaard study (Appendix E) for more detailed data.

Arnold Drive Segment Analysis

Daily 24-hour vehicle counts were collected for two segments north and south of the main SDC site entrance at Harney Drive: 1) Arnold Drive between Carolyn Day Trail and Holt Road, and 2) Arnold Drive between Wilson and Redwood. The 24-hour vehicle volume counts were collected on Wednesday, August 2, 2017, and on Saturday, April 14, 2018. As with intersection counts, the weekday volumes are higher than weekend volumes.

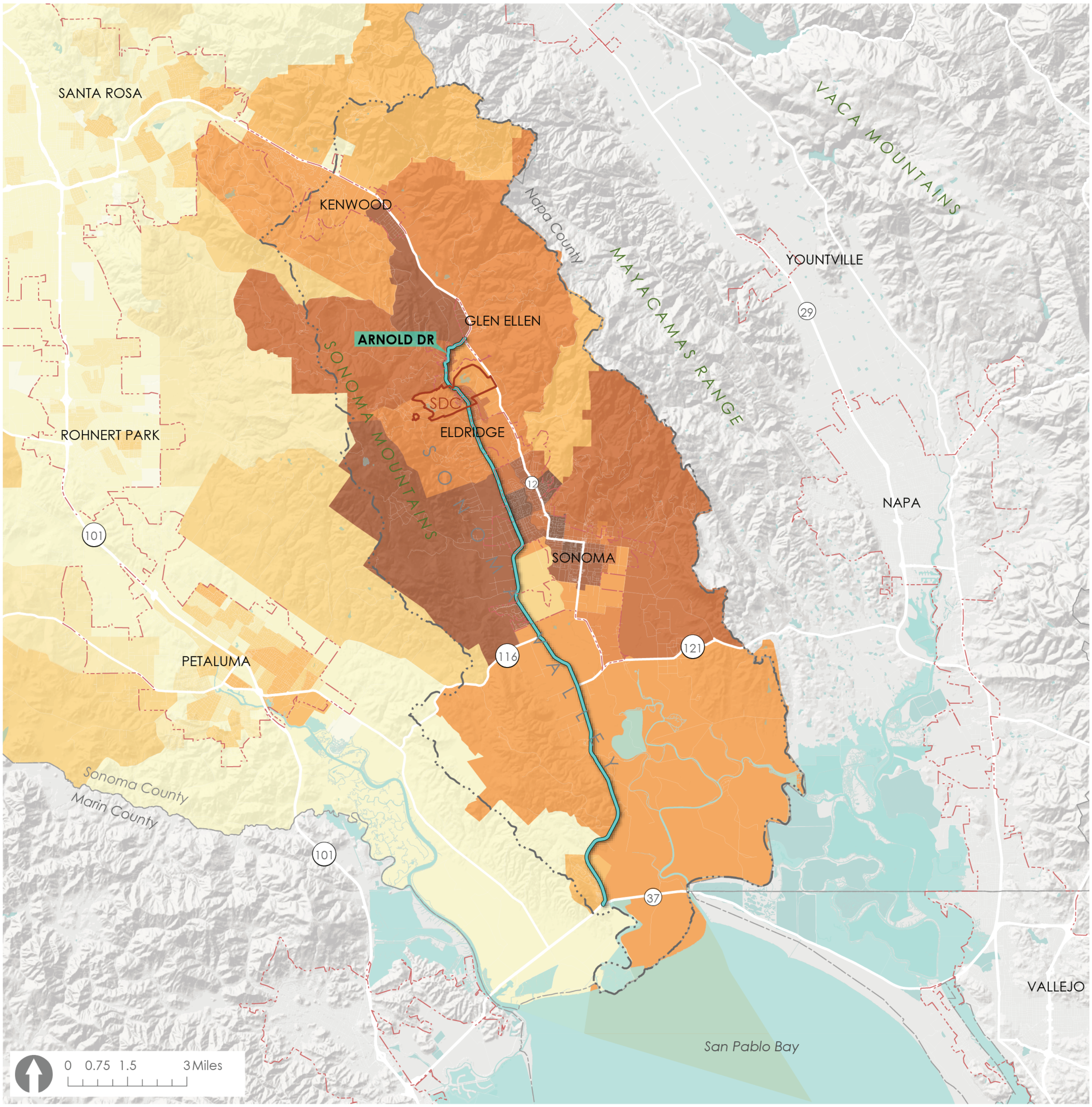
Roadway segment LOS is based on the observed “peak hour”, which in this case is the maximum volume observed in one continuous hour of peak traffic flow in the morning and afternoon during the weekday. Both roadway segments along Arnold Drive operate at LOS A in both directions, indicating significant additional capacity with very low traffic volumes during peak periods (see Appendix E for more detail).

Top: SCT Bus Stop (east side of Arnold Drive, north of Harney)
Bottom: Shuttle Stop

1 LOS is calculated with methods documented in the Transportation Research Board (TRB) Highway Capacity Manual (HCM 2010), and consistent with standards and traffic impact thresholds established by the County of Sonoma and Caltrans.

Figure 7-2

DESTINATIONS OF TRIPS FROM THE SDC AREA (2010)



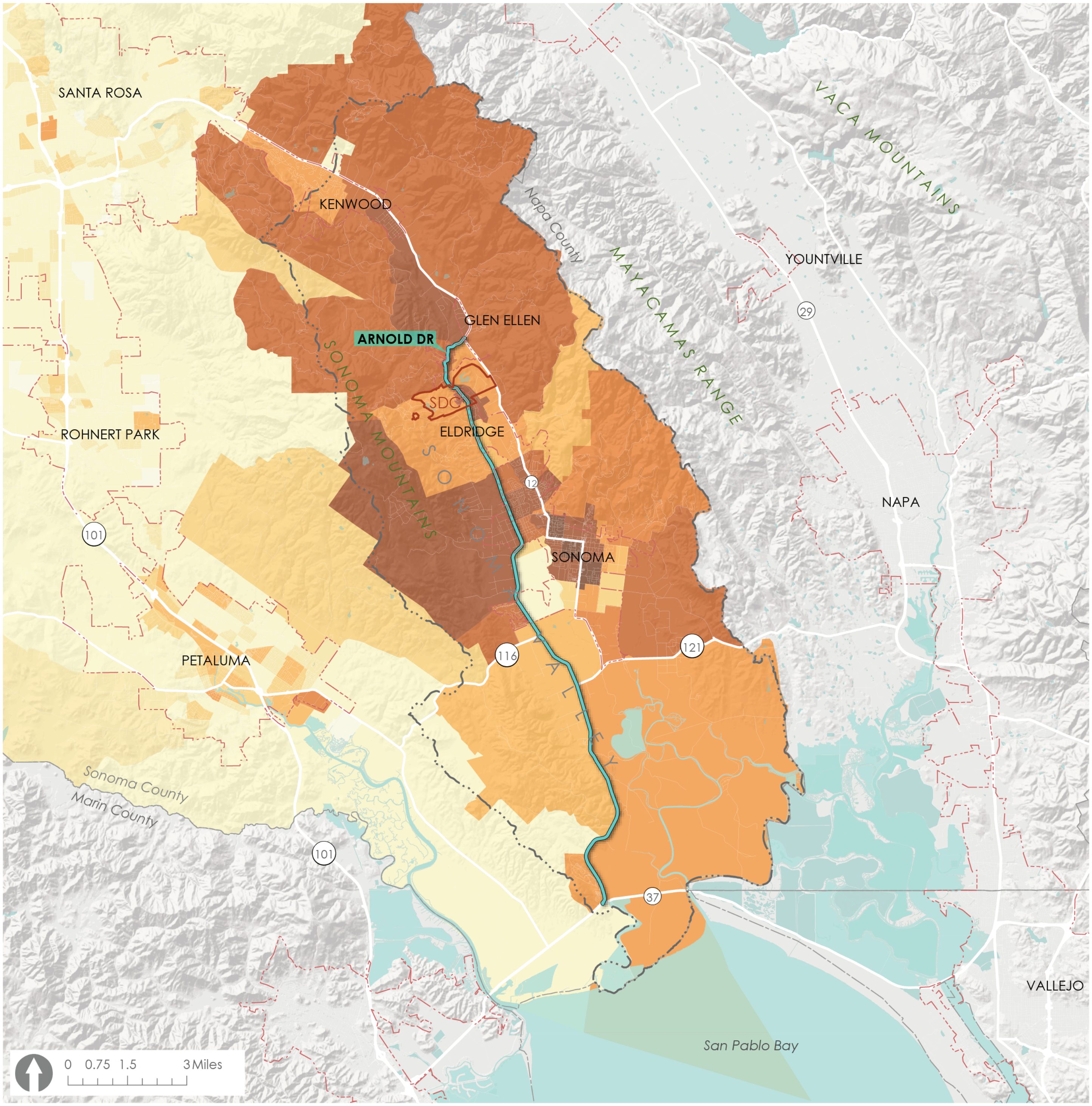
SDC Property
Sonoma Creek Watershed
County Boundary
Water
Urbanized Areas
Arnold Dr.

0%
10%
Destinations of all vehicle trips from Sonoma Valley (% of total trips, by TAZ)

Source
USGS, US Census Bureau, California Geoportal, GreenInfo Network, Sonoma Ecology Center, Sonoma County Travel Model

Figure 7-3

ORIGINS OF TRIPS TO THE SDC AREA (2010)



SDC Property

Sonoma Creek Watershed

County Boundary

Water

Urbanized Areas

Arnold Dr.

0%

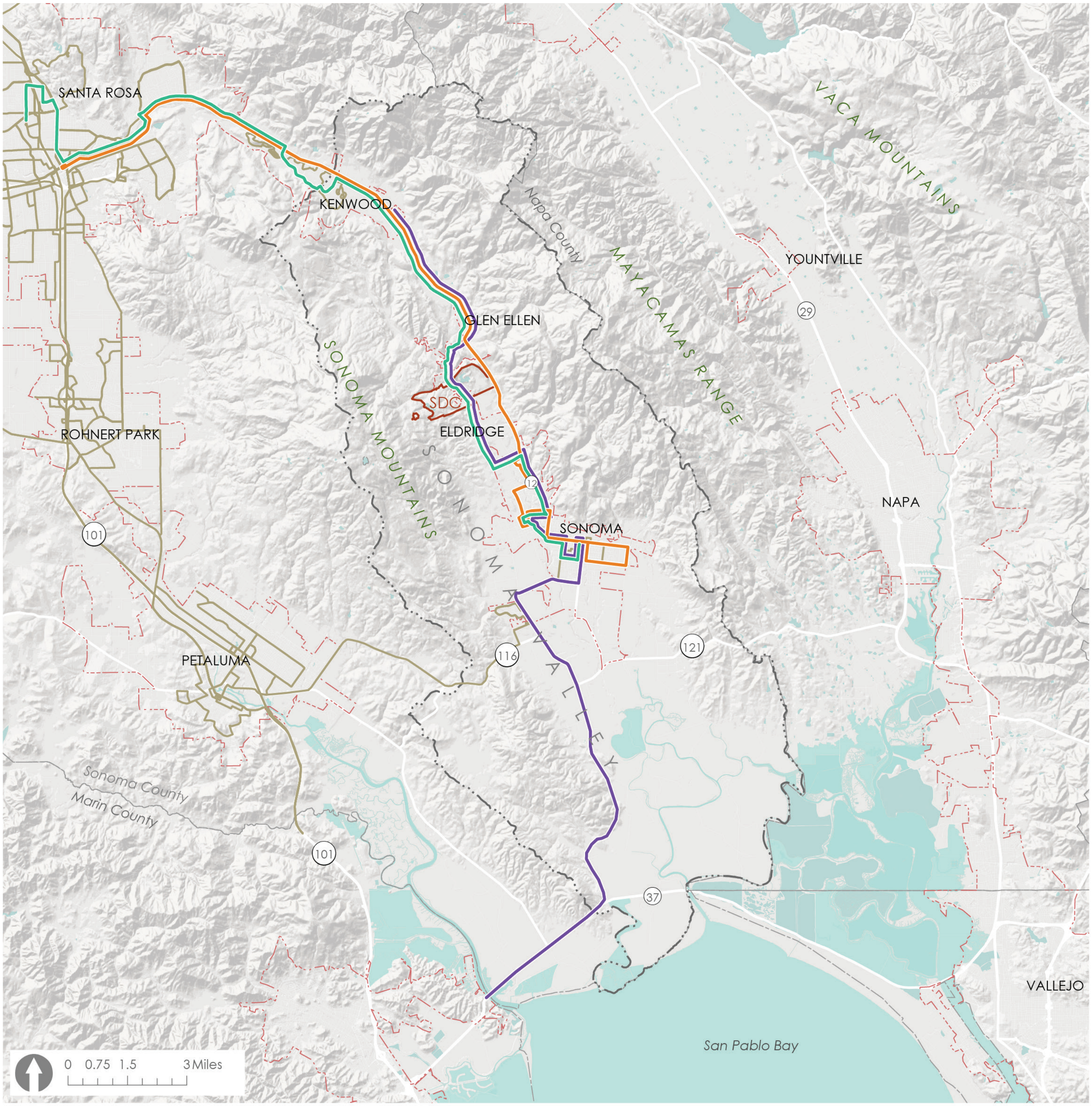
10%

Origins of all vehicle trips to Sonoma Valley (% of total trips, by TAZ)

Source
USGS, US Census Bureau, California Geoportal, GreenInfo Network, Sonoma Ecology Center, Sonoma County Travel Model

Figure 7-4

TRANSIT NETWORK



SDC Property
Sonoma Creek Watershed
County Boundary
Water
Urbanized Areas

Existing Transit
Route 30 - Santa Rosa, Sonoma Valley
Route 34 - Santa Rosa, Sonoma
Route 38 - Sonoma Valley, San Rafael
Other SCTA Routes

Source
USGS, US Census Bureau, California Geoportal, GreenInfo Network, Sonoma Ecology Center, SCTA

TRANSIT ACCESS AND SERVICE

Sonoma County Transit (SCT) provides intercity and local routes throughout Sonoma County, and SCT is the only public transit provider serving the SDC site. Figure 7-4 presents the existing transit network serving SDC.

- Bus Route 30 (Santa Rosa/Sonoma Valley) provides weekday and weekend service between Santa Rosa Kaiser Hospital and Sonoma Plaza.
- Bus Route 38 (Sonoma Valley/San Rafael) provides weekday-only peak hour service between the San Rafael Transit Center and the intersection of Highway 12 and Oakmont Drive in Kenwood. Route 30 operates during most of the day with the exception of late-evening hours; headways are long, with buses scheduled to arrive every 75 to 115 minutes.
- Route 38 operates only in the peak direction, with one southbound bus in the morning and one northbound bus in the evening.

Monthly bus ridership on both bus routes that serve the SDC represents around 10 percent of SCT's total monthly ridership system-wide.

Bus stops are located at the main entrance to SDC, along both sides of Arnold Drive north of Harney. Both the northbound and southbound stops are equipped with a shelter.

There are no planned transit improvements in the vicinity of SDC.

PEDESTRIAN AND BIKE NETWORK IN THE VICINITY OF SDC

Sidewalks in Glen Ellen and Eldridge are discontinuous and mostly exist on residential streets or immediately adjacent to commercial uses. Beyond SDC, Arnold Drive does not have sidewalks and pedestrians must walk on the shoulders or even in the vehicle right-of-way where shoulders are too narrow.

A trailhead and entrance to the Class I multi-use path in Sonoma Valley Regional Park is located on the east side of Arnold Drive north of the Sonoma Creek Bridge. People walking and riding bikes southbound along Arnold Drive must yield to oncoming auto traffic to cross the street and access the multi-use path, creating a hazardous situation.

PLANNED IMPROVEMENTS

The 2010 Sonoma County Bicycle and Pedestrian Master Plan identifies high- and medium-priority projects that would create bicycle connections between the SDC site, the Town of Sonoma, Glen Ellen, and Highway 12. The plan calls for bicycle improvements along Arnold Drive, including a bike route continuing from the intersection of Arnold Drive and Country Club Drive, at the north end of the existing bike lane, to the intersection of Highway 12 and Arnold Drive. New bike routes on Madrone Road and Agua Caliente would connect Arnold Drive and Highway 12. Most improvements would be bicycle lanes (Class II facilities)[2].

A Glen Ellen resident proposed a 4.35-mile "community bikeway" between Eldridge and Glen Ellen in 2017. The suggested route would use neighborhood streets and off-street paths to connect between Dunbar School at the north end of Glen Ellen and Madrone Road, providing an alternate route to Arnold Drive. Establishing the proposed bikeway would require further consideration and feasibility study by the County of Sonoma to determine associated costs and design details, especially at intersections and unpaved segments of the proposed bikeway.

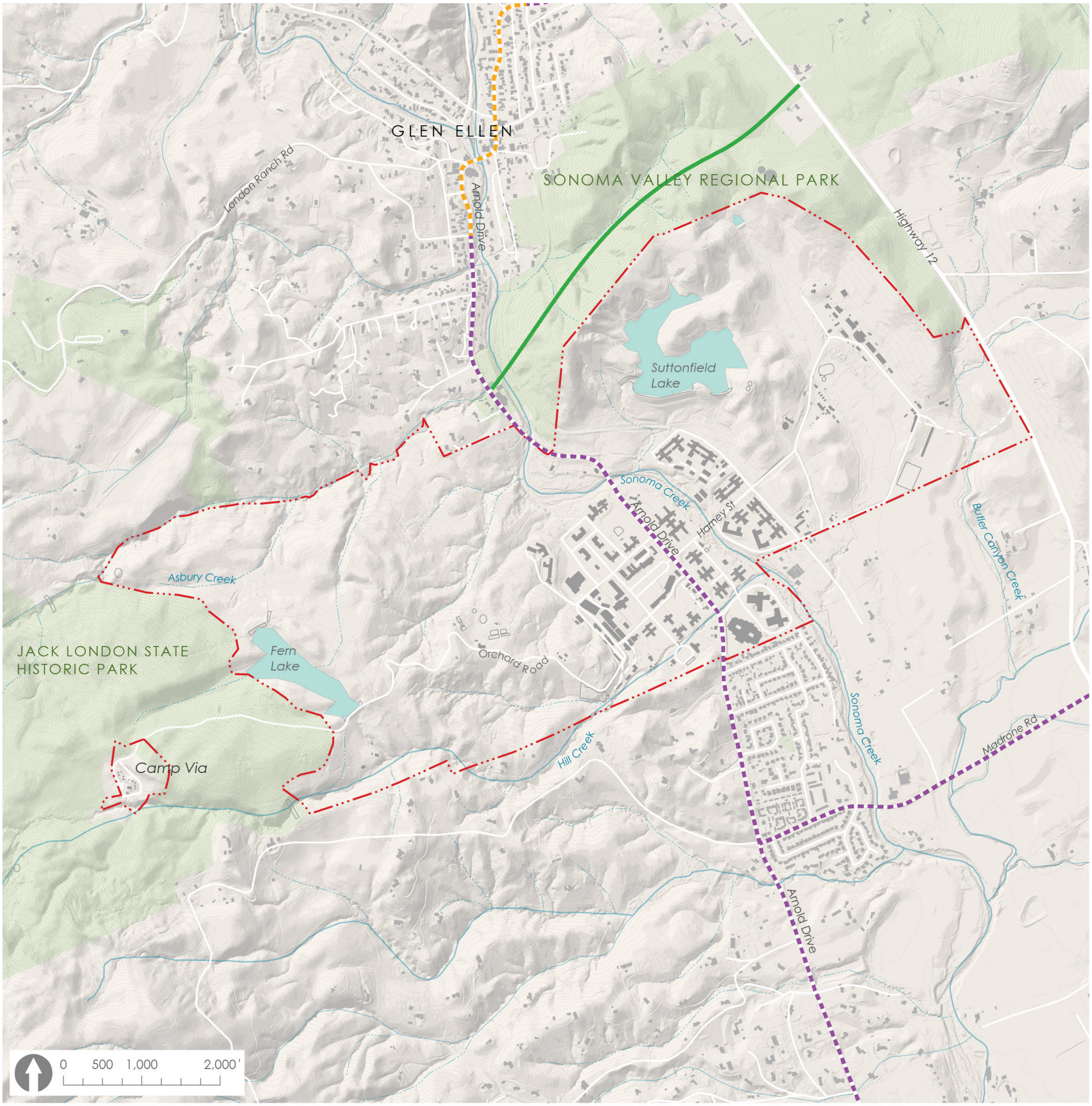
Figure 7-5 presents the existing and planned bikeway network in proximity to the SDC site.

2 Sonoma County Permit and Resource Management Department, Sonoma County Bicycle and Pedestrian Master Plan, 2010, Pages 32-62.

Entrance to Sonoma Valley Regional Park

Figure 7-5

EXISTING AND PLANNED BIKE NETWORK



SDC Property line
Lakes
Ephemeral Streams
Perennial Streams
Intermittent Streams
Protected and Public Lands

Existing/Planned Bikeways
Class I
Class II
Class III

Source
USGS, GreenInfo Network, Sonoma Ecology Center, SCTA

7.2 Streets and Sidewalks on the SDC Site

INTERNAL STREETS

The SDC site features narrow, unstriped, two-lane streets that provide local access to buildings and trailheads. Designated parking is located on Harney Street near the main entrance; unmarked on-street parking is available along the all the internal streets, with the exception of red-painted curbs where fire hydrants are present or at intersection corners.

Several roads near the western and eastern edges of the SDC property provide access to recreational areas, including SDC buildings, picnic areas, and trails on the SDC property and the adjacent Jack London State Historic Park. These roads are gated and use is restricted to pedestrians, bicyclists, and SDC vehicles. Many stretches of these service roads are very narrow, with limited capacity to accommodate two-way traffic. The narrow right-of-way, steep slopes, and occasional hair-pin turns keep vehicle speeds low, and provide a fairly comfortable environment for people walking and biking.

SDC SHUTTLE SERVICE

SDC operates a shuttle for SDC clients, employees, and visitors. Trams offer passenger drop-off/pick-up at building entrances and designated shuttle stops located throughout the SDC site.

PEDESTRIAN AND BICYCLE ACCESS

There are no designated bicycle facilities within the SDC internal road network. Some buildings have bicycle parking near the main entrances; however, many bicycles are left unlocked near building doors and against fencing or other infrastructure. Pedestrian facilities at the SDC site range from paved concrete sidewalks on both sides of most streets in the Core Area to discontinuous sidewalks or painted sidewalks in the campus periphery, to no designated pedestrian right-of-way in outer parts of campus.

Pedestrian amenities like street trees and landscaping, public seating and lighting encourage people to walk by increasing the comfort and security of the pedestrian experience. Arnold Drive has each of these elements, though seating is only available at bus stops. Holt Road is also tree lined, but it does not have lighting or seating available for people walking. Even without widely distributed amenities, however, the SDC campus maintains a walkable feeling because of the low vehicle volumes and speeds.

ROADWAY AND PAVEMENT CONDITIONS

Most of the main campus is laid out with concrete curb, gutter and sidewalks. Most buildings have a significant amount of parking and paved service area around them. Most of the sidewalks have modest to severe issues from minor cracks to broken and uneven pavement. In several locations, sidewalks have cracked at the control joints, and adjacent slabs are significantly out of alignment posing extreme tripping hazards. Roadways are paved with asphalt and the condition of these roads varies from excellent to very poor. Pavement conditions are shown on Figure 7-6. Refer to the full Sherwood Design Engineers report included as Appendix B for additional analysis.

LOW-IMPACT DEVELOPMENT (LID)

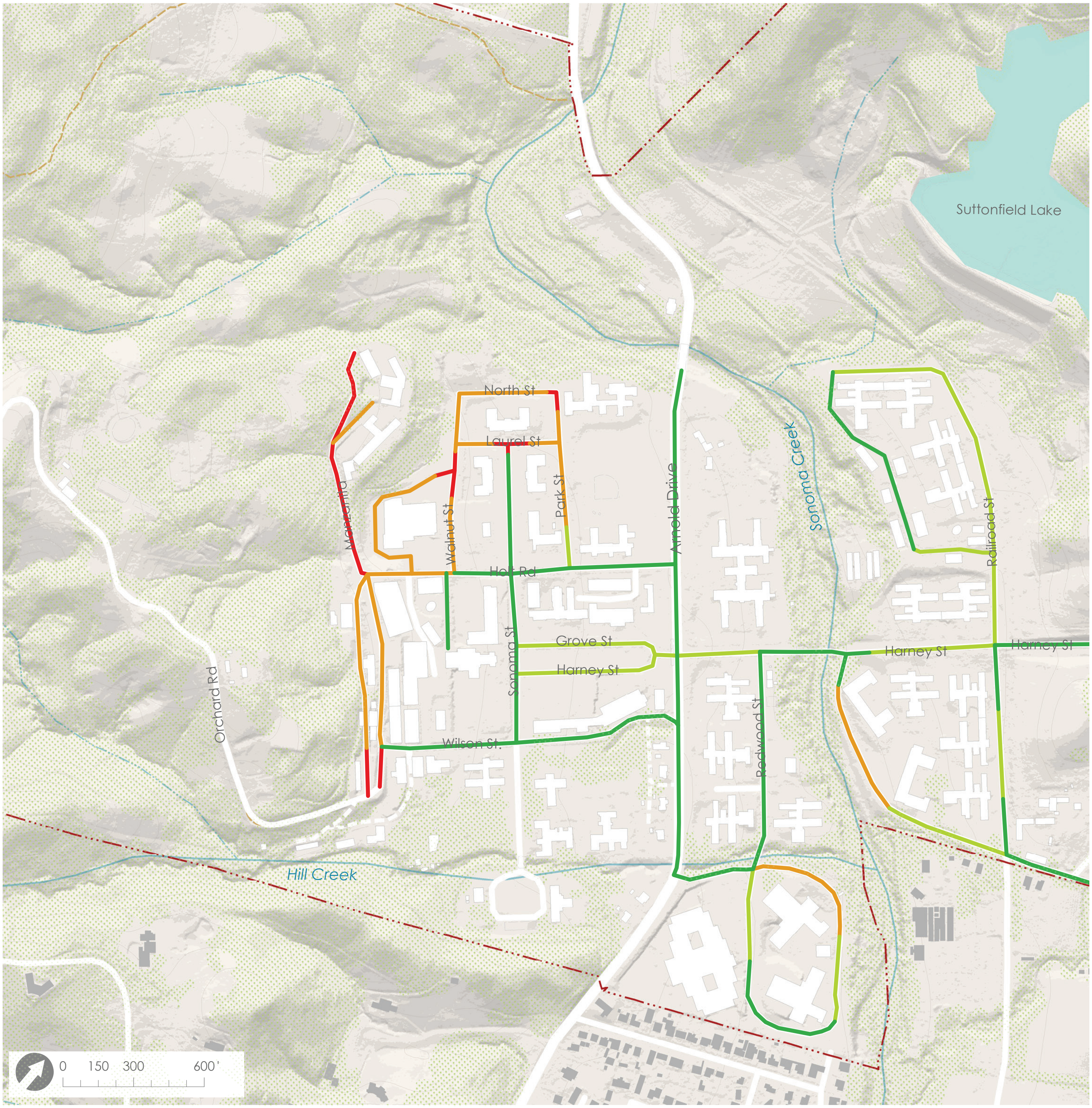
An estimated 74 percent of the core campus area, or 135 acres, is covered with impervious surfaces including paved roads, parking areas, and building roofs. The high level of impervious surfaces results in a significant amount of untreated runoff to the creeks.

There is significant room for implementation of Low-Impact Development techniques to improve stormwater management in the core campus area. Reduction of street width, provision of curb cuts that allow surface runoff to drain to landscaped adjacent bioretention areas, provision of pervious pavement where appropriate and other measures will significantly improve the quality of stormwater discharged from the property while slowing the release of stormwater to local creeks, reducing the risk of flooding and soil erosion.

On-street parking along internal streets on the SDC site (top). Painted sidewalk (bottom).

Figure 7-6

PAVEMENT CONDITIONS



SDC Property

Lakes

Protected and Public Lands

Trails

Ephemeral Streams

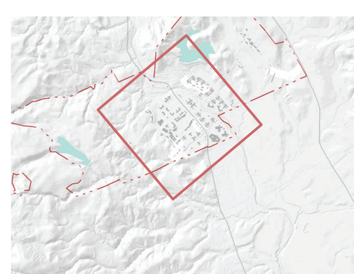
Perennial Streams

Intermittent Streams

Pavement Conditions

- Excellent
- Good
- Maintenance
- Distressed

Source
USGS, GreenInfo Network,
Sonoma Ecology Center



7.3 Infrastructure and Utilities Assessment

The SDC site features extensive water infrastructure, with a self-contained water diversion and treatment plant system; two reservoirs with a capacity of 840 acre-feet of water; a treatment facility capable of producing all the potable water required by the Campus; and site-wide water, wastewater and stormwater distribution systems serving some 1.3 million square feet of buildings on approximately 150 acres. Wet infrastructure is further detailed in the Sherwood Design Engineers report included as Appendix B.

The infrastructure and utilities assessment also evaluates building utilities including HVAC, Plumbing, Electrical, IT/Technology, and Fire and Life Safety systems. The Site Assessment Report prepared by Interface Engineering provides more detail on these systems, and is included here as Appendix F.

WATER SUPPLY SYSTEM

The SDC has an extensive and elaborate raw water collection system that includes wet weather in-stream diversions with storage in man-made reservoirs; collection of spring water; raw water transfer and transmission lines that are primarily managed by gravity flow; and bidirectional flow in transmission lines by use of valves, a primary pump station capable of pumping in either direction, storage tanks located at appropriate hydraulic grades, and a booster pump. Almost all the water for domestic and irrigation use is obtained on site through three surface water diversions on the eastern slope of Sonoma Mountain. Approximately 60 percent of the SDC water supply is drawn from Asbury Creek, approximately 30 percent is drawn from a diversion on Hill Creek, and 10 percent is drawn from a collection of springs and seeps known as Roulette Springs. Other water sources include a diversion from Sonoma Creek and a number of wells in the remote parts of the property.

Raw water is diverted from Hill and Asbury creeks by gravity to Fern Lake and is pumped from Sonoma Creek to Suttonfield Lake. A small tributary referred to as "Unnamed Creek" flows directly into Suttonfield Lake. A 10-inch raw water transfer line is designed to be operated in either direction. It enables operators to transfer water from Fern Lake to Suttonfield Lake by gravity or in the reverse direction by pumping. The same pumps are used for the majority of the raw water transfers on the property, including from Sonoma Creek to Suttonfield Lake, and from Suttonfield Lake and Sonoma Creek to the Water Treatment Plant. A separate pump station transfers water from the 25,000-gallon break tank below the Water Treatment Plant to Fern Lake. The water supply system is described more fully in Chapter 4.

A representational layout of the collection system is shown on Figure 7-7. Raw water distribution, water treatment, and treated water distribution are covered below.

RAW WATER TRANSMISSION SYSTEM

Raw Water Pump Station

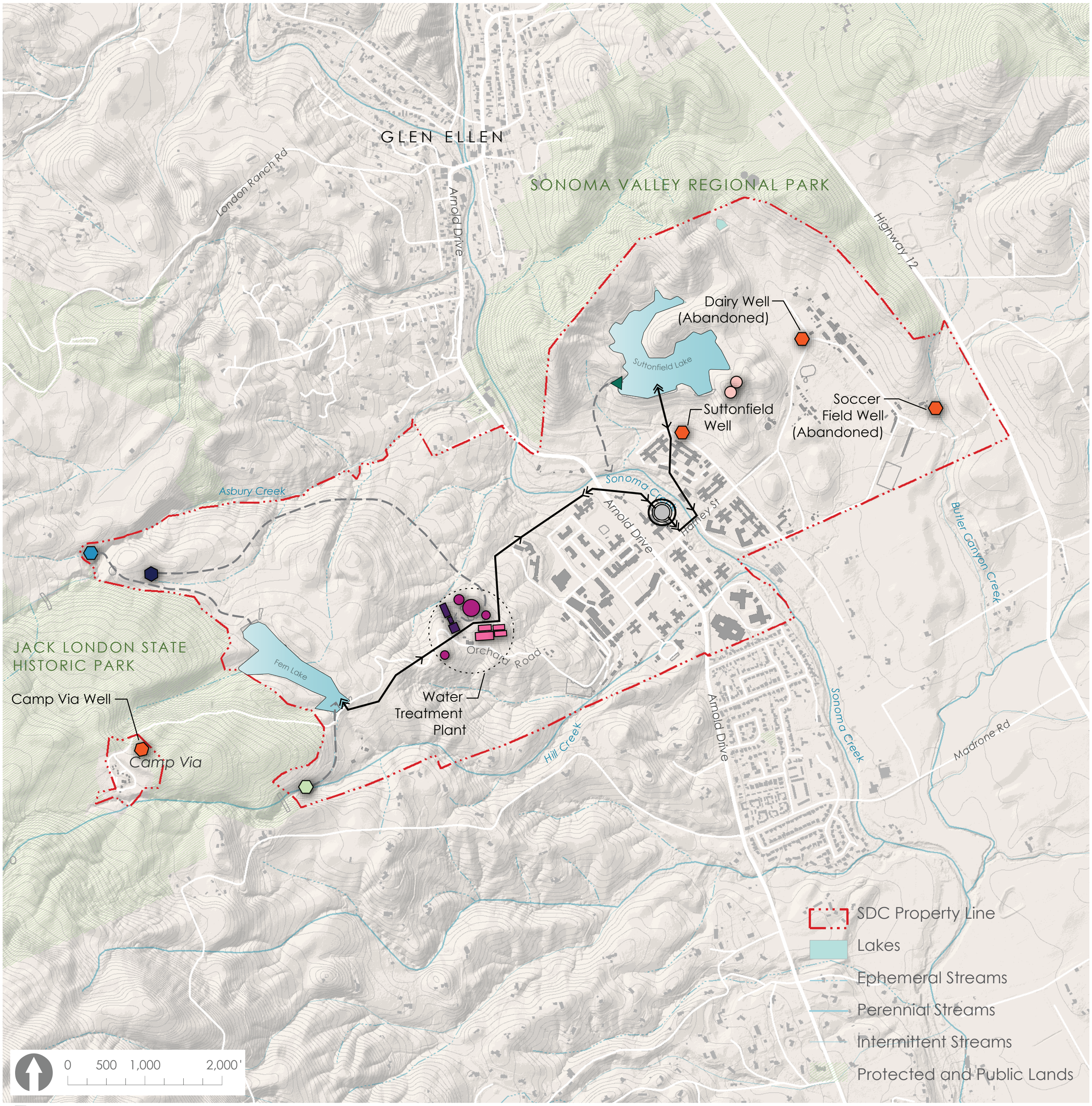
The raw water pump station on the southwest bank of Sonoma Creek houses five pumps of varying capacity: two horizontal pumps (40- and a 50-horsepower (hp) and three vertical pumps (two 50 hp and one 25 hp). By operating appropriate valves, water can be pumped from or to Suttonfield Lake up to the water treatment plant. This flexibility in the use of a single pump station and transmission pipeline allows operators to manage the system to maximize storage capacity and maintain circulation in the system to maintain low bacterial levels of the stored water. Near the Pressure Break Tank at the WTP, there is a 5-hp booster pump that enables operators to transfer water from the WTP area to Fern Lake. While the pump house is old, the pump station and the pumps appear to be in well-maintained condition.

Raw Water Transmission

The raw water transmission line is a single 10-inch ductile iron (DI) pipeline. Joints in the original pipeline were packed with lead and oakum. Over the years, some sections of the pipe have been repaired and replaced with PVC. The pipeline is designed to flow in either direction by manually opening and closing several valves and pumping in the reverse (uphill) direction.

Figure 7-7

WATER SUPPLY SYSTEM



- Hill Diversion
- Asbury Creek Diversion
- Roulette Springs Diversion
- Gravity Flow
- Raw Water Transmission (to flow in either direction depending on pumping)
- Water Treatment Plant (Designed for 1.8 Million Gallons Day)
- Treated Water Storage (1.35 Million Gallons)
- Recirculating Water Storage
- Balancing Tanks (2 x 350,000 Gallons)
- Spillway into Drainage Ditch
- Sonoma Creek Pump Station
- Well

Source
USGS, GreenInfo Network, Sonoma Ecology Center

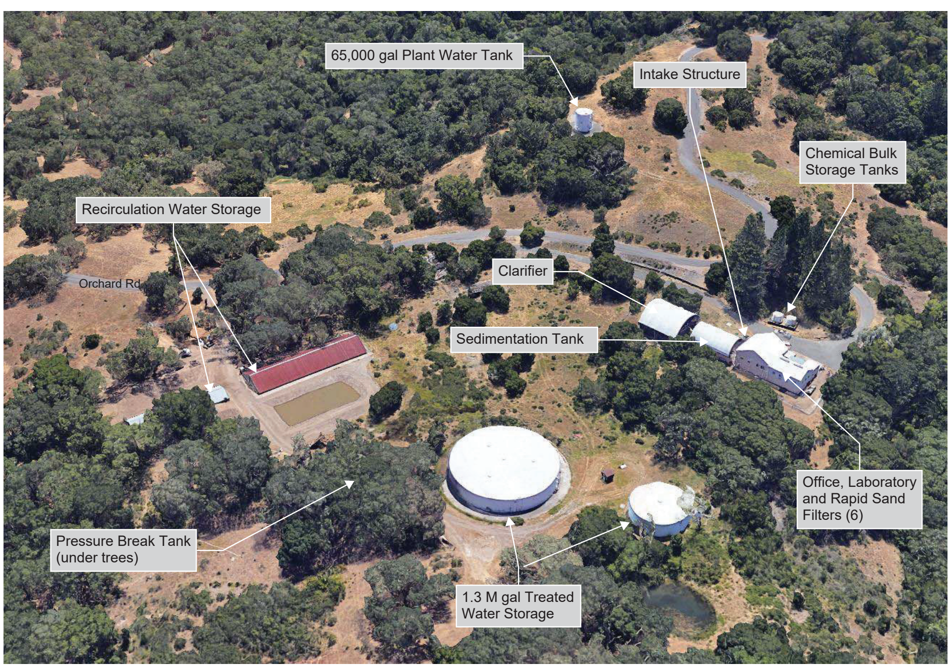
The approximate routing of the raw water transmission line is shown on Figure 7-7 and conveys water by gravity from Fern Lake to the Pressure Break Tank adjacent to the WTP. The break tank is a partially buried 25,000-gallon covered concrete tank under the trees near the recirculation water storage. This tank is necessary to relieve the pressure in the system before transmission to the lower part of the property.

From the WTP/break tank area, the pipeline is routed near the northern edge of the property, skirting around the core campus area to Sonoma Creek and south along the west bank of Sonoma Creek to the pump station. It then continues south to the bridge at Harney Drive where it crosses Sonoma Creek and is routed north along the Creek, around the north side of the east campus where there is a tee connection to Suttonfield Well. It then runs up the dam slope to the Suttonfield Lake intake structure. As noted above, by operation of the pumps and valves, water can be moved in either direction to and from any of the previously described storage facilities.

WATER TREATMENT PLANT

The Water Treatment Plant is at approximately 434 feet elevation west of the main campus. The facility was originally built in the1930s and expanded in 1950 with the construction of four more rapid sand filter beds (for a total of six) and provision of 300,000 gallons of treated water storage. In 1992, chemical systems were added. In 1995 a SCADA system was installed and treated water storage increased with the erection of the 1 million-gallon tank. The plant is fed and functions by gravity, with pumps being used only to backwash the filters and incidental services such as chemical dosing.

The design capacity of the water treatment plant is 1.8 million gallons per day (mgd) and is licensed as a small community water system. Water quality is regulated by the State Water Resources Control Board, Division of Drinking Water (DDW). A bird's-eye view of the treatment plant site is shown here.



A bird's-eye view of the water treatment plant at SDC.

Intake & Pre-Treatment

The water treatment plant receives water from Fern Lake via a 3-inch and a 6-inch-diameter pipeline and from Roulette Springs via a 3-diameter pipeline. The intake structure is a rectangular concrete tank of approximately 500-gallon capacity. Inlet pipes discharge above the free water surface at elevation 434 feet. Chlorine injection for pre-treatment and alum dosing is done at the tank's outlet, low on the tank. Until recently, the facility used an in-line static mixer between the intake box and the flocculation tank, which required a minimum flow of 200 gpm. This unit was switched out in the fall of 2017 with a flash mixer, and the facility is able to operate at lower flow rate—currently at 150 gpm (216,000 gpd—a reduction of about 72,000 gpd). The ability to operate at this lower production rate to serve a lower service demand at the property translates to savings in operation costs.

Flocculation Tank

The flocculation tank (or clarifier) is an open circular treatment unit that brings the water up through the middle of the tank and out across the unit in a slow mix that facilitates flocculation, a process by which the alum causes the small particulate matter in the water to clump large enough to settle out. The Floc Tank is housed inside a metal building and is the gating equipment in this system with respect to the plant capacity. Because of the size and way it operates, it is only possible to operate the treatment plant at flows up to 1,250 gpm. Because of low demand currently at SDC, the plant is operated at its minimum capacity, even though demand is below this minimum production rate.

Sedimentation

After the Floc Tank, the water passes through the 75,000-gallon Sedimentation Tank where water flows from one end of the tank to the other and as it moves, remaining particulate matter drops out. The clear water flows across a weir to a trough and is piped to the rapid sand filters. The Sedimentation Tank was built in the 1950s before regulations and permitting of water treatment plants and was built uncovered, outdoors. Because of current requirements, it must now be covered, and this has been accomplished with a large arched tent-style enclosure.

Filtration

Six rapid sand filtration units operate in parallel to polish the treated water. These units were completely refurbished within the last one to two years and provided with five grades of fresh media. The finished water is chlorinated, and the pH adjusted before being transferred to the treated water storage and distribution system.

Backwash System

There is a 65,000-gallon plant water tank on the top of the knoll across the road from the WTP site. This tank is filled with treated water and used to backwash the filters. The dirty backwash water is transferred to the recirculation basins just down the slope from the WTP. The dirty water is allowed to settle in the first tank, then water is drawn off the top of the first tank and transferred to the second tank where it is allowed to settle again. Water is drawn off the top of the second tank and transferred to the intake structure for treatment.

Chemical Systems and Control Systems

Bulk chemical storage is located on the WTP grounds near the parking area, across from the main building, within a common containment berm. There are two 5,000-gallon tanks, one each for storage of sodium hydroxide (NaOH) and alum. Day tanks are located inside the main building where the filter units and chemical-feed systems are located. The facility manufactures its own chlorine with an on-site chlorine generator that uses common salt in solution to generate sodium hypochlorite (NaOCl). Salt is purchased in 50-pound sacks and stored on pallets near the day tanks. The alum is used as the flocculating agent. Chlorine is used as a disinfecting agent and sodium hydroxide is used to adjust the pH of the finished water to limit corrosion within the distribution network and prevent a resultant elevation in the mineral content in the water. The facility was designed to be able to use polymer to aid in the sedimentation process, but the turbidity and solids content of the raw water is very low, and polymer has never been used.

The SDC has a service contract with Telstar, whose agents check on all the chemical feed, monitoring and control systems on a quarterly basis. As a result, all the feed and injection systems, monitoring, alarm and control systems are well-maintained.

Supervisory Control and Data Acquisition (SCADA) system

The SCADA system and computer are dated but the SCADA system is regularly serviced and is primarily used for its alarm function. When any component in the system reaches a set trigger point, it automatically dials the operator's cell phone. He carries his cell phone with him

24/7. Several of the alarm functions also automatically shut down the treatment plant as a precaution. Since there is only one primary operator, he needs to be immediately responsive to the alarms. Within the past year, a computer failure (rather than a plant failure) triggered the SCADA to shut down the plant. The SCADA system is capable of running the backwash system, but the operator prefers to perform that operation manually. The SCADA system also manages the continuous monitoring of chlorine and turbidity levels in the finished water.

Treated Water Storage

There are two treated water storage tanks adjacent to the WTP; a 1-million-gallon tank and a 300,000-gallon tank. They are welded steel tanks at grade on concrete pads, located at approximately 400 feet (ground elevation).

WATER QUALITY

Raw water quality on the site is quite good, as might be expected from water sources where the watershed is as protected as it is at SDC and where the water supply is so abundant. There are some naturally occurring minerals that, when found in drinking water at high concentrations, pose a problem. A few of them, notably arsenic and nitrate are found on the SDC property. Other constituents of concern include asbestos, primarily because of the prevalence of old asbestos cement pipe in the distribution system, and bacteria, which is always of concern in surface water. The WTP is equipped with a laboratory and tests for a wide range of constituents as prescribed by its license. To date, arsenic and nitrates have been found to be below the maximum allowable contaminant level (MACL); asbestos has not been found; and all raw water is disinfected to kill bacteria both through pre-treatment and prior to storage and distribution of all treated water. In addition, water clarity is described by turbidity and is measured in Nephelometric Turbidity Units (NTU) that determines the concentration of suspended particles in a water sample by measuring how much light scatters when shined through the sample. Typically, a raw water sample taken at the WTP is about 1 NTU, which meets treated water standards. After treatment, water at the SDC is around 0.02 NTU. Please refer to Sherwood Design Engineers' complete report (Appendix B) for more detail on water quality.

TREATED WATER TRANSMISSION AND SYSTEM PRESSURE

Treated Water Transmission Lines

There are three 8-inch transmission lines that carry water from the treated water storage tanks at the WTP to the main campus to feed the domestic water distribution system. In 1989 a 12-inch line was constructed to augment the existing transmission system to increase the fire flow capacity of the system.

Domestic Water Balance Tanks

Two 300,000-gallon welded-steel treated water tanks are located on the knoll south of Suttonfield Lake. These tanks are balance tanks for the gravity-fed water distribution system on the main campus. They function not only to store treated water, but also to maintain a constant pressure in the distribution network and to dampen potential fluctuation in the system pressure. They are located at elevation 370 (ground surface).

Fire Flow

Sonoma County currently adheres to the 2016 Edition of the California Fire Code with specific amendments as adopted by County Ordinance 6184. For site development, the Table B105.1(2) of the California Fire Code provides a schedule of the required site fire flow based on several factors including building square footage and building construction type. Sonoma County Fire has adopted Table B105.1(2). The code also provides for a reduction of the reported fire flows if the building is equipped with a sprinkler system. The reduction in site fire flow is up to 75 percent for nonresidential development and final reduction at the discretion of the Fire Department official.

There are exceptions to the required flows. For multistory buildings of Type 1A and Type 1B construction the code determines the fire flow based on the three largest successive floors, and for parking structures based on the largest floor rather than total building square footage for other types of construction. It should also be noted that said fire flow shall be provided to a building site with a minimum residual pressure of 20 psi in the water main network.

Fire Hydrant Flow tests carried out by JC Chang & Associates (JCCA) at various locations of the site were reviewed for their results, location on site and potential associated implications. With the exception of Test #1, all tests indicated favorable flows of 2,182 gallons per minute or higher. Test #2 read the flow at the same hydrant but took the pressure off a different hydrant resulting in more favorable reading. From these test results it is possible to deduce that Test #1 was off a hydrant connected to a smaller line or different line than that of the hydrant test off Test #2. This may also point to necessary upgrades depending on final layout of future development. All other hydrant tests resulted in favorable conditions ranging in flow rates of 2,182 to 3,330 gallons per minute. Assuming an approval of 50 percent reduction (typically more common than the maximum 75 percent) in fire flows for future development this can be correlated to a flow rate range of 4,300 to 6,600 gallons per minute of the reported values in Table B105.1 (2). This represents a broad range in potential square footage for future buildings.

WATER DISTRIBUTION SYSTEM

The domestic water distribution system at the SDC is complicated for several reasons: double piping—there are parallel pipes in the system that are cross connected in many places (see below on historical dual piped system); age—much of the original piped system is still in use and is prone to failure from corrosion, stress on the pipe from earth movement and tree roots, etc.; and it is a complex, single-pressure-zone system that is currently underutilized presenting efficient operations and maintenance challenges.

Historical Dual-Piped System

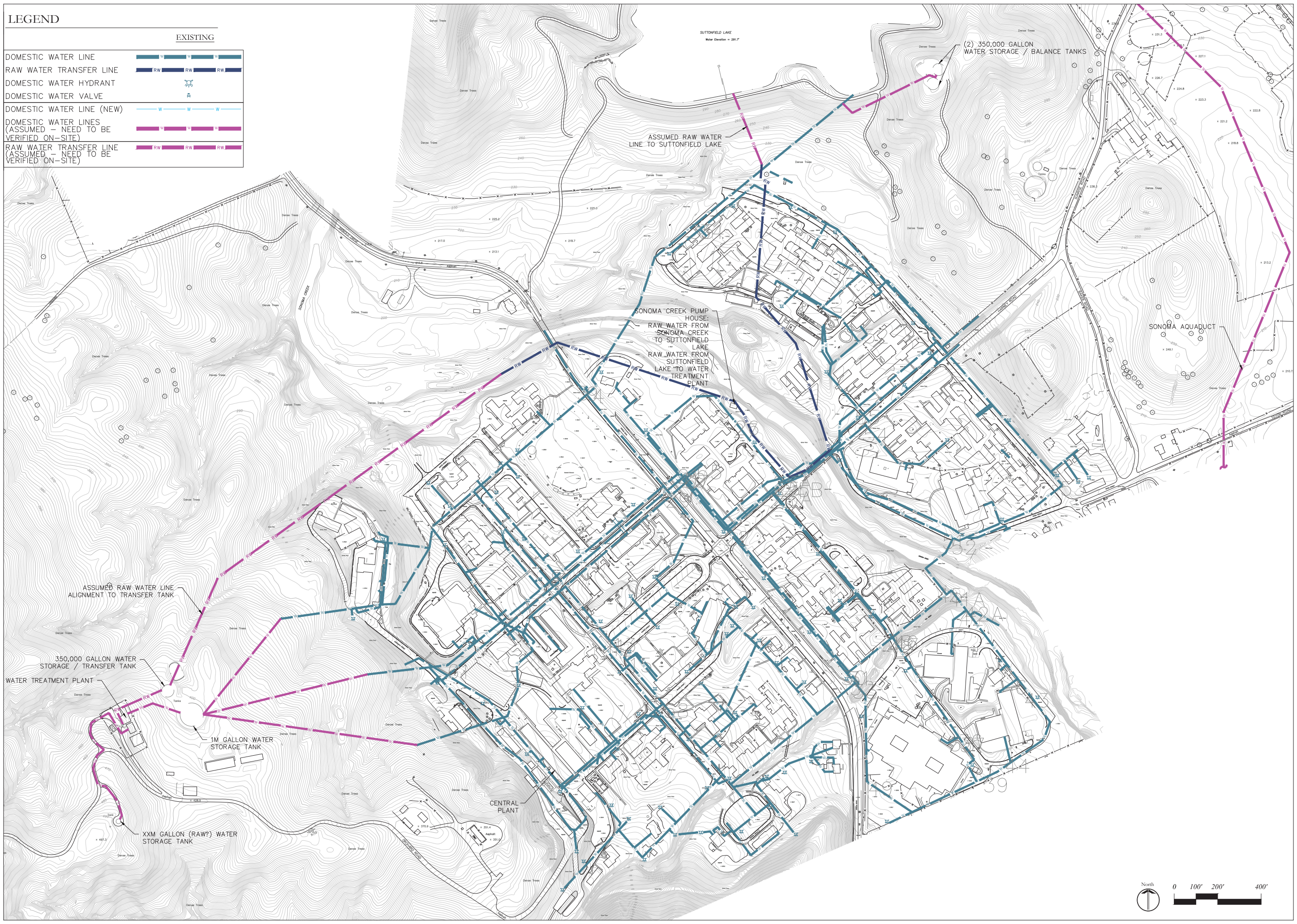
A practice that is just becoming common now, dual plumbing, was the norm at SDC until the mid-1970s. Buildings were double-plumbed to use nonpotable water for toilet flushing. Most of the campus had a nonpotable pipe system running in parallel to the domestic water distribution system, providing low-cost water for irrigation and reducing the demand for treated water. Because of concerns about potential cross-contamination and concerns over possible resident error or accident with nonpotable water, the dual-water system was discontinued. The existing double-pipe system on the campus was not abandoned but was intentionally interconnected, allowing treated water to flow through several parallel pipes. This system was unusual, but did allow maintenance crews ease of making repairs or performing other tasks without inconveniencing residents.

Figure 7-8 illustrates that there are two or more parallel water lines that appear to all be serving the same purpose: increasing flow to buildings without having to install a larger pipe. While with the double pipe system it is easy to make repairs without inconveniencing users because of all the valves and double piping, it also poses different maintenance challenges in that there are a lot more joints, valves, and fittings that could break or leak.

System Integrity

Originally constructed 60 to 100 years ago, the water distribution system has experienced numerous repairs and is now a patchwork of pipe materials. Most of the water mains were built with asbestos-cement (A/C, also called Transite) pipe and laterals with galvanized pipe. Additionally, welded-steel or ductile iron pipe has been used as a material of choice for transmission lines and in some areas, cast-iron pipe has been used for water supply. While A/C pipe is quite durable if undisturbed, it is brittle. In soft or unstable soils or near mature trees, breaks will occur. Galvanized and cast-iron pipe will rust over time. These older pipes are very much at the end of their useful life. Over the years, many repairs have been made, usually using PVC pipe to repair the damaged section of pipe. In 1995, a new water main was installed in the main campus with C-900 pipe (PVC pressure pipe). This relatively new water main is 22 years old and should have at least another 50 years of life left in it. Everything else is considered obsolete.

Figure 7-8
WATER SYSTEM



System Operations and Limiting Conditions

The water distribution system at SDC operates entirely by gravity—without pumps. Pressure in the system is maintained because at the east and west end of the main campus area, pressure is balanced by the free water surface in the storage tanks—the two storage tanks at the WTP and the two balance tanks near Suttonfield Lake—making the whole system operate in a single pressure zone at very low operating cost. What makes the system a challenge is that the distribution network is anything but elegant and includes huge system losses in terms of pressure and flow caused by the redundancies in the system. Pressure loss is primarily attributable to two conditions: friction and leakages. Friction losses increase at every fitting, valve and bend in the pipe and a component of friction loss is related to flow velocity, pipe diameter and length and type of pipe. Older, rougher pipe material generates larger friction losses. For the SDC system where very old, rough pipes are encountered with smaller diameter multiple pipes dominate, the friction losses are going to be large. Additionally, the same parameters lead to significant losses through leakages. These leaks may be small but numerous and will be very difficult to detect. Only when there is a major pipe break can the staff quickly identify the location of a leak and take corrective action. Smaller leaks can continue for years without being identified and corrected.

Domestic Water System Capacity

Modeling the water distribution system would give us an understanding of its capacity for future development. However, the system's complexity, age and condition present substantial challenges. Because the system is in such deteriorated condition, and replacement is recommended, there is little value to be derived from modeling.

The system as designed should be able to produce and distribute to the core campus and beyond 1.8 million gallons per day (MGD) of potable water, enough to support a resident population of approximately 6,600 people. However, because of its present condition, the system is most likely unable to support flows at this level and has not done so for many years.

Domestic Hot Water

- Hot water for most of the buildings is generated by local, single wall steam to water heat exchangers with storage tanks. These heat exchangers are not compliant with current code, which requires a double wall heat exchanger for domestic water applications. All heat exchangers will have to be replaced as buildings are repurposed.
- Some buildings, mainly the residential units along Arnold Dr. and trailer buildings, such as Farrell and Snedeger, generate hot water from tank type electric or gas water heaters.
- Hot water piping is a mix of original galvanized steel pipe and copper tube in areas of repair or renovation.

Record drawings of the existing piping system in the building for verification of pipe sizes and routing were not available.

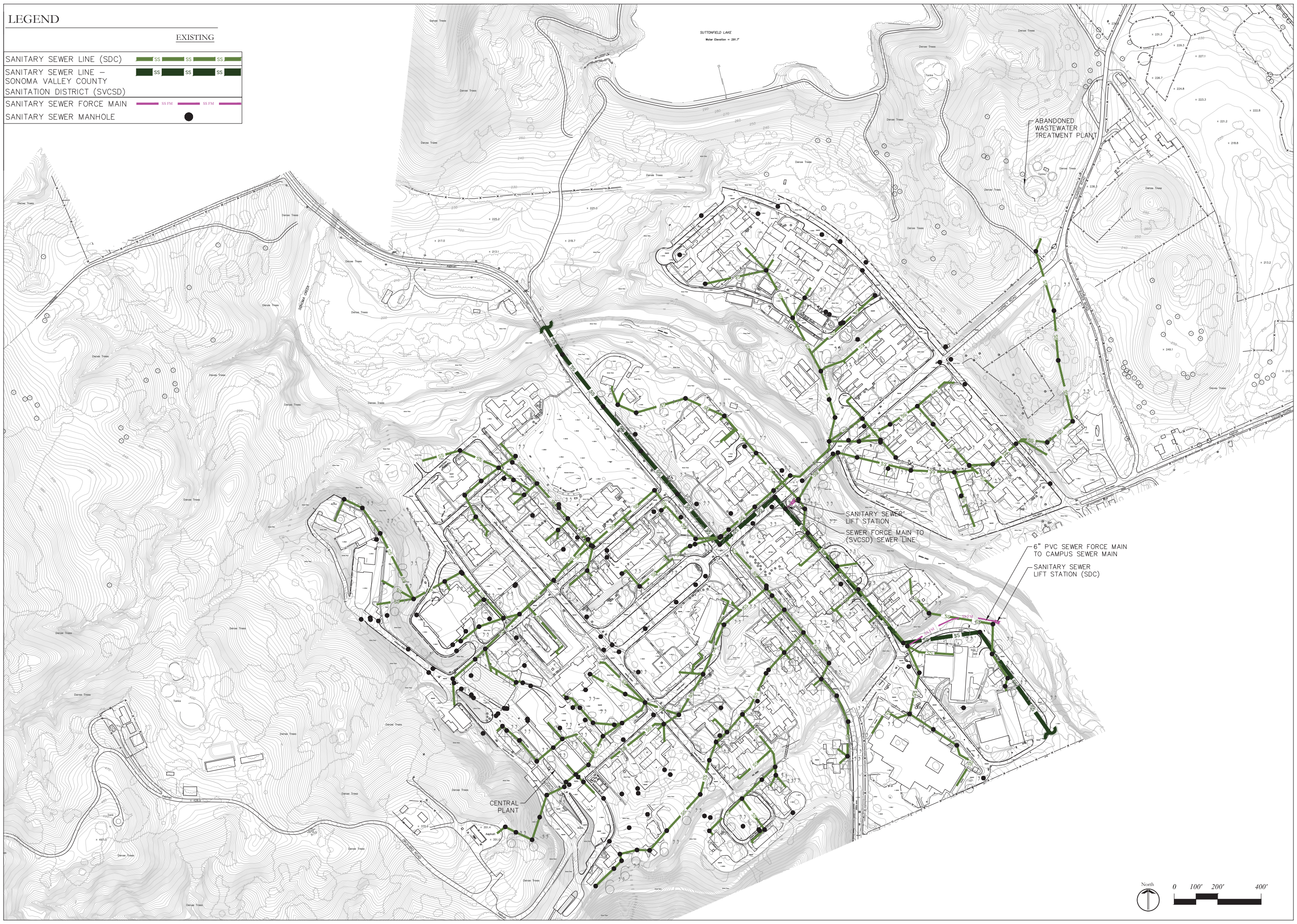
Sonoma County Water Agency and Valley of the Moon Water District Tie-ins

SDC has had an agreement with the Sonoma County Water Agency (SCWA) since 1964 to supply water to the facility in the event the on-site water system is unable to do so. SDC maintains a 6–inch metered connection to the Sonoma Aqueduct, which runs through the eastern part of the property. The SCWA was able to provide domestic water to the property in the past when the WTP was undergoing upgrades. However, the connection point is fitted with a double check-valve backflow prevention system that has failed in the past according to SDC staff. When the valve is opened, water from SDC flows into the SCWA line (rather than water flowing into the SDC line) because the pressure in the SDC line is greater than in the SCWA line and the backflow preventer doesn't work. Until the backflow preventer is replaced, the only way SCWA can provide emergency water to SDC is if the SDC system is drained down and valves closed from the balance tanks and the treatment plant.

SDC also has an agreement with the Valley of the Moon Water District (VOMWD) to provide water to the VOMWD in times of emergency. The agreement stipulates

Figure 7-9

SANITARY SEWER SYSTEM



that any water supplied is a loan and must be repaid in kind. VOMWD maintains a 6–inch metered connection to the SDC treated water line in Arnold Drive. Transfers into the VOMWD requires a 20-horsepower portable pump to transfer water at the stipulated maximum rate of 0.5 gpm.

SANITARY SEWER SYSTEM

Sewer Collection System

The sanitary sewer collection system is reported by SDC facilities staff to consist of primarily vitrified clay pipe for the sewer mains and cast iron for the laterals. However, much of the system was built in the 1920s and '30s and there have been numerous failures and blockages over the years. Staff have attributed the blockages to be caused primarily by root intrusion. Much of the cast-iron pipe has rusted through. Repairs on the system have been made as required, normally with PVC replacing damaged pipe sections. The system should be cleaned and inspected regularly, but the SDC has not had sufficient staff to do so as a part of the regular maintenance schedule. Although most of the PVC sections are probably in fairly good condition, because of the patchwork nature of the system, the entire system is considered to be obsolete and in need of replacement. Refer to Figure 7-9 for a map of the sewer system. The extent of the system to be replaced will depend upon the extent of future development. If the property is developed in a manner that concentrates the built environment within a smaller footprint than the current facilities at the core campus, then the extent of new sewer lines needed may be significantly reduced. Because the entire system is considered obsolete, the system was not modeled for this study.

Sewage Lift Stations

The system operates via gravity flow for all but a small section of the system. There is a lift station located between the south side of Sonoma Creek and Traxler Road across from the Johnson-Ordahl Building. This station was completely refurbished in 2016. Unfortunately, it suffered severe damage during the fires in October 2017. The building was not in the path of the fire, but was so close to the fire line that it spontaneously burst into flames inside the building. The pumps were submerged and survived, but the building itself (basically a metal shed) is seriously damaged and the wiring, controls and associated components were all destroyed. The SDC performed immediate repairs to get the pumps operational, but the pump station needs to be reconstructed if sewage will continue to be collected from the Regamey-Emparan, and part of the Lux and Ordahl-Johnson buildings.

The pump station moves sewage up to the SDC Manhole (MH) #3.2-4 via a 6–inch diameter SDR 35 PVC pipe. From MH 3.2-4, it flows by gravity to the main collection station and bar screen at Harney and the south side of Sonoma Creek.

All sewage at SDC flows to the main collection point located at the southwest side of Harney Avenue west of Sonoma Creek. At this point, the sewage flows through the bar screen to remove trash and debris that may have entered the system upstream before going through the meter to be discharged to Manhole (MH) #99 of the Sonoma Valley County Sanitation District (SVCSD) main sewer line in Redwood Street just south of Harney Avenue. The bar screen has been recently repaired, but it is a 1970s model Jeffrey unit well beyond its useful life. A recent estimate to replace it came in at $125,000. The remaining components of this station include a concrete in-line venturi flow gauge, a monitoring meter that is barely readable because the unit is slowly burning out, and a sampling unit inside an old gutted refrigerator. As with many components at SDC, the maintenance staff have done an admirable job of keeping everything operable, but this station needs to be upgraded in the near future.

There was a second sewage lift station in the east campus that handled all the sewage from the Sunrise campus and Junior Farm areas. This lift station was destroyed in the fires in October. Since the buildings it served are either destroyed or not in service at this time, no interim measures have been taken to replace it.

Abandoned WWTP

There are remnants of an abandoned Wastewater Treatment Plant near the north side of the intersection of Harney and Sunrise. Previously, SDC operated this plant to process sewage from the property, but there are no records of the operations, type of treatment, disposal of sludge, or any other data, probably because wastewater treatment was a wholly unregulated enterprise at that time. In 1954, the treatment plant was shut down and abandoned and all sewage thereafter was discharged into the county sewer trunk line and treated off site.

STORM DRAINAGE

System Description

Traditional stormwater management strategy that was the norm through the 1970s strove to get stormwater into a pipe and off site as quickly as possible. No treatment of stormwater was done before being discharged to local water bodies. This approach to stormwater management is evident at SDC in the rock-lined and concrete-lined roadside channels, stormwater inlets and buried pipelines that transfer the stormwater quickly from buildings and developed areas to discharge directly into the local creeks.

Current strategies of stormwater management aim to work with nature by including groundwater infiltration, maintenance of sustainable riparian corridors, mitigation of peak storm flows to reduce erosion and flood risks, surface level conveyance with energy dissipation amidst appropriately vegetation, rocks, swales, and basins, reduction of heat island effect created by large areas of paved surfaces and related means of creating a more sustainable, natural and aesthetically pleasant built environment.

There are a few noteworthy aspects of the property that provide high quality stormwater management: broad landscaped areas, large trees, and the creeks that have been allowed to retain their natural riparian functions. However, the high ratio of paved areas that drain directly to a piped and channelized storm drain system in the main campus area will need substantial modification to meet current stormwater management requirements. Figure 7-10 shows storm drainage infrastructure at SDC, while Figure 7-11 identifies impervious surfaces.

On the steeper slopes of the property, soil erosion and slippage are concerns. On the main campus, the piped storm drain system has been, for the most part, left to function with little operations or maintenance intervention. Catch basins and gutters have been cleaned when they clog, but otherwise, facilities staff have not had to do very much to just let the stormwater system drain to the creeks.

Facilities staff do not report a problem with drainage during large events. However, several buildings experience water incursion, most likely due to inadequate grading around buildings, thresholds and finished-floor elevations originally constructed too low, or inadequate foundation drainage, rather than because of localized flooding problems.

Like other piped infrastructure on the property, the storm drain system was primarily built in the 1920's and '30s and many of the facilities and pipes are near the end of their useful life. It has been reported (Vanir/Mazzetti, 1998) that some slip-lining was done in the 1990s in a rehabilitation effort. However, according to SDC staff, no part of the storm drain system was ever slip-lined.

The existing system does not meet current requirements for on-site stormwater management. There is no mechanism to prevent discharge of pollutants to the creeks or to reduce peak flow discharges from the system to avoid scouring of creek beds and downstream flooding. These issues will need to be addressed with redevelopment of the property.

Storm Drainage at the Building Level

- Most buildings have roof gutters and downspouts hard piped to a private, campus-owned below grade storm drainage system that discharges to the municipal storm ditch.
- Larger buildings, like the Nelson Treatment Center and Frederickson Receiving building, have roof drain systems with cast iron roof drain leaders inside the building.
- Minor maintenance types of drainage problems were observed, but the drainage system appears to be functional in general.
- Record drawings of the existing systems for verification of pipe sizes and routing were not available.

Figure 7-10
STORM DRAIN SYSTEM

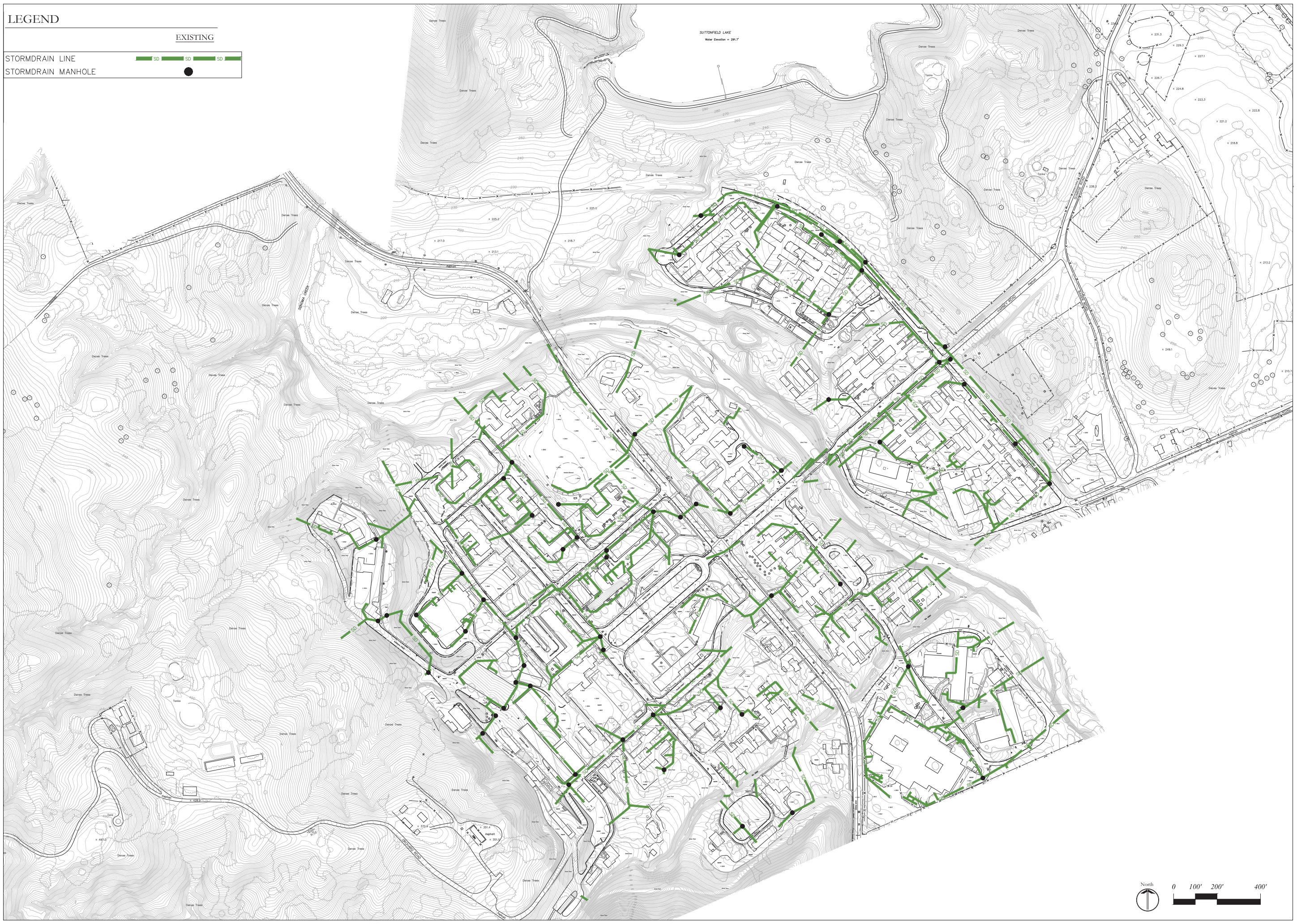
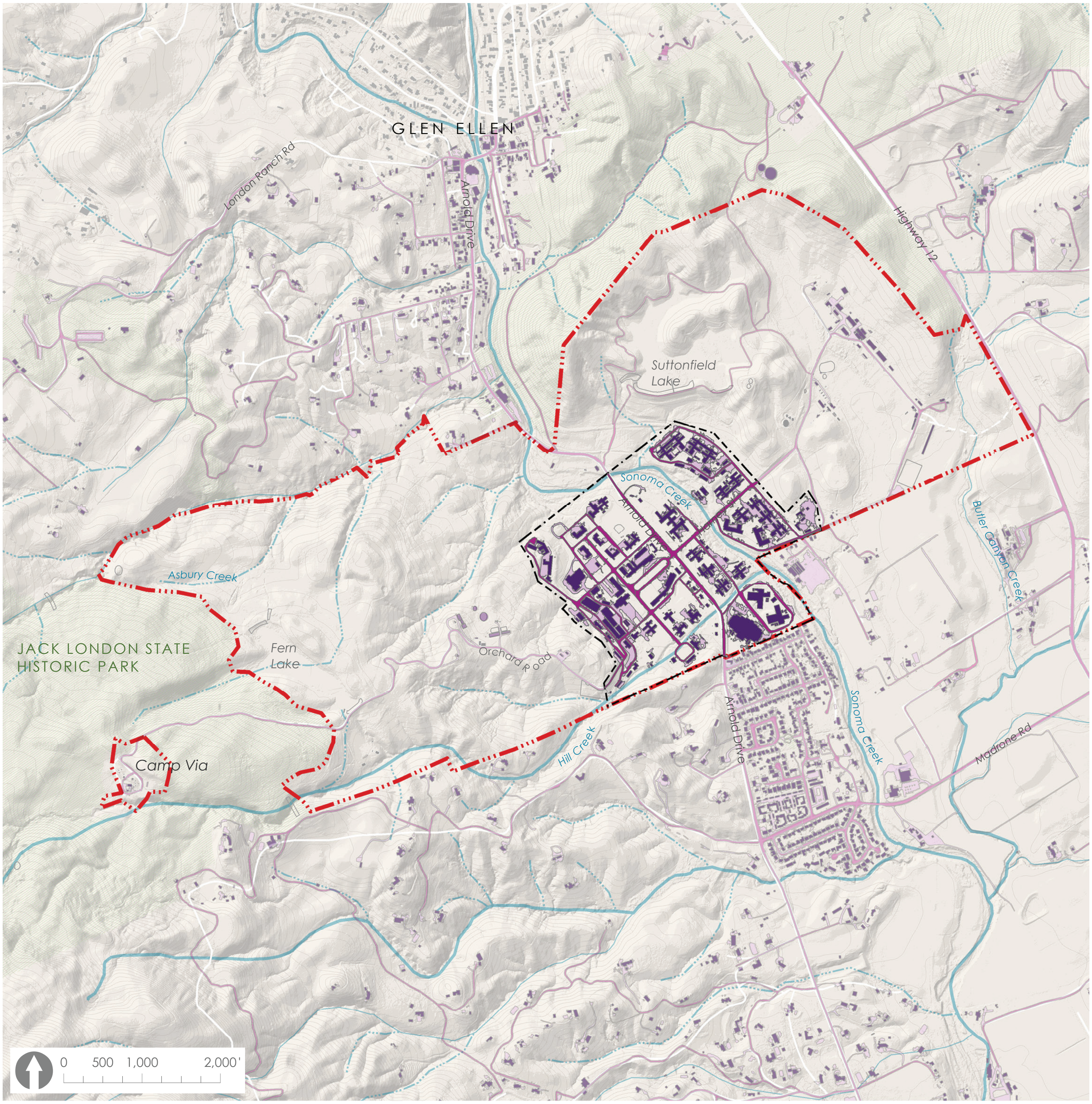


Figure 7-11

IMPERVIOUS AREAS



SDC Property line
Ephemeral Streams
Perennial Streams
Intermittent Streams
Protected and Public Lands
Impervious Study Area
Buildings
Other Impervious
Paved Roads

IMPERVIOUS STUDY AREA

Total Impervious Area:
5,878,894.96 Sq. Ft.
134.96 Acres

Buildings:
1,146,178.04 Sq. Ft
26.31 Acres
20%

Other Impervious:
1,083,903.38 Sq. Ft
24.88 Acres
18%

Paved Roads:
3,648,813.54 Sq.Ft.
83.77 Acres
62%

Source
USGS, GreenInfo Network, Sonoma Ecology Center, Sonoma Veg Map - Sonoma County Vegetation Mapping & LiDAR Program

MECHANICAL

Interface Engineers completed their analysis based on readily observable conditions and as-built drawings. Team engineers analyzed the campus site plan and compared it to information available for buildings, such as year of construction, construction type and building use, to determine which building could be assessed that would be representative of similar building types. This section provides an overview of the team's findings. For more detailed information, please refer to Interface Engineers' Site Assessment Report, including as Appendix F.

Central Plant Mechanical System

Site heating is mainly provided by Central Plant steam system which is well maintained but reaching end-of-life. Steam systems are an older technology that is not utilized by modern systems. This system was designed for a campus the size of the Sonoma Developmental Center (SDC) when it was most heavily populated and is not designed to be easily downsized to serve smaller collections of buildings.

- The plant cooling system consists of two chillers in good condition.
- The plant heating system consists of three boilers (installed between 1950 and 1970) which are in fair but aged condition and would need replacement for continued use.
- The plant cooling towers are in fair condition.
- The Site Emergency Generators consist of three units in good condition.
- The Building Management System (BMS) is tied to (16) buildings throughout the campus.
- Site distribution: Underground steam and condensate pipes are in poor condition in the north-west part of the campus where condensate is not being returned to the plant and will require extensive repair for future use, therefore the system is considered obsolete. Chilled water system is in better condition, but would require extensive investigation for future use.

Building Mechanical System

- **Buildings with the system installed prior to 1970** are heating-only systems. Assuming the steam system is taken off-line due to age, most building heating systems will require upgrade to individual boilers or system replacements.
- **Older Residences**: Most buildings have wall mount steam radiators and would require replacement to meet current code if the buildings are repurposed and brought up to today's standards.
- **Care Facilities built after 1970**: Variable Air Volume (VAV) system with central Air Handling Unit (AHU) providing cooling and reheat coils at the VAVs providing heating would require replacement to meet current code.
- **Support Buildings**: Majority of the utility buildings have heating only which is provided by suspended forced air steam heater. Most are in poor condition and would need to be replaced.
- **Buildings which have been identified as Historical** will fall under current Historical Building Code. Therefore, the existing mechanical air conditioning system could be acceptable for continued use if it is determined not be to a health and safety risk. The system must meet ventilation requirement per current California Mechanical Code. This can normally be achieved through natural ventilation for smaller residences. For larger buildings, new mechanical systems would be required to meet code.
- Most of the buildings assessed do not meet current California Mechanical Code or California Energy Code for ventilation, energy efficiency, and/or controls and thus will require an upgrade/replacement to meet current systems for future use.
- Buildings utilizing steam heating provided by the Central Utility Plant (CUP) could potentially continue to use existing heating systems for conditioning. However, this is dependent on the CUP's continued use in providing steam for heating and pipe to these building.

ELECTRICAL

Site Electrical System

The Site Electrical System is in fair condition as it is currently used but will require extensive upgrade to meet future load requirements as the site is repurposed.

- PG&E's main service and meter is located at a substation near the generator plant building.

Figure 7-12

CENTRAL UTILITY PLANT

  - The electrical distribution throughout the facility is owned and maintained by SDC.
  - Underground primary distribution is high voltage, mostly 12KV and some 2.5KV.
  - Pad mounted transformers serve the buildings on campus. Secondary voltage is typically rated at 208V/3 phase with some 480V/3 phase, and 208V/1 phase for some residential units.
- The Generator Plant has three parallel diesel generator units located near the PG&E main service and meter.
  - The three generators rated 820KW/1025KVA, are in good condition.
  - The three generators will serve power to the site electrical system via automatic transfer switch when PG&E power is not available.

Typical Building Electrical System

The Typical Building Electrical System is in fair condition as currently used but expected to require upgrade for future use.

- Most of the building power service on campus is rated at 208V/3 phase with some 480V/3 phase, and 208V/1 phase for some residential units.
  - Typical main panelboard in the building was installed the same time the building was constructed.
  - Typical electrical load feeds and branch circuits in the building were installed the same time the building was constructed.
  - Some main electrical panelboards and secondary feeders have been replaced particularly for buildings where power service was converted to outdoor type pad mounted transformer (which replaced the indoor transformer used to be mounted in the building basement level)
  - There is a main electrical panel that is corroded and in unusable condition in the P.E.C. Building.
  - Typical electrical devices such as receptacles and switches are from original building construction.
- Typical Lighting Luminaires:
  - Most of the buildings have linear fluorescent lamps.
  - Some incandescent type luminaires are retrofitted with screw on type compact fluorescent lamps.
  - According to Plant Operation's Chief, the building mounted outdoor wall pack luminaires have induction type lamps which are not high intensity.
  - Residential units have several types of luminaires, i.e. linear fluorescent, compact fluorescent, and incandescent type.
  - Street light luminaires are typically acorn pole top type and cobra head type.

General Electrical Comments

- Site Electrical Distribution is in fair condition and no immediate action is needed as currently used.
- Building Electrical Distribution is in fair condition and no immediate action is needed. It is recommended to upgrade the branch circuits and devices if there are opportunities to do so during future renovation.
- Indoor Lighting is in fair condition and no immediate action is needed. It is recommended to upgrade to LED type luminaires and automatic controls if there are opportunities to do so during future renovation.
- Outdoor Lighting is in fair condition and no immediate action is needed. It is recommended to upgrade to LED type luminaires and automatic controls if there are opportunities to do so during future site work.

GAS

Natural Gas

Natural gas is used in a small number of buildings on the campus. It is used in the Boiler/Chiller plant as the main source of fuel for the boilers, in the Main Kitchen for oven and cooktops, and in most of the Residential units along Arnold Drive for kitchen stove ranges and small +/- 40,000 BTU residential type water heaters. Inspection of the distribution system could not be performed as piping is mainly underground.

- The incoming gas pressure from the municipal supply is 145 psi which is unusually high and a potential hazard. Interface Engineering recommends that a more thorough investigation of the system be performed immediately.
- The natural gas system consists of steel pipe, galvanized or black.
- Record drawings of the existing piping system in the building for verification of pipe sizes and routing were not available.

Figure 7-13
SITE ELECTRICAL SYSTEM

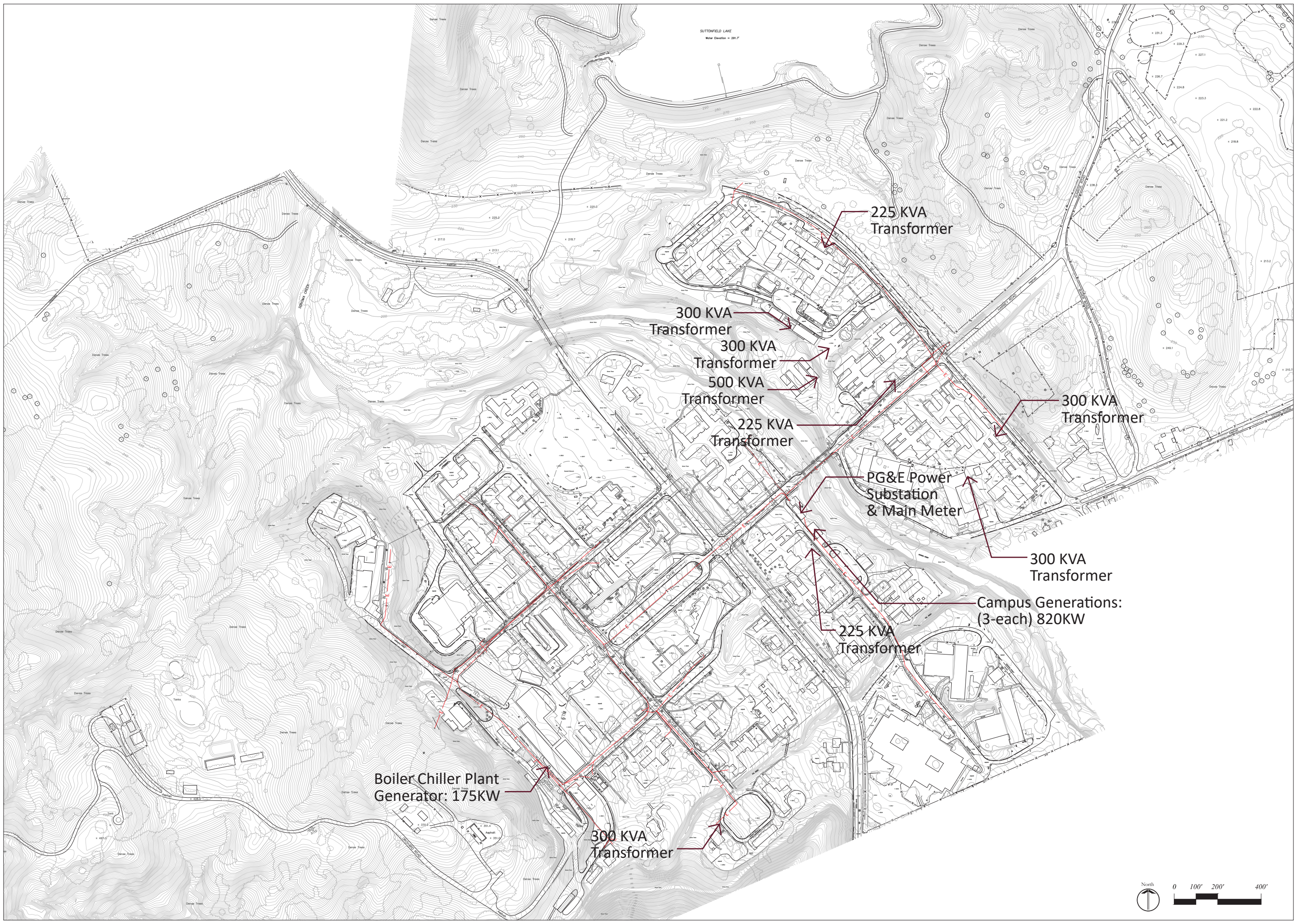


Figure 7-14

TELECOMMUNICATIONS

Additional Notes:

- Site buildings are served via fiber and/or copper cabling in existing underground communication conduits from porter administration building (PAB) with exception of fire house which gets its service overhead from police station.

- Locations further out, i.e. Farm, Water Treatment Plant, get communications services via wireless repeater system.

Emergency Diesel Fuel

- Emergency diesel fuel is used as the backup fuel for the boilers in the power house and for the emergency diesel generators in the generator plant. The fuel systems appear to be in good condition.
- Record drawings of the existing systems for verification of pipe sizes and routing were not available.

TECHNOLOGY

Porter Administration Building

The Porter Administration Building (PAB) is the central hub for voice and data services for the site. This system is designed as a single campus utility and will require extensive upgrade for future use.

- Incoming AT&T service for the site telephone and fiber connection run to second floor PBX and Data Center in PAB.
- All site communications originate from the PAB.

Site Distribution

Equipment and cabling is functional but will need significant upgrade to meet future technology/bandwidth demands.

- Copper and fiber are run in separate underground pathways throughout site.
- Cabling between buildings is owned by SDC.
- Most buildings have copper telephone connections to PAB.
- Select buildings have fiber connections.
    - Fiber connections from PAB run out to several secondary hubs in other buildings and branch out further.
    - 62.5/125-micron multimode fiber cabling used as backbone cabling throughout the site.
- CATV
    - There is no site-wide CATV distribution.
    - Select buildings use DirecTV as the television service provider.

Building Cabling

- Cat 5e cabling is used for data in buildings. There are some instances of Cat 6.
- Cat 3 cabling is used for telephone in buildings.

Future Use

- Entire site was designed to operate as one network. To run a building standalone, it would require bringing new incoming service to each building.

FIRE/LIFE SAFETY

Fire Sprinkler

- Fire sprinkler systems are installed in a limited number of the buildings at the site and those that are installed are mostly older, partial fire sprinkler systems. Partial sprinkler systems are ineffective in controlling fires that occur in spaces outside the area of fire sprinkler protection and the systems can be overrun by these fires. Two complete modern fire sprinkler systems were observed in the building set that was assessed.
- Additionally, except for a couple of relatively recent installations, the sprinkler systems are nearing the end of their expected life and do not exhibit many of the features and resilience of modern systems.

Fire Alarm

- Fire alarm systems are installed in most of the buildings surveyed; however, the fire alarm systems across the campus vary in age and serviceability. There have been many installations of modern fire alarm systems within the last 10 years in the care facilities and a few of the support buildings. These new systems tend to be in excellent condition and provide complete detection. The other fire alarm systems tend to be obsolete and are reaching, or have reached, the end of their expected life.

Central Monitoring

- Sprinkler systems installed in buildings with modern fire alarm systems are monitored by the fire alarm systems which, with a few limited exceptions, report back to the Porter Administration Building. The Administration Building acts as a proprietary monitoring station for the site.
- Many of the sprinkler system that are installed are not monitored by a fire alarm and therefore do not report back to the Administration Building. These systems rely on a passerby's observance of a fire and for them to alert the authorities.

SITE INFRASTRUCTURE CONDITION ANALYSIS

Table 7-1 summarizes the overall condition of site-wide infrastructure systems based on the analysis by Interface Engineering, provided as Appendix F.

Table 7-1

SITEWIDE INFRASTRUCTURE CONDITION SUMMARY

INFRASTRUCTURE	CONDITION
WATER SUPPLY/ TREATMENT	**MU/ SU**
DOMESTIC WATER	**MU**
SANITARY	**O**
STORM DRAINAGE	**O**
CENTRAL UTILITY PLANT (CUP) - CHILLED WATER SYSTEM OVERALL	**MU**
cooling water	SU
water source chillers	MU
Chilled Water Pumps – Primary/Secondary (6)	SU
CUP – STEAM SYSTEM OVERALL	**O**
Boilers (4)	O
Steam Pumps	O
Condensate Pumps	O
INFRASTRUCTURE SITE DISTRIBUTION	
Steam Distribution Piping	O
Chilled Water Distribution Piping	SU
Electrical	SU
Telecom	SU

Notes:

N: New Equipment

MU: System will require moderate upgrade (MU) to meet current code

SU: System will require significant upgrade (SU) and investment for continued use

O: System is obsolete (O) and will require replacement of major equipment for future use

7.4 Building Conditions

OVERVIEW & METHODOLOGY

A brief assessment of buildings at the SDC was conducted in the summer of 2017. The building assessment team evaluated all 292 buildings and structures at Sonoma Developmental Center to some degree. For this Existing Conditions Assessment, a Phase 1: Level 1 Rapid Assessment was conducted by the architects, materials conservators, and structural engineers on the Consultant team, evaluating all of the 141 unique buildings on the site, with a few minor exceptions. A Phase 1 Level 2 Detailed Assessment confirmed structural details and architectural parameters for a select group of buildings and structures.

This chapter represents Page & Turnbull's summary of the building assessment analysis. Building-by-building structural assessment was conducted by DCI; these building-by-building reports are provided as Appendix G.

LEVEL 1 RAPID ASSESSMENT SURVEY METHODOLOGY

Survey of the resources at the Sonoma Developmental Center (SDC) took place in three teams during the weeks of May 29-June 9, 2017. Access was afforded by SDC staff throughout the survey, including interiors and basements (where applicable).

Rapid assessment teams were administrated by Page & Turnbull. Site evaluations typically took place using a custom-built iPad application created by Page & Turnbull to track data collectively. This data has been integrated into the SDC Master Building and Structure Inventory. Detail regarding the survey from each discipline in the building's group is given below:

- Initial investigation of the building resources at SDC determined 141 unique buildings on site. Ten repeating building types are used throughout the site, primarily as residential wards and modular construction. Figure 7-15 shows how these building types are distributed across the western and main sections of the SDC campus.
- Page & Turnbull (Site and Architecture) evaluated 135 buildings and some structures on site over 4 dedicated days. Buildings excluded from this evaluation were of similar typology to those studied or minor support structures such as sheds or garages. The Site evaluation emphasized exterior accessibility observations and feature conditions of the site, while the Building evaluation reviewed the material construction of the buildings. Types of materials were identified for the foundations, exterior walls, roof, windows, and doors. Additional information was identified including the presence of stairs or elevators, interior building materials, and general condition of all building materials. Page & Turnbull's impressions from the Level One Rapid Assessment are indicated in the following section.
- DCI Engineers (Structural) surveyed alongside Page & Turnbull staff. A FEMA P-154 Rapid Assessment Form was used to evaluate basic life safety considerations. DCI's observations are categorized by building type and are also included in a section below.
- Van Brunt Associates (Hazardous Materials) visited most buildings on site to identify hazardous materials that are likely to be encountered. See VBA's individual report for more information.
- Interface Engineering (Mechanical, Electrical, Plumbing, Technology, Fire Safety) evaluated per each building typology, each discipline evaluating approximately 50 buildings. See Interface's individual report for more information.
- SAGE evaluated the agricultural resources alongside P&T and DCI. See this report for additional information.

The results of the Building Team Rapid Assessment have been mapped into four categories:

Exterior Building Accessibility Figure 7-17: this map summarizes exterior accessibility and feature conditions of the immediate site surrounding each building. The evaluation considers nearby parking, ramp access, and site features such as paths, walkways, stairs, entryways and building orientation. Updates required are qualified as minimal, moderate, or significant based on the relative site conditions:

- Minimal updates are required where parking, walkways and building access are nearby, easily traversed and in good condition.
- Moderate updates are required where parking, walkways, or building access vary in condition and remote location.
- Significant updates are required where parking, walkways, and/or building access are remote or in poor

condition.

Building Materials Conditions Figure 7-18: this map reviews the major building elements and deterioration of the buildings. The evaluation provides an overall summary that considers materials condition of foundations, exterior and interior walls, roof, windows, and doors. It does not evaluate code compliance such as exiting, energy efficiency, etc. for any of these same elements. Repairs are qualified as minimal, moderate, or significant based on the relative material condition of all elements of a particular building:

- Minimal Updates is required where most materials are collectively in good condition.
- Moderate Updates is required where some of the major building elements are in poor condition.
- Significant Updates is required where many or most materials are in poor condition.

Structural Condition & Seismic Assessment Figure 7-19 and 7-20: this map identifies the recommended level of strengthening required (minimal, standard, or major):

- Minimal Strengthening = Recommended strengthening is comparatively less than requirements for a building with a similar structural system built in the same geographic area during the same era. In some cases, no strengthening is required to maintain current occupancy.
- Standard Strengthening = Recommended strengthening is typical for a building with a similar structural system built in the same geographic area during the same era.
- Major Strengthening = Recommended strengthening is comparatively greater than requirements for a building with a similar structural system built in the same geographic area during the same era. In some cases, the structure may not be economically feasible to restore and occupy.

Building Hazardous Materials Figure 7-21: this map applies historical unit costs for the removal and abatement of various hazardous materials observed or presumed to exist to determine a preliminary budget for remediation. Influencing cost factors include the presence of surfacing asbestos materials, pipe insulation, the presence of asbestos debris in crawl spaces and the relative available access to these crawl spaces. As a result, the simple buildings and structures were assigned a cost of $0.01-$4.99/SF as a budget number. The highest per square foot estimated cost for building remediation as SDC is $18-22, while the highest cost for utilitarian-type structures is $89/SF for the landscape fuel station.

LEVEL 1 BUILDING SHORTLIST FOR FURTHER STUDY

Following the Rapid Assessment, the Page & Turnbull Team predicted each individual building's potential for reuse, based on building condition and preliminary structural viability for each building type. The purpose of this exercise was to provide the Economic Team a shortlist of buildings to vet against current market analysis. Each building was ranked individually by the Architectural and Structural team as:

1. Good Potential for Reuse
2. Challenging Potential for Reuse
3. Not Recommended for Reuse

Buildings with the highest reuse potential based on physical and structural condition were then evaluated by the Economic Pillar and Land Use Pillar teams to determine a short list of buildings for additional structural investigation and eventual architectural adaptive reuse study. SAGE also contributed to the reuse potential analysis for select agricultural resources.

Forty-five buildings with the highest reuse potential were further evaluated. These are identified and shown on the pages that follow.

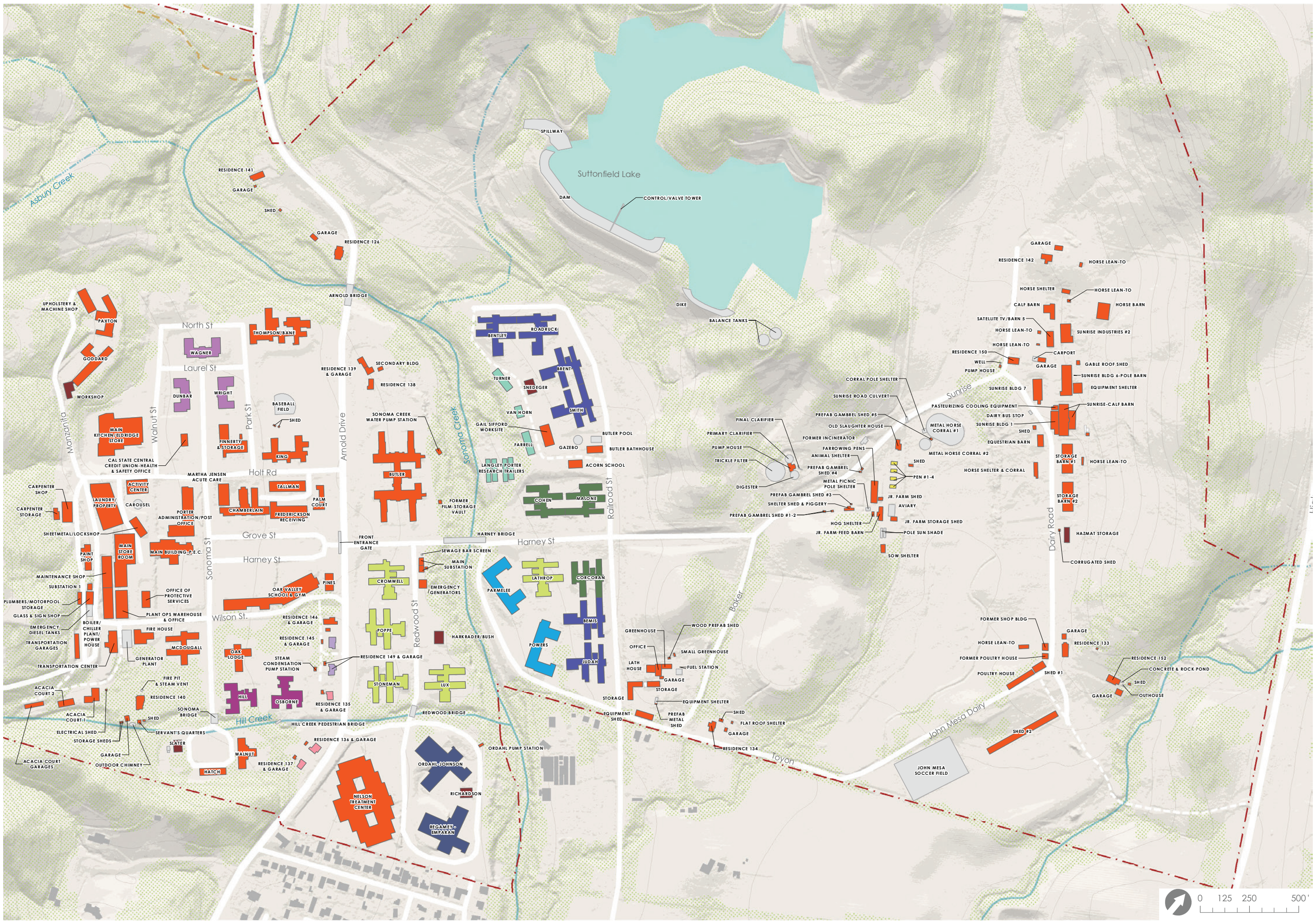
PHASE 1 LEVEL 2 BUILDING ASSESSMENT METHODOLOGY

A Phase 1 Level 2 assessment was conducted by Page & Turnbull and DCI Engineers only. During this evaluation, the architectural team consolidated existing drawings and confirmed the size and layout of the buildings identified by the Project Team for further evaluation. These efforts create an existing physical record of each of the shortlisted buildings and offer a foundation for future Phase 2 work. Available existing drawings for the buildings were used to create floor plans; the layout of each building and basic dimensions were confirmed in the field.

DCI Engineers utilized American Society of Civil Engineers 41-13 "Seismic Evaluation and Retrofit of Existing Structures" (ASCE 41-13) Tier 1 checklists and analysis for the additional detailed assessment. DCI confirmed structural systems indicated in existing structural or architectural drawings for each building in the shortlist for further study. In some cases, the structural systems identified in the Level 1 assessments were modified based on additional information gathered during the Level 2 assessment. Their observations and methodology are further detailed below in the section "Structural Conditions by Building Type."

Figure 7-15

BUILDING PLAN TYPES (MAIN CAMPUS)



LEGEND

- Unique
- C-Plan
- E-Plan
- F-Plan
- H-Plan 1
- H-Plan 2
- H-Plan 3
- X-Plan
- Hog Pen
- Modular 1
- Modular 2
- Cottage
- Officer's Residence
- Camp Via BBQ
- Camp Via Cabin
- Camp Via Restoom
- Structure
- SDC Property

Sources:
Page & Turnbull, JRP Historical Consulting, USGS, GreenInfo Network, Sonoma Ecology Center, WRT

Buildings on the following page were short-listed for Level 2 Buildings Assessment

ACACIA COURT 1 (1914)
DGS#11045

ACACIA COURT 2 (1914)
DGS#11046

ACACIA COURT GARAGES (1923)
DGS#11067

ACTIVITY CENTER (1909)
DGS#11015

BUTLER (1951)
DGS#10982

CARPENTER SHOP (ca. 1952)
DGS#11010

CHAMBERLAIN (1931)
DGS#11080

FINNERTY (1930)
DGS#11075

FIRE HOUSE (1932)
DGS#11004

FREDERICKSON RECEIVING (1958)
DGS#11066

GLASS & SIGN SHOP (1916)
DGS#11076

GODDARD WITH WORKSHOP (1914)
DGS#36966

HATCH (1924)
DGS#11079

KING (1940)
DGS#10988

LAUNDRY/PROPERTY (1950)
DGS#11033

MAIN KITCHEN/ELRIDGE STORE (1954)
DGS#11012

MAIN STORE ROOM (1932)
DGS#11078

MAINTENANCE SHOP (1918)
DGS#11093

MCDOUGALL (1939)
DGS#11064

NELSON (1965)
DGS#10987

OAK LODGE (1908)
DGS#11023

OAK VALLEY SCHOOL (1931/1960)
DGS#11001

ORDAHL-JOHNSON (1958)
DGS#10990

OSBORNE (1940)
DGS#10989

PAINT SHOP (1918)
DGS#11024

PALM COURT (1928-29)
DGS#11069

PARMALEE (ca. 1956)
DGS#10994

PAXTON (1932)
DGS#11022

PINES (1924)
DGS#11090

PLUMBERS/MOTORPOOL STORAGE
(ca. 1926-1931)

STORAGE BARN #1 (1937)
DGS#11073

PORTER ADMINISTRATION / POST OFFICE (1959)
DGS#11002

PROFESSIONAL EDUCATION CENTER (P.E.C.) (1890-91/1908)
DGS#11068

RESIDENCE 136 (1939)
DGS#11057

RESIDENCE 140 (SONOMA HOUSE) (1897)
DGS#11063

RESIDENCE 141 (1897)
DGS#11053

RESIDENCE 145 (1930)
DGS#11016

RESIDENCE 149 (1932)
DGS#11051

RESIDENCE 150 (1897)
DGS#11052

STONEMAN (1950)
DGS#10996

THOMPSON/BANE (1939)
DGS#10991

TRANSPORTATION GARAGES (1930)
DGS#44069

UPHOLSTERY & MACHINE SHOP (1945)
DGS#11013

WAGNER (1926)
DGS#11014

WALNUT (1918)
DGS#11081

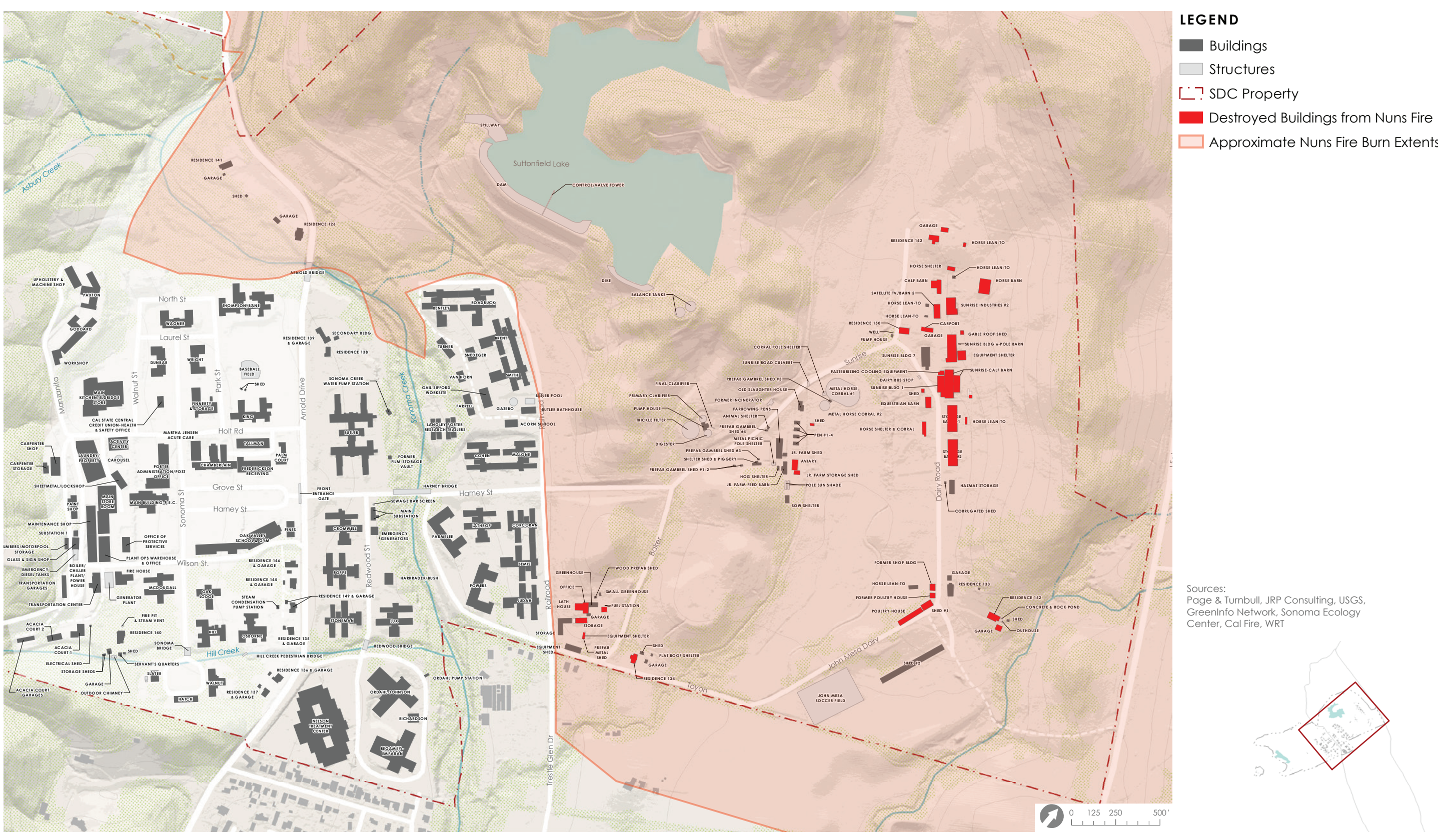
OCTOBER 2017 WILDFIRES

In October 2017, Sonoma, Napa and other North Bay counties experienced a series of major wildfires, which broke out during severe fire weather conditions. Taken together, the fires burned some 245,000 acres and caused an estimated $9.4 billion in insured damages. The fires are believed to have killed at least 44 people and destroyed 8,900 structures across several counties, including over 5,000 homes and businesses in Sonoma County.

One of these fires, the Nuns Fire, burned approximately 56,000 acres, mainly in the Mayacamas Range between Napa and Sonoma valleys, but also across parts of Sonoma Valley and onto Sonoma Mountain to the west. The Nuns Fire burned across a large portion of the SDC site itself, including all of the site west of Railroad Street, and crossing Sonoma Creek and Arnold Drive toward the north end of the site. The fire destroyed most of the buildings in the Sunrise Complex as well as buildings at the Landscape Complex and elsewhere as shown on Figure 7-16.

Figure 7-16

EXTENT OF THE NUNS FIRE AND FIRE-DAMAGED BUILDINGS AT THE SDC SITE



BUILDING CONDITIONS OVERVIEW

With few exceptions, the buildings at the Sonoma Developmental Center have been well-maintained and are in good or fair, serviceable condition.

Most of the institutional buildings are in good to fair condition. Many former patient wards have been converted into office for SDC staff and services. Some are currently occupied or partially occupied, though a warm shutdown of other buildings has already taken place. As of September 2017, a small number of buildings east of Arnold Drive still actively serve or house the remaining population of clients; these occupied buildings are in the best material condition. In general, buildings are clean and well cared for, both inside and out. Warm shut-down procedures have been implemented for the most part when building functions have been consolidated and structures vacated. In this case, buildings are heated and cooled in only a limited capacity, and are closed in order to limit access, however they are not fully mothballed. Water, heat and plumbing are still functional.

The support services buildings vary widely from good condition to poor condition, though most are good. Many of these buildings are still actively used in supporting the functions of the SDC, and as such are maintained as is required by the service they house: Main Kitchen, Laundry, Administration, Carpentry, Main Store room, etc. The majority of the buildings in poorer condition are no longer in use; the state of operation of the service facilities in the out of service buildings was undetermined.

The various single-family residences, for the most part have maintained occupancy, and thus are in relatively good repair. Exceptions include one multi-unit building (Pines), Residence 146 Yellow House, and Residence 152, which all have interior mold issues, and Residence 141 where a small fire in 2016 has precluded continued use.

The agricultural and landscape buildings that survived the Nuns fire show the greatest variety of condition issues. These utilitarian buildings and structures have not been held to the same standards of repair as other buildings at the SDC campus, and thus suffer from more serious material conditions. Those buildings which are actively used have been maintained, but only up to serviceable standards. Unused buildings in this area of SDC are deteriorated; some are in danger of full or partial collapse.

The building site evaluation shown on Figure 7-17 summarizes exterior accessibility and feature conditions of the immediate site surrounding each building. The evaluation considers nearby parking, ramp access, and site features such as paths, walkways, stairs, entryways and building orientation.

The building architectural evaluation (Figure 7-18) reviews the material construction and deterioration of the buildings. The evaluation provides an overall summary that considers foundations, exterior and interior walls, roof, windows, and doors.

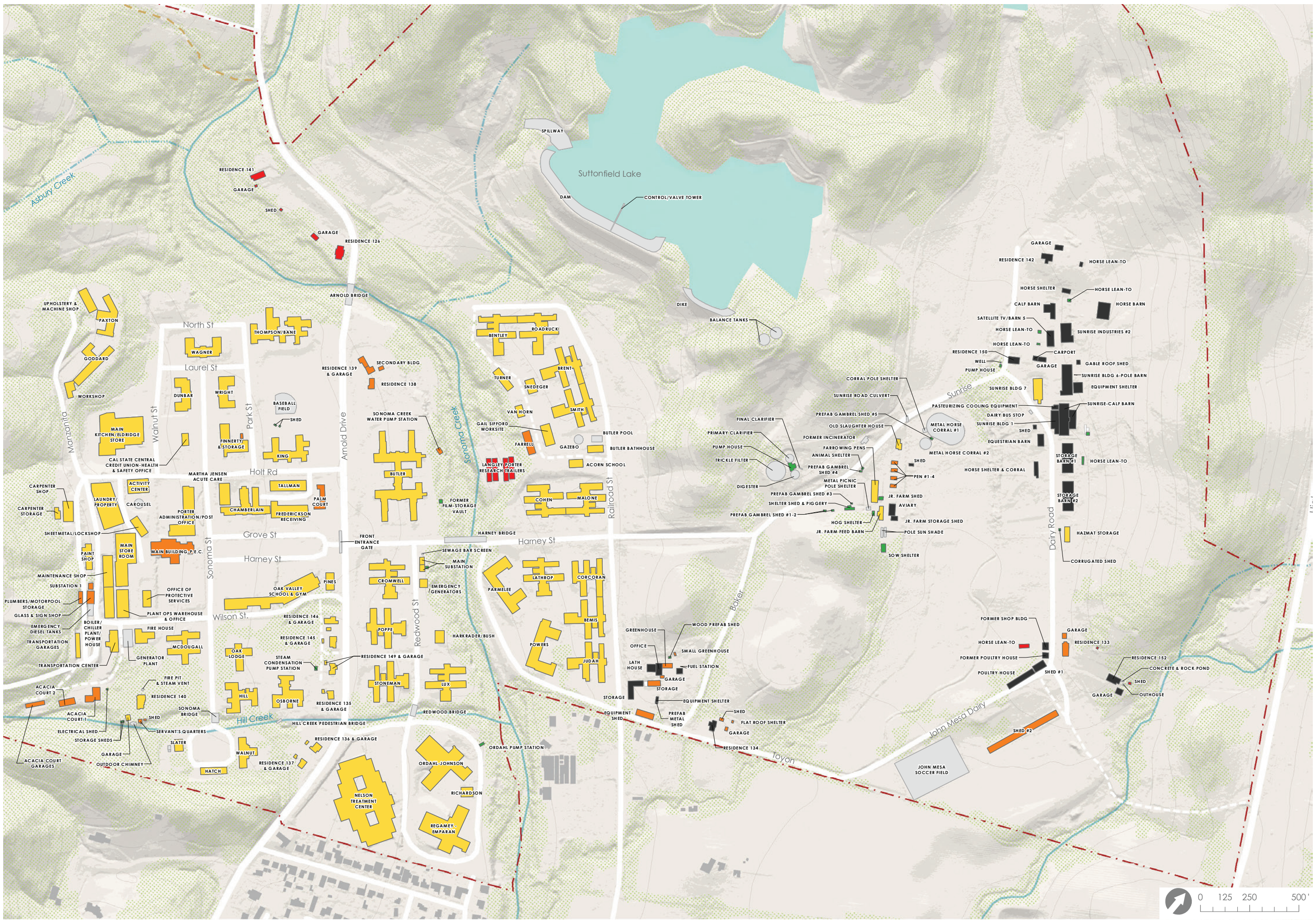
1 *Pines*

2 *Main Kitchen*

3 *Porter Administration*

Figure 7-17

RAPID ASSESSMENT: EXTERIOR BUILDING ACCESSIBILITY**



LEGEND

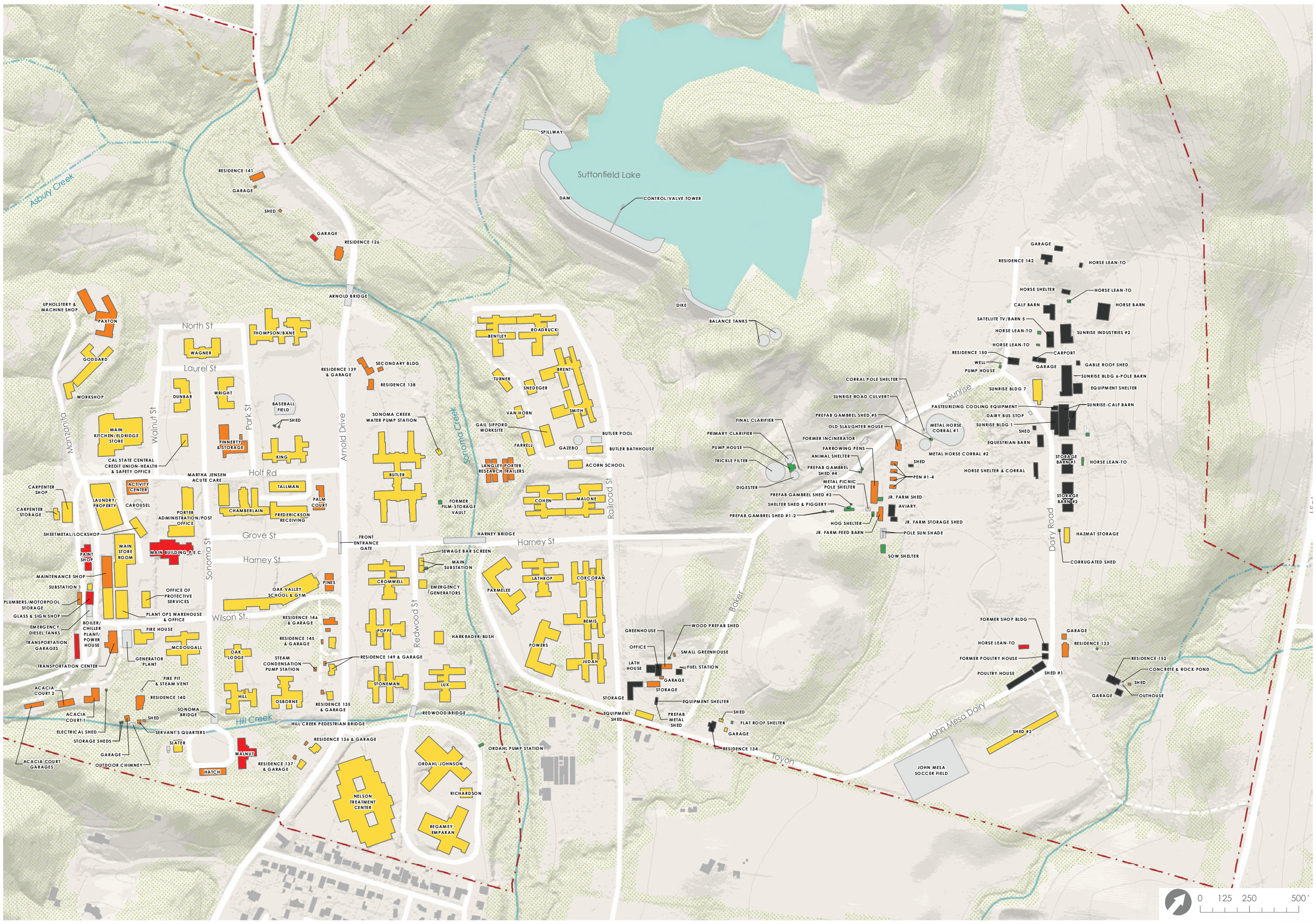
- No Updates Required
- Minimal Updates Required
- Moderate Updates Required
- Significant Updates Required
- Structure Not Evaluated
- Building Not Evaluated
- Building/Structure Destroyed by Fires
- SDC Property

Sources:
Page & Turnbull, JRP Historical Consulting, USGS, GreenInfo Network, Sonoma Ecology Center, WRT

** Excludes interior accessibility. Analysis is based on preliminary rapid assessment only; required updates may change based on building use, occupancy, program requirements, preservation goals, or other factors.

Figure 7-18

RAPID ASSESSMENT: BUILDING MATERIALS EVALUATION**



LEGEND

- No Updates Required
- Minimal Updates Required
- Moderate Updates Required
- Significant Updates Required
- Structure Not Evaluated
- Building Not Evaluated
- Building/Structure Destroyed by Fires
- SDC Property

Sources:
Page & Turnbull, JRP Historical Consulting, USGS, GreenInfo Network, Sonoma Ecology Center, WRT

** Analysis is based on preliminary rapid assessment only; required repairs may change based on structural materials testing, presence of hazardous materials, preservation goals, code requirement for future use or other factors.

STABILIZATION

DCI Engineers identified a priority list of buildings for temporary structural stabilization or water infiltration prevention, most of which have already been vacated. DCI recommends that where prudent and feasible, the following buildings should be temporarily stabilized and waterproofed where specifically noted to reduce the risk of further damage and deterioration or for safety purposes until further evaluation to determine feasibility of repair. Further evaluation including materials testing, removal of non-structural finishes, and full analysis should be conducted if occupancy is intended. This list was generated upon further analysis during Phase 1 Level 2 of the short-listed buildings and therefore is only an evaluation of that subset of buildings – there may be other non-shortlisted buildings at SDC in need of stabilization. Please see Appendix G for the structural condition assessment report for each individual building.

(* indicates priority structural stabilization or water infiltration prevention recommendation)

- Acacia Court 2 – Immediate attention to stop water infiltration and mold issues. *
- Activity Center – Immediate attention to the roof to prevent water infiltration. *
- Finnerty – Immediate attention to area with significant water and mold damage caused by boiler leak. *
- Glass & Sign Shop – Immediate attention to lower level exterior wall with large shear cracks located in the vicinity of the generator chimney stabilizing anchors.
- Oak Lodge – Immediate attention to partial failed basement wall
- Paint Shop – Immediate attention to numerous shear cracks and deteriorated grout if building remains occupied.
- Pines - Immediate attention to stop water infiltration and mold issues.
- Professional Education Center (P.E.C.) – Immediate attention to water infiltration, mold issues, and stabilization. Provide pedestrian barrier around building for safety purposes. *
- Residence 140 Sonoma House, Garage, Servant Quarters and Sheds - Immediate attention to Servants Quarters if any type of occupancy is allowed. *
- Residence 141 and Garage – Immediate attention to fire damage in the kitchen. *
- Residence 146 and Garage - Immediate attention to water infiltration and mold issues. *
- Transportation Garages – Consider providing temporary seismic strengthening with wood x-bracing over two garage bays.
- Walnut - Immediate attention to water infiltration, mold issues, and stabilizzation. *
- Carpenter Shop, Paxton , Paint Shop, Maintenance Shop and Goddard - Anchor and brace, or remove storage racks if occupancy is intended.

BUILDINGS WITH DEFICIENT STRUCTURAL SYSTEMS

DCI Engineers has identified a number of structures and additions that are significantly deficient structural systems, and should be further studied for complete removal. This assessment does not consider historic status or other factors other than current structural condition:

Complete Structures: (* indicates Contributor to Historic District per JRP report dated May 2017)

- PEC (partial) *
- Calf Barn (Dairy Area Building No. 3)
- Carpenter Storage
- Creekside Complex (Langley Porter Research Trailers)
- Jr. Farm Feed Barn (Hog Area Building. No. 10)
- Jr. Farm Storage Shed (Hog Area Building. No. 8)
- Pasteurizing Cooling Equipment (Dairy Area Building No. 7)
- Poultry Area Building 4 (Former Poultry House)
- Poultry Area Building 5 (Former Shop Building)
- Poultry House (Poultry Area Building 2)
- Residence 126 Garage *
- Residence 141 Shed *
- Residence 150 Carport
- Residence 150 Garage
- Residence 152 Shed *
- Transportation Center
- Walnut *
- Sonoma House Servant's Quarters *

Additions:

- Chamberlain (north side)
- Residence 139 Breezeway
- Landscape Storage "L" shaped building, keep addition only
- Residence 142 (rear addition)
- Sunrise Calf Barn addition

STRUCTURAL CONDITIONS BY BUILDING TYPE

DCI Engineers classified each surveyed building in the Phase 1, Level 1 Rapid and Level 2 Detailed Assessments by structural type as part of their overall assessment. DCI initially identified 9 structural types present at SDC during the Level 1 Rapid Assessment. The number of structure types was refined to 12 during the detailed assessment through existing document review and additional observation, and these 12 structure types are listed below. Note that some buildings incorporate a combination of different structural types, such as a wood frame second story over a concrete shear wall, see Figure 7-19.

- W1 – Wood light frame, single family
- W1a – Wood light frame multi-family, multi-story residential
- W2 – Wood frame non-residential
- S3 – Steel light frame (pre-engineered steel building)
- C2 – Concrete shear wall with rigid diaphragms
- C2a – Concrete shear wall with flexible diaphragm
- PC1 – Precast or tilt-up concrete with flexible diaphragm
- PC1a – Precast or tilt-up with rigid diaphragms
- RM1 – Reinforced masonry with flexible diaphragm
- RM2 – Reinforced masonry with rigid diaphragm
- URM – Unreinforced masonry bearing-wall with flexible diaphragm
- URMa – Unreinforced masonry bearing-wall with rigid diaphragm

PRESENTATION MAPPING

To visually simplify structural building system information the following criteria was applied to the presentation mapping:

1. With the exception of W1a, all "a" category structural system types are consolidated into the primary type. Most "a" subsets are isolated occurrences of the primary structural type on the SDC campus. W1a is a primary building type on the SDC campus, therefore the category was not consolidated.
2. Where buildings are a combination of multiple structural systems, only the structural system representing the majority of the building is identified on the presentation mapping. However, custom legend designations are provided for buildings consisting of 50% of two structural system.
3. Descriptions of RM1 and RM2 structural system types have not been provided in the structural narrative. These systems only occur in small ancillary buildings.

Individual building structural condition reports are available in the Appendix. Descriptions of the conditions present for each building type are given below.

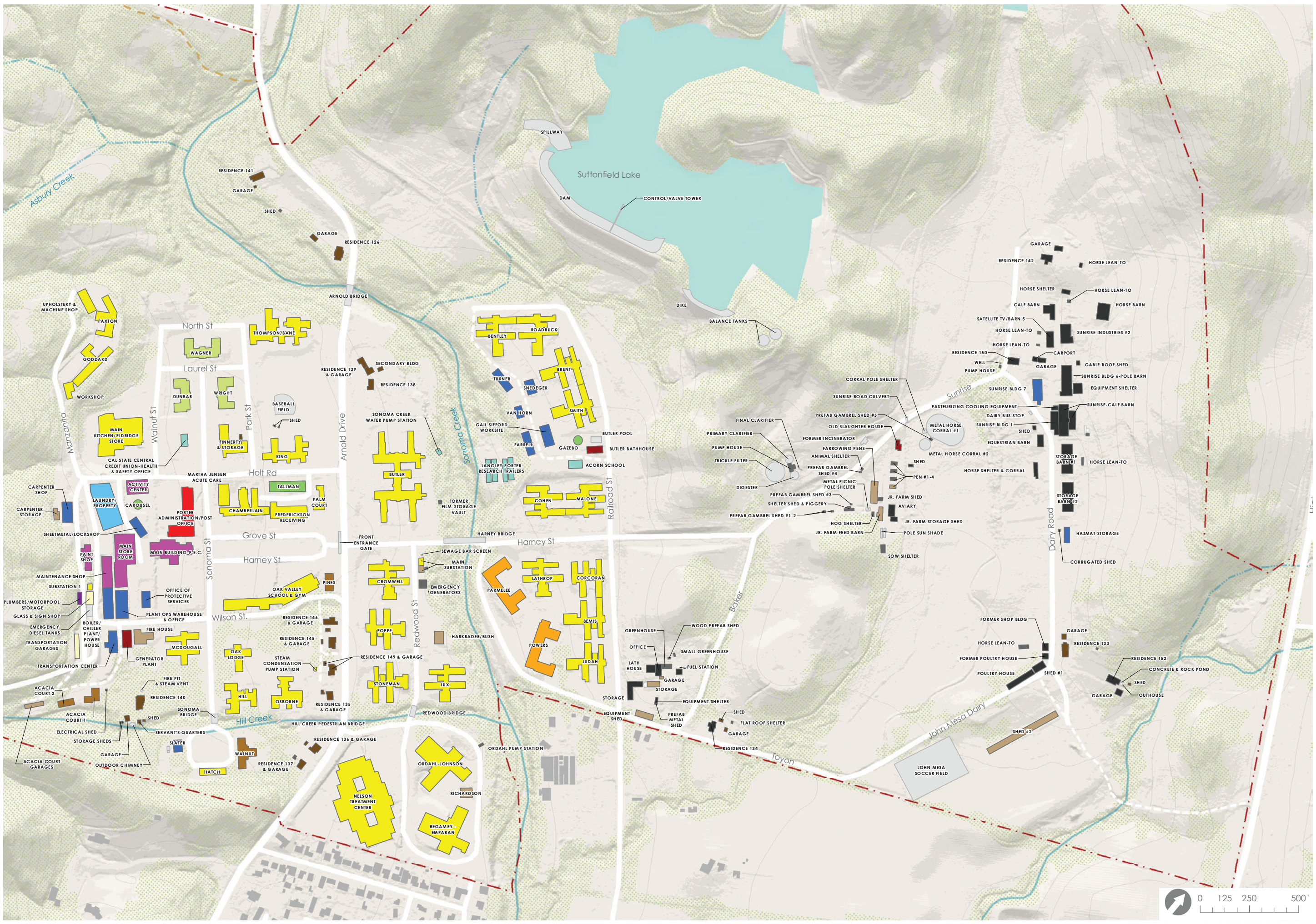
W1 – WOOD LIGHT FRAME SINGLE-FAMILY

Construction Description – Structures of this type were primarily observed during the Level 1 Rapid Assessment, which was limited to cursory visual observations of the interior and exterior of the building. Access to attic and crawl spaces was not available during the rapid assessment. Therefore, based on observations of similar structures in the area that were constructed in the same era, we have assumed that the following structural systems are present.

- The structures have sloped 2-inch wood roof rafters with occasional 2-inch or 1-inch diagonal wood braces and vertical ties, ridge members, and collar ties. Roof sheathing consists of spaced straight sheathing, but structural plywood sheathing over the original sheathing will likely be present on structures which have been reroofed with composite shingles within the past 30-years. Roof framing is supported by wall framing constructed of 2-inch by 4-inch (or 2-inch by 6-inch for multiple stories) studs spaced 16 inches to 24 inches on center. Wall finishes consist of wood lath and plaster on the interior, with either cement plaster (stucco) or wood siding on the exterior. The crawlspace framing and foundations consist of 2-inch floor joists with straight sheathing, supported on continuous exterior concrete footings and interior beam and post lines with isolated concrete piers.
- This is the only building type on the SDC campus for single-family residences. On the SDC campus structures of this type are in good to fair condition, are occupied, and are single-story. Some exceptions are that Residence 140 "Sonoma House" is multi-story, Residence 141 has fire damage in the kitchen area, and Residence 146 is in poor condition due to water infiltration and mold damage.

Figure 7-19

PRIMARY BUILDING STRUCTURAL SYSTEM



LEGEND

- W1 – WOOD LIGHT FRAME, SINGLE FAMILY
- W1a – WOOD LIGHT FRAME MULTI-FAMILY, MULTI-STORY RESIDENTIAL
- W2 – WOOD FRAME NON-RESIDENTIAL
- S3: STEEL LIGHT FRAME (PRE-ENGINEERED STEEL BUILDING)
- S3: STEEL LIGHT FRAME (PRE-ENGINEERED STEEL BUILDING) OVER C2: CONCRETE SHEAR WALLS
- C2: CONCRETE SHEAR WALLS
- W2: WOOD FRAME (INDUSTRIAL) OVER C2: CONCRETE SHEAR WALL
- PC1: PRECAST OR TILT UP CONCRETE SHEAR WALL
- RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS
- RM2 – REINFORCED MASONRY BEARING WALLS WITH RIGID DIAPHRAGM RETROFITTED TO C2: CONCRETE SHEAR WALL
- URM: UNREINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGM
- W2: WOOD FRAME (INDUSTRIAL) OVER URMa: UNREINFORCED MASONRY BEARING WALLS WITH RIGID DIAPHRAGM
- MH: MANUFACTURED HOUSING
- UNIDENTIFIED TYPE
- UNDEFINED ASCE TYPE. CLOSEST MATCH, C3: CONCRETE FRAMES WITH UNREINFORCED MASONRY IN FILL WALLS
- Structure Not Evaluated
- Building Not Evaluated
- Building/Structure Destroyed by Fires
- SDC Property

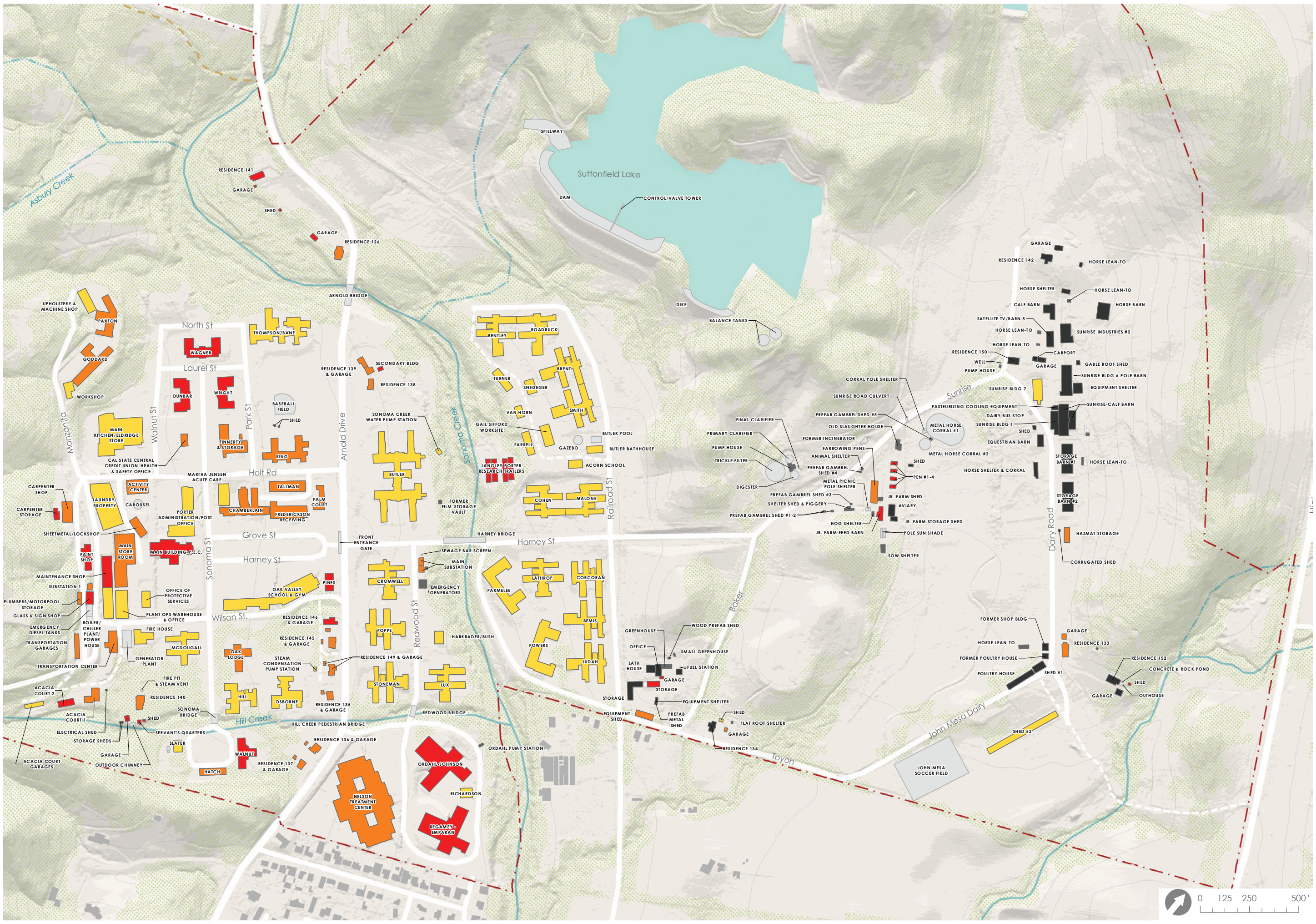
Sources:
Page & Turnbull, JRP Historical Consulting, USGS, GreenInfo Network, Sonoma Ecology Center, WRT

Note:

1. All "a" structural system types are consolidated into the primary type.
2. Buildings comprised of multiple structural types are identified by the type representing the largest area.
3. Buildings comprised of 50% of two structural system and specifically identified in the legend.

Figure 7-20

RAPID ASSESSMENT: BUILDING STRUCTURAL EVALUATION



LEGEND

- Minimal Strengthening Required
- Standard Strengthening Required
- Major Strengthening Required
- Structure Not Evaluated
- Building Not Evaluated
- Building/Structure Destroyed by Fires
- SDC Property

Building/Structure Destroyed by Fires
SDC Property

Seismic Performance - Buildings of this type generally perform very well in seismic events due to inherent redundant qualities of the structural system, low seismic mass, and because they are low rise.

Expected Seismic Damage - The most common structural damage results from a lack of connection between the superstructure and the foundations and inadequate chimney support, particularly unreinforced brick masonry chimneys. Inadequate superstructure to foundation connections can cause the superstructure to disconnect from the foundations which may result in portions of the structure falling to grade level, however, this failure is rare. Unbraced chimneys often fully collapse into the structure or onto adjacent structures. Earthquake-induced cracks in the plaster and stucco (if any) finishes are common but are classified as nonstructural damage.

Recommended Strengthening – Provide full access to attic and crawl space areas to further observe roof and floor framing systems, member sizes, sheathing types, and connections. Install the following if not observed during the additional structural investigations: structural panel sheathing over existing roof straight sheathing with 2-inch blocking and seismic clips at the exterior roof-to-wall diaphragm connections, structural clips and anchors tying the superstructures to the foundations, and chimney bracing.

W1A – WOOD LIGHT FRAME MULTI-FAMILY, MULTI-STORY RESIDENTIAL

Construction Description – Structures of this type were primarily observed during the Level 1 Rapid Assessment, which was limited to cursory visual observation of the interior and exterior of the building. Access to attic and crawl spaces was not available to the observation team during the rapid assessment. However, the majority of these structures have full or partial original construction documents. For structures without original construction documents, an additional site observation visit was done, which provided attic access.

- Structures of this type generally have sloped 2-inch wood roof rafters with occasional 2-inch or 1-inch diagonal wood braces and vertical ties, ridge members, and collar ties. Some structures have site fabricated wood trusses at long span locations. Original roof sheathing consists of straight or diagonal sheathing. Structural plywood sheathing over original sheathing is present on structures which have been reroofed with composite shingles within the past 30-years. Reroofing may not have been done on structures with clay tile roofing. Roof framing is supported by wall framing constructed of 2-inch by 4-inch (or 2-inch by 6-inch for multiple stories) studs spaced 16 inches to 24 inches on center. Original wall sheathing is typically wood lath and plaster on the interior, with either cement plaster (stucco) over straight or diagonal sheathing on the exterior. The crawlspace framing and foundations typically consist of 2-inch floor joists with straight sheathing, supported on continuous exterior concrete footings and interior beam and post lines with isolated concrete piers. Large openings were observed at the ground level for covered porches for a few buildings.
- This is a primary building type of the SDC campus for multi-family residences. Some examples of this type of structure are Palm Court, Pines, Acacia Courts I and II, Oak Lodge, and Walnut. Most structures of this type are in good condition, occupied, two-stories, and have a partial basement for the boiler room, with exception of the following; Walnut is in very poor condition and has been identified as a demolition candidate per structural evaluation, and both Pines and Acacia Court II have water infiltration and related mold issues.

Seismic Performance - Buildings of this type generally performed well in seismic events due to inherent redundant qualities of the structural system, low seismic mass, and because they are low rise.

Expected Seismic Damage - The most common structural damage results from a lack of adequate connections between the superstructure and the foundations, and inadequate chimney support, particularly unreinforced brick masonry chimneys, which often fully collapse into the structure or onto adjacent structures. Multi-story buildings of this type, but with large openings in the exterior walls, will have increased damage due to the increased movement of the structure in a seismic event. Earthquake-induced cracks in the plaster and stucco (if any) finishes are common but are classified as nonstructural damage.

Recommended Strengthening – Provide full access to the attic and crawl space areas to further observe roof and floor framing systems, member sizes, sheathing types, and connections. Install the following if not observed during the additional structural investigation: structural panel sheathing over existing straight sheathing with 2-inch blocking and seismic clips at the exterior roof diaphragm to wall connections, structural panel sheathing on exterior walls with hold-downs from the upper level to the foundation system, structural clips and anchors to tie the superstructure to the foundations, and chimney bracing.

W2 – WOOD FRAMED NON-RESIDENTIAL

Construction Description – Structures of this type were observed during the Level 1 Rapid Assessment and most were included in the Level 2 Detailed Assessments. Of these structures, only the Fire House and Acacia Court Garages have full or partial original construction documents.

- Structures observed of this type generally have sloped or flat 2-inch to 6-inch wood roof members. Long span built up wood trusses with through bolting at the primary connections are present at large open spaces in the Pole Barns and Fire House. Original wood roof sheathing typically consists of diagonal sheathing (or spaced straight sheathing at agricultural buildings). Structural plywood sheathing is most likely present on structures with recent reroofing. Roof framing is supported by wall framing typically constructed of 2-inch by 4-inch (or 2-inch by 6-inch for multiple stories) studs spaced 16 inches to 24 inches on center, or by interior posts and beams, with the expectation of the Pole Barns which are supported by built-up columns and vertical diagonal bracing. Original wall sheathing is typically straight or diagonal sheathing on the exterior with wood lath and plaster at the interior where interior finishes are present. Foundations are shallow continuous exterior and interior isolated footings. Concrete slabs on the ground are present in non-agricultural structures. A dirt floor is present at the Pole Barns.
- This is a primary building type in the agricultural portion of the SDC campus, but not in the historic district. Most structures were observed to be in good to fair condition, occupied, and single-story. The following are the only structures on the "short list" of this structural type: Fire House, Storage/Pole Barns #1 and #2, Acacia Court Garage, Transportation Garage, and Glass and Sign Shop.

Seismic Performance - Buildings of this type generally perform well in moderate seismic events due to inherent redundant qualities of the structural system, low seismic mass, and because they are low rise. Structural performance decreases as the structures increase in size and as their physical condition deteriorates which leads to an increase in structural deficiencies.

Expected Seismic Damage - The most common types of structural damage result from a lack of adequate connections between the superstructure and the foundations, numerous large openings in the exterior walls, long diaphragm spans with high length-to-depth ratios, and lack of structural sheathing capacity at large diaphragm spans. These deficiencies typically result in excessive building movement which results in increased seismic-induced cracks in the exterior walls, interior floors, and roof framing system. Structures with large narrow diaphragms and straight sheathing may permanently deflect from their original position. We anticipate the Fire House will perform very well with negligible (if any) nonstructural damage.

Recommended Strengthening – Provide full access to attic and crawl space areas to further observe and document roof and floor framing systems, member sizes, sheathing types, and connections. Install the following if not observed during the structural investigation: structural panel sheathing over existing straight sheathing with 2-inch blocking and seismic clips at the exterior roof to wall connections, structural panel sheathing on exterior walls with hold-downs from the upper level to the foundation system, and structural clips and anchors to tie the superstructure to the foundations.

S3 – STEEL LIGHT FRAME (PRE-ENGINEERED STEEL BUILDING)

Construction Description – The Carpenter Shop and upper level of the Laundry/Property structures are the only buildings on the SDC campus with this structural system type. Neither structure has original construction documents, therefore, an additional, more detailed site visit observation of the structure was performed to obtain sufficient information to assess each structure. These structures consist of steel moment frames in the transverse (short) direction and steel rod x-bracing frames in the longitudinal direction, with nonstructural sheet metal siding and roofing. The roof diaphragms consist of steel rod bracing in select roof framing bays which aligned with the steel rod braced frames in the longitudinal direction. The Laundry/Property building is anchored and supported by the lower level reinforced concrete structure. The Carpenter Shop has a shallow foundation system with concrete slabs on ground. The interiors of occupied buildings are open with very few interior finishes or partitions and their structural systems are exposed and easily observed. Both structures are single-story, occupied and in good condition.

Seismic Performance – These buildings should perform well due to their inherent low seismic mass, redundancy, and lack of non-structural finishes.

Expected Seismic Damage – Insufficient tension capacity of steel bracing in the walls and roof of each building may result in the elongation or failure of the bracing and subsequent building damage during seismic events.

Recommended Strengthening – Strengthening of the moment frame connections, additional anchor bolts at the moment frame to footing connections, installation of additional rod and diaphragm bracing on the Laundry/Property building, and the replacement of damaged or missing rod bracing on the Carpenter Shop.

1. *URM: Professional Education Center (P.E.C.)*
2. *W1a: Acacia Courts 2*
3. *W1: Sonoma House*
4. *S3: Carpenter Shop*
5. *C2A: McDougall*
6. *C2: Regamey-Emparan*


1


2


3

C2 – CONCRETE SHEAR WALL WITH STIFF DIAPHRAGMS

Construction Description – All structures of this type were observed during the Level 1 Rapid Assessment, which was limited to cursory visual observation of the interior and exterior of the building, and most were included in the Level 2 Detailed Assessments. All of these structures have full or partial original construction documents.

- All of these structures have cast-in-place structural systems. The reinforced concrete shear wall thicknesses range from 6-inches to 12-inches. The roof and floor diaphragms are reinforced concrete slabs or pan joist systems. The foundation systems are shallow reinforced concrete with concrete slabs on the ground, or the concrete columns and walls extend into partial or full concrete basements. Structures of this type are in good condition.
- This is a common non-residential structural type on the SDC campus. The following eleven (11) buildings are identified on the "short list"; Butler, Upholstery and Machine Shop, Frederickson, Nelson Treatment Center, Ordahl/Johnson, Regamey/Emparan, Goddard and Goddard Workshop, Original Chamberlain Structure, Porter Administration, Main Kitchen, and the Oak Valley School Addition. Porter Administration was originally constructed as RM2, and retrofitted with C2 components.

Seismic Performance – The identified buildings are anticipated to perform well (Upholstery and Machine Shop, Butler) to perform poorly (Ordahl/Johnson) depending on a number of factors. In general, the lower performing structures lack concrete shear wall seismic boundary element detailing, are in poor or in fair condition, were constructed in the early 1900's, have low reinforcement steel ratios, are multi-story, have highly stressed shear walls, and have known building deficiencies and irregularities. Buildings anticipated to perform well are in good condition, were constructed in the late 1950's or 1960's, are single-story, and have few known deficiencies or irregularities.

Expected Seismic Damage – Lower performing structures will have increased localized connection failures, increased overall lateral displacement, and increased damage to the lateral system and gravity columns. The higher performing structures will have minor (if any) structural damage.

Recommended Strengthening – For lower performing structures a more detailed investigation and material testing program needs to be implemented to allow for a complete structural building analysis model to be developed. The findings of the structural model analysis may mitigate some of the identified deficiencies and will provide sufficient information to develop structural strengthening recommendations. Additional reinforced concrete shear walls, boundary elements, and reinforcement at openings and coupling beams should be anticipated to resolve known deficiencies.

C2A – CONCRETE SHEAR WALL WITH FLEXIBLE DIAPHRAGMS

Construction Description – All structures of this type were observed during the Level 1 Rapid Assessment, which was limited to cursory visual observation of the interior and exterior of the building, and most were included in the Level 2 Detailed Assessments. Access to attic and crawl spaces were not available to the observation team at that time. However, all of these structures have full or partial original construction documents, with the exception of Hatch.

- All of these structure have cast-in-place concrete walls with wood-framed roof and floor diaphragms. The reinforced concrete shear wall thicknesses range from 6-inches to 10-inches. Structures of this type generally have sloped or flat 2-inch to 6-inch wide roof members, long span built up wood roof trusses over large open spaces or arched concrete frames with concrete purlins. One exception is the Oak Valley Gymnasium which has steel trusses. These structures have straight or diagonal sheathing over the various framing systems. The foundation systems are shallow reinforced concrete with concrete slabs on the ground, or the concrete columns and walls extend into partial or full concrete basements.
- Structures of this type are generally in good condition. This is the most common non-residential structural type on the SDC campus. Some example structures of this type are McDougall, Finnerty, Oak Lodge, and Thompson/Bane.

Seismic Performance – The identified buildings are anticipated to perform well to moderately well. In general, these buildings are in good condition, are single-story, have low seismic mass at the roof level, and are inherently stiff.

Expected Seismic Damage – The higher performing structures (Stoneman, McDougall, etc.) have concrete arches and are expected to have minor (if any) structural damage. Lower performing structures (Finnerty, Oak Lodge, etc.) lack adequate roof diaphragm to concrete wall connections which will result in increased overall lateral displacement and increased cracking in the concrete walls and roof framing.

Recommended Strengthening – The higher performing structures require minimal or no retrofit. The lower performing structures require structural panel sheathing over the roof framing along with connections between the roof diaphragm and concrete wall systems to adequately resist out-of-plane and in-plane lateral seismic forces.

PC1 – PRECAST OR TILT-UP CONCRETE WITH FLEXIBLE DIAPHRAGMS / PC1A – PRECAST OR TILT-UP CONCRETE WITH RIGID DIAPHRAGMS

Construction Description – The Main Store Room Addition is the only PC1 building on the SDC campus. Powers and Parmalee are the only PC1a buildings on the campus. These structures were observed during the Level 1 Rapid Assessment, which was limited to cursory visual observation of the interior and exterior of the building, and were included in the Level 2 Detailed assessments. Concrete tilt-up structures on the SDC campus are single-story structures with fairly simple layouts. Exterior concrete walls are assumed to be formed and cast on the ground adjacent to their final position, and then tilted up and attached to the roof diaphragms. The roof framing on the Main Store Room addition is a wood panelized system which is considered to perform in a "flexible" manner. The panelized roof systems are steel open web joists supported at the exterior on the concrete tilt-up walls and at the interior on steel beams and steel pipe columns. The Powers and Parmalee structures have a two-way reinforced concrete slab which is considered to perform in a "rigid" manner. The roof slab is supported by the concrete exterior and interior concrete tilt-up walls, along with cast-in-place interior reinforced concrete columns. The foundations for all of these structures are continuous exterior and isolated interior shallow reinforced concrete footings. Concrete slabs on the ground are present in all structures.

- All of these building are in good condition, single-story, and well detailed, except for the connection of the Main Store Room Addition to the original structure.

Seismic Performance – The Powers and Parmalee structures will perform well. The Main Store Room addition will perform moderately well, except at the connection between this structure and the original structure which is anticipated to perform poorly.

Expected Seismic Damage – Negligible damage is anticipated for the Powers and Parmalee structures. Some diaphragm-to-wall anchorage connection damage should be expected for the majority of the Main Store Room Addition which may result in limited cracking at the concrete tilt-up wall panels, in general, however, extensive damage and possible partial roof collapses are expected at the connection between the addition structure and the original structure. This is due to the addition being detailed to rely on the original URM structure to provide in-plane and out-of-plane lateral force resistance, which has insufficient capacity to resist the anticipated lateral forces.

Recommended Strengthening – No strengthening is anticipated to be required for Powers or Parmalee. However, for the Main Store Room Addition, new concrete shear walls and connections to the existing panelized wood roof system must be installed to separate the Main Store Room Addition from the original structure. Strengthening of the existing panelized roof system to the concrete tilt-up wall connections will likely be required as well.

URMa – UNREINFORCED MASONRY BEARING-WALL WITH RIGID DIAPHRAGMS.

Construction Description – All structures of this type were observed during the Level 1 Rapid Assessment, but also required an additional Level 2 Detailed Assessment. Of these structures, only a portion of the Paint Shop has original construction documents.

- These building appeared to have weak lime mortar to bond the masonry brick units together, with some structures observed to have cracks in the mortar joints and through bricks. Structural bearing walls consist of two to three wythes (8" to 13" thick) of brick masonry and have turned "header" courses of brick at approximately every 7-12 brick courses vertically to better connect the multiple wythes within the brick walls. Roof and floor framing are typically lightly framed 2-inch wood members supported by the exterior brick bearing walls or interior built-up wood beams or trusses on columns, except for the Main Store Room, which has a steel truss roof framing system. Foundations consist of shallow concrete or brick masonry footings with concrete slabs on the ground. All building of this type on the SDC campus have been identified as contributors to the historic district. Most of these buildings have been modified or added to since the original construction was completed, which, in some cases, creates incomplete structural systems with inherent structural irregularities. The buildings are occupied and in fair to poor condition. The following six (6) buildings URM type structures are identified on the "short list": Activity Center, Maintenance Shop, Main Store Room (Original), Paint Shop, Professional Education Center (P.E.C.), and Plumbers/Motorpool Storage. The lower level of the Plumbers/Motorpool Storage structure is the only URMa type system.

Seismic Performance – These buildings are expected to perform poorly in moderate to severe seismic events due to their general lack of adequate roof and floor diaphragm-to-wall anchorage, deteriorated mortar joints, narrow brick masonry piers between exterior wall openings, inadequate diaphragm strength, poor physical condition, and inadequate out-of-plane wall bracing.

Expected Seismic Damage – Full or partial building collapse should be expected. The P.E.C. in particular will likely experience extensive damage even in low to moderate seismic events.

Recommended Strengthening – A new lateral force resisting system, consisting of reinforced concrete walls and foundations, will need to be installed as the primary lateral force system. Adequate roof and floor to wall connections to resist anticipated in-plane and out-of-plane lateral forces will also need to be installed. Secondary steel pipe column supports are required at large truss or beam to exterior URM wall connections.

7.5 Hazardous Materials

Van Brunt Associates (VBA) visited the exteriors of most of the 288 buildings (and structures) at the SDC site in May and June 2017. Most basements and crawl spaces were viewed and some buildings were open to walk the common corridors. VBA inspected for the suspected presence or absence of various hazardous materials that could impact any repair or renovation. VBA produced a per building cost breakdown to cover the several phases of work to inspect and sample and then test the building materials. The VBA report is included as Appendix H.

This rapid assessment resulted in the following hazardous materials summary:

Many potentially hazardous building materials are heavily regulated. Other potentially hazardous building materials become regulated when disturbed during construction or demolition, or when they may be exposed to the environment in the form of wastes. While asbestos, lead, and PCBs are generally the most stringently regulated, under the general category of potential hazardous waste, light fixture fluorescent tubes would be included, as well as leftover building maintenance chemicals such as paints, cleaning agents, disinfectants, medical waste, lead acid batteries, Freon, elevator components, hydraulic oils, greases, pesticides, and fertilizers, emergency lighting batteries, emergency generators with fuel, lubricating oil, coolants, and lead acid batteries.

Prior to any construction or demolition, all of these hazardous and potentially hazardous materials will be inspected, sampled, or inventoried. The ultimate goal for this work is to ensure workers and the environment is protected during building repairs, renovations, or demolition.

The presence of most hazardous materials in buildings is not necessarily illegal or dangerous. Most potentially hazardous building components in good condition may be left in place. These various hazardous materials become problematic when disturbed during a renovation or demolition.

Adaptive reuse will generally require substantial repair and upgrading. Upgrades involving new finishes such as paint and floor coverings may not trigger expensive abatement and remediation actions. Any remodeling or upgrading work involving mechanical, electrical, plumbing, or layout of floor plans, would trigger moderate to complete abatement and remediation activities.

The current condition of a building is not an accurate indicator of potential reuse. If a building is planned for renovation, the extent and scope of renovation determines which hazardous materials must be abated, removed, stabilized, or even left in place. Building demolition would trigger the most costly hazardous materials abatement program. Generally speaking, all hazardous materials must be removed in order to demolish a building.

VBA also estimated the likely cost to design a cost effective and scope-appropriate abatement program.

Hazardous materials remediation should be designed to be scope-appropriate to the planned construction or repair work, be cost effective, and ensure that all workers and the environment are safe.

The cost estimate included the work for:

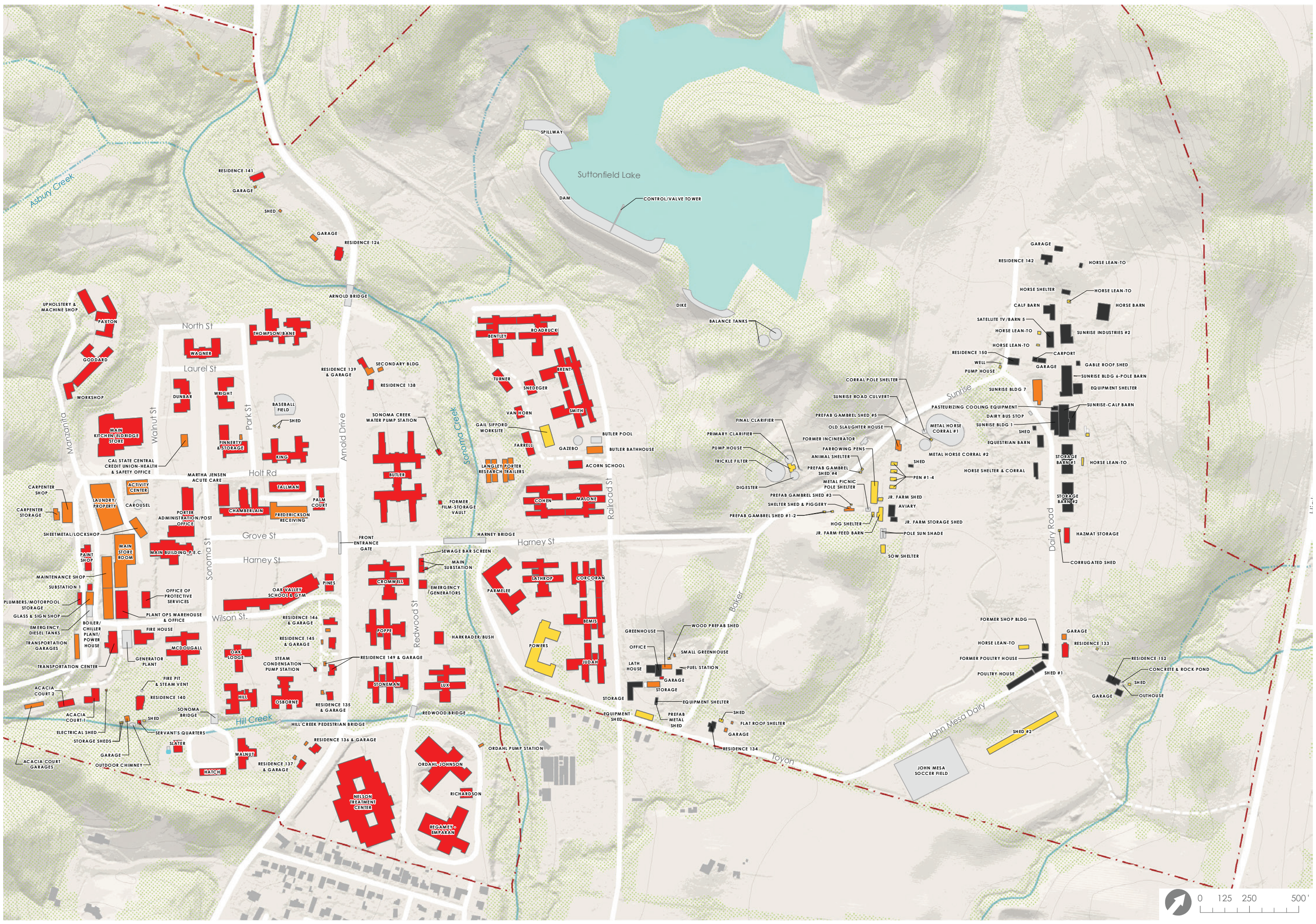
- On-site consultant to inspect, sample and test all building materials;
- The cost for designing the remediation;
- The cost for consultant on-site oversight/project management of the remediation/abatement work;
- The cost for abatement, remediation or stabilization.

The cost estimate was influenced by VBA's experience in renovating large buildings including buildings with contributing or substantial historical fabric. VBA assessed each building noting the size, number of stories, age, construction materials used, and the observed and assumed hazardous materials within each building.

VBA used historical unit costs for the removal and abatement of the various hazardous materials observed or presumed to exist. VBA used a cost per square foot to provide a budget for remediation. Influencing cost factors include the presence of surfacing asbestos materials, pipe insulation, the presence of asbestos debris in crawl spaces and the relative available access to these crawl spaces. Simple buildings were assigned a cost of $1/SF as a budget number. Other buildings have additional costs to reflect the likelihood of increased costs based

Figure 7-21

RAPID ASSESSMENT: BUILDING HAZARDOUS MATERIALS



LEGEND

- $0
- $0.01 - $4.99
- $5.00 - $17.99
- $18.00 plus
- Structure Not Evaluated
- Building Not Evaluated
- Building/Structure Destroyed by Fires
- SDC Property

Sources:
Page & Turnbull, JRP Historical Consulting, USGS, GreenInfo Network, Sonoma Ecology Center, WRT

on conceptual renovation scenarios. The highest cost per SF cost is $18/SF. This cost would permit the interior of a building to be substantially demolished and the hazardous materials removed to accommodate an adaptive reuse.

HAZARDOUS MATERIALS CONDITIONS

Van Brunt and Associates found numerous sewage and water leaks in crawl spaces and basements during their survey. They also found seven buildings of high level concern as they are either historical in nature, extremely deteriorated or damaged, or the environmental remediation cost would be substantial. These buildings are as follows:

- Activity Center: Constructed in 1897, evidence of current and prolonged roof leaks.
- Walnut Building: Constructed in 1918, severe state of deterioration including mold growth.
- Oak Lodge: Constructed in 1907, severe deterioration, bad roofing, and historical settlement issues.
- Finnerty: Constructed in 1930, very ornate exterior features in a state of deterioration.
- P.E.C. Building: Constructed in 1908, severe roofing and water leak intrusion, and partially collapsed floors and roof /ceiling systems.
- Central Steam Plant: Operational but amount of asbestos abatement to replace boilers would be significant.
- Central Steam System: Portions of underground central steam system have been replaced. Significant deterioration of steam system and all repairs or replacement will require asbestos abatement.

7.6 Conceptual Cost Estimates

METHODOLOGY

J.R. Conkey and Associates (JRCA) participated in walking the campus to better understand some of the unique building styles and historical uses the campus has maintained since its inception. JRCA then received from the consultant team an inventory list of the campus buildings and an in-depth study of more than fifty structures including drawings, pictures and field measurements. JRCA reviewed structural reports and hazardous material surveys to understand the potential costs to upgrade the buildings to current codes and standards. JRCA reviewed the assessment of the site utilities report including the central plant, electrical distribution system, domestic and storm water as well as existing roads, sidewalks, landscape and site lighting for the entire campus. With this conceptual data, JRCA has sought to quantify the cost to upgrade typical structures and site elements.

ASSUMPTIONS, INCLUSIONS AND EXCLUSIONS

Cost Estimates

Rough Order of Magnitude ("ROM") Estimates, also called ballpark estimates, are estimates made prior to undertaking project design. The variance between ROM and actual costs can be significant. Cost estimation is more reliable when cost estimates are based upon an approved set of construction drawings and specifications and the estimate has been prepared by a qualified building contractor.

Basic Assumptions

The ROM provided here assumes construction commences immediately and is completed in no more than two years. ROM is expressed in current dollars, escalated by 5 percent to the midpoint of construction. The ROM assumes economies of scale. ROM is based on pre-fire conditions; an in-depth analysis of the fire damage has not been undertaken.

Limiting Factors

A number of factors can impact costs, including but not limited to: economies of scale; physical properties of soil determined by geotechnical investigations; hazardous materials testing results and remediation; historicity; changes in building and land use; compliance with building code requirements and local design guidelines; construction timing or phasing; inflation and economic conditions; labor or material shortages; soft costs including permits and fees; public and quasi-public infrastructure capacity; and, intensity of development.

Funding Sources

The ROM assumes privately-funded construction for non-public uses. Public sources of funding or public uses may have prevailing wage requirements requiring different assumptions.

Central Utility Plant ("CUP") and Other Major Infrastructure

The feasibility of a CUP depends upon future building and land uses and intensity of development. Water treatment plant upgrades, storm water detention and treatment systems, sewer lift station requirements, and any associated maintenance and operational costs are not included.

ROM for Utility Upgrades and Site Work

Due to undefined scope and timing, which are highly speculative at this point, the ROM does not account for cost escalation during project design and engineering, CEQA compliance, plan review and permitting, contracting, or demolition of existing infrastructure or improvements. ROM excludes cost estimates for construction of buildings and supporting structures.

ROM for Building Rehab and Infrastructure Upgrades

Without program data, test-fit studies, and other investigations, it is impossible to determine the suitability of specific buildings or building sites for particular uses. ROM assumes economies of scale for utility upgrades and site work. Phased construction will result in higher costs.

Table 7-2

ROUGH ORDER OF MAGNITUDE COST ESTIMATE FOR UTILITY UPGRADES AND SITE WORK

Infrastructure Assessment	Gross SF	Central Utility Plant	Electrical/ Tele/ Data/ Security	Domestic Water/ Storm/Sewer	Roadways/ Sidewalks/ Curb/ Gutter	Landscape/ Signage/ Lighting	Scope Contingency	Component Sum $/SF	Component Sum Total
Construction Costs									
Materials, Labor & Equipment	1,244,000	$30,855,000	$9,129,000	$5,149,000	$4,182,500	$10,510,000	$3,110,000		$62,935,500
Total Construction Costs	**1,244,000**	**$30,855,000**	**$9,129,000**	**$5,149,000**	**$4,182,500**	**$10,510,000**	**$3,110,000**	**$51.00**	**$62,935,500**
General Contractor Costs									
Estimating Contingency		$3,085,500	$912,900	$514,900	$418,250	$1,051,000	$311,000		$6,293,550
General Conditions		$4,242,563	$1,255,238	$707,988	$575,094	$1,445,125	$427,625		$8,653,631
Overhead & Profit		$3,245,560	$960,257	$541,610	$439,947	$1,105,521	$327,133		$6,620,028
Insurance & Bonds		$1,035,716	$306,435	$172,837	$140,395	$352,791	$104,394		$2,112,568
Escalation (12 Months)		$2,123,217	$628,191	$354,317	$287,809	$723,222	$214,008		$4,330,764
Total Construction and General Contractor Costs	**1,244,000**	**$44,587,555**	**$13,192,020**	**$7,440,652**	**$6,043,994**	**$15,187,659**	**$4,494,160**	**$73.00**	**$90,946,041**
Soft Costs									
Planning/ Environmental		$2,229,378	$659,601	$372,033	$302,200	$759,383	$224,708		$4,547,302
Building Fees		$1,170,423	$346,291	$195,317	$158,655	$398,676	$117,972		$2,387,334
Utility Fees		$2,399,368	$709,896	$400,400	$325,242	$817,286	$241,842		$4,894,034
Architectural, Structural, MEPS		$4,030,938	$1,192,625	$672,672	$546,407	$1,373,040	$406,295		$8,221,977
Project Administration		$1,632,530	$483,013	$272,432	$221,295	$556,081	$164,549		$3,329,901
Total - Project Costs	**1,244,000**	**$56,050,192**	**$16,583,445**	**$9,353,506**	**$7,597,794**	**$19,092,125**	**$5,649,525**	**$92.00**	**$114,326,588**

Table 7-3

ROUGHT ORDER OF MAGNITUTE COST ESTIMATE FOR BUILDING REHAB AND INFRASTRUCTURE UPGRADES

Land Uses w/ Market Demand	**New Construction**		**1889 - 1908 Era**		**1909 - 1917 Era**		**1918 - 1949 Era**		**1950-1962 Era**		**1963-1984 Era**		**Single Family Homes - (no particular Era)**	
ESTIMATE DATE: MARCH 2, 2018	**$/ SF**		**$/ SF**		**$/ SF**		**$/ SF**		**$/ SF**		**$/ SF**		**$/ SF**	
Potential Tenant / Use	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
Residential Multi-family	$330	$450	$480	$730	$480	$840	$450	$830	$470	$870	$470	$860	$390	$700
Residential Single Family	$310	$420	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	$360	$660
Residential Continuing Care	$470	$630	$500	$760	$500	$880	$470	$860	$490	$910	$490	$890	$400	$730
Commercial Office / Institutional	$430	$580	$360	$550	$360	$630	$340	$620	$350	$650	$350	$640	$290	$530
Light Industrial / Fabrication	$300	$410	n/a	n/a	$340	$600	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lodging / Conference	$590	$800	$510	$790	$510	$910	$490	$900	$510	$940	$510	$930	$420	$760
Health Care	$750	$1,010	n/a	n/a	$690	$1,230	n/a	n/a	n/a	n/a	$680	$1,250	n/a	n/a
Site Infrastructure Costs	$74	$100	$79	$100	$79	$100	$74	$100	$78	$100	$74	$100	$74	$100
Building/Site/ Infrastructure Cost Range Total	***$370***	***$1,110***	***$440***	***$890***	***$420***	***$1,330***	***$410***	***$1,000***	***$430***	***$1,040***	***$420***	***$1,350***	***$360***	***$860***

7.7 Considerations for Reuse and Conservation

TRANSPORTATION AND ACCESS

REGIONAL TRAVEL PATTERNS

Arnold Drive provides access to SDC and connects the site to the rest of the regional roadway network. Traffic counts and operations analysis show that nearby intersections and segments of Arnold Drive operate with additional capacity, even during weekday and weekend peak periods. Specific traffic analysis would need to be conducted to estimate the potential traffic generated by of future site reuse. At a general level, the SDC site should be able to accommodate some amount of additional activity without overloading the roadway network.

STREET AND SIDEWALKS

Sidewalks and street trees are present along Arnold Drive within the campus, creating an attractive environment for walking. On internal streets, low vehicle volumes make walking and biking comfortable even where sidewalks and bike lanes are not present. Site reuse may bring additional activity—and traffic—and presents an opportunity to create a more "complete" street environment within the core campus area. Sidewalk or pedestrian path connections along Arnold Drive north and south of campus would knit the campus together with neighboring communities and with the trail system at Sonoma Valley Regional Park, creating a much larger walkable community.

BIKE INFRASTRUCTURE

Bikeways are planned for Arnold Drive and Highway 12, creating longer-distance non-motorized travel options for the Sonoma Valley, including the SDC site. A community-proposed bikeway could be advanced as part of SDC site reuse.

INFRASTRUCTURE AND UTILITIES

WATER SUPPLY SYSTEM

Phased Upgrades

The water treatment plant has been carefully maintained over the years and is still a functioning system that meets state regulations in treatment, monitoring and operations. The filter units have recently been rehabilitated and it will be possible for a new owner or operator to take over the treatment plant without being required to immediately implement significant capital improvements. It is advisable to develop an operations, maintenance and capital improvement plan (CIP) that identifies and schedules necessary improvements to sustain the plant at operational capacity. This will be based on the owner's long-term plan for operations of the plant.

Operations and Maintenance Responsibilities

Current operations of the entire water system are conducted by one primary operator with backup. Continuation of management of the system at such a low staffing level by a new owner-operator is unlikely. A minimum of three full-time staff should be expected. It is expected that an independent operator may be hired on a long-term operations contract to operate the treatment plant and manage the water supply system. This contract could include long-term lease or ownership of the treatment plant and water supply system along with the operations and supply of treated water to the campus. This operator could be a commercial for-profit firm or a public agency such as the Valley of the Moon Water District.

Rates, Fees and Capital Costs

Regardless of whether the new owner of the property operates the system or contracts it out, a means will need to be clearly identified to pay for the system and its operations. Salaries, operation of the facilities, maintenance, chemicals, and funding for capital improvements will need to be primarily paid for by water rates and connection fees. It is expected that these rates will likely be higher than those for nearby neighborhoods to build up a CIP base. If funding could be made available to support a CIP, it may encourage more interest in taking over the responsibility of this system.

Abundance of Water

The abundance of water on this property is highly attractive to local and regional water purveyors, local environmentalists, farmers and vineyard owners. Given the local water demands, there is an opportunity to successfully improve infiltration to groundwater, support healthy riparian habitat, provide additional resources for domestic water and fire protection, reduce local groundwater extraction, and possibly improve downstream surface and groundwater quantity and quality. An important aspect of the next phase of this study will be to examine these opportunities in depth and provide a clear understanding of the costs and benefits of these different water use opportunities.

WATER DISTRIBUTION SYSTEM

Utility Corridor

Because the utility systems at the SDC campus are, by and large, at the end of their useful life and in need of replacement, the site provides an exceptional opportunity to plan for future development by creating utility corridors. These corridors may be actual tunnels with utility pipes installed inside, precast concrete ditches that house a bank of utilities that can be accessed by lifting a cover, or simply by planning where buried utilities will be installed along a common route and locating them with minimum clearance between them. Whichever type of corridor will be most cost-effective for the future SDC development will be determined when alternative development scenarios are considered. Efficient corridor layouts will be considered at that time in conjunction with where future utilities will be required and how they can be constructed over time, phased with related building construction, but planned in advance.

SANITARY SEWER SYSTEM

System Replacement

Although the SDC staff have managed to keep the system functioning, the sewage collection system is beyond its useful life and in generally deteriorated condition. New development on the property will require a functioning sewage collection system that has at least 30 to 50 years of useful life. An expectation that the entire collection system requires replacement is not unreasonable. This could be planned as part of a combined utility corridor (see above). Phasing the construction of a new sewer system would be a reasonable approach to mitigate costs.

On-site Wastewater Treatment and Reuse or Recharge

Construction of an on-site wastewater treatment plant in the east side of the property should be considered. Such a facility could be built to treat SDC wastewater only or it could be built in partnership with, or entirely by, the SVCSD to provide sewage treatment of SDC flows and flows from the nearby upstream community. Treated effluent could then be used in the area in the east campus to restore wetland habitat and infiltrate water into the groundwater, as discussed in Chapter 4; further study is required to identify the most appropriate means to infiltrate water at this location. Excess water could be also be used for irrigation on-site, and sold to adjacent agricultural landowners for irrigation.

Low- Impact Development (LID) Stormwater Management

What the above information reveals is that there is significant room for implementation of Low-Impact Development techniques to improve stormwater management in the core campus area. Reduction of street width, provision of curb cuts that allow surface runoff to drain to adjacent landscaped bioretention areas, provision of pervious pavement where appropriate and other measures as discussed in Section 6.2 above will significantly improve the quality of stormwater discharged from the property while slowing the release of stormwater to local creeks, reducing the risk of flooding and soil erosion.

Please refer to Section 4.5 in the Land + Water chapter for additional discussion of the opportunities for Low-Impact Development measures to manage stormwater and opportunities for local infiltration.

CENTRAL UTILITY PLANT

Site heating is mainly provided by Central Plant steam system which is well maintained but reaching end-of-life. Steam systems are an older technology that is not utilized by modern systems. This system was designed for a campus the size of the Sonoma Developmental Center (SDC) when it was most heavily populated and is not designed to be easily downsized to serve smaller collections of buildings. Steam distribution piping is also in poor condition and would require extensive repair for future use. The steam system is considered obsolete, and the cost to replace it will need to be factored into future site reuse. The related chilled water system is in better condition, but would also require extensive investigation for future use.

BUILDING INFRASTRUCTURE

Interface Engineering MEPFT team went on-site for three days and inspected 53 buildings, selected to represent a cross-section of all buildings on-site in terms of age, use, and building type. The analysis considered the condition of infrastructure as it relates to potential future uses. General conclusions about building mechanical, electrical, natural gas, telecommunications, and fire and life safety systems follow.

- Assuming the steam system is taken off-line due to age, most building heating systems will require upgrade to individual boilers or system replacements.
- The electrical system both sitewide and within typical buildings is in fair condition as currently used but expected to require upgrade for future use.
- Natural gas is used in a small number of buildings on the campus. It is used in the Boiler/Chiller plant as the main source of fuel for the boilers, in the Main Kitchen for oven and cooktops, and in most of the Residential units along Arnold Drive for kitchen stove ranges and small residential type water heaters. Inspection of the distribution system could not be performed as piping is mainly underground. The incoming gas pressure from the municipal supply is unusually high and a potential hazard. A more thorough investigation of the system should be performed.
- Telecommunications equipment and cabling is functional but will need significant upgrade to meet future technology/bandwidth demands.
- Fire sprinkler systems are installed in a limited number of the buildings at the site and those that are installed are mostly older, partial fire sprinkler systems. Partial sprinkler systems are ineffective in controlling fires that occur in spaces outside the area of fire sprinkler protection and the systems can be overrun by these fires. Many of the systems are nearing the end of their expected life and do not exhibit many of the features and resilience of modern systems.
- Fire alarm systems are installed in most of the buildings surveyed. The fire alarm systems across the campus vary in age and serviceability, from modern systems in excellent condition to older systems that are at or near the end of their expected life.

BUILDING INFRASTRUCTURE SUMMARY

Preliminary findings indicated the following likely outcomes:

- Significant upgrades are needed for building-level systems (MEP/F/T);
- Significant upgrades or replacement are needed for Site Distribution networks and the Central Plant;
- The feasibility of a Central Plant for future use needs to be evaluated;
- Decentralized or conventional systems may be more appropriate for the incremental growth of campus reuse.

BUILDING CONDITIONS

BUILDING SITE AND MATERIALS

The site and architecture team, led by Page & Turnbull, evaluated 135 buildings and some structures on the site, and evaluating characteristics of the building site, including exterior access conditions like parking, ramps and walkways, and building entrances. The team also documented building material conditions including exterior walls, roof, windows and doors.

This analysis found that the great majority of buildings required minimal updates with regard to exterior building accessibility. Moderate accessbility upgrades were found to be needed at Palm Court, Acacia Court cottages, and a few others. The Langley Porter Research Trailers were found to require significant upgrades with regard to access. The site and architecture team also found that building materials will require minimal upgrades at most buildings on the site. A few buildings including the P.E.C. Building, Walnut, The Activity Center, and Oak Lodge will require more moderate or significant upgrades.

Future use of the site may take advantage of the architectural character and institutional quality of construction, the variety of building sizes and former uses, and the level of stewardship that has been undertaken to maintain the buildings on campus. Reuse considerations will need to take into account the updates required for accessibility and building code requirements.

STRUCTURAL CONDITIONS

The Structural Team, led by DCI Engineers, conducted a rapid evaluation of the physical condition and structural systems of the same set of 135 buildings, and conducted a more detailed evaluation of 45 buildings and structures. Many buildings on the core campus, especially east of Arnold Drive, were found to be likely to require minimal strengthening. Many others were likely to need at least a "standard" degree of strengthening. Some, including the P.E.C. Building; Wagner, Wright and Dunbar; and Ordahl-Johnson and Regamey-Emparan, indicated the need for major strengthening, potentially challenging the economic feasibility of reuse.

HAZARDOUS MATERIALS

The Hazardous Materials Team (Van Brunt Associates) visited most buildings on site to identify known, observable and presumed hazardous materials that will be encountered. VBA applied historical unit costs for the removal and abatement of various hazardous materials observed or presumed to exist to determine a preliminary budget for remediation. Influencing cost factors include the presence of surfacing asbestos materials, pipe insulation, the presence of asbestos debris in crawl spaces and the relative available access to these crawl spaces. Most buildings at the SDC site were estimated to require $18 to $22 per square foot for remediation.

COST ANALYSIS

Rough, order-of-magnitude (ROM) cost analysis was conducted to assess the potential cost of upgrading site utilities and rehabilitating buildings. This analysis comes with many qualifications. The variance between ROM and actual costs can be significant. Cost estimation is more reliable when cost estimates are based upon an approved set of construction drawings and specifications and the estimate has been prepared by a qualified building contractor. The ROM assumes significant economies of scale, and assumes that construction would commence immediately and be completed in no more than two years. Privately-funded construction is assumed, with no provision for prevailing wage requirements. The ROM does not account for cost escalation; costs associated with CEQA compliance, plan review and permitting, contracting, or demolition of existing infrastructure or improvements. Costs for building rehabilitation do not account for the specific potential needs of end users.

Based on these and other assumptions, the analysis estimates that utility upgrades on the SDC site, including upgrades to the CUP, electrical, telecommunications/ data, water, storm drainage, roadways, sidewalks, curb and gutter, and landscaping, signage and lighting would total approximately $114 million. The largest contributor to this estimated cost, at an estimated $56 million, would be to upgrade the Central Utility Plant—a system which may actually be more likely to be replaced.

Building rehabilitation costs were analyzed based on the era buildings were constructed, and provided as a range, bracketed by low- and high-end costs. Low-end rehabilitation costs for SDC buildings were estimated at between $360 and $440 per square foot, depending on the building era and type. High-end costs were estimated to range from $860 to $1,350 per square foot. By comparison, the cost of new construction was estimated to range from $370 to $1,110 per square foot.

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