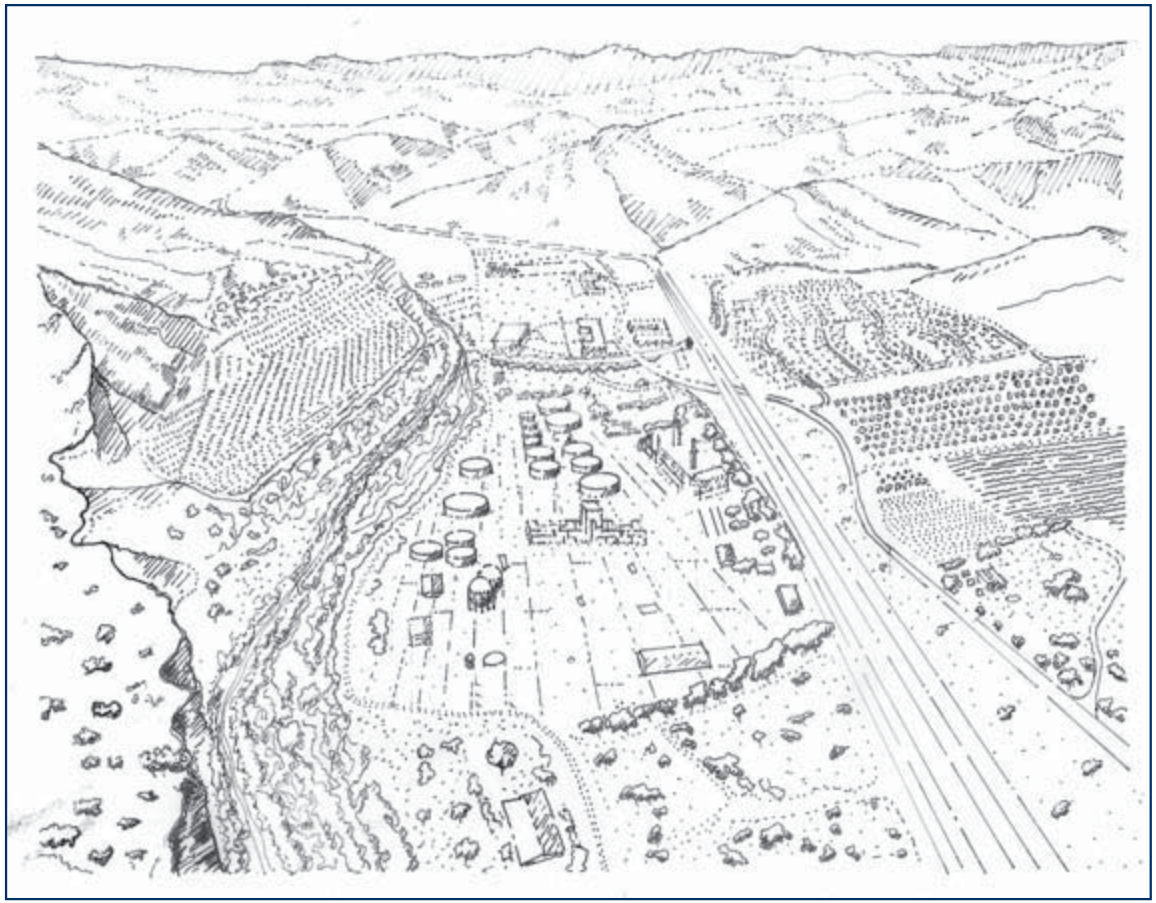
CHAPTER 10: CAÑADA CONFLUENCE

[OPPOSITE] FIGURE 10.1 *Clockwise from left: Existing bird's-eye view of Cañada Confluence area; open space area looking north to the Ventura municipal water purification plant; Mission-era aqueduct remnant; Cañada Larga, box culvert under Highway 33 and concrete channel to the west; the confluence of the Cañada Larga and the Ventura River; former USA Petroleum refinery.*




4TH
OF

Existing Conditions

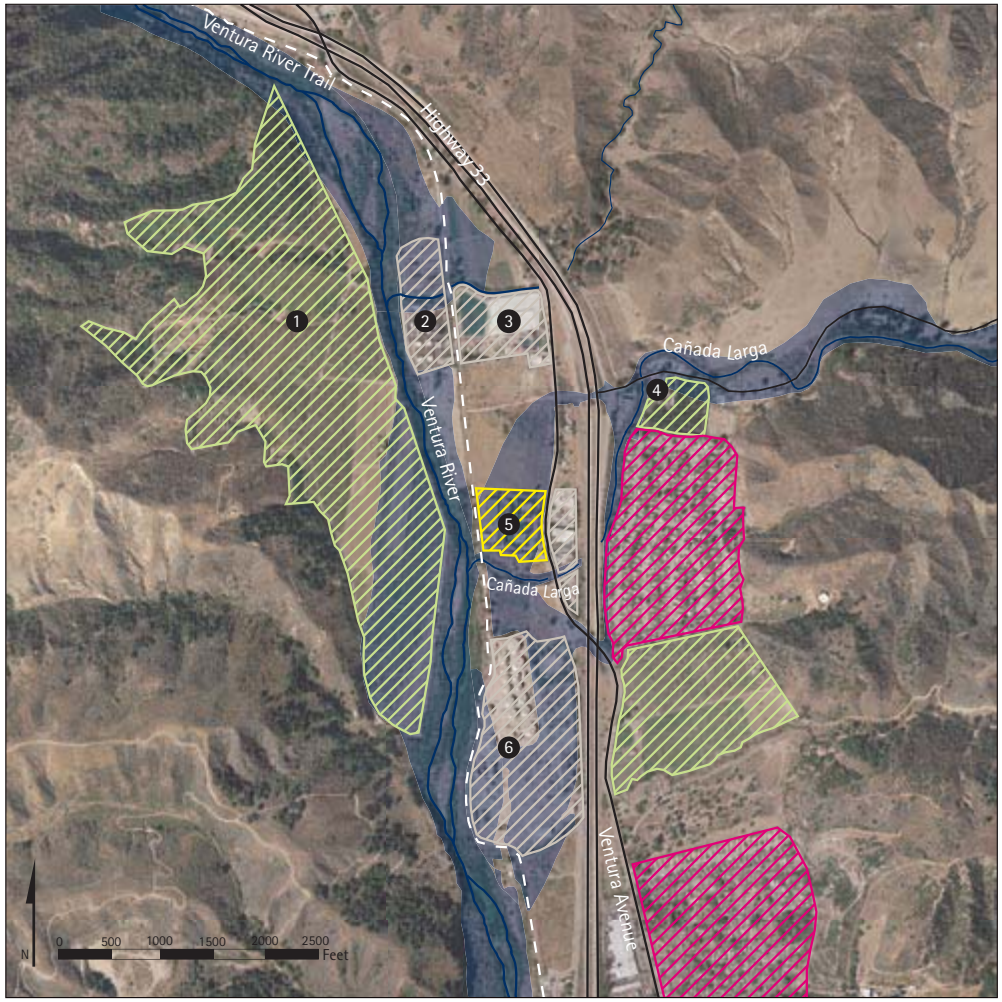
THE NEIGHBORHOOD

The second design site identified by this Vision Plan is centered on the confluence between the main stem of the Ventura River and one of its main tributaries, the Cañada Larga, that lies about one mile downstream from Foster Park. This site presents many opportunities for the development of parkway spaces that encourage a closer relationship between people and the river, while also improving the quality of both surface and groundwater, lessening the risk of flood damage, and developing public support for the remediation of a large contaminated brownfield site.

Both terrain and politics have shaped the developing landscape of the North Avenue area where the Cañada Confluence site is located. To the north, steep hills and mountains constrict the river valley, and the area is largely rural in character. The valley spreads wider to the south where the landscape transitions from vestiges of agriculture and industrial development into urbanization. Political boundaries and policies have also played a role in shaping this landscape.

North Avenue is an unincorporated area of Ventura County, which has policies limiting future development. However, the North Avenue area is also within the sphere of influence of the City of Ventura; its policy on development is more nuanced and it is considering the North Avenue area for annexation (City of Ventura 2005). The North Avenue area is closely associated with its neighbor to the south, the city's Westside community, and it shares some traits with that community. The Westside is one of Ventura's oldest communities and has one of its largest minority and low-income populations. In 1999 it was home to nineteen hazardous waste sites per square mile, compared to just one per square mile in other parts of the city (US Environmental Protection Agency 1999). The combination of a disproportionate number of hazardous waste sites within a large minority/low-income community is an issue of environmental justice for the Westside community, and the existence of hazardous waste at the adjacent Canada Confluence site adds to the seriousness of that situation.

FIGURE 10.2 *Location of Cañada Confluence design site.*



1 Avocado orchards
2 Ojai Wastewater Treatment Plant
3 Ventura Water Purification Plant
4 Aqueduct Remnant
5 Brooks Institute
6 Refinery

Agricultural
Residential
Industrial
Institutional

FIGURE 10.3 *Existing conditions at Cañada Confluence site. Orthophotography: CIRGIS.*

THE SITE

The meeting of streams amid rich riparian habitat endows this site (figure 10.3) with natural attractions for visitors. The existing campus of the Brooks Institute, which has a public exhibit space for photography, adds an element of architectural and cultural interest. However, the area also presents a combination of hydrological impairments, dilapidated or abandoned industrial facilities, and "No Trespassing" signs that make it uninviting, and the brownfield area in the southern portion of the site contains chemical pollutants and asbestos that may render it unsafe for public use in the short term.

Disruption of hydrological processes at this site includes the channelization and culverting of the Cañada Larga where it crosses Highway 33 and Ventura Avenue, erosion affecting both waterways, and water pollutants from point and non-point sources that have caused both waterways to be placed on the EPA's Section 303d list of Impaired Water Bodies. Several large structures and portions of Ventura Avenue lie within the FEMA 100-year floodplain, that is, the path of a projected flood with a 1 percent annual chance as determined by that agency.

The predominantly riverine and riparian ecosystems at the site of the confluence have been degraded by an extensive infestation of the invasive *Arundo donax* species, and those open space areas have been relegated, through the development of agricultural, institutional and industrial facilities, to a narrow strip along the riverside, while much of the site has been left as grassy unimproved lots or dilapidated industrial infrastructure. With the exception of the Ventura River Trail that passes through the site and the public exhibit space within the Brooks Institute, the site is largely inaccessible to the public due to no trespassing postings. Development recommendations that have been publicly considered by the city in conjunction with the proposed annexation would have a significant impact on the Cañada Confluence site, but the importance of striking a balance between mixed-use development and floodplain restoration and the task of stabilizing or removing existing soil and groundwater contaminants will likely make the site a challenging one for planners.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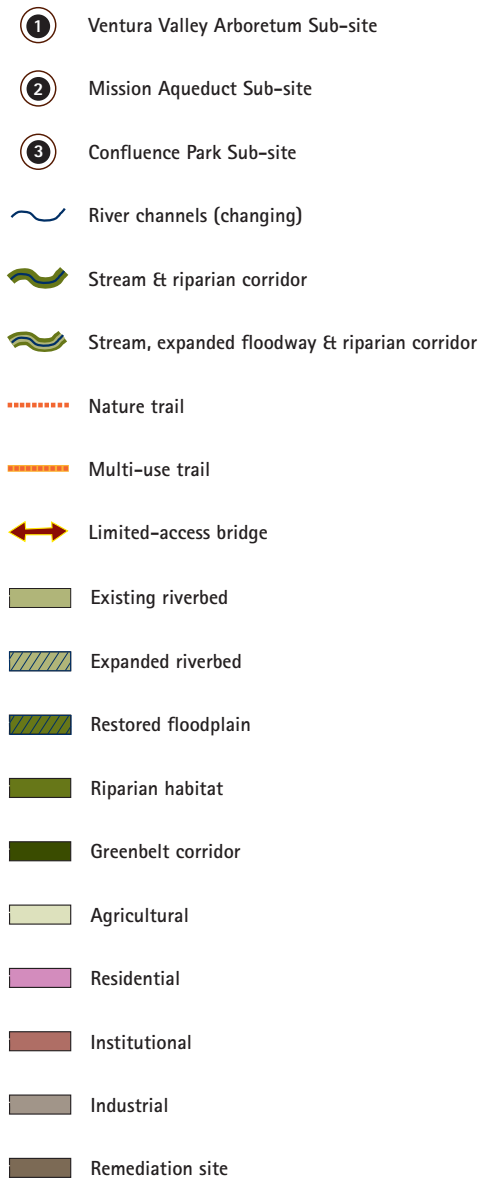
Overview of Design Concepts



Proposals for the site would address hydrological objectives, improve its ecological value, and expand its areas of quality wildlife and plant habitat by increasing the floodplain of the Cañada above the confluence, relocating structures in the FEMA 100-year floodplain, providing areas for water-quality treatment, and commencing the long-term process of mitigating the impacts of decades of industrial development. Meanwhile, suggested improvements would enhance physical and visual access to the river for visitors and provide opportunities for recreation and education that are sensitively integrated into the landscape. The name for the site in this chapter, Cañada Confluence, emphasizes the meeting of two very visible watercourses as a defining site feature.

Design recommendations at the Cañada Confluence focus on three adjacent sub-sites within the overall site. The Ojai Valley Sanitary District Wastewater Treatment Plant and the City of Ventura water purification plant along with approximately twenty acres of unimproved land, are located in the northern portion of the site and are collectively referred to here as the Ventura Valley Arboretum sub-site. The area of an existing remnant of a late eighteenth century aqueduct, east of Highway 33 on the banks of the Cañada Larga, is the second sub-site, referred to as Mission Aqueduct. The third sub-site, Confluence Park, incorporates the Brooks Institute, the actual confluence point of the Ventura River and Cañada Larga, and the former USA Petroleum Refinery and adjacent vacant land, features that form the southern end of the overall Cañada Confluence site.

[LEFT] FIGURE 10.4 *Cañada Confluence, proposed plan. Orthophotography: CIRGIS.*

Ventura Valley Arboretum

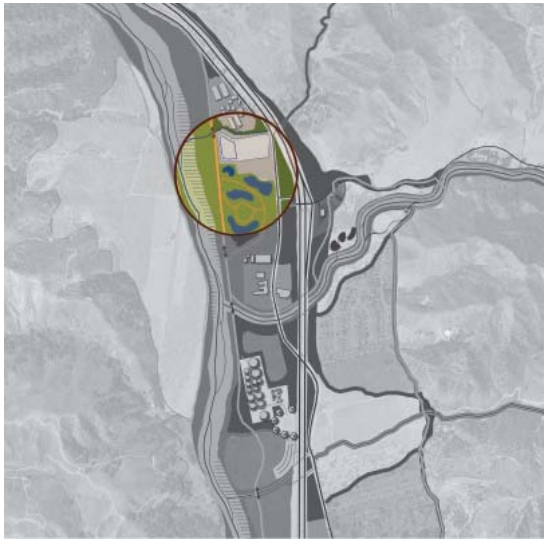


FIGURE 10.5 *Proposed location of Ventura Valley Arboretum.*

EXISTING CONDITIONS

The northern sub-site of the proposed Cañada Confluence is occupied by the Ojai Valley Sanitary District Wastewater Treatment Plant, the Ventura municipal water purification plant and approximately twenty acres of vacant land (figure 10.6). The Ventura River Trail passes the western side of the vacant land and between the water facilities. The experience of traveling on the Ventura River Trail in this area is generally bucolic. However there are significant issues in this sub-site that have an impact on the health of the river and related ecosystems as well as the quality of human use, and these issues are primarily related to the impacts of the county and city water treatment facilities.

The Ventura River floodway (the river channels and the areas of adjacent floodplain that are kept free from development) has a width of approximately 180 feet between the wastewater treatment facilities to the east and the orchards to the west, which is its narrowest stretch in the parkway area (figure 10.7). By way of comparison, the width of the floodway immediately to the north of the treatment plant is 500-600 feet. While a detailed historical survey of river morphology in this area is beyond the scope of this document, the relative narrowness of the river in this location is a cause for concern. The restriction of flow to a narrow zone could increase water velocity and the likelihood of flood damage in this area, and some of the wastewater treatment plant structures have been identified as being at risk for damage from a 100-year flood (Greimann 2006; FEMA 2005). Over the past quarter-century, the intensity of occasional flood flows combined with a lack of sediment in the water due to the impact of the Matilija and Casitas dams, has resulted in erosion that has caused the riverbed in this stretch to drop approximately ten feet in elevation, in many places to the depth of the underlying bedrock (Greimann 2006). In addition to the potential for flood damage and erosion, structural encroachments on the combined river-floodplain system in this area reduce the land available for recreational access and ecosystem function.

Moreover, although the wastewater treatment plant

FIGURE 10.6 *Lot adjacent to the Ventura Water Purification Plant.*

is designed to meet the requirements of its National Pollutant Discharge Elimination System (NPDES) permit, those requirements do not ensure that the effluent that it discharges will match cool, pristine river water. The effluent contains a level of nitrates that may have negative impacts on wildlife and has an average temperature that is too high for an indicator species, steelhead trout (*Oncorhynchus mykiss*). Despite these liabilities, the wastewater treatment facility is important to approximately 23,000 Ojai residents who depend on the plant for sanitation. In addition, the facility has great potential value to the river and its ecosystems and to potential parkway visitors in that it replaces instream water that has been removed from the river for domestic and agricultural use with effluent that, when properly treated, is highly valuable to the ecosystem. Thus, recommendations for this sub-site emphasize the mitigation of the facility's impacts.

1 Avocado orchard

2 Waste treatment plant facilities in 100-year floodplain

3 Ojai Valley Wastewater Treatment Plant

4 Ventura municipal water purification plant

5 River floodway constricted by water facilities

6 Unimproved land (some parcels possibly in agricultural use)

Streams

Major roads

Ventura River floodway

FEMA 100-year floodplain

Industrial

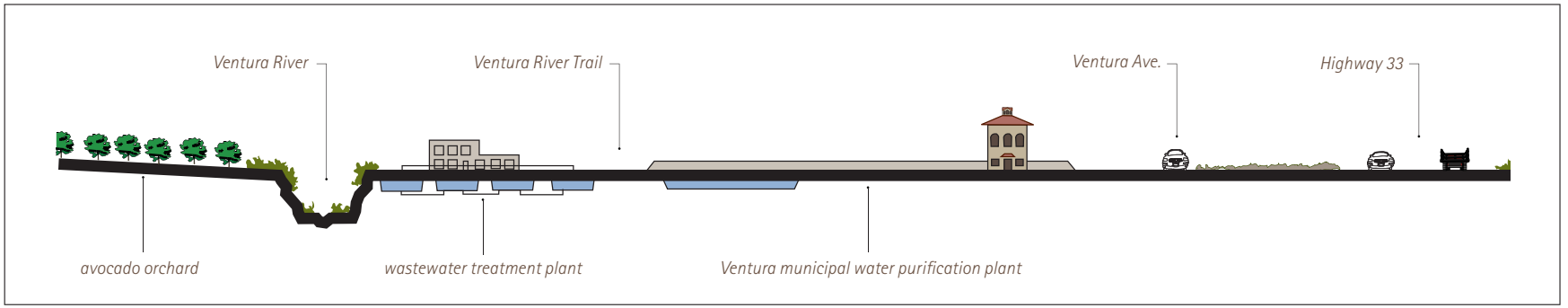


FIGURE 10.7 *Plan view and section A - A' (not to scale) illustrating existing conditions at the Arboretum sub-site. Orthophotography: CIRGIS.*

FIGURE 10.8 *Ventura Valley Arboretum, proposed plan.*

DESIGN RECOMMENDATIONS

The objectives of the Arboretum sub-site are to mitigate the negative impacts of the wastewater treatment plant, increase ecosystem quality, and enhance public use. Relocating structures that are in or adjacent to the FEMA 100-year floodplain would enlarge the river corridor, while establishing a public arboretum that includes polishing ponds would enhance water quality and provide additional space for passive recreation.

Floodplain Restoration

Relocating the wastewater treatment plant facilities away from their present location between the existing river floodway and the Ventura River Trail and removing the levee along the west edge of the plant would restore approximately eleven acres of land to the floodway with attendant benefits for riverine and riparian plants and wildlife. Implementation of this proposal would reduce the risk of flood damage to the treatment plant by relocating structures that are currently in the FEMA 100-year floodplain. Widening the floodway at this spot would spread occasional flood waters out to produce a lower flood intensity, helping to reduce erosion. An approximately one quarter mile section of the River Trail that currently runs between the fences of the Ojai treatment plant and the Ventura water purification plant would, instead, run through the center of a park-like restored floodplain area with native riparian vegetation and enhanced views of the river.

Identification of an alternative site for the treatment plant would require surveys that are beyond the scope of this Vision Plan, but one example of a possible site (figure 10.13, Item 1) is the undeveloped parcel immediately to the north of the Ventura water purification plant and east of the River Trail. Relocation of an industrial facility is a major project and it may not be feasible during the life cycle of the existing plant which is essentially only sixteen years old, since it was extensively renovated in 1996 (CRWQCB-LA 2003). However, the plant may need rebuilding during the long-term implementation of a parkway project, since water treatment facilities typically need to be replaced every twenty-five to forty years (Elmore 2001). Therefore, relocation should be considered as a potential element of a long-term parkway plan.

Ventura Valley Arboretum

The 22 acre parcel immediately south of the Ventura municipal water purification plant presents an opportunity for the creation of a significant public amenity while also improving the quality of effluent entering the river from the wastewater treatment plant. At this location, effluent discharged by the plant would slowly circulate through a series of ponds connected by vegetated wet swales before being returned to the river. These polishing ponds, a form of constructed wetland, would provide habitat for native mesic plant species that have a demonstrated value in removing

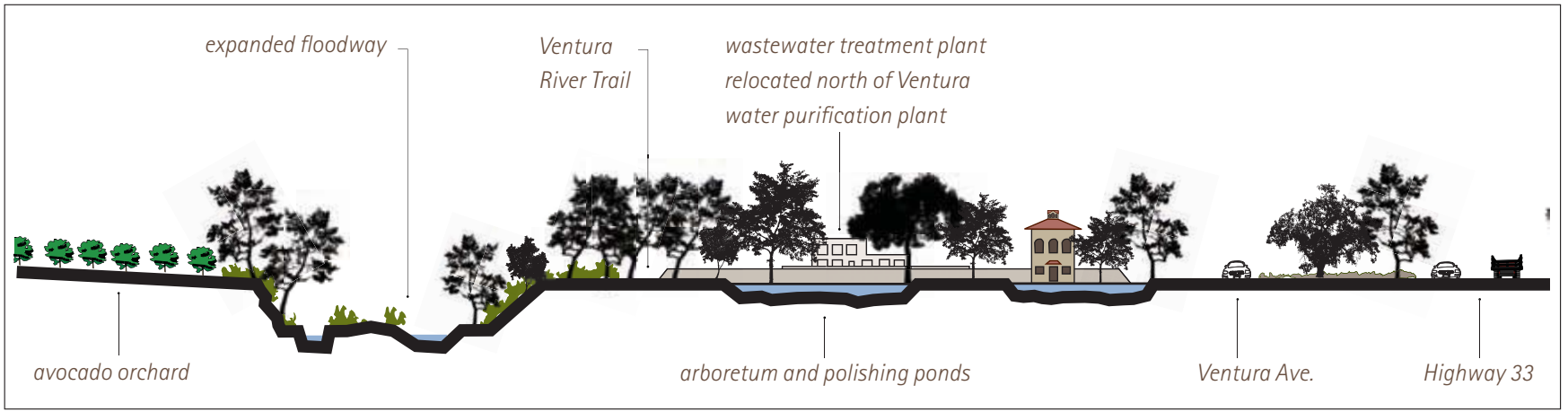


FIGURE 10.9 *Ventura Valley Arboretum. Section A-A'. Not to scale.*

FIGURE 10.10 *Ventura Valley Arboretum. West facing perspective.*

nitrates and other pollutants from water.

In contrast with engineered systems like the subsurface constructed wetland shown in chapter 7, the polishing ponds shown here would use processes similar to those of a natural pond or wetland to give a final treatment push to water that has already been treated in the Ojai plant. The ponds would form the heart of a public arboretum featuring California native tree species. Trees would provide shade for the pond surfaces, helping to lower the temperature of the effluent before it enters the river. Thus, the combination of ponds and arboretum would help to address excess nitrates in the treated effluent that are harmful to wildlife, and excess temperature that imperils steelhead trout *(Oncorhynchus mykiss)* (Leydecker and Grabowski 2006).

Trees and shade would also be an amenity for visitors strolling through the arboretum. Interpretive materials would explain the cleaning functions of the ponds and plants as well as the importance that many of the same plants had in historical Chumash populations for food, medicine and building materials. Finally, the combination of native trees, shrubs and water plants would provide valuable habitat for birds and amphibians. Thus, the Ventura Valley Arboretum would be a place where all elements provide equal benefits for hydrological, ecological, and cultural and recreational functions.

How the Ponds Function

In a natural wetland, a series of biochemical processes dependent on bacteria can remove organic nitrogen (from natural sources as well as from human pollutants like fertilizer) from the water by converting it into benign nitrogen gas that is returned to the atmosphere. Some of these processes take place in the presence of oxygen in the aerobic zone, a thin layer at the top of underwater soil.

Other stages of the process are concentrated just below the aerobic zone in oxygen deprived (anaerobic) soils. Many plants (figure 10.11) work together with microorganisms to make these cleaning processes possible. Two plants that are native to Ventura can play an important role here. Bulrush *(Scirpus californicus*) and Cattail *(Typhus latifolia)* have stems with hollow tubular chambers that transport oxygen from their leaves to their submerged roots, providing a boost to the aerobic or oxidizing stages of the nitrogen conversion process. Bulrush and cattails would be valuable components of the ponds because visitors would benefit from increased awareness regarding the historical importance of these plants to the Ventureno Chumash while they play their role in cleaning the water.

Other native wetland and aquatic plants also play a role in natural cleaning processes by absorbing nitrogen for their own nutrition and providing a supportive context in their root zone for the growth of microorganisms that clean the water. In addition, these plants provide fuel, in the form of carbon from their decomposition, that speeds up the anaerobic stage of the cleaning process.

Due to the direct connection between the arboretum ponds and the Ventura River, an emphasis would be placed on the avoidance of aquatic plants that, while they have shown effectiveness in pollutant removal, are exotic and invasive in this ecosystem. Examples are common reed *(Phragmites australis*) and water hyacinth *(Eichhornia crassipes).*

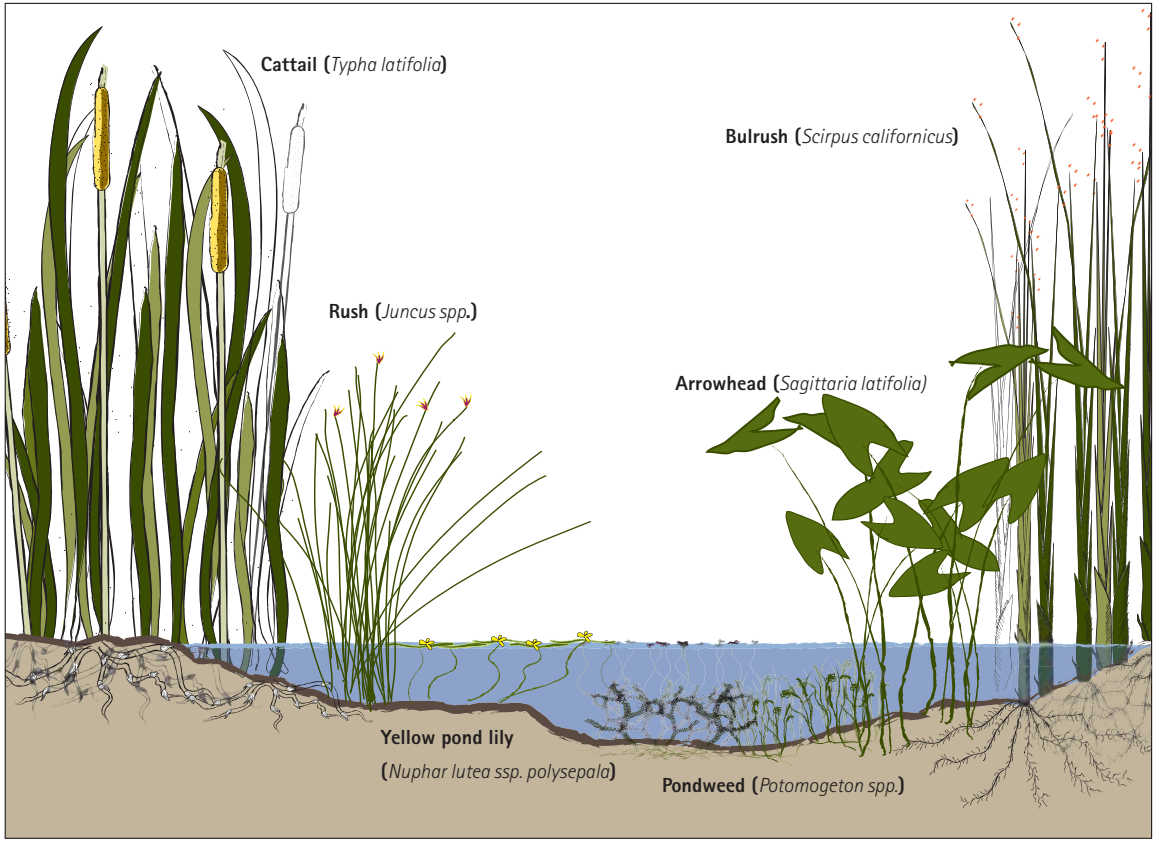


FIGURE 10.11 *Wetland and aquatic plants would play an important role in improving the quality of water in the polishing ponds in addition to contributing to the aesthetic experience for arboretum visitors.*

Mission Aqueduct

FIGURE 10.12 *Location of the historical aqueduct.*

EXISTING CONDITIONS

The Aqueduct

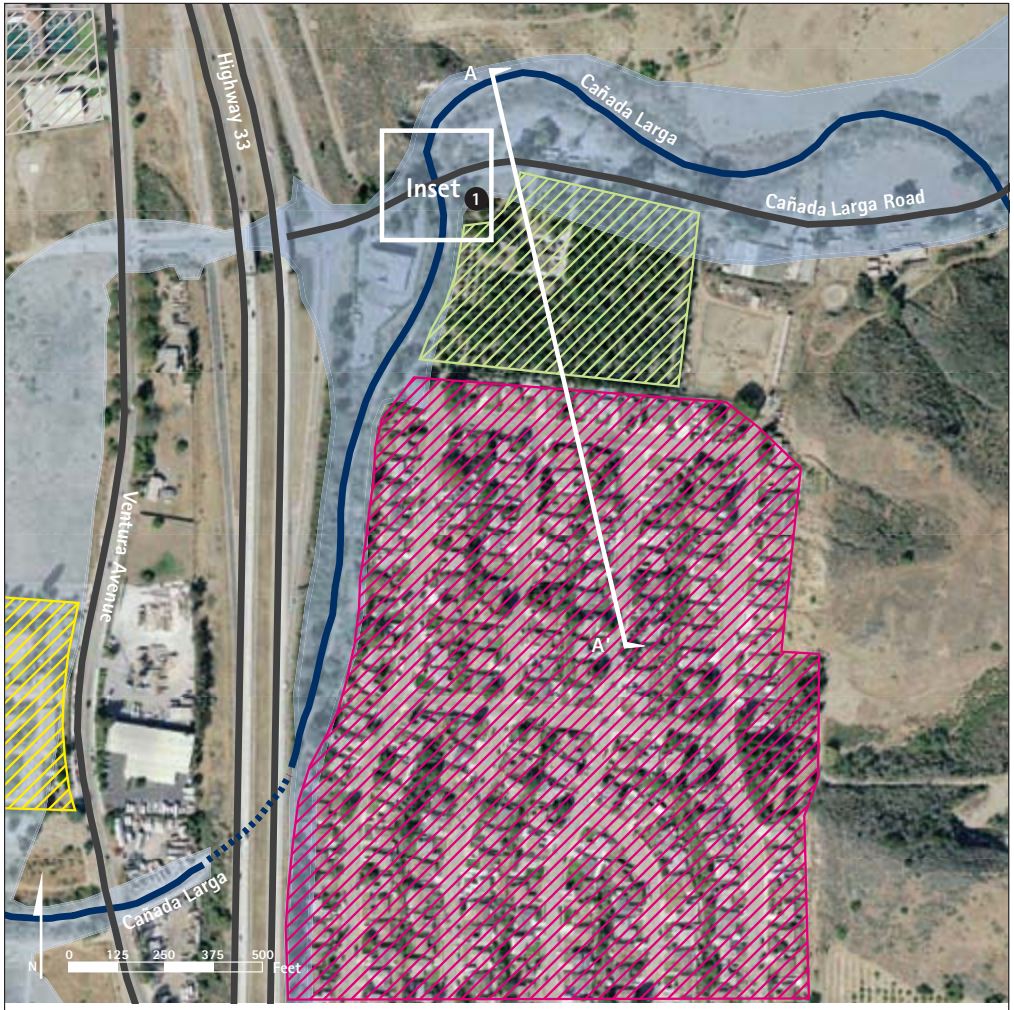
The second area of focus for this Plan within the larger Cañada Confluence site, is a threatened remnant of the San Buenaventura Mission Aqueduct located on the eroding banks of the Cañada Larga to the east and across Highway 33 from the arboretum site. The remnant is a valuable historical resource; a reminder to present day Venturans of the lifeline that once ran the length of the proposed parkway corridor carrying drinking water from the river at present-day Foster Park to the San Buenaventura Mission and settlement. Approximately 100 feet of the aqueduct, a Ventura County historical landmark since 1972, is clearly visible from Cañada Larga Road, but there is no signage to indicate that this crumbling wall was built by Spanish settlers in the late Eighteenth Century. Not only does it lie unprotected within the Cañada Larga's FEMA 100-year floodplain, it is also severely undermined by erosion and flood damage on the banks of the Cañada that has literally removed the ground from under a section of the aqueduct.

The Tributary

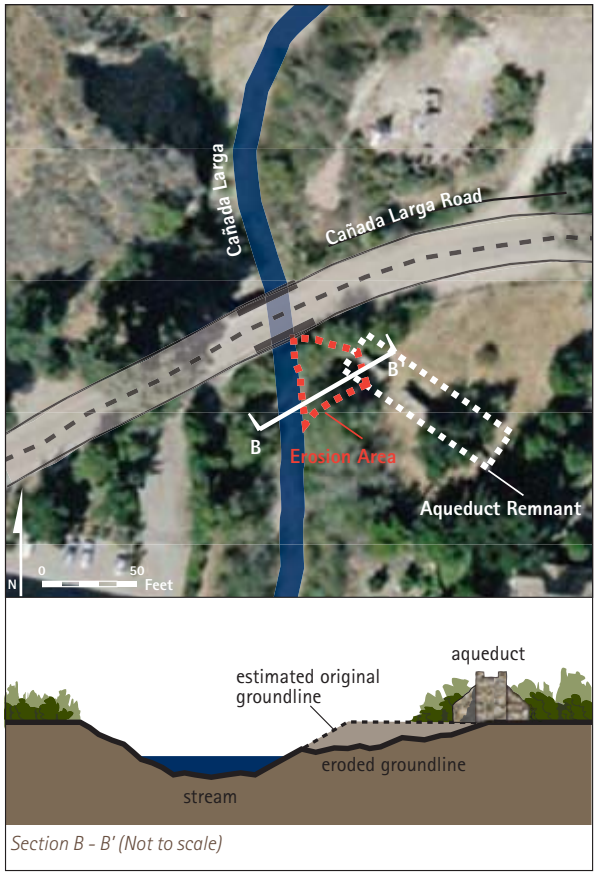
As the Cañada flows through a rural valley for a distance of approximately eight miles from its headwaters to its confluence with the Ventura river, it passes through relatively pristine areas as well as land devoted to cattle grazing. Along the way, water in the stream picks up enough bacterial contamination to render it unhealthy for human contact, and it also carries nitrogen and phosphates in excess of EPA standards. Where the stream reaches the Ventura River Valley just east of Highway 33, it is pushed by Cañada Larga road against a steep eroding bluff. Below that point, the stream has been engineered into two ninety-degree turns which form a dogleg resembling little more than a drainage ditch, tightly nested between the highway and a housing development, before passing underneath Highway 33 and into the Confluence Park sub-site discussed below.

FIGURE 10.13 *Historical aqueduct remnant undermined by erosion.*

Erosion damage to the aqueduct remnant may be a symptom of a larger problem that threatens the southern half of the Cañada Confluence site. FEMA flood maps estimate that in an event with an average annual probability of one percent (a 100-year flood), the Cañada Larga will sweep over the aqueduct, jump its banks at the "dogleg," threaten homes in the residential development, inundate Cañada Larga Road, sweep through the underpass at Highway 33, proceed west and inundate the campus of the Brooks Institute, and finally converge on the Ventura River (FEMA 2005).



1 Aqueduct remnant location
Cañada Larga
Major roads
FEMA 100-year floodplain
Orchard
Housing development
Brooks Institute campus



Section B - B' (Not to scale)

[ABOVE] FIGURE 10.15 *Aerial view and section: Historical aqueduct remnant undermined by erosion. Not to scale. Orthophotography: CIRGIS.*

[LEFT] FIGURE 10.14 *Existing conditions in the vicinity of the historical aqueduct location. See Section A - A' on following page. Orthophotography: CIRGIS;. flood data: FEMA.*

DESIGN CONCEPTS

Objectives for the Aqueduct sub-site include increased flood protection along Cañada Larga, an improved habitat corridor and better water quality, protection from flood damage and erosion for the aqueduct site, and increased cultural awareness regarding the aqueduct remnant as an historical resource. Design recommendations to address these objectives include widening the stream corridor and the floodplain, directing the stream away from the aqueduct site, introducing limited flood detention and point source water quality treatment. Recommendations for visitor use include establishing a network of multi-use trails that would connect the Ventura River and the residential neighborhoods to the east with the valley of the Cañada Larga and the hillsides beyond.

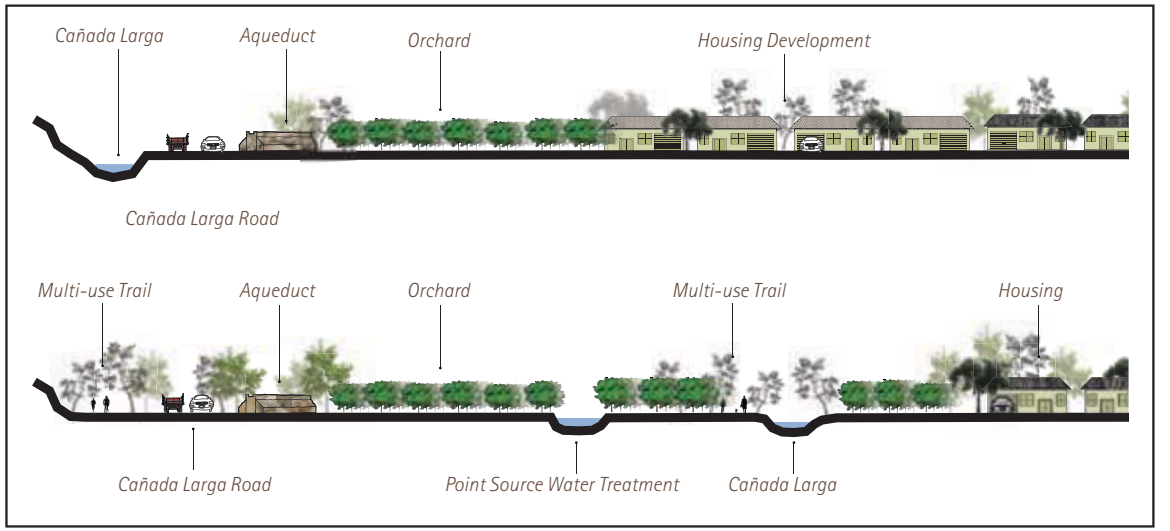


FIGURE 10.16 *Section A-A', existing conditions (above) in comparison with proposed concept (below). Not to scale.*

The very limited step of reinforcing the banks of Cañada Larga immediately to the west of the aqueduct and restoring the terrain underneath it might alleviate the immediate threat of further damage to this historical structure, but it would not address larger issues of flood risk along this constricted stream. Instead, this Plan would increase the flood-handling capacity of the Cañada and improve its function as a habitat corridor by widening the stream and the adjacent floodplain and by reconfiguring the course of the stream to avoid right-angle turns and achieve something close to a meandering pattern — one that would flow away from the aqueduct site. One method for creating more room for the stream would be the removal through attrition, over a twenty to thirty-year period, of between ten and thirty homes along the edge of the adjacent development. The remaining residential neighborhood would be advantaged by the creation of a more attractive natural edge and improved pedestrian connections to the Ventura River as well as decreased flood risk. An expanded orchard along both banks of the Cañada would be compatible with an expanded floodplain and would help protect water quality and habitat along the corridor while preserving agricultural open space in accordance with the regional SOAR policy. Finally, an upstream flood detention basin, if carefully managed in coordination with the operations of similar detention facilities elsewhere in the watershed (Campbell and Ogden 1999) would further increase the capacity for managing occasional floods. Under normal conditions, this shallow basin would support agricultural uses.

A successful stream restoration requires careful study of local topography and geology as well as a review of the stream's historical course and the sequence of development activities that brought it to its current configuration. Thus, the concept illustrated here is a general one and not a suggested map for the course of the future stream.

Establishing small on-site constructed wetlands at multiple farm and ranch sites along the Cañada (e.g. figure 10.17, item 3) would improve water quality in the tributary as well as the Lower Ventura River by removing fertilizer and bacterial contamination at its source, and some residual treatment capacity might be provided by the downstream polishing ponds (discussed in the preceding section).

Efforts to direct public attention toward an historical artifact such as the aqueduct need to be sensitively designed so that increased visibility leads to understanding of its importance and increased stewardship, and not

to increased opportunities for vandalism. However, the aqueduct remnant is currently clearly visible and known to many members of the public, and the existing fence that separates it from the road would not discourage a determined trespasser. This Plan would recommend the creation of a small parking lot, durable interpretive materials, and appropriate fencing to protect and enhance the educational value of this site. Access through multi-use trails would connect this small site into the larger context of the parkway as well as the valley of the Cañada, and the same trails would connect residents of nearby residential neighborhoods to the aqueduct, Cañada, and the Ventura River.

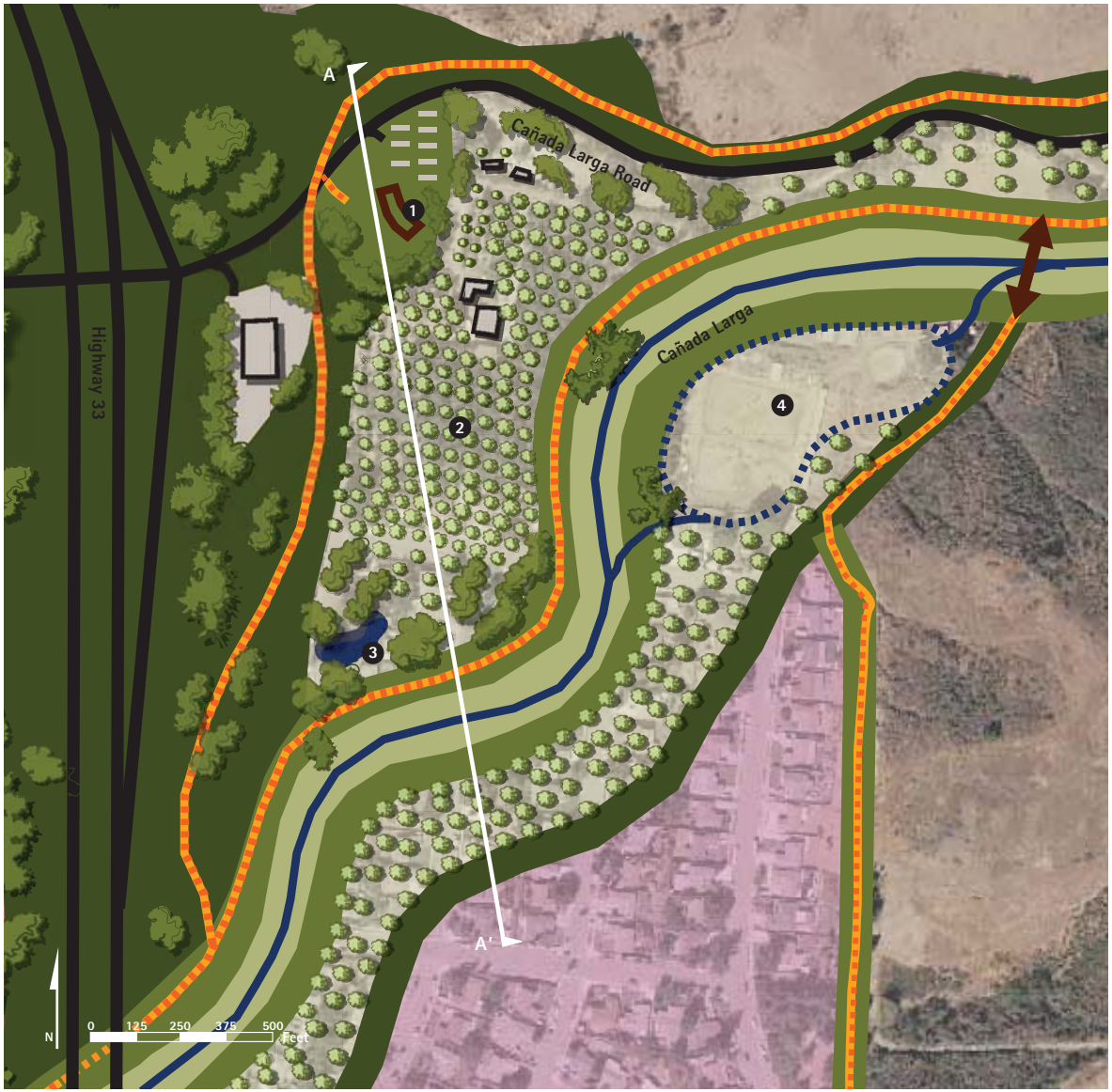


FIGURE 10.17 *Historical aqueduct site, proposed plan.*

Confluence Park

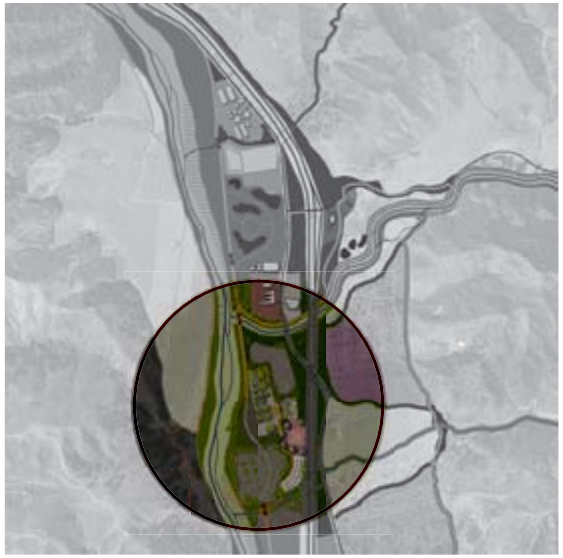


FIGURE 10.18 *Location of the Confluence Park sub-site .*

EXISTING CONDITIONS

The Confluence Park area lies south of the Ventura Valley Arboretum area, and makes up approximately one half of the Cañada Confluence site. The northern portion of this sub-site is an area of mixed land uses consisting of a campus of the Brooks Institute, a boat yard, an undeveloped lot through which the Cañada Larga runs, and the confluence of that stream with the Ventura River. The southern portion of the sub-site consists of the former USA Petroleum refinery. As in the case of the Ventura Valley Arboretum, the Ventura River Trail runs along its western edge, and Highway 33 along its the eastern edge.

Issues at this sub-site include the impairment of ecosystem services, the lack of public open space and access to the river, the culverting of a section of the Cañada Larga, and the existence of contaminated brownfields that may require remediation as a condition for increased public access or future development.

North Area

The Brooks Institute is a private college with a well-respected program in media subjects including photography, photojournalism, and graphic design with campuses in Santa Barbara and Ventura. The school's programs have recently expanded, and the City of Ventura has viewed it as a potential nexus for a larger arts-related development at this site which would possibly include the expansion of Brooks itself into the vacant areas north and south of the existing campus (Brooks 2008; City of Ventura 2005). However, as discussed in connection with the Mission Aqueduct above, parts of the campus, as well as the adjacent vacant lots, lie within the FEMA 100-year floodplain of the Cañada Larga, and the campus has sustained flood damage during recent storm events.

Before entering this site, the Cañada Larga passes through an approximately 300-foot long concrete box culvert under

FIGURE 10.19 *Cañada Larga box culvert under Highway 33.*

FIGURE 10.20 *The confluence of Cañada Larga and the Ventura River.*

FIGURE 10.21 *Existing conditions across the Confluence Park sub-site. Orthophotography: CIRGIS.*

1 Brooks Institute campus

2 Ventura River/Cañada Larga confluence

3 USA Petroleum refinery

Streams

Box culvert

Concrete-sided channel

Major roads

Agricultural

Institutional

Abandoned or underutilized industrial landuse

Residential

FIGURE 10.22 *The Ventura River near its confluence with Cañada Larga.*

Highway 33 and an approximately 325-foot section of open concrete-lined channel. These engineered impairments effectively bar the riverside passage of animals between the Ventura River and the valley and hillsides to the east. A boat yard lies adjacent to the culvert on the island between Highway 33 and Ventura Avenue.

West of Ventura Avenue, as it passes through the undeveloped lot, the Cañada flows through a soft-bottom channel lined with rip rap. The banks and the lot are shady with oaks and other native and non-native vegetation, suggesting that the they currently have moderate ecosystem value. The area also appears to be used as an occasional camping location by homeless individuals and by others for riding dirt bikes. Further west, the southern bank of the Cañada is reinforced by a stretch of gabion wall; sections of the wall are climbable only with difficulty. The bed elevation of the Cañada is several feet higher than that of the Ventura River where the two rivers meet, (possibly the result of erosion discussed in chapter 3), and a concrete weir makes up the difference in grade. Directly above, an attractive bridge provides a crossing for the Ventura River Trail and the setting of the confluence is quiet and natural with impressive views upstream and downstream. However, other than the bridge with its bicycle traffic, there is no point where visitors are invited to approach either stream.

WHAT IS A BROWNFIELD?

"The term 'brownfield' is used to describe abandoned, idled, or underused industrial and commercial property that has been taken out of productive use as a result of actual or perceived risks from environmental contamination." (Dennison 1998)

The Old Refinery

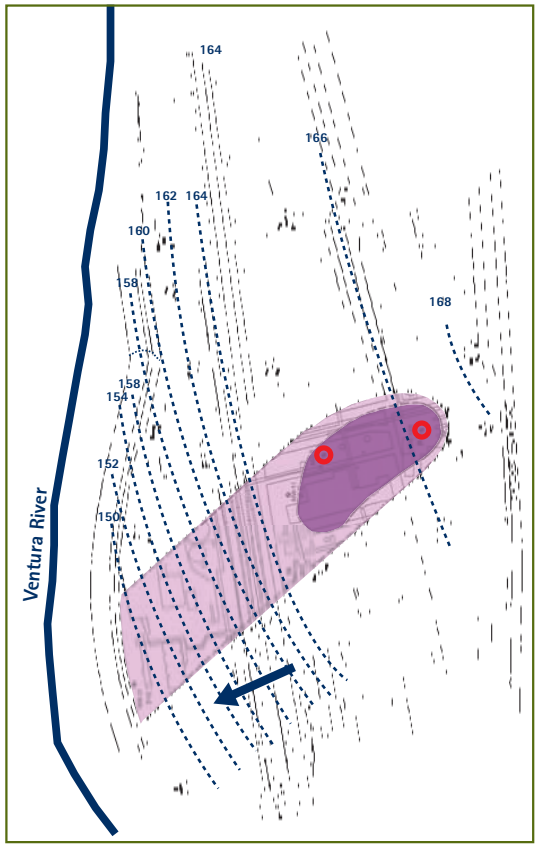
The USA Petroleum refinery site is located south of the confluence area on approximately 60 acres, largely consisting of an asphalt and gravel pad, partly constructed and partly open. This is a brownfield site that is mentioned as a candidate for annexation in the City of Ventura's General Plan (2005). Cracking towers near Crooked Palm Road and a tank farm to the east of the Ventura River Trail rise high above the landscape and could be described as iconic. However, participants at community meetings referred to the area as a "toxic eyesore" and a "rusty hulk." Extensive vandalism, corrosion and removal of exterior metal coatings from refining structures, easily viewed from the Ventura River Trail, reinforce a perception of dilapidation as well as contamination. This perception is reinforced by signs warning of asbestos contamination posted along the perimeter of the property and views of pools of stagnating water next to heaps of waste materials.

This site falls under the jurisdiction of the State Water Resources Control Board (SWRCB 2008) and is currently overseen by the County of Ventura Environmental Health Division (CVEHD). It is part of the County's Voluntary Cleanup, and Leaking Underground Fuel Tank Programs (CVEHD 2008a and b). Two underground fuel storage tanks and associated contaminated soils have already been removed (Stratus Environmental Inc. 2008). In addition a number of groundwater monitoring wells have been installed. Samples are taken quarterly and have shown the presence of petroleum hydrocarbons such as gasoline, benzene, ethyl-benzene, methyl tert-butyl ether (MTBE), xylenes and toluene. One well in particular has shown unacceptably elevated levels of these contaminates (Stratus Environmental Inc. 2008). In addition, recent acts of vandalism have released polychlorinated biphenyls (PCBs) into the soil (Salter 2008). An exhaustive survey of the type and extent of contaminates at the site has not been completed, and a survey of this sort will require the removal of existing above ground tank structures in order to allow further testing of the site. These actions would be completed through the Voluntary Cleanup Program and at the property owner's discretion. However, further inspection and monitoring are planned through the CVEHD (Salter 2008).

Figure 10.24 illustrates the estimated extent of groundwater contamination from methyl tert-butyl ether (MTBE), which is just one of the contaminants identified at the site (Stratus Environmental Inc. 2008). Water quality testing between 2001 and 2005 did not disclose detectable amounts of

FIGURE 10.23 *The former USA Petroleum refinery site.*

GROUNDWATER CONTAMINATION



This diagram, based on well monitoring data from mid-2008, illustrates the estimated location of a plume of MTBE contamination in groundwater below the former USA Petroleum facility. Water from two wells shown here had concentrations of MTBE higher than eight micrograms per liter (µg/L), and the dark purple zone had estimated concentrations above 5 µg/L, both exceeding California's secondary maximum contaminant level (MCL) of 5 µg/L (USGS 2007) for this volatile organic solvent. That MCL is directed toward aesthetic considerations such as taste and odor for drinking water, but MTBE also raises health concerns; the EPA has identified the chemical as a potential carcinogen (USGS 2007).

- Monitoring wells with MTBE 8.2 µg/L or above
- MTBE 5.0 µg/L or above (estimated area)
- MTBE 1.0 µg/L or above (estimated area)
- Direction of groundwater flow
- Water table (elev. in feet above mean sea level)
- Ventura River

FIGURE 10.24 *MTBE contaminated groundwater under the USA Petroleum site. Adapted from Stratus Environmental Inc. 2008.*

MTBE in the Ventura River itself (Leydecker and Grabowski 2006). However, groundwater under the USA Petroleum site flows directly toward the river channels immediately to the West of the site, suggesting the importance of future remediation efforts.

Like the water treatment facilities at the north end of the Canada Confluence site, the western edge of the old refinery site replaces the floodplain of the Ventura River with what appears to be a levee and pushes the river into a narrow cross section. Most of the refinery site is within the FEMA 100-year floodplain (FEMA 2005), a circumstance that further increases the risk of release of contaminants into the river.

CONFLUENCE PARK–REFINERY AREA: DESIGN CONCEPTS

1. Buildings relocated from 100-year floodplain
2. Brooks campus expanded across Ventura Ave.
3. Confluence Park
4. Former refinery - phytoremediation area
5. Poplar plantation (MTBE groundwater plume)

- Stream with riparian corridor
- Nature trail
- Multi-use trail
- Limited access bridge
- Existing riverbed
- Expanded riverbed
- Riparian habitat
- Greenbelt corridor
- Agricultural
- Residential
- Industrial
- Remediation site

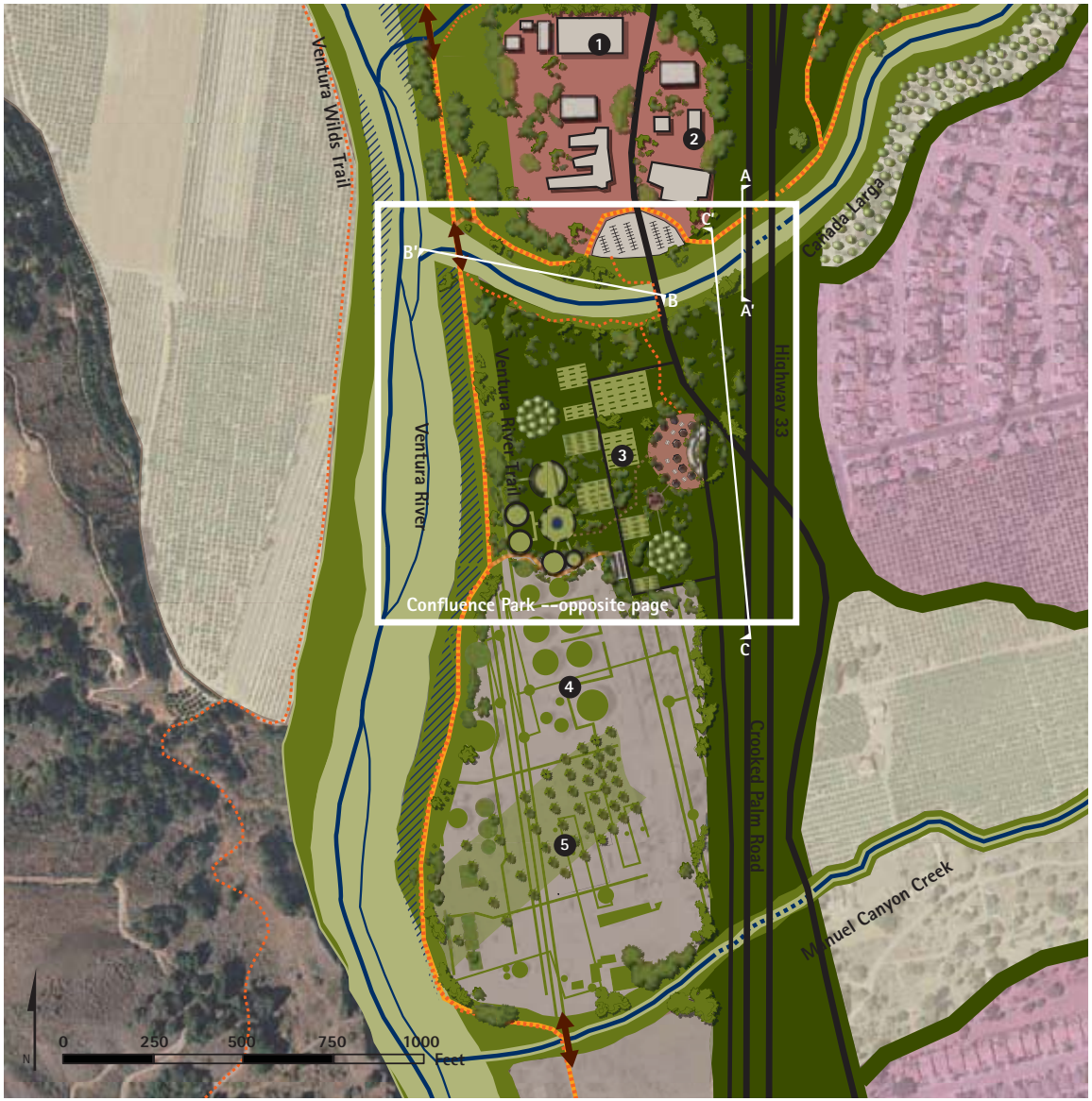
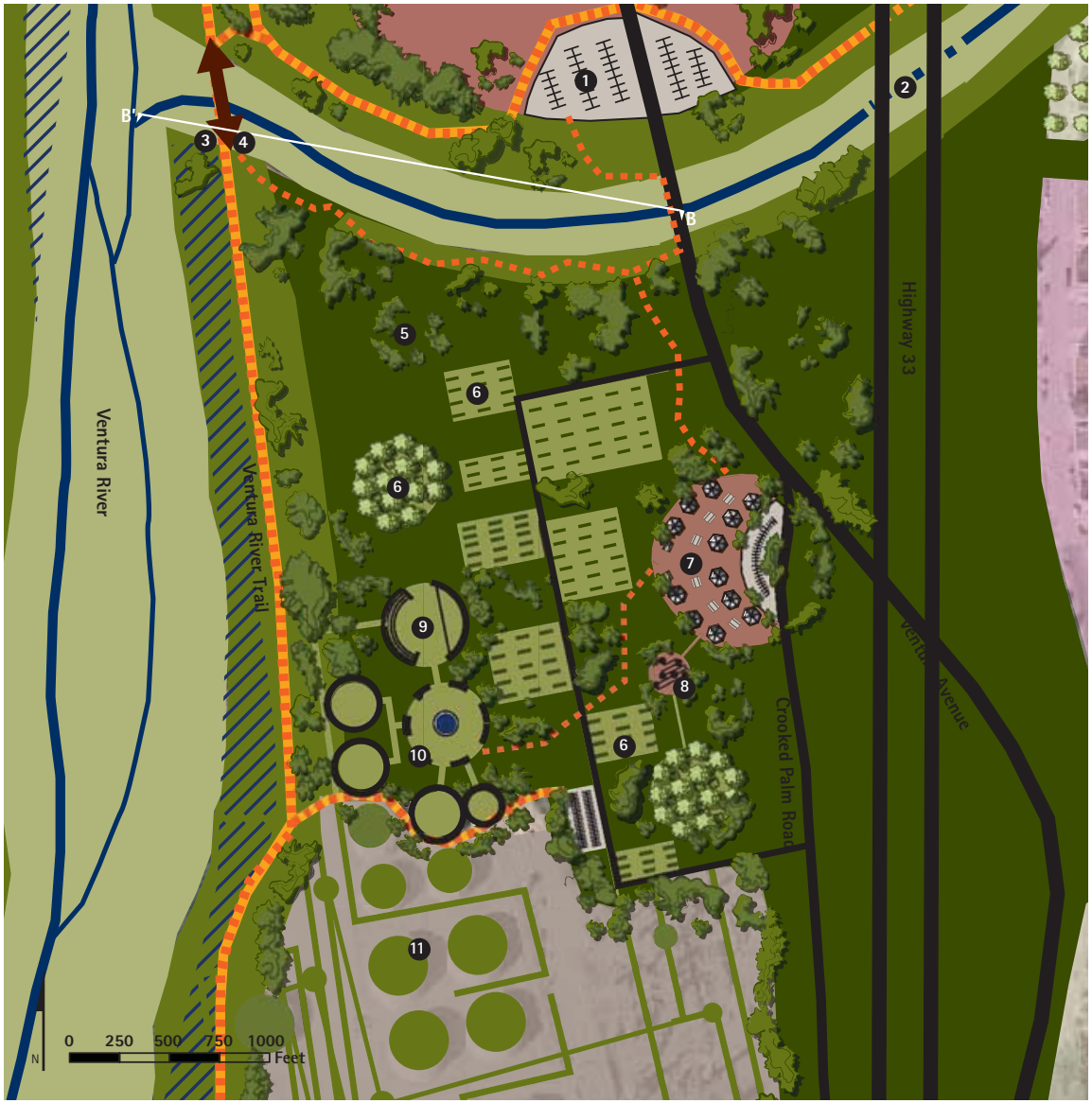


FIGURE 10.25 *Confluence Park and refinery remediation area, proposed plan.*



CONFLUENCE PARK – DETAILED VIEW

1. Combined parking Brooks / Confluence Park
2. Cañada Larga daylighted under Highway 33
3. Access stairs to confluence
4. Riverside observation station
5. Picnic/gathering groves
6. Community gardening area
7. Night market, concession area, restrooms
8. Climbing and play area
9. Oil tank amphitheater
10. Oil tank galleries, recreation, skate park
11. Former refinery - phytoremediation area

FIGURE 10.26 *Confluence Park, proposed plan.*

DESIGN RECOMMENDATIONS

Objectives for the Confluence Park sub-site include mitigating the impacts of development on the Cañada Larga tributary, increasing public access and recreational opportunities near the confluence between this tributary and the Ventura River, planning for future land uses that are compatible with the floodplain, and mitigating a brownfield condition that might otherwise limit future public access to the site. Design recommendations to address those objectives include the daylighting and dechannelization of a portion of the Cañada, the creation of a public park area highlighting the confluence, and the envisioning of a program for the remediation of the brownfield site that increases public awareness of, and support for, the cleanup process while affording limited, safe, public access to portions of the site.

Daylighting the Cañada Larga

This Vision Plan identifies tributaries as features that have strong potential for improving habitat connections between the main stem of the Ventura River and the surrounding valleys and hillsides. The culverting or open channelization of over 600 feet (the length of two football fields) of the Cañada Larga has effectively eliminated natural hydrological and ecological functioning from the stream precisely at the point where it enters and traverses the proposed parkway. Unchanged the channel would serve as a highly visible negative example of river function for visitors to Confluence Park. Instead, this plan recommends the daylighting of the stream through the removal of the box culvert and replacement with a bridge overpass for the highway, as illustrated in figure 10.27. Immediately west of the overpass, between Highway 33 and Ventura Avenue, the existing concrete channel would be replaced by a soft bottom channel with vegetated banks. While economic and engineering considerations may limit the width of the riparian corridor that can be daylighted under the highway, these changes would allow native vegetation and natural processes to reemerge and provide some passage for wildlife.

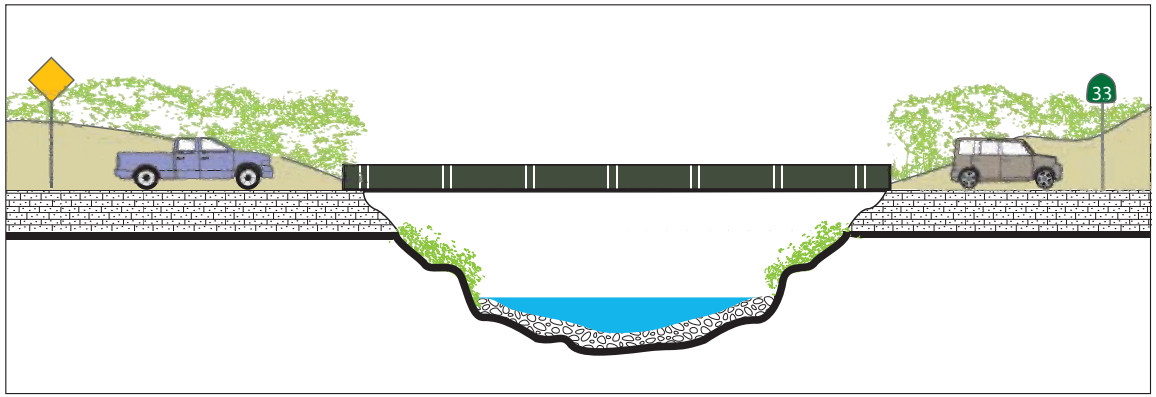


FIGURE 10.27 *Section A-A'. Cañada Larga daylighted at Highway 33. Not to scale.*

Confluence Park

The area immediately south of the Brooks campus would be a crossroads and a convenient rest stop for visitors travelling up or downstream on the Ventura River Trail, visitors coming from trails along the Cañada in the historical aqueduct area, visitors who might park along Ventura Avenue, and potentially, hikers crossing the river from the Ventura Wilds Trail via a limited access bridge. Here, passive recreational opportunities would be concentrated along the banks of the Cañada and at its confluence with the Ventura River. These amenities would include views and access to the confluence, resting and gathering spaces and interpretive materials regarding river processes.

A walkway, with views of the Cañada as well as the hills above the west bank of the Ventura River, would run from Ventura Avenue across the Ventura River Trail and down gabion stairs to the location of the confluence. The park would have an oak woodland character, transitioning into riparian vegetation along the stream and river banks. Oaks and other native trees would be clustered to form a series of small to medium outdoor rooms offering shade and picnic opportunities. In addition to enjoying shade from the oaks, visitors would also have the option to picnic in one of several ramadas along the walkway. One or more of these ramadas would be located to provide direct views of the confluence, with interpretive materials that highlight both dry and wet season conditions on the river. These locations would afford shelter on rainy days as well as an opportunity to safely observe occasional flood conditions, while learning from interpretive materials about the conditions that create floods on this flashy river and the importance of floods as a natural river function.

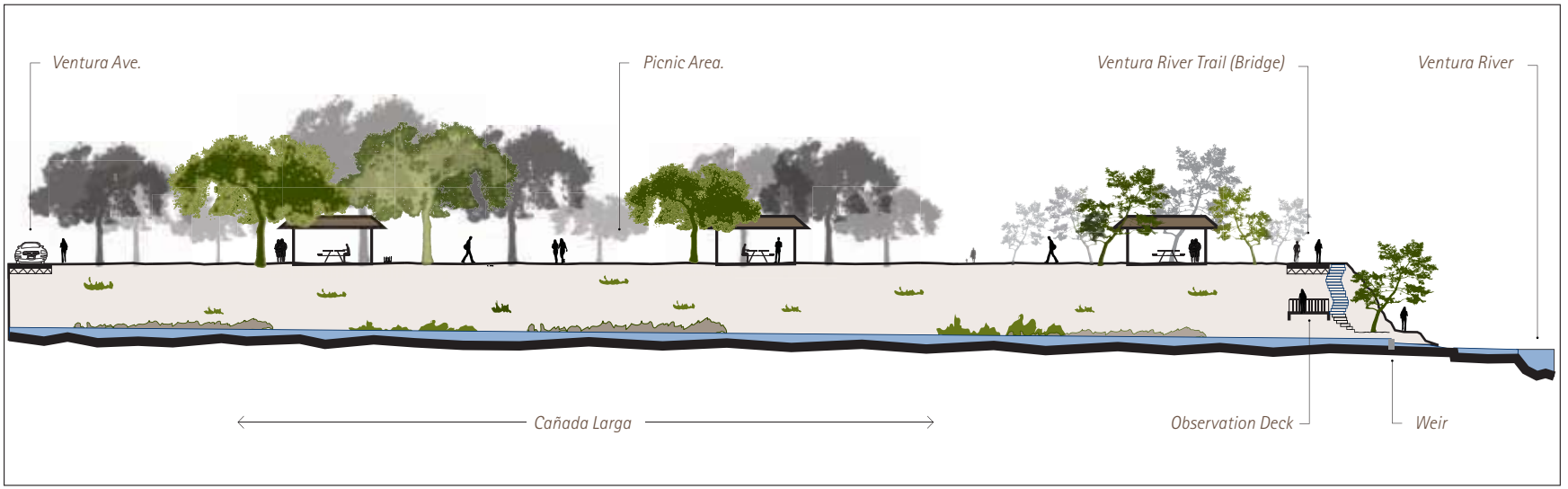


FIGURE 10.28 *Confluence Park Plan section B-B' showing Park, viewed from North, from Ventura Avenue to the confluence. Not to scale.*

Other interpretive materials would address related subjects such as the concept of watershed planning and the relationship between permeable surfaces, groundwater recharge and instream flow in the river; these ideas would be reflected in the design of the park itself, highlighting the use of permeable walking surfaces.

For parkway visitors, Confluence Park would offer an invigorating nexus between passive recreational opportunities and increased awareness of the river and its processes, and cultural opportunities at the adjacent Brooks campus and possibly other future arts related developments in the area. At the same time, the park would preserve valuable open space next to the campus: space that performs valuable ecosystem functions such as groundwater recharge, water quality protection and ecosystem support for native plants and animals.

The Refinery

This Plan envisions the former USA Petroleum refinery site not as a specific future land use, but as a remediation project and a site with an open future. Given the existence of substantial industrial infrastructure and known contaminants, cleaning up the site to the point where it is safe for public use may require many years of planning and implementation, a consideration that suggests that the remediation project itself will be an important feature of the parkway, rather than simply a prior condition to be completed before a parkway plan is implemented. Therefore, this Plan focusses on how a future visit to the Lower Ventura River Parkway can be enriched through increased awareness and appreciation regarding its industrial history, the reasons for remediation at this site, and the remediation process itself.

Remediation Efforts

Although a review of brownfield remediation strategies is beyond the scope of this Plan, a brief overview is useful from the standpoint of identifying opportunities for public interaction with the process; the focus of this discussion.

Brownfield remediation efforts are ultimately aimed at the return of abandoned or underutilized contaminated land to safe use for productive purposes. Anticipated future uses might be developments such as light industry, commercial

FIGURE 10.29 *Stairway from the Ventura River trail to the confluence of Cañada Larga and the Ventura River. Illustration by Ling Wei Lioa.*

space, or housing, or simply the return of the land to a more natural state for the provision of ecosystem services, or a combination of developed and open space. Although the complete cleanup and removal of contaminants from a site, referred to as *cleanup to background levels*, is ideal, recent years have seen an increasing emphasis by federal and state regulators on using environmental risk assessment methodologies to define acceptable risk-based cleanup levels that are less stringent and more economical but deemed adequate, with the anticipated future land use being the key factor. The result of this balancing of technological feasibility, economics, and land use planning is a situation where contaminants might be removed to the extent feasible, or in some cases might be quarantined through encapsulation, clean cover or some other means without being removed (Cairney and Hobson 1998).

Remediation of the refinery site would involve initial testing of the infrastructure, soil, and groundwater at the site (some of which has already occurred), removal and recyling of industrial infrastructure, and the removal or quarantine of any contaminants in the soil or groundwater at the site.

Methods for removal of petroleum-related soil contaminants include on-site excavation and treatment, ex situ approaches involving the removal of the contaminated soil itself from the site and decontamination or disposal of the soil at another location, or in situ approaches such as soil flushing, chemical neutralization, injection and extraction, biodegradation, and phytoremediation. Methods for stabilizing or quarantining of soil contaminants include capping contaminated layers with concrete or other materials, or mixing soil with concrete or other binders to trap contaminants in a solid matrix (Riser-Roberts 1998). Petroleum-related groundwater contaminants might be removed through pumping groundwater, filtering or otherwise treating it, and reinjecting it into the ground. (Riser-Roberts 1998).

This Plan recommends the consideration of phytoremediation as a key strategy that would address both soil and groundwater contamination at the site. Phytoremediation is the use of plants to remove contamination from soil, water, and air, using leaves,

> **"Cultural reuses of brownfields . .** are uses of properties that support those assets of communities that distinguish their architecture, function, residents, or other characteristics from others . . . . If communities are thought of as eco-systems of interdependent social, environmental, and economic ingredients, the history and culture of a community can be seen as the glue that binds these ingredients together." (Singer and Ploetz 2002)

shoots and/or roots to filter, extract, immobilize, stabilize, or biodegrade pollutants (Arthur et al. 2005). The roots of some plants supply carbon and energy to the root zone, rhizoshere, that increases the activity of soil microorganisms that biodegrade petroleum constituents (Arthur et al. 2005; Riser-Roberts 1998). Some plants can take up and isolate heavy metals, often associated with petroleum contamination, in their roots and shoots (Arthur et al. 2005).

A Public Viewport on Remediation

Phytoremediation would be a valuable element in a cleanup program for the refinery site, while also serving other parkway objectives. Phytoremediation strategies for the cleanup of industrial waste employ many of the natural characteristics that make plants valuable for cleaning air, water and soil in natural ecosystems. Many plants native to Ventura, such as cattail (*Typha latifolia*), iris-leaved rush (*Juncus xiphioides*), and bulrush (*Scirpus ssp.*) are useful in these remediation strategies (Arthur et al. 2005), just as they are valuable in natural ecosystems. Thus, employing phytoremediation strategies at the refinery site in a highly visible manner, with appropriate interpretive materials, would increase public awareness regarding the ecosystem services provided by vegetated open space, helping to build stewardship for the river and the parkway.

A highly visible approach to phytoremediation including safe, passive recreational components and ample explanatory materials might also help to generate public support for the remediation process itself. Even a seemingly desirable program like brownfield phytoremediation can generate public controversy, with questions arising about the choice of plants (in some contexts, non-native or even genetically engineered plants), the eventual fate of contaminants, or the safety of the process itself. The consideration of social acceptability for a specific remediation effort can be as important as scientific and technical expertise (Wolfe and Bjornstad 2002).

One idea for using highly visible biological cleanup processes and increasing visitor awareness is suggested by research indicating that deep-rooted trees such as poplar (*Populus deltoides x nigra* and other hybrids) can remove MTBE, a contaminant of concern at the refinery site, from groundwater in aquifers (Hong et al. 2001). A poplar plantation, planted in the path of a plume and appropriately sized depending on the width of the plume and the slope and rate of groundwater flow, can actually capture the plume (Mathews et al. 2003). This would seem to be a promising concept for the refinery site, with its high water table, relatively shallow aquifer and permeable alluvial soils. A stand of poplars or similar deep-rooted trees tracing the path of the MTBE plume (figure 10.24) would draw visitors' attention and create curiousity, presenting an opportunity for effective interpretive signage. One potential limitation is the fact that few poplars are native to this area, and the species with proven effectiveness at this time are both non-native and in some instances, genetically engineered. The need for exotic plant materials versus native ones, and the impact on local native plant communities and biodiversity would need to be assessed.

During some phases of the remediation effort, plants with phytoremediation potential would be established with different planting palettes forming a contrasting figure and ground pattern in order to clearly mark the footprints of former refinery structures and pipeline paths, calling attention to the past use of the site as well as the presence of a remediation effort. If it is determined to be safe, a trail with restrictive fencing could allow visitors to pass through the remediation area, in order to view signage explaining the importance of cleanup efforts and the qualities of the plants being used for phytoremediation.

The Future of the Refinery Site

The ultimate uses of the over sixty acre refinery site remain open in this Vision Plan. City annexation and development prospects, Brooks campus expansion possibilities, and the need for open space and the ecosystem services that it provides, all competing for space. As remediation progresses the following factors would warrant consideration.

First of all, the entire refinery site is in the floodplain of the Lower Ventura River, and significant portions of the site are within the FEMA 100-year floodplain. With the future restoration of the Lower Ventura River and the growth of public appreciation for the benefits of an active floodplain, the portion of the site that is subject to occasional flooding may grow rather than shrink. The outcome of remediation efforts at the site will have an impact on this; if contamination is capped or otherwise contained rather

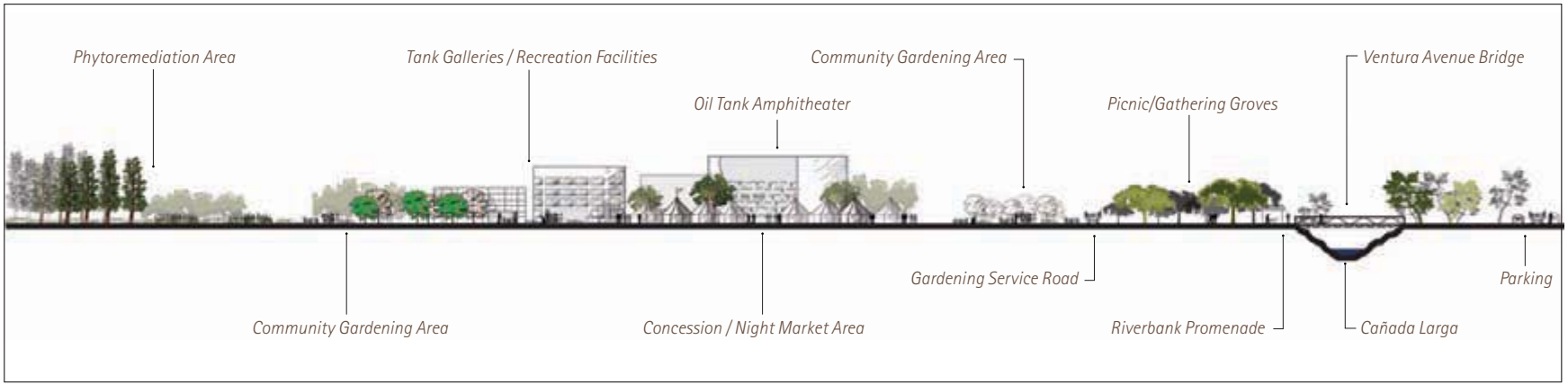


FIGURE 10.30 *Section C-C' showing Confluence Park and the edge of the refinery remediation site viewed from Ventura Avenue and Crooked Palm Road.*

than completely removed, the site may need to be leveed in order to prevent the release of contaminants into the environment during a future extreme flood event. Despite some uncertainty regarding these factors, future uses that are contemplated for the site should be ones that are compatible with some degree of flooding.

Refinery Park

Brownfields present planners with pressing priorities for both economic development and environmental restoration; the fact that these sites also often have historically significant past uses makes them uniquely suitable for a combined approach to social, cultural and economic values that leads to sustainable communities (Singer and Ploetz 2002). Devoting part of the refinery site to a cultural celebration of Ventura's petroleum producing heritage would provide an element of interest for visitors and strengthen their experience of this place.

This plan envisions cultural reuse of part of the refinery site as a refinery heritage park that would provide amenities for private use and community programs. The locations for these features shown in this Plan are illustrative of the concept only. Actual siting would be dependent upon the results of testing, remediation and monitoring activities to ensure that any public uses of the site are safe during or following completion of remediation activities.

The requirements for safe soil assessment, cleanup and monitoring may preclude the retention of any original refinery structures on the site. However, structures and spaces in the park could mimic the forms, distribution and placement of some preexisting storage tanks and refining equipment. For example, the form of an original above-ground storage tank might serve as inspiration for an amphitheater or outdoor gallery for both day and evening use, while the location of a preexisting underground tank could provide a skate park. Other structures might be newly designed and built to mimic refining equipment at a smaller scale, for example, an area of climbing and play equipment near Crooked Palm road that would mimic the preexisting cracking towers.

Some of these features would appeal specifically to groups of children, youth, or senior citizens, while others (such as an amphitheater for movies or performances) would appeal more generally to families or the general public.

A concession stand and rest rooms, visible to motorists on Ventura Avenue and Highway 33, would support park users and provide an incentive for travellers to stop and look. During the evenings on a weekly basis, a night market would be set up in the shadow of the park's structures. A dining experience popularized in Asia, night markets provide a festive outdoor venue in which restaurateurs and retailers can sell their wares while the community has a unique opportunity to get outside and socialize after dark.

FIGURE 10.31 *Night market in Confluence Park near the former USA Petroleum refinery site.*

CONCLUSION

This Plan envisions the area where the Ventura River and Cañada Larga meet as a place where people could celebrate convergences of natural hydrology and urban infrastructure, of present-day development and historical remnants, and of ecosystems and human culture.

"California can improve the quality of life in this state by assisting public agencies and nonprofit organizations in establishing, developing, and restoring river parkways ."

California River Parkways Act of 2004
California Public Resources Code 5751(i)