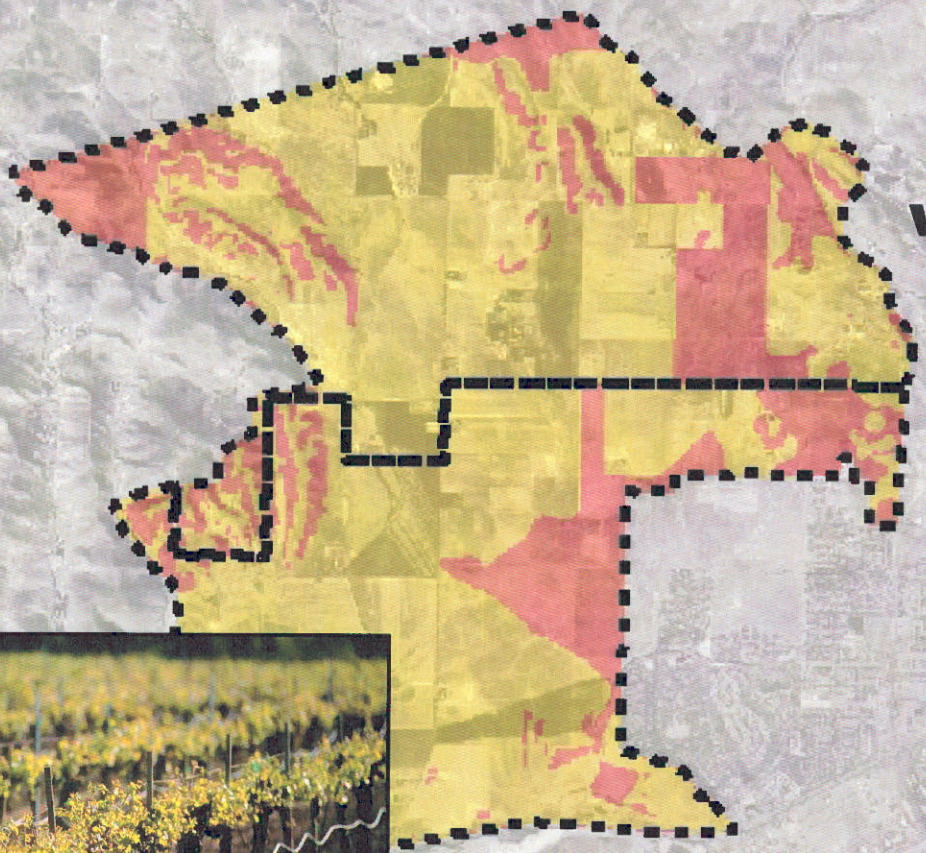
Supplemental Report
Non-Potable Water System
Conceptual Master Plan



Prepared for

Zone 7 Water Agency

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Prepared by

West Yost & Associates

WEST YOST & ASSOCIATES
Consulting Engineers

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EXECUTIVE SUMMARY

At the request of the City of Livermore, the Zone 7 Water Agency (Zone 7) requested that West Yost & Associates (WYA) conceptually identify, evaluate, and develop an estimate of the capital costs for the most viable combinations of supply and infrastructure (including possible use of existing or proposed "in-valley" water system infrastructure), to serve the potentially irrigable areas in North Livermore. In particular, the City of Livermore requested that some of the alternative scenarios to be evaluated include the use of recycled water from its wastewater treatment plant (WWTP).

The scenarios presented in this Supplemental Report are consistent with WYA's Final Draft Report: Non-Potable Water System Conceptual Master Plan (Non-Potable Master Plan), and incorporate all previous work conducted by WYA over the last four years on the Non-Potable Master Plan by reference.

WYA identified the following six potentially available supply and infrastructure scenarios to evaluate:

- Scenario 1: Local Conveyance & Storage, Imported Surface & Tertiary Water
- Scenario 2: Non-Local Conveyance & Storage, Imported Surface & Tertiary Water
- Scenario 3: Tunnel - Direct Delivery on Local Conveyance & Imported Surface Water
- Scenario 4: Off-Peak on Local Conveyance & Imported Surface Water
- Scenario 5: Non-Local Storage and Conveyance & Imported Surface Water
- Scenario 6: No Tunnel - Direct Delivery on Local Conveyance & Imported Surface water

Table ES-1 presents a summary of capital costs for each of the five scenarios presented, along with a graphical flow chart for each component (i.e., supply source, conveyance/storage, and transmission), and description of the pros and cons of each. As shown in Table ES-1, Scenarios 1 and 4 are the lowest cost scenarios. However, the successful completion of both scenarios depends heavily on the timing of local storage projects to be constructed, and discussion with Zone 7 staff indicates that these projects could be more than 10 years away from completion, if they are completed at all. Scenario 2 is the most expensive and still has the uncertainty of Scenarios 1 and 4. Scenarios 3 and 5 are also cost prohibitive.

Scenario 6 is the scenario with the least amount of uncertainty and provides a viable water supply within a reasonable period (within 4 years). Opting for Scenario 6 also builds flexibility into any proposed agricultural supply program. For example, if funding were available soon, surface water entitlements could be purchased, necessary piping/pump stations designed and constructed, and an irrigated agricultural program in the North Livermore area could be operational within 4 years. If these surface water supplies and conveyance capacity are purchased and constructed now, it also provides a platform from which to expand the agricultural program into the South Livermore, Greenville Road, or other area, as local storage opportunities become available in the future.

Detailed financing options were previously discussed in the Non-Potable Master Plan, and are still applicable to any of the scenarios presented in this report.

Table ES-1. Summary of Scenarios Evaluated

Scenario	Supply Sources	Conveyance/Storage	Transmission	Remarks	Capital Cost	$/af	$/acre
1	• Tertiary Water From LWRP • Local Imported Surface Water	• Local/Local (release imported flows into Altamont Creek, divert into local storage and blend w/ tertiary supply)	• Pump out of local storage to meet agricultural demands	PROS • Uses recycled water • 2/3 of the available recycled water still available • Direct supply through financial participation in on-going local conveyance Project • Local conveyance available in 3 years CONS • Timing associated with local storage • Permitting use of Altamont Creek	$78,000,000	$7,800	$12,600
2	• Tertiary water from LWRP • Non-Local Imported Surface Water	• Non-Local / Non-Local and Local (route imported flows into non-local storage, release from non-local storage to local storage to blend w/ tertiary water)	• Pump out of local storage to meet agricultural demands	PROS • Uses recycled water • 2/3 of the available recycled water still available • Does not require financial participation in local conveyance Project CONS • Timing associated with Non-Local Storage • Conveyance from Non-Local storage to Local Storage (Pipe A) may not be included in the cost • Timing associated with local storage	$160,000,000	$16,000	$25,800
3	• Imported Water	• Local / None Required (direct deliveries to meet agricultural demands)	• Divert raw water near Altamont WTP and construct new raw water pipeline to North Livermore for direct deliveries	PROS • Direct supply through financial participation in on-going local conveyance Project • Does not require local storage • Local conveyance available in 3 years CONS • Does not use any recycled water • Permitting pipeline through Altamont Hills	$149,000,000	$14,900	$24,000
4	• Imported Water	• Local / Local (uses off-peak local conveyance capacity and local storage)	• Release imported flow into Altamont Creek during off-peak periods and divert into local storage, then pump out of local storage to meet agricultural demands	PROS • Does not require financial participation in local conveyance Project • Creates local storage for direct delivery • Local conveyance available in 3 years CONS • Does not use any recycled water • Timing associated with local storage • Permitting use of Altamont Creek	$74,000,000	$7,400	$11,900
5	• Imported Water	• Non-Local / Non-Local (uses non-local storage to make direct deliveries to meet agricultural demands)	• Divert water into non-local storage, release water into non-local conveyance on demand to meet North Livermore agricultural demands	PROS • Does not require financial participation in local conveyance Project CONS • Does not use any recycled water • Timing associated with Non-Local Storage • Conveyance from Non-Local storage to Local Storage (Pipe A) may not be included in the cost	$158,000,000	$15,800	$25,500
6	• **Imported Water**	• **Local / None Required (direct deliveries to meet agricultural demands)**	• **Divert raw water near Altamont WTP and construct raw water pipeline parallel to Altamont Pipeline for direct delivery to North Livermore**	**PROS** • **Direct supply through financial participation in on-going local conveyance Project** • **Does not require local storage** • **Local conveyance available in 3 years** **CONS** • **Does not use any recycled water**	**$86,000,000**	**$8,600**	**$13,900**

INTRODUCTION

In July 2005, WYA completed the Final Draft Report Non-Potable Water System Conceptual Master Plan (Non-Potable Master Plan). The Non-Potable Master Plan was the culmination of over four years of studies related to meeting potential future non-potable and agricultural demands in the Tri-Valley area. This Supplemental Report is consistent with the Non-Potable Master Plan and incorporates all previous work conducted by WYA over the last four years on the Non-Potable Master Plan by reference.

As detailed in the Non-Potable Master Plan, WYA identified approximately 14,000 acres within the Zone 7 service area as being suitable for irrigated agricultural activities. Within this area, approximately 6,200 acres are located within the areas defined as North Livermore A and B (North Livermore A has 3,100 acres, and North Livermore B has 3,100 acres). There is currently no existing non-potable water system infrastructure available to serve North Livermore.

At the request of the City of Livermore, Zone 7 requested that WYA conceptually identify, evaluate, and develop an estimate of capital costs for the most viable combinations of supply and infrastructure (including possible use of existing or proposed "in-valley" water system infrastructure), to serve the North Livermore A and B Areas. In particular, the City of Livermore requested that some of the alternative scenarios to be evaluated include the use of recycled water from its WWTP.

The purpose of this Supplemental Report is to document WYA's evaluation of the most viable combinations of supply and infrastructure for North Livermore. This Supplemental Report contains the following sections:

- Description of Potential Agricultural Demands in North Livermore
- Available Recycled Water Supply Options
- Available Surface Water Conveyance Options
- Available Storage Options
- Viable Water Supply Scenarios
- Recommended Water Supply Scenario

DESCRIPTION OF POTENTIAL AGRICULTURAL DEMANDS IN NORTH LIVERMORE

Figure 1 illustrates the location and size of available irrigable acreage within the North Livermore Sub Areas A and B (approximately 6,200 acres). This identified acreage is consistent with work recently completed by the Natural Resources Conservation Service (NRCS), slope criteria specified for Measure D areas, and published planning documents. As detailed in the Non-Potable Master Plan, this acreage was also refined based on economic feasibility (i.e., based on pump lift and power costs).

The total non-potable water demand associated with the acreage identified on Figure 1 is approximately 10,000 acre-feet per year (af/year) using a unit demand factor of 1.61 acre-feet per

acre per year (af/acre/year) for wine grapes. Table 1 presents the total acreage and demand for North Livermore.

Table 1. Projected Non-Potable Demand in North Livermore

Location	Area, acres	Demand, acre-feet
North Livermore A	3,100	5,000
North Livermore B	3,100	5,000
Total	6,200	10,000

(a) Based on a unit demand factor of 1.61 af/acre/year (see Non-Potable Master Plan)

AVAILABLE RECYCLED WATER SUPPLY OPTIONS

As discussed previously, this Supplemental Report only considers recycled water available from the City of Livermore's WWTP; the location of the WWTP is presented on Figure 1. Discussions with City of Livermore staff indicate that the tertiary capacity of its WWTP will only be expanded to 6.5 million gallons per day (mgd) or approximately 7,300 af/year. However, the actual recycled water supply available will depend on existing and proposed City recycled water programs, and the quality of the tertiary recycled water supply.

Proposed City of Livermore Recycled Water Program

The City of Livermore has indicated that it plans to implement a new recycled water use program that will irrigate turf areas within City boundaries with recycled water, using approximately 4.6 mgd of the available tertiary capacity during a maximum day demand condition and approximately 1,800 acre-feet of the total available supply. Once implemented, the City of Livermore's program will only leave 1.9 mgd (6.5 – 4.6 mgd) of tertiary recycled water capacity during a maximum day demand condition and approximately 5,500 af/year (7,300 – 1,800 af/year) of total recycled water supply available for use by others.

Water Quality Constraints

The Non-Potable Master Plan established a maximum boron concentration in the delivered, non-potable water supply, of 0.5 milligrams per liter (mg/L). This maximum boron concentration was established based on the sensitivity of wine grapes to boron concentration; studies indicate that wine grapes are adversely affected at boron concentrations at or above 0.5 mg/L. Water quality data provided by the City of Livermore confirmed that the boron concentration in the tertiary recycled water effluent is approximately 1.2 mg/L and that the boron concentration in the reverse osmosis (RO) unit is above 0.5 mg/L (see Attachment 1). Consequently, the RO effluent at the City of Livermore's WWTP is of insufficient quality to blend down the concentration of boron in the tertiary effluent to 0.5 mg/L.

As detailed in the Non-Potable Master Plan, surface water can be used at a ratio of 4.6 parts surface imported water to 1 part tertiary water to blend down the concentration of boron in the tertiary recycled effluent supply to 0.5 mg/L. Hence, the maximum quantity of recycled water

from the City of Livermore's WWTP that can be used to meet the non-potable demands in North Livermore (~10,000 af/year) is approximately 1,800 af/year based on water quality constraints. Table 2 presents the total available tertiary recycled water supply, and the quantity of tertiary water that can be used based on water quality constraints.

Table 2. Available Recycled Water Supply

Available Tertiary Supply, af/year[(a)]	Usable Tertiary Supply, af/year [(b)]
5,500	1,800

(a) Assumes the City of Livermore implements its proposed turf irrigation program, reducing the available tertiary capacity during a maximum day condition by 4.5 mgd and the total available tertiary supply by approximately 1,800 af/year.

(b) The boron concentration in the effluent of the RO unit precludes its use for blending; consequently, the tertiary supply must be blended with 4.6 parts surface water, limiting the total tertiary supply used to 1,800 acre-feet if only 10,000 acre-feet of demand exists.

The remaining 3,700 af/year of tertiary supply (5,500 – 1,800 af/year) must be discharged down the Livermore Amador Valley Water Management Agency (LAVWMA) Pipeline or used in some other type of expanded agricultural program.

AVAILABLE SURFACE WATER CONVEYANCE OPTIONS

All of the water supply scenarios include the acquisition of imported surface water entitlements. This section describes the options available to convey these newly acquired imported surface water entitlements into the Tri-Valley for distribution to the North Livermore area. Two options are currently available for conveying imported surface water supplies into the Tri-Valley Area: Local Conveyance and Non-Local Conveyance.

Local Conveyance consists of transporting imported surface water using "off-peak" capacity (conveyance capacity available during periods of time when Zone 7's normal operations do not require use of this conveyance capacity), or purchasing "direct delivery capacity" on the proposed expanded "in-valley" conveyance. Non-Local Conveyance consists of purchasing storage and pipeline conveyance capacity from expansion projects located outside of the Tri-Valley area.

Local Conveyance Option

Zone 7 and the California Department of Water Resources (DWR) are currently designing an expansion of "in-valley" conveyance to help meet Zone 7's Municipal and Industrial (M&I) water demands, Zone 7 expects to complete construction and have this local, in-valley conveyance facility operational by 2009. The location of the "in-valley" conveyance is presented on Figure 1. While imported surface water conveyance capacity for agricultural interests is not included in this local expansion project, there is the potential for interested parties to discuss changes to Zone 7 proposed operational strategies to be able to use off-peak conveyance capacity, or possibly purchase a portion of the future, expanded capacity to allow direct deliveries of agricultural water supplies.

Figure 2 presents the Zone's currently proposed monthly operational plan for the expanded local conveyance facility. As shown on Figure 2, approximately 40,000 acre-feet of off-peak conveyance capacity could be made available; however, only 10,000 acre-feet of water supply conveyance capacity is required to satisfy the non-potable water supply needs of North Livermore. It should be noted that by definition, use of the potentially available off-peak conveyance capacity would require local storage facilities to be developed and available to allow this project to proceed. Preliminary discussions with Zone 7 staff indicate that it may be possible for up to 36,200 acre-feet (50 cubic feet per second) of direct delivery capacity to be purchased by agricultural interests, at a proportionate share of the total cost to expand the local conveyance capacity.

Consequently, under specific conditions, up to 40,000 acre-feet of off-peak local conveyance capacity and 36,200 acre-feet of direct delivery conveyance capacity could be available after the proposed local conveyance facility is enlarged. Table 3 presents a summary of the total annual quantities of water that can be delivered through the expanded local conveyance facility, and possibly available for purchase by local agricultural interests.

Table 3. Available Capacity on Local Conveyance

Off-Peak Capacity Available, af/year[(a)]	Direct Delivery Capacity Available, af/year[(b)]	Total Capacity Available, af/year
40,000	36,200	76,200

(a) All water conveyed under this option requires storage. Up to 10,000 acre-feet of conveyance capacity/supply is required for North Livermore

(b) Conveyance capacity must be purchased on a proportionate share basis, based on a percentage of the total expanded capacity that is used.

Non-Local Conveyance Option

As shown on Figure 1, opportunities to participate in the development of conveyance facilities located outside of the Tri-Valley area may also exist. The configuration illustrated on Figure 1 includes conveyance capacity proposed as part of an existing reservoir expansion project. However, this particular non-potable conveyance capacity option may or may not actually be constructed, and its availability is considerably less certain than scenarios that utilize a local conveyance option.

For this study, it was assumed that agricultural interests could purchase non-local conveyance capacity (based on a proportionate share of the total reservoir expansion cost (~500,000 acre-feet)). Although this water would ultimately be directly delivered to agricultural customers, in North Livermore, it would actually be seasonally stored in this non-local storage facility, and then conveyed in the proposed non-local conveyance facilities. It was also assumed that the total annual capacity required (up to 10,000 acre-feet) could be purchased.

AVAILABLE STORAGE OPTIONS

As previously discussed, the use of off-peak conveyance capacity or the use of City recycled water supplies will require the use of seasonal storage facilities. Consequently, two storage options exist to serve a potential agricultural program: local storage and non-local storage. Each is described in more detail below.

Local Storage Option

The cost to construct a reservoir at a size that can accommodate the storage requirements of this study (up to 10,000 acre-feet) greatly increases the cost of implementing any new agricultural project; hence, any economically viable scenario must evaluate the use of existing or potentially future storage facilities. The only potential future storage facility of a size suitable to support the seasonal storage needs of the North Livermore agricultural demands within the Tri-Valley area are several proposed new gravel quarries located just southwest of the City of Livermore airport (see Figure 1).

Based on a review of draft environmental documents prepared for these possible future quarries approximately 4,000 to 20,000 acre-feet of storage volume could become available once quarry activities are completed, and these quarries are reclaimed for other uses. This provides the potential for a "local water storage" facility; however, the associated timing of these quarry projects, if ever, is unreliable. For the purposes of this study, it was assumed that some local storage facility would be available in the future, and that a storage volume of up to 10,500 acre-feet could be purchased by agricultural interests.

Non-Local Storage Option

Potential storage opportunities also exist outside of the Tri-Valley area. The potential non-local storage opportunity illustrated on Figure 1 is the proposed expansion of an existing reservoir located outside the Tri-Valley area. The proposed project expands the reservoirs existing capacity (~100,000 acre-feet) by 400,000 acre-feet to a total storage volume of 500,000 acre-feet. In addition to the proposed reservoir expansion, there is also the proposed installation of a major transmission pipeline to connect this new, expanded facility, to the existing local conveyance system (see Figure 1). However, this particular project may or may not actually be constructed (due to costs, environmental concerns, and other issues). Therefore, the future availability of this project maybe less certain than scenarios that utilize the local storage and conveyance options. For the purpose of this study, it was assumed that this non-local storage and associated non-local conveyance facility would be constructed, and that required storage and conveyance capacity could be purchased by agricultural interests on a proportionate share basis of the total expansion and total storage conveyance capacity cost.

VIABLE WATER SUPPLY SCENARIOS

Using the available water supply sources, storage opportunities, and water conveyance options discussed previously, WYA evaluated alternative water supply scenarios that could provide agricultural water supplies to the North Livermore area. The six potential water supply scenarios that were identified and evaluated are discussed below.

Scenario 1: Local Conveyance & Storage, Imported Surface & Tertiary Water

The first scenario assumes using direct delivery capacity in the local conveyance facility to transport imported surface water supplies into the Tri-Valley area. This water would then be released into Altamont Creek, which naturally flows westward toward the local storage facilities. A new diversion structure would be constructed to divert these imported water supplies into the local storage facility, where it would blend with tertiary recycled water produced at the City's WWTP. This blend of tertiary recycled and imported surface water would be pumped from the local storage facility for direct delivery to the North Livermore agricultural areas. The purpose of the local storage facility is to provide a place to blend water, not to seasonally store water for later use.

Figure 3 presents a flow diagram of this scenario, Figure 4 illustrates how demands are met on a monthly basis, and Figure 5 illustrates the proposed infrastructure requirements. As shown on Figures 3, 4, and 5, the following project elements are required under this scenario:

- Purchase approximately 8,300 acre-feet of imported surface water rights or entitlements,
- Purchase approximately 11.5 cfs of direct delivery capacity in the expanded local conveyance facility,
- Purchase approximately 10,100 acre-feet of local storage capacity,
- Purchase approximately 1,800 acre-feet of tertiary recycled water from the city of Livermore's WWTP,
- Acquire the necessary permits to use Altamont Creek to transport imported surface water from the local conveyance facility to the local storage facility,
- Construct a diversion structure,
- Construct approximately 49,000 feet (about 9 miles) of pipeline from the local storage facility to the North Livermore area, and
- Construct two pump stations.

Table 4 provides a summary of estimated capital facility costs for the infrastructure identified to provide agricultural water service to the North Livermore area under this scenario. As shown on Table 4, the total capital cost is approximately $78 million or approximately $7,800 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcels.

Although this scenario provides a water supply for direct use for an agricultural project in North Livermore (6,200 acres) and uses approximately 1/3 of the City's available tertiary recycled water supply, the timing associated with the availability of the local storage facility, and permitting issues associated with the use of Altamont Creek somewhat reduces this Scenario's viability. Water rights or entitlements and local conveyance capacity should be purchased now (due to rising costs and possible lack of future availability), but could not be used until local storage was available and the use of the Altamont Creek was permitted.

Table 4. Estimated Costs for Scenario 1 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	1,800	af	$900,000
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	10,100	af	$15,150,000
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,000	hp	$2,286,000
Pump Station 2 (for Tertiary)	2,286	$ / hp	25	hp	$57,150
Pump Station 3 (from SBA)	2,286	$ / hp	0	hp	$0
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	4,500	lf	$1,242,000
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	6,000	lf	$1,656,000
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	1,721	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	38,500	lf	$15,939,000
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	0	lf	$0
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	0	lf	$0
				Subtotal	$37,230,150
				Design (10%)	$3,723,015
				Construction Management (10%)	$3,723,015
				Contingency (15%)	$5,584,523
				Program Implementation (5%)	$1,861,508
				Subtotal	**$52,122,210**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	8,300	af	$16,600,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	11.5	cfs	$8,403,846
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	0	af	$0
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [l]	600,000	$ / Diversion	1	Diversion	$600,000
				Subtotal	**$25,603,846**
				Total Capital Cost	**$78,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$12,600
				Total Capital Cost per Acre-feet	**$7,800**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Scenario 2: Non-Local Conveyance & Storage, Imported Surface & Tertiary Water

The second scenario utilizes non-local storage, non-local conveyance facilities, and a new transmission pipeline to transport imported surface water supplies to the local storage facility within the Tri-Valley to blend with the City's tertiary recycled water. This blended tertiary recycled water and imported surface water would then be pumped from the local storage facility for direct delivery to the North Livermore agricultural areas. Similar to Scenario 1, the purpose of the local storage facility is to provide a location to blend the tertiary recycled and imported surface water supplies, prior to delivery, as no seasonal storage is required.

Figure 6 presents a flow diagram of this scenario, Figure 7 illustrates how demands are met on a monthly basis, and Figure 8 illustrates the proposed infrastructure requirements. As shown on Figures 6, 7, and 8, the following project elements are required under this scenario:

- Purchase approximately 9,800 acre-feet of imported surface water rights and entitlements,
- Purchase approximately 9,800 acre-feet of non-local storage capacity (project will also include non-local direct conveyance capacity),
- Purchase approximately 1,800 acre-feet of tertiary recycled water from the City of Livermore's WWTP,
- Purchase approximately 10,100 acre-feet of local storage capacity,
- Construct approximately 114,600 feet (about 22 miles) of pipeline to be able to deliver imported water supplies from the non-local conveyance facility to the local storage facility, and then back from the local storage site to the North Livermore agricultural service area, and
- Construct three pump stations.

Table 5 provides a summary of estimated capital facility costs for the infrastructure identified to provide agricultural water service to the North Livermore are under this scenario. As shown on Table 5, the total capital cost is approximately $160 million or approximately $16,000 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcel.

Although this scenario provides a water supply for direct use by an agricultural project in North Livermore (6,200 acres) and uses approximately 1/3 of the City's available tertiary recycled water supply, the timing associated with the availability of the non-local and local storage facilities, and the non-local conveyance facilities somewhat reduces this Scenario's viability. Water rights or entitlements should be purchased now (due to rising costs and possible lack of future availability), but could not be utilized until non-local and local storage are available. This scenario also assumes that Pipeline A (as shown on Figure 8) would be included in the cost of purchasing storage capacity in the expanded reservoir.

Scenario 3: Tunnel - Direct Delivery on Local Conveyance & Imported Surface Water

The third scenario assumes the use of direct conveyance capacity in the expanded local conveyance facility, and a new transmission pipeline (through the Altamont Hills) to deliver

Table 5. Estimated Costs for Scenario 2 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	1,800	af	$900,000
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	10,100	af	$15,150,000
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,000	hp	$2,286,000
Pump Station 2 (for Tertiary)	2,286	$ / hp	25	hp	$57,150
Pump Station 3 (from SBA)	2,286	$ / hp	720	hp	$1,645,920
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	0	lf	$0
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	6,000	lf	$1,656,000
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	43,100	lf	$11,895,600
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	1,721	$ / lf	27,000	lf	$46,461,600
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	0	lf	$0
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	0	lf	$0
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	0	lf	$0
				Subtotal	$80,052,270
				Design (10%)	$8,005,227
				Construction Management (10%)	$8,005,227
				Contingency (15%)	$12,007,841
				Program Implementation (5%)	$4,002,614
				Subtotal	**$112,073,178**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	9,800	af	$19,600,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	0	cfs	$0
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	0	af	$0
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	9,800	af	$21,560,000
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	9,800	af	$4,900,000
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	0	Diversion	$0
				Subtotal	**$46,060,000**
				Total Capital Cost	**$160,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$25,800
				Total Capital Cost per Acre-feet	**$16,000**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

imported surface water supplies directly to the North Livermore agricultural area. This scenario requires no storage.

Figure 9 presents a flow diagram of this scenario, Figure 10 illustrates how demands are met on a monthly basis, and Figure 11 illustrates the proposed infrastructure requirements. As shown on Figures 9, 10, and 11, the following project elements are required under this scenario:

- Purchase approximately 10,000 acre-feet of imported surface water rights or entitlements,
- Purchase approximately 36 cfs of direct delivery capacity in the expanded local conveyance facility,
- Construct approximately 27,000 feet (about 5 miles) of pipeline from a location near the proposed Altamont WTP to the North Livermore agricultural area, through potentially environmentally sensitive areas (Altamont Hills), and
- Construct one pump station.

Table 6 provides a summary of estimated capital facility costs for the infrastructure identified to provide agricultural water service to the North Livermore area under this scenario. As shown on Table 6, the total capital cost is approximately $149 million or approximately $14,900 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcel.

In addition to having one of the highest projected costs, Scenario 3 also precludes the use of any of the City's tertiary recycled water supplies, and the environmental requirements associated with placing a new transmission pipeline through the Altamont Hills will be a very challenging process.

Scenario 4: Off-Peak Delivery on Local Conveyance & Imported Surface Water

The fourth scenario assumes the use of off-peak capacity in the local conveyance facility enlargement project to transport imported surface water into the Tri-Valley area. This water would be released into Altamont Creek, which flows westward toward the local storage facilities. A new diversion structure would be constructed to divert these imported water supplies into the local storage facility for seasonal storage until needed to meet the agricultural demand of the North Livermore area. Water would then be pumped from the local storage facility to the North Livermore agricultural area as needed.

Figure 12 presents a flow diagram of this scenario, Figure 13 illustrates how demands are met on a monthly basis, and Figure 14 illustrates the proposed infrastructure requirements. As shown on Figures 12, 13, and 14, the following project elements are required under this scenario:

- Purchase approximately 10,100 acre-feet of imported surface water rights or entitlements,
- Purchase off-peak delivery capacity in the local conveyance project,
- Purchase approximately 10,100 acre-feet of local storage capacity,

Table 6. Estimated Costs for Scenario 3 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	0	af	$0
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	0	af	$0
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	0	hp	$0
Pump Station 2 (for Tertiary)	2,286	$ / hp	0	hp	$0
Pump Station 3 (from SBA)	2,286	$ / hp	1,800	hp	$4,114,800
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	0	lf	$0
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	1,721	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	0	lf	$0
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	27,000	lf	$69,692,400
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	0	lf	$0
				Subtotal	$73,807,200
				Design (10%)	$7,380,720
				Construction Management (10%)	$7,380,720
				Contingency (15%)	$11,071,080
				Program Implementation (5%)	$3,690,360
				Subtotal	**$103,330,080**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	10,000	af	$20,000,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	36	cfs	$26,088,462
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	0	af	$0
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	0	Diversion	$0
				Subtotal	**$46,088,462**
				Total Capital Cost	**$149,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$24,000
				Total Capital Cost per Acre-feet	**$14,900**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

- Acquire the necessary permits to use Altamont Creek to transport imported surface water from the local conveyance facility to the local storage facility,
- Construct a diversion structure,
- Construct approximately 43,000 feet (about 8 miles) of pipeline, and
- Construct one pump station.

Table 7 provides a summary of estimated capital costs for the infrastructure identified to provide agricultural water service to the North Livermore area under this scenario. As shown on Table 7, the total capital cost is approximately $74 million or approximately $7,400 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcel.

Although this scenario provides a water supply for use by an agricultural project in North Livermore (6,200 acres) and does not require participation in the local conveyance capacity expansion project, the timing associated with the availability of the local storage facility and permitting issues associated with the use of Altamont Creek somewhat reduces this Scenario's viability. Not only does this scenario not use the City's tertiary recycled water supplies, but water rights or entitlements would have to be purchased now (due to rising costs and the possible lack of future availability), but could not be used until local storage facilities were available or the use of the Altamont Creek was permitted.

Scenario 5: Non-Local Storage and Conveyance & Imported Surface Water

The fifth scenario assumes the direct use of non-local storage and conveyance capacity to transport water to the North Livermore area on demand. This scenario does not require local storage facilities.

Figure 15 presents a flow diagram of this scenario, Figure 16 illustrates how demands are met on a monthly basis, and Figure 17 illustrates the proposed infrastructure requirements. As shown on Figures 15, 16, and 17, the following project elements are required under this scenario:

- Purchase approximately 11,700 acre-feet of imported surface water rights or entitlements,
- Purchase approximately 11,700 acre-feet of non-local storage (also includes non-local conveyance capacity),
- Construct approximately 27,000 feet (about 5 miles) of pipeline from a location northwest of the proposed Altamont WTP, to the North Livermore agricultural area, through potentially environmentally sensitive areas, and
- Construct one pump station.

Table 8 provides a summary of estimated capital costs for the infrastructure identified to provide agricultural water service to the North Livermore area under this scenario. As shown on Table 8, the total capital cost is approximately $158 million or approximately $15,800 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcel.

Table 7. Estimated Costs for Scenairo 4 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	0	af	$0
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	10,100	af	$15,150,000
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,000	hp	$2,286,000
Pump Station 2 (for Tertiary)	2,286	$ / hp	0	hp	$0
Pump Station 3 (from SBA)	2,286	$ / hp	0	hp	$0
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	4,500	lf	$1,242,000
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	1,721	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	38,500	lf	$15,939,000
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	0	lf	$0
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	0	lf	$0
				Subtotal	$34,617,000
				Design (10%)	$3,461,700
				Construction Management (10%)	$3,461,700
				Contingency (15%)	$5,192,550
				Program Implementation (5%)	$1,730,850
				Subtotal	**$48,463,800**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	10,100	af	$20,200,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	0	cfs	$0
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	10,100	af	$5,050,000
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	1	Diversion	$600,000
				Subtotal	**$25,850,000**
				Total Capital Cost	**$74,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$11,900
				Total Capital Cost per Acre-feet	**$7,400**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Table 8. Estimated Costs for Scenario 5 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	0	af	$0
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	0	af	$0
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,800	hp	$4,114,800
Pump Station 2 (for Tertiary)	2,286	$ / hp	0	hp	$0
Pump Station 3 (from SBA)	2,286	$ / hp	0	hp	$0
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required)					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	0	lf	$0
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	1,721	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	0	lf	$0
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	27,000	lf	$69,692,400
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	0	lf	$0
				Subtotal	$73,807,200
				Design (10%)	$7,380,720
				Construction Management (10%)	$7,380,720
				Contingency (15%)	$11,071,080
				Program Implementation (5%)	$3,690,360
				Subtotal	**$103,330,080**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	11,700	af	$23,400,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	0	cfs	$0
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	0	af	$0
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	11,700	af	$25,740,000
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	11,700	af	$5,850,000
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	0	Diversion	$0
				Subtotal	**$54,990,000**
				Total Capital Cost	**$158,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$25,500
				Total Capital Cost per Acre-feet	**$15,800**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Although this scenario provides a water supply for direct use by an agricultural project in North Livermore (6,200 acres), the timing associated with the availability of the non-local storage facility reduces this Scenario's viability. Water rights would have to be purchased now, but could not be utilized until non-local storage is available. Additionally, this scenario does not use any of the City's tertiary recycled water supplies, and assumes that Pipeline A is included in the cost of purchasing non-local storage capacity in the expanded reservoir.

Scenario 6: No Tunnel - Direct Delivery Using Local Conveyance & Imported Surface Water

Scenario six assumes the use of direct conveyance capacity in the expanded local conveyance facility, and a new transmission pipeline (around the Altamont Hills possibly adjacent to the Altamont Treated Water Pipeline) to deliver imported surface water supplies directly to the North Livermore agricultural area. This scenario requires no storage component.

Figure 18 presents a flow diagram of this scenario, Figure 19 illustrates how demands are met on a monthly basis, and Figure 20 illustrates the proposed infrastructure requirements. As shown on Figures 18, 19, and 20, the following project elements are required under this scenario:

- Purchase approximately 10,000 acre-feet of imported surface water rights or entitlements,
- Purchase approximately 36 cfs of direct delivery capacity in the expanded local conveyance facility,
- Construct approximately 65,500 feet (about 12.4 miles) of pipeline from a location near the proposed Altamont WTP, around the Altamont Hills, to the North Livermore agricultural area, and
- Construct one pump station.

Table 9 provides a summary of estimated capital costs for the infrastructure identified to provide agricultural water service to the North Livermore area under this scenario. As shown on Table 9, the total capital cost is approximately $86 million or approximately $8,600 per acre-foot of water delivered. These costs do not include the distribution pipelines necessary to transport water from the proposed transmission main to the individual parcel. Although this scenario can provide a direct supply within four years, it does not have the lowest costs and does not utilize any recycled water.

RECOMMENDED WATER SUPPLY SCENARIO

Table 10 presents a summary of estimated capital facility costs for each of the six scenarios presented. As shown in Table 10, Scenarios 1, 4, and 6 are the lowest costs options. However, all three depend heavily on the timing of either local or non-local storage facilities, and discussion with Zone 7 staff indicates that the non-local storage facility options may be more than 10 years away from completion, if they are completed at all. Scenario 2 is the most expensive project alternative, and still has the uncertainty of Scenarios 1 and 4.

Table 9. Estimated Costs for Scenario 6 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	0	af	$0
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	0	af	$0
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	0	hp	$0
Pump Station 2 (for Tertiary)	2,286	$ / hp	0	hp	$0
Pump Station 3 (from SBA)	2,286	$ / hp	400	hp	$914,400
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	0	lf	$0
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe D: 24" for Non-Local Storage to Local Storage [e,f]	276	$ / lf	0	lf	$0
Pipe E: 24" Tunnel Option for Non-Local Storage [g]	276	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	0	lf	$0
Pipe G: 36" Tunnel Option from SBA (Scenarios 3 & 5) [g]	2,581	$ / lf	0	lf	$0
Pipe H: 36" from SBA, Parallel to Altamont Pipeline [e,f]	414	$ / lf	65,500	lf	$27,117,000
				Subtotal	$28,031,400
				Design (10%)	$2,803,140
				Construction Management (10%)	$2,803,140
				Contingency (15%)	$4,204,710
				Program Implementation (5%)	$1,401,570
				Subtotal	**$39,243,960**

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	10,000	af	$20,000,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	36	cfs	$26,307,692
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	0	af	$0
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	0	Diversion	$0
				Subtotal	**$46,307,692**
				Total Capital Cost	**$86,000,000**
				Agricultural Water Supply in Acre-Feet	10,000
				Irrigated Acreage	6,200
				Total Capital Cost per Irrigated Acre	$13,900
				Total Capital Cost per Acre-feet	**$8,600**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Table 10. Summary of Estimated Capital Costs for Scenarios 1 through 6

Component	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	**Scenario 6**
Imported Surface Water Supply	$16,600,000	$19,600,000	$20,000,000	$20,200,000	$23,400,000	**$20,000,000**
Local Tertiary Water Supply	$1,260,000	$1,260,000	$0	$0	$0	**$0**
Conveyance & Distribution	$38,656,056	$94,503,178	$129,418,542	$32,903,800	$109,180,080	**$65,551,652**
Storage	$21,210,000	$42,770,000	$0	$21,210,000	$25,740,000	**$0**
Total	$78,000,000	$160,000,000	$149,000,000	$74,000,000	$158,000,000	**$86,000,000**
Agricultural Water Supply (acre-feet)	10,000	10,000	10,000	10,000	10,000	**10,000**
Irrigated Acres	6,200	6,200	6,200	6,200	6,200	**6,200**
Capital Cost per Irrigated Acre	$12,600	$25,800	$24,000	$11,900	$25,500	**$13,900**
Capital Cost per Acre-Foot	$7,800	$16,000	$14,900	$7,400	$15,800	**$8,600**

Scenario 6 is the water supply scenario with the least amount of new facility uncertainty, and provides a viable non-potable water supply project for the North Livermore agricultural area within a reasonable period of time (within 4 years, if sufficient funding sources can be developed).

Implementing Scenario 6 also builds significant operational flexibility into any proposed agricultural program. For example, if funding were available soon, surface water entitlements could be purchased, necessary piping/pump stations designed and constructed, and an irrigated agricultural program in the North Livermore area could be operational within 4 years. If these surface water supplies and conveyance capacity are purchased and constructed now, it also provides a great platform from which to expand the agricultural program into South Livermore, Greenville Road, or other areas, as local storage opportunities become available in the future.

Detailed financing options were previously discussed in the Non-Potable Master Plan, and are still applicable to any of the scenarios presented in this report.

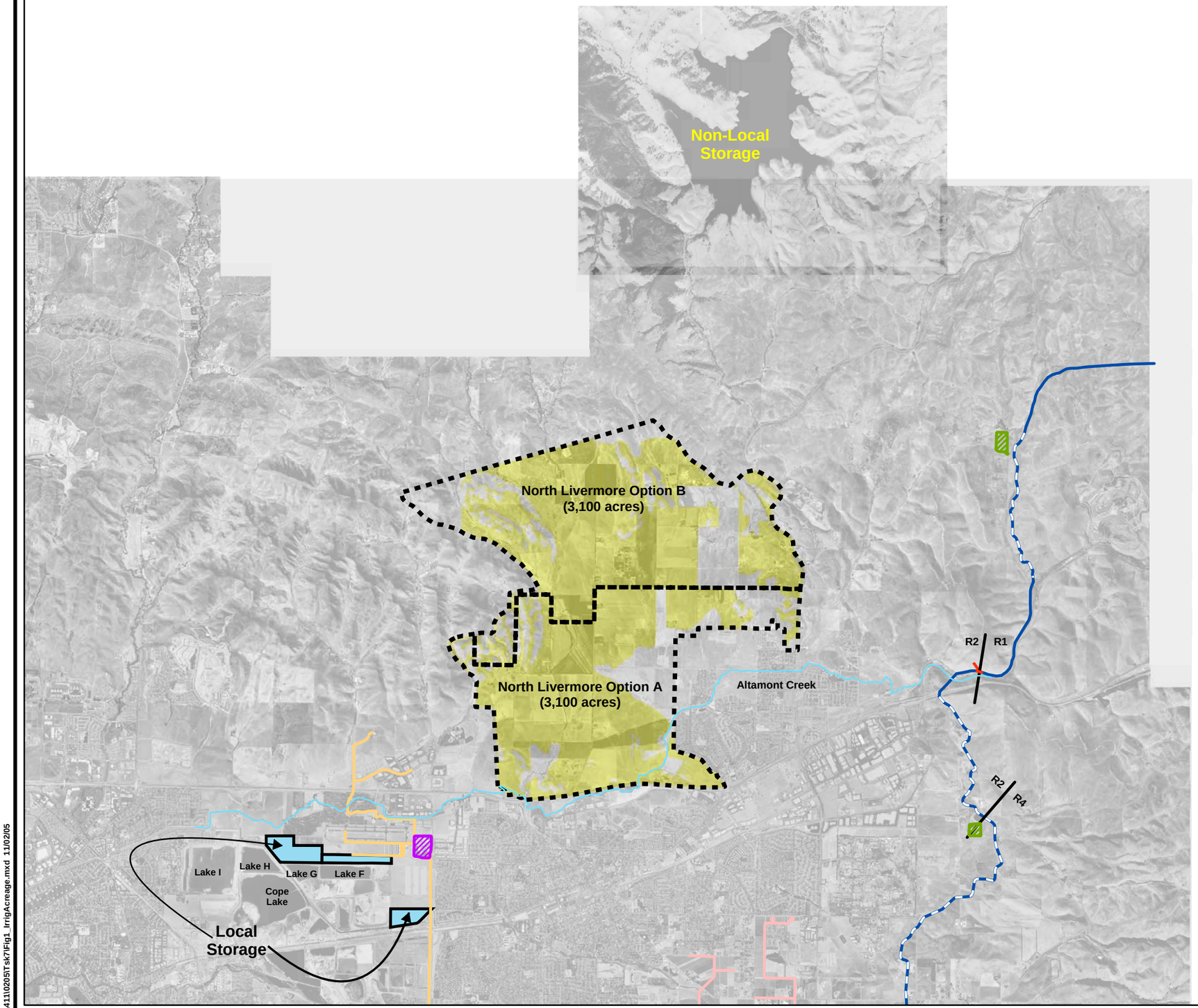

FIGURE 1

Non-Potable Study
Zone 7 Water Agency

POTENTIAL IRRIGABLE ACREAGE IN NORTH LIVERMORE

N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

LEGEND

- Focus Area Boundary
- Revised Irrigable Acreage
- Altamont Creek
- Proposed Altamont WTP
- Existing Livermore WWTP
- Reach
- Turnout
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Potential Future Local Storage

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Figure 2. Conveyance Capacity After SBA Expansion

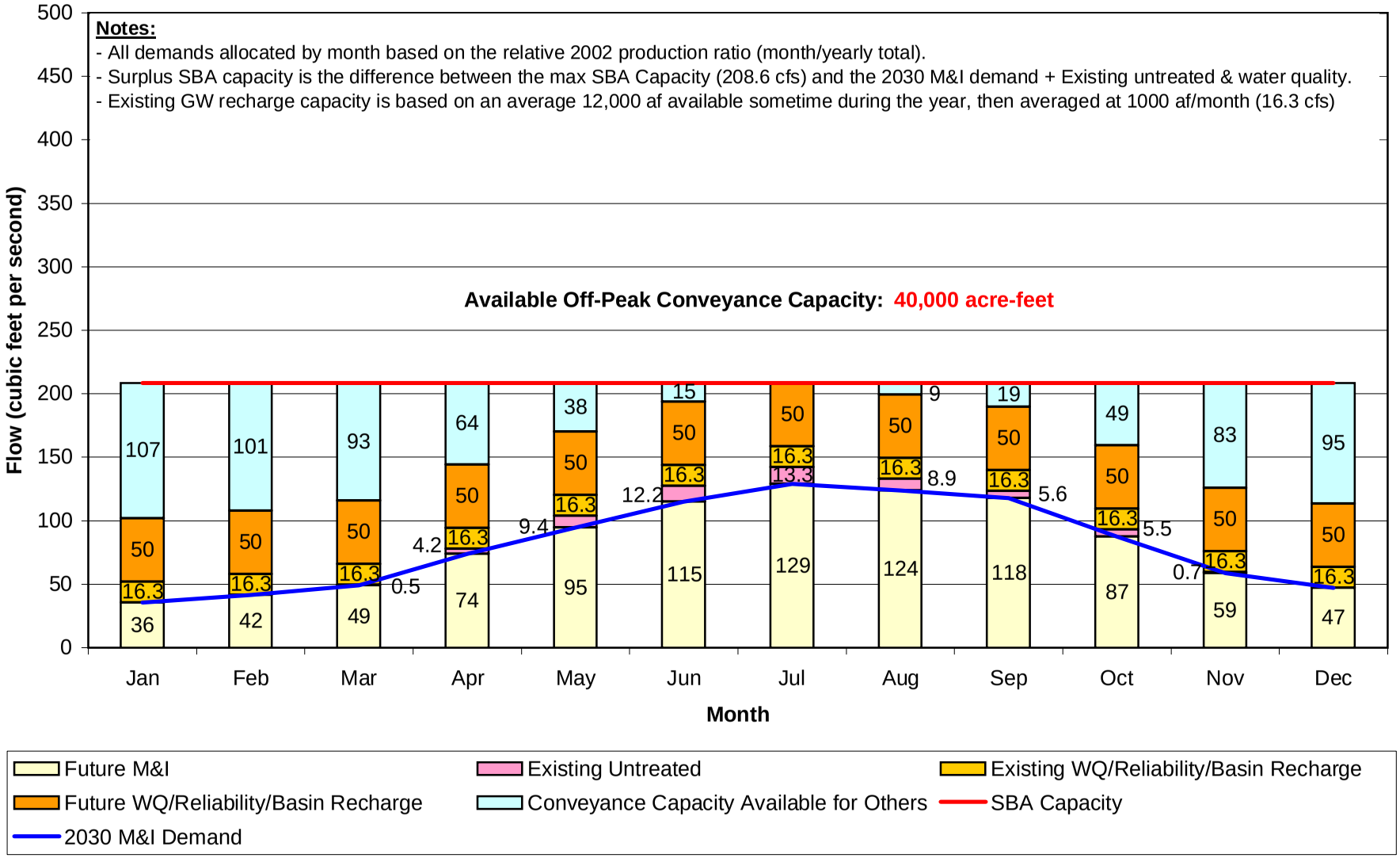


FIGURE 3. Scenario 1: Existing Tertiary/Local Storage/Local Conveyance

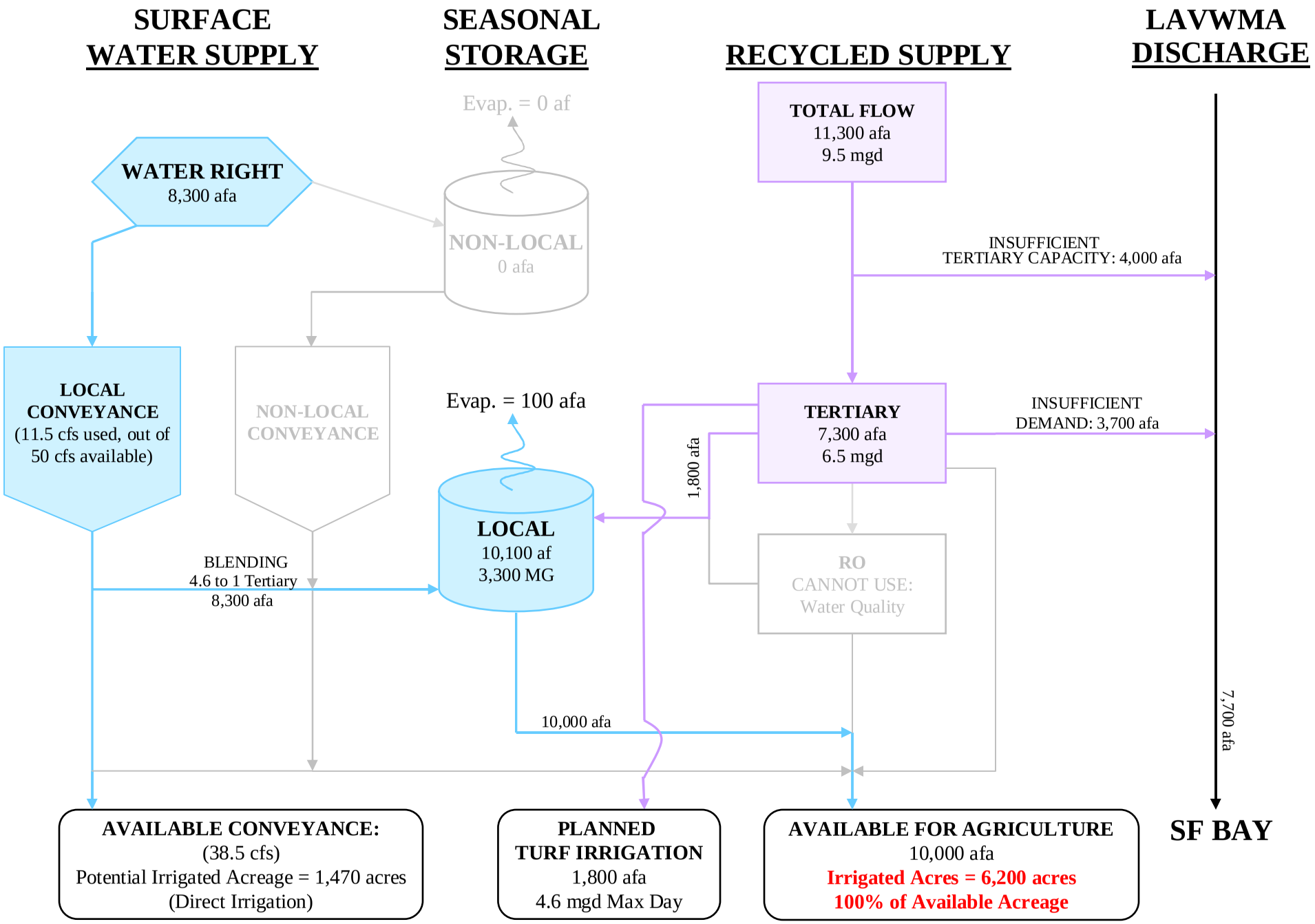


Figure 4. Agricultural Demand & Supply for N. Livermore: Scenario 1

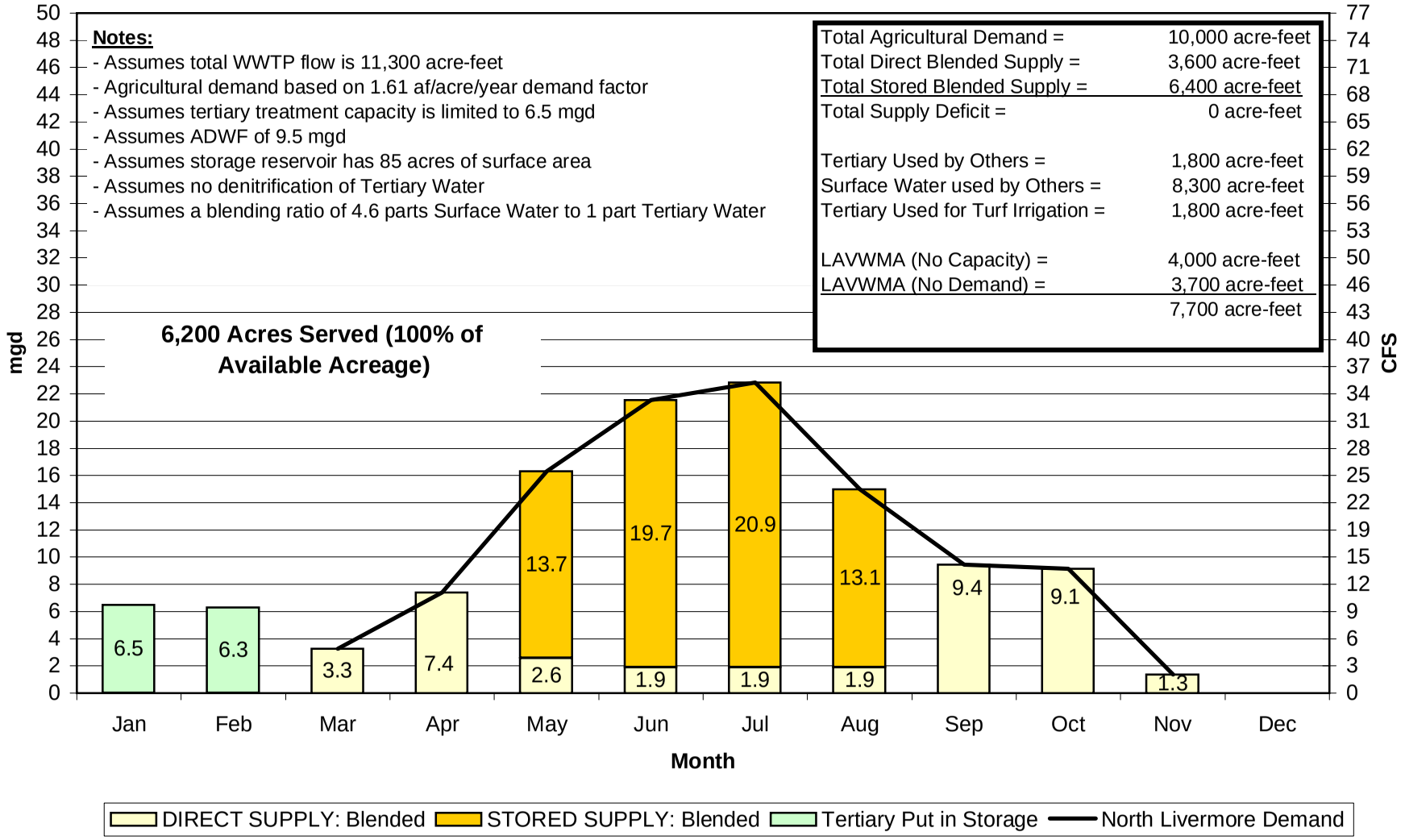
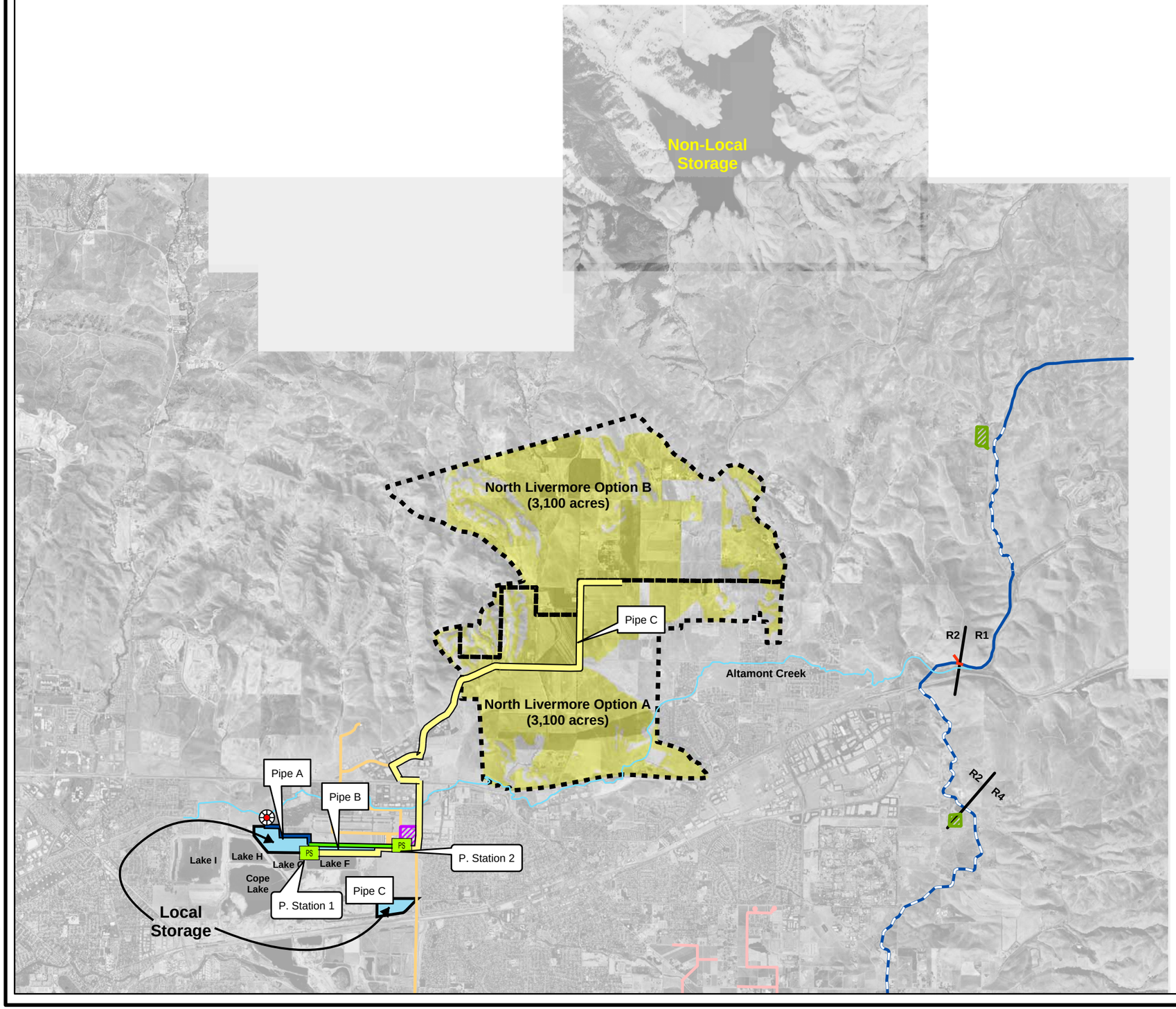


FIGURE 5

Non-Potable Study
Zone 7 Water Agency

SCENARIO 1



N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)

TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $78 Million or $7,800/af

LEGEND

- Diversion Structure
- Altamont Creek
- Reach
- Turnout
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP
- Potential Future Local Storage

ZONE 7 WATER RESOURCES MANAGEMENT

WEST YOST & ASSOCIATES

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FIGURE 6. Scenario 2: Existing Tertiary/Local Storage/Non-Local Facilities

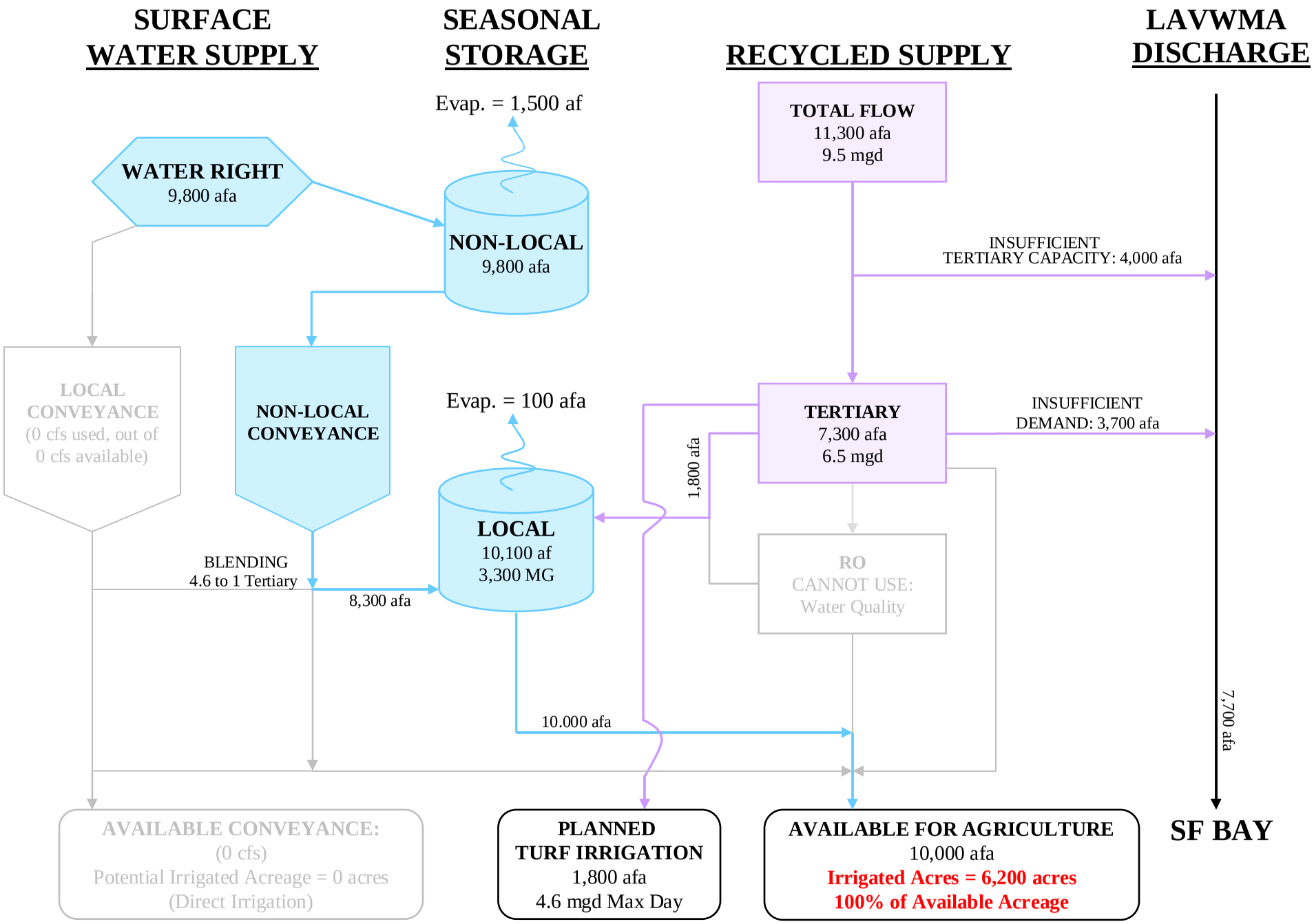


Figure 7. Agricultural Demand & Supply for N. Livermore: Scenario 2

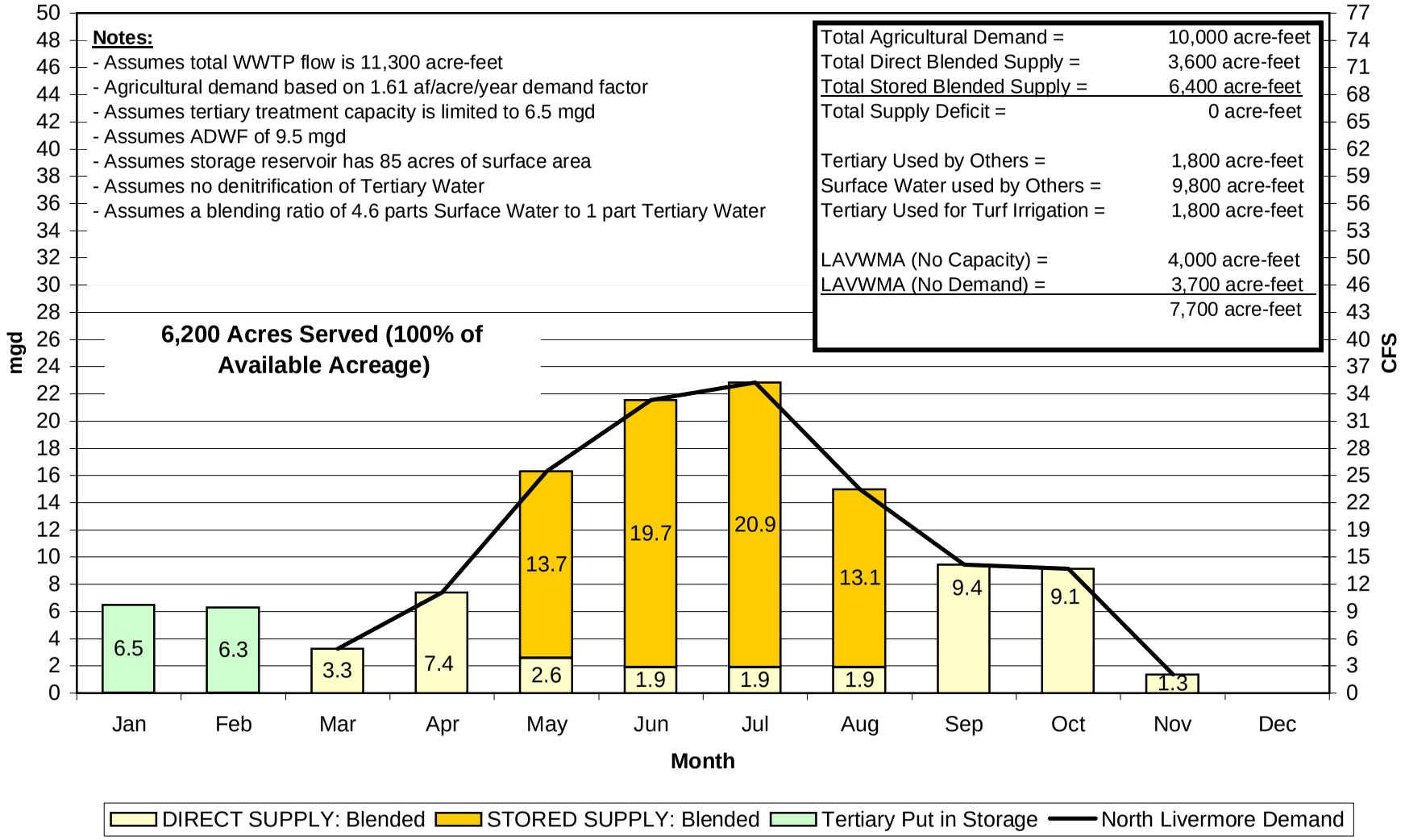
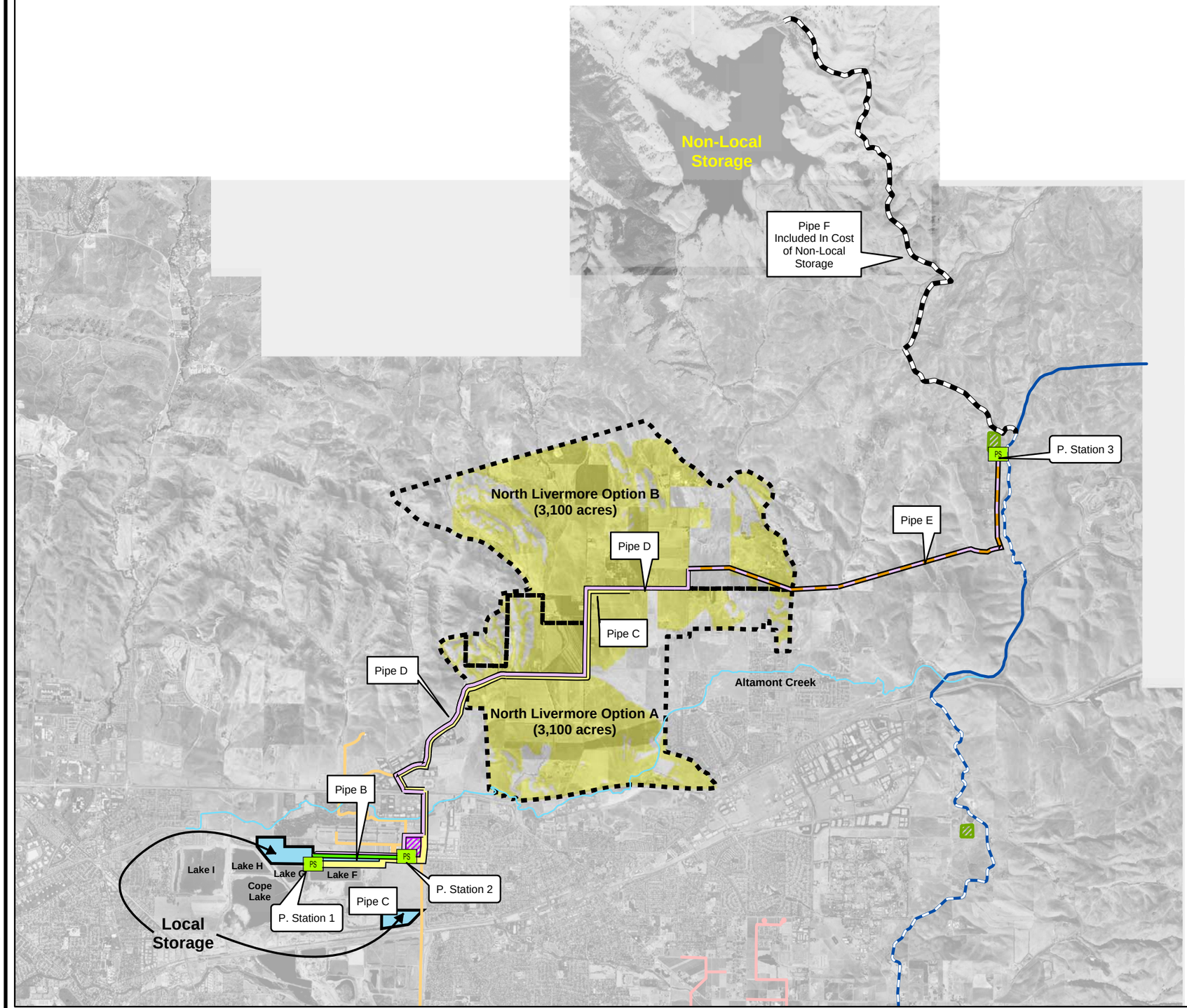


FIGURE 8

Non-Potable Study
Zone 7 Water Agency

SCENARIO 2



N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $160 Million or $16,000/af

LEGEND

- Altamont Creek
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP
- Potential Future Local Storage

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FIGURE 9. Scenario 3: Local Conveyance Facilities – Direct Deliveries

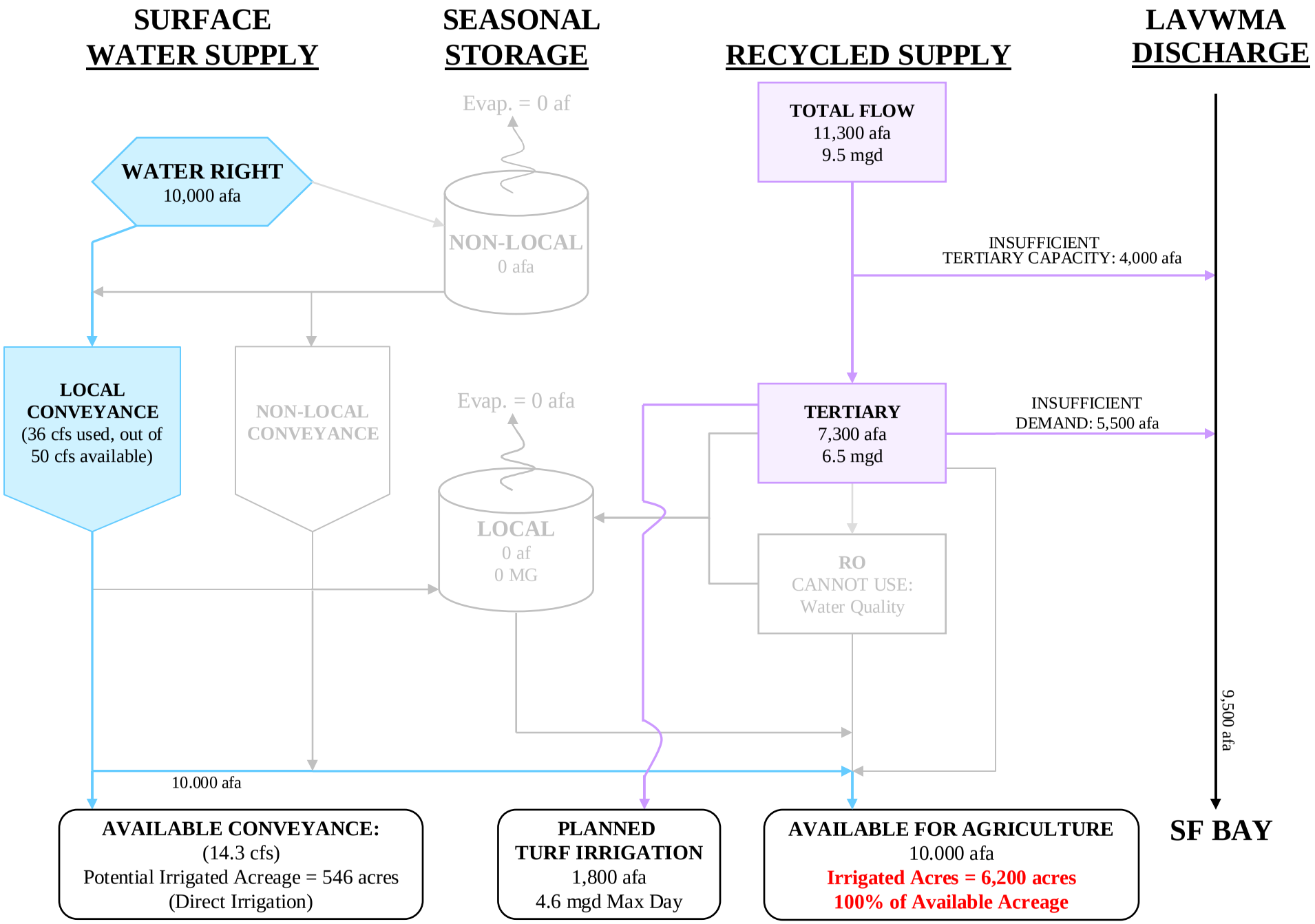


Figure 10. Agricultural Demand & Supply for North Livermore: Scenario 3

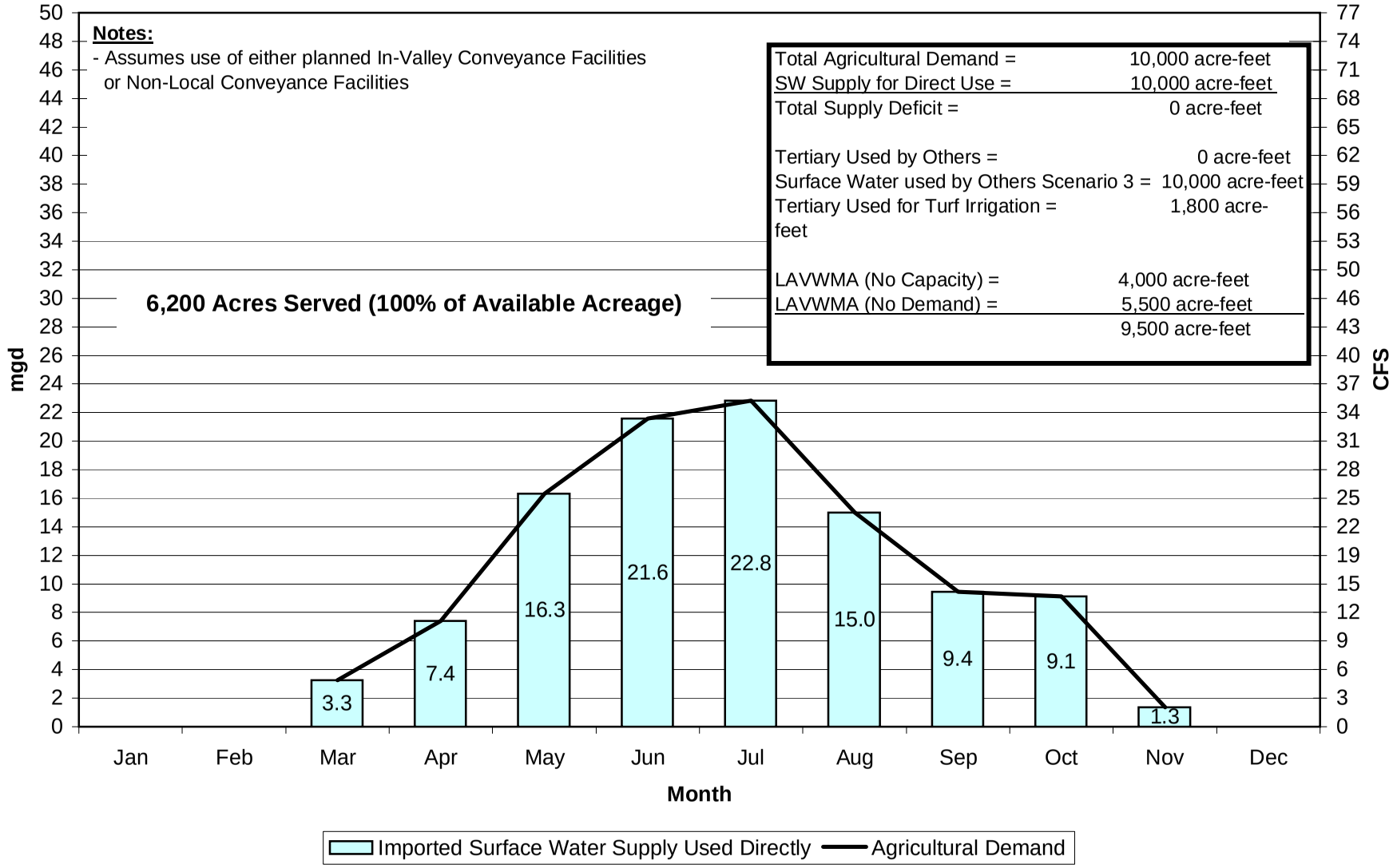
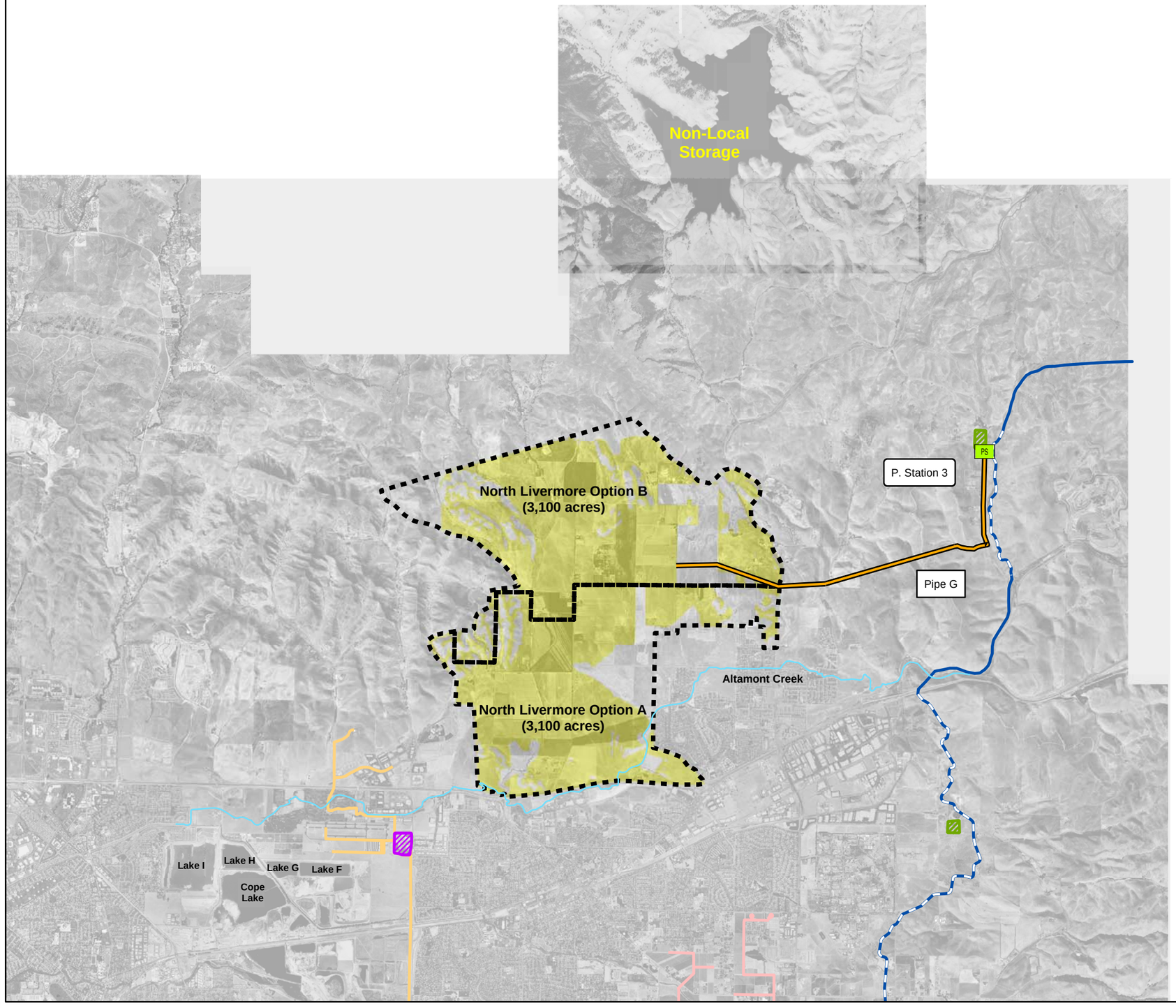


FIGURE 11

Non-Potable Study
Zone 7 Water Agency
SCENARIO 3



N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $149 million or $14,900/af

LEGEND

- Altamont Creek
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP

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ZONE 7 WATER RESOURCES MANAGEMENT

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FIGURE 12. Scenario 4: Local Conveyance Facilities – Off-Peak/Local Storage

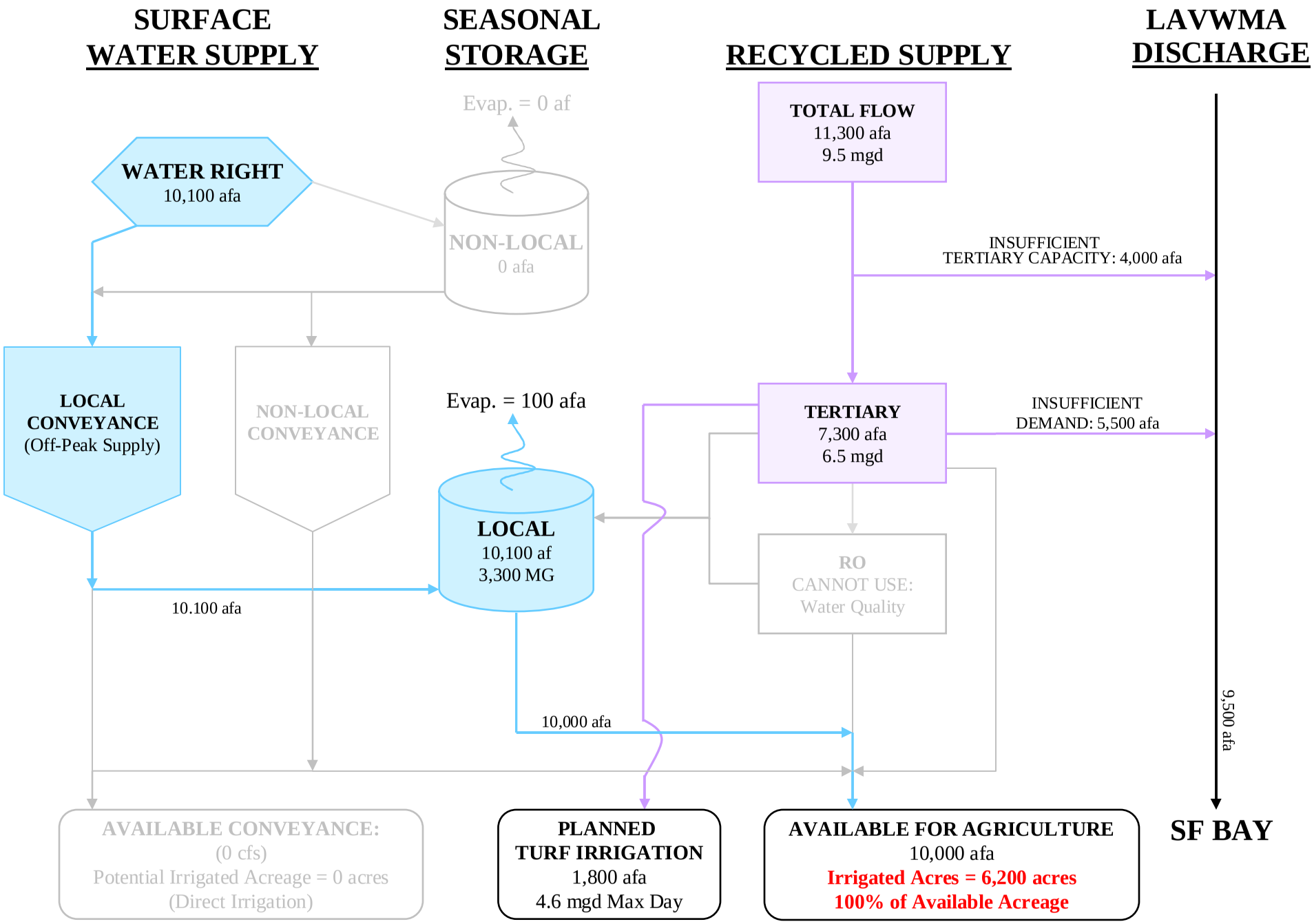
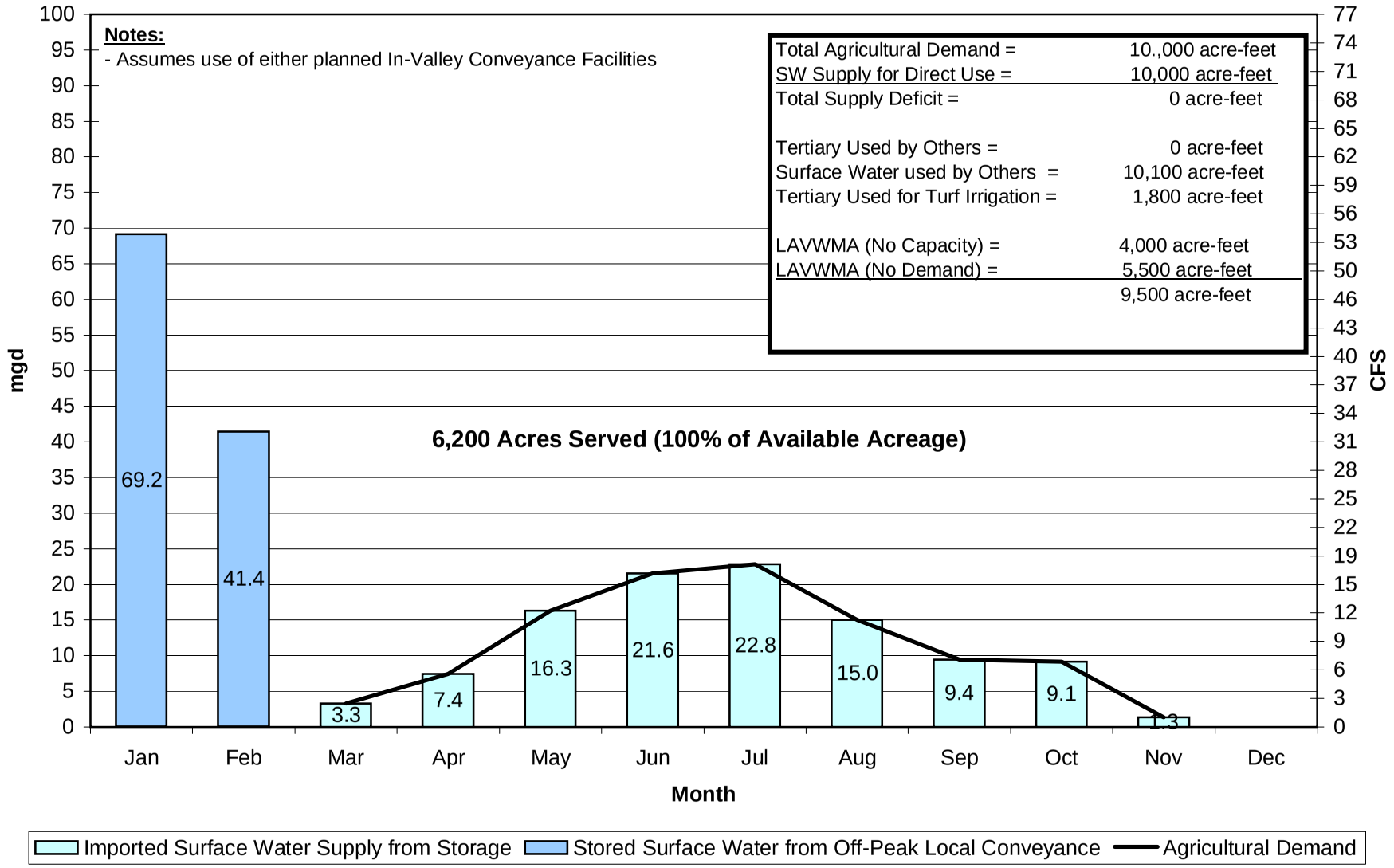


Figure 13. Agricultural Demand & Supply for North Livermore: Scenario 4



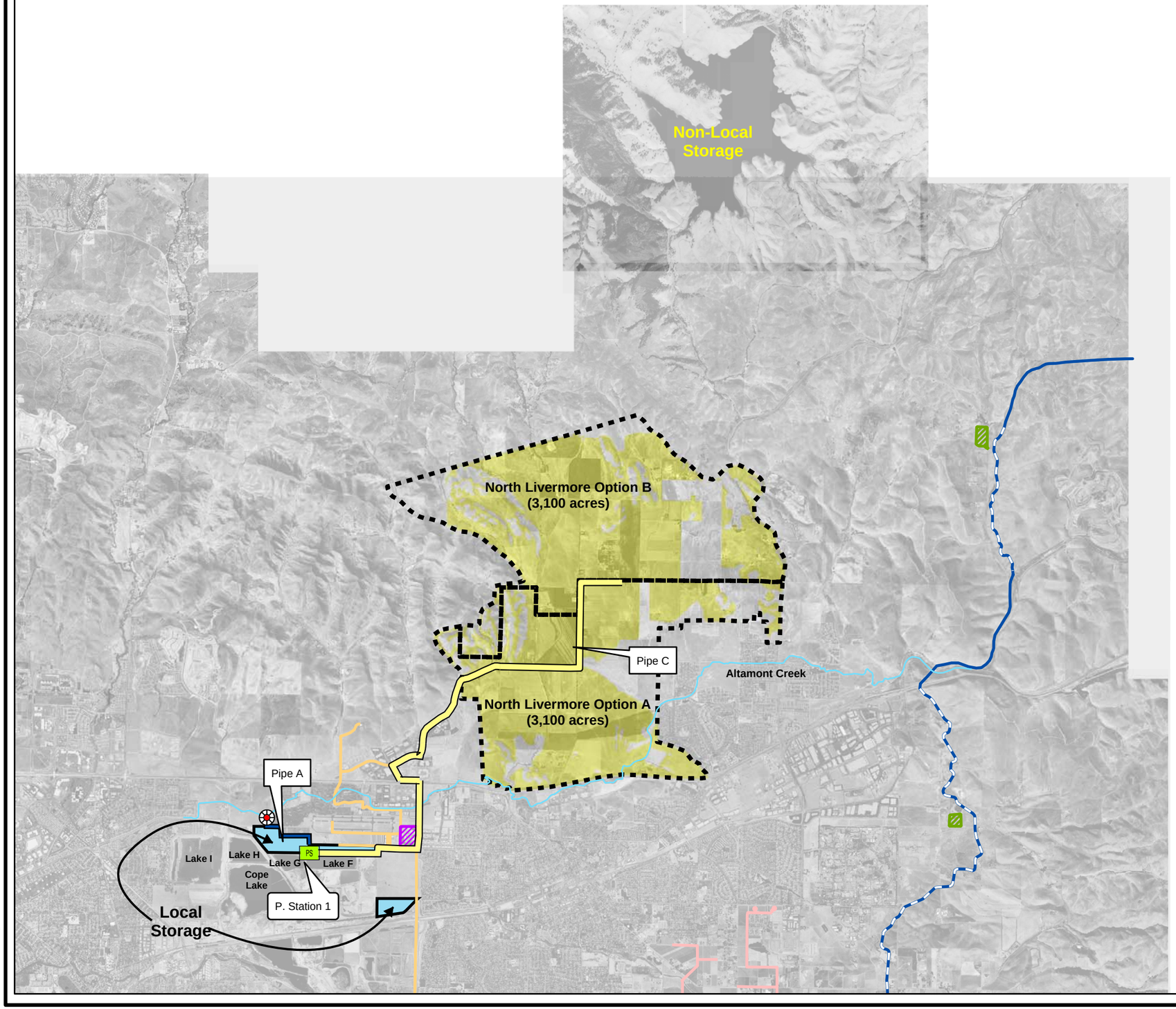


FIGURE 14

Non-Potable Study
Zone 7 Water Agency

SCENARIO 4

N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $74 million or $7,400/af

LEGEND

- Diversion Structure
- Altamont Creek
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP
- Potential Future Local Storage

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FIGURE 15. Scenario 5: Non-Local Conveyance Facilities

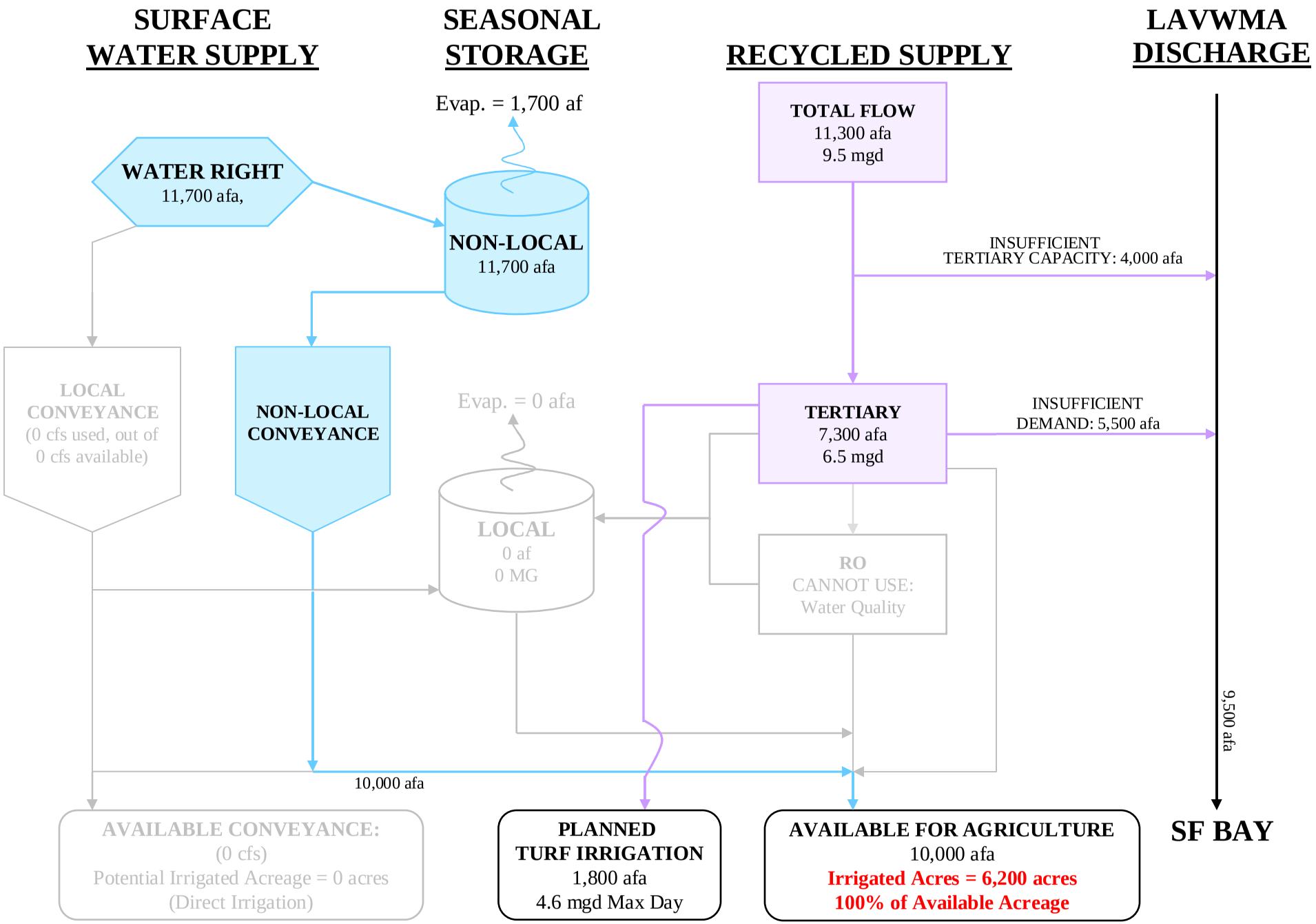


Figure 16. Agricultural Demand & Supply for North Livermore: Scenario 5

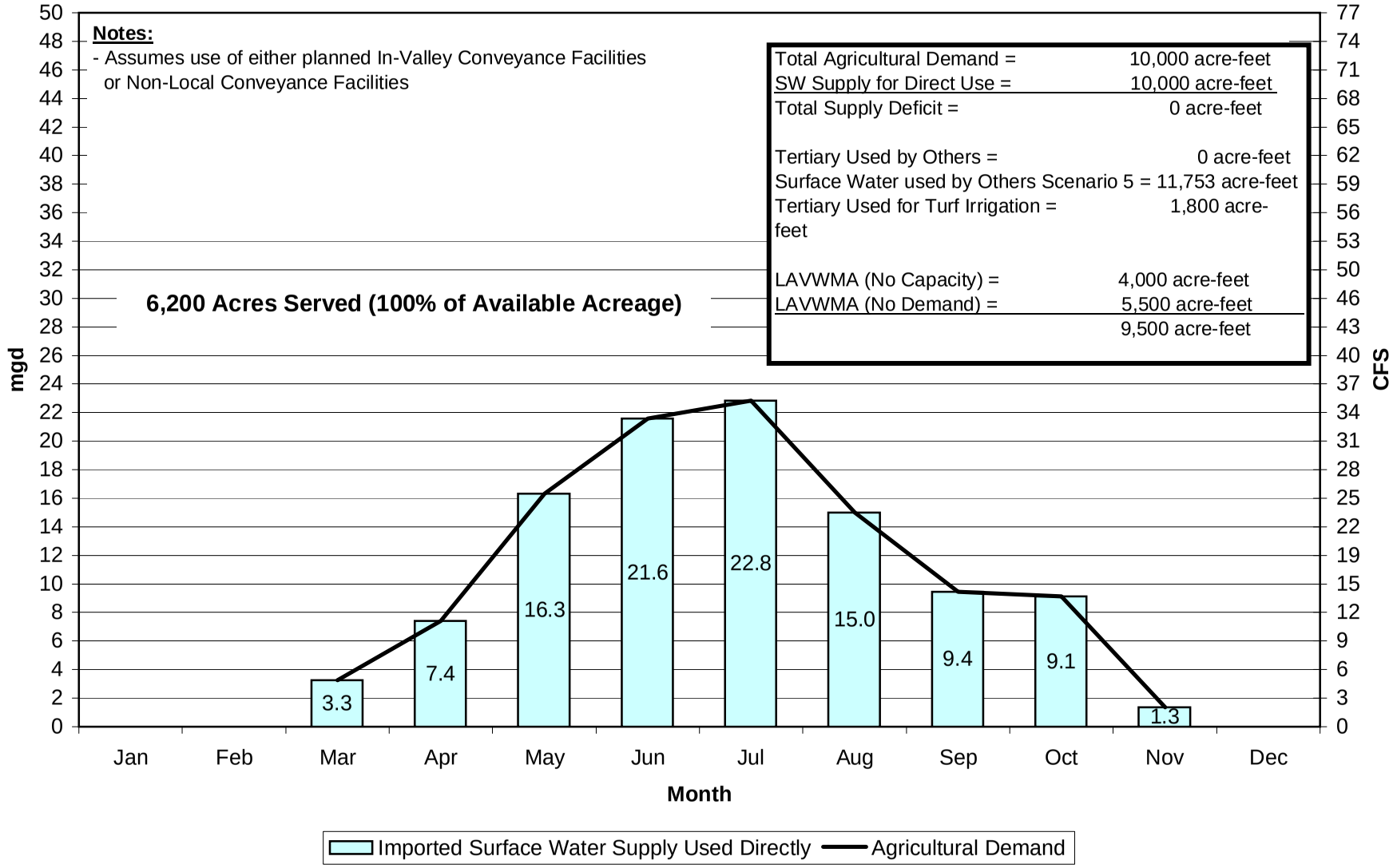
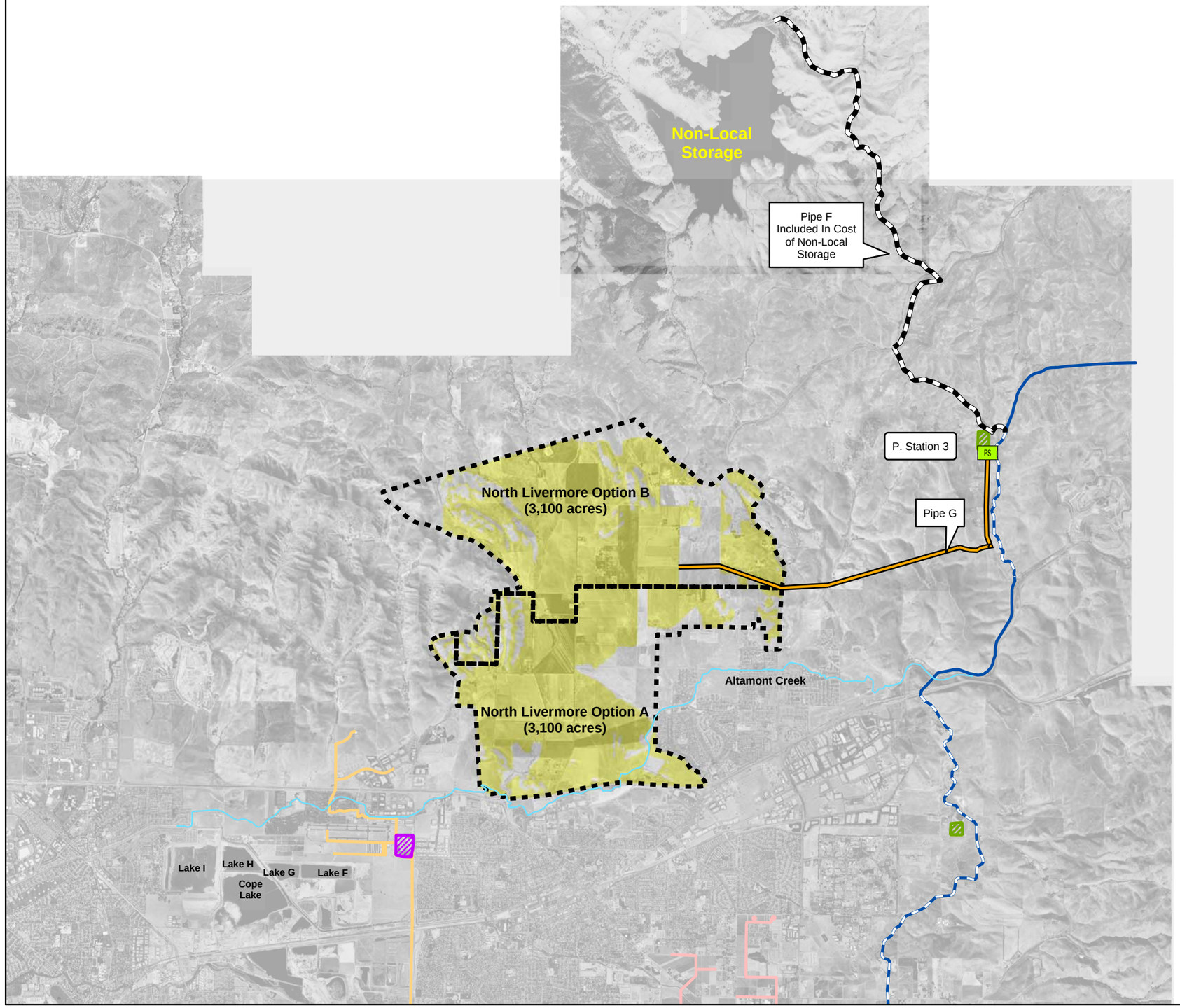


FIGURE 17

Non-Potable Study
Zone 7 Water Agency

SCENARIO 5



N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $158 million or $15,800/af

LEGEND

- Altamont Creek
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP

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FIGURE 18. Scenario 6: Local Conveyance Facilities – Direct Deliveries

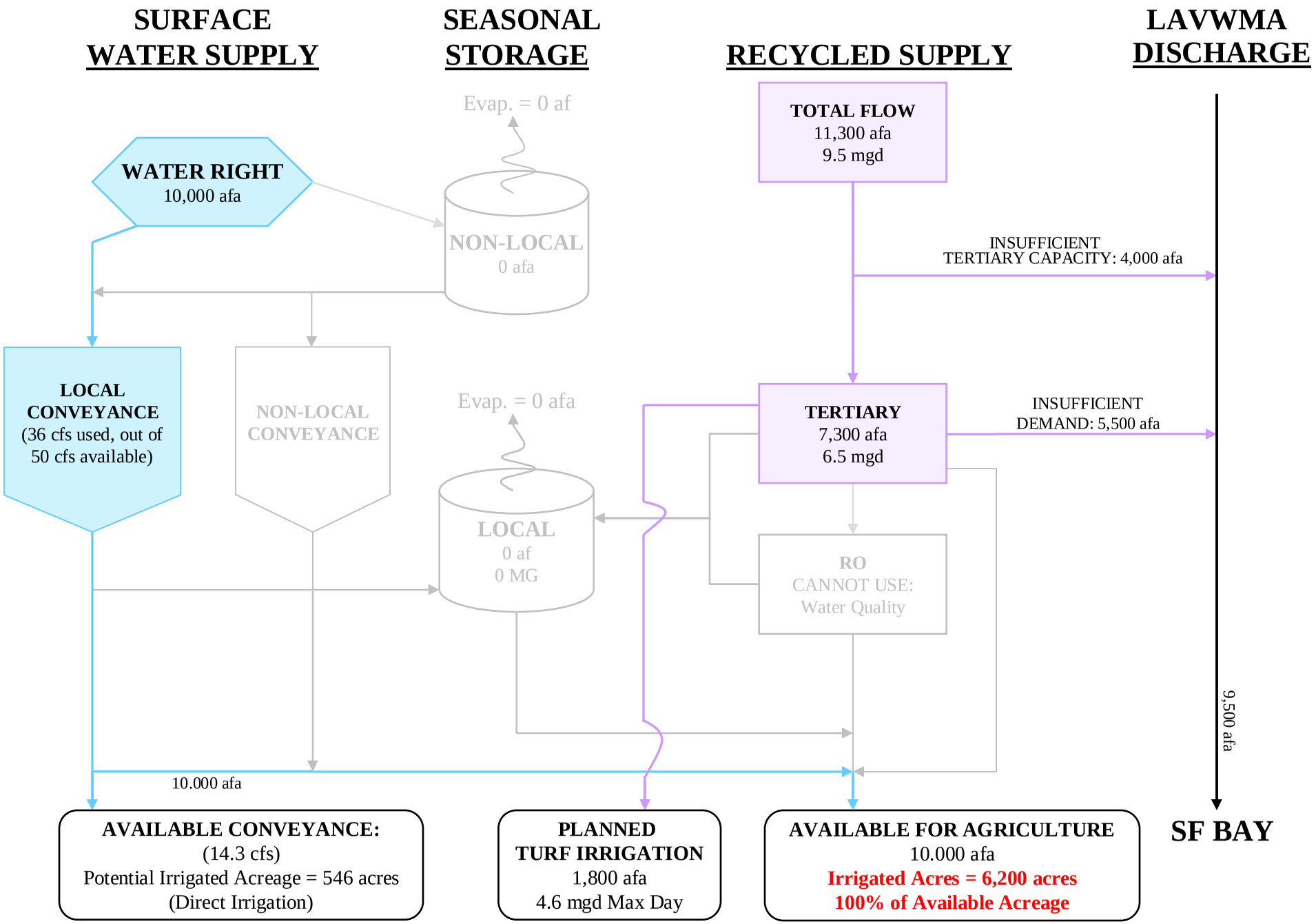


Figure 19. Agricultural Demand & Supply for North Livermore: Scenario 6

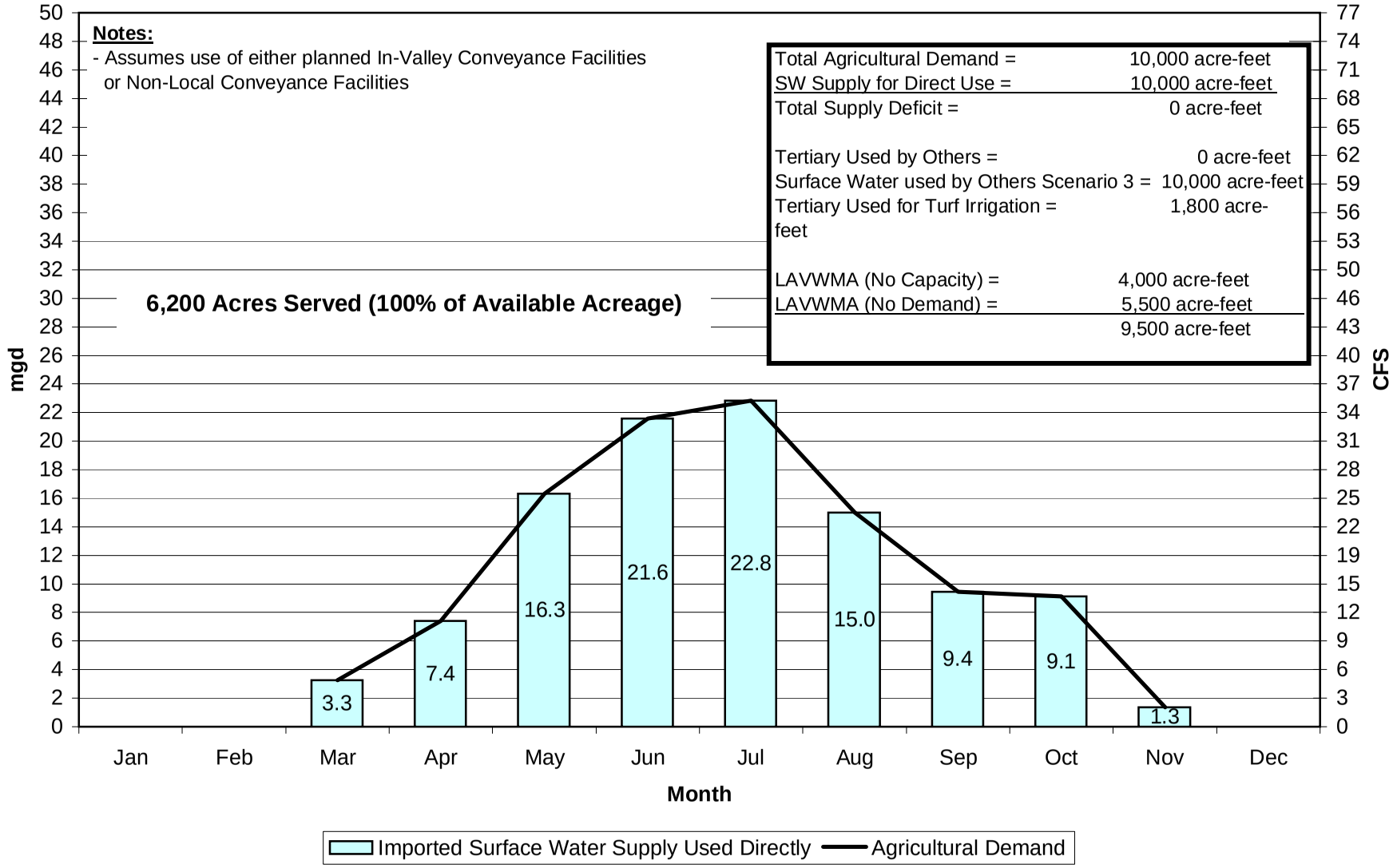
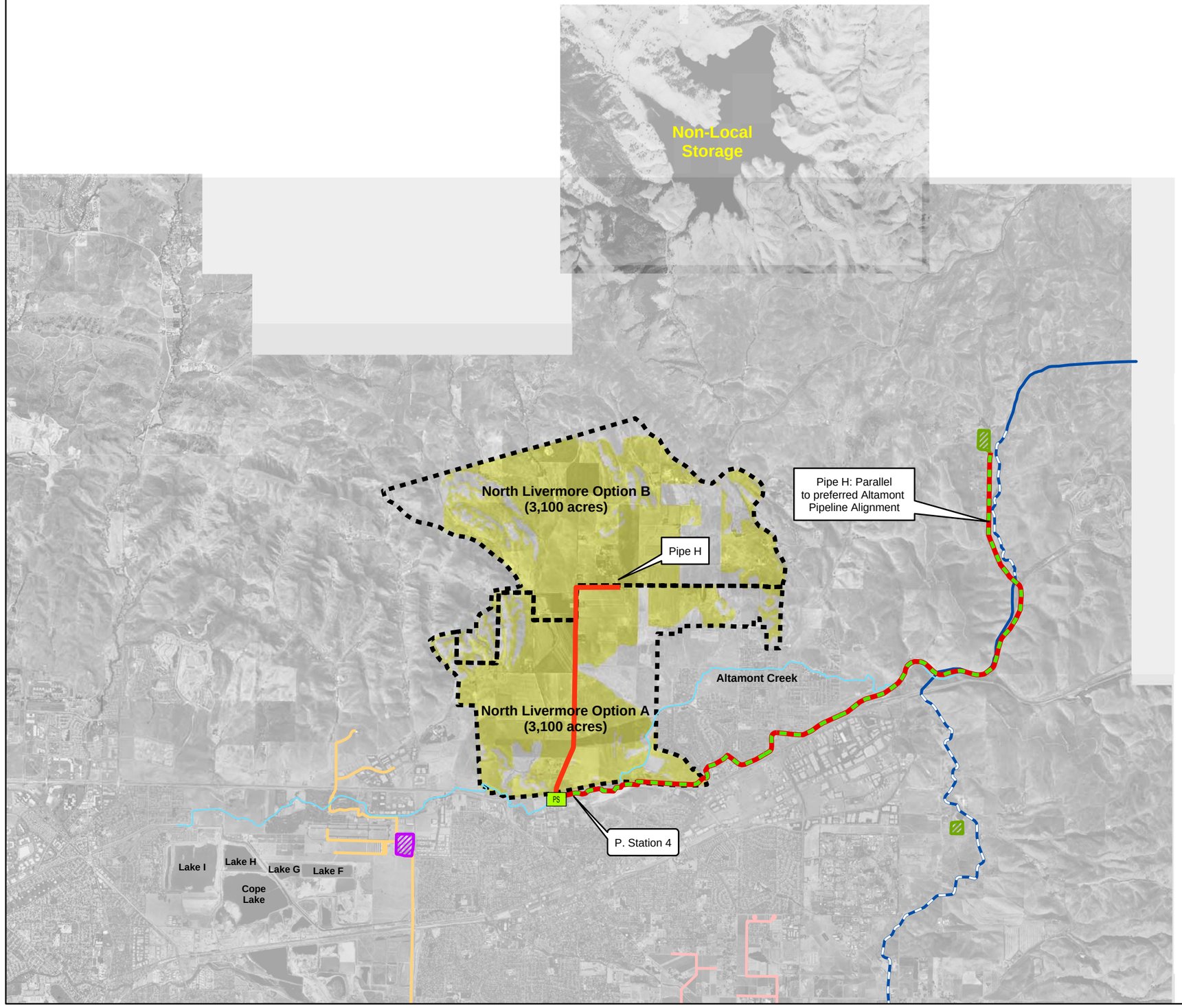


FIGURE 20

Non-Potable Study
Zone 7 Water Agency
SCENARIO 6



N

0 0.3 0.6 1.2

Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
NL Option B = 3,100 acres (5,000 acre-feet)
TOTAL = 6,200 acres (10,000 acre-feet)

TOTAL COST: $86 million or $8,600/af

LEGEND

- Altamont Creek
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Livermore Pipeline
- Wente Pipeline
- Parallel Pipe H & Altamont Pipeline
- Focus Area Boundary
- Revised Irrigable Acreage
- Proposed Altamont WTP
- Existing Livermore WWTP

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ATTACHMENT 1

Copy of Livermore Water Resources Division RO Product Water Quality

CITY OF LIVERMORE WATER RESOURCES DIVISION
RO Product

				NH3	NO3	NO2	NO3 + NO2					
		2.000		2.101	2.102	2.013	2.014	2.105	2.106	2.107	2.108	2.109
Sample Date	Sample Time	INORGANIC PROPERTIES	Salts	Nitrogen, Ammonia as N	Nitrogen: nitrate as N	Nitrogen: nitrite as N	Nitrogen: nitrite + nitrate as N	Boron	Calcium	Chloride	Fluoride	Magnesium
Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
11/21/1997				0.89			0.26					
11/24/1997*					<0.50	0.23			<0.10	2.4	<1.0	<0.10
11/24/1997@				1.3	<0.50	0.22			0.13	2.8	<1.0	0.12
12/01/1997	13:00			0.47			0.13					
12/10/1997	10:30			1.3			0.23					
12/26/1997	13:00			1.3			0.14					
12/29/1997	10:30			0.57			<0.020					
12/29/1997	24HC			0.71	<0.50	<0.15				1.9	<1.0	
01/06/1998				1.2			<0.1					
01/07/1998	24HC			1.4	<0.1	0.03	0.1	0.43	<0.5	4	<0.1	<0.5
01/08/1998	24HC								<0.050			
01/15/1998							<0.05					
01/16/1998				0.93			<0.05					
01/21/1998				0.94	<0.1	0.04	<0.05	0.43	<0.5	3	<0.1	<0.5
01/22/1998				0.6			0.1					
01/28/1998	24HC											
01/31/1998				0.7			<0.1					
02/02/1998				0.7			<0.1					
03/13/1998				1.5			<0.1					
03/13/1998				2.2			<0.1					
03/18/1998				2.0			<0.1					
03/22/1998				0.5			<0.1					
03/31/1998				0.7			<0.1					
04/07/1998	15:10			1.3	<0.1	<0.03	<0.1	0.6	<0.5	3	<0.1	<0.5
04/13/1998	15:00			1.2			<0.1					
04/19/1998	08:00			1.3			<0.1					
05/03/1998	14:30			0.5			<0.1					
05/05/1998	24HC											
05/20/1998	24HC			2.5	<0.1	<0.03	0.1	1.1	0.9	8	<0.1	0.6
05/29/1998	24HC			0.9			<0.1					
06/02/1998	24HC			2.3	0.1	<0.03	<0.1	0.7	<0.5	3	<0.1	<0.5
06/10/1998	1400											
Maximum				2.5	0.1	0.23	0.26	1.1	0.9	8	<1.0	0.6
Minimum				0.47	<0.1	<0.03	<0.1	0.43	<0.10	1.9	<0.1	<0.10

* Skid #1
@ Skid