TECHNICAL MEMORANDUM

To: Anders Hauge, HBA
Robin Cort, Parsons ESA

From: Jeffrey Peters, Questa Engineering

Date: September 19, 1995

Re: Cropping Scenarios for the West County and South Reclamation Alternatives

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This a description of future cropping scenarios developed for the South and West County reclamation (irrigation) alternatives. Three scenarios were developed for the one, five and ten percent Russian River discharge alternatives, with and without the sub-alternative of Sebastapol irrigation. The Sebastapol sub-alternative would provide irrigation water to about 1,600 acres of existing apple orchards and vineyards in the immediate Sebastapol area. The amount of reclaimed water available for use in irrigating crop land is reduced as the percent of winter river discharge increases; hence, the irrigation acreage shown for the scenario is lessened (i.e., the West County one percent alternative irrigation acreage is 6,200, the ten percent alternative is 2,900 acres). Please also note, that the irrigation acreage required for application of the reclaimed water is about 30 percent less for the South County versus the West County alternative. This difference reflects, in large part, the higher evapotranspiration rates in the South County area.

The estimates of total irrigation acres required for wastewater disposal for each of the above percent reclamation alternatives were provided by John Hake, Parsons Engineering Science, based on the project water balance model. The total acreage to be irrigated for each alternative is shown under the "total" rows in Tables 1 and 2.

We distributed this total acreage among five levels of farming intensity:

1. Vineyards;

2. Drip irrigated specialty crops, such as strawberries and artichokes;

3 . Truck crops such as cool season vegetables (lettuce, broccoli, green beans);

4. Forage, hay or silage crops (irrigated hay, sudan grass, field corn); and,

5. Improved, irrigated permanent pasture (with cross fencing for rotational management).

Each progressive level of farming intensity requires a greater input of labor and management and provides a higher return per acre on the commodity grown. The total acreage was arrayed among the three levels of farming intensity to create three technical levels of project-wide agricultural development:

1. High tech, in which the preponderance of the suitable lands in the project alternative areas were assumed to be utilized for more intensively managed vineyards, and specialty and truck crops, with little for forage or irrigated pasture.

2. Medium tech, in which much of the lands were assumed to be utilized for forage, hay or silage production, requiring moderate levels of labor and management, and lesser acreage in specialty or vegetable crops and irrigated pasture.

3. Low tech, in which much of the lands were assumed to be used for irrigated pasture and forage crops, with lower management requirements.

Crops may vary considerably in their consumptive water use requirement (i.e., irrigated alfalfa requires more water than potatoes). Crops watered by drip irrigation methods also typically require much less water (typically 20 to 30 percent less) because of more efficient water deliver to the root zone. The project water balance model uses as a basis for its consumptive water use estimate a mix of crops similar to the medium tech scenario; it includes some drip irrigation.

Since the high tech scenario presents a relatively high proportion of the project area in sprinkler and drip irrigated specialty crops, or drip irrigated vineyards, more land will need to be irrigated in order to beneficially dispose of the same volume of reclaimed water. Given the percentage of specialty crops in the scenario (about 30 percent) and assuming about 70 percent of the water use (drip versus sprinkler), roughly 10 percent more land will be needed in the high tech than the medium tech scenario. This is an approximation suitable for the purposes of this analysis. Accordingly, we have shown the high tech scenario as having about 10 percent more land in irrigation than the medium tech scenario. Using similar reasoning, since the low tech scenario has less land in drip irrigation than the medium tech scenario, we have reduce the irrigated acreage by roughly 10 percent. All final acreage is rounded off to the nearest 100 acres to indicate the general level of the analysis.

Please note that our cropping scenarios are based, to a certain extent, on soil capabilities, soil limitations and cropping restrictions as outlined in the Irrigation Suitability Technical Report and the Irrigation Management Plan. For instance, vegetable crops should be grown primarily on the higher quality, flatter soils of the valley bottoms, with irrigated pasture grown on the steeper, poorer soils of the uplands. Forage crops should be grown on intermediate capability lands. The drip irrigated specialty crops and new vineyards can be grown on gently to moderately sloping lands (up to 10 percent) with deep soils.

If all of the West County lands were suitable for the more intensively farmed truck or drip irrigated specialty crops, the high tech scenario would show 6,800 acres of fruits and vegetables as one extreme, and the low tech scenario would show 5,600 acres of irrigated pasture as the other extreme. The medium tech could consist of 3,300 acres of specialty crops and vegetables, and 3,300 acres of irrigated pasture and forage. This is about the mid-point between the standards set by the two extremes. However, there are not 6,800 acres suitable for vegetables and specialty crops within the West County project area. Since both soil restrictions and crop limitations, as well as the free market decisions of the farmers and ranchers, would likely preclude these extreme conditions (several ranchers with high capability lands may not choose to receive the reclaimed water, or may opt to grow irrigated pasture), we adjusted the acreage to reflect what we thought were more realistic scenarios.

Lands of varying capability are distributed throughout the West and South County project areas, although the majority of high capability valley bottom lands suitable for truck crops are in the Rhonert Park portion of the South County, while sloping lands suitable for vineyards and drip irrigated specialty crops are in the Lakeville Highway area.

This further complicates the analysis and requires that judgments be made in proportioning the acreage among different types of crops. For cost reasons, the project distribution pipeline will deliver water to sub-acres, depending upon acreage needs. For instance, in the five percent alternative it would not be feasible for the South County project to **only** deliver reclaimed water to the higher capability valley bottom, truck crop lands in the immediate Rohnert Park area, while not providing water to the sloping hay lands in this area, and still pipe water all the way to the South for vineyards and drip irrigated specialty crops. Irrigation in the Rhonert Park area would thus consist of a mix of crop types even in the high tech scenario. (Note: In order for this to be feasible, the water users would need to pay for the additional pipeline costs and pay a unit fee for the water, a situation not currently contemplated in the project.)

In the high tech scenario, the assumption is that much, but not all, of the acreage is grown at its highest use (i.e., 75 to 80 percent of high capability lands growing fruits and vegetables, 50 percent of intermediate capability lands growing forage crops, etc.) In the low tech scenario, the lands are not being used according to their highest capability,[1] with only about 10 to 15 percent of the lands suitable for truck and specialty crops being used for those purposes.

In the high tech scenario much, but not all, of the suitable valley lands are shown as being planted with truck crops, with irrigated pasture shown in rough proportion to the

[1] There is an estimated 1,700 acres of high capability lands in the West County and 2,300 acres of high capability lands in the South County study areas.

total acreage of the less suitable sloping upland areas. The thought in showing some small percentage (10 to 15 percent) of forage and pasture in the high tech scenario, was that irrigation water would be delivered to farms and ranches, most of which have a mix of differing capability lands. With the irrigation water provided, the farmer would grow crops based on the land's capability, i.e., some vegetables, some forage crops, some pasture. Forage, hay and silage crops are shown as being grown primarily on the intermediate capability lands. Since irrigated pasture and forage crops can also be grown on the higher capability lands, the medium and low tech cropping intensity scenarios show different mixes between these two. The medium tech scenario was most often set at roughly 40 to 50 percent of the differences between the low tech and high tech scenarios, and with a substantial amount of suitable land in forage crops.

The total acreage required for reclaimed wastewater disposal (the required irrigation acreage) declines as the project alternative discharges more highly treated effluent into the river during permissible winter discharge periods. Therefore, we varied the distribution of the acreage somewhat (not in strict proportion to the amount of low, medium and high capability lands) based on the assumption that if less acreage in the West County or South County project areas were to be irrigated, a much higher proportion would and should go to better capability lands and to farmers with a keen interest in growing higher value crops. The distribution of crop types thus required much judgment and opinion for the small acreage project alternatives.

Nearly all of the irrigable lands in the Sebastapol area are currently being utilized for dry-farmed apples or drip irrigated vineyards. Accordingly, when the Sebastapol irrigation sub-alternative was included in the project scenario, the mix between apple orchards and vineyards is shown in rough proportion to their current distribution (allowing somewhat for an expected continued shift from apples to vineyards).

It should be noted that we have not assumed significant vineyard expansion in the mix in the South County alternative. Since there are currently vineyards being grown by drip irrigation in several South County areas, and there are suitable soils, micro-climates and limited water availability for this low water demand crop, we are assuming that availability of reclaimed irrigation water will not significantly stimulate vineyard development in the South County project area. We are also assuming that the micro-climates throughout much of the West County project area are not suitable for vineyard or orchard development. The high tech scenario assumes about 2,100 acres of drip irrigated specialty crops (strawberries and artichokes) in the one percent discharge alternative in the West County, grown on five to ten percent slopes, and 1,600 acres of vegetables on flat valley bottom slopes. This is about 75 to 80 percent of the suitable lands used for these crops.

For comparison purposes, we have also provided existing condition scenarios in Table 3. These are based on a proportionate distribution of the amount of existing dry-farmed oat hay/silage and native pasture and range. Currently, about 60 percent of the irrigable lands in the South County reclamation alternative are being used for production of dry-

farmed oat hay and silage and 35 percent are being used as native range for diary or beef cattle production.

For purposes of comparative economic analysis of the impacts of the irrigation project, the one percent existing conditions scenario (South County) uses 2,100 acres of hay/silage (60 percent of 3,800) and 1,300 acres of native range (35 percent of 3,800). There are approximately 100 acres of vegetables crops in the South County study area, and about 300 acres in drip irrigated vineyards in the entire area. Since the one percent project represents less than 50 percent of the project area, we used 200 acres of vineyards as a conservative assumption for comparative modeling purposes. For the West County reclamation alternative, about 30 percent of the area is used for oat hay/silage and roughly 65 percent of the area is used for native pasture and range. A very small acreage is currently irrigated pasture using liquid dairy wastes and on-farm reservoir storage (less than about 200 acres). Much of this acreage should not be considered permanent irrigated pasture, as the irrigated acreage is used principally as a means of dairy wastewater disposal, and in many years the farm reservoir storage does not provide enough water to fully meet pasture needs throughout the late summer months. Because of these small areas, we are not including them in the cropping scenarios for existing conditions. The one percent cropping scenarios use 100 acres in irrigated truck crops and vegetables in the West County.

Please keep in mind that considerable reasoning, judgment and opinion relating project size to acreage went into developing the cropping scenarios. A second objective person completing the same analysis could vary the acreage in each category by approximately 200 acres or more, and the result would still be credible. Obviously, there is no truly right or wrong answer. The acreage estimates by contrasting agricultural development scenario provide a starting point for comparative economic analysis of the costs and benefits of the irrigation project. They are thought to be conservative and plausible in that they do not represent extreme cases for either the low tech or high tech scenarios, but represent our thoughts after talking to several knowledgeable experts as to what market conditions might support. We are sending this draft to a number of people with expertise in Sonoma County agriculture to verify that the developed scenarios represent plausible situations for your economic analysis. We also plan on using these same scenarios to examine potential impacts on water quality from soil erosion and agrochemical usage.

cc: Pat Collins
Vern Marble
Dave Smith
Walter Kieser

TABLE 1

Discharge Alternative	Cropping Level	Low Tech Scenario (Acres)	Medium Tech Scenario (Acres)	High Tech Scenario (Acres)
WEST COUNTY RECLAMATION ALTERNATIVE				
1%	Specialty Crops	0	450	2,000
	Vegetable Crops	200	600	1,500
	Forage/Hay/Silage	900	2,750	2,300
	Irrigated Pasture	4,500	2,400	1,000
	TOTAL	**5,600**	**6,200**	**6,800**
5%	Specialty Crops	0	300	1,400
	Vegetable Crops	100	450	1,150
	Forage/Hay/Silage	950	2,000	1,600
	Irrigated Pasture	2,950	1,650	700
	TOTAL	**4,000**	**4,400**	**4,850**
10%	Specialty Crops	0	200	1,050
	Vegetable Crops	200	350	900
	Forage/Hay/Silage	850	1,400	950
	Irrigated Pasture	1,650	950	300
	TOTAL	**2,700**	**2,900**	**3,200**
WEST COUNTY WITH SEBASTAPOL				
1%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-Total	2,200	2,200	2,200
	Specialty Crops	0	300	1,350
	Vegetable Crops	100	450	1,200
	Forage/hay/Silage	950	2,000	1,300
	Irrigated Pasture	2,850	1,550	750
	Sub-Total	**3,900**	**4,300**	**4,600**
	TOTAL	**6,100**	**6,500**	**6,800**

Table 1

(Continued)

Discharge Alternative	Cropping Level	Low Tech Scenario (Acres)	Medium Tech Scenario (Acres)	High Tech Scenario (Acres)
5%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-total	**2,200**	**2,200**	**2,200**
	Specialty Crops	0	150	600
	Vegetable Crops	150	500	900
	Forage/Hay/Silage	600	900	850
	Irrigated Pasture	1,550	1,050	500
	Sub-total	**2,300**	**2,600**	**2,850**
	TOTAL	**4,500**	**4,800**	**5,050**
10%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-total	**2,200**	**2,200**	**2,200**
	Specialty Crops	0	50	450
	Vegetable Crops	50	150	400
	Forage/Hay/Silage	300	500	250
	Irrigated Pasture	550	300	0
	Sub-Total	**900**	**1,000**	**1,100**
	TOTAL	**3,100**	**3,200**	**3,300**

* Sebastapol Irrigation

93012L20.T1

TABLE 2

SOUTH COUNTY RECLAMATION ALTERNATIVE				
Discharge Alternative	Cropping Level	Low Tech Scenario (Acres)	Medium Tech Scenario (Acres)	High Tech Scenario (Acres)
1%	Vineyards	0	300	1,300
	Specialty Crops	0	250	900
	Vegetable Crops	200	800	900
	Forage/Hay/Silage	800	1,300	800
	Irrigated Pasture	2,400	1,150	300
	TOTAL	**3,400**	**3,800**	**4,200**
5%	Vineyards	0	250	600
	Specialty Crops	0	200	600
	Vegetable Crops	200	600	1,200
	Forage/Hay/Silage	600	1,100	300
	Irrigated Pasture	1,500	450	200
	TOTAL	**2,300**	**2,600**	**2,900**
10%	Vineyards	0	200	400
	Specialty Crops	0	150	400
	Vegetable Crops	150	350	700
	Forage/Hay/Silage	400	600	200
	Irrigated Pasture	950	300	100
	TOTAL	**1,500**	**1,600**	**1,800**

Table 2

(Continued)

SOUTH COUNTY WITH SEBASTAPOL				
Discharge Alternative	Cropping Level	Low Tech Scenario (Acres)	Medium Tech Scenario (Acres)	High Tech Scenario (Acres)
1%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-Total	**2,200**	**2,200**	**2,200**
	Vineyards	0	250	600
	Specialty Crops	0	200	600
	Vegetable Crops	200	600	1,100
	Forage/hay/Silage	600	1,100	400
	Irrigated Pasture	1,500	450	200
	Sub-Total	**2,300**	**2,600**	**2,900**
	TOTAL	**4,500**	**4,800**	**5,100**
5%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-total	**2,200**	**2,200**	**2,200**
	Vineyards	0	0	300
	Specialty Crops	0	200	300
	Vegetable Crops	100	400	700
	Forage/Hay/Silage	250	500	200
	Irrigated Pasture	950	200	0
	Sub-total	**1,300**	**1,300**	**1,500**
	TOTAL	**3,500**	**3,500**	**3,700**

Table 2

(Continued)

Discharge Alternative	Cropping Level	Low Tech Scenario (Acres)	Medium Tech Scenario (Acres)	High Tech Scenario (Acres)
10%	Apples*	1,600	1,600	1,600
	Vineyards*	600	600	600
	Sub-total	**2,200**	**2,200**	**2,200**
	Vineyards	0	0	0
	Specialty Crops	0	0	200
	Vegetable Crops	0	100	200
	Forage/Hay/Silage	100	150	0
	Irrigated Pasture	200	50	0
	Sub-Total	**300**	**300**	**400**
	TOTAL	**2,500**	**2,500**	**2,600**

* Sebastapol Irrigation

93012L20.T2

TABLE 3

WEST COUNTY RECLAMATION ALTERNATIVE EXISTING CONDITIONS

	1% Acreage Requirement	5% Acreage Requirement	10% Acreage Requirement
Specialty Crops	0	0	0
Vegetable Crops	100	50	50
Dry-farmed Hay/Silage	2,050	1,350	950
Native Pasture/Range	4,050	3,000	1,900
Total Acreage	6,200	4,400	2,900

W/SEBESTAPOL ALTERNATIVE ACREAGE

	1% Acreage Requirement	5% Acreage Requirement	10% Acreage Requirement
Vineyards	1,600	1,600	1,600
Orchards	600	600	600
Specialty Crops	0	0	0
Vegetable Crops	50	50	50
Dry-farmed Hay/Silage	1,300	800	300
Native Pasture/Range	2,950	1,750	650
Total Acreage	6,500	4,800	3,200

* This is the acreage utilized in the Medium Tech scenario, and is used here for comparing existing conditions soil loss with irrigation project soil loss.

TABLE 3

(Continued)

SOUTH COUNTY RECLAMATION ALTERNATIVE EXISTING CONDITIONS

	1% Acreage Requirement	5% Acreage Requirement	10% Acreage Requirement
Vineyards	200	200	100
Specialty Crops	0	0	0
Vegetable Crops	100	100	50
Dry-farmed Hay/Silage	2,200	1,300	950
Native Pasture/Range	1,300	1,000	500
Total Acreage	3,800	2,600	1,600

w/SEBESATPOL ALTERNATIVE ACREAGE

	1% Acreage Requirement	5% Acreage Requirement	10% Acreage Requirement
Vineyards	1,600	1,600	1,600
Orchards	600	600	600
Specialty Crops	0	0	0
Vegetable Crops	100	50	0
Dry-farmed Hay/Silage	1,600	800	200
Native Pasture/Range	900	450	100
Total Acreage*	4,800	3,500	2,500

* This is the acreage utilized in the Medium Tech scenario, and is used here for comparing existing conditions soil loss with irrigation project soil loss.

Ref.: 93012L20.T3