VALLEY AG RESEARCH

NITRATE LOADING STUDY

Henry Tosta Dairy Facility
20662 San Jose Road
Tracy, California

PRESENTED TO:

San Joaquin County Environmental Health Department

Mr. & Mrs. Henry and Linda Tosta

March 1, 1999

P.O. Box 3794 ▪ Turlock, California 95381 ▪ (209) 668-1403 ▪ Fax (209) 668-2598

I. INTRODUCTION

This report contains the results of the Nitrate Loading Study conducted by Valley Ag Research for the existing Tosta Dairy Facility. The subject dairy is located northwest of the City of Tracy, at 20662 San Jose Road. This dairy site is referenced as the "home" dairy. The Tosta's are currently operating another dairy facility on Reeves Road, one-half mile to the west of the home dairy. This facility is referenced as dairy #1. The Tosta's will suspend operation of this dairy and move all animals to the home dairy, upon its completion. Completion includes construction of additional freestall barns, corrals and enlargement of waste containment structures. There are additional animals owned by the Tosta's located on pasture near the Escalon area. These animals may eventually be moved onto the home dairy. Consequently, this report addresses only the home dairy. Total acreage owned by the Tosta's is 423 Ac: The actual dairy site = 10 Ac and the cropland = 413 Ac. Waste application areas are outlined in the Appendix.

The purpose of this investigation was to quantify and assess the potential nitrate-nitrogen impact to the soil and groundwater underlying the nutrient application acreage. With the proposed increase in animal units at the home dairy site, this report establishes the quantity of nitrogen produced correlates with the nutrient capacity of the referenced cropland. This study is in compliance with the requirements of Section 9-1110 item (c) of the San Joaquin Ordinance Codes.

The San Joaquin County Environmental Health Department considers nitrate contamination a serious threat to the surface and groundwaters of the County. High nitrate concentrations in drinking water can have deleterious effect on infants and fetuses and may also induce abortion in cattle. The United States Environmental Protection Agency (EPA) has determined 10 mg per liter of nitrate-nitrogen (NO_3-N), equivalent to 45 mg per liter nitrate (NO_3) in drinking water to be the Maximum Contaminant Level (MCL). By conducting these types of investigations, the County is better able to locate, quantify and monitor the potential for nitrate impact and impose prevention and/or mitigation measures.

Our research of the subject facility included historical agricultural considerations, soil testing and analyses, groundwater analyses, and manure and wastewater analytical data found in the scientific literature. By examining the chemical and physical properties of the soil and water, the potential of nitrate accumulation can be adequately assessed.

The surrounding study area consists mainly of irrigated agriculture and pasture. There are five dairies of various size in the one-mile radius from the Tosta home dairy. Past history of the subject property is irrigated row crop, forage and pasture.

This document also serves as a directive towards best management practices of nutrient/waste materials. Our investigation demonstrates that animal wastes produced at the subject dairy, can be applied to cropland owned by the Tosta's, providing nitrogen in a timely manner to meet crop N requirements.

nitrate-nitrogen is not occurring, as evidenced by the test results. All of the waste application fields possess an above average Cation Exchange Capacity (CEC) which indicates the clay soil can attract and hold positively charged cations, particularly ammonium ions. Higher CEC soils theoretically reduce nitrate formation by impeding nitrification or the transformation of ammonium to nitrate.

GROUNDWATER ANALYSIS

The Tosta Dairy has three monitoring wells which are orientated around the home dairy site as illustrated on the attached plot map. These wells were installed in 1996 under a requirement by the California Regional Water Quality Control Board and the San Joaquin County Department of Environmental Health. Elevations of the monitoring wells were determined by the engineering firm of Schack and Company, Inc. - Tracy, CA.

Well Number	**Top of Casing Elevation**	**Ground Elevation**	**Depth to Water From T.O.C.**	**Depth to Water From Ground Elevation**	**Depth of Well**	**Water Table Elevation**
MW #1	4.93'	2.38'	6.48'	3.93'	18.10'	-1.55
MW #2	4.89'	2.28'	5.32'	2.71'	23.10'	-0.43
MW #3	4.30'	1.25'	8.15'	5.10'	23.75'	-3.85

The following data was obtained during well purge procedures prior to groundwater sampling:

MONITORING WELL #1 NORTH

Purge Volume	Temperature	pH	Elect. Cond. - EC
Initial - 0 gallons	61.3	7.8	5100
4 gallons	61.7	7.4	5250
8 gallons	61.5	7.4	5170
12 gallons	61.3	7.4	5170
16 gallons	61.4	7.4	5170

III. MASS BALANCE OF NITRATE-NITROGEN LOADING

The initial investigative factors of any nitrate source identification procedure involves the assessment of the site to inventory and identify all potential nitrate sources. This Study identifies all *on-site* sources of nitrate impact which contribute a percentage of the total amount. The nitrate loading potential of the subject facility originates from primarily four sources: **1.)** The corral areas - open corrals, covered corrals and proposed freestall barns. **2.)** The separation basin and wastewater holding pond, **3.)** Septic system impact and **4.)** Solid manure and wastewater application to cropland. Each of the sources and their potential nitrate nitrogen concentration are discussed below:

SPECIFIC NITROGEN SOURCE CONSIDERATIONS

1.) The Corral Areas: Freestall corrals contribute very little nitrogen to the underlying soil due to the concrete-lined flush system which transports wastes from these corrals. In addition, since these corrals will be covered, there is virtually no hydraulic head from rainfall or other sources which would drive the nitrate molecules continually deeper into the soil.

Three factors are of significant importance regarding nitrogen contribution and the mitigation of the potential for nitrate impact from the open corrals. The first mitigating factor concerns the sloping of the open corrals to manage rainwater runoff. Each corral should be sloped 4% to 6% from the center to the ends to promote rainwater runoff. This water management technique reduces percolating water through the soil profile by preventing hydraulic head. Since the soil under the open corrals is composed of a clay material, permeability is reduced. When ponding of water does occur in the open corrals, a sump pump is used to transfer water into the separation basin.

The second factor reducing nitrate impact to the groundwater is the clay content of the soil. The clay content percentage was determined to be 34% by the hydrometer test, ASTM D422: Particle Size Analysis of Soils. These samples were taken from the home application acreage. In addition to this test, a permeability test was also conducted on a representative sample taken from the open corral area. Test results indicate the indigenous soils possess a hydraulic conductivity, k, of 1.3 X 10^{-6} cm/sec. By using an average water table, or zone of saturation depth of 4 feet below grade, the following calculation illustrates that it will *theoretically* take 3 years before a nitrate laden wetting front reaches the saturated zone:

1.3 X 10^{-6} cm/sec. X 60 sec/1 min X (525,600 min/year ÷ 30.5 cm/ft)= 1.34 ft/year.
4 ft ÷ 1.34 ft/yr = 3 years. The dairy has been in operation for over thirty years, consequently, a higher nitrate concentration in the groundwater would be expected.

The third mitigating factor is the soil compaction from the animals. The hooves of the cows act essentially like a "sheepsfoot" soil compactor, creating a high density, low void space soil "cap" in the top six inches of the soil profile. Soil compaction attenuates the downward migration of nitrate molecules by reducing pore water permeability.

2.) Containment Structures: The wastewater system consists of a separation basin and a holding pond. A percentage of nitrogen entering this system will volatilize in the form of ammonia (NH_3) or be adsorbed onto the clay soil particles lining the ponds as ammonium (NH_4). An investigation by Sutton, (1983) suggests that a nitrogen loss from a holding pond system can range from 70% to 80%. Ammonia volatilization occurs from urine, manure wastewater transfer to the ponds and during pond storage. Although both containment structures have not been hydrometer tested for clay content, from the indigenous high clay content soils, the structures are most likely in compliance with liner requirements of the Regional Water Quality Control Board. The ponds can be considered predominately anaerobic. An aerobic environment is required for nitrate conversion to occur. Significant conversion can only take place if the ponds are allowed to dry out. When the manure in the basin and pond is eventually cleaned-out or draglined, it should be done as soon as feasible after the water is pumped to prevent this conversion from taking place.

The second issue regarding the ponds is the natural process of denitrification. This process takes place only in anaerobic environments such as saturated clay soils where the pore space volume is extremely small. It has been documented that nitrate concentrations in groundwater around wastewater holding ponds is comparatively low in high clay content soils.

3.) Septic System Contribution: Data from various sources such as independent investigators, the U.S. EPA, and the Regional Water Quality Control Board estimate nitrogen loadings from domestic sewage from 12 grams N per person per day (g N/capita/day) to a high of 90 g N/capita/day. Hantzche and Finnemore (1992) correlated septic tank effluent concentrations multiplied by water discharge to the septic tank. They formulated a water discharge of 50 gal/capita/day with an effluent concentration of 30-60 mg N/L. It is our opinion that 60 mg N/L is most accurate. The following calculations determine nitrate-nitrogen loading from septic contributions:

25 people max. on-site x 10 gals/day = 250 gals x 3.79 L/gal = 948 L/d x 60 mg N/L = 57 grms N/day x 365 days/yr = 21 kg N/yr x 2.2 lb/kg = 46 lbs N/yr.

4.) NITROGEN PRODUCTION CALCULATIONS

The total nitrogen excreted from dairy animals is difficult to quantify since the rates of several important nitrogen transformation processes such as ammonia volatilization can only be predicted. The following calculations incorporate the use of animal units (AU) to formulate the nitrogen loading. The animal numbers are approximate and represent the projected number of animal types which will eventually move onto the home dairy. Presently, the animals at the home dairy are kept in corrals with scraped alleys. Additional freestalls are proposed for future expansion.

TOTAL ANIMALS		ANIMAL UNIT		TOTAL ANIMAL UNITS
1100 Milk Cows	x	1.4	=	1540
250 Dry Cows	x	1.2	=	300
500 Bred Heifers	x	1.1	=	550
270 Heifers 1-2 yr	x	1.1	=	297
95 Calves	x	0.5	=	48
40 Baby	x	0.25	=	10

Nitrogen loading from liquid waste for milk cows only:
1540 AU x 0.56 lbs N/AU/day x 0.1(10% waste into wastewater) x 50% N retention x 365 d= 15,739 lbs N/yr

Nitrogen loading from dry waste for milk cows only:
1540 AU x 0.56 lbs N/AU/day x 0.9 (90% waste into solids) x 25% N retention x 365 d = 70,825 lbs N/yr

Nitrogen loading from dry waste from dry stock only:
1205 AU x 0.45 lbs N/AU/day x 0.75 (75% waste into solids) x 25% N retention x 365 days = 37,110 lbs N/yr

TOTAL N AVAILABLE IN DRY WASTE = 107,935 lbs N

TOTAL N AVAILABLE IN LIQUID WASTE= 15,739 lbs N

TOTAL N PRODUCTION FOR TOSTA DAIRY FACILITY= 123,674 lbs N

CROPLAND NITROGEN REQUIREMENTS

The existing cropland which is a part of the dairy facility totals 413 acres. All acreage is planted yearly and rotated in silage corn and winter oats:

Corn silage = 250 lbs N/Ac x 413 Ac = 103,250 lbs N required
Oats = 115 lbs N/Ac x 413 Ac = 47,495 lbs N required
TOTAL 150,745 lbs N required

Therefore, a theoretical **nitrogen deficit** of (150,745 lbs - 123,674 lbs) = **27,000 lbs of N** occurs on the cropland farmed by the Tosta's.

IV. CONCLUSIONS AND RECOMMENDATIONS

The data presented above gives an approximate estimate of what is occurring at the subject facility with regard to nitrogen production and crop uptake. There are numerous factors involved in adequately assessing and correlating crop needs and uptake of available nitrogen. From the results of the balance equation, the amount of nitrogen produced by the dairy operation is approximately 82% of the nitrogen needed for optimum crop growth. When large numbers are formulated to assess nitrogen produced vs. nitrogen required, the margin of error can be ±10%. Therefore, it is recommended that sampling and analysis be performed on the 1.) Wastes applied, 2.) Cropland soil and 3.) Tissue samples of the crops to check for N excess. By analysis of these different parameters, it can best be determined which form of nutrient (solid vs. liquid) to apply to a particular field. Additionally, the Estimated Nitrogen Release (ENR) must be taken into consideration when determining nutrient application quantities.

The procedures for determining crop nutritional needs, particularly nitrogen, without overloading the cropland can be a complex process. In an effort to simplify the information required to make best management decisions for optimum crop growth and nutrient utilization, we have provided a Manure Analysis Reference Guide attached with this report. This Guide is published by A & L Agricultural Laboratories and provides one of the best sources of information to determine crop nutrient utilization from animal wastes. The suitable rate of solid and liquid applications is determined by the ability of the soil and crop combination to immobilize and utilize the nutrients in the applied manure, which is detailed on the Worksheets found in this Guide.

In our opinion, the actual dairy site is the primary area of concern with respect to nitrate/nitrogen loading, followed by the cropland. The calculated nitrogen contribution from the on-site sewage disposal systems is comparatively insignificant, especially when the surrounding land use low density factor is considered.

One of the most significant nitrate mitigating factors discovered from this investigation is the process known as denitrification: The microbial reduction of nitrate to nitrogen gas and nitrous oxide. This process is one of the explanations for the relatively low levels of nitrate found in the cropland soils and underlying groundwater. Due to the high clay content cropland soils, the denitrification process prevails in the subsurface anaerobic conditions within the microsite pore spaces of the clay.

Caution must be exercised when irrigating cropland. Tailwater must not be allowed to enter any of the canals or ditches surrounding the cropland. The infiltration and permeability of all nutrient application acreage is comparatively slow and runoff can occur readily. In addition, wastes must be managed at the south end of the corral area so that no solids or liquids enter Nagler Draw.

From the analysis of the groundwater, the gradient and estimated directional flow, nitrate impact to downgradient domestic wells from the subject dairy exclusively, appears remote.

An increase in animal units may be made, up and above the numbers used. However, if an increase in AUs is proposed, an analysis must be made to quantify the additional nitrogen production, in combination with new waste management techniques (e.g., freestall flush system).

If additional septic systems will be installed on the home dairy site, it will be a requirement of the San Joaquin County Environmental Health Department to conduct a percolation test in the location of the proposed leachfield area(s). The elevation of groundwater must be determined at the time of the perc test. If groundwater is located too close to the soil surface, an engineered mound system may have to be designed.

This report serves to assess the environmental impact to the soil and underlying groundwater with respect to nitrate-nitrogen loading. Although this report does not specifically address other environmental issues such as additional macro/micronutrient loading, odor, truck traffic or other factors associated with the farming operation of the dairy, it is our opinion the dairy can be operated under best management practices to mitigate environmental concerns. It must be recognized the dairy operates in a predominately agricultural region where related agricultural operations such as odors, dust, pesticide/nutrient applications and truck traffic are going to occur.

V. LIMITATIONS

The findings, opinions, conclusions and recommendations found in this Nitrate Loading Study are based upon information from standard analytical test procedures, contemporary scientific literature and on-site observations. The data and information contained in this report is deemed reliable by the sources from where it was obtained.

The results of this study are founded on current scientific knowledge to assess factors which are extremely variable and complex and can change at any point in time. Therefore, no guarantee or warranty is expressed or implied against any type of environmental impact.

We appreciate the opportunity to provide this service for you. If there should be any questions regarding the contents of this report, please contact the undersigned.

Respectfully submitted,

VALLEY AG RESEARCH

Don Chesney

Don Chesney, R.E.A.
Registered Environmental Assessor #4675
Agricultural Pest Control Advisor #6237

APPENDICES

APPENDIX A
Site Map

APPENDIX B
Plot Map of Subject Facility - Proposed Future Expansion

APPENDIX C
Soil Analysis Reports

APPENDIX D
A.P.N. Maps and Soil Conservation Maps of Cropland

APPENDIX E
Groundwater Analyses

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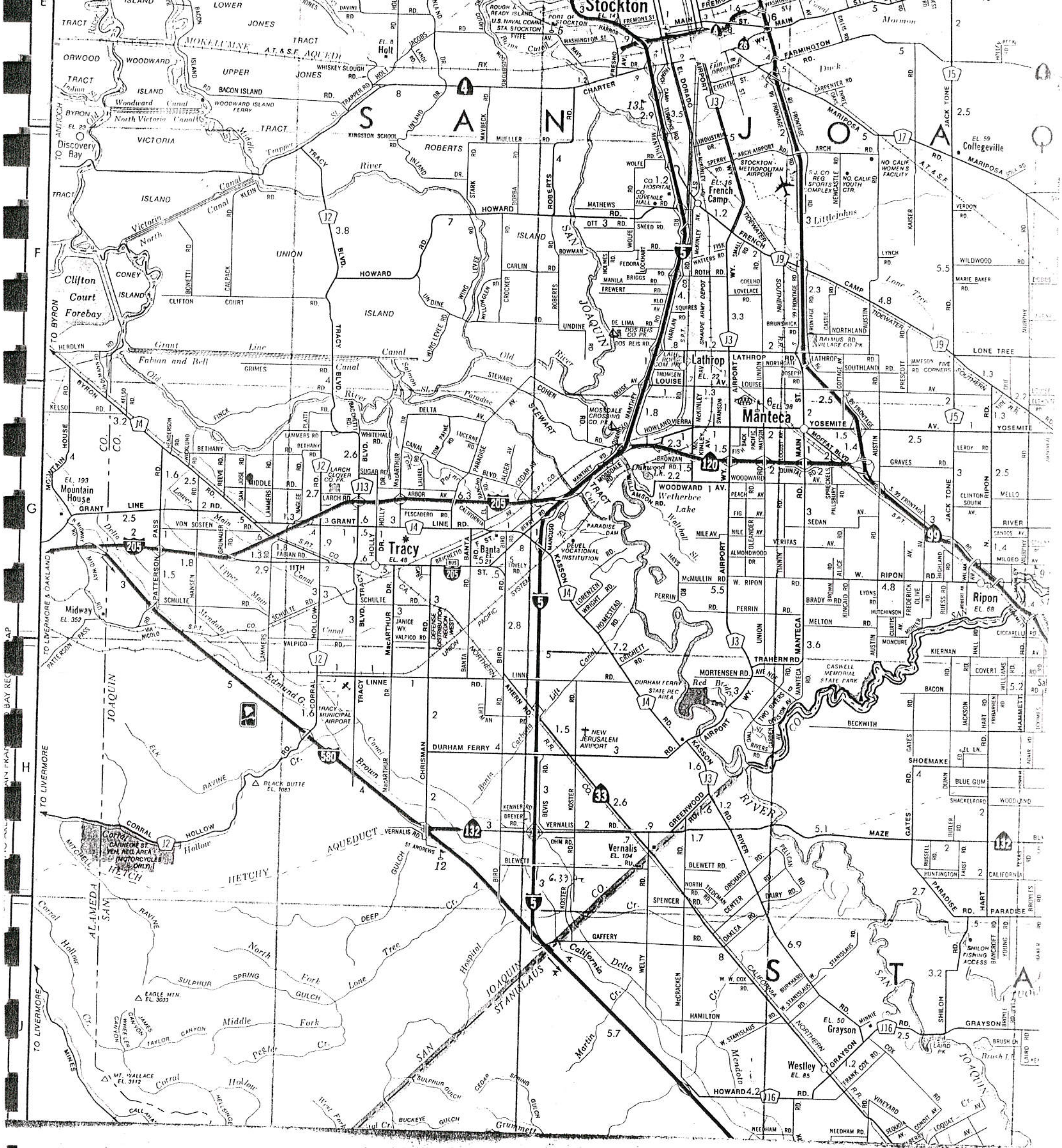
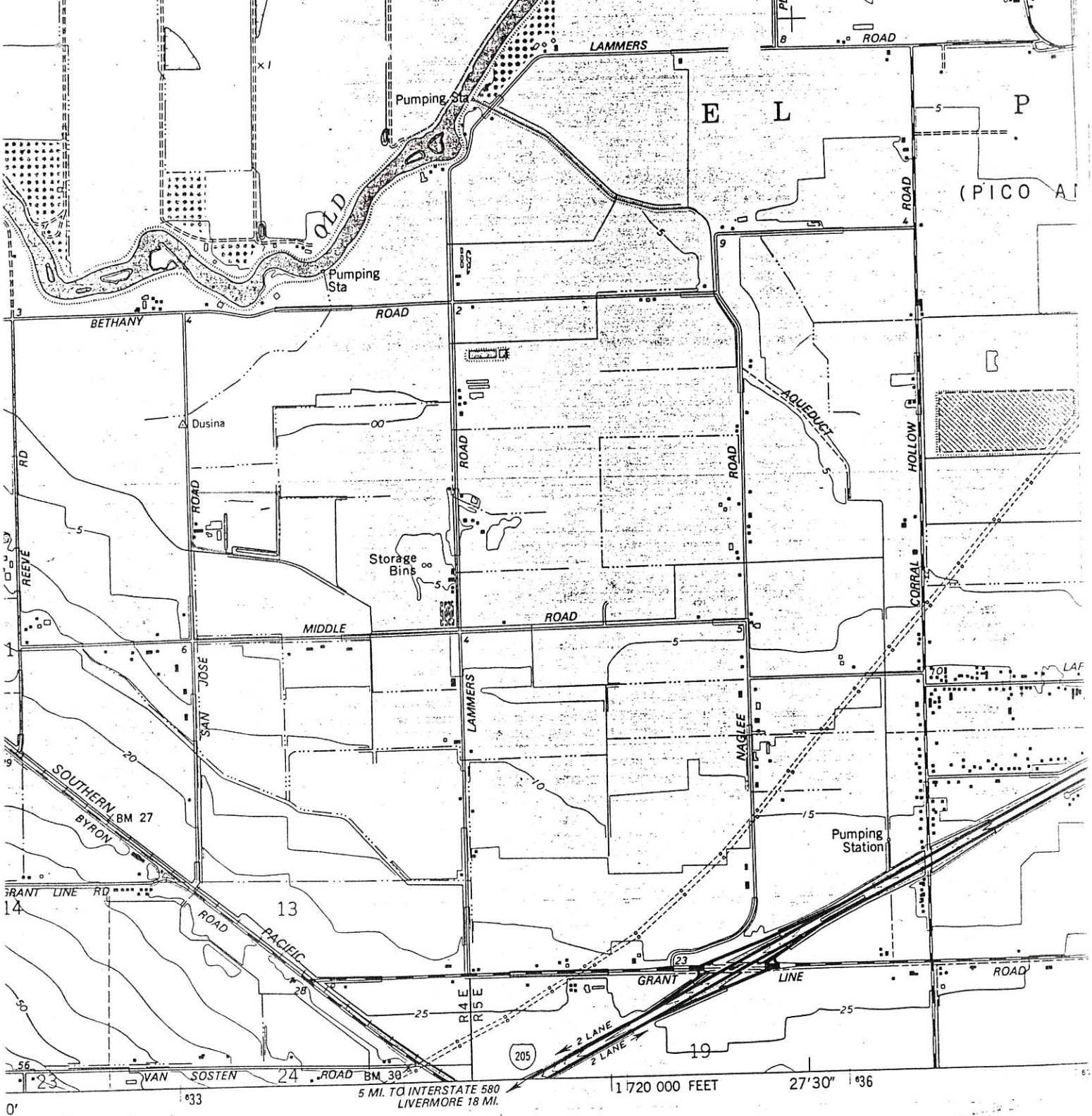
A & L Laboratories - Manure Analysis

APPENDIX A

Site Map



SAN JOAQUIN
STANISLAUS
Stockton
EL. 14
PORT OF STOCKTON
ROUGH & READY ISLAND
U.S. NAVAL COMM. STA STOCKTON
Holt
EL. 8
LOWER JONES TRACT
UPPER JONES
ORWOOD
WOODWARD ISLAND
BACON ISLAND
MOKELUMNE
A.T. & S.F. AQUEDUCT
WHISKEY SLOUGH
WOODWARD ISLAND FERRY
Woodward Canal
North Victoria Canal
VICTORIA ISLAND
TRACT
Discovery Bay
EL. 23
BYRON
TO ANTIOCH
Clifton Court Forebay
CONEY ISLAND
UNION ISLAND
ROBERTS
KINGSTON SCHOOL
HOWARD RD.
Grant Line Canal
Fabian and Bell
Old River
TO BYRON
French Camp
EL. 16
STOCKTON METROPOLITAN AIRPORT
CO. HOSPITAL
CO. JUVENILE HALL
SHARPE ARMY DEPOT
S.J. CO. REG. SPORTS COMPLEX
NO. CALIF. YOUTH CTR.
NO. CALIF. WOMEN'S FACILITY
Collegeville
EL. 59
MARIPOSA RD.
FARMINGTON RD.
CHARTER
Littlejohns
Lone Tree
Lathrop
EL. 22
Manteca
EL. 38
YOSEMITE AV.
MOSSDALE CROSSING CO. PK.
DOS REIS CO. PK.
Mountain House
EL. 193
Midway
EL. 352
TO LIVERMORE & OAKLAND
TO LIVERMORE
Tracy
EL. 48
Banta
EL. 21
LARCH CLOVER CO. PK.
DEUEL VOCATIONAL INSTITUTION
DEFENSE DISTRIBUTION REGION WEST
TRACY MUNICIPAL AIRPORT
Wetherbee Lake
PARADISE DAM
DURHAM FERRY STATE REC. AREA
NEW JERUSALEM AIRPORT
CASWELL MEMORIAL STATE PARK
Ripon
EL. 68
Vernalis
EL. 104
Grayson
EL. 50
Westley
EL. 85
SHILOH FISHING ACCESS
LAIRD PK.
BLACK BUTTE
EL. 1083
CARNEGIE ST. VEH. REC. AREA (MOTORCYCLES ONLY)
CORRAL HOLLOW
EAGLE MTN.
EL. 3033
MT. WALLACE
EL. 3112
HETCH HETCHY AQUEDUCT
California Delta
ALAMEDA
SAN JOAQUIN
STANISLAUS RIVER
SAN JOAQUIN RIVER



lapped, edited, and published by the Geological Survey

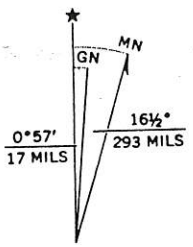
ontrol by USGS and NOS/NOAA

opography by photogrammetric methods from aerial
notographs taken 1974 and planetable surveys 1976
upersedes map dated 1952. Map edited 1978

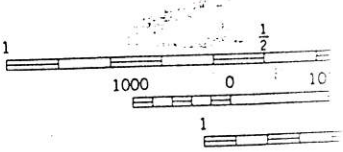
rojection and 10,000-foot grid ticks: California coordinate
stem, zone 3 (Lambert conformal conic)
000-meter Universal Transverse Mercator grid ticks,
one 10, shown in blue. 1927 North American datum

ed tint indicates areas in which only landmark buildings are shown

his map lies within a subsidence area
ertical control based on latest available adjustment



UTM GRID AND 1978 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



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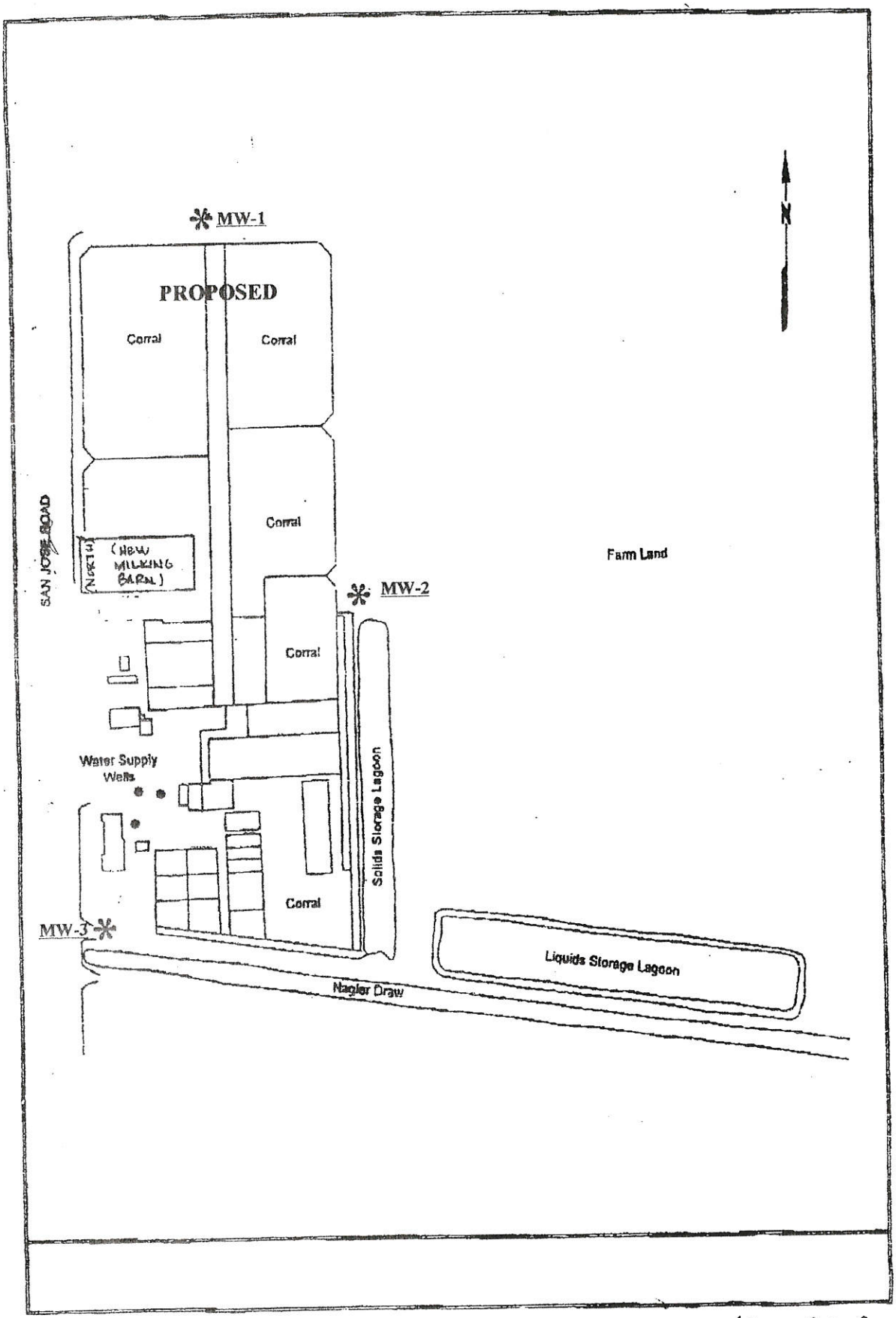
APPENDIX B

Plot Map of Subject Facility - Proposed Future Expansion


MW-1
PROPOSED
Corral
Corral
Corral
NORTH
(NEW MILKING BARN)
SAN JOSE ROAD
MW-2
Corral
Farm Land
Water Supply Wells
Solids Storage Lagoon
Corral
MW-3
Liquids Storage Lagoon
Nagler Draw
N

APPENDIX C

Soil Analysis Reports

REPORT NUMBER
99-036-009

A & L WESTERN AGRICULTURAL LABORATORIES

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Client No: 2778

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VALLEY AG RESEARCH
P.O. BOX 3794
TURLOCK, CA 95381-

GROWER: TOSTA

SUBMITTED BY: DON CHESNEY

DATE OF REPORT 02/09/99 PAGE 1

SOIL ANALYSIS REPORT
(SEE EXPLANATION ON BACK)

SAMPLE NUMBER	LAB NUMBER	ORGANIC MATTER % * RATE	** ENR lbs./A	PHOSPHORUS P_1 (Weak Bray) *** ppm-P RATE	$NaHCO_3$-P (Olsen Method) *** ppm-P RATE	POTASSIUM K * ppm-K RATE	MAGNESIUM Mg * ppm-Mg RATE	CALCIUM Ca * ppm-Ca RATE	SODIUM Na * ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	HYDROGEN H meq/100g	Cation Exchange Capacity C.E.C. meq/100g	PERCENT CATION SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
F123	57401	4.1H	113	74VH	86VH	332M	990VH	3334H	247M	7.3		0.0	26.7	3.2	30.5	62.3	0.0	4.9

SAMPLE NUMBER	NITROGEN NO_3-N ppm-NO_3-N RATE	SULFUR SO_4-S ppm-S RATE	ZINC Zn ppm-Zn RATE	MANGANESE Mn ppm-Mn RATE	IRON Fe ppm-Fe RATE	COPPER Cu ppm-Cu RATE	BORON B ppm-B RATE	EXCESS LIME RATE	SOLUBLE SALTS mmhos/cm RATE	CHLORIDE Cl ppm-Cl RATE	PARTICLE SIZE ANALYSIS % SAND	% SILT	% CLAY	SOIL TEXTURE
F123	18M							L	0.8M					

This report applies only to the sample(s) tested Samples are retained a maximum of thirty days after testing

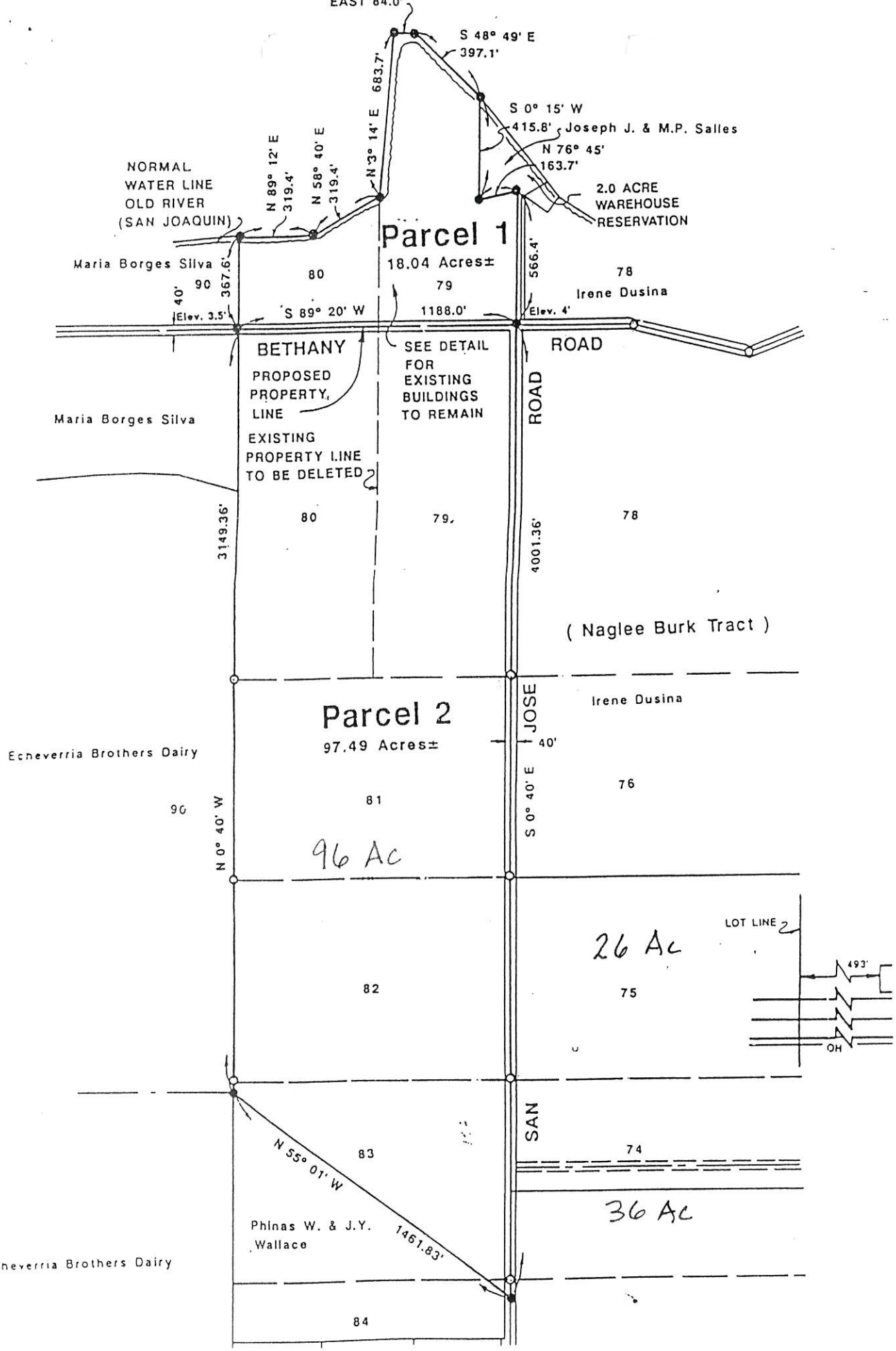
A & L WESTERN AGRICULTURAL LABORATORIES

By MIKE BUTTRESS, CPAg

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), VERY HIGH (VH), AND NONE (-)
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE PPM-P IN SOIL BY 2.3 TO CONVERT TO LBS. PER ACRE P_2O_5
**** MULTIPLY THE PPM-K IN SOIL BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O

APPENDIX D

A.P.N. Maps and Soil Conservation Maps of Cropland


EAST 84.0'
S 48° 49' E
397.1'
683.7'
N 3° 14' E
S 0° 15' W
415.8'
Joseph J. & M.P. Salles
N 76° 45'
163.7'
2.0 ACRE
WAREHOUSE
RESERVATION
NORMAL
WATER LINE
OLD RIVER
(SAN JOAQUIN)
N 89° 12' E
319.4'
N 58° 40' E
319.4'
Parcel 1
18.04 Acres±
Maria Borges Silva
90
367.6'
40'
80
79
78
Irene Dusina
566.4'
Elev. 3.5'
S 89° 20' W
1188.0'
Elev. 4'
BETHANY
ROAD
PROPOSED
PROPERTY
LINE
SEE DETAIL
FOR
EXISTING
BUILDINGS
TO REMAIN
ROAD
Maria Borges Silva
EXISTING
PROPERTY LINE
TO BE DELETED
3149.36'
80
79
78
4001.36'
(Naglee Burk Tract)
Parcel 2
97.49 Acres±
JOSE
40'
Irene Dusina
Echeverria Brothers Dairy
90
N 0° 40' W
81
76
S 0° 40' E
96 Ac
LOT LINE
26 Ac
82
75
493'
OH
SAN
83
74
N 55° 01' W
1461.83'
36 Ac
Phinas W. & J.Y.
Wallace
Echeverria Brothers Dairy
84


ROAD
197
FINCK
RIVER
230
153
159
166
LAMMERS
146
OLD
BETHANY
ROAD
MIDDLE
ROAD
LAMMERS
ROAD
211
274
118
SOUTHERN
PACIFIC
GRANT
LINE
205
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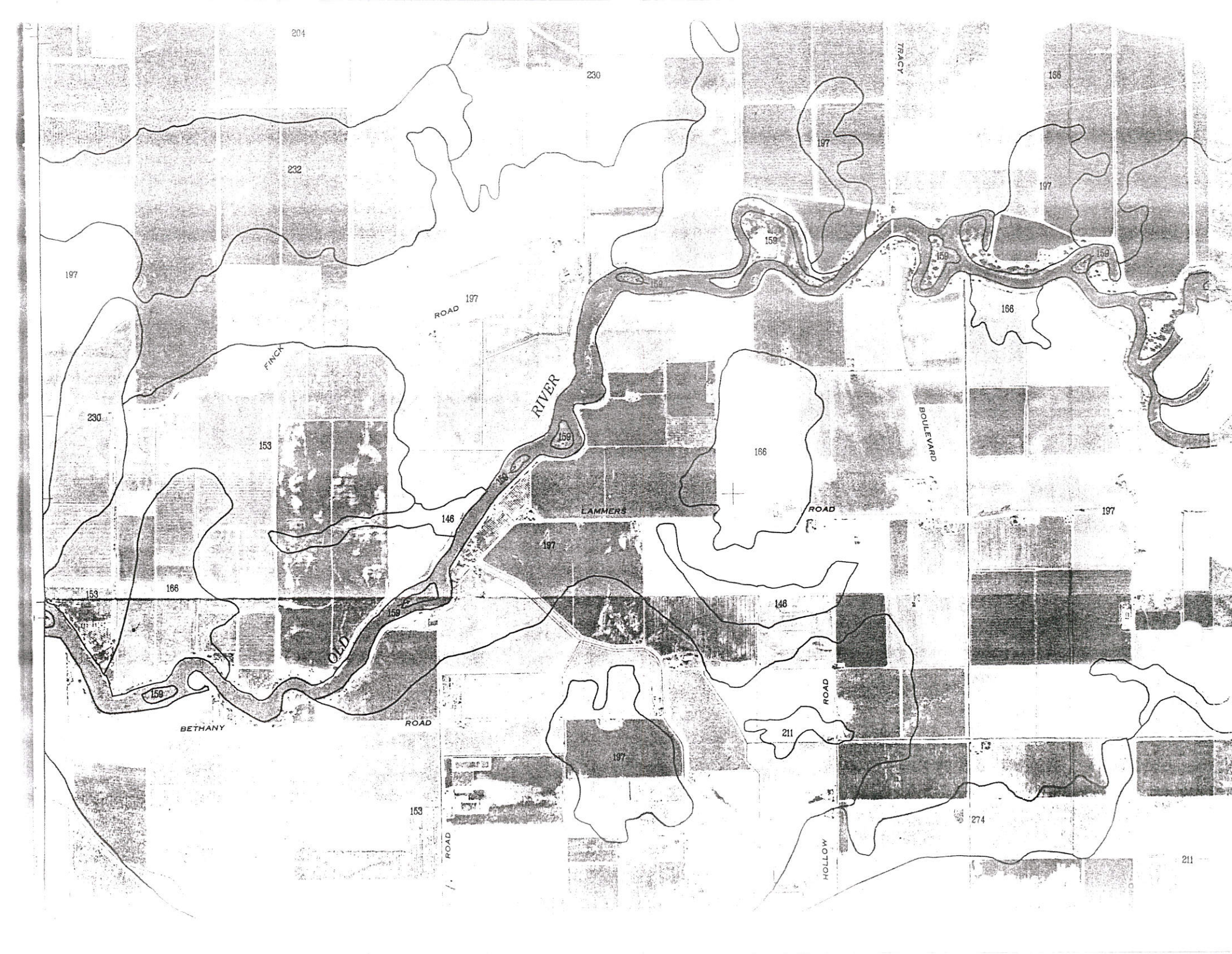
R. 4 E. | R. 5 E.


204
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ROAD
FINCK
RIVER
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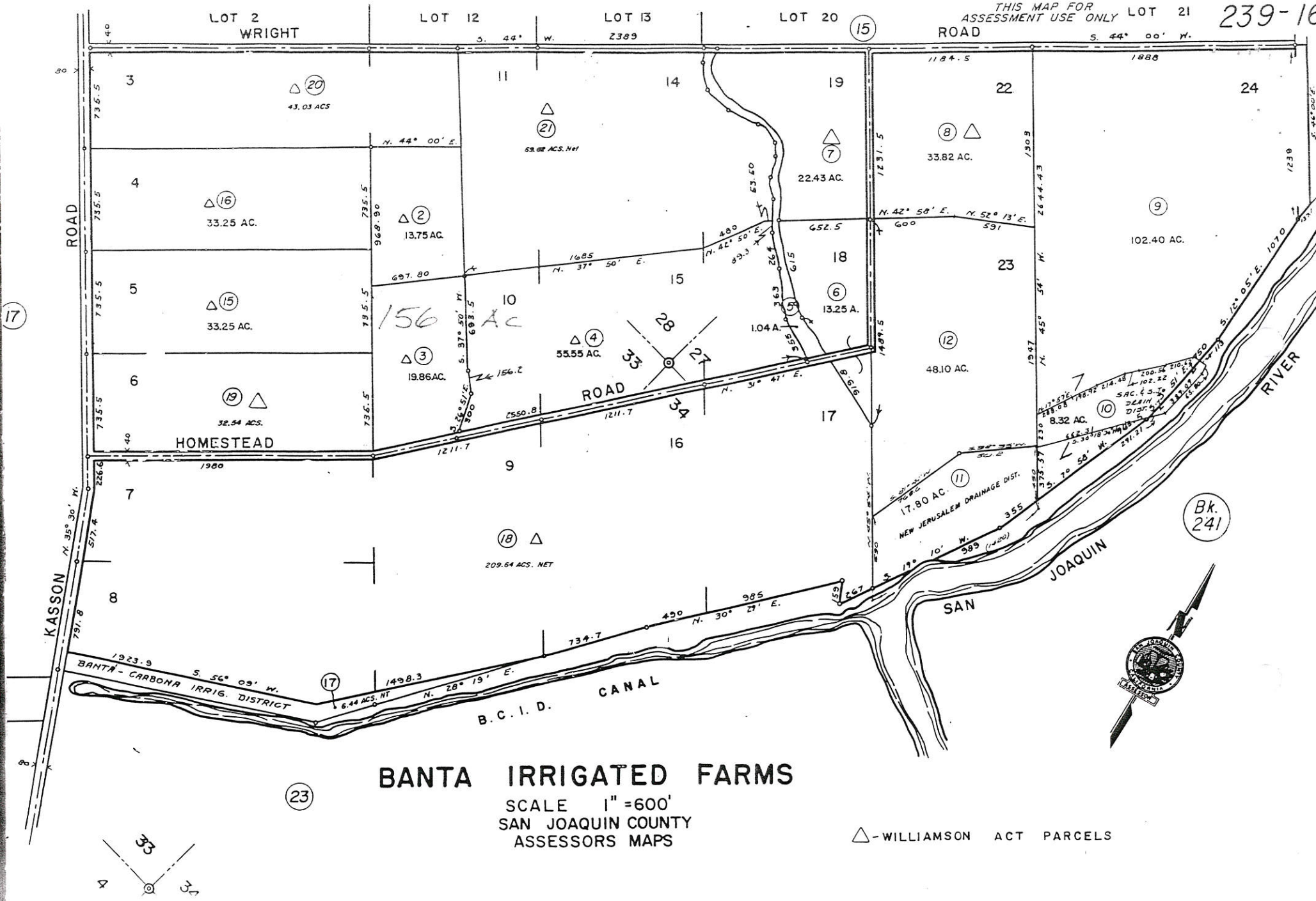
LAMMERS
ROAD
BOULEVARD
TRACY
OLD
BETHANY
ROAD
211
274
HOLLOW
ROAD



BANTA IRRIGATED FARMS

SCALE 1" = 600'

SAN JOAQUIN COUNTY
ASSESSORS MAPS

△ - WILLIAMSON ACT PARCELS


(Joins sheet 24)
SAN JOAQUIN
CANAL
CARBONA
KASSON
ROAD
SANTA
130
97
197
131
144
132
198
167
211
159
274
269
148
133
120

APPENDIX E

Groundwater Analyses

A & L WESTERN AGRICULTURAL LABORATORIES

1311 Woodland Ave. • Ste. #1 • Modesto CA 95351 • (209) 529-4080 • FAX (209) 529-4736

REPORT NUMBER

99-034-003 Client No: 2778 February 16, 1999

Don Chesney
VALLEY AG RESEARCH
P.O. BOX 3794
Turlock, CA 95381

Date Sampled: 02/02/99
Date Received: 02/03/99
Date Completed: 02/11/99

Lab No.	67488	67489	67490
Sample Id.	MW#1 North 4:30	MW#3 South 5:00	Domestic Well 5:30
Total Kjeldahl Nitrogen	5.8 mg/L	6.6 mg/L	2.0 mg/L
Total Dissolved Solids	6588 mg/L	4860 mg/L	604 mg/L
Nitrate	<2 mg/L	5 mg/L	9 mg/L

A & L Western Agricultural Laboratories

Robert Butterfield
Laboratory Director

A & L WESTERN AGRICULTURAL LABORATORIES

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REPORT NUMBER

99-047-063 Client No: 2778 February 24, 1999

Don Chesney
VALLEY AG RESEARCH
P.O. BOX 3794
Turlock, CA 95381

Date Sampled: 02/13/99, 9:00
Date Received: 02/19/99
Date Completed: 02/22/99

Lab No.	67643
Sample Id.	MW# 2 MIDDLE
Total Kjeldahl Nitrogen	10.9 mg/L
Total Dissolved Solids	10304 mg/L
Nitrate	33 mg/L

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Robert Butterfield
Laboratory Director

APPENDIX F

A & L Laboratories - Manure Analysis