

**Investigation of the Taco John's *Escherichia coli* O157:H7 Outbreak
Associated with Iceberg Lettuce**

Final Report

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Executive Summary

On December 14, 2006, the Centers for Disease Control and Prevention (CDC) issued a health alert regarding a foodborne outbreak of *Escherichia coli* O157:H7 that was linked to two Taco John's restaurants located in Minnesota and Iowa in the United States. Approximately 80 individuals were sickened in November and December of that year with no deaths reported.

Investigations conducted by the Minnesota Department of Agriculture and the Iowa Department of Public Health identified shredded iceberg lettuce served in the restaurants as the likely vehicle of transmission with dates of exposure occurring between November 27th, 2006 and December 6th, 2006. Illness onsets were reported to have occurred between November 30th – December 9th, 2006 for the Iowa cases, and December 1st–10th, 2006 for the Minnesota cases. The United State's Food and Drug Administration (FDA), working in conjunction with Minnesota and California public health officials, traced the lettuce to growing regions in California's Central Coast and Central Valley based on information and records collected from a lettuce processor in Minnesota.

Using these traceback findings, the California Food Emergency Response Team (CalFERT) comprised of staff from both FDA and California Department of Public Health (CDPH), was mobilized on December 15th, 2006 to conduct an environmental investigation. Since this investigation covered two growing regions in California, Buttonwillow in Kern County and Santa Maria in Santa Barbara County, two CalFERT teams were dispatched. CalFERT visited several growing fields in both suspect geographical areas. Further investigation, however, was warranted for one implicated farm in the Buttonwillow location (California's Central Valley) due to its close proximity to two dairies and an environmental sample at one of the dairies that was a positive match to the outbreak strain. Also, on this one farm in Buttonwillow, the irrigation and dairy effluent conveyance systems (controlled by the grower) appeared to be combined into a complex piping network — an issue that raised concerns about the potential of microbial cross-contamination between the growing fields of lettuce and nearby dairies.

During the course of the investigation, CalFERT collected 251 samples of water, soil, sediment, swabs (sponge and Moore), fecal matter, and product specimens. These samples were tested for *E. coli* O157:H7 and its shiga toxins. Isolates that were positive for *E. coli* O157:H7 were further analyzed using pulse field gel electrophoresis (PFGE) to determine if the isolates genetically matched the Taco John's outbreak strain. Of the 251 samples collected, 32 samples (~13%) were positive for *E. coli* O157:H7. All 32 positive samples came from the Buttonwillow location. All samples collected in the Santa Maria area were negative for the pathogen. Ten of the 32 positive specimens (~31%) from the Buttonwillow area were determined to genetically match the Taco John's outbreak strain (CDC PulseNet reference # 0612MNEXH-1ml). Of these ten samples (two swabs, four water, three water and sediment, and one soil), six (60%; one swab, one water, three water and sediment, and one soil) were collected in close

proximity to a suspect lettuce growing field, with the remaining four (40%; one swab and three water) coming from the two dairies near the suspect growing farms.

The scope of this report is confined to the potential source fields, harvesters, coolers, and other entities associated with the implicated lettuce as identified by CalFERT.

Background Information

In December of 2006, a foodborne outbreak of *Escherichia coli* O157:H7 was linked to two Taco John's restaurants located in Minnesota and Iowa. Approximately 80 individuals were sickened: 32 in Minnesota (12 confirmed, 20 probable, and one with Hemolytic Uremic Syndrome (HUS), 47 in Iowa (24 confirmed, 23 probable, and two HUS), and a single case in Wisconsin. No deaths were reported. It should be noted that the single case from Wisconsin reportedly ate at 7–9 restaurants during the possible exposure period, one of which was a Taco John's restaurant. Attachment 1 (furnished by the Minnesota Department of Agriculture) provides case definitions and information on the work of both the Minnesota Department of Public Health and the Minnesota Department of Agriculture as related to this outbreak.

Traceback of Implicated Lots

A traceback document review, conducted by the Minnesota Department of Agriculture and the Iowa Department of Public Health, identified shredded iceberg lettuce shipments to Taco John's restaurants from a single processor, Bix Produce Co. (referred to hereafter as Bix, located at 1415 L'Orient Blvd., St. Paul, MN) via Roma of Minnesota, a food service company. The FDA traceback consisted of two legs (IA and MN) which focused on cases with exposure dates between November 27th, 2006 and December 6th, 2006. Traceback records supplied by Bix were incomplete and inconsistent. Therefore, the continuous tracking of specific product shipments from the growing fields to individual restaurants was not possible. Instead, the identification of shipments and their corresponding sources were implicated using a time period approach. By assuming a 12-day shelf life for lettuce, transportation time, and a 2–3 day period at the Taco John's restaurants, the FDA determined that any shipments received at Bix between November 24th, 2006 and November 25th, 2006 and furnished to the two Taco John's restaurants had the highest probability of contamination. In order to further refine this estimate, shipment size was also taken into consideration. These parameters led to the identification of two suppliers of the suspect lettuce: Fresh Kist Produce, LLC (1067 – A Merrill St., Salinas, CA 93901) and Pacific International Marketing (PIM), which does business as Dynasty Farms (740 Airport Blvd. Salinas, CA 93901).

An overview of actual product flow is illustrated in Figure 1. Shipping and purchase order (PO) records obtained by the FDA from each of these suppliers led CalFERT to investigate several farms, dairies, harvesters and cooling facilities in California. Specific

field designations, harvest dates, and harvested amounts implicated by traceback documents are also summarized in Attachments 2 and 3.

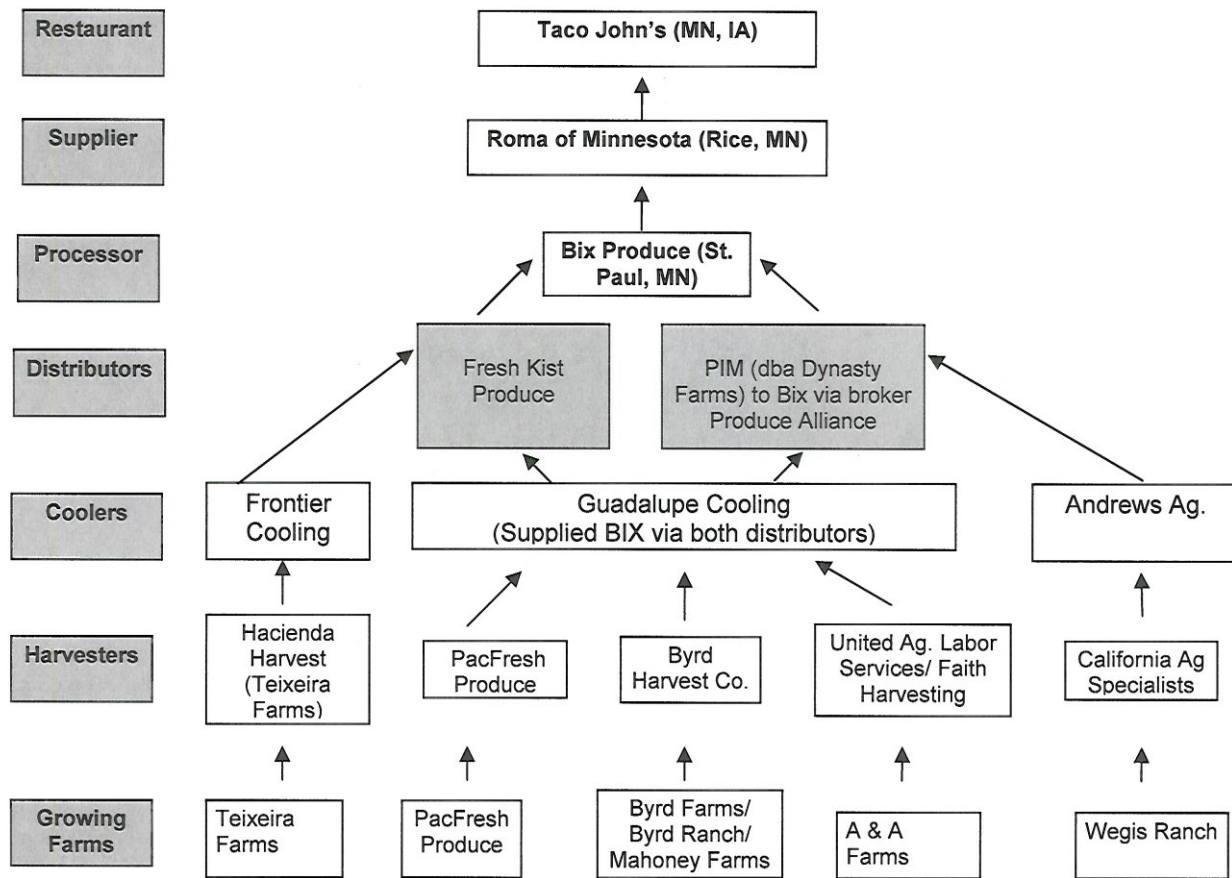


Figure 1. Product flow chart for implicated iceberg lettuce shipments associated with the Taco John's *E. coli* O157:H7 outbreak.

Documents furnished by the Minnesota Department of Agriculture showed that Bix purchase orders matched documents CalFERT obtained directly from Fresh Kist and PIM. Documents reviewed by CalFERT and FDA indicated that two suspected shipments of lettuce were supplied to Bix by Fresh Kist, and at least two other suspected shipments of lettuce were supplied to Bix by PIM via PIM's broker Produce Alliance. Records obtained from Fresh Kist showed that the two lettuce shipments originated from Byrd Farms/Mahoney Farms, PacFresh Produce (dba PacFresh Farms), and Teixeira Farms (Exhibit 1). PIM records showed that their lettuce shipments originated from Wegis Ranch and A&A Farms. The Wegis shipments were harvested between November 10th, 2006 and November 17th, 2006 (Exhibit 2).

More specifically for Fresh Kist, the Bix POs were #208011 = Fresh Kist order #424878, and #208252 = Fresh Kist order #425083 (Exhibits 3, 4). Fresh Kist order #424878 shipped to Bix on November 14th, 2006, implicated Byrd Farms/Mahoney Farms (192

Guadalupe St., Guadalupe, CA 93434). Fresh Kist shipping order #425083 sent to Bix on November 18th, 2006, implicated lots originating from PacFresh Produce (855 N. Blosser Road, Santa Maria, CA) and Teixeira Farms (2600 Bonita Road, Santa Maria, CA) (Exhibit 1).

As for the PIM shipments, the Bix POs were #208139 = PIM order #424641, and #208250 = PIM order #424642 (Exhibit 4). PIM order #424641 shipped to Bix on November 16th, 2006 implicated Wegis Ranch (19000 Wildwood Rd. Buttonwillow, CA) (Exhibits 2, 4–9). PIM order #424642 shipped to Bix on November 18th, 2006 implicated A & A Farms (1615 W. Main St, Santa Maria, CA 93458) (Exhibits 2, 9, 10). On the Buttonwillow PIM traceback leg, a number of business entities were involved in the movement and/or handling of suspect shipments. A summary of the business relationships among the different entities is as follows (Figure 2).

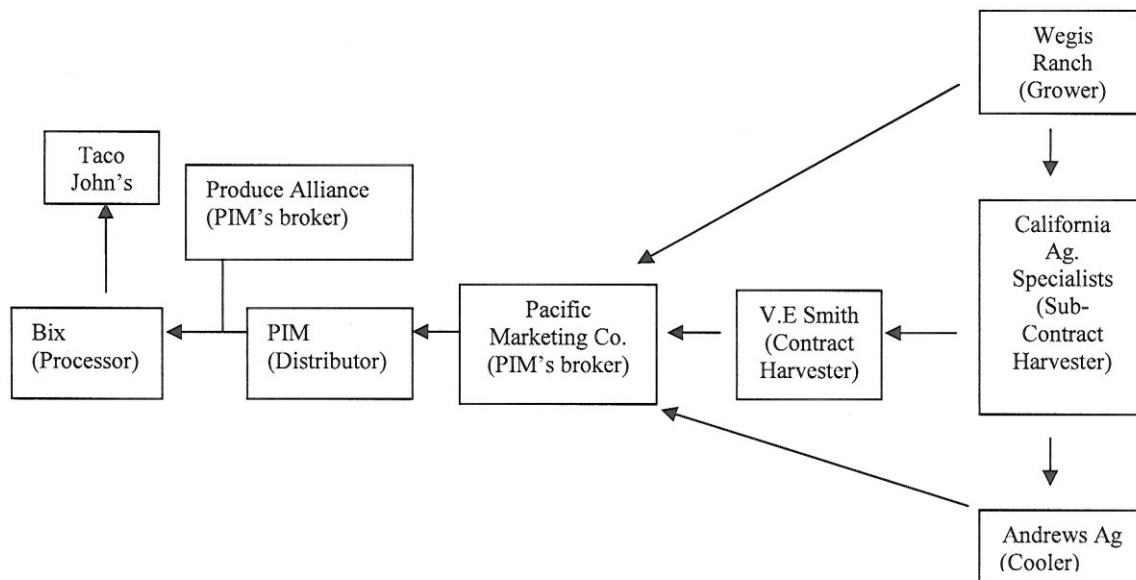


Figure 2. Business relationships relating to the Buttonwillow lettuce shipments to Bix originating at Wegis Ranch.

According to Mr. Kirk Johnston (Director of Food Safety/Quality Assurance at PIM), PIM contracted its purchase order management to Produce Alliance. PIM also contracted with Pacific Marketing Company (no relation to PIM) to arrange and schedule PIM's harvesting operations. PIM supplied lettuce to Bix through Produce Alliance. PIM is a grower-shipper that normally ships produce grown by its own growers. However, during "transitional periods" (described by the firm as the off-season or any period of operational down-time), PIM temporarily outsources both their lettuce growing and harvesting operations. Pacific Marketing Company contracted the harvesting of the lettuce grown on Wegis Ranch to V.E Smith, Inc. Neither Pacific Marketing Company nor V.E. Smith actually handled the product. V.E. Smith, in turn, sub-contracted the

actual harvesting to California Ag. Specialist. California Ag. Specialist harvested the suspect product and transported it to the cooler, Andrews Ag. Inc. Pacific Marketing Company informed CalFERT investigators that they had the same contracts and subcontracts for harvesting all suspect lettuce fields at the Wegis Ranch.

Traceback and document reviews conducted by FDA identified Byrd Farm 1 and Wegis Ranch as the most probable sources of the lettuce at the grower level for the time period of interest. The FDA review also identified Byrd Farms/Mahoney Ranch and Teixeira Farms as possible, but not probable, sources of the lettuce at the grower level. Based on available information, two CalFERT teams were mobilized to conduct environmental investigations. One team was deployed to the Santa Maria area to investigate A & A Farms, Byrd Farms Ranch 1, Byrd Farms/Mahoney Farms, PacFresh Farms, and Teixeira Farms. A second team was deployed to the Buttonwillow area to investigate Wegis Ranch. Information on the environmental investigations of both teams is detailed in the following environmental investigation sections.

Environmental Investigations

I. Santa Maria Area

In December of 2006, CalFERT members visited Santa Maria area firms in response to the Fresh Kist and PIM outbreak traceback legs. The farms listed in Figure 1 were investigated based on available information at the time. The FDA traceback review directed the team to conduct farm investigations for A&A Farms Ranch 4 lot #05 (also referred to as Ranch 405) and Byrd Ranch. The team was also directed to visit other possible farms (mentioned earlier) identified in the traceback and note any major food safety issues. Environmental investigation activities in the Santa Maria area can be found in the following sections.

A&A Farms – Ranch 405 (1615 W. Main St, Santa Maria, CA 93458)

On December 16th, 2006 CalFERT members met Mr. George Adams, President, A&A Farms at Ranch 4 lot #05 (Exhibit 11). The 9.9 acre field was surrounded by other farmland and was barren at the time of the investigation. Neither compost nor manure had been applied to the ranch in the past five years according to Mr. Adams. Three wells supplied water to drip irrigate the lettuce crop of interest. Water samples were collected from each well by CalFERT investigators. Environmental samples from the surrounding area including pond water, canine feces, sediment, and agricultural ditch water were also collected. All samples tested negative for *E. coli* O157:H7 (Attachments 4, 5). Well samples tested by a ranch auditor, Primus Labs, on July 17th, 2006 were reported at ≤ 1 MPN (Most Probable Number) for both total coliforms and *E. coli* (Exhibit 12). Primus Labs had last audited the ranch on August 18th, 2006, and the reported audit score was 100%.

Approximately [REDACTED] pounds of head lettuce was harvested on November 10–17, 2006 into fiber bins by United Ag Labor Services, Inc. (1204 W. Cook St, Santa Maria, CA 93458). The harvest method was conventional cut (i.e., the lettuce was not field cored). All harvested product was vacuum cooled by Guadalupe Cooling (2040 Guadalupe Road, Nipomo, CA). At the time of this investigation, lettuce was not being harvested and therefore harvesting practices were not observed. United Ag Labor Services was not visited. There was no flooding in field 405 according to Mr. Adams. Precipitation in Santa Barbara County was reported at 0.10, 0.16, and 0.31 inches for the months of September, October and November of 2006, respectively (source: California Irrigation Management Information System, CIMIS, Central Coasts Valleys – Santa Barbara – station #107).

Mr. Adams stated that the ranch had minimal animal intrusion and that seagulls occasionally landed on the field. Hornlarks, blackbirds, and rodents were the most common animals frequenting this field. Bomb canisters were used after seed planting to discourage birds from eating the seeds. Canine tracks and feces were observed near the small drainage ponds located on the adjacent ranch to the east. Canine tracks and gopher mounds were also observed on Ranch 405 by CalFERT investigators. There were no dairies or feedlots nearby.

Water samples collected from these ponds and fecal specimens from the aforementioned location were found negative for *E. coli* O157:H7. Environmental samples collected from this location were all negative for *E. coli* O157:H7.

According to ranch management, workers received Good Agricultural Practices (GAPs), sanitation, and Standard Operating Procedures (SOPs) training upon hire. Monthly meetings also provided continued training. A permanent porta-pottie was located on the ranch and was adequately supplied with soap and water at the time of the investigation. The towel dispenser was empty on the day of this CalFERT visit. However, there were no workers on the ranch and the field was barren during the CalFERT visit.

Byrd Farms

The traceback investigation identified the following ranches as having supplied product to Fresh Kist: Byrd Ranch Farms including Byrd Ranch 1 (Fields P–3, P–9, P–10), Mahoney Ranch (14–6), Teixeira Ranch (1405, 1406), and PacFresh Ranch (10–06). CalFERT investigators surveyed the following suspected fields.

Byrd Ranch 1 (192 Guadalupe St., Guadalupe, CA 93434)

On December 20th, 2006 and January 17th, 2007, CalFERT members met Mr. Jon Freitas, Grower – Byrd Ranch 1 and Mr. Jimmy Draper, Harvest Manager – Byrd Farms at Byrd Ranch 1 (Exhibit 13). Byrd Ranch was approximately 170 acres of farmland surrounded by other farmland and a county road (Black Road). The traceback investigation identified Fields P–3 (10.52 acres), P–9 (11.07 acres), and P–10 (11.61 acres) as having supplied iceberg lettuce to Fresh Kist during the time period of interest.

Water samples were collected from the one well supplying Byrd Ranch 1, and results were negative for *E. coli* O157:H7 (Attachment 4). Compost was not used on any of the fields on Byrd Ranch 1 under Byrd Farms cultivation in 2006 according to Mr. Adams. Red Blossom Berries sub-leased fields on the Ranch for strawberry crops. Lettuce and strawberry crops were rotated every 1–2 years. Mr. Freitas stated that gophers and squirrels were a common sighting on the ranch. Bait stations and traps were used year round. CalFERT investigators observed canine, raccoon, and small mammal tracks, possibly opossum, in the agricultural ditches bordering fields of the ranch.

A permanent porta-pottie was located at the maintenance yard one-half mile from the furthest corner of the ranch cultivated by Byrd Farms. The porta-pottie was supplied with soap, water, and towels at time of this investigation. Byrd Ranch 1 was located approximately 0.5 miles from a 200 head sheep ranch to the east, adjacent to a waste water treatment facility to the north, and within 0.7 miles of a biosolid and green waste composter to the northwest. Mr. Freitas told investigators that Byrd Ranch hired Primus Labs as a third party auditor and that Byrd Ranch had always received high audit scores. The last Primus audit was April 2006.

On December 20th, 2006, CalFERT investigators observed more than ten areas with used toilet paper (no feces) in a clump of trees on an adjacent ranch (owned by Ted Ferrari Revocable Trust, leased and operated as Agro-Jal Farms, Inc. Ranch 7, Santa Maria, CA) northwest of Byrd Ranch 1. Agro-Jal Farms, Inc. Ranch 7 had workers in the field on December 20th, and CalFERT investigators observed portable toilets on the premises being used by the workers. The location where the toilet paper was observed on Agro-Jal Farms, Inc. Ranch 7 was approximately 0.5 miles from the middle of Byrd Ranch 1 Field P–10.

On January 17th, 2007 CalFERT investigators observed several clumps of feces with toilet paper on the south side of Byrd Ranch 1. The feces and toilet paper were observed among unused equipment stored next to a berm. Mr. Freitas stated that his workers had access to the porta-pottie at the yard which was approximately one-half mile from the feces and one-quarter mile from the fields of interest. Mr. Freitas said he believed workers from the strawberry fields had defecated on the ranch. Red Blossom Berries sub-leased part of Byrd Ranch 1 from Byrd Farms. Red Blossom Berries also sub-leased to other growers. Mr. Freitas stated that he would contact David Lawrence, Farm Manager, Red Blossom Berries and discuss the problem and make sure that the practices were discontinued immediately. CalFERT investigators collected a sample of the feces. The sample tested negative for *E. coli* O157:H7 by Food and Drug Laboratory Branch, FDLB (Attachment 4).

On January 24th, 2007 CalFERT investigators revisited the Byrd Ranch 1 and saw that a fence had been installed to prevent vehicles from entering Byrd Farms fields from “off-road” areas. Mr. Freitas stated that he planned to install locked gates on the farm roads to further prevent vehicles from entering Byrd Ranch farming operations. The area where the feces were observed on January 17th, 2007 was cleared of trash and there

were no signs of human feces. Mr. Freitas stated that he planned on removing unused farm equipment from the area. On May 15th, 2007 a CalFERT investigator observed this area to be cleared of unused equipment. Locked chains across dirt ranch roads prevented vehicle access from the Red Blossom sub-leased fields onto the fields farmed by Byrd Farms.

On January 24th, 2007 CalFERT investigators informed Mr. Eric Gamble, Manager, Agro-Jal, of the observation on Agro-Jal Farms, Inc. Ranch 7. Mr. Gamble stated he would have the waste removed and have his ranch manager meet with the field supervisors to discuss the problem. On May 15th, 2007 Mr. Gamble accompanied a CalFERT investigator to Ranch 7 and it was observed that the area had been altered, and there was no evidence of human waste.

Approximately [REDACTED] bins total of field cored lettuce grown from seedlings were harvested by Byrd Harvest Company at Byrd Ranch 1 on three separate dates in November 2006 (11/12, 11/13, and 11/20). The seedlings were sprinkler irrigated for the first two weeks and then drip irrigated until harvest. All chemical fertilizers were injected through the drip system.

Mr. Draper, Harvest Manager, reported that calcium hypochlorite with a target level of [REDACTED] ppm free chlorine was used for water during harvest operations. Harvest operations were not being conducted at the time of the CalFERT visit, and therefore investigators could not observe these practices. The lettuce was vacuum cooled by Guadalupe Cooling.

Mahoney Brothers Ranch 14–6 (192 Guadalupe St. Guadalupe, CA)
Teixeira Farms Ranch 1405 and 1406 (2600 Bonita Rd. Santa Maria, CA)
PacFresh Produce, Inc. Ranch 10–06 (855 Blosser Rd. Santa Maria, CA)

Traceback and document reviews conducted by FDA identified the above ranches: Mahoney Brothers Ranch 14–6 (20 acres; cooler: Guadalupe Cooler), Teixeira Farms Ranch 1405 (23 acres) and 1406 (15.5 acres) (cooler: Frontier Cooler), and PacFresh Produce (10.85 acres; cooler: Guadalupe Cooler) as additional possible sources of lettuce. On December 19–20, 2006 CalFERT investigators visited the above identified ranches, conducted interviews with the growers, and surveyed the fields. Wells were the water source used for all ranches. None of the ranches were located adjacent to wildlife areas or open canals or rivers. The Teixeira and PacFresh ranches were barren at the time of this investigation. Eight acres of the Mahoney Ranch were barren and twelve acres were planted with broccoli. Investigators did not collect any samples from the above farms as no egregious conditions or practices were observed.

II. Buttonwillow Area

Wegis Ranch (19000 Wildwood Rd., Buttonwillow, CA 93206)

According to documents obtained from PIM (Exhibits 6, 7), Wegis Ranch provided Bix Produce with ■ bins (■ pounds) of conventional iceberg lettuce with harvest dates of November 13–16, 2006 (Field 212 lot #4). Wegis Ranch provided Bix with other shipments of head lettuce harvested between November 10–14, 2006. CalFERT investigators visited Wegis Ranch, interviewed Wegis Ranch management (Mr. Mike Young, Mr. Richard Young, Mr. Greg Wegis, and Mr. Rick Wegis all co-partners), and conducted an environmental investigation relating to the suspect lettuce growing fields. Initially, Field 212 lot #4 was assessed (Exhibit 14). However, the investigation was expanded to include other suspect fields (Field 212 lot #5, Field 207 lot #6, and Field 227 lot #3) as more information became available via the traceback process. Another factor that led to the expansion of the investigation was the observation of two dairy farms in close proximity to Wegis Ranch and its suspect lettuce growing fields (Figure 3). In the course of this investigation, numerous samples were collected including air, soil, fecal matter, environmental swabs, and water (see Attachment 5 for details).

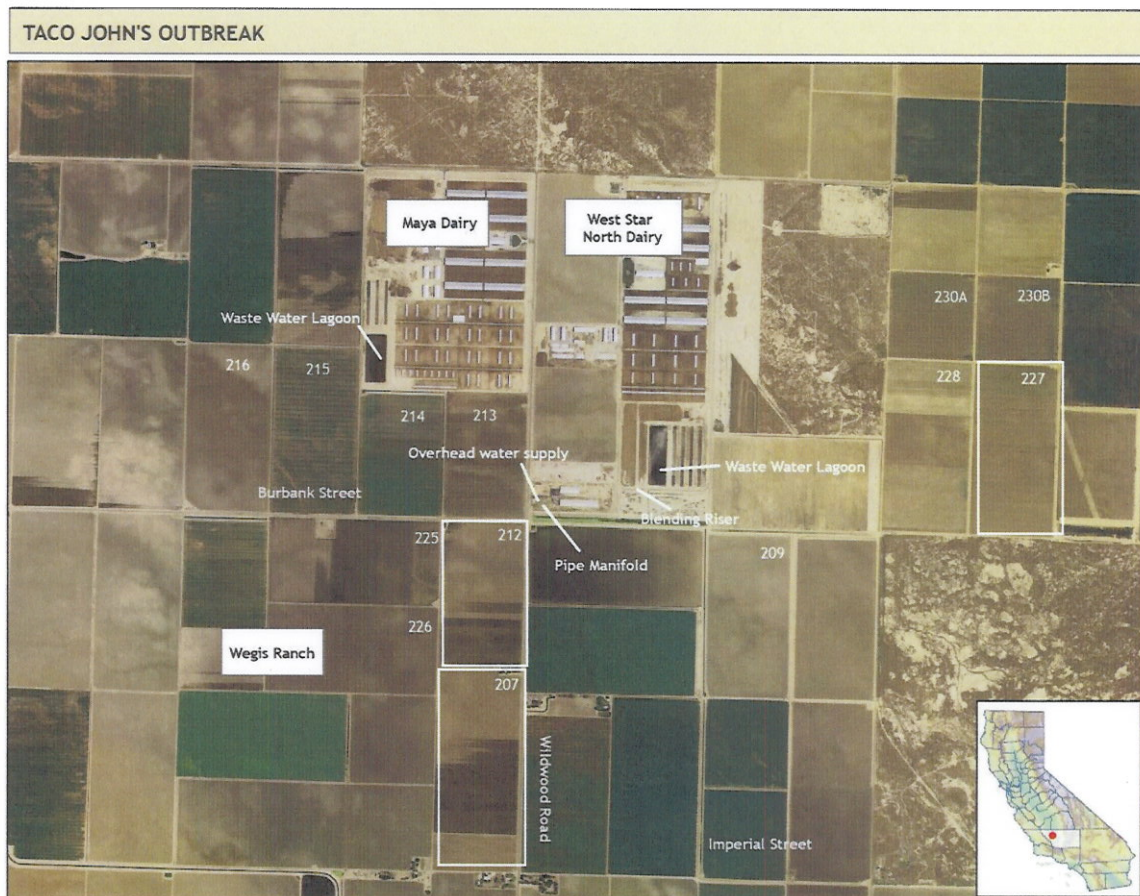


Figure 3. Map of Wegis Ranch and vicinity

Wegis Ranch Lettuce Growing Fields

CalFERT determined that Wegis Ranch grew crops for human consumption (lettuce and tomatoes for processing) on Wegis Ranch grounds (Field 212 = 70.3 acres, Field 207 = 71.44 acres). Wegis Ranch also grew food crops (lettuce and cucumbers for processing) on land owned by West Star North Dairy that encompasses suspect Field 227 (73.34 acres).

CalFERT investigators visited Field 212 lot #4 (17.15 acres) first on December 17th, 2006 and verified that Wegis Ranch did grow conventional iceberg lettuce on the field (Exhibit 15). Field 212 lot #4 was planted on September 2nd, 2006 and harvested November 13–16, 2006. Prior crops on Field 212 lot #4 were tomatoes for processing and corn (for animal feed, silage, only) according to Wegis management.

In addition to Field 212, Wegis Ranch also grew iceberg lettuce on Fields 207 and 227. According to Wegis Ranch planting and harvesting records, Field 207 lot #6 (17.44 acres) was planted on September 8th, 2006 and harvested on November 25–27, 2006 while Field 227 lot #3 (18.9 acres) was planted on August 31st, 2006 and harvested between November 18–21, 2006. For Field 207 Lot #6, records from Pacific Marketing Co. showed harvest dates of November 24–27, 2006 (Exhibit 15).

Wegis Ranch had barley (animal feed crop) growing on the northern 18 acres and southern 18 acres of Field 212 at the time of CalFERT's initial visit to the area. Wegis management stated that the barley was irrigated with district water¹ (Semitropic Water Storage District, SWSD, 1101 Central Avenue, Wasco, CA 93280-0877) since it was on a field used for planting crops for human consumption. The SWSD distributed water from the California Aqueduct.

Field 207 (directly south of Field 212) was also irrigated using water provided by SWSD. At the northeast corner of Field 212, investigators observed a water gate valve that delivers district water through an underground conduit for the east side of Fields 212, 207 and 213, as well as the north side of Fields 212 and 225.

Field 227 was irrigated using well water, and the well providing the water for the field was located on the northeast corner of the parcel. The well on Field 227 had not been tested microbiologically, and only standard well tests (e.g., pump efficiency, pH of water) were performed. CalFERT tested the well water and the result was negative for *E. coli* O157:H7. Wegis management informed investigators that during the investigation, they tested the well for *E. coli* O157:H7 via an independent laboratory, and test results were negative for the pathogen.

Irrigating practices were the same for all three fields (212, 207, and 227) used to grow lettuce. The lettuce was sprinkler irrigated at planting and for two weeks after planting. Thereafter drip irrigation (filtered through ■■■ mesh screen made of polypropylene

¹ The term "district water" is used throughout the report to mean water supplied by the Semitropic Water Storage District (SWSD).

resin) was used along the length of the field. Mr. Michael Young (co-partner) stated that a dilute chlorine solution (■ ppm) was flushed through the drip lines once a week to prevent algae growth. Mr. Young also stated that tail water (runoff water that has drained from an irrigated field) and reservoir water were not used for irrigation. Additionally, there was no reported flooding in Fields 212, 207, and 227. Precipitation in the area was reported as zero, 0.27, and 0.04 inches for the months of September, October and November of 2006, respectively (source: CIMIS, San Joaquin Valley – Shafter/USDA – station #5).

At the northwest corner of Field 212, CalFERT members observed a “holding pond” that appeared to collect waste run-off water from Field 212. A smaller pond and ditch located in the northwest part was also seen. Along the west side of Field 212, there was what appeared to be a drainage ditch, mostly dried, but still containing water further west. There was also a manhole (approximately at the middle of the perimeter of the west side of Field 212) with “SWSD” imprinted on it. Almost all fields were separated by dirt roads except for Fields 207 and 212.

Wegis management informed investigators that three types of fertilizer (10–34–0, liquid ammonium sulfate; CAN17, calcium ammonium nitrate; and An20, ammonium thiosulfate) were used through the irrigation system for the lettuce. Pesticides were applied by aerial spray, and no biological pest control was used.

A labor contractor supplied toilets for the contract employees, and also provided training in sanitation. At approximately 0.5 mile south of Field 212 lot #4, CalFERT members observed a porta-pottie labeled as JA (the labor contracting firm). This toilet had no toilet paper in the north stall which was full to capacity with human fecal matter. This issue was brought up to the attention of Wegis Management for addressing. No field workers (e.g., harvesting crew) were in Field 212 at the time as the field was barren (all three suspect fields had no lettuce on them at that time). According to Wegis management, farm workers use the restrooms located at the management office on the Wegis Ranch premises and porta-potties are furnished for the field workers.

According to Wegis management, ranch employees operated farm machinery, but contract employees were used for weeding. Farm equipment was stored at a farm yard about 0.5 mile northeast of Field 212. The farm equipment yard was observed to be adjacent to a hay cubing facility. Mr. Michael Young stated that the farm equipment was used on all of the farms and ranches, but that certain implements were used only on the lettuce fields. Further conversations with Wegis management revealed that five tractors (model TM 165) were used in all of the fields, suggesting that they were used in multiple locations in addition to the lettuce fields. Mr. Young noted that the lettuce fields were “no till” (i.e., planting crops without prior seedbed preparation such as plowing). Underground permanent drip tape was using for irrigation purposes. The beds were “fully tilled” once a year prior to planting the crop. They were also cultivated once during the growing of the crop.

During a CalFERT visit to the West Star North Dairy on December 19th, 2006, the team observed that the irrigation pipes from the Wegis Ranch equipment storage yard were stored approximately 50 feet from the cattle biosolids from West Star North Dairy. The Wegis Ranch equipment storage yard was adjacent to the west of West Star North Dairy's composting operations. There were two ditches (one lined with concrete) approximately 3 feet deep and 3 feet wide serving as physical obstacles between the farming equipment and the dried manure compost piles. There was also a pond with standing water along the south end of the compost yard of West Star North Dairy and the equipment storage yard of Wegis Ranch.

During the investigation, CalFERT members examined the perimeter of Field 227 (73.34 acres). Field 227 was higher than the adjoining Field 228 by about 6 feet, and was separated by a service road, ditch, and berm (about 15 yards separate the two fields). Field 228 was a field being irrigated with blended lagoon and district water (see Overview of Water Irrigation System: Wegis Ranch, Dairy Farms and Vicinity section). The north side of Field 227 was lower than Field 230B and a newly planted pistachio orchard was observed to be directly to the East (Figure 3). According to Mr. Michael Young, the orchard is owned by Gardner Farms and managed by Mr. Geordy Wise.

Canine tracks were observed on the road along the east side of Field 227 and along the road on the west side of the pistachio orchard. A scat sample (type unknown) was collected from the road directly west of the pistachio orchard. The sample was later tested and determined to be negative for *E. coli* O157:H7. Rodent burrows were observed along the banks of the berm separating the pistachio orchard and Field 227, and rabbit tracks were also identified. Mr. Michael Young stated that there were many ground squirrels in the embankment, and jackrabbits enter the field both from the pistachio orchard east of Field 227 and from the open desert to the south. A fence on the south side of Field 227 was installed to prevent the access of rabbits to the field. Mr. Michael Young reported that at the south end of Field 227, they replanted lettuce because of damage by jackrabbits. This lettuce was not harvested because of the rabbit damage.

In addition to rattlesnakes and garter snakes inhabiting the area, egrets were also observed in fields. CalFERT learned from the United States Department of Agriculture's (USDA) wildlife specialist, via Mr. Joe Bennett, that the Buttonwillow area has had problems with mud hens (i.e. American coots) that graze in fields.

During a follow up visit, investigators walked again around the east perimeter of Field 212. The east and south perimeters of Field 207 were also examined. No significant observations were found around these areas relative to earlier findings. The team, however, examined a mixing pipeline area at the southern section between Field 215 and Field 214 (both located northwest of suspect Field 212 and separated from Field 212 via Burbank St.; Figure 3). It was determined that this area contained a district water pipeline, an irrigation well, and a pipeline which (according to Mr. Michael Young) carries manure water from the Maya Dairy (Exhibit 16). This finding was investigated

further and details are provided under the sections pertinent to the dairies and the area's water conveyance system below.

Animal activity and potential sampling sites were assessed for Fields 212, 207, and 227. Several blackbirds were observed in the distance west of Field 212. Other birds were also seen in a large water puddle due north and adjacent to the Maya Dairy waste water lagoon. Small birds were a problem at germination of planted crops and noise devices were used to discourage them. Mr. Young stated that sheep were used by the West Star North Dairy for grazing on the alfalfa fields. Mr. Young reported that sheep were not used on Fields 207, 212, or 227 and that sheep only grazed on alfalfa fields on the west side of Wildwood Road of the Wegis Ranch. Sheep grazed on the alfalfa fields over the winter, were transported to mountain grazing land in the spring, and slaughtered in the summer. Exhibit 17 and Figure 3 provide information on Wegis Ranch crop rotation from 1995–2007 and location of fields.

Based on conversations with Wegis Ranch management, coyotes, ducks and geese were occasionally observed in the area. There was evidence of animals with prints and scat. Dogs living at houses adjacent to the ranch were known to roam in the fields, and tracks were observed. Two large canines running along the east side of Field 212 were observed.

Wegis Ranch Lettuce Harvesting and Cooling Operations

CalFERT members asked Mr. Michael Young on December 19th, 2006 about the water source that would have been used by the harvester. Mr. Michael Young called Mr. Greg Wegis (co-partner) to ask if he had given permission to the harvester to use ranch water. Mr. Greg Wegis indicated that he had told the harvester to use the overhead water filler, located north of Field 211 adjacent to the hay cubing facility on the premises (Figure 3), to obtain the water used to spray the lettuce after harvest. The source of water from the overhead filler was district water which was not chlorinated. Wegis does not chlorinate the water, but the harvester may during the harvesting operations (see following harvester section). The water from the overhead filler was used for all harvested fields. When investigators sampled from this overhead filler, it was noted that the water was initially brown in color before becoming clear. This sample was found to be negative for *E. coli* O157:H7.

On December 18th, 2006, the harvester and cooler were contacted and inquiries were made focusing on Wegis Ranch Field 212 lot #4. Additional interviews and assessments were conducted regarding Wegis Ranch Field 212 lot #4 and #5, Field 207 lot #6, and Field 227 lot #1 and #3 (January 8th, 2007) as more traceback information became available. Details on the harvesting and cooling operations are provided in the "Harvester" and "Cooler" sections. CalFERT obtained lettuce harvesting documents from Mr. Michael Young who originally received them from Pacific Marketing Co. These documents detailed harvesting dates, amounts of lettuce harvested, type of lettuce harvest (regular/cored), and types of containers used for the identified fields of interest (Exhibit 15).

Documents provided by Pacific Marketing Co. showed regular and cored lettuce were harvested from the fields of interest on the implicated dates (Exhibit 15). The contents of these documents are summarized below in Table 1. Shipment information has been cross-referenced and summarized in Attachment 3.

Table 1. Wegis Ranch harvest dates and amounts

Field/lot	Harvest Date	Type of Lettuce (# of Harvested Bins)
212-4	11/14/06	Regular (■ bins); Cored (■ bins)
	11/15/06	Regular (■ bins); Cored (■ bins)
212-5	11/22/06	Regular (■ bins); Cored (■ bins)
207-6	11/24/06	Regular (■ bins); Cored (■ bins)
227-1	11/13/06	Regular (■ bins); Cored (■ bins)
227-3	11/20/06	Regular (■ bins); Cored (■ bins)
	11/21/06	Regular (■ bins); Cored (■ bins)

Harvester – California Ag. Specialist (179 West Deodar Lane, Lemoore, CA 93245)

Mr. Bill Rangel, Owner, California Ag. Specialist was interviewed by telephone on December 18th, 2006 by CalFERT. The phone interview was conducted because the harvest crews and equipment were in California's Imperial Valley at the time of investigation. No samples were collected as the interview did not entail a site visit. CalFERT members collected information from Mr. Rangel pertaining to Wegis Ranch Field 212 lot #4. Field 212 was the primary field of interest at the time based on available traceback information provided by FDA's Office of Emergency Operations. As more information became available investigators collected additional data regarding Fields 207 and 227 on the Wegis Ranch (as indicated in the preceding section).

According to the Bill of Lading for the product shipped by Pacific Marketing Co. to Dynasty Farms (PIM) (Exhibits 2, 7), the lettuce was harvested as "regular" rather than "clean/cored". Mr. Rangel stated that for this type of harvest, the heads were cut with a knife, placed on a conveyer, sprayed with a solution of ■ pounds of salt per 1000 gallons of water, and dropped into a bin. Certain clients of the firm required the use of salt water for quality purposes. The bins were constructed of corrugated cardboard lined with plastic. The water used was supplied by the Wegis Ranch, and Wegis management confirmed that indeed they did supply the water via the overhead water supply (Figure 3). The bins were transferred to Deniere flatbed trailers (owned by V.E. Smith) and moved to Andrews Ag Inc. for cooling. The knives used in the process were stainless steel with a coring ring on the handle and were supplied by the harvest firm. According to Mr. Rangel, the knives were collected in buckets containing chlorine solution (■ ppm total chlorine) at each break and at the end of the day. The conveyer

belts were cleaned daily with a high pressure washer with hot water and sanitized with [REDACTED] ppm (total chlorine) chlorine sanitizer. The firm supplied disposable gloves, hairnets, and aprons to the harvest workers. Mr. Rangel stated that the average time to fill 12 bins carried by one flatbed was 20 minutes. The bins were covered with a tarp for transfer to the cooler. The tarp was cleaned periodically (not specified).

On May 15th, 2007 a CalFERT investigator interviewed Mr. Jesus Ochoa, Harvesting Operations Manager, California Ag. Specialist. Mr. Ochoa was responsible for overseeing two lettuce harvest crews. Mr. Ochoa reported that workers received food safety training when they were hired and then given brief "refreshers" every two weeks. The workers were trained to remove their rubber gloves during breaks. Upon returning to work after breaks or at the beginning of the day, workers were trained to dip their gloved hands into a bucket with chlorinated water. The harvest knives were dipped into a bucket of chlorinated water at the beginning of the day and after breaks. As mentioned earlier, Mr. Ochoa stated that the target chlorine level for the dip bucket was [REDACTED] ppm total chlorine (which was observed to be inconsistent with Mr. Rangel's statement that the knives were collected in buckets containing [REDACTED] ppm total chlorine). The harvest crew foreman took the knives and aprons home each day. The aprons were reportedly hosed off by the foreman at his house each night. Aprons were replaced every two weeks and new gloves were issued every three days or when needed.

Spray water used on the harvest table was provided by a 300 gallon tank. A 1,000 gallon nurse tank was used to fill the smaller tractor tank. Mr. Ochoa stated that district water was used in both of these tanks during the 2006 harvest on the Wegis Ranch. One gallon of household bleach was added to the 1,000 gallon tank before filling it with district water. The water from this tank was subsequently used to fill the tractor tank. Chlorine tablets (Kem-TER, active ingredient 95% trichloro-atmazine-trione) were added to the tractor tank before filling. Mr. Ochoa stated that the target level of chlorine for the water in the tractor tank was [REDACTED] ppm total chlorine. Mr. Ochoa stated that he puts in [REDACTED] swimming pool chlorine tablets per harvest tractor water tank (300 gal) before filling the tank with water. He also added that when they do not use the entire tank of water in a day, they will add [REDACTED] more tablets the next day if they add more water to the tractor tank.

Mr. Ochoa stated that "[REDACTED]" were used to measure the chlorine levels in harvest sanitized water. The strips measured total hardness, total chlorine, free chlorine, bromine, pH, total alkalinity, and stabilizer. Mr. Ochoa demonstrated how to use the test strip to the CalFERT investigator. However, he held the strip upside down in relationship to the "diagnostic chart". When it was pointed out to him that he held the strip upside down he stated that it didn't matter just as long as "it was all purple." The marker for total chlorine was in fact a faint pink which was probably due to the fact that the water being tested had excessive amounts of chlorine, thus bleaching the test strip. This water solution was measured at 999mV (indicating excessive amounts of chlorine in the water) by the CalFERT investigator using an Oaktron ORP

meter. It was clear that the test strips were not being used properly per manufacturer's instructions.

Daily log sheets were kept for each harvest crew. These sheets were filled in by Mr. Ochoa, not by the crew supervisor. These sheets documented equipment cleaning and hourly chlorine levels for the spray and knife bucket water. These sheets were requested for the 2006 harvest on the Wegis Ranch. Mr. Ochoa supplied these "sanitation" sheets for Wegis Ranch Fields 207 and 212 during the 2006 harvest (Exhibit 18). At a later time, records were provided for Field 227 (Exhibit 18). The chlorine level for the spray water used for harvest and for the knife bucket was recorded as [REDACTED] ppm total chlorine.

Mr. Ochoa reported that harvest equipment was pressure washed and sanitized daily on a farm road out of the harvest area. Equipment was rinsed with heated (180°F) high pressure water. [REDACTED] liquid detergent was sprayed onto the food contact surfaces (with a soak time of five minutes), rinsed with water, and then a sanitizer ([REDACTED] – active ingredient, 3.3% dimethyl benzyl ammonium chloride) was sprayed onto the equipment and rinsed. Mr. Ochoa stated that he used [REDACTED] per five gallons of water. It was observed that the instructions on the container state to mix two ounces per gallon.

Pacific Marketing Co. (Larry Larronde, owner) was contacted via phone on January 8th, 2007 for further harvesting information. Mr. Larronde stated that conventional (regular whole head) lettuce was harvested into "B-Best" corrugated bins and explained that "B-Best" bins were designated as the firm's own private label for conventional lettuce. As for cleaned/cored lettuce, the firm used "Bucked-Off" (firm's own designation) corrugated bins. Mr. Larronde reported that other types of bins were used for private customers. For example, bins designated as "GMC" or "Taylor" were for two different private customers, and plastic bins were designated for another private customer. Mr. Larronde reported that each bin was 47" × 39" × 38" and the holding capacity for each corrugated bin was approximately 800–900 lbs of whole lettuce.

Cooler – Andrews Ag Inc. (13650 Copus Rd. Bakersfield, CA 93313)

Mr. Michael Andrews, CEO, Andrews Ag Inc., was interviewed by CalFERT investigators on December 18th, 2006 as part of the site visit to his cooling facility. Andrews Ag is a grower-shipper-packer and also custom cooler for other shippers.

During the interview, investigators were informed that the lettuce was vacuum cooled, vacuum sealed, and held in cold storage for a few hours before loading and shipping to Bix. No water was used in the vacuum tube during its operation (3D Cooling Inc., 520 Olive, Holtville, CA 92250). The vacuum tube was no longer on the premises at time of the CalFERT visit. The firm rented the vacuum tube from 3D Cooling of Holtville, CA. The vacuum sealer also was no longer on the premises. No environmental sampling was performed due to the absence of processing equipment. No problematic conditions were observed at the time of the site visit. Mr. Andrews stated that when in use, the vacuum tube was cleaned daily with water. The water supply at the firm was well water.

Microbiological testing for well water was performed quarterly by Seaco Technologies. The August and November tests results were collected and found to be negative for total coliforms and *E. coli* (Exhibits 19, 20). Third party and customer audits were done as required by customers. CalFERT obtained receiving and cooling logs for November 16th, 2006 showing that suspect shipment Pacific Marketing Co. (PO #19649 / Bix PO #208139) containing ■ bins (■ lbs) was cooled at the facility (Exhibits 21, 22). Shipping records obtained by CalFERT also showed that the same weight of lettuce was shipped to Bix. Transportation from the cooler to the processor was provided by the customer via the carrier "JFI"; Johnson Feed Inc. (Exhibits 5–7).

Dairy Farms in Proximity to Wegis Ranch

Following the observation of two operational dairy farms (Maya Dairy and West Star North Dairy) in close proximity to the Wegis Ranch lettuce growing fields, CalFERT contacted the owners of both dairies (Mr. Juan I. Echeverria of the Maya Dairy, and Mr. Bennett G. Slegers of the West Star North Dairy) and expanded the scope of this environmental investigation. From these two dairies, CalFERT collected different types of samples including environmental swabs, water, soil, sediment, and animal fecal matter (Attachments 4, 5).

The Maya Dairy was approximately 0.8 and 1.8 miles, respectively, due north from lettuce Fields 212 and 207. The West Star North Dairy was located to the northeast of Fields 212 and 207 approximately 0.65 and 1.65 miles, respectively. The Maya Dairy is situated across Wildwood Rd. and approximately 0.70 miles away from West Star North Dairy (Figure 3). Fields 212 and 207 were downwind from the dairies, and according to Wegis management the prevailing wind was generally from the northwest. There was no lettuce on these two fields at the time of the investigation.

Field 227 was sectioned into four lots (18.9, 18.9, 19.09, and 16.45 acres, respectively) and located to the east of the West Star North Dairy (approximately 1 mile). No lettuce was seen on the field at the time of the investigation. Three of the four lots on Field 227 were barren. The fourth lot (furthest south; 16.45 acres) had remnants of lettuce heads on it which were part of the disked under crop. According to Wegis Ranch management, this lot was replanted due to rabbit damage to the lettuce and was disked under since it did not meet client specifications. Lettuce remnants of this lot were collected by investigators, and later tested negative for *E. coli* O157:H7.

According to Wegis Ranch management and the owners of both dairy farms, all the land and wells associated presently with the dairies were previously owned and maintained by Wegis Ranch. In 2003, Wegis Ranch sold parcels of land to Maya Dairy and West Star North Dairy but maintained control over the water system (also referred to in this report as the irrigation system).

Prior to the establishment of the dairies, the irrigation system was used to route irrigation water (district water) to the fields. After the establishment of the dairies, the water routed via this system to the fields became a blend of dairy waste water from the

respective lagoons and district water (Exhibits 16, 23). This blended water was only applied on fields where feed crops were grown; according to Wegis Ranch management. Blending and routing of the irrigation water to fields was performed by Wegis Ranch.

For the above irrigation system, Mr. Young stated that a blend of 20% waste water and 80% irrigation water (district water) was used to irrigate feed crops, and adamantly stated that the water lines feeding into the lettuce growing fields were not cross contaminated with the waste water lines. Mr. Michael Young stated that they did not use waste water from the Maya and West Star North dairies on their lettuce fields. He also stated that on Fields 212 and 207 they only used district water (Aqueduct) that was pumped via underground emitter hoses. Field 227 was irrigated from a well, located on the northeast corner of field, which pumped water through underground emitter hoses. The emitter hoses had no backflow devices. According to Wegis management, there are only pressure regulating devices that feed to the emitter hoses and that there would be no need for backflow prevention on the underground drip line. The well on Field 227 had a backflow prevention check valve.

Upon learning that the Wegis Ranch's irrigation system is connected to both dairies and that Wegis management blends the dairies discharged wastewater with other water sources for irrigation, CalFERT expanded its environmental investigation to encompass a thorough assessment of the vicinity's water distribution system and conveyances as a whole. Details are provided in the "Overview of Water Irrigation System" section below.

Relative to lettuce growing fields, along the west side of Fields 212 and 207 CalFERT found an irrigation system derived from three sources of water – lagoon water from Maya Dairy, district water, and well water (Figures 3–5 and Exhibit 16). Fields 225 and 226 were adjacent (to the west) and at a higher elevation than suspect lettuce growing Fields 212 and 207 (Figure 4). The approximate distance between fields 225/226 to fields of interest (212 and 207) was 30–40 feet, separated by an unpaved road. Wegis management stated that Fields 225 and 226 were used to grow animal feed only, and investigators saw blended water (a mix of lagoon water with district and/or well water) being used on Fields 225 and 226 among others. Between Fields 225 and 226, along the east end, a piping system combining mixtures of lagoon, district and well water was observed. Further south along the southeast corner of Field 226, another irrigation system combining lagoon and district water was seen. Animal fecal material around the irrigated area was observed. Several samples (including swabs, water, water and sediment, soil, and air) were collected from the southeast corners of Field 225 and 226, and a total of six samples (one swab, one water, three water and sediment, and one soil) were found to match the *E. coli* O157:H7 Taco John's outbreak strain (Attachment 5, 9).

Maya Dairy (18451 Wildwood Rd. Buttonwillow, CA 93206)

On December 17th, 2006, CalFERT investigators visited the Maya Dairy and spoke with its owner, Mr. Juan I. Echeverria. Maya Dairy was determined to be about 15 feet

above the level of Wildwood Rd. As mentioned earlier, suspect Fields 212 and 207 were south of the Maya Dairy and west of Wildwood Rd. Mr. Echeverria stated that he owned fields to the immediate west of the dairy and that he grew animal feed crops on them including alfalfa and corn. Investigators observed a field of barley or wheat due west of the Maya Dairy being irrigated. Water was being pumped from the Maya Dairy into a ditch which was being used to irrigate the field. The water being pumped was very brown in color and investigators questioned whether it was a mix of "waste" water from the dairy and district water from the Aqueduct.

Mr. Echeverria stated that he freely gave water to Wegis Ranch from the lagoon. Mr. Echeverria added that he also pumped water into irrigation ditches to the west and the south of his dairy. According to Mr. Echeverria, the waste water from cleaning the stalls at his dairy was stored in the lagoon to the south west corner of his facility (Figure 3). This occurred after the solids in the waste water were separated from the liquids using a mechanical separator. Following separation, the solids were dried and the finished product was used as bedding. The remaining liquid was then placed into a series of three holding ponds to extract more of the remaining solids. Settling of solids was via gravity. The water from the settling ponds was moved to the lagoon and eventually pumped out to clean the alleyways at the dairy and/or to irrigate fields (feed crops).

On December 19th, 2006 Mr. Echeverria provided CalFERT with the blueprints for the Maya Dairy. The blueprints had no indication of water transfer pipes away from the dairy. Mr. Echeverria repeated that he routinely pumped water to Wegis Ranch from the lagoon on his property, and the water was pumped into the ditch to the west of the dairy. Mr. Echeverria stated he did not know what Wegis Ranch did with the water. Investigators followed the drainage path and noted that the fields to the southwest of the Maya Dairy showed signs of recent maintenance work in their irrigation pipes. Additional follow up was conducted and on January 6th, 2007, CalFERT investigators toured with Mr. Echeverria around the perimeter of the Maya Dairy where he explained more about the dairy water supply and distribution system. CalFERT evaluated the facility's waste handling system including alley flush and collection, solid waste mechanical separation, compost yard, settling ponds and final waste water lagoon operations as described below.

Regarding the alley flush system, waste water from final waste lagoon (used for irrigation of fields) was pumped from the lagoon to flood gates located at the upper most elevation of individual alleyways located between cattle house pens. Flush water exited flush gates set on an electronic timer and flooded down through the alleyway after which it was collected in a drain located at the lowest level of the individual alleyways. Waste from the alley flushes was gravity drained to sediment trap that collected all alley flushes including milking barn and wash pen flushes. Solid waste settled in a three stage sediment trap and was removed by a front end loader on a periodic basis and stored on a cement slab in front of the mechanical solid separators. Liquid waste in the final stage of the sediment trap was pumped up to the mechanical separators where solids were separated from the waste. The solid waste fell through the mechanical separators and was piled in the same area as the solid waste that was removed from

the sediment traps by the front end loader. Then, the solid waste was left to drain for a few days on the cement pad and was transported to the compost yard where it was piled, turned periodically and composted (drying only; no time/temperature curing). The dried waste was put into the freestall barns for bedding. The liquid waste exiting the mechanical separators was pumped to one of three settling ponds. The liquid from the settling pond ran into the final liquid waste lagoon where it was stored until it was pumped either into the farm irrigation distribution system or pumped to alleyway flushes. CalFERT learned that alley flushes occurred three to four times per day. According to Mr. Echeverria, waste solids were collected from settling ponds, allowed to dry, and used as "bedding." Mr. Echeverria stated that this compost was only used at his dairy.

CalFERT members traveled out to the waste water lagoon and noted that there were three main inlets to the lagoon (via gravity) from the three settling ponds. Two outlets existed from the lagoon, one to recycle the water back to the dairy for wash-outs (alleyway flushes) and the other outlet to feed the surrounding fields with the waste water. Final waste lagoon water was pumped from the lagoon to the irrigation distribution system as mentioned earlier. Based on a discussion with Mr. Michael Young and Mr. Rick Wegis, there were four locations that the lagoon water could be pumped by the irrigation system. These four points were shown on maps provided by Mr. Young (Exhibits 16, 23). Investigators again observed that a field located west of lagoon was being irrigated from water being pumped from the end of the field. Mixing pipes were examined and CalFERT performed further assessments to determine where and how the water was being mixed with the Maya's wastewater (see Overview of Water Irrigation System section).

On January 7th, 2007, investigators spoke with Mr. Rick Wegis about the waste water irrigation system for the Maya Dairy and the vicinity. There were discussions pertaining to the irrigation lines and the flow of district, well, and/or lagoon water to various points of the fields. Mr. Rick Wegis provided two maps of the pipelines layout (Exhibits 16, 23) pinpointing the different piping systems within the ranch. A key observation was that the farm irrigation system that utilized dairy runoff water did not have any backflow prevention devices to ensure manure-blended irrigation water did not contaminate the SWSD water system. The farm irrigation system relied mainly on the pressure differential within the SWSD system and the farm system to prevent back flow and subsequent cross-contamination of the SWSD system.

During the above site visit, CalFERT observed an overhead tank filler next to the hay cuber and equipment yard on the Wegis Ranch (located on the east side of the intersection of Wildwood Rd. and Burbank St.). This is the same overhead water supply source from which the harvester obtained its water per Mr. Greg Wegis. Water samples were collected by CalFERT from this filler as well as from a flex hose that fed the emitter lines to nearby Field 212 and a water outlet. Soil was also sampled from an adjoining ditch. These samples tested negative for *E. coli* O157:H7. At the time, Mr. Michael Young stated that Field 212 was presently set up for tomatoes plantings (processed tomatoes) in February, after which Wegis would probably plant barley,

sprinkler irrigate the barley once, and dry farm it afterwards. The barley according to Mr. Michael Young would then be disked under for soil amendments.

The Maya Dairy had two interconnected water wells whose continuous supply is dependent upon line pressure. The wells were located on each side of the entrance driveway of the Maya Dairy; one on the north side and one on the south side. Well water was used to wash the cows in the milking barn in addition to supplying the dairy cooling tanks. According to a waste discharge report submission to the California Regional Water Quality Control Board for Maya Dairy, soil borings had found ground water at depths between 27–39 feet (Attachment 6 p.2). Upon inspection of the wells, it was observed that the air vent to the wells was open to possible contamination. There was also a tank with an unprotected vent next to the wells that injected a chemical (sodium hexametaphosphate) to reduce water hardness. According to Mr. Echeverria, he had never had to chlorinate (shock) his wells. He stated that the wells were maintained by Wegis Ranch. Mr. Echeverria was familiar with the chlorination process since he had chlorinated wells on his other dairy in Chino, California. Mr. Echeverria stated that he paid for all the services provided to wells for the Maya Dairy, but Mr. Rick Wegis was responsible for contracting the service provider. According to Mr. Mike Young, the last treatment conducted on the wells by the provider was May 9th, 2006. CalFERT sampled the water from the north well located on the Maya Dairy, and results were negative for *E. coli* O157:H7. The team, however, was unable to sample the south well as it was not in operation at the time.

Flocks of blackbirds (approximately 500–1000) were observed around the Maya Dairy property. Multiple bird prints were noticed at the edge of standing water north of the settling ponds. Canine-like paw prints were also observed along the west side of the lagoon and settling ponds at the dairy, and two coyotes were seen in the fields west of the dairy. To the north of the settling ponds were several mounds of refuse. Several cattle remains/carcasses were observed in one of the refuse mounds. The hide and lower extremity bones of a calf were seen between the west settling pond and some standing water. Mr. Echeverria stated that during the summer heat of 2006, he lost more cattle than he could have disposed by sending to landfills. Because of the heat wave during the past summer, an emergency permit was issued by Kern County allowing composting cattle on the premises.

West Star North Dairy (26953 Riverside Street, Buttonwillow, CA 93206)

According to Mr. Bennett G. Slegers, Owner, the West Star North Dairy was approximately 1300 acres and encompassed a number of farming fields (all feed crops with the exception of one field, 227). All of the crops grown on the West Star North Dairy property were managed by or leased to Wegis Ranch including the lettuce grown on Field 227. Two wells provided water for the dairy with approximately 160,000 gallons of water used daily for operations. A third well provided water for the lettuce in Field 227. Regional Water Quality Control Board submissions by “West Star Dairy” showed ground water at depths between 30–54 feet (Attachment 7 p. 2).

CalFERT examined the two domestic wells supplying the dairy, and the west well pump was found inoperative. Water samples were collected from the east well and a mixing tank that held water (reservoir tank) from both wells. A colorimetric test (Sensafe) for free chlorine conducted on water from the east well indicated a level ranging between 0–0.25 ppm of free chlorine. A similar test conducted on water collected from the holding tank showed zero ppm of free chlorine in the water.

Mr. Slegers was asked about water testing on the wells supplying the dairy, and investigators were apprised that the California Department of Food and Agriculture (CDFA) normally tests the water on an annual basis. If a well is found to be positive for coliforms, then it would be sampled on a monthly basis until such time that it is again negative for coliforms. When that occurs, well testing will revert back to an annual sampling schedule. Mr. Slegers provided the name of the CDFA Milk and Dairy Food Safety Branch inspector, Mr. Ross Henderson-McBean. CalFERT contacted Mr. Henderson-McBean who noted that both dairies (Maya and West Star North) had ongoing issues of non-compliance with water quality standards in the California Code of Regulations (copies of the Official Order issued by CDFA Milk and Dairy Food Safety Branch were obtained; Attachment 8).

The monthly reports obtained from Inspector Henderson-McBean on both the Maya and West Star North dairies showed several test results with most probable number (MPN) > 1.1/100 ml of total coliforms. Some of these results showed MPN in excess of 23/100 ml for total coliforms. Review of the most recent tests (October – December of 2006) showed the Maya Dairy with a MPN of 5.1/100 ml (total coliforms) for the North well. For the West Star North Dairy, a MPN of 6.9/100 ml for the East well were reported, and results were within tolerances (< 1.1/100 ml) for the West well (Attachment 8). Inspector Henderson-McBean indicated that the West Star North Dairy added a chlorination system to both its domestic wells after December 12th, 2006 as a result of the samples that tested positive for total coliforms during the months of October and November of 2006. Subsequent tests performed in December were negative.

The dairy waste handling system on the West Star North Dairy was evaluated by CalFERT, and it was determined that all alley flushes, barn flushes, roof drains, and rain water runoff were collected in one of two common drain lines that empty into a cement collection pit. Solid wastes were removed from the pit on a daily basis using a front end loader. The remaining liquid waste was then pumped to one of two mechanical separators that separate the solids from the liquid waste. The liquid waste was then pumped to one of four settling ponds or diverted to the alley flush system which operated 3–5 times per day. Solid waste from the mechanical separators and the solids removed by the front end loader were piled for drying. Periodically the piles were spread out and the manure was further dried. After drying, the solid waste was used for bedding in the freestall barns. The solid waste settles to the bottom of the four settling ponds and the liquid waste flowed through a piping system to a designated final settling pond (one of the four ponds mentioned earlier) and then onto the lagoon. Mr. Michael Young stated that West Star North Dairy spreads manure onto their (West Star North) silage fields. Mr. Young stated that the manure was dried, but not composted.

(time/temperature cured). The manure was spread by a contractor. Mr. Young said that the manure was loaded at the dairy on the spreader and then transported to the field for spreading.

There were two pumps located at the West Star Dairy North lagoon. One was used as a back-up alley flush pump while the other was used to pump the liquid waste into the irrigation system that was managed by Wegis Ranch. A tailings ditch was observed on the south side of the lagoon. This was used to transfer tail water off of the fields back into the lagoon. CalFERT observed the water as it was being fed into the lagoon and Mr. Slegers confirmed it was tail water from one of the fields. In the NW corner of Field 209 (Figure 3) several pipes connected to the tail water return system were observed connecting into the “fresh water” supply reservoir that is supplied by the district water system. These pipes either serve as or have the potential to serve as a connection between field irrigation water and the freshwater reservoir. Mr. Michael Young stated that all tail water pipes were buried. The team did not observe any water draining at the time of assessment.

Waste water from the waste lagoon at the West Star North Dairy was commingled with district water and/or well water at an air gap blending riser (Figure 4) in close proximity to the lagoon, and then distributed through the field irrigation system. At the air gap blending riser, a cross connection was observed between the pipe transporting liquid manure from the lagoon and the pipe bringing mixed basin and district water. Gate valves were the only physical separation between the various water sources. No backflow devices were plumbed into the system to prevent cross-contamination of water sources.

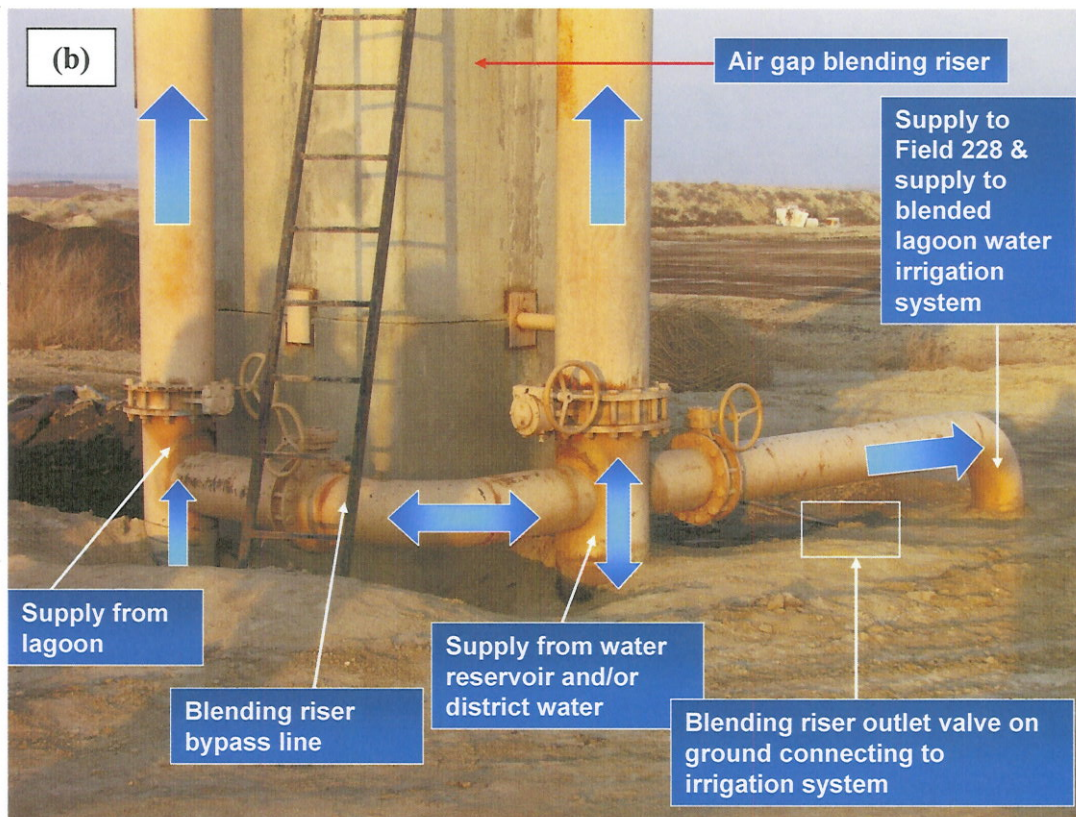


Figure 4. West Star North Dairy air gap blending riser: (a) full view of the riser, (b) close up of the cross connections located at the bottom portion of the riser.

Two lift pumps were observed in the vicinity of the West Star North Dairy south of the lagoon. The pumps were located to the north side of a fresh water reservoir (district water source), also referred to as water canal; located at intersection of Wildwood Rd. and Burbank Street. These pumps were used to move water from the reservoir to a pipe leading to the air gap blending riser discussed earlier. At the air gap blending riser location, Wegis management had the capability to commingle district water with lagoon water (Figure 5). Wegis management also had control of routing this blend to select fields.

The waste water system on the West Star North Dairy and the process of waste removal was similar to the one observed on the Maya Dairy. However, Mr. Slegers stated that the water used to flush the alleyways on his dairy did not come from the lagoon as was the case with Maya Dairy. At West Star North Dairy, liquid waste collected early on at the mechanical solid separators point was used in the alley flush system. The solids were dried and the finished product was used as bedding – a similar practice to that on the Maya side. The liquid waste was then placed into the series of four settling ponds where it was eventually moved to the lagoon and used in irrigation water for grain crops. Again, Mr. Michael Young stated that none of the water from the dairy was used on lettuce fields, only on the grain fields which were intended for animal feed.

On January 10th, 2007, CalFERT investigators revisited the West Star North Dairy and spoke again with Mr. Slegers. This visit came immediately after a second positive sample for *E. coli* O157:H7 (water sample from the West Star North Dairy's waste water lagoon) was found to be a match to the Taco John's outbreak strain (Attachment 5). This positive sample was collected on the premises of the West Star North Dairy, thus necessitating the revisit (Attachment 9). CalFERT inquired more of Mr. Slegers about his dairy operation and any potential inter-relationships between his facility and the Maya Dairy besides the water irrigation system. Mr. Slegers stated that both dairies use the same harvester (feed crops) company to custom chop/cut and harvest their corn and wheat. Mr. Slegers was asked if he shared cattle with the Maya dairy and/or purchased cattle from a common source. Mr. Slegers stated that his newborn calves come from Mendez Farms in Corcoran, CA compared to Maya Dairy which obtains its calves in Tulare, CA. Mr. Slegers stated that the two dairies used different milk shippers. He also mentioned that they did compost some of their dead cattle (separate from Maya) during the heat wave of the past summer following a 2006 proclamation of local emergency throughout Kern County.

Overview of Water Irrigation System: Wegis Ranch, Dairy Farms and Vicinity

The irrigation and dairy effluent conveyance systems controlled by Wegis Ranch appeared to be combined into a complex piping network. In an attempt to understand possible avenues of microbial cross-contamination between the growing fields of lettuce and nearby dairies, an assessment of the areas lagoons, irrigation ditches, tail water ponds, and water district pipes as possible routes of contamination to the fields of

interest was conducted. CalFERT investigators interviewed Wegis Ranch management; Maya Dairy owner, Mr. Juan I. Echeverria; and West Star North Dairy owner, Mr. Ben Slegers on this subject. Both dairy owners deferred to Mr. Rick Wegis for specific knowledge pertaining to the area's water system. Investigators obtained from Mr. Rick Wegis and Mr. Michael Young maps of the irrigation pipes, valves, and check gates for Wegis Ranch, Maya Dairy, and West Star North Dairy (Exhibits 16, 23). Investigators also collected environmental samples in the process consisting of environmental swabs, water, soil, and sediment (Attachments 4, 5).

In addition to the above, and to better understand the local area's connection to the district water system, CalFERT investigators contacted Mr. David Shoals, Senior Engineer Geologist of the Central Valley Regional Water District. Mr. Kerry Elliott, Engineer/ Geologist for Kern County, was also contacted for water quality information. Mr. Shoals stated that although they had no discharge information for either of the two dairies, as they were both only two to three years old, he did provide copies of reviewed environmental submissions that were required for the start up of both dairies including mapping/layouts of facilities and planned water usage (Attachments 6, 7). Review of the documents revealed that most of the materials seemed to be for preliminary plans/designs of both dairies, with more information provided on soil testing. There was also information of the proposed well sites and proposed well designs. There were no water testing results for either dairy.

CalFERT also contacted the SWSD, and Mr. Will Boshman, General Manager, of Semitropic provided water quality reports for both Wegis Ranch and Maya Dairy and a notice for the 2006 maintenance shutdown (Attachment 10). At the time of the investigations, CalFERT confirmed that the last annual maintenance shutdown of the district water system by the SWSD occurred on November 27th, 2006 and opened on January 1st, 2007. Wegis management verified this by stating that district water only flowed approximately eleven months out of the year.

CalFERT learned from Wegis management that Wegis Ranch used both well water and district water to irrigate fields. CalFERT investigators determined that Wegis Ranch also had the capability to blend well and/or district water with lagoon water and use the blend to irrigate fields planted with feed crops. According to Wegis management, the blend was composed of 20% dairy effluent (waste) water and 80% district water (later investigators were informed that the blend could range from 0–100%). Some of these fields were in close proximity to lettuce growing fields as was described earlier.

From discussions with Mr. Michael Young and review of maps provided by Wegis Ranch, technical experts (including dairy specialists) supporting CalFERT determined that the Wegis Ranch irrigation system was connected to Maya Dairy and West Star North Dairy through at least two district water pipes with no backflow prevention devices.

Survey of the Wegis Ranch area and vicinity (included the dairies) revealed that there were several water cross-connections on the grounds. Figure 5 depicts a piping

manifold at West Star Dairy North that interconnects its own irrigation system to the district water pipes, as well as the Wegis Ranch irrigation system located at the intersection of Wildwood Rd. and Burbank St. At that location, a pump on the west end of the water reservoir (Figure 5) was supplied by three sources: a pipe coming from the reservoir, a pipe coming from a nearby tailings pond, and a drain pipe coming from Field 212. Pumped water enters this piping manifold (that also connects pipes from a well pump located on north side) to feed three locations. These locations are (1) fields located on the southeast side of Wildwood Rd, (2) Field 213 which is located on the northwest side of Wildwood Rd., and (3) a return line leading to the fresh water reservoir (Figure 5) at the West Star Dairy North. A well located on the north side of this piping manifold was not operational at the time of this investigation but had the capability to pump well water directly to the fresh water reservoir in addition to the water storage tanks located at the south west corner of the hay cubing yard.

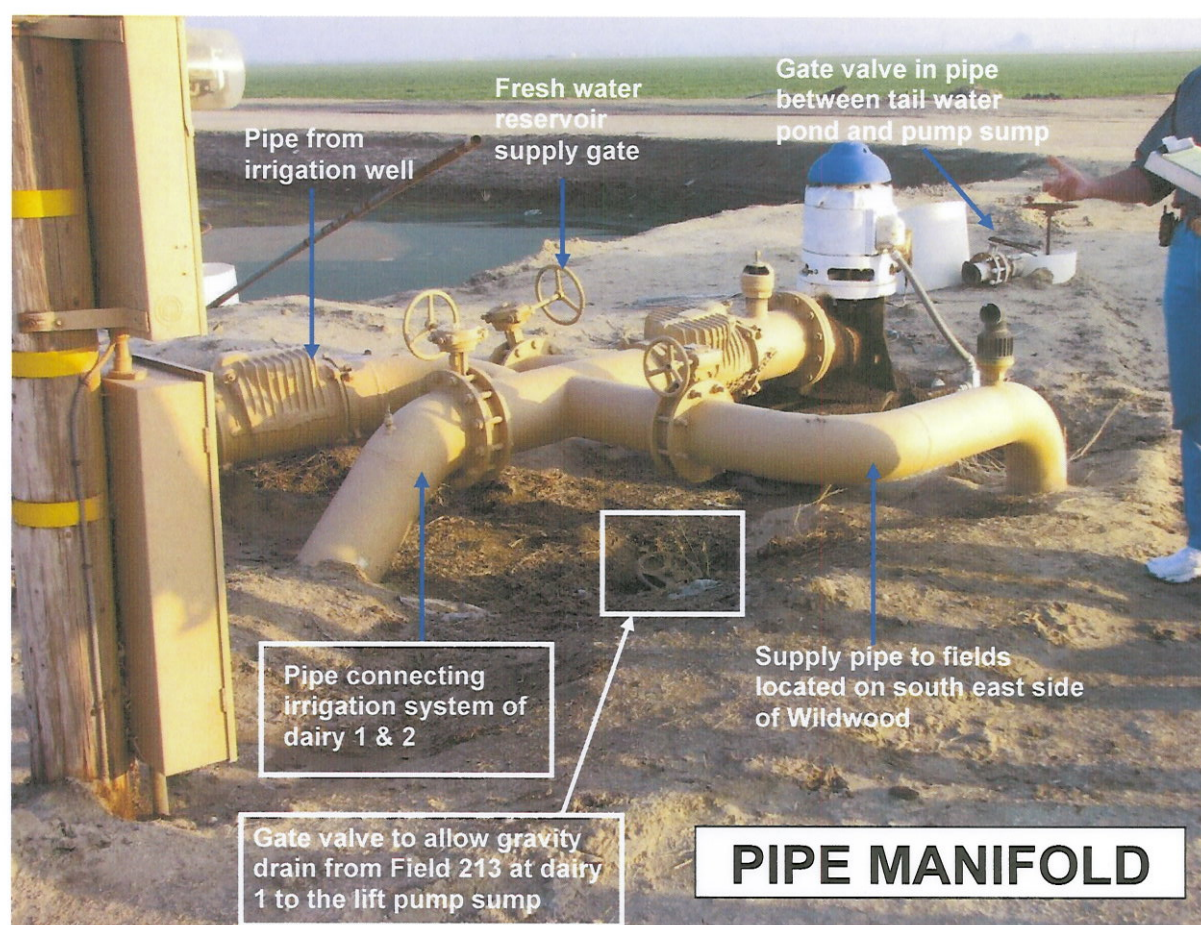


Figure 5. West Star North Dairy water pipe manifold with labels; Dairy 1 = Maya Dairy, Dairy 2= West Star North Dairy

Based on information received from both the grower and dairy owners, CalFERT determined that the area's water pipes were all interconnected. Attachment 11 depicts information on the Wegis Ranch and vicinity water conveyance system. Attachment 11

also illustrates the location where the positive *E. coli* O157:H7 samples matching the Taco John's outbreak strain were collected. There was no apparent protection (e.g. backflow prevention devices) between the manure water and the other water systems. Due to the lack of backflow protection, unplanned high and low pressure differentials within the district system or ranch distribution system could allow the mixed dairy wastewater and freshwater to enter the SWSD supply system and agricultural wells, thus polluting the freshwater agricultural irrigation supply for the area. On February 2nd, 2007, Notices of Violation from the California Regional Water Quality Control Board were issued to both the Maya Dairy and the West Star North Dairy stating that the two firms had possible conditions of pollution by possibly allowing the intermixing of wastewater/well water/ and freshwater as well as applying an excessive rate of nitrogenous waste for the specified field acreage (Attachments 12, 13).

Additional Analysis of Irrigation Water System

On August 1st, 2007, CalFERT investigators including a dairy specialist, along with personnel from the Centers for Disease Control and Prevention (CDC), CDPH Division of Drinking Water and Environmental Management (CDPH-DDWEM), and the Kern County Environmental Health Services Department visited Wegis Ranch again for further assessment of the potential for contamination of irrigation water. During this visit, water samples from various sources of irrigation water were taken for spectral analysis to characterize fluorescence. Analysis of these samples was conducted by the Department of Earth and Planetary Sciences at the University of Tennessee. Measuring the fluorescence properties of different water sources was performed to assess the potential for using natural and artificial tracers to detect possible cross-connections in the irrigation system. It should be noted, that the technique used for spectral analysis is not a standard method, however, it is addressed in several peer reviewed publications including the work of Hudson et al. (2007)².

As part of this visit, the team also visited the SWSD office in Wasco, CA on August 2nd, 2007, and met with Mr. Paul Oshel, District Engineer for the SWSD. Issues that were analyzed during this visit are outlined below.

Interconnections between Different Irrigation Water Systems and Sources

As previously discussed in this report, the SWSD water system, groundwater wells and dairy lagoon wastewater systems are all interconnected on the Wegis Ranch. Some of the SWSD turnouts in that area have check valves (Figure 6 below provides examples of different types of valves) designed to prevent backflow into the SWSD water system. Even where check valves are present, however, these backflow devices have no

² Hudson, N, Baker, A. and Reynolds, D. 2007. Fluorescence analysis of dissolved organic matter in natural, waste, and polluted waters – a review, River Research and Applications, Vol. 23, pp. 631–649.

inspection ports, and so cannot be checked for failure or leakage. In general, check valves are not considered approved backflow prevention assemblies to prevent cross-connections between different water sources. To ascertain that water is flowing only in one direction and there is no backflow, an approved backflow prevention assembly that has test ports on it and is capable of being tested by an approved backflow assembly tester should be installed. Gate valves and butterfly valves do not address backflow and/or cross-connection concerns. The California Regional Water Quality Control Board Notice of Violation reports for the two dairies dated February 27th, 2007 state, "The wastewater distribution system could allow mixed dairy wastewater and freshwater to enter the Semitropic WSD supply system and agricultural supply wells, causing or threatening to cause a condition of pollution."

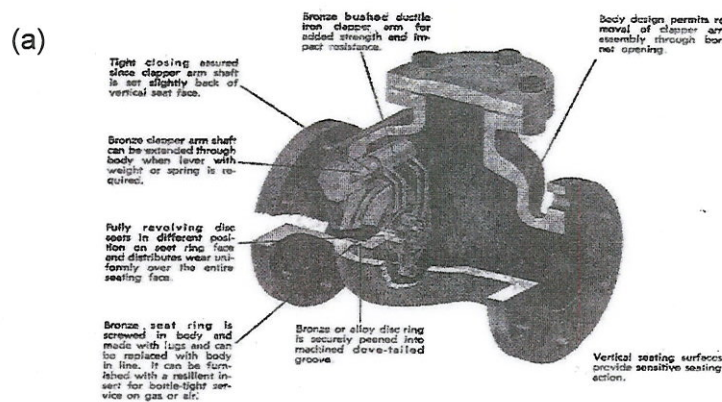


Fig. 18-39 Check valve
(Reprinted from American Cast Iron Pipe Company, M.I.)

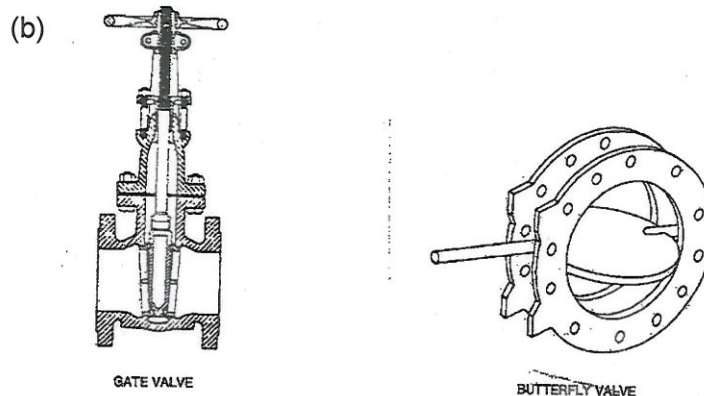


Fig. 3.41 Valve types
(Reprinted from WATER DISTRIBUTION OPERATOR TRAINING HANDBOOK by permission, Copyright 1976, The American Water Works Association)

Figure 6. An illustration of different types of valves³

³ Source of Fig. 6(a) Kerri, K. D. 1998. Water Treatment Plant Operation. Vol. II, California State University, Sacramento Foundation (ISBN 1-884701-26-4).

Source of Fig. 6(b): Kerri, K. D. 1996. Water Distribution System Operation and Maintenance, 3rd ed., California State University, Sacramento Foundation (ISBN 1-884701-16-7).

In addition to the use of check valves on some SWSD turnouts, it was commonly assumed that the higher pressures in the SWSD distribution system would prevent any backflow from the Wegis Ranch irrigation water system. However, there was no pressure monitoring on the SWSD system, so this assertion could not be verified. Pressure differentials are not considered adequate protection for backflow concerns. Providing an air gap or installing a Reduced Pressure (RP) Principle Backflow Prevention assembly (Figure 7) is one protection mechanism to address concerns where there is an existing or potential health hazard.

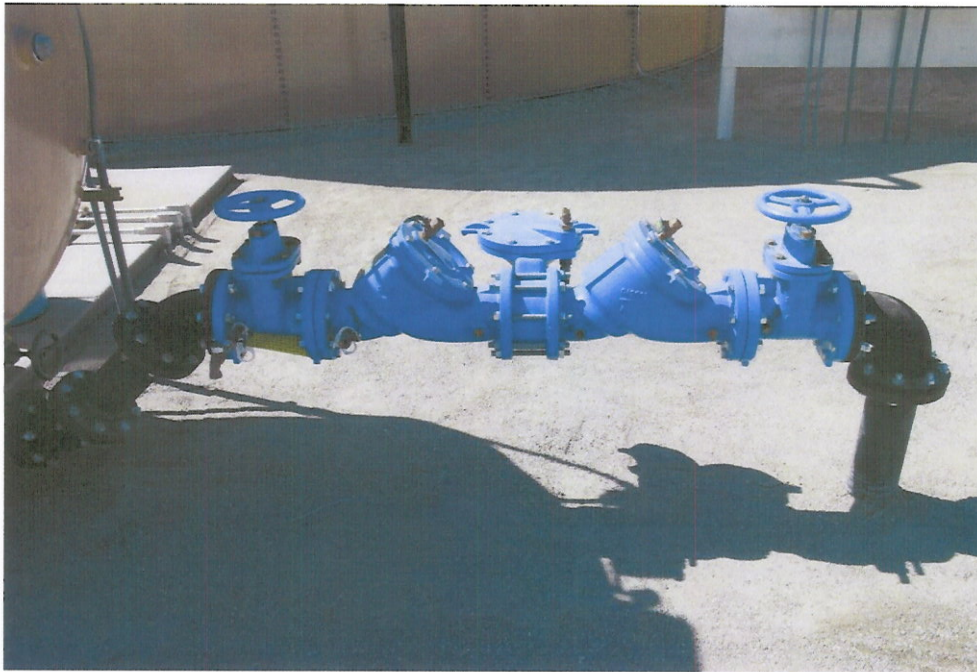


Figure 7. An illustration of a Reduced Pressure (RP) Principle Backflow Prevention assembly

Pressure is maintained in the SWSD system through a series of storage tanks, into which canal water is pumped. SWSD operators manage the elevation of water in the tanks to respond to daily demands, maintaining higher levels in the tanks in response to higher demand and vice versa. Therefore, daily demands are the only available data to determine if operating pressures in the SWSD system are relatively high or low, although this is only an inference that is based on the assumption that the systems are actually operated in the manner outlined by SWSD. Another potential area of concern for low pressure events in the SWSD system was depressurization of the system for repairs. However, no records of repairs or other maintenance activities were available from SWSD for the period when the suspect lettuce crop was in the fields. It was ascertained that there were no power outages during this period of interest, as the SWSD system used transmission line voltage instead of lower voltage lines, and so the system was not subject to rolling blackouts. According to SWSD they never lost power during the time that the suspect crop was in the fields, even if there had been rolling blackouts during that time.

Valves

On the Wegis Ranch, blending of water from various sources (SWSD water, groundwater pumped from onsite wells, and dairy lagoon wastewater) is controlled by manipulating valves in the pipe network and monitoring flow meters to achieve the desired percentages of water from the different sources. For example, at the time of this visit, blended water being applied to Field 226 was reported to consist of 400 gallons per minute (gpm) dairy lagoon water and 1600 gpm well water. Depending on the crop, water from any specific source can constitute up to 100% of the blend. The valves that were observed to be used for controlling this blending were gate valves and butterfly valves, neither of which was designed for this purpose. Gate valves are not designed to regulate flow, but rather to be used as shutoff valves that are either completely open or closed. If used to regulate flow, as they were in this application, they can be subject to premature wear and/or failure, which can cause leakage. Butterfly valves can be used to regulate flows, but were designed for clean water usage. The use of butterfly valves in wastewater applications can lead to the valves not seating properly upon closure, which again can lead to leakage. Butterfly valves in general are subject to leakage due to seat damage. This information was noted in copies of the manufacturer's literature that were part of the materials obtained from Wegis Ranch describing their facilities. If leakage through either of these types of valves had occurred when the valves were thought to be closed, contamination of water from other sources (e.g., SWSD water or groundwater from wells) by dairy lagoon wastewater could have occurred.

Pressure Differences due to Elevation

As previously noted in this report, Field 227 was at a higher elevation than adjacent fields to the west, and the farm irrigation system was unable to pump water up to Field 227. Per Wegis management, this field is irrigated with water from a well at the northeast corner of the field, and blended wastewater never reaches it. However, blended wastewater can be used to irrigate part of Field 228, which is directly to the west of and at a lower elevation than Field 227. In fact, at the time of this visit, blended

wastewater was being applied to a portion of Field 228. In order to irrigate as much of Field 228 as possible, the blending riser is bypassed at times to maintain higher head in the irrigation piping system.

Despite the fact that the farm irrigation system cannot pump water up to Field 227, piping for the farm system is directly connected from the blending riser up to the well in Field 227 (Figure 4). There is no shutoff valve between the pipeline on the north side of Field 227 that carries well water and the pipeline on the east side of Field 228 that carries blended wastewater. Therefore, water being pumped from the Field 227 well could be carried down into the rest of the farm irrigation system. At the time of this visit, this well was being pumped, and a pressure gauge at the well head showed an operating pressure of 28 psi. The elevation difference between this well and Turnout R68 (Figure 8) of the SWSD B369 distribution system is approximately 21 feet, equivalent to 9 psi. A static head of approximately 37 psi could therefore be created at this turnout. According to the SWSD B369 System Design Information, the design operating head at this turnout is 21.61 feet, or 9.4 psi. Therefore, if the blending riser was bypassed at a time when the Field 227 well was pumping, it appears possible that enough head could be created at SWSD turnout R68 to overcome the pressure in the SWSD system and force water from the farm irrigation system into the SWSD system if the gate valve at the turnout was open or not functioning properly (there does not appear to be a check valve at this turnout to prevent backflow). Because portions of the farm pipeline between Turnout R68 and the Field 227 well are used to carry dairy lagoon wastewater, any water potentially forced back into the SWSD system could carry residual wastewater along with it. This is not to say that this was a regular occurrence, but if the blending riser was bypassed and valves at the Field 227 well were open such that water could flow back down into the farm irrigation system adjacent to Field 228, it could occur. This would be especially true if the pressure in the SWSD system were low due to low demand. In the B369 distribution system, there were several days of low or no demand during the time when the lettuce crop of interest was in the field. For example, during 2006, on September 6 and 29, the afternoon of September 30, and October 7 and 12, demand was zero in the B369 subsystem. In addition, there was very low demand in the B369 subsystem on November 7 and 19, 2006. According to SWSD, low demands would correspond with relatively low pressures in the distribution system, as operators would be managing water levels in the storage tanks to correspond to demand, as discussed above.

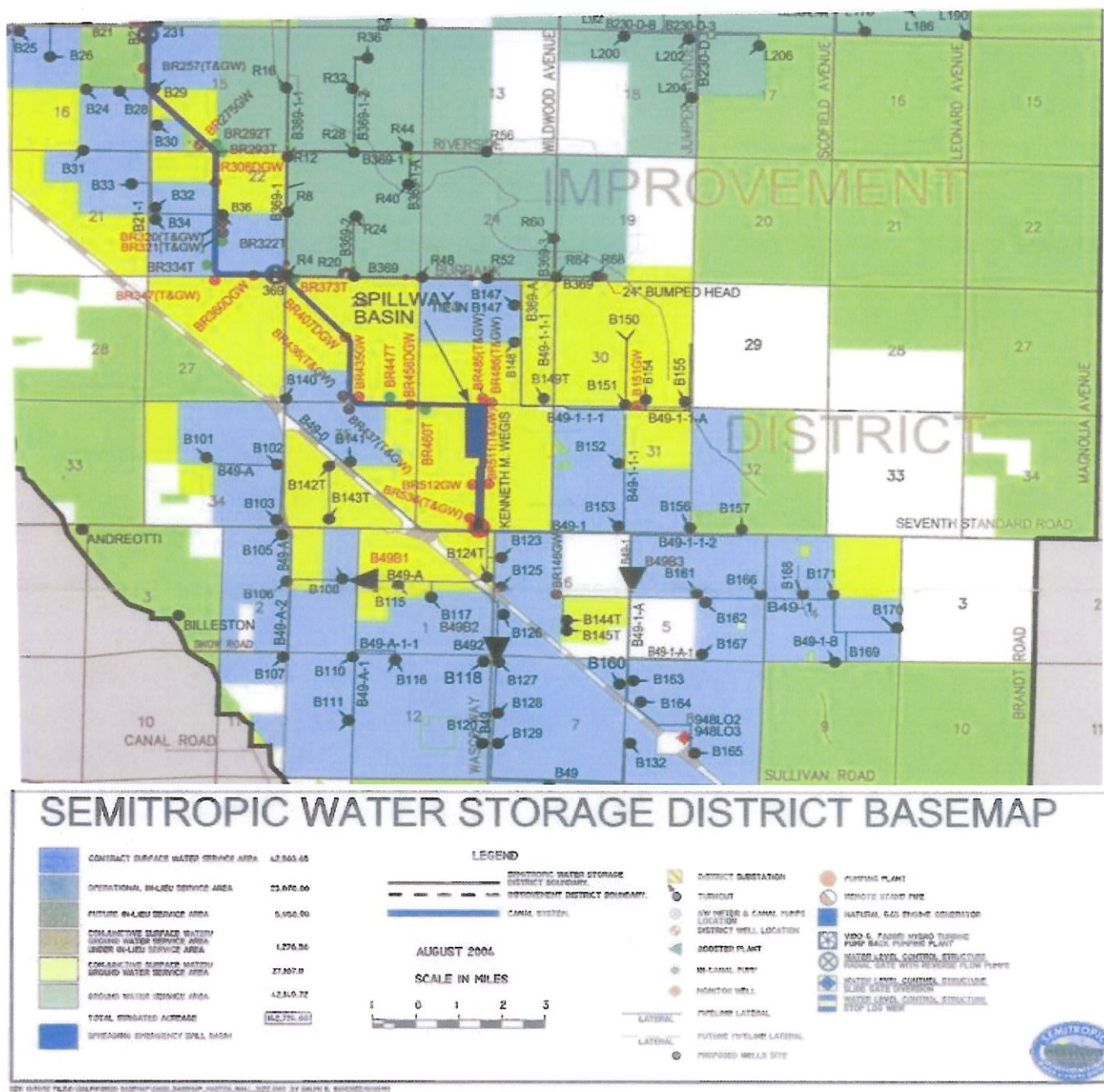


Figure 8. Close-up of SWSD water sources for the Wegis Ranch area

Results from Water Sampling and Spectral Analysis

As mentioned earlier, samples were taken from various sources of irrigation water for fluorescence characterization to assess the potential for using natural and artificial tracers to detect possible cross-connections in the irrigation system. These samples were analyzed by the Department of Earth & Planetary Sciences at the University of Tennessee, and this discussion draws from their analysis of the results. Table 2 below presents the sample locations and results of the fluorescence characterization (see text following Table 2 for discussion of the spectral signatures).

**Table 2. Water samples locations and results of the fluorescence characterization
Ranch harvest dates and amounts**

Sample #	Sample Description	Spectral Signature
1	SWSD Turnout B149T	Protein a, Protein b
2	Blended water applied to Field 226	Protein a
3	Well at Field 225	Protein b
4	SWSD Turnout R68	Humic acid
5	Blended water applied to Field 228	Protein a
6	Well at Field 227	Protein b

The two blended wastewater samples (# 2 and 5) showed similar spectral signatures to sample # 1 from SWSD Turnout B149T, with all three of these samples showing a common protein signature (Protein a). Prior research work has indicated that protein signatures often indicate contamination by wastewater or runoff from stormwater and agricultural areas. Therefore, the result herein is not surprising for the two blended wastewater samples. However, finding a spectral signature in water from SWSD Turnout B149T similar to that from the two blended wastewater samples could indicate a cross-connection or other contamination (such as through leaky pipes that could allow contamination from the surrounding soil to enter pipelines) of the SWSD distribution system in the vicinity of this turnout. In contrast, SWSD Turnout R68 showed a spectral signature indicating humic acid that is typical of surface waters, as would be expected for canal water (no groundwater was pumped into the SWSD system in 2006 because it was a wet year and none was required to fulfill water deliveries).

Results for the two well samples both indicated a similar protein signature (Protein b), but a different protein from that found in the blended wastewater samples. This may indicate that contamination of groundwater has also occurred. Depth to groundwater is

shallow in this area, ranging from 27 to 39 feet on the Maya Dairy to 30 to 54 feet on the North Star West Dairy according to California Regional Water Quality Control Board reports. As previously discussed in this report, results of prior sampling of wells in 2006 by CDFA at the West Star North dairy showed that some samples were positive for total coliforms (Attachment 8). Although this indicator does not necessarily show fecal contamination, these positive samples do indicate that contamination of some sort is reaching groundwater on the West Star North dairy, which is immediately adjacent to Wegis Ranch. Some possible sources and routes of groundwater contamination have been noted earlier in this report, including unprotected vents on wells at this dairy, and cross-connections between irrigation wells and dairy lagoon wastewater. In addition to also noting the cross-connections, the California Regional Water Quality Control Board Notice of Violation reports dated February 27, 2007 described other potential sources of groundwater contamination, including ponding of dairy lagoon wastewater in fields adjacent to solid separator ponds (Attachments 12, 13). The inspection undertaken for the Regional Board reports indicated "the facility has the potential to discharge dairy waste constituents to groundwater."

Results from the fluorescence characterization also indicate that the spectral signatures that were found should be distinct enough from fluorescent dyes used for tracer tests that tracer testing using sub-visual dye concentrations could potentially be used for further analysis of cross-connections or other contamination at this site. Because fluorescence can vary seasonally and be influenced by precipitation, further characterization of different water sources should ideally be undertaken before any tracer testing.

CalFERT Environmental Sampling

A total of 259 samples (251 samples with 8 controls) were collected in the course of this outbreak investigation from the two identified geographical areas in California (Attachments 4, 5). Types of samples collected included cattle biosolids, environmental swabs, fecal matter, field lettuce residue, sediment, soil, and water. Of the 251 samples, 57 samples were collected from the Santa Maria area and the remaining 194 were from the Buttonwillow location. Of these 251 samples, 32 (13%) were positive for the bacterial pathogen *E. coli* O157:H7. All 32 positive samples for the pathogen came from the Buttonwillow location, specifically Wegis Ranch and its neighboring dairies (Attachments 5, 9). All samples (n=57) collected from the Santa Maria area were negative for *E. coli* O157:H7.

Details regarding the samples taken from the Buttonwillow location are as follows.

- Out of the 194 samples collected at the Buttonwillow location, 32 (16.5%) were positive for *E. coli* O157:H7.
- Of the 32 *E. coli* O157:H7 positive samples, ten samples (31%) were found to genetically match the Taco John's outbreak strain (Attachments 5, 14).
- Four of the ten specimens (that genetically matched the outbreak strain) were gathered at the two dairies, and the remaining six were collected at the Wegis Ranch (Attachment 9).

- For the ten samples that were a positive match to the Taco John's outbreak strain:
 1. One sample was collected from a covered alley flush along Maya Dairy's southern border adjacent to Wegis Ranch.
 2. One sample was collected from West Star North Dairy's waste water lagoon.
 3. Two samples were collected from West Star North Dairy at the southeast corner of Field 228 which is adjacent to suspect Field 227.
 4. The six remaining samples from Wegis Ranch came from the southeast corner of Field 225 and the southeast corner of Field 226 (Attachments 5, 9). Both locations were across an access road from Field 212 which was implicated in the initial traceback document review (Figure 3).

Summary of Findings

Of the 251 samples collected in this investigation between the two geographical areas, positive samples for the pathogen *E. coli* O157:H7 came from the Buttonwillow location, specifically Wegis Ranch and the two dairy farms. Four samples originating from the neighboring dairy farms (Maya Dairy and West Star North Dairy) as well as six samples located on the Wegis Ranch, genetically matched the Taco John's outbreak strain. Of the six samples from Wegis Ranch matching the outbreak strain some were collected within 50 feet of Wegis Field 212.

An examination of the area's water irrigation system in addition to irrigation system maps obtained from Wegis management revealed multiple points of confluence between the local water district piping system, Maya Dairy's waste water discharge system, West Star North Dairy's waste water discharge system and the area's irrigation system.

A key finding in this investigation was the dairy wastewater blending and distribution system used by the Wegis Ranch to irrigate crops and distribute water. Because this system has been found to have inadequate backflow protection devices, it presented a possible route for conveyance of contaminated water to fields adjacent to the suspect lettuce growing fields associated with this outbreak. The six matching *E. coli* O157:H7 samples (of water, soil, and environmental swabs) collected from the dairies came from areas where blended water was routed.

In addition to the presence of two large dairies (Maya = [REDACTED] head; West Star North = [REDACTED] head) in close proximity to Wegis Ranch, numerous signs of wildlife intrusion were also observed in the vicinity and at the different growing fields.

Exhibits

1. Facsimile from Fresh Kist Produce correlating growers to Bix shipments (17 pgs.)
2. Facsimile from Pacific International Marketing correlating growers to Bix shipments (1 pg.)
3. Bix PO # 424878 from Fresh Kist PO 208011 Bix B/L for PO #424878 PIM # 424878 to Dynasty #208011- from Guadalupe Cooling (2 pgs.)
4. PIM# 425083 to Dynasty #208252 (2 pgs.)
5. Sales Order form #0758 from JFI to Pacific (November 16th, 2006) for ■ bins of B Best stating order #19649 (1 pg.)
6. Bix PO #208139 detailing arrival of ■ bins on November 20, 2006 (1 pg.)
7. B/L detailing the movement of ■ bins (■■■■ lbs.) of lettuce from Andrews Ag to Bix referring to Pacific Marketing Co. PO #19649 and PIM Order # 424641 (2 pgs.)
8. Bix PO #208250 detailing ■ bins of lettuce arriving on November 21, 2006 (1 pg.)
9. B/L showing product movement from Guadalupe to Bix referencing PO #424642 (1 pg.)
10. Pacific International (dba Dynasty Farms) #424642- ■■■■ lbs of lettuce from A&A Farming (1 pg.)
11. Map of A&A Farms (1 pg.)
12. Primus Labs test results of A&A Farm well water (4 pgs.)
13. Map of Byrd Ranch 1 (1 pg.)
14. Map of Wegis Ranch and its vicinity provided by Mr. Michael Young (1 pg.)
15. Wegis Harvest Summary from Pacific Marketing Co. of Fields 207, 212, 227 (9 pgs.)
16. Map of Maya Dairy and Wegis Ranch water system provided by Mr. Rick Wegis (1 pg.)
17. Wegis Ranch Yearly Crop Rotation, 1995–2007 (1pg.)
18. Sanitation sheets by California Ag. Specialist for Wegis Ranch Fields 212, 207 and 227 (54, 20, and 24 pgs., respectively)
19. McRay Laboratory Analysis Results for Seaco Technologies – August 15, 2006 (1 pg.)
20. McRay Laboratory Analysis Results for Seaco Technologies – November 20, 2006 (1 pg.)
21. Andrews Ag Cooling Log (Tube I) – November 16, 2006 (1 pg.)
22. Andrews Ag Receiving Log (Invoice 2256) Tube I showing receipt of PO #19649 from Dynasty farms via JFI- November 16, 2006 (2 pgs.)
23. Map of West Star North Dairy and Wegis Ranch water system provided by Mr. Rick Wegis (1 pg.)

Attachments

1. Minnesota Department of Health's report on "Outbreak of *Escherichia coli* O157:H7 Infections Associated with Shredded Iceberg Lettuce at Taco John's Restaurants, December 2006."
2. Implicated Shipments of Iceberg Lettuce from the Santa Maria area in Central California to Bix Produce, LLC.
3. Implicated Shipments of Iceberg Lettuce from the Buttonwillow area in Central California to Bix Produce, LLC.
4. Overview of the different types of samples collected at the two identified geographic areas in California during the investigation of the Taco John's *E. coli* O157:H7 outbreak associated with iceberg lettuce. (1 pg)
5. Findings and overview of the samples collected at the Wegis Ranch and vicinity in Buttonwillow, CA. (1 pg.)
6. California Regional Water Quality Control Board report submission by Maya Dairy: "Report of Waste Discharge" by Livingston Dairy Consulting, Inc. (28 pgs)
7. California Regional Water Quality Control Board report submission by West Star North Dairy "Groundwater Monitoring System Workplan, Addendum 1" by Soils Engineering, Inc. (38 pgs.)
8. California Department of Food and Agriculture (CDFA) monthly water reports for West Star North Dairy (10/2005–12/2006) and Maya Dairy (12/2006); (14 pgs)
9. Map and summary of positive samples for *E. coli* O157:H7 matching the Taco John's outbreak strain
10. Copy of Semitropic Water Storage District (SWSD) water shutdown notice November 27th, 2006; (1 pg)
11. Map of Wegis Ranch and Vicinity Water Conveyance System, and Location of *E. coli* O157:H7 Samples that Positively Matched the Taco John's Outbreak Strain.
12. California Regional Water Quality Control Board Inspection Report-Notice of Violation (2/27/07) for Maya Dairy (22 pgs.)
13. California Regional Water Quality Control Board Report-Notice of Violation (2/27/07) for West Star North Dairy (24 pgs.)
14. Map and summary of positive samples for *E. coli* O157:H7