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Date: JAN 1 3 2017
Symbol: EPC-DO-16-361
LA-UR: 16-29607
Locates Action No.: N/A

Mr. John E. Kieling
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling:

Subject: **Technical Area 63 Transuranic Waste Facility Container Storage Unit Construction Notice, Los Alamos National Laboratory, Hazardous Waste Facility Permit, EPA ID #NM0890010515**

The purpose of this letter is to provide notification of the construction of the Technical Area 63 Transuranic Waste Facility (TWF) Container Storage Unit to the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB). This notice is submitted pursuant to the requirements of the New Mexico Administrative Code (NMAC 20.4.1.900) incorporating the Code of Federal Regulations, Title 40 (40 CFR) provisions at 40 CFR §270.30(l)(2). The TWF has been constructed in compliance with the requirements contained in the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit (the Permit) issued to the Department of Energy (DOE) and Los Alamos National Security, LLC (LANS), collectively the Permittees, in November 2010.

The Permittees originally submitted a permit modification request seeking approval for the TWF on August 18, 2011 and this was approved by NMED-HWB on December 23, 2013. The permit modification request contained facility design drawings that illustrated construction details used for the development of the TWF related conditions contained in the Permit. Some minor changes that developed later during the project were subsequently submitted through permit modifications. These included design changes submitted by the Permittees on July 28, 2014 and permit modifications to incorporate changes made during construction of the facility that were originally submitted on March 11, 2016 and supplemented on September 1, 2016.

Enclosure 1 of this submittal includes a comparison of construction related TWF conditions from the Permit referencing the associated drawings or descriptions contained in the original permit modifications

with the construction drawings, material information, or reports for the final project. This is used to demonstrate meeting the requirement in 40 CFR §270.30(l)(2)(i) that the facility has been constructed in compliance with the Permit. Enclosure 2 of this submittal includes the new construction drawings and information listed in the comparison.

Enclosure 3 of this submittal includes a list of operational equipment or items in the Permit that will also be available for review and inspection by NMED-HWB prior to the hazardous waste management operations start date for the TWF. With this submittal, the Permittees are requesting the coordination of this inspection in order to meet the start schedule for the project and provide timely corrections or replacement of equipment if needed.

Enclosure 4 of this submittal includes signed certification pages for this report by facility representatives and a registered professional engineer as required by 40 CFR §§270.11 and 270.30(l)(2)(i). Three hard copies and one electronic copy of this submittal are being delivered to the NMED-HWB. The electronic copy, provided only to the NMED-HWB, contains a reproduction of the hardcopy in portable document format (pdf). If you have comments or questions regarding this report, please contact Karen E. Armijo (DOE) at (505) 665-7314 or Mark Haagenstad (LANS) at (505) 665-2014.

Sincerely,

John C. Bretzke
Division Leader
Environmental Protection and Compliance Division
Los Alamos National Security, LLC

Sincerely,

Karen E. Armijo
Permitting and Compliance Program Manag
National Nuclear Security Administration
Los Alamos Field Office
U.S. Department of Energy

JPM:KEA:MPH:/gb

Enclosure: 1) TA-63 TWF Permit Construction Requirements
2) TA-63 TWF Construction Drawings and Information
3) TA-63 TWF Permit Equipment and Operational Requirements
4) Facility Certification

Cy: Laurie King, USEPA/Region 6, Dallas, TX (E-File)
Kathryn M. Roberts, NMED-HWB, Santa Fe, NM, (E-File)
Dave Cobrain, NMED/HWB, Santa Fe, NM, (E-File)
Neelam Dhawan, NMED-HWB, Santa Fe, NM, (E-File)
Siona Briley, NMED-HWB, Santa Fe, NM (E-File)
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Karen E. Armijo, NA-LA, (E-File)
Janelle Armijo, APM/NA-LA, (E-File)
Paul Holland, LASO-NS-LP, (E-File)
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ENCLOSURE 1

Technical Area 63 Transuranic Waste Facility
Container Storage Unit
Permit Construction Requirements

EPC-DO-16-361

LA-UR-16-29607

Date: JAN 1 3 2017

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Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
1	A.6	**General.** The unit is built at the intersection of Pajarito Road and Puye Road, within the triangle formed by Building 63-111 to the east, Puye Road to the north, and Pajarito Road to the southwest.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in location.
2	A.6	The main structure for the unit is a concrete pad providing a physical base for six waste storage buildings, three waste characterization trailers, and outside storage of waste containers that are too large for placement in the buildings.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change to general plan.
3	A.6	The TWF is constructed on 1.82 acres (79,239 square feet).	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	Slight revision in area calculation included in TWF Construction Upgrades Permit Modification Supplement of September 1, 2016.
4	A.6	The pad is surrounded by a security barrier system.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	Revision to replace security fence with security barrier included in TWF Construction Upgrades Permit Modification of March 11, 2016. Revised Fig. 55, Attachment N, Permit.
5	A.6	The boundary of the hazardous waste management unit is limited to the northern portion of the concrete pad defined by those areas that drain to a retention basin.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in boundary of permitted unit.
6	A.6	Along the northern and western sides of the unit, this is the edge of the concrete pad along the bottom of the retaining walls.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in boundary of permitted unit.
7	A.6	On the east side, the edge of the curbing for the concrete pad is the boundary.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in boundary of permitted unit.
8	A.6	The southern side of the boundary is defined by a painted line in compliance with Permit Section 3.5(2), *Management of Containers.* The line is situated approximately between the south east corner of the retention basin and the curb and gutter at the opposite corner of the fence line along the eastern side of the unit. This is defined by the limits of the catchment that drains to the retention basin.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000; DWG-102355-C55443-C-3001; DWG-102355-C55443-C-1004B	No change in boundary of permitted unit.
9	A.6	The unit also includes a small storage building for calibration sources used for waste characterization activities.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in location or use for Building TA-16-0159
10	A.6.1	**Concrete Pad.** The TWF pad consists of 8-inch thick reinforced concrete to provide support for the site structures and vehicle movement. The pad rests on leveled gravel base course and is nominally 8 inches thick.	TWF PMR, Figure 2-7, C55443, C-5000	DWG-102355-C55443-C-5000	No change in thickness of concrete pad
11	A.6.1	Given the elevation difference on the site, retaining walls were constructed along the northwest portion of the site.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in location of retaining walls

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
12	A.6.1	The pad is sloped in a range from 1.1 to 2.5% to promote drainage of storm water and potential fire suppression water to the retention pond.	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003; DWG-102355-C55443-C-1004B	Only minor differences in slope gradient lines. Range of pad slopes revised by TWF Construction Upgrades Permit Modification Supplement of September 1, 2016.
13	A.6.1	The perimeter of the pad has a 15" to 18” gutter and 6” high curb to provide run-off control.	TWF PMR, Figure 2-7, C55443, C-5000	DWG-102355-C55443-C-5000; DWG-102355-C55443-C-1000	No change in gutter and curb locations and function. Size of gutter revised by TWF Construction Upgrades Permit Modification Supplement of September 1, 2016.
14	A.6.1	A valley gutter isolates the northern portion of the pad.	TWF PMR, Figure 2-5, C55443, C-1000; TWF PMR, Figure 2-7, C55443, C-5000	DWG-102355-C55443-C-1000; DWG-102355-C55443-C-5000	No change in location or design of valley gutter.
15	A.6.1	Storm water and potentially contaminated fire suppression water flow from the northern portion of the pad flows to the valley gutter that drains to the retention basin.	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003; DWG-102355-C55443-C-1004B	Only minor differences in slope gradient lines. No change in function of concrete pad slope.
16	A.6.2	**Storage Buildings**. The five buildings measure 33 x 64 ft or approximately 2112 square feet, and are 15 ft high.	TWF PMR, Figure 2-9, C55444, A-1050	DWG-102355-C55444-A-1050; DWG-102355-C55444-A-3002	No change in building dimensions; actual dimensions are 33'4" x 64'4."
17	A.6.2	These five storage buildings are designated 63-0149, 63-0150, 63-0151, 63-0152, and 63-0153.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in building numbers
18	A.6.2	The storage buildings are constructed as covered single-story structural steel frames. Each of the storage buildings and its structural members are designed to exceed the snow load for roof design, the design wind force for buildings, and the seismic loading for structural components, as described in American Society of Civil Engineers specification ASCE 7-05, Minimum Design Loads for Buildings and Other Structures. The steel frame is an ordinary moment frame with joists to attach roof panels and girts to attach wall panels. The walls of the facility are rigid to provide protection from the elements and external forces. Gypsum board on light gauge metal studs with industrial coating finish the interior walls. The roof is a high quality metal standing seam. Batt insulation in the ceiling and on the inside of the walls reduces heat loss and gain inside the buildings.	TWF PMR, Figure 2-13, C55444, S-3000	DWG-102355-C55444-S-3000; DWG-102355-C55444-A-1051; DWG-102355-C55444-A-3002; DWG-102355-C55444-S-0002	No change in building structural details.

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
19	A.6.2	Electric heaters heat the interior to prevent fire suppression systems and eyewash stations from freezing.	NA	DWG-102355-C55444-M-1000; DWG-102355-C55445-M-1000; DWG-102355-C55444-M-6000; DWG-102355-C55445-M-6000	Heater and eyewashes present.
20	A.6.2	Cooling is provided by venting fans.	NA	DWG-10235-C55444-M-1000; DWG-10235-C55445-M-1000; DWG-10235-C55444-M-6000; DWG-10235-C55445-M-6000	Venting fans present.
21	A.6.2	In order to drain the building in the event of a fire, the floors are constructed to provide a shallow slope (1/8 inch to 1 foot) from the back end of the building towards the front, and then out the roll-up door opening and a loading ramp to the concrete pad outside the building.	TWF PMR, Figure 2-10, C55444, S-1000	DWG-10235-C55444-S-1000; DWG-10235-C55445-S-1000	No change in floor slope and floor configuration.
22	A.6.2	The building floors (i.e., mat slabs) are six inches higher than the outside surface of the concrete pad to prevent run-on, and are sloped toward the roll-up door at the building entrances for drainage, in accordance with 40 CFR §264.175(b)(2) and (c).	TWF PMR, Figure 2-14, C55444, S-5010; Figure 2-10, C55444, S-1000	DWG-10235-C55444-S-1000, DWG-10235-C55444-S-5010; DWG-10235-C55445-S-1000; DWG-10235-C55445-S-5010	No change in curb or floor slope.
23	A.6.2	The concrete floors are coated to provide a sealed surface and chemical resistance, although secondary containment pallets are used to meet the containment requirements of the Permit for potential liquid containing waste containers in the storage buildings and in compliance with 40 CFR §264.175(b)(1). The floor coating standards include: • Minimum Class B per National Fire Protection Association (NFPA); • Radiation resistant as determined by American Society for Testing and Materials, International specification ASTM D 4082; and • Decontaminable to at least 95 percent of total activity removed and certified for Nuclear Coating Service level II.	NA	TA-63 TWF Storage Building Floor Coating Information	No change in floor coating specification. Condition of the structure (e.g., floor cracking or deterioration) will be addressed by the facility program for equipment and structure repair (Permit Section 2.6.2 and Attachment E, Inspection Plan; see Enclosure 4 of this document).
24	A.6.3	**Storage and Characterization Building.** The sixth storage building is divided into a storage area, a staging room used for the thermal equilibrium of containers to prepare for head space gas sampling, and additional support and analytical equipment rooms.	TWF PMR, Figure 2-19, C55445, A-1050	DWG-102355-C55445-A-1050	No change in building layout as constructed.
25	A.6.3	The building dimensions are 80 x 33 ft (approximately 2640 square feet) and 15 feet high. The building is constructed to the same standards as the other storage buildings. The building is numbered 63-0154.	TWF PMR, Figure 2-19, C55445, A-1050; Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000; DWG-102355-C55445-A-1050; DWG-102355-C55445-A-3002	No change in building dimensions and numbering; actual building size is 33'4"x79'11."

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
26	A.6.4	**Characterization Trailers**. The TWF facility includes pads with utility hook-ups for the characterization trailers used to certify containers as meeting DOE WIPP waste acceptance criteria (WAC).	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in locations for characterization trailers.
27	A.6.4	The trailers are numbered 63-0155, 63-0156, and 63-0157 at TA-63.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in characterization trailer numbering.
28	A.6.5	**Retention Basin**. The retention basin is designed to collect surface storm water or melt water run-off from the concrete pavement via the slope (ranging from 1.1% to 2.5%) of the concrete pad, and in the event of a fire at the unit, fire suppression water that could flow out of the storage buildings or from other unit structures to the concrete pad.	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003; DWG-102355-C55443-C-1004B	No change in site grading of permitted unit that would affect purpose of the retention basin. Range of pad slopes revised by TWF Construction Upgrades Permit Modification Supplement of September 1, 2016
29	A.6.5	The designed total retention basin volume also includes a minimum of 1.0 ft of freeboard, resulting in a total capacity of 137,450 gallons (18,375 cubic ft.).	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003; DWG-102355-C55443-C-1017	No change in design volume of the retention basin. The freeboard information was revised in the TWF Construction Upgrades Permit Modification of March 11, 2016. However, subsequent review for this report has determined the freeboard value should remain the same (0.5 ft) as included in the original PMR and this will be resolved with a future permit modification description change to Permit Attachment A.6.5 for clarification.
30	A.6.5	The dimensions of the basin are 125 ft by 42 ft by 3.5 ft deep.	TWF PMR, Figure 2-29, C55443, C-1017	DWG-102355-C55443-C-1017	No change in retention basin plan.
31	A.6.5	The retention basin is equipped with a manual release valve that may be used to discharge collected water that meets appropriate surface water discharge standards, as required by Permit Section 3.14.2.	TWF PMR, Figure 2-29, C55443, C-1017	DWG-102355-C55443-C-1017	No change in retention basin plan.

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32	A.6.5	The concrete mixture used for construction of the retention basin is supplemented with an additive to improve the concrete's water resistance.	NA	TA-63 TWF Retention Basin Sealant Information	No change in presence or purpose of concrete enhancement. Final product used is a penetrating sealant (Xypex) rather than a concrete admixture type of additive (see Enclosure 2 of this document). A text revision to correct this will be made with a future permit modification description change to Permit Attachment A.6.5 for clarification.
33	A.6.6	**Other Project Structures.** However, it (*Note: the Operations Support Building*) provides storage of waste container data and monitoring of key operational parameters (e.g., fire alarm systems, safety equipment status indicators, and communication systems including the public address system) and specific safety structure, system, and component status.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in site layout of structures outside of permitted unit.
34	A.6.6	Vehicle access to the hazardous waste management unit is through a gated driveway located east of the concrete pad. Gates are kept closed and vehicle access to the controlled area within the unit fence line requires check-in at the Operations Support Building. Pedestrian access to the controlled area also requires check-in through the Operations Support Building.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in site layout of structures outside of permitted unit.
35	A.6.6	A fire water supply tank and a utility building that houses two fire water pumps and instrumentation needed to ensure operation of the fire suppression system are located to the north of the Operations Support Building outside the controlled area fence.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in site layout of structures outside of permitted unit.
36	A.6.6	A separate building designated the Characterization Source and Matrix Management (CSMM) Building will house radioactive sealed sources for calibration of RTR and HENC sensors sources.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in site layout.

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37	A.6.7	**Security and Access Control**. The TWF is enclosed by a security barrier system with controlled access gates. This includes a continuous section of prefabricated steel vehicle barriers and an eight foot high chain link fence.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000; DWG-102355-C55443-C-1021	Revision to replace security fence with security barrier included in TWF Construction Upgrades Permit Modification of March 11, 2016. Revised Fig. 55, Attachment N, Permit. Three pedestrian emergency egress gates (crash gates) have been added to the fence line for emergency exit only from the permitted unit area and this will be resolved with a future permit modification description change to Permit Attachment A.6.7 and Figure 55 for clarification (See Item 67).
38	A.6.7	Two vehicle access gates are integrated into the fence line.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change in site layout.
39	A.6.8	**Required Equipment.** The TWF is equipped with safety-alarm systems to alert personnel in the event of an emergency and to evacuate the area. The facility monitor/control system is located in the access control station at the TWF; the system is also connected to the Los Alamos County Consolidated Dispatch Center.	NA	DWG-102355-C57217-F-1002; DWG-102355-C57217-F-6000	Schematic of safety alarms in Operations Building
40	A.6.8	Fire-alarm pull boxes and/or drop box push-button alarms are located pursuant to NFPA standards in the TWF where waste management activities are conducted.	NA	DWG-102355-C57217-F-1003; DWG-102355-C57217-F-6001	Storage building layouts for fire alarm manual pull stations.
41	A.6.8	Once manually activated, an alarm will sound in the TWF access control station and at the LAFD through Los Alamos County Consolidated Dispatch Center.	NA	DWG-102355-C57217-F-6002	Schematic of safety alarms in Operations Building
42	A.6.8	The TWF is also equipped with automatic fire suppression alarm systems. The fire-suppression alarms will be activated when water flow is detected in the sprinkler pipes of the fire-suppression system.	NA	DWG-102355-C57217-F-6002	Schematic of safety alarms in storage buildings and Operations Building.
43	A.6.8	Upon activation of the fire-alarm system, an alarm will sound and lights will flash to alert personnel of emergency conditions. All fire-alarm pull boxes and automatic fire-suppression systems located at the TWF are connected to the LAFD through Los Alamos County Consolidated Dispatch Center.	NA	DWG-102355-C57217-F-6002	Schematic of safety alarms in storage buildings and Operations Building.

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44	A.6.8	In addition to the alarms described above, a public address (PA) system is available to announce emergency conditions or to initiate an evacuation at the TWF. The PA system is audible throughout the TWF and is activated from the access control station in the Operations Support Building.	NA	DWG-102355-C55443-E-6003	Paging system block diagram.
45	A.6.8	Fire hydrants are located in accordance with NFPA standards on the west and east sides of the TWF pad and near the Operations Building. Water is supplied to the fire hydrants by a municipal water system which can provide adequate volume and pressure (i.e., greater than 1,000 gal per minute and 90 pounds per square inch static pressure) to multiple water hoses in the event of a fire.	NA	DWG-102355-C55443-C-1007; Hydraulic Calculation 14055020-FP-CAL-001	Fire hydrant locations (Note 10). Testing showed that a supplemental 200,000 gallon water tank and fire water pumps were needed to meet the flow and pressure requirements of the fire hydrants.
46	A.6.8	Fire protection systems for the TWF storage buildings, including the Storage and Characterization Building 63-0154, include a wet-pipe sprinkler system for fire suppression.	TWF PMR, Figure 2-16, C55444, F-1000; TWF PMR, Figure 2-27, C55445, F-1000	DWG-102355-C57218-F-1003; DWG-102355-C57218-F-1008	Revision from wet-pipe sprinkler system to dry-pipe sprinklers system included in TWF Design Updates Permit Modification, July 28, 2014.
47	A.6.8	Water will be supplied via the 196,000 gallon tank north of the Operations Support Building with a combination of electric fire water pumps backed up with a diesel generator to distribute water to automatic sprinkler systems in the buildings.	TWF PMR, Figure 2-5, C55443, C-1000	DWG-102355-C55443-C-1000	No change to location of fire suppression water storage tank (63-0148) or fire water pump station (63-0147). Revision to fire water storage tank volume, fire pump description, and generator location (Note 18) included in TWF Construction Upgrades Permit Modification Request (PMR) Supplement of September 1, 2016.
48	A.6.8	Personnel decontamination equipment at the TWF includes safety showers and eye wash stations located inside each of the storage buildings. These are situated in all waste storage buildings in accordance with OSHA requirements.	TWF PMR, Figure 2-18, C55444, P-5000	DWG-102355-C55444-P-5000; DWG-102355-C55445-P-5000; DWG-102355-C55444-P-1000; DWG-102355-C55445-P-1000	No change in safety shower and eyewash stations specifications or locations.

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
49	A.6.9	**Control of Run-on/Run-off.** Controlling run-on and run-off at the TWF locations where waste management operations occur is accomplished by the design of the buildings and the use of control structures with appropriate contouring of surface areas. Run-on of storm water into the storage buildings is prevented by walls that enclose raised floors and surface contouring that slopes away from the building to prevent storm water from pooling against the foundations, doors, and loading areas. The internal floors of the buildings are sloped toward the front doors to prevent flooding by precipitation or storm water in addition to providing internal drainage to the outside.	TWF PMR, Figure 2-6, C55443, C-1003; TWF PMR, Figure 2-10, C55444, S-1000; TWF PMR, Figure 2-20, C55445, S-1000	DWG-102355-C55443-C-1003; DWG-102355-C55444-S-1000; DWG-102355-C55445-S-1000	No change in concrete pad slope function or internal slope of storage building floors.
50	A.6.9	The concrete pad within the permitted unit at the TWF site is sloped in a range from 1.1% to 2.5% to promote drainage to the retention pond.	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003; DWG-102355-C55443-C-1004B	No change in site grading of permitted unit that would affect purpose of the retention basin. Range of pad slopes revised by TWF Construction Upgrades Permit Modification Request (PMR) Supplement of September 1, 2016.
51	A.6.9	A retention wall prevents slope failure between the surrounding roads and the site.	TWF PMR, Figure 2-6, C55443, C-1003	DWG-102355-C55443-C-1003	No change in location of retaining wall (Note 2).
52	A.6.10	**Subsurface Vapor Monitoring.** The Permittees shall install a subsurface vapor monitoring network consisting of a minimum of five vapor monitoring wells in the vicinity of the buildings located within the TWF facility to evaluate for vapor-phase contaminants that may migrate from MDA C.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in well number or purpose for monitoring system
53	A.6.10	Two of the monitoring wells must be located as close as possible to the building foundations that are adjacent to the unit boundary facing MDA C and the utility corridor on Puye Road as depicted by locations VMW-1 and VMW-2 on Figure 56 in Attachment N (Figures).	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in location of monitoring wells VMW-1 and VMW-2.
54	A.6.10	A third monitoring well must be located at a point on the western edge of the permitted unit as close as possible to the utility corridor on Pajarito Road as depicted by location VMW-3 on Figure 56.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in location of monitoring well VMW-3

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
55	A.6.10	Two monitoring wells must be located between MDA C and Puye Rd as depicted by locations VMW-4 and VMW-5 on Figure 56.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	Location of VMW-4 revised by October 29, 2015 Report and Permit Figure 56 revised by TWF Construction Upgrades Permit Modification of March 11, 2016
56	A.6.10	Vapor monitoring wells VMW-1, VMW-2, and VMW-3 shall be constructed with a single vapor monitoring port located in the center of a sampling interval between 5 ft and 10 ft below ground surface (bgs). Vapor monitoring wells VMW-4 and VMW-5 shall be constructed with two vapor monitoring ports located at 25 ft and 60 ft below ground surface (bgs). Boreholes will be advanced using hollow stem auger drilling methods. The vapor monitoring wells shall be constructed utilizing the same type of stainless steel (SS) tubing sampling system used at Vapor Monitoring Well 50-613183 at MDA C.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in construction of monitoring wells VMW-1, VMW-2, or VMW-3.
57	A.6.10	Well boreholes for VMW-1, VMW-2, and VMW-3 must be advanced to the design depth of 10 ft bgs. A continuous 0.25 inch stainless steel sampling tube with a screened end opening must then be placed in the borehole centered in the sampling interval (5 ft to 10 ft bgs) depth and clean sand filter pack added as the auger(s) are withdrawn to create a vapor permeable medium in the interval 5 ft to 10 ft bgs. The vapor monitoring wells must then be sealed with 2.5 ft of hydrated bentonite clay overlain by 2 ft of bentonite-cement grout.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in sampling interval for monitoring wells VMW-1, VMW-2, or VMW-3.
58	A.6.10	Well boreholes for VMW-4 and VMW-5 must be advanced to the design depth of 67.5 ft bgs. A minimum 5 ft hydrated bentonite clay plug must be placed above and below each sampling interval. A continuous 0.25 inch stainless steel sampling tube with a screened end opening must be placed in the borehole centered in the 5-foot sampling intervals and clean sand filter pack added as the auger(s) are withdrawn to create a vapor permeable medium in the intervals from 62.5 ft to 57.5 ft bgs and 22.5 ft to 27.5 ft bgs. Bentonite chips shall fill the borehole between sampling interval hydrated bentonite plugs and from the top of the 25 ft sampling interval to 5.5 ft bgs and overlain by a 5 ft bentonite cement grout surface seal.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	No change in sampling interval for monitoring wells VMW-4 or VMW-5.
59	A.6.10	Final construction of the vapor monitoring wells requires the installation of surface completions consisting of traffic-rated, flush-mount steel surface monuments. The Permittees shall take measures to ensure that the surface monuments will not be damaged by snow removal or other maintenance equipment.	Soil Vapor Monitoring System was not included in the TWF PMR. Added to LANL Hazardous Waste Facility Permit with approval December 19, 2013.	TA-63 TWF Soil Vapor Monitoring System Report, October 29, 2015	Change to flush mount well completions included in TWF Design Updates Permit Modification, July 28, 2014. Well casings are above ground and protected by bollards.

Item No.	Permit Section	Requirement	Permit Modification Request Documentation (TWF PMR, August 18, 2011)	Construction Documentation	Notes
60		Fire Control Equipment. Flame or smoke detection equipment and fire alarm pull stations are located within structures at TA-63-0149, TA-63-0150, TA-63-0151, TA-63-0152, TA-63-0153, and TA-63-0154.	NA	DWG-102355-C55443-F-0001; DWG-102355-C55444-F-1001; DWG-102355-C55445-F-1001	Location of fire alarm pull stations and smoke detectors in storage buildings
61	Table D-4	Dry-pipe fire suppression systems are available at TA-63-0149, TA-63-0150, TA-63-0151, TA-63-0152, TA-63-0153, and TA-63-0154.	TWF PMR, Figure 2-16, C55444, F-1000; TWF PMR, Figure 2-27, C55445, F-1000	DWG-102355-C55444-F-1000; DWG-102355-C55445-F-1000	Revision from wet-pipe sprinkler system to dry-pipe sprinklers system included in TWF Design Updates Permit Modification, July 28, 2014.
62	Table D-4	Fire alarm pull stations are available at TA-63-0145, TA-63-0149, TA-63-0150, TA-63-0151, TA-63-0152, TA-63-0153, TA-63-0154, TA-63-0155, TA-63-0156, and TA-63-0157.	NA	DWG-102355-C55443-F-0001; DWG-102355-C55444-F-1001; DWG-102355-C55445-F-1001	Location of fire alarm pull stations in storage buildings.
63	Table D-4	Two fire hydrants are located in TWF. These fire hydrants supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).	NA	DWG-102355-C55443-C-1007	Location of fire hydrants in TWF.
64	Table D-4	**Communication Equipment.** Telephones and the public address system are located inside the Operations Support Building.	NA	DWG-102355-C55443-E-6003	No change in location of telephones or public address system.
65	Table D-4	Employees can be notified of an emergency situation and appropriate response action through the public address system.	NA	DWG-102355-C55443-E-6003	No change in purpose of the public address system.
66	Table D-4	Fire alarm pull stations are located in the storage buildings, the receiving canopy, and at operations support building.	NA	DWG-102355-C57217-F-1002; DWG-102355-C57217-F-1005; DWG-102355-C57217-F-1010; DWG-102355-C57217-F-5002	Receiving canopy structure (TA-63-0145) removed by the Construction Updates Permit Modification of March 11, 2016.
67	Figure 55	Technical Area (TA) 63 Transuranic Waste Facility Site	NA	DWG-10235-C55443-C-1000; DWG-10235-C55443-C-5006	Three pedestrian emergency egress gates (crash gates) have been added to the fence line for emergency exit only from the permitted unit area and this will be resolved with a future permit modification description change to Figure 55 for clarification.

ENCLOSURE 2

Technical Area 63 Transuranic Waste Facility
Container Storage Unit
Construction Drawings and
Information

EPC-DO-16-361

LA-UR-16-29607

Date: JAN 1 3 2017

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Contents:

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Figures

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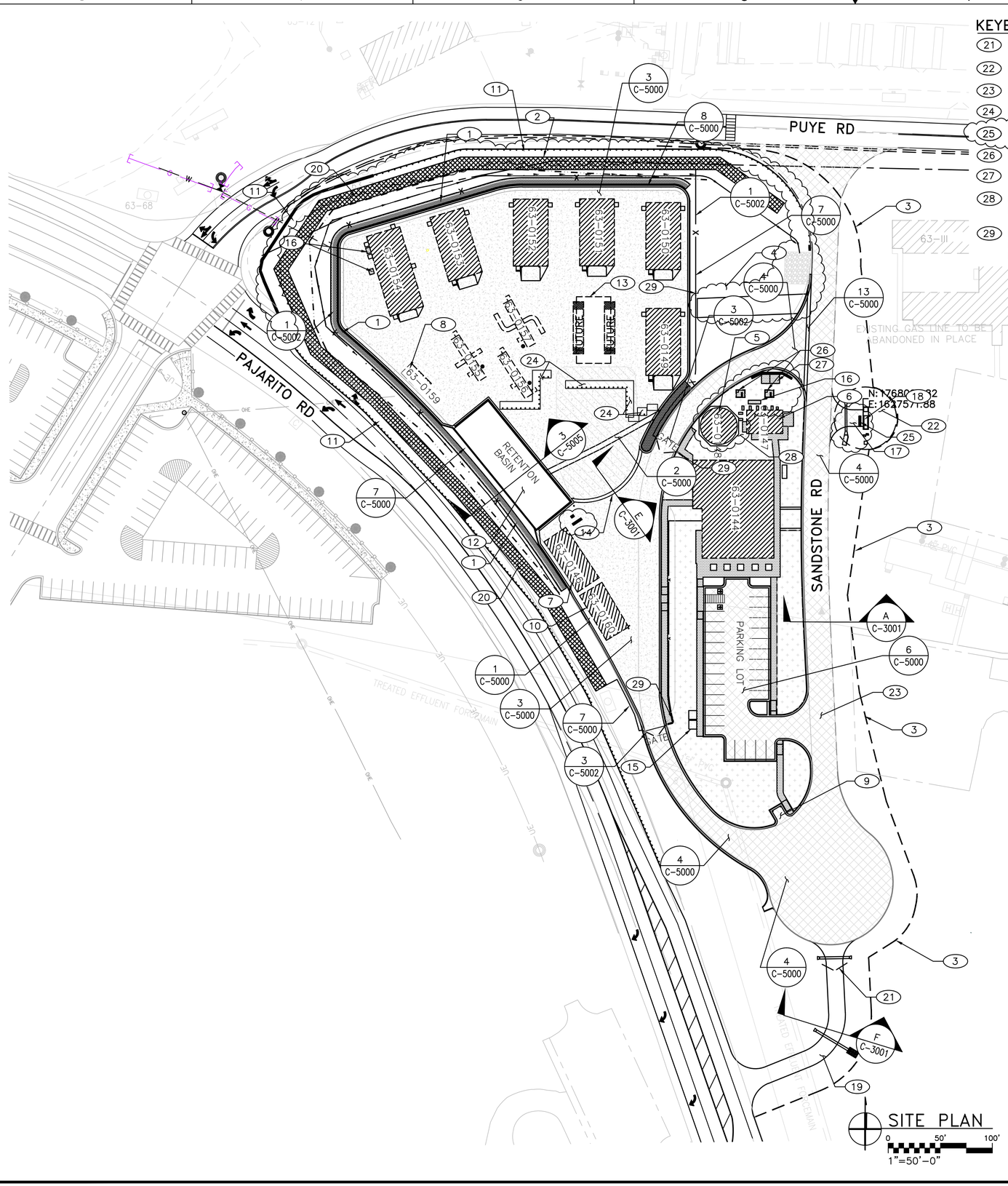
No.	Drawing Identification	Description
1	DWG-102355-55443-C-1000	Overall Site Plan
2	DWG-102355-55443-C-1003	Overall Grading Plan
3	DWG-102355-55443-C-1004B	LIDAR Image Grading Plan
4	DWG-102355-55443-C-1007	Fire Protection Site Plan
5	DWG-102355-55443-C-1017	Retention Basin Foundation Plan
6	DWG-102355-55443-C-1021	Overall Metalith Barrier Plan
7	DWG-102355-55443-C-3001	Sandstone Road Typical Section
8	DWG-102355-55443-C-5000	Miscellaneous Details
9	DWG-102355-55443-C-5006	Miscellaneous Details
10	DWG-102355-55443-E-6003	Operations Support Building – Electrical Diagrams
11	DWG-102355-55443-F-1001	Operations Support Building – Symbol Legend and General Notes
12	DWG-102355-55444-A-1050	Storage Building – Floor Plan
13	DWG-102355-55444-A-1051	Storage Building – Roof Plan
14	DWG-102355-55444-A-3002	Storage Building – Wall Section
15	DWG-102355-55444-F-1000	Storage Building – Fire Protection Plan
16	DWG-102355-55444-F-1001	Storage Building – Fire Detection and Alarm Plan
17	DWG-102355-55444-M-1000	Storage Building – HVAC Plan
18	DWG-102355-55444-M-6000	Storage Building – HVAC Flow Diagram
19	DWG-102355-55444-P-1000	Storage Building – Plumbing Plan
20	DWG-102355-55444-P-5000	Storage Building - Details
21	DWG-102355-55444-S-0002	Storage Building – General Structural Notes
22	DWG-102355-55444-S-1000	Storage Building – Foundation Plan
23	DWG-102355-55444-S-3000	Storage Building – Structural Sections
24	DWG-102355-55444-S-5010	Storage Building – Foundation Details
25	DWG-102355-55445-A-1050	Storage and Characterization Building – Floor Plan
26	DWG-102355-55445-A-3002	Storage and Characterization Building – Wall Section
27	DWG-102355-55445-F-1000	Storage and Characterization Building – Fire Protection Plan
28	DWG-102355-55445-F-1001	Storage and Characterization Building – Fire Detection and Alarm Plan

29	DWG-102355-55445-M-1000	Storage and Characterization Building – HVAC Plan
30	DWG-102355-55445-M-6000	Storage and Characterization Building – HVAC Flow Diagram
31	DWG-102355-55445-P-1000	Storage and Characterization Building – Plumbing Plan
32	DWG-102355-55445-P-5000	Storage and Characterization Building - Details
33	DWG-102355-55445-S-1000	Storage and Characterization Building – Foundation Plan
34	DWG-102355-55445-S-5010	Storage and Characterization Building – Foundation Details
35	DWG-102355-C57217-F-1002	Floor Plan Building 144
36	DWG-102355-C57217-F-1003	Floor Plan Building 146
37	DWG-102355-C57217-F-1005	Floor Plan Building 149
38	DWG-102355-C57217-F-1010	Floor Plan Building 154
39	DWG-102355-C57217-F-5002	Details
40	DWG-102355-C57217-F-6000	FCP-1 Functional Matrix
41	DWG-102355-C57217-F-6001	FCP-2 (FAP) Functional Matrix
42	DWG-102355-C57217-F-6002	SLC Riser Diagram
43	DWG-102355-C57218-F-1003	Fire Sprinkler Floor Plan Storage Building 149
44	DWG-102355-C57218-F-1008	Fire Sprinkler Floor Plan Storage Building 154



KEYED NOTES

21 INSTALL 2–12' SWING GATES

22 PROVIDE 30' RADIUS USING SALVAGED GRAVEL IN THIS AREA

23 SANDSTONE RD SEE SHEET C–1019

24 INSTALL BOLLARDS, SEE SHT C–4000 & C–4001 FOR DETAILS

25 SINGLE JERSEY BARRIER

26 SEISMIC SWITCH, SEE C55446–E–4001

27 TRANSFORMER PAD, SEE C55446–E–5002

28 PROVIDE SALVAGED GRAVEL FROM OPERATION BUILDING 63–0144 NORTH TO SANDSTONE ROAD/ENTRY ROAD

29 PEDESTRIAN GATE WITH EXIT HARDWARE. SEE DETAIL 5/C–5006. EXIT HARDWARE IS GFE. COORDINATE EXACT GATE LOCATION WITH LANL STR.

GENERAL NOTES

1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. EXISTING UTILITY LOCATIONS ARE APPROXIMATE ONLY AND SHALL BE FIELD LOCATED PRIOR TO CONSTRUCTION.
4. THE INTENT OF THIS SHEET IS TO GIVE AN OVERALL SITE PLAN VIEW. SEE SHEETS C–1001 & C–1002 FOR MORE DETAIL.
5. AN OFFSITE AREA WILL BE DESIGNATED BY THE LANL STR TO ALLOW THE SUBCONTRACTOR TO STOCKPILE THE GRAVEL IF THE SUBCONTRACTOR WOULD FIND IT ADVANTAGEOUS. THE STOCK PILE AREA WILL BE WITHIN A ½ MILE OF THE PROJECT SITE.
6. THE SUBCONTRACTOR IS ALLOWED TO LEAVE THE EXISTING TRACK PAD. PRIOR TO PAVING OPERATIONS, THE TRACK PAD WILL BE REMOVED AND RELOCATED AS DIRECTED BY THE LANL STR.
7. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR THE RESETTING OF THE EXISTING JERSEY BARRIER AS NECESSARY FOR THE PROTECTION OF THE JOB SITE, THE SUBCONTRACTOR TRAILER, REMAINING BARRIERS, ETC. WILL BE STAGED IN CLOSE PROXIMITY TO THE JOB SITE TO ELIMINATE INTERFERENCE WITH CONSTRUCTION AS DIRECTED BY THE LANL STR.

KEYED NOTES

1 EXISTING RETAINING WALL BUILT PER TWF PHASE A

2 COLD MIX ASPHALT SWALE.

3 LIMITS OF CONSTRUCTION.

4 EXISTING MONITORING WELL TO REMAIN, DO NOT DISTURB

5 FIRE WATER STORAGE DIAMETER=35 FT, HEIGHT=28 FT, VOLUME=200,000 GAL

6 UTILITY BUILDING, SEE ARCHITECTURAL PLANS

7 FORKLIFT CHARGING STATION

8 CSMM STORAGE BUILDING

9 DUMPSTER PAD

10 EQUIPMENT STORAGE SHED

11 THRIE BEAM SEE SHEET C–1025 & C–1026 FOR DETAILS

12 RETENTION BASIN SEE SHEETS C–1017 & C–5005 FOR DETAILS

13 AREA DESIGNATED AS FUTURE EXPANSION

14 SOUTHERNMOST LIMITS OF THE TWF RCPA PERMITTED AREA

15 LEEDS STORAGE AREA (TYP. 2)

16 EQUIPMENT PADS, SEE C55446–S–5010

17 16' TURNOUT ACCESS (GENERATOR ACCESS)

18 GENERATOR PAD, SEE SHEET C–5008 FOR DETAILS.

19 16' EMERGENCY ACCESS, SEE SHEET C–1019 OF PLANS

20 METALITH BARRIER, SEE SHEET C–1021 OF PLANS

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
7	07–08–16	U		FCN AS–BUILT UPDATES	MR	MT	ESC	BS	
6	02–11–16	U		INCORPORATED FCR–333, DCN–474	MR	MT	ESC	BS	
5	01–14–16	U		INCORPORATED FCR–140, DCN–295	MR	MT	ESC	BS	
4	05–14–14	U		102355–DRN–C55443–0001 ADDED GENERAL NOTES	DP	CLL	ESC	BS	EA
3	03–20–14	U		DRN–14–63–0144–0043 REVISED STORAGE TANK LOCATION	DP	CLL	ESC	BS	EA
2	01–06–14	U		DRN–14–63–0144–0034 ADDED KEYED NOTES	DP	CLL	ESC	BS	EA
1	11–06–13	U		REVISED SITE LAYOUT	DP	CLL	ESC	BS	EA

MANUEL TARIN III NEW MEXICO 18741 PROFESSIONAL ENGINEER

07/08/2016

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

OVERALL SITE PLAN

BLDG TA–63

DRAWN	D PADILLA
DESIGN	C LEY
CHECKED	E CORDOVA
DATE	11–06–13

SUBMITTED BRIAN SULLIVAN

APPROVED FOR RELEASE ED ARTIGLIA

Los Alamos NATIONAL LABORATORY P0 Box 1663 Los Alamos, New Mexico 87545

SHEET C–1000

9 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11–06–13

PROJECT ID 102355 | DRAWING NO C55443 | REV 7

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GRADING PLAN

0 50' 100'

1"=50'-0"

GENERAL NOTES

1. THE INTENT OF THIS SHEET IS GIVE AN OVERVIEW OF THE TWF GRADING CONCEPT. REFER TO SHEETS C-1004 & C-1005 FOR DETAILED GRADING INFORMATION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. EXISTING UTILITY LOCATIONS ARE APPROXIMATE ONLY AND SHALL BE FIELD LOCATED PRIOR TO CONSTRUCTION.
4. THE SUBCONTRACTOR WILL IMPLEMENT AND MAINTAIN BEST MANAGEMENT PRACTICES (BMPs) AND CONTROL MEASURES PRIOR TO AND DURING CONSTRUCTION AS SPECIFIED IN THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP).
5. THE SUBCONTRACTOR WILL STABILIZE ALL DISTURBED AREAS "WITHIN SEVEN CALENDAR DAYS AND AT COMPLETION OF THE PROJECT" IN ACCORDANCE WITH THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) BY LANL.

KEYED NOTES

1. LIMITS OF GRADING WORK
2. RETAINING WALL BUILT PER PHASE A CONSTRUCTION
3. 3:1 FILL SLOPE
4. SOUTHERNMOST LIMITS OF THE RCRA PERMITTED UNIT, LOADING/UNLOADING AREA
5. SEE SHEET C-5008 FOR PAD FOOTING
6. BUILD RIP RAP RUNDOWN PER DETAIL ON C-5013
7. BUILD WIRE ENCLOSED CLASS A RIP RAP PAD 1'D X 30'W X 25'L, FIELD FIT TO CAPTURE WEST SLOPE.
8. REMOVE 80'± OF EXISTING 4" UNDER DRAIN AND CASING DRAINAGE FROM PIPE TO BE DIVERTED TO PROPOSED DITCH

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
5	09-15-16	U		INCORPORATED FCN 49	MR	MT	ESC	BS	
4	01-18-16	U		INCORPORATED FCR-221, DCN-370	MR	MT	ESC	BS	
3	07-15-15	U		FCR-192, DCN-347 UPDATED PROPOSED TOPO	DP	MT	ESC	BS	
2	10-20-14	U		FCR 014, 025 DCN 015 ADD TDS TO ACCESS ROAD/KEYED NOTE	DP	CLL	ESC	BS	
1	11-06-13	U		REVISED SITE LAYOUT	DP	CLL	ESC	BS	EA

WEIDLINGER-ASSOCIATES JV NORTHERN NM

TRU WASTE FACILITY PROJECT

OVERALL GRADING PLAN

BLDG TA-63

DRAWN D PADILLA
DESIGN C LEY
CHECKED E CORDOVA
DATE 11-06-13

SUBMITTED
BRIAN SULLIVAN

APPROVED FOR RELEASE
ED ARTIGLIA

MANUEL TARIN III NEW MEXICO 18741 PROFESSIONAL ENGINEER
09/15/2016

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SHEET C-1003
12 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55443
REV 5

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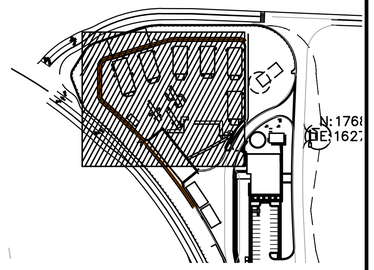
LIDAR IMAGE GRADING PLAN

SCALE: NONE



KEY PLAN

SCALE: NONE

GENERAL NOTES

1. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING PROVIDES AS-BUILT CONDITIONS TAKEN FROM A LIDAR SURVEY OF THE FACILITY. LIDAR SURVEY WAS PROVIDED BY LANL.

MANUEL TARIN III
NEW MEXICO
18741
PROFESSIONAL ENGINEER

06/28/2016

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

LIDAR IMAGE GRADING PLAN

BLDG TA-63

DRAWN	D PADILLA DP
DESIGN	M TARIN MT
CHECKED	E CORDOVA
DATE	06-28-16

SUBMITTED BRIAN SULLIVAN

APPROVED FOR RELEASE ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1004B

13B OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 06-28-16

PROJECT ID	DRAWING NO	REV
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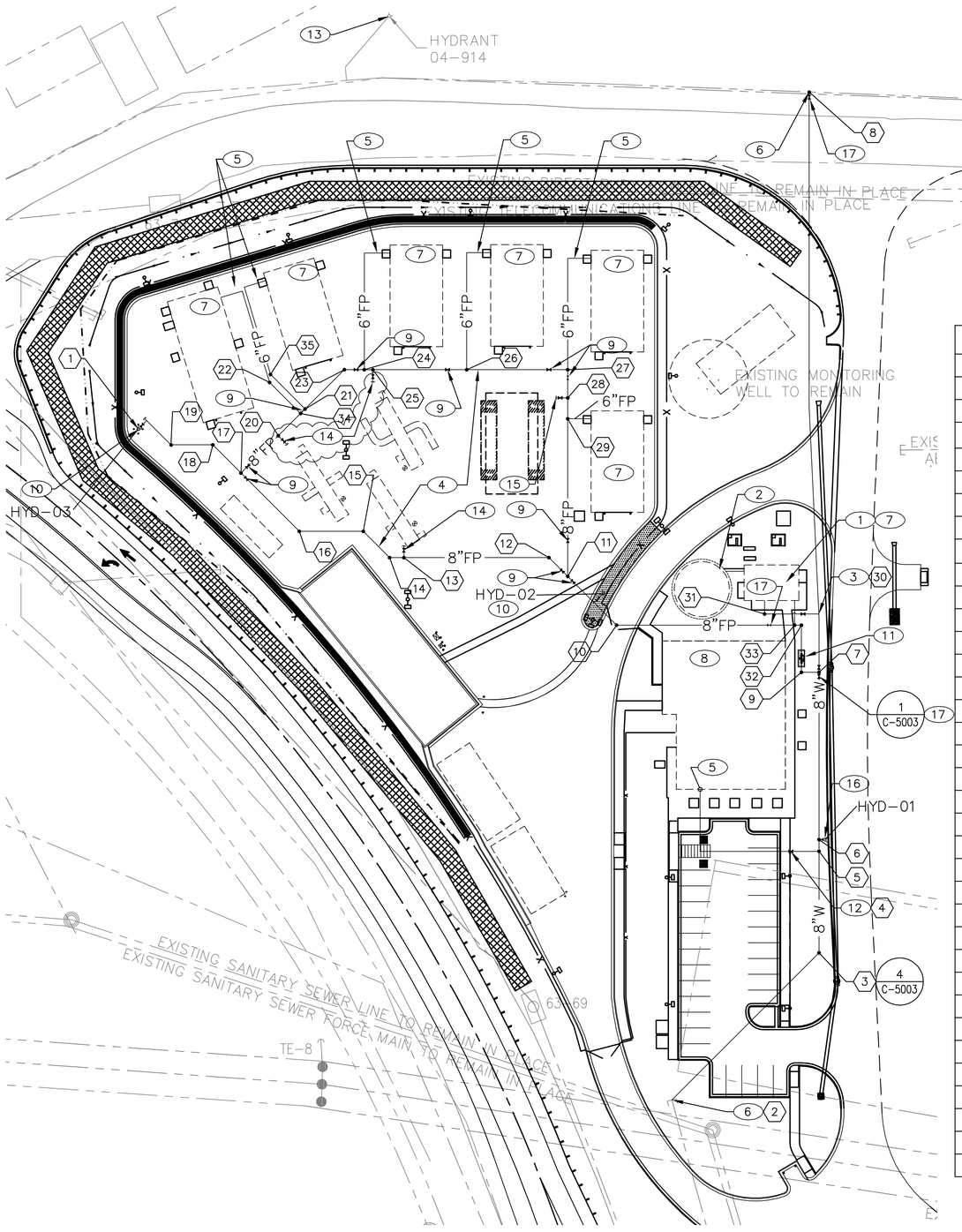


FIRE PROTECTION SITE PLAN

1"=40'-0"

POINT TABLE			
PNT #	DESCRIPTION	NORTHING	EASTING
1	CENTER POINT HYDRANT	1768146.74	1627076.29
2	8" TIE TO EXISTING WATER LINE	1767721.71	1627414.24
3	8" 45° ELBOW	1767814.93	1627507.46
4	CENTER POINT PIV	1767879.24	1627489.62
5	8"x8"x6" TEE	1767879.24	1627507.46
6	8"x8"x6" TEE	1767886.61	1627507.46
7	8" TEE	1767992.69	1627507.46
8	8" TIE TO EXISTING WATER LINE	1768360.32	1627501.27
9	8" 90° ELBOW	1767992.69	1627496.30
10	8" 45° ELBOW	1768022.54	1627379.20
11	8" WYE	1768053.42	1627348.32
12	8" 45° ELBOW	1768065.35	1627336.40
13	8"x8"x6" TEE	1768065.35	1627244.50
14	8" 45° ELBOW	1768065.35	1627235.44
15	8" 45° ELBOW	1768081.99	1627218.80
16	8" 45° ELBOW	1768081.99	1627178.27
17	8"x6"x8" TEE	1768118.92	1627141.35
18	6" 45° ELBOW	1768136.77	1627123.49
19	6" 45° ELBOW	1768136.77	1627097.02
20	8"x8"x6" TEE	1768143.57	1627165.00
21	8"x8"x6" TEE	1768159.51	1627181.94
22	6" ELBOW	1768176.34	1627159.46
23	8" 45° ELBOW	1768184.41	1627206.84
24	8"x8"x6" TEE	1768184.41	1627219.44
25	8"x8"x6" TEE	1768184.41	1627224.87
26	8"x8"x6" TEE	1768184.41	1627284.33
27	8"x6"x8" TEE	1768184.41	1627348.32
28	8"x8"x6" TEE	1768166.52	1627348.32
29	8"x8"x6" TEE	1768153.30	1627348.32
30	8"x8"x4" TEE	1768029.60	1627507.33
31	4" 90° ELBOW	1768029.60	1627472.98
32	8" 90° ELBOW	1768022.54	1627496.30
33	8" x 8" TEE	1768022.54	1627491.98
34	8"x8"x6" TEE	1768156.68	1627179.11
35	6" 45° ELBOW	1767181.44	1627160.02

GENERAL NOTES

1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. EXISTING UTILITY LOCATIONS ARE APPROXIMATE ONLY AND SHALL BE FIELD LOCATED PRIOR TO CONSTRUCTION.
4. STORAGE BUILDINGS, OPERATIONS SUPPORT BUILDING, UTILITY BUILDING, TRAILER COMPLEX AND YARD ARE SEPARATE FIRE AREAS.
5. ALL FIRE WATER PIPE SHALL HAVE A MINIMUM COVER DEPTH OF 4 FEET.
6. REFER TO SHEET C-1006 FOR SITE UTILITY COORDINATION AND SHEET C-3001 FOR UTILITY SECTIONS.
7. A STABLE PIPE BED SUCH AS BACKFILLING AROUND FIRE PROTECTION PIPING TO A HEIGHT OF 18 INCHES OF SAND BEDDING (FROM OUTSIDE OF PIPING) SHALL BE PROVIDED.

KEYED NOTES

1. UTILITY BUILDING WITH ELECTRIC FIRE PUMPS.
2. SAFETY SIGNIFICANT FIRE WATER STORAGE TANK (200,000 GALLON).
3. CONNECTION TO WATER MAIN FOR 4" FIRE WATER STORAGE TANK FILL LINE WITH ALTITUDE VALVE LOCATED IN UTILITY BUILDING.
4. SAFETY SIGNIFICANT FIRE PROTECTION MAIN LINE.
5. CONNECTION TO FIRE PROTECTION RISER.
6. CONNECTION TO WATER MAIN. SUBCONTRACTOR TO BRING PIPE TO WITHIN APPROXIMATELY 3 FEET OF CONNECTION AND PROVIDE ALL MATERIALS AND COORDINATE WITH LANL UTILITIES TO MAKE FINAL TIE-IN.
7. SAFETY SIGNIFICANT AUTOMATIC WET PIPE SPRINKLER SYSTEM FEEDING DRY PIPE SYSTEM IN STORAGE BUILDING.
8. AUTOMATIC WET PIPE SPRINKLER SYSTEM FEEDING DRY PIPE SYSTEM IN STORAGE BUILDING.
9. PROVIDE LOCKABLE DEBRIS CAP (DC 825) BY SW SERVICES, LLC. OR APPROVED EQUAL.
10. SAFETY SIGNIFICANT FIRE HYDRANT, SEE DETAIL 2/C-5006.
11. BACKFLOW PREVENTER ASSEMBLY AND HOT BOX. SEE DETAIL 1/C-5019.
12. POST INDICATOR VALVE, SEE DETAIL 4/C-5006.
13. GENERAL LOCATION OF EXISTING FIRE HYDRANT USED FOR FIRE HYDRANT FLOW TEST.
14. 6" FIRE PROTECTION LINE TO CHARACTERIZATION TRAILERS WITH LOCKABLE DEBRIS CAP. TERMINATE VALVE AND BLIND FLANGE AS CLOSE AS POSSIBLE TO MAIN.
15. 6" FIRE PROTECTION STUB-OUT TO FUTURE BUILDING OR TRAILER WITH LOCKABLE DEBRIS CAP. TERMINATE VALVE AND BLIND FLANGE AS CLOSE AS POSSIBLE TO MAIN.
16. FIRE HYDRANT, SEE DETAIL 2/C-5006.
17. GATE VALVE WITH VALVE BOX, SEE DETAILS ON C-5003.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	01-15-16	U		CN-254, FCR-094	RB				
3	09-30-14	U	EA	FCR-026, UPDATED BUILDING OUTLINES AND SHIFTED FIRE WATER LINE	DB	MT	CM	BS	EA
2	03-20-14	U	EA	DRN-14-63-0144-0043 UPDATED KEY NOTE #9 AND POINT TABLE	DB	MT	CM	BS	EA
1	11-06-13	U	EA	REVISED SITE LAYOUT AND UPDATED NOTES	MT	MT	CM	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
PROJECT SITE

FIRE PROTECTION SITE PLAN

BLDG TA-63

DRAWN	M TARIN
DESIGN	M TARIN
CHECKED	C MOYERS
DATE	11-06-13

SUBMITTED
BRIAN SULLIVAN

APPROVED FOR RELEASE
ED ARTIGLIA

RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER
11/20/13

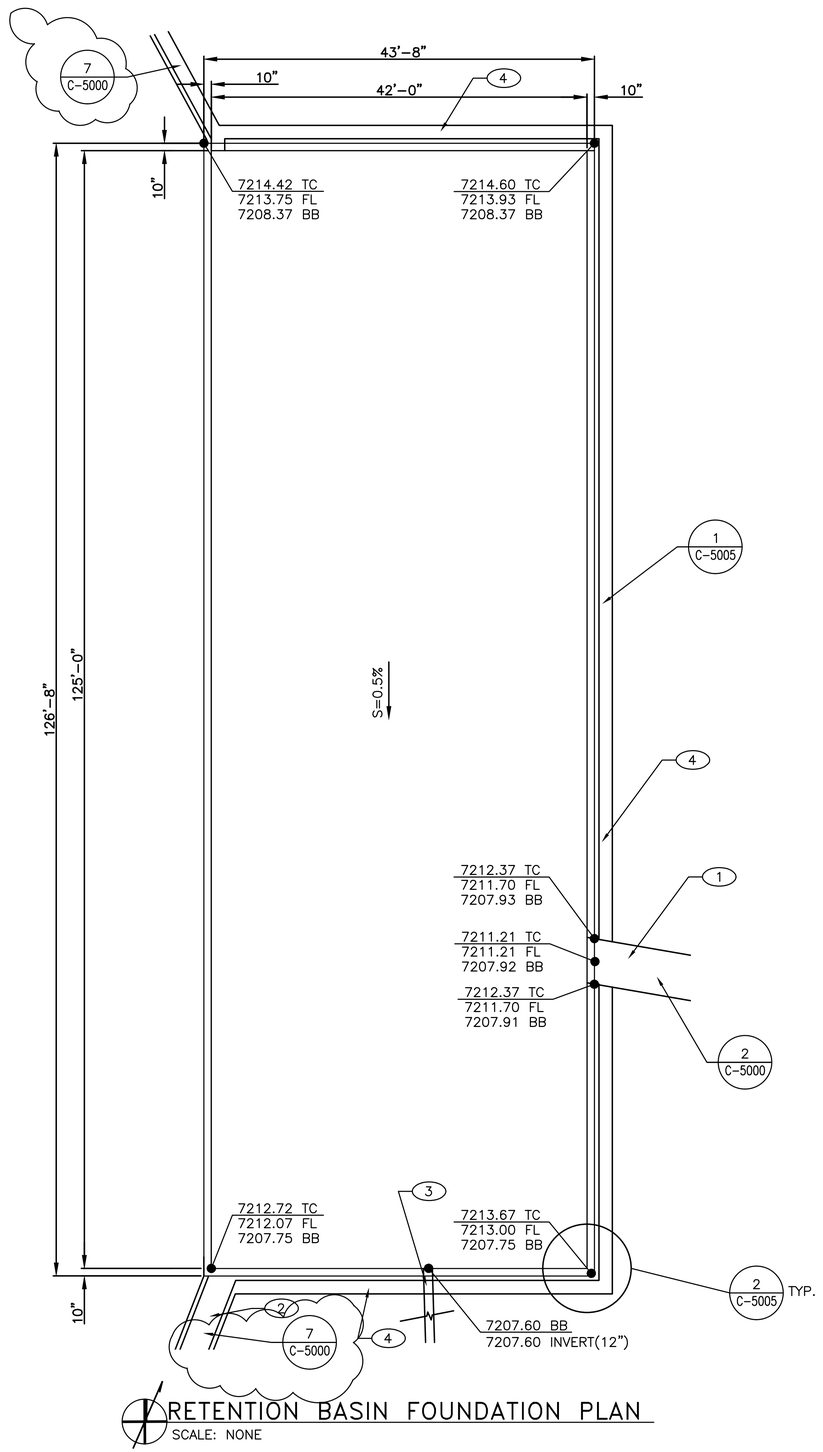
Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET C-1007
16 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55443
REV 4

P:_TECHNOLOGY\LANL\102355 - TRU WASTE FACILITY\500 CAD\SITE\CIVIL\102355-C-1007-R4.DWG



RETENTION BASIN FOUNDATION PLAN

SCALE: NONE

KEYED NOTES

1. 5' CONCRETE VALLEY GUTTER
2. CONCRETE CURB AND GUTTER SPILL WAY, GUTTER PAN CAN VARY TO MATCH BUILDING CONTOUR. MAX PAN THICKNESS TO BE 8".
3. 12" CULVERT PIPE WITH GATE VALVE
4. CONCRETE CURB & GUTTER

GENERAL STRUCTURAL NOTES

1. CODES AND STANDARDS:

   LANL ENGINEERING STANDARDS MANUAL (ESM)–ISD 341–2, CHAPTER 5 SECTION 11.

   DOE–STD–1020 "NATURAL PHENOMENA HAZARDS DESIGN AND EVALUATION CRITERIA FOR DEPARTMENT OF ENERGY FACILITIES"

   DOE–STD–1201–93 "NATURAL PHENOMENA HAZARDS PERFORMANCE CATEGORIZATION CRITERIA FOR STRUCTURES, SYSTEMS AND COMPONENTS"

   DOE–STD–1189–2008, "INTEGRATION OF SAFETY INTO THE DESIGN PROCESS"

   ASCE–7–05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES

   INTERNATIONAL BUILDING CODE IBC–2006

   ACI 318–08 "BUILDING CODE REQUIREMENTS FOR STRUCTURE CONCRETE" CODE AND COMMENTARY

   ASCE 4–98 SEISMIC ANALYSIS OF SAFETY–RELATED NUCLEAR STRUCTURES AND COMMENTARY

   ACI 349–01 CODE REQUIREMENTS FOR NUCLEAR SAFETY RELATED CONCRETE STRUCTURES

   BROOKHAVEN NATIONAL LABORATORY, BNL–BNL–52361, SEISMIC DESIGN AND EVALUATION GUIDELINES FOR THE DOE HIGH–LEVEL WASTE STORAGE TANKS AND APPURTENANCES

   GEOTECHNICAL REPORT WNNNM JV NO.: 11–002–GRPT–002

   ACI 350.2R–04 CONCRETE STRUCTURES FOR CONTAINMENT OF HAZARDOUS MATERIALS

2. DESIGN DATA:

   REINFORCED CONCRETE FOUNDATIONS – NOMINAL WEIGHT (150 pcf)
   REINFORCED CONCRETE COMPRESSIVE STRENGTH f'c = 4.0 ksi AT 28 DAYS

   GRADE 60 REINFORCING STEEL–DEFORMED BARS AND STIRRUPS, ASTM A615, fy = 60 ksi

   MINIMUM SPLICE LENGTH FOR CONTINUOUS #5 REINFORCING = 2'–2" AND FOR #6 REINFORCING = 2'–7".

   RETENTION BASIN SLAB & WALLS SHALL BE WATER CURED PER SPECIFICATIONS.

   DO NOT BACKFILL WALLS UNTIL CONCRETE HAS OBTAINED FULL 28 DAY STRENGTH. BACKFILL EVENLY AROUND BASIN.

   SEISMIC LOADS (ESM CHAPTER 5 – STRUCTURE, ASCE 7–05, SECTION 12 REFER TO PROJECT DESIGN CALCULATIONS.

   SEE SHEET C–1000 FOR LOCATION AND LAYOUT OF RETENTION BASIN.

3. RETENTION BASIN SHALL BE SEALED WITH XYPEX CONCRETE SEALANT OR APPROVED EQUAL IN ACCORDANCE WITH SPECIFICATION 09 9201.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	01–22–16	U		INCORP. FCN–057	MR	MT	Tm	BS	
				DRN–14–63–0144–0043					
3	03–27–14	U		UPDATE BASIN FOUNDATION ELEVATIONS	CH	KC	TM	BS	
2	03–20–14	U		UPDATE BASIN FOUNDATION ELEVATIONS	CH	KC	TM	BS	
1	11–06–13	U	EA	CLASSIFICATION UPDATE	CH	KC	TM		EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

RETENTION BASIN FOUNDATION PLAN

BLDG TA–63

DRAWN	C HOGUE
DESIGN	K CHRISMAN
CHECKED	T MELTON
DATE	11–06–13

SUBMITTED
BRIAN SULLIVAN

APPROVED FOR RELEASE
ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

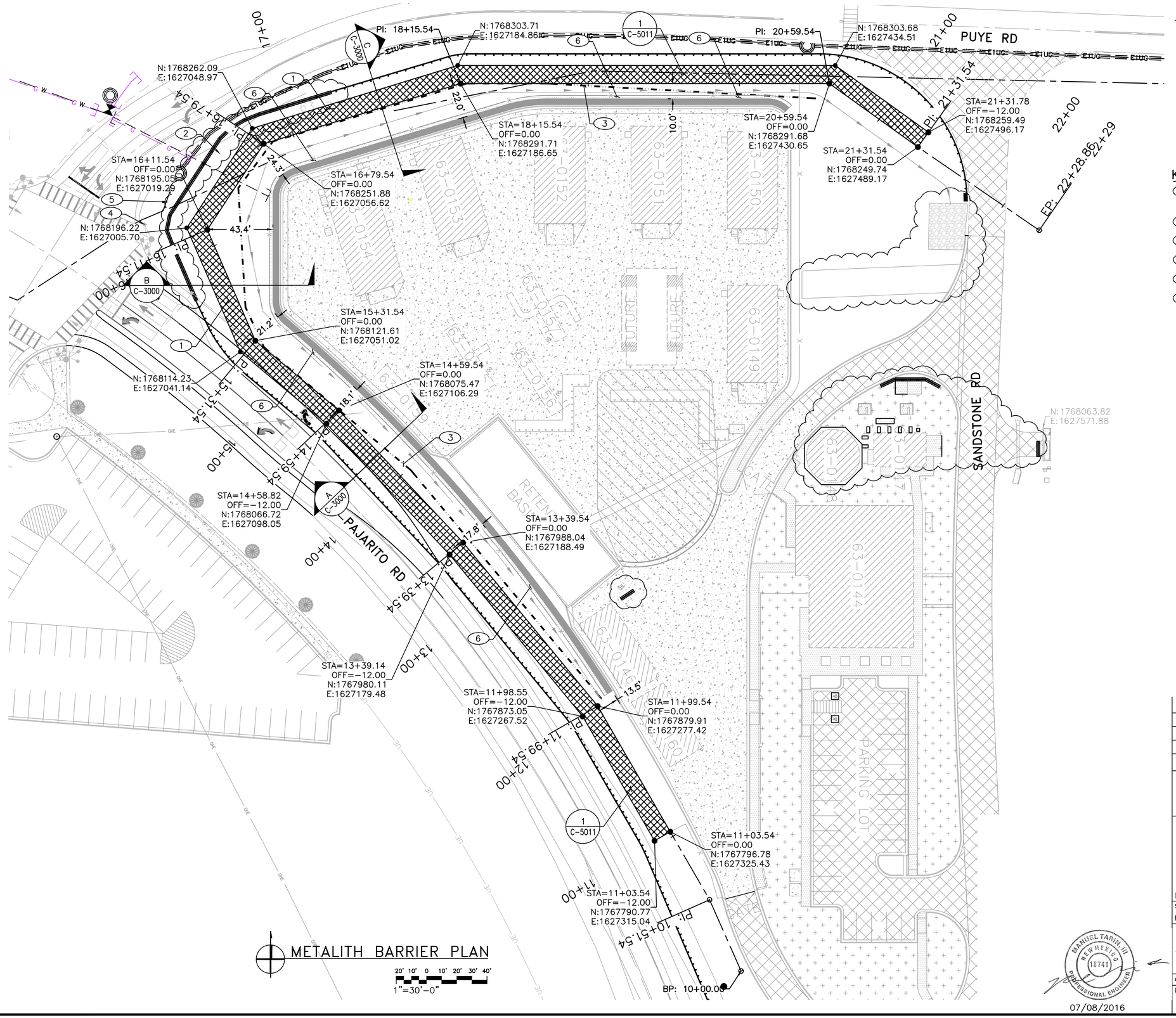
SHEET C–1017
26 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11–06–13

PROJECT ID 102355
DRAWING NO C55443
REV 4

MANUEL TARIN, III NEW MEXICO 18741 PROFESSIONAL ENGINEER
01/28/2016

M:\TRN\10-100-205-05\CADD\SHEETS\102355-C-1017-R4.DWG 1/21/2016 3:05 PM



METALITH BARRIER PLAN

1"=30'-0"

GENERAL NOTES

1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. EXISTING UTILITY LOCATIONS ARE APPROXIMATE ONLY AND SHALL BE FIELD LOCATED PRIOR TO CONSTRUCTION.
4. THE INTENT OF THIS SHEET IS TO GIVE AN OVERALL METALITH BARRIER PLAN VIEW. SEE SHEETS C-1022 & C-1023 FOR MORE DETAIL.
5. SEE TRU-WASTE FACILITY PHASE "A" SITE DESIGN AS-BUILTS FOR RETAINING WALL HEIGHT SHEETS S-1000, S-3000 AND S-3001

KEYED NOTES

(1) METALITH BARRIER (INFRASTRUCTURE DEFENSE TECHNOLOGIES, LLC 3575 MORREIM DRIVE, BELVIDERE, IL 61008).

(2) THRIE BEAM METAL BARRIER, SEE SHEET C-1025 & C-1026.

(3) 2:1 MINIMUM OFFSET LINE FROM EXISTING RETAINING WALL.

(4) ADJUST PULL BOX TO GRADE.

(5) CAP AND BURY EXISTING CULVERT PIPE.

(6) INSTALL SMOOTH 3-STRAND WIRE FENCE. SEE DETAILS ON SHEET C-5020

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	07-08-16	U		FCN AS-BUILT UPDATES	MR	MT	[illegible]	[illegible]	
3	04-19-16	U		FCR-373 DCN 513 RET WALL FENCE	DP	CLL	ESC	BS	
2	12-31-14	U		FCR-060 DCN 221 SECURITY FENCING AROUND METALITH	DP	CLL	ESC	BS	EA
1	11-06-13	U		REVISED SITE LAYOUT	DP	CLL	ESC	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

OVERALL METALITH BARRIER PLAN

BLDG TA-63

DRAWN	D PADILLA
DESIGN	C LEY
CHECKED	E CORDOVA
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET C-1021

30 OF 827

CLASSIFICATION U

REVIEWER ED ARTIGLIA

DATE 11-06-13

PROJECT ID 102355

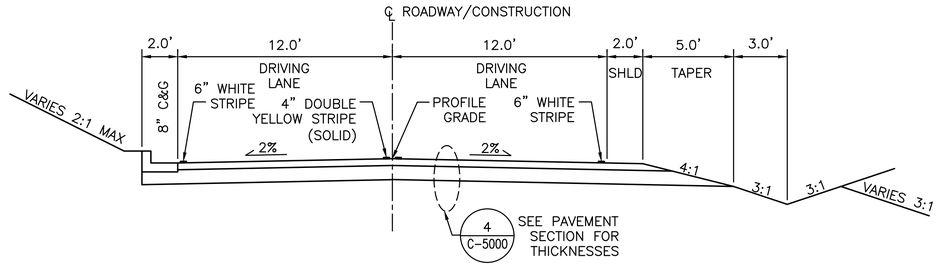
DRAWING NO C55443

REV 4

MANUEL TARIN III NEW MEXICO 18741 PROFESSIONAL ENGINEER

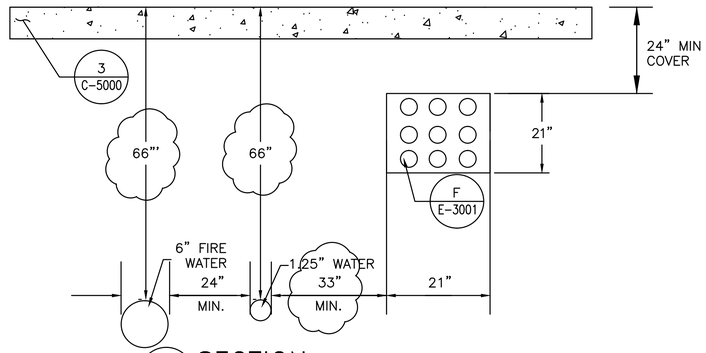
07/08/2016

M:\TRN\10-100-205-05\CADD\SHEETS\102355-C-1021-R1.DWG 7/8/2016 11:24 AM

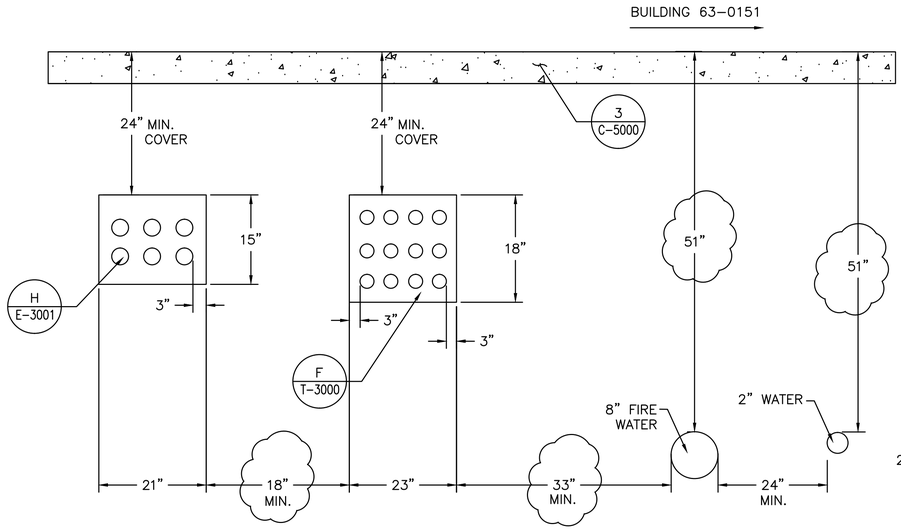


STA 12+22.00 TO STA 18+20.45

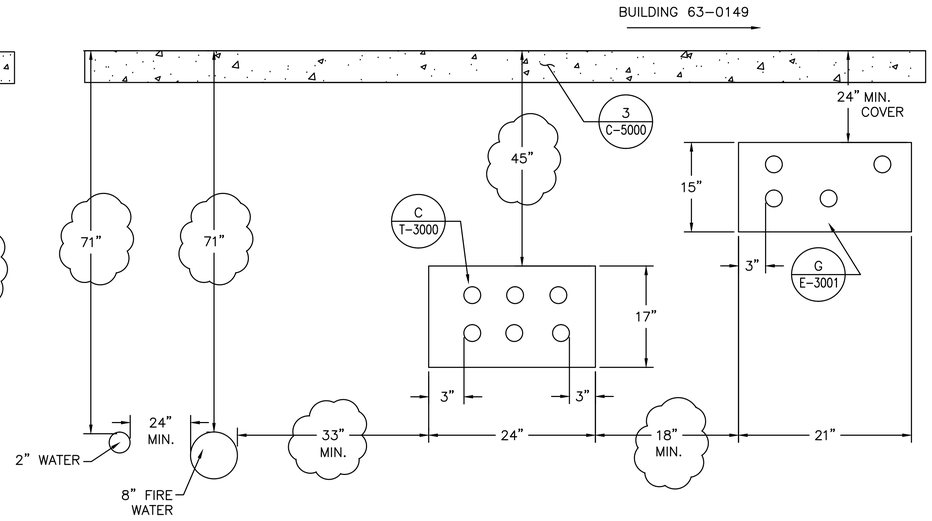
A C-1000 / A C-1019 SANDSTONE ROAD TYPICAL SECTION
SCALE: NONE



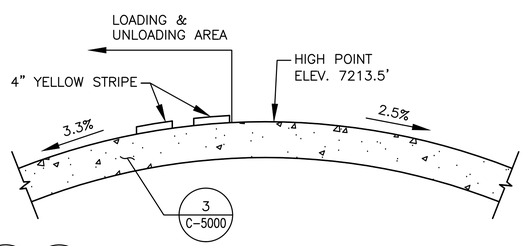
B C-1006 SECTION
SCALE: NONE



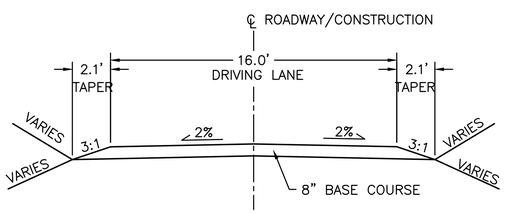
C C-1006 SECTION
SCALE: NONE



D C-1006 SECTION
SCALE: NONE



E C-1000 / E C-1001 / E C-1003 UNLOADING ZONE–SECTION VIEW
SCALE: NONE



F C-1000 / F C-1019 EMERGENCY ROAD TYPICAL SECTION
SCALE: NONE

GENERAL NOTES

1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	01–22–16	U		INCORP. FCR–063, DCN–229 REV. 1	DP	MT			
3	01–07–15	U		DCN–229, FCR–063 REVISED CROSS SECTIONS	DP	CLL	ESC	BS	
2	05–14–14	U		102355–DRN–C55443–0001 REVISED STATIONING	DP	CLL	ESC	BS	EA
1	11–06–13	U		CLASSIFICATION UPDATE	DP	CLL	ESC	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

SANDSTONE ROAD TYPICAL SECTION

BLDG TA–63

DRAWN	D PADILLA
DESIGN	C LEY
CHECKED	E CORDOVA
DATE	11–06–13

SUBMITTED BRIAN SULLIVAN

APPROVED FOR RELEASE ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET C–3001

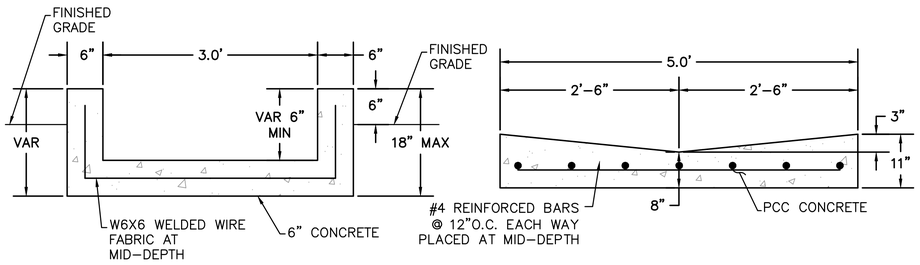
37 OF 827

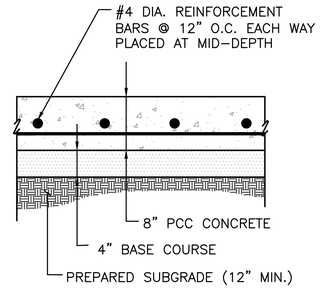
CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11–06–13

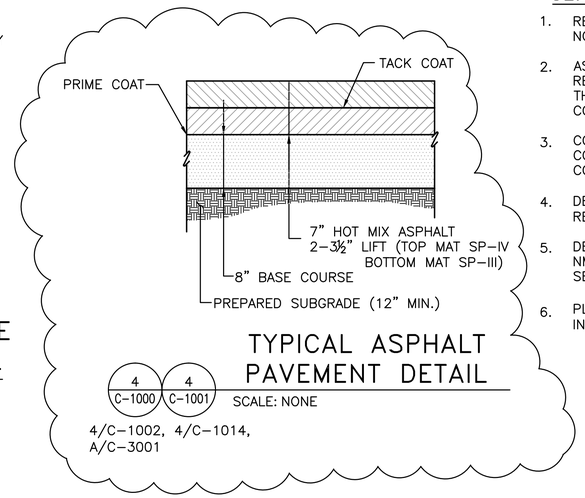
PROJECT ID 102355 | DRAWING NO C55443 | REV 4

MANUEL TARIN III NEW MEXICO 18741 PROFESSIONAL ENGINEER
01/28/2016

M:\TRN\10-100-205-05\CADD\SHEETS\102355-C-3001-R4.DWG 1/21/2016 11:04 PM







GENERAL NOTES

1. REFER TO GEOTECHNICAL REPORT & WNNNM JV NO:11-002-GRPT-002.
2. ASPHALT CONCRETE MATERIALS QUALITY CONSTRUCTION REQUIREMENTS SHOULD CONFORM TO SECTIONS 416, 417, 423 OF THE CURRENT NMDOT SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION.
3. CONCRETE SHOULD BE PER SPECIFICATION 03 3001 REINFORCED CONCRETE OR 03 3053 MISCELLANEOUS CAST-IN-PLACE CONCRETE.
4. DETECTABLE WARNING SURFACE (TRUNCATED DOMES) SHALL BE RECESSED INTO CONCRETE
5. DETECTABLE WARNING SURFACE SHALL COMPLY WITH THE LATEST NMDOT SPECIFICATIONS FOR HIGHWAY & BRIDGE CONSTRUCTION SECTION 608.2.4
6. PLACE ½"WIDE PREMOULDED EXPANSION JOINT FILTER MATERIAL AT INTERVALS NOT TO EXCEED 3 CONTROL JOINTS. (20' MINIMUM)

1/C-1002 / 1/C-1003 — OVERFLOW DETAIL — SCALE: NONE

1/C-1000, 1/C-1005, 1/C-1017

2/C-1000 / 2/C-1001 — VALLEY GUTTER DETAIL — SCALE: NONE

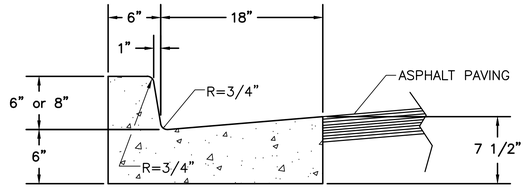
2/C-1004, 2/C-1014, 2/C-1017

3/C-1000 / 3/C-1001 / 3/C-1002 / 3/C-1005 — TYPICAL CONCRETE PAVEMENT DETAIL — SCALE: NONE

B/C-3001, C/C-3001, D/C-3001, E/C-3001

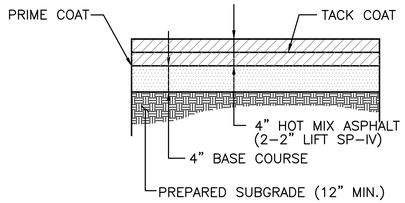
4/C-1000 / 4/C-1001 — TYPICAL ASPHALT PAVEMENT DETAIL — SCALE: NONE

4/C-1002, 4/C-1014, A/C-3001

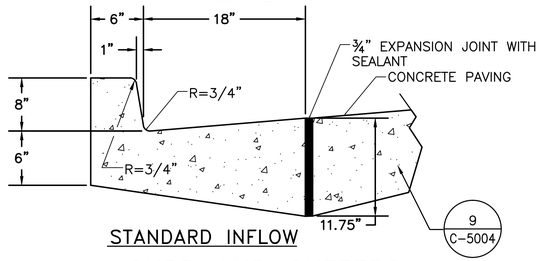


STANDARD INFLOW

5/C-1002 — PARKING LOT CURB AND GUTTERS-STANDARD INFLOW — SCALE: NONE



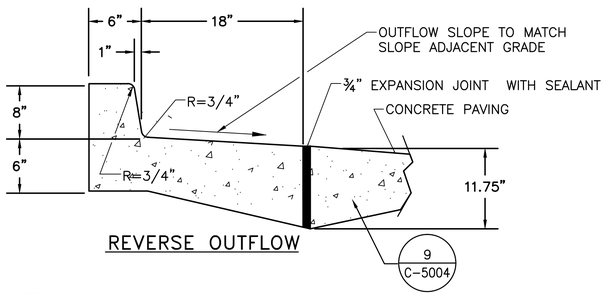
6/C-1000 / 6/C-1002 — TYPICAL PARKING LOT ASPHALT PAVEMENT DETAIL — SCALE: NONE



STANDARD INFLOW

7/C-1000 / 7/C-1001 — CURB AND GUTTERS -STANDARD INFLOW — SCALE: NONE

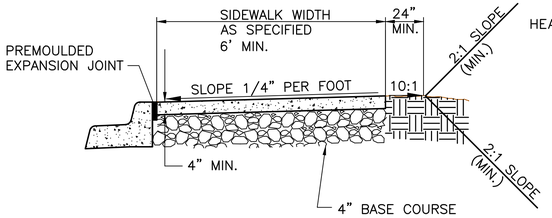
7/C-1002, 7/C-1014, 7/C-1015, 7/C-3000



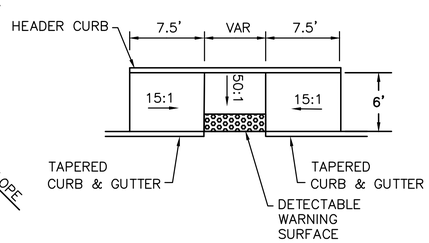
REVERSE OUTFLOW

8/C-1000 / 8/C-1001 — CURB AND GUTTERS-REVERSE OUTFLOW — SCALE: NONE

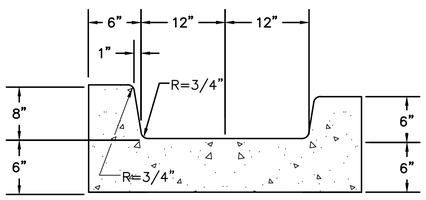
8/C-1014, 8/C-3000



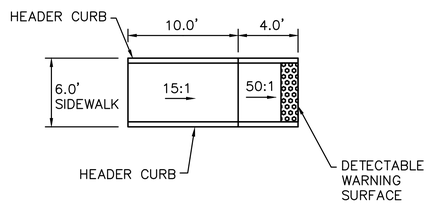
9/C-1001 / 9/C-1002 / 9/C-1014 — SIDEWALK — SCALE: NONE



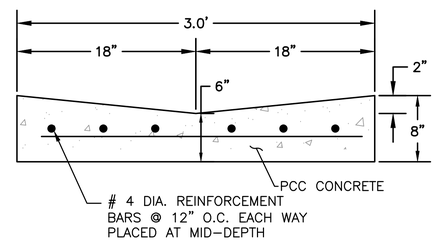
10/C-1002 — ADA RAMP — SCALE: NONE



11/C-1001 / 11/C-1005 — CURB CUT DETAIL — SCALE: NONE



12/C-1002 / 12/C-1005 — SIDEWALK ADA RAMP — SCALE: NONE



13/C-1000 / 13/C-1001 — VALLEY GUTTER DETAIL — SCALE: NONE

07/18/2016

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
5	07-18-16	U		FCN AS-BUILTS	MR	MT	ESC	BS	
4	12-10-15	U		INCORP. FCR-081, DCN-241	MR	MT	ESC	BS	
3	05-14-14	U		102355-DRN-C55443-0001 REVISED CALL OUT	DP	CLL	ESC	BS	
2	01-06-14	U		DRN-14-63-0144-0034 REVISED GENERAL NOTE	DP	CLL	ESC	BS	EA
1	11-06-13	U		REVISED SITE LAYOUT	DP	CLL	ESC	BS	EA

WEIDLINGER-ASSOCIATES JV NORTHERN NM

TRU WASTE FACILITY PROJECT

MISCELLANEOUS DETAILS

BLDG TA-63

DRAWN	D PADILLA
DESIGN	C LEY
CHECKED	E CORDOVA
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

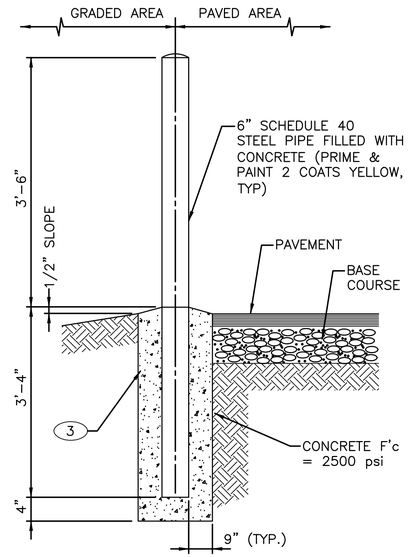
SHEET C-5000

41 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

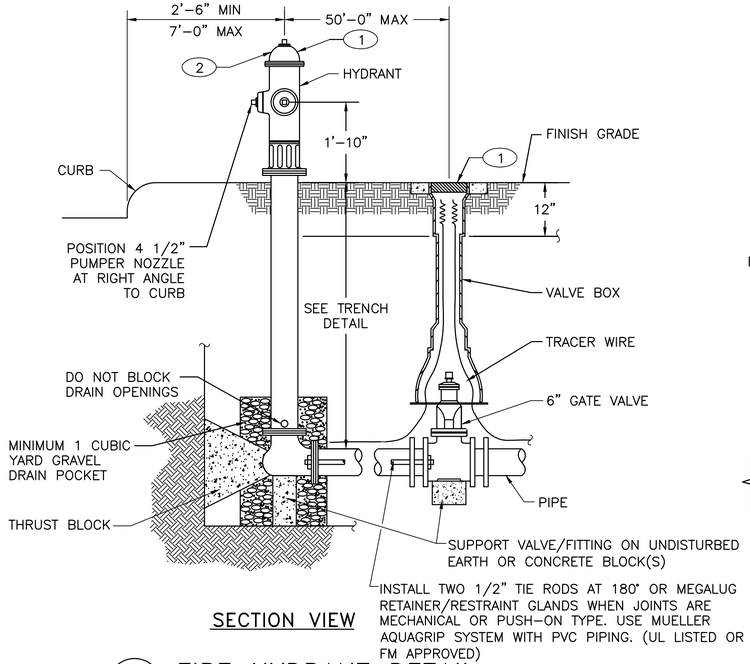
PROJECT ID 102355 | DRAWING NO C55443 | REV 5

M:\TRN\10-100-205-05\CADD\SHEETS\102355-C-5000-R4.DWG 7/18/2016 11:18 AM



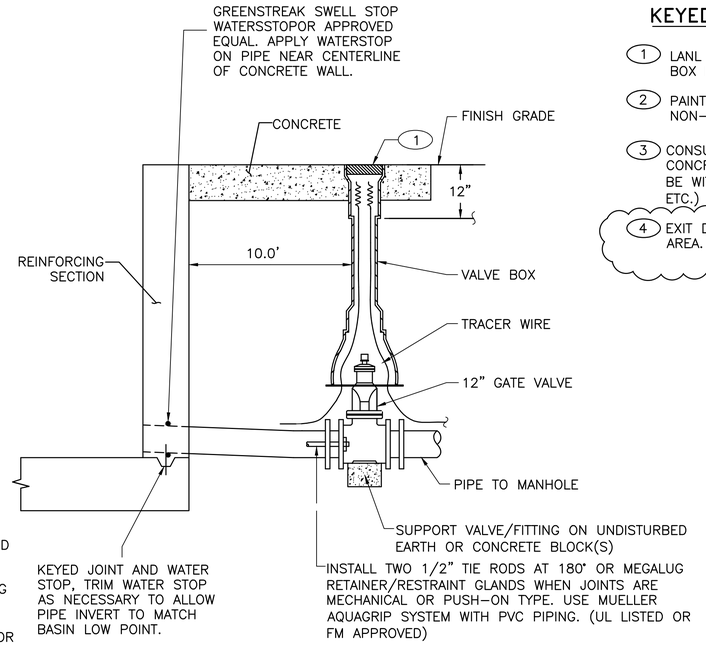
SECTION VIEW

1 C-5004 **BOLLARD DETAIL**
SCALE: NONE



SECTION VIEW

2 C-1006 **FIRE HYDRANT DETAIL**
SCALE: NONE

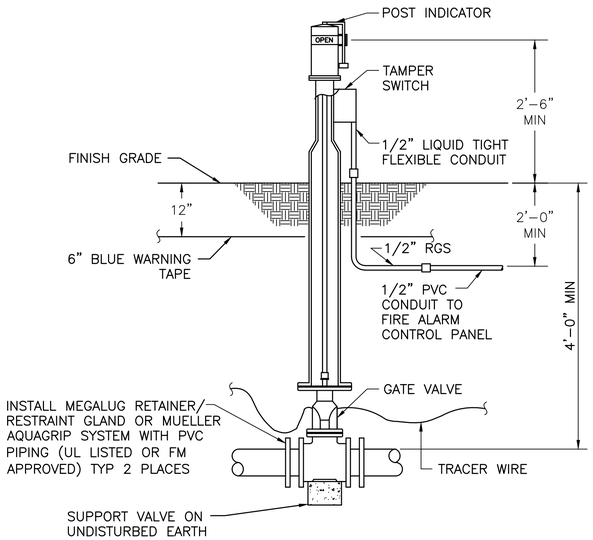


SECTION VIEW

3 C-1012 **BASIN-12" GATE VALVE**
SCALE: NONE

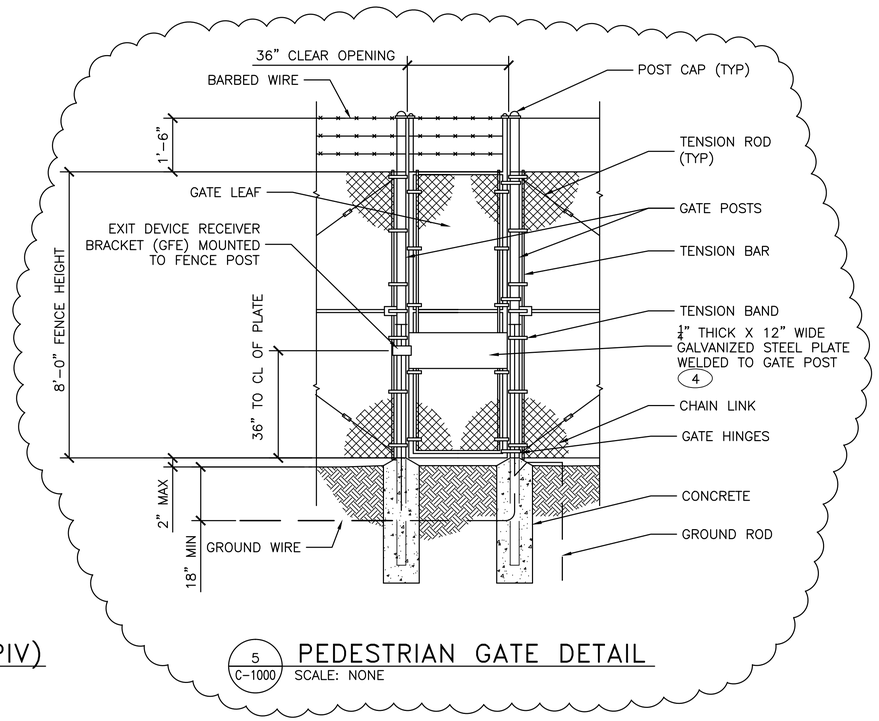
KEYED NOTES

1. LANL WILL NUMBER (METAL STAMP) THE FIRE HYDRANT AND/OR VALVE BOX LID.
2. PAINT HYDRANT BONNET BLACK AND ATTACH LABEL – CAUTION: NON-POTABLE WATER, DO NOT DRINK
3. CONSULT STRUCTURAL ENGINEER OF RECORD BEFORE POURING CONCRETE FOUNDATION FOR BOLLARD IF SIDE OF FOUNDATION WILL BE WITHIN 18" OF BELOW-GRADE OBJECTS (E.G., PIPES, CONDUITS, ETC.) THAT OCCURS WITHIN THE HEIGHT OF THE FOUNDATION.
4. EXIT DEVICE IS GFE. DOOR SHALL SWING OUT FROM THE SECURE AREA. COORDINATE HARDWARE INSTALLATION WITH LANL.



ELEVATION VIEW

4 C-1007 **SHUT-OFF VALVE DETAIL FOR FIRE LINE (PIV)**
SCALE: NONE



5 C-1000 **PEDESTRIAN GATE DETAIL**
SCALE: NONE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	02-11-16	U		INCORP. FCR-333 DCN-474 ADDED DTL 5, REARRANGED DTLS	MR	MT	ESC	BS	
3	01-19-16	U		INCORP. FCR-157 DCN-311	MR	MT	ESC	BS	
2	01-06-14	U		REVISED NOTES DRN 14.63.0144.0034	DP	CLL	ESC	BS	
1	11-06-13	U		CLASSIFICATION UPDATE	DP	CLL	ESC	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT

MISCELLANEOUS DETAILS

BLDG TA-63

DRAWN	D PADILLA
DESIGN	C LEY
CHECKED	E CORDOVA
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

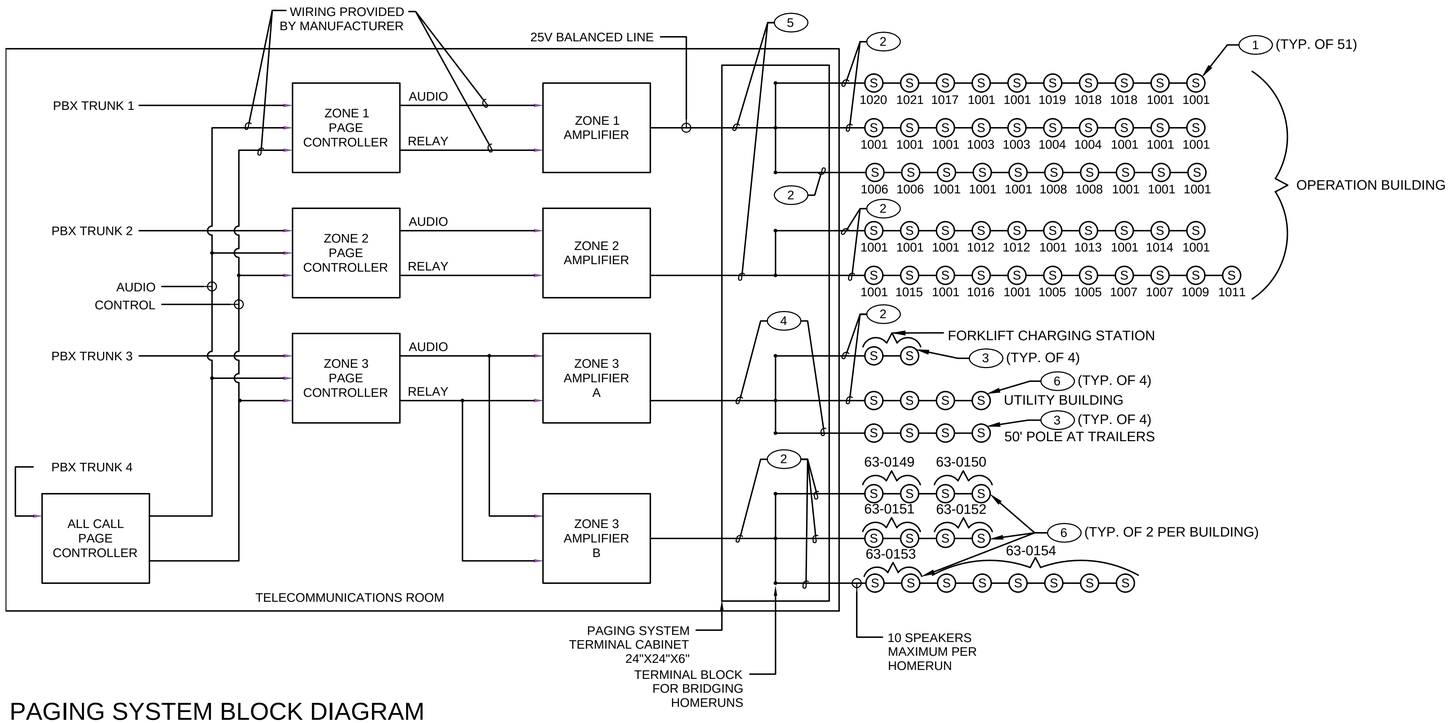
SHEET C-5006
47 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

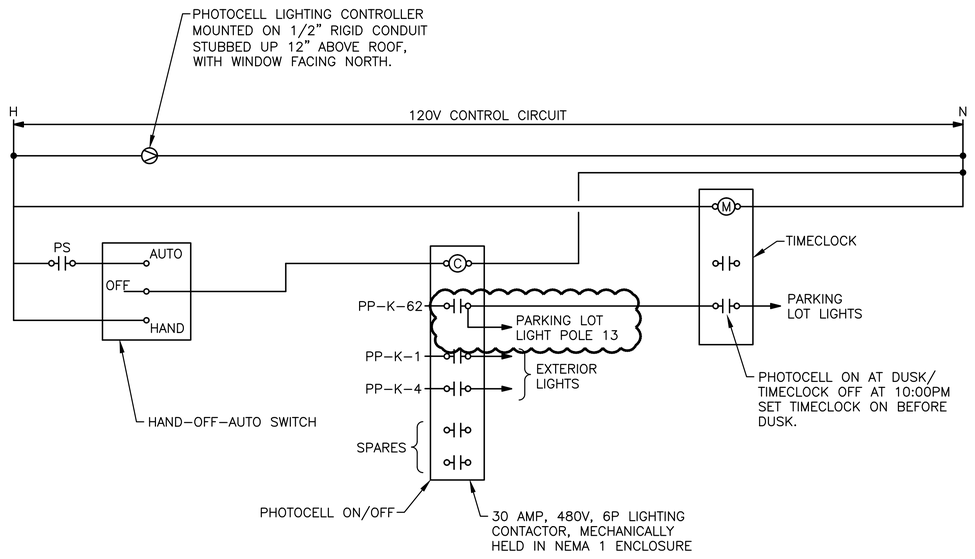
PROJECT ID 102355
DRAWING NO C55443
REV 4

MANUEL TARIN, III NEW MEXICO 18741 PROFESSIONAL ENGINEER
02/11/2016

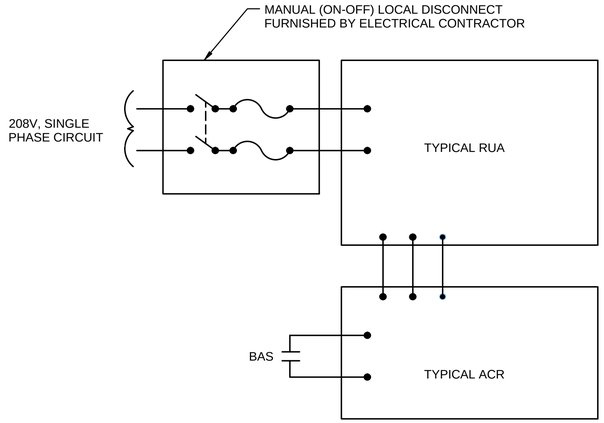
M:\TRN\10-100-205-05\CADD\SHEETS\102355-C-5006-R3.DWG 2/11/2016 9:38 AM



PAGING SYSTEM BLOCK DIAGRAM



EXTERIOR LIGHTING CONTROL DIAGRAM



SEQUENCE OF OPERATION

1. BAS SYSTEM SHALL DETERMINE PRIMARY AND STAND BY UNIT. STAND BY UNIT IS REDUNDANT.
2. ROOM THERMOSTAT SHALL DETERMINE HEATING OR COOLING REQUIREMENTS.
3. REFER TO COMPLETE SEQUENCE OF OPERATION ON MECHANICAL DRAWINGS FOR ASSACIATED BUILDING.

TYPICAL RUA/ACR CONTROL DIAGRAM

GENERAL NOTES

1 THIS DRAWING WAS GENERATED IN REVIT 2011.

2 USE 25 WATT CONSTANT WATTAGE BALLANCED SYSTEMS.

3 AMPLIFIERS SIZED FOR LOAD, LOAD LOSS, PLUS 20% FUTURE GROWTH, PLUS 25% SO AMPLIFIERS WILL NORMALLY OPERATE AT 75% OF RATED OUTPUT.

4 SEQUENCE OF OPERATION:
- A. TO PAGE ANY ZONE -
  - 1) ANY TELEPHONE HANDSET CAN ACCESS THE PUBLIC ADDRESS SYSTEM BY ENTERING CODE # AND ZONE #.
- B. TO PAGE ALL ZONES -
  - 1) ANY TELEPHONE HANDSET CAN ACCESS THE PUBLIC ADDRESS SYSTEM BY ENTERING CODE # AND "ALL CALL" CODE #.

KEYED NOTES

(1) CEILING MOUNTED SPEAKERS TAPPED AT .5 WATTS.

(2) #16 CU TWISTED PAIR

(3) OUT DOOR WEATHER PROOF SPEAKERS TAPPED AT 15 WATTS

(4) #12 CU TWISTED PAIR

(5) #14 CU TWISTED PAIR

(6) OUTDOOR WEATHER PROOF SPEAKERS MOUNTED ON STRUCTURE BELOW ROOF AIMED 45 DEGREES BELOW HORIZONTAL TAPPED AT 1 WATT.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
5	03–02–16	U		DCN–493/FCR–354; UPDATED EXTERIOR LIGHTING CONTROL DIAGRAM	RL	RK	BS	BS	
4	01–15–16	U		FCN–063; UPDATED EXTERIOR LIGHTING CONTROL DIAGRAM	RL	RK	BS	BS	EA
3	11–10–15	U		DCN–395/FCR–254: UPDATED EXTERIOR LIGHTING CONTROL DIAGRAM	RL	RK	BS	BS	EA
2	06–29–15	U		FCR–178/DCN–336 (RFI #335) UPDATED EXTERIOR LIGHTING CONTROL DIAGRAM	RL	RK	BS	BS	EA
1	11–06–13	U		CLASSIFICATION UPDATE	BB	RK	BS	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILTY PROJECT
OPERATIONS SUPPORT BUILDING

ELECTRICAL DIAGRAMS

BLDG 63-0144 TA-63

DRAWN	B.BACKER
DESIGN	R.KRAYER
CHECKED	B.SULLIVAN
DATE	11-06-13

SUBMITTED BRIAN SULLIVAN

APPROVED FOR RELEASE ED ARTIGLIA

ROSS H. KRAYER NEW MEXICO 5026 REGISTERED PROFESSIONAL ENGINEER 3/2/16

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PO Box 1663
Los Alamos, New Mexico 87545

SHEET E-6003

209 OF 827

CLASSIFICATION U

REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID 102355

DRAWING NO C55443

REV 5

TRU WASTE FACILTY PROJECT /25/2015 10:56:33 AM ::\Users\ryan\AppData\Local\Temp\Temp1_Revit - Electrical 6-18-2015.zip\Ops Support Bldg-Elec.rvt

FIRE PROTECTION LEGEND

(ALL ABBREVIATIONS SHOWN ARE NOT NECESSARILY USED ON THE DRAWINGS)

ABBREVIATIONS

A	AMPS
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
ALRM	ALARM SIGNAL
ALTV	ALTITUDE VALVE
ACV	ALARM CHECK VALVE
AC	AIR CONDITIONING
AHU	AIR HANDLING UNIT
ANN	ANNUNCIATOR
BAS	BUILDING AUTOMATION SYSTEM
BDD	BACK DRAFT DAMPER
BFP	BACKFLOW PREVENTER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BHP	BRAKE HORSEPOWER
BTUH	BTU PER HOUR
BP	BUILDING PRESSURE
CA	COMPRESSED AIR
CAV	CONSTANT AIR VOLUME
CONT.	CONTINUATION
CIE	CONTRACTOR INSTALLED EQUIPMENT
CFM	CUBIC FEET PER MINUTE
CV	CHECK VALVE
DX	DIRECT EXPANSION
D	DRAIN
DACP	DIGITAL ALARM COMMUNICATOR TRANSMITTER
DPV	DRY PIPE VALVE
DEMO	DEMOLISH, DEMOLITION
DFACP	DEDICATED FIRE ALARM CONTROL PANEL
DV	DELUGE VALVE
EP	ELECTRIC–PNEUMATIC
ENT	ENTERING
EOLD	END OF LINE DEVICE
ESS	EQUIPMENT SURVEILLANCE SYSTEM
EXH	EXHAUST
°F	DEGREES FAHRENHEIT
FACP	FIRE ALARM CONTROL PANEL
FC	FLEXIBLE CONNECTOR
FD	FLOOR DRAIN
FDC	FIRE DEPT CONNECTION
FDMPR	FIRE DAMPER
F.G.	FILTER GAUGE
FLEX	FLEXIBLE
FM	FACTORY MUTUAL
FMS	FACILITY MANAGEMENT SYSTEM
FPM	FEET PER MINUTE
FT	FLAT TOP
FT.	FEET
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GFE	GOVERNMENT FURNISHED EQUIPMENT
GIE	GOVERNMENT INSTALLED EQUIPMENT
HGT	HEIGHT HEAD, HUB DRAIN
HD	HIGH EFFICIENCY
HEPA	PARTICULATE ARRESTOR
HOA	HAND–OFF–AUTOMATIC
HORIZ	HORIZONTAL
HP	HORSEPOWER
HSTAT	HUMIDISTAT
HTG	HEATING
HTR	HEATER
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HW	HOT
HX	WATER
HYD	HEPA EXHAUST AIR HYDRANT
HZ	HERTZ
IN	INCHES
KW	KILOWATT
KWH	KILOWATT HOUR
LX	LABORATORY EXHAUST AIR
MA	MIXED AIR
MIN	MINIMUM
NA	NOT APPLICABLE
NAC	NOTIFICATION ALARM CIRCUIT
NC	NORMALLY CLOSED
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER (QUANTITY)
OBD	OPPOSED BLADE DAMPER
OA	OUTSIDE AIR
PCM	PROGRAMMABLE CONTROL MODULE
P&ID	PIPING & INSTRUMENTATION DIAGRAM
PI	PRESSURE INDICATOR
PNL	PANEL
POC	POINT OF CONNECTION TO EXISTING
POR	POINT OF REMOVAL FROM EXISTING
PSIG	POUNDS PER SQUARE INCH GAGE
PRV	PRESSURE REDUCING VALVE
PWC	POTABLE WATER COLD
QTY	QUANTITY
RLA	RELIEF AIR
RA	RETURN AIR
RC	RETARD CHAMBER
RPM	REVOLUTIONS PER MINUTE
RTU	REMOTE TERMINAL UNIT
SP	STATIC PRESSURE (INCHES OF WATER)
SA	SUPPLY AIR
SLC	SIGNALING LINE CIRCUIT
SS	SAFETY SIGNIFICANT
SUPR	SUPERVISORY SIGNAL
TX	TOILET EXHAUST
TYP.	TYPICAL
UL	UNDERWRITERS LABORATORIES
VX	VACUUM EXHAUST
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY
VTR	VENT THRU ROOF
V	VALVE
VAC	VOLTS, ALTERNATING CURRENT
VD	VOLUME DAMPER
W/	WITH

FIRE PROTECTION SYMBOLS

SYMBOL	DESCRIPTION
	CHECK VALVE
	SPRINKLER RISER
	INDICATING VALVE
	FIRE DEPARTMENT CONNECTION FREE STANDING
	FIRE DEPARTMENT CONNECTION
	FIRE HYDRANT – TWO HOSE OUTLET
	FIRE HYDRANT – ONE HOSE OUTLET
	FIRE HYDRANT – TWO HOSE OUTLET & PUMPER CONN.
	WALL HYDRANT – TWO HOSE OUTLET
	WATER SYSTEM BLOCK VALVE
	REDUCER
	ALARM VALVE
	DRY–PIPE VALVE
	DELUGE VALVE
	ALARM GONG
TS	P&ID, TAMPER SWITCH
FS	P&ID, FIRE SUPPRESSION WATER FLOW SWITCH
PS	P&ID, FIRE SUPPRESSION PRESSURE SWITCH
	SPRINKLER HEAD SIDE WALL
	SPRINKLER HEAD IN SUSPENDED CEILING W\FLEXHEAD (UNLESS OTHERWISE NOTED ON PLAN)
	RETARD CHAMBER
	VALVE
	PRESSURE REDUCING VALVE
	ANGLE VALVE
P	SMOKE DETECTOR
P D	DUCT SMOKE DETECTOR (PHOTOELECTRIC)
	UNDERGROUND PIPING
	ABOVEGROUND PIPING

FIRE PROTECTION SYMBOLS (CONT.)

SYMBOL	DESCRIPTION
M	MANUAL PULL STATION
S	VALVE SUPERVISORY SWITCH
FS	FLOW SWITCH
H	HEAT DETECTOR
H	HORN
F	FIRE ALARM HORN STROBE
— CA —	COMPRESSED AIR
— D —	DRAIN
— F —	FIRE PROTECTION WATER
	DIRECTION OF FLOW (SCHEMATIC)
FLOW	DIRECTION OF FLOW (GRAPHICAL)
	REDUCER OR INCREASER
	ECCENTRIC REDUCER
	TOP CONNECTION, 45° OR 90°
	BOTTOM CONNECTION, 45° OR 90°
	SIDE CONNECTION
	CAPPED OUTLET
	RISE OR DROP IN PIPE
	RISE IN PIPE
	UNION
	UNIVERSAL TEMPERATURE–PRESSURE FITTING
	OS&Y CONTROL VALVE
	STRAINER
	THERMOMETER
	PRESSURE GAGE
	GAUGE & GAUGE COCK
	BALL VALVE
	LINE BREAK
	POST INDICATING VALVE
	INDICATING CONTROL VALVE
	GROUND VALVE
	HAND VALVE

GENERAL SYMBOLS

1 — ELLIPSE SYMBOL INDICATES A KEYED NOTE. THE NUMBER REFERS TO A SPECIFIC NOTE LISTED IN THE KEYED NOTE LIST

XX–X — HYDRAULIC CALCULATION NODE

X — HYDRAULIC CALCULATION NODE

4–WAY BRACE. PROVIDE AT TOP OF RISERS AS REQUIRED BY NFPA 13 (2010). 4–WAY BRACE CAN BE USED WHERE LATERAL AND LONGITUDINAL BRACES ARE BOTH REQUIRED. SEE DETAIL 3 AND DETAIL 4 ON SHEET F–5000.

LONGITUDINAL BRACE. MINIMUM 45° ANGLE FROM VERTICAL; MAXIMUM SPACING 36'–0". PROVIDE LONGITUDINAL BRACE WITHIN 18'–0" OF FREE END OF PIPE. SEE DETAIL 3 ON SHEET F–5000.

LATERAL BRACE, MINIMUM 45° ANGLE FROM VERTICAL; MAXIMUM SPACING 30'–0". PROVIDE LATERAL BRACE WITHIN 15'–0" OF FREE END OF PIPE. SEE DETAIL 4 ON SHEET F–5000.

GENERAL NOTES

1. ALL STRUCTURAL WELDED CONNECTIONS SHALL BE PERFORMED IN ACCORDANCE WITH LANL APPROVED WELDING SPECIFICATION AND AWS D1.1/D1.1M SPECIFICATION FOR WELDING STEEL. ALL PIPE WELDED CONNECTIONS SHALL BE PERFORMED IN ACCORDANCE WITH LANL APPROVED WELDING SPECIFICATION AND THE APPLICABLE NFPA CODE IDENTIFIED IN THE CONSTRUCTION SPECIFICATION.
2. INSTALL FIRE PROTECTION SYSTEM PER NFPA 13. THE SYSTEM SHALL INCLUDE CONTROL VALVES, PIPING, FITTINGS, SPRINKLER HEADS, HANGERS, BRACING, DRAINS AND ALL OTHER DEVICES REQUIRED FOR A COMPLETE AND FUNCTIONAL SYSTEM IN ACCORDANCE WITH ALL APPLICABLE CODES. REFER TO SPECIFICATION SECTION 211313 "WET PIPE SPRINKLER SYSTEM".
3. THE DESIGN OF THE FIRE PROTECTION SYSTEM FOR THE BUILDINGS SHALL CONFORM TO ORDINARY HAZARD GROUP 2 REQUIREMENTS WITH 500 GPM HOSE STREAM ALLOWANCE FOR 2 HOUR DURATION.
4. CONCEALED SPACE ABOVE DROP CEILING MEETS THE REQUIREMENTS OF NFPA 13, SECTION 8.15.1.2 – "CONCEALED SPACES NOT REQUIRING SPRINKLER PROTECTION", THEREFORE NO SPRINKLERS WILL BE PROVIDED IN THE CONCEALED SPACE.
5. SYMBOLS SHOWN ON THIS SHEET ARE FOR SINGLE–LINE SCHEMATICS. DRAWINGS DEVELOPED USING REVIT SHOW MODELED PIPING AND COMPONENTS THAT ARE DRAWN TO SCALE AND NOT NECESSARILY INCLUDED IN THE SYMBOL LEGEND.

SPRINKLER HANGER TABLE

MAXIMUM DISTANCE BETWEEN HANGERS (FT)						
NOMINAL PIPE SIZE	1"	1–1/4"	1–1/2"	2"	2–1/2"	3"
STEEL PIPE SCHEDULE 40	12	12	15	15	15	15

MAXIMUM DISTANCE BETWEEN HANGERS (FT)					
NOMINAL PIPE SIZE	3–1/2"	4"	5"	6"	8"
STEEL PIPE SCHEDULE 40	15	15	15	15	15

SPRINKLER PIPING SUPPORT NOTES

1. THE UNSUPPORTED LENGTH BETWEEN THE END SPRINKLER AND THE LAST HANGER SHALL NOT BE GREATER THAN 36" FOR 1" PIPE, 48" FOR 1–1/4" PIPE AND 60" FOR 1–1/2" OR LARGER PIPE.
2. THERE SHALL NOT BE LESS THAN ONE HANGER FOR EACH SECTION OF PIPE.
3. VERTICAL RISERS SHALL BE SUPPORTED WITHIN 24" OF THEIR HORIZONTAL CONNECTIONS. INTERMEDIATE SUPPORTS SHALL BE PROVIDED TO LIMIT AXIAL MOVEMENT.

LANL BUILDING OFFICIAL SIG R Throut ID 105567 DATE 12.17.13 ALT # 13-094 APPROVED
REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISO 341 – 2, CH. 16

CHARLES MOYERS NEW MEXICO 16030 LICENSED PROFESSIONAL ENGINEER
11-06-13

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	11–06–13	U	SA	REVISED NOTES	MS	MM	MM	AF	A

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
OPERATIONS SUPPORT BUILDING

SYMBOL LEGEND AND GENERAL NOTES

BLDG 63–0144 TA–63

DRAWN	D. BROERMAN
DESIGN	E. MIYODA
CHECKED	C. MOYERS
DATE	11–06–13

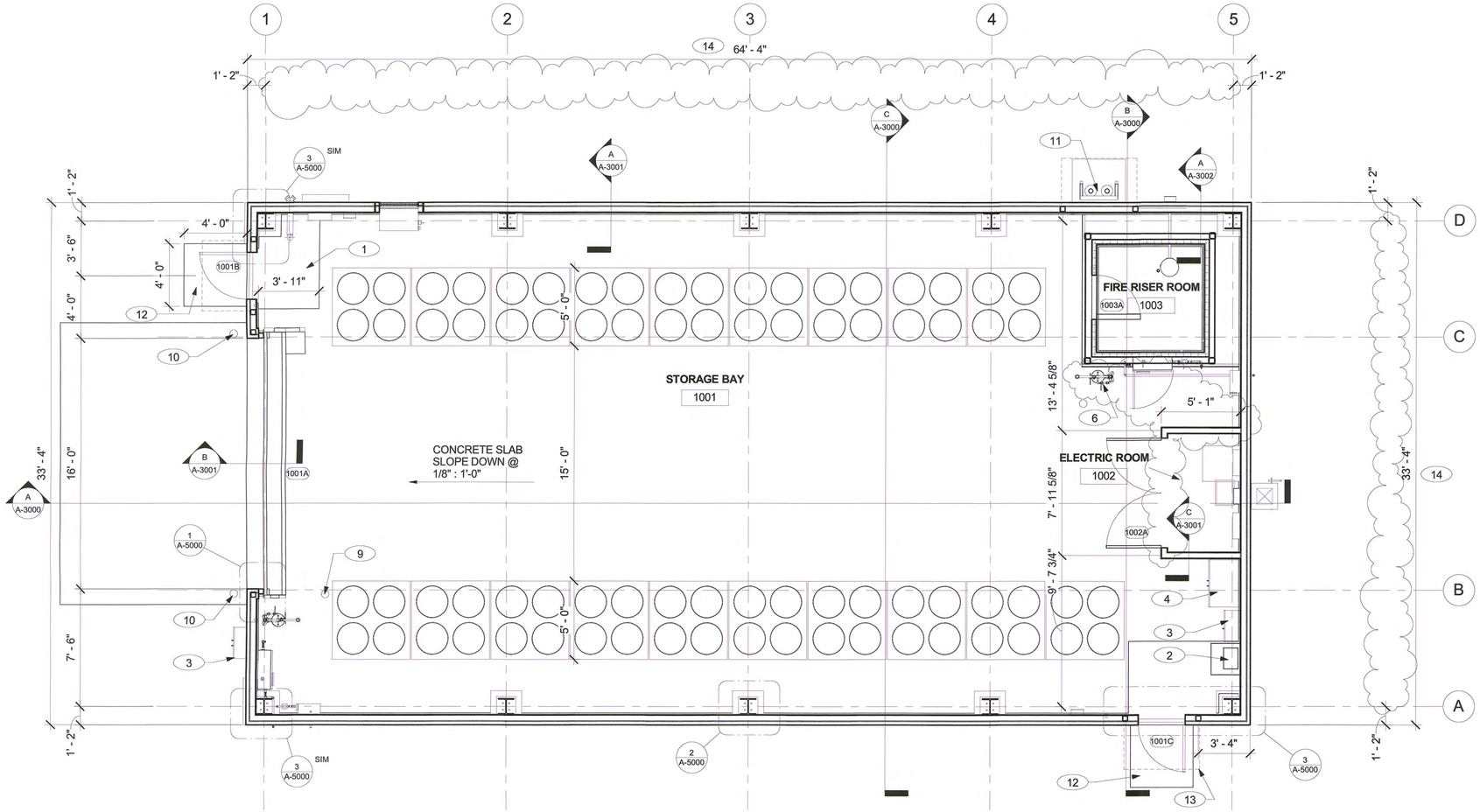
SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F–0001
137 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11–06–13

PROJECT ID 102355 | DRAWING NO C55443 | REV 1



FLOOR PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24" x 36", THEN IT IS A RECUCED SIZE PLOT, USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. PALLETS AND STORAGE CANISTERS ARE NOT IN CONCRACT.
4. 36" HIGH ABOVE FINISHED FLOOR STAINLESS STEEL CORNER GUARDS AT OUTSIDE CORNERS, TYPICAL.
5. SEE STRUCTURAL FOR COLUMN LINE DIMENSIONS.

KEYED NOTES

1. LANDING, SEE STRUCTURAL SHEET S-1000
2. COMPUTER WORK STATION SEE DETAIL 4/A-5002
3. SPILL KIT, GFE
4. SUPPLY CABINET, GFE
5. DECONTAMINATION EQUIPMENT CABINET, GFE
6. EYE WASH AND SHOWER
7. FIRE RISER
8. FIRE EXTINGUISHER
9. BOLLARD, SEE DETAIL 7/A-5002
10. PERMANENT BOLLARD, SEE DETAIL 7/A-5002
11. FIRE SUPPRESSION SYSTEM NITROGEN GAS CYLINDER RACK
12. CONCRETE STOOP, TYPICAL - SEE SHEET C55443 C-5004
13. EDGE OF AWNING ABOVE
14. BUILDING DIMENSIONS ARE SAFETY CLASS. MAXIMUM WIDTH IS 33.8 FEET. MAXIMUM LENGTH IS 64.8 FEET.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	01-15-16	U		FCR-067/DCN-222; FCR-176/DCN-334; FCR-267/DCN-409	AG	EA	SW		
2	05-14-14	U	EA	102355-DRN-C55444-00001 REVISED NOTE	AG	RK	RK	BS	MP
1	11-06-13	U	EA	REVISED FLOOR PLAN	AG	RK	RK	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

FLOOR PLAN

BLDG 63-0149 TA-63

DRAWN: A. GALLEGOS
DESIGN: D.WALLERSTEDT
CHECKED: T. LEACH
DATE: 11-06-13

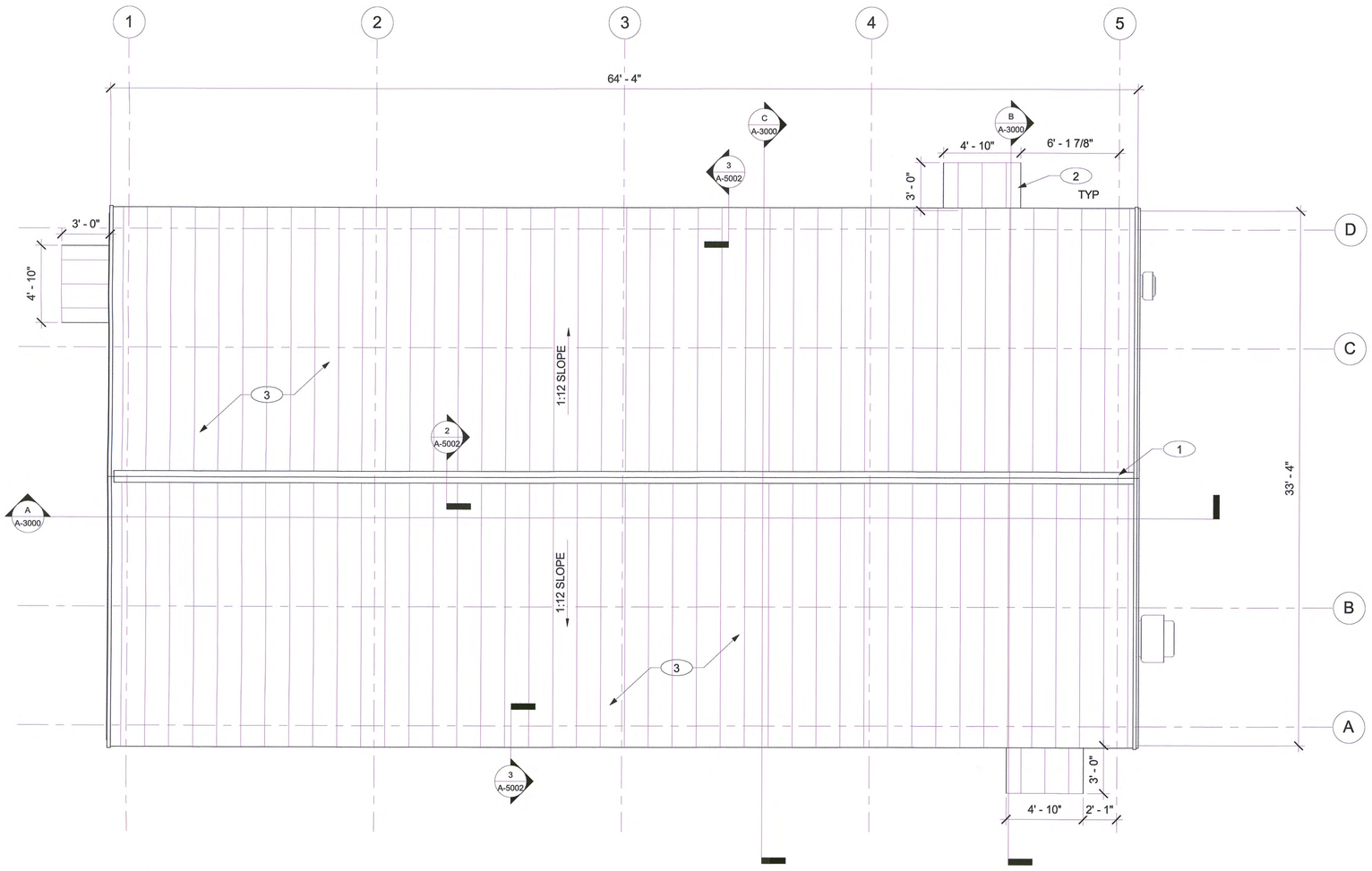
SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET: A-1050
285 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13
PROJECT ID 102355
DRAWING NO C55444
REV 3

STATE OF NEW MEXICO
STEPHEN G. VAN WINKLE
2273
1-20-2016
REGISTERED ARCHITECT



ROOF PLAN

0 1' 2' 4' 6' 8'
1/4"=1'-0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24" X 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. STANDING SEAM METAL ROOF. THIS COMPONENT IS A CLASS A MATERIAL AND IS CLASSIFIED AS SAFETY CLASS.

KEYED NOTES

1. RIDGE CAP.
2. STANDING SEAM METAL AWNING, TYP. - SEE DETAIL 5/A-5002
3. 2" X 18" WIDE STANDING SEAM METAL ROOF

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	01-15-16	U		FCR-102/DCN-260	AG	MT	RK	BS	MP
2	03-20-14	U	EA	DRN-14-63-0149-0045 UPDATED GENERAL NOTE #3	AG	MT	RK	BS	MP
1	11-06-13	U	EA	REVISED AWNINGS	AG	RK	RK	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

ROOF PLAN

BLDG 63-0149 TA-63

DRAWN	A. GALLEGOS
DESIGN	D.WALLERSTEDT
CHECKED	T. LEACH
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

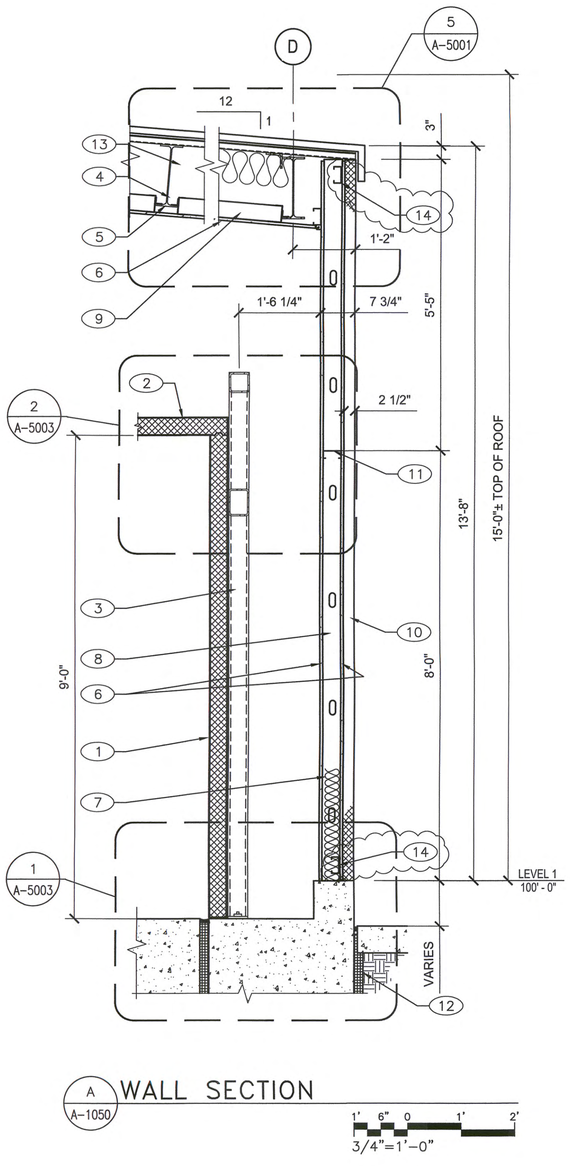
Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET A-1051
286 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13
PROJECT ID 102355
DRAWING NO C55444
REV 3

STATE OF NEW MEXICO
STEPHEN G. VAN WINKLE
2273
1-20-2016
REGISTERED ARCHITECT

P:_TECHNOLOGY\LANL\102355 - TRU Waste Facility\500 CAD\STORAGE BLDGS\ARCH\REVIT\Storage Bldg 149 - Arch.rvt 1/13/2016 5:30:11 PM
TRU WASTE FACILITY PROJECT



A / A-1050 WALL SECTION

1' 6" 0 1' 2'

3/4"=1'-0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24X36, THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY

KEYED NOTES

1. 4" THICK INSULATED METAL CLAD INTERIOR WALL PANELS
2. 4" THICK INSULATED METAL CLAD INTERIOR CEILING PANELS
3. SEISMICALLY RATED STRUCTURAL FRAME
4. 1 1/2" X 3 5/8" 20 GA TRACK
5. 1 1/2 X 1 1/2" CLIP
6. 5/8" TYPE "X" GYP BOARD
7. BATT INSULATION - R13
8. 1 5/8" X 4" 16 GA METAL STUDS @ 16" O.C. AND AT EACH METAL PANEL VERTICAL JOINT
9. 3 5/8" 25 GA METAL STUDS @ 16" O.C.
10. 2 1/2" X 36" INSULATED CORE METAL WALL PANELS SECURE TO STRUCTURE PER MANUFACTURER INSTRUCTIONS.
11. HORIZONTAL BLOCKING FOR METAL PANEL ATTACHMENT. LOCATE AT 108' HEIGHT.
12. 2" PERIMETER INSULATION - R7
13. W14 X 30 BEYOND
14. METAL STUD BLOCKING FOR ATTACHMENT OF KINGSPAN PANELS AS NEEDED AT TOP AND BOTTOM OF WALL

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	01-15-16	U		FCR-183/DCN-341	AG	MT	RK	BS	MP
3	05-14-14	U	EA	102355-DRN-C55444-00001 UPDATED KN 11	AG	RK	RK	BS	EA
2	01-06-14	U	EA	DRN 14.63.0144.0036 UPDATED DETAIL CALLOUTS	AG	RK	RK	BS	
1	11-06-13	U		NEW SHEET					

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

WALL SECTION

BLDG 63-0149 TA-63

DRAWN	A. GALLEGOS
DESIGN	R. KASELOW
CHECKED	T.LEACH
DATE	11-06-13

SUBMITTED
BRIAN SULLIVAN

APPROVED FOR RELEASE
ED ARTIGLIA

STATE OF NEW MEXICO
STEPHEN G. VAN VINKLE
2273
10-2016
REGISTERED ARCHITECT

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET A-3002

291 OF 827

CLASSIFICATION U

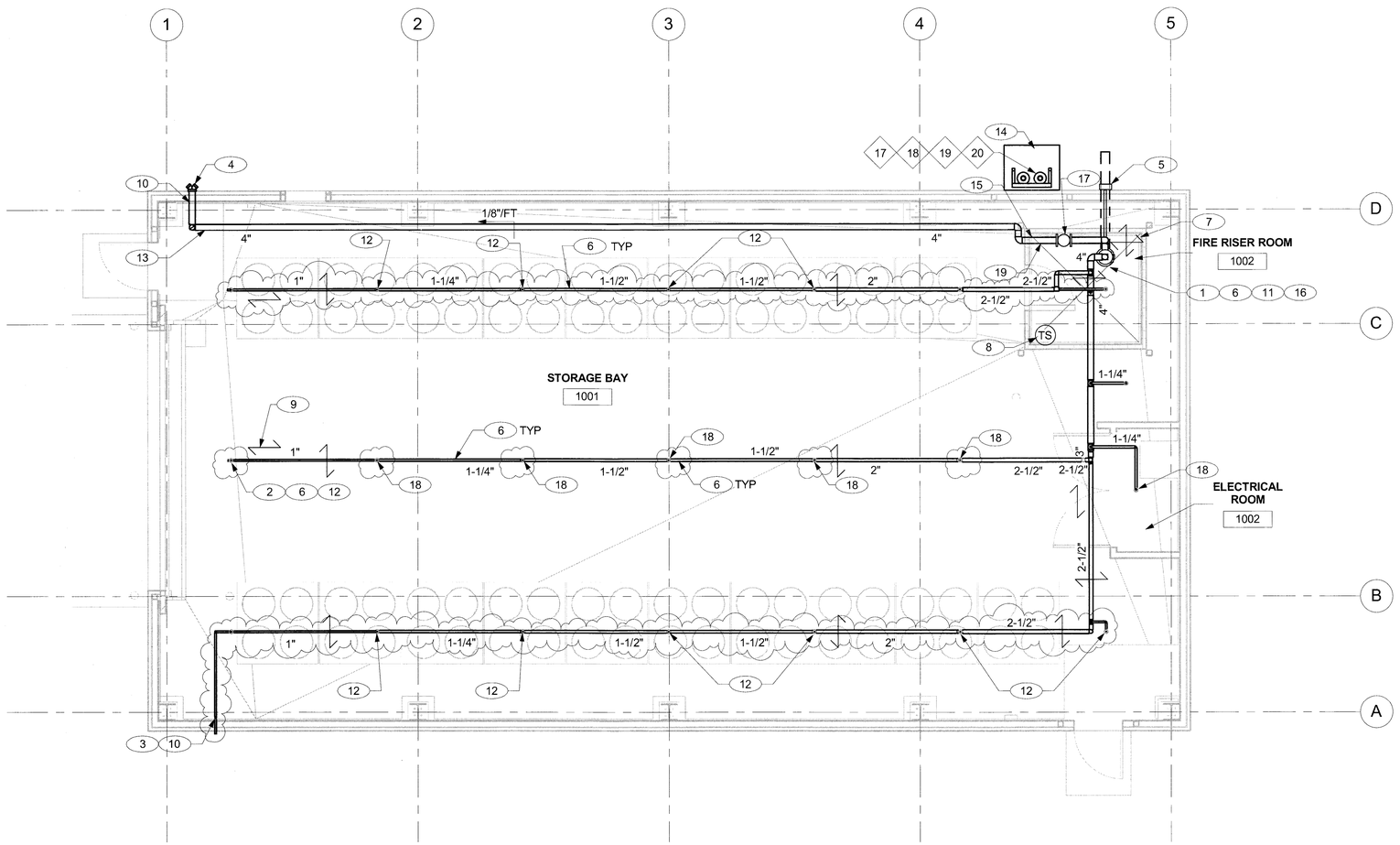
REVIEWER ED ARTIGLIA

DATE 11-06-13

PROJECT ID 102355

DRAWING NO C55444

REV 4



FIRE PROTECTION PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEET F-0001 FOR SYMBOLS, LEGEND, ABBREVIATION AND STRUCTURAL BRACING INFORMATION.
4. FOR SEISMIC BRACING, SEE DETAILS 2 AND 3 ON SHEET F-5000.
5. SEE CALCULATION 11-001-FCAL-001 FOR HYDRAULIC CALCULATIONS.
6. THE SPRINKLER LAYOUT SHOWS DESIGN INTENT. THE FIRE PROTECTION SUBCONTRACTOR IS RESPONSIBLE TO PROVIDE SHOP DRAWINGS AND SUPPORTING CALCULATIONS.
7. PITCH PIPE TO DRAIN TO RISER PER NFPA 13.

KEYED NOTES

1. 6" FIRE PROTECTION RISER WITH DRY PIPE VALVE, SEE DETAIL 1 ON SHEET F-5000.
2. UPRIGHT SPRINKLER, TYPICAL OF 22.
3. INSPECTOR'S TEST STATION.
4. FIRE DEPARTMENT CONNECTION.
5. WALL POST INDICATOR VALVE, SEE PIPE THRU WALL PENETRATION DETAIL 5 ON SHEET F-5000.
6. FIRE PROTECTION COMPONENTS ARE CLASSIFIED AS SAFETY SIGNIFICANT ML-2.
7. SEE DETAIL 3 ON SHEET F-5000 FOR SWAY BRACING.
8. SAFETY SIGNIFICANT TEMPERATURE SENSOR.
9. SEE DETAIL 2 ON SHEET F-5000 FOR SWAY BRACING.
10. SEE DETAIL 5 ON SHEET F-5000 FOR PIPE THRU WALL PENETRATION.
11. SEE DETAIL 2 ON SHEET F-5001 FOR THERMAL BLOCK PENETRATION.
12. INSTALL HIGH TEMPERATURE RATED (286° F) SPRINKLER HEAD NEAR UNIT HEATER.
13. BOTTOM OF 4" PIPE AT 6'-10" AFF AT THIS LOCATION.
14. 2 BOTTLE N2 RACK.
15. SEE DETAIL 3 ON SHEET F-5001 FOR ENCLOSURE WALL PENETRATION.
16. SEE DETAIL 1 ON SHEET F-5001 FOR ENCLOSURE CEILING PENETRATION.
17. CHECK VALVE WITH AUTOMATIC DRIP DRAIN.
18. STANDARD 165° F HEAD.
19. PROVIDE DRY SYSTEM AUXILIARY DRAIN. DRAIN SHALL CONSIST OF A VALVE NOT SMALLER THAN 1/2" AND A PLUG OR A NIPPLE AND CAP.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	03-07-14	U		TRW-IX-63-0149-0045 REVISED FIRE PROTECTION SYSTEM	DB	CM	CM	BS	
1	11-06-13	U		REVISED FIRE PROTECTION SYSTEM	DB	CM	CM	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

FIRE PROTECTION PLAN

BLDG 63-0149 TA-63

DRAWN	D. BROERMAN
DESIGN	E. MIYODA
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

LANL BUILDING OFFICIAL APPROVED
SIG DATE 5-29-14
ID# 119113
ALT.# 13-094 R2
REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISO 341-2, CH. 10

CHARLES MOYERS NEW MEXICO 15030 LICENSED PROFESSIONAL ENGINEER
03-07-14

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F-1000
299 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55444
REV 2

TRU WASTE FACILITY PROJECT 3/7/2014 10:18:28 AM P:_TECHNOLOGY\LANL\102355 - TRU Waste Facility\500 CAD\STORAGE BLDG\SIM-P-FIRE\REVIT\Storage Building 149 - Mech.rvt

GENERAL NOTES

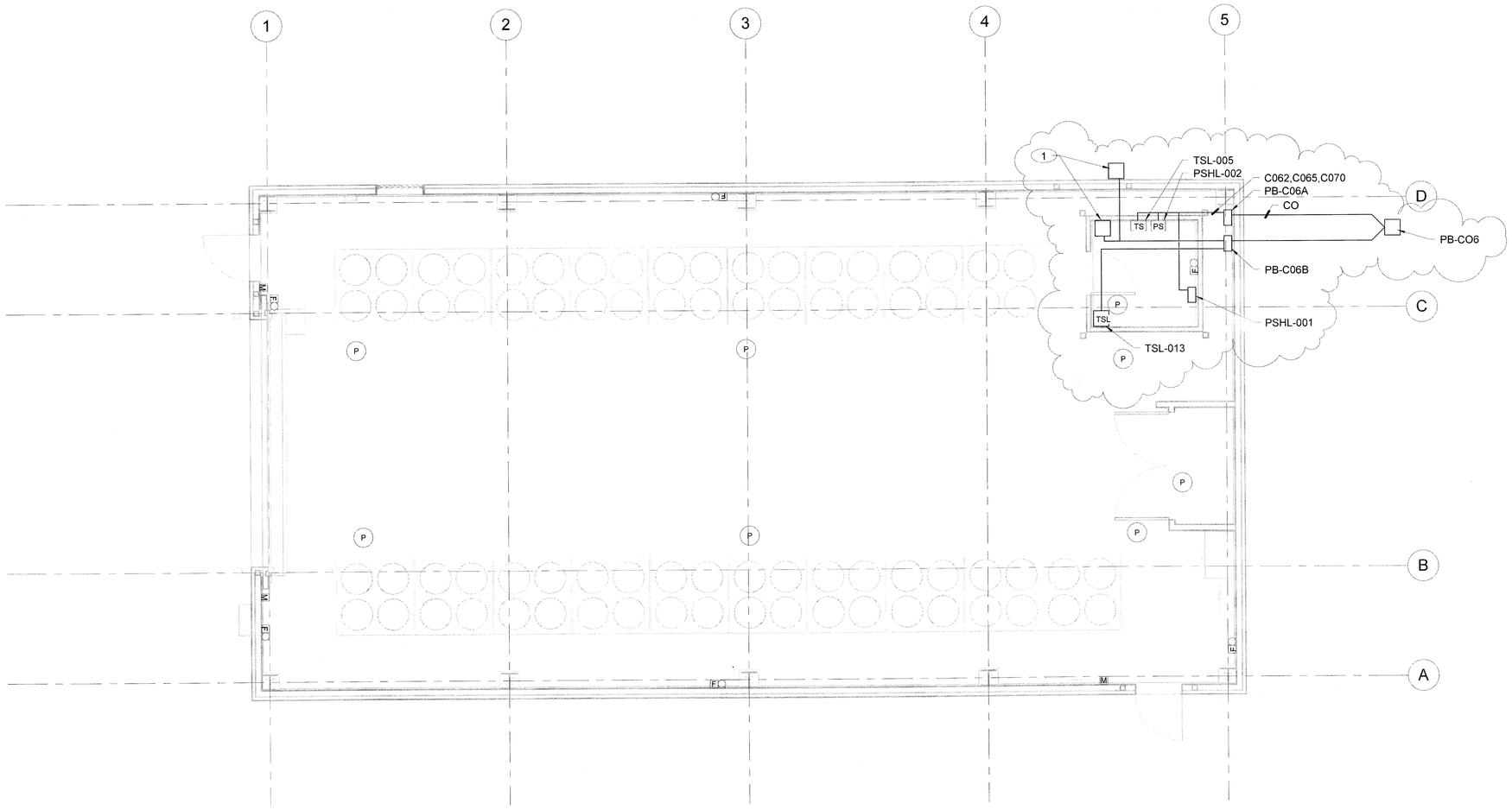
1 IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

2 THIS DRAWING WAS GENERATED IN REVIT 2011.

3 ALL INITIATING DEVICES AND NOTIFICATION APPLIANCES IN THIS BUILDING SHALL BE SUPPORT BY THE SUB-FACP LOCATED IN BUILDING 63-152.

KEYED NOTES

(1) TSL-004, PS-002, AND PIV-002 WIRE TO SAP. INSTALL ONE TSP FOR EACH SIGNAL ROUTED TO SAP VIA PB-C06B.



FIRE DETECTION & ALARM PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	03-20-14	U		DRN-14-63-0149-0045 RECONFIGURE PANEL	BB	RK	BS	BS	
1	11-06-13	U		RELOCATED DEVICES FOR RISER CLOSET	BB	RK	BS	BS	

WEIDLINGER-ASSOCIATES JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

FIRE DETECTION & ALARM PLAN

BLDG 63-0149 TA-63

DRAWN	B.BACKER
DESIGN	R.KRAYER
CHECKED	C.MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

LANL BUILDING OFFICIAL
SIG
ID 119113
DATE 5-29-14
BLDG 13-094 R2
APPROVED

REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISD 341-1 F. CH 16

CHARLES MOYERS NEW MEXICO 16030 LICENSED PROFESSIONAL ENGINEER 03-20-14

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F-1001

300 OF 827

CLASSIFICATION U

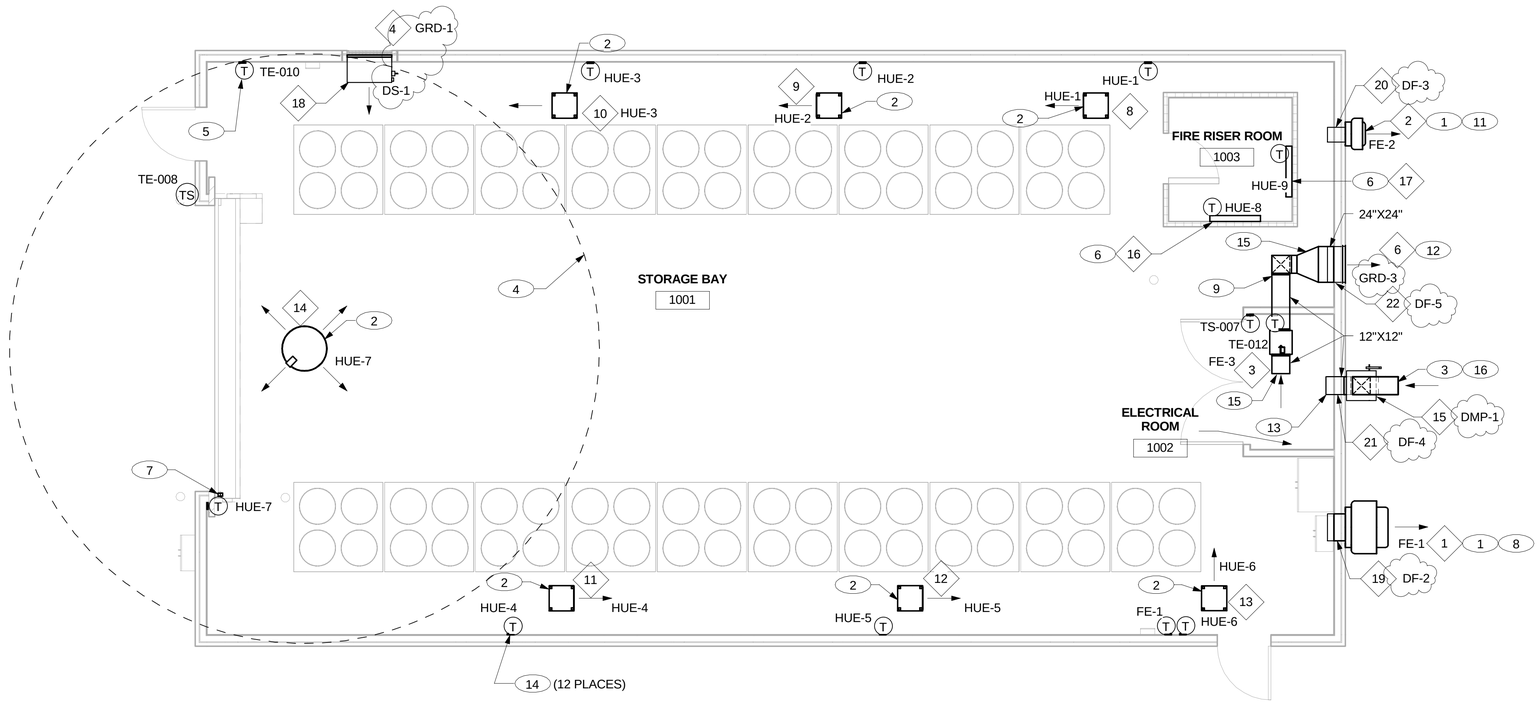
REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID 102355

DRAWING NO C55444

REV 2

TRU WASTE FACILITY PROJECT 3/19/2014 5:54:49 PM C:\Users\bridgettb\Documents\Storage Bldg 1-Elec_BridgettB.rvt



HVAC PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEET M-0001 FOR ABBREVIATIONS, GENERAL NOTES AND LEGEND.
4. SEE SHEET M-6000 FOR AIR FLOW DIAGRAM.
5. SEE SHEETS M-7000 AND M-7001 FOR EQUIPMENT SCHEDULES.
6. SEE DETAIL 4 ON SHEET M-5000 FOR DUCT PENETRATION DETAIL, TYPICAL FOR ALL EXTERIOR WALL PENETRATIONS.

KEYED NOTES

1. EXHAUST FAN WITH WEATHERHOOD, SEE DETAIL 1 ON SHEET M-5000.
2. MOUNT BOTTOM OF UNIT HEATERS HUE-1 THROUGH HUE-7 AT 10'-10" ABOVE FINISH FLOOR (TYPICAL OF 7).
3. SEE DETAIL 6 ON SHEET M-5000.
4. DASHED CIRCLE REPRESENTS AIR PATTERN LIMIT FROM HUE-7.
5. MOUNT TEMPERATURE SENSOR 12" FROM EDGE OF DOOR OPENING AT 48" ABOVE FINISHED FLOOR.
6. MOUNT BOTTOM OF HEATER 8'-6" AFF. MOUNT THERMOSTAT AT 4'-6" AFF.
7. DOOR CLOSURE SIGNAL SWITCH, ZS-001.
8. MOUNT FE-1 AT 9'-2" AFF TO BOTTOM OF DUCT.
9. SEE DETAIL 3 ON SHEET M-5000 FOR DUCT HANGERS.
10. MOUNT BOTTOM OF LOUVER AT 3'-6" AFF, SEE DETAIL 2 ON SHEET M-5000.
11. MOUNT FE-2 AT 11'-9" AFF TO BOTTOM OF DUCT, ABOVE TOP OF FIRE RISER ROOM 1003.
12. MOUNT BOTTOM OF LOUVER AT 9'-0" AFF.
13. MOUNT BOTTOM OF INTAKE AT 1'-10" AFF.
14. THERMOSTAT MOUNTED ON WALL AT 4'-6" AFF, TYPICAL.
15. 12"x12" TO 24"x24" TRANSITION, SEE DETAIL 7 ON SHEET M-5000.
16. PROVIDE 1/2"x1/2" BIRD SCREEN, SEE DETAIL 4 ON SHEET M-5000.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
5	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	JM	BS	
4	03-09-16	U		FCR-357/DCN-496	DB	RB	JM	BS	
3	01-15-16	U	EA	FCR-226/DCN-379, FCR-267/DCN-409	DB	RB	JM	BS	
2	05-14-14	U	EA	102355-DRN-C55444-00001 REVISED NOTE	DB	MT	CM	BS	
1	11-06-13	U	EA	ADDED FIRE RISER ROOM	DB	CM	CM	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

HVAC PLAN

BLDG 63-0149 TA- 63

DRAWN	D. BROERMAN
DESIGN	P. McMAHON
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET M-1000

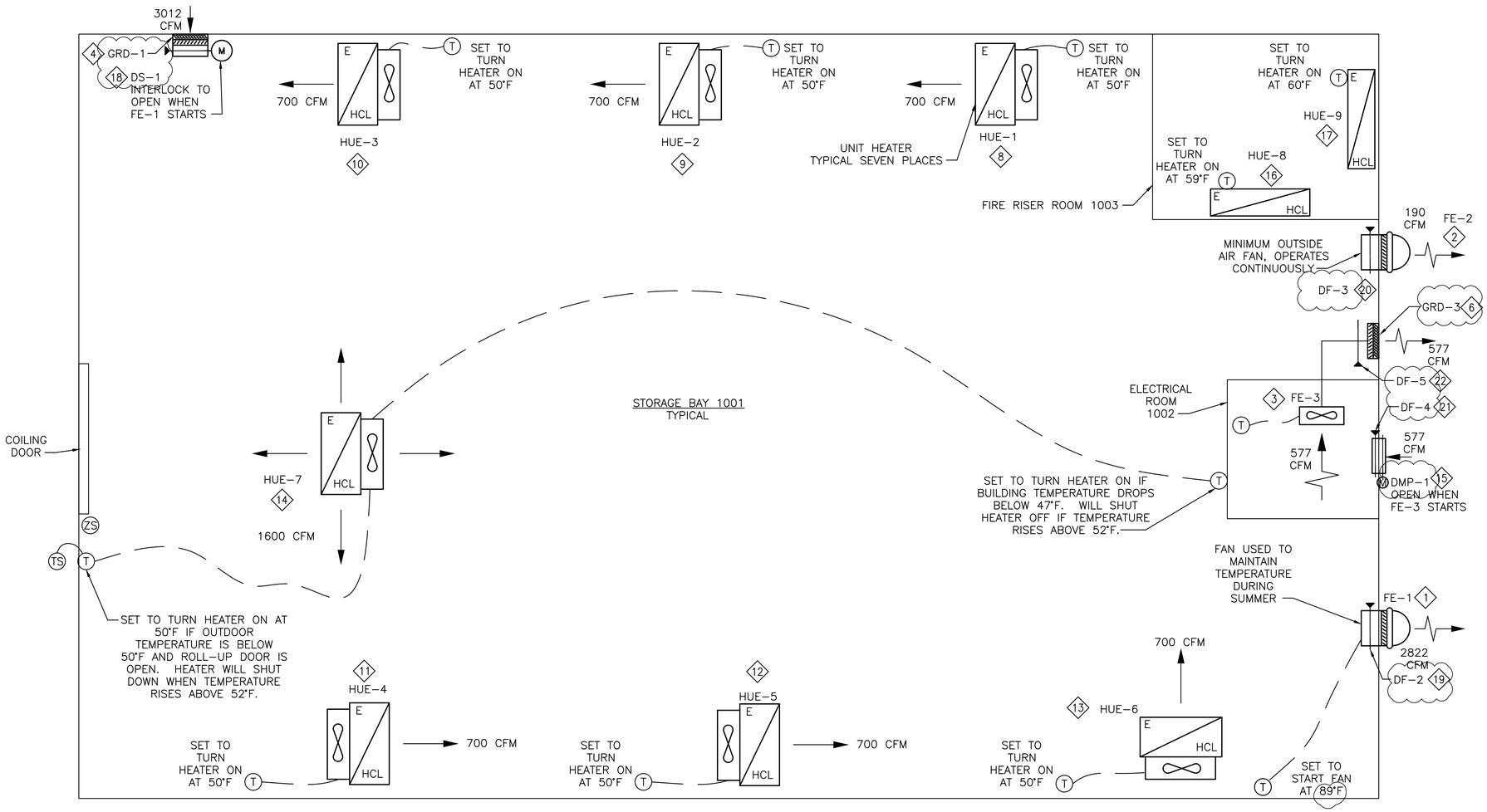
316 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

PROJECT ID 102355 | DRAWING NO C55444 | REV 5

RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER 8/31/16

TRU WASTE FACILITY PROJECT 8/31/2016 3:16:21 PM P:_TECHNOLOGY\LANL\102355 - TRU Waste Facility\500 CAD\STORAGE BLDG\M-P-FIREREVIT\Storage Building 149 - Mech.rvt



HVAC FLOW DIAGRAM

SCALE: NONE

"PRIORITY DRAWING"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	BCB	BS	
1	11-06-13	U		REVISED EQUIPMENT	DB	CM	CM	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

HVAC FLOW DIAGRAM

BLDG 63-0149 TA-63

DRAWN	D. BROERMAN
DESIGN	P. McMAHON
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

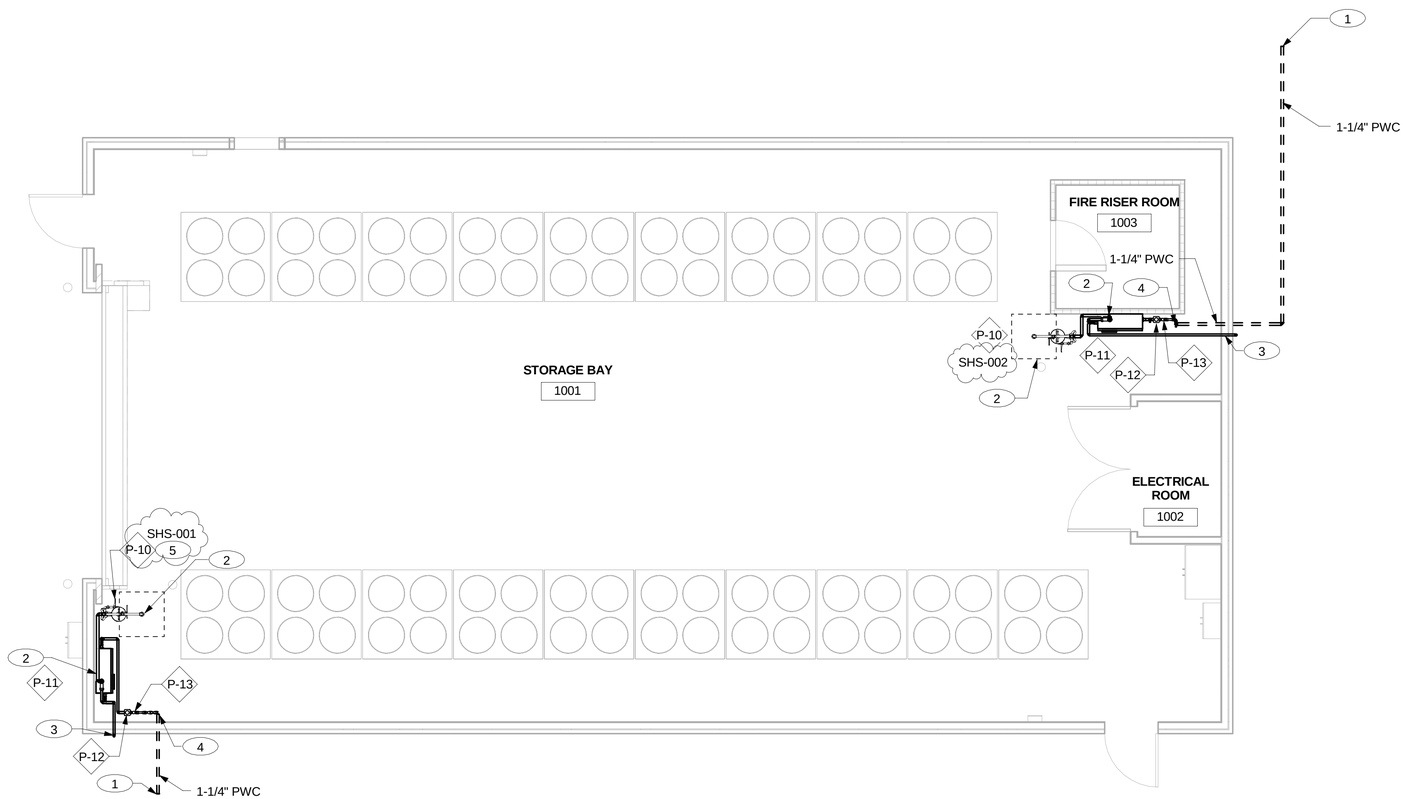
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET M-6000
318 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

PROJECT ID 102355 | DRAWING NO C55444 | REV 2

RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER
5/31/16



PLUMBING PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEET P-0001 FOR SYMBOLS, GENERAL NOTES AND LEGEND.
4. SEE SHEET P-7000 FOR EQUIPMENT SCHEDULES.

KEYED NOTES

1. SEE SITE UTILITY PLAN, SHEET C55443-C-1006 FOR CONTINUATION.
2. SEE DETAIL 1 ON SHEET P-5000 FOR WATER HEATER, CONNECTIONS AND FLOOR PAINTING INSTRUCTIONS.
3. 1" DRAIN FROM WATER HEATER RELIEF VALVE TO OUTSIDE. SEE DETAIL 2 ON SHEET P-5000 FOR WALL PENETRATION.
4. SEE DETAIL 3 ON SHEET P-5000 FOR FLOOR PENETRATION.
5. FIELD LOCATE EMERGENCY SHOWER TO ACCOMMODATE REQUIRED ELECTRICAL CLEARANCES.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	BS	BS	
2	01-15-16	U		FCR-226/DCN-379; FCR-267/DCN-409	DB	RB	BS	BS	
1	11-06-13	U	EA	REVISED LOCATION OF EYEWASH	DB	CM	CM	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

PLUMBING PLAN

BLDG 63-0149 TA- 63

DRAWN	D. BROERMAN
DESIGN	C. MOYERS
CHECKED	E. MIYODA
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

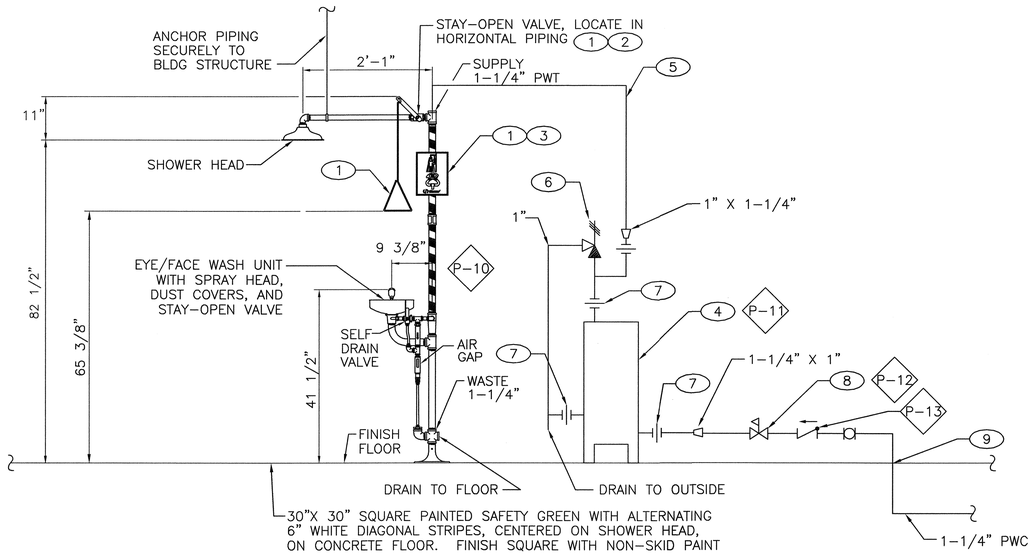
SHEET P-1000

309 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

PROJECT ID 102355 | DRAWING NO C55444 | REV 3

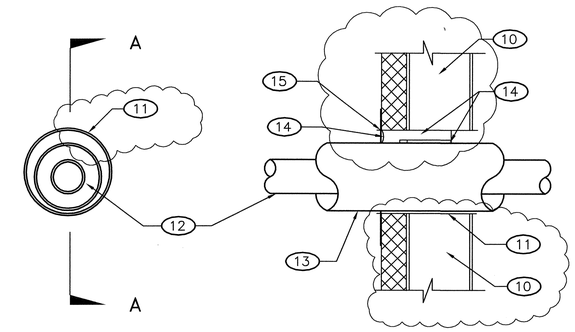
RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER 8/31/16



ELEVATION VIEW

1 / P–1000 SAFETY SHOWER W/EYEWASH DETAIL

SCALE: NONE



PLAN VIEW SECTION A–A

2 / P–1000 PIPE THROUGH WALL PENETRATION

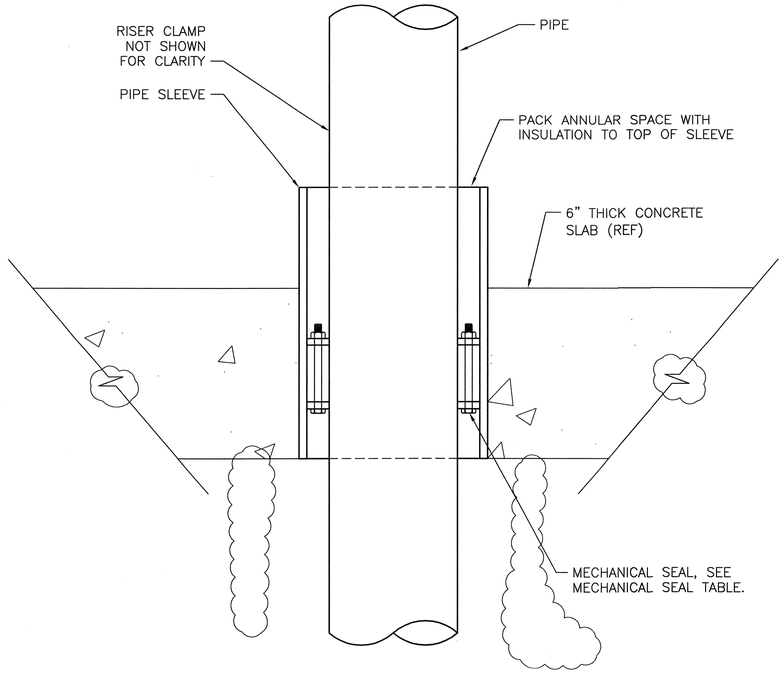
SCALE: NONE

KEYED NOTES:

1. FURNISHED WITH EMERGENCY EQUIPMENT.
2. VALVE TO BE ACCESSIBLE FOR MAINTENANCE.
3. EMERGENCY SIGN(S).
4. ELECTRIC SAFETY SHOWER TEPID WATER HEATER.
5. TEPID WATER SUPPLY.
6. TEMPERATURE AND PRESSURE RELIEF VALVE.
7. PROVIDE DIELECTRIC UNION AT POINTS OF DISSIMILAR METALS.
8. PRESSURE REDUCING VALVE.
9. FLOOR PENETRATION, SEE DETAIL 3 ON SHEET P–5000.
10. 1 HOUR WALL ASSEMBLY – STEEL STUDS.
11. STEEL SLEEVE – CYLINDRICAL SLEEVE.
12. THROUGH PENETRANTS – PIPE OR CONDUIT TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY. THE FOLLOWING TYPES OF METALLIC PIPES OR TUBES MAY BE USED:

    STEEL PIPE – NOM. 2" (51 mm) (OR SMALLER) SCHEDULE 5 (OR HEAVIER) STEEL PIPE.
13. PIPE COVERING.
14. PACKING MATERIAL – MIN. 3" (76 mm) THICKNESS OF MIN. 4 PCF (64 kg/m³) MINERAL WOOL BATT INSULATION FIRMLY PACKED INTO OPENING AS A PERMANENT FORM. PACKING MATERIAL TO BE RECESSED FROM FINISHED SURFACE OF WALL TO ACCOMMODATE THE REQUIRED THICKNESS OF FILL MATERIAL.

    STUDS – THICKNESS, TYPE, NUMBER OF LAYERS AND FASTENERS AS REQUIRED IN THE INDIVIDUAL WALL AND PARTITION DESIGN. MAX SIZE OF OPENING IS 9.800"² (63.2 cm²) WITH A MAX. DIMENSION OF 100" (254 cm).
15. METAL RODENT SHIELD LOCATED ON EXTERIOR OF BUILDING.



SECTION VIEW

3 / P–5000 3 / P–1000 FLOOR PENETRATION DETAIL

SCALE: NONE

MECHANICAL SEAL TABLE			
NOMINAL PIPE SIZE	NOMINAL SLEEVE SIZE	METRASEAL MODEL NO.	REMARKS
4"	6"	10MS–300ES	PIPE SCHEDULE 40 STEEL PIPE, SLEEVE SCHEDULE 40 STEEL PIPE
3"	5"	8MS–300ES	PIPE SCHEDULE 40 STEEL PIPE, SLEEVE SCHEDULE 40 STEEL PIPE
2 1/2"	4"	9MS–200ES	PIPE SCHEDULE 40 STEEL PIPE, SLEEVE SCHEDULE 40 STEEL PIPE
2"	4"	6MS–300ES	PIPE SCHEDULE 40 STEEL PIPE, SLEEVE SCHEDULE 40 STEEL PIPE
1 1/4"	3"	7MS–275ES	PIPE SCHEDULE 40 STEEL PIPE, SLEEVE SCHEDULE 40 STEEL PIPE

MECHANICAL SEAL TABLE			
NOMINAL PIPE SIZE	NOMINAL SLEEVE SIZE	METRASEAL MODEL NO.	REMARKS
8"	10"	9MS–325ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
6"	8"	7MS–325ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
4"	6"	5MS–325ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
2 1/2"	4"	10MS–275ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
2"	3 1/2"	8MS–275ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
1 1/2"	3"	7MS–275ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
1 1/4"	3"	4MS–300ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
1"	2 1/2"	5MS–275ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE
3/4"	2"	4MS–200ES	COPPER TUBE, SLEEVE SCHEDULE 40 STEEL PIPE

LANL BUILDING OFFICIAL
SIG 119113
DATE 12-12-12
LA-UR 13-0094
APPROVED

REVIEWED FOR LANL STANDARDS COMPLIANCE PER LIR 341-2, CH. 16
CHARLES MOYERS NEW MEXICO 16030 LICENSED PROFESSIONAL ENGINEER
11-06-13

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	11–06–13	U		REVISED DETAILS					

WEIDLINGER–NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

DETAILS

BLDG 63–0149 TA–63

DRAWN	D. BROERMAN
DESIGN	C. MOYERS
CHECKED	P. McMAHON
DATE	11–06–13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663, Los Alamos, New Mexico 87545

SHEET P–5000
310 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11–06–13

PROJECT ID 102355
DRAWING NO C55444
REV 1

GENERAL STRUCTURAL NOTES

1. CODES AND MANUALS
   A. INTERNATIONAL BUILDING CODE 2006.
   B. AMERICAN SOCIETY OF CIVIL ENGINEERS, ASCE 7-05, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES.
   C. ACI 318-05 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.D. AISC 360-05, MANUAL OF STEEL CONSTRUCTION.
   E. DOE-STD-1020-2002 NATURAL PHENOMENA HAZARDS DESIGN AND EVALUATION CRITERIA FOR DOE FACILITIES.
   F. ENGINEERING STANDARDS MANUAL ISD 341-2, CHAPTER 5, REV. 5, 11-19-2008
   G. ENGINEERING STANDARDS MANUAL ISD 341-2, CHAPTER 13, REV. 1, 10-27-2006.
   H. LANL DRAFTING MANUAL OST-220-03-01-DM REV. 4, 10-27-2006.
   I. AISC 341-05 SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS, INCLUDING SUPPLEMENT NO.1.
   J. DOE-STD-1189 INTEGRATION OF SAFETY INTO THE DESIGN PROCESS.
   K. AWS D1.1 STRUDTURAL WELDING CODE-STEEL.

2. DESIGN LOADS
   A. NEW BUILDING CLASSIFICATION PER DOE-STD-1020: PC-2. THE BUILDING IS DESIGNED FOR PC-3 WIND AND SNOW LOADS.
   B. SEISMIC DESIGN CATEGORY 2 (SDC-2), LIMIT STATE B PER DOE STD 1189-2008
   C. MINIMUM DESIGN LOADS:
      IN ACCORDANCE WITH LANL ESM, AS AUGMENTED BY ASCE-7, FOR DEAD AND LIVE LOADS, UNLESS NOTED OTHERWISE.
      (a) DEAD LOADS:
         (a1) SELFWEIGHT OF MATERIALS.
         (a2) WEIGHT OF PERMANENT INSTALLED EQUIPMENT.
         (a3) FUTURE FLOOR DESIGN DEAD LOAD: 10 PSF UNIFORM LOAD.

      (b) LIVE LOADS:
         (b1) ROOF DESIGN LIVE LOAD: 30 PSF UNIFORM LOAD OR 2000 LB. CONCENTRATED LOAD.
         (b2) SLAB-ON-GRADE DESIGN LIVE LOAD: 125 PSF UNIFORM LOAD OR 17,500 LB FORKLIFT AXLE LOAD.
   D. THE STRUCTURE HAS BEEN DESIGNED TO RESIST DESIGN LOADS ONLY AS A COMPLETED STRUCTURE. APPLICATIONS OF CONSTRUCTION LOADS TO THE PARTIALLY COMPLETED STRUCTURE SHALL BE CONSIDERED BY THE CONTRACTOR AND SO INCLUDED IN THE DESIGN OF SHORING, BRACING, FORMWORK, AND OTHER SUPPORTING ELEMENTS PROVIDED FOR CONSTRUCTION OF THE STRUCTURE. THE CONTRACTOR SHALL ENSURE THAT ALL CONSTRUCTION LOADS DO NOT EXCEED THE DESIGN LIVE LOADS INDICATED ON THE STRUCTURAL DRAWINGS AND THAT THESE LOADS ARE NOT IMPOSED ON THE STRUCTURAL MEMBERS PRIOR TO THE TIME THAT ALL FRAMING MEMBERS AND THEIR CONNECTIONS ARE IN PLACE.
   E. WIND LOAD PARAMETERS:
      (1) BASIC WIND SPEED: 117 MPH
      (2) EXPOSURE: C
      (3) WIND IMPORTANCE FACTOR I=1.0
      (4) INTERNAL BUILDING PRESSURE COEFFICIENT: GCpi =±0.18
   F. SEISMIC LOAD PARAMETERS:
      (1) PER LANL ESM REV 5, AND DOE-STD 1189, APPENDIX A
      (2) OCCUPANCY CATEGORY IV
      (3) SEISMIC DESIGN CATEGORY: D
      (4) SITE CLASS: D, STIFF SOIL
      (5) DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETERS:
         Sds = 0.75 Sd1 = 0.64
      (6) IMPORTANCE FACTOR: I = 1.5
      (7) SEISMIC FORCE RESISTING SYSTEM:
         ORDINARY STEEL MOMENT FRAME
      (8) DESIGN BASE SHEAR V=CsW: Cs = 0.40, V = 35.10 KIPS
      (9) RESPONSE MODIFICATION COEFFICIENT R = 3.5, Ra = 0.8R
      (10) ANALYSIS PROCEDURE USED:
         EQUIVALENT LATERAL FORCE
   G. SNOW LOAD PARAMETERS:
      (1) PER LANL ESM REV 5.
      (2) GROUND SNOW LOAD: Pg=29 PSF
      (3) SNOW LOAD IMPORTANCE FACTOR: I=1.2
      (4) SNOW EXPOSURE FACTOR: Ce =1.0
      (5) THERMAL FACTOR: Ct =1.1
      (6) FLAT ROOF SNOW LOAD: Pf = 26.8 PSF
      (7) RAIN-ON-SNOW SURCHARGE: NOT CONSIDERED WHERE Pg > 20 PSF

3. GEOTECHNICAL INFORMATION:
   A. PER KLEINFELDER GEOTECHNICAL INVESTIGATION, TRU WASTE FACILITY TECHNICAL AREA 63, KLEINFELDER PROJECT #116662.1.6 ALB 11RP001 MAY 18, 2011.
   B. IBC SOIL CLASSIFICATION:
      3 - CLAYEY SAND (SC), SANDY CLAY (CL), SILT WITH SAND (ML).
   C. ALLOWABLE BEARING PRESSURE FOR:
      (1) FOUNDATIONS, FOUNDED ON TUFF/COMPACTED STRUCTURAL FILL: 2500 PSF
   D. SUBGRADE MODULUS:
      (1) FOUNDATIONS, FOUNDED ON TUFF/COMPACTED STRUCTURAL FILL: 200 PCI
   E. SPECIAL INSPECTION FOR SOILS PER PROJECT "TEST & SPECIAL INSPECTIONS PLAN TPLN-005".
   F. SOIL COEFFICIENT OF FRICTION = 0.40 UNDISTURBED SOIL
      0.45 STRUCTURAL FILL
   G. "AT REST" LATERAL SOIL PRESSURE (Pa) = 35 PCF
   H. PASSIVE SOIL PRESSURE = 330 PCF (SEISMIC) 350 PCF (STATIC)

4. CAST-IN-PLACE CONCRETE (SEE SPECIFICATION SECTION 03 3001.01)
   A. 28 DAY NORMAL WEIGHT CONCRETE COMPRESSIVE STRENGTH: 4000 PSI
   B. REINFORCING:
      (1) REINFORCEMENT STEEL DEFORMED BARS: ASTM A615, GRADE 60 OR ASTM A706, GRADE 60.
      (2) STIRRUPS AND TIES: ASTM A615, GRADE 60 OR ASTM A706, GRADE 60.
   C. STD HOOKS, LAP SPLICES, AND DEVELOPMENT LENGTHS PER ACI 318-05 REFER TO REINFORCING SPLICE AND EMBEDMENT SCHEDULE ON S-7000.
   D. SPECIAL INSPECTION FOR CONCRETE CONSTRUCTION PER PROJECT "TEST & SPECIAL INSPECTIONS PLAN TPLN-005".
   E. REINFORCING BARS SHALL HAVE THE FOLLOWING CONCRETE COVER, UNLESS NOTED OTHERWISE ON THE DRAWINGS:

ITEM	MIN COVER
SLABS AND JOISTS:	
DRY CONDITIONS (TOP AND BOTTOM BARS) -	
#11 BARS AND SMALLER	3/4"
#14 BARS AND #18 BARS	1 1/2"
FORMED CONCRETE SURFACES:	
EXPOSED TO EARTH, WATER AND WEATHER -	
#5 BARS AND SMALLER, W31 OR D31 WIRE AND SMALLER	1 1/2"
#6 THOUGH #8BARS, W45 OR D45 WIRE	2"
FORMED BEAMS AND COLUMNS:	
DRY CONDITIONS -	
STIRUPS AND TIES	1 1/2"
PRINCIPAL REINFORCEMENT	2"
EXPOSED TO EARTH, WATER AND WEATHER -	
STIRUPS AND TIES	2"
PRINCIPAL REINFORCEMENT	2 1/2"
WALLS:	
DRY CONDITIONS -	
#11 BARS AND SMALLER	3/4"
#14 AND #18 BARS	1 1/2"
EXPOSED TO EARTH, WATER AND WEATHER - ALL BARS	2"
FOOTINGS AND BASE SLABS:	
AT FORMED SURFACES AND BOTTOM BEARING ON CONCRETE WORKMAT	2"
AT UNFORMED SURFACES AND BOTTOMS IN CONTACT WITH EARTH	3"
TOP OF FOOTINGS OVER TOP OF PILES	SAME AS SLABS 2"

   F. DETAILING OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL MEET THE REQUIREMENTS OF ACI 315-04, ACI 318-05 AND CRSI MANUAL OF STANDARD PRACTICE PER SECTION 03 3001.01, REINFORCED CONCRETE SPECIFICATIONS.
   G. CAST-IN ANCHORS IN CONCRETE SHALL MEET THE REQUIREMENTS OF SPECIFICATION SECTION 03 1505.

5. STRUCTURAL STEEL (SEE SPECIFICATION SECTION 05 1000.01, 01 4444 & 01 4455)
   A. STRUCTURAL STEEL W-SHAPES: ASTM A992, GRADE 50.
   B. MISCELLANEOUS STEEL SHAPES AND PLATES: ASTM A36.
   C. HOLLOW STRUCTURAL SHAPES: ASTM A500 GRADE B.
   D. STANDARD STEEL PIPE: ASTM A53, GRADE B.
   E. HIGH STRENGTH BOLTS: 3/4"Ø AND 1"Ø ASTM A490 (TENSION CONTROL) 5/8"Ø ASTM A325 ("TURN OF THE NUT" METHOD OR AS INDICATED). "SC" (SLIP CRITICAL) FOR THIS PROJECT ONLY REFERS TO FAYING SURFACES.
   F. NUTS: ASTM A563
   G. HARDENED WASHERS: F436
   H. COMMON BOLTS: ASTM A29/A29M-04, GRADE A
   I. ANCHOR RODS: ASTM F1554, GRADE 36.
   J. DRILLED IN ANCHORS: EXPANSION HILTI KB TZ, UNO. SPECIAL INSPECTION REQUIRED FOR PLACEMENT OF ALL HILTI KB TZ POST INSTALLED ANCHORS. ICC REPORT ESR-1917 ISSUED MAY 1, 2011.
   K. WELDS:
      (1) WELDING SHALL BE IN ACCORDANCE WITH AWS D1.1-04 AND LANL-ESM CHAPTER 13.
      (2) ELECTRODE: USE 70,000 PSI ULTIMATE TENSILE STRENGTH MINIMUM.
   (3) 3/16" MINIMUM FILLET WELDS TO APPLY UNLESS OTHERWISE NOTED.
   L. WELDED SHEAR STUD CONNECTORS: ASTM A36
   M. NON-SHRINK GROUT - MINIMUM COMPRESSIVE STRENGTH 7000 PSI.
   N. HEADED ANCHOR STUD: ASTM A307
   O. SPECIAL INSPECTION FOR STEEL CONSTRUCTION PER PROJECT "TEST & SPECIAL INSPECTIONS PLAN TPLN-005".
   P. EPOXY DOWELS HILTI-HIT-RE 500-SD FOR ADHESIVE ANCHORS AND REBAR IN CRACKED AND UNCRACKED CONCRETE ICC REPORT ESR-2322. SPECIAL INSPECTION REQUIRED FOR ALL EPOXY APPLICATIONS PER PROJECT "TEST & SPECIAL INSPECTIONS PLAN TPLN-005".
   Q. WELDS DESIGNATED AS "DEMAND CRITICAL" SHALL BE MADE WITH A FILLER METAL CAPABLE OF PROVIDING A MINIMUM CHARPY V-NOTCH TOUGHNESS OF 20 FT-LB AT -20°F AS DETERMINED BY THE APPROPRIATE AWS CLASSIFICATION TEST METHOD OR MANUFACTURER CERTIFICATION, AND 40 FT-LB AT 70°F AS DETERMINED BY AISC 341-05 APPENDIX X.

6. STEEL ROOF DECK (SEE SPECIFICATIONS SECTION 05 3000.01)
   A. STEEL ROOF DECK (GALVANIZED) CONFORMING TO ASTM A 653, GRADE 40.
   B. DECK TYPE, PROFILE, AND SECTION PROPERTIES AS INDICATED ON PLANS.
   C. SPECIAL INSPECTION FOR STEEL ROOF DECK PER PROJECT "TEST & SPECIAL INSPECTIONS PLAN TPLN-005".

7. GENERAL CONSTRUCTION
   A. EXECUTE ALL ACTIVITIES IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS INCLUDED AS PART OF THIS DESIGN PACKAGE.

8. SPECIAL INSPECTION:
   A. REQUIREMENTS ARE DESCRIBED IN THE PROJECT "TESTS & SPECIAL INSPECTIONS PLAN TPLN-005".

9. LIGHT GAGE STEEL (SEE SPECIFICATION SECTION 05 4000, 01 4444 & 01 4455)
   A. THE LIGHT GAGE STEEL DESIGN OF MEMBERS AND ALL CONNECTIONS TO MEET THE REFERENCED CODES, LIVE LOADS AND WIND LOADS LISTED IN "DESIGN LOADS" NOTES, AND DEAD LOADS AS IMPLIED FROM ARCHITECTURAL AND MECHANICAL DRAWINGS.
   B. ALL MEMBERS SHALL BE FORMED FROM CORROSION-RESISTANT STEEL MEETING ASTM A1003, STRUCTURAL STEEL GRADE 50, ZINC COATED (G90) FORMED TO CHANNEL SHAPE. SEE SPECIFICATION SECTION 05 4000 FOR COLD-FORMED METAL FRAMING.
   C. ALL OF THE COLD FORMED MEMBERS SHALL COME FROM A SINGLE MANUFACTURER, "DIETRICH" OR EQUAL. THE INSTALLATION SHALL COMPLY WITH THE MANUFACTURER'S RECOMMENDATIONS.
   D. BASE TRACKS SHALL BE SET ON SMOOTH AND LEVEL CONCRETE OR NON-SHRINK GROUT SUCH AS "MASTERFLOW 713" BY MASTER BUILDERS.
   E. PRIOR TO FABRICATION OF FRAMING, THE CONTRACTOR SHALL SUBMIT FABRICATION AND ERECTION DRAWINGS TO THE ENGINEER FOR APPROVAL. SAID DRAWINGS SHALL BE SIGNED AND SEALED BY A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF NEW MEXICO.
   F. ALL CONNECTIONS SHALL BE WELDED CONNECTIONS AND SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE AWS D1.3-98 SPECIFICATION FOR WELDING SHEET STEEL IN STRUCTURES. ALL WELDING SHALL BE PERFORMED BY AWS CERTIFIED WELDERS. ALL WELDS SHALL BE CLEANED AND COATED WITH RUST INHIBITIVE ZINC PAINT.
   G. EXPANSION ANCHORS - PROVIDE MINIMUM 1/2" DIAMETER KWIK BOLT TZ EXPANSION ANCHORS BY HILTI OR EQUAL (ICC ESR-1917 ISSUED MAY 1, 2011), WITH A MINIMUM 3 1/4" EMBEDMENT INTO CONCRETE. MINIMUM SPACING BETWEEN ADJACENT EXPANSION ANCHORS TO BE 5". EXPANSION ANCHORS SHALL BE LOCATED A MINIMUM OF 3" FROM CONCRETE EDGES. USE OVERSIZE WASHERS FOR ATTACHING COLD-FORMED MEMBERS WITH EXPANSION ANCHORS. INSTALL PER THE MANUFACTURER'S SPECIFICATIONS FOR COLD-FORMED CONNECTIONS TO CONCRETE.
   H. SPLICES IN FRAMING COMPONENTS OTHER THAN TOP AND BOTTOM TRACKS ARE NOT PERMITTED.
   I. STUDS SHALL BE INSTALLED SO THE ENDS ARE POSITIONED AGAINST THE INSIDE OF THE RUNNER TRACK WEB PRIOR TO FASTENING AND SHALL BE WELDED TO BOTH FLANGES OF THE UPPER AND LOWER RUNNER TRACKS.
   J. FRAMING OF WALL OPENINGS SHALL INCLUDE HEADERS AND SUPPORTING STUDS AS SHOWN IN DETAILS.
   K. ADDITIONAL STUDS SHALL BE INSTALLED IN THE WALLS TO RESIST THE VERTICAL COMPONENTS OF BRACING LOADS.
   L. THE ALLOWABLE DEFLECTIONS (IN.) FOR VERTICAL WALLS SHALL BE HEIGH (IN.) DIVIDED BY 400. THE ALLOWABLE VERTICAL DEFLECTIONS (IN.) FOR HORIZONTAL FRAMING SHALL BE SPAN (IN.) DIVIDED BY 480 FOR LIVE LOADS AND SPAN (IN.) DIVIDED BY 360 FOR TOTAL LOADS.
   M. THE MINIMUM YIELD STRENGTH OF THE COLD-FORMED FRAMING COMPONENTS SHALL BE AS FOLLOWS:
      (a) 16 GAGE (54 MILS) OR HEAVIER - MINIMUM 50,000 PSI
      (b) ALL TRACKS & ACCESSORIES - MINIMUM 50,000 PSI UNLESS NOTED OTHERWISE
   N. THE COLD-FORMED FRAMING SHALL BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING CODES, STANDARDS AND SPECIFICATIONS:
      (1) IBC 2006
      (2) ANSI/ASCE 7-05
      (3) AISI "SPECIFICATIONS FOR DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS" - 1996
      (4) AISI "STANDARD FOR COLD-FORMED STEEL FRAMING: GENERAL PROVISIONS"-2004
      (5) AISI "STANDARD FOR COLD-FORMED STEEL FRAMING: WALL STUD DESIGN"-2004
      (6) AISI "STANDARD FOR COLD-FORMED STEEL FRAMING: HEADER DESIGN"-2004
      (7) AISI "STANDARD FOR COLD-FORMED STEEL FRAMING: LATERAL DESIGN"-2004
      (8) AISI "STANDARD FOR COLD-FORMED STEEL FRAMING: TRUSS DESIGN"-2004
      (9) AISI "CODE OF STANDARD PRACTICE FOR STRUCTURAL COLD-FORMED STEEL FRAMING"-2005
   O. ALL MEMBERS SHALL BE CUT SQUARELY FOR ATTACHMENT TO PERPENDICULAR MEMBERS OR SLOPE CUT AS REQUIRED FOR AN ANGULAR FIT AGAINST ABUTTING MEMBERS.
   P. FIELD CUTTING OF COLD-FORMED MEMBERS SHALL BE DONE BY SAWING OR SHEARING. TORCH CUTTING OF COLD-FORMED MEMBERS IS NOT PERMITTED.
   Q. ADDITIONAL TEMPORARY BRACING AND SHORING SHALL BE PROVIDED AS REQUIRED TO STABILIZE THE FRAMING AND TO SUPPORT CONSTRUCTION LOADS. TEMPORARY BRACING SHALL REMAIN IN PLACE UNTIL PERMANENT BRACING IS INSTALLED AND/OR ADDITIONAL CONSTRUCTION LOADS ARE REMOVED.
   R. THESE DRAWINGS ARE INTENDED TO INDICATE THE MEMBER SIZES AND SPACINGS REQUIRED. LIGHT GAGE STEEL SUBCONTRACTOR MAY OFFER SUBSTITUTIONS PROVIDED THAT THE SUBSTITUTIONS CAN SUPPORT THE DESIGN LOADS AND ARE COORDINATED WITH THE PROJECT ARCHITECT AND STRUCTURAL ENGINEER.
   S. SHEATHING ON THE COLD-FORMED FRAMING SHALL BE INSTALLED AS INDICATED IN THE ARCHITECTURAL DRAWINGS.
   T. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH OSHA STANDARDS.

JAMES M. WEEKS NEW MEXICO 11384 REGISTERED PROFESSIONAL ENGINEER
1/15/16

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	01/15/16	U		FCR-028, FCR-158, DCN-32, DCN-310	DAK	SD/DAK	DMA	CR	
2	01-06-14	U		"GENERAL STRUCTURAL NOTES MODIFIED"	SD	DMA	CR		
1	11-06-13	U		"GENERAL STRUCTURAL NOTES MODIFIED"	GF	DMA	CR	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

GENERAL STRUCTURAL NOTES

BLDG 63-0149 TA-63

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	Date 12

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

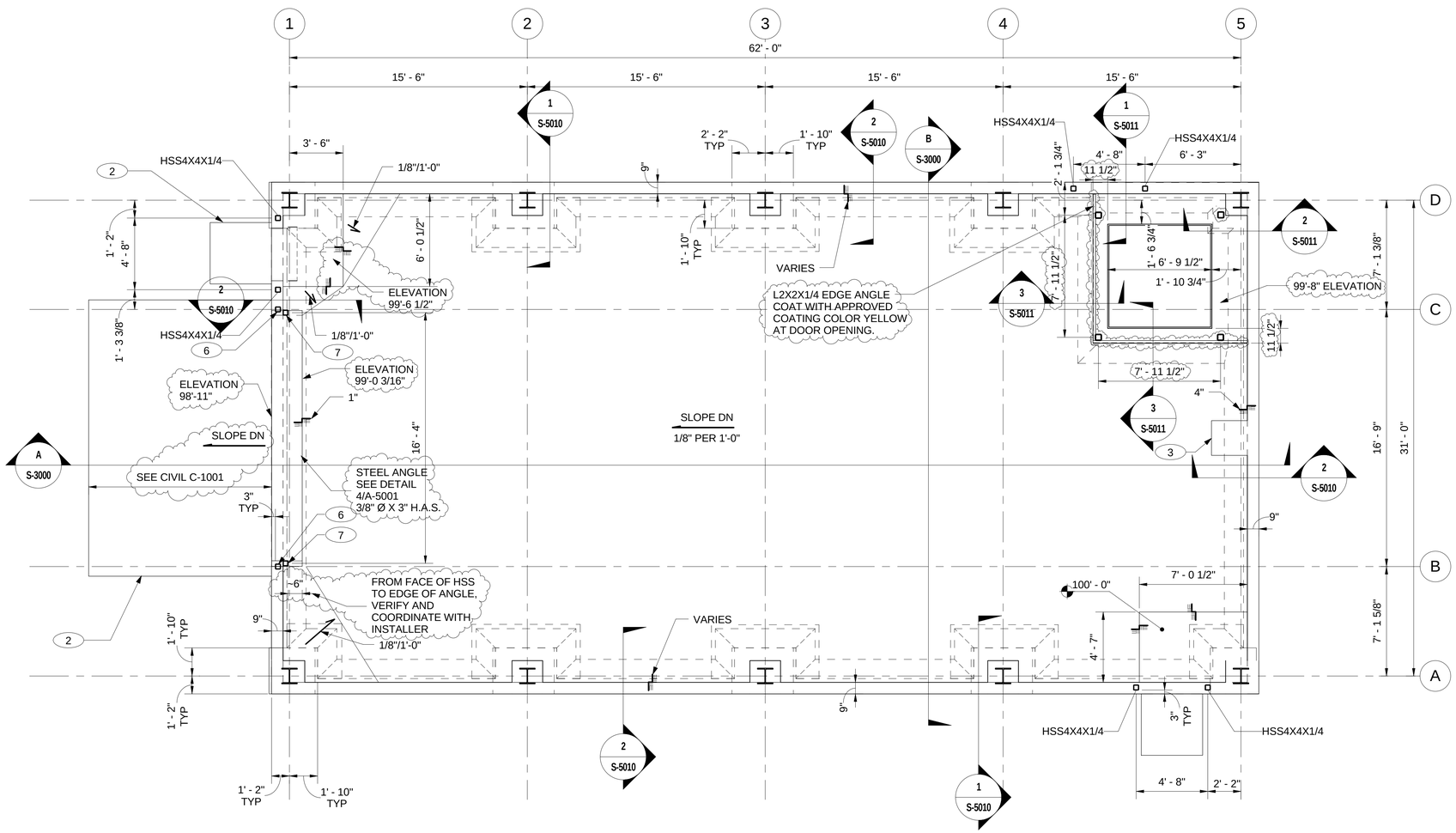
Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET: S-0002
263 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID: 102355
DRAWING NO: C55444
REV: 3

TRU WASTE FACILITY PROJECT 1/14/2016 11:42:01 AM Z:\DOE Projects\LANL\LANL TWF Design\DRAFTING\Models\STORAGE BLDG 149\as-built\Storage Bldg 149-Struct.rvt



FOUNDATION PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES

1. FINISH FLOOR REFERENCE ELEVATION 100'-0" = 7215.83'. SEE PLANS FOR MAT SLAB ELEVATIONS, FOUNDATION PLAN S-1000 AND CIVIL GRADING PLAN C-1005.
2. FLOOR SLOPE = 1/8" PER 1'-0".
3. SEE CIVIL PLANS FOR EXTERIOR SLAB AND PAVING.
4. SEE SOILS REPORT FOR UNDER SLAB AND FOOTING REQUIREMENTS.
5. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
6. THIS DRAWING WAS GENERATED IN REVIT 2014.
7. CONCRETE SLAB, FOOTINGS, AND ALL REINFORCEMENT THEREIN ARE CLASSIFIED AS SAFETY SIGNIFICANT, ML-2.
8. FOR SLAB STEPS, SEE 3/S-5010.

KEYED NOTES

1. 8" CONCRETE MAT SLAB WITH #6@9"O.C. EACH WAY, SEE DETAIL 3/S-5000. SLAB IS PART OF THE LFRS. SAW CUTTING OF SLAB PROHIBITED.
2. CONCRETE STOOPS/RAMPS, SEE CIVIL SITE PLAN C-1001.
3. 6" MIN HOUSEKEEPING PAD PER DETAIL 1/S-5001 AND SCHEDULE ON SHEET S-7000.
4. HSS5X5 FOR FIRE RISER ROOM SUPPORT, SEE DETAIL 4/S-5025.
5. FLOOR SLOPE IS CLASSIFIED AS SAFETY CLASS. MINIMUM FLOOR SLOPE TOWARDS ROLL UP DOOR IS 1%.
6. HSS4X4X1/4 WALL SUPPORT JAMB.
7. HSS4X4X1/4 FIRE DOOR SUPPORT JAMB. VERIFY LOCATION WITH DOOR MANUFACTURER.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	01/15/16	U		FCR-018, FCR-058, FCR-083, DCN-023, DCN-223, DCN-246	DMA	SO	DMA		
2	01-06-14	U		"DETAIL CUT ADDED"	GF	DMA	CR		
1	11-06-13	U		"ADDITION OF AWNING SUPPORT FRAMING"	GF	DMA	CR	BS	

JAMES M. WEEKS NEW MEXICO 11384 REGISTERED PROFESSIONAL ENGINEER
1/15/16

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

FOUNDATION PLAN

BLDG 63-0149 TA- 63

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	Date 12

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

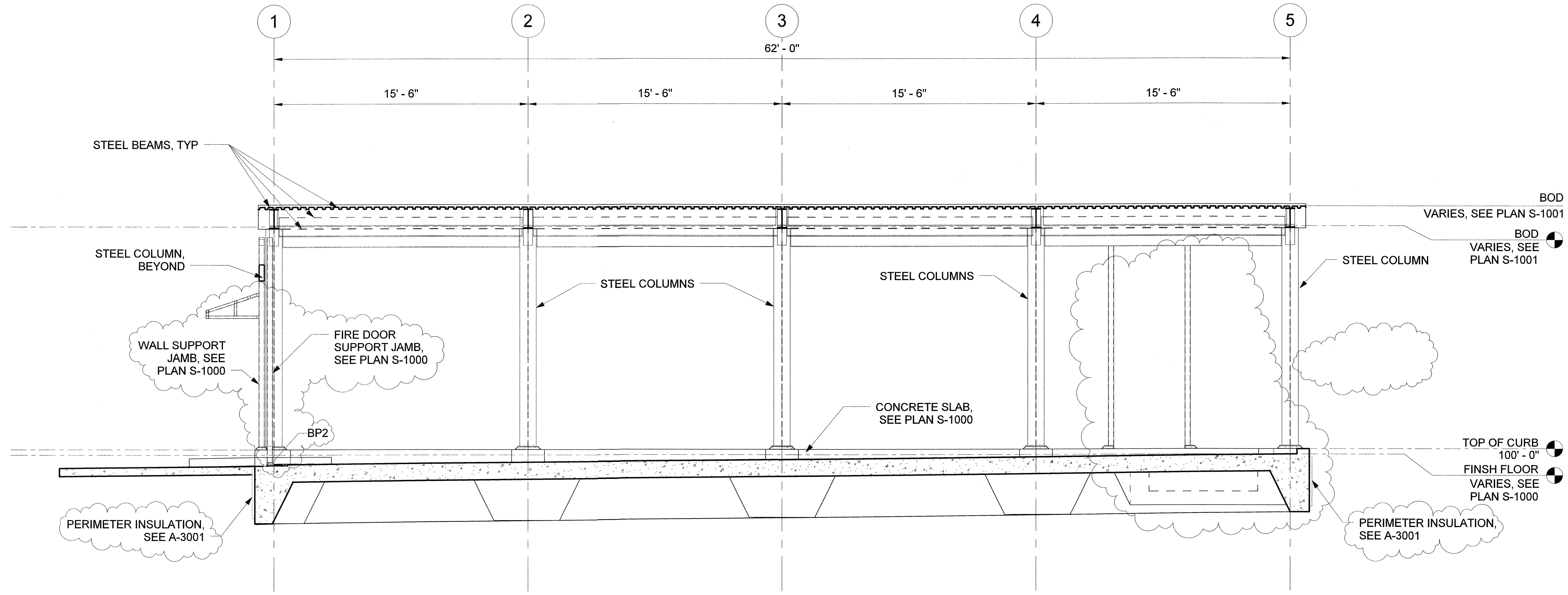
SHEET S-1000
264 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID	DRAWING NO	REV
102355	C55444	3

GENERAL NOTES

1. BASE PLATE SCHEDULE IS LOCATED IN DETAIL 1/S-5000.
2. FINISH FLOOR REFERENCE ELEVATION 100'-0" = 7215.83'. SEE PLANS FOR MAT SLAB ELEVATIONS, FOUNDATION PLAN S-1000 AND CIVIL GRADING PLAN C-1005.
3. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
4. THIS DRAWING WAS GENERATED IN REVIT 2011.

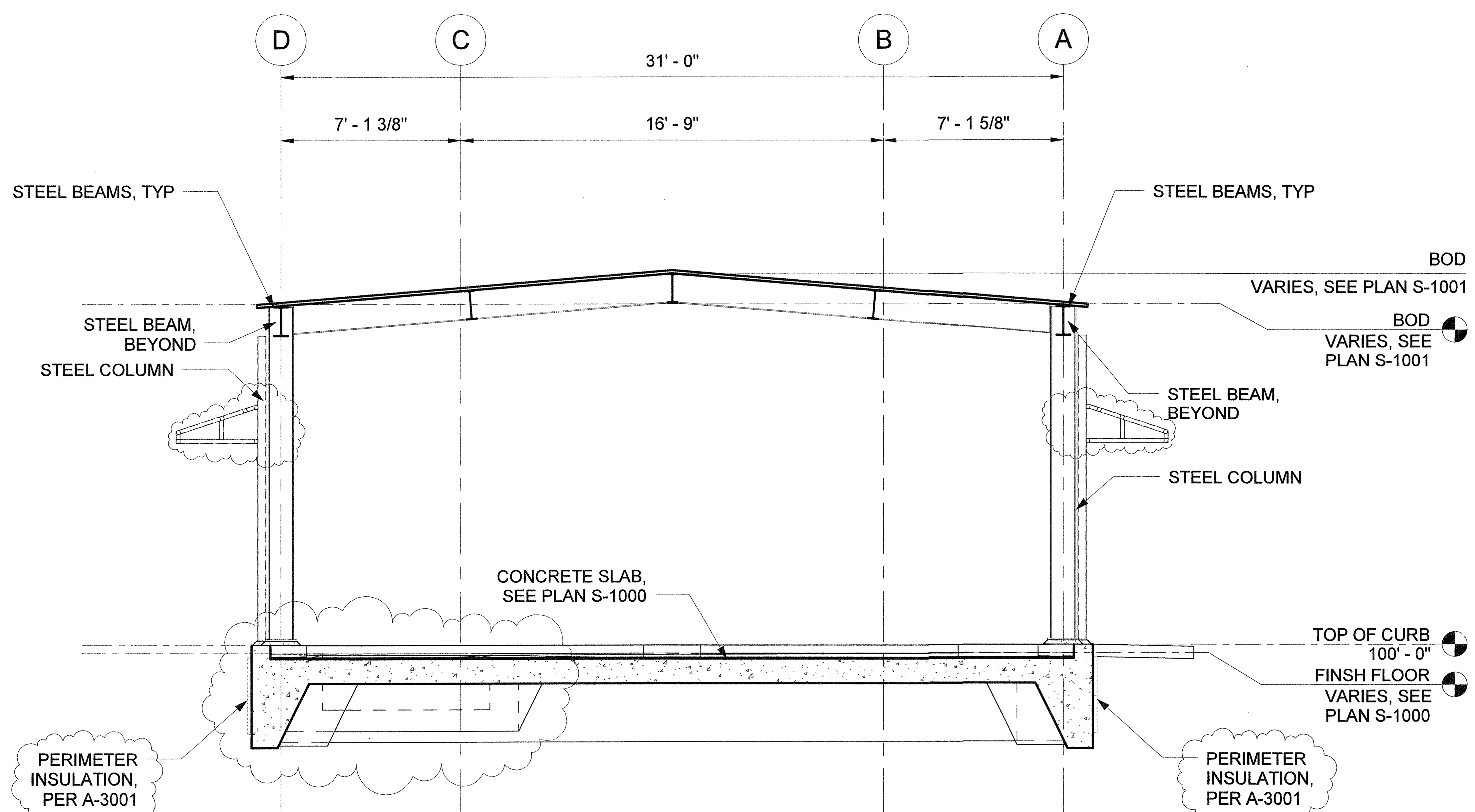


A SECTION

S-1000, S-1001

0 1' 2' 4' 6' 8'

1/4"=1'-0"



B SECTION

S-1000, S-1001

0 1' 2' 4' 6' 8'

1/4"=1'-0"

LANL BUILDING OFFICIAL — APPROVED — 105567 — 12-12-13 — 13-094

JAMES M. WEEKS — NEW MEXICO — 11384 — REGISTERED PROFESSIONAL ENGINEER — 12/31/13

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	11-06-13	U		"ADDITION OF AWNING FRAMING"		DMA			

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

STRUCTURAL SECTIONS

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	11-06-13

BLDG 63-0149 TA-63

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY — PO Box 1663 Los Alamos, New Mexico 87545

SHEET S-3000 — 268 OF 827

CLASSIFICATION U — REVIEWER ED ARTIGLIA — DATE 11-06-13

PROJECT ID 102355 — DRAWING NO C55444 — REV 1

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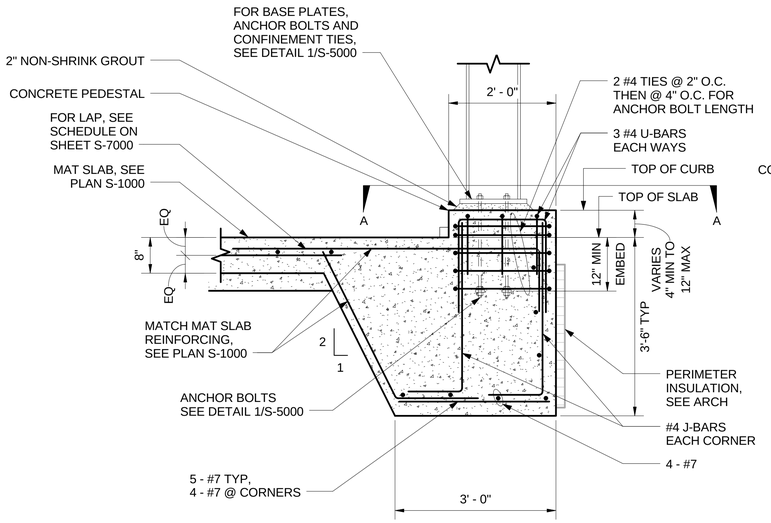
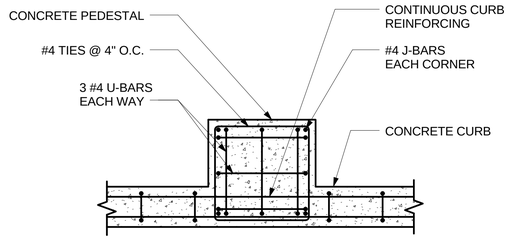




NOTE: SIM @ CORNER CONDITIONS

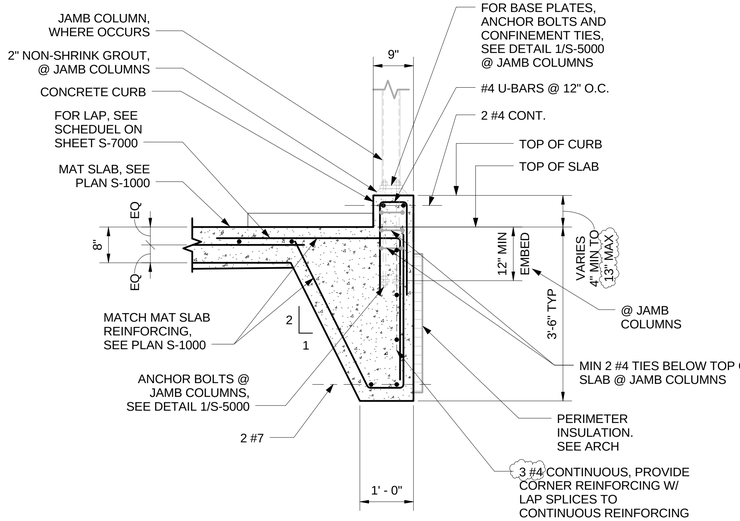
PLAN VIEW A-A

NOTE: FOR EXCAVATION REQUIREMENTS SEE DETAIL 2/S-5000.

1 S-1000

THICKENED COLUMN MAT

1' 6" 0 1' 2'
3/4"=1'-0"

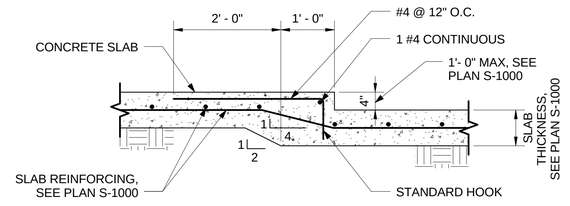


NOTE: FOR EXCAVATION REQUIREMENTS SEE DETAIL 2/S-5000.

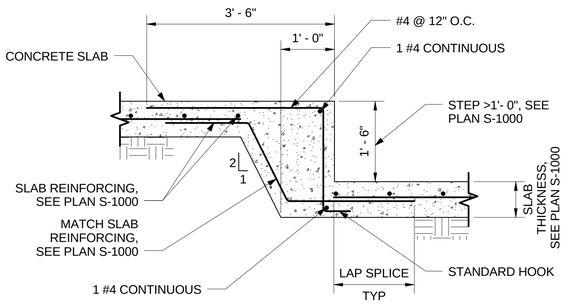
2 S-1000

MAT SLAB TURN DOWN

1' 6" 0 1' 2'
3/4"=1'-0"



1' - 0" MAX



GREATER THAN 1' - 0"

3 S-1000

SLAB STEP

1' 6" 0 1' 2'
3/4"=1'-0"

GENERAL NOTES

1. ABBREVIATIONS AND LEGEND ARE LOCATED ON SHEET S-0001 AND GENERAL STRUCTURAL NOTES ARE LOCATED ON SHEET S-0002.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. THIS DRAWING WAS GENERATED IN REVIT 2014.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	01/15/16	U		FCR-058, DCN-223	DMA	SD DMA	CR		
1	11-06-13	U		"CLASSIFICATION UPDATE"	SD	DMA	CR		

JAMES M. WEEKS NEW MEXICO 11384 REGISTERED PROFESSIONAL ENGINEER
1/15/16

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE BUILDING

FOUNDATION DETAILS

BLDG 63-0149 TA-63

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	Date 11

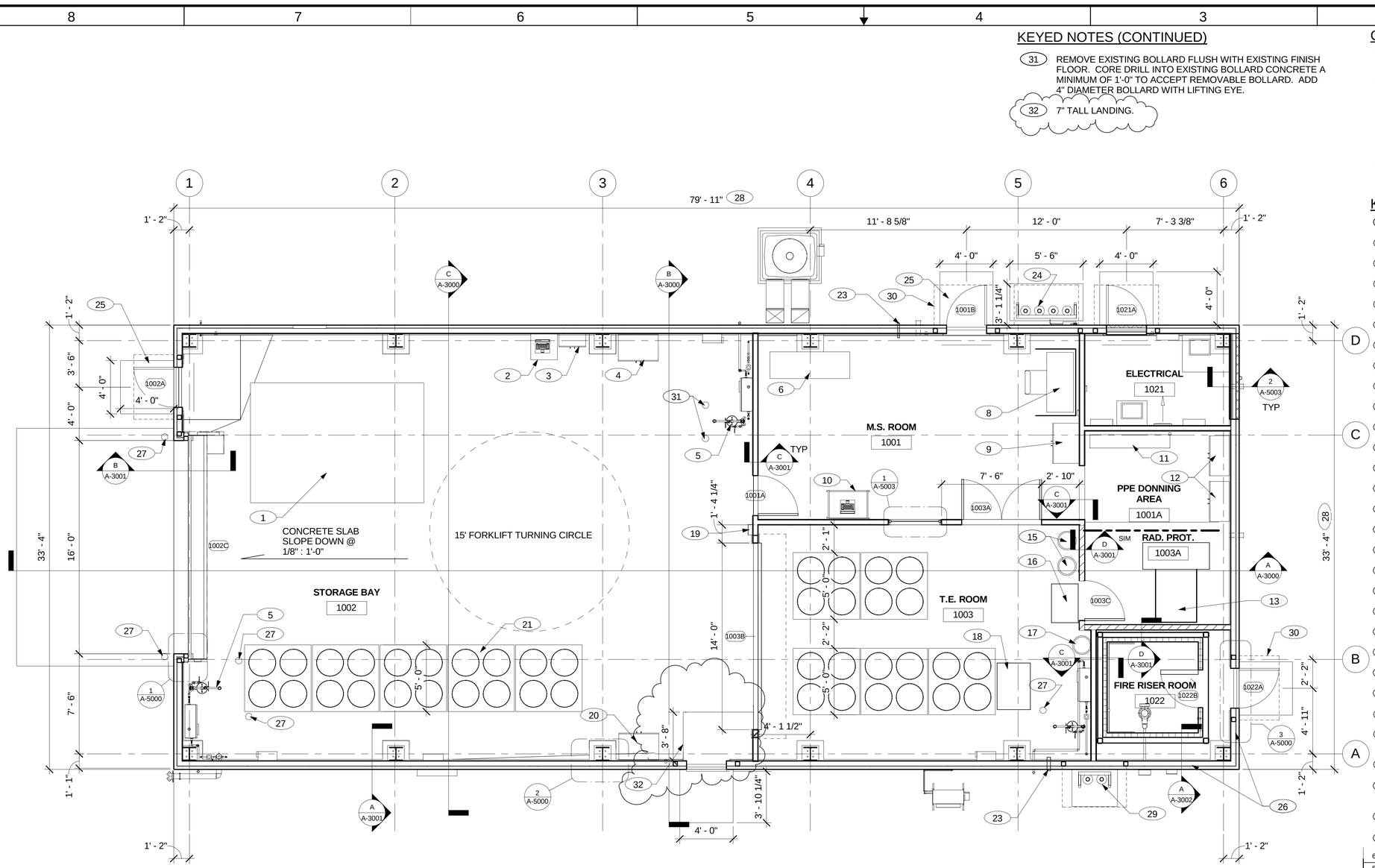
SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663 Los Alamos, New Mexico 87545

SHEET: S-5010
271 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID: 102355
DRAWING NO: C55444
REV: 2



FLOOR PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

KEYED NOTES (CONTINUED)

31 REMOVE EXISTING BOLLARD FLUSH WITH EXISTING FINISH FLOOR. CORE DRILL INTO EXISTING BOLLARD CONCRETE A MINIMUM OF 1'-0" TO ACCEPT REMOVABLE BOLLARD. ADD 4" DIAMETER BOLLARD WITH LIFTING EYE.

32 7" TALL LANDING.

GENERAL NOTES

1. IF THIS SHEET IS NOT 24" x 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. AT THE ELECTRICAL AND MECHANICAL ROOMS, ADD DOOR PLACARDS - LAMINATED PHENOLIC PLASTIC 3/16" THICK x 2" x 6" BEIGE WITH BLACK 1" HIGH LETTERING ENGRAVED HELVETICA BOLD LABELED "ELECTRICAL" AND "MECHANICAL" CENTERED 60" ABOVE THE FLOOR ON THE EXTERIOR SIDE OF THE DOOR WITH ADHESIVE.
4. 36" HIGH ABOVE FINISH FLOOR STAINLESS STEEL CORNER GUARDS AT OUTSIDE CORNERS, TYPICAL.
5. SEE STRUCTURAL FOR COLUMN LINE DIMENSIONS.

KEYED NOTES

1 LARGE CONTAINER AREA
2 COMPUTER WORKSTATION, SEE DETAIL 4/A-5002
3 SPILL KIT, GFE
4 SUPPLY CABINET, GFE
5 EYE WASH AND SHOWER STATION
6 MASS SPECTROMETER (NIC)
7 NOT USED
8 RP-1 COUNTING (NIC)
9 RP-1 STORAGE
10 COMPUTER CART (NIC)
11 BENCH, GFE
12 PPE STORAGE, GFE
13 PCM, GFE
14 FIRE RISER
15 LAUNDRY BIN (NIC)
16 STEP-OFF PAD, GFE
17 WASTE BIN (NIC)
18 HEPA FILTER CART (NIC)
19 FIRE EXTINGUISHER
20 DECONTAMINATION EQUIPMENT CABINET (NIC)
21 STORAGE CONTAINERS & PALLETS (NIC)
22 NOT USED
23 VENT TUBE, SEE SHEET M-1000
24 P-10 GAS BOTTLE RACK LOCATION, SEE DETAIL 3/P-5000
25 CONCRETE STOOP, TYPICAL - SEE SHEET C55443 C-5004.
26 ONE HOUR RATED WALL 10 FEET EITHER SIDE OF WALL MOUNTED POST INDICATOR VALVE
27 PERMANENT BOLLARD, SEE DETAIL 7/A-5002
28 BUILDING DIMENSIONS ARE SAFETY CLASS, ML-1. MAXIMUM LENGTH IS 80.4 FEET. MAXIMUM WIDTH IS 33.8 FEET
29 FIRE SUPRESSION SYSTEM GAS BOTTLE RACK
30 EDGE OF AWNING ABOVE, TYPICAL

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
6	09-15-16	U		FCR-419/DCN-553			SVW	MT	
5	06-01-16	U		FCR-329/DCN-470 R1	AG	SC	SVW	BS	
4	02-23-16	U	EA	FCR-329/DCN-470	AG	SC	SVW	BS	
3	01-15-16	U	EA	FCR-067/DCN-222	AG	SC	SVW	BS	MP
2	05/14/14	U	EA	102355-DRN-C55445-00001 REVISE NOTES	AG	RK	RK	BS	EA
1	11-06-13	U	EA	REVISED FLOOR PLAN	AG	RK	RK	BS	EA

STATE OF NEW MEXICO
STEPHEN G. VAN WINKLE
2273
9-15-2016
REGISTERED ARCHITECT

This stamp is limited to Drawing 55445, Sheet A-1050, Revision 6.

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE AND CHARACTERIZATION BUILDING

FLOOR PLAN

BLDG 63-0154 TA- 63

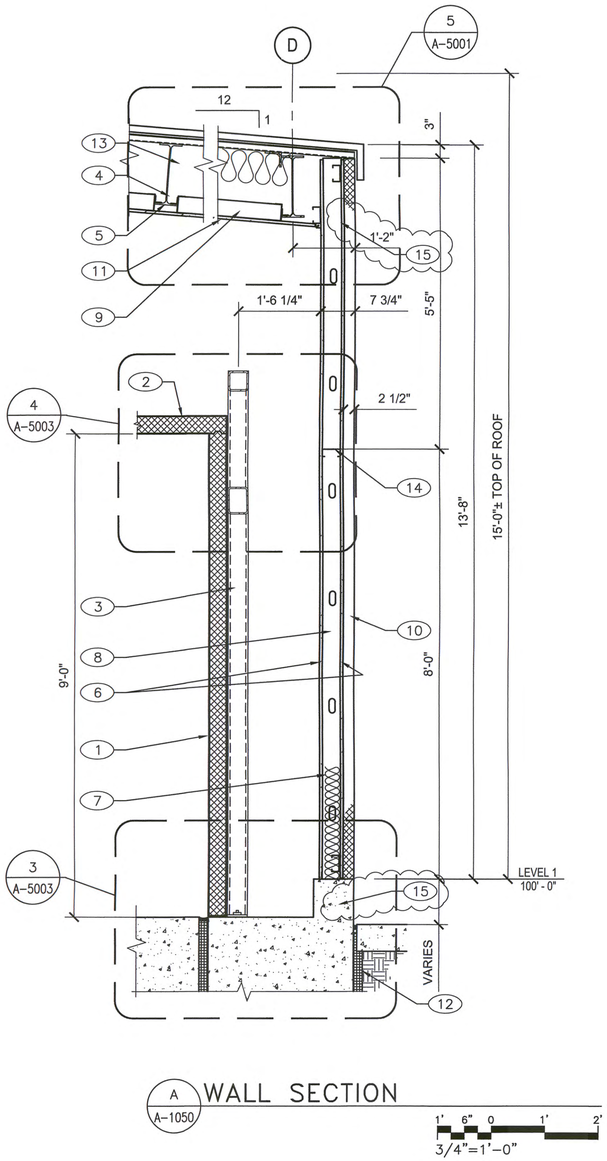
DRAWN	A. GALLEGOS
DESIGN	D.WALLERSTEDT
CHECKED	T. LEACH
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET A-1050
662 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13
PROJECT ID 102355
DRAWING NO C55445
REV 6



A A–1050 WALL SECTION

1' 6" 0 1' 2'

3/4"=1'–0"

GENERAL NOTES

1. IF THIS SHEET IS NOT 24X36, THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY

KEYED NOTES

1. 4" THICK INSULATED METAL CLAD INTERIOR WALL PANELS
2. 4" THICK INSULATED METAL CLAD INTERIOR CEILING PANELS
3. SEISMICALLY RATED STRUCTURAL FRAME
4. 1 1/2" X 3 5/8" 20 GA TRACK
5. 1 1/2 X 1 1/2" CLIP
6. 5/8" TYPE "X" GYP BOARD - 1 LAYER ON EACH SIDE OF METAL STUD WALL
7. BATT INSULATION - R13
8. 1 5/8" X 4" 16 GA METAL STUDS @ 16" O.C. AND AT EACH METAL PANEL VERTICAL JOINT
9. 3 5/8" 25 GA METAL STUDS @ 16" O.C.
10. 2 1/2" X 36" INSULATED CORE METAL WALL PANELS SECURE TO STRUCTURE PER MANUFACTURER INSTRUCTIONS.
11. 5/8" TYPE "X" GYP BOARD
12. 2" PERIMETER INSULATION - R7
13. W14 X 30 BEYOND
14. HORIZONTAL BLOCKING FOR METAL PANEL ATTACHMENT. LOCATE AT 108' HEIGHT
15. METAL STUD BLOCKING FOR ATTACHMENT OF KINGSPAN PANELS AS NEEDED AT TOP AND BOTTOM OF WALL

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
4	01–15–16	U		FCR–187/DCN–343	AG		SVW	AG	
3	05–14–14	U	EA	102355–DRN–C55445–00001 ADDED KEYED NOTE #14	AG	MT	RK	BS	MP
2	01–06–14	U	EA	DRN 14.63.0144.0041 UPDATED DETAIL CALLOUTS	AG	RK	RK	BS	EA
1	11–06–13	U		REVISED SECTIONS & NOTES	AG	RK	RK	BS	

WEIDLINGER-ASSOCIATES JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE AND CHARACTERIZATION BUILDING

WALL SECTION

BLDG 63–0154 TA–63

DRAWN	A. GALLEGOS
DESIGN	R. KASELOW
CHECKED	T.LEACH
DATE	11–06–13

SUBMITTED
BRIAN SULLIVAN

APPROVED FOR RELEASE
ED ARTIGLIA

STATE OF NEW MEXICO
STEPHEN G. VAN WINKLE
2273
1-20-2016
REGISTERED ARCHITECT

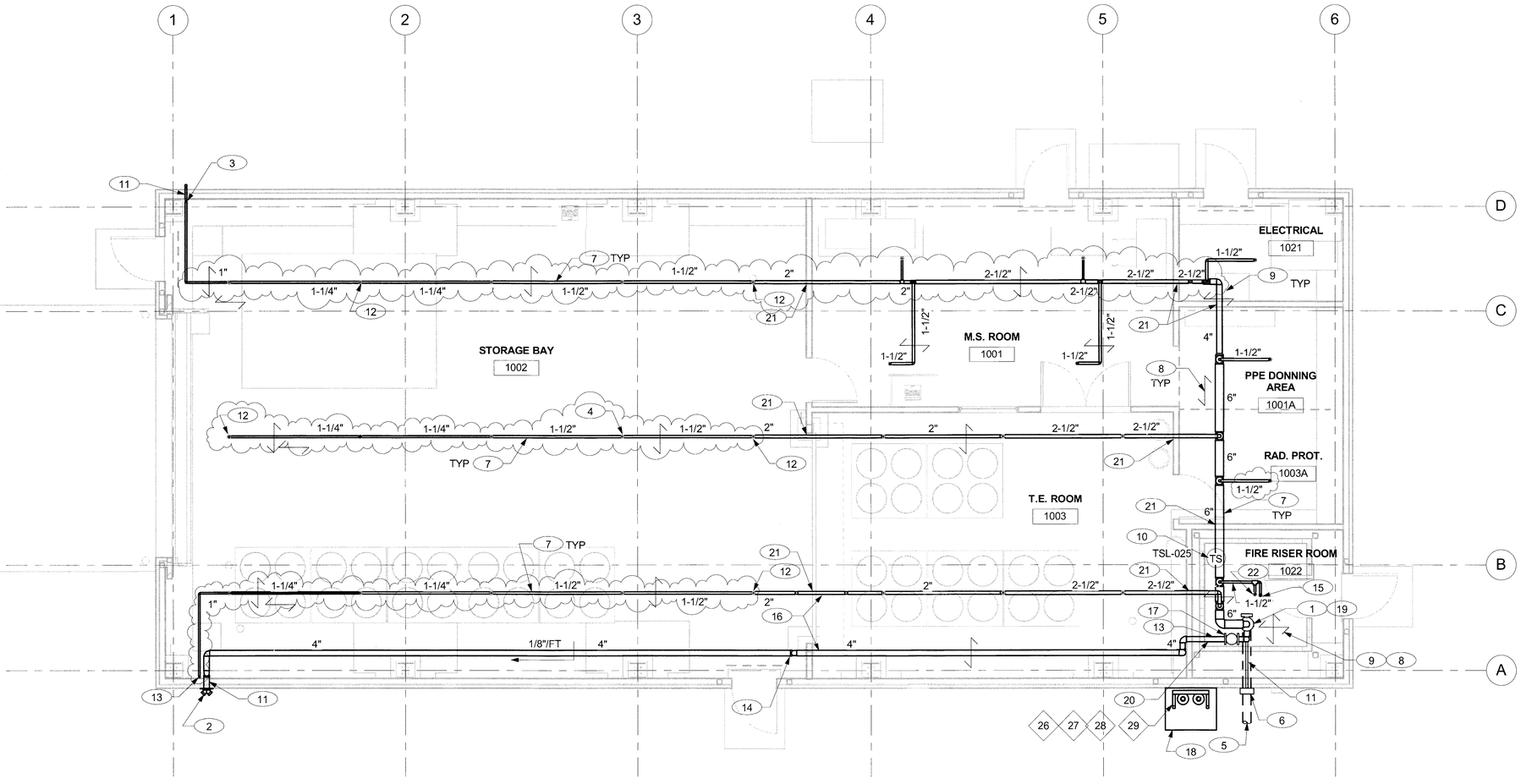
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET A–3002

668 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11–06–13

PROJECT ID 102355 | DRAWING NO C55445 | REV 4



FIRE PROTECTION PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"x36", IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEETS F-0001 AND F-0002 FOR ABBREVIATIONS, GENERAL NOTES, LEGEND AND STRUCTURAL BRACING.
4. FOR SEISMIC BRACING SEE DETAILS 2 AND 3 ON SHEET F-5000.
5. SEE CALCULATION 11-001-FCAL-001 FOR HYDRAULIC CALCULATIONS.
6. SEE DETAIL 3 ON SHEET F-5001 FOR FLOOR PENETRATION DETAIL.
7. THE SPRINKLER LAYOUT SHOWS DESIGN INTENT. THE FIRE PROTECTION SUBCONTRACTOR IS RESPONSIBLE TO PROVIDE SHOP DRAWINGS AND SUPPORTING CALCULATIONS.
8. PITCH PIPE TO DRAIN TO RISER PER NFPA 13, UNLESS NOTED OTHERWISE.

KEYED NOTES:

1. 6" FIRE PROTECTION RISER WITH DRY PIPE VALVE, SEE DETAIL 1 ON SHEET F-5000.
2. FIRE DEPARTMENT CONNECTION.
3. INSPECTOR'S TEST STATION, SEE WALL PENETRATION DETAIL 5 ON SHEET F-5000.
4. UPRIGHT SPRINKLER HEAD (165° F), TYPICAL, UNLESS NOTED OTHERWISE.
5. SEE SHEET C-1007 FOR CONTINUATION.
6. WALL MOUNTED POST INDICATOR VALVE, SEE WALL PENTRATION DETAIL 5 ON SHEET F-5000.
7. FIRE PROTECTION COMPONENTS ARE CLASSIFIED AS SAFETY SIGNIFICANT, ML-2.
8. SEE DETAIL 2 ON SHEET F-5000.
9. SEE DETAIL 3 ON SHEET F-5000.
10. SAFETY SIGNIFICANT TEMPERATURE SENSOR.
11. SEE DETAIL 5 ON SHEET F-5000 FOR PIPE PENETRATION.
12. INSTALL HIGH TEMPERATURE RATED (286° F) SPRINKLER HEAD NEAR UNIT HEATER.
13. PROVIDE DRY SYSTEM AUXILIARY DRAIN. DRAIN SHALL CONSIST OF A VALVE NOT SMALLER THAN 1/2" AND A PLUG OR A NIPPLE AND CAP.
14. PIPE AT 10'-6" AFF AT THIS LOCATION.
15. PENDANT SPRINKLER (165° F).
16. ROUTE PIPE OVER DOOR AND FRAMING.
17. 4" CHECK VALVE.
18. 2 BOTTLE N2 RACK, SEE DETAIL 7 ON F-5000.
19. SEE DETAIL 1 ON SHEET F-5001 FOR ENCLOSURE CEILING PENETRATION.
20. SEE DETAIL 3 ON SHEET F-5001 FOR ENCLOSURE WALL PENETRATION.
21. SIMILAR TO DETAIL 5 ON SHEET F-5000, PIPE PENETRATION DETAIL.
22. UPRIGHT SPRINKLER HEAD LOCATED ABOVE FIRE RISER ROOM.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	03-07-14	U		DRN-14-63-0154-0050 REVISED FIRE PROTECTION SYSTEM	DB	CM	CM	BS	
1	11-06-13	U		REVISED FIRE PROTECTION SYSTEM	DB	CM	CM	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE & CHARACTERIZATION BUILDING

FIRE PROTECTION PLAN

BLDG 63-0154 TA-63

DRAWN	D. BROERMAN
DESIGN	E. MIYODA
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN

APPROVED FOR RELEASE: ED ARTIGLIA

LANL BUILDING OFFICIAL
SIG
ID# 119113
DATE 5-29-14
ADM# 13-094 R2
APPROVED
REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISD 341-2 CH-16

CHARLES MOYERS NEW MEXICO 16030 LICENSED PROFESSIONAL ENGINEER
03-07-14

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F-1000

676 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

PROJECT ID 102355 | DRAWING NO C55445 | REV 2

TRU WASTE FACILITY PROJECT 3/7/2014 10:46:48 AM P:_TECHNOLOGY\LANL\102355 - TRU Waste Facility\500 CAD\STORAGE BLDG - TE ROOM\M-P-FIRE\REVIT\Storage Building 2 - Mech.rvt

GENERAL NOTES

1 IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

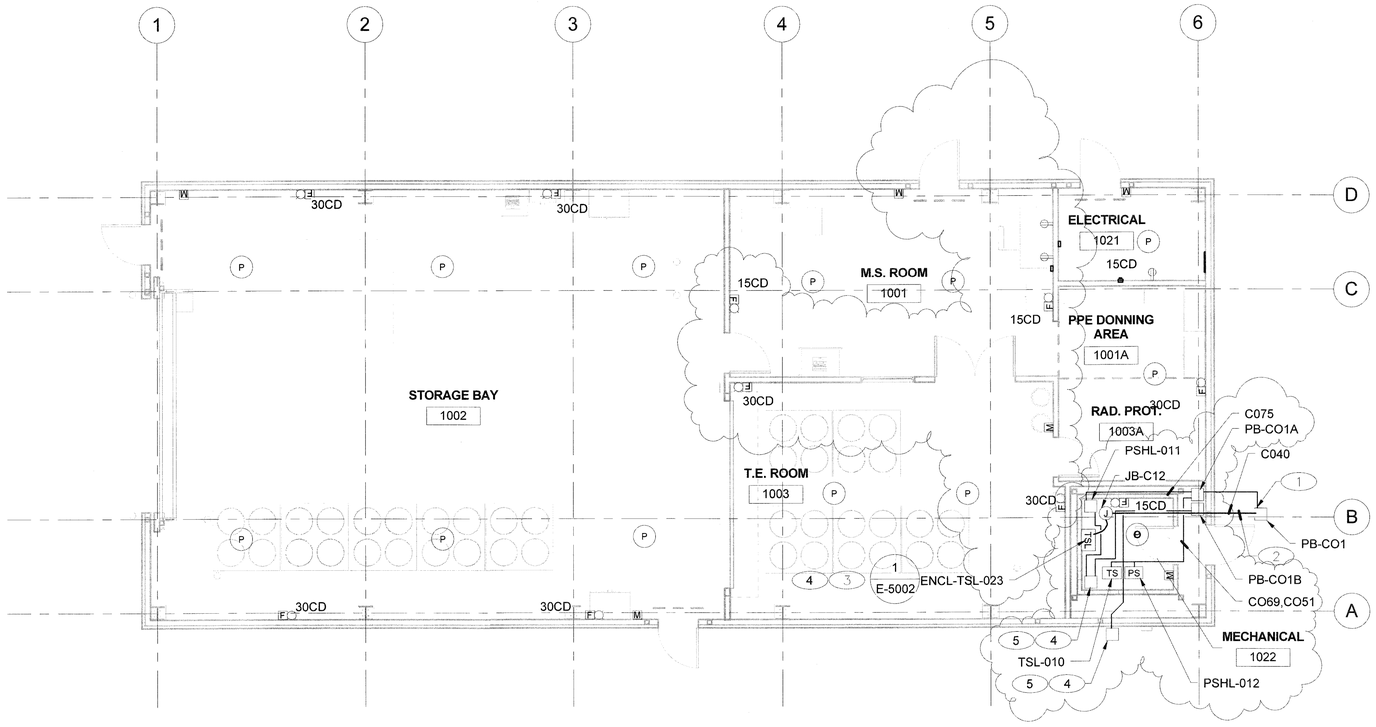
2 THIS DRAWING WAS GENERATED IN REVIT 2011.

3 ALL INITIATING DEVICES AND NOTIFICATION APPLIANCES IN THIS BUILDING SHALL BE SUPPORTED BY THE SUB-FACP LOCATED IN BUILDING 63-0152.

4 COORDINATE ENCLOSURE LOCATION FOR FIRE SYSTEM INSTRUMENTS WITH RTU TEMPERATURE MONITORING SYSTEM. SEE DRAWING C55443 SHEET E-4005.

KEYED NOTES

1. SEE DRAWING C55443 E-1012 FOR LOCATION OF PULL BOX.
2. TRANSITION ABOVE GROUND CONDUIT INSIDE BUILDING FROM 3/4" EMT TO 1-1/2" SCHEDULE 80 PVC UNDERGROUND CONDUIT BY WAY OF RMC 90 DEGREE SWEEP.
3. ENCLOSURE DETAILS ARE SHOWN ON DRAWING C55445 SHEET E-5002.1
4. TSL-023, TS, PS-007, AND PIV-007 WIRE TO SAP. INSTALL ONE TSP FOR EACH SIGNAL ROUTED THROUGH PD-CO1B
5. WIRE IN 3/4" CONDUIT



FIRE DETECTION & ALARM PLAN

0 1' 2' 4' 6' 8'
3/16"=1'-0"

LANL BUILDING OFFICIAL
SIG
ID 119113
DATE 5-29-14
ALT # 13-09482
APPROVED
REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISD 341-2, CH 16

CHARLES MOYERS
NEW MEXICO
16030
LICENSED PROFESSIONAL ENGINEER
03-20-14

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
2	03-20-14	U		DRN-14-63-0154-0050 RECONFIGURE PANEL	BB	RK	BS	BS	EA
1	11-06-13	U		REVISED FOR FIRE RISER CLOSET	BB	RK	BS	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE/CHARACTERIZATION BUILDING

FIRE DETECTION & ALARM PLAN

BLDG 63-0154 TA-63

DRAWN	B.BACKER
DESIGN	R.KRAYER
CHECKED	C.MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET F-1001
677 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55445
REV 2

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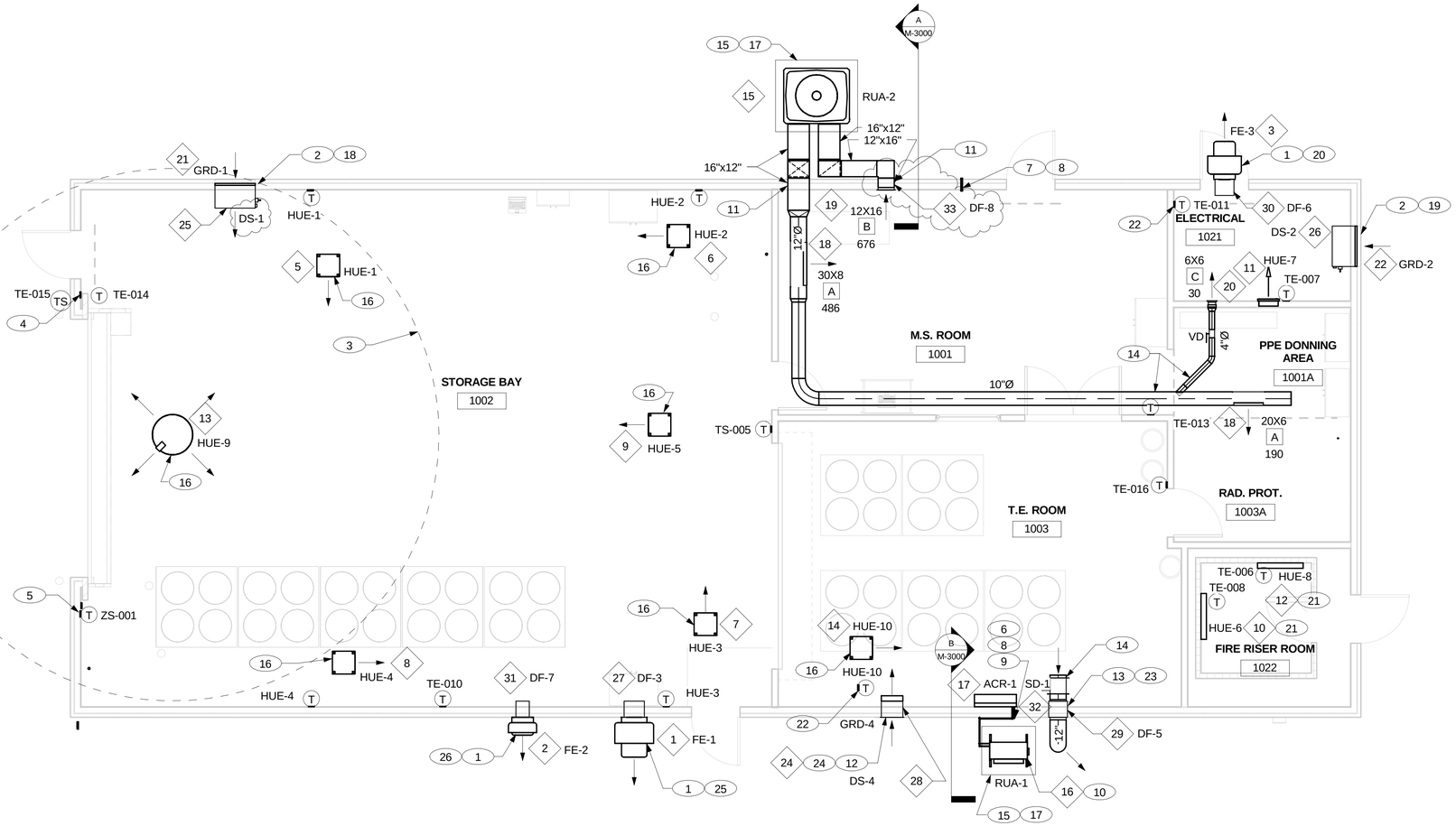


HVAC PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEET M-0001 FOR ABBREVIATIONS, GENERAL NOTES AND LEGEND.
4. SEE SHEET M-6000 FOR HVAC FLOW DIAGRAM.
5. SEE SHEETS M-7000 AND M-7001 FOR MECHANICAL EQUIPMENT SCHEDULES.

KEYED NOTES:

1. SEE DETAIL 1, SHEET M-5000.
2. SEE DETAIL 2 ON SHEET M-5000.
3. DASHED CIRCLE INDICATES AIR PATTERN LIMIT FOR HUE-9.
4. MOUNT TEMPERATURE SENSOR 12" FROM EDGE OF DOOR OPENING AT 48" ABOVE FINISHED FLOOR.
5. DOOR CLOSURE SIGNAL SWITCH ZS-001.
6. 1/2" SUCTION, 1/4" LIQUID, 1/2" CONDENSATE DRAIN.
7. 1" STAINLESS STEEL EXHAUST PIPE FOR MASS SPECTROMETER, LOCATED AT 8'-0" AFF.
8. SEE DETAIL 1 ON SHEET M-5001 FOR PIPE THRU WALL PENETRATION.
9. ROUTE DRAIN THROUGH WALL TO 6" ABOVE GRADE.
10. SEE DETAIL 3 ON SHEET M-5000 FOR SPLIT SYSTEM UNIT DETAIL.
11. SEE DETAIL 2 ON SHEET M-5001 FOR DUCT THRU WALL PENETRATION.
12. SEE DETAIL 3, SHEET M-5002 FOR DUCT DETAIL.
13. SEE DETAIL 2, SHEET M-5002 FOR HEPA EXHAUST DUCT PENETRATION.
14. SEE DETAIL 4, SHEET M-5000 FOR DUCT HANGER DETAIL.
15. CONCRETE PAD, REFER TO SHEET C55445-S-7000.
16. MOUNT BOTTOM OF UNIT HEATERS, HUE-1 THRU HUE-5, HUE-9, AND HUE-10 AT 10'-10" AFF.
17. CONCRETE PAD SHALL EXTEND 6" ON ALL SIDES OF UNIT, COORDINATE SIZE OF PAD WITH GENERAL CONTRACTOR.
18. MOUNT BOTTOM OF LOUVER AT 8'-2" AFF.
19. MOUNT BOTTOM OF LOUVER AT 8'-2" AFF.
20. MOUNT FE-3 AT 10'-6" AFF TO BOTTOM OF DUCT.
21. MOUNT BOTTOM OF HEATER 8'-6" AFF.
22. MOUNT THERMOSTAT AT 48" AFF, TYPICAL.
23. MOUNT BOTTOM OF DUCT AT 6'-8" AFF.
24. MOUNT BOTTOM OF LOUVER AT 9'-2" AFF.
25. MOUNT FE-1 AT 8'-2" AFF TO BOTTOM OF DUCT.
26. MOUNT FE-2 AT 8'-11" AFF TO BOTTOM OF DUCT.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
5	09-14-16	U		FCR-448/DCN-579		RB		MT	
4	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	JMC	BS	
3	06-03-16	U		FCR-315/DCN-471	DB	RB	JMC	BS	
2	01-15-16	U	EA	FCR-233/DCN-386	DB	RB	JMC	BS	EA
1	11-06-13	U	EA	ADDED FIRE RISER ROOM	DB	CM	CM	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE & CHARACTERIZATION BUILDING

HVAC PLAN

BLDG 63-0154 TA- 63

DRAWN	D. BROERMAN
DESIGN	E. MIYODA
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

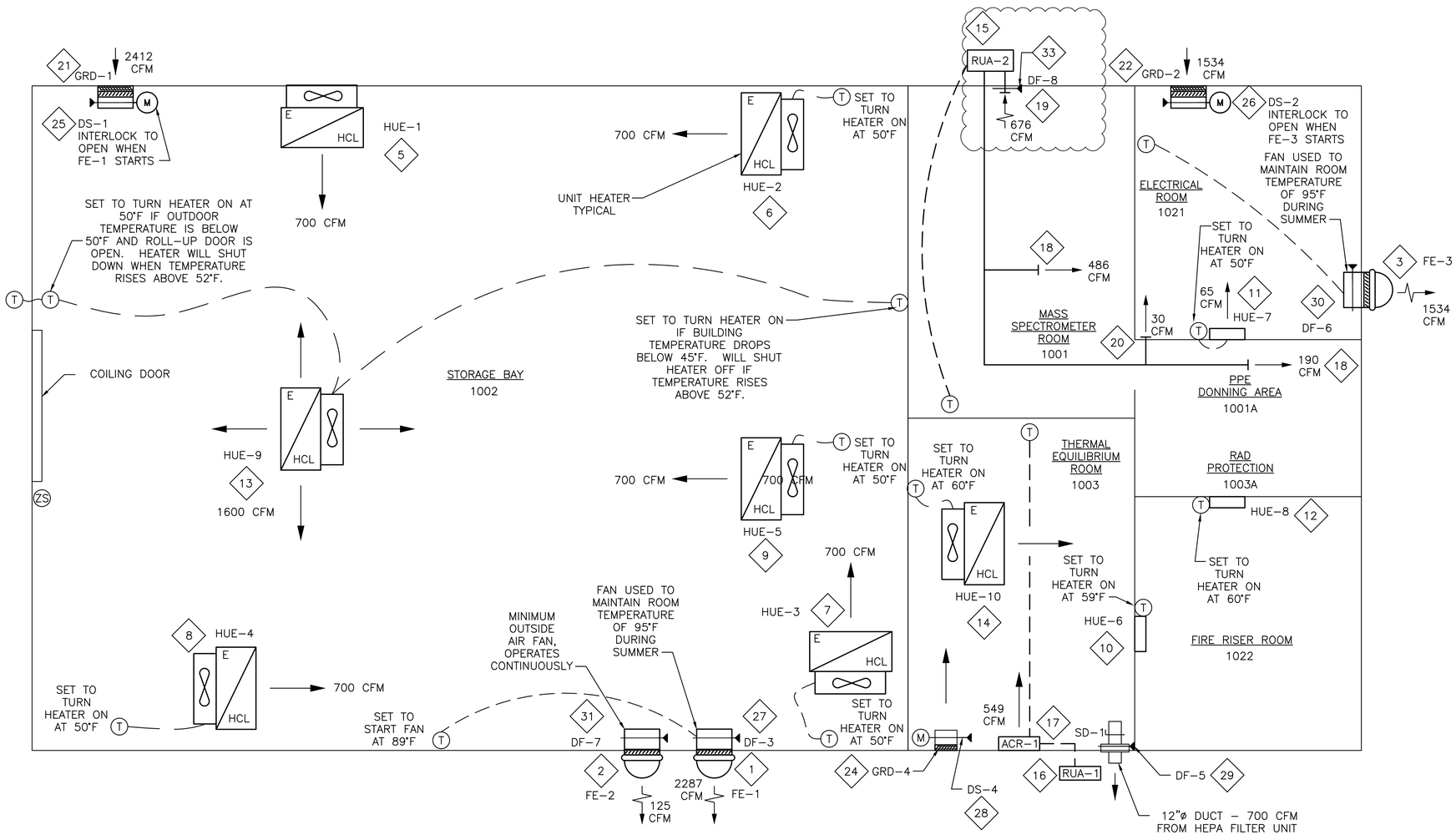
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET M-1000
695 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13
PROJECT ID 102355
DRAWING NO C55445
REV 5

RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER 9/14/16

TRU WASTE FACILITY PROJECT 9/14/2016 3:04:59 PM P:_TECHNOLOGY\LAN\L102355 - TRU Waste Facility\500 CAD\STORAGE BLDG -TE ROOM\M-P-FIRE\REVIT\Storage Building 2 - Mech.rvt



1 M-6000 HVAC FLOW DIAGRAM
SCALE: NONE

"PRIORITY DRAWING"

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
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3	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	JMC	BS	
2	06-06-16	U		FCR-315/DCN-471	DB	RB	JMC	BS	
1	11-06-13	U	EA	REVISED EQUIPMENT	DB	CM	CM	BS	EA

WEIDLINGER-ASSOCIATES JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE AND CHARACTERIZATION BUILDING

HVAC FLOW DIAGRAM

BLDG 63-0154 TA-63

DRAWN	D. BROERMAN
DESIGN	P. McMAHON
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

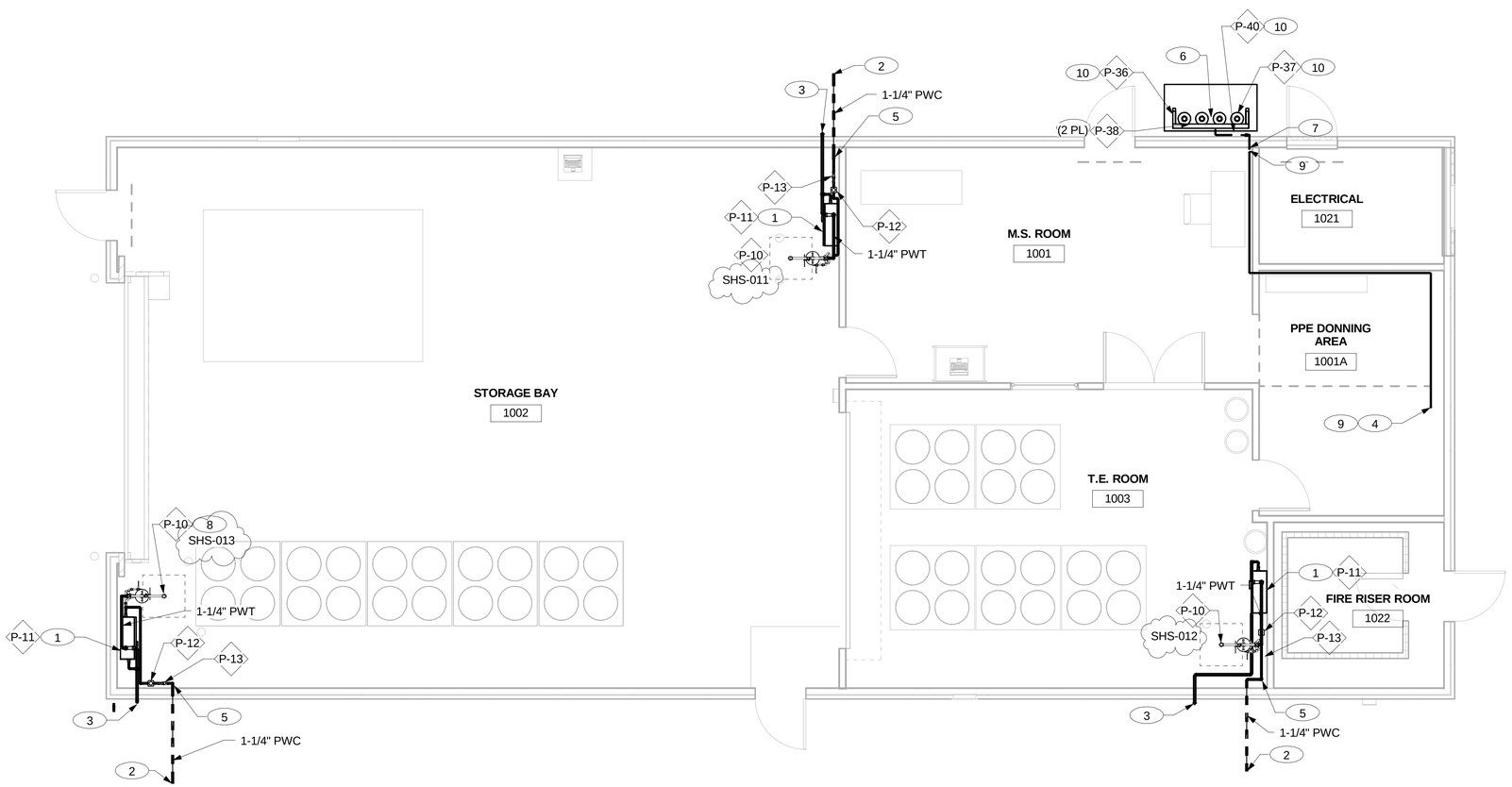
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET M-6000
700 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55445
REV 4

RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER
9/14/16



PLUMBING PLAN

1/4"=1'-0"

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"x36", IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
2. THIS DRAWING WAS GENERATED IN REVIT 2011.
3. SEE SHEET P-0001 FOR SYMBOLS, GENERAL NOTES AND LEGEND.
4. SEE SHEET P-7000 FOR EQUIPMENT SCHEDULE.

KEYED NOTES:

1. SEE DETAIL 1, SHEET P-5000 FOR WATER HEATER, CONNECTIONS, AND FLOOR PAINTING INSTRUCTIONS.
2. SEE SHEET C55443-C-1006 FOR CONTINUATION.
3. 1" DRAIN FROM WATER HEATER RELIEF VALVE TO OUTSIDE. SEE DETAIL 2 ON SHEET P-5001 FOR PIPE THRU WALL PENETRATION.
4. ROUTE P-10 GAS PIPING TO RAD. PROT. AREA. SEE DETAIL 2 ON SHEET P-5000 FOR GAS MANIFOLD. FUTURE.
5. SEE DETAIL 1 ON SHEET P-5001 FOR PIPE THRU FLOOR PENETRATION.
6. SEE DETAIL 3 ON SHEET P-5000 FOR P-10 GAS CYLINDER RACK DETAIL. FUTURE.
7. P-10 PIPE THRU WALL. SEE DETAIL 2 ON SHEET P-5001 FOR PIPE THRU WALL PENETRATION. FUTURE.
8. CENTERLINE OF EMERGENCY SHOWER TO BE 5'-0" FROM EAST WALL. DASHED LINES DENOTE FREE SPACE REQUIRED FOR SHOWER.
9. CAP ABOVE CEILING.
10. FUTURE.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	08-31-16	U		INCORPORATE AS-BUILTS	DB	RB	BS	BS	
2	04-08-16	U		FCR-362/DCN-501	DB	RB	BS	BS	
1	11-06-13	U	EA	MOVED EQUIPMENT	DB	CM	CM	BS	EA

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE & CHARACTERIZATION BUILDING

PLUMBING PLAN

BLDG 63-0154 TA- 63

DRAWN	D. BROERMAN
DESIGN	D. BROERMAN
CHECKED	C. MOYERS
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

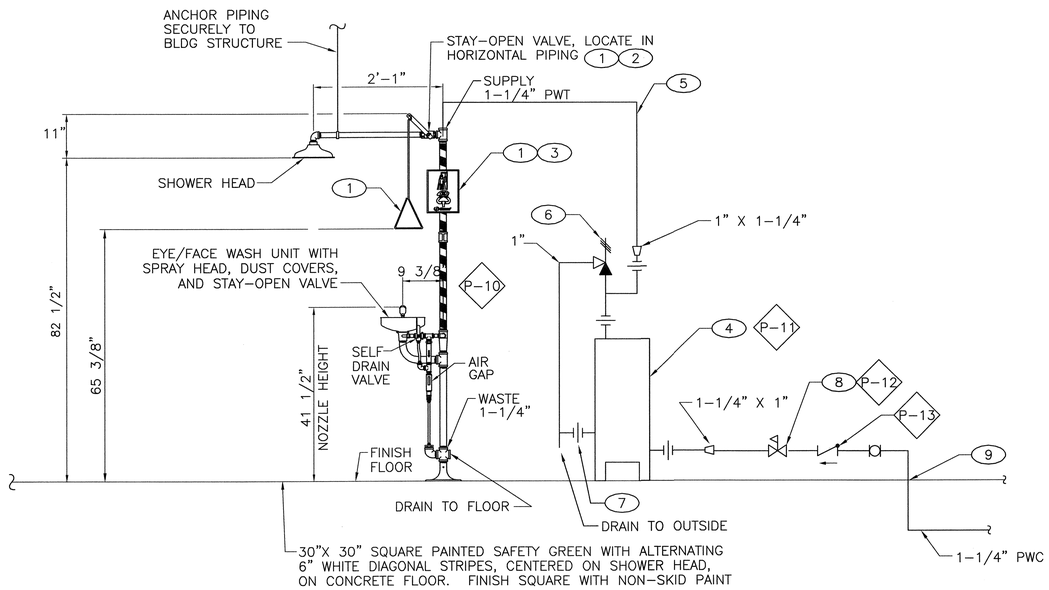
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET P-1000
686 OF 827

CLASSIFICATION U | REVIEWER ED ARTIGLIA | DATE 11-06-13

PROJECT ID 102355 | DRAWING NO C55445 | REV 3

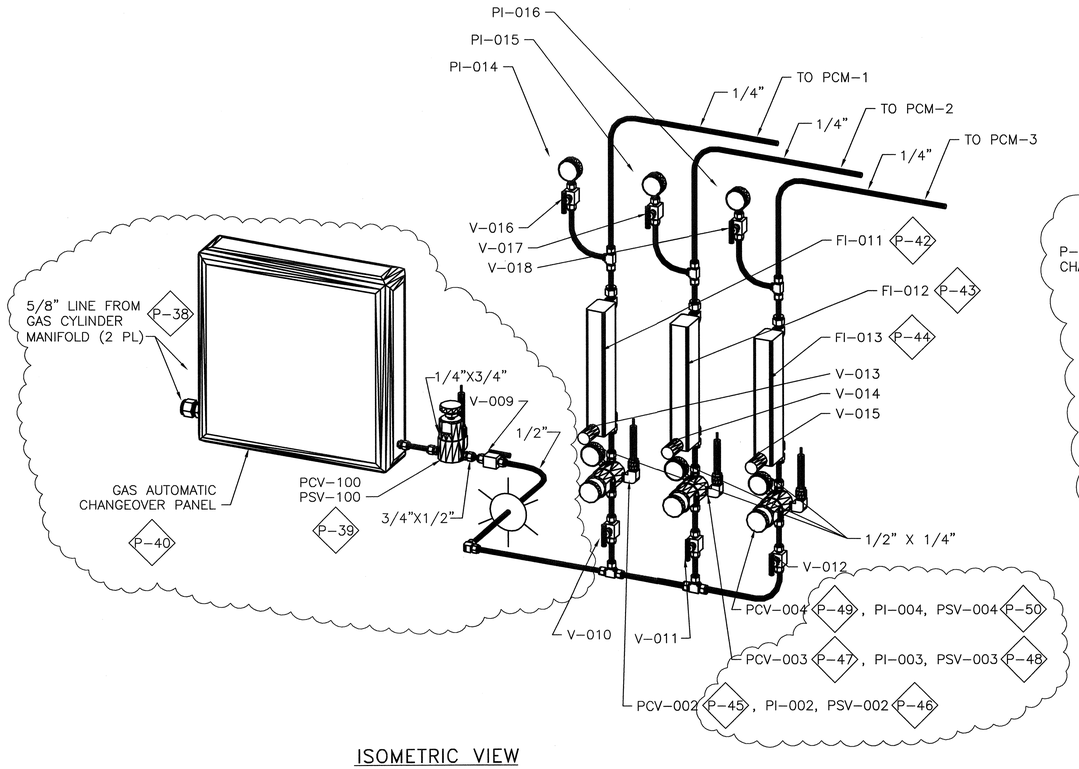
RYAN MICHAEL BARRETT NEW MEXICO 19452 PROFESSIONAL ENGINEER 8/31/16



ELEVATION VIEW

1/P-1000 SAFETY SHOWER W/EYEWASH DETAIL

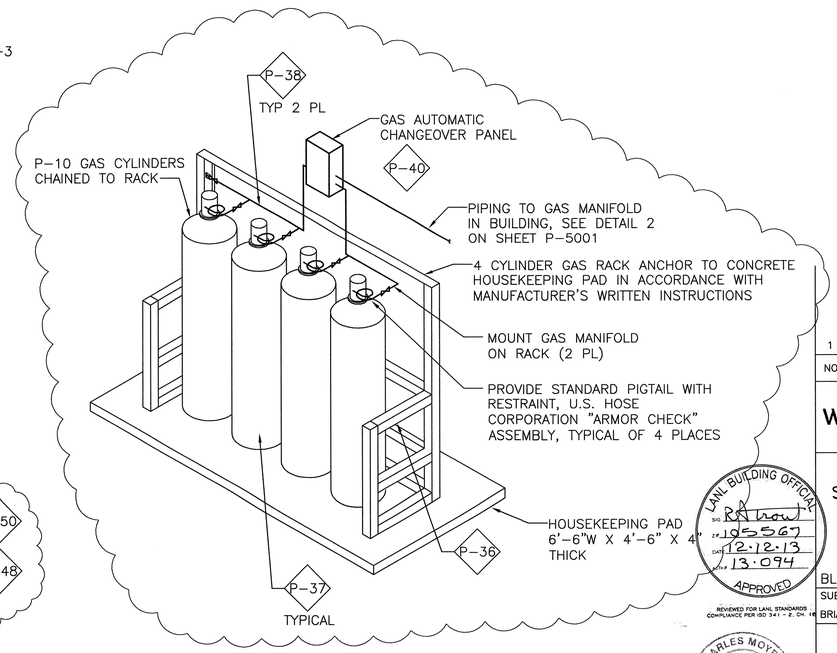
SCALE: NONE



ISOMETRIC VIEW

2/P-1000 P-10 GAS MANIFOLD DETAIL

SCALE: NONE



ISOMETRIC VIEW

3/P-1000 P-10 GAS CYLINDER RACK DETAIL

SCALE: NONE

GENERAL NOTES:

1. SEE SHEET P-7000 FOR EQUIPMENT LIST.

KEYED NOTES:

1. FURNISHED WITH EMERGENCY EQUIPMENT.
2. VALVE TO BE ACCESSIBLE FOR MAINTENANCE.
3. EMERGENCY SIGN(S).
4. ELECTRIC SAFETY SHOWER TEPID WATER HEATER.
5. TEPID WATER SUPPLY.
6. TEMPERATURE AND PRESSURE RELIEF VALVE.
7. PROVIDE DIELECTRIC UNION AT POINT OF DISSIMILAR METALS.
8. PRESSURE REDUCING VALVE.
9. FLOOR PENETRATION, SEE DETAIL 1 ON SHEET P-5001.

LANL BUILDING OFFICIAL
SIG RA Trujillo
ID 195567
DATE 12.12.13
APP. 13.094
APPROVED

REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISO 3-41-2, CH. 16

CHARLES MOYERS NEW MEXICO 16030 LICENSED PROFESSIONAL ENGINEER 11-06-13

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	11-06-13	U		REVISED DETAILS					

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE AND CHARACTERIZATION BUILDING

DETAILS

BLDG 63-0154 TA-63

DRAWN	D. BROERMAN
DESIGN	C. MOYERS
CHECKED	P. McMAHON
DATE	11-06-13

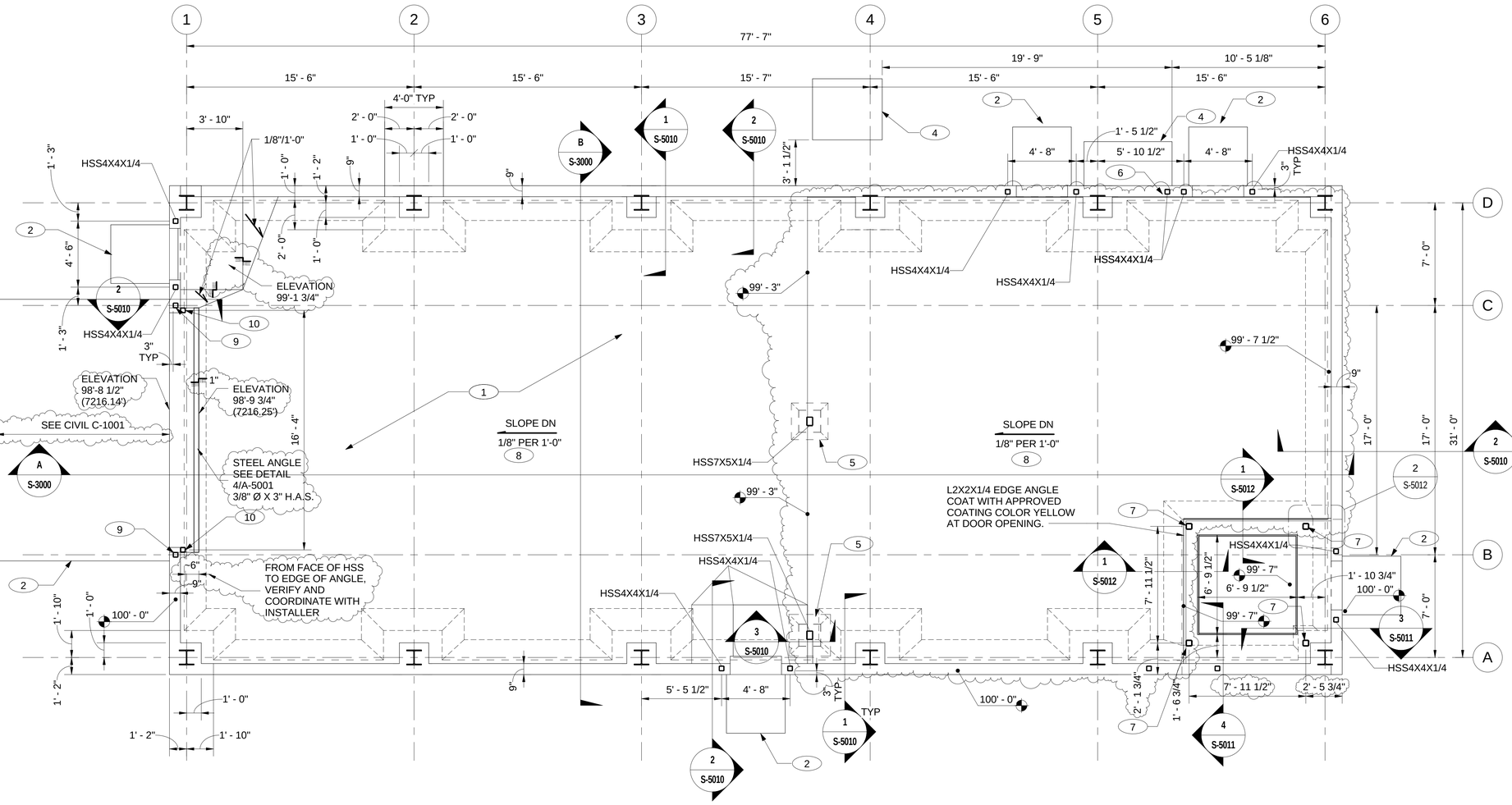
SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET P-5000
687 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA
DATE 11-06-13

PROJECT ID 102355
DRAWING NO C55445
REV 1



FOUNDATION PLAN

0 1' 2' 4' 6' 8'

1/4"=1'-0"

GENERAL NOTES

1. FINISH FLOOR REFERENCE ELEVATION 100'-0" = 7217.43'. SEE PLANS FOR MAT SLAB ELEVATIONS, FOUNDATION PLAN S-1000 AND CIVIL GRADING PLAN C-1005.
2. SEE CIVIL PLANS FOR EXTERIOR SLAB AND PAVING.
3. SEE SOILS REPORT FOR UNDER SLAB AND FOOTING REQUIREMENTS.
4. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
5. THIS DRAWING WAS GENERATED IN REVIT 2014.
6. COORDINATE DRAIN PIPES THRU CURB WITH ARCH.
7. CONCRETE SLABS, FOOTINGS, AND ALL REINFORCEMENT THEREIN ARE CLASSIFIED AS SAFETY SIGNIFICANT, ML-2.
8. FOR SLAB STEPS, SEE 1/S-5011

KEYED NOTES

1. 8" CONCRETE MAT SLAB WITH #6@9"O.C. EACH WAY, SEE DETAIL 3/S-5000. FOR STEPS IN SLAB SEE DETAIL 1/S-5011. SLAB IS PART OF THE LFRS, SAW CUTTING OF SLAB IS PROHIBITED.
2. CONCRETE STOOPS/RAMPS, SEE CIVIL SITE PLAN C-1001.
3. DELETED.
4. 6" MIN HOUSEKEEPING PAD, SEE DETAIL 1/S-5001 AND SCHEDULE ON SHEET S-7000.
5. THICKENED SLAB, SEE DETAIL 3/S-5010.
6. AWNING SUPPORT, FOR LOACATION SEE A-1002.
7. HSS 5X5 FOR FIRE RISER ROOM, SEE DETAIL 4/S-5025.
8. FLOOR SLOPE IS CLASSIFIED AS SAFETY CLASS. MINIMUM FLOOR SLOPE TOWARDS ROLL UP DOOR IS 1%.
9. HSS4X4X1/4 WALL SUPPORT JAMB.
10. HSS4X4X1/4 FIRE DOOR SUPPORT JAMB. VERIFY LOCATION WITH DOOR MANUFACTURER.
11. FOR FLOOR SLOPE ELEVATIONS, SEE ENLARGDE PLAN S-1010.

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	01/15/16	U		FCR-018, FCR-058, FCR-133, DCN-023, DCN-223, DCN-303	DMA	DMA	DMA	CR	
2	01-06-14	U		"DIMENSION ADDED"	GF	DMA	CR	BS	
1	11-06-13	U		"ADDITION OF AWNING & RISER ROOM FRAMING"	GF	DMA	CR	BS	

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE & CHARACTERIZATION BUILDING

FOUNDATION PLAN

BLDG 63-0154 TA- 63

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	Date 12

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

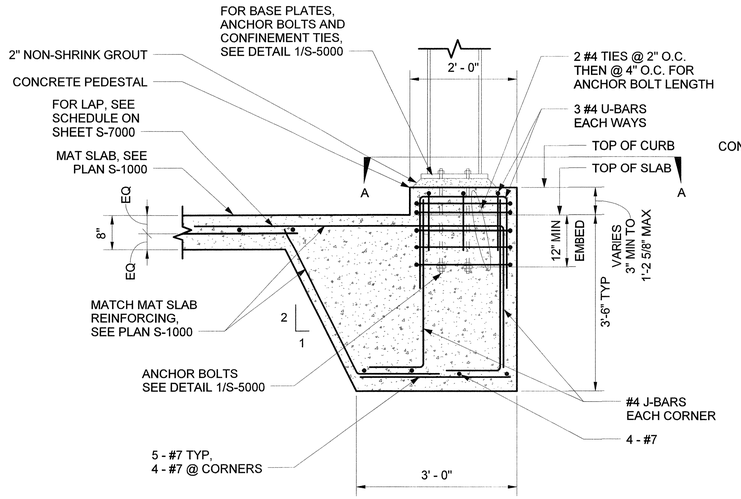
JAMES M. WEEKS NEW MEXICO 11384 REGISTERED PROFESSIONAL ENGINEER
1/15/16

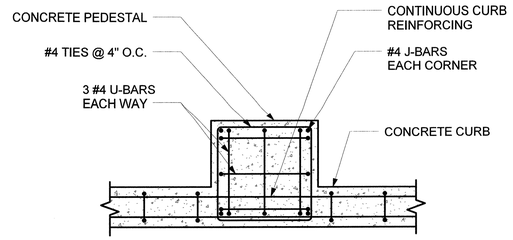
Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET S-1000
640 OF 827

CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13
PROJECT ID 102355
DRAWING NO C55445
REV 3

TRU WASTE FACILITY PROJECT 1/19/2016 2:52:13 PM Z:\DOE Projects\LANL\LANL TWF Design\DRAFTING\Models\STORAGE & CHAR BLDG\as-built\Storage Bldg2-Struct.rvt





NOTE: SIM @ CORNER CONDITIONS

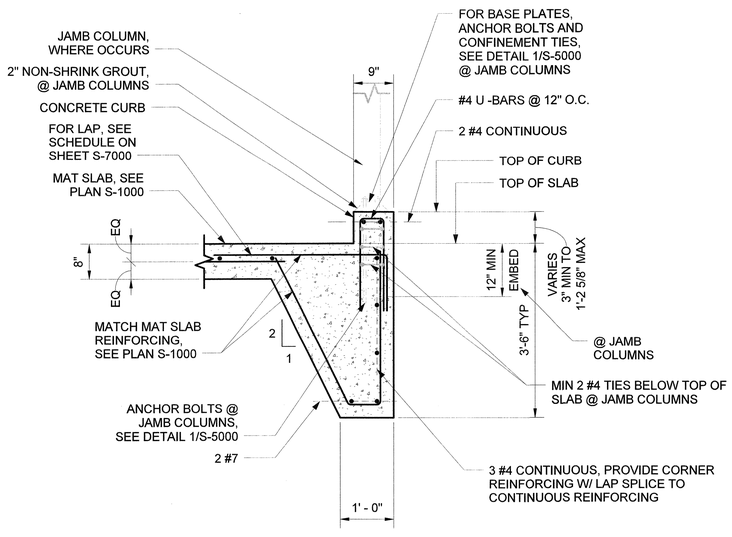
PLAN VIEW A-A

NOTE: FOR EXCAVATION REQUIREMENTS SEE DETAIL 2/S-5000.

1 / S-1000

THICKENED COLUMN MAT

1' 6" 0 1' 2'
3/4"=1'-0"

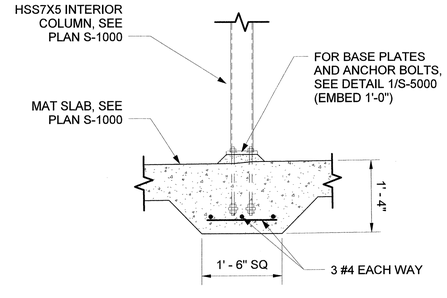


NOTE: SEE DETAIL 2/S-5000 FOR EXCAVATION REQUIREMENTS.

2 / S-1000

MAT SLAB TURN DOWN AT COLUMN

1' 6" 0 1' 2'
3/4"=1'-0"



SLAB REINFORCING NOT SHOWN FOR CLARITY

3 / S-1000

INTERIOR COLUMN

1' 6" 0 1' 2'
3/4"=1'-0"

GENERAL NOTES

1. ABBREVIATIONS AND LEGEND ARE LOCATED ON SHEET S-0001 AND GENERAL STRUCTURAL NOTES ARE LOCATED ON SHEET S-0002.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. THIS DRAWING WAS GENERATED IN REVIT 2011.

LANL BUILDING OFFICIAL
SIG
ID 105567
DATE 12.12.13
ALT ID 13-094
APPROVED
REVIEWED FOR LANL STANDARDS COMPLIANCE PER ISD 341 - 2, CH. 16

JAMES M. WEEKS
NEW MEXICO
11384
REGISTERED PROFESSIONAL ENGINEER
10/31/13

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	11-06-13	U		"CLASSIFICATION UPDATE"	DMA				

WEIDLINGER-NAVARRO JV NORTHERN NM

TRU WASTE FACILITY PROJECT
STORAGE & CHARACTERIZATION BUILDING

FOUNDATION DETAILS

BLDG 63-0154 TA-63

DRAWN	G.FLORES
DESIGN	D.AXELROD
CHECKED	C.ROSENBERGER
DATE	11-06-13

SUBMITTED: BRIAN SULLIVAN
APPROVED FOR RELEASE: ED ARTIGLIA

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

SHEET S-5010
647 OF 827

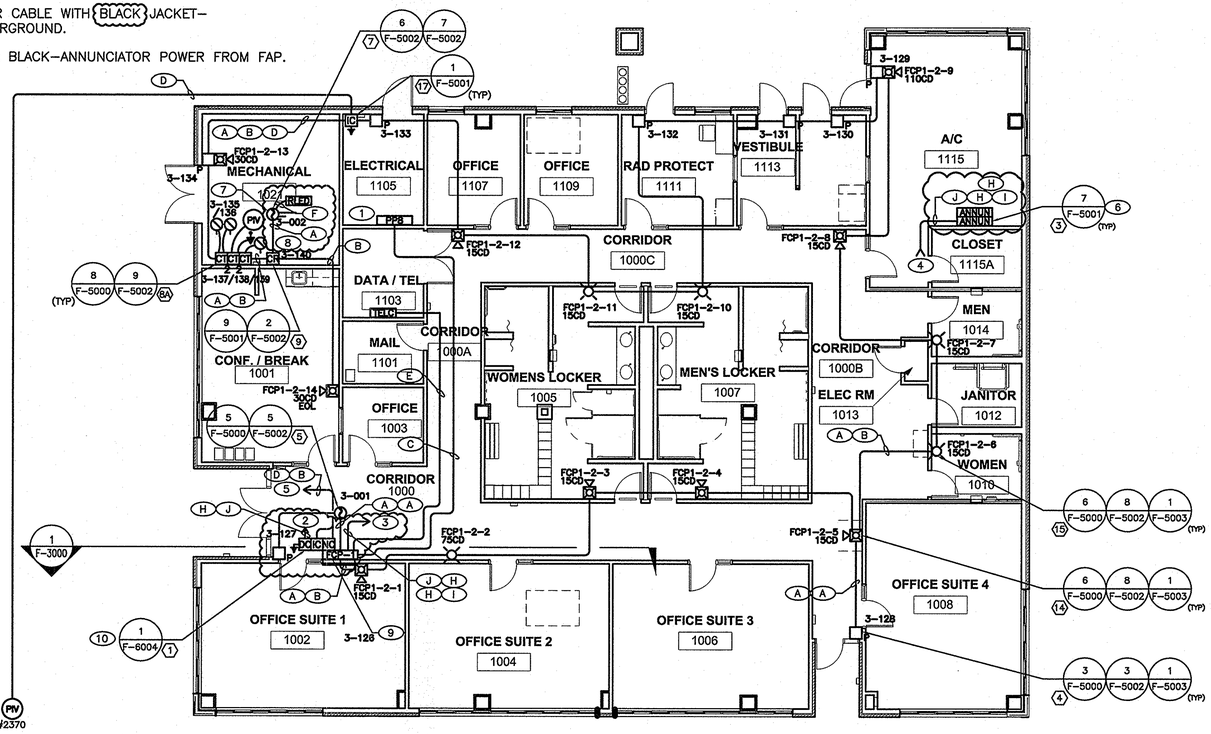
CLASSIFICATION U
REVIEWER ED ARTIGLIA DATE 11-06-13

PROJECT ID	DRAWING NO	REV
102355	C55445	1

TRU WASTE FACILITY PROJECT 10/31/2013 2:53:08 PM C:\Users\flores\Documents\Storage Bldg2-Struct_flores.rvt

WIRING LEGEND

- (A) #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – SLC.
- (B) 2–#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLUE (NEGATIVE), 1 YELLOW (POSITIVE) – NAC.
- (C) 3–#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLACK (PHASE), 1 WHITE (NEUTRAL), 1 GREEN (GROUND) – 120VAC.
- (D) 2–#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 GRAY (NEGATIVE), 1 VIOLET (POSITIVE) – IDC.
- (E) LANL TELECOMMUNICATIONS GROUP TO FURNISH (2) CAT 5E CABLES (4 PAIR) WITH RED SHEATH.
- (F) 2–#16 AWG TFN SOLID COPPER CONDUCTORS, 1 GRAY (NEGATIVE), 1 VIOLET (POSITIVE) – RLED.
- (G) #16 AWG 2 CONDUCTOR FPLR CABLE WITH (BLACK) JACKET– "WET LOCATION" – SLC UNDERGROUND.
- (H) #12 AWG THHN SOLID RED & BLACK–ANNUNCIATOR POWER FROM FAP.
- (I) 2–#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 RED (NEGATIVE), 1 BLACK (POSITIVE) – RS–485.
- (J) #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – RS–485.

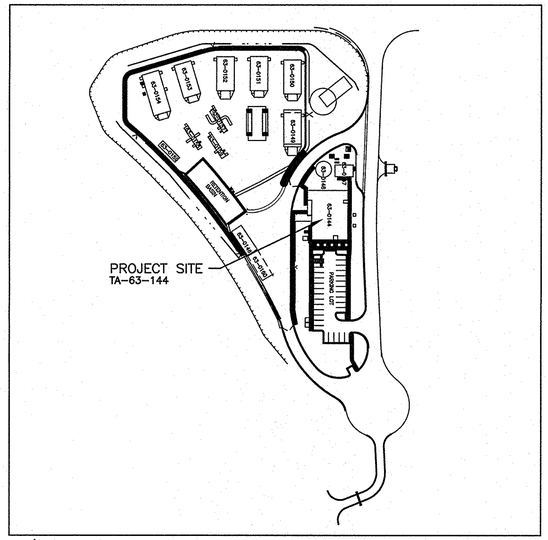


FLOOR PLAN

SCALE: 1/8"=1'–0" BLDG. 144

4' 2' 0 4' 8' 12'

1/8"=1'–0"



LOCATION PLAN

SCALE: NONE TA–63

KEYED NOTES

1. POWER PANEL PP8, USE CKT#70 FOR FCP 120 VAC POWER.
2. RS485 & 24VDC FROM (FAP) BUILDING 152.
3. RS485 ((FAP & FCP)) & 24VDC POWER TO REMOTE ANNUNCIATORS IN ROOM #1115.
4. FROM FCP (REF KEYED NOTE #3).
5. IDC CIRCUIT AND FCP1 NAC CKT#1 TO BUILDING #146.
6. PANEL MOUNTED TO FLUSH MOUNT 4" SQUARE ELECTRICAL BOX APPROXIMATE 5' A.F.F.
7. SUPPLY DUCT SMOKE DETECTOR FOR ERV–1.
8. CONTROL RELAY TO SHUTDOWN ERV–1 SUPPLY FAN.
9. MONITOR MODULE IS FOR IDC CIRCUIT TO PULL STATIONS IN BUILDING 146. MODULE LOCATED INSIDE FCP–1.
10. ALL SURGE SUPPRESSORS AT FCP–1 ARE INSTALLED IN 36" GUTTER BOX, ABOVE CEILIING, ABOVE PANEL. REFER TO SHEET F–5000 DETAIL #7.

GENERAL NOTES

1. LANL TELECOMMUNICATIONS GROUP SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLING. ELECTRICAL CONTRACTOR IS TO INSTALL TELECOMMUNICATIONS CONDUIT. FIRE ALARM CONTRACTOR TO PULL LANL SUPPLIED TELEPHONE CABLE.
2. ALL CONDUITS SHOWN SHALL BE 3/4" EMT UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUCTORS FOR POWER 120VAC SYSTEM. ELECTRICAL CONTRACTORS SHALL INSTALL AND TERMINATE 120VAC SURGE SUPPRESSION DEVICES SUPPLIED BY THE FIRE ALARM CONTRACTOR.
4. ELECTRICAL CONTRACTOR SHALL INSTALL THE FIRE ALARM CONDUIT SYSTEM, INCLUDING JUNCTION BOXES, SUPPORTS, ETC. FIRE ALARM CONTRACTOR SHALL INSTALL WIRE, DEVICES AND TERMINATE THE FIRE ALARM CONDUCTORS.
5. REFER TO THE F–8000 SERIES OF SHEETS FOR BATTERY & VOLTAGE DROP CALCULATIONS.
6. CONDUIT SYSTEM ROUTING SHOWN ON DRAWING IS DIAGRAMMATIC. ELECTRICAL CONTRACTOR MAY DEVIATE FROM PATH SHOWN IF REQUIRED BY EXISTING FIELD CONDITIONS WITHIN THE BUILDING AND/OR EXISTING FIELD CONDITIONS WITHIN THE CEILING SPACE. FIRE ALARM DEVICE SEQUENCE SHALL REMAIN AS SHOWN. ELECTRICAL CONTRACTOR SHALL INSTALL PULL BOXES ON THE NEW CONDUIT RUNS, AS REQUIRED, TO COMPLY WITH NFPA 70 AND TO LIMIT THE CABLE PULLING TENSION AS TO NOT DAMAGE THE NEW CABLING.
7. ALL FIRE ALARM DEVICES, CONDUIT AND CABLING SHOWN IS NEW UNLESS OTHERWISE NOTED.
8. REFER TO SHEETS F–0001 AND E–0001 FOR ADDITIONAL INFORMATION APPLICABLE TO THIS PROJECT.
9. IF THIS SHEET IS NOT 24" X 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

1	03/31/16	–	FCR 247	DP	AG	WC	–	–
0	08/10/15	–	FCR# 102355–0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–
NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884–1970

SIGNATURE 4-5-16 DATE

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

FLOOR PLAN BUILDING 144

BLDG.144 TA–63

DRAWN DP | DESIGN AG | CHECKED WC | DATE 08/10/15

SUBMITTED Tom Roberts

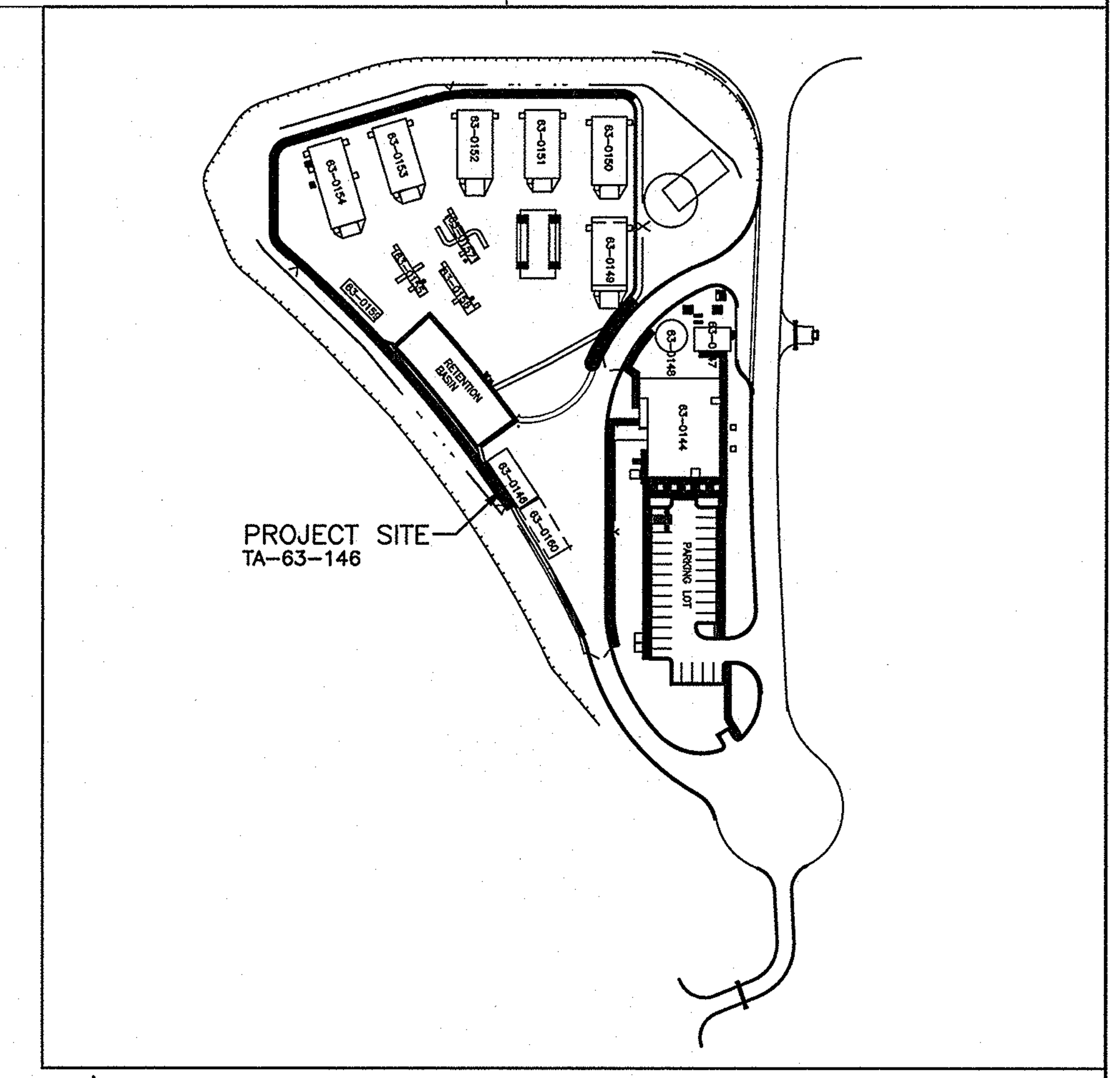
APPROVED FOR RELEASE JULIE MINTON–HUGHES

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET F–1002 05 OF 30

CLASSIFICATION U REVIEWER DATE 7 April 2016

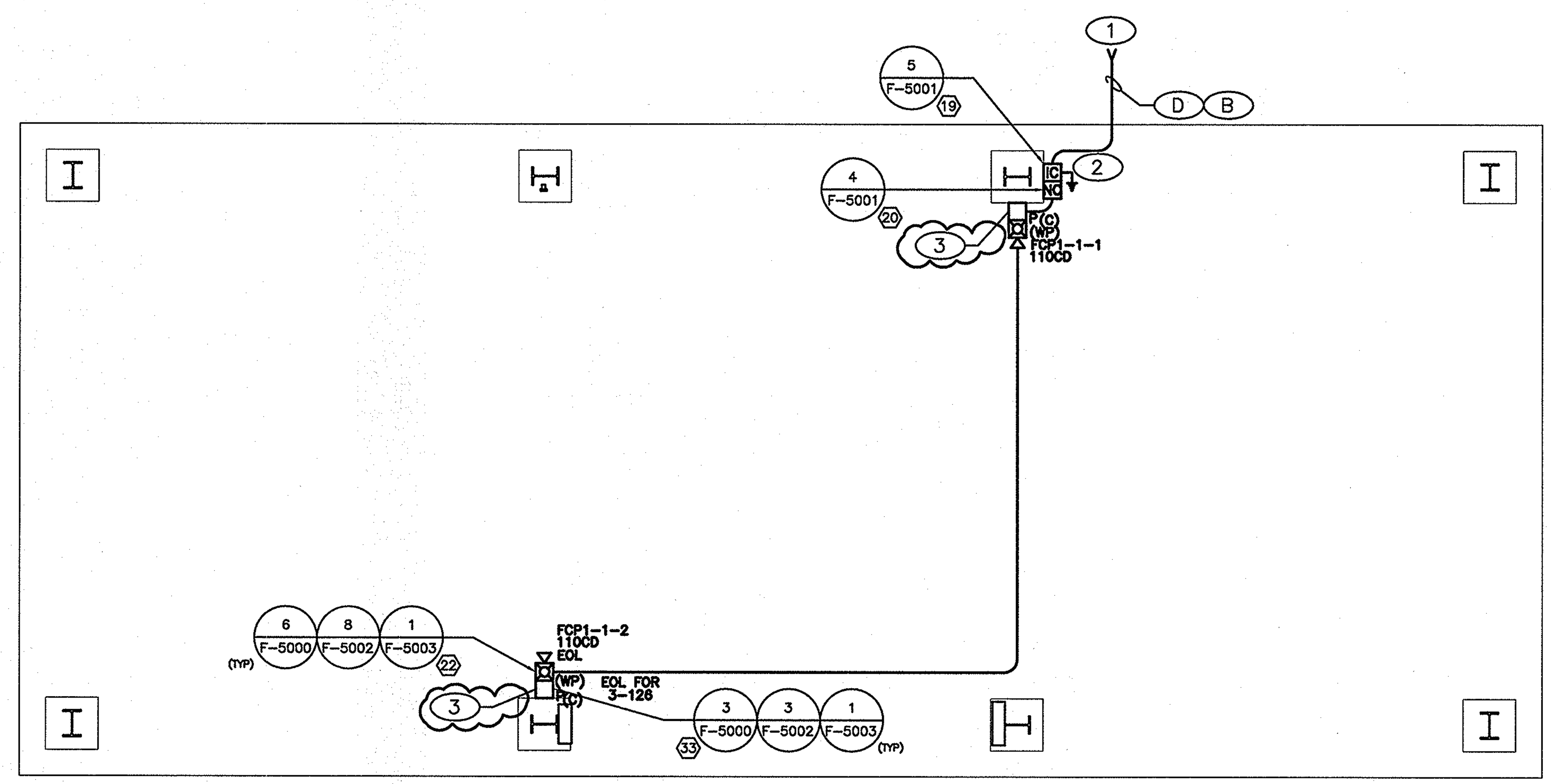
PROJECT ID 102355 DRAWING NO C57217 REV 1



LOCATION PLAN
SCALE: NONE TA-63

KEYED NOTES
1. IDC & NAC CIRCUIT FCP-1 FROM FCP IN BUILDING #144.
2. INSTALL NAC AND SLC SURGE SUPPRESSORS IN NEMA ENCLOSURE (6"x6")
3. INSTALL PULL STATION IN WEATHER PROOF ENCLOSURE (MODEL# STI-1230)

WIRING LEGEND
A. #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – SLC.
B. 2-#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLUE (NEGATIVE), 1 YELLOW (POSITIVE) – NAC.
D. 2-#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 GRAY (NEGATIVE), 1 VIOLET (POSITIVE) – IDC.



FLOOR PLAN
SCALE: 1/4"=1'-0" BLDG. 146

0' 1' 2' 4' 6' 8'
1/4"=1'-0"

GENERAL NOTES
1. LANL TELECOMMUNICATIONS GROUP SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLING. ELECTRICAL CONTRACTOR IS TO INSTALL TELECOMMUNICATIONS CONDUIT. FIRE ALARM CONTRACTOR TO PULL LANL SUPPLIED TELEPHONE CABLE.
2. ALL CONDUITS SHOWN SHALL BE 3/4" EMT UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUCTORS FOR POWER 120VAC SYSTEM. ELECTRICAL CONTRACTORS SHALL INSTALL AND TERMINATE 120VAC SURGE SUPPRESSION DEVICES SUPPLIED BY THE FIRE ALARM CONTRACTOR.
4. ELECTRICAL CONTRACTOR SHALL INSTALL THE FIRE ALARM CONDUIT SYSTEM, INCLUDING JUNCTION BOXES, SUPPORTS, ETC. FIRE ALARM CONTRACTOR SHALL INSTALL WIRE, DEVICES AND TERMINATE THE FIRE ALARM CONDUCTORS.
5. REFER TO THE F-8000 SERIES OF SHEETS FOR BATTERY & VOLTAGE DROP CALCULATIONS.
6. CONDUIT SYSTEM ROUTING SHOWN ON DRAWING IS DIAGRAMMATIC. ELECTRICAL CONTRACTOR MAY DEVIATE FROM PATH SHOWN IF REQUIRED BY EXISTING FIELD CONDITIONS WITHIN THE BUILDING AND/OR EXISTING FIELD CONDITIONS WITHIN THE CEILING SPACE. FIRE ALARM DEVICE SEQUENCE SHALL REMAIN AS SHOWN. ELECTRICAL CONTRACTOR SHALL INSTALL PULL BOXES ON THE NEW CONDUIT RUNS, AS REQUIRED, TO COMPLY WITH NFPA 70 AND TO LIMIT THE CABLE PULLING TENSION AS TO NOT DAMAGE THE NEW CABLING.
7. ALL FIRE ALARM DEVICES, CONDUIT AND CABLING SHOWN IS NEW UNLESS OTHERWISE NOTED.
8. REFER TO SHEETS F-0001 AND E-0001 FOR ADDITIONAL INFORMATION APPLICABLE TO THIS PROJECT.
9. IF THIS SHEET IS NOT 24" X 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970
SIGNATURE	DATE 4-5-16

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
1	03/31/16	–	FCR 247	DP	AG	WC	–	
0	08/10/15	–	FCR# 102355-0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

FLOOR PLAN
BUILDING 146

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

BLDG. 146 TA-63

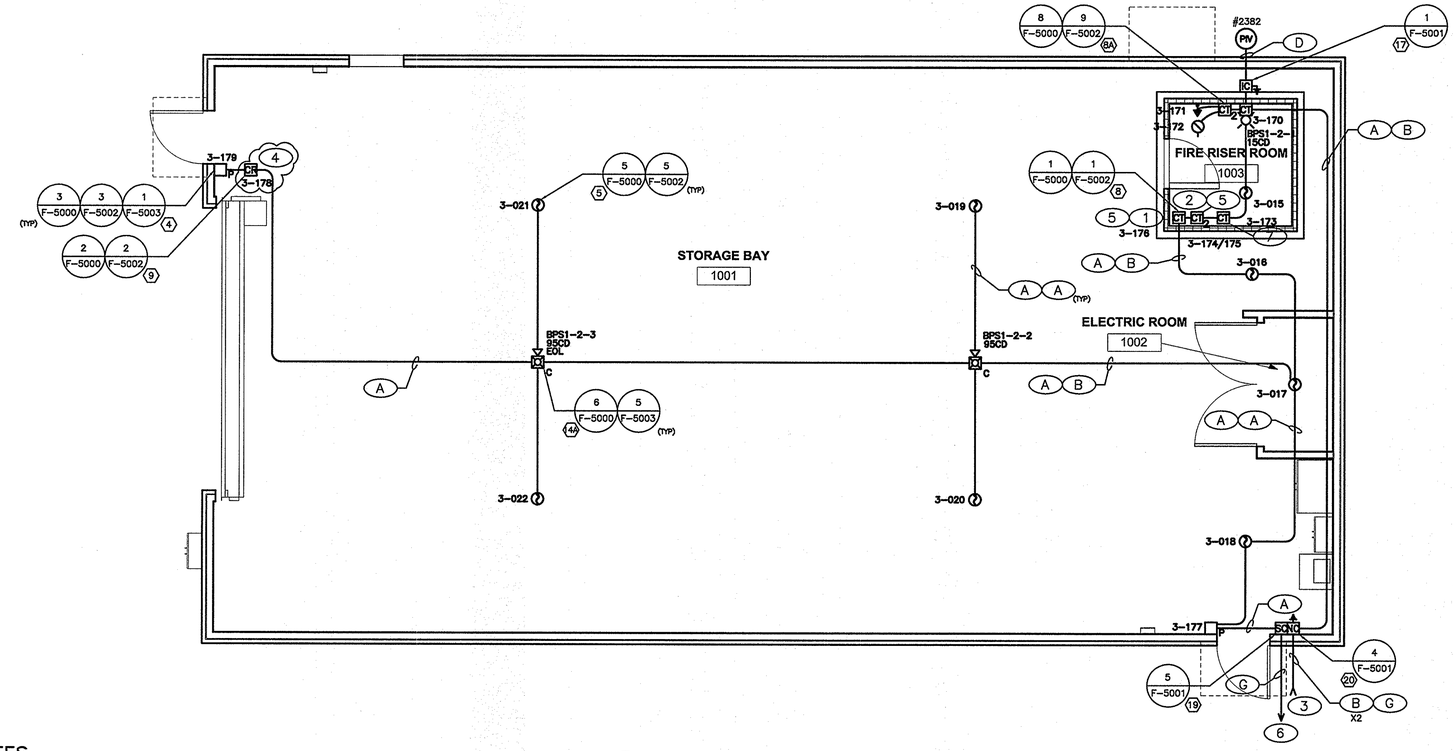
SUBMITTED: Tom Roberts
APPROVED FOR RELEASE: JULIE MINTON-HUGHES

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET F-1003
06 OF 30

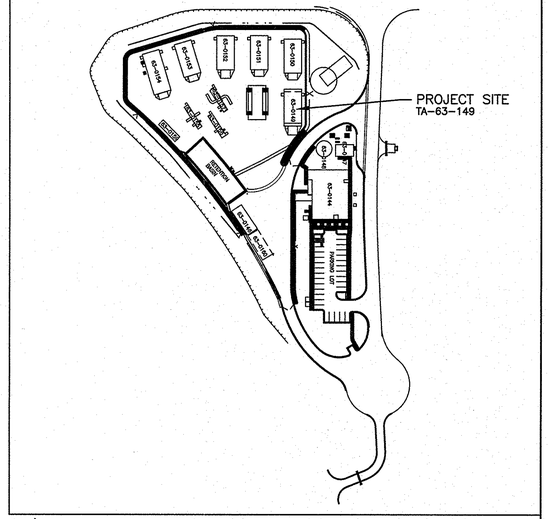
CLASSIFICATION U REVIEWER DATE 7 Apr 2016

PROJECT ID 102355 DRAWING NO C57217 REV 1



FLOOR PLAN
SCALE: 1/4"=1'-0" BLDG. 149

0' 1' 2' 4' 6' 8'
1/4"=1'-0"



LOCATION PLAN
SCALE: NONE TA-63

KEYED NOTES

1. CT MODULE TO MONITOR LOW TEMPERATURE SWITCH. (TSL-005)
2. CT2 MODULE TO MONITOR HIGH/LOW AIR PRESSURE SWITCH (PSHL-001, 002).
3. SLC & NAC CIRCUIT FROM BUILDING 152. FROM PB-C06
4. CONTROL RELAY FOR ROLL-UP DOOR. MOUNT AT 60" ON CENTER A.F.F. (FCR-327).
5. SAFETY SIGNIFICANT INPUT POINTS.
6. 1 1/2" CONDUIT TO BUILDING 147. (SLC TO SAFETY SIGNIFICANT & NON-SAFETY SIGNFICANT J-BOX).
7. CT MODULE TO MONITOR NON SAFETY SIGNIFICANT TEMP SENSOR TSL-013.

WIRING LEGEND

- (A) #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – SLC.
- (B) 2-#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLUE (NEGATIVE), 1 YELLOW (POSITIVE) – NAC.
- (D) 2-#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 GRAY (NEGATIVE), 1 VIOLET (POSITIVE) – IDC.
- (G) #16 AWG 2 CONDUCTOR FPLR CABLE WITH BLACK JACKET– "WET LOCATION" – SLC UNDERGROUND.

GENERAL NOTES

1. LANL TELECOMMUNICATIONS GROUP SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLING. ELECTRICAL CONTRACTOR IS TO INSTALL TELECOMMUNICATIONS CONDUIT. FIRE ALARM CONTRACTOR TO PULL LANL SUPPLIED TELEPHONE CABLE.
2. ALL CONDUITS SHOWN SHALL BE 3/4" EMT UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUCTORS FOR POWER 120VAC SYSTEM. ELECTRICAL CONTRACTORS SHALL INSTALL AND TERMINATE 120VAC SURGE SUPPRESSION DEVICES SUPPLIED BY THE FIRE ALARM CONTRACTOR.
4. ELECTRICAL CONTRACTOR SHALL INSTALL THE FIRE ALARM CONDUIT SYSTEM, INCLUDING JUNCTION BOXES, SUPPORTS, ETC. FIRE ALARM CONTRACTOR SHALL INSTALL WIRE, DEVICES AND TERMINATE THE FIRE ALARM CONDUCTORS.
5. REFER TO THE F-8000 SERIES OF SHEETS FOR BATTERY & VOLTAGE DROP CALCULATIONS.
6. CONDUIT SYSTEM ROUTING SHOWN ON DRAWING IS DIAGRAMMATIC. ELECTRICAL CONTRACTOR MAY DEVIATE FROM PATH SHOWN IF REQUIRED BY EXISTING FIELD CONDITIONS WITHIN THE BUILDING AND/OR EXISTING FIELD CONDITIONS WITHIN THE CEILING SPACE. FIRE ALARM DEVICE SEQUENCE SHALL REMAIN AS SHOWN. ELECTRICAL CONTRACTOR SHALL INSTALL PULL BOXES ON THE NEW CONDUIT RUNS, AS REQUIRED, TO COMPLY WITH NFPA 70 AND TO LIMIT THE CABLE PULLING TENSION AS TO NOT DAMAGE THE NEW CABLING.
7. ALL FIRE ALARM DEVICES, CONDUIT AND CABLING SHOWN IS NEW UNLESS OTHERWISE NOTED.
8. REFER TO SHEETS F-0001 AND E-0001 FOR ADDITIONAL INFORMATION APPLICABLE TO THIS PROJECT.
9. IF THIS SHEET IS NOT 24" X 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970

SIGNATURE DATE 4-5-16

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
1	03/31/16	–	FCR 247/327	DP	AG	WC		
0	08/10/15	–	FCR# 102355-0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

FLOOR PLAN BUILDING 149

BLDG. 149 TA-63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

SUBMITTED Tom Roberts

APPROVED FOR RELEASE JULIE MINTON-HUGHES

Los Alamos NATIONAL LABORATORY P0 Box 1663 Los Alamos, New Mexico 87545

SHEET F-1005

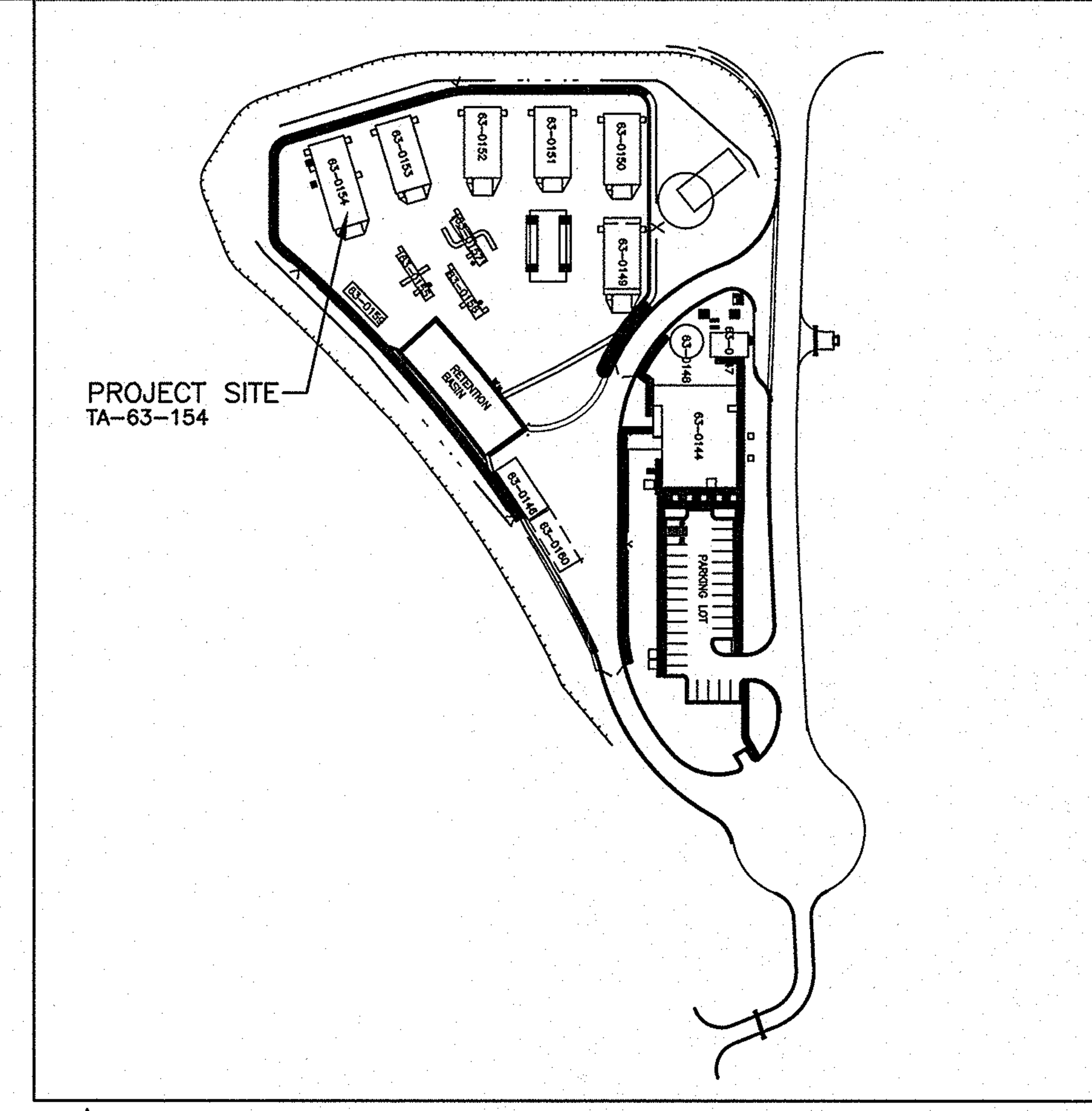
08 OF 30

CLASSIFICATION U REVIEWER DATE 7 Apr 2016

PROJECT ID 102355

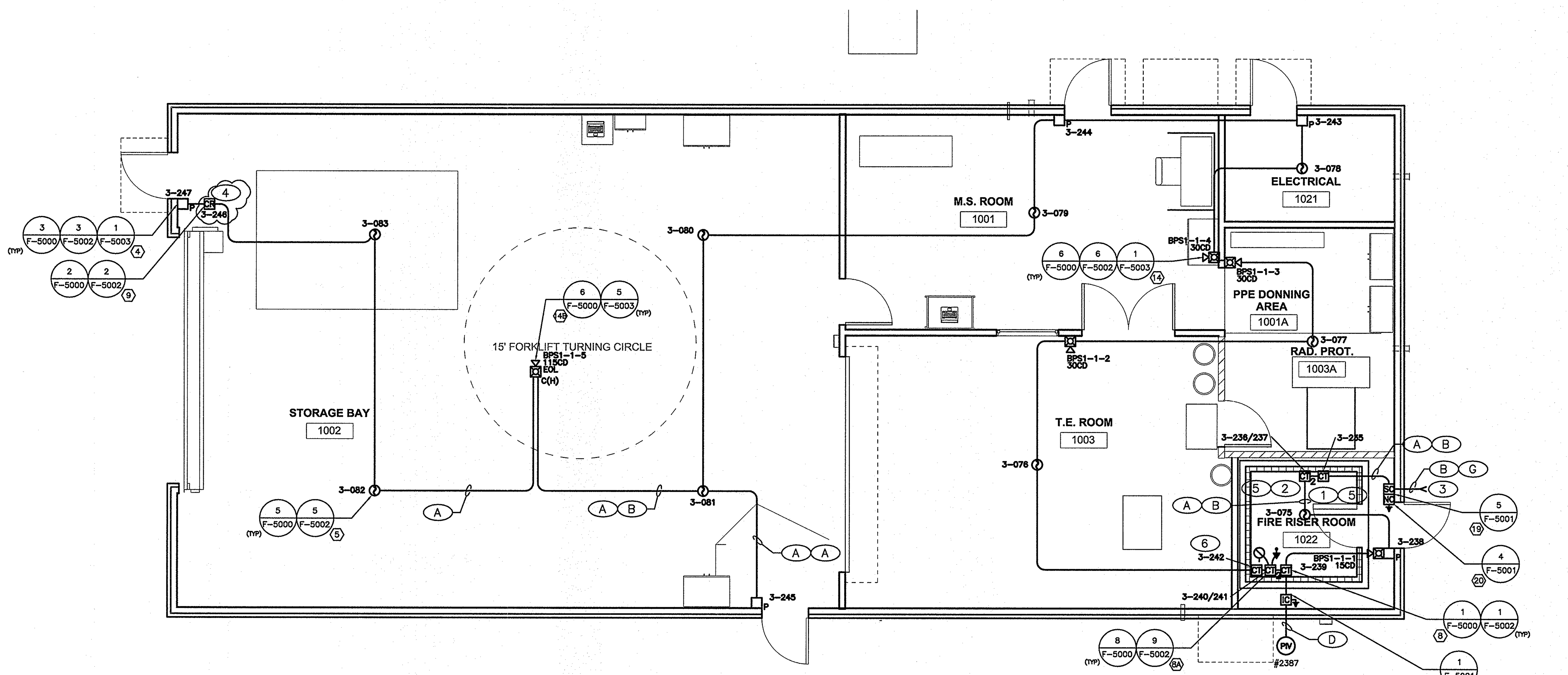
DRAWING NO C57217

REV 1



LOCATION PLAN

SCALE: NONE TA-63



FLOOR PLAN

SCALE: 1/4"=1'-0" BLDGS. 154

0' 1' 2' 4' 6' 8'

1/4"=1'-0"

KEYED NOTES

1. CT MODULE TO MONITOR LOW TEMPERATURE SWITCH. (TSL-010)
2. CT2 MODULE TO MONITOR HIGH/LOW AIR PRESSURE SWITCH (PSHL-011, 012).
3. SLC & NAC CIRCUIT FROM BUILDING 152. FROM PB-C01
4. CONTROL RELAY FOR ROLL-UP DOOR. MOUNT AT 60" ON CENTER A.F.F. (FCR-327).
5. SAFETY SIGNIFICANT INPUT POINTS.
6. CT MODULE TO MONITOR NON SAFETY SIGNIFICANT TEMP SENSOR TSL-023.

WIRING LEGEND

- A — #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET - SLC.
- B — 2-#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLUE (NEGATIVE), 1 YELLOW (POSITIVE) - NAC.
- D — 2-#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 GRAY (NEGATIVE), 1 VIOLET (POSITIVE) - IDC.
- G — #16 AWG 2 CONDUCTOR FPLR CABLE WITH BLACK JACKET- "WET LOCATION" - SLC UNDERGROUND.

GENERAL NOTES

1. LANL TELECOMMUNICATIONS GROUP SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLING. ELECTRICAL CONTRACTOR IS TO INSTALL TELECOMMUNICATIONS CONDUIT. FIRE ALARM CONTRACTOR TO PULL LANL SUPPLIED TELEPHONE CABLE.
2. ALL CONDUITS SHOWN SHALL BE 3/4" EMT UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUCTORS FOR POWER 120VAC SYSTEM. ELECTRICAL CONTRACTORS SHALL INSTALL AND TERMINATE 120VAC SURGE SUPPRESSION DEVICES SUPPLIED BY THE FIRE ALARM CONTRACTOR.
4. ELECTRICAL CONTRACTOR SHALL INSTALL THE FIRE ALARM CONDUIT SYSTEM, INCLUDING JUNCTION BOXES, SUPPORTS, ETC. FIRE ALARM CONTRACTOR SHALL INSTALL WIRE, DEVICES AND TERMINATE THE FIRE ALARM CONDUCTORS.
5. REFER TO THE F-8000 SERIES OF SHEETS FOR BATTERY & VOLTAGE DROP CALCULATIONS.
6. CONDUIT SYSTEM ROUTING SHOWN ON DRAWING IS DIAGRAMMATIC. ELECTRICAL CONTRACTOR MAY DEVIATE FROM PATH SHOWN IF REQUIRED BY EXISTING FIELD CONDITIONS WITHIN THE BUILDING AND/OR EXISTING FIELD CONDITIONS WITHIN THE CEILING SPACE. FIRE ALARM DEVICE SEQUENCE SHALL REMAIN AS SHOWN. ELECTRICAL CONTRACTOR SHALL INSTALL PULL BOXES ON THE NEW CONDUIT RUNS, AS REQUIRED, TO COMPLY WITH NFPA 70 AND TO LIMIT THE CABLE PULLING TENSION AS TO NOT DAMAGE THE NEW CABLING.
7. ALL FIRE ALARM DEVICES, CONDUIT AND CABLING SHOWN IS NEW UNLESS OTHERWISE NOTED.
8. REFER TO SHEETS F-0001 AND E-0001 FOR ADDITIONAL INFORMATION APPLICABLE TO THIS PROJECT.
9. IF THIS SHEET IS NOT 24" X 36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970
SIGNATURE: W. Cobb	DATE: 4-5-16

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
1	03/31/16	–	FCR 247/327	DP	AG	WC	–	–
0	08/10/15	–	FCR# 102355-0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

FLOOR PLAN BUILDINGS 154

BLDG. 154 TA-63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

SUBMITTED: Tom Roberts

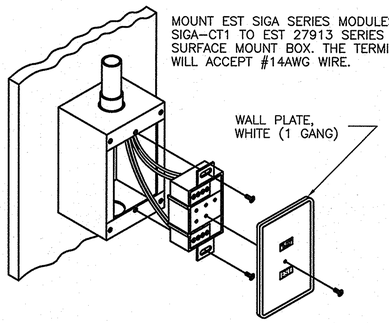
APPROVED FOR RELEASE: JULIE MINTON-HUGHES

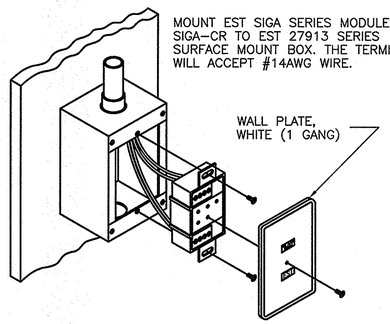
Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

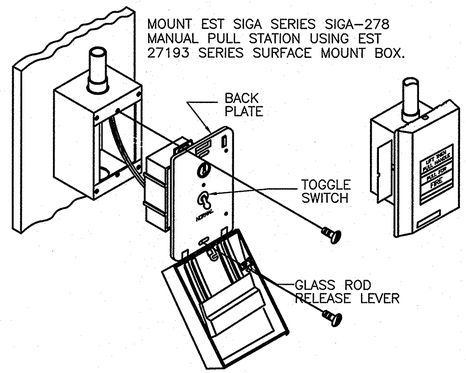
SHEET F-1010 13 OF 30

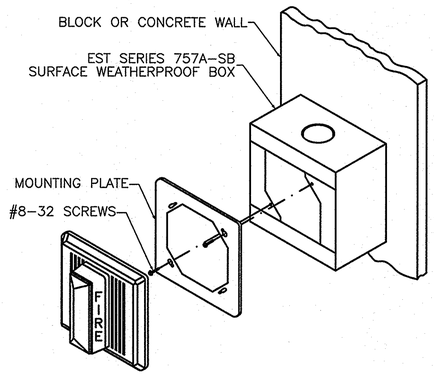
CLASSIFICATION: U REVIEWER DATE 7 Apr 2016

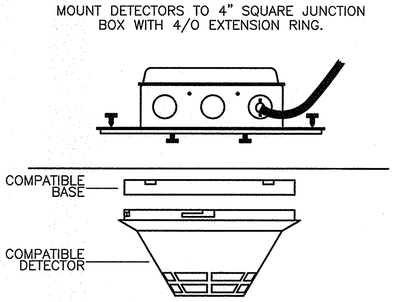
PROJECT ID 102355 DRAWING NO C57217 REV 1

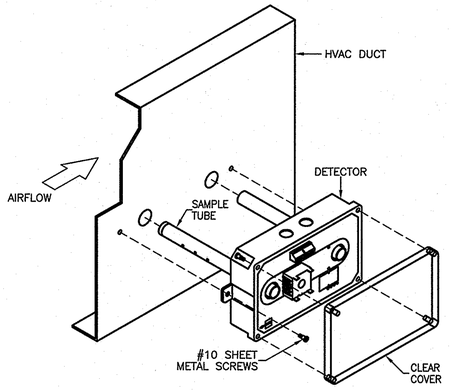


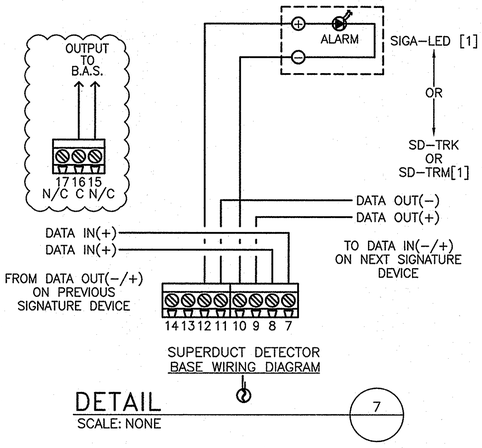


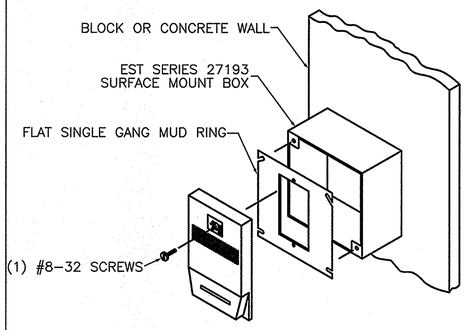


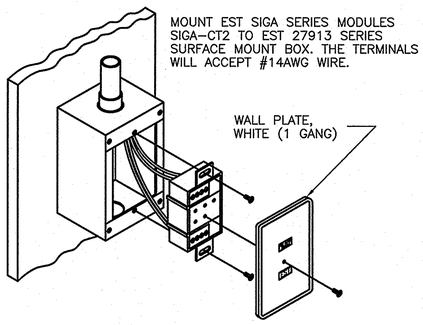












GENERAL NOTES

1. THIS IS A TYPICAL TERMINATION DETAIL SHEET. SOME APPLICATIONS MAY APPEAR ON THIS SHEET AND MAY NOT BE REFERENCED ON THE FLOOR PLAN.

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884–1970

Wm Cobb 4-5-16
SIGNATURE DATE

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
1	03/31/16	–	FCR 247	DP	AG	WC		
0	08/10/15	–	FCR# 102355–0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

DETAILS

BLDG. 144 TA–63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

SUBMITTED Tom Roberts

APPROVED FOR RELEASE JULIE MINTON–HUGHES

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET F–5002

18 OF 30

CLASSIFICATION U REVIEWER DATE 7 Apr 2016

PROJECT ID 102355

DRAWING NO C57217

REV 1

FAP SYSTEM OUTPUTS

FCP-1 SYSTEM INPUTS BUILDINGS 144, & 146		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
	ACTUATE COMMON ALARM VISUAL AND AUDIBLE INDICATOR AT FCP-1 & ANNUNCIATOR																	
	DISPLAY ALARM DEVICE ADDRESS POINT AND LOCATION DESCRIPTION AT FCP-1 & ANNUNCIATOR																	
	ACTUATE SUPERVISORY VISUAL AND AUDIBLE INDICATOR AT FCP-1 & ANNUNCIATOR																	
	DISPLAY SUPERVISORY DEVICE ADDRESS POINT AND LOCATION DESCRIPTION																	
	ACTUATE COMMON TROUBLE VISUAL AND AUDIBLE INDICATOR AT FCP-1 & ANNUNCIATOR																	
	DISPLAY TROUBLE CONDITION AT FCP-1,2 & ANNUNCIATOR																	
	TRANSMIT SUPERVISORY SIGNAL TO CENTRAL STATION																	
	TRANSMIT ALARM TO CENTRAL STATION DEVICES SYSTEM WIDE																	
	ACTUATE BUILDING NOTIFICATION APPLIANCES AND VISUALS																	
	TRANSMIT TROUBLE TO CENTRAL STATION																	
	SILENCE PANEL AND FACILITY AUDIBLES AND VISUALS																	
	CONTROL PANEL AND FACILITY AUDIBLES TO NORMAL (AUDIBLES AND VISUALS STOP)																	
	DISABLE NAC BUILDING #144																	
	DISABLE NAC BUILDING #146																	
	SHUTDOWN ERV-1 SUPPLY FAN																	
	DISABLE ERV-1 SHUTDOWN RELAY																	
1	MANUAL PULL STATIONS	●	●						●	●								1
2	AREA SMOKE DETECTORS	●	●						●	●								2
3	WATER/PRESSURE SWITCH	●	●						●	●								3
4	DUCT SMOKE DETECTOR (ERV-1)			●	●			●								●		4
5	SPRINKLER TAMPER SWITCH (PIV)			●	●			●										5
6	OPEN CIRCUIT, GROUND FAULT					●	●				●							6
7	FIRE ALARM AC POWER FAILURE					●	●				●							7
8	FIRE ALARM SYSTEM LOW BATTERY					●	●				●							8
9	SYSTEM SILENCE											●						9
10	SYSTEM RESET												●					10
11	4X-12SR SWITCH #1					●	●				●			●				11
12	4X-12SR SWITCH #2					●	●				●				●			12
13	4X-12SR SWITCH #3					●	●				●						●	13
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970

SIGNATURE DATE

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
3	05/24/16	–	AS BUILT	DP	AG	WC	–	–
2	05/09/16	–	FCR 250	DP	AG	WC	–	–
1	03/31/16	–	FCR 247	DP	AG	WC	–	–
0	08/10/15	–	FCR# 102355-0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks
security systems · fire evacuation systems · building automation systems · energy solutions · tele data com

TRU WASTE
FACILITY PROJECT

FCP-1
FUNCTIONAL MATRIX

BLDG. 144,146, TA-63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

SUBMITTED: Tom Roberts
APPROVED FOR RELEASE: JULIE MINTON-HUGHES

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F-6000
21 OF 30

CLASSIFICATION | REVIEWER | DATE

PROJECT ID 102355 | DRAWING NO C57217 | REV 3

FAP SYSTEM OUTPUTS

(FAP) SYSTEM INPUTS BUILDINGS 152, 153, 154, 149, 147, 150, & 151 ONLY	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	
1 MANUAL PULL STATIONS	●	●						●	●																	●			1
2 AREA SMOKE DETECTORS	●	●						●	●																	●			2
3 LOW TEMPERATURE SWITCH (SAFETY SIGNIFICANT & NON-SAFETY SIGNIFICANT)			●	●			●																						3
4 HIGH/LOW AIR PRESSURE SWITCH (SAFETY SIGNIFICANT)			●	●			●																						4
5 PRESSURE SWITCH (SPRINKLER SYSTEM)	●	●						●	●																	●			5
6 SPRINKLER TAMPER SWITCH (PIV)			●	●			●																						6
7 LOW WATER LEVEL (SAFETY SIGNIFICANT)			●	●			●																						7
8 GENERATOR FAIL TO START			●	●			●																						8
9 GENERATOR RUNNING			●	●			●																						9
10 AUTOMATIC GENERATOR SHUTDOWN			●	●			●																						10
11 GENERATOR CONTROL SWITCH NOT IN AUTO POSITION			●	●			●																						11
12 ATS #3 GENERATOR CONTROL SWITCH NOT IN AUTO POSITION, MTS SWITCH			●	●			●																						12
13 HEAT TRACE POWER MONITOR			●	●			●																						13
14 OPEN CIRCUIT, GROUND FAULT					●	●			●																				14
15 FIRE ALARM AC POWER FAILURE					●	●			●																				15
16 FIRE ALARM SYSTEM LOW BATTERY					●	●			●																				16
17 SYSTEM SILENCE										●																			17
18 SYSTEM RESET											●																		18
19																													19
20 FIRE PUMP EFP-1&2 PUMP RUNNING			●	●			●																						20
21																													21
22 FIRE PUMP EFP-1&2 LINE POWER PHASE REVERSAL			●	●			●																						22
23 FIRE PUMP EFP-1&2 LINE POWER SINGLE PHASE FAIL			●	●			●																						23
24 4X-12SR SWITCH #1					●	●			●			●																	24
25 4X-12SR SWITCH #2					●	●			●				●																25
26 4X-12SR SWITCH #3					●	●			●					●															26
27 4X-12SR SWITCH #4					●	●			●						●														27
28 4X-12SR SWITCH #5					●	●			●							●													28
29 4X-12SR SWITCH #6					●	●			●								●												29
30 4X-12SR SWITCH #7					●	●			●									●											30
31 4X-12SR SWITCH #8					●	●			●										●										31
32 4X-12SR SWITCH #9					●	●			●											●									32
33 4X-12SR SWITCH #10					●	●			●												●								33
34 4X-12SR SWITCH #11					●	●			●													●							34
35 4X-12SR SWITCH #12					●	●			●														●						35
36 4X-12SR SWITCH #13					●	●			●															●					36
37 4X-12SR SWITCH #14					●	●			●																	●			
38 4X-12SR SWITCH #15					●	●			●																		●		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970

SIGNATURE DATE

NO	DATE	CLASS REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
3	05/24/16	–	AS BUILT	DP	AG	WC	–	–
2	05/09/16	–	FCR 250	DP	AG	WC	–	–
1	03/31/16	–	FCR 247	DP	AG	WC	–	–
0	08/10/15	–	FCR# 102355-0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

security systems · fire evacuation systems · building automation systems · energy solutions · tele data com

TRU WASTE
FACILITY PROJECT

FCP-2 (FAP)
FUNCTIONAL MATRIX

BLDG. 152,149,150,151,153,154,147 TA-63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

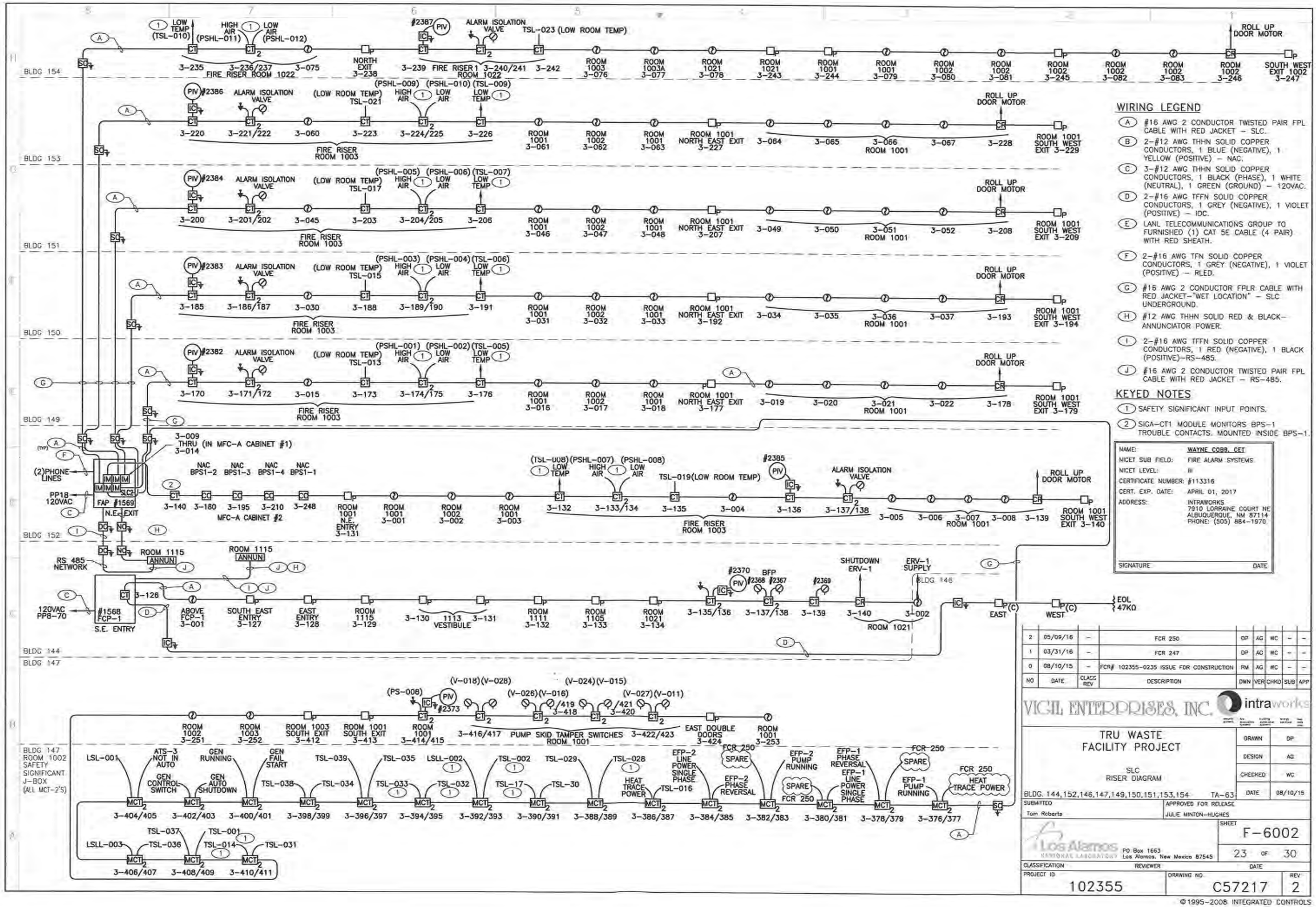
SUBMITTED: Tom Roberts
APPROVED FOR RELEASE: JULIE MINTON-HUGHES

Los Alamos NATIONAL LABORATORY P0 Box 1663 Los Alamos, New Mexico 87545

SHEET F-6001
22 OF 30

CLASSIFICATION REVIEWER DATE

PROJECT ID 102355 | DRAWING NO C57217 | REV 3



WIRING LEGEND

- (A) #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – SLC.
- (B) 2–#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLUE (NEGATIVE), 1 YELLOW (POSITIVE) – NAC.
- (C) 3–#12 AWG THHN SOLID COPPER CONDUCTORS, 1 BLACK (PHASE), 1 WHITE (NEUTRAL), 1 GREEN (GROUND) – 120VAC.
- (D) 2–#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 GREY (NEGATIVE), 1 VIOLET (POSITIVE) – IDC.
- (E) LANL TELECOMMUNICATIONS GROUP TO FURNISHED (1) CAT 5E CABLE (4 PAIR) WITH RED SHEATH.
- (F) 2–#16 AWG TFN SOLID COPPER CONDUCTORS, 1 GREY (NEGATIVE), 1 VIOLET (POSITIVE) – RLED.
- (G) #16 AWG 2 CONDUCTOR FPLR CABLE WITH RED JACKET–"WET LOCATION" – SLC UNDERGROUND.
- (H) #12 AWG THHN SOLID RED & BLACK–ANNUNCIATOR POWER.
- (I) 2–#16 AWG TFFN SOLID COPPER CONDUCTORS, 1 RED (NEGATIVE), 1 BLACK (POSITIVE)–RS–485.
- (J) #16 AWG 2 CONDUCTOR TWISTED PAIR FPL CABLE WITH RED JACKET – RS–485.

KEYED NOTES

1. SAFETY SIGNIFICANT INPUT POINTS.
2. SIGA–CT1 MODULE MONITORS BPS–1 TROUBLE CONTACTS. MOUNTED INSIDE BPS–1.

NAME:	WAYNE COBB, CET
NICET SUB FIELD:	FIRE ALARM SYSTEMS
NICET LEVEL:	III
CERTIFICATE NUMBER:	#113316
CERT. EXP. DATE:	APRIL 01, 2017
ADDRESS:	INTRAWORKS 7910 LORRAINE COURT NE ALBUQUERQUE, NM 87114 PHONE: (505) 884-1970

SIGNATURE DATE

NO	DATE	CLAGG REV	DESCRIPTION	DWN	VER	CHKD	SUB	APP
2	05/09/16	–	FCR 250	DP	AG	WC	–	–
1	03/31/16	–	FCR 247	DP	AG	WC	–	–
0	08/10/15	–	FCR# 102355–0235 ISSUE FOR CONSTRUCTION	RM	AG	WC	–	–

VIGIL ENTERPRISES, INC. intraworks

TRU WASTE FACILITY PROJECT

SLC RISER DIAGRAM

BLDG. 144,152,146,147,149,150,151,153,154 TA–63

DRAWN	DP
DESIGN	AG
CHECKED	WC
DATE	08/10/15

SUBMITTED: Tom Roberts
APPROVED FOR RELEASE: JULIE MINTON–HUGHES

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET F–6002
23 OF 30

CLASSIFICATION REVIEWER DATE

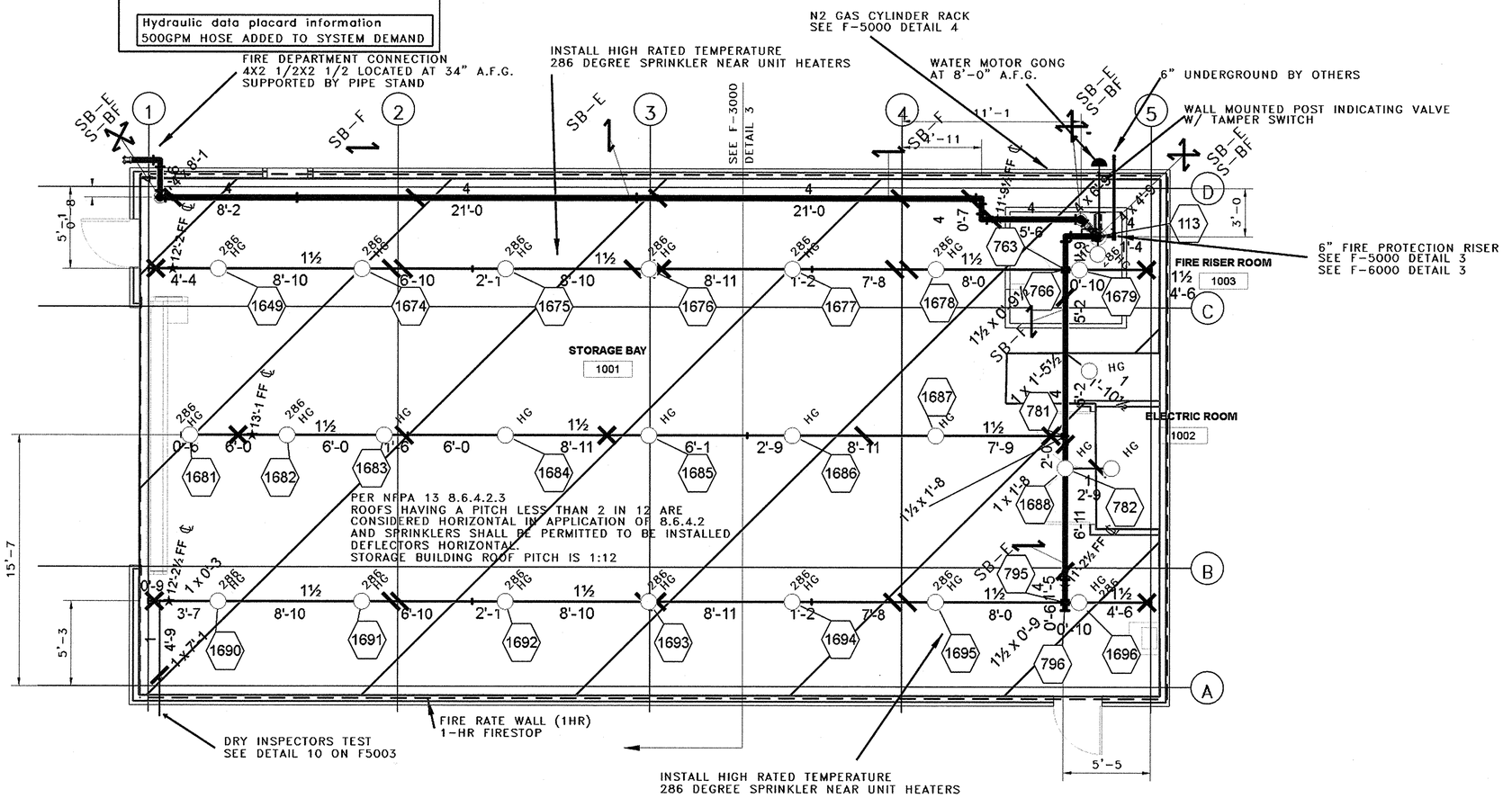
PROJECT ID 102355
DRAWING NO C57217
REV 2

ALL CALCULATIONS MUST PROVIDE A
10PSI SAFETY FACTOR.

HYDRAULIC – SYSTEM	
Location	LANL TRU WASTE FACILITY PROJECT DRY SYSTEM UTILITY BUILDING 149
No. of Sprinklers Flowing	22
Basis of Design	
1. DENSITY	.20 GPM/SQ.FT.
2. DESIGNED AREA OF DISCHARGE	1950 SQ.FT.
System Demand	
1. GPM DISCHARGE	1003GPM
2. RESIDUAL PRESSURE BASE OF THE RISER	53PSI
SAFETY FACTOR	18PSI

Hydraulic data placard information
500GPM HOSE ADDED TO SYSTEM DEMAND

REMOTE AREA INCREASE BY 30% FOR
DRY PIPE SYSTEM PER NFPA 13-11.2.3.2.5.



FIRE PROTECTION SPRINKLER PLAN BUILDING 149

TOTAL AREA PROTECTED BY SPRINKLER SYSTEM=2,019 SQ.FT.
TOTAL SPRINKLERS PER SYSTEM=25
FOR SPRINKLER SYSTEM P&ID SEE SHEET F-6000

0 2' 4' 8'
1/4"=1'-0"

DRY PIPE SYSTEM NOTES

VOLUME = 41 GALLONS
- ALL MAINS SLOPE 1/4" = 10' ON DRY SYSTEM ONLY.
- ALL BRANCH LINES SLOPE 1/2" = 10' ON DRY SYSTEM ONLY.
- ALL MAINS SLOPE BACK TO RISER U.O.N..
- ALL BRANCH LINES SLOPE BACK TO MAIN U.O.N..
- INSPECTORS TEST MUST BE LOCATED AT REMOTE HEAD.
- ALL PIPE TO BE GALVANIZED SCHEDULE 40 WITH GALVANIZED FITTINGS.
- MAXIMUM SPRINKLER SPACING CANNOT EXCEED 100 SQUARE FEET.

W.S.F.P.
NEW MEXICO
LICENSE No. 027496
NICET LEVEL IV
BRAD VOKES
Western States
Fire Protection Co.
Protecting Lives and Property
100103 NICET No.
06/09/2015 REVIEW DATE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
7	11/15/16	U	UC	AS CONSTRUCTED WITH CHANGES	BV	BV	RS	TR	MP
6	07/25/16			FCR432	BV	BV	RS	TR	MP
5	07/19/16			FCR424	BV	BV	RS	TR	MP
4	07/18/16			FCR417	BV	BV	RS	TR	MP
3	02/26/16			FCR322	BV	BV	RS	TR	MP
2	12/30/15			FCR204-R1	BV	BV	RS	TR	MP
1	10/05/15			FCR204	BV	BV	RS	TR	MP

Western States Fire Protection Co. — Protecting Lives and Property — a subsidiary of Ajax Group, Inc.

VIGIL ENTERPRISES, INC.

TRU WASTE FACILITY PROJECT
BLDG 63-0144 THROUGH 63-0154
FIRE SPRINKLER PROTECTION

FIRE SPRINKLER FLOOR PLAN
STORAGE BUILDING 149

DRAWN	B. VOKES
DESIGN	B. VOKES
CHECKED	R. SAUCEDO
DATE	8/6/15

SUBMITTED
TOM ROBERTS

APPROVED FOR RELEASE
MIKE POPE

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET F-1003
07 OF 23

CLASSIFICATION | REVIEWER | DATE

PROJECT ID 102355 | DRAWING NO C57218 | REV 7

ALL CALCULATIONS MUST PROVIDE A
10PSI SAFETY FACTOR.

HYDRAULIC – SYSTEM

Location

LANL TRU WASTE FACILITY PROJECT
DRY SYSTEM
UTILITY BUILDING 154

No. of Sprinklers Flowing	27
Basis of Design	
1. DENSITY	.20 GPM/SQ.FT.
2. DESIGNED AREA OF DISCHARGE	1950 SQ.FT.
System Demand	
1. GPM DISCHARGE	1065GPM
2. RESIDUAL PRESSURE	43PSI
SAFETY FACTOR	26PSI

Hydraulic data placard information
500 GPM ADDED TO SYSTEM DEMAND

REMOTE AREA INCREASE BY 30% FOR
DRY PIPE SYSTEM PER NFPA 13-11.2.3.2.5.

INSTALL HIGH RATED TEMPERATURE
286 DEGREE SPRINKLER NEAR UNIT HEATERS

DRY INSPECTORS TEST
SEE DETAIL 10 ON F5003

SEE F-3000 DETAIL 3

4'-0½

ELECTRICAL
1021

M.S. ROOM
1001

STORAGE BAY
1002

PPE DONNING AREA
1001A

T.E. ROOM
1003

FIRE RISER ROOM
1022

PER NFPA 13 8.6.4.2.3
ROOFS HAVING A PITCH LESS THAN 2 IN 12 ARE
CONSIDERED HORIZONTAL IN APPLICATION OF 8.6.4.2
AND SPRINKLERS SHALL BE PERMITTED TO BE INSTALLED
DEFLECTORS HORIZONTAL.
STORAGE BUILDING ROOF PITCH IS 1:12

6" FIRE PROTECTION RISER
SEE F-5000 DETAIL 3
SEE F-6000 DETAIL 3

DRUM DRIP
LOW POINT DRAIN

FIRE RATE WALL (1HR)
1-HR FIRESTOP

FIRE DEPARTMENT CONNECTION
4X2 1/2X2 1/2 LOCATED AT 34" A.F.G.

INSTALL HIGH RATED TEMPERATURE
286 DEGREE SPRINKLER NEAR UNIT HEATERS

N2 GAS CYLINDER RACK
SEE F-5000 DETAIL 4
6" UNDERGROUND BY OTHERS

WATER MOTOR GONG
AT 8'-0" A.F.G.

WALL MOUNTED POST INDICATING VALVE
W/ TAMPER SWITCH

FIRE PROTECTION SPRINKLER PLAN BUILDING 154

TOTAL AREA PROTECTED BY SPRINKLER SYSTEM=2,526 SQ.FT.
TOTAL SPRINKLERS PER SYSTEM=33
FOR SPRINKLER SYSTEM P&ID SEE SHEET F-6000

0 2' 4' 8'
1/4"=1'-0"

DRY PIPE SYSTEM NOTES

VOLUME = 54 GALLONS
- ALL MAINS SLOPE 1/4" = 10' ON DRY SYSTEM ONLY.
- ALL BRANCH LINES SLOPE 1/2" = 10' ON DRY SYSTEM ONLY.
- ALL MAINS SLOPE BACK TO RISER U.O.N..
- ALL BRANCH LINES SLOPE BACK TO MAIN U.O.N..
- INSPECTORS TEST MUST BE LOCATED AT REMOTE HEAD.
- ALL PIPE TO BE GALVANIZED SCHEDULE 40 WITH GALVANIZED FITTINGS.
- MAXIMUM SPRINKLER SPACING CANNOT EXCEED 100 SQUARE FEET.

W.S.F.P.
NEW MEXICO
LICENSE No. 027496
NICET LEVEL IV
BRAD VOKES
Western States Fire Protection Co.
Protecting Lives and Property
100103 NICET No.
09/09/2015 REVIEW DATE

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
7	11/15/16	U	cc	AS CONSTRUCTED WITH CHANGES	BV	BV	RS	TR	MP
6	07/25/16			FCR432	BV	BV	RS	TR	MP
5	07/19/16			FCR424	BV	BV	RS	TR	MP
4	07/18/16			FCR417	BV	BV	RS	TR	MP
3	02/26/16			FCR322	BV	BV	RS	TR	MP
2	12/30/15			FCR204-R1	BV	BV	RS	TR	MP
1	10/05/15			FCR204	BV	BV	RS	TR	MP

Western States Fire Protection Co. Protecting Lives and Property
VIGIL ENTERPRISES, INC.

TRU WASTE FACILITY PROJECT
BLDG 63-0144 THROUGH 63-0154
FIRE SPRINKLER PROTECTION

FIRE SPRINKLER FLOOR PLAN
STORAGE BUILDING 154

DRAWN	B. VOKES
DESIGN	B. VOKES
CHECKED	R. SAUCEDO
DATE	8/6/15

SUBMITTED
TOM ROBERTS

APPROVED FOR RELEASE
MIKE POPE

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET F-1008
12 OF 23

CLASSIFICATION | REVIEWER | DATE

PROJECT ID 102355 | DRAWING NO C57218 | REV 7

Hydraulic Calculation 14055020-FP-C-001

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ENGINEERING CALCULATIONS

Checking Parameters

	Check Parameter	Y	N	Remarks
1	A new calculation has a unique number; a revised calculation has the next revision number.	X		
2	The objective is clearly stated	X		
3	Any limitations of the calculation are documented.	X		
4	The acceptance criteria are valid and appropriate	X		
5	The analytical methods are valid and appropriate	X		
6	Any computer code used meets the requirements of QIP 3.2	X		
7	The assumptions are reasonable, adequately justified, and appropriately conservative	X		
8	The input values accurately reflect the design and operation that no transcription errors have occurred.	X		
9	The appropriate and conservative input value was selected (especially when an input value may legitimately vary within a range).	X		
10	The reference documents for input values are appropriate	X		
11	The calculation employs the stated methodology.	X		
12	The calculation uses the documented input values and assumptions	X		
13	All formulae, input values, and assumptions, used in the calculation are documented in the corresponding sections.	X		
14	The numerical results of hand calculations are accurate by checking each line and performing each mathematical computation.	X		
15	The numerical results of spreadsheet calculations are accurate by verifying that the input values and computational formulas are correct**.***	X		
16	The macros created with commercial off-the-shelf software are properly written and produce correct results.	X		
17	The numerical results of computer-generated calculations are reasonable, the computer program is applicable and valid, the computer inputs are correct.	X		
18	The results correspond to the objective of the calculation.	X		
19	The results are correctly evaluated against the acceptance criteria	X		
20	The calculation is complete from start to finish, that no gaps are present.	X		
21	The summary and conclusions are accurate	X		

* **Note:** If formula is repeated across multiple spreadsheet cells, the Checker should verify that one cell has the correct formula and spot check the same formula was copied to the other cells.
*** Note:** If the spreadsheet is an approved standard spreadsheet, then it must comply with the requirements of QIP 3.2

a) Alternate Calculation: Checker checks the calculations for attributes as described under the Detailed Review above, except that it is not necessary to check the calculation line by line for numerical accuracy.

1. Checker prepares a new calculation called the "Alternate Calculation" that applies another appropriate method to achieve the same or similar result to gauge the reasonableness and accuracy of the original calculation.

Signature	Date

VIGIL ENTERPRISES, INC.

CALCULATION COVER SHEET

Client: LANL Project: LANL TA-63 TWF				Page 1 of
Calc. Title: Fire Sprinkler Hydraulic Calculations Calc. Number 14055020-FP-CAL-001 Task No.:NA Discipline: FIRE SPRINKLER				QA Class: *(refer to EWP)* Design Verification Req'd: ☒ Yes ☐ No Alternate Method Calculation Used: ☐ Yes ☒ No
Approvals – *Signature/Date*				Assumption(s) Require Confirmation ☐ Yes ☒ No
Preparer	Checker	Design Verifier	Rev. or New Calc. No.	
BRAD VOKES	RUDY SAUCEDO	N/A	REV 2	
DISTRIBUTION				
Senior Project Manager QA Files				

TABLE OF CONTENTS

Objective

1. Analyze flow and pressure requirements of the sprinkler systems for Buildings 144, 147, 149, 150, 151, 152, 153 and 154 to ensure compliance with the authority having jurisdiction, national codes and standards.

Assumptions

1. The sprinkler head layout is based on coordinated design.

Method

1. Layout fire protection piping systems on CAD based engineering equipment. Includes Buildings 144, 147, 149, 150, 151, 152, 153 and 154.
2. Run hydraulic calculations to optimize system requirements. See NFPA 13 (2010 Edition) Section 22.
3. Make decisions on the most efficient use of the sprinkler system.
4. Check compliance with national codes and standards.
5. Submit for approval to the authority having jurisdiction.
6. Verification and Validation for the MEPCAD Software was performed prior to calculations. See attached log sheet and test calculation. See attachment A.

Inputs

1. NFPA 13 (2010 Edition)
2. Fire Hydrant Flow Data was from Hydrant 17-455 at TA-63 near TRU Waste Facility and Building 65-111. Hydrant elevation is 7,201 feet. Test date was 12-11-14. Static Pressure 68 psi, Hydrant Flow was 637 gpm at a Residual Pressure of 60 psi.
3. Fire Pump (by others) rated at 1250 gpm at 52 psi. The fire pump is located in Utility Building 147.
4. Pipe lengths and fittings for piping from Hydrant 17-455 were taken from Fire Protection Site Plan.
5. LBO Drawings C55443, C55444, C55445, C55446, C55904, C55905, C55906 and C55907.

Incoming Letters

1. NA

Software

1. M.E.P.CAD Autosprink VR11, Version: VR11 11.0.30.0, Manufacturer: M.E.P.CAD, Inc. Machine ID CNU2310PVX

References

1. NFPA 13 (2010 Edition)

2. IFC, 2009 International Fire Code, International Code Council, Inc., Washington D.C.
3. M.E.P.CAD Autosprink VR11
4. LANL ESM, Engineering Standards Manual, ISD 341-2, Los Alamos National Laboratories, Los Alamos, New Mexico. Chapter 2, "Fire Protection," Section D40, ""Fire Protection," Rev. 3, 6/18/08.
5. DOE Standard-Fire Protection Design Criteria DOE-STD-1066-99
6. LANL Specification 21 1313 (Wet Pipe Sprinkler Systems)

Conclusions

1. Results are based on the hydraulic calculations provided in attachment B. They include hydraulic calculations for Buildings 144, 147, 149, 150, 151, 152, 153 and 154. The system demands for all buildings are within the capabilities of the TA-63 water supply and fire pump. All calculations included a minimum of 10 psi safety factor and a 500 gal/min hose allowance.

Attachment A

MEPCAD Verification and Validation

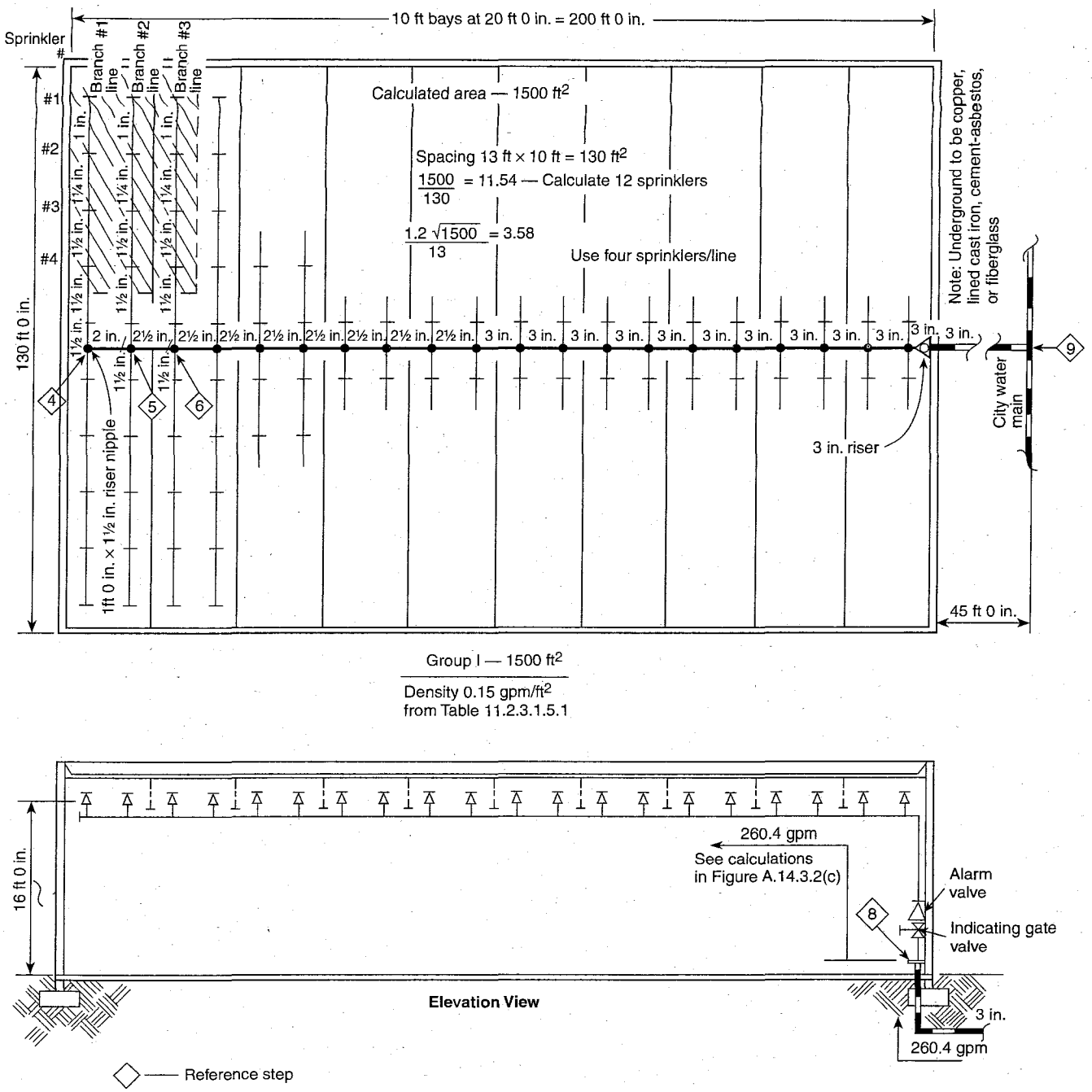


FIGURE A.14.3.2(b) Hydraulic Calculation Example (Plan View and Elevation View).

Contract Name GROUP I 1500 ft² Sheet 2 Of 3

Step No.	Nozzle Ident. and Location	Flow in gpm	Pipe Size	Pipe Fittings and Devices	Equiv. Pipe Length	Friction Loss psi Foot	Pressure Summary	Normal Pressure	D = 0.15 GPM/ ft² Notes K = 5.6	Ref. Step
1	1 BL-1	q Q 19.5	1		L 13.0 F T 13.0	C=120 0.124	P_t 12.1 P_e P_f 1.6	P_t P_v P_n	Q = 130 x 0.15 = 19.5 P = (19.5/5.6)² = 12.1 psi	
2	2	q 20.7 Q 40.2	1¼		L 13.0 F T 13.0	0.125	P_t 13.7 P_e P_f 1.6	P_t P_v P_n	q = 5.65 √13.7	
3	3	q 21.9 Q 62.1	1½		L 13.0 F T 13.0	0.131	P_t 15.3 P_e P_f 1.7	P_t P_v P_n	q = 5.65 √15.3	4
4	4 DN RN	q 23.1 Q 85.2	1½	2T-16	L 20.5 F 16.0 T 36.5	0.236	P_t 17.0 P_e 0.4 P_f 8.6	P_t P_v P_n	q = 5.65 √17 P_e = 1 x 0.433	5
5	CM TO BL-2	q Q 85.2	2		L 10.0 F T 10.0	0.07	P_t 26.0 P_e P_f 0.7	P_t P_v P_n	K = 85.2/√26 K = 16.71	
6	BL-2 CM TO BL-3	q 86.3 Q 171.5	2½		L 10.0 F T 10.0	0.107	P_t 26.7 P_e P_f 1.1	P_t P_v P_n	q = 16.71 √26.1	6
7	BL-3 CM	q 88.1 Q 259.6	2½		L 70.0 F T 70.0	0.231	P_t 27.8 P_e P_f 16.2	P_t P_v P_n	q = 16.7 √27.8	
8	CM TO FIS	q Q 259.6	3	E5 AV15 GV1	L 119.0 F 21 T140.0	0.081	P_t 44.0 P_e 6.5 P_f 11.2	P_t P_v P_n	P_e = 15 x 0.433	8
9	THROUGH UNDER-GROUND TO CITY MAIN	q Q 259.6	3	E5 GV1 T15	L 50.0 F 27.6 T 77.6	C=150 TYPE'M' 0.061	P_t 61.7 P_e P_f 4.7	P_t P_v P_n	F = F_{40} x 1.51 x F_c F_c = [2.981/3.068]^4.87 = 0.869 F = 21 x 1.51 x 0.869 F = 27.6	9
		q Q			L F T		P_t 66.4 P_e P_f	P_t P_v P_n		
		q Q			L F T		P_t P_e P_f	P_t P_v P_n		
							P_t			

FIGURE A.14.3.2(c) Hydraulic Calculations.

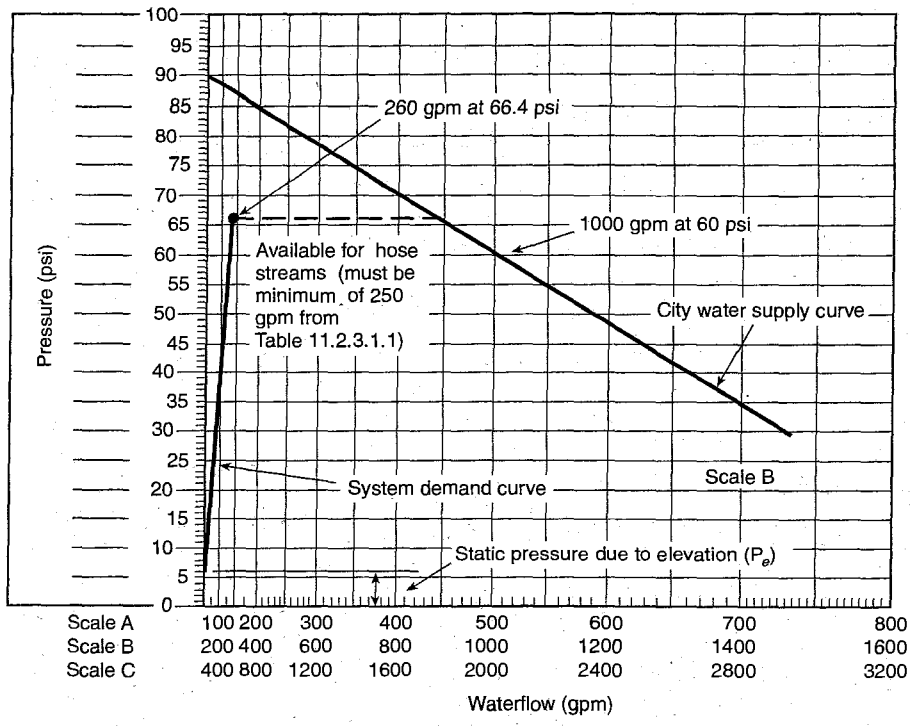


FIGURE A.14.3.2(d) Hydraulic Graph.

Hydraulic Calculations

for

Project Name: Sample Problem

Location: , ,

Drawing Name: IC0099 LANL TWF Sample Problem

Calculation Date: 8/29/2014

Design

Remote Area Number:

Occupancy Classification:	Ordinary Group I
Density:	0.150gpm/ft²
Area of Application:	1500.00ft² (Actual 1504.95ft²)
Coverage per Sprinkler:	130.00ft²
Type of sprinklers calculated:	Upright
No. of sprinklers calculated:	12

Type of System: Volume of Dry or PreAction System: N/A

In-rack Demand: N/A gpm at Node: N/A

Hose Streams: 250.0 at Node: 1 Type: Allowance at Source

Total Water Required (including Hose Streams where applicable):

From Water Supply at Node 1: 510.2 @ 67.2

Name of Contractor: WESTERN STATES FIRE PROTECTION

Address: 1615 1/2 University Blvd. NE,Albuquerque, NM 87102

Phone Number: 226-668-8168 Name of designer: BRAD VOKES

Authority Having Jurisdiction:

Notes:

Automatic peaking results Left: 58.7 Right: N/A

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group I

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler	**101**	**19.5**	**19.5**	**5.6**	**12.1**		
Sprinkler	102	20.8	19.5	5.6	13.7		
Sprinkler	103	21.9	19.5	5.6	15.4		
Sprinkler	104	23.1	19.5	5.6	17.1		
Sprinkler	105	19.8	19.5	5.6	12.5		
Sprinkler	106	21.0	19.5	5.6	14.1		
Sprinkler	107	22.3	19.5	5.6	15.8		
Sprinkler	108	23.5	19.5	5.6	17.6		
Sprinkler	109	20.2	19.5	5.6	13.0		
Sprinkler	110	21.5	19.5	5.6	14.7		
Sprinkler	111	22.7	19.5	5.6	16.5		
Sprinkler	112	23.9	19.5	5.6	18.3		

Most Demanding Sprinkler Data

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 (Foot)	K-Factor	Flow added this step (q) / Total Flow (Q)	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length (Foot)	Length (Foot) Fitting / Total	C Factor / Pf Friction Loss Per Unit (psi)	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
101	15'-10¾	5.6	19.5	1	(See Notes)	13'-0	120	12.1	• • • • • **Route 1** • • • • •
102	15'-10¾		19.5	1.0		13'-0	0.124177	1.6	Sprinkler
102	15'-10¾	5.6	20.8	1¼	(See Notes)	13'-0	120	13.7	Sprinkler
103	15'-10¾		40.3	1.4		13'-0	0.124856	1.6	
103	15'-10¾	5.6	21.9	1½	(See Notes)	13'-0	120	15.4	Sprinkler
104	15'-10¾		62.2	1.6		13'-0	0.131829	1.7	
104	15'-10¾	5.6	23.1	1½	(See Notes)	20'-6	120	17.1	Sprinkler
4	14'-10¾		85.3	1.6		16'-0 36'-6	0.236658	0.4 8.6	2T(8'-0)
4	14'-10¾			2		10'-0	120	26.1	
6	14'-10¾		85.3	2.1		10'-0	0.070090	0.7	
6	14'-10¾		86.5	2½		10'-0	120	26.8	Flow (q) from Route 2
8	14'-10¾		171.9	2.5		10'-0	0.107719	1.1	
8	14'-10¾		88.3	2½		70'-0	120	27.9	Flow (q) from Route 3
22	14'-10¾		260.2	2.5		70'-0	0.232013	16.2	
22	14'-10¾			3	(See Notes)	118'-10¾	120	44.2	
3	1'-0		260.2	3.1		30'-0 148'-10¾	0.080557	6.0 12.0	2E(7'-0), ALV(15'-0), GV(1'-0)
3	1'-0			3	(See Notes)	82'-2½	150	62.2	
1	1'-0		260.2	3.0		82'-2½	0.061329	5.0	Water Supply
			250.0					67.2	Hose Allowance At Source
1			510.2						Total(Pt) Route 1
105	15'-10¾	5.6	19.8	1	(See Notes)	13'-0	120	12.5	• • • • • **Route 2** • • • • •
106	15'-10¾		19.8	1.0		13'-0	0.127451	1.7	Sprinkler

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 (Foot)	K-Factor	Flow added this step (q) / Total Flow (Q)	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length (Foot)	Length (Foot) / Fitting (Foot) / Total (Foot)	C Factor / Pf Friction Loss Per Unit (psi)	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
106	15'-10¾	5.6	21.0	1¼	(See Notes)	13'-0	120	14.1	Sprinkler
107	15'-10¾		40.8	1.4		13'-0	0.128133	1.7	
107	15'-10¾	5.6	22.3	1½	(See Notes)	13'-0	120	15.8	Sprinkler
108	15'-10¾		63.1	1.6		13'-0	0.135275	1.8	
108	15'-10¾	5.6	23.5	1½	(See Notes)	20'-6	120	17.6	Sprinkler
6	14'-10¾		86.5	1.6		16'-0 36'-6	0.242819	0.4 8.9	2T(8'-0)
								26.8	Total(Pt) Route 2
109	15'-10¾	5.6	20.2	1	(See Notes)	13'-0	120	13.0	• • • • • **Route 3** • • • • • Sprinkler
110	15'-10¾		20.2	1.0		13'-0	0.132478	1.7	
110	15'-10¾	5.6	21.5	1¼	(See Notes)	13'-0	120	14.7	Sprinkler
111	15'-10¾		41.7	1.4		13'-0	0.133163	1.7	
111	15'-10¾	5.6	22.7	1½	(See Notes)	13'-0	120	16.5	Sprinkler
112	15'-10¾		64.4	1.6		13'-0	0.140564	1.8	
112	15'-10¾	5.6	23.9	1½	(See Notes)	20'-6	120	18.3	Sprinkler
8	14'-10¾		88.3	1.6		16'-0 36'-6	0.252274	0.4 9.2	2T(8'-0)
								27.9	Total(Pt) Route 3

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

(Actual Inside Diameter / Schedule 40 Steel Pipe Inside Diameter) 4.87 = Factor

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Fittings Legend

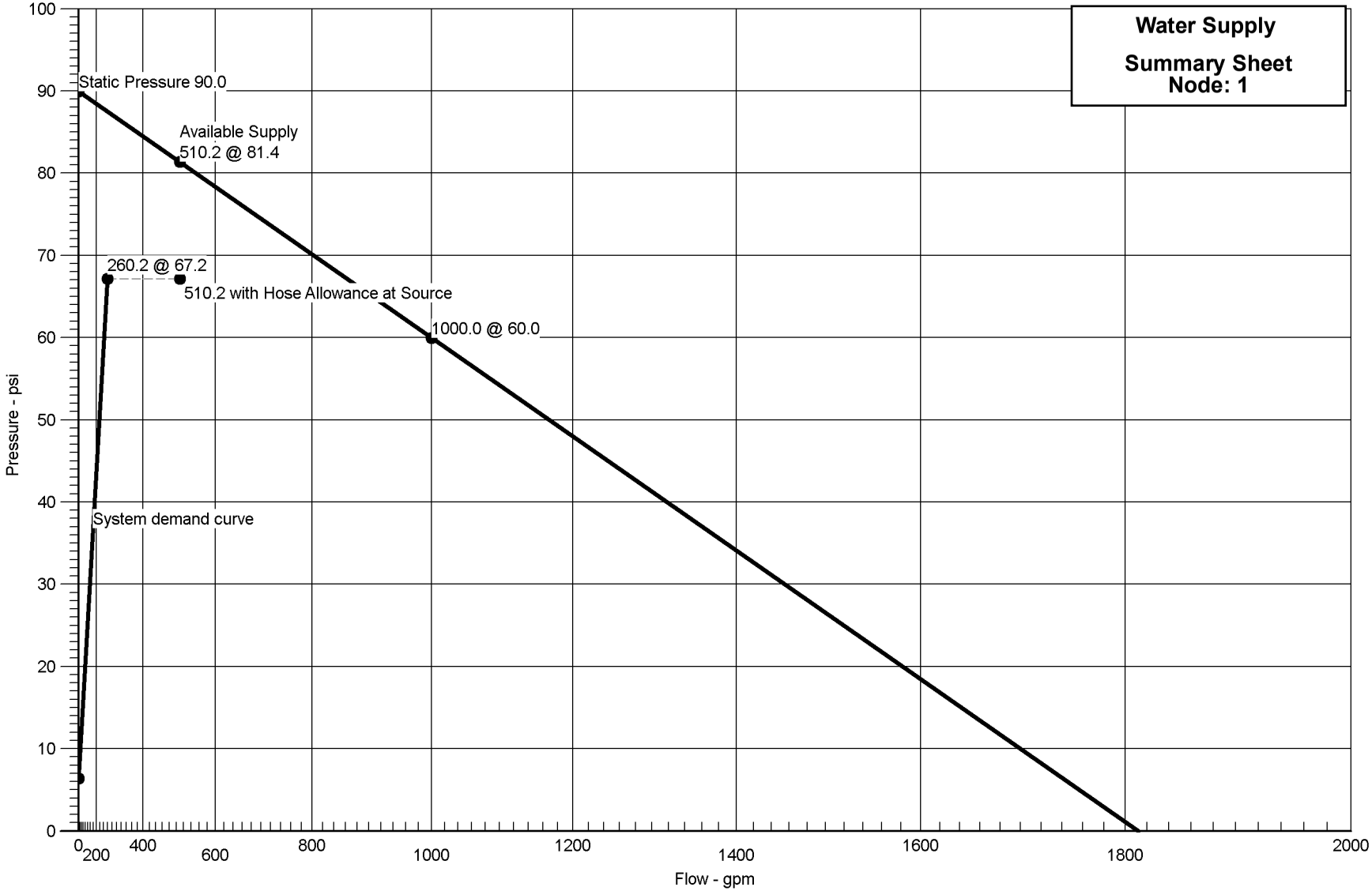
ALV	Alarm Valve	AngV	Angle Valve	b	Bushing
BalV	Ball Valve	BFP	Backflow Preventer	BV	Butterfly Valve
C	Cross Flow Turn 90°	cplg	Coupling	Cr	Cross Run
CV	Check Valve	DelV	Deluge Valve	DPV	Dry Pipe Valve
E	90° Elbow	EE	45° Elbow	Ee1	11¼° Elbow
Ee2	22½° Elbow	f	Flow Device	fd	Flex Drop
FDC	Fire Department Connection	fE	90° FireLock(TM) Elbow	fEE	45° FireLock(TM) Elbow
flg	Flange	FN	Floating Node	fT	FireLock(TM) Tee
g	Gauge	GloV	Globe Valve	GV	Gate Valve
Ho	Hose	Hose	Hose	HV	Hose Valve
Hyd	Hydrant	LtE	Long Turn Elbow	mecT	Mechanical Tee
Noz	Nozzle	P1	Pump In	P2	Pump Out
PIV	Post Indicating Valve	PO	Pipe Outlet	PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve	red	Reducer/Adapter	S	Supply
sCV	Swing Check Valve	Spr	Sprinkler	St	Strainer
T	Tee Flow Turn 90°	Tr	Tee Run	U	Union
WirF	Wirsbo	WMV	Water Meter Valve	Z	Cap

Hydraulic Graph

Job Name: Sample Problem
Remote Area Number:

$N^{1.85}$

Date: 8/29/2014



Software Verification Log

Date	Time	User	Software	Computer	Computer S/N	Result
09/02/2014	8:00am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
09/03/2014	6:00am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
10/21/2014	8:00am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
10/23/2014	10:30am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
12/23/2014	6:00am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
12/24/2014	8:00am	B. Vokes	MEPCAD VR10	HP 8760W	CNU2310PVX	OK
12/29/2014	6:30am	B. Vokes	MEPCAD VR11	HP 8760W	CNU2310PVX	OK
01/30/2015	3:15pm	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
02/02/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
06/01/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
06/08/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
06/16/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
06/18/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
06/19/2015	8:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
07/30/2015	7:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
07/31/2015	7:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
08/02/2015	11:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
08/03/2015	7:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
08/06/2015	7:00am	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK
11/15/2016	1:00pm	B. Vokes	MEPCAD VR11	HP 8760W	CNU231OPVX	OK

Attachment B

MEPCAD Hydraulic Calculations for Buildings 144, 147, 149, 150, 151, 152, 153 and 154

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 144

System

Density: 0.200gpm/ft²	Area of Application: 1500.00ft² (Actual 1523.66ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 26.00 at 21.556	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 15
System Pressure Demand: 42.159	System Flow Demand: 391.34
Total Demand: 891.34 @ 42.159	Pressure Result: +10.947 (20.6%)

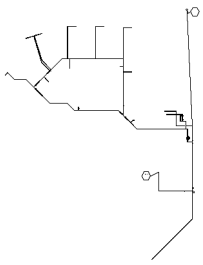
Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
2	Water Supply	637.00	500.00	68.000	60.000

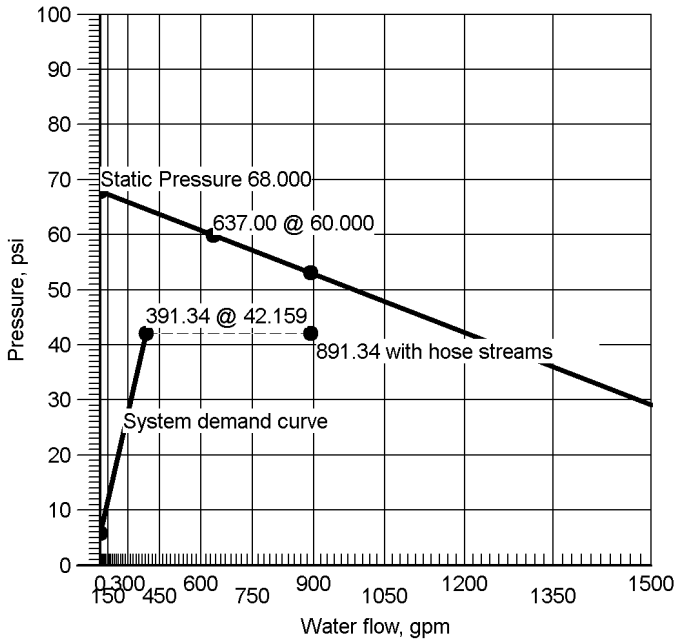
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Building 144 OPS Rev 1



Water Supply at Node 2 (637.00, 500.00, 68.000, 60.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 144
Address 3:	Drawing Name: IC0099 LANL TWF Building 144 OPS Rev 1

System

Most Demanding Sprinkler Data: 5.6 K-Factor 26.00 at 21.556

Hose Allowance At Source: 500.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
391.34	891.34

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 9.86 between nodes 197 and 278

Maximum Velocity Under Ground	
5.59 between nodes 95 and 106	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
242 Gallons	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.200gpm/ft²	1500.00ft² (Actual 1523.66ft²)

Number Of Sprinklers Calculated	Coverage Per Sprinkler
15	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

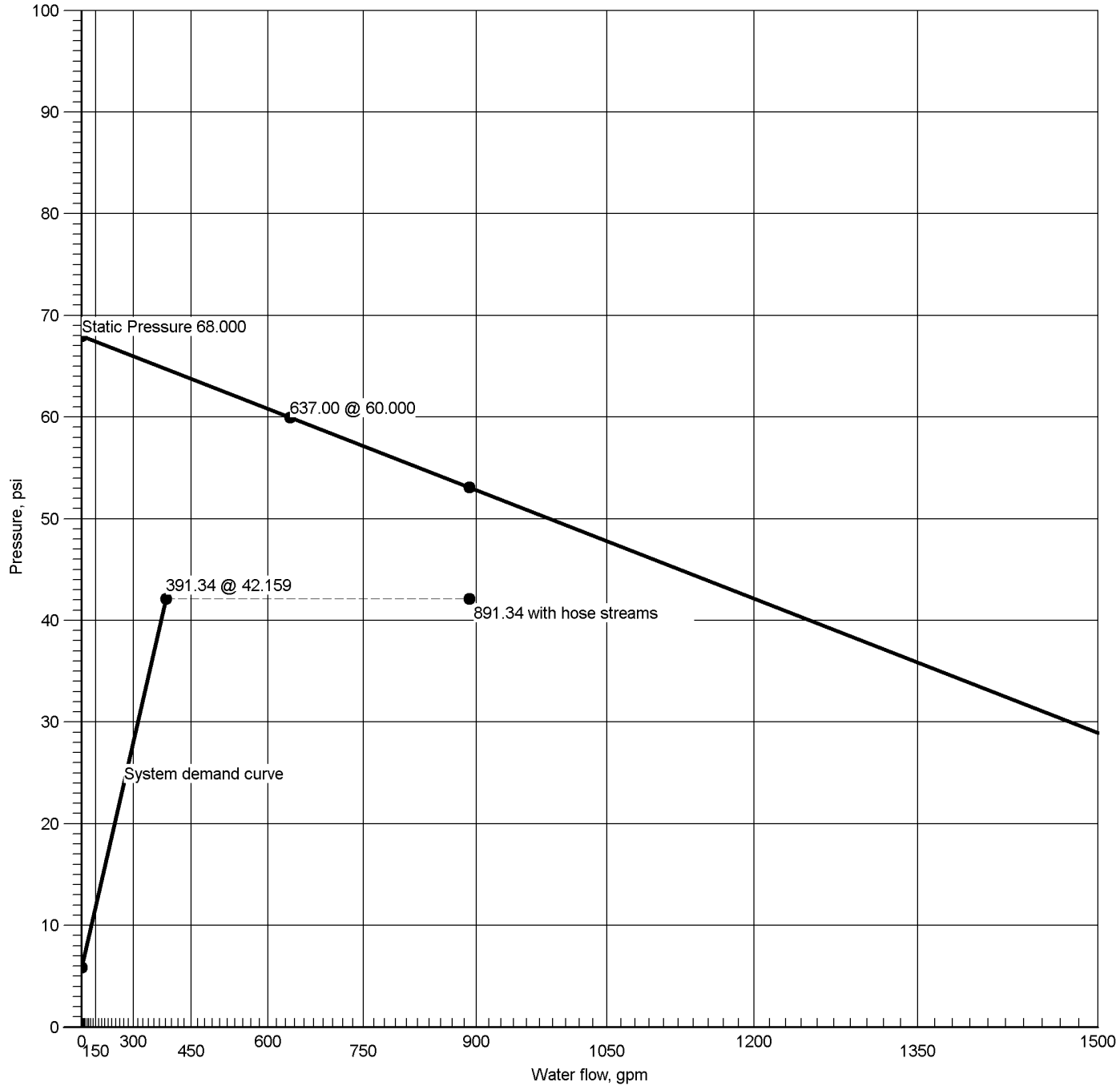
Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
2	Water Supply	500.00	68.000	60.000		637.00	53.106		891.34	42.159	10.947

Contractor

Contractor Number: IC0119		Contact Name: BRAD VOKES	Contact Title: DESIGNER
Name of Contractor: WESTERN STATES FIRE PROTECTION		Phone: 226-668-8168	Extension:
Address 1: 5200 PASADENA AVE NE, SUITE A		FAX: 505-884-1863	
Address 2:		E-mail: BRAD.VOKES@WSFP.US	
Address 3: ALBUQUERQUE, NM 87113		Web-Site:	

Water Supply at Node 2



Hydraulic Graph	Water Supply at Node 2
Static: Pressure	68.000
Residual: Pressure	60.000 @ 637.00
Available Pressure at Time of Test	53.106 @ 891.34
System Demand	42.159 @ 391.34
System Demand (Including Hose Allowance at Source)	42.159 @ 891.34

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Sprinkler 439	26.04	26.00	5.6	21.616		130.00ft²
Sprinkler 448	**26.00**	**26.00**	**5.6**	**21.556**		130.00ft²
Sprinkler 539	25.63	24.00	5.6	20.950		120.00sqft
Sprinkler 548	25.42	24.00	5.6	20.598		120.00sqft
Sprinkler 555	26.39	26.00	5.6	22.205		130.00ft²
Sprinkler 556	26.19	26.00	5.6	21.865		130.00ft²
Sprinkler 557	26.16	26.00	5.6	21.814		130.00ft²
Sprinkler 559	26.04	19.20	5.6	21.623		96.00sqft
Sprinkler 561	26.26	24.00	5.6	21.991		120.00sqft
Sprinkler 562	26.20	24.00	5.6	21.897		120.00sqft
Sprinkler 564	26.47	24.00	5.6	22.340		120.00sqft
Sprinkler 567	25.93	19.20	5.6	21.436		96.00sqft
Sprinkler 571	25.87	24.00	5.6	21.346		120.00sqft
Sprinkler 572	26.22	24.00	5.6	21.925		120.00sqft
Sprinkler 574	26.53	24.00	5.6	22.444		120.00sqft

Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
BL	1.3800	26.00	5.58	120		0.055609	5'-10½	Pf 0.827
448	9'-0½	26.00	5.6	21.556		Sprinkler,	9'-0	Pe -1.912
308	13'-5½			20.471		E(3'-0), mecT(6'-0)	14'-10½	Pv
CM	2.0670	47.71	4.56	120		0.023897	6'-11	Pf 0.165
308	13'-5½	21.71		20.471		Flow (q) from Route 6		Pe 0.000
307	13'-5½			20.636			6'-11	Pv
CM	2.0670	73.74	7.05	120		0.053486	51'-6	Pf 3.424
307	13'-5½	26.04		20.636		Flow (q) from Route 2	12'-6	Pe 0.438
295	12'-5½			24.497		fE(3'-6), mecT(9'-0)	64'-0	Pv
CM	4.0260	310.90	7.84	120		0.029803	5'-0	Pf 0.150
295	12'-5½	237.15		24.497		Flow (q) from Route 3		Pe
278	12'-5½			24.647			5'-0	Pv
CM	4.0260	391.34	9.86	120		0.045618	14'-10½	Pf 1.409
278	12'-5½	80.44		24.647		Flow (q) from Route 7	16'-0	Pe 0.000
197	12'-5½			26.055		fT(16'-0)	30'-10½	Pv
CM	6.0650	391.34	4.35	120		0.006201	14'-3½	Pf 6.659
197	12'-5½			26.055			31'-0	Pe 7.352
106	-4'-6			40.067		fE(10'-0), ALV, BFP(-6.378), E(14'-0), EE(7'-0)	45'-3½	Pv
UG	5.3490	391.34	5.59	150		0.007567	122'-2	Pf 1.216
106	-4'-6			40.067			38'-6	Pe 0.000
95	-4'-6			41.282		E(11'-5½), PIV(2'-5½), T(24'-7)	160'-8	Pv
UG	6.9780	391.34	3.28	150		0.002073	408'-4	Pf 0.866
95	-4'-6			41.282			9'-5	Pe
1	-4'-6			42.148		3PIV(3'-1½)	417'-9	Pv
UG	6.9630	391.34	3.30	150		0.002095	5'-1	Pf 0.011
1	-4'-6			42.148				Pe
2	-4'-6			42.159		Water Supply	5'-1	Pv
		500.00				Hose Allowance At Source		
2		891.34						
• • • • • Route 2 • • • • •								
BL	1.3800	26.04	5.58	120		0.055750	7'-9	Pf 0.933
439	9'-0½	26.04	5.6	21.616		Sprinkler,	9'-0	Pe -1.912
307	13'-5½			20.636		E(3'-0), mecT(6'-0)	16'-9	Pv
• • • • • Route 3 • • • • •								
BL	1.3800	26.16	5.61	120		0.056224	4'-1	Pf 0.566
557	9'-0½	26.16	5.6	21.814		Sprinkler,	6'-0	Pe -1.766
345	13'-1½			20.614		mecT(6'-0)	10'-1	Pv
CM	2.0670	27.02	2.58	120		0.008348	4'-2	Pf 0.035
345	13'-1½	0.87		20.614		Flow (q) from Route 16		Pe -0.012
361	13'-2			20.637			4'-2	Pv
CM	2.0670	22.60	2.16	120		0.006001	9'-4	Pf 0.056
361	13'-2			20.637				Pe 0.011
359	13'-1½			20.705			9'-4	Pv
CM	2.0670	48.79	4.66	120		0.024909	14'-0	Pf 0.349
359	13'-1½	26.19		20.705		Flow (q) from Route 4		Pe 0.000
357	13'-1½			21.053			14'-0	Pv
CM	2.0670	75.18	7.19	120		0.055426	33'-7	Pf 2.555
357	13'-1½	26.39		21.053		Flow (q) from Route 5	12'-6	Pe 0.292
350	12'-5½			23.900		fE(3'-6), mecT(9'-0)	46'-1	Pv
CM	4.0260	237.15	5.98	120		0.018060	19'-5½	Pf 0.597
350	12'-5½	161.97		23.900		Flow (q) from Route 8	13'-7	Pe
295	12'-5½			24.497		2fE(6'-9½)	33'-0½	Pv
• • • • • Route 4 • • • • •								
BL	1.3800	26.19	5.62	120		0.056344	3'-11½	Pf 0.562
556	9'-2	26.19	5.6	21.865		Sprinkler,	6'-0	Pe -1.722
359	13'-1½			20.705		mecT(6'-0)	9'-11½	Pv
• • • • • Route 5 • • • • •								
BL	1.3800	26.39	5.66	120		0.057156	3'-11½	Pf 0.570
555	9'-2	26.39	5.6	22.205		Sprinkler,	6'-0	Pe -1.722
357	13'-1½			21.053		mecT(6'-0)	9'-11½	Pv
• • • • • Route 6 • • • • •								
BL	1.3800	25.42	5.45	120		0.053318	10'-10	Pf 1.697
548	9'-0½	25.42	5.6	20.598		Sprinkler,	21'-0	Pe -1.912
310	13'-5½			20.382		3E(3'-0), T(6'-0), mecT(6'-0)	31'-10	Pv
CM	2.0670	21.71	2.08	120		0.005568	15'-11	Pf 0.089
310	13'-5½			20.382				Pe
308	13'-5½			20.471			15'-11	Pv
• • • • • Route 7 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.3800	25.63	5.50	120	0.054161	9'-10	Pf 1.344
539	9'-0½	25.63	5.6	20.950	Sprinkler,	15'-0	Pe -1.912
310	13'-5½			20.382	3E(3'-0), mecT(6'-0)	24'-10	Pv
CM	2.0670	29.34	2.81	120	0.009721	9'-5	Pf 0.213
310	13'-5½			20.382		12'-6	Pe 0.438
313	12'-5½			21.033	fE(3'-6), mecT(9'-0)	21'-11	Pv
CM	4.0260	80.44	2.03	120	0.002444	10'-3	Pf 0.025
313	12'-5½	51.10		21.033	Flow (q) from Route 14		Pe 0.000
269	12'-5½			21.058		10'-3	Pv
CM	4.0260	50.58	1.27	120	0.001036	8'-6½	Pf 0.018
269	12'-5½			21.058		9'-0	Pe -0.000
218	12'-5½			21.076	mecT(9'-0)	17'-6½	Pv
CM	4.0260	24.34	0.61	120	0.000268	9'-8½	Pf 0.007
218	12'-5½			21.076	mecT(9'-0)	18'-0	Pe 0.000
157	12'-5½			21.084	mecT(9'-0)	27'-8½	Pv
CM	2.0670	24.34	2.33	120	0.006880	72'-8	Pf 0.582
157	12'-5½			21.084		12'-0	Pe -0.897
42	14'-6½			20.769	fT(8'-6), fE(3'-6)	84'-8	Pv
CM	2.0670	50.58	4.84	120	0.026628	8'-6½	Pf 0.228
42	14'-6½	26.24		20.769	Flow (q) from Route 20		Pe 0.154
252	14'-2			21.151		8'-6½	Pv
CM	2.0670	80.44	7.69	120	0.062819	27'-10	Pf 2.753
252	14'-2	29.86		21.151	Flow (q) from Route 19	16'-0	Pe 0.743
278	12'-5½			24.647	2fE(3'-6), mecT(9'-0)	43'-10	Pv
• • • • • Route 8 • • • • •							
BL	1.3800	25.87	5.55	120	0.055108	4'-5½	Pf 1.239
571	8'-11½	25.87	5.6	21.346	Sprinkler,	18'-0	Pe -1.508
398	12'-5½			21.077	4E(3'-0), mecT(6'-0)	22'-5½	Pv
CM	2.0670	56.35	5.39	120	0.032519	12'-5½	Pf 0.406
398	12'-5½	30.48		21.077	Flow (q) from Route 10		Pe -0.001
397	12'-5½			21.482		12'-5½	Pv
CM	2.0670	82.88	7.92	120	0.066390	29'-5	Pf 2.351
397	12'-5½	26.53		21.482	Flow (q) from Route 13	6'-0	Pe -0.002
392	12'-5½			23.831	mecT(6'-0)	35'-5	Pv
CM	4.0260	82.88	2.09	120	0.002583	10'-0	Pf 0.026
392	12'-5½			23.831			Pe
376	12'-5½			23.857		10'-0	Pv
CM	4.0260	161.97	4.08	120	0.008921	4'-10	Pf 0.043
376	12'-5½	79.09		23.857	Flow (q) from Route 9		Pe
350	12'-5½			23.900		4'-10	Pv
• • • • • Route 9 • • • • •							
BL	1.3800	26.20	5.62	120	0.056422	3'-10½	Pf 0.558
562	8'-11½	26.20	5.6	21.897	Sprinkler,	6'-0	Pe -1.687
369	12'-10½			20.768	mecT(6'-0)	9'-10½	Pv
CM	2.0670	26.36	2.52	120	0.007976	12'-0	Pf 0.096
369	12'-10½	0.16		20.768	Flow (q) from Route 18		Pe -0.002
371	12'-10½			20.862		12'-0	Pv
CM	2.0670	52.62	5.03	120	0.028650	12'-5½	Pf 0.357
371	12'-10½	26.26		20.862	Flow (q) from Route 11		Pe -0.002
372	12'-10½			21.217		12'-5½	Pv
CM	2.0670	79.09	7.56	120	0.060881	29'-7	Pf 2.459
372	12'-10½	26.47		21.217	Flow (q) from Route 12	10'-9½	Pe 0.181
376	12'-5½			23.857	fEE(1'-9½), mecT(9'-0)	40'-4½	Pv
• • • • • Route 10 • • • • •							
BL	1.3800	26.22	5.62	120	0.056487	3'-5½	Pf 0.535
572	8'-11½	26.22	5.6	21.925	Sprinkler,	6'-0	Pe -1.507
400	12'-5½			20.953	mecT(6'-0)	9'-5½	Pv
CM	2.0670	30.48	2.91	120	0.010432	12'-0	Pf 0.125
400	12'-5½	4.26		20.953	Flow (q) from Route 17		Pe -0.001
398	12'-5½			21.077		12'-0	Pv
• • • • • Route 11 • • • • •							
BL	1.3800	26.26	5.63	120	0.056645	3'-11	Pf 0.561
561	8'-11½	26.26	5.6	21.991	Sprinkler,	6'-0	Pe -1.689
371	12'-10½			20.862	mecT(6'-0)	9'-11	Pv
• • • • • Route 12 • • • • •							
BL	1.3800	26.47	5.68	120	0.057476	3'-11	Pf 0.569
564	8'-11½	26.47	5.6	22.340	Sprinkler,	6'-0	Pe -1.691
372	12'-10½			21.217	mecT(6'-0)	9'-11	Pv
• • • • • Route 13 • • • • •							
BL	1.3800	26.53	5.69	120	0.057723	3'-6	Pf 0.547
574	8'-11½	26.53	5.6	22.444	Sprinkler,	6'-0	Pe -1.508
397	12'-5½			21.482	mecT(6'-0)	9'-6	Pv
• • • • • Route 14 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.3800	25.93	5.56	120		0.055323	10'-8	Pf 1.088
567	8'-11½	25.93	5.6	21.436		Sprinkler,	9'-0	Pe -1.511
387	12'-5½			21.014		E(3'-0), mecT(6'-0)	19'-8	Pv
CM	4.0260	25.93	0.65	120		0.000301	12'-5½	Pf 0.004
387	12'-5½			21.014				Pe -0.000
349	12'-5½			21.018			12'-5½	Pv
CM	4.0260	51.10	1.29	120		0.001056	14'-3½	Pf 0.015
349	12'-5½	25.18		21.018		Flow (q) from Route 15		Pe 0.000
313	12'-5½			21.033			14'-3½	Pv
• • • • • Route 15 • • • • •								
BL	1.3800	26.04	5.59	120		0.055769	4'-7	Pf 0.757
559	9'-0½	26.04	5.6	21.623		Sprinkler,	9'-0	Pe -1.766
346	13'-1½			20.614		E(3'-0), mecT(6'-0)	13'-7	Pv
CM	2.0670	25.18	2.41	120		0.007324	7'-5½	Pf 0.112
346	13'-1½			20.614			7'-9½	Pe 0.292
349	12'-5½			21.018		fEE(1'-9½), mecT(6'-0)	15'-3½	Pv
• • • • • Route 16 • • • • •								
CM	2.0670	0.87	0.08	120		0.000014	8'-11½	Pf 0.000
346	13'-1½			20.614				Pe
345	13'-1½			20.614			8'-11½	Pv
• • • • • Route 17 • • • • •								
CM	2.0670	4.42	0.42	120		0.000293	4'-10	Pf 0.004
361	13'-2			20.637		fT(8'-6)	8'-6	Pe 0.127
367	12'-10½			20.768			13'-4	Pv
CM	2.0670	4.26	0.41	120		0.000274	12'-4½	Pf 0.004
367	12'-10½			20.768			3'-6	Pe 0.180
400	12'-5½			20.953		fE(3'-6)	15'-10½	Pv
• • • • • Route 18 • • • • •								
CM	2.0670	0.16	0.02	120		0.000001	2'-4½	Pf 0.000
367	12'-10½			20.768		fT(8'-6)	8'-6	Pe -0.000
369	12'-10½			20.768			10'-10½	Pv
• • • • • Route 19 • • • • •								
CM	2.0670	29.86	2.85	120		0.010043	62'-2½	Pf 0.836
269	12'-5½			21.058		mecT(9'-0)	21'-0	Pe -0.743
252	14'-2			21.151		fE(3'-6), fT(8'-6)	83'-2½	Pv
• • • • • Route 20 • • • • •								
CM	2.0670	26.24	2.51	120		0.007909	62'-7	Pf 0.590
218	12'-5½			21.076			12'-0	Pe -0.897
42	14'-6½			20.769		fE(3'-6), fT(8'-6)	74'-7	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 147

System

Density: 0.200gpm/ft²	Area of Application: 610.00ft² (Actual 617.65ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 23.47 at 17.568	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 8
	System Flow Demand: 710.94
Total Demand: 710.94	

Supplies

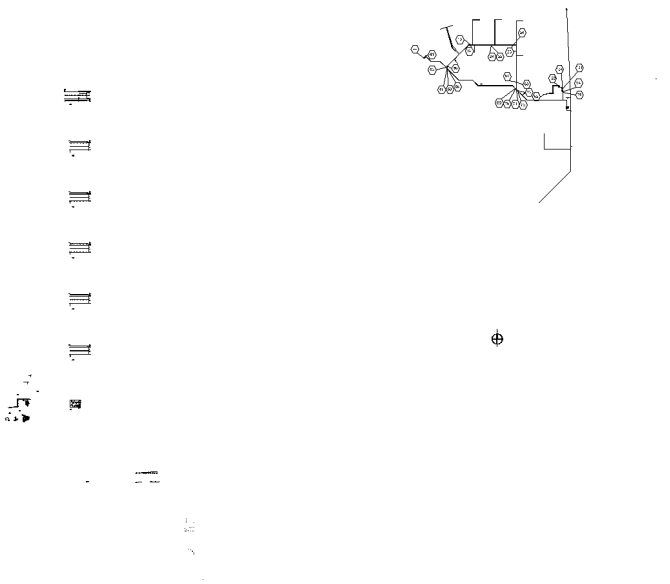
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

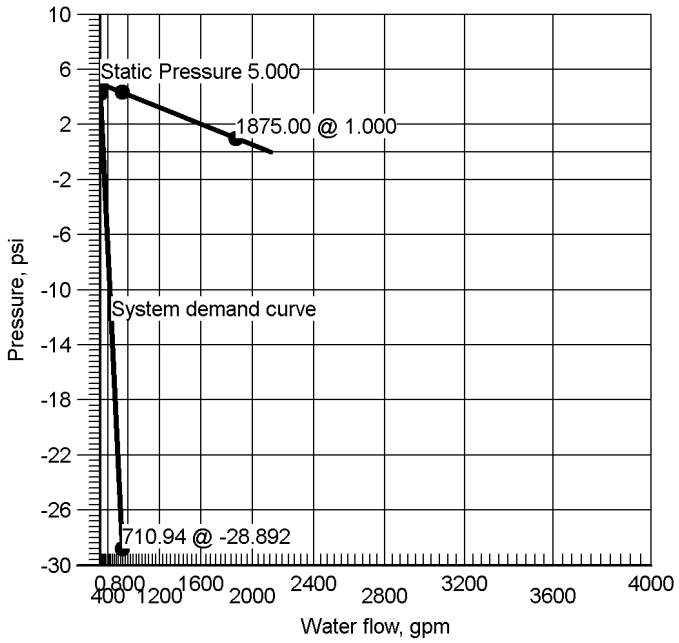
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 147
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 23.47 at 17.568

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
710.94	710.94

Maximum Velocity Above Ground: 20.17 between nodes 985 and 951

Maximum Velocity Under Ground	
7.14 between nodes 41 and 44	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
23 Gallons	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.200gpm/ft²	610.00ft² (Actual 617.65ft²)

Number Of Sprinklers Calculated	Coverage Per Sprinkler
8	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000	1875.00	4.335	710.94	0.000	33.227
131		Pump	75.000	65.000	1250.00	74.793	710.94	41.566	33.227

Pumps: Static = Churn (Pressure @ Zero Flow)

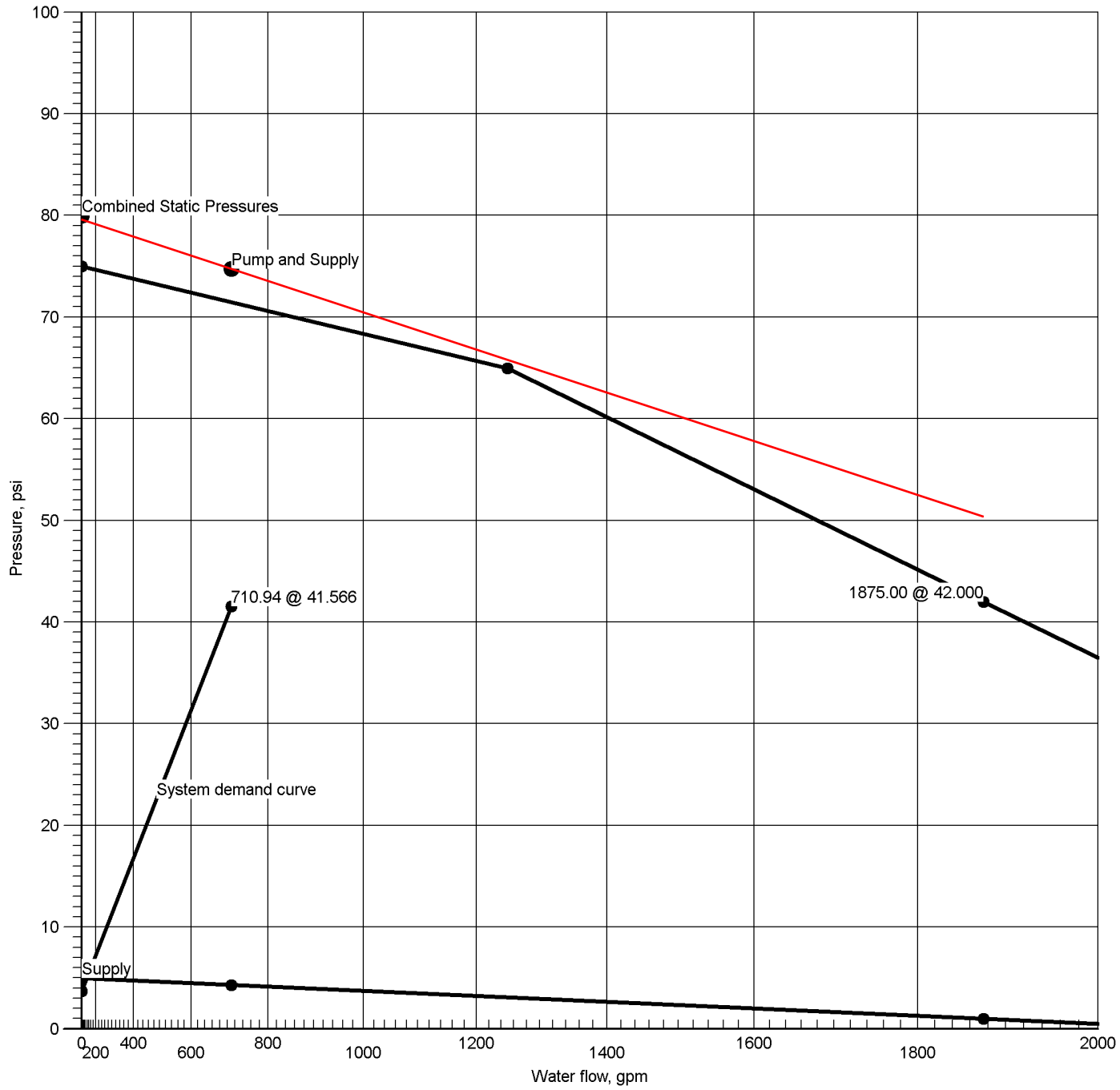
Contractor

	Contractor Number	Contact Name	Contact Title
	IC0119	BRAD VOKES	DESIGNER

Name of Contractor:	Phone	Extension
WESTERN STATES FIRE PROTECTION	226-668-8168	

Address 1	FAX
5200 PASADENA AVE NE, SUITE A	505-884-1863
Address 2:	E-mail: BRAD.VOKES@WSFP.US
Address 3: ALBUQUERQUE, NM 87113	Web-Site:

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
4.335 @ 710.94	74.793 @ 710.94	
System Demand		
41.566 @ 710.94		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	37.964		
Sprinkler	1347	25.97	20.00	5.6	21.502		100.00ft²
Sprinkler	1348	26.37	16.80	5.6	22.169		84.00sqft
Sprinkler	1349	27.15	16.80	5.6	23.500		84.00sqft
Sprinkler	1350	28.02	16.80	5.6	25.036		84.00sqft
Sprinkler	1352	25.07	16.80	5.6	20.042		84.00sqft
Sprinkler	1353	25.92	16.80	5.6	21.426		84.00sqft
Sprinkler	1354	28.98	16.80	5.6	26.775		84.00sqft
Sprinkler	**1697**	**23.47**	**23.47**	**5.6**	**17.568**		117.35sqft

⇨ Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
BL	1.0490	23.47	8.71	120		0.174982	11'-8½	Pf 4.234
1697	9'-10	23.47	5.6	17.568		Sprinkler,	12'-6	Pe -0.243
824	10'-5			21.559		2E(2'-0), PO(8'-6)	24'-2½	Pv
CM	1.6100	49.44	7.79	120		0.086188	7'-1	Pf 0.610
824	10'-5	25.97		21.559		Flow (q) from Route 2		Pe
1348	10'-5			22.169			7'-1	Pv
CM	1.6100	75.81	11.95	120		0.190051	7'-0	Pf 1.330
1348	10'-5	26.37	5.6	22.169		Sprinkler		Pe
1349	10'-5			23.500			7'-0	Pv
CM	1.6100	102.95	16.22	120		0.334809	4'-9½	Pf 3.283
1349	10'-5	27.15	5.6	23.500		Sprinkler,	5'-0	Pe 0.000
829	10'-5			26.783		mecT(5'-0)	9'-9½	Pv
CM	2.0670	130.97	12.52	120		0.154787	10'-3	Pf 1.589
829	10'-5	28.02		26.783		Flow (q) from Route 4		Pe 0.262
951	9'-9½			28.634			10'-3	Pv
CM	2.0670	210.94	20.17	120		0.373807	6'-3½	Pf 7.404
951	9'-9½	50.99		28.634		Flow (q) from Route 3	13'-6	Pe 0.092
985	9'-7			36.129		fE(3'-6), PO(10'-0)	19'-9½	Pv
CM	4.0260	210.94	5.32	120		0.014542	14'-9½	Pf 0.733
985	9'-7			36.129			35'-7	Pe 3.395
119	1'-9			40.257		ALV, PIV(2'-0), 2fE(6'-9½), f(-0.000), T(20'-0)	50'-5	Pv
UG	4.3000	210.94	4.66	120		0.010553	0'-0	Pf 0.582
119	1'-9			40.257			55'-1½	Pe 0.005
74	1'-9			40.843		T(27'-6½), C(27'-6½)	55'-1½	Pv
FM	7.9810	710.94	4.56	120		0.004915	7'-1	Pf 0.723
74	1'-9	500.00		40.843		Flow (q) from Route 6	140'-0	Pe 0.000
131	1'-9			41.566		2T(35'-0), LtE(13'-0), BV(12'-0), CV(45'-0)	147'-1	Pv
Pump			**Velocity**					
131		710.94		41.566		Rating: 65.000 @ 1250.00		
129		Q=710.94	4.56	-29.913		Churn Pressure: 75.000		
FM	7.9810	710.94	4.56	120		0.004915	6'-0	Pf 0.285
129	1'-9			-29.913			52'-0	Pe -1.409
124	5'-0			-31.037		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	710.94	2.04	120		0.000692	83'-8	Pf 0.194
124	5'-0			-31.037			197'-0	Pe 1.951
62	0'-6			-28.892		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00				Hose Allowance At Source		
62		710.94						
• • • • • Route 2 • • • • •								
CM	1.6100	25.97	4.09	120		0.026188	2'-2	Pf 0.057
1347	10'-5	25.97	5.6	21.502		Sprinkler		Pe
824	10'-5			21.559			2'-2	Pv
• • • • • Route 3 • • • • •								
BL	1.0490	25.07	9.31	120		0.197661	7'-0	Pf 1.384
1352	9'-9½	25.07	5.6	20.042		Sprinkler		Pe
1353	9'-9½			21.426			7'-0	Pv
BL	1.0490	50.99	18.93	120		0.735102	4'-9½	Pf 7.208
1353	9'-9½	25.92	5.6	21.426		Sprinkler,	5'-0	Pe 0.000
951	9'-9½			28.634		mecT(5'-0)	9'-9½	Pv
• • • • • Route 4 • • • • •								
BL	1.0490	28.02	10.40	120		0.242827	2'-2½	Pf 1.747
1350	10'-5	28.02	5.6	25.036		Sprinkler,	5'-0	Pe 0.000
829	10'-5			26.783		mecT(5'-0)	7'-2½	Pv
• • • • • Route 5 • • • • •								
BL	1.0490	28.98	10.76	120		0.258391	2'-2½	Pf 1.859
1354	9'-9½	28.98	5.6	26.775		Sprinkler,	5'-0	Pe 0.000
951	9'-9½			28.634		mecT(5'-0)	7'-2½	Pv
• • • • • Route 6 • • • • •								
UG	5.3480	500.00	7.14	150		0.011917	14'-8	Pf 1.081
44	2'-6	500.00		37.964		Hydrant,	76'-0	Pe 3.035
41	-4'-6			42.079		E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150		0.003296	73'-5	Pf 0.301
41	-4'-6			42.079			18'-0	Pe
52	-4'-6			42.381		2EE(9'-0)	91'-5	Pv
UG	6.9630	289.40	2.44	150		0.001199	4'-11	Pf 0.011
52	-4'-6			42.381			4'-0	Pe
53	-4'-6			42.391		PIV(4'-0)	8'-11	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	6.4700	289.40	2.82	120		0.002590	1'-0	Pf 0.003
53	-4'-6			42.391				Pe
54	-4'-6			42.394			1'-0	Pv
UG	6.9630	289.40	2.44	150		0.001199	223'-3	Pf 0.316
54	-4'-6			42.394			40'-0	Pe
69	-4'-6			42.709		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	289.40	2.82	120		0.002590	1'-0	Pf 0.003
69	-4'-6			42.709				Pe
70	-4'-6			42.712			1'-0	Pv
UG	6.9630	289.40	2.44	150		0.001199	3'-11	Pf 0.005
70	-4'-6			42.712				Pe
71	-4'-6			42.717			3'-11	Pv
UG	6.9630	500.00	4.21	150		0.003296	4'-9½	Pf 0.029
71	-4'-6	210.60		42.717		Flow (q) from Route 7	4'-0	Pe
72	-4'-6			42.746		PIV(4'-0)	8'-9½	Pv
UG	6.4700	500.00	4.88	120		0.007123	1'-0	Pf 0.007
72	-4'-6			42.746				Pe
73	-4'-6			42.753			1'-0	Pv
UG	6.9630	500.00	4.21	150		0.003296	165'-8	Pf 0.751
73	-4'-6			42.753			62'-0	Pe 0.000
75	-4'-6			43.503		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	500.00	3.21	120		0.002563	6'-3	Pf 0.049
75	-4'-6			43.503			13'-0	Pe -2.710
74	1'-9			40.843		LtE(13'-0)	19'-3	Pv
• • • • • Route 7 • • • • •								
UG	6.9630	210.60	1.77	150		0.000666	63'-0	Pf 0.045
24	-4'-6			42.526			4'-0	Pe
25	-4'-6			42.571		PIV(4'-0)	67'-0	Pv
UG	6.4700	210.60	2.06	120		0.001439	1'-0	Pf 0.001
25	-4'-6			42.571				Pe
26	-4'-6			42.572			1'-0	Pv
UG	6.9630	210.60	1.77	150		0.000666	119'-6	Pf 0.106
26	-4'-6			42.572			39'-0	Pe
61	-4'-6			42.678		T(35'-0), PIV(4'-0)	158'-6	Pv
UG	6.4700	210.60	2.06	120		0.001439	1'-0	Pf 0.001
61	-4'-6			42.678				Pe
63	-4'-6			42.679			1'-0	Pv
UG	6.9630	210.60	1.77	150		0.000666	21'-6	Pf 0.038
63	-4'-6			42.679			35'-0	Pe
71	-4'-6			42.717		T(35'-0)	56'-6	Pv
• • • • • Route 8 • • • • •								
UG	6.4700	210.60	2.06	120		0.001439	1'-0	Pf 0.001
51	-4'-6			42.410				Pe
50	-4'-6			42.411			1'-0	Pv
UG	6.9630	210.60	1.77	150		0.000666	94'-5½	Pf 0.072
50	-4'-6			42.411			13'-0	Pe
18	-4'-6			42.483		EE(9'-0), PIV(4'-0)	107'-5½	Pv
UG	6.4700	210.60	2.06	120		0.001439	1'-0	Pf 0.001
18	-4'-6			42.483				Pe
19	-4'-6			42.484			1'-0	Pv
UG	6.9630	210.60	1.77	150		0.000666	57'-0	Pf 0.041
19	-4'-6			42.484			4'-0	Pe
22	-4'-6			42.525		PIV(4'-0)	61'-0	Pv
UG	6.4700	210.60	2.06	120		0.001439	1'-0	Pf 0.001
22	-4'-6			42.525				Pe
24	-4'-6			42.526			1'-0	Pv
• • • • • Route 9 • • • • •								
UG	6.9630	210.60	1.77	150		0.000666	4'-8	Pf 0.029
52	-4'-6			42.381		T(35'-0)	39'-0	Pe
51	-4'-6			42.410		PIV(4'-0)	43'-8	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 149

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1966.05ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 22
	System Flow Demand: 1003.20
Total Demand: 1003.20	

Supplies

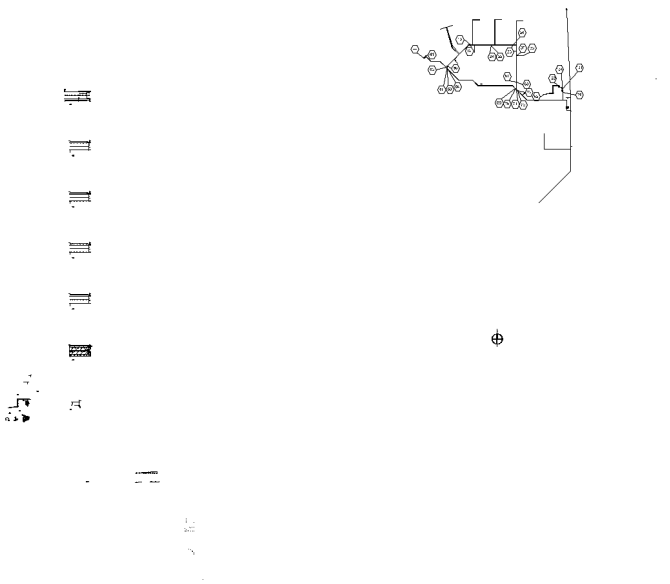
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

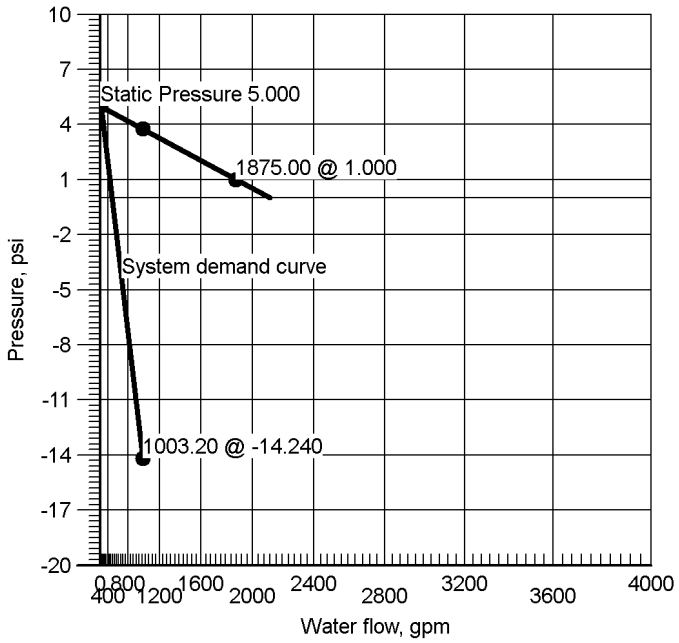
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 149
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1003.20	1003.20

Maximum Velocity Above Ground: 25.69 between nodes 766 and 763

Maximum Velocity Under Ground: 9.79 between nodes 73 and 72

Volume capacity of Wet Pipes:

Volume capacity of Dry Pipes: 41 Gallons

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	
Density	**Area of Application**
0.200gpm/ft²	1950.00ft² (Actual 1966.05ft²)
Number Of Sprinklers Calculated	**Coverage Per Sprinkler**
22	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

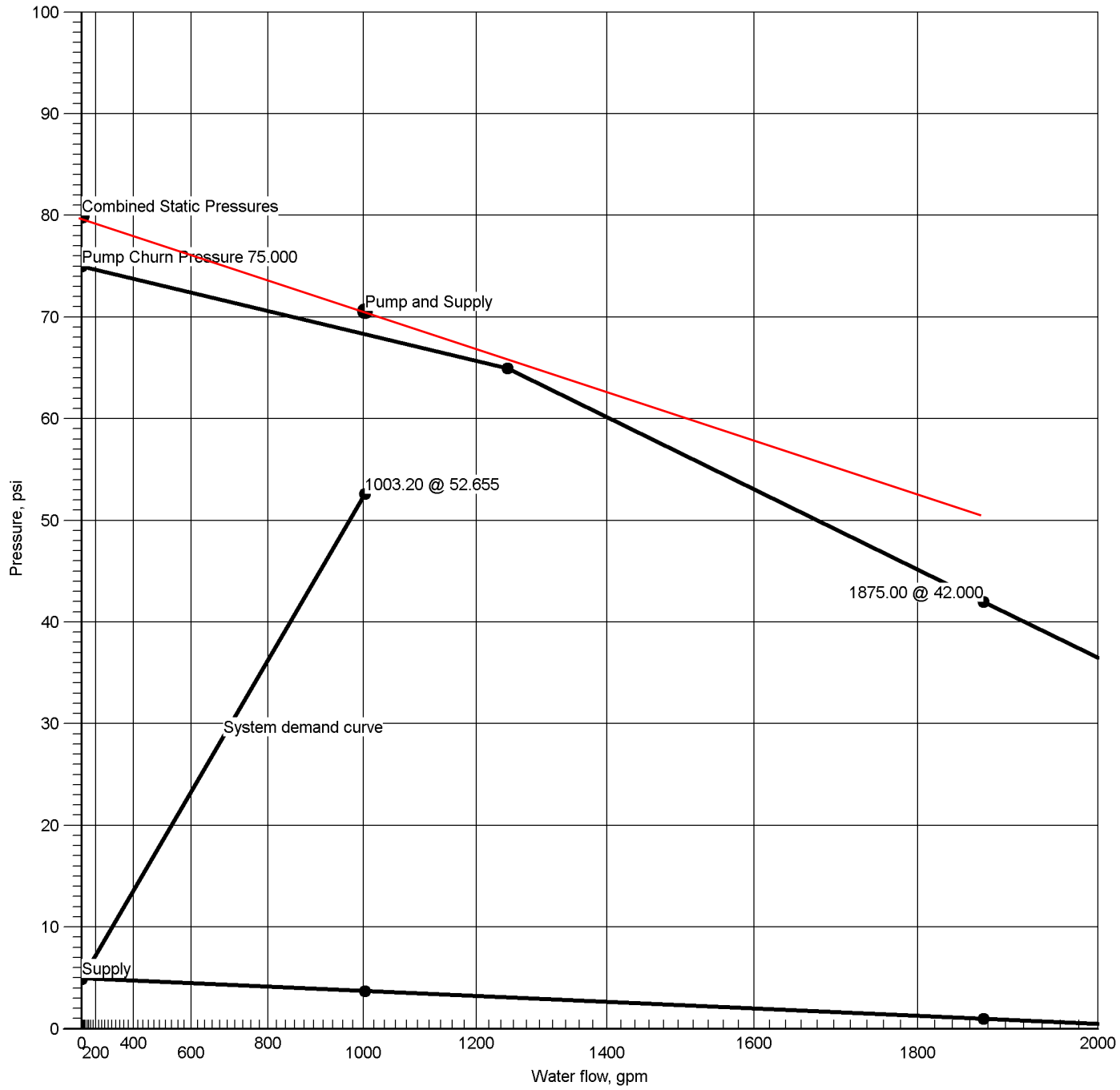
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000	1875.00	3.742	1003.20	0.000	17.982
131		Pump	75.000	65.000	1250.00	70.637	1003.20	52.655	17.982

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

Contractor Number: IC0119		Contact Name: BRAD VOKES	Contact Title: DESIGNER
Name of Contractor: WESTERN STATES FIRE PROTECTION		Phone: 226-668-8168	Extension:
Address 1: 5200 PASADENA AVE NE, SUITE A		FAX: 505-884-1863	
Address 2:		E-mail: BRAD.VOKES@WSFP.US	
Address 3: ALBUQUERQUE, NM 87113		Web-Site:	

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.742 @ 1003.20	70.637 @ 1003.20	
System Demand		
52.655 @ 1003.20		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	45.887		
Sprinkler	1649	19.72	18.43	5.6	12.403		92.15sqft²
Sprinkler	1674	19.89	18.43	5.6	12.614		92.15sqft²
Sprinkler	1675	20.45	18.43	5.6	13.341		92.15sqft²
Sprinkler	1676	21.61	18.43	5.6	14.893		92.15sqft²
Sprinkler	1677	23.51	18.43	5.6	17.622		92.15sqft²
Sprinkler	1678	26.25	18.43	5.6	21.970		92.15sqft²
Sprinkler	1679	31.56	18.43	5.6	31.752		92.15sqft²
Sprinkler	1681	17.96	14.82	5.6	10.291		74.10sqft
Sprinkler	1682	18.07	14.82	5.6	10.414		74.10sqft
Sprinkler	**1683**	**18.43**	**18.43**	**5.6**	**10.829**		92.15sqft²
Sprinkler	1684	19.34	18.43	5.6	11.926		92.15sqft²
Sprinkler	1685	21.10	18.43	5.6	14.192		92.15sqft²
Sprinkler	1686	23.62	18.43	5.6	17.789		92.15sqft²
Sprinkler	1687	26.98	18.43	5.6	23.208		92.15sqft²
Sprinkler	1688	33.14	14.82	5.6	35.016		74.10sqft
Sprinkler	1690	19.55	18.43	5.6	12.184		92.15sqft²
Sprinkler	1691	19.71	18.43	5.6	12.393		92.15sqft²
Sprinkler	1692	20.27	18.43	5.6	13.108		92.15sqft²
Sprinkler	1693	21.42	18.43	5.6	14.635		92.15sqft²
Sprinkler	1694	23.31	18.43	5.6	17.320		92.15sqft²
Sprinkler	1695	26.03	18.43	5.6	21.598		92.15sqft²
Sprinkler	1696	31.29	18.43	5.6	31.224		92.15sqft²

Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	1.6100	54.46	8.58	100		0.144442	7'-6	Pf 1.083
1683	13'-0½	18.43	5.6	10.829		Sprinkler		Pe 0.014
1684	13'-0			11.926			7'-6	Pv
CM	1.6100	73.80	11.63	100		0.253413	8'-10½	Pf 2.249
1684	13'-0	19.34	5.6	11.926		Sprinkler		Pe 0.017
1685	12'-11½			14.192			8'-10½	Pv
CM	1.6100	94.90	14.96	100		0.403486	8'-10½	Pf 3.581
1685	12'-11½	21.10	5.6	14.192		Sprinkler		Pe 0.017
1686	12'-11			17.789			8'-10½	Pv
CM	1.6100	118.52	18.68	100		0.608692	8'-10½	Pf 5.402
1686	12'-11	23.62	5.6	17.789		Sprinkler		Pe 0.017
1687	12'-10½			23.208			8'-10½	Pv
CM	1.6100	145.50	22.93	100		0.889550	9'-8	Pf 14.316
1687	12'-10½	26.98	5.6	23.208		Sprinkler,	6'-5	Pe 0.733
781	11'-2½			38.258		LtE(1'-5), mecT(5'-0)	16'-1	Pv
CM	4.0260	340.22	8.57	100		0.049334	10'-4	Pf 0.510
781	11'-2½	194.72		38.258		Flow (q) from Route 2		Pe 0.008
766	11'-2			38.776			10'-4	Pv
CM	4.0260	503.20	12.68	100		0.101772	9'-9	Pf 3.722
766	11'-2	162.99		38.776		Flow (q) from Route 3	26'-9½	Pe 4.217
113	1'-5½			46.715		2fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	36'-7	Pv
UG	6.4000	503.20	5.02	120		0.007599	6'-5½	Pf 0.464
113	1'-5½			46.715			54'-7	Pe 2.576
39	-4'-6			49.755		3E(18'-2½)	61'-0	Pv
UG	5.3480	503.20	7.19	150		0.012059	19'-0	Pf 0.591
39	-4'-6			49.755			30'-0	Pe
37	-4'-6			50.346		T(30'-0)	49'-0	Pv
UG	6.9630	585.44	4.93	150		0.004414	77'-11	Pf 0.361
37	-4'-6	82.23		50.346		Flow (q) from Route 9	4'-0	Pe -0.000
61	-4'-6			50.707		PIV(4'-0)	81'-11	Pv
UG	6.4700	585.44	5.71	120		0.009536	1'-0	Pf 0.010
61	-4'-6			50.707				Pe
63	-4'-6			50.717			1'-0	Pv
UG	6.9630	585.44	4.93	150		0.004414	21'-6	Pf 0.249
63	-4'-6			50.717			35'-0	Pe
71	-4'-6			50.966		T(35'-0)	56'-6	Pv
UG	6.9630	1003.20	8.45	150		0.011954	4'-9½	Pf 0.105
71	-4'-6	417.77		50.966		Flow (q) from Route 8	4'-0	Pe
72	-4'-6			51.071		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1003.20	9.79	120		0.025830	1'-0	Pf 0.026
72	-4'-6			51.071				Pe
73	-4'-6			51.097			1'-0	Pv
UG	6.9630	1003.20	8.45	150		0.011954	165'-8	Pf 2.722
73	-4'-6			51.097			62'-0	Pe 0.000
75	-4'-6			53.819		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1003.20	6.43	120		0.009294	13'-4	Pf 1.546
75	-4'-6			53.819			153'-0	Pe -2.710
131	1'-9			52.655		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1003.20		52.655		Rating: 65.000 @ 1250.00		
129		Q=1003.20	6.43	-15.688		Churn Pressure: 75.000		
FM	7.9810	1003.20	6.43	120		0.009294	6'-0	Pf 0.539
129	1'-9			-15.688			52'-0	Pe -1.409
124	5'-0			-16.558		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	1003.20	2.88	120		0.001308	83'-8	Pf 0.367
124	5'-0			-16.558			197'-0	Pe 1.951
62	0'-6			-14.240		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00				Hose Allowance At Source		
62		1003.20						
• • • • • Route 2 • • • • •								
CM	1.6100	19.55	3.08	100		0.021697	8'-10½	Pf 0.193
1690	12'-2	19.55	5.6	12.184		Sprinkler		Pe 0.016
1691	12'-2			12.393			8'-10½	Pv
CM	1.6100	39.26	6.19	100		0.078836	8'-10½	Pf 0.700
1691	12'-2	19.71	5.6	12.393		Sprinkler		Pe 0.016
1692	12'-1½			13.108			8'-10½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	1.6100	59.54	9.38	100	0.170308	8'-10½	Pf 1.511
1692	12'-1½	20.27	5.6	13.108	Sprinkler		Pe 0.016
1693	12'-1			14.635		8'-10½	Pv
CM	1.6100	80.96	12.76	100	0.300738	8'-10½	Pf 2.669
1693	12'-1	21.42	5.6	14.635	Sprinkler		Pe 0.016
1694	12'-0½			17.320		8'-10½	Pv
CM	1.6100	104.26	16.43	100	0.480232	8'-10½	Pf 4.262
1694	12'-0½	23.31	5.6	17.320	Sprinkler		Pe 0.016
1695	12'-0			21.598		8'-10½	Pv
CM	1.6100	130.29	20.53	100	0.725238	8'-0	Pf 9.951
1695	12'-0	26.03	5.6	21.598	Sprinkler,	5'-8½	Pe 0.014
796	11'-11½			31.562	T(5'-8½)	13'-8½	Pv
CM	1.6100	161.58	25.46	100	1.079996	0'-9	Pf 6.217
796	11'-11½	31.29		31.562	Flow (q) from Route 5	5'-0	Pe 0.332
795	11'-2½			38.111	mecT(5'-0)	5'-9	Pv
CM	4.0260	161.58	4.07	100	0.012443	8'-4	Pf 0.104
795	11'-2½			38.111			Pe 0.006
782	11'-2½			38.221		8'-4	Pv
CM	4.0260	194.72	4.91	100	0.017572	2'-0	Pf 0.035
782	11'-2½	33.14		38.221	Flow (q) from Route 7		Pe 0.002
781	11'-2½			38.258		2'-0	Pv
• • • • • Route 3 • • • • •							
CM	1.6100	19.72	3.11	100	0.022057	8'-10½	Pf 0.196
1649	12'-2	19.72	5.6	12.403	Sprinkler		Pe 0.016
1674	12'-1½			12.614		8'-10½	Pv
CM	1.6100	39.61	6.24	100	0.080141	8'-10½	Pf 0.711
1674	12'-1½	19.89	5.6	12.614	Sprinkler		Pe 0.016
1675	12'-1			13.341		8'-10½	Pv
CM	1.6100	60.07	9.47	100	0.173120	8'-10½	Pf 1.536
1675	12'-1	20.45	5.6	13.341	Sprinkler		Pe 0.016
1676	12'-0½			14.893		8'-10½	Pv
CM	1.6100	81.68	12.87	100	0.305687	8'-10½	Pf 2.713
1676	12'-0½	21.61	5.6	14.893	Sprinkler		Pe 0.016
1677	12'-0½			17.622		8'-10½	Pv
CM	1.6100	105.18	16.58	100	0.488098	8'-10½	Pf 4.332
1677	12'-0½	23.51	5.6	17.622	Sprinkler		Pe 0.016
1678	12'-0			21.970		8'-10½	Pv
CM	1.6100	131.43	20.71	100	0.737051	8'-0	Pf 10.113
1678	12'-0	26.25	5.6	21.970	Sprinkler,	5'-8½	Pe 0.014
763	11'-11½			32.096	T(5'-8½)	13'-8½	Pv
CM	1.6100	162.99	25.69	100	1.097452	0'-9½	Pf 6.339
763	11'-11½	31.56		32.096	Flow (q) from Route 6	5'-0	Pe 0.340
766	11'-2			38.776	mecT(5'-0)	5'-9½	Pv
• • • • • Route 4 • • • • •							
CM	1.6100	17.96	2.83	100	0.018560	6'-0	Pf 0.111
1681	13'-1	17.96	5.6	10.291	Sprinkler		Pe 0.011
1682	13'-0½			10.414		6'-0	Pv
CM	1.6100	36.04	5.68	100	0.067275	6'-0	Pf 0.404
1682	13'-0½	18.07	5.6	10.414	Sprinkler		Pe 0.011
1683	13'-0½			10.829		6'-0	Pv
• • • • • Route 5 • • • • •							
CM	1.6100	31.29	4.93	100	0.051814	0'-10½	Pf 0.340
1696	11'-11½	31.29	5.6	31.224	Sprinkler,	5'-8½	Pe -0.002
796	11'-11½			31.562	T(5'-8½)	6'-7	Pv
• • • • • Route 6 • • • • •							
CM	1.6100	31.56	4.97	100	0.052625	0'-10½	Pf 0.345
1679	11'-11½	31.56	5.6	31.752	Sprinkler,	5'-8½	Pe -0.002
763	11'-11½			32.096	T(5'-8½)	6'-7	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	33.14	12.30	100	0.464044	1'-8½	Pf 2.456
1688	12'-11	33.14	5.6	35.016	Sprinkler,	3'-7	Pe 0.749
782	11'-2½			38.221	mecT(3'-7)	5'-3½	Pv
• • • • • Route 8 • • • • •							
UG	5.3480	500.00	7.14	150	0.011917	14'-8	Pf 1.081
44	2'-6	500.00		45.887	Hydrant,	76'-0	Pe 3.035
41	-4'-6			50.002	E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150	0.003296	73'-5	Pf 0.301
41	-4'-6			50.002		18'-0	Pe
52	-4'-6			50.303	2EE(9'-0)	91'-5	Pv
UG	6.9630	417.77	3.52	150	0.002364	4'-11	Pf 0.021
52	-4'-6			50.303		4'-0	Pe
53	-4'-6			50.324	PIV(4'-0)	8'-11	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	6.4700	417.77	4.08	120		0.005108	1'-0	Pf 0.005
53	-4'-6			50.324				Pe
54	-4'-6			50.329			1'-0	Pv
UG	6.9630	417.77	3.52	150		0.002364	223'-3	Pf 0.622
54	-4'-6			50.329			40'-0	Pe
69	-4'-6			50.952		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	417.77	4.08	120		0.005108	1'-0	Pf 0.005
69	-4'-6			50.952				Pe
70	-4'-6			50.957			1'-0	Pv
UG	6.9630	417.77	3.52	150		0.002364	3'-11	Pf 0.009
70	-4'-6			50.957				Pe
71	-4'-6			50.966			3'-11	Pv
• • • • • Route 9 • • • • •								
UG	6.9630	82.23	0.69	150		0.000117	63'-0	Pf 0.008
24	-4'-6			50.329			4'-0	Pe
25	-4'-6			50.337		PIV(4'-0)	67'-0	Pv
UG	6.4700	82.23	0.80	120		0.000253	1'-0	Pf 0.000
25	-4'-6			50.337				Pe
26	-4'-6			50.337			1'-0	Pv
UG	6.9630	82.23	0.69	150		0.000117	41'-7	Pf 0.009
26	-4'-6			50.337			35'-0	Pe 0.000
37	-4'-6			50.346		T(35'-0)	76'-7	Pv
• • • • • Route 10 • • • • •								
UG	6.4700	82.23	0.80	120		0.000253	1'-0	Pf 0.000
51	-4'-6			50.308				Pe
50	-4'-6			50.309			1'-0	Pv
UG	6.9630	82.23	0.69	150		0.000117	94'-5½	Pf 0.013
50	-4'-6			50.309			13'-0	Pe
18	-4'-6			50.321		EE(9'-0), PIV(4'-0)	107'-5½	Pv
UG	6.4700	82.23	0.80	120		0.000253	1'-0	Pf 0.000
18	-4'-6			50.321				Pe
19	-4'-6			50.321			1'-0	Pv
UG	6.9630	82.23	0.69	150		0.000117	57'-0	Pf 0.007
19	-4'-6			50.321			4'-0	Pe
22	-4'-6			50.329		PIV(4'-0)	61'-0	Pv
UG	6.4700	82.23	0.80	120		0.000253	1'-0	Pf 0.000
22	-4'-6			50.329				Pe
24	-4'-6			50.329			1'-0	Pv
• • • • • Route 11 • • • • •								
UG	6.9630	82.23	0.69	150		0.000117	4'-8	Pf 0.005
52	-4'-6			50.303		T(35'-0)	39'-0	Pe
51	-4'-6			50.308		PIV(4'-0)	43'-8	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 150

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1966.05ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 22
	System Flow Demand: 1003.20
Total Demand: 1003.20	

Supplies

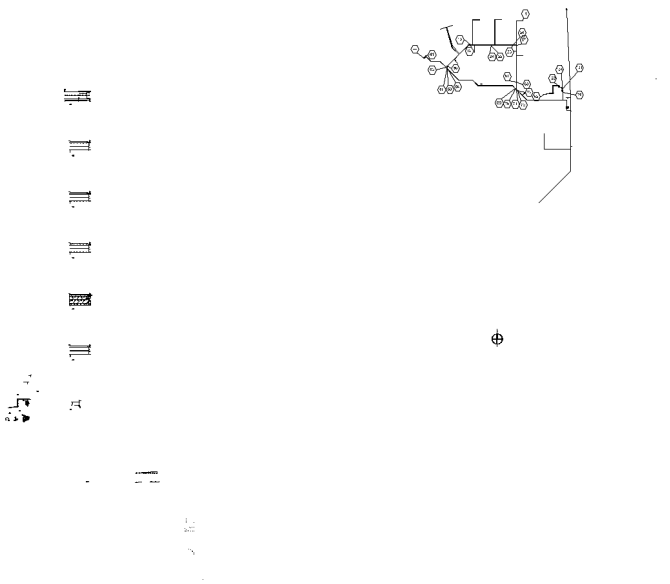
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

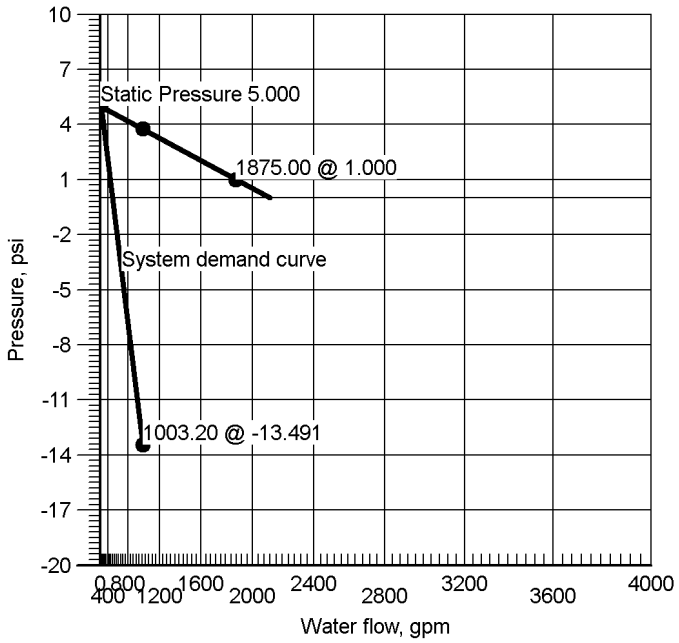
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 150
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1003.20	1003.20

Maximum Velocity Above Ground: 25.69 between nodes 647 and 644

Maximum Velocity Under Ground: 9.79 between nodes 73 and 72

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
	41 Gallons

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	
Density	**Area of Application**
0.200gpm/ft²	1950.00ft² (Actual 1966.05ft²)
Number Of Sprinklers Calculated	**Coverage Per Sprinkler**
22	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

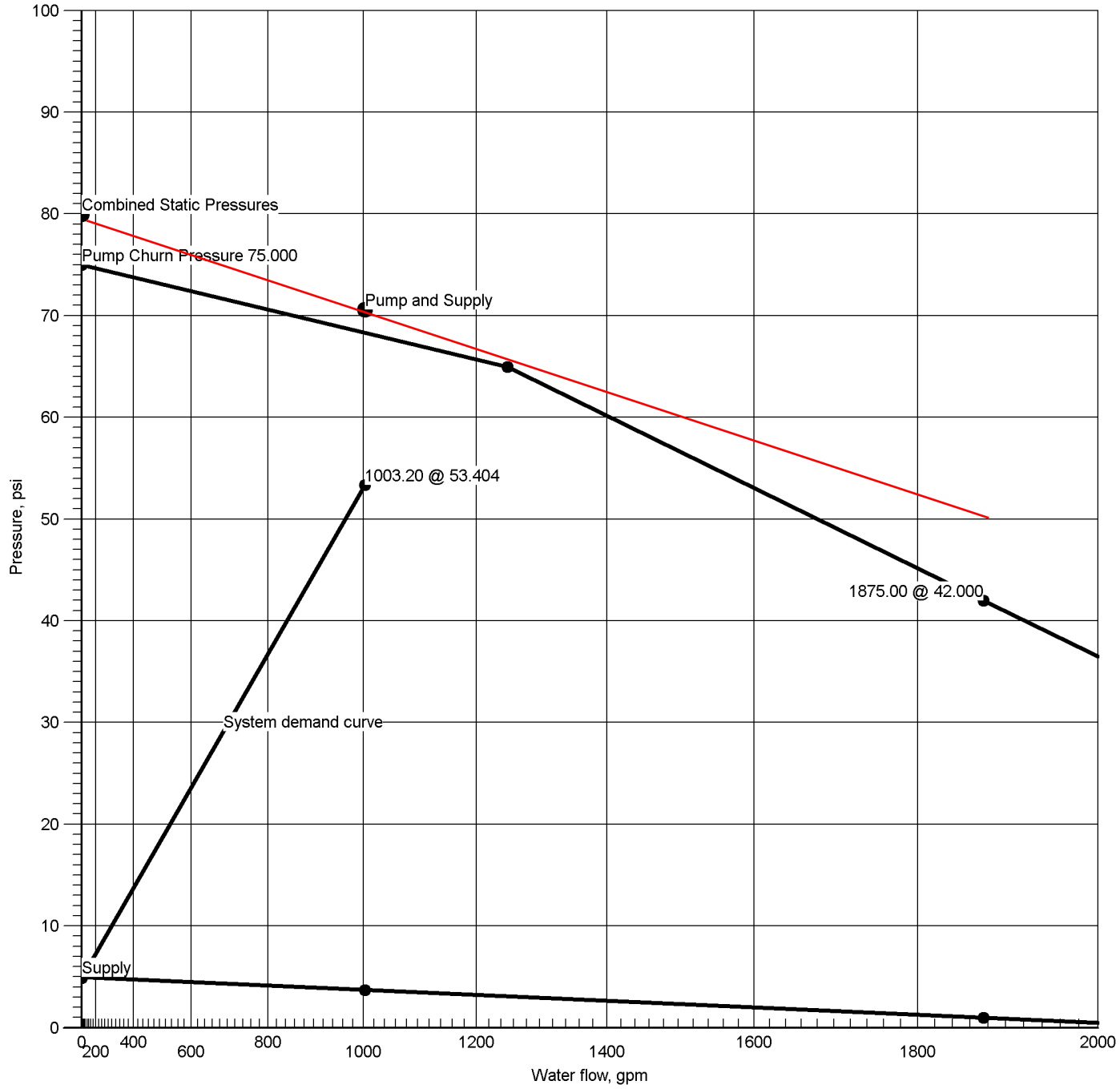
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000		1875.00	3.742		1003.20	0.000	17.233
131		Pump	75.000	65.000		1250.00	70.637		1003.20	53.404	17.233

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number: IC0119	Contact Name: BRAD VOKES	Contact Title: DESIGNER
Name of Contractor: WESTERN STATES FIRE PROTECTION		Phone: 226-668-8168	Extension:
Address 1: 5200 PASADENA AVE NE, SUITE A		FAX: 505-884-1863	
Address 2:		E-mail: BRAD.VOKES@WSFP.US	
Address 3: ALBUQUERQUE, NM 87113		Web-Site:	

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.742 @ 1003.20	70.637 @ 1003.20	
System Demand		
53.404 @ 1003.20		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	46.571		
Sprinkler	1583	19.72	18.43	5.6	12.403		92.15sqft²
Sprinkler	1584	19.89	18.43	5.6	12.614		92.15sqft²
Sprinkler	1585	20.45	18.43	5.6	13.341		92.15sqft²
Sprinkler	1586	21.61	18.43	5.6	14.893		92.15sqft²
Sprinkler	1587	23.51	18.43	5.6	17.622		92.15sqft²
Sprinkler	1588	26.25	18.43	5.6	21.970		92.15sqft²
Sprinkler	1589	31.56	18.43	5.6	31.752		92.15sqft²
Sprinkler	1591	17.96	14.82	5.6	10.291		74.10sqft
Sprinkler	1592	18.07	14.82	5.6	10.414		74.10sqft
Sprinkler	**1593**	**18.43**	**18.43**	**5.6**	**10.829**		92.15sqft²
Sprinkler	1594	19.34	18.43	5.6	11.926		92.15sqft²
Sprinkler	1595	21.10	18.43	5.6	14.192		92.15sqft²
Sprinkler	1596	23.62	18.43	5.6	17.789		92.15sqft²
Sprinkler	1597	26.98	18.43	5.6	23.208		92.15sqft²
Sprinkler	1598	33.14	14.82	5.6	35.016		74.10sqft
Sprinkler	1600	19.55	18.43	5.6	12.184		92.15sqft²
Sprinkler	1601	19.71	18.43	5.6	12.393		92.15sqft²
Sprinkler	1605	20.27	18.43	5.6	13.108		92.15sqft²
Sprinkler	1606	21.42	18.43	5.6	14.635		92.15sqft²
Sprinkler	1607	23.31	18.43	5.6	17.320		92.15sqft²
Sprinkler	1608	26.03	18.43	5.6	21.598		92.15sqft²
Sprinkler	1609	31.29	18.43	5.6	31.224		92.15sqft²

Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	1.6100	54.46	8.58	100		0.144442	7'-6	Pf 1.083
1593	13'-0½	18.43	5.6	10.829		Sprinkler		Pe 0.014
1594	13'-0			11.926			7'-6	Pv
CM	1.6100	73.80	11.63	100		0.253413	8'-10½	Pf 2.249
1594	13'-0	19.34	5.6	11.926		Sprinkler		Pe 0.017
1595	12'-11½			14.192			8'-10½	Pv
CM	1.6100	94.90	14.96	100		0.403486	8'-10½	Pf 3.581
1595	12'-11½	21.10	5.6	14.192		Sprinkler		Pe 0.017
1596	12'-11			17.789			8'-10½	Pv
CM	1.6100	118.52	18.68	100		0.608692	8'-10½	Pf 5.402
1596	12'-11	23.62	5.6	17.789		Sprinkler		Pe 0.017
1597	12'-10½			23.208			8'-10½	Pv
CM	1.6100	145.50	22.93	100		0.889550	9'-8	Pf 14.316
1597	12'-10½	26.98	5.6	23.208		Sprinkler,	6'-5	Pe 0.733
661	11'-2½			38.258		LtE(1'-5), mecT(5'-0)	16'-1	Pv
CM	4.0260	340.22	8.57	100		0.049334	10'-4	Pf 0.510
661	11'-2½	194.72		38.258		Flow (q) from Route 2		Pe 0.008
647	11'-2			38.776			10'-4	Pv
CM	4.0260	503.20	12.68	100		0.101772	9'-9	Pf 3.722
647	11'-2	162.99		38.776		Flow (q) from Route 3	26'-9½	Pe 4.217
112	1'-5½			46.715		2fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	36'-7	Pv
UG	6.4000	503.20	5.02	120		0.007599	6'-5½	Pf 0.464
112	1'-5½			46.715			54'-7	Pe 2.576
11	-4'-6			49.755		3E(18'-2½)	61'-0	Pv
UG	5.3480	503.20	7.19	150		0.012059	90'-1	Pf 1.255
11	-4'-6			49.755			14'-0	Pe
27	-4'-6			51.010		E(14'-0)	104'-1	Pv
UG	6.9630	564.00	4.75	150		0.004119	108'-6	Pf 0.463
27	-4'-6	60.79		51.010		Flow (q) from Route 9	4'-0	Pe
61	-4'-6			51.473		PIV(4'-0)	112'-6	Pv
UG	6.4700	564.00	5.50	120		0.008900	1'-0	Pf 0.009
61	-4'-6			51.473				Pe
63	-4'-6			51.482			1'-0	Pv
UG	6.9630	564.00	4.75	150		0.004119	21'-6	Pf 0.233
63	-4'-6			51.482			35'-0	Pe
71	-4'-6			51.715		T(35'-0)	56'-6	Pv
UG	6.9630	1003.20	8.45	150		0.011954	4'-9½	Pf 0.105
71	-4'-6	439.21		51.715		Flow (q) from Route 8	4'-0	Pe
72	-4'-6			51.820		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1003.20	9.79	120		0.025830	1'-0	Pf 0.026
72	-4'-6			51.820				Pe
73	-4'-6			51.846			1'-0	Pv
UG	6.9630	1003.20	8.45	150		0.011954	165'-8	Pf 2.722
73	-4'-6			51.846			62'-0	Pe 0.000
75	-4'-6			54.567		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1003.20	6.43	120		0.009294	13'-4	Pf 1.546
75	-4'-6			54.567			153'-0	Pe -2.710
131	1'-9			53.404		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1003.20		53.404		Rating: 65.000 @ 1250.00		
129		Q=1003.20	6.43	-14.939		Churn Pressure: 75.000		
FM	7.9810	1003.20	6.43	120		0.009294	6'-0	Pf 0.539
129	1'-9			-14.939			52'-0	Pe -1.409
124	5'-0			-15.809		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	1003.20	2.88	120		0.001308	83'-8	Pf 0.367
124	5'-0			-15.809			197'-0	Pe 1.951
62	0'-6			-13.491		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00				Hose Allowance At Source		
62		1003.20						
• • • • • Route 2 • • • • •								
CM	1.6100	19.55	3.08	100		0.021697	8'-10½	Pf 0.193
1600	12'-2	19.55	5.6	12.184		Sprinkler		Pe 0.016
1601	12'-2			12.393			8'-10½	Pv
CM	1.6100	39.26	6.19	100		0.078836	8'-10½	Pf 0.700
1601	12'-2	19.71	5.6	12.393		Sprinkler		Pe 0.016
1605	12'-1½			13.108			8'-10½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	1.6100	59.54	9.38	100	0.170308	8'-10½	Pf 1.511
1605	12'-1½	20.27	5.6	13.108	Sprinkler		Pe 0.016
1606	12'-1			14.635		8'-10½	Pv
CM	1.6100	80.96	12.76	100	0.300738	8'-10½	Pf 2.669
1606	12'-1	21.42	5.6	14.635	Sprinkler		Pe 0.016
1607	12'-0½			17.320		8'-10½	Pv
CM	1.6100	104.26	16.43	100	0.480232	8'-10½	Pf 4.262
1607	12'-0½	23.31	5.6	17.320	Sprinkler		Pe 0.016
1608	12'-0			21.598		8'-10½	Pv
CM	1.6100	130.29	20.53	100	0.725238	8'-0	Pf 9.951
1608	12'-0	26.03	5.6	21.598	Sprinkler,	5'-8½	Pe 0.014
676	11'-11½			31.562	T(5'-8½)	13'-8½	Pv
CM	1.6100	161.58	25.46	100	1.079996	0'-9	Pf 6.217
676	11'-11½	31.29		31.562	Flow (q) from Route 5	5'-0	Pe 0.332
675	11'-2½			38.111	mecT(5'-0)	5'-9	Pv
CM	4.0260	161.58	4.07	100	0.012443	8'-4	Pf 0.104
675	11'-2½			38.111			Pe 0.006
662	11'-2½			38.221		8'-4	Pv
CM	4.0260	194.72	4.91	100	0.017572	2'-0	Pf 0.035
662	11'-2½	33.14		38.221	Flow (q) from Route 7		Pe 0.002
661	11'-2½			38.258		2'-0	Pv
• • • • • Route 3 • • • • •							
CM	1.6100	19.72	3.11	100	0.022057	8'-10½	Pf 0.196
1583	12'-2	19.72	5.6	12.403	Sprinkler		Pe 0.016
1584	12'-1½			12.614		8'-10½	Pv
CM	1.6100	39.61	6.24	100	0.080141	8'-10½	Pf 0.711
1584	12'-1½	19.89	5.6	12.614	Sprinkler		Pe 0.016
1585	12'-1			13.341		8'-10½	Pv
CM	1.6100	60.07	9.47	100	0.173120	8'-10½	Pf 1.536
1585	12'-1	20.45	5.6	13.341	Sprinkler		Pe 0.016
1586	12'-0½			14.893		8'-10½	Pv
CM	1.6100	81.68	12.87	100	0.305687	8'-10½	Pf 2.713
1586	12'-0½	21.61	5.6	14.893	Sprinkler		Pe 0.016
1587	12'-0½			17.622		8'-10½	Pv
CM	1.6100	105.18	16.58	100	0.488098	8'-10½	Pf 4.332
1587	12'-0½	23.51	5.6	17.622	Sprinkler		Pe 0.016
1588	12'-0			21.970		8'-10½	Pv
CM	1.6100	131.43	20.71	100	0.737051	8'-0	Pf 10.113
1588	12'-0	26.25	5.6	21.970	Sprinkler,	5'-8½	Pe 0.014
644	11'-11½			32.096	T(5'-8½)	13'-8½	Pv
CM	1.6100	162.99	25.69	100	1.097452	0'-9½	Pf 6.339
644	11'-11½	31.56		32.096	Flow (q) from Route 6	5'-0	Pe 0.340
647	11'-2			38.776	mecT(5'-0)	5'-9½	Pv
• • • • • Route 4 • • • • •							
CM	1.6100	17.96	2.83	100	0.018560	6'-0	Pf 0.111
1591	13'-1	17.96	5.6	10.291	Sprinkler		Pe 0.011
1592	13'-0½			10.414		6'-0	Pv
CM	1.6100	36.04	5.68	100	0.067275	6'-0	Pf 0.404
1592	13'-0½	18.07	5.6	10.414	Sprinkler		Pe 0.011
1593	13'-0½			10.829		6'-0	Pv
• • • • • Route 5 • • • • •							
CM	1.6100	31.29	4.93	100	0.051814	0'-10½	Pf 0.340
1609	11'-11½	31.29	5.6	31.224	Sprinkler,	5'-8½	Pe -0.002
676	11'-11½			31.562	T(5'-8½)	6'-7	Pv
• • • • • Route 6 • • • • •							
CM	1.6100	31.56	4.97	100	0.052625	0'-10½	Pf 0.345
1589	11'-11½	31.56	5.6	31.752	Sprinkler,	5'-8½	Pe -0.002
644	11'-11½			32.096	T(5'-8½)	6'-7	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	33.14	12.30	100	0.464044	1'-8½	Pf 2.456
1598	12'-11	33.14	5.6	35.016	Sprinkler,	3'-7	Pe 0.749
662	11'-2½			38.221	mecT(3'-7)	5'-3½	Pv
• • • • • Route 8 • • • • •							
UG	5.3480	500.00	7.14	150	0.011917	14'-8	Pf 1.081
44	2'-6	500.00		46.571	Hydrant,	76'-0	Pe 3.035
41	-4'-6			50.686	E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150	0.003296	73'-5	Pf 0.301
41	-4'-6			50.686		18'-0	Pe
52	-4'-6			50.988	2EE(9'-0)	91'-5	Pv
UG	6.9630	439.21	3.70	150	0.002594	4'-11	Pf 0.023
52	-4'-6			50.988		4'-0	Pe
53	-4'-6			51.011	PIV(4'-0)	8'-11	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	6.4700	439.21	4.29	120		0.005604	1'-0	Pf 0.006
53	-4'-6			51.011				Pe
54	-4'-6			51.016			1'-0	Pv
UG	6.9630	439.21	3.70	150		0.002594	223'-3	Pf 0.683
54	-4'-6			51.016			40'-0	Pe
69	-4'-6			51.699		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	439.21	4.29	120		0.005604	1'-0	Pf 0.006
69	-4'-6			51.699				Pe
70	-4'-6			51.705			1'-0	Pv
UG	6.9630	439.21	3.70	150		0.002594	3'-11	Pf 0.010
70	-4'-6			51.705				Pe
71	-4'-6			51.715			3'-11	Pv
• • • • • Route 9 • • • • •								
UG	6.9630	60.79	0.51	150		0.000067	63'-0	Pf 0.004
24	-4'-6			51.002			4'-0	Pe
25	-4'-6			51.007		PIV(4'-0)	67'-0	Pv
UG	6.4700	60.79	0.59	120		0.000144	1'-0	Pf 0.000
25	-4'-6			51.007				Pe
26	-4'-6			51.007			1'-0	Pv
UG	6.9630	60.79	0.51	150		0.000067	11'-0	Pf 0.003
26	-4'-6			51.007			35'-0	Pe
27	-4'-6			51.010		T(35'-0)	46'-0	Pv
• • • • • Route 10 • • • • •								
UG	6.4700	60.79	0.59	120		0.000144	1'-0	Pf 0.000
51	-4'-6			50.991				Pe
50	-4'-6			50.991			1'-0	Pv
UG	6.9630	60.79	0.51	150		0.000067	94'-5½	Pf 0.007
50	-4'-6			50.991			13'-0	Pe
18	-4'-6			50.998		EE(9'-0), PIV(4'-0)	107'-5½	Pv
UG	6.4700	60.79	0.59	120		0.000144	1'-0	Pf 0.000
18	-4'-6			50.998				Pe
19	-4'-6			50.998			1'-0	Pv
UG	6.9630	60.79	0.51	150		0.000067	57'-0	Pf 0.004
19	-4'-6			50.998			4'-0	Pe
22	-4'-6			51.002		PIV(4'-0)	61'-0	Pv
UG	6.4700	60.79	0.59	120		0.000144	1'-0	Pf 0.000
22	-4'-6			51.002				Pe
24	-4'-6			51.002			1'-0	Pv
• • • • • Route 11 • • • • •								
UG	6.9630	60.79	0.51	150		0.000067	4'-8	Pf 0.003
52	-4'-6			50.988		T(35'-0)	39'-0	Pe
51	-4'-6			50.991		PIV(4'-0)	43'-8	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 151

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1966.05ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 22
	System Flow Demand: 1003.20
Total Demand: 1003.20	

Supplies

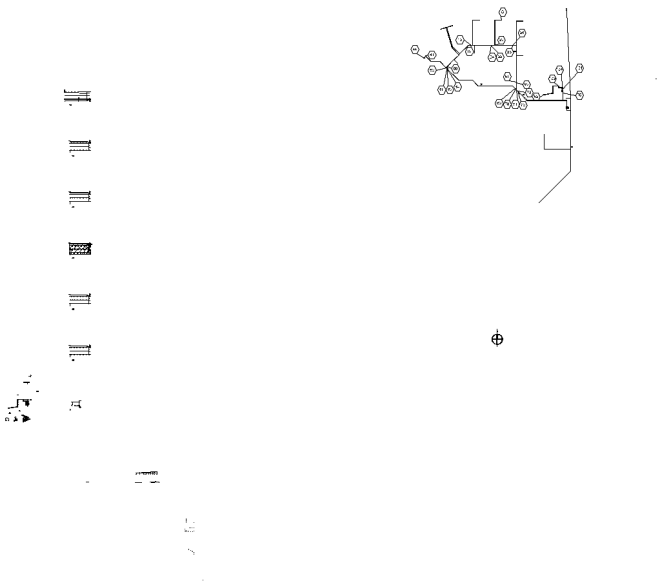
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

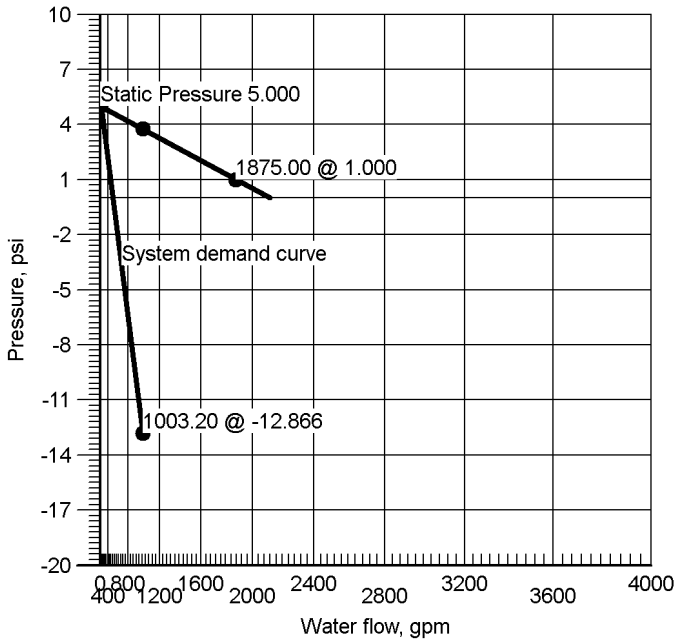
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 151
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1003.20	1003.20

Maximum Velocity Above Ground: 25.69 between nodes 544 and 541

Maximum Velocity Under Ground: 9.79 between nodes 73 and 72

Volume capacity of Wet Pipes:

Volume capacity of Dry Pipes: 41 Gallons

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	
Density	**Area of Application**
0.200gpm/ft²	1950.00ft² (Actual 1966.05ft²)
Number Of Sprinklers Calculated	**Coverage Per Sprinkler**
22	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

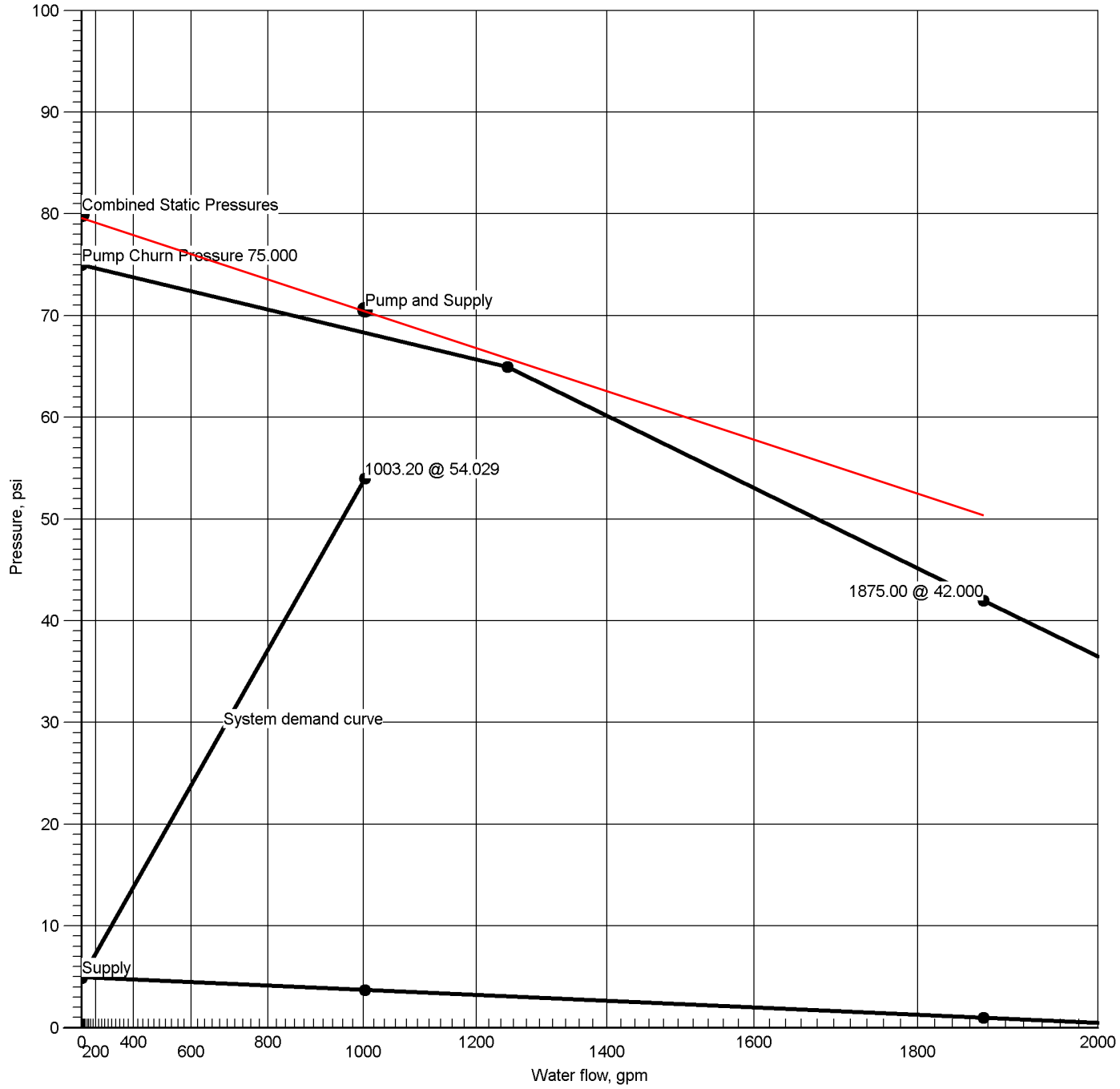
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000	1875.00	3.742	1003.20	0.000	16.608
131		Pump	75.000	65.000	1250.00	70.637	1003.20	54.029	16.608

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

Contractor Number: IC0119		Contact Name: BRAD VOKES	Contact Title: DESIGNER
Name of Contractor: WESTERN STATES FIRE PROTECTION		Phone: 226-668-8168	Extension:
Address 1: 5200 PASADENA AVE NE, SUITE A		FAX: 505-884-1863	
Address 2:		E-mail: BRAD.VOKES@WSFP.US	
Address 3: ALBUQUERQUE, NM 87113		Web-Site:	

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.742 @ 1003.20	70.637 @ 1003.20	
System Demand		
54.029 @ 1003.20		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	47.003		
Sprinkler	1558	19.72	18.43	5.6	12.403		92.15sqft²
Sprinkler	1559	19.89	18.43	5.6	12.614		92.15sqft²
Sprinkler	1560	20.45	18.43	5.6	13.341		92.15sqft²
Sprinkler	1561	21.61	18.43	5.6	14.893		92.15sqft²
Sprinkler	1562	23.51	18.43	5.6	17.622		92.15sqft²
Sprinkler	1563	26.25	18.43	5.6	21.970		92.15sqft²
Sprinkler	1564	31.56	18.43	5.6	31.752		92.15sqft²
Sprinkler	1566	17.96	14.82	5.6	10.291		74.10sqft
Sprinkler	1567	18.07	14.82	5.6	10.414		74.10sqft
Sprinkler	**1568**	**18.43**	**18.43**	**5.6**	**10.829**		92.15sqft²
Sprinkler	1569	19.34	18.43	5.6	11.926		92.15sqft²
Sprinkler	1570	21.10	18.43	5.6	14.192		92.15sqft²
Sprinkler	1571	23.62	18.43	5.6	17.789		92.15sqft²
Sprinkler	1572	26.98	18.43	5.6	23.208		92.15sqft²
Sprinkler	1573	33.14	14.82	5.6	35.016		74.10sqft
Sprinkler	1575	19.55	18.43	5.6	12.184		92.15sqft²
Sprinkler	1576	19.71	18.43	5.6	12.393		92.15sqft²
Sprinkler	1577	20.27	18.43	5.6	13.108		92.15sqft²
Sprinkler	1578	21.42	18.43	5.6	14.635		92.15sqft²
Sprinkler	1579	23.31	18.43	5.6	17.320		92.15sqft²
Sprinkler	1580	26.03	18.43	5.6	21.598		92.15sqft²
Sprinkler	1581	31.29	18.43	5.6	31.224		92.15sqft²

⇨ Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	1.6100	54.46	8.58	100		0.144442	7'-6	Pf 1.083
1568	13'-0½	18.43	5.6	10.829		Sprinkler		Pe 0.014
1569	13'-0			11.926			7'-6	Pv
CM	1.6100	73.80	11.63	100		0.253413	8'-10½	Pf 2.249
1569	13'-0	19.34	5.6	11.926		Sprinkler		Pe 0.017
1570	12'-11½			14.192			8'-10½	Pv
CM	1.6100	94.90	14.96	100		0.403486	8'-10½	Pf 3.581
1570	12'-11½	21.10	5.6	14.192		Sprinkler		Pe 0.017
1571	12'-11			17.789			8'-10½	Pv
CM	1.6100	118.52	18.68	100		0.608692	8'-10½	Pf 5.402
1571	12'-11	23.62	5.6	17.789		Sprinkler		Pe 0.017
1572	12'-10½			23.208			8'-10½	Pv
CM	1.6100	145.50	22.93	100		0.889550	9'-8	Pf 14.316
1572	12'-10½	26.98	5.6	23.208		Sprinkler,	6'-5	Pe 0.733
558	11'-2½			38.258		LtE(1'-5), mecT(5'-0)	16'-1	Pv
CM	4.0260	340.22	8.57	100		0.049334	10'-4	Pf 0.510
558	11'-2½	194.72		38.258		Flow (q) from Route 2		Pe 0.008
544	11'-2			38.776			10'-4	Pv
CM	4.0260	503.20	12.68	100		0.101772	9'-9	Pf 3.722
544	11'-2	162.99		38.776		Flow (q) from Route 3	26'-9½	Pe 4.217
110	1'-5½			46.715		2fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	36'-7	Pv
UG	6.4000	503.20	5.02	120		0.007599	6'-5½	Pf 0.464
110	1'-5½			46.715			54'-7	Pe 2.576
5	-4'-6			49.755		3E(18'-2½)	61'-0	Pv
UG	5.3480	503.20	7.19	150		0.012059	94'-0	Pf 1.664
5	-4'-6			49.755			44'-0	Pe
23	-4'-6			51.419		E(14'-0), PO(30'-0)	138'-0	Pv
UG	6.9630	504.10	4.25	150		0.003347	52'-0	Pf 0.187
23	-4'-6	0.90		51.419		Flow (q) from Route 9	4'-0	Pe
25	-4'-6			51.607		PIV(4'-0)	56'-0	Pv
UG	6.4700	504.10	4.92	120		0.007231	1'-0	Pf 0.007
25	-4'-6			51.607				Pe
26	-4'-6			51.614			1'-0	Pv
UG	6.9630	504.10	4.25	150		0.003347	119'-6	Pf 0.530
26	-4'-6			51.614			39'-0	Pe
61	-4'-6			52.144		T(35'-0), PIV(4'-0)	158'-6	Pv
UG	6.4700	504.10	4.92	120		0.007231	1'-0	Pf 0.007
61	-4'-6			52.144				Pe
63	-4'-6			52.151			1'-0	Pv
UG	6.9630	504.10	4.25	150		0.003347	21'-6	Pf 0.189
63	-4'-6			52.151			35'-0	Pe
71	-4'-6			52.341		T(35'-0)	56'-6	Pv
UG	6.9630	1003.20	8.45	150		0.011954	4'-9½	Pf 0.105
71	-4'-6	499.10		52.341		Flow (q) from Route 8	4'-0	Pe
72	-4'-6			52.445		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1003.20	9.79	120		0.025830	1'-0	Pf 0.026
72	-4'-6			52.445				Pe
73	-4'-6			52.471			1'-0	Pv
UG	6.9630	1003.20	8.45	150		0.011954	165'-8	Pf 2.722
73	-4'-6			52.471			62'-0	Pe 0.000
75	-4'-6			55.193		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1003.20	6.43	120		0.009294	13'-4	Pf 1.546
75	-4'-6			55.193			153'-0	Pe -2.710
131	1'-9			54.029		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1003.20		54.029		Rating: 65.000 @ 1250.00		
129		Q=1003.20	6.43	-14.314		Churn Pressure: 75.000		
FM	7.9810	1003.20	6.43	120		0.009294	6'-0	Pf 0.539
129	1'-9			-14.314			52'-0	Pe -1.409
124	5'-0			-15.184		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	1003.20	2.88	120		0.001308	83'-8	Pf 0.367
124	5'-0			-15.184			197'-0	Pe 1.951
62	0'-6			-12.866		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00				Hose Allowance At Source		
62		1003.20						
• • • • • Route 2 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	1.6100	19.55	3.08	100	0.021697	8'-10½	Pf 0.193
1575	12'-2	19.55	5.6	12.184	Sprinkler		Pe 0.016
1576	12'-2			12.393		8'-10½	Pv
CM	1.6100	39.26	6.19	100	0.078836	8'-10½	Pf 0.700
1576	12'-2	19.71	5.6	12.393	Sprinkler		Pe 0.016
1577	12'-1½			13.108		8'-10½	Pv
CM	1.6100	59.54	9.38	100	0.170308	8'-10½	Pf 1.511
1577	12'-1½	20.27	5.6	13.108	Sprinkler		Pe 0.016
1578	12'-1			14.635		8'-10½	Pv
CM	1.6100	80.96	12.76	100	0.300738	8'-10½	Pf 2.669
1578	12'-1	21.42	5.6	14.635	Sprinkler		Pe 0.016
1579	12'-0½			17.320		8'-10½	Pv
CM	1.6100	104.26	16.43	100	0.480232	8'-10½	Pf 4.262
1579	12'-0½	23.31	5.6	17.320	Sprinkler		Pe 0.016
1580	12'-0			21.598		8'-10½	Pv
CM	1.6100	130.29	20.53	100	0.725238	8'-0	Pf 9.951
1580	12'-0	26.03	5.6	21.598	Sprinkler,	5'-8½	Pe 0.014
573	11'-11½			31.562	T(5'-8½)	13'-8½	Pv
CM	1.6100	161.58	25.46	100	1.079996	0'-9	Pf 6.217
573	11'-11½	31.29		31.562	Flow (q) from Route 5	5'-0	Pe 0.332
572	11'-2½			38.111	mecT(5'-0)	5'-9	Pv
CM	4.0260	161.58	4.07	100	0.012443	8'-4	Pf 0.104
572	11'-2½			38.111			Pe 0.006
559	11'-2½			38.221		8'-4	Pv
CM	4.0260	194.72	4.91	100	0.017572	2'-0	Pf 0.035
559	11'-2½	33.14		38.221	Flow (q) from Route 7		Pe 0.002
558	11'-2½			38.258		2'-0	Pv
• • • • • Route 3 • • • • •							
CM	1.6100	19.72	3.11	100	0.022057	8'-10½	Pf 0.196
1558	12'-2	19.72	5.6	12.403	Sprinkler		Pe 0.016
1559	12'-1½			12.614		8'-10½	Pv
CM	1.6100	39.61	6.24	100	0.080141	8'-10½	Pf 0.711
1559	12'-1½	19.89	5.6	12.614	Sprinkler		Pe 0.016
1560	12'-1			13.341		8'-10½	Pv
CM	1.6100	60.07	9.47	100	0.173120	8'-10½	Pf 1.536
1560	12'-1	20.45	5.6	13.341	Sprinkler		Pe 0.016
1561	12'-0½			14.893		8'-10½	Pv
CM	1.6100	81.68	12.87	100	0.305687	8'-10½	Pf 2.713
1561	12'-0½	21.61	5.6	14.893	Sprinkler		Pe 0.016
1562	12'-0½			17.622		8'-10½	Pv
CM	1.6100	105.18	16.58	100	0.488098	8'-10½	Pf 4.332
1562	12'-0½	23.51	5.6	17.622	Sprinkler		Pe 0.016
1563	12'-0			21.970		8'-10½	Pv
CM	1.6100	131.43	20.71	100	0.737051	8'-0	Pf 10.113
1563	12'-0	26.25	5.6	21.970	Sprinkler,	5'-8½	Pe 0.014
541	11'-11½			32.096	T(5'-8½)	13'-8½	Pv
CM	1.6100	162.99	25.69	100	1.097452	0'-9½	Pf 6.339
541	11'-11½	31.56		32.096	Flow (q) from Route 6	5'-0	Pe 0.340
544	11'-2			38.776	mecT(5'-0)	5'-9½	Pv
• • • • • Route 4 • • • • •							
CM	1.6100	17.96	2.83	100	0.018560	6'-0	Pf 0.111
1566	13'-1	17.96	5.6	10.291	Sprinkler		Pe 0.011
1567	13'-0½			10.414		6'-0	Pv
CM	1.6100	36.04	5.68	100	0.067275	6'-0	Pf 0.404
1567	13'-0½	18.07	5.6	10.414	Sprinkler		Pe 0.011
1568	13'-0½			10.829		6'-0	Pv
• • • • • Route 5 • • • • •							
CM	1.6100	31.29	4.93	100	0.051814	0'-10½	Pf 0.340
1581	11'-11½	31.29	5.6	31.224	Sprinkler,	5'-8½	Pe -0.002
573	11'-11½			31.562	T(5'-8½)	6'-7	Pv
• • • • • Route 6 • • • • •							
CM	1.6100	31.56	4.97	100	0.052625	0'-10½	Pf 0.345
1564	11'-11½	31.56	5.6	31.752	Sprinkler,	5'-8½	Pe -0.002
541	11'-11½			32.096	T(5'-8½)	6'-7	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	33.14	12.30	100	0.464044	1'-8½	Pf 2.456
1573	12'-11	33.14	5.6	35.016	Sprinkler,	3'-7	Pe 0.749
559	11'-2½			38.221	mecT(3'-7)	5'-3½	Pv
• • • • • Route 8 • • • • •							
UG	5.3480	500.00	7.14	150	0.011917	14'-8	Pf 1.081
44	2'-6	500.00		47.003	Hydrant,	76'-0	Pe 3.035
41	-4'-6			51.118	E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	6.9630	500.00	4.21	150		0.003296	73'-5	Pf 0.301
41	-4'-6			51.118			18'-0	Pe
52	-4'-6			51.419		2EE(9'-0)	91'-5	Pv
UG	6.9630	499.10	4.21	150		0.003286	4'-11	Pf 0.029
52	-4'-6			51.419			4'-0	Pe
53	-4'-6			51.449		PIV(4'-0)	8'-11	Pv
UG	6.4700	499.10	4.87	120		0.007099	1'-0	Pf 0.007
53	-4'-6			51.449				Pe
54	-4'-6			51.456			1'-0	Pv
UG	6.9630	499.10	4.21	150		0.003286	223'-3	Pf 0.865
54	-4'-6			51.456			40'-0	Pe
69	-4'-6			52.321		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	499.10	4.87	120		0.007099	1'-0	Pf 0.007
69	-4'-6			52.321				Pe
70	-4'-6			52.328			1'-0	Pv
UG	6.9630	499.10	4.21	150		0.003286	3'-11	Pf 0.013
70	-4'-6			52.328				Pe
71	-4'-6			52.341			3'-11	Pv
• • • • • Route 9 • • • • •								
UG	6.4700	0.90	0.01	120		0.000000	1'-0	Pf 0.000
51	-4'-6			51.419				Pe
50	-4'-6			51.419			1'-0	Pv
UG	6.9630	0.90	0.01	150		0.000000	94'-5½	Pf 0.000
50	-4'-6			51.419			13'-0	Pe
18	-4'-6			51.419		EE(9'-0), PIV(4'-0)	107'-5½	Pv
UG	6.4700	0.90	0.01	120		0.000000	1'-0	Pf 0.000
18	-4'-6			51.419				Pe
19	-4'-6			51.419			1'-0	Pv
UG	6.9630	0.90	0.01	150		0.000000	57'-0	Pf 0.000
19	-4'-6			51.419			4'-0	Pe
22	-4'-6			51.419		PIV(4'-0)	61'-0	Pv
UG	6.4700	0.90	0.01	120		0.000000	1'-0	Pf 0.000
22	-4'-6			51.419				Pe
24	-4'-6			51.419			1'-0	Pv
UG	6.9630	0.90	0.01	150		0.000000	11'-0	Pf 0.000
24	-4'-6			51.419				Pe
23	-4'-6			51.419			11'-0	Pv
• • • • • Route 10 • • • • •								
UG	6.9630	0.90	0.01	150		0.000000	4'-8	Pf 0.000
52	-4'-6			51.419		T(35'-0)	39'-0	Pe
51	-4'-6			51.419		PIV(4'-0)	43'-8	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 152

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1966.05ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 22
	System Flow Demand: 1003.20
Total Demand: 1003.20	

Supplies

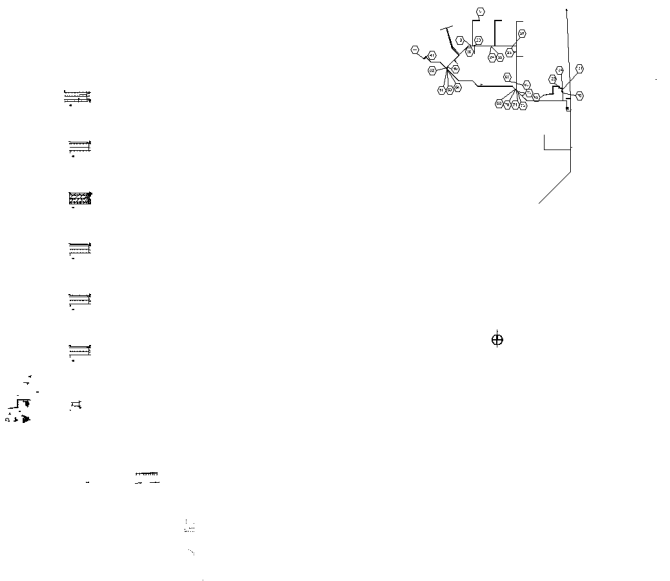
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

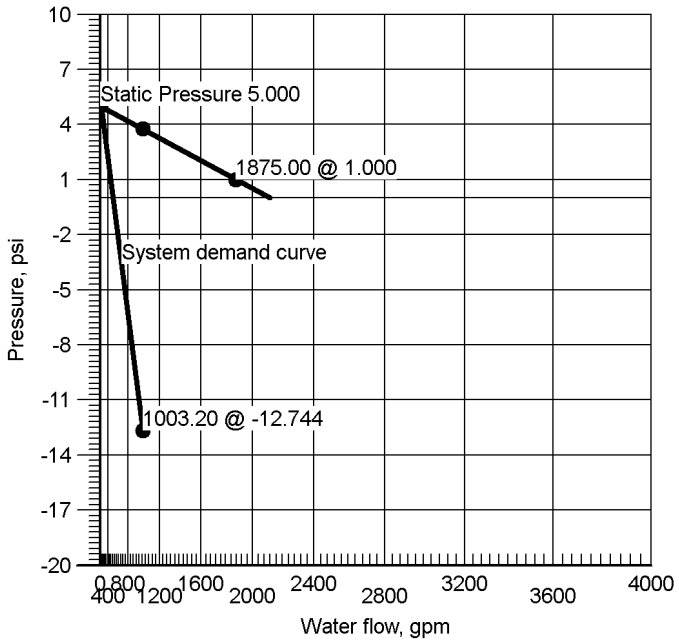
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 152
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1003.20	1003.20

Maximum Velocity Above Ground: 25.69 between nodes 441 and 438

Maximum Velocity Under Ground	
9.79 between nodes 73 and 72	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
	41 Gallons

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.200gpm/ft²	1950.00ft² (Actual 1966.05ft²)

Number Of Sprinklers Calculated	Coverage Per Sprinkler
22	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000		1875.00	3.742		1003.20	0.000	16.487
131		Pump	75.000	65.000		1250.00	70.637		1003.20	54.151	16.487

Pumps: Static = Churn (Pressure @ Zero Flow)

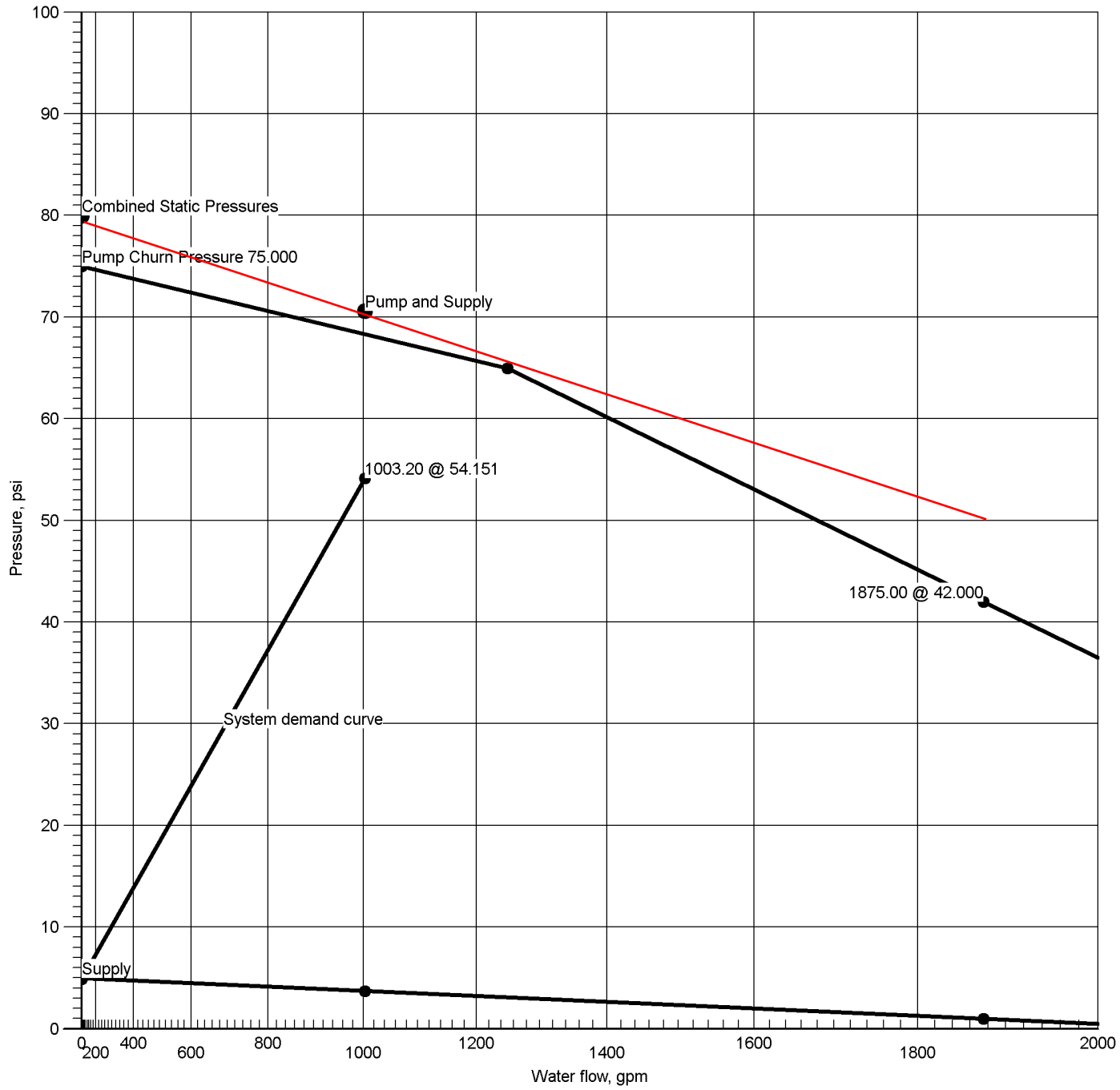
Contractor

	Contractor Number	Contact Name	Contact Title
	IC0119	BRAD VOKES	DESIGNER

Name of Contractor:	Phone	Extension
WESTERN STATES FIRE PROTECTION	226-668-8168	

Address 1	FAX
5200 PASADENA AVE NE, SUITE A	505-884-1863
Address 2	E-mail: BRAD.VOKES@WSFP.US
Address 3: ALBUQUERQUE, NM 87113	Web-Site

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.742 @ 1003.20	70.637 @ 1003.20	
System Demand		
54.151 @ 1003.20		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	47.018		
Sprinkler	1533	19.72	18.43	5.6	12.403		92.15sqft
Sprinkler	1534	19.89	18.43	5.6	12.614		92.15sqft
Sprinkler	1535	20.45	18.43	5.6	13.341		92.15sqft
Sprinkler	1536	21.61	18.43	5.6	14.893		92.15sqft²
Sprinkler	1537	23.51	18.43	5.6	17.622		92.15sqft²
Sprinkler	1538	26.25	18.43	5.6	21.970		92.15sqft²
Sprinkler	1539	31.56	18.43	5.6	31.752		92.15sqft²
Sprinkler	1541	17.96	14.82	5.6	10.291		74.10sqft
Sprinkler	1542	18.07	14.82	5.6	10.414		74.10sqft
Sprinkler	**1543**	**18.43**	**18.43**	**5.6**	**10.829**		92.15sqft²
Sprinkler	1544	19.34	18.43	5.6	11.926		92.15sqft²
Sprinkler	1545	21.10	18.43	5.6	14.192		92.15sqft²
Sprinkler	1546	23.62	18.43	5.6	17.789		92.15sqft²
Sprinkler	1547	26.98	18.43	5.6	23.208		92.15sqft²
Sprinkler	1548	33.14	14.82	5.6	35.016		74.10sqft
Sprinkler	1550	19.55	18.43	5.6	12.184		92.15sqft²
Sprinkler	1551	19.71	18.43	5.6	12.393		92.15sqft²
Sprinkler	1552	20.27	18.43	5.6	13.108		92.15sqft²
Sprinkler	1553	21.42	18.43	5.6	14.635		92.15sqft²
Sprinkler	1554	23.31	18.43	5.6	17.320		92.15sqft²
Sprinkler	1555	26.03	18.43	5.6	21.598		92.15sqft²
Sprinkler	1556	31.29	18.43	5.6	31.224		92.15sqft²

⇨ Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	1.6100	54.46	8.58	100		0.144442	7'-6	Pf 1.083
1543	13'-0½	18.43	5.6	10.829		Sprinkler		Pe 0.014
1544	13'-0			11.926			7'-6	Pv
CM	1.6100	73.80	11.63	100		0.253413	8'-10½	Pf 2.249
1544	13'-0	19.34	5.6	11.926		Sprinkler		Pe 0.017
1545	12'-11½			14.192			8'-10½	Pv
CM	1.6100	94.90	14.96	100		0.403486	8'-10½	Pf 3.581
1545	12'-11½	21.10	5.6	14.192		Sprinkler		Pe 0.017
1546	12'-11			17.789			8'-10½	Pv
CM	1.6100	118.52	18.68	100		0.608692	8'-10½	Pf 5.402
1546	12'-11	23.62	5.6	17.789		Sprinkler		Pe 0.017
1547	12'-10½			23.208			8'-10½	Pv
CM	1.6100	145.50	22.93	100		0.889550	9'-8	Pf 14.316
1547	12'-10½	26.98	5.6	23.208		Sprinkler,	6'-5	Pe 0.733
455	11'-2½			38.258		LtE(1'-5), mecT(5'-0)	16'-1	Pv
CM	4.0260	340.22	8.57	100		0.049334	10'-4	Pf 0.510
455	11'-2½	194.72		38.258		Flow (q) from Route 2		Pe 0.008
441	11'-2			38.776			10'-4	Pv
CM	4.0260	503.20	12.68	100		0.101772	9'-9	Pf 3.722
441	11'-2	162.99		38.776		Flow (q) from Route 3	26'-9½	Pe 4.217
107	1'-5½			46.715		2fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	36'-7	Pv
UG	6.4000	503.20	5.02	120		0.007599	6'-5½	Pf 0.464
107	1'-5½			46.715			54'-7	Pe 2.576
8	-4'-6			49.755		3E(18'-2½)	61'-0	Pv
UG	5.3480	503.20	7.19	150		0.012059	95'-0	Pf 1.676
8	-4'-6			49.755			44'-0	Pe
20	-4'-6			51.431		E(14'-0), PO(30'-0)	139'-0	Pv
UG	6.9630	473.79	3.99	150		0.002984	52'-10½	Pf 0.170
20	-4'-6			51.431			4'-0	Pe
22	-4'-6			51.601		PIV(4'-0)	56'-10½	Pv
UG	6.4700	473.79	4.62	120		0.006447	1'-0	Pf 0.006
22	-4'-6			51.601				Pe
24	-4'-6			51.607			1'-0	Pv
UG	6.9630	473.79	3.99	150		0.002984	63'-0	Pf 0.200
24	-4'-6			51.607			4'-0	Pe
25	-4'-6			51.807		PIV(4'-0)	67'-0	Pv
UG	6.4700	473.79	4.62	120		0.006447	1'-0	Pf 0.006
25	-4'-6			51.807				Pe
26	-4'-6			51.814			1'-0	Pv
UG	6.9630	473.79	3.99	150		0.002984	119'-6	Pf 0.473
26	-4'-6			51.814			39'-0	Pe
61	-4'-6			52.287		T(35'-0), PIV(4'-0)	158'-6	Pv
UG	6.4700	473.79	4.62	120		0.006447	1'-0	Pf 0.006
61	-4'-6			52.287				Pe
63	-4'-6			52.293			1'-0	Pv
UG	6.9630	473.79	3.99	150		0.002984	21'-6	Pf 0.169
63	-4'-6			52.293			35'-0	Pe
71	-4'-6			52.462		T(35'-0)	56'-6	Pv
UG	6.9630	1003.20	8.45	150		0.011954	4'-9½	Pf 0.105
71	-4'-6	529.42		52.462		Flow (q) from Route 8	4'-0	Pe
72	-4'-6			52.567		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1003.20	9.79	120		0.025830	1'-0	Pf 0.026
72	-4'-6			52.567				Pe
73	-4'-6			52.592			1'-0	Pv
UG	6.9630	1003.20	8.45	150		0.011954	165'-8	Pf 2.722
73	-4'-6			52.592			62'-0	Pe 0.000
75	-4'-6			55.314		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1003.20	6.43	120		0.009294	13'-4	Pf 1.546
75	-4'-6			55.314			153'-0	Pe -2.710
131	1'-9			54.151		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1003.20		54.151		Rating: 65.000 @ 1250.00		
129		Q=1003.20	6.43	-14.192		Churn Pressure: 75.000		
FM	7.9810	1003.20	6.43	120		0.009294	6'-0	Pf 0.539
129	1'-9			-14.192			52'-0	Pe -1.409
124	5'-0			-15.062		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	1003.20	2.88	120		0.001308	83'-8	Pf 0.367
124	5'-0			-15.062			197'-0	Pe 1.951
62	0'-6			-12.744		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
		0.00				Hose Allowance At Source		
62		1003.20						
• • • • • Route 2 • • • • •								
CM	1.6100	19.55	3.08	100		0.021697	8'-10½	Pf 0.193
1550	12'-2	19.55	5.6	12.184		Sprinkler		Pe 0.016
1551	12'-2			12.393			8'-10½	Pv
CM	1.6100	39.26	6.19	100		0.078836	8'-10½	Pf 0.700
1551	12'-2	19.71	5.6	12.393		Sprinkler		Pe 0.016
1552	12'-1½			13.108			8'-10½	Pv
CM	1.6100	59.54	9.38	100		0.170308	8'-10½	Pf 1.511
1552	12'-1½	20.27	5.6	13.108		Sprinkler		Pe 0.016
1553	12'-1			14.635			8'-10½	Pv
CM	1.6100	80.96	12.76	100		0.300738	8'-10½	Pf 2.669
1553	12'-1	21.42	5.6	14.635		Sprinkler		Pe 0.016
1554	12'-0½			17.320			8'-10½	Pv
CM	1.6100	104.26	16.43	100		0.480232	8'-10½	Pf 4.262
1554	12'-0½	23.31	5.6	17.320		Sprinkler		Pe 0.016
1555	12'-0			21.598			8'-10½	Pv
CM	1.6100	130.29	20.53	100		0.725238	8'-0	Pf 9.951
1555	12'-0	26.03	5.6	21.598		Sprinkler,	5'-8½	Pe 0.014
470	11'-11½			31.562		T(5'-8½)	13'-8½	Pv
CM	1.6100	161.58	25.46	100		1.079996	0'-9	Pf 6.217
470	11'-11½	31.29		31.562		Flow (q) from Route 5	5'-0	Pe 0.332
469	11'-2½			38.111		mecT(5'-0)	5'-9	Pv
CM	4.0260	161.58	4.07	100		0.012443	8'-4	Pf 0.104
469	11'-2½			38.111				Pe 0.006
456	11'-2½			38.221			8'-4	Pv
CM	4.0260	194.72	4.91	100		0.017572	2'-0	Pf 0.035
456	11'-2½	33.14		38.221		Flow (q) from Route 7		Pe 0.002
455	11'-2½			38.258			2'-0	Pv
• • • • • Route 3 • • • • •								
CM	1.6100	19.72	3.11	100		0.022057	8'-10½	Pf 0.196
1533	12'-2	19.72	5.6	12.403		Sprinkler		Pe 0.016
1534	12'-1½			12.614			8'-10½	Pv
CM	1.6100	39.61	6.24	100		0.080141	8'-10½	Pf 0.711
1534	12'-1½	19.89	5.6	12.614		Sprinkler		Pe 0.016
1535	12'-1			13.341			8'-10½	Pv
CM	1.6100	60.07	9.47	100		0.173120	8'-10½	Pf 1.536
1535	12'-1	20.45	5.6	13.341		Sprinkler		Pe 0.016
1536	12'-0½			14.893			8'-10½	Pv
CM	1.6100	81.68	12.87	100		0.305687	8'-10½	Pf 2.713
1536	12'-0½	21.61	5.6	14.893		Sprinkler		Pe 0.016
1537	12'-0½			17.622			8'-10½	Pv
CM	1.6100	105.18	16.58	100		0.488098	8'-10½	Pf 4.332
1537	12'-0½	23.51	5.6	17.622		Sprinkler		Pe 0.016
1538	12'-0			21.970			8'-10½	Pv
CM	1.6100	131.43	20.71	100		0.737051	8'-0	Pf 10.113
1538	12'-0	26.25	5.6	21.970		Sprinkler,	5'-8½	Pe 0.014
438	11'-11½			32.096		T(5'-8½)	13'-8½	Pv
CM	1.6100	162.99	25.69	100		1.097452	0'-9½	Pf 6.339
438	11'-11½	31.56		32.096		Flow (q) from Route 6	5'-0	Pe 0.340
441	11'-2			38.776		mecT(5'-0)	5'-9½	Pv
• • • • • Route 4 • • • • •								
CM	1.6100	17.96	2.83	100		0.018560	6'-0	Pf 0.111
1541	13'-1	17.96	5.6	10.291		Sprinkler		Pe 0.011
1542	13'-0½			10.414			6'-0	Pv
CM	1.6100	36.04	5.68	100		0.067275	6'-0	Pf 0.404
1542	13'-0½	18.07	5.6	10.414		Sprinkler		Pe 0.011
1543	13'-0½			10.829			6'-0	Pv
• • • • • Route 5 • • • • •								
CM	1.6100	31.29	4.93	100		0.051814	0'-10½	Pf 0.340
1556	11'-11½	31.29	5.6	31.224		Sprinkler,	5'-8½	Pe -0.002
470	11'-11½			31.562		T(5'-8½)	6'-7	Pv
• • • • • Route 6 • • • • •								
CM	1.6100	31.56	4.97	100		0.052625	0'-10½	Pf 0.345
1539	11'-11½	31.56	5.6	31.752		Sprinkler,	5'-8½	Pe -0.002
438	11'-11½			32.096		T(5'-8½)	6'-7	Pv
• • • • • Route 7 • • • • •								
BL	1.0490	33.14	12.30	100		0.464044	1'-8½	Pf 2.456
1548	12'-11	33.14	5.6	35.016		Sprinkler,	3'-7	Pe 0.749
456	11'-2½			38.221		mecT(3'-7)	5'-3½	Pv
• • • • • Route 8 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	5.3480	500.00	7.14	150	0.011917	14'-8	Pf 1.081
44	2'-6	500.00		47.018	Hydrant,	76'-0	Pe 3.035
41	-4'-6			51.133	E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150	0.003296	73'-5	Pf 0.301
41	-4'-6			51.133		18'-0	Pe
52	-4'-6			51.434	2EE(9'-0)	91'-5	Pv
UG	6.9630	529.42	4.46	150	0.003664	4'-11	Pf 0.033
52	-4'-6	29.42		51.434	Flow (q) from Route 9	4'-0	Pe
53	-4'-6			51.467	PIV(4'-0)	8'-11	Pv
UG	6.4700	529.42	5.17	120	0.007917	1'-0	Pf 0.008
53	-4'-6			51.467			Pe
54	-4'-6			51.475		1'-0	Pv
UG	6.9630	529.42	4.46	150	0.003664	223'-3	Pf 0.965
54	-4'-6			51.475		40'-0	Pe
69	-4'-6			52.439	4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	529.42	5.17	120	0.007917	1'-0	Pf 0.008
69	-4'-6			52.439			Pe
70	-4'-6			52.447		1'-0	Pv
UG	6.9630	529.42	4.46	150	0.003664	3'-11	Pf 0.014
70	-4'-6			52.447			Pe
71	-4'-6			52.462		3'-11	Pv
• • • • • Route 9 • • • • •							
UG	6.9630	29.42	0.25	150	0.000017	4'-1½	Pf 0.000
20	-4'-6			51.431			Pe
19	-4'-6			51.431		4'-1½	Pv
UG	6.4700	29.42	0.29	120	0.000038	1'-0	Pf 0.000
19	-4'-6			51.431		4'-0	Pe
18	-4'-6			51.432	PIV(4'-0)	5'-0	Pv
UG	6.9630	29.42	0.25	150	0.000017	94'-5½	Pf 0.002
18	-4'-6			51.432		9'-0	Pe
50	-4'-6			51.433	EE(9'-0)	103'-5½	Pv
UG	6.4700	29.42	0.29	120	0.000038	1'-0	Pf 0.000
50	-4'-6			51.433		4'-0	Pe
51	-4'-6			51.433	PIV(4'-0)	5'-0	Pv
UG	6.9630	29.42	0.25	150	0.000017	4'-8	Pf 0.001
51	-4'-6			51.433		35'-0	Pe
52	-4'-6			51.434	T(35'-0)	39'-8	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 153

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1966.05ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 22
	System Flow Demand: 1003.20
Total Demand: 1003.20	

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

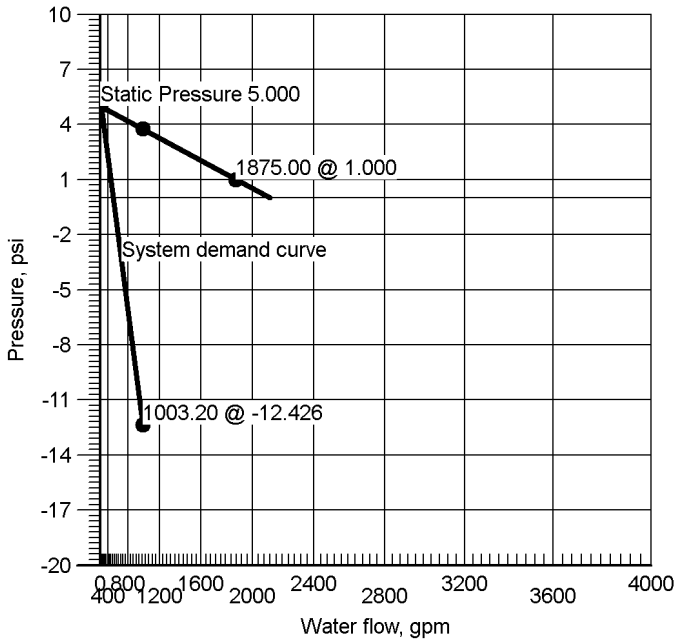
Pumps: Static = Churn (Pressure @ Zero Flow)

Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3

Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 153
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Hose Allowance At Source:

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1003.20	1003.20

Maximum Velocity Above Ground: 25.69 between nodes 338 and 335

Maximum Velocity Under Ground: 9.79 between nodes 73 and 72

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
	41 Gallons

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	
Density	**Area of Application**
0.200gpm/ft²	1950.00ft² (Actual 1966.05ft²)
Number Of Sprinklers Calculated	**Coverage Per Sprinkler**
22	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

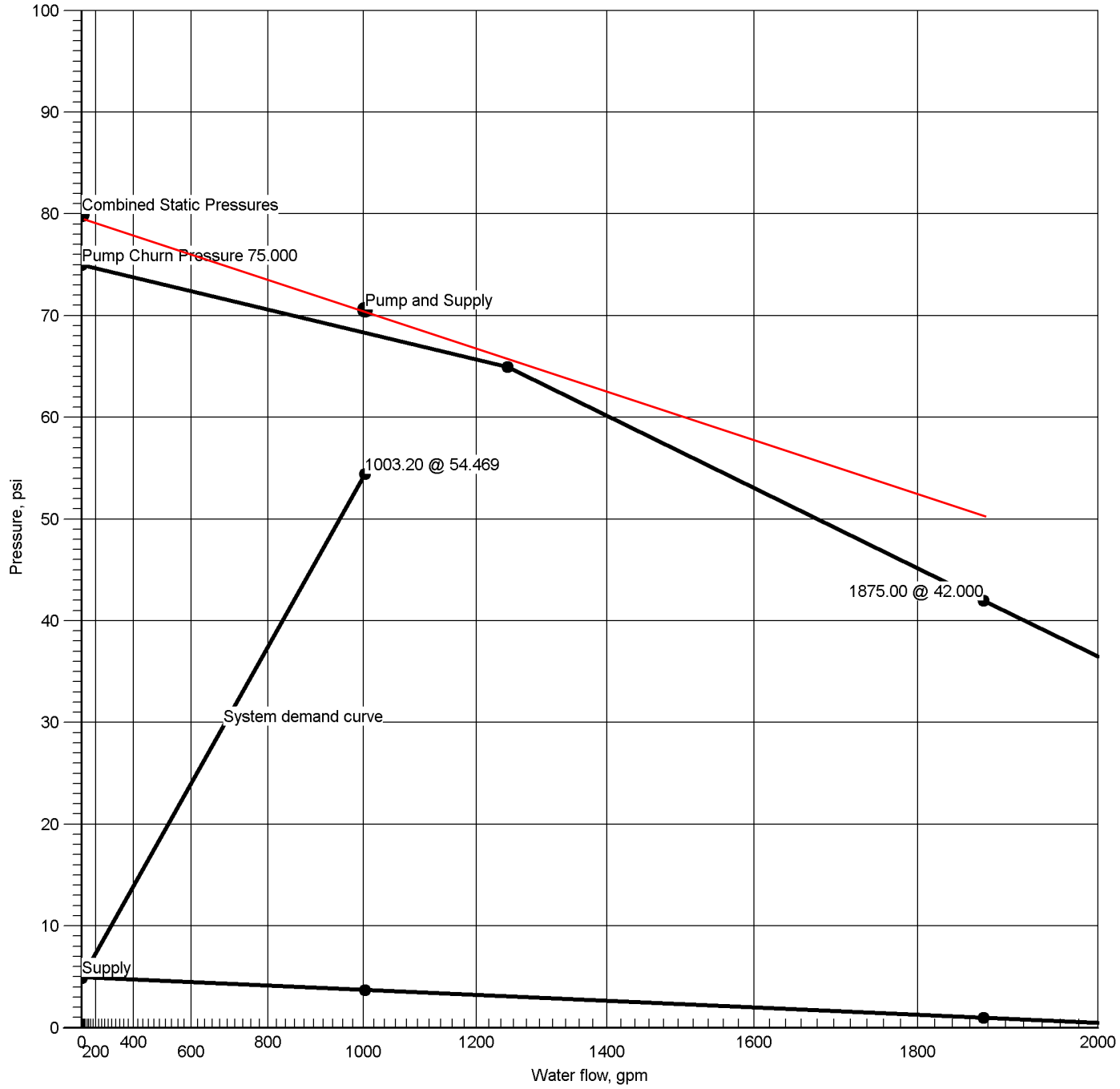
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000	1875.00	3.742	1003.20	0.000	16.169
131		Pump	75.000	65.000	1250.00	70.637	1003.20	54.469	16.169

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

Contractor Number: IC0119		Contact Name: BRAD VOKES	Contact Title: DESIGNER
Name of Contractor: WESTERN STATES FIRE PROTECTION		Phone: 226-668-8168	Extension:
Address 1: 5200 PASADENA AVE NE, SUITE A		FAX: 505-884-1863	
Address 2:		E-mail: BRAD.VOKES@WSFP.US	
Address 3: ALBUQUERQUE, NM 87113		Web-Site:	

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.742 @ 1003.20	70.637 @ 1003.20	
System Demand		
54.469 @ 1003.20		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	47.255		
Sprinkler	1508	19.72	18.43	5.6	12.403		92.15sqft
Sprinkler	1509	19.89	18.43	5.6	12.614		92.15sqft
Sprinkler	1510	20.45	18.43	5.6	13.341		92.15sqft
Sprinkler	1511	21.61	18.43	5.6	14.893		92.15sqft
Sprinkler	1512	23.51	18.43	5.6	17.622		92.15sqft
Sprinkler	1513	26.25	18.43	5.6	21.970		92.15sqft
Sprinkler	1514	31.56	18.43	5.6	31.752		92.15sqft
Sprinkler	1516	17.96	14.82	5.6	10.291		74.10sqft
Sprinkler	1517	18.07	14.82	5.6	10.414		74.10sqft
Sprinkler	**1518**	**18.43**	**18.43**	**5.6**	**10.829**		92.15sqft
Sprinkler	1519	19.34	18.43	5.6	11.926		92.15sqft
Sprinkler	1520	21.10	18.43	5.6	14.192		92.15sqft
Sprinkler	1521	23.62	18.43	5.6	17.789		92.15sqft
Sprinkler	1522	26.98	18.43	5.6	23.208		92.15sqft
Sprinkler	1523	33.14	14.82	5.6	35.016		74.10sqft
Sprinkler	1525	19.55	18.43	5.6	12.184		92.15sqft
Sprinkler	1526	19.71	18.43	5.6	12.393		92.15sqft
Sprinkler	1527	20.27	18.43	5.6	13.108		92.15sqft
Sprinkler	1528	21.42	18.43	5.6	14.635		92.15sqft
Sprinkler	1529	23.31	18.43	5.6	17.320		92.15sqft
Sprinkler	1530	26.03	18.43	5.6	21.598		92.15sqft
Sprinkler	1531	31.29	18.43	5.6	31.224		92.15sqft

Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	1.6100	54.46	8.58	100		0.144442	7'-6	Pf 1.083
1518	13'-0½	18.43	5.6	10.829		Sprinkler		Pe 0.014
1519	13'-0			11.926			7'-6	Pv
CM	1.6100	73.80	11.63	100		0.253413	8'-10½	Pf 2.249
1519	13'-0	19.34	5.6	11.926		Sprinkler		Pe 0.017
1520	12'-11½			14.192			8'-10½	Pv
CM	1.6100	94.90	14.96	100		0.403486	8'-10½	Pf 3.581
1520	12'-11½	21.10	5.6	14.192		Sprinkler		Pe 0.017
1521	12'-11			17.789			8'-10½	Pv
CM	1.6100	118.52	18.68	100		0.608692	8'-10½	Pf 5.402
1521	12'-11	23.62	5.6	17.789		Sprinkler		Pe 0.017
1522	12'-10½			23.208			8'-10½	Pv
CM	1.6100	145.50	22.93	100		0.889550	9'-8	Pf 14.316
1522	12'-10½	26.98	5.6	23.208		Sprinkler,	6'-5	Pe 0.733
352	11'-2½			38.258		LtE(1'-5), mecT(5'-0)	16'-1	Pv
CM	4.0260	340.22	8.57	100		0.049334	10'-4	Pf 0.510
352	11'-2½	194.72		38.258		Flow (q) from Route 2		Pe 0.008
338	11'-2			38.776			10'-4	Pv
CM	4.0260	503.20	12.68	100		0.101772	9'-9	Pf 3.722
338	11'-2	162.99		38.776		Flow (q) from Route 3	26'-9½	Pe 4.217
97	1'-5½			46.715		2fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	36'-7	Pv
UG	6.4000	503.20	5.02	120		0.007599	6'-5½	Pf 0.464
97	1'-5½			46.715			54'-7	Pe 2.576
13	-4'-6			49.755		3E(18'-2½)	61'-0	Pv
UG	5.3480	503.20	7.19	150		0.012059	107'-6½	Pf 1.912
13	-4'-6			49.755			51'-0	Pe -0.000
35	-4'-6			51.667		E(14'-0), EE(7'-0), T(30'-0)	158'-6½	Pv
UG	6.9630	51.43	0.43	150		0.000049	51'-9	Pf 0.003
35	-4'-6			51.667				Pe
50	-4'-6			51.669			51'-9	Pv
UG	6.4700	51.43	0.50	120		0.000106	1'-0	Pf 0.001
50	-4'-6			51.669			4'-0	Pe
51	-4'-6			51.670		PIV(4'-0)	5'-0	Pv
UG	6.9630	51.43	0.43	150		0.000049	4'-8	Pf 0.002
51	-4'-6			51.670			35'-0	Pe
52	-4'-6			51.672		T(35'-0)	39'-8	Pv
UG	6.9630	551.43	4.65	150		0.003951	4'-11	Pf 0.035
52	-4'-6	500.00		51.672		Flow (q) from Route 8	4'-0	Pe
53	-4'-6			51.707		PIV(4'-0)	8'-11	Pv
UG	6.4700	551.43	5.38	120		0.008537	1'-0	Pf 0.009
53	-4'-6			51.707				Pe
54	-4'-6			51.716			1'-0	Pv
UG	6.9630	551.43	4.65	150		0.003951	223'-3	Pf 1.040
54	-4'-6			51.716			40'-0	Pe
69	-4'-6			52.756		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	551.43	5.38	120		0.008537	1'-0	Pf 0.009
69	-4'-6			52.756				Pe
70	-4'-6			52.764			1'-0	Pv
UG	6.9630	551.43	4.65	150		0.003951	3'-11	Pf 0.015
70	-4'-6			52.764				Pe
71	-4'-6			52.780			3'-11	Pv
UG	6.9630	1003.20	8.45	150		0.011954	4'-9½	Pf 0.105
71	-4'-6	451.77		52.780		Flow (q) from Route 9	4'-0	Pe
72	-4'-6			52.885		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1003.20	9.79	120		0.025830	1'-0	Pf 0.026
72	-4'-6			52.885				Pe
73	-4'-6			52.910			1'-0	Pv
UG	6.9630	1003.20	8.45	150		0.011954	165'-8	Pf 2.722
73	-4'-6			52.910			62'-0	Pe 0.000
75	-4'-6			55.632		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1003.20	6.43	120		0.009294	13'-4	Pf 1.546
75	-4'-6			55.632			153'-0	Pe -2.710
131	1'-9			54.469		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1003.20		54.469		Rating: 65.000 @ 1250.00		
129		Q=1003.20	6.43	-13.874		Churn Pressure: 75.000		
FM	7.9810	1003.20	6.43	120		0.009294	6'-0	Pf 0.539
129	1'-9			-13.874			52'-0	Pe -1.409
124	5'-0			-14.744		GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
FM	11.9380	1003.20	2.88	120		0.001308	83'-8	Pf 0.367
124	5'-0			-14.744			197'-0	Pe 1.951
62	0'-6			-12.426		sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00				Hose Allowance At Source		
62		1003.20						
• • • • • Route 2 • • • • •								
CM	1.6100	19.55	3.08	100		0.021697	8'-10½	Pf 0.193
1525	12'-2	19.55	5.6	12.184		Sprinkler		Pe 0.016
1526	12'-2			12.393			8'-10½	Pv
CM	1.6100	39.26	6.19	100		0.078836	8'-10½	Pf 0.700
1526	12'-2	19.71	5.6	12.393		Sprinkler		Pe 0.016
1527	12'-1½			13.108			8'-10½	Pv
CM	1.6100	59.54	9.38	100		0.170308	8'-10½	Pf 1.511
1527	12'-1½	20.27	5.6	13.108		Sprinkler		Pe 0.016
1528	12'-1			14.635			8'-10½	Pv
CM	1.6100	80.96	12.76	100		0.300738	8'-10½	Pf 2.669
1528	12'-1	21.42	5.6	14.635		Sprinkler		Pe 0.016
1529	12'-0½			17.320			8'-10½	Pv
CM	1.6100	104.26	16.43	100		0.480232	8'-10½	Pf 4.262
1529	12'-0½	23.31	5.6	17.320		Sprinkler		Pe 0.016
1530	12'-0			21.598			8'-10½	Pv
CM	1.6100	130.29	20.53	100		0.725238	8'-0	Pf 9.951
1530	12'-0	26.03	5.6	21.598		Sprinkler,	5'-8½	Pe 0.014
367	11'-11½			31.562		T(5'-8½)	13'-8½	Pv
CM	1.6100	161.58	25.46	100		1.079996	0'-9	Pf 6.217
367	11'-11½	31.29		31.562		Flow (q) from Route 5	5'-0	Pe 0.332
366	11'-2½			38.111		mecT(5'-0)	5'-9	Pv
CM	4.0260	161.58	4.07	100		0.012443	8'-4	Pf 0.104
366	11'-2½			38.111				Pe 0.006
353	11'-2½			38.221			8'-4	Pv
CM	4.0260	194.72	4.91	100		0.017572	2'-0	Pf 0.035
353	11'-2½	33.14		38.221		Flow (q) from Route 7		Pe 0.002
352	11'-2½			38.258			2'-0	Pv
• • • • • Route 3 • • • • •								
CM	1.6100	19.72	3.11	100		0.022057	8'-10½	Pf 0.196
1508	12'-2	19.72	5.6	12.403		Sprinkler		Pe 0.016
1509	12'-1½			12.614			8'-10½	Pv
CM	1.6100	39.61	6.24	100		0.080141	8'-10½	Pf 0.711
1509	12'-1½	19.89	5.6	12.614		Sprinkler		Pe 0.016
1510	12'-1			13.341			8'-10½	Pv
CM	1.6100	60.07	9.47	100		0.173120	8'-10½	Pf 1.536
1510	12'-1	20.45	5.6	13.341		Sprinkler		Pe 0.016
1511	12'-0½			14.893			8'-10½	Pv
CM	1.6100	81.68	12.87	100		0.305687	8'-10½	Pf 2.713
1511	12'-0½	21.61	5.6	14.893		Sprinkler		Pe 0.016
1512	12'-0½			17.622			8'-10½	Pv
CM	1.6100	105.18	16.58	100		0.488098	8'-10½	Pf 4.332
1512	12'-0½	23.51	5.6	17.622		Sprinkler		Pe 0.016
1513	12'-0			21.970			8'-10½	Pv
CM	1.6100	131.43	20.71	100		0.737051	8'-0	Pf 10.113
1513	12'-0	26.25	5.6	21.970		Sprinkler,	5'-8½	Pe 0.014
335	11'-11½			32.096		T(5'-8½)	13'-8½	Pv
CM	1.6100	162.99	25.69	100		1.097452	0'-9½	Pf 6.339
335	11'-11½	31.56		32.096		Flow (q) from Route 6	5'-0	Pe 0.340
338	11'-2			38.776		mecT(5'-0)	5'-9½	Pv
• • • • • Route 4 • • • • •								
CM	1.6100	17.96	2.83	100		0.018560	6'-0	Pf 0.111
1516	13'-1	17.96	5.6	10.291		Sprinkler		Pe 0.011
1517	13'-0½			10.414			6'-0	Pv
CM	1.6100	36.04	5.68	100		0.067275	6'-0	Pf 0.404
1517	13'-0½	18.07	5.6	10.414		Sprinkler		Pe 0.011
1518	13'-0½			10.829			6'-0	Pv
• • • • • Route 5 • • • • •								
CM	1.6100	31.29	4.93	100		0.051814	0'-10½	Pf 0.340
1531	11'-11½	31.29	5.6	31.224		Sprinkler,	5'-8½	Pe -0.002
367	11'-11½			31.562		T(5'-8½)	6'-7	Pv
• • • • • Route 6 • • • • •								
CM	1.6100	31.56	4.97	100		0.052625	0'-10½	Pf 0.345
1514	11'-11½	31.56	5.6	31.752		Sprinkler,	5'-8½	Pe -0.002
335	11'-11½			32.096		T(5'-8½)	6'-7	Pv
• • • • • Route 7 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.0490	33.14	12.30	100		0.464044	1'-8½	Pf 2.456
1523	12'-11	33.14	5.6	35.016		Sprinkler,	3'-7	Pe 0.749
353	11'-2½			38.221		mecT(3'-7)	5'-3½	Pv
• • • • • Route 8 • • • • •								
UG	5.3480	500.00	7.14	150		0.011917	14'-8	Pf 1.081
44	2'-6	500.00		47.255		Hydrant,	76'-0	Pe 3.035
41	-4'-6			51.370		E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150		0.003296	73'-5	Pf 0.301
41	-4'-6			51.370			18'-0	Pe
52	-4'-6			51.672		2EE(9'-0)	91'-5	Pv
• • • • • Route 9 • • • • •								
UG	6.9630	451.77	3.81	150		0.002732	63'-0	Pf 0.183
24	-4'-6			51.997			4'-0	Pe
25	-4'-6			52.180		PIV(4'-0)	67'-0	Pv
UG	6.4700	451.77	4.41	120		0.005904	1'-0	Pf 0.006
25	-4'-6			52.180				Pe
26	-4'-6			52.186			1'-0	Pv
UG	6.9630	451.77	3.81	150		0.002732	119'-6	Pf 0.433
26	-4'-6			52.186			39'-0	Pe
61	-4'-6			52.619		T(35'-0), PIV(4'-0)	158'-6	Pv
UG	6.4700	451.77	4.41	120		0.005904	1'-0	Pf 0.006
61	-4'-6			52.619				Pe
63	-4'-6			52.625			1'-0	Pv
UG	6.9630	451.77	3.81	150		0.002732	21'-6	Pf 0.154
63	-4'-6			52.625			35'-0	Pe
71	-4'-6			52.780		T(35'-0)	56'-6	Pv
• • • • • Route 10 • • • • •								
UG	6.9630	451.77	3.81	150		0.002732	42'-8½	Pf 0.152
35	-4'-6			51.667			13'-0	Pe
18	-4'-6			51.819		EE(9'-0), PIV(4'-0)	55'-8½	Pv
UG	6.4700	451.77	4.41	120		0.005904	1'-0	Pf 0.006
18	-4'-6			51.819				Pe
19	-4'-6			51.825			1'-0	Pv
UG	6.9630	451.77	3.81	150		0.002732	57'-0	Pf 0.167
19	-4'-6			51.825			4'-0	Pe
22	-4'-6			51.992		PIV(4'-0)	61'-0	Pv
UG	6.4700	451.77	4.41	120		0.005904	1'-0	Pf 0.006
22	-4'-6			51.992				Pe
24	-4'-6			51.997			1'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	Phone: 1-226-668-8168 / FAX:
Address 1: LOS ALAMOS NATIONAL LABS	State Certification/License Number:
Address 2:	AHJ: LANL FPDO
Address 3:	Job Site/Building: Building 154

System

Density: 0.200gpm/ft²	Area of Application: 1950.00ft² (Actual 1994.34ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829	Hose Streams: 500.00
Coverage Per Sprinkler: Varies	Number Of Sprinklers Calculated: 27
	System Flow Demand: 1065.51
Total Demand: 1065.51	

Supplies

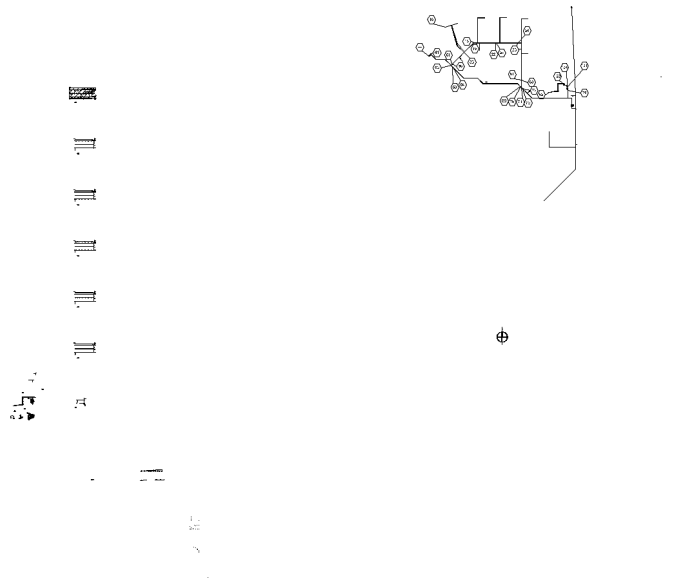
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
62	Tank Supply	1875.00		5.000	1.000
131		1250.00	Pump	75.000	65.000

Pumps: Static = Churn (Pressure @ Zero Flow)

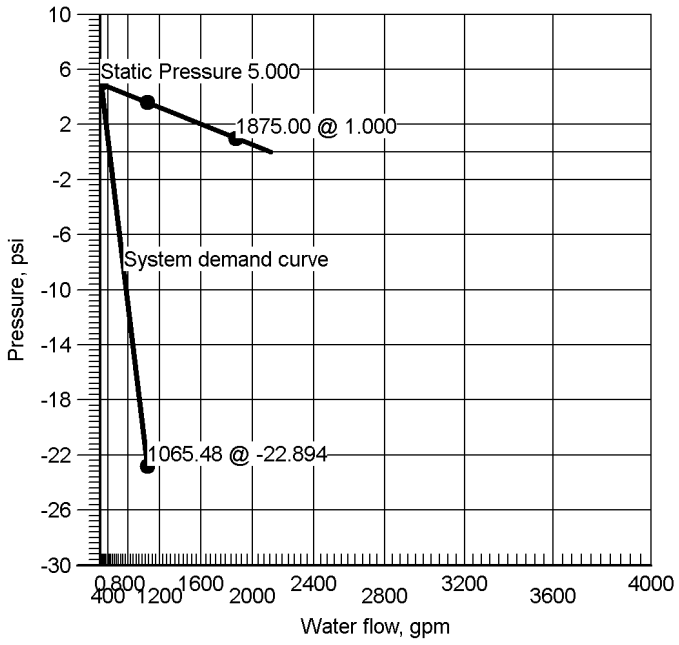
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

IC0099 LANL TWF Rev 3



Tank Supply at Node 62 (1875.00, 0.00, 5.000, 1.000)



Hydraulic Summary

Job

Job Number: IC0099	Design Engineer: Brad Vokes
Job Name: LANL TWF	State Certification/License Number:
Address 1: LOS ALAMOS NATIONAL LABS	AHJ: LANL FPDO
Address 2:	Job Site/Building: Building 154
Address 3:	Drawing Name: IC0099 LANL TWF Rev 3

System

Most Demanding Sprinkler Data: 5.6 K-Factor 18.43 at 10.829

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 44	500.00

Total Hose Streams: 500.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1065.51	1065.51

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 17.99 between nodes 145 and 153

Maximum Velocity Under Ground: 10.40 between nodes 73 and 72

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
	54gal

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	
Density	**Area of Application**
0.200gpm/ft²	1950.00ft² (Actual 1994.34ft²)
Number Of Sprinklers Calculated	**Coverage Per Sprinkler**
27	Varies

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
62	Tank Supply		5.000	1.000		1875.00	3.594		1065.48	0.000	26.488
131		Pump	75.000	65.000		1250.00	69.598		1065.48	43.110	26.488

Pumps: Static = Churn (Pressure @ Zero Flow)

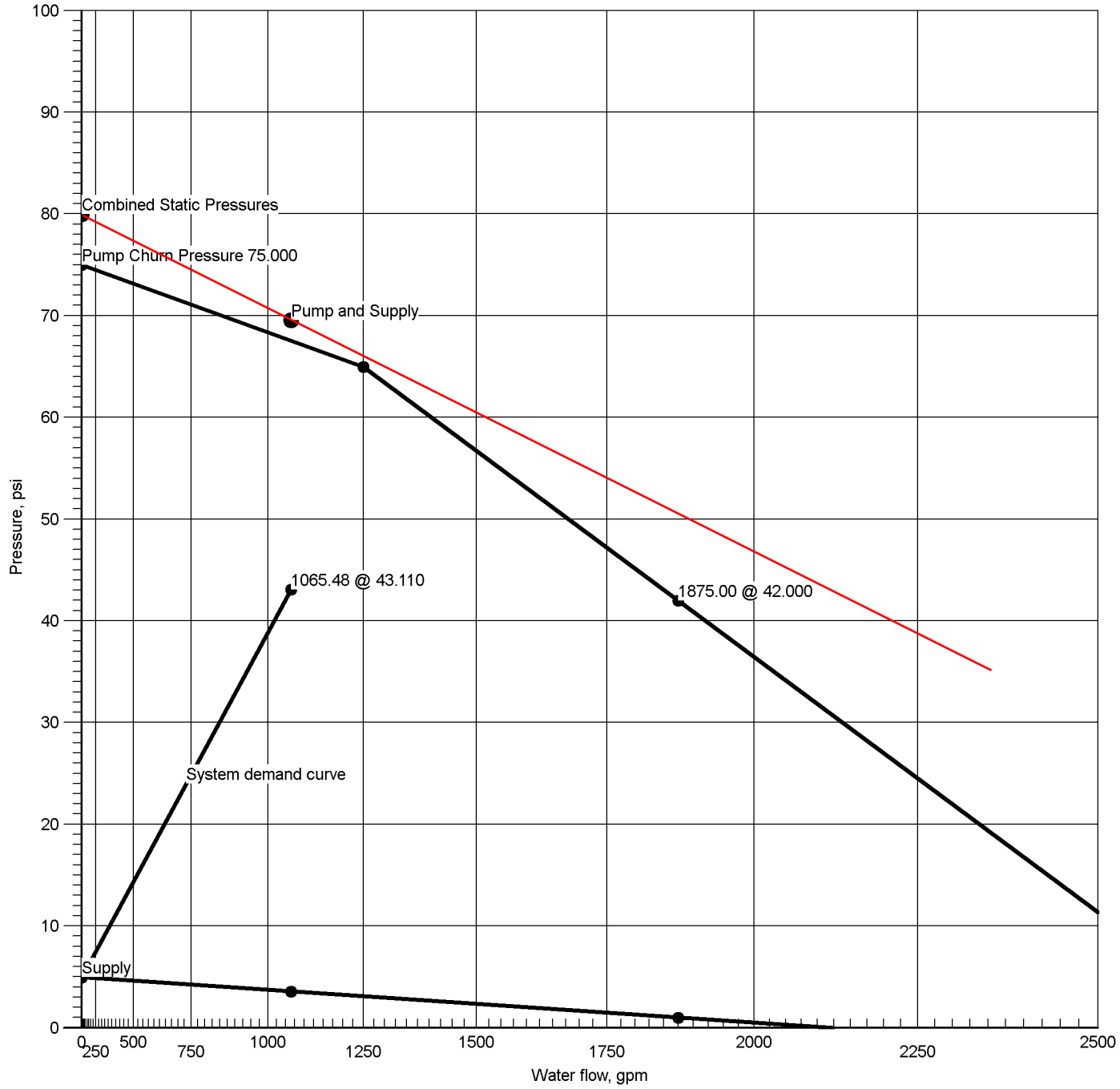
Contractor

	Contractor Number	Contact Name	Contact Title
	IC0119	BRAD VOKES	DESIGNER

Name of Contractor:	Phone	Extension
WESTERN STATES FIRE PROTECTION	226-668-8168	

Address 1	FAX
5200 PASADENA AVE NE, SUITE A	505-884-1863
Address 2	**E-mail**
	BRAD.VOKES@WSFP.US
Address 3	**Web-Site**
ALBUQUERQUE, NM 87113	

Pump at Node 131



Hydraulic Graph	Static + Churn Pressure	Rated Pump Pressure
Pump at Node 131	80.000	65.000 @ 1250.00
Static: Pressure	**Churn Pressure**	
5.000	75.000	
Residual: Pressure		
1.000 @ 1875.00		
Available Pressure at Time of Test	**Available Pressure at Pump Discharge**	
3.594 @ 1065.48	69.598 @ 1065.48	
System Demand		
43.110 @ 1065.48		

Summary Of Outflowing Devices

Job Number: IC0099
Report Description: Ordinary Group II

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		Coverage (Foot)
Hydrant	44	500.00	500.00	267.26	35.245		
Sprinkler	1201	21.03	14.82	5.6	14.109		74.10
Sprinkler	1202	22.18	14.82	5.6	15.685		74.10
Sprinkler	1203	23.66	14.82	5.6	17.853		74.10
Sprinkler	1204	25.39	14.82	5.6	20.558		74.10
Sprinkler	1205	18.78	18.43	5.6	11.244		92.15²
Sprinkler	1206	18.84	18.43	5.6	11.312		92.15²
Sprinkler	1207	19.01	18.43	5.6	11.520		92.15²
Sprinkler	1208	19.35	18.43	5.6	11.943		92.15²
Sprinkler	1209	19.93	18.43	5.6	12.662		92.15²
Sprinkler	1211	26.46	14.82	5.6	22.332		74.10
Sprinkler	1212	26.53	14.82	5.6	22.448		74.10
Sprinkler	1213	26.75	14.82	5.6	22.824		74.10
Sprinkler	1216	18.74	18.43	5.6	11.194		92.15²
Sprinkler	1217	19.30	18.43	5.6	11.877		92.15²
Sprinkler	1218	20.13	18.43	5.6	12.916		92.15²
Sprinkler	1219	20.89	18.43	5.6	13.917		92.15²
Sprinkler	1220	22.36	18.43	5.6	15.941		92.15²
Sprinkler	1223	18.58	18.43	5.6	11.004		92.15²
Sprinkler	1224	18.63	18.43	5.6	11.072		92.15²
Sprinkler	1225	18.80	18.43	5.6	11.275		92.15²
Sprinkler	1226	19.15	18.43	5.6	11.690		92.15²
Sprinkler	1227	19.71	18.43	5.6	12.394		92.15²
Sprinkler	1228	22.62	18.43	5.6	16.320		92.15²
Sprinkler	1229	23.70	18.43	5.6	17.910		92.15²
Sprinkler	1602	18.23	14.82	5.6	10.602		74.10
Sprinkler	1603	18.29	14.82	5.6	10.671		74.10
Sprinkler	**1604**	**18.43**	**18.43**	**5.6**	**10.829**		92.15²

⇨ Most Demanding Sprinkler Data

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	2.0670	54.96	5.25	100		0.043496	7'-6½	Pf 0.328
1604	13'-1	18.43	5.6	10.829		Sprinkler		Pe 0.038
1216	13'-0			11.194			7'-6½	Pv
CM	2.0670	73.69	7.05	100		0.074844	8'-10½	Pf 0.664
1216	13'-0	18.74	5.6	11.194		Sprinkler		Pe 0.018
1217	12'-11½			11.877			8'-10½	Pv
CM	2.0670	92.99	8.89	100		0.115092	8'-10½	Pf 1.021
1217	12'-11½	19.30	5.6	11.877		Sprinkler		Pe 0.018
1218	12'-11			12.916			8'-10½	Pv
CM	2.0670	113.12	10.82	100		0.165370	6'-0	Pf 0.992
1218	12'-11	20.13	5.6	12.916		Sprinkler		Pe 0.008
1219	12'-10½			13.917			6'-0	Pv
CM	2.0670	134.01	12.81	100		0.226267	8'-10½	Pf 2.008
1219	12'-10½	20.89	5.6	13.917		Sprinkler		Pe 0.017
1220	12'-10½			15.941			8'-10½	Pv
CM	2.0670	156.37	14.95	100		0.301021	13'-1½	Pf 7.702
1220	12'-10½	22.36	5.6	15.941		Sprinkler,	12'-5½	Pe 0.711
179	11'-2½			24.355		fT(6'-0½), mecT(6'-5)	25'-7	Pv
CM	4.0260	424.28	10.69	100		0.074227	18'-4	Pf 2.081
179	11'-2½	267.91		24.355		Flow (q) from Route 3	9'-8½	Pe 0.019
200	11'-2			26.454		2fE(4'-10)	28'-0½	Pv
CM	4.0260	565.48	14.25	100		0.126291	7'-11½	Pf 3.780
200	11'-2	141.20		26.454		Flow (q) from Route 2	21'-11½	Pe 4.217
84	1'-5½			34.451		fE(4'-10), DPV, CV(15'-8), PIV(1'-5)	29'-11	Pv
UG	6.4000	565.48	5.64	120		0.009430	5'-11½	Pf 0.228
84	1'-5½			34.451			18'-2½	Pe 2.576
16	-4'-6			37.255		E(18'-2½)	24'-1½	Pv
UG	5.3480	565.48	8.08	150		0.014964	108'-11½	Pf 2.394
16	-4'-6			37.255			51'-0	Pe -0.000
36	-4'-6			39.649		E(14'-0), EE(7'-0), T(30'-0)	159'-11½	Pv
UG	6.9630	86.26	0.73	150		0.000128	47'-9	Pf 0.006
36	-4'-6			39.649				Pe
50	-4'-6			39.655			47'-9	Pv
UG	6.4700	86.26	0.84	120		0.000276	1'-0	Pf 0.001
50	-4'-6			39.655			4'-0	Pe
51	-4'-6			39.656		PIV(4'-0)	5'-0	Pv
UG	6.9630	86.26	0.73	150		0.000128	4'-8	Pf 0.005
51	-4'-6			39.656			35'-0	Pe
52	-4'-6			39.662		T(35'-0)	39'-8	Pv
UG	6.9630	586.26	4.94	150		0.004425	4'-11	Pf 0.039
52	-4'-6	500.00		39.662		Flow (q) from Route 7	4'-0	Pe
53	-4'-6			39.701		PIV(4'-0)	8'-11	Pv
UG	6.4700	586.26	5.72	120		0.009561	1'-0	Pf 0.010
53	-4'-6			39.701				Pe
54	-4'-6			39.711			1'-0	Pv
UG	6.9630	586.26	4.94	150		0.004425	223'-3	Pf 1.165
54	-4'-6			39.711			40'-0	Pe
69	-4'-6			40.876		4EE(9'-0), PIV(4'-0)	263'-3	Pv
UG	6.4700	586.26	5.72	120		0.009561	1'-0	Pf 0.010
69	-4'-6			40.876				Pe
70	-4'-6			40.885			1'-0	Pv
UG	6.9630	586.26	4.94	150		0.004425	3'-11	Pf 0.017
70	-4'-6			40.885				Pe
71	-4'-6			40.902			3'-11	Pv
UG	6.9630	1065.48	8.98	150		0.013363	4'-9½	Pf 0.117
71	-4'-6	479.21		40.902		Flow (q) from Route 10	4'-0	Pe
72	-4'-6			41.020		PIV(4'-0)	8'-9½	Pv
UG	6.4700	1065.48	10.40	120		0.028874	1'-0	Pf 0.029
72	-4'-6			41.020				Pe
73	-4'-6			41.049			1'-0	Pv
UG	6.9630	1065.48	8.98	150		0.013363	165'-8	Pf 3.043
73	-4'-6			41.049			62'-0	Pe 0.000
75	-4'-6			44.091		EE(9'-0), T(35'-0), E(18'-0)	227'-8	Pv
FM	7.9810	1065.48	6.83	120		0.010389	13'-4	Pf 1.728
75	-4'-6			44.091			153'-0	Pe -2.710
131	1'-9			43.110		2LtE(13'-0), 2T(35'-0), BV(12'-0), CV(45'-0)	166'-4	Pv
Pump			**Velocity**					
131		1065.48		43.110		Rating: 65.000 @ 1250.00		
129		Q=1065.48	6.83	-24.449		Churn Pressure: 75.000		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
FM	7.9810	1065.48	6.83	120	0.010389	6'-0	Pf 0.602
129	1'-9			-24.449		52'-0	Pe -1.409
124	5'-0			-25.255	GV(4'-0), LtE(13'-0), T(35'-0)	58'-0	Pv
FM	11.9380	1065.48	3.05	120	0.001462	83'-8	Pf 0.410
124	5'-0			-25.255		197'-0	Pe 1.951
62	0'-6			-22.894	sCV(65'-0), GV(6'-0), 7LtE(18'-0), S	280'-8	Pv
		0.00			Hose Allowance At Source		
62		1065.48					
• • • • • Route 2 • • • • •							
CM	2.0670	18.58	1.78	100	0.005848	8'-10½	Pf 0.052
1223	12'-3	18.58	5.6	11.004	Sprinkler		Pe 0.016
1224	12'-2½			11.072		8'-10½	Pv
CM	2.0670	37.21	3.56	100	0.021142	8'-10½	Pf 0.188
1224	12'-2½	18.63	5.6	11.072	Sprinkler		Pe 0.016
1225	12'-2			11.275		8'-10½	Pv
CM	2.0670	56.01	5.36	100	0.045058	8'-10½	Pf 0.400
1225	12'-2	18.80	5.6	11.275	Sprinkler		Pe 0.015
1226	12'-1½			11.690		8'-10½	Pv
CM	2.0670	75.16	7.19	100	0.077626	8'-10½	Pf 0.689
1226	12'-1½	19.15	5.6	11.690	Sprinkler		Pe 0.015
1227	12'-1			12.394		8'-10½	Pv
CM	2.0670	94.87	9.07	100	0.119443	2'-0½	Pf 1.393
1227	12'-1	19.71	5.6	12.394	Sprinkler,	9'-7½	Pe 0.003
212	12'-1			13.791	fE(2'-6), T(7'-1½)	11'-8	Pv
CM	2.0670	55.64	5.32	100	0.044510	0'-5½	Pf 0.449
212	12'-1			13.791		9'-7½	Pe -0.186
198	12'-6½			14.053	fE(2'-6), T(7'-1½)	10'-1	Pv
CM	2.0670	94.87	9.07	100	0.119443	1'-5	Pf 1.319
198	12'-6½	39.23		14.053	Flow (q) from Route 8	9'-7½	Pe 0.004
199	12'-6			15.376	fE(2'-6), T(7'-1½)	11'-0½	Pv
CM	2.0670	55.64	5.32	100	0.044510	0'-5½	Pf 0.449
199	12'-6			15.376		9'-7½	Pe 0.186
213	12'-1			16.011	fE(2'-6), T(7'-1½)	10'-1	Pv
CM	2.0670	94.87	9.07	100	0.119443	2'-6½	Pf 0.304
213	12'-1	39.23		16.011	Flow (q) from Route 9		Pe 0.005
1228	12'-1			16.320		2'-6½	Pv
CM	2.0670	117.50	11.23	100	0.177412	8'-10½	Pf 1.575
1228	12'-1	22.62	5.6	16.320	Sprinkler		Pe 0.016
1229	12'-0½			17.910		8'-10½	Pv
CM	2.0670	141.20	13.50	100	0.249234	20'-3½	Pf 8.169
1229	12'-0½	23.70	5.6	17.910	Sprinkler,	12'-5½	Pe 0.375
200	11'-2			26.454	fT(6'-0½), mecT(6'-5)	32'-9½	Pv
• • • • • Route 3 • • • • •							
CM	2.0670	18.78	1.80	100	0.005966	8'-10½	Pf 0.053
1205	12'-2	18.78	5.6	11.244	Sprinkler		Pe 0.016
1206	12'-1½			11.312		8'-10½	Pv
CM	2.0670	37.61	3.60	100	0.021568	8'-10½	Pf 0.191
1206	12'-1½	18.84	5.6	11.312	Sprinkler		Pe 0.016
1207	12'-1			11.520		8'-10½	Pv
CM	2.0670	56.62	5.41	100	0.045964	8'-10½	Pf 0.408
1207	12'-1	19.01	5.6	11.520	Sprinkler		Pe 0.016
1208	12'-0½			11.943		8'-10½	Pv
CM	2.0670	75.97	7.26	100	0.079185	8'-10½	Pf 0.703
1208	12'-0½	19.35	5.6	11.943	Sprinkler		Pe 0.016
1209	12'-0½			12.662		8'-10½	Pv
CM	2.0670	95.90	9.17	100	0.121839	7'-2	Pf 1.482
1209	12'-0½	19.93	5.6	12.662	Sprinkler,	5'-0	Pe -0.035
1201	12'-1			14.109	2fE(2'-6)	12'-2	Pv
CM	2.0670	116.93	11.18	100	0.175841	8'-10½	Pf 1.561
1201	12'-1	21.03	5.6	14.109	Sprinkler		Pe 0.016
1202	12'-1			15.685		8'-10½	Pv
CM	2.0670	139.11	13.30	100	0.242470	8'-10½	Pf 2.152
1202	12'-1	22.18	5.6	15.685	Sprinkler		Pe 0.016
1203	12'-0½			17.853		8'-10½	Pv
CM	2.0670	162.77	15.56	100	0.324237	2'-7½	Pf 2.820
1203	12'-0½	23.66	5.6	17.853	Sprinkler,	6'-0½	Pe 0.005
153	12'-0½			20.678	fT(6'-0½)	8'-8½	Pv
CM	2.0670	188.17	17.99	100	0.423963	0'-9½	Pf 3.054
153	12'-0½	25.39		20.678	Flow (q) from Route 5	6'-5	Pe 0.341
145	11'-3			24.073	mecT(6'-5)	7'-2½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	4.0260	188.17	4.74	100	0.016493	6'-0	Pf 0.099
145	11'-3			24.073			Pe 0.005
172	11'-2½			24.176		6'-0	Pv
CM	4.0260	267.91	6.75	100	0.031710	5'-6	Pf 0.174
172	11'-2½	79.75		24.176	Flow (q) from Route 6		Pe 0.004
179	11'-2½			24.355		5'-6	Pv
• • • • • Route 4 • • • • •							
CM	2.0670	18.23	1.74	100	0.005650	6'-0	Pf 0.034
1602	13'-3	18.23	5.6	10.602	Sprinkler		Pe 0.035
1603	13'-2			10.671		6'-0	Pv
CM	2.0670	36.53	3.49	100	0.020431	6'-0	Pf 0.123
1603	13'-2	18.29	5.6	10.671	Sprinkler		Pe 0.035
1604	13'-1			10.829		6'-0	Pv
• • • • • Route 5 • • • • •							
CM	2.0670	25.39	2.43	100	0.010425	6'-6	Pf 0.131
1204	12'-0	25.39	5.6	20.558	Sprinkler,	6'-0½	Pe -0.011
153	12'-0½			20.678	fT(6'-0½)	12'-6½	Pv
• • • • • Route 6 • • • • •							
CM	2.0670	26.46	2.53	100	0.011255	8'-10½	Pf 0.100
1211	11'-11½	26.46	5.6	22.332	Sprinkler		Pe 0.016
1212	11'-11			22.448		8'-10½	Pv
CM	2.0670	53.00	5.07	100	0.040670	8'-10½	Pf 0.361
1212	11'-11	26.53	5.6	22.448	Sprinkler		Pe 0.016
1213	11'-11			22.824		8'-10½	Pv
CM	2.0670	79.75	7.62	100	0.086622	3'-3½	Pf 1.058
1213	11'-11	26.75	5.6	22.824	Sprinkler,	8'-11	Pe 0.294
172	11'-2½			24.176	fE(2'-6), mecT(6'-5)	12'-2½	Pv
• • • • • Route 7 • • • • •							
UG	5.3480	500.00	7.14	150	0.011917	14'-8	Pf 1.081
44	2'-6	500.00		35.245	Hydrant,	76'-0	Pe 3.035
41	-4'-6			39.360	E(14'-0), CV(32'-0), T(30'-0)	90'-8	Pv
UG	6.9630	500.00	4.21	150	0.003296	73'-5	Pf 0.301
41	-4'-6			39.360		18'-0	Pe
52	-4'-6			39.662	2EE(9'-0)	91'-5	Pv
• • • • • Route 8 • • • • •							
DY	2.0670	39.23	3.75	100	0.023315	0'-0	Pf 0.449
212	12'-1			13.791	fE(2'-6), T(7'-1½)	19'-3	Pe -0.186
198	12'-6½			14.053	fE(2'-6), T(7'-1½)	19'-3	Pv
• • • • • Route 9 • • • • •							
DY	2.0670	39.23	3.75	100	0.023315	0'-0	Pf 0.449
199	12'-6			15.376	fE(2'-6), T(7'-1½)	19'-3	Pe 0.186
213	12'-1			16.011	fE(2'-6), T(7'-1½)	19'-3	Pv
• • • • • Route 10 • • • • •							
UG	6.9630	479.21	4.04	150	0.003047	63'-0	Pf 0.204
24	-4'-6			40.030		4'-0	Pe
25	-4'-6			40.234	PIV(4'-0)	67'-0	Pv
UG	6.4700	479.21	4.68	120	0.006585	1'-0	Pf 0.007
25	-4'-6			40.234			Pe
26	-4'-6			40.241		1'-0	Pv
UG	6.9630	479.21	4.04	150	0.003047	119'-6	Pf 0.483
26	-4'-6			40.241		39'-0	Pe
61	-4'-6			40.724	T(35'-0), PIV(4'-0)	158'-6	Pv
UG	6.4700	479.21	4.68	120	0.006585	1'-0	Pf 0.007
61	-4'-6			40.724			Pe
63	-4'-6			40.730		1'-0	Pv
UG	6.9630	479.21	4.04	150	0.003047	21'-6	Pf 0.172
63	-4'-6			40.730		35'-0	Pe
71	-4'-6			40.902	T(35'-0)	56'-6	Pv
• • • • • Route 11 • • • • •							
UG	6.9630	479.21	4.04	150	0.003047	46'-8½	Pf 0.182
36	-4'-6			39.649		13'-0	Pe
18	-4'-6			39.831	EE(9'-0), PIV(4'-0)	59'-8½	Pv
UG	6.4700	479.21	4.68	120	0.006585	1'-0	Pf 0.007
18	-4'-6			39.831			Pe
19	-4'-6			39.837		1'-0	Pv
UG	6.9630	479.21	4.04	150	0.003047	57'-0	Pf 0.186
19	-4'-6			39.837		4'-0	Pe
22	-4'-6			40.023	PIV(4'-0)	61'-0	Pv
UG	6.4700	479.21	4.68	120	0.006585	1'-0	Pf 0.007
22	-4'-6			40.023			Pe
24	-4'-6			40.030		1'-0	Pv

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

TA 63 TWF Retention Basin Sealant Information

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Exhibit I

Attachment A

Los Alamos NATIONAL LABORATORY EST.1943

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671		**STR Name:** Roy Maestas
SUBCONTRACTOR	**Company Name:** J.B. Henderson Construction	**Date Submitted:** 9/10/2014
	Street Address: 1285 Trinity Drive, Suites A&B	☒ **Initial Submittal of a New Document**
	City, State, Zip code: Los Alamos, NM 87544	☐ **Re- Submittal of Previous Document**
	Subcontractor's Point of Contact: Taylor Cardon	
	Submittal Number:	5.1115 (09 9201)
	Submittal Title:	Retention Basin Sealant
	Revision Number:	0
	Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.	
	Subcontractor's Representative's signature: Greg Masterman	Digitally signed by Greg Masterman DN: cn=Greg Masterman, o=JB Henderson, ou, email=gmasterman@jbhenderson.com, c=US Date: 2014.09.10 08:06:42 -06'00'
CONTRACTOR	**Date Received:**	
	Statused By:	Michael Pope
	Date:	9/23/14
	Comments:	
	Status Code: ☒ 1 Reviewed-Work may proceed ☐ 2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments. ☐ 3 Reviewed. Revise and resubmit. Work may not proceed. ☐ 4 Reject. Submittal does not meet requirements. Resubmit. ☐ 5 Permission to proceed not required.	
	Submit comments to:	

Exhibit I

Attachment A

Los Alamos NATIONAL LABORATORY EST. 1943

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671	**STR Name:** Roy Maestas

SUBCONTRACTOR

Company Name: J.B. Henderson Construction	**Date Submitted:** 06/01/16
Street Address: 1285 Trinity Drive, Suites A&B	☒ **Initial Submittal of a New Document**
City, State, Zip code: Los Alamos, NM 87544	☐ **Re- Submittal of Previous Document**
Subcontractor's Point of Contact: Taylor Cardon	
Submittal Number:	5.1134-0001
Submittal Title:	Manufacturer's Field Report Xypec Retention Basin Concrete Sealant (09 9201/1.05.E)
Revision Number:	0

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature: Sonia Lopez

Digitally signed by Sonia Lopez
DN: C=US, E=slopez@jbhenderson.com, O=JB Henderson Construction, CN=Sonia Lopez
Date: 2016.06.01 15:12:50-06'00'

CONTRACTOR

Date Received:	
Statused By:	Michael Pope/Signature on File
Date:	Jun 09, 2016
Comments:	

Status Code:

- ☒ **1 Reviewed-Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

Exhibit I

Attachment A

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671	**STR Name:** Roy Maestas

SUBCONTRACTOR

Company Name: J.B. Henderson Construction	**Date Submitted:** 09/09/15
Street Address: 1285 Trinity Drive, Suites A&B	☒ **Initial Submittal of a New Document**
City, State, Zip code: Los Alamos, NM 87544	☐ **Re- Submittal of Previous Document**
Subcontractor's Point of Contact: Taylor Cardon	URGENT
Submittal Number:	5.1131-0001
Submittal Title:	Product Data Xypex Retention Basin Concrete Sealant (09 9201/1.05.B)
Revision Number:	0
Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.	
Subcontractor's Representative's signature: (GWC)	

CONTRACTOR

Date Received:	
Statused By:	
Date:	
Comments:	
Status Code: ☒ **1 Reviewed-Work may proceed** ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.** ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.** ☐ **4 Reject. Submittal does not meet requirements. Resubmit.** ☐ **5 Permission to proceed not required.**	
Submit comments to:	

XYPEX® CONCENTRATE

07160 | CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

Description

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX CONCENTRATE is the most chemically active product within the Xypex Crystalline Waterproofing System. When mixed with water, this light grey powder is applied as a cementitious slurry coat to above-grade or below-grade concrete, either as a single coat or as the first of a two-coat application. It is also mixed in Dry-Pac form for sealing strips at construction joints, or for the repairing of cracks, faulty construction joints and honeycombs. Xypex prevents the penetration of water and other liquids from any direction by causing a catalytic reaction that produces a non-soluble crystalline formation within the pores and capillary tracts of concrete and cement-based materials.

Recommended for:

- Reservoirs
- Sewage and Water Treatment Plants
- Underground Vaults
- Secondary Containment Structures
- Foundations
- Tunnels and Subway Systems
- Swimming Pools
- Parking Structures

Advantages

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Can seal hairline cracks up to 0.4 mm
- Allows concrete to breathe
- Highly resistant to aggressive chemicals
- Non-toxic
- Does not require a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Can be applied to the positive or the negative side of the concrete surface
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent

Packaging

Xypex Concentrate is available in 20 lb. (9.1 kg) pails, 60 lb. (27.2 kg) pails and 50 lb. (22.7 kg) bags.

Storage

Xypex products must be stored dry at a minimum temperature of 45ºF (7ºC). Shelf life is one year when stored under proper conditions.

Coverage

For normal surface conditions, the coverage rate for each Xypex coat is 6 to 7.2 sq. ft./lb. (1.25 - 1.5 lb./sq. yd. or 0.65 - 0.8 kg/m^2).

Test Data

PERMEABILITY

U.S. Army Corps of Engineers (USACE) CRD C48-73, "Permeability of Concrete", Pacific Testing Labs, Seattle, USA

Two in. (51 mm) thick, 2000 psi (13.8 MPa) Xypex-treated concrete samples were pressure tested up to a 405 ft. (124 m) water head (175 psi/1.2 MPa), the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples (as a result of the crystallization process) became totally sealed and exhibited no measurable leakage.

DIN 1048, "Water Impermeability of Concrete", Bautest – Corporation for Research & Testing of Building Materials, Augsburg, Germany

Twenty cm thick Xypex-treated concrete samples were pressure tested up to 7 bars (230 ft./70 m water head) for 24 hours to determine water impermeability. While the reference specimens measured water penetration up to a depth of 92 mm, Xypex-treated samples measured water penetration of zero to an average of 4 mm.

ÖNORM B 3303, "Water Impermeability of Concrete", Technologisches Gerwerbemuseum, Federal Higher Technical Education & Research Institute, Vienna, Austria

Xypex-treated concrete samples were pressure tested to a maximum 7 bars (230 ft./70 m water head) for 10 days. Test revealed that while 25 ml of water had penetrated the untreated concrete samples, zero ml had penetrated the Xypex-treated samples. Test specimens were then

broken and showed water penetration to a depth of 15 mm on untreated samples but no measurable water penetration on the Xypex-treated samples.

CSN 1209/1321, "Impermeability and Resistance to Pressurized Water", Institute of Civil Engineering, Technology and Testing, Bratislava, Slovak Republic

Xypex-treated and untreated concrete samples were exposed to 1.2 MPa of pressure to determine water permeability. Results showed the Xypex-treated samples provided effective protection against hydrostatic water pressure. Treated and untreated samples were also subjected to contact with silage juices and various petroleum products (e.g. diesel oil, transformer oil, gasoline) at 14 kPa for 28 days. The Xypex-treated samples significantly reduced the penetration of these solutions.

CHEMICAL RESISTANCE

ASTM C 267-77, "Chemical Resistance to Mortars", Pacific Testing Labs, Seattle, USA

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethelyne glycol, pool chlorine and brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Tests following chemical exposure measured an average 17% higher compressive strength in the Xypex-treated specimens over the untreated control samples.

IWATE University Technical Report, "Resistance to Acid Attack", Tokyo, Japan

Xypex-treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H_2SO_4 solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

FREEZE/THAW DURABILITY

ASTM C 672, "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-Icing Chemicals", Twin City Testing Lab, St. Paul, USA

Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 freeze/thaw cycles showed a marked increase in surface deterioration compared to Xypex-treated samples.

JIS A 6204, "Concrete Freeze/Thaw", Japan Testing Center for Construction Materials, Tokyo, Japan

The resonating frequency of both untreated and Xypex-treated concrete samples were measured throughout 435 freeze/thaw cycles. At 204 cycles, the Xypex-treated samples showed 96% relative durability compared to 90% in the untreated samples. At 435 cycles, the Xypex-treated samples measured 91% relative durability compared to 78% in the untreated reference samples.

POTABLE WATER EXPOSURE

NSF 61, "Drinking Water System Component-Health Effects", NSF International, Ann Arbor, USA

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

RADIATION RESISTANCE

U.S.A. Standard No. N69, "Protective Coatings for the Nuclear Industry", Pacific Testing Labs, Seattle, USA

After exposure to 5.76×10^4 rads of gamma radiation, the Xypex treatment revealed no ill effects or damages.

Application Procedures

1. **SURFACE PREPARATION** Concrete surfaces to be treated must be clean and free of laitance, dirt, film, paint, coating or other foreign matter. Surfaces must also have an open capillary system to provide "tooth and suction" for the Xypex treatment. If surface is too smooth (e.g. where steel forms are used) or covered with excess form oil or other foreign matter, the concrete should be lightly sandblasted, waterblasted, or etched with muriatic (HCL) acid.

2. **STRUCTURAL REPAIR** Rout out cracks, faulty construction joints and other structural defects to a depth of 1.5 in. (37 mm) and a width of 1 in. (25 mm). Apply a brush coat of Xypex Concentrate as described in steps 5 & 6 and allow to dry for 10 minutes. Fill cavity by tightly compressing Dry-Pac into the groove with pneumatic packing tool or with hammer and wood block. Dry-Pac is prepared by mixing six parts Xypex Concentrate powder with one part water to a dry, lumpy consistency.

NOTE:

i. Against a direct flow of water (leakage) or where there is excess moisture due to seepage, use Xypex Patch'n Plug then Xypex Dry-Pac followed by a brush coat of Xypex Concentrate. (Refer to Xypex Specifications and Applications Manual for full details.)

ii. For expansion joints or chronic moving cracks, flexible materials such as expansion joint sealants should be used.

3. **WETTING CONCRETE** Xypex requires a saturated substrate and a damp surface. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper curing of the treatment and to ensure the growth of the crystalline formation

deep within the pores of the concrete. Remove excess surface water before the application. If concrete surface dries out before application, it must be re-wetted.

4. **MIXING FOR SLURRY COAT** Mix Xypex powder with clean water to a creamy consistency in the following proportions:

For Brush Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m^2)
5 parts powder to 2 parts water

2.0 lb./sq. yd. (1.0 kg/m^2)
3 parts powder to 1 part water

For Spray Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m^2)
5 parts powder to 3 parts water
(ratio may vary with equipment type)

Do not mix more Xypex material than can be applied in 20 minutes. Do not add water once mix starts to harden. Protect hands with rubber gloves.

5. **APPLYING XYPEX** Apply Xypex with a semi-stiff nylon bristle brush, push broom (for large horizontal surfaces) or specialized spray equipment. The coating must be uniformly applied and should be just under 1/16 in. (1.25 mm). When a second coat (Xypex Concentrate or Xypex Modified) is required, it should be applied after the first coat has reached an initial set but while it is still “green” (less than 48 hours). Light pre-watering between coats may be required due to drying. The Xypex treatment must not be applied under rainy conditions or when ambient temperature is below 40ºF (4ºC). For recommended equipment, contact Xypex Chemical Corporation or your nearest Xypex distributor.

6. **CURING** A misty fog spray of clean water must be used for curing the Xypex treatment. Curing should begin as soon as the Xypex has set to the point where it will not be damaged by a fine spray of water. Under normal conditions, it is sufficient to spray Xypex-treated surfaces three times per day for two to three days. In hot or arid climates, spraying may be required more frequently. During the curing period, the coating must be protected from rainfall, frost, wind, the puddling of water and temperatures below 36ºF (2ºC) for a period of not less than 48 hours after application. If plastic sheeting is used as protection, it must be raised off the Xypex to allow the coating to breathe. Xypex Gamma Cure may be used in lieu of water curing for certain applications (consult with Xypex Chemical Corporation or your nearest Xypex distributor).

NOTE: For concrete structures that hold liquids (e.g. reservoirs, swimming pools, tanks, etc.), Xypex should be cured for three days and allowed to set for 12 days before filling the structure with liquid.

Technical Services

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex representative.

Safe Handling Information

Xypex is alkaline. As a cementitious powder or mixture, Xypex may cause significant skin and eye irritation. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Material Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex representative to obtain copies of Material Safety Data Sheets prior to product storage or use.

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

13731 Mayfield Place, Richmond, BC, Canada V6V 2G9 Toll-free: 1.800.961.4477
Tel: 604.273.5265 Fax: 604.270.0451 E-mail: info@xypex.com Web: www.xypex.com

ISO 9001:2008
FM 63167

GAMMA CURE

07160 | CEMENTITIOUS CRYSTALLINE - CURING

Concrete Waterproofing

Description

XYPEX GAMMA CURE is a curing agent designed specifically for Xypex crystalline waterproofing products. Gamma Cure may be used as an alternative to water curing for certain Xypex applications. It is also used to accelerate the Xypex crystallization process. Xypex Gamma Cure acts as an evaporation retardant by retaining the maximum amount of moisture in the Xypex coating. It also provides a catalyst for the reaction with the Xypex crystalline waterproofing treatment. It is a self-dissipating (2 - 3 days) non-film forming product.

Recommended for:

- Applications where water-curing is not possible
- Hot, dry, windy conditions
- Vertical surfaces

Packaging

Xypex Gamma Cure is available in 1 U.S. gallon (3.79 litre) bottles and 5 U.S. gallon (18.95 litre) pails.

Storage

Xypex products must be stored dry at a minimum temperature of 45ºF (7ºC). Shelf life is one year when stored under proper conditions.

Coverage

One U.S. gallon (3.79 litres) of Gamma Cure when diluted with water will cover approximately 800 sq. ft. (75 m^2).

Application Procedures

1. **CURING OF XYPEX COATING** Dilute one part Gamma Cure with 3 parts clean water. Apply by spraying onto the crystalline waterproofing coating after the coating has reached an initial set, but before it dries (approx. 1 - 2 hours).

2. **PREPARATION OF CONCRETE SUBSTRATE IN HOT, DRY OR WINDY CONDITIONS** Dilute one part Gamma Cure with 3 parts clean water and apply to concrete surface before application of the Xypex crystalline coating. Gamma Cure should be applied while the concrete is still damp from pre-watering.

Technical Services

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex representative.

Safe Handling Information

Gamma Cure is an acidic solution. This product may be a mild to moderate skin and eye irritant. In addition, many of the components of the cementitious products that are used in conjunction with the Gamma Cure may also possess significant skin and eye irritation potential. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Material Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex representative to obtain copies of Material Safety Data Sheets prior to product storage or use.

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

13731 Mayfield Place, Richmond, BC, Canada V6V 2G9 Toll-free: 1.800.961.4477
Tel: 604.273.5265 Fax: 604.270.0451 E-mail: info@xypex.com Web: www.xypex.com

ISO 9001:2008
FM 63167

XYPEX® MODIFIED

07160 | CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

Description

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX MODIFIED can be applied as a second coat to reinforce Xypex Concentrate, or applied by itself to damp-proof the exterior of foundation walls. Applied as a second coat, Xypex Modified chemically reinforces Xypex Concentrate where two coats are required and produces a harder finish. Where damp-proofing is required, a single coat of Modified may be used as an alternative to a spray/tar emulsion. Xypex prevents the penetration of water and other liquids from any direction by causing a catalytic reaction that produces a non-soluble crystalline formation within the pores and capillary tracts of concrete and cement-based materials.

Recommended for:

Xypex Modified is recommended as a single coat for the damp-proofing of foundations or as a second coat with Xypex Concentrate for the following applications:

- Reservoirs
- Sewage and Water Treatment Plants
- Secondary Containment Structures
- Tunnels and Subway Systems
- Underground Vaults
- Foundations
- Parking Structures
- Swimming Pools

Advantages

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Allows concrete to breathe
- Resistant to aggressive chemicals
- Non-toxic
- Does not require dry weather or a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Can be applied to the positive or the negative side of the concrete surface
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent

Packaging

Xypex Modified is available in 60 lb. (27.2 kg) pails and 50 lb. (22.7 kg) bags.

Storage

Xypex products must be stored dry at a minimum temperature of 45ºF (7ºC). Shelf life is one year when stored under proper conditions.

Coverage

For normal surface conditions, the coverage rate for each coat is 6 - 7.2 sq. ft. per lb. (1.25 - 1.5 lb. per sq. yd. or 0.65 - 0.8 kg/m^2).

Test Data

When used in conjunction with Xypex Concentrate:

PERMEABILITY

U.S. Army Corps of Engineers (USACE) CRD C48-73, "Permeability of Concrete", Pacific Testing Labs, Seattle, USA

Two in. (51 mm) thick, 2000 psi (13.8 MPa) Xypex-treated concrete samples were pressure tested up to a 405 ft. (124 m) water head (175 psi/1.2 MPa), the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples (as a result of the crystallization process) became totally sealed and exhibited no measurable leakage.

DIN 1048, "Water Impermeability of Concrete", Bautest – Corporation for Research & Testing of Building Materials, Augsburg, Germany

Twenty cm thick Xypex-treated concrete samples were pressure tested up to 7 bars (230 ft./70 m water head) for 24 hours to determine water impermeability. While the reference specimens measured water penetration up to a depth of 92 mm, Xypex-treated samples measured water penetration of zero to an average of 4 mm.

ÖNORM B 3303, "Water Permeability of Concrete", Technologisches Gerwerbemuseum, Federal Higher Technical Education & Research Institute, Vienna, Austria

Xypex-treated concrete samples were pressure tested to a maximum 7 bars (230 ft./70 m water head) for 10 days. Test revealed that while 25 ml of water had penetrated the untreated concrete samples, zero ml had penetrated the Xypex-treated samples. Test specimens were then broken and showed water penetration to a depth of 15 mm on untreated samples but no measurable water penetration on the Xypex-treated samples.

CSN 1209/1321, "Impermeability and Resistance to Pressurized Water", Institute of Civil Engineering, Technology and Testing, Bratislava, Slovak Republic

Xypex-treated and untreated concrete samples were exposed to 1.2 MPa of pressure to determine water permeability. Results showed the Xypex-treated samples provided effective protection against hydrostatic water pressure. Treated and untreated samples were also subjected to contact with silage juices and various petroleum products (e.g. diesel oil, transformer oil, gasoline) at 14 kPa for 28 days. The Xypex-treated samples significantly reduced the penetration of these solutions.

CHEMICAL RESISTANCE

ASTM C 267-77, "Chemical Resistance to Mortars", Pacific Testing Labs, Seattle, USA

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethelyne glycol, pool chlorine and brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Tests following chemical exposure measured an average 17% higher compressive strength in the Xypex-treated specimens over the untreated control samples.

IWATE University Technical Report, "Resistance to Acid Attack", Tokyo, Japan

Xypex-treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H_2SO_4 solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

FREEZE/THAW DURABILITY

ASTM C 672, "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-Icing Chemicals", Twin City Testing Lab, St. Paul, USA

Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 freeze/thaw cycles showed a marked increase in surface deterioration compared to Xypex-treated samples.

POTABLE WATER EXPOSURE

NSF 61, "Drinking Water System Component-Health Effects", NSF International, Ann Arbor, USA

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

RADIATION RESISTANCE

U.S.A. Standard No. N69 ,"Protective Coatings for the Nuclear Industry", Pacific Testing Labs, Seattle, USA

After exposure to 5.76 x 10^4 rads of gamma radiation, the Xypex treatment revealed no ill effects or damages.

Application Procedures

1. **SURFACE PREPARATION** Concrete surfaces to be treated must be clean and free of laitance, dirt, film, paint, coating or other foreign matter. Surfaces must also have an open capillary system to provide "tooth and suction" for the Xypex treatment. If surface is too smooth (e.g. where steel forms are used) or covered with excess form oil or other foreign matter, the concrete should be lightly sandblasted, waterblasted, or etched with muriatic (HCL) acid.

2. **STRUCTURAL REPAIR** Rout out cracks, faulty construction joints and other structural defects to a depth of 1.5 in. (37 mm) and a width of 1 in. (25 mm). Apply a brush coat of Xypex Concentrate as described in steps 5 & 6 and allow to dry for 10 minutes. Fill cavity by tightly compressing Dry-Pac into the groove with pneumatic packing tool or with hammer and wood block. Dry-Pac is prepared by mixing six parts Xypex Concentrate powder with one part water to a dry, lumpy consistency.

NOTE:

i. Against a direct flow of water (leakage) or where there is excess moisture due to seepage, use Xypex Patch'n Plug then Xypex Dry-Pac followed by a brush coat of Xypex Concentrate. (Refer to Xypex Specifications and Applications Manual for full details.)

ii. For expansion joints or chronic moving cracks, flexible materials such as expansion joint sealants should be used.

3. **WETTING CONCRETE** Xypex requires a saturated substrate and a damp surface. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper curing of the treatment and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess surface water before the application. If concrete surface dries out before application, it must be re-wetted.

4. **MIXING FOR SLURRY COAT** Mix Xypex powder with clean water to a creamy consistency in the following proportions:

For Brush Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m^2)
5 parts powder to 2 parts water

2.0 lb./sq. yd. (1.0 kg/m^2)
3 parts powder to 1 part water

For Spray Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m^2)
5 parts powder to 3 parts water
(ratio may vary with equipment type)

Do not mix more Xypex material than can be applied in 20 minutes. Do not add water once mix starts to harden. Protect hands with rubber gloves.

5. **APPLYING XYPEX** Apply Xypex with a semi-stiff nylon bristle brush, push broom (for large horizontal surfaces) or specialized spray equipment. The coating must be uniformly applied and should be just under 1/16 in. (1.25 mm). When a second coat (Xypex Concentrate or Xypex Modified) is required, it should be applied after the first coat has reached an initial set but while it is still “green” (less than 48 hours). Light pre-watering between coats may be required due to drying. The Xypex treatment must not be applied under rainy conditions or when ambient temperature is below 40ºF (4ºC). For recommended equipment, contact Xypex Chemical Corporation or your nearest Xypex distributor.

6. **CURING** A misty fog spray of clean water must be used for curing the Xypex treatment. Curing should begin as soon as the Xypex has set to the point where it will not be damaged by a fine spray of water. Under normal conditions, it is sufficient to spray Xypex-treated surfaces three times per day for two to three days. In hot or arid climates, spraying may be required more frequently. During the curing period, the coating must be protected from rainfall, frost, wind, the puddling of water and temperatures below 36ºF (2ºC) for a period of not less than 48 hours after application. If plastic sheeting is used as protection, it must be raised off the Xypex to allow the coating to breathe. Xypex Gamma Cure may be used in lieu of water curing for certain applications (consult with Xypex Chemical Corporation or your nearest Xypex distributor).

NOTE: For concrete structures that hold liquids (e.g. reservoirs, swimming pools, tanks, etc.), Xypex should be cured for three days and allowed to set for 12 days before filling the structure with liquid.

Technical Services

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex representative.

Safe Handling Information

Xypex is alkaline. As a cementitious powder or mixture, Xypex may cause significant skin and eye irritation. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Material Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex representative to obtain copies of Material Safety Data Sheets prior to product storage or use.

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

XYPEX®
13731 Mayfield Place, Richmond, BC, Canada V6V 2G9 Toll-free: 1.800.961.4477
Tel: 604.273.5265 Fax: 604.270.0451 E-mail: info@xypex.com Web: www.xypex.com

ISO 9001:2008
FM 63167

Review Cycle	End Date	Status Entered By	Status Entered	Status
SBT-289671-51134-0001 - Mfr Field Report Xypec	Jun 8, 2016	Michael Pope	Jun 9, 2016	1 Reviewed - Work may proceed.

Reviewer	Title	Page	Comment Type	Error Type	Comment Date	Final Disposition	Final Disposition Person	Final Disposition Date
Lopez, James	SBT-289671-51134-0001 - Mfr Field Report Xypec Retention Basin Concrete Sealant.pdf	3	Preference	Status Code: 1 Reviewed - Work may proceed	6/8/2016 13:32	Implement	Pope, Michael	6/9/2016 6:13

AE FIRM ONLY

WEIDLINGER-NAVARRO JV NORTHERN NM	
SUBMISSION #	JOB#

☐ 1 Reviewed- Work may proceed	☐ 3 Reviewed- Revise & Resubmit.Work may NOT proceed.
☐ 2 Reviewed- Revise & Resubmit. Work may proceed subject to incorporation of indicated comments	☐ 4 Reject- Submittal does not meet requirements. Resubmit
	☐ 5 Permission to proceed not required

Reviewed only for general conformance with the project requirements indicated in Contract Documents and for consistency with the project design concept. This review does not relieve the Contractor from responsibility for errors or omissions in designs for which the contractor is responsible, for compliance with all requirements of the Contract Documents, and for the safe and successful construction of the work. This review does not consider the means, methods, techniques, sequences, and operations of construction, or safety precautions or programs incidental thereto, which are the sole responsibility of the Contractor.

Date:_____

Checked By:_____

Signature:_____

AE FIRM ONLY

September 2015

Dear All,

I have reviewed the application of Xypex coatings by Certified Applicators 'GWC' at the LANL TRU Waste Project and have approved its proper placement. Please don't hesitate to contact me if you have any questions, now or in the future.

Stephen Boyd
Xypex Area Representative
970-946-6016
swconsult@durango.net

Reviewer	Title	Page	Comment Type	Error Type	Formatted Comment	Comment Date
Sapp, Lindsay	SBT-289671-51115-0001_Retention Basin Sealant-.pdf	1	Preference	Scriveners Error	Lindsay Sapp commenting for Conrad Ley, Lead Civil WNNNM JV. 1. Reviewed -Work may proceed	9/12/2014 9:21

Exhibit I

Attachment A

Los Alamos NATIONAL LABORATORY EST. 1943

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671	**STR Name:** Roy Maestas

SUBCONTRACTOR

Company Name: J.B. Henderson Construction	**Date Submitted:** 9/10/2014
Street Address: 1285 Trinity Drive, Suites A&B	☒ **Initial Submittal of a New Document**
City, State, Zip code: Los Alamos, NM 87544	☐ **Re- Submittal of Previous Document**
Subcontractor's Point of Contact: Taylor Cardon	
Submittal Number:	5.1115 (09 9201)
Submittal Title:	Retention Basin Sealant
Revision Number:	0

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature: Greg Masterman

Digitally signed by Greg Masterman
DN: cn=Greg Masterman, o=JB Henderson, ou, email=gmasterman@jbhenderson.com, c=US
Date: 2014.09.10 08:06:42 -06'00'

CONTRACTOR

Date Received:	
Statused By:	
Date:	
Comments:	

Status Code:

- ☐ **1 Reviewed-Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

AE FIRM ONLY

WEIDLINGER-NAVARRO JV NORTHERN NM	
SUBMISSION #	JOB#

☐ 1 Reviewed- Work may proceed	☐ 3 Reviewed- Revise & Resubmit.Work may NOT proceed.
☐ 2 Reviewed- Revise & Resubmit. Work may proceed subject to incorporation of indicated comments	☐ 4 Reject- Submittal does not meet requirements. Resubmit
	☐ 5 Permission to proceed not required

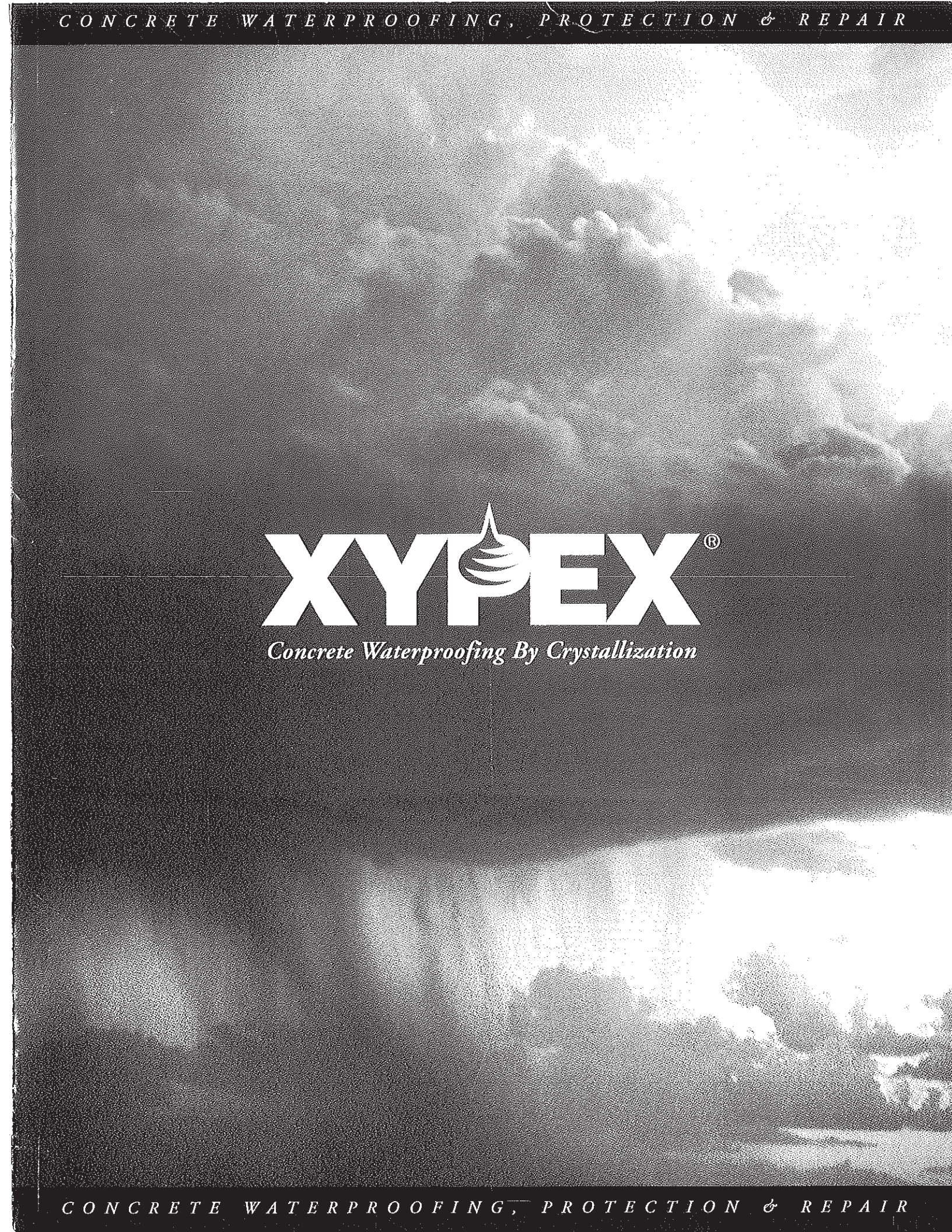
Reviewed only for general conformance with the project requirements indicated in Contract Documents and for consistency with the project design concept. This review does not relieve the Contractor from responsibility for errors or omissions in designs for which the contractor is responsible, for compliance with all requirements of the Contract Documents, and for the safe and successful construction of the work. This review does not consider the means, methods, techniques, sequences, and operations of construction, or safety precautions or programs incidental thereto, which are the sole responsibility of the Contractor.

Date:_____

Checked By:_____

Signature:_____

AE FIRM ONLY

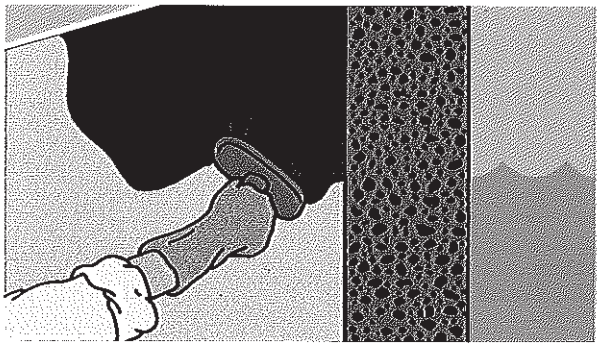


CONCRETE WATERPROOFING, PROTECTION & REPAIR

What is XYPEX Concrete Waterproofing by Crystallization™

XYPEX is a unique chemical treatment for the waterproofing and protection of concrete. Manufactured in the form of a dry powder compound, Xypex consists of Portland cement, very fine treated silica sand and various active proprietary chemicals.

How does XYPEX Waterproof Concrete?

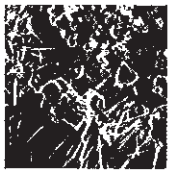


When mixed with water and applied as a cementitious coating, the active chemicals in Xypex cause a catalytic reaction which generates a non-soluble crystalline formation of dendritic...

...fibres within the pores and capillary tracts of concrete. This process permanently seals the concrete against the penetration of water or liquids from any direction.

Electron microscope photos show the sheared face of a concrete control sample and illustrate its reaction to the Xypex crystallization process.

Concrete Before Xypex



Xypex Crystallization Begins

Xypex Crystallization Matures (26 days)

Advantages of XYPEX

Waterproofs underground structures from the inside against hydrostatic pressure.

By the process of osmosis and because the chemicals in Xypex have an affinity with water, the crystalline formation migrates throughout the pores and capillary tracts of concrete even against strong hydrostatic pressure.

Protects concrete and reinforcing steel

The Xypex treatment is highly resistant to most aggressive substances (pH 3-11 constant contact, pH 2-12 periodic contact). By preventing the intrusion of chemicals, salt water, sewage and other harmful materials, Xypex protects concrete and reinforcing steel from deterioration and oxidation. The concrete is also protected against spalling, efflorescence, popouts and other damages caused by weathering, bleeding of the salts and internal expansion and contraction during the freeze-thaw cycle.

Permits concrete to 'breathe'

The Xypex crystalline formation has 'fixed size' air spaces so small that water molecules cannot pass through. However, it does allow the passage of air, thus the concrete is able to 'breathe' and become thoroughly dry, preventing water vapour buildup.

Non-toxic

Xypex products have been approved by the U.S. Environmental Protection Agency, Agriculture Canada, Water Research Council, NSF International, Mairie de Paris and many other government health agencies throughout the world for use on concrete structures that hold potable water or foodstuffs.

Can be applied to moist or 'green' concrete

Xypex coatings require moisture to produce the crystalline formation. Therefore, concrete that is moist or 'green' is ideal for the Xypex treatment. If the concrete is dry, it must be pre-dampened prior to application.

Some other advantages

- Xypex is not just a coating. Because the crystalline formation becomes an integral part of the concrete, Xypex does not rely on its surface coating to waterproof concrete.
- Xypex will seal hairline cracks up to 0.4mm (1/64").
- Xypex does not require costly surface priming or levelling prior to application.
- Xypex cannot puncture, tear or come apart at the seams.
- Xypex does not require protection during backfilling or during placement of steel, wire mesh or other materials.
- Xypex is less costly to apply than most other methods.

Typical XYPEX Projects

- Reservoirs
- Sewage and Water Treatment Tanks
- Tunnels
- Manholes
- Underground Vaults and Cellars
- Foundations
- Parking Decks
- Bridges

Other XYPEX Products

Xypex Admix C-500, C-1000 and C-2000

With the Admix C-Series, Xypex's unique crystalline dry powder compound for the waterproofing, protection and improvement of concrete is added to the concrete mix at time of batching. Admix C-500, C-1000 and C-2000 have been specially formulated to meet varying project and temperature conditions. Xypex Admixes are available in a "no fines" grade.

Xypex DS-1 & DS-2

Xypex Concentrate DS-1 and DS-2 are special formulations which have been designed specifically for a dry-shake application on horizontal concrete prior to finishing.

Xypex Patch'n Plug

Fast setting, non-shrink, high bond strength hydraulic cement compound for concrete repairs. Stops flowing water in seconds. Patch'n Plug seals cracks, tie holes etc. and is also used for the general repair or patching of concrete. Patch'n Plug may be used in conjunction with Xycrylic Admix to increase the compressive strength and bond strength to existing concrete.

Xypex Megamix I and Megamix II

Megamix I is a thin parge coat for the waterproofing and resurfacing of vertical concrete and masonry surfaces. Megamix II is a thick repair mortar used for patching and resurfacing deteriorated concrete, whether vertical or overhead. Megamix II has been specifically formulated as a one-component mortar to produce superior bond, low shrinkage, high strength and durability. Both Megamix products contain Xypex's unique crystalline waterproofing and protection technology.

Xypex FCM 40 & FCM 60

FCM products have exceptional adhesive and elongation characteristics and are used for repairing cracks subject to movement, sealing construction joints, restoring deteriorated concrete, and waterproofing concrete structures. FCM is often used in conjunction with the Xypex Crystalline Concrete Waterproofing and Protection System.

Xypex Restora-Top

Restora-Top products have been specifically formulated for the repair and rehabilitation of horizontal concrete surfaces and provide excellent adhesive properties as well as superior durability and reduced shrinkage.

Xycrylic Admix

An acrylic polymer formulation specifically designed for use as an admix to fortify cement mixes. Xycrylic Admix increases hardness, durability, bonding capability and chemical resistance.

Xypex Gamma Cure

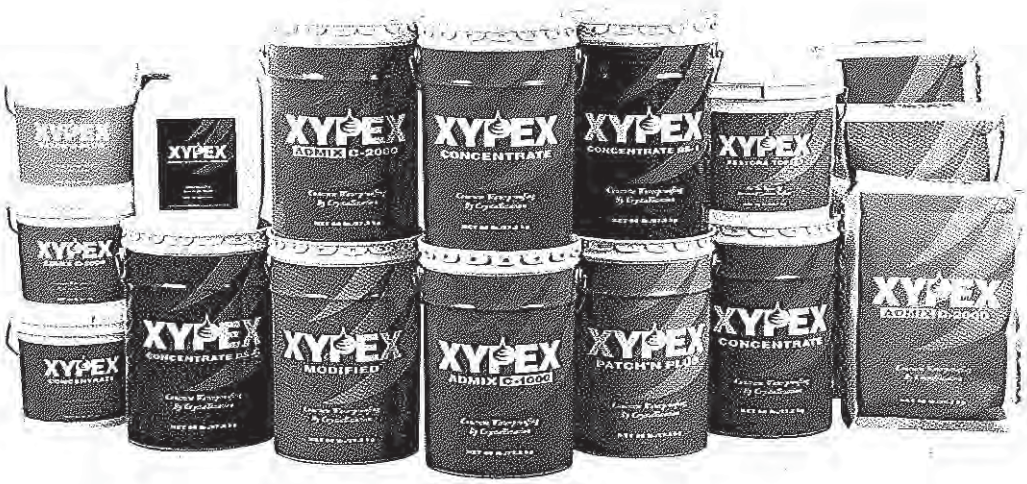
May be used as an alternative to water curing for certain Xypex applications. Consult manufacturer for further information.

Xypex Quickset

Xypex Quickset is a water-soluble liquid compound designed to harden, dustproof and seal the surfaces of fresh or newly cured concrete floors.

Technical Services

For more complete information, assistance in developing specifications, or arranging for application supervision, please contact Xypex Chemical Corporation or the nearest Xypex distributor.



Warranty The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties express or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

ISO 9001:2000
FM 63167

XYPEX CHEMICAL CORPORATION
Richmond, British Columbia, Canada V6V 2G9
Telephone: (604) 273-5265 Website: www.xypex.com

Distributed By:

Independent Test Results

Permeability - U.S. Army Corps of Engineers CRD-C-48-73 "Permeability of Concrete"
Two inch thick, 2000 PSI (13,790 KPa), Xypex-treated concrete samples were pressure tested up to a 123.5m water head (175 PSI-1207 KPa), which was the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples, as a result of the crystallization process, became totally sealed and exhibited no measurable leakage.

Chemical Resistance - A.S.T.M. C267-77 "Chemical Resistance of Mortars"
Xypex-treated cylinders and untreated cylinders were exposed to such chemicals as hydrochloric acid, caustic soda, toluene, mineral oil, ethelyne glycol, pool chlorine and brake fluid. Results of these studies indicated that chemical exposure did not have detrimental effect on the Xypex coating. Tests following chemical exposure indicated average compressive strength increases of 20% for Xypex-treated specimens over untreated control samples.

Freeze-Thaw and De-icing Chemical Resistance - A.S.T.M. C672-76 "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-icing Chemicals"
Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 cycles showed a marked increase in surface deterioration as compared to treated panels.

Radiation Resistance - U.S.A. Standard No. N69-1967 "Protective Coatings for the Nuclear Industry"
After exposure to 5.76×10^4 rads of gamma radiation, the Xypex treatment revealed no ill effects or damages.

Products

Xypex crystalline waterproofing materials are packaged in powder form and are mixed with water for application as a cementitious slurry coating on concrete surfaces, or as a Dry-Pac™ for sealing of construction joints and repair of cracks.

XYPEX® Concentrate

Used as a single coating on above or below grade concrete, or as the first of a two coat application where two coats are required (see Xypex Specification Manual). Also used as a Dry-Pac for sealing strips (fillets) at construction joints and honeycombing. Xypex Concentrate is the most chemically potent of the Xypex crystalline waterproofing material.

XYPEX® Modified

Used as a second coat to reinforce Xypex Concentrate where two coats are required. Also used as an exterior damproofing.

Coverage

For normal surface applications coverage per coat is: 1.5 pounds per square yard (0.8 kilograms per square metre). For construction joint surfaces coverage is: 2.0 pounds per square yard (1.0 kilograms per square metre). See mixing instructions below.

Application Information

Surface Preparation

Concrete surfaces to be treated must be clean and free of laitance, dirt, films, paint, coatings or other foreign matter. The surfaces must also have an open capillary system so as to provide 'tooth and suction' for the Xypex treatment. If surfaces are too smooth, the concrete should be acid etched, waterblasted or lightly sandblasted.

Structural defects such as cracks, faulty construction joints and honeycombing should be routed out to sound concrete and repaired in accordance with the Xypex Repair Procedures (see Specification & Application Manual).

Horizontal surfaces should preferably have a rough wood float or broom finish. All concrete laitance must be removed either by etching with muriatic acid or by waterblasting or sandblasting.

Wetting Concrete

Prior to the application of Xypex, concrete surfaces must be thoroughly wetted with clean water to control surface suction, aid the proper curing of the treatment and ensure the growth of the crystalline formation deep within the pores of the concrete. Of course, excess surface water should be removed before the application.

Mixing For Slurry Coat

Xypex powder is mixed with clean water to a creamy consistency in the following proportions by volume:

Brush application:

1.5 lbs./sq.yd (0.81 kg/sq.m) – 5 parts powder to 2 parts water

2.0 lbs./sq.yd (1.08 kg/sq.m) – 3 parts powder to 1 part water

Spray application:

1.5 lbs./sq.yd (0.81 kg/sq.m) – 5 parts powder to 3 parts water (may vary with equipment type)

Mixing for Dry-Pac

Mix 6 parts Xypex Concentrate powder with one part clean water by volume. Do not mix too wet (i.e. a putty-like consistency), otherwise mix may crack and spall as it dries.

Application

The Xypex treatment should be applied with a semi-stiff bristle brush, broom (for large horizontal applications) or with specialized spray equipment. For recommended equipment contact Xypex Chemical Corporation or your nearest distributor.

The Xypex treatment must be uniformly applied under the conditions and quantities specified. One coat should have a thickness of 1/16 inch (1.5 mm). When a second coat is required, it should be applied after the first coat has reached an initial set but is still 'green' (less than 48 hrs.). Light pre-watering between coats may be required due to drying. The Xypex treatment cannot be applied in rain or during freezing conditions.

Curing

A misty fog spray of water must be used for curing the Xypex treatment. Curing must begin as soon as the Xypex coating has hardened sufficiently so as not to be damaged by a fine spray. Under most conditions it is sufficient to spray Xypex-treated surfaces three times a day for 2-3 days. In hot climates spraying may be required more frequently. During the curing period the Xypex treatment must be protected from rainfall, frost and puddling of water.

For concrete structures that holds liquids (e.g. reservoirs, tanks, etc.), the Xypex treatment should be cured for three days and then allowed to set for 12 days before filling with liquid.

XYPEX MODIFIED

DESCRIPTION

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX MODIFIED can be applied as a second coat to reinforce Xypex Concentrate, or applied by itself to dampproof the exterior of foundation walls. Applied as a second coat, Xypex Modified chemically reinforces Xypex Concentrate where two coats are required and produces a harder finish. Where dampproofing is required, a single coat of Modified may be used as an alternative to a spray/tar emulsion. Xypex prevents the penetration of water and other liquids from any direction by causing a catalytic reaction that produces a non-soluble crystalline formation within the pores and capillary tracts of concrete and cement-based materials.

RECOMMENDED FOR:

Xypex Modified is recommended as a single coat for the dampproofing of foundations or as a second coat with Xypex Concentrate for the following applications:

- Reservoirs
- Sewage and Water Treatment Plants
- Secondary Containment Structures
- Tunnels and Subway Systems
- Underground Vaults
- Foundations
- Parking Structures
- Swimming Pools

ADVANTAGES

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Allows concrete to breathe
- Resistant to aggressive chemicals
- Non-toxic
- Does not require dry weather or a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Can be applied to the positive or the negative side of the concrete surface
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent

PACKAGING

Xypex Modified is available in 60 lb. (27.2 kg) pails and 50 lb. (22.7 kg) bags.

STORAGE

Xypex products must be stored dry at a minimum temperature of 45°F (7°C). Shelf life is one year when stored under proper conditions.

COVERAGE

For normal surface conditions, the coverage rate for each coat is 6 - 7.2 sq. ft. per lb. (1.25 - 1.5 lb. per sq. yd. or 0.65 - 0.8 kg/m²).

TEST DATA

When used in conjunction with Xypex Concentrate:

PERMEABILITY

U.S. Army Corps of Engineers (USACE) CRD C48-73 "Permeability of Concrete" Pacific Testing Labs, Seattle, USA

Two inch (51 mm) thick, 2000 psi (13.8 MPa) Xypex-treated concrete samples were pressure tested up to a 405 ft. (124 m) water head (175 psi/1.2 MPa), the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples (as a result of the crystallization process) became totally sealed and exhibited no measurable leakage.

DIN 1048 "Water Impermeability of Concrete" Bautest – Corporation for Research & Testing of Building Materials, Augsburg, Germany

Twenty cm thick Xypex-treated concrete samples were pressure tested up to 7 bars (230 ft./70 m water head) for

24 hours to determine water impermeability. While the reference specimens measured water penetration up to a depth of 92 mm, Xypex-treated samples measured water penetration of zero to an average of 4 mm.

ÖNORM B 3303 "Water Permeability of Concrete"
Technologisches Gerwerbemuseum, Federal Higher Technical Education & Research Institute, Vienna, Austria

Xypex-treated concrete samples were pressure tested to a maximum 7 bars (230 ft./70 m water head) for 10 days. Test revealed that while 25 ml of water had penetrated the untreated concrete samples, zero ml had penetrated the Xypex-treated samples. Test specimens were then broken and showed water penetration to a depth of 15 mm on untreated samples but no measurable water penetration on the Xypex-treated samples.

CSN 1209/1321 "Impermeability and Resistance to Pressurized Water" Institute of Civil Engineering, Technology and Testing, Bratislava, Slovak Republic

Xypex-treated and untreated concrete samples were exposed to 1.2 MPa of pressure to determine water permeability. Results showed the Xypex-treated samples provided effective protection against hydrostatic water pressure. Treated and untreated samples were also subjected to contact with silage juices and various petroleum products (e.g. diesel oil, transformer oil, gasoline) at 14 kPa for 28 days. The Xypex-treated samples significantly reduced the penetration of these solutions.

CHEMICAL RESISTANCE

ASTM C 267-77 "Chemical Resistance to Mortars"
Pacific Testing Labs, Seattle, USA

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethelyne glycol, pool chlorine and brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Tests following chemical exposure measured an average 17% higher compressive strength in the Xypex-treated specimens over the untreated control samples.

IWATE University Technical Report "Resistance to Acid Attack" Tokyo, Japan

Xypex-treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H_2SO_4 solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

FREEZE/THAW DURABILITY

ASTM C 672 "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-icing Chemicals"
Twin City Testing Lab, St. Paul, USA

Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 freeze/thaw cycles showed a marked increase in surface deterioration compared to Xypex-treated samples.

POTABLE WATER EXPOSURE

NSF 61 "Drinking Water System Component-Health Effects"
NSF International, Ann Arbor, USA

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

RADIATION RESISTANCE

U.S.A. Standard No. N69 "Protective Coatings for the Nuclear Industry" Pacific Testing Labs, Seattle, USA

After exposure to 5.76×10^4 rads of gamma radiation, the Xypex treatment revealed no ill effects or damages.

APPLICATION PROCEDURES

1. SURFACE PREPARATION Concrete surfaces to be treated must be clean and free of laitance, dirt, film, paint, coating or other foreign matter. Surfaces must also have an open capillary system to provide "tooth and suction" for the Xypex treatment. If surface is too smooth (e.g. where steel forms are used) or covered with excess form oil or other foreign matter, the concrete should be lightly sandblasted, waterblasted, or etched with muriatic (HCL) acid.

2. STRUCTURAL REPAIR Rout out cracks, faulty construction joints and other structural defects to a depth of 1.5 inches (37 mm) and a width of one inch (25 mm). Apply a brush coat of Xypex Concentrate as described in steps 5 & 6 and allow to dry for 10 minutes. Fill cavity by tightly compressing Dry-Pac into the groove with pneumatic packing tool or with hammer and wood block. Dry-Pac is prepared by mixing six parts Xypex Concentrate powder with one part water to a dry, lumpy consistency.

Note:

1. Against a direct flow of water (leakage) or where there is excess moisture due to seepage, use Xypex Patch'n Plug then Xypex Dry-Pac followed by a brush coat of Xypex Concentrate. (Refer to Xypex Specifications and Applications Manual for full details.)

2. For expansion joints or chronic moving cracks, flexible materials such as expansion joint sealants should be used.

3. WETTING CONCRETE Xypex requires a saturated substrate and a damp surface. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper curing of the treatment and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess surface water before the application. If concrete surface dries out before application, it must be re-wetted.

4. MIXING FOR SLURRY COAT Mix Xypex powder with clean water to a creamy consistency in the following proportions:

For Brush Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m²)
5 parts powder to 2 parts water

2.0 lb./sq. yd. (1.0 kg/m²)
3 parts powder to 1 part water

For Spray Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m²)
5 parts powder to 3 parts water
(ratio may vary with equipment type)

Do not mix more Xypex material than can be applied in 20 minutes. Do not add water once mix starts to harden. Protect hands with rubber gloves.

5. APPLYING XYPEX Apply Xypex with a semi-stiff nylon bristle brush, push broom (for large horizontal surfaces) or specialized spray equipment. The coating must be uniformly applied and should be just under 1/16 in. (1.25 mm). When a second coat (Xypex Concentrate or Xypex Modified) is required, it should be applied after the first coat has reached an initial set but while it is still "green" (less than 48 hours). Light pre-watering between coats may be required due to drying. The Xypex treatment must not be applied under rainy conditions or when ambient temperature is below 40°F (4°C). For recommended equipment, contact Xypex Chemical Corporation or your nearest Xypex distributor.

6. CURING A misty fog spray of clean water must be used for curing the Xypex treatment. Curing should begin as soon as the Xypex has set to the point where it will not be damaged by a fine spray of water. Under normal conditions, it is sufficient to spray Xypex treated surfaces three times per day for two to three days. In hot or arid climates, spraying may be required more frequently. During the curing period, the coating must be protected from rainfall, frost, wind, the puddling of water and temperatures below 36°F (2°C) for a period of not less than 48 hours after application. If plastic sheeting is used as protection, it must be raised off the Xypex to allow the coating to breathe. Xypex Gamma Cure may be used in lieu of water curing for certain applications (consult with Xypex Chemical Corporation or your nearest Xypex distributor).

Note: For concrete structures that hold liquids (e.g. reservoirs, swimming pools, tanks, etc.), Xypex should be cured for three days and allowed to set for 12 days before filling the structure with liquid.

TECHNICAL SERVICES

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SAFE HANDLING INFORMATION

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WARRANTY

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

ISO 9001:2000
FM 63167

XYPEX
CHEMICAL CORPORATION

13731 Mayfield Place, Richmond, British Columbia, Canada V6V 2G9
Tel: (604) 273-5265 Tel: (800) 961-4477 Fax: (604) 270-0451
E-mail: info@xypex.com Website: www.xypex.com

XYPEX CONCENTRATE

DESCRIPTION

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX CONCENTRATE is the most chemically active product within the Xypex Crystalline Waterproofing System. When mixed with water, this light grey powder is applied as a cementitious slurry coat to above-grade or below-grade concrete, either as a single coat or as the first of a two-coat application. It is also mixed in Dry-Pac form for sealing strips at construction joints, or for the repairing of cracks, faulty construction joints and honeycombs. Xypex prevents the penetration of water and other liquids from any direction by causing a catalytic reaction that produces a non-soluble crystalline formation within the pores and capillary tracts of concrete and cement-based materials.

RECOMMENDED FOR:

- Reservoirs
- Sewage and Water Treatment Plants
- Underground Vaults
- Secondary Containment Structures
- Foundations
- Tunnels and Subway Systems
- Swimming Pools
- Parking Structures

ADVANTAGES

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Can seal hairline cracks up to 0.4 mm
- Allows concrete to breathe
- Highly resistant to aggressive chemicals
- Non-toxic
- Does not require a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Can be applied to the positive or the negative side of the concrete surface
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent

PACKAGING

Xypex Concentrate is available in 20 lb. (9.1 kg) pails, 60 lb. (27.2 kg) pails and 50 lb. (22.7 kg) bags.

STORAGE

Xypex products must be stored dry at a minimum temperature of 45°F (7°C). Shelf life is one year when stored under proper conditions.

COVERAGE

For normal surface conditions, the coverage rate for each Xypex coat is 6 to 7.2 sq. ft./lb. (1.25 - 1.5 lb./sq. yd. or 0.65 - 0.8 kg/m^2).

TEST DATA

PERMEABILITY

U.S. Army Corps of Engineers (USACE) CRD C48-73 "Permeability of Concrete" Pacific Testing Labs, Seattle, USA

Two inch (51 mm) thick, 2000 psi (13.8 MPa) Xypex-treated concrete samples were pressure tested up to a 405 ft. (124 m) water head (175 psi/1.2 MPa), the limit of the testing apparatus. While untreated samples showed marked leakage, the Xypex-treated samples (as a result of the crystallization process) became totally sealed and exhibited no measurable leakage.

DIN 1048 "Water Impermeability of Concrete" Bautest – Corporation for Research & Testing of Building Materials, Augsburg, Germany

Twenty cm thick Xypex-treated concrete samples were pressure tested up to 7 bars (230 ft./70 m water head) for 24 hours to determine water impermeability. While the reference specimens measured water penetration up to a depth of 92 mm, Xypex-treated samples measured water penetration of zero to an average of 4 mm.

ÖNORM B 3303 "Water Impermeability of Concrete" Technologisches Gerwerbemuseum, Federal Higher Technical Education & Research Institute, Vienna, Austria

Xypex-treated concrete samples were pressure tested to a maximum 7 bars (230 ft./70 m water head) for 10 days. Test revealed that while 25 ml of water had penetrated the untreated concrete samples, zero ml had penetrated the Xypex-treated samples. Test specimens were then broken and showed water penetration to a depth of 15 mm on untreated samples but no measurable water penetration on the Xypex-treated samples.

CSN 1209/1321 "Impermeability and Resistance to Pressurized Water" Institute of Civil Engineering, Technology and Testing, Bratislava, Slovak Republic

Xypex-treated and untreated concrete samples were exposed to 1.2 MPa of pressure to determine water permeability. Results showed the Xypex-treated samples provided effective protection against hydrostatic water pressure. Treated and untreated samples were also subjected to contact with silage juices and various petroleum products (e.g. diesel oil, transformer oil, gasoline) at 14 kPa for 28 days. The Xypex-treated samples significantly reduced the penetration of these solutions.

CHEMICAL RESISTANCE

ASTM C 267-77 "Chemical Resistance to Mortars" Pacific Testing Labs, Seattle, USA

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethelyne glycol, pool chlorine and brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Tests following chemical exposure measured an average 17% higher compressive strength in the Xypex-treated specimens over the untreated control samples.

IWATE University Technical Report "Resistance to Acid Attack" Tokyo, Japan

Xypex-treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H_2SO_4 solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

FREEZE/THAW DURABILITY

ASTM C 672 "Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-icing Chemicals" Twin City Testing Lab, St. Paul, USA

Xypex-treated samples restricted chloride ion concentration to below the level necessary to promote electrolytic corrosion of reinforcing steel. Visual examination of untreated panels after 50 freeze/thaw cycles showed a marked increase in surface deterioration compared to Xypex-treated samples.

JIS A 6204 "Concrete Freeze/Thaw" Japan Testing Center For Construction Materials, Tokyo, Japan

The resonating frequency of both untreated and Xypex-treated concrete samples were measured throughout 435 freeze/thaw cycles. At 204 cycles, the Xypex-treated samples showed 96% relative durability compared to 90% in the untreated samples. At 435 cycles, the Xypex-treated samples measured 91% relative durability compared to 78% in the untreated reference samples.

POTABLE WATER EXPOSURE

NSF 61 "Drinking Water System Component-Health Effects" NSF International, Ann Arbor, USA

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

RADIATION RESISTANCE

U.S.A. Standard No. N69 "Protective Coatings for the Nuclear Industry" Pacific Testing Labs, Seattle, USA

After exposure to 5.76×10^4 rads of gamma radiation, the Xypex treatment revealed no ill effects or damages.

APPLICATION PROCEDURES

1. SURFACE PREPARATION Concrete surfaces to be treated must be clean and free of laitance, dirt, film, paint, coating or other foreign matter. Surfaces must also have an open capillary system to provide "tooth and suction" for the Xypex treatment. If surface is too smooth (e.g. where steel forms are used) or covered with excess form oil or other foreign matter, the concrete should be lightly sandblasted, waterblasted, or etched with muriatic (HCL) acid.

2. STRUCTURAL REPAIR Rout out cracks, faulty construction joints and other structural defects to a depth of 1.5 inches (37 mm) and a width of one inch (25 mm). Apply a brush coat of Xypex Concentrate as described in steps 5 & 6 and allow to dry for 10 minutes. Fill cavity by tightly compressing Dry-Pac into the groove with pneumatic packing tool or with hammer and wood block. Dry-Pac is prepared by mixing six parts Xypex Concentrate powder with one part water to a dry, lumpy consistency.

Note:

1. Against a direct flow of water (leakage) or where there is excess moisture due to seepage, use Xypex Patch'n Plug then Xypex Dry-Pac followed by a brush coat of Xypex

Concentrate. (Refer to Xypex Specifications and Applications Manual for full details.)

2. For expansion joints or chronic moving cracks, flexible materials such as expansion joint sealants should be used.

3. WETTING CONCRETE Xypex requires a saturated substrate and a damp surface. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper curing of the treatment and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess surface water before the application. If concrete surface dries out before application, it must be re-wetted.

4. MIXING FOR SLURRY COAT Mix Xypex powder with clean water to a creamy consistency in the following proportions:

For Brush Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m²)
5 parts powder to 2 parts water

2.0 lb./sq. yd. (1.0 kg/m²)
3 parts powder to 1 part water

For Spray Application

1.25 - 1.5 lb./sq. yd. (0.65 - 0.8 kg/m²)
5 parts powder to 3 parts water
(ratio may vary with equipment type)

Do not mix more Xypex material than can be applied in 20 minutes. Do not add water once mix starts to harden. Protect hands with rubber gloves.

5. APPLYING XYPEX Apply Xypex with a semi-stiff nylon bristle brush, push broom (for large horizontal surfaces) or specialized spray equipment. The coating must be uniformly applied and should be just under 1/16 in. (1.25 mm). When a second coat (Xypex Concentrate or Xypex Modified) is required, it should be applied after the first coat has reached an initial set but while it is still "green" (less than 48 hours). Light pre-watering between coats may be required due to drying. The Xypex treatment must not be applied under rainy conditions or when ambient temperature is below 40°F (4°C). For recommended equipment, contact Xypex Chemical Corporation or your nearest Xypex distributor.

6. CURING A misty fog spray of clean water must be used for curing the Xypex treatment. Curing should begin as soon as the Xypex has set to the point where it will not be damaged by a fine spray of water. Under normal conditions, it is sufficient to spray Xypex-treated surfaces three times per day for two to three days. In hot or arid climates, spraying may be required more frequently. During the curing period, the coating must be protected from rainfall, frost, wind, the puddling of water and temperatures below 36°F (2°C) for a period of not less than 48 hours after application. If plastic sheeting is used as protection, it must be raised off the Xypex to allow the coating to breathe. Xypex Gamma Cure may be used in lieu of water curing for certain applications (consult with Xypex Chemical Corporation or your nearest Xypex distributor).

Note: For concrete structures that hold liquids (e.g. reservoirs, swimming pools, tanks, etc.), Xypex should be cured for three days and allowed to set for 12 days before filling the structure with liquid.

TECHNICAL SERVICES

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SAFE HANDLING INFORMATION

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WARRANTY

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ISO 9001:2000
FM 63167

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CHEMICAL CORPORATION

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Tel: (604) 273-5265 Tel: (800) 961-4477 Fax: (604) 270-0451
E-mail: info@xypex.com Website: www.xypex.com

XYPEX PATCH'N PLUG

DESCRIPTION

XYPEX PATCH'N PLUG is a specially designed, fast-setting, non-shrink, high-bond-strength, hydraulic cement compound for concrete patching and repair. Patch'n Plug stops flowing water in seconds and is used to seal cracks, tie holes, and other defects in concrete. The high performance characteristics of Patch'n Plug are enhanced by Xypex's unique crystalline waterproofing technology.

RECOMMENDED FOR:

- Stopping an active flow of water through cracks
- Repair of concrete substrates before the application of Xypex coating materials

ADVANTAGES

- Single component (simply add water)
- Fast setting: two to three minutes at 70°F (21°C)
- Excellent structural strength
- As durable as the masonry and concrete to which it is applied
- Non-metallic (won't rust or deteriorate)
- Non-toxic

PACKAGING

Xypex Patch'n Plug is available in 20 lb. (9.1 kg) pails and 60 lb. (27.2 kg) pails.

STORAGE

Xypex products must be stored dry at a minimum temperature of 45°F (7°C). Shelf life is one year when stored under proper conditions.

COVERAGE

One 60 lb. (27.2 kg) pail of Xypex Patch'n Plug will produce 0.64 cubic feet (0.02 cu. metres) of mortar.

TEST DATA

PHYSICAL PROPERTY	TEST METHOD	TYPICAL RESULT	
Compressive Strength	**ASTM C109**	**psi**	**(MPa)**
at 24 hours		2100	(14.3)
at 7 days		3100	(21.3)
at 28 days		4500	(31.0)
Setting Time	**ASTM C266**	**minutes**	**seconds**
Initial Set		3	50
Final Set		9	10
Tensile Bond Pull-Off	**CSA A23.2-6B**	**psi**	**(MPa)**
		120	(0.8)

Note: Samples prepared with 1 part water to 3.25 parts dry powder by volume (1 part water to 4 parts dry powder by mass). Setting time was determined using Gilmore needles.

PLUGGING INSTRUCTIONS

1. PREPARATION Rout out crack or hole by chiseling or chipping to a minimum depth of one inch (25 mm). Form a square or dovetail shaped space (do not use a "V" cut). Flush away all loose materials and dirt from the cavity with water and a stiff brush.

2. MIXING Add 1 part water to 3.5 parts Patch'n Plug by volume and mix to the consistency of a stiff putty. Do not mix more than can be used in 3 minutes. For best results, water temperature should be approximately 60°F - 70°F (15°C - 20°C).

3. PLUGGING Form plug with gloved hand. Place plug into cavity pressing firmly until plug is hard. When sealing cracks, begin at the highest point and work down.

Note: Where there is a high volume of water flow due to extreme hydrostatic pressure, a bleeder hose may be necessary to relieve the water pressure while sealing the repair area. (See procedures on reverse side.)

Follow these steps:

a. With a concrete chisel and hammer (or chipping gun), cut open a cavity at the point of greatest water flow.

b. Place a stiff section of hose or pipe into the cavity and secure in place with Patch'n Plug to force water through the hose. This relieves the pressure so that the area can be patched. Allow a minimum of 24 hours for hardening.

c. Remove bleeder hose and plug remaining hole. If necessary, reduce water flow by inserting steel wool or wooden plug in the remaining hole before patching.

PATCHING INSTRUCTIONS

1. SURFACE PREPARATION Rout out faulty concrete until sound substrate is reached. Remove all loose materials from area and saturate with clean water. Allow water to be absorbed into the concrete, then remove excess water.

2. MIXING For fast repairs to concrete or masonry, add water to Patch'n Plug powder (1.5 parts water to 4 parts powder by volume). Mix to a workable mortar consistency and trowel on as required. For large repairs, mix 1 part Patch'n Plug with 2 parts mason sand or small aggregate (3/8 in. or 10 mm minus crushed stone). Maximum ratio is 40 lb. (18.2 kg) stone to one 60 lb. pail (27.2 kg) of Patch'n Plug.

ABNORMAL TEMPERATURES

During above normal ambient temperatures, mixing water should not exceed 90°F (32°C) and Xypex Patch'n Plug material should not exceed 70°F (21°C). Below normal ambient temperatures will retard the setting time of Patch'n Plug. In this situation, Xypex materials should be stored at normal temperatures (see Storage) and mixing water should be heated to increase setting speed.

TECHNICAL SERVICES

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Department of Xypex Chemical Corporation or your local Xypex representative.

SAFE HANDLING INFORMATION

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TA63 TWF Storage Building Floor Coating

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Exhibit I

Attachment A

Los Alamos NATIONAL LABORATORY EST. 1943

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671	**STR Name:** Roy Maestas

SUBCONTRACTOR

Company Name: J.B. Henderson Construction	**Date Submitted:** 11/12/14
Street Address: 1285 Trinity Drive, Suites A&B	☒ **Initial Submittal of a New Document**
City, State, Zip code: Los Alamos, NM 87544	☐ **Re- Submittal of Previous Document**
Subcontractor's Point of Contact: Taylor Cardon	
Submittal Number:	5.0579 (09 9600/1.3.A.3)
Submittal Title:	Testing Agency Certification of Nuclear Decontaminability (Special Coatings)
Revision Number:	0

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature:

CONTRACTOR

Date Received:	
Statused By:	Michael Roy
Date:	11/24/14

Comments:

#1

Status Code:

- ☒ **1 Reviewed-Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

Exhibit I
Attachment A

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: 289671	**STR Name:** Roy Maestas

SUBCONTRACTOR

Company Name: J.B. Henderson Construction	**Date Submitted:** 11/23/15
Street Address: 1285 Trinity Drive, Suites A&B	☐ **Initial Submittal of a New Document**
City, State, Zip code: Los Alamos, NM 87544	☒ **Re- Submittal of Previous Document**
Subcontractor's Point of Contact: Taylor Cardon	
Submittal Number:	5.0578-0001
Submittal Title:	Paint Schedule Special Coatings (09 9600/1.3.A.2)
Revision Number:	6

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature:

Sonia Lopez

Digitally signed by Sonia Lopez
DN: cn=Sonia Lopez, o=JB Henderson Construction, ou, email=slopez@jbhenderson.com, c=US
Date: 2015.11.23 11:48:54 -07'00'

(Red Head)

CONTRACTOR

Date Received:	
Statused By:	
Date:	
Comments:	

Status Code:

- ☒ XX **1 Reviewed-Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

AE FIRM ONLY

WEIDLINGER-NAVARRO JV NORTHERN NM	
SUBMISSION #	JOB#

☐ 1 Reviewed- Work may proceed	☐ 3 Reviewed- Revise & Resubmit.Work may NOT proceed.
☐ 2 Reviewed- Revise & Resubmit. Work may proceed subject to incorporation of indicated comments	☐ 4 Reject- Submittal does not meet requirements. Resubmit
	☐ 5 Permission to proceed not required

Reviewed only for general conformance with the project requirements indicated in Contract Documents and for consistency with the project design concept. This review does not relieve the Contractor from responsibility for errors or omissions in designs for which the contractor is responsible, for compliance with all requirements of the Contract Documents, and for the safe and successful construction of the work. This review does not consider the means, methods, techniques, sequences, and operations of construction, or safety precautions or programs incidental thereto, which are the sole responsibility of the Contractor.

Date:_____

Checked By:_____

Signature:_____

AE FIRM ONLY

Project	LANL TruWaste Facility TA63 - J.B. Henderson Construction				
09 9600	5.0578-1 09 9600/1.3.A.2 - PAINT SCHEDULE Special Coatings				
Building	Location	Surface Preparation	Coat/DFT	Name Color/Sheen	Application Method
Storage 0149, 0150, 0151, 0152, 0153	Storage, Electrical, Riser -Room Floors	Diamond Grind as per ASTM D4259	1st 1.5 -2 Mils	PPGAmerlock Sealer/Gloss	Brush/Roller
			2nd 6-8 Mils	PPGAmerlock2 Pearl Grey Gloss	Brush/Squeegee/Roller
			3rd 5-7 Mils	PPGPSX700 Pearl Grey Gloss	Brush/Roller
Storage 0149, 0150, 0151, 0152, 0153	Storage, Electrical- Walls & Ceiling HM Doors/ Frames	N/A Gyp Board Light Sand HM Doors/ Frames	1st, 2nd,3rd 2-3 Mils per coat	PPGPitt-Tech 90-374 PC835 Porcelain White/Gloss	Brush/Roller/Spray
	Fire Riser Steel	Light Sand	1st,2nd 2-3 Mils Per Coat	PPGPitt-Tech 90-374 ½ PC842 Cooling Tower	Brush/Roller
Storage & Character-ization Building	Rooms 1001, 1001A, 1002, 1003, 1003A, 1021, 1022- Floors	Diamond Grind as per ASTM D4259	1st 1.5-2 Mils	PPGAmerlock Sealer/Gloss	Brush/Roller
			2nd 6-8 Mils	PPGAmerlock2 Pearl Grey Gloss	Brush/Squeegee/Roller
			3rd 5-7 Mils	PPGPSX700 Pearl Grey Gloss	Brush/Roller
Storage & Character-ization Building	Rooms 1001, 1001A, 1002, 1003, 1003A, 1021, 1022- Walls/Ceilings HM Doors/Frames	N/A Gyp Board Light Sand HM Doors/Frames	1st, 2nd,3rd 2-3 Mils Per Coat	PPGPitt-Tech 90-374 PC835 Porcelain White Gloss	Brush/Roller/Spray

							PG. 2/2
Building	Location	Surface Preparation	Coat/DFT	Name Color/Sheen	Application Method		
Storage & Character-ization Building	Fire Riser Steel	Light Sand	1st, 2nd 2-3 Mils Per coat	PPGPitt-Tech 90-374 ½ PC842 Cooling Tower	Brush/Roller		
Operations Building	Rooms 1111, 1113- Floors	Diamond Grind as per ASTM D4259	1st 1.5-2 Mils	PPGAmerlock Sealer/Gloss	Brush/Roller		
			2nd 6-8 Mils	PPGAmerlock2 Pearl Grey Gloss	Brush/Squeegee/Roller		
			3rd 5-7 Mils	PPGPSX700 Pearl Grey Gloss	Brush/Roller		
Operations Building	Rooms 111, 1113 Walls, Ceilings HMDoors/Frames	N/A Gyp Board Light Sand HMDoors/Frames	1st,2nd,3rd 2-3 Mils per coat	PPGPitt-Tech 90-374 PC835 Porcelain White	Brush/Roller/Spray		

Reviewer	Title	Page	Comment Type	Error Type	Formatted Comment	Standard/Spec Reference	Comment Date
Tarin, Manuel	SBT-289671-50579-0001_Testing Agency Cert Nuclear Decontaminability.pdf	2	Preference	Other	Reviewed by Sam Chlebana. Reviewed. Work may proceed.		11/21/2014 13:18

Exhibit I

Attachment A

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

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Revision Number:	0
Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.	
Subcontractor's Representative's signature:	

CONTRACTOR

Date Received:	
Statused By:	
Date:	
Comments:	
Status Code: ☐ **1 Reviewed-Work may proceed** ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.** ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.** ☐ **4 Reject. Submittal does not meet requirements. Resubmit.** ☐ **5 Permission to proceed not required.**	
Submit comments to:	

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WEIDLINGER-NAVARRO JV NORTHERN NM	
SUBMISSION #	JOB#

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Date:_____

Checked By:_____

Signature:_____

AE FIRM ONLY

PPG Protective & Marine Coatings

79 Ronzo Road, Bristol, CT 06010 Tel: 203-232-3896

November 6, 2014

Mr. Michael Hunter
Vice President
Red Head Painting

Re: PSX 700 Level II Certification

Dear :

Please be advised that PPG PMC product PSX 700 has been fully tested and is an acceptable coating for use in Nuclear Facilities Coating Service Level II applications. This testing includes:

Radiation Tolerance (1E+09)
Decontamination (>95% removal)
Chemical Resistance (ASTM D3912)
Fire Resistance (ASTM E84) Class B <25

I trust this information satisfies your needs at this time. If you have any questions, or require additional information, please feel free to call me at 203-232-3896.

Sincerely,

John F. De Barba

John F. De Barba
Technical Service Manager

cc: R. Knapp

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ENCLOSURE 3

Technical Area 63 Transuranic Waste Facility
Container Storage Unit
Permit Equipment and Operational Requirements

EPC-DO-16-361

LA-UR-16-29607

Date: JAN 1 3 2017

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Technical Area 63 Transuranic Waste Facility (TWF) Operations Equipment and Project Requirements from LANL Hazardous Waste Facility Permit for NMED Approval

No.	Item	Description	LANL Hazardous Waste Facility Permit Citation
1	Spill kits	Typically sorbents, neutralizers, personnel protection equipment (PPE)	A.6.8, Table D-5
2	Cleanup equipment	Shovels, bags, drums, over-pack drums	A.6.8, Table D-5
3	Safety data sheets	Available for cleaners, solvents used on site	A.6.8, Table D-5
4	First aid kits	Sufficient for minor injuries	Table D-5
5	Hearing protection	Sufficient to mitigate noise impacts	Table D-5
6	Secondary containment pallets	For free liquid waste containers	A.6.9
7	Fire extinguishers	ABC or BC rated portable fire extinguishers available	A.6.8, Table D-5
8	Communication equipment	All personnel have access to internal alarm or emergency communication device. Personnel working alone have access to two way radio, cell phone, or landline telephone without having to enter another building.	2.10.3, Table D-5
9	Ignitable or reactive waste boundary restriction	Demarcation or knowledge of storage restriction for ignitable or reactive waste within 15 meters of the TWF fence line	2.8, 3.14.1(2)
10	Training	Hazardous waste management workers and supervisor training	2.7
11	Inspection plan	Plan for daily/weekly RCRA inspections	2.6
12	Records repository	Location for copies of Operating Record, Contingency Plan, Inspection Record Forms, training records	2.12.2 (as applicable), 2.11.3(1), 2.6.3
13	Program for soil vapor monitoring	In place for quarterly sampling, analysis, and reports after operations commence	3.14.3
14	Program for equipment and structure repair	In place to resolve repairs for any actions required (ARs) forthcoming from inspection program after operations commence	2.6.2
15	Evacuation plans/areas	Evacuation plan with routes and signals. Signs posted.	2.11.2, 2.11.3

No.	Item	Description	LANL Hazardous Waste Facility Permit Citation
16	Arrangements with local authorities	Los Alamos Fire Department notification of waste types, constituents, quantities, and location.	2.10.5
17	Pallets	Pallets and drum binding for stacking as necessary	3.5.1(2)
18	Waste container labels	Hazardous, radioactive and free liquids labels	3.6
19	Warning signs	Bilingual warning signs stating posted on the perimeter fences and gates in accordance with Permit Section 2.5.2, Warning Signs.	A.6.7
20	Badge readers	Personnel security access	A.6.7

ENCLOSURE 4

Facility Certification

EPC-DO-16-0361

LA-UR-16-29607

Date: JAN 1 3 2017

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

1-9-17

John C. Bretzke — **Date Signed**
Division Leader
Environmental Protection and Compliance Division
Los Alamos National Security, LLC
Los Alamos National Laboratory
Operator

09 Jan 2017

Karen E. Armijo — **Date Signed**
Permitting and Compliance Program Manager
National Nuclear Security Administration
Los Alamos Field Office
U.S. Department of Energy
Owner/Operator

CERTIFICATION

This certification was prepared in accordance with generally accepted professional engineering principles and practice pursuant to the requirements of 20.4.1 NMAC, incorporating 40 CFR §270.30(l)(2)(i), for a registered professional engineer's certification. These services have been performed with the care and skill ordinarily exercised by members of the profession practicing under similar conditions at this time. No other warranty is either expressed or implied. The finding and certification are based on 1) review of the project construction drawings associated with the construction of the Technical Area 63 Transuranic Waste Facility (TA-63 TWF); 2) review of the relevant materials specifications associated with the project; 3) review of the permit conditions for the TA-63 TWF contained in the LANL Hazardous Waste Facility Permit (the Permit); 4) observation of the construction procedures and activities for the project; and 5) discussion with project and environmental personnel responsible for the production of this report.

With the signature and seal below, I certify that the construction of the TA-63 TWF Container Storage Unit was conducted in accordance with the conditions of the Permit. The information presented in this report is, to the best of my knowledge and belief, true, accurate, and complete.

Respectfully,
Los Alamos National Security, LLC

MD Pope

Michael D. Pope
New Mexico Registered Professional Engineer No. 9428
Expires: 12-31-2018
Date: 12-19-2016