Exhibit 3

CONSTRUCTION PLANS

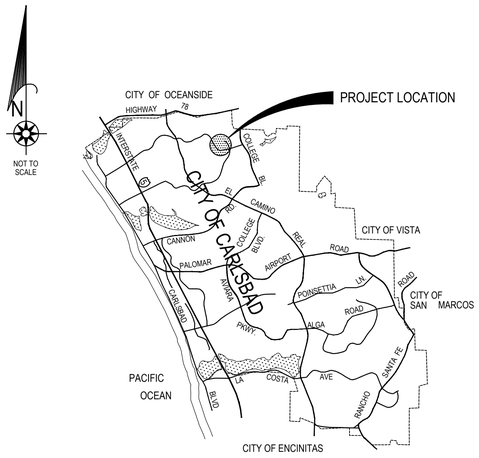
FOR THE

VILLAS LIFT STATION REPLACEMENT
CIP 5550

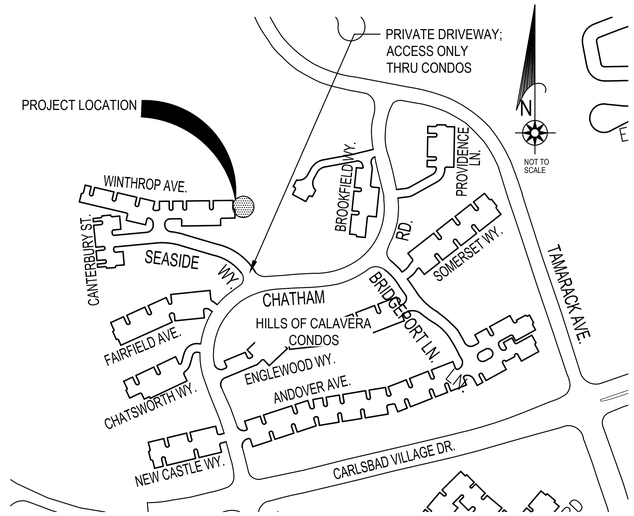
City of Carlsbad

CITY OF CARLSBAD, UTILITIES DEPARTMENT

CARLSBAD, CALIFORNIA



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

SHEET INDEX

ORDER	SHEET NUMBER	SHEET TITLE
1	G-001	TITLE SHEET
2	G-002	NOTES, LEGEND AND ABBREVIATIONS
3	G-003	STRUCTURAL NOTES
4	D-101	DEMOLITION PLAN
5	ED-501	ELECTRICAL DEMOLITION - I
6	ED-502	ELECTRICAL DEMOLITION - 2
7	ED-601	ELECTRICAL SINGLE LINE DIAGRAM MODIFICATIONS
8	ID-101	P&ID MODIFICATIONS
9	C-101	SITE IMPROVEMENTS
10	C-401	CANOPY DETAIL
11	C-402	FENCE SECTION VIEW
12	C-501	SITE DETAILS
13	M-101	MECHANICAL IMPROVEMENTS
14	M-501	MECHANICAL DETAILS
15	E-001	ELECTRICAL SYMBOLS, NOTES, AND ABBREVIATIONS
16	E-101	ELECTRICAL SITE PLAN
17	E-501	ELECTRICAL DETAILS
18	E-601	SINGLE LINE DIAGRAM AND PANEL SCHEDULE
19	E-602	ELECTRICAL PUMP CONTROL DIAGRAM
20	E-603	ELECTRICAL PUMP CONTROL DIAGRAM
21	I-001	P&ID LEGEND, SYMBOLS, AND ABBREVIATIONS
22	I-101	P&ID
23	I-102	PANEL ELEVATIONS

CITY COUNCIL MEMBERS

MATT HALL - MAYOR

PRIYA BHAT-PATEL - COUNCIL MEMBER

KEITH BLACKBURN - COUNCIL MEMBER

CORI SCHUMACHER - COUNCIL MEMBER

TERESA ACOSTA - COUNCIL MEMBER

SCOTT CHADWICK
CITY MANAGER

PAZ GOMEZ
DEPUTY CITY MANAGER, PUBLIC WORKS

JUNE 2021

REGISTERED PROFESSIONAL ENGINEER
CASEY L. RANES
No. C78713
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DECLARATION OF ENGINEER OF WORK

I HEREBY DECLARE THAT THE DESIGN OF THE IMPROVEMENTS AS SHOWN ON THESE PLANS COMPLIES WITH PROFESSIONAL ENGINEERING STANDARDS AND PRACTICES. AS THE ENGINEER IN RESPONSIBLE CHARGE OF THE DESIGN OF THESE IMPROVEMENTS, I ASSUME FULL RESPONSIBLE CHARGE FOR SUCH DESIGN. I UNDERSTAND AND ACKNOWLEDGE THAT THE PLAN CHECK OF THESE PLANS BY THE CITY OF CARLSBAD IS A REVIEW FOR THE LIMITED PURPOSE OF ENSURING THE PLANS COMPLY WITH CITY PROCEDURES AND OTHER APPLICABLE POLICIES AND ORDINANCES. THE PLAN CHECK IS NOT A DETERMINATION OF THE TECHNICAL ADEQUACY OF THE DESIGN OF THE IMPROVEMENTS. SUCH PLAN CHECK DOES NOT, THEREFORE, RELIEVE ME OF MY RESPONSIBILITY FOR THE DESIGN OF THESE IMPROVEMENTS.

AS ENGINEER OF WORK, I AGREE TO INDEMNIFY AND SAVE THE CITY OF CARLSBAD, ITS OFFICERS, AGENTS AND EMPLOYEES HARMLESS FROM ANY AND ALL LIABILITY, CLAIMS, DAMAGES OR INJURIES TO ANY PERSON OR PROPERTY WHICH MIGHT ARISE FROM THE NEGLIGENT ACTS, ERRORS OR OMISSIONS OF THE ENGINEER OF WORK.

ENGINEER | C78713 LICENSE NO. | 6/24/2021 DATE

"AS BUILT"

P.E. _____ EXP. _____ DATE

G-001

REVIEWED BY:

INSPECTOR DATE

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 1 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
TITLE SHEET

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532-3

P:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG - REVISED: 2/23/21

GENERAL NOTES

1. THIS PLAN SUPERSEDES ALL OTHER PLANS PREVIOUSLY APPROVED BY THE CITY OF CARLSBAD REGARDING IMPROVEMENTS SHOWN ON THIS SET OF PLANS.
2. A RIGHT-OF-WAY PERMIT FROM THE CITY ENGINEER WILL BE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. PRIOR TO PERMIT ISSUANCE, A CERTIFICATE OF INSURANCE MUST BE FILED NAMING THE CITY OF CARLSBAD AS ADDITIONAL INSURED ON THE PERMITTEE'S POLICY IN THE MINIMUM AMOUNT AND A RATING AND SIZE CATEGORY AS SPECIFIED IN THE GENERAL PROVISIONS.
3. NO WORK SHALL BE COMMENCED UNTIL ALL PERMITS HAVE BEEN OBTAINED FROM THE CITY AND OTHER APPROPRIATE AGENCIES AND CITY NOTICE TO PROCEED IS ISSUED.
4. NO REVISIONS WILL BE MADE TO THESE PLANS WITHOUT THE WRITTEN APPROVAL OF THE CITY ENGINEER, NOTED WITHIN THE REVISION BLOCK, ON THE APPROPRIATE SHEET OF THE PLANS AND TITLE SHEET.
5. ACCESS FOR FIRE AND OTHER EMERGENCY VEHICLES SHALL BE MAINTAINED AT THE PROJECT SITE AT ALL TIMES DURING CONSTRUCTION.
6. A PRE-CONSTRUCTION MEETING SHALL BE HELD AT THE SITE PRIOR TO THE BEGINNING OF WORK AND SHALL BE ATTENDED BY ALL REPRESENTATIVES RESPONSIBLE FOR CONSTRUCTION, INSPECTION, SUPERVISION, TESTING AND ALL OTHER ASPECTS OF THE WORK. THE CONTRACTOR SHALL SCHEDULE THE MEETING BY CALLING THE INSPECTION LINE AT (760) 602-2780 AT LEAST FIVE (5) WORKING DAYS PRIOR TO STARTING CONSTRUCTION. APPROVED DRAWINGS MUST BE AVAILABLE PRIOR TO SCHEDULING.
7. ALL INSPECTION REQUESTS OTHER THAN FOR PRE-CONSTRUCTION MEETING WILL BE MADE BY CALLING THE ENGINEERING 24-HOUR INSPECTION REQUEST LINE AT (760) 602-2780. INSPECTION REQUESTS MUST BE RECEIVED PRIOR TO 2:00 P.M. ON THE DAY BEFORE THE INSPECTION IS NEEDED. INSPECTIONS WILL BE MADE THE NEXT WORK DAY UNLESS YOU REQUEST OTHERWISE. REQUESTS MADE AFTER 2:00 P.M. WILL BE SCHEDULED FOR TWO FULL WORK DAYS LATER.
8. THE CONTRACTOR SHALL DESIGN, CONSTRUCT AND MAINTAIN ALL SAFETY DEVICES, INCLUDING SHORING, AND SHALL BE SOLELY RESPONSIBLE FOR CONFORMING TO ALL LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS AND REGULATIONS. CONTRACTOR TO PROVIDE 24/7 SITE SAFETY.
9. THE CONTRACTOR SHALL CONFORM TO LABOR CODE SECTION 6705 BY SUBMITTING A DETAIL PLAN TO THE CITY ENGINEER AND/OR CONCERNED AGENCY SHOWING THE DESIGN OF SHORING, BRACING SLOPE OR OTHER PROVISIONS TO BE MADE OF WORKER PROTECTION FROM THE HAZARD OF CAVING GROUND DURING THE EXCAVATION OF SUCH TRENCH OR TRENCHES OR DURING THE PIPE INSTALLATION THEREIN. THIS PLAN MUST BE PREPARED FOR ALL TRENCHES FIVE FEET (5') OR MORE IN DEPTH AND APPROVED BY THE CITY ENGINEER AND/OR CONCERNED AGENCY PRIOR TO EXCAVATION. IF THE PLAN VARIES FROM THE SHORING SYSTEM STANDARDS ESTABLISHED BY THE CONSTRUCTION SAFETY ORDERS, TITLE 8, CALIFORNIA ADMINISTRATIVE CODE, THE PLAN SHALL BE PREPARED BY A REGISTERED ENGINEER AT THE CONTRACTOR'S EXPENSE. A COPY OF THE OSHA EXCAVATION PERMIT MUST BE SUBMITTED TO THE INSPECTOR PRIOR TO EXCAVATION.
10. IF ANY ARCHAEOLOGICAL RESOURCES ARE DISCOVERED WITHIN ANY WORK ZONE DURING CONSTRUCTION, OPERATIONS WILL CEASE IMMEDIATELY, AND THE PERMITTEE WILL NOTIFY THE CITY ENGINEER. OPERATIONS WILL NOT RESTART UNTIL THE PERMITTEE HAS RECEIVED WRITTEN AUTHORITY FROM THE CITY ENGINEER TO DO SO.
11. ALL OPERATIONS CONDUCTED ON THE SITE OR ADJACENT THERETO, INCLUDING WARMING UP, REPAIR, ARRIVAL, DEPARTURE OR OPERATION OF TRUCKS, EARTHMOVING EQUIPMENT, CONSTRUCTION EQUIPMENT AND ANY OTHER ASSOCIATED GRADING EQUIPMENT SHALL BE LIMITED TO THE PERIOD BETWEEN 8:00 A.M. AND 4:30 P.M. EACH DAY, MONDAY THRU FRIDAY AND IN ACCORDANCE WITH WORK HOURS PER SPECIFICATIONS. NO EARTHMOVING OR GRADING OPERATIONS SHALL BE CONDUCTED ON WEEKENDS OR HOLIDAYS. (A LIST OF CITY HOLIDAYS IS AVAILABLE AT THE ENGINEERING DEPARTMENT COUNTER.)
12. ALL OFF-SITE HAUL ROUTES SHALL BE SUBMITTED BY THE CONTRACTOR TO THE CITY ENGINEER FOR APPROVAL TWO FULL WORKING DAYS PRIOR TO BEGINNING OF WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DEBRIS OR DAMAGE OCCURRING ALONG THE HAUL ROUTE OR ADJACENT STREETS AS A RESULT OF THE GRADING OPERATION.
13. NO BLASTING SHALL BE COMMENCED WITHOUT A CITY ENGINEER APPROVED BLASTING PROGRAM AND BLASTING PERMIT.
14. THE EXISTENCE AND LOCATION OF UTILITY STRUCTURES AND FACILITIES SHOWN ON THE CONSTRUCTION PLANS WERE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. ATTENTION IS CALLED TO THE POSSIBLE EXISTENCE OF OTHER UTILITY FACILITIES OR STRUCTURES NOT SHOWN OR IN A LOCATION DIFFERENT FROM THAT SHOWN ON THE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN ON THE PLANS AND ANY OTHER EXISTING FACILITIES OR STRUCTURES NOT SHOWN.
15. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING FACILITIES (ABOVEGROUND AND UNDERGROUND) WITHIN THE PROJECT SITE SUFFICIENTLY AHEAD OF THE CONSTRUCTION TO PERMIT THE REVISIONS OF THE CONSTRUCTION PLANS IF IT IS FOUND THAT THE ACTUAL LOCATIONS ARE IN CONFLICT WITH THE PROPOSED WORK. THE CONTRACTOR SHALL POTHOLE ALL EXISTING UNDERGROUND UTILITY CROSSINGS PRIOR TO THE START OF ANY WORK AS NOTED ON THESE PLANS.
16. THE CONTRACTOR SHALL NOTIFY AFFECTED UTILITY COMPANIES (SEE BELOW) AT LEAST TWO FULL WORKING DAYS PRIOR TO STARTING CONSTRUCTION NEAR THEIR FACILITIES AND SHALL COORDINATE WORK WITH A COMPANY REPRESENTATIVE.

CARLSBAD MUNICIPAL WATER DISTRICT	(760) 438-2722
UNDERGROUND SERVICE ALERT	811
SDG&E	(800) 660-7343
AT&T DISTRIBUTION	(619) 574-3661
SPECTRUM CABLE	(760) 438-7741
CITY OF CARLSBAD (STREETS AND STORM DRAIN)	(760) 434-2980

17. THE ORIGINAL DRAWINGS SHALL BE REVISED TO REFLECT AS-BUILT CONDITIONS PRIOR TO FINAL ACCEPTANCE OF WORK BY THE CITY.
18. THE CONTRACTOR SHALL REPLACE IN KIND AND IN ACCORDANCE WITH ALL CITY OF CARLSBAD STANDARDS ALL EXISTING IMPROVEMENTS INCLUDING BUT NOT LIMITED TO PAVEMENT, SIDEWALKS, CURBS AND GUTTERS, MEDIAN IMPROVEMENTS, BERMS, PAVED AND DIRT ROADS, DRAINAGE DITCHES, CULVERTS, DRAIN PIPES, SEWER LATERALS, WATER SERVICES, LANDSCAPING, HARDSCAPE IRRIGATION FACILITIES, TRAFFIC CONTROL LOOPS, ABOVE AND BELOW GROUND, DAMAGED DURING CONSTRUCTION OF THE PROJECT, EXCEPT AS SPECIFICALLY INDICATED ON THE DRAWINGS.
19. THE CONTRACTOR SHALL OBTAIN AN EXCAVATION PERMIT FROM THE DIVISION OF INDUSTRIAL SAFETY BEFORE ANY EXCAVATION AND SHALL PROVIDE PROOF OF OSHA NOTIFICATION AND SHALL ADHERE TO ALL PROVISIONS OF THE STATE CONSTRUCTION SAFETY ORDERS.
20. DEMOLITION WORK SHALL BE LOW IMPACT AND MINIMIZES DISTURBANCES TO LOCAL RESIDENTS. NO JACKHAMMERING IS ALLOWED.

SEWER NOTES

1. SEWER MAIN AND APPURTENANCES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "CITY OF CARLSBAD ENGINEERING STANDARDS (LATEST EDITION), VOLUME 1 – GENERAL DESIGN STANDARDS, CHAPTER 6-DESIGN CRITERIA FOR GRAVITY SEWER LINES AND APPURTENANCES, AND VOLUME 3 – STANDARD DRAWINGS AND NOTES AND THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION (GREEN BOOK).
2. BEFORE ANY CONNECTION TO THE CITY'S EXISTING SYSTEM, A PERMIT SHALL BE OBTAINED FROM THE CITY. IT MUST BE SIGNED AND APPROVED BY THE CITY ENGINEER AND SUPERINTENDENT.
3. BEFORE CONSTRUCTION BEGINS IN ANY PUBLIC RIGHT OF WAY, A CITY RIGHT OF WAY PERMIT SHALL BE REQUIRED.
4. CONTRACTOR SHALL DESIGN, FURNISH AND INSTALL TEMPORARY SEWER BYPASSING PLAN AS NECESSARY DURING CONSTRUCTION, TO KEEP SEWER SYSTEM OPERATIONAL AT ALL TIMES PER SPECIFICATION SECTION 02999. PLAN SHALL BE SUBMITTED TO THE CITY FOR APPROVAL PRIOR TO CONSTRUCTION. BYPASS PUMPING SYSTEM LOCATED AT THE TWO (2) UPSTREAM MANHOLES OF THE WET WELL SHALL BE CAPABLE OF CONVEYING 110 GPM AT 90 FEET OF TDH AND 146 GPM AT 79 FEET OF TDH. SHUTOFF HEAD SHALL BE 115 FEET (MINIMUM).

WATER NOTES

1. WATER MAIN AND APPURTENANCES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "CITY OF CARLSBAD ENGINEERING STANDARDS" (LATEST EDITION) VOLUMES 2 & 3, AND SAN DIEGO COUNTY DEPARTMENT OF HEALTH SERVICES REQUIREMENTS.
2. CONSTRUCTION OF WATER MAINS SHALL ADHERE TO THE "CRITERIA FOR THE SEPARATION OF WATER MAINS AND SANITARY SEWERS" PUBLISHED BY THE STATE OF CALIFORNIA'S DEPARTMENT OF PUBLIC HEALTH.
3. BEFORE ANY CONNECTION OR SHUT DOWN OF VALVES ON EXISTING CMWD LINES, A PERMIT SHALL BE OBTAINED FROM THE CMWD OFFICE AND MUST BE SIGNED AND APPROVED BY THE CITY OF CARLSBAD'S DEPUTY CITY ENGINEER AND THE UTILITY OPERATION'S PUBLIC WORKS MANAGER.
4. NO TREES SHALL BE REMOVED AS PART OF WORK – ANY EXCEPTIONS SHALL REQUIRE WRITTEN PERMISSION FROM THE CITY ENGINEER.
5. ALL BURIED COPPER PIPING AND APPURTENANCES SHALL BE PROTECTED BY MEANS OF CATHODIC PROTECTION.
6. MINIMUM SPACING BETWEEN RECYCLED WATER WATER, POTABLE WATER SERVICES AND SEWER SERVICES SHALL BE 10 FEET. A MINIMUM 4-FOOT SEPARATION MAY BE CONSIDERED AT THE DISCRETION OF THE CMWD.
7. THE TOP OF WATER METER BOXES SHALL BE FLUSH WITH THE FINISHED SURFACE GRADE.
8. AXIAL DEFLECTION AT THE PIPE JOINTS ARE NOT ALLOWED. THE USE OF A HIGH-DEFLECTION COUPLING AT A PIPE JOINT MAY BE PERMITTED BY THE INSPECTOR ON A CASE BY CASE BASIS NOT TO EXCEED 4 DEGREES TOTAL DEFLECTION PER COUPLING (2 DEGREES/EACH GASKET). USE CERTAINTEED "VINYL-IRON" H.D. FOR C900.

TEMPORARY BMP NOTES

1. IN CASE EMERGENCY WORK IS REQUIRED, CONTACT THE ENGINEERING DEPARTMENT AT (760) 602-2740.
2. EQUIPMENT AND WORKERS FOR EMERGENCY WORK SHALL BE MADE AVAILABLE AT ALL TIMES DURING THE RAINY SEASON. ALL NECESSARY MATERIALS SHALL BE STOCKPILED ON SITE AT CONVENIENT LOCATIONS TO FACILITATE RAPID CONSTRUCTION OF TEMPORARY DEVICES WHEN RAIN IS EMINENT.
3. FOR PROJECTS COVERED BY STATE SWPPP/WDID, IN ACCORDANCE WITH THE CONSTRUCTION ORDER ISSUED BY THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, THE QUALIFIED SWPPP PRACTITIONER (QSP) SHALL UPDATE AND MAINTAIN THE WATER POLLUTION CONTROL (WPC) PLAN TO ADDRESS UPDATED SITE CONDITIONS OF THE PROJECT. THE UPDATED WPC PLAN AND UPDATED SWPPP SHALL BE KEPT AT THE PROJECT SITE AND MADE AVAILABLE TO THE CITY INSPECTOR. ADDITIONAL CONSTRUCTION BMP'S BEYOND THE ORIGINAL APPROVED SWPPP SHALL BE PROVIDED TO ADDRESS SITE CONDITIONS NOT ANTICIPATED. THE QSP SHALL REPORT BMP DEFICIENCIES TO THE CITY INSPECTOR. THE QSP SHALL OBTAIN APPROVAL FROM THE QUALIFIED SWPPP DEVELOPER AND THE CITY INSPECTOR REGARDING ANY SIGNIFICANT CHANGES TO BMP DEPLOYMENT.
4. THE CONTRACTOR SHALL RESTORE ALL EROSION CONTROL DEVICES TO WORKING ORDER TO THE SATISFACTION OF THE CITY ENGINEER AFTER EACH RUN-OFF PRODUCING RAINFALL.
5. THE CONTRACTOR SHALL INSTALL ADDITIONAL EROSION CONTROL MEASURES AS MAY BE REQUIRED BY THE CITY ENGINEER DUE TO UNCOMPLETED GRADING OPERATIONS OR UNFORESEEN CIRCUMSTANCES WHICH MAY ARISE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT PUBLIC TRESPASS ONTO AREAS WHERE IMPOUNDED WATERS CREATE A HAZARDOUS CONDITION.
7. ALL EROSION CONTROL MEASURES PROVIDED PER THE APPROVED SWPPP AND/OR EROSION CONTROL PLAN SHALL BE INCORPORATED HEREON.
8. GRADED AREAS AROUND THE PROJECT PERIMETER MUST DRAIN AWAY FROM THE FACE OF SLOPE AT THE CONCLUSION OF EACH WORKING DAY.
9. ALL REMOVABLE PROTECTIVE DEVICES SHOWN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY WHEN THE FIVE (5) DAY RAIN PROBABILITY FORECAST EXCEEDS FIFTY PERCENT (50%). SILT AND OTHER DEBRIS SHALL BE REMOVED AFTER EACH RAINFALL.
10. ALL GRAVEL BAGS SHALL BE BURLAP TYPE WITH 3/4 INCH MINIMUM AGGREGRATE.
11. SHOULD GERMINATION OF HYDROSEEDED SLOPES FAIL TO PROVIDE EFFECTIVE COVERAGE OF GRADED SLOPES (90% COVERAGE) PRIOR TO NOVEMBER 15, THE SLOPES SHALL BE STABILIZED BY PUNCH STRAW INSTALLED IN ACCORDANCE WITH SECTION 35.023 OF THE EROSION AND SEDIMENT CONTROL HANDBOOK OF THE DEPARTMENT OF CONSERVATION, STATE OF CALIFORNIA.
12. TIER 1 MINOR SWPPP REQUIRED. SEE GENERAL PROVISIONS.

LEGEND

RIGHT-OF-WAY AND PROPERTY LINES
EASEMENT GRANTED TO THE CITY
CENTERLINE
CURB AND GUTTER
PAVEMENT EDGE
RETAINING WALL
WOOD FENCE
CHAIN FENCE
FLOW LINE
EXISTING ELECTRICAL CONDUIT
EXISTING GAS LINE
EXISTING STORM DRAIN
EXISTING SANITARY SEWER MAIN
EXISTING TELEPHONE CONDUIT
EXISTING SANITARY SEWER MANHOLE
EXISTING WATER VALVE
EXISTING THRUST BLOCK
EXISTING LIGHT POLE
PROPOSED ELECTRICAL CONDUIT
PROPOSED LIGHT POLE
PROPOSED PULLBOX
PROPOSED PRESSURE TRANSMITTER
EXISTING HOSE BIB
EXISTING GUARD POST
EXISTING CONCRETE PAVING
PROPOSED CONCRETE PAVING
EXISTING UNPAVED SURFACE

SPECIAL NOTES

1. CONTRACTOR TO COORDINATE WITH RESIDENTS IN THE AREA, HOMEOWNERS ASSOCIATION, AND CITY CONSTRUCTION MANAGER THROUGHOUT CONSTRUCTION. KEEP RESIDENT DRIVEWAYS AND PARKING ACCESSIBLE AT ALL TIMES DURING CONSTRUCTION.
2. CONTRACTOR SHALL INSTALL TEMPORARY NOISE BARRIERS ON TEMPORARY FENCE OR AS APPROVED, TO KEEP NOISE LEVELS BELOW CITY REQUIREMENTS DURING CONSTRUCTION.

BENCHMARK

ELEVATIONS SHOWN HEREON ARE BASED UPON CITY OF CARLSBAD BENCHMARK POINT NO. 89 CLSV-089, ELEVATION 281.13 FEET (NAVD 88).

DESCRIPTION: 2.5" DISK IN SOUTH CURB OF CARLSBAD VILLAGE DRIVE IN MIDDLE OF CURVE CONCAVE NORTHEAST 0.205 FT SOUTHEASTERLY OF VICTORIA AVENUE.

BASIS OF COORDINATES

THE BEARINGS SHOWN HEREON ARE BASED UPON THE CALIFORNIA COORDINATE SYSTEM OF 1983, CCS83, ZONE 6, (2018.50) IN ACCORDANCE TO THE CALIFORNIA PUBLIC RESOURCES CODE SECTIONS 8801-8819; SAID BEARINGS WERE DETERMINED LOCALLY UPON FIELD-OBSERVED TIES TO THE FOLLOWING LEICA SMARTNET NORTH AMERICA REFERENCE NETWORK STATIONS (C.O.R.S.):

S.N.N.A. CAOS:
NORTHING = 2017460.65' EASTING = 6216589.73'

S.N.N.A. CASO
NORTHING = 1877183.42' EASTING = 6293621.68'

ABBREVIATIONS

AB	AGGREGATE BASE	NO	NUMBER
AC	ASPHALT CONCRETE	NPT	NATIONAL PIPE THREAD
APWA	AMERICAN PUBLIC WORKS ASSOCIATION	NTS	NOT TO SCALE
AV	AIR-VACUUM RELEASE VALVE	OC	ON CENTER
AVE	AVENUE	OD	OUTSIDE DIAMETER
AWWA	AMERICAN WATER WORKS ASSOCIATION	OPNG	OPENING
@	AT	PB	PULL BOX
		PCC	PORTLAND CONCRETE CEMENT
BF	BLIND FLANGE	PE	PLAIN END
BM	BENCHMARK	P/L	PROPERTY LINE
BLDG	BUILDING	POC	POINT OF CONNECTION
BLVD	BOULEVARD	PP	POWER POLE
BO	BLOW-OFF ASSEMBLY	PRV	PRESSURE REDUCING VALVE
BOT	BOTTOM	PSI	POUNDS PER SQUARE INCH
		PVC	POLYVINYL CHLORIDE
C	CONDUIT		
CI	CAST IRON	R, RAD	RADIUS
CL	CLASS	RCP	REINFORCED CONCRETE PIPE
C/L	CENTERLINE	RD	ROAD
CLR	CLEAR, CLEARANCE	REQ'D	REQUIRED
CML&C	CEMENT MORTAR LINED AND COATED	RT	RIGHT
		R/W	RIGHT-OF-WAY
CMU	CONCRETE MASONRY UNIT		
CMWD	CARLSBAD MUNICIPAL WATER DISTRICT	S	SLOPE, SOUTH
		SCH	SCHEDULE
CONC	CONCRETE	SD	STORM DRAIN
CONT	CONTINUOUS	SHT	SHEET
COORD	COORDINATE	SPEC	SPECIFICATION
COR	CORNER	SS	STAINLESS STEEL
CU	CUBIC	ST	STREET
CV	CHECK VALVE	STA	STATION
CY	CUBIC YARD	STD	STANDARD
		STL	STEEL
DIA	DIAMETER		
DTL	DETAIL	TC	TOP OF CURB
DI	DROP (DRAINAGE) INLET	TDH	TOTAL DYNAMIC HEAD
DR	DRIVE	TEL	TELEPHONE
DWG	DRAWING	THK	THICK
DWY	DRIVEWAY	TG	TOP OF GRADE
		TYP	TYPICAL
E	EAST		
EA	EACH	V	VOLT
EP	EDGE PAVING	VERT	VERTICAL
EQ	EQUAL		
ER	EDGE ROAD	W/	WITH
ELEV	ELEVATION	W	WEST, WATER
ELEC	ELECTRIC	WM	WATER METER
ENGR	ENGINEER	WV	WATER VALVE
EW	EACH WAY		
EXIST	EXISTING		
FG	FINISH GROUND		
FH	FIRE HYDRANT		
FL	FLOW LINE		
FS	FINISHED SURFACE		
FT	FOOT OR FEET		
FLG	FLANGED		
GA	GAUGE		
GAL	GALLON		
GALV	GALVANIZED		
GPM	GALLON PER MINUTE		
GR	GRADE		
GRD	GROUND		
GV	GATE VALVE		
H	HEIGHT		
HB	HOSE BIB		
HORIZ	HORIZONTAL		
HWY	HIGHWAY		
IP	IRON PIPE		
INV	INVERT		
ID	INSIDE DIAMETER		
JCT	JUNCTION		
L	LENGTH		
LAT	LATERAL		
LF	LINEAR FEET		
LT	LEFT		
MAX	MAXIMUM		
MFR	MANUFACTURER		
MH	MANHOLE		
MIN	MINIMUM		
MISC	MISCELLANEOUS		
N	NORTH		

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

G-002

REGISTERED PROFESSIONAL ENGINEER CASEY L. RAINES No. 67813 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 2 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
NOTES, LEGEND AND ABBREVIATIONS

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532-3

STRUCTURAL NOTES

CONCRETE

1. ALL CONCRETE CONSTRUCTION SHALL CONFORM WITH CHAPTER 19 OF THE CODE AND WITH THE PROVISIONS OF ACI 318, LATEST EDITION.
2. REINFORCED CONCRETE IS DESIGNED BY THE "ULTIMATE STRENGTH DESIGN METHOD".
3. CONCRETE MIXES SHALL BE DESIGNED BY THE APPROVED TESTING LABORATORY AND APPROVED BY THE STRUCTURAL ENGINEER. THE COMPRESSIVE STRENGTH OF THE CONCRETE SHALL BE PROPORTIONED BASED ON SECTION 1905 OF THE CODE.
4. SCHEDULE OF STRUCTURAL CONCRETE 28–DAY STRENGTH AND TYPES, UNLESS NOTED OTHERWISE:

LOCATION IN STRUCTURE	STRENGTH (PSI)	DENSITY (PCF)	W/C RATIO
ALL CONCRETE FOOTINGS	4000	150	0.50
CONCRETE SLAB ON GRADE	5000	150	0.40
TIP FLOOR SLAB ON GRADE AND ELEVATED SECTION	6000	150	0.40
ALL BUILDING CONCRETE WALLS AND ELEVATED SLABS ON METAL DECK	5000	150	0.45
SITE WALS	4000	150	0.45

5. PORTLAND CEMENT SHALL CONFORM TO ASTM C 150, TYPE II.
6. AGGREGATE FOR HARDROCK CONCRETE SHALL CONFORM TO ALL REQUIREMENTS AND TESTS OF ASTM C 33 AND PROJECT SPECIFICATIONS. EXCEPTIONS MAY BE USED ONLY WITH PERMISSION OF THE STRUCTURAL ENGINEER.
7. AGGREGATE AT SLAB TYPES A, B, C, D AND E TO HAVE MAX LA ABRASION INDEX OF 30% AND NO RECYCLED CONCRETE.
8. AGGREGATE FOR LIGHT WEIGHT (110PCF) CONCRETE SHALL BE EXPANDED SHALE CONFORMING TO ASTM C 330 AND PROJECT SPECIFICATIONS. EXCEPTIONS MAY BE USED ONLY WITH PERMISSION OF THE STRUCTURAL ENGINEER.
9. CONCRETE MIXING OPERATION, ETC. SHALL CONFORM TO ASTM C 94.
10. PLACEMENT OF CONCRETE SHALL CONFORM TO CODE SECTION 1905 AND PROJECT SPECIFICATIONS. CLEAN AND ROUGHEN TO 1/4" AMPLITUDE ALL CONCRETE SURFACES AGAINST WHICH NEW CONCRETE IS TO BE PLACED.
11. ALL REINFORCING BARS, ANCHOR BOLTS AND OTHER CONCRETE INSERTS SHALL BE WELL SECURED IN POSITION PRIOR TO PLACING CONCRETE.
12. PROVIDE SLEEVES FOR PLUMBING AND ELECTRICAL OPENINGS IN CONCRETE BEFORE PLACING. DO NOT CUT ANY REINFORCING WHICH MAY CONFLICT. CORING IN CONCRETE IS NOT PERMITTED. NOTIFY THE STRUCTURAL ENGINEER IN ADVANCE OF CONDITIONS NOT SHOWN ON THE DRAWINGS. SEE THESE DRAWINGS FOR ADDITIONAL RESTRICTIONS ON THE PLACEMENT OF OPENINGS IN SLABS AND WALLS.
13. PIPES LARGER THAN 1–1/2" DIAMETER SHALL NOT BE EMBEDDED IN STRUCTURAL CONCRETE EXCEPT WHERE SPECIFICALLY APPROVED BY STRUCTURAL ENGINEER. PIPES SHALL NOT DISPLACE OR INTERRUPT REINFORCING BARS, SPACE EMBEDDED PIPES AND SLEEVES AT A MINIMUM OF 3 DIAMETERS ON CENTER.
14. WHERE INDICATED ON THE PLANS CONCRETE IDENTIFIED AS TYPE V, LOW PERMEABILITY SHALL MEET THE REQUIREMENTS ABOVE AS WELL AS THOSE OF ACI 318 EXPOSURE CLASS C, INCLUDING BUT NOT LIMITED TO: ASTM C130 TYPE V CEMENT, 15% ASTM C618, TYPE F FLY ASH AND SHALL INCLUDE 11 OZ. MOXIE SHIELD 1800 ADMIXTURE PER CWT.
15. CONCRETE SHALL ACHIEVE 100% DESIGN STRENGTH PRIOR TO INSTALLATION OF METAL CONCRETE BUILDING COLUMNS OR EQUIPMENT.

STRUCTURAL STEEL

1. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED BY A LICENSED FABRICATOR SHOP.
2. ALL STRUCTURAL STEEL SHALL CONFORM TO THE ASTM DESIGNATION AS INDICATED BELOW (UNO):

WF & WT SHAPES	A992
ANGLES, CHANNELS, PLATES UNO, CONNECTION PLATES, AND MISC	A36
PIPE COLUMNS	A53, GRADE B
HSS SECTIONS	A500, GRADE B
BOLTS	A325
BOLTS IN CONCRETE UNO	F1554 36 KSI (UNO)

3. THE STRUCTURAL STEEL FABRICATOR SHALL FURNISH SHOP DRAWINGS TO THE ENGINEER OF ALL STEEL FOR STRUCTURAL ENGINEER'S REVIEW AND APPROVAL BEFORE FABRICATION.
4. BOLT HOLES USED IN STEEL SHALL BE 1/16" LARGER IN DIAMETER THAN NOMINAL SIZE OF BOLT USED, EXCEPT AS NOTED.
5. ALL STRUCTURAL STEEL SURFACES THAT ARE ENCASED IN CONCRETE, MASONRY OR SPRAY ON FIREPROOFING, OR ARE ENCASED BY BUILDING FINISH, SHALL BE LEFT UNPAINTED.
6. ALL WELDING IS TO BE DONE BY CERTIFIED WELDERS USING E70XX ELECTRODES (UNO). ALL WELDS SHALL BE IN CONFORMITY WITH THE PROJECT SPECIFICATIONS AND THE CODE FOR WELDING IN BUILDING CONSTRUCTION (AWS D1.1 LATEST REVISION) OF THE AMERICAN WELDING SOCIETY. SEE SPECIAL INSPECTIONS SECTION FOR WELDING INSPECTION REQUIREMENTS. USE OF E70T–4 WIRE IS NOT PERMITTED.
7. WHERE FABRICATION OF STRUCTURAL LOAD–BEARING MEMBERS AND ASSEMBLIES IS BEING PERFORMED ON THE PREMISES OF FABRICATOR'S SHOP, SPECIAL INSPECTION OF THE FABRICATED ITEMS SHALL BE REQUIRED.
8. SPECIAL INSPECTIONS ARE NOT REQUIRED WHERE THE WORK IS DONE ON THE PREMISES OF A FABRICATOR REGISTERED AND APPROVED TO PERFORM SUCH WORK WITHOUT SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTION AGENCY. APPROVAL SHALL BE BASED ON SECTION 1704.2 OF THE CODE. AT COMPLETION OF FABRICATION, THE APPROVED FABRICATOR SHALL SUBMIT A CERTIFICATE OF COMPLIANCE TO THE BUILDING OFFICIAL STATING THAT THE WORK WAS PERFORMED IN ACCORDANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS.
9. WELD LENGTHS CALLED FOR ON PLANS ARE THE NET EFFECTIVE LENGTH REQUIRED. WHERE FILLET WELD SYMBOL IS GIVEN WITHOUT INDICATION OF SIZE, USE MINIMUM SIZE WELDS AS SPECIFIED IN AISC 360–16 SECTION J2.2b.
10. ALL EXPOSED STRUCTURAL STEEL AND MISCELLANEOUS METAL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION UNO.
11. THE SPECIAL INSPECTIONS FOR STEEL ELEMENTS OF BUILDINGS AND STRUCTURES SHALL BE AS REQUIRED BY SECTION 1704.3 OF THE CODE AND CONSTRUCTION DOCUMENTS.

    EXCEPTIONS:
    SPECIAL INSPECTION OF THE STEEL FABRICATION PROCESS SHALL NOT BE REQUIRED WHERE THE FABRICATOR DOES NOT PERFORM ANY WELDING, THERMAL CUTTING OR HEATING OPERATION OF ANY KIND AS PART OF THE FABRICATION PROCESS. IN SUCH CASES, THE FABRICATOR SHALL BE REQUIRED TO SUBMIT A DETAILED PROCEDURE FOR MATERIAL CONTROL THAT DEMONSTRATES THE FABRICATOR'S ABILITY TO MAINTAIN SUITABLE RECORDS AND PROCEDURES SUCH THAT, AT ANY TIME DURING THE FABRICATION PROCESS, THE MATERIAL SPECIFICATION, GRADE AND MILL TEST REPORTS FOR THE MAIN STRESS–CARRYING ELEMENTS ARE CAPABLE OF BEING DETERMINED.
12. HOT–ROLLED SHAPES AND BUILT UP SECTIONS (NOT PART OF SLRS) WITH A FLANGE THICKNESS EXCEEDING 2 IN (i.e. HEAVY SHAPES), SPLICED USING COMPLETE–JOINT– PENETRATION GROOVE WELDS SHALL BE SUPPLIED WITH CHARPY V–NOTCH (CVN) IMPACT TEST RESULTS IN ACCORDANCE WITH ASTM A6/A6M, THE IMPACT TEST SHALL MEET A MINIMUM AVERAGE VALUE OF 20 FT–IBS ABSORBED ENERGY AT +70° F.
13. ALL SPLICES IN HEAVY SHAPES (SEE NOTES 13.) SHALL COMPLY WITH AISC 360–16 SECTION J1.5.
14. BEAM COPES AND WELD ACCESS HOLES SHALL COMPLY WITH AISC 360–16 SECTION J1.6.
15. ALL WELD MATERIAL SHALL COMPLY WITH AISC 360–16 SECTION J2.6.
16. THE THERMAL CUTTING OF ALL MEMBERS SHALL COMPLY WITH AISC 360.10 SECTION M2.2.

REGISTERED PROFESSIONAL ENGINEER — CASEY L. RANES — No. C78713 — Exp. 12-31-22 — CIVIL — STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 **F** 1 949 250 0541
E irvmail@ghd.com **W** www.ghd.com

DIGALERT — CALL TOLL FREE 811 — TWO WORKING DAYS BEFORE YOU DIG — Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

G–003

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 3 — CITY OF CARLSBAD, ENGINEERING DEPARTMENT — SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
STRUCTURAL NOTES

APPROVED: DAVE PADILLA

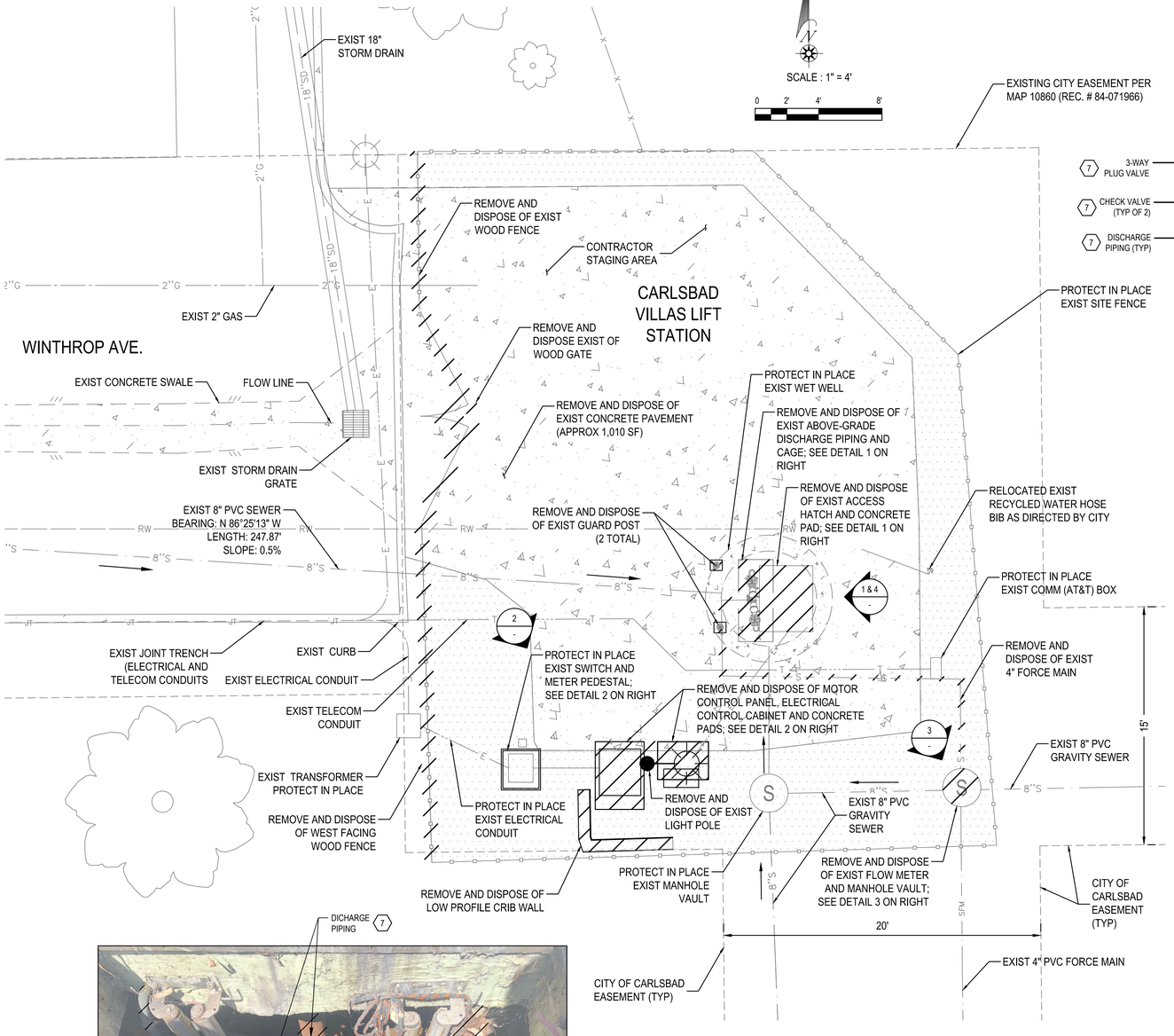
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532–3

D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/17



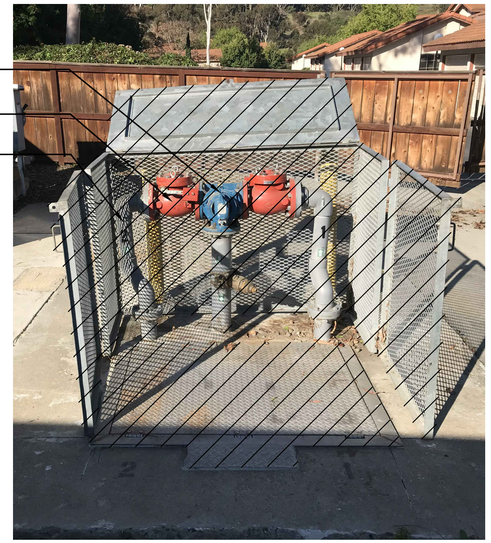
DEMOLITION PLAN
SCALE : 1" = 4'

LEGEND

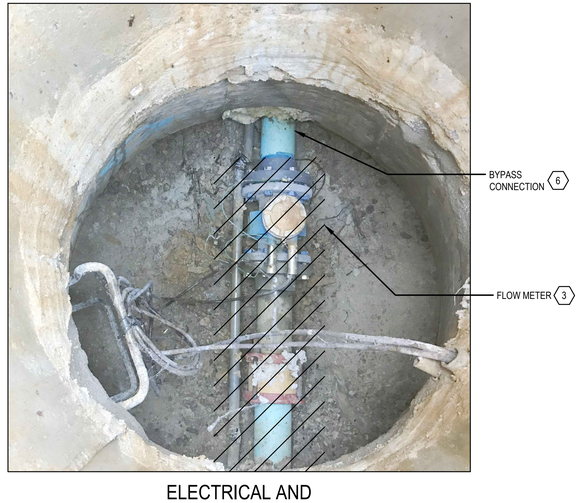
ITEMS TO BE REMOVED PER DEMOLITION NOTES

EXISTING CONCRETE PAVEMENT

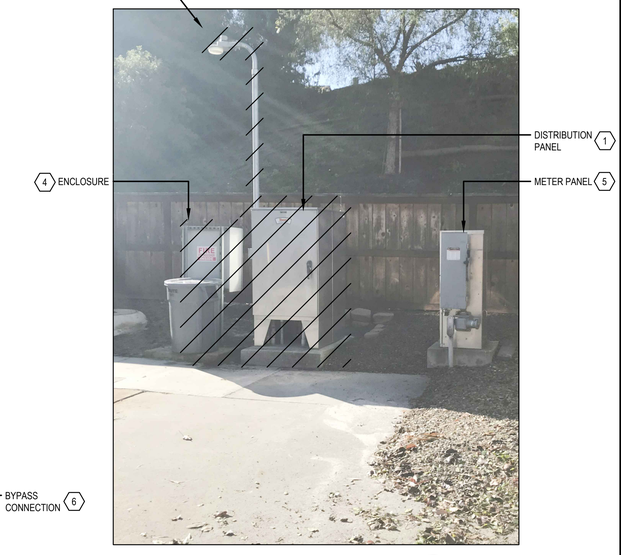
EXISTING GRAVEL AREA



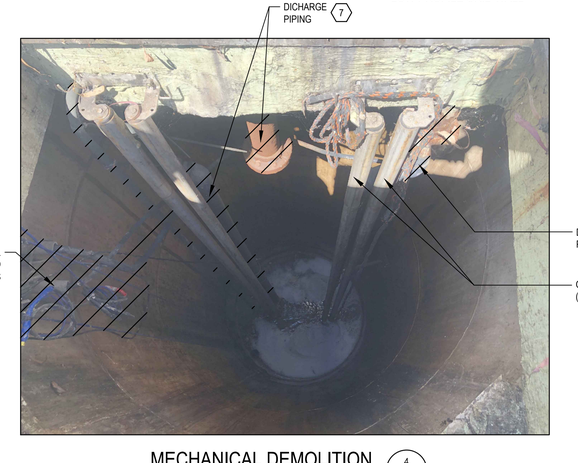
MECHANICAL DEMOLITION
SCALE : NTS
1



ELECTRICAL AND MECHANICAL DEMOLITION
SCALE : NTS
3



ELECTRICAL DEMOLITION
SCALE : NTS
2



MECHANICAL DEMOLITION
SCALE : NTS
4

SHEET GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE A TEMPORARY SEWER BYPASS PLAN FOR REVIEW AND APPROVAL PRIOR TO DEMOLITION.
2. PROTECT IN PLACE ALL EXISTING INFRASTRUCTURE UNLESS NOTED OTHERWISE

SHEET KEYNOTES

1. DISCONNECT, REMOVE AND DISPOSE OF EXISTING DISTRIBUTION PANEL AND CONTROL PANEL. PROTECT IN PLACE EXISTING UTILITY POWER CIRCUIT AND ASSOCIATED CONDUIT. EXISTING UTILITY POWER CIRCUIT AND ASSOCIATED CONDUIT TO BE RE-USED FOR NEW EQUIPMENT.
2. DISCONNECT, REMOVE AND DISPOSE OF EXISTING LIGHT POLE AND ASSOCIATED POWER CIRCUIT.
3. DISCONNECT, REMOVE AND DISPOSE OF EXISTING FLOW METER AND ASSOCIATED POWER AND CONTROL WIRING.
4. REMOVE AND DISPOSE OF EXISTING ENCLOSURE.
5. PROTECT IN PLACE EXISTING ELECTRICAL SERVICE AND TRANSFER SWITCH.
6. CONNECT TO EXISTING 4" FORCE MAIN WITH APPLICABLE FITTING FOR TEMPORARY SEWER BYPASS DURING CONSTRUCTION.
7. REMOVE AND DISPOSE OF EXISTING DISCHARGE PIPING AND VALVES INCLUDING THE BASE ELBOWS CONNECTED TO THE PUMPS.
8. REMOVE AND DISPOSE OF EXISTING PUMP CONTROL WIRING AND CONDUITS.
9. PROTECT IN PLACE EXISTING GUIDE RAILS.

DIGALERT
CALL TOLL FREE 811
TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR _____ DATE

D-101

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

REGISTERED PROFESSIONAL ENGINEER CASEY L. RANES No. C78713 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

SHEET	CITY OF CARLSBAD	SHEETS
4	ENGINEERING DEPARTMENT	23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
DEMOLITION PLAN

APPROVED: DAVE PADILLA
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL	PROJECT NO.	DRAWING NO.
CHKD BY: PA	CIP 5550	532-3
RVWD BY: BW		

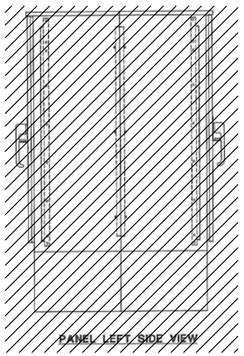
SHEET GENERAL NOTES

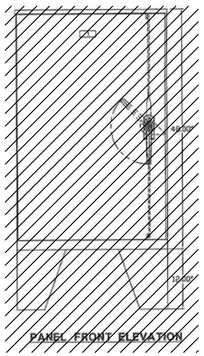
1. CONTRACTOR SHALL PROTECT IN PLACE ALL EXISTING CONDUIT NOT DESIGNATED FOR REMOVAL.
2. PROTECT IN PLACE EXISTING CONDUITS UNLESS NOTED OTHERWISE.

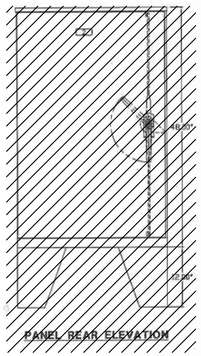
SHEET KEYNOTES

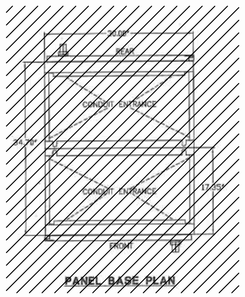
1. DISCONNECT AND REMOVE DUPLEX PANEL.
2. REMOVE ALL EQUIPMENT INSIDE PLC SECTION AND RE-INSTALL IT IN THE NEW CONTROL PANEL.

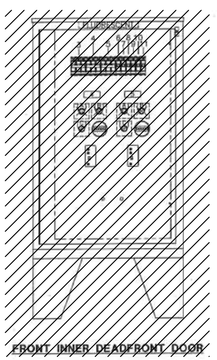
1 TYP.

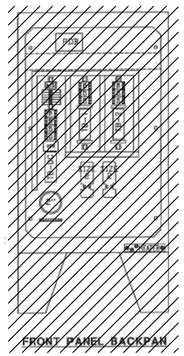


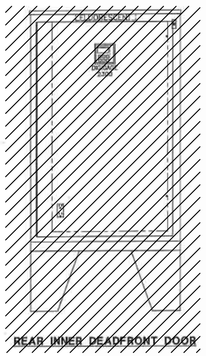




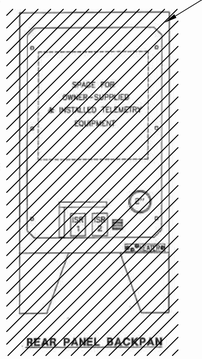








2



NAMEPLATE SCHEDULE

TAG#	QTY	TYPE	INSCRIPTION
1	1	PLATE	MOTOR CONTROL SECTION
2	1	PLATE	LEVEL CONTROLS & TELEMETRY
3	1	PLATE	MAIN DISCONNECT
4	2	PLATE	PUMP 1
5	2	PLATE	PUMP 2
6	1	PLATE	TELEMETRY CONTROLS
7	1	PLATE	LEVEL CONTROLLER
8	1	PLATE	HEATERS, LIGHTS & RECEPTACLE
9	1	PLATE	SPARE
10	1	PLATE	SPARE
11	1	PLATE	SPARE

23 2 P .75" x 3" THERMAL & MOISTURE PROTECTION RELAY

ENCLOSURE CONSTRUCTION NOTES

1. EXTERIOR 12 GA. H.D. GALV. STEEL AND INTERIOR 14 GA. COLD ROLLED STEEL ELECTRICALLY WELDED AND REINFORCED WHERE REQUIRED.
2. CONSTRUCTION WILL BE NEMA 3R.
3. ALL NUTS, BOLTS, SCREWS AND HINGES WILL BE STAINLESS STEEL.
4. NUTS, BOLTS & SCREWS WILL NOT BE VISIBLE FROM OUTSIDE OF ENCLOSURE.
5. PLASTIC NAMEPLATES WILL BE PROVIDED AS REQUIRED.
6. CONTROL WIRING WILL BE MARKED AT BOTH ENDS BY PERMANENT WIRE MARKERS.
7. A PLASTIC COVERED WIRING DIAGRAM WILL BE ATTACHED TO THE INSIDE OF THE FRONT DOOR.
8. ENCLOSURE WILL BE FACTORY WIRED AND CONFORM TO REQUIRED NEMA STANDARDS.
9. COLOR TO BE: **61GRAY**

TESCO'S POLY-PORC COATING SYSTEM

INCLUDES A FIVE STAGE DIP TANK METAL PREPARATION PROCESS:
1. ALKALINE CLEANER 160°F.
2. CLEAR WATER RINSE.
3. IRON PHOSPHATE APPLICATION 150°F.
4. CLEAR WATER RINSE.
5. INHIBITIVE RINSE TO SEAL PHOSPHATED SURFACES 120°F

FINISHED WITH AN ELECTROSTATICALLY APPLIED DRY POLYESTER POWDER COATING THEN BAKED @ 350°F TO CURE.

Underwriters Laboratories Inc.
File No. E62062

TESCO CONTROLS INC.
916 395-8800
SACRAMENTO, CA.

TESCO # T-38897
24-000

INDUSTRIAL CONTROL PANEL

VOLTAGE	PHASE	WIRES	MAINS AMPERES	HZ
208V	3	4	100	60

SUITABLE FOR USE ON A CIRCUIT CAPABLE OF DELIVERING NOT MORE THAN

AMPERES		AT VOLTAGE	
10,000	RMS SYM.	208	V

METER SOCKET RATING N/A A. CONT.
ENCLOSURE: NEMA 3R

REV	DATE	BY	DESCRIPTION

TESCO CONTROLS, INC.
3434 52ND AVENUE
SACRAMENTO, CA 95823
(916) 395-8800

DUPLEX PANEL ELEVATION

CITY OF CARLSBAD
VILLAS LIFT STATION DUPLEX PUMP CONTROL PANEL
ELECTRICAL DISTRIBUTION AND CONTROL

DATE	DESIGN BY	DRAWN BY	CHK'D BY	SHEET #	DRAWING #
08-18-10	KD	KD		01 OF –	38897-01

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

ED-501

DATE	INITIAL		DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK		REVISION DESCRIPTION	OTHER APPROVAL		CITY APPROVAL	

SHEET 5 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL DEMOLITION – 1

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

REGISTERED PROFESSIONAL ENGINEER MARY MANN No.E20033 ELECTRICAL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

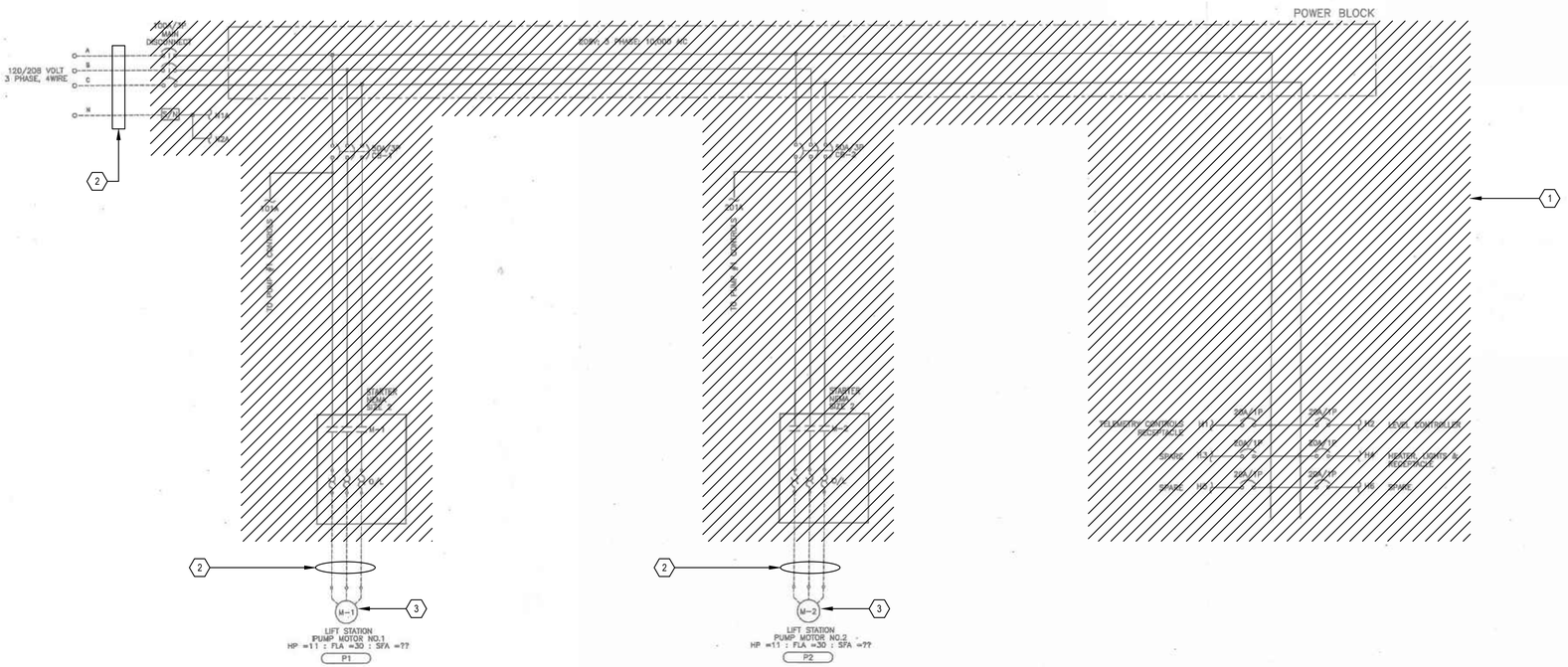
D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.dwg REVISED: 2/23/17

SHEET GENERAL NOTES

1. DISCONNECT AND REMOVE EXISTING LIGHTING.

SHEET KEYNOTES

1. DISCONNECT AND REMOVE EQUIPMENT AND ASSOCIATED POWER AND CONTROL WIRES.
2. PROTECT IN PLACE POWER CONDUCTORS AND CONDUIT.
3. PROTECT IN PLACE PUMP AND ASSOCIATED CONDUIT.



REV	DATE	BY	DESCRIPTION

TESCO CONTROLS, INC.
3434 52ND AVENUE
SACRAMENTO, CA 95823
(916) 395-8800

THREE LINE DIAGRAM

CITY OF CARLSBAD
VILLAS LIFT STATION DUPLEX PUMP CONTROL PANEL
ELECTRICAL DISTRIBUTION AND CONTROL

DATE	DESIGN BY	DRAWN BY	CHK'D BY	SHEET #	DRAWING #
08-18-10	KD	KD		02 OF –	38897-02

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

ED-502

REGISTERED PROFESSIONAL ENGINEER — No.E20033 — ELECTRICAL — STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 6 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL DEMOLITION – 2

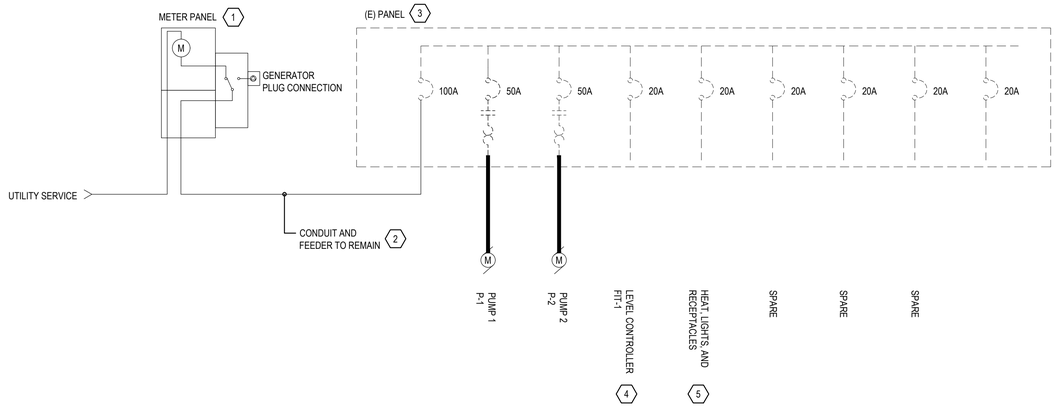
APPROVED: DAVE PADILLA
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/9/17



1 (E) SINGLE LINE DIAGRAM

NO SCALE

SHEET KEY NOTES

1. COORDINATE ALL WORK ON/AROUND UTILITY EQUIPMENT WITH THE CITY. EXISTING SERVICE TO REMAIN.
2. INSPECT THE EXISTING CABLE AND MEGER TEST. MAKE SURE IT IS LONG ENOUGH TO REACH IN TO THE NEW PANEL, REPLACE OTHERWISE.
3. EXISTING TESCO PANEL TO BE DEMOLISHED.
4. DISCONNECT AND REMOVE THE FLOW METER.
5. DISCONNECT AND REMOVE HEAT, LIGHT, AND RECEPTACLE.

REGISTERED PROFESSIONAL ENGINEER — BRENT WARD — No.E20033 — ELECTRICAL — STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 **F** 1 949 250 0541
E irvmail@ghd.com **W** www.ghd.com

DIGALERT — CALL TOLL FREE 811 — TWO WORKING DAYS BEFORE YOU DIG — Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

ED-601

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL		

SHEET 7 — CITY OF CARLSBAD, ENGINEERING DEPARTMENT — SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL SINGLE LINE DIAGRAM MODIFICATIONS

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

I:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/17

SHEET GENERAL NOTES

1. DRAWING INTENT IS TO DEPICT DEMO WORK FOR PROCESS AND INSTRUMENTATION.

PLC/SCADA

POWER SOURCE

FIELD

LOW LOW LEVEL

LOW LEVEL

HIGH HIGH LEVEL

LEVEL INDICATOR

FLOW INDICATOR

LSLL 101

LSL 101

LSHH 101

LIT 101

LE 101

FIT 101

FE 101

8" PVC INFLUENT LINE

A.H. NO. 7

208V 11HP

208V 11HP

(E) WET WELL LIFT STATION

(E) VAULT

(E) 8" PVC

(E) A.H. NO 13

(E) 8" PVC

A.H. NO. 11

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

ID-101

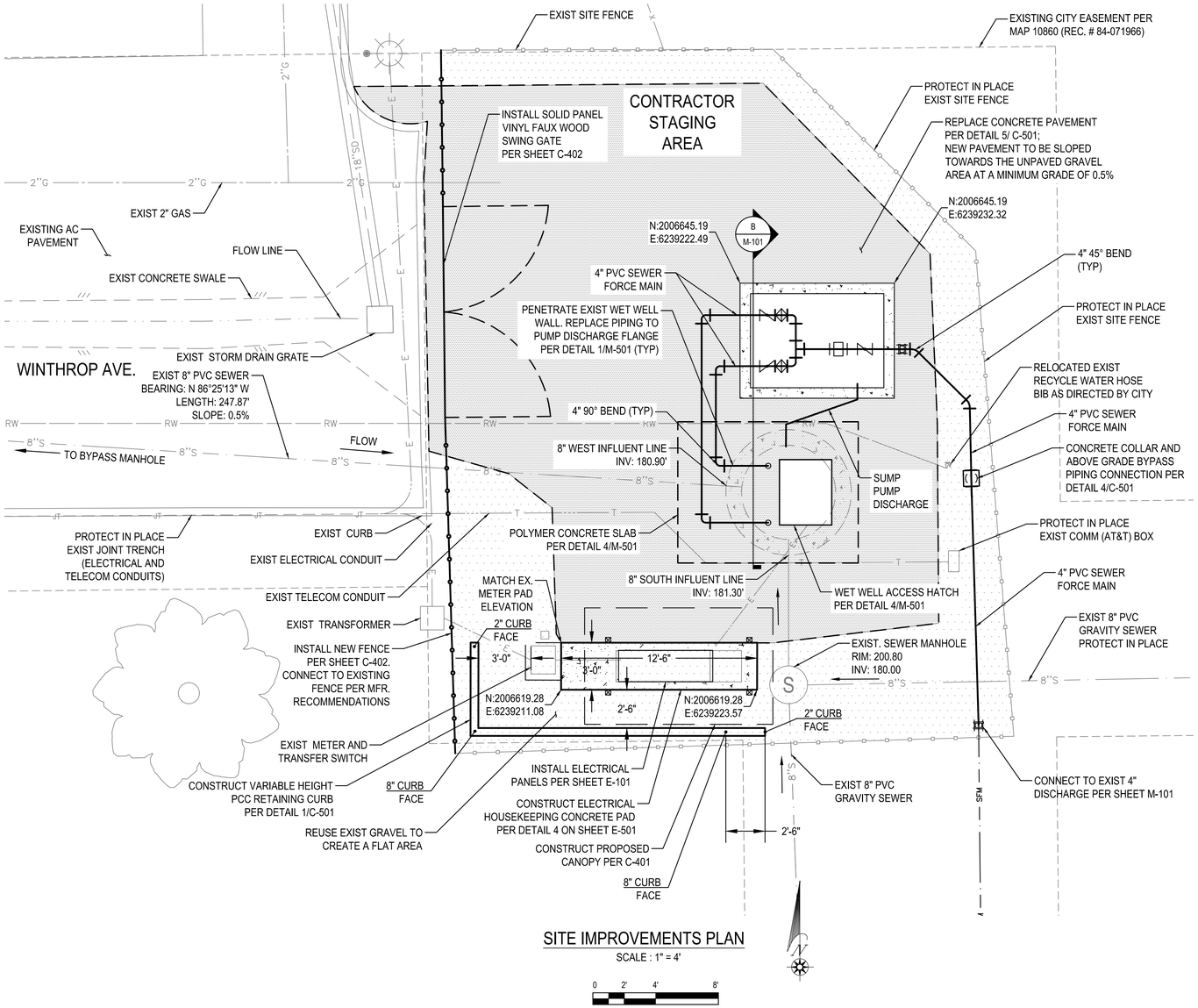
REVIEWED BY:

INSPECTOR DATE

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

SHEET 8	CITY OF CARLSBAD ENGINEERING DEPARTMENT — SHEETS 23
IMPROVEMENT PLANS FOR:	VILLAS LIFT STATION REPLACEMENT P&ID MODIFICATIONS
APPROVED:	DAVE PADILLA
CITY ENGINEER	RCE 55974 EXPIRES 12/31/2022 DATE
DWN BY: AC CHKD BY: MM RVWD BY: MM	PROJECT NO. CIP 5550 — DRAWING NO. 532-3



SITE IMPROVEMENTS PLAN

SCALE : 1" = 4'

0 2' 4' 8'

LEGEND

PROPOSED CONCRETE PAVEMENT REPLACEMENT

EXISTING GRAVEL AREA

SHEET GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE CONCRETE JOINTS AT NO MORE THAN 15-FOOT SPACING.
2. ELECTRICAL HOUSEKEEPING PADS SHALL BE ELEVATED TO MATCH EXISTING METER PEDESTAL HEIGHT.
3. COORDINATE LIMITS OF VARIABLE HEIGHT RETAINING CURB WITH CITY. ENDS SHALL BE 2-INCHES ABOVE SURROUNDING GRADE.
4. PROTECT IN PLACE ALL EXISTING INFRASTRUCTURE UNLESS NOTED OTHERWISE.
5. CONTRACTOR SHALL PROVIDE ADDITIONAL STAGING AREA AS REQUIRED AT THE CONTRACTOR'S EXPENSE.
6. ALL PVC PIPING SHALL BE SCHEDULE 80 AND SOLVENT WELDED UNLESS OTHERWISE SHOWN.

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

C-101

REGISTERED PROFESSIONAL ENGINEER CASEY L RANEY No. C76713 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 9 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
SITE IMPROVEMENTS

APPROVED: DAVE PADILLA

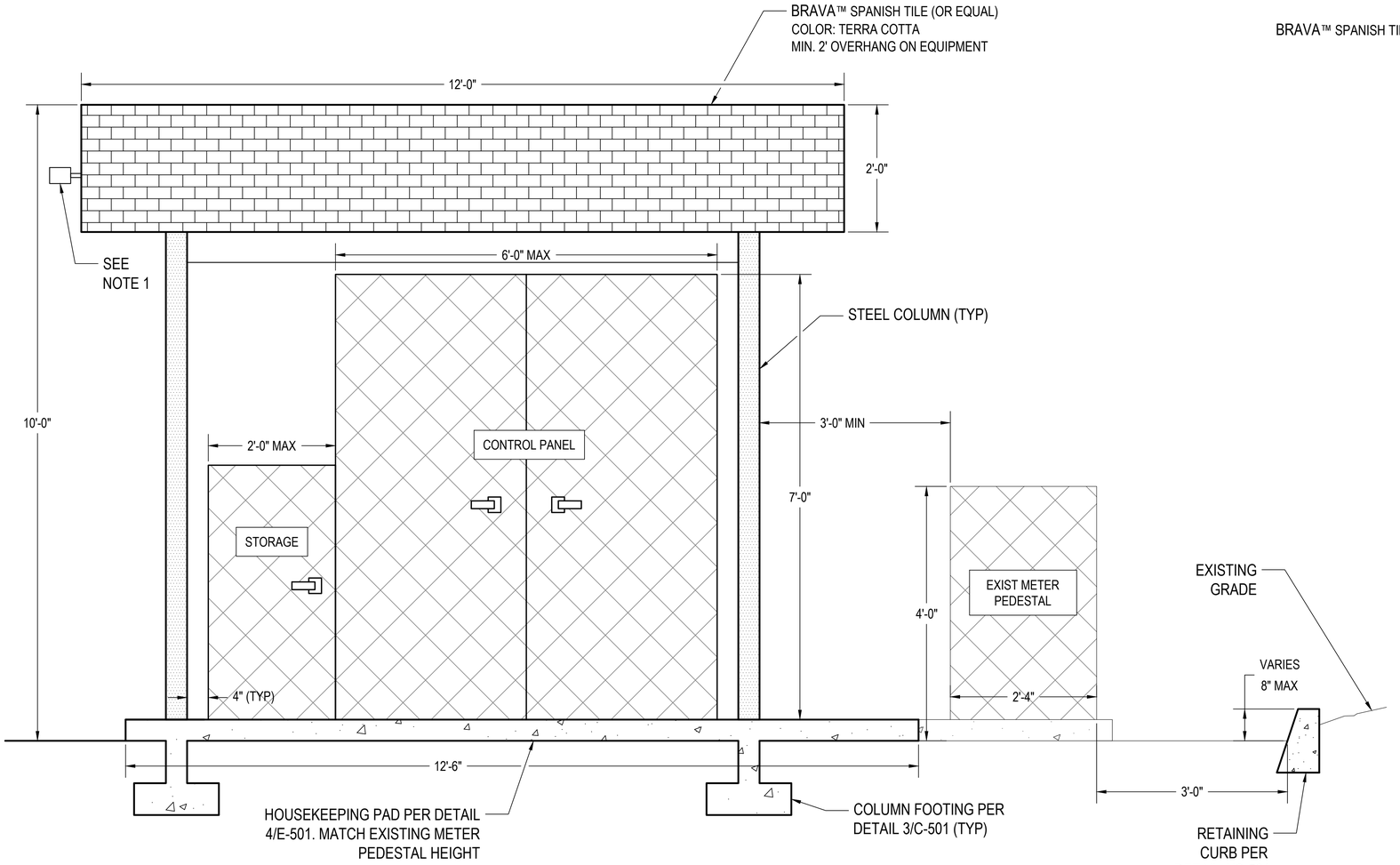
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL CHKD BY: PA RVWD BY: BW

PROJECT NO. CIP 5550

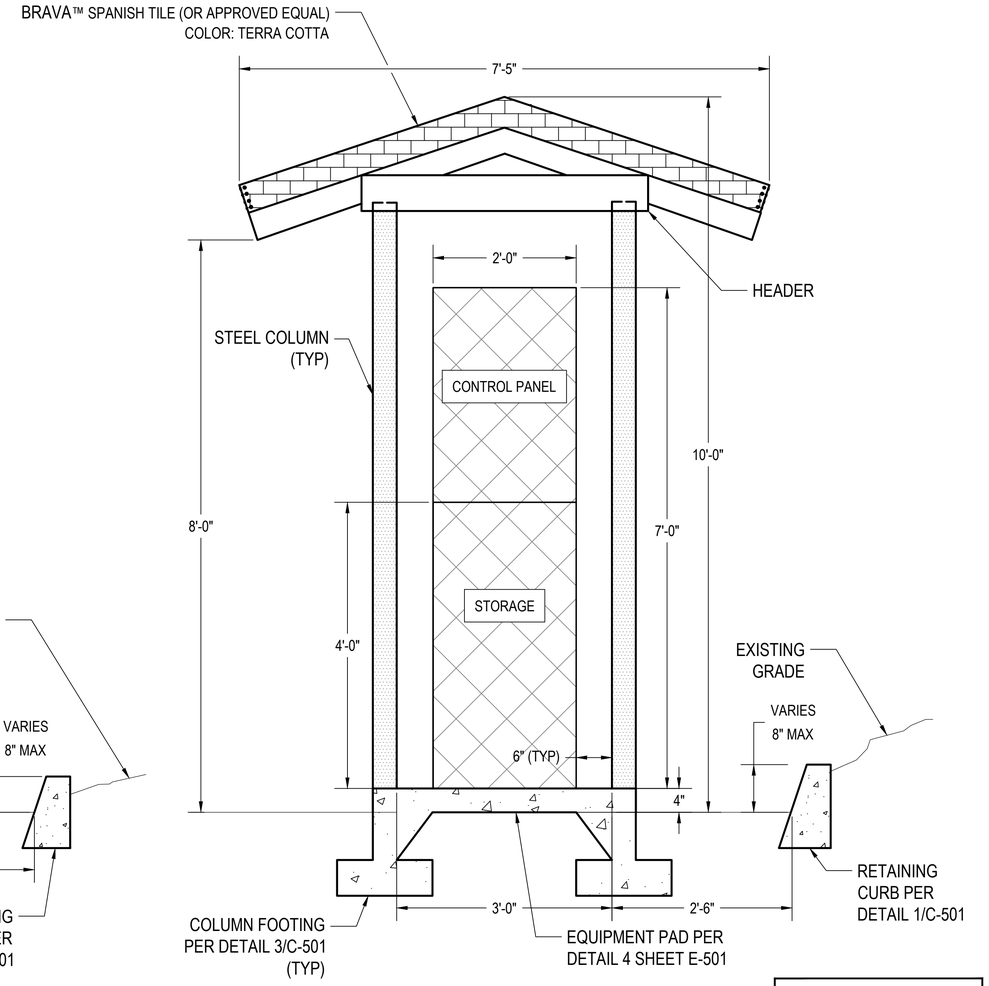
DRAWING NO. 532-3

D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/9/2022



1 - NORTH ELEVATION VIEW OF CANOPY

SCALE : NTS



2 - EAST ELEVATION VIEW OF CANOPY

SCALE : NTS

SHEET GENERAL NOTES

1. PROVIDE LED FLOOD LIGHT TO WET WELL AREA.
2. ELECTRICAL HOUSEKEEPING PADS SHALL BE ELEVATED TO MATCH EXISTING METER PEDESTAL HEIGHT.
3. COORDINATE LIMITS OF VARIABLE HEIGHT RETAINING CURB WITH CITY. ENDS SHALL BE 2-INCHES ABOVE SURROUNDING GRADE.

BRAVA Spanish Tile Specifications

Description	Weight/Tile	Dimensions
Spanish Field Tile	2.85 lbs.	16½" x 13"; 13½" Exposure
Eave Starter	0.6 lbs.	11¾" x 2½"
Ridge Closure	0.6 lbs.	11¾" x 3"
Hip/Ridge	3.6 lbs.	17½" x 8¼" x 9"
Top Ridge	4 lbs.	17" x 10" x 10 3/8"
Bull Nose	3.7 lbs.	17½" x 7¾"x 8¾"
Rake	2.8 lbs.	16" x 5½"x 6½"

REGISTERED PROFESSIONAL ENGINEER
CASEY L RANEY
No. C76713
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DIGALERT
CALL TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

C-401

DATE	INITIAL		DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK		REVISION DESCRIPTION	OTHER APPROVAL		CITY APPROVAL	

SHEET 10 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
CANOPY DETAIL

APPROVED: DAVE PADILLA

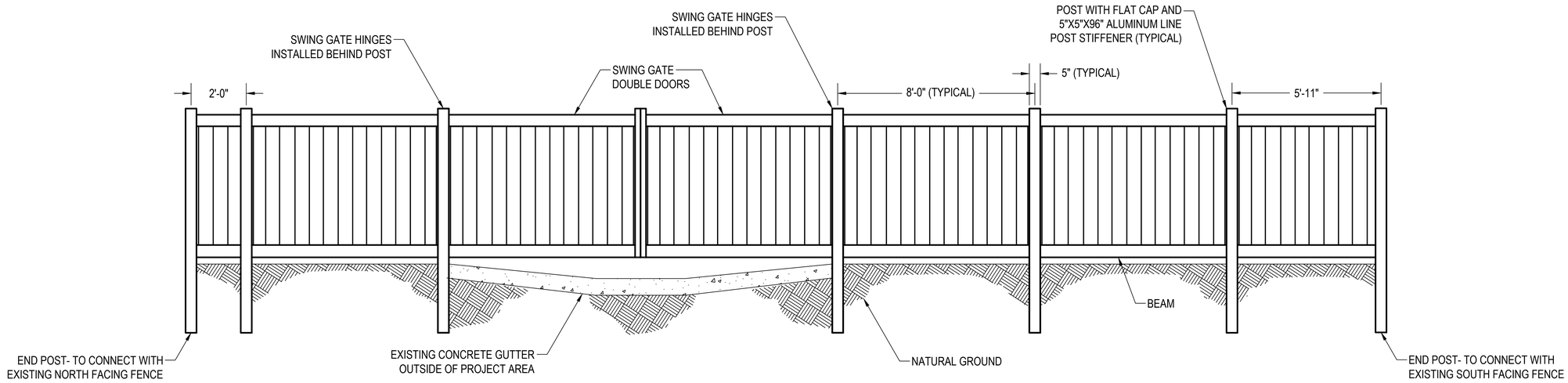
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL
CHKD BY: PA
RVWD BY: BW

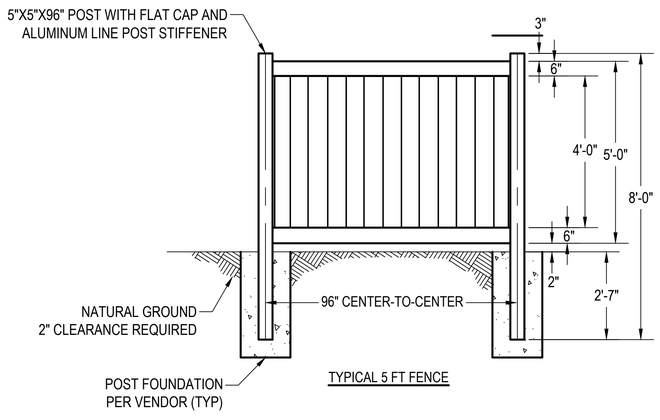
PROJECT NO. CIP 5550

DRAWING NO. 532-3

D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/9/17



WEST WALL - PROFILE VIEW INTO SITE



TYPICAL 5 FT FENCE

NOTES

1. VINYL PANELS ARE CHESTERFIELD W/CERTAGRAIN MODEL. WOOD PANEL TEXTURE IS BRAZILLIAN BLEND COLOR AND 100% SCREENED.
2. PICKETS ARE 7" WIDE TONGUE AND GROVE PICKETS
3. ALL FENCE POSTS ARE TOPPED WITH FLAT CAP ACCENT (FLUSH WITH POST).
4. SWING GATE HAS DOUBLE DOOR MANUAL OPENING WITH ROLLERS AT THE BOTTOM FOR EASE OF OPENING. VINYL PANEL AND POST MATERIAL IS SAME AS FENCE.
5. SWING GATE SWINGS INTO THE SITE (AWAY FROM STREET)
6. SWING GATE HINGE IS OF UPHILL TYPE TO ACCOMMODATE FOR UPWARD SLOPE AT SITE

REGISTERED PROFESSIONAL ENGINEER
CASEY L RAINES
No. C76713
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 **F** 1 949 250 0541
E irvmail@ghd.com **W** www.ghd.com

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

C-402

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 11 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
FENCE SECTION VIEW

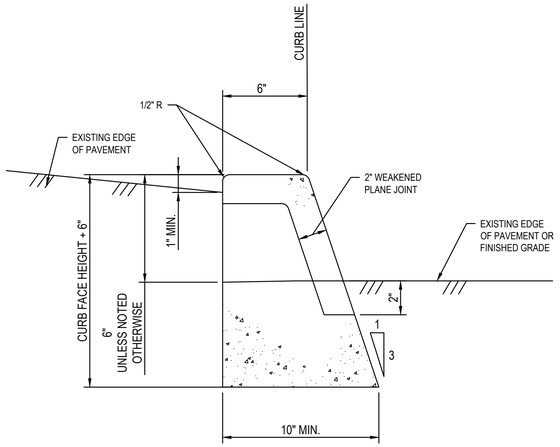
APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532-3

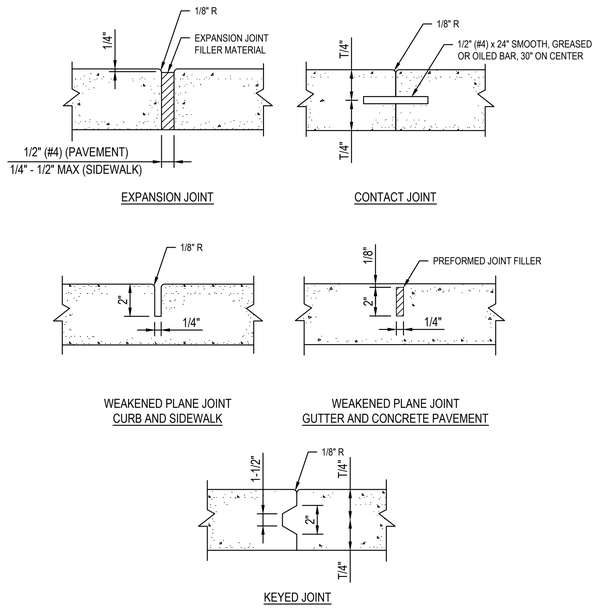


NOTES:

1. CONCRETE SHALL BE 520-C-2500.
2. SEE SAN DIEGO REGIONAL STANDARD DRAWINGS G-9 AND G-10 FOR JOINT DETAIL
3. SLOPE TOP OF CURB 2% MAX TOWARD GUTTER.

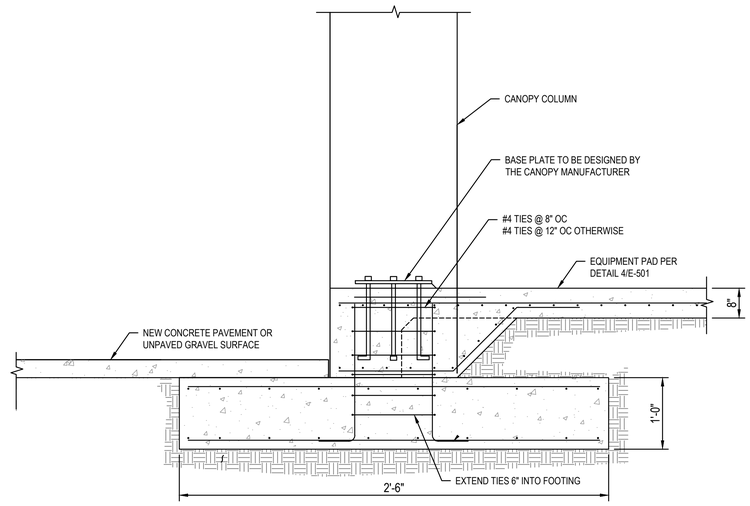
1 - RETAINING CURB

SCALE : NTS



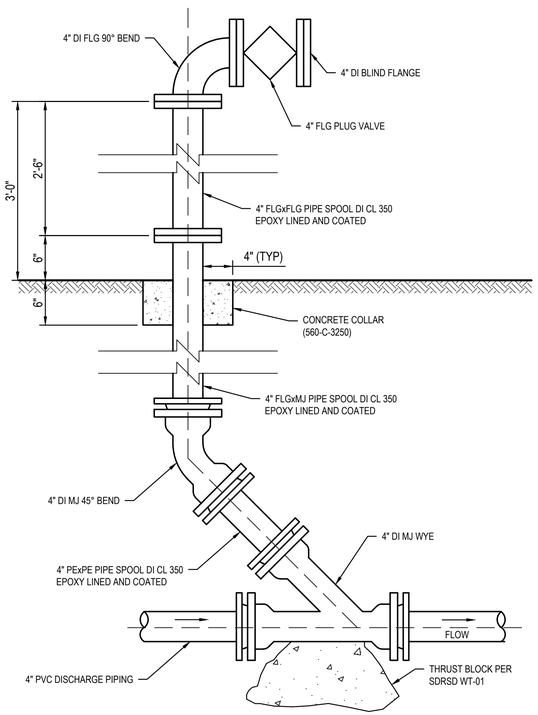
2 - CONCRETE JOINTS

SCALE : NTS



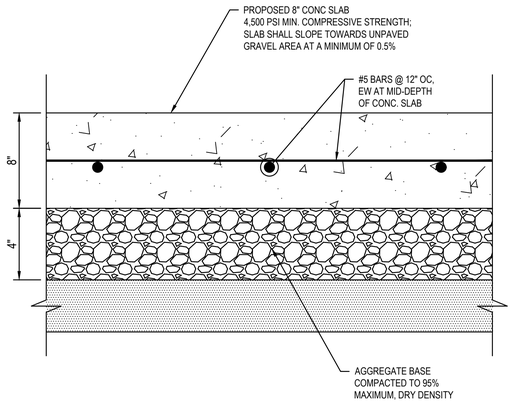
3 - COLUMN FOOTING AND EQUIPMENT PAD TIE-IN

SCALE : NTS



4 - BYPASS PIPING CONNECTION

SCALE : NTS



NOTES:

1. CONTRACTOR SHALL PROVIDE CONSTRUCTION JOINTS AT 15-FOOT MAX.
2. PROVIDE A 3/4" CHAMFER AT ALL EXPOSED CONCRETE CORNERS.

5 - CONCRETE PAVEMENT

SCALE : NTS

REGISTERED PROFESSIONAL ENGINEER CASEY L. RANES No. C76713 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 **F** 1 949 250 0541
E irvmail@ghd.com **W** www.ghd.com

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

C-501

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 12 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
SITE DETAILS

APPROVED: DAVE PADILLA

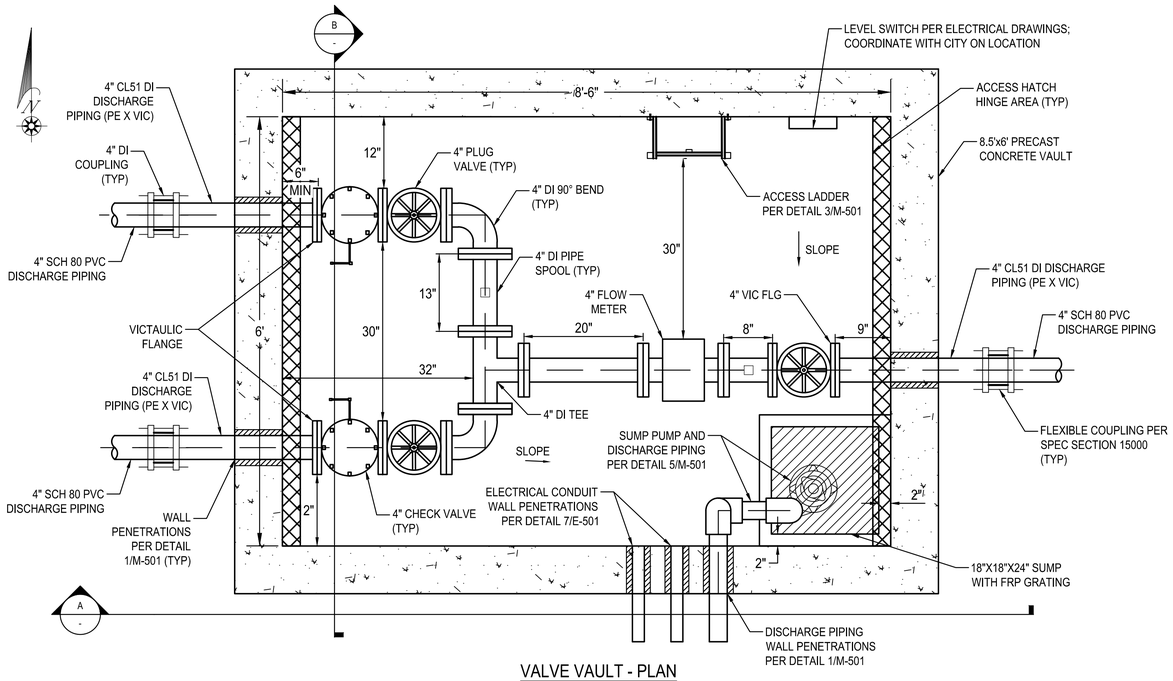
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

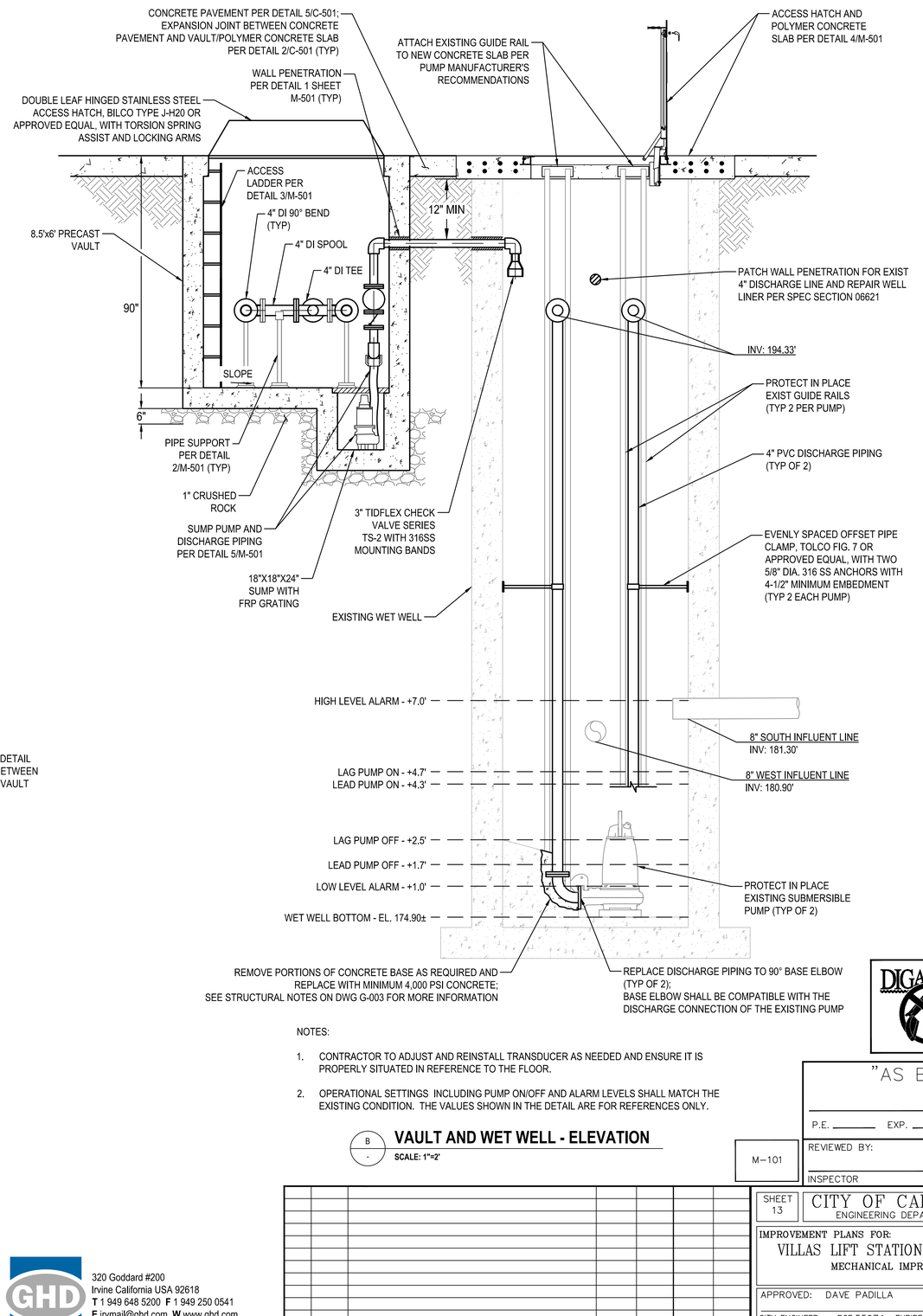
DRAWING NO. 532-3

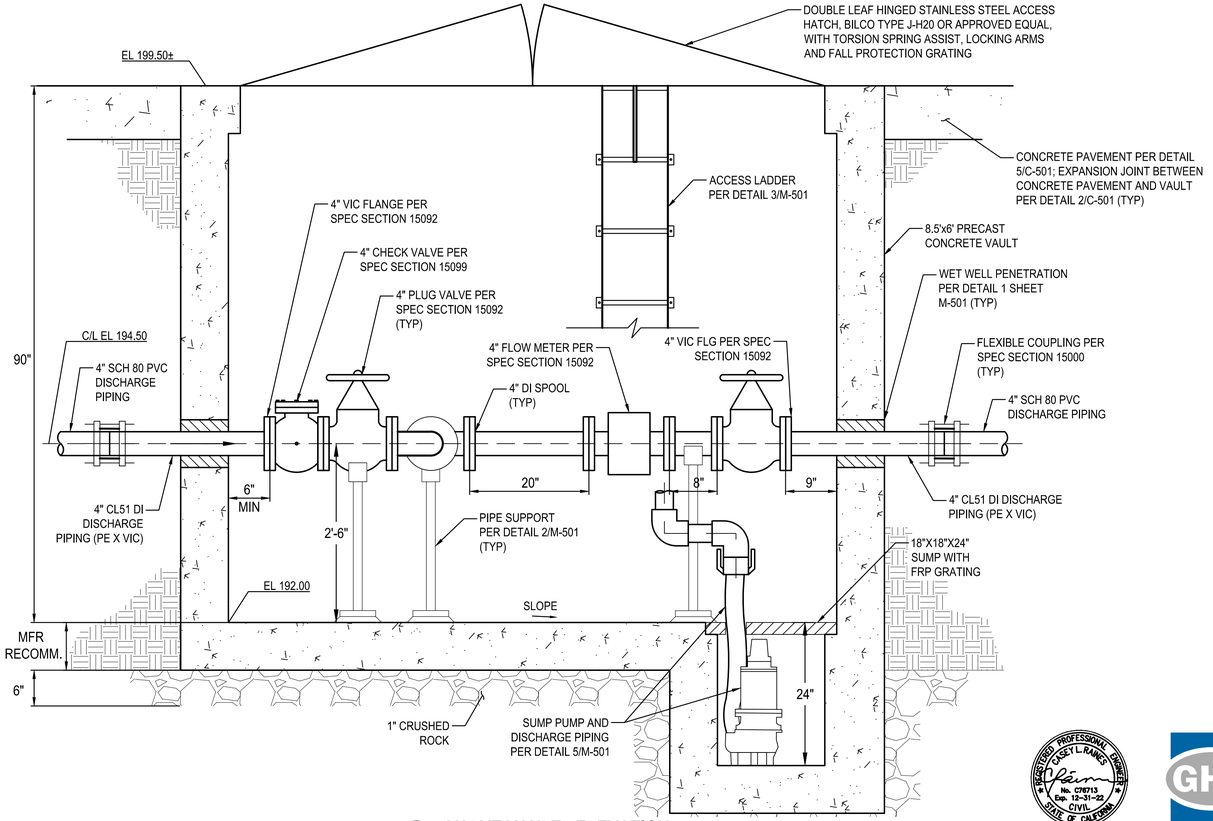
P:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/17



VALVE VAULT - PLAN

SCALE : 1" = 1'





VALVE VAULT - ELEVATION

SCALE: 1"=1'

NOTES:

1. CONTRACTOR TO ADJUST AND REINSTALL TRANSDUCER AS NEEDED AND ENSURE IT IS PROPERLY SITUATED IN REFERENCE TO THE FLOOR.
2. OPERATIONAL SETTINGS INCLUDING PUMP ON/OFF AND ALARM LEVELS SHALL MATCH THE EXISTING CONDITION. THE VALUES SHOWN IN THE DETAIL ARE FOR REFERENCES ONLY.

VAULT AND WET WELL - ELEVATION

SCALE: 1"=2'

REGISTERED PROFESSIONAL ENGINEER CASEY L. RAINES No. C76713 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR _____ DATE

M-101

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 13 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:

VILLAS LIFT STATION REPLACEMENT

MECHANICAL IMPROVEMENTS

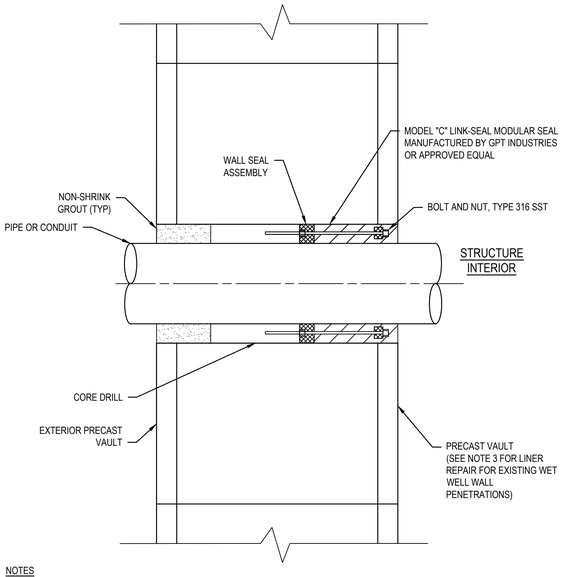
APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532-3



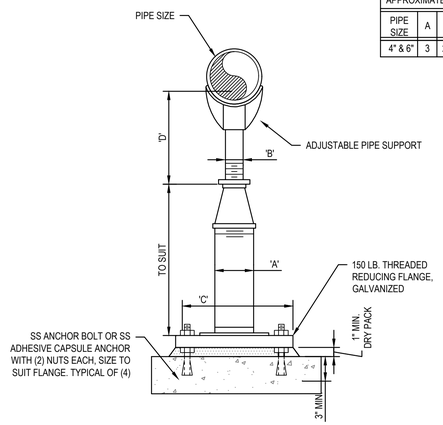
NOTES

1. INSIDE DIAMETER OF EACH WALL OPENING SHALL BE OF THE SIZE RECOMMENDED BY THE SEAL MANUFACTURER TO FIT THE PIPE OR CONDUIT AND TO ENSURE A WATER-TIGHT JOINT.
2. WALL SEAL ASSEMBLY SHALL BE OF THE MODULAR MECHANICAL TYPE, CONSISTING OF INTERLOCKING SYNTHETIC RUBBER LINKS SHAPED TO FILL THE ANNULAR SPACE BETWEEN THE PIPE AND THE WALL OPENING. A PRESSURE PLATE SHALL BE PROVIDED UNDER EACH BOLT HEAD AND NUT, WITH THE SEAL CONSTRUCTED TO PROVIDE ELECTRICAL INSULATION BETWEEN WALL AND PIPE. WALL SEAL ASSEMBLY SHALL BE LINK SEAL AS MANUFACTURED BY GPT INDUSTRIES OR APPROVED EQUAL. ALL HARDWARE SHALL BE STAINLESS STEEL, GRADE 316.
3. FOR PENETRATIONS THROUGH THE EXISTING WET WELL WALL, THE INTERIOR WALL LINER SHALL BE REPAIRED AFTER THE WALL PENETRATION PER SPECIFICATION SECTION 06621.

1 - WALL PENETRATION

SCALE : NTS

ADJUSTABLE PIPE SUPPORT APPROXIMATE DIMENSION IN INCHES					
PIPE SIZE	A	B	C	D MIN	D MAX
4" & 6"	3	2 1/2	9	11 5/8	15 1/4

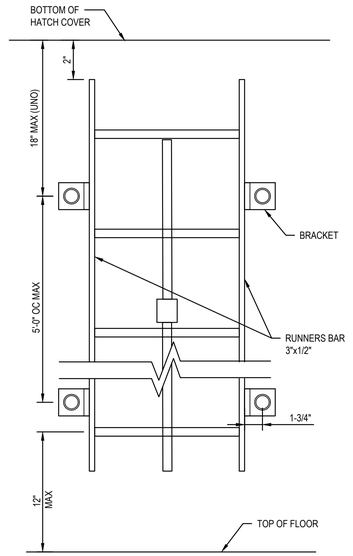


NOTES:

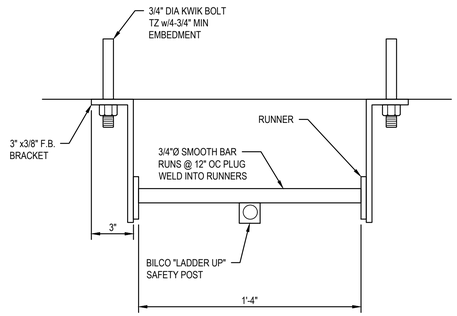
1. UNDER VALVES, METERS, OR OTHER SPECIAL APPURTENANCES A FABRICATED SUPPORT PIECE MAY BE BE UTILIZED AS ACCEPTABLE TO ENGINEER.
2. WHERE SHOWN UNDER PIPE OR VALVE FLANGE, PROVIDE FLANGE CRADLE SUPPORT BY MATERIAL RESOURCES OR ENGINEER APPROVED EQUAL.
3. PROVIDE TYPE 316 STAINLESS STEEL UNITS.
4. SIZE OF SUPPORT COMPONENTS AND THEIR CONNECTIONS SHOWN FOR PIPE, DUCT, HVAC, AND EQUIPMENT ANCHORAGE SYSTEM ARE MINIMUM REQUIREMENTS (INCLUDING ANCHOR BOLT SIZE, SPACING, AND EMBEDMENT LENGTH). CONTRACTOR SHALL DESIGN ALL SUPPORT COMPONENTS AND THEIR CONNECTIONS PER SPECIFICATIONS AND INCREASE SIZES AS REQUIRED BY DESIGN CALCULATIONS.
5. AS AN ALTERNATIVE, CONTRACTOR MAY USE ADJUSTABLE PIPE SUPPORT WITH BASE BY PIPELINE PRODUCTS, MODEL PS-S

2 - ADJUSTABLE PIPE SUPPORT

SCALE : NTS



ELEVATION VIEW



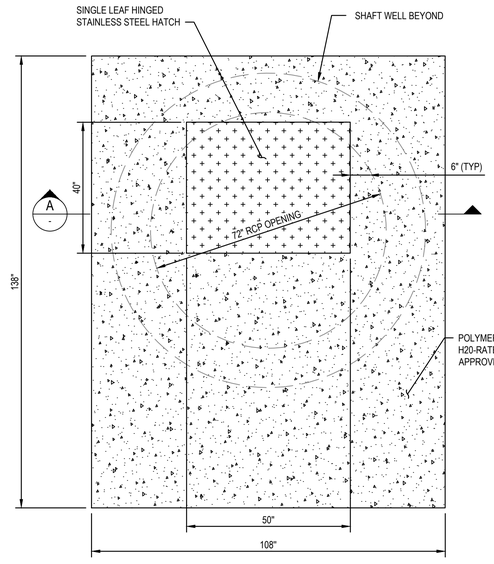
PLAN VIEW

NOTES:

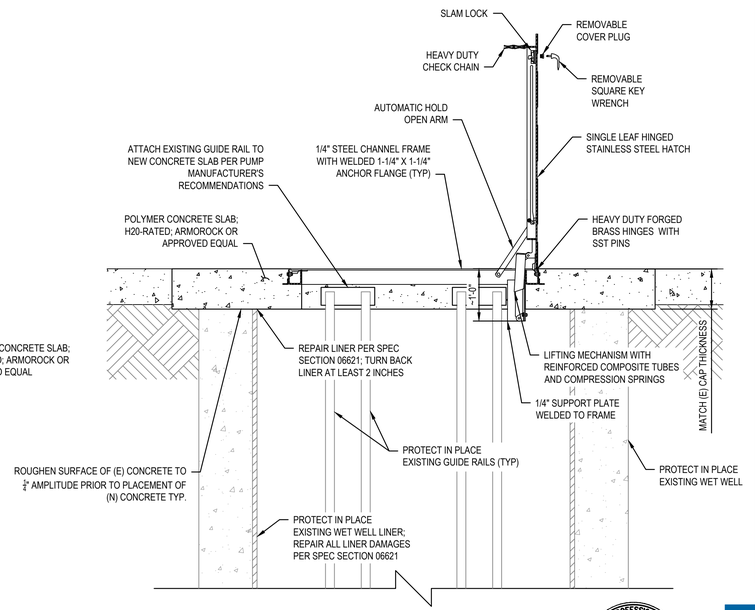
1. ACCESS LADDER SHALL BE GALVANIZED STEEL LADDER WITH WALL BRACKETS ANCHORED INTO CONCRETE WALL, INCLUDING LAD-SAF VERTICAL FALL ARREST SYSTEM OR APPROVED EQUAL. INSTALL LADDER PER MANUFACTURER'S RECOMMENDATION AND PROVIDE REMOVABLE EXTENSION.

3 - ACCESS LADDER

SCALE : NTS



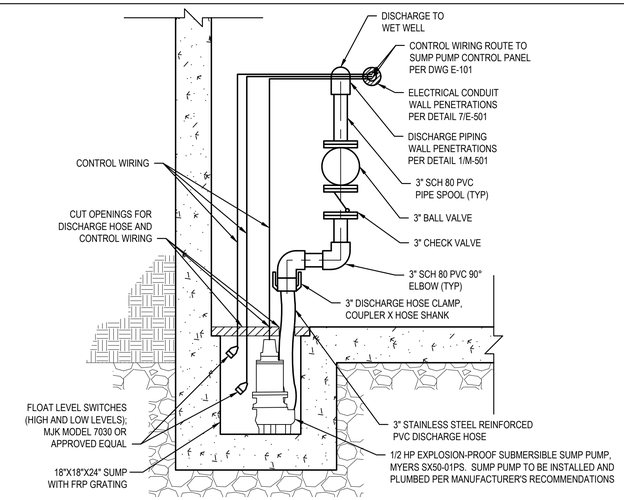
PLAN VIEW



SECTION A

4 - HATCH FOR WET WELL

SCALE : NTS



5 - SUMP PUMP CONNECTION

SCALE : NTS

REGISTERED PROFESSIONAL ENGINEER CASEY L. RANES No. C76713 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

M-501

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 14 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
MECHANICAL DETAILS

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: SS/AL
CHKD BY: PA
RVWD BY: BW

PROJECT NO. CIP 5550

DRAWING NO. 532-3

P:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/2017

ELECTRICAL SYMBOLS LEGEND

ABBREVIATIONS

(D)	DEMOLISH
(E)	EXISTING
(F)	FUTURE
(N)	NEW
A	AMPERES
AC	ALTERNATING CURRENT
AF	AMP FRAME
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AIC	AMPS INTERRUPTING CAPACITY
ANN	ANNUNCIATOR
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BAT	BATTERY
BFG	BELOW FINISH GRADE
CATV	CABLE TELEVISION
C	CONDUIT
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CO	CONDUIT ONLY
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
CU	COPPER
DC	DIRECT CURRENT
EF	EXHAUST FAN
EGU	ENGINE GENERATOR UNIT
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENT	ELECTRICAL NON-METALLIC TUBING
EP	EXPLOSION PROOF
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FC	FOOT CANDLE
FU	FUSE
GND	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
GFR	GROUND FAULT RELAY
HID	HIGH INTENSITY DISCHARGE
HOA	"HAND-OFF-AUTO" SWITCH
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HVAC	HEATING, VENTILATION & AIR-CONDITIONING
IG	ISOLATED GROUND
JB	JUNCTION BOX
KAIC	KILO-AMPS INTERRUPTING CAPACITY
KV	KILOVOLT
KVA	KILOVOLT-AMP
KW	KILOWATT
KWH	KILOWATT-HOUR
LPS	LOW PRESSURE SODIUM
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MH	METAL HALIDE
MLO	MAIN LUGS ONLY
MV	MEDIUM VOLTAGE
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NTS	NOT TO SCALE
OC	ON CENTER
PA	PUBLIC ADDRESS
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PB	PULL BOX, ELECTRICAL
RECPT	RECEPTACLE, OUTLET
RGS	RIGID GALVANIZED STEEL (CONDUIT)
RVSS	REDUCED VOLTAGE SOFT START
RTU	REMOTE TERMINAL UNIT
TV	TELEVISION MONITOR (SET)
TVSS	TRANS. VOLT. SURGE SUPPRESSOR
UF	UNDER FLOOR
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
VA	VOLT-AMP
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF
WPI	WEATHERPROOF IN USE
XFMR	TRANSFORMER

LIGHTING

- LIGHTING FIXTURE, RECESSED
- RECESSED DOWN LIGHT FIXTURE
- RECESSED DIRECTIONAL FIXTURE (ARROW INDICATES AIMING)
- LIGHTING FIXTURE, SURFACE MOUNTED
- SURFACE, PENDANT OR OTHER FIXTURE
- LARGE DIAMETER PENDANT, DEPICTING APPROXIMATE DIAMETER
- LIGHTING FIXTURE, WALL MOUNTED
- WALL-MOUNTED HID, INCANDESCENT, OR COMPACT FLUORESCENT FIXTURE
- LIGHTING FIXTURE, PENDANT OR CABLE HUNG
- LIGHT TRACK AND TRACK-MOUNTED FIXTURES
- BATH FAN WITH INTEGRAL LIGHT
- EXIT SIGN, SINGLE FACE WITH DIRECTIONAL ARROWS AS INDICATED
- EXIT SIGN, DOUBLE FACE WITH DIRECTIONAL ARROWS AS INDICATED
- EXIT SIGN, LOW LEVEL (LL)
- COMBINATION EXIT/EMERGENCY LIGHT FIXTURE MOUNTING HEIGHT: +8'-0" AFF, UON
- EMERGENCY FIXTURE MOUNTING HEIGHT: +8'-0" AFF, UON
- DENOTES FIXTURE CONNECTED TO EMERGENCY CIRCUIT
- ADJUSTABLE SPOT OR FLOOD (ARROW INDICATES AIMING)
- OUTDOOR SITE LIGHT, POLE MOUNTED LUMINAIRE ARROW INDICATES AIMING DIRECTION, IF APPLICABLE
- BOLLARD OR POST-TOP FIXTURE

SWITCHING

- $ — LIGHT SWITCH, SPST - MOUNTING HEIGHT: +44" AFF, UON
- $2 — LIGHT SWITCH, DPST - MOUNTING HEIGHT: +44" AFF, UON
- $3 — LIGHT SWITCH, 3-WAY - MOUNTING HEIGHT: +44" AFF, UON
- $a,L — LOW VOLTAGE SWITCH, MOMENTARY CONTACT, 3-POS., CENTER-OFF, MOUNTING HEIGHT: +44" AFF, UON (a: DENOTES SWITCH)
- $T — TIMER SWITCH - MOUNTING HEIGHT: +44" AFF, UON
- 1a — DENOTES SWITCH; DENOTES CIRCUIT — CIRCUIT AND SWITCH DESIGNATION FOR LIGHTING FIXTURE
- 6R5 — DENOTES RELAY; DENOTES CIRCUIT — CIRCUIT AND RELAY DESIGNATION FOR LIGHTING FIXTURES (SEE CORRESPONDING LIGHTING CONTROL PANEL RELAY SCHEDULE)
- D1 — DIMMER SWITCH - MOUNTING HEIGHT: +44" AFF, UON
- PP1 — OCCUPANCY SENSOR POWER PACK, 1-CIRCUIT, MOUNTED ABOVE CEILING
- PP2 — OCCUPANCY SENSOR POWER PACK, 2-CIRCUIT MOUNTED ABOVE CEILING
- CS1 — OCCUPANCY SENSOR, CEILING MOUNTED, LINE VOLTAGE
- CS2 — OCCUPANCY SENSOR, CEILING MOUNTED, LOW VOLTAGE
- W1 — OCCUPANCY SENSOR, WALL MOUNTED, LINE VOLTAGE, 1-CIRCUIT MOUNTING HEIGHT: +44" AFF, UON
- W2 — OCCUPANCY SENSOR, WALL MOUNTED, LINE VOLTAGE, 2-CIRCUIT MOUNTING HEIGHT: +44" AFF, UON
- PC — PHOTO CONTROL SWITCH - MOUNT ON BUILDING EXTERIOR
- TC — TIME CLOCK FOR LIGHTING CONTROL

POWER

- DUPLEX RECEPTACLE, 20A 125V 2P 3W, GROUNDING TYPE, MOUNTING HEIGHT: +18" AFF UON (+48" DENOTES HEIGHT IN INCHES AFF (INTERIOR) AFG (EXTERIOR))
- DUPLEX RECEPTACLE - SPLIT WIRED, SWITCHED
- DUPLEX RECEPTACLE - EMERGENCY POWER
- DUPLEX RECEPTACLE - CEILING MOUNTED (C)
- FLOOR RECEPTACLE, 20A 125V 2P 3W, GROUNDING TYPE, FLUSH TYPE UON
- DOUBLE DUPLEX RECEPTACLE, 20A 125V 2P 3W, GROUNDING TYPE, MOUNTING HEIGHT: +18" AFF UON
- SINGLE RECEPTACLE, 20A 125V 2P 3W, GROUNDING TYPE, MOUNTING HEIGHT: +18" AFF UON
- SPECIAL PURPOSE RECEPTACLE AS DESIGNATED (OR) SEE 'SPECIAL SYMBOLS' ON EACH SHEET
- DUAL SERVICE RECESSED FLOOR BOX WITH DUPLEX AND DATA RECEPTACLES
- J OR J — JUNCTION BOX, CODE SIZED UON
- FLOOR JUNCTION BOX
- DISCONNECT SWITCH - FUSED WHERE APPLICABLE
- MOTOR STARTER, COMBINATION WITH DISCONNECT SWITCH
- MOTOR STARTER OR CONTROLLER
- M — MOTOR CONNECTION
- CEILING EXHAUST FAN
- WH OR WH — WATER HEATER
- P — POWER POLE: P=POWER, T=TELEPHONE, D=DATA, C=COMBINATION
- TEST PORT
- GROUND ROD
- GUY WIRE AND ANCHOR
- T — THERMOSTAT (SEE MECHANICAL DRAWINGS) COORDINATE MOUNTING HEIGHT
- BT — BYPASS TIMER OR TIME SWITCH
- PUSHBUTTON
- LC — LIGHTING CONTACTOR

COMMUNICATION

- CCTV CAMERA, CEILING MOUNT
- I — INTERCOM CALL IN SWITCH - MOUNTING HEIGHT: +44" AFF, UON
- TELEPHONE OUTLET FOR WALL MOUNTED TELEPHONE MOUNTING HEIGHT: +44" AFF UON
- DATA OUTLET - MOUNTING HEIGHT: +18" AFF UON
- 1,2 — DENOTES # OF TELEPHONE JACKS; TELEPHONE/DATA OUTLET, FLUSH TYPE UON MOUNTING HEIGHT: +18" AFF UON; DENOTES # OF DATA JACKS
- SURFACE RACEWAY WITH POWER AND TELEPHONE/DATA RECEPTACLES AS INDICATED
- HTV — CATV OUTLET - MOUNTING HEIGHT: +96" AFF UON
- HAV1 — AUDIO/VIDEO OUTLET - MOUNTING HEIGHT: +18" AFF UON
- HC — CLOCK WITH BUZZER - MOUNTING HEIGHT: SEE PLANS
- HB — BELL, STANDARD 6" - MOUNTING HEIGHT: SEE PLANS PA SYSTEM
- HS — SPEAKER - WALL MOUNTED
- S — PA SYSTEM SPEAKER - CEILING MOUNTED
- HS — PA SYSTEM HORN - MOUNTING HEIGHT: SEE PLANS

EQUIPMENT

- MAIN SWITCHBOARD
- DISTRIBUTION PANEL BOARD
- COMBINATION METER/MAIN SERVICE PANEL
- OR — BRANCH CIRCUIT PANEL BOARD, SURFACE OR FLUSH MOUNTED
- OR — LIGHTING CONTROL PANEL
- OR — SIGNAL TERMINAL CABINET OR CONTROL PANEL SURFACE OR FLUSH MOUNTED
- SIGNAL TERMINAL BACKBOARD
- N30 — CONCRETE UNDERGROUND HAND HOLE (NUMBER DENOTES CHRISTY SIZE)
- T OR Δ — TRANSFORMER

CONDUIT

- CONDUIT INSTALLED ABOVE GRADE
- CONDUIT INSTALLED UNDERGROUND OR UNDER SLAB
- CONDUIT STUB-OUT WITH CAP
- FLEXIBLE CONDUIT WHIP TO LIGHT FIXTURE OR EQUIPMENT
- L1-4 — INDICATES CIRCUIT BREAKER I.D.; INDICATES BRANCH PANEL
- CONDUIT HOME RUN TO DESIGNATED PANEL, TERMINAL, OR CONTROL CABINET
  EXAMPLES: L1-6,8 — COMMA INDICATES MULTIPLE SINGLE POLE CIRCUITS; L1-10/12 — SLASH INDICATES MULTI-POLE CIRCUIT
- NOTE FOR CONDUIT: THE TIC MARKS INDICATE THE QUANTITY OF #12 AWG WIRES OR, IF INDICATED, THE QUANTITY OF OTHER SIZE WIRE OR CABLES.
- SEE THE SINGLE LINE DIAGRAM FOR FEEDER SIZES.
  EXAMPLES: = (3) #12; = (2) #10 #10; = (1) TYPE F1 CABLE. SEE CABLE SCHEDULE. F1

OBJECT LINES

- NEW OBJECTS (HEAVY CONTINUOUS LINES, UNDERGROUND CONDUIT HEAVY DASHED LINES)
- EXISTING OBJECTS TO REMAIN. MAY INCLUDE NEW CIRCUITING ETC. (FINE CONTINUOUS LINES, UNDERGROUND CONDUIT FINE DASHED LINES)
- EXISTING OBJECTS TO BE DEMOLISHED (EXTRA FINE DASHED LINES, SCREENED)

ANNOTATION

- 1 — KEYNOTE
- 10 — RACEWAY, FEEDER OR CIRCUIT DESIGNATION (SEE SCHEDULE)
- A / 180 — DENOTES TYPE; LIGHTING FIXTURE TYPE DESIGNATION (SEE SCHEDULE); DENOTES WATTS
- 1 / E-501 — DETAIL NUMBER; DETAIL INDICATOR; SHEET NUMBER ON WHICH DETAIL APPEARS
- A / E-301 — SECTION LETTER; SECTION INDICATOR; SHEET NUMBER ON WHICH SECTION APPEARS
- WH / 1 — MECHANICAL EQUIPMENT DESIGNATION (SEE SCHEDULE)

DIAGRAM

- ALARM, INDICATING LIGHT, SIGNAL LIGHT OR STROBE
- AT / AF — CIRCUIT BREAKER - SIZE AND TYPE AS INDICATED
- XXX/X NEMA XX — CIRCUIT BREAKER IN NEMA ENCLOSURE SIZE AND TYPE AS INDICATED
- OL — THERMAL OVERLOAD RELAY
- XXX/X / SIZE / OL — COMBINATION MOTOR CONTROLLER, STARTER, CIRCUIT BREAKER TYPE
- SHUNT TRIP
- DRAW-OUT TYPE CONNECTION
- DISCONNECT SWITCH WITH FUSE
- FUSE - SIZE AS INDICATED
- INTERLOCK, ELECTRICAL
- M — METER, ELECTRICAL
- M — MOTOR - SIZE AS INDICATED
- TRANSFER SWITCH, ATS: AUTOMATIC, MTS: MANUAL
- G — GENERATOR UNIT - RATED AS INDICATED
- TRANSFORMER, PAD MOUNT
- TRANSFORMER, DRY TYPE
- POTENTIAL TRANSFORMER WITH FUSE
- CURRENT TRANSFORMER
- SURGE ARRESTOR - LIGHTING
- GROUNDING ELECTRODE OR CONNECTION

SCHEMATIC

- BATTERY CHARGER
- C — COIL RELAY
- CONTACT - NORMALLY CLOSED
- CONTACT - NORMALLY OPEN
- DC BATTERY
- ETM — ELAPSED TIME METER
- FLOAT OR LEVEL SWITCH - NORMALLY CLOSED
- FLOAT OR LEVEL SWITCH - NORMALLY OPEN
- LIMIT SWITCH - NORMALLY CLOSED
- LIMIT SWITCH, NORMALLY OPEN
- R — PILOT LIGHT, LED TYPE - COLOR AS INDICATED
- PRESSURE SWITCH - CLOSED ON INCREASE
- PRESSURE SWITCH - OPEN ON INCREASE
- PUSH BUTTON, MOMENTARY - NORMALLY CLOSED
- PUSH BUTTON, MOMENTARY - NORMALLY OPEN
- RECTIFIER
- O / H / A — SELECTOR SWITCH - HAND-OFF-AUTO
- SWITCH - NORMALLY CLOSED
- SWITCH - NORMALLY OPEN
- TEMPERATURE SWITCH - NORMALLY CLOSED
- TEMPERATURE SWITCH - NORMALLY OPEN
- TIMER SWITCH - NORMALLY CLOSED
- TIMER SWITCH - NORMALLY OPEN

DIGALERT — CALL TOLL FREE 811 — TWO WORKING DAYS BEFORE YOU DIG — Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR _____ DATE

E-001

REGISTERED PROFESSIONAL ENGINEER — BRAD T. MARCH — No.E20033 — ELECTRICAL — STATE OF CALIFORNIA

GHD

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL		DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK		REVISION DESCRIPTION	OTHER APPROVAL		CITY APPROVAL	

SHEET 15 | CITY OF CARLSBAD, ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL SYMBOLS, NOTES, AND ABBREVIATIONS

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

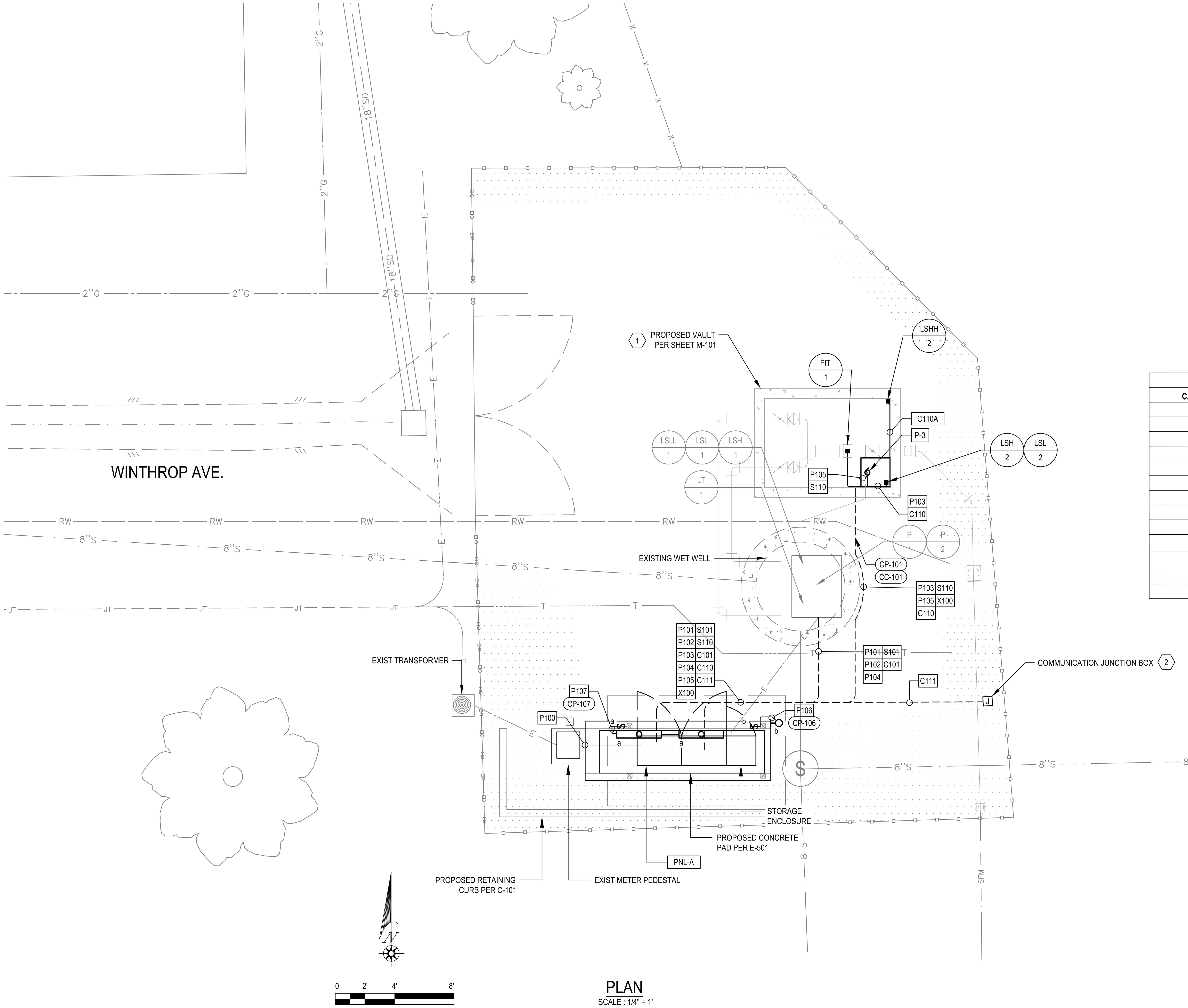
DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

SHEET KEYNOTES

1. COORDINATE WITH VAULT VENDER FOR THE PENETRATION OF (5) 1" ELECTRICAL CONDUITS THOUGH THE WALL.
2. PROTECT AND PLACE THE EXISTING PHONE LINE COMMUNICATION.
3. REFER TO M-501 FOR VAULT AND CONDUIT PENETRATION DETAILS.



PLAN
SCALE : 1/4" = 1'

CABLE AND CONDUIT SCHEDULE					
CABLE/CKT	CONDUIT	FROM	TO	WIRE/CABLE	NOTES
P100	(E)	METER PANEL	PNL-A		EXISTING
P101	(E)	PNL-A	PUMP P-1		EXISTING
P102	(E)	PNL-A	PUMP P-2		EXISTING
P103	CP-101 (2")	PNL-A	SUMP PUMP P-3	(2) #10 AWG + #10 GND	NEW
P105	CP-101 (2")	PNL-A	FLOW METER - FIT-1	(2) #12 AWG + #12 GND	NEW
P106	CP-106 (1")	PNL-A	FLOOD LIGHT	(2) #12 AWG + #12 GND	NEW
P107	CP-107 (1")	PNL-A	CANOPY LIGHTING	(2) #12 AWG + #12 GND	NEW
C101	(E)	PNL-A	LEVEL SWITCH		EXISTING
C110	CC-101 (2")	PNL-A	SUMP PUMP P-3 & LSH & LSL	(6) #14 AWG + #14 GND	NEW
C110A	CC-101 (2")	PNL-A	LEVEL SWITCH (LSHH)	(2) #14 AWG + #14 GND	NEW
C111	(E)	PNL-A	COMM JUNCTION BOX		EXISTING
S101	(E)	PNL-A	LT-1		EXISTING
S110	CC-101 (2")	PNL-A	VAULT	(2) #16 STP (SHIELDED) + GND	NEW

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. ______ EXP. ______ DATE

REVIEWED BY:

INSPECTOR DATE

E-101

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 16 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

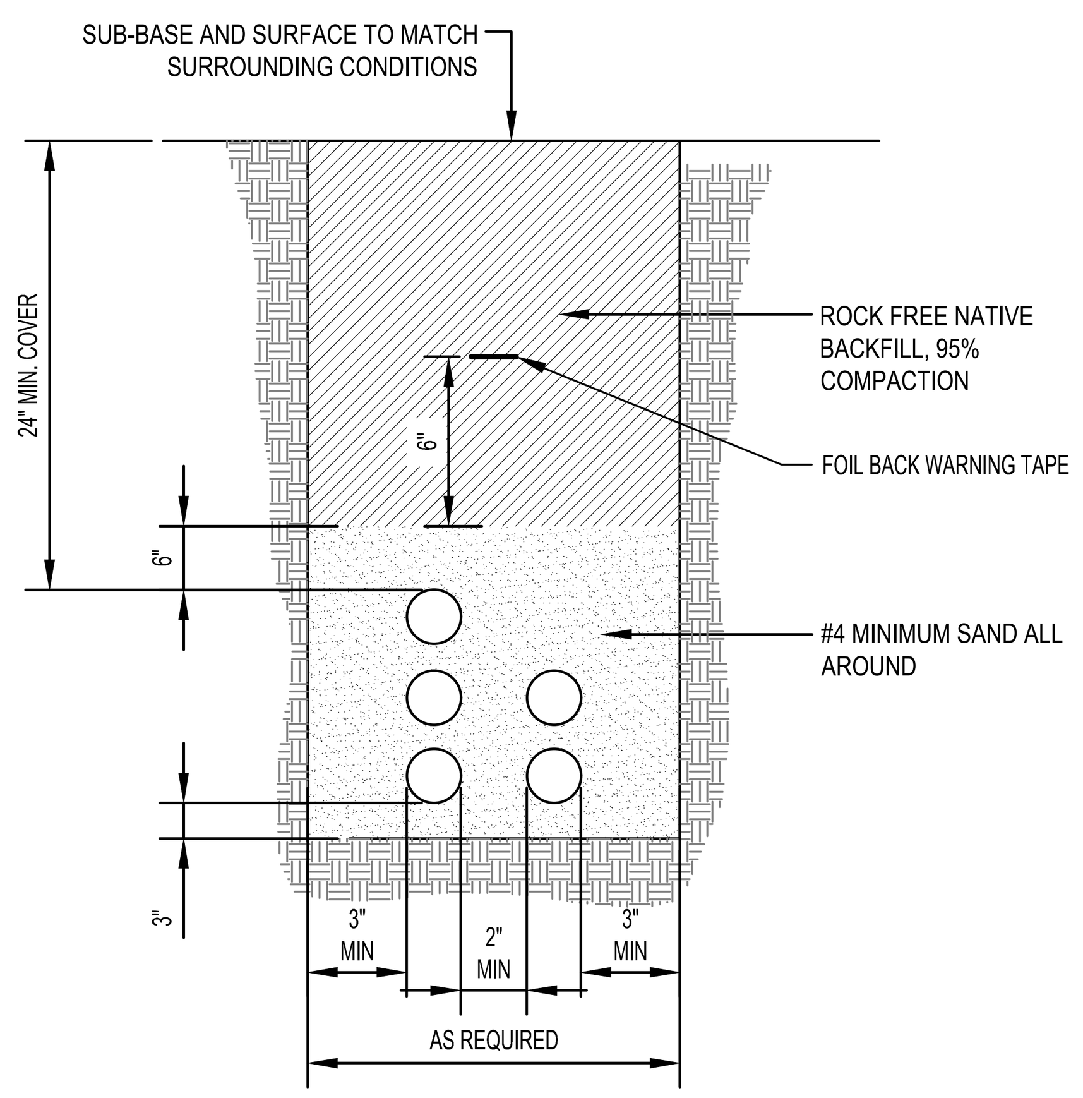
IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL SITE PLAN

APPROVED: DAVE PADILLA
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

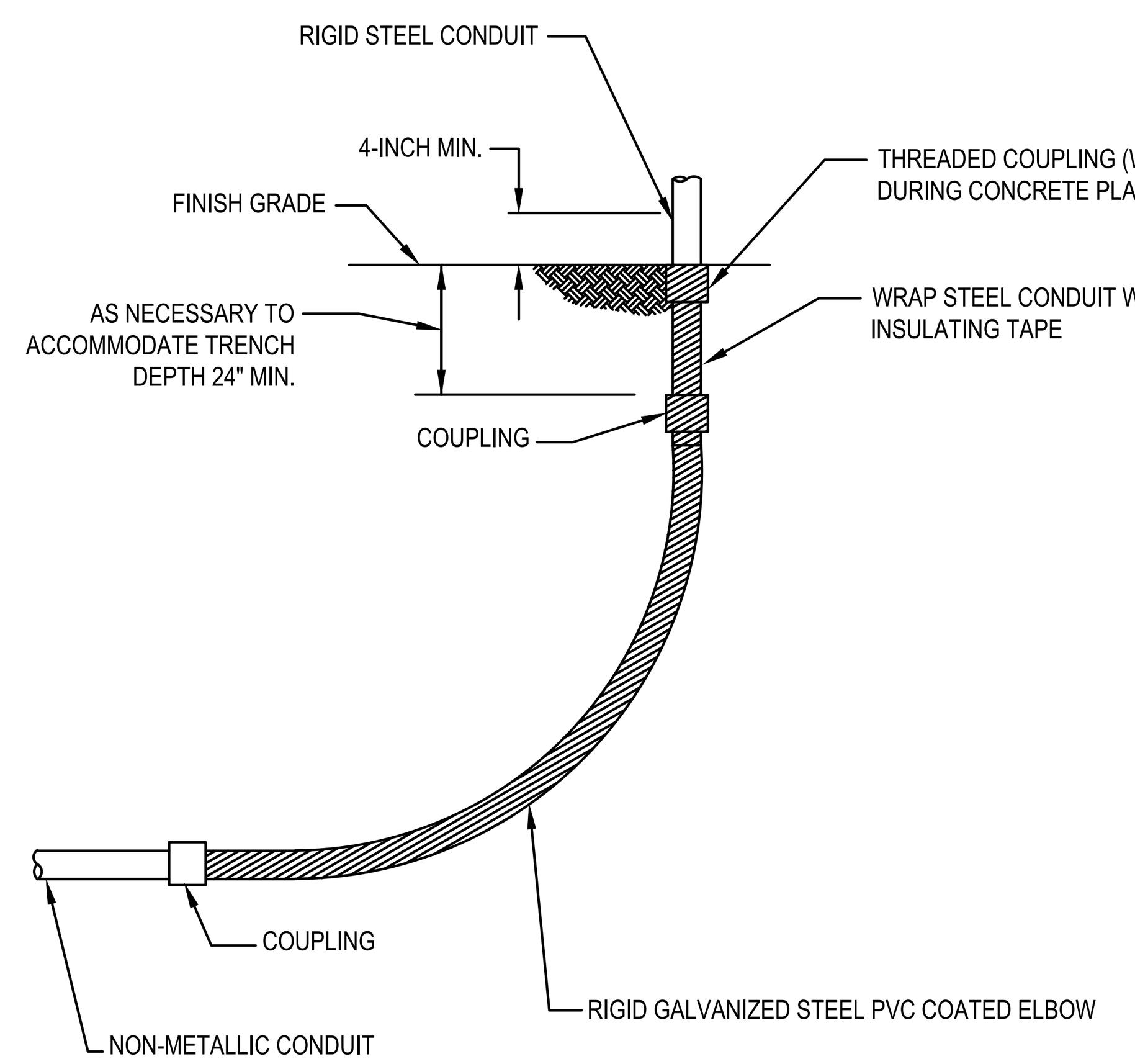
DRAWING NO. 532-3



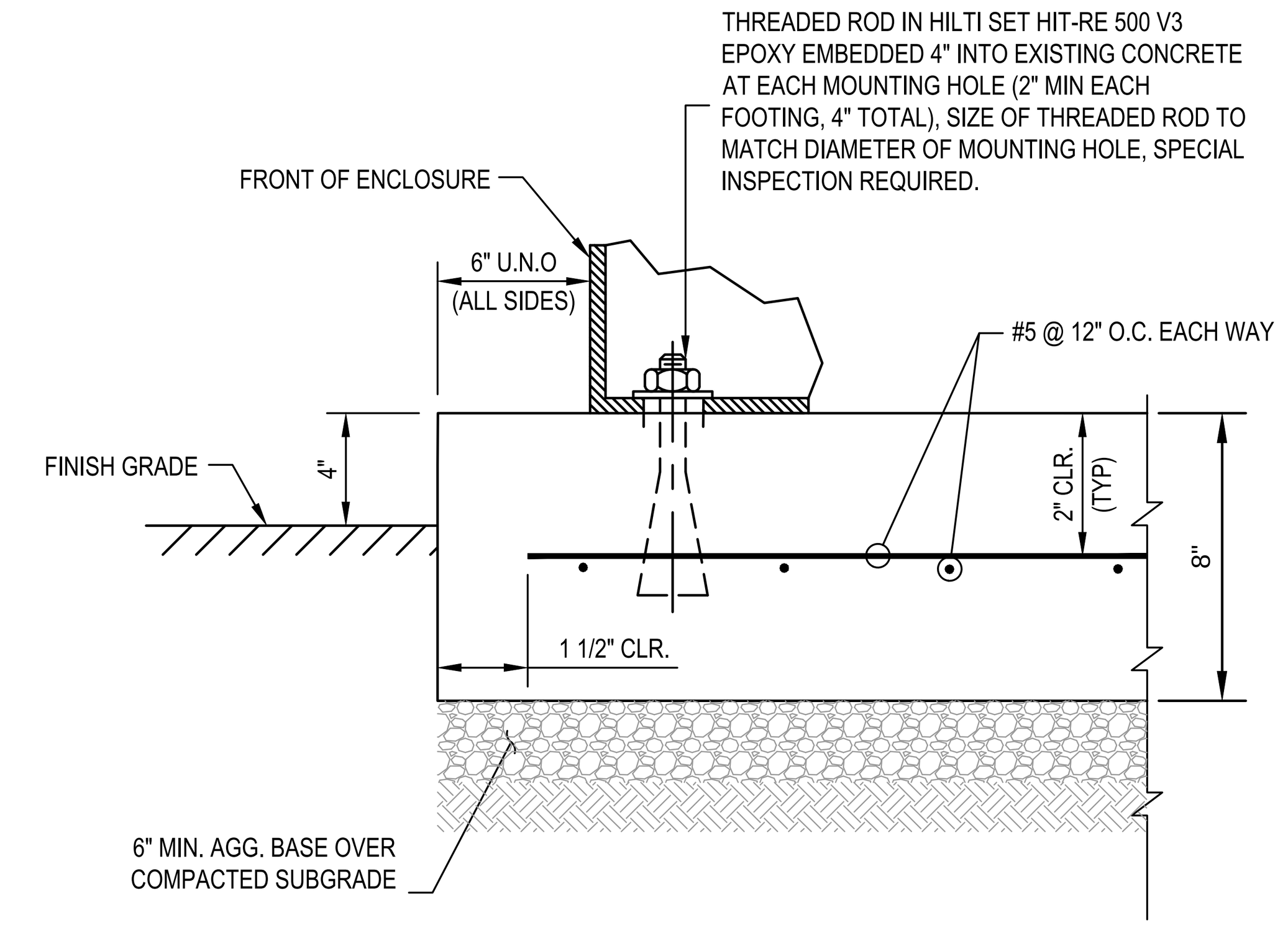
NOTE:

1. MAINTAIN A MINIMUM VERTICAL SEPARATION OF 12" WHEN CROSSING UTILITIES. ROUTE CONDUIT EITHER ABOVE OR BELOW OTHER UTILITIES AS NECESSARY TO ACHIEVE THIS SEPARATION WHILE MAINTAINING THE MINIMUM BACKFILL COVERAGE.
2. PROVIDE BASE AND INTERMEDIATE CONDUIT SPACERS.

1 TRENCH SECTION NOT TO SCALE



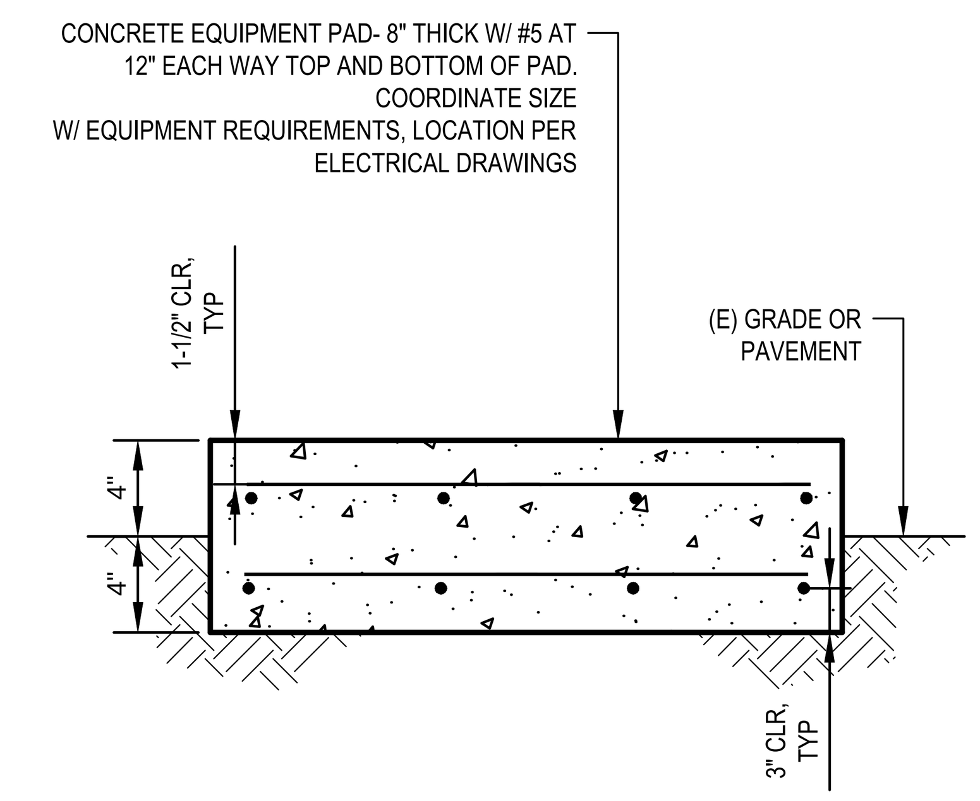
2 TYPICAL CONDUIT STUB UP NOT TO SCALE



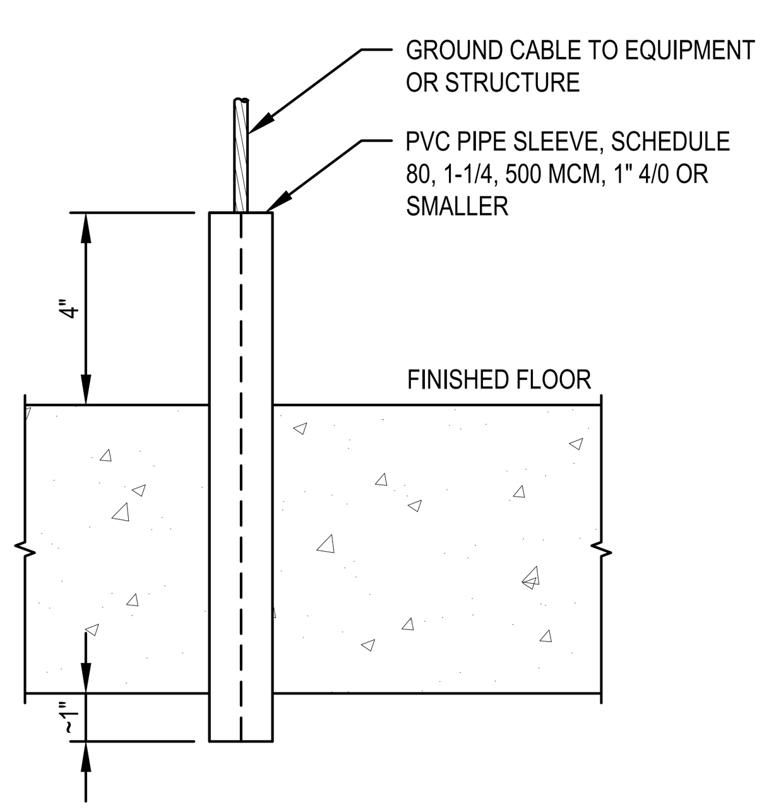
NOTE:

ADJUST CONCRETE PAD SIZE TO MATCH EQUIPMENT PROVIDED.

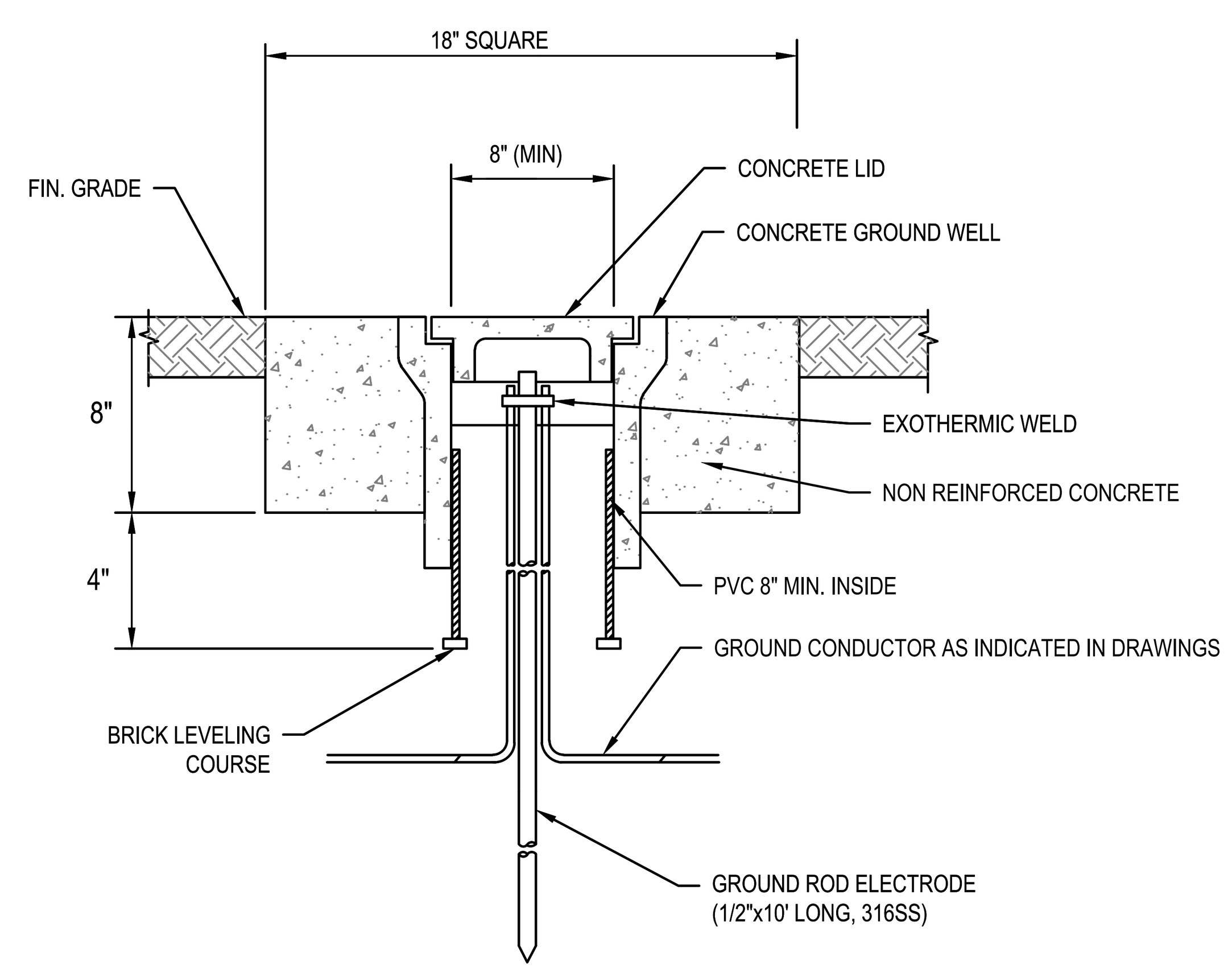
3 EQUIPMENT PAD NOT TO SCALE



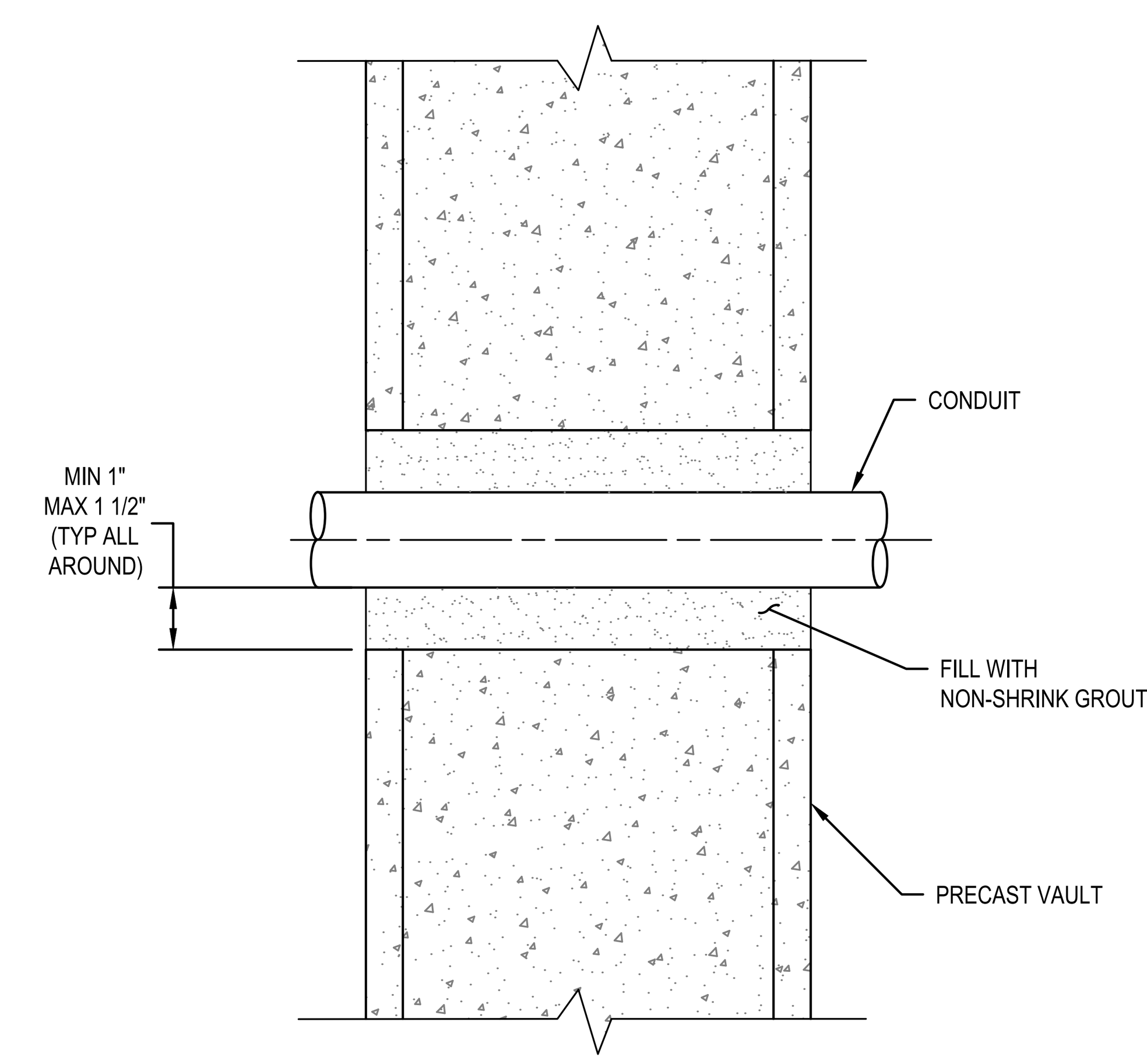
4 EQUIPMENT PAD NOT TO SCALE



5 GROUND CABLE STUB UP NOT TO SCALE



6 TYPICAL GROUND WELL DETAIL NOT TO SCALE



NOTE:

1. PROVIDE NON-DESTRUCTIVE TESTING TO DETERMINE LOCATIONS OF REINFORCEMENT. MAINTAIN MIN. 2" CLEAR BETWEEN CORE DRILLED OPENING AND REINFORCEMENT.
2. ROUGHEN SURFACE OF OPENING TO A 1/8" AMPLITUDE AND APPLY EPOXY CEMENT BONDING AGENT IMMEDIATELY PRIOR TO GROUTING.
3. PROVIDE 8" MINIMUM CENTER-TO-CENTER SPACING FOR CONDUITS.

7 CORE HOLE PENETRATION NOT TO SCALE

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

E-501

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 17 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL DETAILS

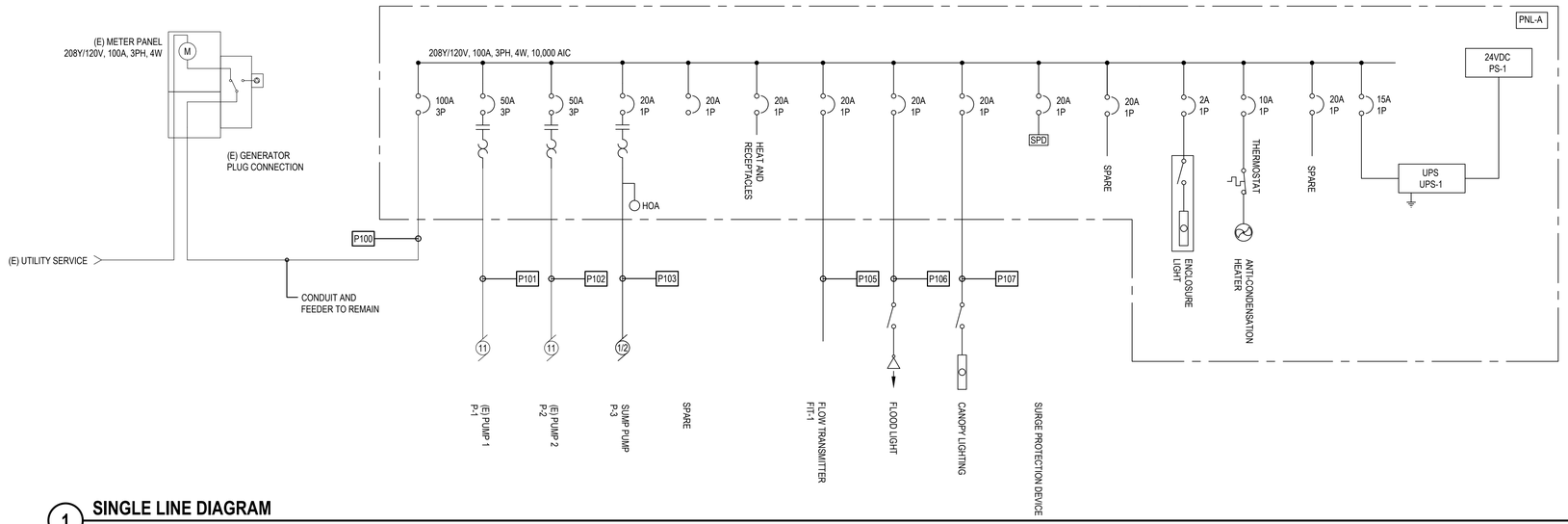
APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3



1 SINGLE LINE DIAGRAM

NO SCALE

SHEET GENERAL NOTES

1. COORDINATE ALL WORK ON/AROUND UTILITY EQUIPMENT WITH SDGE AND CITY.
2. ALL NEW CONDUITS SHALL BE 1".

PANEL SCHEDULE

PANEL NAME: **PNL-A** | VOLTAGE: 208/120 | NEMA RATING: 3R | MOUNTING: | NOTES:
MAINS RATING: 100 A MCB | PHASE: 3 | AIC RATING: 10,000 | LOCATION:
BUS RATING: 100 A | WIRE: 4 | DEMAND FACTOR: STD

CKT NO.	USE	DESCRIPTION	BKR SIZE	CKT KVA	CKT AMPS	WIRE SIZE	WIRE LENGTH (FT)	VOLTAGE DROP %	PHASE	VOLTAGE DROP %	WIRE LENGTH (FT)	WIRE SIZE	CKT AMPS	CKT KVA	BKR SIZE	DESCRIPTION	USE	CKT NO.
1	M	PUMP 1 "P-1"	50/3	3.75	31.25				A	0.11	25	12	1.50	0.18	20/1	TELEMETRY CONTROLS RECEPT		2
3	M		50/3	3.75	31.25				B						20/1	SPARE		4
5	M		50/3	3.75	31.25				C	0.24	25	12	3.33	0.40	20/1	HEATER AND RECEPTACLE		6
7	M	PUMP 2 "P-2"	50/3	3.75	31.25				A	0.12	25	12	1.67	0.20	20/1	CANOPY LIGHT		8
9	M		50/3	3.75	31.25				B							SPACE		10
11	M		50/3	3.75	31.25				C	0.06	25	12	0.83	0.10	20/1	FLOOD LIGHT		12
13	M	SUMP PUMP "P-3"	20/1	1.20	10.00	10	50	0.88	A			12	0.83	0.10	20/1	FLOW TRANSMITTER		14
15		SPACE							B						20/1	SPARE		16
17		SPACE							C							SPARE		18

CONNECTED KVA		DEMAND KVA		DEMAND AMPS
PHASE A:	9.2	10.1		84.3
PHASE B:	7.5	8.4		70.3
PHASE C:	8.0	8.9		74.5

STD DEMAND LOAD BASED ON 125% OF THE LARGEST MOTOR AND 100% OF THE REMAINING MOTORS, 125% OF CONTINUOUS LOADS, 100% OF NONCONTINUOUS LOADS, AND 50% OF RECEPTACLE LOADS BEYOND THE FIRST 10KVA

USE LEGEND		
ID	LOAD TYPE	ASSUMED PF
H	HVAC	0.85
L	LIGHTING	0.80
M	MOTOR	0.85
R	RECEPTACLE	0.80
P	PANEL	0.85
O	OTHER	0.85

VOLTAGE DROP CALCULATION

VOLTAGE DROP IS BASED ON THE IEEE RED BOOK AND 2017 NEC CHAPTER 9 TABLE 9 FORMULA:

VD = I * (R * PF + X * SIN(ACOS(PF)) * L

WITH AN ADDITIONAL MULTIPLIER OF 2 FOR SINGLE PHASE AND 1.732 FOR 3-PHASE LOADS

R AND X VALUES ARE TAKEN FROM 2017 NEC CHAPTER 9 TABLE 9. LENGTH IS IN 1000FT INCREMENTS

ASSUMPTIONS:

POWER FACTOR	VARIED BY LOAD TYE
CONDUIT TYPE	RGS
WIRE MATERIAL	CU

2 PANEL SCHEDULE

NO SCALE

DIGALERT — CALL TOLL FREE 811 — TWO WORKING DAYS BEFORE YOU DIG — Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

E-601

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

REGISTERED PROFESSIONAL ENGINEER — MINH T. MAI — No. E20033 — ELECTRICAL — STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

SHEET 18 | CITY OF CARLSBAD, ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
SINGLE LINE DIAGRAM AND PANEL SCHEDULE

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

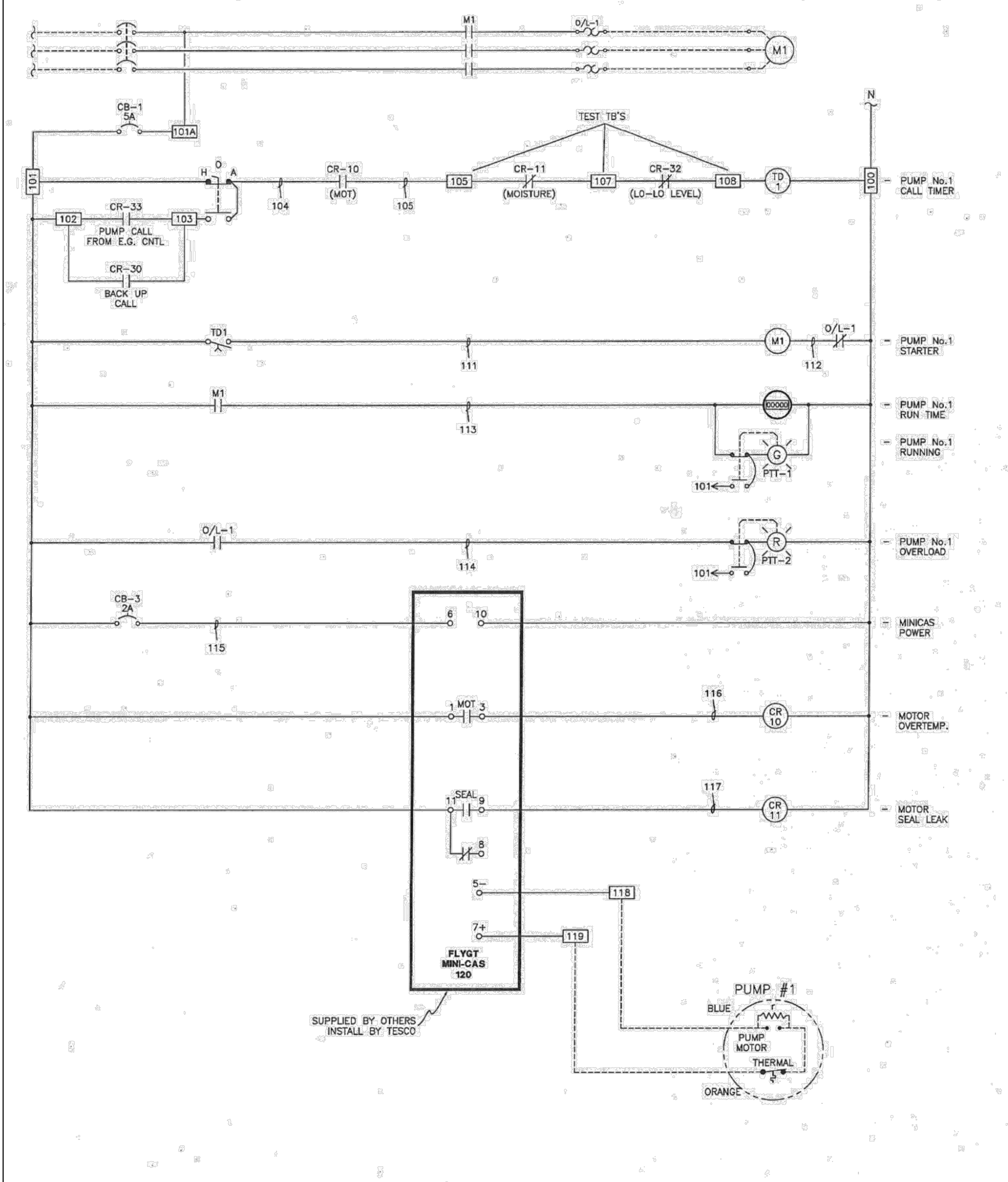
DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

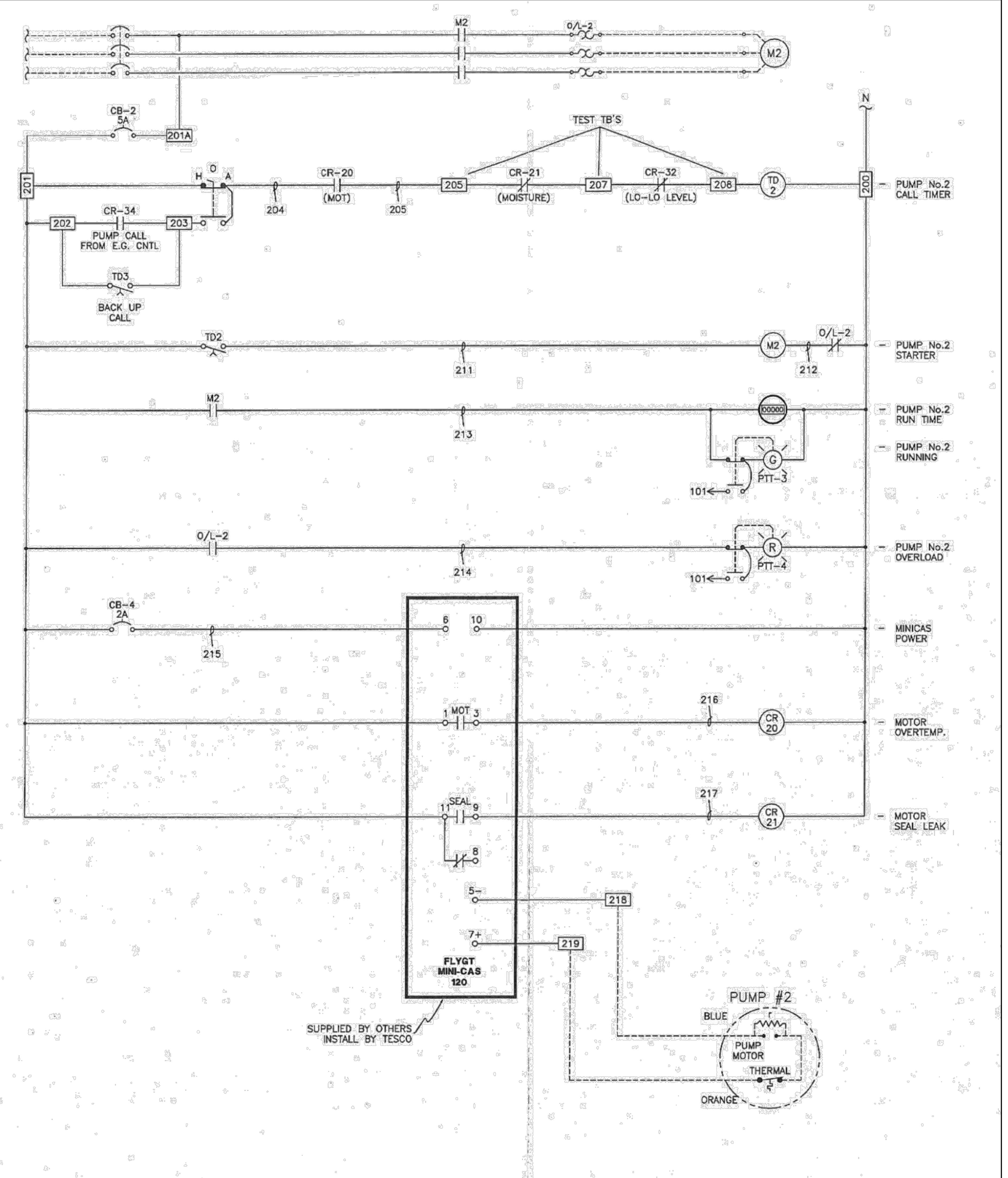
DRAWING NO. 532-3

SHEET GENERAL NOTES

1. DIAGRAM IS NOT INTENDED TO INDICATE ALL CONNECTIONS OR HARDWARE AND IS INTENDED TO CONVEY DESIGN INTENT ONLY.
2. SIZE ALL SYSTEM COMPONENTS BASED ON SYSTEM CONNECTED LOADS.
3. PROVIDE AND CONFIGURE ALL CONNECTIONS, DEVICES AND COMPONENTS AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.



PUMP No.1 CONTROL WIRING DIAGRAM



PUMP No.2 CONTROL WIRING DIAGRAM

DIGALERT
CALL TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. ______ EXP. ______ DATE

REVIEWED BY:

INSPECTOR DATE

E-602

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 19 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL PUMP CONTROL DIAGRAM

APPROVED: DAVE PADILLA
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

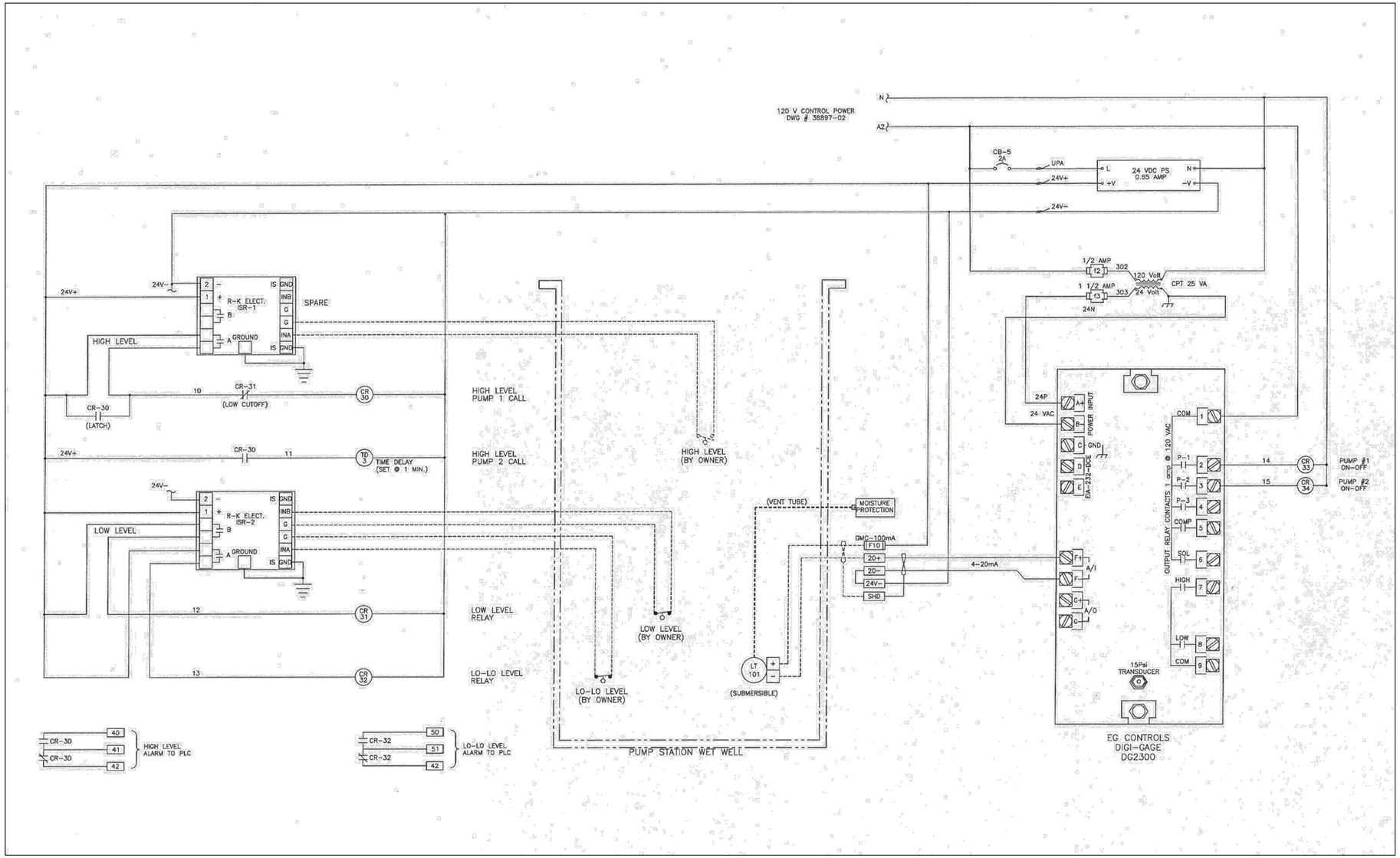
DWN BY: JJVI
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

SHEET GENERAL NOTES

1. DIAGRAM IS NOT INTENDED TO INDICATE ALL CONNECTIONS OR HARDWARE AND IS INTENDED TO CONVEY DESIGN INTENT FOR NEW CONTROL PANEL ONLY.
2. PANEL SHOP TO USE THIS DRAWING AS A BASE TO DESIGN NEW PANEL .
3. PROVIDE AND CONFIGURE ALL CONNECTIONS, DEVICES AND COMPONENTS AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.



DIGALERT
CALL TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

E-603

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER J. MANN
No. E20033
ELECTRICAL
STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 20 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
ELECTRICAL PUMP CONTROL DIAGRAM

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

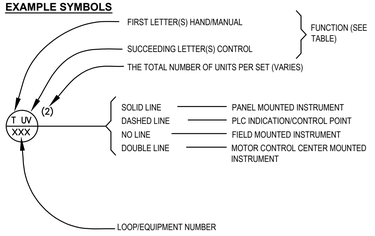
DWN BY: JJVI
CHKD BY: MM
RVWD BY: MM

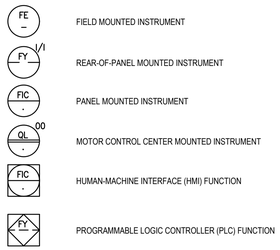
PROJECT NO. CIP 5550

DRAWING NO. 532-3

INSTRUMENTATION IDENTIFICATION

EXAMPLE SYMBOLS



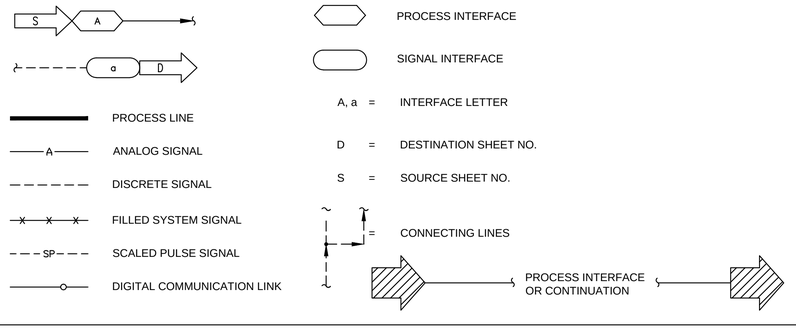


INSTRUMENT SOCIETY OF AMERICA TABLE

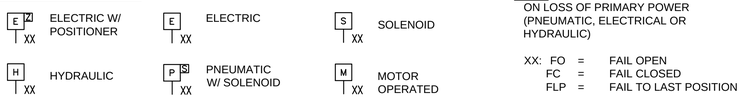
	FIRST LETTER (S)		SUCCEEDING LETTERS		
LETTER	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (+)	ALKALINITY		ALARM	
B	BURNER FLAME		USERS CHOICE (+)	USERS CHOICE (+)	USERS CHOICE (+)
C	CONDUCTIVITY	CHLORINE		CONTROL	
D	DENSITY (S.G)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGE		GLASS	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION				MIDDLE
N	USERS CHOICE (+)		USERS CHOICE (+)	USERS CHOICE (+)	USERS CHOICE (+)
O	USERS CHOICE (+)		ORIFICE		
P	PRESSURE (OR VACUUM)		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT	INTEGRATE	INTEGRATE		
R			RECORD OR POINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE	TURBIDITY			TRANSMIT
U	MULTIVARIABLE (+)	ULTRASONIC	MULTIFUNCTION	MULTIFUNCTION (+)	MULTIFUNCTION (+)
V	VISCOSITY			VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED (+)		UNCLASSIFIED (+)	UNCLASSIFIED (+)	UNCLASSIFIED (+)
Y	EVENT			RELAY OR COMPUTE (+)	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(+) WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS.

INTERFACE SYMBOLS AND LINE LEGEND



ACTUATOR SYMBOLS



NOTE:
ON LOSS OF PRIMARY POWER (PNEUMATIC, ELECTRICAL OR HYDRAULIC)

XX: FO = FAIL OPEN
FC = FAIL CLOSED
FLP = FAIL TO LAST POSITION

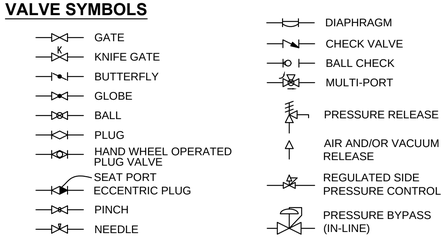
SELF CONTAINED VALVE AND EQUIPMENT TAG NUMBERS

D:

CP	=	CONTROL PANEL
F	=	FILTRATION UNIT
FM	=	FLOW METER
G	=	GATE
GR	=	GRIT REMOVAL
M	=	MECHANICAL EQUIPMENT
P	=	PUMP
PCV	=	PRESSURE CONTROL VALVE
PRV	=	PRESSURE RELIEF VALVE
RB	=	REFUSE BIN
S	=	AUTOMATIC BARSCREEN
T	=	TANK
TCV	=	TEMPERATURE CONTROL VALVE
UV	=	ULTRAVIOLET TREATMENT
WP	=	WASH PRESS

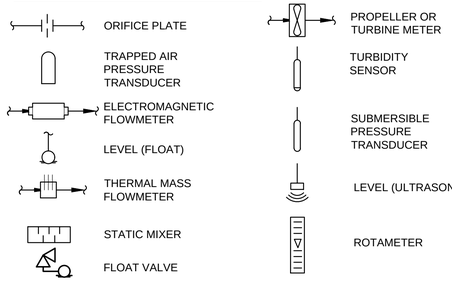
A = UNIT IDENTIFIER
XXX = LOOP NUMBER
WW = FACILITY OR STRUCTURE IDENTIFIER
D = EQUIPMENT IDENTIFIER

VALVE SYMBOLS



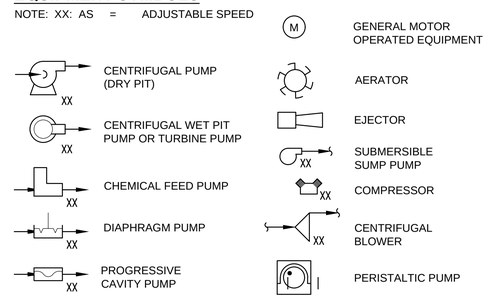
GATE SYMBOLS

PRIMARY ELEMENT SYMBOLS

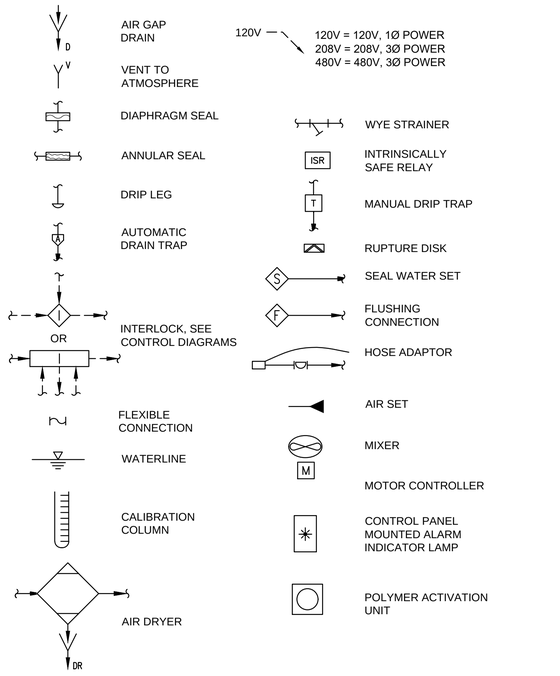


EQUIPMENT SYMBOLS

NOTE: XX: AS = ADJUSTABLE SPEED



MISCELLANEOUS SYMBOLS



FLOW STREAM IDENTIFICATION

LEGEND	SERVICE	LEGEND	SERVICE
AIR	COMPRESSED AIR	PW	POTABLE WATER
BW	BACKWASH	RAS	RETURN ACTIVATED SLUDGE
CH	CHEMICAL FEED	RS	RAW SEWAGE
CL	SODIUM HYPOCHLORITE	SA	SAMPLE
D	DRAIN	SE	SECONDARY EFFLUENT
FBW	FILTER BACKWASH	SH	SODIUM HYPOCHLORITE
FTW	FILTER TO WASTE	SW	STORM WATER
FE	FINAL EFFLUENT	TE	TERTIARY EFFLUENT
OF	OVERFLOW	TI	TERTIARY INFLUENT
P	POLYMER	UW	UTILITY WATER
PT	POND TRANSFER	VAC	VACUUM AIR
		WAS	WASTE ACTIVATED SLUDGE

ABBREVIATIONS

DC	DIRECT CURRENT	OC	OPEN-CLOSE (D)
FE	FLOW ELEMENT	OCA	OPEN-CLOSE-AUTO
FIT	FLOW TRANSMITTER	OOR	ON-OFF-REMOTE
HMI	HUMAN-MACHINE INTERFACE	OSC	OPEN-STOP-CLOSE
HOA	HAND-OFF-AUTO	PF	PULSE FREQUENCY
LCP	LOCAL CONTROL PANEL	pH	HYDROGEN ION CONCENTRATION
LE	LEVEL ELEMENT	PLC	PROGRAMMABLE LOGIC CONTROLLER
LOR	LOCAL-OFF-REMOTE	PWR	POWER
LR	LOCAL-REMOTE	QTY	QUANTITY
LS	LEVEL SWITCH	THERM OL	THERMAL OVERLOAD
LSH	LEVEL SWITCH HIGH	TYP	TYPICAL
LSL	LEVEL SWITCH LOW	VFD	VARIABLE FREQUENCY DRIVE
LT	LEVEL TRANSMITTER		
MCC	MOTOR CONTROL CENTER		
MFR	MANUFACTURER		

GENERAL NOTES

1. THIS IS A STANDARD LEGEND, THEREFORE NOT ALL OF THIS INFORMATION MAY BE USED ON THIS PROJECT.
2. COMPONENTS AND PANELS SHOWN WITH ONE OR MORE ASTERISKS * ARE PART OF A PACKAGE SYSTEM, SEE EQUIPMENT SPECIFICATIONS.

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

I–001

REGISTERED PROFESSIONAL ENGINEER BRADY MANN No.E20033 ELECTRICAL STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 21 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
P&ID LEGEND, SYMBOLS, AND ABBREVIATIONS

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

P:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/17

(E) PLC/SCADA

POWER SOURCE

FIELD

LALL 1 DI — LOW LOW LEVEL
LAL 1 DI — LOW LEVEL
LAH 1 DI — HIGH LEVEL
LT 1 AI — LEVEL TRANSMITTER

Y1 1 DO — ENABLE
Y1 1 DI — RUNNING
YA 1A DI — ALARM
YA 1B DI — FAULT
Y1 2 DO — ENABLE
Y1 2 DI — RUNNING
YA 2A DI — ALARM
YA 2B DI — FAULT

LAHH 2 DI
FI 1 AI — FLOW INDICATOR

HOA MS-208VAC
HOA MS-208VAC
HOA MS-120VAC

LSLL 1
LSL 1
LSH 1
LT 1
LE 1
LSL 2
LSH 2
LSHH 2
FIT 1
FE 1

(E) M-1
(E) M-2
M-3

4"
4"
4"

(E) 8" PVC WEST INFLUENT LINE

(E) WET WELL LIFT STATION

VAULT

(E) 8" PVC

(E) SEWER MANHOLE

(E) 8" PVC

DIGALERT — CALL TOLL FREE 811 — TWO WORKING DAYS BEFORE YOU DIG — Underground Service Alert

"AS BUILT"

P.E. _____ EXP. _____ DATE

REVIEWED BY:

INSPECTOR DATE

I-101

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 22 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
P&ID

APPROVED: DAVE PADILLA

CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

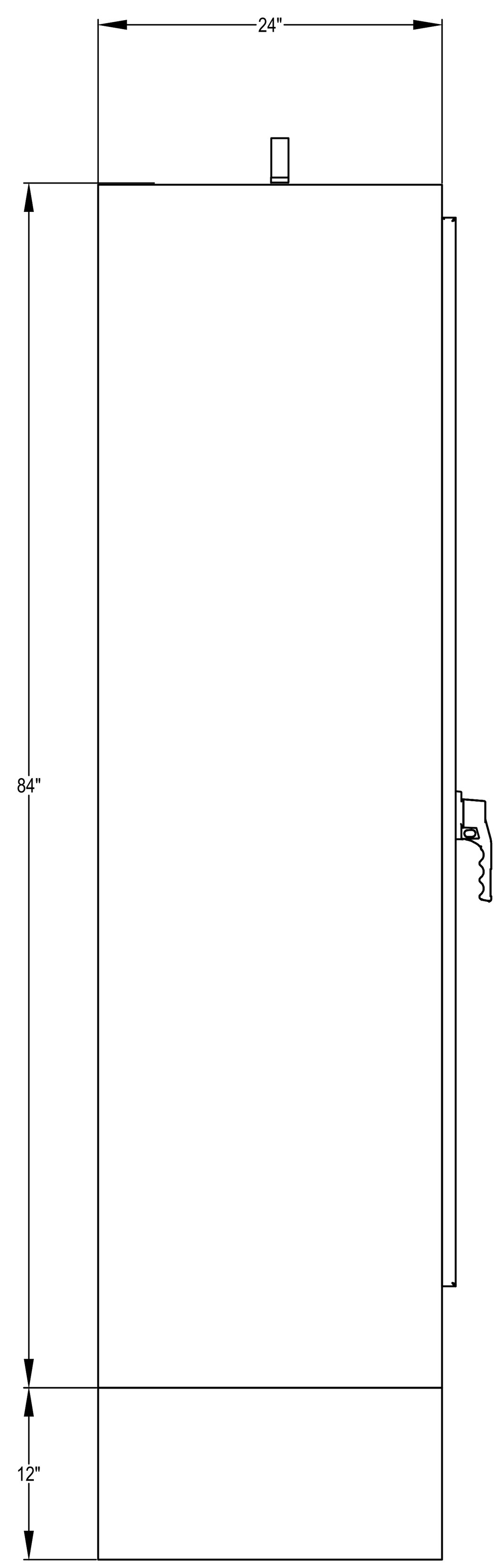
REGISTERED PROFESSIONAL ENGINEER — BRADY WANN — No. E20033 — ELECTRICAL — STATE OF CALIFORNIA

GHD
320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

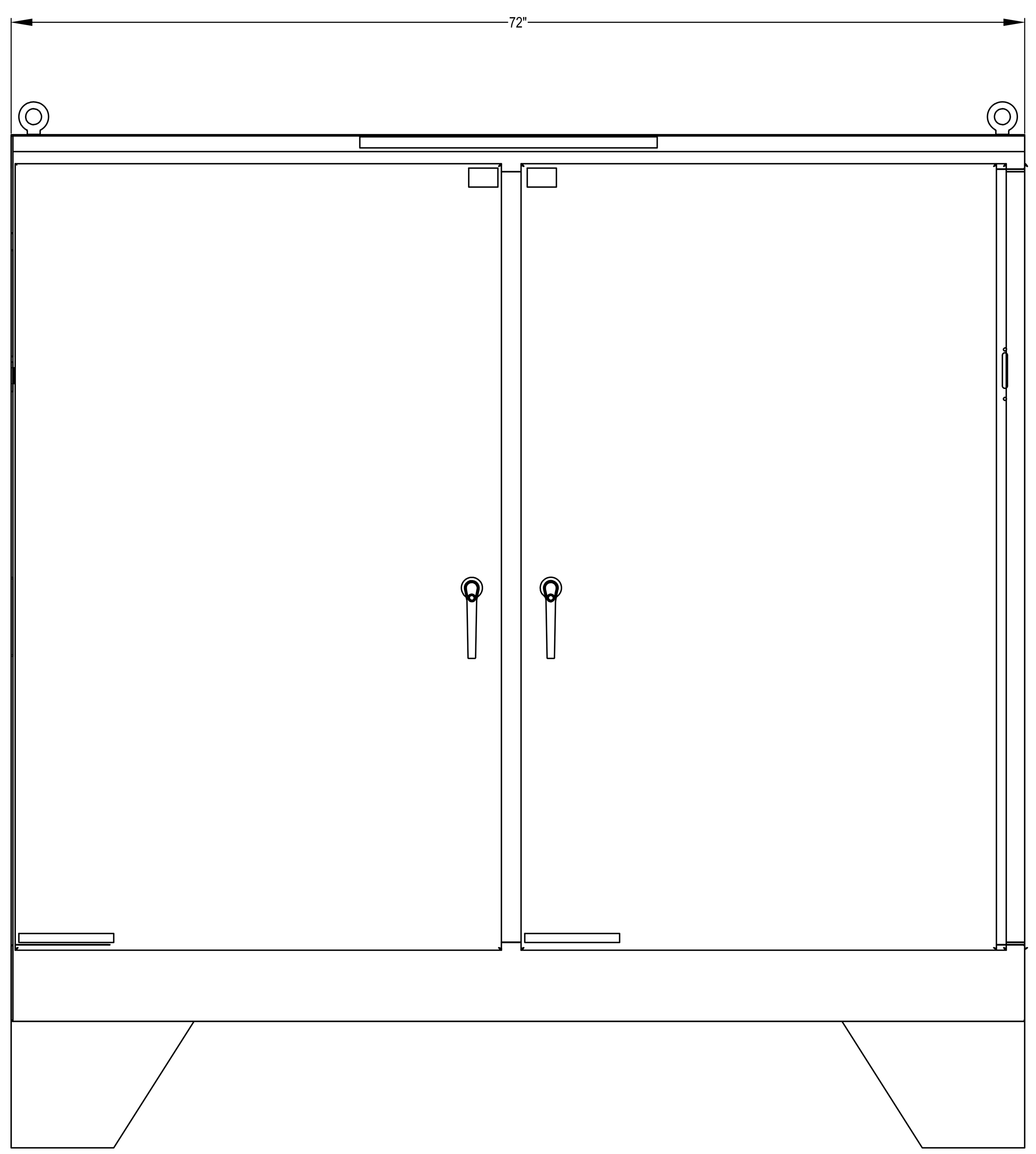
D:\DRAWING FILES\TITLE SHEETS\IMPROVEMENT TITLE SHEET.DWG REVISED: 2/23/17

SHEET GENERAL NOTES

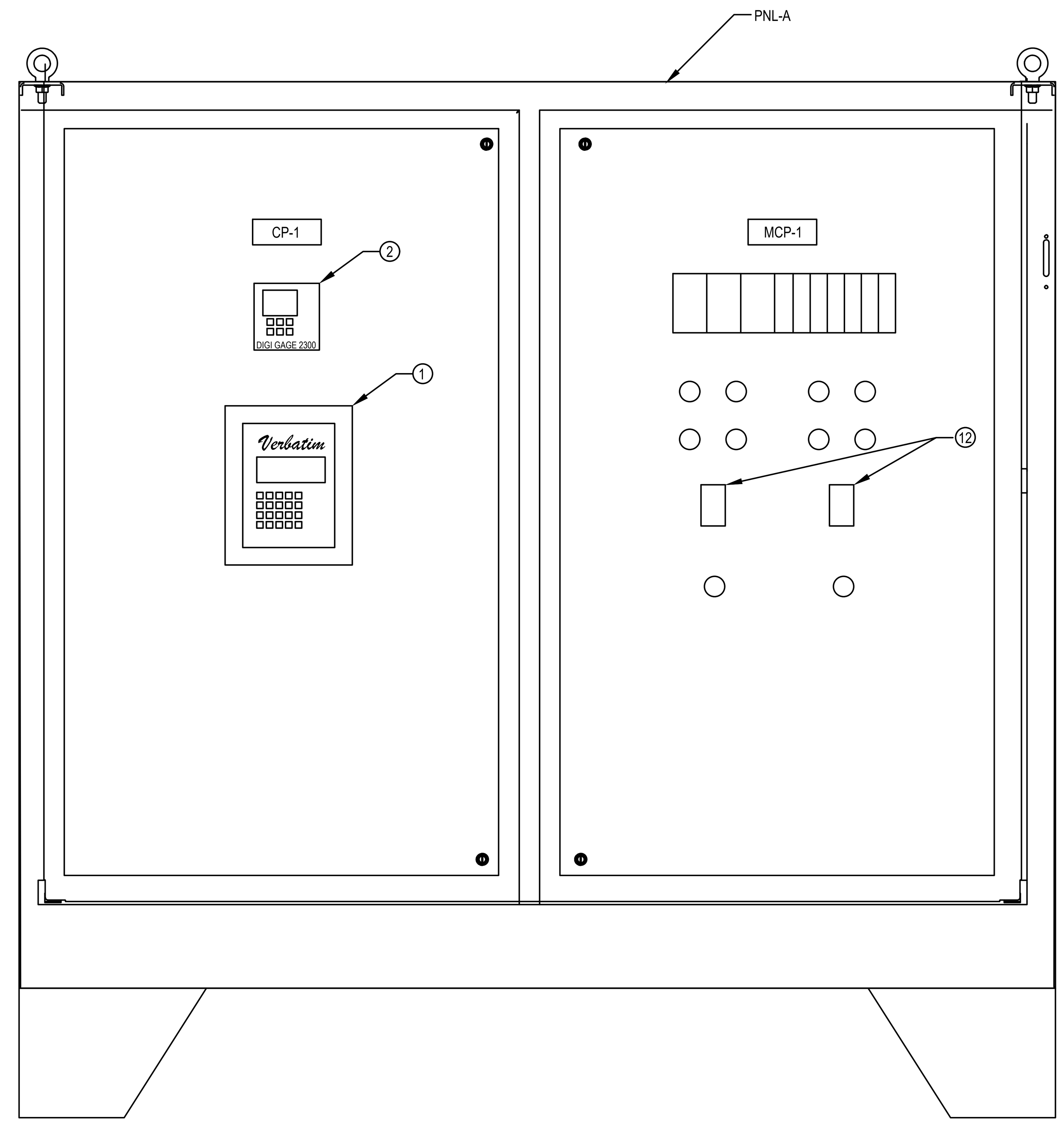
1. CONTROL PANEL LAYOUT IS SHOWN SCHEMATICALLY, PANEL SHOP TO PROVIDE FINAL LAYOUT.
2. DISCONNECT EXISTING PARTS IN PLC SECTION AND REINSTALL INTO FINAL PANEL LAYOUT.
3. MISSION CONTROL AND EXISTING HARDWARE TO BE RECONNECTED SIMILAR TO THE EXISTING CONDITIONS. CITY TO DO PROGRAMMING TO MATCH EXISTING.



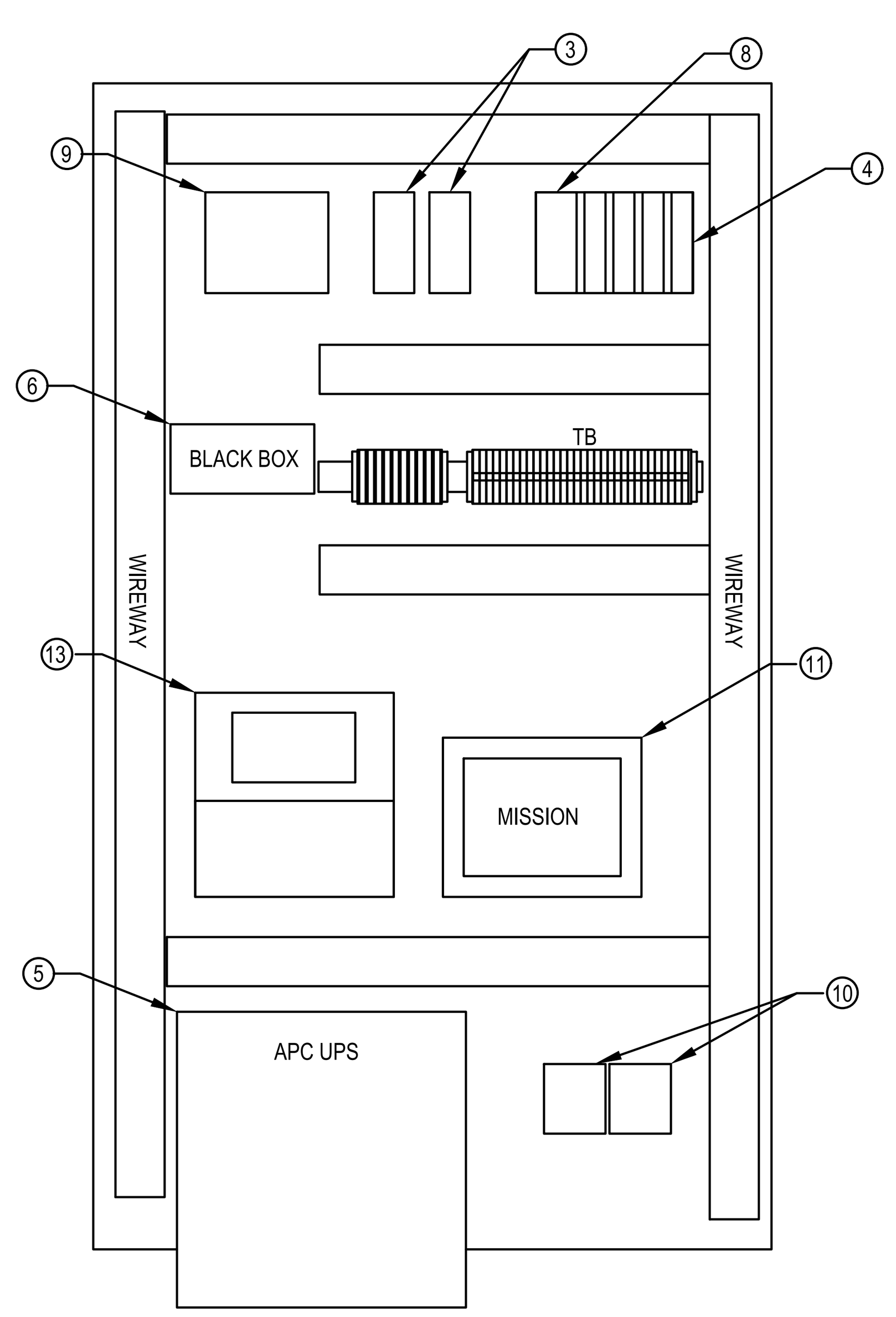
PANEL SIDE VIEW
SCALE : NO SCALE



PANEL FRONT DOOR CLOSED
SCALE : NO SCALE



PANEL FRONT DOOR OPEN
SCALE : NO SCALE



PANEL PLC SECTION INSIDE VIEW
SCALE : NO SCALE

ITEM	DESCRIPTION	QTY
1	(E) VERBATIM REMOTE ALARM DIALING MONITOR WITH SOLID STATE MESSGAE RECORDING	1
2	(N) DIGI GAGE PLUS BY EG CONTROLS	1
3	(E) SNAP-PS5 & SNAP-PS24	2
4	(E) I/O MODULES	4
5	(E) BACK-UPS BE-650G	1
6	(E) BLACKBOX MODEM	1
7	(E) FLYGT MINICAS LEAK DETECTION	2
8	(E) OPTO 22 SNAP B3000 BRAIN	1
9	(E) OPTO 22 CIRCUIT BOARD	1
10	(E) SIGNAL ISOLATOR	2
11	(E) MISSION CONTROL	1
12	(N) FLYGT RELAY LEAK & OH PROTECTION	2
13	(N) FLOW TRANSMITTER	1

PARTS LIST
SCALE : NO SCALE

REGISTERED PROFESSIONAL ENGINEER No.E20033 ELECTRICAL STATE OF CALIFORNIA

320 Goddard #200
Irvine California USA 92618
T 1 949 648 5200 F 1 949 250 0541
E irvmail@ghd.com W www.ghd.com

DIGALERT CALL TOLL FREE 811 TWO WORKING DAYS BEFORE YOU DIG
Underground Service Alert

"AS BUILT"

P.E. ______ EXP. ______ DATE

REVIEWED BY:

INSPECTOR DATE

I-102

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 23

CITY OF CARLSBAD
ENGINEERING DEPARTMENT

SHEETS 23

IMPROVEMENT PLANS FOR:
VILLAS LIFT STATION REPLACEMENT
PANEL ELEVATIONS

APPROVED: DAVE PADILLA
CITY ENGINEER RCE 55974 EXPIRES 12/31/2022 DATE

DWN BY: AC
CHKD BY: MM
RVWD BY: MM

PROJECT NO. CIP 5550

DRAWING NO. 532-3

CITY OF CARLSBAD

FINAL TECHNICAL SPECIFICATIONS

for the construction of

VILLAS LIFT STATION REPLACEMENT

CIP 5550

May 2021

Prepared by:

320 Goddard Way, Suite 200
Irvine, CA 92618

CITY OF CARLSBAD
VILLAS LIFT STATION REPLACEMENT
TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01010 SUMMARY OF WORK

PART 1 WORK COVERED BY CONTRACT DOCUMENTS

The City of Carlsbad is rehabilitating the Villas Lift Station which includes replacement of discharge piping, replacement of wet well roof slab, installation of one (1) vault, replacement of electrical cabinets, and miscellaneous site improvements located at the east end of Winthrop Avenue cul-de-sac.

The Villas Lift Replacement project includes:

A. Removal of existing pumps, valves, piping, and appurtenances as shown on the Drawings.

B. Replace the existing PVC and DIP pump discharge piping in the wet well, which is currently deteriorated. The existing, above-grade discharge piping and valve enclosure will be removed.

C. The existing flow meter and manhole will be removed. A new flow meter will be installed inside a new vault. The force main piping from the existing manhole vault to the new flow meter will be replaced. A permanent bypass pump connection will be constructed outside of the new vault.

D. Install new check valves and isolation valves inside a new vault. The force main piping from the wet well to the new valve vault will be replaced.

E. Install a new sump pump (Myers SX50-01PS, 1/2 HP) inside a new vault. A new sump pump discharging piping and control wiring will be installed from the sump pump.

F. Install a new panel lineup for pump controls, motor starters, run time meter, and alarm panel. A weather canopy with lighting will be installed over the new electrical panel lineup.

G. Install new access gate.

H. Purchase a spare pump (Flygt NP 3127.070, 11 HP, 230V, 3 Phase) for the Lift Station.

I. Demolish original lift station concrete pad adjacent to the wet well.

J. Contractor to verify pressure class for the existing PVC force main in the field during construction.

K. Other work as shown or specified in the Contract Documents or approved by the City.

PART 2 WORK SEQUENCE AND CONSTRAINTS

2.1 Continuity of Villas Lift Station Operations – General

Construction under this Contract involves work to be conducted at the Villas Lift Station and connections to the existing sewer force main and electrical systems.

The existing pumps and electrical systems are currently and continuously conveying sewer discharge and power and those functions shall not be interrupted except as specified herein. The Contractor shall coordinate the work to avoid any interference with normal operation of the sewer discharge and electrical systems.

In addition to the requirements specified elsewhere in these Contract Documents, the Contractor is advised of the following constraints to the work sequence and schedule.

The work under this Contract shall be conducted in a manner that will minimize roadway closures or traffic obstructions caused by construction. No road shutdowns will be allowed. No driveways shall be blocked. Parking must be made available to adjacent residents at all times.

The Contractor shall note that only certain structures, tie-ins and constraints are addressed in this section. All work, whether or not addressed here, shall be governed by applicable parts of this section, and schedules and procedures further submitted for approval.

Changes to existing utilities or any new connection thereto must be coordinated to provide the least possible interference with sewer system operations. Prior to any connections to existing utilities all materials, fittings, supports, equipment and tools shall be on the site and all necessary labor scheduled prior to starting any connection work.

The Contractor shall include all work described in this section in the construction schedule. The sequence and constraints identified in this section shall be followed in the construction of the work. However, alternatives to these sequences and constraints may be submitted by the Contractor for review by the City.

No utility shall be disconnected without prior written approval from the utility owner and City. When it is necessary to connect a utility, the Contractor shall give at least two week notice to the utility owner and to the City for approval of the proposed schedule.

Specific sequencing constraints include:

A. The pre-construction conference shall be coordinated to accommodate attendance by representatives of the City and associated property owners. Coordination with Home Owners Association and property owners shall continue throughout the project duration.

B. Contractor shall provide the following submittals for review and approval prior to construction and ordering materials in accordance with the Special Provisions:
   - Temporary sewer bypass plan identifying flows, connections, and spill prevention measures
   - Stormwater Pollution Control Plan
   - List of items for demolitions
   - Proposed piping
   - Proposed valves and appurtenances
   - Proposed precast vaults
   - Proposed polymer concrete
   - Proposed sump pump
   - Proposed access hatch and fall protection system
   - Proposed canopy system
   - Proposed electrical system components

C. Pressure testing of the pipelines shall be completed under the Contract. See Section 15044 for testing requirements.

D. The Contractor shall maintain access to work sites and operation of the Villas Lift Station.

E. The Contractor shall install temporary fencing and temporary noise blanket for site security and noise attenuation in accordance with City bylaws.

2.2 Work Site Access

Continuous access to the City and CMWD's facilities shall be provided at all times during the project. Access routes shall be provided by the Contractor and approved by the City and property Owners. The Contractor will be responsible for providing any temporary signage and controls to notify of any traffic routing or public access.

PART 3 FURNISHED MATERIALS

CMWD shall provide use of water for testing purposes. Contractor should obtain a temporary meter for water used during construction as approved by CMWD.

PART 4 TRENCH EXCAVATIONS

No trench shall be left open during periods when the Contractor is not at the site of work. Trenches in these areas shall either be backfilled and temporarily paved, where applicable, or covered with steel trench plates.

PART 5 UNDERGROUND FACILITIES

The Contractor shall exercise care in all excavations to avoid damage to existing underground facilities. This shall include potholing and hand digging in those areas where underground facilities are known to exist until they have been sufficiently located to avoid damage to the facilities.
The Contractor shall exercise care in maintaining those pipes to be abandoned and/or removed which are required for the continuing operation of the existing sewer discharge system until such time as they can be abandoned. The Contractor shall exercise extreme caution in working in any area adjacent to existing facilities.

No additional compensation shall be provided the Contractor for compliance with the provisions of this section for the damage and repair of such utilities or facilities due to the lack of care.

For work at the lift station the Contractor is responsible for coordinating all existing project documentation, including but not limited to, the Contract Documents and existing record drawings for the determination of the location of all underground utilities or facilities. If the Contractor determines that existing utilities or facilities interfere with the new Work and were not shown or were incorrectly shown in the Contract Documents, the Contractor shall notify the City.

Coordinate with utility companies and agencies as required. The Contractor shall verify the location of all existing facilities (aboveground and underground), including exploratory excavations, within the project site sufficiently ahead of the construction to permit the revisions

of the construction plans if it is found that the actual locations are in conflict with the proposed work.

PART 6 ACCESS FOR OTHER PERSONNEL

During the course of the work of this Contract adjacent existing facilities will be used and maintained by City personnel. The Contractor shall coordinate its work in such a way as to interfere as little as possible with the routine work of existing facilities except in direct pursuit of the work of this Contract and as favorably reviewed by the City. The Contractor shall provide safe access at all times to all existing facilities for personnel and equipment.

END OF SECTION

SECTION 01025 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. Measurement and payment for bid items listed in the proposal shall be based upon use of a lump sum or unit price method. Extra work or changes in the Work shall be accomplished as provided in the Special Provisions.

1.2 PAYMENT

A. Payment for Unit Price Items

Payment for a unit price bid item shall be based upon the amount shown in the bid schedule multiplied by the total quantity measurement of the item and shall be full compensation for furnishing all supervision, planning, design, design engineering fees, labor, transportation, materials, equipment, tools and appurtenances required for construction of the item complete in place in accordance with the Plans and Specifications.

B. Payment for Lump Sum Items

Payment for lump sum bid items shall be based upon the amount shown in the bid schedule and shall be full compensation for furnishing all supervision, planning, design, design engineering fees, labor, transportation, materials, equipment, tools and appurtenances required for construction of the unit of work complete in place in accordance with the Plans and Specifications.

C. Work Not Listed in the Bid Schedule

Costs for related work and appurtenances which are required and/or implied by the General Provisions, Technical Specifications, Special Provisions and Plans and are not listed as a separate bid item but are necessary to complete the project shall be included in the appropriate bid item or items within the proposal.

PART 2 MATERIALS

2.1 GENERAL (MEASUREMENT)

A. Measurement for unit price quantities shall be based upon the appropriate bid item in the proposal. The actual quantity of measurement shall be as constructed by Contractor in place in conformance with the Plans and Specifications.

2.2 UNIT MEASUREMENTS

A. Measurement for bid items involving units of the item shall be based upon the number of units counted as indicated in the bid item.

2.3 LUMP SUM MEASUREMENT

A. Measurement for a lump sum bid item shall be considered as a complete project or a portion of a project constituting a unit. The items to be included in the lump sum bid shall be as specified in the proposal bid item and/or the Standard or Special Provisions.

2.4 PAYMENT FOR TESTING

A. Party responsible for payment for testing is identified in individual sections under tests required. Where specifications are silent regarding responsible party paying for tests, costs of first tests will be paid by Owner.

B. If testing or inspection indicates failure of a material or procedure to meet Contract Document requirements, Owner will backcharge Contractor for retesting and reinspection costs incurred by testing or inspection agency of Owner's choice.

C. Additional tests and inspections not specified herein but requested by Owner will be paid for by Owner, unless result of such tests and inspections are found to not comply with Contract Documents, in which case Owner will pay all costs for initial testing as well as retesting and reinspection and backcharge Contractor for retesting and reinspection.

D. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply shall be paid by Contractor direct to testing laboratory.

E. Cost of testing which is required solely for convenience of Contractor in his scheduling and performance of Work shall be borne by Contractor.

F. Contractor shall pay all costs for correcting deficiencies.

2.5 REDUCTION IN PAYMENT FOR DEFICIENT WORK

A. Payment for work failing to meet pressure test requirements, but accepted at Owner's discretion, shall be reduced by an amount equal to Owner's current wholesale cost of water times the excess leakage per hour at test pressure times 240,000 hours.

PART 3 EXECUTION

3.1 BID ITEM DESCRIPTIONS

This section defines the bid items listed in the bid schedule and describes measurement and payment provisions for each of the bid items.

Bid Item 1 – Mobilization and Demobilization

A. Includes all costs for mobilization and demobilization of construction equipment. Payment shall be made at seventy five (75%) percent of the bid item amount on the first progress payment and the remaining amount on the final progress payment, subject to the provisions below.

B. Payment for this item will be made at the contract lump sum price named in the Bid Schedule under Item No. 1, which price shall constitute full compensation for all work and expenditures required to mobilize, provide bonds and insurance, obtain required permits, take preconstruction photos and videos, prepare project schedule, provide project sign, preparation of staging areas, perform required surveys, testing, site maintenance and cleanup, remove and reinstall existing site facilities as required, comply with all General and Supplementary conditions, demobilize, provide record drawings, and warranties, and provide cleanup of construction site complete in place, as required by the Contract Documents with sole exclusion of payments to be made as defined herein for other items in Bid Schedule.

C. Work to be paid for under this item shall also include furnishing, setting up, and removing Contractor's operations at project site including temporary offices, utilities, staging areas, security, etc. The work shall also include furnishing any temporary construction facilities and trailers required by the Contract Documents.

Bid Item 2 – Excavation Safety Measures

A. Payment for this item will be made at the lump sum price named in the Bid Schedule under Item No. 2, which price shall constitute full compensation for all work and expenditures required to furnish and install all necessary excavation safety measures including, but not limited to sheeting, shoring and bracing or equivalent method for protection of life and limb in trenches and open excavation in conformance with applicable safety orders, complete in place.

Bid Item 3 – Demolition

A. Measurement for payment for the removal of the existing valves, pipe and appurtenances will be based upon all labor, materials and equipment necessary to remove the existing valves, pipe and appurtenances as shown; removal of the existing isolations valves, existing check valves, flow meter and manhole, removal of pvc piping, fittings and appurtenances as shown; removal of concrete pad and associated piping to the pump discharge header; trench excavation; supporting exposed utilities and pipes; bedding; backfill; proper disposal of removed items; and any appurtenant work as required by the Contract Documents.

B. Payment for removing the existing valves, pipe and appurtenances will be made at the lump sum price named in the Bid Schedule under Item No. 3 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 4 – Potholing

A. Measurement for payment for locating, potholing, exposing, and protecting existing utilities will be included and any appurtenant work as required by the Contract Documents.

B. Payment will be made at the lump sum price named in the Bid Schedule under Item No. 4 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 5 – Temporary Sewer Bypass Pumping

A. Measurement per specification including design, furnish, and install, mobilization and demobilization as necessary to complete a sewer system bypass during lift station reconstruction, including connections, piping, backup, odor control, security, and cleanup will be made for this lump sum bid item.

B. Payment will be made at the lump sum price named in the Bid Schedule under Item No. 5 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 6 – Storm Water Pollution Prevention Plan

A. Measurement for payment for preparing a Storm Water Pollution Prevention Plan as required by the Contract Documents.

B. Payment will be made at the lump sum price named in the Bid Schedule under Item No. 6 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 7 – Pre-cast Vault

A. Measurement for payment for the construction of a new pre-cast vault will be based upon all labor, materials and equipment necessary to construct the new precast vault as shown on Contract Documents and includes installing a new precast vault with sump, installing a sump pump with electrical and control wiring and discharge piping, trench excavation; supporting exposed utilities and pipes; adequate protection of existing and proposed facilities; bedding; backfill; and any appurtenant work as required by the Contract Documents.

B. Payment for constructing the new precast valve vault will be made at the lump sum price named in the Bid Schedule under Item No. 7 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 8 – Wet Well Roof Slab and Hatch

A. Measurement for payment for the construction of a new wet well roof slab and access hatch will be based upon all labor, materials and equipment necessary to construct the new slab and access hatch as shown on Contract Documents and includes installing a new polymer concrete slab and swing access hatch to the existing wet well, demolition of existing concrete slab and hatch; adequate protection of existing and proposed facilities; bedding; backfill; and any appurtenant work as required by the Contract Documents.

B. Payment for constructing the new concrete roof slab and access hatch will be made at the lump sump price named in the Bid Schedule under Item No. 8 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 9 – Construct 4” SCH80 PVC Discharge Piping

A. Measurement for payment for the construction of a 4” schedule 80 PVC piping and appurtenances for discharge piping will be based upon all labor, materials and equipment

necessary to construct the discharge piping and appurtenances as shown and includes furnishing and installing an 4" schedule 80 PVC piping and associated fittings; furnishing and installing adapters for the discharge piping connection; trench excavation; supporting exposed utilities and pipes; bedding; backfill; wet well concrete base repairs and any appurtenant work as required by the Contract Documents.

B. Payment for constructing the 4" schedule 80 PVC piping, appurtenances, bracing, brackets, pipe clamps and hardware for discharge piping will be made at the linear feet named in the Bid Schedule under Item No. 9 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 10 – Construct 4" DIP Discharge Piping and Valves

A. Measurement for payment for the construction of a 4" ductile iron piping and appurtenances for discharge piping will be based upon all labor, materials and equipment necessary to construct the discharge piping, valves, and appurtenances as shown and includes furnishing and installing an 4" ductile iron piping, valves, and associated fittings; furnishing and installing adapters for the discharge piping connection, concrete thrust blocks and support collars; trench excavation; supporting exposed utilities and pipes; bedding; backfill; and any appurtenant work as required by the Contract Documents.

B. Payment for constructing the 4" ductile iron piping, valves, and appurtenances for discharge piping will be made at the lump sum price named in the Bid Schedule under Item No. 10 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 11 – Install 4" Flow Meter

A. Measurement for payment for the installation of a 4" flow meter and appurtenances will be based upon all labor, materials and equipment necessary to install the flow meter, conduits, cables, and appurtenances as shown and any appurtenant work as required by the Contract Documents.

B. Payment for constructing the 4" flow meter and appurtenances for the flow meter will be made based on the contract unit price bid for each named in the Bid Schedule under Item No. 11 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 12 – 6' High Vinyl Fence and Gate

C. Measurement for payment for the installation of a 6' high vinyl fence and site access gate will be based upon all labor, materials and equipment necessary to install the fence, posts, foundation, access gate and appurtenances as shown and any appurtenant work as required by the Contract Documents.

D. Payment for constructing the 6' high vinyl fence and gate will be made at the lump sum price named in the Bid Schedule under Item No. 12 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 13 – Remove and Replace Existing PCC Pavement

A. Measurement for payment for removal and replacement of existing PCC Pavement will be based upon all labor, materials and equipment necessary to remove and replace the existing PCC pavement as shown; proper disposal of existing pavement; adequate protection of existing and proposed facilities; resurfacing with concrete pavement; and any appurtenant work as required by the Contract Documents.

B. Payment for removal and replacement of existing PCC pavement will be made at the unit price per square foot (SF) named in the Bid Schedule under Item No. 13 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 14 – Electrical Demolition

A. Measurement for payment for removal and replacement of existing control enclosure, pull boxes, storage enclosure, and flood lighting will be based upon all labor, materials and equipment necessary to remove and replace the control enclosure, pull boxes, conduits, and flood lights as shown and includes removal and proper disposal of existing flood lighting; furnishing and installing new flood light poles and lighting; remove and reconstruct a concrete base; furnishing and installing associated electrical conduits; trench excavation; bedding; backfill; and any appurtenant work as required by the Contract Documents.

B. Payment for removal and replacement of existing control enclosure, pull boxes, storage enclosure, and flood lighting will be made at the lump sum price named in the Bid Schedule under Item No. 14 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 15 – Foundation for New MCP and Storage Cabinets

A. Measurement for payment for replacement of existing PCC housekeeping pads, concrete curb and associate work around to tie-in with existing concrete will be based upon all labor, materials and equipment necessary to replace the existing concrete pads for MCP and storage cabinet and any appurtenant work as required by the Contract Documents.

B. Payment for replacement of existing concrete pads, concrete curb and associate work around to tie-in with existing concrete will be made at the lump sum price named in the Bid Schedule under Item No. 15 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 16 – New MCP Power and Control Enclosure

A. Measurement for payment for new MCP Power and Control Enclosure will be based upon all labor, materials and equipment necessary to furnish and install a new MCP and Storage Cabinet as shown and includes re-use of existing panels; connection to existing conduits; and any appurtenant work as required by the Contract Documents.

B. Payment for installation of the MCP and storage cabinets will be made at the lump sum price named in the Bid Schedule under Item No. 16 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 17 –New Canopy with Lights

A. Measurement for payment for new Canopy with Lights will be based upon all labor, materials and equipment necessary to furnish and install a new canopy and any appurtenant work as required by the Contract Documents.

B. Payment for installation of the canopy and lighting will be made at the lump sum price named in the Bid Schedule under Item No. 17 and shall constitute full compensation of all such work as required per the Contract Documents.

Bid Item 18 –New Spare Pump

C. Measurement for payment for new spare pump (Flygt Model NP 3127.070 3" volute, 11 HP, 230V, 3 Phase, 60 Hz, 3550 RPM, 248 impeller, 1 x 50 Ft. length of SUBCAB 4G10+S(2x0,5) submersible cable, FLS leakage detector, volute is prepared for Flush Valve) will be based upon all labor, materials and equipment, necessary to furnish the new spare pump and any appurtenant work as required by the Contract Documents.

D. Payment for furnishing the new spare pump will be made at the contract unit price for each named in the Bid Schedule under Item No. 18 and shall constitute full compensation of all such work as required per the Contract Documents.

3.2 Contractor's Cost Breakdown (Applicable for Lump Sum Work)

For work to be performed for a lump sum amount, the Contractor shall submit a cost breakdown to the City prior to the first payment and within ten (10) days after Notice to Proceed. The cost breakdown, as agreed upon by the Contractor, the Engineer and the City, shall be used for preparing future estimates for partial payments to the Contractor, and shall list the major items of work with a price fairly apportioned to each item. Mobilization, overhead, bond, insurance, other general costs and profit shall be prorated to each item so that the total of the prices for all items equal the lump sum price. At the discretion of the City, mobilization, bond and insurance costs may be provided for separately if accompanied by invoices to verify actual expenses.

The cost breakdown shall be generally in the same format as the Contract specifications divisions and subdivisions, with major items of work listed individually. The cost breakdown shall be by structure, civil, landscaping, or other logical division of work. The cost breakdown for architectural, structural, mechanical, and electrical work shall include separate items for identifiable portions of the Work. The cost breakdown shall include separate allowances for any testing and startup work required. Measurable approximate quantities of work performed by the Contractor or its subcontractors shall be provided. For quantities that are the sum total of several individual quantities, backup summaries shall be provided which list the individual descriptions and quantities. These summaries then will be used to determine the quantities of work in place in subsequent progress payment requests.

The above is a statement of the intent of the Contract Documents to provide a moderate level of detail, acceptable to the City, to allow a fair and reasonable estimate to be made of the value of work installed. The detail of the cost breakdown must be sufficient to provide timely processing of the monthly progress payment request.

The cost breakdown will be subject to the approval of the City, and upon request, the Contractor shall substantiate the price for any or all items and provide additional level of detail, including quantities of work. The cost breakdown shall be sufficiently detailed to permit its use by the City as

one of the bases for evaluating requests for payments. The City shall be the sole judge of the adequacy of the cost breakdown.

The cost breakdown shall be solely used to determine progress payments. The cost breakdown shall not be considered in determining payment or credit for additional or deleted work.

END OF SECTION

SECTION 02050 SITE DEMOLITION

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, equipment, facilities, transportation and services necessary to complete demolition as shown on the Drawings and/or specified herein.

B. The general extent of the site demolition work is shown on the Drawings and can include, but is not necessary limited to the following:

1. Demolition, removal and disposal of designated items.
2. Careful removal and salvage of designated items.
3. Disconnection and capping of existing utility lines.
4. Incidental demolition of abandoned utility lines.
5. Protection of existing plant material.
6. Implementation of temporary erosion control measures and construction Best Management Practices (BMP) in accordance with current regulations.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Sections 01530 and 02223

1.3 STANDARD SPECIFICATIONS

Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the Standard Specifications for Public Works Construction (SSPWC).

1.4 SUBMITTALS

A. Indicate the proposed time line for site demolition work including all required shut off times and capping of utility services on the project schedule.

B. Submit a written description of all proposed salvage, demolition and removal procedures for review before work is started. Procedures shall include:

1. List of items to be removed and disposition of materials specified to be salvaged.
2. Plan of coordination with other work in progress.
3. Disconnection schedule of utility services.
4. Detailed description of methods and equipment to be used for each operation.
5. Sequence of operations.

C. Submit a stormwater pollution control plan for review and approval prior to construction.

PART 2 MATERIALS

Not used.

PART 3 EXECUTION

3.1 GENERAL

Structures shall be demolished and removed in compliance with SSPWC subsection 306-5 and the requirements indicated herein. Refer to Drawings for extent of demolition work.

3.2 POLLUTION CONTROL

A. Storm water pollution control shall be executed per the approved storm water pollution control plan, including but not limited to the implementation of temporary erosion control measures and construction BMPs.

B. Water sprinkling, temporary enclosures, chutes, and other suitable methods as approved by the City shall be used for dust suppression.

C. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.3 PROTECTION

A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities in compliance with Section 01530.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary and in accordance with Section 01530. Any existing item or area damaged during construction operations shall be replaced or repaired at no additional cost to the project and subject to the acceptance of the Owner.

D. Unless otherwise indicated, the Contractor shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. Erect barriers, fences, guard rails, enclosures, chute, and shoring as necessary to protect personnel, structures, and utilities remaining intact.

F. Coordinate arrangements for items to be salvaged and turned over to the City.

G. The Contractor shall protect the nearby existing equipment such as control panels and others from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.4 STRUCTURE DEMOLITION

A. Building structures and appurtenances shall be demolished, as shown and required to complete work, in compliance with governing regulations.

B. Small structures may be removed intact when approved by authorities having jurisdiction.

C. Demolition shall proceed in a systematic manner, from top of structure to ground.

D. Concrete and masonry shall be demolished in small sections. Use bracing and shoring to prevent collapse.

E. Demolition equipment shall be dispersed throughout structure and demolished materials removed to prevent excessive loads on supporting walls, floors or framing.

3.5 BELOW-GRADE DEMOLITION

A. Footings, foundation walls, below-grade construction and concrete slabs on grade shall be demolished and removed to a depth which will not interfere with new construction, but not less than 12 inches below existing ground surface or future ground surface, whichever is lower. All floors of basements, vaults and other underground structures shall be broken up.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum compaction of 95%.

C. All fill and compaction shall be in accordance with Section 02223.

D. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.6 DEMOLITION OF UTILITIES AND RELATED EQUIPMENT

A. The locations of existing utilities, as may be shown on the Drawings, are approximate. Should existing utilities not shown on the Drawings be encountered during construction operations, notify the City immediately, and re-direct work to avoid delay. The City shall then determine what action, if any, is required.

B. Remove all abandoned utilities as indicated and as uncovered by the work, and terminate in a manner conforming to code.

C. Remove and salvage designated items and related equipment and deliver to a location acceptable to the City.

D. All active or inactive utilities within the construction area should be protected, relocated, or abandoned. Any underground pipes greater than two inches in diameter to be abandoned within new improvement areas should be removed, and the exposed portion of pipes at the limits of pipe removal should be capped. Existing pipes greater than two inches in diameter may be abandoned in-place by filling them with lean cement slurry.

E. Remove underground piping as indicated, or as necessary and backfill to designated compaction density. Caution shall be exercised so as not to damage underground piping not scheduled for removal.

F. Lines scheduled for removal which connect to active systems shall have their active remaining portions capped, plugged, or blind flanged as appropriate.

G. Materials used for pipe terminations and temporary connections shall be the same as existing lines. Fittings and flanges shall be of weight and class suitable for the service in which used.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the Owner. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish, and other materials resulting from demolition operations shall be removed and disposed of in compliance with all laws and regulations. Burning of removed materials from demolished structures shall not be permitted.

3.8 CLEANING

A. During and upon completion of work, the Contractor shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a clean condition.

B. Clean adjacent structures and facilities of dust, dirt, and debris caused by demolition and return adjacent areas to condition existing prior to start of work.

END OF SECTION

SECTION 02223 TRENCHING, EXCAVATION, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.1 DESCRIPTION

This section includes materials, testing, and installation for trench excavation, backfill, and compaction of piping, conduit, manholes, and vaults.

1.2 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM C 131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 150 - Portland Cement
ASTM D 75 - Practice for Sampling Aggregates
ASTM 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557 - Test Method for Moisture-Density Relations of Soils Using a Modified Effort
ASTM D 2419 - Test Method for Sand Equivalent Values of Soil and Fine Aggregate
ASTM D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods
ASTM D 3776 - Test Method for Mass Per Unit Area (Weight) of Woven Fabric
ASTM D 4253 - Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Plate
ASTM D 4254 - Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751 - Test Method for Determining the Apparent Opening Size of a Geotextile
CAL-OSHA - Title 8 General Industry Safety Orders

1.3 RELATED WORK SPECIFIED ELSEWHERE

Standard Specifications 15000, 15044, and 15061.

1.4 GEOTECHNICAL TESTING

The Contractor shall engage the services of a geotechnical engineering firm or individual licensed in the State of California to monitor soil conditions during earthwork, trenching, bedding, backfill, and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards and as follows:

A. The soils technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.

B. Density and optimum moisture content of soil shall be determined by the use of the sand cone method, ASTM D 1556, or nuclear density gauge method, ASTM D 2922 & D 3017. Since the composition of the pipe and the walls of the trench have an effect on the nuclear density gauge output, a minimum of 25% of the density and optimum moisture tests shall be made using the sand cone method.

C. Determine laboratory moisture-density relations of existing soil by ASTM D 1557, Method C and/or D.

D. Determine the relative density of cohesion less soils by ASTM D 1557, Method C and/or D.

E. Sample backfill material by ASTM D 75.

F. Express "relative compaction" as a percentage of the ratio of the in-place dry density to the laboratory maximum dry density.

A report of all soils tests performed shall be stamped and signed by the soils firm or individual and shall be submitted by the Contractor prior to the filling of the Notice of Completion by the City. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

1.5 PIPE ZONE

The pipe zone includes the full-width of the trench from 6-inches below the bottom of the pipe to 12-inches above the top of the pipe and extends into manhole or vault excavations to the point of connection to or penetration of such structure.

1.6 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the pavement zone in paved areas, or to the existing surface in unpaved areas, and extends into manhole or vault excavations above the pipe zone.

1.7 PAVEMENT ZONE

The pavement zone includes the concrete or asphalt concrete pavement and aggregate base section placed over the trench zone and extends into manhole or vault excavations above the trench zone.

1.8 PROTECTION OF EXISTING UTILITIES AND FACILITIES

The Contractor shall be responsible for the care and protection of all existing utilities, facilities, and structures that may be encountered in or near the area of the work.

1.9 PROTECTION OF EXISTING LANDSCAPING

The Contractor shall be responsible for the protection of all the trees, shrubs, fences, and other landscape items adjacent to or within the work area.

1.10 ACCESS

The Contractor shall provide continuous, unobstructed access to all driveways, water valves, hydrants, or other property or facilities within or adjacent to the work areas.

1.11 SAFETY

A. Protection of workers within trenches shall be as required by the California Labor Code.

B. All excavations shall be performed in a safe manner and shall be protected and supported in accordance with CAL-OSHA regulations.

C. Barriers and traffic delineators shall be placed in accordance with the requirements of the agency having jurisdiction.

1.12 BLASTING

Blasting for excavation shall not be performed without the written permission of the City Procedures and methods of blasting shall conform to all Federal, State, and local laws and ordinances.

1.13 PIPE JACKING

Pipe jacking may be permitted in accordance with Section 15125. City approval is required in advance of such operations.

1.14 EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and legally dispose of all excess excavated material and demolition debris.

B. It is the intent of these specifications that all surplus material shall be legally disposed of by the Contractor. Before acceptance of the work by City, the Contractor shall provide the City with written releases signed by all property owners with whom the Contractor has entered into agreements for disposing of excess excavated material, absolving the City from any liability connected therewith.

1.15 CHANGES IN LINE AND GRADE

In the event obstructions not shown on the plans are encountered during the progress of the work, and which will require alterations to the plans, the Engineer shall have the authority to change the plans and order the necessary deviation from the line and grade. The Contractor shall not deviate from the specified line and grade without prior written approval by the City.

1.16 HYDROSTATIC TESTING

Pre-testing of the piping system may be performed for the Contractor's convenience at any time. However, the final hydrostatic pressure test, as described in Section 15044, shall be performed following the completion of all backfilling and trench zone compaction with a minimum of 2.5-feet of material over the pipe.

PART 2 MATERIALS

2.1 GENERAL

The Contractor shall furnish backfill material as specified below. All materials used in and above the pipe zone shall be capable of attaining the required relative density.

2.2 IMPORTED SAND – PIPE ZONE

Imported sand shall be used within the Pipe Zone for installations of PVC Pressure Pipe, Ductile-Iron Pipe, Cement-Mortar Coated Steel Pipe, Tape-Wrapped Steel Pipe, and Paint-Coated Pipe.

A. Imported sand shall be free from clay balls, organic matter, and other deleterious substances and shall have a coefficient of permeability greater than 0.014 measured in accordance with ASTM D2434 or a sand equivalent of greater than 30 per ASTM D2419.

B. Resistivity for imported sand shall be not less than 2,000 ohm-cm when maximum chloride concentration of 200 mg/l when measured in accordance with California Test Method 422 and a maximum sulfate concentration of 500mg/l when measures in accordance with California Test Method 417.

C. Imported Sand shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
½ inch	100
No. 4	75-100
No. 16	35-75
No. 50	10-40
No. 200	0-10

2.3 CRUSHED ROCK – PIPE ZONE

Crushed Rock shall be used in the Pipe Zone on PVC Gravity Sewer Pipe. Crushed rock shall be clean, crushed stone free of organic matter. Crushed rock shall be certified to contain less than 1% asbestos by weight or volume and shall conform to the following gradation and requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
1-Inch	100
3/4-Inch	90-100
1/2-Inch	30-60
3/8-Inch	0-20
No. 4	0-5
No. 8	---
ASTM C 131 Testing Grade	B

Test	Test Method	Requirement
Percentage Wear	ASTM C 131	---
100 Revolutions	---	15 Maximum
500 Revolutions	---	52 Maximum

2.4 TRENCH PLUGS

Trench plugs consisting of compacted Imported Granular Material or sand cement slurry shall be installed on piping systems that are backfilled with crushed rock.

2. 5 EARTH BACKFILL MATERIAL – TRENCH ZONE

A. Earth backfill is defined as materials removed from the required excavations and used as backfill of earth fill. Earth backfill that meets the requirements specified herein may be used for all backfill or fill, except where imported materials are shown on the Plans or specified herein. Do not use stockpiled topsoil for backfill or fill.

B. Earth backfill shall be excavated materials that are free from organic matter, roots, debris, and rocks larger than 4 inches in the greatest dimension.

C. Earth backfill used in the trench zone shall be native granular materials free from roots, debris, and organic matter with less than 50 percent passing the No. 200 sieve and more than 40 percent passing the No. 4 sieve and rock particles with a maximum dimension no greater than 4 inches.

D. Where the onsite materials are determined by the Engineer to be unsuitable, imported fill shall be provide by the Contractor.

2.6 SAND-CEMENT SLURRY

Sand-cement slurry shall consist of two sacks, 188 pounds, of Portland cement per cubic yard of sand and sufficient moisture for workability. City approval is required for use of slurry as a backfill material.

2.7 FILTER FABRIC

Filter fabric shall be manufactured from polyester, nylon, or polypropylene. Material shall be of non-woven construction and shall meet the following requirements:

Grab tensile strength (ASTM D 4632):	100 lbs. minimum for a 1-inch raveled strip
Weight (ASTM D 3776):	4.5 oz./yd^2)
Apparent opening size (ASTM D 4751):	0.006-inch

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

A. Areas where work is to be performed shall be cleared of all trees, shrubs, rubbish, and other objectionable material of any kind, which, if left in place, would interfere with the proper performance or completion of the completed work, would impair its subsequent use, or would form obstructions therein.

B. Organic material from clearing and grubbing operations will not be incorporated in the trench backfill and shall be removed from the project site or retained and incorporated into the topsoil.

3.2 PAVEMENT, CURB, AND SIDEWALK REMOVAL

Bituminous or concrete pavements, curbs, and sidewalks shall be removed and replaced in accordance with the requirements of the agency having jurisdiction.

3.3 DEWATERING

A. The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering excavations or other parts of the work. Dewatering shall be performed by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Dewatering methods may include well points, sump points, suitable rock or gravel placed as pipe bedding for drainage and pumping, temporary pipelines, or other means, all subject to the approval of the City. The cost of all dewatering activities shall be borne by the Developer or Contractor.

B. Sewer systems shall not be used as drains for dewatering trenches or excavations, nor for disposal of collected or accumulated groundcover, without the approval of the agency of jurisdiction.

C. Concrete shall not be poured in water, nor shall water be allowed to rise around concrete or mortar until it has set at least four hours.

D. The Contractor is responsible for meeting all Federal, State, and local laws, rules, and regulations regarding the treatment and disposal of water from dewatering operations at the construction site.

3.4 SHORING AND SHIELDING

A. The Contractor's design and installation of shoring shall be consistent with the rules, orders, and regulations of CAL-OSHA.

B. Excavations shall be shored, sheeted, and supported such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.

C. The sheeting and shoring shall be arranged so as not to place any stress on portions of the completed work until the general construction has proceeded far enough to provide ample strength.

D. Care shall be exercised in the moving or removal of trench shields, sheeting, and shoring to prevent the caving or collapse of the excavation faces being supported.

3.5 CORRECTION OF OVEREXCAVATION

Over-excavations shall be corrected by backfilling with approved imported granular material or crushed rock, compacted to 90% relative compaction, as directed by the City.

3.6 FOUNDATION STABILIZATION

A. When unsuitable soil materials are encountered, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Technician, and as acceptable to the City. The sub-grade shall be restored with compacted Imported Granular Material or crushed rock as recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

B. When rock encroachment is encountered, the rock shall be removed to a point below the intended trench or excavation sub-grade as determined necessary in the field by the Soils Technician, and as acceptable to the City. The sub-grade shall be restored with compacted Imported Granular Material as recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

C. When excessively wet, soft, spongy, or similarly unstable material is encountered at the surface upon which the bedding or base material is to be placed, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Technician, and as acceptable to the City. Restore the trench with crushed rock enclosed in filter fabric as directed by the Engineer. Larger size rocks, up to 3-inches, with appropriate gradation, may be used if recommended by the Soils Technician. Place the appropriate bedding or base material on this restored foundation.

3.7 TRENCH EXCAVATION AND PLACEMENT OF BEDDING

A. Excavate the trench to the lines and grades shown on the drawings with allowance for 6-inches of pipe bedding material. The trench section shall be as shown on the Standard Drawings.

B. The maximum length of open trench shall be 500-feet except by permission of the City or County. The distance is the collective length at any location, including open excavation and pipe laying, which has not been backfilled to the elevation of the surrounding gate.

C. Trench walls shall be sloped or shored per the requirements of CAL-OSHA.

D. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions.

E. Place the specified thickness of bedding material over the full width of the trench. Grade the top of the pipe base ahead of the pipe laying to provide a firm, uniform support along the full length of pipe.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

G. Trenches for main pipelines and all appurtenances shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone, and Pavement Zone.

H. Trench widths shall be in accordance with the Standard Drawings.

I. Trench depth shall be as required to install pipelines in accordance with the Approved Plans and these Standard Specifications. Unless shown otherwise in the Approved Plans, the minimum cover for pipelines shall be as follows:

Pipeline Application	Minimum Cover Required
Potable Water	36-inches
Recycled Water	48-inches
Sewer	60-inches

3.8 MANHOLE AND VAULTS

A. The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations. The walls of the excavation shall be sloped or shored per the requirements of CAL-OSHA.

B. Manholes and vaults shall be placed at the location and elevation shown on the plans, on undisturbed soil with 6-inches of compacted crushed rock base.

C. Manhole and vault excavations shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone, and Pavement Zone.

3.9 COMPACTION REQUIREMENTS

A. Compaction shall be accomplished by mechanical means. Consolidation by water settling methods such as jetting or flooding is prohibited.

B. If the backfill fails to meet the specified relative compaction requirements, the backfill shall be reworked until the requirements are met. All necessary excavations for density tests shall be made as directed by the Soils Technician, and as acceptable to the Engineer. The requirements of the Agency having jurisdiction shall prevail on all public roads.

C. Compaction tests shall be performed at random depths, and at random intervals not to exceed 150-feet, as directed by the Soils Technician or City.

D. Relative compaction shall be determined by the impact or field compaction test made in accordance with ASTM D 1557 Procedure C.

E. Unless otherwise shown on the plans, standard drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

1. Pipe zone – 90% relative compaction.

2. Trench zone – 90% relative compaction.

3. Structural section in paved areas – per agency requirements, 95% minimum.

4. Imported Granular Material for over excavation or foundation stabilization – 90% relative density.

F. All excavations are subject to compaction tests.

3.10 TRENCH PLUGS

Trench plugs shall be installed at 200-foot intervals along the entire length of piping systems. Trench plugs shall be 10-feet in length and shall encompass the entire pipe zone. Additional trench plugs may be required as directed by the Engineer.

3.11 PIPE ZONE BACKFILL

A. Care shall be taken in placing the imported granular backfill material simultaneously around the main pipeline and appurtenance pipes so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe or on the sides of the pipe. Care shall be taken to place material simultaneously on both sides of the pipe to prevent lateral movement. This area shall be mechanically compacted to attain 90% relative density. Care shall be taken when compacting appurtenance laterals 2-inches and smaller to prevent the crushing or denting of the copper lateral. Additional lifts of 12-inches or less thickness may be required on 16-inch or larger diameter pipe to attain complete support of the haunch area. Soils tests may be taken on this layer or backfill.

B. After the spring line backfill has been approved by the Soils Technician, backfill of the remainder of the Pipe Zone may proceed. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

C. Place and compact the imported granular material at a maximum of 12-inch lifts. Compact all material placed in the Pipe Zone by mechanical methods. Sand cone tests shall be taken on this layer of backfill.

D. The use of a backhoe mounted compaction wheel is prohibited within the pipe zone to 12-inches above the top of the pipe.

E. Under no circumstances shall consolidation by water settling or water-setting methods (i.e., jetting, diking, etc.) be permitted.

3.12 TRENCH ZONE BACKFILL

A. After the Pipe Zone material has been placed, compacted, approved by the Soil Technician, and accepted by the City, backfill in the Trench Zone may proceed.

B. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be performed with the type and size of equipment necessary to accomplish the work. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density. The Contractor shall repair or replace any pipe, fitting, manhole, or structure damaged by the installation operations as directed by the City.

3.13 PAVEMENT ZONE BACKFILL AND RESTORATION

A. After the Trench Zone material has been placed, compacted, approved by the Soil Technician, and accepted by the City, backfill in the Pavement Zone may proceed as necessary in accordance with the requirements of the agency having jurisdiction.

B. Replace bituminous and concrete pavement, curbs, and sidewalks removed or damaged during construction in accordance with the requirements of the agency having jurisdiction.

END OF SECTION

SECTION 02999 – TEMPORARY SEWAGE BYPASS SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Performance Requirements:

1. It is essential to the operation of the existing sewage system that there be no interruption in the flow of sewage throughout the duration of the Project. Provide, maintain, and operate all temporary facilities such as dams, plugs, flow-through plugs, pumping equipment (both primary and backup units as required), conduits, and all necessary power to intercept the sewage flow before it reaches the point where it would interfere with the Work, carry it past the Work, and return it to the existing sewer downstream of the Work.

2. Design, install, and operate the temporary pumping systems where required.

3. Convey the sewage safely past this Work area. Do not stop or impede the main flows under any circumstances.

4. Maintain sewage flow around the Work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage and flooding, including the routing of sewage overflow in the event of failure of any bypass system.

5. Protect water resources, wetlands, and other natural resources.

6. The Contractor is responsible to have qualified personnel to oversee the bypass pumping operations 24 hours per day, 7 days per week, including holidays.

B. Design Requirements:

1. Provide flow through plugs, pumps of adequate size to handle peak flow per Section 1.5 below, and/or temporary discharge piping, to ensure that the total flow of the various pipelines and service connections can be safely diverted around the sections to be rehabilitated.

2. Install a total of two (2) pumps where pumping is required, each of which shall be capable of pumping the total contributing flows (100 percent redundancy). All pumps shall be online, isolated by individual valves, and be ready for use within five minutes in the event of an emergency or breakdown of an on-line pump.

3. Engine-driven pumps and pump equipment used shall be in accordance with Rule 11, Exemptions (from permits), Section d.2.i (https://www.sandiegocounty.gov/content/sdc/apcd/en/Rule_Development/Rules_and_Regulations/) and shall be equipped with a brake horsepower rating of less than 50. Contractor shall be responsible for adhering to SDAPCD requirements and shall be responsible for any SDAPCD permitting costs. The Contractor shall be responsible for any resulting costs of non-compliance with SDAPCD requirements.

4. Provide onsite portable lights for emergency use only.

5. Provide standby power facilities for emergency use if pumps are equipped with electric motors.

6. Flow bypass systems shall be designed by a CA registered professional engineer.

7. Contractor shall provide pipeline plugs as necessary for all shutdowns, temporary bypass operations, or where handling of upstream flows is proposed in lieu of or in addition to bypass pumping.

8. Contractor shall provide noise dampening devices for the bypass pumps to meet the noise attenuation requirements for the City.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All Work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these Specifications.

B. Comply with the applicable editions of the following codes, regulations and standards.

1. Codes and Regulations:

SDAPCD	San Diego County Air Pollution Control District

2. Industrial Standards:

ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
SSPWC	Standard Specifications for Public Works Construction, "Greenbook"

C. Comply with laws and regulations of the applicable federal, state, county, city, and special district jurisdictions, which includes, but is not limited to, the following:

1. Regional Water Quality Control Board, San Diego Region (RWQCB)

2. California Department of Public Health

3. San Diego County Air Pollution Control District (SDAPCD)

4. City of Carlsbad

D. Comply with the applicable reference Specifications as directed in the General Conditions.

1.3 SUBMITTALS

A. Detailed plans and descriptions outlining complete flow bypass pumping system for flow rerouting. Bypass system plan shall include an emergency response plan to be followed in the event of a failure of the bypass system, and shall outline in detail the proposed sequencing for all proposed system outages, system startup and switchovers, including time of day and amount of time required, and emergency response details regarding personnel involved and cleanup procedures as applicable. All plans shall be submitted to the Engineer at least 10 working days prior to required operation of bypass system. All plans shall be stamped and signed by a CA registered professional engineer. System outages are not permitted.

B. The Plans shall also include containment areas, location and type of manhole level sensors, and locations of support equipment such as control panels and standby power if required. Identify any proposed changes from the information shown in the Contract Documents and bypass plans for the temporary handling of sewage flow.

C. Where pumping is required, submit complete information on pumping system. Location for temporary pumps, pipe routing, manhole tie in locations, and pumping and flow handling methods shall be submitted with bypass system plan. If flow handling without a bypass system (i.e., plugging upstream pipelines and utilizing a combo truck to capture upstream flows) is proposed, Contractor shall provide sufficient detail in the bypass system plan for the complete operation of the flow handling scheme.

D. Where standby generators are required, submit complete information on generation system.

E. All bypass pumping equipment shall be rated for low noise rate compliance. If pumping is required outside normal working hours, generators shall be “Whisper Quiet” and rated for low noise rate compliance in commercial neighborhoods and per City of Carlsbad code. Generators shall not produce noise such that a reasonable person of normal sensitiveness residing in the work area is caused discomfort or annoyance. The Contractor shall submit proposed equipment, inclusive of dBA ratings to the Engineer for approval prior to use.

F. Provide emergency contact names and phone numbers of Contractor’s supervisor and personnel qualified to remediate any disruption in bypass pumping operations.

G. The Contractor shall provide all necessary means to safely convey the sewage past the work area.

H. The Contractor shall immediately notify the CITY should a sanitary sewer overflow (SSO) occur and take the necessary action to clean up and disinfect the spillage to the satisfaction of the CITY and/or other governmental agency. If sewage is spilled into public or private property, the Contractor shall wash down, clean up, and disinfect the spillage to the satisfaction of the property owner, CITY, and/or other governmental agency.

1.4 QUALITY ASSURANCE

A. General:

1. Comply with the requirements specified herein and the applicable reference sections of the General Requirements and Additional General Requirements.

B. Contractor Qualifications:

1. Comply with the requirements for the certifications, licenses, training, skills, experience, and other qualifications specified in Part 1 of this Specification.

2. The bypass CONTRACTOR shall have a minimum of five (5) years of experience in temporary handling of sewage flows in projects of similar size and nature.

C. Contractor to be completely responsible for any overflow or spillage of raw sewage due to failure of any bypass system.

D. Contractor to pay any fines or costs associated with such spillages.

E. Contractor to be responsible for any cleanup or restoration resulting from such spillages.

F. Contractor shall demonstrate that flow bypass system performs in conformance with these requirements prior to putting into use. Demonstration shall require CITY concurrence for proper operations.

G. Contractor shall provide flow bypass around the section of pipe designated for rehabilitation. The bypass system shall be made by plugging the line at an existing upstream manhole(s) and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow.

1.5 FLOWS

A. Considerations for project area flow bypass / handling setup are provided below. It is the Contractor's responsibility to review the various considerations for project setup and execution for the preparation of the bypass system plan/submittal.

1. Bypass pumping system located at the two (2) upstream manholes of the wet well shall be capable of conveying up to 110 gallons per minute (gpm) peak flow and 60 gpm average flow.

1.6 CONTINGENCY

A. During the startup of and/or switchover from a flow bypass system, Contractor shall have tanker trucks available onsite, as a contingency for collection of flows. Size and number of trucks shall be adequate to contain and dispose of all sewage in the case of bypass failure. Tanker trucks may be emptied at an approved location. Tanker trucks may also be used as part of the flow handling approach. Use of tanker trucks, and contingency equipment and approach shall be specifically addressed in the Bypass System Plan submittal.

PART 2 - PRODUCTS

2.1 PUMP SYSTEMS

A. Pumps may be gas, electric, or diesel powered.

B. Pumps may be end suction or submersible.

C. Temporary K-rails, fencing, gates, locks and screening shall be provided to protect and screen the pump system and equipment within the roadway from the public. Contractor shall provide the CITY with keys to locks.

D. Bypass duty and standby pumps shall be designed for raw sewage applications, resistant to ragging, and capable of passing a 3-inch solid sphere. Pumps shall be self-priming with suction lift sufficient to avoid sewer surcharge. The self-priming system shall allow the pumps to start dry and run dry without causing damage. Pumps may be equipped with a vacuum-assisted self-priming device. Any orifice designed to discharge air during pump priming shall be connected to a portable activated carbon scrubber or shall be equipped with a designated activated carbon scrubber such that the discharged air does not exceed a concentration of hydrogen sulfide equivalent (HSE) in the foul air of 10 parts per billion by volume (ppbv), as measured at locations ten (10) feet downwind from the bypass pump and discharge manhole.

E. All engines and pumps shall be critically silenced for sound control in such a manner that the maximum noise level does not exceed 65 db within 5 feet of the bypass equipment.

F. Pumps shall have a minimum total dynamic head (TDH) and flow capacities to meet the flow and lift requirements shown on the Drawings.

G. In calculating the total dynamic head (TDH), the maximum C value permitted is one hundred twenty (120) for steel or aluminum pipe, and one hundred forty (140) for plastic pipe. Minor losses and suction pipe losses shall be included in TDH calculations.

H. Pumps shall be capable of readily starting up after a non-operational period during low-flow conditions and be capable of operating twenty-four (24) hours per day, while handling the full range of flows.

I. 100 percent standby pumping shall be provided. Standby pump(s) shall be sized to match the duty pump(s).Standby pumping equipment shall be at the site continuously during bypassing to provide standby pumping capacity.

J. Standby pumping equipment shall be fully connected to the suction (as applicable) and discharge piping of the duty pumps so the system is available at any time.

K. Each electrically powered pumping unit setup shall be supplied with a backup power supply fully capable to run the connected pumping units.

L. Electrically powered standby pumps shall be fully connected to the provided power supplies (primary and backup) so the system is available at any time.

2.2 BYPASS PIPING

A. General:

1. Bypass piping shall be rubber gasketed with a minimum pressure rating of 200 psi and no visible leaks under operating conditions. Bypass piping shall be yelomine pipe or approved equal. Alternatively, fused/jointless HDPE or equal is allowed. Aluminum pipe is not allowed.

2. Pipe supports, thrust restraints, and valves shall be provided, including an air valve at the high point. Piping shall be sufficiently restrained and supported to prevent movement during pump cycling. For protection against damage, the above ground bypass pipe shall be protected in place by concrete K-rail with screens or plywood barriers. Buried piping shall be capable of traffic loading. Piping buried in recessed trenches with pinned or anchored trench plates shall be flush with existing grade.

3. Any costs for cutting and restoring AC paving, curb and gutters, driveways and sidewalk to install the bypass piping shall be included in the Bid

4. Any costs for removal and replacing of landscaping as required by temporary system piping location shall be included in the Bid.

B. Suction Pipes

1. Suction pipes shall be sized per the anticipated dry/wet weather flows as shown on the Drawings and shall not be smaller than the pump intake. Suction pipes shall not cause a restriction in the flow.

2. CONTRACTOR is responsible to determine adequate pump on/off cycles and surcharge level in the manhole. Contractor is responsible and shall provide a statement accepting full responsibility and liability for damage to upstream properties due to backflow during bypassing.

C. Discharge Pipes

1. Discharge piping that crosses roads shall be routed below grade and protected.

2. Discharge pipes shall be sized per the anticipated dry/wet weather flows as shown on the Drawings or specified herein.

3. Where the bypass piping discharges into a manhole, the discharge pipe shall extend into the manhole, ending at the elevation of the center of the trunk sewer.

2.3 TEMPORARY PLUGGING OF SEWER

A. Plugs shall be appropriate for the application. The plug length shall be suitable for the specific application.

B. Plugs shall be a heavy-duty inflatable type with a steel rod through plug centerline, a retaining plate and an eye-lift on both ends.

C. Plugs shall be new, and shall show no cracks and/or signs of damage. The plugs shall have a flexible sealing design to compensate for any irregular interior surface of the pipe.

D. Plugs shall be equipped with continuous pressure monitoring. A pressure alarm shall be provided for plugs that will cause a sewage spill in the event there is a failure. The alarm shall occur when the pressure drops below the minimum pressure recommended by the manufacturer. The low-pressure signal shall be connected to an audible alarm and light. Alarm circuit shall be intrinsically safe suitable for a Class I, Division 1 environment. The installed pressure shall be as recommended by the manufacturer for the application.

1. Pressure gauge, if using a pneumatic plug, shall be visible form the surface.

E. The eye-lifts shall be secured to a 5/8-inch diameter stainless steel pulling cable accessible for removal without entry.

F. Inflatable flow-through plugs shall be installed immediately upstream of the dry manhole to aid emergency removal of the plug.

G. Provide a double block and bleed to protect workers per OSHA where required.

H. Plug seating areas shall be cleaned prior to installation from grit, grease, and other materials and shall be restrained with metal cable 2 times greater in strength than the load on the plug.

2.4 MANHOLE LEVEL SENSORS WITH ALARM

A. Each bypass pumping suction manhole shall be fitted with a level monitoring system connected to an audible alarm and light to monitor the water level during bypass pumping operations.

B. The level shall be monitored by a float, ultrasonic level device, radar level device or other means suitable for monitoring sewage level.

C. The level device shall be installed directly below manhole opening for inspection and maintenance.

D. Sensor shall be suitable for a Class I, Division 1 environment. Alarm circuit shall be intrinsically safe suitable for a Class I, Division 1 environment.

E. Level shall be set to indicate a pumping failure as early as possible. Mounting height of the level sensor shall be acceptable to the ENGINEER.

2.5 AUTODIALER

A. All alarms shall be transmitted to the CONTRACTOR (Phone number to be provided after kickoff) with an autodialer using cellular communications. The alarm shall inform the CONTRACTOR based on the CITY's assigned MH identification system. The CONTRACTOR is responsible for responding to all alarms related to the temporary sewage bypass system

2.6 CONTROL POWER

A. Ensure that sensors and appurtenances have a continuous and reliable power source.

B. Provide a continuous control power source for the alarm indicating lights, level controls, audible alarms, and autodialer.

C. If a standby generator is provided, then the generator shall meet the noise requirements per the Contract Documents. All requirements for power distribution shall be provided.

2.7 TEMPORARY ENGINE-GENERATOR SET(S)

A. Furnish and connect temporary diesel-fueled generator set(s) to provide a temporary power source(s) as required.

1. For each set, provide a fuel tank containing no less than the one hundred fifty percent (150%) of the set's full day usage.

2. Provide proper grounding for each fuel tank and each generator set.

3. Verify and comply with any City/local jurisdiction permit requirements for fuel delivery and onsite fuel storage.

B. For each diesel-fueled generator set, pre-wire a single Form "C" dry contact, rated 2 A, 250 V ac, for each of the following two (2) signals, to an external terminal block located in a readily accessible NEMA 4X terminal box mounted at the set:

1. A TROUBLE combined alarm signal that includes the following:

   a. Diesel-fueled generator set malfunction.

   b. Low fuel level (less than twenty-five percent (25%) of the fuel tank).

2. Generator RUN status.

C. Provide automatic remote dialing to notify CONTRACTOR's designated personnel of the diesel-fueled generator set alarm conditions specified herein.

D. Ensure reliable operation and required availability of the diesel-fueled generator set(s) by performing the following:

1. Inspect the set and its components at least once a day, including both working and non-working days.

2. Continuously monitor fuel availability to each diesel-fueled generator set. Fill up the fuel tank to the maximum allowable tank capacity, at least once a day, including both working and non-working days.

E. Coordinate with the ENGINEER the following activities related to the diesel-fueled generator set's external alarm and status wiring:

1. The alarm and status signals shall use the autodialer.

PART 3 - EXECUTION

3.1 GENERAL

A. If pumping is required across a street or driveway that cannot be closed to traffic, the discharge piping shall be:

1. Temporarily buried, backfilled, and paved.

2. Ramps adequate to allow crossing by traffic may be used only during work hours when the Contractor is on the project site. Collapsible conduit shall not be allowed.

B. Bypass pumping and flow diversion shall be monitored at all times by a competent person trained with operating the pumping equipment.

C. Rehabilitated pipelines may be utilized to convey sewage prior to final acceptance, provided all pipe and structures downstream have been tested, cleaned, inspected, and accepted.

D. Contractor shall conform to all State safety precautions and provisions pertaining to confined space entry when entering any manhole.

E. All bypassing will require coordination with CITY staff at least 48 hours in advance. System outages are not permitted.

F. If more than one generator is in operation, provide a minimum spacing of 50 feet between generators.

G. A conceptual bypass Work plan is included in Appendix A below.

3.2 FIELD QUALITY CONTROL

A. Test and commission the flow bypass system to ensure proper operation and confirm there is no leakage. The testing and commissioning shall be acceptable to the Engineer before placing the flow bypass system online and starting any sewer rehabilitation activities. When pumping is utilized and as soon as the bypass system is proved to be operating as specified, the Contractor shall stop the pump(s) and install and operate each standby pump to test its capability and establish a switchover time.

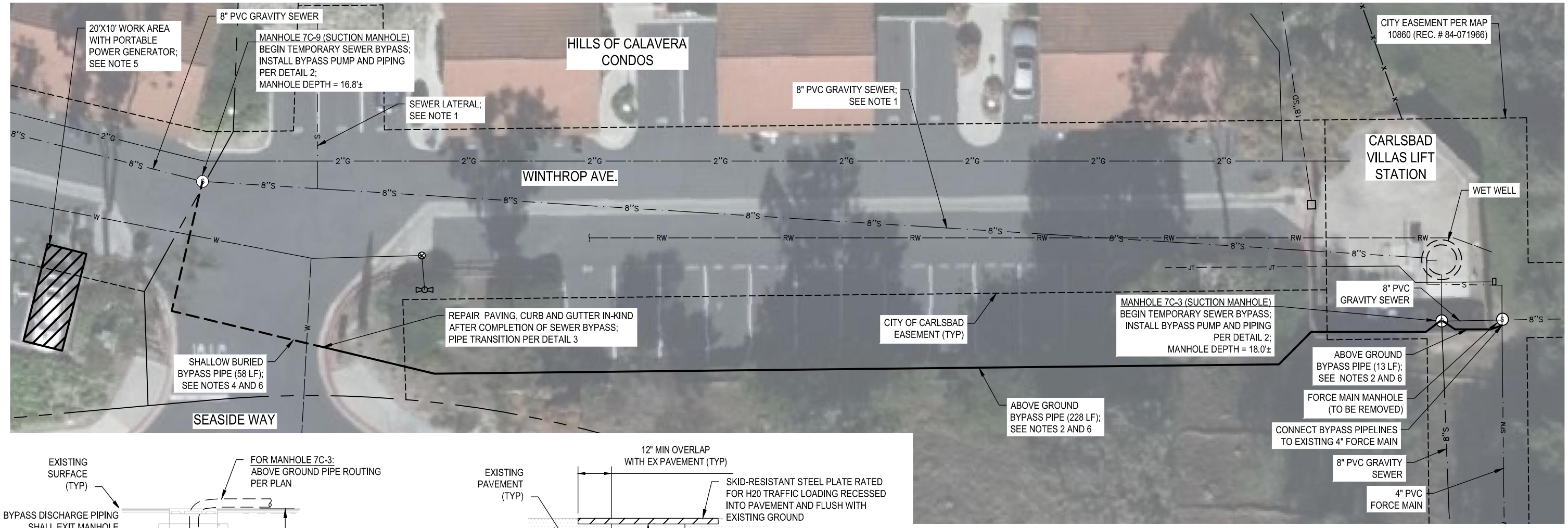
B. Each temporary pump, generator set, and engine driven equipment shall be logged and documentation shall be submitted with the following; date of delivery to the site, run time of equipment while on site (number of hours), date of removal of equipment from site.

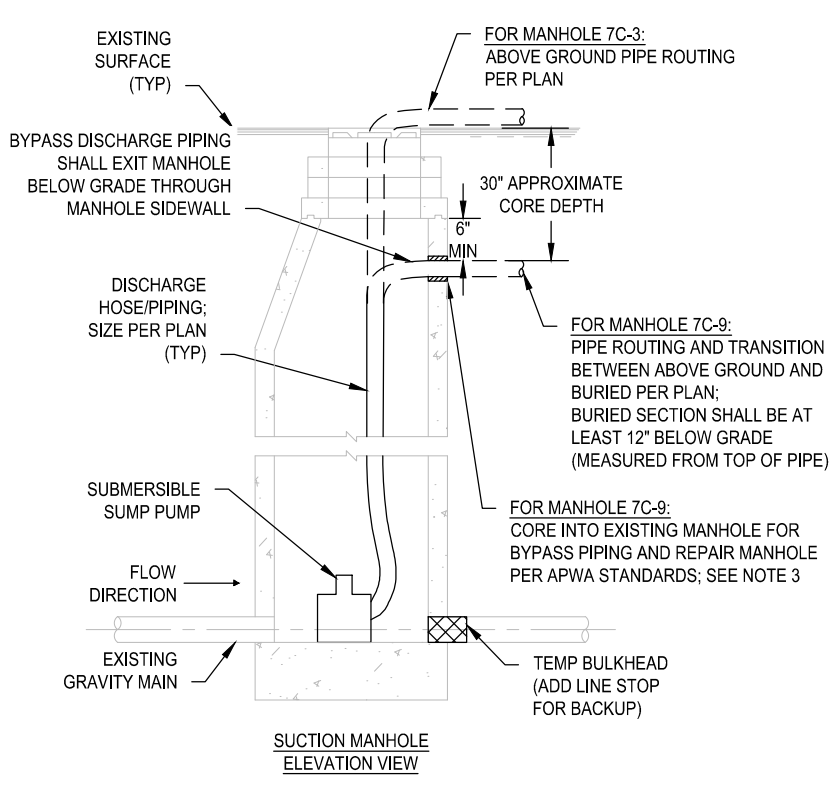
C. The Contractor shall visually inspect the entire bypass pumping and piping system for leaks or spills at minimum 2 times per day, at beginning and end of shifts, or as directed by City inspector. The Contractor shall also create an inspection log and shall enter the time of the inspections and the condition of the piping and the name of the inspector into the log for review by the Engineer.

D. The Contractor is responsible for all operation and monitoring of the temporary sewer bypass systems, 24 hours a day / 7 days a week, and should not rely on City staff or facilities.

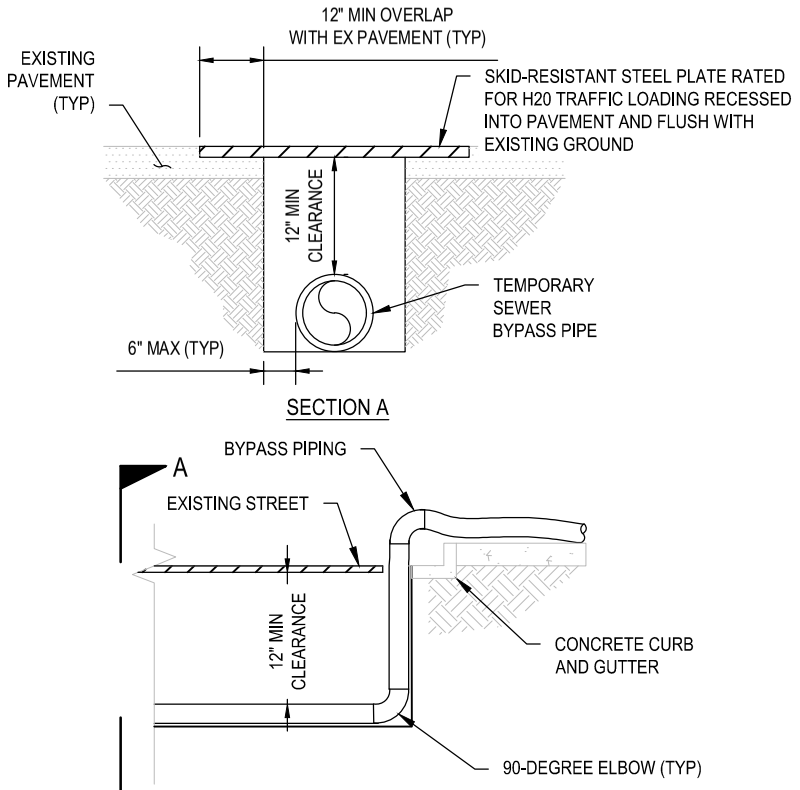
APPENDIX A

CONCEPTUAL BYPASS WORK PLAN





2 TYPICAL MANHOLE BYPASS CONFIGURATION
SCALE NTS



3 SHALLOW BURIED BYPASS PIPE TRANSITION
SCALE NTS

BYPASS PLAN
SCALE 1" = 20'

NOTES

1. CONTRACTOR SHALL CONFIRM THE SEWER CLEANOUT ELEVATION FOR EACH BUILDING SEWER LATERAL TO DETERMINE THE MAXIMUM ALLOWABLE SURCHARGE ELEVATION IN MANHOLE 7C-9 FOR BYPASS PUMPING OPERATIONS. CONTRACTOR SHALL MONITOR THE SURCHARGE ELEVATION IN MANHOLE 7C-9 TO ENSURE BACKFLOW INTO THE DWELLINGS DOES NOT OCCUR.
2. PUMP SUCTION AND DISCHARGE PIPING SHALL BE SUFFICIENTLY RESTRAINED AND SUPPORTED TO PREVENT MOVEMENT DURING PUMP CYCLING. CONTRACTOR SHALL PROVIDE TRAFFIC-RATED RAMPS TO PROTECT THE ABOVE GROUND BYPASS PIPING AS APPLICABLE.
3. ALL MANHOLE PENETRATIONS SHALL BE MADE BY CORE DRILLING. CORE LOCATION SHALL BE AT LEAST 6 INCHES AWAY FROM ANY PRE-CAST MANHOLE COLD JOINTS. INTERIOR COATING SHALL BE REPAIRED AFTER CORE DRILLING. CORE OPENING SHALL BE GROUTED WITH NON-SHRINK GROUT AFTER COMPLETION OF SEWER BYPASS PER APWA STANDARDS. EXISTING PVC LINER SHALL BE REPAIRED IN-KIND PERMANENTLY WITH 6" OVERLAP AT ALL PENETRATIONS.
4. SHALLOW BURIED BYPASS PIPE SHALL BE AT LEAST 12" BELOW GRADE (MEASURED FROM THE TOP OF PIPE). TRENCH SHALL BE COVERED WITH ANCHORED TRENCH PLATES OR APPROVED EQUAL. TRENCH REPAIRS SHALL BE COMPLETED IN ACCORDANCE WITH CITY REQUIREMENTS (OR THE CONTRACT DOCUMENTS).
5. CONTRACTOR SHALL OBTAIN APPROVAL FROM HILLS OF CALAVERA CONDOS HOA PRIOR TO USING RESIDENTIAL PARKING FOR EQUIPMENT STAGING.
6. BYPASS PIPE SHALL BE YELOMITE PIPE WITH CERTA-LOK JOINTS OR FUSED HDPE PIPE (200 PSI RATING MINIMUM). ALUMINUM PIPE IS NOT ALLOWED.
7. CONTRACTOR SHALL SUBMIT A BYPASS PLAN FOR APPROVAL IN ACCORDANCE WITH SECTION 02999 DETAILING THE SPECIFIC PROCEDURES AND EQUIPMENT PROPOSED FOR USE.
8. CONTRACTOR SHALL MAINTAIN ACCESS TO GARAGES AND FOR TRASH PICKUP AT ALL TIMES DURING THE TEMPORARY SEWER BYPASS.

No.	Issue	Checked	Approved	Date
Author	Drafting Check	Project Manager		
Designer	Design Check	Project Director		

Bar is one inch on original size sheet
0 1"

GHD Inc.
175 Technology Drive Suite 200
Irvine California 92618 USA
T 1 949 648 5200 F 1 949 648 5299
www.ghd.com

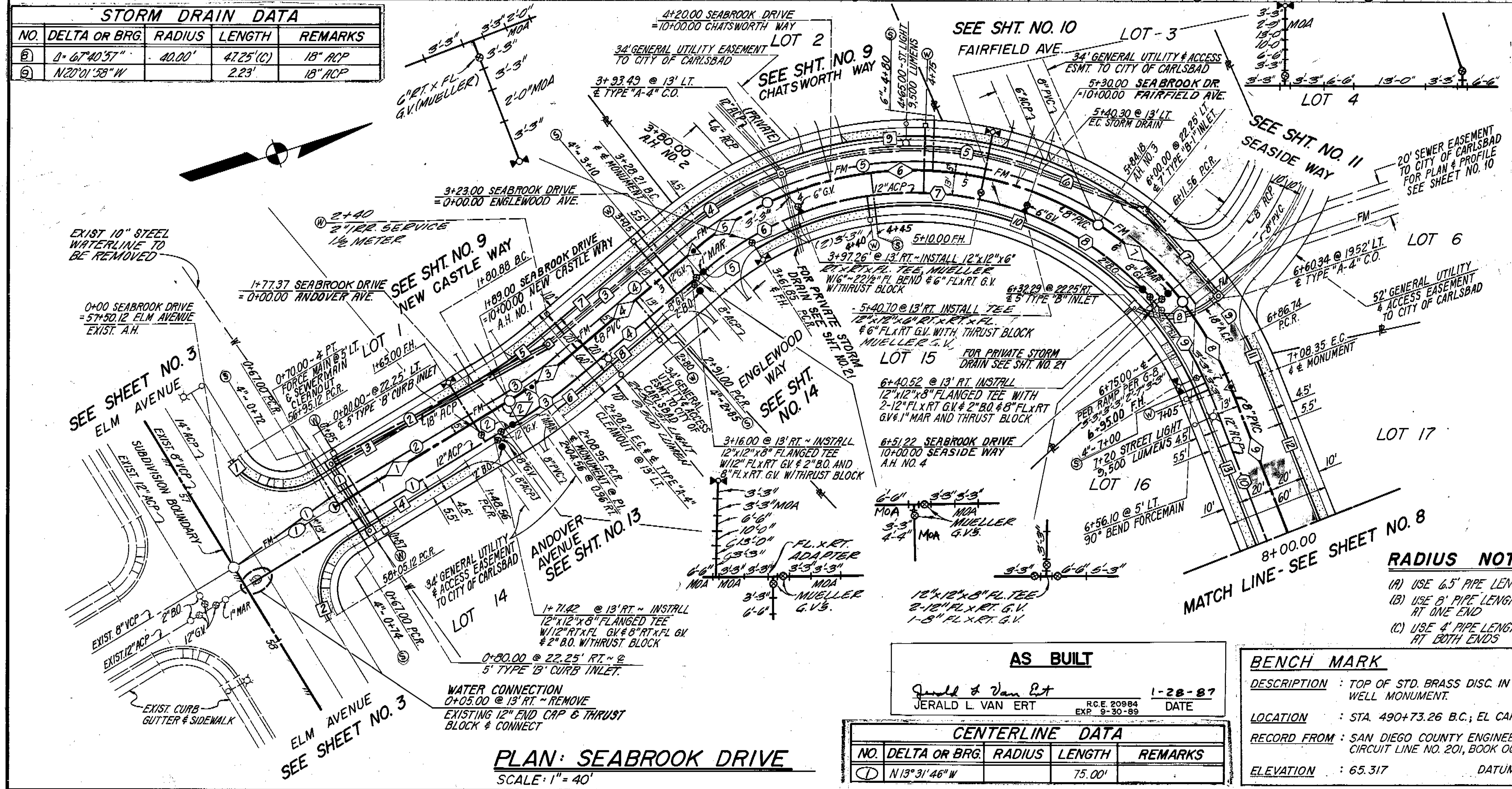
Client: CITY OF CARLSBAD
Project: VILLAS LIFT STATION REPLACEMENT
Project No.: 11212986 | Date: JUN 2021 | Scale: AS SHOWN

Title: TEMPORARY SEWER BYPASS PLAN
Size: ANSI B
APPENDIX A
Sheet No: 1

Plot Date: 24 June 2021 - 4:43 PM
Plotted By: Andy Leung
Filename: \\ghdnet\ghd\US\Irvine\Projects\56\11212986\Digital_Design\ACAD 2018\Figures\11212986-BYPASS PLAN 202106.dwg

STORM DRAIN DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
8	Δ=67°40'57"	40.00'	47.25'(C)	18" ACP
9	N20°01'58"W		2.23'	18" ACP



CURB DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	Δ=90°00'00"	35'	54.98'	6" TYPE "G" CURB
2	Δ=90°00'00"	35'	54.98'	"
3	N13°31'46"W		113.88'	"
4	N13°31'46"W		81.56'	"
5	Δ=9°02'23"	280'	44.18'	"
6	Δ=3°40'41"	320'	20.54'	"
7	N22°34'09"W		100.00'	"
8	N22°34'09"W		62.79'	"
9	Δ=81°06'59"	220'	311.46'	"
10	Δ=99°15'52"	180'	311.85'	"
11	Δ=6°11'26"	220'	23.77'	"
12	N86°19'57"E		91.65'	"
13	N86°19'57"E		91.65'	6" TYPE "G" CURB

WATER DATA ALL CLASS 150

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N13°31'46"W		166.42'	12" A.C.P.
2	N13°31'46"W		9.47'	"
3	Δ=9°02'23"	313'	49.38'	"
4	N22°34'09"W		87.79'	"
5	N22°34'09"W		12.21'	"
6	Δ=19°46'55"	187'(A)	64.56'	"
7	Δ=4°05'29"	187'(A)	134.11'	"
8	Δ=28°35'51"	187'(A)	93.34'	"
9	Δ=19°25'51"	187'(A)	63.42'	"
10	N86°19'57"E		91.65'	12" A.C.P.

STORM DRAIN DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N76°28'14"E		40.50'	18" A.C.P.
2	N11°06'36"W		142.13'	"
3	N22°34'09"W		98.00'	"
4	Δ=18°09'43"	213'(B)	67.52'	"
5	Δ=41°31'12"	213'(B)	154.35'	"
6	N38°11'20"E		63.45'	"
7	N66°29'04"E		62.48'	18" A.C.P.

SEWER DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N13°31'46"W		105.88'	8" P.V.C.
2	Δ=1°33'01"	300'	8.12'	"
3	Δ=7°29'22"	300'	39.21'	"
4	N22°34'09"W		100.00'	"
5	Δ=14°50'12"	200'	51.79'	"
6	Δ=58°29'36"	200'	204.18'	"
7	Δ=19°12'20"	200'	67.04'	"
8	Δ=16°21'55"	200'	57.13'	"
9	N86°19'57"E		91.65'	8" P.V.C.

FORCE MAIN DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N17°36'54"W		70.18'	4" F.M.
2	N13°31'46"W		110.88'	"
3	Δ=9°02'23"	295'	46.54'	"
4	N22°34'09"W		100.00'	"
5	Δ=93°56'02"	205'	336.09'	4" F.M.

RADIUS NOTES

(A) USE 6.5' PIPE LENGTHS
(B) USE 8' PIPE LENGTHS BEVELED AT ONE END
(C) USE 4' PIPE LENGTHS BEVELED AT BOTH ENDS

AS BUILT

Jerald L. Van Ert — 1-28-87
JERALD L. VAN ERT — R.C.E. 20984 EXP. 9-30-89 — DATE

CENTERLINE DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N13°31'46"W		75.00'	

BENCH MARK

DESCRIPTION : TOP OF STD. BRASS DISC IN CENTERLINE WELL MONUMENT.
LOCATION : STA. 490+73.26 B.C.; EL CAMINO REAL.
RECORD FROM : SAN DIEGO COUNTY ENGINEER LEVEL CIRCUIT LINE NO. 201, BOOK 001, PAGE 20.
ELEVATION : 65.317 DATUM : M.S.L.

ENGINEER OF WORK

Jerald L. Van Ert — 6-6-83
JERALD L. VAN ERT R.C.E. 20984 DATE

DATE	BY	REVISIONS		APP'D
2-8-84	R.E.C.	Revised Grades	4/1/84	Dant
9-4-86	[illegible]	AS BUILT - CITY OF CARLSBAD	2/25/87	Dant

RICK ENGINEERING COMPANY
PLANNERS · CIVIL ENGINEERS · LAND SURVEYORS
5620 FRIARS ROAD SAN DIEGO CALIFORNIA 92110
PHONE 291-0707

PRIVATE CONTRACT

SHEET 7 — CITY OF CARLSBAD — ENGINEERING DEPARTMENT — SHEETS 24

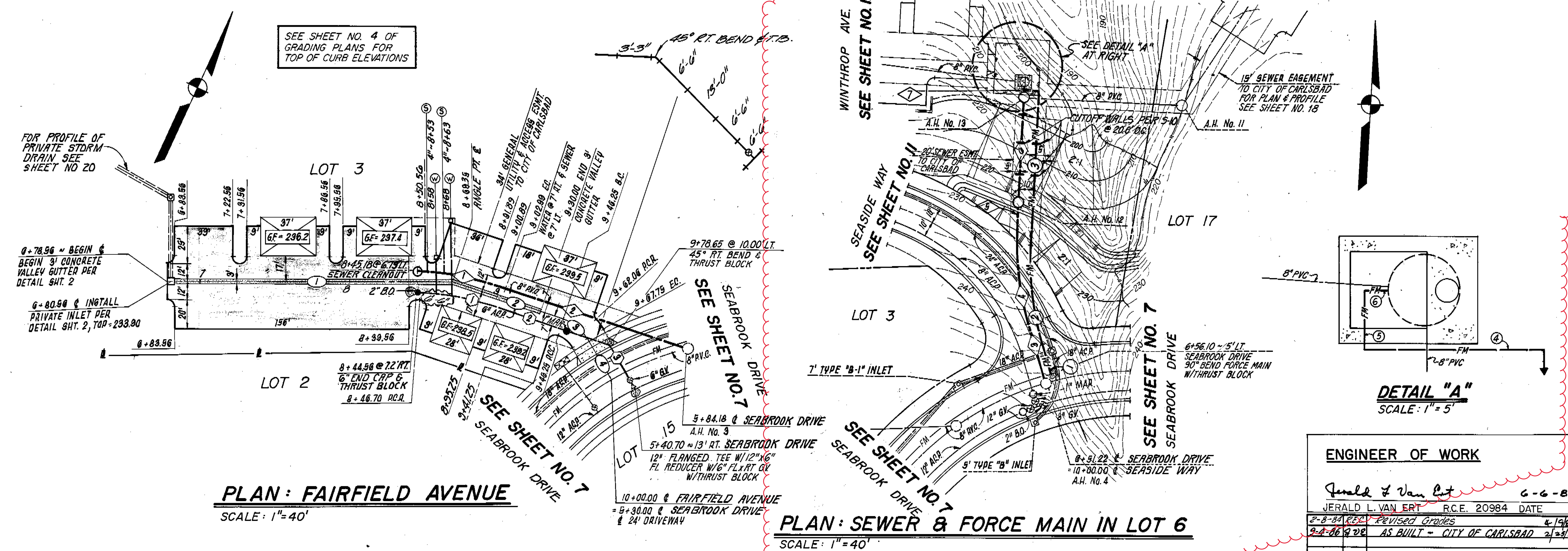
PLAN FOR THE IMPROVEMENT OF:
SEABROOK DRIVE
STA. 0+00.00 TO 8+00.00
IN THE VILLAS AT CALAVERA HILLS CT. 82-16

APPROVED: 2/6/84 — CITY ENGINEER — RE 33081 — DATE: 6-6-83
SCALES: HORZ: AS SHOWN VER:
DWN BY: / CHKD BY: / FIELD BY: — PROJECT Nº C.T. 82-16 — DRAWING Nº 231-1B

JOB Nº 8800

CMWD 82-406
DRAWER NO. G-33
F388

SAN DIEGO BLUE PRINT CO.



SEWER DATA				
NO.	DELTA or BRG.	RADIUS	LENGTH	REMARKS
1	Δ=15°55'32"	214'	59.48'	8" P.V.C.
2	N84°10'45"E		127.93'	"
3	N20°01'58"W		40.86'	"
4	Δ=19°16'08"	200'	67.26'	"
5	N00°45'50"W		14.00'	"
6	N00°45'50"W		71.22'	"
7	N00°45'50"W		7.00'	8" P.V.C.

CENTERLINE DATA				
NO.	DELTA or BRG.	RADIUS	LENGTH	REMARKS
1	N 65° 43' 00" E		190.79'	
2	N 84° 10' 45" E		76.90'	
3	Δ- 41° 03' 35"	30'	21.50'	
4	N 54° 45' 40" W	-	32.28'	

WATER DATA (ALL CLASS 150)				
NO.	DELTA or BRG.	RADIUS	LENGTH	REMARKS
1	Δ- 15° 59' 32"	200'±	55.59'	6" ACP.
2	N 84° 10' 45" E	-	77.79	"
3	N 54° 45' 40" W		34.62'	6" ACP

* USE ALTERNATING 6'-6" LENGTHS.

FORCE MAIN DATA				
NO.	DELTA or BRG.	RADIUS	LENGTH	REMARKS
1	N20°01'58"W		19.92'	4" PVC.-FORCE MAIN
2	Δ=19°16'08"	200'	67.26'	"
3	N00°45'50"W		98.67'	"
4	N89°14'10"E		15.00'	"
5	N00°45'50"W		4.77'	"
6	N89°14'10"E		2.01'	4" PVC.-FORCE MAIN

SAN DIEGO BLUE PRINT CO.

AS BUILT
Jerald L Van Ert
JERALD L. VAN ERT R.C.E. 20984 EXP. 9-30-89 1-28-87 DATE

BENCH MARK
DESCRIPTION : TOP OF STD. BRASS DISC. IN CENTERLINE WELL MONUMENT.
LOCATION : STA. 490+73.26 B.C.; EL CAMINO REAL.
RECORD FROM : SAN DIEGO COUNTY ENGINEER LEVEL CIRCUIT LINE NO. 201, BOOK 001, PAGE 20.
ELEVATION : 65.317 DATUM : M. S. L.

ENGINEER OF WORK
Jerald L Van Ert 6-6-83
JERALD L. VAN ERT R.C.E. 20984 DATE

DATE	BY	REVISIONS		APP'D
2-8-84	R.E.C.	Revised Grades	2/9/84	Dan
9-4-86	R.E.C.	AS BUILT - CITY OF CARLSBAD	2/25/87	Dan

RICK ENGINEERING COMPANY
PLANNERS · CIVIL ENGINEERS · LAND SURVEYORS
5620 FRIARS ROAD SAN DIEGO CALIFORNIA 92110
PHONE 291-0707
PRIVATE CONTRACT

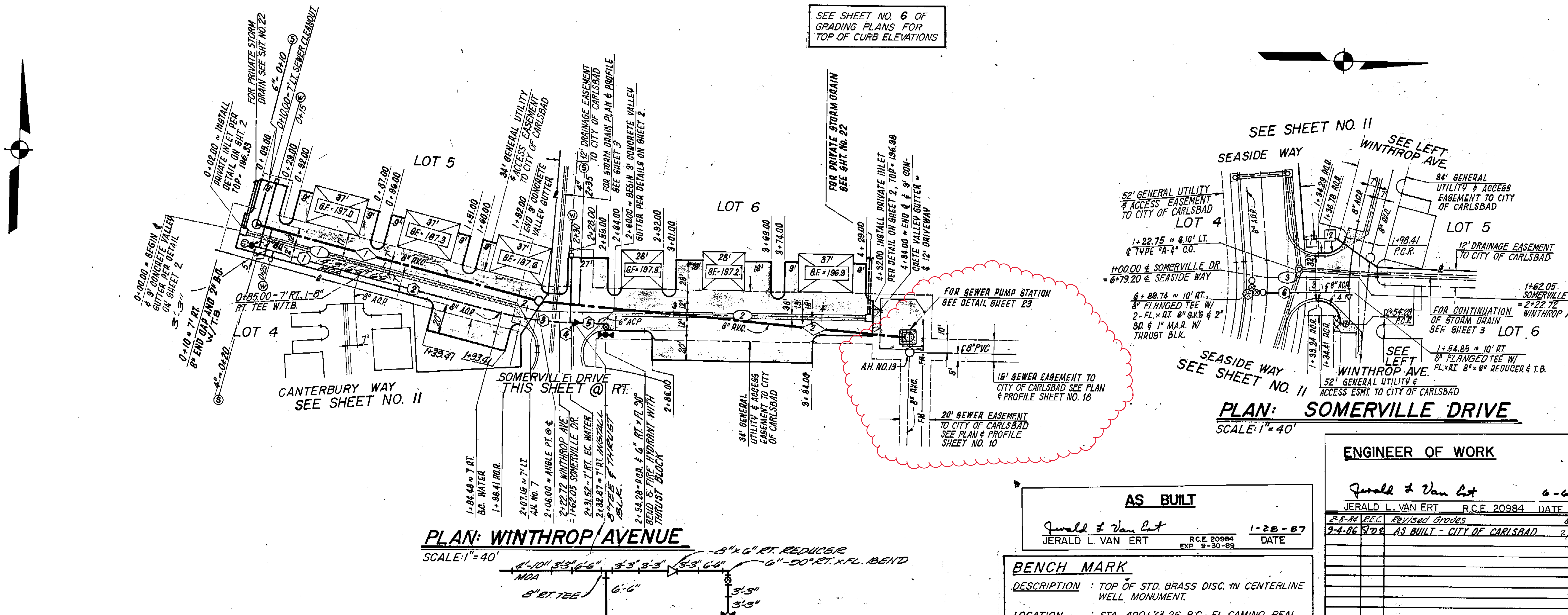
SHEET 10 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 24

PLAN FOR THE IMPROVEMENT OF:
FAIRFIELD AVENUE & SEWER & FORCE MAIN-LOT 6
IN THE VILLAS AT CALAVERA HILLS CT. 82-16

APPROVED: 2-16-84 David Hauser CITY ENGINEER RE. 33081
DATE: 6-6-83
SCALES: HORZ: AS SHOWN VER:
DWN BY: CHKD BY: FIELD BY:
PROJECT NO. C.T. 82-16
DRAWING No. 231-1B

JOB No 8800

CMWD 82-406
DRAWER No. 6-53
F388



CENTERLINE DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N76°51'58"W		208.00'	
2	N83°14'10"E		226.00'	
3	N15°56'51"W		62.05'	

SEWER DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS*
1	N76°51'58"W		197.15'	8" PVC
2	N86°25'13"W		247.87'	8" PVC

WATER DATA (ALL CLASS 150)

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N 76° 51' 58 W		79.00'	8" A.C.P.
2	N76°51'58"W		99.48'	8" ACP
3	Δ-13°53'52"	200.00'*	48.51'	8" ACP
4	N83°14'10"E		1.35'	8" ACP
5	N83°14'10"E		21.41'	6" ACP
6	N01°56'51"W		65.11'	8" ACP

* USE 6'-6" LENGTHS

CURB DATA

NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N01°56'51"W		4.49'	6" TYPE "G" CURB
2	Δ-74°55'07"	15.00'	19.61'	"
3	N01°56'51"W		1.17'	"
4	Δ-91°11'01"	15.00'	23.87'	6" TYPE "G" CURB

AS BUILT

JERALD L. VAN ERT R.C.E. 20984 EXP. 9-30-89 — 1-28-87 DATE

BENCH MARK

DESCRIPTION: TOP OF STD. BRASS DISC IN CENTERLINE WELL MONUMENT.
LOCATION: STA. 490+73.26 B.C.; EL CAMINO REAL.
RECORD FROM: SAN DIEGO COUNTY ENGINEER LEVEL CIRCUIT LINE NO. 201, BOOK 001, PAGE 20.
ELEVATION: 65.317 DATUM: M.S.L.

ENGINEER OF WORK

JERALD L. VAN ERT R.C.E. 20984 6-6-83 DATE

DATE	BY	REVISIONS		APP'D
2-8-84	P.E.C.	Revised Grades	2/9/84	
9-4-86		AS BUILT - CITY OF CARLSBAD	2/12/87	

RICK ENGINEERING COMPANY
PLANNERS · CIVIL ENGINEERS · LAND SURVEYORS
5620 FRIARS ROAD SAN DIEGO CALIFORNIA 92110
PHONE 291-0707

PRIVATE CONTRACT

SHEET 12 — CITY OF CARLSBAD ENGINEERING DEPARTMENT — SHEETS 24

PLAN FOR THE IMPROVEMENT OF:
WINTHROP AVENUE & SOMERVILLE DRIVE
IN THE VILLAS AT CALAVERA HILLS CT. 82-16

APPROVED: 2/ /84 RE 33081 CITY ENGINEER
DATE: 6-6-83
SCALES: HORZ: AS SHOWN VER:
DWN BY: R.C.A. CHKD BY: FIELD BY:
PROJECT NO. C.T. 82-16
DRAWING NO. 231-18

JOB № 8800

CMWD 82-406
DRAWER NO. 6-53
F588

SAN DIEGO BLUE PRINT CO.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 03000 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 DESCRIPTION

This section describes materials and methods for formwork, reinforcement, mixing, placement, curing and repairs of concrete, and the use of cementitious materials and other related products. This section includes concrete, mortar, grout, reinforcement, thrust and anchor blocks, valve support blocks, and manhole bases.

1.2 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM A 185	-	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615/A 615M	-	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 150	-	Specification for Portland Cement
ASTM C 494	-	Specification for Chemical Admixtures for Concrete
ASTM C 881	-	Specification for Epoxy-Resin-Base Bonding Systems for Concrete
CRSI	-	Recommended Practice for Placing Reinforcing Bars
SSPWC	-	Standard Specifications for Public Works Construction "Greenbook"

1.3 RELATED WORK SPECIFIED ELSEWHERE

Standard Specifications 02223, 15000, 15041, 15044, and 16640.

1.4 APPLICATIONS

The following materials, referenced in other sections, shall be provided and installed in accordance with this specification for the applications noted below:

A. Concrete for thrust and anchor blocks for horizontal and vertical bends, ductile-iron or steel fittings, fire hydrant bury ells, and support blocks for valves 4-inches and larger, all in accordance with the Standard Drawings.

B. Concrete for collars, cradles, curbs, encasements, gutters, manhole bases, protection posts, sidewalks, splash pads, and other miscellaneous cast-in-place items.

C. Mortar for filling and finishing the joints between manhole and vault sections and setting manhole grade rings and cover frames. Mortar may also be used for repairs of minor surface defects of no more than ¼-inch in depth of ½-inch in width on non-structural, cast-in-place items such as splash pads or concrete rings around manholes. (Note that large voids, structural concrete and pipe penetrations into vaults shall be repaired with non-shrink grout; repairs to precast manholes and vaults and cast-in-place manhole bases shall be repaired with an epoxy bonding agent and repair mortar, as outlined below).

D. Epoxy bonding agent for bonding repair mortar to concrete on repairs to damaged surfaces to precast or cast-in-place concrete manoles and vaults.

E. Repair mortar for repair to damaged surfaces of precast or cast-in-place concrete manholes and vaults. An epoxy bonding agent shall be used in conjunction with repair mortar.

F. Non-shrink grout for general purposes repair of large construction voids, pipe penetrations into vaults and grouting of base plates for equipment or structural members.

G. Epoxy adhesives for grouting of anchor bolts.

H. Protective epoxy coating for application to reinforcing steel with existing concrete structures exposed during construction.

I. Damp-proofing for application to the exterior surfaces of concrete manholes and vaults located at or below the water table or where showing evidence of moisture or seepage, and as directed by the Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver reinforcing steel to the site bundled and tagged with identification. Store on skids to keep bars clean and free of mud and debris. If contaminated, all bars shall be cleaned by wire brushing, sand blasting, or other means prior to being set in forms.

PART 2 MATERIALS

2.1 CONCRETE

A. All Portland cement concrete shall conform to the provisions of Sections 201, 202, and 303 of the Standard Specifications for Public Works Construction (Greenbook).

B. Class 560-C-3250 concrete, as described in the Greenbook, Section 201, shall be used for all applications unless otherwise directed by the City. The maximum water/cement ratio shall be 0.53 by weight, and the maximum slump shall be 4-inches.

C. In certain circumstances, rapid-setting concrete may be required. Accelerating admixtures shall conform to ASTM C-494 and may be used in the concrete mix as permitted by the City. Calcium chloride shall not be used in concrete.

2.2 REINFORCING STEEL

A. Reinforcing steel shall conform to ASTM A 615, Grade 60.

B. Fabricate reinforcing steel in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute.

2.3 WELDED FIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

2.4 TIE WIRE

Tie wire shall be 16-gage minimum, black, soft annealed.

2.5 BAR SUPPORTS

Bar supports in beams and slabs exposed to view after removal of forms shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.6 FORMS

A. Forms shall be accurately constructed of clean lumber. The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags or holes.

B. Metal form systems may be used upon City approval. Include manufacturer's data for materials and installation with the request to use a metal form system.

2.7 MORTAR

Cement mortar shall consist of a mixture of Portland cement, sand, and water. One part cement and two parts sand shall first be combined, and then thoroughly mixed with the required amount of water.

2.8 EPOXY BONDING AGENT

The epoxy bonding agent shall be an epoxy-resin-based product intended for bonding new mortar to hardened concrete and shall conform to ASTM C 881. The bonding agent shall be selected from the Approved Materials List.

2.9 REPAIR MORTAR

Repair mortar shall be a two-component, cement-based product specifically designed for structurally repairing damaged concrete surfaces. The repair mortar shall exhibit the properties of high compressive and bond strengths and low shrinkage. A medium-slump repair mortar shall be used on horizontal surfaces, and a non-sag, low-slump repair mortar shall be used on vertical or overhead surfaces. Repair mortar shall be selected from the Approved Materials List.

2.10 NON-SHRINK GROUT

Non-shrink grout shall be a non-metallic cement-based product intended for filling general construction voids or grouting base plates for equipment or structural members. The non-shrink grout shall exhibit the properties of high compressive and bond strengths and zero shrinkage, and shall be capable of mixing to a variable viscosity ranging from a dry pack to a fluid consistency as required for the application. The non-shrink grout shall be selected from the Approved Materials List.

2.11 EPOXY ADHESIVE

Epoxy adhesive shall be a high-modulus epoxy-resin-based product intended for structural grouting of anchor bolts and dowels to concrete. The epoxy adhesives shall conform to ASTM C 881. A pourable, medium-viscosity epoxy shall be used on horizontal surfaces, and a heavy-bodied, non-sag epoxy gel shall be used on vertical surfaces. The epoxy adhesives shall be selected from the Approved Materials List.

2.12 PROTECTIVE EPOXY COATING

The protective epoxy coating shall be an epoxy-resin-based product exhibiting high bond strength to steel and concrete surfaces, and shall conform to ASTM C 881. The protective epoxy coating shall be selected from the Approved Materials List.

2.13 DAMP-PROOFING FOR CONCRETE STRUCTURES

Damp-proofing material shall consist of two coats of a single-component self-priming, heavy-duty cold-applied coal tar selected from the Approved Materials List.

PART 3 EXECUTION

3.1 FORMWORK

A. The Contractor shall notify the City a minimum of one working day in advance of intended placement of concrete to enable the City to check the form lines, grades, and other required items before placement of concrete.

B. The form surfaces shall be cleaned and coated with form oil prior to installation. The form surfaces shall leave uniform form marks conforming to the general lines of the structure.

C. The forms shall be braced to provide sufficient strength and rigidity to hold the concrete and to withstand the necessary fluid pressure and consolidation pressures without deflection from the prescribed lines.

D. Unless otherwise indicated on the plans, all exposed sharp concrete edges shall be 3/4-inch chamfered.

3.2 REINFORCEMENT

A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

B. All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings or as directed by the City.

C. Do not straighten or re-bend reinforcing steel in a manner that will damage the material. Do not use bars with bends not shown on the drawings. All steel shall be cold bent – do not use heat.

D. All bars shall be free from rust, scale, oil, or any other coating that would reduce or destroy the bond between concrete and steel.

E. Position reinforcing steel in accordance with the Approved Plans and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms in order to provide the concrete coverage equal to that required of the bars. If required by the Engineer, the Contractor shall install bars additional to those shown on the drawings for the purpose of securing reinforcement in position.

F. Place reinforcement a minimum of 2-inches clear of any metal pipe, fittings, or exposed surfaces.

G. The reinforcement shall be so secured in position that it will not be displaced during the placement of concrete.

H. All reinforcing steel, wire mesh, and tie wire shall be completely encased in concrete.

I. Reinforcing steel shall not be welded unless specifically required by the Approved Plans or otherwise directed by the Engineer.

I. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

J. Minimum lap for all reinforcement shall be 40 bar diameters unless otherwise specified on the Approved Plans.

K. Place additional reinforcement around pipe penetrations or openings 6-inches diameter or larger. Replace cut bars with a minimum of 1/2 of the number of cut bars at each side of the opening, each face, each way, same size. Lap with the uncut bars a minimum of 40 bar diameters past the opening dimension. Place one same size diagonal bar at the four diagonals of the opening at 45° to the cut bars, each face. Extend each diagonal bar a minimum of 40 bar diameters past the opening dimension.

L. Wire mesh reinforcement is to be rolled flat before being placed in the form. Support and tie wire mesh to prevent movement during concrete placement.

M. Extend welded wire fabric to within 2-inches of the edges of slabs. Lap splices at least 1-1/2 courses of the fabric and a minimum of 6-inches. Tie laps and splices securely at ends and at least every 24-inches with 16-gauge black annealed steel wire. Pull the fabric into position as the concrete is placed by means of hooks, and work concrete under the steel to ensure that it is at the proper distance above the bottom of the slab.

3.3 EMBEDDED ITEMS

All embedded items, including bolts, dowels and anchors, shall be held correctly in place in the forms before concrete is placed.

3.4 MORTAR MIXING

The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended. Mortar shall be used as soon as possible after mixing and shall show no visible sign of setting prior to use. Re-mixing of mortar by the addition of water after signs of setting are evident shall not be permitted.

3.5 MIXING AND PLACING CONCRETE

A. All concrete shall be placed in forms before taking its initial set.

B. No concrete shall be placed in water except with permission of the City.

C. As the concrete is placed in forms, or in rough excavations (i.e., thrust or anchor blocks), it shall be thoroughly settled and compacted throughout the entire layer by internal vibration and tamping bars.

D. All existing concrete surfaces upon which or against which new concrete is to be placed shall be roughened, thoroughly cleaned, wetted, and grouted before the new concrete is deposited.

3.6 CONCRETE FINISHING

A. Immediately upon the removal of forms, voids shall be neatly filled with cement mortar, non-shrink grout, or epoxy bonding agent and repair mortar as required for the application and as directed by the City.

B. The surfaces of concrete exposed to view shall be smooth and free from projections or depressions.

C. Exposed surfaces of concrete not poured against forms, such as horizontal or sloping surfaces, shall be screeded to a uniform surface, steel-trowelled to densify the surface, and finished to a light broom finish.

3.7 PROTECTION AND CURING OF CONCRETE

The Contractor shall protect all concrete against damage. Exposed surfaces of new concrete shall be protected from the direct rays of the sun by covering them with plastic film wrap and by keeping them damp for at least 7 days after the concrete has been placed, or by using an approved curing process. Exposed surfaces shall be protected from frost by covering with tarps for at least 5 days after pouring.

3.8 REPAIRS TO DAMAGED CONCRETE SURFACES

Minor surface damage to hardened cast-in-place or precast concrete may be repaired, at the discretion of the City, using the specified materials in accordance with the manufacturer's recommendations and the following procedures:

A. Cast-in-place or precast concrete for manholes and vaults: Remove loose or deteriorated concrete to expose a fractured aggregate surface with an edge cut to

a ninety degree angle to the existing surface. Clean all debris from the area, apply a 20 mil coat of epoxy bonding agent to the prepared surface, and place repair mortar while the epoxy is still wet and tacky. On horizontal surfaces, for repair depths greater than 2-inches, add aggregate to the repair mortar as recommended by the manufacturer. On vertical or overhead surfaces, for repair depths greater than 2-inches, apply the repair mortar in successive lifts, scarifying the lifts, allowing them to harden, and applying a scrub coat of the material prior to proceeding with the next lift. Cure the material as for concrete in accordance with this specification.

B. General Purpose: Remove loose and deteriorated concrete by mechanical means, sandblasting, or high-pressure water blasting. Clean all debris from the area and apply non-shrink grout in a 1/4-inch minimum thickness, at the desired consistency, ranging from a dry pack, to a fluid-poured into a formed area, according to the application. Cure the material as for concrete in accordance with this specification.

3.9 EPOXY ADHESIVES FOR ANCHOR BOLT INSTALLATION

Anchor bolts grouted in place with an epoxy adhesive shall be installed using the specified materials in accordance with the manufacturer's recommendations and the following general procedures: Drill the hole with a rotary percussion drill to produce a rough, unpolished hole surface. the hole shall be sized to the manufacturer's recommendations and should be approximately 1/4-inch wider than the diameter of the bolt, with a depth equal to 10 to 15 times the bolt diameter. Remove debris and dust with a stiff bristle brush and clean using compressed air. Utilizing a medium-viscosity epoxy for horizontal surfaces, and a gel-type non-sag epoxy for vertical surfaces, apply the material to fill the hole to approximately half its depth. Insert the bolt, forcing it down until the required embedment depth and projection length are attained and then twist the bolt to establish a bond. Secure the bolt firmly in place in the permanent position until the epoxy sets.

3.10 PROTECTIVE EPOXY COATING

Following core drilling at existing concrete structures, clean the exposed concrete surface and ends of reinforcing steel and apply two coats of protective epoxy coating for a total dry film thickness of 10-15 mils. Allow the material to cure between coats and prior to continuing the installation through the penetration.

3.11 DAMP-PROOFING FOR THE EXTERIOR OF CONCRETE STRUCTURES

Following completion of the exterior surfaces of manholes and vaults, including necessary repairs and piping penetrations into the structure, apply the specified material to prepared concrete surfaces in accordance with the manufacturer's recommendations. The surfaces to be coated shall be fully-cured and free of laitance and contamination. The material shall be applied to all exterior surfaces below a point 12-inches above the water table or indications of seepage or moisture as directed by the Engineer. Apply two 15 mil coats, curing between coats, prior to backfill and/or immersion in accordance with the manufacturer's recommendations.

3.12 THRUST AND ANCHOR BLOCKS

Concrete thrust and anchor blocks shall be poured against wetted, undisturbed soil in accordance with the Standard Drawings and as directed by the City. The concrete shall be placed so that fittings and valves will be accessible for repairs or replacement. Prior to filling the pipeline with water, the concrete for thrust and anchor blocks shall cure for the following number of days:

Thrust Blocks	3 days minimum
Anchor Blocks	7 days minimum

A. Safe Soil Bearing Load:

Soil	Safe Bearing Load
Muck, peat, etc.***	0 PSF
Soft Clay	500 PSF
Fine Sand	1,000 PSF
Decomposed Granite (D.G.)	1,500 PSF
Sandy Gravel	2,000 PSF
Cemented Sandy Gravel	2,000 PSF
Hard Shale	2,500 PSF
Granite	10,000 PSF

***In muck or peat soils, competent resistance shall be achieved by removal and replacement with ballast or sufficient stability to resist the intended thrusts. Consult the project geotechnical consultant.

B. Thrust Block Placement and Sizing:

Thrust blocks shall be located at all unrestrained pipe fittings and bear against firm, undisturbed soil. The thrust blocks shall be centered on the fitting so that the bearing area is exactly opposite the resultant direction of the thrust, refer to the Standard Drawings. Care shall be taken to prevent the placed thrust block concrete from eliminating maintenance access to the valve operators. All thrust block excavation location, shape, and the City prior to pouring the concrete shall verify size. The size, in sq. ft., of the thrust block can be calculated by dividing the thrust by the safe bearing load.

For instance, use a 12-inch pipe, 45° end, at 200 psi test pressure with a D.G. trench the value of 11,720# of thrust can be obtained from the upper chart and 1,500#/sq. ft. safe bearing load from the lower chart as follows:

11,720# x 2 / 1,500#/Sq. ft. = 15.6 sq. ft. or 16 sq.

Therefore, for this example, the trench wall adjacent to the fitting shall be excavated to the dimensions of 4 ft. x 4 ft. or 3.5 ft. x 5 ft. or some closely approximate multipliers to achieve the minimum required 16 sq. ft. bearing area.

C. Anchor Block Placement and Sizing:

For all vertical bends in pipelines (downward bends) that do not have restrained joints, the fittings shall be retained in place by means of an anchor block. The block shall be sized to withstand the thrust exerted for the particular deflection angle at the required test pressure plus 10%. (Do not rely on the restraining benefit from the soil). The City shall verify the size chosen and the reinforcing steel required.

The size, in cu. ft. of the anchor block can be calculated by dividing the thrust by the unit weight of concrete (i.e., one cu. ft. or concrete weighs approximately 145#). For instance, use the same 12-inch pipe, 45° bend, at 200 psi test pressure – the value of 11,720# of thrust can be obtained from the upper chart:

11,720# x 2 / 145# = 162 cu. ft. (plus 10%) = 178 cu. ft. or 6.6 cu. yd.

Therefore, for this example, the anchor block shall be 5.5' x 5.5' x 6' or 6' x 6' x 5', or some closely approximate multipliers to achieve a minimum of 178 cu. ft. of concrete.

3.13 VALVE SUPPORT BLOCKS

Valve support blocks shall be installed as described below and in accordance with the Standard Drawings:

A. Support blocks below valves shall be cut into the side of the trench a minimum of 12-inches.

B. Support blocks shall extend up to a height of adjoining pipe and shall have a minimum depth below the valve of 12-inches.

C. Support blocks shall be installed so that the valves will be accessible for repairs.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

Section 06621 Copolymer Lining

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. This section sets forth the requirements for the structural polymer PVC Co-Lining system for rehabilitating manholes in accordance with the limits shown on the Drawings. The CONTRACTOR shall be responsible for monitoring confined space and providing adequate ventilation and safe working conditions in accordance with all applicable Cal/OSHA requirements for working within the sanitary sewer and structures.

B. The Work included under this section consists of furnishing all labor, equipment, materials and incidentals required to rehabilitate existing reinforced concrete manholes as shown on the Drawings. Work shall include, but not be limited to, cleaning of concrete surfaces, reinforcing steel treatment and repair, application of a primer, Structural Polymer, activator, PVC Lining System, seam material and testing. Rehabilitation shall be continuous and shall connect to existing PVC lining and to manhole lining without any gaps, holes, or defects that may allow corrosion of cementitious material.

1.2 **REFERENCE SPECIFICATIONS, CODES, AND STANDARDS**

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C501	Test Method for Relative Resistance of Unglazed Tile by the Taber Abraser
ASTM C794	Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C881	Specification for Epoxy-Resin Base Bonding Systems for Concrete
ASTM C920	Specification for Elastomeric Joint Sealants
ASTM D256	Test Methods for Impact Resistance of Plastics
ASTM D412	Test Method for Rubber Properties in Tension
ASTM D638	Test Method for Tensile Properties of Plastics
ASTM D695	Test Method for Compressive Properties of Rigid Plastics
ASTM D792	Test Methods for Specific Gravity and Density of Plastics
ASTM D1004	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1044	Test Method for Resistance of Transparent Plastics to Surface Abrasion
ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D1653A	Test Method for Water Vapor Transmission of Organic Film
ASTM D1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2240	Test Method for Rubber Property - Durometer Hardness

ASTM D4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating
ASTM D4259	Standard Practice for Abrading Concrete
ASTM D4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
ASTM E329	Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM F1249	Method for Water Transmission Rate through Plastic Film and Sheeting
ICRI 310.2	Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
SSPWC	Standard Specification for Public Works Construction Section 210-2.3 Plastic Liner

1.3 CONTRACTOR SUBMITTALS

A. Provide 5 references which show that the CONTRACTOR has previous successful experience with each specified or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the CONTRACTOR applied the protective coating.

B. The manufacturer shall provide written certification that the coating CONTRACTOR's supervisor and each applicator performing Work on the project have been trained and approved by the manufacturer to apply the selected coating system. The manufacturer shall state whether or not it has verified that the CONTRACTOR is going to use the proper mixing, coating application, heating, and environmental control equipment for the specified coating products.

C. CONTRACTOR shall provide a written letter from the manufacturer stating that the CONTRACTOR is certified and experienced in the application of the specified coating systems. The letter shall state the manufacturer and model number of mixing, heating, and pumping equipment to be used to apply the specified coating system.

D. PRODUCT DATA SHEET

1. For each concrete rehabilitation product to be used the CONTRACTOR shall submit the following product data.

a. Technical data sheet for each product used, including statements on the suitability of the material for the intended use.

b. Instructions and recommendations for surface preparation, mixing, handling, application, curing and proper storage.

c. Material safety data sheet for each product used.

d. Plastic liner proof of compliance with requirements of SSPWC 210-2.3.

e. Written certification from the manufacturer(s) of the selected rehabilitation products that the rehabilitation materials are compatible with each other.

f. The manufacturer(s) shall provide written certification that the concrete repair Subcontractor’s Supervisor and each of the applicators performing Work on the project has been trained and is an approved applicator for the repair materials selected.

g. Test reports on previously tested polymer mortar materials shall be accompanied by the manufacturer's statement that the previously tested material is the same type, quality, manufacture, and make as that proposed for use in this project. Test reports are required for epoxy resin and aggregates. The evidence shall show that deficiencies mentioned in the report of that inspection have been corrected.

2. The following submittals are required:

a. Lining system design details and system materials.

b. Manufacturer's application instructions, including:

(1) Product Material Safety Data Sheets.

(2) Certified laboratory test reports for structural polymer density and pipe pH.

(3) Maximum storage life and storage requirements.

(4) Mixing and proportioning requirements (as applicable).

(5) Environmental requirements for application and worker safety, including ventilation, humidity, and temperature ranges.

(6) Information and data on adhesive products and cleaners used in the repair of the existing and installation of the new liner.

(7) Thickness of activator and structural polymer or mastic applied over the surface of the PVC sheet and at joints, respectively.

(8) Curing time.

(9) Proof that the chemical resistance test specified in SSPWC Subsection 210-2.3.3 will be met.

(10) Shape, size and type of material of forms used for the installation of the PVC lining system. Description of the forms installation and removal procedure.

3. A layout and application sequencing plan which includes PVC individual sheet dimension and order of application. This plan shall be approved by the ENGINEER before starting Work specified in this subsection.

E. DAILY PROJECT RECORDS

1. The CONTRACTOR shall maintain an accurate written daily record of the amount of each material used for the protective lining system that is delivered to the job each day, and the amount used in the lining system each day. At the end of each Work shift, the CONTRACTOR shall furnish to the ENGINEER a signed copy of the daily record, along with the amount (square feet) of protective lining system installed during that shift.

1.4 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Manufacturer shall have 1 year of experience fabricating the proposed product for the structural polymer PVC lining system.

2. CONTRACTOR shall have 1 year of experience installing structural polymer PVC lining system in pipes greater than 48 inches in diameter. The CONTRACTOR shall have installed a minimum of 500 linear feet of the self-forming grouted lining system in the crowns of pipes larger than 48 inches in diameter. Project experience that included full lining (360 degree) shall not be considered as applicable experience. In addition, the Work shall be performed by a lining CONTRACTOR or Subcontractor who is licensed and certified by the manufacturer of the protective lining system specified. Each applicator who will be applying the protective lining system shall be certified by the manufacturer.

B. STANDARDIZATION

1. Materials and supplies provided shall be the standard products of manufacturers. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the ENGINEER that they are equal in composition, durability, and usefulness for the purpose intended.

C. QUALITY CONTROL BY CONTRACTOR

1. To demonstrate conformance with the specified requirements for the materials, the CONTRACTOR shall provide the services of an independent testing Laboratory which complies with the requirements of ASTM E329. The testing Laboratory shall sample and test PVC and structural polymer materials as required in this section. Costs of testing Laboratory services shall be borne by the CONTRACTOR.

D. PERFORMANCE AND DESIGN REQUIREMENTS

1. Chemical Resistance. The PVC sheet liner, sealant material and surface activator shall act as a cured seam sealant through molecular bonding and shall conform to the chemical resistance test requirements of SSPWC Subsection 210-2.3.3 for chemical solutions at listed concentrations.

2. The installed PVC lining shall remain leak proof up to a minimum hydrostatic pressure that is equivalent to 15 feet above the invert of the manhole. PVC liner shall meet the requirements of SSPWC 210-2.3.

E. TRAINING CERTIFICATION

1. Manufacturer certification shall be required of applicators used for the liner and structural polymer installation Work, including pumping and computer equipment operators.

F. SERVICES OF MANUFACTURER

1. The CONTRACTOR shall require the coating manufacturers to furnish the following services:

a. The manufacturer's representative shall provide at least three 8-hour days of on-site observation and site specific recommendations relative to surface preparation, mixing, application, curing, and final testing of its product on test areas.

b. Manufacturer shall have a technical representative on site during liner installation and structural polymer application. Representative shall confirm that cleaning and surface preparation meet manufacturer’s requirements and installation is in accordance with manufacturer’s recommendations.

c. The manufacturer's representative shall provide technical support to resolve field problems associated with the manufacturer's products furnished under this Contract or the application thereof throughout the duration of the Work.

d. The lining manufacturer shall provide written certification that the lining Subcontractor's Supervisor and each applicator performing Work on the project has been trained and approved to apply the selected lining system.

1.5 QUANTITY

A. Plastic (PVC) liner repairs shall have the sizes and estimated quantity of two (2) penetrations at the proposed discharge piping locations.

PART 2 - PRODUCTS

2.1 MATERIAL DELIVERY

A. Approved materials shall be shipped in original manufacturer’s containers and such additional packaging as needed to protect the materials from damage during transport. Containers shall be plainly labeled to show manufacturer’s name, product name, batch number, date of manufacture, quantity of contents and storage requirements.

2.2 MATERIAL STORAGE

A. Stored materials shall be protected from excessive heat, cold and weathering. Activator treated PVC sheeting delivered to the job site shall be protected from debris contamination and maintained at 70°F minimum.

2.3 STRUCTURAL POLYMER

A. Structural polymer shall be a high solids polyurethane. It shall be non-flow and shall be resistant to weathering, aging, dilute (10%) solutions of sulfuric acid and intermittent wetting by raw sewage. Structural Polymer shall be Linabond Structural Polymer Mastic as manufactured by Linabond, Inc., Los Angeles, CA, or equal. The testing of the structural polymer material shall comply with the requirements specified in ASTM D1621.

2.4 PVC SHEET LINER

A. Polyvinyl chloride lining material shall be a homogenous thermoplastic sheet recommended by the manufacturer of the structural polymer; Vinylthane liner by Linabond, Inc., or equal. Liner shall conform to Subsection 210-2 (except paragraphs 210-2.4.2 and 210-2.4.4.) and shall exhibit the following minimum physical properties:

Specification	**Requirement**
Specific gravity, ASTM D792	1.33
Hardness, Shore A ASTM D2240	84
Tensile, ASTM D882	2,300 psi
Elongation, ASTM D882	300%
Brittle Point, Model E ASTM D746	-22ºF
Tear Strength, ASTM D1004	250 psi
Thickness	40 mils
Color	White

2.5 SURFACE ACTIVATOR

A. Surface activator shall be a catalytic polyurethane providing cross linking with the PVC sheet liner and the structural polymer and shall be Linabond CLA-2 as manufactured by Linabond, Inc., Los Angeles, CA, or equal.

2.6 SEAM MATERIAL

A. This component is an expansionless version of Linabond's structural polymer which retains the chemical and adhesive properties of the structural polymer while permitting relatively flat, smooth laps between adjacent PVC sheets. Seam material shall be of the type manufactured by Linabond, Inc., Los Angeles, CA, or equal.

2.7 WATER INFILTRATION CEMENT PLUG

A. Single component, extremely fast setting, non-shrink, expansive type, hydraulic cement for repair of underwater concrete or concrete subject to hydrostatic water pressure. Approved products include the following:

1. Hydroplug as manufactured by Nox-Crete Products Group.
2. Subac Underwater Cement as manufactured by Subac Underwater Cement.

2.8 CONCRETE RESURFACER

A. Repair mortar with voids between ¼ inch and 2 inches in depth or width shall be a pneumatically or troweled cementitious, silica fume, fiber-reinforced, high strength shrinkage-compensated portland cement mortar. Approved products include the following:

1. Mortar Mix as manufactured by Rapid Set Construction Cement Products.

2. Cement All as manufactured by Rapid Set Construction Cement Products.

3. Five Star Structural Concrete V/O as manufactured by Five Star Products, Inc.

4. Or approved equal

2.9 STAINLESS STEEL FASTENERS

A. All counter sunk anchor bolts for anchoring the upstream termination strips shall be Type 316 stainless steel, similar to the 1/4-inch diameter Rawl Flat Head Steel Spike, No. 5632 or approved equal. All anchor bolts shall provide a minimum 3 inches of embedment into the concrete pipe wall. Each anchor bolt shall be installed with Rawl/Sika Foil Fast two-part epoxy injection gel or equal. Anchor bolts shall be spaced 18 inches on center. Stainless steel 316 anchor bolts are a special order item and must be ordered as the first item of Work.

2.10 TERMINATION STRIP

A. Termination (Batten) strips shall be 1/4-inch thick by 1 1/2-inches wide Type 316 stainless steel with counter sunk holes 18 inches on center to fit the anchor bolts specified.

2.11 CORROSION INHIBITOR

A. Reinforcing steel, exposed by corrosion or during surface preparation operations, shall be treated with a water-based epoxy resin, anticorrosion coating and bonding agent such as Armatec 110 EpoCem, manufactured by the Sika Corporation, or equal.

PART 3 - EXECUTION

3.1 GENERAL CONDITIONS

A. GENERAL

1. The CONTRACTOR shall follow the requirements of the Specifications and the manufacturer's recommendations in terms of surface preparation, application equipment and techniques, and environmental limitations.

2. After the CONTRACTOR has cleaned all concrete surfaces, the CONTRACTOR shall thoroughly inspect all surfaces. The CONTRACTOR shall notify the ENGINEER, in writing, of any defects or discrepancies which will not allow him to complete his Work properly. Commencement of Work shall be construed as acceptance of the surfaces and it shall be the responsibility of the CONTRACTOR to correct any defect appearing in the surfaces, once the Work has begun.

3. The general limits for PVC lining shall be as specified and shown with minor adjustments as directed by the ENGINEER based upon conditions observed. The CONTRACTOR's Work shall result in the interior of the pipe designated for rehabilitation having a continuous PVC lining as shown on the Plans without holes, gaps, breaks, or unsealed seams. The PVC lining shall be sealed to existing PVC liners and manhole rehabilitation material as shown or recommended by the manufacturer.

B. ENVIRONMENTAL LIMITS

1. Lining and concrete repair shall not be performed if environmental conditions are not within the manufacturer(s) recommended limits. No lining Work shall be performed under the following conditions:

a. Temperatures exceeding the manufacturer's recommended maximum and minimum allowable.

b. Dust or smoke laden atmosphere.

c. Damp or humid weather where relative humidity is above manufacturer's maximum allowable or greater than 85%.

2. The project is located in a sanitary sewer environment where the Work will be exposed to hydrogen sulfide laden air and extended periods of high relative humidity. These “normal atmospheric conditions” may restrict the application and inhibit the cure of the specified lining systems. The CONTRACTOR shall provide facilities to maintain substrate and atmospheric conditions within the controlled environment, with respect to temperature and relative humidity, within the limits established by the manufacture of the product(s) selected to ensure proper application and cure of the lining systems.

C. SAFETY REQUIREMENTS

1. A “breathing air” apparatus and compressor shall be provided for structural polymer spray and hydroblast cleaning operators, if ventilation air flows towards the operators or is required to meet Cal/OSHA breathing air requirements. The compressor shall be equipped with high temperature and carbon monoxide alarms and shall use an in-line filter bed to remove moisture. The CONTRACTOR shall provide compressed air breathing equipment for the ENGINEER and any other personnel, if working in close proximity to mist produced by the structural polymer application and hydroblast cleaning.

D. SEQUENCE OF WORK:

1. STRUCTURAL POLYMER

a. The CONTRACTOR shall perform the Work in the following sequence:

(1) Construction of temporary platform

(2) Cleaning of pipe interior

(3) Reinforcing steel treatment (if necessary)

(4) Structural Reinforcement Repair (as directed by ENGINEER)

(5) Repair of concrete defects

(6) Installation of welded wire mesh

(7) Structural Polymer application

(8) Installation of liner

(9) Testing

2. SELF-FORMING STRUCTURAL POLYMER

a. The CONTRACTOR shall perform the Work in the following sequence:

(1) Construction of temporary platform

(2) Cleaning of pipe interior

(3) Reinforcing steel treatment (if necessary)

(4) Structural Reinforcement Repair (as directed by ENGINEER)

(5) Repair of concrete defects

(6) Installation of welded wire mesh

(7) Installation of liner

(8) Structural Polymer application

(9) Testing

3.2 SURFACE PREPARATION OF CONCRETE

A. All loose, brown carbonated, deteriorated, or unsound concrete shall be removed in the immediate vicinity of the damaged documented areas to provide a substrate that is tightly adhered to the surfaces of the structure.

B. The CONTRACTOR shall cut and remove any loose existing delaminated PVC liner and the remaining edge of the liner shall be at an embedded locking (T-Lock) anchor that is tightly adhered to the wall.

C. Concrete surfaces shall be prepared per SSPC SP13 abrasive blasting to remove the top 0.125 inches of existing concrete and to produce a surface roughness equivalent to that of ICRI 310.2 Concrete Surface Profile 5.

D. All surfaces shall be cleaned using high pressure water. Water cleaning equipment including pumps, hoses, connectors, valves and nozzles shall be capable of producing a blast pressure of 5,000 psi. CONTRACTOR shall remove all grease, dirt, rocks, rust, spalled masonry (including mortar, concrete, and brick), and other deleterious materials and debris from the interior of the pipe. The finished interior surface shall consist of sound concrete with exposed aggregate.

E. In accordance with ASTM D4262, test to determine the pH of the concrete surface after the surface has been thoroughly blasted and cleaned. If the pH is outside the range recommended by the coating manufacturer, then the surface must be neutralized by removing concrete until a surface pH of 7 or greater is obtained prior to any coating application. One pH test shall be performed every 50 square feet, or less, and at locations determined by the Coating Inspector.

F. The CONTRACTOR shall test for capillary moisture in accordance with ASTM D4263. Moisture tests shall be taken every 200 square feet or less and at locations determined by the INSPECTOR. If capillary moisture is present, the coating manufacturer shall be consulted to determine primer requirements and special coating application criteria.

G. The CONTRACTOR shall use a concrete mortar to rebuild the existing concrete to 2 inches in depth following abrasive blasting. Concrete mortar must be scrubbed into substrate filling all pores and voids. While the scrub coat is still plastic, force material against the edge of repair, working toward center. The CONTRACTOR shall use a trowel to repair the existing concrete with a high early strength mortar, as specified, prior to the installation of the epoxy primer. Hand application is not acceptable. The repaired concrete shall be finished with a masonry brush with 4-inch long Tampico fibers, completely cured, and dried according to the manufacturer's recommendations.

H. As per ACI recommendations for portland cement concrete, curing is required. Moist cure with wet burlap and polyethylene, and a fine mist of water. Moist curing should commence immediately after finishing.

I. After curing, and prior to coating, the repaired concrete shall be lightly abrasive blast cleaned to remove curing agents, laitance, surface contaminants and to produce a surface roughness equivalent to that of ICRI 310.2 Concrete Surface Profile 3.

J. Surfaces shall be cleaned of all dust and residual particles by dry air blast cleaning, vacuuming, or other approved methods prior to lining application as approved by the Coating Inspector.

K. The resurfaced concrete shall be examined by the Coating Inspector by tapping with a 1 pound hammer over the repair areas. If hollow and soft areas are present, the CONTRACTOR shall chip out the area and reapply the mortar.

3.3 SURFACE PREPARATION OF EXISTING LINER

A. The CONTRACTOR shall cut and remove any existing delaminated PVC liner and the remaining edge of the liner shall be at an embedded locking (T-Lock) anchor that is tightly adhered to the wall.

B. The existing PVC liner shall be abraded with 60 Grit sandpaper and be detergent cleaned per SSPC SP1 when the new PVC liner will overlap it. Formula 409, or equal, shall be used to clean the existing liner prior to applying the material.

3.4 REINFORCING STEEL TREATMENT

A. Where corrosion or surface preparation activities have exposed reinforcing steel the following procedure shall be used:

1. If half the diameter of the reinforcing steel, or more, is exposed, chip out behind the reinforcing steel a minimum of ½ inch for placement of grout or polymer concrete.

2. Abrasive blast all exposed reinforcing steel surfaces to remove all contaminants and corrosion products.

3. Determine section area loss of reinforcing steel. Perform structural reinforcement repair as directed by the ENGINEER. Structural reinforcement repair shall include providing and installing wire fabric and mortar as directed by the ENGINEER.

4. Structural reinforcement repair shall be used only when directed by the ENGINEER. ENGINEER shall determine and identify the area over which such repair shall be performed, and the quantities and limits of wire mesh to be placed.

5. If the reinforcing steel has more than 50% of the cross sectional area lost along its exposed length, the reinforcing steel shall be replaced and spliced to sound, adjacent reinforcing steel. The CONTRACTOR shall remove enough of the concrete around the circumference of the reinforcing bar to accommodate the splices and/or coupler installation and to allow for bonding between the reinforcing steel and the new cementitious mortar material. Removals shall allow for a ½-inch gap around the circumference of the reinforcing steel or coupler.

6. Apply a 20 mil (wet) coat of corrosion inhibitor to all surfaces of the clean, exposed reinforcing steel with stiff brush or spray equipment. Cure to tack-free 2 to 3 hours.

7. Apply a second 20 mil (wet) coat of corrosion inhibitor and allow for 2-hour to 3-hour cure prior to placement of polymer mortar, cementitious mortar, or grout.

3.5 REPAIR OF CONCRETE DEFECTS

A. CRACKS:

1. Cracks shall be filled with the specified polymer mortar according to the following procedure:

a. Deepen the crack as necessary to ensure a minimum depth of 1/8 inch.

b. Apply a scrub coat of the polymer mortar, prepared according to the manufacturer's recommendations, to the prepared substrate.

c. While the scrub coat is still wet, force the polymer mortar into the cavity.

d. Strike off and level as required.

3.6 LINING SYSTEM APPLICATION

A. Proportioning and Mixing. Structural polymer materials shall be mixed and proportioned in accordance with the manufacturer's written instructions with the equipment specified by the manufacturer. Pumping equipment and computer equipment utilizing an integrated DAQ system with built in alarms shall be approved by manufacturer prior to use. All equipment shall be maintained and operated per the manufacturer's written instructions. Filters shall be checked twice daily (if operated) and cleaned as necessary. At all times during use, the spray equipment shall be attended by a qualified operator certified by the manufacturer.

B. Structural Polymer. Structural polymer shall only be applied to a clean, prepared and dry sound concrete surface, as specified above. Structural polymer shall cover all exposed aggregate, and provide a smooth surface for application of the PVC liner. Prior to application of the PVC sheets and rolling of same, the mastic shall provide a minimum of 1-inch thick cover over the surface of the exposed concrete aggregate material. In areas where the pipe reinforcing bars are exposed, the net cover over the reinforcement, before application and rolling of the PVC sheets, shall be 2 inches minimum. Structural polymer shall be applied in lifts not to exceed 1-inch thickness. The maximum thickness of the cumulative lifts shall be no more than 2 inches.

C. Application of the PVC liner after the installation of the structural polymer shall be in accordance with manufacturer's specifications, but in any event not later than 45 minutes after application of the structural polymer, after which the area must be resprayed and allowed to tack again.

D. Activator. Apply activator to clean, dry PVC sheets in accordance with manufacturer's instructions. Allow to dry "tack-free" prior to embedding sheet in the structural polymer. Activator shall be applied to sheets in a warm (70 degree F minimum), protected environment and allowed to dry prior to shipment to the job site. Protect prepared sheet from debris contamination.

E. Sheet Liner. The activator prepared surface of the PVC sheet liner shall be pressed into the structural polymer and rolled to remove trapped air. Seams shall overlap a minimum of 4 inches in the downstream direction. Maximum size of sheets along the length of the pipe shall not exceed 8 feet in any dimension, and the PVC shall be in one continuous piece to cover the crown and sides of the pipe as shown on the Plans. PVC sheets shall be applied while the structural polymer is still tacky. Following the removal of the support system, the 4-inch overlapping seams shall be embedded in seam material as shown on the Plans.

F. Fiberglass Support Panels. A support system consisting of sections of flexible but stiff 4-foot wide by 12-foot long fiberglass panels, shall be pressed up by jacks into the new PVC liner surface while the structural polymer is finishing its exothermic reaction with the pipe. Each fiberglass panel section using four jack supports shall ensure that a very uniform flat finish formed pipe interior from the termination edges of the liner near the bottom of the pipe to the crown of the pipe is attained.

G. The formwork shall be made of activated PVC liner sheets and shall provide a complete seal of all the concrete surfaces to be lined in accordance with the limits as shown on the Drawings. Care shall be taken to keep the activated PVC liner sheets clean and free of dust and protected from debris contamination. The CONTRACTOR shall utilize the maximum size PVC liner sheets possible with a minimum number of seams. The vertical and horizontal seams shall be joined with the "H" channels and the intersecting walls shall be joined using the preformed angles. The bottom, leading or terminating edges of the liner sheets shall be inserted in "J" Channels or joiner strips and sealed in accordance with the details shown in the Drawings. All the PVC liner sheets, channels, and angles shall be activated and allowed to dry to tack free prior to joining. An adequate amount of sealant shall be applied to form a bead along the seam after joining.

H. Sheet Liner Terminations. The PVC lining system shall extend to the limits shown on the Plans. Where the new lining meets the existing lining, the new liner shall overlap the existing liner by a minimum of 4 inches. Methods for overlapping the existing liner at the downstream and leading (upstream) edge of the liner are shown on the Plans. Along the length of the pipe, on both sides, and on the upstream end where the end of the liner will terminate, saw-cut into the wall of the concrete pipe and embed the liner in structural polymer covered with seam material, as shown on the Plans.

3.7 INSPECTION AND TESTING

A. The surface of the installed liner will be visually inspected by the Coating Inspector for proper adhesion, air pockets, edge or seam defects, rips, tears, and punctures. The newly applied PVC liner shall be spark tested per NACE SP0188 and any defect that is identified by the spark test shall be properly repaired and retested. The spark testing shall be done with a Tinker and Rasor Holiday Detector (Model AP-W) or equal set at 20,000 volts.

B. The Project Quality Control Plan shall be submitted by the CONTRACTOR for approval by the ENGINEER. All quality assurance testing shall be provided by the CONTRACTOR at no additional cost to CITY.

C. To assure proper adhesion of the PVC lining to the structural polymer and the structural polymer to the concrete surface, the protective lining system shall have a "peel test" performed at locations previously designated by the Coating Inspector and prepared by the lining CONTRACTOR. The test shall be the "Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants" per ASTM Designation C794 and modified for field test conditions. Preparation of the 1-inch wide pulling strips, during the CONTRACTOR's lining installation, shall be as directed by the Coating Inspector. The allowable minimum value for the peel strength test shall be per the protective lining system manufacturer's recommendation but shall not be less than 16 pounds per linear inch after 3 days of curing at a minimum ambient temperature of 55°F.

3.8 REPAIR OF DEFECTS

A. The CONTRACTOR shall repair all defects found in the lining system. Areas with poor adhesion or air inclusions, edge or seam defects, punctures or other defects, shall be repaired. The repair may include cutting and removing all the defective areas and relining; drilling and injecting polyurethane seam material into defective areas and lining with a flexible PVC liner. The protective lining system used in the relining or the flexible PVC lining to be applied shall overlap the adjacent lined areas a minimum of 4 inches in all directions and shall be reinspected.

3.9 WARRANTY

A. The CONTRACTOR and manufacturers shall warrant the lining system applications for a period of 1 year after Final Acceptance of the Work. Failures identified in the warranty inspections described below shall be repaired by the CONTRACTOR at no cost to CITY.

3.10 WARRANTY INSPECTION

A. Warranty inspections shall be conducted at the end of 11 months following acceptance of the Work. Normal wear of the lining systems shall be repaired at CITY's expense at the time of inspection based on the escalated unit costs established in this Contract. All lining applications found to be deficient or defective during the warranty period shall be repaired by the CONTRACTOR, to the satisfaction of the ENGINEER, in accordance with this Specification and the material manufacturer's recommendations at no cost to CITY. Deficient or defective linings include poor adhesion or air inclusions, edge or seam defects, blisters, peeling, disbondment or other defects. The final inspection video shall be used to assist in determining normal wear of the coating systems.

B. CITY shall establish a date for the inspection and notify the CONTRACTOR 30 days in advance. The CONTRACTOR shall supply adequate safety equipment and interior lighting for the inspection as required.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09900 PAINTING AND COATING

PART 1 GENERAL

1.1 DESCRIPTION

This section described the requirements for the preparation of surfaces and subsequent application of protective coatings. The Contractor shall furnish all labor, materials and equipment required for satisfactory completion of all items contained herein. The Contractor shall furnish all necessary safety equipment and protective clothing, as well as be responsible for proper instruction and supervision of their use. Requirements for steel storage reservoirs are specified elsewhere in the Specifications.

1.2 RELATED WORK DESCRIBED ELSEWHERE

The Contractor shall refer to the following Specification section(s) for additional requirements:

A. Summary of Work: 01010

1.3 SUBMITTALS

Contractor shall furnish submittals in accordance with the requirements of the GENERAL PROVISIONS. The following submittals are required:

A. Submit a chart of the manufacturer's available colors for color selection well in advance of painting operation.

B. Submit manufacturer's data sheets showing the following information:

1. Recommended surface preparation.

2. Minimum and maximum recommended dry-film thicknesses per coat for prime, intermediate, and finish coats.

3. Percent solids by volume.

4. Recommended thinners.

5. Statement verifying that the selected prime coat is recommended by the manufacturer for use with the selected intermediate and finish coats.

6. Application instructions including recommended application, equipment, humidity, and temperature limitations.

7. Curing requirements and instructions.

C. Submit certification that all coatings conform to applicable local Air Quality Management City rules and regulations for products and application.

1.4 PAYMENT

Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 MATERIALS

2.1 GENERAL

All materials shall be those of current manufacture and shall meet all applicable regulations for the application and intended service. All coats of any particular coating system shall be of the same manufacturer and shall be approved by the manufacturer for the intended service. In the event that a product specified herein is no longer manufactured or does not meet current regulations, the Contractor shall provide a substitute, currently manufactured product of at least equal performance which meets all applicable regulations subject to Engineer's approval, at no additional cost.

All materials shall be delivered to the Project Site in their original, unopened containers bearing the manufacturer's name, brand, and batch number. Standard products of manufacturers other than those specified will be accepted when it is proved to the satisfaction of the Engineer they are equal in composition, durability, usefulness and convenience for the purpose intended. Paint listed in the system refers to products of the following manufacturers and distributors:

Ameron Corrosion Control Division, Brea, CA
I.C. Devoe, Louisville, KY
Engard Coating Corporation, Long Beach, CA
I. DuPont de Nemours & Company, Los Angeles, CA
Tnemec Company, Inc., Kansas City, MO 64141

All surfaces to be coated or painted shall be in the proper condition to receive the material specified before any coating or painting is done. No more sandblasting or surface preparation than can be coated or painted in a normal working day will be permitted. All sharp edges, burrs, and weld spatter shall be removed. All concrete and masonry surfaces shall cure 30 days prior to coating or painting.

Surface preparation, prime coatings, and finish coats for the various systems are specified herein. Unless otherwise noted, all intermediate and finish coats shall be of contrasting colors. It is the intent that the coating alternates specified herein serve as a general guide for the type of coating desired.

2.2 VALVES

A. Exterior Coating: Coat metal valves located above ground, in vaults or in structures the same as the adjacent piping. If the adjacent piping is not coated, then coat valves per this Specification section unless otherwise noted. Apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in the field. Finish coat shall match the color of the adjacent piping. Coat handwheels and floor stands the same as the valves. Coat the exterior of buried metal valves at the place of manufacture per this specification.

B. Coating (Devoe Alternate): Prime coat shall be BarRust 231 or Devran 200 applied at 2 to 3 mils dry-film thickness. Intermediate coat shall be Devran 224H Epoxy applied at 2 to 4 mils dry-film thickness. Finish coat shall be 379 Urethane applied at 2 to 3 mils dry-film thickness.

C. Interior Lining: Valves 4-inches and larger shall be coated on their interior metal surfaces excluding seating areas and bronze and stainless-steel pieces. Sandblast surfaces in accordance with SSPC-SP-10 (near white blast cleaning). Remove all protuberances which may produce pinholes in the lining. Round all sharp edges to be coated. Remove any contaminants which may prevent bonding of the lining. Coat the interior ferrous surfaces using one of the following methods:

1. Apply powdered thermosetting epoxy per the manufacturer's application recommendations to a thickness of 10 to 12 mils.

2. Apply two coats of polyamide epoxy to a dry-film thickness of 10 to 12 mils total. Follow the manufacturer's application recommendations including minimum and maximum drying time between the required coats.

3. Apply two coats of Tnemec Series 140 (for potable water) or Series 69 (for non-potable water), or equal, to a dry film thickness of 10 to 12 mils total. Follow manufacturer's application recommendations including minimum and maximum drying time between required coats.

4. Apply two coats of Devoe Bar-Rust 233H Epoxy applied to a dry-film thickness of 6 to 8 mils, each. Total dry-film thickness shall be 10 to 12 mils minimum.

All epoxy lining shall be applied at the factory by the manufacturer of the valve, and shall meet current Volatile Organic Compound (VOC) content regulations. Epoxy lining for potable water valves shall also be listed by National Sanitation Foundation (NSF) for contact with potable water.

Test the valve interior linings at the factory with a low-voltage holiday detector. The lining shall be holiday free.

2.3 METAL, INTERIOR AND EXTERIOR, NORMAL EXPOSURE

A. General: The Contractor shall paint all exposed steelwork, non-galvanized handrails, exposed pipework, fittings, all mechanical equipment, pumps, motors, doors, door frames and window sash with this coating system. All metalwork previously given a shop prime coat approved by the Owner's Representative shall be touched up as required in the field with Tnemec Series 4 Versare Primer or equal.

B. Surface Preparation: All exterior metal surfaces which are to be painted shall be commercial blast cleaned per Specification SP-6 (commercial blast cleaning) except as otherwise specified, in locations where sandblasting would damage previously coated surfaces and installed equipment, and in locations where dry sandblasting is prohibited. The above locations in which SP-6 commercial sandblasting is not possible shall be given a SP-3 power tool cleaning. This sandblasting shall be done not more than 8 hours ahead of the painting, subject to humidity and weather conditions between the time of

sandblasting and painting operations. If any rusting or discoloration of sandblasted surfaces occurs before painting, such rusting or discoloration shall be removed by additional sandblasting. Sandblasted surfaces shall not be left overnight before painting.

C. Coating (Tnemec Alternate): Prime coat or spot prime coat as required shall be Tnemec Series 4 Versare primer applied to a dry-film thickness of 2 to 3.5 mils. Two or more finish coats of Tnemec Series 2H Tneme-Gloss enamel shall be applied to a thickness of 1.5 to 3.5 mils. Total dry-film thickness of the complete system shall be 7 mils, minimum.

D. Coating (Devoe Alternate): Prime coat or spot prime as required shall be 4140 Q.D. Alkyd Primer. Two or more finish coats of Devshield 4328 Alkyd applied to a dry-film thickness of 1.5 to 2 mils, each. Total dry-film thickness of the complete system shall be 5 mils, minimum.

2.4 METAL, SUBMERGED OR INTERMITTENTLY SUBMERGED

A. General: All submerged metalwork, gates, equipment, valves, exposed pipework and all other metalwork within areas which will be submerged, except as noted hereinafter, shall be painted with this coating system.

B. Surface Preparation: All metal surfaces shall be field sandblasted according to SSPC-SP-10 (near white blast cleaning).

C. Coating (Tnemec Alternate): Prime coat shall be Tnemec Series 69 Epoxoline II applied to a dry-film thickness of 4 to 6 mils. Two finish coats of Tnemec Series 69 Epoxoline II shall be applied to a dry-film thickness of 4 to 6 mils each coat. Total try- film thickness of the complete system shall be a minimum of 12 mils.

D. Coating (Devoe Alternate): Apply two coats of Bar-Rust 233H Epoxy applied to a dry-film thickness of 6 to 8 mils each coat. Total dry-film thickness of the complete system shall be a minimum of 12 mils.

2.5 METAL, SEVERE EXPOSURE TO MOISTURE OR CHEMICAL FUMES

A. Surface Preparation: All metal surfaces shall be field sandblasted according to SSPC-SP-10 (near white blast cleaning).

B. Coating (Tnemec Alternate): Prime coat shall be Tnemec Series 104 H.S. Epoxy to a dry-film thickness of 6 to 10 mils. One or more finish coats of Tnemec Series 104 H.S. Epoxy topcoat shall be applied. Total dry-film thickness shall be a minimum of 12 mils.

C. Coating (Devoe Alternate): Prime coat shall be Catha-Coat 304V Zinc, 2 to 3 mils dry-film thickness. Intermediate coat shall be Devran 224H Epoxy applied at 4 to 6 mils dry-film thickness. Finish coat shall be Devthane 379 Urethane applied at 2 to 3 mils dry-film thickness. Total dry-film thickness shall be 8 mils minimum.

2.6 METAL, HIGH-TEMPERATURE EXPOSURE

A. General: Engine mufflers, exhaust systems and other metal surfaces subjected to high temperatures shall be coated with this system.

B. Surface Preparation: Surface shall be field sandblasted in accordance with SSPC-SP-10 (near white blast cleaning).

C. Coating (Tnemec Alternate): One coat of Tnemec Series 90-96 Tneme-Zinc to a minimum total dry-film thickness of 2 to 3.5 mils.

D. Coating (Devoe Alternate): One coat of Catha-Coat 304V Zinc to a dry-film thickness of 2 to 4 mils.

2.7 METAL, GALVANIZED, ALUMINUM, COPPER, OR BRASS

A. Surface Preparation: Surfaces shall be solvent cleaned in accordance with SSPC-SP-1 (solvent cleaning) and SSPC-SP-2 (hand tool cleaning).

B. Coating: Pre-treatment prime coat shall be Tnemec Series 32-1215 Tneme-Grip or Sinclair 7113 Wash Primer applied at mil dry-film thickness. Next, apply recommended coating or paint for the particular surface to be coated.

C. Coating (Devoe Alternate): Pre-treatment prime coat shall be Devoe BarRust 231 primer applied at 3 mil dry-film thickness. Next, apply recommended coating or paint for the particular surface to be coated.

2.8 METAL, BURIED

A. General: The Contractor shall coat all buried metal which includes valves, bolts, nuts, structural steel and fittings. It does not include steel storage reservoirs.

B. Surface Preparation: Sandblast to SSPC-SP-6 (commercial blast cleaning)

C. Coating (Tnemec Alternate): Prime none. Finish with two coats of Tnemec Series 46-465 H.B. Tnemecol or equal at 10 to 12 mils dry-film thickness, each. Total dry-film thickness shall be 20 mils minimum.

D. Coating (Devoe Alternate): Prime with Devtar 221 (5A) Epoxy applied at 8 mil dry-film thickness. Two coats of Devtar (5A) Epoxy applied at 8 mils dry-film thickness, each. Total dry-film thickness shall be 24 mils, minimum.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall arrange with the Owner's Representative so that all surface preparation may be inspected and approved prior to the application of any coatings.

The Contractor is hereby notified that the Engineer will inspect the Work prior to the expiration of the warranty period and all defects in workmanship and material shall be repaired by the Contractor, at his own expense.

3.2 WORKMANSHIP

It is the intent of the Specifications that finishes shall be provided which meet standards for best grades of painting. Drop cloths shall be placed where required to protect floors, surfaces and equipment from spatter and dropping, not to receive paint or coatings.

The Contractor shall take all necessary precautions to protect all adjacent Work and all surrounding property and improvements from any damage whatsoever as a result of the painting and coating operation.

Only good, clean brushes and equipment shall be used and all brushes, buckets, and spraying equipment shall be cleaned immediately at the end of each painting period.

Each coat of paint shall be of the consistency as supplied by the manufacturer, or thinned, if necessary, and applied in accordance with manufacturer's instructions. Each coat shall be well brushed, rolled or sprayed to obtain a uniform and evenly applied finish. Work shall be free from "runs", "bridges", "shiners", or other imperfections due to faulty intervals. Particular care shall be taken to obtain a uniform unbroken coating over all bolts, threads, nuts, welds, edges and corners. Paint shall not be applied in extreme heat, in dust or smoke laden air, or in damp or humid weather, unless written permission of the Engineer is obtained.

If paint is applied by spray, the air pressure used shall be within the ranges recommended by both the paint and spray equipment manufacturers. Spray painting shall be conducted under controlled conditions and the Contractor shall be fully responsible for any damage occurring from spray painting.

Care shall be exercised not to damage adjacent Work during sandblasting operations. Stainless steel need not be sandblasted. Blasted surfaces shall not be left overnight before coating. All dust shall be removed from the surface following sandblasting.

3.3 APPLICATION PROCEDURES

A. Surfaces to be Coated: All surfaces of materials furnished and constructed are to be painted or coated per the Specifications except as indicated below.

B. Surfaces Not To Be Coated: The following surfaces shall not be coated unless otherwise noted on the Plans and shall be fully protected when adjacent areas are painted.

Aluminum grating	Machined surfaces
Aluminum surfaces	Metal letters
Bearings	Mortar-coated pipe and fittings
Brass and copper tubing, submerged*	Nameplates on machinery
Buried pipe	Pipe interior*
Couplings	Shafts
Grease fittings	Stainless steel
Hardware	Switch plates
Lighting fixtures	

* unless specifically required on the Plans or elsewhere in the Specifications

C. Protection of Surfaces Not To Be Coated: Surfaces not intended to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent paint

materials from falling on or marring adjacent surfaces. Working parts of mechanical and electrical equipment shall be protected from damage during surface preparation and painting process. Openings in motors shall be safely masked to prevent paint and other materials from entering the motors. All masking materials shall be completely removed and surfaces cleaned at completion of painting operations.

D. Weather Conditions: Paint shall not be applied in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5°F above the dew point.

Paint shall not be applied when the relative humidity is above 80%, the air temperature is above 90°F, or the temperature of metal to be painted is above 125°F.

Alkyd, chlorinated rubber, inorganic zinc, silicone aluminum, or silicone acrylic paints shall not be applied if air or surface temperature is below 50°F or expected to be below 50°F within 24 hours.

Epoxy, coal tar epoxy, acrylic latex, and polyurethane paints shall not be applied on an exterior or interior surface if air or surface temperature is below 50°F or expected to drop below 50°F within 24 hours.

3.4 SURFACE PREPARATION

A. General: Sandblast or prepare only as much surface area as can be coated in one day. All sharp edges, burrs, and weld spatter shall be removed. Epoxy-coated pipe that has been factory coated shall not be sandblasted.

B. SSPC Specifications: Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", or "blast cleaning" or similar words are used in the Specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structures Paint Council, Surfaces Preparation Specifications, ANSI A159.1) Specifications listed below:

SP-1 Solvent Cleaning	SP-2 Hand Tool Cleaning
SP-3 Power Tool Cleaning	SP-5 White Metal Blast Cleaning
SP-6 Commercial Blast Cleaning	SP-7 Brush-Off Blast Cleaning
SP-8 Pickling	SP-10 Near White Blast Cleaning

Oil and grease shall be removed from aluminum and copper surfaces in accordance with SSPC SP-1 using clean cloths and cleaning solvents.

Weld spatter and weld slag shall be removed from metal surfaces. Rough welds, beads, peaked corners, and sharp edges including erection lugs shall be ground smoothly in accordance with SSPC SP-2 and SSPC SP-3.

Welds shall be neutralized with a chemical solvent that is compatible with the specified coating materials using clean cloths and chemical solvent.

C. Abrasive Blast Cleaning: Dry abrasive blast cleaning shall be used for metal surfaces. Do not recycle or reuse contaminated blast particles.

Dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said 8-hour period.

Prevent damage to adjacent coatings during blast cleaning. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.5 PROCEDURES FOR THE APPLICATION OF COATINGS

The recommendations of the coating manufacturer shall be followed, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

Coating materials shall be kept at a uniform consistency during application. Each coating shall be applied evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. A different shade or tint shall be used on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

Only thinners recommended by the coating manufacturer shall be used. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material.

Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

A. Paint Mixing: Multiple-component coatings shall be prepared using all the contents of each component container as packaged by the paint manufacturer. Partial batches shall not be used. Multiple-component coatings that have been mixed beyond their pot life shall not be used. Small quantity kits for touch-up painting and for painting other small areas shall be provided. Only the components specified and furnished by the paint manufacturer shall be mixed. For reasons of color or otherwise, additional components shall not be intermixed, even within the same generic type of coating.

B. Field Touch Up of Shop-Applied Prime Coats: Organic Zinc Primer: Surfaces that are shop primed with inorganic zinc primers shall receive a field touch up of organic zinc primer to cover all scratches or abraded areas. Organic zinc coating system shall have a minimum volume solids of 54% and a minimum zinc content of 14 pounds per gallon. Coating shall be of the converted epoxy, epoxy phenolic, or urethane type and shall be manufactured by the prime coat and finish coat manufacturer.

Other Primers: Surfaces that are shop primed with other than organic zinc primer shall receive a field touch up of the same primer used in the original prime coat.

3.6 DRY-FILM THICKNESS TESTING AND REPAIR

A. Special Instructions to the Contractor: The Contractor shall furnish to the Owner at no charge for use during execution of the Work, necessary dry-film thickness gauge and electrical flaw detection equipment. The Contractor shall perform the holiday (pinholes) inspection in the presence of the Owner's Representative, and the Contractor shall monitor wet film measurements throughout the application of each coat of coating.

B. Coating Thickness Testing: Coating thickness specified for steel surfaces shall be measured with a magnetic-type dry-film thickness gauge. Dry-film thickness gauge shall be provided as manufactured by Mikrotest or Elcometer. Each coat shall be checked for the correct dry-film thickness. Measurement shall not be made until a minimum of eight hours after application of the coating. Non-magnetic surfaces shall be checked for coating thickness by micrometer measurement of cut and removed coupons. Contractor shall repair coating at all locations where coupons are removed.

C. Holiday Testing: The finish coat (except zinc primer and galvanizing) shall be tested by the Contractor in the presence of the Engineer for holidays and discontinuities with an electrical holiday detector of the low-voltage, wet-sponge type in accordance with ASTM G62-14. Detector shall be provided as manufactured by Tinker, Rasor, K-D Bird Dog, or approved equal.

D. Repair: If the item has an improper finish, color, insufficient film thickness, or holidays, the surface shall be cleaned and top-coated with the specified paint material to obtain the specified color and coverage. Visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the Specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.7 CLEANUP

Upon completion of all painting and coating Work, the Contractor shall remove all surplus materials and rubbish. The Contractor shall repair all damage and shall leave the premises in a clean and orderly condition.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09902 PETROLATUM WAX TAPE COATING

PART 1 GENERAL

1.1 SCOPE

This section covers the work necessary to furnish and install petrolatum wax tape coating on buried ferrous materials including pipe flanges, bolted fittings and couplings, valves and other buried pipeline appurtenances, complete, as shown or specified.

1.2 SUBMITTALS DURING CONSTRUCTION

Submit manufacturer's technical product data, details, installation instructions and general product recommendations.

1.3 PRODUCT IDENTIFICATION

The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the Contract Documents.

PART 2 MATERIALS

2.1 GENERAL

Wrap all exposed surfaces of buried ferrous pipe, flanges, couplings and other pipeline appurtenances (including bolts, nuts, etc.) with petrolatum wax tape, unless another corrosion protection system (other than a factory-installed paint coating) is otherwise specified or indicated by the Contract Drawings. Exposed piping shall be wrapped only where specifically called out on the Drawings. Ductile iron pipe encased with polyethylene sheathing shall not be wrapped with this product.

2.2 PRIMER

Exposed surfaces shall be prime coated with a blend of petrolatum, plasticizer, and corrosion inhibitor having a paste-like consistency. The material shall have the following properties:

Pour Point	400-100° F
Flash Point	350° F minimum
Approximate Coverage	1 gal/100 square feet
Color	Brown

The primer shall be Trenton Wax-Tape Primer or equivalent.

2.3 WAX TAPE

Two types of petrolatum wax tape shall be available from the manufacturer: one type for buried installations and another type for above-ground installations.

Buried Installations: The covering material shall be a plastic-fiber felt tape, saturated with a blend of petrolatum, plasticizers, and corrosion inhibitors that is easily formable over irregular surfaces. The tape shall have the following properties:

Color	Brown
Saturant Pour Point	115° - 125°F
Thickness	70-90 mils
Dielectric Strength	170 volts/mil
Tape Width	6 inches

Wax tape shall be Wax-Tape #1 as manufactured by The Trenton Corporation (Ann Arbor, Michigan), or approved equal.

2.4 OUTER COVERING

The primed and wax-tape wrapped surface shall be wrapped with a plastic tape covering consisting of three (3) layers of 50 gauge, clear, polyvinylidene chloride, high cling membranes wound together as a single sheet. The material shall have the following properties:

Width	6 inches
Thickness	1.5 mils
Dielectric Strength	2000 volts/mil
Water Absorption	Negligible
Color	Clear

The outer covering shall be Trenton Poly-Ply or approved equal.

2.5 OTHER PETROLATUM WAX TAPE SYSTEM COMPONENTS

Any components not listed above, but required for a complete petrolatum wax tape coating system as recommended for this application by the manufacturer shall be provided at no additional cost to Owner.

PART 3 EXECUTION

3.1 GENERAL

The petrolatum wax tape system shall be installed in conformance with the manufacturer's recommendations.

END OF SECTION

SECTION 13345 FLOW MEASURING SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

The Contractor shall provide flow measuring systems, complete and operable, in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

ANSI/NCSL-2540-1 Calibration Laboratory and Measuring and Test Equipment General Requirements
ANSI B16.5 Pipe Fittings and Flanged Fittings, NPS 1/2 through NPS 24
ANSI/AWWA C207 Steel Pipe Flanges for Waterworks – Sizes 4 in through 144 in

1.3 RELATED SECTIONS

The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09900, Protective Coating
2. Section 15000, General Piping Systems and Appurtenances

1.4 Contractor SUBMITTALS

A. Shop Drawings shall conform to the requirements of Section 15000 - Piping Systems and Components. Provide catalog information and calibration sheets with the following information.

1. Project name
2. Loop number
3. Tag number
4. Manufacturer
5. Model number
6. Serial number
7. Calibration range
8. Calibration data: input, output, and error at 10, 50, and 90% of span
9. Switch setting, contact action, and deadband for discrete elements
10. Space for comments
11. Space for sign-off by Instrumentation Supplier and date
12. Test equipment used and associated serial

PART 2 - PRODUCTS

2.1 MAGNETIC FLOW MEASURING SYSTEMS

B. Magnetic flow measuring systems shall be of the low frequency electromagnetic induction type and produce a DC pulsed signal directly proportional to and linear with the liquid flow rate. Complete zero stability shall be an inherent characteristic of the flowmeter system. Each magnetic flow metering system shall include a metering tube, remote mounted transmitter/display, signal cable (length as required), and flowmeter grounding rings. The remote mounted transmitter/display is to be mounted by the Contractor in the PLC panel being furnished by the City.

1. The metering tube shall have the following attributes:

   a. Constructed of Type 316 stainless steel with flanged connections.

   b. Use a minimum of 2 bullet-nosed, self-cleaning electrodes.

   c. Liner in conformance with the manufacturer's recommendation for the intended service.

   d. Electrodes constructed of materials which are in conformance with the manufacturer's recommendation for the intended service.

   e. Meter housing rated NEMA 6 and IEC IP68. Meter coating consisting of epoxy paint finish.

   f. Two grounding rings that conform to the manufacturer's bore and material recommendation for the intended service. Grounding rings shall be designed to protect and shield from abrasion the liner edge interface at the meter end.

2. The microprocessor-based remote signal converter/transmitter shall have the following attributes. Contractor is responsible for determining the required cable length to connect the remote signal converter to the flow meter.

   a. Use DC pulse technique to drive flux-producing coils.

   b. Convert DC pulse signal from the tube to a standardized 4-20 mA signal into a minimum of 700 ohms.

   c. A LCD display for flow rate, percent of span, and totalizer.

   d. An operator interface consisting of keypads which respond to English text entry.

   e. Integral zero return to provide a consistent zero output signal in response to an external dry contact closure.

   f. Integral low flow cutoff and zero return.

   g. Automatic range change.

   h. Capable of measuring flow in both directions.

   i. Programmable parameters including meter size, full scale Q, magnetic field frequency, primary constant, time constant.

j. Data retention for a minimum of 5 years without auxiliary power (main or battery).

k. Self diagnostics and automatic data checking.

l. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.

m. Produce a programmable pulsed output for totalized flow indication at the pump station controller.

n. Tolerate ambient temperature operating limits of -20 to +140 degrees F.

o. Transmitter housing shall be rated NEMA 4X and IEC IP67 temporary immersion.

C. Calibration: Each magnetic flowmeter system shall be hydraulically calibrated at a facility which is traceable to the National Institute of Standards and Technologies. The calibration procedure shall conform to the requirements of ANSI/NCSL-2540-1. A real-time computer-generated printout of the actual calibration data indicating apparent and actual flows at 20, 40, 60, 80 and 100% of the calibrated range shall be submitted to the CONSTRUCTION MANAGER at least 30 days before shipment of the meters to the project site.

D. Performance: The flow metering system shall conform to the following requirements:

1. Time constant = 0.5 to 1000 seconds; galvanic or optic isolation.

2. Accuracy: 0.25% of flow rate from 10 to 100% full scale for velocities over 3 feet per second.

3. Repeatability: 0.25% full scale.

4. Power consumption: 30 watts or less.

5. Power Requirements: 120 VAC, ± 10%.

E. Manufacturers:

1. Endress Hauser Proline, Promag 5W4C1H - C6ELHP2DUA1S0B

PART 3 - EXECUTION

3.1 GENERAL

Flow meters shall be installed in accordance with manufacturer's instructions. Install flow meter remote/transmitter display in City furnished PLC panel, including all wiring. Coordinate placement of transmitter/display box with the City.

3.2 START-UP AND TRAINING

A qualified factory representative shall provide programming of the flow meter and provide training on the operation, maintenance, and programming of the flow meter. Provide one (1) four-hour day

minimum.

3.3 CALIBRATION

A. General: All devices provided under the instrumentation sections shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

B. Calibration Points: Each instrument shall be calibrated at 25, 50, 75, and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.

C. Bench Calibration: Instruments that have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the City.

D. Field Calibration: Instruments that were not bench-calibrated shall be calibrated in the field to insure proper operation in accordance with the instrument loop diagrams or specification data sheets.

E. Calibration Tags: A calibration and testing tag shall be attached to each piece of equipment or system at a location determined by the City. The Contractor shall sign the tag when calibration is complete. The City will sign the tag when the calibration and testing has been accepted.

3.4 LOOP TESTING

A. The entire system shall be checked for proper installation, calibrated and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittal and these Specifications. The loop tests shall be implemented using I&C Engineer approved forms and checklists. Each loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. Each Loop Status Report sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the Contractor.

1. Project Name
2. Loop number
3. Tag number, description, manufacturer, and model number for each element
4. Installation bulletin number
5. Specification sheet number
6. Loop description number
7. Adjustment check
8. Space for comments

9. Space for loop sign-off by Contractor and date

** END OF SECTION **

[THIS PAGE INENTIONALLY LEFT BLANK]

SECTION 15000 GENERAL PIPING SYSTEM AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

This Section describes the requirements and procedures for piping systems and appurtenances that apply to a number of other complimentary Specification Sections. The items are listed in this Section to avoid repetition in Sections elsewhere. This Section includes, but is not limited to: Temporary above ground piping (high line), wet taps, flexible pipe couplings, grooved and shouldered end couplings, joint restraint system, field touch up, bolts, nuts, polyethylene wrap, warning/identification tape, tracer wire, gate well and extension stems, meter boxes, abandonment and removal of existing facilities, and salvage.

1.2 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1.3 RELATED WORK SPECIFIED ELSEWHERE

CMWD Standard Drawings

1.4 SUBMITTALS

Submit manufacturers' catalog data showing dimensions, materials of construction by ASTM reference and grade and coatings.

1.5 LINING CONTAMINATION PREVENTION

Volatile organic compounds present in the linings of items in contact with potable water or recycled water shall not exceed concentrations allowed by the latest requirements of the State Office of Drinking Water and Department of Health Services. Some products and materials may also require proof of NSF certification on the lining materials to be used.

1.6 TEMPORARY ABOVEGROUND PIPE (HIGH LINE)

High line piping, where shown on the Approved Plans or required by the City Engineer, shall be furnished, installed, disinfected, connected, maintained, and removed by the Contractor. Bacteriological sampling and testing shall be performed by a State of California Certified testing laboratory. The Contractor shall provide a submittal to the City showing pipe layout, materials, sizing, flow calculations, schedule and duration of use, and disinfection for all high line piping. The submittal shall be reviewed and approved by the Engineer prior to ordering or delivery of any materials.

1.7 PIPE TAPPING (WET TAP)

All pipe tap (wet tap) connections to existing pipelines, whether for mainline extensions or service laterals, shall be performed by the Contractor under the inspection of the City. The Contractor shall provide materials and labor to excavate, pour thrust block, backfill, compact, and repair pavement as indicated in this Section.

1.8 JOINT RESTRAINT SYSTEM

Joint Restraint Systems may be used for PVC or ductile-iron pipe only with prior approval of the City Engineer. Joint restraint systems shall be used in the place of, or in conjunction with, concrete thrust blocks as directed. Restrained joint systems shall be wax tape coated and polyethylene encased. Contractor shall submit shop drawings, calculations, and catalog data for joint restraint systems.

Splined gaskets, also known as joint restraint gaskets, may be used for PVC or ductile- iron pipe located within casings, or for PVC pipe casings, only.

1.9 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be used for all ferrous metal materials that are not protected with anodes.

A. Polyethylene wrap shall be used for the protection of buried valves in conjunction with wax tape.

B. Polyethylene sleeves shall be used for the protection of buried ductile iron pipe and fittings. Where the use of a sleeve is not practical, the fittings may be wrapped. Additionally, all bolted connections shall be coated with wax tape in accordance with Section 09902.

C. Polyethylene wrap or sleeves may also be installed around buried PVC pipe for recycled water identification.

1.10 WARNING/IDENTIFICATION TAPE

Warning/identification tape shall be used to identify location of underground utilities and to act as a warning against accidental dig-ins of buried utilities. Warning/identification tape shall be used on all underground water and recycled water mains, potable and recycled water irrigation systems, sewer mains, and all related appurtenances. Warning/identification tape shall also be used on cathodic protection wiring systems and tracer wire brought into and out of access ports.

1.11 GATE WELLS

Gate Wells shall be used for buried valves 4" and larger, unless otherwise indicated on the Standard Drawings. Gate well box and lid shall be used on all gate wells.

1.12 VALVE STEM EXTENSION

Valve Stem Extensions shall be installed when the valve operating nut is more than 5' below grade. Stem extensions shall be of sufficient length to bring the operating nut to a point between 12" and 18" below the gate well lid.

1.13 METER BOXES

A. Meter boxes shall be used for all water meters.

B. Meter boxes shall be sized for the specific meter size or size as indicated on the Standard Drawings.

1.14 RECYCLED WATER IDENTIFICATION

Facilities installed for the use of recycled water shall be identified with purple color coating, identification labels, or signs.

1.15 CURB IDENTIFICATION MARK FOR SERVICES

The Contractor shall mark the location of all potable water, recycled water and sewer laterals at the curb crossing by stamping the face of the curb in 2" high letters as described below:

A. Potable water laterals shall be stamped with a letter "W".

B. Recycled water laterals shall be stamped with a letter "RW".

C. Sewer laterals be stamped with a letter "S".

PART 2 MATERIALS

2.1 TEMPORARY ABOVEGROUND PIPE (HIGH LINE)

High line piping layout, materials and appurtenances shall be as indicated on the approved submittal.

2.2 FLEXIBLE PIPE COUPLINGS

Flexible pipe couplings shall be in accordance with the Approved Materials List and as described below:

A. Steel Couplings shall have middle rings made of steel conforming to ASTM A 36/A 36M, A 53 (Type E or S), or A 512 having a minimum yield strength of 207 MPa (30,000 psi). Follower rings shall be ductile-iron per ASTM A 536, or steel per ASTM A 108, Grade 1018 or ASTM A 510, Grade 1018. Minimum middle ring length shall be 7" for pipe sized 6" through 24".

B. Sleeve bolts shall be made of stainless steel per ASTM A193 and shall have a minimum yield strength of 276 MPa (40,000 psi), an ultimate yield strength of 414 MPa (60,000 psi), and shall conform to AWWA C111.

2.3 GROOVED END OR SHOULDERED COUPLINGS FOR DUCTILE IRON OR STEEL PIPE

Groove end or shouldered couplings shall be in accordance with the Approved Materials List and as described below:

A. Use square-cut shouldered or grooved ends per AWWA C606. Grooved-end couplings shall be malleable iron per ASTM A 47, or ductile iron per ASTM A536. Gaskets shall be per ASTM D 2000.

B. Bolts in exposed service shall conform to ASTM A 183, 69 MPa (10,000 psi) tensile strength.

2.4 JOINT RESTRAINT SYSTEM

Joint Restraint Systems shall be ductile-iron and shall consist of a split-ring restraint with machined (not cast) serrations – on the inside diameter, a back-up ring, and connecting bolts, and shall be selected from the Approved Materials List.

Splined gaskets, also known as joint restraint gaskets, shall be a rubber-ring type with stainless steel locking segments vulcanized into the gasket.

2.5 FIELD TOUCH-UP APPLICATIONS

All surfaces of metallic appurtenances in contact with potable water and not protected from corrosion by another system shall be shop-coated by the manufacturer. Appurtenances with damaged coatings shall be repaired or replaced as directed by the Engineer. Touch-up of damaged surfaces, when allowed by the Engineer, shall be performed in accordance with the manufacturer's recommendations.

2.6 BOLTS AND NUTS

Bolts and nuts shall be as indicated below.

A. Stainless steel bolts and nuts shall be used. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and Grade 8M for nuts. Use lubricant for stainless steel belts and nuts. Lubricant shall be Husky Lube “O” Seal by Husk-ITT Corporation or equal

B. All bolt heads and nuts shall be hexagonal, except where special shapes are required. Bolts shall be of such length that not less than 1/4" or more than 1/2" shall project past the nut in tightened position.

C. Provide a washer under each nut and under each bolt head. Use washers of the same materials as the nuts.

2.7 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be as indicated below and shall be selected from the Approved Materials List. Polyethylene materials shall be kept out of direct sunlight exposure.

A. Polyethylene sleeves shall be a minimum 0.012" thick polyethylene plastic in accordance with AWWA C105.

B. Polyethylene wrap shall be a minimum 0.008" thick polyethylene plastic in accordance with AWWA C105.

C. Polyethylene wrap and sleeves shall be clear for use with potable water and purple for use with recycled water.

D. Polyethylene or vinyl adhesive tape a minimum of 2" wide or plastic tie straps shall be used to secure polyethylene encasement.

2.8 WARNING/IDENTIFICATION TAPE

Warning/identification tape shall be as indicated below and in accordance with the Approved Materials List.

A. Tape shall be an inert plastic film or metallic formulated for prolonged underground use that will not degrade when exposed to alkalies, acids and other destructive substances commonly found in soil.

B. Tape shall be puncture-resistant and shall have an elongation of two times its original length before parting.

C. Tape shall be colored to identify the type of utility intended for identification. Printed message and tape color shall be as follows:

Printed Message	Tape Color
Caution: Waterline Buried Below	Blue
Caution: Recycled Waterline Buried Below	Purple
Caution: Cathodic Protection Cable Buried Below	Red
Caution: Electric Line Buried Below	Red

Ink used to print messages shall be permanently fixed to tape and shall be black in color with message printed continuously throughout.

D. Tape shall be minimum 0.004" thick x 6" wide with a printed message on one side. Tape used with the installation of onsite potable and recycled water irrigation systems shall be a minimum of 3" wide.

2.9 INSULATING UNIONS & COUPLINGS

A. For insulating unions, use a molded nylon sealing sleeve mounted in a three- piece malleable-iron body (ASTM A47 or A197). Use thread ends when connecting to steel piping, and copper solder joint when connecting to copper piping. Minimum working pressure shall be 150 psi.

B. Threaded insulating couplings shall provide dielectric protection from electrolytic corrosion at points where piping of dissimilar metals is joined.

2.10 GATE WELLS

Valve gate wells shall be as indicated below in accordance with the Approved Materials List.

A. Valve gate well size and material shall be as follows:

Valve Size	Gate Well Size and Material
4” and Larger	8" diameter Class 150, C-900 PVC

1. PVC gate wells for use in recycled water system applications shall be white.

2. PVC gate wells for use in potable water system applications shall be white or blue.

B. Gate well lids shall be as indicated below in accordance with the Approved Materials List.

1. Gate well box lids shall be circular ductile-iron, and shall include a skirt for a close fit inside the upper portion of the gate well. Lids shall be cast with the AGENCY NAME (CMWD) and the word WATER for use on potable water systems, and Recycled Water for recycled water systems.

2. Lids shall be Brooks 4TT with long skirt or approved equal.

3. Normally closed potable water valves and recycled water valves shall use box lids by Brooks 3RT or approved equal.

4. Lid sizes shall be as follows:

Valves	Gate Well Lid
4” and Larger where the speed limit is 35 mph or greater	Machined ductile-iron frame and 8" lid with 6" long skirt

2.11 VALVE STEM EXTENSIONS

Stem extensions shall be complete with operating nut, location ring, and lower socket to fit valve-operating nut. The configuration of the extension stem nut shall match that of the valve it operates.

A. Stem extensions shall be square fiberglass tubing glued together to make a continuous one-piece unit used to a maximum length 8’.

B. Steel stem extensions shall be used where the maximum length of the extension exceeds 8' or at the request of the City Engineer. Steel stem extensions may be round or square hot-dipped galvanized steel tubing of solid design (no pinned couplings permitted) with guides.

2.12 METER BOXES

Meter boxes shall be polymer-type boxes with lids selected from the Approved Materials List.

A. Meter box sizes shall be as follows:

Meter Box Size	Meter Box Uses
12" x 20"	1" water services
17" x 30"	2" water services

B. Meter box lids for use in potable water system applications shall be gray.

C. Meter box lids for use in recycled water system applications shall be purple.

2.13 RECYCLED WATER IDENTIFICATION

Materials used to identify pipe and appurtenances used for recycled water, not manufactured in purple color, shall be as described in Volume 2 of the Carlsbad Engineering Standards.

PART 3 EXECUTION

3.1 TEMPORARY ABOVEGROUND PIPE (HIGH LINE)

A. All high line piping, fittings, and service connections shall be furnished, installed, and maintained by the Contractor, and the Contractor shall make connections to a water source designated by the City Engineer.

B. All pipe, valves, fittings, hose and connections furnished by the Contractor shall be of good quality, clean, and suitable for conveying potable water in the opinion of the City Engineer.

C. The high line pipe shall be installed in such a manner that it will not present a hazard to traffic and will not interfere with access to homes and driveways along its route.

D. Valves shall be installed at 200' intervals or as directed by the City Engineer. The use of pressure reducing valves (PRV) may be required as directed by the City Engineer.

E. The Contractor shall be responsible for disinfecting all high lines, connections, and flushing.

F. Following disinfection and acceptance of the high line as a potable water system, the Contractor shall maintain continuous service through the high line piping to all consumers normally served both directly and indirectly by the pipeline.

G. Upon completion of the work, the Contractor shall remove the high line piping and appurtenances.

H. If progress in making repairs to the high line is inadequate, the City Engineer, may order necessary corrective measures. Corrective measures may consist of directing City personnel or another contractor to complete the work. All costs for corrective measures shall be borne by the Contractor.

3.2 CONNECTION TO EXISTING FACILITIES (WET TAPS AND CUT-IN INSTALLATIONS)

The Contractor shall furnish the tapping sleeve or tee, valves and all other materials as called for in the Standard Specifications in accordance with the Approved Materials List. The Contractor shall provide all equipment and labor required for the excavation and installation of the connection including, but not limited to, backfill and pavement replacement. In certain circumstances the Contractor may be required to provide a water truck, high line, and fittings as part of the equipment for making the connections. In addition, the Contractor shall assist the City in alleviating any hardship incurred during a shutdown for connections. Emergency standby equipment or materials may be required of the Contractor by the City Engineer.

Wet taps or cut-in tee and valve installations shall be performed as follows:

A. Prior to construction, Contractor shall pothole the existing pipe at the location of the proposed connection. The City shall inspect the pothole prior to Contractor's repair of trench. Contractor shall record the following information on as-built drawings:

1. Pipe size, outside diameter.
2. Pipe type such as ACP, PVC, Ductile-Iron or Steel.
3. Pipe class and/or pressure rating.
4. Elevation, grade, and alignment.
5. Location of collars, pipe bells, fittings or couplings, if found.
   Note: Collars, bells, fittings, or couplings shall not be within 18-inches of the outer dimension of the tapping saddle.
6. Potential conflicts with existing utilities.

B. To facilitate the proposed connection and allow for slight adjustments in alignment, the Contractor shall leave a minimum 10' gap between the new pipe installation and the proposed connection point at the existing water main. The Contractor shall leave a gap longer than 10' if conditions warrant, or if directed by the Engineer.

C. The new pipeline shall have successfully passed pressure testing in accordance with Section 15044 and disinfection and bacteriological testing in accordance with Section 15041 prior to proceeding with the connection to the existing pipeline.

D. After the City Engineer has given approval to proceed with the connection, the Contractor shall schedule with the City for the wet tap or cut-in installation.

1. Shutdowns will be scheduled at the convenience of the City. Shutdowns may be scheduled for nights or weekends if required.

2. The Contractor shall give the City a minimum of 5 working days notice prior to any proposed excavation or shutdown of existing mains or services. Scheduling shall be subject to approval by the City Engineer.

3. The City may postpone or reschedule any shutdown operation if, for any reason, the City Engineer believes that the Contractor is improperly prepared with competent personnel, equipment, or materials to proceed with the connection.

4. If progress in completing the connection within the time specified is inadequate, the Engineer may order necessary corrective measures. Corrective measures may consist of directing City personnel or another contractor to complete the work. All costs for corrective measures shall be borne by the Contractor.

E. Contractor may proceed with excavation only after potholing has been completed, materials have been approved and delivered, and wet tap or cut-in installation has been scheduled with approved Connection Permit.

1. The Contractor shall saw-cut pavement, excavate and provide and install shoring and steel plating, when necessary, one day prior to the wet tap or cut-in installation.

2. The Contractor shall provide lights, barricades and traffic control in accordance with the agency of jurisdiction and as deemed necessary for the excavation by the Engineer.

3. The Contractor shall de-water existing mains in full compliance with NPDES standards where cut-in installations are required and shall be done in the presence of the Engineer and in accordance with Section 15041. Only City personnel are authorized to operate existing valves. The Contractor shall be responsible for any and all damage resulting from unauthorized operation of existing City facilities.

4. The Contractor under the inspection of the City shall perform the following work for wet taps and cut-in installations:

a. Wet taps: Disinfect and install and tapping saddle and tapping valve and perform tapping operations.

b. Cut-ins: Cut and remove portions of existing mains, and disinfect and install tees, valves, couplings, and appurtenances required to complete the closure. The Contractor shall discard pipe and appurtenances removed from service in accordance with this Section.

5. After the Contractor has performed tapping or cut-in operations, and the Engineer has given approval to proceed, the Contractor shall complete the installation as shown on the Approved Plans in accordance with the Standard Specifications including, but not limited to:

a. Disinfecting and installing the pipe section(s) necessary to make the closure to the new system.

b. Installing and setting the valve gate well(s) in accordance with the Standard Drawings.

c. Installing thrust and anchor blocks in accordance with Section 03000.

d. Completing all backfill and compaction of the trench in accordance with Section 02223.

e. Repairing or replacing pavement as necessary.

3.3 FLEXIBLE PIPE COUPLINGS

Flexible pipe couplings shall be installed in accordance with the manufacturers recommendations and as described below:

A. Use plain-end pipe with flexible couplings per AWWA C200. Provide joint harnesses per AWWA M11 for aboveground applications or where indicated on the Approved Plans.

B. Flexible couplings may be used only where indicated on the drawings.

C. Clean oil, scale, rust, and dirt from the pipe ends and touch-up the epoxy coating and allow time for curing before installing the coupling. Clean the gaskets before installing.

D. Follow the manufacturer's recommendation for installation and bolt torque using a properly calibrated torque wrench.

E. Lubricate the bolt threads with graphite prior to installation.

3.4 GROOVED-END OR SHOULDERED COUPLINGS FOR DUCTILE IRON OR STEEL PIPE

Grooved-end or shouldered couplings shall be installed in accordance with the manufacturer's recommendations and as described below:

A. Grooved-end or shouldered joint couplings shall be installed per AWWA C606 and the manufacturer's recommendations.

B. Clean loose scale, rust, oil, grease, and dirt from the pipe or fitting groove and touch-up the epoxy coating as necessary, allowing time for curing before installing the coupling.

C. Clean the gasket before installation. Apply a lubricant selected from the Approved Materials List to the gasket exterior including lips, pipe ends, and housing interiors.

D. Fasten the coupling alternately and evenly until the coupling halves are seated. Follow the manufacturer's recommendation for bolt torque using a properly calibrated torque wrench.

3.5 JOINT RESTRAINT SYSTEM

Joint Restraint Systems shall be installed in accordance with the manufacturers recommendations and as described below:

A. Length of pipe to be restrained on each side of bends, tees, reducers and other fittings shall be determined by the Private Engineer or manufacturer of the restraint device and approved by the City Engineer.

B. Split ring restraint shall be installed on the spigot end of pipe, connected to a back-up ring which seats behind the bell of the adjoining pipe or fitting.

C. Restraint devices can be installed prior to lowering pipe into the trench.

D. Splined gaskets, also known as joint restraint gaskets, shall be installed in accordance with the manufacturer's recommendations.

3.6 BOLTS AND NUTS

A. All bolts and nuts shall be new and unused.

B. Bolts and nuts shall be cleaned, if needed, by wire brushing and lubricated prior to assembly.

C. Tighten nuts uniformly and progressively.

D. Buried bolts and nuts shall be coated with wax tape in accordance with Section 09902 prior to being encased with polyethylene.

E. All stainless steel bolts shall be coated with an anti-seize compound selected from the Approved Materials List.

F. Bolts and nuts shall not be reused once tightened. Used bolts and nuts shall be discarded and removed from the job.

3.7 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall completely encase and cover all buried metal surfaces not otherwise protected with a cathodic protection system. All bolted connections shall be coated with wax tape prior to polyethylene encasement.

Pipe & Fittings: All ductile-iron pipe and fittings shall be encased with polyethylene sleeves in accordance with Method A described in AWWA C105, except that tees may be encased with polyethylene wrap in accordance with Method C described in AWWA C105.

Valves: Buried valves shall have only the stem and operating nut exposed and the wrap shall be attached so that valve operation will not disturb the wrapping or break the seal. Refer to the applicable valve specification to determine other coating requirements.

B. Polyethylene sleeves shall be secured with polyethylene or vinyl adhesive tape or plastic tie straps at the ends and quarter points along the sleeve in a manner that will hold the sleeve securely in place during backfill. Polyethylene wrap shall be secured with polyethylene or vinyl adhesive tape in a manner that will hold the wrap securely in place during backfill.

3.8 WARNING/IDENTIFICATION TAPE

Warning/Identification Tape shall be installed as described below in accordance with the Standard Drawings.

A. Tape shall be placed at the top of the pipe zone 12" above and centered over the utility intended for identification. Tape used with onsite potable and recycled water irrigation systems shall be installed at 6" above the pipe.

B. Tape shall be installed with the printed side up and run continuously along the entire length of the utility intended for identification. Tape shall be installed on the main piping and all appurtenant laterals, including blowoffs, air valve assemblies, fire hydrants, and services. Tape splices shall overlap a minimum of 24" for continuous coverage.

C. Tape shall be installed prior to placement of the Trench Zone Backfill.

3.9 GATE WELLS AND VALVE STEM EXTENSIONS

Gate wells shall be installed as shown on the Standard Drawings and as described below:

A. Gate wells shall be installed as shown on the Standard Drawings and as described below:

B. The top exterior portion of the gate well lid and ring shall be coated in accordance with Section 09900.

C. Valve Stem Extensions shall be installed when the valve operating nut is more than 5' below grade. Stem extensions shall be of sufficient length to bring the operating nut to a point between 12" and 18" below the gate well lid. Valve stem extensions shall be installed in accordance with the Standard Drawings.

3.10 METER BOX INSTALLATION

Meter boxes shall be installed at the elevations and locations shown on the Approved Plans and in accordance with the Standard Drawings. Near the completion of the project, a final meter box adjustment to finish grade may be required. Water meters shall not be installed until final adjustments are made to the meter box and approved by the City.

3.11 ABANDONMENT OR REMOVAL FROM SERVICE OF EXISTING FACILITIES

Before excavating for new mains that are to replace existing pipes or services, the Contractor shall make provisions for the continuation and maintenance of service to customers as directed by the City Engineer.

Abandonment or removal from service of existing mains, appurtenances or water services shown on the Approved Plans or as called for by the City Engineer shall be as directed by the City Engineer.

Abandonment or removal from service of existing mains, appurtenances or water services shown on the Approved Plans or as called for by the City Engineer shall be as indicated below and in accordance with the Standard Drawings:

A. Abandonment in place:

1. Existing pipe 4" and smaller shall have a short section of pipe removed and pipe ends encased in concrete.

2. Existing pipe 6" through 14" shall be cut and plugged with concrete or shall be pressure-grouted at intervals of 200' as recommended by the Engineer.

3. Existing pipe 16" and larger shall be entirely filled by pressure-grouting or by blown sand as determined by the Engineer.

4. Existing pipe ends shall be filled with concrete.

5. All valves shall be removed with remaining pipe or fittings permanently sealed with blind flange or concrete plug.

6. Gate wells shall be cut 24" below grade and filled with 1-2 slurry sack concrete or removed and replaced with compacted backfill.

7. Water service corporation stops shall be closed. Meter boxes and curb stops shall be removed. Service laterals shall be cut back a minimum of 24-inches below the finish grade.

8. Water services to be abandoned that are connected to pipelines that will remain in service shall be abandoned in-place.

B. Removal by excavation:

1. Existing pipe and appurtenances shall be removed from the ground as indicated on the Approved Plans or as directed by the City Engineer.

2. Contractor shall provide measures that allow for the removal of existing sewer mains and appurtenances with no leakage of raw sewage. Transportation of sewer mains and appurtenances removed from service shall be in waterproof trucks to prevent raw sewage from leaking on public streets.

3. Removal of asbestos-cement pipe (ACP) and sewer mains and appurtenances shall be in accordance with all applicable State and Federal requirements. Legal disposal is the responsibility of the Contractor. Obtain approval from the agency having disposal jurisdiction with respect to disposal sites.

4. Backfill, compaction, and surface repair of all excavations for removal of pipe and appurtenances shall be made in accordance with the Approved Plans, Section 02223 of the Standard Specifications, and the Standard Drawings.

3.12 SALVAGE

When the Contractor is required to remove existing pipe and appurtenances, or portions thereof, from the ground, such material may, at the discretion of the Engineer, be considered salvage. All materials identified as salvage are considered property of the City.

A. The Contractor shall remove and temporarily stockpile all materials identified as salvage in a safe location that will not disrupt traffic or shall deliver salvage to the City's Field Operations Yard as directed by the City Engineer.

B. The Contractor shall legally dispose of all other materials in an appropriate manner. Disposal is the responsibility of the Contractor. Obtain concurrence from the agency having disposal jurisdiction with respect to disposal sites and transportation methods.

3.13 RECONNECTIONS

A. The Contractor may encounter unused service laterals or appurtenant piping connected to an existing pipeline being replaced. Laterals and appurtenance piping that will not be connected to the new pipeline shall be abandoned as described in section 3.11.

B. Existing service laterals or appurtenances to be connected to new pipelines shall be installed as shown on the Approved Plans or as directed by the City Engineer in accordance with the Standard Drawings.

END OF SECTION

SECTION 15044 HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 GENERAL

1.1 DESCRIPTION

This section describes the requirements and procedures for pressure and leakage testing of all pressure mains.

1.2 RELATED WORK SPECIFIED ELSEWHERE

CMWD Standard Drawings
CMWD Standard Specifications 15000, 15041, and 15061

1.3 REQUIREMENTS PRIOR TO TESTING

A. Provide testing procedure submittal including testing pressure, testing schedule, test bulkhead locations, and water supply details.

B. All piping, valves, fire hydrants, services, and related appurtenances shall be installed prior to testing.

C. The pipe trench shall have trench zone backfill placed and compacted with a minimum of 2.5' of material over the pipe.

D. All concrete anchor blocks shall be allowed to cure a sufficient time to develop a minimum strength of 2,000 psi (13.79 MPa) before testing.

E. Pressure tests on exposed and aboveground piping shall be conducted only after the entire piping system has been installed and attached to pipe supports, hangers or anchors as shown on the Approved Plans.

F. Steel pipelines shall not be tested before the mortar lining and coating on all pipe lengths within the line have been in place for a minimum of fourteen (14) days. Cement-mortar lined pipe shall not be filled with water until a minimum of eight hours has elapsed after the last joint has been mortared.

1.4 CONCURRENT HYDROSTATIC TESTING AND DISINFECTION OF PIPELINES

Hydrostatic testing of pipelines shall be performed prior to or concurrently with the disinfection operations in accordance with Section 15041. In the event repairs are necessary, as indicated by the hydrostatic test, the City may require additional disinfection in accordance with Section 15041.

1.5 CONNECTION TO EXISTING MAINS

Hydrostatic testing shall be performed prior to connections to existing mains. A City Connection Permit authorizing connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results. Connection to existing mains shall be performed in accordance with Section 15000.

PART 2 MATERIALS

2.1 WATER

A. Potable water shall be used for hydrostatic testing of potable and recycled water mains.

B. Potable water shall be supplied by a City-approved source. Make-up water for testing shall also be potable water.

C. A chlorinated water solution, in accordance with Section 15041, shall be used to charge the line and for make-up water when hydrostatic testing and disinfection operations are combined.

D. Meet all applicable state and local requirements for disposal of testing water.

2.2 CONNECTIONS

A. Testing water shall be supplied through a metered connection equipped with a backflow prevention device in accordance with Section 15112 at the point of connection to the potable water source used.

B. The Contractor shall provide any temporary piping needed to deliver potable water to the piping that is to be tested. Temporary piping shall be in accordance with Section 15000.

PART 3 EXECUTION

3.1 GENERAL

A. All water systems shall be pre-tested to insure passage of test prior to scheduling official test with inspector.

B. The Contractor shall provide the City with a minimum of 48 hours' notice prior to the requested date and time for hydrostatic tests.

C. The Contractor shall furnish all labor, materials, tools, and equipment for testing.

D. Temporary blocking during the tests will be permitted only at temporary plugs, caps or where otherwise directed by the City.

E. All valves and appurtenances shall be operated during the test period. The test shall be conducted with valves in the open position. The Contractor is not permitted to operate any valves on the City’s system.

F. At the onset of testing, all valves, air vacuum assemblies, blowoffs, and services shall be monitored for possible leakage and repairs made, if necessary, before the test proceeds. The appurtenances shall be monitored through the duration of the testing.

G. For pipe with porous lining, such as cement mortar, the pipe shall be filled with water and placed under a slight pressure for a minimum of forty-eight (48) hours prior to the actual hydrostatic test.

H. Testing shall be made before connecting the new line with the existing City pipes and mains.

I. The pipeline should be filled at a rate such that the velocity of flow is less than 1 fps.

J. Maximum length of pipe to be included in any one (1) test shall not exceed 2,500 linear feet or vertical elevation difference of 58 feet.

3.2 FIELD TEST PROCEDURE

A. Before applying the specified test pressure, care shall be taken to release all air within the pipe and appurtenances to be tested. Air shall be released through services, fire hydrants, air release valves, or other approved locations.

B. The leakage shall be considered as the total amount of water pumped into the pipeline during the test period.

C. Apply and maintain the test pressure by means of a hydraulic force pump.

D. Maintain the test pressure for the following duration by restoring it whenever it falls an amount of 5 psi:

Pipe Diameter (inches)	Hours
18 and less	4
20 to 36	8
Greater than 36	24

E. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage for various sizes of PVC & DIP with rubber gaskets are shown in the following table:

TYPE OF PIPE: P.V.C. & D.I.P.
CLASSES: 150 & 200

Pipe Sizes (inches)	Allowable Leakage Gals/4 hrs/1000' of pipe
4"	.33 Gals
6"	.50 Gals
8"	.66 Gals
10"	.83 Gals
12"	.99 Gals
14"	1.16 Gals
16"	1.32 Gals
18"	1.49 Gals
20"	1.66 Gals
24"	1.98 Gals

F. The allowable leakage for welded steel pipe shall be zero gallons.

G. The allowable leakage for piping having threaded, brazed, or welded (including solvent welded) joints shall be zero gallons.

H. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

3.3 TEST PRESSURE

Pipe sizes in excess of 16” diameter shall be tested at a pressure based on test pressure as shown on the drawings. If no test pressure is shown, the pipeline at the low point in test section shall be pumped to a hydrostatic test pressure of 125 percent of the operating pressure or pipe class, whichever is the greater. Pressure shall be maintained for a duration shown in section 3.2 and shall be repumped when it falls an amount of 5 p.s.i.

Pipe sizes 16” diameter and less shall be tested at 75 p.s.i. in excess to the pressure class of the pipeline. Pressure shall be maintained for a duration shown in section 3.2 and shall be repumped when it falls an amount of 5 p.s.i.

The test pump gauge and meter shall be connected to the water main at a location other than the highest point in the line, in order to allow release of air from the high point. Means shall be provided for accurately measuring the quantity of water pumped through a meter and pumped into the pipe immediately, during and after the test period in order to maintain or restore the initial test pressure. All pipe, fittings, valves, services and appurtenances shall be subjected to the hydrostatic test and irrespective of the measured quantity of leakage, all detectable leaks shall be repaired by the Contractor at the contractor’s expense and no cost to Carlsbad Municipal Water District.

If a tested system is damaged or a leak occurs after official test the entire system or portion of system will be retested as directed by Inspector.

END OF SECTION

SECTION 15056 DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 DESCRIPTION

This section includes materials and installation of ductile iron pipe and fittings for sanitary sewer main systems.

1.2 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ANSI B16.42 Ductile iron pipe flanges and flanged fittings, classes 150 and 300.
ASTM A536 Specification for ductile iron castings.
AWWA C104 Cement mortar lining for ductile iron pipe and fittings for water
AWWA C105 Polyethylene encasement for ductile iron pipe systems
AWWA C111 Rubber-gasket joints for ductile iron pipe
AWWA C600 Installation of ductile iron water mains and their appurtenances

1.3 RELATED WORK SPECIFIED ELSEWHERE

CMWD Standard Drawings
CMWD Standard Specifications 09900, 15000, 15044, and 15064

1.4 SERVICE APPLICATION

Ductile-iron pipe shall be used only in specific areas, locations, and uses allowed by the City.

1.5 DESIGN REQUIREMENTS

A. General:
   1. Ductile-iron pipe and fittings shall be manufactured per AWWA C110, C111, C115, C150, C151, and C153. Gray-iron and cast-iron fittings or flanges shall not be used.
   2. Ductile-iron fittings manufactured per AWWA C153 shall be installed on mains 12" and smaller only.
   3. Joints for ductile-iron pipe and fittings shall be mechanical, flanged, or push-on in accordance with AWWA C110, C111, and C153.
   4. Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron pipe and ductile-iron fittings shall have a pressure rating equal to or greater than the adjacent piping.
   5. Joints in buried piping may be of the push-on, flanged or mechanical-joint type per AWWA C111 except where particularly specified on the Approved Drawings.
   6. Joints that are aboveground, within structures, or submerged shall be flanged unless otherwise shown on the Approved Plans.

B. Unless otherwise specified, ductile-iron flanges shall be in accordance with AWWA C115, rated at a working pressure of 1,724 KPa (250 psi). Where required in order to connect to

the flanges of 1,724 KPa (250 psi) butterfly valves, or as otherwise shown on the approved plans, ductile-iron flanges shall be compatible with AWWA C207, Class "F". Maximum working pressure of flanges shall be as specified in AWWA or ASME/ANSI. Flanges shall be integrally cast per AWWA C110 or shop-threaded per AWWA C115. Flanges shall be solid. Hollow-back flanges are not permitted. Gray-iron or cast-iron flanges are not permitted. Threading of flanges in the field is not permitted. Where threaded flanges are used, the pipe or spool piece to which they are connected will be hydrostatically tested in the presence of the Engineer prior to installation. The pipe section or spool piece shall be hydrostatically tested for 15 minutes at the pressure rating of the flanges. No leaks shall be permitted.

C. Plain ends shall conform to the requirement of AWWA C151 and to the dimensions included within AWWA C110 to accept a mechanical joint, push-on joint, flanged coupling adaptor, flexible coupling, or grooved coupling. Refer to Section 15000 for coupling descriptions.

D. The exterior surfaces of all pipe and fittings shall be factory coated with a minimum one-(1) mil thick petroleum asphaltic material per AWWA C110 and C151.

E. All pipe and fittings shall be cement-mortar lined in accordance with AWWA C104, using the double thickness requirements indicated in said standard. Type II or Type V Portland cement per ASTM C 150 shall be used.

1.6 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe and fittings has been subjected to and met the tests specified for ductile-iron pipe and fittings per AWWA C110, C111, C115, C150, C151, and C153, as applicable.

B. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.

C. Ductile-iron pipe shall bear indelible identification markings as required by AWWA C151.

1.7 SUBMITTALS

The following items shall be submitted and reviewed by the City prior to shipping of ductile-iron pipe and fittings:

A. An affidavit of compliance with AWWA C104, C110, C111, C115, C150, C151, C153, and the requirements of this specification.

B. Typical joint details.

C. Typical details and description of lining and coating.

D. Calculations supporting selected wall thickness.

E. Calculations demonstrating that each proposed restrained joint arrangement can resist the applied forces.

F. Cathodic protection materials.

1.8 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of ductile-iron pipe and fittings shall follow the recommendations of AWWA C600 and as specified herein:

A. Handling of pipe shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the pipe, linings, and coatings. The pipes shall not be dropped or dragged.

B. During transport, the pipe shall be supported and secured against movement using padded devices in such a manner to prevent damage.

C. Stored pipe shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location in a manner that will ensure proper use with respect to types and sizes.

D. Pipe laid out for installation shall be placed on earth berms or timber cradles adjacent to the trench in the numerical order of installation.

E. Maintain plastic end caps on all pipe and fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside the pipe for moisture control.

F. Under no circumstances shall ropes or other devices be attached through the fitting's interior for handling.

1.9 RECYCLED WATER IDENTIFICATION

Ductile-iron pipe and fittings for recycled water shall be identified with purple-colored coating, purple polyethylene sleeves, identification labels or signs in accordance with Section 15000.

1.10 CORROSION PROTECTION

Polyethylene encasement shall be installed on all buried ductile-iron pipe and fittings in accordance with Section 15000. Additionally, all buried ductile iron fittings with bolted connections (flanges, mechanical joints, etc) shall be coated with wax tape in accordance with Section 09902.

1.11 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for ductile-iron pipe and fittings in accordance with Section 15000.

PART 2 MATERIALS

2.1 DUCTILE-IRON

Ductile-iron pipe and appurtenant components and materials shall be selected from the Approved Materials List in accord with the Standard Drawings.

2.2 GASKETS

A. Mechanical joint rubber gasket configuration and materials shall comply with AWWA C111, and according to the applicable joint type and pressure rating of the piping system.

B. Flange gaskets shall be 1/8" thick acrylic or aramid fibers bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes. Ring gaskets extending to the inner edge of the bolt circumference may be used only upon approval of the City Engineer.

C. Push-on joint rubber gaskets shall be per AWWA C111.

D. If organic solvents or petroleum products are encountered during the course of the work, alternate gasket materials or joint treatment may be required by the Engineer.

2.3 BOLTS AND NUTS FOR FLANGES

Bolts and nuts shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.4 WAX TAPE COATING

Wax Tape shall be provided for buried applications in accordance with Section 09902 and the Approved Materials List.

2.5 CERAMIC EPOXY LINING

Ductile iron pipe shall be painted in accordance with Section 09900, Section 2.3. Paint coating shall be grey. Contractor shall submit a chart of the manufacturer's available colors for color selection well in advance of painting operation.

2.6 CERAMIC EPOXY LINING

Ceramic Epoxy lining shall be used for all wastewater piping. Approved products include the following:

A. Finish coat (1 coat at 30 mils DFT), Protecto 401 as manufactured by Induron Coatings, Inc.

2.7 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be provided for buried applications in accordance with Section 15000 and selected from the Approved Materials List.

2.8 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be provided for buried applications in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.1 GENERAL

At all times when the work of installing pipe is not in progress, including worker break times, ends of the pipe shall be closed with a vermin-proof and child-proof cap or plug. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials.

3.2 TRENCHING, BACKFILLING AND COMPACTING

Trenching, backfilling and compacting shall be performed in accordance with Section 02223.

3.3 DEWATERING

The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering trench excavations or other parts of the work. Any damage caused by flooding of the trench shall be the Contractor's responsibility. Dewatering shall be performed by methods that will maintain a dry excavation, preservation of the final lines and grades and protection of all utilities. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipeline appurtenances or trench materials shall be repaired or replaced as directed by the Engineer.

3.4 PIPE INSTALLATION

When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter. The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench as follows:

A. Inspect each pipe and fitting before lowering the pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep pipe clean during and after installation.

B. Install pipe according to the manufacturer's approved order of installation. Install pipes uphill if the grade exceeds 10%. Lower the pipe onto the bedding at the proper lines and grades.

C. The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed, except they shall not exceed the deflections allowed in AWWA C600 according to joint type. Combined deflections at rubber gasket or flexible coupling joints shall not exceed that recommended by the manufacturer.

D. The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

E. Pipe Assembly:
   1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.
   2. Mechanical Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

F. During installation operations, do not place tools, clothing, or other materials in the pipe.

G. When pipe installation is not in progress, including worker break times, ends of the pipe shall be closed with a vermin-proof and child-proof cap or plug. Do not permit trench water, animals, or foreign material to enter the pipe.

3.5 CORROSION PROTECTION

Polyethylene encasement shall be installed on all buried ductile-iron pipe and fittings in accordance with Section 15000. Additionally, all buried ductile iron fittings with bolted connections (flanges, mechanical joints, etc) shall be coated with wax tape in accordance with Section 09902.

3.6 FLANGED PIPE AND FITTINGS

Flanged connections shall be installed where indicated on the Approved Drawings.

A. Bolt holes shall straddle the horizontal and vertical centerlines.

B. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

C. Bolts and nuts shall be lubricated with a City-approved anti-seize compound.

D. Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.

E. Coat the exterior of exposed flanges, bolts and nuts located aboveground or within vaults in accordance with Section 09910.

3.7 MECHANICAL JOINT CONNECTIONS

A. Install mechanical joint connections per AWWA C600 and the manufacturer's recommendations.

B. Prior to installation of the mechanical joint, clean the socket and plain end of the pipe. Lubricate both the gasket and plain end of the pipe with an approved lubricant per AWWA C111 immediately prior to slipping the gasket onto the plain end of the pipe.

C. Tighten the bolts to the normal range of bolt torque per the manufacturer's recommendations and AWWA C600, Table 1, as follows:

Pipe Diameter	Bolt Size	Range of Torque
3”	5/8”	61-81 N-M (45-60 ft.-lb.)
4-24”	3/4”	102-122 N-M (75-90 ft.-lb.)
30-36”	1”	136-163 N-M (100-120 ft.-lb.)

3.8 CROSSES

A. Each flanged ductile-iron cross shall be installed with flanged ductile-iron pipe spools between the cross and the valves. The spools are included to position the valves a sufficient distance from the cross to allow installation of the thrust blocks without conflicting with the valve actuators.

B. The spools shall be 18" long for pipe sizes 8" through 12", and 24" long for pipe sizes 16" and larger.

C. The spools shall be equal in class to the adjacent pipe.

3.9 JOINT BONDING AND CATHODIC PROTECTION

Bonding of joints to provide continuity, flange insulation kits, internal epoxy linings, and other cathodic protection items and materials shall be installed where shown on the Approved Plans in accordance with the Standard Drawings.

3.10 COUPLINGS FOR DUCTILE-IRON PIPE

Mechanical type flexible joints shall be installed where shown on the Approved Drawings. Grooved couplings shall be used in vaults and above ground. Flexible couplings may be used, where indicated on the drawings, below ground, but may also be used above ground with restrained joints. Flanged coupling adapters shall be used for buried pipelines, where allowed by the City.

A. Grooved joint couplings shall be installed per AWWA C606 and as indicated in Section 15000.

B. Flanged coupling adapters, where allowed by the City, shall be installed per the manufacturer's recommendations.

C. Flexible couplings shall be installed per Section 15000 and the manufacturer's recommendations.

D. All couplings for ductile-iron pipe shall be shop-coated in accordance with Section 15000.

3.11 CONCRETE

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standards Drawings.

3.12 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.13 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.14 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION

SECTION 15092 MISCELLANEOUS COUPLINGS, PIPE AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

All valves, couplings, and appurtenances shall conform to requirements of the standard dimensions and pressure classification of the immediately adjacent pipe, valve or appurtenance as specified.

1.2 RELATED WORK DESCRIBED ELSEWHERE

The Contractor shall refer to the following Specification section(s) for additional requirements:

A. Painting and Coating: 09900
B. Petrolatum Wax Tape Coating: 09902

1.3 SUBMITTALS

Contractor shall furnish submittals in accordance with the requirements of Section 2-5.3 of the GENERAL PROVISIONS. The following submittals are required:

A. Submit Shop Drawings for all miscellaneous couplings, pipe and appurtenances. Shop Drawings shall include listing of materials of construction, with ASTM reference and grade, including lining and paint coating intended for use, with lining and coating manufacturers' and paint numbers listed.

1.4 PAYMENT

Payment for the Work in this section shall be included as part of the lump-sum or unit- price bid amount for which such Work is appurtenant thereto.

PART 2 MATERIALS

2.1 GASKETS, NUTS, AND BOLTS

Gaskets for flanged joints shall be "drop-in" type asbestos composition sheet packing, graphited on both sides, "drop-in" type, conforming to the requirements of ANSI B16.21 and shall be as manufactured by Crane Co., Garlock or approved equal.

Bolts and studs for aboveground installations shall be Type 316 stainless steel and shall conform to ASTM A193, "Alloy-Steel Bolting Material for High Temperature Service." Bolts and nuts shall be heavy hexagon series. Nuts shall be Type 316 stainless steel conforming to ASTM A194, "Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service" Grade 8M. The fit shall be ANSI B1.1, "Unified Screw Threads," Class 2, except that Class 3 fit shall be used in holes tapped for studs. Threads may be made by either cutting or cold forming.

Between 1/4-inch and 3/8-inch shall project through the nut when drawn tight. Washers shall be provided for each nut and shall be the same material as each nut. All buried flanges, including bolts, nuts and washers, shall be encased in wax tape per Section 09902.

All bolt threads shall be lubricated with non-oxide grease. Flanged faces shall be wire brushed and cleaned prior to joining each flange.

2.2 WAX TAPE COATING

Unless otherwise specified on the Plans, all couplings and appurtenances for underground installation shall be encased in wax tape per Section 09902 and the City Standard Drawings.

2.3 PAINTING AND COATING

All miscellaneous couplings, pipe and appurtenances referenced in this section shall be painted and coated, interior and exterior, in accordance with Section 09900, Painting and Coating.

2.4 FLEXIBLE COUPLINGS

Joints for which flexible couplings are required, shall be selected from the Approved Materials list. Gaskets shall be plain rubber gaskets. Threads on bolts of compression collars shall be lubricated with non-oxide grease before assembling the coupling.

2.5 PIPE UNIONS

Screw unions may be employed on pipelines 2-1/2-inches in diameter and smaller. Pipes and fittings made of non-ferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings, unions or couplings manufactured by Smith-Blair, Pipe Seal and Insulator Co. or approved equal.

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 15099 PROCESS VALVES, REGULATORS AND MISCELLANEOUS VALVES

PART 1 GENERAL

1.1 DESCRIPTION

This section includes materials, testing and installation of manually operated process valves such as check valves, pressure control valves, pressure reducing valves and ball valves.

1.2 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

American Water Works Association
AWWA C508 Standards for Swing Check Valve ASTM
B62 Standards for Ball Vales

1.3 RELATED WORK SPECIFIED ELSEWHERE

CMWD Standard Drawings
CMWD Specification Sections 09900, 15000, and 15044

1.4 SERVICE APPLICATIONS

Check valves, pressure control valves, pressure reducing valves, bronze gate valves and ball valves are primarily used in the installation of sanitary sewer main appurtenances and where called for on the Approved Plans and indicated on the Standard Drawings.

1.5 SUBMITTALS

The following items shall be submitted to the City for review and approval prior to ordering or delivery of valves per Section 2-5.3 of the GENERAL PROVISIONS.

A. The valve manufacturers catalog data showing the size to be used, valve dimensions, pressure rating and materials of construction.

B. Manufacturers catalog data on the lining materials to be used.

C. Installation procedures including field adjustments as required.

1.6 SIZING OF VALVES

Valves shall be the same size as the appurtenance in which they are to be installed with unless otherwise called for on the Approved Plans or indicated on the Standard Drawings.

1.7 VALVE ENDS

Valve ends shall be compatible with the piping system or appurtenance in which they are to be installed or as called for on the Approved Plans or indicated on the Standard Drawings.

1.8 DELIVERY, STORAGE AND HANDLING

Valves shall be delivered and stored in accordance with the manufacturer's recommendations. Valves shall remain in factory packaging until ready for installation. Valves shall not be stored in contact with bare ground.

1.9 POLYETHYLENE WRAP

Polyethylene wrap shall be used for the buried installation of valves in accordance with Section 15000.

1.10 GATE WELLS AND EXTENSION STEMS

Valve boxes and extension stems shall be installed in accordance with Section 15000 and the Standard Drawings.

PART 2 MATERIALS

2.1 RUBBER-FLAPPER SWING CHECK VALVE

A. Swing check valves and appurtenant components shall be in accordance with AWWA C508 and selected from the Approved Materials List. A submittal will be required as described in this Section.

B. Rubber-flapper swing check valves shall have a heavily constructed ductile-iron body and cover. The body shall be long pattern design (not wafer), with integrally cast-on end flanges. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.

C. Flapper shall be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check valves shall have full pipe size flow area. Seating surface shall be on a 45º angle requiring the flapper to travel only 35º from closed to full open position, for minimum head loss and non-slam closure.

D. Buna-N flapper shall be high-strength coated fabric, coated both sides with 70 DURO, which creates an elastic spring effect, molded internally, to assist the flapper to close against a slight head to prevent slamming. When essential to create backflow through the check valve, as directed by the City Engineer, an external backflow device shall be furnished.

E. Valve ends shall be flanged ductile-iron in accordance with Section 15056 unless otherwise called for on the Approved Plans or directed by the City Engineer.

F. Check valves shall be tested by the manufacturer and the test results shall be approved by the City Engineer prior to shipment to the project. Check valves must unseat at a head no

greater than 24".

2.2 ECCENTRIC PLUG VALVE

Eccentric plug valves, 4-inch through 12-inch shall be of the non-lubricated type. Minimum pressure rating shall be 175 psi. Unless noted otherwise on the drawings, ends shall be flanged, Class 125 per ANSI B-16.1. Plugs shall be provided with Polytetrafluoroethylene (PTFE) grit excluders to protect the upper and lower journal bearings.

Materials of construction shall be as follows:

Component	Material	Specification
Body	Ductile Iron	ASTM A536, Grade 65-45-12
Plug	Ductile Iron	ASTM A536, Grade 65-45-12
Journal Bearings	Sintered Stainless Steel	ANSI 316

Plugs shall have neoprene, Buna-N facing to provide drip-tight shutoff. Valve body seats shall have a raised welded-in overlay of not less than 90 percent nickel. Plug shall be of the one-piece design. Proof of design shall accompany submittals and leak tests shall accompany shipment.

External valve trim and all exposed threaded components shall be corrosion resistant alloys of stainless steel, Type 316L.

Valves shall be Dezurik Series 100 PEC or Pratt-Milliken 600 series.

2.3 SMALL DIAMETER ISOLATING VALVES

Provide all small diameter valves and cocks for shut-off process connections, instrumentation and other miscellaneous uses in accordance with the Approved Plans. These valves shall be of the same material and pressure rating as the adjacent process piping. Shutoff valves shall be compatible with instrumentation and other equipment in accordance with the manufacturer's recommendations.

2.4 CORPORATION STOPS

Corporation stops shall be in the ball type with a bronze body and T-Head operator. Valve ends shall be compatible with the piping system in which they are being installed or as called for on the Approved Plans or indicated on the Standard Drawings. Corporation stops shall be rated for a minimum pressure of 1,379 KPa (200 psi). Corporation stops shall be selected from the Approved Materials List.

2.5 ANGLE METER STOPS

Angle meter stops shall be the ball type with a bronze body and 90º lock wing. Valve ends shall be flare style inlet and swivel meter nut for 1" and meter flange for 2" outlets. Angle meter stops shall be rated for a minimum pressure of 1,379 KPa (200 psi). Angle meter stops shall be selected from the Approved Materials List.

2.6 CUSTOMER METER SHUT-OFF VALVE

Customer meter shut-off valves shall be the ball type with a bronze body and lever handle operator. Valve ends shall be swivel meter nut for 1" inlets and meter flange for 2" inlets. Customer meter

shut-off valves shall be rated for a minimum pressure of 200 psi. The City Engineer may require the use of a customer meter shut-off valve equipped with a 90º lock wing.

2.7 BALL VALVES

Ball valves 2" and smaller shall be of bronze construction conforming to ASTM B62 and equipped with a T-Head or lever handle operator as required. Valve ends shall be compatible with the piping system in which they are being installed or as indicated on the Approved Plans or Standard Drawings. Ball valves shall be rated for a minimum pressure of 1,379 KPa (200 psi). Ball valves shall be selected from the Approved Materials List.

2.8 BACKFLOW PREVENTERS

Backflow preventers shall be selected from the Approved Materials List.

2.9 POLYTHYLENE WRAP

Polyethylene wrap shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.10 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.1 INSTALLATION

A. Valves shall be set in true alignment straddling the centerline of pipe with the valve operator in the vertical position unless otherwise noted on the Approved Plans or shown on the Standard Drawings.

B. Valves shall be installed in accordance with the manufacturer's recommendations and the applicable section of these specifications for the piping material and joint type being used.

C. Aboveground valves shall be rigidly held in place using supports and hangers in accordance with the Approved Plans and Standard Drawings. The stem orientation of valves in elevated piping shall be as approved by the City Engineer for accessibility, except that no valves shall be installed with stems aligned below horizontal. Saddle type valve supports shall be provided. Supports shall be of rugged construction providing at least one hundred twenty degrees (120º) under support for the valve body. Valve supports shall be constructed of steel, and shall be anchored to the foundations using stainless steel anchor bolts.

3.2 POLYETHYLENE WRAP

Installation of polyethylene wrap for buried valves shall be in accordance with Section 15000.

3.3 GATE WELLS AND EXTENSION STEMS

Gate wells and extension stems for buried valves shall be in accordance with Section 15000 and the Standard Drawings.

3.4 HYDROSTATIC TESTING

Valves shall be hydrostatically tested in conjunction with the pipelines in which they are installed in accordance with Section 15044.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16050 GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 INTENT

A. It is the intent of these specifications that all electrical work specified herein, be coordinated as required with the work of all other trades identified in other divisions of the specifications and the drawings, so that all installations shall operate as designed. All systems shall be completely assembled, tested, adjusted, and demonstrated to be ready for operation in compliance with the requirements of the Contract Documents before acceptance by the Owner and Engineer.

B. Electrical system layout indicated on the drawings is generally diagrammatic. Locations of outlets and equipment shall be governed by architectural, structural and mechanical conditions and obstructions. Any reasonable change in location of outlets and equipment prior to the rough in shall be done without additional expense to the Owner. This does not apply to equipment, which is located by dimensions on the drawings. Equipment shall be located within 1/8 inch of the dimensional location indicated on the drawings unless otherwise permitted by the Owner or Engineer. The Contractor shall verify in the field all dimensions and clearances affecting the installation of his work in relation to established datum, to building openings and clearances, and to the work of other trades. Should interferences occur which will necessitate any deviation from the layout or dimensions indicated, the Owner or Engineer shall be notified and any changes approved before proceeding with the work.

C. Rigid components such as bus, bus duct, throat connection, and enclosures shall be aligned and connected with special care to prevent excessive stress in joints, supports, and connections. Installations of all equipment shall be straight and plumb to building structures.

D. Equipment with moving parts such as switches, circuit breakers, and switch operating mechanisms shall be carefully aligned to ensure free mechanical operation.

1.2 SUMMARY

A. The work included under these specifications shall include furnishing and the installation of new, specified materials and equipment and the providing of engineering data, accessories, and field services as stipulated herein and in accordance with the Contract Documents.

1.3 ELECTRICAL LIMITS OF CONTRACT

A. Electrical Contractor shall furnish all conduit, wiring and electrical devices required to interconnect the existing meter pedestal with new electrical enclosure and wiring to existing pump and instruments in wet well and to new valve box sump pump and flowmeter as further detailed in the drawings and specifications.

B. Electrical Contractor shall re-use the equipment inside the PLC panel, replace any parts with new model in case any equipment is outdated or obsolete. Coordinate with Owner. Coordinate with Owner for telemetry and communication of the site.

1.4 HAZARDOUS WASTE

A. Electrical Contractor shall be responsible for effecting and coordinating safe disposal of all electrical equipment removed or renovated under this contract that contains recognized hazardous materials including, but not limited to, the following list:
1. Fluorescent lamps.
2. Fluorescent lamp ballasts.

B. Electrical Contractor shall submit all documents, chain of custody and receipts confirming proof of proper disposal of the hazardous materials indicated above to the Owner and/or Engineer.

1.5 REFERENCES - CODES AND STANDARDS

A. Applicable codes and standards will be referred to in other sections of this division by acronyms as defined below:

1.	NECA	National Electrical Contractor's Association
2.	ANSI	American National Standards Institute
3.	ASME	American Society of Mechanical Engineers
4.	Fed Specs	Federal Specifications
5.	IEEE	Institute of Electrical and Electronic Engineers
6.	IES	Illuminating Engineering Society
7.	NEC	National Electrical Code
8.	NEMA	National Electrical Manufacturers Association
9.	NFPA	National Fire Protection Association
10.	UL	Underwriters' Laboratories
11.	CAL OSHA	California Occupational Safety and Health Act

B. The edition of referenced codes and standards, in effect as of the date of contract, shall constitute minimum requirements and shall be strictly complied with unless supplemented or modified by more stringent requirements of the Contract Documents.

1.6 REGULATORY REQUIREMENTS

A. Electrical equipment and materials shall be installed in conformance with all applicable requirements of NFPA, local power company, federal, state, and local codes,

B. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, acceptable testing and listing agencies as suitable for the purpose specified and shown. The Contractor shall immediately notify the Owner and Engineer of any provision in the contract document that are contrary to any applicable codes.

1.7 SAFETY

A. All work shall be performed in a safe manner in accordance with all federal, state and local codes and regulations including any Owner safety regulations or procedures. In addition, the following special electrical precautions as a minimum shall be observed.

B. Shutdowns
   1. Prior to any work on any electrical circuits, circuits shall be de-energized, tested for absence of voltages, residual voltage discharged and the circuit properly tagged and locked out.
   2. All electrical shutdowns shall be coordinated and scheduled with Owner and/or Engineer to minimize effect on adjacent areas.

C. Lockout / Tag out Procedure:
   1. Contractor shall use the Owner's standard Lockout/Tag out procedure. A copy of the program will be provided to the Contractor prior to start of work.
   2. Contractor shall have a recognized Lockout/Tag out program that complies with OSHA Standard 29, CFR 1910.47, and/or California Code of Regulations, Title 8, Electrical Safety Orders 2329.4. This program shall be submitted to the Owner and/or Engineer for approval prior to start of work.

1.8 COORDINATION WITH OTHER TRADES

A. The Contractor shall be responsible for coordinating with other trades or subcontractors working on the project so that all work shall be completed without interruption of the schedule. This shall include all installations necessary to support the structural, architectural, and mechanical conditions.

B. Any changes in construction or coordination requirements that deviate from the intent or requirements of the specifications and/or drawings must be described and detailed in writing and submitted to the Owner and/or Engineer for approval.

C. The Contractor shall provide for all contingencies where required to operate any equipment prior to completion of electrical work.

D. The Contractor shall be responsible for checking all contract drawings and coordinating his work accordingly. **RECEIVING, HANDLING, AND STORAGE**

E. The Contractor shall provide for receiving, handling, and storage of all material and equipment in accordance with Division 1 requirements of these specifications.
   1. Materials and equipment stored on the Owner's premises shall be moved by the Contractor without additional cost, if requested by the Owner and/or Engineer.
   2. The Contractor shall be responsible for the safe keeping of all materials and equipment stored on the Owner's premises.

F. Cleaning:
   1. The exterior and interior surfaces of each equipment item shall be cleaned of sand, dirt, and other foreign materials after its removal from storage and immediately before its movement to its final location.

2. Before initial operation of individual items of equipment, the Contractor shall remove all dirt, mortar, and other material, which has been spilled, misplaced, or has been allowed to mar the finished surfaces.
3. The interior of all electrical equipment, including relays and electrical contacts, shall be thoroughly wiped and vacuumed clean before the equipment is energized.

G. Debris Removal:
1. All debris generated by or as a result of the work of the electrical contractor shall be removed from the site and disposed of as directed by the Owner and/or Engineer, but not less than once each work day.

1.9 EQUIPMENT FOUNDATIONS AND CONCRETE WORK

A. Concrete pads for mounting Main Control Panel (PNL-A) shall be provided as indicated on the drawings and in accordance with other sections of these Specifications.

B. The Contractor shall provide anchor bolts for floor-mounted equipment as required by California Title 24 for seismic bracing of equipment.

C. Equipment shall be leveled and grouted in accordance with Division 3 of these specifications. Concrete materials, placing methods, and general workmanship shall conform to applicable sections of Division 3..

1.10 MISCELLANEOUS MATERIAL

A. Contractor shall furnish all wire, raceway and accessories for equipment interconnections as necessary to obtain a complete operable system, in accordance with the Contract Documents.

B. Miscellaneous materials, except those specified to be furnished by the Owner or other contractors, shall be furnished as required for the complete erection of the equipment. These materials shall include, but shall not be limited to, grout, shims, wedges, dowels, anchors, supports, equipment mounting sill channels, bolting, gaskets, packing, welding rod, and consumable gases.

1.11 MATERIAL SUBSTITUTION

A. If equipment manufacturers are identified by name, and it is indicated that equipment of equal quality and performance will be accepted, the Contractor may submit alternate items to the Engineer for approval.

B. If only one manufacturer is indicated, no alternate equipment will be accepted.

C. Re-design of electrical or any other trade’s work that is required due to the Contractor's use of an approved alternate item; arrangement of equipment; and/or layout other than specified herein, shall be done by the Contractor at his expense. Redesign and detailed plans shall be subject to approval by the Engineer.

D. Engineer’s approval of redesigned or altered drawings submitted by Contractor, shall not relieve the Contractor of his responsibility to provide a complete and operable installation.

E. Equipment and materials installed without approval of the Owner and/or Engineer shall be subject to removal and replacement at the Contractor's expense with approved materials.

F. Equipment and/or materials identified on the drawings or in these specifications by manufacturer's name and/or part number are so identified for the sole purpose of establishing the type and quality of the equipment and/or materials. Such specific, non-generic callouts are not in any way intended to rule out or establish preemptory qualifications relative to manufacturers not identified specifically by name.

1.12 TERMINATIONS

A. All electrical equipment shall be suitable for connection to 75 degree C rated cable and/or wire loaded to its 75 degree C ampacity.

1.13 AREA CLASSIFICATIONS

A. Electrical equipment shall be suitable and rated for the areas in which it is installed. Special areas will be identified and indicated on the drawings.

B. Outdoor equipment shall be NEMA 3R, 4, or 4X, as required by the drawings.

1.14 EXCAVATION AND BACKFILL

A. Excavation and backfill required for the installation of electrical work shall be as indicated on civil, structural or electrical drawings and in accordance with other sections of these specifications.

1.15 PAINTING AND FINISHING

A. Unless otherwise noted, electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil-resistant enamel. The finish color shall be manufacturer's ANSI color standard. Shop primer shall be manufacturer's standard phosphatized coating compatible with the finish enamel.

B. Furnish at least two (2) quarts of touchup paint of the same type and color as the factory applied paint for all different paints used.

C. Finishes marred during shipping, handling, or installation shall be touched up to match the original factory finish. Finish painting of conduit, hangers, and other installation materials will be performed along with general painting of the structure.

D. All galvanized surfaces on which the galvanizing is removed by cutting, drilling, or by any other operation shall be re-galvanized with "Galvanizing Powder M-321" as manufactured by the American Solder and Flux Company of Philadelphia, Pennsylvania; with "Zincilate 810" as manufactured by Industrial Metal Protective, Inc., of Dayton, Ohio; with "Zinc Rich" coating as manufactured by ZRC Chemical Products Company, Quincy,

Massachusetts; or acceptable equal. The Contractor shall furnish this protective material and shall apply it in the field to any surface where the galvanized coating is broken or removed either intentionally or unintentionally.

1.16 SLEEVES AND OPENINGS

A. The Contractor shall be responsible for all required sleeves and openings for electrical raceways, cables and equipment. Contractor shall provide required sleeves and openings, not provided during structure fabrication, using a hacksaw, a hole saw, or a core drill subject to approval by the Owner and/or Engineer.

B. Engineer shall verify the location of openings to be cut through structural concrete (floors, columns, etc) prior to cutting or drilling by Contractor. Use existing spare openings if at all possible, even if it requires a longer conduit run.

C. Finishing Box-outs. Openings that have been cut through walls and floors of masonry or concrete for the passage of raceways shall be finished either by grouting around the conduit or by grouting 3/16-inch (5 mm) thick steel bands around the periphery of the openings. Where sleeves or bands are installed in floors, they shall project 4 inches (100 mm) above the finished floors.

D. Openings beneath Equipment. Where the cables are in conduits and the conduit projects through the opening, opening beneath equipment shall be closed with grout. Closure plates of transit, micarta, or similar material shall be used to close openings beneath equipment where the cables entering the equipment are not in enclosing raceways. The plates shall not be less than 3/8-inch (5 mm) thick and shall be cut to fit closely around the outside surfaces of the cable where the cable passes through the plates. Edges of the holes in these plates shall be rounded and smoothed to prevent damage to the cable. The plates shall be securely fastened to the floor or to the equipment, and all openings around the plates shall be caulked with an effective putty seal or acceptable equal method.

E. Unused openings beneath equipment shall be covered with solid plates of the same material as closure plates for those openings through which conduit or cable enter the equipment. These plates shall be securely fastened to the floor or to the equipment and caulked as indicated above.

1.17 WELDING

A. Welding shall completely fuse the welded member to the supporting steel and shall be neat in appearance. All workmen performing ferrous welding of any kind shall be qualified according to the procedures for qualification tests for fillet welders described in American Welding Society Publication AWS-D1.1, Structural Welding Code. Documentation of approved qualification testing shall be available upon request of the Engineer.

1.18 INSULATION

A. All supports for raceways connected to equipment, piping, and raceways that have been electrically insulated from contact with other structures, shall be properly installed to prevent shunting of the insulation.

1.19 NAMEPLATES

A. All nameplates for electrical equipment shall be permanently attached to the front of the equipment.

1.20 STARTUP

A. The Contractor shall, at a minimum, perform the following tests as applicable for each item of equipment or system installed under this Contract:
   1. Verify correctness of all wiring installed under this contract.
   2. Check wiring for shorts, continuity and grounds.
   3. All ground fault interrupt devices shall be tested individually.

B. The Contractor shall be responsible for operation and maintenance, including all costs thereof, for systems or equipment temporarily placed in operation for testing and adjusting purposes.

C. Complete all testing and startup procedures.

1.21 INSPECTIONS AND TESTS

A. Tests shall be performed on all electrical equipment and complete systems as required under the various sections of these specifications prior to being placed in operation.

B. All tests shall be made after notification, and in the presence of, the Owner and/or Engineer and authorities having jurisdiction. Contractor shall supply all labor, materials, instruments, and supplies of any kind, required for testing. Material and equipment damaged or shown to be defective during tests or unable to perform at design or rated capacity, shall be repaired or replaced by the Contractor at no additional expense, to the satisfaction of the Owner and/or Engineer.

C. Two (2) copies of all test results and/or reports shall be submitted to the Engineer following completion of tests. Submittals shall be bound in standard three-ring binders, tabbed and indexed throughout for easy readability.

1.22 MANUFACTURER'S INSPECTION AND SUPERVISION

A. Contractor shall provide the services of a trained manufacturer's representative, to inspect and advise during the installation of the electrical equipment.

B. The service described above shall be provided as determined necessary by the Contractor for proper installation of the equipment. Availability of these services shall not relieve the Contractor of responsibility for technical supervision of his construction personnel.

C. The presence of a manufacturer's representative shall not relieve the Contractor of responsibility for the work under these specifications.

1.23 BOLTED ELECTRICAL CONNECTIONS

A. Where bolted electrical current-carrying connections are made, the metal surfaces shall be thoroughly cleaned and coated with an oxide inhibitor such as Penetrox A or No-Oxide A compound.

B. The tightness of each bolt in each factory-made bolted electrical connection shall be validated during erection and connection of the equipment.

C. It shall be the Contractor's responsibility to certify that the tightness of each bolt in all bolted electrical connections, factory or field, is in accordance with the manufacturer's recommendations.

D. Bolted electrical connections shall be tightened with manual torque wrenches. Torque wrenches shall be so constructed that they will visually or audibly indicate when the proper torque is reached. The Contractor is responsible for the accuracy of each torque wrench and shall provide documentation of testing by an acceptable laboratory or testing agency when requested by the Engineer.

E. Torque Values. If the equipment manufacturer's erection instructions do not include recommended torque values for bolt tightening or specify an alternate method for tightening bolted electrical connections, torque values shall be in accordance with UL Std 486A and/or those listed in the table below.

TORQUE VALUES FOR DRY, NON-PLATED, NON-LUBRICATED BOLTS					
Bolt Size	18-8 Stainless Steel (Inch-lbs)	Brass (Inch-lbs)	Silicon Bronze (Inch-lbs)	Aluminum 24ST-4 (Inch-lbs)	316 Stainless Steel (Inch-lbs)
1/4"-20	75.2	61.5	68.8	45.6	78.8
1/4"-28	94.0	77.0	87.0	57.0	99.0
5/16"-18	132	107	123	80	138
5/16"-24	142	116	131	86	147
3/8"-16	236	192	219	143	247
3/8"-24	259	212	240	157	271
7/16"-15	376	317	349	228	393
7/16"-20	400	327	371	242	418
1/2"-13	517	422	480	313	542
1/2"-20	541	443	502	328	565
9/16"-12	682	558	632	413	713
9/16"-18	752	615	697	456	787
5/8"-11	1,110	907	1,030	715	1,160
5/8"-18	1,244	1,016	1,154	798	1,301

TORQUE VALUES FOR DRY, NON-PLATED, NON-LUBRICATED BOLTS					
Bolt Size	18-8 Stainless Steel (Inch-lbs)	Brass (Inch-lbs)	Silicon Bronze (Inch-lbs)	Aluminum 24ST-4 (Inch-lbs)	316 Stainless Steel (Inch-lbs)
3/4"-10	1,530	1,249	1,416	980	1,582
3/4"-16	1,490	1,220	1,382	958	1,558
7/8"-9	2,328	1,905	2,140	1,495	2,430
7/8"-14	2,318	1,895	2,130	1,490	2,420
1"-8	3,440	2,815	3,185	2,205	3,595
1"-14	3,110	2,545	2,885	1,995	3,250

F. Connection Bolt Tightness Check:
   1. The tightened bolts in electrical connections shall be checked at random as selected by, and in the presence of, the Engineer. The Contractor shall provide calibrated hand torque wrenches and the necessary platforms, equipment, and personnel for the random check.
   2. The number of bolts checked shall be acceptable to the Engineer based upon observance of the quality and completeness of the tightening operations. A minimum of 10 percent of the bolts in each connection, but not less than two bolts in each connection, shall be checked.
   3. The Contractor shall be responsible for coordinating the checking of bolt tightness so that minimum interference with equipment erection and connection will be experienced. Removal of covers and similar dismantling of equipment to permit the Engineer to witness the testing of bolt tightness of enclosed connections shall be part of the work included under these specifications.
   4. Checking of tightness of electrical connections in the presence of the Engineer is intended to assist the Contractor in avoiding the expense of repairing costly connection failures. This check shall not relieve the Contractor of complete responsibility for the integrity of the electrical connections.

1.24 LUBRICATION

A. The Contractor will furnish all oils, greases, and other lubricants required to place equipment in operation. The Contractor shall apply lubricants in accordance with the manufacturer's recommendations. The lubricants used shall be acceptable to the Owner and/or Engineer. Furnish Material Safety Data Sheets (MSDS) identifying all classified hazardous materials proposed for usage to the Engineer with submittals.

1.25 WIRING

A. In general, all devices furnished under these specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks.
   1. Terminal blocks shall be furnished for:
      a. Conductors requiring connection to circuits external to the specified equipment
      b. Internal circuits crossing shipping splits

c. Equipment where parts replacement and maintenance will be facilitated. Splices will not be permitted in control wiring or instrument leads.

2. All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

3. Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices, shall be permanently labeled to coincide with the identification indicated on the drawings.

B. A shorting type terminal block shall be installed at an accessible location for each set of current transformers supplied with the equipment furnished under these specifications. The shorting terminal block shall be the one nearest the current transformers. No other shorting type terminal blocks are required unless specified otherwise.

C. All connections requiring disconnect plug and receptacle type devices shall be provided with factory-terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory-wired into junction boxes containing terminal blocks for external connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket.

D. Any proposed changes will need to be submitted for approval by the Engineer, prior to any conduit or wire installation. Any delay to the schedule as a result of a proposed change shall be the responsibility of the Electrical Contractor.

1.26 DRAWINGS

A. The Electrical Contractor shall supply shop drawings for the new Main Control Panel (PNL-A). Information indicated on the Contractor's shop drawings shall include:

1. Detailed wiring schematics of the individual panel items, as they actually will appear in the panel.
2. Panel construction details.
3. Detailed internal layout and materials schedule, with each item of equipment identified by item number and name.

B. Shop drawings shall be provided for review and approval prior to the contractor commencing construction.

C. Contractor shall designate a set of project drawings as the job "Record Drawings". This set shall be located at the jobsite and maintained in a clean undamaged state. This set shall be updated with red line markups to accurately reflect all construction field deviation change orders and any additional work authorized by Owner and/or Engineer. During construction the record set shall be available to any representative of the Owner and/or Engineer for review and inspection at site.

D. As-constructed record drawings and red-line markups shall be provided within 10 working days following acceptance of work-in-place.

E. The following as-constructed drawings shall be provided in AutoCAD and pdf format:

1. Shop drawings
2. Any significant changes to the design drawings as a result of contractor preference. Specifically this shall include any changes which were approved by the Engineer only if drafting is completed by the Contractor.

F. As-constructed red-line markup drawings shall be provided to capture any deviation from the design drawings that are not the result of contractor preference. These shall be supplied as two (2) hard copies on ANSI B or D sized paper, as well as a scanned pdf copy.

G. Electronic submission of as-constructed drawings and red-line markups (AutoCAD and pdf) shall be provided as two (2) complete sets on compact disc.

1.27 TERMINAL BLOCKS

A. Terminal blocks shall be furnished with white marking strips and, where permitted by the safety codes and standards, shall be without covers. Not less than 25 percent spare, unused terminals shall be furnished on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

B. Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounted terminal blocks will be acceptable.

C. All terminal blocks, except internal terminal blocks in factory pre-wired electronic systems cabinets, shall be rated 600-volts minimum and shall have strap screw terminals. Terminal blocks for 10 AWG and smaller 600-volt insulated conductors shall be Marathon 1500 series, or acceptable equal. Terminal blocks shall be appropriately sized for larger wire size or higher voltage insulated incoming conductors as necessary.

1.28 RODENT PROOFING

A. The Contractor shall make all pad-mounted electrical equipment panels rodent proof by closing all exterior openings using metal plates or metal screens. This shall be accomplished either by the manufacturer in the fabrication of the equipment, or by the Contractor after installation of the equipment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 16056 ELECTRICAL DEMOLITION, REMOVALS, AND RELOCATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Demolition and removal of existing electrical equipment and components.

B. Save electrical equipment inside the PLC panel for Relocation into the new control Panel.

C. Disconnection and removal of existing power distribution and control circuit raceways and conductors.

D. Removal of concrete equipment pads.

1.02 RELATED SECTIONS

A. Special Provisions
B. Section 16050 – ELECTRICAL GENERAL
C. Section 16196 – ELECTRICAL SYSTEM IDENTIFICATION
E. Section 16950 – TESTING AND INSPECTION

1.03 ELECTRICAL DEMOLITION, REMOVALS, AND RELOCATIONS

A. General

1. Ensure that all hardware items and replacement equipment are on hand prior to attempting any demolition, modification, or remedial work.

2. Equipment, conduits, cables and materials that are abandoned in place shall be provided with tags, labels and nameplates indicating “Spare Equipment” or similar text. Labels shall be provided as specified in Division 16 specifications.

3. The City reserves the right to remove any equipment or materials scheduled for demolition or removal up to the date of demolition, or removals actually begin. The removal, or failure to remove, by the City, any equipment or material scheduled for demolition or removal shall not be cause for any additional charges by the Contractor. The Contractor shall notify the City in writing at least 30 days prior to beginning any demolition.

4. Contractor shall take necessary precautions to insure against damage to existing materials or equipment to remain in place, to be reused or to remain the property of the City. Repair or replace damaged materials and equipment at no additional cost to the City.

B. Equipment Demolition and Removals

1. Equipment and Materials

a. Refer to the Contract Drawings for details and limits of equipment and materials demolition and removals.

b. Contractor shall furnish labor to disconnect and/or remove items shown on the Contract Drawings and as specified. Carefully dismantle and salvage electrical equipment, switches, fixtures, instruments, conduits, cables, wiring, control panels, etc. as necessary to perform the proposed changes.

2. Conduits, Conductors and Cables

a. Where electrical equipment is removed or relocated, also remove all wiring back to source panelboard, MCC, switch or to last remaining device on the same circuit, unless otherwise noted on the drawings. Associated conduits, hangers, supports, etc. shall be removed unless otherwise noted or required to maintain the support and operation of remaining equipment.

b. Remove all extraneous wires and exposed conduits for all mechanical, and electrical devices to be removed or abandoned.

c. Wires shown for removal which are in underground duct banks, or embedded conduit shall be removed unless otherwise noted.

d. Contractor shall disconnect and remove related equipment and conduit mounting hardware, equipment mounting racks, and equipment associated with materials to be removed unless otherwise required to maintain the support and operation of remaining equipment.

e. Any conduit abandoned in concrete slabs, walls, or other inaccessible locations shall be left empty except for a nylon pull wire. Ends shall be capped with push plugs for future use.

f. If cables cannot be removed due to a collapsed or deformed duct, etc. cut cable at duct entrance at each end and tag cable as “Abandoned Cable”, “collapsed duct” or similar text. Notify the City of these conditions.

3. Salvage Materials

a. Deliver on the premises to a location directed by the City, existing material and equipment which is removed and is desired by the City or is indicated to remain on the property of the City.

b. All instrumentation equipment designated for removal shall be turned over to the City regardless if equipment is specifically shown or scheduled. This shall include pressure transmitters, flow and level elements, and associated transmitters and/or electronics units.

c. Equipment and materials not indicted for relocation, reuse, or salvage shall become the property of the Contractor and shall be removed by the Contractor from the premises and properly disposed of.

C. Equipment Relocations

1. Re-route conduits and cables where shown on the Contract Drawings and as necessitated by architectural, mechanical, and HVAC changes and for new electrical work.

2. Provide materials, and hardware for patching, plugging, and refurbishing equipment intended for reuse. Provide new nameplates for reused electrical work.

3. Where the work specified herein or under other divisions necessitates relocation of existing equipment, foundations, conduits, wiring, etc. perform all work and make necessary modifications to existing work as required to leave the completed system in a finished and workmanlike condition.

4. Contractor shall include all necessary equipment and components as required to relocate equipment from the existing locations to the new proposed locations. Equipment shall be tested prior to being disconnected and relocated. Any deficiencies in the equipment operation shall be brought to the attention of the Engineer. Once the equipment has been fully tested, the Contractor shall schedule the relocation of the unit(s). After the unit(s) has been relocated and reconnected. The Contractor shall perform testing as required to demonstrate the operation of the unit(s).

D. Structure Repairs & Refinishing

1. Rehabilitate and relocate items of equipment as required and as indicated on the Contract Drawings or specified.

2. Fill and patch penetrations, holes, damaged surfaces, etc. to restore a smooth finish to floors, ceilings, and walls.

1.05 SUBMITTALS

A. Submit detailed circuit wiring lists for motor control center power and telemetry panel circuit disconnections, removals and reconnections.

B. Submit detailed circuit wiring list for existing meter panel circuit disconnections, removals, and reconnections.

C. Provide a detailed sequence of construction plan, in coordination with the other trades, for performing the demolition of the existing meter panel, MCC and pressure transmitter, pumps and lighting.

D. Contractor shall submit a copy of Circuit Identification Tables to the Engineer for review and approval prior to disconnecting any circuits.

PART 2 MATERIALS

2.01 GENERAL

A. Refer to Division 16 for electrical material requirements.

PART 3 EXECUTION

3.01 SEQUENCE OF CONSTRUCTION

A. Contractor shall determine the electrical requirements for the sequence of construction to coordinate with the overall construction schedule.

END OF SECTION

SECTION 16100 GROUNDING

PART 1 GENERAL

1.01 SECTION INCLUDES

All new or modified work of this Contract, including, but limited to:

A. Metallic water services.
B. Equipment housings
C. Metal raceways.
D. Grounding terminals of outlets.
E. Outdoor lighting fixtures and poles.
F. Footing rebar.
G. Ductbanks.
H. Manholes.
I. Pullboxes.
J. Metallic panels and conduit.
K. Transformer secondary neutrals.

Take special precautions to ground all equipment in strict accordance with the NEC and as otherwise noted in these specifications.

1.02 RELATED SECTIONS

A. Special Provisions
B. Division 2 Sections
C. Section 16050 - ELECTRICAL-GENERAL
D. Section 16950 - TESTING AND INSPECTION

1.03 REFERENCES

All materials and installations shall be in accordance with the latest revisions of the following:

1. National Electric Code
2. Underwriters Laboratories, Inc.

1.04 SUBMITTALS

A. Provide submittals in accordance with the Special Provisions and Section 16050.

B. Submitted for all materials used in connection with the grounding system.

C. Certified test reports of grounding system resistance.

PART 2 MATERIALS

2.01 ELECTRODES

A. Copper-Clad Ground Rods

1. Rods shall be ¾" diameter, minimum of 10' long unless otherwise shown on the Contract Drawings. Rods shall be steel core with copper molten welded or electrolytically bonded to exterior.

2. Manufacturers

    a. Copperweld Steel Company
    b. Thompson Lightning Protection, Inc.
    c. Or Equal

2.02 CONDUCTOR

A. Ground Conductor (Above Grade) – Type THW insulated wire in conduit or other raceway. Color code insulation per NEC.

B. Ground System Conductor (Buried) - Soft drawn or soft annealed stranded copper, tinned bare concentric conductor.

C. Equipment Bonding Conductor – For sizes 8 AWG and smaller, solid ASTM B-1. For sizes 6 AWG and larger, stranded ASTM B-8.

2.03 CONNECTORS

A. Compression-Type Fittings

1. Construction – Two bolts and a minimum of 1-1/2 inches in length.

2. Manufacturers

    a. Thomas & Betts
    b. Burndy Corporation
    c. Or Equal

B. Welded Connection

1. Construction – Molded fusion-welding process.

2. Manufacturers

    a. Cadweld
    b. Thermoweld
    c. Or Equal

C. Mechanical Connection

1. Construction – Mechanical lugs securely fastened using silicon bronze hardware.

2. Manufacturers

    a. Thomas & Betts
    b. Burndy Corporation
    c. Or Equal

PART 3 EXECUTION

3.01 GENERAL

A. Install ground system or grid as shown on the Contract Drawings. Install such that tops of driven ground rods are a minimum of 12 inches below grade, except for chemically filled ground rods which shall be installed per the manufacturer's recommendations. Ground rods are to be driven at least 2 feet below the groundwater level. Depth of the conductor system is to be 30 inches minimum with a minimum length of 20 feet. Thermoweld rods to copper, grounding conductor or use approved mechanical connections to rods where grounding conductor is No. 4 or smaller.

B. When rods are shown and cannot be driven due to boulders or rock formations, install grounding plates below groundwater level or a minimum of 6 feet below grade.

C. Final resistance to ground of completed ground system shall be a maximum of 5 ohms in accordance with Section 16950. If tests indicate higher than 5 ohms resistance, then the Contractor shall install additional rods or plates at no additional cost to Owner to lower the resistance to below 5 ohms.

3.02 CONNECTIONS

A. Buried Connection - Made with either thermal welded or compression fitting specially made for grounding systems

B. Exposed Connection - Made with grounding system compression-type fittings.

C. Connection to Metal – Make all connections to water pipes, steel surfaces, etc., using mechanical connectors.

D. Thoroughly clean all surfaces to bright bare metal to accept ground connections.

3.03 GROUNDING ELECTRODE CONDUCTOR

A. Size per NEC 250-66 unless larger size is shown on the Contract Drawings:

3.04 MAIN SERVICE GROUNDS

A. Bond ground system securely to:

1. Connect grounding electrode conductor to building water service. (If available and if metallic water pipe is used and is of sufficient conductive length to insure continuity, provide jumpers around meters or other removable devices as required.)

2. Connect two grounding electrode conductors in conduit to facility grounding grid or system.

3.07 INTERIOR CONDUIT AND RACEWAY SYSTEM

A. Electrical integrity of conduit system shall be maintained throughout. Provide bonding jumpers at fittings as required; jumpers shall be no longer than required. Provide separate ground wire for all conduit systems.

3.08 CONDUIT AND RACEWAY SYSTEM

A. Provide separate ground wire for all conduit systems leaving the Meter Pedestal. Size per NEC 250-122 in NEC.

3.09 FEEDERS

A. Include an insulated grounding conductor, sized per NEC 250-66, in each conduit. Bond all served equipment frames, enclosures, ground bars, etc., to this conductor. Make all conductor terminations and connections using compression lugs or fittings designed and UL labeled for the purposes.

3.10 SEPARATE GROUND

A. Basic intent of grounding specification is that grounding conductor be completely separate from system neutral and connect neutral to ground at the main service grounding point only. Run separate insulated (green) grounding conductors from all grounding points independently back to main service ground. Where ground passes through panels and disconnects, ground lugs shall be brazed or bolted to panel or disconnect housings with neutral bus or lug isolated from same. Ground all metallic conduits at each panel. Clean paint from metal to accept ground lugs.

3.11 METALLIC, NON-CURRENT CARRYING ENCLOSURE

A. Connect to ground bar at load center supplying same through conduit system using proper fittings at junction boxes, expansion joints, and between ground bushings on each conduit within all sheetmetal enclosures.

3.12 SHIELDED CABLE

A. Shielding to be continuous and grounded at one point only unless otherwise required by equipment manufacturer's recommendations.

3.13 GROUND CONDUIT LABELS

A. Label all service, equipment frame or motor grounding conduits containing only grounding conductors – "SUPPLEMENTAL GROUND" Label to identify item being grounded.

3.15 INDEPENDENT GROUND SYSTEMS

A. The grounding system described here shall be independent from the lightning protection ground system. See Section 16671.

3.20 DUCTBANK GROUND CONDUCTOR

A. Bond ductbank ground conductor to the building ground system when provided, or when a new building ground system was not provided, install a new ground rod and bond the ductbank ground to it.

B. Bond ductbank grounds to manhole ground rod, if available.

3.21 GROUND ROD INSPECTION/TEST WELLS

A. Provide ground rod inspection/test wells where shown on the Contract Drawings.

END OF SECTION

SECTION 16120 CONDUCTORS

PART 1 GENERAL

1.1 SUMMARY

A. This section covers all labor, material, tools, equipment and services required to install building wire and cable, service entrance cable, control cables, wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 16050 – General Electrical

B. Section 16130 – Raceways and Boxes

C. Section 16196 – Electrical Equipment Identification

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A.	ASTM B 3	Soft or Annealed Copper Wire
B.	ASTM B 496	Compact Round Concentric-Lay-Stranded Copper Conductors
C.	ASTM B 8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
D.	ANSI C 2	National Electrical Safety Code – latest edition
E.	IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
F.	IEEE 399	Recommend Practice for Industrial and Commercial Power System Analysis.
G.	NECA	(National Electrical Contractors Association) - Standard of Installation.
H.	NEMA WC-26	Wire and Cable Packaging
I.	NETA ATS	National Electrical Testing Association Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
J.	NFPA 70	National Electrical Code – latest edition.
K.	UL 83	Thermoplastic-Insulated Wires and Cables.
L.	UL 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors.

M. UL 510 Polyvinyl Chloride, Polyethylene and Rubber Insulating Tapes.

1.4 SYSTEM DESCRIPTION

A. The applications for cable, wire and connectors required, but not limited to, are as follows:
   1. Power distribution circuitry.
   2. Lighting circuitry.
   3. Appliance and equipment circuitry.
   4. Line voltage wiring to miscellaneous equipment.

1.5 PROJECT CONDITIONS

A. All wire and cables shall be minimum No. 12 AWG copper conductor unless otherwise shown on drawings.

B. All conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is diagrammatic unless dimensioned.

D. Route wire and cable as required to complement project conditions.

E. The contractor shall be responsible for any and all raceways and raceway/cable supports in accordance with all other sections of these specifications.

1.6 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, acceptable testing and listing agencies as suitable for the purpose specified and shown.

1.7 CONTRACTOR SUBMITTALS

A. Product Data:
   1. Submit manufacturer’s catalog and technical data for cables.

B. Field Test Report:
   1. Measure overall insulation resistance to ground. Provide certified test report for Engineer’s Review.

1.8 CLOSEOUT SUBMITTALS

A. Provide project record documents showing actual locations of components and circuits.

B. Submit final certified test reports of all insulation resistance tests.

1.9 QUALIFICATIONS

A. Manufacturer shall be a Company specializing in manufacturing products specified in this section with a minimum of five (5) years experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products on site in accordance with Division 1 requirements.

B. Accept cable and accessories on site in manufacturer's packaging. Inspect for damage.

C. Store and protect cable and accessories from the environment in accordance with manufacturer’s published instructions. Provide adequate heating and ventilation to prevent condensation.

D. Damaged items shall be replaced at no additional cost to Owner.

1.11 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 feet of length shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Domestic manufacturer regularly engaged in the manufacture of Building Wire and Cable products for at least five (5) years as follows:
   1. American Wire and Cable.
   2. Cerro Wire and Cable Co.
   3. General Cable Corp.
   4. Okonite Co.
   5. Or Approved Equal.

2.2 BUILDING WIRE AND CABLE

A. Building wire and cable shall be UL83 compliant, insulated, single conductor, copper, solid or stranded, rated for 600-volts AC. The insulation shall be thermoplastic material rated for 90 degrees Celsius dry locations, 75 or 90 degrees Celsius wet locations, THW, THHN/THWN, RHW or XHHW, per ANSI/NFPA 70.

B. For Interior Dry Location: Use only building wire, THHN/THWN insulation rated 90 degree Celsius, in raceway.

C. For Exterior Wet or Dry Locations: Use only XHHW insulation rated for 90 degree Celsius, in raceway.

D. For Underground Dry or Wet Locations: Use only XHHW insulation rated 90 degree Celsius, in raceway.

E. For connections to electrical equipment, coordinate wire type with equipment manufacturer.

2.3 SERVICE ENTRANCE CABLES

A. Service entrance cables shall be insulated, single conductor, copper, stranded, rated for 600-volts AC, type XHHW insulation.

2.4 INSTRUMENTATION AND CONTROL CABLES

A. Instrumentation cables for field mounted equipment and devices shall be minimum two (2) conductor No. 16 AWG, tin-coated copper, stranded, shielded twisted pair, 80 degree Celsius, PVC insulation foil shield with overall heavy duty polyethylene jacketing, rated for 600-volt AC.

B. Control cables to field mounted equipment and devices shall be a single conductor, insulated, No. 12 AWG minimum, copper, solid or stranded, rated for 600-volts AC. The insulation shall be thermoplastic material rated for 90 degrees Celsius dry locations, 75 degrees Celsius wet locations, THHN/THWN or XHHW, per ANSI/NFPA 70 and compliant with UL 83.

C. Multi-conductor control cables for field mounted equipment and devices shall consist of several single conductor, insulated No. 12 AWG minimum, copper, solid or stranded, rated for 600-volts AC with an overall protective PVC jacket. The insulation shall be thermoplastic material rated for 90 degrees Celsius dry locations, 75 degrees Celsius wet locations, THHN/THWN or XHHW, per ANSI/NFPA 70 and compliant with UL 83. Circuit identification shall consist of Method 1 - color coding in accordance with ICEA S-66-524, Appendix K Table K-2.

D. Instrumentation and control cable connected to equipment or devices within control panels shall be sized per requirements of equipment manufacturer (minimum #16 AWG).

2.5 WIRING CONNECTORS

A. Split Bolt Connectors:
   1. FCI Burndy Corp.
   2. Cooper Crouse Hinds.
   3. O.Z./Gedney Co.
   4. Thomas & Betts Co.
   5. 3-M Co.

B. Solderless Pressure Connectors:
   1. FCI Burndy Corp.
   2. Ideal Industries Co.
   3. Thomas & Betts Co.
   4. 3-M Co.

C. Spring Wire Connectors:
   1. Ideal Industries Co.

2. 3-M Co.

D. Compression Connectors:
1. FCI Burndy Corp.
2. Thomas & Betts Co.
3. 3-M Co.

2.6 WIRE COLOR CODE

A. Color-code all conductors:
1. Wire sizes No. 10 AWG and smaller shall have integral color-coded insulation.
2. Wire sizes No. 8 AWG and larger may have black insulation but shall be identified by color-coded electrical tape at all junction, splice, pull, or termination points.
3. Color tape shall be applied to at least 3 inches of the conductor at the termination ends and in junction or pull boxes or where readily accessible.
4. Conductors for all systems shall not change color at splice points.
5. Where there are two or more neutrals in one conduit, each shall be individually identified with the proper circuit.
6. For No. 4 AWG and larger ground conductors, identify with green tape at both ends and all visible points, included in all junction boxes.
7. Each phase wire shall be uniquely color-coded as indicated below:

120/240-Volts	120/208-Volts	277/480-Volts
Phase A - Black	Phase A – Black	Phase A - Brown
Phase B – Red	Phase B – Red	Phase B - Orange
Neutral - White	Phase C – Blue	Phase C - Yellow
Ground - Green	Neutral – White	Neutral - White or Natural Gray
	Ground – Green	Ground - Green

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that mechanical work likely to damage wire and cable has been completed.

B. Verify that raceway installation is complete and supported as required by the specifications.

3.2 PREPARATION

A. Test raceway with a mandrel and thoroughly swab out to remove foreign material before pulling cables.

B. For conduits sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel.

C. For conduits sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. Then draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel.

3.3 EXISTING WORK

A. Disconnect and remove exposed and/or abandoned wire and cable. Patch surfaces where removed cable pass through building finishes.

B. Disconnect abandoned circuits and remove wire and cable. Remove abandoned boxes if wire and cable servicing them is abandoned and/or removed. Provide blank cover for abandoned boxes that are not removed.

C. Ensure access to existing wiring connections which remain active and which require access. Modify installation or provide access panel as appropriate.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as otherwise specified.

E. Tag and repair existing wire and cable that remain or are being reused.

3.4 INSTALLATION

A. General:
   1. Install wire and cable in accordance with manufacturer's instructions and NECA "Standard of Installation".
   2. Route wire and cable as required to meet project conditions.
   3. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.
   4. Protect exposed cable from damage.
   5. Pull all conductors into raceway at same time.
   6. Use suitable wire pulling lubricant for building wire No. 4 AWG and larger. Lubricant shall not be deleterious to the cable sheath, jacket or outer covering.
   7. Do not exceed cable manufacturer's recommended pulling tension limits when installing wire or cable.
   8. Support cables above accessible ceiling using standard support methods to support cables from structure. Do not rest cable on ceiling panels.
   9. Neatly train and lace wiring inside boxes, equipment, and panelboards

B. Cable and Wire Size:
   1. Conductor sizes are based on copper unless specifically indicated as aluminum or "AL".
   2. Use conductor no smaller than No. 12 AWG for power and lighting circuits.
   3. Use conductor no smaller than No. 14 AWG for control circuits.

4. Use No. 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
5. Use No. 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.
6. Use stranded conductor for all feeders, branch and control circuits.

C. Cable Identification
1. Identify all wires and cables as specified in other Sections of these Specifications.

D. Special Techniques – Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors. Where an anti-oxidation lubricant is used, apply liberally, coating all exposed conductor surfaces.
2. Use suitable cable fittings and connectors for the environment in which they are installed.
3. Underground splices shall be made in a pull-box and shall be UL listed for wet locations.
4. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
5. Use split bolt connectors for copper conductor splices and taps, No. 8 AWG and larger.
6. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, No. 10 AWG and smaller.
7. Tape un-insulated conductors and connector with two layers of half-lapped rubber insulating compound tape and two layers of half-lapped, 7-mil electrical tape, Scotch 33+, or equal.
8. Stranded conductors for control circuits shall have fork or ring terminals crimped on for all device terminations. Bare stranded conductors shall not be placed directly under the screws.

3.5 FIELD QUALITY CONTROL

A. Field inspection and test shall be performed under provisions of NETA ATS section 7.3 (2) – Low Voltage Cables, 600-Volt Maximum as follows.
1. Visual and Mechanical Inspection:
a. Compare cable data with drawings and specifications.
b. Inspect exposed sections of cable for physical damage and correct connection in accordance with single-line diagram.
c. Inspect all bolted electrical connections for high resistance using one of the following methods:
1) Use of low-resistance ohm-meter in accordance with NETA section 7.3.2.2 (Electrical Tests).
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data from NETA ATS Table 10.12.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Verify cable color coding with applicable specifications and National Electrical Code.

2. Electrical Tests
    a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute.
    b. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable, in accordance with NETA Section 7.3.2.1 (Visual and Mechanical Inspection).
    c. Perform continuity test to insure correct cable connection.
    d. Correct malfunctions and/or deficiencies immediately as detected at no additional cost to the District, including additional verification testing.
    e. Subsequent to final wire and cable terminations, energize all circuitry and demonstrate functional adequacy in accordance with system requirements.
3. Test Values
    a. Compare bolted connection resistance to values of similar connections.
    b. Bolt-torque levels should be in accordance with NETA ATS Table 10.12 unless otherwise specified by the manufacturer.
    c. Micro-ohm or milli-volt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
    d. Minimum insulation-resistance values should not be less than 50 meg-ohms.
    e. Investigate deviations between adjacent phases.

END OF SECTION

SECTION 16130 RACEWAY AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface and buried raceways, wireways, outlet boxes, pull boxes, junction boxes, hand holes and concrete manholes.

1.2 RELATED SECTIONS

A. Section 16120 – Conductors

B. Section 16196 – Electrical Equipment Identification

1.3 REFERENCES - CODES AND STANDARDS

A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit.

D. ASTM A 48 Standard Specification for Grey Iron Castings.

E. NECA (National Electrical Contractor's Association) – "Standard of Installation."

F. NEMA FB 1 (National Electrical Manufacturers Association) – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

G. NEMA OS 1 (National Electrical Manufacturers Association) – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

H. NEMA OS 2 (National Electrical Manufacturers Association) – Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

I. NEMA RN 1 (National Electrical Manufacturers Association) – Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

J. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.

K. NEMA TC 3 (National Electrical Manufacturers Association) – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. NEMA TC 6 - Non-Metallic Conduit.

M. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1,000 Volts Maximum).

N. NFPA 70 National Electrical Code (NEC). Latest approved edition

O. UL 1 Flexible Metal Conduit

P. UL 6 Rigid Metal Conduit

Q. UL 514B Conduit, Tubing and Cable Fittings.

R. UL 651 Rigid Non-Metallic Conduit

S. UL 797 Electrical Metallic Tubing

T. UL 1242 Intermediate Metal Conduit

1.4 SYSTEM DESCRIPTION

A. Raceway, boxes and manholes located as indicated on drawings and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway, boxes and manholes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground more than 5 feet (1,500 mm) outside foundation wall: Provide Schedule 40 non-metallic conduit encased in concrete.

C. Underground within 5 feet from foundation wall: Provide rigid steel or Schedule 40 non-metallic conduit encased in concrete.

D. In or Under Slab on Grade: Provide Schedule 40 non-metallic conduit encased in concrete. Provide Galvanized with tape wrap rigid steel factory bends greater than 22.5 degrees and for stub-ups through concrete slabs.

E. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

F. In Slab above Grade: Provide galvanized rigid steel conduit. Provide cast or concrete-tight sheet metal boxes.

G. Exposed Dry Locations: Provide galvanized rigid steel conduit. Provide cast boxes.

H. Concealed Dry Locations: Provide electrical metallic tubing for sizes less than 2-inches. Provide galvanized rigid steel or intermediate steel conduit in sizes 2-inches or larger. Provide cast or sheet metal boxes.

1.5 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch (19 mm) unless otherwise specified.

1.6 SUBMITTALS

A. Submit markups of any changes in the conduit routing plan, for review and approval, prior to installation.

B. Product Data: Submit for the following:
   1. Rigid Steel Conduit.
   2. PVC Coated galvanized rigid steel conduit.
   3. Intermediate steel conduit.
   4. Electrical Metallic Tubing (EMT).
   5. Flexible metal conduit.
   6. Liquid tight flexible metal conduit.
   7. Nonmetallic conduit.
   8. Raceway fittings.
   9. Conduit bodies.
   10. Surface raceway.
   11. Pull boxes, junction boxes and manholes.

1.7 CLOSEOUT SUBMITTALS

A. Include the following in the project Record Documents (as specified in the Section 16050):
   1. Record actual routing of conduits. Provide record (as-built) drawings marked in red to show actual routing of the underground raceway and cable when different from the original contract drawings. Prepare on new, clean set of contract drawings.
   2. Record actual locations and mounting heights of outlet, pull boxes, junction boxes and manholes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC and PVC-coated metallic conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Galvanized Rigid Steel Conduit (GRSC or RGS), couplings and elbows shall be hot-dip galvanized, rigid mild steel in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with threaded ends.

B. Intermediate Metal Conduit (IMC). Raceway shall be hot-dipped galvanized mild steel in accordance with ANSI C80.6 and UL 1242 and shall bear the UL label. Conduit shall have same characteristics of rigid steel except for thinner wall.

C. Polyvinyl Chloride (PVC) coated galvanized rigid steel conduit and intermediate metal conduit shall be in accordance with NEMA RN 1. Coating shall be applied under controlled factory conditions. Prior to coating, conduit shall meet requirements of ANSI C80.1 and UL 6 or ANSI C80.6 and UL 1242 as appropriate. PVC coated conduits shall have ultra-violet (UV) inhibitor in the coating material.

D. Electrical Metallic Tubing (EMT). Electrical metallic tubing, including elbows and bends, shall be zinc coated, mild steel in accordance with the requirements of ANSI C80.3 and UL 797. The interior and exterior surfaces of the tubing shall have a continuous zinc coating. Conduit shall be formed with a continuous welded seam, with a uniform wall thickness, in minimum 10-foot lengths.

E. Flexible Metal Conduit shall be galvanized steel meeting the requirements of UL 1. Flexible aluminum conduit is not permitted.

F. Liquid-Tight Flexible Metal Conduit shall be plastic-jacketed, galvanized steel, "Sealtite" Type EF for general service areas or Type HC for high-temperature when used under raised floor or in air plenums. Conduit shall be UL listed.

G. Non-Metallic Conduit shall be as follows:
   1. Schedule 40: Conduit shall be 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.
   2. Spacers used in duct bank installations shall be high impact plastic, interlocking bases, and intermediate type spacers. Place spacers between 6 and 10 feet apart.

H. Rigid aluminum conduits and flexible metal or non-metallic conduits are not permitted on this project.

2.2 RACEWAY FITTINGS

A. Couplings and Thread Protectors. Each length of threaded conduit shall be provided complete from the manufacturer with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

B. Metal Conduit Fittings shall conform to the requirements of UL 514B where this standard applies. Galvanized iron or galvanized steel fittings shall be used with steel conduit. Threaded fittings shall engage a minimum of five threads made up wrench-tight and be compatible with conduit. EMT fittings shall be compression type, UL approved for rain tight applications and setscrew type with insulated throat for indoor applications.

C. Liquid-Tight Flexible Conduit Fittings shall be galvanized steel, T&B 53XX series insulated throat, and shall bear the UL label. Die-cast malleable fittings are not acceptable.

D. Liquid-Tight Flexible Metal Conduit Fittings shall be galvanized steel similar to T&B “Tite-Bite”.

E. Non-Metallic Conduit Fittings shall be of same material and strength characteristics as the conduit and shall be solvent welded as recommended by manufacturer. End bells shall be plastic, high impact, tapered to fit. Where conduit transition from non-metallic to metallic is required, provide non-metallic female “terminal” adapter. Non-metallic “male” adapters are not acceptable.

F. Special Fittings. Conduit sealing, explosion proof, dust proof, and other types of special fittings shall be provided as required and shall be consistent with the area and equipment with which they are associated. Fittings installed outdoors or in damp locations shall be sealed and gasketed. Outdoor fittings shall be of heavy cast construction. Hazardous area fittings and conduit sealing shall conform to NEC requirements for the area classification.

G. Bushings shall be provided for the termination of all conduits not terminated in hubs, couplings or insulated throat connectors. Grounding type insulated bushings with insulating inserts in metal housings shall be provided for conduit 1-1/4 inches and larger. Standard bushings shall be galvanized steel or malleable iron in all sizes.

H. Locknuts. One interior and one exterior locknut shall be provided for all conduit terminations not provided with threaded hubs and couplings. Locknuts shall be designed to securely bond with the conduit to the box when tightened. Locknuts shall be so constructed that they will not be loosened by vibration.

I. Unions. Watertight conduit unions shall be Appleton or Crouse-Hinds Type UNF or UNY, or approved equal.

J. Raintight Conduit terminating hubs, where indicated on the drawings or required by these specifications, shall be Meyer’s rigid conduit hubs, or approved equal.

2.3 CONDUIT BODIES

A. Malleable iron conduit bodies shall be cast malleable iron with tensile strength meeting ASTM A 48, Class 30A requirements. Malleable conduit bodies shall be finished with an epoxy powder coating. Cover shall be malleable iron with captive screws.

B. All conduit bodies’ entrances shall be machined NPT threads with a smooth, rounded, internal conduit stop bushing.

C. All conduit bodies shall be equipped with a sealed and gasketed cover. Cover shall be secured using stainless steel machine screws.

2.4 CONDUIT SUPPORTS

A. Conduit supports shall be furnished and installed in accordance with other section of these specifications. Conduits shall be supported so that fittings are accessible. Support systems shall be limited to electrical conduits only.

B. Hanger rods shall be 3/8-inch diameter galvanized threaded steel rods, minimum. Conduit racks over 18-inch wide, over one level, or supporting 2-inch RSC or larger, shall be 1/2-inch diameter rod minimum.

C. Conduit Clamps. Conduits in single runs or groups of two shall be supported by steel clamps and clamp backs. They shall be galvanized malleable iron or approved equal cast ferrous metal for steel conduit or tubing.

D. Support Channels. Supports for banks of three of more conduits shall be constructed of formed steel support channels (Unistrut, Kindorf, Superstrut, B-Line or approved equal) with associated conduit or tubing clips. Support channels shall be steel, hot-dip galvanized after fabrication with galvanized steel clips for steel conduit or tubing.

E. Wall Penetrations. All conduits, raceways, cables and sleeve penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed with a UL-approved fire stopping system, in accordance with specification Section 16060 – Basic Electrical Materials and Methods.

2.5 OUTLET BOXES AND SWITCH BOXES

A. Manufacturers: Firms regularly engaged in the manufacturing of electrical raceways of the types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized flat rolled sheet steel outlet wiring boxes of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

C. Outlet boxes used in wet outdoor locations, surface mounted shall be cast metal (FS or FD type) with mounting lugs and gasketed covers.

D. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, per NEC requirements.

E. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.6 PULL BOXES, JUNCTION BOXES, HANDHOLES AND MANHOLES

A. Sheet Metal Boxes shall be NEMA OS 1, NEMA rating as indicated on drawings. Minimum 16 gauge galvanized steel construction with stainless steel hinged cover and neoprene gasket. Cover shall be secured to the body with a continuous, full length, piano type hinge and stainless steel pin on one side and captive screw on the other side. Door shall be equipped with padlock hasp with sealing hole provisions.

1. Provide #10-32 tapped hole provisions for optional ground lug kit.
2. Provide 0.375-16 collar studs for mounting optional panel.
3. Provide external mounting feet for secure wall mounting.
4. Finish: Wash and phosphate undercoat with ANSI 61 gray polyester power finish.

B. Surface-Mounted Cast Metal Box: NEMA 250, NEMA Type 3R or 4 as indicated, flat-flanged, surface- mounted junction box:
1. Material: Cast Iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Concrete pull boxes, vaults and hand holes for power, lighting, controls and telecommunications shall be pre-cast concrete boxes, sized as indicated on the drawing. Pull boxes shall be equipped with a concrete cover for non traffic rated locations OR cast-in frame, galvanized steel, adjustable, high impact traffic cover (H-20 load rated), sump, lifting lugs, and conduit knock-outs as indicated on the drawings. Knockout location and sizes shall be coordinated with the duct bank for each location. Cover shall be engraved with the words - – “POWER”, “LIGHTING”, “CONTROLS”, COMM/DATA”, “TELEPHONE” or similar as applicable.

2.7 CLOSURE FOAM

A. All conduit, raceways, cables and sleeves penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed by closure foam as in Dow Corning #3-6548 silicone RTV, GE RTV 850 silicone foam, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough in.

3.2 EXISTING WORK

A. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.

B. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION OF RACEWAYS

A. Routing
1. Install raceway and boxes in accordance with NECA “Standard of Installation.”

2. Conduit routing shown on drawings is diagrammatic only. Contractor shall field route conduit and raceways between equipment and devices as required to obtain a complete wiring system.
3. All exposed conduits shall be installed parallel or perpendicular to dominant surfaces with right-angle turns made of symmetrical bends or fittings.
4. Conduit shall not be installed on the outside face of exposed columns, but shall be routed on the web or on the inside of a flange of the column.
5. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.
6. Conduit shall be located at least 6 inches from hot water or steam pipes and from other hot surfaces

B. Moisture Pockets
1. Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a hole shall be drilled in the bottom of a pull box or a "C-type" conduit fitting provided in the low point of the conduit run.

C. Couplings and Unions
1. Metal conduit shall be joined by threaded conduit couplings, with the conduit ends butted.
2. The use of running threads, Erickson type couplings, split couplings or similar unions are not permitted.

D. Conduit Bodies
1. Conduit bends shall meet the requirements of NEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.
2. Conduits or tubing deformed or crushed in any way shall be removed from the job site.

E. Bends and Offsets
1. Changes in direction of conduits shall be made with fittings or bends.
2. Conduit bends shall meet the requirements of NEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.
3. Bends shall be made using appropriate tools or mechanical equipment. The use of a pipe tee or vise for bending conduit or tubing will not be permitted.
4. For non-metallic conduit or plastic coated steel, approved factory bends and offsets shall be used.
5. Conduits or tubing deformed or crushed in any way shall be removed from the job site.
6. Install no more than the equivalent of three 90 degree bends between boxes or outlets

F. Cutting and Threading
1. The plane of all conduit ends shall be square with the centerline.
2. Where threads are required, they shall be cut and cleaned prior to conduit reaming.

3. The ends of all conduit and tubing shall be reamed to remove all rough edges and burrs.
4. Cutting oil shall be used in threading operations; the dies shall be kept sharp, and provisions shall be made for chip clearance.
5. Threads on conduits and fittings shall be lubricated with conducting and sealing compound.
6. All steel conduits shall be coated after threading with cold-galvanized zinc coating. The Contractor shall supply this protective material and shall apply it in the field prior to installing conduit or fittings.

G. All steel conduit, exposed to weather or in contact with earth, shall be re-galvanized after threading with "Galvanizing Powder M-321" as manufactured by the American Solder and Flux Company of Philadelphia, Pennsylvania; "Zincilate 810" as manufactured by Industrial Metal Protectives, Inc., of Dayton, Ohio; "Zinc Rich" coating as manufactured by ZRC Chemical Products Company, Quincy, Massachusetts; or approved equal. The Contractor shall supply this protective material and shall apply it in the field.

H. Connections to Boxes and Cabinets
1. Conduit shall be securely fastened to all boxes and cabinets.
2. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit.
3. The locknuts, both inside and outside, shall then be tightened sufficiently to bond the conduit securely to the box.
4. Locknuts on connectors shall be tightened securely to bond the connectors.

I. All conduits entering enclosures outdoors or in wet areas shall enter through Meyer's hubs, or approved equal, or threaded openings.

J. Cleaning
1. Precautions shall be taken to prevent the accumulation of water, dirt, or concrete in the conduit.
2. Conduit in which water or other foreign materials have been permitted to accumulate shall be thoroughly cleaned or, where such accumulation cannot be removed by methods acceptable to the Owner /Engineer, the conduit shall be replaced.
3. For conduits sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of foreign materials. For conduits less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles and foreign material.

K. Empty Conduit
1. All conduits installed for future use shall have a polypropylene pull line with a minimum tensile strength of 200 lbs., Jet Line, Cat. No. 232, polyolefin, or approved equal. Pull line shall be secures at both ends to ensure future accessibility.

L. Identification

1. All conduits shall be identified in accordance with other section of these specifications.

M. Grounding
1. All conduits shall be grounded in accordance with specification Section 16050 – Basic Electrical Materials and Methods.
2. A solid or stranded bare copper or green insulated copper solid or stranded ground wire shall be provided in all conduits and raceways.

N. Galvanized Rigid Steel Conduit
1. Galvanized rigid steel conduit shall be installed in areas exposed to weather, vehicle traffic, in hazardous classified areas, for penetrations through foundations, and 10 feet before transition from below grade to 8 feet above grade, unless otherwise noted on the drawings.
2. Steel conduit in contact with earth shall be protected by "Scotchwrap" 10 mil tape applied in double thickness using 50 percent lap turns to 6 inches above grade and 6 inches beyond transition.
3. Expansion joints shall be used where required.

O. Intermediate Steel Conduit
1. Intermediate steel conduit may be installed in lieu of galvanized rigid steel conduit in all above ground areas where rigid steel conduit is permitted, except for wires over 600- volts, unless otherwise specified.

P. Polyvinyl Chloride (PVC) Coated Galvanized Rigid Steel Conduits and Intermediate Steel Conduit
1. PVC -coated, steel conduit and fittings shall be installed where highly corrosive conditions exist, indoors or outdoors.
2. The Contractor shall patch any damaged coating according to the manufacturer's instructions.

Q. Electrical Metallic Tubing
1. Electrical metallic tubing shall be installed for all circuits, indoors above concrete slab, where not subject to conditions outlined for rigid galvanized steel conduits.

R. Rigid Aluminum Conduit
1. Not acceptable on this project.

S. Flexible Metal Conduit, Steel or Aluminum
1. Flexible conduit inserts not greater than 30 inches in length, shall be installed in all conduit runs, which are supported by both building steel and by structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by isolated structures on separate foundations.
2. Flexible conduit shall be installed in conduit runs, which cross expansion joints.
3. Special areas, such as plant office control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room or office framing.

4. Flexible conduit shall be installed adjacent to all equipment and devices, which move in relation to the supply conduit due to vibration, normal operation of the mechanism, or thermal expansion.
5. Conduit shall be connected to pressure switches, thermocouples, solenoids, and similar devices with flexible conduit. Flexible conduit shall be installed adjacent to the motor terminal housing for motors requiring 4-inch and smaller conduit.
6. Flexible metal conduit inserts not greater than 6 feet in length shall be installed for light fixture tap conductors.

T. Liquid-Tight Flexible Metal Conduit
1. Liquid-tight flexible metal conduit shall be used in place of regular flexible conduit for connections to motors and transformers, in areas exposed to weather, moisture or oil, and under raised floors.
2. Liquid-tight flexible metal conduit may be used in place of flexible metal conduit where not otherwise required.

U. Non-Metallic Conduit
1. Schedule 40 shall be used for all power, signal feeders and branch circuits, in earth or enclosed in concrete, unless otherwise noted on the drawings. Conduits must be buried in earth in accordance with the NEC.

V. Conduit Support
1. Fasten conduit supports to building structures and surfaces in accordance with Section 16050 – Basic Electrical Materials and Methods.
2. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
3. Do not use wire, ceiling support wires or perforated pipe straps to support conduit. Remove any temporary installation support wire.

W. Spacing of Supports
1. All conduit runs shall be rigidly supported, except where buried in concrete,.
2. Each conduit shall be supported within one (1) foot of junction boxes and fittings.
3. Spacers used in duct bank installations shall be placed no more than 6 to 10 feet apart.
4. Support spacing along conduit runs shall be as follows.

Conduit Size	Maximum Distance Between Supports
½ inch through 1-1/4 inch	5 feet
1-1/2 inch and larger	8 feet

X. Ground and bond raceway and boxes in accordance with Section 16050 – Basic Electrical Materials and Methods.

3.4 CABINET AND BOX INSTALLATION

A. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Locate boxes and conduit bodies so as to ensure ready accessibility of electrical wiring, maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. In inaccessible ceiling areas, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices with each other.

E. Use flush mounting outlet boxes in finished areas.
   1. Do not install flush mounting boxes back-to-back in walls.
   2. Provide minimum 6-inch separation between adjacent boxes.
   3. Provide minimum 24-inch separation in acoustic rated walls.
   4. Use stamped steel bridges to fasten flush mounting outlet box between studs.
   5. Secure flush mounting box to interior wall and partition studs.
   6. Accurately position to allow for surface finish thickness.
   7. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
   8. Use adjustable steel channel fasteners for hung ceiling outlet box.

F. Support boxes independently of conduits.

G. Use code sized gang box where more than one device is mounted together. Do not use sectional box. Use code sized gang box with plaster ring for single device outlets.

H. Use cast outlet box in exterior locations where exposed to the weather and wet locations (interior or exterior).

I. Coordinate installation of electrical boxes and fittings with cable and raceway installation work. Provide knockout closures to cap unused knockout holes where blanks have been removed.

J. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections where fastened with a locknut or bushing on rounded surface.

K. Fasten boxes rigidly to substrate or structural surfaces to which they are being mounted, or solidly embed electrical boxes in concrete or masonry as appropriate.

L. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.

M. Conduit openings in boxes shall be made with a hole saw or shall be punched.

N. Cabinets and boxes shall be rigidly mounted.
   1. Mounting on concrete shall be secured by self-drilling anchors.
   2. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both.
   3. Cabinets shall be leveled and fastened to the mounting surface with not less than ¼-inch air space between the enclosure and mounting surface.
   4. All mounting holes in the enclosure shall be used.

O. Large Pull Boxes - Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
   1. Interior Dry Locations - Use hinged enclosure.
   2. Other Locations - Use surface mounted box of appropriate location classification.

3.5 ANCHORS

A. Where supports for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shell anchors with externally split expansion shells, single-cone expanders, and annular break-off grooved chucking cones. Anchors shall be Phillips "Red Head" or approved equal.

3.6 PULL BOX AND VAULT INSTALLATION

A. Openings or “knockouts” in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.

B. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.

C. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the plans.

D. All joints between precast concrete vault sections shall be made watertight. The plastic joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. The outside of the entire structure shall be coated with an approved water proofing material.

E. Access doors shall be built up such that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the District. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.

F. Ladders shall be installed using Type 316 stainless steel capsule anchors.

G. Ladders shall be attached a minimum of 3 places to the vault wall.

H. Ladder shall be centered under access door opening.

3.7 ADJUSTING

A. Install knockout closures in unused openings in boxes.

3.8 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore manufacturer's finish.

END OF SECTION

SECTION 16142 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Weather-resistant receptacles.
   3. Wall-switches

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. TVSS: Transient voltage surge suppressor.

E. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

D. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

E. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Cooper; 5351 (single), CR5362 (duplex).
   2. Hubbell; HBL5351 (single), HBL5352 (duplex).
   3. Leviton; 5891 (single), 5352 (duplex).
   4. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:
   1. Straight blade, non-feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
   2. Cooper; VGF20.
   3. Hubbell; GFR5352L.

4. Pass & Seymour; 2095.
5. Leviton; 7590.

C. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
2. Cooper; TWR270.
3. Hubbell; RR155WRTR.
4. Leviton; TWR15.
5. Pass & Seymour; 3232TRWR.
6. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Killark; Division of Hubbell Inc.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material: Smooth, high-impact thermoplastic.
3. Material for Damp Locations: Smooth, high-impact thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.7 FINISHES

A. Device Color: White, unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Division 16 Section "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped,

or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16191 ELECTRICAL SUPPORTS, ANCHORS AND FASTENERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.

B. Equipment Mounting Racks

C. Anchors and fasteners.

1.2 REFERENCES

NECA	National Electrical Contractors Association
ANSI/NFPA 70	National Electrical Code

1.3 RELATED SECTIONS

A. Special Provisions
B. Division 2 Specifications

1.4 SUBMITTALS

A. Product Data - Provide manufacturer's catalog data for fastening systems.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other third-party testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes - Provide products which incorporate corrosion resistance adequate for the conditions in which they are to be installed.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products and designing system supports.

2.2 STEEL CHANNEL

A. Non-PVC Coated

1. Ductile Iron

a. Description - Hot dipped galvanized steel channel designed for use with steel fittings, spring backed washers and nuts.

b. Manufacturers

1) Kindorf.
2) Uni-Strut.
3) B-Line.
4) Globe.

2. Stainless Steel

a. Description - For the purpose of this Section, all stainless steel (S.S.) channel shall be Type 316.

b. All fasteners, fittings, clamps, saddles and accessories as shall be Type 304 or 316 stainless steel.

c. Manufacturer

1) Uni-Strut.
2) B-Line.

2.3 ALUMINUM SUPPORTS

A. Provide aluminum channels, angles and supports for equipment mounting racks and overhead conduit support systems as detailed on the Contract Drawings.
B. Provide aluminum backboards and instrumentation supports as detailed on the Contract Drawings for supporting instrumentation equipment and control panel enclosures.

2.4 FIBERGLASS CHANNEL

A. Description - Pultruded materials of glass strands and polyester resins to form rigid, high strength, non-corrosive, non-flammable structural channels, connectors and fasteners.

B. Manufacturers

1. Robroy Industries.
2. Enduro.
3. Aickinstrut.
4. Strut Tech.

C. All strut and hanger rods in corrosive areas shall be fiberglass manufactured in a continuous process whereby linear glass strands, continuous mat laminates, and corrosion resistant polyester resins form a uniform rigid thermoset finished shape. The fiberglass parts shall be self-extinguishing with a V-O classification in the UL 94 test for flammability. Hanger rod washers shall be stamped from protruded flat stock. Hex nuts and strut nuts shall be injection molded. Other hardware shall be PVC coated to a nominal 15 mils. The bond between metal and plastic shall be equal to or greater than the tensile strength of the plastic. Manufacturers: Robroy Industries, OCAL, or equal.

2.5 TWO-PIECE MALLEABLE IRON CLAMPS

A. Cast malleable iron strap clamp sized to match conduit with mating malleable iron clamp backs (spacers). Clamp back shall be thick enough to provide 1/4-inch standoff from conduit to wall. Cadmium plated anchor and washer. Manufacturer - O-Z/Gedney, Thomas & Betts, Appleton, Raco, or equal.

B. PVC coated cast malleable iron strap clamp sized to match conduit with mating malleable iron clamp back (spacer). Clamp back shall be thick enough to provide 1/4-inch standoff from conduit to wall. Stainless steel anchor and washer. Manufacturer - Robroy, Thomas & Betts, Ocal, Perma-Cote Industries, Kor Kap, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Refer to Contract Drawings for materials of construction for overhead conduit support racks, equipment mounting racks (EMRs), instrumentation supports, and general mounting configurations.

2. Install products in accordance with manufacturer's instructions.

3. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit. Anchor conduits to or support from structural members only.

4. Fasteners used to anchor any material or equipment weighing 75 lbs or more to concrete or masonry shall be adhesive grouted anchor in accordance with Section 03600, PART 2. All other materials or equipment weighing less than 75 lbs may be supported via drilled anchors.

5. Do not use spring steel clips and clamps.

6. Do not use powder-actuated anchors.

7. Do not drill or cut structural members.

8. Install supports in a manner that does not interfere with or weaken the bolts when attaching to structural steel. Obtain the Engineer's written approval of any drilling or cutting on the structure.

9. Through spaces where surface mounting is not available, install multiple conduits on electrical channel rack, either hung or wall mounted. Provide space on each rack for 25 percent additional conduits.

10. All hung systems with conduits 3-inch or larger shall also have lateral seismic supports at each hanger.

11. Support conduit passing through above-grade floors so that sealing sleeves or mechanical link seals do not carry the weight of the conduit.

12. Secure conduit installed in poured-in-place concrete to reinforcing bars with tie wires. Install suitable brackets secured to forms in the absence of reinforcing bars.

13. Install individual surface mounted conduit with two-piece cast malleable iron clamp assembly.

14. Install surface-mounted cabinets and panelboards with minimum of four or six anchors, depending upon the number of normal anchor points. See table at the end of this section.

15. In wet and damp locations use fiberglass or stainless steel channel supports to stand cabinets, panelboards and mounting panels 1/2-inch (12 mm) off wall. Aluminum components shall be provided as detailed on the Contract Drawings.

16. Finish of all supports shall be compatible with painting system specified previously or with conduit material in corrosive or wet areas, except where stainless steel is used.

17. After thorough investigation of architectural, structural and shop drawings related to work to determine how equipment, fixtures, conduit, panelboards, etc. are to be supported, mounted or suspended, provide:

    a. Extra steel bolts, inserts, pipe stands, brackets, or any other items required for proper support.

    b. Supporting accessories where required, whether or not shown on Drawings.

18. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

19. Refer to details on the Contract Drawings for free standing and railing mounted construction and for any other details of special conditions.

20. Fasteners, brackets and supports shall be fabricated in accordance with Section 05500 and as specified herein.

B. In areas where spray insulation is to be applied, install steel channel standoffs for electrical conduit, boxes and enclosures prior to installation of insulation.

   Provide conduit extensions to all boxes and enclosures. Install connecting conduit, boxes and/or enclosures over the installed insulation.

C. Support applications.

   1. Unclassified Areas - Galvanized steel channel system or malleable iron clamps.

   2. Interior Corrosive or Wet Locations - Fiberglass reinforced plastic channel system. Provide aluminum equipment mounting racks and supports where shown or detailed on the Contract Drawings.

   3. Exterior Areas - Stainless steel channel system. Provide aluminum where shown on the Contract Drawings.

D. Anchor and Fastener Application Schedule - See Schedule at end of this Section.

E. Support Spacing

1. Metallic Conduit - Not more than 8 feet on center. Types A, A-1, B, E, E-1 within 3 feet of each outlet box, junction box, cabinet or fitting. Type C, within 18 inches of box or fitting. Support boxes, fittings, or cabinets independent of conduit system.

2. Non-Metallic Conduit

    a. Sizes up through 1-1/4-inches diameter - not more than 3 feet on center.

    b. Sizes 1-1/2-inches diameter and larger - Not more than 4 feet on center.

    c. Within 18 inches of each outlet box, junction box, cabinet or fitting.

3. Maximum Deflection

    a. Metallic Conduit - 1/100th of span between supports.

    b. PVC Conduit - 1/360th of span between supports.

(continued)

END OF SECTION

ANCHOR AND FASTENER APPLICATION SCHEDULE

ITEM CATEGORY	MOUNTING SURFACES					
	WOOD, PLYWOOD	WALLBOARD, GYPSUM, FRP, COMPOSITION	HOLLOW MASONRY	SOLID MASONRY	CAST CONCRETE	SHEET METAL
Individual conduit	F	G	D	A	A	E
Steel/FRP channel	F, I	D	D	A	A	E
Structures; i.e., conduit rack, cable tray	F, I	D	D	A	A	--
Devices and equipment less than 75 lbs. (Note 4)	I	Note 1	D	A	A	Note 2
Devices and equipment 75 lbs. or more (Note 4)	I	Note 2	H	B, H	B, C, H	Note 2
Mounting panels (Note 3)	I	Note 1	D	B, H	B, C, H	Note 2

Key to Anchor Types:

A - Drilled (lead insert in masonry, expansion bolt in concrete)
B - Adhesive grouted anchor
C - Cast in place insert
D - Toggle bolt, hollow wall fastener
E - Sheet metal screw
F - Wood screw
G - Sheet rock screw
H - Through bolt
I- Lag screw

In wet, exterior, or corrosive, all fasteners and anchors shall be stainless steel. In all unclassified areas, cadmium-plated fasteners shall be used.

Notes:

(1) Support via plywood mounting panel lagged to studs or via electrical channel lagged to studs.
(2) Do not mount to these surfaces.
(3) Panels mounted to masonry or concrete surfaces shall have 1/2-inch air space between surface and panel via stainless steel spacers.
(4) Provide two additional support connections; minimum of four or six, depending on number of normal connection points. This requirement may necessitate fabricating the additional connections. Maintain NEMA rating of enclosure.

SECTION 16196 ELECTRICAL EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of the electrical systems and equipment requiring identification is shown on the drawings, and the extent of identification required is specified herein and in individual sections of work requiring identification. The types of electrical identification specified in this section include the following:
   1. Exposed conduit color banding.
   2. Buried cable warnings.
   3. Cable/conductor identification.
   4. Operational instructions and warnings.
   5. Danger signs.
   6. Equipment/system identification signs.

1.2 REFERENCES - CODES AND STANDARDS

A. ANSI Z535.1 - Safety Color Code

B. APWA ULCC - Uniform Color Code for Buried Utilities.

C. NFPA 70 National Electrical Code (NEC). Latest approved edition.

1.3 SYSTERM DISCRIPTION

A. Identify all electrical equipment as stated below:
   1. All Switchboards, Distribution Panelboards, Power and Lighting Panels, Motor Control Panel, and all electrical equipment enclosure shall be identified using laminated plastic nameplates. The equipment number, voltage rating, current rating, number of phases, connection type, short circuit interrupting rating, and circuit number shall be shown
   2. Identify all receptacles and lighting switches, by the circuit number shown on the drawings using ¼-inch high white characters on ½-inch wide black stick-on tape placed on the wall directly above the device if the device is wall mounted. Place the tape on the device enclosure if the device is not wall mounted.
   3. All motors, starters, disconnect switches, and control devices shall be identified by circuit number, with ¼-inch high white characters on a ½-inch wide black stick-on tape.
   4. All branch circuits in outlet boxes shall be identified with circuit number using wrap-around labels (T&B, BRADY or 3M).
   5. All underground raceway or cable shall be marked with buried warning tape along its entire length.
   6. All exposed raceway longer than 10 feet in length shall be identified.
   7. Panelboard Directories: Furnish all panelboards with a complete 8-1/2-inch by 11-inch typewritten directory mounted in the inner door under a clear plastic cover set in a metal frame.

1.4 SUBMITTALS

A. Catalog data for nameplates, labels, and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 – National Electrical Code.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, approved testing and listing agencies as suitable for the purpose specified and shown.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates
   1. Engraved three-layer laminated plastic, white letters on black background for normal power and white letters on red background for emergency power. Communications and control cabinets shall be labeled with white letters on green background.
   2. Locations
      a. Each electrical distribution and control equipment enclosure.
      b. Communication cabinets.
      c. Motor control centers, including each combination module.
   3. Letter Size
      a. Use 1/8-inch letters for identifying individual equipment and loads.
      b. Use ¼-inch letters for identifying grouped equipment, loads, panelboards, and transfer switch.
      c. Use ½-inch letters for identifying the main switchboard, motor control centers, and large distribution switchboards.

B. Labels
   1. Embossed adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles, control device stations, and multi-outlet devices.
   2. Thickness
      a. 1/16-inch for units up to 20 square inches or 8-inch length; 1/8-inch for larger units.

2.2 WIRE MARKERS

A. Manufacturers
   1. Brady
   2. Thomas & Betts

3. 3-M Co.

B. Description: Cloth, tape, split sleeve, or tubing type wire markers, self-adhesive.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, control panels, motor controllers and starters, and each load connection.

D. Legend
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on contract drawings.
2. Control Circuits: Control wire number indicated on shop drawings.
3. Neutral Conductors: Clearly indicate the branch circuit or feeder number the neutral serves. In multi-wire circuits where the neutral is shared, mark the neutral with the circuit number of the “A” phase.

2.3 CONDUIT MARKERS

A. Provide manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, minimum of 3 mils thick and 1-1/2-inch wide extending 360 degrees around conduits; designed for self-adhesive attachment to conduit. Except as otherwise indicated, provide lettering that indicates the voltage of the conductor(s) in the conduit. Provide 8-inch minimum length for 2-inch and smaller conduit, 12-inch minimum length for larger conduit.

B. Identify conduits containing conductors above 600-volts with the following alternating markers
1. DANGER - HIGH VOLTAGE
2. The voltage, as applicable (i.e. – 12-kV, 4.16-kV, 480-Volts, 240-Volts, etc.)

C. Location: Furnish markers for each conduit longer than 10 feet.

D. Spacing: 20 feet on center.

E. Color: Unless otherwise indicated or required by governing regulation, provide orange markers with black letters.
1. Fire Alarm System: Red w/black letters.
2. Telephone System: Green w/yellow letters.
3. Data/Communication. System: White w/black letters.
4. Emergency System: Orange w/black letters.

2.4 FASTENERS

A. Secure all labels and nameplates with self-tapping stainless steel screws. Use contact type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in the electrical identification work, with the corresponding designations shown, specified or

scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

2.6 UNDERGROUND WARNING TAPE

A. Three-inch minimum width, 5 mil thickness, foil bonded polyethylene tape, detectable type, with suitable continuous warning legend describing buried electrical lines. Tape color shall conform to APWA uniform color code using ANSI Z535.1 safety colors. Text shall be black, 2-inch minimum letters.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

B. Coordination: Where identification is to be applied to surfaces that require finish, install identification after completion of painting.

C. Regulations: Comply with governing regulations and the requests of governing authorities for the identification of electrical work.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws, rivets, or adhesive.

C. Secure nameplate to outside moveable surface of door on panelboard.

D. Conduit Identification:
   1. Where electrical conduit is exposed in spaces with exposed mechanical piping, which is identified by a color-coded method, apply color-coded identification on the electrical conduit in a manner similar to the piping identification. Except as otherwise indicated, use orange as the coded color for conduit.
   2. Paint red band or provide red tape on each fire alarm conduit longer than 10 feet, minimum 20 feet on center.

E. Cable/Conductor Identification:
   1. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where the wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided.
   2. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.

F. Operational Identification and Warnings
   1. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems, and electrically connected mechanical systems and general systems and equipment, including the prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.

G. Danger Signs
   1. In addition to the installation of danger signs required by governing regulations and authorities, install appropriate danger signs at the locations indicated and at locations subsequently identified by the Installer of electrical work as constituting similar dangers for persons in or about the project.
   2. High Voltage
      a. Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
      b. Critical Switches/Controls
      c. Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

H. Equipment/System Identification Signs
   1. Install an engraved plastic-laminate sign on each major unit of electrical equipment in the building; including the central or master unit of each electrical system and the communication/signal systems, unless the unit is specified with its own self-explanatory identification or signal system.
   2. Except as otherwise indicated or specified, provide single line of test, ½-inch high lettering on 1-1/2-inch high sign (2-inch high where two lines are required), white lettering in black field.
   3. Provide text matching terminology and numbering of the contract documents and shop drawings.
   4. Provide signs for each unit of the following categories of electrical work
      a. Major electrical switchboard
      b. Electrical substation
      c. Motor control center
      d. Fire alarm control panel and annunciators.

I. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrata with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrata.

J. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION

SECTION 16500 LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site lighting fixtures.

B. Lamps.

C. Accessories.

D. Disconnect plugs.

E. Site Lighting Poles

1.2 RELATED SECTIONS

A. Special Provisions
B. Section 16050 - ELECTRICAL-GENERAL
C. Section 16130 – BOXES & RACEWAY

1.3 REFERENCES

ANSI/NFPA 70	National Electrical Code
ANSI/NFPA 101	Life Safety Code
NEMA WD 6	Wiring Devices-Dimensional Requirements

1.4 SUBMITTALS

A. Submittals shall be made in accordance with the Special Provisions and Section 16050.

B. Submit shop drawings for all light fixtures and poles specified in this Section and as scheduled on the Contract Drawings. Provide complete descriptive information including fixture accessories, luminaire disconnect plugs and installation instructions.

C. Manufacturer's Instructions - Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.

D. Manufacturer's Instructions - Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Submit warranty information for fixtures, ballasts, and lamps.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 Specifications.

B. Update record drawings with actual locations of lighting as defined in Section 16050.

C. For each type of fixture, provide name of manufacturer, fixture catalog number, operating voltage, lamp type, manufacturer catalog number, and wattage.

D. Provide copies of warranties for each type of fixture, ballast, and lamp.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 Specifications.

B. Maintenance Data - Include replacement parts list and maintenance instructions.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 Specifications.

B. Accept products on site. Inspect for damage.

C. Protect poles from finish damage by handling carefully.

1.9 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division 1 Specifications.

B. Provide spare parts as listed below; new and in original packaging; prior to final completion of the work to be stored on site at the direction of the Owner. No spare lamps shall be used to equip lighting fixtures for final acceptance.

C. Provide a total of two spare lamps to suit new floodlights.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

A. Refer to drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers' instructions and as indicated in the drawings.

B. Install accessories furnished with each luminaire.

C. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

D. Bond products and metal accessories to branch circuit equipment grounding conductor.

E. Install specified lamps in each floodlight.

F. Contractor shall provide increased wire and conduit sizes as required to accommodate for voltage drop per schedule in Section 16120. Contractor shall consider overall conductor path from panelboard (power source) through last fixture, including switch travelers.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

B. Measure illumination levels for record.

C. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

D. After new lighting installation is complete, operate each luminaire and inspect for improper connections and operation. While the lights are on, conduct a load test on each 120-volt lighting circuit. Report the circuit number, circuit breaker size, wire size, description of load, and result of the load test for each circuit. Bring to the attention of the field engineer any results which are not in accordance with the NEC. Demonstrate that disconnect plugs are provided for fluorescent fixtures as specified.

3.3 ADJUSTING

A. Adjust work under provisions of Division 1 Specifications.

B. Aim and adjust luminaires to correct position as directed.

C. Relamp luminaires that have failed lamps at Substantial Completion.

3.4 CLEANING

A. Clean work under provisions of Division 1 Specifications.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

END OF SECTION

Section 17150 METERS, GENERAL

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install all meters and flow measurement devices with associated instrumentation and controls as shown and specified herein, complete and operable, for functions including flow measurement, density determination, and batch metering of fluids including water, wastewater, chemicals, gases, and sludges, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09800, Protective Coating

2. Section 16050, General Electric

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All Work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these Specifications.

B. Comply with the applicable editions of the following codes, regulations and standards.

1. Codes and Regulations:

CCR	California Code of Regulations, Title 24, Part 2, California Building Code (CBC)

2. Industry Standards:

ASME B16.1	Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250)
ASME G00079	Fluid Meters, Their Theory And Application, Report of ASME Research Committee, 6th Edition
AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 in. Through 144 in. (100 mm Through 3,600 mm)
AWWA C701	Cold-Water Meters - Turbine Type for Customer Service
AWWA C702	Cold-Water Meters - Compound Type
AWWA C704	Propeller Type Meters for Waterworks Applications

3. Other Standards:

HI	Hydraulic Institute

C. Comply with the applicable reference Specifications as directed in the General Requirements and Additional General Requirements.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the General Requirements, Additional General Requirements and as specified herein.

B. Shop Drawings: The CONTRACTOR shall submit complete shop drawings of all meters for review in accordance with the General Requirements, Additional General Requirements and as specified herein.

C. Manufacturer's Data: The CONTRACTOR shall also furnish certified curves indicating flow versus differential pressure with the shop drawings, and any other information called for in the individual meter specifications.

D. O & M Manuals: The CONTRACTOR shall furnish to the ENGINEER copies of complete operation and maintenance instructions of all the metering systems including instrumentation and controls, in accordance with the General Requirements, Additional General Requirements and as specified herein.

E. Spare Parts: The CONTRACTOR shall submit as part of the shop drawing submittal a list of recommended spare parts for each piece of equipment according to the provisions of the General Requirements, Additional General Requirements and as specified herein.. CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment.

1. During the term of this Contract, the CONTRACTOR shall notify the ENGINEER in writing about any manufacturer's modification of the identified spare parts, such as part number, interchangeability, model change, or others.

F. Special Tools: A list of special tools required shall be submitted to the ENGINEER for acceptance. After acceptance, the CONTRACTOR shall supply these tools suitably wrapped and identified for application. Special tools shall include substitute steel spools for each meter for maintenance purposes. Each spool shall be labeled to identify the meter for which temporary replacement is required. The label shall include the meter identification number, size, and service.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications

1. Comply with the requirements for the certifications, licenses, training, skills, experience, and other qualifications specified in Article entitled “Manufacturer's Service Representative” of this Specification.

2. Inspection and Testing Requirements: After installation, the CONTRACTOR shall obtain the services of an experienced factory service representative to inspect and test all meters for proper performance and installation.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Erection and Startup Assistance: During erection and startup of the plant, the CONTRACTOR shall obtain all necessary assistance from an experienced factory service representative to ensure a correct and first class installation, in accordance with the manufacturer's instructions.

B. Instruction of City Personnel: After completion of the installation and during startup of the plant, the CONTRACTOR shall instruct CITY personnel in the proper operation, maintenance, and repair of all metering equipment. For this purpose, the CONTRACTOR shall obtain the services of an experienced factory service representative, who shall spend sufficient time on the site to fully instruct CITY operating personnel on all phases of its equipment.

1.7 WARRANTY

A. Accuracy Requirements: Unless otherwise specified herein, the flowmeters shall be guaranteed to register flow to an accuracy of plus or minus 2 percent of actual flow throughout the range specified.

1. All density measuring equipment shall have a degree of accuracy within plus or minus 2 percent of actual solids content over the range specified for each density measurement system.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's published instructions, under the supervision of the manufacturer's representative, under the general review of the ENGINEER. All installations shall be accomplished by competent craftsmen in a workmanlike manner.

B. The meters shall be installed in easily accessible locations for ease of reading and maintenance and, where shown, for balancing flow in several lines in conjunction with throttling and shutoff valves. Wherever possible, all meters shall be installed in such a way to provide the manufacturer's recommended straight approach and straight piping downstream and in relation to any control valves upstream or downstream. All meters and shutoff and balancing valves shall be firmly supported from the structure or from the floor with approved supports. All meter installations shall meet the seismic requirements for support and bracing as specified in the California Building Code. Inline meters shall be installed to provide full-line flow and not less than the manufacturer's recommended head at all times.

3.2 TESTING

A. Equipment shall be prepared for operational use in accordance with manufacturer's instructions, including bench test and calibration, where required.

B. Each item shall be subjected to an operating test over the total range of capability of the equipment. Where applicable, tests shall be conducted in accordance with the Test Standards of the Hydraulic Institute. The CONTRACTOR shall obtain copies of factory test certifications and shall notify the ENGINEER one (1) week in advance of all tests to be conducted onsite.

3.3 CLEANUP

A. After completion and testing of its Work, the CONTRACTOR shall remove all debris from the site, clean all meters, controls, cabinets, and other metering appurtenances, to hand over each system in perfect operating condition.

3.4 ACCEPTANCE BY CITY

A. Final Acceptance of the equipment is contingent on satisfactory operation after installation.

* * * * * *

SECTION 17448 CONTROL PANELS

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16050: General Electrical

B. Section 17500: Programmable Logic Controllers

1.2 DESCRIPTION

A. Provisions: The General Requirements from a part of this Section.

B. Work Included: This Section covers control panels shown on the Electrical or Instrumentation Drawings, or as specified in either Division 16 or 17, and sets minimum standards for all packaged unit panels.

C. Contractor to install new TESCO Control Panel with motor starter and distribution power and re-use equipment in existing TESCO PLC panel (see DWG E-601 and I-102). The existing parts are:

ITEM	DESCRIPTION	QTY
1	(E) VERBATIM REMOTE ALARM DIALING MONITOR WITH SOLID STATE MESSGAE RECORDING	1
2	(N) DIGI GAGE PLUS BY EG CONTROLS	1
3	(E) SNAP-PS5 & SNAP-PS24	2
4	(E) I/O MODULES	4
5	(E) BACK-UPS BE-650G	1
6	(E) BLACKBOX MODEM	1
7	(E) FLYGT MINICAS LEAK DETECTION	2
8	(E) OPTO 22 SNAP B3000 BRAIN	1
9	(E) OPTO 22 CIRCUIT BOARD	1
10	(E) SIGNAL ISOLATOR	2
11	(E) MISSION CONTROL	1
12	(N) FLYGT RELAY LEAK & OH PROTECTION	2
13	(N) FLOW TRANSMITTER	1

PARTS LIST

D. The equipment listed above are operational and at service.

E. Replace existing DIGI Gage with new DIGI Gage Plus.

F. Install new model Flygt relay.

G. New flowmeter to be installed.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 1 General Standards for Industrial Controls and Systems
   2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
   4. ICS 6 Enclosures for Industrial Controls and Systems

B. Underwriters Laboratories (UL) Publication:
   1. 508 Industrial Control Equipment

1.4 SUBMITTALS

A. The Control panel Submittal shall provide the panel layout, equipment list, wiring and loop diagram, and equipment cut sheets.

1.5 CERTIFICATION

A. UL Label:
   1. Each control panel and terminal cabinet shall bear the UL label except as noted in the following paragraph. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault interrupters, isolation transformers, fuses, and any other necessary equipment, even though such equipment is not indicated on the Drawings. The fabricator shall be an approved UL listed manufacturer.
   2. Control panel enclosures containing instruments mounted through the enclosure walls or door shall meet all requirements for UL labeling as above, but no UL label is required. This exception applies only if UL Recognized instruments for the intended purpose are not made.

1.6 PRODUCT DELIVERY AND HANDLING

A. Ship assembled control panels in one sections for installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. Control Panel (PNL-A):
   1. The Control panel shall be housed in a dead front, NEMA 4 enclosure, 72”H x 84” W x 24 ”D free standing pedestal enclosure, from Hoffman or approved equal. see DWG I-102

B. The existing PLC and I/O shall be used for signals from site, add new I/O modules incase required.

C. A nameplate shall be mounted on the outside of the door of the enclosure as shown on the Drawings.

D. Control panels shall be thoroughly cleaned and sand blasted per Steel Structures Painting Council Specification SSPC-SP-6 (Commercial Blast) after which surfaces shall receive a prime coat Amercoat 185 or approved equal, 3-mils DFT, for a total thickness of the prime plus finish system of 6 mils. The finished color of the outside surfaces shall be selected by the Engineer, unless otherwise indicated. Interior of the control panel, back-panel, and side-panels shall have a white finish coat.

2.2 CONTROL PANEL MATERIALS

A. The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cut-outs.
   1. All high spots, butts, and rough spots shall be ground smooth.
   2. The surfaces shall be sanded or sandblasted to a smooth, clean bright finish.
   3. All traces of oil shall be removed with a solvent.
   4. The first coat of primer shall be applied immediately.

B. Structural shapes and strap steel shall comply with ASTM A 283 – Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.
   1. Bolting Material: Commercial quality carbon steel bolts, nuts, and washers shall be ½-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex end machine bolts. All nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have SAE standard lock washers.

C. Panels shall be of sufficient size to adequately enclose all instruments designated as “panel-mounted” plus ample interior clearance to allow for installation, general servicing, and maintenance of the instruments. Elevations and horizontal spacing shall be subject to Engineer’s approval.

2.3 CONTROL PANEL ELECTRICAL REQUIREMENTS

A. Wiring Duct: Wiring duct shall be manufactured of Noryl and shall be of the restricted slot design, white in color. Panduit or approved equal. Size shall be based on actual wiring requirements. All duct shall be precisely cut for a precision fit. All covers shall be readily accessible. All analog signals shall be run in separate ducts.

B. Cable Ties: Cable ties shall be self-locking with stainless steel locking tables as manufactured by Thomas & Betts. Adhesive backed type mounting bases shall not be used.

C. Terminal Blocks: Terminal blocks shall be din rail mounted, 20A, and 300V. All terminals shall be complete with marking tags. Terminals shall be Allen Bradley 1492-W, ABB (Entrelec) Series M4/6.NC; or equal.

D. Fuse Terminal Blocks: Fuse terminal blocks shall be the same profile, but different color as the feed through terminal blocks, and shall have blown fuse light indicator. Fuse terminal blocks shall be Phoenix Contact Type UK 4-TG, or equal.

E. Disconnect Terminal Blocks: Disconnect terminal blocks shall be of knife disconnect type. The blocks shall have a universal foot for mounting on DIN rail and a width of the feed through block. Disconnect terminal blocks shall be Phoenix Contact Type UK 5-MTK-P/P. or equal.

F. Wiring Methods: Wiring methods and materials for all panels shall be in accordance with the N.E.C. requirements for General Purpose (no open wiring) unless otherwise indicated.

G. Signal and Control Circuit Wiring:
   1. Wire type and sizes: Conductor shall be flexible stranded copper machine tool wire, UL listed Type MTW, and shall be rated 600-volts. Wires for instrument control circuits and alarm input circuits shall be No. 14 AWG. All other wires, including shielded cables, shall be No. 16 AWG minimum.
   2. Wire Insulation Colors: Conductors supplying 120 VAC power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Neutral circuit conductors shall have white insulation. Equipment ground conductors shall have green insulation. Insulation for ungrounded 120 VAC control circuit conductors shall be red. All wires energized by a voltage source external to the control panels shall have yellow insulation. Insulation for all DC conductors shall be blue.
   3. Signal Cable – Non Computer Use:
      a. Signal wire shall be twisted pair or triads in conduit or troughs. Cable shall be constructed of No. 18 AWG copper signal wires with THWN or THHN insulation.
      b. Color code for instrument signal wiring shall be as follows: Postiive (+) – White; Negative (-) - Black.
      c. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.
   4. Industrial Ethernet Cable:
      a. Shielded (STP) Ethernet Cable shall be used to connect the PLCs and radios to the Industrial Ethernet Switches. See Section 40 96 10 for requirements.
   5. Wire Marking: Wire numbers shall be marked using white numbered wire markers make from plastic-coated cloth, Brady Type B-500 or approved equal, or shall be heat-shrink plastic.
   6. Flexible conduit is not acceptable except when specifically approved by the Engineer in writing.
   7. Conduit fittings shall be Crouse-Hings cast fittings or approved equal.
   8. Panels shall be provided with two separate ground bars, one for power ground and one for signal ground. Provide the ground bars with tapped holes to accommodate ground connections from various devices in the panel. Provide insulator kit for signal ground bar. Connect all signal shield grounds within the panel to the signal ground bar. Suggested ground bar and insulator kit: Square D Part #PK12GT and #PKGTAB.
   9. For case grounding, panel shall be provided with a ¼-inch by 1-inch copper ground bus complete with solderless connector for one No. 4 AWG bare stranded copper cable. The copper cable shall be provided by the Contractor and be connected to a system ground loop.

H. Panel Lights and Receptacles: Panels shall be internally lighted by fluorescent lamps, provided with guards and a toggle switch located convenient to each access door. One duplex GFI type receptacle shall be provided in each panel section. The lights and receptacles shall be wired to outgoing terminal blocks for dedicated 120 volt, 60 Hertz, single-phase supply.

I. Power Supply Wiring:
   1. Unless otherwise indicated, all instruments and motor controls shall operate on 115 volt, 60 Hz circuits.
   2. When instruments do not come equipped with integral fuses, provide fuses as required for the protection of individual instruments against fault currents. Fuses shall be mounted on the back of the panel in a fuse holder, and each fuse shall be identified by a service name tag. Fuses shall be manufactured by Bussmann Manufacturing Division, Type KAW TRON or approved equal.

J. 24 VDC Power Supply: Panels shall be equipped with a linear 24 volt D.C. power supply for driving current loops and other D.C. powered equipment. It shall be solidly mounted, labeled and located in plain view oriented for ease of maintenance. Unit shall be sized based on 200% of load requirements of equipment actually furnished. 24 VDC power supply shall be manufactured by Power One or approved equal.

K. DIN Rail Mount Circuit Breakers: Circuit breakers shall be 115 VAC, single pole as manufactured by Allen Bradley Series 1492-CB1; or approved equal.

L. Relay Sockets: Sockets for control relays shall be rated 5 amperes. Terminal screws shall be on the "Pressure Screw" type. Sockets shall be mounted via DIN rail and related hardware. Sockets shall be as manufactured by Allen Bradley Series 700-HN101; or approved equal.

M. Control Relay: Magnetically held relays shall have one spare contact. Control relays shall have contacts rated for 10-ampere inductive load, 125 volts, with coil voltage, number of poles, and pole arrangement as indicated on the plans. Relays shall be of the indicating type. Provide Allen Bradley Series 700-HA; or approved equal.

N. Push Buttons, and Indicating Lights:
   1. Type: Heavy duty, oil tight.
   2. NEMA 12 rated to match panel in which mounted.
   3. Push Button Contacts:
      a. Provide one normally open and one normally closed contact.
      b. Type: Double break, silver contacts with moveable contact blade providing scrubbing action.
      c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts but not less than 10 Amps resistive at 120 VAC/VDC continuous.
   4. Indicating Lights:
      a. Type: 120 VAC.
      b. Lamps: High visibility LED type, long life (20,000 hours minimum).
      c. Indicating lights shall be push-to-test.

O. Uninterruptible Power Supplies: Powerware (Part #FC010BB2A0A0A0A); or approved equal.

2.4 SPARE PARTS

A. The Contractor shall furnish to the Engineer all necessary spare parts of components required to maintain the system. Prior to final acceptance of work, the Contractor shall provide a spare parts listing of all necessary spare parts and quantities for review by the Owner's Representative. The spare parts shall include, but not be limited to, the following minimum requirements:

DESCRIPTION	QUANTITY
24 VDC Power Supply	1
Control Relay	2

B. The Contractor shall deliver to the Owner all the required spare parts upon final acceptance of the work. The spare parts shall not be used as replacement parts during the guarantee period.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 16950 and manufacturer test procedure.

B. Install each control panel level and plumb, and secure by the favorably reviewed seismic mounting method. Doors shall swing freely and close tightly.

C. Provide a 3-inch-high concrete pad for each field-mounted, freestanding control panel. Provide a 3-1/2-inch-high I-beam kick panel for each control-room mounted, freestanding panel.

D. Carefully repair any damage to the structure, components or finish to the satisfaction of the Engineer. Clean all nameplates.

E. Exercise care at all times after installation of control panels to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

F. For all metal panels mounted on concrete walls or floors, install 1/8-inch shims, and paint the back sides and bottom of the panels with Mobil Hi-Build Bituminous Coating 35-J-10; Koppers Bitumastic Super Tank Solution; or approved equal. Film thickness shall be 10-mils minimum.

END OF SECTION

SECTION 17500 PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes Programmable Logic Controller (PLC) hardware for control and interface of process and measurement equipment, control systems and ancillary systems.

B. Use existing PLC and I/O and communication hardware and controller and install in the new control panel.

C. Programming of the PLC will be done by city, Contractor to coordinate activities.

1.2 RELATED WORK

A. Section 16050: General Electrical

B. Section 16120: Conductors

C. Section 16100: Grounding

D. Section 16130: Raceways and Boxes

E. Section 16196: Electrical Equipment Identification

1.3 REFERENCES

A. Instrumentation, Systems, and Automation Society (ISA):
   1. S5.1, Instrumentation Symbols and Identification.
   2. PR12.6, Installation of Intrinsically Safe Systems for Hazardous Locations
   3. S5.4, Standard Instrument Loop Diagrams.
   4. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   5. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

B. National Electrical Manufacturers Association (NEMA):
   1. ICS 1, Industrial Control and Systems: General Requirements.
   2. ICS 2, Industrial Control Devices, Controllers and Assemblies.
   3. ICS 3, Industrial Control and Systems: Factory Built Assemblies.
   4. ICS 4, Industrial Control and Systems: Terminal Blocks.
   5. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.
   6. ICS 6, Industrial Control and Systems: Enclosures.
   7. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   8. IA 2.2, Programmable Controllers - Equipment Requirements and Tests.
   9. IA 2.3, Programmable Controllers - Programming Languages.

1.4 DEFINITIONS

A. Analog Signals: 4-20mA DC two-wire circuits conforming to ANSI/ISA S50.1

B. Control Loop: The control scheme describing the control of a single process variable or a group of related process variables. The control loop includes the relevant part of the process, the process variable sensor and associated transmitter(s), the input signals, the controller, the control output signal, and the actuator.

C. Controller: A primary element that functions to provide loop control. Controllers have provisions for a process variable input signal, a control output signal, setpoint adjustment, tuning of the PID control parameters and provide for an interface of the values within the process variables and the setpoints. They are panel mounted programmable logic controllers, which are microprocessor-based systems having provisions for multiple inputs and outputs for both discrete and analog control capability, with the ability for advanced Human Machine Interface.

D. Dead-time Compensation: A time based offset algorithm derived value used to predicatively control systems that have a delayed feedback process variable.

E. Discrete Signals: Two state based logic signals that are either DC or 120-Vac.

F. HART: Highway Addressable Remote Transducer (Communications Protocol).

G. HMI: Human Machine Interface.

H. Loop Tuning: Part of the control system startup and commissioning process and includes the process of adjusting the gain, reset and rate parameters to obtain effective and stable response of the system to changes in the setpoint or external disturbances.

I. PID: Control action, Proportional-Integral-Derivative. Control feed-back or feed-forward algorithm used as a mechanism to tune a system for intended operation.
   1. Proportional determines the reaction to the error.
   2. Integral determines the reaction based on the sum of the errors.
   3. Derivative determines the reaction to the rate at which the rate has been changing.

J. PLC: Programmable Logic Controller.

K. Redundancy: Redundant configurations of systems and equipment are referred to using mathematical formulas based on the parameter “N”, such as; “N + 1” or “2N”. In this convention, N is the number of systems or pieces of equipment which must be operational to accomplish normal operation of the system.
   1. N + X redundancy refers to a system configuration in which the total number of units provided is equal to the number needed to meet the load, N, plus some number of operationally redundant units, X. For example, if a system requires 1 PLC to normally function and another for hot standby, the system would be described as N + 1, where N = 1.
   2. XN redundancy refers to a system configuration in which the total number of units provided is some multiple, X, of the number required to meet the load. For example, if a system requires 1 PLC to normally function and another is provided for hot standby, it would be described as 2N, where N = 1.

L. SCADA: Supervisory Control and Data Acquisition. A SCADA System is a group of computers and servers running software dedicated for SCADA purposes. This SCADA software collects and exchanges data over industrial networks with PLCs, device level controllers, and all other

connected or networked devices. The SCADA software will allow for control, trending, graphic display, alarming, alarm tracking, historical logging of values in a database and reporting of collected data.

1.5 SYSTEM DESCRIPTION

A. Configuration:
   1. Contractor to reuse existing equipment listed in drawing I-102 and provide the wiring as it is in existing PLC panel.

   2. Programing of the PLC and communication will be done by city, Contractor to coordinate..

1.6 SUBMITTALS

A. Shop Drawings: Provide shop drawings indicating the arrangement and layout of panel, component spacing and enclosure size. Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements.

B. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

C. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets. Include copy of as-built drawings.

B. Operation and Maintenance Data: Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.
   1. Provide 1 Compact Disk (CD) containing all programmable logic code to Owner upon project closeout for each unique program.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Conform to specified service conditions during and after installation of programmable controllers. Maintain area free of dirt and dust during and after installation of products.

1.10 MAINTENANCE SERVICE

A. Not apply.

1.11 MAINTENANCE MATERIALS

A. Not used.

PART 2 - PRODUCTS

2.1 PROGRAMMABLE CONTROLLER

A. Existing PLC and I/O.

2.2 SOURCE QUALITY CONTROL

A. Test programmable controller in accordance with NEMA IA 2.2.

PART 3 - EXECUTION

3.1 EXISTING WORK (If apply)

A. Not apply.

3.2 INSTALLATION

A. Do not install products until major construction is complete and building interior is enclosed and heated.

B. Install and connect control panel assembly.

C. Connect and configure input and output devices.

D. Establish network communications over SCADA network.

E. Participate in commissioning activities that include testing and verify that all controls and systems function as intended.

F. Perform loop tuning and PID control adjustments for intended operation.

3.3 FIELD QUALITY CONTROL

A. Procedures, Forms, and Checklists:
   1. Conduct all testing in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
   2. Describe each test item to be performed.

3. Have space after each test item description for sign off by appropriate party after satisfactory completion.

B. Perform operational testing on control systems to verify proper operation and field wiring connections to verify intended system function as part of the project commissioning.

C. Calibrate connected devices and adjust programming characteristics, where required to provide a fully functional system.

3.4 INTEGRATORS FIELD SERVICES

A. Install, prepare and start up programmable controller.

3.5 DEMONSTRATION AND TRAINING

A. Not apply.

3.6 INPUT/OUTPUT SCHEDULE

LOCATION: ENTER LOCATION						
CONTROLLER ID: ENTER PLC ID						
Point ID	**Tag ID**	**Signal Type**	**Scale**	**Device ID**	**Function**	**Comm Protocol**

END OF SECTION