SUNRISE ENGINEERING

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HYDE PARK CITY
CITY HALL WELL HOUSE AND TRANSMISSION LINE
ADDENDUM #5

FEBRUARY 28, 2025

PLANHOLDER:

This Addendum #5 shall become part of the plans, specifications, and contract documents of the above-mentioned project, and all provisions of the contract shall apply hereto.

Bidders shall acknowledge receipt of all addenda by number in the space provided in the bid documents.

This Addendum #5 covers the following items:

- Answering Questions that have been received through 2/27/25 @ 5 PM.
- Updates to structural sheets
  - Scales were corrected on ST3, ST4, ST5
  - Post Cap was added to column schedule on ST3
  - Beam B4 on the Beam Schedule on ST4 was changed
  - Detail 201 on ST7 was updated to show rigid insulation on perimeter foundation wall. Detail 304 0n ST8 was added.

The ENGINEER will be taking questions throughout the bidding process. Please submit your questions by emailing them to jnelson@sunrise-eng.com. The ENGINEER will stop receiving questions on **March 3rd at 4:00 PM** to allow for ample time to respond to the questions. All questions received after this time will not be answered. The bids will be opened at the Hyde Park City Hall located at 113 E Center Street, Hyde Park City, UT 84318 on **March 6th at 2:00 PM**.

Questions and Answers

Below are the following questions that have been submitted with their corresponding answers:

Q: In section 16010.2.5 (L) of the specifications, It is stating to install OZ entrance seals on all conduits entering the building below grade. Do all conduits stubbed up in the slab require this? Do conduits that start and end in the same building require this? Or is it just for conduits that enter the building from outside of the building? If needed could you please include the model of OZ seal with this RFI?

A: No, conduits stubbed up in the slab do not require this. Conduits that start and end in the same building do not require this. This specification would be for if the building had a basement below grade or if the project involved a vault with a conduit. Since the building is a slab on grade it is not required.

Q: Will you require the Storm drains to be camera inspected?

A: No. Storm drain pipe inspection will follow specification 02226.3.7

Q: Do you have any information as to the disinfecting procedures for the water tank after connection is complete?

A: Utah Administrative R309-545-19 states: Drinking water storage tanks shall be disinfected before being put into service for the first time and after being entered. The tank shall be cleaned of all refuse and shall then be washed with drinking water prior to adding the disinfectant. AWWA Standard C652-11 shall be followed for tank disinfection. Upon completing any of the three methods for storage tank chlorination, as outlined in AWWA C652-11, the water system must properly dispose of residual super-chlorinated waters in the outlet pipes. Other super-chlorinated waters, which are not to be ultimately diluted and delivered into the distribution system, shall also be properly disposed. Chlorinated water discharged from the storage tank shall be disposed of in conformance with R317 of the Utah Administrative Code.

AWWA Standard C652-19 is an updated version of C652-11 to follow and will be provided with this addendum.

Q: Can you include dimensions or detail for the manhole at the water tank?

A: Yes. A detail sheet will be provided from the construction plan set for the hatch into the existing water tank. We will also provide pictures of the hatch. The opening is 4’x8’ and about half of that is space for a ladder and the other half is a removable grate.

Q: Addendum 2 says trench to be backfilled with native, does this apply to both water main and storm drain pipes?

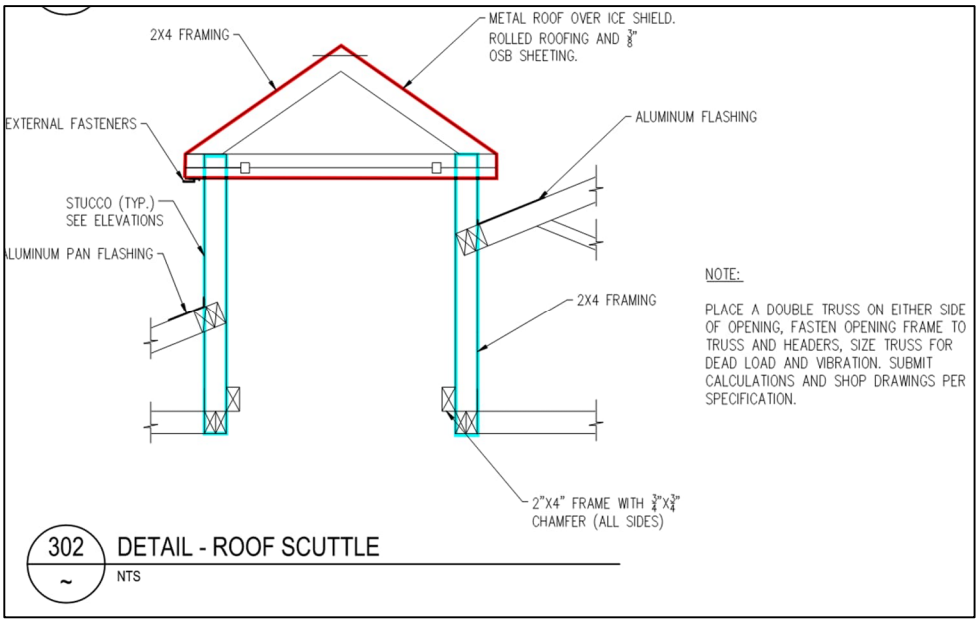
A: Yes. Installation of native shall follow specification 02105, 02200, and 02222. All pipes will still require imported pipe bedding.

Q: Do you have any size information on the pump assembly used during test pumping?

A: Yes. The shroud would have been the largest diameter portion of the pump assembly and measured 10.75" OD.

Q: Can more information be provided on the design intent of the scuttle?

A: The intent is for the portion highlighted in red below to be able to be fully removed from the support framing highlighted in blue. There would be one external pin type fastener on each side to hold the scuttle in place.



Sincerely,

PROFESSIONAL ENGINEER
No. 13229831
JOSHUA NELSON
2/27/25
STATE OF UTAH

Josh Nelson, PE
Sunrise Engineering

ANSI/AWWA **C652-19**

(Revision of ANSI/AWWA C652-11)

AWWA Standard

Disinfection of Water-Storage Facilities

Effective date: April 1, 2020.
First edition approved by Board of Directors June 15, 1980.
This edition approved Oct. 28, 2019.
Approved by American National Standards Institute Nov. 12, 2019.

American Water Works Association

Approved American National Standard ANSI

STANDARD Since 1881

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. This standard does not supersede or take precedence over or displace any applicable law, regulation, or code of any governmental authority. AWWA standards are intended to represent a consensus of the water industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice section of *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

Caution Notice: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; 212.642.4900, or e-mailing info@ansi.org.

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Committee Personnel

The AWWA Standards Committee on Disinfection of Facilities, which reviewed and approved this standard, had the following personnel at the time of approval:

Betsy Reilley, *Chair*

General Interest Members

G. Boyd (*liaison, nonvoting*), Standards Council Liaison, The Cadmus Group, Seattle, Wash.
K.C. Choquette, Iowa Department of Public Health, Des Moines, Iowa
J.M. Henderson, West Linn, Ore.
E. Meek (*liaison, nonvoting*), Standards Engineer Liaison, AWWA, Denver, Colo.
A.A. Rosenblatt, Gordon & Rosenblatt LLC, New York, N.Y.
S. Vidika, Dixon Engineering Inc., Medina, Ohio
J.S. Wailes, Black Hawk, Colo.
M.L. Wentink, Nebraska DHHS DPH, North Platte, Neb.

Producer Members

R.J. Gordhamer, Measurement Technologies Inc., Redmond, Wash.
M.P. Parker, Statewide Aquastore Inc., East Syracuse, N.Y.
P.L. Smith, Smith LaSalle Inc., Western Springs, Ill.

User Members

Z. Bukhari, American Water, Voorhees, N.J.
R.C. Lorenz, Westerville Water Plant, Westerville, Ohio
P.M. Marchand, Providence Water Supply Board, Providence, R.I.
J.A. Nilson, Seattle Public Utilities, Seattle, Wash.
D. O'Connor, Philadelphia Water Department, Philadelphia, Penn.
B. Reilley, Massachusetts Water Resources Authority, Boston, Mass.
G.J.R. Rhoads, Metro Water District of Southern California, La Verne, Calif.
E.D. Schwartz, New Jersey American Water, Hillsborough, N.J.

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Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C652.*

I. Introduction.

I.A. *Background*. This standard describes methods of disinfecting water-storage tanks. The disinfecting agents discussed in this standard are chlorine solutions, and several combinations of free chlorine residual and contact time (CT) are provided. The chlorine solutions may be derived from liquid chlorine (Cl_2), calcium hypochlorite ($Ca(OCl)_2$), or sodium hypochlorite (NaOCl).

I.B. *History*. This standard was first approved on June 15, 1980, under the designation ANSI/AWWA D105, Standard for Disinfection of Water-Storage Facilities. The 1980 edition was developed from information originally contained in AWWA D102-64, modified to include disinfection of water-storage facilities constructed of steel or other materials. The standard was redesignated ANSI/AWWA C652 with the 1986 edition. It was later revised in 1992 and again in 2002. The 2011 edition was approved by the AWWA Board of Directors on June 12, 2011. This edition was approved on Oct. 28, 2019.

I.C. *Acceptance*. In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF† International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). AWWA and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.‡ Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. Specific policies of the state or local agency.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
† NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.
‡ Persons outside the United States should contact the appropriate authority having jurisdiction.

2. Two standards developed under the direction of NSF, NSF/ANSI/CAN* 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects.

3. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex,*† and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI/CAN 61 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA C652 does not address additives requirements. Thus, users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.

2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.

3. Determine current information on product certification.

II. Special Issues.

II.A. *Information on Application of This Standard*. Utilities are increasingly focusing on water-storage reservoir management and maintenance as part of preserving distribution system water quality. Disinfection of water-storage tanks presents special challenges because of the quantity of water that must be dealt with, the conditions of the water supplied to the tank, and the ability to collect representative samples of the water in the tank.

Disinfection of tanks and other facilities used for drinking water relies on high levels of free chlorine to ensure bacteria and other potential pathogens are inactivated. It should be noted that pH and temperature are two important factors affecting

* Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

† Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20001.

the disinfection process. Hypochlorous acid and hypochlorite are the two forms of chlorine present in water at pH greater than 3. Hypochlorous acid has been shown to be significantly more effective than hypochlorite for disinfection. Above pH 9, there is essentially no hypochlorous acid, only hypochlorite. Temperature also affects the effectiveness of disinfection; low temperatures are not as effective as high temperatures for chlorine disinfection. The high chlorine dosages required in this standard are necessary to provide effective disinfection under varying conditions of pH, temperature, and other factors.

In addition, systems using chloramines in their water supply will need to consider the impacts of chloramines and free chlorine mixing within the tank to be disinfected. Higher chlorine doses will be required to achieve the specified free chlorine residuals listed in this standard (to pass through breakpoint chlorination). Depending on the method selected, if a free chlorine residual is present in the tank to be activated into the water system, it could result in depressed residuals in the service area it supplies.

Following disinfection and before activating the tank for use, water in the storage tank should be tested to determine that it meets expected parameters typical in the system. Consider especially the work done in the tank and appropriate parameters to measure. Test results should confirm that the water quality is appropriate for distribution. Although this assessment is unique for each system, suggested test parameters include pH, alkalinity, turbidity, odor, and specific conductance. If the tank was painted or if epoxy was applied, measuring levels of volatile organic compounds (VOCs) or other components of the coating material (such as zinc) may be necessary, noting that the trihalomethanes (THMs) chloroform, bromodichloromethane, dibromochloromethane, and bromoform, which are part of the VOC test, are a result of disinfection, not coating materials, and would be expected to be present. Satisfactory chlorine residual and coliform results are also required.

When collecting samples for analysis of coliform or other parameters, it is important that the sample represent the water quality in the tank. Sample taps need to be clean and sanitary. In some cases, samples may need to be collected from the top of the tank or hatch. When sampling from the top of the tank or hatch, use of a depth sampler may be beneficial to best represent the quality of water that will enter the system.

For bacteriological tests, the results of testing must show no coliform. Given the different test procedures available for coliform analysis, results should be expressed as "confirmed coliform" and should be <1 cfu/100 mL, < 1 MPN/100 mL, or "Absent."

While bacteriological testing in accordance with Section 5 is used to verify the absence of coliform organisms and is generally accepted as verification that acceptable

disinfection has been accomplished, following sanitary procedures during the course of all work is necessary to ensure the disinfected tank will be ready for activation.

Disinfectants other than chlorine may be appropriate to use. While this standard describes only the use of liquid chlorine (gas), sodium hypochlorite solutions, and calcium hypochlorite, the applicability of other disinfectants should be evaluated. Ozone, chlorine dioxide, and chemical cleaners have been used, and these warrant further investigation. Whichever disinfectant or method is selected, approval from the local regulatory agency may be required.

Depending upon the nature of the work in the water-storage facility, disinfection may or may not be required. Storage facilities dewatered for purposes of entering the tank and performing painting, repairs, or other highly invasive activities shall be disinfected and sampled. In some cases, the tank may remain in service, or isolated, for minimally intrusive activities such as remotely operated vehicle (ROV) or diver inspections. Where rigorous sanitary procedures have been followed, only sampling may be required.

As more frequent inspections and cleaning of reservoirs are required, utilities are turning to methods that minimize downtime and wasted water. Utilities may use methods employing divers or ROVs for both inspection and sediment removal. Section 4.4 of this standard describes the disinfection procedures and operational considerations for conducting inspection and cleaning in potable-water-storage facilities. Any underwater retrieval of ROVs with divers must be performed in accordance with all aspects of this standard. When selecting a contractor to perform this type of work, it is essential to evaluate their experience, safety procedures, and methods. Each bidder should be willing to meet the minimum requirements set by this standard for safe performance of the work. This standard includes references to pertinent OSHA regulations. There are specific technical skills a purchaser should look for when considering a firm for this type of work, such as the following:

- Qualifications for conducting in-service operations in compliance with OSHA.
- Qualifications for inspecting and evaluating steel/concrete/wood or membrane-covered reservoirs.
- Résumés for the specific personnel who will perform underwater inspection and/or cleaning.

Section 4.4 does not address the following items, each of which must be specified by the purchaser:

1. The type of inspection to be performed (structural, coating, bottom sediment, cathodic protection, bacteriological, etc.).
2. The technical requirements of the inspection and/or cleaning.

For additional guidance, refer to AWWA Manual M42, *Steel Water-Storage Tanks*.

Section 4.4 does not attempt to rewrite existing safety standards and relies on the existing applicable OSHA Standards, including but not limited to

- OSHA, 29 CFR, Subpart T, Commercial Diving Operations, 1910.401 through 1910.440.
- OSHA, 29 CFR, Permit-Required Confined Spaces, 1910.146.

III. Use of This Standard. This standard describes methods of disinfecting water-storage facilities that are newly constructed, have been entered for construction or inspection purposes, or continue to show the presence of coliform bacteria during normal operation. In addition, the standard defines disinfection procedures for underwater inspections because water utilities increasingly are employing divers and ROVs to conduct underwater inspections and/or cleaning of in-service potable-water-storage facilities to minimize water loss and downtime normally associated with necessary maintenance. The standard does not describe the type and technical requirements of underwater inspection and/or cleaning or the required skill level of the diving inspector. This standard is meant to be used for tanks within public water systems and is not intended for storage tanks within premise plumbing systems in buildings. Premise plumbing components in buildings use a wide variety of materials, including some that may not be compatible with the chlorine concentrations in this standard.

A storage facility is defined as a reservoir from which water, without further treatment other than booster disinfection, is supplied directly to the distribution piping system for domestic use. From a practical standpoint, this standard applies to the disinfection of covered storage facilities constructed of steel, concrete, or materials that would provide a similar structure from a water quality standpoint. Because wood may support the growth of coliform bacteria, it is recommended that any submerged wood surface (columns, baffles, etc.) be coated with epoxy or other durable, effectively impermeable paint or coating approved for domestic water use.

Parts of this standard may be applicable to the disinfection of large, finished-water, open storage reservoirs, such as reservoirs formed by concrete or earth dams, but these

applications are incidental, and this standard is not intended to cover those kinds of storage facilities.

Three methods of chlorinating storage facilities are described in this standard. Each purchaser should decide which method is most suitable for a given situation. In selecting the method to be used, personnel should consider the availability of materials and equipment for disinfection, the training of personnel who will perform the disinfection, chlorinated water disposal options, and safety. For example, gas chlorination should be used only when properly designed and constructed equipment is available; makeshift equipment is not acceptable when liquid-chlorine cylinders are used. Spray equipment should be used inside the storage facility only when thorough ventilation is ensured or when appropriate protection is provided using canister-type gas masks or self-contained breathing units. If a chlorination method is selected that requires the storage facility to be drained in order to dispose of highly chlorinated water, thorough consideration should be given to the effect on the receiving environment. If there is any question as to whether a chlorinated-waste discharge may cause damage to fish life, plant life, physical installations, or other downstream water uses of any type, an adequate amount of a reducing agent should be applied to the discharged water to thoroughly neutralize the chlorine residual. The effects of chloramines in the potable supply should also be evaluated in terms of dosing and ability to meet specified free chlorine residual requirements.

It is the responsibility of the user of an AWWA standard to determine that the products and procedures described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives*. This standard is written as though the work will be done by the purchaser's personnel. If the purchaser is contracting for the work to be done, appropriate provisions should be included in the contract agreement to ensure the contractor is specifically instructed as to his or her responsibilities. At a minimum, the purchaser should specify the following:

1. Standard used—that is, ANSI/AWWA C652, Disinfection of Water-Storage Facilities, of latest revision.
2. Details of federal, state, and local requirements (Sec. 4.1.1).
3. Whether compliance with NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects, is required.
4. Method of disinfection to be used.

5. Any required disposal and precautions to be taken in disposing of chlorinated water in the storage facility.

6. Bacteriological testing and method to be used.

7. Redisinfection procedure if required.

III.B. *Modification to Standard*. Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major changes made in this revision of ANSI/AWWA C652 are as follows:

1. Additions were made to address concerns in achieving chlorine levels in chloraminated systems throughout the standard.

2. Clarification was added regarding the use of this standard with public water system tanks and not for tanks used within premise plumbing systems (Sec. III and Sec. 1.1)

3. Provides clarification on when disinfection, sampling, or both may be required (Sec. II.A. and Sec. 1.1).

4. Acknowledges ROVs may be used for tank inspections.

5. Appendix C – Disposal of Highly Chlorinated Water has been deleted. For dechlorination procedures, the standard now refers to ANSI/AWWA C655, Field Dechlorination.

6. Definitions for chloramine, inspection firm, liquid chlorine (gas), reclaimed water, and wastewater have been added.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail at standards@awwa.org.

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ANSI/AWWA C652-19
(Revision of ANSI/AWWA C652-11)

American Water Works Association
Dedicated to the World's Most Important Resource®

AWWA Standard

Disinfection of Water-Storage Facilities

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard for disinfection of water-storage facilities describes materials, facility preparation, application of disinfectant to interior surfaces of facilities, and sampling and testing for the presence of coliform bacteria, chlorine residual, and acceptable aesthetic water quality. The standard also includes disinfection procedures for underwater inspection and/or cleaning of potable-water-storage facilities but does not describe the technical aspects of underwater inspection and/or cleaning. All new storage facilities shall be disinfected before they are placed in service. Depending upon the nature of work performed on an existing tank and the potential for contamination, disinfection and/or sampling only may be appropriate. Storage facilities dewatered for purposes of entering the tank and performing painting, repairs, or other highly invasive activities shall be disinfected and sampled. In some cases, the tank may remain in service, or isolated, for minimally intrusive activities such as ROV or diver inspections. Where rigorous sanitary procedures have been followed, only sampling may be required. This standard is meant to be used for tanks within public water systems and is not intended for storage tanks within premise plumbing systems in buildings. Premise plumbing components in buildings use a wide variety of materials, including some that may not be compatible with the chlorine concentrations in this standard.

Sec. 1.2 Purpose

The purpose of this standard is to define the minimum requirements for the disinfection of water-storage facilities, including the preparation of water-storage facilities, application of chlorine, procedures for disinfecting underwater inspection and cleaning equipment, and sampling and testing for the presence of coliform bacteria, chlorine residual, and acceptable aesthetic water quality.

Sec. 1.3 Application

This standard can be referenced in specifications for the disinfection of water-storage facilities and can be used as a guide in preparing water-storage facilities for disinfection procedures following inspection or maintenance. These procedures include the application of chlorine, disinfection procedures to be used during underwater inspections and/or cleaning, and testing for the presence of coliform bacteria, chlorine residual, and acceptable aesthetic water quality. The stipulations of this standard apply when this document has been referenced and then only to the disinfection of water-storage facilities.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ANSI*/AWWA B300—Hypochlorites.

ANSI/AWWA B301—Liquid Chlorine.

ANSI/AWWA C655—Field Dechlorination.

Standard Methods for the Examination of Water and Wastewater. APHA,† AWWA, and WEF‡ Washington, D.C. (latest edition).

Additional materials relating to activity according to this standard include the following:

Chlorine Basics—The Chlorine Institute Inc.§

Safety Data Sheets for forms of chlorine used (provided by suppliers).

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
† American Public Health Association, 800 I Street NW, Washington, DC 20001.
‡ Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.
§ The Chlorine Institute Inc., 1300 Wilson Blvd., Suite 525, Arlington, VA 22209.

NSF/ANSI/CAN* 60—Drinking Water Treatment Chemicals—Health Effects.

NSF/ANSI/CAN 61—Drinking Water System Components—Health Effects.

Safety Management for Utilities. AWWA Manual M3. AWWA, Denver.

Water Chlorination/Chloramination Practices and Principles. AWWA Manual M20. AWWA, Denver.

Water Treatment. WSO Series, Grade 2. AWWA, Denver.

Water Quality and Treatment: A Handbook on Drinking Water. AWWA, Denver.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Available chlorine:* A measure of the amount of chlorine in chlorinated lime, hypochlorite compounds, chloramines, and other materials that are used for disinfection as compared to the amount in elemental (liquid or gaseous) chlorine.

2. *Chloramine:* Chlorine combined with ammonia. Used by many water systems to provide a long-lasting disinfectant residual through the formation of monochloramine.

3. *Chlorine, combined:* The amount of chlorine combined with ammonia (NH_3) or other compounds in water.

4. *Chlorine, free:* Also called free available chlorine, the amount of chlorine available as dissolved gas (Cl_2), hypochlorous acid (HOCl), and hypochlorite (OCl^-) that is not combined with ammonia (NH_3) or other compounds in water that is available for disinfection.

5. *Chlorine residual:* Concentration of chlorine species present in water after the oxidant demand has been satisfied.

6. *Chlorine, total:* The summation of free chlorine, combined chlorine, and organochlorine species.

7. *Contractor:* The party that provides the work and materials for placement or installation.

8. *Inspection firm:* A company that specialized in potable water-storage facilities that should have access to resources in the traditional engineering disciplines and have specific training and experience in the design, fabrication,

* Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

erection, inspection, sanitary integrity, coating, disinfection procedures, and maintenance of potable water-storage facilities.

9. *Liquid chlorine (gas):* The commercially available form of liquefied elemental chlorine gas. (The term *liquid chlorine* is sometimes used to describe a hypochlorite solution. The use of this term is discouraged. See ANSI/AWWA B300—Hypochlorites.)

10. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

11. *Organochlorine:* Any organic compound containing chlorine as a constituent. Organochlorine compounds can form when chlorine reacts with organic substances.

12. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.

13. *Potable water:* Water that is safe and satisfactory for drinking and cooking.

14. *Reclaimed water:* Wastewater that becomes suitable for beneficial use as a result of treatment.

15. *ROV:* Remotely operated vehicle.

16. *Supplier:* The party that supplies material or services. A supplier may or may not be the manufacturer.

17. *Wastewater:* A combination of the liquid and water-carried waste from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and stormwater that may be present.

SECTION 4: REQUIREMENTS

Sec. 4.1 Materials and Cleaning

4.1.1 *Materials.* Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water, wastewater, and reclaimed water systems as applicable.

4.1.2 *Materials entering tank*. Scaffolding, planks, tools, rags, and other materials not part of the structural or operating facilities of the tank shall be removed. Then the surfaces of the walls, floor, and operating facilities of the storage facility shall be cleaned thoroughly using a high-pressure water jet, sweeping, scrubbing, or equally effective means. Water, dirt, and foreign material

accumulated in this cleaning operation shall be discharged from the storage facility or otherwise removed. Water used for cleaning, preparation of solutions, and tank filling shall be potable water.

4.1.3 *Other materials*. Following the cleaning operation, the vent screen, overflow screen, and any other screened openings shall be checked and put in satisfactory condition to prevent birds, insects, and other possible contaminants from entering the facility. Any material required to be in the operating storage facility after the cleaning procedure has been completed shall be clean and sanitary when placed in the facility. In these instances, care shall be taken to minimize the introduction of dirt or other foreign material.

Sec. 4.2 Forms of Chlorine for Disinfection

The forms of chlorine that may be used in the disinfecting operations are liquid chlorine (gas), sodium hypochlorite solution, and calcium hypochlorite granules or tablets. Appropriate personal protective equipment should be worn when using these products.

4.2.1 *Liquid chlorine (gas)*. Liquid chlorine (gas) conforming to ANSI/AWWA B301 contains 100 percent available chlorine and is packaged in steel containers usually of 100-lb, 150-lb, or 1-ton (45.4-kg, 68.0-kg, or 907.2-kg) net chlorine weight. Liquid chlorine (gas) shall be used only (1) in combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high-concentration solution feed to the water to be chlorinated; (2) under the direct supervision of a person who is familiar with chlorine's physiological, chemical, and physical properties, and who is trained and equipped to handle any emergency that may arise; and (3) when appropriate safety practices to protect working personnel and the public are observed. Makeshift equipment is not acceptable when liquid chlorine (gas) cylinders are used.

4.2.2 *Sodium hypochlorite*. Sodium hypochlorite conforming to ANSI/AWWA B300 is available in liquid form in glass, rubber-lined, or plastic containers typically ranging in size from 1 qt (0.95 L) to 5 gal (18.92 L). Containers of 30 gal (113.6 L) or larger may be available in some areas.

Sodium hypochlorite contains approximately 5–15 percent available chlorine, and the storage conditions and time must be controlled to minimize its deterioration. (Available chlorine is expressed as a percent of weight when the concentration is 5 percent or less, and usually as a percent of volume for higher concentrations. Percent × 10 = grams of available chlorine per liter of hypochlorite)

4.2.3 *Calcium hypochlorite*. Calcium hypochlorite conforming to ANSI/AWWA B300 is available in granular form or in small tablets and contains approximately 65 percent available chlorine by weight. Tablets dissolve in approximately 7 h and adequate contact time must be given. The material should be stored in a cool, dry, dark environment to minimize its deterioration.

Caution: Do not use calcium hypochlorite intended for swimming pool disinfection, as this material has been sequestered and is extremely difficult to eliminate after the desired contact time has been achieved.

Sec. 4.3 Methods of Chlorination

Three methods of chlorination are explained in this standard. Typically, only one method will be used for a given storage-facility disinfection, but combinations of the methods may be used. The three methods are (1) chlorination of the full storage facility such that, at the end of the appropriate retention period, the water will have a free chlorine residual of not less than 10 mg/L; (2) spraying or painting of all storage facility water-contact surfaces with a solution of 200 mg/L free chlorine; and (3) a two-step process of chlorinating the bottom portion of the storage facility with 50 mg/L free chlorine followed by filling to overflow with potable water. It shall be held full for a period of not less than 24 h. In chloraminated systems, achieving a free chlorine residual requires the addition of sufficient additional chlorine to pass through breakpoint chlorination.

4.3.1 *Chlorination method 1*. The water-storage facility shall be filled to the overflow level with potable water to which enough chlorine shall be added to provide a free chlorine residual in the full facility of not less than 10 mg/L at the end of the appropriate 6-h or 24-h period, as described in Sec. 4.3.1.4. This method should be evaluated to assess its appropriateness for chloraminated systems. For chloraminated systems, additional chlorine may be required to achieve a free chlorine residual of 10 mg/L. The chlorine, either as liquid chlorine, sodium hypochlorite, or calcium hypochlorite, shall be introduced into the water as described in the following subsections.

4.3.1.1 Liquid-chlorine (gas) use. Liquid chlorine (gas) shall be introduced into the water filling the storage facility in such a way as to give a uniform chlorine concentration during the entire filling operation. Portable chlorination equipment shall be carefully operated and shall include a liquid-chlorine cylinder, gas-flow chlorinator, chlorine ejector, safety equipment, and an appropriate solution tube to inject the high-concentration chlorine solution into the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and

near the storage facility such that the chlorine solution will mix readily with the influent water.

4.3.1.2 Sodium hypochlorite use. Sodium hypochlorite shall be added to the water entering the storage facility by means of a chemical-feed pump or shall be applied by hand-pouring into the storage facility and allowing the influent water to provide the desired mixing.

4.3.1.2.1 When a chemical-feed pump is used, the concentrated chlorine solution shall be pumped through an appropriate solution tube to inject the high-concentration chlorine solution at a rate that will give a uniform chlorine concentration in the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage facility, or through an appropriate valve located on the storage facility such that the chlorine solution will mix readily with the filling water.

4.3.1.2.2 When sodium hypochlorite is poured into the storage facility, the filling of the storage facility shall begin immediately thereafter or as soon as any removed manhole covers can be closed. Sodium hypochlorite may be poured through the cleanout or inspection manhole in the lower course or level of the storage facility, in the riser pipe of an elevated tank, or through the roof manhole. Sodium hypochlorite shall be poured into the water in the storage facility when the water is not more than 3 ft (0.9 m) in depth, nor less than 1 ft (0.3 m) in depth or as close thereto as manhole locations permit.

4.3.1.3 Calcium hypochlorite use. Calcium hypochlorite granules or tablets broken or crushed to sizes not larger than ¼-in. (6.4-mm) maximum dimension may be poured or carried into the storage facility through the cleanout or inspection manhole in the lower course or level of the storage facility, into the riser pipe of an elevated tank, or through the roof manhole. The granules or tablet particles shall be placed in the storage facility before flowing water into it. The granules or tablets shall be located so that the influent water will circulate through the calcium hypochlorite, dissolving it during the filling operation. The calcium hypochlorite shall be placed only on dry surfaces unless adequate precautions are taken to provide ventilation or protective breathing equipment.

4.3.1.4 Retention period. After the storage facility has been filled with the disinfecting water, it shall stand full as follows: (1) for a period of not less than 6 h when the water entering the storage facility has been chlorinated uniformly by gas-feed equipment or chemical pump, or (2) for a period of not less than 24 h when the storage facility has been filled with water that has been mixed with sodium

hypochlorite or calcium hypochlorite within the storage facility as described in Sec. 4.3.1.2 and 4.3.1.3.

4.3.1.5 Handling of disinfection water. After the retention period stated in Sec. 4.3.1.4, the free chlorine residual in the storage facility shall be reduced to a concentration appropriate for distribution by completely draining the storage facility and refilling with potable water, or by a combination of additional holding time and blending with potable water having a lower chlorine concentration. Following this procedure and subject to satisfactory bacteriological testing, appropriate chlorine residual, and acceptable aesthetic water quality (as described in Sec. 5.1), the water may be delivered to the distribution system.

4.3.1.5.1 Refer to ANSI/AWWA C655 Field Dechlorination for dechlorination procedures, if dechlorination is required. The environment into which the chlorinated water is to be discharged shall be inspected. Federal, state or provincial, and local environmental regulations may require special provisions or permits before disposal of highly chlorinated water. Proper authorities should be contacted before disposal of highly chlorinated water.

4.3.2 *Chlorination method 2*. A solution of at least 200 mg/L free chlorine shall be applied directly to the surfaces of parts of the storage facility that would be in contact with water when the storage facility is full to the overflow elevation.

4.3.2.1 Method of application. The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat surfaces to be treated, including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have free chlorine of not less than 10 mg/L when filled with water. Overflow piping need not be disinfected.

4.3.2.2 Retention. The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 min, after which potable water shall be admitted, the drain piping purged of the 10 mg/L chlorinated water, and the storage facility then filled to its overflow level. Following this procedure and subject to satisfactory bacteriological testing, appropriate chlorine residual, and acceptable aesthetic water quality as described in Sec. 5.1, the water may be delivered to the distribution system.

4.3.2.3 For any chlorinated water discharges to the environment, refer to ANSI/AWWA C655 Field Dechlorination, if dechlorination is required. The environment into which the chlorinated water is to be discharged shall be inspected. Federal, state or provincial, and local environmental regulations may

require special provisions or permits before disposal of highly chlorinated water. Proper authorities should be contacted before disposal of highly chlorinated water.

4.3.3 *Chlorination method 3*. Water and chlorine shall be added to the storage facility in amounts such that the solution will initially contain at least 50 mg/L free chlorine and will fill approximately 5 percent of the total storage volume. This solution shall be held in the storage facility for a period of not less than 6 h. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. It shall be held full for a period of not less than 24 h. Highly chlorinated water shall then be purged from the drain piping. Following this procedure and subject to satisfactory bacteriological testing, appropriate chlorine residual, and acceptable aesthetic water quality as described in Sec. 5.1, the remaining water may be delivered to the distribution system. It should be noted that the final chlorine residual may be either as free, total, or combined chlorine depending on the potable water characteristics.

4.3.3.1 Adding chlorine. Chlorine shall be added to the storage facility by the method described in Sec. 4.3.1.1, 4.3.1.2, or 4.3.1.3. In chloraminated systems, the addition of excess chlorine may be required to eliminate the combined chlorine and achieve the specified free chlorine residual (breakpoint chlorination).

4.3.3.2 For any chlorinated water discharges to the environment, refer to ANSI/AWWA C655 Field Dechlorination, if dechlorination is required. The environment into which the chlorinated water is to be discharged shall be inspected. Federal, state or provincial, and local environmental regulations may require special provisions or permits before disposal of highly chlorinated water. Proper authorities should be contacted before disposal of highly chlorinated water.

Sec. 4.4 Disinfection Procedures When Conducting Underwater Inspection and/or Cleaning of Potable-Water-Storage Facilities

4.4.1 *Pre-job meeting*. A pre-job meeting involving the contractor and purchaser representatives shall be held to ensure the following: that the personnel understand the configuration of the reservoir and the disinfection procedures; that underwater appurtenances are identified; that time restrictions are discussed; that the diving conditions are considered; that safety procedures are in place; and that inspection and/or cleaning requirements are understood. Any problems associated with logistics should be resolved at this time. Clear communication between purchaser operations personnel and the contractor is essential.

4.4.2 *Storage-facility isolation*. It is strongly recommended that the water-storage facility be removed from service and isolated from the system before

inspection and/or cleaning by closing inlet and outlet valves. Flowmeters and the tank level should be monitored to verify that the facility has been isolated. The underwater inspection and/or cleaning should be made with the reservoir as full as possible, while still leaving room for access to the roof area. If the reservoir must be inspected with the inlet/outlet valves in the open position, system valves further upstream or downstream should be closed. Off-line inspection and/or cleaning of storage facilities may not be possible or convenient for certain tanks or clearwells. In-service diving and/or ROV work may be completed safely, but strict attention to safety is required. If special operational conditions necessitate underwater inspection and/or cleaning without isolation, diving and/or ROV work should be done during periods when positive flow into the reservoir is maintained and rates into or out of the water-storage facility are minimal. For underwater inspection and/or cleaning of nonisolated facilities having a common inlet/outlet pipe, it is strongly recommended that a positive flow into the storage facility be maintained during the dive.

4.4.3 *Storage-facility access*. Special care should be taken to keep equipment and personnel clean before entering the tank. Dirt and contaminants on the reservoir roof/adjacent to the hatch can contaminate equipment. Before the facility access hatch is opened, the hatch and immediate area shall be cleaned of loose dirt and debris.

4.4.4 *Initial water quality*. The purchaser shall establish the chlorine residual and turbidity in the reservoir water before entering it. The purchaser should take representative water samples from several depths and locations, if possible, and analyze for chlorine residual and turbidity. The results shall be recorded. Chlorine residual testing is not necessary if the system does not operate with a chlorine residual. If the water-storage facility remains in service during the cleaning operation, samples shall be collected daily from the tank and tested for coliform bacteria, chlorine residual (if applicable), and turbidity.

4.4.5 *Equipment and personnel requirements*.

4.4.5.1 Equipment and clothing. Diving, ROV, and float inspection equipment used for inspection and/or cleaning of potable-water-storage facilities shall be dedicated for that purpose only. Equipment shall be constructed and maintained in such a fashion so that water quality will not be affected. Equipment shall be available for inspection.

4.4.5.1.1 According to this standard, both SCUBA (self-contained underwater breathing apparatus) and externally supplied air methods are acceptable air sources.

4.4.5.1.2 Equipment exposed to the water shall be suitable for disinfection. Divers shall be completely encapsulated with no bare skin exposed. Other personnel that enter the tank shall wear a dry suit that covers any portion of the body that may potentially contact the water. Diving clothing shall be of the dry-suit type and shall be in good condition, free from tears, scrapes, unrepaired areas, or other imperfections that may impair the integrity of the suit. Equipment and dry suits dedicated for potable-water underwater inspection and/or cleaning work shall be stored in a manner that prevents both chemical and bacteriological contamination.

4.4.5.1.3 There shall be no contact of the mouth or head with the water during any underwater operations. The head shall be fully encapsulated by one or a combination of the following: helmet or dry suit hood with full-face mask.

4.4.5.1.4 Divers shall have communication in accordance with federal, state or provincial, and local regulations.

4.4.5.1.5 Underwater operations may be videotaped or documented with still photographs at the purchaser's request.

4.4.5.1.6 Disturbing tank-bottom sediment may impair water quality. Sediment may contain bacteria, which if resuspended can cause contamination. Disturbed sediment will create localized turbidity. In some cases, it may be desirable to disturb a small area of thin sediment to inspect the underlying coating or floor condition. Divers or ROVs shall not disturb the sediment in any way unless explicitly approved by the purchaser to do so; this includes "walking on the floor."

4.4.5.2 Personnel requirements. Because of the hazardous nature of this work, which combines elevated work, confined-space entry, and diving, the contractor performing the work shall comply with all federal, state or provincial, and local regulations.

4.4.5.2.1 Certain diving contractors who have been providing these services for many years may not have the formal certifications listed subsequently. Purchasers should carefully review the documentation of training and experience for these firms and require a detailed personal diver's log for the personnel who will conduct the on-site work. The presentation of a sport diver certification card for SCUBA by itself is not acceptable proof of proper training.

The following is a limited list of examples of diver qualifications that are acceptable—but not without detailed documentation of training and direct tank inspection and/or cleaning work experience:

- US Navy Second Class Diver Training
- ANSI/ACDE 01 (latest version) Commercial Diver Certification
- ADCI Commercial Certification

4.4.5.2.2 Personnel on the dive team and/or float inspection team must be OSHA Confined Space Certified. These certificates should be provided on the job site for all personnel.

4.4.5.2.3 All personnel on the dive team and/or float inspection team shall be free of communicable disease and shall not have been under a physician's care within the seven-day period before the entering of the facility. No person who knowingly has an abnormal temperature or symptoms of illness shall work in a water-storage facility.

4.4.5.2.4 The American Red Cross or an equivalent agency shall certify all dive/float inspection team members in the use of CPR and first aid.

4.4.5.3 Safety. The dive team shall comply with all applicable local, state or provincial, and federal safety requirements and shall provide all necessary safety equipment suitable for the specific access opening, depth to water, and other aspects of the water-storage facility to be inspected.

4.4.5.3.1 The contractor/inspection firm shall have a comprehensive safety manual on-site, which addresses all of the potential hazards. The safety manual shall include certifications for all safety and emergency response requirements at the site. The contractor/inspection firm shall have a method and the equipment readily available for the extraction of an injured diver and a method for lowering a person to the ground who is incapacitated. This may include the use of a properly trained and equipped local fire department or rescue squad. The use of an outside response team must be covered in the pre-job meeting, and they must be able to respond quickly or be on-site during the work.

4.4.6 *Equipment and personnel disinfection*. All equipment (including ROV and rafts) and personnel that will enter the water-storage facility shall be disinfected immediately before entry into the potable-water reservoir. Any equipment making contact with the tank roof must be disinfected again before entry into the water. The method of equipment disinfection can be submersion in, spraying with, or sponging with disinfectant solution as defined in Sec. 4.3.2. The diver and the clothing shall be disinfected after the diver is suited up and on top of

the tank as per Sec. 4.3.2. Care must be taken when applying disinfectant solution to the diver, ROV, float, and other cleaning equipment so that any excess, runoff, or spillage is controlled so it does not enter the reservoir. Handle chlorine solutions with care so as not to contact personnel clothing or skin. Appropriate personal protective equipment should be worn when using these products.

4.4.7 *Post-inspection chlorine residual, turbidity, and bacteriological testing*. Collect samples and test as described in Section 5, Verification. If the storage tank was removed from service, satisfactory bacteriological and chlorine residual (if applicable) results are required before the facility can be placed back in service. If it is necessary to rebuild chlorine residuals in the storage facility, bacteriological samples should be collected after chlorine residuals are brought to an acceptable level.

4.4.8 *Affidavit of compliance*. The purchaser may require that the contractor performing the inspection and/or cleaning services provide an affidavit of compliance with the requirements of this standard.

SECTION 5: VERIFICATION

Sec. 5.1 Water Quality Sampling and Testing

5.1.1 *Standard conditions*. Samples representing the contents of the water-storage facility shall be collected. After the chlorination procedure is completed and before the storage facility is placed in service, water from the full facility shall be sampled and tested for coliform bacteria and chlorine residual in accordance with the latest edition of *Standard Methods for the Examination of Water and Wastewater*.

5.1.1.1 Results of testing. If the test for coliform organisms is negative and chlorine residuals are at acceptable distribution system levels, the storage facility may be placed in service. If the test shows the presence of coliform bacteria, the situation shall be evaluated by qualified personnel. In this case, repeat samples shall be taken until two consecutive samples are negative, or the storage facility shall be subjected to disinfection.

5.1.1.2 Care in sampling. The samples shall be taken from a sample tap on the outlet piping from the storage facility or from a sample tap connected directly to the storage facility, or sampling from the top of the tank or hatch may be required. In any case, the operation shall ensure that the sample collected is from

water that has been in the storage facility. Sample equipment and methods shall follow aseptic techniques for bacteria sampling.

5.1.1.3 Recommended additional samples. It may be advisable to collect samples of water flowing into the storage facility to determine if coliforms are present in the typical potable water source, particularly if coliform bacteria are found in the tank.

5.1.1.4 Optional sampling and testing. Following disinfection and before activating the tank for use, water in the storage tank should be tested to determine that it meets expected parameters typical in the system. Test results should confirm that the water quality is appropriate for distribution. Although this assessment is unique for each system, suggested test parameters include pH, alkalinity, turbidity, odor, and specific conductance. If the tank was painted or if epoxy was applied, measuring levels of VOCs or other components of the coating material (such as zinc) may be necessary (noting that THMs, which are part of the VOC test, are a result of disinfection, not coating materials, and would be expected to be present). Depending on the size of the storage facility, more samples may be appropriate. While the number of samples above the required number is up to the discretion of the water system operator, suggested numbers include one sample for tanks of 10 MG or less, and an additional sample for each additional 10 MG volume using another tap or hatch if available. The specific number of samples necessary should be determined beforehand and will depend on tank volume and sample tap or hatch availability.

5.1.1.5 If the water-storage tank is not promptly returned to service, the situation should be evaluated to determine if the water quality may have been affected and if additional testing is warranted. Test results should confirm that the water quality is appropriate for distribution. Although this assessment is unique for each system, parameters considered for testing include disinfectant residual, total coliform bacteria, heterotrophic plate count (HPC), turbidity, pH, alkalinity, total chlorine, odor, and specific conductance.

SECTION 6: DELIVERY

This standard has no applicable information for this section.

APPENDIX A

Chlorine Residual Testing

This appendix is for information only and is not part of ANSI/AWWA C652.

SECTION A.1: DPD DROP DILUTION METHOD (FOR FIELD TEST)

The N,N-diethyl-p-phenylenediamine (DPD) drop dilution method of approximating residual chlorine is suitable for concentrations above 10 mg/L, such as those applied in the disinfection of water mains or tanks.

Sec. A.1.1 Apparatus

1. A graduated cylinder for measuring distilled water.
2. An automatic or safety pipette.
3. Two dropping pipettes that deliver a 1-mL sample in 20 drops. One pipette is for dispensing the water sample, and the other is for dispensing the DPD and buffer solutions. The pipettes should not be interchanged.
4. A comparator kit containing a suitable range of standards.

Sec. A.1.2 Reagents

1. DPD indicator solution. Prepare as prescribed in *Standard Methods for the Examination of Water and Wastewater* (latest edition), Section 4500-Cl F.2b.
2. Phosphate buffer solution. Prepare as prescribed in *Standard Methods for the Examination of Water and Wastewater* (latest edition), Section 4500-Cl F.2a.

Sec. A.1.3 Procedure

1. Add 10 drops of DPD solution and 10 drops of buffer solution (or 20 drops of combined DPD–buffer solution) to a comparator cell.
2. Fill the comparator cell to the 10-mL mark with distilled water.

3. With a dropping pipette, add the water sample one drop at a time; mix until a red color is formed that matches one of the color standards.

4. Record the total number of drops used and the final chlorine reading obtained (that is, the chlorine reading of the matched standard).

5. Calculate the milligrams per liter of chlorine residual as follows:

$$\text{mg / L chlorine} = \frac{\text{reading} \times 200}{\text{drops of sample}}$$

SECTION A.2 HIGH-RANGE CHLORINE TEXT KITS

Several manufacturers produce high-range chlorine test kits that are inexpensive, easy to use, and satisfactory for the precision required.

APPENDIX B

Chlorine Dosages

This appendix is for information only and is not a part of ANSI/AWWA C652.

Table B.1 Amounts of chemical required to give various chlorine concentrations in 100,000 gal (378.5 m^3) of water*

			Sodium Hypochlorite Required						Calcium Hypochlorite Required	
Desired Chlorine Concentration in Water	Chlorine Required		5% Available Chlorine		10% Available Chlorine		15% Available Chlorine		65% Available Chlorine	
mg/L	*lb*	(*kg*)	*gal*	(*L*)	*gal*	(*L*)	*gal*	(*L*)	*lb*	(*kg*)
2	1.7	(0.8)	3.9	(14.7)	2.0	(7.6)	1.3	(4.9)	2.6	(1.1)
10	8.3	(3.8)	19.4	(73.4)	9.9	(37.5)	6.7	(25.4)	12.8	(5.8)
50	42.0	(19.1)	97.0	(367.2)	49.6	(187.8)	33.4	(126.4)	64.0	(29.0)

*Amounts of sodium hypochlorite are based on concentrations of available chlorine by volume. For either sodium hypochlorite or calcium hypochlorite, extended or improper storage of chemicals may cause a loss of available chlorine. Also, amounts do not take into account chlorine demand or chlorine residual that might be present in the water.

Table B.2 Amounts of chemical required to give a chlorine concentration of 200 mg/L in various volumes of water*

				Sodium Hypochlorite Required						Calcium Hypochlorite Required	
Volume of Water		Chlorine Required		5% Available Chlorine		10% Available Chlorine		15% Available Chlorine		65% Available Chlorine	
gal	(*L*)	*lb*	(*kg*)	*gal*	(*L*)	*gal*	(*L*)	*gal*	(*L*)	*lb*	(*kg*)
10	(37.9)	0.02	(9.1)	0.04	(0.15)	0.02	(0.08)	0.02	(0.08)	0.03	(13.6)
50	(189.3)	0.10	(45.4)	0.20	(0.76)	0.10	(0.38)	0.07	(0.26)	0.15	(68.0)
100	(378.5)	0.20	(90.7)	0.40	(1.51)	0.20	(0.76)	0.15	(0.57)	0.30	(136.1)
200	(757.1)	0.40	(181.4)	0.80	(3.03)	0.40	(1.51)	0.30	(1.14)	0.60	(272.2)

*Amounts of sodium hypochlorite are based on concentrations of available chlorine by volume. For either sodium hypochlorite or calcium hypochlorite, extended or improper storage of chemicals may cause a loss of available chlorine. Also, amounts do not take into account chlorine demand or chlorine residual that might be present in the water.

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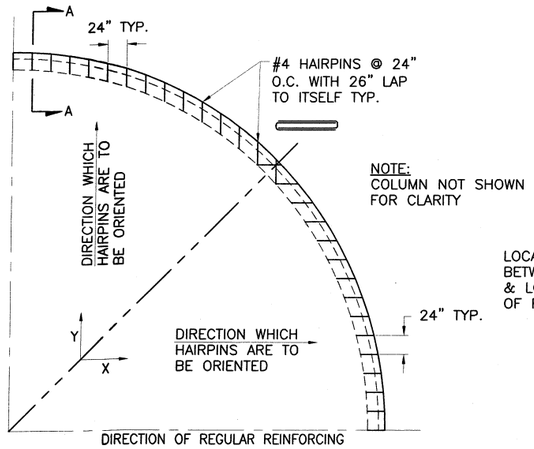
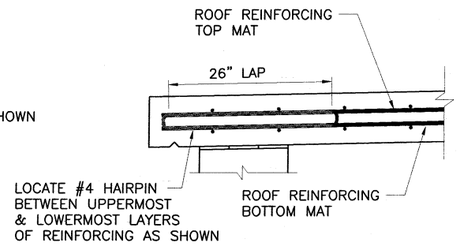
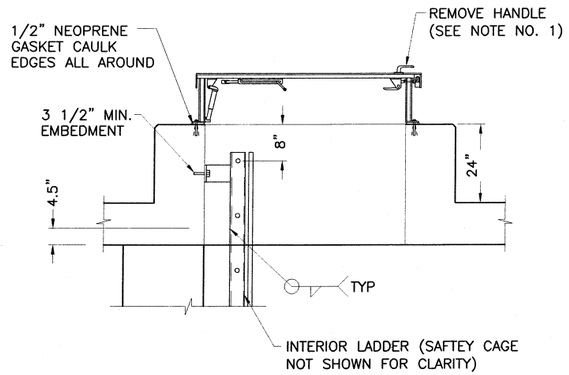


A PLAN - HAIRPIN ORIENTATION
NOT TO SCALE



SECTION-AA



B SECTION - ROOF HATCH
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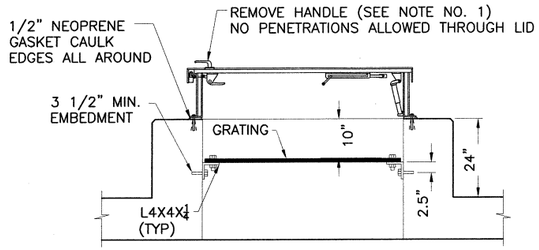

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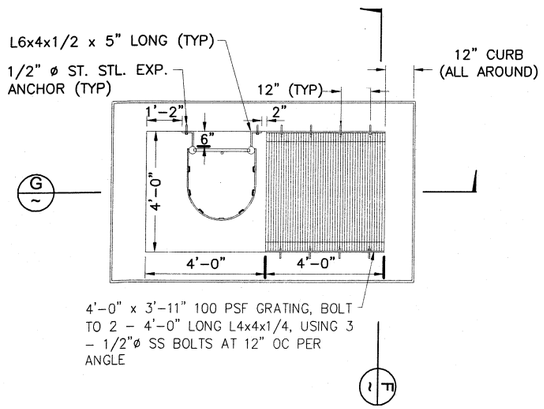
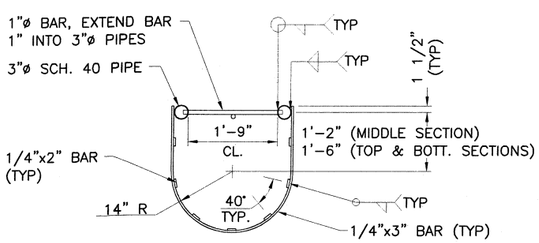
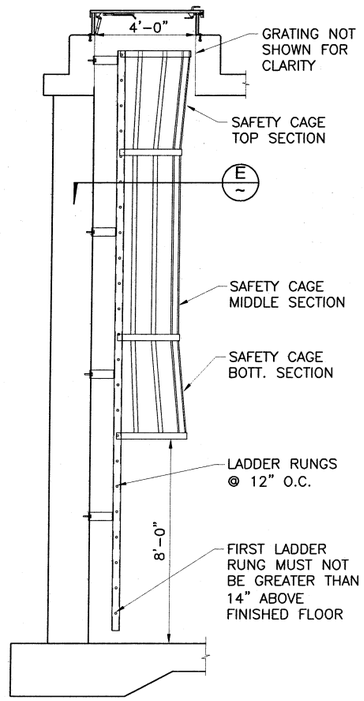


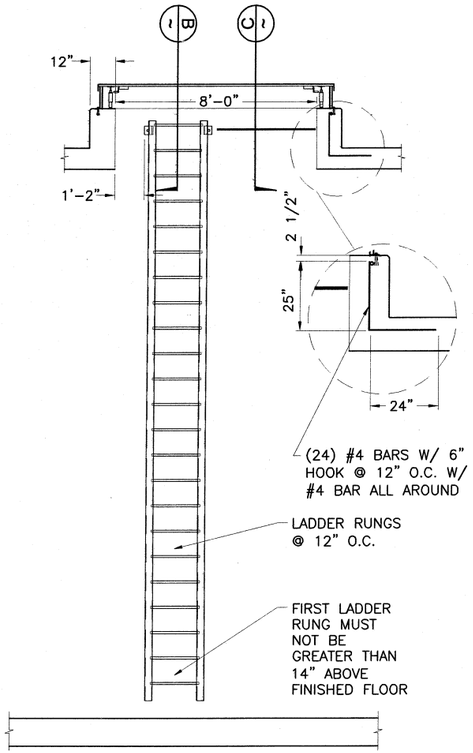
D DETAIL-ROOF HATCH & INTERIOR LADDER
NO SCALE



E SECTION - SAFETY CAGE
NOT TO SCALE



F SECTION - INTERIOR LADDER
NOT TO SCALE



NOTE: SAFETY CAGE NOT SHOWN FOR CLARITY

G SECTION - INTERIOR LADDER
NOT TO SCALE

ROOF HATCH & LADDER NOTES:

1. ROOF HATCH SHALL BE 8'x 4' 'BILCO' HATCH OR APPD. EQ. HINGED ON THE 8'-0" SIDE, MODIFIED TO OMIT INTERIOR AND EXTERIOR HANDLES, AND PROVIDED W/ CONCEALED PADLOCK HASP. ALL ST. STL. HARDWARE AND FULLY ENCLOSE CURB.
2. ROOF HATCH TO BE MANUFACTURED OF ALUMINUM.
3. ALL LADDER MATERIAL FOR PIPE SIDE RAILS, RUNGS, BRACKETS, AND BASE PLATES TO BE HOT DIPPED GALVANIZED A36 STL. GALVANIZE AFTER ALL WELDING COMPLETE.
4. LADDER RUNGS TO BE SOLID RODS.
5. ALL WELDS TO BE 1/4" MIN.
6. ALL ALUM. IN CONTACT WITH CONCRETE MUST BE COATED WITH A HEAVY BITUMASTIC COATING OR EPOXY PAINT.
7. USE ST. STL. 316 FOR ALL BOLTS UNLESS NOTED OTHERWISE.
8. WHERE ST. STL. BOLTS ARE IN CONTACT WITH DISSIMILAR METALS, USE INSULATING SLEEVES AND PHENOLIC WASHERS TO ELECTRICALLY ISOLATE THE BOLTS.

REGISTERED PROFESSIONAL ENGINEER
No. 334535
Scott L. Archibald
STATE OF UTAH
7/18/07

REV NO.	COMMENT	DATE

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HYDE PARK CITY

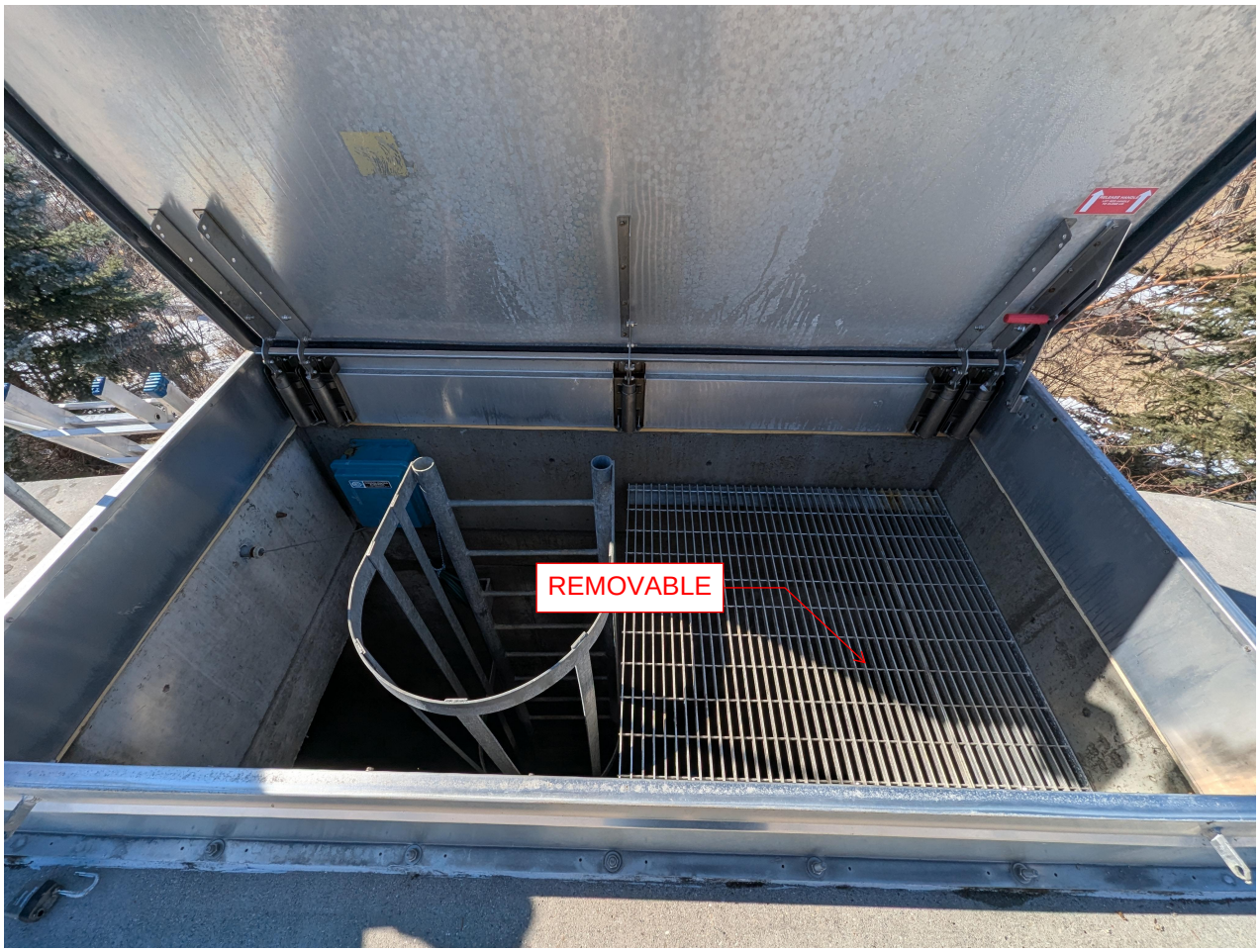
1.5 MILLION GALLON WATER TANK

TANK SECTIONS AND DETAILS

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
03086	JDJ	JDJ	SLA	13 of 30	T6

Lion's Park Tank Hatch

Note that the top of tank is about 9' from the existing ground. A ladder is required to get on top of the tank and access the hatch.. It is important to be aware of the difficult access, and site access limitations.



STRUCTURAL SPECIFICATIONS & REQUIREMENTS

BID SET

A. DESIGN CRITERIA:

1. BUILDING CODES:
   2021 INTERNATIONAL BUILDING CODE
   ACI 318-14 "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY"
   ASCE 7-16 "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"
   MASONRY STRUCTURES TMS 402-16/ACI 530-16/ASCE 5-16
   2018 NATIONAL DESIGN SPECIFICATION for WOOD CONSTRUCTION WITH COMMENTARY
2. RISK CATEGORY III PER IBC TABLE 1604.5
3. DESIGN DEAD LOADS:
   ROOF DL = 16.1 PSF
   WALL DL = 13 PSF
4. LIVE LOAD:
   ROOF LL = 20 PSF
   FLOOR LL = 100 PSF
5. SNOW LOAD: PER ASCE 7-16
   IMPORTANCE FACTOR Is = 1.10
   GROUND SL = 44 PSF
   FLAT/SLOPED ROOF SL USED FOR DESIGN = 31 PSF
6. WIND LOADING: PER ASCE 7-16
   BASIC WIND SPEED V = 110 MPH, IMPORTANCE FACTOR Iw = 1.0
   KD = 0.85
   EXPOSURE CATEGORY = C
   TOPOGRAPHIC FACTOR KZT = 1.0
   GUST EFFECT FACTOR G = 0.85
   BUILDING = ENCLOSED
   FOR WIND PRESSURES USED IN DESIGN, SEE CALCULATIONS
7. SEISMIC LOADING: PER ASCE 7-16
   SITE CLASS D "STIFF SOIL", SEISMIC IMPORTANCE FACTOR I_e = 1.00
   S_S = 1.022g
   S_1 = 0.341g
   S_{DS} = 0.818g
   S_{D1} = N/A
   C_s = 0.158
   R = 6.5
   SEISMIC DESIGN CATEGORY D PER ASCE 7-16 TABLE 11.6-2
   LATERAL FORCE RESISTING SYSTEM IS AS FOLLOWS:
   A.15 LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE

B. GENERAL REQUIREMENTS:

1. DIMENSIONS: CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE PRIOR TO CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ENGINEER OF RECORD.
2. THE CONTRACTOR MUST SUBMIT IN WRITING ANY REQUESTS FOR MODIFICATIONS TO THE PLANS AND SPECIFICATIONS. SHOP DRAWINGS SUBMITTED TO THE STRUCTURAL ENGINEER FOR REVIEW DO NOT CONSTITUTE "IN WRITING" UNLESS IT IS CLEARLY NOTED THAT SPECIFIC CHANGES ARE BEING REQUESTED.
3. LOADS FROM CONSTRUCTION MATERIALS SHALL BE SPREAD OUT IF PLACED ON FRAMED FLOORS OR ROOFS. CONSTRUCTION LOADS SHALL NOT EXCEED THE DESIGN LIVE LOAD PER SQUARE FOOT LISTED IN THE DESIGN CRITERIA. CONTRACTOR SHALL PROVIDE ADEQUATE SHORING AND OR BRACING WHERE STRUCTURE HAS NOT ATTAINED DESIGN STRENGTH.
4. THESE DOCUMENTS HAVE BEEN PREPARED USING STANDARDS OF PROFESSIONAL CARE AND COMPLETENESS AS REQUIRED FOR THIS OR SIMILAR LOCALITIES. THEY ASSUME THAT THE WORK DEPICTED WILL BE PERFORMED BY AN EXPERIENCED CONTRACTOR AND/OR WORKMEN WHO HAVE A WORKING KNOWLEDGE OF THE APPLICABLE CODE STANDARDS AND REQUIREMENTS AND OF INDUSTRY ACCEPTED STANDARD GOOD PRACTICE. AS NOT EVERY CONDITION OR ELEMENT IS (OR CAN BE) EXPLICITLY SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL USE INDUSTRY ACCEPTED STANDARD GOOD PRACTICE FOR MISCELLANEOUS WORK NOT EXPLICITLY SHOWN.
5. THESE DRAWINGS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, PROCEDURES, LAGGING, SHORING, BRACING, FORM-WORK, ETC. AS REQUIRED FOR THE PROTECTION OF LIFE AND PROPERTY DURING CONSTRUCTION.

C. FOUNDATION REQUIREMENTS:

1. FOUNDATIONS FOR THE STRUCTURES SHOWN IN THE PLANS WERE DESIGNED BASED ON THE GEOTECHNICAL INVESTIGATION REPORT HYDE PARK CITY – CITY HALL WELL HOUSE, DATED DECEMBER 3, 2024. LOAD-BEARING VALUES OF THE SOILS ARE PROVIDED IN THE REPORT. CONTINUOUS AND SPREAD FOOTINGS DESIGNED FOR ALLOWABLE BEARING PRESSURE OF 1800 PSF PER THE SOILS REPORT. IF SOIL CONDITIONS ARE FOUND TO BE DIFFERENT THAN THE TYPES LISTED ABOVE OR OF UNUSUAL MAKE-UP, OR SUB-STANDARD, PLEASE CONTACT THE ENGINEER OF RECORD.
2. "IT IS RECOMMENDED THAT THE PROPOSED WELL HOUSE BE CONSTRUCTED ON SPREAD FOOTINGS. FOOTINGS SHOULD NOT BE INSTALLED ON LOOSE OR DISTURBED SOILS, UNDOCUMENTED FILL, TOPSOIL, CONSTRUCTION DEBRIS, FROZEN SOIL, OR WITHIN PONDED WATER. IF UNSUITABLE SOILS ARE ENCOUNTERED, THEY SHOULD BE OVER-EXCAVATED AND REPLACED WITH STRUCTURAL FILL. STRUCTURAL FILL PLACED BELOW FOOTINGS SHOULD EXTEND LATERALLY BEYOND THE EDGES OF THE FOUNDATION. STRUCTURAL FILL, WITH A MINIMUM THICKNESS OF 1 FOOT, SHOULD BE PLACED BENEATH THE FOOTING. STRUCTURAL FILL PLACED BELOW FOOTINGS SHOULD EXTEND LATERALLY BEYOND THE EDGES OF THE FOUNDATION A DISTANCE OF 1.5 FEET AND THEN 1 FOOT FOR EVERY FOOT OF DEPTH BELOW THE FOUNDATION." SEE GEOTECHNICAL INVESTIGATION REPORT FOR MORE INFORMATION.

D. CONCRETE REQUIREMENTS:

1. ALL CONCRETE CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH ACI 318 AND ACI 301, EXCEPT AS MODIFIED BY THE CONSTRUCTION DOCUMENTS.
2. CONCRETE SHALL HAVE THE FOLLOWING COMPRESSIVE STRENGTHS:

CONCRETE	MIN. f'c (28 DAYS)	SLUMP	W/C RATIO	CLASS
FOUNDATIONS	4500 PSI	3" TO 5"	0.45	F2
INT. SLAB-ON-GRADE	4000 PSI	3" TO 5"	0.45	F2
CONCRETE NOT NOTED	4500 PSI	3" TO 5"	0.45	F2

   SLUMP: CONCRETE w/ ADMIXTURES SHALL HAVE A MAXIMUM SLUMP OF 7".

3. ADMIXTURES:
   3.1. AIR ENTRAINMENT ASTM C-260
   3.2. CALCIUM CHLORIDE NOT PERMITTED
   3.3. ALUMINUM PRODUCTS NOT PERMITTED
4. CONCRETE MIXES SHALL BE DESIGNED BY A CERTIFIED LABORATORY, STAMPED BY AN APPROPRIATELY LICENSED SPECIALTY ENGINEER, AND APPROVED BY THE ENGINEER OF RECORD. MIX DESIGNS SHALL INCLUDE THE PROJECT NAME AND INDICATE THEIR USE WITHIN THE STRUCTURE. MIX DESIGNS SHALL BE PROPORTIONED TO MINIMIZE SHRINKAGE AND HAVE PROVEN SHRINKAGE CHARACTERISTICS OF 0.05% OR LESS BASED ON TESTING PER ASTM C157.
5. IF USED, EARLY STRENGTH CONCRETE SHALL BE PROPORTIONED TO DEVELOP THE 28 DAY COMPRESSIVE STRENGTH AT THE AGE REQUIRED BY THE CONTRACTOR. CONTRACTOR SHALL SUBMIT TEST DATA FOR REVIEW BY THE STRUCTURAL ENGINEER TO SUBSTANTIATE THE CONCRETE STRENGTH AT THE REQUIRED AGE.
6. ALL CONCRETE SHALL BE NORMAL WEIGHT OF 145 POUNDS PER CUBIC FOOT USING HARD ROCK AGGREGATES CONFORMING TO ASTM C33 U.N.O. WHERE LIGHTWEIGHT CONCRETE IS SPECIFIED, CONCRETE SHALL BE 110 POUNDS PER CUBIC FOOT USING AGGREGATES CONFORMING TO ASTM C330. LARGEST NOMINAL AGGREGATE SIZE SHALL BE 1-1/2" OR GREATER FOR SLABS ON GRADE AND 3/4" OR GREATER FOR ALL OTHER CONCRETE U.N.O.
7. PORTLAND CEMENT SHALL CONFORM TO ASTM C150. TYPE V CEMENT SHALL BE USED FOR CONCRETE IN CONTACT WITH EARTH. TYPE II CEMENT MAY BE USED ELSEWHERE. CEMENT SHALL BE TYPE V WITH POZZOLAN WHERE CONCRETE IS IN CONTACT WITH SOIL CONTAINING VERY SEVERE SULFATE EXPOSURE.
8. FLY ASH MAY BE USED IN CONCRETE, SUBJECT TO APPROVAL BY THE ARCHITECT AND ENGINEER, PROVIDED THE FOLLOWING CONDITIONS ARE MET:
   8.1. FLY ASH SHALL COMPLY WITH ASTM C618.
   8.2. CEMENT CONTENT SHALL BE REDUCED A MINIMUM OF 15 PERCENT UP TO A MAXIMUM OF 25 PERCENT WHEN COMPARED TO AN EQUIVALENT CONCRETE MIX DESIGN WITHOUT FLY ASH. FLY ASH CONTENT SHALL NOT COMPRISE MORE THAN 35 PERCENT OF THE TOTAL CEMENTITIOUS CONTENT. THE WATER-CEMENT RATIO SHALL BE CALCULATED BASED ON THE TOTAL CEMENTITIOUS MATERIAL IN THE MIX.
   8.3. CLASS F FLY ASH SHALL BE USED IN SULFATE RESISTANT CONCRETE WITH f'c EQUAL TO OR GREATER THAN 4000 PSI. CLASS C FLY ASH MAY BE USED ELSEWHERE.
9. WATER SOLUBLE CHLORIDE ION CONCENTRATIONS IN CONCRETE SHALL BE LIMITED PER ACI 318, SECTION 4.4.
10. ALL CONCRETE EXPOSED TO FREEZE/THAW CYCLES OR DEICING CHEMICALS SHALL CONFORM TO ACI 318, SECTION 4.2.
11. TIME BETWEEN CONCRETE BATCHING AND PLACEMENT SHALL BE IN ACCORDANCE WITH ASTM C94.
12. CONCRETE MIXING, PLACEMENT, AND QUALITY SHALL BE PER IBC SECTION 1905. MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED. SLABS ON GRADE NEED TO BE VIBRATED ONLY AROUND AND UNDER FLOOR DUCTS OR SIMILAR ELEMENTS. REMOVE ALL DEBRIS FROM FORMS BEFORE PLACING CONCRETE. CONCRETE SHALL NOT BE DROPPED THROUGH REINFORCING STEEL SO AS TO CAUSE SEGREGATION OF AGGREGATES. UNCONFINED FALL OF CONCRETE SHALL NOT EXCEED 5 FEET.
13. PROTECT CONCRETE FROM DAMAGE OR REDUCED STRENGTH DUE TO COLD OR HOT WEATHER IN ACCORDANCE WITH ACI 305 AND 306. CONTRACTOR SHALL TAKE SPECIAL CURING PRECAUTIONS TO MINIMIZE SHRINKAGE CRACKING OF CONCRETE SLABS.
14. ALL REINFORCING STEEL SHALL BE SET AND TIED IN PLACE PRIOR TO POURING OF CONCRETE, EXCEPT VERTICAL DOWELS FOR MASONRY WALL REINFORCING MAY BE "FLOATED" IN PLACE. DO NOT FIELD BEND BARS PARTIALLY EMBEDDED IN HARDENED CONCRETE UNLESS SPECIFICALLY INDICATED OR APPROVED BY THE ENGINEER OF RECORD.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PLACEMENT AND LOCATION OF ANY AND ALL EMBED ITEMS INCLUDING PLATES, BOLTS, AND OTHER INSERTS SPECIFIED IN THE DRAWINGS.
16. ALL ITEMS TO BE CAST IN CONCRETE SUCH AS REINFORCEMENT, DOWELS, BOLTS, ANCHORS, SLEEVES, ETC., SHALL BE SECURELY POSITIONED IN THE FORMS.

D. CONCRETE REQUIREMENTS CONTINUED:

17. MECHANICAL, ELECTRICAL, AND PLUMBING PENETRATIONS / EMBEDDED CONDUITS SHALL COMPLY WITH THE FOLLOWING:
    17.1. ELECTRICAL CONDUITS MAY BE EMBEDDED IN STRUCTURAL CONCRETE ONLY AS NOTED IN TYPICAL DETAILS FOR WALLS AND CAST-IN-PLACE ELEVATED SLABS (EMBEDDED CONDUITS IN CONCRETE OVER STEEL DECK ARE NOT PERMITTED) OR WHERE SPECIFICALLY APPROVED IN WRITING BY THE ENGINEER. PIPING SHALL NOT BE EMBEDDED IN STRUCTURAL CONCRETE U.N.O. EMBEDDED ITEMS SHALL NOT IMPAIR THE STRENGTH OF THE MEMBER.
    17.2. REFER TO TYPICAL DETAILS FOR ACCEPTABLE CONDUIT, PIPING, AND DUCT PENETRATIONS THRU SLABS AND WALLS. DO NOT CUT ANY REINF. THAT MAY INTERFERE WITH PERMITTED PENETRATIONS. OPENINGS SHALL NOT BE CORED WITHOUT PRIOR WRITTEN APPROVAL OF ENGINEER. PENETRATIONS THRU BEAMS AND COLUMNS ARE PERMITTED ONLY WHERE SPECIFICALLY DETAILED.
    17.3. CONTRACTOR SHALL SUBMIT SHOP DRAWING SHOWING SIZES AND DIMENSIONED LOCATIONS OF ALL PENETRATIONS AND EMBEDDED CONDUITS IN WALLS AND ELEVATED SLABS. SHOP DRAWING MUST BE APPROVED BY ENGINEER PRIOR TO CONCRETE PLACEMENT. PENETRATIONS AND EMBEDDED CONDUITS NOT SHOWN ON APPROVED SHOP DRAWING WILL NOT BE PERMITTED UNLESS SPECIFICALLY APPROVED IN WRITING BY THE ENGINEER.
18. FORMWORK, SHORING, AND RESHORING SHALL BE DESIGNED PER ACI 347 RECOMMENDATIONS BY AN APPROPRIATELY LICENSED SPECIALTY ENGINEER EXPERIENCED IN THIS TYPE OF WORK AND SHALL BE SUBMITTED TO ENGINEER OF RECORD FOR REVIEW. FOR MULTISTORY CONSTRUCTION, SHORING/RESHORING DESIGN SHALL DEMONSTRATE THAT SHORES/RESHORES WILL BE PROVIDED FOR A SUFFICIENT NUMBER OF FLOORS TO DISTRIBUTE IMPOSED CONSTRUCTION LOADS TO SEVERAL SLAB LEVELS WITHOUT CAUSING EXCESSIVE STRESSES AND SLAB DEFLECTIONS. FOR PURPOSES OF SHORING/RESHORING CALCULATIONS, MAGNITUDES OF REDUCED LIVE LOADS SHALL BE TAKEN TO BE 60% OF VALUES INDICATED IN BASIS FOR DESIGN U.N.O.
19. CONSTRUCTION JOINTS OR POUR JOINTS IN STRUCTURAL ELEMENTS (BEAMS, COLUMNS, ELEVATED SLABS, ETC.) NOT SPECIFICALLY SHOWN OR NOTED ON THE DRAWINGS REQUIRE PRIOR APPROVAL OF THE ENGINEER. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING PROPOSED JOINTS TO ENGINEER FOR APPROVAL.
20. CONSTRUCTION JOINT SURFACES SHALL BE CLEANED AND LAITANCE REMOVED. HORIZONTAL JOINT SURFACES SHALL BE ROUGHENED TO 1/4" AMPLITUDE. THOROUGHLY WET ALL JOINT SURFACES AND REMOVE STANDING WATER IMMEDIATELY PRIOR TO NEW CONCRETE PLACEMENT.
21. CONCRETE SHALL BE CURED IN ACCORDANCE WITH ACI 318, SECTIONS 5.11.1 OR 5.11.2, WHICHEVER IS APPLICABLE, UNLESS ALTERNATE METHODS HAVE BEEN APPROVED BY THE ARCHITECT AND ENGINEER. WHERE CURING COMPOUNDS HAVE BEEN APPROVED FOR SLAB CURING, CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING COMPATIBILITY OF COMPOUNDS WITH ANTICIPATED FLOOR FINISH (e.g., RESILIENT TILE) PRIOR TO CURING COMPOUND APPLICATION.
22. CONCRETE FINISH DESIGNATION:
    F1 – AS CAST FORM FINISH
    F2 – ROUGH FINISH
    F3 – SMOOTH FINISH
    F4 – SMOOTH RUBBED FINISH
    F5 – GROUT CLEANED RUBBED FINISH
    F6 – CORK FLOATED RUBBED FINISH
    F7 – UNFORMED FINISH
    F8 – BLASTED FINISH
    F9 – ARCHITECTURAL FINISH
    F10 – TOOLED FINISH
    S1 – FLOATED FINISH
    S2 – TROWEL FINISH
    S3 – BROOM FINISH
    S4 – EXPOSED AGGREGATE FINISH
    S5 – CHEMICAL HARDENER FINISH

E. REINFORCING STEEL REQUIREMENTS:

1. REINFORCING STEEL SHALL BE DETAILED AND PLACED IN ACCORDANCE WITH ACI 318 AND CRSI'S MANUAL OF STANDARD PRACTICE.
2. REINFORCING STEEL SHALL CONFORM TO ASTM A615 OR ASTM A706 (A706 REQUIRED FOR ALL REINFORCING TO BE WELDED) AND SHALL BE GRADE 60 (fy = 60 KSI) DEFORMED BARS U.N.O. REINFORCING IN SLABS ON GRADE MAY BE GRADE 40 (fy = 40 KSI) DEFORMED BARS FOR ALL BARS #4 AND SMALLER U.N.O. ON PLANS OR DETAILS.
3. ALL DIMENSIONS SHOWING THE LOCATION OF REINFORCING STEEL NOT NOTED AS "CLEAR" OR "CLR." ARE TO CENTER OF STEEL. CLEAR COVER FOR NON-PRESTRESSED CONCRETE REINFORCING SHALL BE AS NOTED BELOW, U.N.O. ON PLANS OR DETAILS. CLEAR COVER FOR PRESTRESSED CONCRETE AND FOR PRECAST CONCRETE MANUFACTURED UNDER PLANT CONTROL CONDITIONS SHALL BE PER ACI 318, SECTIONS 7.7.2 AND 7.7.3, RESPECTIVELY.

EXPOSURE CONDITION:	COVER:
CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH	3"
EXPOSED TO WEATHER (INCLUDES SLABS ON GRADE)	
NO. 5 AND SMALLER	1 1/2"
NO. 6 AND LARGER	2"
NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND STRUCTURAL SLABS, WALLS, JOISTS	
NO. 11 AND SMALLER	3/4"

4. LAP SPLICES OF REINFORCING STEEL SHALL CONFORM TO TYPICAL REBAR LAP SCHEDULE U.N.O. NO TACK WELDING OF REINFORCING BARS ALLOWED. LATEST ACI CODE AND DETAILING MANUAL APPLY. AT WALLS AND FOOTINGS, PROVIDE BENT CORNER BARS TO MATCH AND LAP WITH HORIZ. BARS AT ALL CORNERS AND INTERSECTIONS U.N.O. VERT. WALL BARS SHALL BE SPLICED AT OR NEAR FLOOR LINES. SPLICE TOP BARS AT CENTER LINE OF SPAN AND BOTTOM BARS AT THE SUPPORT IN SPANDRELS, BEAMS, GRADE BEAMS, ETC., U.N.O. ON PLANS OR DETAILS.

E. REINFORCING STEEL REQUIREMENTS CONTINUED:

5. MECHANICAL SPLICE COUPLERS SHALL HAVE CURRENT ICC APPROVAL AND SHALL BE CAPABLE OF DEVELOPING 125% OF THE SPLICED BAR'S YIELD STRENGTH.
6. ALL REINFORCING SHALL BE BENT COLD. BARS SHALL NOT BE UN-BENT AND RE-BENT. FIELD BENDING OF REBAR SHALL NOT BE ALLOWED UNLESS SPECIFICALLY NOTED.
7. WELDING OF REINFORCING BARS, METAL INSERTS, AND CONNECTIONS SHALL BE MADE ONLY AT LOCATIONS SHOWN ON PLANS OR DETAILS. SEE WELDING SECTION OF G.S.N. FOR ADDITIONAL REQUIREMENTS.
8. REINFORCING BAR SPACINGS SHOWN ON PLANS ARE MAX. ON CENTER DIMENSIONS. DOWEL ALL VERT. REINFORCING TO FOUNDATION. SECURELY TIE ALL BARS IN LOCATION BEFORE PLACING CONCRETE. MIN. CLEAR SPACING BETWEEN PARALLEL REINFORCEMENT SHALL BE THE LARGER OF 1-1/2 TIMES NOMINAL BAR DIA. OR 1-1/3 TIMES MAX. AGGREGATE SIZE OR 1-1/2". CLEAR SPACING LIMITATION APPLIES ALSO TO CLEAR DISTANCE BETWEEN A CONTACT LAP SPLICE AND ADJACENT SPLICES OR BARS.
9. MIN. REINFORCING AT EDGES OF CONCRETE WALL OPENINGS SHALL BE (2) #5 BARS. EXTEND THE GREATER OF THE DEVELOPMENT LENGTH OF THE BAR PER TYPICAL REBAR LAP SCHEDULE OR 24" MIN. PAST EDGES OF OPENING U.N.O. HOOK ENDS AT INTERFERENCE WITH EXTENSION.

F. WOOD REQUIREMENTS:

1. ALL SILL PLATES AND OTHER WOOD MEMBERS IN CONTACT WITH CONCRETE OR CMU SHALL BE PRESSURE TREATED LUMBER PER THE APPLICABLE AWPA STANDARD U1 AND M4 FOR THE SPECIES, PRODUCT, PRESERVATIVE AND END USE. REDWOOD IS ALSO AN ACCEPTABLE ALTERNATIVE. PRESERVATIVES SHALL BE LISTED IN SECTION 4 OF AWPA U1.
2. FASTENERS FOR PRESSURE PRESERVATIVE AND FIRE-RETARDANT-TREATED WOOD SHALL BE OF HOT-DIPPED GALVANIZED STEEL, STAINLESS STEEL, SILICON BRONZE OR COPPER OR ONE-HALF-INCH DIAMETER OR GREATER STEEL BOLTS.
3. ALL SOLID SAWN LUMBER SHALL BE DOUGLAS FIR NO. 2 GRADE OR HIGHER. SILL PLATES SHALL HAVE A WIDTH AT LEAST EQUAL TO THE WIDTH OF THE WALL STUDS. ALL STUDS IN STUD WALLS SHALL BE CUT SO THAT STUDS HAVE FULL END BEARING AND IS FLUSH AGAINST SILL PLATE.
4. ALL SHEATHING PANELS SHOULD BE IDENTIFIED WITH THE APPROPRIATE TRADEMARK OF APA, AND SHALL MEET THE LATEST REQUIREMENTS OF THE LATEST EDITION OF VOLUNTARY PRODUCT STANDARD PS1, VOLUNTARY PRODUCT STANDARD PS2, OR APA PRP-108 PERFORMANCE STANDARDS.
5. ROOF AND FLOOR SHEATHING SHALL BE APA RATED SHEATHING EXP 1 OR EXT AND SHALL HAVE A SPAN RATING OF 24/16 MINIMUM. ALL PANELS WHICH HAVE ANY EDGE OR SURFACE EXPOSED LONG TERM TO THE WEATHER SHALL BE CLASSIFIED AS EXT. OSB OR EQUIVALENT GRADE AND SPAN RATING MAY BE USED IN LIEU OF PLYWOOD PROVIDED THE THICKNESS IS EQUAL OR GREATER THAN THE REQUIRED PLYWOOD THICKNESS. SHEATHING THICKNESS SHALL BE AS SPECIFIED ON THE PLANS. EDGE NAILING AND FIELD NAILING SHALL BE AS SPECIFIED ON THE PLANS. ROOF SHEATHING SHALL BE ORIENTED SO THAT THE LONG AXIS IS PERPENDICULAR TO THE TRUSS SPAN DIRECTION. THE SHORT EDGES OF THE PLYWOOD SHOULD BE STAGGERED (CASE 1 IBC TABLE 2306.3.1). ALL PANEL EDGES SHOULD BE BLOCKED.
6. NAILS SHALL CONFORM TO REQUIREMENTS OF ASTM F 1667. NAILS USED FOR FRAMING AND SHEATHING CONNECTIONS SHALL HAVE MINIMUM AVERAGE BENDING YIELD STRENGTHS AS FOLLOWS:
   80 KIPS PER SQUARE INCH 0.177" < SHANK DIA. < 0.254"
   90 KIPS PER SQUARE INCH 0.142" < SHANK DIA. < 0.177"
   100 KIPS PER SQUARE INCH 0.099" < SHANK DIA. < 0.142"
7. ENGINEERED WOOD JOISTS (I-JOISTS) SHALL BE BCI 6000 1.8 (ICC ESR-1336), LP SOLIDSTART LPI 20 PLUS (ICC EST-1305), OR TRUS JOIST TJI 210 (ICC ESR-1153) MINIMUM SERIES. SUBSTITUTIONS TO PRODUCT SERIES, JOIST DEPTHS, AND ON-CENTER SPACINGS ARE ALLOWED TO THE EXTENT THAT THE PROPOSED SUBSTITUTIONS MEETS OR EXCEEDS THE MINIMUM SPECIFIED DESIGN CRITERIA FOR UNIFORMLY DISTRIBUTED LOADING PREVIOUSLY LISTED AND DEFLECTION LIMITS LISTED BELOW FOR THE JOIST SPANS SHOWN ON THE FRAMING PLANS. SPECIAL LOADING CASES NOT COVERED BY THE MANUFACTURER'S PUBLISHED SPAN TABLES SHALL ONLY BE APPROVED BY THE E.O.R.

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HYDE PARK CITY

CITY HALL WELL HOUSE

ABBREVIATIONS AND LEGEND

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	25 of 72	ST1

G. PREFABRICATED WOOD TRUSS REQUIREMENTS:

1. PREFABRICATED WOOD TRUSSES SHALL BE DESIGNED, FABRICATED, AND ERECTED IN ACCORDANCE WITH THE TRUSS PLATE INSTITUTE "NATIONAL DESIGN STANDARD FOR METAL PLATE CONNECTED WOOD TRUSS CONSTRUCTION" AND SHALL BE PROVIDED BY AN APPROVED FABRICATOR. PREFABRICATED OPEN WEB TRUSSES SHALL BE DESIGNED, FABRICATED, AND SUPPLIED BY REDBUILT (ICC ESR-1774) OR OTHER ICC APPROVED FABRICATOR WITH THE PRIOR APPROVAL OF THE E.O.R. DESIGN LOADS FOR OPEN WEB TRUSSES SHOWN ON THE DRAWINGS ARE ALLOWABLE STRESS DESIGN (ASD) LOADS.
2. ALL MEMBERS RECEIVING FASTENERS PER STRUCTURAL DRAWINGS SHALL HAVE A SPECIFIC GRAVITY OF 0.42 OR HIGHER, U.N.O.
3. MAX. DEFLECTION LIMITS FOR TRUSSES/RAFTERS SHALL BE AS FOLLOWS:

LOCATION:	LIVE LOAD:	TOTAL LOAD:
ROOF	SPAN/360	SPAN/240

4. TRUSSES SHALL BE DESIGNED TO SUPPORT THEIR SELF WEIGHT, PLUS LIVE LOAD, SUPERIMPOSED DEAD LOAD (INCLUDING BUT NOT LIMITED TO ALL MECHANICAL AND OTHER EQUIPMENT), AND ATTIC LOADS AS REQUIRED PER IBC TABLE 1607.1 AND SHALL BE DESIGNED TO RESIST ALL DRAG FORCES, SHEAR WALL UPLIFT AND DOWNWARD LOADS, AND OTHER SPECIAL LOADS NOTED ON THE DRAWINGS.
5. ALL TRUSS TO TRUSS CONNECTIONS SHALL BE SPECIFIED BY THE TRUSS DESIGNER AND INCLUDED IN THE TRUSS DIAGRAMS. ALL CONNECTORS SHALL HAVE CURRENT ICC APPROVAL.
6. TRUSS DIAGRAMS AND KEYED LAYOUT SHALL BE AVAILABLE TO FIELD INSPECTOR AT THE JOB-SITE AT THE TIME OF ROOF NAILING AND FRAMING INSPECTION.
7. SHOP DRAWINGS, ERECTION DRAWINGS, AND DESIGN CALCULATIONS SEALED BY AN APPROPRIATELY REGISTERED ENGINEER SHALL BE SUBMITTED FOR REVIEW. SHOP DRAWINGS SHALL SHOW ANY SPECIAL DETAILS REQUIRED AT BEARING POINTS.
8. BRIDGING SIZE AND SPACING SHALL BE AS DESIGNATED BY THE TRUSS MANUFACTURER.

H. QUALITY CONTROL AND INSPECTION REQUIREMENTS:

1. QUALITY CONTROL AND INSPECTIONS SHALL BE PERFORMED AS REQUIRED IN IBC 2021 CHAPTER 17. AS STATED IN IBC 2021 1704.2.1, "THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE AND ENGINEERS OF RECORD INVOLVED IN THE DESIGN OF THE PROJECT ARE PERMITTED TO ACT AS THE APPROVED AGENCY AND THEIR PERSONNEL ARE PERMITTED TO ACT AS THE SPECIAL INSPECTORS FOR THE WORK DESIGNED BY THEM, PROVIDED THEY QUALIFY AS SPECIAL INSPECTORS."

I. SPECIAL INSPECTION REQUIREMENTS:

1. SPECIAL INSPECTION AND QUALITY ASSURANCE, AS REQUIRED BY SECTION 1705 OF THE IBC, SHALL BE PROVIDED BY AN INDEPENDENT AGENCY EMPLOYED BY THE OWNER UNLESS WAIVED BY THE BUILDING OFFICIAL. THE CONTRACTOR SHALL COORDINATE AND COOPERATE WITH THE REQUIRED INSPECTIONS. ALL TESTING AND INSPECTION REPORTS SHALL BE SENT TO THE ENGINEER OF RECORD FOR REVIEW. ITEMS REQUIRING SPECIAL INSPECTION AND QUALITY ASSURANCE ARE SHOWN IN THIS SECTION.
2. SOILS PER IBC SECTION 1705.6 AND TABLE 1705.6 BELOW:
   - 2.1. SPECIAL INSPECTION SHALL BE PROVIDED PRIOR TO POURING CONCRETE FOOTINGS.
   - 2.2. SPECIAL INSPECTION SHALL BE PROVIDED PRIOR TO PLACEMENT OF FILL AND DURING PLACEMENT OF FILL.

TABLE 1705.6
REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE OF INSPECTION OR TEST	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	–	X
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL.	–	X
3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS.	–	X
4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL.	X	–
5. PRIOR TO PLACEMENT OF COMPACTED FILL, INSPECT SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY.	–	X

3. CONCRETE CONSTRUCTION PER IBC SECTION 1705.3 AND TABLE 1705.3 BELOW:

TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE OF INSPECTION OR TEST	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[b]	IBC REFERENCE
1. INSPECT REINFORCEMENT, INCLUDING PRESTRESSING TENDONS, AND VERIFY PLACEMENT.	–	X	ACI 318: CH. 20, 25.2, 25.3, 26.6.1–26.6.3	1908.4
2. REINFORCING BAR WELDING: a. VERIFY WELDABILITY OF REINFORCING BARS OTHER THAN ASTM A706. b. INSPECT SINGLE-PASS FILLET WELDS, MAXIMUM 5/16. c. INSPECT ALL OTHER WELDS.	– – X	X X –	AWS D1.4 ACI 318: 26.6.4	–
3. INSPECT ANCHORS CAST IN CONCRETE.	–	X	ACI 318: 17.8.2	–
4. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS:[a] a. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS. b. MECHANICAL ANCHORS AND ADHESIVE ANCHORS NOT DEFINED IN 4.a.	X –	– X		–
5. VERIFY USE OF REQUIRED DESIGN MIX.	–	X	ACI 318: CH. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
6. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	–	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	1908.10
7. INSPECT CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	X	–	ACI 318: 26.5	1908.6, 1908.7, 1908.8
8. VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.	–	X	ACI 318: 26.5.3–26.5.5	1908.9
9. INSPECT PRESTRESSED CONCRETE OF: a. APPLICATION OF PRESTRESSING FORCES. b. GROUTING OF BONDED PRESTRESSING TENDONS.	X X	– –	ACI 318: 26.10	–
10. INSPECT ERECTION OF PRECAST CONCRETE MEMBERS.	–	X	ACI 318: 26.9	–
11. VERIFY IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE AND PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS AND STRUCTURAL SLABS.	–	X	ACI 318: 26.11.2	–
12. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	–	X	ACI 318: 26.11.1.2(b)	–

a. WHERE APPLICABLE, SEE SECTION 1705.13, SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE.
b. SPECIFIC REQUIREMENTS FOR SPECIAL INSPECTION SHALL BE INCLUDED IN THE RESEARCH REPORT FOR THE ANCHOR ISSUED BY AN APPROVED SOURCE IN ACCORDANCE WITH 17.8.2 IN ACI 318, OR OTHER QUALIFICATION PROCEDURES. WHERE SPECIFIC REQUIREMENTS ARE NOT PROVIDED, SPECIAL INSPECTION REQUIREMENTS SHALL BE SPECIFIED BY THE REGISTERED DESIGN PROFESSIONAL AND SHALL BE APPROVED BY THE BUILDING OFFICIAL PRIOR TO THE COMMENCEMENT OF THE WORK.

3. CONCRETE CONSTRUCTION PER IBC SECTION 1705.3:
   - 3.1. SPECIAL INSPECTIONS NOT REQ'D. PER SECTION 1705.3, EXCEPTION 2.3 (STRUCTURAL DESIGN OF FOUNDATIONS IS BASED ON COMPRESSIVE STRENGTH f'_c = 2,500 psi)

J. DEFERRED SUBMITTAL REQUIREMENTS:

1. SHOP DRAWINGS OR REPORTS FOR THE FOLLOWING ITEMS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER OF RECORD PRIOR TO FABRICATION OR CONSTRUCTION (AS APPLICABLE) U.N.O.

   CONCRETE CYLINDER TESTS
   REINFORCING STEEL
   CONCRETE MIX DESIGN
   STRUCTURAL STEEL

2. CONTRACTOR SHALL REVIEW AND STAMP SHOP DRAWINGS PRIOR TO SUBMITTING. CONTRACTOR'S REVIEW SHALL CHECK FOR COMPLETENESS/COMPLIANCE WITH CONTRACT DOCUMENTS.
3. SHOP DRAWINGS ARE REVIEWED BY ENGINEER ONLY FOR GENERAL COMPLIANCE WITH THE STRUCTURAL DRAWINGS. RESPONSIBILITY FOR CORRECTNESS SHALL REST WITH THE CONTRACTOR. SHOP DRAWINGS DO NOT SUPERSEDE OR REPLACE THE CONTRACT DRAWINGS OR SPECIFICATIONS. CHANGES, SUBSTITUTIONS, OR DEVIATIONS FROM CONTRACT DRAWINGS AND/OR SPECIFICATIONS WILL NOT BE ACCEPTED VIA SHOP DRAWING REVIEW. ALL SUCH MODIFICATIONS SHALL BE SUBMITTED SEPARATELY FOR ENGINEER'S REVIEW.
4. PREFABRICATED COMPONENTS, SPECIALTY ITEMS, OR DESIGN-BUILD ELEMENTS NOTED ON THE STRUCTURAL DRAWINGS, BUT WHICH REQUIRE THE MFR. OR SUPPLIER TO PROVIDE THE DESIGN, SHALL BE SUBMITTED BY THE CONTRACTOR TO THE ARCHITECT AND/OR ENGINEER FOR REVIEW AS A DEFERRED SUBMITTAL. DEFERRED SUBMITTALS REQ'D. BY THE STRUCTURAL ENGINEER OF RECORD SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:

   STEEL JOISTS/JOIST GIRDERS
   STEEL RAILING

5. DEFERRED SUBMITTALS SHALL INCLUDE CALCULATIONS AND DRAWINGS PREPARED AND STAMPED BY AN APPROPRIATELY LICENSED ENGINEER (SPECIALTY ENGINEER) SHOWING LOCATION AND MAGNITUDE OF LOADS, CONFIGURATION AND SIZE OF MEMBERS, AND COMPATIBILITY OF SUBMITTAL ITEM WITH THE PRIMARY STRUCTURAL SYSTEM.
6. THE PURPOSE OF THE STRUCTURAL ENGINEER'S REVIEW OF DEFERRED SUBMITTALS SHALL BE LIMITED TO DETERMINING THAT THE DRAWINGS AND CALCULATIONS HAVE BEEN PROPERLY SEALED, THAT THE LOAD CRITERIA IS IN GENERAL CONFORMANCE WITH THE CONTRACT DOCUMENTS AND WITH THE REFERENCED BUILDING CODE, THAT CONNECTIONS TO THE PRIMARY STRUCTURE ARE COMPATIBLE WITH THE PRIMARY DESIGN, AND THAT THE PRIMARY STRUCTURE IS CAPABLE OF SUPPORTING THE IMPOSED LOADS.
7. THE STRUCTURAL ENGINEER WILL RELY UPON THE SPECIALTY ENGINEER'S SEAL AS CERTIFICATION THAT THE ITEMS DESIGNED BY THE SPECIALTY ENGINEER COMPLY WITH THE CRITERIA SET FORTH IN THE CONTRACT DOCUMENTS AND APPLICABLE CODES AND STANDARDS. THE STRUCTURAL ENGINEER SHALL NOT BE RESPONSIBLE FOR THE ADEQUACY OF DESIGNS PROVIDED BY OTHERS.
8. FOR ALL SUBMITTALS, ANY CORRECTIONS NOTED WILL BE MARKED ON ONE (1) COPY SET ONLY AND RETURNED. ADDITIONAL COPIES OF ANY SUBMITTAL WILL BE RETURNED UNMARKED. CONTRACTOR SHALL BE RESPONSIBLE FOR REPRODUCING ENGINEER'S CORRECTIONS ON ADDITIONAL COPIES REQ'D. ONE COPY SET MAY BE RETAINED FOR THE ENGINEER'S RECORDS. ALLOW FIVE (5) TO TEN (10) WORKING DAYS FOR THE ENGINEER'S REVIEW.
9. REFER TO APPLICABLE G.S.N. SECTIONS FOR FURTHER REQUIREMENTS SPECIFIC TO INDIVIDUAL SUBMITTALS.

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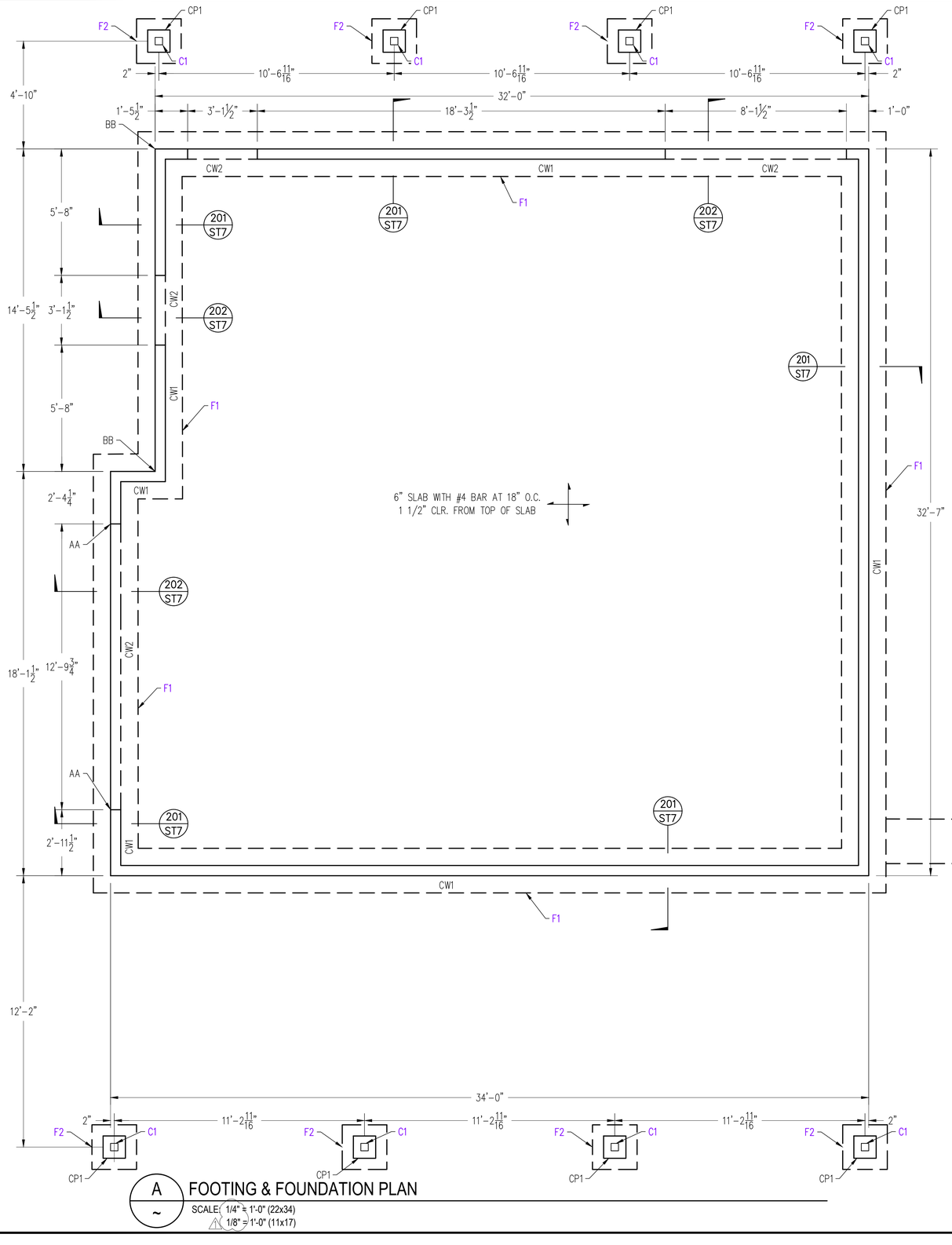
CITY HALL WELL HOUSE
ABBREVIATIONS AND LEGEND

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	26 of 72	ST2



A FOOTING & FOUNDATION PLAN

SCALE: 1/4" = 1'-0" (22x34)
1/8" = 1'-0" (11x17)

SEE CIVIL FOR CMU SCREEN WALL LAYOUT

CONCRETE WALL SCHEDULE

MARK	THICKNESS	HEIGHT	VERT. REINFORCING	HORIZ. REINFORCING	TOP OF WALL ELEV.
CW1	8"	2'-0"	#4 AT 9" O.C. CENTERED	#4 AT 9" O.C. CENTERED	4586.40'
CW2	8"	1'-0"	#4 AT 9" O.C. CENTERED	#4 AT 9" O.C. CENTERED	4585.90'
CP1	1'-0"	2'-0"	SEE DETAIL 209/ST7	SEE DETAIL 209/ST7	4586.40'

HOLDOWN SCHEDULE

MARK	TYPE	NAILING	ANCHOR BOLT	MIN. BOLT EMBED.
AA	LSTHD8	(16) 10d x 3.25"	N/A	N/A
BB	SDHD14	(24) 10d x 3.25"	N/A	N/A

FOOTING SCHEDULE

MARK	WIDTH	LENGTH	THICKNESS	REINFORCEMENT	BOT. OF FOOTING ELEV.
F1	2'-0"	CONT.	12"	#4@9" AT BOTTOM	4583.40'
F2	2'-0"	2'-0"	12"	(4) #4 E.W. AT BOTTOM	4583.40'

COLUMN SCHEDULE

MARK	SIZE	BASEPLATE TYPE	BASEPLATE DIM.	ANCHOR BOLT	POST CAP
C1	6"x6"	ABU POST BASE	ABU66Z	1/2" DIA. TITEN HD SCREW ANCHOR W/ 6" MIN. EMBED. INTO CONC.	AC6 POST CAP

- SEE TYPICAL BASEPLATE DETAIL 104/ST7 FOR ADDITIONAL INFORMATION
- ANCHOR RODS SHALL BE ASTM F1554 GRADE 36 ALL-THREAD RODS WITH A MIN. OF 9" EMBED. INTO THE CONC. PIER
- ALL 6"x6" WOOD POSTS TO BE WRAPPED IN WHITE ALUMINUM FASCIA.

FOUNDATION REQUIREMENTS

F1. VERIFY LOCATION AND SIZE OF ALL INSERTS AND OPENINGS IN SLAB, WALLS, AND FLOORS WITH ARCH'L, MECH, PLUMBING, AND ELECT. PRIOR TO CONSTRUCTION.

F2. ALL FOOTINGS AND SLABS SHALL BE PLACED ON STRUCTURAL FILL AS DEFINED IN THE GEOTECHNICAL REPORT. THE MOISTURE CONTENT OF STRUCTURAL FILL SHOULD BE CONDITIONED TO NEAR OPTIMUM WATER CONTENT, PLACED IN UNIFORM LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED PER REQUIREMENTS OF THE GEOTECHNICAL REPORT.

F3. ALL STANDARD WALL FOOTINGS SHALL EXTEND TO AT LEAST 30 INCHES BELOW FINISHED GRADE FOR FROST PROTECTION.

F4. F1, F2, F3, ETC... DENOTES FOOTING PER FOOTING SCHEDULE ON THIS SHEET.

F5. CW1, CW2, CW3, ETC... DENOTES CONCRETE WALL PER CONCRETE WALL SCHEDULE ON THIS SHEET.

F6. CONCRETE CONTROL JOINTS SHOULD BE AS SHOWN ON THESE PLANS AND PER DETAIL 104 ON SHEET ST6.

F7. CONCRETE CONTRACTOR TO REFER TO SHEET ST8 FOR REQUIRED REINFORCEMENT TO MATCH MASONRY REINFORCEMENT.

F8. PLACE SLABS ON GRADE OVER VAPOR BARRIER (AS REQ'D) PER THE GEOTECHNICAL REPORT.

F9. FOR SMALL PIPES/CONDUITS, THROUGH FOUNDATION WALLS AND FOOTINGS, SEE DETAIL 103 ON SHEET ST6.

F10. CONCRETE LAP SPLICE REQUIREMENTS PER DETAIL 102 ON SHEET ST6.

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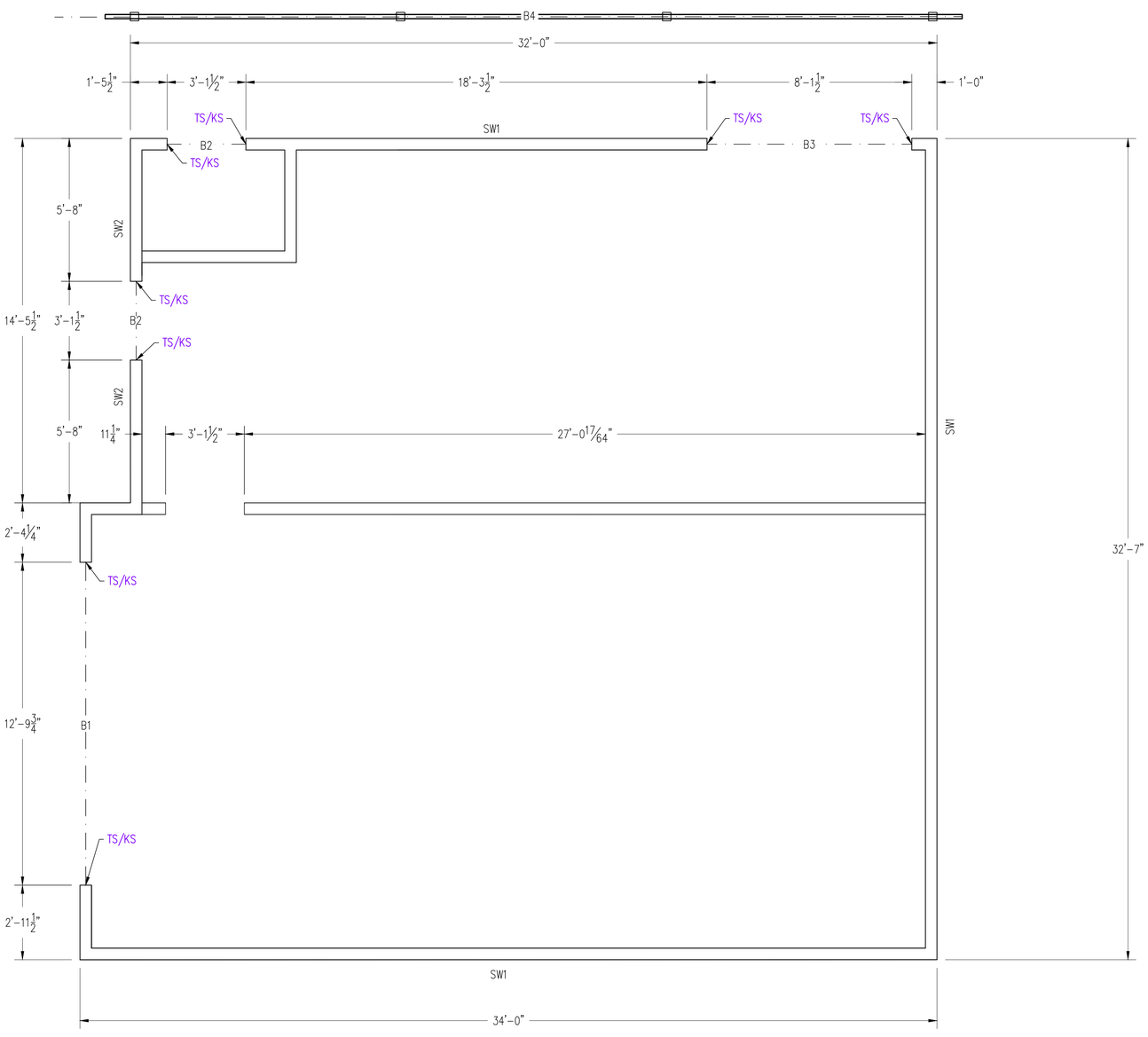
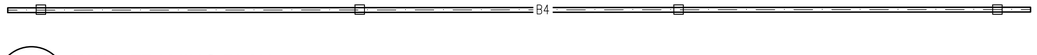
FOOTING & FOUNDATION PLAN

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	27 of 72	ST3





A ~ WALL FRAMING PLAN

SCALE: 3/8" = 1'-0" (22x34)
3/16" = 1'-0" (11x17) ⚠1

FRAMING REQUIREMENTS

F1. NOTIFY ENGINEER OF RECORD FOR PENETRATIONS THROUGH BEAMS, JOISTS, COLUMNS AND OTHER STRUCTURAL MEMBERS. PENETRATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE ENGINEER AND MANUFACTURER OF THE STRUCTURAL ELEMENT.

F2. ALL BEAMS, HEADERS, JOISTS, AND TRUSSES SHALL HAVE SUFFICIENT BEARING AREA PER REQUIREMENTS OF THE AMERICAN WOOD COUNCIL NATIONAL DESIGN SPECIFICATION (NDS) 2018. ALL BEARING POINTS SHALL HAVE A CONTINUOUS LOAD PATH TO FOUNDATIONS. FRAMING NAILING SHALL BE PER DETAIL 208 ON ST7.

F3. ALL FINISHES SHALL BE PER THE ARCHITECT, CONTRACTOR, AND OWNER. ENGINEER OF RECORD IS NOT RESPONSIBLE FOR WATER PROOFING AND CORROSION PROTECTION OF STRUCTURAL ELEMENTS. THIS RESPONSIBILITY FALLS SOLELY UPON THE CONTRACTOR AND ARCHITECT.

F4. ALL HARDWARE SHOWN ON THE PLANS SHALL BE SIMPSON STRONG TIE OR APPROVED EQUAL. SEE G.S.N. FOR REQUIREMENTS..

F5. DOUBLE 2x BEAMS SHOULD BE STITCHED TOGETHER PER MFR. RECOMMENDATIONS.

F6. B1, B2, B3, ETC... DENOTES THE TYPE OF BEAM OR HEADER PER THE BEAM/HEADER SCHEDULE.

F7. AA, BB, CC, ETC... DENOTES THE TYPE OF SHEAR WALL HOLDOWN PER THE HOLDOWN SCHEDULE.

F8. KS = KING STUD, TS = TRIMMER STUD, TP = TRIMMER POST, ES = END STUD, EP = END POST. PROVIDE A MINIMUM OF (1) KS AND (1) TS AT ALL OPENINGS, U.N.O. ON PLAN OR IN BEAM SCHEDULE ON THIS SHEET. PROVIDE CONTINUOUS BEARING TO THE FOUNDATION FOR (2) TS OR GREATER.

F9. EXTERIOR STUD WALLS SHALL BE 2x6 AT 16" O.C. 2x6 STUDS MAY BE REPLACED BY MANUFACTURED STUD OF EQUAL OR GREATER DIMENSIONS. BOTTOM PLATES SHALL BE 2x"WALL WIDTH" TREATED LUMBER CONNECTED TO THE FOUNDATION WITH 1/2" DIA. ANCHOR BOLTS AT 32" O.C. WITH 7" MINIMUM EMBEDMENT INTO CONCRETE, U.N.O. IN SHEAR WALL SCHEDULE. ANCHOR BOLTS IN SHEAR WALLS REQUIRE 0.25"x3"x3" SQUARE PLATE WASHERS.

SHEAR WALL SCHEDULE

MARK	WALL	PLY/OSB THICK	FASTENERS FIELD	FASTENERS EDGE	BLOCK AT ADJOINGING PANEL EDGES	BOTTOM PLATE & ANCHOR BOLTS/NAILING	END STUDS
SW1	2x6	7/16"	10d AT 12" O.C.	10d AT 6" O.C.	2x6	2x6 W/ 1/2" DIA. A.B. AT 32" O.C. AT FOUND. 2x6 W/ 16d AT 4" O.C. AT FRAMING	(2) 2x6 STUDS
SW2	2x6	7/16"	10d AT 12" O.C.	10d AT 3" O.C.	(2) 2x6	2x6 W/ 1/2" DIA. A.B. AT 32" O.C. AT FOUND. 2x6 W/ 16d AT 4" O.C. AT FRAMING	(2) 2x6 STUDS

BEAM SCHEDULE

MARK	TYPE	SIZE	TRIMMER STUDS/POST	KING STUDS/POST
B1	LVL	(2) 1.75X9.25	(2) 2X6	(3) 2X6
B2	DFL #2	(2) 2X8	(1) 2X6	(1) 2X6
B3	LVL	(2) 1.75X18	(2) 2X6	(2) 2X6
B4 ⚠1	GLULAM	5.5X7.5	-	-

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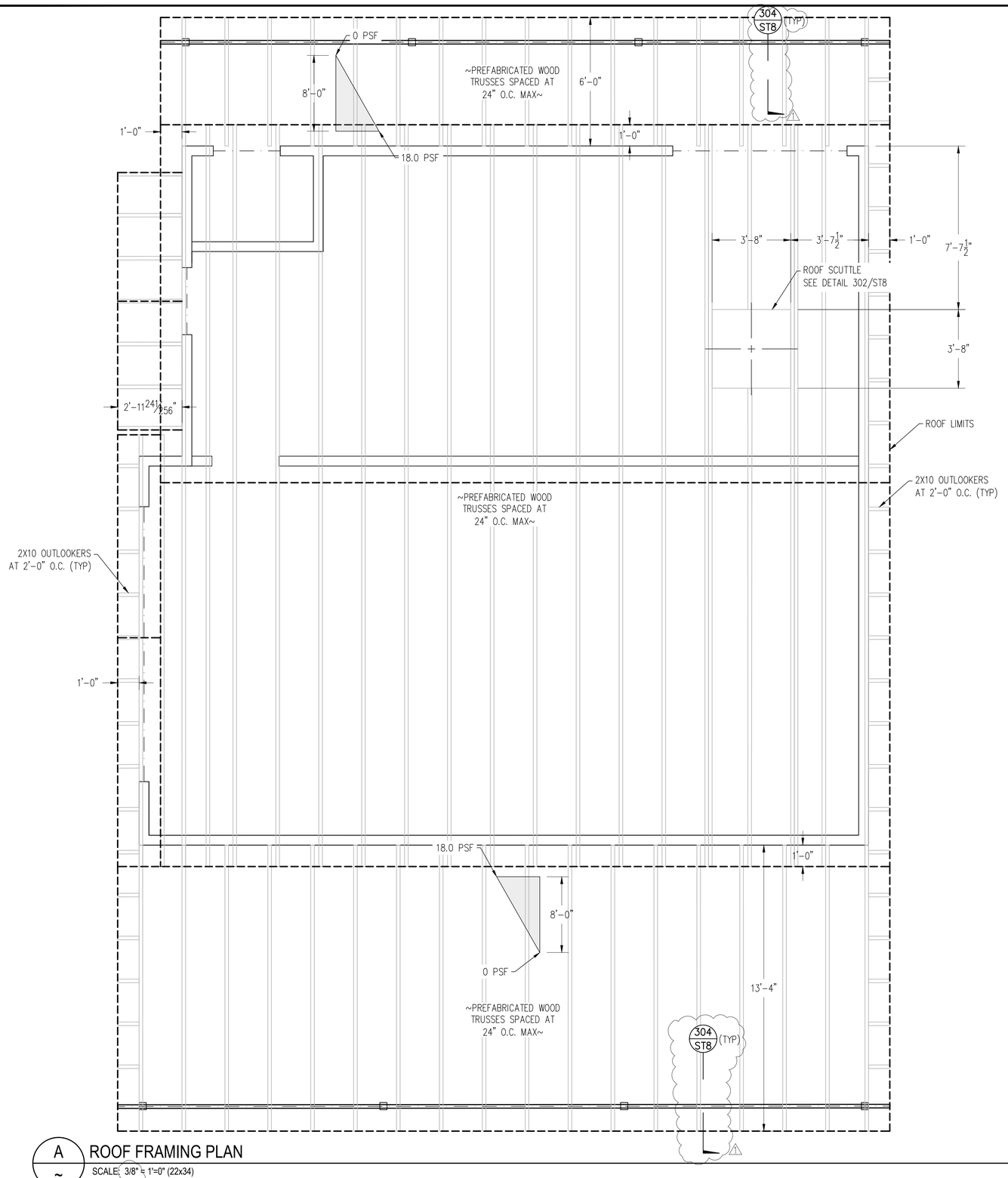
FLOOR FRAMING PLAN

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	28 of 72	ST4



A ~ ROOF FRAMING PLAN

SCALE: 3/8" = 1'=0" (22x34)
⚠1 3/16"= 1'-0" (11x17)

ROOF FRAMING REQUIREMENTS

R1. NOTIFY ENGINEER OF RECORD FOR PENETRATIONS THROUGH BEAMS, JOISTS, COLUMNS AND OTHER STRUCTURAL MEMBERS. PENETRATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE ENGINEER AND MANUFACTURER OF THE STRUCTURAL ELEMENT.

R2. ALL BEAMS, HEADERS, JOISTS, AND TRUSSES SHALL HAVE SUFFICIENT BEARING AREA PER REQUIREMENTS OF THE AMERICAN IRON AND STEEL INSTITUTE (AISI). ALL BEARING POINTS SHALL HAVE A CONTINUOUS LOAD PATH TO FOUNDATIONS.

R3. ALL FINISHES SHALL BE PER THE OWNER. ENGINEER OF RECORD IS NOT RESPONSIBLE FOR WATER PROOFING AND CORROSION PROTECTION OF STRUCTURAL ELEMENTS. THIS RESPONSIBILITY FALLS SOLELY UPON THE CONTRACTOR .

R4. ALL HARDWARE SHOWN ON THE PLANS SHALL BE SIMPSON STRONG TIE OR APPROVED EQUAL. SEE G.S.N. FOR REQUIREMENTS.

R5. B1, B2, B3, ETC... DENOTES THE TYPE OF BEAM OR HEADER PER THE BEAM/HEADER SCHEDULE.

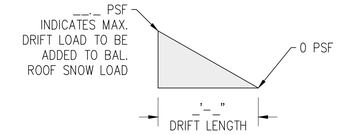
R6. SW1, SW2, SW3, ETC... DENOTES THE TYPE OF SHEAR WALL PER THE SHEAR WALL SCHEDULE.

R7. KS = KING STUD, TS = TRIMMER STUD, TP = TRIMMER POST, ES = END STUD, EP = END POST. PROVIDE A MINIMUM OF (1) KS AND (2) TS AT ALL OPENINGS, U.N.O. PROVIDE CONTINUOUS BEARING TO THE FOUNDATION FOR (2) TS OR GREATER.

R8. WHERE NOT DESIGNATED AS A SHEAR WALL, ALL EXTERIOR WALLS SHALL BE SHEATHED PER SW1 OF THE SHEAR WALL SCHEDULE.

R9. ALL MAN DOORS SHALL BE 3068 HOLLOW METAL INSULATED DOORS, ALL ROLL-UP DOORS SHALL BE 8070 HOLLOW METAL INSULATED DOORS W/ HARDWARE PER THE MANUFACTURER.

R10. DRIFT LOADS SHALL BE AS INDICATED ON THE PLANS BY THE FOLLOWING SYMBOL AND NOTATIONS AS SHOWN BELOW:



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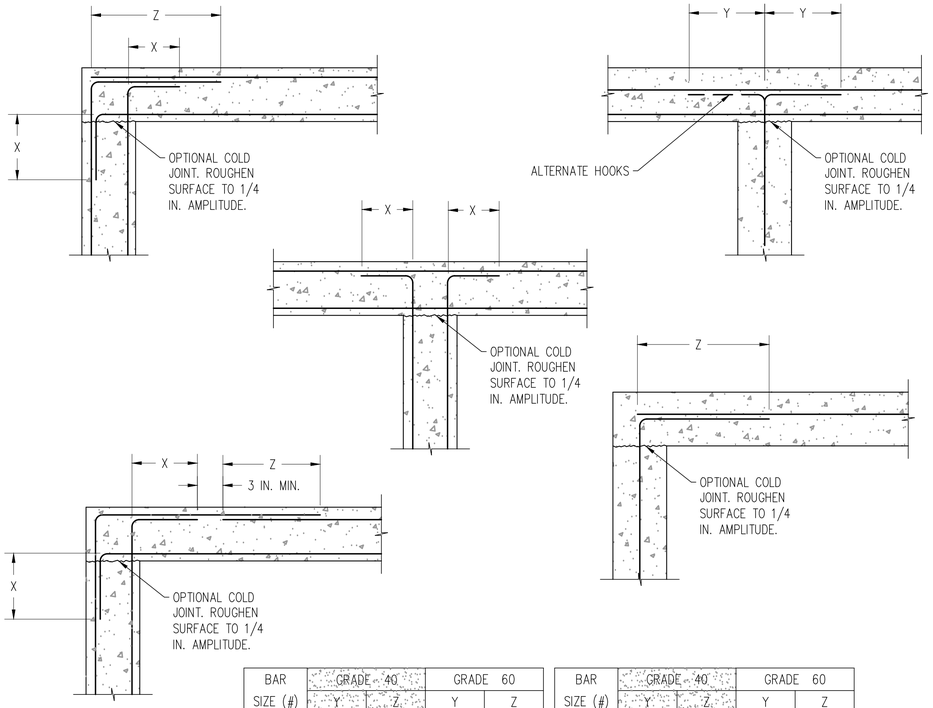
ROOF FRAMING PLAN

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	29 of 72	ST5

BID SET



BAR SIZE (#)	GRADE 40		GRADE 60	
	Y	Z	Y	Z
#4	12"	20"	12"	20"
#5	12"	20"	15"	26"
#6	13"	22"	18"	31"

BAR SIZE (#)	GRADE 40		GRADE 60	
	Y	Z	Y	Z
# 7	18"	31"	23"	39"
# 8	25"	39"	30"	51"
# 9	29"	49"	38"	65"

1. REFER TO STD. HOOK DETAIL FOR LENGTH OF DIMENSION "X"
2. THIS DETAIL TO BE USED ONLY WHEN NO OHTER DETAIL IS INDICATED ON THE DRAWINGS.

101 ~ HORIZONTAL REINF. AT WALL INTERSECTIONS

NTS

CONCRETE LAP AND DEVELOPMENT SCHEDULE

BAR SIZE (#)	F'c = 4500 PSI TENSION			
	LTE TOP ①	LTE OTHER	LTS TOP ①	LTS OTHER
#3	15	12	20	15
#4	20	16	26	20
#5	25	19	32	25
#6	30	23	39	30
#7	54	42	71	54
#8	62	48	81	62

A. ALL TABULATED VALUES ARE IN UNITS OF INCHES U.N.O.

B. AT CONTRACTOR'S OPTION, MECHANICAL SPLICE COUPLERS PER G.S.N. MAY BE USED IN LIEU OF LAP SPLICES

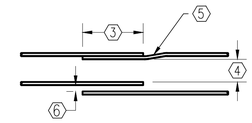
C. SEE G.S.N. FOR ACTUAL CONCRETE SPECIFICATIONS AND MIN. CLR. COVER / CLR. SPACING REQUIREMENTS

D. SCHEDULED VALUES ARE BASED ON CLASS "B" TENSION LAP SPLICES U.N.O., NORMAL WT. CONCRETE, AND UNCOATED GRADE 60 REINF. FOR OTHER CONDITIONS NOTED BELOW, MODIFY TABULATED VALUES AS INDICATED:

E. E.1. FOR DEVELOPMENT LENGTH AND CLASS "A" LAP SPLICES, WHERE SPECIFICALLY NOTED ON PLANS OR DETAILS, DIVIDE TABULATED VALUES BY 1.3. CLASS "A" SPLICES SHALL BE LOCATED SUCH THAT NO MORE THAN 1/2 OF THE TOTAL REINF. IS LAPPED WITHIN THE REQUIRED LAP LENGTH
E.2. FOR LIGHTWEIGHT CONCRETE, MULTIPLY TABULATED VALUES BY 1.3
E.3. FOR EPOXY COATED REBAR, MULTIPLY TABULATED VALUES BY 1.5
E.4. FOR GRADE 75 REINF., MULTIPLY TABULATED VALUES BY 1.25

F. LCE = COMPRESSION EMBEDMENT LENGTH
LCS = COMPRESSION LAP SPLICE LENGTH
LTE = TENSION EMBEDMENT LENGTH
LTS = TENSION LAP SPLICE LENGTH

G. "TOP" BARS ARE HORIZONTAL BARS PLACED SUCH THAT MORE THAN 12 IN. OF FRESH CONCRETE IS CAST BELOW BAR. ALL BARS THAT ARE NOT "TOP" BARS ARE "OTHER" BARS UNLESS NOTED OTHERWISE ALL HOOKS SHALL EXTEND TO THE FAR FACE (LESS 2" COVER)



CONCRETE LAP AND DEVELOPMENT NOTES

① TOP BARS ARE HORIZ. BARS PLACED SUCH THAT MORE THAN 12" OF FRESH CONCRETE IS CAST IN MEMBER BELOW SPLICE

② WHERE BARS OF UNEQUAL SIZE LAP ONE ANOTHER, USE TABULATED LAP LENGTH FOR SMALLER BAR U.N.O.

③ LAP SPLICE LENGTH PER SCHEDULE

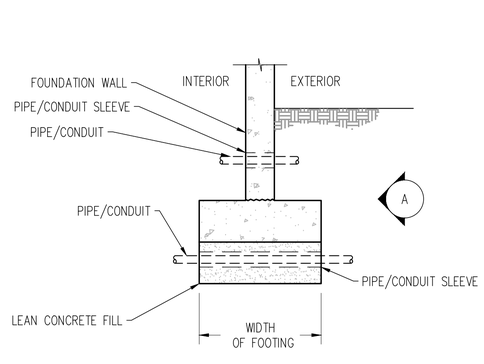
④ CLEAR DISTANCE BETWEEN ADJACENT BARS OR SPLICES TO BE USED IN DETERMINING APPLICABLE LAP LENGTH FROM SCHEDULE

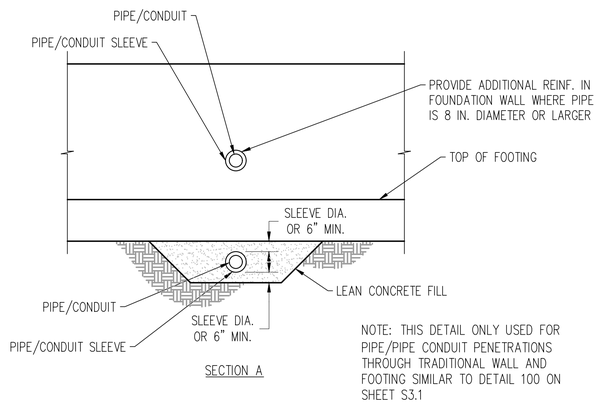
⑤ OPTIONAL OFFSET. SEE STANDARD REBAR BEND DETAILS FOR OFFSET REQUIREMENTS

⑥ FOR NON-CONTACT LAP SPLICES, MIN. CLEAR DISTANCE BETWEEN SPLICED BARS SHALL BE PER GENERAL STRUCTURAL NOTES. MAX. CLEAR DISTANCE SHALL BE 1/5 THE TABULATED LAP LENGTH OR (6"- "DB"), WHICHEVER IS LESS, WHERE "DB" = BAR DIA.

102 ~ CONCRETE LAP/DEVELOPMENT SCHEDULE

NTS



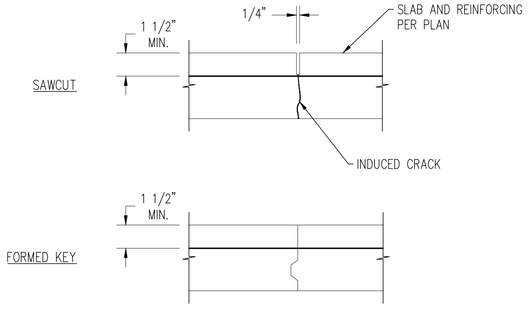


SECTION A

NOTE: THIS DETAIL ONLY USED FOR PIPE/PIPE CONDUIT PENETRATIONS THROUGH TRADITIONAL WALL AND FOOTING SIMILAR TO DETAIL 100 ON SHEET S3.1

103 ~ PIPE CONDUIT AT FOOTING

NTS



NOTE:
1. CONSTRUCTION JOINTS MADE WITH "PNA DIAMOND DOWELS".
2. CONTRACTOR'S OPTION TO USE EITHER SAWN OR FORMED JOINT

104 ~ CONTROL JOINT IN SLAB

NTS

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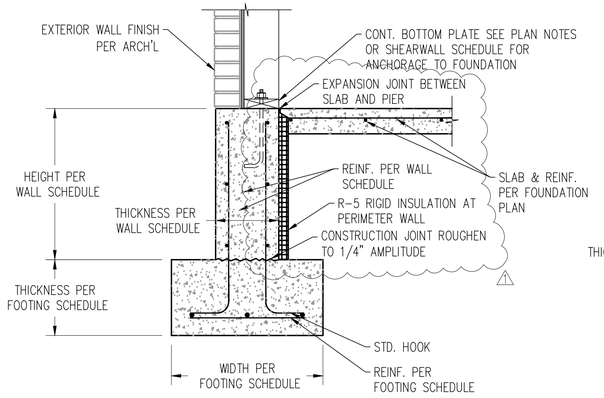
STRUCTURAL DETAILS

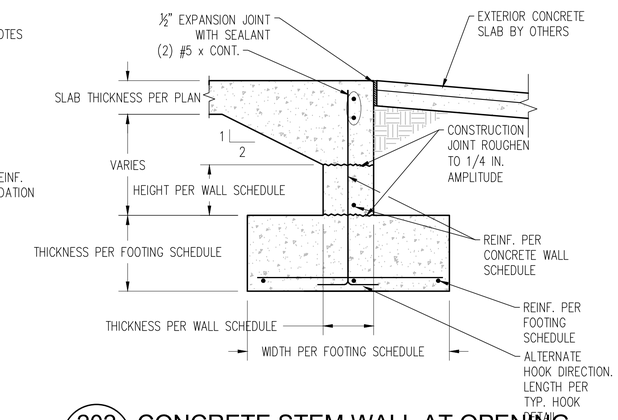
SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	30 of 72	ST6

BID SET



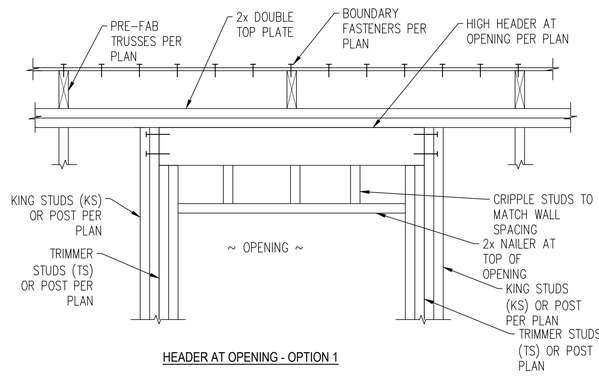
201 ~ CONCRETE STEM WALL AT FOOTING

NTS

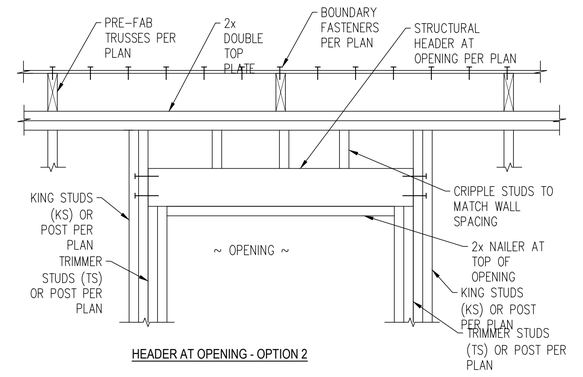


202 ~ CONCRETE STEM WALL AT OPENING

NTS



HEADER AT OPENING - OPTION 1

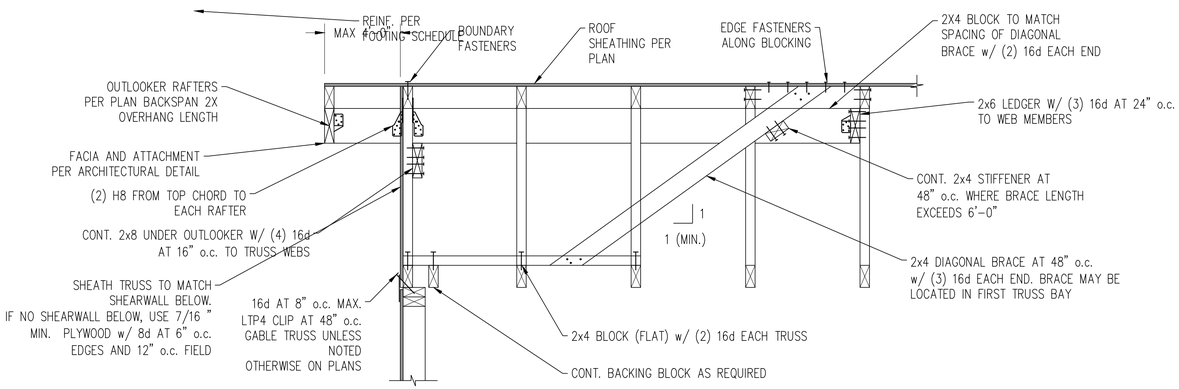


HEADER AT OPENING - OPTION 2

203 ~ FRAMING AT STRUCT. HEADER

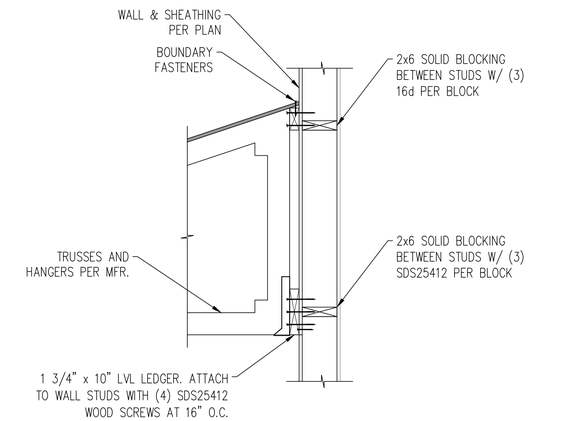
NTS

NOTE: (1) TRIMMER STUD AND (1) KING STUD REQUIRED WHERE NOT NOTED ON PLAN



204 ~ END WALL TRUSS

NTS



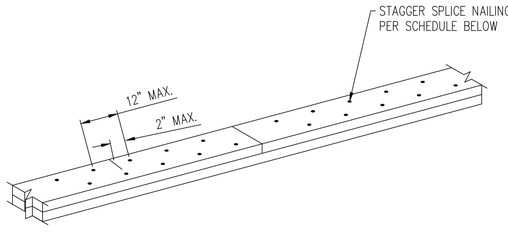
207 ~ TRUSSES AT EXTERIOR WALL

NTS

NAILING SCHEDULE	
CONNECTION	MINIMUM NAILING, ONE ON PLANS OR DETAILS
JOIST OR TRUSS TO TOP PLATE SILL, ETC.	(3) 16d or (3) x 0.131" TOENAIL
BRIDGING TO JOIST	(2) 8d COMMON OR (2) 3" x 0.131" TOENAIL EA. END
BOTTOM PLATE TO JOIST OR BLOCKING (AT SHEAR WALLS, SEE SHEAR WALL NAIL SCHEDULE)	16d AT 16" o.c. OR 3" x 0.131" AT 8" o.c.
TOP AND BOTTOM PLATE TO POST	(2) 16d COMMON, (3) 3" x 0.131", END NAIL
TOP PLATE TO STUD	(2) 16d COMMON, (3) 3"x 0.131", END NAIL
STUD TO BOTTOM PLATE	TOENAILS: (4) 8d COMMON OR (4) 3" x0.131", (4) 16d AT 3x AND LARGER. END NAILS: (2) 16d COMMON OR (3) 3" x 0.131", (2) 20d AT 3x
DOUBLE OR MULTIPLE BUILT-UP STUDS (POSTS)	(2) 16d COMMON AT 16" o.c., OR (3) 3" 0.131", AT 8" o.c., FACE NAIL
DOUBLE OR MULTIPLE TOP PLATES	(2) 16d COMMON AT 16" o.c., OR (3) 3" 0.131", AT 12" o.c., FACE NAIL
BLOCKING BTWN. JOIST OR RAFTERS TO TOP PLATE	(3) 16d COMMON, (3) 3" x 0.131", TOENAIL
RIM JOISTS TO TOP PLATE	16d AT 6" o.c. OR 3" x 0.131" AT 6" o.c., TOENAIL
TOP PLATES, LAPS & INTERSECTIONS	(2) 16d COMMON OR (3) 3" x 0.131", FACE NAIL
CONT. HEADER, TWO OR MORE LAMINATIONS	16d COMMON AT 16" o.c. ALONG EACH EDGE
CEILING JOIST TO PLATE	(3) 16d OR (5) 3" x 0.131", FACENAIL
CONT. HEADER TO INTERMEDIATE SUPPORT(S)	(4) 8d COMMON TOENAILCEILING JOISTS
LAPS OVER PARTITIONS	(3) 16d OR (4) 3" x 0.131", FACENAIL
CEILING JOISTS TO PARALLEL RAFTERS	(3) 16d OR (4) 3" x 0.131", FACENAIL
RAFTER OR TRUSS TO PLATE	(2) 16d COMMON, (3) 3" 0.131", TOENAIL
CORNER GT/RAFTER TO PLATE	(4) 16d, TOENAILBUILT-UP CORNER STUDS16d AT 16" o.c. OR 3" x 0.131" AT 16" o.c.
A: SEE PLAN OR GSN FOR TOP PLATE SPLICE CONNECTION B: MISC. NAILING SHALL BE PER IBC TABLE 2304.5.1	

208 ~ TYPICAL NAILING SCHEDULE

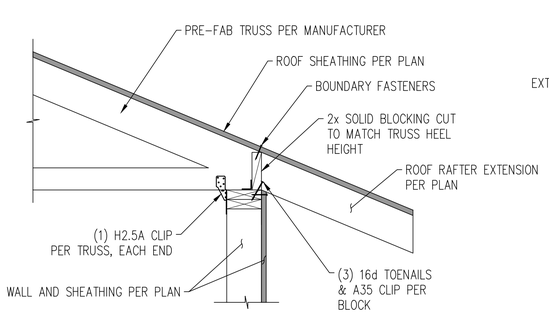
NTS



TOP PLATE	# OF NAILS EA. SIDE OF SPLICE
2x4	32
2x6	44
2x8	54
# OF NAILS REPRESENTS NAILS REQ'D TO EQUAL STRENGTH OF TOP PLATE	

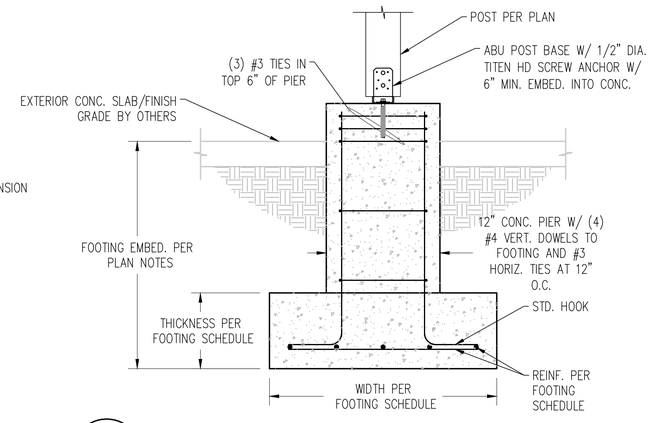
205 ~ TOP PLATE SPLICE TYP.

NTS



206 ~ TRUSS TO WALL CONN.

NTS



209 ~ CONCRETE PIER AT FOOTING

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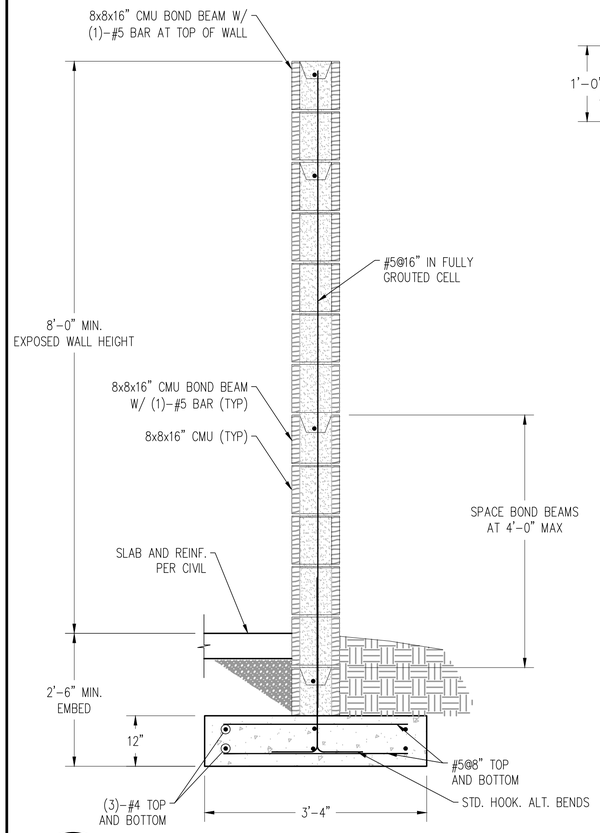
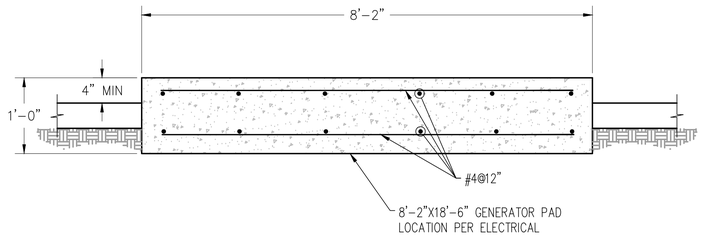
STRUCTURAL DETAILS

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	31 of 72	ST7



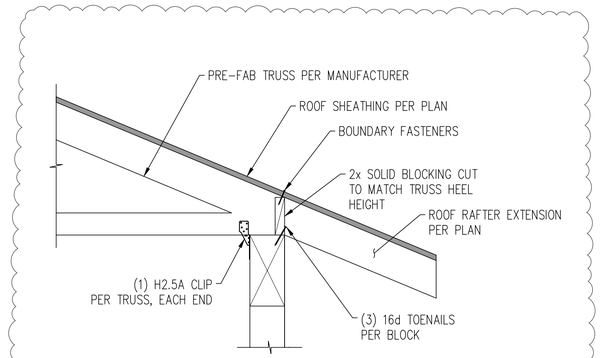
301 ~ CMU WALL

NTS



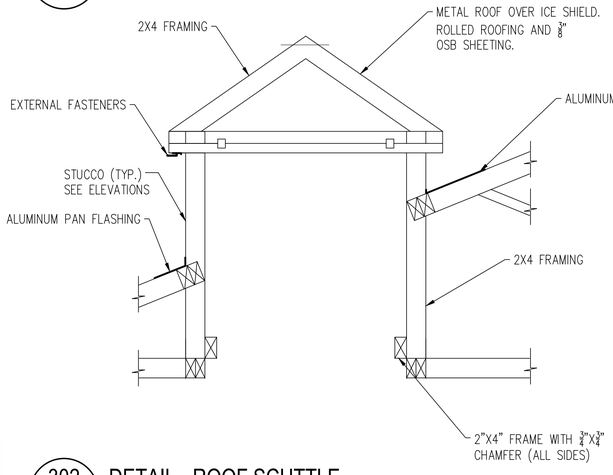
303 TYP GENERATOR PAD TYPICAL SECTION

NTS



304 ~ TRUSS TO WOOD BEAM

NTS



302 ~ DETAIL - ROOF SCUTTLE

NTS

NOTE:

PLACE A DOUBLE TRUSS ON EITHER SIDE OF OPENING, FASTEN OPENING FRAME TO TRUSS AND HEADERS, SIZE TRUSS FOR DEAD LOAD AND VIBRATION. SUBMIT CALCULATIONS AND SHOP DRAWINGS PER SPECIFICATION.

BID SET

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STRUCTURAL DETAILS

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
10660	SDW		SDW	32 of 72	ST8