BRIGHAM CITY

PUBLIC WORKS STANDARDS
for
Development, Design, & Construction

8th Edition
December 2024

Prepared By: JONES & ASSOCIATES CONSULTING ENGINEERS

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FOR DEVELOPMENT, DESIGN,

AND CONSTRUCTION

for

BRIGHAM CITY

SUBMITTED & RECOMMENDED:

Brett M. Jones — 12/05/24

Brett M. Jones, P.E.
City Engineer
Date

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Attest, City Recorder
Date

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SECTION 1 GENERAL

1.01 Ordinances Govern

Nothing in this document shall be construed to be contrary to Brigham City Ordinances. Should a conflict exist between this document and the Ordinances, the Ordinances shall govern.

1.02 Conformance with Federal, State, and Local Laws

Nothing in this document shall relieve the Developer, Engineer, or Contractor from abiding by any and all Federal, State, and local laws.

1.03 Definitions

A. Chapter – When "Chapter" is written, it shall be as if "Brigham City Ordinance, Chapter" is written.

B. Contractor – The individual, firm, co-partnership, or corporation, and his, their, or its heirs, executors, administrators, successors, and assigns, or the lawful agent of any such individual firm, partnership, covenanter, or corporation, or his, their, or its surety under the contract bond, constituting one of the principals to the contract and undertaking to perform the Work.

C. Drawings – The City-approved construction drawings, the Brigham City Public Works Standard Drawings, and/or the Manual of Standard Drawings, as applicable.

D. Developer – The person or company sponsoring construction of the improvements.

E. Development – The subject subdivision, minor subdivision, or building.

F. Improvements – See "Work."

G. Improvement Plans – See "Drawings."

H. Inspector – The authorized representative of the City or City Engineer assigned to make all necessary inspections of the Work performed or being performed, or of materials furnished or being furnished by the Contractor.

I. Standards – When "Standards" is written, it shall be as if "Brigham City Development, Design, and Construction Standards" is written.

J. Title XV – When "Title XV" is written, it shall be as if "Brigham City Ordinance, Title XV, Chapter 155 Subdivisions" is written.

K. Work – All types of work necessary to provide safe access and utility service to and within proposed subdivision or site, including, but not limited to, site grading, utility installation, and street construction. Work includes all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and

equipment into such construction; and may include related services such as testing, start-up, and commissioning.[1]

L. See also "Title XV, Chapter 155 – Subdivisions" of the Brigham City Ordinances. Where definition conflicts arise between City Ordinance and this document, the definitions in this document shall take precedence when in reference to this document.

1.04 Acronyms

A. BC – Brigham City

B. BMP – Best Management Practice

C. CFP – Capital Facilities Plan

D. DDW – Division of Drinking Water

E. DWQ – Division of Water Quality

F. DWRi – Division of Water Rights

G. FEMA – Federal Emergency Management Agency

H. HOA – Homeowners' Association

I. LID – Low Impact Development

J. PVC – Polyvinylchloride Pipe

K. RCP – Reinforced Concrete Pipe

L. UAC – Utah Administrative Code

M. UDEQ – Utah Department of Environmental Quality

N. UDOT – Utah Department of Transportation

O. UPDES – Utah Pollutant Discharge Elimination System

P. UPRR – Union Pacific Railroad

Q. USACE – United States Army Corps of Engineers

R. UTA – Utah Transit Authority

1.05 Variances from the Public Works Standards

A. When a Developer believes that meeting a specific requirement contained within the current edition of the Brigham City Public Works Standards is technically infeasible, Developer may make application to the Director of Public Works or his Designee (Director) for a variance from the Standards. This application shall include technical reasoning for the proposed variance along with a proposed solution. The Director shall assess whether the request meets the goals and requirement of the Standards without unduly jeopardizing the

[1] From EJCDC© C-700, Standard General Conditions of the Construction Contract.

public's interest. Upon review of the application, the Director may grant or deny the variance from the Standards. In the event that the variance request is denied by the Director, the applicant may appeal to the City Board of Appeals for a final determination.

SECTION 2 DEVELOPMENT STANDARDS

2.01 Approval Procedure

See Title XV, Chapter 155 - Subdivisions of the Brigham City Ordinances for details.

2.02 Developer Responsibilities

A. Required Improvements and Guarantees – see Title XV – Subdivisions of Brigham City Ordinances.

B. Permits and Approvals

1. Developer is responsible for obtaining all necessary permits and approvals for the construction of the Improvements. Copies of all applications and approved permits shall be submitted to the City. Agencies/permits that may be required include, but are not limited to:

   a. DDW Plan Approval (pre-construction)

   b. DDW Operating Permit (post-construction)

   c. UPDES NOI and NOT

   d. DWRi Stream Alteration

   e. DWRi Dam Safety

   f. EPA 404 Wetlands

   g. FEMA LOMA and/or LOMR

   h. UDOT

   i. Others as applicable

C. Improvements

1. The required improvements shall include:

   a. All street improvements in front of all lots along all dedicated streets to a connection with existing improvements of the same kind and to the boundary(ies) of the subdivision (excluding through remnant or remainder parcels).

   b. All street, storm drain lines, water lines, sewer lines, and any other buried utility lines and conduits shall be installed to the boundary lines of the subdivision where reasonably expected to extend as determined by the City Engineer and based on anticipated future development and the City's Capital Facilities Plans (CFPs) and/or master plans. Design must provide for future extension to adjacent development and be compatible with the contour of the ground.

2. Upsizing based on CFPs – The Developer will be required to construct/install infrastructure sized in accordance with the City's currently adopted CFPs. The City will

be responsible for paying difference in cost between the master planned infrastructure size and the minimum infrastructure size required for the development.

3. Seal Coat Escrow – Developer shall include in the financial guarantee monies sufficient for the installation of the seal coat. These monies shall be released to City at Substantial Completion for completion by the City.
4. Street Signage Escrow– Developer shall include in the financial guarantee monies sufficient for the installation of the street signage. These monies shall be released to City at Substantial Completion for completion by the City.
5. Temporary Turnaround Escrow – See Section 3.06.J of this document.
6. Materials and Construction Testing Escrow – Developer shall escrow for all materials and construction testing. Testing will be performed by one of the City's selected testing agencies. Developer/contractor is responsible for all coordination. See Section 4.03.I for more information.
7. Survey and Mapping of New Improvements – Developer shall reimburse City for time spent surveying in locations of new improvements, including but not limited to manholes, valves, and fire hydrants, and adding such improvements to the City maps.

2.03 Subdivision Standards

A. The general standards for subdivision layout and development are found in Title XV – Subdivisions.

B. See also Section 3 – Design Standards and Section 4 – Construction Standards of this document.

2.04 Geotechnical Investigation

A. A geotechnical investigation should be conducted for the following:

1. All new subdivisions with more than two (2) lots;
2. All commercial subdivisions and sites;
3. Any subdivision that includes public infrastructure improvements;
4. Any development in the Sensitive Lands zone; and
5. Upon request of the City Engineer.

B. The geotechnical investigation should be complete in nature, and its findings shall be summarized in a Geotechnical Report. The Geotechnical Report shall be signed and sealed by a licensed Professional Engineer with expertise in the field of geotechnical engineering.

C. See Appendix B for requirements regarding the Geotechnical Report, including minimum testing requirements and design parameters.

SECTION 3 DESIGN STANDARDS

3.01 Required Improvements

A. See Title XV for information on the required improvements.

B. See also Section 5 – Standard Specifications and Section 6 – Standard Drawings, Plans, and Details of this document for additional information.

3.02 Improvement Plans

A. Complete and detailed, and signed and sealed (in accordance with Utah Code 58-22-602) construction plans and drawings of improvements shall be submitted to the City for the review by the City Engineer prior to receiving final plat approval and prior to commencing construction.

B. No construction, including dirt work, shall begin until plans have been checked and approved by the City Engineer, final approval is granted by the City Council, and all required permits are in place. Clearing and grubbing is allowed upon approval by Director of Public Works or his designee.

C. The Engineer of Record must provide a written certification (signed and dated), to be included on the final improvement plans, that states the following:

1. As the Engineer-of-Record, I hereby certify that to the best of my knowledge these construction plans and supporting documentation (Plans) comply with the applicable City Code, Public Works Standards, local, State, and Federal regulations, and general engineering practices (Standards). I understand and agree that:

    a. The City's acceptance of these Plans shall not be construed to be a permit for, or an approval of, any variance from any provisions of the Standards.

    b. Any communication from the City giving feedback on the Plans shall be construed as feedback only and shall not be interpreted as authorization to vary from or cancel the provisions of the Standards.

    c. The City's acceptance of these Plans, or feedback from the City on whether the Plans meet the Standards, shall not prevent the City from requiring the correction of errors in the Plans at any time, including during the construction of improvements.

    d. Any exceptions to the Standards granted by the appropriate governing agency have been provided in writing to the City.

D. The following instructions are for the purpose of standardizing the preparation of drawings to obtain uniformity in appearance, clarity, size, and style. The plans and designs shall meet the standards defined in the specifications and drawings hereinafter outlined. The minimum information required on the drawings for improvements is as follows:

1. All drawings and/or prints shall be clear and legible and conform to industry standard engineering and drafting practices.

2. Drawings shall be legible and to a common scale when printed on 11”x 17” paper.
3. Both plan view and centerline profile must be shown. On subdivisions along steep cross slopes, profiles for each side of the street may be required to be shown.
4. Plan and profiles shall indicate design and/or existing grades a minimum of 200 feet beyond the limits of the proposed project.
5. All wet utilities (water, sewer, storm drain, secondary, irrigation) shall be shown in plan and profiles views.

E. Each set of plans shall be accompanied by a separate sheet of details for special structures which are to be constructed and are not covered by the City Standards. All structures shall be designed in accordance with the minimum Brigham City Standards and approved by the City Engineer.

F. Separate drawings of elements of the Brigham City Standards shall not be required to be redrawn and submitted with the construction drawings unless specific deviations from the standards are requested for approval; however, the construction drawings shall refer to the specific items of the Standards that are to be incorporated into the Work.

G. The plan and profile construction plans shall be submitted in portable document format (“pdf”). Upon approval, the developer’s engineer shall provide the City Engineer with electronic files of the final plat and improvement plans in AutoCAD or other City Engineer approved format. A hard copy of the approved construction plans bearing the signature of the City Engineer shall be kept available at the construction site. Prior to final acceptance by the City, the developer, developer’s representative, contractor, or project engineer shall submit to the City Engineer a set of "as built" drawings for permanent City file record.

3.03 Sanitary Sewer Design

A. All design shall be in accordance with Utah Administrative Code R317.

1. Changes in pipe size shall occur in a manhole. Match 0.8 depth point of sewer lines. (UAC R317-3-2.2-H)
2. Drops are required for all flowline elevation differences in excess of two (2) feet.

B. Pipe shall be as follows:

1. 4-inch through 15-inch – ASTM D3034, SDR 35, green
2. 18-inch and greater – ASTM F679, green
3. Force mains’ pressure class shall be specified by design engineer and shall be adequate for pressure in the main being designed.
4. When encountered, Orangeburg and/or clay tile pipe shall be replaced from the main to the property line with the above piping type.

C. All terminating sewer mains shall end with a city standard manhole.

D. Service lateral connection shall not be allowed in sewer manholes.

E. All sewer shall be gravity unless otherwise approved by the City.

F. Collection lines shall be located in public rights-of-way or private road rights-of-way. Collection lines shall not be located on private property (easements) without the express written permission from the City. If such case is granted, easement shall be a minimum width of 20 feet and shall be dedicated to Brigham City.

G. All sanitary sewer systems shall be public and shall connect to a public sewer line. Private sanitary sewer systems may be permitted on singularly owned property provided they discharge directly to a public sewer system and obtain the express written permission from the City.

H. Sewer mains shall not exceed 8% without approval of City Engineer.

3.04 Water Design

A. All design shall be in accordance with Utah Administrative Code R309.

B. Water Main Pipe shall be as follows:

1. 12-inch and smaller – AWWA C900 DR 14, blue
2. 14-inch and greater– AWWA C900 DR 18, blue
3. Upon approval: 4-inch through 12-inch – Ductile Iron, pressure class 350
4. Upon approval: 14-inch and greater – Ductile Iron, pressure class 250
5. Upon approval: HDPE, ductile iron pipe size, DR 11 or 9, as specified by City Engineer
6. Material type shall be designated to specific locations based on soil conditions and system pressure ratings.
7. When encountered, galvanized pipe shall be replaced from the main to the property line as required in the Drawings.

C. Valves are required on all branches of tees and crosses. On unbroken lengths of water line, valves are required:

1. At 800 foot (maximum) spacing in residential areas, and
2. At 500 foot (maximum) spacing in commercial and industrial areas.

D. Air/vacuum valves shall be provided at all high points; however, lines shall be designed as such to minimize high points when feasible.

E. At dead end lines, including temporary dead ends, provide fire hydrant at termination point.

F. Where a water line crosses surface water, designer/engineer shall contact the DDW and the City prior to final design.

G. All fire lines shall meet public works standards but shall remain privately owned and maintained.

H. Water lines may be curved, with a minimum radius of twice the manufacturer's minimum radius. A reduction in the radii may be granted with the following requirements:

1. No service connections are reasonably anticipated along the curvature, and

2. With the express and written approval by both the City Engineer and the Water Supervisor.

I. Fire hydrants

1. Fire hydrants are to be installed in locations as required by the fire code and approved by the Fire Marshal and City Engineer, with a minimum spacing of 500 feet.

2. Fire hydrants shall not be located within 10 feet of any sanitary sewer line or manhole.

3. A three (3) foot radius clear space shall be provided around all fire hydrants. No above ground features or driveways are permitted in the clear space.

3.05 Secondary Water Design

A. Secondary water lines shall be installed for all new subdivision within the City. This may be accomplished with either an independent Secondary Water system or construction of infrastructure to be connected to a future city system, as determined feasible by the City Engineer or Water System Representative.

B. Pipe shall be a minimum of 6-inch in diameter and be as follows:

1. Pressurized

a. 12-inch and smaller – AWWA C900 DR 14, purple

b. 14-inch and greater – AWWA C900 DR 18, purple

c. 30-inch and greater – consult City Engineer

2. Gravity: consult City Engineer

C. Valves are required on all branches of tees and crosses, or as approved by the Director of Public Works or designee.

D. Drains shall be installed to a storm drain at low spots on the system. Details for the drain valves, manholes, rings, and covers are given in the Standard Drawings.

E. Air/vacuum valves shall be installed at no more than 1,000 foot spacing and at high points. Details for the air/vacuum valves, manholes, rings, and covers are given in the Standard Drawings.

F. Consideration shall be made for gravity draining of mainlines to a drain valve.

3.06 Street/Road Design

A. Streets shall be designed in accordance with these Standards, standard engineering practices, and AASHTO and MUTCD guidelines.

B. Plans should show horizontal and vertical curve information, including radii, k-values, points of curvature, intersection, inflection, and tangency, etc.

C. Local (residential) streets shall have not less than 333' radius curves[2] unless specifically approved by the City Engineer.

D. No changes of grade in excess of 1.5% shall be permitted without a vertical curve.

E. Sight triangles shall be shown as per the City Code.

F. Horizontal points of curvature shall not be located closer than 150' from the center of an intersection.

G. Intersections

1. Roadway centerlines shall intersect at 90 degrees. Where a 90 degree angle is not feasible, the intersection angle may be reduced to as low as 80 degrees with the City Engineer's concurrence. In no case shall the angle be less than 80 degrees.

H. Cul-de-sacs

1. Length of cul-de-sac shall not exceed 650 feet as shown in the Standard Drawings.

I. Pavement/Pavement Section

1. Developments

   a. Pavement section shall be designed by the developer's geotechnical engineer and included in the Geotechnical Report submitted to the City. See Appendix B of this document for Geotechnical Report Minimum Requirements, including testing requirements and design parameters.

2. City Projects

   a. Pavement section shall be included in the Project plans.

3. See sheet R-1 for pavement notes.

J. Temporary Turnarounds

1. When turnaround cannot be constructed outside of subdivision, it shall be located on a portion of the subdivision lots (as needed) with the developer placing in escrow an amount of money sufficient to complete the street improvements to the subdivision boundary. These funds will be used at such time the street is extended.

2. The lot(s) on which the turnaround is constructed shall be restricted as follows:

[2] AASHTO A Policy on Geometric Design of Highways and Streets (2011); Table 3-13b.

a. Platted as an “R” (restricted) lot.

b. This lot cannot be sold or building permits issued until the road is extended beyond the subdivision boundary, complete with curb, gutter, and sidewalk.

3. Drainage onto adjacent property must be by written approval (easement) of adjacent property owner.

4. When a temporary turnaround is required at the end of a road where the road and the extension of the road are parts of an approved phased development, in lieu of constructing a paved temporary turnaround in accordance with the Standard Drawings:

a. When extension of the road is expected to begin construction within 12 months of conditional acceptance of the road and associated temporary turnaround, Developer may construct 12-inch thick untreated base course temporary turnaround (dimensions per the Standard Plans) and place in escrow the cost of the asphalt paving. Escrow will be released to developer upon approval of subsequent phase.

b. If construction of the extension of the road has not begun within 12 months of conditional acceptance of the road and associated temporary turnaround, City may, at its discretion, utilize the monies in escrow to pave the temporary turnaround.

K. UDOT

1. Roadway intersections with UDOT-controlled streets shall be in accordance with UDOT standards. A copy of the approved UDOT Access and/or Encroachment Permit(s) shall be submitted to the City.

3.07 Storm Drain and Drainage Design

See Appendix A for Storm Drain and Drainage Design Standards.

A. Low Impact Development – See Appendix A

80th Percentile Storm Retention – See Appendix A

SECTION 4 CONSTRUCTION STANDARDS

4.01 General

A. General Conditions

1. Permit/License: When the work is in progress, Contractor shall have at the work site a copy of the permit and his contractor's license number.

2. Private Access: Temporary all weather roadways, driveways, walks, and rights-of-way for vehicles and pedestrians shall be constructed and continuously maintained where required.

3. Street Excavation in Winter: Excavation of City streets during the winter months (herein defined as November 15 to April 1) will be allowed only if the work is a new service connection, required maintenance or emergency, or otherwise approved by the Public Works Department. Permanent patching of City streets excavated in the winter may be delayed until April 1 with the following provisions: Within five (5) working days from the completion of the excavation, the permittee provides/maintains a 1-1/2" thick temporary winter asphalt surface until such time as the permanent asphalt surface is installed; the permittee shall provide/maintain a temporary untreated base course surface until such time as the temporary winter asphalt surface is installed. These provisions apply regardless of whether the permittee or City crews are performing the permanent resurfacing.

4. Street Excavation in Summer: Excavation of City streets during the summer months is herein defined as April 1 to November 15. Permanent hot asphalt patching of City streets in the summer shall be within five (5) days from the completion of the excavation. The permittee shall provide/maintain a temporary untreated base course surface until such time as the permanent hot asphalt patch surface is installed.

5. Existing Utilities: The contractor shall use extreme caution to avoid a conflict, contact, or damage to existing utilities, such as power lines, sewer lines, storm drains, street lights, telephone lines, cable television lines, water lines, gas lines, poles, or other appurtenances during the course of construction of this project. Any such conflict, contact, or damage shall be immediately communicated to said utility company and the Public Works Department. All projects shall be “Blue Staked” prior to construction.

6. Preconstruction Pictures: The permittee shall secure pictures of the conditions of the existing public way improvements such as curbing, sidewalk, landscaping, asphalt surfaces, etc. In the event that public way improvements are damaged and no pictures were taken, the Public Works Department will assume the correction of the damage is the responsibility of the permittee.

B. Licensing

1. Contractor (including all sub-contractors) must be properly licensed with the State of Utah. The acceptable licenses shall be in accordance with UAC R156-55a-301.

2. Exceptions: A license shall not be required by the City when the permittee is a public utility company. (Subcontractors for utility companies shall have a valid contractor's license.)

C. Permits

Developer/Contractor is responsible for obtaining all necessary permits for the construction of the Improvements prior to commencement of said Improvements. Agencies/permits required may include, but are not limited to:

1. City Excavation

a. Brigham City's Department of Public Works issues permits to control any excavation and construction operations in the public right-of-way. All contractors, sub-contractors, and utility companies proposing to construct, repair, or replace any facility within the public right-of-way shall contact the Brigham City Public Works Department and complete all permit requirements prior to commencing proposed work.

b. Duration and Extensions – Subject to the Public Works Department's approval, permits which expire may be extended by paying a permit extension fee. The length of the extension determined by the permittee shall be subject to the approval of the Public Works Department.

c. Work by utility companies and contractors in constructing facilities in new subdivision streets shall be required to obtain a "No Fee Public Right-of-Way Permit" and will be subject to City inspection and compliance with all requirements.

d. Emergency Work

(i) Maintenance of pipelines or facilities in the public way may proceed without a permit when emergency circumstances demand the work be done immediately provided a permit could not reasonably and practicably have been obtained beforehand.

(ii) In the event that emergency work is commenced on or within any public way of the City, the Public Works Department shall be notified within one-half hour when the work commences or as soon as possible from the time the work is commenced. Contact shall be made to the City's "on call" personnel. If emergency work is commenced during off business hours, the Public Works Department will be notified within one (1) hour of the start of work on the first regular business day of which City offices are open after such work commences, and, at the discretion of the Public Works Department, a permit may be issued

which shall be retroactive to the date when the work was begun. Before commencing the emergency work, all necessary safety precautions for the protection of the public and the direction and control of traffic shall be taken. None of the provisions of these regulations are waived for emergency situations except for the prior permit requirement.

e. Enforcement: Violators of these regulations of working within the Public Way shall be subject to the provisions of the applicable Brigham City Ordinances.

f. No Fee Permits: The Public Works Department reserves the right to issue "no fee permits" for work in the public way when the following conditions are met:

   (i) When utility companies are doing excavation work and such work is required in conjunction with a City Public Works Department project and the work is required to be accomplished prior to the execution of the Public Works Department contract.

   (ii) When the City Public Works Department is repairing or maintaining public way facilities such as curbs, gutters, cross drains, storm drains, traffic facilities, driveway, sidewalk, etc., and such work requires excavation.

g. Permit Waivers: Working within the public way without a permit is not permissible unless the permit is waived by the Public Works Department. Waivers may be granted by the Public Works Department when any of the following conditions occur.

   (i) When routine maintenance work which is being done by City, State, or utility personnel does not involve excavations in the City's public way, i.e. crack sealing, street resurfacing and repair, snow plowing, sanding, sweeping, garbage collection, storm drain cleaning, leaves pickup, above grade work, etc.

   (ii) When a permittee allows other contractors or utility companies to perform work in the permitted trench limits.

   (iii) When utilities shall be relocated or adjusted in conjunction with a City Public Works Department sponsored project provided the utility work is being accomplished within one (1) week of the time the City or its contractor is scheduled to begin construction at that location and provided the work is coordinated and approved by the City's Public Works Department.

h. Revocation of No Fee Permits and Permit Waivers: "Permit Waivers" and "No Fee Permits" shall be revoked by the Public Works Department if the work is found to be defective or requires action or supplemental inspection by the Public Works Department. In the revocation proceedings, the Public Works Department shall serve written notice which defines the problems encountered and the time (at least one day) the permittee has to correct the problem. If the work is not satisfactorily completed within the time specified, the "Permit Waiver" or the "No Fee Permit"

shall be revoked. The permittee shall be required to secure a Fee Permit before proceeding to complete the work.

i. Completion by City, Liability for Costs: If the work is unduly delayed by the permittee, or if the public interests so demand, the Public Works Department shall have authority to complete the permit work. The Public Works Department shall do the work only after written notice has been given to the permittee, and the permittee fails to respond to the Public Works Department's request. The actual cost of such work incurred by the City including a fifteen percent (15%) overhead charge shall be paid by the permittee.

2. USACE/DWRi Stream Alteration – Stream Alteration
3. UPDES
4. Dam Safety (DWRi)
5. UPRR Railroad Encroachment
6. UTA Encroachment
7. UDOT
8. Box Elder County Surveyor's Monument

D. Excavation Operations

1. Blue Stakes: Before commencing excavation operations, the permittee shall call "Blue Stakes" at 1-800-662-4111 or 811.

E. Traffic Control Devices: Traffic control devices such as construction signs, barricades, and cones must be in place before excavation begins.

F. Protection of Paved Surfaces: In order to avoid unnecessary damage to paved surfaces, backhoes, outriggers, tracked equipment, or any other construction equipment that may prove damaging to asphalt shall use rubber cleats or paving pads when operating on or crossing said surfaces.

G. Open Trench Limits: Open trenches will be limited to one block at a time or 660 feet, whichever is less.

H. Public Road Closure: No public roads shall be closed without prior written approval from Brigham City Corporation. In the event of a planned road closure, Contractor shall notify the City, Public Works Department, Fire Department, emergency services dispatch, US Postal Service, Box Elder School District, and Utah Transit Authority (UTA) a minimum of 24 hours prior to the closure. In the case of an emergency, the above listed agencies will soon be notified at the soonest possible time.

I. Sidewalk Closure: When it is permitted to close the sidewalk, flashing barricades and "Sidewalk Closed" signs must be placed on the sidewalk immediately adjacent to the work area. "Sidewalk Closed Ahead, Cross Here" signs must be placed at the closest adjacent

sidewalks, intersections, or alternate routes to warn pedestrians of the closing so they may safely access the alternate route.

J. Environmental Controls

1. Dust and Debris: The permittee or contractor shall keep dust and debris controlled at the work site at all times. If necessary, a container shall be provided for debris and dusty areas shall be wet down. The permittee or contractor shall be responsible for the cleanup of mud or debris from public roads deposited by vehicles or construction equipment exiting the work site. The City reserves the right to shut down the work or issue a citation if dust is not controlled.

2. Noise: The permittee or contractor shall keep neighborhood free of noise nuisance in accordance with the Noise Ordinance.

K. Cleanup: The permittee or contractor shall remove all equipment, material, barricades, and similar items from the right-of-way. Areas used for storage of excavated material will be smoothed and returned to their original contour. Vacuum sweeping or hand sweeping shall be required when the City determines cleaning equipment is ineffective.

L. Storm Water: All Contractors working within the boundaries of Brigham City shall conform to all requirements and regulations as outlined by the Brigham City Storm Water Management Plan. Copies of the plan are available in the Brigham City Offices.

M. Fencing and Signs

1. Fencing and barricade equipment shall conform to MUTCD standards. Fencing shall also conform to the following:

a. No advertisements shall be placed on barricades or construction signs.

b. Fencing and associated signs shall be removed and areas where signs are placed shall be restored to the pre-construction condition following construction.

2. Fencing (6' chain-link panels) shall be placed around all excavation pits adjoining pedestrian accesses traveled by the public. No construction activity (excavations, etc.) which may be of any risk to public safety shall remain unattended overnight.

3. All projects abutting the public rights of way shall be fenced

4.02 Pre-Construction Conference

A. The preconstruction conference shall not be held until the City Engineer has approved and signed the construction plans.

B. A preconstruction conference shall be held before any excavation or other work is begun in the subdivision or Project. The meeting will include:

1. City Engineer

2. Developer or Project Manager

3. Subdivision or Project Engineer
4. All contractors and subcontractors involved with installing the subdivision or project improvements
5. Representatives of affected Brigham City Departments
6. Representatives of local utility companies as may be required by Brigham City

C. Items pertaining to the construction and inspection of the subdivision or Project improvements will be discussed.

4.03 Construction

A. Specifications

1. Contractor shall be responsible for constructing all improvements in accordance with the Technical Specifications, per Section 5 of this document.
2. Deviations from such shall be reviewed and authorized by the City Engineer on a case-by-case basis.

B. Plans and Details

1. Contractor shall be responsible for constructing all improvements in accordance with the Drawings, Plans, and Details, per Section 6 of this document.
2. Deviations from such shall be reviewed and authorized by the City Engineer on a case-by-case basis.

C. Sequence/Timing

1. All underground utility work shall be completed prior to placement and compaction of the roadway base course. Utilities, including service lines, not installed prior to roadway construction shall be bored as approved by the Director of Public Works.
2. All concrete collars shall be installed within fourteen (14) days of asphalt placement.

D. Inspection

1. All construction work involving the installation of improvements in the subdivision or project shall be subject to inspection by the City. It shall be the responsibility of the person responsible for construction to insure that inspections take place where and when required. Certain types of construction shall have continuous inspection, while others may have only periodic inspections.

E. Requests for Inspections

1. Requests for inspections shall be made to the Public Works Department by the person responsible for the construction.
2. Requests for inspection on work requiring continuous inspection shall be made three (3) working days prior to the commencing of the work.

3. Notice shall also be given one (1) day in advance of the starting of work requiring periodic inspection, unless specific approval is given otherwise by the City.

F. Continuous inspection

1. May be required on (but not limited to) the following types of work:

   a. Laying of street surfacing

   b. Placing of concrete for curb and gutter, sidewalks, and other structures

   c. Laying of sewer pipe, irrigation pipe, drainage pipe, water mains, water service laterals and testing.

2. On construction requiring continuous inspection, no work shall be done except in the presence or by permission of the City Engineer or authorized city representative.

G. Periodic inspections

1. Shall be required on (but not limited to) the following types of work:

   a. Street grading and gravel base

   b. Excavations for curb and gutter and sidewalks

   c. Excavations for structures

   d. Trenches for laying pipe

   e. Forms for curb and gutter, sidewalks and structures

H. Substantial and Final Completion Inspections

1. A substantial completion inspection shall be requested by the Contractor and made by the City Engineer or authorized representative after all construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work within a period of thirty (30) days of the date of the City Engineer's or authorized representative's Punchlist defining the faulty or defective work.

2. A final completion inspection shall be requested by the Contractor and made by the City Engineer or authorized representative after all faulty and defective work has been corrected.

I. Testing

1. Development Projects

   a. Developer/Contractor shall select, hire, and pay a City-approved qualified testing firm.

   b. Developer/Contractor shall be responsible for all testing in accordance with the Technical Specifications per Section 5 of this document.

c. Testing reports shall be submitted to City weekly for review. Areas with failed tests shall be corrected and retested.

d. Failure to have improvements tested as they are constructed may be cause for work stoppage or rejection by City.

e. City has the option to conduct independent testing at their discretion.

2. City Projects

a. Developer/Contractor shall select, hire, and pay a City-approved qualified testing firm.

b. Developer/Contractor shall be responsible for all testing in accordance with the Technical Specifications per Section 5 of this document.

c. Testing reports shall be submitted to City weekly for review. Areas with failed tests shall be corrected and retested.

d. Failure to have improvements tested as they are constructed may be cause for work stoppage or rejection by City.

e. City has the option to conduct independent testing at their discretion.

J. Safety

1. Contractor is solely responsible for jobsite safety.

2. Contractor shall comply with all local, state, and federal rules and regulations regarding jobsite safety.

3. City and/or its authorized representatives shall have the authority to shut down a job when unsafe working conditions are found.

4.04 Miscellaneous

A. Enforcement

1. Violators of the regulations as set forth in the Brigham City Standards for work in the Public Way shall be subject to the provisions as set forth in the current City Code.

B. Guarantees

1. City's Protective Liability Insurance: The permittee shall indemnify and hold the City harmless from and against any and all liability, damages, claims, demands, costs and expenses of whatsoever nature, including court costs and counsel fees, arising from or growing out of any injury to or death of any person or persons, whomsoever, or for loss of or damage to any property whatsoever, (including loss or damage to the tools, plant, or equipment of the permittee) resulting directly or indirectly from the carrying on of the work herein specified, and to that end shall purchase on the City's behalf, City's Protective Liability Insurance with limits of $1 million for injury to or death of one

person, and $1 million for one accident; and Property Damage Liability Insurance with limits of $1 million for each accident and $1 million aggregate.

2. Bonding: Bonding as required by Brigham City Code, Ordinance, and current rate structure.

SECTION 5 TECHNICAL SPECIFICATIONS

5.01 Technical Specifications for Brigham City

A. Adoption of Divisions 01 through 34 of the Manual of Standard Specifications, as published by Utah LTAP Center, Utah State University, Logan, Utah, current edition, with all published amendments. (Commonly known as the *APWA Specifications*)

B. Modifications and Additions to Manual of Standard Specifications (see Appendix C)

5.02 Order of Precedence

A. Approved project-specific specifications (when applicable)

B. Modifications and Additions to Manual of Standard Specifications

C. Manual of Standard Specifications, current edition, with all published amendments

SECTION 6 STANDARD DRAWINGS, PLANS, AND DETAILS

6.01 Standard Drawings, Plans, and Details for Brigham City

A. Brigham City Standard Drawings, current edition (See Appendix D)

B. Adoption of Manual of Standard Plans, published by Utah LTAP Center, Utah State University, Logan, Utah, current edition, with all published amendments. (Commonly known as the *APWA Plans*)

6.02 Order of Precedence

A. Approved project-specific drawings and details (when applicable)

B. Brigham City Standard Drawings, current edition

C. Manual of Standard Plans, current edition, with all published amendments, when not covered by one of the aforementioned items

APPENDIX A – STORM DRAIN AND DRAINAGE DESIGN GUIDELINES

APPENDIX A

STORM DRAIN AND DRAINAGE DESIGN STANDARDS

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EXHIBITS

1. NOAA Point Precipitation Frequency Estimates – Intensity

2. NOAA Point Precipitation Frequency Estimates – Depth

3. Summary of Allowable LID BMPs

A1. General Provisions

A. This document represents the reporting, design, and construction standards for private and public design and construction as it relates to storm drainage within the City.

B. A Storm Water Report is required for all new development and redevelopment projects.

C. Implementation of LID measures and 80TH percentile storm retention does not eliminate the requirement for detention/retention as contained in this document, but may be included within the designed detention/retention volumes calculated.

A2. Definitions and Acronyms

The following terms shall be defined as follows in this document relating to storm water:

A. 80th Percentile Storm – The rainfall event whose precipitation total is greater than or equal to 80 percent of all storm events over a given period of record.

B. Best Management Practices (BMPs) – Construction practices and control measures necessary to protect against pollution generated by construction sites.

C. Common Plan of Development – "Common plan of development or sale" means one plan for development or sale, separate parts of which are related by any announcement, piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, plat, blueprint, contract, permit application, zoning request, computer design, etc.), physical demarcation (including contracts) that identify the scope of the project. A plan may still be a common plan of development or sale even if it is taking place in separate stages or phases, is planned in combination with other construction activities, or is implemented by different owners or operators.[1] Common plans of development may be residential, commercial, or industrial in nature.

D. Detention Basin – A water storage pond designed to store a volume of water that reduces the post-development peak runoff of a storm to the pre-development runoff rate or other rate as defined by the governing body. This is accomplished by the use of an outlet which controls the rate of flow out of the pond into the receiving storm drain or water body. Detention ponds contain an inlet, outlet, and spillway; the inlet and outlet may be one and the same. The detention basin is intended to drain the storm water within a period of time to make the volume available for the next storm event.

E. Development – Any man-made change to unimproved land, including but not limited to site preparation, excavation, filling, grading, paving, and construction of buildings or other structures.

F. Disturb – To alter the physical condition, natural terrain or vegetation of land by clearing, grubbing, grading, excavating, filling, building or other construction activity.

[1] General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s); State of Utah Department of Environmental Quality, Division of Water Quality; May 12, 2021.

G. Drain Inlet – A point of entry into a sump, storm water basin, or storm drain system.

H. Drinking Water Source Protection Zone – Zones determined by geo-hydrology designed to protect groundwater aquifers of a well in a culinary water system.

I. DWQ – Acronym for Division of Water Quality, a division of the UDEQ.

J. Freeboard – The vertical distance between the emergency spillway and the top of the basin embankment.

K. General Permit for discharges from MS4 (Permit) – Authorization for a municipal separate storm sewer system to discharge storm water into waters of the United States.

L. Hardscape – Generally impervious areas, typically streets, sidewalks, driveways, parking areas, and roofs.

M. Infiltration – The movement of water through the soil surface and into the soil;[2] the movement of water downward from the ground surface through the upper soil.[3]

N. Infiltration Rate – The rate at which water actually enters the soils during a storm.[2]

O. Infiltration System (storm water) – A system which is designed to return storm water runoff into an underground aquifer.

   1. Bioretention facilities, rain gardens, and tree boxes that are designed to slow down and hold storm water runoff for biological treatment and use by vegetative uptake are not considered to be infiltration systems if they are isolated from groundwater. Groundwater isolation may be achieved with impermeable liners or an underdrain that does not discharge into a dug, bored, drilled or driven well, improved sinkhole or other subsurface fluid distribution system.

   2. The discharge of storm water piping below grade for the purpose of infiltration is considered a Class V injection well facility.

P. Injection Well, Class V – As defined in Utah Administrative Code R317-7-2:

   1. A bored, drilled, or driven shaft whose depth is greater than its largest surface dimension, OR

   2. A dug hole whose depth is greater than its largest surface dimension, OR

   3. An improved sinkhole, OR

   4. A subsurface fluid distribution system.

Q. Low Impact Development (LID) – An approach to land development (or re-development) that works with nature to more closely mimic pre-development hydrologic functions, reduces or minimizes the quantity of storm water runoff, and protects or improves water

[2] Linsley/Franzini/Freyberg/Tchobanglous. (1992). *Water Resources Engineering and Environmental Engineering.* New York: McGraw-Hill Inc.

[3] Lindeburg. (2003). *Civil Engineering Reference Manual.* Belmont, CA: Professional Publications, Inc.

quality in receiving water bodies.

R. LID Analysis and Report – A written analysis of a development or redevelopment site that (1) identifies appropriate methods to reduce storm water runoff, (2) identifies the pollutants to target for each drainage area, and (3) selects appropriate structural controls to implement on the site.

S. Municipal Separate Storm Sewer System (MS4) – The storm water conveyance system owned by the City which includes streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains. For a full definition, see UAC 317-8.

T. Outlet – The discharge mechanism of a detention basin, typically a pipe containing a head gate or orifice to control the release of water out of the basin.

U. Percolation – The movement of water through the subsurface soil layers, usually continuing downward to the groundwater table,[3] measured by a Standard Percolation Test in units of minutes per inch.

V. Pollutant – Chemicals, sediment, trash, disease-carrying organisms, and other contaminants picked up by storm water which is conveyed into rivers, streams, and other water bodies.

W. Redevelopment – Alteration of a property that change the footprint of a site or building.

X. Retention Basin –A water storage pond designed to store the runoff volume of a storm and dispose of water through percolation, infiltration, and evaporation within a period of time to make the volume available for the next storm event. A retention basin contains an inlet and spillway, but no structural outlet.

Y. Softscape – Generally pervious areas, such as native vegetation and landscaped areas.

Z. Spillway, Emergency – A storm drain basin feature that controls and guides storm water as it spills over the basin's embankment.

AA. Spillway, Internal – A storm drain basin feature that allows excess water to leave the basin through discharge piping which is set at an elevation below the emergency spillway.

BB. Storm Drain System – The system of conveyances (including but not limited to catch basins, detention basins, retention basins, infiltration galleries, curbs, gutters, ditches, cross drains, roads, man-made channels, sumps, pipes, etc.) owned and operated by the City, which is designed and used for collecting and/or conveying storm water.

CC. Storm Water Pollution Prevention Plan (SWPPP) – A written plan that evaluates and minimizes the impact of pollutants on storm water through the use of control measures and activities that target pollution sources. A SWPPP template can be found on the UDEQ Water Quality website.

DD. Storm Water Report – A written analysis of a development or redevelopment site that estimates the volume and rate of storm water runoff generated by the proposed improvements. The report details rationale and calculations for establishing the sizes of storm water piping and storage facilities in compliance with this document. This Report

shall also contain the calculations for determining the 80th Percentile Storm volume and methods evaluated and selected to manage the rainfall on-site.

1. This Report may be combined with the LID Analysis and Report.

EE. Storm Water Runoff – Precipitation that is not intercepted or otherwise captured at a site which eventually enters into natural water bodies such as rivers, streams, and lakes.

FF. Subsurface Fluid Distribution System – An assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground. (i.e. infiltration galleries, underground retention)

GG. UAC – Acronym for Utah Administrative Code.

HH. UDEQ – Acronym for Utah Department of Environmental Quality.

A3. Rainfall Hydrology

A. All storm drain system components shall be designed to accommodate the 100-year storm event, unless otherwise stated.

B. Storm Specifications

1. Local storm drain piping shall be designed for the 10-year storm, where the street or other aboveground conveyance will carry the difference to the 100-year storm.
2. Storm drain piping connecting two (2) streets through private property shall be designed for the 100-yr storm.
3. Local detention basins, including all piping into the basin from the nearest point of entry, shall be designed to accommodate the 10-year storm event with a maximum discharge of 0.1 cubic feet per second (cfs).
4. Local retention basins, including all piping into the basin from the nearest point of entry, shall be designed to accommodate the 100-year, 2-hour storm.
5. Regional detention basins, including all piping into the basin from the nearest point of entry, shall be designed to accommodate the 100-year storm event.
6. The storm duration used for the sizing of basins shall be based upon the worst-case scenario.
7. See Exhibits 1 and 2 for rainfall data.

C. Hydrologic Methodology

1. Parameters

a. Hardscape – Proposed streets and sidewalk areas plus the estimated hardscape areas (roofs, driveways, patios, walkways etc.) determined by using a recent subdivision with similarly sized lots, or calculated area as measured from approved site plan.

b. Softscape – The remaining area of the subdivision not hardscape.

2. Developments less than 20 acres

   a. The Rational Method may be used. A computer model may also be used. See paragraph 3 for more information.

   b. Rainfall Intensity – When using the Rational Method, use the rainfall intensity table provided in Exhibit 1 of this document.

   c. Runoff Coefficients – The following C-values shall be used when using the Rational Method:

      i. Hardscape – 0.90

      ii. Softscape (open space, landscaping) – 0.25

      iii. Values from published sources may be used when pre-approved by the City Engineer.

3. Developments larger than 20 acres

   a. A City Engineer-approved computer model shall be used.

   b. Rainfall Pattern and Depth – The following rainfall pattern shall be used. This pattern is based on the Farmer-Fletcher Distribution. This pattern is for a 1-inch unit storm and must be multiplied by rainfall depth for storms of other magnitudes, as provided in Exhibit 2.

Farmer-Fletcher Distribution

Unit Storm

Time (Min.)	Depth (inches)	Time (Min.)	Depth (inches)	Time (Min.)	Depth (inches)	Time (Min.)	Depth (inches)	Time (Min.)	Depth (inches)	Time (Min.)	Depth (inches)
1	0	11	0.004	21	0.033	31	0.052	41	0.012	51	0.005
2	0	12	0.005	22	0.034	32	0.045	42	0.011	52	0.005
3	0.002	13	0.008	23	0.035	33	0.04	43	0.01	53	0.004
4	0.002	14	0.009	24	0.038	34	0.035	44	0.009	54	0.004
5	0.002	15	0.009	25	0.039	35	0.03	45	0.009	55	0.004
6	0.002	16	0.013	26	0.045	36	0.022	46	0.008	56	0.003
7	0.002	17	0.017	27	0.052	37	0.02	47	0.006	57	0.003
8	0.002	18	0.02	28	0.054	38	0.018	48	0.006	58	0.002
9	0.003	19	0.024	29	0.054	39	0.016	49	0.005	59	0.002
10	0.003	20	0.029	30	0.054	40	0.014	50	0.005	60	0.001

A4. Storm Drain System

A. Independent System (applicable to all new construction)

1. Storm waters shall not be conveyed in irrigation ditches.
2. Irrigation waters shall not be conveyed in storm drain systems.

B. Groundwater

1. Where adverse groundwater conditions exist, the City may allow the installation of a subsurface land drain system. Laterals may be installed to each lot for clear groundwater only (discharge of surface water to the storm drain system shall only be permitted upon approval from the City Engineer). Subsurface lines shall be installed with a slope adequate for proper drainage. A backflow control device may be required at the confluence of the land drain system and storm drain system, as determined by the City Engineer.

C. Piping

1. Storm Drain Lines
    a. All storm drain lines considered part of the City's storm drain system shall be reinforced concrete pipe (RCP), of appropriate class when installed in the public right-of-way.
    b. Minimum size for storm drain mains shall be 15-inch diameter.
    c. Public storm drain pipes shall not be curved.
    d. See section A3 for sizing requirements.
2. Land Drain Lines
    a. All land drains shall be RCP or PVC.
    b. Minimum size for land drain mains shall be 8-inch diameter.
    c. Minimum size for land drain laterals shall be 4-inch diameter.
3. Pipe specifications are included in Section 5 of the Public Works Standards.
4. Reimbursement / Pioneering Agreements – Where determined by the City Engineer and/or the Storm Drain Capital Facilities Plan, larger drain lines shall be installed to accommodate future development. The cost to provide adequate storm drainage for a development shall be paid for by the Developer. Upsizing will be coordinated at the time of development. The cost of upsizing will be the responsibility of the City or as defined in the agreement.

D. Access – Storm drain lines shall have cleanout boxes, inlets, or manholes installed at all changes in grade or alignment, with a maximum distance of 400 feet between accesses. Structures shall be installed in accordance with the Technical Specifications and Standard Drawings.

E. Sumps

1. Sumps are not allowed in the City's storm drain system, except as approved by the City Engineer on a case-by-case basis.
2. Sumps shall not be permitted within zones 1, 2, or 3 of any Drinking Water Source Protection Zone of any drinking water source.
3. Class V Injection Well permitting is required.

F. Grates

1. Grates shall be provided at all entrances/exits of the storm drain system, and on the upstream end of all culverts greater than 50-ft in length.
2. Grates shall be provided on catch basins, junction boxes, control structures, etc.
3. Bar spacing shall be designed for location, function, and safety. (Generally, bar spacing should not exceed three (3) inches.)

A5. Detention and Retention Basins

A. When Required

1. Storm drainage basins are required for all development; however, residential developments less than one (1) acre are not required to have detention or retention, except when determined by the City Engineer.
2. In an effort to increase the City's ability to more easily manage storm events, Regional Detention Basins shall be constructed wherever possible, as shown in the City's Storm Water Master Plan.
3. As shown in the City's Storm Water Master Plan, Developer may be required to participate in the construction of a new regional detention basin or the upgrading of an existing detention basin that is designated as a regional detention basin in lieu of onsite detention within the proposed development, if the development is located within a regional detention basin's drainage subbasin.

B. Basin Property, Easement, and Access

1. Public Basins – Public basins shall be located on a separate parcel dedicated to the City with frontage along a public roadway. The developer shall provide the City permanent access to any public basin.
2. Private Basin – Private basins serving multiple lots shall be located on a separate parcel, owned by the home-or land-owners association. Private basins serving a single lot shall be located within the lot. The City shall be provided an easement to, around, and across the basin for emergency access, operation, and/or repair for a private basin.

3. Access – Each basin shall be constructed with sufficient, all-weather, drivable access to all structures from a public street. A turnaround area shall be provided at the termination of the access road.

C. Maintenance and Ownership

Actual ownership and responsibility shall be specifically defined in the Owner's Dedication, Certificates, Development Agreements, or by Deed.

1. Local Basins – Local basins shall be constructed by the developer. Following conditional acceptance of the construction, the operation and maintenance shall be conveyed to the City when applicable.
2. Regional Basins – Regional basins shall be owned and maintained by the City, constructed according to the criteria herein, and approved of the City Engineer.
3. Private Basins
    a. Single Lots (Non-residential only) – When approved, private basins shall be owned and maintained by the property owner.
    b. Multiple Lots – When approved, private basins shall be owned and maintained by the the Homeowners' Association.
    c. Access may be provided from a private street provided an access easement is granted to the City providing access to/from the basin from a public street.
    d. For all private basins, Developer is required to enter into a Long-Term Storm Water Maintenance Agreement with the City.

D. Basin Volume

1. All basin designs and calculations shall be included in the Storm Water Report and submitted to and reviewed by the City Engineer for approval.
2. Volume shall be measured to the internal spillway (overflow) elevation.
3. Volume in pipes, ditches, or roadside swales shall not be considered in the volume calculation for detention and retention basins.
4. Storage of water shall not be allowed in parking lots.

E. Allowable Discharge Design

1. See Section A3.B for storm specifications.
2. Discharge shall not exceed the lesser of:
    a. Pre-development runoff with pre-development, meaning the condition of the land prior to settlement, or
    b. The discharge rate determined by using the standard rate of 0.1 cubic feet per second per total acre.

Show all calculations or provide spreadsheet or program file.

3. Calculations shall be based on the total acreage of the development draining to the basin.
4. Pass-through of offsite drainage through the development must be considered and will be allowed.

F. Detention and Retention Basin Elements

1. Depth – Basins should not exceed three (3) feet in depth as determined from its lowest point to the overflow or spillway, unless it is completely fenced and secured from trespassing, or as otherwise approved by the City.
2. Side slopes – Side slopes shall not be steeper than 3:1 (horizontal to vertical).
3. Bottom Slope – The basin floor shall be designed so as to prevent the permanent ponding of water. The slope of the floor of the basin shall not be less than 1% to provide drainage of water to the outlet grate and prevent prolonged wet, soggy, or unstable soil conditions.
4. Freeboard – At least one (1) foot of freeboard is required (berm above the high water mark).
5. Spillways / Overflow
    a. Internal spillways are preferred for development.
    b. The spillway shall be designed to carry the 200-year storm flow minus the 100-year storm flow which is handled by the outlet control structure.
    c. Spillways shall introduce flows back into the pipe or stream downstream of the outlet control.
    d. Spillways shall include a maintained swale and drainage easement to a safe location.
    e. The spillway shall be designed to prevent erosion.
    f. All spillways shall be designed to protect adjacent embankments, nearby structures, and surrounding properties.
6. Ground Covers – The surface area of the basin shall be hydro-seeded, hydro-mulched, or sodded. Use seed mixture found in the Technical Specifications. A minimum of four (4) inches of top soil must be installed prior to sod or hydro-seed placement. A sprinkler irrigation system is also required for all grassed basins. Developer/contractor is responsible for establishing vegetation.
7. Embankment (Fill) Construction – If a raised embankment is constructed for a basin (constructed with granular materials), it shall be provided with a minimum of 6-inches of clay or bentonite cover on the inside of the berm to prevent water passage through the soil.

8. Excavation (Cut) Construction – If the basin is constructed primarily by excavation, then it may be necessary to provide an impermeable liner (for detention basins) and land drain system when constructed in the proximity of basements or other below grade structures as determined by the geotechnical investigation.

9. Multi-Use Basins – Basins may be designed as multi-use facilities when appropriate precautions are incorporated into the design. If amenities such as pavilions, playground equipment, volleyball courts, etc. are to be constructed within the water detention area of a basin, they shall be designed appropriately. Structures shall be designed for saturated soil conditions and bearing capacities are to be reduced accordingly. Restrooms shall not be located in areas of inundation. Inlet and outlet structures should be located as far as possible from all facilities. No wood chips or floatable objects may be used in the area that will be inundated.

10. Fencing – A conveniently-located access gate, appropriately sized for entrance by maintenance vehicles and equipment, shall be provided for fenced basins. Fencing should not be located at the top of the basin embankment where maintenance equipment, vehicles, and personnel need access. Fencing shall be 6-ft tall chain link in accordance with these Public Works Standards and shall conform to City Zoning Requirements.

G. Detention Basins

1. Percolation – No reduction due to percolation for detention basins volumes shall be permitted.

2. Outlet Control

   a. Private detention basins may have a calculated fixed orifice plate mounted on the outlet of the basin.

   b. Public detention basins shall have movable, screw-type head gates set at the calculated opening height with a stop block required to carry the maximum allowable discharge.

3. Low Flow Piping – The inlet and outlet structures may be located in different areas of the basin, requiring a buried pipe to convey any base flows that enter and exit the basin. (Cross gutters and surface flows are prohibited.) The minimum pipe size and material for the low flow pipe shall be 15-inch RCP or as otherwise specified by the City Engineer.

4. Oil/Sediment Separators

   a. Sizing and design of oil/sediment separators shall be reviewed by the City Engineer and City Personnel prior to installation.

      i. Manufacturer's recommendations for sizing must be followed with calculations submitted to the City.

ii. Consideration must be given to frequency and ease of maintenance of the structure

iii. Separator may either be installed upstream or downstream of detention basin, appropriately sized for such location.

b. Any site dealing with large parking lots or particularly dirty parking lots such as auto repair and maintenance will be required to have an oil separator

c. Private basins shall have contracts in place with a local sewer company to periodically clean the Separator (at least annually).

H. Retention Basins (excludes 80th Percentile Storm Retention; see Section A7)

1. Retention basins must be specifically approved by the City Engineer.

2. Retention basins shall not be permitted within zones 1, 2, or 3 of any Drinking Water Source Protection Zone of any drinking water source.

3. An approved oil/sediment separator shall be installed upstream of retention basin.

4. Retention Basin Criteria – Retention basins may be permitted if the following conditions apply:

a. The distance between the nearest City storm drain and the boundary of the development is greater than:

i. For residential development: 500 feet or 50 feet times the number of lots in the entire development (whichever is greater);

ii. For commercial development: 20 feet times the number of parking stalls on the site.

b. The basin is not located within a Hazardous Area (such as a steep slope) or some other sensitive area (such as a Drinking Water Source Protection Zone).

c. Site is topographically incapable of draining to the City system.

d. Recommendation by the City Engineer.

5. Percolation Rate for Retention Basins

a. A percolation test shall be performed by a licensed tester. The percolation test shall be performed at the elevation of the proposed grade of the bottom of the retention basin.

b. Due to degradation of soils ability to percolate over time, only 80% of the percolation rate shall be used in the calculations for the retention basins.

6. Retention basins shall be designed to completely drain within 48 hours of the primary storm event.

I. Subsurface Fluid Distribution Systems

1. Subsurface Fluid Distribution Systems are allowed for private basins only.
2. See Paragraph H for requirements related to Percolation Rate for Retention Basins.
3. A Class V injection well permit is required.
4. An approved oil/sediment separator shall be installed upstream of subsurface fluid distribution system.
5. Subsurface Fluid Distribution Systems are not allowed for storm water disposal if located in Zone 1 or 2 of a drinking water source. They may be allowed in Zone 3 or 4 of a drinking water source if they are equipped with appropriate pretreatment and approved by the City Engineer.
6. Examples of Subsurface Fluid Distribution Systems include but are not limited to: ADS StormTech® systems, ACF Environmental R-Tanks® and similar; perforated pipe infiltration galleries, etc.

A6. Water Quality

A. Long-term Best Management Practices (BMPs) shall be used to maintain, to the maximum extent practical, the quality of the water to the pre-developed condition.

B. Construction BMPs shall be implemented per the City's Storm Water Management Plan.

A7. 80TH Percentile Storm Retention

A. All new development and redevelopment projects equal to or greater than one (1) acre, or projects that are less than one (1) acre that are part of a larger common plan of development or sale, shall be required to manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 80TH percentile rainfall event [storm]. This objective must be accomplished by the use of practices that are designed, constructed, and maintained to infiltrate, evapotranspire, and/or harvest and reuse rainwater. If meeting this retention standard is technically infeasible, a rationale shall be provided on a case-by-case basis for the use of alternative design criteria. The project must document and quantify that infiltration, evapotranspiration, and rainwater harvesting have been used to the maximum extent technically feasible and that full employment of these controls are infeasible due to site constraints.[3]

B. In Brigham City, the 80th percentile storm has been determined to be 0.54 inches of depth.

C. The intent is to manage water as close as possible to the point at which it falls.

D. Calculations and implementation rationale must be contained in the Storm Water Report.

E. LID measures should be implemented to meet the 80th Percentile Storm requirements.

F. Implementation of this retention standard does not eliminate the requirement for detention/retention basins as described in Section A5, but may be included within the designed detention/retention volumes calculated.

A8. Low Impact Development

All new development and redevelopment projects equal to or greater than one (1) acre, or projects that are less than one (1) acre that are part of a larger common plan of development or sale, shall be required to evaluate Low Impact Development (LID) approaches to infiltrate, evapotranspire, and/or harvest and use storm water from the site to protect water quality.[4]

A. Structural controls may include green infrastructure practices such as:

1. Rainwater harvesting (e.g. rain barrels)
2. Rain gardens
3. Permeable pavement or pavers (not permitted on public streets)
4. Vegetated swales
5. Preservation of vegetation (non-disturbance)
6. Xeriscaping
7. Others as approved by the City Engineer

B. LID approaches must be evaluated and detailed in a LID Analysis and Report, which shall be submitted to and approved by the City Engineer.

C. If an LID approach cannot be utilized, the Applicant must document an explanation of the reasons preventing this approach and the rationale for the *chosen alternative controls* on a case by case basis for each project.[3]

D. Implementation of LID measures does not eliminate the requirement for detention/retention basins as described in Section A5, but may be included within the designed detention/retention volumes calculated.

[4] Adapted from General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s); State of Utah Department of Environmental Quality, Division of Water Quality; May 12, 2021.

EXHIBIT 1 – NOAA POINT PRECIPITATION FREQUENCY ESTIMATES – INTENSITY

NOAA Atlas 14, Volume 1, Version 5
Location name: Brigham City, Utah, USA*
Latitude: 41.5061°, Longitude: -112.0158°
Elevation: 4456.74 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.55** (1.36-1.78)	**1.96** (1.73-2.26)	**2.68** (2.34-3.08)	**3.34** (2.89-3.84)	**4.38** (3.72-5.08)	**5.34** (4.40-6.24)	**6.48** (5.20-7.66)	**7.82** (6.04-9.40)	**9.97** (7.32-12.3)	**12.0** (8.38-15.1)
10-min	**1.18** (1.03-1.35)	**1.49** (1.31-1.72)	**2.03** (1.78-2.35)	**2.54** (2.20-2.92)	**3.34** (2.83-3.86)	**4.07** (3.35-4.75)	**4.93** (3.95-5.83)	**5.95** (4.60-7.15)	**7.59** (5.56-9.37)	**9.10** (6.37-11.5)
15-min	**0.972** (0.848-1.12)	**1.23** (1.08-1.42)	**1.68** (1.47-1.94)	**2.10** (1.82-2.41)	**2.76** (2.34-3.20)	**3.36** (2.77-3.93)	**4.08** (3.26-4.81)	**4.92** (3.80-5.91)	**6.27** (4.60-7.74)	**7.52** (5.27-9.49)
30-min	**0.654** (0.572-0.750)	**0.826** (0.730-0.954)	**1.13** (0.988-1.30)	**1.41** (1.22-1.63)	**1.85** (1.57-2.15)	**2.26** (1.87-2.64)	**2.74** (2.20-3.24)	**3.31** (2.56-3.98)	**4.22** (3.10-5.21)	**5.06** (3.55-6.39)
60-min	**0.404** (0.354-0.464)	**0.512** (0.451-0.591)	**0.701** (0.612-0.807)	**0.874** (0.756-1.01)	**1.15** (0.973-1.33)	**1.40** (1.16-1.64)	**1.70** (1.36-2.01)	**2.05** (1.58-2.46)	**2.61** (1.92-3.23)	**3.13** (2.19-3.95)
2-hr	**0.264** (0.236-0.299)	**0.332** (0.296-0.375)	**0.432** (0.382-0.488)	**0.525** (0.460-0.594)	**0.676** (0.580-0.770)	**0.814** (0.683-0.934)	**0.974** (0.794-1.13)	**1.17** (0.918-1.38)	**1.47** (1.10-1.79)	**1.75** (1.25-2.18)
3-hr	**0.205** (0.186-0.230)	**0.255** (0.231-0.286)	**0.321** (0.289-0.360)	**0.383** (0.342-0.431)	**0.481** (0.422-0.544)	**0.570** (0.490-0.650)	**0.677** (0.566-0.783)	**0.801** (0.650-0.942)	**1.00** (0.776-1.21)	**1.19** (0.882-1.47)
6-hr	**0.140** (0.128-0.154)	**0.172** (0.157-0.190)	**0.211** (0.192-0.232)	**0.245** (0.221-0.271)	**0.297** (0.265-0.330)	**0.340** (0.299-0.380)	**0.388** (0.336-0.440)	**0.444** (0.376-0.509)	**0.546** (0.448-0.640)	**0.638** (0.509-0.763)
12-hr	**0.090** (0.083-0.099)	**0.111** (0.102-0.122)	**0.135** (0.123-0.149)	**0.156** (0.142-0.172)	**0.187** (0.168-0.208)	**0.213** (0.188-0.237)	**0.240** (0.209-0.271)	**0.269** (0.229-0.307)	**0.314** (0.260-0.366)	**0.350** (0.283-0.416)
24-hr	**0.058** (0.053-0.064)	**0.071** (0.065-0.079)	**0.087** (0.079-0.095)	**0.099** (0.091-0.109)	**0.117** (0.106-0.129)	**0.132** (0.119-0.144)	**0.146** (0.131-0.161)	**0.162** (0.144-0.178)	**0.183** (0.161-0.201)	**0.199** (0.175-0.220)
2-day	**0.034** (0.031-0.038)	**0.042** (0.038-0.046)	**0.050** (0.046-0.056)	**0.058** (0.053-0.064)	**0.068** (0.062-0.075)	**0.076** (0.069-0.084)	**0.085** (0.076-0.093)	**0.093** (0.083-0.103)	**0.105** (0.093-0.117)	**0.115** (0.100-0.127)
3-day	**0.025** (0.023-0.028)	**0.031** (0.028-0.034)	**0.037** (0.034-0.041)	**0.043** (0.039-0.047)	**0.050** (0.045-0.056)	**0.056** (0.051-0.063)	**0.063** (0.056-0.070)	**0.069** (0.061-0.077)	**0.078** (0.069-0.087)	**0.085** (0.074-0.095)
4-day	**0.021** (0.019-0.023)	**0.025** (0.023-0.028)	**0.031** (0.028-0.034)	**0.035** (0.032-0.039)	**0.042** (0.037-0.046)	**0.047** (0.042-0.052)	**0.052** (0.046-0.058)	**0.057** (0.051-0.064)	**0.065** (0.057-0.072)	**0.071** (0.061-0.079)
7-day	**0.014** (0.013-0.016)	**0.018** (0.016-0.020)	**0.022** (0.019-0.024)	**0.025** (0.022-0.028)	**0.029** (0.026-0.032)	**0.033** (0.029-0.036)	**0.036** (0.032-0.040)	**0.040** (0.035-0.045)	**0.045** (0.039-0.050)	**0.049** (0.042-0.055)
10-day	**0.011** (0.010-0.013)	**0.014** (0.013-0.016)	**0.017** (0.015-0.019)	**0.019** (0.018-0.022)	**0.023** (0.021-0.025)	**0.025** (0.023-0.028)	**0.028** (0.025-0.031)	**0.031** (0.027-0.034)	**0.034** (0.030-0.038)	**0.037** (0.032-0.041)
20-day	**0.007** (0.007-0.008)	**0.009** (0.008-0.010)	**0.011** (0.010-0.012)	**0.012** (0.011-0.014)	**0.014** (0.013-0.016)	**0.016** (0.014-0.017)	**0.017** (0.015-0.019)	**0.018** (0.017-0.020)	**0.020** (0.018-0.022)	**0.021** (0.019-0.024)
30-day	**0.006** (0.006-0.007)	**0.007** (0.007-0.008)	**0.009** (0.008-0.010)	**0.010** (0.009-0.011)	**0.012** (0.011-0.013)	**0.013** (0.012-0.014)	**0.014** (0.013-0.015)	**0.015** (0.014-0.016)	**0.016** (0.015-0.018)	**0.017** (0.016-0.019)
45-day	**0.005** (0.005-0.005)	**0.006** (0.006-0.007)	**0.007** (0.007-0.008)	**0.008** (0.008-0.009)	**0.009** (0.009-0.010)	**0.010** (0.009-0.011)	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.013** (0.012-0.014)	**0.014** (0.012-0.015)
60-day	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.007-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.009)	**0.009** (0.009-0.010)	**0.010** (0.009-0.011)	**0.011** (0.010-0.012)	**0.011** (0.010-0.012)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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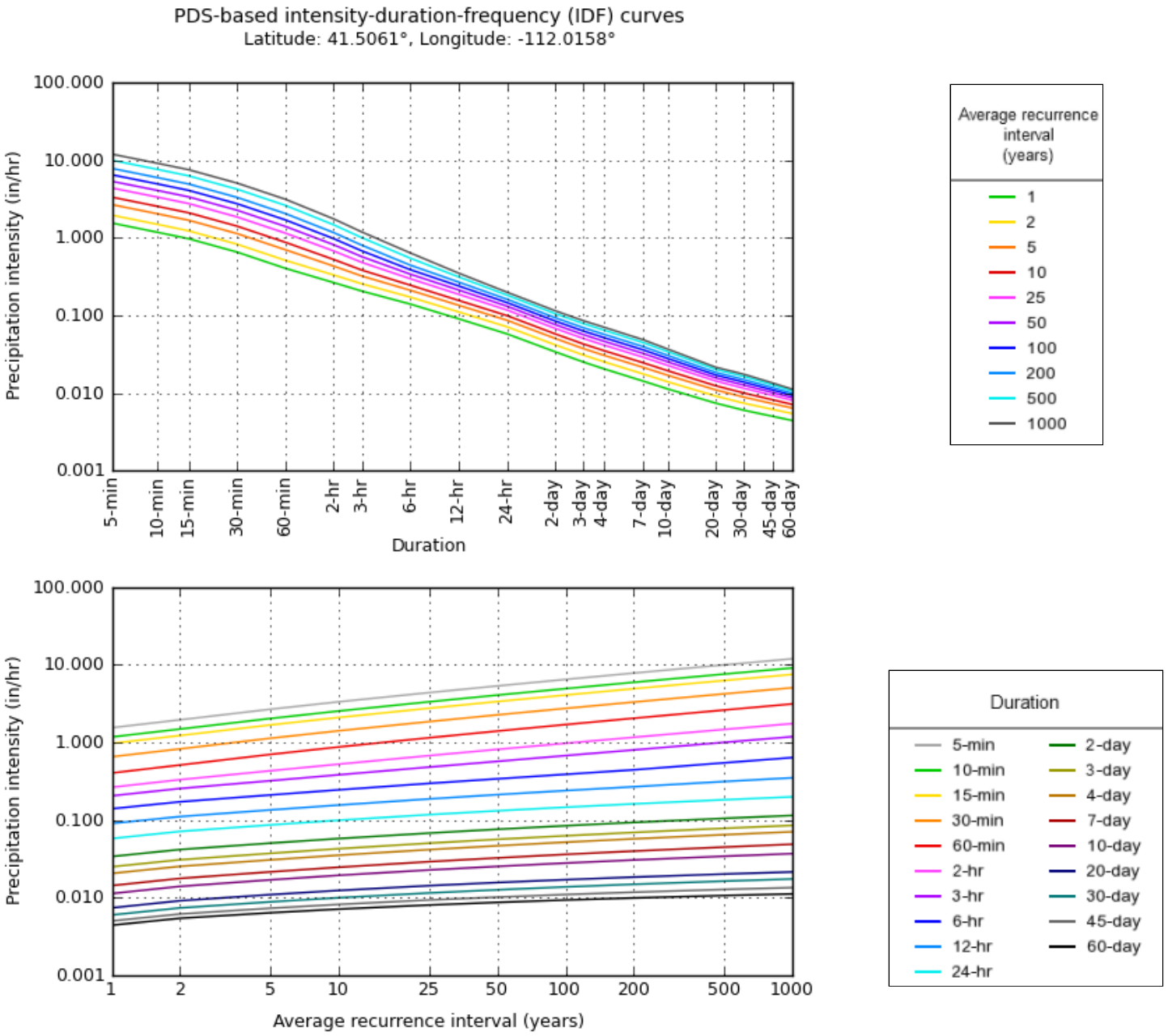
PF graphical



NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Fri Jun 7 21:30:24 2019

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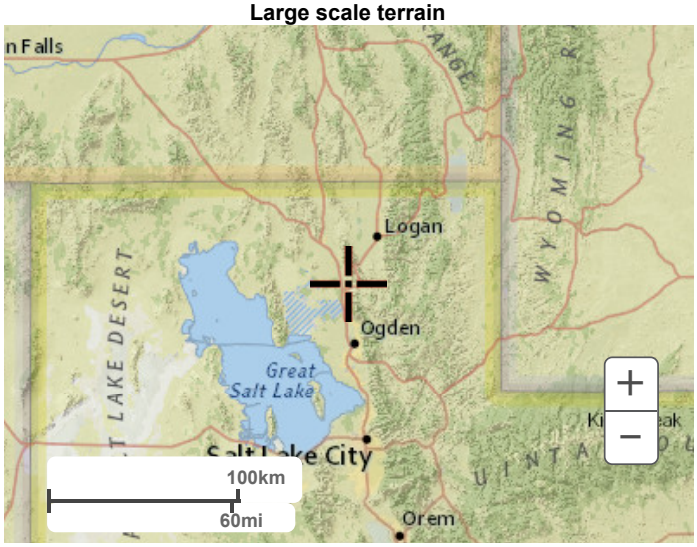
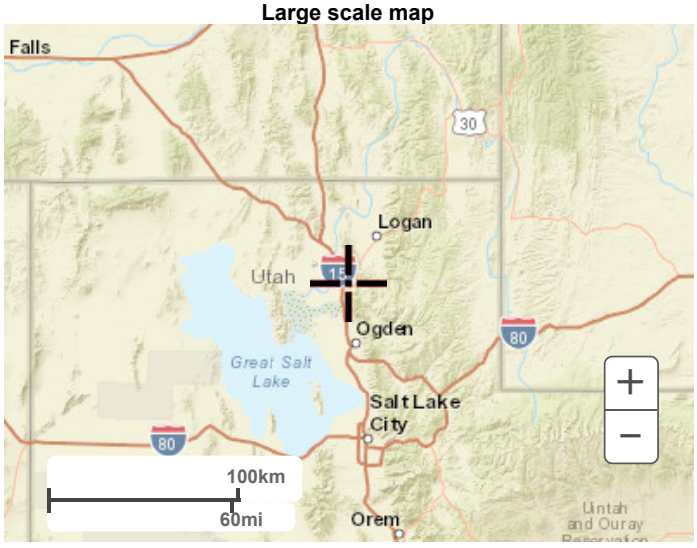
Maps & aerials

Small scale terrain

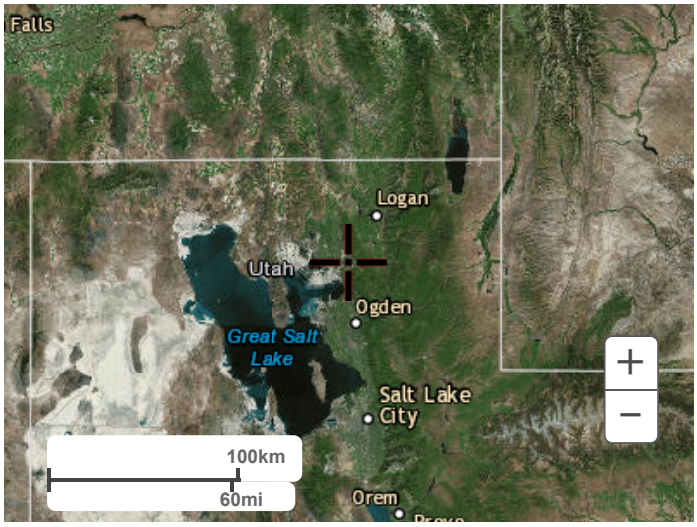
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

EXHIBIT 2 – NOAA POINT PRECIPITATION FREQUENCY ESTIMATES – DEPTH

NOAA Atlas 14, Volume 1, Version 5
Location name: Brigham City, Utah, USA*
Latitude: 41.5061°, Longitude: -112.0158°
Elevation: 4456.74 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.129 (0.113-0.148)	0.163 (0.144-0.188)	0.223 (0.195-0.257)	0.278 (0.241-0.320)	0.365 (0.310-0.423)	0.445 (0.367-0.520)	0.540 (0.433-0.638)	0.652 (0.503-0.783)	0.831 (0.610-1.02)	0.996 (0.698-1.26)
10-min	0.196 (0.171-0.225)	0.248 (0.219-0.286)	0.339 (0.296-0.391)	0.423 (0.366-0.487)	0.556 (0.471-0.644)	0.678 (0.559-0.792)	0.822 (0.658-0.971)	0.992 (0.767-1.19)	1.26 (0.927-1.56)	1.52 (1.06-1.91)
15-min	0.243 (0.212-0.279)	0.307 (0.271-0.354)	0.420 (0.367-0.484)	0.524 (0.454-0.603)	0.689 (0.584-0.799)	0.840 (0.693-0.982)	1.02 (0.816-1.20)	1.23 (0.950-1.48)	1.57 (1.15-1.94)	1.88 (1.32-2.37)
30-min	0.327 (0.286-0.375)	0.413 (0.365-0.477)	0.566 (0.494-0.652)	0.706 (0.611-0.813)	0.927 (0.787-1.08)	1.13 (0.933-1.32)	1.37 (1.10-1.62)	1.66 (1.28-1.99)	2.11 (1.55-2.61)	2.53 (1.77-3.20)
60-min	0.404 (0.354-0.464)	0.512 (0.451-0.591)	0.701 (0.612-0.807)	0.874 (0.756-1.01)	1.15 (0.973-1.33)	1.40 (1.16-1.64)	1.70 (1.36-2.01)	2.05 (1.58-2.46)	2.61 (1.92-3.23)	3.13 (2.19-3.95)
2-hr	0.529 (0.473-0.598)	0.663 (0.591-0.750)	0.863 (0.765-0.975)	1.05 (0.920-1.19)	1.35 (1.16-1.54)	1.63 (1.37-1.87)	1.95 (1.59-2.27)	2.33 (1.84-2.76)	2.94 (2.19-3.58)	3.50 (2.50-4.36)
3-hr	0.617 (0.558-0.692)	0.766 (0.693-0.859)	0.964 (0.867-1.08)	1.15 (1.03-1.29)	1.45 (1.27-1.63)	1.71 (1.47-1.95)	2.03 (1.70-2.35)	2.40 (1.95-2.83)	3.01 (2.33-3.64)	3.56 (2.65-4.40)
6-hr	0.838 (0.768-0.920)	1.03 (0.941-1.14)	1.26 (1.15-1.39)	1.47 (1.33-1.63)	1.78 (1.59-1.98)	2.04 (1.79-2.28)	2.33 (2.01-2.63)	2.66 (2.25-3.05)	3.27 (2.68-3.83)	3.82 (3.05-4.57)
12-hr	1.09 (0.999-1.20)	1.34 (1.23-1.47)	1.63 (1.49-1.79)	1.88 (1.71-2.07)	2.26 (2.02-2.50)	2.56 (2.27-2.86)	2.89 (2.51-3.26)	3.24 (2.76-3.70)	3.78 (3.13-4.41)	4.22 (3.42-5.02)
24-hr	1.39 (1.27-1.53)	1.71 (1.56-1.89)	2.08 (1.90-2.29)	2.39 (2.18-2.62)	2.82 (2.55-3.09)	3.16 (2.85-3.47)	3.51 (3.15-3.86)	3.88 (3.46-4.26)	4.38 (3.87-4.83)	4.78 (4.19-5.28)
2-day	1.63 (1.49-1.81)	2.01 (1.83-2.22)	2.42 (2.21-2.68)	2.77 (2.52-3.07)	3.26 (2.95-3.61)	3.65 (3.29-4.04)	4.06 (3.64-4.48)	4.48 (3.99-4.95)	5.05 (4.46-5.60)	5.51 (4.81-6.12)
3-day	1.80 (1.64-2.00)	2.22 (2.02-2.46)	2.69 (2.44-2.98)	3.08 (2.79-3.42)	3.63 (3.27-4.02)	4.07 (3.65-4.51)	4.52 (4.03-5.01)	4.99 (4.42-5.54)	5.64 (4.95-6.28)	6.15 (5.34-6.86)
4-day	1.98 (1.79-2.20)	2.43 (2.21-2.71)	2.95 (2.67-3.28)	3.39 (3.06-3.77)	4.00 (3.59-4.44)	4.48 (4.01-4.98)	4.98 (4.43-5.54)	5.50 (4.85-6.13)	6.22 (5.44-6.95)	6.79 (5.87-7.61)
7-day	2.41 (2.18-2.69)	2.98 (2.70-3.33)	3.62 (3.27-4.03)	4.15 (3.74-4.63)	4.89 (4.39-5.45)	5.47 (4.89-6.10)	6.08 (5.40-6.78)	6.70 (5.92-7.48)	7.54 (6.60-8.44)	8.21 (7.13-9.21)
10-day	2.72 (2.48-3.01)	3.36 (3.07-3.73)	4.08 (3.71-4.52)	4.66 (4.24-5.17)	5.46 (4.94-6.05)	6.07 (5.47-6.73)	6.71 (6.02-7.44)	7.35 (6.55-8.16)	8.21 (7.25-9.14)	8.87 (7.78-9.91)
20-day	3.56 (3.26-3.89)	4.39 (4.03-4.80)	5.26 (4.83-5.75)	5.96 (5.45-6.50)	6.86 (6.27-7.48)	7.53 (6.86-8.21)	8.20 (7.44-8.94)	8.85 (7.99-9.68)	9.69 (8.70-10.6)	10.3 (9.22-11.3)
30-day	4.33 (3.99-4.73)	5.33 (4.91-5.82)	6.37 (5.88-6.96)	7.20 (6.63-7.86)	8.30 (7.63-9.07)	9.11 (8.35-9.96)	9.93 (9.07-10.9)	10.7 (9.76-11.8)	11.8 (10.6-12.9)	12.6 (11.3-13.8)
45-day	5.42 (5.00-5.87)	6.67 (6.15-7.23)	7.90 (7.28-8.55)	8.86 (8.15-9.59)	10.1 (9.27-10.9)	11.0 (10.1-11.9)	11.9 (10.8-12.8)	12.7 (11.6-13.8)	13.8 (12.5-15.0)	14.6 (13.1-15.9)
60-day	6.38 (5.88-6.89)	7.83 (7.22-8.47)	9.22 (8.50-9.96)	10.3 (9.47-11.1)	11.6 (10.7-12.5)	12.5 (11.5-13.6)	13.5 (12.3-14.6)	14.3 (13.1-15.5)	15.4 (14.0-16.7)	16.1 (14.6-17.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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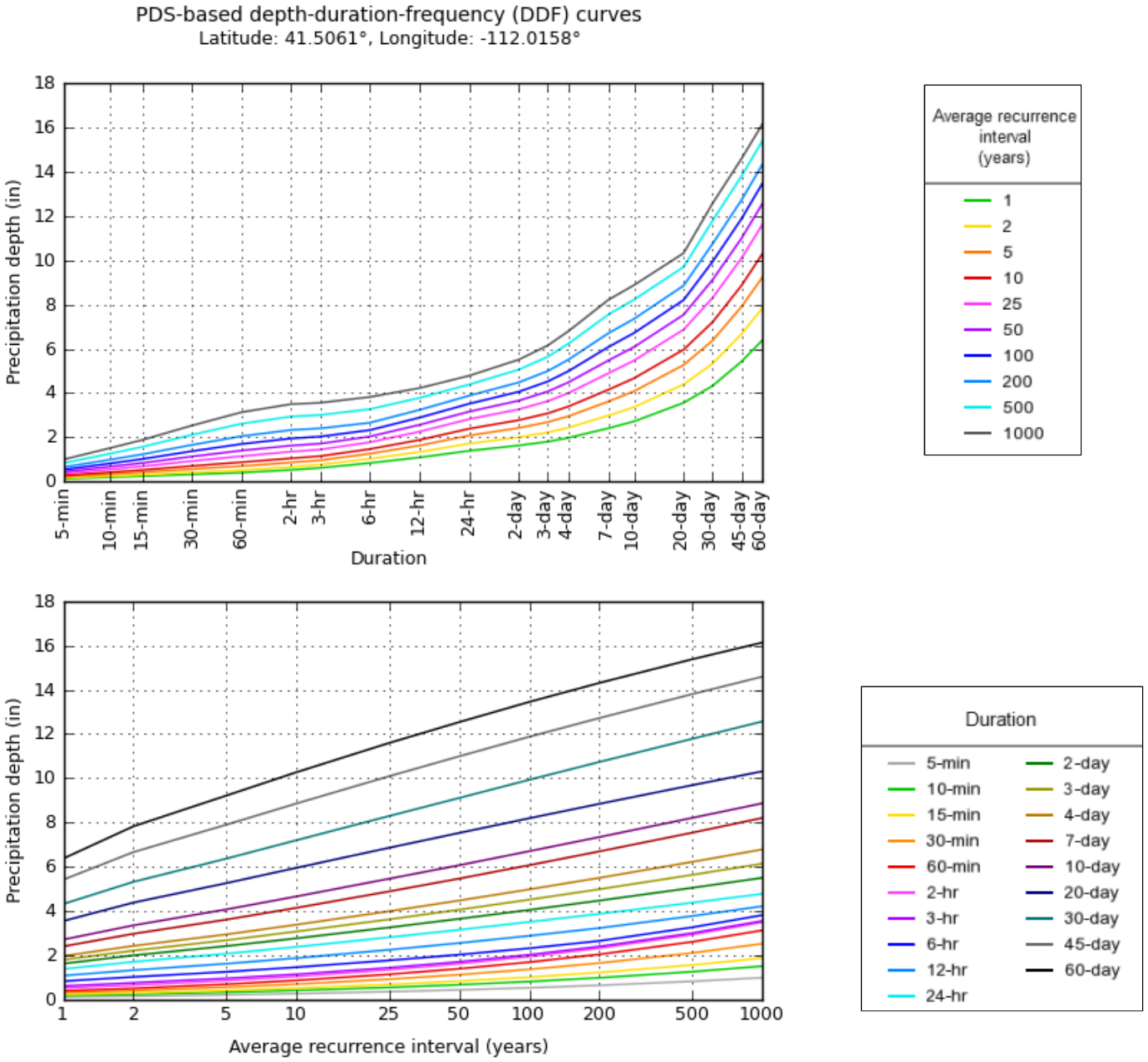
PF graphical



NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Fri Jun 7 21:27:36 2019

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Maps & aerials

Small scale terrain

EXHIBIT 3 – SUMMARY OF ALLOWABLE LID BMPs

Summary of LID BMPs and Recommendations on Where to Allow
from *A Guide to Low Impact Development within Utah*

https://deq.utah.gov/water-quality/low-impact-development

				Primary Functions				Where Permitted				
LID BMP Category	LID BMP Type	Fact Sheet ID	Removal Effectiveness[1]	Bioretention	Volume Retention	Biofiltration	Maintenance Effort	Residential - Public Roads	Residential - Private Roads	Residential - Multi-family	Commercial	Industrial
Bioretention	Rain Garden	BR-1	high	yes	yes	yes	low-med	yes	yes	yes	yes	yes
	Bioretention Cell	BR-2	high	yes	yes	yes	low-med	yes	yes	yes	yes	yes
	Bioswale	BR-3	medium	yes	some	yes	low	yes	yes	yes	yes	yes
	Vegetated Strip	BR-4	med-high	yes	some	yes	low	yes	yes	yes	yes	yes
	Tree Box Filter	BR-5	med-high	yes	varies	yes	medium	yes	yes	yes	yes	yes
	Green Roof	BR-6	med-high	yes	yes	yes	med-high	no[2]	no[2]	no[2]	yes	yes
Pervious Surfaces	Pervious Surfaces	PS-1	high	yes	yes	some	low-med	no[2]	no[2]	yes	yes	yes
Infiltration Devices[5]	Infiltration Basin[3]	ID-1	high	yes	yes	yes	low	yes	yes	yes	yes	yes
	Infiltration Trench	ID-2	high	yes	yes	some	low	no	yes	yes	yes	no
	Dry Well[3,4]	ID-3	high	yes	yes	no	low-med	yes	yes	yes	yes	no
	Underground Infiltration Gallery[3,4]	ID-4	high	yes	yes	no	low-med	yes	yes	yes	yes	yes
Harvest and Reuse	Harvest and Reuse	HR-1	varies	varies	yes	varies	low	no[2]	no[2]	no[2]	yes	yes

Notes

[1] Sediment, Nutrients, Metals, Bacteria, Oil/Grease

[2] Individual homes may utilitize BMP, but it will not count towards LID and retention requirement for development.

[3] Requires pre-treatment

[4] Requires UIC Class V injection well permit from State of Utah

[5] Other factors (e.g. drinking water source protection zone, contaminated groundwater, etc.) may limit use.

APPENDIX B – GEOTECHNICAL INVESTIGATION REPORT MINIMUM REQUIREMENTS

APPENDIX B

GEOTECHNICAL INVESTIGATION REPORT MINIMUM REQUIREMENTS

B1. General Provisions

A. All reports shall include the Minimum Testing Requirements and use the Design Parameters as detailed below.

B. All reports shall be signed and sealed by a registered Professional Engineer licensed in Utah.

B2. Report Contents

A. Geotechnical Investigation Report submitted to Brigham City shall generally include the following contents, as applicable.

CONTENTS

1.0 Project Description/Overview
- *1.1 Existing Conditions*
- *1.2 Proposed Improvements*

2.0 Site Conditions
- *2.1 Surface Conditions*
- *2.2 Subsurface Conditions*
- *2.3 Groundwater*

3.0 Subsurface Investigation
- *3.1 Percolation Test*
- *3.2 Infiltration Test*

4.0 Laboratory Testing

5.0 Geologic Hazards
- *5.1 Rock Fall*
- *5.2 Faulting*
- *5.3 Seismic/Ground Motions*
- *5.4 Lateral Spread*
- *5.5 Liquefaction Potential*
- *5.6 Landslide and Scarps*
- *5.7 Debris Flow/Alluvial Fan*
- *5.8 Expansive/Collapsible Soils*
- *5.9 Avalanche*

6.0 Earthwork
- *6.1 Site Preparation and Grading*
- *6.2 Temporary Excavations*
- *6.3 Permanent Cut and Fill Slopes*
- *6.4 Fill Material Composition, Placement, and Compaction*
- *6.5 Roadway and Embankments Fill*
- *6.6 Structural Fill*

6.7 Utility Trenches
6.8 Re-use of Excavated Soil Materials
7.0 Foundations
7.1 Foundation Recommendations
7.2 Installation Requirements
7.3 Estimated Settlement
7.4 Lateral Resistance
8.0 Static and Seismic Lateral Earth Pressures (Active, Moderately Yielding, At-Rest, and Passive Conditions)
9.0 Floor Slabs
10.0 Drainage Recommendations
10.1 Surface
10.2 Subsurface
10.3 Foundation Drains/Subdrains
11.0 Pavement Section
11.1 (See Section B4)
11.2 Exterior Concrete Flatwork
12.0 Retaining Walls (Required for all retaining walls taller than 4 feet, when used)
12.1 Surface and Subsurface Drainage
12.2 Internal and Global Stability (Static and Seismic Loading)
12.3 Dimensions and Elevations
12.4 Settlements
12.5 Construction Inspection
13.0 Slope Stability (Required for slopes greater than 25%)
14.0 References
Tables
Figures
A. Project Location/Site Map
B. Boring/Test Pit Locations
C. Boring/Test Pit Logs
D. Key to Symbols for Boring/Test Pit Logs
Appendices, as needed

B3. Minimum Testing Requirements

A. Borings (B) and Test Pits (TP), either known as a "hole"
1. Total: Minimum 1 hole per 2 acres, rounded up
a. Example: 5.5 acre site: 5.5÷2 = 2.75, round up to 3 holes
2. Roadway: 1 hole + 1 hole per 500 lf of roadway (rounded up, along centerline alignment) (counts towards Total)
a. Example: 10.5 acre subdivision with 1,850 lf of roadway centerline
i. Roadway: 1 + (1,850÷500) = 4.7, round up to 5 holes
ii. Total, minimum: 10.5÷2 = 5.25, round up to 6 holes

iii. Therefore, 6 total holes are required for subdivision, with 5 of the holes being along the roadway alignment.

3. Commercial sites: 1 hole + 1 hole per 5,000 square feet (rounded up) for buildings
   a. Example: 13,500 sf building: 1 + (13,500÷5,000) = 3.7, round up to 4 holes
4. Additional borings or test pits as may be required for a representative sampling of the site, as determined by the geotechnical engineer.

B4. Minimum Design Parameters for Pavement

A. Local/Residential
   1. 75,000 ESALS
   2. 20-yr design life
   3. 3% growth factor

B. Cul-de-Sac
   1. 50,000 ESALS
   2. 20-yr design life
   3. 3% growth factor

C. Minor Collector (as shown on the City's Master Street Map)
   1. 300,000 ESALS
   2. 20-yr design life
   3. 3% growth factor

D. Major Collector / Minor Arterial
   1. Contact City for traffic requirements

APPENDIX C – MODIFICATIONS AND ADDITIONS TO MANUAL OF STANDARD SPECIFICATIONS

APPENDIX C

MODIFICATIONS AND ADDITIONS TO THE *2017 MANUAL OF STANDARD SPECIFICATIONS*

as published by:
Utah LTAP Center
Utah State University
Logan Utah
2017

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SECTION 03 20 00 M
CONCRETE REINFORCING (MODIFIED)

PART 3 EXECUTION

3.1 **PLACING**

Add paragraphs F and G as follows:

F. No steel shall extend from or be visible on any finished surface

G. All steel shall have a minimum of 1.5-inches of concrete cover.

SECTION 03 30 04 M
CONCRETE (Modified)

PART 2 PRODUCTS

2.4 ADDITIVES

Add paragraph F as follows:

F. Fiber Reinforcement: A minimum of 1pound per cubic yard of polyolefin fiber reinforcement shall be evenly distributed into the mix. Mixing shall be as recommended by the manufacturer/ supplier such that the fibers do not ball up. Polyolefin fibers shall meet the requirements of ASTM C1116 and ASTM D7508.

2.5 MIX DESIGN

Replace paragraph A with the following:

A. **Class:** When not specified in the plans or project specification, use the following table to select the class of concrete required for the application:

Class	Application
5,000	Reinforced structural concrete
4,000	Sidewalks, curb, gutter, cross gutters, waterways, pavements, and unreinforced footings and foundations
3,000	Thrust blocks
2,000	Anchors, mass concrete

SECTION 03 30 10 M
CONCRETE PLACEMENT (Modified)

PART 3 EXECUTION

3.2 PREPARATION

Add paragraph F as follows:

F. No concrete shall be placed until the surfaces have been inspected and approved by the City Engineer or City Inspector.

Add Section 22 13 29 Sanitary Sewerage Pumps

SECTION 22 13 29
SANITARY SEWERAGE PUMPS

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. Pumps shall be capable of handling raw, unscreened sewerage. Pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. Pump, its appurtenances, and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

1.2 SECTION INCLUDES

A. Submersible sewerage pump with controls and components.

B. Coordinate installation with work of separate trades.

1.3 RELATED WORK

A. Section 33 32 19 – Sanitary Sewerage Pump Stations

1.4 REFERENCES

A. IPC-2012 International Plumbing Code

B. National Electrical Manufacturers Association (NEMA)

C. National Fire Protection Association (NFPA)

D. Underwriters' Laboratories, Inc. (UL)

1.5 SUBMITTALS

A. Substitutions: Section 01 25 00.

B. Shop Drawings: Section 01 33 00 for pumps, electrical connections, and controls.

C. Pump Curves: Certified pump performance characteristics with pump and system operating point plotted. Include net positive suction head (NPSH) curve.

D. Motor and Cable Insulation Test: For moisture content or insulation defects.

E. Certified copies of all the factory and construction site test data sheets and reports.

F. Pump manufacturer's certificate that installation is correct and the pump(s) function properly relative to flow, speed, vibration, and amperage draw.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list indicating all components of the systems.

2. Include complete diagrams of the internal wiring for each item of equipment.

3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.6 **HANDLING AND STORAGE**

A. Protect against damage and dirt during shipping and storage.

1.7 **PUMP WARRANTY**

A. The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a minimum period of five (5) years or 10,000 hours under the Municipal Wastewater-Permanent Installation Warranty Policy under normal use, operation, and service. The warranty shall be in printed form and apply to all similar units.

1.8 **LOCAL PUMP SERVICE FACILITY**

A. At the time of bidding, there shall be a fully accredited service facility within 100 miles of the project site having factory trained technicians and a full stock of repair parts for a complete overhaul of the proposed pumps.

1.9 **EXPERIENCE**

A. The pump manufacturer shall have a minimum of 1,000 units of similar type pumps, installed and operating for no less than five (5) years in the United States.

PART 2 PRODUCTS

2.1 **MAJOR PUMP COMPONENTS**

A. Gray case iron, Class 30 casing, with smooth surfaces devoid of blow holes and other irregularities.

B. Stainless steel exposed bolts and nuts, Section 05 05 23.

C. Waterproof exterior. Manufacturer select exterior spray with PVC epoxy primer chloric rubber paint finish.

2.2 **CASTING**

A. Each pump casting shall be constructed of fine-grained cast iron. The casting shall be designed for a minimum working pressure of 50 psig and hydrostatically tested to 1½ times the working pressure.

2.3 MECHANICAL SEAL

A. Each pump shall be provided with a mechanical seal system running in an oil reservoir having separate, constantly hydrodynamically lubricated lapped seal faces. The lower seal unit shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper seal shall contain one stationary tungsten-carbide ring and one positively driven carbon ring. The seal system shall not rely upon the pumped media for lubrication.

2.4 **DISCHARGE CONNECTION ELBOW**

A. Installed in the wet well.

B. Make connection of pump to discharge connection elbow automatic when pump is lowered into place in a simple downward motion.

C. Provide sliding guide bracket and guide bar(s) as part of the discharge connection elbow.

D. Guarantee sealing of the discharge interface.

2.5 **MATING SURFACES**

A. Seal all mating surfaces. Do not use secondary sealing compounds, gaskets, grease, or other devices.

2.6 **CABLE ENTRY**

A. Watertight and submersible seal for cable entry into pump.

B. Isolate cable entry junction chamber and motor from each other so foreign material entering through the pump top (if any) shall not have access to the motor.

C. Do not use epoxies, silicones, or other secondary sealing systems.

2.7 **PUMP MOTOR**

A. Squirrel-cage, induction, shell type design, housed in an air-filled, watertight chamber, NEMA Design B type with stator winding and stator leads insulated against moisture and temperatures less than 311 deg F

B. Design for continuous duty, capable of sustaining a minimum of 10 starts per hour.

C. Capable of continuous operation at totally, partially, or non-submerged conditions.

2.8 **JUNCTION CHAMBER**

A. Junction chamber to contain the terminal board.

B. Connection Between Cable and Stator Leads: Perfectly leak-proof.

2.9 **COOLING SYSTEM**

A. Provide an adequately designed cooling system for the pump(s).

B. Provide provision for external cooling and flushing.

2.10 **THERMAL SENSORS**

A. Use thermal sensors to monitor stator temperatures that are wired to the control panel.

2.11 **PUMP SHAFT SEAL**

A. Carbon steel, C 1036, shaft completely isolated from the pumped liquid by a mechanical rotating shaft seal system. Seals require neither maintenance nor adjustment, which can be easily inspected and replaced.

B. Do not use a pressure differential consisting of a single or double spring action between upper and lower sealing units to offset external pressure and to affect shaft sealing.

C. Use oil as seal lubricant. Provide drain and inspection plug, with a positive anti-leak seal that is easily accessible from the outside.

2.12 **SHAFT BEARINGS**

A. Permanently lubricated bearings capable of five (5) years continuous operation.

B. Use bearings capable of operating for short periods of time with the discharge valve closed.

2.13 **IMPELLER**

A. One piece, cast iron, statically and dynamically balanced, double shrouded, non-clogging design having a long thrulet without acute turns capable of handling solids, fibrous materials, heavy sludge, and other similar materials, and capable of passing 2-inch solids.

B. Fit the impeller and the shaft by sliding and using a key to lock.

2.14 **VOLUTE**

A. Designed with smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.

2.15 **PUMP MOTOR CABLE**

A. Use pump motor cable suitable for submersible pump application. Conform cable sizing to NEC specifications for pump motors.

B. Seal pump cable end with a high quality protective covering to make it impervious to moisture or water seepage before electrical installation.

C. Provide 1 foot extra length of cable for each 50 feet of depth.

D. Provide 10 feet of extra cable beyond surface plate.

E. Provide corrosion resistant shield where cable passes pump volute.

2.16 **LEAK DETECTION**

A. Manufacturers requiring moisture detection devices for warranty shall supply a lockout device with a manual reset in the control panel.

2.17 **ACCESS FRAME, GUIDES, AND DOOR**

A. Provide access frame to the discharge connection elbows complete with hinges and flush locking mechanism, upper guide holder and level sensor(s) cable holder. Provide frame with sliding nut rails to attach the accessories required. Lower guide bar holder(s) shall be integral with the discharge connection elbow.

B. Provide guide bars of the size necessary to lift and lower the pump(s) without bending, binding, or vibration. Do not support any portion of the weight of the pump of the guide bars.

C. Provide surface plate with adequate rigidity to support the system, but with sufficient openings to allow free access to cable, vent, and water.

D. Access doors of skid proof design.

E. All components stainless steel. Hatches may be aluminum or as approved by City Engineer. J-Vent may be galvanized or as approved by City Engineer.

2.18 **CONDUIT SYSTEMS**

A. Section 26 05 33.

B. Do not use flexible conduit.

2.19 **CONTROL PANEL**

A. Solid state logic circuitry operational in temperature range of -40 deg F and +120 deg F and waterproof, designed for outdoor use, lockable and containing line voltage pump power circuit and lower voltage pilot control circuit or approved equivalent. The pilot control circuit takes power from the same terminal board. Perform the following functions:

1. Start and stop pumps at required water levels.
2. Alternate the sequence of starting via manual or automatic selection.
3. Start progressively more pumps if water level in sump continues to rise.
4. Instant disconnect from power source in the event of major electrical fault.

B. Equip the panel with all protective devices for motors as disconnects, relays, hand-auto-off switches designed for three phase 480/277 volt power system to control the pumps via the operation of the liquid sensors.

C. On/off pump running lights in the control panel for each pump.

D. Adjustable thermostat heater.

E. Conduit penetrations shall not be allowed through the top of the control panel unless approved by City Engineer.

2.20 **TIMERS**

A. Provide timers such that the operating time of each pump can be continuously monitored. Fit each timer with a reset capability to restart timing cycle.

PART 3 EXECUTION

3.1 **INSTALLATION**

A. Check impeller, motor rating, and electrical connections for compliance with manufacturer's recommendations.

B. Secure pumps as indicated and per the manufacturer's recommendations.

3.2 **PUMP TESTING AND START-UP**

A. Qualified millwright to check, align, and certify pumps before start-up.

B. Before submergence, run the pump dry to establish correct rotation and mechanical integrity.

C. Run the pump for a minimum of 30 minutes submerged, under six (6) feet of water minimum. Retest motor and cable insulation.

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

E. System Testing: Run a complete operating test of the pumps and associated equipment after installed in the field:

1. Dry Test: Turn on the power to all equipment. With pump station dry, activate pump liquid level sensors sequentially, check “pumps’ running lights” on the control panel to

check for proper operation. Deactivate all sensors. Check configurations for lead and lag pumps. Repeat process to check for change in lead pump.

2. Wet Test: Provide a source of water adequate for this test. Conduct this test identically to the Dry Test. All equipment must pass these tests. Repair or replace any equipment failing to operate properly at no additional cost to OWNER.

F. Start-up: Instruct OWNER's personnel, Section 01 78 23.

END OF SECTION

SECTION 31 23 16 M
EXCAVATION (Modified)

PART 3 EXECUTION

3.3 GENERAL EXCAVATION REQUIREMENT

Add paragraph I as follows:

I. Excavation for pipelines under existing curb and gutter, concrete slabs, or sidewalks shall be open cut. In no case shall tunneling be allowed. At the option of the City Engineer, jacking under permanent facilities may be allowed based on his/her direction.

Add Section 31 23 20 Fill

SECTION 31 23 20
FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-structural fill materials.

B. Non-structural placement and compaction.

1.2 REFERENCEs

A. **ASTM Standards**

D 698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
D 1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. When requested by ENGINEER, submit laboratory dry density and optimum laboratory moisture content for each type of fill to be used.

1.4 QUALITY ASSURANCE

A. Do not change material sources without ENGINEER's knowledge.

B. Reject material that does not comply with the requirements specified in this Section.

1.5 STORAGE

A. Safely stockpile materials.

B. Separate differing fill materials, prevent mixing, and maintain optimum moisture content of materials.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any fill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.

B. Control erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section to required density.

1.7 ACCEPTANCE

A. General: Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.

B. Lift thickness: One test per Lot.

C. Compaction: One test per Lot. Verify density using nuclear tests, ASTM D 2922. Compaction and Lot sizes as follows:

1. Compact to 92% Standard Proctor
2. One Lot = 1500 square feet per lift

1.8 **WARRANTY**

A. Repair settlement damage at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 **FILL MATERIALS**

A. Material shall be free from sod, grass, trash, rocks larger than four (4) inches in diameter, and all other material unsuitable for construction of compacted fills.

2.2 **WATER**

A. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.

B. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Implement the traffic control plan requirements, Section 01 55 26.

B. Verify material meets maximum size requirements.

C. If ground water is in the intended fill zone, dewater.

3.2 **PROTECTION**

A. Protect existing trees, shrubs, lawns, structures, fences, roads, sidewalks, paving, curb and gutter and other features.

B. Protect above or below grade utilities. Contact utility companies to repair utility damage. Pay all cost of repairs.

C. Avoid displacement of and damage to existing installations while compacting or operating equipment.

D. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.

E. Restore any damaged structure to its original strength and condition.

3.3 **LAYOUT**

A. Identify required line, levels, contours, and datum.

B. Stake and flag locations of underground utilities.

C. Upon discovery of unknown utility or concealed conditions, notify ENGINEER.

D. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.

E. If discrepancy is found between Contract Documents and site, ENGINEER shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to CONTRACTOR or OWNER.

3.4 **SUBGRADE**

A. Protect Subgrade from desiccation, flooding, and freezing.

B. Before placing fill over Subgrade, get ENGINEER's inspection of subgrade surface preparations.

C. If Subgrade is not readily compactable get ENGINEER’s permission to stabilize the subgrade.

3.5 **TOLERANCES**

A. Compaction: Ninety-two (92) percent minimum relative to a standard proctor density, Section 31 23 26.

B. Lift Thickness (before compaction):

1. Eight (8) inches when using riding compaction equipment.

2. Six (6) inches when using hand held compaction equipment.

3.6 **CLEANING**

A. Remove stockpiles from site. Grade site surface to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 31 41 00 M
SHORING (Modified)

PART 1 GENERAL

1.2 **PRICE – MEASUREMENT AND PAYMENT**

A. In Trenching, Shoring:

Revise subparagraph 1 to read as follows:

1. A two (2) part Protective System is required if each Side of the Trench is to be shored. The use of a Trench Box shall be classified as one Protective System.

1.4 **DESIGN OF PROTECTIVE SYSTEMS**

Add paragraphs C and D as follows:

C. Trenches five (5) feet deep or greater require a protective system unless the excavation is made entirely in stable rock. If less than five (5) feet deep, a competent person may determine that a protective system is not required.

D. Trenches 20 feet deep or greater require that the protective system be designed by a registered professional engineer or be based on tabulated data prepared and/or approved by a registered professional engineer in accordance with 1926.652(b) and (c).

1.5 **SUBMITTALS**

Revise paragraph A to read as follows:

A. Submit a Protective System plan:

1. When excavation is over twenty (20) feet deep, or
2. When requested by ENGINEER.

Add Article 1.6 as follows:

1.6 **REFERENCES**

A. 29 CFR Part 1910 – Occupational Safety and Health Standards

B. 29 CFR Part 1926 Subpart P – Excavations

PART 3 EXECUTION

3.4 INSPECTIONS

Add paragraph C as follows:

C. OWNER and/or ENGINEER may order an immediate work stoppage if working conditions are thought to be unsafe. Work may resume only after proper safety precautions are implemented.

SECTION 32 01 06 M
STREET NAME SIGNS (Modified)

PART 1 GENERAL

1.2 **REFERENCES**

Add paragraph C as follows:

C. **Brigham City Public Works Standard Drawings**

SECTION 32 01 13.64 M
CHIP SEAL (Modified)

PART 1 GENERAL

1.2 **REFERENCES**

A. **ASTM Standards:**

Add the following to paragraph A:

C 29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

C 330 Standard Specification for Lightweight Aggregates for Structural Concrete

Rename Article 1.5 as follows:

1.5 **WEATHER AND CONDITIONS**

A. Temperature

Add subparagraph 4 as follows:

4. Do not place if forecasted temperature is expected to drop below 40 deg F within 72 hours of placement.

B. Moisture and Wind:

Add subparagraph 1 as follows:

1. Do not place chip seal coat if surface moisture is present.

PART 2 PRODUCTS

2.1 **ASPHALT BINDER**

Revise paragraph B to read as follows:

A. Emulsified Asphalt: CRS-2P or LMCRS-2, Section 32 12 03. Use any of the following additives to match aggregate particle charge, weather conditions, and mix design:

(Subparagraphs 1-5 remain unchanged.)

Replace Article 2.2 with the following:

2.2 **COVER AGGREGATE**

A. Material

1. Standard Chip: Use 100%crusher processed virgin aggregate consisting of natural stone, gravel, or slag meeting the requirements of Table 1 for Standard Chip Seal Coat.

2. Lightweight Chip: Use100% crusher-processed rotary-kiln lightweight expanded shale chips meeting the requirements of Table 1 for Lightweight Chip Seal Coat. (Utelite or approved equal).

Table 1 – Physical Properties of Cover Materials					
	Standard	**Standard Chip**		**Lightweight Chip**	
	ASTM	**Min**	**Max**	**Min**	**Max**
Dry-unit weight (rodded), lb/ft^3	C 29	--	100	--	60
Wear (hardness or toughness), percent	C 131	--	30	--	30
Angularity (2 fractured or angular faces), percent	D 5821	60	--	--	--
Soundness (weight loss), percent	C 88	--	12	--	10
Polishing, BPN	D 3319	30	--	31	--
Flats or elongates (1:3 ratio), percent	D 4791	--	10	--	--
Friable particles, percent	C 142	--	3	--	2
NOTES a) Wear of aggregate retained on No. 8 sieve. b) Soundness for combined coarse and fine aggregate measured using five (5) cycles Na_2SO_4.					

B. Gradation: Analyzed on a dry weight and percent passing basis. Meet the gradation limits in Table 2.

Table 2 – Master Grading Bands for Cover Materials					
		Percent Passing			
	Test Method	**Standard Chip**		**Lightweight Chip**	
Sieve	**ASTM**	**Grade A (UDOT Type I)**	**Grade C (UDOT Type II)**	**Type A**	**Type C (UDOT Lightweight)**
1/2”	C 136	100	98-100	100	90-100
3/8”		85-100	69-91	80-100	55-80
No. 4		0-20	0-11	5-40	0-5
No. 8		0-5	0-6	0-20	0-3
No. 16		-	-	0-10	-
No. 200	C 117	0-1	0-1.5	-	0-1

Replace Article 2.3 with the following:

2.3 **FOG SEAL/FLUSH COAT**

A. Material: Use cationic emulsified asphalt grade CSS-1h, Section 32 12 03.

Add Article 2.4 as follows:

2.4 **MIX DESIGN**

A. Select type and grade of emulsified asphalt, ASTM D 3628.

B. Determine application rates based on evaluation of road conditions and per manufacturer's recommendation. Submit mix design for approval by Engineer.

C. Application rates should be in the following ranges, unless otherwise approved by Engineer.

1. Emulsion: Use Table 3.

Table 3 – Emulsion Application Rate		
	Application Rate (gal/sy)	
Emulsion	**Standard Chip**	**Lightweight Chip**
CRS-2P	0.37-0.44	0.32 – 0.35
LMCRS-2	0.37-0.44	0.32 – 0.35

2. Cover Material: Use Table 4.

Table 4 – Cover Material Application Rate			
	Unit Weight (lbs/ft^3)	**Application Rate (lbs/sy)**	
Lightweight Chip		**Type A**	**Type C**
	45 – 50	9.6	11.8
	50 – 55	10.6	13.1
	55 – 60	11.6	14.3
Standard Chip		**Grades A & C**	
	60-65	17.0	
	65-70	18.4	
	70-75	19.8	
	75-80	20.7	
	80-85	22.1	
	85-90	23.5	
	90-95	24.9	
	95-100	25.8	

3. Fog Seal/Flush Coat: Use 0.10 – 0.12 gal/sy at a 2:1 dilution rate.

PART 3 EXECUTION

3.2 PREPARATION

Add paragraph F as follows:

F. Cover manholes, valves boxes, storm drain inlets, and other service utility features before placing any chip seal coat.

3.4 APPLICATION

Revise paragraph A to read as follows:

A. Asphalt Emulsion: Keep viscosity between 50 and 100 centistokes during application, ASTM D 2170. Keep temperature to a minimum of 145 deg F.

Revise Article 3.6 to read as follows:

3.6 FOG SEAL/FLUSH COAT

A. Apply within 24 hours of placing chips.

B. Keep viscosity between 50 and 100 centistokes, during application, ASTM D 2170.

C. See also Section 32 01 13.50.

SECTION 32 01 90 M
MAINTENANCE OF PLANTING (Modified)

PART 1 GENERAL

1.2 **GRASS MAINTENANCE**

Add the following sentence immediately following the end of paragraph A:

Contractor shall mow the lawn until the end of the date of Substantial Completion. The number of mowing to be provided by the Contractor shall be determined by the growth pattern of the lawn. There shall be no minimum number of mowing set forth, only that the health and vitality of the lawn shall be maintained. At no time shall the height of the lawn exceed 4½".

SECTION 32 12 05 M
BITUMINOUS CONCRETE (MODIFIED)
(Amendment 2 of the 2017 Edition APWA Specifications)

PART 1 GENERAL

1.4 SUBMITTALS

Revise paragraph C as follows:

Replace item 11 with the following:

11. Tensile Strength Ratio or Hamburg Rut Test results.

Add the following item:

14. Unless otherwise specified, Road Class II shall be used for the selection of Mix Design parameters.

SECTION 32 12 13.13 M
TACK COAT (Modified)

PART 3 EXECUTION

3.3 **APPLICATION**

B. Application Rate: Typically as follows:

1. Emulsions, 0.05 to 0.15 gallons per square yard.

Add subparagraph a as follows:

a. For Thin Overlays, 0.12 to 0.15 gallons per square yard.

SECTION 32 12 16.13 M
PLANT-MIX BITUMINOUS PAVING (Modified)

PART 3 EXECUTION

3.8 **TOLERANCES**

A. Compaction: Target is 94 percent of ASTM D2041 (Rice density) plus or minus two (2) percent.

Add subparagraph 1 as follows:

1. Thin Overlay – Target is 92.5 percent of ASTM D2041 (Rice density) plus or minus two (2) percent.

SECTION 32 16 13 M
DRIVEWAY, SIDEWALK, CURB, GUTTER (Modified)

PART 3 EXECUTION

3.9 **CONTRACTION JOINTS**

B. Curb, Gutter, Waterway:

Revise subparagraph 1 to read as follows:

1. Place joints at intervals not exceeding 10 feet.

3.5 **EXPANSION JOINTS**

B. Sidewalks:

Add subparagraph 5 as follows:

5. Place expansion joints wherever new sidewalk adjoins existing sidewalks, driveways, or aprons.

C. Curb, Gutter, Waterway:

Add subparagraph 4 as follows:

1. Place expansion joint where new curb and gutter adjoins existing curb and gutter.

SECTION 32 31 13 M
CHAIN LINK FENCES AND GATES (Modified)

PART 2 PRODUCTS

2.6 POSTS, CAPS, RAILS, COUPLINGS

A. Posts, Frames, Stiffeners, Rails: ASTM F 1043:

Revise applicable rows of Table 1 to read as follows:

Top Rail	1-5/8” pipe

PART 3 EXECUTION

3.6 INSTALLATION OF FENCE FABRIC

Revise paragraph A to read as follows:

A. Place fence fabric on roadway side of posts unless otherwise specified. Place fabric approximately 1 inch above the grounds. Maintain a straight grade between posts by excavating ground high points and filling depressions with soil.

SECTION 32 31 16 M
WELDED WIRE FENCES AND GATES (Modified)

PART 1 GENERAL

1.2 **REFERNCES**

Add paragraph D as follows:

D. UDOT Standard Drawing

FG 2A Right of Way Fence and Gates (Metal Post)

FG 2B Right of Way Fence and Gates (Metal Post)

PART 3 EXECUTION

3.2 **INSTALLATION**

Add paragraph N as follows:

N. Install per UDOT Standard Drawings FG 2A and FG 2B.

Add Section 32 31 23 Poly(Vinyl Chloride)(PVC) Fences and Gates

SECTION 32 31 23
POLY(VINYL CHLORIDE)(PVC) FENCES AND GATES

PART 4 GENERAL

1.10 **SECTION INCLUDES**

A. PVC fencing, posts, gates, and appurtenances.

1.11 **REFERNCES**

A. **ASTM Standards:**

D 1784	Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
F 626	Fence Fittings
F 964	Rigid Poly(Vinyl Chloride)(PVC) Exterior Profiles Used for Fencing and Railing
F 1999	Installation of Rigid Poly(Vinyl Chloride)(PVC) Fence Systems

1.12 **SUBMITTALS**

A. Drawings: Indicate plan layout, grid, size and spacing of components, accessories, fittings, anchorage, and post section.

B. Data: Submit manufacturer's installation instructions and procedures, including details of fence and gate installation.

C. Submit sample of fence fabric and typical accessories.

PART 2 PRODUCTS

2.1 **GENERAL**

A. Products from other qualified manufacturers having a minimum of 5 years' experience manufacturing PVC fencing will be acceptable by the architect as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size, and fabrication. PVC Profiles, lineals, and extrusions used as components must "meet or exceed" the minimum performance guidelines laid out in ASTM 964.

2.2 **PVC FENCE**

A. Pickets, rails, and posts fabricated from PVC extrusion. The PVC extrusions shall comply with ASTM D 1784, Class 14344B and have the following characteristics:

Specific Gravity (+/- 0.02)	1.4
Using 0.125 specimen Izod impact ft. lbs./in. notch	23.0
Tensile strength, psi	6,910
Tensile modulus, psi	336,000
Flexural yield strength, psi	10,104
Flexural modulus, psi	385,000
DTUL at 264 psi	67˚C

B. All fence parts made from PVC shall have a minimum thickness of 0.17 in except where specified otherwise.

2.3 **POST CAPS**

A. Molded, one piece.

B. Cross Section: Match post or gate upright cross section.

C. Thickness: 0.095" minimum.

D. Configuration: Flat or four-sided as required for installation to top of posts and gate.

2.4 **ACCESSORIES**

A. Standard gate brace, screw caps, rail end reinforcers, and other accessories as required.

2.5 **MISCELLANEOUS MATERIALS**

A. Stiffener Chemicals: Galvanized steel structural channel. Configure channels for concealed installation within PVC rails with pre-drilled holes for drainage. Aluminum extruded channel available upon request.

1. Cross Section: 3.00" x 3.00" x 1.500" hourglass shape to grip picket.

2. Thickness: 0.040 Gauge (minimum)

B. Fasteners and Anchorage: Stainless Steel. All fasteners to be concealed or colored heads to match. Provide sizes as recommended by fence manufacturer.

C. PVC Cement: As recommended by fence manufacturer.

2.6 **GATE HARDWARE AND ACCESSORIES**

A. General: Provide hardware and accessories for each gate according to the following requirements.

B. Hinges: Size and material to suit gate size, non-lift-off type, self-closing, glass filled nylon with stainless steel adjuster plate, offset to permit 120 degree gate opening. Provide one pair of hinges for each gate.

1. Stainless Steel, painted with carbo zinc base.

2. Finish: Pre-painted, 2 coats "Polane."

3. Color: Black Gravity Latch or dual access gravity latch.

C. Latch: Manufacturers' standard self-latching, thumb latch, pre-finished steel, or stainless steel gravity latch. Provide one latch per gate.

1. Finish: Match gate hinge finish.

D. Hardware: Stainless Steel. Provide sizes as recommended by fence manufacturer.

1. Finish: Match gate hinge finish.

2.7 **CONCRETE**

A. Use Class 3000 concrete. Section 03 30 04.

2.8 **REINFORCING FOR FILLED POSTS**

A. Steel Reinforcing:

1. Steel Reinforcing Bars: ASTM A 615. Grade 60. Deformed (#4 or ½").

2. Install 2 bars for each corner or gate post as specified in the drawings.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Locate and preserve utilities, Section 31 23 16.

B. Excavation, Section 31 23 16.

C. Review to ASTM F 567 and CLFMI products manual for chain link fence installation.

D. Protect roots and branches of trees and plants to remain.

E. Limit amount of clearing and grading along fence line to permit proper installation.

3.2 **LAYOUT OF WORK**

A. Accurately locate and stake locations and points necessary for installation of fence and gates.

B. General arrangements and location of fence and gates are indicated. Install except for minor changes required by unforeseen conflicts with work of other trades.

3.3 **INSTALLATION – GENERAL**

A. Install fence in compliance with manufacturer's written instructions.

B. PVC components shall be carefully handled and stored to avoid contact with abrasive surfaces.

C. Install components in sequence as recommended by fence manufacturer.

D. Install fencing as indicated on the drawings provided.

E. Variations from the installation indicated must be approved.

F. Variations from the fence and gate installation indicated and all costs for removal and replacement will be the responsibility of the CONTRACTOR.

3.4 INSTALLATION OF POSTS

A. Excavation

1. Drill or hand-excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
2. If not indicated on drawings, excavate holes for each post to a minimum diameter of 12 inches.
3. Unless otherwise indicated, excavate hole depths not less than 30 inches or to frost line.

B. Posts

1. Install posts in one piece, plumb and in line. Space as noted in the drawings. Enlarge excavation as required to provide clearance indicated between post and side of excavation.
2. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
    a. Unless otherwise indicated, terminate top of concrete footings 3 inches below adjacent grade and trowel to a crown to shed water.
    b. Secure posts in position for manufacturer's recommendations until concrete sets.
    c. After installation of rails and unless otherwise indicated, install reinforcing in posts in opposing corners of post as shown and fill end and gate posts with concrete to level as indicated. Concrete fill shall completely cover the reinforcing steel and gate hardware fasteners. Consolidate the concrete by striking the post face with a rubber mallet, carefully tamping around the exposed post bottom.
    d. Install post caps. Use #8 screws, nylon washers and snap caps.
    e. Remove concrete splatters from PVC fence materials with care to avoid scratching.

3.5 INSTALLATION OF RAILS

A. Top and Bottom Rails

1. Install rails in one piece into routed hole fabricated into posts to receive top and bottom rails, and middle where necessary. Except at sloping terrain, install rails level.
    a. Prior to installation of rails into posts, insert concealed steel channel stiffeners in top rail, where necessary. Bottom rails shall include minimum 2-¼" drainage holes.
    b. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.

B. Middle Rails:

1. Where necessary, install middle rails in one piece into routed hole in posts with larger holes facing down. Except at sloping terrain, install middle rails level. Secure mid rail to pickets with 2-#8 x 1-1/2" screws evenly spaced.
    a. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.

3.6 **INSTALLATION OF FENCE FABRIC/PICKETS**

A. Pickets: Install pickets in one piece as per manufacturer recommendations. Install pickets plumb.

3.7 **INSTALLATION ON SLOPING TERRAIN**

A. At sloping terrain rails may be racked (sloped) or stepped to comply with manufacturer's recommendations.

3.8 **INSTALLATION OF GATES**

A. Prior to installation of rails into posts, apply PVC cement into sockets per manufacturer's recommendations. Bottom rail shall include minimum 2-¼" drainage holes.

B. Assemble gate prior to fence installation to accurately locate hinge and latch post. Align gate horizontal rails with fence horizontal rails.

C. Install gates plumb, level, and secure for full opening without interference according to manufacturer's instructions.

D. Gate Latch Installation. Install gate latch according to manufacturer's instructions.

E. Allow minimum 72 hours to let concrete set-up before opening gates.

END OF SECTION

SECTION 32 84 23 M
UNDERGROUND IRRIGATION SYSTEMS (Modified)

PART 1 GENERAL

1.1 SECTION INCLUDES

Add paragraphs B and C as follows:

B. Underground irrigation system for private systems only.

C. This section shall not be used for irrigation or secondary water distribution systems.

SECTION 32 92 00 M
TURF AND GRASS (Modified)

PART 2 GENERAL

1.3 SUBMITTALS

Add paragraph C as follows:

C. Submit seed mix if proposing alternate to seed mix shown in paragraph 2.1.D below.

PART 2 PRODUCTS

2.1 SEED

Add paragraphs D and E as follows:

D. Seed Mix: For improved areas with irrigation, use Table 1. For non-improved areas requiring a native seed mix and all other areas, use Table 2. If unclear, check with City Engineer.

Table 1 – Seed Mix for Improved Areas

Seed No.	Botanical Name	Common Name	% by Weight
1	Poa pratensis	Adlephi	10
2	Poa pratensis	Columbia	30
3	Poa pratensis	Midnight	20
4	Poa pratensis	Ram I	10
5	Poa pratensis	Sydsport	20
6	Perennial Rye	Citation	10

Table 2 – Seed Mix for Other Areas

Seed No.	Botanical Name	Common Name	% by Weight
1	Agropyron cristatum 'Fairway'	Fairway Crested Wheatgrass	15
2	Agropyron riparium 'Sodar'	Streambank Wheatgrass	20
3	Bromus inermis 'Manchar'	Smooth Brome	32
4	Fescue rubra 'Fortress'	Red Fescue	25
5	Poa compressa 'Reuben's'	Reuben's Canadian Bluegrass	6
6	Trifolium repens	White Dutch Cover	2

E. The seed mixture shall meet the minimum tested requirements of A.N.A. The seed shall be the current year's crop, guaranteed by the supplier as follows:

1. 80% Germination Rate, 28 pounds per bushel or equivalent.
2. 72% Purity and 80% pure live seed.

3. No more than 2% inert matter.
4. No noxious weeds and no more than 0.1% weed seed.

2.4 ACCESSORIES

Replace paragraph A with the following:

A. Commercial fertilizer shall be a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

PART 3 EXECUTION

3.3 **FERTILIZING**

Revise paragraph A to read as follows:

A. Apply fertilizer at a rate of 6 pounds per 1,000 square feet or as required by soil analysis.

3.4 **SEEDING**

Revise paragraph A to read as follows:

B. Apply seed at a rate of eight (8) pounds per 1,000 square feet evenly in two (2) intersecting directions. Rake in lightly.

Add Section 33 05 12 Conductive Tracer Wire for Pipe Installation

SECTION 33 05 12
CONDUCTIVE TRACER WIRE FOR PIPE INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

This section covers the requirements for installation of a conductive tracer wire with underground pipe.

1.2 SYSTEM DESCRIPTION

Install electrically continuous tracer wire with access points as described herein to be used for locating pipe with an electronic pipe locator after installation.

PART 2 PRODUCTS

2.1 Tracer wire shall be fourteen (14) gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors shall be 3M DBR, or approved equal, and shall be watertight and provide electrical continuity.

PART 3 EXECUTION

3.1 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

A. General: Tracer wire shall be installed in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that the wire remains adjacent to the pipe. The tracer wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all new water valve boxes, water meter boxes, and fire hydrants, as applicable to the utility line being installed.

3.2 TESTING

CONTRACTOR shall perform a continuity test on all tracer wire in the presence of ENGINEER or ENGINEER's representative. Testing shall be performed prior to road construction.

3.3 REPAIR / RESTORATION

If the tracer wire is found to be not continuous after testing, CONTRACTOR shall repair or replace the failed segment of the wire.

END OF SECTION

SECTION 33 05 25 M
PAVEMENT RESTORATION (Modified)

PART 1 GENERAL

1.2 REFERENCES

Replace paragraph A with the following:

A. **Brigham City Public Works Standard Drawings**

PART 2 PRODUCTS

2.2 ASPHALT PAVEMENT

Revise paragraph A to read as follows:

A. Permanent Warm Weather Asphalt Concrete: Section 32 12 05 M unless indicated otherwise.

Revise paragraph C to read as follows:

C. Pavement Sealing:

1. Crack Seal: Section 32 01 17
2. Chip Seal: Section 32 01 13.64 and 32 01 13.64 M.
3. Fog Seal: Section 32 01 13.50.

PART 3 EXECUTION

3.5 ASPHALT PAVEMENT RESTORATION

Revise paragraphs A and B to read as follows:

A. Follow Brigham City Public Works Standard Drawings.

B. Match existing pavement thickness or 4-inches minimum, whichever is greater.

SECTION 33 08 00 M
COMMISSIONING OF WATER UTILITIES (Modified)

PART 3 EXECUTION

3.5 **INFILTRATION TEST**

Revise paragraph A to read as follows:

A. General: 150 gallons per inch diameter per mile per day. If the ground water table is less than two (2) feet above the crown of the pipe, the infiltration test is not required.

Revise Article 3.6 in its entirety to read as follows:

3.6 **EXFILTRATION TEST**

A. Non-Pressurized System:

1. General: Air test or hydrostatic test is CONTRACTOR's choice.
2. Air Test:
   a. Plastic Pipe: ASTM F 1417.
      (i) For pipe up to 30 inches diameter, pressure drop is 0.5 psi.
      (ii) For pipe larger than 30 inches diameter, isolated joint test is 3.5 psi maximum pressure drop is 1.0 psi in 5 seconds.
   b. Concrete Pipe:
      (i) ASTM C 1214 for concrete pipe 4" to 24" diameter.
      (ii) ASTM C 1103 for concrete pipe 27" and larger.
3. Hydrostatic Test: Provide air release taps at pipeline's highest elevations and expel all air before the test. Insert permanent plugs after test has been completed.
   a. Plastic Pipe: ASTM F 2497.
   b. Concrete Pipe: ASTM C 497. Abide by Section 3 and Section 16 in the ASTM standard and applicable recommendations of manufacturer.

B. Pressurized System:

1. Pressure Test: All newly laid pipe segments and their valves, unless otherwise specified, shall be subjected to a hydrostatic pressure test of 200 psi or 50 psi above working pressure, whichever is higher. The hydrostatic pressure test shall be conducted after the pipe segments have been partially backfilled.
2. Duration of Pressure Test: The duration of each hydrostatic pressure test shall be at least two (2) hours.
3. Test Procedure: Each pipe segment shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. Testing against closed valves will be allowed. The pump, pipe connection, and all necessary apparatus including gauges

and meters shall be furnished by the CONTRACTOR. CONTRACTOR shall provide all labor and equipment necessary to perform the test.

4. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, air release mechanisms shall be installed, if necessary, at points of highest elevation, and afterwards tightly capped.

5. Examination Under Pressure: All pipes, fittings, valves, hydrants, joints, and other hardware will be subject to examination under pressure during the hydrostatic test. Any defective pipes, fittings, hydrants, valves, or other hardware discovered in consequence of this pressure test shall be removed and replaced by the CONTRACTOR with sound material, at no expense to the OWNER, and the test shall be repeated until the ENGINEER is satisfied.

6. No piping installation will be acceptable until the leakage is less than the amount allowed by industry standards for the type of pipe material being tested. Or, if no standard prevails, than the number of gallons per hour is determined by the formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Where: Q = allowable leakage, gallons per hour

L = length of pipe under test, feet

D = diameter of pipe, inches

P = average test pressure, psig

SECTION 33 11 00 M
WATER DISTRIBUTION AND TRANSMISSION (Modified)

PART 1 GENERAL

1.1 SECTION INCLUDES

Revise paragraph A to read as follows:

A. Installation of a pressurized water pipe system, excluding a secondary water system. Refer to Section 33 17 00 if the system is a secondary water system.

1.2 REFERENCES

Revise paragraph B to read as follows:

B. **Brigham City Public Works Standard Drawings**

Add the following to paragraph C. AWWA Standards:

C105	Polyethylene Encasement for Ductile Iron Pipe Systems
C110	Ductile-Iron and Gray-Iron Fittings
C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
C223	Fabricated Steel and Stainless Steel Tapping Sleeves
M14	AWWA Recommended Practice for Backflow Prevention and Cross-Connection Control

Add paragraphs F and G as follows:

F. ANSI/NSF Standards:

61	Drinking Water System Components – Health Effects

G. Utah Administrative Code

R309	Drinking Water

1.3 PERFORMANCE REQUIREMENTS

Replace paragraph A with the following:

A. Depth of Cover:

1. Minimum as indicated on the drawings. If minimum cannot be achieved, contact ENGINEER.
2. Maximum of 72 inches unless indicated on the plans or approved by ENGINEER.

1.5 SITE CONDITIONS

Revise paragraph D to read as follows:

D. Do not operate <u>any</u> water valve until its owner and water company's permission is secured.

PART 2 PRODUCTS

2.1 PIPES AND FITTINGS

Revise paragraph A to read as follows:

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities indicated. Use only NSF 61 approved products in drinking water systems. All such products shall be appropriately stamped with the NSF logo.

Add paragraphs E and F as follows:

E. Mechanical Joint Fittings: Ductile iron, Class 250

F. Flanged Fittings: Ductile iron, Class 250

2.3 VALVE BOX

Revise paragraph A to read as follows:

A. Buried Valves in Traffic Areas: Cast iron two (2) piece slip sleeve type, 5-1/4 inch shaft, with a drop lid, rated for HS-20 loading.

Revise paragraph C to read as follows:

C. Markings: Potable water main line valves box covers shall contain the wording “WATER.”

Add Articles 2.9 and 2.10 as follows:

2.9 TAPPING SLEEVE AND VALVE

A. AWWA C223.

B. Sleeve shall be full circumferential seat with all stainless steel tapping sleeve.

C. Flanged outlet with flanged by MJ valve.

2.10 FIRE SPRINKLER/SUPPRESSION LINES

A. Lines:

1. PVC C900 DR-14, or as approved in writing by OWNER or ENGINEER.
2. Meet all specifications for main lines.

B. Valve:

1. All fire lines shall be equipped with an isolation gate valve located at the main line.

PART 3 EXECUTION

3.3 LAYOUT

Replace paragraph B with the following:

B. The Utah Division of Drinking Water must grant an exception where a potable water line crosses under a sanitary sewer line.

3.4 INSTALLATION – PIPE AND FITTING

A. General:

Add subparagraphs 3 through 7 as follows:

3. Encase all buried ductile iron valves, fitting, connections, and specialties in minimum 8 mil. polyethylene sheets in accordance with AWWA C105.
4. Waterline shall be laid and maintained to lines and grades established by the drawings, with fittings and valves at the required locations. Deviations as approved in writing by OWNER or ENGINEER.
5. Lay water lines on a continuous grade to avoid high points except as shown on the plans.
6. Cut edges and rough ends shall be ground smooth. Bevel end for push-on connections.
7. Do not drop pipe or fittings into trench.

Add paragraph I as follows:

I. Tie-Ins:

1. All tie-ins shall be made dry and not on a day proceeding a weekend or holiday.
2. OWNER requires 48-hours' notice for water turn-off.
3. At least 24-hours prior to a service disruption, CONTRACTOR shall notify all affected water users.
4. Where shutting down a line is not feasible as determine by OWNER or ENGINEER, CONTRACTOR shall make a wet tap using a tapping sleeve and valve.

3.5 INSTALLATION – CONCRETE THRUST BLOCK

Revise paragraph A to read as follows:

A. Brigham City Public Works Standard Drawings.

3.8 INSTALLATION – TAPS

Revise paragraph A to read as follows:

A. Brigham City Public Works Standard Drawings.

3.9 **INSTALLATION – SERVICE LINE**

Revise paragraph C to read as follows:

C. Meter Box: Brigham City Public Works Standard Drawings.

Add paragraph D as follows:

D. New Water Service Line

1. 1" Service

a. All laterals must be of one continuous polyethylene tube between the corp stop and the meter box. No joints are allowed.

2. 1.5" and 2" Services

a. All solder joints shall be 95-5 solder or better, or Mueller compression fittings.

3.10 **INSTALLATION – WATERMAIN LOOP (SYPHON)**

Revise paragraph A to read as follows:

A. Brigham City Public Works Standard Drawings.

3.12 **BACKFILLING**

B. Trenches: Section 33 05 20:

Revise subparagraphs 1 and 2 to read as follows:

1. Pipe zone backfill, Brigham City Public Works Standard Drawings.
2. Trench backfill, Brigham City Public Works Standard Drawings.

3.13 **SURFACING RESTORATION**

A. Roadway Trenches and Patches: Section 33 05 25:

Revise subparagraphs 1 and 2 to read as follows:

1. Asphalt concrete patch, Brigham City Public Works Standard Drawings.
2. Concrete pavement patch, contact OWNER for instructions.

Add Article 3.14 as follows:

3.14 **FIRE SPRINKLER/SUPPRESSION LINES**

A. Notify OWNER 48 hours prior to installation.

B. Unless written authorization is given by OWNER, no services shall be connected to the fire sprinkler/suppression lines.

C. Location: As approved by OWNER.

SECTION 33 12 16 M
WATER VALVES (Modified)

PART 1 GENERAL

1.2 REFERENCES

Modify the fourth (4th) item in paragraph A to read as follows:

C509 Resilient-Seated Gate Valves for Water Supply Service

Add paragraph B as follows:

B. **Brigham City Public Works Standard Drawings**

PART 2 PRODUCTS

2.1 VALVES – GENERAL

A. Underground:

Add subparagraph 3 as follows:

3. Valves over five (5) feet in depth shall have a valve nut extension stem.

2.2 GATE VALVES

Add paragraph D as follows:

D. Model: Mueller A-2361, Clow 2639

Add Article 2.10 as follows:

2.10 AIR/VACUUM RELIEF VALVES

A. Operation: Relieve air build-up and/or allow intrusion of air to prevent vacuum conditions within pipe.

B. Location: Valve and vent placement location as approved by OWNER or ENGINEER.

C. Connection: Service saddle.

PART 3 EXECUTION

3.1 INSTALLATION

Add paragraphs D, E, and F as follows:

D. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure-containing bolting, and cleanliness of valve ports and seating surfaces.

E. Examine all valves for damage or defects immediately prior to installation.

F. Mark and hold defective materials for inspection by OWNER or ENGINEER. Replace rejected materials.

SECTION 33 12 19 M
HYDRANTS (Modified)

PART 1 GENERAL

1.2 REFERENCES

Revise paragraph A to read as follows:

A. **Brigham City Public Works Standard Drawings**

PART 2 PRODUCTS

2.1 DRY-BARREL FIRE HYDRANT

Add paragraph C as follows:

C. Model: Mueller Super Centurion, Clow Medallion.

2.2 VALVES

Revise paragraph A to read as follows:

C. Gate Valve: Section 33 12 16.

2.3 ACCESSORIES

Revise paragraph D to read as follows:

D. Valve Box, Valve Vault: Section 33 11 00.

PART 3 EXECUTION

3.2 INSTALLATION

Revise paragraph A to read as follows:

C. Install hydrant according to Brigham City Public Works Standard Drawings and AWWA M17.

Revise paragraph H to read as follows:

H. Install thrust block according to Brigham City Public Works Standard Drawings.

SECTION 33 12 33 M
WATER METER (Modified)

PART 1 GENERAL

1.2 **REFERENCES**

Add paragraph B as follows:

E. **Brigham City Public Works Standard Drawings.**

PART 2 PRODUCTS

2.2 **METERS FOR SERVICE PIPING**

Revise paragraph A to read as follows:

F. OWNER shall supply and set all 1" meters. All other meters supplied and set by CONTRACTOR.

2.3 **SERVICE LINE, VALVES, AND FITTINGS**

Revise paragraph A to read as follows:

A. Service Pipe: Smooth wall polyethylene, Section 33 05 06.

Revise paragraph B to read as follows:

B. Service Valves and Fittings:

1. AWWA C800.
2. 1-Inch Service Laterals – Brass corporation stops with CC thread.
3. 1.5-Inch and 2-Inch Service Laterals – Copper or brass screw-type fittings (ball valves, strainers, nipples, tees, bends, etc.).
4. 3-Inch and 4-Inch Service Laterals
    a. Ductile iron pipe.
    b. Cast iron, flanged valves and fittings.
5. Greater than 4-Inch – Coordinate with and obtain approval from OWNER and ENGINEER.

Replace Article 2.4 with the following:

2.4 **METER BOXES**

A. See Brigham City Public Works Standard Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

Revise paragraph D to read as follows:

D. OWNER Supplied Meters: Installed by OWNER unless indicated otherwise.

Add paragraphs E and F as follows:

E. Install one solid piece of copper pipe from main to meter.

F. Install service laterals with 48-inches of cover, minimum.

SECTION 33 13 00 M
DISINFECTION (Modified)

PART 1 GENERAL

1.2 REFERENCES

Revise paragraph B to read as follows:

B. Utah Administrative Code

R309 Drinking Water

Add paragraph C as follows:

C. NSF/ANSI Standards:

60 Drinking Water Treatment Chemicals – Health Effects

1.4 **SUBMITTALS**

Delete paragraphs B, C, and D in their entirety.

Add Article 1.8 as follows:

1.8 **WORK PERFORMED BY OWNER**

A. OWNER will perform bacteriological and high chlorine sampling and testing. CONTRACTOR shall provide all other work associated with this Section.

PART 2 PRODUCTS

2.1 **DISINFECTANT**

Add paragraph E as follows:

E. All products shall comply with NSF/ANSI 60.

PART 3 EXECUTION

3.1 **PREPARATION**

Add paragraphs C and D as follows:

C. Notify OWNER at least 72 hours prior to any flushing or disinfecting.

D. Install temporary connections for flushing water lines after disinfection. After the satisfactory completion of the flushing work, remove and plug the temporary connection.

3.2 **DISINFECTION OF WATER LINES**

Revise paragraph D to read as follows:

D. Coordinate with OWNER to collect a bacteriological water sample at end of line to be tested. If sample fails bacteriological test, flush system and retest. Continue flushing and retesting until sample passes test.

Revise paragraph G to read as follows:

G. After a passing bacteriological test sample is obtained, let the system relax for 24 hours. Flush and coordinate with OWNER to collect a subsequent bacteriological sample for testing. If the subsequent test passes, then water line is acceptable.

3.5 **FIELD QUALITY CONTROL**

A. Bacteriological Test:

Revise subparagraphs 1 and 2 to read as follows:

1. Coordinate with OWNER to collect samples for testing no sooner than 16 hours after system flushing.
2. OWNER will have water samples analyzed per State of Utah requirements.

Add Article 3.6 as follows:

3.6 **SPECIAL PROCEDURE FOR TAPPING SLEEVES**

A. Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.

Add Section 33 32 19 Sanitary Sewerage Pump Stations

SECTION 33 32 19
SANITARY SEWERAGE PUMP STATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast wet well, valve vault, and accessories.

B. Pump discharge piping from pumps to five (5) feet outside of valve vault where it will be connected to force main.

1.2 REFERENCES

A. Drawings (Project-Specific)

B. Brigham City Public Works Standard Drawings

C. Section 22 13 29 – Sanitary Sewerage Pumps

D. Division 26 – Electrical

1.3 SUBMITTALS

A. Shop Drawings for precast wet well and valve vault based on structure/layout shown on the Drawings. Submittals shall include the following:

1. Precast design, including calculations and drawings, sealed by a Professional Engineer licensed to practice in the State of Utah.
2. Drawings shall provide general layout, member thickness, and reinforcement layout.
3. Concrete mix design.
4. Joint sealing and pipe passage details.
5. Setting instructions.
6. Fabrication schedule and plant operations contact name and phone number.

B. Shop Drawings for Generator

C. Shop Drawings for Accessories: Provide cutsheets for hatches, valves, and gauges.

1.4 DESIGN REQUIREMENTS

A. Precast Wet Well and Valve Vault

1. Precast top slab and wall panels shall be designed for AASHTO Classification H-20 traffic loading.
2. Precast wall panels shall be designed to withstand soil and water pressure on full height of outside wall of the structure with no water in the structure.
3. Cast-in-place base slab of wet well shall be designed using a factor of safety of 1.5 against buoyancy. Top steel shall handle net uplift pressures.

4. Precast base slab of valve vault shall be designed using a factor of safety of 1.5 against buoyancy. Top steel shall handle net uplift pressures.

1.5 **QUALITY ASSURANCE**

A. Precast wet well and valve vault:

1. Qualifications: The precaster shall be PCI-certified; design shall be sealed by a Professional Engineer licensed to practice in the State of Utah.

2. Inspections: City reserves the right to inspect the precasting facility prior to and during fabrication, and to collect samples of materials during the fabrication process for testing. Manufacturer shall accommodate facility inspection and sample collection.

PART 2 PRODUCTS

2.1 **WET WELL**

A. Walls:

1. Precast reinforced concrete sections; comply with ASTM C478; inside diameter to be as shown on the Drawings.

2. Joints: Tongue and groove with o-ring gaskets; comply with ASTM C443.

3. Preformed Bituminous Sealant: Federal Specification SS-S-210A and AASHTO M-198B.

B. Top and Bottom Slab:

1. Top Slab:

a. Precast; comply with ASTM C478.

b. Openings as shown on the Drawings.

c. Thickness; minimum 8-inches.

2. Bottom slab:

a. Cast-in-place.

b. Sized to counteract buoyancy forces.

3. Cast-in-place concrete; Sections 03 20 00, 03 30 04, 03 30 10.

4. Precast concrete; Section 03 40 00.

5. Concrete fill; Section 03 30 04.

2.2 **VALVE VAULT**

A. Walls, Top and Bottom Slabs:

1. Precast reinforced concrete sections.

2. Top slab thickness; minimum 8-inches.

3. Precast concrete; Section 03 40 00.

4. Reinforcing steel meeting ASTM A615 or A616, certified Grade 60.

5. Welded wire fabric conforming to ASTM A185.

6. Poured and vibrated and constructed using steel forms.
7. Wall joints to be sealed water-tight with gasket and polyurethane sealant.
8. Wall penetrations for drain piping field-cored.

2.3 GENERATOR

A. An auxiliary power generator is required in an open-air enclosure adjacent to the pump station control building (See Standard Details).

1. Generator size shall be sized based on the size and design of the pumps and the sewer lift station complete. Each site shall be a case by case design as reviewed by the City Sewer Division.

B. Generator Requirements:

1. Natural Gas Operation – connection to natural gas distribution system
2. Weather Proof Enclosure
3. Automatic Start/Automatic Power Transfer Switches
4. Exercise Timers - shall be connected to the control panel and run/load the unit 15-30 minutes each week or as determined by the City Sewer Division.
5. Startup and Training
6. Engine Cooler/Heater
7. All applicable connections and parts
8. Sound attenuation enclosures shall meet requirements set forth in City Code.

C. Submit all applicable manufacturer information to City for review and approval.

2.4 ACCESSORIES

A. Hatches (wet well and valve vault):

1. Manufacturers:
   a. Halliday Products, Inc., The Bilco Company, or approved equal.
2. Load Rating: AASHTO H-20 wheel loading, 16,000 lb. wheel load.
3. Frame:
   a. Material: Extruded aluminum sections shaped to serve as a continuous drainage gutter with a 1-1/2 inch drain coupling.
   b. Anchors: Continuous anchor flange.
4. Cover:
   a. Material: 1/4 inch mill finish aluminum diamond plate, reinforced with stiffening ribs.
   b. Hinges: 316 stainless steel; butt type with compression spring operators enclosed in telescopic tubes.
   c. Hold Open Arm: 316 stainless steel; automatically locks door at 90 degree position; provide vinyl grip handle to release door for closing.

d. No separate wrench required to open.

5. Hardware and Fasteners: 316 stainless steel.

6. Accessories: Provide one recessed lock box padlock arrangement for each door supplied. The recessed lock box shall have an independently hinged cover for access to the padlock. Owner will provide padlock upon acceptance of the pump station.

7. Finishes:

a. Bituminous Coating for Surface Which Will Contact Concrete: SSPC Paint 12, solvent- type bituminous mastic, normally free of sulfur, compounded for 15 mil dry film thickness per coat.

B. Pump Discharge Pipe Supports:

1. Type 316 stainless steel.

2. Pipe supports shall be designed and located to adequately and rigidly support the piping, brace against thrusts, anchor the piping between expansion couplings, brace against uplift, and maintain the piping in proper alignment and to proper grade.

3. All piping shall be assumed to be full of water. All design shall conform to the requirements of "Pipe Hangers and Supports – Materials and Design." SP-58, Manufacturer's Standardization Society of Valve and Fittings Industry.

C. Valve Vault Drain:

1. Pipe: 4-inch ASTM D3034 SDR 35 pipe, or as shown on the plans.

2. Flap Valve: Provide flap valve to prevent sewer gases from wet well from entering valve vault.

D. Liquid Level Sensors:

1. Milltronics Hydoranger 200 with an XPS-10 Ultrasonic Transducer or approved equal. Sensor to monitor the water elevations for the high level alarm, lag pump turn on, lead pump turn on, and pump off.

2. One (1) High Level Alarm Redundancy Anchor Scientific P20NO liquid level sensor with 20 feet of electrical cable, each with mounting bracket to 1-inch pipe. Level sensors shall be a non-floating, displacement type. Level sensors shall be rated for operation at milliwatt levels.

2.5 **PUMP DISCHARGE PIPING**

A. Ductile Iron Pipe and Fittings:

1. Pipe: Designed in accordance with AWWA C150; manufactured in accordance with AWWA C151; thickness Class 53; furnished in minimum nominal 18 foot laying lengths.

2. Fittings: AWWA C110 or C153; sleeves to be long mechanical joint type.

3. Exterior Coating: Bituminous material outside.

4. Interior Lining: AWWA C104 cement mortar with seal coat.

5. Buried Joints: AWWA C111, rubber gasket, push-on or mechanical type.

6. Exposed Joints: Flanged Type; comply with AWWA C115 Appendix A, and ANSI B16.1, Class 125; bolts and nuts zinc plated.

2.6 VALVES

A. Plug Valves (2½ to 12-inch):

1. Manufacturer: Henry Pratt Ballcentric, or approved equal.
2. Valve flanges shall be ANSI B16.1, Class 125.
3. Non-lubricated, eccentric cast iron plug (ASTM A126, Class B) with resilient plug facings, (Neoprene or BunaN) cast iron body (ASTM A126, Class B.
4. Valve shall be equipped with a gear actuator and a handwheel, minimum 12-inch diameter.
5. Valves shall be open with a quarter turn counterclockwise, looking down at valve stem.
6. Valves shall provide drip-tight shutoff in either direction up to 175 psi.
7. Valve Gear Actuators, if needed, shall be totally enclosed wormgear type, oil or grease lubricated and sealed for watertightness, with self-lubricating bronze or 316 stainless steel sleeve bearings, thrust bearings, built-in adjustable opening and closing stops and valve position indicators. Each actuator shall be sized to require not more than 300 inch pounds of torque in the input shaft to seat and unseat the valve plugs at the pressure drops specified herein. Note: Hand wheel force shall not exceed 25-pounds to turn.

B. Ball Check Valves:

1. Manufacturer: Flomatic 408, or approved equal.
2. Meeting AWWA C508
3. Designed to be fully automatic in operation and specifically suited to serve where solids, fibers or highly viscous materials.
4. Ball check valves will have one moving part, the ball, which moves automatically out of the path of flow, providing an unobstructed smooth flow through the valve body. Upon discontinuation of flow the ball automatically rolls back to the closed position, providing a positive seal against back pressure or backflow

C. Air Release Valve, when shown:

1. Manufacturer: Val Matic Model 49A, or approved equal.
2. Single chamber body enclosing a series of control floats to regulate the passage of air between the pipeline and the atmosphere.

2.7 PRESSURE GAGES

A. When specified, the following shall be installed on the pump discharge pipe in the location as indicated on the Drawings.

1. Pressure Gauge; Manufacturer – Type 1279 Dura gauge Pressure Gauge Model No: 45-1279-SS-04L-XLL-0/200 psi by ASHCROFT or equal, with stainless steel case. Pressure gage shall be able to operate in the pressure range of 0 psi – 200 psi. Install pressure gauge mounted directly above the pressure diaphragm seal.

2. Pressure Diaphragm Seal – Type 200 Series Welded or Bonded Diaphragm Seal by ASHCROFT and 316 SS Case or Equal. Pressure diaphragm seal shall be able to operate in the pressure range of 0 psi – 200 psi.
3. Pressure Gage Shut Off Valve – 1-inch Apollo 316 stainless steel ball valve, Model 76-10501, or equal. Ball valve shall be able to operate in the pressure range of 0 psi – 200 psi. Install service ball valve between the process piping and the pressure assembly.

2.8 **CONTROLS**

A. "ABS" QCII control panel with option package "B." For each pump motor, there shall be included: a combination circuit breaker/overload with manual reset for protection against current overloads, short-circuit protection, and disconnect for all phases; across-the-line magnetic contact; hand/off/automatic pump operations selector switch; intrinsically safe solid state duplex pump controller with an automatic solid state alternator for two pumps (providing alternating operation of pumps under normal conditions, or in case of high level, allowing both pumps to operate simultaneously) and high level alarm function.

B. The following additional options shall be included with the panel:

1. NEMA 4X Gasketed, lockable enclosure
2. High Level Alarm light - panel mounted
3. Condensation heater
4. Running time meter(s)
5. Pump run light(s)
6. Secondary Lightening arrester
7. 3 Phase Power Monitor Phase protection
8. Automatic Telephone Dialer, Raco Verbatim 8-channel:
    a. Pump called for but fails to run alarm output
    b. Power Failure
    c. High wet well level
    d. Loss of echo failure
    e. Low level alarm
9. Manual Emergency/Normal Power Transfer Switch with Generator Receptacle
10. High-level float

PART 3 EXECUTION

3.1 **GENERAL**

A. Install materials and equipment in accordance with manufacturer's instructions.

B. Excavate and backfill; see Sections 31 23 16 and 31 05 13 as applicable, and the following:

1. Provide 12 inch thick foundation of #3 sewer rock under bottom slabs.

3.2 **WET WELL AND VALVE VAULT**

A. Install base with top surface level and install walls level and plumb.

B. Provide grout in wet well and in valve vault sloping to drain.

3.3 **HATCHES**

A. Coat all surfaces of hatch which will come in contact with concrete with bituminous coating.

B. Install hatch plumb and level in cast-in-place slab, free from distortion or defects, and at the elevation indicated.

C. Install drain piping in valve vault unit from frame to sump; see Paragraph 3.4 for drain piping.

D. Install hatches for proper access to equipment, ladders, etc.

3.4 **VALVE VAULT DRAIN PIPING**

A. Route piping in orderly manner and maintain gradient.

B. Install piping to conserve space and not interfere with use of space.

C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Incorporate provisions for expansion, contraction, and supports as recommended by the pipe manufacturer. Provide adapters, connectors, and fittings for connecting to other types of pipe, fittings, and drains.

3.5 **PUMP DISCHARGE PIPING**

A. Buried: See Section 33 11 00.

B. Exposed:

1. Tighten flanged joints with all bolts taking equal stress.

2. Install wall openings and supports at proper elevation.

3.6 **VALVES**

A. Install valves plumb and level, free from distortion and strain.

B. Install valves at proper horizontal location and elevation.

C. Tighten flanged joints with all bolts taking equal stress.

D. Install plug valves with valve seat location on pump discharge side.

E. Install check valves in accordance with manufacturer’s recommendations.

F. Install air release valve assemblies in accordance with manufacturer’s recommendations and as shown on the Drawings.

3.7 **PRESSURE GAGES**

A. Install pressure gages in accordance with manufacturer’s recommendations, when shown on the Drawings.

3.8 **FIRE EXTINGUISHERS**

A. Install in the locations shown on the Drawings.

3.9 **FIELD QUALITY CONTROL**

A. Provide complete functional testing of all operating equipment.

B. Pump Discharge Piping:

1. Pressure and leakage test, and completion of tests: see Section 33 08 00.

END OF SECTION