CITY OF TACOMA

DEPARTMENT OF PUBLIC UTILITIES
WATER DIVISION

ADDENDUM NO. 1 **DATE: 4/27/2021**

REVISIONS TO: Request for Bids Specification No. TW21-0047F
HOOD STREET FACILITIES AND SOUTH TACOMA PUMP STATION SEISMIC UPGRADES

NOTICE TO ALL BIDDERS:

This addendum is issued to clarify, revise, add to or delete from, the original specification documents for the above project. This addendum, as integrated with the original specification documents, shall form the specification documents. The noted revisions shall take precedence over previously issued specification documents and shall become part of this contract.

REVISIONS TO THE SUBMITTAL DEADLINE:

The submittal deadline has been changed to 11:00 a.m., Pacific Time, Tuesday, May 11, 2021.

REVISIONS TO THE SPECIAL PROVISIONS:

Section 4.30 – Delete the following statement: Bidders submitting proposals must acknowledge that the Geotechnical Report has been received and reviewed by qualified individuals by signing the Acknowledgement of Geotechnical Report in the Proposal.

REVISIONS TO THE APPENDICES:

Appendix A – Permits

Add the attached screenshot showing issue of a Site Development Permit for this project. Note: Requirement for Pre-Construction Meeting.

Appendix B – Reference Drawings

Add Combined Stormwater Site Plan and Construction Stormwater Pollution Prevention Plan Report prepared by Jacobs Engineering, Inc. and HDR Engineering, Inc.

Appendix C – Geotechnical Report

Add the attached Geotechnical Seismic Evaluation Report prepared by Donald G. Anderson with CH2M, dated 12/22/2017.

QUESTIONS AND ANSWERS:

Question 1: **I see posted on the DJC the Hood Street Facilities and South Tacoma Pump Station Seismic Upgrades project. In the solicitation it mentions that there will be a polyurea coating applied. I am interested in finding out whether or not a coatings inspector will be utilized for this project. If so, I would love an opportunity in providing a proposal for the inspection services for this project. I have a Level III inspector that lives in Lakewood so I am certain I can be very competitive. QCIC has been in business since 2001 and has provided NACE coatings inspection services in hundreds of water and wastewater projects from potable water reservoirs ranging in size from 250,000 gallon to 22 MG, clarifiers, digesters, manholes, liftstations, etc.**

Answer 1: All information about the project is in the specification and this addendum.

Question 2: **Below is a list of sheets where the background cannot be printed out legibly due to layering in the source documents. Can the plans be provided that allow the backgrounds visuals to be improved?**

a. 20-S-101
b. 20-S-201
c. 20-H-101
d. 20-H-201
e. 20-E-101
f. 30-S-101
g. 30-S-102
h. 30-S-201
i. 30-S-202
j. 50-D-101
k. 50-S-101
l. 50-D-102

Answer 2: Plans published by ARC have adequate contrast for purposes of preparing a bid in response to this request for bids.

Question 3: **Will the City consider extending the bid due date to May 14th to allow for 4 weeks for proposal/estimate development?**

Answer 3: See response under heading of Revisions to the Submittal Deadline

Question 4: **Special Provisions, paragraph 4.30, Subsurface Conditions, indicates the following:**

- **1st paragraph: "In preparation of Drawings and Specifications, the Consultants have conducted subsurface explorations documented in a geotechnical report."**
- **4th paragraph: "A copy of this report is included as an Appendix to these specification documents"**

The geotechnical report is NOT currently included in the specifications. Please provide a copy of the referenced geotechnical report.

Answer 4: See response under heading of Revisions to Appendices.

Question 5: **Special Provisions, paragraph 4.30, Subsurface Conditions, 4th paragraph indicates "Bidders submitting proposals must acknowledge that the Geotechnical Report has been received and reviewed by qualified individuals by signing the Acknowledgement of Geotechnical Report in the Proposal." No such form is included in the bid packet. Please provide the referenced form or delete this requirement.**

Answer 5: See response under heading of Revisions to Special Provisions.

Question 6: **Any chance of another site visit to bid this project?**

Answer 6: No

Question 7: **If we submit our bid via email, do you want the original documents/or bid bond send via mail? If so, do we have a certain number of days after the due date to get them in the mail?**

Answer 7: If submitting your bid electronically, a scanned version of the original bid bond shall accompany your electronic submittal. The original bid bond shall be sent to the Contracting Agency and postmarked no later than the day of the bid opening. Original bid bonds will be delivered to: City of Tacoma, Procurement & Payables Division, Tacoma Public Utilities, P.O. Box 11007, Tacoma WA 98411-0007

NOTE: Acknowledge receipt of this addendum by initialing the corresponding space as indicated on the signature page. Vendors who have already submitted their bid/proposal may contact the Purchasing Division at 253-502-8468 and request return of their bid/proposal for acknowledgment and re-submittal. Or, a letter acknowledging receipt of this addendum may be submitted in an envelope marked Request for Bids, Specification No. TW21-0047F, Addendum No. 1. The City reserves the right to reject any and all bids, including, in certain circumstances, for failure to appropriately acknowledge this addendum.

cc: Michel Peloquin

Record SDEV20-0475:
Site Development
Record Status: Precon Meeting Required

Add to cart
Add to collection

Record Info Payments Conditions 1

A notice was added to this record on 04/02/2021.
Condition: Ready to Issue Pending Pre-Construction Meeting Severity: Notice
Total Conditions: 1 (Notice: 1)

View Condition

Work Location

1002 SOUTH TACOMA WAY

Combined Stormwater Site Plan and Construction Stormwater Pollution Prevention Plan Report Short Form – Freshwater

The Combined Stormwater Site Plan (SSP) and Construction Stormwater Pollution Prevention Plan (SWPPP) Report Short Form may be used for smaller projects. These typically will not trigger the need to install stormwater facilities to meet the intent of Minimum Requirement #6 (water quality), Minimum Requirement #7 (flow control), or Minimum Requirement #8 (Wetlands Protection). These projects typically fall within or below the following thresholds:

- The project adds or replaces between 2,000 and 5,000 square feet of hard surface.
- The project disturbs between 7,000 square feet and 1 acre of land.

This short form is not intended to replace the contents of the Stormwater Management Manual (SWMM) but is intended to provide an easy to use form that will help comply with the Minimum Requirements of the SWMM. This short form is appropriate for many projects in the City of Tacoma but may not be appropriate for all smaller projects. Environmental Services may require the preparation of a formal SSP and SWPPP per Volume 1 and Volume 2 of the SWMM based upon the project scope.

Utilize this Short Form for projects that discharge to freshwater bodies – these typically include those located in the Joe's Creek, Leach Creek, or Flett Creek Watersheds. For all other project locations, utilize the Combined Stormwater Site Plan and Construction Stormwater Pollution Prevention Plan Report Short Form – Marine located at www.cityoftacoma.org/stormwatermanual_shortforms.

The Combined SSP/SWPPP shall include both the completed attached report with associated appendices and a site plan which includes the following information at minimum. The site plan shall clearly show all necessary features and be drawn to scale. Provide at least two pages – one showing the BMPs that will be used during construction and one showing the site in the final condition including all permanent BMPs and final cover conditions (landscaping). Onsite field verification of actual conditions is required in order to complete the combined SSP and SWPPP. Environmental Services may also require additional information if warranted by project parameters.

- Vicinity Map
- Address, Parcel Number, Permit Number, and Street Names
- Parcel Lines
- North Arrow
- Boundaries of existing vegetation (e.g. tree lines, grassy areas, pasture areas, fields, etc.)
- Onsite or adjacent critical areas and associated buffers (e.g. wetlands, steep slopes, streams, etc.).
- Existing and proposed contours. Provide survey information if available; if unavailable, the City of Tacoma DART Map or govME MapGuide may be used to obtain estimated contours.
- Areas proposed to be cleared and graded.

- All cut and fill slopes, indicating top and bottom of slope catch lines.
- Indicate all locations where upstream runon enters the site and locations where runoff leaves the site.
- Show spot elevations, dimensions, and direction of flow in any ditches, swales, culverts, and pipes that will be used during construction.
- Indicate locations and outlets of any dewatering systems (usually to sediment trap).
- Identify and show the location of all erosion control techniques to be used during and after construction.
- Include details for proposed temporary erosion and sediment control best management practices.
- Finish floor elevations of all proposed structures.
- Show the location of all existing improvements, including all known utilities.
- Show the location of all proposed improvements including:
    - The location and dimensions of any hard surfaces
        - The building footprint shall show the dimension of the roof footprint to fully show the amount of hard surface coverage
    - Pipe types and slopes for all proposed utilities
    - Location and dimension of any proposed stormwater system (infiltration trench, drywell, rain garden, etc.)
    - The location and dimension for vegetated flowpaths (if dispersion is proposed)
- Details for any proposed stormwater facility.
- For compliance with BMP L613: Post-Construction Soil Quality and Depth, hatch or otherwise clearly mark the location of soils amendments and the type of amendment proposed.
- Provide a proposed landscape plan which may include a separate planting plan for any proposed rain gardens (see Volume 6, Section 2.2.2.1.2.9).

Combined Stormwater Site Plan and Construction Stormwater Pollution Prevention Plan Report Short Form - Freshwater

City of Tacoma Site Development or Work Order Permit Number(s): SDEV20-0475

Prepared By: Jacobs Engineering

Date Prepared: March 3, 2021

City of Tacoma SWMM Version Project is required to follow: 2021

Chapter 1 – Project Overview

Project Address: 1002 S Tacoma Way Tacoma, WA 98409

Parcel Number: 0320084114

Size of Parcel (acres or square feet): 9.65 acres

Brief description of project: Structural seismic upgrades of three existing facilities on-site

Associated City of Tacoma Permit Number(s) (e.g., land use permits, residential building permits): BLDCA20-0463

Applicant Name: Michel Peloquin

Applicant Address: 3628 South 35th St

Applicant Phone Number: 253-502-8212

Applicant E-mail: mpeloqui@ci.tacoma.wa.us

Property Owner Name: Tacoma Public Utilities – Tacoma Water

Property Owner Address: 3628 South 35th St

Property Owner Phone Number: 253-502-8212

Property Owner E-mail: mpeloqui@ci.tacoma.wa.us

Identify other agency permits required or associated with the subject parcel (e.g., hydraulic permits, Army Corps 404 permits). Provide Permit numbers if available: NA

Project Location Watershed: Foss Waterway

First Waterbody Encountered in Entire Downstream Flowpath: storm drains to catch basins (refer to 2012 HDR Stormwater Site Plan Report)

Final (Ultimate) Discharge Waterbody: Foss Waterway

In the table below, list all site improvements that have occurred on this site since January 1, 2003. Include all new hard surfaces and land disturbances. Provide short description of improvement including approximate square footage and related City of Tacoma Permit Number:

Year of Improvement	Description	Hard Surface Created (ft^2)	Amount of Land Disturbed (ft^2)	Related City of Tacoma Permit Number
2013	New Groundwater Treatment Facility	7,361	14,688	

Complete the following table as applicable to the proposed project (include onsite and offsite improvements): Note that table shows total areas including the 2013 Groundwater Treatment Facility (HDR) project and this 2021 project. This project does not create new hard surface area, the replaced hard surface is 25,600 SF and the disturbed area is 28,600 SF. Refer to Appendix J for proposed land disturbing activities for 2021 construction improvements.

Description[a]	Onsite	Offsite	Total
Existing Conditions			
Total Project Area[b] (ft^2)	420,400	0	420,400
Existing hard surface (ft^2)	220,000	0	220,000
Existing vegetation area (ft^2)	200,400	0	200,400
Proposed Conditions			
Total Project Area[b] (ft^2)	420,400	0	420,400
Amount of new hard surface (ft^2)	7,361	0	7,361
Amount of new pollution generating hard surface (PGHS)[c] (ft^2)	7,361	0	7,361
Amount of replaced hard surface (ft^2)	29,900	0	29,900
Amount of replaced PGHS[d] (ft^2)	29,900	0	29,900
Amount of new plus replaced hard surface (ft^2)	37,261	0	37,261
Amount of new + replaced PGHS (ft^2)	37,261	0	37,261
Amount of existing hard surfaces converted to vegetation (ft^2)	3,027	0	3,027
Amount of Land Disturbed (ft^2)	39,737	0	39,737
Vegetation to Lawn/Landscaped (acres)	0	0	0
Native Vegetation to Pasture (acres)	0	0	0
Existing hard surface to remain unaltered (ft^2)	187,624	0	187,624
Existing vegetation area to remain unaltered (ft^2)	193,039	0	193,039

a. All terms are defined in the SWMM glossary.
b. The total project area in the existing condition should typically match the total project area in the proposed condition. The total project area includes those areas that remain unaltered and those areas that will be altered.
c. The "amount of new PGHS" should be part of or all of "amount of new hard surfaces"
d. The "amount of replaced PGHS" should be part of or all of the "amount of replaced hard surfaces".

Chapter 2 – Existing Condition Summary

Existing Site Conditions

1. Existing site conditions. (Check all that apply)
   ☐Forest ☐Pasture/prairie grass ☒Pavement ☒Landscaping
   ☐Brush ☒Trees ☒Structure/Building ☐Other: Click here to enter text.
2. Describe how stormwater flows across/from the site. (Check all that apply)

   ☐Sheet Flow ☐Gutter ☒Catch Basin ☐Ditch/Swale
   ☒Stormwater Pipes ☐Stream/Creek ☐Other: Click here to enter text.

3. Existing Site Topography (Check all that apply)
   ☒Flat ☐Rolling ☒Steep
4. Are there any known historical drainage problems such as flooding, erosion, etc.?

   ☐Yes (show on site plan) ☒No
5. Existing utilities (Check all that are on the site and show on site map with legend)

   ☒Stormwater ☒Water ☒Wastewater ☐Other: Click here to enter text.
6. Are sensitive and critical areas present on or near the site (i.e. vegetative buffers, wetlands, **steep slopes**, floodplains, geologic hazard areas, streams, creeks, ponds, ravines, springs, etc.)?

   ☒Yes (show on site plan) ☐No
7. Are existing fuel tanks present on the site?

   ☒Yes (show on site plan) ☐No
8. Is this site within the South Tacoma Groundwater Protection District (on GovME or SWMM Volume 1, Chapter 2, Figure 1 - 2)?

   ☒Yes ☐No
9. Is the site within the aquifer recharge area (on GovME under Building and Land Use/ Critical Areas)?

   ☐Yes ☒No
10. Are groundwater wells present onsite and/or within 100 feet of the site?

    ☐Yes (show on site plan) ☒No
11. Are septic systems present onsite and/or within 100 feet of the site?

    ☐Yes (show on site plan) ☒No
12. Are there existing public and/or private easements on the project site?

    ☐Yes (show on site plan & provide recording numbers) ☒No
13. When a soils report is required (see Volume 3, Appendix B of the SWMM), provide a soils report (attach soils report as Appendix to this SSP Report).
    A geotechnical report is included in the SWPPP Appendix I as Appendix E of the Tacoma Water South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir, Stormwater Site Plan, 2012, HDR,prepared by Shannon & Wilson, inc., May 2011.

Chapter 3 – Offsite Analysis (Qualitative)

1. Provide a map showing the downstream drainage path leading from the site to the receiving waterbody or ¼ mile (whichever is less). The map must show the location of the stormwater conveyance location and describe pipe diameters. Include map in appendices of this stormwater site plan. Alternatively, in writing below, describe the downstream drainage path leading from the site to the receiving waterbody or ¼ mile (whichever is less). {e.g. water flows from the project site into the existing concrete curb-line which connects to a catch basin at intersection of X and Y streets. A 12-inch pipe system conveys water another 1000 feet to a ravine/wetland.}:
   (Per Section 3, Offsite Analysis, of the January 2012 HDR Stormwater Site Plan Report and applicable for current site improvements) The project has no increase in new hard surface area, therefore only a qualitative downstream analysis is required. Stormwater runoff from the proposed improvements at the Hood Street Reservoir site will be conveyed to an existing stormwater manhole that discharges out of an existing 6-inch conveyance line, which conveys runoff to the 60-inch-diameter stormwater main located along South Tacoma Way. The 60-inch stormwater main ultimately discharges into The Foss Waterway. No conveyance capacity or flooding problems have been reported within one quarter mile of the site. Since the runoff is being discharged to an existing main there will be no impacts to wetlands, groundwater, or stream channel erosion. As mentioned above, no off-site runoff enters the site. All stormwater runoff from the site is generated on-site and will exit via the proposed stormwater conveyance system.

2. Perform a site visit to investigate the drainage system ¼ mile downstream from the project and check the boxes below indicating any visual signs of drainage problems:

   ☒No sign of drainage problems

   ☐Damaged catch basins

   ☐Damaged pipes

   ☐Excessive leaf fall or debris blocking catch basin

   ☐Localized flooding (large puddles)

   ☐Signs of erosion (sediment build-up in curb line)

   ☐Other: dedicated drainage site visit not possible due to COVID-19; during previous site visits, no sign of drainage problems

Date of Inspection: 04/15/2019

Weather at the time of the inspection (was it raining during site visit?): sunny

Chapter 4 – Low Impact Development Principles

Where feasible, sites shall use the following low impact development site design principles. Check those principles that will be used onsite. The applicant is not required to revise their proposed design in order to accommodate these principles, but shall use the principles when feasible.

☒Minimization of land disturbance by fitting development to the natural terrain.

☒Minimization of land disturbance by confining construction to the smallest area feasible and away from critical areas.

☒Preservation of natural vegetation.

☐Locating impervious surfaces over less permeable soils.

☐Clustering buildings

☐Minimizing Impervious Surfaces

Chapter 5 – Discussion of Minimum Requirements

Check the box which describes how each of the Minimum Requirements will be satisfied. The applicant can check the boxes that apply or describe the alternate means used to comply with the Minimum Requirements. Review Volume 1 of the SWMM to determine which Minimum Requirements apply to a project.

Minimum Requirement #1 – Preparation of a Stormwater Site Plan

☒This Combined SSP and SWPPP Report Short Form and associated plan set satisfy this requirement.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention

☒This Combined SSP and SWPPP Report Short Form and associated plan set satisfy this requirement.

Minimum Requirement #3 – Source Control of Pollution

☐*For a single family residence*, the homeowner shall comply with all Best Management Practices (as applicable) contained in Volume 4, Chapter 3 of the 2016 SWMM.

☒*For commercial or industrial facilities*, complete the "Worksheet for Commercial and Industrial Activities" contained in Volume 4, Chapter 2 of the 2016 SWMM. Attach the worksheet as an appendix to this Report. The owner or operator shall comply with all BMPs checked.

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

All boxes should be checked for this Minimum Requirement. If all boxes cannot be checked an exception to the Minimum Requirement may be required per Volume 1, Section 3.5 of the SWMM.

☒The natural (or existing) drainage patterns have been maintained to the maximum extent feasible.

☒Discharges from the project site occur at the natural (or existing) location to the maximum extent feasible.

☒Discharge from the project site will not cause a significant adverse impact to downstream receiving waters and downgradient properties.

Minimum Requirement #5 – Onsite Stormwater Management

Minimum Requirement #5 is dependent upon the watershed in which the project is located. See Volume 3 and Volume 6 of the SWMM for feasibility and design requirements for onsite stormwater management techniques. If there are multiple surface types (i.e. more than one roof), ensure the means of onsite management is described for each.

Include a description of how the facility size was determined including any calculations used to determine the facility size. Show the amount of surface area mitigated for each surface type and each facility. **Include sizing calculations as an attachment to this SSP.** See Volume 3, Appendix B of the SWMM to determine if a soils report is required for the facility type chosen. **Include soils report as an attachment to this SSP**.

Place a checkmark next to the BMP proposed to be used for each surface type. Complete an infeasibility checklist to determine which BMPs are appropriate for the project. See www.cityoftacoma.org/stormwatermanual_shortforms for infeasibility checklists for each BMP. Attach the completed infeasibility checklist(s) as an appendix to this SSP Report. Include an Operation and Maintenance Manual for all permanent facilities as an attachment to this SSP Report.

One of the following for each surface type must be utilized if feasible.

Stormwater facilities are not being modified as part of this project and no additional impervious surfaces are being created. Cumulative impacts from previous projects since 2003 include 2013 modifications. Refer to January 2012 HDR Stormwater Site Plan Report for discussion of onsite stormwater management impacts.

Roofs:

Required BMPs: The following BMPs must be analyzed for feasibility in the order shown. If all BMPs required to be analyzed are found to be infeasible the applicant may utilize BMP L605: Collect and Convey per the SWMM.

1. Analyze All For Feasibility (if no options are feasible continue to 2)
   - ☐BMP L614: Full Dispersion
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L602: Downspout Infiltration Trench
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L602: Downspout Dry Well
     - ☐Not feasible – see infeasibility checklist in appendices
2. Analyze Either for Feasibility (if not feasible continue to 3)
   - ☐BMP L601: Rain Garden
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L630: Bioretention
     - ☐Not feasible – see infeasibility checklist in appendices
3. Analyze Both for Feasibility (if not feasible continue to 4)
   - ☐BMP L603: Dispersion Trench
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L603: Splashblocks
     - ☐Not feasible – see infeasibility checklist in appendices
4. Analyze for Feasibility
   - ☐BMP L604: Perforated Stubout
     - ☐Not feasible – see infeasibility checklist in appendices

☐No Roofs – Not Required

☒Required BMPs are not feasible – utilize BMP L605: Collect and Convey

Other Hard Surfaces:

Required BMPs: The following BMPs must be analyzed for feasibility in the order shown. If all BMPs required to be analyzed are found to be infeasible the applicant may utilize BMP L605: Collect and Convey per the SWMM. Additional treatment may be required if proposing to infiltrate pollution generating surfaces in the South Tacoma Groundwater Protection District. See Volume 5, Appendix D of the SWMM.

1. Analyze for feasibility (if not feasible continue to 2)
   - ☐BMP L614: Full Dispersion
     - ☐Not feasible – see infeasibility checklist in appendices
2. Analyze any one for feasibility (if not feasible continue to 3)
   - ☐BMP L633: Permeable Pavement
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L601: Rain Garden
     - ☐Not feasible – see infeasibility checklist in appendices
   - ☐BMP L630: Bioretention
     - ☐Not feasible – see infeasibility checklist in appendices

3. Analyze all for feasibility
   ☐BMP L611: Concentrated Flow Dispersion
      ☐Not feasible – see infeasibility checklist in appendices
   ☐BMP L612: Sheet Flow Dispersion
      ☐Not feasible – see infeasibility checklist in appendices

☐Required BMPs are not feasible – utilize BMP L605: Collect and Convey

Lawn and Landscaped Areas:

Required BMP: The following BMP must be analyzed for feasibility. Place a checkmark next to the option(s) that will be utilized onsite.

☐BMP L613: Post Construction Soil Quality and Depth
- ☐Option 1: Leave Native Vegetation and Soil Undisturbed
- ☐Option 2: Amend the Existing Site Topsoil
- ☐Option 3: Stockpile existing topsoil during grading and replace it prior to planting.
- ☐Option 4: Import Topsoil Mix

☐Required BMP is not feasible – see infeasibility checklist attached in appendices

Minimum Requirement #9 – Operation and Maintenance

☐See operation and maintenance manual contained in appendix of this Stormwater Site Plan Short Form Report.

☒No stormwater facilities are proposed for this project (all stormwater is being collected and conveyed to the City system). *Note: Refer to attached HDR Stormwater Site Plan Report for O&M related to 2013 site modification in Appendix I.*

Minimum Requirement #10 – Offsite Analysis and Mitigation

See Chapter 3 of this Stormwater Site Plan Short Form Report. Additionally, refer to 2012 HDR stormwater site plan.

Construction Stormwater Pollution Prevention Plan

13 Elements of a Construction SWPPP

The **following 13 elements are required for each SWPPP**. If an element does not apply to the project site, describe why the element does not apply. Check off those BMPs that are proposed to be used to meet the requirements of the 13 elements below. Everything that is checked below must be shown on the site plan. If a BMP is checked as a possible contingent BMP, state that in this report. Only those erosion and sediment control techniques most pertinent to small construction sites are included here. More detailed information on construction BMPs can be found in Volume 2 of the City of Tacoma Stormwater Management Manual. The BMP numbers referenced are BMPs located in the City of Tacoma SWMM. Attach those BMPs from the SWMM that will be used for the project as a separate appendix.

Element #1 – Preserve Vegetation and Mark Clearing Limits

Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum extent practicable. If it is not practicable to retain the duff layer in place, it should be stockpiled onsite, covered to prevent erosion, and replaced immediately upon completion of the ground-disturbing activity.

All construction projects must clearly mark any clearing limits, sensitive areas and their buffers, and any trees that will be preserved prior to beginning any land disturbing activities, including clearing and grading. Clearly mark the limits both in the field and on the plans. Limits shall be marked in such a way that any trees or vegetation to remain will not be harmed. See Figure 3 -

13 of the SWMM.

The BMP(s) being proposed to meet this element are:
☐BMP C101: Preserving Natural Vegetation
☐BMP C102: Buffer Zones
☒BMP C103: High Visibility Fence
☒BMP C233: Silt Fence
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #2 – Establish Construction Access

All construction projects subject to vehicular traffic shall provide a means of preventing vehicle "tracking" of soil from the site onto City streets or neighboring properties. Limit vehicle ingress and egress to one route if possible. All access points shall be stabilized with a rock pad construction entrance per BMP C105 or other City of Tacoma approved BMP. The applicant should consider placing the entrance in the area for future driveway(s), as it may be possible to use the rock as a driveway base material. The entrance(s) must be inspected weekly, at a minimum, to ensure no excess sediment buildup or missing rock.

If sediment is tracked offsite, it shall be swept or shoveled from the paved surface immediately. Keep streets clean at all times. Street washing for sediment removal is not allowed as it can transport sediment to downstream water courses and clog the downstream stormwater system.

The location of the proposed construction entrance must be identified on the site plan.

The BMP(s) being proposed to meet this element are:
☐BMP C105: Stabilized Construction Entrance/Exit
☒BMP C107: Construction Road/Parking Area Stabilization
☒Other (Describe Method): Construction access can be achieve via existing paved access way.
Or
☐This element is not required for this project because: Click here to enter text.

Element #3 – Control Flowrates

Protect properties and waterways downstream of the project site from erosion due to increases in volume, velocity, and peak flow of stormwater runoff from the project site.

Permanent infiltration facilities shall not be used to control flowrates during construction unless specifically approved in writing by Environmental Services.

The BMP(s) being proposed to meet this element are:
☐BMP C203: Water Bars
☐BMP C207: Check Dams
☐BMP C209: Outlet Protection
☐BMP C235: Wattles
☒BMP C240: Sediment Trap
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #4 – Install Sediment Controls

Stormwater runoff from disturbed areas must pass through an appropriate sediment removal device prior to leaving a construction site or discharging into an infiltration facility.

Install/construct the sediment removal BMP before site grading.

The BMP(s) being proposed to meet this element are:
☒BMP C233: Silt Fence
☐BMP C234: Vegetated Strip
☐BMP C235: Wattles
☒BMP C240: Sediment Trap
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #5 – Stabilize Soils

Stabilize exposed and unworked soils by applying BMPs that protect the soils from raindrop impact, flowing water, and wind. Minimize the amount of soil exposed during construction activity. Minimize the disturbance of steep slopes. Minimize soil compaction and, unless infeasible, preserve topsoil.

From October 1 through April 30, no soils shall remain exposed or unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This applies to all soils on site whether at final grade or not.

The BMP(s) being proposed to meet this element are:
☐BMP C120: Temporary and Permanent Seeding
☐BMP C121: Mulching
☐BMP C122: Nets and Blankets
☒BMP C123: Plastic Covering
☐BMP C124: Sodding
☐BMP C125: Compost
☐BMP C126: Topsoiling
☐BMP C140: Dust Control
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #6 – Protect Slopes

Design and construct cut-and-fill slopes in a manner to minimize erosion.

Protect slopes by diverting water at the top of the slope. Reduce slope velocities by minimizing the continuous length of the slope, which can be accomplished by terracing and roughening slope sides. Establishing vegetation on slopes will protect them as well.

The BMP(s) being proposed to meet this element are:
☐BMP C120: Temporary and Permanent Seeding
☐BMP C121: Mulching
☐BMP C122: Nets and Blankets
☐BMP C200: Interceptor Dike and Swale
☐BMP C203: Water Bars
☐BMP C204: Pipe Slope Drains
☐BMP C205: Subsurface Drains

☐BMP C207: Check Dams
☐BMP C208: Triangular Silt Dike
☐Other (Describe Method): Click here to enter text.
Or
☒This element is not required for this project because: Project site is flat and has no slopes between excavation and downstream outlets. Slopes upstream of excavation and stockpiles are vegetated preventing oncoming flow.

Element #7 – Protect Drain Inlets

Protect all storm drain inlets that are operable during construction to ensure untreated stormwater does not enter conveyance system. Install catch basin protection on all catch basins within 500 feet downstream of the project. The catch basin inlet protection shown in Figure 2-45 is the only catch basin protection allowed within the City right of way. Once the site is fully stabilized, catch basin protection must be removed.

The BMP(s) being proposed to meet this element are:
☒BMP C220: Storm Drain Inlet Protection
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #8 – Stabilize Channels and Outlets

Stabilize all temporary onsite conveyance channels. Provide stabilization to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of conveyance systems.

The BMP(s) being proposed to meet this element are:
☐BMP C122: Nets and Blankets
☐BMP C202: Channel Lining
☐BMP C207: Check Dams
☐BMP C209: Outlet Protection
☐Other (Describe Method): Click here to enter text.
Or
☒This element is not required for this project because: Given flat project site; conveyance channels are not present on-site. Silt fence will be present along perimeter at top of downstream slopes.

Element #9 – Control Pollutants

Handle and dispose of all pollutants, including demolition debris and other solid wastes in a manner that does not cause contamination of the stormwater. Provide cover and containment for all chemicals, liquid products (including paint), petroleum products, and other materials. Handle all concrete and concrete waste appropriately. All discharges to the City sanitary sewer system require City approval, which may include a Special Approved Discharge (SAD) permit, see http://www.cityoftacoma.org/government/city_departments/environmentalservices/wastewater/wastewater_permits_and_manuals for additional information.

The BMP(s) being proposed to meet this element are:
☒BMP C151: Concrete Handling
☐BMP C152: Sawcutting and Surfacing Pollution Prevention
☐BMP C153: Material Delivery, Storage, and Containment

☒BMP C154: Concrete Washout Area
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #10 – Control Dewatering

Clean, non-turbid dewatering water, such as groundwater, can be discharged to the stormwater system provided the dewatering flow does not cause erosion or flooding of receiving waters. All other water shall be discharged to the City wastewater system.

All discharges to the City wastewater system require City approval, which may include a Special Approved Discharge (SAD) permit.

The BMP(s) being proposed to meet this element are:
☐BMP C203: Water Bars
☐BMP C236: Vegetative Filtration
☒Other (Describe Method): Due to upstream vegetated area and flat terrain, construction stormwater is anticipated to be limited to water precipitating within the boundaries of the project site. Construction stormwater shall be stored within sediment trap or other water storage feature until turbidity meets requirements for discharge to stormwater system. Contractor to acquire SAD permit on an as needed basis to comply with permit requirements for dewatering.
Or
☐This element is not required for this project because: Click here to enter text.

Element #11 – Maintain BMPs

Maintain and repair temporary erosion and sediment control BMPs as needed. Inspect all BMPs at least weekly and after every storm event.

Remove all temporary erosion and sediment control BMPs within 30 days after final site stabilization or if the BMP is no longer needed. Any trapped sediment should be removed or stabilized onsite. No sediment shall be discharged into the storm drainage system or natural conveyance systems.

The BMP(s) being proposed to meet this element are:
☒BMP C150: Materials on Hand
☒BMP C160: Erosion and Sediment Control Lead
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #12 – Manage the Project

Phase development projects in order to prevent soil erosion and the transport of sediment from the project site during construction.

Coordinate all work before initial construction with subcontractors and other utilities to ensure no areas are prematurely worked.

An Erosion Control Lead is required for all construction sites. The Erosion Control Lead is the party responsible for ensuring that the proposed erosion and sediment control BMPs are appropriate for the site and are functioning. They are also responsible for updating the SWPPP as necessary as site conditions warrant. They must be available 24 hours a day to ensure compliance.

The BMP(s) being proposed to meet this element are:
☒BMP C150: Materials on Hand
☒BMP C160: Erosion and Sediment Control Lead

- Name of ESC Lead: Click here to enter text.
- Phone Number for ESC Lead: Click here to enter text.

☐BMP C162: Scheduling
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Element #13 – Protect BMPs

Protect all permanent stormwater BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the BMPs. Restore all BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP shall include removal of all sediment. Keep heavy equipment off of infiltration surfaces.

The BMP(s) being proposed to meet this element are:
☐BMP C102: Buffer Zone
☒BMP C103: High Visibility Fence
☐BMP C200: Interceptor Dike and Swale
☐BMP C201: Grass-Lined Channels
☐BMP C207: Check Dams
☐BMP C208: Triangular Silt Dike (TSD) (Geotextile-Encased Check Dam)
☐BMP C231: Brush Barrier
☒BMP C233: Silt Fence
☐BMP C234: Vegetated Strip
☐Other (Describe Method): Click here to enter text.
Or
☐This element is not required for this project because: Click here to enter text.

Complete the following information regarding construction sequencing, phasing, and scheduling:

Construction Sequencing

The standard construction sequence is as follows:

- Mark clearing/grading limits.
- Schedule an inspection with the City to verify clearing/grading limits and TESC BMP placement prior to the start of any work on the site.
- Clear, grade, and fill site as outlined in the site plan while implementing and maintaining TESC BMPs at the same time.
- Install proposed site improvements (hard surface, landscaping, etc.).
- Schedule an inspection with the City for approval of permanent site stabilization protection and site grades.
- Remove TESC BMPs as permitted by the City inspector and repair permanent landscaping as necessary.
- Monitor and maintain permanent erosion protection (lawn/landscaping) until fully established.

List any changes from the standard construction sequence outlined above: No changes

Construction Phasing

Construction phasing: If construction is going to occur in separate phases, describe: NA

Construction Schedule

Provide a proposed construction schedule (dates construction begins and ends and dates for any construction phasing).

Start Date: Nov 2021

End Date: June 2022

Interim Phasing Dates: Site Grading work limited, no anticipated phasing

Wet Season Construction Activities: *Wet season occurs from October 1 to April 30*. Describe construction activities that will occur during this time period: Project construction to begin during wet season. Standard construction sequencing will generally be followed including implementation of BMPs prior to ground disturbance. Localized shallow excavation and grading activities around two existing buildings. Localized shoring, excavation and grading activities at reservoir inlet, outlet and drain piping. Stockpiles will be covered and located away from sloped areas. Installation of hard surfacing anticipated to occur in spring 2022. Removal of BMPs after substantial completion and upon approval from City inspector.

NOTE: Additional erosion control measures beyond those shown may be required to manage site runoff.

Stormwater Site Plan and Construction Stormwater Pollution Prevention Plan Appendices

The following are potential appendices that may be required for your project. Only includes those items applicable to your project. Additional appendices may be required in addition to those typical appendices shown below.

Appendix A – Qualitative Analysis Map **– Not applicable this project**

- See Chapter 3 for additional information of what should be included on this map.

Appendix B – Completed Infeasibility Checklists **– Not applicable this project**

- See Chapter 5, Minimum Requirement #5 for additional information for what to include in this appendix.

Appendix C – Stormwater Facility Sizing **– Not applicable this project**

- Complete all relevant information in Appendix C. Remove sizing information that is not relevant to the project.
- See Volume 3 of the SWMM for information on how to size onsite stormwater BMPs.

Appendix D – Soils Report **– Refer to Appendix I, Stormwater Site Plan, 2012 HDR**

- See Volume 3, Appendix B of the SWMM.

Appendix E – BMP Operation and Maintenance Manual **– Not applicable this project**

- If a permanent stormwater BMP is proposed for this project, an O&M Manual is required.

Appendix F – Source Control Worksheet for Commercial and Industrial Facilities

- Required for commercial and industrial facilities. See Volume 4, Chapter 2 of the SWMM.

Appendix G – Temporary Erosion and Sediment Control BMPs

- Only include applicable BMPs from Volume 2 of the SWMM.

Appendix H – Project Flowchart

Appendix I – 2012 Tacoma Water South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir – Stormwater Site Plan HDR (January 9, 2012)

Appendix J – Proposed 2021 Improvements Disturbed Land Calculations

Appendix F – Completed Source Control Worksheet for Commercial and Industrial Facilities

Attach completed source control worksheet if the project is a commercial or industrial facility.

Chapter 2 Worksheet for Commercial and Industrial Activities

This worksheet is designed for use by business and industry operators. Complete the entire worksheet by checking the appropriate boxes for all activities that take place at the work site. If any of the activities as being performed outdoors, use the activity code on the worksheet to find the recommended BMPs contained in Chapter 4 .

Activity Code (BMP)	Type of Activity	Are you involved in this? If so, check if it occurs:	
		Indoors[a]	Outdoors[b]
BMP W100 - CLEANING AND WASHING ACTIVITIES			
W100	Covers cleaning and washing of tools, engine parts, cooking equipment, fleet vehicles yards, car dealerships, carpet cleaners, etc.	X	
SECTION A2 - TRANSFERS OF LIQUID OR SOLID MATERIALS			
A201	Loading and Unloading Areas for Liquid or Solid Material – for loading and unloading of materials at industrial and commercial facilities.	X	
A202	Fueling at Dedicated Stations – includes gas stations, pumps at fleet vehicle yards or shops, and other privately owned pumps.		
A203	Vehicle Maintenance Activities – covers oil changes and other engine fluids.		
A204	Mobile Fueling of Vehicles and Heavy Equipment – includes fleet fueling, wet fueling, and wet hosing.		
SECTION A3 - PRODUCTION AND APPLICATION ACTIVITIES			
A301	Concrete and Asphalt Mixing and Production at Stationary Sites – applies to mixing of raw materials on-site to produce concrete or asphalt.		
A302	Concrete Pouring, Concrete Cutting, and Asphalt Application at Temporary Sites – includes construction sites, and driveway and parking lot resurfacing.		
A303	Manufacturing and Post-processing of Metal Products – includes machining, grinding, soldering, cutting, welding, quenching, rinsing, etc.		
A304	Wood Treatment Areas – includes wood treatment using pressure processes or by dipping or spraying.		
A305	Commercial Composting – includes commercial composting facilities operating outside.		
A306	Landscaping and Lawn/Vegetation Maintenance, Including Vegetation Removal, Herbicide and Insecticide Application, Fertilizer Application, Irrigation, Watering, Gardening, and Lawn Care – includes businesses involved in landscaping, applying pesticides and managing vegetation.		
A307	Painting, Finishing, and Coating of Vehicles, Boats, Buildings, and Equipment – includes surface preparation and the applications of paints, finishes, and/or coatings.		
A308	Commercial Printing Operations – includes materials used in the printing process.		

Activity Code (BMP)	Type of Activity	Are you involved in this? If so, check if it occurs:	
		Indoors[a]	Outdoors[b]
A309	Manufacturing Activities (Outside) - includes outdoor manufacturing areas.		
SECTION A4 - STORAGE ACTIVITIES			
A401	Storage or Transfer (Outside) of Solid Raw Materials, By-products, or Finished Products.		
A402	Storage and Treatment of Contaminated Soils – applies to contaminated soils that are excavated and left on-site.		
A403	Temporary Storage or Processing of Fruits or Vegetables – includes processing activities at wineries, fresh and frozen juice makers, and other food and beverage processing operations.		
A404	Storage of Solid Wastes and Food Wastes – includes regular garbage and all other discarded non-liquid items.		
A405	Farmer's Markets		
A406	Recyclers and Scrap Yards – includes scrapped equipment, vehicles, empty metal drums, and assorted recyclables.		
A407	Treatment, Storage, or Disposal of Dangerous Wastes – Refer to Ecology and the Tacoma-Pierce County Health Department for more information.		
A408	Storage of Liquid, Food Waste, or Dangerous Waste Containers – includes containers located outside a building and used for temporary storage.		
A409	Storage of Liquids in Permanent Above-ground Tanks – includes all liquids in above-ground tanks.	X	X
A410	Parking and Storage for Vehicles and Equipment – includes public and commercial parking lots.		
SECTION A5 - CONSTRUCTION ACTIVITIES			
A501	Clearing, Grading, and Preparation of Construction Sites – applies to land developing activities and to residential yard clearing and grading projects.		X
A502	Demolition of Buildings – applies to removal of existing buildings and subsequent clearing of the rubble.		
A503	Building Repair, Remodeling, and Construction – applies to construction of buildings, general exterior building repair work and remodeling of buildings.	X	X
SECTION A6 - DUST CONTROL AND SOIL AND SEDIMENT CONTROL			
A601	Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots.		X
A602	Dust Control at Manufacturing Sites – includes grain dust, sawdust, coal, gravel, crushed rock, cement, and boiler fly ash.		
A603	Soil Erosion and Sediment Control at Industrial Sites – includes industrial activities that take place on soil.		X
SECTION A7 - OTHER ACTIVITIES			
A701	Commercial Animal Handling Areas – includes kennels, fenced pens, veterinarians, and businesses that board animals.		

Activity Code (BMP)	Type of Activity	Are you involved in this? If so, check if it occurs:	
		Indoors[a]	Outdoors[b]
A702	Log Sorting and Handling – applies to log yards typically located at sawmills, ports, and pulp mills.		
A703	Boat building, Mooring, Maintenance, and Repair – includes all types of maintenance, repair, and building operations.		
A704	Logging – applies to logging activities that fall under Class IV general forest practices.		
A705	Mining and Quarrying of Sand, Gravel, Minerals, Peat, Clay, Rock, and Other Materials – does not include excavation at construction sites.		
A706	Swimming Pool and Spa Cleaning and Maintenance – includes every swimming pool and spa not at a single family residence. Commercial pool cleaners are included here for all pools.		
A707	Deicing and Anti-icing Operations for Airports and Streets - includes aircraft, runways/taxiways, streets and highways.		
A708	Roof and Building Drains at Manufacturing and Commercial Buildings – These sites will be referred to the Puget Sound Clean Air Agency.		
A709	Urban Streets – includes recommended BMPs.		
A710	Railroad Yards		
A711	Maintenance of Utility Vaults – includes public and private utility maintenance activities.		X
A712	Maintenance of Roadside Ditches and Culverts		
A713	Spills of Oil and Hazardous Substances		
A714	Water Reservoir, Transmission Mainline, Wellhead, and Hydrant Flushing Activities		X
SECTION S1 - SOURCE CONTROL BMPs			
S101	Eliminate Illicit Sewer to Storm Drainage System Connections		
S102	Dispose of Contaminated Stormwater and Waste Materials Properly	X	X
S103	Discharge Process Wastewater to a Sanitary Sewer, Holding Tank, or Water Treatment System	X	X
S104	Cover the Activity with a Roof of Awning		
S105	Cover the Activity with an Anchored Tarp or Plastic Sheet		X
S106	Pave the Activity Area and Slope to a Sump or Holding Tank, or Oil/Water Separator		
S107	Surround the Activity Area with a Curb, Dike, or Berm or Elevate the Activity		
S108	Implement Integrated Pest Management Measures		
S109	Cleaning Catch Basins		X

a.If any of these activities occur indoors, then BMPs are not required, provided no indoor drains or processes can ultimately contact stormwater or be transported to surface waters such as rivers, lakes and streams. Ensure that liquids, powders, dusts and fine granular materials stay confined indoors. Otherwise BMPs will be required.

b.If any of these activities occur outdoors, then use the activity code to find the appropriate BMPs described in Chapter 4.

Appendix G – Temporary Erosion and Sediment Control BMPs

Attach only those BMPs from Volume 2 of the SWMM that will be utilized for the project.

2.2 BMP C102: Buffer Zone

2.2.1 Purpose

Creation of an undisturbed area or strip of natural vegetation or an established suitable planting that will provide a living filter to reduce soil erosion and stormwater runoff velocities.

2.2.2 Conditions of Use

Buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Vegetative buffer zones can be used to protect natural swales and can be incorporated into the natural landscaping of an area.

Do not use critical area buffer zones as sediment treatment areas. Do not disturb critical area buffers.

2.2.3 Design and Installation Specifications

- Preserve natural vegetation or plantings in clumps, blocks, or strips as this is generally the easiest and most successful method. However, single specimen trees and plants should also be preserved.
- Leave all unstable slopes in their natural, undisturbed state.
- Mark clearing limits and keep all equipment and construction debris out of the natural areas. Steel construction fencing is the most effective method of protecting sensitive areas and buffers. Alternatively, wire-backed silt fence on steel posts is marginally effective. Flagging alone is not allowed.
- Keep all excavations and material storage areas outside the dripline of trees and shrubs.
- Do not push debris or extra soil into the buffer zone area because it will cause damage from burying and smothering.
- Vegetative buffer zones for streams, lakes or other waterways shall be established by the City or other state or federal permits or approvals.

2.2.4 Maintenance Standards

- Inspect the area frequently to make sure fencing remains in place and the area remains undisturbed. Fix or replace damaged fencing immediately.

2.3 BMP C103: High Visibility Fence

2.3.1 Purpose

Fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances or roads.
- Protect areas where marking with survey tape or flagging may not provide adequate protection.

2.3.2 Conditions of Use

To establish clearing limits, plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

2.3.2.1 Design and Installation Specifications

- High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 lbs./ft. using the ASTM D4595 testing method.
- If appropriate, install fabric silt fence in accordance with BMP C233 to act as high visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirement of this BMP.
- Design and install metal fences according to the manufacturer's specifications.
- Metal fences shall be at least 3 feet high and must be highly visible.
- Do not wire or staple fences to trees.

2.3.2.2 Maintenance Standards

- If the fence has been damaged or its visibility reduced, it shall be repaired or replaced immediately and visibility restored.

2.8 BMP C121: Mulching

2.8.1 Purpose

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. Only the most common types are discussed in this section.

2.8.2 Conditions of Use

As a temporary cover measure, mulch should be used:

- On disturbed areas that require cover measures for less than 30 days.
- As a cover for seed.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.
- Mulch may be applied at any time of the year and must be refreshed periodically.
- Tackifiers shall be plant-based, such as guar or alpha plantago, or chemical-based such as poly-acrylamide or polymers.
- Install mulch or tackifier products per manufacturer's recommendations.

2.8.3 Design and Installation Specifications

- Mulch shall be compost, chipped site vegetation, hydro-mulch, wood-based mulch or wood straw, wood strand mulch, or straw. See Table 2 - 8 for specifications, application rates, and additional information.
- A minimum of 2” of mulch is required. Increase the mulch thickness until the ground is 95% covered (not visible under the mulch). Thickness may need to increase for disturbed areas in or near sensitive or other areas susceptible to erosion.
- Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Compost has a higher specific gravities (densities) than straw, wood, or chipped material.

2.8.4 Maintenance Standards

- The thickness of the cover must be maintained.
- Remulch and/or protect with a net or blanket any areas that experience erosion. If the erosion problem is drainage related, then fix the problem and remulch the eroded area.

Table 2 - 8: Mulch Standards and Guidelines

Compost

- Compost shall:
  - Meet the definition for "composted material" per WAC 173-350-100 and comply with standards in WAC 173-350-220, except the feedstock may contain biosolids or manure feedstocks.
  - Be coarse compost meeting the following size gradations (by dry weight) when tested in accordance with the U.S. Composting Council "Test Methods for the Examination of Compost and Composting" (TMECC) Test Method 02.02-B.

Sieve Size	Minimum Percent Passing
3"	100
1"	90
3/4"	70
¼"	40

  - Have no visible water or dust during handling.
  - Have soil organic matter content of 40% to 65%.
  - Have a carbon to nitrogen ratio below 25:1. Carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.
  - Be applied a minimum of 2" thick (~100 tons/acre) though thicker application rates may provide more effective control.
- Do not use near wetlands or phosphorus impaired waterbodies.
- Compost can be later tilled into soils to help meet the requirements of BMP L613 – Post-Construction Soil Quality and Depth as required per Minimum Requirement #5.

Compost specifications are also contained in Vol 5, Appendix E.

Chipped Site Vegetation

- Chipped site vegetation shall:
  - Have an average size of 2-4" with gradations from fine to 6" in length for texture, variation, and interlocking properties.
  - Be applied a minimum of 2" thick.
- Do not apply on slopes greater than 10%.
- Do not use within 200 feet of surface waterbodies.
- Using chipped site vegetation is a cost-effective way to dispose of debris associated with clearing and grubbing material. The decomposition of the chipped vegetation may help impart nutrients for grass establishment.

Table 2 - 8: Mulch Standards and Guidelines

Hydro-mulch
• Hydro-mulch shall: ◦ Be applied with seed and tackifier. • May be applied without seed and tackifier if application rate is doubled. ◦ Have no growth inhibiting factors. ◦ Have fibers less than ¾” in length to ensure machinery does not clog. ◦ Be applied at 35-45 pounds per 1,000 sf or 1500-2000 pounds per acre with a hydromulcher.

Table 2 - 8: Mulch Standards and Guidelines

Wood-based Mulch or Wood Straw
• Wood-based mulch or straw mulch shall: ◦ Have no visible water or dust during handling. ◦ Be purchased from a supplier with a Solid Waste Handling Permit or a supplier that is exempt from solid waste regulations. ◦ Be applied 2” thick (~100 tons/acre) • Wood-based mulch or wood straw is often called “hog” or “hogged fuel”. • The preparation of wood-based mulch typically does not account for weed seed control so the inclusion of weed plants or seeds should be monitored and minimized or prevented during application.
Wood Strand Mulch
• Wood strand mulch shall be: ◦ A blend of loose long, thin wood pieces derived from native conifers or deciduous trees with high length-width ratio. ◦ A minimum of 95% of the wood strand shall have lengths between 2” and 10” with a width and thickness between 1/16” and 3/8”. ◦ Free of resin, tannin, or other compounds that are detrimental to plant establishment and growth. ◦ Applied 2” thick. • Do not use sawdust or wood shavings.
Straw
• Straw shall be: ◦ Air-dried. ◦ Free from undesirable seed and coarse material. ◦ Applied 2”-3” thick (5 bales per 1000 ft2 or 2-3 tons per acre) • Thickness may be reduced by half when used with seeding. • Hand-application requires a greater thickness than blown straw to ensure required coverage. ◦ Held in place by crimping, using a tackifier, or covering with netting. Blown straw shall be held in place using a tackifier. • Although straw can be cost-effect, straw can introduce and/or encourage weed species and has no long-term benefits so should only be used when other materials are unavailable. • Do not used within the ordinary high-water elevation of surface waters (due to flotation).

2.10 BMP C123: Plastic Covering

2.10.1 Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

2.10.2 Conditions of Use

- Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.
- Plastic is particularly useful for protecting cut and fill slopes and stockpiles.
- The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than six months) applications.
- Due to rapid runoff caused by plastic covering, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Whenever plastic is used to protect slopes, water collection measures must be installed at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. At no time is clean runoff from a plastic covered slope to be mixed with dirty runoff from a project.
- Other uses for plastic include:
  - Temporary ditch liner;
  - Pond liner in temporary sediment pond;
  - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored;
  - Emergency slope protection during heavy rains; and
  - Temporary drainpipe (“elephant trunk”) used to direct water.

2.10.3 Design and Installation Specifications

See Figure 2.11.

Plastic slope cover must be installed as follows:

- Run plastic up and down slope, not across slope.
- Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
- Minimum of 8-inch overlap at seams.
- On long or wide slopes, or slopes subject to wind, all seams should be taped.
- Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
- Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and pound a wooden stake through each to hold them in place. Alternative options for holding plastic in place exist and may be considered with COT approval.
- Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion;

- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

2.10.4 Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
- When the plastic is no longer needed, it shall be completely removed.
- Properly dispose of products used to weigh down covering.

2.12 BMP C125: Compost

2.12.1 Purpose

The purpose of compost is to help establish vegetation and filter stormwater thus removing fine sediment and other contaminants. Compost can be used alone as a compost blanket, as a berm, or inside a sock.

2.12.2 Conditions of Use

- Do not use if stormwater will discharge to a nutrient sensitive waterbody.
- Do not use as a storm drain inlet protection measure.

2.12.3 Design and Installation Specifications

- Compost shall:
  - Meet the definition for "composted material" per WAC 173-350-100 and comply with standards in WAC 173-350-220, except the feedstock may contain biosolids or manure feedstocks.
  - Be coarse compost meeting the following size gradations (by dry weight) when tested in accordance with the U.S. Composting Council "Test Methods for the Examination of Compost and Composting" (TMECC) Test Method 02.02-B.

Sieve Size	Minimum Percent Passing
3"	100
1"	90
3/4"	70
¼"	40

  - Have no visible water or dust during handling.
  - Have soil organic matter content of 40% to 65%.
  - Have a carbon to nitrogen ratio below 25:1. Carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.
- Do not use near wetlands or phosphorus impaired waterbodies.
- Compost can be later tilled into soils to help meet the requirements of BMP L613 – Post-Construction Soil Quality and Depth as required per Minimum Requirement #5.

City of Tacoma TAGRO Potting Soil can be used as an alternative to the compost component in BMP C125.

Compost specifications are also contained in Volume 5, Appendix E.

Compost Blankets

Compost blankets are simply compost blanketed over an area.

- Place compost 3" thick.
- Compost can be blown onto slopes up to 2:1 or spread by hand on shallower slopes.
- Compost can be mixed with a seed mix to ensure rapid vegetation.

- Compost does not need to be removed after construction phase unless required by the project engineer or geotechnical professional.

Compost Berms

Compost berms are a perimeter sediment control that can be used instead of silt fence.

- Do not use compost berms on steep slopes.
- Berm width shall be a minimum of 2 feet.
- Berm height shall be a minimum of 12 inches.
- Berm width shall be twice the berm height.

Compost can be blown in place or placed by front-end loader.

Compost should be spread over proposed landscaped section when construction is complete to aid in revegetation.

Compost Socks

Compost socks are similar to straw wattles.

- Sock material that is biodegradable will last up to 6 months and can be used for soil amendment after 6 months.
- Sock material that is non-biodegradable must be removed after construction is complete.
- Place socks perpendicular to flow.
- Walk socks in place to ensure good soil contact.
- Install wooden stakes every 12” on steep slopes or every 24” on shallow slopes

2.12.4 Maintenance Standards

Compost Blankets

- Inspect compost regularly.
- Ensure a 3” thick blanket.

Compost Berms

- Inspect compost berm regularly.
- Ensure vehicular traffic does not cross berm and track compost offsite. If this occurs, sweep compost immediately.

Compost Socks

- Do not allow erosion or concentrated runoff under or around the barrier.
- Inspect the socks after each rainfall and repair any socks that tear or are not abutting the ground.

2.18 BMP C150: Materials On Hand

2.18.1 Purpose

Quantities of erosion prevention and sediment control materials should be kept on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy summer rains. Having these materials onsite reduces the time needed to implement BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements.

2.18.2 Conditions of Use

Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric, and steel “T” posts.

- Materials are stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or developer could keep a stockpile of materials that are available to be used on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at a location less than one hour from the project site.

2.18.3 Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. Table 2 - 9 provides a good minimum that will cover numerous situations.

Table 2 - 9: Materials on Hand

Material	Measure	Quantity
Clear Plastic, 6 mil	100 foot roll	1-2
Drainpipe, 6 or 8 inch diameter	25 foot section	4-6
Sandbags, filled	each	25-50
Quarry Spalls	ton	2-4
Washed Gravel	cubic yard	2-4
Geotextile Fabric	100 foot roll	1-2
Catch Basin Inserts	each	2-4
Steel “T” Posts	each	12-24

2.18.4 Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials used as needed.

2.19 BMP C151: Concrete Handling

2.19.1 Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. .Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

2.19.2 Conditions of Use

Utilize these management practices any time concrete is used.

Concrete construction projects include, but are not limited to, the following:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Offsite disposal
2. Concrete washout areas
3. De minimus washout to formed areas awaiting concrete

2.19.3 Design and Installation Specifications

- Wash concrete truck drums at an approved offsite location or in designated concrete washout areas only.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not pump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into the stormwater conveyance system, open ditches, streets, or streams.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.

- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.Always use forms or solid barriers for concrete pours within 15-feet of surface waters.
- Refer to BMPs C252 and C253 for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit for pH monitoring requirements if the project involves one of the following activities:
  - Significant concrete work (as defined in the Construction Stormwatwer General Permit).
  - The use of engineered soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
  - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

2.19.4 Maintenance Standards

Containers shall be checked for holes in the liner daily during concrete pours and repaired the same day.

2.22 BMP C154: Concrete Washout Area

2.22.1 Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, or performing onsite washout in a designated area to prevent pollutants from entering surface waters or groundwater.

2.22.2 Conditions of Use

Use concrete washout best management practices on construction projects where:

- It is not possible to dispose of all concrete wastewater and washout offsite (ready mix plant, etc.)
- Concrete truck drums are washed onsite.
- Concrete is used as a construction material.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

NOTE:

- Auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) may be washed into formed areas awaiting concrete pour.

2.22.3 Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved offsite location or in designated concrete washout areas only.
- Do not wash out concrete trucks onto the ground, or into the stormwater conveyance system, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated concrete washout areas.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Identify concrete washout area on the TESC plan.

- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for the contractor's superintendent or Erosion and Sediment Control Lead (BMP C160) to oversee and enforce concrete waste management procedures.
- Install a sign adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

Contracts

Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement Considerations:

- Locate washout area or temporary concrete washout facilities at least 50 feet from sensitive areas such as storm drains, open ditches, or water bodies, including wetlands.
- Allow convenient access for concrete trucks, preferably near the area where the concrete is being poured.
- If trucks need to leave a paved area to access washout, prevent track-out with a pad of rock or quarry spalls (BMP C105). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The washout area volume installed should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, washouts may be placed in multiple locations for ease of use by concrete truck drivers.

Concrete Truck Washout Procedures

- Washout concrete truck drums in designated concrete washout areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of offsite.

Concrete Washout Area Installation

- Install concrete washout areas prior to starting concrete work.
- Construct concrete washout areas of sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. It is recommended that the minimum length and width be 10 feet.
- Plastic lining should be a minimum of 10-mil polyethylene sheeting and free of holes, tears, or other defects that compromise impermeability.

- Lath and flagging should be commercial grade.
- Install liner seams per manufacturer's recommendations.
- Prepare soil base free of rocks or other debris that may cause tears of holes in plastic lining.

2.22.4 Inspection and Maintenance

- Inspect and verify that concrete washout BMPs are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into designated washout areas and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.
- During periods of concrete work, inspect daily to verify continued performance.
  - Check overall condition and performance.
  - Check remaining capacity (% full).
  - If using self-installed washout facilities, verify plastic liners are intact and sidewalls are not damaged.
  - If using prefabricated containers, check for leaks.
- Maintain washout facilities to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- If the washout is nearing capacity, vacuum and dispose of the waste material in an approved manner.
  - Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
  - Do not use wastewater system without obtaining a City of Tacoma Special Approved Discharge permit. Call Source Control at 253.591.5588 for more information.
  - Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to predicted wet weather to prevent accumulation and overflow of precipitation.
  - Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused onsite or hauled away for disposal or recycling.
- When you remove materials from the self-installed concrete washout, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

2.22.5 Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, remove and properly dispose of the hardened concrete, slurries and liquids.
- Remove materials used to construct temporary concrete washout facilities from the site of the work and dispose of or recycle it.

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled, repaired, and stabilized to prevent erosion.

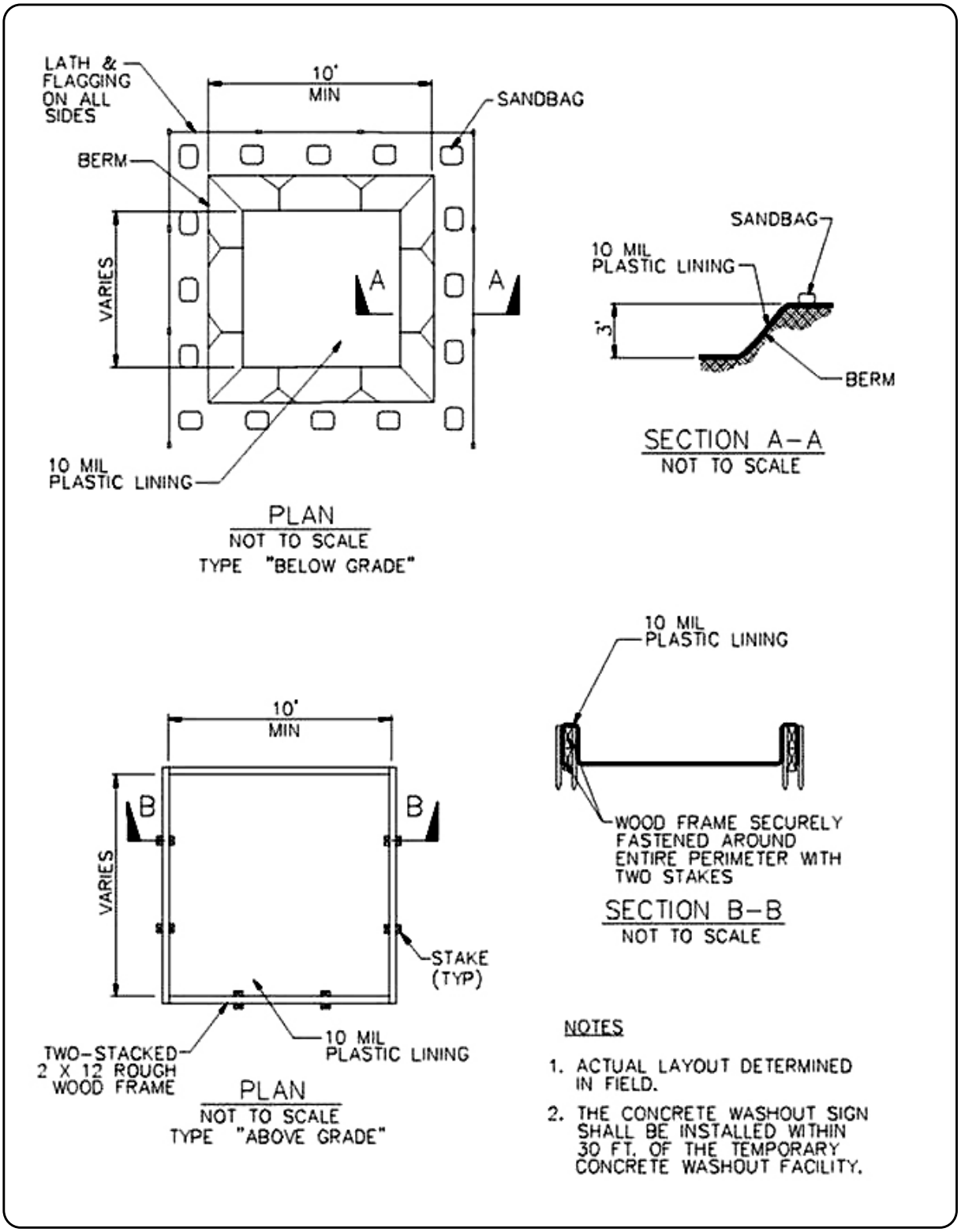


Figure 2-7 Temporary Concrete Washout Facility

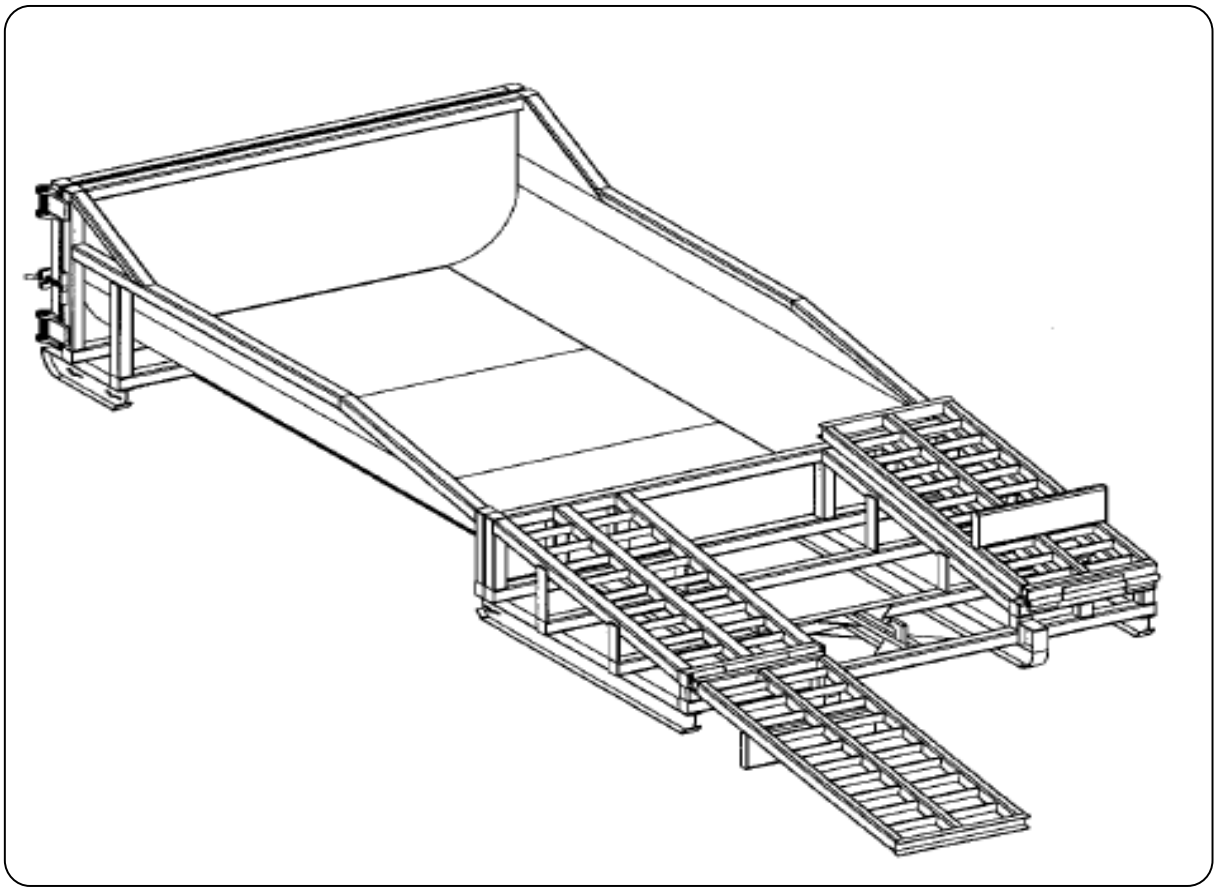


Figure 2-8 Prefabricated Concrete Washout Container with Ramp

2.23 BMP C160: Erosion and Sediment Control Lead

2.23.1 Purpose

The project proponent must designate at least one person as the responsible representative in charge of erosion and sediment control (ESC) and water quality protection. The designated person shall be the erosion and sediment control (ESC) lead, who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

2.23.2 Conditions of Use

- An erosion and sediment control contact is required for all project sites.
- A certified erosion and sediment control lead (CESCL) or certified professional in erosion and sediment control (CPESC) is required on projects that include, but are not limited to:
  - Construction activity that disturbs one acre of land or more.
- Projects disturbing less than one acre must have an Erosion Sediment Control Lead (ESC) conduct inspections. The ESC Lead does not have to have CESCL or CPESC certification.
- The CESCL, CPESC, or ESC Lead shall be identified in the SWPPP and shall be onsite or on-call at all times.
- The CESCL, CPESC, or ESC Lead must be knowledgeable in the principles and practices of erosion and sediment control and have the skills to assess:
  - Site conditions and construction activities that could impact the quality of stormwater.
  - Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

2.23.3 Specifications

- The CESCL lead shall:
  - Have a current certified erosion and sediment control lead (CESCL) certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology.
- For additional information concerning the Certified Professional in Erosion and Sediment Control program please go to https://envirocertintl.org/cpesc/.
- The ESC lead shall have authority to act on behalf of the contractor or developer and shall be available, on call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, email, and address of the designated ESC lead.
- An ESC lead may provide inspection and compliance services for multiple construction projects in the same geographic region.
- Duties and responsibilities of the ESC lead shall include, but are not limited to, the following:
  - Inspecting all areas disturbed by construction activities, all BMPs and all stormwater discharge points at least once every calendar week and within 24 hours of any

discharge from the site. The ESC lead may reduce the inspection frequency for temporary stabilized, inactive sites to monthly.

- Examining stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen.
- Evaluating the effectiveness of BMPs.
- Maintaining a permit file on site at all times which includes the SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.
- Updating all project drawings and the Construction SWPPP with changes made.
- Keeping daily logs and inspection reports. Inspection reports should include:
  - Inspection date/time.
  - Weather information, general conditions during inspection, and approximate amount of precipitation since the last inspection.
  - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
    - Locations of BMPs inspected,
    - Locations of BMPs that need maintenance,
    - Locations of BMPs that failed to operate as designed or intended, and
    - Locations where additional or different BMPs are required.
  - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
  - Any water quality monitoring performed during inspection.
  - General comments and notes, including a brief description of any BMP repairs, maintenance, or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.
- Keep an inventory of equipment onsite.

2.34 BMP C220: Inlet Protection

2.34.1 Purpose

To prevent coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

2.34.2 Conditions of Use

- Use where inlets are to be made operational before permanent stabilization of the disturbed drainage area.
- Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by another sediment trapping device.
- Table 2 - 10 lists several options for inlet protection. All of the methods for storm drain inlet protection are prone to plugging and require a high frequency of maintenance. Drainage areas should be limited to 1 acre or less. Emergency overflows may be required where stormwater ponding would cause a hazard. If an emergency overflow is provided, additional end-of-pipe treatment may be required.

Table 2 - 10: Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/Earthen Surfaces	Conditions of Use
Excavated drop inlet protection	Yes, temporary flooding will occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30’ x 30’ per acre.
Block and gravel drop filter	Yes	Paved or earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and mesh filter	No	Paved	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or earthen	Frequent maintenance required.
Curb inlet protection with a wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Earthen	Sturdy, but limited filtration.
Culvert inlet sediment trap			18-month expected life.

2.34.3 Design and Installation Specifications

Excavated Drop Inlet Protection

- An excavated impoundment around the inlet. Sediment settles out of the stormwater prior to entering the stormwater conveyance system..
- Provide depth of 1 to 2 feet, as measured from the crest of the inlet structure.
- Slope sides of excavation no steeper than 2H:1V.

- Minimum volume of excavation 35 cubic yards.
- Shape excavation to fit site with longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water problems.
- Clear the area of all debris.
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- It may be necessary to build a temporary dike to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

- A block and gravel filter is a barrier formed around the storm drain inlet with standard concrete blocks and gravel. See Figure 2-17.
- Provide a height 1 to 2 feet above inlet.
- Recess the first row 2 inches into the ground for stability.
- Support subsequent courses by placing a piece of 2x4 lumber through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet with the following characteristics:
    - Provide an inlet slope of 3H:1V.
    - Provide an outlet slope of 2H:1V.
    - Provide a 1-foot wide level stone area between the structure and the inlet.
    - Use inlet slope stones 3 inches in diameter or larger.
    - For outlet slope use gravel ½- to ¾-inch at a minimum thickness of 1-foot.

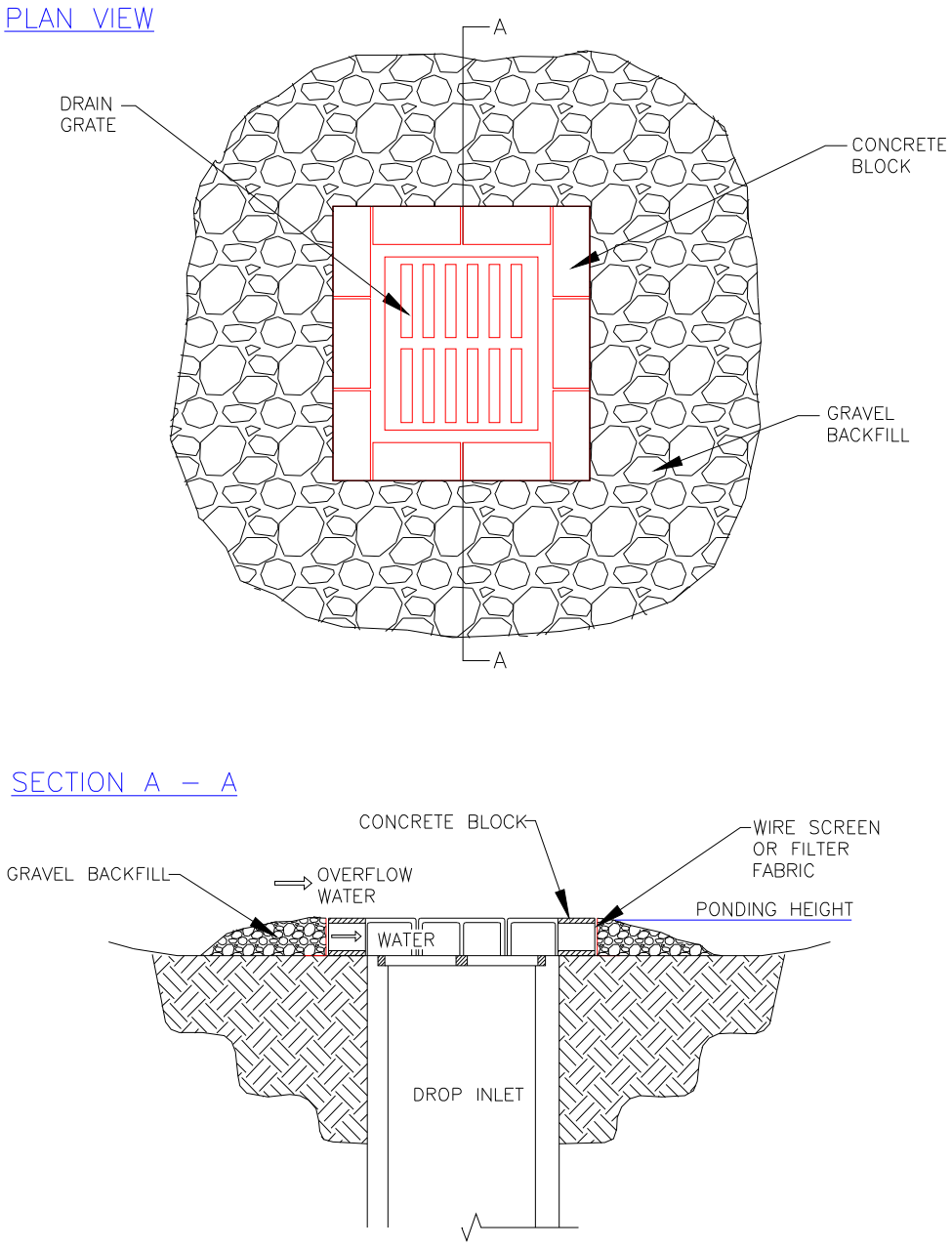
Gravel and Wire Mesh Filter

- A gravel and wire mesh filter is a gravel barrier placed over the top of the inlet (see Figure 2-18). This structure does not provide an overflow.
- Use a hardware cloth or comparable wire mesh with 1/2-inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.

- Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

- Inserts (Figure 2-19) shall be designed by the manufacturer for use at construction sites. The limited sediment storage capacity increases the frequency of inspection and maintenance required, which may be daily for heavy sediment loads. The maintenance requirements can be reduced by combining a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way.
- Provide a minimum of 5 cubic feet of storage.
- Requires dewatering provisions.
- Provide a high-flow bypass that will not clog under normal use at a construction site.
- The catch basin filter is inserted in the catch basin just below the grating.



NOTE:
1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE INLET.
3. THE TOP OF THE STRUCTURE (POND HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DIKE MAY BE NECCESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.

Figure 2-17 Drop Inlet with Block and Gravel Filter

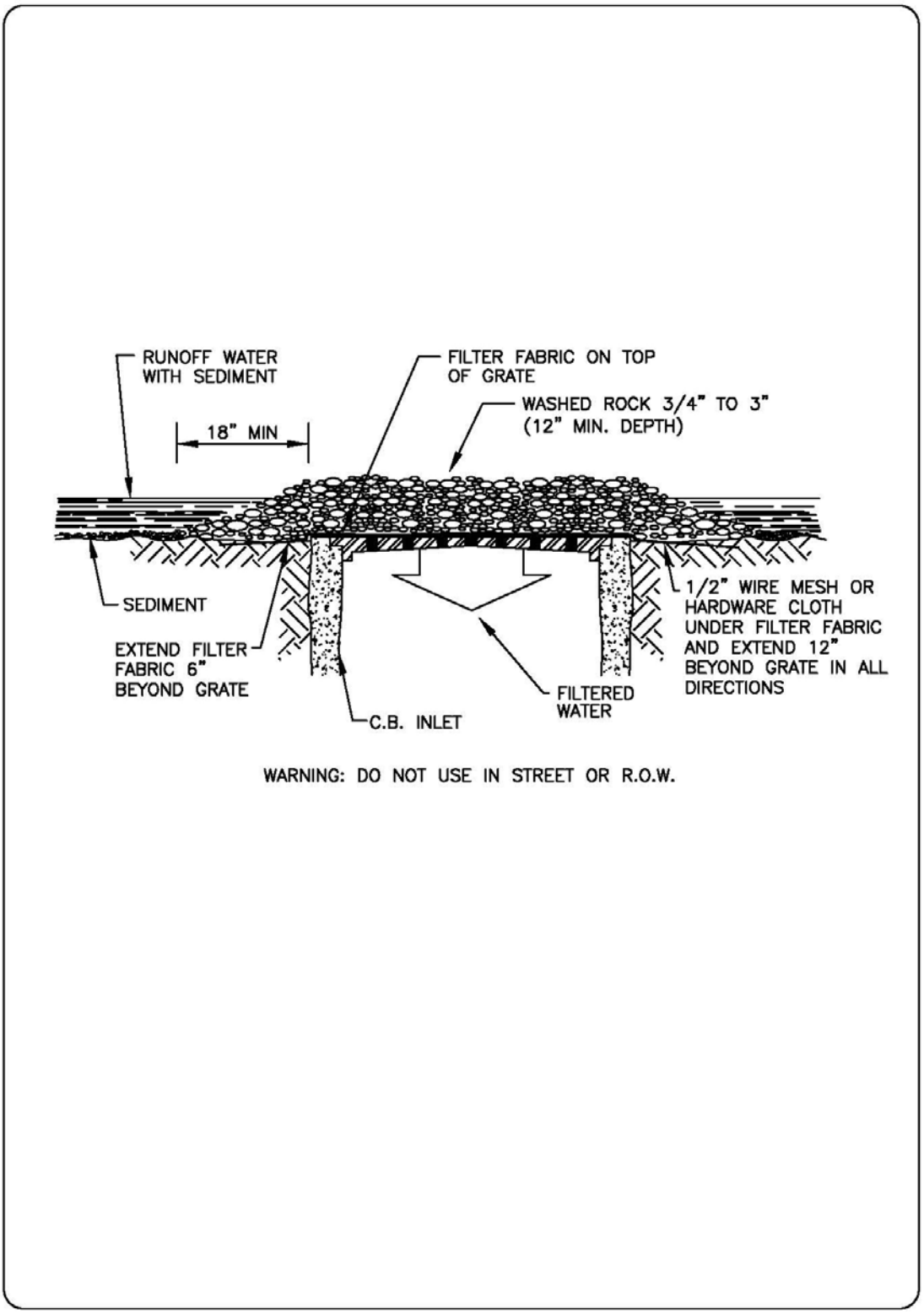
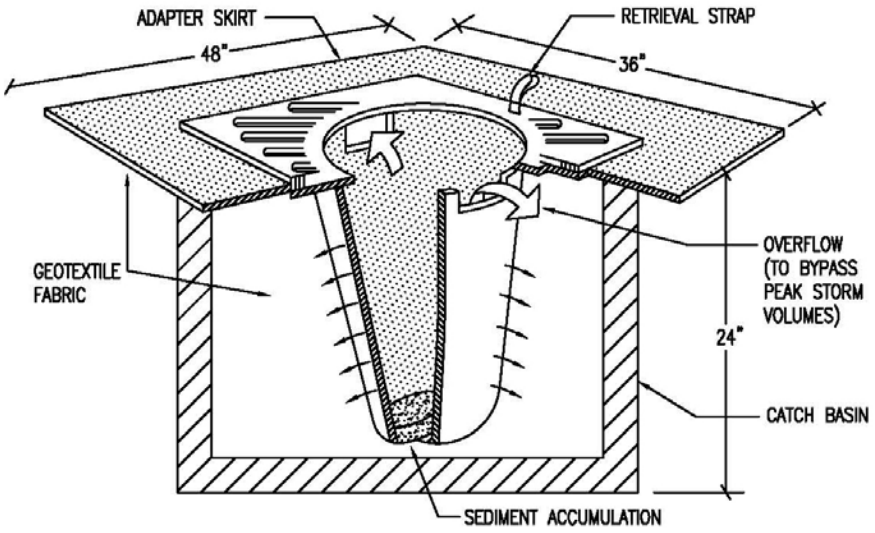


Figure 2-18 Gravel and Wire Mesh Filter



INLET PROTECTION NOTES:

1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.

BAG FILTER

NOT TO SCALE

Figure 2-19 Catchbasin Filter

Curb Inlet Protection with Wooden Weir

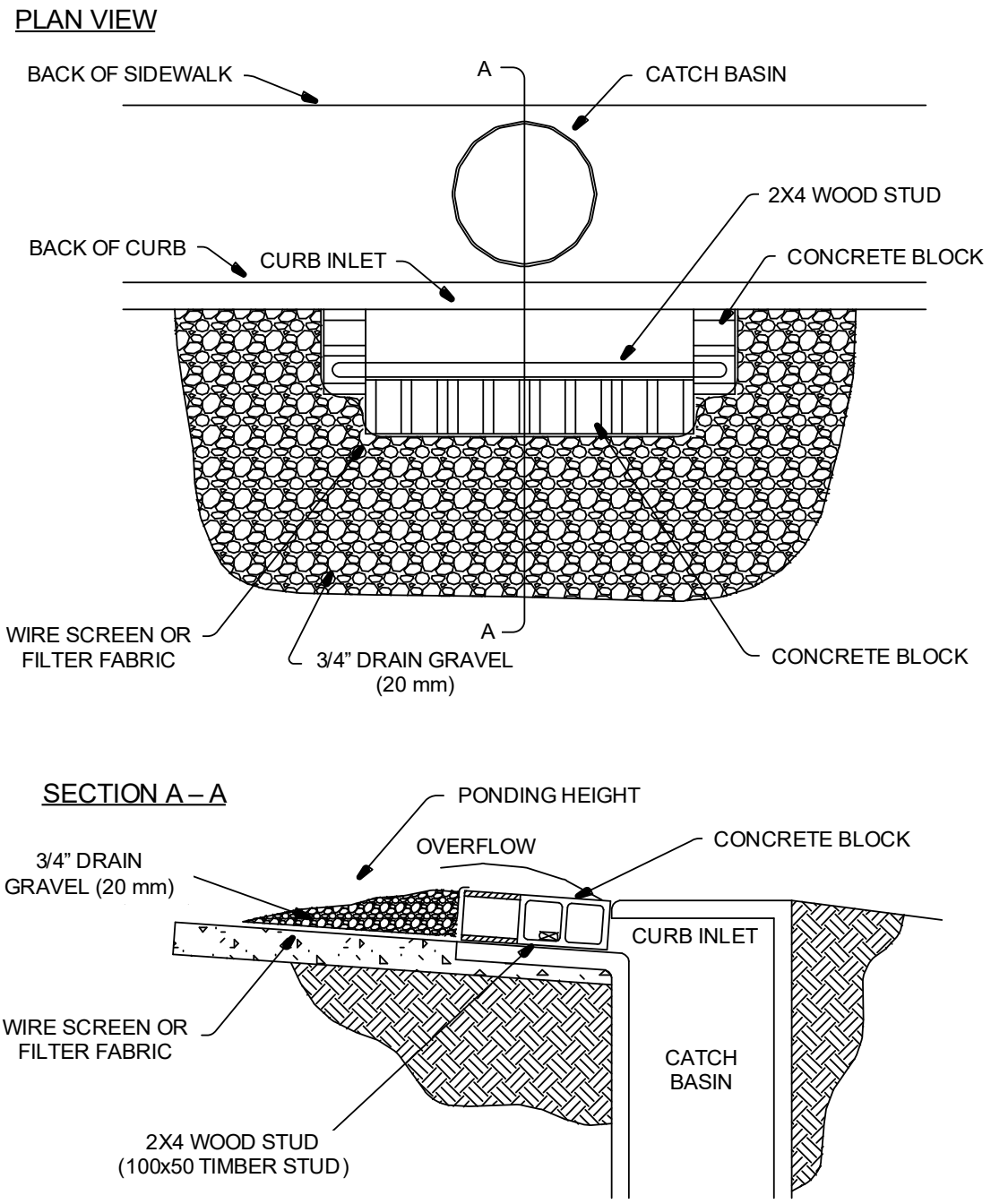
Barrier formed around a curb inlet with a wooden frame and gravel.

- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on frame anchors.

Block and Gravel Curb Inlet Protection

Barrier formed around an inlet with concrete blocks and gravel. See Figure 2-20.

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.



NOTE:
1. USE BLOCK AND GRAVEL TYPE SEDIMENT BARRIER WHEN CURB INLET IS LOCATED IN GENTLY SLOPING STREET SEGMENT, WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. BARRIER SHALL ALLOW FOR OVERFLOW FROM SEVERE STORM EVENT.
3. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

Figure 2-20 Block and Gravel Curb Inlet Protection

Curb and Gutter Sediment Barrier

Sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure 2-21.

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the outside of the berm sized to sediment trap standards for protecting a culvert inlet.

2.34.4 Maintenance Standards

- Inspect inlet protection frequently, especially after storm events. If the insert becomes clogged, clean or replace it.
- For systems using stone filters: If the stone filter becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced. Since cleaning of gravel at a construction site may be difficult, an alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.
- Do not allow accumulated sediment to enter the storm drain system.
- Inlet protection shall be removed when area is fully stabilized and erosion and sediment controls are no longer needed.

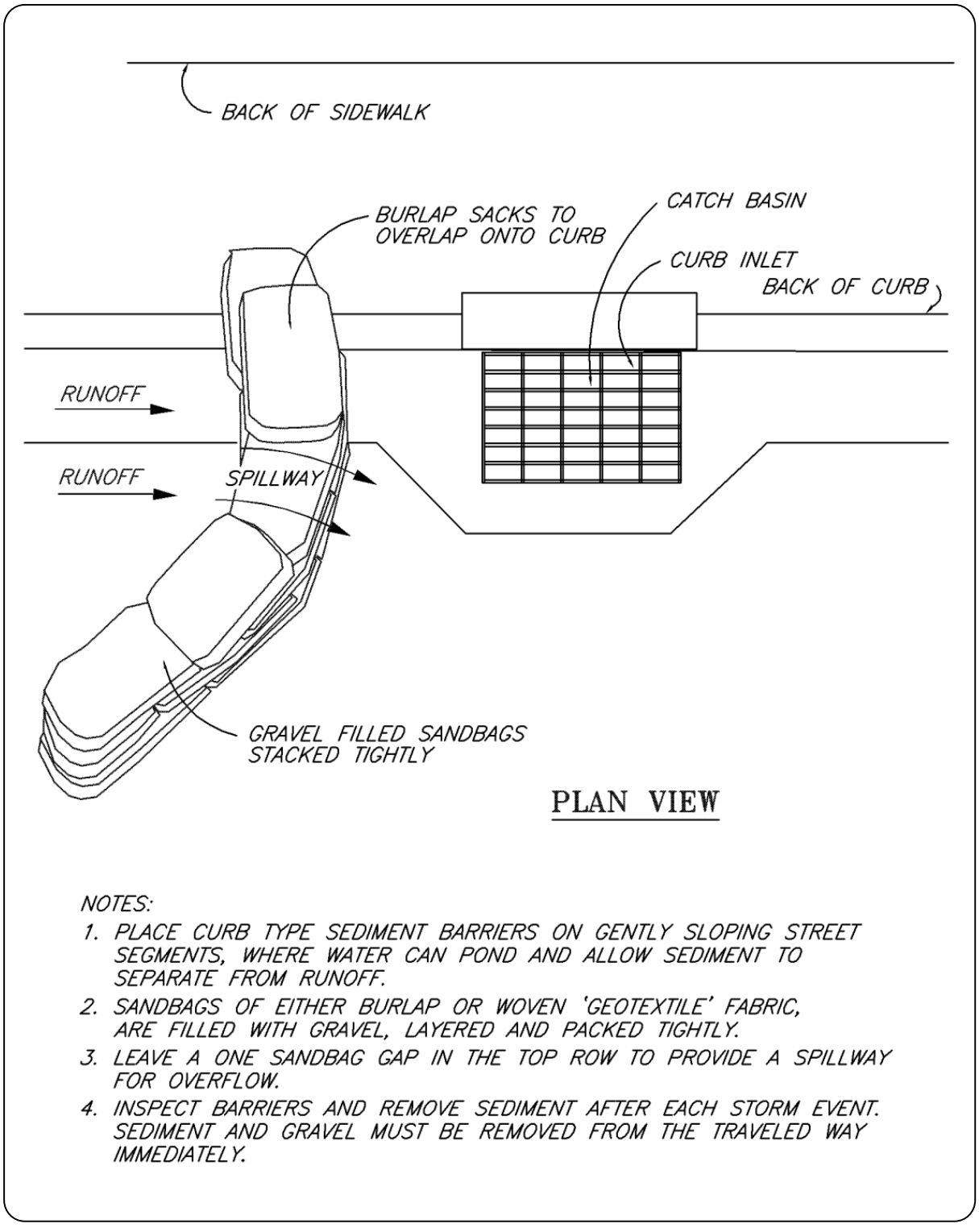


Figure 2-21 Curb and Gutter Sediment Barrier

2.37 BMP C233: Silt Fence

2.37.1 Purpose

Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

2.37.2 Conditions of Use

- Silt fence may be used downslope of all disturbed areas.
- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use them in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

2.37.3 Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards or WSDOT Standard Specification 9-33.2(1) Table 6. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table 12: Geotextile Fabric Standards for Silt Fence):

Table 2 - 11: Geotextile Fabric Standards for Silt Fence

Standard	Description
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for silt film wovens (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. minimum for extra strength fabric. 100 lbs. minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength fabrics with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.

- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0° F to 120° F.
- 100 percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure 2-24: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:
  - The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
  - Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
  - The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
  - The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
  - Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
  - Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
  - Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
  - Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
  - Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
  - Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:

        - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
        - No. 6 steel rebar or larger.
        - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
        - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
        - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.
    - Locate the silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
    - If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion..The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
        - Check dams shall be approximately 1-foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
        - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.
- Refer to Figure 2-25: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:
    - The base of both end posts must be at least 2 to 4 inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    - Install posts 3 to 4 feet apart in critical retention areas and a maximum of 6 feet apart in standard applications.
    - Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
    - Install posts with the nipples facing away from the geotextile fabric.
    - Attach the geotextile fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1 inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    - Wrap approximately 6 inches of geotextile fabric around the end posts and secure with 3 ties.
    - No more than 24 inches of a 36-inch geotextile fabric is allowed above ground level.
    - Compact the soil immediately next to the geotextile fabric with the front wheel of a tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips.Check and correct

the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

2.37.4 Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

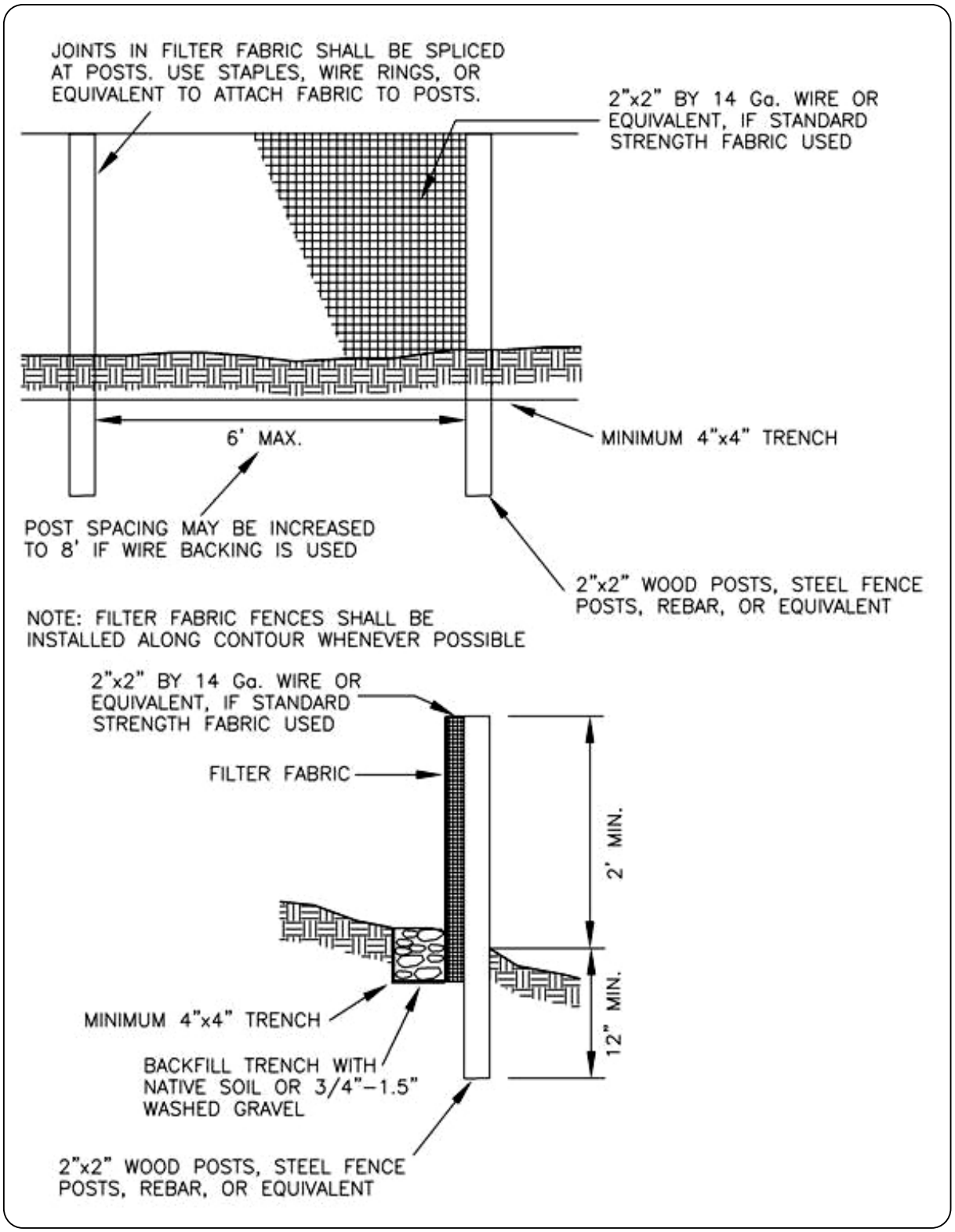


Figure 2-23 Silt Fence

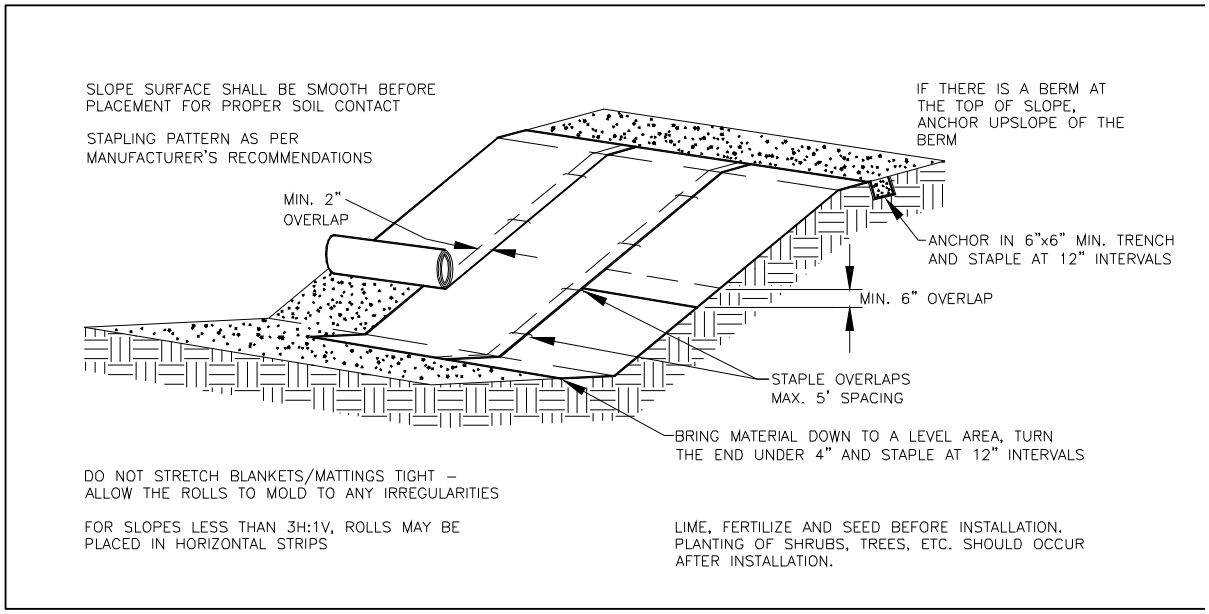


Figure 2-24 Silt Fence Installation by Slicing

2.39 BMP C235: Wattles

2.39.1 Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

2.39.2 Conditions of Use

- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles
  - In disturbed areas that require immediate erosion protection.
  - On exposed soils during the period of short construction delays, or over winter months.
  - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.
- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

2.39.3 Design Criteria

- See Figure 2-26 for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, dig the trenches to a depth of 5 to 7 inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at contour intervals of 10-to 25- feet apart depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches .
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.

- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Live cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

2.39.4 Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

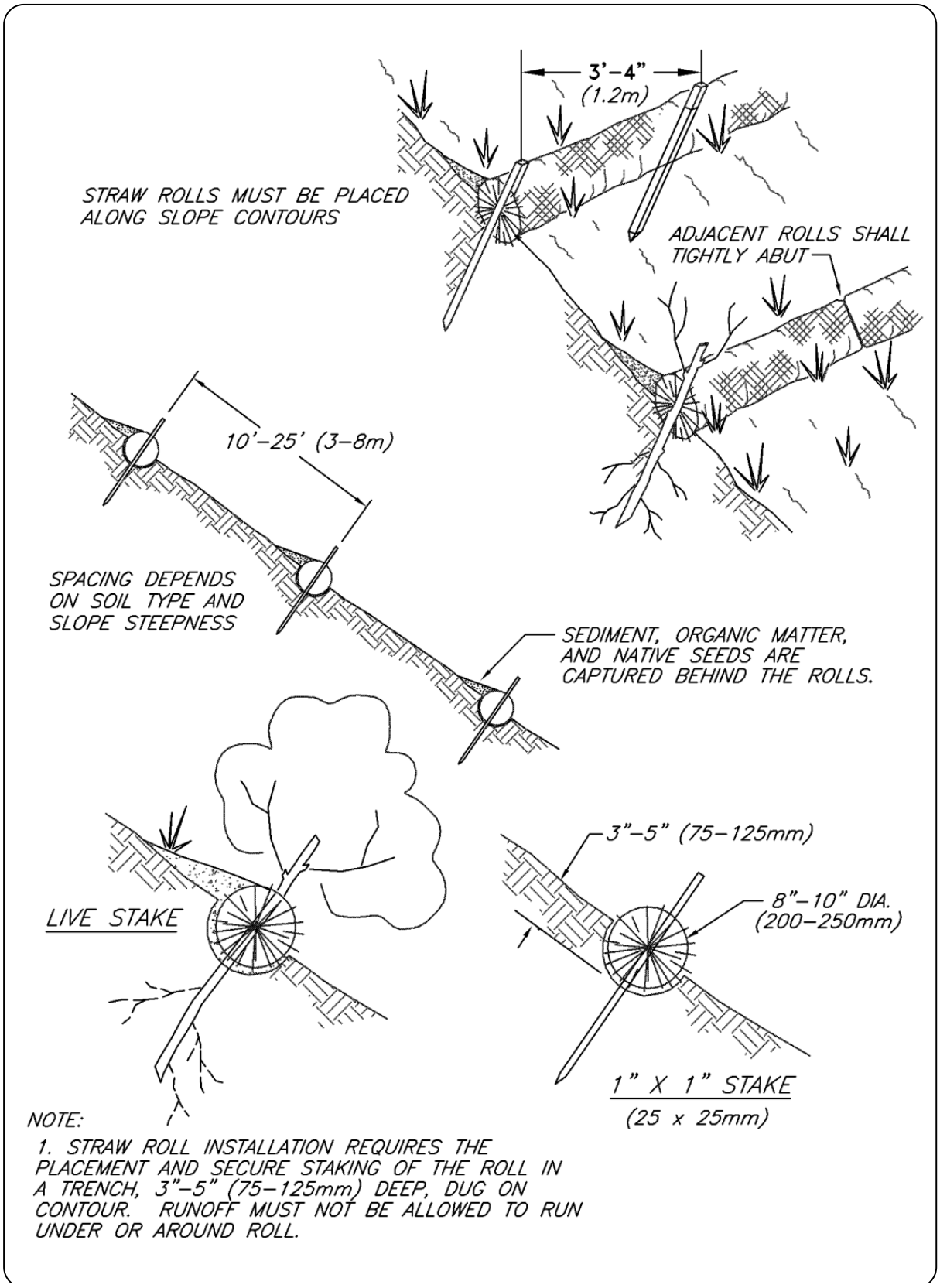


Figure 2-25 Straw Wattles

2.41 BMP C240: Sediment Trap

2.41.1 Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites cleared and/or graded during construction. Install sediment traps, along with other perimeter controls, before any land disturbance takes place in the drainage area.

2.41.2 Conditions of Use

- Sediment traps are intended for use on sites where the tributary drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of six months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the site area is permanently protected against erosion by the installation of vegetation and/or structures.
- Sediment traps are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.
- When permanent facilities are used as temporary sedimentation facilities, the surface area requirement of a sediment trap must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the trap or pond shall be enlarged to comply with the surface area requirement.
- A skimmer may be used for the sediment trap outlet.

2.41.3 Design and Installation Specifications

See Figure 2-27 and Figure 2-28 for details.

If permanent runoff control facilities are part of the project, they should be used for sediment retention.

- To determine the sediment trap geometry, first calculate the design surface area (*SA*) of the trap, measured at the invert of the weir. Use the following equation:

  $SA = FS(Q_2/Vs)$

  Where:

  SA = Design surface area, in square feet, of the sediment trap measured at the invert of the weir.

  Q_2= Design inflow, in cubic feet per second, based on the peak discharge from the developed 2-year runoff event from the contributing drainage area as computed in the hydrologic analysis. The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used.

  Alternatively, Q_2 = Design inflow (cfs) based on the 2-year return period flowrate, predicted by WWHM for the developed (unmitigated site). Use the 10-year return period flowrate if the project size, expected timing and duration of construction, or

downstream conditions warrant a higher level of protection. Q_{10} is the 10-year return period flowrate, predicted by WWHM.

Vs= The settling velocity of the soil particle of interest. The 0.02 millimeter (medium silt) particle with an assumed density of 2.65 grams per cubic centimeter has been selected as the particle of interest and has a settling velocity (*Vs*) of 0.00096 feet per second.

FS= A safety factor of 2 to account for non-ideal settling.

Therefore, the equation for computing surface area becomes:

SA = 2 x Q_2/0.00096 or

= 2080 (Q_2)

NOTE: Even if permanent facilities are used, they must still have a surface area that is at least as large as that derived from the above formula. If they do not, the pond must be enlarged.

- Smaller sites may use the minimum pond sizes in Table 2 - 14 instead of providing calculations.

Table 2 - 14: Sediment Trap Sizing

Contributing Area (acres)	Required Surface Area of Pond (sq. ft.)
1/8 acre or less	130
¼ acre or less	260
½ acre or less	520
¾ acre or less	780
1 acre or less	1040

- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.
- Sediment traps may not be feasible on utility projects due to the limited work space or short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.
- The basic geometry of the pond can now be determined using the following design criteria:
  - Required surface area SA (from the equation above) at top of riser.
  - Minimum 3.5-foot depth from top of riser to bottom of pond.
  - Maximum 3H:1V interior side slopes and maximum 2H:1V exterior slopes. The interior slopes can be increased to a maximum of 2H:1V if fencing is provided at or above the maximum water surface.

- One foot of freeboard between the top of the riser and the crest of the emergency spillway.
- Flat bottom.
- Minimum 1-foot deep spillway.
- Length-to-width ratio between 3:1 and 6:1.

2.41.4 Maintenance Standards

- Remove sediment from the trap when it reaches 1-foot in depth.
- Repair any damage to the pond embankments or slopes.

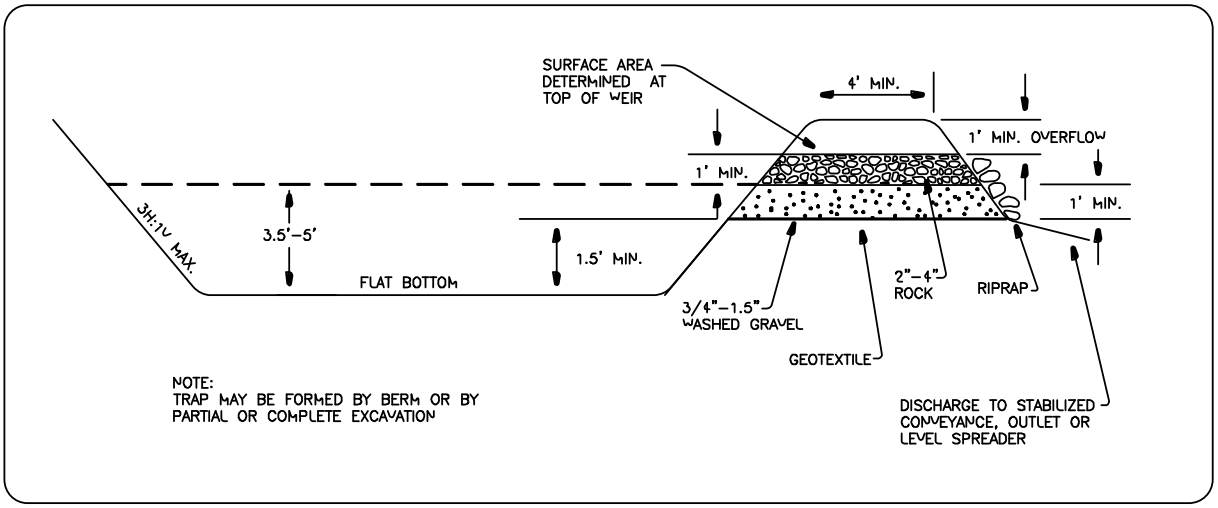


Figure 2-27 Cross-Section of a Sediment Trap

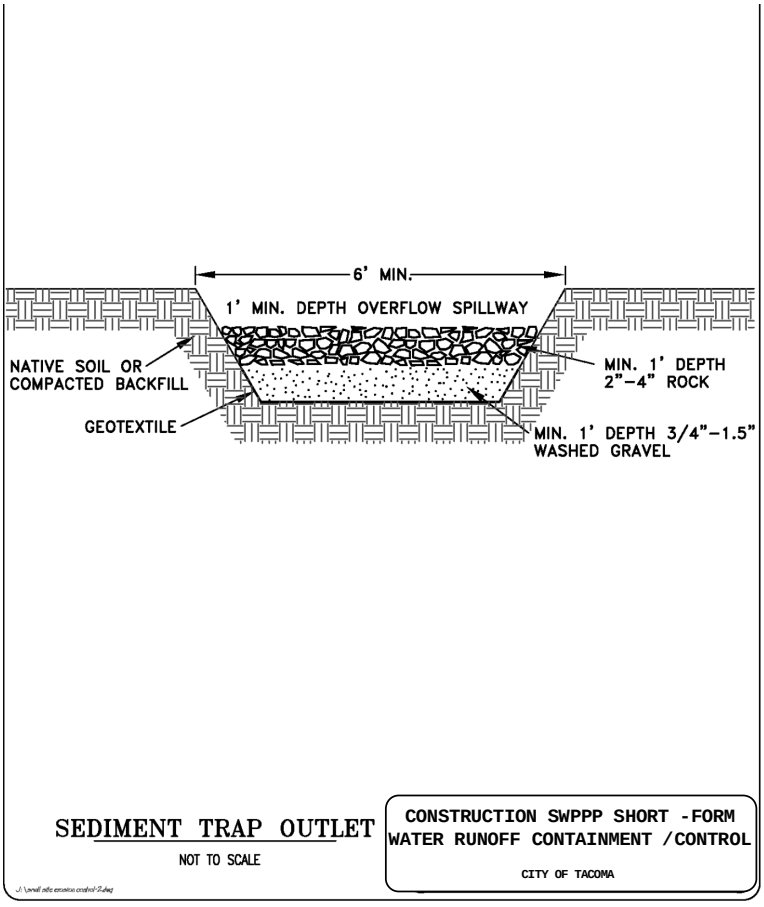


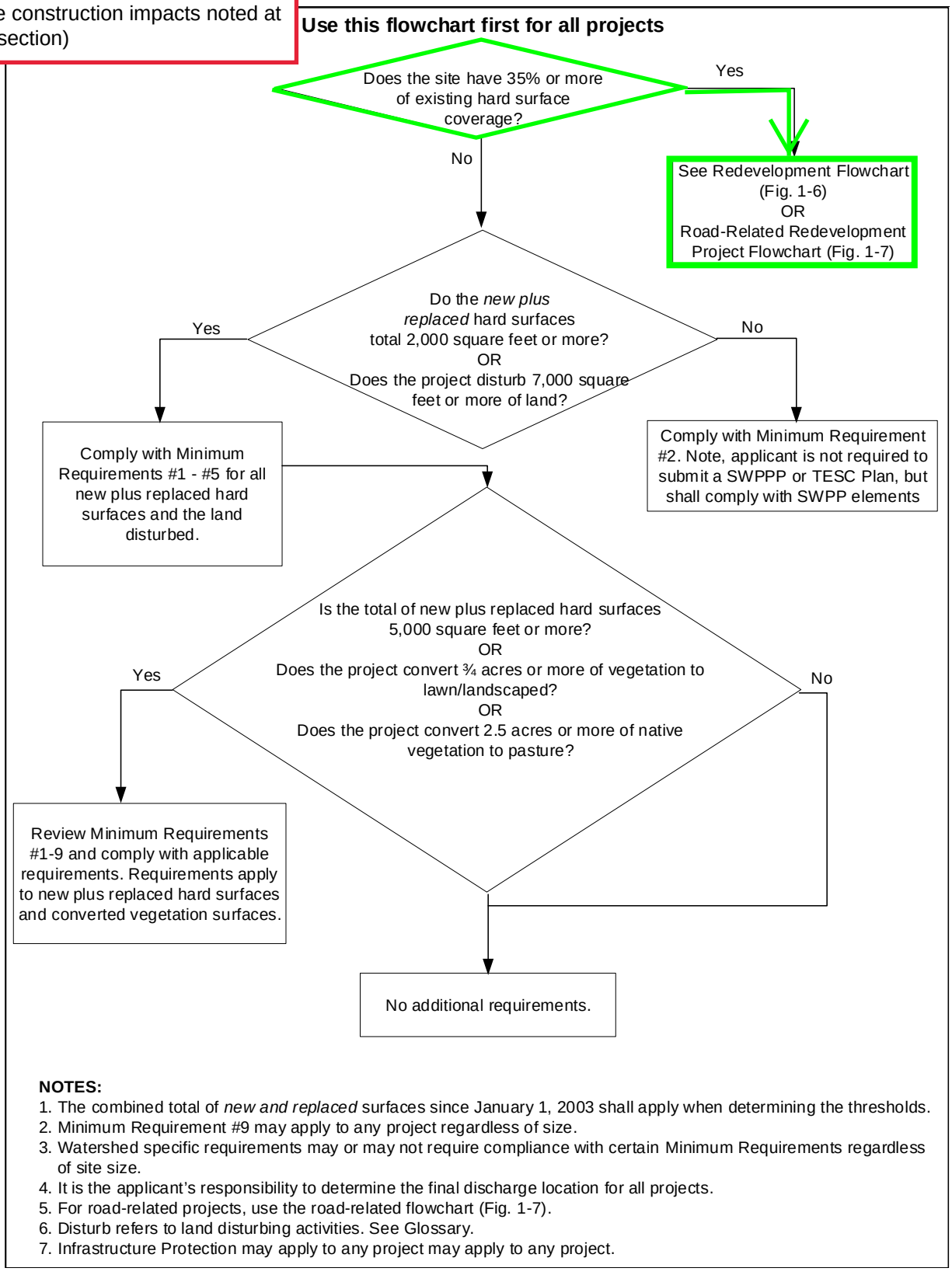
Figure 2-28 Sediment Trap Outlet

Appendix H – Project Flow Chart

The following project flow charts show:

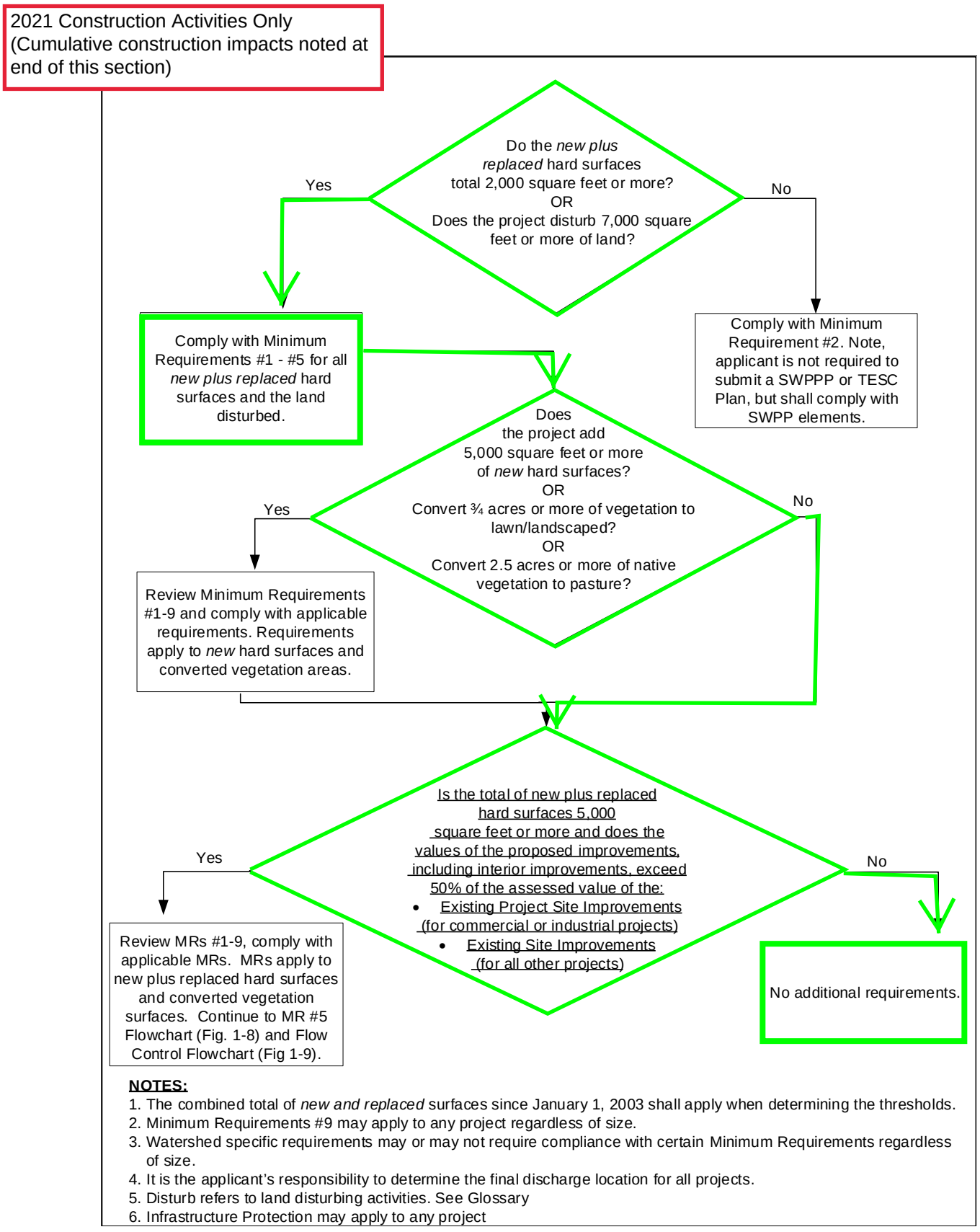
1. Proposed 2021 Constuction Activities
2. Cumulative 2013 and Proposed 2021 Construction Activities

2021 Construction Activities Only
(Cumulative construction impacts noted at end of this section)



NOTES:
1. The combined total of *new and replaced* surfaces since January 1, 2003 shall apply when determining the thresholds.
2. Minimum Requirement #9 may apply to any project regardless of size.
3. Watershed specific requirements may or may not require compliance with certain Minimum Requirements regardless of site size.
4. It is the applicant's responsibility to determine the final discharge location for all projects.
5. For road-related projects, use the road-related flowchart (Fig. 1-7).
6. Disturb refers to land disturbing activities. See Glossary.
7. Infrastructure Protection may apply to any project may apply to any project.

Figure 1 - 5. Project Flowchart



NOTES:

1. The combined total of *new and replaced* surfaces since January 1, 2003 shall apply when determining the thresholds.
2. Minimum Requirements #9 may apply to any project regardless of size.
3. Watershed specific requirements may or may not require compliance with certain Minimum Requirements regardless of size.
4. It is the applicant's responsibility to determine the final discharge location for all projects.
5. Disturb refers to land disturbing activities. See Glossary
6. Infrastructure Protection may apply to any project

Figure 1 - 6. Redevelopment Flowchart

Cumulative Construction Activities
(Includes 2013 and Proposed 2021)

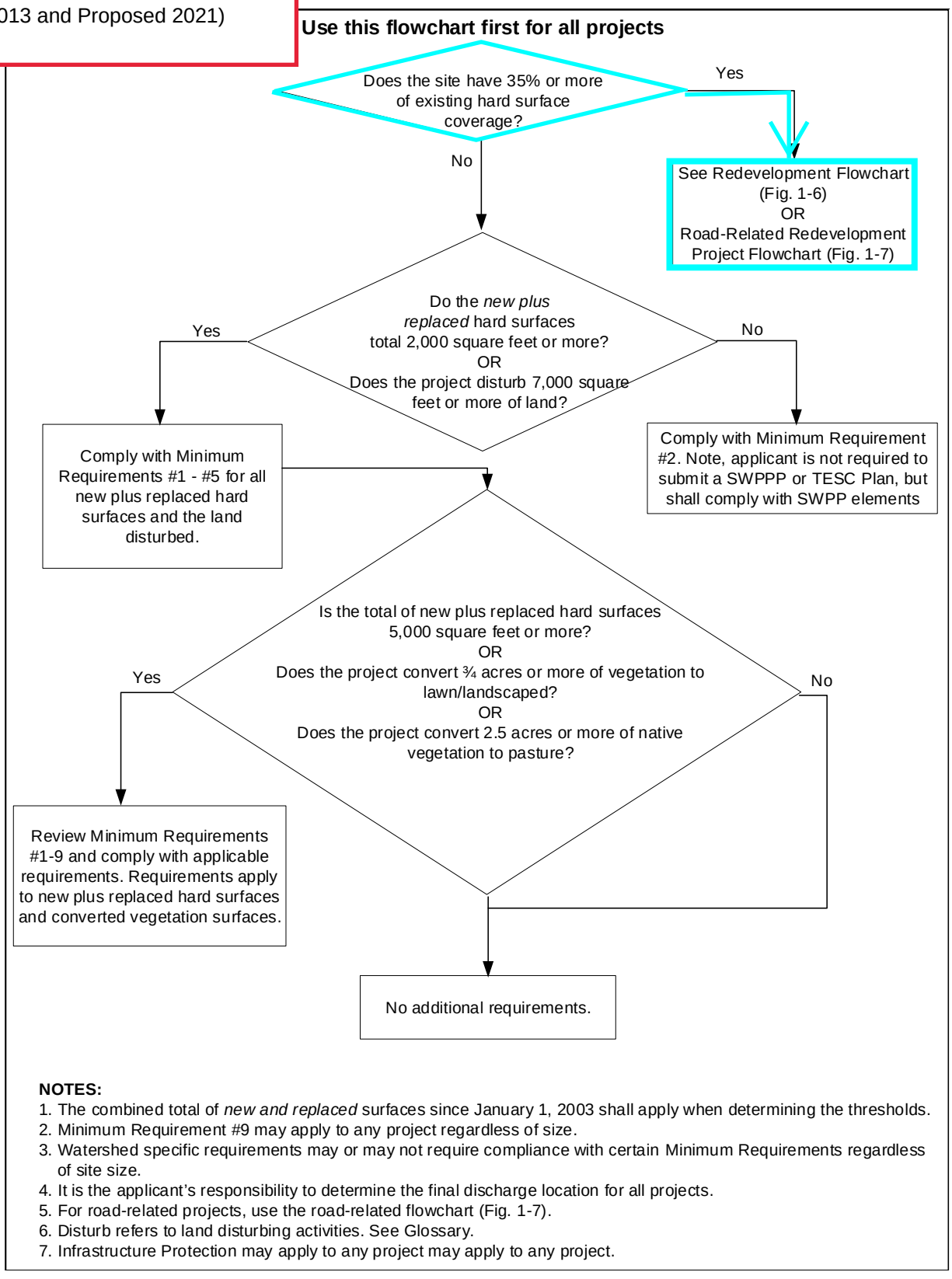
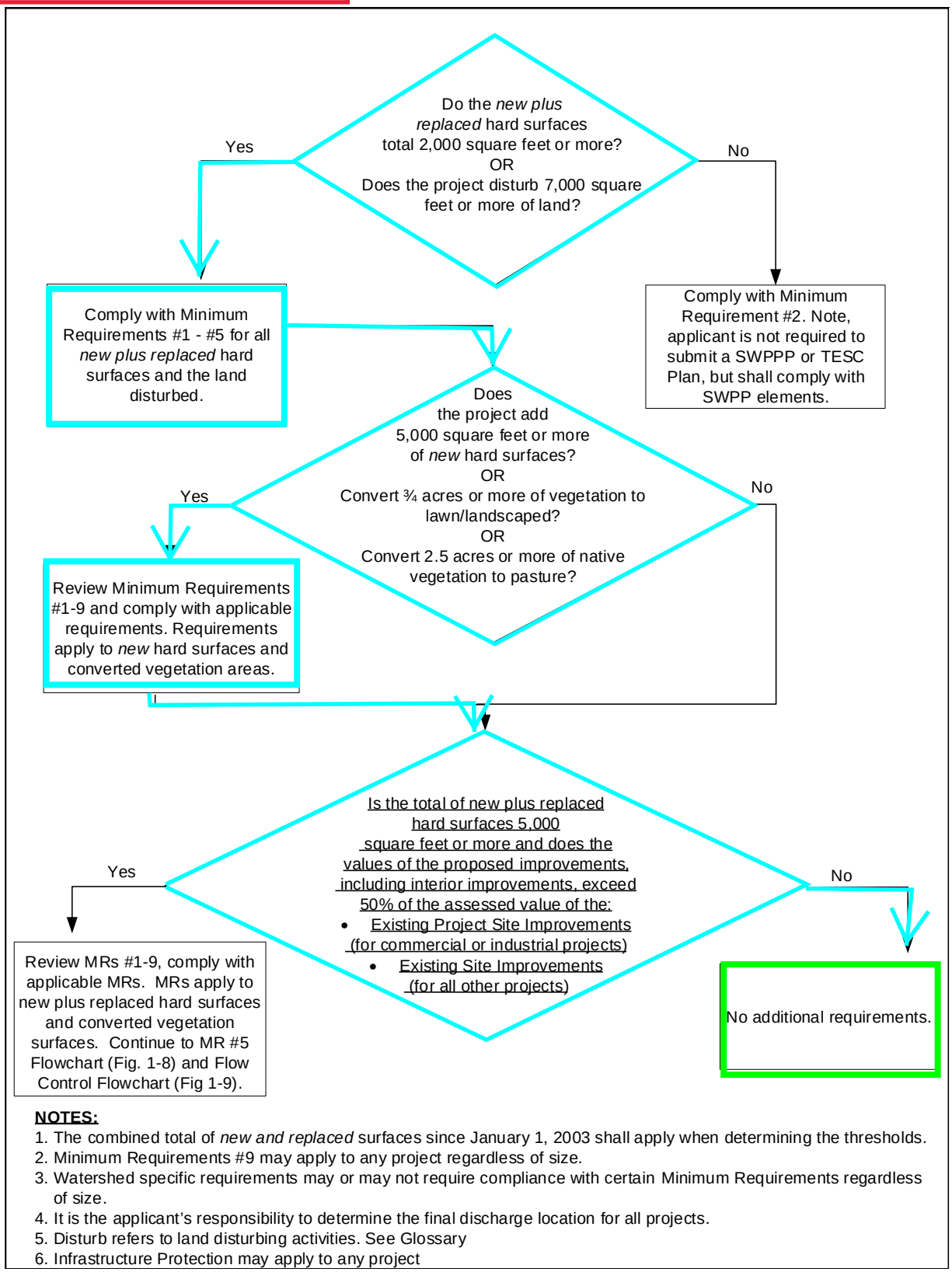


Figure 1 - 5. Project Flowchart



NOTES:

1. The combined total of *new and replaced* surfaces since January 1, 2003 shall apply when determining the thresholds.
2. Minimum Requirements #9 may apply to any project regardless of size.
3. Watershed specific requirements may or may not require compliance with certain Minimum Requirements regardless of size.
4. It is the applicant's responsibility to determine the final discharge location for all projects.
5. Disturb refers to land disturbing activities. See Glossary
6. Infrastructure Protection may apply to any project

Figure 1 - 6. Redevelopment Flowchart

Appendix I – 2012 Tacoma Water South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir – Stormwater Site Plan HDR

Tacoma Water
South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir

Stormwater Site Plan

Hood Street Reservoir
1002 South Tacoma Way
Tacoma, WA 98409

January 9, 2012

Prepared for the Tacoma Water:

HDR Engineering, Inc.
Bellevue, Washington

500 108th Avenue NE
Suite 1200
Bellevue, WA 98004-5549
(425) 450-6200

Certificate of Engineer

The technical material and data contained in this report for **the South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir Project** were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Allen C. Fitz, P.E.
Project Engineer
HDR Engineering, Inc.

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1.0 Project Overview

Tacoma Public Utilities Water Division (Tacoma Water) is the drinking water supplier to the City of Tacoma. One of the facilities owned and operated by the utility is the 10-million gallon (MG) Hood Street Reservoir. The reservoir's primary supply is treated surface water from the Green River/North Fork Wellfield supply. That supply is augmented with the seasonal operation of the South Tacoma Wellfield, which consists of 13 wells that can provide over 40 million gallons per day (MGD) of groundwater to the reservoir.

Tacoma Water currently provides corrosion control treatment to the Green River/North Fork Wellfield supply by pH adjustment using caustic soda, but the South Tacoma Wellfield supply is not treated for corrosion control. A corrosion control treatment facility addition at the Hood Street Reservoir is being designed so that when the South Tacoma Wellfield is seasonally operated, there will not be a significant impact on lead and copper corrosion in household plumbing due to blending of the two disparate sources within the reservoir and the distribution system. Corrosion control treatment will consist of adding 25% caustic soda solution.

In addition, Tacoma Water is required by a voter-backed ordinance (RCW 57.08.012) to fluoridate its drinking water supply. Currently, Tacoma Water fluoridates its Green River supply, but the South Tacoma Wellfield is not fluoridated. To provide equal treatment of the drinking water, Tacoma Water will also begin fluoridating the South Tacoma Wellfield groundwater by adding 23% hydrofluorosilicic acid.

Proposed improvements affecting stormwater management include construction of a new chemical storage and handling building (the Corrosion Control and Fluoridation Building, approximately 1,500 square feet), asphalt and concrete paving (approximately 7,000 square feet), and new stormwater collection, conveyance, and treatment systems.

This report describes the existing stormwater conditions, as well as proposed temporary and permanent stormwater management designs. Design of the conveyance and treatment facilities and preparation of this Stormwater Site Plan are in accordance with the guidelines and criteria provided in :

- *City of Tacoma Surface Water Management Manual, September 2008*
- *Department of Ecology's Stormwater Management Manual for Western Washington, 2005 (Ecology Manual)*

The following table is the project checklist per the Surface Water Management Manual – Appendix A: Stormwater Site Plan Submittal Requirements Checklist.

Table 1.1 Project Overview

Parameter	Value	Applicable Chapter of this Report
Permit requested	Building Permit and Grading Permit	(none)
Other permits required	None	(none)
Project location	1002 South Tacoma Way, Tacoma, WA Parcel Number: 0320084114	(blank)
Current and proposed condition and land-use	Current and proposed land-use: Utilities	2 – Existing Condition Summary

Parameter	Value	Applicable Chapter of this Report
Size of parcel	9.65 acres total	2 – Existing Condition Summary
Acreage developed, redeveloped, replaced, or converted	0.49 acres	4 – Permanent Stormwater Control Plan
Current assessed value and cost of proposed improvements	2011 assessed value: $5,394,200 Proposed improvements: $1,883,000	(blank)
Watershed	Thea Foss Waterway	2 – Existing Condition Summary
Proposed flow control improvements	None required	4 – Permanent Stormwater Control Plan
Proposed runoff treatment improvements	New stormwater water quality wetvault	4 – Permanent Stormwater Control Plan
Proposed conveyance improvements	New stormwater pipes on site.	4 – Permanent Stormwater Control Plan
Proposed discharge location and improvements	Connection to existing stormwater manhole that leads to 60” stormwater main along South Tacoma Way.	4 – Permanent Stormwater Control Plan
Downstream condition, impacts, and problem	No problems reported in existing stormwater mains.	3 – Offsite Analysis
Locations of surface water run-on to the property	None. All stormwater generated by onsite ground.	2 – Existing Condition Summary

2.0 Existing Condition Summary

The principal existing structures at the site consist of the Hood Street Reservoir, the Chlorination Building, and the Hydropower and Pump Building. The first two structures are operated by Tacoma Water while the last building is operated by Tacoma Power. These buildings will not be structurally modified by the addition of the Corrosion Control and Fluoridation Building and are not part of the proposed project.

The site is generally flat but is bounded by a manmade hill to the south that separates the site from Interstate 5 (I-5) and a manmade steep slope on the north that to match grade with South Tacoma Way (Figure 1). The majority of the parcel is impervious surface area consisting of the reservoir, the existing structures, asphalt road surfaces and gravel road surfaces. The southern hill and the northern slope are vegetated with trees, shrubs, ivy, and grass. The land to the northeast is an existing ravine while Yakima Avenue is to the east. Immediately east of the site are large stormwater detention ponds owned by the Washington State Department of Transportation. This project does not affect nor connect to those ponds.

All stormwater runoff generated on-site is routed to the existing on-site stormwater conveyance system that was constructed prior to 2000. The catch basins capture the stormwater and conveys it to the 60-inch-diameter stormwater main located along South Tacoma Way. The stormwater mains ultimately discharge to the Thea Foss Waterway.

There have been no known incidences of flooding or erosion onsite. The vegetated northern slope down towards South Tacoma Way exhibits some evidence of erosion. See Appendix E (Geotechnical Report) for more discussion regarding the existing soil and steep slope conditions. The only other site-sensitive issue associated with this project is that it is located within the South Tacoma Groundwater Protection District. Otherwise, the project area is not located in or near 100-year floodplains, wetlands, vegetative buffers, geologic hazard areas, any surface water bodies, Superfund sites, groundwater wells, or septic fields.

The site has active-use Tacoma Water and Tacoma Power facilities, there are multiple buried drinking water pipes ranging in size from 3-inch-diameter blow-offs to 42-inch-diameter pipelines. Some of these pipes will be modified or abandoned as part of this project. The existing on-site sanitary sewer service is damaged and will be being replaced by this project. Low- and high-voltage power lines and transformers serve the Hydropower and Pump Building, and new power lines will be installed to provide electricity to the new structures. There is a propane-fired emergency generator, with fuel for the generator stored in an above-ground tank located next to the Chlorination Building.

3.0 Offsite Analysis

The project adds less than 10,000 square feet of new impervious surface area, therefore only a qualitative downstream analysis is required. Stormwater runoff from the proposed improvements at the Hood Street Reservoir site will be conveyed to an existing stormwater manhole that discharges out of an existing 6-inch conveyance line, which conveys runoff to the 60-inch-diameter stormwater main located along South Tacoma Way. The 60-inch stormwater main ultimately discharges into Thea Foss Waterway (Figure 2). No conveyance capacity or flooding problems have been reported within one quarter mile of the site. Since the runoff is being discharged to an existing main there will be no impacts to wetlands, groundwater, or stream channel erosion. As mentioned above, no off-site runoff enters the site. All stormwater runoff from the site is generated on-site and will exit via the proposed stormwater conveyance system.

4.0 Permanent Stormwater Control Plan

The proposed site work associated with the construction of the corrosion control treatment facility is limited to an area of approximately 21,500 square feet on the existing Hood Street Reservoir Site (Figure 3). The project will add approximately 7,300 square feet of new impervious surface area, replace approximately 4,300 square feet of existing impervious surface area, and convert approximately 3,000 square feet of existing impervious to lawn. Included in Appendix B are flow chart summaries used to determine which Minimum Requirements are applicable to the project and what level of on-site stormwater management, flow control, and treatment are required. Stormwater plan and profiles are shown in Figures 4 and 5.

4.1 Threshold Discharge Areas and Applicable Requirements for On-Site Stormwater Management, Treatment, Flow Control and Wetlands Projection

Impervious area totals for the project site are provided in Table 4.1

Table 4.1 Impervious and Converted Pervious Area Tabulations

	Non-PGIS (ft^2)	Non-PGIS (ac.)	PGIS (ft^2)	PGIS (ac)	Impervious Totals (ft^2)	Impervious Totals (ac.)
Existing Imp.	0	0.00	14,002	0.32	14,002	0.32
New Imp.	0	0.00	7,361	0.17	7,361	0.17
Replaced Imp.	2,316	0.05	4,720	0.11	7,036	0.16
Existing Imp. to Remain	0	0.00	3,776	0.09	3,776	0.09
Existing Imp. Converted to Pervious	0	0.00	3,027	0.07	3,027	0.07

As stated above, Appendix 1 contains flow charts used to determine the applicable Minimum Requirements, and the required levels for flow control. Based on the amount of new and replaced impervious surface, all 12 Minimum Requirements must be applied to the project. Water quality will be provided for all new and replaced pollution-generating surfaces, but flow control is not required because the project does not add greater than 10,000 square feet of impervious surface, convert 2.5 acres or more of native vegetation to pasture, convert 0.75 acres or more of native vegetation to lawn or landscape, or increase the 100-year peak flow rate by 0.1 cubic feet per second. Section 5.0 includes further discussion of the Minimum Requirements applicability.

4.2 Pre-Developed Site Hydrology

The entire Hood Street Reservoir site is contained within a single Threshold Discharge Area (TDA). Construction activities associated with the corrosion control treatment facility project will be limited to within a 0.5-acre portion of the site. The geotechnical report, included in Appendix E, indicates that the existing site soils are primarily fill down to approximately 10 feet below grade. The fill exhibits characteristics similar to Vashon advanced outwash. Native soil was encountered at a depth of 9 feet below grade, which was also classified as Vashon advanced outwash. For this reason, a hydraulic soils group of A/B was used for all hydrologic modeling.

The Western Washington Hydrology Model (WWHMv4©) was used to model the pre- and post-developed site hydrology for the project. In addition, the existing conditions were modeled to compare the 100-year peak discharge to the post-developed conditions to determine if flow control is required for the project. Table 4.2 provides land cover information used for the pre-developed and existing conditions models. As directed by the Tacoma Surface Water Management Manual, the pre-developed land cover was modeled as "forested".

Table 4.2 Pre-developed and Existing Conditions Land Use

	Land Use			
	Forest, A/B Soils (ac.)	**Lawn, A/B Soils (ac.)**	**Impervious-Pavement/Gravel (ac.)**	**Total Area (ac.)**
Pre-developed	0.49	0.00	0.00	0.49
Existing	0.00	0.17	0.32	0.49

Table 4.4 (below) provides a summary of the WWHMv4© results; complete output reports are provided in Appendix C.

4.3 Developed Site Hydrology

The post-developed land covers used in WWHMv4© are summarized in Table 4.3 below and shown in Figure 6.

Table 4.3 Post-developed Conditions Land Use

		Land Use			
	Forest, A/B Soils (ac.)	**Lawn, A/B Soils (ac.)**	**Impervious-Building (ac.)**	**Impervious-Pavement/Gravel (ac.)**	**Impervious Totals (ac.)**
Post-developed	0.00	0.07	0.05	0.37	0.42

Table 4.4 provides a summary of the WWHMv4© results; complete output reports are provided in Appendix C.

Table 4.4 Pre-developed, Existing, and Post-Developed Conditions Hydrologic Model Outputs

	WWHMv4© Event Results			
	2-year (cfs)	**10-year (cfs)**	**25-year (cfs)**	**100-year (cfs)**
Pre-developed	0.0001	0.0002	0.0002	0.0004
Existing	0.10	0.16	0.19	0.24
Post-developed	0.13	0.20	0.24	0.31

According to the modeling results, the 100-year peak flow will be increased by approximately 0.07 cubic feet per second under the proposed conditions as compared to the existing conditions. The implications of these modeling results on flow control requirements are discussed below in Section 4.4.

4.4 Performance Standards and Goals

Per Minimum Requirement 7, flow control is not required as the project does not add more than 10,000 square feet of impervious surface, convert 2.5 acres or more of native vegetation to pasture, convert 0.75 acres or more of native vegetation to lawn or landscape, or increase the 100-year flow frequency by 0.1 cubic feet per second or more.

The project is located in the Thea Foss Waterway watershed (Figure 2), therefore basic treatment is required at a minimum for water quality. The project site use does not necessitate enhanced water quality treatment, phosphorous control, or oil control. Water quality treatment will be provided in the form of a wetvault. Further description of the proposed water quality treatment design is provided in section 4.6.

4.5 Flow Control System

Flow control is not required for the project.

4.6 Water Quality System

Site constraints and spatial limitations eliminate the possibility of providing an above-ground water quality facility, therefore a wetvault is proposed for the project. Volume 5, Section 8.2.2 of the Surface Water Management Manual provides design guidance for wetvaults, which state that the 91st percentile, 24-hour runoff volume as determined with WWHMv4© shall be used for the vault sizing. Water quality treatment is only required for pollution-generating surfaces, but since runoff from non-pollution-generating surfaces will not be separated from the pollutant laden runoff, the wetvault has been sized to receive all runoff from the proposed project. The required wetvault volume is provided in Table 4.6, while detailed model results are included in Appendix C and Figure 7.

Table 4.6 Post-developed Water Quality Volume

	WWHMv4© 91st percentile, 24-hour Water Quality Volume Results (cubic feet)
Post-developed	2,108

4.7 Conveyance System Analysis and Design

Hydrologic and hydraulic calculations for the proposed stormwater conveyance system (Figures 5 and 5) were calculated with StormShed3G©. Peak runoff was calculated using the SCS method and the proposed land cover. A uniform flow analysis was conducted using Manning's equations. Calculations were performed in accordance with the methods and assumptions stated in Volume 3 of the City of Tacoma's SWMM.

Volume 3, Section 3.2 of the SWMM provides design criteria for all existing and new conveyance systems, which requires pipe systems less than 24 inches in diameter to be designed to convey at a minimum the 10-year, 24-hour peak flow rate without surcharging (the water depth in the pipe must not exceed 90% of the diameter).

During the 10-year, 24-hour peak flow event, model results for the proposed conveyance system show pipe velocities ranging from 1.9 to 5.1 feet per second. In addition, the ratio of water depth to pipe diameter ranged 0.2 to 0.64, which meets the surcharging design criteria. See Appendix C for detailed StormShed 3G© outputs.

5.0 Minimum Requirements

Minimum requirements 1 through 12 apply to the project according to the City of Tacoma SWMM Flow Charts (see Appendix 1).

5.1 M.R. #1: Preparation of a Stormwater Site Plan

This Stormwater Site Plan addresses M.R. #1.

5.2 M.R. #2: Construction Stormwater Pollution Prevention (SWPP)

A construction Stormwater Pollution Prevention Plan (CSWPPP) has been prepared under a separate cover in compliance with the General Permit. The CSWPPP must be implemented by the selected contractor at the beginning with initial soil disturbance and until final stabilization. A log book must be maintained by the contractor for all on-site construction activities and must include a record of the implementation of the CSWPPP, any updates to the CSWPPP, site inspections, and the results of any stormwater quality monitoring. A Construction Emergency Contact Sheet must also be kept in the log book and updated regularly.

5.3 MR #3: Source Control of Pollution

The objective of source control is to prevent pollutants from contaminating stormwater runoff and entering receiving rivers, lakes, and streams. Typical pollutants of concern include pH, suspended solids, oils and greases, and oxygen-demanding substances. For the Hood Street Reservoir site specifically, the only expected pollutants of concern are suspended solids, particularly during clearing and grading activities. To reduce and minimize sediment-laden runoff during construction activities, the erosion control measures including silt fence and catch basin inserts will be used.

5.4 MR #4: Preservation of Natural Drainage Systems and Outfalls

Currently, the onsite runoff discharges into a 60-inch-diameter stormwater main located along South Tacoma Way that ultimately discharges to the Foss Waterway. The proposed stormwater improvements will discharge to this same 60-inch-diameter main, preserving the current discharge point.

5.5 MR #5: On-Site Stormwater Management

Approximately 3,000 square feet of existing impervious asphalt roadway will be converted to lawn. These areas will utilize amended soils in accordance with post-construction soil quality standards provided in Volume 6 of the Surface Water Management Manual. Onsite stormwater infiltration was considered for the Hood Street Reservoir. However, the site investigation determined that there is no available space for such a facility. The area to the south of the proposed construction (towards I-5) is either a steep hill or the location of several of Tacoma Water's existing large-diameter drinking water supply pipes. The area to the west is already used by the Washington State Department of Transportation's dedicated stormwater ponds for I-5 while the area to the east is Tacoma Water's Hood Street Reservoir and its multiple buried drinking water pipes.

The only area that was available is to immediately adjacent to the proposed new building set back from and parallel to the slope overlooking South Tacoma Way to the north. Appendix E of the Stormwater Site Plan contains the geotechnical report for the site. The report summarizes the following information about the site:

> **Section 6.1.2.1 Slope Instability** (page 5 of the report)
> The project site is located on a bench in a relatively steep slope. A seismic event could cause the relatively loose soil on the slope surface to slide.
>
> **Section 6.5 Slope Stability** (page 9 of the report)
> In our opinion, the Northern Slope will continue to erode and experience shallow surface sliding.

Based upon this information, the engineers' opinion was that stormwater disposal using onsite infiltration would increase the rate of slope erosion as well as potentially increase the affected area of erosion, thereby compromising the structural integrity of the proposed new building as well as the existing road and trees.

As a result, onsite infiltration was deemed to be infeasible for this project given the lack of available area to the east, south, and west of the site, and the unsuitable area immediately adjacent to and north of the building.

For similar reasons, roof downspout controls such, as downspout infiltration or downspout dispersion, are not utilized because of geotechnical concerns related to steep slopes and slope instability. Instead, the roof runoff will be conveyed through the proposed stormwater conveyance system and wetvault and discharged into the City-owned system. See Appendix E (Geotechnical Report) for more discussion regarding the steep slope conditions.

5.6 MR #6: Runoff Treatment

Runoff treatment is required for this project. Section 4.4 and 4.6 provide detailed discussion of those requirements and the proposed designs, respectively.

5.7 MR #7: Flow Control

Flow control is not required for this project, as discussed in Section 4.4 and 4.5.

5.8 MR #8: Wetlands Protection

Stormwater runoff from the site does not discharge to a wetland, and no wetlands are located within the vicinity of the project.

5.9 MR #9: Basin/Watershed Planning

The project site is located within the Foss Waterway watershed. Flow control and basic water quality treatment are required when the appropriate thresholds are reached. This project triggers requirements for water quality treatment, but not for flow control.

5.10 MR #10: Operation and Maintenance

Guidelines and recommendations for long-term operation and maintenance of the proposed stormwater facilities is discussed are provided in Section 6.0 and Appendix D of this report. These recommendations are in accordance with the Surface Water and Management Manual, Volume 1.

5.11 MR #11: Offsite Analysis and Mitigation

The proposed project work will not significantly increase runoff from the site, and the downstream conveyance system has no known capacity issues. Therefore offsite mitigation is not needed. The offsite analysis is discussed in further detail in Section 3.0 of this report.

5.12 MR #12 Financial Liability

Not applicable.

6.0 Operations and Maintenance Manual

All inspection, maintenance, and operations shall be completed in accordance with current City ordinances and codes, and in accordance with the current Department of Ecology Stormwater Management Manual. Maintenance and operations manuals are provided in Appendix D of this report. Onsite stormwater facilities will be maintained by Tacoma Water staff.

7.0 Construction Stormwater Pollution Prevention Plan

A detailed construction stormwater pollution prevention plan has been prepared under a separate cover in accordance with the General Permit. The CSWPPP must be implemented

beginning with initial soil disturbance and until final stabilization. A log book must be maintained by the contractor for all on-site construction activities and must include a record of the implementation of the CSWPPP, any updates to the CSWPPP, site inspections, and the results of any stormwater quality monitoring. A Construction Emergency Contact Sheet must also be kept in the log book and updated regularly.

A temporary erosion and sedimentation control plan has been prepared for the project, and is included in Figure 8. Proposed erosion control BMPs include high visibility fence, silt fence, straw wattles, and storm drain inlet protection. The selected contractor will be responsible for final BMP selection and implementation, as well as maintaining those BMPs and adapting them as necessary throughout construction, and updating the CSWPPP with any field changes.

TACOMA WATER
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HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

VICINITY MAP

DATE
10/26/2011

FIGURE
1

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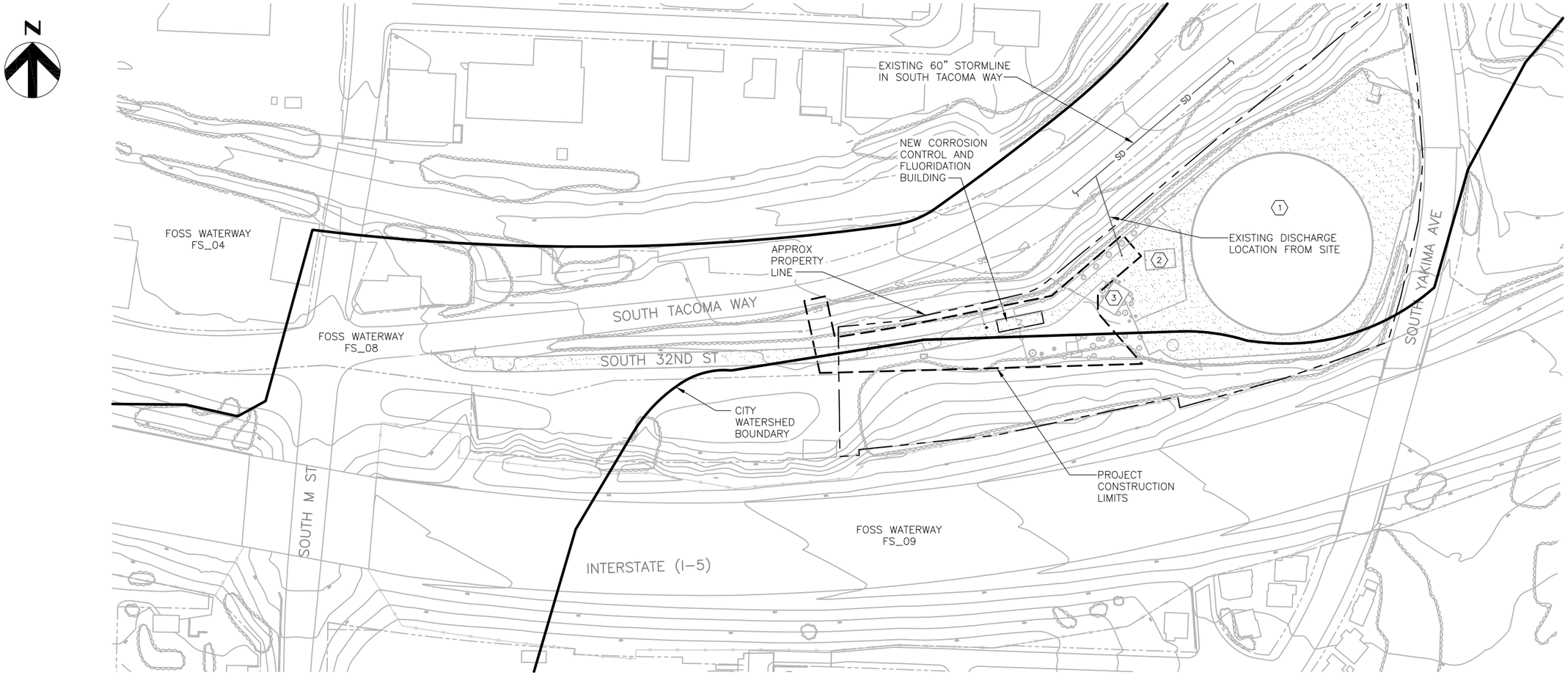

SITE PLAN

SCALE: 1"=100'

STRUCTURE KEY NOTES:

1. EXISTING HOOD STREET RESERVOIR
2. EXISTING HYDROPOWER STATION
3. EXISTING CHLORINATION BUILDING

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HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

BASIN MAP

DATE
10/26/2011

FIGURE
2

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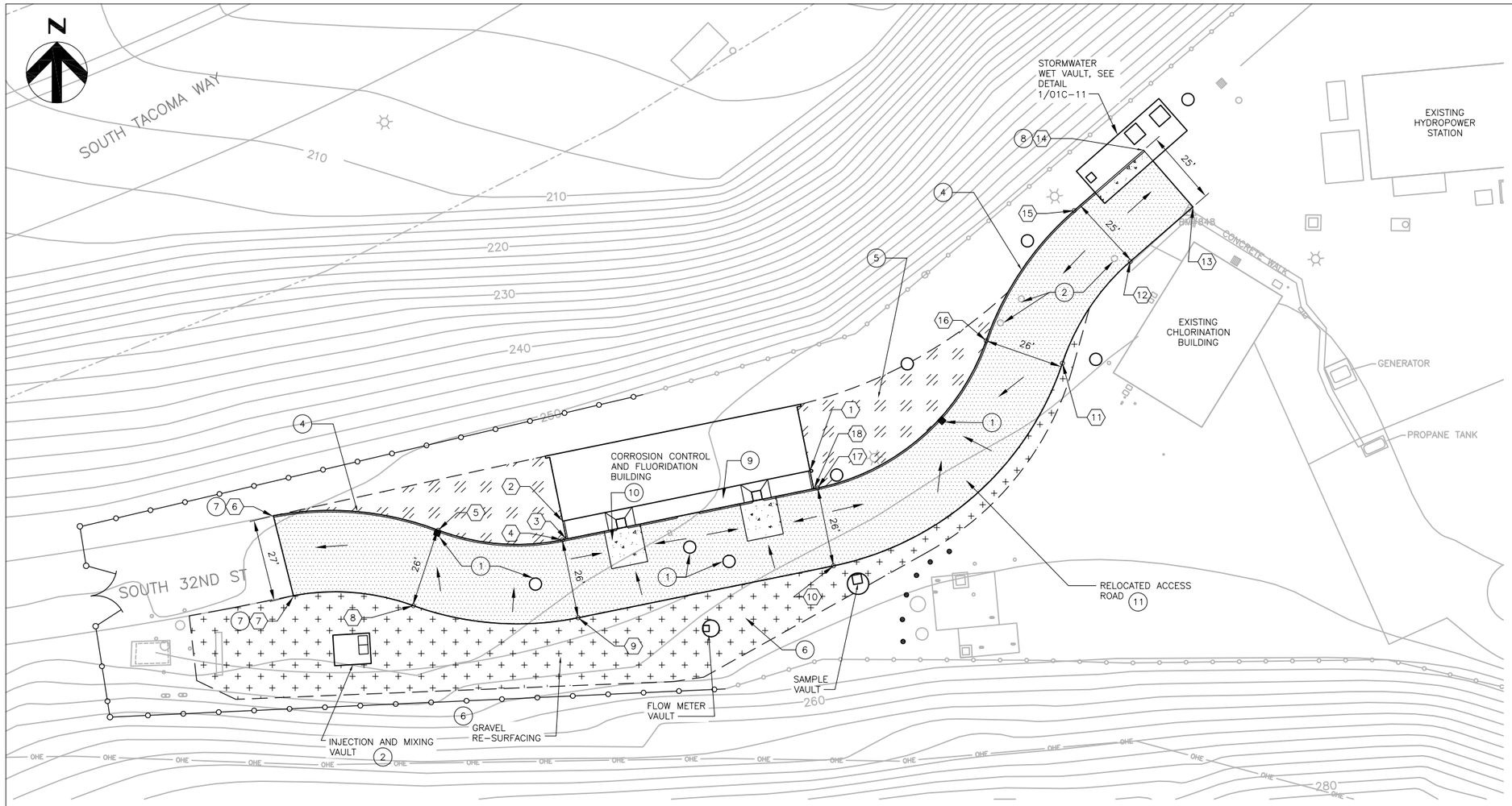

SITE SURFACING AND GRADING PLAN

SCALE: 1"=20'

CONSTRUCTION NOTES:

1. ADJUST NEW AND EXISTING MANHOLE AND CATCH BASIN RIMS TO BE FLUSH WITH NEW ASPHALT OF THE RELOCATED ACCESS ROAD.
2. EXISTING MANHOLES AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE. VERIFY THE CORRECT LOCATIONS TO AVOID DAMAGE OR DISTURBANCE.
3. ANY AREAS OUTSIDE OF GRAVEL AND PAVED AREAS SHALL BE RESTORED PER SPEC SECTION 02935. SEED MIX PER ENGINEERS DIRECTION.
4. CEMENT CONCRETE TRAFFIC CURB AND GUTTER PER TACOMA STANDARD PLAN SU-03. INSTALL CURB AND GUTTER ALONG NORTHERN SIDE OF THE NEW RELOCATED ACCESS ROAD.
5. SOILS TO BE AMENDED PER SPEC SECTION 02940.
6. 4" COMPACTED CRUSHED SURFACING TOP COURSE. SEE CIVIL DETAIL 3/01C-21. SLOPE DOWN TO NEW RELOCATED ACCESS ROAD.
7. POINTS 6 AND 7 ARE APPROXIMATE, ADJUST RELOCATED ACCESS ROAD WIDTH AND CURVES TO MATCH EXISTING.
8. POINT 14 IS APPROXIMATE, ADJUST RELOCATED ACCESS ROAD EDGE TO MATCH EXISTING, MATCH NEW CURB TO EXISTING CURB.
9. 4" THICK CONCRETE SIDEWALK.
10. DELIVERY APRON AND SPILL CATCH BASIN PER DETAIL 2/01C-27.
11. PAVEMENT REMOVAL AND REPLACEMENT PER DETAIL 2/01C-21.

COORDINATE TABLE

(1)	NORTHING	EASTING	DESCRIPTION
1	698135.674	1157098.808	NE CORNER OF CONCRETE SIDEWALK, EL 253.5
2	698119.201	1157017.833	NW CORNER OF CONCRETE SIDEWALK, EL 253.5
3	698113.313	1157019.031	SW CORNER OF CONCRETE SIDEWALK, EL 253.3
4	698113.048	1157017.725	PC 74' R, EOP, EL 253.47
5	698116.228	1156977.113	PRC 100' R, EOP, EL 251.7
6	698120.966	1156923.142	AP, APPROX EOP, MATCH EXST EL
7	698094.786	1156929.711	PC 74' R, APPROX EOP, MATCH EXST EL
8	698091.513	1156968.995	PRC 100' R, EOP, EL 252.5
9	698087.569	1157022.908	PT, EOP, EL 253.47
10	698104.574	1157106.495	PC 100' R, EOP, EL 253.47
11	698170.931	1157181.425	PRC 74' R, EOP, EL 253.80
12	698204.218	1157203.629	PT, EOP, MATCH EXST EL
13	698222.084	1157224.158	AP, EOP, MATCH EXST EL
14	698240.654	1157207.997	AP, EOP, MATCH EXST EL
15	698220.872	1157185.268	PC 100' R, EOP, MATCH EXST EL
16	698178.270	1157156.458	PRC 74' R, EOP, EL 252.5
17	698130.052	1157101.312	PT, EOP, EL 253.47
18	698129.786	1157100.006	SE CORNER OF CONCRETE SIDEWALK, EL 253.3

TACOMA WATER
TACOMA PUBLIC UTILITIES

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HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

SITE MAP AND GRADING PLAN

DATE
10/26/2011

FIGURE
3

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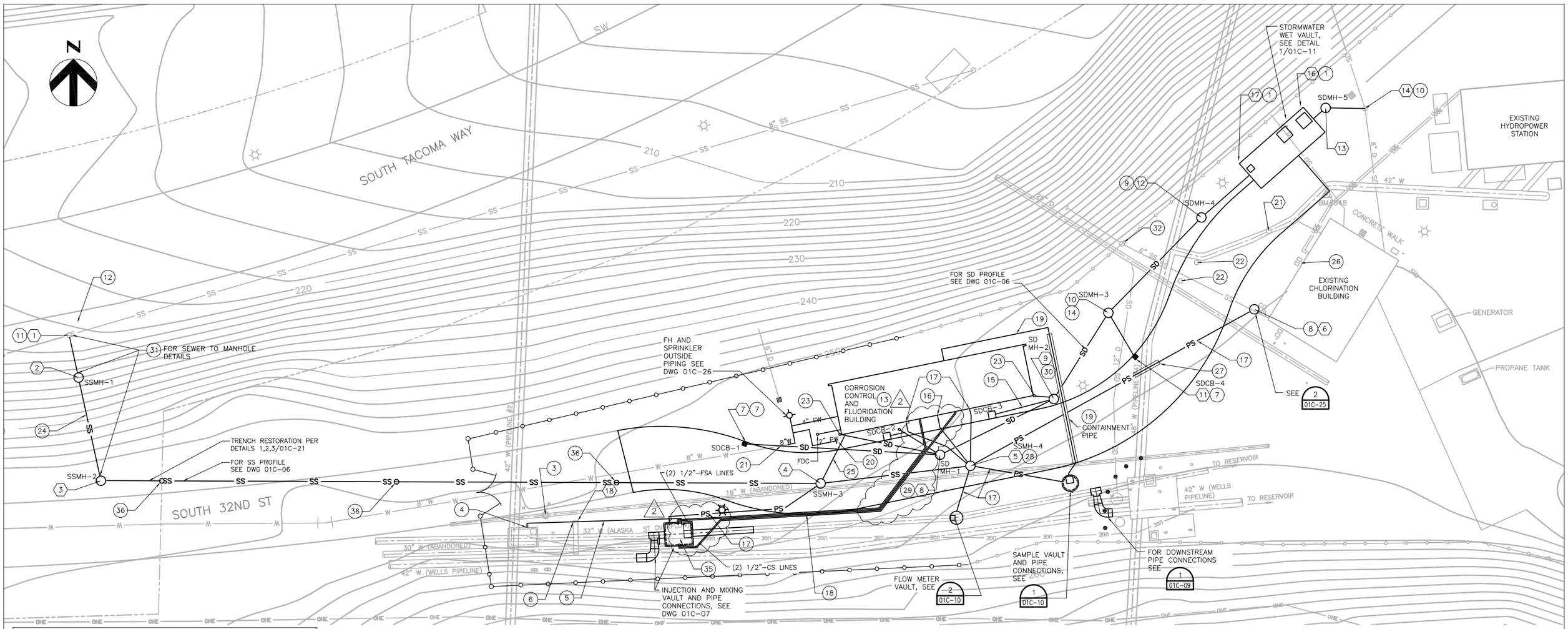

①	NORTHING	EASTING	DESCRIPTION
1	698161.274	1156691.175	CENTER OF EXST SSMH IN S TACOMA WAY SHOULDER
2	698143.329	1156695.127	CENTER OF SSMH-1
3	698099.723	1156704.574	CENTER OF SSMH-2
4	698098.597	1157008.942	CENTER OF SSMH-3
5	698106.029	1157072.310	CENTER OF SSMH-4
6	698172.170	1157192.346	CENTER OF SUMP/GRINDER PUMP (APPROX SEE NOTE 8)
7	698152.130	1157141.943	CENTER OF SDCB-1
8	698110.677	1157059.445	CENTER OF SDMH-1
9	698134.276	1157107.534	CENTER OF SDMH-2
10	698170.698	1157130.644	CENTER OF SDMH-3
11	698152.124	1157141.949	CENTER OF SDCB-2 TYPE 1 RIM EL 252.3 (APPROX) IE = 250.0' 6" OUT (NW)
12	698210.978	1157169.977	CENTER OF SDMH-4
13	698257.282	1157222.514	CENTER OF SDMH-5
14	698257.015	1157239.153	CENTER OF EXST BRICK SDMH (APPROX)
15	698262.551	1157233.542	NOT USED
16	698257.981	1157211.964	N CORNER OF STORMWATER WET VAULT
17	698234.839	1157185.707	W CORNER OF STORMWATER WET VAULT
18	698082.802	1156906.262	N CORNER OF EXISTING BURIED CONCRETE COLLAR (APPROX)

SITE PIPING PLAN

SCALE: 1"=20'

CONSTRUCTION NOTES:

1. COORDINATES FOR STORMWATER WET VAULT ARE THE OUTSIDE CORNER OF THE VAULT.
2. EXISTING PIPING AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE. VERIFY THE CORRECT LOCATIONS. AVOID DAMAGE OR DISTURBANCE.
3. PROTECT EXISTING MH OVER ABANDONED 16" C.I. PIPE.
4. CONNECT 2" W TO EXISTING TAP ON 42" W (PIPELINE # 2) LOCATED INSIDE THE VAULT. RUN 2" W THROUGH NORTH WALL OF VAULT. SEE VAULT PENETRATION DETAIL. PENETRATION SHALL BE A MINIMUM OF 2.5' BELOW CEILING OF VAULT PER DWG 01C-24.
5. INSTALL NEW 2" W WITH A MINIMUM PIPE COVER OF 3'.
6. LOCATE NEW 2" W TO AVOID BURIED COLLAR.
7. LOCATE CATCH BASINS FLUSH WITH BOTTOM EDGE OF CURB.
8. LOCATE EXISTING SEWER AND INSTALL SEWAGE PUMP STATION A MINIMUM OF 6' FROM BLDG WALL EDGE. PLUG EXISTING 6" SEWER DOWNSTREAM WITH CONCRETE.
9. NEW SDMH 4 IS LOCATED IN THE VICINITY OF EXISTING 48" W (PIPELINE #4). AVOID AND PROTECT EXISTING PIPELINE.
10. CONNECT NEW SD TO EXISTING BRICK SDMH. REMOVE BRICK REQUIRED FOR PENETRATION, REINSERT BRICK AND GROUT AROUND PIPE. IF CONNECTION CANNOT BE MADE WHILE MAINTAINING MH INTEGRITY, REPLACE MH PER TACOMA STD DETAIL SU-17 FROM 5' BELOW NEW SD INVERT TO SURFACE.
11. CONNECT NEW SS TO EXISTING SSMH. RECHANNEL MH BOTTOM TO CONVEY FLOW TO EXISTING DOWNSTREAM SEWER PIPE.
12. PROVIDE TRAFFIC CONTROL MEASURES PER STANDARD SPECIFICATIONS WHEN OPERATING NEAR S. TACOMA WAY.
13. SEE MECHANICAL DWGS FOR COORDINATION OF PIPES THAT CONNECT TO THE NEW CORROSION CONTROL AND FLUORIDATION BUILDING.
14. 6" SD
15. 4" SD
16. 4" SS
17. 1-1/2" PS
18. (2) FSA AND (2) CS DOUBLE CONTAINMENT PIPES. SLOPE PIPES TOWARDS INJECTION/MIXING VAULT. MIN SLOPE = 2%. PIPES TO RUN BENEATH ALL OTHER PIPES IN RELOCATED ACCESS ROAD.
19. (2) 1/2" SAMPLE LINES IN 3" SCH 80 PVC ENCASEMENT PIPE WHERE SHOWN.
20. SEE DRAWING 01M-01 FOR CONTINUATION OF WATER LINE INTO BUILDING.
21. CONNECT TO EXISTING 8" W PER DWG 01C-26.
22. EXISTING WATER MANHOLES.
23. ROOF LEADER DRAIN, CONNECT TO SDMH.
24. PROVIDE 3 TRENCH PLUGS BETWEEN SSMH 1 & 2, EQUAL SPACING, SEE DETAIL 4/01C-21.
25. 4" SS.
26. EXISTING ELECTRICAL AND COMMUNICATION HAND HOLES PER DWG 01E-01.
27. INSTALL PS IN 4" DI CASING PIPE. LENGTH OF PIPE TO BE CENTERED AT CROSSING WITH WATER MAIN. CASING PIPE TO BE LONGEST STANDARD LENGTH AVAILABLE. FILL VOIDS BETWEEN PS AND CASING WITH SAND-CEMENT GROUT. CAP ENDS WITH CONCRETE.
28. SEE DETAIL 3/01C-20 FOR SSMH CONFIGURATION.
29. SEE DETAIL 2/01C-20 FOR SDMH CONFIGURATION.
30. SEE DETAIL 5/01C-21 FOR SDMH CONFIGURATION.
31. SEE DETAIL 6/01C-21 FOR PIPE TO MH CONNECTION.
32. CAP AND PLUG EXISTING DOWNSTREAM SS PIPE LOCATED IN MH.
33. A FLEXIBLE PIPE TO MANHOLE CONNECTOR TO BE UTILIZED IN ALL CONNECTIONS OF RIGID AND FLEXIBLE PIPES TO NEW PRECAST CONCRETE MANHOLES (UNLESS OTHERWISE STATED) TO PROVIDE A WATERTIGHT JOINT BETWEEN THE PIPE AND THE MANHOLE PER TACOMA PUBLIC WORKS DESIGN MANUAL SECTION 5.010G. THE CONNECTOR SHALL BE "KOR-N-SEAL" WITH "WEDGE KORBAND" OR ENGINEER APPROVED EQUIVALENT.
34. BARE GALVANIZED METAL SHALL NOT BE USED FOR MATERIALS THAT CONVEY STORMWATER, SUCH AS SEDIMENT RISERS, ROOFS, CANOPIES, SIDING, GUTTERS, DOWNSPOUTS, ROOF DRAINS AND PIPES. ANY GALVANIZED MATERIALS SHALL HAVE AN INERT, NONLEACHABLE FINISH, SUCH AS BAKED ENAMEL, FLUOROCARBON PAINT (SUCH AS KYNAR OR HYLAR), FACTORY APPLIED EPOXY, PURE ALUMINUM, OR ASPHALT COATING. ACRYLIC PAINT, POLYESTER PAINT, FIELD APPLIED, AND ZINC-ALUMINUM ALLOY (SUCH AS GALVALUME OR ZINCALUME) COATINGS ARE NOT ACCEPTABLE.
35. FIELD RELOCATE EXISTING UGE AROUND INJECTION AND MIXING VAULT.
36. PROVIDE SS CO PER TACOMA PUBLIC WORKS STD PLAN NO. SU-24.

HDR

APPROVED

MANAGER

TACOMA WATER
TACOMA PUBLIC UTILITIES

SOUTH TACOMA WELLFIELD TREATMENT
HSR CORROSION CONTROL AND FLUORIDATION

SITE PIPING PLAN

DATE

FIGURE 4

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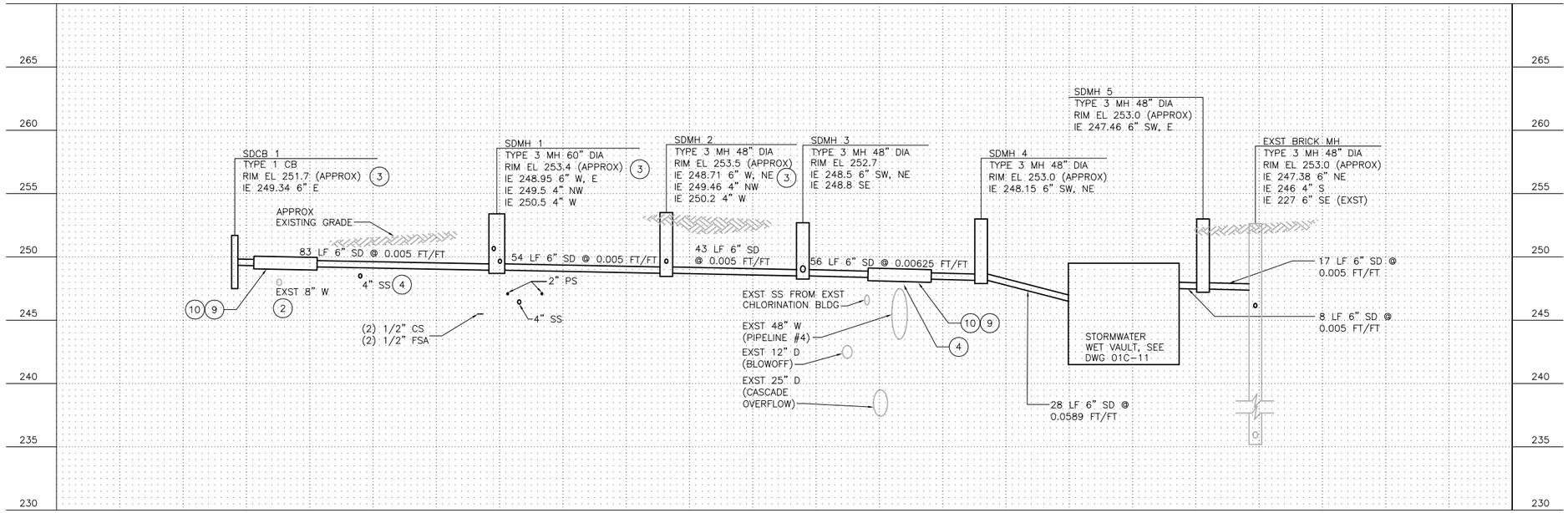
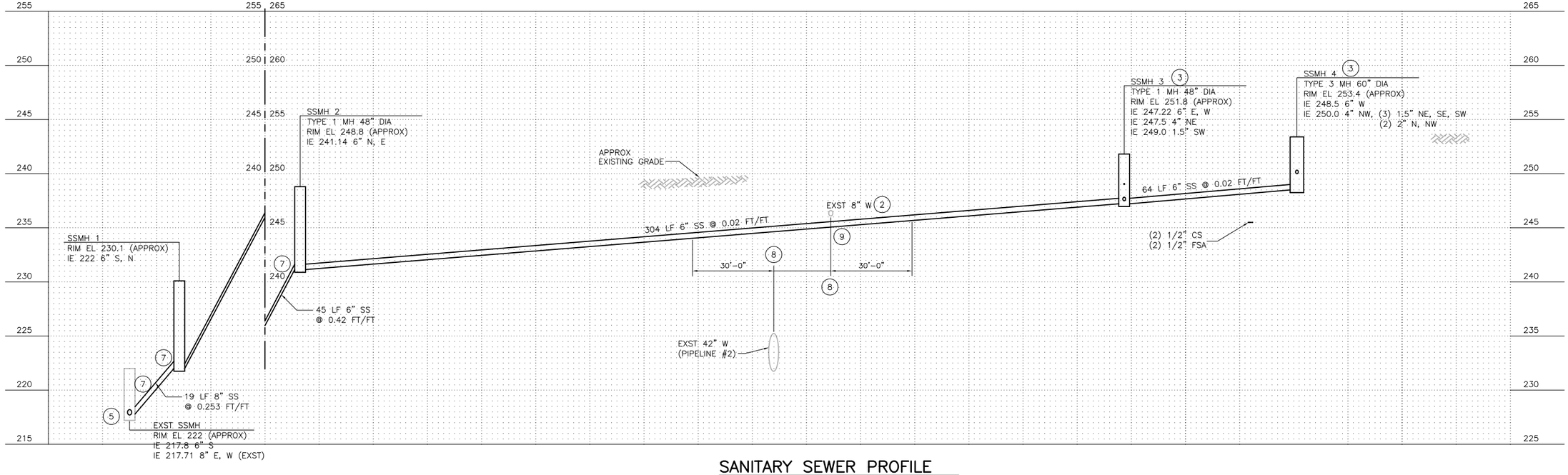


STORM SEWER PROFILE

SCALE: 1"=20' H, 1"=5' V



SANITARY SEWER PROFILE

SCALE: 1"=20' H, 1"=5' V

CONSTRUCTION NOTES:

1. EXISTING UNDERGROUND UTILITIES. CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF EXISTING UTILITIES TO AVOID DAMAGE OR DISTURBANCE.
2. EXISTING 8" W IS ESTIMATED TO BE AT A DEPTH BETWEEN 3-4 FEET AND IS NOT EXPECTED TO CONFLICT WITH NEW STORM DRAIN AND SANITARY SEWER.
3. ADJUST MANHOLES AND CATCH BASIN RIM ELEVATIONS BASED ON FINAL SURFACING AND GRADING PLAN, DWG 01C-04.
4. INSTALL HIGH LOAD POLYSTYRENE (PER STANDARD SPECIFICATIONS) BETWEEN THE NEW AND EXISTING PIPES THAT ARE WITHIN A 6" VERTICAL SEPARATION.
5. CONNECT NEW SS TO EXISTING MH. INVERT OF NEW SS TO BE 3" MINIMUM ABOVE EXISTING SEWER INVERT IN MANHOLE.
6. PROVIDE 3 TRENCH PLUGS BETWEEN SSMH1 AND SSMH2, EQUALLY SPACED. SEE DETAIL 4 ON 01C-21.
7. SEE DETAIL 6 ON 01C-21 FOR PIPE TO MH CONNECTIONS WHERE SLOPE EXCEEDS 10%.
8. ENCASE SS WITH CONCRETE (MIN THICKNESS = 6") FOR 30' ON EACH SIDE OF CROSSINGS WITH EXISTING WATER MAINS AND THE FULL DISTANCE BETWEEN.
9. LENGTH OF PIPE SHALL BE CENTERED AT CROSSING WITH WATER MAIN SO THAT JOINT WILL BE EQUIDISTANT FROM WATER MAIN, PIPE AT THIS LOCATION SHALL BE LONGEST STANDARD LENGTH AVAILABLE.
10. INSTALL 6" SD IN 10" D.I. CASING PIPE. FILL VOIDS BETWEEN PIPE AND CASING WITH SAND CEMENT GROUT. BACKFILL AROUND CASING WITH 6" THICK CDF. CAP ENDS WITH CONCRETE.

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MANAGER

TACOMA WATER
TACOMA PUBLIC UTILITIES

SOUTH TACOMA WELLFIELD TREATMENT
HSR CORROSION CONTROL AND FLUORIDATION

STORM SEWER AND SANITARY SEWER PLAN AND PROFILE

DATE

FIGURE 5

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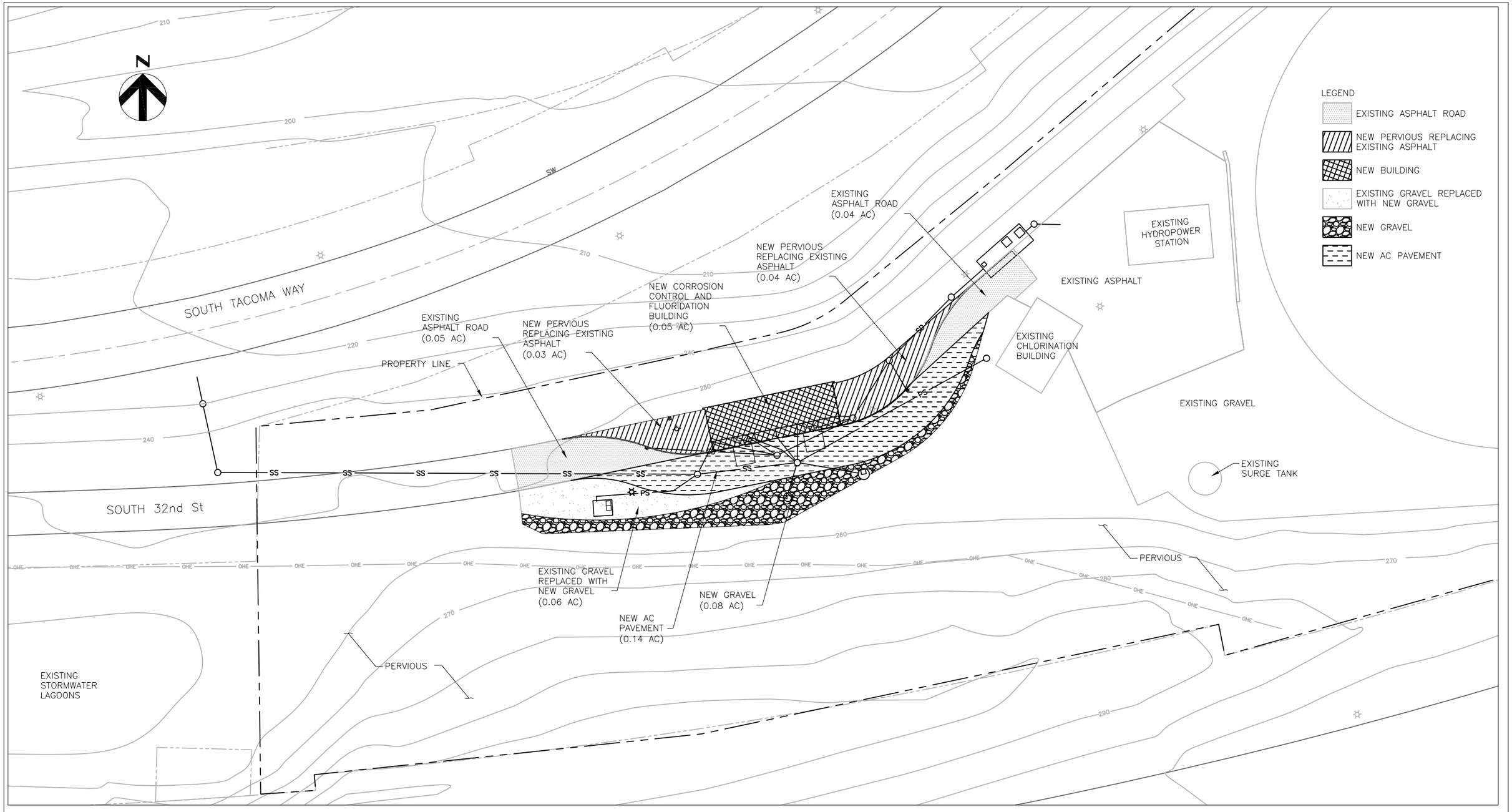

SITE PLAN

SCALE: 1"=30'

PROPOSED CONDITION LAND COVER

Land Cover	AREA (ACRES)
ROOF/BUILDING	0.05
GRAVEL	0.14
PAVEMENT	0.23
TOTAL IMPERVIOUS	**0.42**
PERVIOUS	0.07
TOTAL AREA	0.49

TACOMA WATER
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HDR

PROJECT AREA

DATE
10/26/2011

FIGURE
6

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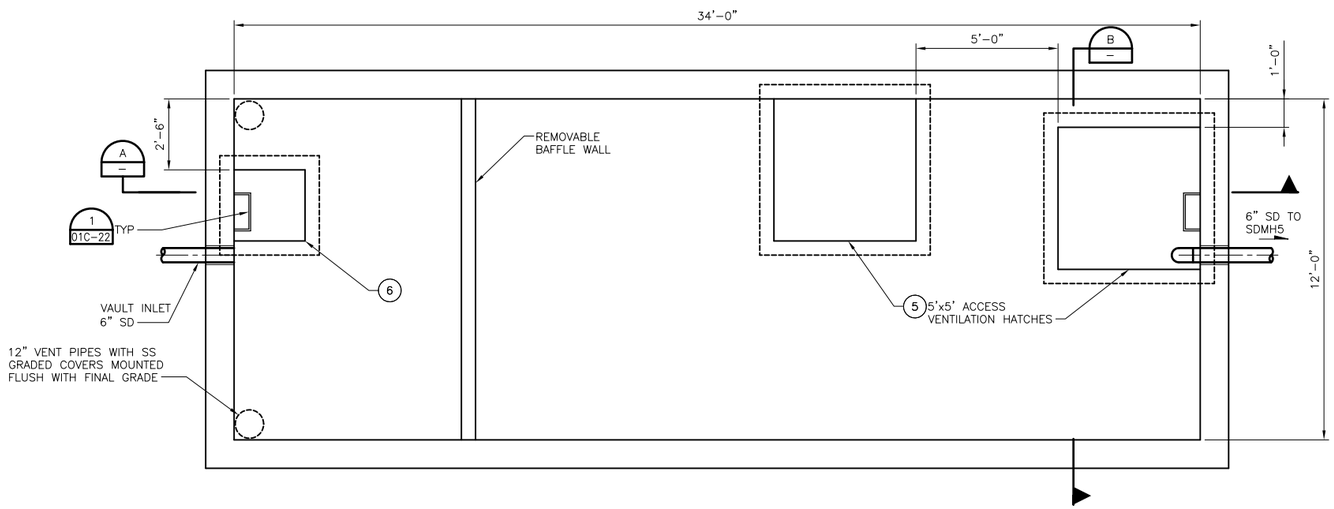
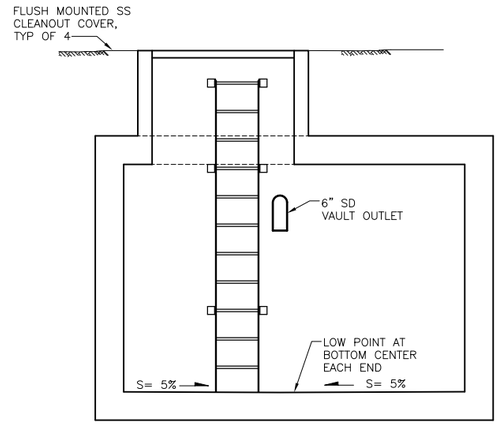
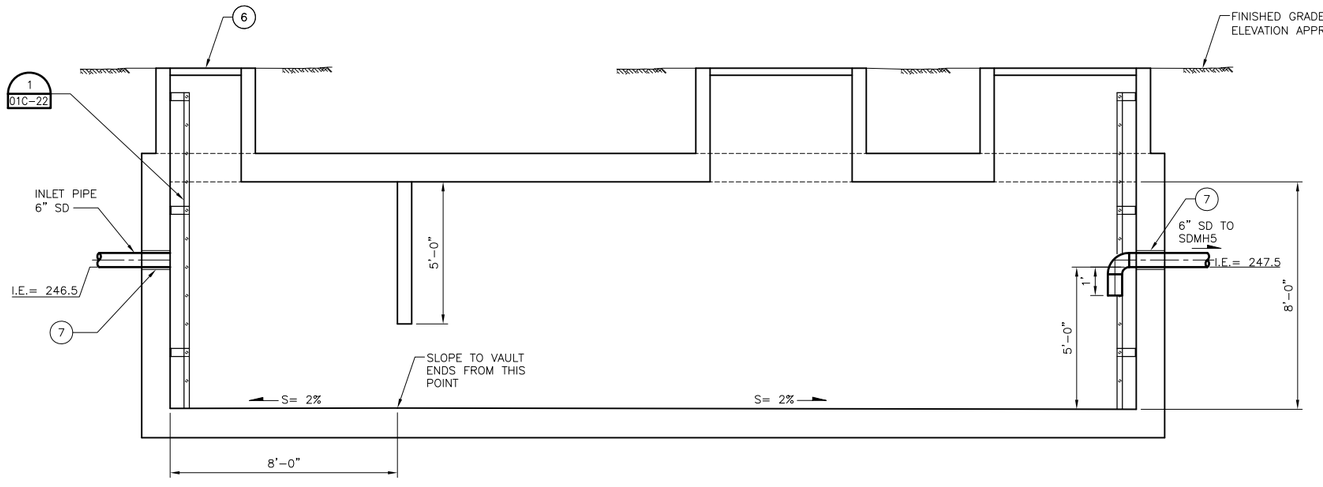


PLAN VIEW



SECTION B



SECTION A

NOTES:

1. VAULT PER SECTION 02540.
2. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED WITH WATER STOPS.
3. GALVANIZED MATERIALS SHALL NOT BE USED UNLESS PROPERLY COATED. SEE NOTE 34 ON 01C-03.
4. SEDIMENT THAT HAS ACCUMULATED IN THE WET VAULT SHALL BE REMOVED AFTER CONSTRUCTION HAS BEEN COMPLETED.
5. 5'x5' ACCESS OPENING SHALL BE PROVIDED WITH LOCKABLE GRATES. SEE SPECIFICATION 05505. GRATES SHALL BE DESIGNED TO SUPPORT A LIVE LOAD OF 150psf SEE DETAIL 7 ON 00S-03 FOR GRATING SUPPORTS.
6. 2.5'x2.5' ACCESS OPENING WITH SINGLE LEAF ACCESS HATCH.
7. SEAL WITH NON-POROUS, NON-SHRINK GROUT WHERE PIPES ENTER AND LEAVE VAULT.

STORMWATER WET VAULT DETAIL 1 (01C-03, 01C-04)

SCALE: 3/8"=1'-0"

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HDR

HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

STORMWATER WET VAULT PLAN AND SECTIONS

DATE 10/26/2011

FIGURE 7

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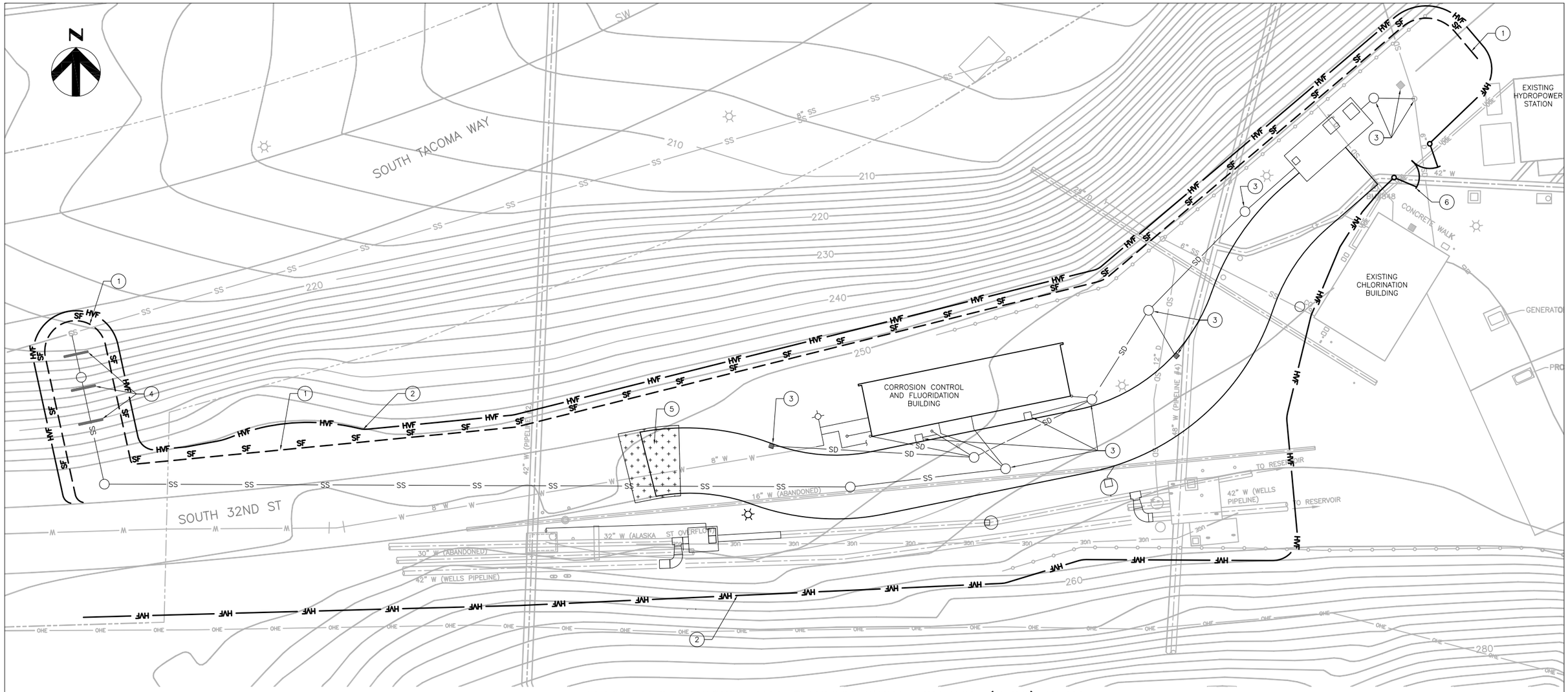

TEMPORARY EROSION AND SEDIMENTATION CONTROL (TESC) PLAN

SCALE: 1"=20'

CONSTRUCTION NOTES:

1. SILT FENCE PER TACOMA STD BMP C233.
2. HIGH VISIBILITY FENCE PER TACOMA STD BMP C103.
3. INSTALL STORM DRAIN INLET PROTECTION PER TACOMA STD BMP C220.
4. STRAW WATTLE PER TACOMA STD BMP C235.
5. STABILIZED CONSTRUCTION ENTRANCE PER TACOMA STD BMP C105. SEE DWG 01C-01 FOR SITE ACCESS ENTRANCE.
6. TEMPORARY INNER SECURITY FENCE/GATE.

STANDARD NOTES:

1. APPROVAL OF THIS EROSION/SEDIMENTATION CONTROL (ESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G. SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).
2. THE IMPLEMENTATION OF THESE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE APPLICANT/CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.
3. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE APPLICANT/CONTRACTOR FOR THE DURATION OF CONSTRUCTION.
4. THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM OR ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.
5. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.
6. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE APPLICANT/CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.
7. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 48 HOURS FOLLOWING A MAJOR STORM EVENT.
8. AT NO TIME SHALL MORE THAN ONE FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN SEDIMENT TRAP. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT-LADEN WATER INTO THE DOWNSTREAM SYSTEM.
9. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
10. COVER STOCKPILES WITH CLEAR PLASTIC OR OTHER MULCHING MATERIALS WITHIN 2 DAYS (OCTOBER 1 THROUGH APRIL 30) OR 7 DAYS (MAY 1 THROUGH SEPTEMBER 30) OF THE FORMATION

TACOMA WATER
TACOMA PUBLIC UTILITIES

HDR

HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

TESC PLAN

DATE
10/26/2011

FIGURE
8

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APPENDIX A

STORMWATER SITE PLAN SUBMITTAL REQUIREMENTS CHECKLIST

Appendix B Stormwater Site Plan Submittal Requirements Checklist

The Submittal Requirements Checklist is intended to aid the design engineer in preparing a Stormwater Site Plan. All items included in the following checklist must be addressed as part of any stormwater site plan. The City recommends the design engineer follow the order and structure of the checklist to facilitate review, which in turn will expedite permit issuance.

Chapter 1 – Project Overview

The project overview is intended to be a summary of detailed information contained in the body of the Stormwater Site Plan.

- ☑ Identify type of permit requested and permit number
- ☑ Identify other permits required (e.g. hydraulic permits, Army Corps 404 permits, wetlands, etc.).
- ☑ Identify the project location (including address, legal description, and parcel number).
- ☑ Brief description of project to include the following:
  - ☐ Current and proposed condition/land-use
  - ☐ Size of parcel
  - ☐ Acreage developed, redeveloped, replaced or converted by the project
  - ☐ Current assessed value and cost of proposed improvements (for redevelopment projects)
  - ☐ Watershed
  - ☐ Proposed flow control improvements
  - ☐ Proposed runoff treatment improvements
  - ☐ Proposed conveyance improvements
  - ☐ Proposed discharge location and improvements
  - ☐ Downstream condition, impacts and problem
  - ☐ Locations of surface water run-on to the property
  - ☐ Reference appropriate Sections/Chapters/Appendices of the document for detailed descriptions.

Chapter 2 – Existing Condition Summary

The Existing Condition Summary is intended to provide a complete understanding of the project site and must be based on thorough site research and investigation.

- ☑ Describe, discuss and identify the following for the project site:
  - ☐ Topography
  - ☐ Land use and ground cover
  - ☐ Natural and man-made drainage patterns
  - ☐ Points of entry and exit for existing drainage to and from the site
  - ☐ Any known historical drainage problems such as flooding, erosion, etc.
  - ☐ Existing utilities (storm, water, sewer)
  - ☐ Areas with high potential for erosion and sediment deposition
  - ☐ Locations of sensitive and critical areas (i.e. vegetative buffers, wetlands, steep slopes, floodplains, geologic hazard areas, streams, creeks, ponds, ravines, springs, etc).
  - ☐ Existing fuel tanks
  - ☐ Groundwater wells on-site and within 100 feet of site

- ☐ Septic systems on-site and/or within 100 feet of the site
- ☑ Identify difficult site conditions.
- ☐ State whether the project is located in an aquifer recharge area or wellhead protection area as defined by the Tacoma-Pierce County Health Department, the Environmental Protection Agency or by the City.
- ☐ Identify any Superfund areas in the vicinity, and state whether they are tributary to, or receive drainage from, the project site.
- ☐ Identify any specific requirements included in a basin plan for the area.
- ☐ Include references to relevant reports such as basin plans, flood studies, groundwater studies, wetland designations, sensitive area designations, environmental impact statements, environmental checklists, lake restoration plans, water quality reports, etc. Where such reports impose additional conditions on the Proponent, state these conditions and describe any proposed mitigation measures.
- ☑ Grading Plan per requirements.
- ☑ A soil report to identify the following:
  - ☐ Soil types
  - ☐ Hydrologic soil group classification
  - ☐ Groundwater elevation
  - ☐ Presence of perched aquifers, aquitards and confined aquifers
  - ☐ Location of test pits
  - ☐ Infiltration rates determined per the requirements of Volume 3 (where applicable)
  - ☐ Discussion of critical areas or geologic hazards where present
- ☐ Soil reports should be contained in Appendix A of the report or as a separate document.
- ☐ Describe the 100-year flood hazard zone.

Chapter 3 – Off-Site Analysis

The City requires a qualitative discussion of the off-site upstream and downstream system for all projects. Where 10,000 square feet or more of new impervious surface is added and flow control is not provided, a quantitative analysis is also required. Detailed calculations will be contained in Appendix B of the report. Volume 1, Chapter 4 describes the Off-site Analysis. In addition, a list of elements to be included is provided as follows.

Qualitative Analysis

- ☐ Review all available plans, studies, maps pertaining to the off-site study area.
- ☑ Investigate the drainage system ¼ mile downstream from the project by site visit, including the following items:
  - ☐ Problems reported or observed during the resource review
  - ☐ Existing/potential constrictions or capacity deficiencies in the drainage system
  - ☐ Existing/potential flooding problems
  - ☐ Existing/potential overtopping, scouring, bank sloughing, or sedimentation
  - ☐ Significant destruction of aquatic habitat (e.g., siltation, stream incision)
  - ☐ Existing public and private easements through the project site and their corresponding widths
  - ☐ Qualitative data on features such as land use, impervious surface, topography, soils, presence of streams, and wetlands
  - ☐ Information on pipe sizes, channel characteristics and drainage structures
  - ☐ Verification of tributary drainage areas

- ☐ Date and weather at the time of the inspection

☑ Describe the drainage system and its existing and predicted problems through observations, reports, and hydraulic modeling (as necessary) of the City-specified design storm event described in Chapter 3 of Volume 3. Describe all existing or potential problems as listed above (e.g. pooling water or erosion). The following information shall be provided for each existing or potential problem:

- ☐ Magnitude of or damage caused by the problem
- ☐ General frequency and duration
- ☐ Return frequency of storm or flow when the problem occurs (may require quantitative analysis)
- ☐ Water elevation when the problem occurs
- ☐ Names and concerns of the parties involved
- ☐ Current mitigation of the problem
- ☐ Possible cause of the problem
- ☐ Whether the project is likely to aggravate the problem or create a new one

☐ Properly include off-site areas in drainage calculations. N/A

Quantitative Analysis (see Volume 3, Section 3.1.2)

- ☐ Clearly describe tail water assumptions.
- ☐ Summarize results in text.
- ☐ Include calculations in Appendix B of the report.
- ☐ Discuss potential fixes for capacity problems.
- ☐ Provide profiles where appropriate.

Chapter 4 – Permanent Stormwater Control Plan

Chapter 4 will contain the information used to select, size and locate permanent stormwater control BMPs for the project site.

Pre-Developed Site Hydrology

☑ Provide a list of assumptions and site parameters for the pre-developed condition.

☑ Identify all sub-basins within, or flowing through, the site. Use consistent labeling for all sub-basins throughout figures, calculations and text.

☑ For each sub-basin, identify current land use, acreage, hydrologic soil group and land use to be modeled under pre-developed conditions. The format used in Example Table 1 show below is recommended.

☐ Provide justification for land uses other than forest. N/A

☑ Summarize output data from the pre-developed condition. Example Table 2a or 2b are recommended formats.

☐ Include completed Hydraulic Analysis worksheet (see Appendix C in this volume) and hydrologic calculations in Appendix C of the report. — N/A, No flow control

☑ For WWHM models, provide model files electronically.

Example Table 1

Sub-Basin ID	Land Use and Cover Condition	Acreage	Soil Group	Modeled as: (List CN)	Comments

Example Table 2a

Pre-Developed Condition Event Output: SBUH			
Basin ID:			
	Peak Flow (cfs)	**Volume (ac-ft)**	**Area (ac)**
2-year existing			
10-year existing			
25-year existing			
100-year existing			

Example Table 2b

Pre-Developed Condition Event Output: WWHM		
Basin ID:		
	Peak Flow (cfs)	**Area (ac)**
2-year existing		
10-year existing		
25-year existing		
100-year existing		

Developed Site Hydrology

- ☑ Provide a list of assumptions and site parameters for the developed condition.
- ☑ Identify all sub-basins within, or flowing through, the site. Use consistent labeling for all sub-basins throughout figures, calculations and text.
- ☑ For each sub-basin, identify current land use, acreage, hydrologic soil group and land use to be modeled under developed conditions. The format used in Example Table 1 is recommended.
- ☑ Summarize output data from the developed condition. The formats used in Example Table 2a or 2b are recommended.
- ☐ Include completed Hydraulic Analysis worksheet (see Appendix C in this volume) and hydrologic calculations in Appendix C of the report. N/A - No flow control

Performance Goals and Standards

- ☑ Indicate total acreage of impervious surfaces, pollution-generating impervious surfaces and pollution-generating pervious surfaces for each Threshold Discharge Area (TDA). The format used in Example Table 3 is recommended.
- ☑ Include applicable decision chart (Figure 4, Figure 5 or Figure 6) with treatment requirements

clearly marked and supported.

- ☐ Include applicable decision chart (Figure 5) with flow control requirements clearly marked and supported. If flow control facilities are required, indicate that they are required.
- ☐ State conclusions from decision and flow charts.

Example Table 3

Threshold Discharge Area ID:	
Total pollution generating pervious surface (PGPS)	acres
Total pollution generating impervious surface ((PGIS)	acres
Native vegetation converted to lawn/landscape	acres
Total effective impervious surface	acres
Increase in 100-yer storm peak	cfs

Flow Control System (where required)

- ☐ Identify sizing system used.
- ☐ Summarize model results.
- ☐ Describe proposed flow control system and appurtenances, including size, type and characteristics of storage facility and control structure.
- ☐ Provide a drawing of the flow control facility and its appurtenances, including:
- ☐ Include Hydraulic Analysis Worksheet, calculations, and computer printouts (including stage storage tables) for the flow control system to be included in Appendix C of the report.

Water Quality System (where required)

- ☑ Identify the sizing method used.
- ☑ Summarize model results.
- ☑ Identify treatment methods used, including size, type and characteristics of treatment facility and appurtenances.
- ☑ Provide a drawing of the treatment facility and its appurtenances, including:
  - ☐ Dimensions
  - ☐ Inlet/outlet sizes and elevations
  - ☐ Location of the facility on the project site
  - ☐ Appurtenances/fittings
- ☑ Calculations for the water quality design storm and facility sizing calculations must be included in Appendix D of the report.
- ☐ Where appropriate, include manufacturer's specifications in Appendix D of the report.

Conveyance System Analysis and Design

- ☑ Illustrate the proposed conveyance system on a project site plan.
- ☑ Identify pipe sizes, types and slopes.
- ☑ Describe capacities, design flows and velocities for each reach.
- ☑ Include conveyance calculations in Appendix E of the report.

Chapter 5 – Discussion of Minimum Requirements

Chapter 5 is intended as a checklist for the applicant and reviewer to verify that the applicable Minimum Requirements have been met within the project submittal.

- ☑ Include applicable flowcharts for determining minimum requirements (Figure 4, Figure 5 or Figure 6) with decision path clearly marked.
- ☑ List the minimum requirements that apply to the project.
- ☑ Discuss how the project satisfies each minimum requirement.
- ☑ Indicate where in the project documentation each minimum requirement is satisfied.

Chapter 6 – Operation and Maintenance Manual

The Operation and Maintenance Manual may be included in the Stormwater Site Plan, however it shall be written with the intention of becoming a stand-alone document for the project owner once the project is complete. The Operation and Maintenance Manual must include:

- ☑ A narrative description of the on-site storm system.
- ☑ An 11 x 17 inch map of the site, with the locations of the **treatment/detention/infiltration/etc.** facilities prominently noted. This is needed to enable the Operation and Maintenance manual to be a stand-alone document.
- ☑ The person or organization responsible for maintenance of the on-site storm system, including the phone number and current responsible party.
- ☑ Where the Operation and Maintenance manual is to be kept. Note that it must be made available to the City for inspection.
- ☑ A description of each flow control and treatment facility, including what it does and how it works. Include any manufacturer's documentation.
- ☑ A description of all maintenance tasks and the frequency of each task for each flow control and treatment facility. Include any manufacturer's recommendations.
- ☑ A sample maintenance activity log indicating emergency and routine actions to be taken.

Chapter 7 – Construction Stormwater Pollution Prevention Plan

- ☐ Short-Form – Please refer to Volume 2 – Appendix C for a complete checklist, or
- ☑ Formal/Long-Form – Please refer to Volume 2 – Chapter 2 for a complete checklist.

Appendices

- ☑ Appendix A – Operations and Maintenance Manual
- ☑ Appendix B – Construction Stormwater Pollution Prevention Plan
- ☑ Appendix C – Submittal Requrements Checklist
- ☐ Appendix D – Hydraulic Analysis Worksheet
- ☐ Appendix E – Bond Qualities Worksheet
- ☑ Appendix F – Other reports, as required

Required Drawings

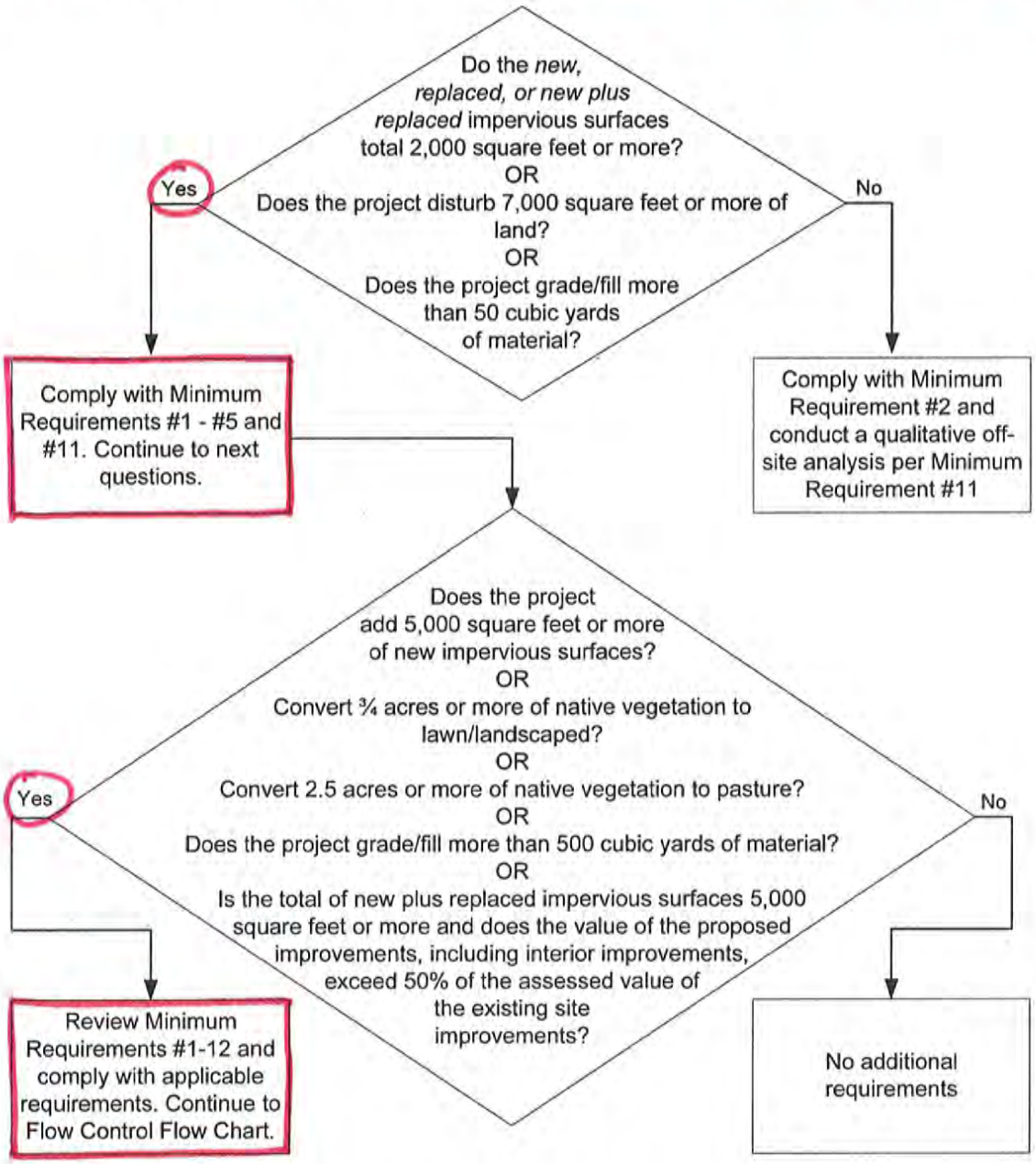
Project drawings shall be provided as required in Chapter 4, and shall include the following:

- ☑ Vicinity Map
- ☑ Site Map and Grading Plan
- ☑ Basin Map
- ☑ Storm Plan and Profile
- ☑ Erosion Control Plan
- ☑ Detail Sheets

APPENDIX B

MINIMUM REQUIREMENTS FLOW CHARTS

Tacoma Water
South Tacoma Groundwater Treatment Facilities:
Hood Street Reservoir

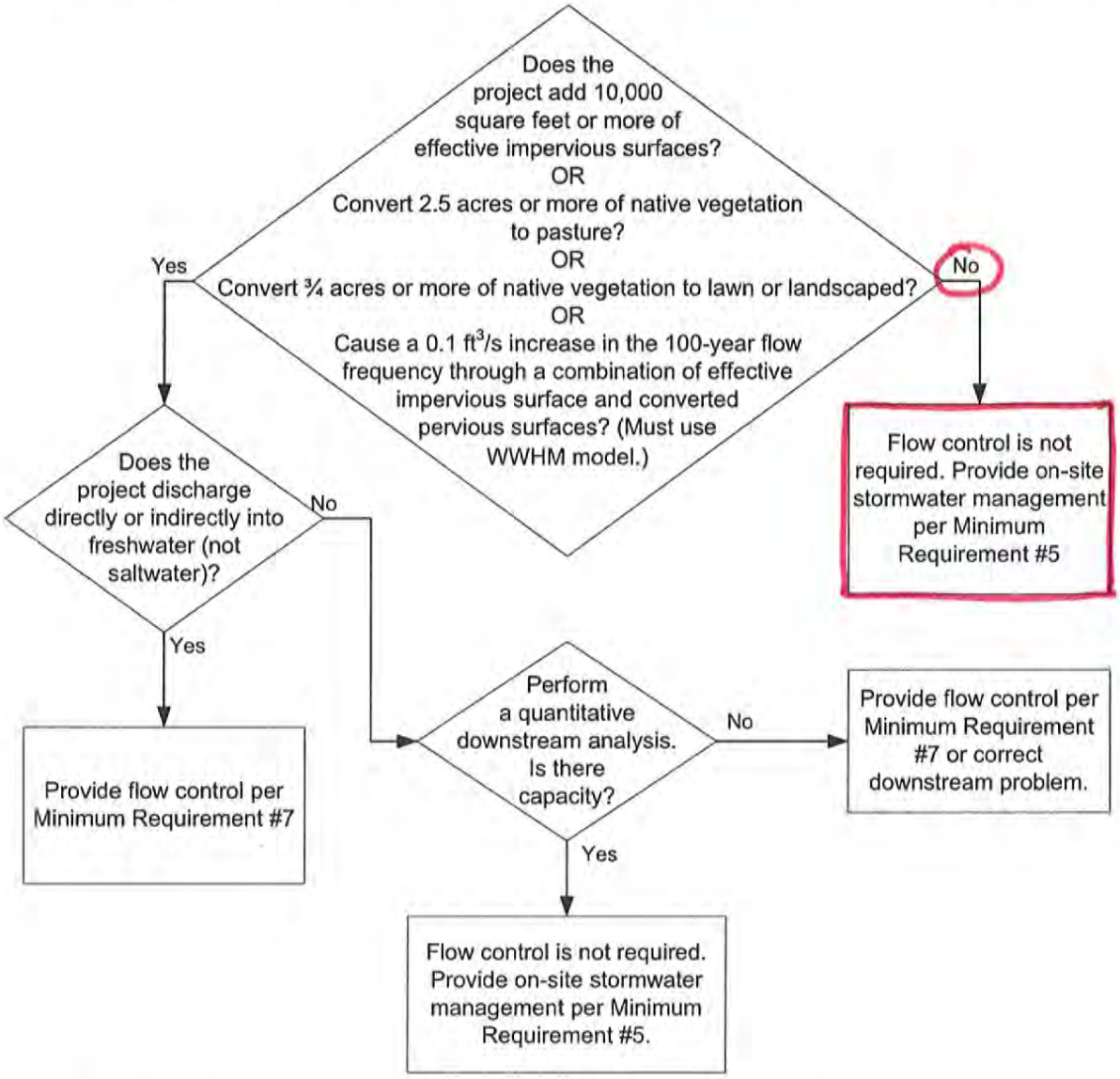


NOTES:

1. The combined total of new and replaced surfaces since January 1, 2003 shall apply when determining the thresholds.
2. Minimum Requirement #12 may apply to any project regardless of site size.
3. Watershed specific requirements may or may not require compliance with certain minimum requirements regardless of site size.
4. It is the applicant's responsibility to determine the final natural discharge location for all projects.

Figure 4. Determining Minimum Requirements for New and Redevelopment Project Sites

Tacoma Water
South Tacoma Groundwater Treatment Facilities:
Hood Street Reservoir



NOTES:

1 Minimum Requirement #12 may apply to any project regardless of site size.
2. Watershed specific requirements may or may not require compliance with certain minimum requirements regardless of site size.
3. Direct discharges into the Puyallup River do not require flow control. Provide on-site stormwater management per Minimum Requirement #5.
4. It is the applicant's responsibility to determine the final natural discharge location for all projects.

Figure 5. Determining Minimum Requirements for Flow Control

APPENDIX C

STORMWATER MODELING RESULTS

WWHM4

PROJECT REPORT

Project Name: TacomaWater_WQ
Site Name : Hood Reservoir
Site Address:
City : Tacoma
Report Date : 10/3/2011
Gage : McMillin
Data Start : 1948/10/01
Data End : 1996/09/30
(adjusted) **Precip Scale:** 0.00
Version : 2011/01/14

PREDEVELOPED LAND USE

Name : Pre-Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
A B, Forest, Steep	.49

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Proposed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
A B, Lawn, Flat	.07

Impervious Land Use	Acres
ROADS FLAT	0.367
ROOF TOPS FLAT	0.053

Element Flows To:
Surface **Interflow** **Groundwater**

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000101
5 year	0.000151
10 year	0.00019
25 year	0.000249
50 year	0.000298
100 year	0.000354

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.126873
5 year	0.16965
10 year	0.200015
25 year	0.240783
50 year	0.272942
100 year	0.306672

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0.0484 acre-feet

On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 0.1352 **cfs.**
Off-line facility target flow: 0.0352 **cfs.**
Adjusted for 15 min: 0.079 **cfs.**

Perlnd and Implnd Changes

No changes have been made.

WWHM4

PROJECT REPORT

Project Name: TacomaWater_EX
Site Name : Hood Reservoir
Site Address:
City : Tacoma
Report Date : 10/3/2011
Gage : McMillin
Data Start : 1948/10/01
Data End : 1996/09/30
(adjusted) **Precip Scale:** 0.00
Version : 2011/01/14

PREDEVELOPED LAND USE

Name : Existing Conditions
Bypass: No

GroundWater: No

Pervious Land Use	Acres
A B, Lawn, Flat	.17

Impervious Land Use	Acres
ROADS FLAT	0.32

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.098661
5 year	0.132477
10 year	0.156558
25 year	0.188971
50 year	0.214595
100 year	0.241518

Perlnd and Implnd Changes
No changes have been made.

Worksheet for Wetvault Outlet Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient		0.014	→ **Ductile Iron Pipe, Manning's per Table 35, Vol. 3, Ch. 3 of Tacoma SWMM**
Channel Slope		0.00500	ft/ft
Diameter		0.50	ft
Discharge		**0.29**	**ft³/s →100yr developed flow per WWHMv4 output**

Results

Normal Depth		**0.34**	**ft → pipe diameter, therefore pipe capacity adequate**
Flow Area		0.14	ft²
Wetted Perimeter		0.96	ft
Top Width		0.47	ft
Critical Depth		0.27	ft
Percent Full		67.4	%
Critical Slope		0.00940	ft/ft
Velocity		2.08	ft/s
Velocity Head		0.07	ft
Specific Energy		0.40	ft
Froude Number		0.67	
Maximum Discharge		0.40	ft³/s
Discharge Full		0.37	ft³/s
Slope Full		0.00316	ft/ft
Flow Type	SubCritical		

GVF Output Data

Normal Depth Over Rise	67.38	%
Normal Depth	0.34	ft
Critical Depth	0.27	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00940	ft/ft

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
Reach 8	0.305	0.1305	0.3803	0.3431	0.202	0.4039	6 in Diam	1.7565	1.937	0.00	Basin D
DS 2 Reach	0.02	0.0136	0.1337	0.102	0.0717	0.2153	4 in Diam	0.9884	1.5329	0.00	Basin F
Spill Reach 2	0.064	0.0322	0.1265	0.2545	0.1146	0.3439	4 in Diam	1.2117	1.45	0.00	Basin C
DS 1 Reach	0.02	0.0136	0.1265	0.1078	0.0737	0.2211	4 in Diam	0.9511	1.45	0.00	Basin E
Spill Reach 1	0.061	0.0322	0.1253	0.2571	0.1152	0.3457	4 in Diam	1.2032	1.4357	0.00	Basin B
Reach 1	0.09	0.0418	0.3582	0.1166	0.1156	0.2312	6 in Diam	1.2145	1.8241	0.00	Basin A
Reach 2	0.171	0.0876	0.3465	0.2527	0.1713	0.3427	6 in Diam	1.472	1.7649	0.00	
Reach 3	0.255	0.1334	0.3651	0.3654	0.2091	0.4183	6 in Diam	1.714	1.8595	0.00	
Reach 4	0.56	0.2639	0.4147	0.6365	0.2897	0.5794	6 in Diam	2.2377	2.1119	0.00	
Reach 5	0.56	0.2639	1.2679	0.2082	0.1549	0.3097	6 in Diam	5.0976	6.4574	0.00	
Reach 6	0.56	0.2639	0.3694	0.7144	0.3126	0.6253	6 in Diam	2.0435	1.8814	0.00	
Reach 7	0.56	0.2639	0.3582	0.7369	0.3195	0.639	6 in Diam	1.9925	1.8241	0.00	

Layout Report: Proposed

Event	Precip (in)
6 month 24 hr	1.44
2 yr 24 hr	2.00

10 year	3.00
100 year	4.10

Reach Records

Record Id: DS 1 Reach

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 1	**UpNode**	Downspout 1
Material	unspecified	**Size**	4 in Diam
Ent Losses	Groove End w/Headwall		
Length	40.80 ft	**Slope**	0.51%
Up Invert	249.71 ft	**Dn Invert**	249.50 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: DS 2 Reach

Section Shape:	Circular

Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 2	**UpNode**	Downspout 2
Material	unspecified	**Size**	4 in Diam
Ent Losses	Groove End w/Headwall		
Length	7.00 ft	**Slope**	0.57%
Up Invert	249.50 ft	**Dn Invert**	249.46 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 1

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 1	**UpNode**	SDCB 1
Material	unspecified	**Size**	6 in Diam
Ent Losses	Square Edge w/Headwall		
Length	83.00 ft	**Slope**	0.47%

Up Invert	249.34 ft	**Dn Invert**	248.95 ft

Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 2

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 2	**UpNode**	SDMH 1
Material	unspecified	**Size**	6 in Diam
Ent Losses	Square Edge w/Headwall		
Length	54.00 ft	**Slope**	0.44%
Up Invert	248.95 ft	**Dn Invert**	248.71 ft

Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Hold up invert.	Hold down invert.	

Record Id: Reach 3

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 3	**UpNode**	SDMH 2
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		
Length	43.00 ft	**Slope**	0.49%
Up Invert	248.71 ft	**Dn Invert**	248.50 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 4

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	

DnNode	SDMH 4	**UpNode**	SDMH 3
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		
Length	56.00 ft	**Slope**	0.63%
Up Invert	248.50 ft	**Dn Invert**	248.15 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 5

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	Wet Vault	**UpNode**	SDMH 4
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		
Length	28.00 ft	**Slope**	5.89%
Up Invert	248.15 ft	**Dn Invert**	246.5008 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 6

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 5	**UpNode**	Wet Vault
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		
Length	8.00 ft	**Slope**	0.50%
Up Invert	247.50 ft	**Dn Invert**	247.46 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 7

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	EXIST Brick MH	**UpNode**	SDMH 5
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		
Length	17.00 ft	**Slope**	0.47%
Up Invert	247.46 ft	**Dn Invert**	247.38 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Reach 8

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 3	**UpNode**	SDCB 2
Material	unspecified	**Size**	6 in Diam
Ent Losses	Groove End w/Headwall		

Length	18.90 ft	**Slope**	0.53%
Up Invert	248.90 ft	**Dn Invert**	248.80 ft

Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Record Id: Spill Reach 1

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 1	**UpNode**	Spill Catch Basin 1
Material	unspecified	**Size**	4 in Diam
Ent Losses	Groove End w/Headwall		
Length	21.80 ft	**Slope**	0.50%
Up Invert	249.61 ft	**Dn Invert**	249.50 ft

Conduit Constraints				
Min Vel	**Max Vel**	**Min Slope**	**Max Slope**	**Min Cover**
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr

Hold up invert.	Hold down invert.	

Record Id: Spill Reach 2

Section Shape:	Circular		
Uniform Flow Method:	Manning's	**Coefficient:**	0.014
Routing Method:	Travel Time Shift	**Contributing Hyd**	
DnNode	SDMH 2	**UpNode**	Spill Catch Basin 2
Material	unspecified	**Size**	4 in Diam
Ent Losses	Groove End w/Headwall		
Length	23.50 ft	**Slope**	0.51%
Up Invert	250.32 ft	**Dn Invert**	250.20 ft

Conduit Constraints

Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	**Ex/Infil Rate**	0.00 in/hr
Hold up invert.	Hold down invert.		

Node Records

Record Id: Downspout 1

Descrip:	Downspout 1	Increment	0.10 ft
Start El.	249.71 ft	Max El.	250.71

			ft
Void Ratio	100.00		
Dummy Type Node			

Record Id: Downspout 2

Descrip:	Prototype Record	Increment	0.10 ft
Start El.	249.50 ft	Max El.	250.50 ft
Void Ratio	100.00		
Dummy Type Node			

Record Id: EXIST Brick MH

Descrip:	Existing MH	Increment	0.10 ft
Start El.	227.60 ft	Max El.	253.00 ft
Void Ratio	100.00		
Condition	Existing	Structure Type	MH-TYPE 3-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: SDCB 1

Descrip:	Furthest US CB	Increment	0.10 ft
Start El.	249.34 ft	Max El.	251.70 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: SDCB 2

Descrip:	Proposed Catchbasin	Increment	0.10 ft
Start El.	248.80 ft	Max El.	252.70 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: SDMH 1

Descrip:	Proposed Manhole	Increment	0.10 ft
Start El.	248.95 ft	Max El.	253.40 ft
Void Ratio	100.00		

Condition	Proposed	Structure Type	MH-TYPE 3-60
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	19.635 sf
MH/CB Type Node			

Record Id: SDMH 2

Descrip:	Proposed Manhole	Increment	0.10 ft
Start El.	248.71 ft	Max El.	253.50 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	MH-TYPE 3-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: SDMH 3

Descrip:	Proposed Manhole	Increment	0.10 ft
Start El.	248.50 ft	Max El.	252.70 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	MH-TYPE 3-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf

MH/CB Type Node

Record Id: SDMH 4

Descrip:	Proposed Manhole	Increment	0.10 ft
Start El.	248.15 ft	Max El.	253.00 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	MH-TYPE 3-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: SDMH 5

Descrip:	Proposed Manhole	Increment	0.10 ft
Start El.	247.46 ft	Max El.	253.00 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	MH-TYPE 3-48
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: Spill Catch Basin 1

Descrip:	Spill Catch Basin 1	Increment	0.10 ft
Start El.	249.60 ft	Max El.	253.00 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	GRATE INLET TYPE 1
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	7.7638 sf
MH/CB Type Node			

Record Id: Spill Catch Basin 2

Descrip:	Spill Catch Basin 2	Increment	0.10 ft
Start El.	250.30 ft	Max El.	253.00 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	GRATE INLET TYPE 1
Ent Ke	Groove End w/Headwall (ke=0.20)	Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	7.7638 sf
MH/CB Type Node			

Record Id: Wet Vault

Descrip:	Prototype Record	Increment	0.10 ft
Start El.	246.50 ft	Max El.	253.00 ft

Void Ratio	100.00		
Dummy Type Node			

Contributing Drainage Areas

Record Id: Basin A

Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.02 ac	**DCIA**	0.07 ac
Pervious CN	80.00	**DC CN**	90.57
Pervious TC	6.30 min	**DC TC**	6.30 min

Pervious CN Calc

Description	SubArea	Sub cn
Open spaces, lawns,parks (>75% grass)	0.02 ac	80.00
Pervious Composited CN (AMC 2)		80.00

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Flow over Grass	8.60 ft	9.0%	0.24	2.00 in	1.3893 min
Pervious TC						1.3893 min

DCI - CN Calc

Description	SubArea	Sub cn
Gravel Roads & Parking Lots	0.04 ac	85.00
Impervious surfaces (pavements, roofs, etc)	0.03 ac	98.00
DC Composited CN (AMC 2)		90.5714

DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min

Record Id: Basin B

Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.006 ac	**DCIA**	0.055 ac
Pervious CN	80.00	**DC CN**	92.09
Pervious TC	6.30 min	**DC TC**	6.30 min

Pervious CN Calc

Description	SubArea	Sub cn
Open spaces, lawns,parks (>75% grass)	0.006 ac	80.00
Pervious Composited CN (AMC 2)		80.00

Pervious TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Sheet	Dense grasses	9.40 ft	9.0%	0.24	2.00 in	1.4918 min
Pervious TC						1.4918 min

DCI - CN Calc		
Description	**SubArea**	**Sub cn**
Gravel Roads & Parking Lots	0.025 ac	85.00
Impervious surfaces (pavements, roofs, etc)	0.03 ac	98.00
DC Composited CN (AMC 2)		92.0909

DCI - TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min

Record Id: Basin C

Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.017 ac	**DCIA**	0.047 ac
Pervious CN	80.00	**DC CN**	93.30

Pervious TC	6.30 min	DC TC	6.30 min

Pervious CN Calc

Description	SubArea	Sub cn
Open spaces, lawns,parks (>75% grass)	0.017 ac	80.00
Pervious Composited CN (AMC 2)		80.00

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Dense grasses	24.70 ft	9.0%	0.24	2.00 in	3.2312 min
Pervious TC						3.2312 min

DCI - CN Calc

Description	SubArea	Sub cn
Gravel Roads & Parking Lots	0.017 ac	85.00
Impervious surfaces (pavements, roofs, etc)	0.03 ac	98.00
DC Composited CN (AMC 2)		93.2979

DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min

Record Id: Basin D

Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.18 ac	**DCIA**	0.125 ac
Pervious CN	80.00	**DC CN**	96.34
Pervious TC	8.3477 min	**DC TC**	6.30 min

Pervious CN Calc

Description	SubArea	Sub cn
Open spaces, lawns,parks (>75% grass)	0.18 ac	80.00
Pervious Composited CN (AMC 2)		80.00

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Dense grasses	80.90 ft	9.0%	0.24	2.00 in	8.3477 min
Pervious TC						8.3477 min

DCI - CN Calc

Description	SubArea	Sub cn
Gravel Roads & Parking Lots	0.016 ac	85.00
Impervious surfaces (pavements, roofs, etc)	0.109 ac	98.00
DC Composited CN (AMC 2)		96.336

DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min

Record Id: Basin E

Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.00 ac	**DCIA**	0.02 ac
Pervious CN	0.00	**DC CN**	98.00
Pervious TC	0.00 min	**DC TC**	6.30 min

DCI - CN Calc

Description	SubArea	Sub cn
Impervious surfaces (pavements, roofs, etc)	0.02 ac	98.00
DC Composited CN (AMC 2)		98.00

DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min

Record Id: Basin F

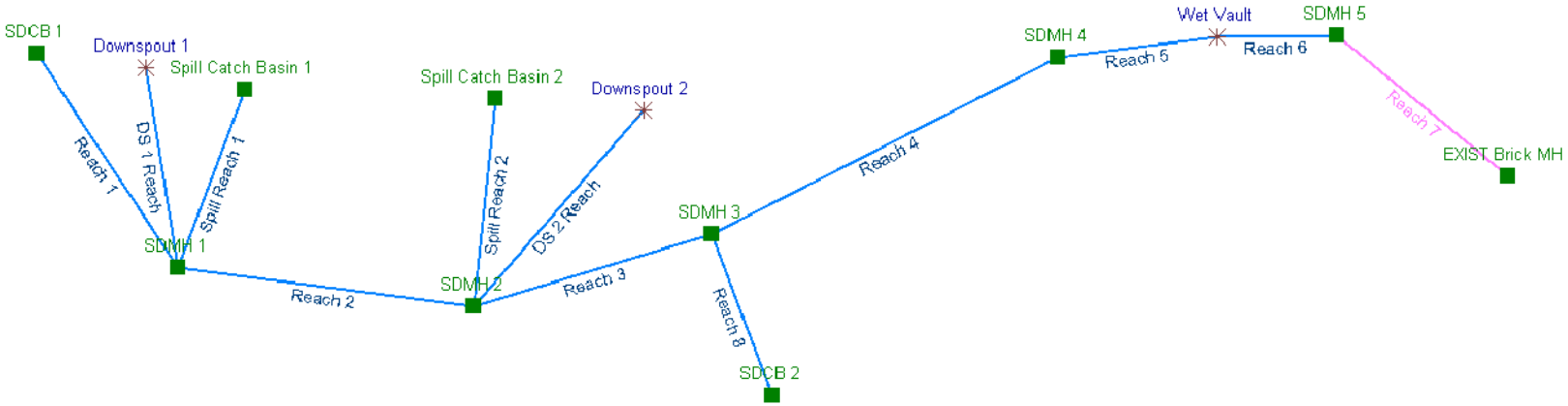
Design Method	SCS	**Rainfall type**	TYPE1A.RAC
Hyd Intv	10.00 min	**Peaking Factor**	484.00
Storm Duration	24.00 hrs	**Abstraction Coeff**	0.20
Pervious Area	0.00 ac	**DCIA**	0.02 ac
Pervious CN	0.00	**DC CN**	98.00
Pervious TC	0.00 min	**DC TC**	6.30 min

DCI - CN Calc

Description	SubArea	Sub cn
Impervious surfaces (pavements, roofs, etc)	0.02 ac	98.00
DC Composited CN (AMC 2)		98.00

DCI - TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Sheet	Min Tc	0.00 ft	0.0%	6.3	0.00 in	6.30 min
Pervious TC						6.30 min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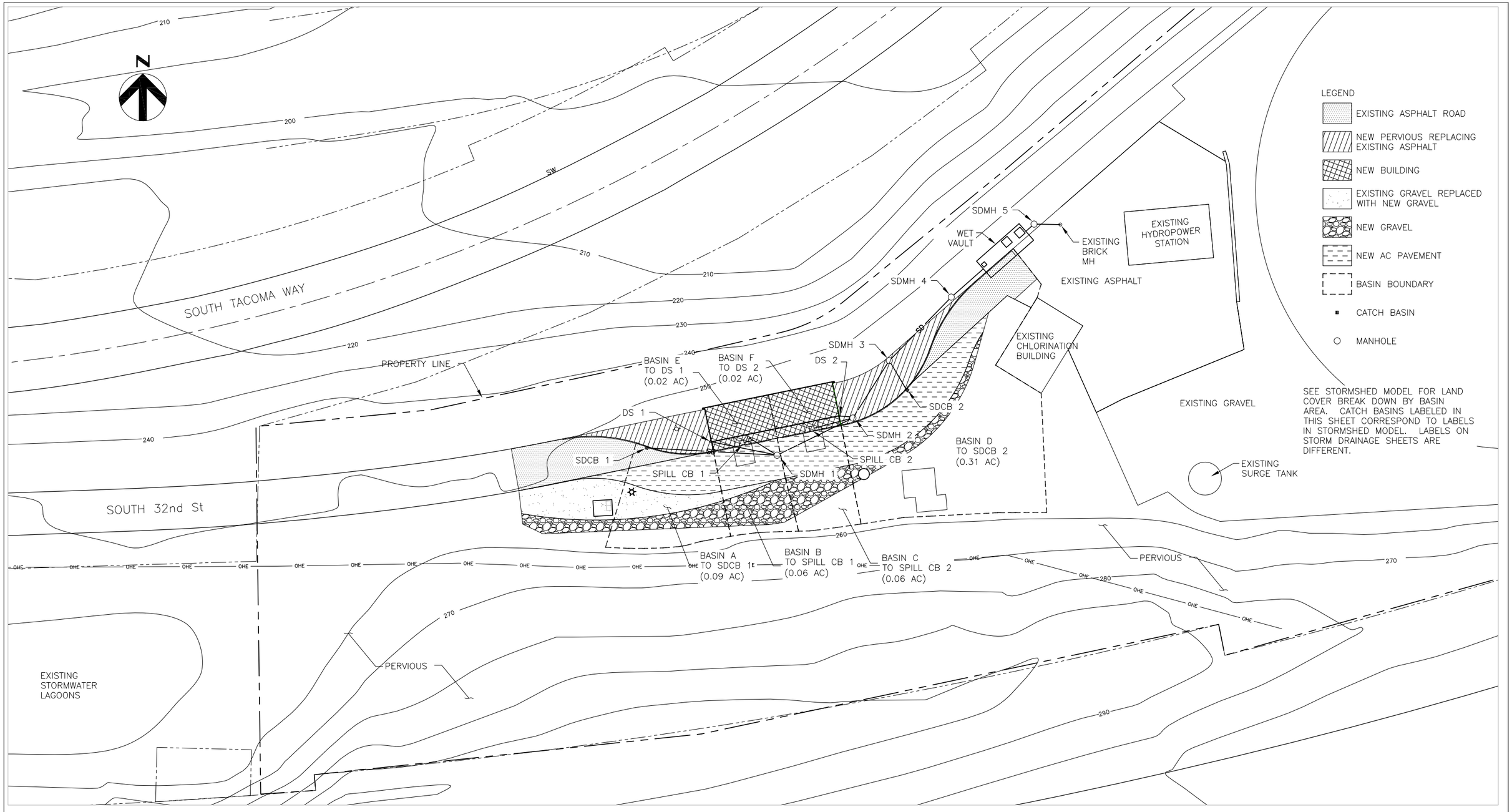
Downspout 1
Spill Catch Basin 1
Spill Catch Basin 2
Downspout 2
Wet Vault
SDMH 5
SDMH 4
Reach 1
DS 1 Reach
Spill Reach 1
Spill Reach 2
DS 2 Reach
Reach 4
Reach 5
Reach 6
Reach 7
EXIST Brick MH
SDMH 1
SDMH 2
SDMH 3
Reach 2
Reach 3
Reach 8
SDCB 2



SITE PLAN
SCALE: 1"=30'

TACOMA WATER
TACOMA PUBLIC UTILITIES

HDR

CATCH BASIN DRAINAGE AREAS

DATE
10/26/2011

FIGURE
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APPENDIX D

OPERATIONS AND MAINTENANCE MANUAL

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Tacoma Water
South Tacoma Groundwater Treatment Facilities: Hood Street Reservoir

Stormwater Operations and Maintenance Manual

Hood Street Reservoir
1002 South Tacoma Way
Tacoma, WA 98409

Prepared for the Tacoma Water:

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Bellevue, Washington

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Bellevue, WA 98004-5549
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1.0 Introduction

The following Operations and Maintenance Manual is for the stormwater management features associated with the Tacoma Public Utilities Water Division (Tacoma Water) Hood Street Reservoir Facility located at 1002 South Tacoma Way, Tacoma, WA, Parcel Number 0320084114. All operations and maintenance of the facilities described herein will be performed by Tacoma Water staff. This manual shall be kept on-site at all times, and must be made available for inspection by the City of Tacoma.

Stormwater facilities described in this manual are: catch basins, a wetvault, catch basin inserts, compost amended soil, and spill catchment basins, and containment sump pumps. The discussion of each facility includes a description of the facility, what it does, how it works, required maintenance activities, and the required frequency of maintenance. Figure 1 shows a map of the proposed site configuration, with callouts indicating each of the stormwater facilities.

2.0 Project Overview

(Tacoma Water) is the drinking water supplier to the City of Tacoma. One of the facilities owned and operated by the utility is the 10-million gallon (MG) Hood Street Reservoir. The reservoir's primary supply is treated surface water from the Green River/North Fork Wellfield supply. That supply is augmented with the seasonal operation of the South Tacoma Wellfield, which consists of 13 wells that can provide over 40 million gallons per day (MGD) of groundwater to the reservoir.

Tacoma Water currently provides corrosion control treatment to the Green River/North Fork Wellfield supply by pH adjustment using caustic soda, but the South Tacoma Wellfield supply is not treated for corrosion control. A corrosion control treatment facility addition at the Hood Street Reservoir is being designed so that when the South Tacoma Wellfield is seasonally operated, there will not be a significant impact on lead and copper corrosion in household plumbing due to blending of the two disparate sources within the reservoir and the distribution system.

Proposed improvements affecting stormwater management include construction of a new chemical storage and handling building (the Corrosion Control and Fluoridation Building, approximately 1,500 square feet), asphalt and concrete paving (approximately 7,000 square feet), and new stormwater collection, conveyance, and treatment systems.

3.0 Stormwater Facility Operations and Maintenance

The following sections describe each of the stormwater components present at the Hood Street Reservoir Facility. Required maintenance items and inspection frequency are also discussed. A sample maintenance log has been included in Table 1.

3.1 Catch Basins

Description: Catch basins are installed at local low points within the site, and used to collect surface runoff from impervious surfaces. Runoff collected in the catch basins is conveyed through a closed pipe system, to the proposed wetvault for water quality treatment, before being ultimately discharged into the existing stormwater conveyance main line in South Tacoma Way.

Required Maintenance: Catch basins must be inspected annually and after major storm events for evidence of trash or debris accumulation, sediment build-up, contamination, structure damage, and vegetation growth. A complete list of items to be inspected is included at the end

of this manual. This list, which is provided in the Tacoma SWM Manual, also includes standard maintenance practices that are required based on the inspection results.

3.2 Wetvault

Description: A wetvault is an underground structure designed to have a permanent pool of water (wetpool) which dissipates energy and improves the settling of particulate pollutants.

Required Maintenance: The wetvault must be inspected annually and after major storm events for evidence of trash or debris accumulation, sediment build-up, contamination, structure damage, and ventilation problems. A complete list of items to be inspected is included at the end of this manual. This list, which is provided in the Tacoma SWM Manual, also includes standard maintenance practices that are required based on the inspection results. .

3.3 Catch Basin Inserts

Description: Catch basin inserts are a form of storm drain inlet protection, used to prevent coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area. They will only be used while the site is under construction, and removed after all exposed soils are stabilized.

Required Maintenance: Catch basin inserts must be inspected after major storm events for evidence of trash or debris accumulation, sediment build-up, and pollutant removal effectiveness. A complete list of items to be inspected is included at the end of this manual. This list, which is provided in the Tacoma SWM Manual, also includes standard maintenance practices that are required based on the inspection results.

3.4 Compost Amended Soil

Description: Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. These functions are largely lost when development strips away native soil and vegetation and replaces it with minimal topsoil and sod. Not only are these important stormwater functions lost, but such landscapes themselves become pollution generating pervious surfaces due to increased use of pesticides, fertilizers and other landscaping and household/industrial chemicals, the concentration of pet wastes, and pollutants that accompany roadside litter. Soil amendments are required for the disturbed areas of sites subject to Minimum Requirement #5 of the Tacoma SWM Manual.

Required Maintenance: Compost amended soil must be inspected annually and after major storm events for evidence of erosion/scouring, compaction, and vegetation growth. A complete list of items to be inspected is included at the end of this manual. This list, which is provided in the Tacoma SWM Manual, also includes standard maintenance practices that are required based on the inspection results.

3.5 Spill Catchment Basins

Description: The spill catchment basins immediately outside of the new Corrosion Control and Fluoridation Building each have two outlets, one leading into the chemical storage and containment areas inside the new building and one towards the new site stormwater drains. There is a valve on each outlet to control how collected liquids will be diverted. Each valve has

a position arrow on it to provide clear visual indication of whether the valve is open or closed. Each valve will also have signal contacts used to interlock its operation.

Operation: The valves and basins have two modes of operation: Normal and Chemical Delivery. The following text describes both modes of operation. This information will be included in the new facility's O&M manual.

Normal – The valves and basins will operate in this mode for the vast majority of the time.

1. The valve to the containment area is closed.
2. The valve to the stormwater drain is open.
3. Any stormwater conveyed into the catchment basins will be routed to the stormwater system.

Chemical Delivery – This mode of operation will occur whenever a chemical tanker truck pulls up to the Corrosion Control and Fluoridation Building to replenish the chemicals stored inside. A delivery would occur between once a week to once a month during times the facility is operating and last for approximately one hour.

1. When a delivery truck is scheduled to arrive, the Tacoma Water mechanic will manually open the valve leading to the containment area.
2. Then the mechanic will manually close the valve to the stormwater system.
3. When the truck arrives, the driver will park over the containment area and hook up the transfer hoses to the building.
4. The driver will then transfer chemicals from the delivery truck into the indoor storage tanks.
    a. Any spills that might occur will enter the catch basin and flow to the indoor containment area.
5. When the chemical delivery is complete, the driver will unhook the hoses and drive away.
6. The Tacoma Water mechanic will visually inspect the basin for liquids.
    a. If a liquid is detected, the mechanic will test the pH of the liquid using a pH test strip. A portable Hach pH meter may be used to verify readings.
    b. Any liquid discharged to the City's stormwater system must be within a pH range of 6.5 to 9.0 (WAC 173-201A). If the pH is high (indicating caustic soda) or low (indicating fluorosilicic acid), then the mechanic will conduct a chemical clean-up procedure.
    c. For caustic soda, some spills may be neutralized using vinegar (< 1-gallon spills) or muriatic acid (> 1-gallon spills). Larger caustic soda spills and all fluorosilicic acid spills will be removed by vactor truck and disposed of as hazardous materials.
    d. If no liquids are detected, the liquid pH is neutral and most likely is stormwater, or after a chemical clean-up procedure is completed, the mechanic will manually close the valve to the containment area and then manually open the valve leading to the stormwater system.

There is an automated shut-off valve between the exterior hose connection and the chemical tanks. The valve is normally closed. Step 4 (chemical transfer) can not proceed unless that valve is open. The valve only automatically opens when all five of the following conditions are met:

1. There are no liquids detected in the containment area of either chemical storage room.
2. The liquid levels within the chemical tanks are below the high level alarm.
3. The exterior safety eyewash and shower is operational.
4. The catchment basin valve leading to the stormwater system is closed (as recognized by the signal contacts inside the valve).
5. The catchment basin valve leading to the chemical containment area is open (as recognized by the signal contacts inside the valve).

Failure of any single condition will prevent or stop the chemical delivery from occurring. Conditions 4 and 5 are to ensure that any spilled chemical does not reach the stormwater system.

Maintenance: The valves and catchment basins are inspected before and after each use. In addition, the valves and catchment basin will be part of the facility's overall annual inspection and maintenance program.

3.6 Containment Sump Pumps

Description: The containment sump pumps are provided primarily to discharge washdown water from the chemical rooms or groundwater from the underground vaults; the water is not anticipated to contain any chemical. The sump pumps will be operated manually and do not have any floats or level contacts to trigger an automatic start.

Operation: The Tacoma Water mechanic will operate the sump pumps in the following manner:

1. The sump contains high- and low-level contacts.
2. The sensor triggers a visual and audible alarm as well as sends a signal to the Tacoma Water Control Center at Tacoma Public Utilities.
3. The Tacoma Water mechanic will inspect the sump for liquids when the high-level sensor is activated.
    a. If a liquid is detected, the mechanic will test the pH of the liquid using a pH test strip. A portable Hach pH meter may be used to verify readings.
    b. The mechanic will call the Tacoma Water Control Center regarding the liquid.
    c. Any liquid discharged to the City's sanitary sewer system must be within a pH range of 5.5 to 11.0 (TMC Chapter 12.08). If the pH is high (indicating caustic soda) or low (indicating fluorosilicic acid), then the mechanic will report a chemical spill and conduct a chemical clean-up procedure.
    d. For caustic soda, some spills may be neutralized using vinegar (< 1-gallon spills) or muriatic acid (> 1-gallon spills). Larger caustic soda spills and all fluorosilicic acid spills will be removed by vactor truck and disposed of as hazardous materials.
    e. After confirmation of neutral pH, the mechanic will notify the Tacoma Water Control Center and turn on the sump pump to discharge the contents to the sanitary sewer.
    f. The sump pump will turn off when the low-level contact is closed.

g. Tacoma Water mechanic completes monitoring log documenting the discharge. (the attached Table 1 is an example of the log used).

By implementing this procedure, use of the sump pumps is a conscious decision made after the liquid is checked for appropriateness for sanitary sewer discharge. The majority of the water that will be detected in the sump is drinking water used to wash down and clean the chemical rooms or groundwater entering the Injection and Mixing Vault.

Maintenance: The sump pumps are inspected before and after each use. In addition, they will be part of the facility's overall annual inspection and maintenance program. Table 2 is an example log to document the Tacoma Water's inspections and any maintenance conducted on the sump pumps.

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Table 1. Example Discharge Monitoring Log

Date	Room/ Location	Type of Liquid (water, caustic soda, FSA, other)	Estimated Volume (gallons)	Tested pH	Neutralization?	Final pH	Comments?	Employee

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Table 2. Example Maintenance Log

Date	Inspector	Stormwater Facility	Maintenance Required (Y/N)	Comments

APPENDIX E

GEOTECHNICAL REPORT

Geotechnical Report
South Tacoma Wellfield Groundwater
Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

May 17, 2011

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Excellence. Innovation. Service. Value.

Since 1954.

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SOUTH TACOMA WELLFIELD GROUNDWATER TREATMENT FACILITIES
HOOD STREET RESERVOIR
TACOMA, WASHINGTON

1.0 INTRODUCTION

This report presents the results of subsurface explorations and geotechnical engineering studies performed for the proposed Hood Street Reservoir (HSR) improvements in Tacoma, Washington. Our geotechnical studies included evaluating the subsurface conditions and formulating geotechnical engineering recommendations for use in the design and construction of the proposed project.

Our geotechnical scope of services included:

- Observing excavation of three test pits;
- Performing geotechnical laboratory testing;
- Conducting engineering analyses; and
- Preparing this geotechnical report.

We prepared a preliminary geotechnical review of the proposed structures in 2009. During our review, we performed a geologic reconnaissance at the project site. We presented the results of our reconnaissance and review in a letter dated May 22, 2009. We have incorporated our previous findings into this report.

We provided our services in general accordance with our proposal as authorized by Mr. David A. Peters on February 11, 2011.

2.0 SITE AND PROJECT DESCRIPTION

The HSR is located near downtown Tacoma, west of South Thompson Avenue and between South Tacoma Way and Interstate 5 (Figure 1). The site is occupied by a 10-million-gallon, 325-foot-diameter, concrete, covered reservoir, a treatment building, and a hydropower plant. The base of the reservoir is about 15 feet below the existing ground surface (bgs). The reservoir was constructed in 1987, replacing a smaller irregularly shaped, open, concrete-lined pond that was about 15 feet deep.

The reservoir, treatment building, and hydropower plant are located on a level bench. A gravel-surfaced road rings the reservoir and the space north of the buildings.

The ground surface on the southern side of the structures slopes up to the south (Southern Slope), and the ground surface to the north of the structures slopes down to the north (Northern Slope). The angle of the Southern Slope ranges from 25 to 35 degrees; the Northern Slope ranges from 35 to 45 degrees. The slopes are vegetated with low brush and trees.

The proposed project includes the following:

- A corrosion control and fluoridation building, about 17 feet tall, with an 80- by 20-foot footprint, and a total foundation dead load of about 1,000 kips;
- A chemical mixing/injection vault, about 20 feet deep and 9 feet in diameter;
- A flow meter vault, about 15 feet deep and 6 feet in diameter;
- Gravel surfacing near the proposed structures,
- Relocating the access road to the south of the proposed corrosion control and fluoridation building; and
- New gravity and force main steel and concrete pipelines.

Figure 2 shows the existing and proposed structure locations. Our scope of services did not include providing recommendations for gravel surfacing or relocating the access road.

3.0 SUBSURFACE EXPLORATIONS

To evaluate the subsurface conditions at the locations of the proposed structures, we observed excavation of three test pits. Tacoma Water excavated each test pit to depths of 10 to 13 feet. Test pits TP-1 and TP-2 were excavated to locate existing pipelines at the project site. Because these test pits were excavated in utility locations, the fill depth may not be representative of the fill depth across the site.

Figure 2 shows the approximate locations of the test pits. We estimated the test pit locations by measuring from existing site features and transposing from existing site plans. The test pit locations and elevations should be considered approximate.

Appendix A, Subsurface Explorations, describes the methodology and procedures used for locating, excavating, and sampling the test pits. Figures A-2 through A-4 in Appendix A show the test pit logs.

4.0 GEOTECHNICAL LABORATORY TESTING

We performed geotechnical laboratory tests on selected samples retrieved from the test pits and used these tests to characterize soil index properties. We used the index properties to estimate the soil engineering properties. The soil tests included visual classification, natural water content, and mechanical sieve analysis. The Shannon & Wilson soils laboratory conducted the tests. Appendix B, Geotechnical Laboratory Testing Procedures and Results, describes the test methods and summarizes the test results.

5.0 GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Regional Geology

The project is located in the central portion of the Puget Lowland, an elongated, north-south depression situated between the Olympic Mountains and the Cascade Range. Repeated glaciation in this region strongly influenced the present-day topography, geology, and groundwater conditions in the project area.

Geologists generally agree that the Puget Sound area was subjected to six or more major glacial events, five of which may have overridden the Tacoma area. Glacial ice for these glaciations originated in the Coast Range and Canadian Rockies and generally flowed southward into the Puget Lowland. Each glaciation deposited new sediment and partially eroded previous sediments. During the intervening periods when glacial ice was not present, normal stream processes, wave action, and landsliding eroded and reworked some of the glacially derived sediment, further complicating the geologic setting. In the project area, the glacial and interglacial deposits (nonglacial soils deposited in between glacial events) are estimated to be thicker than 1,600 feet (Buchanan-Banks and Collins, 1994).

During the most recent glaciation that covered the central Puget Lowland (termed Vashon), glacial ice is estimated to have been about 2,300 feet thick in the project area (Thorson, 1989). As the ice proceeded southward, meltwater streams deposited sand and gravel (advance outwash). The weight of the glacial ice resulted in compaction (overconsolidation) of the glacial and nonglacial soils. Subglacial meltwater streams eroded into overconsolidated soil, forming north-trending valleys.

As the Vashon glacier receded north, meltwater issued from the glacier, depositing recessional glacial sediment in valleys. The recessional glacial deposits are overlain by younger (Holocene Epoch), relatively loose and soft, post-glacial soils.

Tectonically, the Puget Lowland is located in the forearc of the Cascadia Subduction Zone. The tectonics and seismicity of the region are the result of the relative northeastward subduction of the Juan de Fuca Plate beneath the North American Plate. North-south compression is being accommodated primarily beneath the Puget Lowland by a series of west and northwest-trending thrust faults that extend to depths of about 12 miles. The nearest active fault to the project is the Tacoma Fault, a collective term for a series of several east-trending, north-dipping fault splays beneath Tacoma. The nearest fault splay may extend through Commencement Bay and the Puyallup River, about 2 miles from the project site. Geologic evidence indicates that Holocene movement occurred on this fault zone.

5.2 Soil

The test pits exposed fill placed during reservoir construction. The fill comprised loose to medium dense, slightly silty to silty, sandy gravel/gravelly sand. The composition of the fill is similar to Vashon advance outwash; however, the fill is less dense than advance outwash and contains organic material and woody debris. TP-1 and TP-2 encountered fill to the bottom of the excavations, about 10 to 13 feet bgs. TP-3 encountered fill to a depth of about 9 feet bgs.

About 9 feet bgs, test pit TP-3 exposed dense to very dense, slightly silty to silty, gravelly sand, which is likely Vashon advance outwash. The advance outwash extended to the bottom of test pit TP-3, about 13 feet bgs.

About 7 feet bgs, test pit TP-2 exposed very dense sandy gravel (Vashon advance outwash) in the sidewall of the excavation. The advance outwash was likely excavated to install the utilities observed in TP-2.

5.3 Groundwater

We did not observe groundwater during the test pit excavations. However, groundwater may be present below the test pit excavation depth (about 13 feet).

6.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

The following sections present our geotechnical engineering recommendations for design and construction of the proposed structures. We based our engineering recommendations on our understanding of the proposed structures, and on the results of field explorations and laboratory testing.

6.1 Seismic Design Considerations

6.1.1 Ground Motions

The project is located in a moderately active seismic region. For design, IBC (2009) considers an earthquake with a 2 percent probability of exceedance in 50 years, or about a 2,500-year return period (with a deterministic maximum cap in some regions). To characterize the design ground motion, IBC (2009) considers two spectral response acceleration (SRA) values:

- Short-period spectral acceleration (0.2-second period), S_S; and
- Spectral acceleration at the 1-second period, S_1.

For our geotechnical engineering analyses, we also considered the peak ground acceleration (PGA) of the maximum considered earthquake. The U.S. Geological Survey and Frankel and others (2002) have conducted regional probabilistic ground motion studies to estimate the bedrock SRA values in the project area. Figure 3 presents the mapped bedrock SRA values.

IBC (2009) also considers the effect of local soil conditions on the design SRA values. To account for site amplification/damping effects, we scale the bedrock SRA values by site soil response factors. The site classification determines the site soil response factors. Based on the subsurface conditions encountered in the test pits, we recommend using a Site Class D to characterize the site subsurface conditions. Figure 3 presents the Site Class D design response spectrum for the project site.

6.1.2 Earthquake-induced Geologic Hazards

Earthquake-induced geologic hazards that may affect any given site include slope instability, fault rupture, liquefaction, and liquefaction-associated effects (such as settlement, loss of shear strength, bearing capacity failures, loss of lateral support, ground oscillation, and lateral spreading).

6.1.2.1 Slope Instability

The project site is located on a bench in a relatively steep slope. A seismic event could cause the relatively loose soil on the slope surface to slide. We recommend locating the proposed structures away from the top of the slope on the north side of the project site to reduce the potential for impacts from slope instability. Section 6.5 provides additional details.

6.1.2.2 Fault Rupture

While the site is located within the Tacoma Fault zone, the actual risk posed by ground rupture is relatively small. The return period for large earthquakes on the fault that may rupture the ground surface is on the order of thousands of years. The probability that a given rupture would occur at the ground surface of the project site is also very small. Therefore, the joint probability of ground surface rupture during a Tacoma Fault Zone earthquake is remote.

6.1.2.3 Liquefaction

Because groundwater was not encountered in the site explorations, and because of the relatively dense nature of the site soil below the fill, the risk of liquefaction and liquefaction-associated effects at the project site is low.

6.2 Foundation Recommendations

We recommend using spread footings to support the proposed structures. Spread footings should:

- Bear in compacted structural fill;
- Be designed for an allowable soil bearing pressure of 3,000 pounds per square foot (psf);
- Have a minimum width of 18 inches; and
- Bear at least 24 inches below the lowest adjacent final grade;

Because the existing fill at the project site is relatively loose, we recommend overexcavating 2 feet below the footing depth and replacing the soil with compacted structural fill.

The difference in elevation between adjoining footings should not be greater than one-half the clear distance between footings. Where adjoining continuous footings are at different elevations, the upper footing should be stepped down to the lower footing.

Our recommendations assume that the footing subgrades are prepared according to our recommendations in Sections 7.1 and 7.6.

For the above soil types and bearing pressures, we estimate that:

- The total settlement of the footings would be about ½ to 1½ inches.

- Differential settlement between adjacent footings, or over the span of a continuous footing, would be about ¼ to 1 inch.
- Most settlement would take place simultaneously with loading.

6.3 Lateral Earth Pressures

The lateral pressures against buried structures depend on many factors, including:

- Method of backfill placement;
- Degree of compaction;
- Backfill slope;
- Surcharge loads;
- Type of backfill soil and/or adjacent native soil;
- Drainage provisions; and
- Whether the wall can yield laterally during or after backfill placement.

We provide the following recommendations for lateral earth pressures:

- If the wall will be allowed to deflect laterally or rotate 0.001 times the wall height, it should be designed using an active lateral earth pressure equivalent to a fluid unit weight of 35 pounds per cubic foot (pcf).
- If the wall will be restrained from deflecting laterally or rotating 0.001 times the wall height, it should be designed using an at-rest lateral earth pressure equivalent to a fluid unit weight of 55 pcf.
- The walls should be analyzed for seismic loading conditions using a uniformly distributed pressure increase of 5 psf per foot of wall height (added to static loading).

These pressures assume that:

- The slope behind the walls is level.
- The backfill behind the walls is placed and compacted in accordance with our recommendations in Figure 5 and Section 7.2.
- The backfill behind the structures is well drained.

We used the Mononobe-Okabe equation to estimate the seismic lateral load increment. We used a horizontal seismic coefficient of 0.16 gravity (g), which is about one-half of the soil PGA value. The magnitude of this coefficient accounts for the fact that the PGA occurs only a few times within the record of earthquake shaking and that the actual earthquake ground motion is cyclic in nature, as opposed to a static force.

The walls should also be designed for surcharge loads acting behind the walls. Figure 4 presents recommendations for surcharge loads that could be applied to the walls. These surcharges should be added to the lateral earth pressures described above.

Backfill should not be placed behind walls until the walls are capable of supporting lateral loads.

6.4 Lateral Resistance

Lateral resistance for the proposed structures would be provided by passive pressure against the embedded portion of the foundations and by friction along their bases. We provide the following recommendations for lateral resistance:

- Use a passive earth pressure corresponding to an equivalent fluid unit weight of 300 pcf, which includes a strain-compatibility factor of safety (FS) of 1.5.
- Neglect passive pressure in the upper 2 feet and to depths where soil could be removed.
- Use a coefficient of friction of 0.27 (includes an FS of 1.5) between cast-in-place concrete and compacted structural fill/compacted native soil.

Our recommendations assume that:

- Groundwater is below the structures and drainage is provided as shown in Figure 5.
- The backfill around the structure is compacted in accordance with the recommendations for structural fill outlined in Section 7.2.

6.5 Slope Stability

During our 2009 geologic reconnaissance, we did not observe signs of instability on the Southern Slope. However, we did observe signs of instability on the Northern Slope.

In our geotechnical review letter dated May 22, 2009, we provided the following observations about the Northern Slope:

- About 60 feet north of the fence line, a bowl-shaped landslide scar is about 30 feet wide. The upper edge of the scar is at the fence line.
- The slope has numerous areas of small erosional gullies and surficial landslide scars.
- Many of the trees on the slope are leaning outward, which indicates active creep of the upper few feet of soil.

- For much of the roadway along the upper edge of the slope, the outer 1 to 3 feet of the crushed rock surface has settled slightly, likely due to slope movement.

In our opinion, the Northern Slope will continue to erode and experience shallow surface sliding. Based on our experience with similar slopes in the Puget Sound Region, the slope will trend toward an angle of about 1.5 horizontal to 1 vertical (1.5H:1V). The proposed structures should be located behind this area of potential erosion and sliding.

6.6 Floor Slabs

The base of the structures may be constructed as slabs-on-grade bearing on compacted structural fill or compacted native soil. Structural fill should be compacted according to our recommendations in Section 7.2 and the slab subgrade should be prepared according to our recommendations in Section 7.1. We recommend using a vertical modulus of subgrade reaction of 120 pounds per cubic inch in the design of the floor slab-on-grade.

As a capillary break, we recommend placing a minimum of 6 inches of washed pea gravel (⅜ inch to No. 8 sieve size) or washed, uniformly graded, clean, crushed rock (less than 2 percent passing the No. 200 sieve and a maximum particle size of ½ inch) beneath the floor slab. If pea gravel is used, a 3-inch-thick layer of washed, clean, crushed rock can be placed over a 3-inch minimum layer of washed pea gravel to provide a more firm working surface on which to place the slab reinforcement. Pea gravel or crushed rock should be compacted with at least three complete passes of a vibrating plate compactor.

Figure 5 shows a typical floor slab detail.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Site Preparation and Grading

We recommend the following steps for preparing the footprints of the proposed structures:

- Clear trees and brush;
- Remove roots, stumps, concrete, asphalt, and other debris;
- Strip topsoil and expose inorganic soil (typically about 2 feet deep);
- Excavate to the desired grades;
- Proof roll the exposed subgrade surface and compact as needed to achieve a dense and unyielding condition; and

- Overexcavate 2 feet below footings or to dense advance outwash and backfill with compacted structural fill.

Areas that are wet, soft, loose, or yielding under the proof rolling/compaction process should be further compacted, removed and reconditioned, or replaced with compacted structural fill so that a dense and unyielding condition is achieved.

We note that test pits were excavated and loosely backfilled at the site. If structures will bear on areas excavated for test pits, the test pit fill should be re-excavated and compacted to a dense, unyielding condition.

We recommend that a qualified geotechnical engineer or the engineer's representative be on-site to evaluate the exposed subgrade during site preparation and grading.

7.2 Fill Placement, Compaction, and Use of On-site Soil

All fill soil placed beneath or adjacent to the proposed structures should be structural fill. Structural fill soil should:

- Consist of a well-graded mixture of sand and gravel;
- Be free of organics and debris;
- Have a moisture content within ±2 percent of its optimum;
- Have a gravel content between 25 and 50 percent retained on a No. 4 sieve; and
- Have a maximum particle size of 3 inches.

Structural fill placed behind/within walls should have less than 5 percent fines (material passing the No. 200 mesh sieve, based on the minus ¾ inch fraction). Other imported structural fill should contain less than 15 percent fines. All fines should be nonplastic. Examples of suitable fill soil gradations from the Washington State Department of Transportation (WSDOT) and American Public Works Association (APWA) Standard Specifications (WSDOT/APWA, 2010) include Gravel Backfill for Walls, Section 9.03-12(2), for walls; and Gravel Borrow, Section 9-03.14(1), for other areas.

Based on the results of our grain size analyses (Appendix B), the existing site soil is generally slightly silty, gravelly sand. In our opinion, the existing site soil could be reused as structural fill, provided that:

- Organic material and other deleterious debris is removed from the soil;
- The soil is moisture-conditioned as necessary to within ±2 percent of its optimum water content; and

- Particles greater than 3 inches in diameter are removed from the soil.

Existing site soil should not be used as structural fill behind walls.

Before placing structural fill, we recommend draining ponded water from the area. We recommend placing structural fill in uniform lifts and compacting the fill to a dense and unyielding condition, at least 95 percent of the Modified Proctor maximum dry density (ASTM International D 1557). We recommend that a qualified geotechnical engineer or the engineer's representative be on site to observe structural fill placement and compaction.

Hand-operated mechanical compactors should be used within 3 feet of wall faces; heavy equipment compactors should not be used near walls. Lift thickness should not exceed 12 inches for heavy equipment compactors or 6 inches for hand-operated mechanical compactors.

7.3 Excavations and Temporary Shoring

Unshored, temporary excavation slopes may be used where planned excavation limits will not undermine existing structures, interfere with other construction, or extend beyond construction limits. Where there is not enough area for sloped excavations, temporary shoring should be provided. If temporary shoring is required, we recommend that it be designed to withstand the lateral earth pressures provided in Section 6.3.

We anticipate that temporary shoring may be for the chemical mixing/injection vault and the flow meter vault excavations. A possible temporary shoring method could involve placing a large-diameter steel casing into the ground, then excavating inside. Sheet piles could also be used for temporary shoring. However, because of the dense, granular nature of the advance outwash soil, sheet piles could have difficulty achieving adequate penetration to resist lateral earth pressures.

The suitable temporary soil excavation slopes will depend on factors such as:

- The presence and abundance of groundwater;
- The type and density of the soil;
- The depth of excavation;
- Surcharge loading adjacent to the excavation, such as that from excavated material or construction equipment; and
- The duration of construction.

For planning purposes, we recommend assuming that temporary slopes could be excavated at 1.5H:1V in the existing soil above the water table. The slopes may be subject to erosion. We recommend protecting the slope against erosion during construction.

Consistent with conventional construction practice, the Contractor should be responsible for temporary excavation slopes. The Contractor is continually at the site, is able to observe the nature and conditions of the subsurface materials encountered, including groundwater, and is responsible for the methods, sequence, and schedule of construction. Flatter cut slopes or temporary shoring could be required where loose soil or seepage is encountered, or if instability is observed. Regardless of the construction method used, all excavation work should be accomplished in compliance with applicable local, state, and federal safety codes.

7.4 Dewatering

The test pit excavations reached depths of up to 13 feet without encountering groundwater. The excavations for the proposed structures will likely extend as deep as 20 feet and could encounter groundwater. If the excavations encounter groundwater, dewatering will be required.

We recommend dewatering as necessary so that construction, including excavation, form work, concrete placement, and backfilling, can be done in the dry. We recommend maintaining groundwater levels at least 2 feet below the level of the excavation to provide suitable working conditions and prevent possible blowout and/or heaving conditions. Construction dewatering would be required if groundwater seepage up through the bottom of the excavation is anticipated or observed during construction. Construction dewatering could include the use of sumps, well points, or dewatering wells. If limited groundwater seepage with low hydraulic head is encountered, coarse-grained fill material over the bottom of the excavation may be sufficient to protect the exposed soil.

The Contractor should be made responsible for controlling all surface and groundwater whenever encountered. If dewatering is necessary, the method of dewatering selected by the Contractor should be evaluated by a geotechnical engineer experienced in groundwater control.

Depending on the Contractor's proposed excavation means and methods, additional subsurface explorations may be required to appropriately design temporary shoring/dewatering systems.

7.5 Utilities

We recommend trenching and backfilling utilities in accordance with WSDOT/APWA Standard Specifications (2010). We anticipate that conventional equipment could excavate the trenches. Based on the soil observed in the test pits, we do not anticipate that groundwater will be encountered in the upper 10 feet of the soil profile. However, groundwater may be encountered below 10 feet.

If groundwater is encountered, construction equipment may disturb exposed soil. The Contractor should take precautions to prevent subgrade disturbance. If the subgrade becomes disturbed due to wet conditions, we recommend:

- Implementing dewatering as described in Section 7.4, and
- Excavating disturbed soil below the utility bedding level.

Backfill utility trenches with structural fill compacted as specified in Section 7.2. Heavy compaction equipment should not be allowed until sufficient cover is placed and compacted over the pipe. Pipe zone bedding should meet the soil gradation from WSDOT/APWA Standard Specifications (2010) Gravel Backfill for Pipe Zone Bedding, Section 9-03.12(3).

We recommend a minimum cover over utilities of 2 feet measured from the crown of the pipes or conduits to the pavement subgrade elevation. Catch basins, utility vaults, and other structures installed flush with the pavement should be designed and constructed to transfer wheel loads to the base of the structure, where applicable.

7.6 Wet Weather Earthwork

In the project area, wet weather generally begins about mid-October and continues through about May, although rainy periods could occur at any time of year. Therefore, we recommend scheduling earthwork during the dry weather months of June through September. The site soil could be difficult to compact if the moisture content significantly exceeds the optimum. Performing earthwork during dry weather would reduce these problems and costs associated with rainwater, erosion control, and handling of wet soil. However, should wet weather/wet condition earthwork be unavoidable, we recommend the following:

- The ground surface in and surrounding the construction area should be sloped as much as practical to promote precipitation runoff away from work areas and to prevent water from ponding.

- Work areas or slopes should be covered with plastic. The use of sloping, ditching, sumps, dewatering, and other measures should be employed as necessary to permit proper completion of the work.
- Earthwork should be accomplished in small sections to reduce exposure to wet conditions. That is, each section should be small enough that removal of unsuitable soils and placement and compaction of clean structural fill could be accomplished on the same day. The size of construction equipment may have to be limited to prevent soil disturbance. It may be necessary to excavate soils with a backhoe, or equivalent, located so that equipment does not pass over the excavated area. This would reduce subgrade disturbance caused by equipment traffic.
- No soil should be left uncompacted and exposed to moisture. A smooth-drum vibratory roller, or equivalent, should roll the surface to seal out as much water as practical.
- In-place soil or fill soil that becomes wet and unstable and/or too wet to suitably compact should be removed and replaced with structural fill.
- Excavation and placement of structural fill material should be observed on a full-time basis by a geotechnical engineer (or representative) experienced in wet weather/wet condition earthwork to determine that all work is being accomplished in accordance with the project specifications and our recommendations.
- Grading and earthwork should not be accomplished during periods of heavy, continuous rainfall.

We recommend that the above requirements for wet weather/wet condition earthwork be incorporated into the contract specifications.

8.0 ADDITIONAL SERVICES

We recommend that Shannon & Wilson be retained to review those portions of the plans and specifications pertaining to geotechnical aspects of construction to evaluate if they are consistent with our recommendations. We also recommend that we observe the geotechnical aspects of construction, which will allow us to verify the subsurface conditions as they are exposed during construction and to evaluate if the work is accomplished in accordance with our recommendations.

9.0 LIMITATIONS

This report was prepared for the exclusive use of Tacoma Water, HDR Engineering, Inc., and the project design team. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions such as those interpreted from

the exploration logs and presented in the discussions of subsurface conditions included in this report.

Within the limitations of the scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either expressed or implied.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist, and further assume that the explorations are representative of the subsurface conditions throughout the HSR project site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the explorations. Our conclusions and recommendations are based on our understanding of the project as described in this report and the site conditions as interpreted from the explorations.

If, during final design and construction, subsurface conditions different from those encountered in the field explorations are observed or appear to be present, we should be advised at once so that we could review these conditions and reconsider our recommendations where necessary. If there is substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed because of natural forces or construction operations at or adjacent to the site, we recommend that this report be reviewed to determine the applicability of the conclusions and recommendations concerning the changed conditions or the time lapse.

Unanticipated soil conditions are commonly encountered and cannot fully be determined merely by taking soil samples from a limited number of test pits. Such unexpected conditions frequently require that additional expenditures be made to attain properly constructed projects. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

The scope of our geotechnical services did not include any environmental assessment or evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air on or below the site, or any evaluation for disposal of contaminated soils or groundwater.

The scope of our geotechnical services did not include evaluating potential impacts to natural resources, including wetlands, endangered species, or environmentally critical areas. Shannon & Wilson has staff experienced in these issues should they arise.

Shannon & Wilson, Inc. has prepared Appendix C, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

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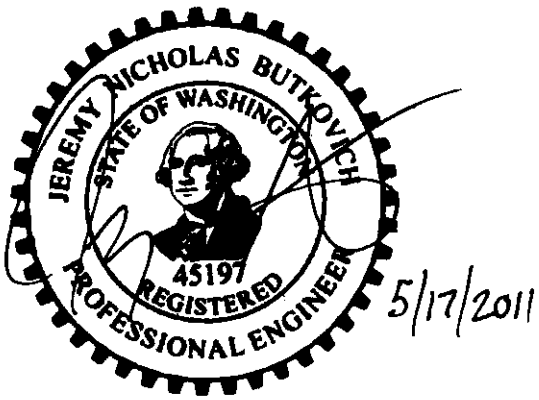


Jeremy N. Butkovich, P.E.
Principal Engineer

JNB:CWY:CAR:WTL/jnb

10.0 REFERENCES

ASTM International (ASTM), 2010, Annual book of standards, Construction, v. 4.08, Soil and rock (I): D 420 – D 4914: West Conshohocken, Pa.

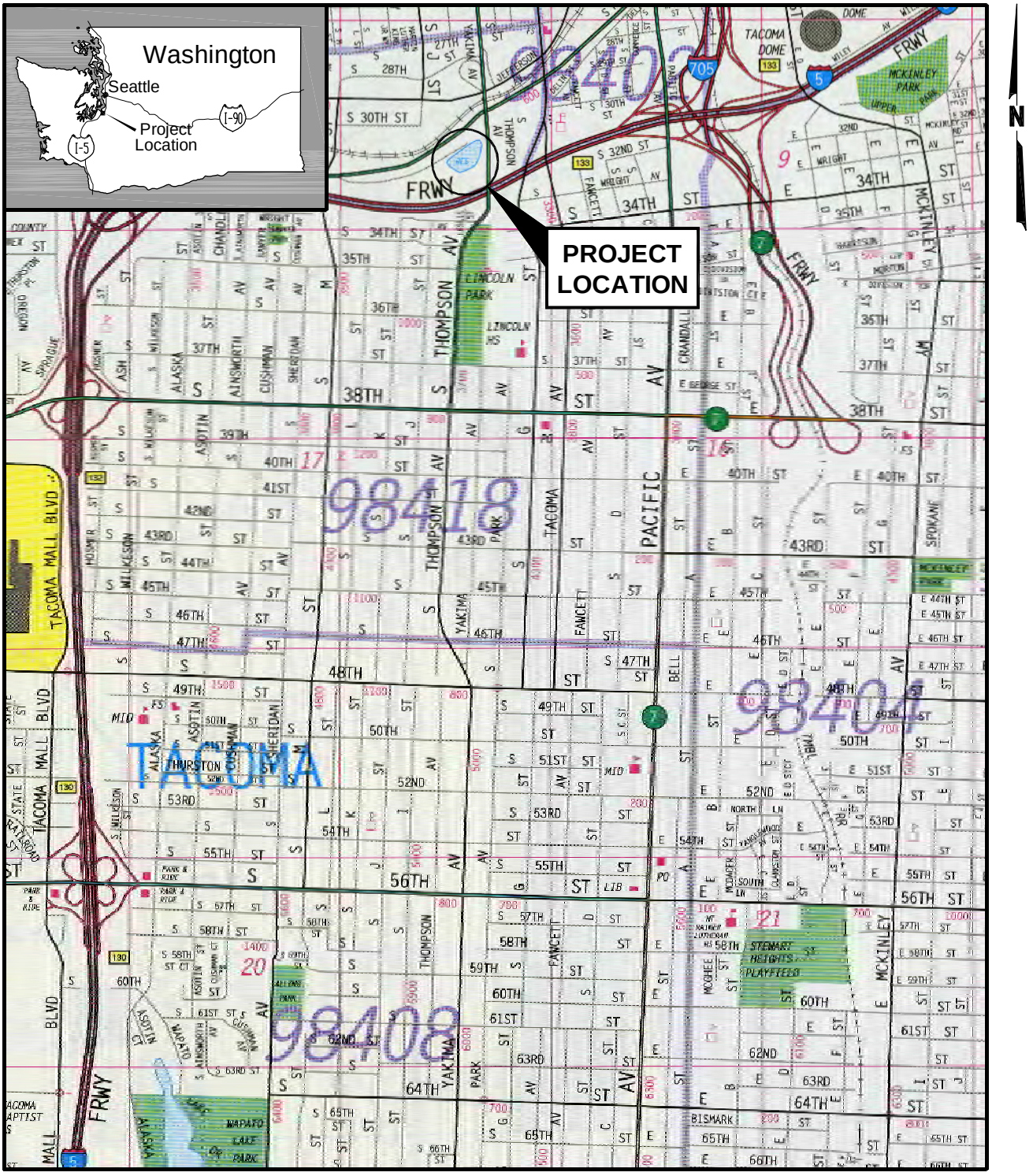
Buchanan-Banks, J.M. and Collins, D.S., 1994, Map Showing Depth to bedrock of the Tacoma and part of the Centralia 30' x 60' Quadrangles, Washington: USGS Misc Field Studies Map MF-2265, scale 1:100,000.

Frankel, A.D.; Petersen, M.D.; Mueller, C.S.; Haller, K.M.; Wheeler, R.L.; Leyendecker, E.V.; Wesson, R.L.; Harmsen, S.C.; Cramer, C.H.; Perkins, D.M.; and Rukstales, K.S., 2002, Documentation for the 2002 update of the national seismic hazard maps: USGS Open-File Report 02-420.

International Building Code, 2009, International Code Council, 2009.

Thorson, R.M., 1989, Glacio-isostatic response of the Puget Sound area, Washington: Geological Society of America Bulletin, v. 101, no. 9, p. 1163-1174.

Washington State Department of Transportation and American Public Works Association (WSDOT/APWA), 2010, Standard specifications for road, bridge, and municipal construction: English Units, M 41-10: Olympia, Wash.



0 1/4 1/2 1

Scale in Miles

NOTE

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

VICINITY MAP

May 2011 21-1-21473-001

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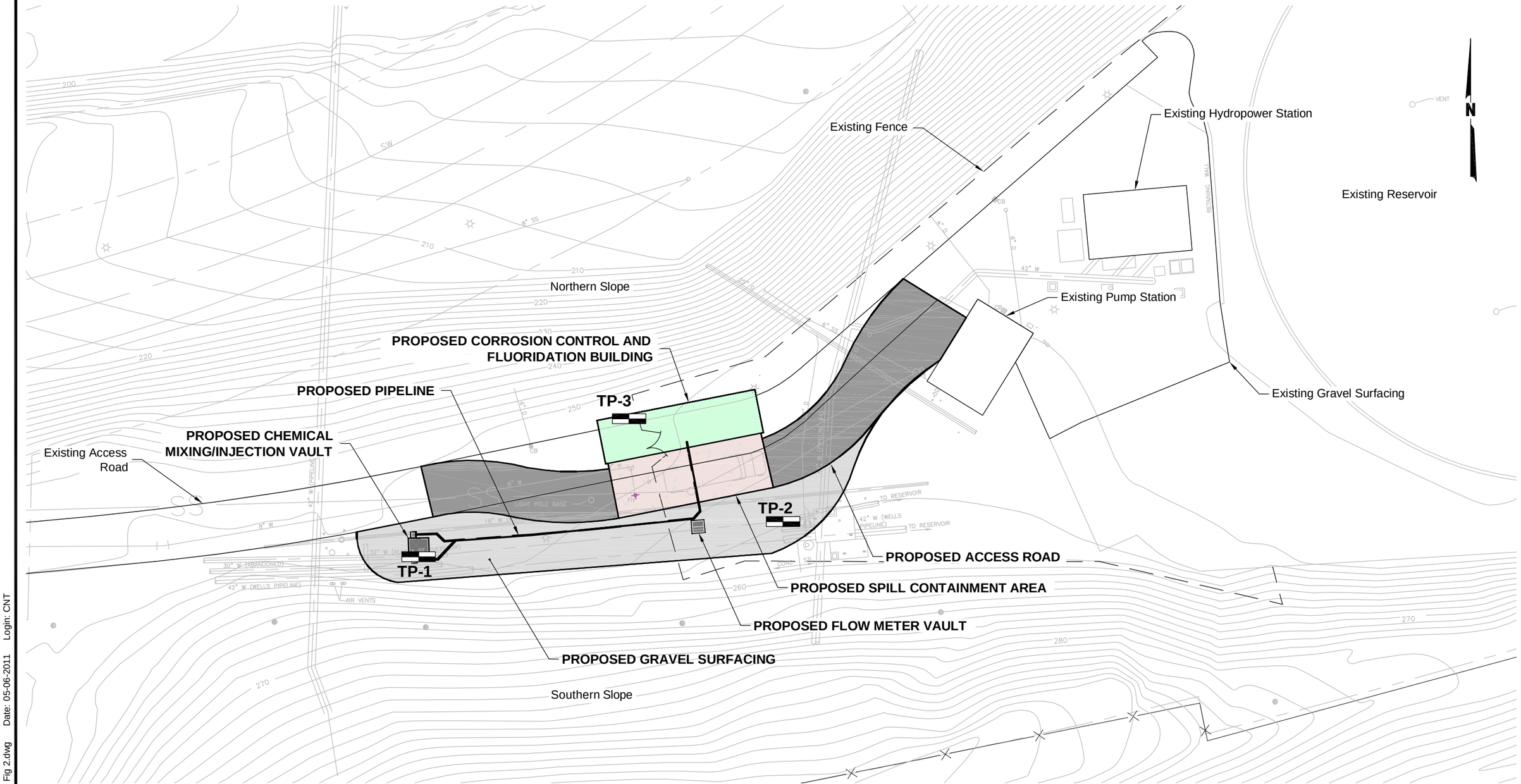
FIG. 1

Filename: J:\21\21473-001\21-1-21473-001 Fig 1.dwg Date: 05-02-2011 Login: lr



LEGEND

TP-1 Test Pit Designation and Approximate Location

NOTE

This figure was adapted from client file *00C-PP01-30.dwg* , received 04-19-2011.

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

SITE AND EXPLORATION PLAN

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FIG. 2

Filename: J:\21\21473-001\21-1-21473-001 Fig 2.dwg Date: 05-06-2011 Login: CNT

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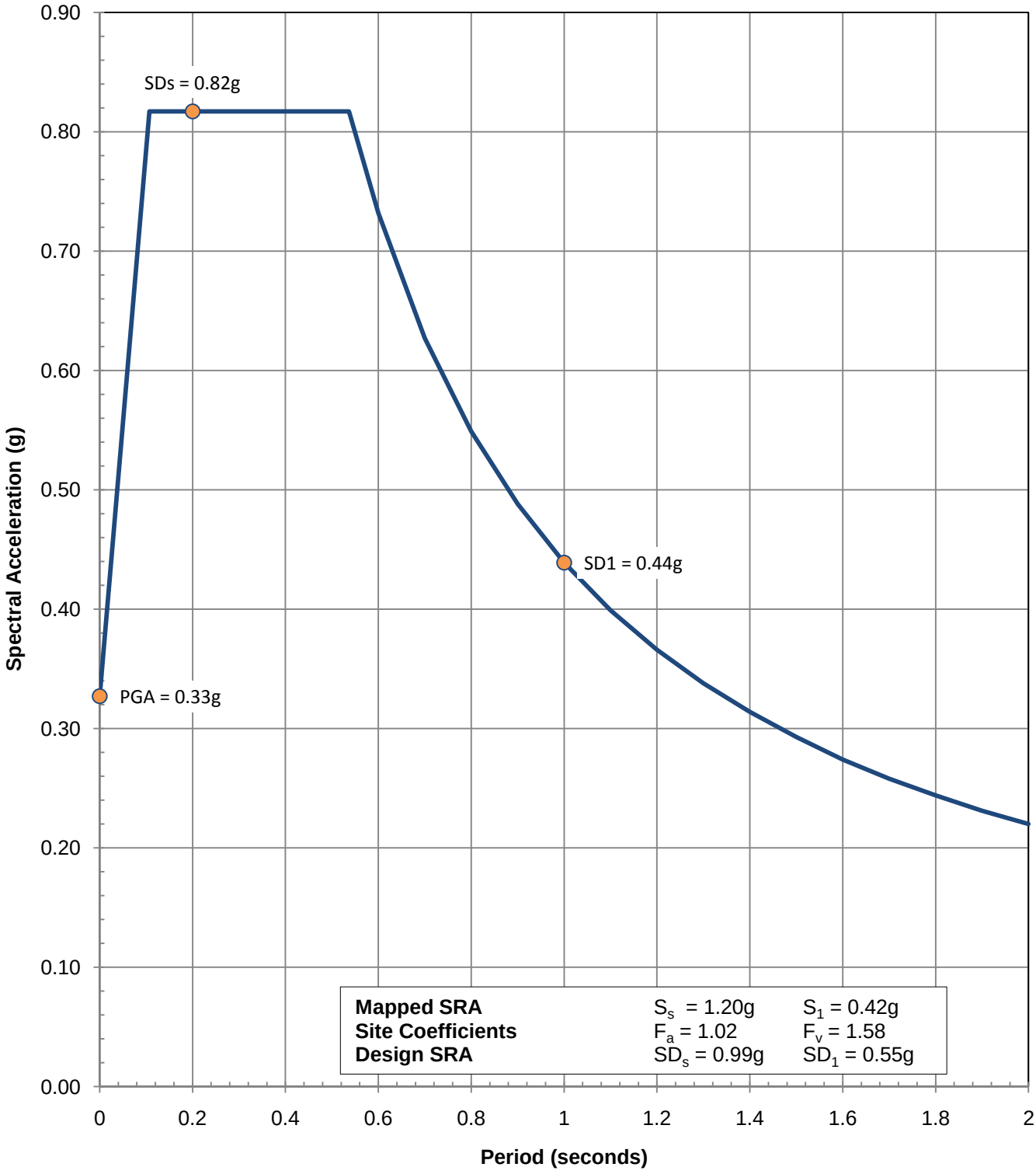

NOTES

1. The Mapped SRA values are based on regional probabilistic ground motion studies conducted by the U.S. Geological Survey and Frankel and others (2002).
2. The design seismic event corresponds to an earthquake with a 2 percent probability of exceedance in 50 years. Based on U.S. Geological Survey deaggregation information, the design earthquake has a 7.0 magnitude and is located about 34 miles from the project site.
3. g = acceleration due to gravity (about 32.2 feet per second per second)
   SRA = Spectral Response Acceleration

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

IBC (2009) DESIGN RESPONSE SPECTRUM
SITE CLASS D

May 2011 21-1-21473-001

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FIG. 3

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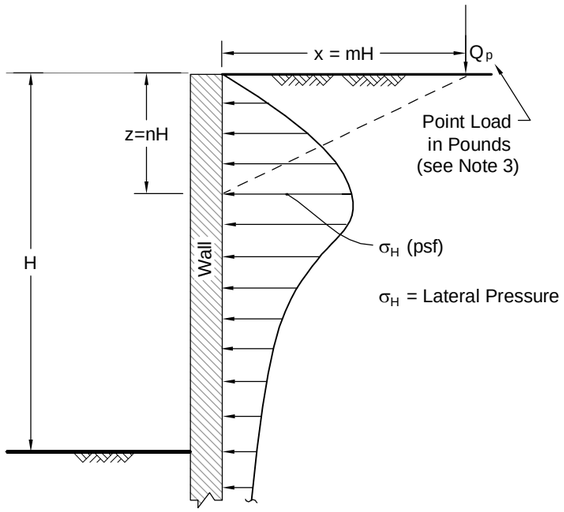
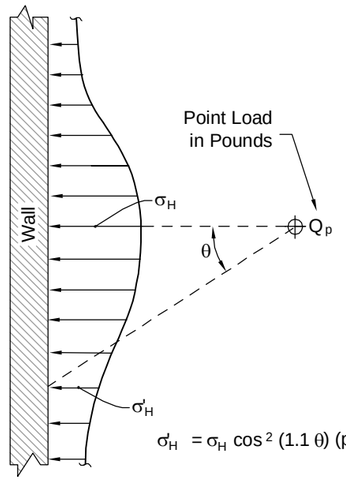


ELEVATION VIEW

For $m \le 0.4$: $\sigma_H = 0.28 \frac{Q_p}{H^2} \frac{n^2}{(0.16 + n^2)^3}$ (psf) (see Note 3)

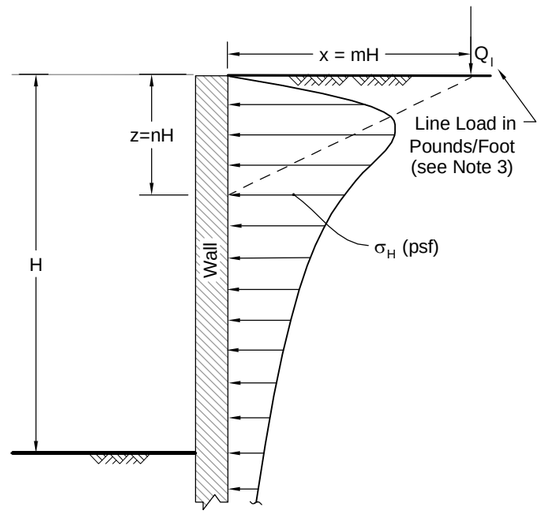
For $m > 0.4$: $\sigma_H = 1.77 \frac{Q_p}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3}$ (psf)



PLAN VIEW

A) LATERAL PRESSURE DUE TO POINT LOAD
i.e. SMALL ISOLATED FOOTING OR WHEEL LOAD

(NAVFAC DM 7.2, 1986)



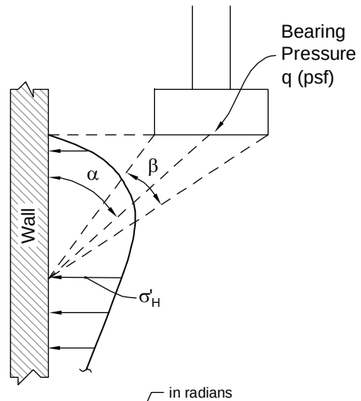
ELEVATION VIEW

For $m \le 0.4$: $\sigma_H = 0.20 \frac{Q_l}{H} \frac{n}{(0.16 + n^2)^2}$ (psf) (see Note 3)

For $m > 0.4$: $\sigma_H = 1.28 \frac{Q_l}{H} \frac{m^2 n}{(m^2 + n^2)^2}$ (psf)

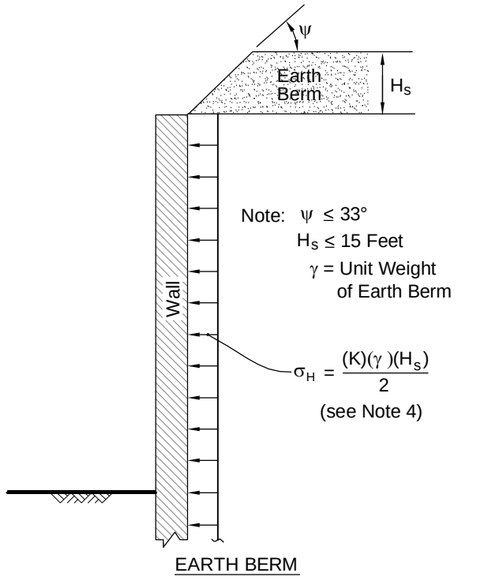
B) LATERAL PRESSURE DUE TO LINE LOAD
i.e. NARROW CONTINUOUS FOOTING
PARALLEL TO WALL

(NAVFAC DM 7.2, 1986)

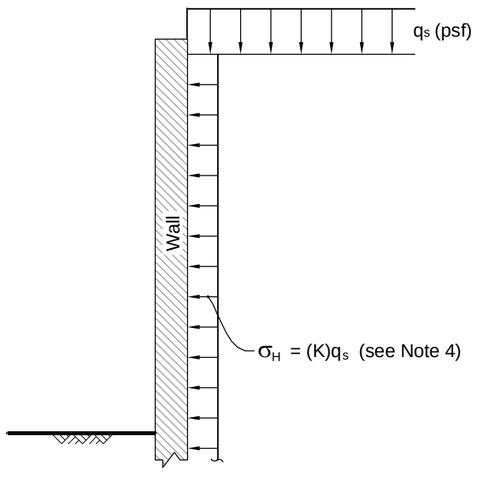


C) LATERAL PRESSURE DUE TO STRIP LOAD

(derived from Fang, *Foundation Engineering Handbook* , 1991)



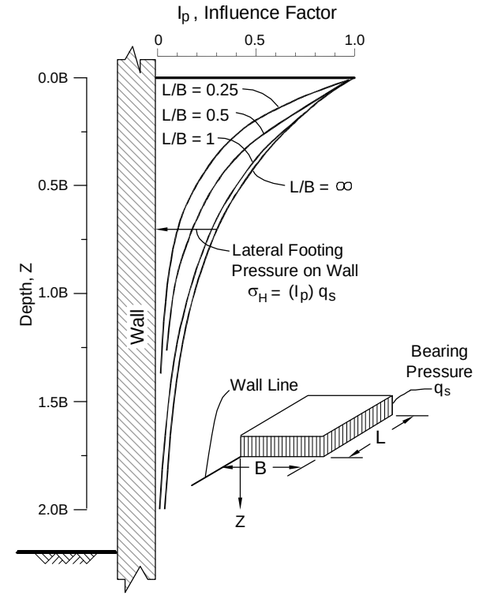
EARTH BERM



UNIFORM SURCHARGE

D) LATERAL PRESSURE DUE TO EARTH BERM
OR UNIFORM SURCHARGE

(derived from Poulos and Davis, *Elastic Solutions for Soil and Rock Mechanics* , 1974; and Terzaghi and Peck, *Soil Mechanics in Engineering Practice* , 1967)



E) LATERAL PRESSURE DUE
TO ADJACENT FOOTING

(derived from NAVFAC DM 7.2, 1986; and Sandhu, *Earth Pressure on Walls Due to Surcharge* , 1974)

NOTES

1. Figures are not drawn to scale.
2. Applicable surcharge pressures should be added to appropriate permanent wall lateral earth and water pressure.
3. If point or line loads are close to the back of the wall such that $m \le 0.4$, it may be more appropriate to model the actual load distribution (i.e., Detail E) or use more rigorous analysis methods.
4. Use a K value of K=0.5 for at-rest conditions, and K=0.3 for active conditions.
5. For areas where fill will be placed immediately behind and above the top elevation of the wall, Diagram D can be used to determine loads on the wall. For narrow fills adjacent to the wall, Diagram C can be used.

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

RECOMMENDED SURCHARGE LOADING FOR TEMPORARY AND PERMANENT WALLS

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FIG. 4

File: J:\21\21473-001\21-1-21473-001 Fig 4.dwg Date: 05-02-2011 Author: lr

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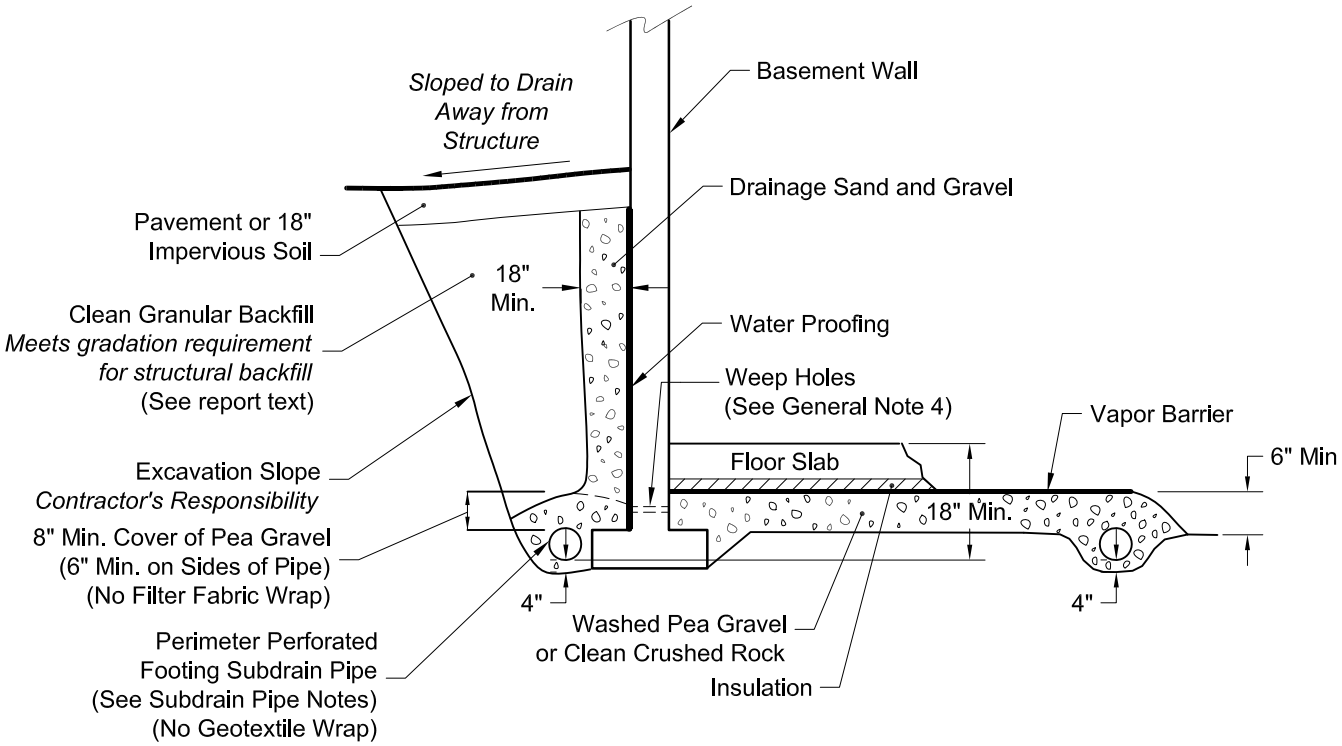

Not to Scale

MATERIALS

Drainage Sand & Gravel with one of the Following Specifications:

1. Mixture of 50% washed pea gravel and 50% washed concrete sand.
2. Sand backfill for sand drains (WSDOT 9-03.13).

GENERAL NOTES

1. See report text for recommendations on structural fill placement and compaction
2. Drainage gravel beneath floor slab should be hydraulically connected to subdrain pipe. Use of 2" diameter weep holes as shown is one applicable method.

SUBDRAIN PIPE NOTES

1. 6" minimum diameter perforated or slotted pipe; tight joints; sloped to drain (6"/100' min. slope).
2. Provide cleanouts.
3. Perforated pipe holes (3/16" to 3/8" dia.) to be in lower half of the pipe with lower quarter segment unperforated for water flow.
4. Slotted pipe to have 1/8" maximum width slots.
5. Pipe invert should be at least as low as the top of the footing.
6. No filter fabric wrap or sock.

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

TYPICAL WALL SUBDRAINAGE AND BACKFILLING

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FIG. 5

File: J:\211\21473-001\21-1-21473-001 Fig 5.dwg Date: 05-03-2011 Author: bac

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APPENDIX A

SUBSURFACE EXPLORATIONS

APPENDIX A

SUBSURFACE EXPLORATIONS

TABLE OF CONTENTS

FIGURES

APPENDIX A

SUBSURFACE EXPLORATIONS

A.1 GENERAL

The field exploration program for this project consisted of digging and sampling three test pits. The test pit logs are presented as Figures A-2 through A-4. Approximate locations of these test pits are shown in Figure 2 in the main text. We estimated the test pit locations by field measuring from existing site features. A soil classification and log key is presented in Figure A-1 as a reference for symbols and information presented on the test pit logs.

A.2 TEST PITS

City of Tacoma Water (CTW) excavated three test pits, designated TP-1 through TP-3, from February 14 to 16, 2011. Test pit TP-1 was excavated to a depth of approximately 10 feet, and test pits TP-2 and TP-3 were excavated to a depth of approximately 13 feet. The test pits were loosely backfilled by tamping the soil with the excavator bucket.

CTW excavated the test pits using their own crew and equipment. A representative from CTW was on site to mark and estimate the location of known utilities. CTW excavated test pits TP-1 and TP-2 using a John Deere 160LC excavator. We sampled and observed test pits TP-1 and TP-2 while CTW located existing utilities at the eastern and western portions of the site (2 active water lines, a retired water line, and a live power conduit). The CTW excavated test pit TP-3 using a John Deere 310SG excavator/front end loader. Test pit TP-3 was excavated near the northwest corner of the proposed corrosion control and fluoridation building.

A Shannon & Wilson field representative logged the exposed soils and collected soil samples. Selected soil samples from the tests pits were collected and analyzed in our Seattle, Washington laboratory for grain size analysis.

A.3 REFERENCE

ASTM International (ASTM), 2010, Annual book of standards, Construction, v. 04.08, Soil and rock (I): D 420 – D 5611: West Conshohocken, Pa.

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this page. Soil descriptions are based on visual-manual procedures (ASTM D 2488) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 40 percent, by weight, of the soil. Major consituents are capitalized (i.e., SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace of gravel).

GRAIN SIZE DEFINITION

DESCRIPTION	SIEVE NUMBER AND/OR SIZE
FINES	< #200 (0.8 mm)
SAND*	
- Fine	#200 to #40 (0.8 to 0.4 mm)
- Medium	#40 to #10 (0.4 to 2 mm)
- Coarse	#10 to #4 (2 to 5 mm)
GRAVEL*	
- Fine	#4 to 3/4 inch (5 to 19 mm)
- Coarse	3/4 to 3 inches (19 to 76 mm)
COBBLES	3 to 12 inches (76 to 305 mm)
BOULDERS	> 12 inches (305 mm)

** Unless otherwise noted, grain size varies from fine to coarse.*

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) (From USACE Tech Memo 3-357)

MAJOR DIVISIONS			GROUP SYMBOL	GRAPHIC SYMBOL	TYPICAL DESCRIPTION
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Clean Gravels *(less than 5% fines)*	GW		Well-graded gravels, gravels, gravel/sand mixtures, little or no fines
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines *(more than 12% fines)*	GC		Silty gravels, gravel-sand-silt mixtures
			GW		Clayey gravels, gravel-sand-clay mixtures
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Clean Sands *(less than 5% fines)*	SW		Well-graded sands, gravelly sands, little or no fines
			SP		Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines *(more than 12% fines)*	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Inorganic silts of low to medium plasticity, rock flour, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL		Inorganic clayss of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Organic	OL		Organic silts and organic silty clays of low plasticity
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Inorganic clays or medium to high plasticity, sandy fat clay, or gravelly fat clay
			CH		Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
		Organic	OH		Organic clays of medium to high plasticity, organic silts
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat, humus, swamp soils with high organic content (see ASTM D 4427)

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, slightly silty fine SAND)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, silty CLAY/clayey SILT; GW/SW, sandy GRAVEL/ gravelly SAND)* indicate that the soil may fall into one of two possible basic groups.

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

SOIL CLASSIFICATION AND LOG KEY

April 2011 21-1-21473-001

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FIG. A-1

Filename: J:\211\21473-001\21-1-21473-001 TPs.dwg Date: 05-05-2011 Login: KXW

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

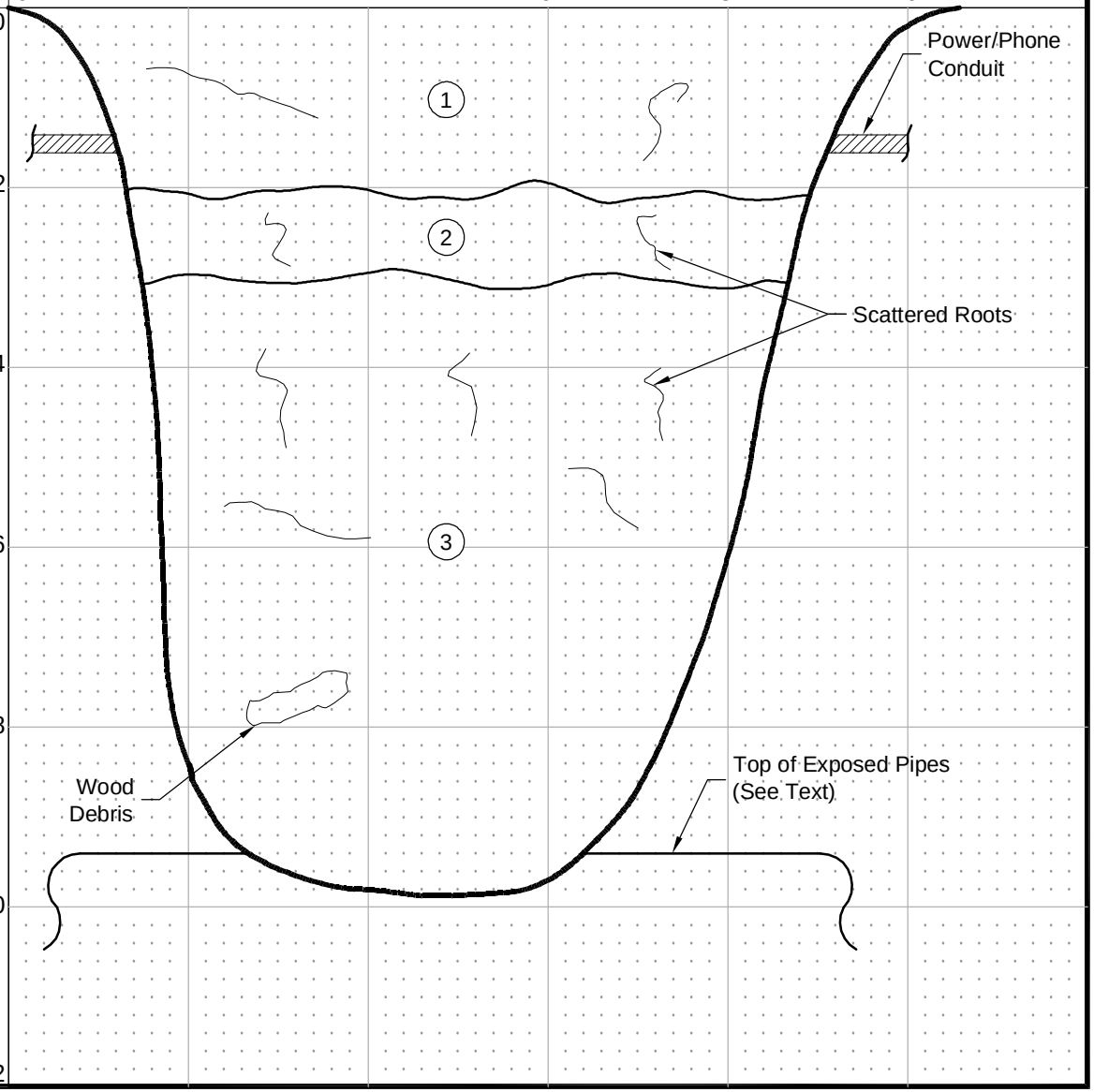
JOB NO: 21-1-21473-001 DATE: 2-14-2011 LOCATION: See Site and Exploration Plan

PROJECT: Hood Street Reservoir

LOG OF TEST PIT TP-1

Sketch of South Pit Side — Surface Elevation: 252 Feet

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Loose, gray-brown, gravelly SAND, trace of silt, scattered 2 to 4 inch diameter cobbles; moist; abundant roots; (Fill).	None Observed			0
(2) Loose, red-brown, slightly silty to silty, gravelly SAND; moist; scattered roots; (Fill).			S-1	2
(3) Loose to medium dense, gray-brown, gravelly SAND, trace of silt, occasional 2 to 4 inch diameter cobbles; roots to bottom of hole, occasional wood debris; (Fill).			S-3	
			S-6	6
			Bag 1	8
				10
				12



NOTES

1. Exposed 42 inch diameter concrete pipe at south end approximately 9.5 feet deep (running east/west).
2. Exposed 30 inch diameter steel pipe and 32 inch diameter steel pipe running parallel to 42 inch diameter concrete pipe approximately 5 feet to the north.
3. Exposed power/phone conduits at approximately 1.5 feet deep.

FIG. A-2

Filename: J:\211\21473-001\21-1-21473-001 TPs.dwg Date: 05-03-2011 Login: bac

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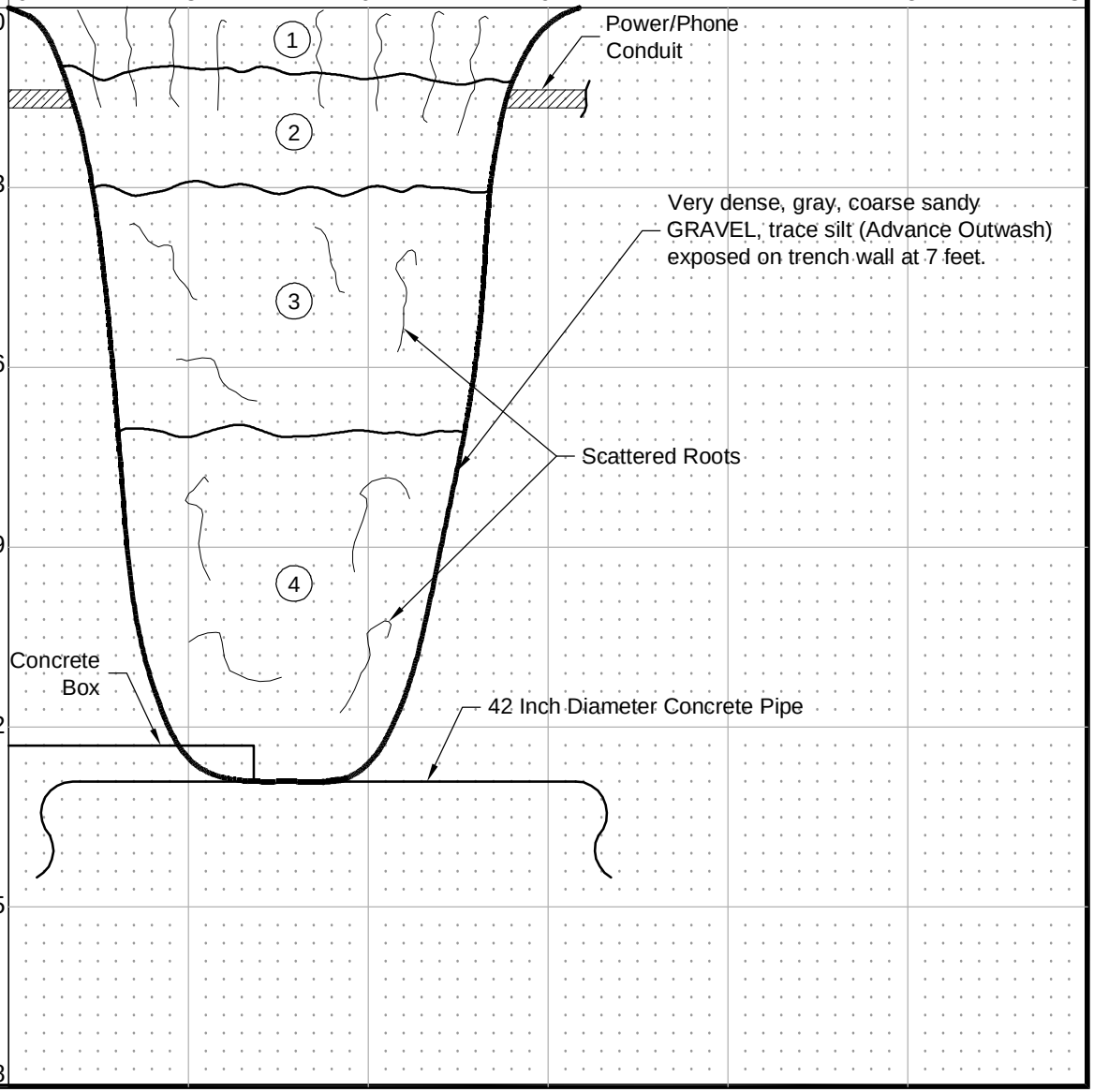
Geotechnical and Environmental Consultants

JOB NO: 21-1-21473-001 DATE: 2-14-2011 LOCATION: See Site and Exploration Plan

PROJECT: Hood Street Reservoir

LOG OF TEST PIT TP-2

Sketch of South Pit Side — Surface Elevation: 255 Feet



SOIL DESCRIPTION

(1) Loose, dark brown, slightly sandy SILT; numerous organics; (Fill).

(2) Very loose to loose, red-brown, slightly silty to silty, gravelly SAND, scattered 2 to 4 inch diameter cobbles; moist; scattered roots; (Fill).

(3) Loose to medium dense, brown-gray, slightly silty, sandy GRAVEL, scattered 2 to 4 inch diameter cobbles; moist; occasional organics; (Fill).

(4) Loose to medium dense, brown, silty, gravelly SAND, scattered 2 to 4 inch diameter cobbles with occasional pockets of dark brown, sandy silt with organics; (Fill).

NOTES

1. Exposed 42 inch diameter concrete pipe at south end approximately 13 feet deep.
2. Power/phone conduits on south side approximately 1.5 feet deep.
3. Concrete block (transition from concrete to steel pipe) at approximately 13 feet deep.

FIG. A-3

Filename: J:\211\21473-001\21-1-21473-001 TPs.dwg Date: 05-03-2011 Login: bac

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Geotechnical and Environmental Consultants

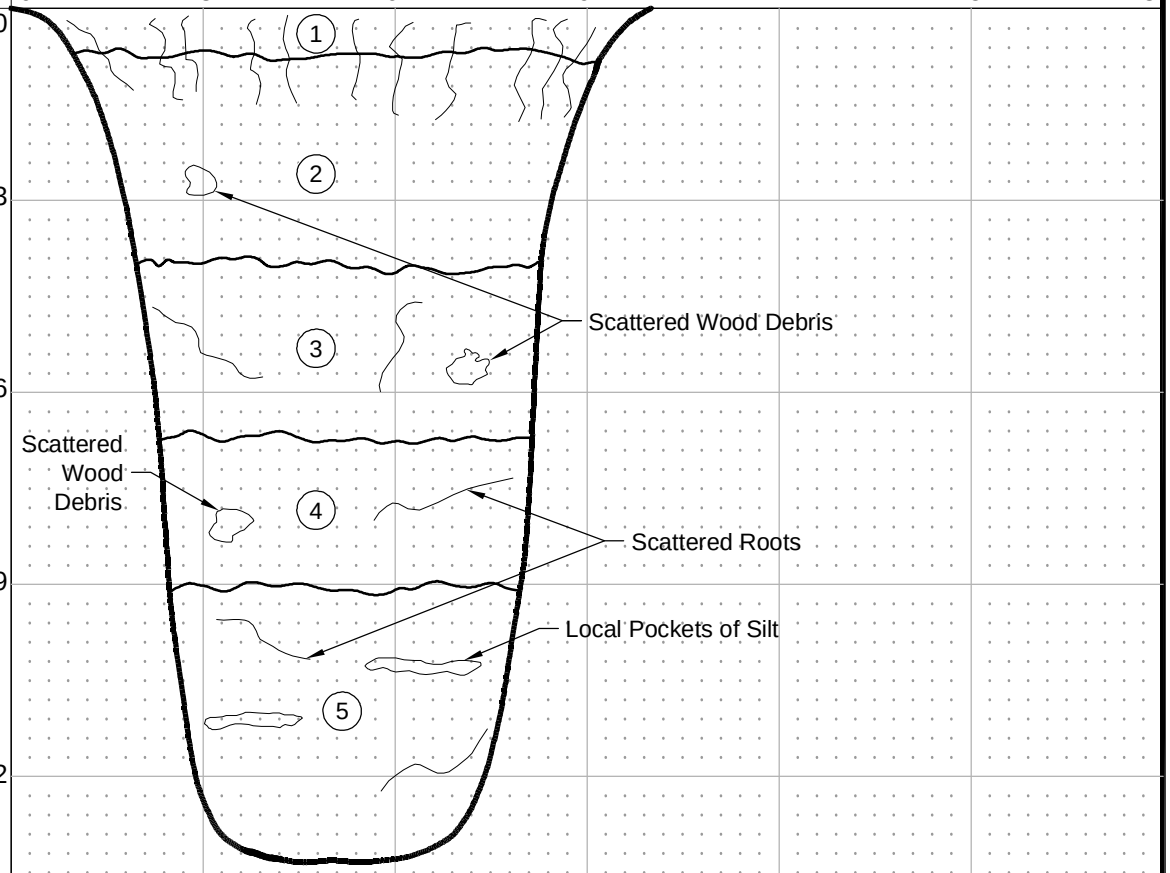
LOG OF TEST PIT TP-3

JOB NO: 21-1-21473-001 DATE: 2-16-2011 LOCATION: See Site and Exploration Plan

PROJECT: Hood Street Reservoir

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Topsoil	None Observed		S-1	0
(2) Loose, brown, slightly silty, gravelly SAND; moist; abundant roots; (Fill).			S-2 + Bag 1	3
(3) Loose to medium dense, brown, slightly silty, gravelly SAND, scattered 2 to 4 inch diameter cobbles; moist; scattered roots; (Fill).			S-3	6
(4) Medium dense, red-brown, slightly silty to silty, gravelly SAND, scattered 2 to 4 inch diameter cobbles; moist; scattered roots; (Fill).			S-4	9
(5) Dense to very dense, gray-brown, slightly silty, gravelly SAND, local pockets of sandy silt; moist; scattered roots; (Advance Outwash).			S-5	12
			S-6 and Bag	15
				18

Sketch of Northwest Pit Side Surface Elevation: 253 Feet



NOTE

Sloughing during dig after approximately 8 feet.

FIG. A-4

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APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

TABLE OF CONTENTS

FIGURE

APPENDIX B

GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS

B.1 INTRODUCTION

This appendix contains descriptions of the procedures and the results of laboratory tests performed on the soil samples obtained from the field explorations for the Hood Street Reservoir project in Tacoma, Washington. We tested the samples to evaluate the index properties of the soils at the project site.

The Shannon & Wilson, Inc. laboratory conducted the testing during March 2011. Laboratory testing consisted of visual classification and grain size analyses.

B.2 CLASSIFICATION

All soil samples were classified using the Unified Soil Classification System (USCS). A summary of this classification system is shown in Figure A-1 (Appendix A). Classification of the samples tested in the laboratory was based on ASTM International (ASTM) D 2487, Standard Test Method for Classification of Soil for Engineering Purposes. Samples not tested in the laboratory were classified based on ASTM D 2488, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure).

B.3 GRAIN SIZE ANALYSIS

The grain size distribution of selected samples was tested in general accordance with ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils. Results of these analyses are presented in Figure B-1. Each gradation sheet provides the USCS group symbol, the sample description, and water content.

B.4 REFERENCE

ASTM International (ASTM), 2010, 2010 Annual book of standards, Construction v. 04.08, Soil and rock (I): D 420 – D 5779: West Conshohocken, Pa.

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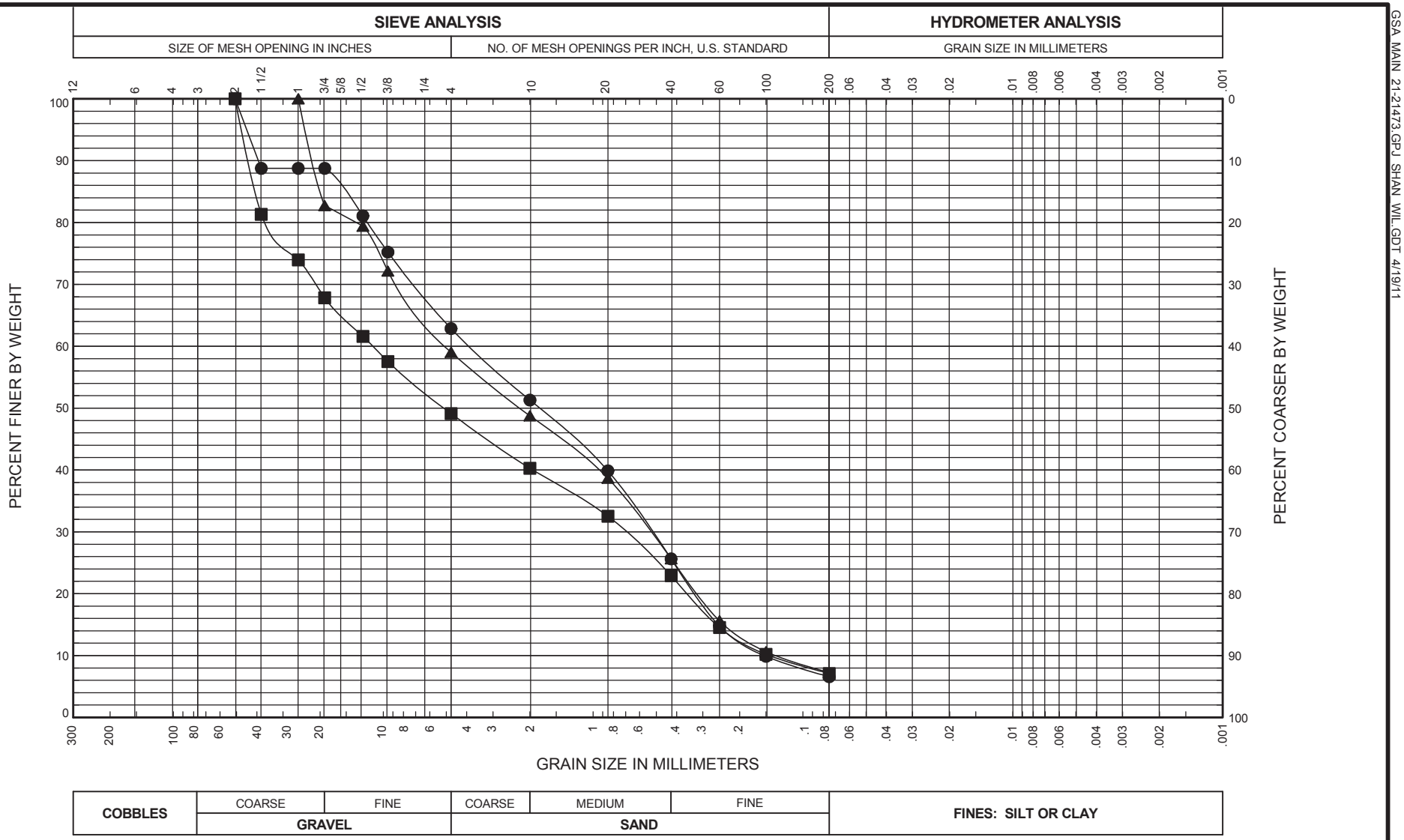

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● TP-1, S-1	2.0	SP-SM	Gray-brown, slightly silty, gravelly SAND	6.6	21.1			
■ TP-2, S-1	3.0	GP-GM	Brown, slightly silty, sandy GRAVEL	7.1	7.7			
▲ TP-3, S-3	6.0	SP-SM	Gray-brown, slightly silty, gravelly SAND	7.3	8.6			

South Tacoma Wellfield Treatment Facilities
Hood Street Reservoir
Tacoma, Washington

GRAIN SIZE DISTRIBUTION

April 2011 21-1-21473-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1

FIG. B-1

GSA MAIN 21-21473.GPJ SHAN WIL.GDT 4/19/11

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APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report 21-1-21473-001

Date: May 17, 2011
To: Mr. Pierre Kwan
HDR Engineering, Inc.

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

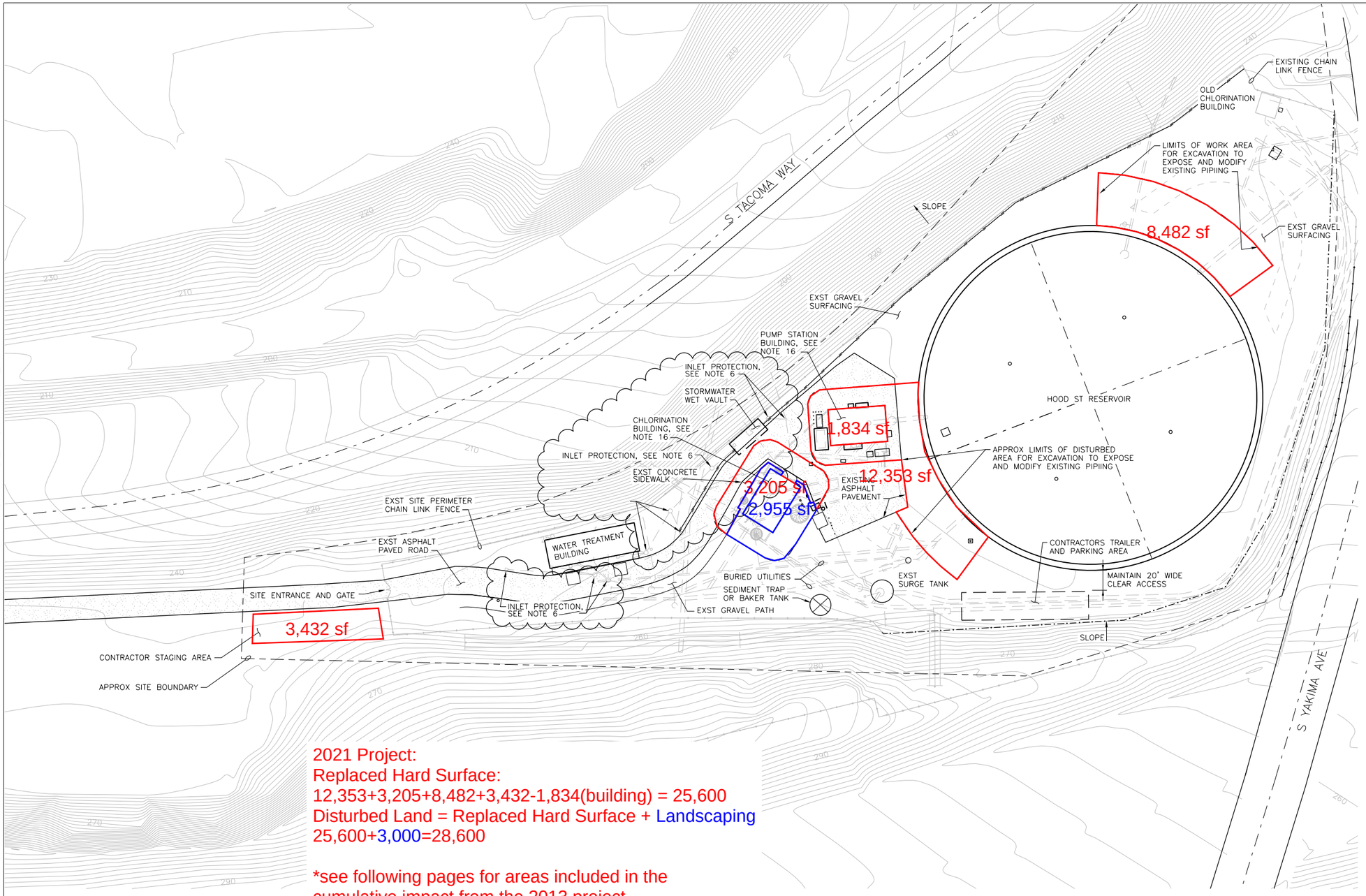
To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix J – Disturbed Land Calculations



2021 Project:
Replaced Hard Surface:
12,353+3,205+8,482+3,432-1,834(building) = 25,600
Disturbed Land = Replaced Hard Surface + Landscaping
25,600+3,000=28,600

*see following pages for areas included in the cumulative impact from the 2013 project

0 50 100 150
SCALE IN FEET

SITE PLAN
SCALE: 1"=50'-0"

CESCL NAME: TO BE UPDATED BY CONTRACTOR
CESCL CONTACT: ###-###-####
CESCL EMAIL:

EROSION AND SEDIMENT CONTROL NOTES

1. CONTRACTOR TO UPDATE THE COMBINED STORMWATER SITE PLAN (SSP) AND STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IF THERE ARE CHANGES TO THIS PLAN PRIOR TO CONSTRUCTION. ANY MODIFICATIONS SHALL BE IN ACCORDANCE WITH CITY OF TACOMA STORMWATER MANAGEMENT MANUAL AND DEPARTMENT OF ECOLOGY CONSTRUCTION STORMWATER GENERAL PERMIT REQUIREMENTS. NO EARTH DISTURBING ACTIVITY SHALL OCCUR PRIOR TO APPROVAL OF MODIFICATIONS.
2. IMPLEMENT AND MAINTAIN EROSION CONTROL DEVICES DURING CONSTRUCTION. SUBMIT AN EROSION AND SEDIMENT CONTROL PLAN, AND PROVIDE DUST CONTROL, SEE SPECIFICATIONS.
3. THE MEASURES SHOWN ON THESE PLANS ARE THE MINIMUM THAT ARE REQUIRED FOR THE ANTICIPATED SITE CONDITIONS. PROVIDE ADDITIONAL MEASURES AS NEEDED DUE TO WEATHER, AND/OR FIELD CONDITIONS, AND/OR CONSTRUCTION ACTIVITIES.
4. PREVENT DEBRIS AND OTHER MATERIALS FROM ENTERING SURFACE WATERS DURING CONSTRUCTION, AND COMPLY WITH WATER QUALITY PROTECTION REQUIREMENTS PER APPLICABLE LAWS AND REGULATIONS, AND AS DESCRIBED IN THE SPECIFICATIONS.
5. DO NOT DISCHARGE TURBID WATER GENERATED FROM CONSTRUCTION ACTIVITIES DIRECTLY TO ANY STREAMS, STORM WATER SYSTEM INLETS, OR DRAINAGE DITCHES BEFORE THE SOLIDS HAVE SETTLED OUT OF THE WATER AND NTU READINGS ARE LESS THAN 25 AS MEASURED BY A TURBIDIMETER.
6. ADD INLET PROTECTION AS NECESSARY TO ALL CATCH BASINS AND DRAINAGE STRUCTURES THAT RECEIVE STORMWATER RUNOFF WITHIN THE PROJECT AREA AND THAT MAY OR MAY NOT BE SHOWN ON THE TESC PLANS. PROVIDE INLET PROTECTION FOR ALL STORM DRAIN INLETS DOWNSLOPE AND WITHIN 500 FEET OF A DISTURBED CONSTRUCTION AREA. ONLY BAG FILTER TYPE CATCH BASIN FILTERS ARE ALLOWED IN THE CITY ROW. INLET PROTECTION DETAIL PER 10-C-014 DETAIL 6.
7. PROTECT AND PRESERVE ALL EXISTING VEGETATION BEYOND THE CLEARING LIMITS. INSTALL STABILIZED CONSTRUCTION ENTRANCES ON ALL UNSURFACED CONSTRUCTION ROADS WHERE THE CONSTRUCTION ROADS EXIT ONTO PAVED ROADWAYS.
8. THE TESC FACILITIES SHOWN ON THIS PLAN WILL BE CONSTRUCTED PRIOR TO EXCAVATION AND GRADING SO AS TO ENSURE THAT THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE STRUCTURES, AND ADJACENT PROPERTIES IS MINIMIZED.
9. FOLLOWING CONSTRUCTION, STABILIZE SITE TO MEET EXISTING CONDITIONS BEFORE REMOVING ANY SILT FENCE, SEDIMENT TRAPS OR OTHER SEDIMENT BMP'S. SEDIMENT SHALL NOT BE ALLOWED TO ENTER ANY STREAM OR DITCH AS A RESULT OF RUNOFF THAT MAY OCCUR AFTER CONSTRUCTION IS COMPLETED.
10. THE CONTRACTOR APPOINTED CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL) WILL PROVIDE WEEKLY INSPECTION AND MAINTENANCE OF ALL TESC MEASURES. TESC MEASURES WILL BE IN WORKING CONDITION AT ALL TIMES. IMMEDIATELY REPAIR, REPLACE, AND INSTALL ADDITIONAL MEASURES SO THAT THEY ARE EFFECTIVE IN PREVENTING EROSION AND SEDIMENTATION.
11. AFTER ANY 24-HOUR RUNOFF PRODUCING EVENT, THE CESCL WILL INSPECT THE TESC MEASURES FOR INTEGRITY. ANY DAMAGED TESC MEASURES WILL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND REPAIRED IMMEDIATELY. THE INSPECTION FREQUENCY FOR TEMPORARILY STABILIZED, INACTIVE SITES WILL BE REDUCED TO ONCE EVERY CALENDAR MONTH. APPROPRIATE BMPS SHALL BE APPLIED PER PROJECT SWPPP.
12. DO NOT DISCHARGE ANY CLEANING SOLVENTS OR CHEMICALS UTILIZED FOR TOOL OR EQUIPMENT CLEANING TO THE GROUND. PERFORM REFUELING OF EQUIPMENT AWAY FROM THE DRAINAGE FACILITIES IN SUCH A MANNER AS TO PREVENT SPILLS FROM ENTERING THE GROUNDWATER OR WATER BODIES (INCLUDING WETLANDS). SPILLS SHALL BE PREVENTED FROM HITTING THE GROUND.
13. PROPERLY DISPOSE OF ALL CONSTRUCTION DEBRIS IN AN APPROVED MANNER AND AT A PERMITTED LANDFILL FACILITY.
14. MAINTAIN CITY STREETS, PAVED TRAILS, AND SHOULDERS WITH STREET SWEEPING AS NECESSARY TO REMOVE CONSTRUCTION GENERATED SEDIMENT.
15. KEEP COPIES OF ALL PERMITS ON THE JOB SITE AND READILY AVAILABLE FOR REFERENCE BY AGENCY PERSONNEL, THE CONSTRUCTION SUPERINTENDENT, CONSTRUCTION MANAGERS AND LEAD WORKERS, AND SITE AND LOCAL GOVERNMENT INSPECTORS.
16. MAXIMUM DISTURBED AREA AT PUMP STATION AND CHLORINATION BUILDING IS APPROXIMATELY 10-FEET BEYOND EXCAVATION LIMITS.
17. TRAVEL ONLY ON PAVED OR GRAVEL SURFACES. CHECK FOR AND REMOVE SOURCES OF TRACKOUT PRIOR TO EXITING SITE. IMPLEMENT TRACKOUT BMP CONTROLS AS NEEDED TO PREVENT TRACKOUT.

LEGEND

- APPROXIMATE LIMITS OF WORK
- SILT FENCE, SEE 1 / 10-C-011
- HIGH VISABILITY FENCE, PLACE AT TOE OF EXISTING SLOPE
- APPROXIMATE SITE BOUNDARY
- EXISTING PERIMETER FENCE

811 Know what's below. Call before you dig.

KENNETH GEORGE MCRAE, STATE OF WASHINGTON, 54933, REGISTERED PROFESSIONAL ENGINEER

NO.	REVISION	DATE	BY	APP'D.	REV. COMPL.
6					
5					
4					
3					
2					
1					

Jacobs

DWG. REFERENCE | FIELD BOOK REFERENCE | DATA FILE

DATE NOVEMBER 2020
DESIGN CE
DRAWN CE
DIGITIZED
CHECKED CK

0" 1" 2"

WBS ELEMENT
CADNET PROJECT NAME: SEISMIC UPGRADES
SECTION
FACILITY ADDRESS 1002 S TACOMA WAY
CADNET FILE NAME: 10-C-003.DGN

APPROVED
MANAGER

TACOMA WATER
TACOMA PUBLIC UTILITIES

CITY OF TACOMA - TACOMA PUBLIC UTILITIES
HOOD STREET FACILITIES

TESC PLAN AND CONTRACTOR STAGING AREA

SCALE AS SHOWN
CONSULTANTS DRAWING NO. 10-C-003
TACOMA WATER DRAWING NO.
SHEET 10 OF 58

4.1 Threshold Discharge Areas and Applicable Requirements for On-Site Stormwater Management, Treatment, Flow Control and Wetlands Projection

Impervious area totals for the project site are provided in Table 4.1

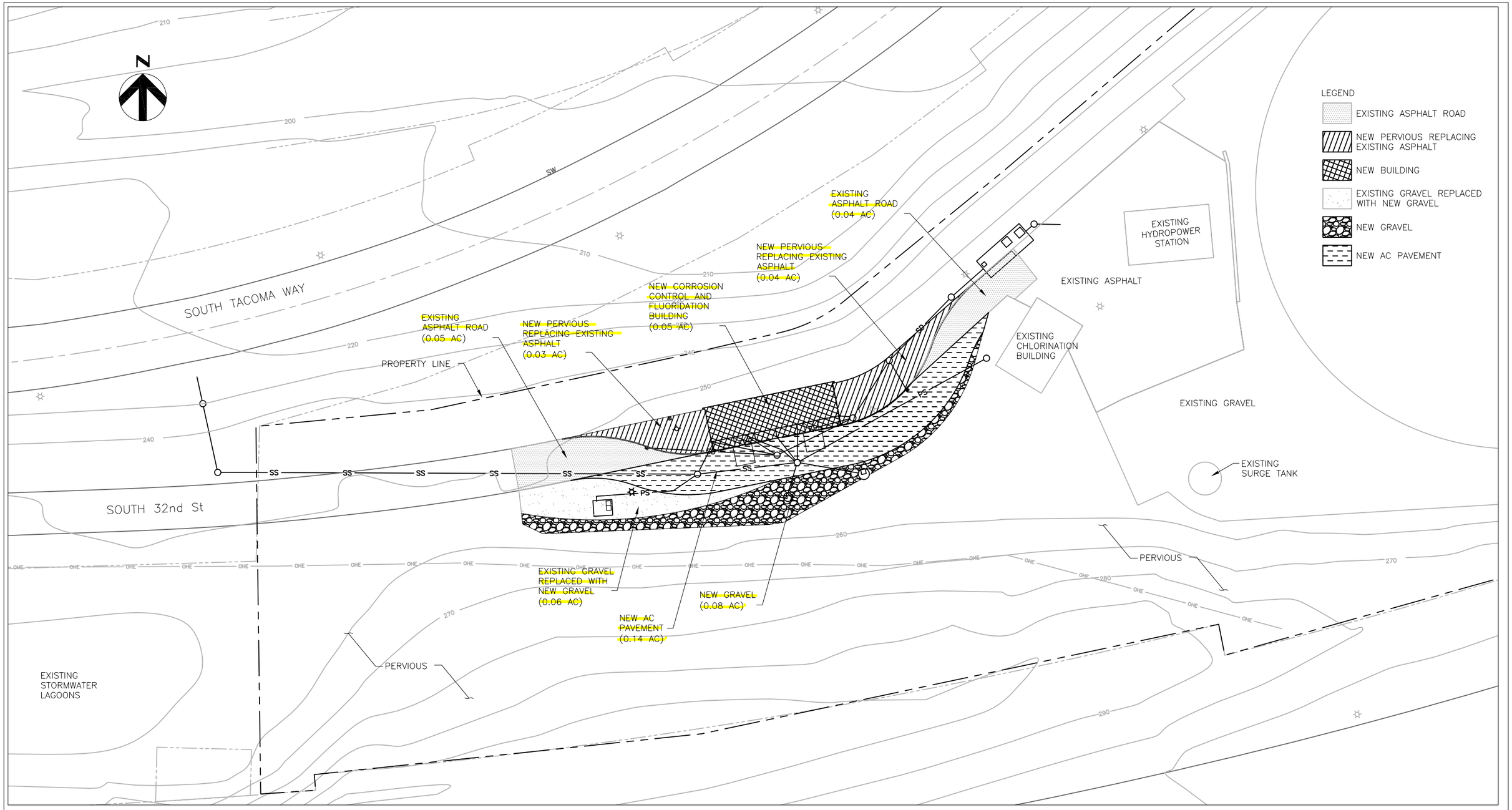
Table 4.1 Impervious and Converted Pervious Area Tabulations

	Non-PGIS (ft^2)	Non-PGIS (ac.)	PGIS (ft^2)	PGIS (ac)	Impervious Totals (ft^2)	Impervious Totals (ac.)
Existing Imp.	0	0.00	14,002	0.32	14,002	0.32
New Imp.	0	0.00	7,361	0.17	7,361	0.17
Replaced Imp.	2,316	0.05	4,720	0.11	7,036	0.16
Existing Imp. to Remain	0	0.00	3,776	0.09	3,776	0.09
Existing Imp. Converted to Pervious	0	0.00	3,027	0.07	3,027	0.07

As stated above, Appendix 1 contains flow charts used to determine the applicable Minimum Requirements, and the required levels for flow control. Based on the amount of new and replaced impervious surface, all 12 Minimum Requirements must be applied to the project. Water quality will be provided for all new and replaced pollution-generating surfaces, but flow control is not required because the project does not add greater than 10,000 square feet of impervious surface, convert 2.5 acres or more of native vegetation to pasture, convert 0.75 acres or more of native vegetation to lawn or landscape, or increase the 100-year peak flow rate by 0.1 cubic feet per second. Section 5.0 includes further discussion of the Minimum Requirements applicability.

4.2 Pre-Developed Site Hydrology

The entire Hood Street Reservoir site is contained within a single Threshold Discharge Area (TDA). Construction activities associated with the corrosion control treatment facility project will be limited to within a 0.5-acre portion of the site. The geotechnical report, included in Appendix E, indicates that the existing site soils are primarily fill down to approximately 10 feet below grade. The fill exhibits characteristics similar to Vashon advanced outwash. Native soil was encountered at a depth of 9 feet below grade, which was also classified as Vashon advanced outwash. For this reason, a hydraulic soils group of A/B was used for all hydrologic modeling.



SITE PLAN
SCALE: 1"=30'

PROPOSED CONDITION LAND COVER

Land Cover	AREA (ACRES)
ROOF/BUILDING	0.05
GRAVEL	0.14
PAVEMENT	0.23
TOTAL IMPERVIOUS	**0.42**
PERVIOUS	0.07
TOTAL AREA	0.49

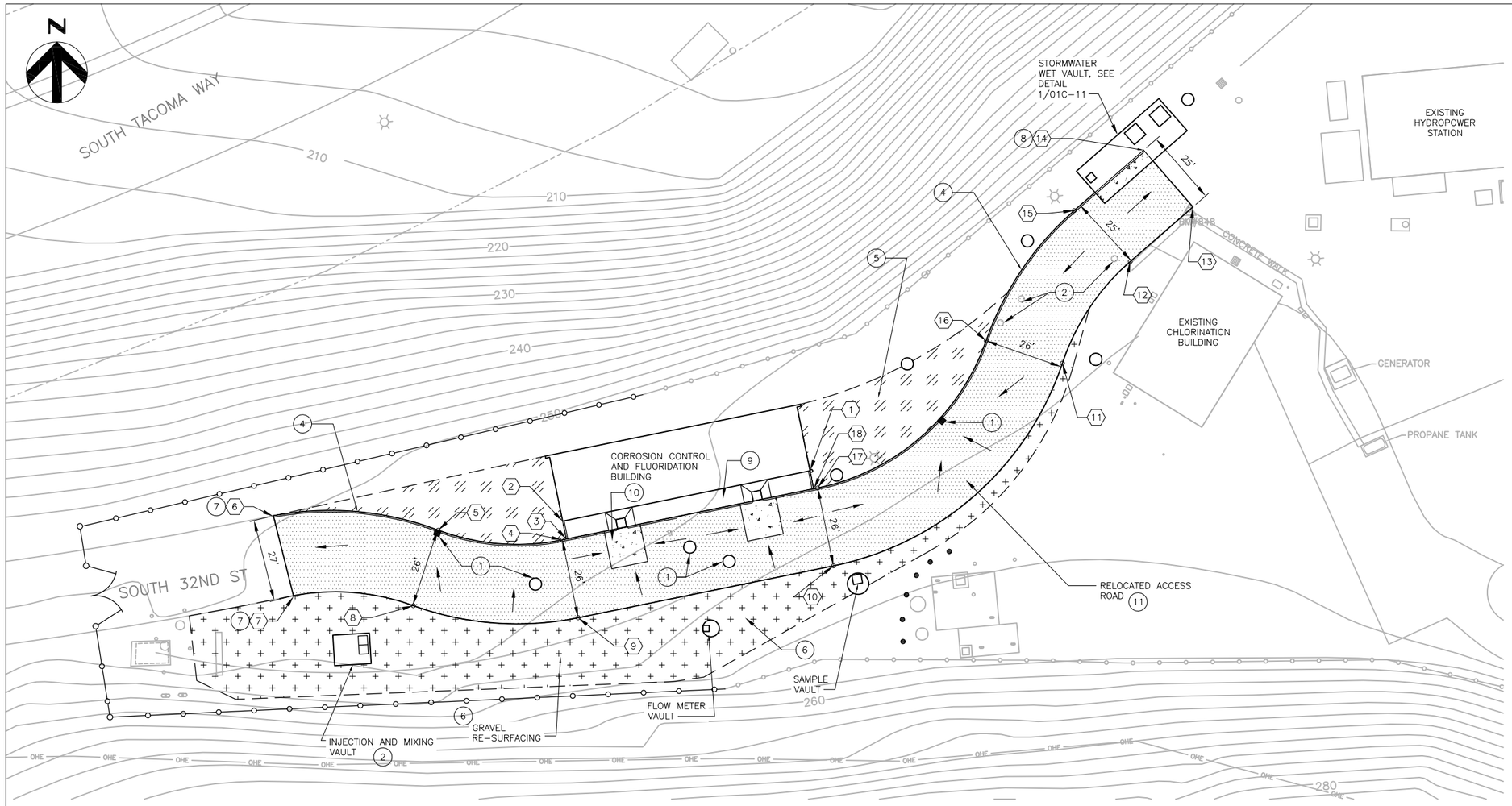
TACOMA WATER
TACOMA PUBLIC UTILITIES

HDR

PROJECT AREA

DATE
10/26/2011

FIGURE
6



SITE SURFACING AND GRADING PLAN

SCALE: 1"=20'

CONSTRUCTION NOTES:

1. ADJUST NEW AND EXISTING MANHOLE AND CATCH BASIN RIMS TO BE FLUSH WITH NEW ASPHALT OF THE RELOCATED ACCESS ROAD.
2. EXISTING MANHOLES AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE. VERIFY THE CORRECT LOCATIONS TO AVOID DAMAGE OR DISTURBANCE.
3. ANY AREAS OUTSIDE OF GRAVEL AND PAVED AREAS SHALL BE RESTORED PER SPEC SECTION 02935. SEED MIX PER ENGINEERS DIRECTION.
4. CEMENT CONCRETE TRAFFIC CURB AND GUTTER PER TACOMA STANDARD PLAN SU-03. INSTALL CURB AND GUTTER ALONG NORTHERN SIDE OF THE NEW RELOCATED ACCESS ROAD.
5. SOILS TO BE AMENDED PER SPEC SECTION 02940.
6. 4" COMPACTED CRUSHED SURFACING TOP COURSE. SEE CIVIL DETAIL 3/01C-21. SLOPE DOWN TO NEW RELOCATED ACCESS ROAD.
7. POINTS 6 AND 7 ARE APPROXIMATE, ADJUST RELOCATED ACCESS ROAD WIDTH AND CURVES TO MATCH EXISTING.
8. POINT 14 IS APPROXIMATE, ADJUST RELOCATED ACCESS ROAD EDGE TO MATCH EXISTING, MATCH NEW CURB TO EXISTING CURB.
9. 4" THICK CONCRETE SIDEWALK.
10. DELIVERY APRON AND SPILL CATCH BASIN PER DETAIL 2/01C-27.
11. PAVEMENT REMOVAL AND REPLACEMENT PER DETAIL 2/01C-21.

COORDINATE TABLE

(1)	NORTHING	EASTING	DESCRIPTION
1	698135.674	1157098.808	NE CORNER OF CONCRETE SIDEWALK, EL 253.5
2	698119.201	1157017.833	NW CORNER OF CONCRETE SIDEWALK, EL 253.5
3	698113.313	1157019.031	SW CORNER OF CONCRETE SIDEWALK, EL 253.3
4	698113.048	1157017.725	PC 74' R, EOP, EL 253.47
5	698116.228	1156977.113	PRC 100' R, EOP, EL 251.7
6	698120.966	1156923.142	AP, APPROX EOP, MATCH EXST EL
7	698094.786	1156929.711	PC 74' R, APPROX EOP, MATCH EXST EL
8	698091.513	1156968.995	PRC 100' R, EOP, EL 252.5
9	698087.569	1157022.908	PT, EOP, EL 253.47
10	698104.574	1157106.495	PC 100' R, EOP, EL 253.47
11	698170.931	1157181.425	PRC 74' R, EOP, EL 253.80
12	698204.218	1157203.629	PT, EOP, MATCH EXST EL
13	698222.084	1157224.158	AP, EOP, MATCH EXST EL
14	698240.654	1157207.997	AP, EOP, MATCH EXST EL
15	698220.872	1157185.268	PC 100' R, EOP, MATCH EXST EL
16	698178.270	1157156.458	PRC 74' R, EOP, EL 252.5
17	698130.052	1157101.312	PT, EOP, EL 253.47
18	698129.786	1157100.006	SE CORNER OF CONCRETE SIDEWALK, EL 253.3

TACOMA WATER
TACOMA PUBLIC UTILITIES

HDR

HOOD STREET RESERVOIR CORROSION CONTROL AND FLUORIDATION FACILITY

SITE MAP AND GRADING PLAN

DATE
10/26/2011

FIGURE
3

Appendix C

Geotechnical Seismic Evaluation Report