**DISCLAIMER: THIS IS AN EXAMPLE SSP REPORT – CALCULATIONS ARE NOT ACCURATE. THIS IS JUST MEANT TO PROVIDE AN EXAMPLE OF WHAT A COMPLETE SSP MIGHT LOOK LIKE**

**Stormwater Site Plan (SSP) Report**

Coldest Ice Convenience Store

**Prepared For**

SDEV21-210X and WO21-210Y

**Project Location**

7801 S. Sheridan

6640001161

**Stormwater Site Plan Prepared By**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Contact Telephone Number** | **Email Address** |
| Awesome Engineer | Engineer, Inc. | 253-123-1234 | awesomeengineer@engineerinc.com |

**Date Prepared**

05/04/2021

I hereby certify that this Amazingly Perfect Stormwater Site Plan was prepared by me or under my direct supervision. Blah, blah, blah, 12345 RCW. Etc. etc. etc. WAC 12.34.56X



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**Notes for Preparer:**

When completing the Stormwater Site Plan Report provide all required information in the textbox forms under each section and delete any sections from the report and appendices that are not applicable to the proposed project. Further information and guidance on the information required can be found in the comment bubbles to the right of each section. Once the report has been completed delete all comment bubbles and grey highlighted instructions, select the References tab and update the Table of Contents, and input the figure/table numbers and names in List of Figures and List of Tables under the contents page above.

## Project Information

1. **Project Contacts**

See Title Page for Stormwater Site Plan Development Team

1. **Property Owner**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Mailing Address** | **Contact Telephone Number** | **Email Address** |
| Penny Frogmore | None | 1234 Frogmore Place, Britain, UK | 123456789 | pfrogmore@frogmore.com |

1. **Applicant (if different than Property Owner)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Mailing Address** | **Contact Telephone Number** | **Email Address** |
| Alice Construction | Construction Org | 4321 Workplace Avenue | 987654321 | aconstr@const.com |

1. **Associated Permits**
2. See Title Page for City of Tacoma Permit Numbers
3. Associated City of Tacoma Permit Number(s)

None

1. Other Federal, State, or Local Associated Permit Types and Numbers

None

1. **Vesting**
2. City of Tacoma Stormwater Management Manual Edition Used

2021 Stormwater Management Manual (SWMM)

1. If using a manual other than the most current version, provide vesting justification:

NA

## Project Overview

1. **Provide a brief description of the proposed project.**

This project will construct a convenience store on a currently vacant lot. Improvements will include the construction of the convenience store and associated parking lot and all associated above and below ground utilities.

## Existing Project Site Conditions

1. **Answer the following questions, provide additional description, and provide figures (if necessary) to describe the existing site conditions.**
2. Describe in one or two sentences the existing project site use:

The existing site use is a vacant lot with a mix of gravel and vegetation.

1. Describe in words or show on a figure the stormwater runoff patterns (natural and artificial) and the points where stormwater enters and exits the project site.

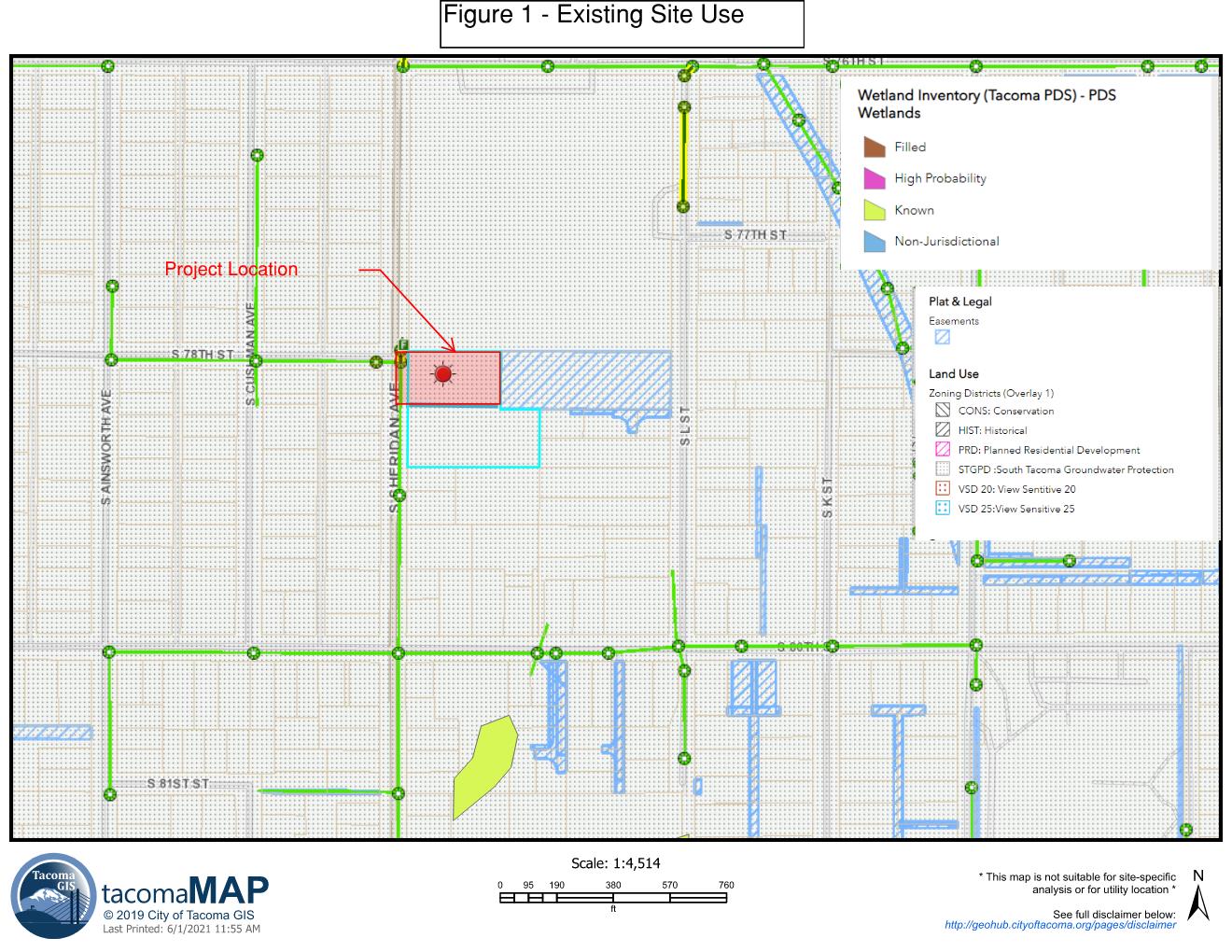
Stormwater follows contours and generally flows from west to east where it enters the City of Tacoma stormwater system.

1. Answer the following questions to help describe the existing site conditions. If Answer is Yes, include an associated figure(s) that shows location. Answers must be based upon site reconnaissance and readily available mapping data. See SWMM – Volume 2, Chapter 3 for resources.

|  |  |  |
| --- | --- | --- |
| **Questions** | **Answer** | **Data Source(s)** |
| Are groundwater protection areas located on the project site or within 500 feet of the project site? | Yes  No  Unknown | Aquifer Recharge Areas (Pierce County) tMap Layer |
| Are wetlands and/or their buffers located on the project site or within 500 feet of the project site? | Yes  No  Unknown | Wetland Inventory (Tacoma PDS) tMap Layer. |
| Are steep slopes located on the project site or within 500 feet of the project site? | Yes  No  Unknown | tMap Layer   * Landslide Hazard Areas. * Contours |
| Are floodplains located on the project site or within 500 feet of the project site? | Yes  No  Unknown | Flooding Layers – tMap Layer. |
| Are streams located on the project site or within 500 feet of the project site? | Yes  No  Unknown | Streams Layer (Pierce County) – tMap |
| Are creeks located on the project site or within 500 feet of the project site? | Yes  No  Unknown | Waterbodies Layer (Pierce County) – tMap |
| Are ravines located on the project site or within 500 feet of the project site? | Yes  No  Unknown | tMap Layers:   * Landslide Hazard Areas * Contours * Streams Layer (Pierce County) |
| Are springs located on the project site or within 500 feet of the project site? | Yes  No  Unknown | * Landslide Hazard Areas (Pierce County) * Streams (Pierce County)? |
| Are any other sensitive areas or critical areas located on the project site or within 500 feet of the project site? | Yes  No  Unknown | tMap Layers:   * Aquifer Recharge Areas (Pierce County) * Biodiversity Corridors (Tacoma) * Landslide Hazard Areas (Pierce County) * Liquifaction Susceptibility (WADNR) * Mine Hazard Areas (Tacoma) * Non-Wetland/No Stream (Tacoma PDS) * Streams (Pierce County) * Wetland Inventory (Tacoma PDS) |
| Are any structures located on the project site? | Yes  No  Unknown |  |
| Are any fuel tanks or other storage tanks (above or below-ground) located on the project site? | Yes  No  Unknown | tMap Layers:   * Regulated USTs and Active Facilities (Ecology) * Regulated USTs and Inactive Facilities (Ecology) |
| Are any groundwater wells located on the project site or within 100 feet of the project site? | Yes  No  Unknown | Source Water Assessment Program (SWAP) Map |
| Are any septic systems located on the project site or within 100 feet of the project site? | Yes  No  Unknown | Sewer Cards |
| Are any Superfund sites located on the project site or within 100 feet of the project site? | Yes  No  Unknown | Cleanups in My Community v1.0 tmap layer. |
| Are any Flood Hazard Areas located on the project site or within 100 feet of the project site? | Yes  No  Unknown | Flooding Layers tMap layer. |
| Is the project located in the South Tacoma Groundwater Protection District? | Yes  No  Unknown | Land Use – Zoning District 1 – tMap Layer. |
| Are any public or private easements located on the project site? | Yes  No  Unknown | * Plat and Legal – Easements – tMap layer. * Pierce County Assessor Parcel Search |

1. Additional Information

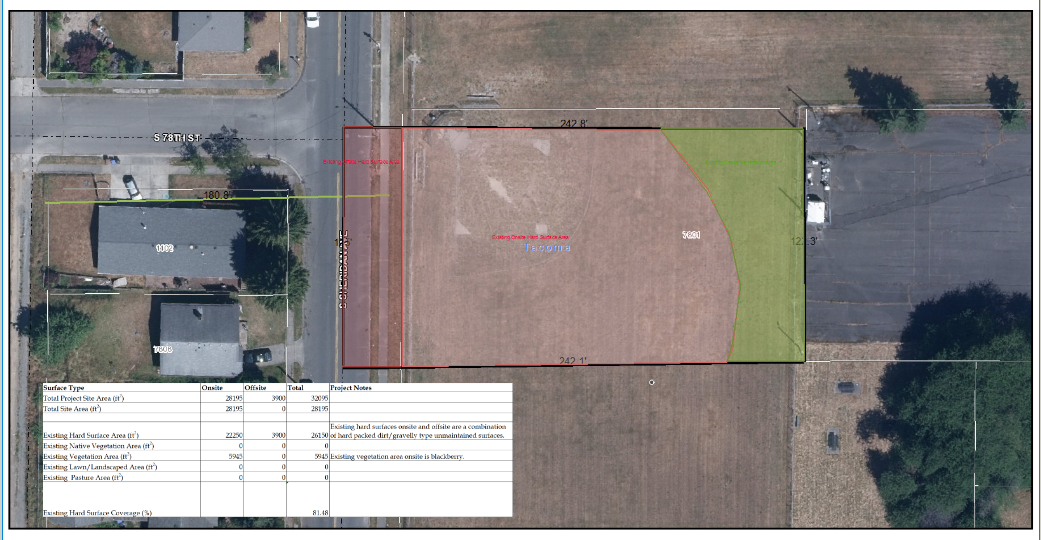
Figure 1 – Existing Site Use only shows the legend for items that were present on or near the site. See tMap for all other relevant legend items as necessary. Project has only one Threshold Discharge Area.



1. **Existing Project Site Condition Basin Map**

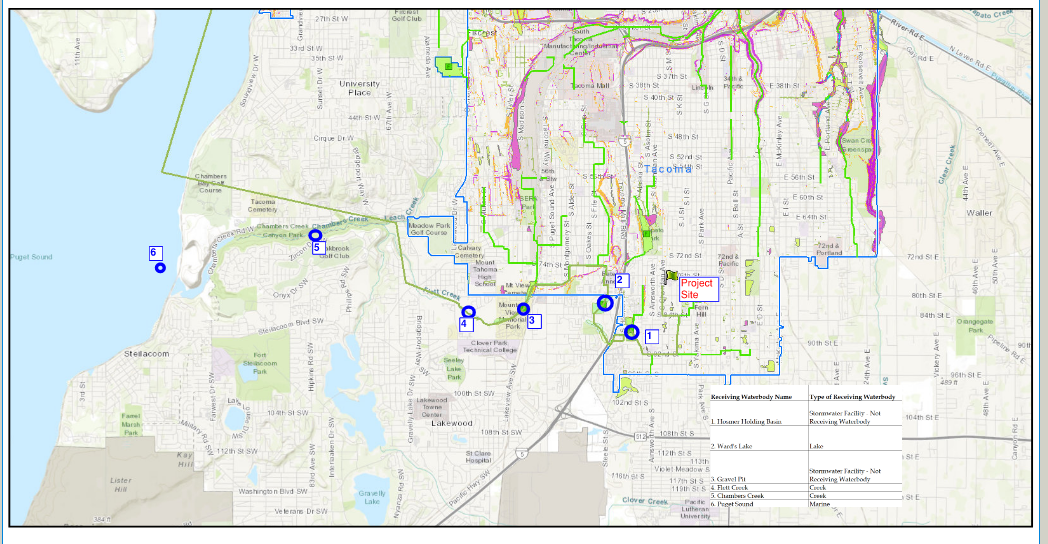
Figure 2 – Existing Condition Basin Map

Red Area is existing hard surface area. Green is existing vegetation area.



1. **Downstream Flowpath – Existing Condition**

**Figure 3 – Downstream Flowpath**



## Proposed Project Site Conditions

**A. Describe in words and provide figure(s) to describe the proposed project site conditions.**

1. Describe in one or two sentences the proposed project site use:

The proposed site is a convenience store with associated parking lot and drive aisles. Offsite improvements including sidewalk installation and roadway replacement are required. There will be no fuel tanks installed, no groundwater wells installed and no septic systems installed. No new easements are required for the project. See Civil Sheets C-07 and C-08 for the full site plan showing improvements.

1. Describe in words or show on a figure the stormwater runoff patterns (natural and artificial) and the points where stormwater enters and exits the project site.

Stormwater runoff patterns remain the same between existing and proposed conditions. Stormwater generally enters the site from the west and will discharge into the City of Tacoma Stormwater System via a piped discharge to a structure.

1. Provide a figure showing:

* the proposed improvements (buildings, sidewalks, parking lots, utilities, etc.),
* fuel tanks (above and below ground) that are proposed or will remain in place, proposed groundwater wells on the project site
* proposed septic systems
* proposed public and private easements

There will be no fuel tanks installed, no groundwater wells installed and no septic systems installed. No new easements are required for the project. See Civil Sheet C-07 and C-08 for full site plan showing improvements.

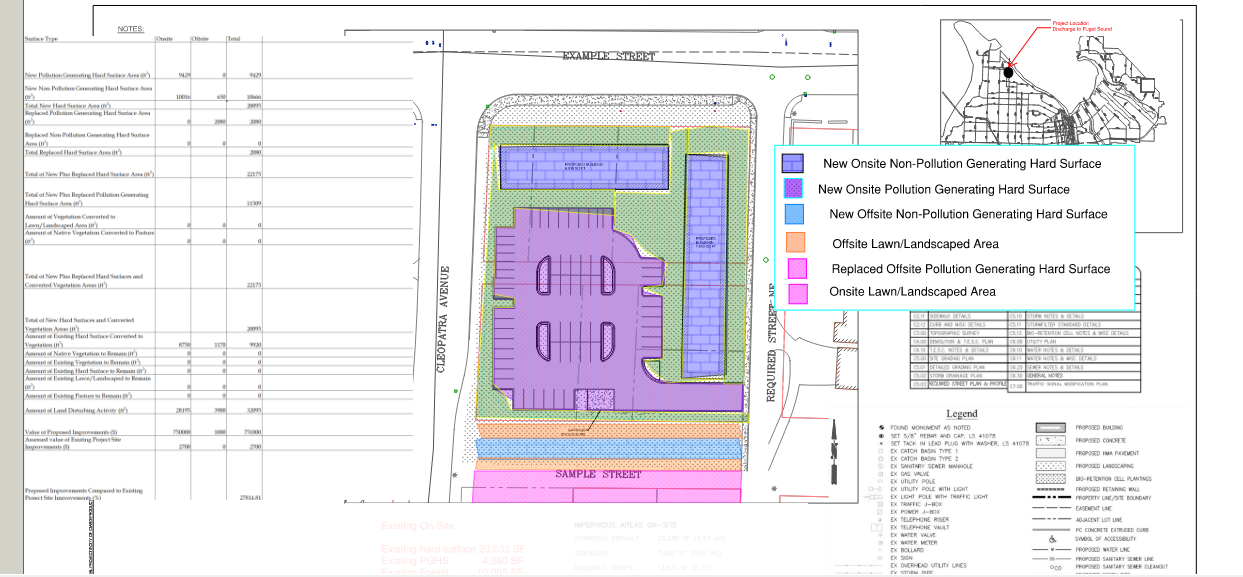
1. Additional Information

No additional information needed.

See Civil Sheets C-07 and C-08

1. **Proposed Project Site Condition Basin Map** .

**Figure 4 – Example Proposed Project Site Condition Map (Note: this figure would not be approved because the legend for “Onsite Lawn/Landscaping Area” doesn’t match the hatch on the figure.)**



**C. Downstream Flowpath – Proposed Condition**

See Figure 3 – Downstream Flowpath. Flowpath does not change from existing to proposed conditions.

## Minimum Requirement Determination

1. **Table 1 - Project Thresholds (note: this project has only one TDA)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Surface Type** | **Onsite** | **Offsite** | **Total** |
| Total Project Site Area (ft2) | 28195 | 3900 | 32095 |
| Total Site Area (ft2) | 28195 | 0 | 28195 |
| Existing Hard Surface Area (ft2) | 22250 | 3900 | 26150 |
| Existing Native Vegetation Area (ft2) | 0 | 0 | 0 |
| Existing Vegetation Area (ft2) | 5945 | 0 | 5945 |
| Existing Lawn/Landscaped Area (ft2) | 0 | 0 | 0 |
| Existing Pasture Area (ft2) | 0 | 0 | 0 |
| Existing Hard Surface Coverage (%) |  |  | 81.48 |
| New Pollution Generating Hard Surface Area (ft2) | 9429 | 0 | 9429 |
| New Non-Pollution Generating Hard Surface Area (ft2) | 10016 | 650 | 10666 |
| Total New Hard Surface Area (ft2) |  |  | 20095 |
| Replaced Pollution Generating Hard Surface Area (ft2) | 0 | 2080 | 2080 |
| Replaced Non-Pollution Generating Hard Surface Area (ft2) | 0 | 0 | 0 |
| Total Replaced Hard Surface Area (ft2) |  |  | 2080 |
| Total of New Plus Replaced Hard Surface Area (ft2) |  |  | 22175 |
| Total of New Plus Replaced Pollution Generating Hard Surface Area (ft2) |  |  | 11509 |
| Amount of Vegetation Converted to Lawn/Landscaped Area (ft2) | 0 | 0 | 0 |
| Amount of Native Vegetation Converted to Pasture (ft2) | 0 | 0 | 0 |
| Total of New Plus Replaced Hard Surfaces and Converted Vegetation Areas (ft2) |  |  | 22175 |
| Total of New Hard Surfaces and Converted Vegetation Areas (ft2) |  |  | 20095 |
| Amount of Existing Hard Surface Converted to Vegetation (ft2) | 8750 | 1170 | 9920 |
| Amount of Native Vegetation to Remain (ft2) | 0 | 0 | 0 |
| Amount of Existing Vegetation to Remain (ft2) | 0 | 0 | 0 |
| Amount of Existing Hard Surface to Remain (ft2) | 0 | 0 | 0 |
| Amount of Existing Lawn/Landscaped to Remain (ft2) | 0 | 0 | 0 |
| Amount of Existing Pasture to Remain (ft2) | 0 | 0 | 0 |
| Amount of Land Disturbing Activity (ft2) | 28195 | 3900 | 32095 |
| Value of Proposed Improvements ($) | 750000 | 1000 | 751000 |
| Assessed value of Existing Project Site Improvements ($) | 2700 | 0 | 2700 |
| Proposed Improvements Compared to Existing Project Site Improvements (%) |  |  | 27814.81 |

1. **Table 2- Receiving Waterbody Table**

|  |  |
| --- | --- |
| **Receiving Waterbody Name** | **Type of Receiving Waterbody** |
| Hosmer Holding Basin | Stormwater Facility - Not Receiving Waterbody |
| Ward's Lake | Lake |
| Gravel Pit | Stormwater Facility - Not Receiving Waterbody |
| Flett Creek | Creek |
| Chambers Creek | Creek |
| Puget Sound | Marine |

1. **Table 3 – Minimum Requirements Required**

|  |  |
| --- | --- |
| **Applicable Minimum Requirements** | **Applicable Surface Type Requiring Mitigation** |
| MR #1-#5 | New and Replaced Hard Surfaces and Converted Vegetation Areas and Land Disturbed |
| MR#6 | New and Replaced PGHS |
| MR#7 | New and Replaced Hard Surfaces and Converted Vegetation Areas |
| MR#9 | NA |

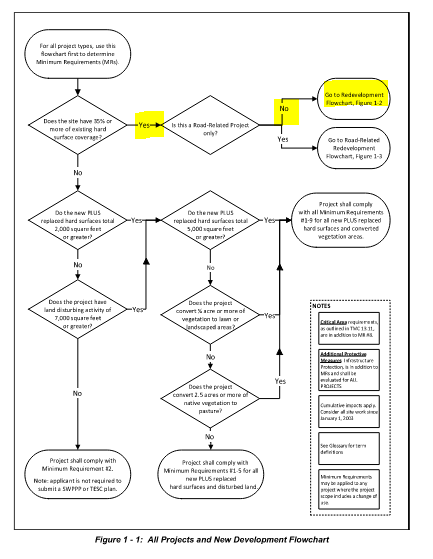
1. **Cumulative Impacts**
   1. Table (Insert Table Number)- Cumulative Impacts

NA

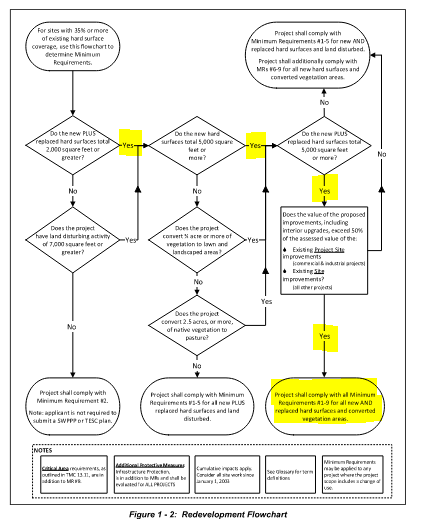
* 1. Cumulative Impacts Discussion

Development has not occurred on the site since 2003.

1. **Flowcharts**



**Figure 5 - All Projects and New Development Flowchart**



**Figure 6 – Redevelopment Flowchart**

## Discussion of Minimum Requirements

### Minimum Requirement #1 – Preparation of a Stormwater Site Plan

This Stormwater Site Plan Report and the Coldest Ice Convenience Store Civil Plans are being used to meet Minimum Requirement #1.

Description of Site Appropriate Development Principles

Where practicable, projects shall use the following site appropriate development principles. Put a checkmark next to the principles that will be used for the project. Project design is not required to be changed in order to accommodate site appropriate development principles, but where feasible, these principles must be used. If none of the site development principles are feasible, place a checkmark next to that box below.

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.

Site appropriate development principles are not practicable because of project design.

### Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan

The Construction Stormwater Pollution Prevention Plan is available as a stand-alone document as part of the Permit submittal.

### Minimum Requirement #3 – Source Control

1. Description of Final Site Use

The final site will be a convenience store with associated parking lot and drive aisles. The convenience store will have a small deli section with precooked items.

1. Source Control BMPs

Table 4 – Source Control BMPs

|  |  |  |
| --- | --- | --- |
| **BMP** | **Property/Site Type or Activity Type** | **Potential Pollutant(s) Associated with Activity or Pollutant that BMP is being used for.** |
| BMP S100: Correcting Illicit Discharges to the Stormwater System | All commercial and industrial sites. | Wastewater, process water. |
| BMP S101: Labeling Stormwater Inlet | All commercial and industrial sites. | Wastes from dumping. |
| BMP S102: Formation of a Pollution Prevention team | All commercial and industrial sites. |  |
| BMP S103: Preventative Maintenance/Good Housekeeping | All commercial and industrial sites. |  |
| BMP S104: Spill Prevention and Cleanup | All commercial and industrial sites. | Leaks and spills of liquid and solid waste. |
| BMP S105: Employee Training | All commercial and industrial sites. |  |
| BMP S106: Inspections | All commercial and industrial sites. |  |
| BMP S107: Record Keeping | All commercial and industrial sites. |  |
| BMP S111: Cleaning Building Structures and Related Equipment | Outside washing of building structures including pressure washing of sidewalks, walkways, etc. and/or where washing may come into contact with precipitation or stormwater. | Heavy metals, pH, suspended solids, grit, paint chips, and biochemical oxygen demand (BOD) |
| BMP S114: Loading and Unloading Areas for Liquid and Solid Material | Loading and unloading of liquid and solid materials at industrial and commercial sites. | Fuel leaks and spills, oils, powders, organics, heavy metals, salts, acids, alkalis |
| BMP S117: Storage of Solid Wastes and Food Wastes | Outside storage of solid waste including ordinary garbage and/or where storage may come into contact with precipitation or stormwater. | Toxic organic compounds, oil and grease, heavy metals, nutrients, suspended solids, COD, BOD |
| BMP S139: Stormwater System Maintenance | All properties with stormwater systems. | Excess sediment, oils, hydrocarbons and sediment |
| BMP S143: Landscaping and Lawn/Vegetation Management | Properties and areas in the ROW that have landscaping and/or lawn areas. | Toxic organic compounds, heavy metals, oils, total suspended solids, coliform bacteria, fertilizers, and pesticides. |
| BMP S162: Proper Disposal | Disposing of any liquid or solid waste. | Liquid and solid waste. |

### Minimum Requirement #4 – Preserving Drainage Patterns and Outfalls

1. Description of Drainage Patterns and Outfalls

Stormwater will continue to flow in the general direction as the existing condition. Stormwater will discharge to the same receiving waterbodies as in the existing condition.

1. Description of Concentrated and/or Increased Volume or Flowrate and Mitigation

This project is proposing to discharge stormwater to the City of Tacoma system. See Section 7 – Additional Protective Measure – Infrastructure Protection for more information.

### Minimum Requirement #5 – Onsite Stormwater Management

This project will utilize: The List Approach

List #2 BMPs were analyzed for feasibility.

For Lawn and Landscaped Areas – BMP L613: Post Construction Soil Quality and Depth – Option 3 – Amend in Place will be used on all areas that will be lawn/landscaped in the final scenario.

For roofs the following BMPs were analyzed for feasibility.

BMP L602: Downspout Full Infiltration was deemed infeasible. See infeasibility checklist in Appendix A and Soils Report – Page 9. Per the Project Soils Report, high groundwater has made this BMP infeasible.

BMP L630: Bioretention was deemed infeasible. See infeasibility checklist in Appendix A and Soils Report – Page 9. Per the Project Soils Report, high groundwater has made this BMP infeasible.

BMP L603: Downspout dispersion was deemed infeasible. See infeasibility checklist in Appendix A and Figure 7 which shows flowpath distances cannot be maintained.

BMP L604: Perforated Stub-Outs was deemed infeasible. See infeasibility checklist in Appendix A and Soils Report – Page 9. . Per the Project Soils Report, high groundwater has made this BMP infeasible.

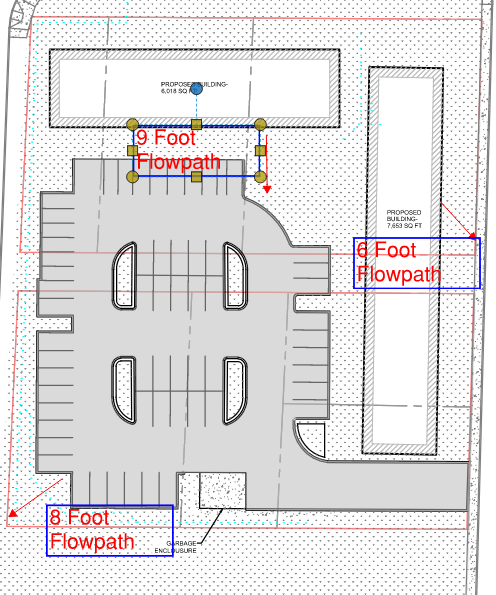
For Other Hard Surfaces the following were analyzed for infeasibility:

BMP L614: Full Dispersion was deemed infeasible. See infeasibility checklist – Appendix A.

BMP L633: Permeable Pavements was deemed infeasible. See infeasibility checklist – Appendix A and Soils Report – Page 9. . Per the Project Soils Report, high groundwater has made this BMP infeasible.

BMP L630: was deemed infeasible. See above.

BMP L612: Sheet Flow Dispersion was deemed infeasible. See infeasibility checklist and Figure 7 which shows flowpath length cannot be accommodated.



**Figure 7 – Flowpath Lengths – Dispersion BMPs**

### Minimum Requirement #6 – Stormwater Treatment

1. Description of Compliance Need

Minimum Requirement #6 is required for this project because the project creates more than 5,000 square feet of new and replaced pollution generating hard surface area. See Figure 8 – Stormwater Treatment Basin and Table 1 – Project Thresholds for quantities.

Project only has one TDA. Requirement applies to all new and replaced pollution generating hard surfaces.

1. Compliance Mechanism(s)
2. Treatment type required

Oil control is not required because there were less than 300 trip ends per day and ADT is less than 100 per 1000 SF of gross building area. See Traffic Report – Coldest Ice – Page 12. An excerpt from the Traffic Report is included below for reference.

“Per standard accepted engineering traffic study procedures, trips ends for this project have been determined to be 249 and ADT is 57 per 1000 SF of gross building area. See Traffic Report attached under separate cover.

Enhanced treatment is required for all pollution generating hard surfaces.

1. Stormwater treatment basin map

See Figure 8 – Stormwater Treatment Basin Map

1. State the BMP(s) being used.

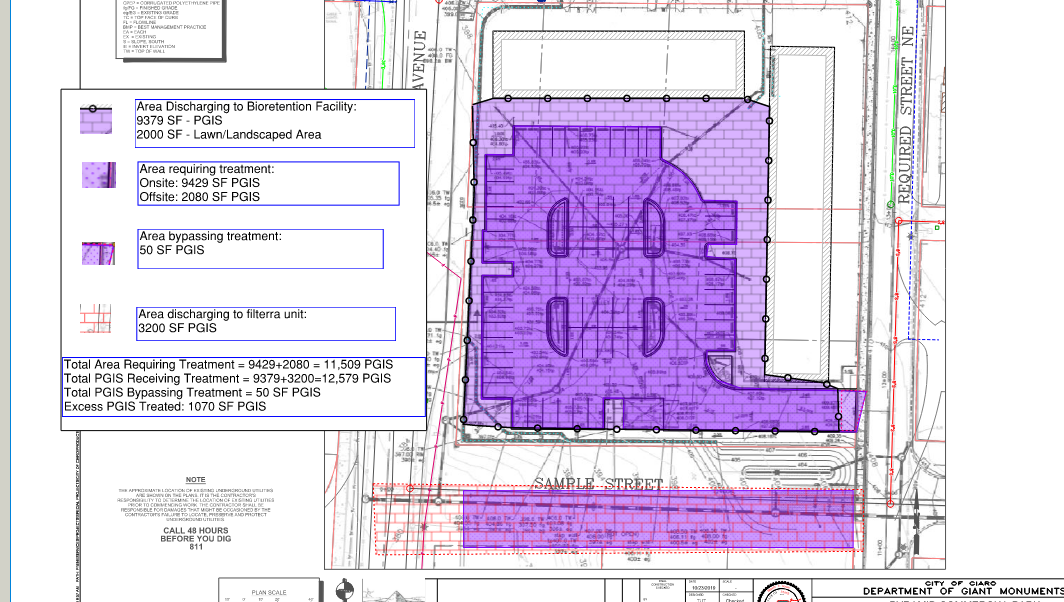
Onsite a bioretention facility (BMP T630) with an underdrain and liner will be used to treat stormwater. Offsite, a filterra unit (BMP T1300) will be used to treat the pollution-generating surfaces in the Right-of-Way. See Appendix B for complete calculations.

The filterra GULD is included in Appendix E.

Note: In MR #5 discussion, it is stated that BMP T630 is not feasible due to high groundwater, that was referring to a bioretention facility that would infiltrate. This bioretention facility will be used for treatment only and will not infiltrate due to the liner and underdrain.

**Figure 8 – Stormwater Treatment Basin Map**

**NOTE: for this SSP to be approved, changes to the hatches would be required for clarity.**



### Minimum Requirement #7 – Flow Control

1. Description of Compliance Need

This project creates more than 10,000 square feet of effective impervious surface so flow control is required. See Figure 9 – Flow Control Basin Map and Table 1 – Project Thresholds for quantities.

Project only has one TDA. Requirement applies to all new and replaced hard surfaces.

1. Compliance Mechanism(s)
2. Describe flow control type required (ex. Forested, existing).

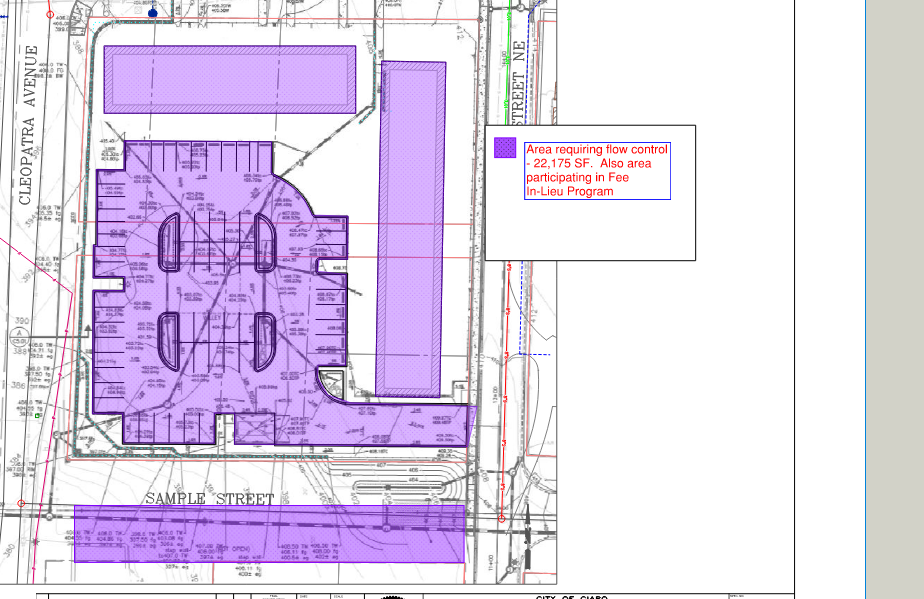
Project is required to provide flow control to forested conditions. Project is proposing to participate in the City of Tacoma Fee In-Lieu Program. See stand-alone Fee In-Lieu application.

1. Provide a flow basin map clearly showing surfaces requiring flow control and surfaces receiving flow control (facility contributing areas).

See Figure 9 – Flow Control Basin Map

1. State the BMP(s) being used.

The project will utilize the City of Tacoma Fee In-Lieu Program. The application form is included as a separate document.



**Figure 9 – Flow Control Basin Map**

### Minimum Requirement #8 – Wetlands Protection

1. Description of Compliance Need

The project is not required to comply with MR #8 because the project does not discharge into a wetland.

### **Minimum Requirement #9 – Operation and Maintenance**

For facilities that will be maintained by a private property owner include the following language: The Operation and Maintenance Manual is available as a stand-alone document as part of the Permit submittal.

For facilities that will be maintained by the City of Tacoma include the following language: The City of Tacoma is responsible for creating and keeping an Operation and Maintenance Manual for all facilities that will be maintained by the City of Tacoma.

## Additional Protective Measure – Infrastructure Protection

1. **Description of Compliance Need**

The project is not required to complete a quantitative downstream analysis. The project does not add any surface area to the downstream system (everything in the current condition enters the City stormwater system). The changes from pervious to impervious surface are less than 5,000 square feet – there is a decrease in impervious surface area. Per the SWMM volume 1 Section 1.5, no analysis is required.

## Conveyance System Design

1. **Include all information necessary to show how the conveyance system was designed.**

See Appendix B for all calculation outputs. The onsite conveyance system was designed assuming backwater effects to have 0.5 feet of freeboard between the water surface and the top of the maintenance hole or catch basin at the 10-year, 24-hour storm event. At the 100-year, 24-hour storm event, no overtopping was shown in the modeling outputs.

# Appendices

## Minimum Requirement #5 – Infeasibility Checklists

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Roofs BMP L602: Downspout Full Infiltration (Infiltration Trenches and Drywells) Version: 07/01/2021 | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | |
| Questions #1-7 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries and certain design criteria. | | | | |
| **Question Number** | **Question** | **Yes** | **No** | **NA** |
| 1 | Can the infiltration trench or drywell be placed 10 feet or more from any building structure? |  |  |  |
| 2 | Can the infiltration trench or drywell be placed 5 feet or more from any other structure or property line? |  |  |  |
| 3 | Can the infiltration trench or drywell be placed 50 feet or more from the top of any slope 20% or greater? |  |  |  |
| 4 | Can the infiltration trench or drywell be placed 50 feet or more from geologically hazardous areas? |  |  |  |
| 5 | Can the infiltration trench or drywell meet setback requirements from Onsite Sewage Systems per WAC 246-272A-0210? |  |  |  |
| 6 | Will installing an infiltration trench or drywell cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (6a-6e). |  |  |  |
| 6a | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act |  | | |
| 6b | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts |  | | |
| 6c | Public health and safety standards |  | | |
| 6d | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way |  | | |
| 6e | Critical Area Preservation Ordinance |  | | |
| 7 | Can the design standards in BMP L602 be met? |  |  |  |
| 7a | Describe the design standards that cannot be met: | | | |
| Questions #8-10 relate to infeasibility criteria that are based upon subsurface characteristics and require a soils report to determine infeasibility. | | | | |
| 8 | Was the soil classified as being clay, sandy clay, clay loam, silty clay loam, sandy clay loam, or silt according to the USDA Textural Soil Triangle? (An answer of yes means this BMP is not feasible). |  |  |  |
| 9 | Is the depth from proposed final grade to the seasonal high groundwater table or other impermeable layer equal to or greater than 3 feet? |  |  |  |
| 10 | Is the depth from the bottom of the infiltration trench or drywell to the seasonal high groundwater table equal to or greater than 1 foot? |  |  |  |

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| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Roofs or Other Hard SurfaceBMP L630: BioretentionVersion: 07/01/2021 | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | |
| Questions #1-18 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries. Citation of the following do not need site-specific written recommendations from a Washington State Licensed Professional Engineer or Washington State Licensed Professional Geologist though some criteria may require professional services to determine if the infeasibility criteria apply. | | | | |
| **Question Number** | **Question** | **Yes** | **No** | **NA** |
| **1** | **Can the bioretention facility be placed 10 feet or more from any building structure?** |  |  |  |
| 2 | Can the bioretention facility be placed 5 feet or more from any other structure or property line? |  |  |  |
| 3 | Can the bioretention facility be placed 50 feet or more from the top of any slope greater than 20%? |  |  |  |
| 4 | Can the bioretention facility be placed 50 feet or more from geologically hazardous areas? |  |  |  |
| 5 | Can the bioretention facility be located outside of designated erosion or landslide hazard areas? |  |  |  |
| 6 | Can the bioretention facility be located greater than 100 feet from an underground storage tank whose capacity including tank and underground connecting pipe is 1100 gallons or more? |  |  |  |
| 7 | Can the bioretention facility be located greater than 10 feet from an underground storage tank (tank used for petroleum product, chemical, or liquid hazardous waste storage) whose capacity including tank and underground connecting pipe is 1100 gallons or less? |  |  |  |
| 8 | Can the bioretention facility be located greater than 100 feet of a closed or active landfill? |  |  |  |
| 9 | Can the bioretention facility be located greater than 100 feet from drinking water well or a spring used for drinking water supply? |  |  |  |
| 10 | Can the bioretention facility be placed 10 feet or more from small on-site sewage disposal drainfields? (For large on-site sewage disposal setbacks see WAC Chapter 246-727B). |  |  |  |
| 11 | Can the bioretention facility be located on slopes less than 8%? |  |  |  |
| 12 | Is the bioretention facility compatible with the surrounding drainage system (e.g., project drains to an existing stormwater system whose elevation precludes proper connection to the bioretention facility)? |  |  |  |
| 13 | For properties with known soil or groundwater contamination, can the bioretention facility be located greater than 100 feet from an area known to have deep soil contamination? |  |  |  |
| 14 | For properties with known soil or groundwater contamination, can the bioretention facility be located such that infiltration will not increase or change the direction of the migration of pollutants in the groundwater? (Based upon groundwater modeling). |  |  |  |
| 15 | For properties with known soil or groundwater contamination, can the bioretention facility be located in an area that does not have contaminated surface soils that are proposed to remain in place? |  |  |  |
| 16 | For properties with known soil or groundwater contamination, can the bioretention facility be located in areas not prohibited by an approved cleanup plan under the state Model Toxics Control Act or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW? |  |  |  |
| 17 | For bioretention facilities that are constructed with imported compost materials, can the bioretention facility be located greater than ¼ mile from a phosphorus-sensitive waterbody? (Does not apply to discharges to Wapato Lake). |  |  |  |
| 18 | Will installing a bioretention facility cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (18a-18e). |  |  |  |
| 18a | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act |  | | |
| 18b | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts |  | | |
| 18c | Public health and safety standards |  | | |
| 18d | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way |  | | |
| 18e | Critical Area Preservation Ordinance |  | | |
| Questions #19-21 relate to infeasibility criteria that are based upon subsurface characteristics and require a soils report to determine infeasibility. | | | | |
| 19 | Is the depth from the lowest level of the bioretention soil mix or any underlying gravel layer to the seasonal high groundwater table or other impermeable layer equal to or greater than 1 foot? This applies only if the contributing area to the bioretention facility has less than 5,000 square feet of pollution-generating impervious surface, and less than 10,000 square feet of impervious surface, and less than ¾ acre pervious surface. |  |  |  |
| 20 | Is the depth from the lowest level of the bioretention soil mix or any underlying gravel layer to the seasonal high groundwater table or other impermeable layer equal to or greater than 3 feet? This applies only if the contributing area to the bioretention facility has: 5,000 square feet or greater of pollution-generating impervious surface, or 10,000 square feet or greater of impervious surface, or more ¾ acre pervious surface AND the bioretention facility cannot be broken down into amounts smaller than those listed above. |  |  |  |
| 21 | Was the soil classified as having a measured native soil saturated hydraulic conductivity of 0.3 in/hour or more*?* |  |  |  |
| **Questions 22-29 require evaluation of site specific conditions and a written recommendation from an appropriate Washington State Licensed Professional (e.g., Professional Engineer, Professional Geologist, Professional Hydrogeologist).** | | | | |
| 22 | Will the proposed bioretention facility location threaten the safety or reliability of preexisting underground utilities, preexisting underground storage tanks, preexisting structures, or preexisting road or parking lot surfaces? (An answer of yes means the BMP is infeasible). |  |  |  |
| 23 | Will the proposed bioretention facility location allow for a safe overflow pathway to the City stormwater system or a private stormwater system? |  |  |  |
| 24 | Are there reasonable concerns about erosion, slope failure, or downgradient flooding due to infiltration? (An answer of yes means the BMP is infeasible). |  |  |  |
| 25 | Is the project located in an area whose groundwater drains into an erosion hazard or landslide hazard area? (An answer of yes means the BMP is infeasible). |  |  |  |
| 26 | Will infiltrating water threaten existing below grade basements? (An answer of yes means the BMP is infeasible). |  |  |  |
| 27 | Will infiltrating water threaten shoreline structures such as bulkheads? (An answer of yes means the BMP is infeasible). |  |  |  |
| 28 | Is there lack of usable space onsite for bioretention facilities at redevelopment sites? (An answer of yes means the BMP is infeasible). |  |  |  |
| 29 | For public road projects, is there insufficient space within the ROW to install a bioretention facility? (An answer of yes means this BMP is infeasible). |  |  |  |

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| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Roofs and Other Hard Surfaces BMP L614: Full Dispersion Version: 07/01/2021 | | | | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | | | | |
| Questions #1-9 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries and certain design criteria. | | | | | | | |
| **Question Number** | | **Question** | **Yes** | | | **No** | **NA** |
| 1 | | Can the flow spreader and dispersion areas be placed 10 feet or more from any building structure? |  | | |  |  |
| 2 | | Can the flow spreader and dispersion areas be placed 5 feet or more from any other structure or property line? |  | | |  |  |
| 3 | | Can the dispersion areas be placed 50 feet or more from the top of any slope 15% or greater? |  | | |  |  |
| 4 | | Can the dispersion areas be placed 50 feet or more from geologically hazardous areas? |  | | |  |  |
| 5 | | Can the dispersion area be located outside of critical areas, critical area buffers, streams, or lakes? |  | | |  |  |
| 6 | | Can the flow spreader and dispersion area maintain setbacks from Onsite Sewage Systems per WAC 246-272A-0210? |  | | |  |  |
| 8 | | Will installing a full dispersion system cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (8a-8e). |  | | |  |  |
| 8a | | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act |  | | | | |
| 8b | | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts |  | | | | |
| 8c | | Public health and safety standards |  | | | | |
| 8d | | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way |  | | | | |
| 8e | | Critical Area Preservation Ordinance |  | | | | |
| 9 | | Can the design standards in BMP L614 be met? |  | | |  |  |
| 9a | | Describe the design standard that cannot be met: Full Dispersion is not intended for commercial properties. | | | | | |
| **Questions #10 require evaluation of site specific conditions and a written recommendation from an appropriate Washington State Licensed Professional (e.g., Professional Engineer, Professional Geologist, Professional Hydrogeologist).** | | | | | | | |
| 10 | | Will the use of a full dispersion cause erosion or flooding problems onsite or on adjacent properties? (An answer of yes means this BMP is not feasible). |  | | |  |  |
| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Roofs BMP L603: Downspout Dispersion (Dispersion Trenches and Splashblocks) Version: 07/01/2021 | | | | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | | | | |
| Questions #1-10 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries and certain design criteria. | | | | | | | |
| **Question Number** | | **Question** | **Yes** | | | **No** | **NA** |
| 1 | | Can the dispersion trench or splashblocks be placed 10 feet or more from any building structure? |  | | |  |  |
| 2 | | Can the dispersion trench or splashblocks be placed 5 feet or more from any other structure or property line? |  | | |  |  |
| 3 | | Can the dispersion trench or splashblocks be placed 50 feet or more from the top of any slope 15% or greater? |  | | |  |  |
| 4 | | Can the dispersion trench or splashblocks be placed 50 feet or more from geologically hazardous areas? |  | | |  |  |
| 5 | | Can the dispersion trench or splashblock maintain setbacks from Onsite Sewage Systems per WAC 246-272A-0210? |  | | |  |  |
| 6 | | Is it possible to maintain or construct a vegetated flowpath of at least 25 feet from the outlet of a dispersion trench and any property line, structure, stream, wetland, other infiltration or dispersion system, or impervious surface? |  | | |  |  |
| 7 | | Is it possible to maintain or construct a vegetated flowpath of at least 50 feet from the outlet of a dispersion trench and any slope greater than 15%? |  | | |  |  |
| 8 | | Is it possible to maintain or construct a vegetated flowpath of at least 50 feet from the outlet of splashblock and any property line, structure, slope over 15%, stream, wetland, other infiltration or dispersion system, or impervious surface? |  | | |  |  |
| 9 | | Will installing a dispersion trench or splashblocks cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (9a-9e). |  | | |  |  |
| 9a | | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act |  | | | | |
| 9b | | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts |  | | | | |
| 9c | | Public health and safety standards |  | | | | |
| 9d | | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way |  | | | | |
| 9e | | Critical Area Preservation Ordinance |  | | | | |
| 10 | | Can the design standards in BMP L603 be met? |  | | |  |  |
| 10a | | Describe the design standard that cannot be met: | | | | | |
| **Questions #11 require evaluation of site specific conditions and a written recommendation from an appropriate Washington State Licensed Professional (e.g., Professional Engineer, Professional Geologist, Professional Hydrogeologist).** | | | | | | | |
| 11 | | Will the use of a dispersion trench or splashblocks cause erosion or flooding problems onsite or on adjacent properties? (An answer of yes means this BMP is not feasible). |  | | |  |  |
| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Roofs BMP L604: Perforated Stub-out Connections. Version: 07/01/2021 | | | | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | | | | |
| Questions #1-7 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries and certain design criteria. | | | | | | | |
| **Question Number** | | **Question** | **Yes** | | | **No** | **NA** |
| 1 | | Can the perforated stub-out connection be placed 10 feet or more from any building structure? |  | | |  |  |
| 2 | | Can the perforated stub-out connection be placed 5 feet or more from any other structure or property line? |  | | |  |  |
| 3 | | Can the perforated stub-out connection be placed 50 feet or more from the top of any slope 20% or greater? |  | | |  |  |
| 4 | | Can the perforated stub-out connection be placed 50 feet or more from geologically hazardous areas? |  | | |  |  |
| 5 | | Can the perforated stub-out connection meet setback requirements from Onsite Sewage Systems per WAC 246-272A-0210? |  | | |  |  |
| 6 | | Will installing a perforated stub-out connection cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (6a-6e). |  | | |  |  |
| 6a | | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act |  | | | | |
| 6b | | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts |  | | | | |
| 6c | | Public health and safety standards |  | | | | |
| 6d | | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way |  | | | | |
| 6e | | Critical Area Preservation Ordinance |  | | | | |
| 7 | | Can the design standards in BMP L604 be met? |  | | |  |  |
| 7a | | Describe the design standard that cannot be met: | | | | | |
| Questions #8 relates to infeasibility criteria that are based upon subsurface characteristics and require a soils report to determine infeasibility. | | | | | | | |
| 8 | | Is the depth from the bottom of the perforated stub-out connection to the seasonal high groundwater table equal to or greater than 1 foot? |  | | |  |  |
| City of Tacoma Stormwater Management Manual – Infeasibility ChecklistSurface Type: Other Hard SurfaceBMP L633: Permeable PavementVersion: 07/01/2021 | | | | | | | |
| It is not necessary to answer all questions when determining if a BMP is feasible for Minimum Requirement #5 – The List Approach. Unless otherwise noted, a single answer of No means the BMP is considered infeasible for meeting Minimum Requirement #5 – The List Approach. Applicant may choose which questions to answer when determining feasibility. | | | | | | | |
| Questions #1-24 relate to infeasibility criteria that are based onconditions such as topography and distances to predetermined boundaries. Citation of the following do not need site-specific written recommendations from a Washington State Licensed Professional Engineer or Washington State Licensed Professional Geologist though some criteria may require professional services to determine if the infeasibility criteria apply. | | | | | | | |
| **Question Number** | **Question** | | | **Yes** | **No** | | **NA** |
| **1** | **Can the permeable pavement be placed 10 feet or more from any building structure?** | | |  |  | |  |
| 2 | Can the permeable pavement be placed 5 feet or more from any other structure or property line? | | |  |  | |  |
| 3 | Can the permeable pavement be placed 50 feet or more from the top of any slope greater than 20%? | | |  |  | |  |
| 4 | Can the permeable pavement be placed 50 feet or more from geologically hazardous areas? | | |  |  | |  |
| 5 | Can the permeable pavement be located outside of designated erosion or landslide hazard areas? | | |  |  | |  |
| 7 | Can the permeable pavement be located greater than 10 feet from an underground storage tank (tank used for petroleum product, chemical, or liquid hazardous waste storage) whose capacity including tank and underground connecting pipe is 1100 gallons or less? | | |  |  | |  |
| 8 | Can the permeable pavement be located greater than 100 feet of a closed or active landfill? | | |  |  | |  |
| 9 | Can the permeable pavement be located greater than 100 feet from drinking water well or a spring used for drinking water supply if the permeable pavement is (or has run-on from) a pollution-generating hard surface? | | |  |  | |  |
| 10 | Can the permeable pavement be placed 10 feet or more from small on-site sewage disposal drainfields? (For large on-site sewage disposal setbacks see WAC Chapter 246-727B). | | |  |  | |  |
| 11 | Can the permeable pavement be constructed such that the subgrade is less than 6%? | | |  |  | |  |
| 12 | Can the permeable pavement be constructed such that the wearing course is less than 6% (after reasonable attempts have been made to design the grade)? | | |  |  | |  |
| 13 | Is the location for permeable pavement a multi-level parking garage, above a culvert, or a bridge? An answer of yes means the BMP is not feasible. | | |  |  | |  |
| 14 | Does the road receive more than very low traffic volumes? (Roads with a projected average daily traffic volume of 400 vehicles or less). This infeasibility criterion cannot be used for sidewalks or non-traffic bearing surfaces. An answer of yes means the BMP is not feasible. | | |  |  | |  |
| 15 | Does the road receive more than very low truck traffic? (Roads not subject to through truck traffic but may receive up to weekly use by utility trucks, daily school bus use, and multiple daily use by pick-up trucks, mail/parcel delivery trucks, and maintenance vehicles.). This infeasibility criterion cannot be used for sidewalks or non-traffic bearing surfaces. An answer of yes means the BMP is not feasible. | | |  |  | |  |
| 16 | Does the area typically generate high concentrations of oil due to high traffic turnover or frequent transfer of oil? (See SWMM for additional guidance.) An answer of yes means the BMP is not feasible. | | |  |  | |  |
| 17 | Can the permeable pavement be located outside of areas with industrial activity as identified in 40 CFR 122.26(b)14? | | |  |  | |  |
| 18 | Can permeable pavement be located outside of areas where the risk of concentrated pollutant spills is likely such as gas stations, truck stops, and industrial chemical storage areas? | | |  |  | |  |
| 19 | Can permeable pavement be located outside of areas likely to have long-term excessive sediment deposition after construction? | | |  |  | |  |
| 20 | For properties with known soil or groundwater contamination, can the permeable pavement be located greater than 100 feet from an area known to have deep soil contamination? | | |  |  | |  |
| 21 | For properties with known soil or groundwater contamination, can the permeable pavement be located such that infiltration will not increase or change the direction of the migration of pollutants in the groundwater? (Based upon groundwater modeling). | | |  |  | |  |
| 22 | For properties with known soil or groundwater contamination, can the permeable pavement be located in an area that does not have contaminated surface soils that are proposed to remain in place? | | |  |  | |  |
| 23 | For properties with known soil or groundwater contamination, can the permeable pavement be located in areas not prohibited by an approved cleanup plan under the state Model Toxics Control Act or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW? | | |  |  | |  |
| 24 | Will installing permeable pavement cause conflicts with any of the following? (An answer of yes means this BMP is infeasible.) Place a checkmark next to the applicable item (24a-24e). | | |  |  | |  |
| 24a | Requirements of the Historic Preservation Laws and Archeology Laws, Federal Superfund or Washington State Model Toxics Control Act, Federal Aviation Administration requirements for airports, or Americans with Disability Act | | |  | | | |
| 24b | Special zoning district design criteria adopted and being implemented through any City of Tacoma planning efforts | | |  | | | |
| 24c | Public health and safety standards | | |  | | | |
| 24d | Transportation regulations to maintain the option for future expansion or multi-modal use of public rights-of-way | | |  | | | |
| 24e | Critical Area Preservation Ordinance | | |  | | | |
| Questions #25-28 relate to infeasibility criteria that are based upon subsurface characteristics and require a soils report to determine infeasibility. | | | | | | | |
| 25 | Is the depth from the lowest layer designed as part of the permeable pavement section to the seasonal high groundwater elevation, bedrock, or other impermeable layer equal to or greater than 1 foot? | | |  |  | |  |
| 26 | For pollution generating pervious pavement surfaces, can the soil suitability criteria for treatment be met? (See SWMM – BMP L633) | | |  |  | |  |
| 27 | Was the soil classified as having a measured native soil saturated hydraulic conductivity of 0.3 in/hour or more*?* | | |  |  | |  |
| 28 | Is the existing impervious surface that will be replaced non-polluting generating and located over an outwash soil with a saturated hydraulic conductivity of 4 inches/hour or greater? | | |  |  | |  |
| **Questions 29-40 require evaluation of site specific conditions and a written recommendation from an appropriate Washington State Licensed Professional (e.g., Professional Engineer, Professional Geologist, Professional Hydrogeologist).** | | | | | | | |
| 29 | Will the proposed permeable pavement location threaten the safety or reliability of preexisting underground utilities, preexisting underground storage tanks, preexisting structures, or preexisting road or parking lot surfaces? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 30 | Will infiltrating and ponded water compromise existing adjacent impervious pavements? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 31 | Are there reasonable concerns about erosion, slope failure, or downgradient flooding due to infiltration? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 32 | Can the permeable pavement be located outside area whose groundwater drains into an erosion hazard or landslide hazard area? | | |  |  | |  |
| 33 | Will infiltrating water threaten existing below grade basements? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 34 | Will infiltrating water threaten shoreline structures such as bulkheads? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 35 | Can permeable pavement be located away from the bottom of steep, erosion prone areas that are likely to erode sediment? | | |  |  | |  |
| 36 | Can permeable pavement be located away from fill soils that can become unstable when saturated? | | |  |  | |  |
| 37 | Will permeable pavement construction on steep slopes cause erosion and structural failure? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 38 | Will permeable pavement construction on steep slopes cause runoff velocities that preclude adequate infiltration at the pavement surfaces? (An answer of yes means the BMP is infeasible). | | |  |  | |  |
| 39 | Can permeable pavement provide sufficient strength to support the anticipated loads? | | |  |  | |  |
| 40 | Are underlying soils suitable for supporting traffic loads when saturated? | | |  |  | |  |

## Soils Report

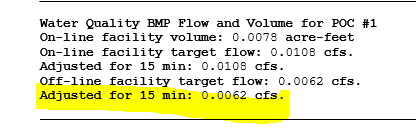
The Soils Report is available as a stand-alone document as part of the Permit submittal. It is titled: Coldest Ice Convenience Store – Geotechnical Analysis – Dated 04/17/2021.

## Stormwater Treatment Calculations

**Filterra Calculations:**

Offline Water Quality Flowrate: 0.0062 CFS

Snip from WWHM Calculation – See Full WWHM Report After This Calculation



Per General Use Level Designation, the minimum size filter surface-area is calculated by dividing the water quality flowrate (ft3/sec) by the infiltration rate (ft/sec) to obtain required surface area (ft2)

Infiltration Rate (per GULD) for Enhanced Treatment: 175 in/hour.

175 in/hr \* (1 hr/3600 sec) \* (1ft/12in) = 0.0041ft/sec

0.0062 ft3/sec / 0.0041 ft/sec = 1.512 ft2

A 4 x 4 filterra Vault will be used.

**WWHM2012**

**PROJECT REPORT**

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**Project Name:** Offsite Stormwater Treatment – filterra Unit

**Site Name:**

**Site Address:**

**City :**

**Report Date:** 5/18/2021

**Gage :**

**Data Start :** 10/01/1901

**Data End :** 09/30/2059

**Precip Scale:** 1.00

**Version Date:** 2019/09/13

**Version :** 4.2.17

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**Low Flow Threshold for POC 1 :** 50 Percent of the 2 Year

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**High Flow Threshold for POC 1:** 50 year

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**PREDEVELOPED LAND USE**

**Name :** Basin 1

**Bypass:** No

**GroundWater:** No

**Pervious Land Use acre**

**Pervious Total 0**

**Impervious Land Use acre**

**ROADS FLAT 0.073**

**Impervious Total 0.073**

**Basin Total 0.073**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Element Flows To:**

**Surface Interflow Groundwater**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MITIGATED LAND USE**

**Name :** Basin 1

**Bypass:** No

**GroundWater:** No

**Pervious Land Use acre**

**Pervious Total 0**

**Impervious Land Use acre**

**ROADS FLAT 0.073**

**Impervious Total 0.073**

**Basin Total 0.073**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Element Flows To:**

**Surface Interflow Groundwater**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**ANALYSIS RESULTS**

**Stream Protection Duration**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Predeveloped Landuse Totals for POC #1**

**Total Pervious Area:0**

**Total Impervious Area:0.073**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Mitigated Landuse Totals for POC #1**

**Total Pervious Area:0**

**Total Impervious Area:0.073**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Flow Frequency Return Periods for Predeveloped. POC #1**

**Return Period Flow(cfs)**

**2 year** 0.025583

**5 year** 0.034341

**10 year** 0.040706

**25 year** 0.049417

**50 year** 0.056409

**100 year** 0.063845

**Flow Frequency Return Periods for Mitigated. POC #1**

**Return Period Flow(cfs)**

**2 year** 0.025583

**5 year** 0.034341

**10 year** 0.040706

**25 year** 0.049417

**50 year** 0.056409

**100 year** 0.063845

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**Stream Protection Duration**

**Annual Peaks for Predeveloped and Mitigated. POC #1**

**Year Predeveloped Mitigated**

1902 0.030 0.030

1903 0.034 0.034

1904 0.038 0.038

1905 0.017 0.017

1906 0.019 0.019

1907 0.025 0.025

1908 0.021 0.021

1909 0.026 0.026

1910 0.025 0.025

1911 0.028 0.028

1912 0.046 0.046

1913 0.020 0.020

1914 0.084 0.084

1915 0.017 0.017

1916 0.032 0.032

1917 0.012 0.012

1918 0.026 0.026

1919 0.016 0.016

1920 0.021 0.021

1921 0.018 0.018

1922 0.028 0.028

1923 0.020 0.020

1924 0.037 0.037

1925 0.016 0.016

1926 0.030 0.030

1927 0.025 0.025

1928 0.018 0.018

1929 0.037 0.037

1930 0.038 0.038

1931 0.018 0.018

1932 0.020 0.020

1933 0.020 0.020

1934 0.032 0.032

1935 0.017 0.017

1936 0.024 0.024

1937 0.035 0.035

1938 0.017 0.017

1939 0.022 0.022

1940 0.038 0.038

1941 0.038 0.038

1942 0.029 0.029

1943 0.028 0.028

1944 0.041 0.041

1945 0.031 0.031

1946 0.024 0.024

1947 0.019 0.019

1948 0.026 0.026

1949 0.040 0.040

1950 0.022 0.022

1951 0.034 0.034

1952 0.038 0.038

1953 0.035 0.035

1954 0.021 0.021

1955 0.019 0.019

1956 0.019 0.019

1957 0.021 0.021

1958 0.026 0.026

1959 0.026 0.026

1960 0.020 0.020

1961 0.058 0.058

1962 0.025 0.025

1963 0.019 0.019

1964 0.054 0.054

1965 0.024 0.024

1966 0.020 0.020

1967 0.028 0.028

1968 0.024 0.024

1969 0.022 0.022

1970 0.024 0.024

1971 0.024 0.024

1972 0.078 0.078

1973 0.046 0.046

1974 0.033 0.033

1975 0.034 0.034

1976 0.036 0.036

1977 0.016 0.016

1978 0.026 0.026

1979 0.028 0.028

1980 0.027 0.027

1981 0.026 0.026

1982 0.021 0.021

1983 0.028 0.028

1984 0.028 0.028

1985 0.032 0.032

1986 0.016 0.016

1987 0.029 0.029

1988 0.017 0.017

1989 0.016 0.016

1990 0.021 0.021

1991 0.031 0.031

1992 0.029 0.029

1993 0.033 0.033

1994 0.023 0.023

1995 0.018 0.018

1996 0.024 0.024

1997 0.021 0.021

1998 0.025 0.025

1999 0.028 0.028

2000 0.024 0.024

2001 0.019 0.019

2002 0.035 0.035

2003 0.021 0.021

2004 0.031 0.031

2005 0.059 0.059

2006 0.028 0.028

2007 0.031 0.031

2008 0.026 0.026

2009 0.019 0.019

2010 0.025 0.025

2011 0.026 0.026

2012 0.024 0.024

2013 0.023 0.023

2014 0.022 0.022

2015 0.037 0.037

2016 0.023 0.023

2017 0.038 0.038

2018 0.022 0.022

2019 0.033 0.033

2020 0.027 0.027

2021 0.023 0.023

2022 0.039 0.039

2023 0.048 0.048

2024 0.052 0.052

2025 0.025 0.025

2026 0.028 0.028

2027 0.031 0.031

2028 0.012 0.012

2029 0.020 0.020

2030 0.040 0.040

2031 0.012 0.012

2032 0.021 0.021

2033 0.027 0.027

2034 0.021 0.021

2035 0.026 0.026

2036 0.021 0.021

2037 0.028 0.028

2038 0.026 0.026

2039 0.053 0.053

2040 0.021 0.021

2041 0.026 0.026

2042 0.030 0.030

2043 0.034 0.034

2044 0.023 0.023

2045 0.019 0.019

2046 0.021 0.021

2047 0.026 0.026

2048 0.021 0.021

2049 0.031 0.031

2050 0.023 0.023

2051 0.033 0.033

2052 0.025 0.025

2053 0.021 0.021

2054 0.042 0.042

2055 0.026 0.026

2056 0.034 0.034

2057 0.016 0.016

2058 0.032 0.032

2059 0.039 0.039

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**Stream Protection Duration**

**Ranked Annual Peaks for Predeveloped and Mitigated. POC #1**

**Rank Predeveloped Mitigated**

1 0.0839 0.0839

2 0.0784 0.0784

3 0.0590 0.0590

4 0.0581 0.0581

5 0.0538 0.0538

6 0.0531 0.0531

7 0.0516 0.0516

8 0.0483 0.0483

9 0.0459 0.0459

10 0.0455 0.0455

11 0.0424 0.0424

12 0.0406 0.0406

13 0.0396 0.0396

14 0.0396 0.0396

15 0.0393 0.0393

16 0.0391 0.0391

17 0.0384 0.0384

18 0.0383 0.0383

19 0.0380 0.0380

20 0.0380 0.0380

21 0.0380 0.0380

22 0.0375 0.0375

23 0.0374 0.0374

24 0.0372 0.0372

25 0.0366 0.0366

26 0.0363 0.0363

27 0.0354 0.0354

28 0.0353 0.0353

29 0.0352 0.0352

30 0.0340 0.0340

31 0.0339 0.0339

32 0.0337 0.0337

33 0.0335 0.0335

34 0.0335 0.0335

35 0.0334 0.0334

36 0.0333 0.0333

37 0.0329 0.0329

38 0.0329 0.0329

39 0.0322 0.0322

40 0.0321 0.0321

41 0.0320 0.0320

42 0.0315 0.0315

43 0.0314 0.0314

44 0.0310 0.0310

45 0.0309 0.0309

46 0.0308 0.0308

47 0.0308 0.0308

48 0.0307 0.0307

49 0.0305 0.0305

50 0.0303 0.0303

51 0.0303 0.0303

52 0.0292 0.0292

53 0.0285 0.0285

54 0.0285 0.0285

55 0.0283 0.0283

56 0.0283 0.0283

57 0.0283 0.0283

58 0.0282 0.0282

59 0.0281 0.0281

60 0.0279 0.0279

61 0.0277 0.0277

62 0.0277 0.0277

63 0.0276 0.0276

64 0.0276 0.0276

65 0.0276 0.0276

66 0.0272 0.0272

67 0.0272 0.0272

68 0.0265 0.0265

69 0.0264 0.0264

70 0.0264 0.0264

71 0.0263 0.0263

72 0.0263 0.0263

73 0.0260 0.0260

74 0.0258 0.0258

75 0.0258 0.0258

76 0.0257 0.0257

77 0.0256 0.0256

78 0.0256 0.0256

79 0.0256 0.0256

80 0.0256 0.0256

81 0.0255 0.0255

82 0.0255 0.0255

83 0.0255 0.0255

84 0.0254 0.0254

85 0.0251 0.0251

86 0.0251 0.0251

87 0.0250 0.0250

88 0.0250 0.0250

89 0.0247 0.0247

90 0.0247 0.0247

91 0.0245 0.0245

92 0.0244 0.0244

93 0.0242 0.0242

94 0.0241 0.0241

95 0.0239 0.0239

96 0.0239 0.0239

97 0.0238 0.0238

98 0.0238 0.0238

99 0.0237 0.0237

100 0.0234 0.0234

101 0.0234 0.0234

102 0.0231 0.0231

103 0.0230 0.0230

104 0.0230 0.0230

105 0.0228 0.0228

106 0.0225 0.0225

107 0.0224 0.0224

108 0.0223 0.0223

109 0.0218 0.0218

110 0.0215 0.0215

111 0.0214 0.0214

112 0.0213 0.0213

113 0.0211 0.0211

114 0.0211 0.0211

115 0.0210 0.0210

116 0.0209 0.0209

117 0.0209 0.0209

118 0.0208 0.0208

119 0.0208 0.0208

120 0.0208 0.0208

121 0.0207 0.0207

122 0.0207 0.0207

123 0.0206 0.0206

124 0.0206 0.0206

125 0.0206 0.0206

126 0.0204 0.0204

127 0.0202 0.0202

128 0.0200 0.0200

129 0.0199 0.0199

130 0.0198 0.0198

131 0.0198 0.0198

132 0.0197 0.0197

133 0.0195 0.0195

134 0.0194 0.0194

135 0.0194 0.0194

136 0.0191 0.0191

137 0.0190 0.0190

138 0.0187 0.0187

139 0.0186 0.0186

140 0.0186 0.0186

141 0.0185 0.0185

142 0.0183 0.0183

143 0.0180 0.0180

144 0.0178 0.0178

145 0.0173 0.0173

146 0.0172 0.0172

147 0.0170 0.0170

148 0.0170 0.0170

149 0.0170 0.0170

150 0.0165 0.0165

151 0.0163 0.0163

152 0.0158 0.0158

153 0.0156 0.0156

154 0.0156 0.0156

155 0.0155 0.0155

156 0.0125 0.0125

157 0.0122 0.0122

158 0.0120 0.0120

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**Stream Protection Duration**

**POC #1**

**The Facility PASSED**

**The Facility PASSED.**

**Flow(cfs) Predev Mit Percentage Pass/Fail**

0.0128 4771 4771 100 Pass

0.0132 4235 4235 100 Pass

0.0137 3724 3724 100 Pass

0.0141 3283 3283 100 Pass

0.0146 2935 2935 100 Pass

0.0150 2620 2620 100 Pass

0.0154 2373 2373 100 Pass

0.0159 2112 2112 100 Pass

0.0163 1919 1919 100 Pass

0.0168 1713 1713 100 Pass

0.0172 1540 1540 100 Pass

0.0176 1397 1397 100 Pass

0.0181 1272 1272 100 Pass

0.0185 1141 1141 100 Pass

0.0190 1049 1049 100 Pass

0.0194 957 957 100 Pass

0.0198 861 861 100 Pass

0.0203 794 794 100 Pass

0.0207 727 727 100 Pass

0.0212 645 645 100 Pass

0.0216 595 595 100 Pass

0.0220 544 544 100 Pass

0.0225 498 498 100 Pass

0.0229 467 467 100 Pass

0.0234 419 419 100 Pass

0.0238 390 390 100 Pass

0.0242 347 347 100 Pass

0.0247 320 320 100 Pass

0.0251 294 294 100 Pass

0.0256 268 268 100 Pass

0.0260 243 243 100 Pass

0.0264 219 219 100 Pass

0.0269 201 201 100 Pass

0.0273 188 188 100 Pass

0.0278 174 174 100 Pass

0.0282 160 160 100 Pass

0.0287 146 146 100 Pass

0.0291 137 137 100 Pass

0.0295 126 126 100 Pass

0.0300 122 122 100 Pass

0.0304 114 114 100 Pass

0.0309 105 105 100 Pass

0.0313 96 96 100 Pass

0.0317 89 89 100 Pass

0.0322 84 84 100 Pass

0.0326 79 79 100 Pass

0.0331 75 75 100 Pass

0.0335 67 67 100 Pass

0.0339 62 62 100 Pass

0.0344 61 61 100 Pass

0.0348 58 58 100 Pass

0.0353 57 57 100 Pass

0.0357 55 55 100 Pass

0.0361 53 53 100 Pass

0.0366 48 48 100 Pass

0.0370 46 46 100 Pass

0.0375 43 43 100 Pass

0.0379 42 42 100 Pass

0.0383 37 37 100 Pass

0.0388 34 34 100 Pass

0.0392 33 33 100 Pass

0.0397 28 28 100 Pass

0.0401 28 28 100 Pass

0.0405 28 28 100 Pass

0.0410 27 27 100 Pass

0.0414 27 27 100 Pass

0.0419 27 27 100 Pass

0.0423 24 24 100 Pass

0.0428 23 23 100 Pass

0.0432 22 22 100 Pass

0.0436 22 22 100 Pass

0.0441 21 21 100 Pass

0.0445 20 20 100 Pass

0.0450 20 20 100 Pass

0.0454 17 17 100 Pass

0.0458 16 16 100 Pass

0.0463 15 15 100 Pass

0.0467 15 15 100 Pass

0.0472 15 15 100 Pass

0.0476 15 15 100 Pass

0.0480 15 15 100 Pass

0.0485 14 14 100 Pass

0.0489 14 14 100 Pass

0.0494 13 13 100 Pass

0.0498 13 13 100 Pass

0.0502 13 13 100 Pass

0.0507 12 12 100 Pass

0.0511 12 12 100 Pass

0.0516 12 12 100 Pass

0.0520 11 11 100 Pass

0.0524 11 11 100 Pass

0.0529 11 11 100 Pass

0.0533 10 10 100 Pass

0.0538 10 10 100 Pass

0.0542 9 9 100 Pass

0.0546 9 9 100 Pass

0.0551 9 9 100 Pass

0.0555 9 9 100 Pass

0.0560 8 8 100 Pass

0.0564 8 8 100 Pass

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**Water Quality BMP Flow and Volume for POC #1**

**On-line facility volume:** 0.0078 **acre-feet**

**On-line facility target flow:** 0.0108 **cfs.**

**Adjusted for 15 min:** 0.0108 **cfs.**

**Off-line facility target flow:** 0.0062 **cfs.**

**Adjusted for 15 min:** 0.0062 **cfs.**

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**LID Report**

LID Technique Used for Total Volume Volume Infiltration Cumulative Percent Water Quality Percent Comment

Treatment? Needs Through Volume Volume Volume Water Quality

Treatment Facility (ac-ft.) Infiltration Infiltrated Treated

(ac-ft) (ac-ft) Credit

Total Volume Infiltrated 0.00 0.00 0.00 0.00 0.00 0% No Treat. Credit

Compliance with LID Standard 8 Duration Analysis Result = Passed

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**Perlnd and Implnd Changes**

No changes have been made.

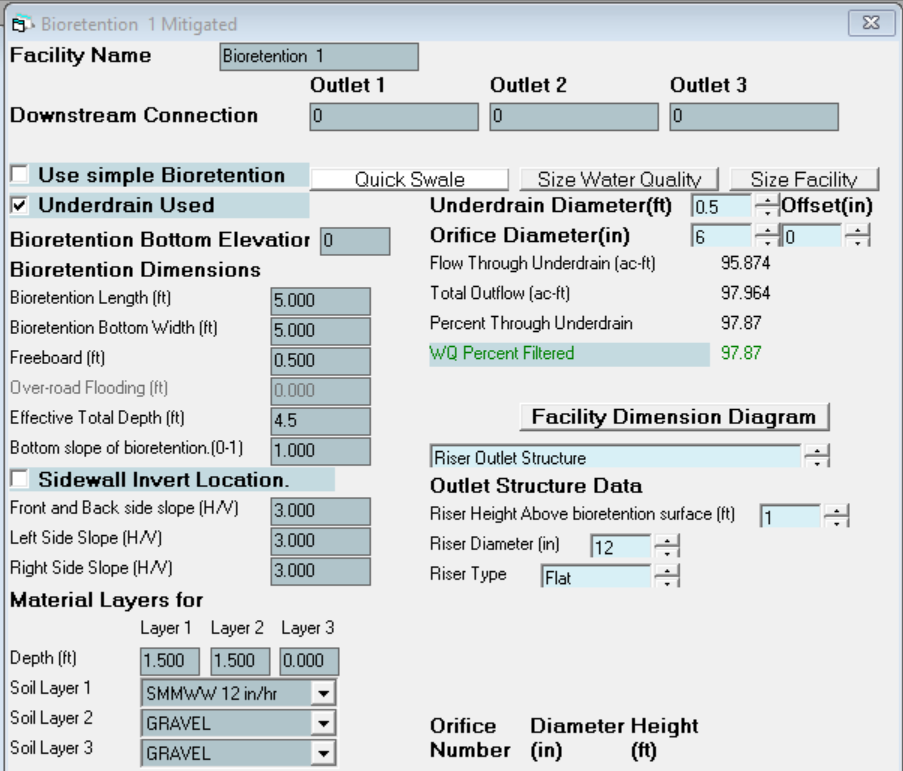
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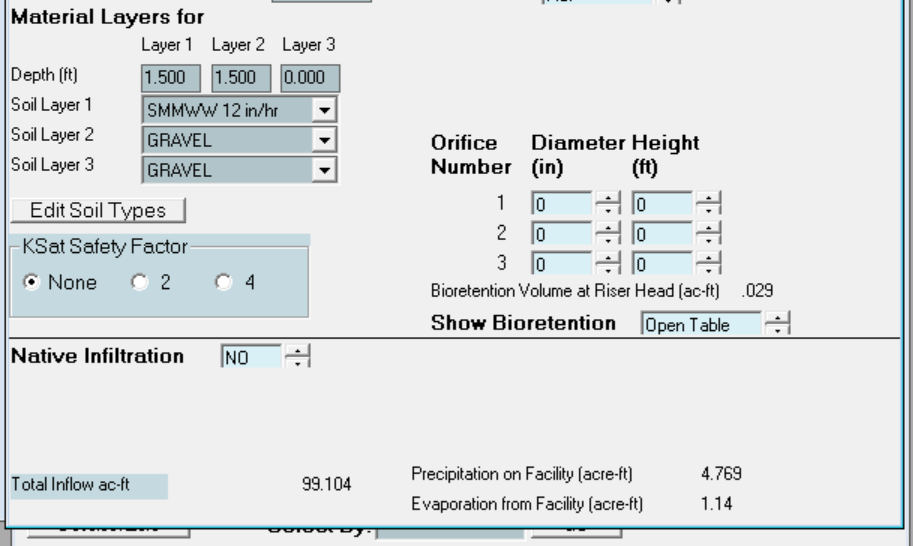
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**Bioretention Facility Sizing Calculations**

The bioretention facility was sized using the bioretention element in WWHM. A 5 foot by 5 foot bioretention facility is able to filter 97.87% which is higher than the 91% required treatment percentage.

Below is a screen shot from the WWHM bioretention facility. Included below that is the WWHM Model Report Output.





**WWHM2012**

**PROJECT REPORT**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Project Name:** Onsite Bioretention Facility

**Site Name:**

**Site Address:**

**City :**

**Report Date:** 5/18/2021

**Gage :**

**Data Start :** 10/01/1901

**Data End :** 09/30/2059

**Precip Scale:** 1.00

**Version Date:** 2019/09/13

**Version :** 4.2.17

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**Low Flow Threshold for POC 1 :** 50 Percent of the 2 Year

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**High Flow Threshold for POC 1:** 50 year

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**PREDEVELOPED LAND USE**

**Name :** Basin 1

**Bypass:** No

**GroundWater:** No

**Pervious Land Use acre**

**C, Lawn, Mod .0459**

**Pervious Total 0.0459**

**Impervious Land Use acre**

**ROADS FLAT 0.215**

**Impervious Total 0.215**

**Basin Total 0.2609**

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**Element Flows To:**

**Surface Interflow Groundwater**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MITIGATED LAND USE**

**Name :** Basin 1

**Bypass:** No

**GroundWater:** No

**Pervious Land Use acre**

**C, Lawn, Mod .0459**

**Pervious Total 0.0459**

**Impervious Land Use acre**

**ROADS FLAT 0.215**

**Impervious Total 0.215**

**Basin Total 0.2609**

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**Element Flows To:**

**Surface Interflow Groundwater**

Surface retention 1 Surface retention 1

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**Name :** Bioretention 1

**Bottom Length:** 5.00 ft.

**Bottom Width:** 5.00 ft.

**Material thickness of first layer:** 1.5

**Material type for first layer:** SMMWW 12 in/hr

**Material thickness of second layer:** 1.5

**Material type for second layer:** GRAVEL

**Material thickness of third layer:** 0

**Material type for third layer:** GRAVEL

**Underdrain used**

**Underdrain Diameter (feet):** 0.5

**Orifice Diameter (in.):** 6

**Offset (in.):** 0

**Flow Through Underdrain (ac-ft.):** 95.874

**Total Outflow (ac-ft.):** 97.964

**Percent Through Underdrain:** 97.87

**Discharge Structure**

**Riser Height:** 1 ft.

**Riser Diameter:** 12 in.

**Element Flows To:**

**Outlet 1 Outlet 2**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bioretention 1 Hydraulic Table**

**Stage(feet) Area(ac.) Volume(ac-ft.) Discharge(cfs) Infilt(cfs)**

0.0000 0.012144 0.000000 0.0000 0.0000

0.0495 0.011936 0.000007 0.0000 0.0000

0.0989 0.011628 0.000015 0.0000 0.0000

0.1484 0.011323 0.000023 0.0000 0.0000

0.1978 0.011022 0.000033 0.0000 0.0000

0.2473 0.010726 0.000043 0.0001 0.0000

0.2967 0.010434 0.000054 0.0001 0.0000

0.3462 0.010145 0.000067 0.0001 0.0000

0.3956 0.009861 0.000080 0.0002 0.0000

0.4451 0.009580 0.000095 0.0002 0.0000

0.4945 0.009304 0.000111 0.0003 0.0000

0.5440 0.009032 0.000128 0.0004 0.0000

0.5934 0.008764 0.000147 0.0005 0.0000

0.6429 0.008500 0.000166 0.0005 0.0000

0.6923 0.008240 0.000187 0.0006 0.0000

0.7418 0.007983 0.000210 0.0007 0.0000

0.7912 0.007731 0.000234 0.0009 0.0000

0.8407 0.007483 0.000259 0.0011 0.0000

0.8901 0.007240 0.000286 0.0011 0.0000

0.9396 0.007000 0.000315 0.0013 0.0000

0.9890 0.006764 0.000345 0.0015 0.0000

1.0385 0.006532 0.000377 0.0017 0.0000

1.0879 0.006304 0.000410 0.0020 0.0000

1.1374 0.006081 0.000446 0.0022 0.0000

1.1868 0.005861 0.000483 0.0022 0.0000

1.2363 0.005645 0.000522 0.0025 0.0000

1.2857 0.005434 0.000563 0.0028 0.0000

1.3352 0.005226 0.000606 0.0032 0.0000

1.3846 0.005022 0.000651 0.0036 0.0000

1.4341 0.004823 0.000698 0.0037 0.0000

1.4835 0.004628 0.000747 0.0039 0.0000

1.5330 0.004436 0.000794 0.0044 0.0000

1.5824 0.004249 0.000842 0.0048 0.0000

1.6319 0.004066 0.000893 0.0053 0.0000

1.6813 0.003886 0.000945 0.0056 0.0000

1.7308 0.003711 0.001000 0.0057 0.0000

1.7802 0.003540 0.001057 0.0063 0.0000

1.8297 0.003373 0.001116 0.0068 0.0000

1.8791 0.003210 0.001177 0.0116 0.0000

1.9286 0.003051 0.001240 0.0116 0.0000

1.9780 0.002896 0.001306 0.0116 0.0000

2.0275 0.002745 0.001375 0.0116 0.0000

2.0769 0.002598 0.001445 0.0116 0.0000

2.1264 0.002455 0.001518 0.0116 0.0000

2.1758 0.002316 0.001594 0.0116 0.0000

2.2253 0.002181 0.001672 0.0116 0.0000

2.2747 0.002050 0.001752 0.0116 0.0000

2.3242 0.001924 0.001836 0.0116 0.0000

2.3736 0.001801 0.001922 0.0116 0.0000

2.4231 0.001682 0.002010 0.0116 0.0000

2.4725 0.001568 0.002101 0.0116 0.0000

2.5220 0.001457 0.002195 0.0116 0.0000

2.5714 0.001351 0.002292 0.0116 0.0000

2.6209 0.001248 0.002392 0.0116 0.0000

2.6703 0.001150 0.002495 0.0116 0.0000

2.7198 0.001055 0.002600 0.0116 0.0000

2.7692 0.000965 0.002709 0.0116 0.0000

2.8187 0.000879 0.002820 0.0116 0.0000

2.8681 0.000796 0.002935 0.0116 0.0000

2.9176 0.000718 0.003053 0.0116 0.0000

2.9670 0.000644 0.003174 0.0116 0.0000

3.0000 0.000574 0.003256 0.0116 0.0000

**Surface retention 1 Hydraulic Table**

**Stage(feet) Area(ac.) Volume(ac-ft.) Discharge(cfs) To Amended(cfs) Wetted Surface**

3.0000 0.012144 0.003256 0.0000 0.0069 0.0000

3.0495 0.012460 0.003864 0.0000 0.0069 0.0000

3.0989 0.012779 0.004488 0.0000 0.0074 0.0000

3.1484 0.013102 0.005128 0.0000 0.0076 0.0000

3.1978 0.013430 0.005784 0.0000 0.0079 0.0000

3.2473 0.013761 0.006457 0.0000 0.0081 0.0000

3.2967 0.014097 0.007146 0.0000 0.0083 0.0000

3.3462 0.014436 0.007851 0.0000 0.0085 0.0000

3.3956 0.014780 0.008573 0.0000 0.0088 0.0000

3.4451 0.015128 0.009313 0.0000 0.0090 0.0000

3.4945 0.015479 0.010070 0.0000 0.0092 0.0000

3.5440 0.015835 0.010844 0.0000 0.0095 0.0000

3.5934 0.016195 0.011636 0.0000 0.0097 0.0000

3.6429 0.016559 0.012446 0.0000 0.0099 0.0000

3.6923 0.016927 0.013274 0.0000 0.0101 0.0000

3.7418 0.017299 0.014120 0.0000 0.0104 0.0000

3.7912 0.017675 0.014985 0.0000 0.0106 0.0000

3.8407 0.018055 0.015868 0.0000 0.0108 0.0000

3.8901 0.018439 0.016770 0.0000 0.0111 0.0000

3.9396 0.018827 0.017692 0.0000 0.0113 0.0000

3.9890 0.019219 0.018632 0.0000 0.0115 0.0000

4.0385 0.019615 0.019593 0.0800 0.0118 0.0000

4.0879 0.020015 0.020573 0.2754 0.0120 0.0000

4.1374 0.020420 0.021572 0.5323 0.0122 0.0000

4.1868 0.020828 0.022592 0.8261 0.0124 0.0000

4.2363 0.021240 0.023632 1.1332 0.0127 0.0000

4.2857 0.021657 0.024693 1.4294 0.0129 0.0000

4.3352 0.022077 0.025774 1.6924 0.0131 0.0000

4.3846 0.022502 0.026877 1.9054 0.0134 0.0000

4.4341 0.022930 0.028000 2.0620 0.0136 0.0000

4.4835 0.023363 0.029144 2.1721 0.0138 0.0000

4.5000 0.023508 0.029531 2.2994 0.0139 0.0000

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**Name :** Surface retention 1

**Element Flows To:**

**Outlet 1 Outlet 2**

Bioretention 1

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**ANALYSIS RESULTS**

**Stream Protection Duration**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Predeveloped Landuse Totals for POC #1**

**Total Pervious Area:0.0459**

**Total Impervious Area:0.215**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Mitigated Landuse Totals for POC #1**

**Total Pervious Area:0.0459**

**Total Impervious Area:0.215**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Flow Frequency Return Periods for Predeveloped. POC #1**

**Return Period Flow(cfs)**

**2 year** 0.077441

**5 year** 0.104792

**10 year** 0.124796

**25 year** 0.152311

**50 year** 0.174492

**100 year** 0.198164

**Flow Frequency Return Periods for Mitigated. POC #1**

**Return Period Flow(cfs)**

**2 year** 0.032388

**5 year** 0.062528

**10 year** 0.086885

**25 year** 0.122038

**50 year** 0.151079

**100 year** 0.182333

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**Stream Protection Duration**

**Annual Peaks for Predeveloped and Mitigated. POC #1**

**Year Predeveloped Mitigated**

1902 0.089 0.056

1903 0.099 0.011

1904 0.121 0.049

1905 0.051 0.037

1906 0.056 0.011

1907 0.079 0.079

1908 0.063 0.038

1909 0.076 0.032

1910 0.074 0.077

1911 0.085 0.024

1912 0.152 0.133

1913 0.059 0.034

1914 0.261 0.041

1915 0.052 0.011

1916 0.095 0.055

1917 0.036 0.011

1918 0.076 0.035

1919 0.048 0.011

1920 0.065 0.028

1921 0.055 0.034

1922 0.089 0.059

1923 0.060 0.039

1924 0.110 0.020

1925 0.047 0.011

1926 0.089 0.046

1927 0.073 0.027

1928 0.056 0.011

1929 0.112 0.068

1930 0.113 0.011

1931 0.056 0.041

1932 0.060 0.041

1933 0.059 0.057

1934 0.102 0.085

1935 0.050 0.011

1936 0.072 0.011

1937 0.104 0.086

1938 0.052 0.026

1939 0.065 0.011

1940 0.114 0.055

1941 0.112 0.010

1942 0.089 0.063

1943 0.086 0.028

1944 0.126 0.120

1945 0.092 0.052

1946 0.074 0.011

1947 0.055 0.030

1948 0.077 0.068

1949 0.117 0.071

1950 0.066 0.011

1951 0.100 0.010

1952 0.125 0.125

1953 0.114 0.119

1954 0.063 0.021

1955 0.057 0.011

1956 0.056 0.009

1957 0.062 0.037

1958 0.080 0.077

1959 0.081 0.049

1960 0.061 0.011

1961 0.179 0.065

1962 0.075 0.046

1963 0.055 0.011

1964 0.170 0.031

1965 0.074 0.068

1966 0.061 0.019

1967 0.089 0.011

1968 0.072 0.035

1969 0.065 0.035

1970 0.076 0.047

1971 0.074 0.067

1972 0.247 0.083

1973 0.134 0.075

1974 0.100 0.040

1975 0.111 0.089

1976 0.115 0.063

1977 0.046 0.011

1978 0.084 0.085

1979 0.084 0.010

1980 0.084 0.011

1981 0.077 0.026

1982 0.063 0.011

1983 0.087 0.057

1984 0.087 0.042

1985 0.101 0.032

1986 0.050 0.014

1987 0.084 0.073

1988 0.051 0.039

1989 0.047 0.033

1990 0.063 0.034

1991 0.094 0.061

1992 0.086 0.072

1993 0.099 0.038

1994 0.071 0.053

1995 0.053 0.010

1996 0.074 0.063

1997 0.065 0.011

1998 0.079 0.074

1999 0.081 0.010

2000 0.073 0.011

2001 0.057 0.011

2002 0.114 0.033

2003 0.062 0.054

2004 0.092 0.056

2005 0.177 0.011

2006 0.082 0.010

2007 0.094 0.091

2008 0.077 0.027

2009 0.057 0.013

2010 0.075 0.065

2011 0.077 0.010

2012 0.074 0.071

2013 0.071 0.022

2014 0.066 0.010

2015 0.120 0.048

2016 0.069 0.010

2017 0.112 0.117

2018 0.072 0.074

2019 0.108 0.104

2020 0.085 0.011

2021 0.070 0.065

2022 0.117 0.011

2023 0.142 0.033

2024 0.167 0.124

2025 0.074 0.035

2026 0.082 0.058

2027 0.091 0.030

2028 0.036 0.010

2029 0.060 0.033

2030 0.117 0.076

2031 0.037 0.011

2032 0.062 0.009

2033 0.078 0.010

2034 0.061 0.040

2035 0.081 0.079

2036 0.061 0.052

2037 0.082 0.011

2038 0.084 0.081

2039 0.157 0.010

2040 0.063 0.046

2041 0.080 0.020

2042 0.090 0.082

2043 0.099 0.060

2044 0.070 0.049

2045 0.057 0.022

2046 0.063 0.040

2047 0.076 0.011

2048 0.062 0.062

2049 0.093 0.065

2050 0.071 0.031

2051 0.103 0.105

2052 0.074 0.044

2053 0.063 0.048

2054 0.137 0.080

2055 0.077 0.011

2056 0.099 0.011

2057 0.049 0.029

2058 0.093 0.017

2059 0.116 0.070

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**Stream Protection Duration**

**Ranked Annual Peaks for Predeveloped and Mitigated. POC #1**

**Rank Predeveloped Mitigated**

1 0.2606 0.1333

2 0.2470 0.1248

3 0.1793 0.1244

4 0.1765 0.1195

5 0.1696 0.1194

6 0.1669 0.1170

7 0.1568 0.1050

8 0.1516 0.1040

9 0.1423 0.0908

10 0.1370 0.0886

11 0.1342 0.0856

12 0.1258 0.0851

13 0.1246 0.0847

14 0.1210 0.0829

15 0.1201 0.0819

16 0.1173 0.0807

17 0.1170 0.0805

18 0.1170 0.0791

19 0.1159 0.0788

20 0.1146 0.0774

21 0.1144 0.0765

22 0.1137 0.0761

23 0.1135 0.0750

24 0.1134 0.0739

25 0.1122 0.0737

26 0.1120 0.0729

27 0.1119 0.0725

28 0.1106 0.0713

29 0.1101 0.0711

30 0.1079 0.0702

31 0.1043 0.0684

32 0.1035 0.0680

33 0.1022 0.0678

34 0.1013 0.0666

35 0.1001 0.0654

36 0.0999 0.0652

37 0.0994 0.0646

38 0.0992 0.0646

39 0.0990 0.0634

40 0.0985 0.0631

41 0.0951 0.0628

42 0.0944 0.0621

43 0.0942 0.0614

44 0.0929 0.0601

45 0.0926 0.0589

46 0.0924 0.0577

47 0.0920 0.0572

48 0.0908 0.0569

49 0.0898 0.0558

50 0.0894 0.0557

51 0.0893 0.0553

52 0.0892 0.0552

53 0.0890 0.0538

54 0.0887 0.0530

55 0.0871 0.0517

56 0.0868 0.0516

57 0.0861 0.0493

58 0.0855 0.0488

59 0.0849 0.0487

60 0.0848 0.0484

61 0.0844 0.0479

62 0.0841 0.0466

63 0.0840 0.0463

64 0.0839 0.0461

65 0.0836 0.0460

66 0.0821 0.0443

67 0.0819 0.0416

68 0.0817 0.0414

69 0.0812 0.0412

70 0.0811 0.0406

71 0.0805 0.0403

72 0.0803 0.0400

73 0.0797 0.0400

74 0.0794 0.0391

75 0.0787 0.0386

76 0.0781 0.0381

77 0.0775 0.0380

78 0.0772 0.0373

79 0.0767 0.0368

80 0.0766 0.0351

81 0.0765 0.0350

82 0.0763 0.0349

83 0.0761 0.0347

84 0.0760 0.0344

85 0.0755 0.0336

86 0.0750 0.0335

87 0.0749 0.0333

88 0.0744 0.0332

89 0.0743 0.0331

90 0.0742 0.0328

91 0.0742 0.0317

92 0.0741 0.0316

93 0.0740 0.0315

94 0.0737 0.0306

95 0.0737 0.0304

96 0.0734 0.0299

97 0.0730 0.0294

98 0.0721 0.0277

99 0.0721 0.0276

100 0.0721 0.0273

101 0.0714 0.0266

102 0.0712 0.0258

103 0.0710 0.0256

104 0.0702 0.0238

105 0.0698 0.0221

106 0.0689 0.0218

107 0.0660 0.0210

108 0.0656 0.0200

109 0.0653 0.0199

110 0.0652 0.0194

111 0.0646 0.0167

112 0.0645 0.0137

113 0.0635 0.0135

114 0.0632 0.0115

115 0.0631 0.0114

116 0.0631 0.0114

117 0.0630 0.0113

118 0.0626 0.0113

119 0.0626 0.0113

120 0.0623 0.0113

121 0.0623 0.0113

122 0.0622 0.0112

123 0.0619 0.0111

124 0.0611 0.0111

125 0.0611 0.0111

126 0.0608 0.0111

127 0.0606 0.0111

128 0.0605 0.0110

129 0.0605 0.0109

130 0.0604 0.0109

131 0.0593 0.0109

132 0.0591 0.0109

133 0.0574 0.0109

134 0.0572 0.0108

135 0.0571 0.0108

136 0.0568 0.0108

137 0.0563 0.0108

138 0.0562 0.0108

139 0.0559 0.0108

140 0.0556 0.0107

141 0.0555 0.0107

142 0.0553 0.0106

143 0.0547 0.0105

144 0.0535 0.0105

145 0.0519 0.0105

146 0.0516 0.0103

147 0.0513 0.0103

148 0.0509 0.0102

149 0.0501 0.0101

150 0.0497 0.0101

151 0.0485 0.0100

152 0.0479 0.0099

153 0.0469 0.0099

154 0.0468 0.0098

155 0.0464 0.0098

156 0.0373 0.0098

157 0.0358 0.0094

158 0.0355 0.0094

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**Stream Protection Duration**

**POC #1**

**The Facility PASSED**

**The Facility PASSED.**

**Flow(cfs) Predev Mit Percentage Pass/Fail**

0.0387 4618 1105 23 Pass

0.0401 4072 1012 24 Pass

0.0415 3559 932 26 Pass

0.0428 3165 869 27 Pass

0.0442 2830 795 28 Pass

0.0456 2532 726 28 Pass

0.0469 2264 665 29 Pass

0.0483 2035 608 29 Pass

0.0497 1833 562 30 Pass

0.0511 1652 519 31 Pass

0.0524 1481 475 32 Pass

0.0538 1337 439 32 Pass

0.0552 1211 402 33 Pass

0.0565 1093 363 33 Pass

0.0579 999 332 33 Pass

0.0593 913 305 33 Pass

0.0607 825 275 33 Pass

0.0620 755 254 33 Pass

0.0634 693 231 33 Pass

0.0648 627 211 33 Pass

0.0661 573 188 32 Pass

0.0675 535 174 32 Pass

0.0689 478 158 33 Pass

0.0703 444 148 33 Pass

0.0716 401 134 33 Pass

0.0730 366 125 34 Pass

0.0744 335 109 32 Pass

0.0757 312 97 31 Pass

0.0771 276 84 30 Pass

0.0785 254 75 29 Pass

0.0799 231 68 29 Pass

0.0812 212 61 28 Pass

0.0826 197 55 27 Pass

0.0840 177 51 28 Pass

0.0853 168 46 27 Pass

0.0867 153 41 26 Pass

0.0881 142 38 26 Pass

0.0895 126 35 27 Pass

0.0908 118 33 27 Pass

0.0922 112 29 25 Pass

0.0936 107 27 25 Pass

0.0949 102 26 25 Pass

0.0963 98 25 25 Pass

0.0977 89 23 25 Pass

0.0991 81 21 25 Pass

0.1004 75 21 28 Pass

0.1018 74 20 27 Pass

0.1032 68 20 29 Pass

0.1045 64 19 29 Pass

0.1059 58 16 27 Pass

0.1073 57 14 24 Pass

0.1087 55 13 23 Pass

0.1100 55 12 21 Pass

0.1114 53 10 18 Pass

0.1128 50 10 20 Pass

0.1141 46 10 21 Pass

0.1155 41 9 21 Pass

0.1169 39 7 17 Pass

0.1183 36 6 16 Pass

0.1196 34 3 8 Pass

0.1210 32 3 9 Pass

0.1224 31 3 9 Pass

0.1237 31 3 9 Pass

0.1251 29 1 3 Pass

0.1265 27 1 3 Pass

0.1279 27 1 3 Pass

0.1292 26 1 3 Pass

0.1306 26 1 3 Pass

0.1320 26 1 3 Pass

0.1333 23 1 4 Pass

0.1347 22 0 0 Pass

0.1361 22 0 0 Pass

0.1375 21 0 0 Pass

0.1388 21 0 0 Pass

0.1402 21 0 0 Pass

0.1416 20 0 0 Pass

0.1429 18 0 0 Pass

0.1443 17 0 0 Pass

0.1457 17 0 0 Pass

0.1471 17 0 0 Pass

0.1484 16 0 0 Pass

0.1498 16 0 0 Pass

0.1512 15 0 0 Pass

0.1525 14 0 0 Pass

0.1539 14 0 0 Pass

0.1553 14 0 0 Pass

0.1567 13 0 0 Pass

0.1580 12 0 0 Pass

0.1594 12 0 0 Pass

0.1608 12 0 0 Pass

0.1621 12 0 0 Pass

0.1635 12 0 0 Pass

0.1649 11 0 0 Pass

0.1663 11 0 0 Pass

0.1676 10 0 0 Pass

0.1690 10 0 0 Pass

0.1704 9 0 0 Pass

0.1717 8 0 0 Pass

0.1731 7 0 0 Pass

0.1745 7 0 0 Pass

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**Water Quality BMP Flow and Volume for POC #1**

**On-line facility volume:** 0.0078 **acre-feet**

**On-line facility target flow:** 0.0108 **cfs.**

**Adjusted for 15 min:** 0.0108 **cfs.**

**Off-line facility target flow:** 0.0062 **cfs.**

**Adjusted for 15 min:** 0.0062 **cfs.**

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**LID Report**

LID Technique Used for Total Volume Volume Infiltration Cumulative Percent Water Quality Percent Comment

Treatment? Needs Through Volume Volume Volume Water Quality

Treatment Facility (ac-ft.) Infiltration Infiltrated Treated

(ac-ft) (ac-ft) Credit

retention 1 POC N 89.15 N 0.00

Total Volume Infiltrated 89.15 0.00 0.00 0.00 0.00 0% No Treat. Credit

Compliance with LID Standard 8 Duration Analysis Result = Failed

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Perlnd and Implnd Changes**

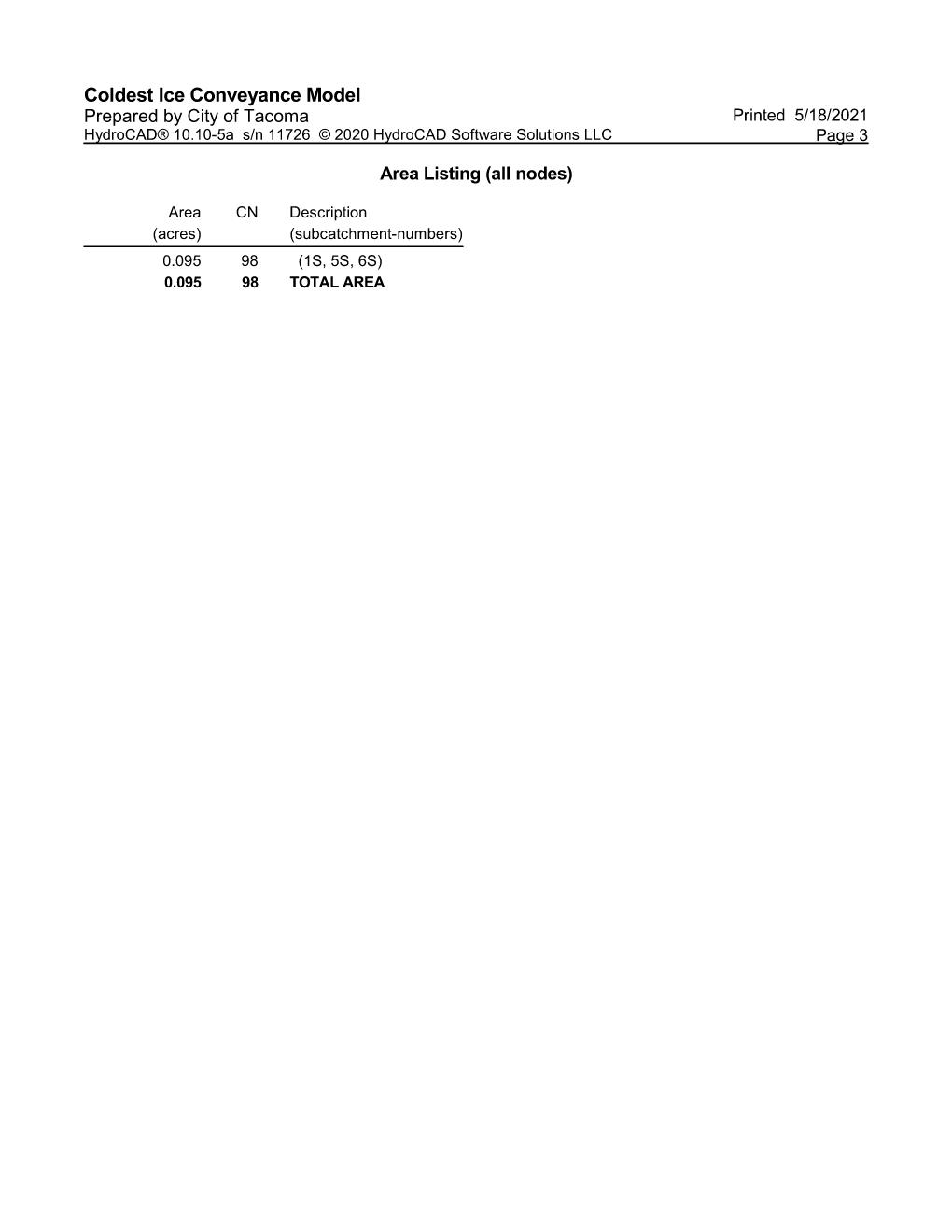
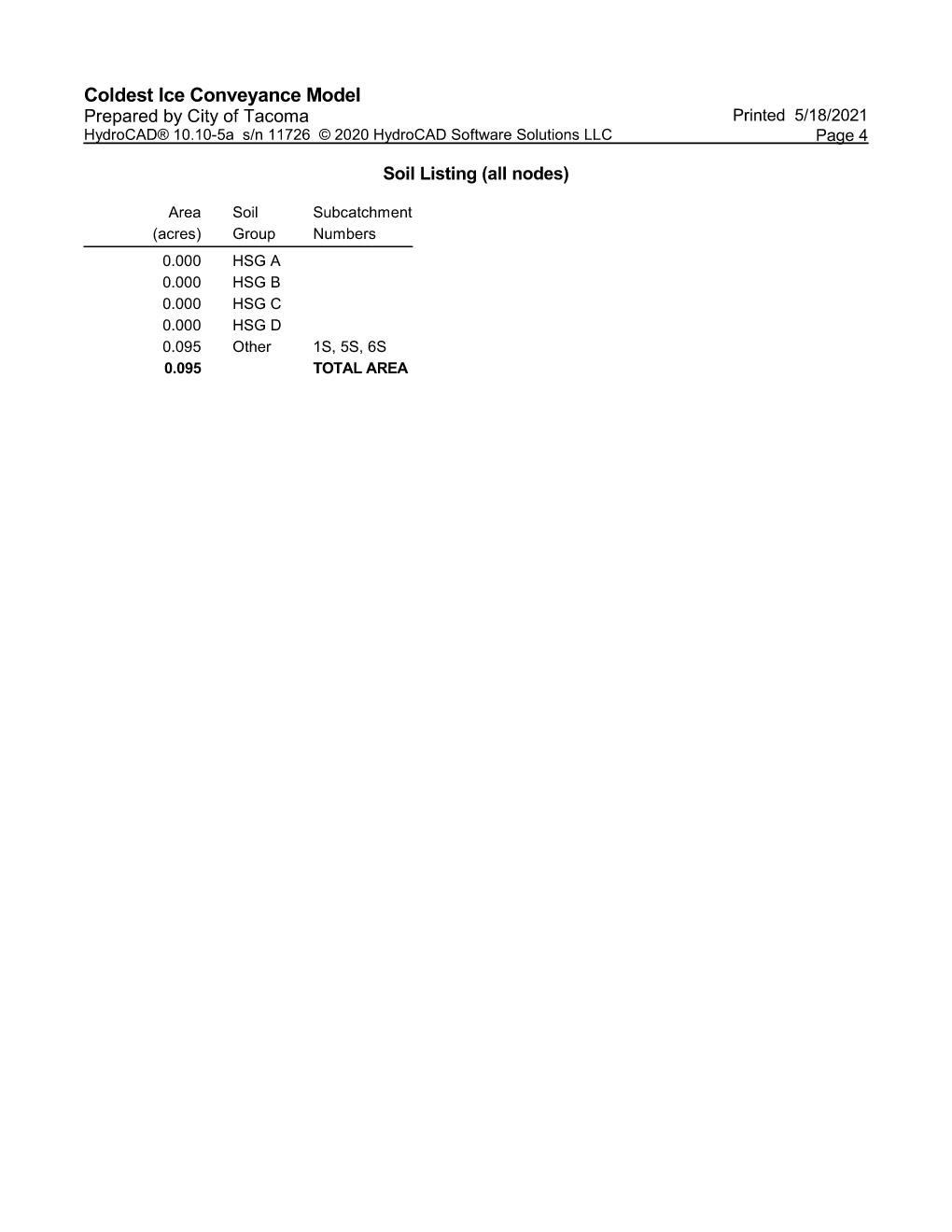
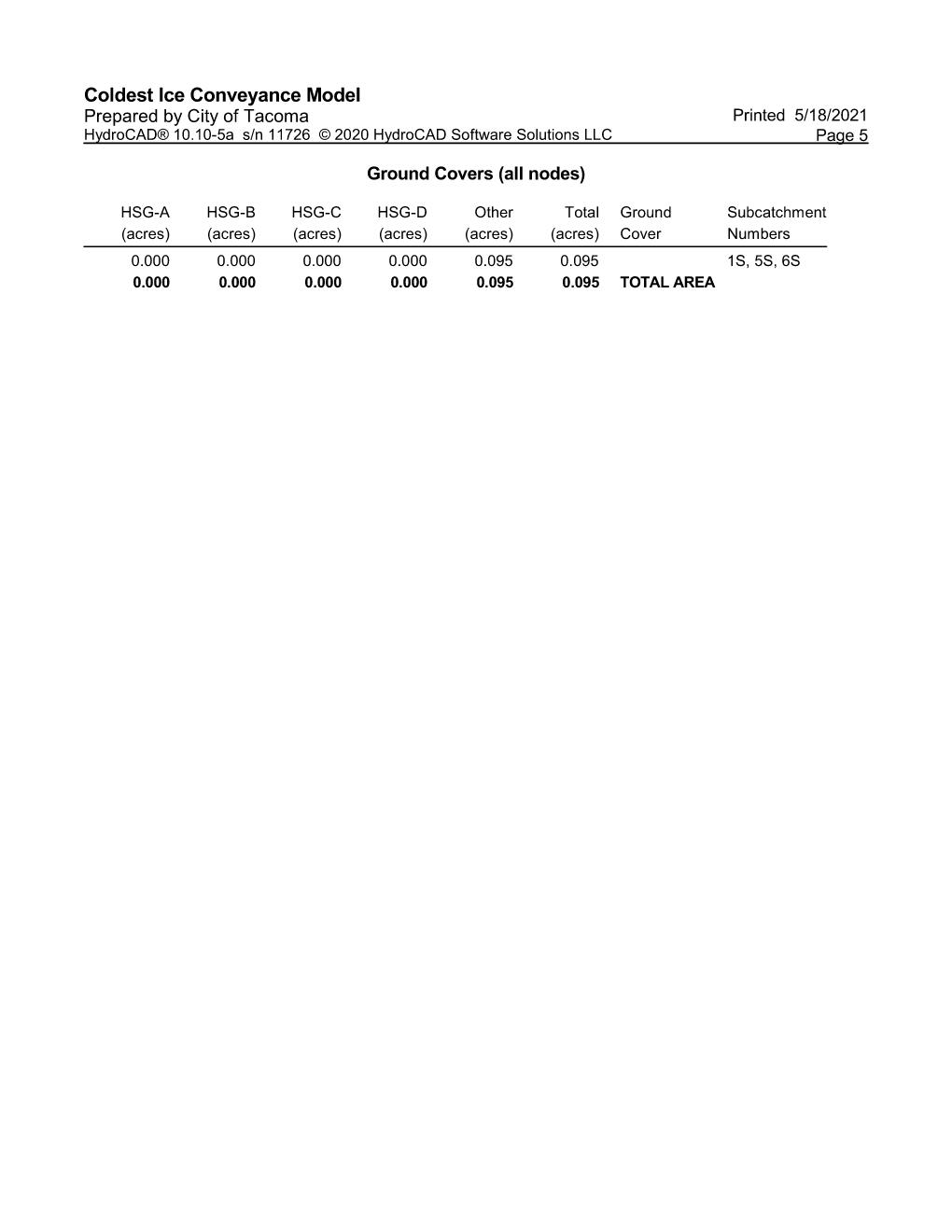
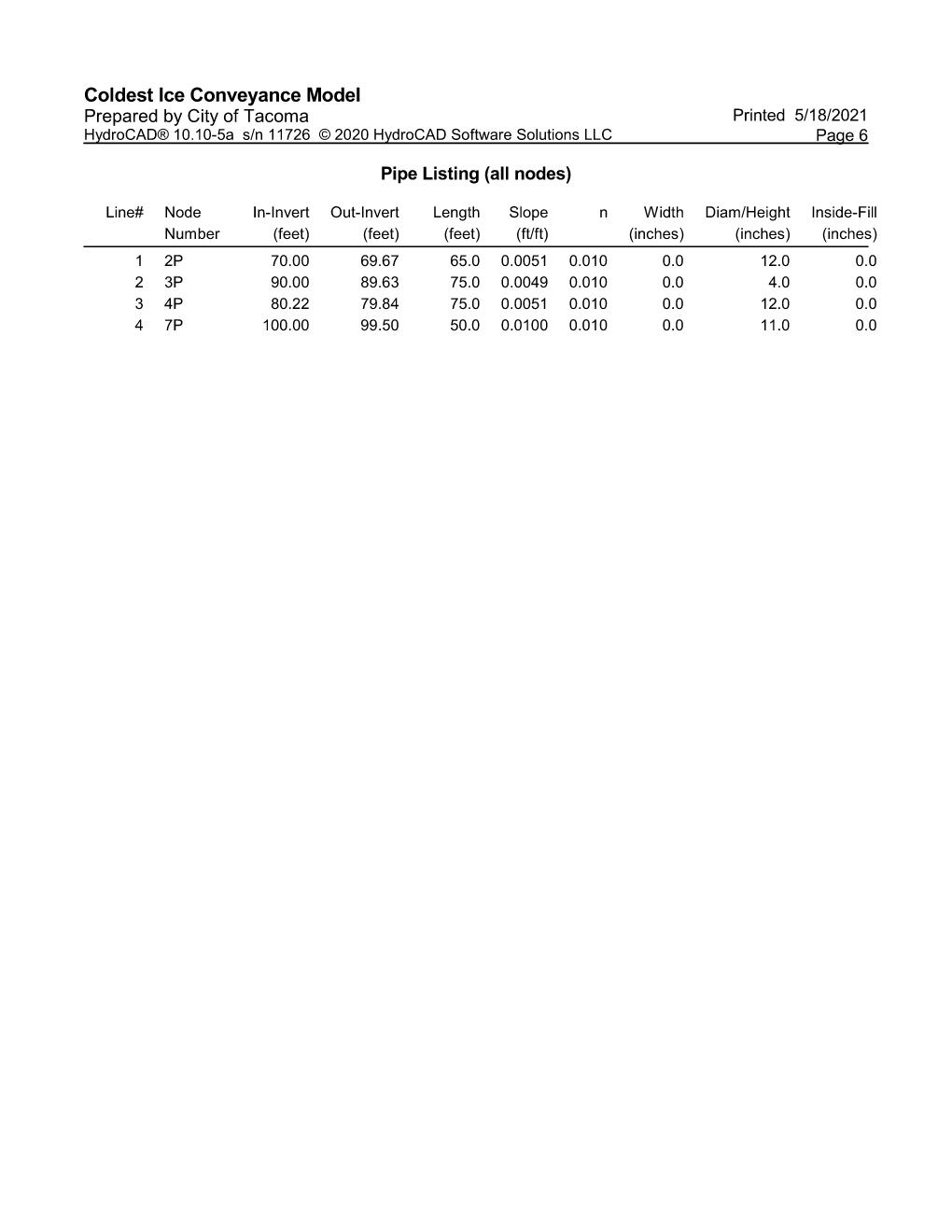
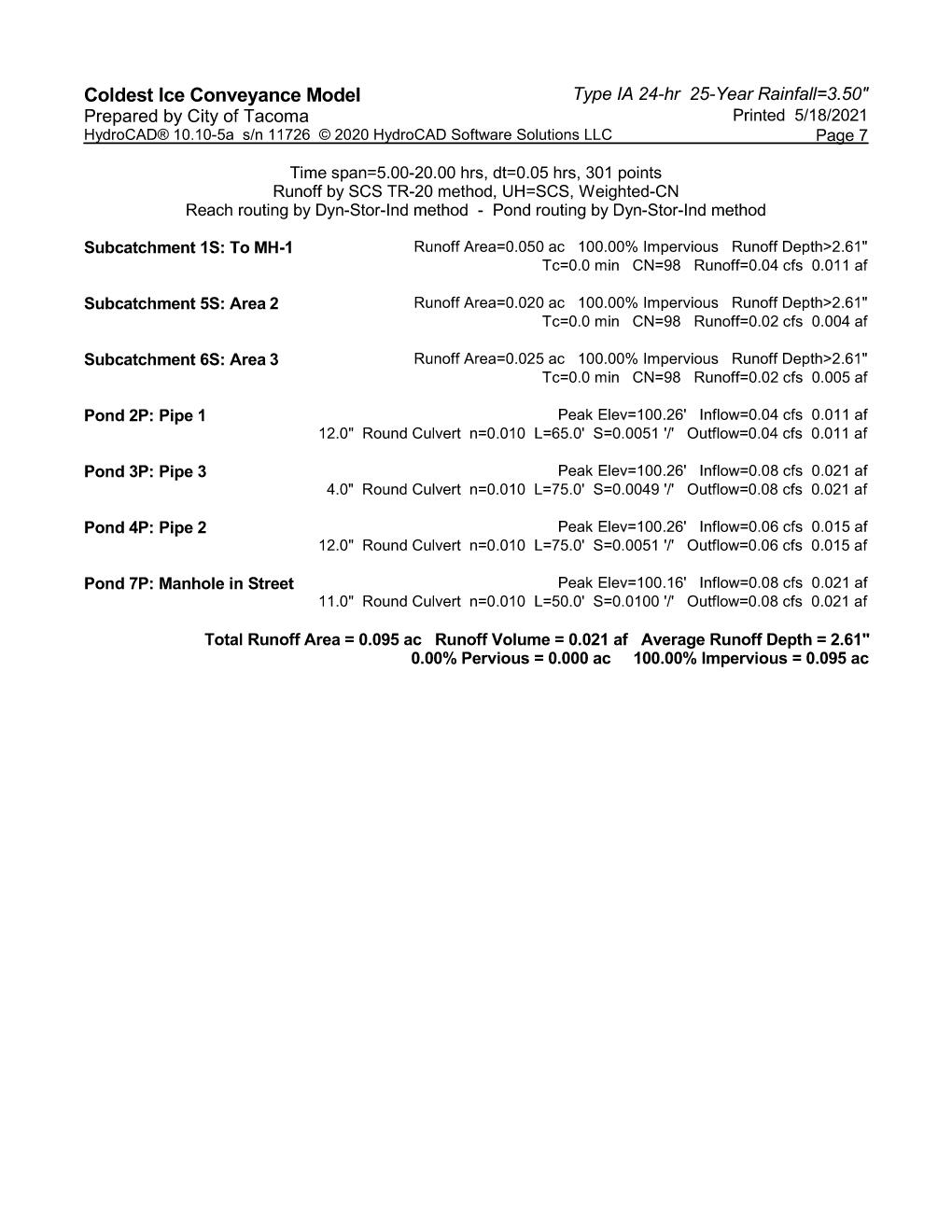
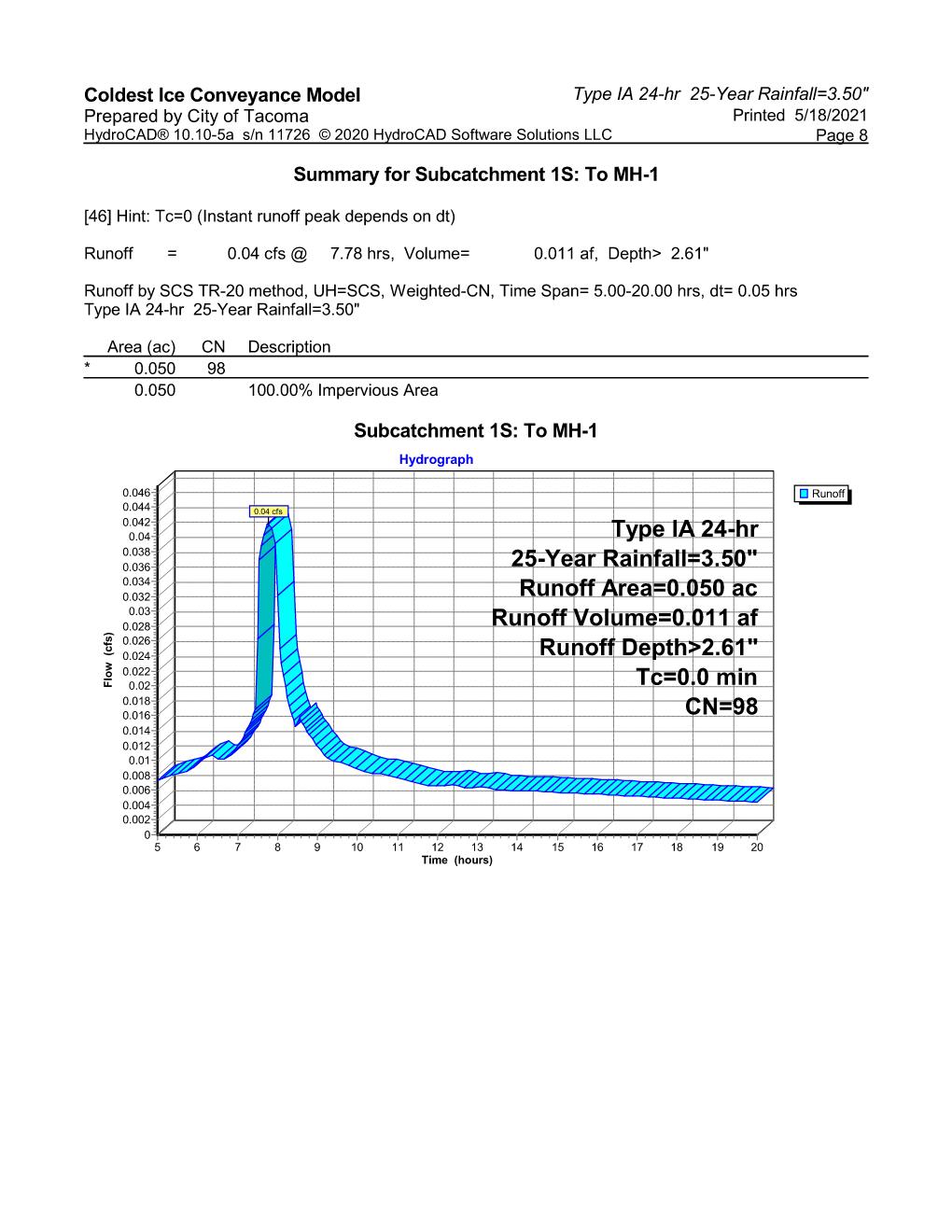
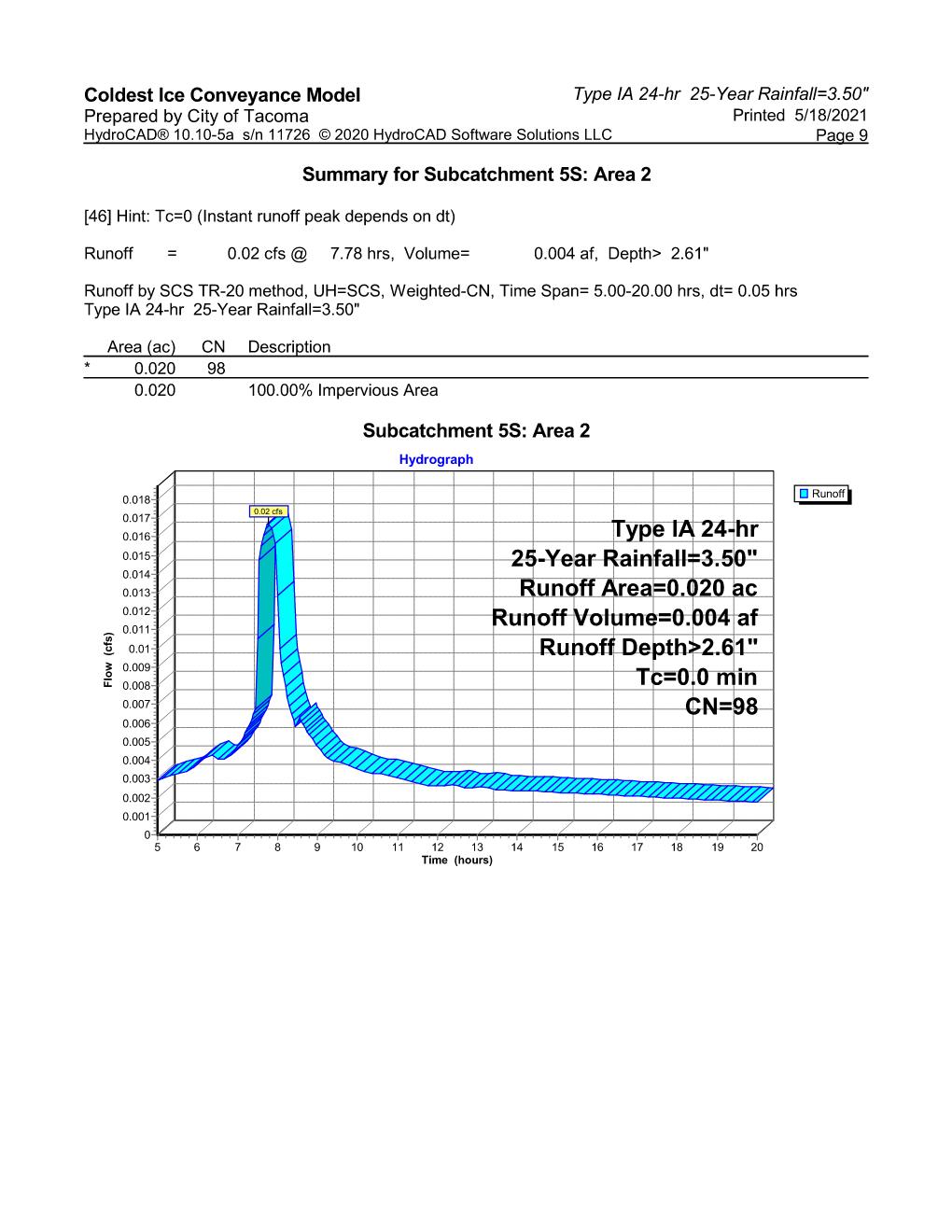
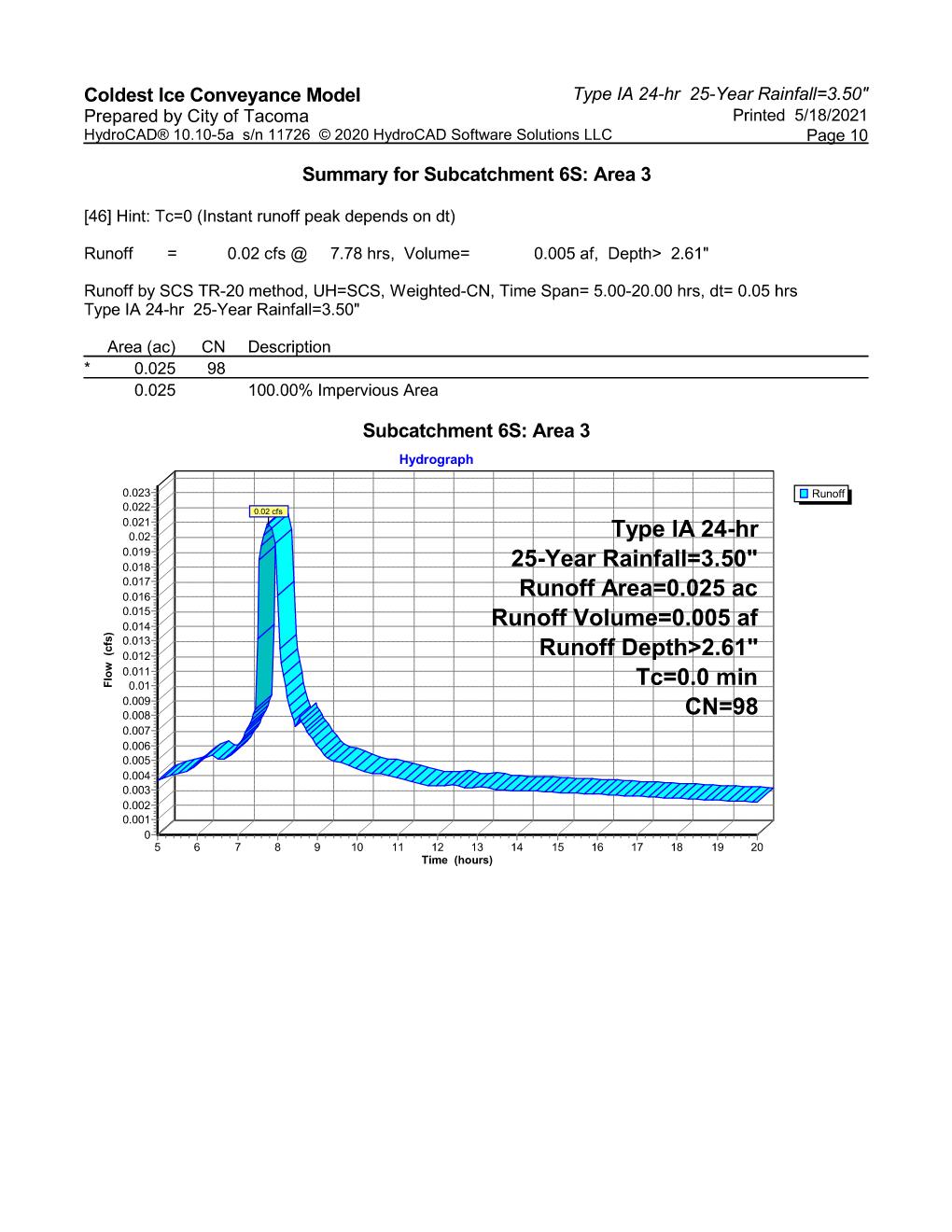
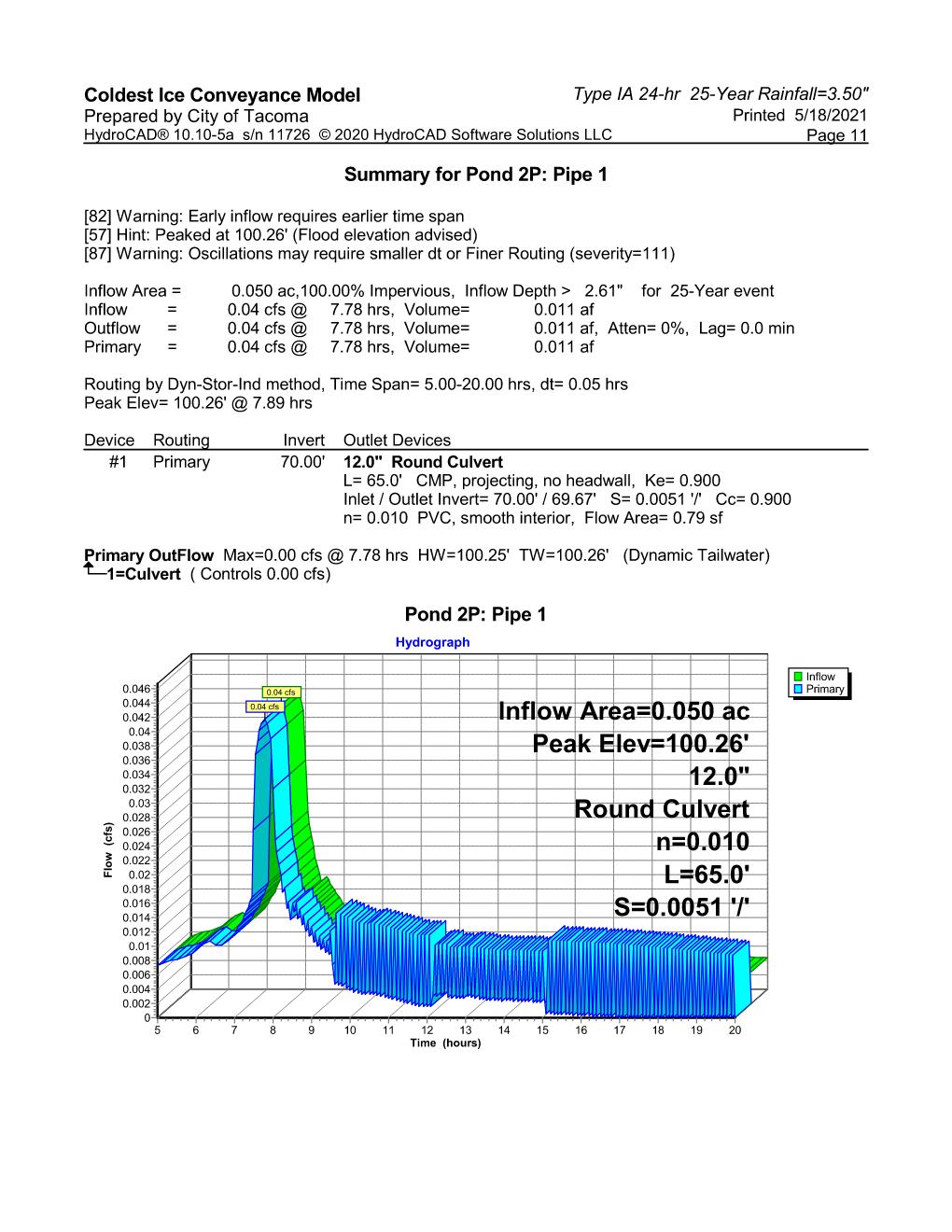
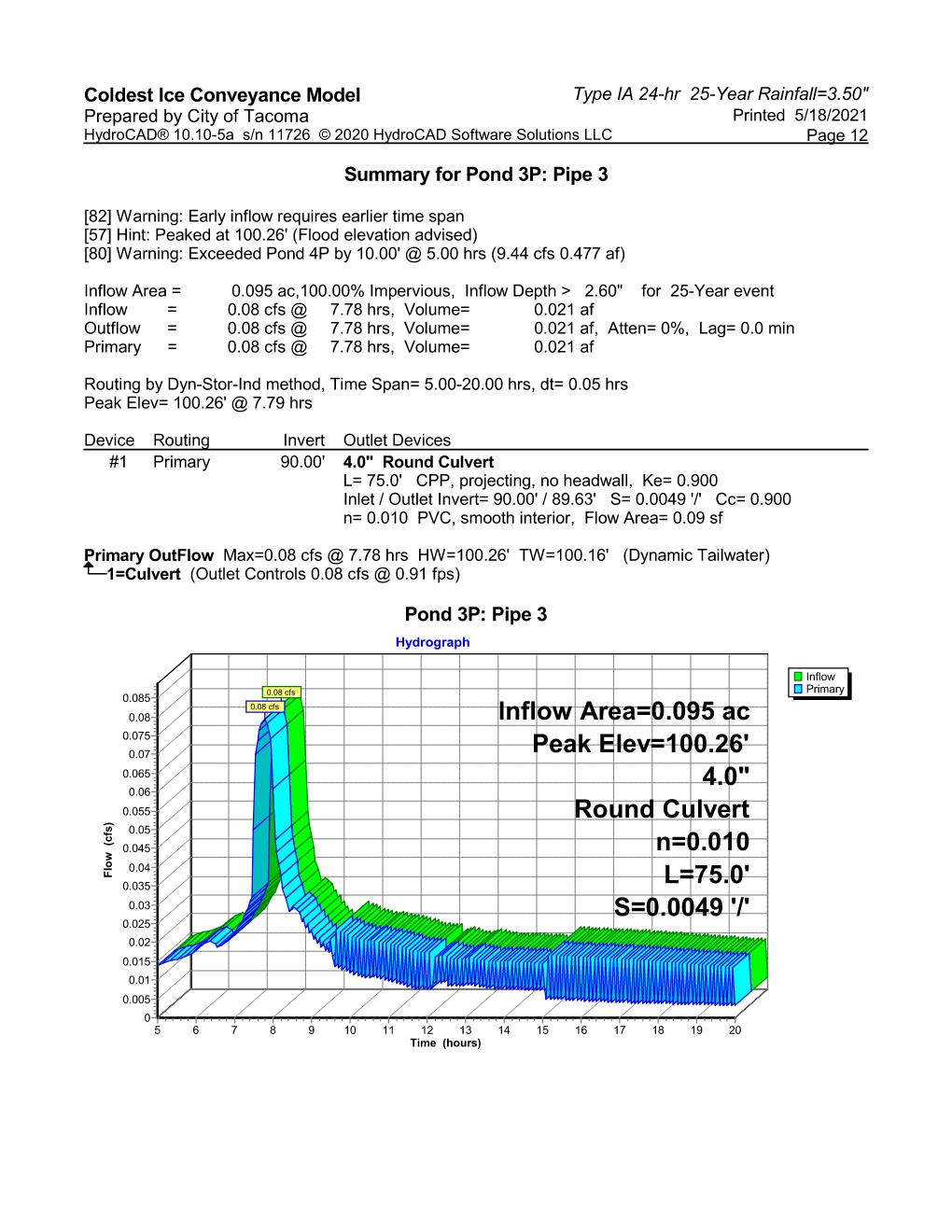
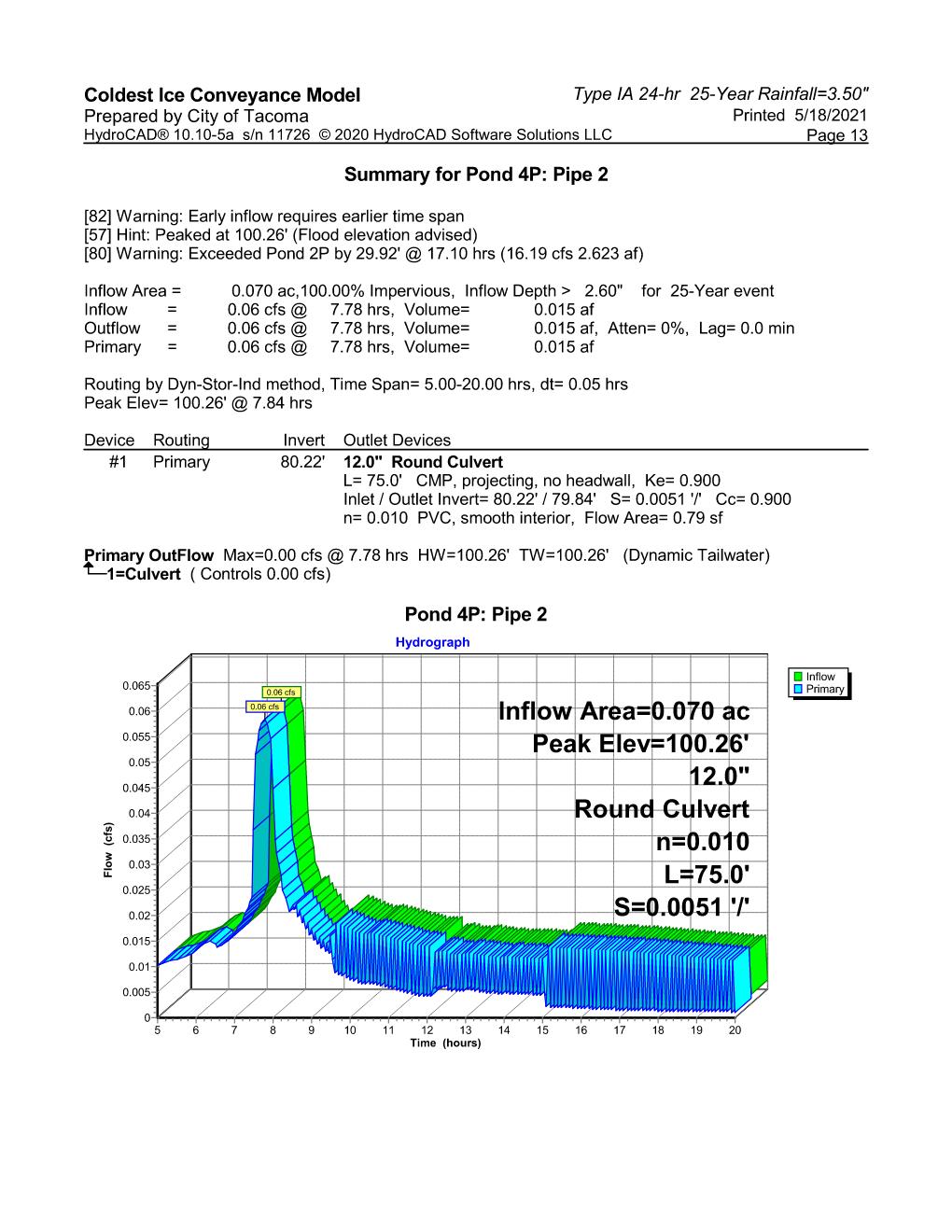
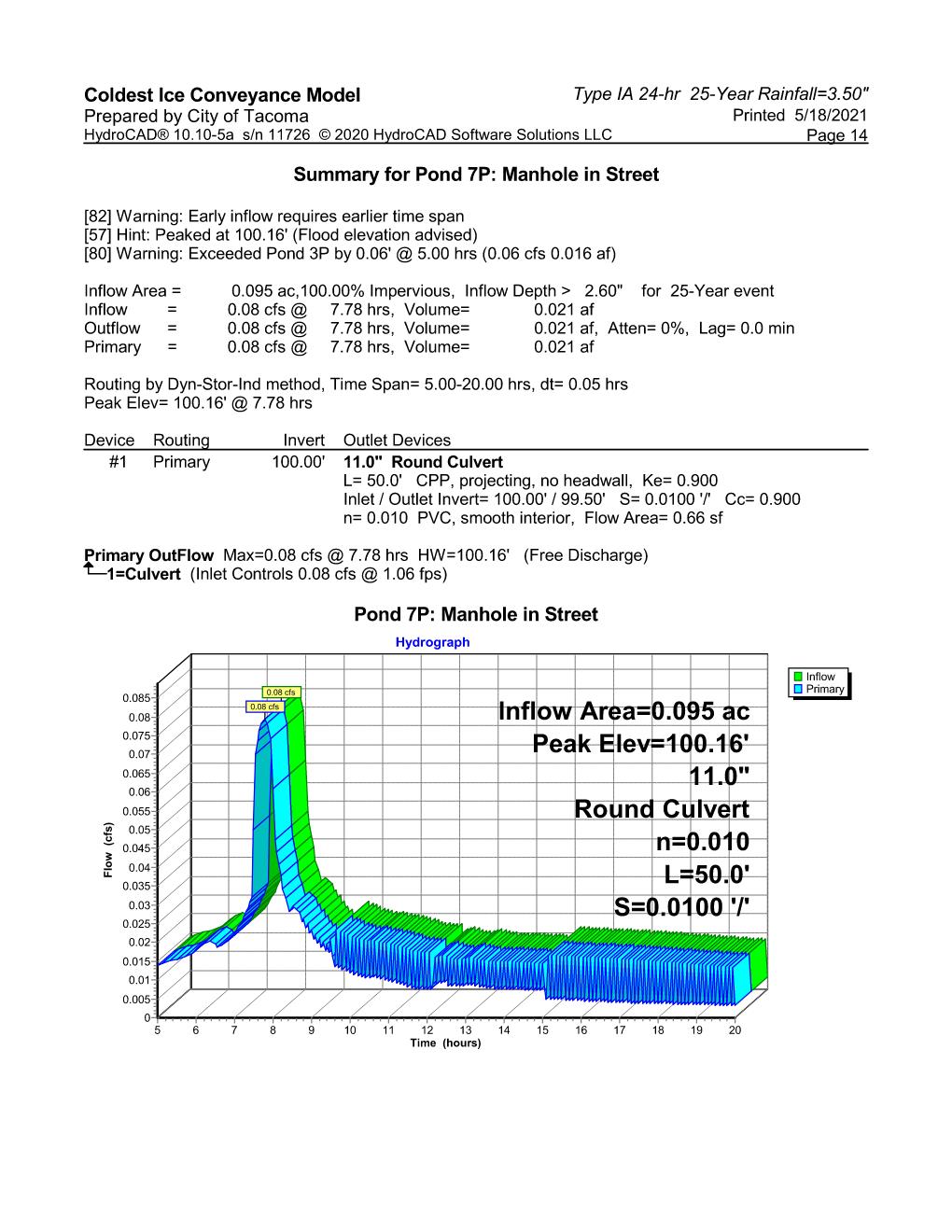
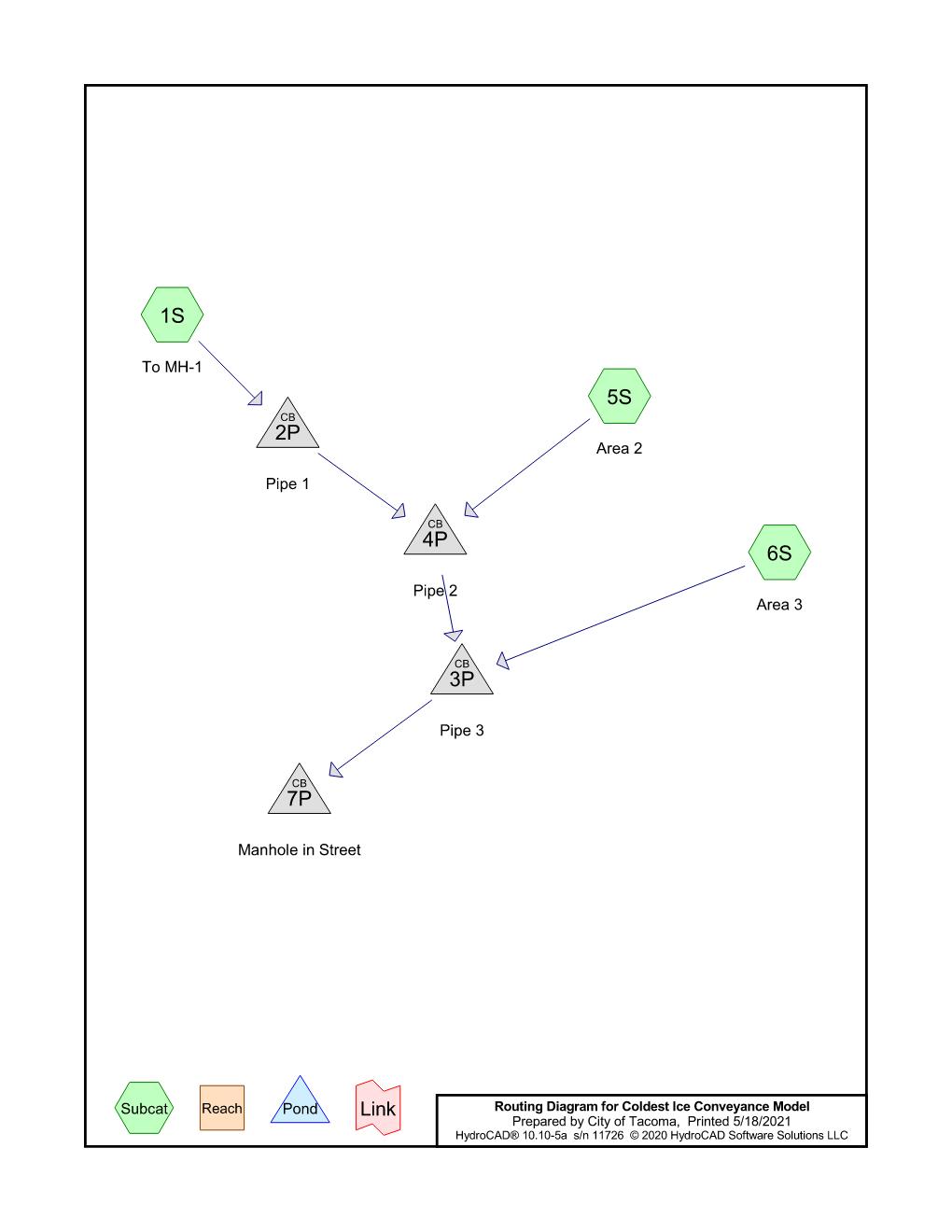
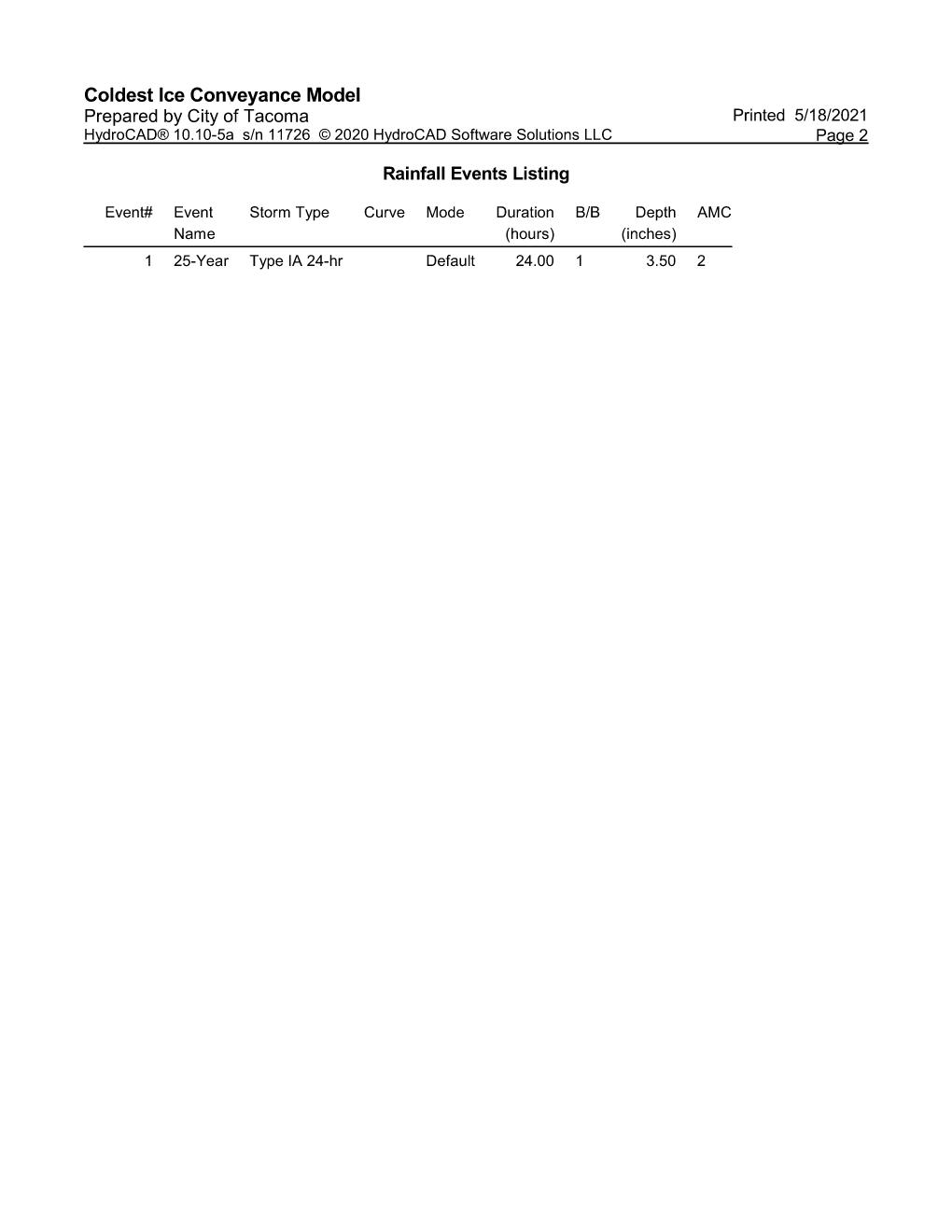
No changes have been made.

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## Conveyance System Design

The model shows that the system can accommodate the 25-year storm event with 0.5 feet of freeboard between top of water surface elevation and top of structure. A 25-year storm event of 3.5 inches was used. A tailwater elevation of 100.9 was chosen which is 90% full at the connection to the City system.

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## Emerging Technology Use Level Designations

See next page.

