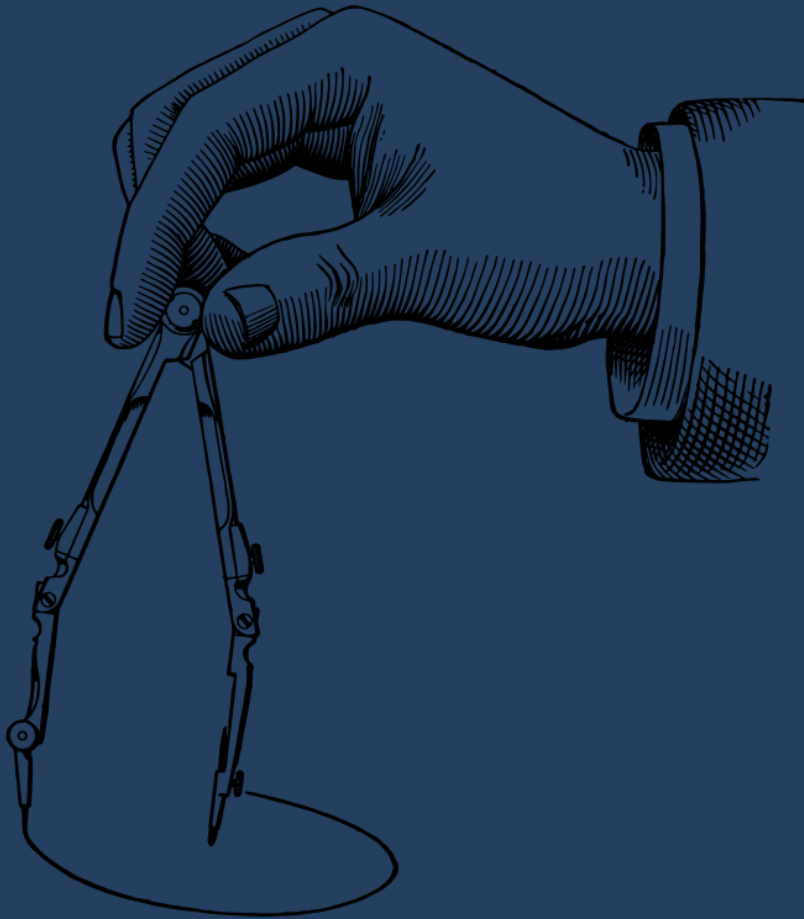


# GHE CAD STANDARDS

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MANUAL

# **GHE CAD STANDARDS MANUAL**

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**Oregon Department of Transportation  
Highway Division  
Technical Services Branch  
Geo-Environmental Section**

**Geotechnical Engineering\Geology, Hydraulic Engineering, and  
Environmental Disciplines**

**January 2018**

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503.986.3380

Revision History:



## ***Acknowledgement***

This manual is presented as a team effort, working together in collaboration to create an easy to read, comprehensive set of CAD instructions. The team for this manual consists of people who gave of themselves to this project with their time, energy, and creativity:

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# Chapter 1 – Introduction

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## 1.1 Preface

The Geo, Hydro and Environmental (GHE) CAD Standards Manual establishes policies, procedures, methods and standards for developing and preparing final GHE contract plans. Outside agency personnel, consulting engineering staff, and ODOT staff are to use this manual in conjunction with ODOT's Contract Plans Manual (CPM) to prepare contract plans. The CPM provides an overview of ODOT's universal standards, policies, and procedures used by all disciplines to prepare ODOT contract plans.

The GHE CAD Standards Manual is intended for use by engineering staff in the preparation of ODOT contract plans for the GHE disciplines. This manual is a work in progress and will continue to grow as chapters are added and content is completed. Updates to the completed chapters will occur at periodically scheduled intervals. The procedures and drafting requirements described here have been developed for and by the individual disciplines included, and have been vetted by region staff and stakeholders across the state.

## 1.2 Introduction

The intent of this manual is to provide policies, procedures and discipline specific CAD and drafting standards to use in the development of contract plan sheets specific to each individual sub discipline within ODOT's Geology\Geotechnical, Hydraulic, and Environmental fields. The GHE CAD Standards Manual consists of; an initial chapter covering General Drawing Information pertaining to all discipline's plans development, plus a separate chapter for each GHE discipline. Each discipline specific chapter will include an *overview* of contract plans preparation using MicroStation and ODOT's standard workspace, a *development* section giving detailed instruction for plans development specific to the discipline, a drafting *check list*, and finally *example drawing(s)*.

**Overview** — explains ODOT's intended purpose for and process used to produce that particular portion of the contract plans, and specifies who is responsible for which tasks and who is to give final approval.

**Development** — gives detailed instruction for developing that particular portion of the contract plans. Included are step-by-step procedures (with graphics) for the creation of plan sheets, the treatment of reference files, the placement of cells and required items, plus other topics.

**Check List** — provides the designer/drafter a means to check off and verify that all required elements are included on the plan sheets.

**Example Drawing(s)** — fall at the end of each chapter and provide a visual of the required content and formatting of the final plan sheets for the individual disciplines.

The discipline specific chapters of this manual are published as they are developed. Some of GHE's disciplines currently have a Technical Bulletin to describe CAD and

Drafting standards, and some disciplines are still in need of standards documentation. When a technical Bulletin, or other form of documentation, does exist, a link is provided.

This manual will continue to grow as program resources are assigned and disciplines are able to address the subject of CAD and drafting standards. When Technical Bulletins come due for updates and a decision is made to add that information to this manual, the bulletin will be rescinded accordingly.

It is the user's responsibility to insure that they are using the latest version of this document. Always check the web pages shown in this document, as well as in the CPM, for the latest information and updates.

Consultants and outside agency personnel, working on ODOT projects, must download the ODOT Workspace for MicroStation V8i.

ODOT\_space.exe can be found on the ODOT website at:

<https://www.oregon.gov/ODOT/HWY/CONSULTANT/Pages/Consultants-Portal.aspx>

ODOT\_space.exe is a self-extracting program. Please follow the instructions in Readme\_ODOTspace.html to extract the contents of the ODOT\_space.exe.

### 1.3 References

#### **Erosion Control Manual**

[https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/erosion\\_control\\_manual\\_nav.pdf](https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/erosion_control_manual_nav.pdf)

#### **Geotechnical Design Manual**

[https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/pages/geotechnical\\_design\\_manual.aspx](https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/pages/geotechnical_design_manual.aspx)

#### **Roadside Development Design Manual**

<https://www.oregon.gov/ODOT/HWY/TECHSERV/Pages/alphamanuals.aspx>

#### **Hydraulics Manual**

[https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/Pages/hyd\\_manual\\_info.aspx](https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/Pages/hyd_manual_info.aspx)

#### **Oregon Standard Drawings & Oregon Standard Details**

[https://www.oregon.gov/ODOT/HWY/ENGSERVICES/pages/standard\\_drawings\\_home.aspx](https://www.oregon.gov/ODOT/HWY/ENGSERVICES/pages/standard_drawings_home.aspx)

#### **Oregon Standard Specifications for Highway Construction**

[https://www.oregon.gov/ODOT/HWY/SPECS/pages/standard\\_specifications.aspx#2015\\_Standard\\_Specifications](https://www.oregon.gov/ODOT/HWY/SPECS/pages/standard_specifications.aspx#2015_Standard_Specifications)

# Chapter 2– General Drawing Information

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The General drawing Information chapter is a compilation of all the CAD and drafting standards that equally apply to the development of Contract Plan sheets for all of the GHE disciplines. Discipline specific information is provided in the individual discipline chapters.

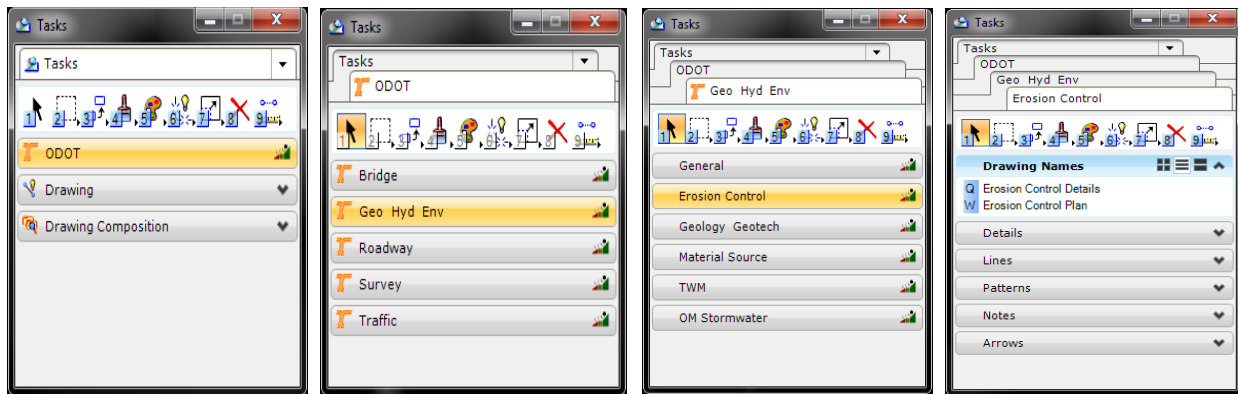
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- 2.2 File Naming Convention ..... 3
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## 2.1 Tasks and Workflows

ODOT's current CAD standards are available by using the MicroStation Tasks and Workflows. This menu provides the correct selection of the most up-to-date notes, text styles, symbols, line styles, line weights, levels, and cells by discipline.

As the GHE, disciplines expand their CAD standards, new tasks and workflows will appear in the workspace to assist drafters. To keep the task tabs to a reasonable size, rarely used design elements may only be available in the cell libraries. Every element developed for each discipline is available either in the tasks and workflows or in a cell library.

An open task & workflow in ODOT's MicroStation workspace will look similar to the following example. (Follow the yellow highlighted task tabs from left to right).



To assist workflow, every discipline tab contains a General tab and all the General tabs contain the same elements. These elements are the most common and essential elements used on most, if not all, ODOT plan sheets.

Note: It is the user's responsibility to ensure that the ODOT Workspace Tasks & Workflows are the latest version, before and during design of all projects. ODOT reserves the right to update the workspace and associated cells at any time. See the links below for access to the ODOT workspace Tasks & Workflows.

<https://www.oregon.gov/ODOT/HWY/CONSULTANT/Pages/Consultants-Portal.aspx>

[https://www.oregon.gov/ODOT/HWY/CONSULTANT/Pages/Consultants-Portal.aspx#Consultant\\_Subscription\\_Email\\_List](https://www.oregon.gov/ODOT/HWY/CONSULTANT/Pages/Consultants-Portal.aspx#Consultant_Subscription_Email_List)



## 2.2 File Naming Convention

File naming rules have been established for use in ProjectWise and must be followed. Logical names for documents, by type and origin, allow users to easily locate files and are essential to the success of ProjectWise and ODOT's project design process. A document-naming tool is provided in ProjectWise and its use is required for naming new documents and maintaining naming consistency. Instructions for using the naming tool are located in the [ProjectWise User Manual](#).

The generic file name format is shown as follows:

***OriginID\_ProjectID\_Filename\_##.ext.***

For further explanation on ODOT's file naming convention refer to the [ProjectWise File Naming Manual](#).

To see the complete list of approved file names for all disciplines, reference document [PW\\_DocumentNameList.pdf](#) in ProjectWise, in the **Standards>PW\_Standards** folder.

## 2.3 Sheet Numbering and Sequencing

GHE Contract plans are sequenced and numbered in specific order. The normal arrangement and sheet numbering system is described in [chapter 2.0 of the CPM](#). Table 2-1 lays out the sheet order and sheet numbering system for all ODOT disciplines.

For GHE the disciplines are listed in the sequence they appear in a set of contract plans and are noted, into what sheet numbering series they fall. The Environmental disciplines are in the "F" numbering series, the Geology\Geotechnical disciplines in the "G" series, and the Hydraulic disciplines in the "H" series. The order in which they are listed in the table is how they are sequenced within a set of plans.

## 2.4 Plans Sheet Order

Each GHE plan set generally begins with the plan sheet/s and ends with the detail sheet/s. At times, it may be necessary to provide a separate sheet for notes, etc., and these sheets follow the Plan sheets.

On occasion, a project may require a Layout sheet to appear first in the plan set. For example, a project containing multiple retaining walls will need a layout sheet showing the location of each wall along the length of the project, plus the locations of all the subsurface borings. Discipline specific plan sheet order is addressed in more detail in the following chapters.

### Plan Sheet

A plan sheet may contain only a plan view and some notes, or it may contain a plan and profile or plan and elevation. Notes, legends and tables are placed on the sheet containing the design items they pertain to, whenever possible.

When laying out the content of each sheet in a plan set, it is up to the project drafter to make determinations based on their expertise and drafting knowledge. Consultation with the EOR (Engineer of Record), or designer, is recommended when uncertainties arise.

### Detail Sheet

A detail sheet generally contains the construction details of all the parts of the plan, but may also contain cross sections, notes and tables.

Each discipline specific chapter in this manual is followed by example plan sets to further describe the design elements to use, the preferred layout of sheets, and the order of sheets in the plan set.

### 2.5 Sheet Naming

The sheet names (titles) to be applied to each sheet are determined by the discipline and what is on the sheet. What is on each sheet is partly determined by the extent of the project design and the project area size. Again, the content of each sheet is laid out by the drafter, working with the EOR/designer when necessary.

For example, a project requiring a full sheet of only cross sections might be named as **LANDSLIDE CORRECTION CROSS SECTIONS**, where as a sheet with only one cross section and several details might be named as **LANDSLIDE CORRECTION CROSS SECTION AND DETAILS**. The main objective is to be accurate and consistent from plan set-to-plan set and project-to-project across the state.

The following is a list of approved sheet names for each discipline. Break titles into two lines of text when needed.

ROADSIDE DEVELOPMENT GENERAL NOTES  
ROADSIDE DEVELOPMENT SCHEDULES  
ROADSIDE DEVELOPMENT DEMOLITION PLAN  
ROADSIDE DEVELOPMENT SITE LAYOUT PLAN  
ROADSIDE DEVELOPMENT GRADING PLAN / SECTION  
ROADSIDE DEVELOPMENT SITE PREPARATION PLAN / SECTION  
ROADSIDE DEVELOPMENT SOIL PREPARATION PLAN  
ROADSIDE DEVELOPMENT IRRIGATION PLAN / SCHEDULE  
ROADSIDE DEVELOPMENT PLANTING PLAN / SECTION  
ROADSIDE DEVELOPMENT RESTORATION PLAN / SECTION  
ROADSIDE DEVELOPMENT SITE DETAILS

EROSION AND SEDIMENT CONTROL PLAN  
EROSION AND SEDIMENT CONTROL DETAILS

WETLAND MITIGATION PLAN  
WETLAND MITIGATION DETAILS

GEOTECHNICAL DATA  
EXPLORATION LOCATION INDEX

RETAINING WALL PLAN AND ELEVATION  
RETAINING WALL DETAILS

SOUND WALL PLAN AND ELEVATION  
SOUND WALL DETAILS

ROCKFALL MITIGATION PLAN  
ROCKFALL MITIGATION DETAILS

MANDATORY MATERIAL SOURCE  
MANDATORY BORROW SOURCE  
MANDATORY DISPOSAL SITE  
MANDATORY STOCK PILE SITE

PROSPECTIVE MATERIAL SOURCE  
PROSPECTIVE BORROW SOURCE  
PROSPECTIVE DISPOSAL SITE

LANDSLIDE CORRECTION PLAN  
LANDSLIDE CORRECTION DETAILS

HAZARDOUS MATERIAL PLAN  
HAZARDOUS MATERIAL DETAILS

STORMWATER PLAN  
STORMWATER FACILITY PLAN  
STORMWATER FACILITY PLANTING PLAN  
STORMWATER FACILITY PLANTING MATERIALS SCHEDULE  
STORMWATER ACCESS DETAILS

CULVERT PLAN AND ELEVATION  
CULVERT DETAILS

FISH PASSAGE PLAN  
FISH PASSAGE DETAILS

TEMPORARY WATER MANAGEMENT CONCEPT PLAN  
TEMPORARY WATER MANAGEMENT CONCEPT DETAILS

BANK PROTECTION PLAN  
BANK PROTECTION DETAILS

WATERWAY ENHANCEMENT PLAN

## WATERWAY ENHANCEMENT DETAILS

## 2.6 Standard Text

ODOT's standard font for contract plans is **Lucida Sans Unicode**. The following table specifies the sizes and styles of the most common text items used in the GHE disciplines. All of ODOT's text styles are listed in the text attributes tasks and workflows pull down menu.

Font	Use/Description	Symbol gy	Size	Italics
<b>ODOT Notes</b>	All existing and proposed notes and labels	CO=4	H = 0.0063 W = 0.0063	True
<b>ODOT Titles</b>	All plan, profile, cross section and detail Titles	CO=4	H = 0.0104 W = 0.0104	True
<b>ODOT Subtitles</b>	subtitles	CO=4	H = 0.0104 W = 0.0104	

## 2.7 Seed and Cache Files

### Seed Files

ODOT's seed files are set up with the appropriate ODOT MicroStation preferences and are chosen when a project file is first created. In the *New drawing* dialog box there are three entries at the bottom; 1. *File Name*, 2. *Save as type*, and 3. *Seed*. Before naming and saving a new file, choose the file type from the dropdown and browse to the preferred seed, then name the file and choose Save.

Refer to [Chapter 2 section 2.2 of the CPM](#) for more information regarding ODOT's seed files.

GHE has 2 seed files available. Both seed files contain elements most commonly used on their particular plan sheets along with a basic format for sheet layout. All elements can be copied, moved, or element matched from the seed.

- **Seed\_OM.dgn** provides a DFI plan sheet template for use in operational plans for "Stormwater Facility Operation and Maintenance" manuals.
- **Seed\_TWM.dgn** provides a Temporary Water Management concept plan sheet for contract plans.

### Cache Files

ODOT's cache files are chosen through the MicroStation *Reference* dialog and added to the file by the user, after the new drawing has been created. Cache files provide a general sheet layout format with the most commonly used elements that can be copied, moved, or element matched by the drafter. Cache files provide a kind of template with quick and convenient access to the elements needed to build the specific plan sheet type.

GHE has 3 Cache files available:

- ecV8\_cache.dgn provides cached elements used on Erosion and Sediment Control plan sheets.
- msV8\_cache.dgn provides cached elements used on Material Source plan sheets.
- RDSideV8\_cache.dgn provides cached elements used on Roadside Development and Wetland plan sheets.

## 2.8 Cell Libraries

All ODOT disciplines have a cell library. Some disciplines share a cell library, such as the Geology/Geotechnical disciplines of Material Sources and Geotechnical Data. Both of these disciplines share the **Geo.cell** cell library. Cell libraries are accessed in ODOT's MicroStation workspace. The Tasks and Workflows access the cell libraries for each task.

## 2.9 Base Map

An up-to-date and accurate design base file is essential to creating a set of sheets for a contract plan set. All GHE design base files reference in, the same basic upstream files. They include; the existing topography base, the Right-of-way base, the roadway design base, and the Bridge or large culvert design base if applicable.

The discipline specific CAD design base file is created and owned by the project drafter and used in the development of the contract plan sheets.

Refer to the [ODOT ProjectWise User Manual](#) for full explanation of how to use base files, design files and plan sheet files. Plan sheet assembly and folder locations for these files are also explained in the user manual.

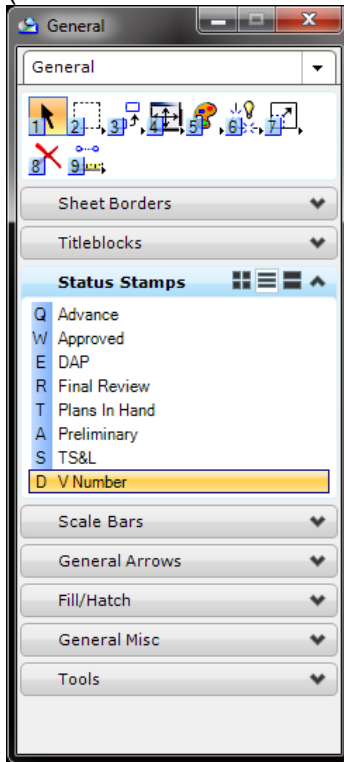
Items/levels to keep on in each file that is referenced into the CAD design base file are listed in the checklists at the end of each discipline chapter in this manual. GHE disciplines not yet published here may be found in the old "Contract Plans Development Guide" or in a Technical Bulletin. These publications will be referred to throughout this document.

## 2.10 Milestone submissions

Milestone submissions are dictated by the project schedule and facilitated by the folder structure within Project Wise.

The ODOT CAD workspace provides individual cells to use for the different milestone states. The cells are located in the ODOT.cel library and are accessible through the General tab in the workspace Tasks & Workflows.

The correct status cells, including the V-Number cell, are to be placed in the top right corner of every contract plans sheet. A location dot appears when the titleblock cell is placed in the drawing file. Snap the correct status cell to this construction dot. (Construction dots will not print).



Need something here regarding the request for a V-Number. Whether complete instructions or a link to the CPM, (yet to be determined). Instructions from Lloyd Bledsoe: “Contact Maps and Plans”. “There is a form on the Geometronics website”.

Refer to the [ProjectWise User Manual](#) and [Chapter 4 of the CPM](#) for instructions regarding milestones, final plans and digital signatures.

### 2.11 ProjectWise

ProjectWise is the content management tool selected for ODOT’s engineering/non engineering files and associated data. ProjectWise enables collaboration and increased efficiencies within a managed environment for internal and external users.

See [Technical Services ProjectWise directive TSB16-01 \(D\)](#) for information on the use of ProjectWise in ODOT’s highway design process.

See the Training folder in ProjectWise for How-to documents and video’s.

Contact the **Region ProjectWise Admin Staff** or the **ProjectWise Support Team** with questions. See the [ODOT ProjectWise User Manual](#) for contact information.

## 2.12 Common Abbreviations

(Refer to document when available, with a link)

# 3.0– Geotechnical Data

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### 3.1 Overview

Projects involving earthworks or subsurface materials undergo geologic investigations and explorations of the subsurface materials to determine the existing conditions. Considerable experience, skill, and judgment are required to interpret and characterize subsurface conditions in order to provide geotechnical design parameters. Providing contractors and ODOT construction staff with clear and understandable subsurface information is essential for a successful project. Delivering this information to our contractors provides them with an understanding of the geologic conditions of the project from which they can determine their means and methods for construction. This allows contractors to bid with the same knowledge as the Agency and ultimately reduces risks, claims, and contract change orders.

The Agency has maintained a standard practice of providing geologic information in contract plans since the early days of bridge construction. *Foundation Data Sheets* were originally developed for bridge foundation construction and were included in the Contract Plans only for bridge structures. The Foundation Data format was unsatisfactory for other earthworks and grading applications.

**'Geotechnical Data' sheets** supersede *Foundation Data Sheets*, based on changes developed by the Subsurface Information Subcommittee comprised of ODOT Geologists, Geotechnical Engineers, Drafters, Construction Engineers, and representatives from Contract Claims. 'Geotechnical Data' sheets build upon the design base drawings and are used as the required sheet for the Contract Plans.

The methods and procedures in this Chapter aid in providing uniformity and clarity in the presentation of subsurface information in the contract plans. Using these standards in the development of 'Geotechnical Data' sheets assures that all contractors, and ODOT personnel involved with construction, receive the information needed to perform geotechnical-related construction project work.

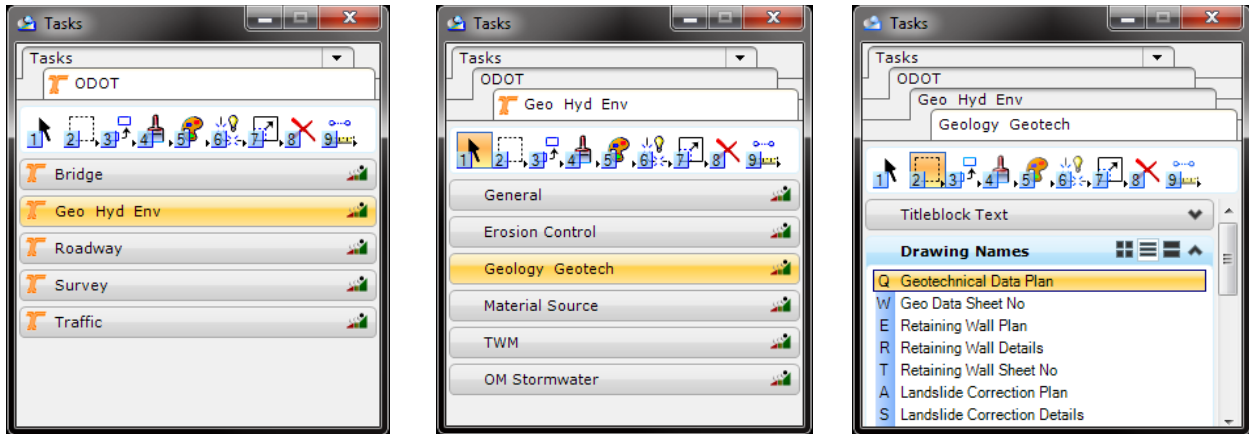
### 3.2 Development

'Geotechnical Data' sheets are produced for contract plans through collaboration between the project geotechnical engineer, the engineering geologist, and the drafting resource. The engineer and geologist are responsible for developing the subsurface data, based on the exploration results, to be shown on the Geotechnical Data sheet submitted for the contract plans.

The project Drafter is responsible for developing the plan sheets showing the subsurface conditions in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the Contract Plans Manual (CPM).

#### 3.2.1 Tasks and Workflows

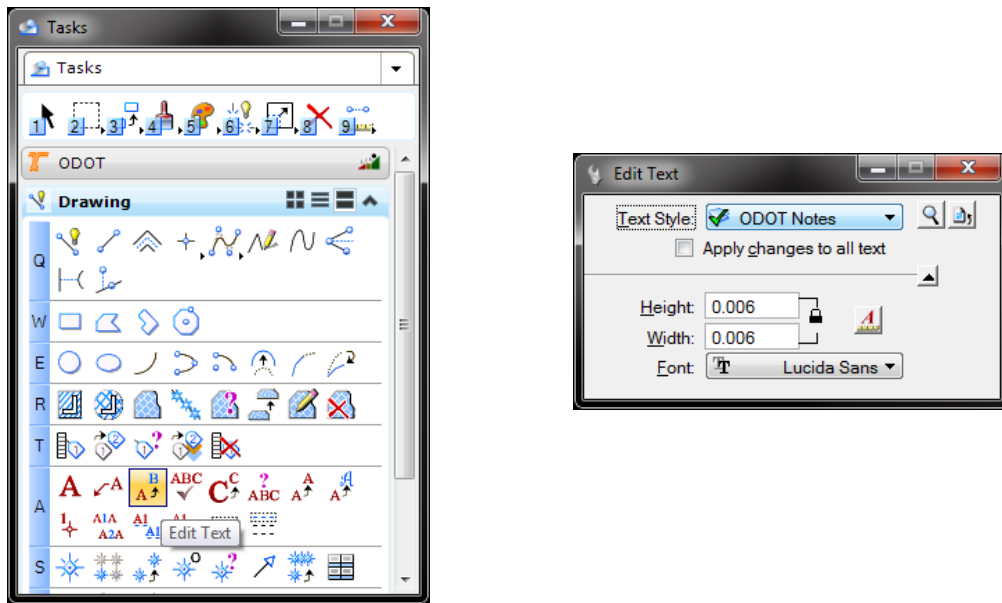
ODOT's MicroStation workspace contains the tasks and workflows for ODOT's technical disciplines. This includes a Geology Geotech work flow for the development of Geology and Geotechnical related plan sheets, including 'Geotechnical Data' sheets.



This chapter will further describe the specific tasks, tools and other standards; such as text styles, sheet layout, cells, etc., used to create a Geotechnical Data sheet.

**Standard Text**

Refer to [Chapter 2.0 – General Drawing Information](#) for a list of ODOT’s standard text styles.

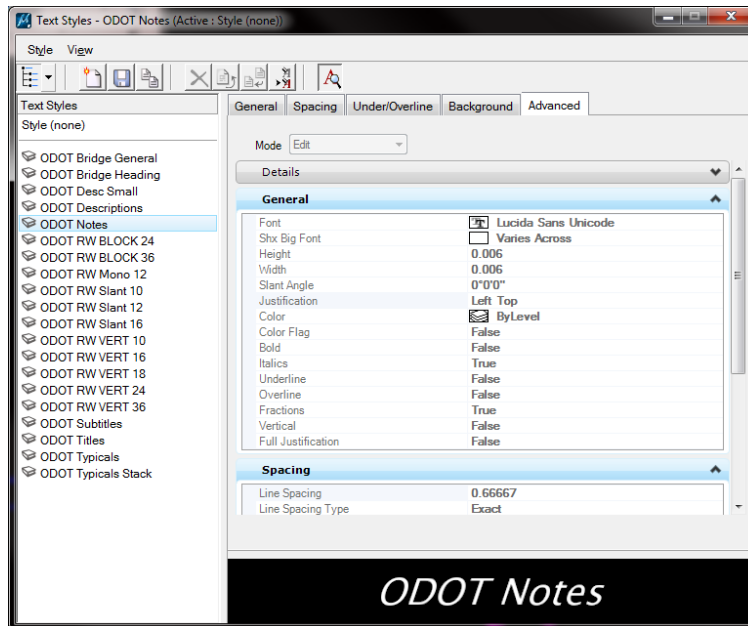


The standard text styles are available in the text tools located in the Drawing tab of the main Tasks dialog within the MicroStation workspace.

Three standard ODOT text styles are used on ‘Geotechnical Data’ sheets:

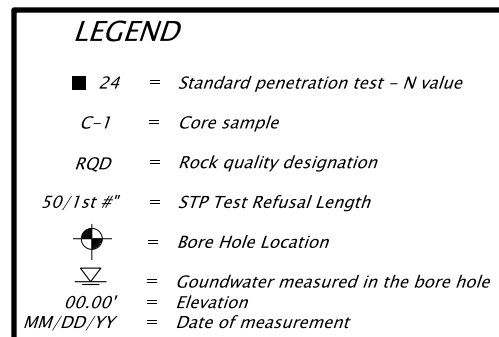
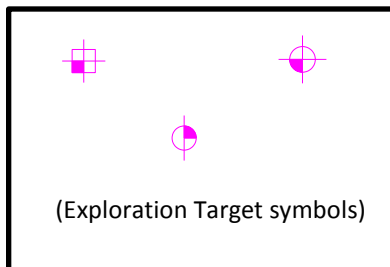
- ODOT Notes
- ODOT Subtitles
- ODOT Titles

These text styles can be set in the text attributes tools.



**Cell Library**

The cell library for the Geology/Geotechnical disciplines is called **Geo.cel**. Many of the elements necessary to complete a Geotech Data sheet are located in this cell library. The cell library is accessed by the Geology Geotech tasks and workflows for the needed tools. Tools used on Geotech Data sheets include elements such as; a profile grid, Unit Descriptions, a Core Table, Standard Notes, etc.



**Seed and Cache**

Seed and Cache files are also provided in the ODOT MicroStation workspace. See [Chapter 2](#) for more information on seed and cache files, plus a link to access the ODOT workspace.

**3.2.2 File Name and Sheet Name**

**File Name**

ODOT has a set list of CAD file names to use, based on an approved file naming convention developed for use within ODOT’s new data management system called [ProjectWise](#).

The project drafter must coordinate with the other disciplines involved in the project to determine individual structures/features where ‘Geotechnical Data’ sheets are required. Each discipline has a

specific file name assigned to 'Geotechnical Data' sheets for their structures/features. Each project drafter is responsible for naming individual files according to their discipline specific standards.

The approved file naming for 'Geotechnical Data' sheets is located in the [ProjectWise Document Name List](#).

### Sheet Name (Title)

'Geotechnical Data' sheets are named as 'GEOTECHNICAL DATA'. A new seed file has been added to the seeds in the workspace. The new file, titled *seed\_titleblock.dgn*, provides users with a reference file similar to the previously used .nam file. The new seed contains sheet titles by discipline, in the 'Sheet Title' space of the titleblock. The file is divided into different models, one for each discipline. Each sheet title within a model resides on a separate level, so that your choice can remain turned on while all other sheet name levels are turned off.

Refer to [chapter 2; section 2.5 Sheet Naming](#), for a complete list of approved GHE sheet names.

### 3.2.3 Drawing Sequence and Sheet Numbering

#### Drawing Sequence

To allow for ease of use during construction, 'Geotechnical Data' sheets are placed with the structure or feature they are developed for. Placing the 'Geotechnical Data' sheets in this way assures that those involved with construction can easily find the subsurface information for each feature. With this information they can better understand the subsurface conditions and their effect on that particular feature without the burden of having to look in multiple places throughout the plan set.

'Geotechnical Data' sheets are ordered within the sheet series so they are placed after the design plan sheet and before the profile sheet for the structure or feature they are intended for. When a structure or feature has the plan and profile depicted on one single sheet then the Geotechnical Data Sheet immediately follows that sheet. The exception to this rule is Geotechnical Data Sheets developed for Cuts, Fills, and Embankments. They will be associated with the appropriate Plan View sheet and will follow the Profile Sheet for that section. Generally this will be the Roadway design portion of the plans.

The project drafter must coordinate with the other disciplines involved in the project, to determine individual structures/features where 'Geotechnical Data' sheets are required. Each discipline has a specific sheet number assigned to 'Geotechnical Data' sheets for their structures/features. Each project drafter is responsible for numbering their individual sheets according to their discipline specific standards.

When 'Geotechnical Data' sheets are produced for numerous structures/features within a project, an (Index sheet), depicting the locations covered by the data sheets should be produced to aid in locating the appropriate information. The Index sheet appears in the 'G' series section of the project plans set. The 'G' designation is the major category for where the Index sheet belongs within the project plans set.

The index sheet is titled *Exploration Location Index*. References to the locations of the 'Geotechnical Data' sheets throughout the project plan set are appropriately noted on this Index sheet. Each Geotechnical Data sheet within the plan set should reference the Exploration Locations Index.

Duplication and overlap of information on individual 'Geotechnical Data' sheets, or on multiple sheets within one discipline, should be avoided. Duplication of information among multiple disciplines may be necessary, at times, in order to provide all the information available for multiple structures/features. For example: Two exploration bore holes for two features that are in close proximity to each other,

such as a retaining wall and a Signal Pole, will appear the same on the Geotechnical Data sheets for the Retaining Wall as it will on the Geotechnical Data sheets for the Signal Pole. This means, the same information will appear in two separate sections of the project plans. This gives the contractor who is building the Retaining Wall, access to the Geotechnical Data for his part of the project, and it will appear with the rest of the retaining Wall plans. The same will be true for the Signal Pole contractor.

### Sheet Numbering

'Geotechnical Data' sheets that are placed with the plan sheets for a structure or feature will take on the sheet numbering series of that structure or feature. For example, if the 'Geotechnical Data' sheet is intended for a feature in the C04 series of the plans it might be numbered C04D and the feature profile is then numbered C04E.

The exception to this rule is the "Exploration Location Index" sheet for the project, plus the 'Geotechnical Data' sheets that do not apply to any specific structure or feature; they are placed in the Geology\Geotechnical, or 'G' series, portion of the contract plans. Geotechnical Data sheets, including the Exploration Location Index, are the first sheets to appear in the 'G' series and are numbered as GA##, as shown in [Table 2-1 of the CPM](#)

### 3.2.4 Plan and Profile Sheet

The content of a Geotechnical Data plan sheet is based on the final bore logs produced by the Project Geologist. Location and placement of explorations, legend development, and unit descriptions are the responsibility of the Project Geologist to assure the unit descriptions match the corresponding descriptions on the Final Logs for each exploration.

Placement of each piece of a plan sheet, such as Legends, Tables, and Notes; are the responsibility of the project drafter, using their expertise to assure conformity to the CAD standards for 'Geotechnical Data' sheets. The MicroStation workspace provides drafters with all the essential CAD elements needed to develop plan sheets according to current CAD standards.

### Layout

'Geotechnical Data' sheets can be arranged in multiple ways to clearly and thoroughly depict subsurface conditions. The minimal items to display on a Geotechnical Data Sheet are a plan and profile showing the subsurface conditions that underlie the subject structure/feature with the profile along the centerline. The centerline may be the roadway centerline, or it could be the centerline of a wall, bridge, or other feature.

This principle layout should be provided for every structure/feature but it does not restrict additional details on separate sheets that aid in the understanding of the underlying geologic conditions. In some instances, a Section or Cross-section may be used in lieu of a Profile. Some feature plan sets begin with a plan view only sheet(s) followed by the profile sheet(s).

Additional profiles offset from centerline or along structure alignments may also be produced. Cross-sections may be used in place of, or to supplement the profile for wide features or where complex geology exists. Sections may also be drawn at skewed angles to the centerline where needed to best display subsurface conditions or to show a specific element such as the principal axis of a landslide.

Each plan sheet includes a legend and general notes. All sheets displaying the depth of each bore log will also include unit descriptions. Rock core tables are included when appropriate.

### Plan View

The plan view for a Geotechnical Data sheet shows all existing structure(s)/feature(s) in addition to the proposed structure(s)/feature(s). Locate and label all existing and proposed bent and abutment location for any bridges. Provide a footprint, or general layout, of all other structures and features. These features should be presented at a scale suitable for easy viewing. See figure 3.2.4.1 Plan View.

The alignment to be used for construction of the structure/feature should be clearly shown. Stationing should be sufficient to orient the drawing and to provide reference to the important elements of the structure/feature being constructed. Stationing should follow the CPM requirements for stationing from left to right on the sheet. Where structure-specific alignments are used for construction, the project alignment should also be shown

The location of all explorations such as borings, test pits, cone penetrometer tests, seismic lines or other subsurface explorations must be shown. Each location is to be identified with the correct symbology and label. The survey location should appear directly adjacent to the exploration number. Survey information should include the exploration number, the name of the alignment, and the station and offset with right (Rt) or left (Lt) offset indicated.

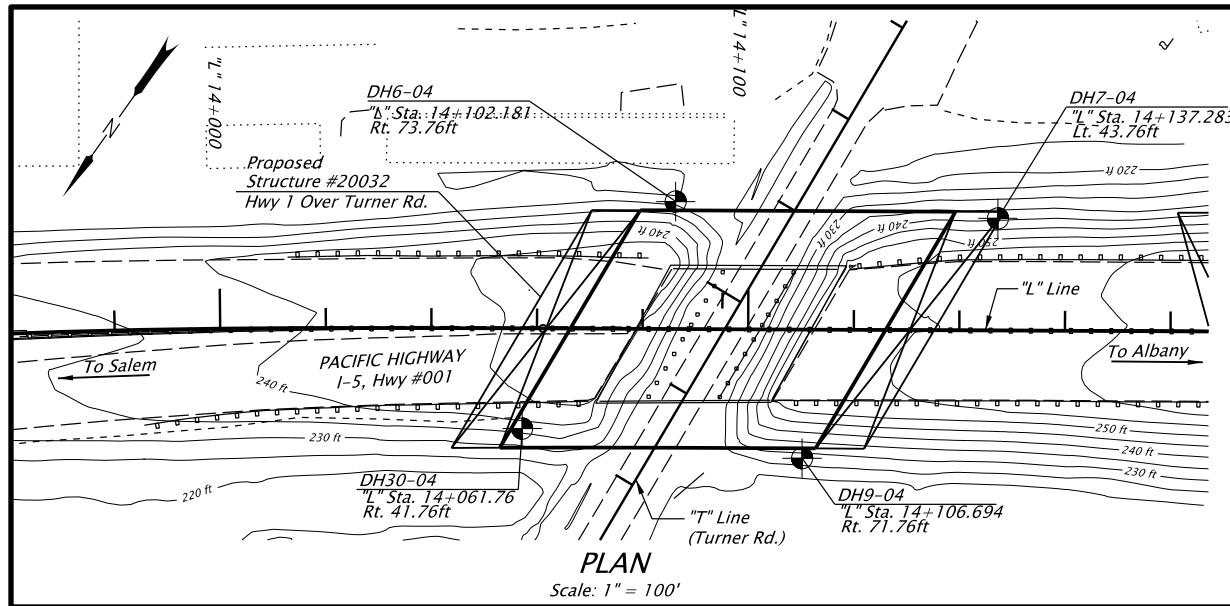


Figure 3.2.4.1 Plan View

For projects without alignments, the coordinates of the exploration are to be shown instead. These coordinates should be the same as the project coordinate system. If cone penetrometer, pressure meter, vane shear, packer or other in-situ testing is performed; a note stating that the results of these tests are available in the Geotechnical Data Report is to be included.

Where bodies of water lie within the plan view of the structure or feature, their boundaries should be clearly shown with direction of flow indicated by an arrow pointing in the direction of flow. Every waterway should be labeled with the name of that body of water. If the waterway is unnamed, it should be labeled as such. Intermittent waterways should be labeled or depicted as such with the appropriated symbology.

Gray-shading the contours will allow feature linework and symbology to stand out, which aids the readability of the plan. Contours must be displayed with numeric labels indicating their elevation at an

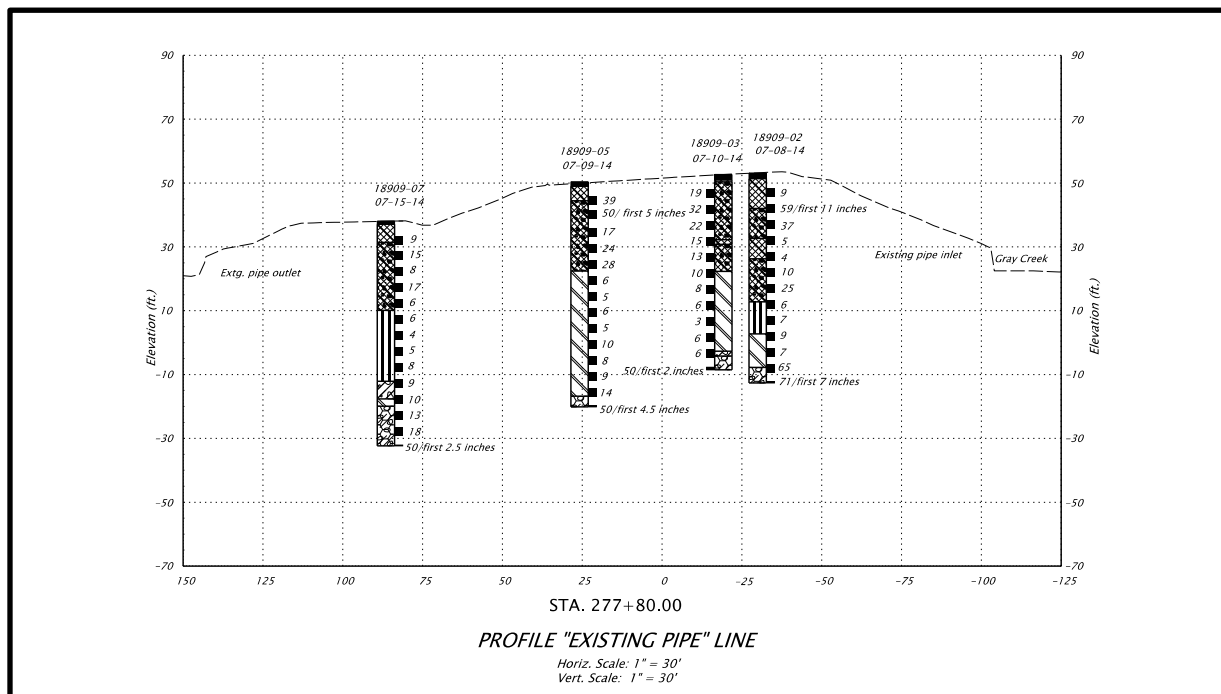
appropriate interval. **Do not** include unit labels (i.e. Ft or M). The contour interval should be stated somewhere on the plan sheet.

Features or lines that don't serve a clear purpose with respect to conveying information about the site conditions tend to clutter and distract from the intent of the drawing and should be omitted. See the check list for items that are to remain turned on.

**Profile View**

The profile view shows the engineering geology interpretation of the subsurface conditions at the site. This interpretation is depicted by **graphic columns** or "stick logs" that represent each exploration at the station and elevation at which they occur along the alignment. Graphic columns consist of separate sections that represent the subsurface materials by patterned symbology. A Unit Description is used to describe the materials represented by the patterns, and shown in a legend format located along the far right edge of the sheet. See figure 3.2.4.2 Profile View.

Profiles are shown along the alignment(s) used for construction as described in the preceding LAYOUT section. Each graphic column should be aligned with the corresponding exploration symbol on the plan view immediately above the profile. Profiles are displayed on station and elevation grids. The stations should be labeled on the bottom of the grid. Elevations should be labeled on the left and right side of the grid. Grid lines may be subdued to avoid conflict with graphic columns showing geologic interpretations or the various graphic column labels. Profiles should be labeled as "PROFILE 'LINE NAME'". For example 'PROFILE "SB1" LINE'.



**Figure 3.2.4.2 Profile View**

It is common for numerous explorations to be shown on any single profile which can obscure data or lead to a cluttered appearance. Several options can be used to alleviate this situation:

- Expand the horizontal scale of the drawing

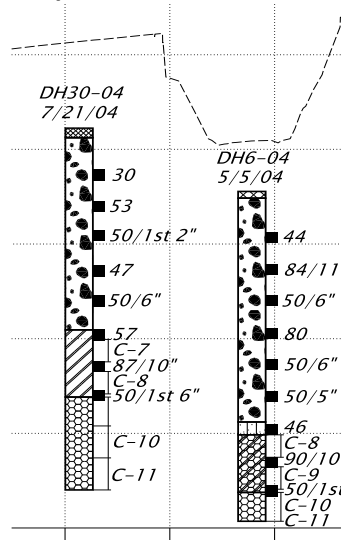
- Relocate the exploration and descriptive text to a different point on the drawing with an arrow connecting it to its true location
- Use supplemental sections, profiles, or cross-sections.

Sheets produced for supplemental profiles will be identical in format to the standard Geotechnical Data Sheet.

**Elevation View**

Some project features, such as landslides or retaining walls, do not require an alignment. In these cases the profile view can be labeled as 'ELEVATION'. The grid and subsurface information is shown exactly the same on an elevation view as it is on a profile view.

**Graphic Columns**







Graphic columns are labeled at the top with the exploration number, offset (optional), and the date the boring was completed. Additional information with depth is shown alongside the graphic column. Samples and in-situ test results are shown with their designated symbols at the depth they were taken, or performed, along the right side of the graphic column. SPT intervals are to be labeled by their N-Value. Sample intervals are denoted by the vertical length of the symbol. Continuous sampling methods such as rock coring are shown by dimensions labeled with the sample name. Groundwater is shown on the left side of the graphic column. The standard groundwater symbols should be placed at the depth of the highest and lowest groundwater levels measured. These symbols should be labeled with the groundwater elevation and the date the sample was taken.

**Unit Descriptions**

Unit descriptions and their corresponding symbols are displayed in a legend-style format. The Project Geologist must compile, and provide to the drafter, the descriptions for the engineering geologic units to be shown in the legend based only on the explorations shown on that sheet. The drafter arranges the unit descriptions in a manner to allow space for a legend of symbols, notes, and core tables. Unit descriptions, legends, etc., generally appear along the far right edge of the plan sheet.

**UNIT DESCRIPTIONS**

 <p>Sandy GRAVEL, GW, brown, nonplastic, dry to wet, dense. ....</p>	 <p>Clayey SAND to SAND, with some Gravel locally, ....</p>
 <p>Silty CLAY with trace Organics, Organic CLAY, and Clayey ....</p>	 <p>BASALT, brown, black, red and grey, ....</p>

Specific information may be conveyed on a Data Sheet from other project data sources. An example of this would be a specific note on a boulder-bearing Engineering Geologic unit that did not encounter boulders in the sheet's specific borings, but were found elsewhere in the same unit.



**Rock Core Tables**

Rock Core Tables are used to show specific rock core data for each boring. Each graphic column with rock coring should have a corresponding table that includes the core run, percent recovery, hardness, and Rock Quality Designation (RQD). These tables are ideally shown below the profile where the corresponding graphic column occurs. Sheet space limitations may require a different distribution of the rock core tables. It is the project drafter’s responsibility to use their expertise to locate the rock core tables in a reasonable place on the plan sheets.



10352-02

Core	% Rec.	Hardness	R.Q.D.
C1	16	R1	
C2	100	R1	100%
C3	100	R1	89%

**Legend and Notes**

The workspace contains a legend of symbols and their descriptions, commonly used on ‘Geotechnical Data’ sheets. Every Geotechnical Data sheet requires a legend of symbols.

**LEGEND**

- 24 = Standard penetration test – N value
- C-1 = Core sample
- RQD = Rock quality designation
- 50/1st #” = STP Test Refusal Length
-  = Bore Hole Location
-  = Groundwater measured in the bore hole
- 00.00’ = Elevation
- MM/DD/YY = Date of measurement

A set of standard notes are included in the workspace to provide further project information. Additional notes may be added at the discretion of the project Geologist and should clearly convey correct project information.

**NOTES:**

1. Groundwater not encountered during exploration.
2. Elevations shown are based on North American Vertical Datum (1988)
3. Geotechnical data shown is a consolidation of information and/or revision in terminology from the drill logs. More detailed subsurface data is available on the drill logs in the geotechnical report, which is available from the Engineer.
4. Core drilling used to extend boring depth upon auger drilling refusal.

**3.2.5 Detail sheet**

**Sections and Cross-Sections**

Details for ‘Geotechnical Data’ sheets generally display sections or cross-sections. Sections and cross-sections are typically used to improve understanding for large structures/features or complex subsurface conditions. However, they are required for all landslides and for cuts and embankments that are large enough to necessitate subsurface exploration. Cross-sections should be considered for wide or skewed structures, structures founded on spread footings, and where variable-lengths of deep foundations result from high local relief or geologic structure.

Plan views may be shown on section and cross-section sheets where needed. Sections and cross-sections may be shown on plan and profile sheets when space allows. When section sheets are used, the section line should be shown on the Plan View of the primary geotechnical data sheet and labeled with the appropriate section arrow and designation.

Sections and cross-sections should include the existing ground line along the section and the graphic columns showing the subsurface conditions as described in the preceding PROFILE VIEW section. Sections should also be drawn on a grid with the elevations labeled on the left and right side of the grid and the horizontal offset from centerline labeled on the bottom of the grid. Grid lines may be subdued to avoid conflict with graphic columns showing geologic interpretations or the various graphic column labels.

Cross-sections developed perpendicular to the centerline alignment may be labeled as “SECTION ‘Station’ “. Sections developed at any angle other than perpendicular should be labeled as “SECTION ‘alphabetic letter – alphabetic letter’ “(i.e. A-A).

### 3.3 Check List

Geotechnical Data Drawing Check List:

(Depending on the project, some items may not apply).

- Border, title block, sheet title, sheet number
- Title block information complete
- Professional of record stamp
- “V” number or project status stamp
- Index sheet (if needed)
- Plan view
- Profile/section view(s)
- North arrow
- Scales noted
- Existing roadway
- Existing structures (e.g. bridge, culvert, wall, sign bridge, etc.)
- Existing utilities
- Existing contours
- Contours labeled
- Bore hole locations with labels (including station and offset)
- Proposed roadway with alignment and stationing
- Proposed structures
- Proposed utilities
- Proposed contours
- All structures labeled with assigned structure numbers
- Waterway(s) labeled and flow direction shown
- Right-of-way lines
- Temporary construction easements
- Construction limits
- Graphic columns and labels
- Groundwater marks
- SPT marks
- Cross section(s)
- Detail(s)
- Legends, notes, unit descriptions and core tables

### 3.4 Example Drawing(s)

The following ‘Geotechnical Data’ sheet drawings are included to provide a few examples where these sheets are required in a set of plans. These drawings demonstrate typical sheet layouts with regards to the placement of project exploration data and the key CAD components.

### 3.4.1 Example Bridge Geotechnical Data Sheet

#### UNIT DESCRIPTIONS

??N-???

Silty SAND, SM, brown, nonplastic, wet, dense. (Alluvial)

BASALT, grey and brown with grey yellow red and black, predominately decomposed to moderately weathered, R0 to R1 and some R2, grey to black jointed and partly friable to S1, S40, S60, S80, fragments, residual (Columbia River Basalt)

BASALT and Vesicular BASALT, grey with black and brown, mostly jointed and partly to fresh, R2 to R4, very close to medium jointed. (Columbia River Basalt)

Cobbly and Gravelly soil with Sandy Silt or Clay and some Organics locally. (Fill)

Clayey SILT to Silty CLAY, MH, CH, monted grey to black, plastic, moist to wet, stiff to very stiff. (Alluvial)

Sandy GRAVEL and Cobbly GRAVEL with some silty sand, mostly to silty, to silty to OK, brown to grey, nonplastic, moist to wet, dense to very dense. (Alluvial)

#### GENERAL NOTES:

- 5' Contour Interval
- Groundwater not encountered during exploration.
- Elevations are based on North American Vertical Datum (1985).
- Geotechnical data shown on this drawing are a consolidation of information and/or revision in terminology from the drill logs. More detailed subsurface data is available on the drill logs in the original report, which is available from the Engineer.
- Core drilling used to extend boring depth upon auger drilling refusal.
- In accordance with ASTM D1586-84, N values are reported for an interval of 3X ft, except as noted.

#### LEGEND

■ 24 = Standard penetration test - N value  
 C-1 = Core sample  
 RQD = Rock quality designation  
 50'/31# = STP Test Refusal Length  
 = Bore Hole Location  
 = Elevation  
 = Date of measurement

#### DH30-04

Core	% Rec.	Fractures	R.O.D.
C1	60	R0	0
C2	60	R0	0
C3	97	R3-R4	40
C4	100	R3-R4	46
C10	100	R4	46
C11	80	R4-R2	72

#### DH9-04

Core	% Rec.	Fractures	R.O.D.
C1	100	R2-R4	34
C2	94	R3	30
C3	100	R4	60
C10	100	R4	80

#### DH7-04

Core	% Rec.	Fractures	R.O.D.
C1	98	R1-R2	0
C2	100	R3-R4	54
C3	100	R4	68
C9	100	R4	70

#### DH6-04

Core	% Rec.	Fractures	R.O.D.
C1	86	R0-R1	0
C2	86	R1	0
C3	86	R2-R4	33
C10	100	R2-R4	33
C11	38	R2-R4	20

#### STRUCTURE DATA

STRUCTURE NO.: 00000  
 BRIDGE NO.: 00000  
 SCALE: 8000  
 HWY: \_\_\_\_\_  
 I/F: \_\_\_\_\_  
 COUNTY: \_\_\_\_\_  
 DATE: \_\_\_\_\_

DESIGNER: Name \_\_\_\_\_  
 DRAWER: Name \_\_\_\_\_  
 CHECKER: Name \_\_\_\_\_

SHEET NO. \_\_\_\_\_  
 J## \_\_\_\_\_

OREGON DEPARTMENT OF TRANSPORTATION

STRUCTURE NAME: \_\_\_\_\_  
 PROJECT TITLE: \_\_\_\_\_  
 COUNTY: \_\_\_\_\_

EXPIRES: MM-DD-YYYY  
 (FORM REVISION PROCEDURE AVAILABLE UPON REQUEST)

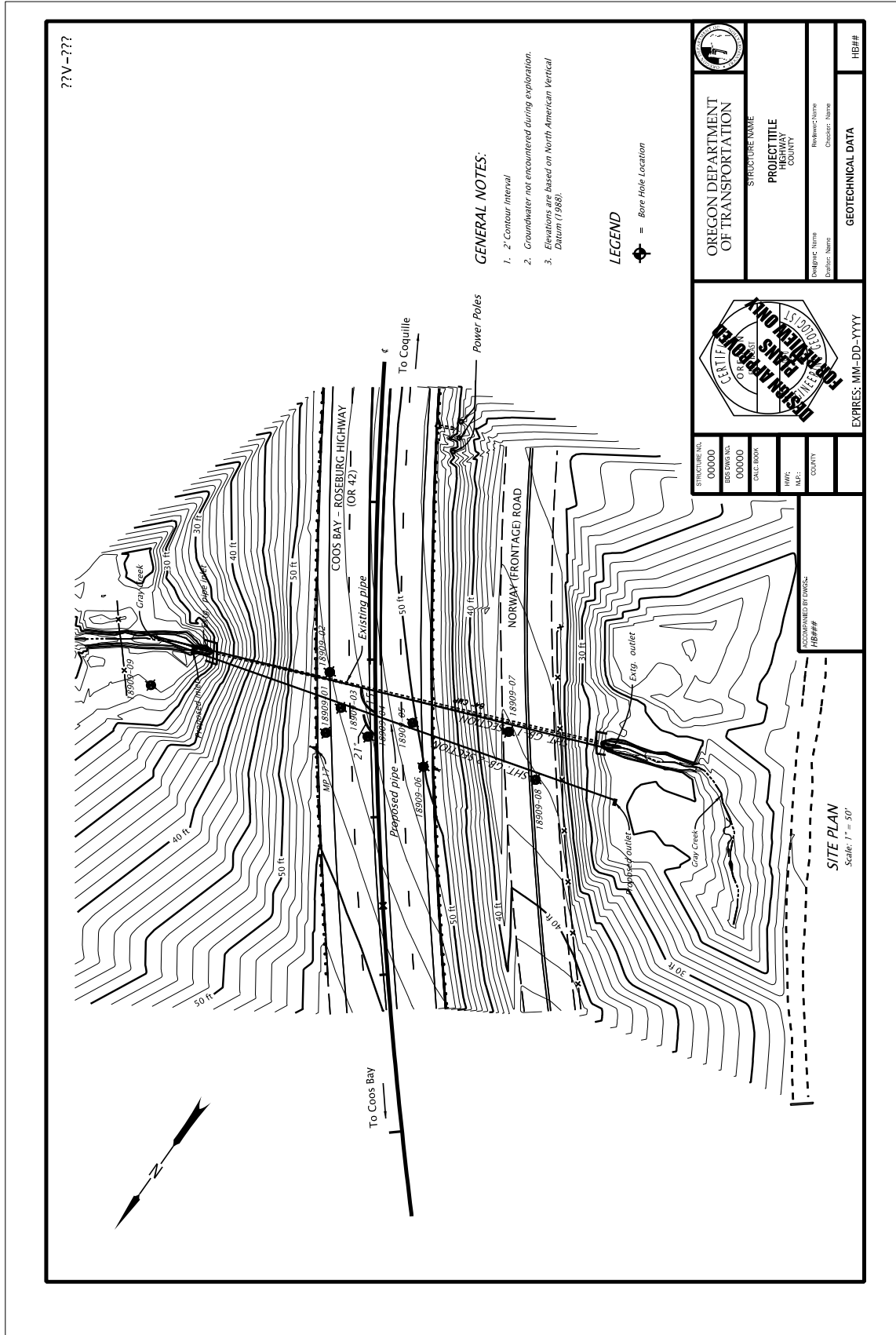
#### PLAN

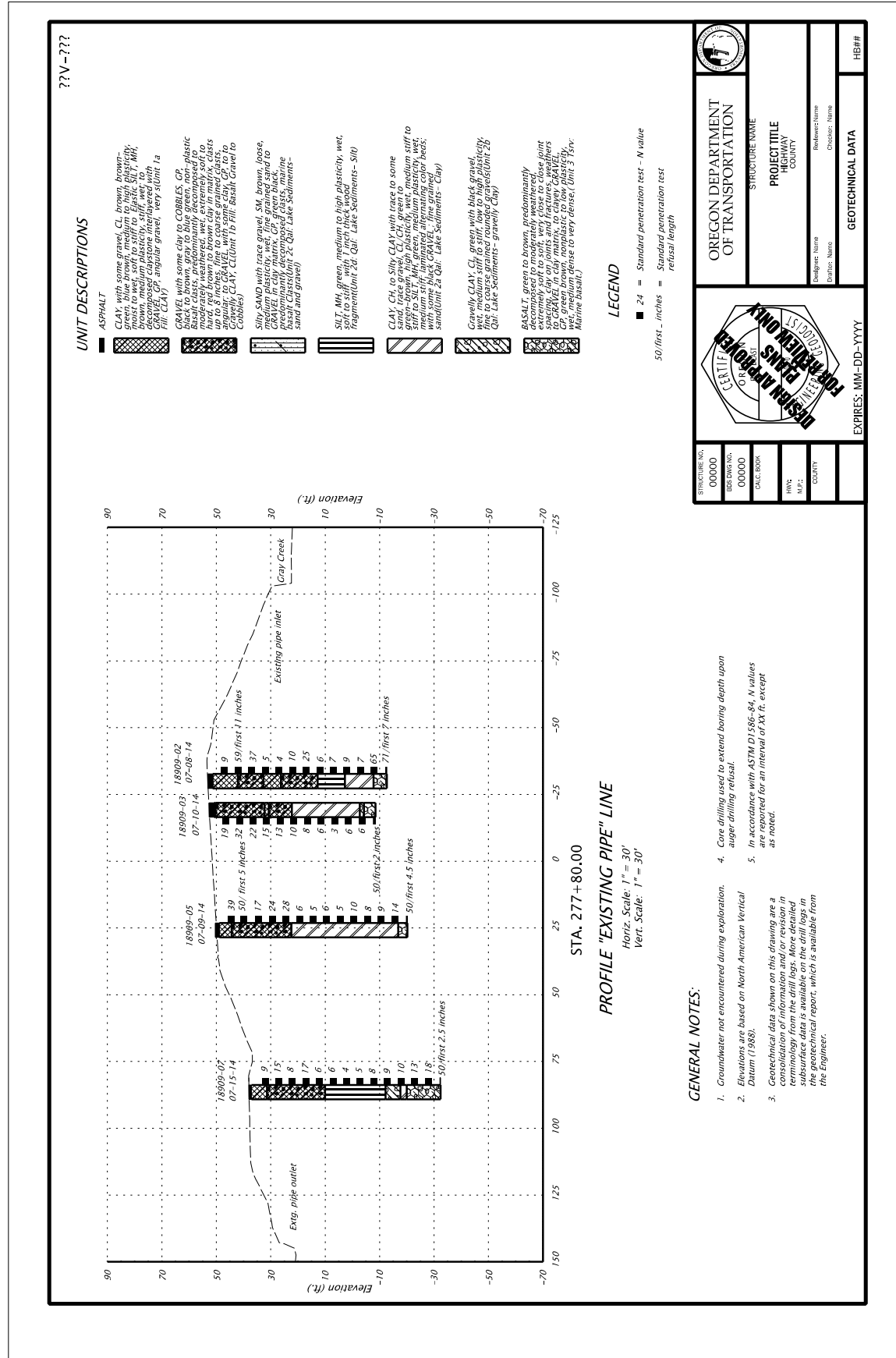
Scale: 1" = 100'

#### PROFILE "L" LINE

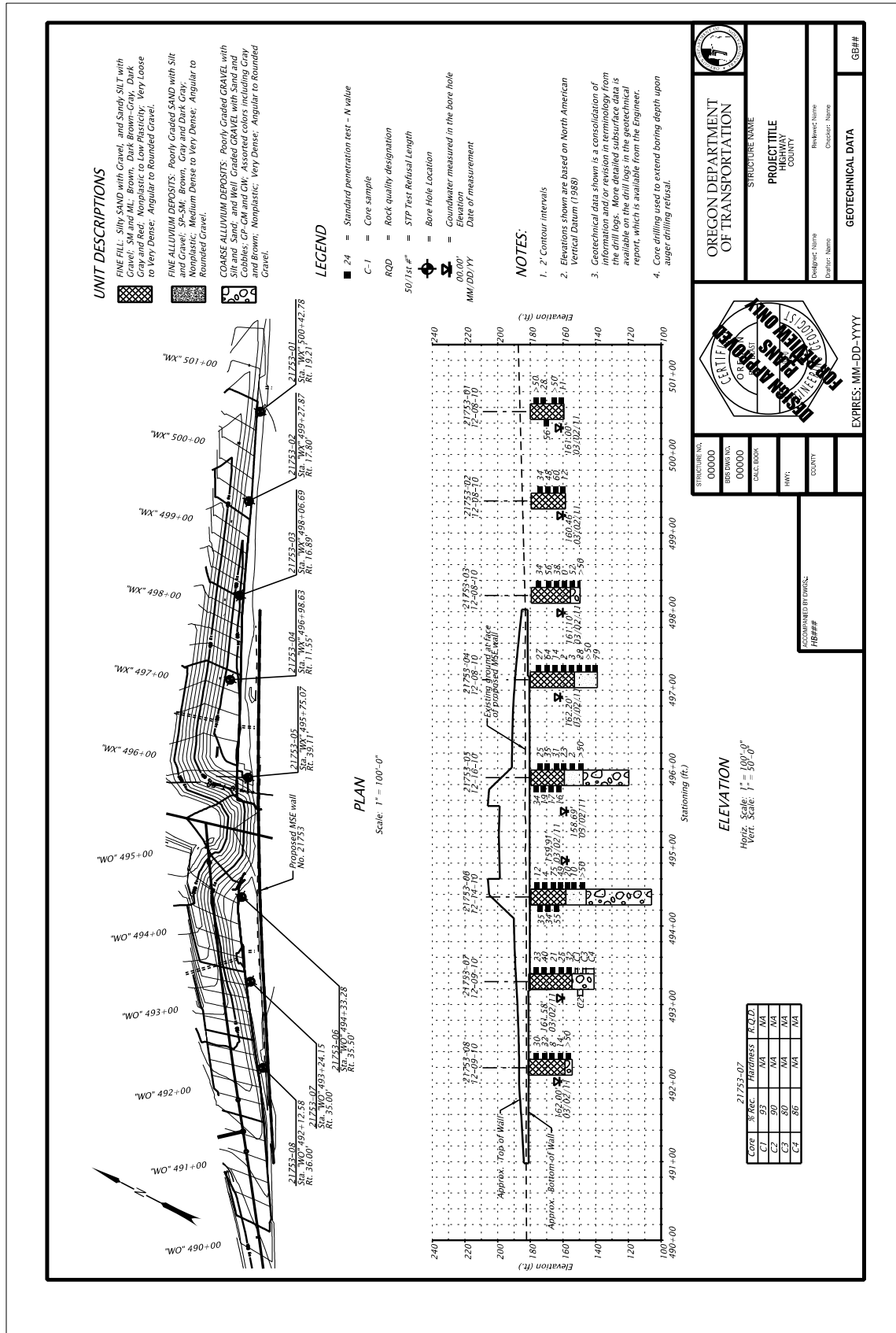
Horiz. Scale: 1" = 100'  
 Vert. Scale: 1" = 40'

3.4.2 Example Culvert Geotechnical Data Sheets





3.4.3 Example Wall Geotechnical Data Sheet



**This chapter to be completed at a later date.**



Chapter 4 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 4 – Retaining Walls

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[Placeholder for chapter specific Table of Contents]



**This chapter to be completed at a later date.**



Chapter 5 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 5 – Sound Walls

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[Placeholder for chapter specific Table of Contents]

**This chapter to be completed at a later date.**



Chapter 6 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 6 – Landslide Mitigation

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[Placeholder for chapter specific Table of Contents]

**This chapter to be completed at a later date.**



Chapter 7 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 7 – Rock Slope Mitigation

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[Placeholder for chapter specific Table of Contents]

**This chapter to be completed at a later date.**



Chapter 8 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 8 – Material Source/Disposal Sites

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**This chapter to be completed at a later date.**



Chapter 9 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 9 – Hazmat

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[Placeholder for chapter specific Table of Contents]

**This chapter to be completed at a later date.**



Chapter 10 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 10 – Water Quality Facilities

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**This chapter to be completed at a later date.**



Chapter 11 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 11 – Culverts

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[Placeholder for chapter specific Table of Contents]



Chapter 12 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# 12.0– Facility Identification Markers

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## 12.1 Overview

ODOT installs standard field markers at each culvert and each stormwater facility owned, operated and maintained by the department. Field markers help maintenance crews, scoping teams, and asset management employees, identify facilities when field locating structures within ODOT's system.

Each facility is assigned a unique drainage facility ID number (DFI) which is typically included on specified markers. See the [Hydraulic Design Manual Chapter 17](#) for instructions on how to obtain a DFI number.

ODOT's standard drawings, **RD398 Culvert ID Marker** and **RD399 Stormwater Treatment and Storage Facility Field Markers** specify the marker types and locations for each type of facility. See the [Hydraulic Design Manual Chapter 17](#) for field marker types and descriptions.

The methods and procedures in this chapter describe how and where each field marker type is displayed on the plan sheets to provide accurate marker information.

This chapter will further describe the specific CAD standards; such as sheet layout, cells, tasks and workflows etc., used to show facility ID marker information on culvert plan sheets and on stormwater facility plan sheets.

Culvert field marker standards are different from stormwater facility field marker standards. This chapter addresses them separate from each other to avoid confusion. Sections 12.2 – 12.5 addresses culvert ID markers, and Sections 12.6 – 12.9 addresses stormwater facility ID markers.

## 12.2 Development of Culvert ID Marker Sheets

Culvert sheets are produced for contract plans through collaboration between the project Hydraulic/Roadway engineer (Engineer of Record) and the drafting resource.

The EOR is responsible for developing the culvert design to be shown on the culvert sheets for the contract plans, and providing the drafter with the design files.

The project drafter is responsible for developing plan sheets that reference the project base files and the culvert design files, in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the Contract Plans Manual (CPM).

### 12.2.1 Tasks and Workflows

ODOT's MicroStation workspace contains a "Culvert" task and workflow, located in the Geo Hyd Env tab of the tasks and workflows. See figure 12.2.1.1. The workflow contains symbols, a location table, patterns, etc., for culvert plans. Tasks and workflows are a work in progress and will be added to and revised as time goes on.

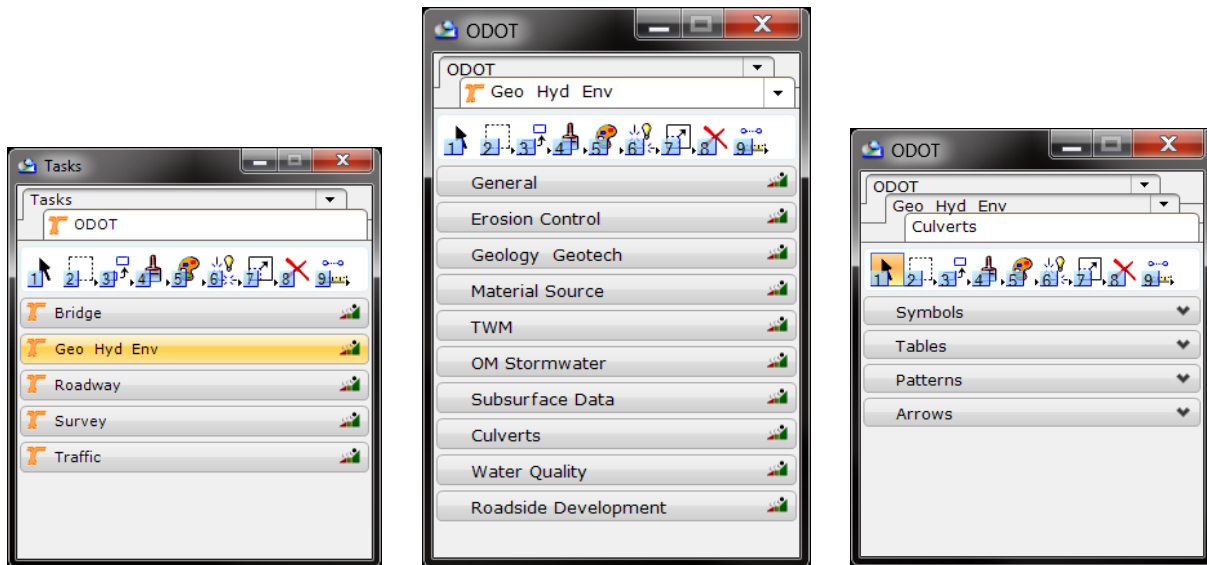


Figure 12.2.1.1 Culvert Tasks and Workflows

### Cell Library

The cell library used for developing plans for all Hydraulics related disciplines, including culvert plans, is named **Hydro.cel**. The elements necessary to complete a culvert ID marker plan are located in this cell library. The cell library is accessed by the Culvert tasks and workflow tab and includes elements such as; a Culvert ID Marker Table, Culvert Marker Type 1 and Type 2 symbols, plus Standard Notes, etc.

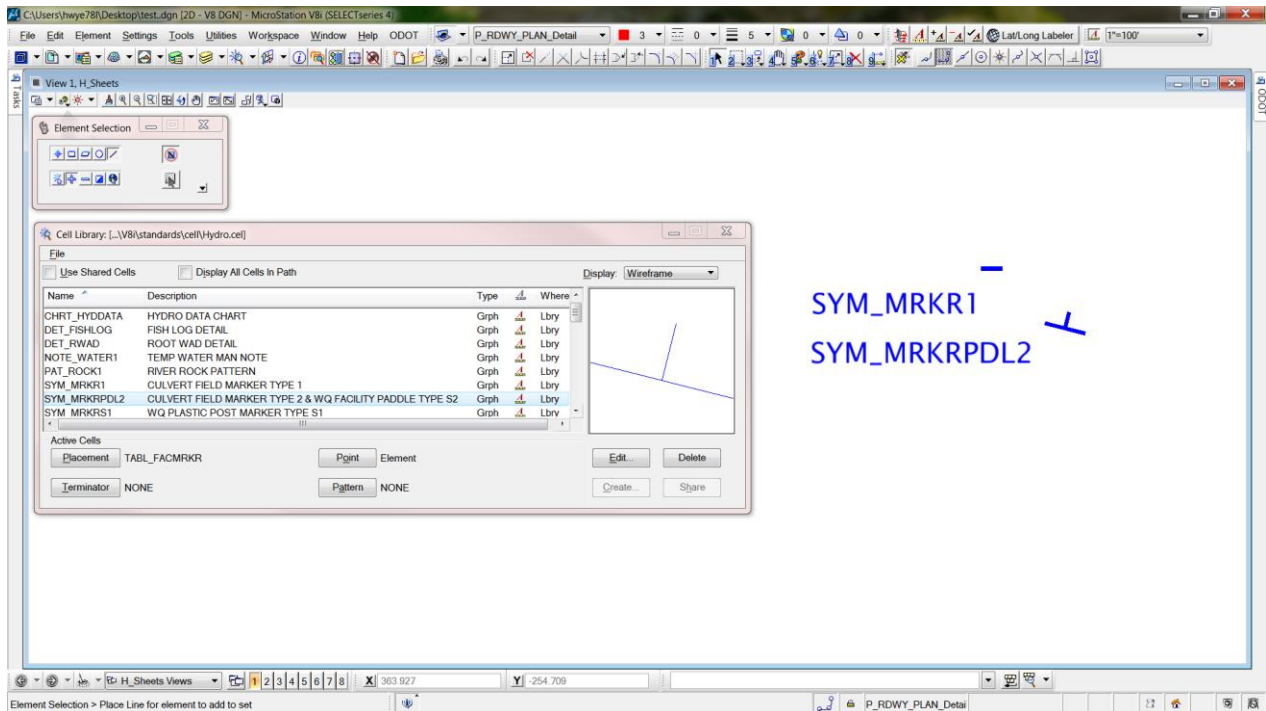


Figure 12.2.1.2 Hydro Cell Library Dialogue Box

### Seed and Cache

Seed and cache files are provided in the ODOT MicroStation workspace. See [Chapter 2](#) for more information on seed and cache files, plus a link to access the ODOT workspace.

Seed and cache files for GHE disciplines are in different stages of development and when finalized are included in the ODOT MicroStation workspace.

### 12.2.2 File Name and Sheet Name

#### File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT's data management system [ProjectWise](#).

The approved file naming for culvert plan sheets is located in the [ProjectWise File Naming Tool](#).

#### Sheet Name (Title)

Sheet titles for each discipline are located in seed file, ***seed\_titleblock.dgn***. The title block seed file contains a separate model for each disciplines sheet series. Sheet names for each discipline are located on separate levels within the models, so the correct sheet name can remain turned on while all others are turned off.

Refer to the [CPM, Chapter 3 – Plan Sheet Title Block](#) for complete information about the title block seed file, its use, and a list of correct sheet names.

Culvert ID marker locations are shown on the plan sheet for each culvert. The sheet title for culvert plans is located in the “H\_Sheets” model in the titleblock seed file.

### 12.2.3 Drawing Sequence and Sheet Numbering

#### Drawing Sequence

Culvert plans are located in the “H” series section of ODOT's Contract Plans. The “H” series is reserved for all hydraulic discipline plan sets. Culvert plans appear after the Stormwater plans and before the Fish Passage plans within the “H” series.

See the [CPM Chapter 2 -Table 2-1 “Drawing Order and Sheet Numbering”](#) for drawing order and sheet numbering of Culvert Plans.

#### Sheet Numbering

Culvert plan sheets generally begin with a plan and a profile/elevation of the culvert on the first sheet. This first sheet of a single culvert project is numbered HB01, the second sheet being HB02, etc. Subsequent sheets may contain details/cross sections, plus tables and notes, etc.

Sheet numbering options for projects with multiple culverts is described in the [CPM, Chapter 2](#).

### 12.2.4 Plan Profile/Elevation Sheet

#### Layout

Arrange Culvert sheets to clearly show the culvert design. Provide a plan view with a profile or elevation view of the culvert directly below the plan view. See Chapter 2 of the [Roadway CAD Manual](#) for plan and profile sheet layout options.

Clearly show the location of all culvert facility ID markers on the plan view. Specify the exact information that must be included on the field marker in the construction notes, and include a reference to ODOT's Standard Drawing **RD398 Culvert ID Marker**.

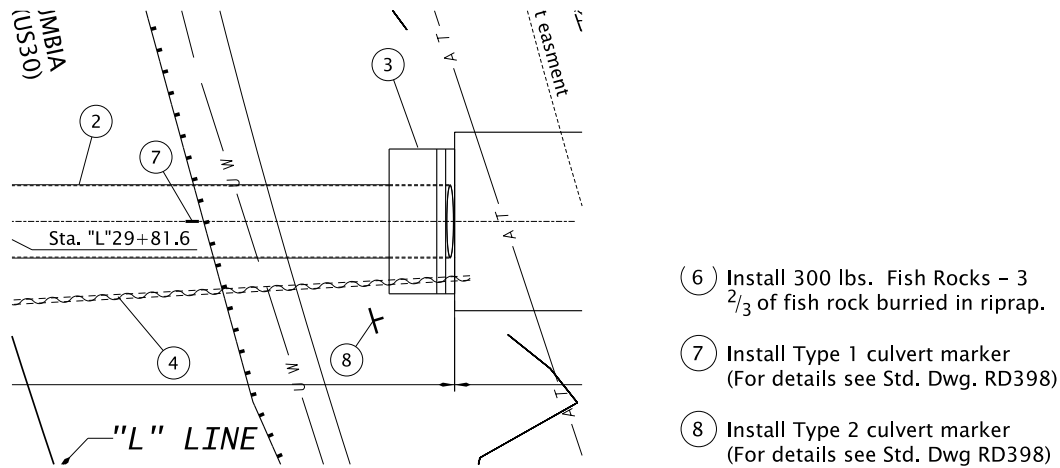


Figure 12.2.4.1 Culvert Plan with ID Marker Locations and Construction Notes

Include the Culvert ID Marker Table (Figure 12.2.4.2) to provide the location, the facility ID number, and the type of each marker for the culvert.

The cell for the table is called TABL\_CULVMRKR, and is included in the hydro cell library. The table can also be accessed from the culvert tasks and workflows. The marker table provides space for listing each culvert location by station and MP, and includes the DFI#. Some culverts also have structure numbers assigned and added to the table. Marker types are included with check boxes. There are two types of culvert ID markers, type 1 and type 2. See Section 12.3 of this manual for more information on marker types.

### CULVERT ID MARKER TABLE

CULVERT LOCATION		STRUCTURE #	DFI #	TYPE 1 MARKER		TYPE 2 MARKER	
STATION	MP			INLET	INLET & OUTLET	INLET	INLET & OUTLET
"LC" 000-000.00 Rt.	000.00	00000	D01234	✓		✓	

See St. Dwg. RD398

✓ Check where appropriate

Figure 12.2.4.2 Culvert ID Marker Location Table

See [Chapter 11 - Culverts](#) for more information on developing culvert plan sheets.

### 12.3 Culvert ID Marker Types

The EOR is responsible for providing the drafter with the location and type of each marker, along with the culvert ID numbers. The drafter is responsible for providing this information on the plan view by placing the appropriate cell, label, construction notes and table. In the construction notes always include reference to the standard drawing (when one applies).

#### Type 1 Culvert ID Marker

Type 1 culvert ID markers are a green preformed fused thermoplastic tape installed along the edge of pavement at the inlet end of the culvert.

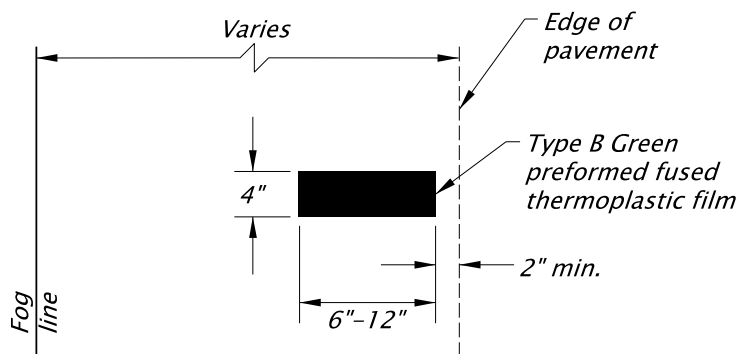


Figure 12.3.1 Type 1 Marker Size and Placement

Type 1 culvert markers are required for all culverts regardless of size. See the [Hydraulics Manual - Chapter 17](#) for complete Type 1 Culvert Marker guidance.

Culverts with a span of 48" and less:

- The Project Roadway Engineer determines the marker location. Culverts 48 inches and less are typically placed on the Roadway Drainage and Utility plans within the "D" series sheets. See the [CPM Chapter 2](#).

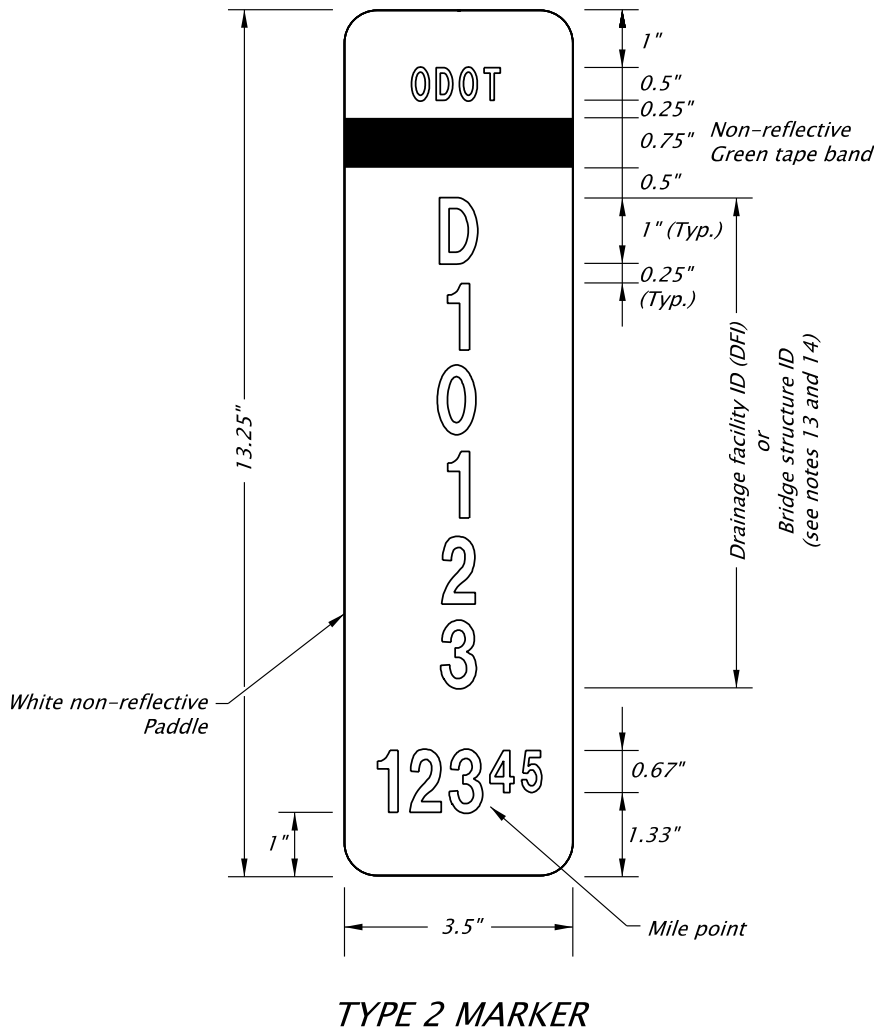
Culverts with a span greater than 48" and less than 20':

- The Project Hydraulic Engineer determines the marker location. Culverts in this size range are placed in the Culvert plans within the "H" series sheets. See [CPM Chapter 2](#).

#### Type 2 Culvert ID Marker

The Type 2 culvert ID marker is a white non-reflective aluminum paddle with black lettering and green strip, mounted onto a steel post or permanent feature. When placing the type 2 marker symbol, face the paddle parallel to the roadway on the plan view. (Paddle style markers are installed facing parallel to the roadway to avoid distracting the traveling public, but are clear to maintenance crews.) The type 2 style marker paddle

displays the mile point and DFI# assigned to the culvert. See [Hydraulics Manual - Chapter 17](#) for more information on Type 2 Culvert Markers.



**Figure 12.3.2 Type 2 Paddle Style Marker**

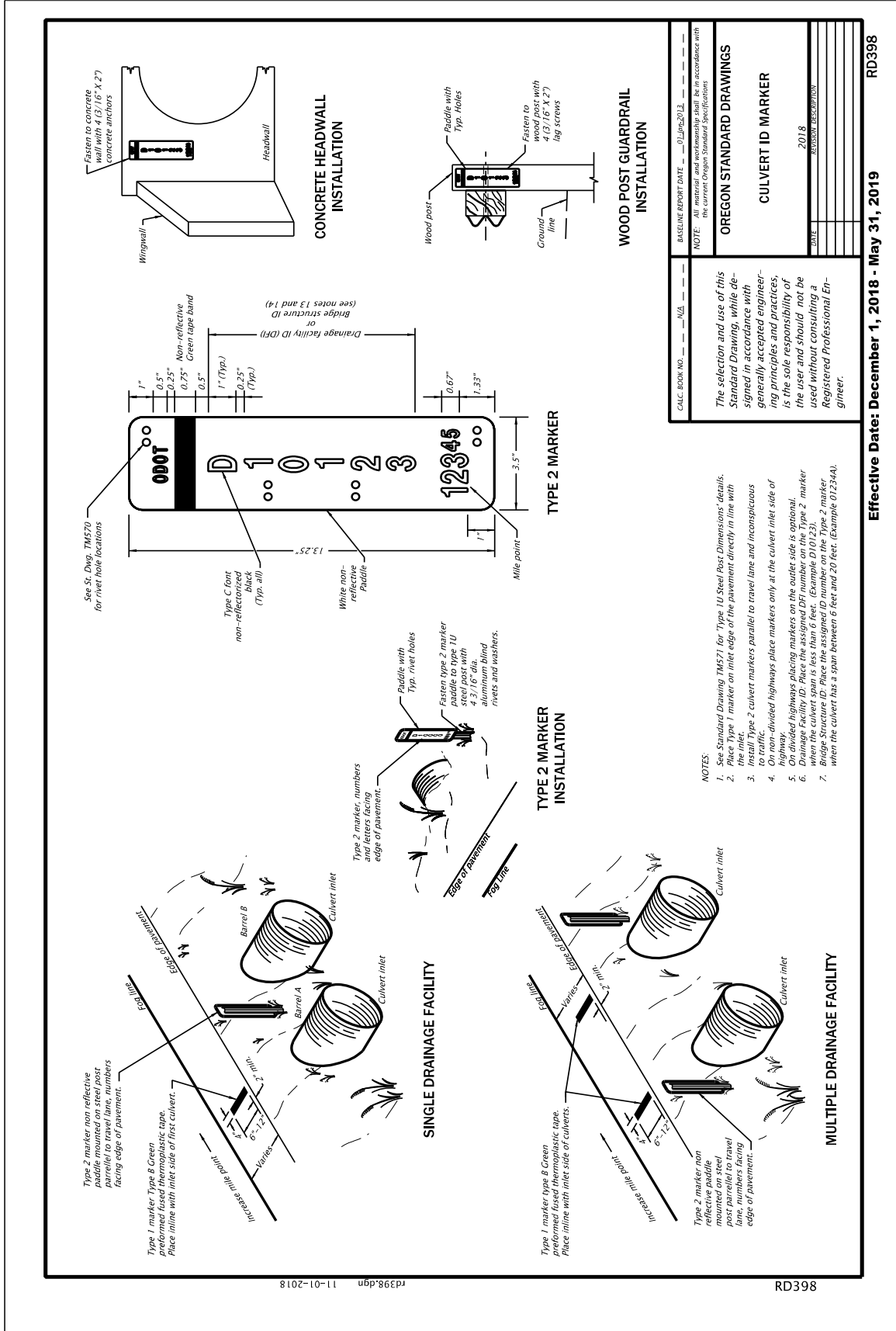
Paddle dimensions, paddle mounting guidance, and installation details are shown on Standard Drawing RD398.

**Standard Drawing RD398 – Culvert ID Marker**

Standard drawing RD398 describes the culvert ID markers in detail and includes size, color and installation guidance. Include RD398 in all culvert plan sets with culvert ID markers. Standard drawings are stamped by an EOR and supported by engineering analysis, calculations, and/or justification. Standard Drawings cannot be modified by designers on a project-by-project basis.

See ODOT’s engineering [website](#) for more detailed information regarding the use of standard drawings.

Figure 12.3.3 Standard Drawing – RD398 Culvert ID Marker





### 12.4 Check List

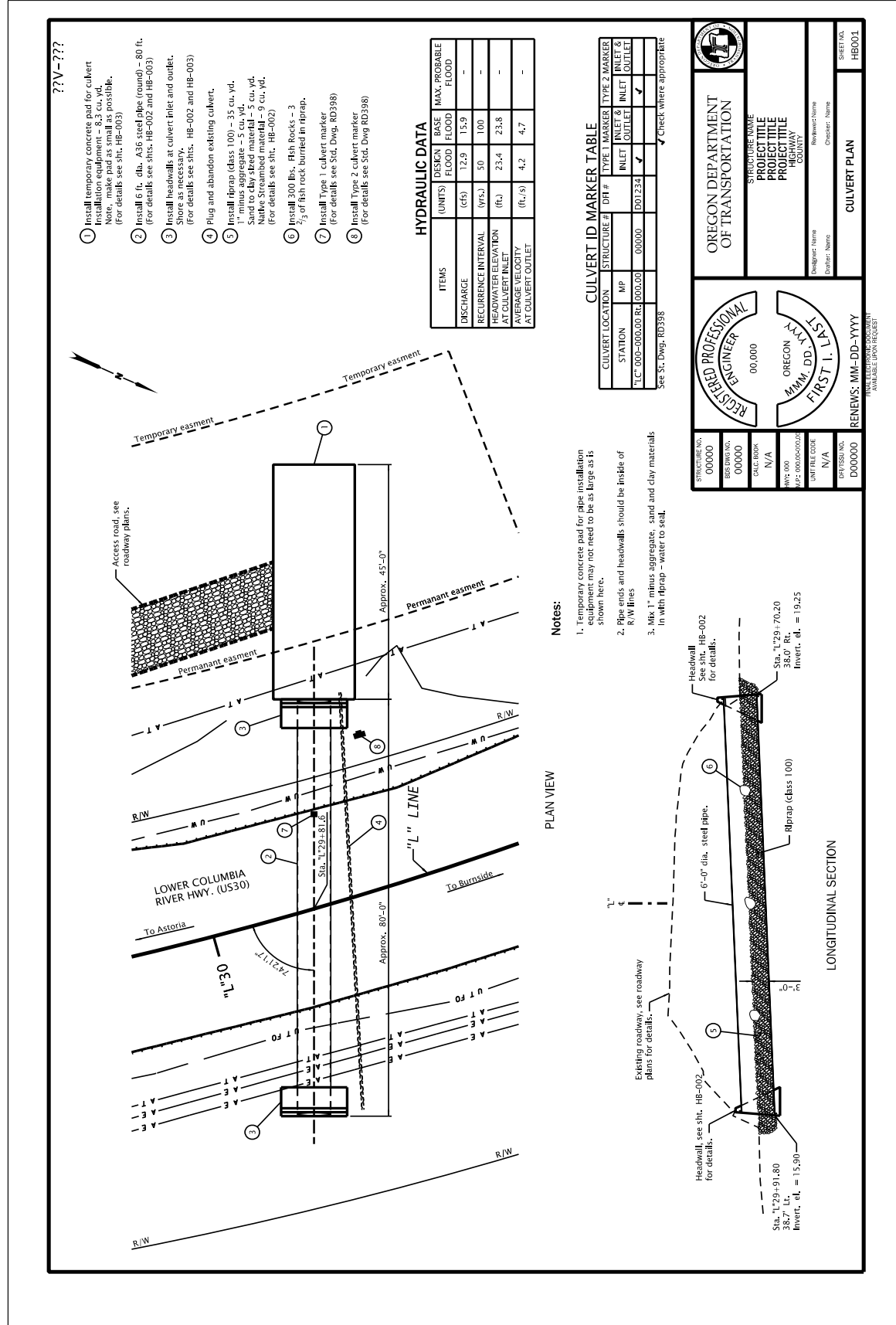
The drafting check list contains all items to be included on Culvert plan sheets. (Depending on the project, some items may not apply).

- Border, title block, sheet title, sheet number
- Title block information complete
- Professional of record stamp
- "V" number or project status stamp
- Index sheet (if needed)
- Plan view
- Profile view
- North arrow
- Scales noted
- Existing roadway
- Existing structures (e.g. bridge, culvert, wall, sign bridge, etc.)
- Existing utilities
- Existing contours
- Contours labeled
- Proposed roadway with alignment and stationing
- Proposed structures
- Proposed utilities
- Proposed contours
- All culverts labeled with assigned structure numbers
- All culverts labeled with assigned DFI numbers
- Waterway(s) labeled and flow direction shown
- Right-of-way lines
- Temporary construction easements
- Construction limits
- Detail(s)
- Legend, notes and field marker table
- Marker type
- Marker location
- Marker symbol
- Marker callout
- Marker label information

### 12.5 Example Drawing(s)

The following culvert ID marker example drawings demonstrate typical sheet layouts for proposed culvert plans showing ID marker locations and other key CAD components. Refer to the MicroStation workspace for the most recent CAD standards elements available.

Figure 12.5.1 Example Culvert ID Marker drawing



### 12.6 Development of Stormwater Facility ID Marker Sheets

Stormwater sheets are produced for contract plans through collaboration between the project Hydraulic/Roadway engineer (EOR) and the drafting resource.

The EOR is responsible for developing the stormwater design to be shown on the sheets for the contract plans, and providing the drafter with the design files.

The project drafter is responsible for developing plan sheets that reference the project base files and the stormwater design files, in a format consistent with the current CAD and drafting standards provided in the ODOT MicroStation workspace, this manual, and the Contract Plans Manual (CPM).

#### 12.6.1 Tasks and Workflows

ODOT’s MicroStation workspace contains a “Stormwater” task and workflow, located in the Geo Hyd Env tab of the tasks and workflows. See figure 12.6.1.1. The workflow contains symbols, a location table, patterns, etc., for stormwater plans. Tasks and workflows are a work in progress and will be added to and revised as time goes on.

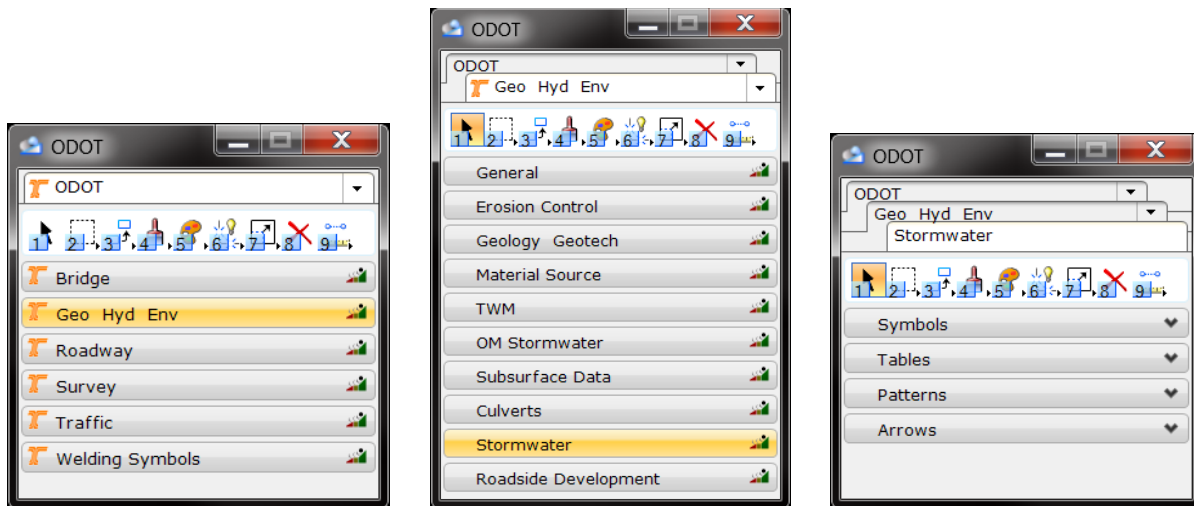


Figure 12.6.1.1 Stormwater Facilities Tasks and Workflows

#### Cell Library

The cell library used for developing plans for all Hydraulics related disciplines, including stormwater plans, is named **Hydro.cel**. The elements necessary to complete a stormwater ID marker plan are located in this cell library. The cell library is accessed by the stormwater tasks and workflow tab and includes elements such as; a Stormwater Facility ID Marker Table, Stormwater Marker type 1 and type 2 symbols, plus Standard Notes, etc.

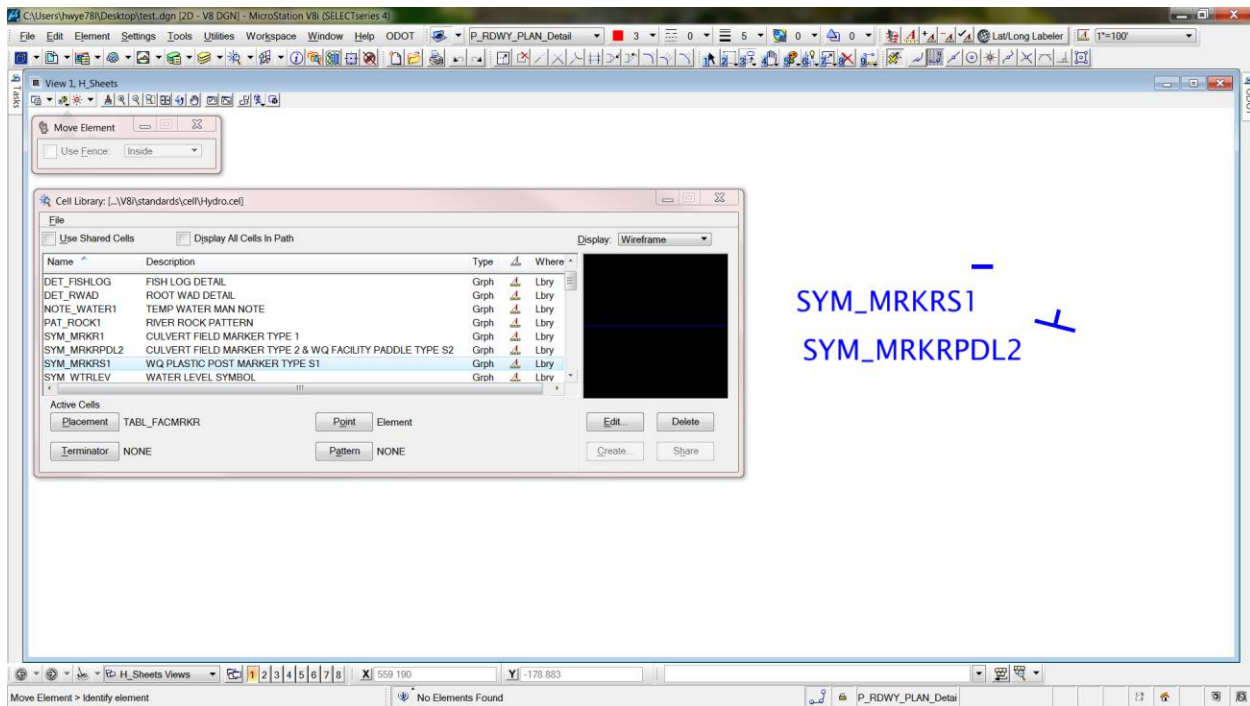


Figure 12.6.1.2 Hydro Cell Library dialog Box

### Seed and Cache

Seed and cache files are provided in the ODOT MicroStation workspace. See [Chapter 2](#) for more information on seed and cache files, plus a link to access the ODOT workspace.

Seed and cache files for GHE disciplines are in different stages of development and when finalized are included in the ODOT MicroStation workspace.

### 12.6.2 File Name and Sheet Name

#### File Name

ODOT uses a set list of CAD file names, based on an approved file naming convention developed for use within ODOT’s data management system [ProjectWise](#).

The approved file naming for stormwater plan sheets is located in the [ProjectWise File Naming Tool](#).

#### Sheet Name (Title)

Sheet titles for each discipline are located in seed file, **seed\_titleblock.dgn**. The title block seed file contains a separate model for each disciplines sheet series. Sheet names for each discipline are located on separate levels within the models, so the correct sheet name can remain turned on while all others are turned off.

Refer to the [CPM, Chapter 3 – Plan Sheet Title Block](#) for complete information about the title block seed file, its use, and a list of correct sheet names.

Stormwater Facility ID marker locations are shown on the plan sheet for each facility. The sheet title for stormwater plans is located in the “H\_Sheets” model in the titleblock seed file.

### 12.6.3 Drawing Sequence and Sheet Numbering

#### Drawing Sequence

Stormwater plans are located in the Hydraulic (“H”) series section of ODOT’s Contract Plans. The “H” series is reserved for all Hydraulic discipline plan sets. Stormwater plans appear first within the “H” series.

See the [CPM Chapter 2 -Table 2-1 “Drawing Order and Sheet Numbering”](#) for drawing order and sheet numbering of Stormwater Plans.

#### Sheet Numbering

Stormwater plan sheets generally begin with a plan and profile/elevation/cross sections, of the stormwater facility on the first sheet. The first sheet of a single facility project is numbered HA01, the second sheet being HA02, etc. Subsequent sheets may contain details/cross sections, plus tables and notes, etc. Sheet numbering options for projects with multiple facilities is described in the [CPM, Chapter 2](#).

### 12.6.4 Plan and Profile/Elevation Sheet

#### Layout

Arrange sheets to clearly depict the stormwater facility design. Provide a plan view of the facility with a profile or elevation view directly below the plan view. See Chapter 2 of the [Roadway CAD Manual](#) for plan and profile sheet layout options.

Clearly show the location of all stormwater facility ID markers on the plan view. Specify the exact information that must be included on the field marker in the construction notes, and include a reference to ODOT’s Standard Drawing **RD399 Stormwater Treatment and Storage Facility Field Markers**.

Include the Stormwater Field Marker table (Figure 12.6.4.1) to provide the location and type of each marker for the stormwater facility.

The cell for the table is called TABL\_FACMRKR, and is included in the hydro cell library. The table can also be accessed from the stormwater tasks and workflows. The marker table provides space for listing each facility location by station and MP and includes the DFI# and check boxes for marker types. There are two types of stormwater facility ID markers, type S1 and type S2.

**FACILITY ID MARKER TABLE**

FACILITY LOCATION		DFI #	TYPE S2 MARKER		TYPE S1 MARKER	
STATION	MP		BEGIN	END	RED	GREEN
Sta. "LC" 000-000.00 Rt.	000.00	D01234	✓	✓	✓	

✓ Check where appropriate  
 Red = Beginning of facility  
 Green = End of facility

**Figure 12.6.4.1 Stormwater Facility ID Marker Location Table**

See [Chapter 10 – Stormwater Facilities](#) for more information on developing stormwater facility plan sheets.

### 12.7 Stormwater Facility ID Marker Types

The EOR is responsible for providing the location and type of each marker. The drafter is responsible for providing this information on the plan view by placing the appropriate cell, label, construction notes and table. In the construction notes always include reference to the standard drawing (when one applies).

#### Type S1 Stormwater Facility ID Marker

Type S1 stormwater facility ID markers are non-reflective flexible plastic posts embedded into the ground. Type S1 markers are red or green in color. The red plastic post marks the beginning of the facility maintenance area and the green plastic post marks the end. Placement of these markers is 4 to 6 feet from edge of pavement or face of curb.

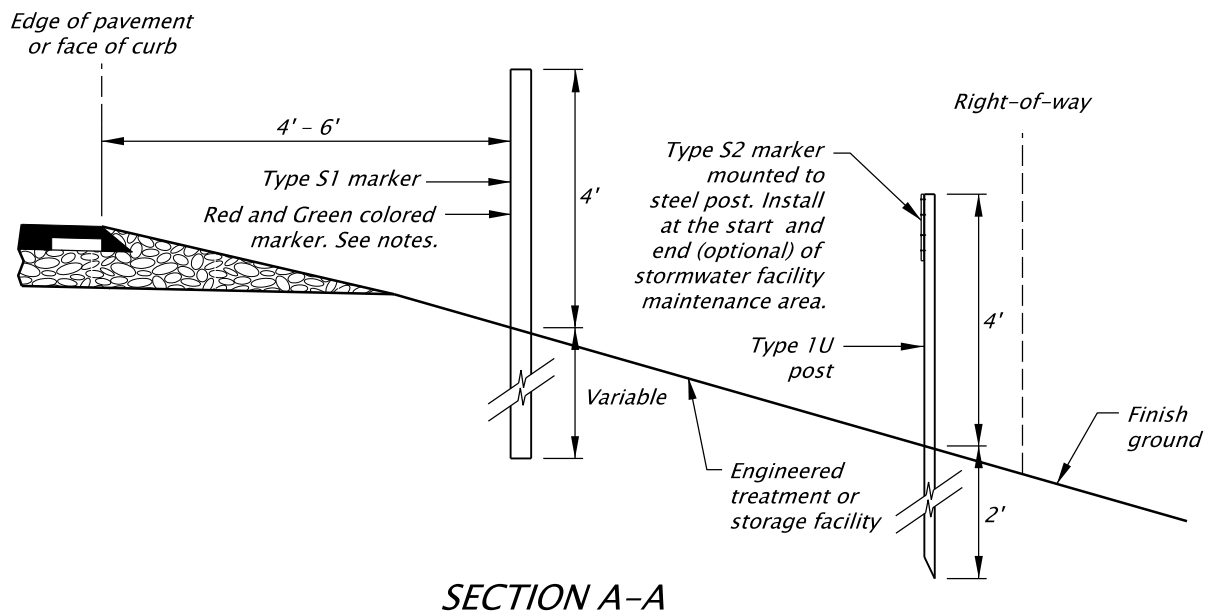
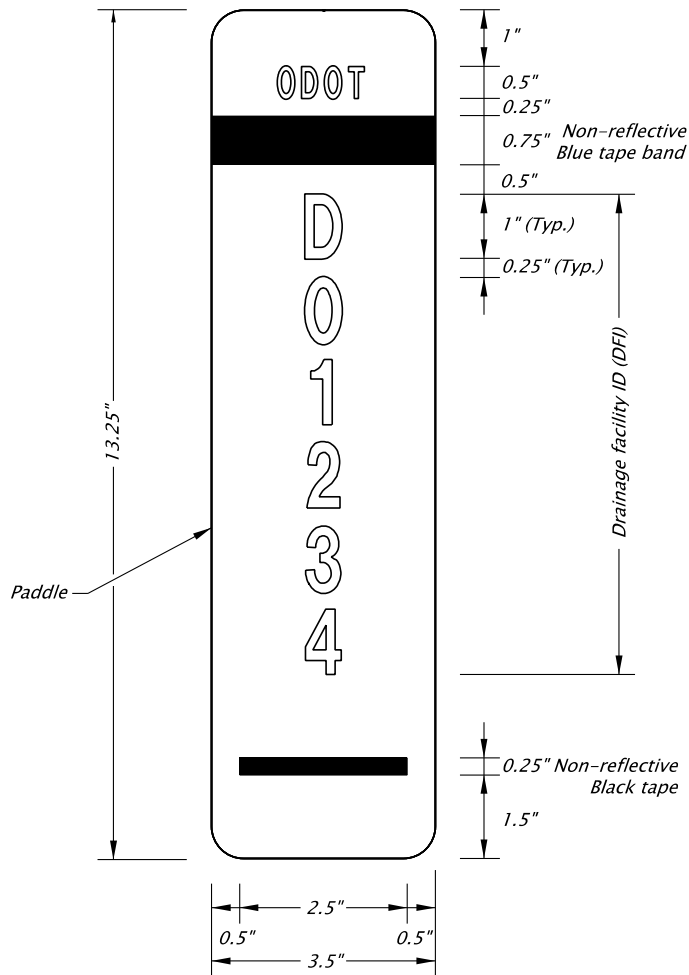


Figure 12.7.1 Type S1 and S2 Markers Placement

See [Hydraulics Manual - Chapter 17](#) for complete Type S1 Culvert Marker guidance.

#### Type S2 Stormwater Facility ID Marker

The type S2 stormwater facility ID marker is a white non-reflective aluminum paddle with black lettering and green strip, mounted onto a steel post or permanent feature. The paddle displays the mile point location of the facility and the drainage facility identification (DFI) number assigned to the facility. Placement of these markers is at the beginning of the facility near the right-of-way boundary, see Figure 12.7.1. Paddle style markers are installed facing parallel to the roadway to avoid distracting the traveling public.



**TYPE S2 MARKER**

**Figure 12.7.2 Type S2 Paddle Style Marker**

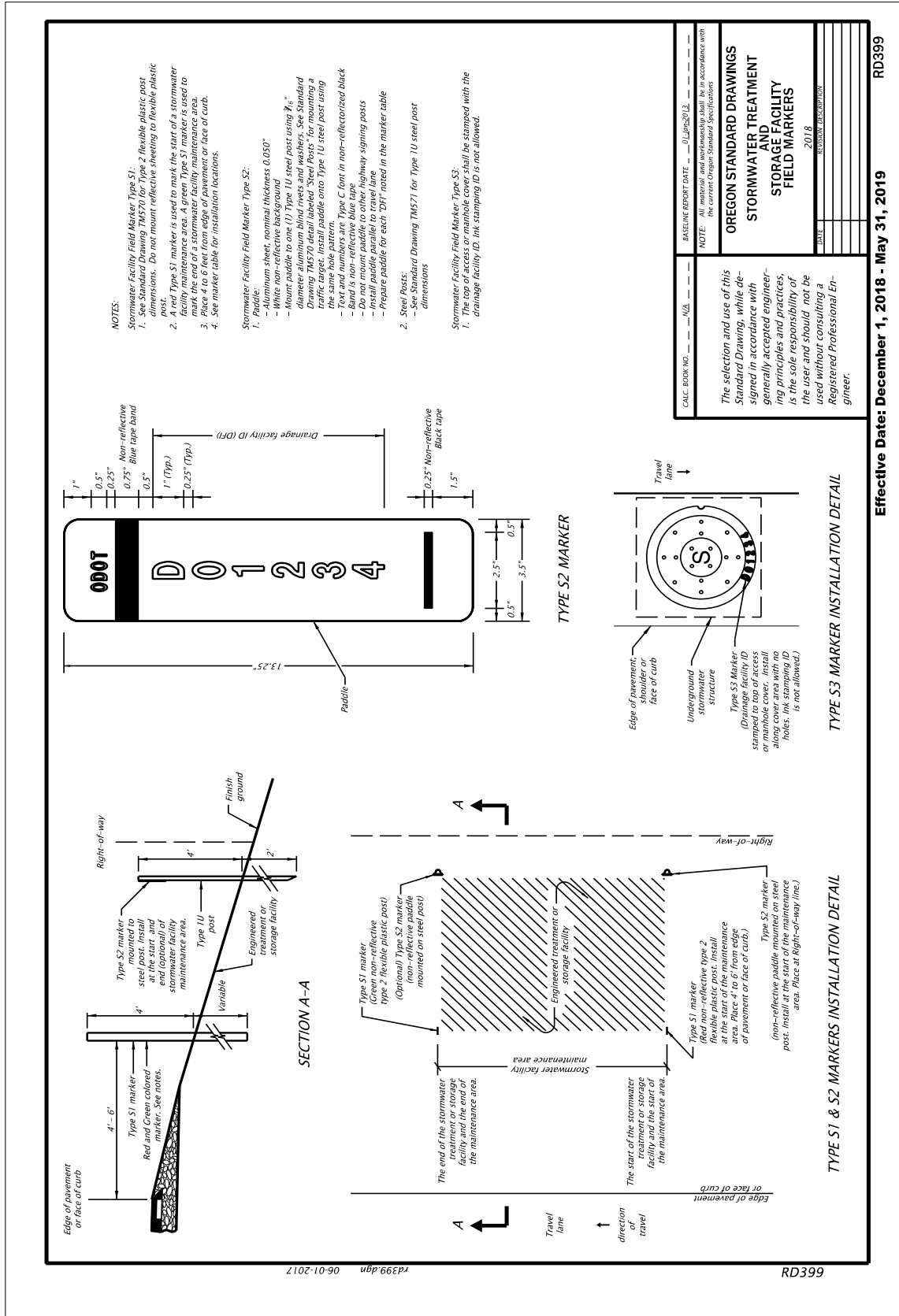
Paddle dimensions, paddle mounting guidance and installation details are shown on Standard Drawing RD399. See [Hydraulics Manual - Chapter 17](#) for complete Type S2 Field Marker guidance.

**Standard Drawing RD399 – Stormwater Treatment and Storage Facility Field Markers.**

Standard drawing RD399 describes the stormwater facility ID markers in detail and includes size, color and installation guidance. Include RD399 in all stormwater facility plan sets with ID markers. Standard drawings are stamped by an EOR and are supported by engineering analysis, calculations, and/or justification. Standard Drawings cannot be modified by designers on a project-by-project basis.

See ODOT’s engineering [website](#) for more detailed information regarding the use of standard drawings.

Figure 12.7.3 Standard Drawing – RD399 Stormwater Treatment and Storage Facility Field Markers





## 12.8 Check List

The drafting check list below contains all items to be included on Culvert plan sheets. (Depending on the project, some items may not apply).

- Border, title block, sheet title, sheet number
- Title block information complete
- Professional of record stamp
- "V" number or project status stamp
- Index sheet (if needed)
- Plan view
- Profile view
- North arrow
- Scales noted
- Existing roadway
- Existing structures (e.g. bridge, culvert, wall, sign bridge, etc.)
- Existing utilities
- Existing contours
- Contours labeled
- Proposed roadway with alignment and stationing
- Proposed structures
- Proposed utilities
- Proposed contours
- All Culverts labeled with assigned structure numbers
- All Culverts labeled with assigned DFI numbers
- Waterway(s) labeled and flow direction shown
- Right-of-way lines
- Temporary construction easements
- Construction limits
- Detail(s)
- Legend, notes and field Marker table
- Marker type
- Marker location
- Correct marker Symbol
- Marker callout
- Marker label information

## 12.9 Example Drawing(s)

The following Stormwater example drawings demonstrate typical sheet layouts for proposed facility plans showing stormwater facility ID marker locations and other key CAD components.

These drawings are provided as a guide for developing final Contract Plans and not all project scenarios are covered. Drawings have been taken from miscellaneous ODOT projects, reviewed for accuracy and readability, and updated to meet current design and drafting standards. Due to these changes, all project information has been removed from each drawing rendering them usable only as examples of the required CAD and drafting standards.

Refer to the MicroStation workspace for the most recent CAD standards components available.

GHE discipline specific program leads and the GHE drafting program lead are available to help resolve any standards issues not covered by this or other manuals. [Contact information on Geo-Environmental website.](#)

Figure 12.9.1 Example Stormwater Facility ID Marker Drawing – Plan Sheet

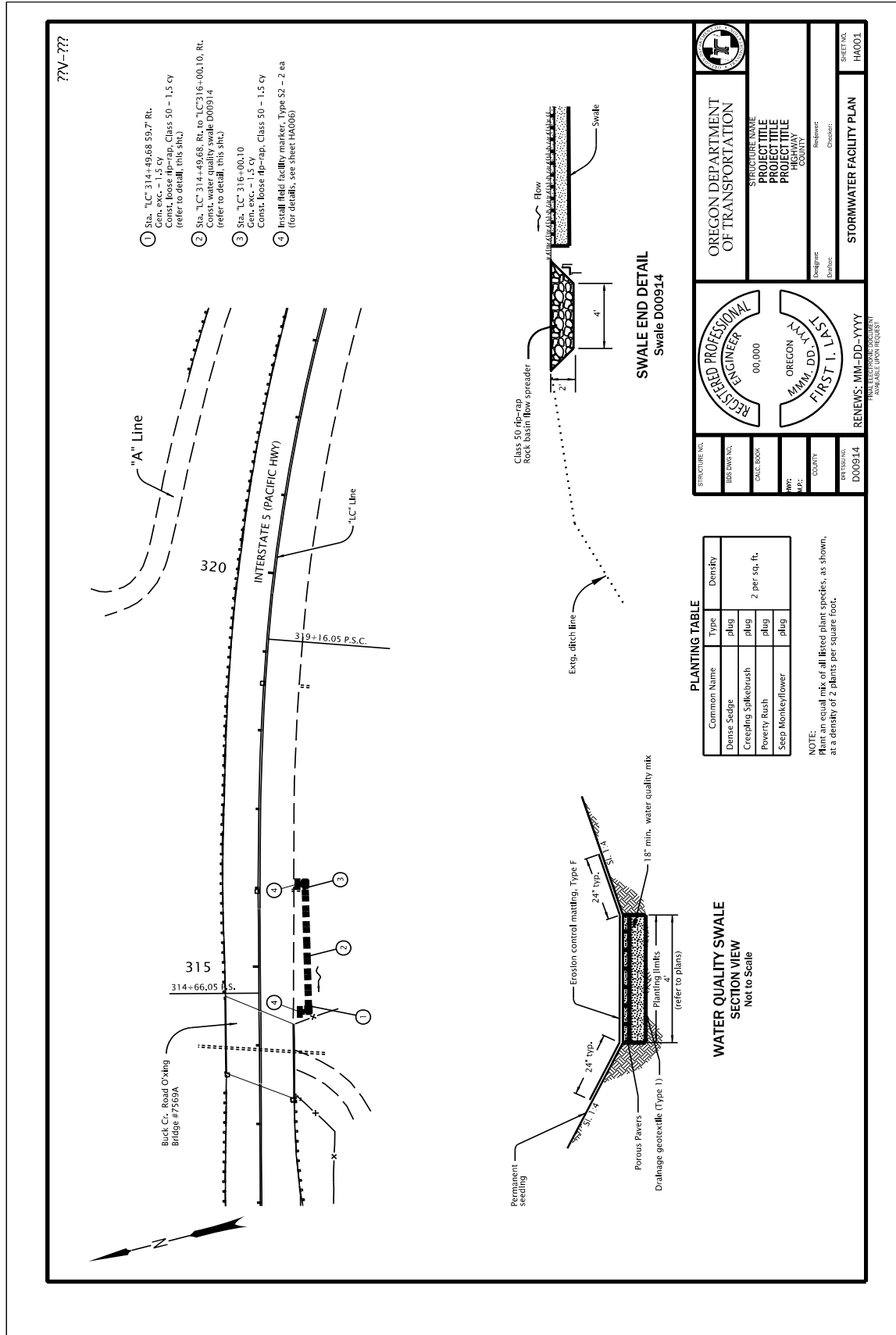
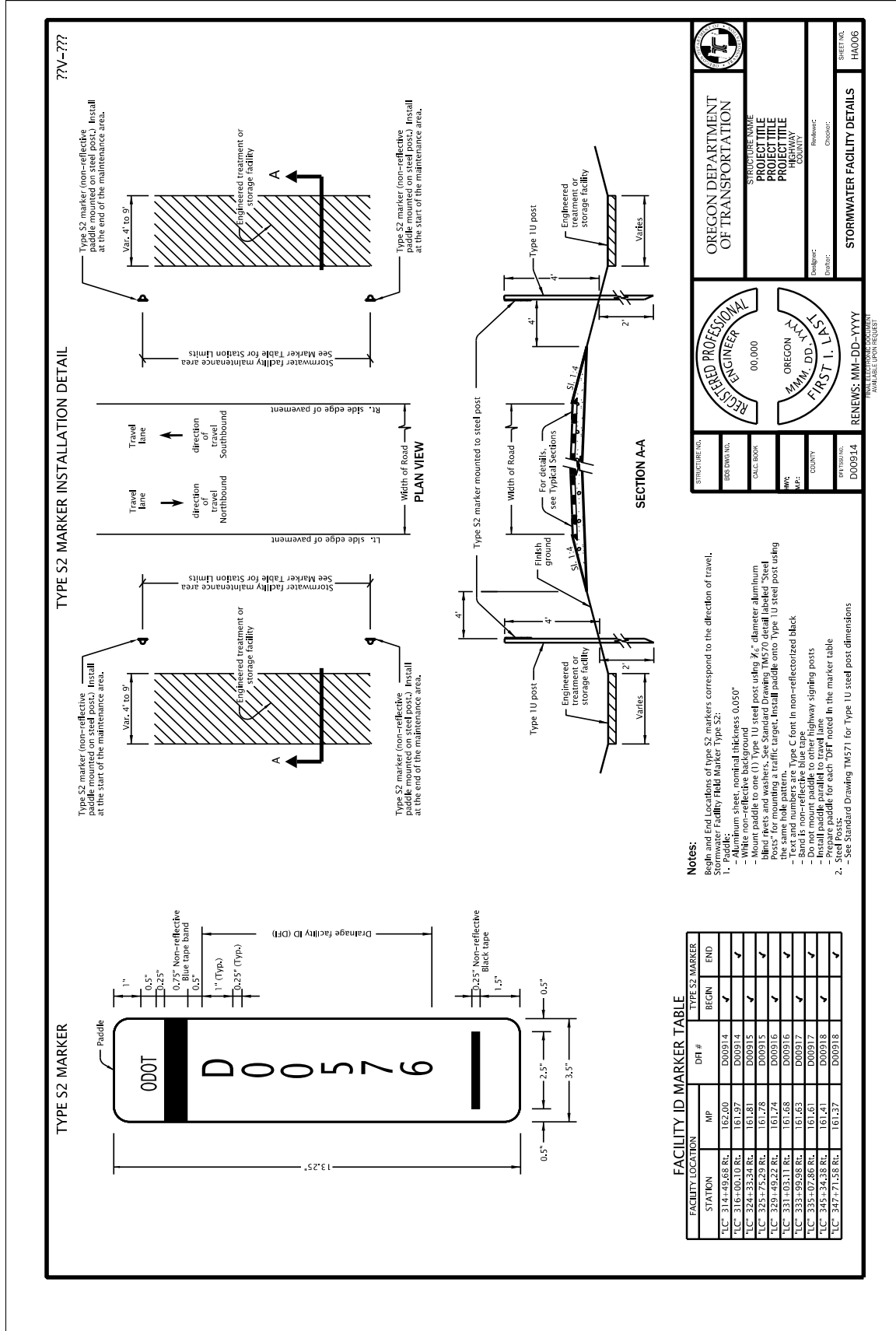


Figure 12.9.2 Example Stormwater Facility ID Marker Drawing – Detail Sheet



REGISTRATION INFORMATION

REGISTERED PROFESSIONAL ENGINEER  
00,000  
OREGON  
MMM, DD, YYY  
FIRST I, LAST

PROJECT TITLE  
PROJECT TITLE  
HIGHWAY  
SECTION NAME

DESIGNED BY: [Blank]  
DRAWN BY: [Blank]  
CHECKED BY: [Blank]  
DATE: [Blank]

STORMWATER FACILITY DETAILS

SHEET NO. H0006

STRUCTURE NO.  
DESIGN NO.  
CALC. BOOK  
DATE  
CITY  
OFFICE NO. D00914

REVISIONS: MM-DD-YYYY  
FINAL DESIGN DOCUMENT  
UNLESS OTHERWISE NOTED

**FACILITY ID MARKER TABLE**

FACILITY LOCATION	MP	DFI #	TYPE S2 MARKER
			BEGIN
			END
T.C. 314-449.68 Rt.	162.00	D00914	✓
T.C. 316-100.10 Rt.	161.97	D00914	✓
T.C. 324-333.34 Rt.	161.81	D00915	✓
T.C. 325-725.29 Rt.	161.78	D00916	✓
T.C. 329-493.22 Rt.	161.74	D00916	✓
T.C. 331-033.11 Rt.	161.68	D00917	✓
T.C. 333-993.98 Rt.	161.63	D00917	✓
T.C. 335-107.86 Rt.	161.61	D00918	✓
T.C. 345-343.38 Rt.	161.41	D00918	✓
T.C. 347-71.58 Rt.	161.37	D00918	✓

**This chapter to be completed at a later date.**



Chapter 14 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 14 – Fish Passage

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[Placeholder for chapter specific Table of Contents]

**This chapter to be completed at a later date.**



Chapter 15 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 15 – Waterway Enhancements

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[Placeholder for chapter specific Table of Contents]



**This chapter to be completed at a later date.**



Chapter 16 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 16 – Bank Protection

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[Placeholder for chapter specific Table of Contents]



Chapter 17 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 17 – Temporary Water Management

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**[Placeholder for chapter specific Table of Contents]**

Please see Technical Bulletin [GE14-01\(B\) Temporary Water Management \(TWM\) Plans Drafting Guidance](#)

**This chapter to be completed at a later date.**



Chapter 18 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 18 – Roadside Development

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[Placeholder for chapter specific Table of Contents]

Interim: [GE11-01\(B\) Evaluating Compensatory Mitigation site locations and Site Restoration to minimize conflicts with highway operations and maintenance](#)

**This chapter to be completed at a later date.**



Chapter 19 – GHE CAD Standards

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GEO-ENVIRONMENTAL SECTION

OREGON DEPARTMENT OF TRANSPORTATION

# Chapter 19 – Erosion and Sediment Control

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**[Placeholder for chapter specific Table of Contents]**

Interim:

[GE09-03\(A\) Sediment Fences and Straw Bales for Sediment Control](#)

[GE12-01\(A\) Correct Use of Erosion and Sediment Control Specification Language](#)

[GE14-02\(B\) Erosion and Sediment Control](#)



