# HABITAT ASSESSMENT

## Garden Apartments Project:
## Phase I of The Cove Development Plan

**Oregon City, Oregon**
**Lower Clackamas River (6th Field HUC 170900110607)**
**(T2S, R2E, S29)**

**Chinook Salmon (*Oncorhynchus tshawytscha*)**
Lower Columbia River ESU
Upper Willamette River ESU

**Coho Salmon (*Oncorhynchus kisutch*)**
Lower Columbia River ESU

**Steelhead (*Oncorhynchus mykiss*)**
Lower Columbia River DPS

**Essential Fish Habitat (EFH)**

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PHS Project Number: 5511

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# 1.0 INTRODUCTION

This Habitat Assessment (HA) addresses the potential effects of the proposed Garden Apartments Project: Phase I of The Cove Development Plan (the project) on fish species listed as threatened or endangered under the federal Endangered Species Act (ESA). This document also addresses the potential effects of the proposed project on designated or proposed critical habitat, and on Essential Fish Habitat (EFH) as designated under the Magnuson-Stevens Fishery Conservation Act (MSA). The proposed project will result in the placement of fill material within the 100-year floodplain of the Clackamas River, therefore requiring a Land Use Approval from the City of Oregon City (City) and Conditional Letter of Map Revision (CLOMR) from the Federal Emergency Management Agency (FEMA). The purpose of this document is to assist the City and FEMA in assuring that the proposed project meets the requirements of Section 9 and Section 10 of the ESA in regard to the National Flood Insurance Program (NFIP). Section 9 prohibits "take" (i.e., harm or harassment) of any endangered species, which also extends to threatened species through Section 4(d). Section 10 provides exceptions to the take prohibition through issuance of an incidental take permit.

## 1.1 Project Background

Grand Cove LLC is proposing to construct a multi-family residential mixed-use complex at the intersection of Main Street and South Agnes Avenue near Clackamette Cove in Oregon City (see Figure 1). The existing vacant property was formerly occupied by The Glacier Ready Mix Concrete Plant which ceased operation in 2007 and vacated the site in 2008; all associated buildings were then demolished. The proposed mixed-use complex will include 244 multi-family residential units (Garden Apartments) and two non-residential (i.e., office) buildings. Residential facilities will also include 374 parking spaces, eight detached garages, a community center, a pool, and a maintenance building. The proposed project is considered Phase I of the larger master plan development around Clackamette Cove, referred to as the "The Cove" Development. Construction of the Garden Apartments will also include roadway improvements along Main Street (including a new roundabout), stormwater treatment improvements, temporary trailhead parking for the adjacent Clackamas River Trail, and shoreline restoration (see Figure 2).

Preparation of the Garden Apartments site will require grading (cut and fill) within the 100-floodplain of the Clackamas River (i.e., Clackamette Cove). Specifically, approximately 115,205 cubic yards of fill will be required to raise the proposed site above the base flood elevation (47.8 feet). The City's municipal code requires balanced cut/fill for any proposed development within the Flood Management Overlay District. As such, all fill material for construction of the apartments will be sourced from within the 100-year floodplain of the Clackamas River, and will include approximately 81,710 cubic yards of excavation from the proposed North Park site, and approximately 7,221 cubic yards from grading along Main Street and 3,819 cubic yards from grading at Lot 1 (see Figure 2). In addition, pursuant to the Soil Excavation and Site Improvement Agreement between Grand Cove LLC and the Oregon City Urban Renewal Commission (URC), approximately 22,455 cubic yards of excess (i.e., "banked") floodplain capacity associated with the Jug Handle Project will be factored in to the net balance. Proposed grading activities will not occur below the ordinary high water (OHW) of Clackamette Cove, and no fill will be placed within the floodway. However, proposed grading will require the removal of up to 16 riparian trees located along the bank of Clackamette Cove in the proposed North Park excavation area.

5511
6/26/15

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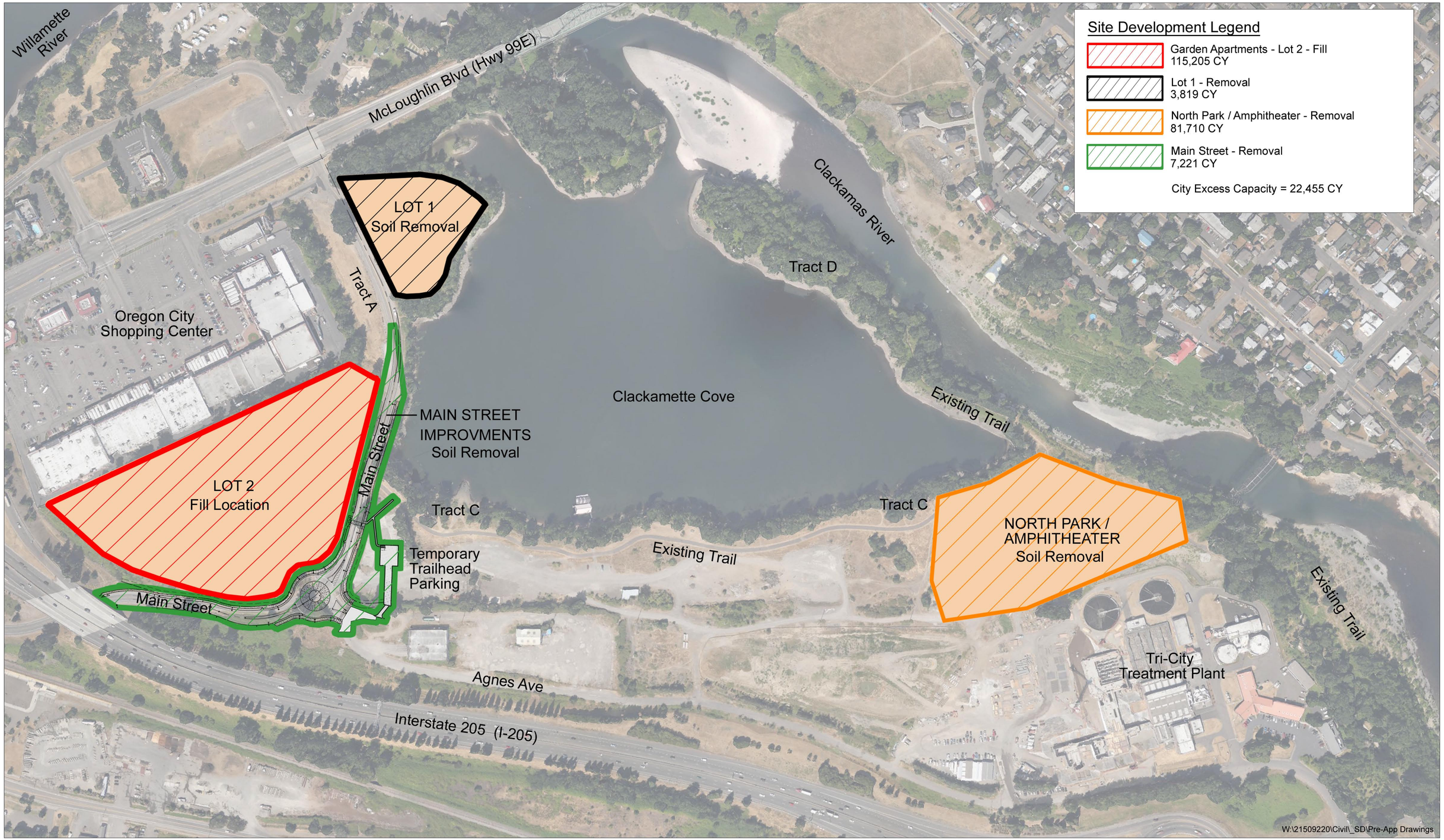
Project Area

Garden Apartments Project: Phase I of The Cove Development Plan
Oregon City, OR (Google Earth 2015)

FIGURE
1




# The Cove - Garden Apartments

Figure 2 - Project Site Plan

DATE: July 8, 2015

OREGON CITY, OREGON

Cardno
Shaping the Future

SCALE IN FEET
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## 1.2 Species and Critical Habitat

Activities associated with the proposed project will occur within the 100-floodplain of the Clackamas River (i.e., Clackamette Cove). As such, the project has the potential to affect habitat for ESA-listed Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*) (see Table 1). Each of these listed fish species has the potential to occur within the vicinity of the project action area. In addition, proposed project activities have the potential to affect designated Critical Habitat and EFH for Pacific salmon. Further discussion of the natural history and potential occurrence of ESA-listed fish species within the action area is provided in Section 4.0.

**Table 1. ESA-listed species included in this assessment[1].**

| Species | Population | Federal Status | Closest Designated Critical Habitat | Potential Use of Action Area |
|---|---|---|---|---|
| **Chinook salmon** *O. tshawytscha* | Lower Columbia River ESU | Threatened (70FR37160) | Clackamas River | Rearing and migration |
| | Upper Willamette River ESU | Threatened (70FR37160) | Clackamas River | Rearing and migration |
| **Coho salmon** *O. kisutch* | Lower Columbia River ESU | Threatened (70FR37160) | Proposed for the Clackamas River | Migration |
| **Steelhead** *O. mykiss* | Lower Columbia River DPS | Threatened (71FR834) | Clackamas River | Rearing and migration |

[1]Sources: NMFS 2015; StreamNet 2015

In addition to the fish species listed in Table 1, there are eight ESA-listed wildlife and plant species with the potential to occur within the vicinity of the project action area, including the northern spotted owl (*Strix occidentalis caurina*), streaked horned lark (*Eremophila alpestris strigata*), yellow-billed cuckoo (*Coccyzus americanus*), Bradshaw's desert-parsley (*Lomatium bradshawii*), Kincaid's lupine (*Lupinus sulphureus* spp. *kincaidii*), Nelson's checker-mallow (*Sidalcea nelsoniana*), water howellia (*Howellia aquatilis*), and Willamette daisy (*Erigeron decumbens*) (USFWS 2015). Furthermore, a non-essential experimental population (NEP) of bull trout (*Salvelinus confluentus*) were recently reintroduced into the Clackamas River by the U.S. Fish and Wildlife Service (USFWS) in an effort promote the recovery of the species. However, based on a review of existing database information and onsite habitat conditions; it was determined that there are no suitable habitats or known occurrences of these species within the project action area. As such, it is reasonably certain that the proposed project will have no effect on ESA-listed wildlife and plant species, or bull trout.

# 2.0 EVALUATION METHODS

Factors considered in evaluating potential project impacts include the species' dependence on specific habitat components that will be removed or modified, the abundance and distribution of habitat components in the project vicinity, distribution and population levels of the species (if known), the possibility of direct effects, the degree of effects to habitat, and the potential to mitigate the adverse effects. These factors are relevant both for the survival of individuals of the species and populations, and recovery prospects for the species. The method of analysis used in this HA is to determine the environmental baseline for the action area, discuss how the proposed

action will affect the environmental baseline, and then use that information to arrive at a determination of effect. Specifically, for analysis of potential project impacts to ESA-listed fish species, this HA utilizes methods outlined in *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996).

Given that proposed project activities will only occur within the 100-year floodplain, analysis of potential effects to the environmental baseline will focus primarily on water quality, hydrology, floodplain connectivity, and riparian vegetation. The information presented in this HA is based on a review of existing database information, site visits (see Appendix A: Photographs), and discussions with the project design team. Research on fish presence within the action area was conducted through a review of online databases (NMFS 2015; StreamNet 2015), and discussions with the ODFW District Fish Biologist (Tom Murtagh).

# 3.0 PROJECT DESCRIPTION

## 3.1 Garden Apartments

As discussed above, the proposed project will include construction of a multi-family residential mixed-use complex (Garden Apartments), roadway improvements along Main Street (including a new roundabout), stormwater treatment improvements, temporary trailhead parking for the Clackamas River Trail, and shoreline restoration (see Appendix B: Project Plan Sheets). Preparation of the Garden Apartments site will require approximately 115,205 cubic yards of fill in order to raise the proposed site above the base flood elevation (47.8 feet). All fill material for construction of the apartments will be sourced from within the 100-year floodplain of the Clackamas River; therefore resulting in a balanced cut and fill within the City's Flood Management Overlay District.

Construction of the Garden Apartments and associated Phase I improvements are scheduled to begin in October 2015, with completion by December 2016. Additional phases of The Cove Development will likely occur beyond 2016, and are not included in this analysis. The following is a general sequence of proposed construction activities, further detailed discussion is provided in the sections below:

1. Conduct overall project mobilization and implement environmental controls (i.e., erosion and sediment control measures).
2. Clear vegetation, remove existing concrete building pads from site, and begin grading.
3. Construct temporary trailhead parking.
4. Excavate material from the proposed North Park site, Tri-City dirt pile, and Main Street.
5. Construct proposed roadway and stormwater improvements.
6. Complete finish grading at the Garden Apartments and North Park site.
7. Hydro-seed and revegetate disturbed areas, and install shoreline restoration plantings.
8. Construct Garden Apartments and associated buildings.

### 3.1.1 Floodplain Excavation and Fill

Prior to any grading activities within the floodplain, construction limits and no work zones will be clearly demarcated, and erosion control measures (i.e., sediment fencing, straw wattles, etc.) will be placed according to the project Erosion and Sediment Control Plan (ESCP). As stated above, all fill material for construction of the Garden Apartments will be sourced from within the floodplain, including approximately 81,710 cubic yards of excavation from the proposed North Park site, and approximately 7,221 cubic yards from grading along Main Street and 3,819 cubic yards from grading at Lot 1. In addition, approximately 22,455 cubic yards of excess (i.e., "banked") floodplain capacity associated with the Jug Handle Project will be factored in to the net balance.

Proposed grading activities will not occur below the OHW of Clackamette Cove, and no fill will be placed within the floodway. However, proposed grading will require the removal of up to 16 riparian trees located along the bank of Clackamette Cove in the proposed North Park excavation area. In addition, proposed excavation and soil removal at the North Park site will require temporary relocation of approximately 920 lineal feet of the existing Clackamas River Trail (see Appendix B). Grading will be accomplished using excavators and dozers, and all heavy equipment will access the project site via existing roadways and previously disturbed upland areas. All areas temporarily disturbed during project construction will be stabilized (i.e., hydro-seeded) and revegetated (as necessary).

### 3.1.2 Roadway Improvements

Proposed roadway improvements along Main Street will include the addition of sidewalks, bike lanes, and planter strips along 650 linear feet of Main Street on the north side of the proposed Garden Apartments, and along 720 feet on the east side of the proposed apartments. In addition, a new roundabout intersection will be constructed at the intersection of Main Street and Agnes Street (see Appendix B). Furthermore, a temporary gravel parking lot (consisting of 14 parking spaces) will be constructed at the trailhead of the Clackamas River Trail to accommodate recreational users during proposed construction activities. Proposed roadway improvements will likely be constructed concurrently with the proposed grading activities.

### 3.1.3 Stormwater Management

The proposed development of the Garden Apartments and associated roadway improvements will result in approximately 9 acres of pollutant generating impervious surface within the project area (Cardno 2015). As such, new stormwater facilities are proposed for treatment of expected pollutants (i.e. oil, polycyclic aromatic hydrocarbons [PAHs], heavy metals, nutrients, and sediment) associated with roof runoff and vehicle use within the apartment complex and along the improved roadway (see Appendix C: Preliminary Drainage Report). Currently, stormwater runoff from the proposed Garden Apartment site consists primarily of overland flow across approximately 6.8 acres of existing concrete and gravel surfaces, with no formal water quality treatment. Stormwater from Main Street sheet flows into roadside ditches that drain into storm pipes that outfall into Clackamette Cove.

New stormwater facilities will include a combination of Low Impact Development Approach (LIDA) swales and Contech StormFilters (Cardno 2015). The LIDA swales will collect and treat stormwater runoff through vegetation and soil media, while also providing flow attenuation.

The StormFilters will contain cartridges filled with filter media designed to remove stormwater pollutants associated with runoff. The facilities are designed to accept 33% of the 2-year, 24-hour storm event (0.83 inches of precipitation) in accordance with the City Stormwater and Grading Design Standards (Cardno 2015). Stormwater exiting the LIDA swales and StormFilters from the proposed Garden Apartments and roadway improvements will be directed (via pipes) to an existing 36-inch stormwater pipe located along Main Street that outfalls into Clackamette Cove. In addition, a portion of the stormwater generated from the offsite basins surrounding the Garden Apartments will be collected into an existing 15-inch pipe that also outfalls into Clackamette Cove (see Appendix C).

Portions of the existing 36-inch stormwater pipe will be upsized to a 48-inch pipe during construction of the proposed Main Street roadway improvements to provide additional stormwater capacity for future development. However, the existing 36-inch and 15-inch *outfalls* into Clackamette Cove will be retained and no new outfalls are proposed. Stormwater detention will not be required given the relative size of the drainage basin (>100 square miles) for the receiving water body (i.e., Clackamas River).

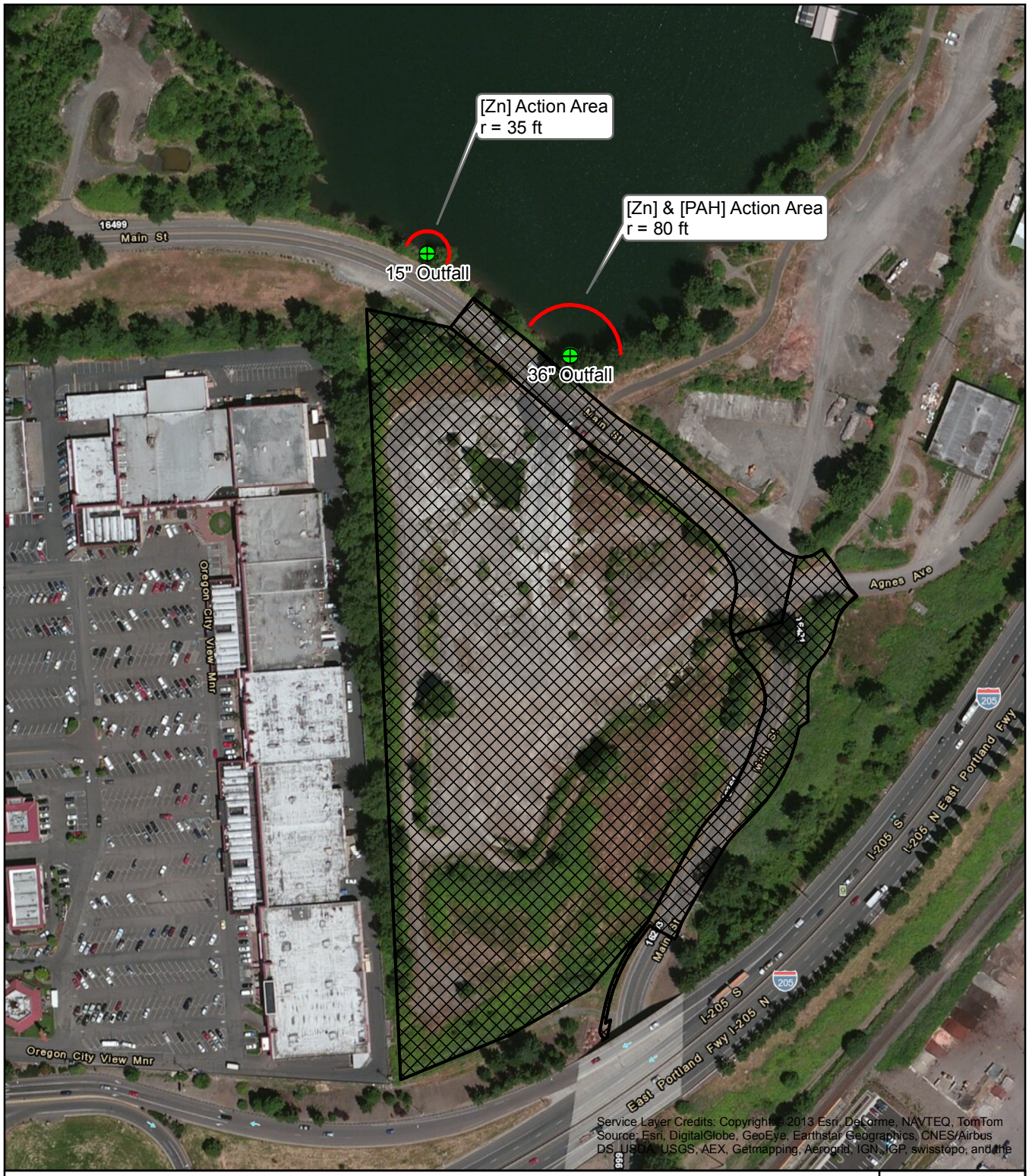
### 3.1.4 Shoreline Restoration/Mitigation

The proposed project will include shoreline restoration and plantings to mitigate for 1.08 acres (47,243 square feet) of permanent disturbance within the City's Natural Resource Overlay District (NROD). This includes mitigation for the removal of up to 16 riparian trees associated with proposed grading in the North Park excavation area. The number of trees and shrubs to be planted was calculated based on the size of the disturbance area within the NROD. Native trees and shrubs from the Oregon City Native Plant List will be planted at a rate of five trees and twenty-five shrubs per every five hundred square feet of disturbance area. The total disturbance area for the proposed project, including temporary and permanent impacts, is approximately 47,243 square feet, which results in 472 trees and 2,362 shrubs to be planted. The proposed mitigation planting plan, including plant species diversity and spacing, is shown in Appendix B, Figures 6-6C.

For impacts to the North Park site, the required 26,730 square-foot mitigation area will be within tax lots 1100 (22E20) and 3600 (22E29) between the Clackamas River Trail and the OHW of the Clackamas River and/or Clackamette Cove. For the Main Street roadway improvements, the required 12,426 square-foot mitigation area will be within tax lot 3600 (22E29), between the Main Street easement and the OHW of the Clackamette Cove. For the Garden Apartments site, 21,546 square feet of the required 55,330 square-foot mitigation area will be within tax lot 2900 (22E29), adjacent to Wetland A. The remaining 33,784 square feet of mitigation area will be reached in tax lot 3600 adjacent to the mitigation area for the North Park site (see Appendix B, Figures 6-6C). It is anticipated that the mitigation will improve the functional value of the vegetated corridor by removing invasive species and increasing native plant diversity and coverage.

## 3.2 Action Area

For the purposes of this analysis, the project action area includes all areas directly or indirectly affected by the proposed project. The action area is not limited to the project footprint, but also includes staging, stockpile, and mitigation areas, as well as areas downstream that could experience effects relative to floodplain modification and water quality (see Figure 3).




**Cove: Garden Apartments**

Mixing Zone Action Area for Stormwater Discharge to Clackamette Cove

Project Outfall

Action Area Limits

Project Area

0 100 200 400 Feet

otak

HanmiGlobal Partner

**Fig 3.**

The additional in-water extent of the action area beyond the project footprint is based on the results of a detailed mixing zone analysis that evaluated the limits of the potential project-related downstream effects of treated stormwater on aquatic species (see Appendix D) (Otak 2015).

The analysis focused on three pollutants of concern that typically occur at elevated concentrations in stormwater effluent, including dissolved copper (dCu), dissolved zinc (dZn), and PAHs (specifically fluoranthene). The downstream extent of the action area represents the furthest distance at which each of these pollutant concentrations may exceed water quality criteria (as established in the analysis), given existing baseline conditions and proposed stormwater BMPs (Otak 2015). The indirect effects of treated stormwater beyond this action area are likely indistinguishable given the considerable dilution factor of downstream water bodies, and the ameliorating effects of dissolved and particulate organic carbon. Further detailed discussion of the potential indirect effects of treated stormwater is provided in Section 6.2.1.

## 3.3 Conservation Measures

Appropriate conservation measures have been incorporated into the proposed project design to minimize and avoid adverse effects to ESA-listed fish species, their designated critical habitat elements, and EFH. These measures will include the following:

- Prior to any grading activities within the floodplain, construction limits and no work zones will be clearly demarcated, and erosion control measures will be placed according to the project Erosion and Sediment Control Plan (ESCP). All work will comply with Oregon DEQ and City erosion control requirements.
- A Pollution Control Plan (PCP) will be prepared by the Contractor and carried out commensurate with the scope of the project that includes the following:
    - Best management practices to confine, remove, and dispose of construction waste.
    - Procedures to contain and control a spill of any hazardous material.
    - Steps to cease work under high flow (i.e., flood) conditions.
- Proposed grading activities will maintain a net balance of cut and fill within the floodplain, and no work will occur below the OHW of Clackamette Cove or in the associated floodway.
- Temporary access roads and staging areas will be located so as to avoid wetland and waters impacts.
- All equipment cleaning and refueling will occur at least 150 feet from regulated wetlands and waters.
- All vehicles will be inspected daily for fluid leaks before leaving the vehicle staging area.
- All upland areas temporarily disturbed during project staging and construction will be restored to their pre-construction grade and revegetated (as necessary).
- The proposed project will include shoreline restoration and plantings (472 trees and 2,362 shrubs) to mitigate for 1.08 acres (47,243 square feet) of permanent disturbance within the City's NROD. This includes mitigation for the removal of up to 16 riparian trees associated with grading in the North Park excavation area.

# 4.0 NATURAL HISTORY AND SPECIES OCCURRENCE

## 4.1 Lower Columbia River Chinook Salmon

Chinook salmon of the Lower Columbia River (LCR) Evolutionarily Significant Unit (ESU) were originally listed as threatened on March 24, 1999 (64 FR 14308) and were reaffirmed on June 28, 2005 (70 FR 37160). The LCR Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean, upstream to a transitional point between Washington and Oregon east of the Hood River and White Salmon River. The LCR Chinook salmon ESU also includes Oregon's Willamette River to Willamette Falls, exclusive of spring-run Chinook salmon in the Clackamas River, as well as 17 artificial propagation programs (70 FR 37160).

Critical Habitat for the LCR Chinook salmon ESU was designated on September 2, 2005 (70 FR 52630) and became effective on January 2, 2006, and includes the mainstem of the Clackamas River within the vicinity of the action area. Primary constituent elements (PCEs) associated with LCR Chinook salmon within the action area include freshwater rearing sites and migration corridors (70 FR 52630). The physical and biological features identified by NMFS as essential for LCR Chinook salmon rearing and migration include floodplain connectivity, available forage, natural cover, water quality and quantity, and corridors free of artificial obstructions (70 FR 52630). For additional information on the general habitat requirements, life history, and limiting factors for recovery of the LCR Chinook salmon ESU see the Federal Register Notice published on June 28, 2005 (70 FR 37160).

<u>Occurrence within the Action Area</u>

LCR Chinook salmon utilize the Clackamas River within the vicinity of the action area for spawning, rearing, and migration (StreamNet 2015). Adult LCR Chinook salmon typically begin their fall migration into the Clackamas River in August, with runs continuing through December, and egg incubation and fry emergence continuing through March (USGS 2003, PGE 2015). Juvenile LCR Chinook salmon can be found rearing in the lower Clackamas River throughout the year. LCR chinook presence within Clackamette Cove is likely limited to juvenile rearing during the cooler months (fall, winter, spring). The cove does provide off-channel refugia during high flows and may provide additional aquatic food sources (pers. comm. with Tom Murtagh [ODFW] on June 4, 2015). However, given the relatively shallow, lake-like conditions of the cove, lack of natural in-water/over-water structures or sufficient riparian vegetation, warm summer temperatures, and presence of warm-water predator species (e.g., bass), it is reasonably certain that the cove does not provide preferable rearing habitat for juvenile salmonids during the summer months.

## 4.2 Upper Willamette River Chinook Salmon

Chinook salmon of the Upper Willamette River (UWR) ESU were originally listed as threatened on March 24, 1999 (64 FR 14308) and reaffirmed as threatened on June 28, 2005 (70 FR 37160) and August 15, 2011 (76 FR 50448). The UWR Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook in the Willamette River and its tributaries above Willamette Falls (64 FR 14308). Seven artificial propagation programs are considered to be part of the ESU (70 FR 37160). Fall-run Chinook salmon above Willamette Falls were introduced and are not considered part of this ESU.

Critical Habitat for the UWR Chinook salmon ESU was designated on September 2, 2005 (70 FR 52630) and became effective on January 2, 2006, and includes the mainstem of the Clackamas River within the vicinity of the action area. PCEs associated with UWR Chinook salmon within the action area include freshwater rearing sites and migration corridors (70 FR 52630). The physical and biological features identified by NMFS as essential for UWR Chinook salmon rearing and migration include floodplain connectivity, available forage, natural cover, water quality and quantity, and corridors free of artificial obstructions (70 FR 52630). For additional information on the general habitat requirements, life history, and limiting factors for recovery of the UWR Chinook salmon ESU see the Federal Register Notice published on June 28, 2005 (70 FR 37160).

Occurrence within the Action Area

UWR Chinook salmon utilize the Clackamas River within the vicinity of the action area primarily for rearing and migration between upstream spawning areas and the Pacific Ocean (StreamNet 2015). Adult UWR Chinook salmon typically begin their spring migration into the Clackamas River in March, and continue through November (PGE 2015). Juveniles can generally be found rearing in the lower Clackamas River year round. As with LCR chinook, UWR Chinook presence within Clackamette Cove is also likely limited to juvenile rearing during the cooler months (fall, winter, spring). The cove does provide off-channel refugia during high flows and may provide additional aquatic food sources (pers. comm. with Tom Murtagh [ODFW] on June 4, 2015). However, it is reasonably certain that the cove does not provide preferable rearing habitat for juvenile salmonids during the summer months.

## 4.3 Lower Columbia River Coho Salmon

Coho salmon of the LCR ESU were listed as threatened on June 28, 2005 (70 FR 37160) and reaffirmed as threatened on August 15, 2011 (76 FR 50448). Originally part of the larger Lower Columbia River/Southwest Washington ESU, the LCR ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia River up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, as well as 25 artificial propagation programs (70 FR 37160). Critical Habitat for the LCR coho salmon ESU was proposed on January 14, 2013 (78 FR 2726) and includes the mainstem of the Clackamas River within the vicinity of the action area. For additional information on the general habitat requirements, life history, and limiting factors for recovery of the LCR coho salmon ESU see the Federal Register published on June 28, 2005 (70 FR 37160).

Occurrence within the Action Area

LCR coho salmon utilize the Clackamas River within the vicinity of the action area primarily for migration between upstream spawning areas and the Pacific Ocean (StreamNet 2015). Adult LCR coho salmon typically begin their migration into the Clackamas River in August, and continue through March (USGS 2003, PGE 2015). Juvenile coho salmon typically do not rear in the lower Clackamas River, and presence within Clackamette Cove would be very limited.

## 4.4 Lower Columbia River Steelhead

The LCR steelhead Distinct Population Segment (DPS) was originally listed as threatened on March 19, 1998 (63 FR 13347) and reaffirmed on January 5, 2006 (71 FR 834). This DPS includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), as well as 10 artificial propagation programs. Excluded are steelhead populations in the upper Willamette River Basin above Willamette Falls, and from the Little and Big White Salmon Rivers, Washington (71 FR 834).

Critical Habitat for the LCR steelhead DPS was designated on September 2, 2005 (70 FR 52630) and became effective on January 2, 2006, and includes the mainstem of the Clackamas River within the vicinity of the action area. PCEs associated with LCR steelhead within the action area include freshwater rearing sites and migration corridors (70 FR 52630). The physical and biological features identified by NMFS as essential for LCR steelhead rearing and migration include floodplain connectivity, available forage, natural cover, water quality and quantity, and corridors free of artificial obstructions (70 FR 52630). For additional information on the habitat requirements, life history, and limiting factors for recovery of the LCR steelhead DPS see the Federal Register published on January 5, 2006 (71 FR 834).

Occurrence within the Action Area

LCR steelhead utilize the Clackamas within the vicinity of the action area primarily for rearing and migration between upstream spawning areas and the Pacific Ocean (StreamNet 2015). Adult LCR steelhead typically begin their summer migration into the Clackamas River in April, and continue through November (PGE 2015); with winter steelhead beginning migration in December, and continuing through May (USGS 2003, PGE 2015). Juvenile LCR steelhead can general be found rearing in the lower Clackamas River throughout the year. As with Chinook, LCR steelhead presence within Clackamette Cove is also likely limited to juvenile rearing during the cooler months (fall, winter, spring). The cove does provide off-channel refugia during high flows and may provide additional aquatic food sources (pers. comm. with Tom Murtagh [ODFW] on June 4, 2015). However, it is reasonably certain that the cove does not provide preferable rearing habitat for juvenile salmonids during the summer months.

# 5.0 ENVIRONMENTAL BASELINE

## 5.1 Baseline Conditions within the Action Area

Clackamette Cove is a bay-like extension of the Clackamas River that was created by former gravel mining operations. The area was first excavated in 1964, and is connected to the Clackamas River through a dredged channel located just upstream of the Willamette River confluence. Much of the existing project site south and east of Clackamette Cove consists of vacant industrial lands. As discussed above, the proposed location of the Garden Apartments to the south is on an existing vacant property formerly occupied by The Glacier Ready Mix Concrete Plant, which ceased operation in 2007 and vacated the site in 2008; all associated buildings were then demolished. East of Clackamette Cove, the Rossman Landfill operated between 1960 and 1969. Afterward, the area was used for the manufacture of asphalt and concrete and as a log loading area. This portion of the site has remained generally undeveloped since 1986.

The site's topography has generally been disturbed by past land uses, with areas of debris (including piles of rock, concrete, and other materials), gravel, remnants of loading docks, buildings and other industrial structures occurring throughout much of the site. A steep bank separates Clackamette Cove from the project site. In general, the site's topography is nearly level to gently sloping, with areas of minor topographic relief resulting from the past land uses. Several old structures, including piers and cantilevered decks are located within the cove or on the cove's banks. The Clackamas County sheriff's office has a boat facility on the cove and an associated gravel parking lot in the eastern portion of the site. The Clackamas River Trail extends through the site. This paved pedestrian/bicycle trail generally parallels the east side of Clackamette Cove and connects Main Street to Washington Street, approximately one mile to the north. Existing riparian vegetation along the banks of Clackamette Cove consists primarily of scattered cottonwood trees (*Populus balsamifera*), supporting a relatively sparse understory of deciduous shrubs and Himalayan blackberry (*Rubus armeniacus*).

### 5.1.1 Matrix of Pathways and Indicators for Salmonids

NMFS has developed an analytical framework for evaluating the baseline conditions of the "pathways" by which an action can have potential effects on anadromous salmonids and their habitats. This framework is referred to as the *Matrix of Pathways and Indicators* (NMFS 1996). Within this framework, NMFS defines properly functioning condition (PFC) as the sustained presence of natural habitat-forming processes (e.g., hydraulic runoff, bedload transport, channel migration, riparian vegetation succession) that are necessary for the long-term survival and recovery of the species (NMFS 1999). This includes those essential physical features that support spawning, incubation, rearing, feeding, sheltering, migration, and other necessary behaviors. Such physical features generally include adequate stream flow, unimpeded fish passage, appropriate water quality and temperature, deep pools, loose gravel for spawning, abundant large tree trunks and root wads, off-channel refugia, and intact riparian reserves. The baseline conditions of pathways and indicators for anadromous salmonids within the action area are summarized in Table 2 below.

**Table 2. Baseline Conditions of Pathways and Indicators for anadromous salmonids within the action area.**

| PATHWAYS AND INDICATORS | ENVIRONMENTAL BASELINE |
|---|---|
| **Water Quality** | |
| Temperature | **Not Properly Functioning –** Clackamas River is water quality limited for summer temperature exceedance (ODEQ 2015). Clackamette Cove is relatively shallow, and lacks natural in-water/over-water structures and sufficient riparian vegetation. |
| Sediment/Turbidity | **Not Properly Functioning –** adjacent land uses (i.e., urban development, roads, and agriculture) provide significant sources of sedimentation to the lower Clackamas River and Clackamette Cove. |

| PATHWAYS AND INDICATORS | ENVIRONMENTAL BASELINE |
|---|---|
| Chemical Contamination/Nutrients | **Not Properly Functioning –** Clackamas River is 303(d) listed and water quality limited for multiple parameters including biological criteria, dissolved oxygen, E. coli, lead, and mercury (ODEQ 2015). |
| **Habitat Access** | |
| Physical Barriers | **At Risk –** numerous man-made barriers along the mainstem Clackamas River, most provide upstream and downstream passage at base and low flows. |
| **Habitat Elements** | |
| Substrate | **Not Properly Functioning –** substrates are dominated by sand, silt, and small gravel; Clackamette Cove is a former gravel quarry and has been significantly altered. |
| Large Wood | **Not Properly Functioning –** Clackamette Cove does not appear to meet Large Wood Debris (LWD) standards and lacks potential recruitment given the heavily modified condition of the surrounding shoreline. |
| Pool Frequency | **Not Properly Functioning –** Clackamette Cove does not appear to meet pool frequency or LWD recruitment standards given the heavily modified condition of the substrate and surrounding shoreline. |
| Pool Quality | **At Risk –** Clackamette Cove has few deep pools present and inadequate cover and temperature. |
| Off-Channel Habitat | **At Risk –** Clackamette Cove provides backwater and low-energy areas; however, minimal cover is provided. |
| Refugia | **At Risk –** habitat refugia exist within Clackamette Cove but are not adequately buffered by intact riparian reserves. |
| **Channel Conditions and Dynamics** | |
| Width/Depth Ratio | **At Risk –** ratio is likely < 10; however Clackamette Cove has been heavily modified within the action area. |
| Streambank Condition | **At Risk –** Clackamette Cove has been significantly altered by past quarry activity; however the banks appear to be 80-90% stable due to presence of limited riparian vegetation. |
| Floodplain Connectivity | **At Risk –**reduced linkage of wetland, floodplain and riparian areas to main channel of Clackamas River. |

| PATHWAYS AND INDICATORS | ENVIRONMENTAL BASELINE |
|---|---|
| **Flow/Hydrology** | |
| Peak/Base Flows | **At Risk** – peak flows, base flows, and flow timing are altered relative to an undisturbed watershed due to upstream dams and surrounding development. |
| Drainage Network Increase | **Not Properly Functioning** – significant increases in drainage network density due to roads and development (i.e., >25%). |
| **Watershed Conditions** | |
| Road Density and Location | **Not Properly Functioning** –road densities are greater than $3mi/mi^2$. |
| Disturbance History | **Not Properly Functioning** – greater than 15% equivalent clear-cut area within the watershed. |
| Riparian Reserves | **Not Properly Functioning** – riparian reserve system within the vicinity of the action area is fragmented and poorly connected. |

# 6.0 ANALYSIS OF EFFECTS

This section addresses direct, indirect, and interrelated/interdependent effects on ESA-listed fish species and their designated critical habitat elements that may result from proposed project actions given the conservation measures to be employed. In addition, this section describes anticipated cumulative effects from non-federal actions that may take place within or near the project action area. Factors considered in the analysis include: proximity of the action, distribution, timing and nature of the effect, duration, disturbance frequency, intensity, and severity. As stated above, given that proposed project actions will only occur within the 100-year floodplain of the Clackamas River (i.e., Clackamette Cove), analysis of potential effects to the environmental baseline will focus primarily on water quality, hydrology, floodplain connectivity, and riparian habitat. This effects analysis is based on the best scientific data available concerning the impact of the proposed project on ESA-listed fish species and their designated critical habitat elements.

## 6.1 Direct Effects

Direct effects include all immediate impacts (adverse and beneficial) resulting from project-related actions. As discussed above, the proposed project will not require work below the OHW of the Clackamas River (i.e., Clackamette Cove). Potential project-related direct effects to ESA-listed species may include temporary degraded *water quality* associated with excavation and grading along the immediate shoreline of Clackamette Cove near the North Park site. Further analyses of these potential effects are discussed below.

### 6.1.1 Water Quality

Sediment/Turbidity

Increases in turbidity from suspension of fine sediments can adversely affect filter-feeding macro-invertebrates within the vicinity of the project site and reduce forage quantity for salmonids, therefore disrupting behavioral patterns, including feeding and sheltering. Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such seasonal high pulse exposures (NMFS 2011).

Short-term, localized project-related increases in background turbidity levels may occur as a result of activities associated with excavation and grading along the immediate shoreline of Clackamette Cove. As discussed above, appropriate erosions and sediment control measures have been incorporated into the proposed project design to minimize and avoid adverse effects to ESA-listed fish species during project construction. Given the proposed conservation measures, including no work below the OHW of Clackamette Cove and development and implementation of an ESCP; any potential increases in background turbidity associated with excavation and grading along the shoreline will be very limited and highly localized, and are not expected to result in any long-term, significant effects to ESA-listed fish species or net change in function of the in-stream habitat.

Chemical Contamination

Equipment operating near Clackamette Cove represents potential sources of chemical contamination. Accidental spills of construction materials or petroleum products would adversely affect water quality and potentially impact ESA-listed species. Development and implementation of a Pollution Control Plan (PCP) that will include containment measures and spill response for construction-related chemical hazards will significantly reduce the likelihood for chemical releases within the action area. In addition, proposed conservation measures, including no work below the OHW of Clackamette Cove, and inspection of equipment operating within 150 feet of the river will further reduce the potential for chemical contamination within the action area.

## 6.2 Indirect Effects

Indirect effects of a proposed action are those impacts that are reasonably certain to occur later in time (after construction of the project is complete). The proposed project will require cut/fill within the 100-year floodplain of the Clackamas River (i.e., Clackamette Cove), remove riparian vegetation, and construct new stormwater facilities; therefore resulting in potential indirect effects to baseline habitat components such as *water quality*, *hydrology*, *floodplain connectivity*, and *riparian vegetation*. Further analysis of these potential indirect effects is provided below.

### 6.2.1 Water Quality

Stormwater runoff from roads, culverts, and parking lots delivers a wide variety of pollutants to aquatic ecosystems, including nutrients, metals, petroleum-related compounds, and sediment washed off the road surface (NMFS 2009). These ubiquitous pollutants are a source of potential adverse effects to salmon and steelhead, even at ambient levels. Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by the next high flow. These contaminants also accumulate in

the prey and tissues of juvenile salmonids where, depending on the level of exposure, they cause a variety of lethal and sublethal effects, including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (NMFS 2009).

Although untreated stormwater runoff often contains pollutants at or below levels that can be detected with current analytical methods, dissolved heavy metals (i.e., copper and zinc) and PAHs can occur at detectable levels that can exceed thresholds for sublethal effects. Those exceedances are an indicator of adverse effects potentially resulting from exposure to other pollutants. Although the large number of pollutants and much larger number of toxicological interactions in urban stormwater make specific mechanisms of toxicological effects difficult to predict, there is ample evidence that the mixture of toxins in urban stormwater can degrade habitat enough to substantially reduce its ability to support spawning, feeding, and growth to maturity (NMFS 2009).

As discussed above, the new stormwater facilities will be designed to accept 33% of the 2-year, 24-hour storm event (0.83 inches of precipitation), and will not require detention. A detailed mixing zone analysis was performed for the proposed project to evaluate the limits of the potential downstream effects of treated stormwater on aquatic species (see Appendix D). The analysis focused on the three pollutants of concern that typically occur at elevated concentrations in stormwater effluent, including dCu, dZn, and fluoranthene. The concentrations above background (i.e., “action levels”) at which these pollutants have the potential to elicit adverse effects to ESA-listed fish species were based on established NMFS criteria for bioavailable dCu (2.3 µg), dZn (5.6 µg), and fluoranthene (0.77 µg/L) (NMFS 2014; Otak 2015).

The analysis calculated treated stormwater runoff volume from the project area and compared it to the receiving water volume available for dilution. The effective dilution factor (DF) required to achieve water quality criteria was then calculated using the expected stormwater effluent pollutant concentrations (as determined from the project Water Quality Analysis [Appendix E]) and background pollutant concentrations within the Clackamette Cove (as determined from water quality sampling [Appendix F]) to define the downstream extent of the action area (Otak 2015). As such, the downstream extent of the action area (Figure 3) represents the furthest distance at which each of these pollutant concentrations may exceed water quality criteria (as established in the analysis), given existing baseline conditions and proposed stormwater BMPs. The indirect effects of treated stormwater beyond this action area are likely indistinguishable given the considerable dilution factor of downstream water bodies, and the ameliorating effects of dissolved and particulate organic carbon.

Based on the results of the mixing zone analysis, and limited occurrence of ESA-listed salmonids within the action area during the summer months (i.e., when water levels and the dilution factor are at their lowest); it is reasonably certain that project related indirect effects of treated stormwater on ESA-listed salmonids will be insignificant and discountable. The analysis indicates that “action levels” for dCu will immediately dilute below water quality criteria upon leaving the project site and entering the receiving water body (i.e., Clackamette Cove). In addition, potential exposure of ESA-listed salmonids to slightly elevated concentrations of dZn and fluoranthene within the relatively small action area will be extremely low given the conservative water elevation used in the dilution analysis (i.e., 6 feet below OHW), and lack of preferable rearing habitat for juvenile salmonids during the summer months (i.e., warm

temperatures along the shoreline during low water and no natural cover). Furthermore, it is reasonably certain that the proposed stormwater design will not result in any measurable increase or concentration of sediment transporting flows that would negatively affect ESA-listed salmonids or their habitats.

### 6.2.2 Hydrology

Changes in the magnitude, duration, or recurrence intervals of low summer base flows and/or flood flows can impact the quantity and quality of habitat available for anadromous fish. Flood flow depths, volumes, velocities and flow paths have an important effect on the way salmonid habitat is formed (FEMA 2013). Increased flood velocities can impact salmonid habitat through increased bank erosion, increased sediment transport, and reduction in low-flow refugia such as pools and side-channels. In addition, changes in low summer base flows can effect water temperatures, dissolved oxygen levels, and prey availability.

As discussed above, the proposed project will maintain a net balance of cut and fill within the 100-year floodplain of the Clackamas River, and no work will occur below the OHW of Clackamette Cove. Therefore, it is reasonably certain that proposed grading within the floodplain and associated development of the Garden Apartments will not alter the magnitude, duration, or recurrence intervals of low summer base flows and/or flood flows within the action area to a level that would result in a measurable or observable negative impact to ESA-listed salmonids. The proposed excavation of approximately 81,710 cubic yards of material from the proposed North Park site will provide for additional flood storage along the immediate shoreline of Clackamette Cove during shorter interval flood events (i.e. < 100-year). In addition, given the existing baseline conditions and location of the Garden Apartments site, the proposed remapping of the floodplain following the placement of fill material at this site will not result in the loss of quantity or quality of habitat available for anadromous fish.

### 6.2.3 Floodplain Connectivity

Accessibility to floodplain habitat is important to the biological processes necessary for anadromous fish survival. Floodplain connectivity allows for natural lateral stream migration and provides off-channel areas with a high abundance of terrestrial and aquatic food sources. In addition, floodplain connectivity allows juvenile salmonids access to refugia and natural cover from predators, while also providing natural filtration of excess nutrients and increasing overall habitat complexity (NMFS 2013).

As discussed above, preparation of the Garden Apartments site will require approximately 115,205 cubic yards of fill in order to raise the proposed site above the base flood elevation (47.8 feet). All fill material for construction of the apartments will be sourced from within the 100-year floodplain of the Clackamas River, including approximately 81,710 cubic yards of excavation from the proposed North Park site, and approximately 7,221 cubic yards from grading along Main Street and 3,819 cubic yards from grading at Lot 1. In addition, approximately 22,455 cubic yards of excess (i.e., “banked”) floodplain capacity associated with the Jug Handle Project will be factored in to the net balance. Proposed excavation and grading activities will maintain existing floodplain connectivity with the Clackamas River. All areas of excavation along the immediate shoreline of Clackamette Cove will be graded to insure that area of increased flood storage will not strand fish during flood events.

### 6.2.4 Riparian Vegetation

Impacts to riparian vegetation communities can have significant effects on in-stream habitat functions such as water temperature, recruitment of large woody debris, filtering of sediment and pollutants, erosion control, bank stability, and food input (FEMA 2013). As discussed above, proposed grading activities will require the removal of up to 16 riparian trees located along the bank of Clackamette Cove in the proposed North Park excavation area. Given the limited use of Clackamette Cove by juvenile salmonids during the warm summer months, it is reasonably certain that any temporal loss associated with riparian vegetation removal will not result in long-term, significant effects to ESA-listed fish species or net change in function of the in-stream habitat. Proposed shoreline restoration and mitigation efforts (i.e., planting 472 trees and 2,362 shrubs) will likely improve the functional value of the riparian reserves along the Clackamas River and Clackamette Cove by removing invasive species and increasing native plant diversity and coverage.

## 6.3 Cumulative Effects

Cumulative effects are defined as the effects of all "non-federal" actions (i.e., state, local, private, or tribal) that are reasonably certain to occur within the foreseeable future. Additional projects in the vicinity of the action area are anticipated as population growth and development continues in the region. Associated road, residential, and commercial development, as well as maintenance and upgrading of existing infrastructure are therefore likely in the foreseeable future. The proposed project is considered Phase I of the larger master plan development around Clackamette Cove, referred to as the "The Cove" Development. Additional phases of The Cove Development will likely occur beyond 2016, and are not included in this analysis. The influence of these activities cannot be quantified in this document, but have been incorporated qualitatively in the environmental baseline.

## 6.4 Summary of Effects

Based on the species' life stages, existing baseline conditions, actions described above, and proposed conservation measures; it is reasonably certain that the proposed project will not result in "take" of ESA-listed salmonids. Proposed grading activities within the floodplain and associated development of the property are not expected to result in any measurable effects to ESA-listed salmonids or their designated critical habitat. In addition, it is reasonably certain that the potential project related indirect effects of treated stormwater on ESA-listed salmonids will be immeasurable and discountable. The potential effects of the proposed action on the environmental baseline conditions are summarized below (Table 3).

**Table 3. Checklist for Documenting Environmental Baseline and Effects of Proposed Actions on Relevant Indicators for ESA-listed fish species within the action area.**

| PATHWAYS AND INDICATORS | ENVIRONMENTAL BASELINE | EFFECTS OF PROPOSED ACTION |
|---|---|---|
| **Water Quality** | | |
| Temperature | Not Properly Functioning | **Maintain** |
| Sediment/Turbidity | Not Properly Functioning | **Maintain** |
| Chemical Contamination | Not Properly Functioning | **Maintain (-)** |
| **Habitat Access** | | |
| Physical Barriers | At Risk | **Maintain** |
| **Habitat Elements** | | |
| Substrate | Not Properly Functioning | **Maintain** |
| Large Wood | Not Properly Functioning | **Maintain** |
| Pool Frequency | Not Properly Functioning | **Maintain** |
| Pool Quality | At Risk | **Maintain** |
| Off-Channel Habitat | At Risk | **Maintain** |
| Refugia | At Risk | **Maintain** |
| **Channel Conditions and Dynamics** | | |
| Width/Depth Ratio | At Risk | **Maintain** |
| Streambank Condition | At Risk | **Maintain** |
| Floodplain Connectivity | At Risk | **Maintain** |
| **Flow/Hydrology** | | |
| Peak/Base Flows | At Risk | **Maintain** |
| Drainage Network Increase | Not Properly Functioning | **Maintain** |
| **Watershed Conditions** | | |
| Road Density/Location | Not Properly Functioning | **Maintain** |
| Disturbance History | Not Properly Functioning | **Maintain** |
| Riparian Reserves | Not Properly Functioning | **Maintain (+)** |

Maintain = no localized, temporary, or system-wide effect
Maintain (-) = localized or temporary effect, no system-wide effect
Maintain (+) = localized benefit, no system-wide effect
Restore = system-wide benefit

# 7.0 FINDING OF EFFECT

## 7.1 LCR Chinook Salmon, UWR Chinook Salmon, LCR Coho Salmon, and LCR Steelhead

Evaluation of the potential effects of the proposed actions indicates that it is reasonably certain that the project will not result in "take" of LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, or LCR steelhead, given the species' life stages, existing baseline conditions and proposed conservation measures discussed above. As such, a determination of **may affect, not likely to adversely affect** has been made with regard to the aforementioned species. This finding of effect satisfies the requirements of Section 9 of the ESA, and will not require an incidental take permit under Section 10.

## 7.2 Designated Critical Habitat

Designated critical habitat for UWR steelhead is located outside the project action area, along the mainstem of the Clackamas River. The proposed project will have **no effect** on designated critical habitat for LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, or LCR steelhead.

# 8.0 ESSENTIAL FISH HABITAT

The Sustainable Fisheries Act of 1996 (Public Law 104-267) amended the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to establish new requirements designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan (FMP). The MSA requires Federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (MSA §305(b)(2)). Adverse effect means any impact that reduces quality and/or quantity of EFH, and may include direct, indirect, site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Any reasonable attempt to encourage the conservation of EFH must also take into account actions that occur outside EFH, such as upstream and upslope activities that may result in adverse effects.

## 8.1 Identification of Essential Fish Habitat

As defined in the MSA, EFH includes "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". For the purpose of interpreting this definition, *waters* include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish. *Substrate* includes sediment, hard bottom, structures underlying the waters, and associated biological communities (50 CFR 600.810). Along the Pacific coast (excluding Alaska), the Pacific Fishery Management Council (PFMC) manages EFH for three FMPs, including Pacific salmon, coastal pelagic species, and groundfish.

Pacific salmon EFH includes all streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers identified by PFMC (PFMC 1999). Chief Joseph Dam,

Dworshak Dam, and the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee Dams) are among the listed man-made barriers that represent the upstream extent of the Pacific salmon fishery EFH. Salmon EFH excludes areas upstream of longstanding naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). In the estuarine and marine areas, proposed designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception (PFMC 1999).

## 8.2 Analysis of Effects

Section 6.0 of this HA provides an analysis of potential project effects to the habitat elements (i.e., waters and substrate) that make up EFH for Pacific salmon. This project has been designed with several conservation measures to minimize and avoid potential adverse effects to EFH. As such, a determination of **no adverse effect** has been made with regard to EFH.

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# Appendix A

## Project Photographs

Photo 1:

View to the south showing existing conditions at the proposed Garden Apartments site.

Photo 2:

View to the north showing existing conditions at the proposed Garden Apartments site.

Project #5511
Date 6/10/15

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Photo documentation for the Garden Apartments Project
(Photos taken on April 24, 2015)

Photo 3:

View to the northwest showing the existing 36-inch stormwater outfall located along the bank of Clackamette Cove.

Photo 4:

View to the north showing where stormwater from the existing 36-inch outfall enters Clackamette Cove.

Project #5511
Date 6/10/15

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Photo documentation for the Garden Apartments Project
(Photos taken on April 24, 2015)

Photo 5:

View to the northeast showing existing conditions along the eastern shoreline of Clackamette Cove.

Photo 6:

View to the northwest showing existing conditions along the southern shoreline of Clackamette Cove.

Project #5511
Date 6/10/15

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Photo documentation for the Garden Apartments Project
(Photos taken on April 24, 2015)

Photo 7:

View to the northwest showing the proposed North Park excavation area along the shoreline of Clackamette Cove.

Photo 8:

View to the north showing the proposed North Park excavation area above the shoreline.

Project #5511
Date 6/10/15

Photo documentation for the Garden Apartments Project
(Photos taken on April 24, 2015)

Pacific Habitat Services, Inc.
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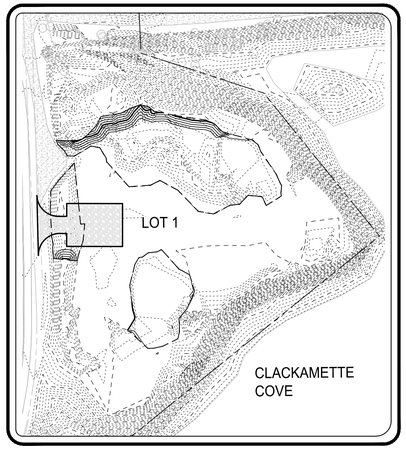
# Appendix B

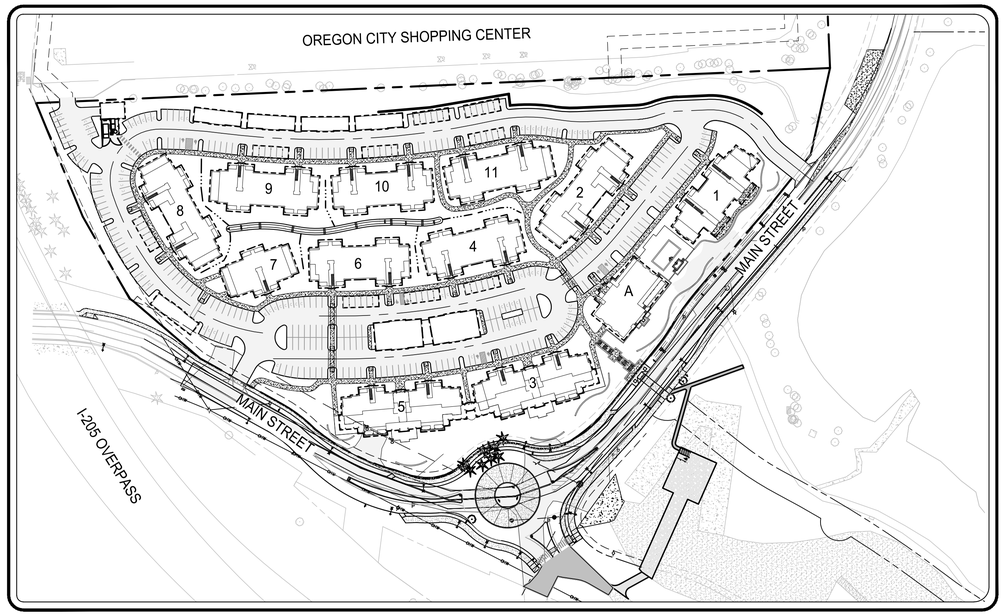
## Project Plan Sheets

# THE COVE - GARDEN APARTMENTS

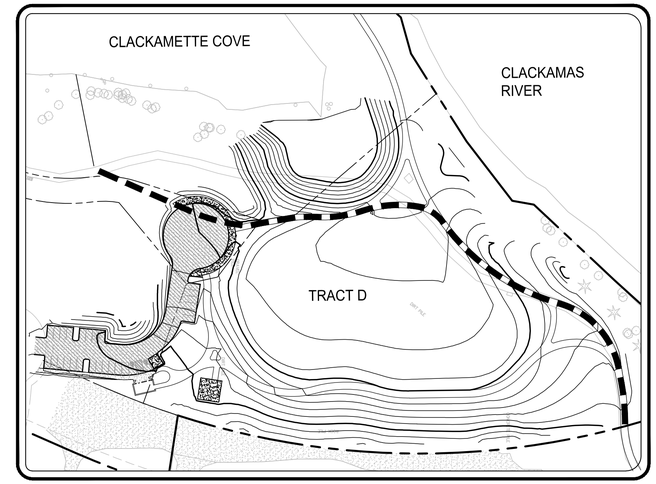
OREGON CITY, OREGON
DDP SUBMITTAL



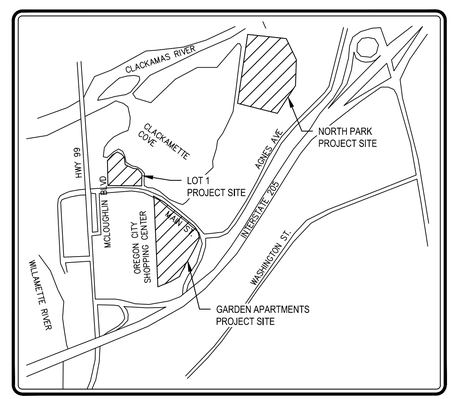

*LOT 1 SITE MAP*
SCALE: NTS




*GARDEN APARTMENTS SITE MAP*
SCALE: NTS




*NORTH PARK SITE MAP*
SCALE: NTS




*VICINITY MAP*
SCALE: NTS

## INDEX OF SHEETS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| C0.0 | COVER SHEET |
| C0.1 | OVERALL EXISTING CONDITIONS |
| C1.0 | EXISTING CONDITIONS PLAN - GARDEN APARTMENTS |
| C1.1 | EXISTING CONDITIONS PLAN - NORTH PARK |
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| C2.1 - C2.3 | SITE PLAN |
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| C3.3 | GRADING PLAN- TEMPORARY PATH & PARKING |
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| L1.0 & L1.1 | EXISTING VEGETATION PLANS |
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| L4.1 & L4.2 | ONSITE PLANTING PLANS |
| L5.0 | ONSITE PLANTING LEGEND, PROJECT DETAILS & NOTES |


## PROJECT TEAM


*APPLICANT*
GRAND COVE, LLC
ATTN: PAUL HERSKOWITZ
4582 S ULSTER STREET SUITE 1200
DENVER, CO 80237
PHONE: (720) 272-7226

*PLANNING*
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ATTN: LLOYD HILL, AIA
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*PLANNING*
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ATTN: LAURA TERWAY
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PHONE: (503) 496-1561
FAX: (503) 657-7892

*STREET*
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FAX: (503) 650-9590

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CLACKAMAS FIRE DISTRICT #1
ATTN: MIKE BOUMANN
2930 SE OAK GROVE BLVD
MIKWAUKIE, OREGON 97267
PHONE: (503) 496-1517
FAX: (503) 742-2860


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www.cardno.com


COVER SHEET
THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

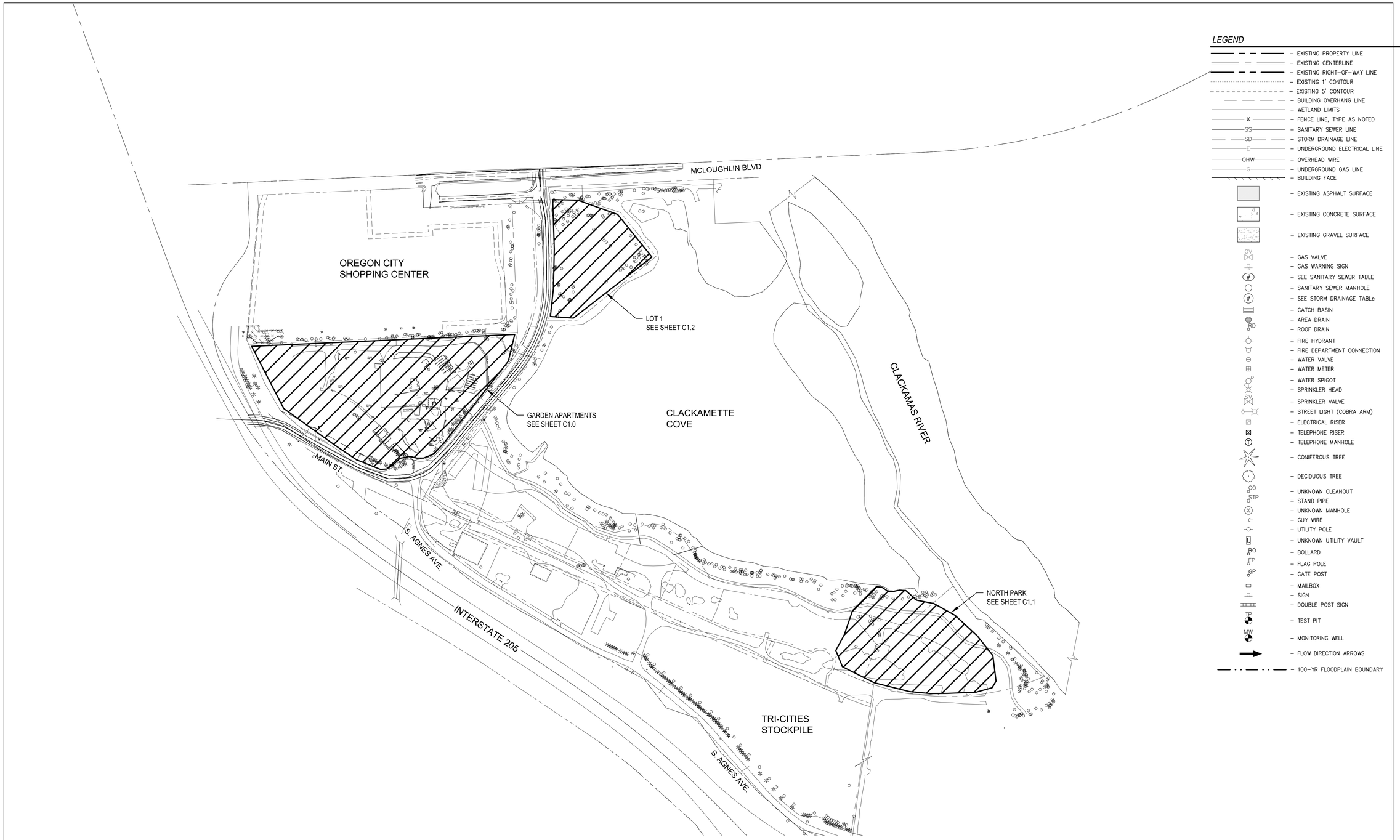
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
COVER

SHEET NUMBER
C0.0

LAND USE # —


Plot Stamp: 7/8/2015 3:22:14 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-03-COVER.dwg, Tab: Layout1

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- WETLAND LIMITS
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- SD — STORM DRAINAGE LINE
- E — UNDERGROUND ELECTRICAL LINE
- OHW — OVERHEAD WIRE
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- EXISTING CONCRETE SURFACE
- EXISTING GRAVEL SURFACE
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- GAS WARNING SIGN
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- SANITARY SEWER MANHOLE
- # — SEE STORM DRAINAGE TABLe
- CATCH BASIN
- AREA DRAIN
- RD — ROOF DRAIN
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- WATER METER
- WATER SPIGOT
- SPRINKLER HEAD
- SV — SPRINKLER VALVE
- STREET LIGHT (COBRA ARM)
- ELECTRICAL RISER
- TELEPHONE RISER
- T — TELEPHONE MANHOLE
- CONIFEROUS TREE
- DECIDUOUS TREE
- CO — UNKNOWN CLEANOUT
- STP — STAND PIPE
- UNKNOWN MANHOLE
- GUY WIRE
- UTILITY POLE
- U — UNKNOWN UTILITY VAULT
- BO — BOLLARD
- FP — FLAG POLE
- GP — GATE POST
- MAILBOX
- SIGN
- DOUBLE POST SIGN
- TP — TEST PIT
- MW — MONITORING WELL
- FLOW DIRECTION ARROWS
- 100-YR FLOODPLAIN BOUNDARY

EXISTING CONDITIONS PLAN:
THIS PLAN IS INTENDED FOR USE AS AN EXISTING CONDITIONS PLAN SHOWING THE CONDITIONS OF THE SITE PRIOR TO CONSTRUCTION. INFORMATION SHOWN ON THIS PLAN WAS DEVELOPED FROM THE TOPOGRAPHIC SURVEY AND SITE OBSERVATIONS BY THE ENGINEER. NOT ALL SURFACE FEATURES MAY BE SHOWN. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION TO DETERMINE WORK SPECIFIC DETAILS. TOPOGRAPHIC INFORMATION PROVIDED BY CARDNO WRG DATED OCTOBER 4, 2006.

### BENCHMARK:

OREGON STATE HIGHWAY VERTICAL CONTROL RECEIVED FROM CLACKAMAS COUNTY ENGINEERING DEPARTMENT.

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PUBLISHED NGVD 29 ELEV.=56.117 FEET
CONVERTED TO NAVD 88 ELEV.=59.587 FEET

### UTILITY STATEMENT:

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SCALE: 1"=50'
50 25 0 50

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www.cardno.com

# OVERALL EXISTING CONDITIONS
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRIAN R. SCHEER WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

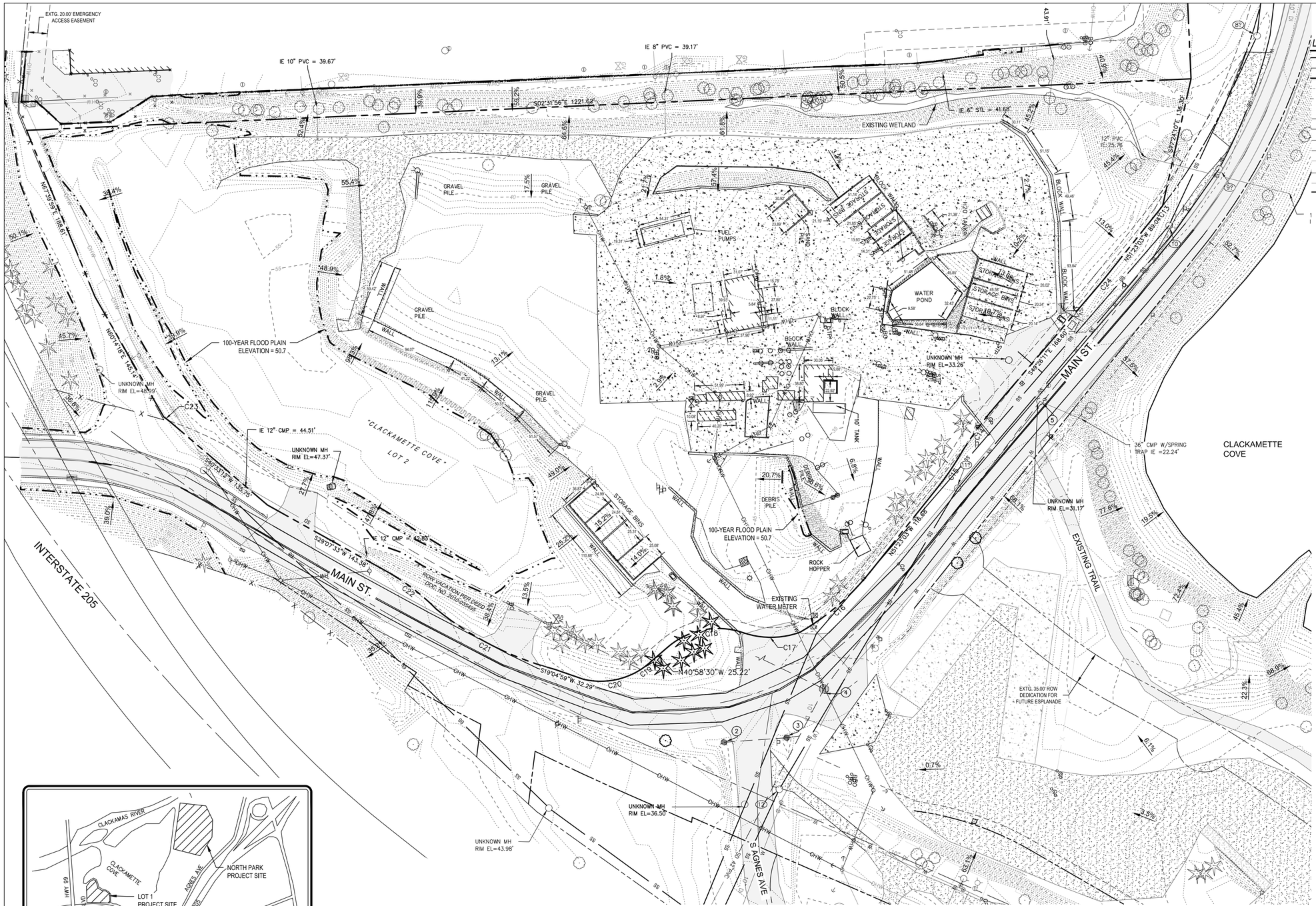
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
EXISTING

SHEET NUMBER
C0.1

LAND USE # —

Plot Stamp: 7/9/2015 3:22:34 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-DD-EXISTING.dwg, Tab: C0.1




## LEGEND

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- WETLAND LIMITS
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- ROOF DRAIN
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- FIRE DEPARTMENT CONNECTION
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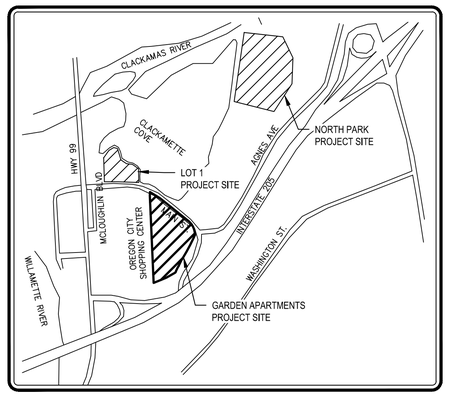


VICINITY MAP

SCALE: NTS

## STORM DRAINAGE TABLE:

(2) 2' SQUARE BOX DRAIN
RIM = 34.30'
12" CONC (N) IE = 31.50'
SUMP IE = 31.50'
SUMP IE = 32.40'

(3) 2' SQUARE BOX DRAIN
RIM = 33.46'
12" CONC (S) IE = 30.16'
12" CONC (NW) IE = 29.96'
SUMP IE = 30.06'
SUMP IE = 31.06'

(4) GRATED STORM MANHOLE
RIM = 35.03'
12" CONC (SW) IE = 28.03'
42" PVC (SE) (NW)
INVERT ELEVATION = 25.88'

(5) STORM DRAIN MANHOLE
RIM=31.17'
36" CMP (N)
42" PVC (SE)
INVERT ELEVATION = 22.27'

## SANITARY SEWER TABLE:

(8) SANITARY SEWER MANHOLE
RIM=30.31'
42" CONC (W)
42" CONC (E)
INVERT ELEVATION = 21.15'

(9) SANITARY SEWER MANHOLE
RIM=29.76'
84" CONC (W)
84" CONC (E)
INVERT ELEVATION = 12.60'

(10) SANITARY SEWER MANHOLE
RIM=33.06'
42" CONC (W)
42" CONC (E)
INVERT ELEVATION = 20.88'

(11) SANITARY SEWER MANHOLE
RIM=31.94'
84" CONC (E)
84" CONC (W)
INVERT ELEVATION = 12.97'

(12) SANITARY SEWER MANHOLE
RIM=36.13'
84" CONC (E)
84" CONC (W)
INVERT ELEVATION = 13.33'

(13) SANITARY SEWER MANHOLE
RIM=42.71'
72" CONC (N)
54" CONC (S)
42" CONC (W)
INVERT ELEVATION = 18.48'

(14) FLOW CONTROL STRUCTURE
RIM=42.33'
72" CONC (N)
72" CONC (S)
72" CONC (W)
INVERT ELEVATION = 13.47'

(15) SANITARY SEWER MANHOLE
RIM=42.39'
72" CONC (N)
72" CONC (S)
INVERT ELEVATION = 18.34'

(16) SANITARY SEWER MANHOLE
RIM=43.00'
72" CONC (N)
72" CONC (S)
INVERT ELEVATION = 14.30

## BENCHMARK:

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50 25 0 50

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# EXISTING CONDITIONS PLAN - GARDEN APARTMENTS

# THE COVE - GARDEN APARTMENTS

GRAND COVE, LLC

OREGON CITY, OREGON

| A | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
BRIAN R. SHERMAN WILLIAMS
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
EXISTING

SHEET NUMBER
C1.0

LAND USE # —

Plot Stamp: 7/9/2015 3:22:41 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\6922-DD-EXISTING.dwg, Tab: C1.0

CLACKAMETTE COVE

100-YEAR FLOOD PLAIN
ELEVATION = 50.7

100-YEAR FLOOD PLAIN
ELEVATION = 50.7

100-YEAR FLOOD PLAIN
ELEVATION = 50.7

100-YEAR FLOOD PLAIN
ELEVATION = 50.7

DIRT PILE

DIRT PILE

DIRT PILE

GRAVEL PILE

ROCK PILE

CONCRETE PILE

IE 12" PVC = 37.40'

1+00

2+00

2+50

## LEGEND

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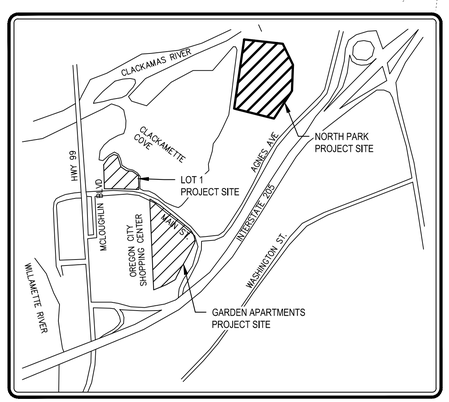


VICINITY MAP
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# EXISTING CONDITIONS PLAN - NORTH PARK
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN R. SEPTER
WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
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| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
EXISTING

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C1.1

LAND USE # —

Plot Stamp: 7/9/2015 3:22:48 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-DD-EXISTING.dwg, Tab: C1.1

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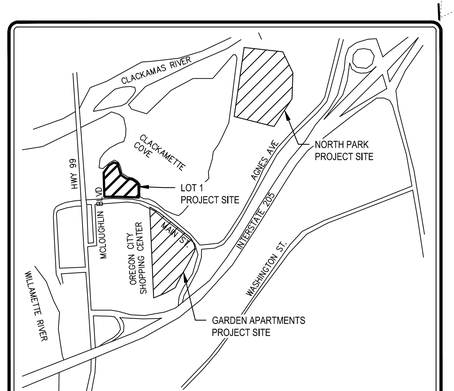


VICINITY MAP

SCALE: NTS

EXISTING CONDITIONS PLAN:
THIS PLAN IS INTENDED FOR USE AS AN EXISTING CONDITIONS PLAN SHOWING THE CONDITIONS OF THE SITE PRIOR TO CONSTRUCTION. INFORMATION SHOWN ON THIS PLAN WAS DEVELOPED FROM THE TOPOGRAPHIC SURVEY AND SITE OBSERVATIONS BY THE ENGINEER. NOT ALL SURFACE FEATURES MAY BE SHOWN. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION TO DETERMINE WORK SPECIFIC DETAILS. TOPOGRAPHIC INFORMATION PROVIDED BY CARDNO WRG DATED OCTOBER 4, 2006.

### BENCHMARK:

OREGON STATE HIGHWAY VERTICAL CONTROL RECEIVED FROM CLACKAMAS COUNTY ENGINEERING DEPARTMENT.

"A STANDARD OSHD DISK STAMPED "56 G 220 1934" LOCATED IN THE NORTHEAST CORNER OF THE JOHN MCLAOUGHLIN BRIDGE OVER THE CLACKAMAS RIVER.

PUBLISHED NGVD 29 ELEV.=56.117 FEET
CONVERTED TO NAVD 88 ELEV.=59.587 FEET

### UTILITY STATEMENT:

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

SCALE: 1"=50'

50 25 0 50

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www.cardno.com

# EXISTING CONDITIONS PLAN - LOT 1
# THE COVE - GARDEN APARTMENTS
## GRAND COVE, LLC
## OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRIAN R. SCHMIDT WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

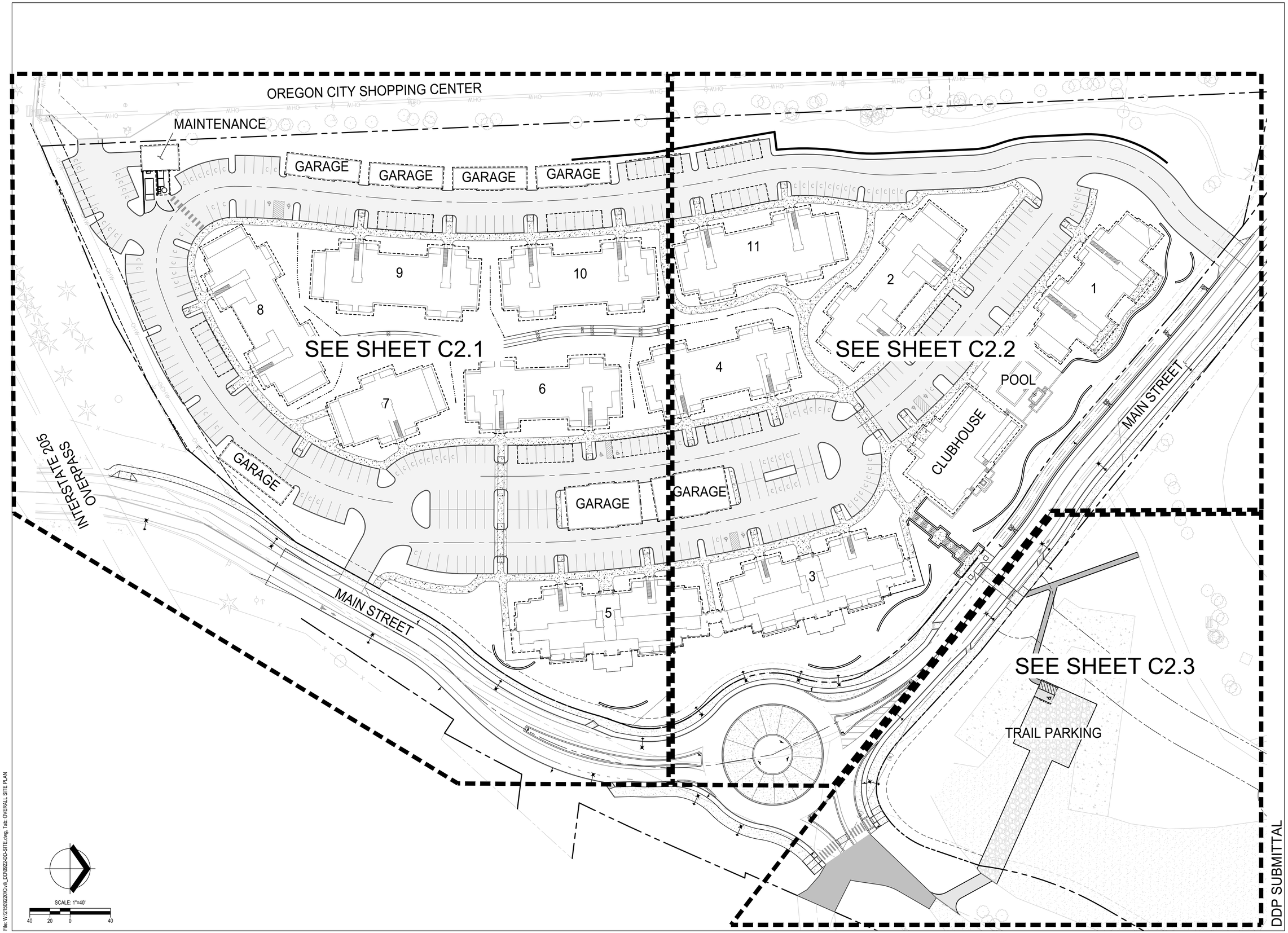
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
EXISTING

SHEET NUMBER
C1.2

LAND USE # —

Plot Stamp: 7/8/2015 3:22:55 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\9224DD-EXISTING.dwg, Tab: C1.2




DDP SUBMITTAL

Plot Stamp: 7/9/2015 3:23:27 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\09220-DD-SITE.dwg, Tab: OVERALL SITE PLAN

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www.cardno.com

# OVERALL SITE PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENT RYAN WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
OVERALL SITE

SHEET NUMBER
C2.0

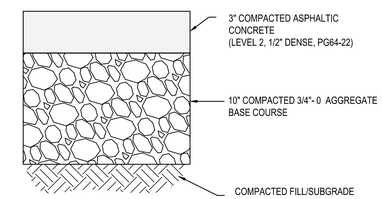
LAND USE # —

## LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT LINE
- PROPOSED BUILDING AND OVERHANG
- PROPOSED CURB
- PROPOSED WALL
- PROPOSED CONCRETE
- PROPOSED DITCH LINE

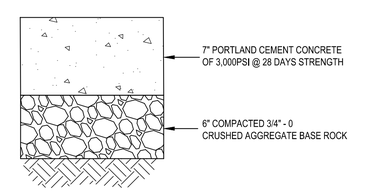
## CONSTRUCTION NOTES

1. PROPOSED STANDARD CURB (TYPICAL).
2. PROPOSED STANDARD ADA ACCESSIBLE PARKING STALL STRIPPING AND SIGNAGE (TYPICAL).
3. PROPOSED TRASH ENCLOSURE WITH (2) 6 YARD COMINGLE RECYCLING, 24 YARD TRASH COMPACTOR, COMPACTOR, AND GLASS BINS.
4. PROPOSED ADA ACCESSIBLE RAMP.
5. PROPOSED GARAGE. SEE ARCHITECTURAL PLANS FOR MORE INFORMATION.
6. PROPOSED STANDARD CONCRETE SIDEWALK.
7. PROPOSED CONCRETE CROSSWALK WITH IMPACT SLAB PER SECTION ON THIS SHEET.
8. PROPOSED COVERED PARKING.
9. PROPOSED COMPACT PARKING STALL STRIPING (TYPICAL).
10. PROPOSED DRIVEWAY INSTALLED AS PART OF PUBLIC IMPROVEMENTS.
11. PROPOSED STORM SWALE. SEE STORM PLAN FOR MORE INFORMATION.
12. PROPOSED PIER-SUPPORTED DECKS. SEE ARCHITECTURAL PLANS FOR MORE INFORMATION.
13. PROPOSED VAN ACCESSIBLE ADA PARKING STALL STRIPPING AND SIGNAGE (TYPICAL).
14. PROPOSED RED NO PARKING FIRE PAINT.
15. PROPOSED WALL SEE GRADING PLAN FOR INFORMATION.
16. PROPOSED CROSSWALK TO TRASH ENCLOSURE.

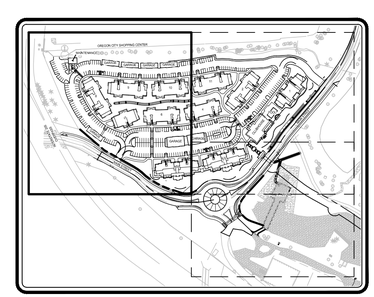



### VEHICLE ASPHALT PAVEMENT SECTION

* REQUIRED COMPACTION BASED UPON GEOTECHNICAL RECOMMENDATION BY ASH CREEK DATED NOVENBER 12, 2009




### CONCRETE CROSSWALK SECTION



### KEY MAP

SCALE: NTS

SCALE: 1"=30'

30 15 0 30

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www.cardno.com

# SITE PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENT R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

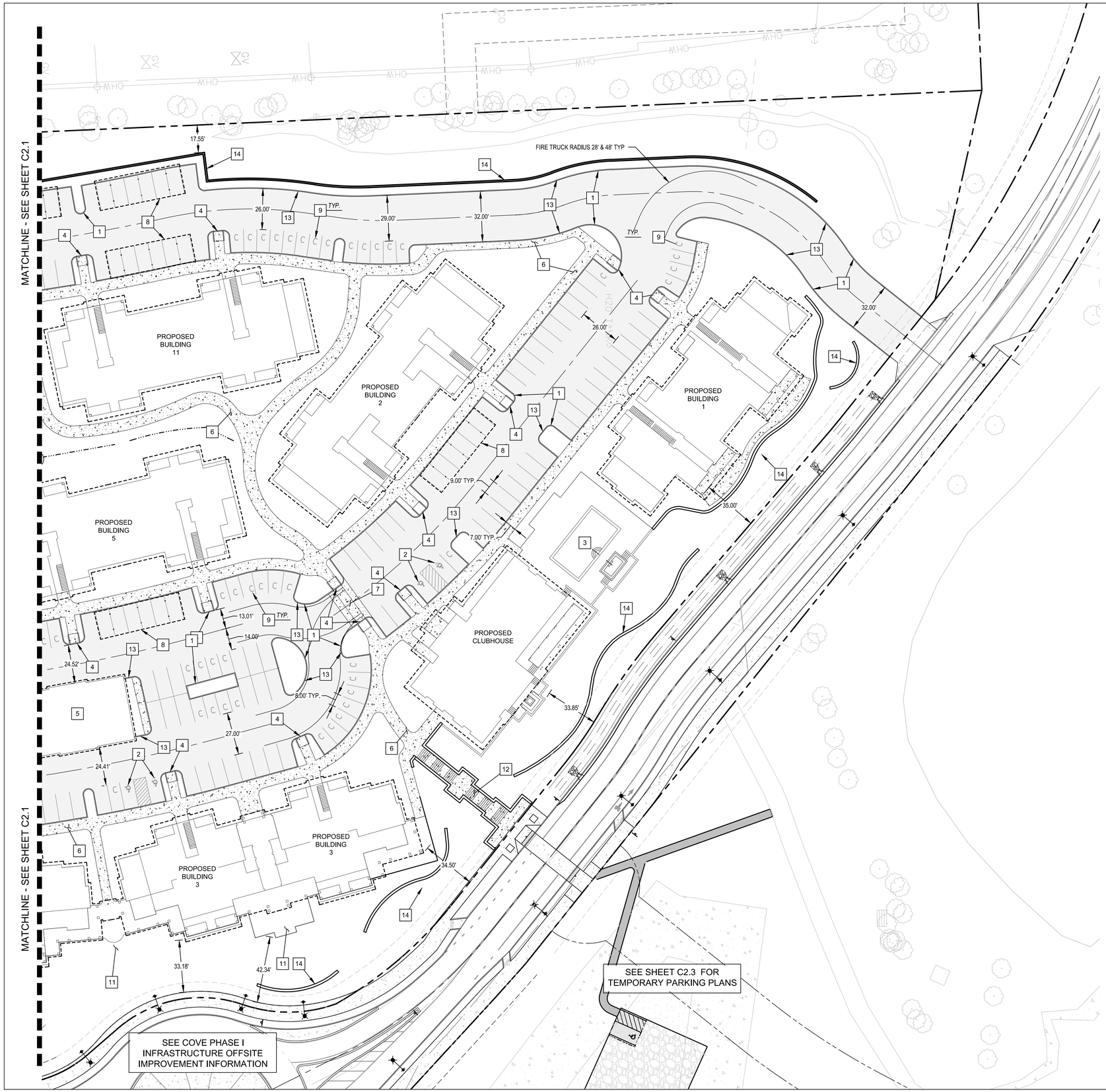
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
SITE PLAN

SHEET NUMBER
C2.1

LAND USE # —

Plot Stamp: 7/9/2015 3:23:38 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-DD-SITE.dwg, Tab: C2.1

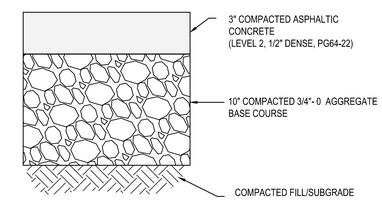



## LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT LINE
- PROPOSED BUILDING AND OVERHANG
- PROPOSED CURB
- PROPOSED WALL
- PROPOSED CONCRETE
- PROPOSED DITCH LINE

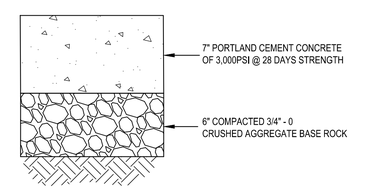
## CONSTRUCTION NOTES

1. PROPOSED STANDARD CURB (TYPICAL).
2. PROPOSED STANDARD ADA ACCESSIBLE PARKING STALL STRIPPING AND SIGNAGE (TYPICAL).
3. PROPOSED POOL AREA. SEE ARCHITECTURAL PLANS FOR MORE INFORMATION.
4. PROPOSED ADA ACCESSIBLE RAMP.
5. PROPOSED GARAGE. SEE ARCHITECTURAL PLANS FOR MORE INFORMATION.
6. PROPOSED STANDARD CONCRETE SIDEWALK.
7. PROPOSED CONCRETE CROSSWALK PER SECTION ON THIS SHEET.
8. PROPOSED COVERED PARKING (TYPICAL).
9. PROPOSED COMPACT PARKING STALL STRIPING (TYPICAL).
10. PROPOSED DRIVEWAY INSTALLED AS PART OF PUBLIC IMPROVEMENTS.
11. PROPOSED PIER-SUPPORTED DECKS. SEE ARCHITECTURAL PLANS FOR MORE INFORMATION.
12. PROPOSED STAIRS. SEE GRADING PLAN AND ARCHITECTURAL PLAN FOR MORE DETAILS.
13. PROPOSED RED NO PARKING FIRE PAINT.
14. PROPOSED WALL SEE GRADING PLAN FOR INFORMATION.

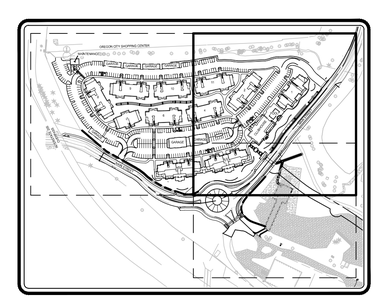



VEHICLE ASPHALT PAVEMENT SECTION

* REQUIRED COMPACTION BASED UPON GEOTECHNICAL RECOMMENDATION BY ASH CREEK DATED NOVENBER 12, 2009




CONCRETE CROSSWALK SECTION



KEY MAP
SCALE: NTS

SCALE: 1"=30'
30 15 0 30

PRELIMINARY

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# SITE PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
OREGON
R. BRYAN SCHMIDT WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

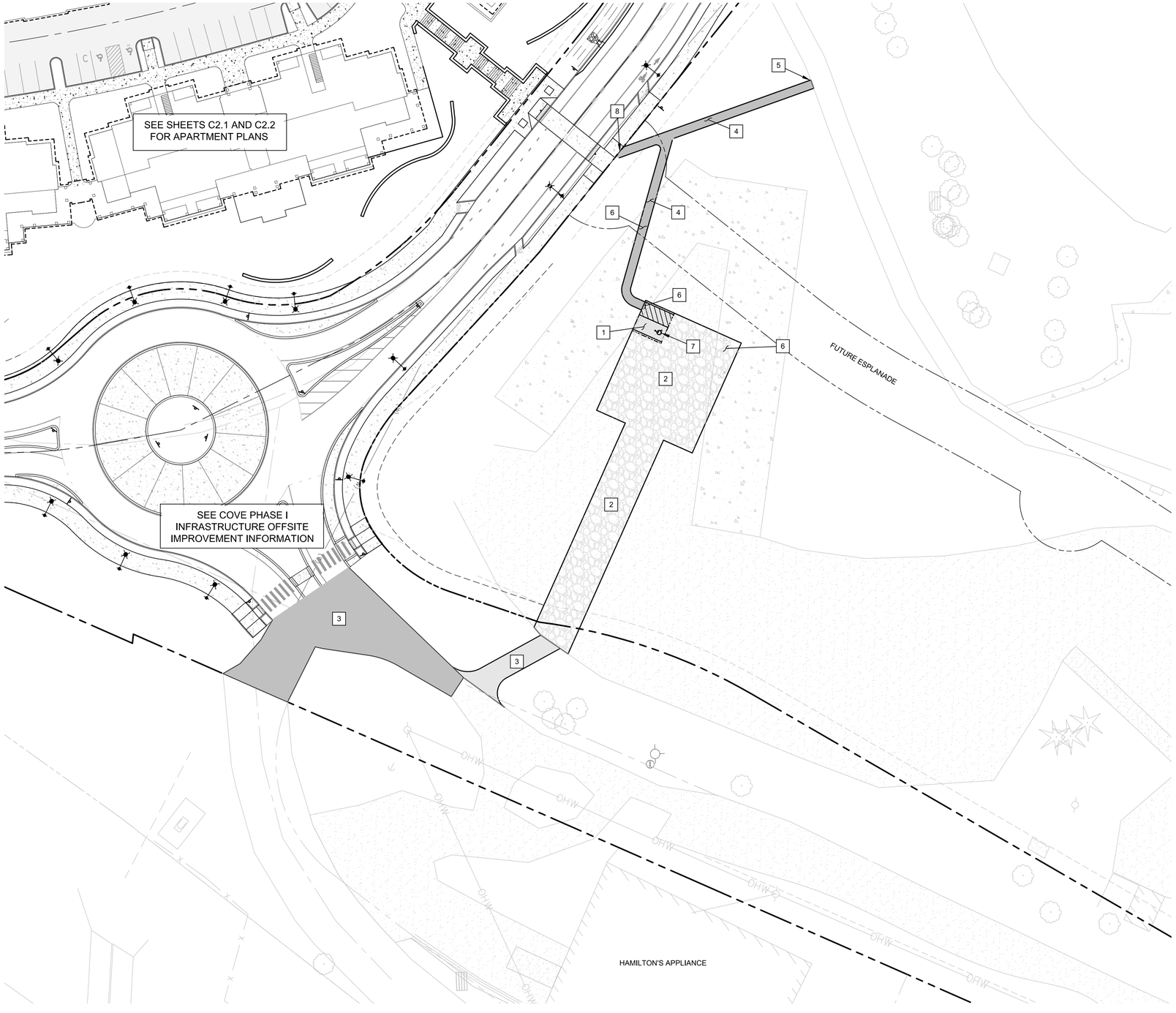
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
SITE PLAN

SHEET NUMBER
C2.2

LAND USE # —

Plot Stamp: 7/9/2015 3:23:47 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\6922DD-SITE.dwg, Tab: C2.2

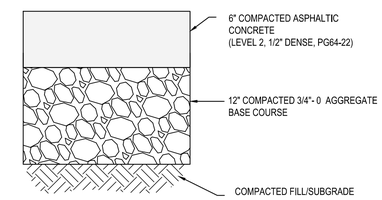



## LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT LINE
- PROPOSED BUILDING AND OVERHANG
- PROPOSED CURB
- PROPOSED WALL
- PROPOSED CONCRETE

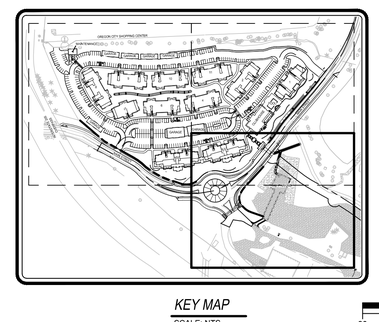
## CONSTRUCTION NOTES

1. PROPOSED ASPHALT FOR TEMPORARY ADA PARKING.
2. EXISTING GRAVEL ROAD AND PARKING LOT TO BE CLEANED AND RECOMPACTED.
3. PROPOSED TEMPORARY AC DRIVE.
4. PROPOSED TEMPORARY ASPHALT PATH.
5. CONNECTION TO EXISTING PATH.
6. REMOVE CONCRETE AS NECESSARY FOR GRAVEL PARKING LOT AND ADA PARKING.
7. PROPOSED STANDARD ADA ACCESSIBLE PARKING STALL STRIPPING AND SIGNAGE (TYPICAL).
8. CONNECT TO PROPOSED SIDEWALK INSTALLED AS PART OF PUBLIC IMPROVEMENTS.




## TEMPORARY ASPHALT PAVEMENT SECTION

* REQUIRED COMPACTION BASED UPON GEOTECHNICAL RECOMMENDATION BY ASH CREEK DATED NOVENBER 12, 2009



## KEY MAP

SCALE: NTS

SCALE: 1"=30'

30 15 0 30

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# SITE PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

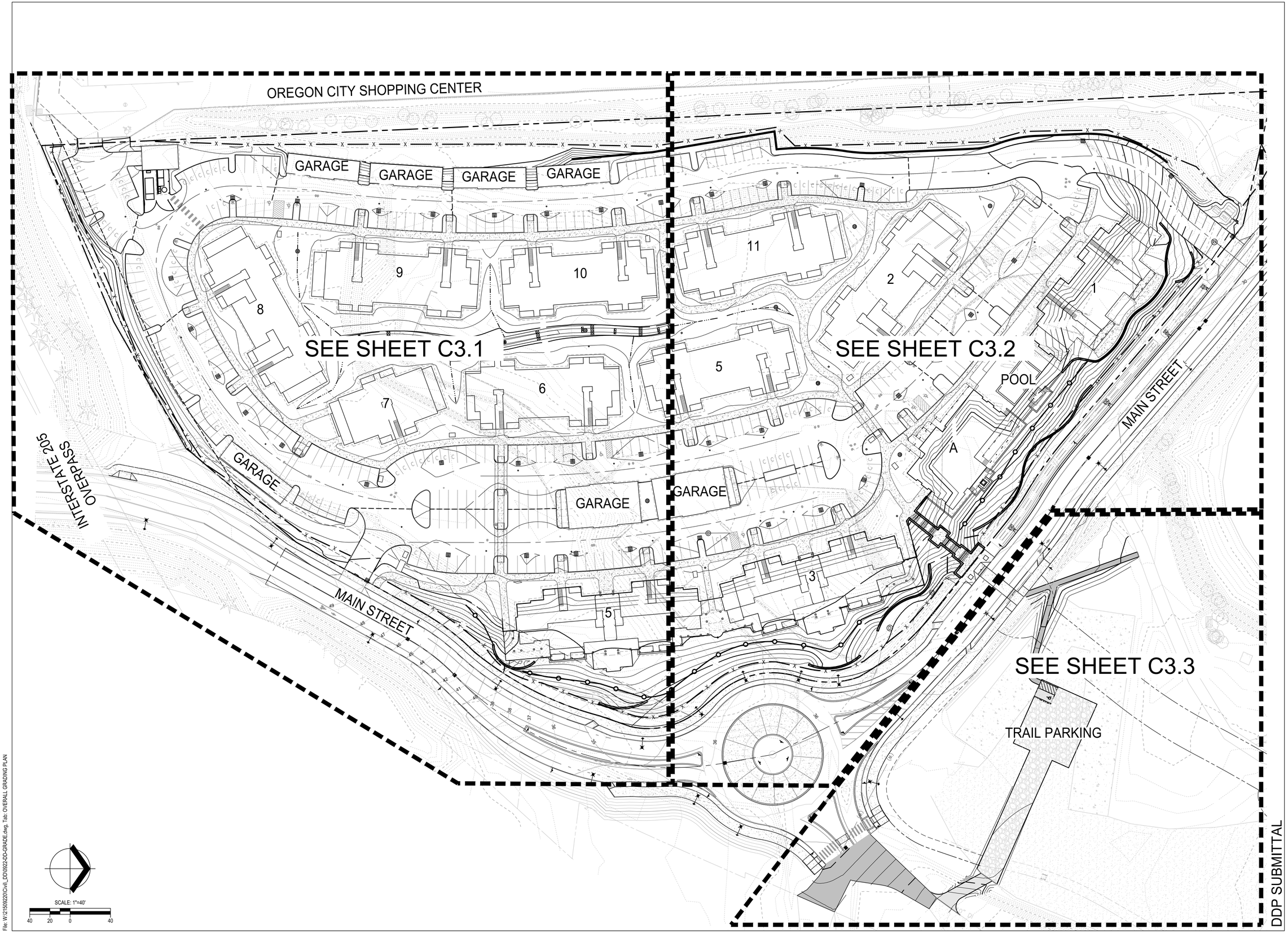
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
SITE PLAN

SHEET NUMBER
C2.3

LAND USE # —

Plot Stamp: 7/9/2015 3:23:57 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-02-SITE.dwg, Tab: SITE PLAN




DDP SUBMITTAL

Plot Stamp: 7/8/2015 3:24:59 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-03-GRADE.dwg, Tab: OVERALL GRADING PLAN

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# OVERALL GRADING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

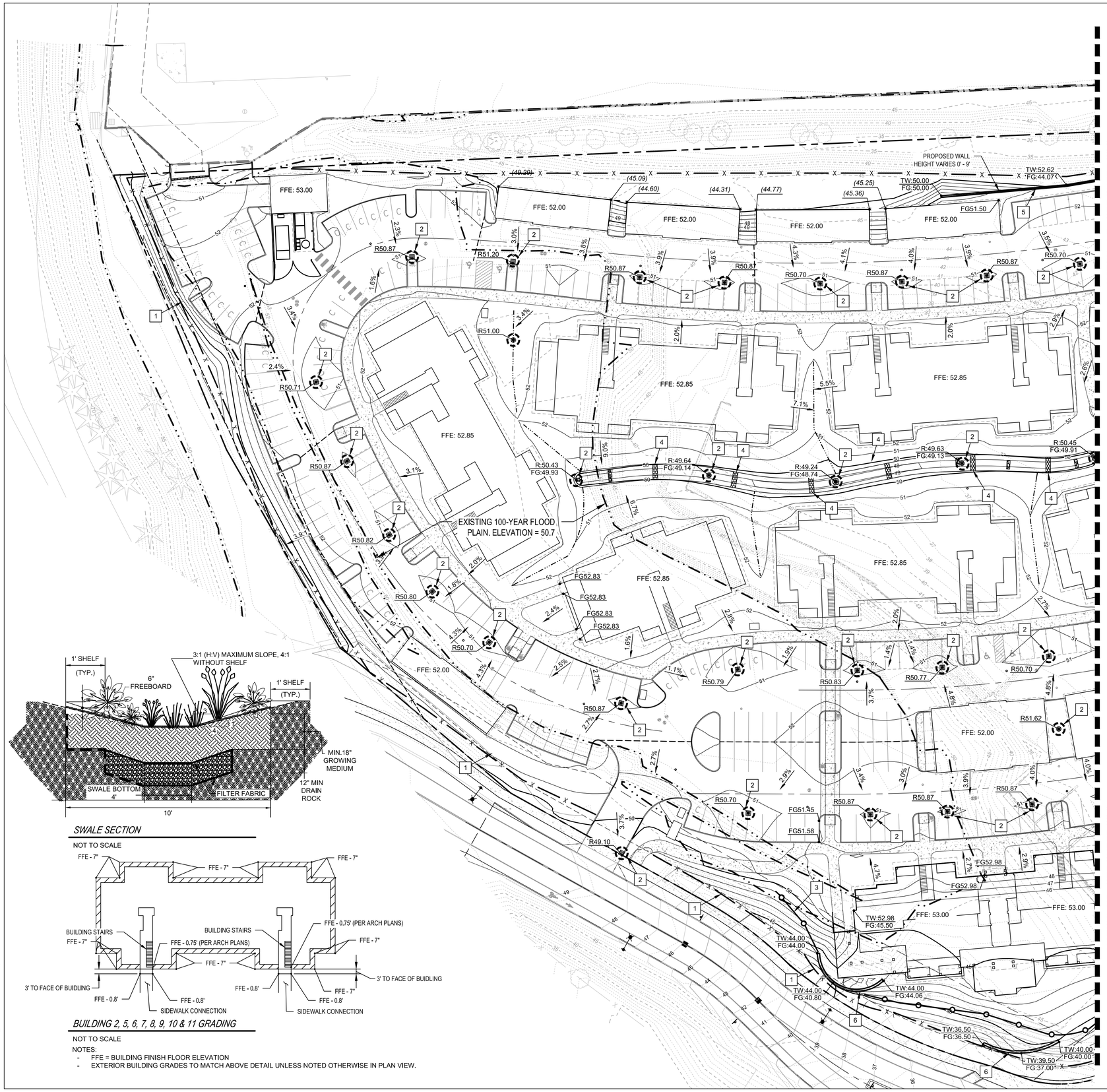
REGISTERED PROFESSIONAL ENGINEER
BRENDAN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
OVERALL GRADING

SHEET NUMBER
C3.0

LAND USE # —







## SWALE SECTION

NOT TO SCALE




## BUILDING 2, 5, 6, 7, 8, 9, 10 & 11 GRADING

NOT TO SCALE

NOTES:
- FFE = BUILDING FINISH FLOOR ELEVATION
- EXTERIOR BUILDING GRADES TO MATCH ABOVE DETAIL UNLESS NOTED OTHERWISE IN PLAN VIEW.

## LEGEND

- EXISTING PROPERTY LINE
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- PROPOSED 5' CONTOUR
- PROPOSED 1' CONTOUR
- PROPOSED RIDGE LINE
- PROPOSED DITCH LINE
- PROPOSED CURB
- PROPOSED SEDIMENT FENCE
- PROPOSED STRAW WATTLE
- EXISTING 100-YR FLOODPLAIN BOUNDARY
- PROPOSED INLET PROTECTION
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN

## ADA NOTE

PAVEMENT IN A.DA. PARKING AREA TO BE 2% MAXIMUM SLOPE IN ANY DIRECTION

## EROSION CONTROL NOTES

1. PROPOSED SEDIMENT FENCE.
2. PROPOSED INLET PROTECTION.
3. PROPOSED STRAW WATTLE.
4. PROPOSED PERMANENT CHECK DAM.

## ABBREVIATIONS

| | |
|---|---|
| R | RIM ELEVATION |
| TW | TOP OF WALL ELEVATION |
| FG | FINISH GRADE ELEVATION |
| FFE | FINISH FLOOR ELEVATION |
| (XX.XX) | EXISTING ELEVATION |

## NOTE:

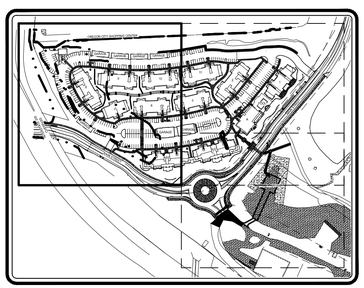
FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.

## CONSTRUCTION NOTES

5. CONSTRUCT LOCK + LOAD WALL.
6. CONSTRUCT ROCKERY WALL.

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88



## KEY MAP

SCALE: NTS

SCALE: 1"=30'

30 15 0 30

DDP SUBMITTAL

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www.cardno.com

# GRADING & EROSION CONTROL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

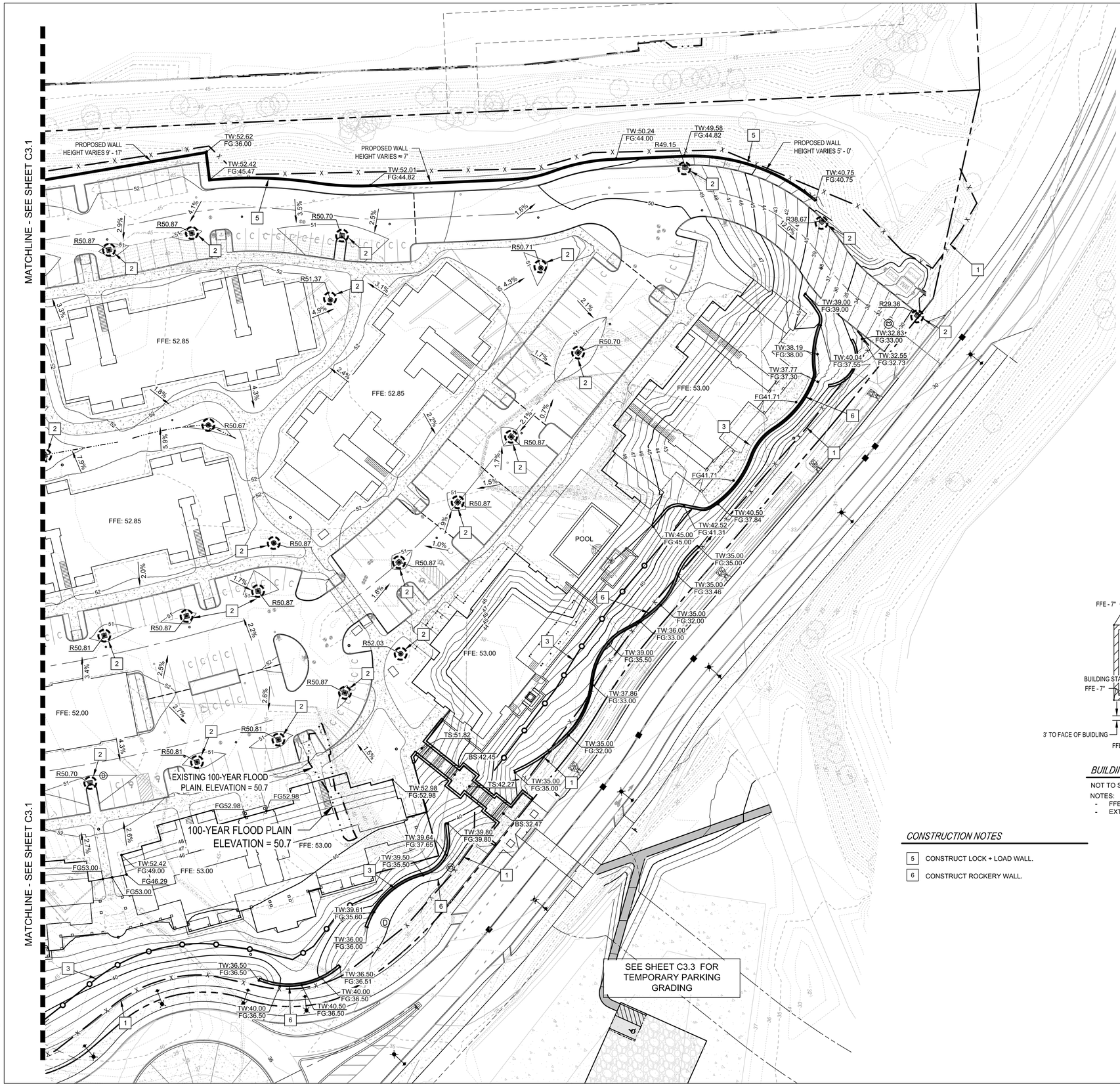
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
GRADING PLAN

SHEET NUMBER
C3.1

LAND USE # —

Plot Stamp: 7/9/2015 3:25:17 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\09220-GRADE.dwg, Tab: C3.1




## LEGEND

- EXISTING PROPERTY LINE
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- PROPOSED 5' CONTOUR
- PROPOSED 1' CONTOUR
- PROPOSED RIDGE LINE
- PROPOSED DITCH LINE
- PROPOSED CURB
- PROPOSED SEDIMENT FENCE
- PROPOSED STRAW WATTLE
- EXISTING 100-YR FLOODPLAIN BOUNDARY
- PROPOSED INLET PROTECTION
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN

## ADA NOTE

PAVEMENT IN A.DA. PARKING AREA TO BE 2% MAXIMUM SLOPE IN ANY DIRECTION

## EROSION CONTROL NOTES

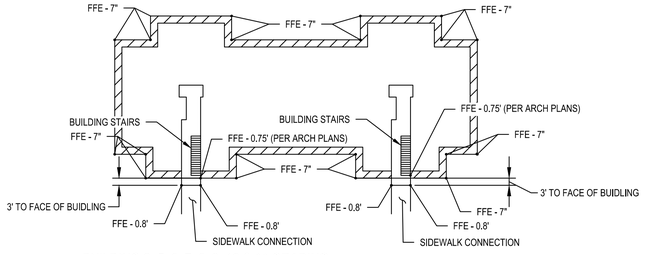
1. PROPOSED SEDIMENT FENCE.
2. PROPOSED INLET PROTECTION.
3. PROPOSED STRAW WATTLE.

## ABBREVIATIONS

| | |
|---|---|
| R | RIM ELEVATION |
| TW | TOP OF WALL ELEVATION |
| FG | FINISH GRADE ELEVATION |
| FFE | FINISH FLOOR ELEVATION |
| (XX.XX) | EXISTING ELEVATION |

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88



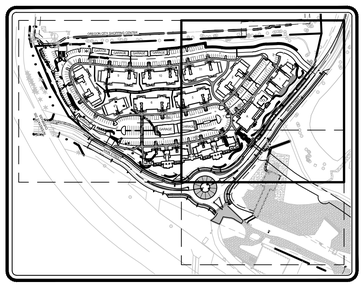

## BUILDING 2, 5, 6, 7, 8, 9, 10 & 11 GRADING

NOT TO SCALE

NOTES:
- FFE = BUILDING FINISH FLOOR ELEVATION
- EXTERIOR BUILDING GRADES TO MATCH ABOVE DETAIL UNLESS NOTED OTHERWISE IN PLAN VIEW.

## CONSTRUCTION NOTES

5. CONSTRUCT LOCK + LOAD WALL.
6. CONSTRUCT ROCKERY WALL.



## KEY MAP

SCALE: NTS

SCALE: 1"=30'

30 15 0 30

DDP SUBMITTAL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# GRADING & EROSION CONTROL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENT R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

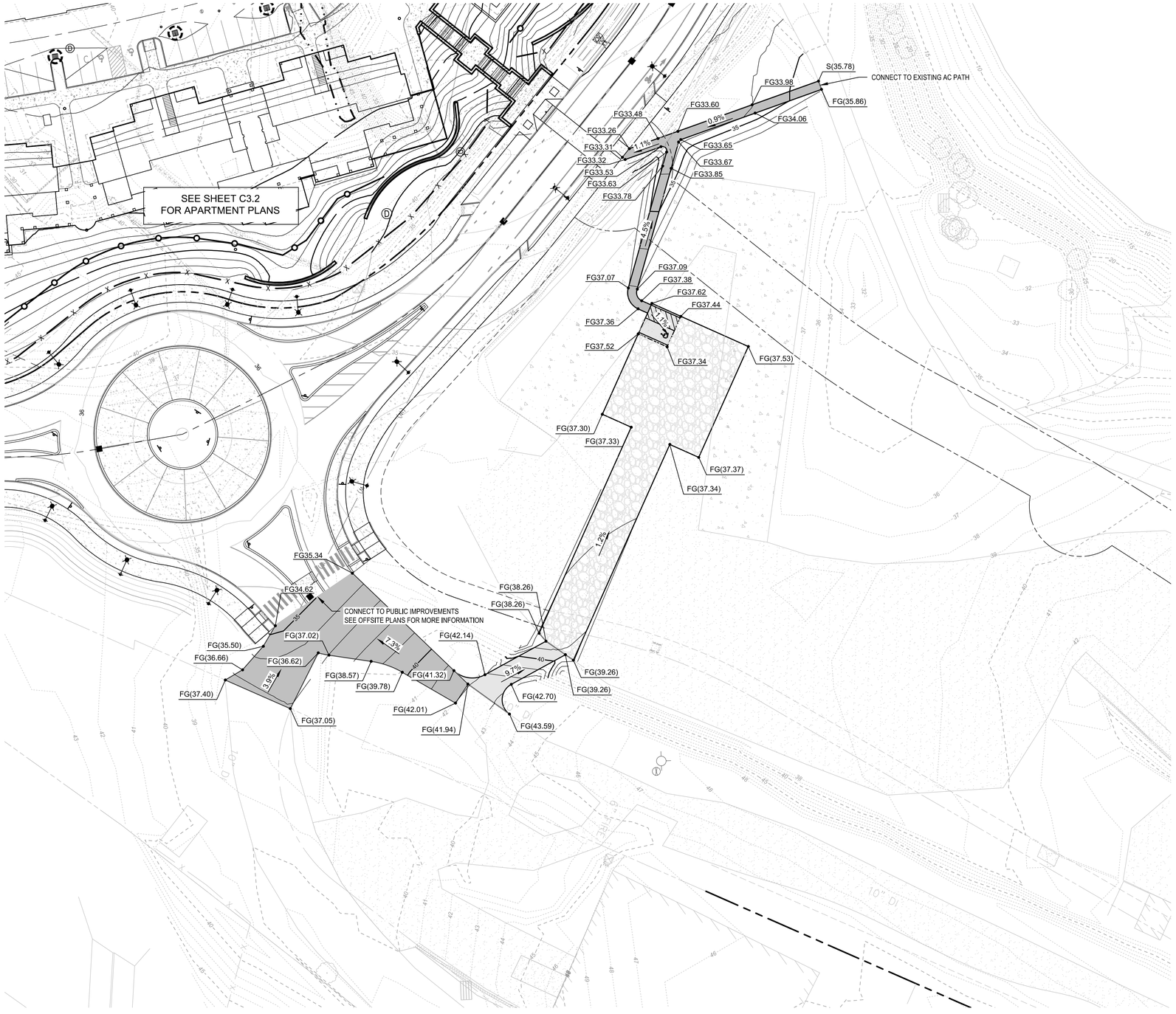
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
GRADING PLAN

SHEET NUMBER
C3.2

LAND USE # —

Plot Stamp: 7/9/2015 3:25:39 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\0922-DD-GRADE.dwg, Tab: C3.2




## LEGEND

- EXISTING PROPERTY LINE
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- PROPOSED 5' CONTOUR
- PROPOSED 1' CONTOUR
- PROPOSED RIDGE LINE
- PROPOSED DITCH LINE
- PROPOSED CURB
- PROPOSED SEDIMENT FENCE
- PROPOSED SEDIMENT FENCE
- PROPOSED INLET PROTECTION
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN
- TREE TO BE REMOVED

## ADA NOTE

PAVEMENT IN A.DA. PARKING AREA TO BE
2% MAXIMUM SLOPE IN ANY DIRECTION

## EROSION CONTROL NOTES

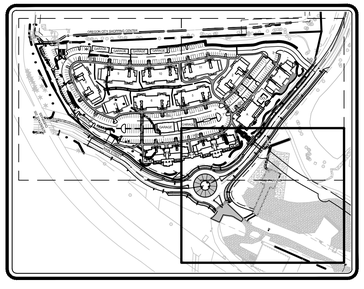
1. PROPOSED SEDIMENT FENCE.
2. PROPOSED INLET PROTECTION.
3. PROPOSED STRAW WATTLE.

## ABBREVIATIONS

| | |
|---|---|
| R | RIM ELEVATION |
| TW | TOP OF WALL ELEVATION |
| FG | FINISH GRADE ELEVATION |
| FFE | FINISH FLOOR ELEVATION |
| (XX.XX) | EXISTING ELEVATION |

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88



KEY MAP
SCALE: NTS

SCALE: 1"=30'
30 15 0 30

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# GRADING PLAN - TEMPORARY PATH & PARKING
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

REGISTERED PROFESSIONAL ENGINEER
OREGON
JANUARY 14, 1994
BRENT R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

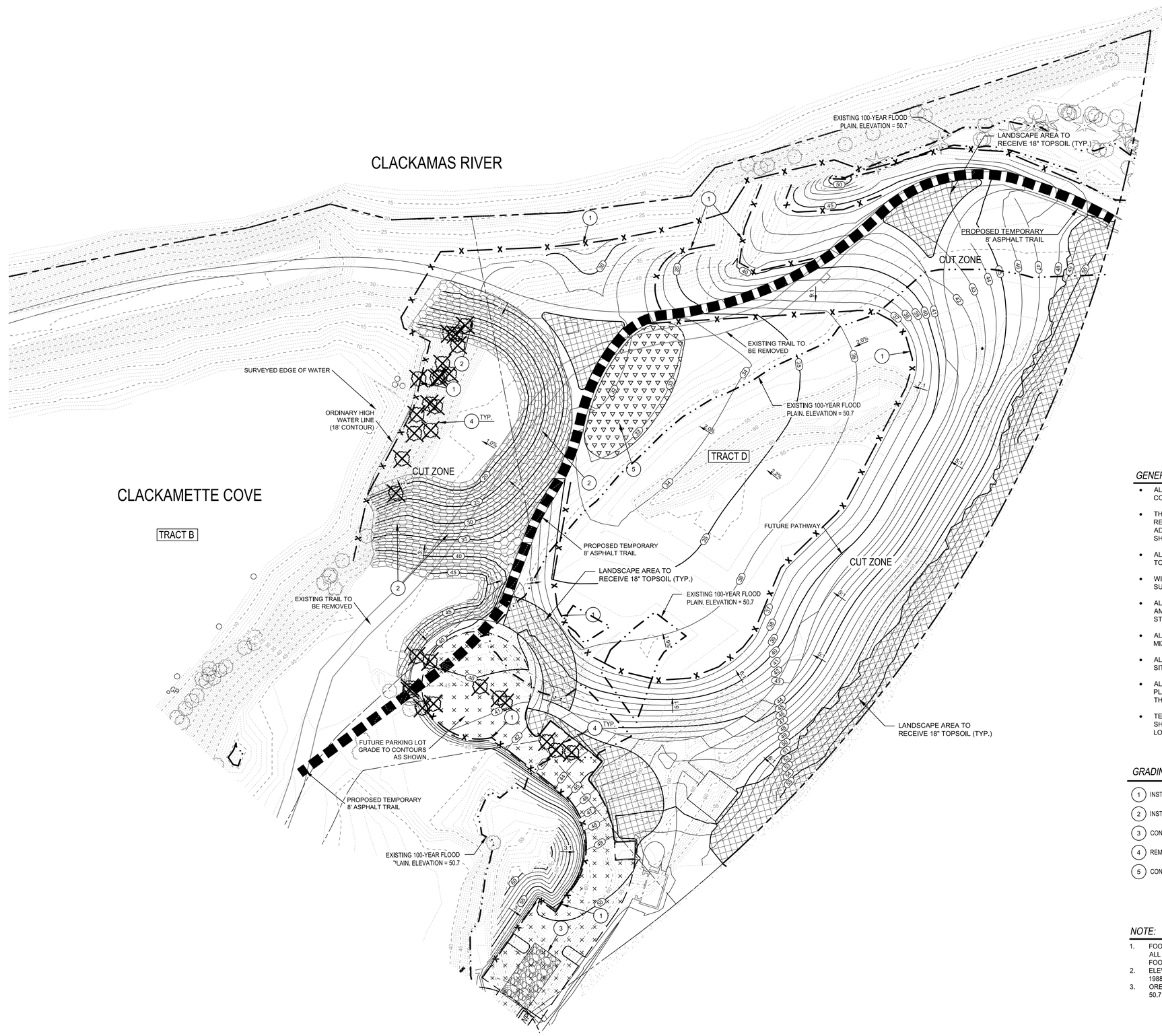
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
GRADING PLAN

SHEET NUMBER
C3.3

LAND USE # —

Plot Stamp: 7/9/2015 3:25:59 PM - Kyle Sidden (Portland)
File: W:\21509220\Civil_DD\0922-DD-GRADE.dwg, Tab: GRADING PLAN




## LEGEND

- PROPERTY BOUNDARY LINE
- 49 - EXISTING MINOR CONTOUR
- 50 - EXISTING MAJOR CONTOUR
- 49 - FINISH GRADE 1 FOOT CONTOUR FOR THIS PHASE OF WORK
- 50 - FINISH GRADE 5 FOOT CONTOUR FOR THIS PHASE OF WORK
- EXISTING TREES
- EXISTING TREES TO BE REMOVED
- PROPOSED SEDIMENT FENCE
- 100-YR FLOODPLAIN BOUNDARY
- PROPOSED 8FT WIDE TEMPORARY ASPHALT TRAIL
- PROPOSED STABILIZED CONSTRUCTION ENTRANCE
- PROPOSED AREA TO RECEIVE 18" TOPSOIL
- PROPOSED SLOPE STABILIZATION MATTING
- AREA NOT TO BE PLACED WITH TOPSOIL
- TEMPORARY SEDIMENT POND

## GENERAL EROSION CONTROL & GRADING NOTES:

- ALL SEDIMENT FENCE TO BE INSTALLED IN AREAS SHOWN AT LEVEL CONTOURS.
- THIS SITE WILL BE SUBJECT TO A ZERO TURBIDITY DISCHARGE REQUIREMENT. CONTRACTORS MUST BE PREPARED TO IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES IF THOSE SHOWN ON THIS PLAN ARE INSUFFICIENT.
- ALL AREAS OUTSIDE OF THE FUTURE PARKING LOT, CONTOURS ARE SHOWN TO FINISH GRADE
- WITH THE FUTURE PARKING LOT AREA, CONTOURS ARE SHOWN TO SUBGRADE
- ALL AREAS OUTSIDE OF THE FUTURE PARKING LOT SHALL RECEIVE 4" AMENDED TOP SOIL EXCEPT AREAS NOTED ON PLAN TO RECEIVE 18". (SITE STRIPPINGS CAN BE REUSED IF AMENDED)
- ALL DISTURBED AREAS SHALL BE HYDROSEEDED WITH EROSION CONTROL MIX AFTER GRADING HAS BEEN COMPLETED
- ALL AREAS SHALL BE GRADED TO ELIMINATE ANY PONDING OF WATER ON SITE.
- ALL FINISH GRADED AREAS TO BE TOPOGRAPHICALLY SURVEYED PRIOR TO PLANTING, PAVING, WINTERIZATION OR ANY FINAL INSPECTIONS TO INSURE THE SITE IS IN COMPLIANCE WITH FLOOD PLAIN BALANCE OF CUT & FILL
- TEMPORARY ASPHALT TRAIL SHALL MEET ADA REQUIREMENTS. TRAIL SHALL HAVE A CROSS SLOPE SHALL NOT EXCEEDING 2% AND A LONGITUDINAL RUNNING SLOPE NOT EXCEEDING 5%

## GRADING & EROSION CONTROL CONSTRUCTION NOTES:

1. INSTALL SEDIMENT FENCE.
2. INSTALL SLOPE STABILIZATION MATTING.
3. CONSTRUCT CONSTRUCTION ENTRANCE.
4. REMOVE EXISTING TREE.
5. CONSTRUCT TEMPORARY SEDIMENT POND.

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88

SCALE: 1"=40'

40 20 0 40

DDP SUBMITTAL

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TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
www.cardno.com

# NORTH PARK GRADING AND EROSION CONTROL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENDAN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

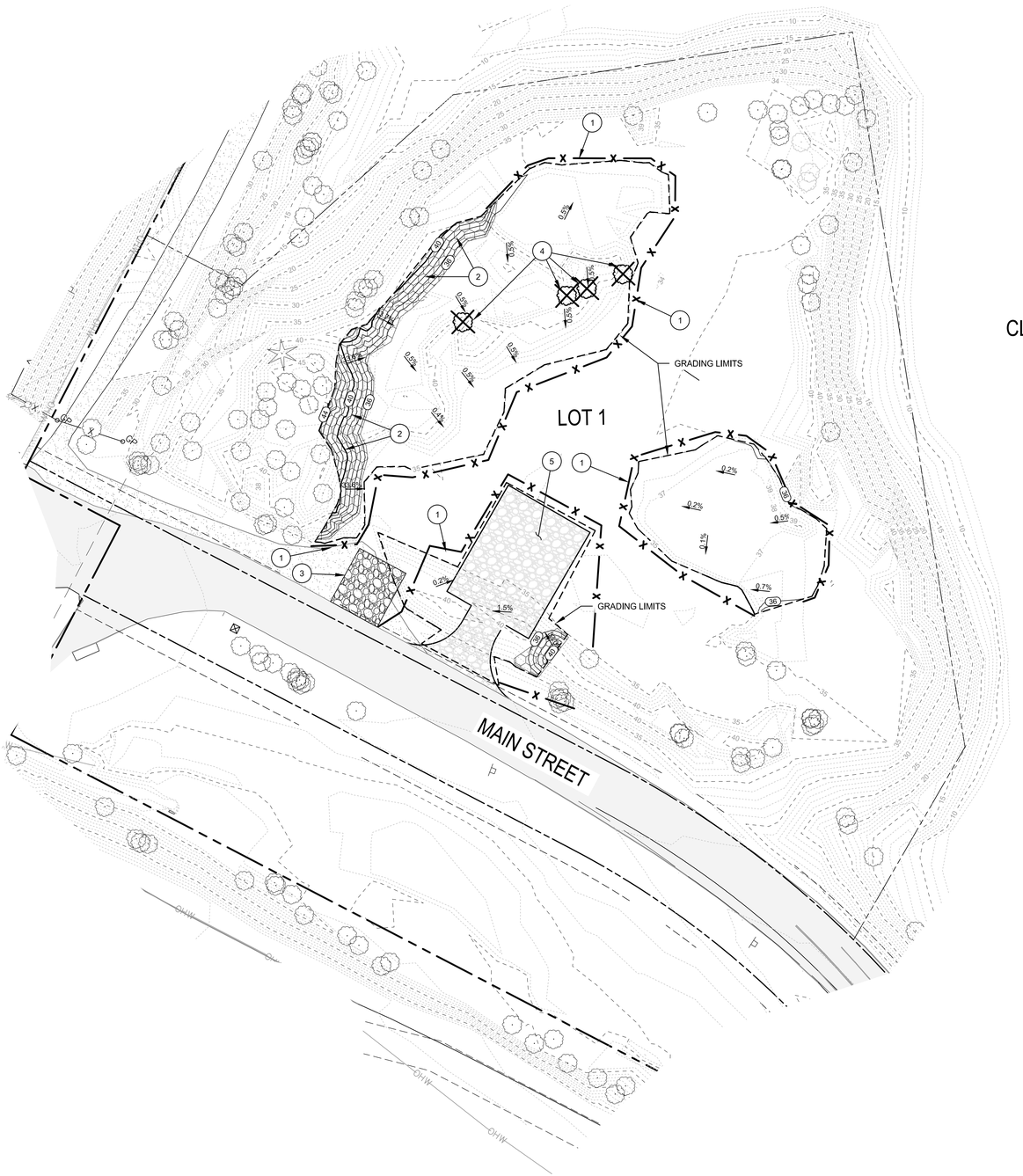
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
NORTH PARK

SHEET NUMBER
C3.4

LAND USE # —

Plot Stamp: 7/9/2015 3:28:41 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_LD\Park Grading\09224D-GRADE-NORTH PARK.dwg, Tab: NORTH PARK GRADING AND EROSION CONTROL PLAN




## LEGEND

- PROPERTY BOUNDARY LINE
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- FINISH GRADE 1 FOOT CONTOUR FOR THIS PHASE OF WORK
- FINISH GRADE 5 FOOT CONTOUR FOR THIS PHASE OF WORK
- GRADING LIMITS
- EXISTING TREES
- PROPOSED SEDIMENT FENCE
- PROPOSED STABILIZED CONSTRUCTION ENTRANCE
- PROPOSED SLOPE STABILIZATION MATTING

## GENERAL EROSION CONTROL & GRADING NOTES:

- ALL SEDIMENT FENCE TO BE INSTALLED IN AREAS SHOWN AT LEVEL CONTOURS.
- THIS SITE WILL BE SUBJECT TO A ZERO TURBIDITY DISCHARGE REQUIREMENT. CONTRACTORS MUST BE PREPARED TO IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES IF THOSE SHOWN ON THIS PLAN ARE INSUFFICIENT.
- ALL DISTURBED AREAS SHALL BE HYDROSEEDED WITH EROSION CONTROL MIX AFTER GRADING HAS BEEN COMPLETED
- ALL AREAS SHALL BE GRADED TO ELIMINATE ANY PONDING OF WATER ON SITE.
- ALL FINISH GRADED AREAS TO BE TOPOGRAPHICALLY SURVEYED PRIOR TO PLANTING, PAVING, WINTERIZATION OR ANY FINAL INSPECTIONS TO INSURE THE SITE IS IN COMPLIANCE WITH FLOOD PLAIN BALANCE OF CUT & FILL

## GRADING & EROSION CONTROL CONSTRUCTION NOTES:

1. INSTALL SEDIMENT FENCE.
2. INSTALL SLOPE STABILIZATION MATTING.
3. CONSTRUCT CONSTRUCTION ENTRANCE.
4. REMOVE EXISTING TREE
5. CONSTRUCT TEMPORARY PARKING

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88

SCALE: 1"=40'

40 20 0 40

DDP SUBMITTAL

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www.cardno.com

# LOT 1 GRADING AND EROSION CONTROL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

PRELIMINARY NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
BRIAN R. WILLIAMS
EXPIRES: 06/30/16

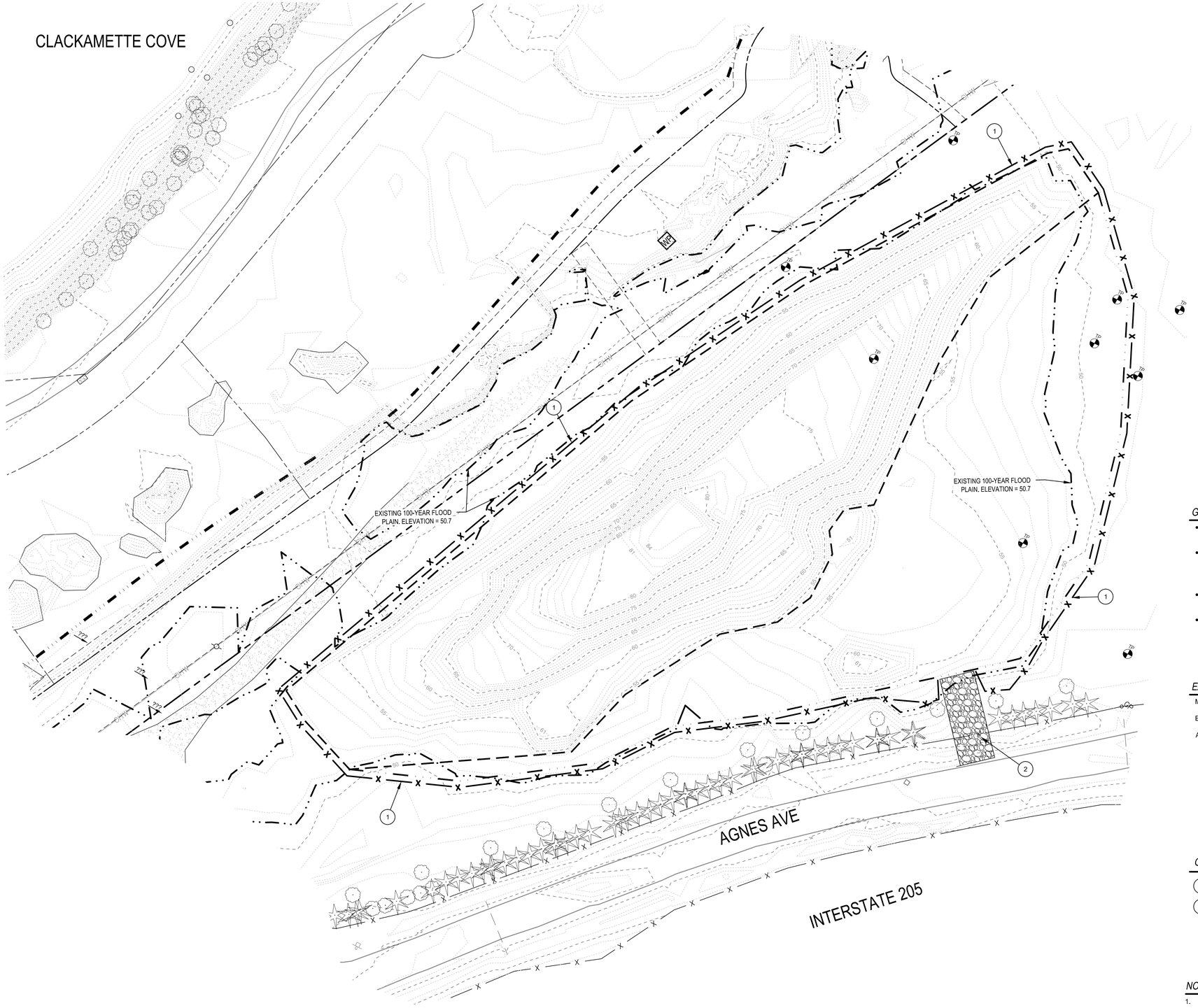
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
LOT 1

SHEET NUMBER
C3.5

LAND USE # —

Plot Stamp: 7/8/2015 3:26:49 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\Park Grading\0922-DD-GRADE-NORTH PARK.dwg, Tab: LOT 1 GRADING AND EROSION CONTROL PLAN




## LEGEND

- PROPERTY BOUNDARY LINE
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- FINISH GRADE 1 FOOT CONTOUR FOR THIS PHASE OF WORK
- FINISH GRADE 5 FOOT CONTOUR FOR THIS PHASE OF WORK
- MAIN STOCK PILE LIMITS
- EXPANDED PILE LIMITS
- 100-YR FLOODPLAIN BOUNDARY
- EXISTING TREES
- PROPOSED SEDIMENT FENCE
- PROPOSED STABILIZED CONSTRUCTION ENTRANCE

## GENERAL EROSION CONTROL & GRADING NOTES:

- ALL SEDIMENT FENCE TO BE INSTALLED IN AREAS SHOWN AT LEVEL CONTOURS.
- THIS SITE WILL BE SUBJECT TO A ZERO TURBIDITY DISCHARGE REQUIREMENT. CONTRACTORS MUST BE PREPARED TO IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES IF THOSE SHOWN ON THIS PLAN ARE INSUFFICIENT.
- ALL DISTURBED AREAS SHALL BE HYDROSEEDED WITH EROSION CONTROL MIX AFTER GRADING HAS BEEN COMPLETED
- ALL AREAS SHALL BE GRADED TO ELIMINATE ANY PONDING OF WATER ON SITE.

## EARTHWORK QUANTITIES

MAIN STOCKPILE VOLUME: +/- 43,600 CY

EXPANDED STOCKPILE VOLUME: +/- 58,075 CY

ANTICIPATED VOLUME TO BE USED: +/- 42,500 CY

## GRADING & EROSION CONTROL CONSTRUCTION NOTES:

1. INSTALL SEDIMENT FENCE.
2. CONSTRUCT CONSTRUCTION ENTRANCE.

## NOTE:

1. FOOTING DRAINS ARE TO BE LOCATED AROUND ALL BUILDINGS AND RETAINING WALLS. TIE FOOTING DRAINS INTO PROPOSED ROOF DRAINS.
2. ELEVATIONS ARE IN NORTH AMERICAN DATUM OF 1988 (NAVD88)
3. OREGON CITY DESIGN FLOOD ELEVATION (DFE) IS 50.7 FEET NAVD88

SCALE: 1"=40'

40 20 0 40

DDP SUBMITTAL

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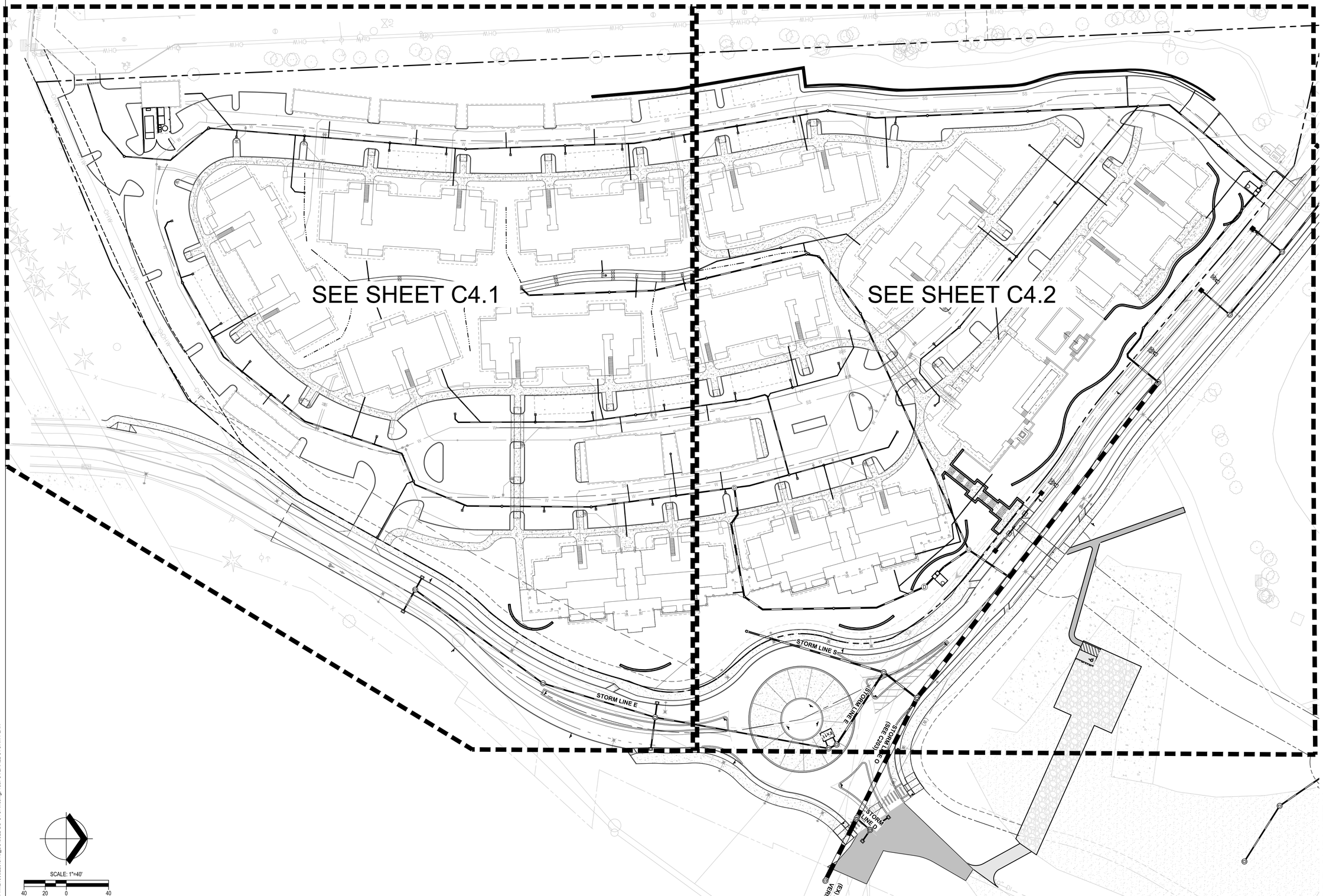
# GRADING PLAN - TRI-CITY STOCKPILE
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENDAN S. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |
| SHEET TITLE | TRI-CITY |
| SHEET NUMBER | C3.6 |
| LAND USE # | --- |

Plot Stamp: 7/9/2015 3:26:56 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\Park Grading\09224DD-GRADE-NORTH PARK.dwg, Tab: GRADING PLAN - TRI-CITY STOCKPILE

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Plot Stamp: 7/9/2015 3:27:54 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\09220-DD-STORM.dwg, Tab: OVERALL STORM PLAN

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# OVERALL STORM PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

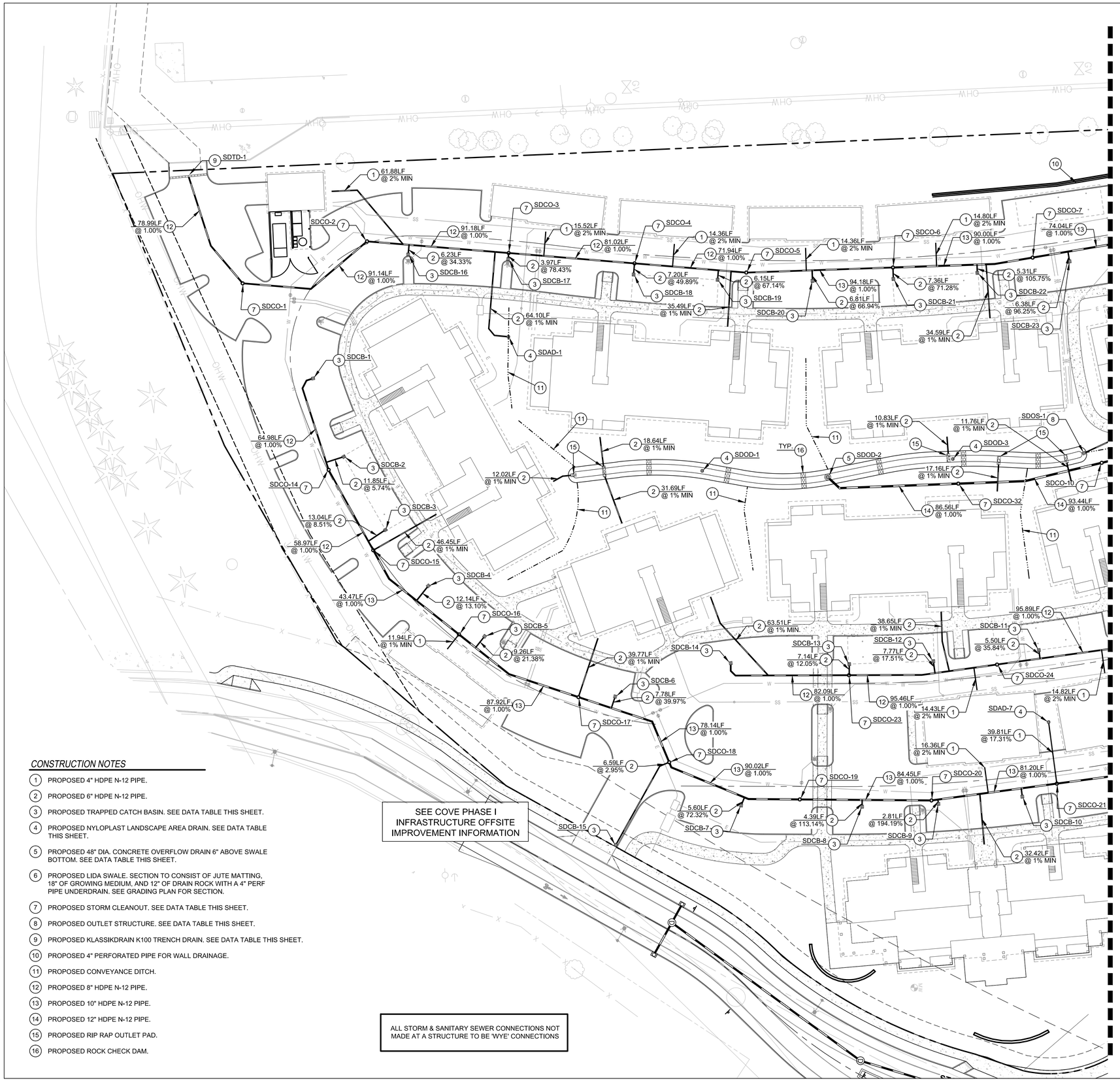
REGISTERED PROFESSIONAL ENGINEER
BRENT R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
OVERALL STORM

SHEET NUMBER
C4.0

LAND USE # —




## CONSTRUCTION NOTES

1. PROPOSED 4" HDPE N-12 PIPE.
2. PROPOSED 6" HDPE N-12 PIPE.
3. PROPOSED TRAPPED CATCH BASIN. SEE DATA TABLE THIS SHEET.
4. PROPOSED NYLOPLAST LANDSCAPE AREA DRAIN. SEE DATA TABLE THIS SHEET.
5. PROPOSED 48" DIA. CONCRETE OVERFLOW DRAIN 6" ABOVE SWALE BOTTOM. SEE DATA TABLE THIS SHEET.
6. PROPOSED LIDA SWALE. SECTION TO CONSIST OF JUTE MATTING, 18" OF GROWING MEDIUM, AND 12" OF DRAIN ROCK WITH A 4" PERF PIPE UNDERDRAIN. SEE GRADING PLAN FOR SECTION.
7. PROPOSED STORM CLEANOUT. SEE DATA TABLE THIS SHEET.
8. PROPOSED OUTLET STRUCTURE. SEE DATA TABLE THIS SHEET.
9. PROPOSED KLASSIKDRAIN K100 TRENCH DRAIN. SEE DATA TABLE THIS SHEET.
10. PROPOSED 4" PERFORATED PIPE FOR WALL DRAINAGE.
11. PROPOSED CONVEYANCE DITCH.
12. PROPOSED 8" HDPE N-12 PIPE.
13. PROPOSED 10" HDPE N-12 PIPE.
14. PROPOSED 12" HDPE N-12 PIPE.
15. PROPOSED RIP RAP OUTLET PAD.
16. PROPOSED ROCK CHECK DAM.

## LEGEND

- EXISTING PROPERTY LINE
- PROPOSED SETBACK LINE
- EXISTING EASEMENT LINE
- PROPOSED WATER LINE
- PROPOSED STORM DRAIN PIPE
- PROPOSED SANITARY PIPE
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING SANITARY MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN
- PROPOSED SWALE OVERFLOW
- PROPOSED STORM CLEANOUT
- PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE VAULT
- PROPOSED WATER METER
- PROPOSED DCVA
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED CONVEYANCE DITCH
- PROPOSED RIP RAP PAD
- PROPOSED ROCK CHECK DAM

## CATCH BASIN DATA

SDCB-1
RIM: 50.71
IE OUT (8"S) = 47.71

SDCB-2
RIM: 50.87
IE OUT (6"S) = 47.87

SDCB-3
RIM: 50.82
IE OUT (6"SE) = 47.82

SDCB-4
RIM: 50.80
IE OUT (6"SE) = 47.80

SDCB-5
RIM: 50.70
IE OUT (6"SE) = 47.70

SDCB-6
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-7
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-8
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-9
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-10
RIM: 50.87
IE OUT (6"W) = 47.87

## CATCH BASIN DATA

SDCB-11
RIM: 50.70
IE OUT (8"E) = 47.70

SDCB-12
RIM: 50.77
IE OUT (6"E) = 47.77

SDCB-13
RIM: 50.83
IE OUT (6"E) = 47.83

SDCB-14
RIM: 50.79
IE OUT (8"E) = 47.79

SDCB-15
RIM: 49.10
IE OUT (6"NW) = 46.10

SDCB-16
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-17
RIM: 51.20
IE OUT (6"W) = 48.20

SDCB-18
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-19
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-20
RIM: 50.70
IE OUT (6"W) = 47.70

## CATCH BASIN DATA

SDCB-21
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-22
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-23
RIM: 50.70
IE OUT (6"W) = 47.70

## AREA DRAIN DATA

SDAD-1
RIM: 51.00
IE OUT (6"S) = 48.00

SDAD-7
RIM: 51.62
IE OUT (4"E) = 48.62

## OVERFLOW DRAIN DATA

SDOD-1
RIM: 49.64
IE IN (4"N) = 47.14
IE OUT (4"S) = 47.14

SDOD-2
RIM: 49.24
IE IN (4"N) = 46.74
IE IN (4"S) = 46.74
IE OUT (12"NE) = 46.74

SDOD-3
RIM: 49.63
IE IN (4"N) = 47.13
IE OUT (4"S) = 47.13

## OUTLET STRUCTURE DATA

SDOS-1
RIM: 49.91
IE IN (6"NW) = 47.52

## TRENCH DRAIN DATA

SDTD-1
RIM: 49.93
IE OUT (6"E) = 47.70

## CLEANOUT DATA

SDCO-1
RIM = 52.48'
IE (8") = 46.91'

SDCO-2
RIM = 51.43'
IE (8") = 46.00'

SDCO-3
RIM = 51.37'
IE (8") = 45.09'

SDCO-4
RIM = 51.17'
IE (8") = 44.28'

SDCO-5
RIM = 51.35'
IE (8") = 43.56'

SDCO-6
RIM = 51.18'
IE (10") = 42.62'

SDCO-7
RIM = 51.17'
IE (10") = 41.72'

SDCO-10
RIM = 51.28'
IE (12") = 44.94'

SDCO-14
RIM = 51.36'
IE (8") = 47.06'

SDCO-15
RIM = 51.47'
IE (10") = 46.47'

## CLEANOUT DATA

SDCO-16
RIM = 51.24'
IE (10") = 45.69'

SDCO-17
RIM = 51.39'
IE (10") = 44.81'

SDCO-18
RIM = 51.26'
IE (10") = 44.03'

SDCO-19
RIM = 51.37'
IE (10") = 43.13'

SDCO-20
RIM = 51.06'
IE (10") = 42.29'

SDCO-21
RIM = 51.32'
IE (10") = 41.48'

SDCO-23
RIM = 51.20'
IE (8") = 46.97'

SDCO-24
RIM = 51.21'
IE (8") = 46.01'

SDCO-32
RIM = 51.09'
IE (12") = 45.88'

SCALE: 1"=30'
30 15 0 30

DDP SUBMITTAL

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PORTLAND
5415 SW WESTGATE DR, STE 100, PORTLAND, OR 97221
TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
www.cardno.com

# STORM PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BRENT R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

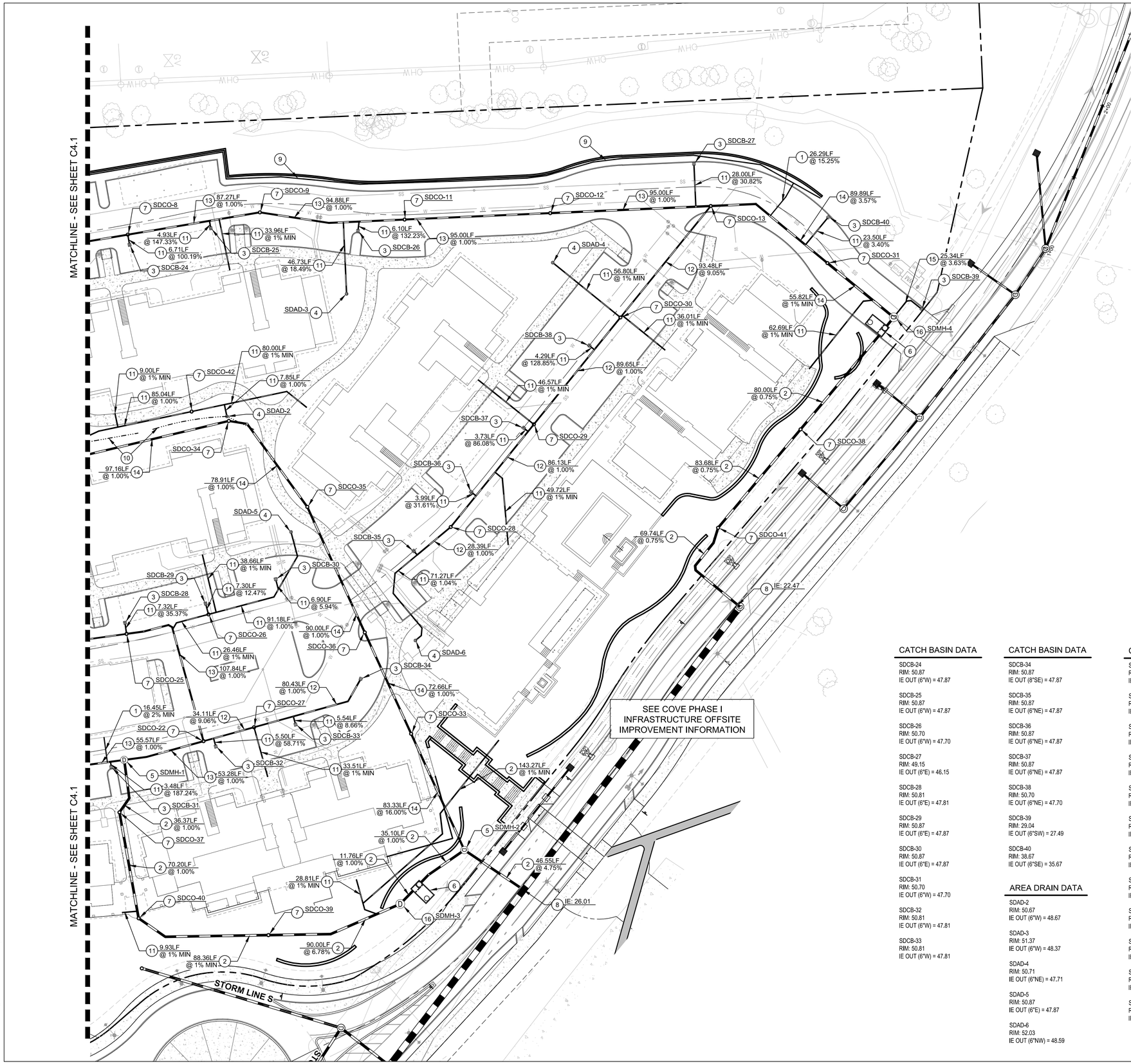
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
STORM PLAN

SHEET NUMBER
C4.1

LAND USE # —

Plot Stamp: 7/9/2015 3:28:13 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\09222-DD-STORM.dwg, Tab: C4.1




## LEGEND

- EXISTING PROPERTY LINE
- PROPOSED SETBACK LINE
- EXISTING EASEMENT LINE
- PROPOSED WATER LINE
- PROPOSED STORM DRAIN PIPE
- PROPOSED SANITARY PIPE
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING SANITARY MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN
- PROPOSED STORM CLEANOUT
- PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE VAULT
- PROPOSED WATER METER
- PROPOSED DCVA
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED CONVEYANCE DITCH

ALL STORM & SANITARY SEWER CONNECTIONS NOT MADE AT A STRUCTURE TO BE 'WYE' CONNECTIONS

## CONSTRUCTION NOTES

1. PROPOSED 4" HDPE N-12 PIPE.
2. PROPOSED 15" HDPE N-12 PIPE.
3. PROPOSED TRAPPED CATCH BASIN. SEE DATA TABLE THIS SHEET.
4. PROPOSED NYLOPLAST LANDSCAPE AREA DRAIN. SEE DATA TABLE THIS SHEET.
5. PROPOSED 48" MANHOLE. SEE DATA TABLE THIS SHEET.
6. PROPOSED 8' X 14' PEAK DIVERSION STORMFILTER TREATMENT VAULT.
7. PROPOSED STORM CLEANOUT. SEE DATA TABLE THIS SHEET.
8. CONNECT TO STORMLINE INSTALLED AS PART OF PUBLIC IMPROVEMENTS.
9. PROPOSED 4" PERFORATED PIPE FOR WALL DRAINAGE.
10. PROPOSED CONVEYANCE DITCH.
11. PROPOSED 6" HDPE N-12 PIPE.
12. PROPOSED 8" HDPE N-12 PIPE.
13. PROPOSED 10" HDPE N-12 PIPE.
14. PROPOSED 12" HDPE N-12 PIPE.
15. PROPOSED 6" HDPE C900 PIPE.
16. PROPOSED 60" SEDIMENTATION MANHOLE. SEE DATA TABLE THIS SHEET.

## CATCH BASIN DATA

SDCB-24
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-25
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-26
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-27
RIM: 49.15
IE OUT (6"E) = 46.15

SDCB-28
RIM: 50.81
IE OUT (6"E) = 47.81

SDCB-29
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-30
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-31
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-32
RIM: 50.81
IE OUT (6"W) = 47.81

SDCB-33
RIM: 50.81
IE OUT (6"W) = 47.81

## CATCH BASIN DATA

SDCB-34
RIM: 50.87
IE OUT (8"SE) = 47.87

SDCB-35
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-36
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-37
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-38
RIM: 50.70
IE OUT (6"NE) = 47.70

SDCB-39
RIM: 29.04
IE OUT (6"SW) = 27.49

SDCB-40
RIM: 38.67
IE OUT (6"SE) = 35.67

## AREA DRAIN DATA

SDAD-2
RIM: 50.67
IE OUT (6"W) = 48.67

SDAD-3
RIM: 51.37
IE OUT (6"W) = 48.37

SDAD-4
RIM: 50.71
IE OUT (6"NE) = 47.71

SDAD-5
RIM: 50.87
IE OUT (6"E) = 47.87

SDAD-6
RIM: 52.03
IE OUT (6"NW) = 48.59

## CLEANOUT DATA

SDCO-8
RIM = 51.08'
IE (10") = 40.98'

SDCO-9
RIM = 51.38'
IE (10") = 40.11'

SDCO-11
RIM = 51.21'
IE (10") = 39.17'

SDCO-12
RIM = 50.26'
IE (12") = 38.22'

SDCO-13
RIM = 49.51'
IE (12") = 37.17'

SDCO-22
RIM = 51.09'
IE (10") = 43.97'

SDCO-25
RIM = 51.15'
IE (10") = 45.05'

SDCO-26
RIM = 51.06'
IE (6") = 46.96'

SDCO-27
RIM = 51.18'
IE (8") = 47.06'

SDCO-28
RIM = 51.21'
IE (8") = 47.56'

SDCO-29
RIM = 51.05'
IE (8") = 46.70'

SDCO-30
RIM = 51.06'
IE (8") = 45.80'

## CLEANOUT DATA

SDCO-31
RIM = 37.97'
IE (15") = 33.96'

SDCO-33
RIM = 52.29'
IE (12") = 41.55'

SDCO-34
RIM = 50.93'
IE (12") = 43.97'

SDCO-35
RIM = 51.87'
IE (12") = 43.18'

SDCO-36
RIM = 52.08'
IE (12") = 42.28'

SDCO-37
RIM = 51.90'
IE (15") = 40.56'

SDCO-38
RIM = 33.05'
IE (15") = 23.62'

SDCO-39
RIM = 40.40'
IE (15") = 37.10'

SDCO-40
RIM = 44.98'
IE (15") = 39.86'

SDCO-41
RIM = 34.06'
IE (15") = 22.99'

SDCO-42
RIM = 51.60'
IE (6") = 48.37'

## MANHOLE DATA

SDMH-1
RIM: 50.99
IE IN (10"N) = 43.43
IE IN (10"S) = 40.92
IE OUT (15"E) = 40.92

SDMH-2
RIM: 34.80
IE IN (12"SW) = 28.22
IE IN (15"SE) = 28.22
IE OUT (15"NE) = 28.22

SDMH-3
RIM: 35.16
IE IN (15"SE) = 31.00
IE OUT (15"NW) = 31.00

SDMH-4
RIM: 30.91
IE IN (6"NW) = 26.57
IE IN (15"SW) = 26.57
IE OUT (15"SE) = 26.57

SCALE: 1"=30'

30 15 0 30

DDP SUBMITTAL

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# STORM PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
REGINALD B. WILLIAMS
EXPIRES: 06/30/16

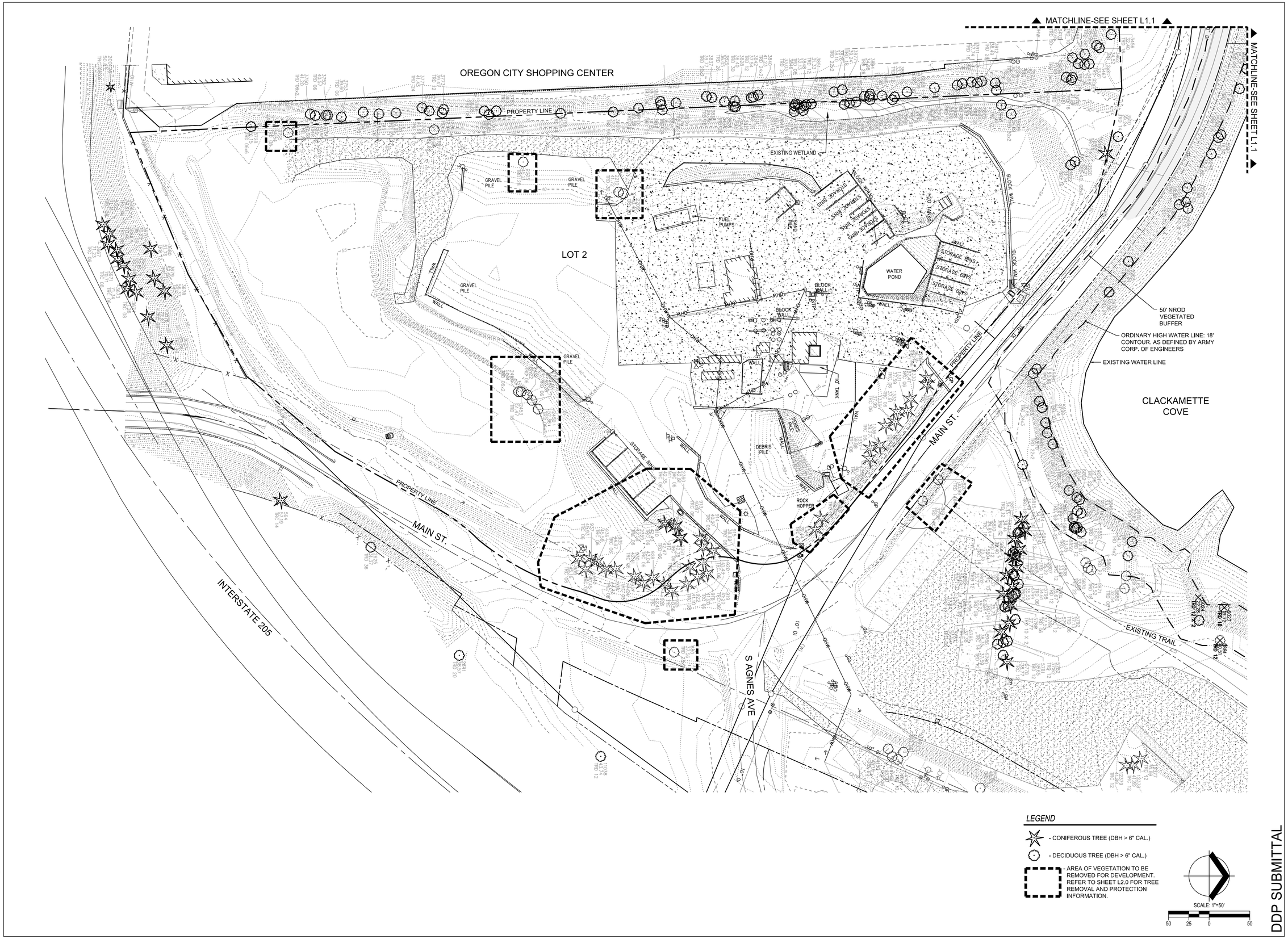
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
STORM PLAN

SHEET NUMBER
C4.2

LAND USE # —

Plot Stamp: 7/8/2015 3:28:33 PM - Kyle Glidden (Portland)
File: W:\21509220\Civil_DD\09224-DD-STORM.dwg Tab: C2.1




## LEGEND

- CONIFEROUS TREE (DBH > 6" CAL.)
- DECIDUOUS TREE (DBH > 6" CAL.)
- AREA OF VEGETATION TO BE REMOVED FOR DEVELOPMENT. REFER TO SHEET L2.0 FOR TREE REMOVAL AND PROTECTION INFORMATION.

SCALE: 1"=50'

50 25 0 50

DDP SUBMITTAL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www.cardno.com


# EXISTING VEGETATION PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
PATRICK E. GEORGE
OREGON
02/23/11
EXPIRES 05/31/16

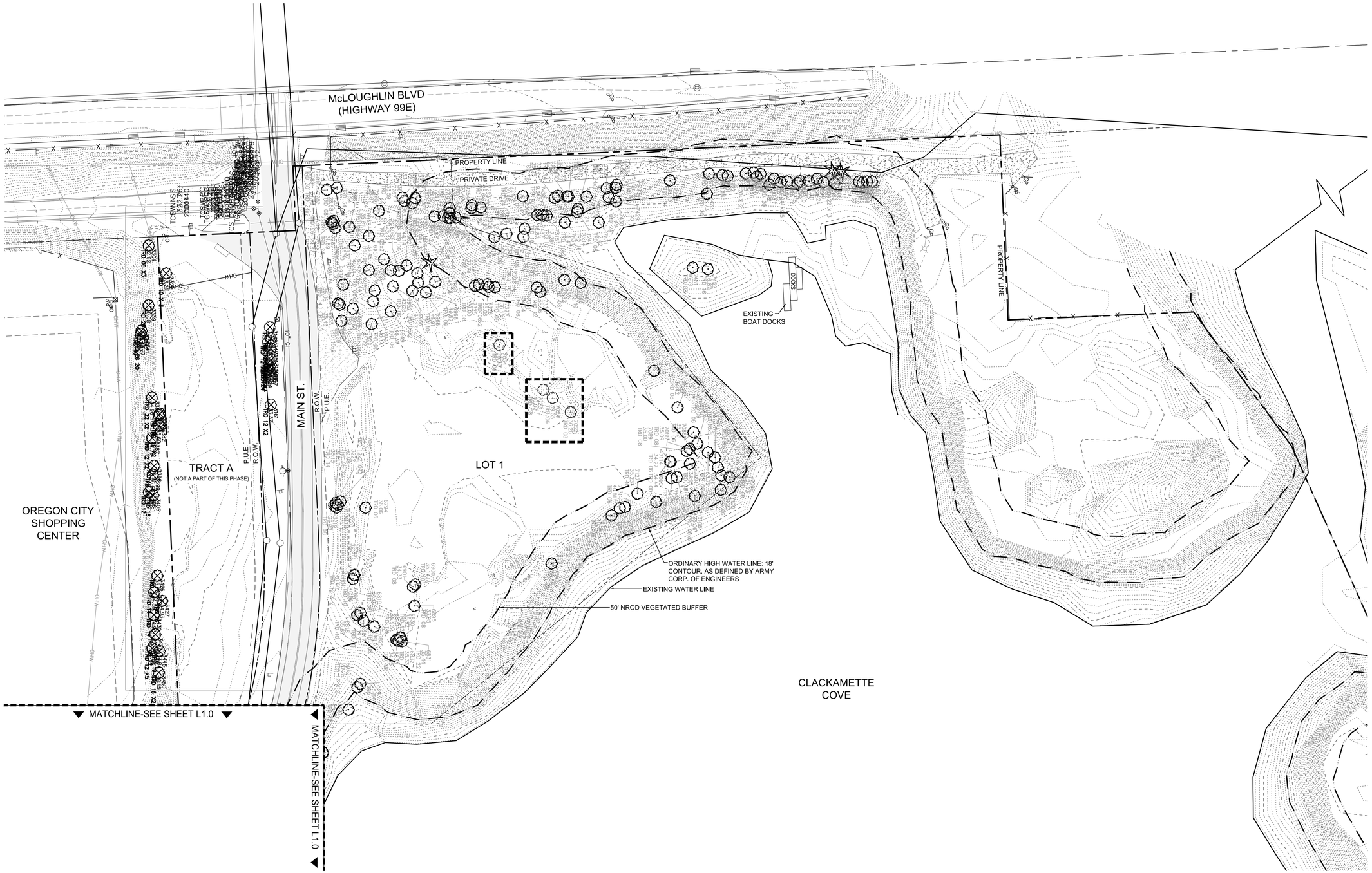
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
EX. VEGETATION PLAN

SHEET NUMBER
L1.0

LAND USE # —


Plot Stamp: 7/9/2015 3:32:17 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN A - EXISTING.dwg Tab: L1.0




*LEGEND*

- CONIFEROUS TREE (DBH > 6" CAL.)
- DECIDUOUS TREE (DBH > 6" CAL.)
- AREA OF VEGETATION TO BE REMOVED FOR DEVELOPMENT. REFER TO SHEET L2.0 FOR TREE REMOVAL AND PROTECTION INFORMATION.

SCALE: 1"=50'

50 25 0 50

DDP SUBMITTAL

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# EXISTING VEGETATION PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

REGISTERED LANDSCAPE ARCHITECT
PRELIMINARY NOT FOR CONSTRUCTION
BRIAN PATTON
OREGON
09/29/11
EXPIRES 05/31/16

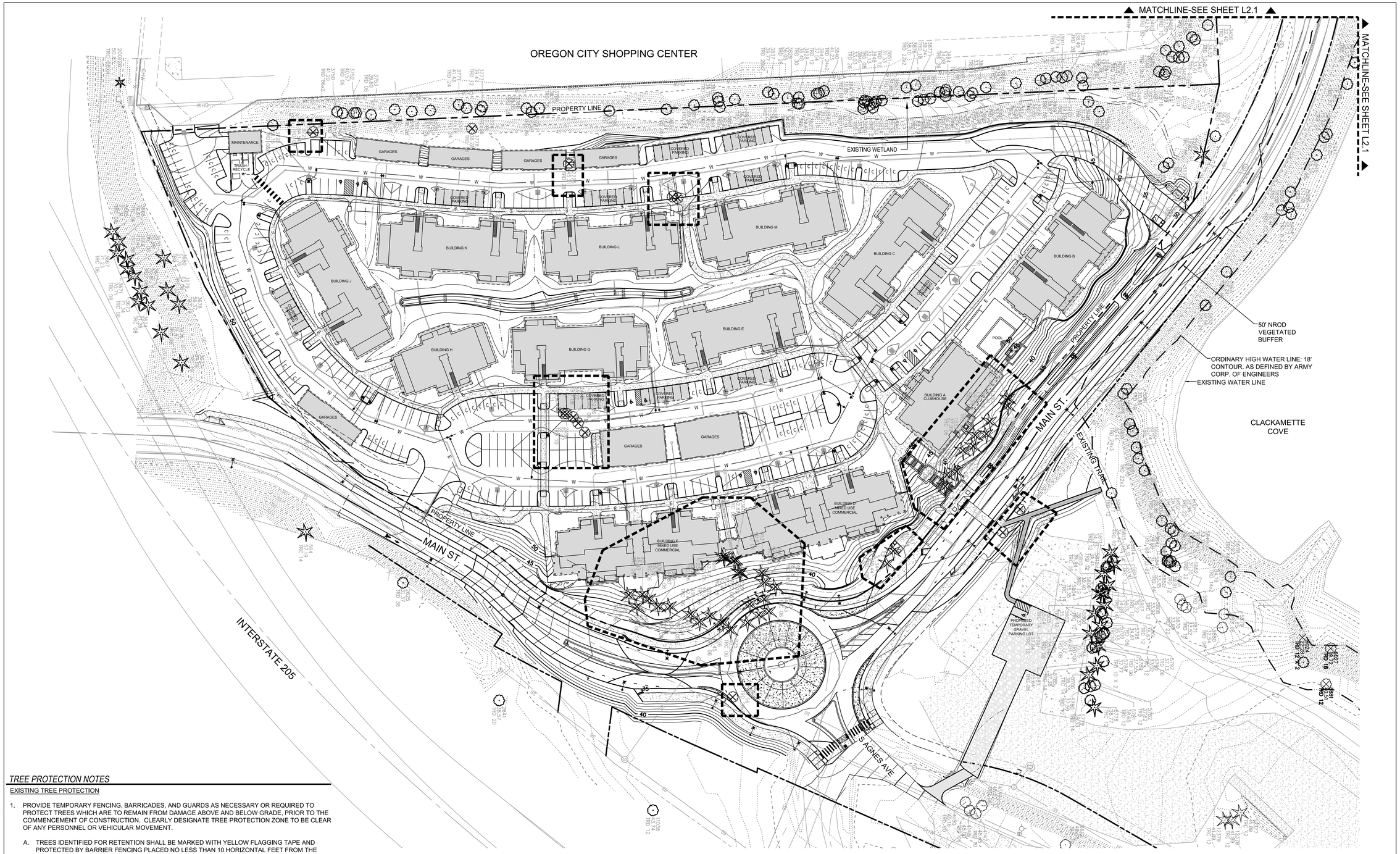
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
EX. VEGETATION PLAN

SHEET NUMBER
L1.1

LAND USE # —

Plot Stamp: 7/9/2015 3:32:22 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN A - EXISTING.dwg, Tab: L1.1




## TREE PROTECTION NOTES

EXISTING TREE PROTECTION

1. PROVIDE TEMPORARY FENCING, BARRICADES, AND GUARDS AS NECESSARY OR REQUIRED TO PROTECT TREES WHICH ARE TO REMAIN FROM DAMAGE ABOVE AND BELOW GRADE, PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CLEARLY DESIGNATE TREE PROTECTION ZONE TO BE CLEAR OF ANY PERSONNEL OR VEHICULAR MOVEMENT.

   A. TREES IDENTIFIED FOR RETENTION SHALL BE MARKED WITH YELLOW FLAGGING TAPE AND PROTECTED BY BARRIER FENCING PLACED NO LESS THAN 10 HORIZONTAL FEET FROM THE OUTSIDE EDGE OF THE TRUNK IN ALL DIRECTIONS OR BENEATH THE TREE DRIPLINE, WHICHEVER IS GREATER. CLUSTERS OF TREES MAY BE PROTECTED BY CONTINUOUS FENCING FOLLOWING THE SAME GUIDELINES.

   B. REQUIRED FENCING SHALL BE A MINIMUM OF SIX FEET TALL, SUPPORTED WITH METAL POSTS PLACED NO FARTHER THAN 10 FEET ON CENTER, SET 24 INCHES (MIN.) INTO GRADE (AVOID DAMAGING ROOTS). FENCING FABRIC SHALL BE CHAIN-LINK OR RED VINYL MESH, AND SHOULD BE INSTALLED FLUSH WITH THE INITIAL UNDISTURBED GRADE. SECURE TOP AND BOTTOM OF FENCING WITH TENSION WIRE SECURED TO POSTS.

   C. NO CONSTRUCTION ACTIVITY SHALL OCCUR WITHIN THE TREE PROTECTION ZONE, INCLUDING, BUT NOT LIMITED TO, DUMPING OR STORAGE OF MATERIALS SUCH AS BUILDING SUPPLIES, SOIL WASTE ITEMS, EQUIPMENT, OR PARKED VEHICLES.

2. PROTECT ROOT SYSTEMS OF TREES TO REMAIN FROM FLOODING, EROSION, OR EXCESSIVE WETTING RESULTING FROM DEWATERING OPERATIONS AND COMPACTION. DO NOT STORE CONSTRUCTION MATERIALS OR PERMIT VEHICLES TO DRIVE OR PARK WITHIN THE DRIP LINE AREA OF ANY TREE TO REMAIN. PROTECT ALL PLANT GROWTH, INCLUDING ROOT SYSTEMS OF TREES, FROM THE DUMPING OF REFUSE OR CHEMICALLY INJURIOUS MATERIAL OR LIQUIDS, AND CONTINUAL PUDDLING OF RUNNING WATER. PROTECT AGAINST UNAUTHORIZED CUTTING, BREAKING, OR SKINNING OF ROOTS AND BRANCHES, SKINNING, AND BRUISING OF BARK. DO NOT ALLOW FIRES ON SITE.

3. MAINTAIN PROTECTION FEATURES THROUGHOUT THE CONSTRUCTION PROCESS. IMMEDIATELY REPAIR ANY ALTERATION TO PROTECTION MEASURES BY CONSTRUCTION PROCESS. AFFECT ALTERATIONS TO PROTECTION MEASURES IMMEDIATELY UPON DIRECTION OF OWNER'S REPRESENTATIVE. MONITOR MAINTENANCE MEASURES DAILY.

4. DO NOT CHANGE THE EXISTING GRADE BENEATH DRIPLINE OF TREES TO REMAIN.

5. ALL EXCAVATION REQUIRED TO OCCUR WITHIN THE DRIPLINE OF ANY EXISTING TREE SHALL BE RESTRICTED TO MANUAL LABOR. THE USE OF TRENCHERS, AUGERS, BACKHOES, TRACTORS OR ANY OTHER TYPE OF MACHINERY/POWER EQUIPMENT IS PROHIBITED.

PRUNING OF EXISTING TREES:

1. WHERE PRUNING APPEARS NECESSARY, REVIEW CONDITIONS WITH ARBORIST OR OWNER'S REPRESENTATIVE BEFORE PROCEEDING AND COMPLY WITH HIS/HER DIRECTIVES. ALL TREE PRUNING OR ROOT CUTTING SHALL BE PERFORMED WITH STERILE SHARP PRUNING INSTRUMENTS; DO NOT BREAK, CHOP OR TEAR. ALL ROOTS 2 INCHES IN DIAMETER OR GREATER THAT REQUIRE PRUNING, SHALL BE DONE BY A STATE-CERTIFIED ARBORIST. NO PRUNING SHALL OCCUR WITHOUT THE EXPLICIT APPROVAL OF THE ARBORIST OR OWNER'S REPRESENTATIVE.

## TREE REMOVAL TOTALS

(52) EXISTING TREES TO BE REMOVED.
(2) ONSITE TREES ARE LESS THAN 6" DBH.

OFFSITE:
(10) EXISTING TREES TO BE REMOVED TOTALING (198) CALIPER INCHES.

LOT 1:
(4) EXISTING TREES TO BE REMOVED TOTALING (28) CALIPER INCHES.
REFER TO SHEET L2.1 FOR LOT 1 TREE LOCATIONS.

ONSITE:
(38) EXISTING TREES TO BE REMOVED TOTALING (328) CALIPER INCHES.

*TREE MITIGATION IS ONLY REQUIRED IN LOT 1 FOR THE (4) EXISTING TREES LOCATED OUTSIDE OF THE NATURAL RESOURCE OVERLAY DISTRICT (NROD) VEGETATED BUFFER. THESE REQUIRED MITIGATION TREES WILL BE INSTALLED DURING THE CONSTRUCTION OF LOT 1 IN PHASE 4. ALL OTHER TREES DO NOT REQUIRE MITIGATION PER CONDITION OF APPROVAL #13 FOUND WITHIN LAND USE DECISION FILE # CP 08-05 / DP 08-13, DATED 01/26/09.*

## TREES TO BE REMOVED

*TREE ID TAG # - TREE DBH*

| OFFSITE: | ONSITE: | | |
|---|---|---|---|
| 680 - 28x2 | 910 - 6 | 1326 - 6 | 2359 - 6 |
| 819 - 14x3 | 911 - 6 | 1327 - 6 | 2360 - 6 |
| 820 - 14x4 | 912 - 6 | 1330 - 6 | 2361 - 6 |
| 918 - 6 | 913 - 6 | 1331 - 6 | 2450 - 6x3 |
| 919 - 6 | *914 - 5* | 1332 - 6 | 2451 - 6 |
| 920 - 6 | 915 - 6 | 1333 - 6 | 2452 - 6 |
| 921 - 6 | 928 - 6 | 1335 - 6 | 2453 - 10 |
| 922 - 8 | 930 - 6 | 1336 - 6 | 2454 - 6x2 |
| 925 - 6 | *931 - 5* | 1337 - 6 | 3725 - 8 |
| 926 - 6 | 934 - 6 | 1338 - 6 | 3778 - 18 |
| | 935 - 6 | 1343 - 8 | |
| LOT 1: | 936 - 6 | 1344 - 8 | |
| 7023 - 8 | 937 - 6 | 2209 - 20 | |
| 7024 - 6 | 939 - 6 | 2210 - 30 | |
| 7034 - 6 | 940 - 6 | 2225 - 28 | |
| 7052 - 8 | | | |

## LEGEND

- CONIFEROUS TREE (DBH > 6" CAL.) TREE TO REMAIN
- DECIDUOUS TREE (DBH > 6" CAL.) TREE TO REMAIN
- CONIFEROUS TREE (DBH > 6" CAL.) TREE TO BE REMOVED
- DECIDUOUS TREE (DBH > 6" CAL.) TREE TO BE REMOVED
- AREA OF VEGETATION TO BE REMOVED FOR DEVELOPMENT.

SCALE: 1"=50'
50 25 0 50

DDP SUBMITTAL

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TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
www.cardno.com

# TREE REMOVAL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
PATRICK J. TAYLOR
OREGON
06/26/11
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES 05/31/16

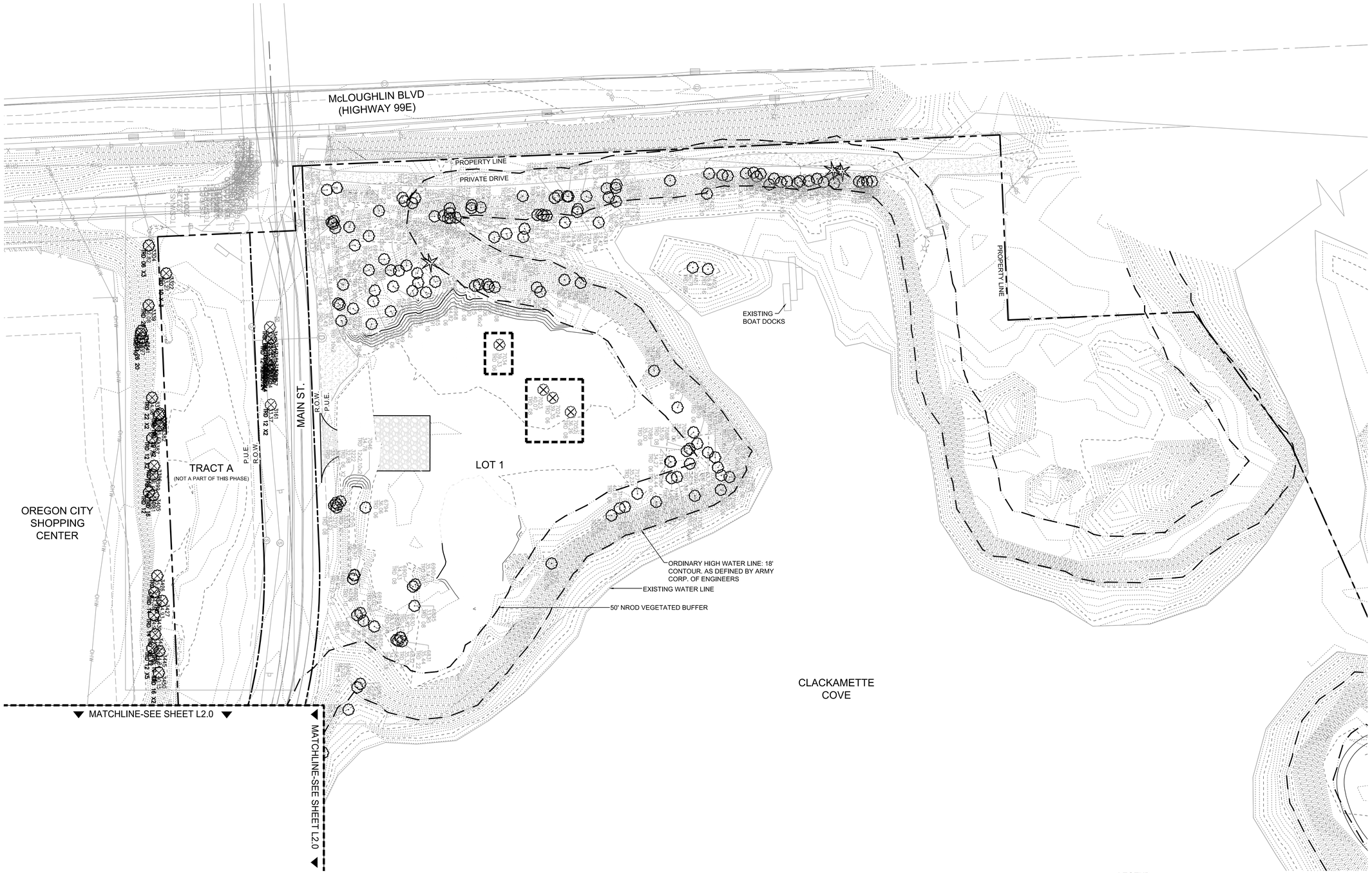
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
TREE REMOVAL PLAN

SHEET NUMBER
L2.0

LAND USE # —

Plot Stamp: 7/9/2015 3:33:21 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN B - TREE REMOVAL.dwg, Tab: L2.0




*LEGEND*

- CONIFEROUS TREE (DBH > 6" CAL.) TREE TO REMAIN
- DECIDUOUS TREE (DBH > 6" CAL.) TREE TO REMAIN
- CONIFEROUS TREE (DBH > 6" CAL.) TREE TO BE REMOVED
- DECIDUOUS TREE (DBH > 6" CAL.) TREE TO BE REMOVED
- AREA OF VEGETATION TO BE REMOVED FOR DEVELOPMENT.

REFER TO SHEET L2.0 FOR TREE REMOVAL SUMMARY AND TREE PROTECTION NOTES.

SCALE: 1"=50'

50 25 0 50

DDP SUBMITTAL

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www.cardno.com

# TREE REMOVAL PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
PRELIMINARY NOT FOR CONSTRUCTION
BRIAN W. PAYNE
OREGON
06/26/11
EXPIRES 05/31/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
TREE REMOVAL PLAN

SHEET NUMBER
L2.1

LAND USE # —

Plot Stamp: 7/9/2015 3:33:31 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN B - TREE REMOVAL.dwg, Tab: L2.1

REFER TO SHEET L3.1 AND L3.2 FOR PLANTING LEGEND.
QUANTITIES IN LEGEND ARE FOR ALL SHEETS.
REFER TO SHEET L5.0 FOR PLANTING DETAILS AND NOTES.

N

0 15 30 60 120

DDP SUBMITTAL

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# OFFSITE PLANTING PLAN - OVERALL
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| | DATE | DESCRIPTION | BY |
|---|---|---|---|
| A | | | |

REGISTERED LANDSCAPE ARCHITECT
BRIAN WAYNE PEGG
OREGON
03/23/11
EXPIRES 05/31/16

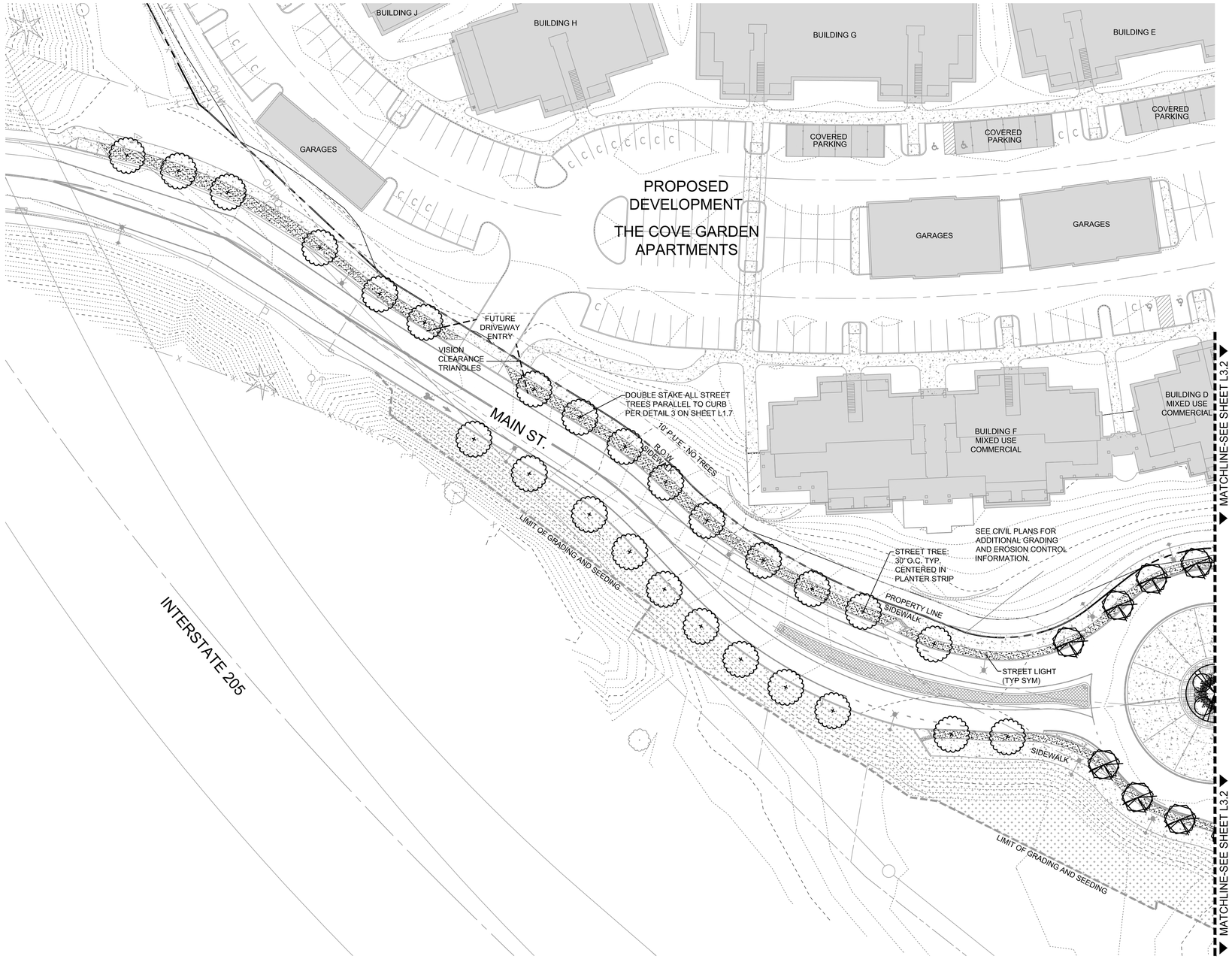
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
OFF PLANT - OVERALL

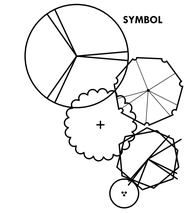
SHEET NUMBER
L3.0

LAND USE # —

Plot Stamp: 7/9/2015 3:34:08 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN D - OFFSITE PLANTING PLAN.dwg, Tab: L3.0




## OFFSITE STREETSCAPE PLANT MATERIAL SCHEDULE




**TREES**

| ITEM | SIZE | QTY. |
|---|---|---|
| *ABIES GRANDIS* GRAND FIR | 6' HT. / B&B AS SHOWN | 1 |
| *ALNUS RUBRA* RED ALDER | 2" CAL. / B&B AS SHOWN | 11 |
| *ACER RUBRUM 'AUTUMN FLAME'* AUTUMN FLAME RED MAPLE | 2" CAL. / B&B AS SHOWN | 27 |
| *ACER GRISEUM* PAPERBARK MAPLE | 2" CAL. / B&B AS SHOWN | 10 |
| *ACER CIRCINATUM* VINE MAPLE | 2 GAL. MULTI-STEM | 4 |

SYMBOL

**SHRUBS & ACCENTS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *MAHONIA AQUIFOLIUM* TALL OREGON GRAPE | 1 GAL. 4'-0" O.C. | 47 |
| *SYMPHORICARPOS ALBA* COMMON SNOWBERRY | 1 GAL. 4'-0" O.C. | 29 |
| *ROSA NOOTKANA* NOOTKA ROSE | 1 GAL. 5'-0" O.C. | 32 |
| *POLYSTICHUM MUNITUM* SWORD FERN | 1 GAL. 3'-6" O.C. | 43 |
| *SARCOCOCCA RUSCIFOLIA* FRAGRANT SARCOCOCCA | 1 GAL. 3'-6" O.C. | 12 |

SYMBOL

**GROUNDCOVERS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *JUNIPERUS SABINA 'BUFFALO'* BUFFALO JUNIPER | 1 GAL. 3'-0" O.C. | 630 SF 82 PLANTS |
| *ARCTO. UVA-URSI 'MASSACHUSETTS'* KINNIKINNIK | 1 GAL. 3'-0" O.C. | 5,960 SF 765 PLANTS |
| *DIAMOND GREEN TURF MIX* SUNMARK - TROUTDALE, OR | SEED 8 LBS. / 1,000 SF | 6,150 SF 50 LBS |
| *FESTUCA RUBRA 'RUBRA'* NATIVE RED FESCUE | SEED 8 LBS. / 1,000 SF | 66,465 SF 532 LBS |
| *SEDGE RUSH MIX* 50% CAREX STIPATA 50% JUNCUS PATENS | ROOTED PLUG 6" O.C. | 866 SF 3,992 PLANTS 1,996 EACH |

QUANTITIES IN LEGEND ARE FOR ALL SHEETS.
REFER TO SHEET L5.0 FOR PLANTING DETAILS AND NOTES.

N

0 15 30 60 120

DDP SUBMITTAL

Cardno
Shaping the Future
PORTLAND
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TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
www.cardno.com

# OFFSITE PLANTING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED LANDSCAPE ARCHITECT
PAUL E. GIBBS
OREGON
05/26/11
EXPIRES 05/31/16
PRELIMINARY NOT FOR CONSTRUCTION

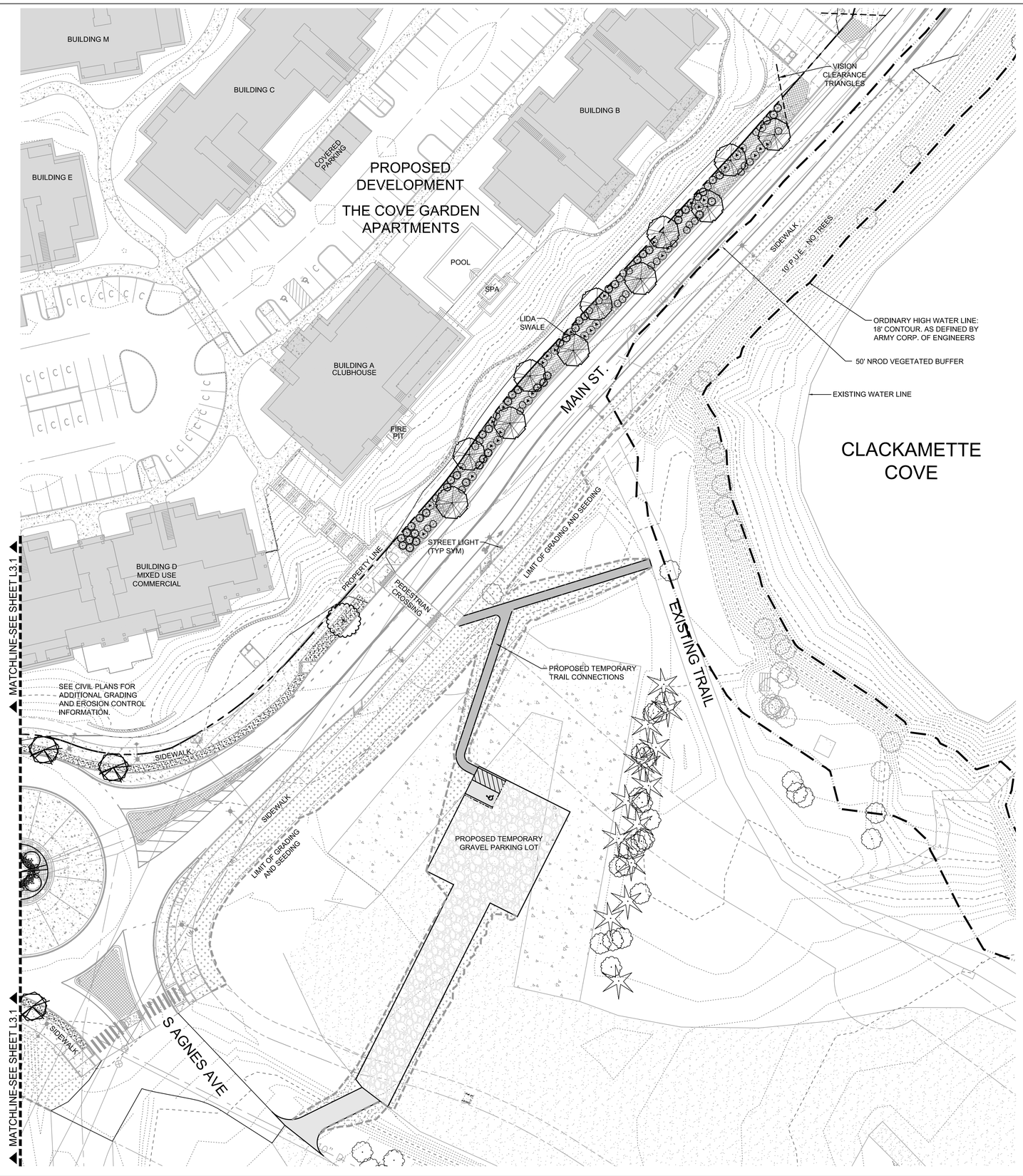
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
OFFSITE PLANTING PLAN

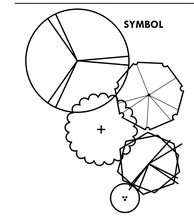
SHEET NUMBER
L3.1

LAND USE # —

Plot Stamp: 7/9/2015 3:34:19 PM - Kyle Glidden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN D - OFFSITE PLANTING PLAN.dwg, Tab: L3.1




## OFFSITE STREETSCAPE PLANT MATERIAL SCHEDULE




**TREES**

| ITEM | SIZE | QTY. |
|---|---|---|
| *ABIES GRANDIS* GRAND FIR | 6' HT. / B&B AS SHOWN | 1 |
| *ALNUS RUBRA* RED ALDER | 2" CAL. / B&B AS SHOWN | 11 |
| *ACER RUBRUM 'AUTUMN FLAME'* AUTUMN FLAME RED MAPLE | 2" CAL. / B&B AS SHOWN | 27 |
| *ACER GRISEUM* PAPERBARK MAPLE | 2" CAL. / B&B AS SHOWN | 10 |
| *ACER CIRCINATUM* VINE MAPLE | 2 GAL. MULTI-STEM | 4 |

SYMBOL

**SHRUBS & ACCENTS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *MAHONIA AQUIFOLIUM* TALL OREGON GRAPE | 1 GAL. 4'-0" O.C. | 47 |
| *SYMPHORICARPOS ALBA* COMMON SNOWBERRY | 1 GAL. 4'-0" O.C. | 29 |
| *ROSA NOOTKANA* NOOTKA ROSE | 1 GAL. 5'-0" O.C. | 32 |
| *POLYSTICHUM MUNITUM* SWORD FERN | 1 GAL. 3'-6" O.C. | 43 |
| *SARCOCOCCA RUSCIFOLIA* FRAGRANT SARCOCOCCA | 1 GAL. 3'-6" O.C. | 12 |

SYMBOL

**GROUNDCOVERS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *JUNIPERUS SABINA 'BUFFALO'* BUFFALO JUNIPER | 1 GAL. 3'-0" O.C. | 630 SF 82 PLANTS |
| *ARCTO. UVA-URSI 'MASSACHUSETTS'* KINNIKINNIK | 1 GAL. 3"-0" O.C. | 5,960 SF 765 PLANTS |
| *DIAMOND GREEN TURF MIX* SUNMARK - TROUTDALE, OR | SEED 8 LBS. / 1,000 SF | 6,150 SF 50 LBS |
| *FESTUCA RUBRA 'RUBRA'* NATIVE RED FESCUE | SEED 8 LBS. / 1,000 SF | 66,465 SF 532 LBS |
| *SEDGE RUSH MIX* 50% CAREX STIPATA 50% JUNCUS PATENS | ROOTED PLUG 6" O.C. | 866 SF 3,992 PLANTS 1,996 EACH |

QUANTITIES IN LEGEND ARE FOR ALL SHEETS.
REFER TO SHEET L5.0 FOR PLANTING DETAILS AND NOTES.

N

0 15 30 60 120

DDP SUBMITTAL

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PORTLAND
5415 SW WESTGATE DR, STE 100, PORTLAND, OR 97221
TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
www.cardno.com

# OFFSITE PLANTING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED LANDSCAPE ARCHITECT
BRANDY W. TAYLOR
OREGON
03/23/11
EXPIRES 05/31/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
OFFSITE PLANTING PLAN

SHEET NUMBER
L3.2

LAND USE # —

Plot Stamp: 7/9/2015 3:34:31 PM - Kyle Glidden (Portland)
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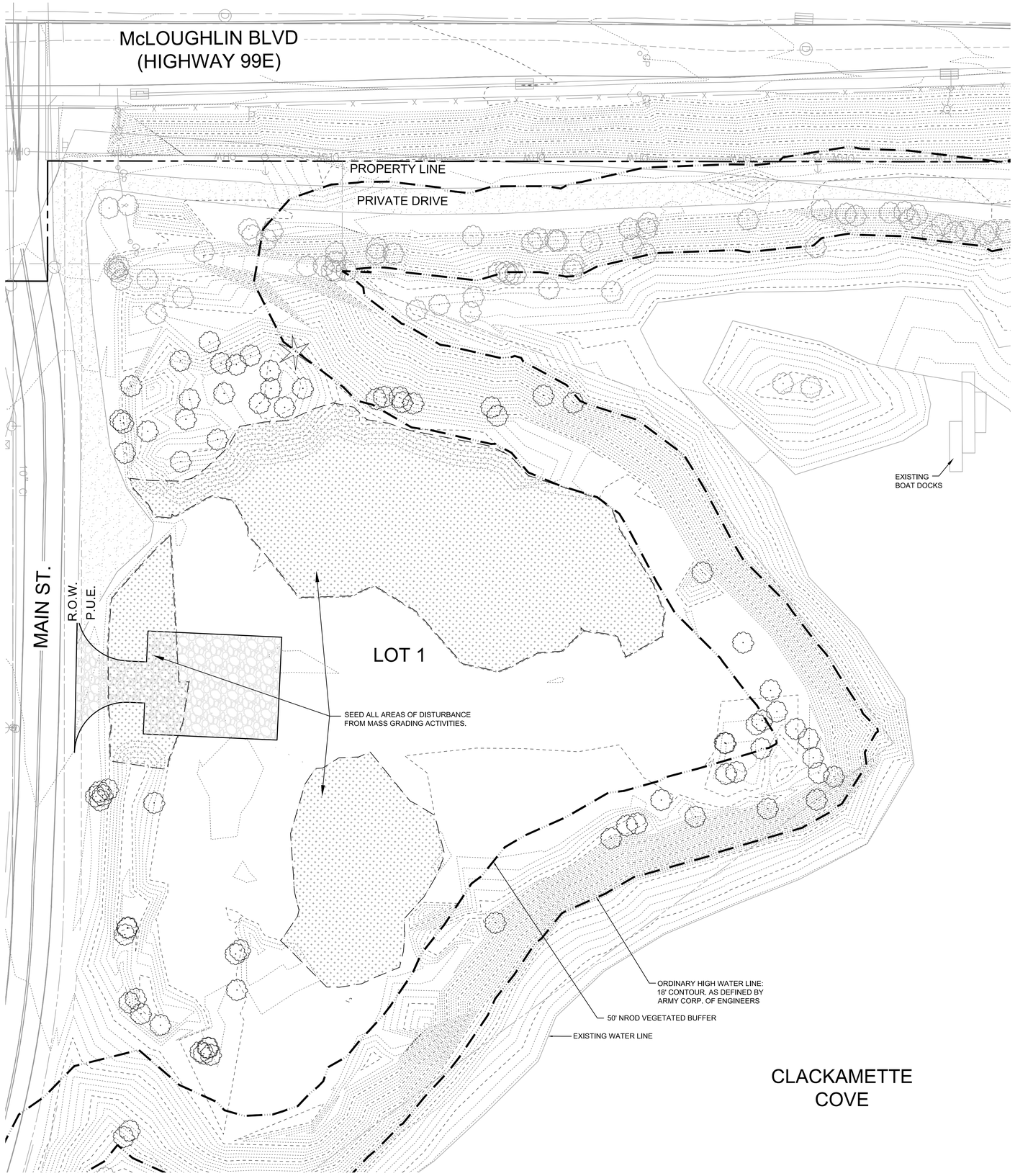
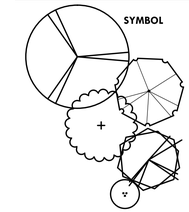



## OFFSITE STREETSCAPE PLANT MATERIAL SCHEDULE




**TREES**

| ITEM | SIZE | QTY. |
|---|---|---|
| *ABIES GRANDIS* GRAND FIR | 6' HT. / B&B AS SHOWN | 1 |
| *ALNUS RUBRA* RED ALDER | 2" CAL. / B&B AS SHOWN | 11 |
| *ACER RUBRUM 'AUTUMN FLAME'* AUTUMN FLAME RED MAPLE | 2" CAL. / B&B AS SHOWN | 27 |
| *ACER GRISEUM* PAPERBARK MAPLE | 2" CAL. / B&B AS SHOWN | 10 |
| *ACER CIRCINATUM* VINE MAPLE | 2 GAL. MULTI-STEM | 4 |

SYMBOL

**SHRUBS & ACCENTS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *MAHONIA AQUIFOLIUM* TALL OREGON GRAPE | 1 GAL. 4'-0" O.C. | 47 |
| *SYMPHORICARPOS ALBA* COMMON SNOWBERRY | 1 GAL. 4'-0" O.C. | 29 |
| *ROSA NOOTKANA* NOOTKA ROSE | 1 GAL. 5'-0" O.C. | 32 |
| *POLYSTICHUM MUNITUM* SWORD FERN | 1 GAL. 3'-6" O.C. | 43 |
| *SARCOCOCCA RUSCIFOLIA* FRAGRANT SARCOCOCCA | 1 GAL. 3'-6" O.C. | 12 |

SYMBOL

**GROUNDCOVERS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *JUNIPERUS SABINA 'BUFFALO'* BUFFALO JUNIPER | 1 GAL. 3'-0" O.C. | 630 SF 82 PLANTS |
| *ARCTO. UVA-URSI 'MASSACHUSETTS'* KINNIKINNIK | 1 GAL. 3"-0" O.C. | 5,960 SF 765 PLANTS |
| *DIAMOND GREEN TURF MIX* SUNMARK - TROUTDALE, OR | SEED 8 LBS. / 1,000 SF | 6,150 SF 50 LBS |
| *FESTUCA RUBRA 'RUBRA'* NATIVE RED FESCUE | SEED 8 LBS. / 1,000 SF | 66,465 SF 532 LBS |
| *SEDGE RUSH MIX* 50% CAREX STIPATA 50% JUNCUS PATENS | ROOTED PLUG 6" O.C. | 866 SF 3,992 PLANTS 1,996 EACH |

QUANTITIES IN LEGEND ARE FOR ALL SHEETS.
REFER TO SHEET L5.0 FOR PLANTING DETAILS AND NOTES.

N

0 15 30 60 120

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# OFFSITE PLANTING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

REGISTERED LANDSCAPE ARCHITECT
PRELIMINARY NOT FOR CONSTRUCTION
RANDALL W. PAPSON
OREGON
03/23/11
EXPIRES 05/31/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
OFFSITE PLANTING PLAN

SHEET NUMBER
L3.3

LAND USE # —

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REFER TO SHEET L5.0 FOR THE ONSITE PLANT LEGEND, AND PROJECT DETAILS AND NOTES.

QUANTITIES INDICATED IN THE ONSITE PLANT LEGEND ARE FOR ALL SHEETS.

N

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# ONSITE PLANTING PLAN - OVERALL
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED LANDSCAPE ARCHITECT
PATRICK TAYLOR
OREGON
02/23/11
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES 05/31/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
ONSITE PLANT - OVERALL

SHEET NUMBER
L4.0

LAND USE # —

Plot Stamp: 7/9/2015 3:35:53 PM - Kyle Glosden (Portland)
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REFER TO SHEET L5.0 FOR THE ONSITE PLANT LEGEND, AND PROJECT DETAILS AND NOTES.

QUANTITIES INDICATED IN THE ONSITE PLANT LEGEND ARE FOR ALL SHEETS.

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DDP SUBMITTAL

Plot Stamp: 7/9/2015 3:36:06 PM - Kyle Glidden (Portland)
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| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

# ONSITE PLANTING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

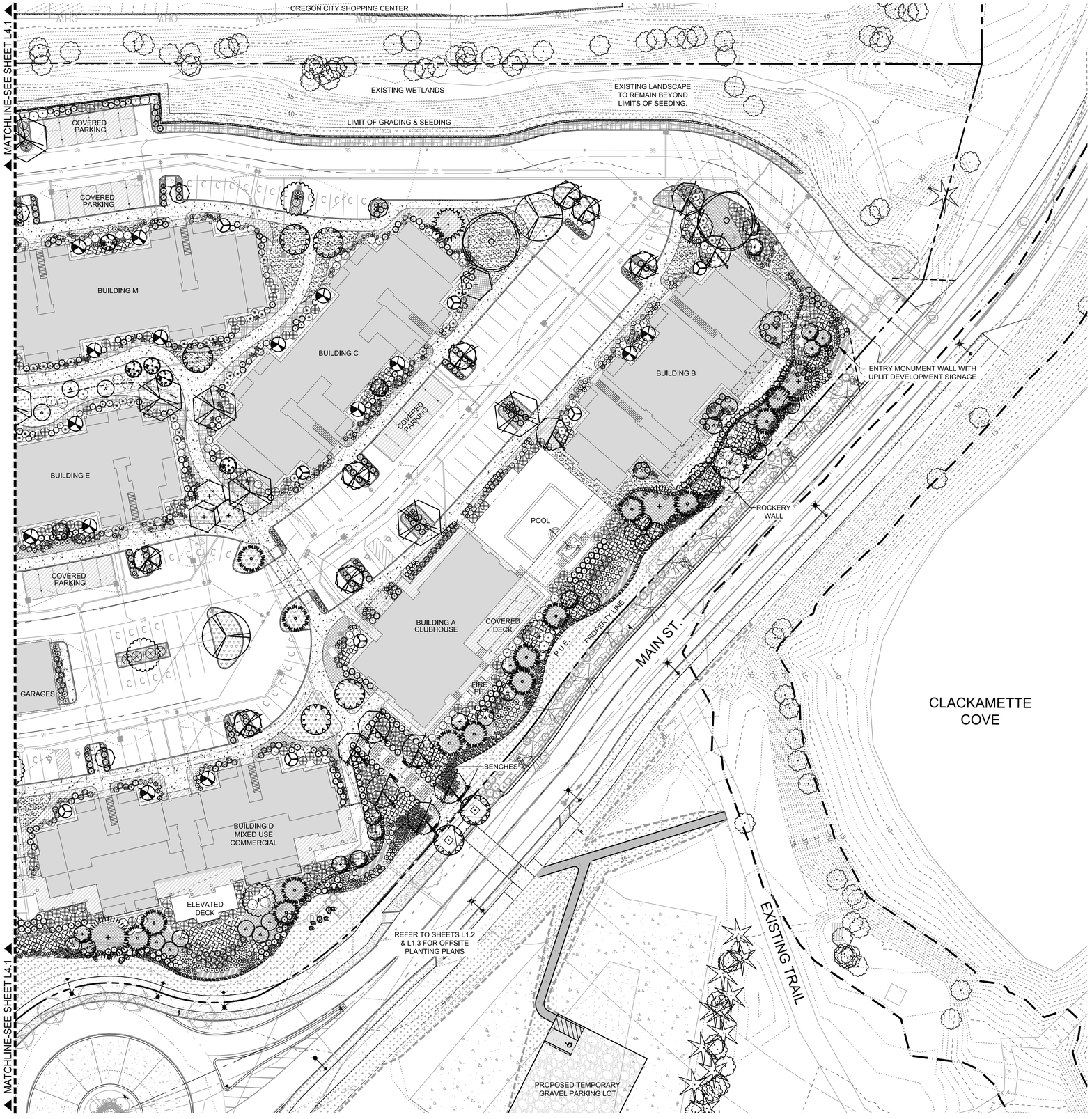
REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
PATRICK W. PAYNOR
OREGON
03/23/11
EXPIRES 05/31/16
PRELIMINARY NOT FOR CONSTRUCTION

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
ONSITE PLANTING PLAN

SHEET NUMBER
L4.1

LAND USE # —




REFER TO SHEET L5.0 FOR THE ONSITE PLANT LEGEND, AND PROJECT DETAILS AND NOTES.

QUANTITIES INDICATED IN THE ONSITE PLANT LEGEND ARE FOR ALL SHEETS.

N

0 15 30 60 120

DDP SUBMITTAL

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www.cardno.com

# ONSITE PLANTING PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PRELIMINARY NOT FOR CONSTRUCTION
LANDSCAPE ARCHITECT
PATRICK GAYNOR
OREGON
06/26/15
EXPIRES 05/31/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
PLANTING PLAN

SHEET NUMBER
L4.2

LAND USE # —

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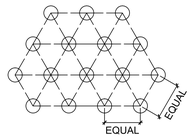
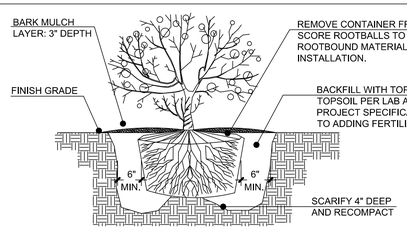



ALL GROUND COVER SHALL BE PLANTED AT EQUAL TRIANGULAR SPACING PER ON CENTER SPACING AS SPECIFIED ON PLANTING PLAN.

LOCATE GROUND COVER ONE HALF OF SPECIFIED SPACING DISTANCE FROM ANY CURB, SIDEWALK, OR OTHER HARD SURFACE, UNLESS OTHERWISE NOTED.

## 1 GROUNDCOVER SPACING DIAGRAM

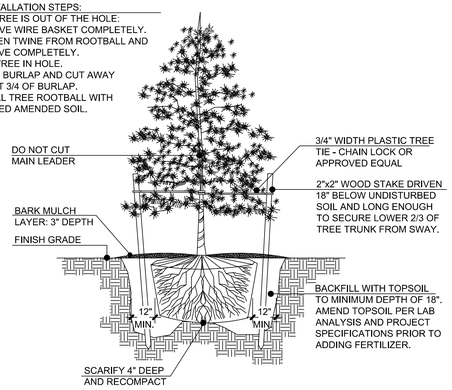
NOT TO SCALE




## 2 SHRUB PLANTING

NOT TO SCALE

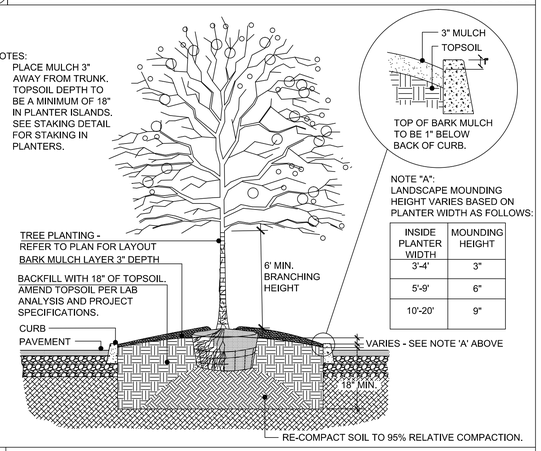
TREE INSTALLATION STEPS:
1. WHILE TREE IS OUT OF THE HOLE:
   - REMOVE WIRE BASKET COMPLETELY.
   - LOOSEN TWINE FROM ROOT BALL AND REMOVE COMPLETELY.
2. PLACE TREE IN HOLE.
3. UNFOLD BURLAP AND CUT AWAY AT LEAST 3/4 OF BURLAP.
4. BACKFILL TREE ROOTBALL WITH APPROVED AMENDED SOIL.




## 3 DECIDUOUS TREE PLANTING

NOT TO SCALE

NOTES:
- PLACE MULCH 3" AWAY FROM TRUNK.
- TOPSOIL DEPTH TO BE A MINIMUM OF 18" IN PLANTER ISLANDS.
- SEE STAKING DETAIL FOR STAKING IN PLANTERS.

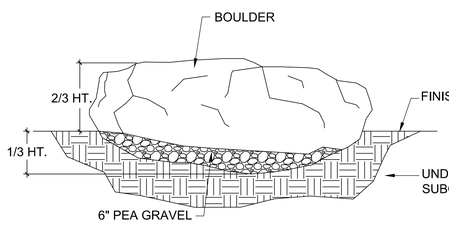



NOTE "A": LANDSCAPE MOUNDING HEIGHT VARIES BASED ON PLANTER WIDTH AS FOLLOWS:

| INSIDE PLANTER WIDTH | MOUNDING HEIGHT |
|---|---|
| 3'-4' | 3" |
| 5'-9' | 6" |
| 10'-20' | 9" |

## 4 EVERGREEN TREE PLANTING

NOT TO SCALE




## 5 SOIL MOUNDING ISLANDS AND PERIMETER

NOT TO SCALE

ONSITE LANDSCAPE COMPLIANCE

SITE AREA: *499,070 SF*
REQUIRED SITE LANDSCAPE AREA:
*10% or 49,907 SF*
PROPOSED SITE LANDSCAPE AREA:
*38.9% or 194,016 SF GROSS LANDSCAPE AREA*
*LESS 10,497 SF OF PARKING LOT LANDSCAPE*
*LEAVES 183,519 SF or 36.8% SITE LANDSCAPE*

PARKING LOT AREA: *102,478 SF*
REQUIRED PARKING LOT LANDSCAPE:
*10% or 10,248 SF*
PROPOSED PARKING LOT LANDSCAPE:
*10.2% or 10,497 SF*

TREES PER PARKING STALL
PARKING STALLS: *407*
REQUIRED: *1 TREE / 6 STALLS or 68 TREES*
PROPOSED: *68 TREES*

ONSITE SWALE DESIGN STANDARDS

ZONE A: WET - 2,328 SF
ZONE B: DRY - 1,000 SF

ZONE A REQUIRES: PER 100 SF
3 LARGE SHRUBS / SMALL TREES
4 SMALL SHRUBS
115 GROUNDCOVER PLANTS

ZONE B REQUIRES: PER 100 SF
1 TREE
3 LARGE SHRUBS / SMALL TREES
4 SMALL SHRUBS
115 GROUNDCOVER PLANTS

ZONE A PROPOSED: (FACTOR OF 23.28)
71 LARGE SHRUBS / SMALL TREES
94 SMALL SHRUBS
2,689 GROUNDCOVER PLANTS

ZONE B PROPOSED: (FACTOR OF 10)
10 TREES
30 LARGE SHRUBS / SMALL TREES
40 SMALL SHRUBS
1,150 GROUNDCOVER PLANTS

## 6 LANDSCAPE BOULDER

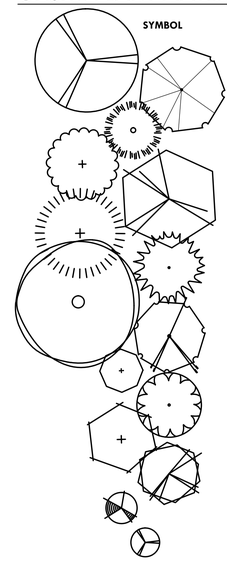
NOT TO SCALE

## 7 ONSITE LANDSCAPE SUMMARY

## 8 TOPSOIL NOTES

1. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE A NUMBER IN THE BASE BID TO FURNISH AND INSTALL AMENDED TOPSOIL IN ALL LANDSCAPE BEDS AND SEEDED AREAS AS SPECIFIED BELOW UNLESS OTHERWISE NOTED. AMENDED TOPSOIL SHALL INCLUDE ALL NECESSARY FERTILIZERS, ORGANIC AND INORGANIC AMENDMENTS, BASED ON INDUSTRY STANDARDS FOR EXCEPTIONAL PLANT DEVELOPMENT.
   - SCARIFY ALL PLANTING AREA SUBGRADE TO A DEPTH OF 6". INSTALL & TILL IN 2" LAYER OF AMENDED TOPSOIL INTO SCARIFIED SUBGRADE AND RE-COMPACT TO 95%.
   - PROVIDE MIN. 18" DEPTH AMENDED TOPSOIL IN ALL TREE / SHRUB PLANTING AREAS.
   - PROVIDE MIN. 18" DEPTH AMENDED TOPSOIL IN ALL PLANTER ISLANDS PLUS TOPSOIL MOUNDING REQUIREMENT. REFER TO DETAIL 5 / L3.0 FOR TOPSOIL MOUNDING.
2. UPON BEING AWARDED THE CONTRACT, THE GENERAL CONTRACTOR SHALL COORDINATE WITH A STATE LICENSED SOIL LABORATORY AND THE LANDSCAPE ARCHITECT, TO DETERMINE THE SUITABILITY AND AVAILABILITY OF THE EXISTING SITE TOPSOIL. THE CONTRACTOR SHALL SEND THE TOPSOIL TO A SOIL LABORATORY FOR ANALYSIS STATING THAT THE TOPSOIL BE ANALYZED FOR A LANDSCAPE CROP. AFTER RECEIVING RECOMMENDATIONS FROM THE SOILS EXPERT FORWARD A COPY TO THE OWNERS REPRESENTATIVE AT WHICH TIME A DECISION WILL BE MADE BY THE OWNER AS TO WHETHER OR NOT THE EXISTING ON-SITE STOCKPILE WILL BE USED FOR THE PROJECT.
3. TOPSOIL SHALL BE OBTAINED FROM NATURALLY WELL-DRAINED SITES WHERE TOPSOIL OCCURS AT LEAST 4 INCHES DEEP. DO NOT OBTAIN FROM BOGS OR MARSHES. IMPORTED TOPSOIL TO COMPLY WITH ASTM D 5268, WITH A PH RANGE OF 5.5 TO 7.0, FREE OF STONES 1 INCH OR LARGER IN ANY DIMENSION, AND ANY OTHER EXTRANEOUS MATERIALS (ROCKS, STICKS, RUBBISH, SOD) HARMFUL TO PLANT GROWTH. AN ADDITIONAL SOILS ANALYSIS WILL BE REQUIRED FOR THE IMPORTED TOPSOIL.
4. AMENDED IMPORTED TOPSOIL SHALL INCLUDE ALL NECESSARY FERTILIZER AND AMENDMENTS PER THE SOIL ANALYSIS RECOMMENDATIONS. TOPSOIL ANALYSIS SHALL STATE ORGANIC MATTER, INORGANIC MATTER (SILT, CLAY AND SAND), DELETERIOUS MATERIAL, PH, MINERAL AND PLANT-NUTRIENT CONTENT. IN ADDITION THE REPORT SHALL ALSO STATE RECOMMENDED QUANTITIES (BY PERCENTAGE OF WEIGHT 1.E. 2 LBS OF 15-15-15 PER 1000SF) OF NITROGEN, PHOSPHORUS AND POTASH, NUTRIENTS AND ANY LIMESTONE, ALUMINUM SULFATE, OR OTHER SOIL AMENDMENTS TO BE ADDED TO PRODUCE A SATISFACTORY AMENDED TOPSOIL. FURNISH REPORT AND RECOMMENDATIONS TO LANDSCAPE ARCHITECT FOR REVIEW AND WRITTEN APPROVAL 30 DAYS PRIOR TO MOBILIZATION.
5. IN ADDITION TO THE SOILS ANALYSIS RECOMMENDATIONS THE LANDSCAPE CONTRACTOR SHALL ADD A 1 INCH LAYER OF APPROVED COMPOST HUMUS MATERIAL IN ALL TREE AND SHRUB PLANTING AREAS AND TREE WELLS. SUBMIT CUT SHEET OF COMPOST MATERIAL TO LANDSCAPE ARCHITECT FOR REVIEW AND WRITTEN APPROVAL PRIOR TO PURCHASE.
6. PRIOR TO PLACEMENT OF TOPSOIL SCARIFY AND LOOSEN SUBGRADE OF PLANTING BED AREA TO A MINIMUM DEPTH OF 6 INCHES. REMOVE STONES LARGER THAN 1" IN ANY DIMENSION IN TREE/ SHRUB PLANTING AREAS AND 1/2" IN ALL LAWN AREAS, AND STICKS, ROOTS, RUBBISH AND OTHER EXTRANEOUS MATERIALS. REMOVE WEEDS FROM EXISTING SUBGRADE AND TREAT WITH NECESSARY HERBICIDE TO PREVENT WEED GROWTH. SPREAD HALF OF THE AMENDED TOPSOIL MIXTURE AND WORK INTO TOP OF LOOSEN SUBGRADE TO CREATE A TRANSITION LAYER. PLACE REMAINING HALF OF THE TOPSOIL TO THE DEPTH REQUIRED TO MEET THICKNESS, GRADES AND ELEVATIONS SHOWN, AFTER LIGHT ROLLING AND NATURAL SETTLEMENT.
7. WITHIN TREE WELLS, REMOVE EXISTING SOIL AND OTHER DEBRIS, TO A MINIMUM DEPTH OF 18" AND REPLACE WITH AMENDED TOPSOIL. ADD ADDITIONAL SOIL AS REQUIRED PER CITY DETAILS AND NOTES.
8. THE CONTRACTOR SHALL SUBMIT TO THE LANDSCAPE ARCHITECT, SHIPPING TICKETS FOR IMPORTED TOPSOIL AND COMPOST MATERIAL, 60 DAYS PRIOR TO INSTALLATION FOR REVIEW AND WRITTEN APPROVAL.

## ONSITE PLANT MATERIAL SCHEDULE




**TREES**

| ITEM | SIZE | QTY. |
|---|---|---|
| *ABIES GRANDIS* GRAND FIR | 6' HT. / B&B AS SHOWN | 3 |
| *ALNUS RUBRA* RED ALDER | 2" CAL. / B&B AS SHOWN | 4 |
| *PINUS CONTORTA* SHORE PINE | 6' HT. / B&B AS SHOWN | 24 |
| *ACER RUBRUM 'AUTUMN FLAME'* AUTUMN FLAME RED MAPLE | 2" CAL. / B&B AS SHOWN | 22 |
| *BETULA JAQUEMONTII* JACKMONTI BIRCH | 2" CAL. / B&B AS SHOWN | 12 |
| *PSEUDOTSUGA MENZIESII* DOUGLAS FIR | 6' HT. / B&B AS SHOWN | 7 |
| *THUJA PLICATA* WESTERN RED CEDAR | 6' HT. / B&B AS SHOWN | 5 |
| *QUERCUS GERRYANA* OREGON WHITE OAK | 2" CAL / B&B AS SHOWN | 9 |
| *CORNUS FLORIDA 'CHEROKEE BRAVE'* FLOWERING DOGWOOD | 2" CAL. / B&B AS SHOWN | 13 |
| *CARPINUS BETULUS 'FRANS FONTAINE'* FRANS FONTAINE HORNBEAM | 2" CAL. / B&B AS SHOWN | 19 |
| *PRUNUS 'SNOW GOOSE'* SNOW GOOSE CHERRY | 2" CAL. / B&B AS SHOWN | 7 |
| *STEWARTIA PSEUDOCAMELLIA* JAPANESE STEWARTIA | 2" CAL. / B&B AS SHOWN | 6 |
| *ACER GRISEUM* PAPERBARK MAPLE | 2" CAL. / B&B AS SHOWN | 18 |
| *THUJA PLICATA 'HOGAN'* HOGAN CEDAR | 6' HT / B&B AS SHOWN | 47 |
| *JUNIPERUS VIRGINIANA 'CUPRESSIFOLIA'* HILLSPIRE JUNIPER | 6' HT. B&B / AS SHOWN | 23 |

**SHRUBS & ACCENTS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *MAGNOLIA STELLATA* STAR MAGNOLIA | 6' HT. MULTI STEM | 10 |
| *ACER CIRCINATUM* VINE MAPLE | 4' MIN. HT. / B&B MULTI-STEM | 46 |
| *AMELANCIER ALNIFOLIA* SERVICEBERRY | 4' MIN. HT. / B&B CLUMP | 26 |
| *CORNUS SERICEA 'KELSEYI'* KELSEY DOGWOOD | 2 GAL. 3"-0" O.C. | 112 |
| *CORNUS STOLONIFERA* RED OSIER DOGWOOD | 2 GAL. 5'-0" O.C. | 79 |
| *MAHONIA AQUIFOLIUM* TALL OREGON GRAPE | 2 GAL. 4'-0" O.C. | 856 |
| *MYRICAL CALIFORICA* PACIFIC WAX MYRTLE | 3 GAL. 6'-0" O.C. | 111 |
| *JUNIPERUS x PFITZERIANA 'SEA GREEN'* SEA GREEN JUNIPER | 2 GAL. 5'-0" O.C. | 217 |
| *POLYSTICHUM MUNITUM* SWORD FERN | 1 GAL. 3'-6" O.C. | 422 |

**SHRUBS & ACCENTS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *VACCINIUM OVATUM* EVERGREEN HUCKLEBERRY | 2 GAL. 5'-0" O.C. | 344 |
| *RIBES SANGUINEUM* RED CURRANT | 2 GAL. 4'-6" O.C. | 139 |
| *RUDBECKIA FULGIDA sp. 'GOLDSTRUM'* BLACK-EYED SUSAN | 1 GAL 1'-6" O.C. | 222 |
| *SPIRAEA DOUGLASII* DOUGLAS SPIREA | 2 GAL. 4'-6" O.C. | 24 |
| *SYMPHORICARPOS ALBA* COMMON SNOWBERRY | 2 GAL. 4'-0" O.C. | 112 |
| *VIBURNUM CARLESII* KOREANSPICE VIBURNUM | 3 GAL. 5'-0" O.C. | 169 |
| *VIBURNUM PLICATUM 'TOMENTOSUM'* DOUBLEFILE VIBURNUM | 2 GAL. 6'-0" O.C. | 24 |
| *JASMINUM POLYANTHUM* PINK STAR JASMINE | 1 GAL. 2'-0" O.C. | 50 |
| *SARCOCOCCA RUSCIFOLIA* FRAGRANT SARCOCOCCA | 2 GAL. 3'-6" O.C. | 250 |
| *SALVIA OFFICINALIS 'BERGGARTEN'* BERGGARTEN SAGE | 1 GAL. 3'-0" O.C. | 138 |
| *ROSEMARINUS OFFICINALIS 'ARP'* ARP ROSEMARY | 2 GAL. 3'-6" O.C. | 254 |
| *CAL. x ACUT. 'KARL FOERSTER'* KARL FOERSTER REED GRASS | 1 GAL. 3'-6" O.C. | 54 |
| *PENN. ALOPECUROIDES 'HAMELN'* HAMELN FOUNTAIN GRASS | 1 GAL. 2'-6" O.C. | 379 |
| *IMPERATA CYLINDRICA 'RED BARON'* JAPANESE BLOOD GRASS | 1 GAL. 2'-0" O.C. | 190 |

**GROUNDCOVERS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *JUNIPERUS SABINA 'BUFFALO'* BUFFALO JUNIPER | 1 GAL. 3'-0" O.C. | 10,391 SF 1,330 PLANTS |
| *JUNIPERUS SABINA 'TAMARISCIFOLIA'* TAM JUNIPER | 1 GAL. 3'-0" O.C. | 4,856 SF 622 PLANTS |
| *RUBUS CALCYNOIDES 'EMERALD CARPET'* EMERALD CARPET CREEPING RUBUS | 1 GAL. 3'-0" O.C. | 7,500 SF 960 PLANTS |
| *ARCTO. UVA-URSI 'MASSACHUSETTS'* MASSACHUSETTS KINNIKINNIK | 1 GAL. 3"-0" O.C. | 24,545 SF 3,142 PLANTS |
| *OPHIOPOGON JAPONICUS* GREEN MONDO GRASS | 1 GAL. 1'-0" O.C. | 850 SF 985 PLANTS |
| *DIAMOND GREEN TURF MIX* SUNMARK - TROUTDALE, OR | SEED 8 LBS / 1,000 SF | 8,560 SF 69 LBS |
| *FESTUCA RUBRA 'RUBRA'* NATIVE RED FESCUE | SEED 5 LBS / 1,000 SF | 49,060 SF 245 LBS |
| *SEDGE RUSH MIX* 50% CAREX STIPATA 50% JUNCUS PATENS | 4" POT 115 / 100 SF | 3,084 SF 3,546 PLANTS 1,773 EACH |

**MISCELLANEOUS**

| ITEM | SIZE | QTY. |
|---|---|---|
| *QUARRIED BASALT BOULDER* FROM A LOCAL SUPPLIER | S = 24" H x 24" W M = 30" H x 36" W L = 36" H x 48" W | S = 670 M = 48 L = 23 |

1. CONTRACTOR TO VERIFY WITH OWNER AND UTILITY COMPANIES THE LOCATIONS OF ALL UTILITIES PRIOR TO CONSTRUCTION, TO DETERMINE IN THE FIELD THE ACTUAL LOCATIONS AND ELEVATIONS OF ALL EXISTING UTILITIES. WHETHER SHOWN ON THE PLANS OR NOT. THE CONTRACTOR SHALL CALL UTILITY PROTECTION SERVICE 72 HOURS PRIOR TO CONSTRUCTION.
2. CONTRACTOR SHALL EXAMINE FINISH SURFACE, GRADES, TOPSOIL QUALITY AND DEPTH. DO NOT START ANY WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED. VERIFY LIMITS OF WORK BEFORE STARTING.
3. CONTRACTOR TO REPORT ALL DAMAGES TO EXISTING CONDITIONS AND INCONSISTENCIES WITH PLANS TO THE LANDSCAPE ARCHITECT.
4. ALL PLANT MASSES TO BE CONTAINED WITHIN A 3" LAYER OF BARK MULCH BED, UNLESS NOTED OTHERWISE.
5. BED EDGE TO BE NO LESS THAN 12" AND NO MORE THAN 18" FROM OUTER EDGE OF PLANT MATERIAL BRANCHING. WHERE GROUND-COVER OCCURS, PLANT TO LIMITS OF AREA AS SHOWN.
6. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE IN ALL LANDSCAPE BEDS.
7. CONTRACTOR TO FINE GRADE AND ROCK-HOUND ALL PLANTING AREAS PRIOR TO PLANTING, TO PROVIDE A SMOOTH SURFACE, FREE OF IRREGULARITIES (BUMPS OR DEPRESSIONS) & EXTRANEOUS MATERIAL OR DEBRIS.
8. QUANTITIES ARE INTENDED TO ASSIST CONTRACTOR IN EVALUATING THEIR OWN TAKE OFFS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR BID QUANTITIES AS INDICATED ON THE PLANS. IF THERE IS A DISCREPANCY BETWEEN THE NUMBER IN THE PLANT LEGEND AND THE QUANTITY OF GRAPHIC SYMBOLS SHOWN, THE GRAPHIC SYMBOL QUANTITY SHALL GOVERN.
9. COORDINATE PLANTING INSTALLATION WITH INSTALLATION OF UNDERGROUND SPRINKLER AND DRAINAGE SYSTEMS.
10. CONTRACTOR SHALL NOT REMOVE ANY TREES DURING CONSTRUCTION WITHOUT THE EXPRESS WRITTEN CONSENT OF THE LANDSCAPE ARCHITECT. EXISTING VEGETATION TO REMAIN SHALL BE PROTECTED AS INDICATED IN THE TREE PROTECTION PLANS.
11. WHERE PROPOSED TREE LOCATIONS OCCUR UNDER EXISTING OVERHEAD UTILITIES OR CROWD EXISTING TREES, NOTIFY LANDSCAPE ARCHITECT TO ADJUST TREE LOCATIONS.
12. LANDSCAPE MAINTENANCE PERIOD BEGINS IMMEDIATELY AFTER THE COMPLETION OF ALL PLANTING OPERATIONS AND ACKNOWLEDGEMENT THAT ALL PUNCH LIST ITEMS HAVE BEEN COMPLETED BY THE CONTRACTOR. MAINTAIN TREES, SHRUBS, LAWNS AND OTHER PLANTS UNTIL FINAL ACCEPTANCE OR 90 DAYS AFTER NOTIFICATION AND ACCEPTANCE, WHICHEVER IS LONGER. WARRANTY ALL FOUNDATION PLANTINGS AND LAWN AREAS FOR ONE YEAR, AND ALL WATER QUALITY FACILITY PLANTINGS FOR A PERIOD OF 2 YEARS FROM THE DATE OF ACCEPTANCE.
13. REMOVE EXISTING WEEDS FROM PROJECT SITE PRIOR TO THE ADDITION OF ORGANIC AMENDMENTS AND FERTILIZER.
14. PROVIDE 1' LAYER OF COMPOST IN TREE AND SHRUB BEDS. TILL COMPOST IN TO AMENDED TOPSOIL PRIOR TO TREE AND SHRUB PLANTING. INCORPORATE ANY SLOW RELEASE FERTILIZERS TO THE TOP 4 INCHES OF TOPSOIL.
15. CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FOR ALL PLANT MATERIAL SUBSTITUTIONS FROM THE LANDSCAPE ARCHITECT 90 DAYS PRIOR TO INSTALLATION. PLANT SUBSTITUTIONS WITHOUT PRIOR WRITTEN APPROVAL THAT DO NOT COMPLY WITH THE DRAWINGS AND SPECIFICATIONS MAY BE REJECTED BY THE LANDSCAPE ARCHITECT AT NO COST TO THE OWNER. THESE ITEMS MAY BE REQUIRED TO BE REPLACED WITH PLANT MATERIALS THAT ARE IN COMPLIANCE WITH THE DRAWINGS.
16. CONTRACTOR SHALL BE RESPONSIBLE TO SECURE ALL PLANT MATERIAL IN THE SIZE SPECIFIED ON PLAN PRIOR TO INSTALLATION. IN THE EVENT THE PLANT MATERIAL IS NOT AVAILABLE IN THE SIZE SPECIFIED, THE CONTRACTOR SHALL SUBMIT TO THE OWNERS' REPRESENTATIVE, AND THE LANDSCAPE ARCHITECT, A WRITTEN ESTIMATE TO INCREASE PLANT MATERAIL (AND INSTALL) THE NEXT AVAILABLE CONTAINER SIZE PLANT (I.E. 4" POT TO ONE GALLON CONTAINER, 2" CALIPER TREE TO 2.5" CALIPER).
17. CONTRACTOR SHALL BE RESPONSIBLE TO IMPLEMENT BEST MANAGEMENT PRACTICES TO STABILIZE ALL SLOPES 3:1 OR GREATER AND PREVENT EROSION OR MOVEMENT OF SOIL FROM SLOPES. THIS COULD INCLUDE, BUT NOT LIMITED TO, EROSION CONTROL FABRIC, STAKING, NETTING, AND STRAW WATTLES. SUBMIT METHOD OF SLOPE STABILIZATION TO LANDSCAPE ARCHITECT FOR REVIEW AND WRITTEN APPROVAL 30 DAYS PRIOR TO IMPLEMENTATION.
18. PRIOR TO MOBILIZATION THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT, IN WRITING, IF THEY BELIEVE ANY OF THE PLANT MATERIAL IDENTIFIED ON THE PLAN MAY NOT BE SUITABLE FOR THE SITE OR MAY DIE. SUBSTITUTION REQUESTS MAY BE GRANTED BY THE LANDSCAPE ARCHITECT PRIOR TO THE START OF CONSTRUCTION ACTIVITIES. IF NOTIFICATION IS NOT GIVEN TO THE LANDSCAPE ARCHITECT ALL PLANTING WHICH FAILS TO GROW (EXCEPT FOR DEFECTS RESULTING FROM LACK OF ADEQUATE MAINTENANCE AS DETERMINED BY THE OWNER, NEGLECT OR VANDALISM) SHALL BE REPLACED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.
19. NOTIFY THE LANDSCAPE ARCHITECT IN WRITING, WHEN CONDITIONS DETRIMENTAL TO PLANT GROWTH ARE ENCOUNTERED, SUCH AS RUBBLE FILL, POOR PLANTING SOIL, ADVERSE DRAINAGE CONDITIONS, OR OBSTRUCTIONS, PRIOR TO PLANTING.
20. PLANTING RESTRICTIONS:
    PLANTING IS NOT PERMITTED DURING THE FOLLOWING CONDITIONS, UNLESS OTHERWISE APPROVED IN WRITING BY THE LANDSCAPE ARCHITECT.
    A. COLD WEATHER: LESS THAN 32 DEGREES FAHRENHEIT.
    B. HOT WEATHER: GREATER THAN 90 DEGREES FAHRENHEIT.
    C. WET WEATHER: HEAVY RAINS AND/OR SATURATED SOILS.
    D. WINDY WEATHER: WIND VELOCITIES GREATER THAN 20 M.P.H.
    E. WINTER MONTHS: OCTOBER 15TH THROUGH APRIL 15TH.
21. ALL PLANTING AREAS SHALL BE WATERED WITH AN AUTOMATIC UNDERGROUND IRRIGATION SYSTEM UNLESS NOTED OTHERWISE.
22. DO NOT LOCATE TREES IN EASEMENTS.
23. SEE CIVIL PLANS FOR EXISTING TREES TO REMAIN ON SITE.
24. ALL PLANTS MUST COMPLY TO THE AMERICAN STANDARD FOR NURSERY STOCK. THOSE THAT DO NOT WILL BE REJECTED. CALIPER TREES SHALL BRANCH AT 6' HT., UNLESS APPROVED BY THE LANDSCAPE ARCHITECT.

## 9 LANDSCAPE PLANTING NOTES

DDP SUBMITTAL


Cardno
Shaping the Future
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www.cardno.com


# ONSITE PLANTING LEGEND, PROJECT DETAILS & NOTES

# THE COVE - GARDEN APARTMENTS

GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT
PATRICK TAYLOR BWP
OREGON
09/23/11
EXPIRES 05/31/16

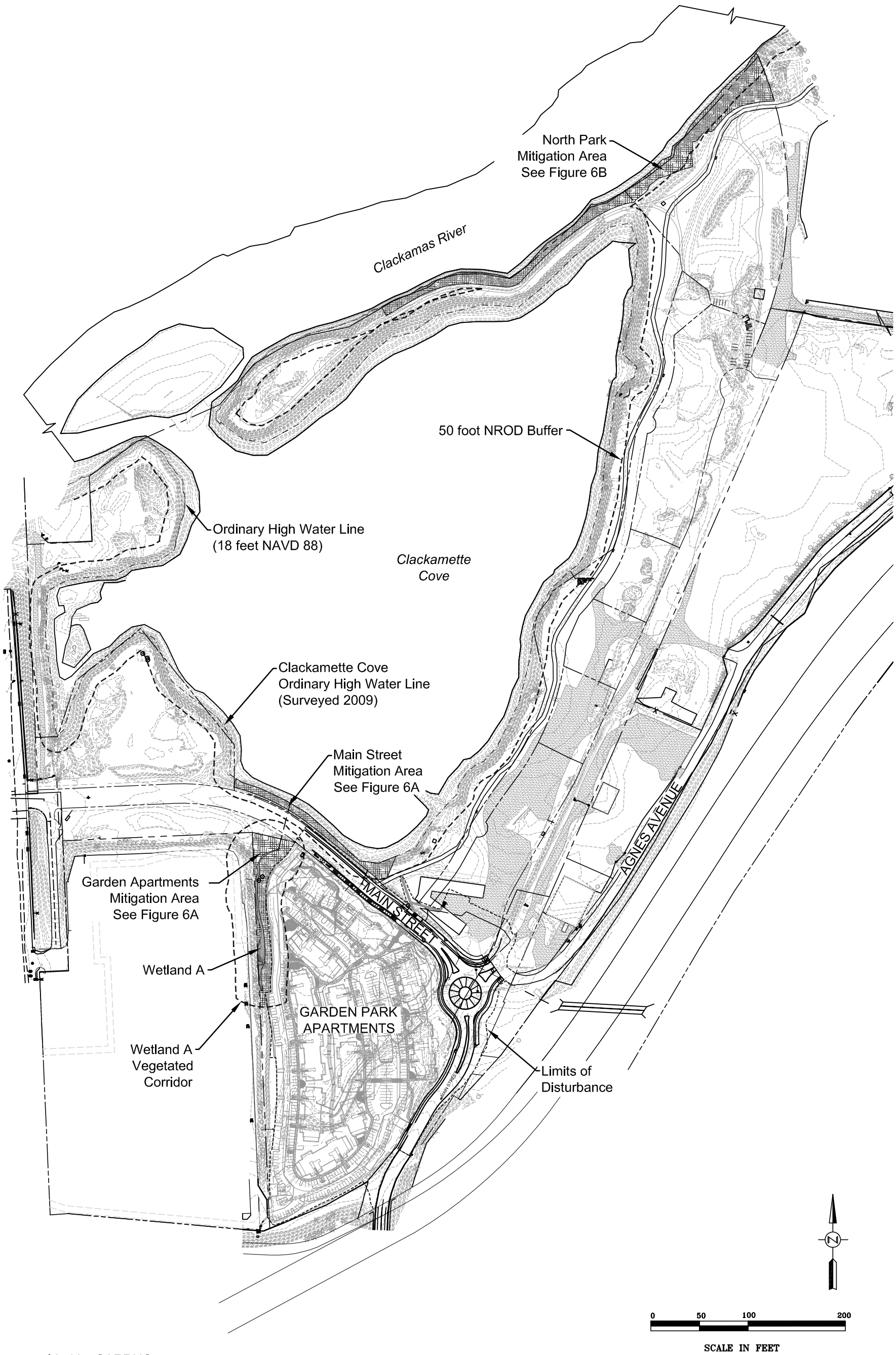
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | PEG |
| DESIGNED | PEG |
| CHECKED | BWP |
| PROJECT # | 21509220 |

SHEET TITLE
DETAILS & NOTES

SHEET NUMBER
L5.0

LAND USE # —


Plot Stamp: 7/9/2015 3:36:38 PM - Kyle Glisden (Portland)
File: W:\21509220\Landscape_DD\DDP SET\9220-DD-LS PLAN F - ONSITE PLANTING PLAN.dwg, Tab: L5.0




Site Plan provided by CARDNO

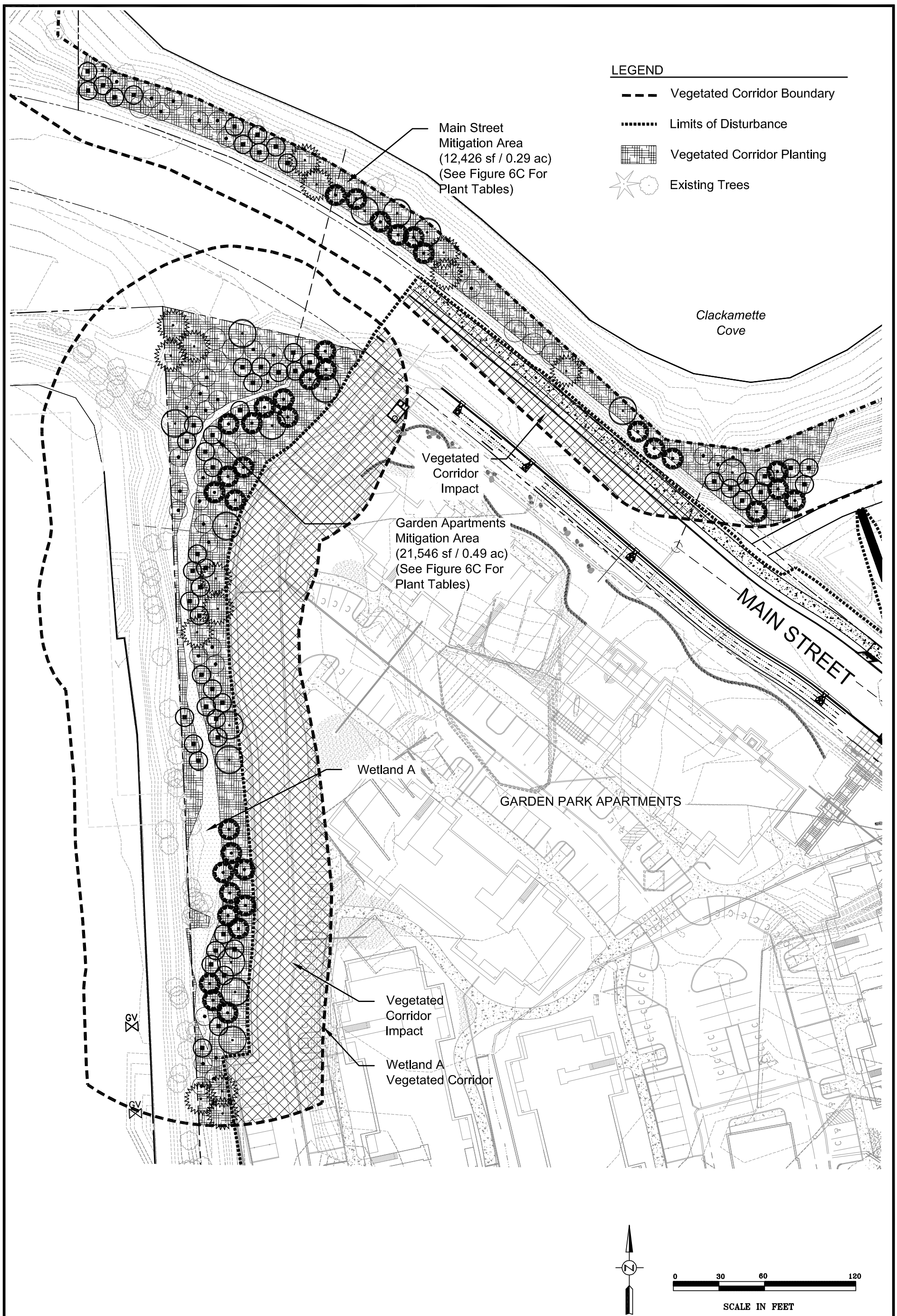

PHS
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855


Garden Park Apartments NROD Mitigation Area and Planting Plan Overview

The Cove, Phase 1 - Oregon City Oregon

FIGURE
6

6-29-2015




Site Plan provided by CARDNO

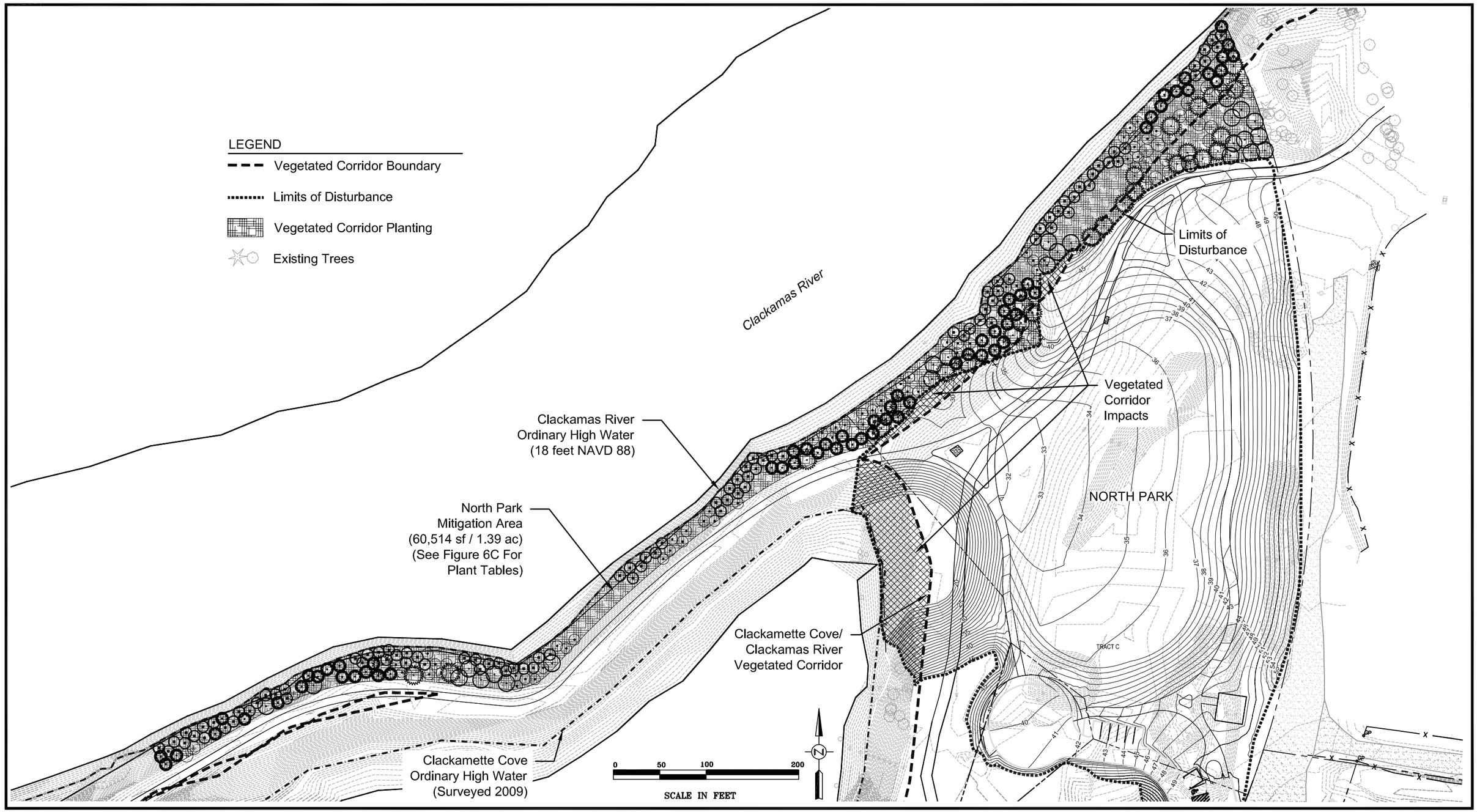
Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Garden Park Apartments and Main Street NROD Mitigation Areas and Planting Plan

The Cove, Phase 1 - Oregon City Oregon

FIGURE 6A

6-29-2015




PHS

Site Plan provided by CARDNO

North Park Mitigation Area and Planting Plan

The Cove, Phase 1 - Oregon City Oregon

FIGURE 6B

6-29-2015

X:\Project Directories\5500\5511 Garden Apartments\AutoCAD\Plot Dwgs\Fig6B Mitigation Plan NPark.dwg, 6/30/2015 5:06:20 PM

TREES: (Minimum of 472 plantings)
The owner's representative will approve individual plant material and location of plant material prior to installation. Plantings may vary in size dependent on whether they are live cuttings, bare root stock or container stock, however, no initial plantings may be shorter than twelve inches in height. No more than one-third of the trees may be of the same genus.

| Symbol | Botanical Name | Common Name | Size (min) | Spacing | Quantity |
|---|---|---|---|---|---|
| | *Acer maacrophyllum* | Big-leaf maple | 12-in | As shown | 42 |
| | *Alnus rubra* | Red alder | 12-in | As shown | 100 |
| | *Fraxinus latifolia* | Oregon ash | 12-in | As shown | 150 |
| | *Pseudotsuga menziesii* | Douglas-fir | 12-in | As shown | 40 |
| | *Quercus garryana* | Oregon white oak | 12-in | As shown | 40 |
| | *Thuja plicata* | Western red cedar | 12-in | As shown | 100 |

SHRUBS: (Minimum of 2,362 plantings)
The owner's representative will approve individual plant material and location of plant material prior to installation. Plantings may vary in size dependent on whether they are live cuttings, bare root stock or container stock, however, no initial plantings may be shorter than twelve inches in height. Shrubs shall consist of at least three different species.

| Symbol | Botanical Name | Common Name | Minimum Height | Spacing |
|---|---|---|---|---|
| | *Amelanchier alnifolia* | Service-berry | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |
| | *Cornus alba* | Red-osier dogwood | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |
| | *Crataegus douglasii* | Douglas hawthorn | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |
| | *Gaultheria shallon* | Salal | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |
| | *Rosa nutkana* | Nootka rose | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |
| | *Symphoricarpos albus* | Snowberry | 12-in | 4-5' O.C. individual, 8-10' O.C. clustered |

SEED MIX
Broadcast or hydroseed application to bare soil areas in early fall.

| Botanical Name | Common Name | USFWS Rating | SEEDING RATES (lbs./ac. PLS*) |
|---|---|---|---|
| *Agrostis exeratea* | Spike bentgrass | FAC | 15 |
| *Bromus carinatus* | California brome-grass | UPL | 10 |
| *Bromus sitchensis* | Alaska brome | UPL | 10 |
| *Elymus glaucus* | Blue wildrye | FACU | 15 |
| *Festuca subulata* | Bearded fescue | FACU | 10 |
| | | | Total Seeding Rate = 60 lbs/ac |

*PLS = pure live seed; depends on assessed purity and germination rates.

PHS

Site Plan provided by CARDNO

Plant Tables for
Garden Apartments, Main Street and North Park Mitigation Area

The Cove, Phase 1 - Oregon City Oregon

FIGURE
6C

6-29-2015

# Appendix C

## Preliminary Drainage Report

# Preliminary Drainage Report

## Cove: Garden Apartments

21509220

Prepared for
Lloyd Hill Architecture
1914 Willamette Falls Drive, Suite 280
West Linn, Oregon
97068

June 15, 2015

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# Document Information

| | |
|---|---|
| Prepared for | Lloyd Hill Architecture |
| Project Name | Cove: Garden Apartments |
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| Date | June 15, 2015 |

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# Document Control

| Version | Date | Author | Author Initials | Reviewer | Reviewer Initials |
|---|---|---|---|---|---|
| 1 | 6/15/2015 | Atalia Raskin | ASR | Mike Towle | MDT |
| | | | | | |
| | | | | | |

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# EXECUTIVE SUMMARY

The proposed Cove: Garden Apartment project is located southwest of Main Street in Oregon City, Oregon (See Vicinity Map). The project will redevelop a gravel quarry to include eleven multi-family buildings totaling 244 units. There will be 374 parking spaces and eight detached garage structures. Residential facilities include a community center, pool, and two mixed-use buildings with non-residential space.

The project includes roadway and infrastructure improvements to Main Street. These improvements are discussed in a separate memorandum, *Main Street Stormwater Management Approach*, by Cardno and dated June 19, 2015. This memorandum is included within the Technical Appendix.

The design follows the City of Oregon City *Stormwater and Grading Design Standards*, issued in December 1999 and the standards within the Surface Water Management Agency of Clackamas County (SWMACC) Rules and Regulations using the *Surface Water Quality Facilities Technical Guidance Handbook dated 1991,* as well as the *Clean Water Services Low Impact Development Approaches Handbook dated July, 2009*.

**Water Quality**

The project discharges into the Clackamette Cove, a former gravel quarry that connects with the Clackamas River just upstream of the Willamette River. The Clackamas River is classified as water quality limited for dissolved oxygen and biological criteria. Typical pollutants from multi-family residential projects include: nutrients, pesticides, metals, oil, grease and other petroleum products, and sediment. Dissolved copper, dissolved zinc, and PAHs are generally the primary constituents of concern for stormwater runoff in Oregon streams and rivers for their impact on ESA listed species. These pollutants are specially targeted for treatment in the selected stormwater management system. The water quality storm is listed below.

- Water Quality Storm: 33% of the 2-yr, 24-hour storm event (0.83-inch precipitation depth).

The stormwater management system at the development was designed to maximize stormwater treatment through Contech StormFilters and LIDA swales.

The selected StormFilter contains cartridges filled with ZPG filter media (a mixture of zeolite, perlite, and granular activated carbon), which are designed to remove sediment, metals, and stormwater pollutants from stormwater runoff.

LIDA swales are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They also provide pollutant reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers. Specific elements are incorporated into the swale design to increase the effectiveness of this stormwater facility type. Design elements include trapped catch basins to remove coarse sediment, using soil media to provide stormwater filtration, and vegetation to will provide plant uptake.

The calculated peak water quality flow from the 7.18 acres of new impervious area is 1.47 cu-ft/sec with an approximate 13,619 cu-ft runoff volume.

**Water Quantity**

The project will connect into the proposed storm sewer within Main Street. The public storm sewer connects into an existing storm sewer before discharging into the Clackamette Cove. The Clackamette Cove exits into the Clackamas River just upstream of the Willamette River. Both the Clackamas and Willamette Rivers have drainage basins larger than 100 sq.-miles, the upper limit requiring stormwater detention. Therefore, detention is not required for this project.

**Conveyance Analysis**

A complete onsite conveyance analysis will be completed within the Final Drainage Report.

**Preliminary Hydrology Analysis**

A hydrology analysis was completed and is included within the Technical Appendix. The memorandum discusses the hydrology impacts that may occur on the receiving watershed and storm sewer as a result of the Cove development.

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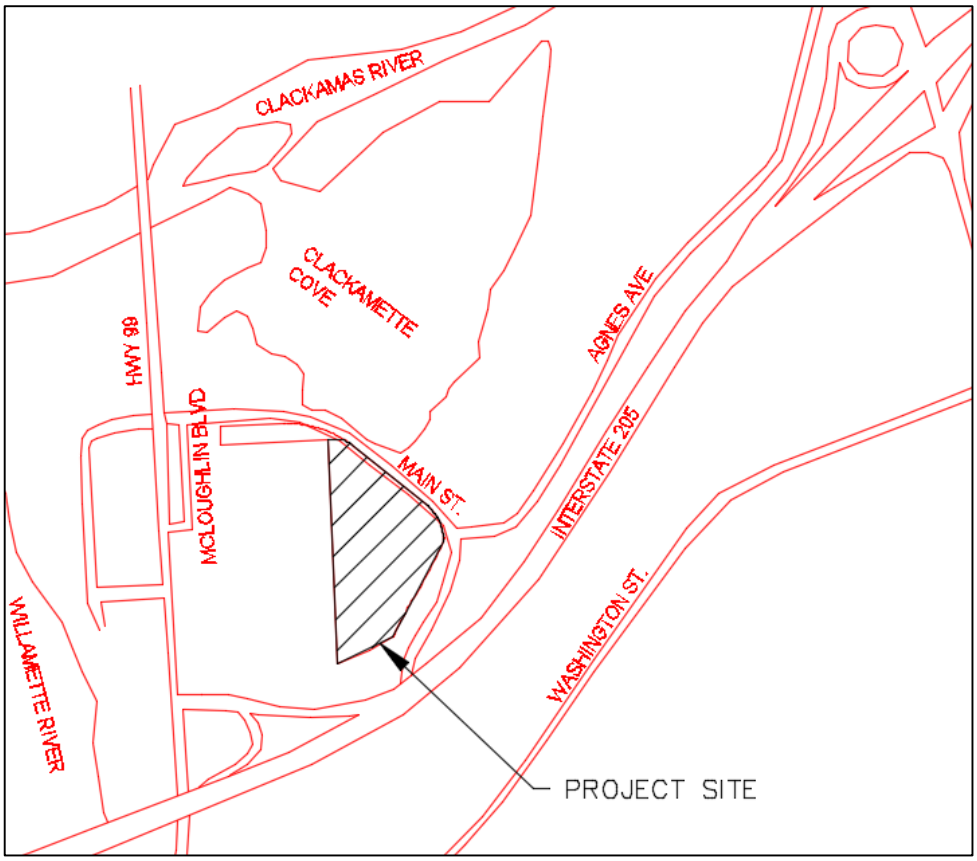
# 1 VICINITY MAP

**Figure 1-1 Vicinity Map**



# 2 PROJECT DESCRIPTION

## 2.1 Project Overview

The proposed Cove: Garden Apartment project is located southwest of Main Street in Oregon City, Oregon (See Vicinity Map). The project will redevelop a gravel quarry to include eleven multi-family buildings totaling 244 units. There will be 374 parking spaces and eight detached garage structures. Residential facilities include a community center, pool, and two mixed-use buildings with non-residential space.

The project includes roadway and infrastructure improvements to Main Street. These improvements are discussed in a separate memorandum, *Main Street Stormwater Management Approach*, by Cardno and dated June 19, 2015. This memorandum is included within the Technical Appendix.

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# 3 EXISTING CONDITIONS

## 3.1 Topography

The existing site slopes towards the Clackamette Cove with slopes of approximately 2-percent. Elevations at the site range from approximately 25 feet within the ditch located along the north and west side of the site up to 55 feet in the southern area of the site. A majority of the site to be developed is above the 35 feet elevation level. The ordinary high water for the Clackamette Cove is 18 feet.

## 3.2 Climate

The site is located in Oregon City, located approximately 90 miles inland from the Pacific Ocean. There is a gradual change in seasons with defined seasonal characteristics. Average daily temperatures range from 35°F to 82°F. Average annual rainfall recorded in this area is 47 inches.

## 3.3 Site Geology

There are two underlying soil types on the site as classified by the United States Department of Agriculture Soil Survey of Clackamas County, Oregon. These soil types are identified below in Table 3-1 (See Technical Appendix: Soil Survey of Clackamas County Area, Oregon).

**Table 3-1 Soil Characteristics**

| Soil Type | Hydrologic Group |
|---|---|
| Urban Land | D |
| Newberg Fine Sandy Loam | B |

Group B soils have moderate infiltration rates when thoroughly saturated, while group D soils have very slow infiltration rates when thoroughly saturated. Group D soils is the dominant soil type. Therefore, a soil classification of group D was conservatively assigned to the whole site.

## 3.4 Hydrology

Runoff from the site consists primarily of overland flow across concrete and gravel surfaces. Runoff drains into the Clackamette Cove prior to entering the Clackamas River, a tributary to the Willamette River. There is no water quality treatment for stormwater on the site. Stormwater runoff exits the area four ways: 1) through an

offsite basin in the northwest, 2) through the existing 36-inch culvert outfall, 3) through the existing 15-inch culvert outfall and 4) sheet flow into the Cove.

### 3.5 Basin Areas

Surface areas impacted by this project are shown in Table 3-2. The existing site is approximately 59.3 percent impervious. Impervious surfaces include, concrete and compacted gravel at the site. (See Technical Appendix: Exhibit 1 – Existing Basin Delineation).

**Table 3-2 Existing Basin Areas**

| Basin | Impervious Area (ac) | Gravel Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|---|
| Onsite | 3.288 | 3.510 | 4.659 | 11.457 |

# 4 PROPOSED CONDITIONS

### 4.1 Hydrology

The proposed site will collect stormwater runoff through catch basins and roof drains and convey runoff to two StormFilter Vaults and a LIDA swale. Collected and treated runoff will discharge from the site into an existing public storm sewer in Main Street. The public storm sewer is being upsized through the Main Street improvements to accommodate future upstream development. The public storm sewer discharge into the Clackamette Cove through a 36-inch diameter pipe at an elevation of 22.24 feet. This is above the ordinary high water elevation of 18 feet. The drainage ditch located to the north and west of the site will not be impacted by this project.

### 4.2 Curve Number

The curve number represents runoff potential from the soil. The major factors for determining the CN values are hydrologic soil group, cover type, treatment, hydrologic condition and antecedent runoff condition. The selected pervious curve number is 90 – Open Space in good Condition (See Technical Appendix: Table 2-2 – Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas).

### 4.3 Time of Concentration

The time of concentration ($T_C$) as described in NEH-4 Chapter 15 is defined in two ways; the time for runoff to travel from the furthermost point of the watershed to the point in question, and the time from the end of excess rainfall to the point of inflection on the trailing limb of the unit hydrograph. Time of concentration can be estimated from several formulas.

The minimum time of concentration is 5 minutes in highly developed urban areas (i.e. parking lots) and the maximum is 100 minutes in rural areas. A condition time of concentration of 5 minutes was used for our delineated sub-basin.

### 4.4 Basin Areas

Impervious and pervious areas for proposed conditions are shown in Table 4-1. The proposed site will be 63.2 percent impervious (See Technical Appendix: Exhibit 2 – Proposed Basin Delineation).

**Table 4-1 Proposed Basin Areas**

| Basin | Impervious Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|
| Onsite | 7.179 | 4.278 | 11.457 |

# 5 HYDROLOGIC ANALYSIS DESIGN GUIDELINES

## 5.1 Design Guidelines

The analysis and design criteria used for stormwater management described in this section will follow the City of Oregon City *Stormwater and Grading Design Standards*, Chapter 6 Collection and Conveyance Facilities. Section 6.3 describes the allowable flow determination methods including the selected SBUH method.

## 5.2 Hydrograph Method

Rainstorms occur naturally over long periods of time. The most effective way of estimating storm rainfall is by using the hydrograph method. The hydrograph method generates storm runoff based on physical characteristics of the site. The Santa Barbara Urban Hydrograph (SBUH) was used for this analysis. The SBUH method is based on the curve number (CN) approach, and uses the Soil Conservation Service's (SCS) equations for computing soil absorption and precipitation excess. The SBUH method converts the incremental runoff depths into instantaneous hydrographs, which are then routed through an imaginary reservoir with a time delay equal to the basin time of concentration.

xpswmm 2013 Version 15.1 was used for our hydrology and hydraulics analysis. xpswmm is based on the public domain xpswmm program and is an approved method of analysis by Oregon City.

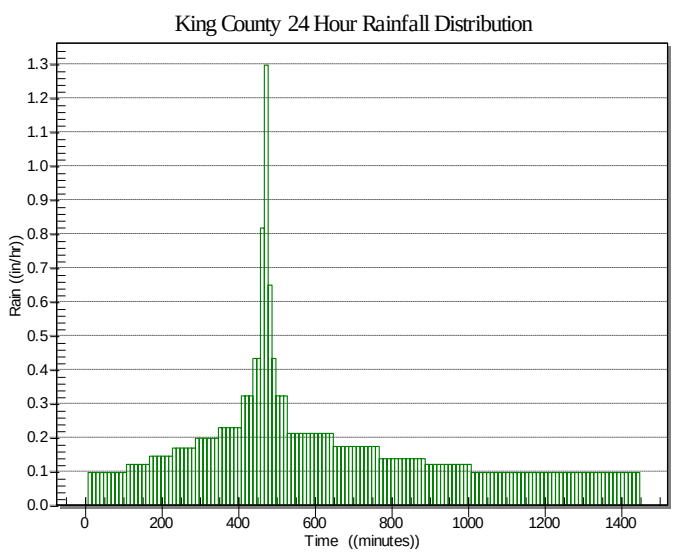
## 5.3 Design Storm

The rainfall distribution to be used within the Oregon City jurisdiction is the design storm of 24-hour duration based on the standard King County rainfall distribution. A typical King County 24-hour rainfall distribution for a 25-year storm event is shown in Figure 5-1.

**Table 5-1 Precipitation Depth**

| Recurrence interval (years) | Total Precipitation Depth (in) |
|---|---|
| WQ | 0.83 |
| 10 | 3.40 |
| 25 | 4.00 |
| 50 | 4.40 |
| 100 | 4.50 |

**Figure 5-1 25 Year King County Type 1A Rainfall Ditribution**



# 6 HYDRAULIC ANALYSIS AND DESIGN CHARACTERISTICS

## 6.1 Design Guidelines

The analysis and design criteria described in this section will follow the City of Oregon City *Stormwater and Grading Design Standards*. Chapter 6 – Collection and Conveyance Facilities requires storm drainage system and facilities be designed to convey the 10-year storm event without surcharge.

## 6.1 Manning's 'n' Values for Pipes

A Manning's 'n' value of 0.013 was selected for all of the storm drain pipes. Additionally an exit loss coefficient between 0.02 and 0.25 was added into each catch basin and manhole. The value is dependent upon the angle of the pipe leaving each catch basin or manhole.

## 6.2 System Performance

A complete conveyance analysis will be completed in the final drainage analysis.

## 6.1 Backwater Elevation

The proposed conveyance systems will be modeled both with and without the backwater of 50.7 feet (City established design flood elevation).

# 7 WATER QUALITY

## 7.1 Water Quality Guidelines

All water quality facilities were designed per criteria set forth by the *City of Oregon City Stormwater and Grading Design Standards* to facilitate the treatment of all stormwater runoff from the proposed site. The facilities will be designed to capture and treat runoff from 1/3 of the 2-year, 24-hour storm event.

## 7.2 Water Quality Facility

The project discharges into the Clackamette Cove, a former gravel quarry that connects with the Clackamas River just upstream of the Willamette River. The Clackamas River is classified as water quality limited for dissolved oxygen and biological criteria. Typical pollutants from multi-family residential projects include nutrients, pesticides, metals, oil, grease and other petroleum products, and sediment. Dissolved copper, dissolved zinc, and PAHs are generally the primary constituents of concern for stormwater runoff in Oregon streams and rivers for their impact on ESA listed species. These pollutants are specially targeted for treatment in the selected stormwater management system. The water quality storm is listed below.

- Water Quality Storm: 33% of the 2-yr, 24-hour storm event (0.83-inch precipitation depth).

The stormwater management system at the development was designed to maximize stormwater treatment through Contech StormFilters and LIDA swales.

LIDA swales are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They also provide pollutant reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers. Specific elements are incorporated into the swale design to increase the effectiveness of this stormwater facility type. Design elements include trapped catch basins to remove coarse sediment, using soil media to provide stormwater filtration, and vegetation to will provide plant uptake.

### 7.2.1 Mechanical Treatment

Contech StormFilter vaults are the selected water quality facilities. These facilities were selected for their ability to integrate into the proposed site plan. Each StormFilter system will have the standard cartridge size with an 18-inch drop and have a treatment capacity of 0.033 cfs (15 gpm). The maximum bypass flow is 1.80 cfs; an internal bypass structure will be provided for stormwater vaults. The selected StormFilter contains cartridges filled with ZPG filter media (a mixture of zeolite, perlite, and granular activated carbon), which are designed to remove sediment, metals, and stormwater pollutants from stormwater runoff.

Table 7-1 lists the number of cartridges within each system. Two facilities will provide treatment to the required surface area.

**Table 7-1 Mechanical Water Quality Facilities**

| Basin # | Impervious Area (ac) | Water Quality Flow Rate (cfs) | Quantity of Cartridges | Facility Type |
|---|---|---|---|---|
| North | 3.122 | 0.642 | 20 | 8x11 Vault |
| South | 3.230 | 0.661 | 20 | 8x11 Vault |
| Total | 6.352 | - | 40 | - |

### 7.2.2 LIDA Facilities

The site plan includes LIDA Swales. LIDA Swales are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They also provide pollutant reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers.

The LIDA Swales are proposed sloped swales. Sloped swales are linear landscaped reservoirs with slopes of 0.5 to 1.0%, bottom widths of 4 feet, check dams, and 3 to 1 sloped side walls. Overflows will be provided for water depths greater than 6 inches. A perforated pipe surrounded by gravel will collect the treated stormwater and convey it to the public storm sewer. The LIDA Swales section is listed below:

- Freeboard Depth: 6 inches
- Maximum Treatment Water Depth: 6 inches
- Growing Media Depth: 18 inches
- Gravel Depth: 12 inches

Table 7-2 lists the area of the proposed LIDA Swale, and the proposed impervious draining to the facility.

**Table 7-2 LIDA Swale Design**

| Basin | Swale Surface Area (sq.-ft) | Length (ft) | Impervious Area Draining to Facility (ac) |
|---|---|---|---|
| Swale | 3,298 | 325 | 0.723 |

# 8 WATER QUANTITY

## 8.1 Water Quantity Guidelines

The proposed stormwater management system will discharge site runoff to an existing storm sewer. As part of the conveyance analysis the public storm sewer will be evaluated for capacity. Pervious conveyance studies of the public storm sewer found to be able to convey site flows. The Clackamette Cove exits into the Clackamas River just upstream of the Willamette River. Both the Clackamas and Willamette Rivers have drainage basins larger than 100 sq.-miles, the upper limit requiring stormwater detention. Therefore detention is not required for this project.

# 9 SUMMARY

The proposed storm management approach follows the *City of Oregon City Stormwater and Grading Design Standards.* The Cove: Garden Apartments storm system was designed to provide water quality treatment by Contech StormFilters and a LIDA Swale.

In conclusion, the proposed stormwater management system will meet the requirements of the City of Oregon City.

Cove: Garden Apartments

# Technical Appendix

Supporting Material

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## Technical Appendix

- Exhibit 1 – Existing Basin Delineation
- Exhibit 2 – Proposed Basin Delineation

- Sheet C0.0 Cover Sheet
- Sheet C1.0 Existing Conditions Plan
- C2.0 Site Plan
- C3.0 Grading and Erosion Control Plan
- C4.0-C4.2 Storm Plan

- Hydrologic Soils Group – Clackamas County
- Table 2-2 – Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas

- xpswmm Hydrographs
  - Water Quality
  - 25-year
- Preliminary Hydrology Analysis Memorandum, Cardno, June 19, 2015
- Main Street Stormwater Management Approach Memorandum, Cardno, June 19, 2015

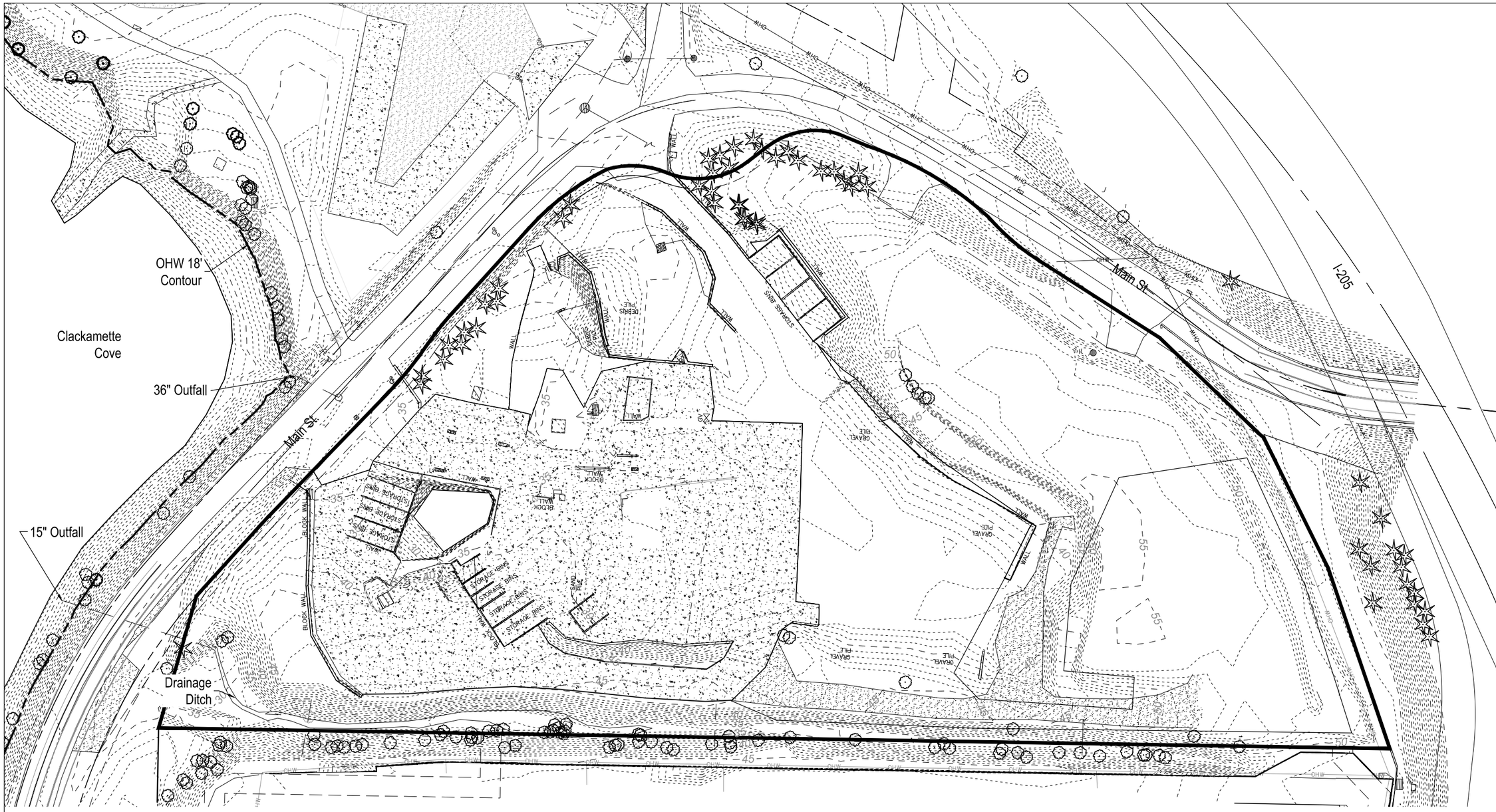
# 10 REFERENCES

Soil Survey of Clackamas County Area
NRCS

Technical Release 55 – Urban Hydrology of Small Watersheds
U.S. Department of Agriculture, NRCS

Surface Water Management Agency of Clackamas County, Rules and Regulations,
Issued December 2013

Surface Water Quality Facilities Technical Guidance Handbook,
Issued August 1991.




| Basin | Impervious Area (ac) | Gravel Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|---|
| Existing | 3.288 | 3.510 | 4.659 | 11.457 |

SCALE: 1"=100'

100 50 0 100

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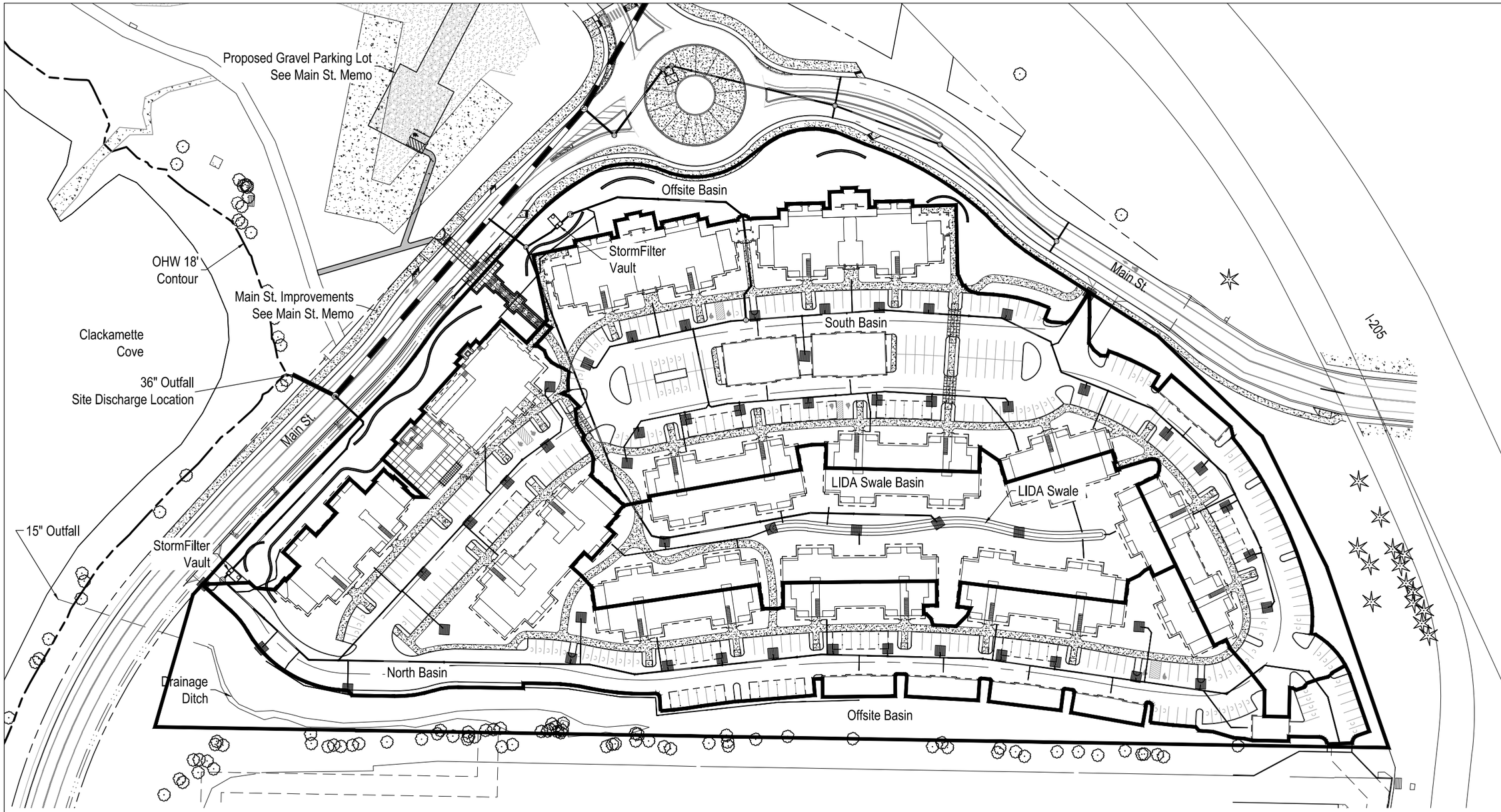
# EXISTING BASIN DELINEATION
# COVE: GARDEN APARTMENTS

GRAND COVE LLC
Oregon City, Oregon

PROJECT NO. 211509220
DATE: 06/19/2015
BY: ASR
EXHIBIT: 1




| Basin | Impervious Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|
| North | 3.122 | 0.586 | 3.708 |
| South | 3.230 | 0.479 | 3.709 |
| LIDA Swale | 0.723 | 0.770 | 1.493 |
| Offsite | 0.104 | 2.443 | 2.547 |
| Total | 7.179 | 4.278 | 11.457 |

SCALE: 1"=100'

100 50 0 100

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# PROPOSED BASIN DELINEATION
# COVE: GARDEN APARTMENTS

GRAND COVE LLC
Oregon City, Oregon

PROJECT NO. 211509220
DATE: 06/19/2015
BY: ASR
EXHIBIT: 2

# THE COVE - GARDEN APARTMENTS

OREGON CITY, OREGON
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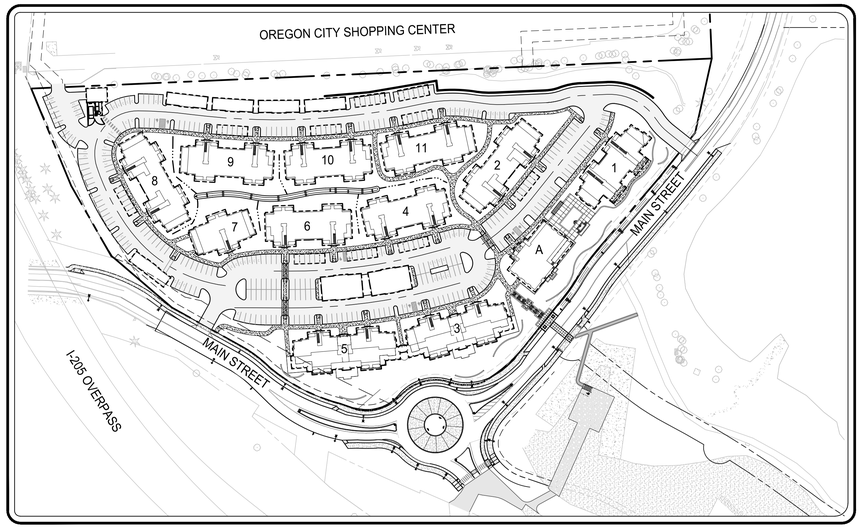
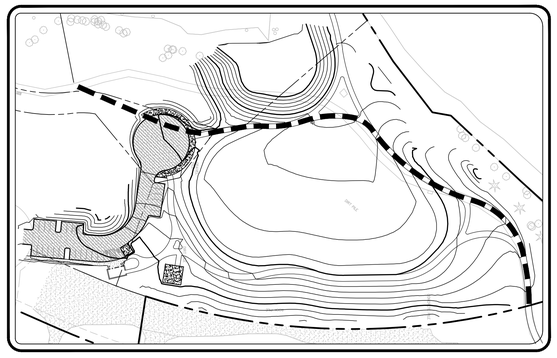
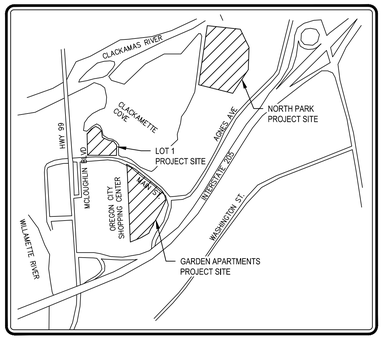
*LOT 1 SITE MAP*
SCALE: NTS




*GARDEN APARTMENTS SITE MAP*
SCALE: NTS



*NORTH PARK SITE MAP*
SCALE: NTS




*VICINITY MAP*
SCALE: NTS

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MIKWAUKIE, OREGON 97267
PHONE: (503) 496-1517
FAX: (503) 742-2860

## INDEX OF SHEETS


| | |
|---|---|
| C0.0 | COVER SHEET |
| C1.0 | EXISTING CONDITIONS PLAN- GARDEN APARTMENTS |
| C1.1 | EXISTING CONDITIONS PLAN- NORTH PARK |
| C1.2 | EXISTING CONDITIONS PLAN- LOT 1 |
| C2.0 | OVERALL SITE PLAN |
| C2.1 - C2.3 | SITE PLAN |
| C3.0 | OVERALL GRADING PLAN |
| C3.1 - C3.2 | GRADING AND EROSION CONTROL PLANS |
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| C3.4 | NORTH PARK GRADING AND EROSION CONTROL PLAN |
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| L1.0 & L1.1 | EXISTING VEGETATION PLANS |
| L2.0 & L2.1 | TREE REMOVAL PLANS |
| L3.0 | OFFSITE PLANTING PLAN - OVERALL |
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| L4.1 & L4.2 | ONSITE PLANTING PLANS |
| L5.0 | ONSITE PLANTING LEGEND, PROJECT DETAILS & NOTES |


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COVER SHEET
THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
BEN WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
COVER

SHEET NUMBER
C0.0

LAND USE # ---


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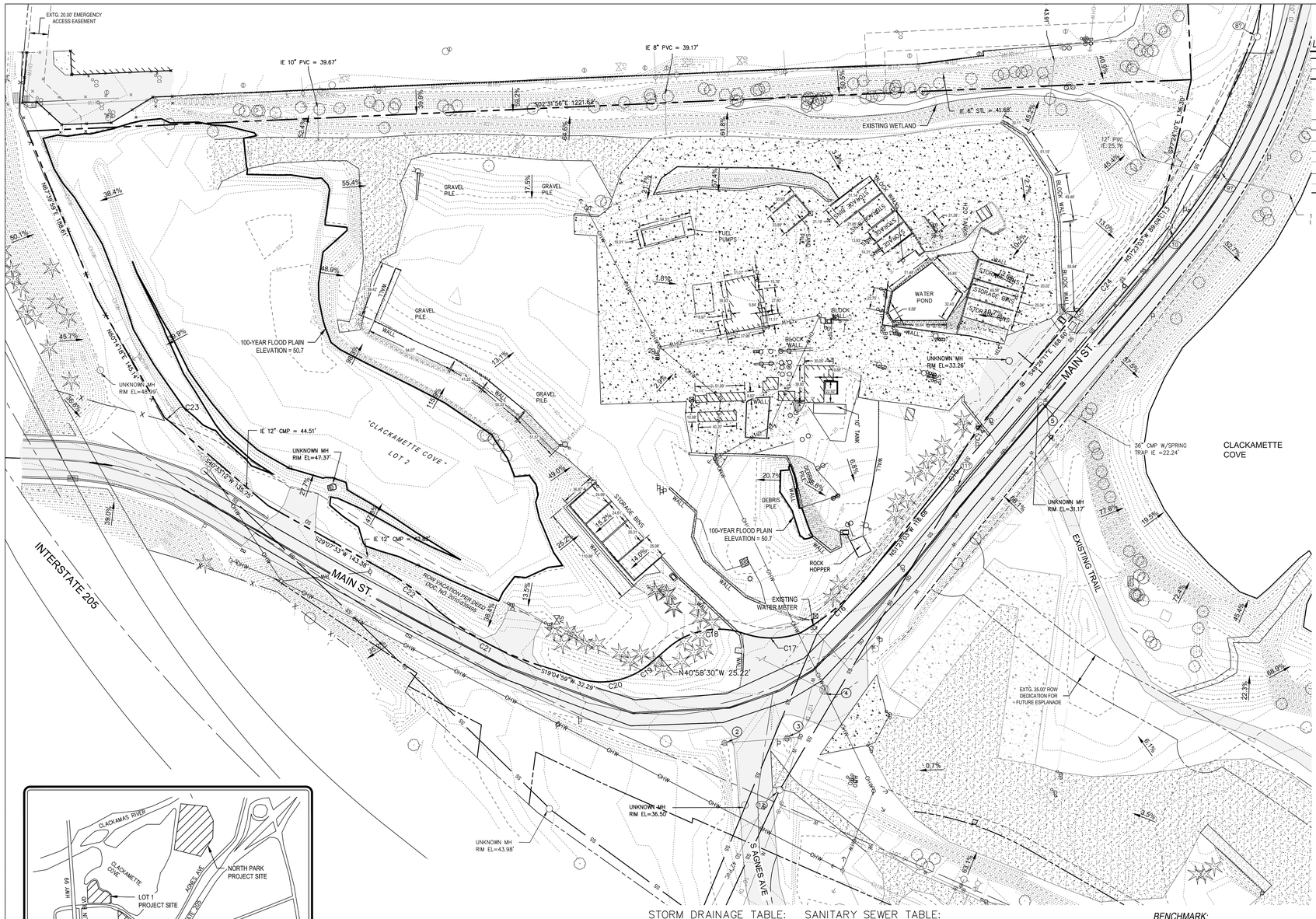
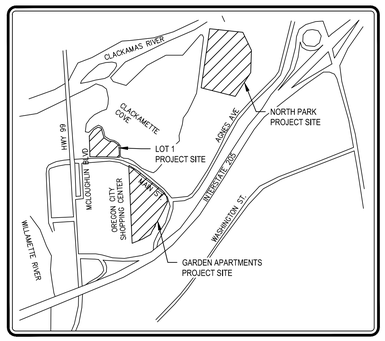



## LEGEND

- EXISTING PROPERTY LINE
- EXISTING CENTERLINE
- EXISTING RIGHT-OF-WAY LINE
- EXISTING 1' CONTOUR
- EXISTING 5' CONTOUR
- BUILDING OVERHANG LINE
- WETLAND LIMITS
- X — FENCE LINE, TYPE AS NOTED
- SS — SANITARY SEWER LINE
- SD — STORM DRAINAGE LINE
- E — UNDERGROUND ELECTRICAL LINE
- OHW — OVERHEAD WIRE
- G — UNDERGROUND GAS LINE
- BUILDING FACE
- EXISTING ASPHALT SURFACE
- EXISTING CONCRETE SURFACE
- EXISTING GRAVEL SURFACE
- GAS VALVE
- GAS WARNING SIGN
- SEE SANITARY SEWER TABLE
- SANITARY SEWER MANHOLE
- SEE STORM DRAINAGE TABLe
- CATCH BASIN
- AREA DRAIN
- RD — ROOF DRAIN
- FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- WATER VALVE
- WATER METER
- WATER SPIGOT
- SPRINKLER HEAD
- SPRINKLER VALVE
- STREET LIGHT (COBRA ARM)
- ELECTRICAL RISER
- TELEPHONE RISER
- TELEPHONE MANHOLE
- CONIFEROUS TREE
- DECIDUOUS TREE
- CO — UNKNOWN CLEANOUT
- TP — STAND PIPE
- UNKNOWN MANHOLE
- GUY WIRE
- UTILITY POLE
- UNKNOWN UTILITY VAULT
- BO — BOLLARD
- FP — FLAG POLE
- GP — GATE POST
- MAILBOX
- SIGN
- DOUBLE POST SIGN
- TP — TEST PIT
- MW — MONITORING WELL
- FLOW DIRECTION ARROWS




VICINITY MAP
SCALE: NTS

EXISTING CONDITIONS PLAN:
THIS PLAN IS INTENDED FOR USE AS AN EXISTING CONDITIONS PLAN SHOWING THE CONDITIONS OF THE SITE PRIOR TO CONSTRUCTION. INFORMATION SHOWN ON THIS PLAN WAS DEVELOPED FROM THE TOPOGRAPHIC SURVEY AND SITE OBSERVATIONS BY THE ENGINEER. NOT ALL SURFACE FEATURES MAY BE SHOWN. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION TO DETERMINE WORK SPECIFIC DETAILS. TOPOGRAPHIC INFORMATION PROVIDED BY CARDNO WRG DATED OCTOBER 4, 2006.

## STORM DRAINAGE TABLE:

(2) 2' SQUARE BOX DRAIN
RIM = 34.30'
12" CONC (N) IE = 31.50'
SUMP IE = 31.50'
SUMP IE = 32.40'

(3) 2' SQUARE BOX DRAIN
RIM = 33.46'
12" CONC (S) IE = 30.16'
12" CONC (NW) IE = 29.96'
SUMP IE = 30.06'
SUMP IE = 31.06'

(4) GRATED STORM MANHOLE
RIM = 35.03'
12" CONC (SW) IE = 28.03'
42" PVC (SE) (NW)
INVERT ELEVATION = 25.88'

(5) STORM DRAIN MANHOLE
RIM=31.17'
36" CMP (N)
42" PVC (SE)
INVERT ELEVATION = 22.27'

## SANITARY SEWER TABLE:

(8) SANITARY SEWER MANHOLE
RIM=30.31'
42" CONC (W)
42" CONC (E)
INVERT ELEVATION = 21.15'

(9) SANITARY SEWER MANHOLE
RIM=29.76'
84" CONC (W)
84" CONC (E)
INVERT ELEVATION = 12.60'

(10) SANITARY SEWER MANHOLE
RIM=33.06'
42" CONC (W)
42" CONC (E)
INVERT ELEVATION = 20.88'

(11) SANITARY SEWER MANHOLE
RIM=31.94'
84" CONC (E)
84" CONC (W)
INVERT ELEVATION = 12.97'

(12) SANITARY SEWER MANHOLE
RIM=36.13'
84" CONC (E)
84" CONC (W)
INVERT ELEVATION = 13.33'

(13) SANITARY SEWER MANHOLE
RIM=42.71'
72" CONC (N)
54" CONC (S)
42" CONC (W)
INVERT ELEVATION = 18.48'

(14) FLOW CONTROL STRUCTURE
RIM=42.33'
72" CONC (N)
72" CONC (S)
72" CONC (W)
INVERT ELEVATION = 13.47'

(15) SANITARY SEWER MANHOLE
RIM=42.39'
72" CONC (N)
72" CONC (S)
INVERT ELEVATION = 18.34'

(16) SANITARY SEWER MANHOLE
RIM=43.00'
72" CONC (N)
72" CONC (S)
INVERT ELEVATION = 14.30

## BENCHMARK:

OREGON STATE HIGHWAY VERTICAL CONTROL RECEIVED FROM CLACKAMAS COUNTY ENGINEERING DEPARTMENT.

"A STANDARD OSHD DISK STAMPED "56 G 220 1934" LOCATED IN THE NORTHEAST CORNER OF THE JOHN MCLAOUGHLIN BRIDGE OVER THE CLACKAMAS RIVER.

PUBLISHED NGVD 29 ELEV.=56.117 FEET
CONVERTED TO NAVD 88 ELEV.=59.587 FEET

## UTILITY STATEMENT:

THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

SCALE: 1"=50'
50 25 0 50

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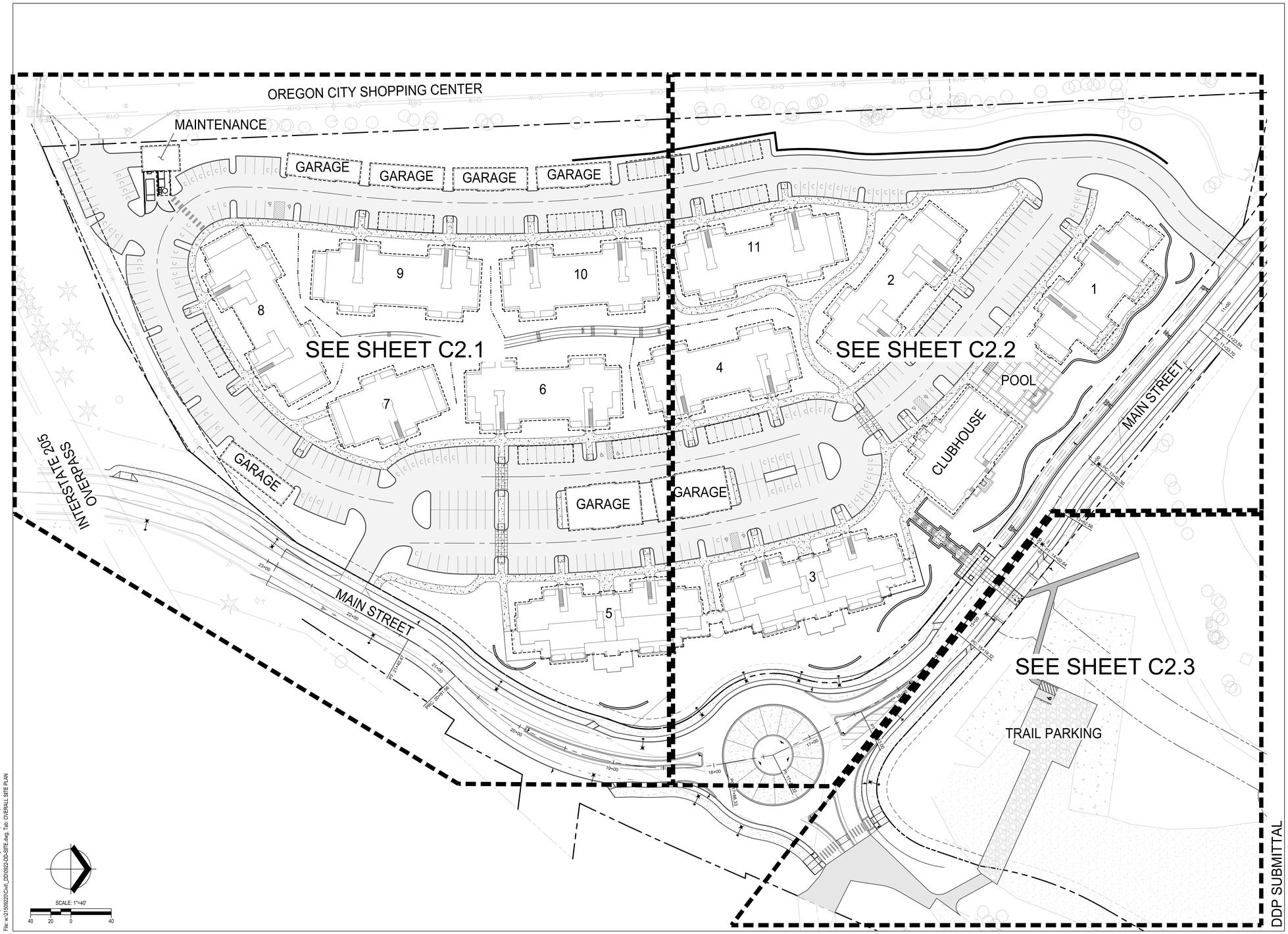
EXISTING CONDITIONS PLAN - GARDEN APARTMENTS
THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |
| SHEET TITLE | EXISTING |
| SHEET NUMBER | C1.0 |
| LAND USE # | — |

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OVERALL SITE PLAN
THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

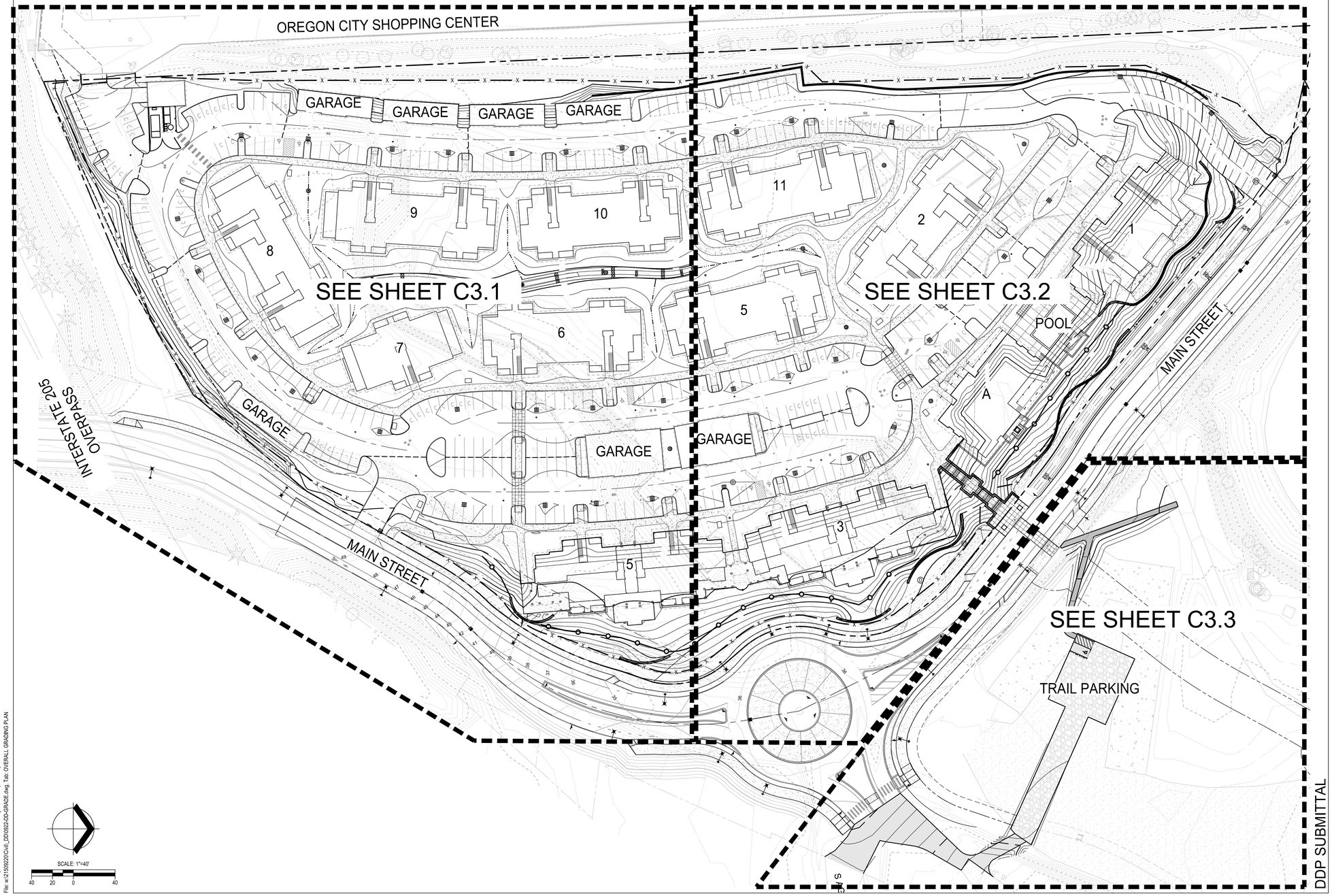
REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
OVERALL SITE

SHEET NUMBER
C2.0

LAND USE # –

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OVERALL GRADING PLAN
THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
FRANK D. WILLIAMS
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
OVERALL GRADING

SHEET NUMBER
C3.0

LAND USE # —

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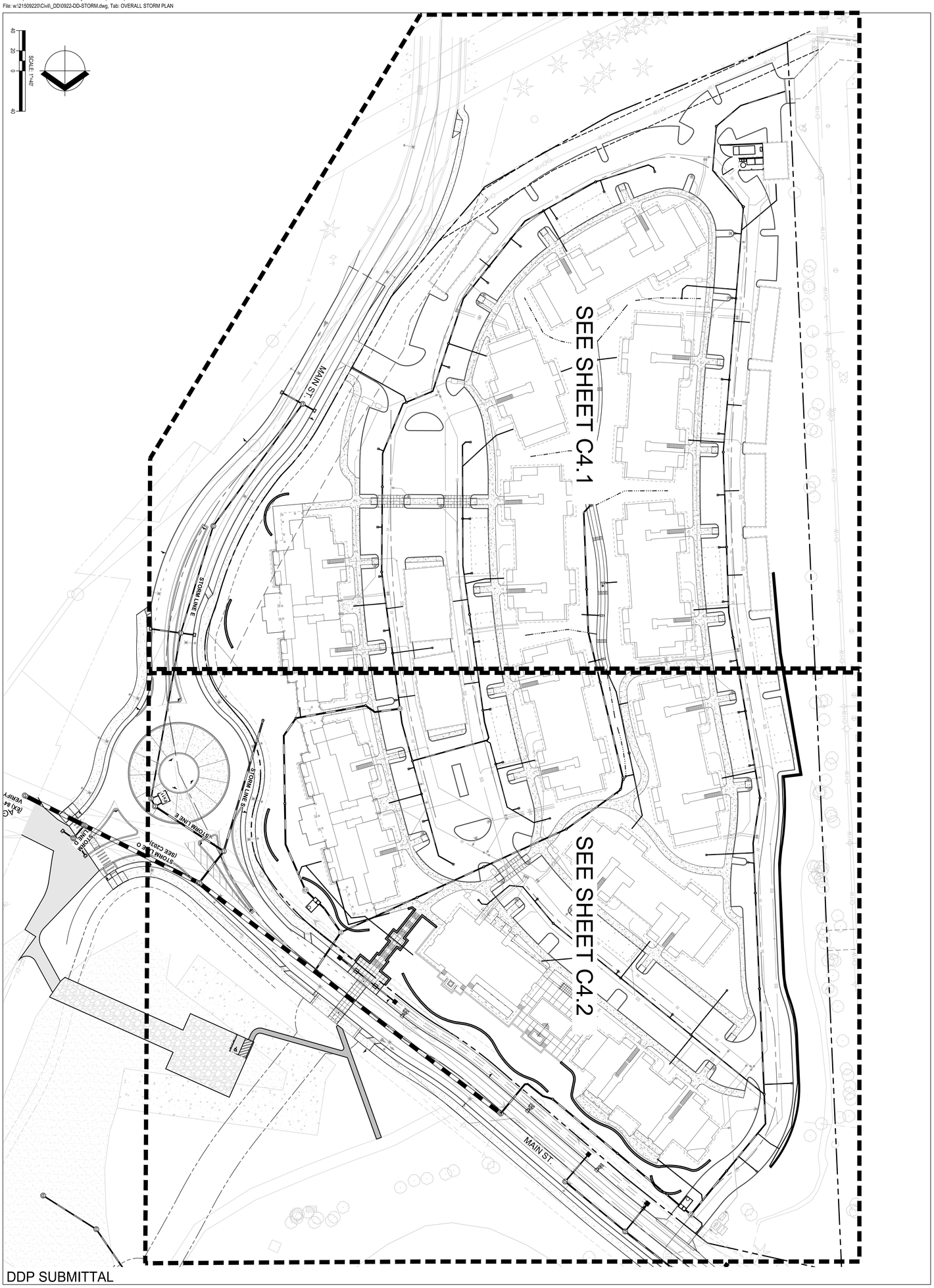


DDP SUBMITTAL

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

OVERALL STORM PLAN

# THE COVE - GARDEN APARTMENTS

GRAND COVE, LLC

OREGON CITY, OREGON


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PORTLAND
5415 SW WESTGATE DR, STE 100, PORTLAND, OR 97221
TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
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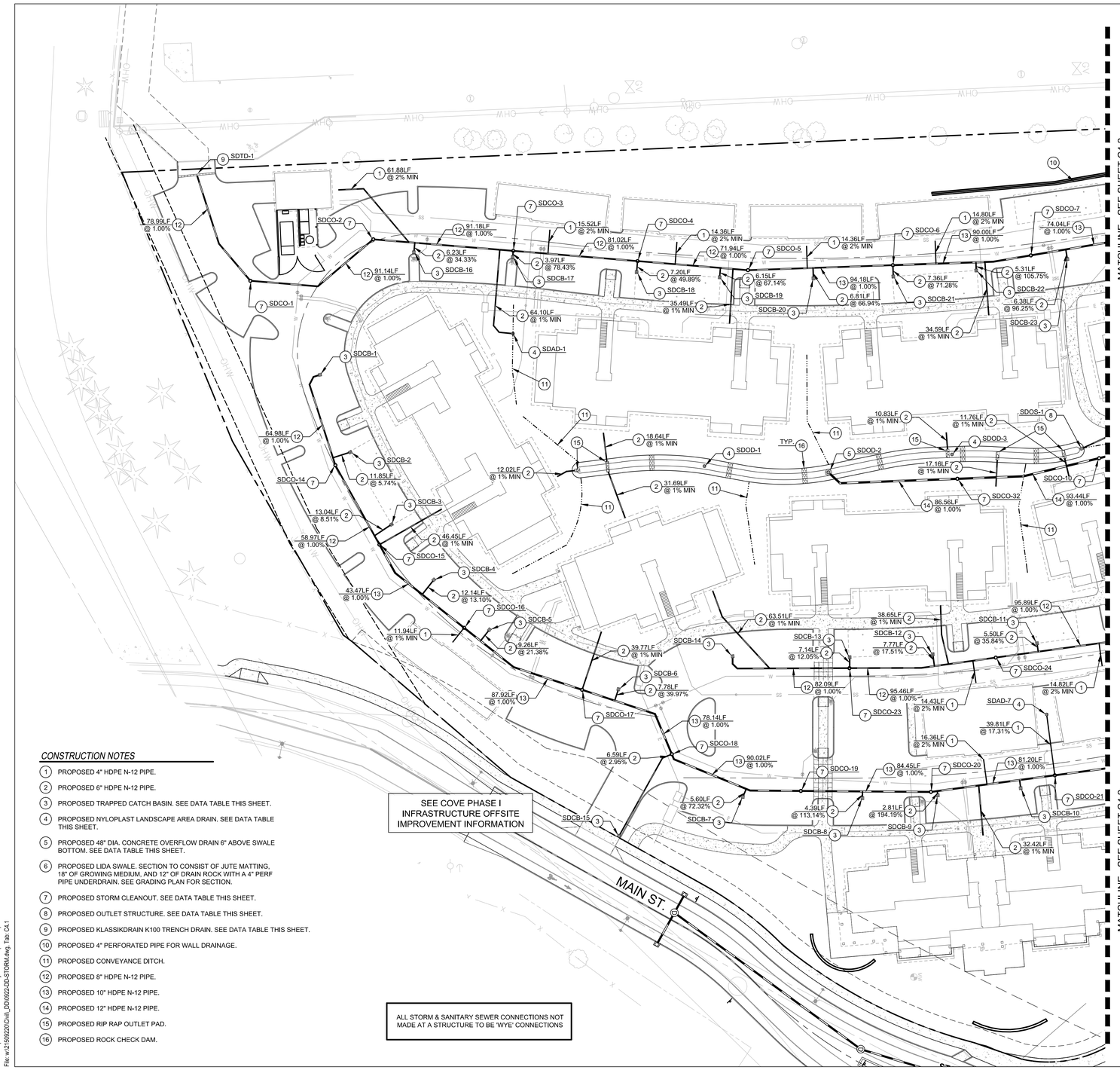
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |
| SHEET TITLE | OVERALL STORM |
| SHEET NUMBER | C4.0 |
| LAND USE # | — |

REGISTERED PROFESSIONAL ENGINEER
BRIAN R. WILLIAMS
EXPIRES: 06/30/16

PRELIMINARY
NOT FOR CONSTRUCTION




ALL STORM & SANITARY SEWER CONNECTIONS NOT MADE AT A STRUCTURE TO BE 'WYE' CONNECTIONS

## CONSTRUCTION NOTES

1. PROPOSED 4" HDPE N-12 PIPE.
2. PROPOSED 6" HDPE N-12 PIPE.
3. PROPOSED TRAPPED CATCH BASIN. SEE DATA TABLE THIS SHEET.
4. PROPOSED NYLOPLAST LANDSCAPE AREA DRAIN. SEE DATA TABLE THIS SHEET.
5. PROPOSED 48" DIA. CONCRETE OVERFLOW DRAIN 6" ABOVE SWALE BOTTOM. SEE DATA TABLE THIS SHEET.
6. PROPOSED LIDA SWALE. SECTION TO CONSIST OF JUTE MATTING, 18" OF GROWING MEDIUM, AND 12" OF DRAIN ROCK WITH A 4" PERF PIPE UNDERDRAIN. SEE GRADING PLAN FOR SECTION.
7. PROPOSED STORM CLEANOUT. SEE DATA TABLE THIS SHEET.
8. PROPOSED OUTLET STRUCTURE. SEE DATA TABLE THIS SHEET.
9. PROPOSED KLASSIKDRAIN K100 TRENCH DRAIN. SEE DATA TABLE THIS SHEET.
10. PROPOSED 4" PERFORATED PIPE FOR WALL DRAINAGE.
11. PROPOSED CONVEYANCE DITCH.
12. PROPOSED 8" HDPE N-12 PIPE.
13. PROPOSED 10" HDPE N-12 PIPE.
14. PROPOSED 12" HDPE N-12 PIPE.
15. PROPOSED RIP RAP OUTLET PAD.
16. PROPOSED ROCK CHECK DAM.

## LEGEND

- EXISTING PROPERTY LINE
- PROPOSED SETBACK LINE
- EXISTING EASEMENT LINE
- PROPOSED WATER LINE
- PROPOSED STORM DRAIN PIPE
- PROPOSED SANITARY PIPE
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING SANITARY MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN
- PROPOSED SWALE OVERFLOW
- PROPOSED STORM CLEANOUT
- PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE VAULT
- PROPOSED WATER METER
- PROPOSED DCVA
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED CONVEYANCE DITCH
- PROPOSED RIP RAP PAD
- PROPOSED ROCK CHECK DAM

### CATCH BASIN DATA

SDCB-1
RIM: 50.71
IE OUT (8"S) = 47.71

SDCB-2
RIM: 50.87
IE OUT (6"S) = 47.87

SDCB-3
RIM: 50.82
IE OUT (6"SE) = 47.82

SDCB-4
RIM: 50.80
IE OUT (6"SE) = 47.80

SDCB-5
RIM: 50.70
IE OUT (6"SE) = 47.70

SDCB-6
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-7
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-8
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-9
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-10
RIM: 50.87
IE OUT (6"W) = 47.87

### CATCH BASIN DATA

SDCB-11
RIM: 50.70
IE OUT (6"E) = 47.70

SDCB-12
RIM: 50.77
IE OUT (6"E) = 47.77

SDCB-13
RIM: 50.83
IE OUT (6"E) = 47.83

SDCB-14
RIM: 50.79
IE OUT (8"E) = 47.79

SDCB-15
RIM: 49.10
IE OUT (6"NW) = 46.10

SDCB-16
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-17
RIM: 51.20
IE OUT (6"W) = 48.20

SDCB-18
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-19
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-20
RIM: 50.70
IE OUT (6"W) = 47.70

### CATCH BASIN DATA

SDCB-21
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-22
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-23
RIM: 50.70
IE OUT (6"W) = 47.70

### AREA DRAIN DATA

SDAD-1
RIM: 51.00
IE OUT (6"S) = 48.00

SDAD-7
RIM: 51.62
IE OUT (4"E) = 48.62

### OVERFLOW DRAIN DATA

SDOD-1
RIM: 49.64
IE IN (4"N) = 47.14
IE OUT (4"S) = 47.14

SDOD-2
RIM: 49.24
IE IN (4"N) = 46.74
IE IN (4"S) = 46.74
IE OUT (12"NE) = 46.74

SDOD-3
RIM: 49.63
IE IN (4"N) = 47.13
IE OUT (4"S) = 47.13

### OUTLET STRUCTURE DATA

SDOS-1
RIM: 49.91
IE IN (6"NW) = 47.52

### TRENCH DRAIN DATA

SDTD-1
RIM: 49.93
IE OUT (8"E) = 47.70

### CLEANOUT DATA

SDCO-1
RIM = 52.48'
IE (8") = 46.91'

SDCO-2
RIM = 51.43'
IE (8") = 46.00'

SDCO-3
RIM = 51.37'
IE (8") = 45.09'

SDCO-4
RIM = 51.17'
IE (8") = 44.28'

SDCO-5
RIM = 51.35'
IE (8") = 43.56'

SDCO-6
RIM = 51.18'
IE (10") = 42.62'

SDCO-7
RIM = 51.17'
IE (10") = 41.72'

SDCO-10
RIM = 51.28'
IE (12") = 44.94'

SDCO-14
RIM = 51.36'
IE (8") = 47.06'

SDCO-15
RIM = 51.47'
IE (10") = 46.47'

### CLEANOUT DATA

SDCO-16
RIM = 51.24'
IE (10") = 45.69'

SDCO-17
RIM = 51.39'
IE (10") = 44.81'

SDCO-18
RIM = 51.26'
IE (10") = 44.03'

SDCO-19
RIM = 51.37'
IE (10") = 43.13'

SDCO-20
RIM = 51.06'
IE (10") = 42.29'

SDCO-21
RIM = 51.32'
IE (10") = 41.48'

SDCO-23
RIM = 51.20'
IE (8") = 46.97'

SDCO-24
RIM = 51.21'
IE (8") = 46.01'

SDCO-32
RIM = 51.09'
IE (12") = 45.88'

SCALE: 1"=30'

30 15 0 30

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TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
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# STORM PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| A | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY NOT FOR CONSTRUCTION
BARRETT R. SCOTT WILLIAMS
EXPIRES: 06/30/16

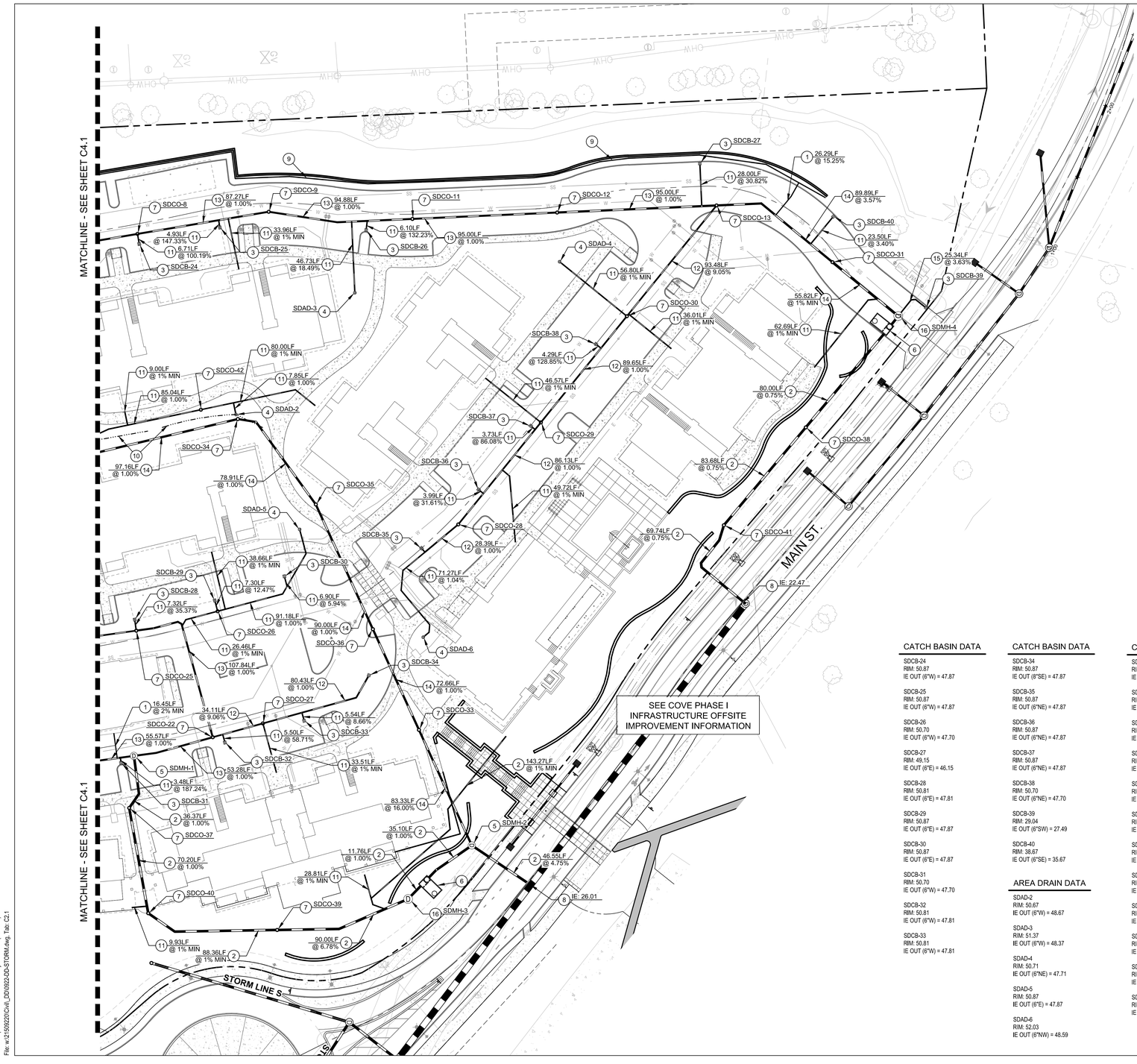
| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
STORM PLAN

SHEET NUMBER
C4.1

LAND USE # —

Plot Stamp: 6/26/2015 2:31:07 PM - Kyle Glisden (Portland)
File: w:\21509220\civil_DD\9220-SITDRN.dwg - Tab: C4.1




## LEGEND

- EXISTING PROPERTY LINE
- PROPOSED SETBACK LINE
- EXISTING EASEMENT LINE
- PROPOSED WATER LINE
- PROPOSED STORM DRAIN PIPE
- PROPOSED SANITARY PIPE
- EXISTING CATCH BASIN
- EXISTING STORM DRAIN MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING SANITARY MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPE AREA DRAIN
- PROPOSED STORM CLEANOUT
- PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE VAULT
- PROPOSED WATER METER
- PROPOSED DCVA
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED FIRE HYDRANT
- PROPOSED WATER VALVE
- PROPOSED CONVEYANCE DITCH

ALL STORM & SANITARY SEWER CONNECTIONS NOT MADE AT A STRUCTURE TO BE 'WYE' CONNECTIONS

## CONSTRUCTION NOTES

1. PROPOSED 4" HDPE N-12 PIPE.
2. PROPOSED 15" HDPE N-12 PIPE.
3. PROPOSED TRAPPED CATCH BASIN. SEE DATA TABLE THIS SHEET.
4. PROPOSED NYLOPLAST LANDSCAPE AREA DRAIN. SEE DATA TABLE THIS SHEET.
5. PROPOSED 48" MANHOLE. SEE DATA TABLE THIS SHEET.
6. PROPOSED 8' X 14' PEAK DIVERSION STORMFILTER TREATMENT VAULT.
7. PROPOSED STORM CLEANOUT. SEE DATA TABLE THIS SHEET.
8. CONNECT TO STORMLINE INSTALLED AS PART OF PUBLIC IMPROVEMENTS.
9. PROPOSED 4" PERFORATED PIPE FOR WALL DRAINAGE.
10. PROPOSED CONVEYANCE DITCH.
11. PROPOSED 6" HDPE N-12 PIPE.
12. PROPOSED 8" HDPE N-12 PIPE.
13. PROPOSED 10" HDPE N-12 PIPE.
14. PROPOSED 12" HDPE N-12 PIPE.
15. PROPOSED 6" HDPE C900 PIPE.
16. PROPOSED 60" SEDIMENTATION MANHOLE. SEE DATA TABLE THIS SHEET.

### CATCH BASIN DATA

SDCB-24
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-25
RIM: 50.87
IE OUT (6"W) = 47.87

SDCB-26
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-27
RIM: 49.15
IE OUT (6"E) = 46.15

SDCB-28
RIM: 50.81
IE OUT (6"E) = 47.81

SDCB-29
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-30
RIM: 50.87
IE OUT (6"E) = 47.87

SDCB-31
RIM: 50.70
IE OUT (6"W) = 47.70

SDCB-32
RIM: 50.81
IE OUT (6"W) = 47.81

SDCB-33
RIM: 50.81
IE OUT (6"W) = 47.81

### CATCH BASIN DATA

SDCB-34
RIM: 50.87
IE OUT (8"SE) = 47.87

SDCB-35
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-36
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-37
RIM: 50.87
IE OUT (6"NE) = 47.87

SDCB-38
RIM: 50.70
IE OUT (6"NE) = 47.70

SDCB-39
RIM: 29.04
IE OUT (6"SW) = 27.49

SDCB-40
RIM: 38.67
IE OUT (6"SE) = 35.67

### AREA DRAIN DATA

SDAD-2
RIM: 50.67
IE OUT (6"W) = 48.67

SDAD-3
RIM: 51.37
IE OUT (6"W) = 48.37

SDAD-4
RIM: 50.71
IE OUT (6"NE) = 47.71

SDAD-5
RIM: 50.87
IE OUT (6"E) = 47.87

SDAD-6
RIM: 52.03
IE OUT (6"NW) = 48.59

### CLEANOUT DATA

SDCO-8
RIM = 51.08'
IE (10") = 40.98'

SDCO-9
RIM = 51.38'
IE (10") = 40.11'

SDCO-11
RIM = 51.21'
IE (10") = 39.17'

SDCO-12
RIM = 50.26'
IE (12") = 38.22'

SDCO-13
RIM = 49.51'
IE (12") = 37.17'

SDCO-22
RIM = 51.09'
IE (10") = 43.97'

SDCO-25
RIM = 51.15'
IE (10") = 45.05'

SDCO-26
RIM = 51.06'
IE (6") = 46.96'

SDCO-27
RIM = 51.18'
IE (8") = 47.06'

SDCO-28
RIM = 51.21'
IE (8") = 47.56'

SDCO-29
RIM = 51.05'
IE (8") = 46.70'

SDCO-30
RIM = 51.06'
IE (8") = 45.80'

### CLEANOUT DATA

SDCO-31
RIM = 37.97'
IE (15") = 33.96'

SDCO-33
RIM = 52.29'
IE (12") = 41.55'

SDCO-34
RIM = 50.93'
IE (12") = 43.97'

SDCO-35
RIM = 51.87'
IE (12") = 43.18'

SDCO-36
RIM = 52.08'
IE (12") = 42.28'

SDCO-37
RIM = 51.90'
IE (15") = 40.56'

SDCO-38
RIM = 33.05'
IE (15") = 23.62'

SDCO-39
RIM = 40.40'
IE (15") = 37.10'

SDCO-40
RIM = 44.98'
IE (15") = 39.86'

SDCO-41
RIM = 34.06'
IE (15") = 22.99'

SDCO-42
RIM = 51.60'
IE (6") = 48.37'

### MANHOLE DATA

SDMH-1
RIM: 50.99
IE IN (10"N) = 43.43
IE IN (10"S) = 40.92
IE OUT (15"E) = 40.92

SDMH-2
RIM: 34.80
IE IN (12"SW) = 28.22
IE IN (15"SE) = 28.22
IE OUT (15"NE) = 28.22

SDMH-3
RIM: 35.16
IE IN (15"SE) = 31.00
IE OUT (15"NW) = 31.00

SDMH-4
RIM: 30.91
IE IN (6"NW) = 26.57
IE IN (15"SW) = 26.57
IE OUT (15"SE) = 26.57

SCALE: 1"=30'

30 15 0 30

DDP SUBMITTAL

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TEL: (503) 419 - 2500 FAX: (503) 419 - 2600
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# STORM PLAN
# THE COVE - GARDEN APARTMENTS
GRAND COVE, LLC
OREGON CITY, OREGON

| # | DATE | DESCRIPTION | BY |
|---|---|---|---|

REGISTERED PROFESSIONAL ENGINEER
OREGON
BRIAN R. WILLIAMS
PRELIMINARY NOT FOR CONSTRUCTION
EXPIRES: 06/30/16

| | |
|---|---|
| DATE | 06/26/2015 |
| DRAWN | KRG |
| DESIGNED | BRS |
| CHECKED | MDT |
| PROJECT # | 21509220 |

SHEET TITLE
STORM PLAN

SHEET NUMBER
C4.2

LAND USE # —

Plot Stamp: 6/26/2015 2:31:26 PM -Kyle Glidden (Portland)
File: w:\21509220\Civil_D\09092-GS-STORM.dwg, Tab: C2.1

# Hydrologic Soil Group—Clackamas County Area, Oregon

Map Scale: 1:2,260 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 9, Sep 19, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 26, 2014—Sep 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Clackamas County Area, Oregon (OR610) | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| 67 | Newberg fine sandy loam | A | 0.6 | 4.5% |
| 82 | Urban land | | 12.6 | 95.5% |
| **Totals for Area of Interest** | | | **13.2** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

## Table 2.2
## Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas

(Sources: TR 55, 1986, and Stormwater Management Manual, 1992. See Section 2.1.1 for explanation)

| Cover type and hydrologic condition. | CNs for hydrologic soil group A | B | C | D |
|---|---|---|---|---|
| **Curve Numbers for Pre-Development Conditions** | | | | |
| **Pasture, grassland, or range-continuous forage for grazing:** | | | | |
| Fair condition (ground cover 50% to 75% and not heavily grazed). | 49 | 69 | 79 | 84 |
| Good condition (ground cover >75% and lightly or only occasionally grazed) | 39 | 61 | 74 | 80 |
| **Woods:** | | | | |
| Fair (Woods are grazed but not burned, and some forest litter covers the soil). | 36 | 60 | 73 | 79 |
| Good (Woods are protected from grazing, and litter and brush adequately cover the soil). | 30 | 55 | 70 | 77 |
| **Curve Numbers for Post-Development Conditions** | | | | |
| **Open space (lawns, parks, golf courses, cemeteries, landscaping, etc.)**[1] | | | | |
| Fair condition (grass cover on 50% - 75% of the area). | 77 | 85 | 90 | 92 |
| Good condition (grass cover on >75% of the area) | 68 | 80 | 86 | 90 |
| **Impervious areas:** | | | | |
| Open water bodies: lakes, wetlands, ponds etc. | 100 | 100 | 100 | 100 |
| Paved parking lots, roofs[2], driveways, etc. (excluding right-of-way) | 98 | 98 | 98 | 98 |
| **Permeable Pavement (See Appendix C to decide which condition below to use)** | | | | |
| Landscaped area | 77 | 85 | 90 | 92 |
| 50% landscaped area/50% impervious | 87 | 91 | 94 | 96 |
| 100% impervious area | 98 | 98 | 98 | 98 |
| Paved | 98 | 98 | 98 | 98 |
| Gravel (including right-of-way) | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | 72 | 82 | 87 | 89 |
| **Pasture, grassland, or range-continuous forage for grazing:** | | | | |
| Poor condition (ground cover <50% or heavily grazed with no mulch). | 68 | 79 | 86 | 89 |
| Fair condition (ground cover 50% to 75% and not heavily grazed). | 49 | 69 | 79 | 84 |
| Good condition (ground cover >75% and lightly or only occasionally grazed) | 39 | 61 | 74 | 80 |
| **Woods:** | | | | |
| Poor (Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning). | 45 | 66 | 77 | 83 |
| Fair (Woods are grazed but not burned, and some forest litter covers the soil). | 36 | 60 | 73 | 79 |
| Good (Woods are protected from grazing, and litter and brush adequately cover the soil). | 30 | 55 | 70 | 77 |

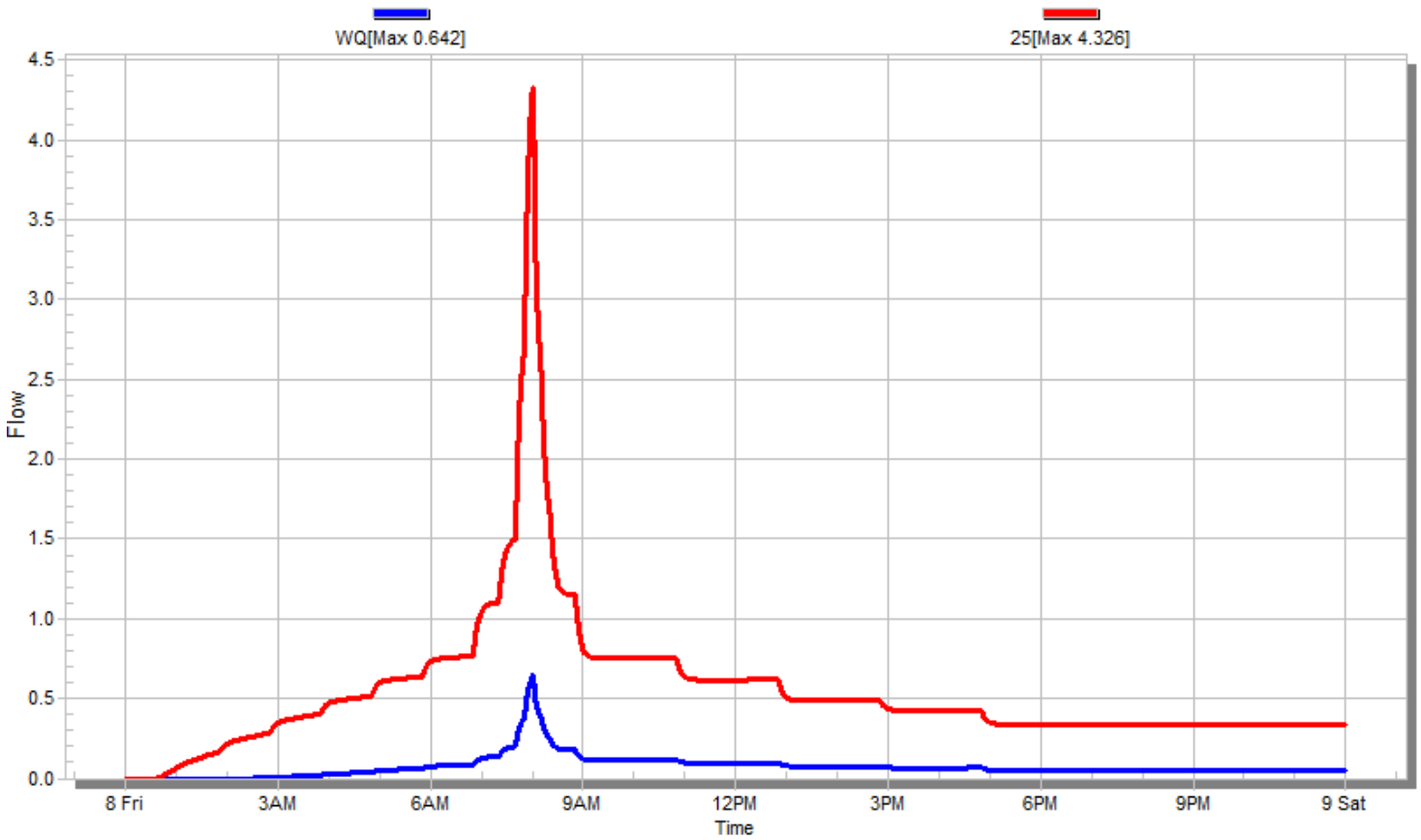
| **Single family residential**[3]**:** Dwelling Unit/Gross Acre | Should only be used for subdivisions > 50 acres | Average Percent impervious area[3,4] | |
|---|---|---|---|
| 1.0 DU/GA | | 15 | Separate curve number |
| 1.5 DU/GA | | 20 | shall be selected for |
| 2.0 DU/GA | | 25 | pervious & impervious |
| 2.5 DU/GA | | 30 | portions of the site or |
| 3.0 DU/GA | | 34 | basin |
| 3.5 DU/GA | | 38 | |
| 4.0 DU/GA | | 42 | |
| 4.5 DU/GA | | 46 | |
| 5.0 DU/GA | | 48 | |
| 5.5 DU/GA | | 50 | |
| 6.0 DU/GA | | 52 | |
| 6.5 DU/GA | | 54 | |
| 7.0 DU/GA | | 56 | |
| 7.5 DU/GA | | 58 | |
| PUD's, condos, apartments, commercial businesses, industrial areas & & subdivisions < 50 acres | %impervious must be computed | Separate curve numbers shall be selected for pervious and impervious portions of the site | |

For a more detailed and complete description of land use curve numbers refer to chapter two (2) of the Soil Conservation Service's Technical Release No. 55 , (210-VI-TR-55, Second Ed., June 1986).

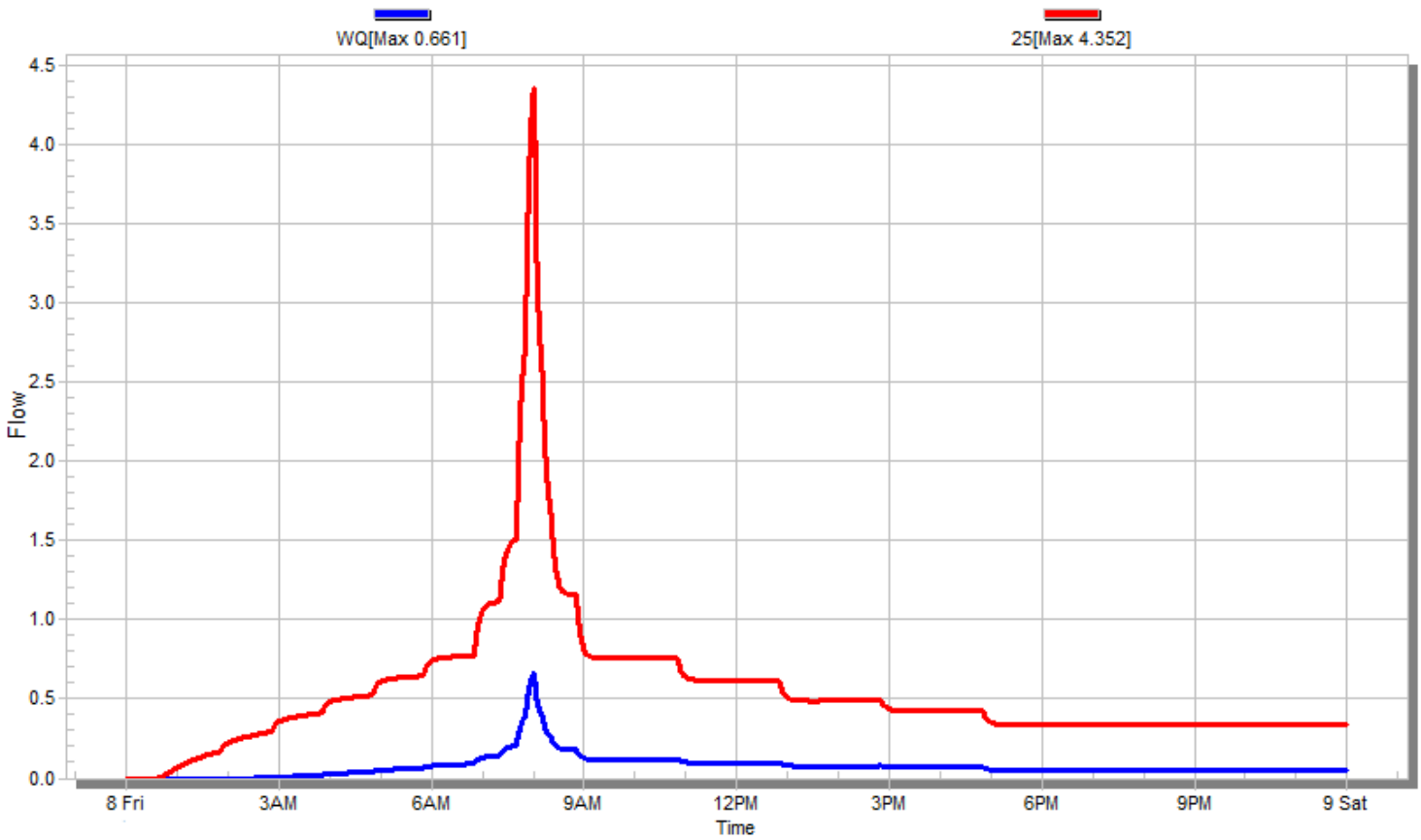
[1] Composite CN's may be computed for other combinations of open space cover type.
[2]Where roof runoff and driveway runoff are infiltrated or dispersed according to the requirements in Chapter 3, the average percent impervious area may be adjusted in accordance with the procedure described under "Flow Credit for Roof Downspout Infiltration" (Section 3.1.1), and "Flow Credit for Roof Downspout Dispersion" (Section 3.1.2).
[3]Assumes roof and driveway runoff is directed into street/storm system.
[4]All the remaining pervious area (lawn) are considered to be in good condition for these curve numbers.

## Hydrographs

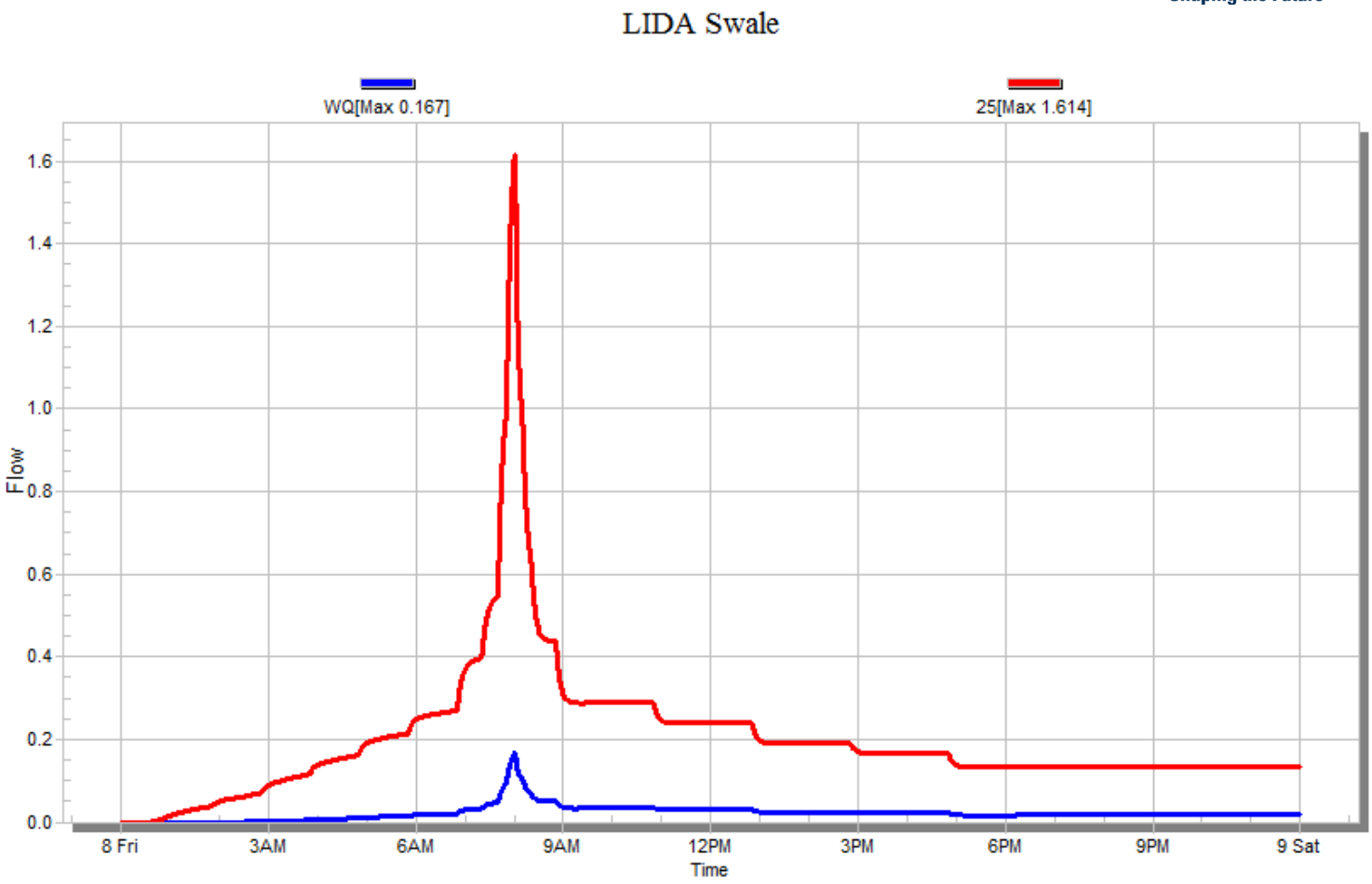
North Basin Hydrograph




South Basin Hydrograph



## Hydrographs



# MEMORANDUM

5415 SW Westgate Drive
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Portland, Oregon 97221
USA

**Phone** **(503) 419-2500**
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**www.cardno.com**

To: City of Oregon City

From: Atalia Raskin, PE
WR Senior Project Engineer

Date: June 19, 2015

Project: The Cove: Phase 1 Infrastructure
Cardno#: 21509220
Re: Preliminary Hydrology Analysis

## Hydrologic Analysis

Alterations to land surface characteristics have been shown to change the runoff generating processes. This occurs as the infiltration capacity of the native soils is eliminated or greatly reduced by covering and compacting soils and removing native vegetation. Gutters and storm sewers on developed sites convey stormwater runoff more rapidly to stream channels than sheet flow and shallow groundwater flow. Additionally, the increased flow, the longer duration of higher flows, and the increased stormwater pollutant concentrations generated by urban developments can degrade stream channels and harm aquatic life.

This memorandum discusses the hydrology impacts that may occur as a result of the Cove: Garden Apartments and Main Street Improvements and what measures are being proposed to decrease these impacts. The analysis reviewed proposed development impacts on the receiving watershed and storm sewer, including the Clackamette Cove and Clackamas River.

## Effects on the Watershed and Existing Drainage Patterns

The proposed Cove: Garden Apartment and Main Street Improvements change the land surface conditions by increasing the amount of impervious surface from the former gravel quarry processing plant to a multi-family apartment complex. The existing site contains concrete, gravel, and pervious surfaces covered with grasses and blackberries. The proposed project will increase the amount of impervious surfaces include roof and parking lot area. The project increases the amount of impervious area by 0.75 acres. The development will improve the quality of the site's pervious area with additional trees and landscaping. Street trees will be planted along Main Street that currently do not exist along the street. The additional tree cover over impervious area will increase evapotranspiration of rainfall thereby reducing stormwater runoff.

The increased amount of impervious area and the proposed onsite storm sewer will likely increase the amount of stormwater runoff generated at the site. The proposed public storm sewer in Main Street is designed to accommodate this additional runoff and runoff from future developments draining to this storm line. The public storm sewer discharges directly into the Clackamette Cove, above the ordinary high water elevation of 18 (NAVD 88).

The Clackamette Cove drains into the Clackamas River just upstream of its confluence with the Willamette River. Both the Clackamas and Willamette Rivers have drainage basins larger than 100 sq.-miles, the upper limit shown to influence channel stability. Therefore, the project will not degrade stream channels. Stormwater detention is not proposed and is not required at this project. Stormwater infiltration is not possible for the Cove: Garden Apartments, the site is being filled to remove the proposed buildings from the floodplain elevation and the City of Oregon City jurisdictional design flood elevation (DFE). Proposed roadside swales will treat and infiltrate runoff as soils allow.

## Clackamas River Specific Considerations

The Clackamas River is required to follow OAR 340-041-0350 The Three Basin Rule: Clackamas, McKenzie & North Santiam. The Three Basin Rule states that in order to preserve or improve the existing high quality of municipal water supplies, recreation, and aquatic life new or increased waste discharges are prohibited. The Clackamette Cove joins the Clackamas River downstream of the water system intake. Additionally, the Clackamas River is classified as water quality limited for TMDL's for dissolved oxygen and biological criteria. The proposed project will meet these requirements by providing water quality treatment and sending runoff to an existing outfall.

The proposed development will result in approximately 9.0 acres of pollutant generating impervious surface within the project area. New stormwater facilities are proposed for treatment of expected pollutants (i.e., PAHs, heavy metals, nutrients, oil and sediment) associated with roof runoff and vehicle use within the apartment complex and along the improved roadway. The existing site and roadway have no formal water quality treatment. Typical pollutants from multi-family residential projects include: nutrients, pesticides, metals, oil, grease and other petroleum products, and sediment. Dissolved copper, dissolved zinc, and PAHs are generally the primary constituents of concern for stormwater runoff in Oregon streams and rivers for the impact on ESA listed species. These pollutants are specially targeted for treatment in the selected stormwater management system. The water quality storm is listed below.

- Water Quality Storm: 33% of the 2-yr, 24-hour storm event (0.83-inch precipitation depth).

The stormwater management system was designed to maximize stormwater treatment through Contech StormFilters and LIDA swales. The selected StormFilter contains cartridges filled with ZPG filter media (a mixture of zeolite, perlite, and granular activated carbon), which are designed to remove sediment, metals, and stormwater pollutants from wet weather runoff.

A decreased concentration of pollutants will remain within the treated stormwater runoff. These pollutants will be diluted with the Clackamette Cove water to concentrations below Oregon state water quality criteria levels.

## Conclusion

The proposed project review the hydrology effects on the watershed and storm sewer. The project drains to the Clackamette Cove, followed by the Clackamas River and Willamette River. Because both of these Rivers are classified as having large drainage basins, the project will not result in stream channel degradation within the watershed. Additionally, the project provides water quality treatment to target pollutants to protect water quality and aquatic life.

# MEMORANDUM

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To: City of Oregon City

From: Atalia Raskin, PE
WR Senior Project Engineer

Date: June 19, 2015

Project: The Cove: Phase 1 Infrastructure
Cardno#: 21509220
Re: Main Street Stormwater Management Approach

---

The proposed project will complete roadway and infrastructure improvements to Main Street in Oregon City, Oregon. The Main Street improvements are a part of the larger Cove development, and the specific development of Lot 2 (Garden Apartments) anticipated to develop concurrently with the Main Street improvements. The project will construct a roundabout at the Main Street and Agnes Street intersection. Street construction includes grading, utility installation, landscaping, and installing public water quality facilities. Additionally a gravel parking lot will be constructed for trail access.

This memorandum will discuss the proposed stormwater management approach for the Main Street Improvements and the downstream analysis of the public storm sewer in Main Street. A complete Drainage Report of the phase 1 infrastructure improvements will be included within the Final Drainage Report.

The design follows the *Stormwater and Grading Design Standards* by the City of Oregon City, issued in December 1999 and the standards within the Surface Water Management Agency of Clackamas County (SWMACC) Rules and Regulations using the *Surface Water Quality Facilities Technical Guidance Handbook* dated 1991, as well as the *Clean Water Services Low Impact Development Approaches Handbook* dated July, 2009.

**Project Description**

The existing roadway has two traffic lanes and a bike lane along on side of the roadway. The roadway does not include curbs and gutters. Runoff flows to grassy roadside ditches on either side of the roadway.

> Existing Impervious Area = 1.55 acres

The proposed roadway also has two traffic lanes. Proposed bike lanes, curb and gutter, and sidewalks will be located on both sides of the roadway. Stormwater runoff northwest of the roundabout will be treated through LIDA planters, while stormwater runoff southeast of the roundabout will be treated through Contech StormFilters.

> Proposed Impervious Area = 1.82 acres

A gravel parking lot will be constructed to allow trail access. The parking lot is must pervious gravel, although the lot includes concrete paths and an ADA parking stall.

> Proposed Impervious Area = 0.03 acres

**Stormwater Management Approach**

Stormwater treatment will be provided within the public right-of-way through the use of LIDA swales. LIDA swales are landscaped reservoirs that collect and treat stormwater runoff through vegetation and soil media. They may also provide pollutant reduction and flow attenuation to reduce hydraulic impacts from urban developments on downstream rivers. Contech StormFilters will be used in areas where it is infeasible to construct LIDA Swales.

- Area Draining to LIDA Swales = 0.87 acres
- Area Draining to Contech StormFilters = 0.95 acres

The attached exhibits show the roadway improvements in existing and proposed conditions.

**Floodplain Analysis**

The City of Oregon City regulates development within the floodplain using the jurisdictional Design Flood Elevation (DFE). The DFE is the extents of the 1996 flood event and exceeds the elevation listed on the FEMA FIRM MAP. The DFE for the site is 50.7 (NAVD 88). The proposed street improvements will remain within the floodplain. Cut and fill calculations were completed to ensure the overall Cove developed is balanced.

**Regional Conveyance Analysis**

A regional storm conveyance sewer is located within Main Street. A conveyance analysis was completed to determine the conveyance capacity of this storm line in projected future conditions. A verity of information was reviewed to complete the regional storm conveyance analysis, including the following documents:

- Oregon City Drainage Master Plan, January 1988, Otak Incorporated.
- Clackamas County FIS, June 17, 2008, FEMA
- Field Survey – Completed in 2008 by WRG Design, Inc.
- Oregon City GIS on OCWebMaps, viewed June 2015.

The greater Cove development including the Cove: Garden Apartments and Main Street are located within the Clackamas drainage basin. The regional basin draining to the storm sewer in Main Street includes the Kelly Field Basin. The Drainage Master Plan did not complete a hydraulic analysis for these regional basins. Information on the existing storm sewer was collected from a field survey completed by WRG Design, Inc. in 2008.

*Basin Area*

The contributing upstream area is composed of 10 sub-basins. The upper most basins (8, 9, and 10) are located on the former Rossman Landfill. The basins now contain a Home Depot, The End of the Oregon Trail Interpretive Center, a golf driving range, and developed and undeveloped parcels. The area will likely be redeveloped in the future as a regional mall. Stormwater runoff from these basins flow west to roadside ditches along Washington Street. A 36-inch culvert crosses Washington Street, where it outfalls to an open flat grassy area. Two basins are located between Washington Street and the rail road tracks (6 and 7). Both basin 6 and 7 are developed. Businesses in basin 7 include a landscape store, Amtrak station, and the Maverick welding supply store. Businesses in basin 6 include the Metro transfer station. The transfer station drains to a large detention pond, although the detention pond was not included within the downstream analysis.

Stormwater runoff crosses under a rail road bridge through an open channel. One basin is located between the rail road tracks and I-205 (Basin 5). Basin 5 is a vegetated basin. In 2012, the basin was graded to provide flood management and planted as a natural resource district. This basin will not be developed in the future. The restoration was completed in conjunction with the OR 213: I-205 Redland Road overcrossing project. Stormwater runoff continues under I-205 through double12-ft by 12-ft box culverts. Basin 4 is located west of I-205. The basin contains two buildings

and gravel parking lots. Basin 3 is the proposed the Cove: Garden Apartments and Main Street improvements.

Basin 2 drains to an existing 15-inch culvert crossing Main Street. The culvert collects a drainage ditch located west of the Cove: Garden Apartments and Main Street northwest of the proposed roundabout. Basin 1 is the area surrounding the Clackamette Cove and includes area where stormwater runoff sheet flows into the Cove. This basin will be developed during future phases of the Cove development. Basin 1 will discharge to the Clackamette Cove through flow spreaders in future conditions. Neither Basin 1 nor 2 drains to the 36-inch culvert.

Table 1-1 lists basin areas and the projected future project impervious area. Impervious area is listed for proposed (The Cove: Garden Apartments and Main Street Improvement) and future (Basin 1, 2, 8, 9, 10). Basin delineation are shown in Exhibit 3 – Upstream Basin Delineation, attached.

**Table 1-1 Upstream Basin Areas**

| Basin | Impervious Area, ac | Pervious Area, ac | Total Area, ac | Discharge |
|---|---|---|---|---|
| 1 | 11.89 | 6.40 | 18.29 | Sheetflow |
| 2 | 1.63 | 4.42 | 6.05 | 15" Outfall |
| 3 | 8.13 | 4.39 | 12.52 | 36" Outfall |
| 4 | 2.24 | 19.76 | 22.01 | 36" Outfall |
| 5 | 4.97 | 24.79 | 29.76 | 36" Outfall |
| 6 | 8.50 | 10.11 | 18.61 | 36" Outfall |
| 7 | 5.09 | 8.58 | 13.67 | 36" Outfall |
| 8 | 26.26 | 6.57 | 32.83 | 36" Outfall |
| 9 | 4.71 | 1.18 | 5.89 | 36" Outfall |
| 10 | 9.12 | 2.28 | 11.40 | 36" Outfall |
| Total | 82.54 | 88.48 | 171.02 | - |

*Hydrologic & Hydraulic Analysis*
An xpswmm model was created for the downstream system to analysis the conveyance capacity of the public storm sewer.

*Runoff*
The curve number represents runoff potential from the soil. The major factors for determining the CN values are hydrologic soil group, cover type, treatment, hydrologic condition and antecedent runoff condition. The selected pervious curve numbers are 90 – Open Space in good Condition and 91 – Gravel (Attached: Table 2-2 – Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas). Composite curve numbers were calculated for each delineated sub-basin (Attached: Composite Curve Number Calculations).

The time of concentration ($T_C$) as described in NEH-4 Chapter 15 is defined in two ways; the time for runoff to travel from the furthermost point of the watershed to the point in question, and the time from the end of excess rainfall to the point of inflection on the trailing limb of the unit hydrograph. Time of concentration can be estimated from several formulas. The minimum time of concentration is 5 minutes in highly developed urban areas (i.e. parking lots) and the maximum is 100 minutes in rural areas. A condition time of concentration was calculated for each delineated sub-basin (Attached: Time of Concentration).

The Santa Barbara Urban Hydrograph (SBUH) was used for this analysis. The SBUH method is based on the curve number (CN) approach, and uses the Soil Conservation Service's (SCS) equations for computing soil absorption and precipitation excess. The SBUH method converts the incremental runoff depths into instantaneous hydrographs, which are then routed through an imaginary reservoir with a time delay equal to the basin time of concentration.

Calculated runoff data is provided for the 25 and 100-year storm event, as calculated within xpswmm (Attached: xpswmm Schematic Layout and Runoff Data).

*Conveyance*
The hydraulic model starts east of Washington Street and heads 2,575 ft (0.49 miles) west to the 36-inch outfall into the Clackamette Cove. The conveyance system was simplified to include the main conveyance pipes. A complete conveyance analysis of the Garden Apartment and Main Street storm sewer will be completed in the Final Drainage Report.

Maximum flow in a storm drainage pipe occurs at approximately 0.94do (Depth of flow section (do) – depth of flow normal to the direction of flow). At 0.94do the section factor of uniform flow has a maximum value which results in optimum flow for a section without surcharge conditions. During a 25-year storm event, the proposed conveyance system will operate at or below 0.94do, with a minimum freeboard of 1.0 feet. The proposed conveyance system includes links P2 and P3. Some of the existing culverts and pipes upstream of the development are surcharge. Link 1 will be upsized in the future by the City of Oregon City (Attached: xpswmm Conveyance Table).

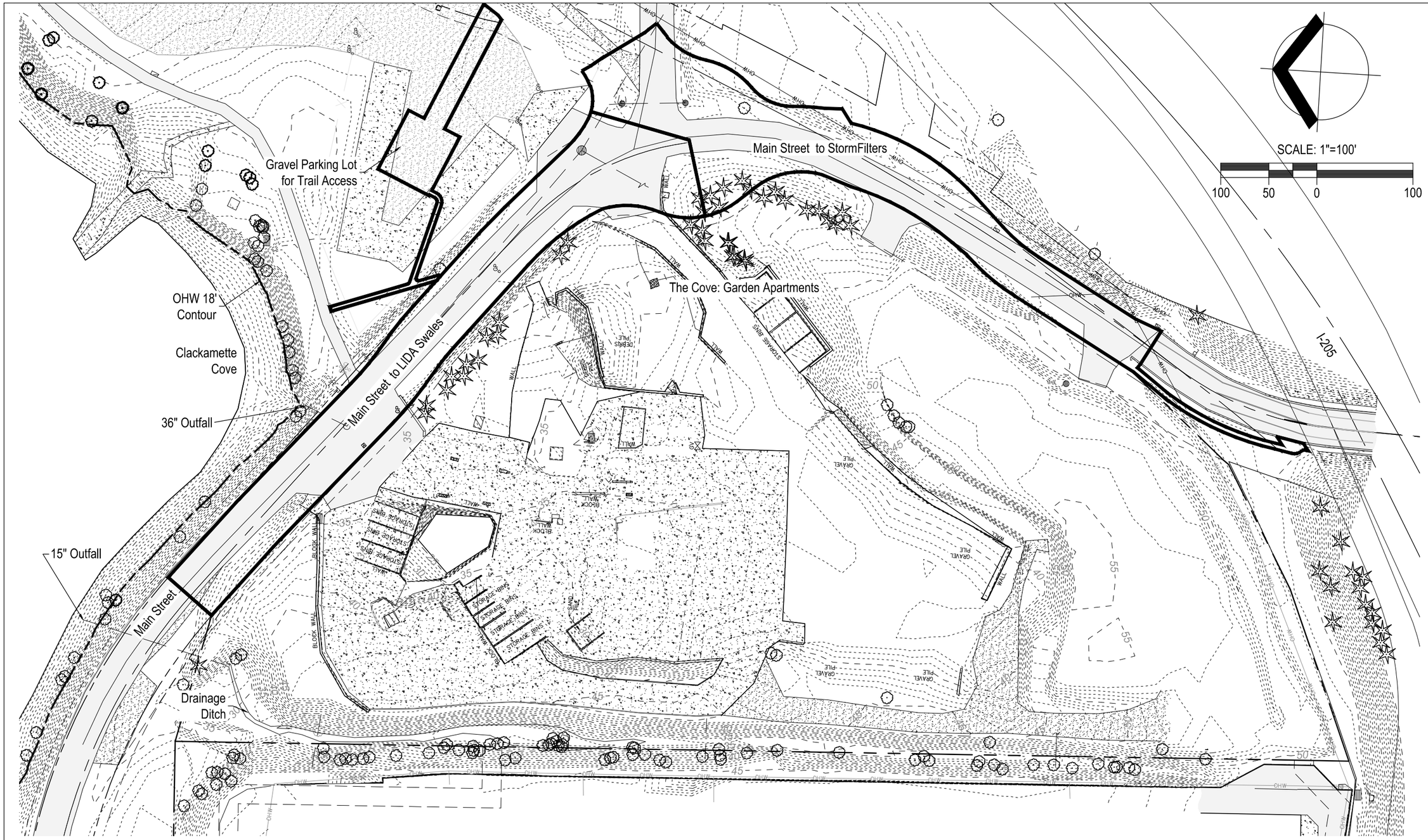
**Conclusion**

The proposed project will provide stormwater treatment to the Main Street infrastructure improvement project through the use of LIDA swales and Contech StormFilters. StormFilters are used in locations were LIDA swales are infeasible to construct. The design follows the *Stormwater and Grading Design Standards* by the City of Oregon City, issued in December 1999 and the standards within the Surface Water Management Agency of Clackamas County (SWMACC) Rules and Regulations using the *Surface Water Quality Facilities Technical Guidance Handbook dated 1991,* as well as the *Clean Water Services Low Impact Development Approaches Handbook dated July, 2009*.

A downstream analysis was completed to size the proposed public storm sewer in Main Street. The analysis was completed under proposed and project future development conditions. In conclusion, the proposed stormwater management system will meet the requirements of the City of Oregon City.

**Attachments:**

- Exhibit 1 – Existing Main Street Basin Delineation
- Exhibit 2 – Proposed Main Street Basin Delineation
- Exhibit 3 – Upstream Basin Delineation
- Table 2-2 – Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas Composite Curve Number Calculations
- Time of Concentration
- xpswmm
    - Schematic Layout
    - Runoff Data
    - Conveyance Table




| Basin | Impervious Area (ac) | Gravel Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|---|
| Gravel Lot | 0.017 | 0.159 | 0.016 | 0.192 |
| Main Street to StormFilters | 0.621 | 0.000 | 0.442 | 1.063 |
| Main Street to LIDA Swales | 0.912 | 0.000 | 0.162 | 1.074 |
| Total | 1.550 | 0.159 | 0.620 | 2.329 |

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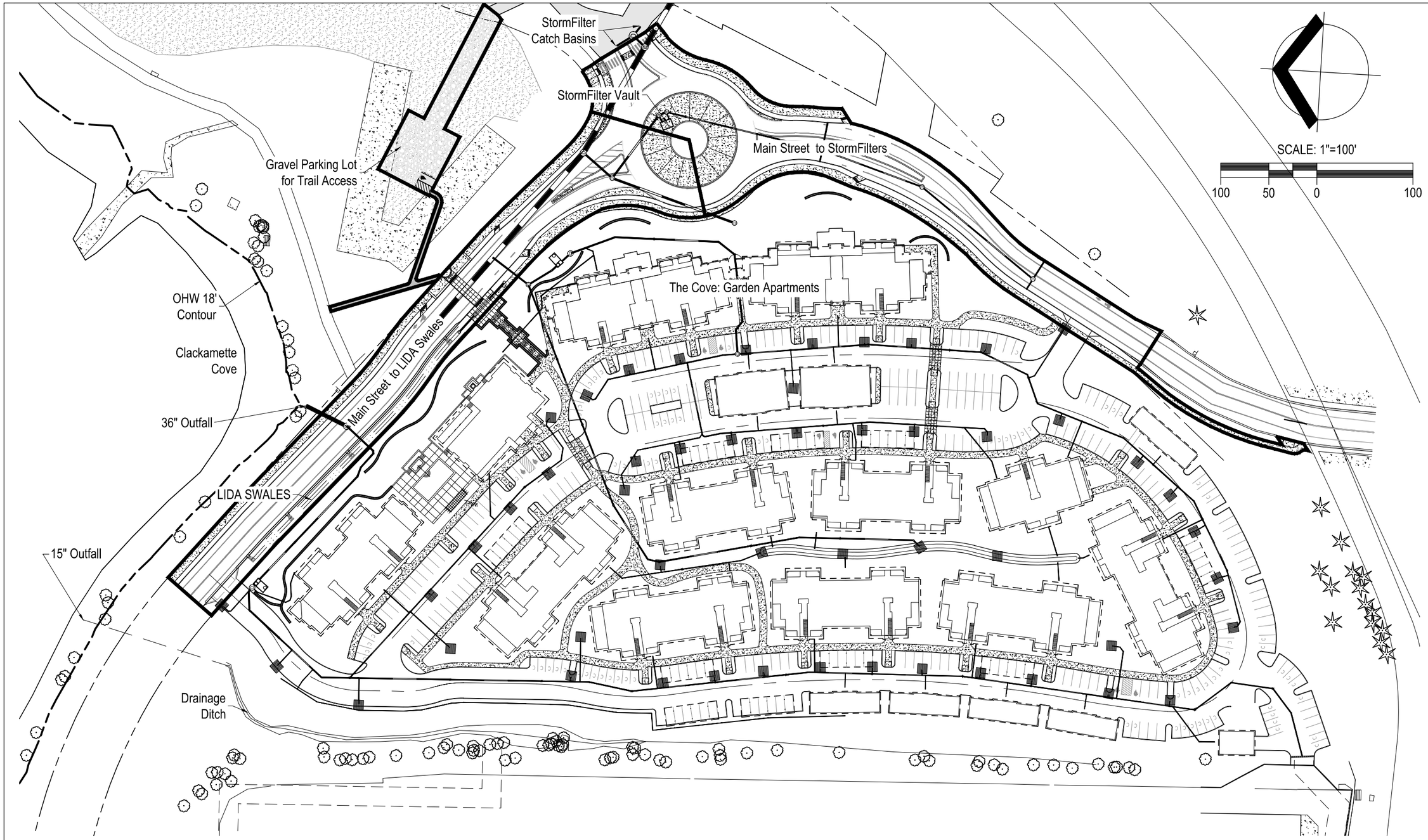
# EXISTING MAIN STREET BASIN DELINEATION
# COVE: PHASE 1 INFRASTRUCTURE

GRAND COVE LLC
Oregon City, Oregon

PROJECT NO. 211509220
DATE: 06/19/2015
BY: ASR
EXHIBIT: 1




| Basin | Impervious Area (ac) | Gravel Area (ac) | Pervious Area (ac) | Total Area (ac) |
|---|---|---|---|---|
| Gravel Lot | 0.033 | 0.159 | 0.000 | 0.192 |
| Main Street to StormFilters | 0.953 | 0.000 | 0.110 | 1.063 |
| Main Street to LIDA Swales | 0.871 | 0.000 | 0.203 | 1.074 |
| Total | 1.857 | 0.159 | 0.313 | 2.329 |

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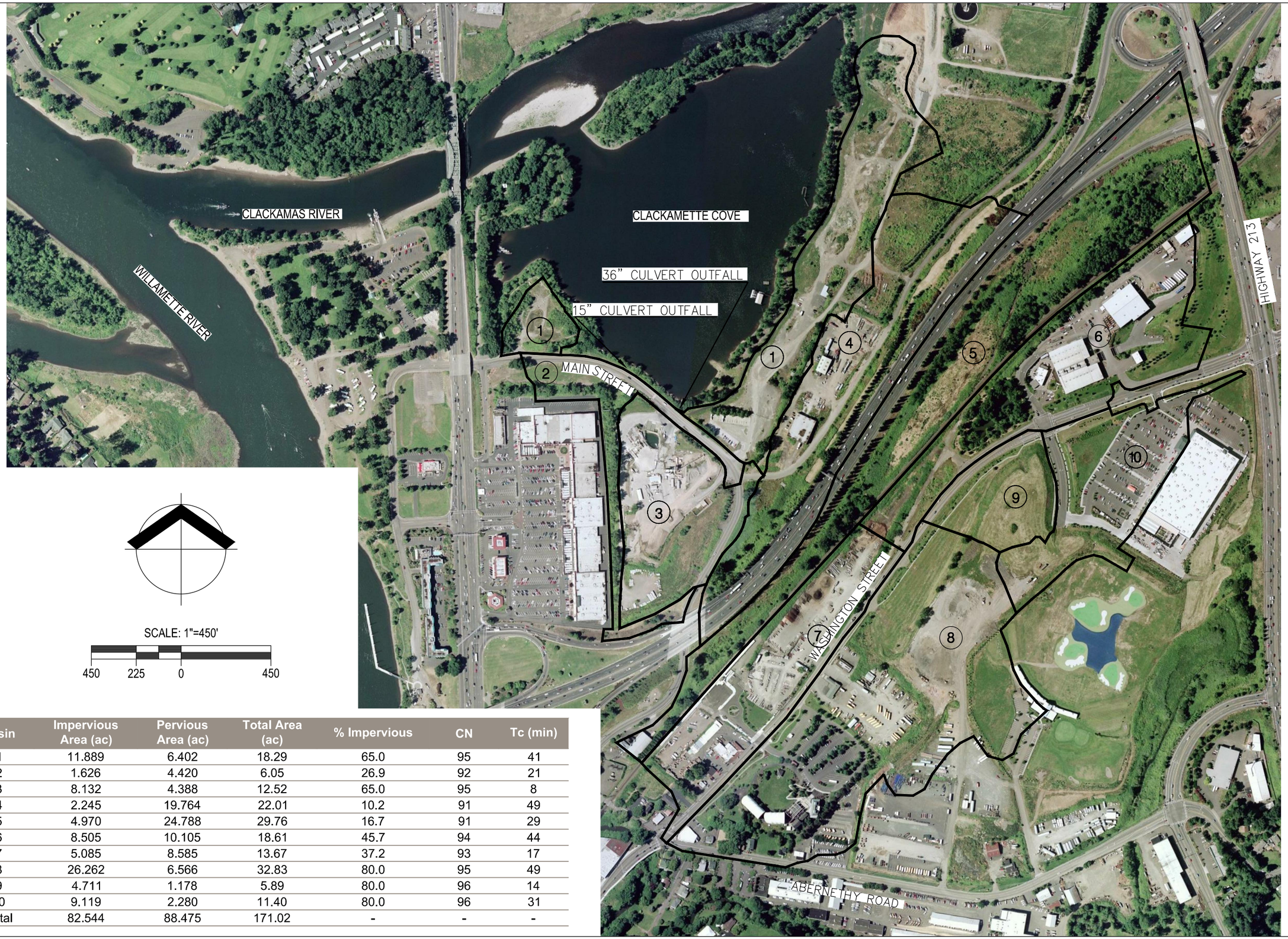
# PROPOSED MAIN STREET BASIN DELINEATION
## COVE: PHASE 1 INFRASTRUCTURE

GRAND COVE LLC
Oregon City, Oregon

PROJECT NO. 211509220
DATE: 06/19/2015
BY: ASR
EXHIBIT: 2




| Basin | Impervious Area (ac) | Pervious Area (ac) | Total Area (ac) | % Impervious | CN | Tc (min) |
|---|---|---|---|---|---|---|
| 1 | 11.889 | 6.402 | 18.29 | 65.0 | 95 | 41 |
| 2 | 1.626 | 4.420 | 6.05 | 26.9 | 92 | 21 |
| 3 | 8.132 | 4.388 | 12.52 | 65.0 | 95 | 8 |
| 4 | 2.245 | 19.764 | 22.01 | 10.2 | 91 | 49 |
| 5 | 4.970 | 24.788 | 29.76 | 16.7 | 91 | 29 |
| 6 | 8.505 | 10.105 | 18.61 | 45.7 | 94 | 44 |
| 7 | 5.085 | 8.585 | 13.67 | 37.2 | 93 | 17 |
| 8 | 26.262 | 6.566 | 32.83 | 80.0 | 95 | 49 |
| 9 | 4.711 | 1.178 | 5.89 | 80.0 | 96 | 14 |
| 10 | 9.119 | 2.280 | 11.40 | 80.0 | 96 | 31 |
| Total | 82.544 | 88.475 | 171.02 | - | - | - |

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# UPSTREAM BASIN DELINEATION
# COVE: PHASE 1 INFRASTRUCTURE

GRAND COVE LLC
Oregon City, Oregon

PROJECT NO. 21509220
DATE: 06/19/2015
BY: ASR
EXHIBIT: 3

## Table 2.2
## Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas

(Sources: TR 55, 1986, and Stormwater Management Manual, 1992. See Section 2.1.1 for explanation)

| Cover type and hydrologic condition. | CNs for hydrologic soil group A | B | C | D |
|---|---|---|---|---|
| **Curve Numbers for Pre-Development Conditions** | | | | |
| **Pasture, grassland, or range-continuous forage for grazing:** | | | | |
| Fair condition (ground cover 50% to 75% and not heavily grazed). | 49 | 69 | 79 | 84 |
| Good condition (ground cover >75% and lightly or only occasionally grazed) | 39 | 61 | 74 | 80 |
| **Woods:** | | | | |
| Fair (Woods are grazed but not burned, and some forest litter covers the soil). | 36 | 60 | 73 | 79 |
| Good (Woods are protected from grazing, and litter and brush adequately cover the soil). | 30 | 55 | 70 | 77 |
| **Curve Numbers for Post-Development Conditions** | | | | |
| **Open space (lawns, parks, golf courses, cemeteries, landscaping, etc.)**[1] | | | | |
| Fair condition (grass cover on 50% - 75% of the area). | 77 | 85 | 90 | 92 |
| Good condition (grass cover on >75% of the area) | 68 | 80 | 86 | 90 |
| **Impervious areas:** | | | | |
| Open water bodies: lakes, wetlands, ponds etc. | 100 | 100 | 100 | 100 |
| Paved parking lots, roofs[2], driveways, etc. (excluding right-of-way) | 98 | 98 | 98 | 98 |
| **Permeable Pavement (See Appendix C to decide which condition below to use)** | | | | |
| Landscaped area | 77 | 85 | 90 | 92 |
| 50% landscaped area/50% impervious | 87 | 91 | 94 | 96 |
| 100% impervious area | 98 | 98 | 98 | 98 |
| Paved | 98 | 98 | 98 | 98 |
| Gravel (including right-of-way) | 76 | 85 | 89 | 91 |
| Dirt (including right-of-way) | 72 | 82 | 87 | 89 |
| **Pasture, grassland, or range-continuous forage for grazing:** | | | | |
| Poor condition (ground cover <50% or heavily grazed with no mulch). | 68 | 79 | 86 | 89 |
| Fair condition (ground cover 50% to 75% and not heavily grazed). | 49 | 69 | 79 | 84 |
| Good condition (ground cover >75% and lightly or only occasionally grazed) | 39 | 61 | 74 | 80 |
| **Woods:** | | | | |
| Poor (Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning). | 45 | 66 | 77 | 83 |
| Fair (Woods are grazed but not burned, and some forest litter covers the soil). | 36 | 60 | 73 | 79 |
| Good (Woods are protected from grazing, and litter and brush adequately cover the soil). | 30 | 55 | 70 | 77 |

| **Single family residential**[3]**:** Dwelling Unit/Gross Acre | Should only be used for subdivisions > 50 acres | Average Percent impervious area[3,4] | |
|---|---|---|---|
| 1.0 DU/GA | | 15 | Separate curve number |
| 1.5 DU/GA | | 20 | shall be selected for |
| 2.0 DU/GA | | 25 | pervious & impervious |
| 2.5 DU/GA | | 30 | portions of the site or |
| 3.0 DU/GA | | 34 | basin |
| 3.5 DU/GA | | 38 | |
| 4.0 DU/GA | | 42 | |
| 4.5 DU/GA | | 46 | |
| 5.0 DU/GA | | 48 | |
| 5.5 DU/GA | | 50 | |
| 6.0 DU/GA | | 52 | |
| 6.5 DU/GA | | 54 | |
| 7.0 DU/GA | | 56 | |
| 7.5 DU/GA | | 58 | |
| PUD's, condos, apartments, commercial businesses, industrial areas & & subdivisions < 50 acres | %impervious must be computed | Separate curve numbers shall be selected for pervious and impervious portions of the site | |

For a more detailed and complete description of land use curve numbers refer to chapter two (2) of the Soil Conservation Service's Technical Release No. 55 , (210-VI-TR-55, Second Ed., June 1986).

[1] Composite CN's may be computed for other combinations of open space cover type.
[2]Where roof runoff and driveway runoff are infiltrated or dispersed according to the requirements in Chapter 3, the average percent impervious area may be adjusted in accordance with the procedure described under "Flow Credit for Roof Downspout Infiltration" (Section 3.1.1), and "Flow Credit for Roof Downspout Dispersion" (Section 3.1.2).
[3]Assumes roof and driveway runoff is directed into street/storm system.
[4]All the remaining pervious area (lawn) are considered to be in good condition for these curve numbers.

# Composite Curve Number Calculations

| | | | | | |
|---|---|---|---|---|---|
| Subject | CN - Downstream Analysis | By | ASR | Date | 6/19/2015 |
| Project | 2150922 | | | | |

**Runoff Curve Number - Proposed**

$$CN(Weighted) = \frac{Total_Product}{Total_Area}$$

| Soil Name and Hydrologic group | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connect impervious area ratio) | CN HSG A | CN HSG B | CN HSG C | CN HSG D | Area acres | Product of CN **X** area |
|---|---|---|---|---|---|---|---|
| **Basin 1** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 6.40 | 576 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 11.89 | 1165 |
| | | Totals | | | | 18.29 | 1741 |
| | | Use CN | | | | 95 | |
| **Basin 2** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 4.42 | 398 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 1.63 | 159 |
| | | Totals | | | | 6.05 | 557 |
| | | Use CN | | | | 92 | |
| **Basin 3** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 4.39 | 395 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 8.13 | 797 |
| | | Totals | | | | 12.52 | 1192 |
| | | Use CN | | | | 95 | |
| **Basin 4** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 1.44 | 131 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 18.32 | 1649 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 2.25 | 220 |
| | | Totals | | | | 22.01 | 2000 |
| | | Use CN | | | | 91 | |
| **Basin 5** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 24.79 | 2231 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 4.97 | 487 |
| | | Totals | | | | 29.76 | 2718 |
| | | Use CN | | | | 91 | |
| **Basin 6** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 10.11 | 909 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 8.51 | 833 |
| | | Totals | | | | 18.61 | 1743 |
| | | Use CN | | | | 94 | |
| **Basin 7** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 6.40 | 582 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 2.19 | 197 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 5.09 | 498 |
| | | Totals | | | | 13.67 | 1277 |
| | | Use CN | | | | 93 | |

# Composite Curve Number Calculations

| Subject | CN - Downstream Analysis | By | ASR | Date | 6/19/2015 |
|---|---|---|---|---|---|
| Project | 2150922 | | | | |

**Runoff Curve Number - Proposed**

$$CN(Weighted) = \frac{Total_Product}{Total_Area}$$

| Soil Name and Hydrologic group | Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connect impervious area ratio) | CN HSG A | CN HSG B | CN HSG C | CN HSG D | Area acres | Product of CN **X** area |
|---|---|---|---|---|---|---|---|
| **Basin 8** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 6.50 | 592 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 6.57 | 591 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 19.76 | 1937 |
| | | Totals | | | | 32.83 | 3119 |
| | | Use CN | | | | 95 | |
| **Basin 9** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 1.18 | 106 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 4.71 | 462 |
| | | Totals | | | | 5.89 | 568 |
| | | Use CN | | | | 96 | |
| **Basin 10** | | | | | | | |
| D | Gravel roads & parking lots | | | | 91 | 0.00 | 0 |
| D | Open spaces-lawns, parks, golf courses, cemeteries | | | | 90 | 2.28 | 205 |
| D | Impervious surfaces-pavement, roofs, etc. | | | | 98 | 9.12 | 894 |
| | | Totals | | | | 11.40 | 1099 |
| | | Use CN | | | | 96 | |

# Time of Concentration

| | | | | | |
|---|---|---|---|---|---|
| **SUBJECT** | Time of Concentration - Downstream Analysis | | | | |
| **PROJECT NO.** | 21509220 | **BY** | ASR | **DATE** | 6/19/2015 |

| | Basin 1 | Basin 2 | Basin 3 | Basin 4 | Basin 5 |
|---|---|---|---|---|---|
| **SHEET FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Surface Description | **Type 2 Fallow (no residue)** | **Type 2 Fallow (no residue)** | **Type 1 Smooth Surface** | **Type 4 Cultivated (residue > 20%)** | **Type 3 Cultivated (residue < 20%)** |
| Manning's "n" | **0.05** | **0.05** | **0.011** | **0.17** | **0.06** |
| Flow Length, L (<300 ft) | **300** ft | **300** ft | **300** ft | **300** ft | **228** ft |
| 2-Yr 24 Hour Rainfall, $P_2$ | **2.6** in | **2.6** in | **2.6** in | **2.6** in | **2.6** in |
| Land Slope, s | **0.00077** ft/ft | **0.0132** ft/ft | **0.06** ft/ft | **0.017** ft/ft | **0.0800** ft/ft |
| **OUTPUT** | | | | | |
| Travel Time | 0.67 hr | 0.21 hr | 0.03 hr | 0.51 hr | 0.10 hr |
| **SHALLOW CONCENTRATED FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Surface Description | **Unpaved** | **Unpaved** | **Unpaved** | **Unpaved** | **Unpaved** |
| Flow Length, L | **202** ft | **900** ft | **556** ft | **1348** ft | **2500** ft |
| Watercourse Slope*, s | **0.119** ft/ft | **0.013** ft/ft | **0.009** ft/ft | **0.006** ft/ft | **0.012** ft/ft |
| **OUTPUT** | | | | | |
| Average Velocity, V | 5.57 ft/s | 1.84 ft/s | 1.53 ft/s | 1.25 ft/s | 1.77 ft/s |
| Travel Time | 0.010 hr | 0.136 hr | 0.101 hr | 0.300 hr | 0.393 hr |
| **CHANNEL FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Cross Sectional Flow Area, a | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ |
| Wetted Perimeter, $P_w$ | **0** ft | **0** ft | **0** ft | **0** ft | **0** ft |
| Channel Slope, s | **0** ft/ft | **0** ft/ft | **0** ft/ft | **0** ft/ft | **0** ft/ft |
| Manning's "n" | **0.013** | **0.24** | **0.24** | **0.24** | **0.24** |
| Flow Length, L | **0** ft | **0** ft | **0** ft | **0** ft | **0** ft |
| **OUTPUT** | | | | | |
| Average Velocity | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s |
| Hydraulic Radius, r = a / $P_w$ | 0.00 ft | 0.00 ft | 0.00 ft | 0.00 ft | 0.00 ft |
| Travel Time | 0.00 hr | 0.00 hr | 0.00 hr | 0.00 hr | 0.00 hr |
| **Watershed or Subarea $T_c$ =** | **0.68 hr** | **0.35 hr** | **0.14 hr** | **0.81 hr** | **0.49 hr** |
| **Watershed or Subarea $T_c$ =** | **41 minutes** | **21 minutes** | **8 minutes** | **49 minutes** | **29 minutes** |

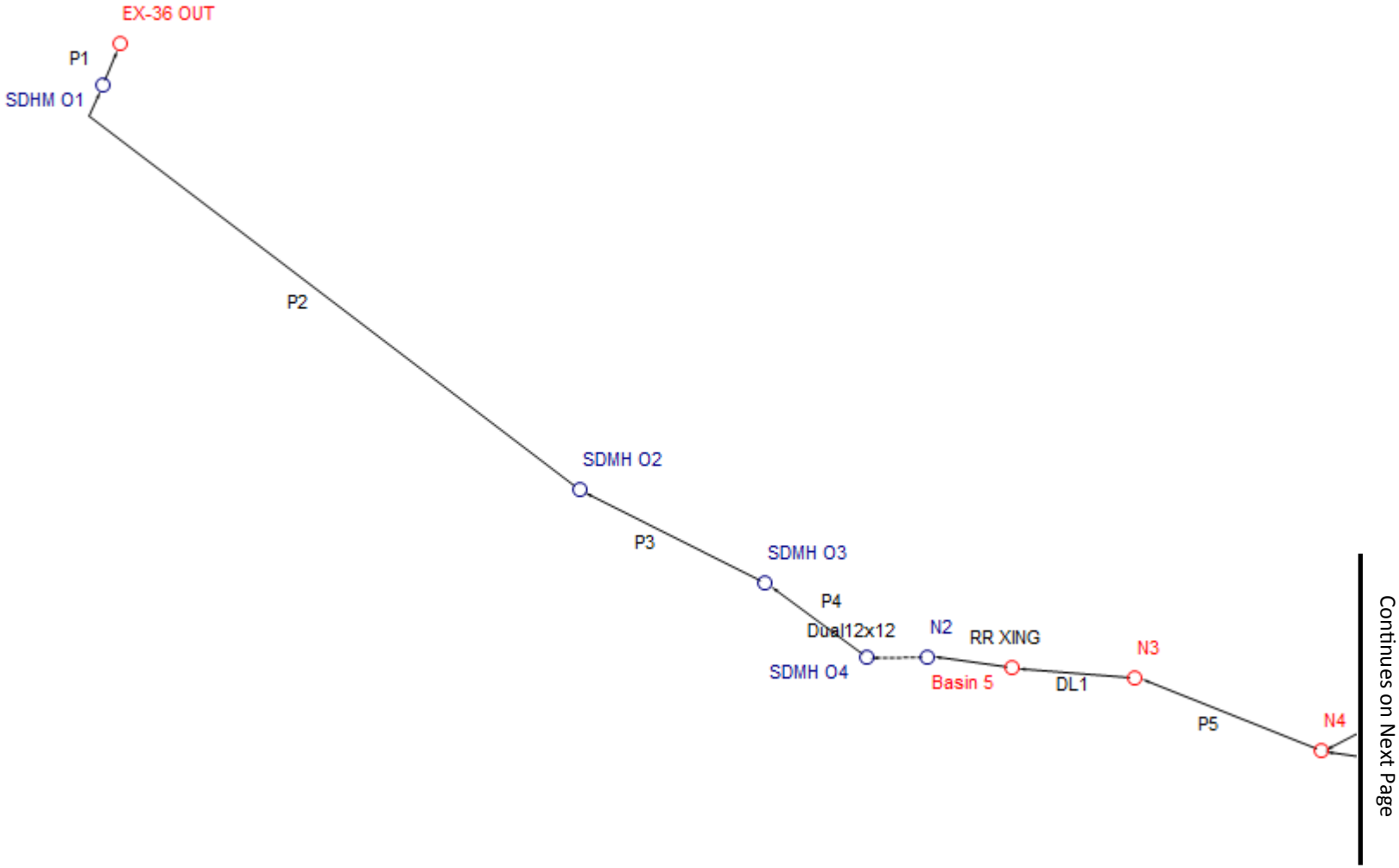
# Time of Concentration

| | | | | | |
|---|---|---|---|---|---|
| **SUBJECT** | Time of Concentration - Downstream Analysis | | | | |
| **PROJECT NO.** | 21509220 | **BY** | ASR | **DATE** | 6/19/2015 |

| | Basin 6 | Basin 7 | Basin 8 | Basin 9 | Basin 10 |
|---|---|---|---|---|---|
| **SHEET FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Surface Description | **Type 4 Cultivated (residue > 20%)** | **Type 1 Smooth Surface** | **Type 4 Cultivated (residue > 20%)** | **Type 3 Cultivated (residue < 20%)** | **Type 4 Cultivated (residue > 20%)** |
| Manning's "n" | **0.17** | **0.011** | **0.17** | **0.06** | **0.17** |
| Flow Length, L (<300 ft) | **285** ft | **300** ft | **300** ft | **300** ft | **282** ft |
| 2-Yr 24 Hour Rainfall, $P_2$ | **2.6** in | **2.6** in | **2.6** in | **2.6** in | **2.6** in |
| Land Slope, s | **0.07** ft/ft | **0.016** ft/ft | **0.017** ft/ft | **0.027** ft/ft | **0.0180** ft/ft |
| **OUTPUT** | | | | | |
| Travel Time | 0.28 hr | 0.06 hr | 0.51 hr | 0.19 hr | 0.48 hr |
| **SHALLOW CONCENTRATED FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Surface Description | **Unpaved** | **Unpaved** | **Unpaved** | **Unpaved** | **Unpaved** |
| Flow Length, L | **1170** ft | **1384** ft | **1348** ft | **582** ft | **605** ft |
| Watercourse Slope*, s | **0.002** ft/ft | **0.011** ft/ft | **0.006** ft/ft | **0.062** ft/ft | **0.100** ft/ft |
| **OUTPUT** | | | | | |
| Average Velocity, V | 0.72 ft/s | 1.69 ft/s | 1.25 ft/s | 4.02 ft/s | 5.10 ft/s |
| Travel Time | 0.450 hr | 0.227 hr | 0.300 hr | 0.040 hr | 0.033 hr |
| **CHANNEL FLOW** | | | | | |
| **INPUT** | **VALUE** | **VALUE** | **VALUE** | **VALUE** | **VALUE** |
| Cross Sectional Flow Area, a | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ | **0** $ft^2$ |
| Wetted Perimeter, $P_w$ | **0** ft | **0** ft | **0** ft | **0** ft | **0** ft |
| Channel Slope, s | **0** ft/ft | **0** ft/ft | **0** ft/ft | **0** ft/ft | **0** ft/ft |
| Manning's "n" | **0.013** | **0.24** | **0.24** | **0.24** | **0.24** |
| Flow Length, L | **0** ft | **0** ft | **0** ft | **0** ft | **0** ft |
| **OUTPUT** | | | | | |
| Average Velocity | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s | 0.00 ft/s |
| Hydraulic Radius, r = a / $P_w$ | 0.00 ft | 0.00 ft | 0.00 ft | 0.00 ft | 0.00 ft |
| Travel Time | 0.00 hr | 0.00 hr | 0.00 hr | 0.00 hr | 0.00 hr |
| **Watershed or Subarea $T_c$ =** | **0.73 hr** | **0.29 hr** | **0.81 hr** | **0.23 hr** | **0.51 hr** |
| **Watershed or Subarea $T_c$ =** | **44 minutes** | **17 minutes** | **49 minutes** | **14 minutes** | **31 minutes** |

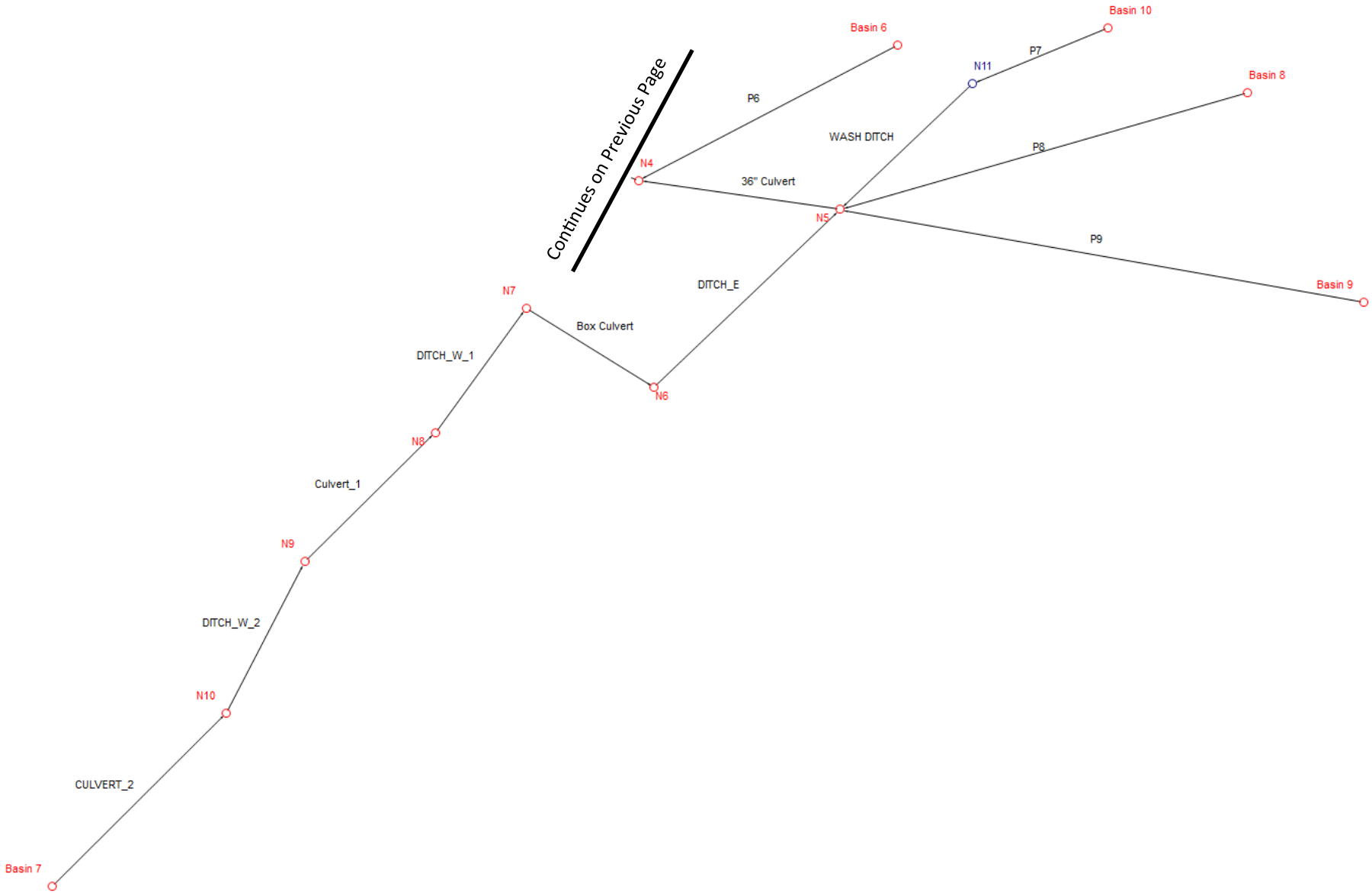
**The Cove — Schematic Layout**

**Downstream Analysis**



**The Cove — Schematic Layout**

**Downstream Analysis**



| XPSWMM RUNOFF DATA - 25-YR STORM EVENT - SUB-BASINS TO 36-INCH OUTFALL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| THE COVE - OREGON CITY, OREGON | | | | | | | | |
| Node Information | | | | | Runoff Information | | | |
| Node Name | Area | Impervious | Curve Number | Tc | Rainfall | Infiltration | Surface Runoff | |
| | acre | % | | min. | in | in | in | cfs |
| SDMH O2* | 12.52 | 65.0 | 0 | 8 | 4.00 | 0.63 | 3.37 | 18.57 |
| SDMH O4 | 22 | 10.2 | 91 | 49 | 4.00 | 1.04 | 2.96 | 13.32 |
| Basin 5 | 29.76 | 16.7 | 91 | 29 | 4.00 | 1.04 | 2.96 | 23.21 |
| Basin 6 | 18.61 | 45.7 | 93 | 44 | 4.00 | 0.74 | 3.27 | 13.43 |
| Basin 7 | 13.67 | 37.2 | 93 | 17 | 4.00 | 0.84 | 3.16 | 14.37 |
| Basin 8* | 32.83 | 80.0 | 98 | 49 | 4.00 | 0.63 | 3.37 | 23.28 |
| Basin 9* | 5.89 | 80.0 | 98 | 14 | 4.00 | 0.52 | 3.48 | 7.36 |
| Basin 10* | 11.4 | 80.0 | 97 | 31 | 4.00 | 0.52 | 3.48 | 10.28 |

| XPSWMM RUNOFF DATA - 100-YR STORM EVENT - SUB-BASINS TO 36-INCH OUTFALL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| THE COVE - OREGON CITY, OREGON | | | | | | | | |
| Node Information | | | | | Runoff Information | | | |
| Node Name | Area | Impervious | Curve Number | Tc | Rainfall | Infiltration | Surface Runoff | |
| | acre | % | | min. | in | in | in | cfs |
| SDMH O2* | 12.52 | 65.0 | 0 | 8 | 4.50 | 0.64 | 3.86 | 21.20 |
| SDMH O4 | 22 | 10.2 | 91 | 49 | 4.50 | 1.06 | 3.44 | 15.59 |
| Basin 5 | 29.76 | 16.7 | 91 | 29 | 4.50 | 1.06 | 3.44 | 27.10 |
| Basin 6 | 18.61 | 45.7 | 93 | 44 | 4.50 | 0.75 | 3.76 | 15.46 |
| Basin 7 | 13.67 | 37.2 | 93 | 17 | 4.50 | 0.85 | 3.65 | 16.58 |
| Basin 8* | 32.83 | 80.0 | 98 | 49 | 4.50 | 0.64 | 3.86 | 26.69 |
| Basin 9* | 5.89 | 80.0 | 98 | 14 | 4.50 | 0.53 | 3.98 | 8.37 |
| Basin 10* | 11.4 | 80.0 | 97 | 31 | 4.50 | 0.53 | 3.98 | 11.70 |

* Note: These basins include assumed % impervious area under future development conditions.

**XPSWMM CONVEYANCE DATA ( 25-YEAR STORM EVENT ) WITH POST BASINS AND UPGRADED STORM LINE IN MAIN STREET**

**OFFSITE TO EXISTING 36-INCH CULVERT - THE COVE - OREGON CITY, OREGON**

| Location | | | Conduit Properties | | | Conduit Results | | | | | | Conduit Profile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Link | Station From | Station To | Diameter | Length | Slope | Design Capacity | Qmax/ Qdesign | Max Flow | Max Velocity | Max Flow Depth | y/d0 | US Ground Elev. | DS Ground Elev. | US IE | DS IE | US Freeboard | DS Freeboard | US HGL | DS HGL |
| | | | ft | ft | % | cfs | | cfs | ft/s | ft | | ft | ft | ft | ft | ft | ft | ft | ft |
| P1 | SDHM O1 | EX-36 OUT | 3.00 | 47.32 | 0.06 | 16.79 | 5.74 | 96.39 | 13.63 | 3.82 | 1.00 | 31.25 | 50.70 | 22.27 | 22.24 | 5.16 | 25.58 | 26.09 | 25.12 |
| P2 | SDMH O2 | SDHM O1 | 4.00 | 376.41 | 0.88 | 134.70 | 0.72 | 96.39 | 10.22 | 3.62 | 0.91 | 35.32 | 31.25 | 25.78 | 22.27 | 6.81 | 5.16 | 28.51 | 26.09 |
| P3 | SDMH O3 | SDMH O2 | 4.00 | 127.13 | 1.00 | 143.62 | 0.59 | 84.93 | 11.41 | 2.53 | 0.63 | 34.83 | 35.32 | 27.25 | 25.78 | 5.26 | 6.81 | 29.57 | 28.51 |
| P4 | SDMH O4 | SDMH O3 | 4.00 | 58.56 | 3.71 | 276.51 | 0.31 | 84.90 | 17.53 | 2.12 | 0.53 | 41.65 | 34.83 | 29.62 | 27.25 | 10.44 | 5.26 | 31.21 | 29.57 |
| RR XING | Basin 5 | N2 | 4.06 | 50.00 | 0.42 | 309.82 | 0.23 | 71.73 | 4.36 | 2.16 | 0.53 | 50.00 | 50.00 | 29.39 | 29.18 | 18.45 | 18.74 | 31.55 | 31.26 |
| DL1 | N3 | Basin 5 | 3.50 | 16.00 | -0.12 | 118.95 | 0.44 | 51.92 | 3.12 | 2.19 | 0.63 | 35.00 | 50.00 | 29.37 | 29.39 | 3.42 | 18.45 | 31.58 | 31.55 |
| P5 | N4 | N3 | 4.00 | 11.50 | 0.17 | 59.90 | 0.87 | 51.91 | 7.26 | 2.24 | 0.56 | 42.92 | 35.00 | 29.39 | 29.37 | 11.29 | 3.42 | 31.63 | 31.58 |
| P6 | Basin 6 | N4 | 4.00 | 511.00 | 0.30 | 78.86 | 0.17 | 13.38 | 3.73 | 2.24 | 0.56 | 38.00 | 42.92 | 30.93 | 29.39 | 5.86 | 11.29 | 32.14 | 31.63 |
| 36" Culvert | N5 | N4 | 3.00 | 343.50 | 0.49 | 46.92 | 0.85 | 39.92 | 5.58 | 3.24 | 1.00 | 36.61 | 42.92 | 31.09 | 29.39 | 2.28 | 11.29 | 34.33 | 31.63 |
| WASH DITCH | N11 | N5 | 3.21 | 413.00 | 1.18 | 826.77 | 0.01 | 10.23 | 1.16 | 3.24 | 1.00 | 43.00 | 36.61 | 35.95 | 31.09 | 6.60 | 2.28 | 36.40 | 34.33 |
| P7 | Basin 10 | N11 | 2.00 | 259.00 | 1.37 | 26.49 | 0.39 | 10.28 | 7.07 | 0.99 | 0.50 | 43.00 | 43.00 | 39.50 | 35.95 | 2.51 | 6.60 | 40.49 | 36.40 |
| P8 | Basin 8 | N5 | 2.50 | 430.00 | 0.85 | 37.84 | 0.61 | 23.24 | 6.90 | 3.24 | 1.00 | 37.50 | 36.61 | 34.75 | 31.09 | 1.19 | 2.28 | 36.31 | 34.33 |
| P9 | Basin 9 | N5 | 1.50 | 96.00 | 0.85 | 9.71 | 0.76 | 7.35 | 4.15 | 3.24 | 1.00 | 37.50 | 36.61 | 31.91 | 31.09 | 3.05 | 2.28 | 34.45 | 34.33 |
| DITCH_E | N6 | N5 | 3.75 | 270.00 | 0.21 | 345.66 | 0.03 | 9.88 | 0.65 | 3.24 | 0.86 | 36.61 | 36.61 | 26.87 | 31.09 | 2.28 | 2.28 | 34.33 | 34.33 |
| Box Culvert | N7 | N6 | 4.00 | 120.30 | 1.05 | 257.60 | 0.08 | -18.99 | -0.80 | 7.46 | 1.00 | 35.43 | 36.61 | 28.13 | 26.87 | 1.10 | 2.28 | 34.33 | 34.33 |
| DITCH_W_1 | N8 | N7 | 3.00 | 247.00 | 1.20 | 293.65 | 0.03 | 8.86 | 1.24 | 6.20 | 1.00 | 35.24 | 35.43 | 31.10 | 28.13 | 0.91 | 1.10 | 34.33 | 34.33 |
| Culvert_1 | N9 | N8 | 3.00 | 59.50 | 0.32 | 37.69 | 0.22 | 8.45 | 3.13 | 3.23 | 1.00 | 35.43 | 35.24 | 31.29 | 31.10 | 1.09 | 0.91 | 34.34 | 34.33 |
| DITCH_W_2 | N10 | N9 | 2.50 | 272.00 | 0.47 | 462.96 | 0.02 | 10.22 | 0.91 | 3.05 | 1.00 | 35.26 | 35.43 | 32.57 | 31.29 | 0.92 | 1.09 | 34.34 | 34.34 |
| CULVERT_2 | Basin 7 | N10 | 2.00 | 60.00 | 0.15 | 8.76 | 1.64 | 14.35 | 6.23 | 1.77 | 0.89 | 35.20 | 35.26 | 32.66 | 32.57 | 0.79 | 0.92 | 34.41 | 34.34 |
| Dual12x12 | N2 | SDMH O4 | 12.00 | 257.50 | 0.01 | 369.56 | 0.10 | 35.89 | 1.86 | 1.61 | 0.13 | 50.00 | 41.65 | 29.18 | 29.62 | 18.74 | 10.44 | 31.26 | 31.21 |
| Dual12x12 | N2 | SDMH O4 | 12.00 | 257.50 | 0.01 | 369.56 | 0.10 | 35.89 | 1.86 | 1.61 | 0.13 | 50.00 | 41.65 | 29.18 | 29.62 | 18.74 | 10.44 | 31.26 | 31.21 |

**XPSWMM CONVEYANCE DATA ( 100-YEAR STORM EVENT ) WITH POST BASINS AND UPGRADED STORM LINE IN MAIN STREET**

**OFFSITE TO EXISTING 36-INCH CULVERT - THE COVE - OREGON CITY, OREGON**

| Location | | | Conduit Properties | | | Conduit Results | | | | | | Conduit Profile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Link | Station From | Station To | Diameter | Length | Slope | Design Capacity | Qmax/ Qdesign | Max Flow | Max Velocity | Max Flow Depth | y/d0 | US Ground Elev. | DS Ground Elev. | US IE | DS IE | US Freeboard | DS Freeboard | US HGL | DS HGL |
| | | | ft | ft | % | cfs | | cfs | ft/s | ft | | ft | ft | ft | ft | ft | ft | ft | ft |
| P1 | SDHM O1 | EX-36 OUT | 3.00 | 47.32 | 0.06 | 16.79 | 6.58 | 110.43 | 15.59 | 4.26 | 1.00 | 31.25 | 50.70 | 22.27 | 22.24 | 4.72 | 25.46 | 26.53 | 25.24 |
| P2 | SDMH O2 | SDHM O1 | 4.00 | 376.41 | 0.88 | 134.70 | 0.82 | 110.43 | 10.23 | 4.06 | 1.00 | 35.32 | 31.25 | 25.78 | 22.27 | 6.36 | 4.72 | 28.96 | 26.53 |
| P3 | SDMH O3 | SDMH O2 | 4.00 | 127.13 | 1.00 | 143.62 | 0.68 | 97.46 | 11.52 | 2.98 | 0.75 | 34.83 | 35.32 | 27.25 | 25.78 | 4.94 | 6.36 | 29.89 | 28.96 |
| P4 | SDMH O4 | SDMH O3 | 4.00 | 58.56 | 3.71 | 276.51 | 0.35 | 97.41 | 17.73 | 2.44 | 0.61 | 41.65 | 34.83 | 29.62 | 27.25 | 10.27 | 4.94 | 31.38 | 29.89 |
| RR XING | Basin 5 | N2 | 4.06 | 50.00 | 0.42 | 309.82 | 0.27 | 82.43 | 4.46 | 2.30 | 0.57 | 50.00 | 50.00 | 29.39 | 29.18 | 18.31 | 18.57 | 31.69 | 31.43 |
| DL1 | N3 | Basin 5 | 3.50 | 16.00 | -0.12 | 118.95 | 0.51 | 60.43 | 3.20 | 2.34 | 0.67 | 35.00 | 50.00 | 29.37 | 29.39 | 3.27 | 18.31 | 31.73 | 31.69 |
| P5 | N4 | N3 | 4.00 | 11.50 | 0.17 | 59.90 | 1.01 | 60.42 | 7.77 | 2.40 | 0.60 | 42.92 | 35.00 | 29.39 | 29.37 | 11.13 | 3.27 | 31.79 | 31.73 |
| P6 | Basin 6 | N4 | 4.00 | 511.00 | 0.30 | 78.86 | 0.20 | 15.40 | 3.84 | 2.40 | 0.60 | 38.00 | 42.92 | 30.93 | 29.39 | 5.74 | 11.13 | 32.26 | 31.79 |
| 36" Culvert | N5 | N4 | 3.00 | 343.50 | 0.49 | 46.92 | 0.99 | 46.64 | 6.43 | 3.52 | 1.00 | 36.61 | 42.92 | 31.09 | 29.39 | 2.00 | 11.13 | 34.61 | 31.79 |
| WASH DITCH | N11 | N5 | 3.21 | 413.00 | 1.18 | 826.77 | 0.01 | 11.64 | 1.45 | 3.52 | 1.00 | 43.00 | 36.61 | 35.95 | 31.09 | 6.57 | 2.00 | 36.43 | 34.61 |
| P7 | Basin 10 | N11 | 2.00 | 259.00 | 1.37 | 26.49 | 0.44 | 11.70 | 7.34 | 1.07 | 0.53 | 43.00 | 43.00 | 39.50 | 35.95 | 2.43 | 6.57 | 40.57 | 36.43 |
| P8 | Basin 8 | N5 | 2.50 | 430.00 | 0.85 | 37.84 | 0.70 | 26.61 | 7.11 | 3.52 | 1.00 | 37.50 | 36.61 | 34.75 | 31.09 | 0.99 | 2.00 | 36.51 | 34.61 |
| P9 | Basin 9 | N5 | 1.50 | 96.00 | 0.85 | 9.71 | 0.86 | 8.36 | 4.71 | 3.52 | 1.00 | 37.50 | 36.61 | 31.91 | 31.09 | 2.72 | 2.00 | 34.78 | 34.61 |
| DITCH_E | N6 | N5 | 3.75 | 270.00 | 0.21 | 345.66 | 0.03 | 10.78 | 0.65 | 3.52 | 0.94 | 36.61 | 36.61 | 26.87 | 31.09 | 2.00 | 2.00 | 34.61 | 34.61 |
| Box Culvert | N7 | N6 | 4.00 | 120.30 | 1.05 | 257.60 | 0.08 | -20.48 | -0.86 | 7.74 | 1.00 | 35.43 | 36.61 | 28.13 | 26.87 | 0.82 | 2.00 | 34.61 | 34.61 |
| DITCH_W_1 | N8 | N7 | 3.00 | 247.00 | 1.20 | 293.65 | 0.03 | 10.06 | 1.28 | 6.48 | 1.00 | 35.24 | 35.43 | 31.10 | 28.13 | 0.63 | 0.82 | 34.61 | 34.61 |
| Culvert_1 | N9 | N8 | 3.00 | 59.50 | 0.32 | 37.69 | 0.26 | 9.82 | 3.24 | 3.51 | 1.00 | 35.43 | 35.24 | 31.29 | 31.10 | 0.81 | 0.63 | 34.62 | 34.61 |
| DITCH_W_2 | N10 | N9 | 2.50 | 272.00 | 0.47 | 462.96 | 0.03 | 11.38 | 0.93 | 3.33 | 1.00 | 35.26 | 35.43 | 32.57 | 31.29 | 0.64 | 0.81 | 34.62 | 34.62 |
| CULVERT_2 | Basin 7 | N10 | 2.00 | 60.00 | 0.15 | 8.76 | 1.89 | 16.56 | 6.19 | 2.07 | 1.00 | 35.20 | 35.26 | 32.66 | 32.57 | 0.47 | 0.64 | 34.73 | 34.62 |
| Dual12x12 | N2 | SDMH O4 | 12.00 | 257.50 | 0.01 | 369.56 | 0.11 | 41.24 | 1.95 | 1.78 | 0.15 | 50.00 | 41.65 | 29.18 | 29.62 | 18.57 | 10.27 | 31.43 | 31.38 |
| Dual12x12 | N2 | SDMH O4 | 12.00 | 257.50 | 0.01 | 369.56 | 0.11 | 41.24 | 1.95 | 1.78 | 0.15 | 50.00 | 41.65 | 29.18 | 29.62 | 18.57 | 10.27 | 31.43 | 31.38 |

# Appendix D

## Mixing Zone Analysis

# Technical Memorandum

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**From:** Joshua Owens, PE - Otak

**Copies:** Atalia Raskin, PE - Cardno

**Date:** July 16, 2015

**Subject:** Cove: Garden Apartments, Stormwater Discharge Water Quality Action Area

**Project No.:** 17644

## Introduction

Stormwater effluent from the future Cove: Garden Apartments development in Oregon City, OR will carry pollutants into Clackamette Cove that may adversely impact sensitive aquatic species. Pollutants of concern for the sensitive aquatic species present in this area, and that are known to occur at elevated concentrations in stormwater effluent, are dissolved copper (*dCu*), dissolved zinc (*dZn*) and polycyclic aromatic hydrocarbons (*PAH*). When stormwater discharges into the receiving waters the elevated pollutant concentrations may temporarily exceed water quality criteria until it mixes and dilutes with receiving waters. This evaluation was performed to determine the extent of the area that may see pollutant concentrations above the water quality criteria (action area) shown in **Figure 1**.

- Runoff volume for the development areas was determined for the jurisdictional water quality storm event (0.83 inches of rainfall in 24 hours) using the Santa Barbara Unit Hydrograph method.
- Typical pollutant concentrations of treated stormwater effluent by treatment type were determined from literature review and provided by Cardno (Cardno, 2015). Fluoranthene was selected as the representative *PAH* because it had the most complete data available is the most common *PAH* found in stormwater and at the highest concentrations. From here on *PAH* in this document refers to fluoranthene. Treated stormwater effluent will mix with Clackamette Cove to dilute the stormwater pollutants and achieve water quality criteria concentrations.
- Water quality criteria were determined based on review of literature that had been previously accepted by the National Marine Fisheries Service for consultations on similar projects (NMFS, 2014). This included the use of the Biotic Ligand Model to determine criteria for *dCu* and *dZn* based on site specific water chemistry.
- A water sample in Clackamette Cove was taken on 04/23/2015 by PHS to determine background pollutant concentrations and water chemistry required to use the Biotic Ligand Model

- Receiving water volume available for dilution was calculated from bathymetry derived from hydrographic survey performed in November 2005. Water volume is dependent on the water surface elevation (stage) at the time of the runoff, which is generally controlled by the Clackamas River, although it may also be controlled by Willamette River backwater during larger flow events. To be conservative, volume should be calculated at a low stage (less volume available for dilution results in larger action areas); unfortunately detailed stage data is not available for Clackamette Cove. Materials provided from Cardno showed an ordinary high water (OHW) elevation of 18 feet, to estimate low stage a water surface elevation of 12 feet was used to calculate volume.

Figure 1: Action areas for proposed development outfalls to Clackamette Cove.

## Stormwater Discharge

The jurisdictional (Oregon City, OR) water quality event is 0.83 inches in 24 hours. Runoff volume was calculated using the Santa Barbara Urban Hydrograph (SBUH) method. The development will use two stormwater outfalls into Clackamette Cove. A 36-inch outfall will collect onsite stormwater from the apartments, offsite stormwater from transportation improvements that will be performed with the development, and additional existing contributing areas. The 15-inch outfall will collect offsite stormwater from the east side of the development. All development and improvement areas will be treated prior to discharging into Clackamette Cove with the facilities shown in Table 1.

| Table 1: Stormwater discharge characteristics | | | |
|---|---|---|---|
| Outfall | Contributing Area | Facility Type | Water Quality Volume ($ft^3$) |
| 36” | Onsite | Stormfilter Cartridge | 12,700 |
| 36” | Onsite | BioSwale | 1,000 |
| 36” | Offsite | Stormfilter Cartridge | 1,900 |
| 15” | Offsite | Bioswale | 1,800 |

The development will be treated with a combination of bioswales and StormFilter cartridges. Typical discharge concentration (minimum, median, and maximum) of *dCu*, *dZn*, and *PAH* for each of these treatment methods was provided by Cardno (2015) based on available data and literature (Table 2). Data represented a wide range of sites, including variation in facilities, land use, and rainfall characteristics. Median values were selected as typical for the following reasons:

1) The median values in relation to the range of values indicates there is likely a skew to the higher values resulting from few large data points that are not representative.
2) Typical rainfall patterns at the site are frequent low-intensity events during the spring, winter, and fall seasons which don’t allow for a lot of pollution build-up on impervious surface between events.
3) The development is residential with an access road that is not a through road, limiting automotive use which is a major source of heavy metals. This land use will also require less pavement maintenance, limiting the amount of *PAH* that is associated with asphalt sealant.
4) Improvements in treatment facility design, technologies, standards and maintenance over the past decade will improve short- and long-term facility performance.

| Table 2: Typical stormwater discharge concentrations of *dCu*, *dZn*, and *PAH* | | | |
|---|---|---|---|
| Treament Facility | *dCu* | *dZn* | *PAH* |
| Bioswale Range | 1.1 – 42.0 | 3.5 - 259 | 0.01 – 1.13 |
| **Bioswale Median** | **9.3** | **32.5** | **0.49** |
| Stormfilter Cartridge Range | 0.9 – 107.7 | 26.4 – 164.0 | 0.06 – 4.87 |
| **Stormfilter Cartridge Median** | **15.4** | **51** | **2.13** |

## Water Quality Criteria

The National Marine Fisheries Service (NMFS) has established action levels of 2.3 µg/L above background (no background reported) for *dCu* and 5.6 µg/L above background (minimum background concentration of 3 µg/L) for *dZn*. (NMFS, 2014). Experiments conducted to determine these action levels were done using zinc sulfate or copper sulfate in soft water from lake or municipal sources (Hecht et. al., 2007; Sprague, 1968). This metal form is highly bioavailable and these water sources are expected to have minimal concentrations of naturally occurring water chemistries that would decrease metal toxicity, especially dissolved organic carbon (DOC) that would bind with *dCu* and *dZn* to reduce their bioavailability. Therefore the NMFS action levels are considered to be for bioavailable *dCu* and *dZn*.

DOC has a strong ameliorating effect on dissolved metal toxicity by binding with the metal to form ligands, preventing the metal from binding at receptor sites in sensitive tissues (e.g. gill, olfactory). The Biotic Ligand Model (Paquin et. al., 2002) has been developed to determine the interaction and uptake of dissolved metals with aquatic organisms in the presence of DOC, hardness, alkalinity, and other chemical constituents. Biotic Ligand Model, version 2.2.3 (BLM), (HDR HydroQual, 2014) was used to determine the bioavailable fraction of *dCu* and *dZn* in natural waters receiving treated stormwater effluent. Required water chemistry input data was measure from water samples taken from the potential action area within and adjacent to the project area, or estimated from other sources. The input data is shown in Table 3.

| Table 3: Receiving water chemistry used for the Biotic Ligand Model | | | |
|---|---|---|---|
| Parameter | Unit | Value | Source |
| Temperature | °C | 10 | Estimated |
| pH | - | 7.7 | USGS stream monitoring |
| DOC | mg/L | 1.2 | Sample 4/23/2015 |
| Humic Acid | % | 10 | Typical Value |
| Ca | mg/L | 5.2 | Sample 4/23/2015 |
| Mg | mg/L | 1.8 | Sample 4/23/2015 |
| Na | mg/L | 3.4 | Sample 4/23/2015 |
| K | mg/L | 0.4 | Sample 4/23/2015 |
| SO4 | mg/L | 0.1 | Sample 4/23/2015 |
| Cl | mg/L | 1.9 | Sample 4/23/2015 |
| Alkalinity | mg/L CaCO3 | 24 | Sample 4/23/2015 |
| S | mg/L | 0.001 | Typical value (not used in calculation) |

The bioavailable concentrations of *dCu* and *dZn* was calculated by subtracting the concentration of metal bound to DOC from the total dissolved metal concentration. Sampling resulted in background concentration of *dCu* and *dZn* of 0 µg/L; therefore the NMFS action levels were 2.3 µg/L for bioavailable *dCu* and 5.6 µg/L for bioavailable *dZn*. Total *dCu* and *dZn* concentration corresponding to the NMFS action levels for bioavailable *dCu* and *dZn* were determined using the BLM by iteratively adjusting the Total *dCu* and *dZn* concentrations until the bioavailable concentrations where equal to the NMFS action levels. The BLM was also used to estimate the site specific LC50 for Total *dCu* and *dZn* for *O. mykiss* (rainbow trout), based on exposure of bioavailable metals to gill tissue.

Neither NMFS, EPA, or any other applicable jurisdiction have developed or adopted aquatic life water quality criteria for any of the individual *PAH* compounds or for *Total PAH*. The EPA ECOTOX database (http://cfpub.epa.gov/ecotox/) was searched for studies assessing the toxicity of commonly occurring individual *PAH* compounds on salmonids. Levine (1997) reported a lowest observable effect concentration (LOEC) of 0.78 µg/L benzo(a)pyrene on *O. mykiss* for durations ranging from one to five days. Spehar et al (1999) reported an LC50 of 7.7 µg/L fluoranthene on *O. mykiss* for duration of four days, other studies reported higher LC50 values. EPA recommends using an acute-to chronic ratio (ACR) of 10 to calculate the chronic concentration if the acute concentration is known (EPA 1991). This results in a chronic concentration of fluoranthene to *O. Mykiss* of 0.77 µg/L, very similar to the 0.78 µg/L reported for benzo(a)pyrene. Concentrations of 0.77 µg/L and 7.7 µg/L were used as the respective chronic and acute water quality criteria for *PAH*. Resulting water quality criteria for *dCu*, *dZn*, and *PAH* are shown in Table 4. "Action Level Total Dissolved" is the criteria used to delineate the action area.

| Table 4: *dCu*, *dZn* and *PAH* water quality criteria (µg/L) | | | |
|---|---|---|---|
| | Water quality criteria concentration | | |
| Description | *dCu* | *dZn* | *PAH* |
| Action Level Total Dissolved[1] | **56.2** | **17.2** | **0.77** |
| Action Level Bioavailable[2A,2B] | 2.3 | 5.6 | 0.77 |
| LC50 Total Dissolved[3] | 82.7 | 84.3 | 7.7 |
| LC50 Bioavailable[4] | 8.4 | 37.7 | 7.7 |
| Background Total Dissolved[5] | 0 | 0 | 0 |
| Background Bioavailable[4] | 0 | 0 | 0 |

[1] Total dissolved concentration when bioavailable concentration is equal to the water quality criteria/NMFS action level (NMFS 2014), this value is used to calculate dilution requirements in comparison with discharged concentrations.
[2A] Copper bioavailable water qualilty criteria is calculated as (background concentration + 2.3 µg/L) according to NMFS (2014)
[2B] Zinc bioavailable water qualilty criteria is calculated as (background concentration + 5.6 µg/L) with a maximum value of 8.6 ug/L according to (NMFS 2014)
[3] Estimated using BLM 2.2.3 for rainbow trout (*O. mykiss*)
[4] Calculated as (total dissolved concentration) - (concentration bound by DOC)
[5] Taken from water quality sampling performed 11/04/2014

## Action Area Delineation - Dilution Factors and Volume

The action area was delineated using a simple dilution model for complete mixing with receiving waters in the vicinity of the outfall until the necessary dilution is achieved to meet the action area water quality criteria. The volume of receiving waters available for dilution as a function of distance from the outfall was calculated using bathymetry data and a water surface elevation of 12 feet. This is a conservative approach because the water surface elevation is estimated to be a generally low stage which results in less volume, and because the entire discharge volume is considered to enter Clackamette Cove at once and be well mixed within the action area, whereas over the course of the discharge mixing is likely to take place over a greater area than is shown with pollutants leaving the action area at concentrations below the water quality criteria. This resulted in an action area with a radius of 35 feet from the 15 inch outfall for *dZn* and an action area with a radius of 80 feet from the 36 inch outfall for *dZn* and *PAH* (Figure 1).

The dilution factor represents the amount of receiving water that is required to mix with the treated stormwater discharge to meet water quality criteria. A dilution factor of 1 means that the stormwater is already at the water quality criteria, less than 1 means that the stormwater is below the water quality criteria, and greater than 1 means that the stormwater must be diluted to meet the water quality criteria. Since the background concentration is 0 in all cases the dilution factor is simply

$$Eq\ 1: Volume\ Dilution\ Factor\ (DF) = \frac{C_1}{C_2}$$

Where:
$C_1$ = Stormwater discharge concentration
$C_2$ = Water quality criteria concentration

The total resultant dilution volume ($V_3$) can then be calculated if the *DF* and total runoff volume ($V_1$) is known.

$$Eq\ 2: Dilution\ Volume\ (V_3) = DF \times V_1$$

Dilution factors and volumes were calculated for *dCu*, *dZn*, and *PAH* for the 36-inch and 15-inch outfalls and summarized in Table 5. If the dilution factor is less than one, the discharge already meets the water quality criteria and there is no need for dilution, therefore dilution volume is not included.

| Table 5: Dilution factors and volume required to meet water quality criteria | | | | | |
|---|---|---|---|---|---|
| | 36" Outfall | | | | 15" Outfall |
| Description | Onsite | Onsite | Offsite | Total | Offsite |
| Treatment | StormFilter Cartridge | Bioswale | StormFilter Cartridge | | Bioswale |
| Water Quality Volume ($ft^3$) | 12700 | 1000 | 1900 | 15600 | 1800 |
| **Dissolved Copper** | | | | | |
| Discharge, median [µg/L] | 15.4 | 9.3 | 15.4 | 15.0 | 9.3 |
| LC50 WQ Criteria (µg/L) | 82.7 | 82.7 | 82.7 | 83.7 | 82.7 |
| LC50 Dilution Factor | 0.19 | 0.11 | 0.19 | 0.18 | 0.11 |
| LC50 Dilution Volume ($ft^3$) | - | - | - | - | - |
| Action Area WQ Criteria (µg/L) | 56.5 | 56.5 | 56.5 | 56.5 | 56.5 |
| Action Area Dilution Factor | 0.27 | 0.16 | 0.27 | 0.27 | 0.16 |
| Action Area Dilution Volume ($ft^3$) | - | - | - | - | - |
| **Dissolved Zinc** | | | | | |
| Discharge, median [µg/L] | 51 | 32.5 | 51 | 49.8 | 32.5 |
| LC50 WQ Criteria (µg/L) | 84.3 | 84.3 | 84.3 | 84.3 | 84.3 |
| LC50 Dilution Factor | 0.60 | 0.39 | 0.60 | 0.59 | 0.39 |
| LC50 Dilution Volume ($ft^3$) | - | - | - | - | - |
| Action Area WQ Criteria (µg/L) | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 |
| Action Area Dilution Factor | **2.97** | **1.89** | **2.97** | **2.90** | **1.89** |
| Action Area Dilution Volume ($ft^3$) | 37657 | 1890 | 5634 | **45180** | **3401** |
| **Polycylic Aromatic Hydrocarbon** | | | | | |
| Discharge, median [µg/L] | 2.13 | 0.49 | 2.13 | 2.0 | 0.49 |
| LC50 WQ Criteria (µg/L) | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 |
| LC50 Dilution Factor | 0.28 | 0.06 | 0.28 | 0.26 | 0.06 |
| LC50 Dilution Volume ($ft^3$) | - | - | - | - | - |
| Action Area WQ Criteria (µg/L) | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| Action Area Dilution Factor | **2.77** | 0.64 | **2.77** | **2.63** | 0.64 |
| Action Area Dilution Volume ($ft^3$) | 35131 | n/a | 5256 | **41023** | **1145** |

The LC50 criteria are met with treatment in all cases and requires no further consideration. The action area criteria are met for *dCu* at both outfalls and does not require dilution, it is met for *PAH* at the 15-inch outfall but requires dilution at the 36-inch outfall, it is not met for *dZn* at either outfall and requires dilution. Since the dilution volume for *dZn* and *PAH* at the 36-inch outfall is similar the dilution volume calculated for *dZn* was used for both because it is slightly higher.

## Dispersion of Pollutants from Action Area

The dilution analysis considered the runoff volume from a single jurisdictional water quality event. To demonstrate that pollutants will not persist in the same area over multiple events a transportation analysis was done using the following diffusion equation, which corrects for boundary conditions:

$$Eq\ 3: c(x,t) = 2\left(\frac{m_p}{2\sqrt{\pi E t}} e^{-\frac{x^2}{4Et}}\right)\frac{A_x}{A_0}$$

Where
$c(x,t)$ = concentration at radial distance from action area $x$ and at time $t$
$m_p$ = total mass of particles normalized to the cross sectional area of the outer bounds of the action area
E = horizontal turbulent diffusion coefficient
$A_0$ = Cross-sectional area at the boundary of the action area
$A_x$ = Cross-sectional area at radial distance $x$ from action area

The horizontal turbulent diffusion coefficient (E) is highly variable with typical lake values ranging from 40 $ft^2$/hr to 40,000,000 $ft^2$/hr (Chapra, 1997). Higher values of E result in material dispersing through the lake quickly, whereas lower values indicate that the material will persist in one location. Since there is no way to estimate E in Clackamette Cove without a detailed tracer study a conservatively low value of E (400 $ft^2$/hr) was chosen for analysis. It is likely that E is higher as Clackamette Cove drains with the falling hydrograph of the Clackamas River, which will draw material towards the outlet of the cove and enhance mixing. **Figure 2** and **Figure 3** show the concentration profile moving outward from the action area at various elapsed times from complete mixing for the 36-inch and 15-inch outfalls respectively.

**Figure 2** shows that *dZn* concentration in the action area of the 36-inch outfall drops from 49.8 µg/L to about 3.3 µg/L after 1 day and to about 1.2 µg/L after 7 days. This indicates that pollutants will be effectively dispersed between events and additive effects of multiple events do not require consideration. Furthermore if multiple events do occur close together most of the pollutants will be flushed in the first event and subsequent events will likely not have high pollutant concentrations.

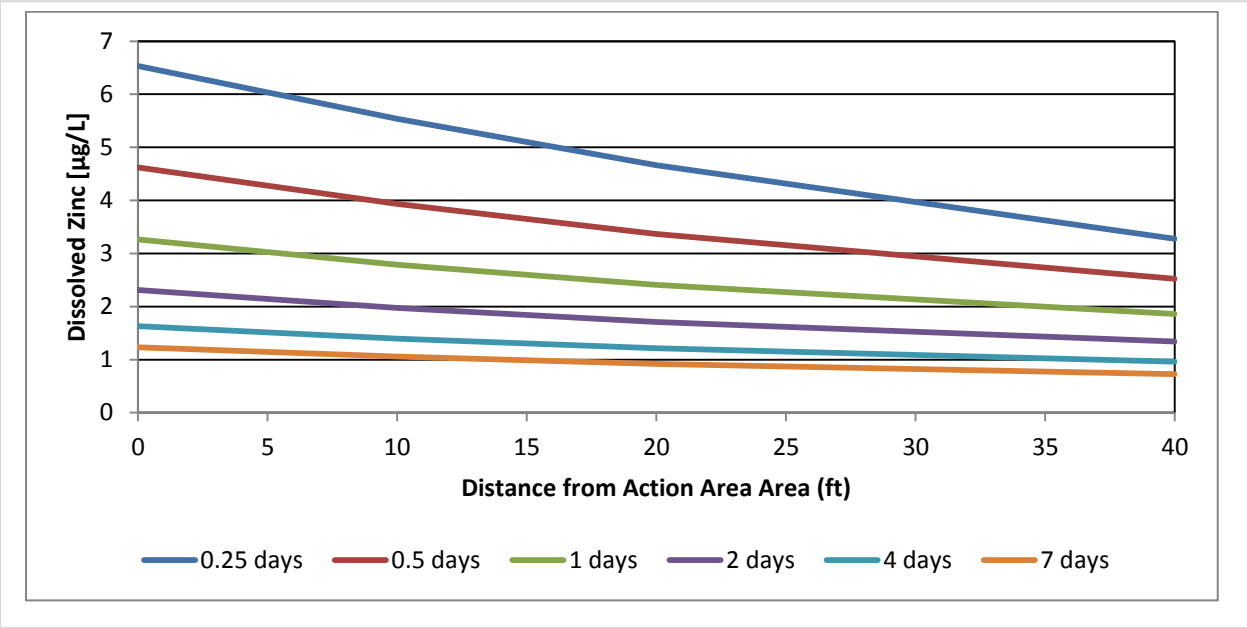


Figure 2: Dispersion of dissolved zinc from action area at 36" outfall showing concentration profile with distance from action area at elapsed times after complete mixing.

**Figure 3** shows that *dZn* concentration in the action area of the 15-inch outfall drops from 32.5 µg/L to about 1.9 µg/L after 0.25 day and to about 0.9 µg/L after 1 day. This dispersion occurs at the same time-scale as the event itself. This indicates that pollutants will effectively be dispersed during the event and it is likely that *dZn* concentrations will only exceed action area criteria in a much smaller are than is shown in Figure 1.

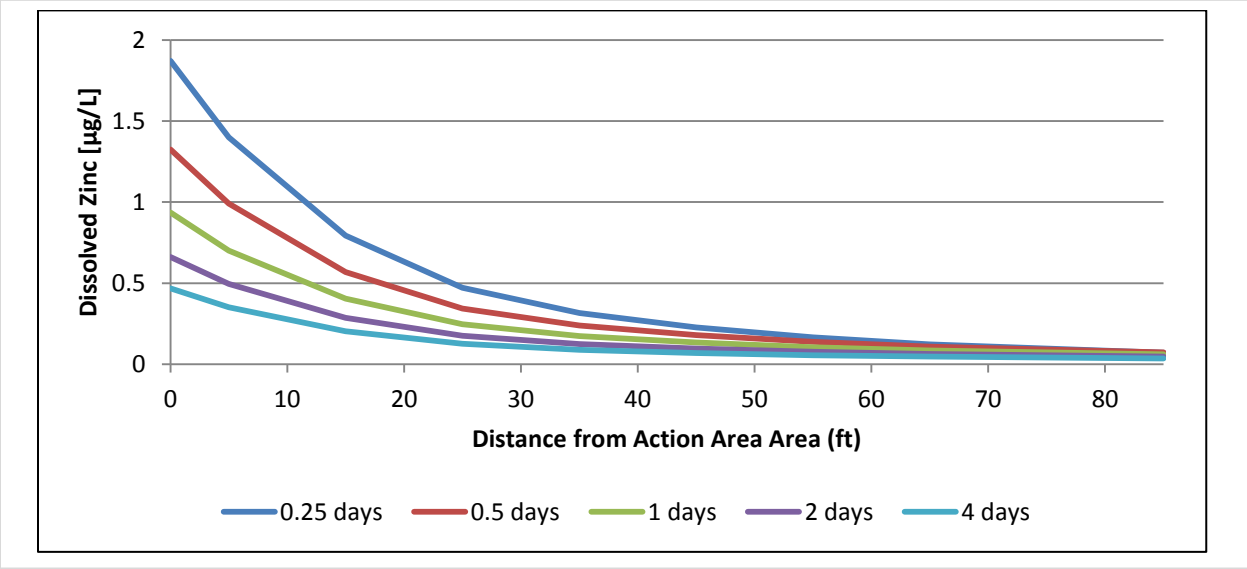


Figure 3: Dispersion of dissolved zinc from action area at 15-inch outfall showing concentration profile with distance from action area at elapsed times after complete mixing.

## Conclusions

- *dCu*, *dZn*, and *PAH* are all reduced to below LC50 concentrations by treatment.
- The presence of DOC in the receiving water and its slight alkalinity removes bioavailable *dCu* to below action levels, eliminating toxicity.
- The presence of DOC in the receiving water and its slight alkalinity removes some bioavailable *dZn,* but it is still above action levels and requires dilution at both outfalls.
- Bioswales treat *PAH* to be below action levels for the 15-inch outfall. Stormfilters provide the main treatment for the 36-inch outfall and they do not treat *PAH* to below action levels, therefore dilution is required for *PAH* at the 36-inch outfall.
- Dilution is provided by the receiving waters, the necessary volume is provided within the action area shown in **Figure 1**.
- Pollutants disperse from the action area fairly quickly and multiple runoff events will not increase the pollutant concentrations at the outfall. Because of this quick dispersal and other conservative assumptions it is likely that the action areas will be smaller than what is shown in **Figure 1**.

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# Appendix E

## Water Quality Analysis

# MEMORANDUM

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To: Eric Campbell, PHS

From: Atalia Raskin, PE
WR Senior Project Engineer

Date: May 1, 2015

Project: Cove: Garden Apartments
Cardno#: 9150220
Re: Water Quality Analysis Copper, Zinc and PAH (Fluoranthene)

## Introduction

The proposed Cove: Garden Apartment project is located southwest of Main Street in Oregon City, Oregon. The project will redevelop a gravel processing operation to include 11 multi-family buildings totaling 244 units. There will be 374 parking spaces and eight detached garage structures. Residential facilities include a community center, pool, and two mixed-use buildings with non-residential space.

The project discharges into the Clackamette Cove, a former gravel quarry that connects with the Clackamas River just upstream of the Willamette River. Both rivers contain Endanger Species Act (ESA) listed species. This memorandum lists the range and median expected pollutant concentrations for dissolved copper, dissolved zinc and the polycyclic aromatic hydrocarbons (PAH) fluoranthene.

## Estimated Dissolved Metal and PAH Concentrations

*Dissolved Metals (Copper and Zinc)*

Some of the commonly understood sources of dissolved metals include vehicle brake pads, architectural copper, various roofing material and gutters, copper-containing pesticides, air emission, galvanized metals, and paints and wood preservatives. Potential dissolved metal concentrations that would be present at the proposed Cove: Garden Apartments include deposits from associated traffic, parked cars and building materials.

Once deposited, dissolved metals exposed to rainfall can be washed off and become a part of stormwater runoff. A paper completed for the Oregon Department of Transportation on copper speciation in highway stormwater runoff (Nason, et al 2011) summarized research relating to factors that affect dissolved metal concentrations. A summary is listed below:

- Rainfall Duration – The amount of rainfall is more important to predicting concentrations than the intensity of the storm event. Longer storm events are able to dilute the concentrations in stormwater runoff. More pollutants are washed off during the beginning of a storm event than during the end.
- Land-use - Land-use categories don't affect the mean concentrations within stormwater runoff. Urban vs. non-urban has a stronger correlation. This was shown even when comparing concentration from roadways having the same Average Daily Traffic (ADT) counts.
- Storm Frequency – Dissolved pollutant loads reach a steady-state concentration within approximately one to two weeks.

These findings indicate reported dissolved metal concentrations from published literature can be used to estimate median dissolved metal concentrations in stormwater runoff, regardless of land-use type. A literature search was completed to predict the likely peak concentrations of dissolved copper and zinc from stormwater runoff. A summary of reported dissolved copper and zinc levels are listed in the following tables.

**Table 1-1 Dissolved Metal Concentrations – Dissolved Copper**

| Range of Dissolved Copper (µg/L) | Median Value Dissolved Copper (µg/L) | Reference |
|---|---|---|
| 1-121 | 9.9 | Kayhanian, et al (2003)* |
| <3-33 | 5 | Bannerman, et al (1996)* |
| 1.5-45.5 | 11.6 | WERF, et al (2007)* |
| 1-21 | 3.5 | Harrision, et al (1997)* |
| <1-110 | 4 | Strecker, et al (1997)* |
| 12.8-22.7 | 17.3 | Nason, et al (2012) |

*As reported in Table 2.5 Dissobled Copper in Stormwater (Nason, et al (2011))

**Table 1-2 Dissolved Metal Concentrations - Dissolved Zinc**

| Range of Dissolved Zinc (µg/L) | Median Value Dissolved Zinc (µg/L) | Reference |
|---|---|---|
| 31-77 | 60 | Strecker, et al (1997) |
| 43.8-193 | 60 | Nason, et al (2014) |

*PAH (Fluoranthene)*

Sources of PAH in stormwater runoff include combustion of fossil fuels through the application of asphalt sealants on parking lot surfaces. Less research is available on the amount of PAHs in stormwater runoff. A sealant will not be applied with the construction of Cove: Garden Apartment. Sealants are typically applied after the parking lot pavement begins to degrade.

Concentrations of fluoranthene were selected as a representative PAH due to the observation that this compound was most commonly measured in urban stormwater at the highest concentrations of observed PAHs. The table lists reported concentration levels.

**Table 1-3 PAH Concentrations - Fluoranthene**

| Range of Fluoranthene (µg/L) | Median Value Fluoranthene (µg/L) | Reference |
|---|---|---|
| 0.045-0.955 | 0.178 | Milesi, et al (2006) |
| 0.1-8.7 | 3.8 | Mahler, et al (2003) |

**Removal Efficiencies**

The proposed project will install stormwater treatment facilities to remove pollutants from stormwater. The selected stormwater treatment facilities at the site include LIDA swales and Contech StormFilter cartridges with ZPG media.

*LIDA Swale*

The International Stormwater Best Management Practices Database (BMP Database) was used to estimate the range of dissolved metals removed from the LIDA Swale. The BMP Database doesn't report removal efficiencies for PAHs.

The LIDA Swale will collect and treat 0.86 acres of impervious roof area at the site. The proposed LIDA Swale is designed following Clean Water Services guidelines. Design elements include trapped catch basins to remove coarse sediment, using soil media to provide stormwater filtration, and vegetation to will provide plant uptake.

Removal efficiencies were obtained from the BMP Database. The proposed LIDA Swale most closely resembles the bioswale as defined by the BMP Database. The BMP Database provides statistical results from several testing sites throughout the country and different land-uses. A simplified summary table is listed below for dissolved copper and zinc.

**Table 1-4 Release Concentrations – Dissolved Copper and Zinc**

| Metal | Bioswale Discharged Range of Dissolved Copper (µg/L) | Bioswale Discharged Median Value Dissolved Copper (µg/L) |
|---|---|---|
| Copper | 1.11-42.0 | 9.31 |
| Zinc | 3.5-259 | 32.5 |

A literal remove was completed to estimate the removal efficiencies for PAHs from stormwater runoff as the BMP Database doesn't report removal efficiencies.

Resent research by Washington State University, NOAA, and US Fish and Wildlife service has found that within controlled testing, bioretention treatment of urban arterial street runoff removes PAHs levels to below detection levels (>92%) (McIntyre, et al (2014). Another study by University of Maryland found bioretention facilities remove 87% of average PAHs (DiBlasi, et al 2009).

Applying the removal efficiency of 87% to the values listed in Table 1-3 lists the range and mean expected released fluoranthene concentration expected at the site based on the higher reported concentrations.

**Table 1-5 Release Concentrations – PAH, Fluoranthene**

| Bioswale Discharge Range of Fluoranthene (µg/L) | Bioswale Discharge Median Value Fluoranthene (µg/L) |
|---|---|
| 0.013-1.131 | 0.494 |

*StormFilters*

StormFilter vaults will collect and treat 6.388 acres of impervious area at the site. The selected StormFilter contains filter cartridges filled with ZPG filter media (a mixture of zeolite, perlite, and granular activated carbon), which are designed to remove sediments, metals, and stormwater pollutants from wet weather runoff. The StormFilter ZPG cartridges have following removal rates based on several studies conducted on ZPG media (Milesi, et al (2006)).

**Table 1-6 Removal Efficiencies from StormFilter Cartridges Filled with ZPG Media**

| Pollutant | Removal Efficiency (%) | Reference |
|---|---|---|
| Fluoranthene | 44 | Milesi, et al (2006) |
| Dissolved Copper | 11 | Herrera (2011) |
| Dissolved Zinc | 15 | Herrera (2011) |

Table 1-7 lists the range of removal concentrations from the highest reported values in the tables above (Table 1-1, 1-2, and 1-3).

**Table 1-7 Release Concentrations – Dissolved Copper, Zinc and Fluoranthene**

| Pollutant | StormFilter Discharge Range (µg/L) | StormFilter Discharge Median Value (µg/L) |
|---|---|---|
| Fluoranthene | 0.056-4.872 | 2.128 |
| Dissolved Copper | 0.89-107.69 | 15.397 |
| Dissolved Zinc | 26.36-164.05 | 51 |

## Conclusion

This memorandum lists the range and median expected pollutant concentrations for dissolved copper, dissolved zinc and the PAH fluoranthene. Where available, reported values were taken from the BMP Database, and from peer reviewed research when BMP Database data was unavailable. Manufacturer reported testing was used as appropriate.

**References**

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Milesi, C., S.A. de Ridder, D. Deleon, H. Wachter, 2006. A comparison of two media filtration BMP treatment for the removal of PAHs and Phthalates from roadway runoff. StormCon 2006 paper.

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# Appendix F

## Water Quality Sampling Results

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

# ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-49272-1
Client Project/Site: Clackamette

For:
Pacific Habitat
9450 SW Commerce Circle, Suite #180
Wilsonville, Oregon 97070

Attn: Dale Groff

Kelly R. Garretts

*Authorized for release by:*
*5/7/2015 10:25:43 AM*
Kelly Garretts, Project Manager II
(253)248-4961
kelly.garretts@testamericainc.com

Designee for

Sarah Murphy, Project Manager I
(253)922-2310
sarah.murphy@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

*This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.*

*Results relate only to the items tested and the sample(s) as received by the laboratory.*

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# Case Narrative

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Job ID: 580-49272-1

### Laboratory: TestAmerica Seattle

**Narrative**

**Job Narrative**
**580-49272-1**

**Comments**
No additional comments.

**Receipt**
The sample was received on 4/23/2015 11:45 AM; the sample arrived in good condition, properly preserved and, where required, on ice.
The temperature of the cooler at receipt was 2.3º C.

**GC/MS Semi VOA**
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

**Metals**
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

**General Chemistry**
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

**Organic Prep**
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

# Definitions/Glossary

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Qualifiers

### Metals

| Qualifier | Qualifier Description |
|---|---|
| 4 | MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable. |

### General Chemistry

| Qualifier | Qualifier Description |
|---|---|
| 4 | MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable. |

## Glossary

| Abbreviation | These commonly used abbreviations may or may not be present in this report. |
|---|---|
| ¤ | Listed under the "D" column to designate that the result is reported on a dry weight basis |
| %R | Percent Recovery |
| CFL | Contains Free Liquid |
| CNF | Contains no Free Liquid |
| DER | Duplicate error ratio (normalized absolute difference) |
| Dil Fac | Dilution Factor |
| DL, RA, RE, IN | Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample |
| DLC | Decision level concentration |
| MDA | Minimum detectable activity |
| EDL | Estimated Detection Limit |
| MDC | Minimum detectable concentration |
| MDL | Method Detection Limit |
| ML | Minimum Level (Dioxin) |
| NC | Not Calculated |
| ND | Not detected at the reporting limit (or MDL or EDL if shown) |
| PQL | Practical Quantitation Limit |
| QC | Quality Control |
| RER | Relative error ratio |
| RL | Reporting Limit or Requested Limit (Radiochemistry) |
| RPD | Relative Percent Difference, a measure of the relative difference between two points |
| TEF | Toxicity Equivalent Factor (Dioxin) |
| TEQ | Toxicity Equivalent Quotient (Dioxin) |

# Client Sample Results

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Client Sample ID: POND

**Date Collected: 04/23/15 10:40**
**Date Received: 04/23/15 11:45**

**Lab Sample ID: 580-49272-1**
**Matrix: Water**

### Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

| Analyte | Result | Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Naphthalene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| 2-Methylnaphthalene | ND | | 0.025 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| 1-Methylnaphthalene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Acenaphthylene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Acenaphthene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Fluorene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Phenanthrene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Anthracene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Fluoranthene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Pyrene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Benzo[a]anthracene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Chrysene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Benzo[b]fluoranthene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Benzo[k]fluoranthene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Benzo[a]pyrene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Indeno[1,2,3-cd]pyrene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Dibenz(a,h)anthracene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |
| Benzo[g,h,i]perylene | ND | | 0.019 | | ug/L | | 04/27/15 12:44 | 04/30/15 12:22 | 1 |

| *Surrogate* | *%Recovery* | *Qualifier* | *Limits* | *Prepared* | *Analyzed* | *Dil Fac* |
|---|---|---|---|---|---|---|
| *Terphenyl-d14* | *104* | | *64 - 150* | *04/27/15 12:44* | *04/30/15 12:22* | *1* |

### Method: 200.7 Rev 4.4 - Metals (ICP)

| Analyte | Result | Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| **Calcium** | **5.2** | | 1.1 | | mg/L | | 04/30/15 15:32 | 05/01/15 12:18 | 1 |
| **Magnesium** | **1.8** | | 1.1 | | mg/L | | 04/30/15 15:32 | 05/01/15 12:18 | 1 |
| Potassium | ND | | 3.3 | | mg/L | | 04/30/15 15:32 | 05/01/15 12:18 | 1 |
| **Sodium** | **3.4** | | 2.0 | | mg/L | | 04/30/15 15:32 | 05/01/15 12:18 | 1 |

### Method: 200.8 - Metals (ICP/MS) - Dissolved

| Analyte | Result | Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Copper | ND | | 0.0020 | | mg/L | | 04/30/15 16:48 | 05/01/15 12:17 | 1 |
| Zinc | ND | | 0.0070 | | mg/L | | 04/30/15 16:48 | 05/01/15 12:17 | 1 |

### General Chemistry

| Analyte | Result | Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| **Chloride** | **1.9** | | 0.90 | | mg/L | | | 04/29/15 16:32 | 1 |
| Sulfate | ND | | 1.2 | | mg/L | | | 04/29/15 16:32 | 1 |

| Analyte | Result | Qualifier | RL | RL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| **Alkalinity** | **24** | | 5.0 | | mg/L | | | 04/30/15 10:20 | 1 |
| **Bicarbonate Alkalinity as CaCO3** | **24** | | 5.0 | | mg/L | | | 04/30/15 10:20 | 1 |
| Carbonate Alkalinity as CaCO3 | ND | | 5.0 | | mg/L | | | 04/30/15 10:20 | 1 |
| Hydroxide Alkalinity as CaCO3 | ND | | 5.0 | | mg/L | | | 04/30/15 10:20 | 1 |

### General Chemistry - Dissolved

| Analyte | Result | Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| **Dissolved Organic Carbon** | **1.2** | | 0.10 | | mg/L | | | 04/27/15 09:53 | 1 |

# QC Sample Results

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

**Lab Sample ID: MB 580-187889/1-A** — **Client Sample ID: Method Blank**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188200** — **Prep Batch: 187889**

| Analyte | MB Result | MB Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Naphthalene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| 2-Methylnaphthalene | ND | | 0.026 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| 1-Methylnaphthalene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Acenaphthylene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Acenaphthene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Fluorene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Phenanthrene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Anthracene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Fluoranthene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Pyrene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Benzo[a]anthracene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Chrysene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Benzo[b]fluoranthene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Benzo[k]fluoranthene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Benzo[a]pyrene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Indeno[1,2,3-cd]pyrene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Dibenz(a,h)anthracene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |
| Benzo[g,h,i]perylene | ND | | 0.020 | | ug/L | | 04/27/15 12:44 | 04/30/15 11:17 | 1 |

| *Surrogate* | *MB %Recovery* | *MB Qualifier* | *Limits* | *Prepared* | *Analyzed* | *Dil Fac* |
|---|---|---|---|---|---|---|
| *Terphenyl-d14* | *104* | | *64 - 150* | *04/27/15 12:44* | *04/30/15 11:17* | *1* |

**Lab Sample ID: LCS 580-187889/2-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188200** — **Prep Batch: 187889**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Naphthalene | 2.00 | 1.56 | | ug/L | | 78 | 56 - 125 |
| 2-Methylnaphthalene | 2.00 | 1.53 | | ug/L | | 77 | 56 - 125 |
| 1-Methylnaphthalene | 2.00 | 1.66 | | ug/L | | 83 | 54 - 125 |
| Acenaphthylene | 2.00 | 1.74 | | ug/L | | 87 | 62 - 125 |
| Acenaphthene | 2.00 | 1.70 | | ug/L | | 85 | 63 - 125 |
| Fluorene | 2.00 | 1.86 | | ug/L | | 93 | 69 - 125 |
| Phenanthrene | 2.00 | 1.71 | | ug/L | | 86 | 70 - 125 |
| Anthracene | 2.00 | 1.79 | | ug/L | | 89 | 50 - 125 |
| Fluoranthene | 2.00 | 2.09 | | ug/L | | 105 | 70 - 145 |
| Pyrene | 2.00 | 2.00 | | ug/L | | 100 | 70 - 133 |
| Benzo[a]anthracene | 2.00 | 2.03 | | ug/L | | 101 | 65 - 125 |
| Chrysene | 2.00 | 2.09 | | ug/L | | 105 | 70 - 125 |
| Benzo[b]fluoranthene | 2.00 | 1.94 | | ug/L | | 97 | 70 - 129 |
| Benzo[k]fluoranthene | 2.00 | 2.21 | | ug/L | | 110 | 70 - 123 |
| Benzo[a]pyrene | 2.00 | 1.71 | | ug/L | | 86 | 45 - 125 |
| Indeno[1,2,3-cd]pyrene | 2.00 | 2.09 | | ug/L | | 105 | 70 - 136 |
| Dibenz(a,h)anthracene | 2.00 | 2.20 | | ug/L | | 110 | 69 - 154 |
| Benzo[g,h,i]perylene | 2.00 | 2.05 | | ug/L | | 102 | 65 - 153 |

## Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

**Lab Sample ID: LCS 580-187889/2-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188200** — **Prep Batch: 187889**

| Surrogate | LCS %Recovery | LCS Qualifier | Limits |
|---|---|---|---|
| Terphenyl-d14 | 103 | | 64 - 150 |

**Lab Sample ID: LCSD 580-187889/3-A** — **Client Sample ID: Lab Control Sample Dup**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188200** — **Prep Batch: 187889**

| Analyte | Spike Added | LCSD Result | LCSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Naphthalene | 2.00 | 1.65 | | ug/L | | 82 | 56 - 125 | 6 | 20 |
| 2-Methylnaphthalene | 2.00 | 1.53 | | ug/L | | 76 | 56 - 125 | 0 | 20 |
| 1-Methylnaphthalene | 2.00 | 1.70 | | ug/L | | 85 | 54 - 125 | 2 | 20 |
| Acenaphthylene | 2.00 | 1.72 | | ug/L | | 86 | 62 - 125 | 1 | 20 |
| Acenaphthene | 2.00 | 1.72 | | ug/L | | 86 | 63 - 125 | 1 | 20 |
| Fluorene | 2.00 | 1.74 | | ug/L | | 87 | 69 - 125 | 7 | 20 |
| Phenanthrene | 2.00 | 1.67 | | ug/L | | 84 | 70 - 125 | 2 | 20 |
| Anthracene | 2.00 | 1.72 | | ug/L | | 86 | 50 - 125 | 4 | 20 |
| Fluoranthene | 2.00 | 2.09 | | ug/L | | 105 | 70 - 145 | 0 | 20 |
| Pyrene | 2.00 | 1.95 | | ug/L | | 97 | 70 - 133 | 3 | 20 |
| Benzo[a]anthracene | 2.00 | 1.96 | | ug/L | | 98 | 65 - 125 | 4 | 20 |
| Chrysene | 2.00 | 2.05 | | ug/L | | 102 | 70 - 125 | 2 | 20 |
| Benzo[b]fluoranthene | 2.00 | 1.90 | | ug/L | | 95 | 70 - 129 | 2 | 20 |
| Benzo[k]fluoranthene | 2.00 | 2.11 | | ug/L | | 105 | 70 - 123 | 5 | 20 |
| Benzo[a]pyrene | 2.00 | 1.63 | | ug/L | | 82 | 45 - 125 | 5 | 20 |
| Indeno[1,2,3-cd]pyrene | 2.00 | 2.02 | | ug/L | | 101 | 70 - 136 | 3 | 20 |
| Dibenz(a,h)anthracene | 2.00 | 2.10 | | ug/L | | 105 | 69 - 154 | 5 | 20 |
| Benzo[g,h,i]perylene | 2.00 | 1.97 | | ug/L | | 98 | 65 - 153 | 4 | 20 |

| Surrogate | LCSD %Recovery | LCSD Qualifier | Limits |
|---|---|---|---|
| Terphenyl-d14 | 103 | | 64 - 150 |

## Method: 200.7 Rev 4.4 - Metals (ICP)

**Lab Sample ID: MB 580-188295/21-A** — **Client Sample ID: Method Blank**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | MB Result | MB Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Calcium | ND | | 1.1 | | mg/L | | 04/30/15 15:32 | 05/01/15 11:44 | 1 |
| Magnesium | ND | | 1.1 | | mg/L | | 04/30/15 15:32 | 05/01/15 11:44 | 1 |
| Potassium | ND | | 3.3 | | mg/L | | 04/30/15 15:32 | 05/01/15 11:44 | 1 |
| Sodium | ND | | 2.0 | | mg/L | | 04/30/15 15:32 | 05/01/15 11:44 | 1 |

**Lab Sample ID: LCS 580-188295/22-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Calcium | 10.0 | 9.96 | | mg/L | | 100 | 85 - 115 |
| Magnesium | 10.0 | 9.54 | | mg/L | | 95 | 85 - 115 |

# QC Sample Results

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Method: 200.7 Rev 4.4 - Metals (ICP) (Continued)

**Lab Sample ID: LCS 580-188295/22-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | | | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Potassium | | | 10.0 | 9.60 | | mg/L | | 96 | 85 - 115 | | |
| Sodium | | | 10.0 | 9.55 | | mg/L | | 95 | 85 - 115 | | |

**Lab Sample ID: LCSD 580-188295/23-A** — **Client Sample ID: Lab Control Sample Dup**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | | | Spike Added | LCSD Result | LCSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | | | 10.0 | 10.2 | | mg/L | | 102 | 85 - 115 | 2 | 20 |
| Magnesium | | | 10.0 | 9.86 | | mg/L | | 99 | 85 - 115 | 3 | 20 |
| Potassium | | | 10.0 | 9.85 | | mg/L | | 99 | 85 - 115 | 3 | 20 |
| Sodium | | | 10.0 | 10.0 | | mg/L | | 100 | 85 - 115 | 5 | 20 |

**Lab Sample ID: 720-64441-I-1-C MS** — **Client Sample ID: Matrix Spike**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MS Result | MS Qualifier | Unit | D | %Rec | %Rec. Limits | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 67 | | 10.0 | 77.7 | 4 | mg/L | | 109 | 70 - 130 | | |
| Magnesium | 110 | | 10.0 | 123 | 4 | mg/L | | 121 | 70 - 130 | | |
| Potassium | 5.2 | | 10.0 | 15.3 | | mg/L | | 100 | 70 - 130 | | |
| Sodium | 220 | | 10.0 | 228 | 4 | mg/L | | 118 | 70 - 130 | | |

**Lab Sample ID: 720-64441-I-1-D MSD** — **Client Sample ID: Matrix Spike Duplicate**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MSD Result | MSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 67 | | 10.0 | 78.8 | 4 | mg/L | | 120 | 70 - 130 | 1 | 20 |
| Magnesium | 110 | | 10.0 | 125 | 4 | mg/L | | 139 | 70 - 130 | 1 | 20 |
| Potassium | 5.2 | | 10.0 | 15.6 | | mg/L | | 103 | 70 - 130 | 2 | 20 |
| Sodium | 220 | | 10.0 | 231 | 4 | mg/L | | 144 | 70 - 130 | 1 | 20 |

**Lab Sample ID: 720-64441-I-1-B DU** — **Client Sample ID: Duplicate**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188393** — **Prep Batch: 188295**

| Analyte | Sample Result | Sample Qualifier | | DU Result | DU Qualifier | Unit | D | | | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calcium | 67 | | | 70.2 | | mg/L | | | | 5 | 20 |
| Magnesium | 110 | | | 117 | | mg/L | | | | 5 | 20 |
| Potassium | 5.2 | | | 5.47 | | mg/L | | | | 5 | 20 |
| Sodium | 220 | | | 227 | | mg/L | | | | 5 | 20 |

# QC Sample Results

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Method: 200.8 - Metals (ICP/MS)

**Lab Sample ID: LCS 580-188312/14-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Copper | 0.100 | 0.0988 | | mg/L | | 99 | 85 - 115 |
| Zinc | 0.100 | 0.106 | | mg/L | | 106 | 85 - 115 |

**Lab Sample ID: LCSD 580-188312/15-A** — **Client Sample ID: Lab Control Sample Dup**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | Spike Added | LCSD Result | LCSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Copper | 0.100 | 0.100 | | mg/L | | 100 | 85 - 115 | 2 | 20 |
| Zinc | 0.100 | 0.107 | | mg/L | | 107 | 85 - 115 | 1 | 20 |

**Lab Sample ID: MB 580-188047/9-B** — **Client Sample ID: Method Blank**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | MB Result | MB Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Copper | ND | | 0.0020 | | mg/L | | 04/30/15 16:48 | 05/01/15 10:59 | 1 |
| Zinc | ND | | 0.0070 | | mg/L | | 04/30/15 16:48 | 05/01/15 10:59 | 1 |

**Lab Sample ID: 580-49372-A-1-D MS** — **Client Sample ID: Matrix Spike**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MS Result | MS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|---|---|
| Copper | ND | | 0.100 | 0.0943 | | mg/L | | 94 | 70 - 130 |
| Zinc | 0.012 | | 0.100 | 0.107 | | mg/L | | 95 | 70 - 130 |

**Lab Sample ID: 580-49372-A-1-E MSD** — **Client Sample ID: Matrix Spike Duplicate**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MSD Result | MSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper | ND | | 0.100 | 0.0923 | | mg/L | | 92 | 70 - 130 | 2 | 20 |
| Zinc | 0.012 | | 0.100 | 0.106 | | mg/L | | 94 | 70 - 130 | 1 | 20 |

**Lab Sample ID: 580-49372-A-1-C DU** — **Client Sample ID: Duplicate**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 188405** — **Prep Batch: 188312**

| Analyte | Sample Result | Sample Qualifier | DU Result | DU Qualifier | Unit | D | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|
| Copper | ND | | ND | | mg/L | | NC | 20 |
| Zinc | 0.012 | | 0.0117 | | mg/L | | 0.6 | 20 |

# QC Sample Results

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Method: 300.0 - Anions, Ion Chromatography

**Lab Sample ID: MB 580-188199/3** — **Client Sample ID: Method Blank**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188199**

| Analyte | MB Result | MB Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | ND | | 0.90 | | mg/L | | | 04/29/15 09:28 | 1 |
| Sulfate | ND | | 1.2 | | mg/L | | | 04/29/15 09:28 | 1 |

**Lab Sample ID: LCS 580-188199/4** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188199**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Chloride | 50.0 | 50.7 | | mg/L | | 101 | 90 - 110 |
| Sulfate | 50.0 | 50.2 | | mg/L | | 100 | 90 - 110 |

**Lab Sample ID: LCSD 580-188199/5** — **Client Sample ID: Lab Control Sample Dup**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188199**

| Analyte | Spike Added | LCSD Result | LCSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | 50.0 | 50.7 | | mg/L | | 101 | 90 - 110 | 0 | 15 |
| Sulfate | 50.0 | 50.2 | | mg/L | | 100 | 90 - 110 | 0 | 15 |

**Lab Sample ID: 580-49167-B-1 MS ^5** — **Client Sample ID: Matrix Spike**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188199**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MS Result | MS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | 25 | | 45.0 | 67.8 | | mg/L | | 96 | 90 - 110 |
| Sulfate | 1800 | | 60.0 | 1750 | 4 | mg/L | | -161 | 90 - 110 |

**Lab Sample ID: 580-49167-B-1 MSD ^5** — **Client Sample ID: Matrix Spike Duplicate**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188199**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MSD Result | MSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chloride | 25 | | 45.0 | 69.2 | | mg/L | | 99 | 90 - 110 | 2 | 15 |
| Sulfate | 1800 | | 60.0 | 1770 | 4 | mg/L | | -125 | 90 - 110 | 1 | 15 |

## Method: SM 2320B - Alkalinity

**Lab Sample ID: LCS 580-188237/2** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188237**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Alkalinity | 100 | 99.3 | | mg/L | | 99 | 85 - 115 |

## Method: SM 2320B - Alkalinity (Continued)

**Lab Sample ID: 580-49347-A-2 DU** — **Client Sample ID: Duplicate**
**Matrix: Water** — **Prep Type: Total/NA**
**Analysis Batch: 188237**

| Analyte | Sample Result | Sample Qualifier | DU Result | DU Qualifier | Unit | D | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|
| Alkalinity | 18 | | 16.2 | | mg/L | | 9 | 17 |
| Bicarbonate Alkalinity as CaCO3 | 18 | | 16.2 | | mg/L | | 9 | 20 |
| Carbonate Alkalinity as CaCO3 | ND | | ND | | mg/L | | NC | 20 |
| Hydroxide Alkalinity as CaCO3 | ND | | ND | | mg/L | | NC | 20 |

## Method: SM 5310C - Organic Carbon, Dissolved (DOC)

**Lab Sample ID: MB 440-251275/2-A** — **Client Sample ID: Method Blank**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 251334**

| Analyte | MB Result | MB Qualifier | RL | MDL | Unit | D | Prepared | Analyzed | Dil Fac |
|---|---|---|---|---|---|---|---|---|---|
| Dissolved Organic Carbon | ND | | 0.10 | | mg/L | | | 04/27/15 08:56 | 1 |

**Lab Sample ID: LCS 440-251275/1-A** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 251334**

| Analyte | Spike Added | LCS Result | LCS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Dissolved Organic Carbon | 10.0 | 10.8 | | mg/L | | 108 | 90 - 110 |

**Lab Sample ID: MRL 440-251334/3** — **Client Sample ID: Lab Control Sample**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 251334**

| Analyte | Spike Added | MRL Result | MRL Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|
| Dissolved Organic Carbon | 0.100 | 0.109 | | mg/L | | 109 | 50 - 150 |

**Lab Sample ID: 440-107538-L-1-B MS** — **Client Sample ID: Matrix Spike**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 251334**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MS Result | MS Qualifier | Unit | D | %Rec | %Rec. Limits |
|---|---|---|---|---|---|---|---|---|---|
| Dissolved Organic Carbon | 3.6 | | 10.0 | 14.4 | | mg/L | | 108 | 80 - 120 |

**Lab Sample ID: 440-107538-L-1-C MSD** — **Client Sample ID: Matrix Spike Duplicate**
**Matrix: Water** — **Prep Type: Dissolved**
**Analysis Batch: 251334**

| Analyte | Sample Result | Sample Qualifier | Spike Added | MSD Result | MSD Qualifier | Unit | D | %Rec | %Rec. Limits | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dissolved Organic Carbon | 3.6 | | 10.0 | 14.6 | | mg/L | | 110 | 80 - 120 | 1 | 20 |

# Lab Chronicle

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Client Sample ID: POND

**Lab Sample ID: 580-49272-1**

**Date Collected: 04/23/15 10:40**

**Matrix: Water**

**Date Received: 04/23/15 11:45**

| Prep Type | Batch Type | Batch Method | Run | Dilution Factor | Batch Number | Prepared or Analyzed | Analyst | Lab |
|---|---|---|---|---|---|---|---|---|
| Total/NA | Prep | 3520C | | | 187889 | 04/27/15 12:44 | JDR | TAL SEA |
| Total/NA | Analysis | 8270D SIM | | 1 | 188200 | 04/30/15 12:22 | ERZ | TAL SEA |
| Total/NA | Prep | 200.7 | | | 188295 | 04/30/15 15:32 | PAB | TAL SEA |
| Total/NA | Analysis | 200.7 Rev 4.4 | | 1 | 188393 | 05/01/15 12:18 | HJM | TAL SEA |
| Dissolved | Filtration | FILTRATION | | | 187906 | 04/27/15 13:11 | EBH | TAL SEA |
| Dissolved | Prep | 200.8 | | | 188312 | 04/30/15 16:48 | PAB | TAL SEA |
| Dissolved | Analysis | 200.8 | | 1 | 188405 | 05/01/15 12:17 | FCW | TAL SEA |
| Total/NA | Analysis | 300.0 | | 1 | 188199 | 04/29/15 16:32 | RSB | TAL SEA |
| Total/NA | Analysis | SM 2320B | | 1 | 188237 | 04/30/15 10:20 | JLS | TAL SEA |
| Dissolved | Filtration | Filtration | | | 251275 | 04/27/15 06:17 | YZ | TAL IRV |
| Dissolved | Analysis | SM 5310C | | 1 | 251334 | 04/27/15 09:53 | YZ | TAL IRV |

**Laboratory References:**

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

# Certification Summary

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

## Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

| Authority | Program | EPA Region | Certification ID | Expiration Date |
|---|---|---|---|---|
| Alaska (UST) | State Program | 10 | UST-022 | 03-02-16 |
| California | State Program | 9 | 2901 | 01-31-17 |
| L-A-B | DoD ELAP | | L2236 | 01-19-16 |
| L-A-B | ISO/IEC 17025 | | L2236 | 01-19-16 |
| Montana (UST) | State Program | 8 | N/A | 04-30-20 |
| Oregon | NELAP | 10 | WA100007 | 11-06-15 |
| US Fish & Wildlife | Federal | | LE192332-0 | 02-28-16 |
| USDA | Federal | | P330-11-00222 | 04-08-17 |
| Washington | State Program | 10 | C553 | 02-17-16 |

## Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

| Authority | Program | EPA Region | Certification ID | Expiration Date |
|---|---|---|---|---|
| Alaska | State Program | 10 | CA01531 | 06-30-15 |
| Arizona | State Program | 9 | AZ0671 | 10-13-15 |
| California | LA Cty Sanitation Districts | 9 | 10256 | 01-31-16 * |
| California | State Program | 9 | 2706 | 06-30-16 |
| Guam | State Program | 9 | Cert. No. 12.002r | 01-23-16 |
| Hawaii | State Program | 9 | N/A | 01-29-16 |
| Nevada | State Program | 9 | CA015312007A | 07-31-15 |
| New Mexico | State Program | 6 | N/A | 01-29-15 * |
| Northern Mariana Islands | State Program | 9 | MP0002 | 01-29-15 * |
| Oregon | NELAP | 10 | 4005 | 01-29-16 |
| USDA | Federal | | P330-09-00080 | 06-06-15 |

## Laboratory: TestAmerica Portland

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

| Authority | Program | EPA Region | Certification ID | Expiration Date |
|---|---|---|---|---|
| Alaska (UST) | State Program | 10 | UST-012 | 12-26-15 |
| California | State Program | 9 | 2597 | 09-30-15 |
| Oregon | NELAP | 10 | OR100021 | 01-09-16 |
| USDA | Federal | | P330-11-00092 | 04-17-17 |
| Washington | State Program | 10 | C586 | 06-23-15 |

* Certification renewal pending - certification considered valid.

# Sample Summary

Client: Pacific Habitat
Project/Site: Clackamette

TestAmerica Job ID: 580-49272-1

| Lab Sample ID | Client Sample ID | Matrix | Collected | Received |
|---|---|---|---|---|
| 580-49272-1 | POND | Water | 04/23/15 10:40 | 04/23/15 11:45 |

TestAmerica Portland
9405 SW Nimbus Avenue
Beaverton, OR 97008
Phone: 503.906.9200 Fax:

580-49272 Chain of Custody

# ain of Custody Record

091123

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210 (0713)

| Client Contact | Project Manager: Dale Groff | Site Contact: | Date: 4/23/2015 | COC No: |
|---|---|---|---|---|
| Company Name: Pacific Habitat Services | Tel/Fax: (503) 570-0800 | Lab Contact: | Carrier: Dale Groff | ____ of ____ COCs |
| Address: 9450 SW Commerce Circle, Suite 180 | Analysis Turnaround Time | | | Sampler: |
| City/State/Zip: Portland, Oregon 97070 | ☐ CALENDAR DAYS ☐ WORKING DAYS | | | For Lab Use Only: |
| Phone: (503) 570-0800 | TAT if different from Below ____ | | | Walk-in Client: |
| Fax: (503) 570-0855 | ☐ 2 weeks | | | Lab Sampling: |
| Project Name: Clackamette | ☐ 1 week | | | |
| Site: | ☐ 2 days | | | Job / SDG No.: |
| P O # | ☐ 1 day | | | |

| Sample Identification | Sample Date | Sample Time | Sample Type (C=Comp, G=Grab) | Matrix | # of Cont. | Filtered Sample (Y / N) | Perform MS / MSD (Y / N) | dissolved zinc | dissolved copper | PAH | dissolved organic carbon | alkalinity | pH | magnesium | calcium | sodium | potassium | chloride | sulfate | Sample Specific Notes: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pond | 4/23/15 | 10:40 | G | water | 6 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other ____

**Possible Hazard Identification:**
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

**Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)**

☐ Return to Client ☐ Disposal by Lab ☐ Archive for ____ Months

**Special Instructions/QC Requirements & Comments:**

2.3 IR/P-L

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.: ____

| Relinquished by: | Company: | Date/Time: | Received by: | Company: | Date/Time: |
|---|---|---|---|---|---|
| Dale C Groff | Pacific Habitat Services | 4/23/15 1145 | [signature] | TAP | 4/23/15 1145 |
| Relinquished by: | Company: | Date/Time: | Received by: | Company: | Date/Time: |
| Relinquished by: | Company: | Date/Time: | Received in Laboratory by: | Company: | Date/Time: |



5/7/2015

# Login Sample Receipt Checklist

Client: Pacific Habitat

Job Number: 580-49272-1

**Login Number: 49272**

**List Source: TestAmerica Seattle**

**List Number: 1**

**Creator: Gonzales, Steve**

| Question | Answer | Comment |
|---|---|---|
| Radioactivity wasn't checked or is </= background as measured by a survey meter. | N/A | |
| The cooler's custody seal, if present, is intact. | N/A | |
| Sample custody seals, if present, are intact. | N/A | |
| The cooler or samples do not appear to have been compromised or tampered with. | True | |
| Samples were received on ice. | True | |
| Cooler Temperature is acceptable. | True | |
| Cooler Temperature is recorded. | True | |
| COC is present. | True | |
| COC is filled out in ink and legible. | True | |
| COC is filled out with all pertinent information. | True | |
| Is the Field Sampler's name present on COC? | True | |
| There are no discrepancies between the containers received and the COC. | True | |
| Samples are received within Holding Time. | True | |
| Sample containers have legible labels. | True | |
| Containers are not broken or leaking. | True | |
| Sample collection date/times are provided. | True | |
| Appropriate sample containers are used. | True | |
| Sample bottles are completely filled. | True | |
| Sample Preservation Verified. | N/A | |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True | |
| Containers requiring zero headspace have no headspace or bubble is <6mm (1/4"). | N/A | |
| Multiphasic samples are not present. | N/A | |
| Samples do not require splitting or compositing. | N/A | |
| Residual Chlorine Checked. | N/A | |

# Login Sample Receipt Checklist

Client: Pacific Habitat

Job Number: 580-49272-1

**Login Number: 49272**
**List Number: 2**
**Creator: Ornelas, Olga**

**List Source: TestAmerica Irvine**
**List Creation: 04/24/15 12:06 PM**

| Question | Answer | Comment |
|---|---|---|
| Radioactivity wasn't checked or is </= background as measured by a survey meter. | True | |
| The cooler's custody seal, if present, is intact. | True | |
| Sample custody seals, if present, are intact. | True | |
| The cooler or samples do not appear to have been compromised or tampered with. | True | |
| Samples were received on ice. | True | |
| Cooler Temperature is acceptable. | True | |
| Cooler Temperature is recorded. | True | |
| COC is present. | True | |
| COC is filled out in ink and legible. | True | |
| COC is filled out with all pertinent information. | True | |
| Is the Field Sampler's name present on COC? | True | |
| There are no discrepancies between the containers received and the COC. | True | |
| Samples are received within Holding Time. | True | |
| Sample containers have legible labels. | True | |
| Containers are not broken or leaking. | True | |
| Sample collection date/times are provided. | True | |
| Appropriate sample containers are used. | True | |
| Sample bottles are completely filled. | True | |
| Sample Preservation Verified. | N/A | |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True | |
| Containers requiring zero headspace have no headspace or bubble is <6mm (1/4"). | True | |
| Multiphasic samples are not present. | True | |
| Samples do not require splitting or compositing. | True | |
| Residual Chlorine Checked. | N/A | |