RIVERBEND LANDFILL
TIER II CORRECTIVE ACTION RESPONSE
DEQ FILE #106959
1200-Z NPDS STORMWATER PERMIT
2016-WLOTC-1423

YAMHILL COUNTY, OREGON

JUNE 9, 2017
GLA PROJECT NO. AS17.1026
Revision 1

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1.0 INTRODUCTION AND PURPOSE

The Riverbend Landfill (RL) is located approximately 3 miles southwest of McMinnville, Oregon, and is owned and operated by Riverbend Landfill Company (RLC). RL is covered by a National Pollutant Discharge Elimination System (NPDES) 1200-Z Industrial Stormwater Discharge Permit (Permit), assigned by the State of Oregon, Department of Environmental Quality (DEQ), File Number 106959. This Tier II Corrective Action is a result of RL exceeding the statewide benchmark for the geometric mean of E. coli during the 2014-2015 monitoring period at the Outfall 1C sampling point. The DEQ submitted a warning letter with opportunity to correct on March 7, 2016 requesting, among other things, that RLC:

*Submit a Tier II Corrective Action Response in accordance with Schedule A.12 page 17-18 of the 1200-Z permit, for the statewide benchmark E. coli at Outfall 1C. The geometric mean of E. coli during the 2014-2015 monitoring period exceeded the statewide benchmark and is subject to Tier II corrective action.*

GLA submitted a Tier II Corrective Action Response on September 30, 2016 on behalf of RL, which described proposed corrective actions developed with the goal of achieving compliance with the permitted statewide benchmarks presented in Schedule A.9 of the Permit. RL is withdrawing the September 30, 2016 Tier II Corrective Action Response.

This Tier II Corrective Action Response by Geo-Logic Associates, Inc. (GLA), submitted on behalf of RL, is intended to replace the previously proposed corrective action measures in order to provide improved and more effective corrective measures with the goal of achieving compliance to the permitted statewide benchmarks presented in Schedule A.9 of the Permit.
2.0 EXISTING STORMWATER RUN-OFF MANAGEMENT

Existing stormwater run-off features for the entire RL site are described in the Stormwater Pollution Control Permit (SWPCP) by SCS Engineers, dated June 2016 (SCS, 2016). Existing stormwater run-off features relevant to the proposed corrective action are generally discussed below and are associated with Drainage Area 1 (DA 1) and Drainage Area 6 (DA 6). Figures 1-2 and 1-3 from SCS 2016, which depict the existing stormwater run-off features and drainage areas, are presented in Appendix A for reference. SCS 2016 Figure 1-2 depicts the drainage areas and outfalls for the entire facility. SCS 2016 Figure 1-3 depicts the various collection, conveyance, and water quality devices, including the Outfall 1C location, for DA 1 and the front entrance of the facility.

2.1 Drainage Area 1

Stormwater run-off from DA 1 is infiltrated into the ground or discharged offsite to the drainage ditch along SW Highway 18 (outfalls 1A and 1B) or to an Unnamed Creek north of RL (outfall 1C), as shown on SCS Figures 1-2 and 1-3, Appendix A. Stormwater discharge from Outfalls 1A and 1B generally comes from the asphalt-paved facility entrance, site access road, and catch basins CB 1A and CB 1B located in the parking lot to the south of the administration building. It is understood from SCS 2016 that stormwater from Outfall 1A is not exposed to RL industrial activities. Stormwater from Outfall 1B is currently designed to not be exposed to RL industrial activities, it is however, currently being monitored for exposure to RL industrial activities.

Stormwater runoff from the remainder of DA 1 currently discharges through Outfall 1C to the ground surface and eventually to the Unnamed Creek north of RL. Stormwater discharge to Outfall 1C is currently conveyed through a system of catch basins, vortex separators, sedimentation basins, piping, a water quality swale, a stilling basin, and a dispersion trench.

Discharge at Outfall 1C is considered to be exposed to RL industrial activities and has experienced levels in exceedance of statewide benchmarks for the geometric mean of E. coli have been recorded during monitoring. The various features currently contributing stormwater run-off to Outfall 1C are described below, and depicted on SCS Figure 1-3, Appendix A:

- Sedimentation Basin 1B (SB 1B) is located in the southwest section of DA 1 and receives stormwater run-off from a portion of the front entrance facility, paved and unpaved areas near the scale house, and associated site access roads.

- Sedimentation Basin 1B discharges to a 24-inch diameter conveyance pipe located at its northeast corner that conveys stormwater north to a 60-inch diameter manhole (SDFSMH-1). The 24-inch diameter conveyance pipe also collects stormwater from a series of catch basins and manholes situated throughout DA 1 that are tied-in to the conveyance pipe at various locations as shown on SCS Figure 1-3, Appendix A.

- Manhole SDFSMH-1 primarily transfers stormwater to the water quality swale via an 8-inch diameter pipe and then to the stilling basin and dispersion trench near the north boundary of DA 1. The manhole has a 24-inch diameter overflow pipe that transfers stormwater to the stilling basin and then the dispersion trench during storms over the
Design Storm. The dispersion trench discharges at Outfall 1C.

2.2 Drainage Area 6

Stormwater run-off from DA 6 is routed to Sedimentation Basin 1A (SB 1A), which is located to the southwest of SB 1B. Currently stormwater from SB 1A ultimately discharges at Outfall 6. The various features contributing stormwater run-off to Outfall 6 from DA 6 are described below:

- Sedimentation Basin 1A is located southwest of SB 1B and receives stormwater run-off from a series of drainage ditches and conveyance piping from a majority of DA 6.
- SB 1A has three potential discharge locations:
  1. A gravity drain to Detention Pond 2.
  2. A 24-inch diameter conveyance pipe to SB 1B, which is currently plugged or capped.
  3. A pump station to the leachate pond, which is currently abandoned and only contains the piping and manifold, no pump.
- The SB 1A gravity drain discharges to an approximately 800-foot long conveyance ditch, roughly parallel to SR 18, along the northwest boundary of RL.
- The 800-foot long conveyance ditch discharges to DP 2, which has an outlet pipe at its south end that discharges to a drainage swale.
- The drainage swale winds through the existing north poplar tree farm area to an unnamed drainage at Outfall 6.

Stormwater run-off in DA 6 comes from the asphalt paved MSE Berm (Phase 1B area), the northern section of active landfill Module 8D and inactive Modules 5, the active haul road through active landfill Modules 9 and 8D and inactive Modules 5, 8A, 8B, and 8C (SCS, 2016).

SCS 2016 indicates that in response to the DEQ’s March 7, 2016 request, RL recently implemented new control measures within DA 6 in an attempt to:

1. more effectively separate potentially contaminated stormwater originating from the Module 9 area and non-contaminated stormwater within the asphalt-lined ditch along the MSE Berm haul road
2. convey contaminated stormwater to the leachate management system. These control measures included the following:

- Moving the active face area away from the MSE Berm haul road as waste filling progresses in Module 9.
- Re-grading of the Module 9 slopes as filling continued in this area. This re-grading includes constructing a drainage ditch at the toe of the slope of Module 9 adjacent to the asphalt-lined drainage ditch atop of the MSE Berm. This drainage ditch is at a lower elevation than the asphalt-lined ditch (conveying non-contaminated stormwater) thus achieving better separation between potentially contaminated stormwater in this area and non-contaminated stormwater in the asphalt-lined ditch.
- Constructing two temporary sumps to collect stormwater conveyed from the recently
constructed ditch at the toe of the Module 9 slope (as noted above). Stormwater collected in these sumps are pumped to the leachate management system and do not discharge at the site outfall locations.
3.0 HYDROLOGY AND DESIGN INTENT

The existing stormwater management system was designed by Wallis Engineering in December of 2013. The design report (without appendices) is included as Appendix C for reference. The design of the Tier II Corrective Action uses the same general drainage basin characteristics and software methods to maintain a continuity of design development for this facility.

The primary difference for the current work is the application of the Water Quality Storm rainfall event required for Tier II Corrective Action. The base facility capacity for heavier storms is not being altered by the proposed modifications to the onsite stormwater management facilities. Development of the design water quality storm for Tier II Corrective Action and associated site runoff is shown in Appendix C.

ORIGINAL DESIGN SUMMARY FOR THE RECYCLING AREA DRAINAGE BASIN

The design water quality storm for the original design used a one-year, Type 1A, 24-hour storm appropriate for this site. Wallis Engineering’s design report shows that runoff of the water quality storm from upstream of the recycle area does not significantly overflow SB 1B. The design intent was that the stormceptor unit and the water quality swale were to manage water quality storm runoff from the recycle area alone. Upstream drainage basins relied on the settling action in the ponds for storm water quality. Runoff from larger storms and upstream pond overflows were routed to pass through the stormceptor and over flow a diversion weir bypassing the stormwater quality swale.

TIER II CORRECTIVE ACTION SUMMARY FOR THE RECYCLING AREA DRAINAGE BASIN

The vicinity design water quality storm required for Tier II Corrective Action is 50% of the two-year, Type 1A, 24-hour storm. As the storm intensity and return period relationship are not proportional, the Tier II requirement results in a runoff value twice as large as the original design, shown by the following table:

<table>
<thead>
<tr>
<th>Summary of Runoff from Riverbend Landfill Recycling Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Original Design Wallis 2013</strong></td>
</tr>
<tr>
<td>Runoff Area, sq ft</td>
</tr>
<tr>
<td>Tc, min</td>
</tr>
<tr>
<td>CN</td>
</tr>
<tr>
<td>Rainfall Depth, inches</td>
</tr>
<tr>
<td>Runoff Depth, inches</td>
</tr>
<tr>
<td>Peak Flow, cfs</td>
</tr>
<tr>
<td>Peak Flow, gpm</td>
</tr>
</tbody>
</table>
TIER II CORRECTIVE ACTION HYDRAULIC DESIGN INTENT

The additional runoff required for Tier II Corrective Action essentially breaks the original stormwater quality design by adding upstream storm pond overflow and overloading the stormceptor/water quality swale system. Our objective is to maintain the current water quality design intent for this system.

1) Separate the upstream pond overflow from the existing downstream water quality facilities by:
   - installing an interceptor line to pick up the storm sewers in the recycle area
   - installing a bypass line to route the upstream pond overflow to the outlet dispersion trench and bypass the existing stormceptor and water quality swale

2) Enhancing the treatment capability of the existing grassed water quality swale by
   - adding a passive filtration system for storm water quality in the grassed swale for enhanced TSS removal
   - using a filter media specifically developed to handle bacteria in stormwater runoff

Basis of Design Filter Installation

Given the supplier’s recommendation for the unit volume of media required for unit stormwater flow, the size and number of filter socks was determined to handle runoff from the recycling area during the Tier II compliance water quality storm.

A set of filters was laid out to enhance treatment and provide system backup. The “flow through” order through the treatment swale is:

   - An initial single 12” sock to catch first flush fines that passed through the stormceptor unit and extend the service life of the primary filter banks.
   - A primary bank of three stacked socks providing filtration and bacteria treatment per the suppliers’ recommendations
   - A redundant/back up bank of three socks to provide treatment as the primary filter begins to clog and overflows, extending the service life of the filter system
   - A final single sock to reduce flow velocity in the swale and provide for a degree of final settling and filtration for the higher strength low flows.

Relevant assumptions, hydrographs, and calculations are provided in Appendix C.
4.0 PROPOSED CORRECTIVE ACTION MEASURES

4.1 General

Currently DA 6 discharges at Outfall 6 and there are no exceedances of the statewide benchmark for the geometric mean of E. coli to date. It is proposed herein that the stormwater runoff from DA 6, which collects in Sediment Basin 1A, will be conveyed to Sediment Basin 1B through the existing capped 24-inch CPE pipe and continue to the north in the proposed stormwater conveyance system to Outfall 1C as described in more detail in Section 4.3 below. A portion of the stormwater flows from DA 6 will be re-routed through a proposed stormwater conveyance system bypass to ultimately discharge at Outfall 1C. This re-routing is not anticipated to adversely affect the concentrations at Outfall 1C as there are no exceedances of the statewide benchmark for the geometric mean of E. coli in Outfall 6 to date.

DA 1 contributes stormwater runoff, which is considered to be exposed to RL industrial activities, to the north end of the RL site for discharge at Outfall 1C. Corrective action measures are required to address the exceedance of the statewide benchmark for the geometric mean of E. coli during the 2014-2015 monitoring period at the Outfall 1C sampling point. Corrective action measures are proposed herein and have been developed to achieve the permitted statewide benchmarks, presented in Schedule A.9 of the Permit, at Outfall 1C.

Corrective action measures consist of three general aspects with the goal of separating stormwater run-off that is exposed to RL industrial activities from that which is not. Stormwater contaminated with E. coli is anticipated to be coming from the Z-wall and recycle area stormwater interceptor area due to contact with the municipal waste from the bins.

The aspects of the system are described below:

1. Separate Recycle Stormwater Interceptor and Z-wall area from rest of DA 1. The Z-wall area is the area where E. coli is anticipated to be coming from. The rest of DA 1 consists of stormwater not anticipated to be contaminated from E. coli. The Z-wall and recycle area will be separated from DA 1 by delineating Drainage Area 1C (DA 1C), as detailed in the 2013 Wallis Engineering design report and shown on Figure A-1 in Appendix A.

2. Re-route the stormwater flows from SB 1A and SB 1B through existing stormwater trunk lines to proposed stormwater manhole SDMH-D. Construct new 24-inch CPE pipe stormwater bypass to convey stormwater to the Existing Stormwater Dispersion Trench at the north end of DA 1 where stormwater will be monitored at the new monitoring location 006, as shown on Drawing 3 in Appendix B, before entering the Stormwater Dispersion Trench and continue to flow through Outfall 1C.

3. Route stormwater flows from Recycle and Z-Wall area (DA 1C) to the existing stormwater conveyance system through the existing stormwater manhole SDMH-2. Convey stormwater in the existing 24-inch CPE stormwater collection piping to the existing swale, which will be improved with biofilters. Stormwater will filter through the biofilters, which will treat the E. coli before the stormwater will be monitored at the new monitoring location.
location 001, as shown on Drawing 3 in Appendix B, and is routed through the existing Stormwater Dispersion Trench and continue to Outfall 1C.

4.2 Rationale

Implementation of both aspects of the conceptual corrective action measures in addition to the already implemented separation of potentially contaminated run-off from Module 9, as detailed in the SWPCP and reiterated in part in Section 2.0 Existing Stormwater Run-Off Management above, is expected to reduce the potential for exceedances of statewide benchmarks by separating potentially contaminated stormwater from non-contaminated stormwater and filtering the potentially contaminated stormwater through biofilters for treatment.

The selected biofilter is Filtrex® Envirosoxx®, or similar, which is a tubular sediment and erosion control compost filter sock that incorporates Bactoloxx® for bacteria removal. The compost filter sock will be laid in a stacked fashion and secured perpendicular to flow in an existing grassed stormwater quality swale. Surface water runoff in the swale can flow freely through the compost filter sock where it is treated by the Bactoloxx. According to the manufacturer, “Bactoloxx is a natural sorbent especially designed for stormwater pollution prevention practices, such as sediment control, check dams, inlet protection, biofiltration and bioretention systems. It is used to reduce coliform bacteria loads in stormwater runoff, particularly near animal feeding operations, pet frequented areas, and urban watersheds where bacteria in runoff is an issue. Specific coliforms targeted by this product include, but are not limited to, genera Escherichia, Klebsiella, Enterobacter, and Citrobacter, including E. coli and fecal coliforms.”

Faucette et.al, 2009 documents a laboratory study where removal of fecal bacteria, in addition to other pollutants, was evaluated and compared for a filter sock alone and a filter sock treated with Bactoloxx. The study found that the filter sock alone had a removal efficiency of 74% for TC and 75% for E. coli. The authors concluded that “Removal efficiency by the FS was likely due to their ability to remove sediment and the affinity bacteria have for attaching to sediment particulates.” The study found that the filter sock treated with Bactoloxx removed 99% of both TC and E. coli from the simulated runoff. The authors concluded that “The elevated removal efficiency found in this treatment is likely from the flocculation of bacteria provided by the Bactoloxx.”

4.3 Corrective Action Operation Plan Summary

Specific components of the proposed corrective action are described below, and shown on the drawings in Appendix B. The water balance is discussed in Section 3.0 Hydrology and Design Intent of this report. Implementation of the proposed corrective action would begin upon DEQ approval. It is estimated that procurement and installation would be completed by the permit deadline of June 30, 2017.
DRAINAGE AREA 6

SB 1A
SB 1A will continue to receive stormwater run-off from the areas of the landfill located within DA 6. The two existing 18-inch gravity drains from the SB 1A to the conveyance ditch will be plugged or capped to prevent flow from SB 1A to the west. The existing 24-inch diameter conveyance pipe between the SB 1A and the SB 1B will be uncapped to allow flow from SB 1A to SB 1B.

SB 1B
SB 1B will continue to receive stormwater from the surrounding paved areas as well as from SB 1A.

Existing 24-inch Diameter Conveyance Pipe
The existing 24-inch diameter conveyance pipe at the northeast corner of SB 1B will be altered to separate Recycle Area catch basin flows from SB 1A/SB 1B flows. SB 1A/SB 1B flows will be routed directly to the existing stilling basin and dispersion trench (Outfall 1C). Recycle Area catch basin flows will be routed to the existing 60-inch manhole and then the water quality swale containing the biofilter.

The existing 12-inch line from SDMH-3 to SDCB-13 will be removed and a bulkhead will plug the remaining opening in SDMH-3. A new manhole (SDMH-D) will be installed on the existing 24-inch diameter conveyance pipe approximately 20 feet south of SDMH-2, followed by removal of the existing 24-inch line between SDMH-D and SDMH-2. A bulkhead will plug the remaining opening in SDMH-2.

New 24-inch Diameter Conveyance Pipe
A new 24-inch diameter conveyance pipe will be installed between SDMH-D and the existing stilling basin and dispersion trench (Outfall 1C). The new 24-inch diameter conveyance pipe will slope at approximately 1.66% and will incorporate three new manholes at changes in direction along its path and one 45 degree bend anchor joint:

- SDMH-C will have an inlet invert elevation (IE) of 141.38 and an outlet IE of 141.28.
- SDMH-B will have an inlet IE of 139.57 and an outlet IE of 139.47.
- SDMH-A will have an inlet IE of 138.21 and an outlet IE of 138.11.
- A 45 degree bend anchor joint will be included approximately 10 feet southeast of the 24-inch diameter conveyance pipe outlet to the stilling basin.

The new 24-inch diameter conveyance pipe will have an outlet IE to the stilling basin of 137.50 feet and will consist of a typical flared end section for concrete pipe, which is similar to the existing outlet.

DRAINAGE AREA 1C

New 12-inch CPEP
A new 12-inch CPEP line will be installed between SDCB-13 and SDMH-2 to route stormwater
from west and south Recycle Area catch basins to the existing water quality swale. The new 12-inch CPEP will slope at approximately 3.86% and will incorporate two new manholes at changes in direction along its path:

- SDMH-F will have an inlet IE of 145.91 and an IE of 145.81.
- SDMH-E will have an inlet IE of 142.57 and an outlet IE of 142.47.

Stormwater entering the SDMH-2 will flow as originally designed to the existing 60-inch diameter manhole near the southeast corner of the water quality swale. The existing 60-inch diameter manhole includes an 8-inch diameter pipe that discharges stormwater to the water quality swale and a 24-inch diameter overflow pipe that currently discharges to the stilling basin and then the dispersion trench.

**Existing Water Quality Swale Improvements**

The existing water quality swale will be improved with the installation of Filtrexx® Envirosoxx® with BactoLoxx® biofilter at four locations, as shown on Drawing No. 4 in Appendix B, for bacteria removal.
5.0 COST ESTIMATE

A cost estimate is provided in Appendix D.
6.0 OPERATION AND MAINTENANCE SCHEDULE

Monthly inspection will be conducted in accordance with the Riverbend Landfill Monthly Inspection Report Form, SCS 2016 Appendix F. Appendix F includes the following for drainage pipes, ditches, catch basins, and including the biofiltration system:

Check the drainage ditches, pipes and catch basins for sediment accumulation, debris, and other potential pollutants. Remove potential pollutants if observed. Use additional control measures such as sediment controls, oil booms, if needed.

Any stormwater discharged at Outfall 1C will be monitored and visually inspected in accordance with Schedule B.2 and Schedule B.7 of the Permit.

Any required maintenance or repairs will be recorded and available for review upon DEQ request.

The minimum inspection and maintenance for the biofilter shall be as recommended by the manufacturer. If the Filtrex® Envirosoxx® with BactoLoxx® is utilized the following are recommendations by the manufacturer:

INSPECTION AND MAINTENANCE

1. Routine inspection should be conducted within 24 hours of a runoff or flow event for the first year after installation or until permanent vegetation has established.

2. The Contractor shall maintain the filtration system in a functional condition at all times and it shall be routinely inspected.

3. If the filtration system has been damaged, it shall be repaired, or replaced if beyond repair.

4. The Contractor shall remove sediment at the base of the upslope side of the Soxx Baffle when accumulation has reached 1/2 of the effective height of the Soxx, or as directed by the Engineer.

5. If a filtration system becomes clogged with debris or solids, they shall be maintained so as to assure proper hydraulic flow through. Overflow or undercutting of contaminated water is not acceptable.

6. If Soxx baffle becomes clogged with sediment or hydraulic flow is significantly reduced it may be replaced with a new Soxx Baffle.

7. If minor undercutting occurs, the areas may be plugged with sand or additional FilterMedia. If undercutting continues, leveling or minor grading of ground surface may be required to increase surface contact with Soxx.

8. Filtration systems shall be maintained until disturbed area above the device has been permanently stabilized and construction activity has ceased.
9. Filtration systems shall be maintained until contaminated water has fully percolated through the device.

10. The FilterMedia®, GrowingMedia®, sediment, and filtrate may be dispersed on site once solids separation is complete and if there are no concerns with soil and water contamination, or as determined by the Engineer.

11. If a filtration system is to be vegetated, the Contractor shall maintain the vegetation in the filtration system in a functional condition at all times and it shall be routinely inspected.

12. Vegetated filtration systems shall be maintained until a uniform minimum cover of 70% of the applied area has been vegetated, permanent vegetation has established, or as required by the jurisdictional agency.

13. Vegetated filtration systems may need to be irrigated in hot and dry weather and seasons, or arid and semi-arid climates to ensure vegetation establishment.

14. Where filtration system vegetation does not establish, it fails, or rilling occurs, the Contractor will repair, reseed, or provide an approved and functioning alternative.

15. No additional fertilizer or lime is required for vegetation establishment and maintenance.

16. Regular mowing of filtration system vegetation to a minimum height of 4 in (100mm) and a maximum height of 10 in (250mm) will deter invasive weeds, allow sunlight to kill captured pathogens.

17. Sediment shall be removed once it reaches 25% of the height of the vegetation (mowed) to prevent diversion of storm runoff and reduction of vegetation health and cover.
7.0 CONCLUSIONS AND LIMITATIONS

The assumptions presented in this report and the enclosed attachments are based upon a review of previous reports and drawings listed in Section 8.0 References of this report. If the project scope of work changes from that described herein, our analyses should be reviewed and modified, if necessary. This report was prepared in accordance with generally accepted soils, civil engineering, and foundation engineering practices applicable at the time the report was prepared and for the project location. GLA makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement, and as presented in this report.

Our recommendations consist of professional opinions and conclusions, based on the scope of work outlined herein and that adequate follow-up engineering, field investigations and construction quality assurance are provided, as necessary, to verify that the assumptions used in the design are accurate and the work is constructed properly. It is recommended that GLA be provided the opportunity for a general review of any final construction documents prepared by other consultants or contractors in order that our recommendations may be properly interpreted and implemented.
8.0 REFERENCES

SCS, 2016: SCS Engineers, Stormwater Pollution Control Plan, Plan Date: June 2016, NPDES 1200-Z Industrial Stormwater General Permit, File Number: 106959, Name: Riverbend Landfill. SCS Project Number 04212024.16,


APPENDIX A

SCS 2016 REVISED SWPCP FIGURES 1-2 AND 1-3
WALLIS 2013/GLA FIGURE A-1
PROJECT NO. 04212024.16
J.D.

SITE SUBSTRUCTURE LOCATIONS PROVIDED BY WASTE MANAGEMENT.
2. EXISTING CONTOURS BASED ON AERIAL DIGITIZATION PROVIDED BY MILLER CREEK AERIAL MAPPING, FLOWN ON 2-8-2016.
3. DRAINAGE AREA SIZE ARE APPROXIMATE.

STATEMAP PLAN
STORMWATER POLLUTION CONTROL PLAN
RIVERBEND LANDFILL
MCMINNVILLE, OREGON
RIVERBEND LANDFILL
TIER II CORRECTIVE ACTION RESPONSE
MCINNVILLE, OREGON
SURFACE WATER DRAINAGE

NOTES:
1. UPDATED BASIN NUMBER PER JASON DAVENDOHRS SCS ENGINEERS 08/01/2017.
2. 2017 MODIFICATIONS FOR TIER II COMPLIANCE ARE SHOWN ON 2013 WALLIS STORM BASIN MAP.

DATE OF ISSUE: 09/28/2017

This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the title block, solely in respect of the construction operation, and maintenance of the facility named in the title block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing on any other facility or for any other purpose.
APPENDIX B

PROPOSED CORRECTIVE ACTION RESPONSE DRAWINGS
This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the Use block, solely in respect of the construction, operation, and maintenance of the facility named in the Use block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing by any other entity for any other purpose.
EXISTING TERRACED CONC FLOW SPREADER

FILTREXX SOXX

DETAIL

1. EXISTING TERRACED CONC FLOW SPREADER
2. INSTALL FILTERS WITH 3" FILTER SOCK WITHIN 6" WIDE FLAT BASE
3. EXISTING PERIMETER TOP OF BANK
4. EXISTING SLOPE FLOWLINE
5. "2"X2" HARDWOOD STAKES @ 10" OC, DRIVEN 12" INTO UNDISTURBED SLOPE BOTTOM STABILIZE LUNCHE AND UPPER FILTER SOCKS

FILTREXX SOXX FILTER ANCHORING

SECTION II

PROJECT SPECIAL PROVISIONS AND SPECIFICATION REFERENCE

The work shall conform to the current edition of "Oregon Standard Specifications for Construction" prepared by the Oregon Department of Transportation, as indicated by the sections referenced below:

STORM SEWER - GENERAL STD SPEC 02445.40
MATERIALS
HEAVY PIPE 5SB 26 - STD SPEC 02445.30
SPECIAL END CONNECTION - STD SPEC 02445.10 / STD DWG 39524
STORM SEWER CONSTRUCTION - STD SPEC 02445.40
JOINING PIPE - STD SPEC 02445.43
POLYETHYLENE PIPE INSTALLATION STD SPEC 02445.43(0)
INSTALLING - STD SPEC 02445.43
FINISHING, CLEANING UP AND TESTING - STD SPEC 02445.43
EXCISION: ONLY DEFLECTION TESTING WILL BE REQUIRED, AND TENDER WIRE IS NOT REQUIRED
STORM SEWER MANHOLE GENERAL - STD SPEC 02445.40
MATERIALS
PRECAST MANHOLES & BAILS - STD SPEC 02445.10, 2445.20 / STD ENGS RD 339 & RD 344
MANHOLES SHALL BE 48" INSIDE DIAMETER
MANHOLE FRAMES & LIDS SHALL BE NILDER 1550 WITH OPEN PICK HOLE, NON ROCKING LID OR EQUAL
MANHOLE CONSTRUCTION - STD SPEC 02445.40
MANHOLE - PIPE CONNECTIONS - STD SPEC 02445.42 / STD DWG RD 279
PRECAST MPU INSTALLATION JOINTS, JAMB (FRAMES) - STD SPEC 02445.42, PROVIDE INTERMEDIATE STEPS IN PRECAST UNITS CLEANING - STD SPEC 02445.70, TESTING OF MANHOLES IS NOT REQUIRED
STORM SEWER TRENCH EXCAVATION, SECTIONS AND BACKFILL - STD SPEC 02445.40
TRENCH OF EXCESS EXCAVATED MATERIALS - STD SPEC 02445.40
EXCAVATION MATERIALS - STD SPEC 02445.12
TRENCH BACKFILL - STD SPEC 02445.14
LID, JEM, DRAINAGE MATERIAL - STD SPEC 02445.1, THROUGH ROADS OR AREAS SUBJECT TO VEHICLE TRAFFIC CLASS A, EXCAVATED MATERIAL, THROUGHOUT ALL OFF ROAD AREAS
CONSTRUCTION FOR FIELDJOINT AND BIFURCATION - STD SPEC 02445.40
ENGINEERING - STD SPEC 02445.43
ENGINEERING - STD ENGS RD 339 FOR TRENCH BACKFILL, SECTIONS, AND PIPE ZONE
ENGINEERING - STD SPEC 02445.44
PIPE, REDUCER, JEM, DRAINAGE - STD SPEC 02445.44
SURFACE REJOIN - STD SPEC 02445.44
FILTREXX SOXX
BIFURCATION INSTALLATION SHALL BE CONFORM FILLED FILTER SOCKS, "FILTERSOXX." "FILTERSOXX" MEDIA SHALL BE CONFORMMED WITH BACTERIA REMOVAL AGENT "MICROBLAST" THE BIOFILTER MOUNTED BLACKSPACE BARRIERS ACROSS THE EXISTING DISTRIBUTED STORMWATER SYSTEM HORIZONTAL NORTH OF THE "Z-WALL" AREA, SOCKS SHALL BE 12" DIAMETER AND EXTEND FULLY ACROSS THE TREATMENT SPREAD
INSTALLATION CONSISTS OF TWO SETS OF 3 STACKED AND ANCHORED SOCKS WITH ONE SET OF 3 SOCKS PROVIDING A REACTIVITY/BIOPROCESSING TREATMENT CATHETERS, TWO 3" PIPES OF SOCKS SHALL BE INSTALLED IN UPSTREAM AND COMPACT OF THE STACKED SOCKS TO PROVIDE LOW FLOW PRE-TREATMENT AND FINAL PRUNING
EXISTING FLOW SPREADERS IN THE SLOPE SHALL BE ADDED OR TO DEPLY LOAD THE DOWNSTREAM SOCK FILTERS
ANCHOR FILTERS PER THE PLAN DETAIL
STACKED FILTER SOCKS SHOULD BE INSTALLED WITH TOP AT LEAST 6" BELOW THE ADJACENT PERIMETER OF THE SLOPE TO ALLOW LARGER TRIM TO ELECT THE FLOWERS WITHIN THE SLOPE CHANNEL. SET FILTER SOCK 4" INTO THE CHANNEL, BOTTOM AND SPREAD THE STACK IF REQUIRED TO PROVIDE THE ABOVE 6" OPENING SPREADER
CONSTRUCTION EROSION CONTROL
INSTALL, SET FENCE AND STACKED STRAW BALES AS CALLED OUT ON THE PLAN. REMOVE EROSION CONTROL UPON COMPLETION OR SITE RECOMMENDED AT NEGATIVE. SEE STD DWG RD15040 FOR SHIFT FENCE INSTALLATION
SITE RESTORATION SHALL BE "Z-WALL" TO AS GOOD OR BETTER THAN CURRENT CONDITION AND CONFORM TO WASTE MANAGEMENT PROPER STANDARDS FOR
PROPERTY MAINTENANCE, MATERIA AND THICKNESS
NOT USE ASPHALT, MATERIALS, OR TREATMENTS
SEEDING AND EROSION MIT FOR ALL OFF ROAD DISTURBED AREAS

This drawing has been prepared and/or issued for the benefit of the client and is the property of Geo-Logic Associates, Inc. and is not to be used for any other purpose or by any other party without the written consent of Geo-Logic Associates, Inc.

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1430 Spring Hill Dr., Dallas, Oregon 97338
p: (503) 547-2954
f: (503) 547-2955

RIVERBEND LANDFILL
TIER II CORRECTIVE ACTION RESPONSE
MCMINNVILLE, OREGON
WASTE MANAGEMENT PROJECT
FILTER DETAILS & PROJECT SPECIFICATIONS
ISSUED FOR CONSTRUCTION
HYDROCAD STORMWATER MODELING
SCHEMATIC USED FOR FACILITY DESIGN
AND ADAPTED FOR TIER II

CURRENT STORMWATER
OUTFALL

GRASSED SWALE FOR TREATMENT TO BE
MODIFIED FOR FILTREXX INSTALLATION

WQ DESIGN RUNOFF IS FROM THE
RECYCLING AREA BASIN ALONE FOR
BOTH ORIGINAL DESIGN & TIER II

POND 2 DOES NOT OVERFLOW FOR
THE ORIGINAL DESIGN WQ STORM

WQ DESIGN RUNOFF IS FROM THE
RECYCLING AREA BASIN ALONE FOR
BOTH ORIGINAL DESIGN & TIER II

POND 2 DOES NOT OVERFLOW FOR
THE ORIGINAL DESIGN WQ STORM

RIVERBEND LANDFILL
TIER II CORRECTIVE
ACTION RESPONSE
MCMINNVILLE, OREGON

ISSUED FOR CONSTRUCTION
OREGON STANDARD DRAWINGS
TABLE A

<table>
<thead>
<tr>
<th>&quot;A&quot; (in)</th>
<th>&quot;B&quot; (in)</th>
<th>&quot;C&quot; (in)</th>
<th>&quot;D&quot; (in)</th>
</tr>
</thead>
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<tr>
<td>4</td>
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<td>4</td>
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<tr>
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<td>21</td>
<td>16</td>
<td>6</td>
<td>12</td>
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<tr>
<td>24</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>30</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
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<td>36</td>
<td>24</td>
<td>6</td>
<td>14</td>
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<td>42</td>
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<td>6</td>
<td>14</td>
</tr>
<tr>
<td>48</td>
<td>24</td>
<td>6</td>
<td>14</td>
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<td>54</td>
<td>24</td>
<td>6</td>
<td>14</td>
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<td>6</td>
<td>14</td>
</tr>
<tr>
<td>72</td>
<td>24</td>
<td>6</td>
<td>14</td>
</tr>
</tbody>
</table>

For pipes over 72" diameter, see general note 3.

GENERAL NOTES FOR ALL DETAILS:

1. Surfacing of paved areas shall comply with street cut Std. Drg. RD302.
2. For pipe installation in embankment areas where the trench method will not be used and the pipe is ≥ 36" diameter, increase dimension "B" to nominal pipe diameter.
3. Pipes over 72" diameter are structures, and are not applicable to this drawing.
4. See Std. Drg. RD336 for tracer wire details (When required).

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications.
General Notes for All Details:

1. All precast products shall conform to requirements of ASTM C478.
2. Standard precast manhole section diameter shall be 48". Use 42" if specified by the Engineer.
3. See Std. Drg. RD345 for pipe to manhole connections.
5. Adjust 24" maximum.
6. All connecting pipes shall have a tracer wire, or approved alternate.
7. See Std. Drg. RD337 for manhole safety ladder.
8. See Std. Drg. RD336 for details not shown.
9. See Std. Drg. RD356 for manhole covers and frames, manhole adjustment rings, etc.
10. Max. pipe diameter varies with pipe material.
12. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.

Pipe (Typ.)
(See general note 10)

Joint type varies with manufacturer (Typ.)
All joints shall be sealed with non-shrink grout, preformed plastic or rubber ring to form a watertight seal

Tracer wire,
(See Detail "A" on Std. Drg. RD336)

24" max.
(See general note 5)

Varies (12" max.)
(See general note 5)

Pipe connection varies (Typ.)
(See general note 3)

Precast riser(s) (As required)

Precast flat slab top

Precast riser(s) (As required)

Precast grade ring(s)
(As required)

Adjustment ring(s)
(As required)

Finish grade

Concrete bench,
slope varies: 1/2/ft. min.

Frame and precast grade ring(s) shall be sealed with non-shrink grout, preformed plastic or rubber ring to form a watertight seal

Provide manhole steps unless otherwise specified. Concentric cone may be used if steps or ladders are not required.

Tracer wire,
(See Detail "A" on Std. Drg. RD336)

24" max.
(See general note 5)

Varies (12" max.)
(See general note 5)

Precast conical top

Joint type varies with manufacturer (Typ.)
All joints shall be sealed with non-shrink grout, preformed plastic or rubber ring to form a watertight seal

Tracer wire,
(See Detail "A" on Std. Drg. RD336)

24" max.
(See general note 5)

Varies (12" max.)
(See general note 5)

Precast grade ring(s)
(As required)

Adjustment ring(s)
(As required)

Finish grade

Manhole cover and frame

Precast grade ring(s)
(As required)

Adjustment ring(s)
(As required)

Finish grade

Manhole cover and frame

General Notes for All Details:

1. All precast products shall conform to requirements of ASTM C478.
2. Standard precast manhole section diameter shall be 48". Use 42" if specified by the Engineer.
3. See Std. Drg. RD345 for pipe to manhole connections.
5. Adjust 24" maximum.
6. All connecting pipes shall have a tracer wire, or approved alternate.
7. See Std. Drg. RD337 for manhole safety ladder.
8. See Std. Drg. RD336 for details not shown.
9. See Std. Drg. RD356 for manhole covers and frames, manhole adjustment rings, etc.
10. Max. pipe diameter varies with pipe material.
12. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS
STANDARD STORM SEWER MANHOLE

Effective Date: June 1, 2017 - November 30, 2017

RD335
GENERAL NOTES FOR ALL DETAILS:

1. All concrete shall be commercial grade concrete.
2. Channels shall be constructed to provide smooth slopes and radii to outlet pipe.
3. Bases may be precast or cast in place.
4. Max. pipe diameter varies with pipe material.
5. Use on 42" and 48" diameter manhole.
6. Extend pipe into manhole and grout smooth. Pipe(s) may extend 2" max. beyond the interior manhole wall.
7. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.
8. All precast products shall conform to the requirements of ASTM C478.
10. See Std. Drg. RD336 for manhole steps details.
12. At spring line of pipe, extend channel up to crown line on 12:1 batter.

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

CAST IN PLACE MANHOLE BASE
(For invert channel details, see precast option at right)

All reinforcement shall be 2" clear of nearest face of conc., unless otherwise shown.

PLAN

PRECAST MANHOLE BASE

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

Effective Date: June 1, 2017 – November 30, 2017

OREGON STANDARD DRAWINGS

STANDARD MANHOLE BASE SECTION

CALC. BOOK NO. N/A

MACHINE REPORT DATE 14-Jul-2014

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications.

Standards:

2015

Rating Submission
**SEDIMENT FENCE AND GEOTEXTILE BURY DETAIL - TYPE 1**

- Angle ends of sediment fence to assure sediment is trapped.
- Connect fence ends with either the turned ends or the post spacing overlap end connection.
- Join two runs of fence by wrapping end posts a minimum of two full wraps.

**NOTES:**
1. Use 2" x 2" wood fence posts.
2. Posts to be installed on downhill side of sediment fence. Position posts to prevent separation from geotextile.
4. Locate fence no closer than three feet to the toe of a slope.
5. Wing spacing shall comply with table 1.

**TABLE 1** FENCE SPACING FOR GENERAL APPLICATION

<table>
<thead>
<tr>
<th>Grade</th>
<th>Maximum Spacing on Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade &lt; 10%</td>
<td>300'</td>
</tr>
<tr>
<td>10% ≤ Grade &lt; 15%</td>
<td>150'</td>
</tr>
<tr>
<td>15% ≤ Grade &lt; 20%</td>
<td>100'</td>
</tr>
<tr>
<td>20% ≤ Grade &lt; 30%</td>
<td>50'</td>
</tr>
<tr>
<td>Grade ≥ 30%</td>
<td>25'</td>
</tr>
</tbody>
</table>

**TABLE 2** POST SPACING

<table>
<thead>
<tr>
<th>Post Spacing</th>
<th>Sediment Fence with Geotextile elongation less than 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'</td>
<td>Sediment Fence with Geotextile elongation 50% or more</td>
</tr>
<tr>
<td>4'</td>
<td>Sediment Fence with Geotextile elongation 50% or more</td>
</tr>
</tbody>
</table>

**O C E R N S T A N D A R D D R A W I N G S**

**SEDIMENT FENCE**

**Effective Date:** June 1, 2017 - November 30, 2017

**NOTE:** All material and workmanship shall be in accordance with the current Oregon Standard Specifications.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.
One 10 ft run of 18" dia sock or Two 10 ft runs of 12" dia sock will handle 300 gpm design flow install two sets behind existing spreaders as a redundant capacity for unexpected clogging

As-Bit 125 LF 8" @ 0.46% will carry 301 gpm at flow depth of 0.43 ft Existing pipe has the capacity to carry the Tier II WQ Storm runoff
Biofilter Sizing - For Stormwater Bacteria Control
Tier II Compliance
3/23/2017 Basil Orechwa PE, GLA - Beaver Dam, WI

Design Intent
Bacteria Control is to be by passive methods - flow through filtering
Product selected is a Compost Filter Sock - Filtrexx Bioswale
Filter is to be "Envirosoxx" media treated with bacteria removal agent "BactoLoxx"
Biofilter to be installed in an existing grassed stormwater quality swale
stacked transverse to the swale to form a series of weirs
One filter to have full flow treatment capacity
Use two sock check dams - one redundant - to allow for unexpected clogging

Design Parameters
Design Flow - 50% of 2 Year 24 Hour Storm 301 gpm
Recommended Loading (per Filtrex) for 8" dia sock 7.5 gpm/linear foot
reduce to volume of media per unit flow:

<table>
<thead>
<tr>
<th>Dia</th>
<th>Sq in</th>
<th>cu in/lin ft</th>
<th>cu in/gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>50.2</td>
<td>602.4</td>
<td>80.3</td>
</tr>
</tbody>
</table>

Work out how many stacked socks of what dia are required for the design flow
24170.3 cu in for design flow 10 ft swale bottom width 120 in wide
201.4 sq in media required across ditch - try 2 Sock 100.7 sq in/sock
socks can be furnished in 8, 12, 18, 24, and 32" dia

<table>
<thead>
<tr>
<th>Dia</th>
<th>Sq in</th>
<th>Use this option</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>113</td>
<td>Two stacked socks provides enough media (use 3 - 2 for base and 1 on top)</td>
</tr>
<tr>
<td>18</td>
<td>254.3</td>
<td>a single sock has the area required</td>
</tr>
</tbody>
</table>

Use this option
RIVERBEND LANDFILL FRONT ENTRANCE IMPROVEMENTS FACILITY
SURFACE WATER DRAINAGE REPORT, EXCLUDING APPENDICES
Riverbend Landfill Front Entrance Improvements
Facility Surface Water Drainage Report

Riverbend Landfill
McMinnville, Oregon

Prepared for:

Waste Management, Pacific Northwest Group

December 2013

Prepared by:

David Brokaw, P.E.

Wallis Engineering, PLLC
215 W. 4th Street, Suite 200
Vancouver, WA 98660
Riverbend Landfill Front Entrance Improvements
Facility Surface Water Drainage Report

Facility Surface Water Drainage Report for:
Riverbend Landfill
McMinnville, Oregon

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Facility Surface Water Drainage Report

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Facility Surface Water Drainage Report

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   Proposed Site Plan and Stormwater Facilities Map
   Landfill Basin Delineation Map - Geosyntec
   NOAA Atlas 2, Volume X Precipitation Frequency Maps

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   WC-19 Front Entrance Stormwater Pond Plan
Riverbend Landfill Front Entrance Improvements
Facility Surface Water Drainage Report

I. INTRODUCTION
Waste Management Pacific NW Group, a Waste Management Company, owns and operates Riverbend Landfill, located at 13469 SW Highway 18 in McMinnville, Yamhill County, Oregon. Riverbend Landfill sits on approximately 300-acres, surrounded mostly by undeveloped agricultural land, and bordered by Highway 18 to the west and the South Yamhill River to the south, as shown in Appendix A.

Riverbend landfill is expanding and reconfiguring the active fill area and final contours, expanding longitudinally to maximize the height of the landfill. The entrance to the property, located north of the active fill area, will also be reconfigured, with the demolition of some existing facilities and the development of new facilities.

The facility surface water drainage report focuses specifically on the stormwater improvements downstream of the northern landfill basin, a total of 32.8 acres, and the front entrance improvements, a total of 4.1 acres. These areas combined create a total drainage area of 36.9 acres.

The active fill area evaluated for the drainage analysis was delineated by GeoSyntec based upon full build-out of the proposed landfill configuration at closure. The drainage area was delineated to divert all uncontaminated runoff to the landfill perimeter and conveyed to downstream stormwater facilities. The details of GeoSyntec’s design and stormwater analysis are not included in this report.

All stormwater improvements downstream of the active fill area, including the front entrance improvements, are being designed by Wallis Engineering and are shown in Appendix A. The design includes the separation of contaminated and uncontaminated water. All water coming in contact with solid waste, including water from the proposed, fueling station and recycling center drop box area, shall be treated as contaminated water. Contaminated water shall be controlled, collected and conveyed into the leachate collection system and shipped off site for treatment by Clean Water Services.

The facility surface water drainage report has been prepared in accordance with the requirements of Clean Water Services (CWS) Design and Construction Standards, dated June 2007, and includes maps showing the project vicinity, existing and proposed site plan and stormwater facilities, GeoSyntec’s proposed landfill configuration at closure, and details for sizing water quality and quantity facilities and conveyance system.

Wallis Engineering
December 2013
II. METHODOLOGY
The drainage analysis was conducted utilizing an NRCS Type 1A storm with rainfall depths approximated from NOAA Atlas 2, Volume X precipitation frequency maps for McMinnville, Oregon, referenced in Appendix A. The Santa Barbara Urban Hydrograph (SBUH) method was used as the basis for all stormwater runoff calculations. The modeling methodology utilized for the drainage analysis was HydroCAD 10.00.

Rainfall depth, duration and antecedent moisture conditions (AMC) were input into the model to establish the initial hydrologic parameters, as shown below in Table 1.

Table 1: 24-Hour Precipitation Frequency at Riverbend Landfill

<table>
<thead>
<tr>
<th>Storm Recurrence Interval</th>
<th>Depth (inches)</th>
<th>Duration (hours)</th>
<th>AMC*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Year</td>
<td>2.60</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>10-Year</td>
<td>3.80</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>25-Year</td>
<td>4.25</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>100-Year</td>
<td>5.25</td>
<td>24</td>
<td>2</td>
</tr>
</tbody>
</table>

*AMC 2 corresponds to normal ground moisture levels prior to the storm

McMinnville, Oregon lies between two mean seasonal precipitation (MSP) isohyets on the precipitation frequency maps, therefore the rainfall depths were estimated by interpolation.

The runoff parameters input into the model were the contributing basin pervious and impervious areas, time of concentration, and curve numbers and are detailed in Table 2 below.

Table 2: Runoff Parameters

<table>
<thead>
<tr>
<th>Basin</th>
<th>Area (acres)</th>
<th>Weighted CN</th>
<th>Time of Concentration (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill Basin</td>
<td>32.82</td>
<td>92</td>
<td>31.8</td>
</tr>
<tr>
<td>Pond 1 Basin</td>
<td>0.26</td>
<td>98</td>
<td>5</td>
</tr>
<tr>
<td>Pond 2 Basin</td>
<td>1.05</td>
<td>93</td>
<td>5</td>
</tr>
<tr>
<td>North Road Swale Basin</td>
<td>0.29</td>
<td>95</td>
<td>5</td>
</tr>
<tr>
<td>Recycling Area Basin</td>
<td>2.50</td>
<td>96</td>
<td>5</td>
</tr>
</tbody>
</table>

NRCS curve numbers were used to calculate runoff from the landfill and front entrance. The front entrance is hydrologic soil group C, evaluated from the NRCS Soil Survey, referenced in Appendix B. The pervious areas within the front entrance improvement area were assumed to be fair condition open space (grass cover 50-75%), corresponding to the landscaped areas within the front entrance. The front entrance impervious areas correspond to paved areas and
The Landfill basins will exist in a variety of states during rainfall events. Runoff from areas of the landfill that are being filled with waste will be diverted to the leachate collection system and will not enter the stormwater facilities. Areas connected to the facility for the purpose of design are assumed to be either tarped (equivalent to an impervious roadway, CN= 98) or in final cover condition with an 18" grassed vegetative layer. This vegetative layer drains to an impervious membrane, collected in underdrains and reintroduced to the surface conveyance. See Figure 1 below for example final cover profile. For the purpose of design, this area is assumed to be poor condition open space (grass cover <25%) over hydrologic soil group D. The Northern Landfill Basin was analyzed assuming 70% of surface area will be in final cover and 30% will be tarped.

![Figure 1 - Final Cover Profile](image-url)

**Figure 1 - Final Cover Profile**

Time of Concentration: The time of concentration for the landfill drainage basins was calculated using TR-55 methodology through the hydrocad software. The landfill drainage is routed to this basin along a series of surface geomembrane-lined ditches. Calculations are included in the hydrocad report. The time of concentration for the pond basins (1,2, and 3), the north road swale basin and the recycling area basin were all assumed to be 5 minutes due to their impervious nature and proximity to design elements.

The peak Water Quality, 2, 10, 25 and 100-year pre and post development runoff rates from HydroCAD for each basin are detailed below in Table 3 and Table 4.
Riverbend Landfill Front Entrance Improvements  
Facility Surface Water Drainage Report

Table 3: Peak Pre-Development Runoff Rates

<table>
<thead>
<tr>
<th>Basin</th>
<th>Water Quality (cfs)</th>
<th>2-Year Storm (cfs)</th>
<th>10-Year Storm (cfs)</th>
<th>25-Year Storm (cfs)</th>
<th>100-Year Storm (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>0.00</td>
<td>6.04</td>
<td>13.21</td>
<td>16.13</td>
<td>22.90</td>
</tr>
</tbody>
</table>

Table 4: Peak Post-Development Runoff Rates

<table>
<thead>
<tr>
<th>Basin</th>
<th>Water Quality (cfs)</th>
<th>2-Year Storm (cfs)</th>
<th>10-Year Storm (cfs)</th>
<th>25-Year Storm (cfs)</th>
<th>100-Year Storm (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill Basin</td>
<td>0.79</td>
<td>10.20</td>
<td>17.08</td>
<td>19.71</td>
<td>25.57</td>
</tr>
<tr>
<td>Pond 1 Basin</td>
<td>0.05</td>
<td>0.16</td>
<td>0.24</td>
<td>0.26</td>
<td>0.33</td>
</tr>
<tr>
<td>Pond 2 Basin</td>
<td>0.15</td>
<td>0.52</td>
<td>0.80</td>
<td>0.91</td>
<td>1.17</td>
</tr>
<tr>
<td>North Road Swale Basin</td>
<td>0.05</td>
<td>0.15</td>
<td>0.23</td>
<td>0.27</td>
<td>0.33</td>
</tr>
<tr>
<td>Recycling Area Basin</td>
<td>0.32</td>
<td>1.33</td>
<td>2.01</td>
<td>2.27</td>
<td>2.84</td>
</tr>
<tr>
<td>Outfall</td>
<td>0.26</td>
<td>5.82</td>
<td>12.64</td>
<td>15.31</td>
<td>21.28</td>
</tr>
</tbody>
</table>

The detention facilities were design to match the pre and post development runoff rates for the 2, 10 and 25-year storms. The 25 year peak post-development runoff rates for each basin were utilized to design the stormwater conveyance systems.

III. FACILITY DESIGN

The design objectives for this project were water quality treatment and stormwater flow control and attenuation. The existing and proposed site plan and stormwater facilities are detailed in Appendix A.

A. Water Quality Treatment Facilities

The water quality treatment facilities were designed to remove suspended particles (TSS) from the runoff and convey flow to downstream facilities. Treatment facilities include pre-treatment manholes, vegetated water quality swales, and water quality basins.

According to CWS, the minimum design storm for sizing water quality facilities is the water quality storm. The water quality storm is defined as a dry weather storm event totaling 0.36 inches of precipitation falling in 4 hours with an average storm return period of 96 hours. The water quality storm depth, volume (WQV) and flow (WQF) for each basin are detailed within the Post Development Hydrocad report in Appendix E and summarized in Table 5 below.
Riverbend Landfill Front Entrance Improvements  
Facility Surface Water Drainage Report

Table 5: Water Quality Volume and Flow

<table>
<thead>
<tr>
<th>Basin</th>
<th>WQ Storm (in)</th>
<th>Area (acres)</th>
<th>WQV (ft³)</th>
<th>WQF (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill Basin</td>
<td>0.36</td>
<td>32.82</td>
<td>7,748</td>
<td>0.79</td>
</tr>
<tr>
<td>Pond 1 Basin</td>
<td>0.36</td>
<td>0.26</td>
<td>187</td>
<td>0.15</td>
</tr>
<tr>
<td>Pond 2 Basin</td>
<td>0.36</td>
<td>1.05</td>
<td>551</td>
<td>0.05</td>
</tr>
<tr>
<td>North Road Swale Basin</td>
<td>0.36</td>
<td>0.29</td>
<td>174</td>
<td>0.32</td>
</tr>
<tr>
<td>Recycling Area Basin</td>
<td>0.36</td>
<td>2.50</td>
<td>1,613</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>36.92</strong></td>
<td><strong>10,273</strong></td>
<td><strong>1.36</strong></td>
<td></td>
</tr>
</tbody>
</table>

The individual water quality treatment facility designs are detailed in the following sections.

i. Pre-Treatment Manhole

The two pre-treatment water quality manhole used for the design are a proprietary treatment device designed by Conotech Engineered Solutions, LLC. The first pre-treatment manhole was designed to convey runoff from the Landfill Basins and route it to the sediment forebay of the extended dry basin. The second pre-treatment manhole collects sediment from the front entrance prior to discharge into the exit water quality swale. The pre-treatment manholes are designed to treat the water quality flow and convey the 25-year peak flow. The WQ flow and 25-year, 24 hour results from HydroCAD are detailed below in Table 6.

Table 6: Pre-Treatment Manhole Results

<table>
<thead>
<tr>
<th>Pre-Treatment Manhole</th>
<th>Storm</th>
<th>Flow (cfs)</th>
<th>Storm Volume (ft³)</th>
<th>Outlet Velocity (ft/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WQ</td>
<td>0.79</td>
<td>7,748</td>
<td>1.92</td>
</tr>
<tr>
<td>1</td>
<td>25-year</td>
<td>19.71</td>
<td>398,558</td>
<td>8.21</td>
</tr>
<tr>
<td>2</td>
<td>WQ</td>
<td>0.32</td>
<td>5,079</td>
<td>2.22</td>
</tr>
<tr>
<td>2</td>
<td>25-year</td>
<td>15.31</td>
<td>180,563</td>
<td>6.57</td>
</tr>
</tbody>
</table>

Sizing details for the pre-treatment manhole provided by Conotech Engineered Solutions, LLC. is included in Appendix C.

ii. Vegetated Swales

The front entrance improvements include two vegetated swales for water quality treatment. The vegetated swales were designed to convey the water quality flow, with a minimum Wallis Engineering  
December 2013
hydraulic residence time of 9 minutes, maximum water design depth of 0.5 feet, 1-foot minimum freeboard, maximum velocity of 2 feet per second based on the 25-year storm, and Manning “n” value of 0.24.

The first water quality swale (water quality swale (entrance)) receives runoff from the North Road swale basin and was designed with 4:1 side slopes, 2-foot bottom width, 2-foot channel depth, 0.5% slope and 135-foot length.

The second water quality swale (water quality swale (exit)) receives runoff from all basins and was designed with 4:1 side slopes, 10-foot bottom width, 1-foot channel depth, 1% slope and 120-foot length. The water quality average flow depth and hydraulic residence time results from HydroCAD are detailed below in Table 7.

<table>
<thead>
<tr>
<th></th>
<th>Channel Depth (ft)</th>
<th>Average Flow Depth (ft)</th>
<th>Hydraulic Residence Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality Swale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Entrance)</td>
<td>2</td>
<td>0.09</td>
<td>27.7</td>
</tr>
<tr>
<td>Water Quality Swale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Exit)</td>
<td>1</td>
<td>0.21</td>
<td>9.5</td>
</tr>
</tbody>
</table>

The HydroCAD results confirm the vegetated swale design meets the 0.5 foot maximum water design depth requirement and 9 minute minimum hydraulic residence time requirement. The 25-year, 24 hour results from HydroCAD are detailed below in Table 8.

<table>
<thead>
<tr>
<th></th>
<th>25-Year Peak Storm (cfs)</th>
<th>Total Swale Capacity (cfs)</th>
<th>Maximum Velocity (ft/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality Swale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Entrance)</td>
<td>0.27</td>
<td>0.85</td>
<td>0.19</td>
</tr>
<tr>
<td>Water Quality Swale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Exit)</td>
<td>1.68</td>
<td>6.92</td>
<td>0.33</td>
</tr>
</tbody>
</table>

The HydroCAD results confirm the vegetated swale design meets the 25-year storm maximum velocity requirement. Sizing details for the vegetated swales are included in the Post Development HydroCAD report in Appendix E.

Two concrete level spreaders were incorporated into the design of the water quality swale (exit) to convert concentrated runoff to sheet flow and disperse it uniformly into the ditch inlet located downstream of the swale and upstream of the dispersion trench.
iii. Extended Dry Basin (Pond 1)

The extended dry basin was designed based on the requirements of clean water services to provide a 48 hour residence time for the water quality storm to allow for settling of solids out of discharge flows. The residence time is obtained through the use of an orifice at a flow control manhole downstream of the basin. The orifice was sized using the orifice equation from Clean Water Services. See Appendix C for orifice calculations.

B. Water Quantity Facilities

The water quantity facilities were designed to manage the 24-hour storm events ranging from the 2-year return storm to the 25-year return storm. The water quantity facilities include a combination water quality and quantity extended dry basin with a sediment forebay and flow control discharge (pond 1), a detention basin with flow control discharge (pond 2) and pumped discharge to infiltration within the poplar grove (from pond 1).

Stormwater quantity on-site detention facilities are designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from the 2-year return storm to the 25-year return storm.

The pre-development basin is assumed to be farmstead on HSG class C soils with a CN of 82. Due to the lack of pre-development contour data, the time of concentration was estimated to be approximately 25 minutes.

i. Extended Dry Basin (Pond 1)

A partial downstream analysis was performed to estimate which stormwater facilities would be required to provide stormwater flow control and attenuation. The results suggested that the runoff from the Northern Landfill Basin should be sized for detention, therefore an extended dry basin was incorporated into the stormwater design.

The extended dry basin receives flow from the Northern Landfill Basin and includes a sediment forebay, which was sized to be 20% of the treatment volume. The detention basin was sized to include an additional 20% volume to account for sediment storage. The extended dry basin was designed as a trapezoidal basin with 3:1 side slopes, 4-foot depth, including 0.4 foot permanent pool depth. It was sized to contain the volume of runoff from the 100-year, 24-hour storm and maintain a minimum 1-foot freeboard from the 25-year, 24-hour storm water surface elevation. To supplement the pond storage a series of pumps is installed within the basin that discharge to infiltration facilities within the poplar grove to accommodate larger flow events. See Pump Wallis Engineering December 2013
discussion below. The storage calculations are detailed in the Post Development Hydrocad report in Appendix E. The design elevations and storage of the extended dry basin are detailed below in Table 9.

<table>
<thead>
<tr>
<th>Pond #</th>
<th>Bottom Elevation (ft)</th>
<th>Permanent Pool Elevation (ft)</th>
<th>Top Elevation (ft)</th>
<th>Forebay Volume (ft³)</th>
<th>Detention Basin Volume (ft³)</th>
<th>Total Extended Dry Basin Volume (ft³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>148.00</td>
<td>148.40</td>
<td>152.00</td>
<td>10,242</td>
<td>25,948</td>
<td>36,190</td>
</tr>
</tbody>
</table>

The peak storm elevation HydroCAD results were evaluated to determine the depth of ponding in the basin to verify the design parameters effectively contain the runoff and meet the minimum freeboard requirements. The peak ponding elevation HydroCAD results are detailed below in Table 10.

<table>
<thead>
<tr>
<th>Pond #</th>
<th>WQ Storm Peak Elevation (ft)</th>
<th>2-Year Storm Peak Elevation (ft)</th>
<th>25-Year Storm Peak Elevation (ft)</th>
<th>100-Year Storm Peak Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>149.06</td>
<td>150.41</td>
<td>150.84</td>
<td>151.11</td>
</tr>
</tbody>
</table>

The hydrocad results confirm that the elevation meets the minimum freeboard requirement and the ponds are sized appropriately.

ii. Pump Discharge (Pond 1)

A series of pumps is installed within pond 1 to divert larger event flows to an infiltration facility within the poplar grove. The pumps utilized are existing onsite 13 and 19 hp flygt pumps. Pump information is included in Appendix F. The first set of pumps is set to activate at flows greater than the Water quality event. This first set of pumps are a 13 and 19 hp pump set up in a manifold to discharge to an 8" force main. This discharge travels approximately 1300 feet to an perforated dispersion pipe anchored to a riprap trench.

The second pump is for emergency high flow events. It is a 13 hp flygt pump and is activated during events larger than the 2 year storm event. It is connected to a 6" force main that discharges approximately 175 feet into the poplar grove.
iii. Outlet Control (Pond 1)

The outlet control structure of the extended dry basin consists of a water quality control orifice, broad-crested rectangular weir and outlet culvert. The water quality control orifice was designed to achieve a 48 hour drawdown in the detention basin. The weir was set to convey flows larger than the water quality event into an outlet pipe to the downstream facilities. The sizing of the control structure is detailed in in the Post Development Hydrocad report in Appendix E.

iv. Detention Basin (Pond 2)

The detention basin receives flow from pond 1, the north road swale and the southern area of the front entrance. This pond is designed as a trapezoidal basin with 3:1 side slopes, 4-foot depth, including 0.3 foot permanent pool depth. It was sized to provide attenuation of flows to match the pre and post development runoff rates at the front entrance outfall (see dispersion trench analysis below). This pond will contain the volume of runoff from the 100-year, 24-hour storm and maintain a minimum 1-foot freeboard from the 25-year, 24-hour storm water surface elevation.

<table>
<thead>
<tr>
<th>Pond #</th>
<th>Bottom Elevation (ft)</th>
<th>Permanent Pool Elevation (ft)</th>
<th>Top Elevation (ft)</th>
<th>Pond Volume (ft³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>147.50</td>
<td>147.80</td>
<td>151.00</td>
<td>12,600</td>
</tr>
</tbody>
</table>

v. Outlet Control (Pond 2)

The outlet control structure of the detention pond consists of a water quality control orifice, broad-crested rectangular weir and outlet culvert. The water quality control orifice was designed to provide attenuation of design flow events while maintaining freeboard within the detention pond. The weir was set to convey flows larger than the water quality event into an outlet pipe to the downstream facilities. The sizing of the control structure is detailed in the Post Development Hydrocad report in Appendix E.

vi. Flow-Splitter Manhole

The flow-splitter manhole was designed to convey runoff from all basins and route the water quality flow into the water quality swale (exit) and remaining flow into the dispersion trench. The HydroCAD results are detailed below in Table 12.
Table 12: Flow-Splitter Manhole HydroCAD Results

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Outflow into Swale (cfs)</th>
<th>Outlet Velocity into Swale (ft/s)</th>
<th>Outflow into Dispersion Trench (cfs)</th>
<th>Outlet Velocity into Dispersion Trench (ft/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality Storm</td>
<td>0.32</td>
<td>1.92</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>25-Year Storm</td>
<td>1.68</td>
<td>4.82</td>
<td>15.31</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Sizing details for the flow-splitter manhole are included in the Post Development HydroCAD report in Appendix E.

vii. Sampling Manhole

A 48" diameter sampling manhole is installed prior to the outfall to the dispersion to allow for sampling of flows prior to discharge. The sampling manhole is designed with a 6" interior drop to allow for collection of flowing water from the upstream system.

viii. Dispersion Trench

The dispersion trench is the most downstream facility in the stormwater design and receives runoff from all basins, receiving flow directly from the water quality swale (exit) and the flow-splitter manhole. The dispersion trench was designed as a 130-foot long broad-crested rectangular weir. The detention requirements to manage post development runoff at predevelopment rates is summarized in Table 13. The runoff at 25-year, 24-hour results from HydroCAD are detailed below in Table 14.

Table 13: Pre and Post Development Runoff Rates

<table>
<thead>
<tr>
<th>Design Storm</th>
<th>Pre-Development Peak Runoff Rates (cfs)</th>
<th>Post-Development Peak Runoff Rates (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6.04</td>
<td>5.85</td>
</tr>
<tr>
<td>10</td>
<td>13.21</td>
<td>12.62</td>
</tr>
<tr>
<td>25</td>
<td>16.13</td>
<td>15.30</td>
</tr>
</tbody>
</table>
Table 14: Dispersion Trench 25-Year, 24-Hour HydroCAD Results

<table>
<thead>
<tr>
<th>25-Year Storm Peak Flow (cfs)</th>
<th>25-Year Storm Peak Volume (ft³)</th>
<th>Outlet Velocity (ft/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.30</td>
<td>180,528</td>
<td>0.95</td>
</tr>
</tbody>
</table>

The HydroCAD results confirm the 2, 10 and 25-year storm peak pre-development runoff rates do not exceed the post-development runoff rates per CWS standards section 4.03.4 (b). Sizing details for the dispersion trench are included in the Post Development Hydrocad report in Appendix E.

C. Conveyance

The stormwater conveyance system was designed in accordance with Chapter 5 of CWS Design and Construction Standards and the ODOT Hydraulics Manual. The diameter of the circular conduit needed to convey full flow was calculated based on the 25-year post development peak rate of runoff calculated from HydroCAD. The conveyance system was designed as a gravity flow system.

The proposed mainline storm sewer, extending from the pre-treatment manhole, through the extended dry basin, water quality manhole, flow-splitter manhole and finally into the dispersion trench is a 24 inch diameter PVC pipe. The majority of the mainline pipe will be installed at a minimum 0.39% slope. A 24” diameter pipe installed at this slope has a capacity of approximately 18.5 cfs. The 25 year design storm peak flow within this culvert is 15.31cfs. The calculations for the mainline storm sewer are detailed in the Post Development Hydrocad report in Appendix E.

The receiving channels of the outlets were designed to be protected with Class 50 riprap, placed over a woven geo-textile fabric at scour critical areas, to reduce the velocity of flow into the receiving channel.

IV. CONCLUSION

The following conclusions summarize the results of the drainage analysis and design:

- The drainage design criteria and analysis used for the drainage calculations satisfy the requirements of Clean Water Services Design and Construction Standards.
Riverbend Landfill Front Entrance Improvements  
Facility Surface Water Drainage Report

- The final full build-out of the proposed landfill configuration at closure, including the drainage structures, was designed by GeoSyntec. The final cover drainage structures are not included in this report.

- Detention pond capacities and outlets are designed in accordance with the rules for the 25-year peak rainfall event and will also accommodate the peak runoff from the 100-year rainfall event.

- Storm sewer capacities and outlets are designed in accordance with the rules for the 25-year peak rainfall event.

- The proposed entrance improvements will not adversely alter existing or current permitted drainage patterns.
REFERENCES


APPENDIX D
COST ESTIMATE
## Tier II Compliance - Storm System Modification Infrastructure Costs

3/23/2017 Basil Orechwa PE, GLA - Beaver Dam, WI

<table>
<thead>
<tr>
<th>Costs without Filters &amp; Treatment Swale Work</th>
<th>$ Unit</th>
<th>$ Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 LF 12&quot; Storm Sewer</td>
<td>$45</td>
<td>$5,400</td>
</tr>
<tr>
<td>218 LF 24&quot; Storm Sewer</td>
<td>$65</td>
<td>$14,170</td>
</tr>
<tr>
<td>5 Each Storm Manholes</td>
<td>$4,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>3 Each MH Connections</td>
<td>$2,000</td>
<td>$6,000</td>
</tr>
<tr>
<td>1 LS Site Restoration</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>Contingencies</td>
<td>15% $9,835.50</td>
<td></td>
</tr>
</tbody>
</table>

Cost Subtotal without Swale Work $75,406