CCR Rule Operating Criteria | §257.81
Run-on and Run-off Control for CCR Landfills

Final

Coal Combustion Residual Landfill
Hunter Power Plant
Castle Dale, Utah

October 7, 2021

PREPARED FOR

PacifiCorp
1407 West North Temple
Salt Lake City, UT 84116
(801) 521-0376
Fax (801) 220-4748

PREPARED BY

Tetra Tech
4750 West 2100 South
Suite 400
Salt Lake City, UT 84120

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify, as a Professional Engineer in the State of Utah, that the information in this document was assembled under my direct supervisory control. This report is not intended or represented to be suitable for reuse by PacifiCorp or others without specific verification or adaptation by the Engineer.

I hereby certify, as a Professional Engineer in the State of Utah that this report has been prepared in accordance with and meets the requirements of 40 Code of Federal Regulations §257.81.

Chad Tomlinson

October 7, 2021

Chad Tomlinson, P.E. Date

PROFESSIONAL ENGINEER
Chad Tomlinson
No. 4777863-2202
CHAD TOMLINSON
10/7/2021
STATE OF UTAH

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1. INTRODUCTION

The Hunter Power Plant is located approximately 2.5 miles south of Castle Dale, Utah. The site vicinity is shown on **Figure 1**.

This report addresses the requirements of §257.81 – Run-on and Run-off Controls for CCR Landfills [1], as it pertains to the Coal Combustion Residual Landfills at the Plant and represents the first 5-year periodic assessment. The purpose of this assessment is to confirm that the previous analyses and designs and initial Run-On and Run-Off assessment for the CCR Landfill still complies with the requirements of §257.81.

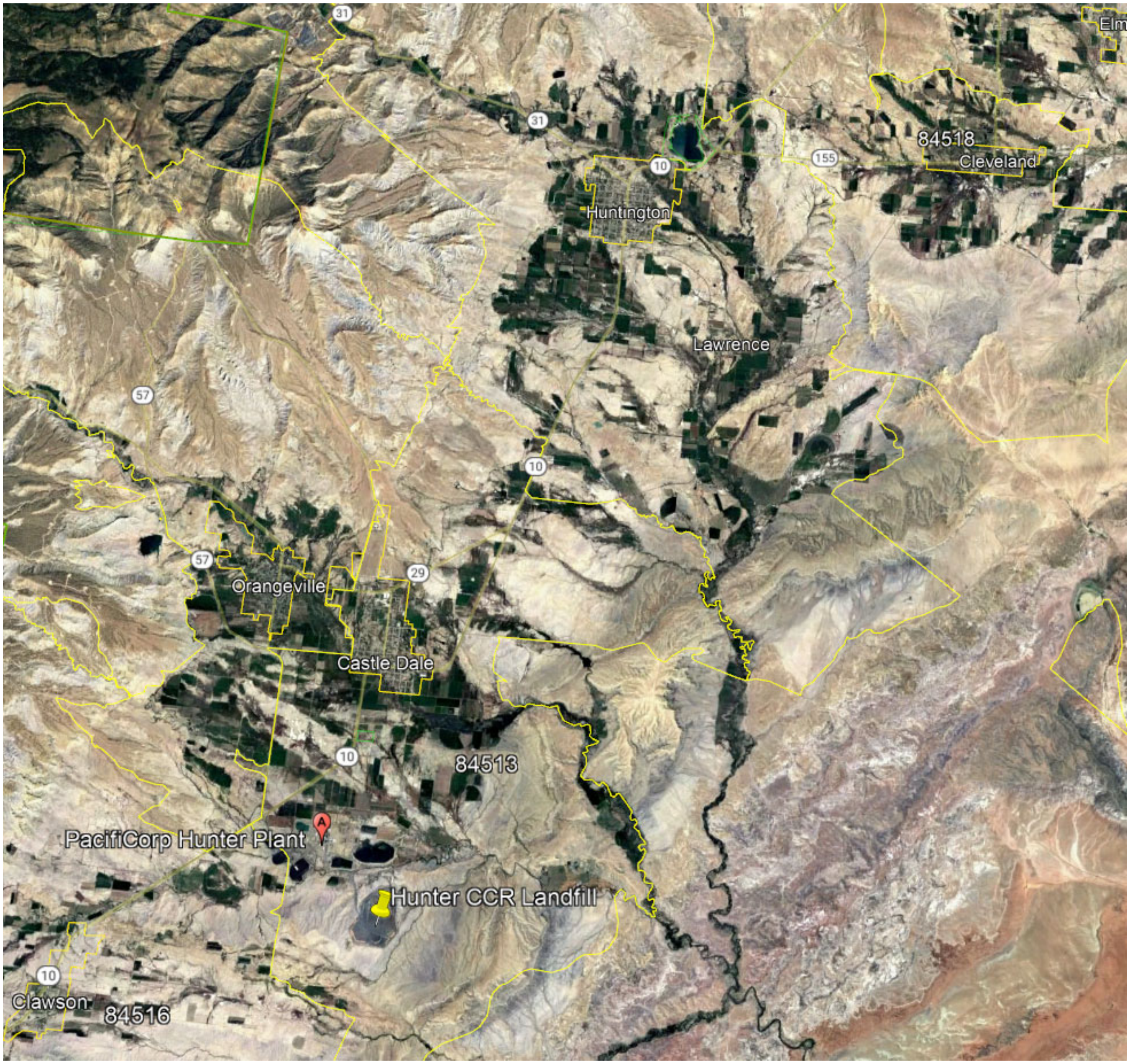

Figure 1. Hunter Power Plant Vicinity Map

2. EXISTING CONDITIONS

The PacifiCorp Hunter Power Plant is a coal-fueled steam-electric operation with three operating units having a total generating capacity of 1,577.2 MW. The CCR Landfill is located approximately 1.4 miles southeast of the plant. The majority of the CCR Landfill is used for disposal of dry bottom ash, fly ash, and flue gas desulfurization (FGD) material with a smaller portion permitted as a Class IIIb Industrial Waste Landfill (see **Figure 2**).

The CCR Landfill occupies approximately 230 acres and includes existing access roads, perimeter ditch and the zero-discharge stormwater retention basin (104 acre-ft capacity). Based on a review of design documents, the total capacity of the CCR Landfill is 44.5 million cubic yards (MCY).

Based on the annual inspection of the CCR Landfill on August 24, 2021, conducted in accordance with the requirements of §257.84(b), Tetra Tech did not find any changes in the operation and construction of the CCR Landfill that deviated from the designs discussed in this assessment. Tetra Tech confirmed that all the stormwater control features were being maintained in a manner to conserve their design capacity.

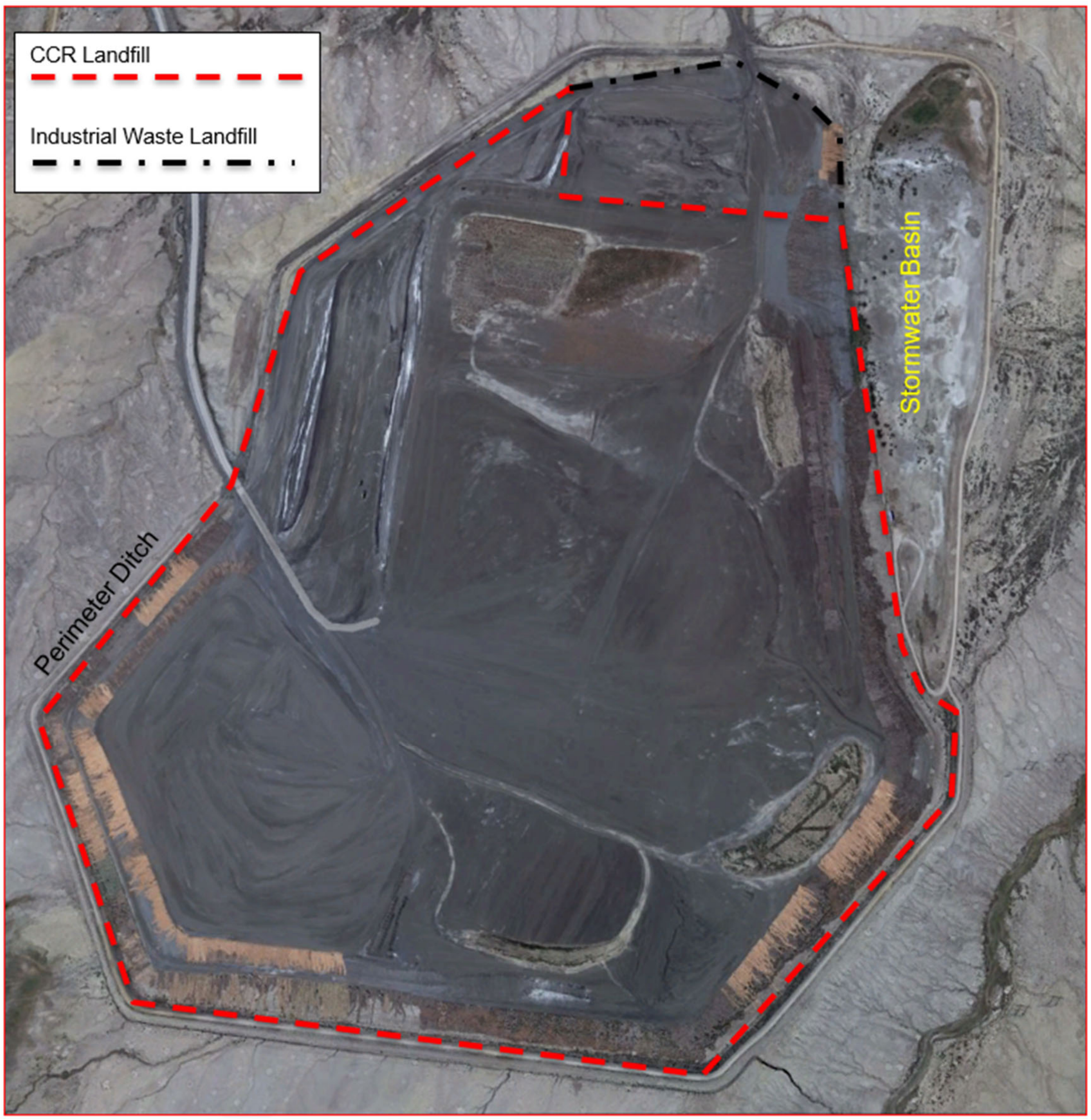

Figure 2. Hunter Power Plant CCR Landfill Layout

3. RUN-ON / RUN-OFF PLAN

3.1 Introduction

Run-on and run-off controls for the CCR Landfill are presented in the Hunter Plant CCR Landfill Draft Basis of Design Memorandum and CCR Landfill Design Documents prepared by URS dated November 2015 and December 2015, respectively [2,3]. The Run-On and Run-Off Control System Plan provided herein is based on a review and assessment of the drawings and design calculations prepared by URS and the initial Run-On and Run-Off Control System Plan prepared by URS in September 2016 [4] in accordance with §257.81 Run-on and Run-off Controls [1].

3.2 CCR Rule Requirements

Rule §257.81 requires CCR regulated landfills to adequately collect and manage run-off from a 24-hour, 25-year storm, and maintain a run-on control system to prevent upland run-off from entering a landfill. Run-on, as defined by the EPA, includes any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill. Run-off, as defined by the EPA, includes any rainwater, leachate, or other liquid that drains over land from any part of a CCR landfill. The rule also requires that the run-on and run-off systems be supported by adequate design documentation and calculations certified by a registered professional engineer.

3.3 Run-Off Control System

The design of the CCR Landfill was developed to control the direction and velocity of run-off to prevent erosion. During operation of the landfill this is achieved by sloping the CCR Landfill surface to maintain a positive slope toward the edges and collecting the water in perimeter channels located at the toe of the slopes. The perimeter drainage channels ultimately discharge to the stormwater basin. Refer to **Figure 3** for a layout of the Landfill and run-off control features.

As part of the closure of the CCR Landfill, each area will be sloped to prevent ponding of stormwater (to minimize infiltration into the CCR Landfill), and the positive slopes for each watershed drain to channels installed on two 20-foot wide benches, one at elevation 5700 ft above mean sea level (amsl) and one at 5750 ft amsl, to collect side slope drainage. The benches will be sloped inwards towards the Landfill. The run-off from the benches and from upstream slopes will be collected in rock lined ditches and routed to the downdrains. The downdrains consist of rock-lined chutes to dissipate energy, underlain by a geotextile liner and a permeable bedding layer to prevent erosion of the underlying cover and CCR materials.

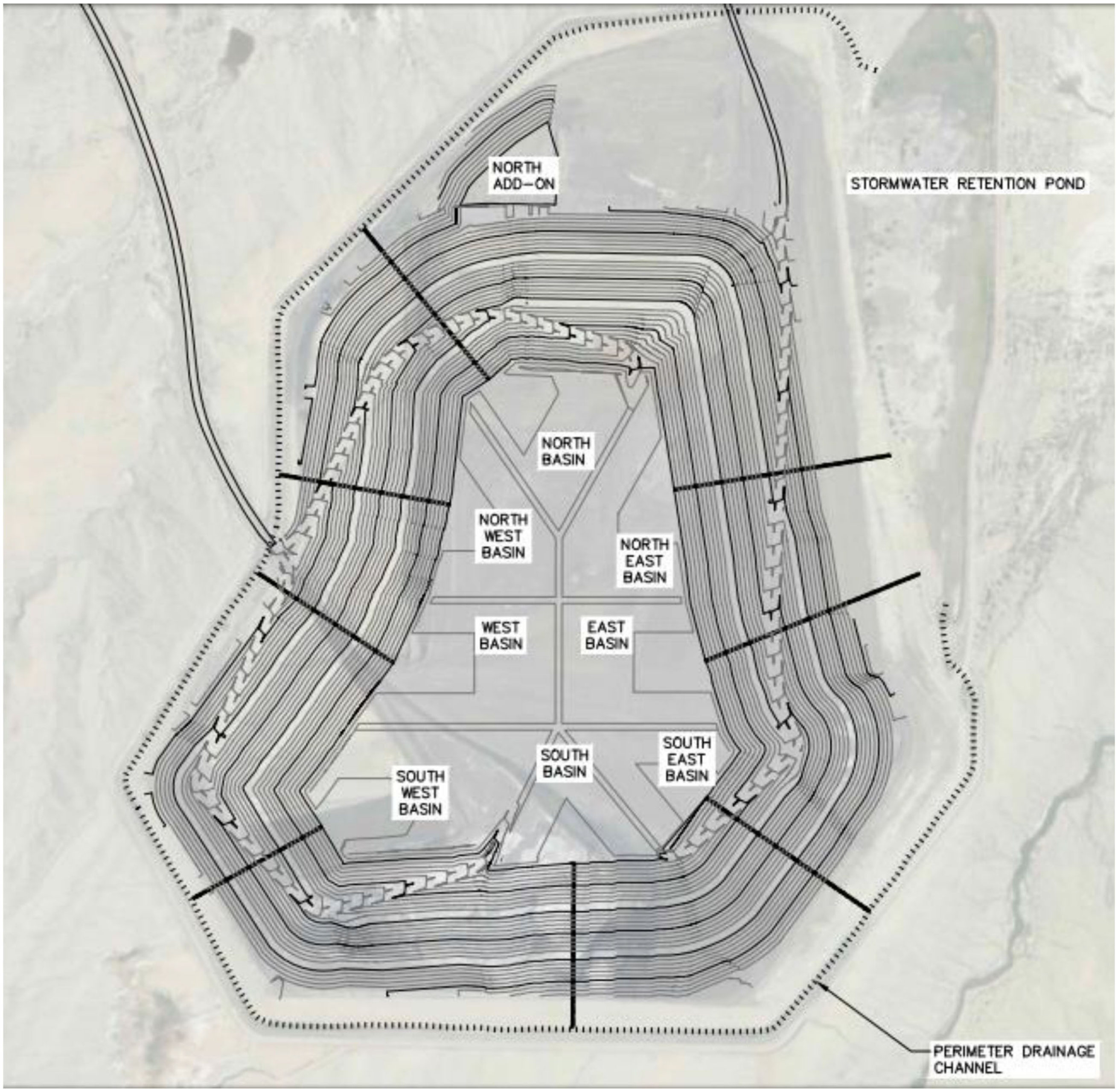

Figure 3. Watershed Delineations of the CCR Landfill

Each downdrain includes stilling basins at the benches and at the connections to the perimeter drainage channel. The rock-lined stilling basins were designed to create a hydraulic jump to dissipate energy from the water. **Figure 4** shows a detail of the chute and stilling basin design based on the guidance in Design of Rock Chutes [5]. At the time of the August 24, 2021 inspection, Tetra Tech did not observe that the benches, side slope channels or downdrains had been constructed. However, it was confirmed that these features would be constructed as part of the final closure of the various areas of the CCR Landfill. Tetra Tech did confirm that all surface water run-off from the landfill was being effectively collected in the perimeter ditches.

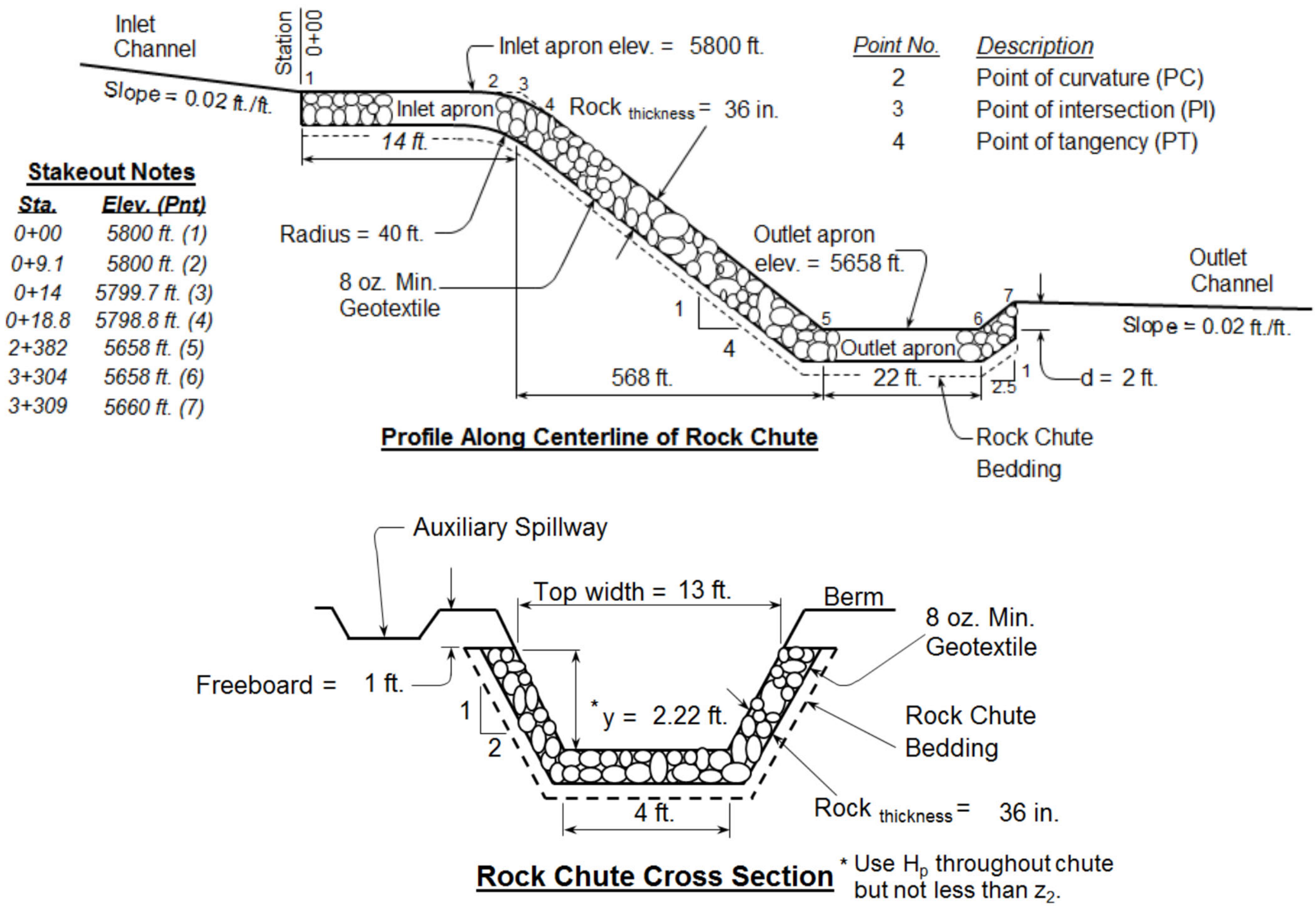

Figure 4. Typical Chute and Stilling Basin from Design of Rock Chutes

Culverts have been installed where downdrains cross haul roads. Culverts and channels were designed to convey water at low velocity and have an impermeable liner. Culverts and channels will include rock material to dissipate energy and prevent erosion or transport of materials as detailed in the Design Documents [3].

3.4 Run-On Control System

Due to the location of the CCR Landfill and the surrounding topography of the area, adjacent off-site areas primarily drain away from the site. The perimeter ditch system described above has been constructed with a berm on the west side to prevent surface water from running on to the CCR Landfill. On the southern side of the landfill, a ditch has been constructed to intercept run-on and graded to covey run-on away from the site.

3.5 Design Storm

The 25-year, 24-hour design storm rainfall depth is required to meet the CCR rule requirements. All temporary diversion ditches and berms have been designed for this storm event. The downdrains, stilling basins, culverts, roadways, and benches were also design for this storm event. The permanent perimeter drainage channel and stormwater retention pond have been designed based on a 100-year, 24-hour storm which exceeds CCR rule requirements. The storm events were modeled with a SCS Type II distribution hyetograph. The design rainfall depth was determined from the latest National Weather Service Rainfall Atlas for Utah (Atlas 14, Volume I) [4]. The 25-year, 24-hour rainfall depth for the Hunter Plant vicinity was determined to be 1.82 inches. The existing stormwater retention basin and perimeter drainage channels have been constructed to accommodate a 100-year, 24-hour rainfall depth which for the Hunter Plant vicinity was determined to be 2.23 inches. Based on Tetra Tech's review of the 100-year 24-hour and 25-year 24-hour storm event for the site, the actual rainfall depth is reported as 2.24 and 1.83 inches; however, these minor discrepancies between storm event depths do not have a material impact on the sizing of the stormwater run-on and run-off system features.

3.6 Hydrologic and Hydraulic Analysis

The Hydrologic and Hydraulic modeling was performed by URS [3] and have been reviewed by Tetra Tech. The Soil Conservation Service (SCS) Technical Release 55 (TR-55) method was selected to model hydrology and time of concentration. Run-off losses were modeled using the SCS Runoff Curve Number (CN) Method. For concentration times, TR-55 methodology was used to calculate sheet and shallow flows, and Manning's Equation was used to calculate channelized flow.

The final cover material for the CCR Landfill will consist of 24 inches of compacted native soils overlaid by six inches of native topsoil and revegetated with a combination of native grasses [6]. A CN of 88 was selected to represent the surface of the CCR Landfill. Although information pertaining to the cover material was not available, a curve number of 88, which corresponds to a natural desert landscape based on a hydrologic soil group D is appropriate.

The permanent drainage ditches of the CCR Landfill and the stormwater retention pond were sized for the 100-year, 24-hour storm, and the stormwater retention pond was designed to adequately store 120% of the run-off from that storm. The additional 20% capacity accounts for sediment which may enter the stormwater retention pond with the run-off. This exceeds the requirements of the CCR rule.

Over the course of the 25-yr, 24-hour storm the peak flows are adequately conveyed by the temporary drainage ditches, permanent drainage ditches, and stored in the stormwater retention pond without any overtopping.

3.5.1 Perimeter Drainage Channel Design

The perimeter drainage channel currently collects run-off from the graded slopes and conveys it to the stormwater retention pond. A high point exists in the southwest corner of the Landfill and a northwest and southeast channel segment drain from the high point around the CCR Landfill to the stormwater retention pond. The calculated 100-year, 24-hour peak flow is 175.36 cubic feet per second (cfs) for the northwest segment and 80.72 cfs for the southeast segment. The channel size and geometry varies. Previous investigations by URS [3] indicated sections of the channel have been silted in and did not provide the necessary flood carrying capacity. A 2 ft minimum channel depth and 4-foot minimum bottom width with 3:1 side slopes is required to carry the peak flows without overtopping. A site inspection performed by Tetra Tech documented that channel segments are currently free of sediment and meet these geometric requirements to contain the peak flows.

The northwest perimeter drainage channel is culverted under two haul roads. The culverts are designed to convey the 100-year, 24-hour peak flow within the channel. The western culvert has a smaller tributary area and is designed for 55 cfs. The northern culvert has a larger tributary area and is designed for 175 cfs. Modeling by URS [3] indicated that both culverts overtopped when subject to the 100-year, 24-hour peak flows. Ponded water at the western culvert inlet remains on site and, therefore, was determined to not require replacement. Ponded water at the northern culvert inlet flows off site and, therefore, was directed to be upgraded to a 4-foot diameter culvert. Tetra Tech's site inspection confirmed that this upgrade is complete.

3.5.2 Bench Drainage Ditch Design

The bench drainage ditches were designed to convey runoff collected on two benches constructed around the Landfill at elevations 5700 ft and 5750 ft to the nearest downdrain. The flow capacity of the bench drainage ditch is 1.76 cfs. The flow capacity of the bench drainage ditch, including the capacity of the inward sloping bench, is 35.60 cfs. The greatest bench drainage ditch 25-year, 24-hour peak flow was calculated to be 11.23 cfs and the 100-year, 24-hour peak flow was calculated to be 15.57 cfs. Runoff from both storm events can be contained on the benches. During Tetra Tech's August 24, 2021 inspection, the bench drainage ditches had not been constructed as the CCR Landfill is still in operation. These bench drainage ditches will be installed as part of the final closure of the CCR Landfill.

3.5.3 Downdrains and Stilling Basin Designs

The downdrains, once installed as part of the final closure, will convey runoff from the top of the CCR Landfill and the bench drainage ditches down the CCR Landfill sideslopes and into the perimeter drainage channels. Stilling basins will be installed and will serve as energy dissipators and will be constructed where the downdrains cross the benches and terminate in the perimeter drainage channel. Several downdrains are culverted under the Landfill haul roads.

3.5.4 Stormwater Retention Pond Design

The stormwater retention pond was designed and constructed to retain all surface water run-off throughout development of the CCR Landfill. The stormwater retention pond was sized to contain run-off from the 100-yr 24-hr storm event and has a total capacity of 104 acre-ft. It also includes an overflow system to prevent overtopping during extreme events. During Tetra Tech’s inspection, plant personnel indicated that they have never observed ponded water throughout the entire extent of the stormwater retention basin. Tetra Tech also observed that there was negligeable deposition of sediment in the stormwater retention pond suggesting that the original design capacity has been preserved.

3.7 Stormwater Best Management Practices

Per the CCR Rule, under Section 257.81(b), storm water best management practices (BMPs) shall be employed at the site to comply with CFR 257.3-3, which stipulates that a facility shall not cause a discharge of pollutants, dredged material, or fill material to waters of the United States or cause non-point source pollution of waters of the United States. The collection of all storm water on the active portion of the CCR Landfill, as discussed earlier in this section, is performed with drainage channels and a single stormwater retention pond.

3.8 Compliance Summary

The run-on and run-off control system plan described above meets the requirements of §257.81.

4. SOURCE(S)

[1] Environmental Protection Agency (EPA) 40 CFS § 257 Disposal of Coal Combustion Residuals from

[2] Electric Utilities. Dated April 17, 2015. 201 pp.

[3] URS, 2015. Hunter Power Plant CCR Landfill Draft Basis of Design Memorandum. November 2015

[4] URS, 2015. Hunter Plant PacifiCorp CCR Landfill Design Documents. December 2015.

[5] URS, 2016. Run-On and Run-Off Control System Plan Hunter Power Plant. Coal Combustion Residual Landfill. September 2016.

[6] Design of Rock Chutes, 1998. Robinson, Rice, Kadavy, ASAE.

[7] CCR Landfill Closure Plan Hunter Power Plant. Coal Combustion Residual Landfill. Revision 3. January 2017

5. REVISIONS

Revision Number	Date	Revision Made	By Whom
B	9/14/2021	Draft Issued to PacifiCorp	Chad Tomlinson
0	10/7/2021	Final Issued to PacifiCorp (revised per comments received)	Chad Tomlinson

APPENDIX A: NOAA Atlas 14, Volume 1, Version 5 | Point Precipitation Frequency Estimates for Hunter Plant CCR Landfill

NOAA Atlas 14, Volume 1, Version 5
Location name: Castle Dale, Utah, USA*
Latitude: 39.1561°, Longitude: -111.0125°
Elevation: 5626.99 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.104** (0.090-0.124)	**0.134** (0.116-0.159)	**0.187** (0.161-0.221)	**0.234** (0.199-0.278)	**0.310** (0.256-0.368)	**0.378** (0.306-0.451)	**0.458** (0.362-0.548)	**0.550** (0.422-0.663)	**0.696** (0.509-0.854)	**0.826** (0.584-1.03)
10-min	**0.159** (0.136-0.188)	**0.204** (0.176-0.242)	**0.285** (0.244-0.336)	**0.357** (0.303-0.424)	**0.472** (0.390-0.560)	**0.575** (0.465-0.686)	**0.697** (0.551-0.834)	**0.837** (0.642-1.01)	**1.06** (0.775-1.30)	**1.26** (0.889-1.56)
15-min	**0.197** (0.169-0.233)	**0.253** (0.218-0.300)	**0.353** (0.303-0.416)	**0.442** (0.376-0.525)	**0.585** (0.484-0.695)	**0.713** (0.577-0.851)	**0.864** (0.683-1.03)	**1.04** (0.796-1.25)	**1.31** (0.961-1.61)	**1.56** (1.10-1.94)
30-min	**0.265** (0.228-0.314)	**0.340** (0.294-0.404)	**0.475** (0.408-0.561)	**0.595** (0.507-0.707)	**0.788** (0.651-0.936)	**0.961** (0.776-1.15)	**1.16** (0.919-1.39)	**1.40** (1.07-1.69)	**1.77** (1.29-2.17)	**2.10** (1.48-2.61)
60-min	**0.328** (0.282-0.389)	**0.421** (0.364-0.500)	**0.588** (0.505-0.694)	**0.737** (0.627-0.875)	**0.975** (0.806-1.16)	**1.19** (0.961-1.42)	**1.44** (1.14-1.72)	**1.73** (1.33-2.09)	**2.19** (1.60-2.68)	**2.60** (1.84-3.23)
2-hr	**0.393** (0.343-0.457)	**0.496** (0.431-0.578)	**0.669** (0.582-0.778)	**0.828** (0.712-0.961)	**1.08** (0.909-1.26)	**1.31** (1.08-1.54)	**1.58** (1.26-1.86)	**1.89** (1.47-2.25)	**2.39** (1.78-2.90)	**2.85** (2.04-3.51)
3-hr	**0.438** (0.390-0.504)	**0.551** (0.489-0.637)	**0.722** (0.641-0.832)	**0.876** (0.768-1.01)	**1.12** (0.965-1.29)	**1.33** (1.12-1.54)	**1.59** (1.32-1.88)	**1.90** (1.53-2.27)	**2.40** (1.86-2.93)	**2.85** (2.14-3.55)
6-hr	**0.550** (0.494-0.621)	**0.685** (0.617-0.774)	**0.866** (0.777-0.977)	**1.02** (0.910-1.15)	**1.24** (1.09-1.41)	**1.44** (1.25-1.64)	**1.68** (1.43-1.93)	**1.97** (1.64-2.28)	**2.46** (2.00-2.96)	**2.91** (2.31-3.58)
12-hr	**0.665** (0.605-0.735)	**0.823** (0.750-0.913)	**1.02** (0.921-1.13)	**1.18** (1.07-1.31)	**1.40** (1.25-1.56)	**1.58** (1.40-1.76)	**1.77** (1.55-1.99)	**2.01** (1.73-2.31)	**2.49** (2.08-2.99)	**2.94** (2.39-3.62)
24-hr	**0.901** (0.815-0.997)	**1.12** (1.01-1.24)	**1.37** (1.23-1.51)	**1.56** (1.41-1.73)	**1.83** (1.64-2.03)	**2.03** (1.81-2.26)	**2.24** (1.98-2.49)	**2.45** (2.15-2.74)	**2.72** (2.36-3.06)	**2.96** (2.52-3.65)
2-day	**1.01** (0.923-1.12)	**1.25** (1.14-1.38)	**1.52** (1.39-1.68)	**1.74** (1.58-1.92)	**2.04** (1.83-2.24)	**2.26** (2.03-2.49)	**2.49** (2.22-2.77)	**2.72** (2.40-3.03)	**3.03** (2.63-3.40)	**3.26** (2.81-3.69)
3-day	**1.08** (0.988-1.20)	**1.34** (1.22-1.48)	**1.63** (1.48-1.80)	**1.87** (1.69-2.06)	**2.18** (1.96-2.40)	**2.42** (2.17-2.67)	**2.67** (2.37-2.96)	**2.92** (2.57-3.25)	**3.25** (2.81-3.65)	**3.51** (3.00-3.96)
4-day	**1.16** (1.05-1.28)	**1.43** (1.30-1.58)	**1.74** (1.58-1.92)	**1.99** (1.80-2.19)	**2.33** (2.09-2.57)	**2.59** (2.31-2.85)	**2.85** (2.53-3.16)	**3.12** (2.73-3.47)	**3.48** (3.00-3.89)	**3.75** (3.20-4.23)
7-day	**1.29** (1.18-1.42)	**1.60** (1.46-1.77)	**1.95** (1.77-2.13)	**2.23** (2.02-2.43)	**2.59** (2.34-2.83)	**2.87** (2.58-3.14)	**3.16** (2.82-3.46)	**3.43** (3.04-3.79)	**3.80** (3.32-4.24)	**4.08** (3.52-4.59)
10-day	**1.43** (1.31-1.56)	**1.77** (1.62-1.94)	**2.16** (1.98-2.35)	**2.47** (2.25-2.68)	**2.87** (2.60-3.11)	**3.16** (2.85-3.45)	**3.46** (3.10-3.79)	**3.75** (3.33-4.12)	**4.13** (3.62-4.57)	**4.40** (3.83-4.92)
20-day	**1.73** (1.58-1.90)	**2.15** (1.96-2.36)	**2.65** (2.41-2.89)	**3.03** (2.76-3.31)	**3.52** (3.19-3.85)	**3.90** (3.50-4.26)	**4.27** (3.81-4.68)	**4.63** (4.11-5.09)	**5.11** (4.47-5.67)	**5.46** (4.74-6.09)
30-day	**2.05** (1.87-2.25)	**2.54** (2.32-2.78)	**3.08** (2.82-3.37)	**3.50** (3.19-3.81)	**4.03** (3.66-4.39)	**4.42** (3.99-4.81)	**4.79** (4.31-5.24)	**5.16** (4.59-5.66)	**5.61** (4.95-6.20)	**5.94** (5.19-6.61)
45-day	**2.40** (2.20-2.63)	**2.97** (2.73-3.25)	**3.60** (3.31-3.93)	**4.08** (3.74-4.44)	**4.69** (4.28-5.09)	**5.12** (4.66-5.56)	**5.53** (5.01-6.01)	**5.93** (5.34-6.47)	**6.40** (5.72-7.04)	**6.72** (5.98-7.44)
60-day	**2.72** (2.49-2.98)	**3.37** (3.09-3.69)	**4.10** (3.75-4.48)	**4.64** (4.25-5.06)	**5.34** (4.87-5.81)	**5.84** (5.30-6.36)	**6.32** (5.70-6.91)	**6.77** (6.06-7.44)	**7.32** (6.50-8.09)	**7.70** (6.79-8.56)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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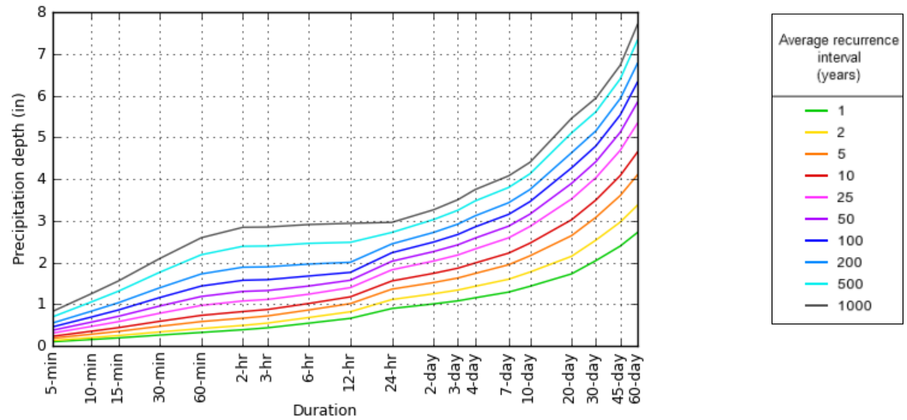
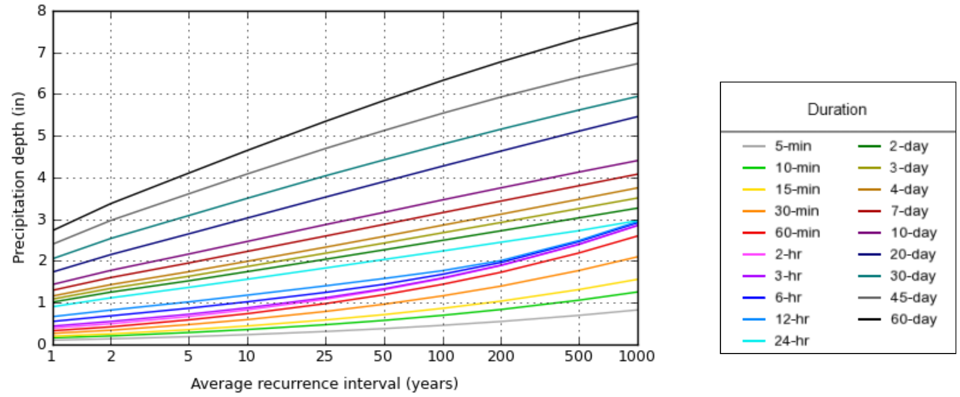
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.1561°, Longitude: -111.0125°





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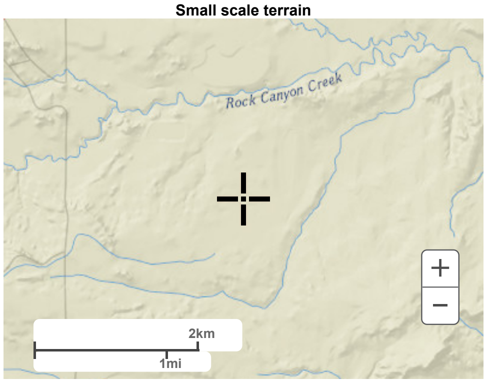
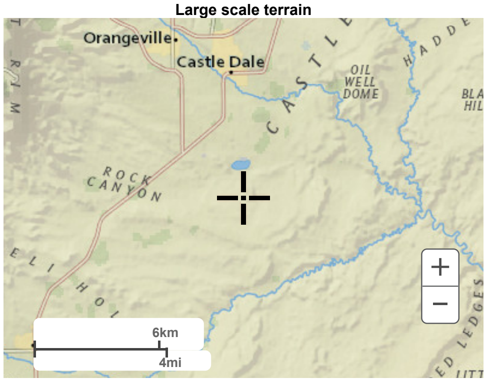
Maps & aerials

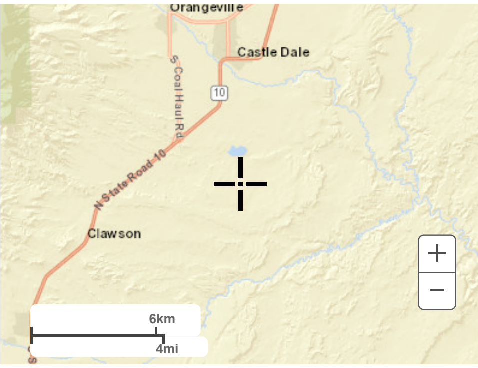
Small scale terrain



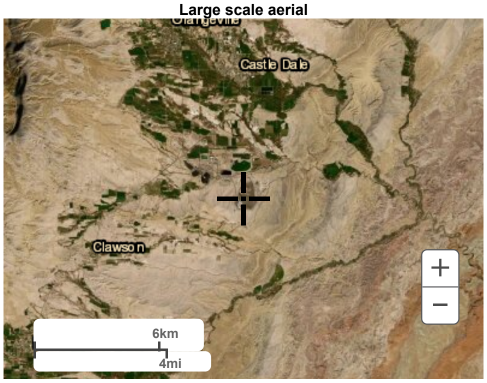
Large scale terrain



Large scale map



Large scale aerial



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