MODULE 13

Module 13: Impoundments/Treatment Facilities

[§§77.457/77.461/77.526/77.531/Chapter 105]

13.1 Treatment

Provide a plan for the treatment of surface and groundwater drainage from the areas disturbed by the mining activities. Include a construction and treatment narrative, flow diagram, design criteria, and design calculations (which include the proposed capacity) of the treatment facilities. Identify treatment chemicals to be used. Do not include any facilities included in Module 12.

<u>Construction and Treatment Narrative</u>:

The initial site development of the Northern Tract Quarry consists of 3 phases. For Phase 1, collection ditches CD-1 and CD-2 will be constructed to allow for initial development and overburden soil removal of the Northern Tract Quarry. Collection Ditch CD-1 collects stormwater runoff from roughly an 11 acre area and Collection Ditch CD-2 collects stormwater runoff from roughly a 33 acre area, of which approximately 3 acres consists of the adjacent access road and approximately 41 acres consists of area available for overburden soil removal. These ditches convey the runoff to the existing Pitts Quarry. The accumulated water in the Pitts Quarry will then be incrementally pumped to the Lower Mill Pond system. Refer to Module 12 for design criteria and calculations related to these ditches.

NT Pond No. 1 and the associated collection ditches CD-3 and CD-4 will be constructed to begin Phase 2 of development. NT Pond No. 1 will collect stormwater runoff from roughly 18 acres of area downstream of Collection Ditch CD-1, of which approximately 3 acres consists of the adjacent access road and approximately 15 acres consists of area available for overburden soil removal. Collected stormwater runoff detained by NT Pond No. 1 will be incrementally pumped to the Pitts Quarry (if needed) and ultimately to the Lower Mill Pond (LMP) system over a period of 2 to 7 days after the occurrence of the storm. Once NT Pond No. 1 and the associated collection ditches are established, overburden removal and development of the Northern Tract Quarry in the Phase 2 area may advance.

NT Pond No. 2 and associated collection ditches CD-5 and CD-6 will be constructed to begin Phase 3 development. The area of overburden removal in Phases 1 and 2 will be maintained to drain towards Pitts Quarry, or into the Northern Tract Quarry. NT Pond No. 2 will collect stormwater runoff from roughly 28 acres of area downstream of collection CD-2 and CD-4, of which approximately 4 acres consists of the adjacent access road and approximately 24 acres consists of area available for overburden removal. Collected stormwater runoff detained by NT Pond No. 2 will be pumped to the Pitts Quarry (if needed) and ultimately to the LMP system over a period of 2 to 7 days after the occurrence of the storm. Once NT Pond No. 2 and the associated collection ditches are established, overburden removal and development of the Northern Tract Quarry in the Phase 3 area may advance.

<u>Design Criteria</u>:

Both NT Pond No. 1 and No. 2 are designed to detain, without discharging, the stormwater runoff from a storm less than or equal to a Soil Conservation Service (SCS) Type II, 24-hour duration, 100-year recurrence interval storm event. Typically, when mining is proposed within a sensitive watershed such as a High Quality (HQ) watershed as designated in 25 Pa. Code Chapter 93, the sedimentation impoundment is required to have the capacity to contain the runoff from a 10-year, 24-hour precipitation event, per the PADEP Engineering Manual for Mining Operations. This requires an impoundment constructed with a minimum total capacity of approximately 8,600 cubic feet per drainage acre. The ponds proposed for the Northern Tract Quarry permit area can store the runoff from the 100-year storm, without the use of any spillway or conveyance structure, and provide 1.5 feet of freeboard. Therefore, the proposed ponds are conservatively sized to provide storm storage capacity that greatly exceeds the minimum requirement.

SCS curve number methodology was used to calculate the stormwater runoff volume for each pond, considering a curve number of 86 (assuming disturbed conditions and hydrologic soil group B) for the runoff area and a rainfall depth of 8.03 inches. Both of the ponds are designed to have 2,000 cubic-feet per drainage acre for sediment storage, consistent with PADEP requirements. Since the ponds are design to detain the 100-year storm event runoff, NT Pond Nos. 1 and 2 have approximately 27,000 cubic-feet per acre and 30,000 cubic-feet per acre of settling volume, respectively. This settling volume is significantly larger than the typical settling volume required by the PADEP of 5,000 cubic feet per acre, minus applicable reductions.

Although not activated for the 100-yr storm event, both ponds are provided with an emergency spillway. The spillways are configured with a riprap lining to preclude uncontrolled erosion in the event of being activated. However, these spillways are not anticipated to be activated except during rare or extreme storm events that exceed a 24-hour duration, 100-year storm event. The ponds are configured to provide sufficient volume to store the volume of the 24-hour, 100-year storm event without the need for any type of dewatering (e.g. via spillway or pumping) during the storm. Thus, the ponds can passively control the 100-year design storm without discharge and be dewatered at a later time

after cessation of the storm. Electric turbine pumps are proposed in each pond to facilitate dewatering of the ponds in 2 to 7 days, and to maintain the ponds' normal pool elevations.

13.2 Quarry/Pit Sump

Provide a description of the sump including size, location, depth, method of pumping, etc. (Key location to Exhibits 6.2 and 9).

The location and size of the quarry sump will vary as mining progresses to the final configuration depicted on Exhibit 9 – Operations Map. Electric turbine pumps with diesel backup capabilities will be maintained in the quarry to transfer water collected in NT Ponds 1 and 2 into the LMP system. Alternately, water collected in NT Ponds 1 and 2 may be pumped directly to the LMP System.

13.3 Dams and Impoundments (General) Do not include any facilities included in Module 12

a) Proposed use. **Collection and Sediment Removal**

b) Map and location (key to maps). **Refer to Exhibit 13 drawings for plans, cross-sections, and details of NT Pond Nos. 1 and 2.**

c) Provide a design report and construction plans and specifications to include detailed cross-sections and plan view scale drawings of the proposed structure which show: principal spillway, dewatering devices, embankment details (including maximum height, top width, and cutoff trench), crest of emergency spillway and existing ground.

Refer to Exhibit 13 drawings for plans, cross-sections, and details of NT Pond Nos. 1 and 2. Additionally, design calculations for each pond, demonstrating how the proposed configurations meet PADEP criteria, are attached to this module.

As discussed in Module 13.1, accumulated water in NT Pond Nos. 1 and 2 will be pumped to the Pitts Quarry (if needed) and ultimately to the LMP system for ultimate discharge into Miney Branch through NPDES Outfall 001 (NPDES Permit PA0009059). The existing LMP system has adequate capacity to accommodate this additional water as discussed in the following section.

Per the NT Pond Calculations provided with this permit application, the anticipated pumping rate at NT Pond No. 1 will range from 400 gallons per minute (gpm) to 1,000 gpm, considering a dewatering time of 7 days to 2 days, respectively, per PADEP requirements. Similarly, NT Pond No. 2 will have a pumping rate ranging from approximately 650 gpm to 1,800 gpm (7 day to 2 day dewatering time). Thus, the total pumping rate tributary to the LMP from the NT Ponds will range from 1,050 gpm to 2,800 gpm, depending on the chosen pump capacities.

The NT Ponds are designed to detain the runoff from a 100-year, 24-hour storm event without discharging. Therefore, the NT Ponds have excess available storage volume that, during normal operations, will allow for temporarily detaining accumulated water in the NT Ponds to accommodate mining operations. Thus, after a storm event, the accumulated water in the NT Ponds could be allowed to remain in the pond for two to five days. Then, the NT ponds could be dewatered in the following two to five days (within seven days total), depending on the chosen pump capacities. This will allow for a staged dewatering process at the LMP system where the runoff that is passively conveyed to the LMP system (the runoff from its tributary watershed) will be discharged from the pond in the short term through the perforated riser spillways, and the accumulated runoff from the NT Ponds and other sources can be pumped to the LMP system at a later time for subsequent release. Once the Northern Tract Quarry is developed such that it will detain water in the bottom of the pit, the ability to complete a staged dewatering process will be improved since the water can be detained in the quarry pit for an even longer duration. Therefore, the discharge rate at NPDES Outfall 001 will be unchanged considering the addition of the pumped water from the proposed NT Ponds.

An evaluation of the LMP system was provided to the PADEP on October 26, 2017 in report titled NPDES Permit No. PA0009059 Application Final Addendum Report. This submission was made in response to comments provided by the PADEP regarding the associated NPDES permit renewal. Per the NPDES report, the total spillway capacity of the LMP system is 775.7 cubic feet per second (cfs), while providing 2 feet of freeboard. The

anticipated pumping rate from the proposed NT Ponds is anticipated to be no greater than 2,800 gpm (1,000 gpm from NT Pond No. 1 and 1,800 gpm from NT Pond No. 2) or 6.2 cfs. As previously mentioned, the NT Ponds are configured so that the water conveyed from these ponds as part of dewatering will be discharged to the LMP system after the storm event has ceased in most cases. However, even if dewatering of the NT Ponds occurred during a storm event at the LMP system, the additional 6.2 cfs of flow is negligible considering the overall discharge capacity of the LMP system.

d) If the impoundment is located outside of the area covered by the geology and hydrology description contained in Modules 7 and 8, include a preliminary geology and hydrology report.

Not Applicable

e) Describe the potential effect on the structure from subsidence from underground mining when applicable.

Not Applicable

f) If the detailed design plans are not included with the initial submittal of this application, identify when the detailed design plans will be submitted. (**Note:** The detailed design plans must be approved by the Department before construction of the structure begins.) **Not Applicable. All detailed design plans are included with this submittal.**

13.4 Class C Dams

A separate permit is required for impoundments that meet one or more of the following:

1) a contributory drainage area exceeding 100 acres;

2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 ft;

3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet.

(**Note:** A permit processing fee of $1500 should be included for structures that meet the above criteria. Permits for impoundments that meet the above mentioned criteria and are to be left in place after mining will be submitted to the Division of Dams Safety, Bureau of Waterways Engineering for their review and approval.)

The proposed NT Pond Nos. 1 and 2 have contributory areas of less than 100 acres, do not include dams that exceed 15 feet in height, and do not impound more than 50 acre-feet at the maximum storage elevation. Therefore, a separate dam permit is not applicable.

13.5 Operation and Maintenance Requirements

Describe the operation and maintenance requirements for the structure, including dewatering of the impoundments following storm events.

The dewatering of NT Pond Nos. 1 and No. 2 is to be maintained by pumping. The ponds will be inspected after every storm event or on a minimum weekly basis. The inspection will entail a visual inspection of the impounded water level and clarity; measurement of the sediment storage level to ascertain its level relative to the maximum permitted sediment cleanout level; observation of the conditions of the emergency spillway, embankment crest, and pond interior and exterior slopes; and observation of other pertinent features of the pond and adjoining areas (such as contributing ditches). The ponds will be dewatered by pumping within 2 to 7 days following a storm event. Physical markers within the pond will provide reference points for identifying when the pond is approaching sediment capacity and requires cleaning. An access road is provided in each pond to facilitate sediment cleanout operations. Sediment will be removed from the ponds as necessary to maintain accumulated sediment levels at or below the prescribed sediment cleanout elevation. The removed sediment will be disposed in approved areas at the Charmian Site.

13.6 Removal

Describe the timetable and plans for removal of the impoundment and reclamation of the area.

Once the Northern Tract Quarry is developed and the contributory areas to the ponds are encompassed within the quarry, and the depth of the quarry can detain the runoff volume from storm events without impacting mining operations, NT Pond No. 1 and NT Pond No. 2 may be removed. The operator will submit a revised E & S plan for approval to the Department prior to removing NT Pond No. 1 and/or NT Pond No. 2. The E & S plan will show that no storm water from the mining area will be directed to Tom's Creek or unnamed tributary to Tom's Creek, located next to Iron Springs Road.

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Mining Programs

POND CERTIFICATION

Permittee Specialty Granules, LLC
Permit No. Pending
Pond NT Pond No. 1
Township Hamiltonban Township
County Adams County, Pennsylvania
Engineer/Land Surveyor D'Appolonia Engineering Division of GTI
Date ______

Instructions: Complete first page and submit with permit application. Use both pages to certify completed impoundment.

Sedimentation ponds and other impoundments must be constructed in accordance with the approved permit before any disturbance of the area to be drained into the pond. Impoundment requiring a Chapter 105 permit or is equal to or greater than 20 acre-feet storage capacity must be inspected during construction under the supervision of, and certified to the Department upon completion of construction by a registered professional engineer. If impoundment does not require a Chapter 105 permit or is less than 20 acre-feet storage capacity, it must be inspected during construction, and certified by a registered professional engineer or a registered professional land surveyor.

Any enlargement, reduction in size, reconstruction, or other modification, that may affect the stability or operation must be approved by the Department. Pond must be certified and approved prior to the start of any other mining activities.

Unless otherwise specified in your permit, use this form for the sedimentation pond and other impoundment certification. Submit 1 original and 2 copies to the appropriate District Mining Office. All information must be provided, otherwise it will be returned for completion.

U.S.G.S. Quadrangle: Iron Springs, Pennsylvania___Location (point of discharge): Latitude 39° 46′ 9.2″;Longitude77° 26′ 37.9″ or
Location from ***Bottom Right*** corner of U.S.G.S. Quadrangle: - inches North; - inches West
HYDROLOGY: Drainage Area 18.37 acres Design Storm 100-yr Average Watershed Slope 0.25 ft/ft
Land Use Unmanaged Forestland Soil Type HSG B Curve Number 86 (Disturbed) Peak Discharge 0 cfs (100-yr storm)

		Permit Application	***As Constructed***
Embankment	Top Width (Minimum)	12 ft	
	Outside Slope (Maximum) (_H: _ V)	2H:1V	
	Inside Slope (Maximum)	2H:1V	
	Top Elevation	1060.0	
	Bottom Elevation	1045.0	
	Upstream Toe Elevation	1058.5	
	Downstream Toe Elevation	1048.5	
	Type of Cover	Vegetated/Coarse Aggregate	
	Incised Slope (if any)	Yes	
	Inside Slope (Maximum) (_H: _V)	2H:1V	
	Top Elevation	1060	
	Bottom Elevation	1045.0	
Principal Spillway	Type	See Dewatering Device	
	Conduit Diameter (if barrel/riser give both)	N/A	
	Inlet Elevation	N/A	
	Outlet Protection	N/A	
	Spillway Capacity	N/A	
Dewatering Device	Type/Size	Pumping System	
	Inlet Elevation	1047.0	
	Discharge Regulation (ie., self draining or valved)	-	
	Discharge Capacity (cubic feet/second)	0.89 to 2.23 cfs (400 to 1000 gpm)	
	Time to Dewater Full Pond	2 to 7 days	
Emergency Spillway	Type	Open Channel Spillway	
	Width	8 ft	
	Depth (with 2 feet of freeboard)	1.5 ft	
	Length	24 ft	
	Sideslopes	10H:1V	
	Crest Elevation	1058.5	
	Slope	0.0 ft/ft	
	Type of Lining/Protection	R-3 Riprap/AASHTO No. 57	
	Spillway Capacity (provide design calculations)	21 cfs at El 1059.5	
Storage Capacity	Length @ Bottom	802 ft	
	Width @ Bottom	12 ft to 33 ft	
	Length @ Crest of Emergency Spillway	862 ft	
	Width @ Crest of Emergency Spillway	65.5 ft to 87 ft	
	Volume @ Crest of Emergency Spillway	537,159 cf (12.33 ac-ft)	

Permittee ______________________________

Permit No. ______________________________

Pond ______________________________

Township ______________________________

County ______________________________

TO BE COMPLETED AFTER CONSTRUCTION

1. Has the facility been constructed at the location shown in the approved permit? ☐ Yes ☐ No
2. Is the emergency spillway constructed at the location shown in the approved plan? ☐ Yes ☐ No
3. Is the principal spillway constructed at the location shown in the approved plan? ☐ Yes ☐ No
4. Are the collection channel inlets constructed with adequate inlet protection and at the location shown in the approved plan? ☐ Yes ☐ No
5. Identify any conditions or deficiencies in the facility that need to be corrected.

Construction Inspection

Stage of Construction (specify stage e.g. layout, impoundment/embankment construction, spillway/piping installation)	**Date of Inspection**	**Inspected By**

Supervising Professional Engineer/Registered Professional Land Surveyor ______________________________

Address ______________________________

____

Telephone Number ______________________________

I certify in accordance with 25 Pa Code Section 77.531 that the above-mentioned structure is complete and has been constructed.

____

Signature of Registered Professional Engineer/Registered Professional Land Surveyor Date

____

Registration Number and Expiration Date

SEAL

______________________________ ______________________________

Signature of Permittee or Responsible Official Date Title

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Mining Programs

POND CERTIFICATION

Permittee Specialty Granules, LLC
Permit No. Pending
Pond NT Pond No. 2
Township Hamiltonban Township
County Adams County, Pennsylvania
Engineer/Land Surveyor D'Appolonia Engineering Division of GTI
Date

Instructions: Complete first page and submit with permit application. Use both pages to certify completed impoundment.

Sedimentation ponds and other impoundments must be constructed in accordance with the approved permit before any disturbance of the area to be drained into the pond. Impoundment requiring a Chapter 105 permit or is equal to or greater than 20 acre-feet storage capacity must be inspected during construction under the supervision of, and certified to the Department upon completion of construction by a registered professional engineer. If impoundment does not require a Chapter 105 permit or is less than 20 acre-feet storage capacity, it must be inspected during construction, and certified by a registered professional engineer or a registered professional land surveyor.

Any enlargement, reduction in size, reconstruction, or other modification, that may affect the stability or operation must be approved by the Department. Pond must be certified and approved prior to the start of any other mining activities.

Unless otherwise specified in your permit, use this form for the sedimentation pond and other impoundment certification. Submit 1 original and 2 copies to the appropriate District Mining Office. All information must be provided, otherwise it will be returned for completion.

U.S.G.S. Quadrangle: Iron Springs, Pennsylvania Location (point of discharge): Latitude 39° 46′ 4.8″; Longitude 77° 26′ 9.2″ or
Location from ***Bottom Right*** corner of U.S.G.S. Quadrangle: - inches North; - inches West
HYDROLOGY: Drainage Area 28.19 acres Design Storm 100-yr Average Watershed Slope 0.25 ft/ft
Land Use Unmanaged Forestland Soil Type HSG B Curve Number 86 (Disturbed) Peak Discharge 0 cfs (100-yr storm)

		Permit Application	***As Constructed***
Embankment	Top Width (Minimum)	12 ft	
	Outside Slope (Maximum) (_H: _ V)	2H:1V	
	Inside Slope (Maximum)	2H:1V	
	Top Elevation	1010.0	
	Bottom Elevation	995.0	
	Upstream Toe Elevation	1004.5	
	Downstream Toe Elevation	998.5	
	Type of Cover	Vegetated/Coarse Aggregate	
	Incised Slope (if any)	Yes	
	Inside Slope (Maximum) (_H: _V)	2H:1V	
	Top Elevation	1075.0	
	Bottom Elevation	995.0	
Principal Spillway	Type	See Dewatering Device	
	Conduit Diameter (if barrel/riser give both)	N/A	
	Inlet Elevation	N/A	
	Outlet Protection	N/A	
	Spillway Capacity	N/A	
Dewatering Device	Type/Size	Pumping System	
	Inlet Elevation	997.0	
	Discharge Regulation (ie., self draining or valved)	-	
	Discharge Capacity (cubic feet/second)	1.45 to 4.01 cfs (650 to 1,800 gpm)	
	Time to Dewater Full Pond	2 to 7 days	
Emergency Spillway	Type	Open Channel Spillway	
	Width	8 ft	
	Depth (with 2 feet of freeboard)	1.5 ft	
	Length	18 ft	
	Sideslopes	10H:1V	
	Crest Elevation	1008.5	
	Slope	0.0 ft/ft	
	Type of Lining/Protection	R-3 Riprap/AASHTO No. 57	
	Spillway Capacity (provide design calculations)	21 cfs at El 1008.5	
Storage Capacity	Length @ Bottom	1286 ft	
	Width @ Bottom	13 ft to 23 ft	
	Length @ Crest of Emergency Spillway	1346 ft	
	Width @ Crest of Emergency Spillway	62 ft to 97 ft	
	Volume @ Crest of Emergency Spillway	910,367 cf (20.90 ac-ft)	

Permittee ______________________

Permit No. ______________________

Pond ______________________

Township ______________________

County ______________________

TO BE COMPLETED AFTER CONSTRUCTION

1. Has the facility been constructed at the location shown in the approved permit? ☐ Yes ☐ No
2. Is the emergency spillway constructed at the location shown in the approved plan? ☐ Yes ☐ No
3. Is the principal spillway constructed at the location shown in the approved plan? ☐ Yes ☐ No
4. Are the collection channel inlets constructed with adequate inlet protection and at the location shown in the approved plan? ☐ Yes ☐ No
5. Identify any conditions or deficiencies in the facility that need to be corrected.

Construction Inspection

Stage of Construction (specify stage e.g. layout, impoundment/embankment construction, spillway/piping installation)	**Date of Inspection**	**Inspected By**

Supervising Professional Engineer/Registered Professional Land Surveyor ______________________

Address ______________________

____

Telephone Number ______________________

I certify in accordance with 25 Pa Code Section 77.531 that the above-mentioned structure is complete and has been constructed.

____
Signature of Registered Professional Engineer/Registered Professional Land Surveyor Date

____
Registration Number and Expiration Date

SEAL

______________________ ______________________
Signature of Permittee or Responsible Official Date Title

MODULE 13 - CALCULATION BRIEF

MODULE 13 - CALCULATION BRIEF

DECEMBER 2017

NORTHERN TRACT QUARRY
SPECIALTY GRANULES LLC
HAMILTONBAN AND LIBERTY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

SECTION H

NT POND DESIGN

DAPPOLONIA

By:	MJD	Date:	06/22/16	Subject:	N.T. Pond Design	Sheet No.:	1 of 9
Chkd. By:	WRO	Date:	10/18/16		Northern Tract Quarry	Proj. No.:	152596A

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N.T. POND DESIGN
NORTHERN TRACT QUARRY
CHARMAIN SITE, SPECIALTY GRANULES, LLC.
ADAMS COUNTY, PENNSYLVANIA

PURPOSE

The purpose of these calculations is to design two ponds for Phase 2 and Phase 3 of the intial site development of the Northern Tract Quarry for Specialty Granules LLC. The ponds have enough capacity to contain without discharging runoff from a 100-year storm event. Both ponds are designed with limited encroachment on the mine plan and avoid monitoring wells where feasible. Design of the ponds is based on Pennsylvania Department of Environmental Protection (PADEP) regulations.

RAINFALL DEPTHS

SCS Storms: Storm routing for all storm events will be performed using the TR-55 SCS method with a 24-hour, Type II rainfall distribution. The following depths were obtained from the NOAA Point Precipitation Frequency Estimates for the site (Attachment 1):

Storm Frequency	Depth (Inches)
100-yr	8.03

WATERSHED CURVE NUMBERS

The curve number for the site is based on the TR-55 methodology (Ref #2). Based upon the hydrologic soil group (HSG) ratings of the site soils from a soil survey, the entire watershed is HSG B. The entire site, with exception of the pond areas (CN = 100), is assumed to be disturbed with a curve number of 86. Refer to Attachment 2 for the soil survey map.

DAPPOLONIA

By: MJD	Date: 06/22/16	Subject: N.T. Pond Design	Sheet No.: 2 of 9
Chkd. By: WRO	Date: 10/18/16	Northern Tract Quarry	Proj. No.: 152596A

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RUNOFF INFILTRATION

Runoff and infiltration amounts were calculated using SCS Curve Number methodology (Ref. #2) based on the rainfall amount and site soil properties.

100-Yr Design Storm Rainfall = 8.03 in. (Based on Attachment 1)

Runoff, $Q = (P-I_a)^2/[(P-I_a)+S]$ [Eq. 2-1]

Assuming $I_a = 0.2S$, [Eq. 2-2]

$Q = (P-0.2S)^2/(P + 0.8S)$ where, [Eq. 2-3]

P = rainfall, in.
S = potential maximum retention after runoff begins, in. = (1000/CN) - 10 [Eq. 2-4]

CN = curve number = 86 (Based on Web Soil Survey Attachment 2)

Q_{runoff} = 6.4 in. (surface runoff flowing away from the site)

$Q_{infiltration}$ = 1.7 in. (surface runoff infiltrated into site soils)

N.T. POND PROPERTIES

The following is a summary of the major components of N.T. Pond 1 (Phase 2) and N.T. Pond 2 (Phase 3):

	N.T. Pond 1	**N.T. Pond 2**
Minimum Embankment Crest El.	1060.0	1010.0
Pond Bottom El.	1045.0	995.0
Embankment Top Width	12 ft	12 ft
Sediment Cleanout El.	1047.0	997.0
Auxiliary Spillway:		
Crest Elevation	1058.5	1008.5
Bottom Width	8 ft	8 ft
Shape	Trapezoidal	Trapezoidal
Lining	R-3 Riprap	R-3 Riprap

DRAINAGE AREAS

Refer to the watershed drawings for the drainage areas of Phase 2 and Phase 3 Initial Site Development.

	Ditch CD-3 (Acres	Ditch CD-4 (Acres)	Direct Watershed (Acres)	Pond Area (Acres)	Total Area (Acres)
N.T. Pond 1	4.50	7.92	4.33	1.62	18.37

	Ditch CD-5 (Acres)	Ditch CD-6 (Acres)	Direct Watershed (Acres)	Pond Area (Acres)	Total Area (Acres)
N.T. Pond 2	6.85	8.43	10.25	2.66	28.19

DAPPOLONIA

By:	MJD	Date:	06/22/16	Subject:	N.T. Pond Design	Sheet No.:	3 of 9
Chkd. By:	WRO	Date:	10/18/16		Northern Tract Quarry	Proj. No.:	152596

N:\2015\152596 - SGI\Northern Tract\NT Pond Design\[N.T. Pond Design.xlsx]Stage-Storage

STAGE-STORAGE RELATIONSHIP

N.T. Pond 1

Elevation	Area (SF)	Conic Approximation Area (SF)	Incremental Volume (CF)	Total Volume (CF)	Total Volume (AC-FT)
1045	15,778		0	0	0.00
1046	19,187	17,455	17,455	17,455	0.40
1047	**22,639**	**20,889**	**20,889**	**38,344**	**0.88**
1048	26,132	24,365	24,365	62,709	1.44
1049	29,667	27,881	27,881	90,589	2.08
1050	33,247	31,440	31,440	122,029	2.80
1051	36,856	35,036	35,036	157,065	3.61
1052	40,491	38,659	38,659	195,725	4.49
1053	44,154	42,309	42,309	238,034	5.46
1054	47,845	45,987	45,987	284,021	6.52
1055	51,560	49,691	49,691	333,712	7.66
1056	55,300	53,419	53,419	387,131	8.89
1057	59,067	57,173	57,173	444,304	10.20
1058	62,858	60,953	60,953	505,257	11.60
1058.5	**64,756**	**63,805**	**31,902**	**537,159**	**12.33**
1059	66,654	65,703	32,851	570,011	13.09
1060	70,514	68,575	68,575	638,586	14.66

N.T. Pond 2

Elevation	Area (SF)	Conic Approximation Area (SF)	Incremental Volume (CF)	Total Volume (CF)	Total Volume (AC-FT)
995.0	29,042				0.00
996.0	34,548	31,755	31,755	31,755	0.73
997.0	**40,109**	37,294	37,294	**69,049**	**1.59**
998.0	45,726	42,887	42,887	111,936	2.57
999.0	51,398	48,534	48,534	160,470	3.68
1000.0	57,130	54,239	54,239	214,709	4.93
1001.0	62,894	59,989	59,989	274,698	6.31
1002.0	68,680	65,766	65,766	340,464	7.82
1003.0	74,488	71,564	71,564	412,028	9.46
1004.0	80,341	77,396	77,396	489,424	11.24
1005.0	86,191	83,249	83,249	572,673	13.15
1006.0	92,062	89,110	89,110	661,783	15.19
1007.0	97,956	94,994	94,994	756,777	17.37
1008.0	103,874	100,901	100,901	857,678	19.69
1008.5	**106,890**	105,378	52,689	**910,367**	**20.90**
1009.0	109,802	108,343	54,171	964,538	22.14
1010.0	115,850	112,812	112,812	1,077,351	24.73

DAPPOLONIA

By: MJD	Date: 06/22/16	Subject: N.T. Pond Design	Sheet No.: 4 of 9
Chkd. By: WRO	Date: 10/18/16	Northern Tract Quarry	Proj. No.: 152596A

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MINIMUM STORAGE VOLUMES

Required Sediment Storage Volume

Based on 2,000 cubic feet of sediment volume per disturbed acre per Engineering Manual for Mining Operations (Ref. #8), minimum of 1.0' Sediment Storage (Ref. #1)

N.T. Pond 1	36,740	CF
N.T. Pond 2	56,380	CF

Required Settling Storage Volume

Based on 5,000 cubic feet of settling volume per disturbed acre. (Ref. #1)

N.T. Pond 1	91,850	CF
N.T. Pond 2	140,950	CF

SUMMARY OF STORAGE VOLUMES

	Spillway Crest El. Volume CF	2.0' Sediment Volume CF	Available Settling Volume CF
N.T. Pond 1	537,159	38,344	498,815
N.T. Pond 2	910,367	69,049	841,318

	Drainage Area SF	Pond Area SF	Runoff Volume CF	Settling Volume vs. Runoff Volume CF
N.T. Pond 1	729,683	70,514	433,947	64,868
N.T. Pond 2	1,112,106	115,850	666,984	174,334

	Normal Pool Elevation	Spillway Invert Elevation	100-Year Storm Elevation	Freeboard (ft)
N.T. Pond 1	1047.0	1058.5	1057.5	2.54
N.T. Pond 2	997.0	1008.5	1006.8	3.22

DAPPOLONIA

By:	MJD	Date:	06/22/16	Subject:	N.T. Pond Design	Sheet No.:	5 of 9
Chkd. By:	WRO	Date:	10/18/16		Northern Tract Quarry	Proj. No.:	152596A

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DEWATERING TIME

Per the PADEP Erosion and Sediment Pollution Control Program Manual, the ponds must dewater the storage volume in 2 to 7 days (4 to 7 days for special protection watersheds). The 2-day and 4-day dewatering scenarios consider the storage volume from the sediment cleanout elevation (1047.0/997.0) to the 100-year storm peak runoff elevation. The peak runoff elevations are listed in the table on the previous page. The 7-day dewatering scenario considers the storage volume from the sediment cleanout elevation to the spillway crest elevation. The pond spillways are 1.5' below the embankment crest (El. 1058.5/1008.5). It is assumed the only form of discharge is due to the proposed pumping system, therefore the stage-discharge relationship utilized for calculating the dewatering time is a constant rate proportional to the pump size. The following tables list the pumping rates to dewater the ponds.

N.T. Pond 1

Elevation	**Storage**		**Discharge**	**Volume**	**Avg. Discharge**	**Time**	
(ft)	**(ac-ft)**	**(cf)**	**(cfs)**	**(cf)**	**(cfs)**	**(s)**	**(days)**
1047	0.88	38,344	2.23				
1048	1.44	62,709	2.23	24,365	2.23	10,935	0.1
1049	2.08	90,589	2.23	27,881	2.23	12,513	0.1
1051	3.61	157,065	2.23	66,476	2.23	29,834	0.3
1053	5.46	238,034	2.23	80,969	2.23	36,339	0.4
1055	7.66	333,712	2.23	95,678	2.23	42,940	0.5
1057	10.20	444,304	2.23	110,592	2.23	49,634	0.6
1057.5	10.84	472,291	2.23	27,987	2.23	12,560	0.1
			(1000 gpm)			**Total**	**2.3**

DAPPOLONIA

By: MJD	Date: 06/22/16	Subject: N.T. Pond Design	Sheet No.: 6 of 9
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Elevation	**Storage**		**Discharge**	**Volume**	**Avg. Discharge**	**Time**	
(ft)	**(ac-ft)**	**(cf)**	**(cfs)**	**(cf)**	**(cfs)**	**(s)**	**(days)**
1047	0.88	38,344	1.23				
1048	1.44	62,709	1.23	24,365	1.23	19,882	0.2
1049	2.08	90,589	1.23	27,881	1.23	22,751	0.3
1051	2.80	122,029	1.23	31,440	1.23	25,655	0.3
1053	3.61	157,065	1.23	35,036	1.23	28,589	0.3
1055	5.46	238,034	1.23	80,969	1.23	66,070	0.8
1057	7.66	333,712	1.23	95,678	1.23	78,073	0.9
1057.5	10.84	472,291	1.23	138,579	1.23	113,080	1.3
			(550 gpm)			**Total**	**4.1**

Elevation	**Storage**		**Discharge**	**Volume**	**Avg. Discharge**	**Time**	
(ft)	**(ac-ft)**	**(cf)**	**(cfs)**	**(cf)**	**(cfs)**	**(s)**	**(days)**
1047	0.88	38,344	0.89				
1048	1.44	62,709	0.89	24,365	0.89	27,337	0.3
1049	2.08	90,589	0.89	27,881	0.89	31,282	0.4
1051	3.61	157,065	0.89	66,476	0.89	74,586	0.9
1053	5.46	238,034	0.89	80,969	0.89	90,847	1.1
1055	7.66	333,712	0.89	95,678	0.89	107,351	1.2
1057	10.20	444,304	0.89	110,592	0.89	124,085	1.4
1058.5	12.33	537,159	0.89	92,855	0.89	104,183	1.2
			(400 gpm)			**Total**	**6.5**

DAPPOLONIA

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N.T. Pond 2

Elevation	Storage		Discharge	Volume	Avg. Discharge	Time	
(ft)	(ac-ft)	(cf)	(cfs)	(cf)	(cfs)	(s)	(days)
997	1.59	69,049	4.01				
998	2.57	111,936	4.01	42,887	4.01	10,693	0.1
999	3.68	160,470	4.01	48,534	4.01	12,101	0.1
1001	6.31	274,698	4.01	114,228	4.01	28,481	0.3
1003	9.46	412,028	4.01	137,330	4.01	34,241	0.4
1005	13.15	572,673	4.01	160,645	4.01	40,054	0.5
1006.8	16.90	736,033	4.01	163,360	4.01	40,731	0.5
			(1800 gpm)			**Total**	**1.9**

Elevation	Storage		Discharge	Volume	Avg. Discharge	Time	
(ft)	(ac-ft)	(cf)	(cfs)	(cf)	(cfs)	(s)	(days)
997	1.59	69,049	1.78				
998	2.57	111,936	1.78	42,887	1.78	24,060	0.3
999	3.68	160,470	1.78	48,534	1.78	27,228	0.3
1001	6.31	274,698	1.78	114,228	1.78	64,082	0.7
1003	9.46	412,028	1.78	137,330	1.78	77,042	0.9
1005	13.15	572,673	1.78	160,645	1.78	90,122	1.0
1006.8	16.90	736,033	1.78	163,360	1.78	91,645	1.1
			(800 gpm)			**Total**	**4.3**

Elevation	Storage		Discharge	Volume	Avg. Discharge	Time	
(ft)	(ac-ft)	(cf)	(cfs)	(cf)	(cfs)	(s)	(days)
997	1.59	69,049	1.45				
998	2.57	111,936	1.45	42,887	1.45	29,612	0.3
999	3.68	160,470	1.45	48,534	1.45	33,511	0.4
1001	6.31	274,698	1.45	114,228	1.45	78,870	0.9
1003	9.46	412,028	1.45	137,330	1.45	94,821	1.1
1005	13.15	572,673	1.45	160,645	1.45	110,919	1.3
1007	17.37	756,777	1.45	184,104	1.45	127,117	1.5
1008.5	20.90	910,367	1.45	153,590	1.45	106,048	1.2
			(650 gpm)			**Total**	**6.7**

DAPPOLONIA

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SPILLWAY DESIGN

The spillways for N.T. Pond 1 and N.T. Pond 2 will be modeled as a broad-crested weir. The spillway has 10H:1V side slopes and is lined with R-3 riprap choked with AASHTO #57 to allow vehicles to cross for pond maintenance. The ponds are designed to contain, without discharging, the SCS 100-year storm event with a minimum of one foot of freeboard. Although the spillway will not be activated for the design storm,the spillway channel is designed considering a one foot flow depth.

The following calculations are specific to N.T. Pond 2, however both N.T. Pond 1 and N.T. Pond 2 have the same sizing and stage-discharge relationship for the spillway.

Crest Elevation =	1010.0	ft.
Invert Elevation of Spillway =	1008.5	ft.
Crest Length of Spillway =	8.00	ft.
Breadth of Crest of Spillway =	18.00	ft.

SPILLWAY STAGE-DISCHARGE RELATIONSHIP

BROAD-CRESTED WEIR FLOW

Q=CLH(3/2) (Ref. 7)

where:

C = discharge coefficient (Ref. 7, Appendix A-5)

L = effective crest length (feet)

H = head above crest (feet)

H(ft)	C	Q(cfs)
0.00	0.00	0.00
0.20	2.68	1.92
0.40	2.70	5.46
0.60	2.70	10.04
0.80	2.64	15.11
1.00	2.63	21.04

LINING STABILITY

The maximum permissible velocity of R-3 riprap is listed in the Erosion and Sediment Control Manual (Ref. 1). The continuity equation (Q = V*A) calculates the maximum velocity with 1.0' head above the crest.

Maximum Channel Velocity	1.17	ft/s
Maximum Permissible Velocity	6.5	ft/s
Is Lining Sufficient?	Yes	
Lining Type	R-3 Riprap	

DAPPOLONIA

By: MJD	Date: 06/22/16	Subject: N.T. Pond Design	Sheet No.: 9 of 9
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REFERENCES

1) Erosion and Sediment Pollution Control Program Manual, Pennsylvania Department of Environmental Protection, Office of Water Management, March 2000.

2) Urban Hydrology for Small Watersheds, Technical Release Number 55 (TR-55), United States Department of Agriculture, Soil Conservation Service, 2nd Edition, June 1986.

3) Earth Dams and Reservoirs, Technical Release No. 60, U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, July 2005.

4) Applied Hydrology and Sedimentology for Disturbed Areas, Third Printing 1985, B.J. Barfield, R.C. Warner, and C.T. Hann, Published by Oklahoma Technical Press, 1981.

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6) Handbook of Hydraulics - Sixth Edition, Brater and King, McGraw-Hill Book Company, 1976.

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8) *Engineering Manual For Mining Operations,* Department of Environmental Protection Bureau of Mining Programs, January 1999.

ATTACHMENT 1

NOAA Point Precipitation Frequency Estimates

NOAA Atlas 14, Volume 2, Version 3
Location name: Fairfield, Pennsylvania, US*
Latitude: 39.7678°, Longitude: -77.4403°
Elevation: 1240 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

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	0.356 (0.319-0.398)	0.427 (0.382-0.477)	0.512 (0.457-0.571)	0.578 (0.516-0.644)	0.670 (0.594-0.745)	0.741 (0.654-0.822)	0.818 (0.717-0.906)	0.899 (0.784-0.996)	1.01 (0.875-1.12)	1.11 (0.948-1.23)
10-min	0.555 (0.498-0.621)	0.670 (0.599-0.748)	0.799 (0.714-0.892)	0.897 (0.801-0.999)	1.03 (0.914-1.14)	1.13 (1.00-1.26)	1.24 (1.09-1.38)	1.35 (1.18-1.50)	1.51 (1.30-1.67)	1.63 (1.40-1.81)
15-min	0.682 (0.612-0.763)	0.822 (0.735-0.918)	0.987 (0.882-1.10)	1.11 (0.990-1.24)	1.28 (1.13-1.42)	1.41 (1.24-1.56)	1.55 (1.36-1.72)	1.69 (1.47-1.87)	1.89 (1.63-2.09)	2.04 (1.75-2.26)
30-min	0.907 (0.814-1.01)	1.10 (0.988-1.23)	1.36 (1.21-1.52)	1.55 (1.38-1.73)	1.82 (1.61-2.02)	2.03 (1.79-2.25)	2.25 (1.98-2.50)	2.49 (2.17-2.75)	2.83 (2.44-3.13)	3.10 (2.65-3.43)
60-min	1.11 (0.998-1.24)	1.36 (1.22-1.52)	1.71 (1.53-1.91)	1.98 (1.77-2.21)	2.37 (2.10-2.63)	2.69 (2.37-2.98)	3.03 (2.66-3.36)	3.39 (2.96-3.76)	3.93 (3.39-4.35)	4.38 (3.75-4.84)
2-hr	1.29 (1.16-1.46)	1.58 (1.41-1.77)	2.00 (1.78-2.24)	2.34 (2.08-2.62)	2.85 (2.52-3.18)	3.29 (2.89-3.67)	3.79 (3.30-4.21)	4.35 (3.76-4.83)	5.23 (4.47-5.79)	6.00 (5.09-6.65)
3-hr	1.44 (1.29-1.64)	1.75 (1.56-1.99)	2.20 (1.96-2.50)	2.57 (2.28-2.91)	3.13 (2.76-3.54)	3.62 (3.17-4.08)	4.18 (3.63-4.69)	4.81 (4.14-5.39)	5.79 (4.93-6.48)	6.66 (5.61-7.46)
6-hr	1.84 (1.65-2.10)	2.23 (1.99-2.54)	2.78 (2.48-3.17)	3.25 (2.88-3.69)	3.95 (3.47-4.47)	4.57 (3.99-5.16)	5.29 (4.58-5.95)	6.10 (5.24-6.86)	7.37 (6.24-8.27)	8.51 (7.13-9.55)
12-hr	2.31 (2.05-2.64)	2.80 (2.48-3.19)	3.48 (3.08-3.96)	4.07 (3.58-4.63)	4.98 (4.35-5.63)	5.80 (5.03-6.55)	6.75 (5.79-7.59)	7.85 (6.66-8.81)	9.59 (8.01-10.7)	11.2 (9.21-12.5)
24-hr	2.71 (2.47-3.00)	3.25 (2.96-3.61)	4.05 (3.68-4.49)	4.75 (4.30-5.26)	5.85 (5.25-6.44)	6.85 (6.11-7.52)	8.03 (7.09-8.77)	9.41 (8.23-10.2)	11.6 (10.0-12.6)	13.7 (11.6-14.8)
2-day	3.14 (2.85-3.51)	3.77 (3.42-4.22)	4.68 (4.24-5.24)	5.49 (4.95-6.12)	6.75 (6.04-7.50)	7.90 (7.02-8.75)	9.25 (8.16-10.2)	10.8 (9.46-11.9)	13.4 (11.5-14.7)	15.7 (13.3-17.3)
3-day	3.34 (3.04-3.73)	4.01 (3.65-4.47)	4.96 (4.50-5.53)	5.80 (5.23-6.45)	7.10 (6.37-7.87)	8.29 (7.38-9.16)	9.66 (8.54-10.7)	11.3 (9.88-12.4)	13.9 (12.0-15.2)	16.3 (13.8-17.8)
4-day	3.55 (3.23-3.95)	4.25 (3.87-4.73)	5.24 (4.76-5.83)	6.10 (5.52-6.77)	7.45 (6.69-8.24)	8.67 (7.74-9.56)	10.1 (8.93-11.1)	11.7 (10.3-12.9)	14.4 (12.4-15.8)	16.8 (14.3-18.4)
7-day	4.13 (3.79-4.55)	4.93 (4.52-5.44)	6.03 (5.52-6.65)	6.98 (6.37-7.68)	8.44 (7.65-9.27)	9.75 (8.79-10.7)	11.3 (10.1-12.3)	13.0 (11.5-14.2)	15.7 (13.8-17.2)	18.2 (15.7-19.9)
10-day	4.73 (4.36-5.20)	5.64 (5.19-6.19)	6.81 (6.25-7.47)	7.81 (7.15-8.55)	9.32 (8.49-10.2)	10.7 (9.66-11.6)	12.2 (11.0-13.3)	13.9 (12.4-15.1)	16.5 (14.6-18.0)	18.9 (16.5-20.6)
20-day	6.38 (5.97-6.87)	7.54 (7.04-8.10)	8.85 (8.26-9.51)	9.94 (9.26-10.7)	11.5 (10.7-12.4)	12.9 (11.9-13.8)	14.4 (13.3-15.4)	16.1 (14.7-17.2)	18.6 (16.9-20.0)	20.8 (18.7-22.3)
30-day	7.88 (7.43-8.41)	9.26 (8.72-9.87)	10.7 (10.1-11.4)	11.9 (11.2-12.6)	13.6 (12.7-14.5)	15.0 (14.1-16.0)	16.6 (15.4-17.6)	18.3 (16.9-19.4)	20.8 (19.1-22.1)	22.9 (20.9-24.4)
45-day	9.87 (9.32-10.5)	11.5 (10.9-12.2)	13.1 (12.4-13.9)	14.4 (13.6-15.3)	16.2 (15.3-17.2)	17.7 (16.7-18.8)	19.3 (18.1-20.4)	21.0 (19.6-22.3)	23.4 (21.8-24.9)	25.4 (23.5-27.0)
60-day	11.7 (11.1-12.4)	13.7 (13.0-14.5)	15.4 (14.6-16.3)	16.8 (16.0-17.8)	18.8 (17.8-19.9)	20.4 (19.3-21.6)	22.1 (20.8-23.4)	24.0 (22.5-25.3)	26.5 (24.7-28.0)	28.6 (26.6-30.3)

[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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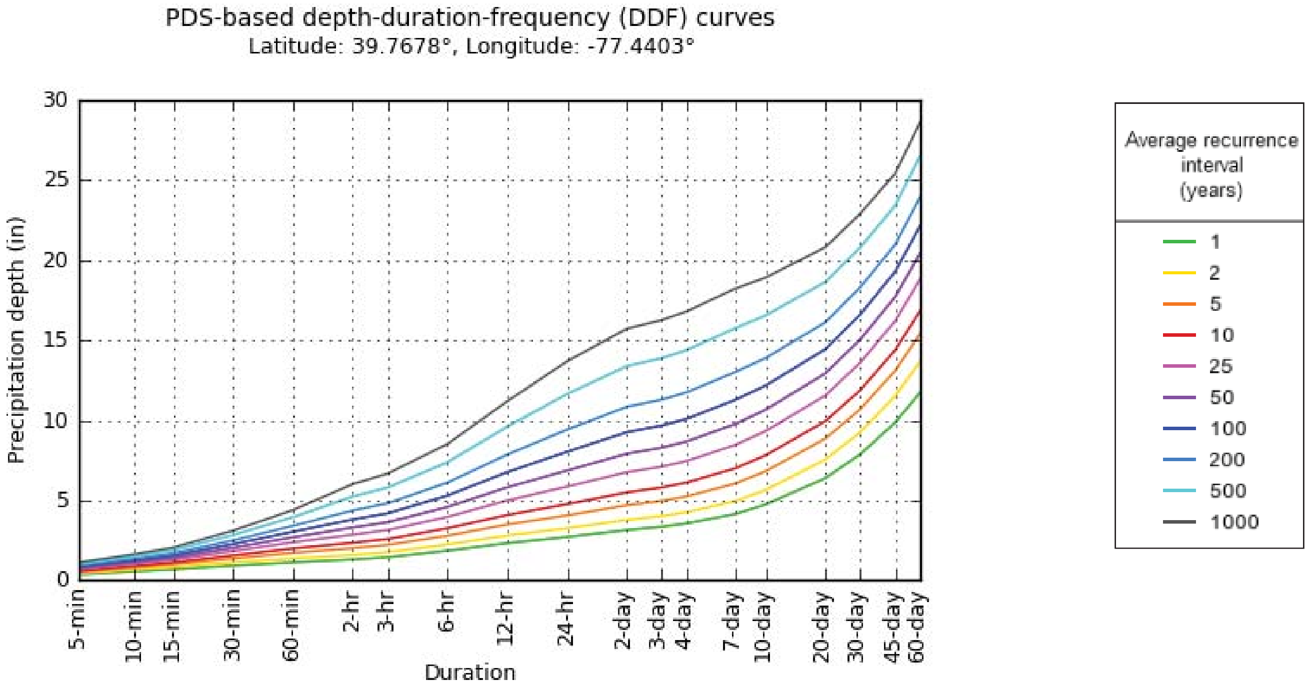
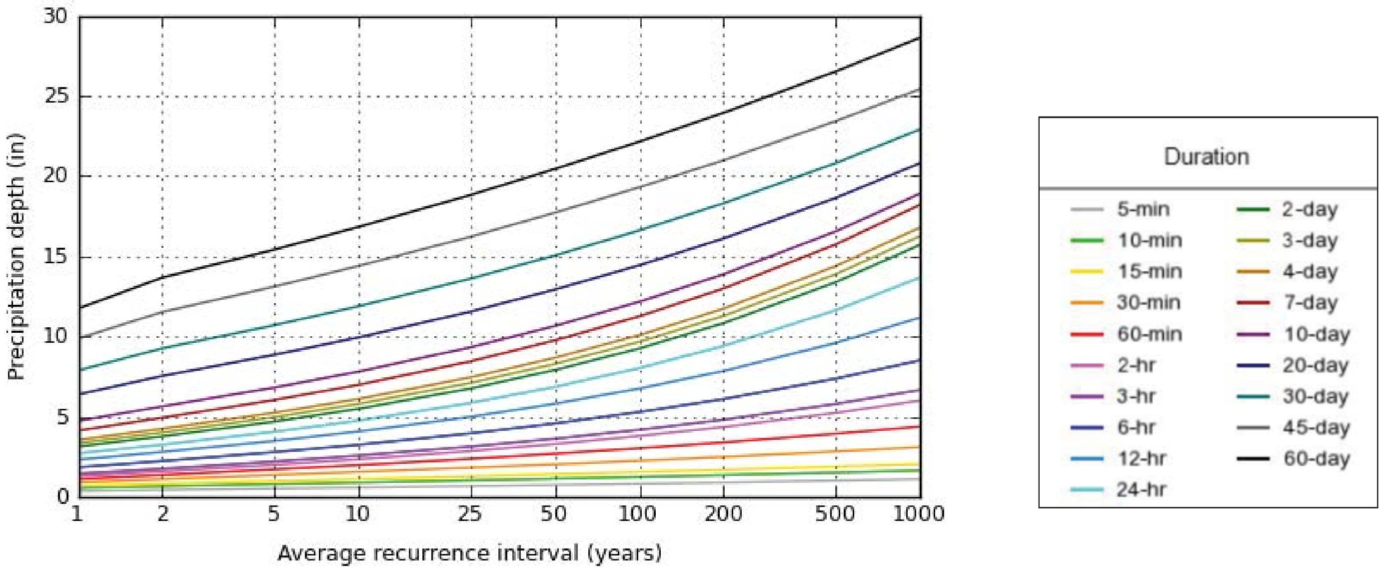
PF graphical





NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Wed Dec 16 18:57:04 2015

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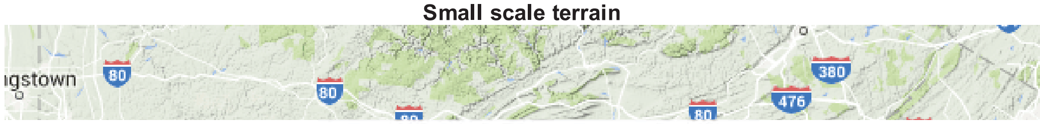
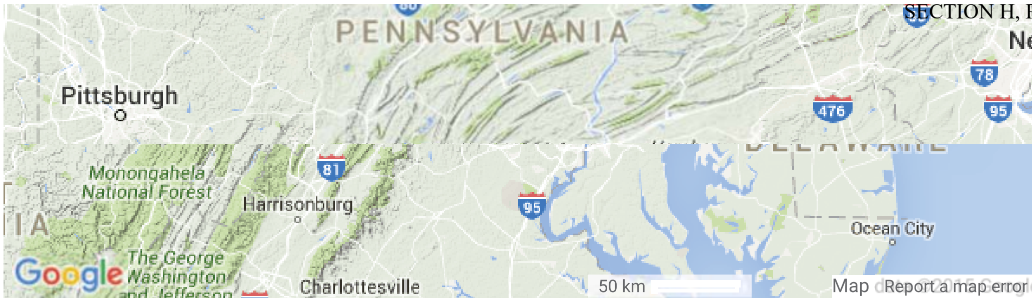
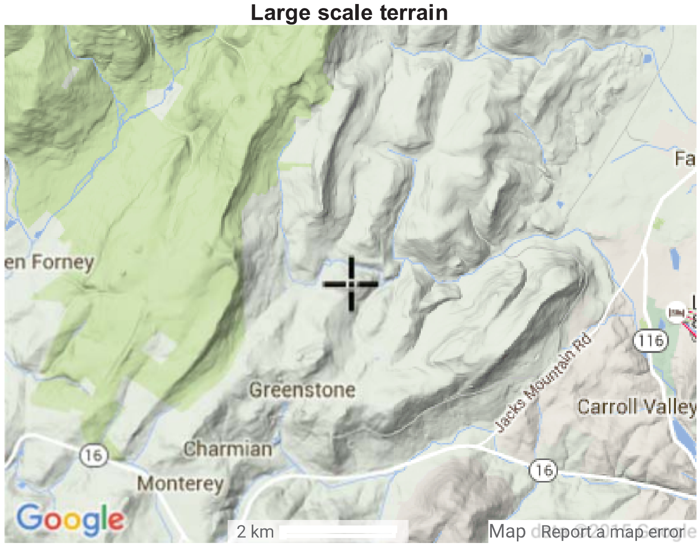
Maps & aerials

Small scale terrain



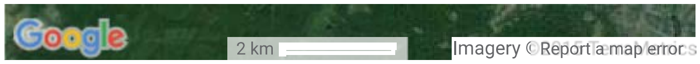


Large scale terrain



Large scale map

Large scale aerial



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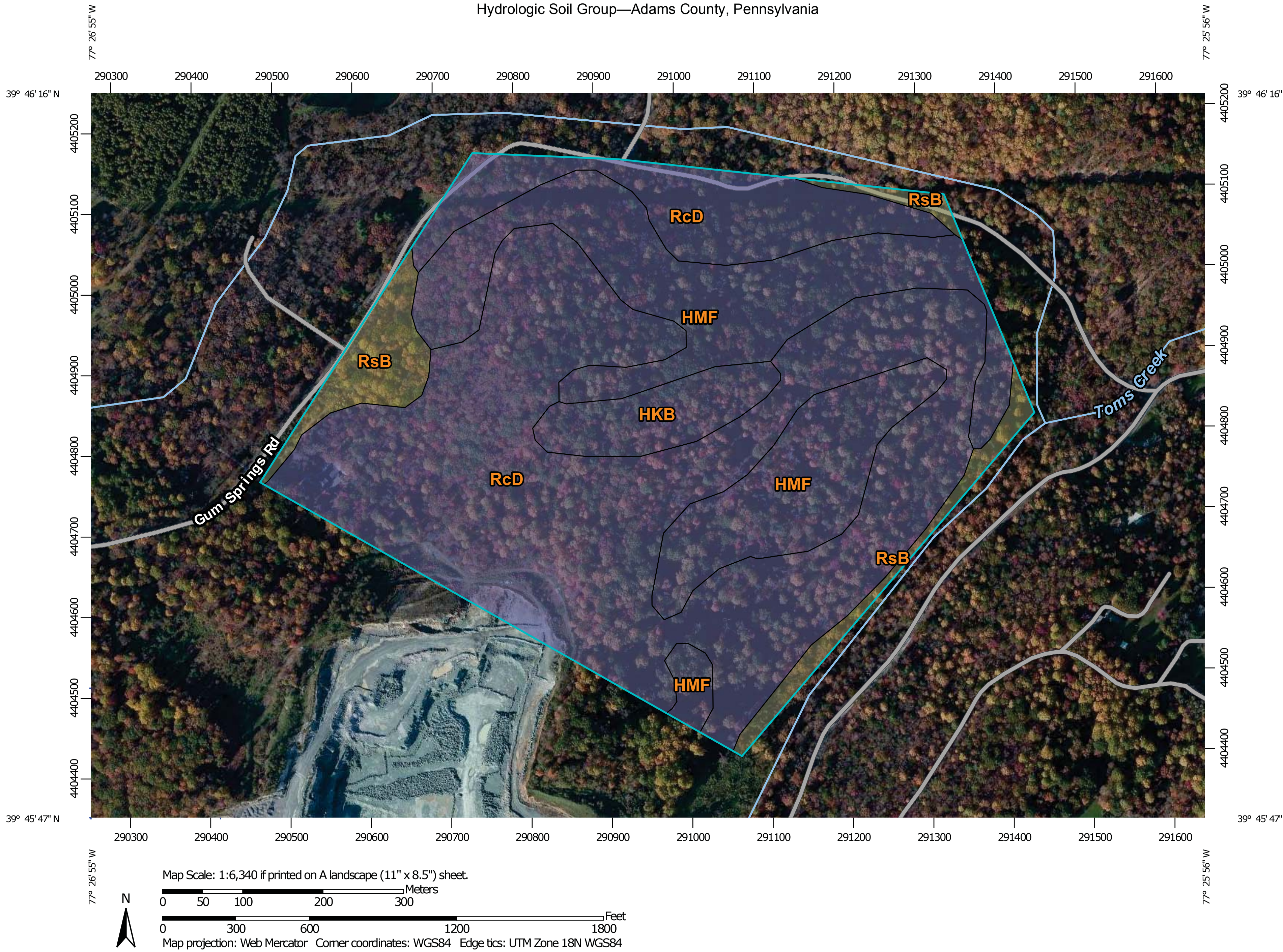
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

ATTACHMENT 2

Natural Resources Conservation Servie

Soil Survey Report

Hydrologic Soil Group—Adams County, Pennsylvania



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Adams County, Pennsylvania
Survey Area Data: Version 11, Nov 16, 2015

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

Date(s) aerial images were photographed: Apr 14, 2011—Nov 6, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Adams County, Pennsylvania (PA001)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
HKB	Highfield, Catoctin, and Myersville soils, 0 to 8 percent slopes, very stony	B	5.1	4.5%
HMF	Highfield and Catoctin channery silt loams, 25 to 70 percent slopes, very stony	B	31.0	27.6%
RcD	Ravenrock-Highfield-Rock outcrop complex, 15 to 25 percent slopes	B	69.1	61.4%
RsB	Rohrersville silt loam, 0 to 15 percent slopes, very stony	C/D	7.3	6.5%
Totals for Area of Interest			**112.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION I

NT POND NO.2 CONNECTING CHANNEL

D'APPOLONIA

By:	MJD	Date:	05/26/17	Subject:	NT Pond No.2	Sheet No.:	1 of 5
Chkd. By:	QDW	Date:	06/01/17		Connecting Channel Design	Proj. No.:	152596A

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NT POND NO.2 CONNECTING CHANNEL
EROSION AND SEDIMENT CONTROL PLAN - STAGE 5
NORTHERN TRACT QUARRY
CHARMIAN SITE, SPECIALTY GRANULES, LLC.
ADAMS COUNTY, PENNSYLVANIA

PURPOSE

The following calculations were performed to determine the feasibility of routing water through a channel from the two portions of NT Pond No. 2 during Erosion and Sediment Control (E&SC) Plan Stage 5 at the Northern Tract Quarry. A feasibility analysis was performed to determine if routing a flow matching the incoming peak flow could be attainable with a given channel configuration. This calculation will determine the sizing of the connecting channel which will provide a means to convey water from the smaller pond to the larger pond during E&SC Stage 5.

CHANNEL GEOMETRY

Since the two separated portions of NT Pond No.2 are being constructed to the same embankment crest elevation (El) 1010, establishing a sloped channel would not be ideal to connect the ponds. The channel will have a constant bottom elevation and will be located downstream of the access road, but upstream of the compost filter sock sediment traps.

ANALYSIS

Determine the channel configuration with a given maximum elevation in the smaller portion of NT Pond No.2 to convey the peak flow from the 100-year SCS storm entering the pond.

NT POND NO. 2 PROPERTIES

Embankment Crest Elevation:	1010	feet	
Maximum Allowable Pool Elevation:	1009	feet	
Pond Bottom Elevation:	995	feet	
Sediment Cleanout Elevation:	997	feet	
Peak Flow into the smaller portion of NT Pond No.2	70	cfs	(The peak flow from ditch CD-5 was conservatively assumed the peak flow into the pond (Ref#3))

SYSTEM HYDRAULICS

The Bernoulli Equation was utilized to analyze the proposed channel to determine whether gravity flow routing would be feasible. The version of Bernoulli Equation utilized for this analysis is as follows:

$$Z_1 = Z_2 + \frac{V^2}{2g} + \sum H_L$$

Where:
Z_1 = maximum allowable headwater elevation in the pond
Z_2 = top of flow elevation in connecting channel
V = velocity of the water flowing through the channel
g = acceleration due to gravity
ΣH_L = sum of all head losses within the system

To determine the channel bottom elevation, an estimated channel configuration is needed to calculate cross-sectional flow area. A minimum one foot of freeboard is required in the ponds, this will dictate the flow depth in the channel.

Channel Bottom Width:	5.0	FT
Channel Depth:	4.0	FT
Channel Bottom Elevation:	1006.0	
Flow Depth:	2.0	FT
Side Slopes (_H:1V)	2	
Flow Area:	18.00	SF
Wetted Perimeter:	13.94	FT

The continuity equation was used to determine the velocity in the channel considering the proposed channel's cross-sectional area.

$$Q = VA$$

Where:
Q = flow rate
V = average velocity over the cross-section of the channel
A = cross-section area of flow in the channel

D'APPOLONIA

By:	MJD	Date:	05/26/17	Subject:	NT Pond No.2	Sheet No.:	3 of 5
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HEAD LOSS

Head loss due to friction (h_f) was calculated using Manning's Equation. S is the slope of the energy grade line (EGL) which equates to the energy head loss over the length of the channel.

$$S = h_f/L$$

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

$$h_f = L\left(\frac{Qn}{1.486AR^{2/3}}\right)^2$$

Where:
L = Length of channel
S = Slope of energy grade line
n = Manning's coefficient of roughness
Q = Flow rate
A = Flow area
R = Hydraulic Radius (A/P)
P = Wetted Perimeter

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By:	MJD	Date:	05/26/17	Subject:	NT Pond No.2	Sheet No.:	4 of 5
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An analysis was conducted applying Bernoulli's equation between the beginning and end of the channel. This analysis allows for the calculation of the required bottom elevation of the channel to achieve the desired 70 cfs flow rate.

Elevation, Z_2 (ft) (*Flow depth with ditch configuration*)		1008.0	ft
Flow Area (sf)		18.0	sf
Required Flow Rate (cfs)		70.0	cfs
Velocity (ft/s)		3.89	ft/s
Acceleration of Gravity (ft/s^2)		32.2	ft/s^2
Calculated Velocity Head Constant (ft)	$\frac{V^2}{2g}$	0.23	ft

The head losses in the channel due to friction:

Length of Channel (ft)	415	ft
Manning's n	0.02	(Assume straight, excavated channel)
Hydraulic Radius (ft)	1.29	ft
Head Loss due to friction (h_f)	0.81	ft

Pond Headwater Elevation, Z_1 (ft) **1009.0**

(Required to maintain 70 cfs flow rate)

D'APPOLONIA

By:	MJD	Date:	05/26/17	Subject:	NT Pond No.2	Sheet No.:	5 of 5
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2) Western Dynamics, Inc. - Head Loss Coefficients
3) Collection Ditch Design for Northern Tract Quarry, Specialty Granules LLC. Charmian Site, Adams County, PA. Prepared by D'Appolonia. July 2016.