3

Basis of Design

Oil-Water Separation Improvements and Stormwater Management

October 2012

CDF007686

Basis of Design

Oil-Water Separation Improvements and Stormwater Management

October 2012

Prepared For
Canton Drop Forge
4575 Southway St. SW
Canton, OH

Privileged & Confidential
Attorney-Client Work Product
Prepared at the Request of Counsel

1540 Eisenhower Place, Ann Arbor, MI 48108 • 734.971.7080 Phone • 734.971.9022 Fax
www.TRCsolutions.com

CDF007687

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Section 1
Introduction

1.1 Introduction

Canton Drop Forge (CDF) uses reprocessed oil as a release aid during the iron forging process. A significant portion of CDF's process wastewater containing oil, water (condensed steam), cooling water leaks, and occasional stormwater (due to roof leakage), flows from catch basins in the vicinity of furnaces, hydraulic presses, and steam hammers within CDF's forge building, and flows by gravity to a previously-installed sub-grade grit chamber and oil-water separator (OWS) located immediately south of the facility's main forge and furnace shop. Effluent from the OWS is discharged to Pond #2. Some additional process water is generated at/near the facility's boiler house building. This process water is routed to a steam-oil separator for oil removal, and the condensed hot water is discharged to storm piping and is then routed to Pond #2. Oil recovered at these separator units is hauled off-site for recycling.

Stormwater from the facility lay-down yards and roof drains discharge by gravity through manholes, catch basins, and sub-grade piping directly to Pond #1 and Pond #2.

1.2 Purpose of this Document

This document has been prepared to accomplish the following:

- Define current site conditions based on observations and measurements by TRC and CDF personnel in September 2012.
- Define a conceptual approach to improve OWS and oil reclamation, to minimize the quantity of oil that may be discharged to any of the on-site ponds, and to define an appropriate discharge option for water. A list of all assumptions is provided with the conceptual design contained herein.
- Present a proposed implementation schedule for OWS improvements, integrated with site-wide investigation and pond remediation efforts being conducted under the Ohio Voluntary Action Program (VAP).

Additional data will be gathered during the VAP Phase II Investigation and the final design efforts for OWS improvements. As this additional data, and any conclusions drawn from this additional data, are developed, the assumptions and conceptual design elements detailed herein will be adjusted as necessary.

Section 2
Current Conditions

On September 4 and 5, 2012, two TRC engineers were on-site to measure and assess process and stormwater flow conditions. Additionally, to aid in the assessment, historical records pertaining to the OWS, sub-grade piping, and the stormwater retention ponds were reviewed. During the first day of the assessment, occasional light rain showers were noted, and during the second day of the assessment, the weather was generally clear.

Figure 1 is a current conditions site plan, and Figure 2 is a current conditions process flow diagram (PFD) for the facility.

Based on the presence of oil within retention Ponds #1 and #2, the OWS is not performing as designed. The following observation were noted:

- Process Flow: On three occasions during the two day event, the process water flow rate to the separator was measured, and ranged from approximately 77 to 108 gallons per minute (gpm). The flow rate measurements are documented in Appendix A.
- Oil-Water Separator Inlet Piping: Subgrade process piping leading to the OWS is 6-inch diameter cast iron pipe. Assuming the pipe is installed at 0.5 to 1% grade and is in fair condition, maximum gravity flow through this pipe is not expected to exceed 165 to 230 gpm (see Appendix B).
- Pond #1 Discharge and Oil-Water Separator Discharge Pipeline: The existing OWS pumps and the Pond #1 pump discharge into a common manhole vault (2 ft by 2 ft by 3 ft deep, approx., located immediately west of Building A), from which the discharged water flows by gravity within a 6-inch and 8-inch diameter pipeline (for approximately 400 ft), and then within a 12-inch pipeline (combined with stormwater flow from catch basins located along the north side of the facility for approximately 350 ft) to Pond #2. The 6-inch diameter gravity drainage pipe located immediately west of CDF's administrative building is most likely limited to a flow capacity of approximately 230 gpm (see Appendix B). Above this rate, it is likely that the discharge manhole where the 6-inch diameter pipeline originates will overtop and cause some surface flooding.
- Process Water from Boiler House: Water flow within Manhole J, located downstream of the Boiler House, appeared clear and free of oil. Numerous catch basins and roof drains discharge stormwater into this manhole (and other downstream pipelines) during storm events.
- Stormwater Pipelines along the West End of the Plant: Although there is potential for some residual oil to flow from this pipeline and catch basins, only a light sheen near some of the catch basins was observed. No significant oil was observed during the non-storm monitoring event.

Section 3
Basis of Conceptual Design

TRC's conceptual design, detailed on Figures 3 and 4, is based on certain site-specific measurements, calculations, or assumptions detailed in Table 1 and further defined in Appendices A through C. This conceptual design will be used to formulate a final technical design for installation of improvements to CDF's existing process water and stormwater infrastructure to achieve the following project objectives:

- Eliminate the discharge of oil and/or oily wastewater to any on-site pond.
- Determine appropriate discharge options for process effluent water.
- Separate, to the maximum extent possible, process water discharges from stormwater flows.
- Facilitate the process water and stormwater improvements in conjunction with pond remediation efforts under the Ohio VAP to avoid disruptions in facility operations.

3.1 Design Concepts

To achieve CDF's project objectives, the following modifications to CDF's currently existing infrastructure have been identified, and are reflected in the proposed site plan and revised facility PFD in Figures 3 and 4, respectively:

- Removal of the existing OWS and replacement with a hydraulically larger OWS. The new separator would contain no coalescing filters and no moving parts to decrease maintenance requirements. The new separator would be installed below grade and the separator's water effluent would be discharged to the City of Massillon's sanitary sewer system for treatment. If the effluent cannot be discharged to the City of Massillon's sanitary sewer, the conceptual design described herein, will be substantially changed to accommodate an alternate water discharge option.
- Separation of process water from stormwater to the maximum extent possible by directing effluent from the steam-oil separator to the new proposed OWS, and then to the sanitary sewer for discharge.
- Coordinate OWS and stormwater improvements with Pond #1 and Pond #2 remediation activities performed under the Ohio VAP.
- As best management practices (BMPs) for stormwater, equip all stormwater discharge outfalls with coalescing plate-type separators to capture any residual free-phase oils and suspended solids that may discharge with stormwater to the on-site stormwater retention ponds (Pond #1 or Pond #2).

- As a final BMP measure for all site ponds, equip all ponds with a floating oil boom station at the inlet at each pond to retain any oil sheen at the outfall location so that during routine maintenance and monitoring activities any sheen may be immediately observed and promptly removed.

Each of these concepts is described in more detail in the following subsections.

3.2 OWS Replacement

The existing OWS is not performing as designed to completely remove oil from process water. Therefore, this unit will be removed and replaced with a hydraulically-larger OWS unit that is designed for effective oil removal without reliance upon coalescing filter elements.

Prior to installation, the existing OWS would be excavated and removed from service, the excavation cavity would be expanded as necessary, and once the cavity is prepared per the manufacturer's requirements, the new OWS would be installed below grade. A below-grade OWS replacement has been selected because the elimination of influent feed pumps will improve the separation process by eliminating any emulsification potential that may occur as a result of the pumping process.

3.3 OWS Pipeline Installation

Water discharged as OWS effluent will be pumped through a 6-inch subgrade force main to the City of Masillon's sanitary sewer connection, located at the northwest corner of the facility. The OWS will be equipped with dual effluent pumps with only one pump operational during normal discharge conditions to provide redundancy in the event of a pump failure. If a power failure occurs, the OWS effluent pumps will be connected to an emergency electrical generator so that the OWS discharge to the sanitary sewer is not interrupted.

3.4 Process Water-Stormwater Separation

Process water that is currently discharged to storm drains in the northern portion of the facility will be redirected to the new OWS so that all process water can be discharged to the sanitary sewer system. To accomplish this, process water in the vicinity of the Boiler House Building will be directed to a new installed catch basin, and then pumped through below and/or above grade piping (through the facility) to the OWS influent piping located along the western edge of the Forge Shop.

3.5 Stormwater Best Management Practices (BMP) Installation

To maximize the separation of process water and stormwater and to improve the quality of the stormwater prior to its discharge to any of the on-site stormwater ponds, stormwater BMPs will be utilized to the maximum extent possible. These BMPs will include:

- Installation of coalescing plate-type stormwater-oil interceptors to remove residual oil and suspended solids prior to the discharge of stormwater to the on-site retention ponds.
- Installation of floating oil booms at each pond outfall to retain any residual oil at the outfall so that if can be readily seen and removed during periodic site inspections.
- General facility maintenance and structural modifications may be performed to reduce the flow of stormwater to process drains within the building.
- Incorporation of other best oil handling practices within the facility, to minimize the transfer of oil to storm drains.

Section 4
Proposed Oil-Water Separation Improvement Implementation Schedule and Integration with Ohio VAP Activities

Table 2 contains a proposed implementation schedule for the oil-water separation improvement concepts described in Section 3. Schedule details are described below:

- As a first action, final process water disposition should be established and permitting should be initiated as necessary. TRC contacted Ms. Dawn Casten (City of Massillon) and she stated that the City of Massillon is equipped to handle the hydraulic load that would be discharged as process water from CDF, and she did not expect a long permitting period (up to 2 months) as she anticipates that the Permit to Install and the city discharge application would be readily reviewed by Ohio EPA and the City of Massillon. Ms. Casten also stated that preliminary testing will be required as part of the application process to confirm that effluent quality would meet discharge requirements. In particular, CDF's effluent will most likely be subject to organic loading limitations.
- Complete the installation of a manhole, pump, and piping to facilitate the transfer of process water from the vicinity of the Boiler House Building to the new OWS.
- As an early action item, the replacement OWS should be designed and fabricated (approximately 12-16 weeks). Once it is available for installation, the existing OWS should then be removed. During this removal process, a temporary above-ground OWS and any necessary transfer pumps would be rented to treat process water during the construction process. Prior to the OWS installation, OWS effluent pipe installation could be initiated to expedite the overall installation process.
- Following OWS installation, perform pond remediation efforts as coordinated under Ohio VAP. Concurrent with remediation efforts, performed under Ohio VAP, stormwater outfalls, equipped with stormwater-oil interceptors, should be installed.
- Following pond remediation efforts consistent with Ohio VAP, floating oil containment booms should be installed at the stormwater and OWS outfall structures within each pond.
- Following the implementation of all OWS improvements, establish a comprehensive inspection and maintenance program for all process water treatment and stormwater management processes.

Once implemented, the following tasks will be performed on a routine basis to maintain and monitor the performance of the installed OWS improvements:

- Accumulation of sediment within the new process water OWS and within the Oil-stormwater separators at each stormwater outfall will be monitored and removed (by vacuum truck or other similar means).
- Collected oil within the process OWS will be automatically pumped to an above ground storage tank, and transferred from the storage truck to storage totes for off-site recycling.
- OWS's installed at each stormwater outfall will be monitored periodically for the accumulation of oil. The collected oil will be removed periodically based on manufacturer's recommendations (using a vacuum truck, pump, or bailer device).
- The emergency back-up power supply unit will be periodically tested per manufacturer's recommendations to assure that the unit will operate without hesitation in the event of a power failure.
- Water retained behind the floating oil booms installed in Ponds #1 and #2 will be periodically inspected, particularly following rainstorm events, to assess whether any inadvertent oil release was discharged to any pond as a result of stormwater flows.
- Periodic process water discharge monitoring in accordance with City of Massillon sampling requirements.

Tables

Table 1
Basis of Conceptual Design
Oil-Water Separation Improvements and Stormwater Management

Canton Drop Forge
6545 Southway St SW
Canton, OH

Item No.	Design Parameter	Value	Measurement, Calculation, or Assumption	Source or Basis
1	Process Water Flow Rate			
	- Flow to OWS, max.	108 gpm	Measurement	on-site measurements--Sept. 2012; see Appendix A
	- Steam-Oil Separator Flow Rate	20 gpm	Assumption	CDF Process Knowledge
	- Total Combined Flow to New Proposed OWS	192 gpm	Calculation	combined process flow + 50% factor of safety
2	Stormwater Flow Rate			60% of 2yr, 30 min (1.14 in/hr)
	- Commingle with Process Water	50 gpm	Calculation	see Appendix C
	- Flow to Pond #1	1250 gpm	Calculation	see Appendix C
	- Flow to Pond #2	2500 gpm	Calculation	see Appendix C
3	Proposed Maximum Flow Rate to New OWS	250 gpm	Calculation	Existing Process Flow + Stormwater Flow
4	Existing OWS Inlet Pipe			
	- diameter	6-inch diameter	Assumption	Facility As-Built
	- slope	1 ft per 100 ft	Assumption	Facility As-Built
	- pipe condition (as basis for friction factor)	dirty; Manning's f = 0.015	Assumption	17 yr old pipe; visual
	- Max Flow	235 gpm	Calculation	see Appendix B
5	Oil Physical Properties			
	- density	0.884 g/ml	Measurement	Crystal Laboratories (Canton OH); 8/24/12
	- kinematic viscosity	100.95 mm^2/sec	Measurement	Crystal Laboratories (Canton OH); 8/24/12
6	Organic Compounds in Oil			
	- benzene	28 ug/kg	Measurement	Crystal Laboratories (Canton OH); 8/24/12
	- cumene	225 ug/kg	Measurement	Crystal Laboratories (Canton OH); 8/24/12
	- naphthalene	8899 ug/kg	Measurement	Crystal Laboratories (Canton OH); 8/24/12
	- total xylenes	119 ug/kg	Measurement	Crystal Laboratories (Canton OH); 8/24/12
7	City of Massilon Wastewater Limits			
	- Oil & Grease	100 mg/L	Assumption	Conversation with Dawn Casten (City of Massillon)
	- total organic load	300 mg/L BOD	Assumption	Conversation with Dawn Casten (City of Massillon)
	- other likely limitations (no values stated)	P, SO4-, S2-, TDS, TSS	Assumption	Conversation with Dawn Casten (City of Massillon)

Table 2
Oil and Water Flow Assessment and Oil Separation Schedule
Canton Drop Forge

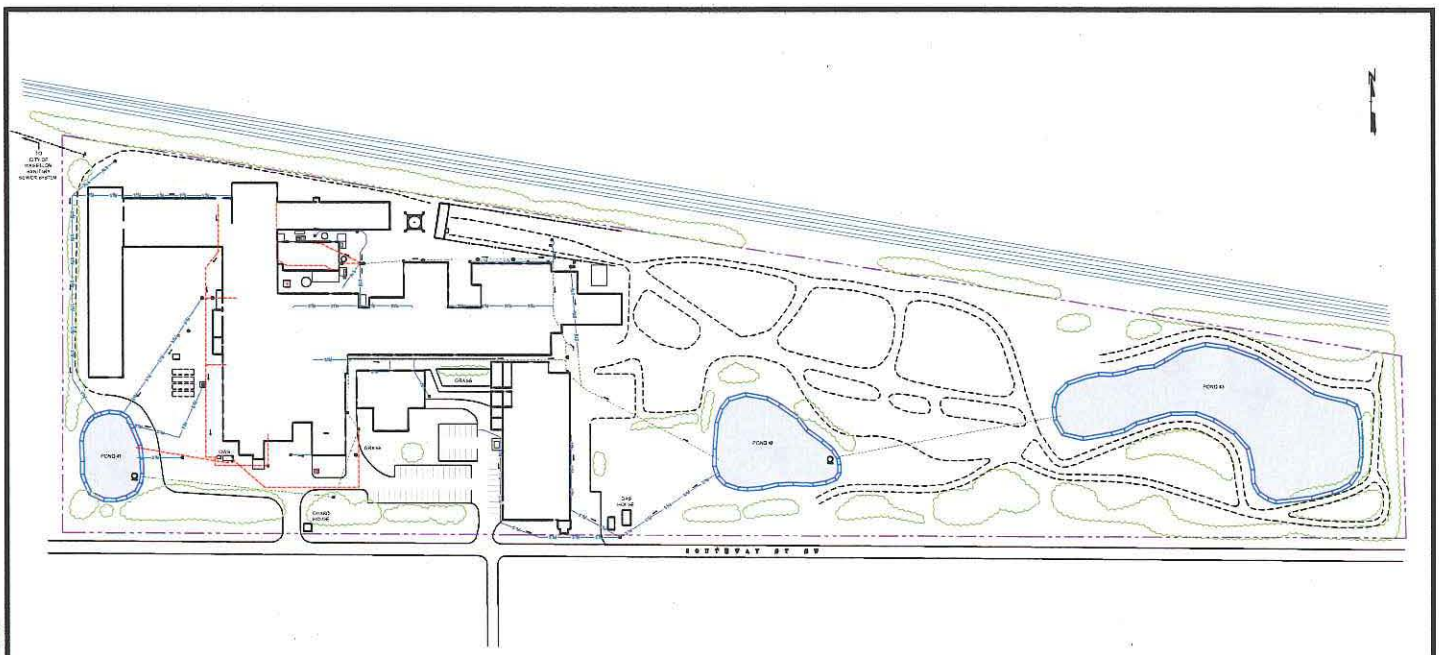
ID	Task Name
1	Pre-Design Surveying & Sampling
2	Permitting
3	Design; Plans & Specifications
4	OWS Fabrication/Delivery
5	Contractor Bidding/Selection
6	Installations
7	OWS Effluent Piping
8	Process Water Diversion (Manhole, Pump & Piping)
9	OWS Removal/Installation
10	Pond Remediation (coordinated under Ohio VAP)
11	Stormwater Outfalls/Stormwater-Oil Interceptors
12	Pond Boom Installations
13	Misc. BMP Installations/Improvements
14	Shake-Down/Start-Up/As-Built Drawing Preparation

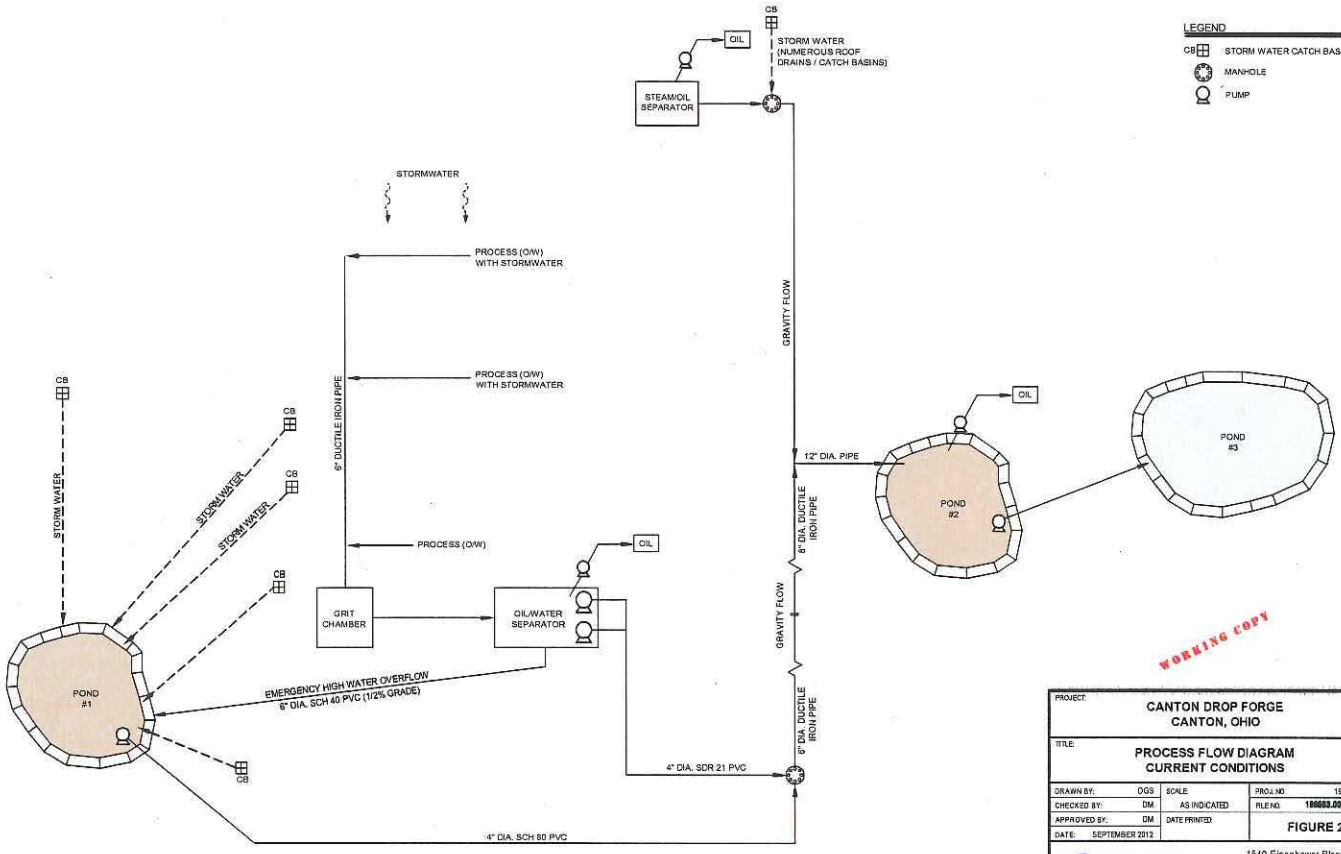
Project: Oil & Water Flow Assessment
Date Printed: Tue 10/2/12

Task — Summary
Milestone — Project Summary

\\ntapa-annarbor\aam-vol1\-\WPAAM\PJT2\196663\0000\OWS Schedule.mpp

Figures


TO
CITY OF
MASSILLON
SANITARY
SEWER SYSTEM
POND #1
POND #2
POND #3
POND #4
GRASS
GRASS
GRASS



PROJECT: CANTON DROP FORGE
CANTON, OHIO

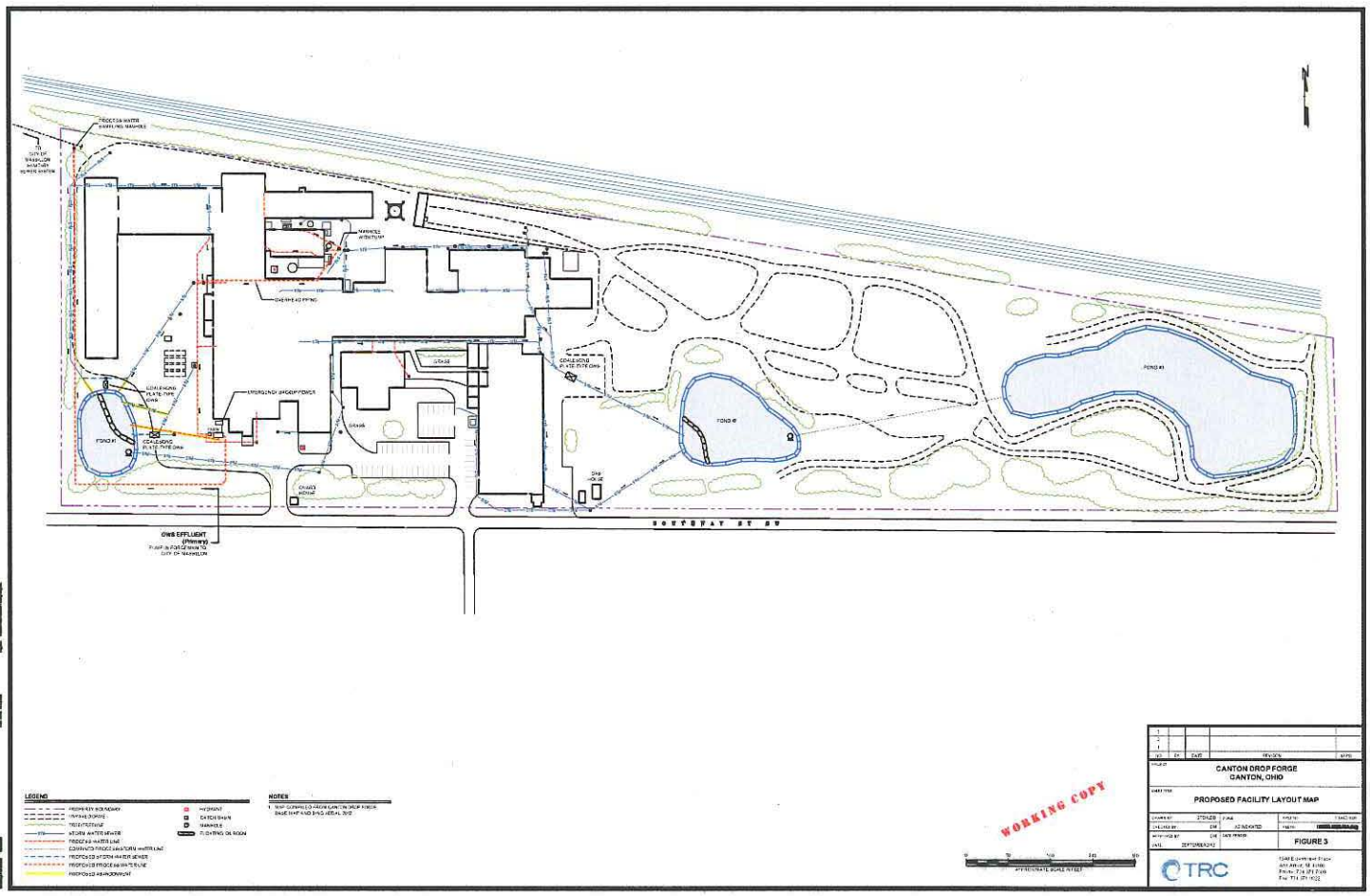
TITLE: PROCESS FLOW DIAGRAM
CURRENT CONDITIONS

DRAWN BY:	DGS	SCALE:		PROJ. NO.	195663.0000
CHECKED BY:	DM	AS INDICATED		FILE NO.	195663.0000.02.dwg
APPROVED BY:	DM	DATE PRINTED:		FIGURE 2	
DATE:	SEPTEMBER 2012				

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108
Phone: 734.971.7080
Fax: 734.971.9022

Drawing Name: J:_TRC\Canton Drop Forge\195663\0000\195663.0000.02.dwg
Operator Name: STEHLE, DONNA
Drawing Plot Size: 8.5x11.0
Dwg Size: 8.50 Ub
Plot Date: September 28, 2012
Plot Time: 11:01 AM
Attached Xrefs:
Attached Images:
Layout: FIGS PFD Ex Cands

CDF007701



LEGEND

- PROPERTY BOUNDARY
- CENTRAL DROPS
- TRUCK PATHWAY
- STORM WATER SEWER
- FROCE MAIN LINE
- COMBINED FROCE MAIN/STORM WATER LINE
- PROPOSED STORM WATER SEWER
- PROPOSED FROCE MAIN PIPELINE
- PROPOSED ABANDONMENT
- HYDRANT
- CATCH BASIN
- MANHOLE
- FLOATING OIL BOOM

NOTES

1. MAP COMPILED FROM CANTON DROP FORGE BASE MAP AND SAS AERIAL SUS

WORKING COPY

0 50 100 200 400

APPROXIMATE SCALE IN FEET

NO.	BY	DATE	REVISION	APPD
1				
2				
3				

PROJECT: CANTON DROP FORGE
CANTON, OHIO

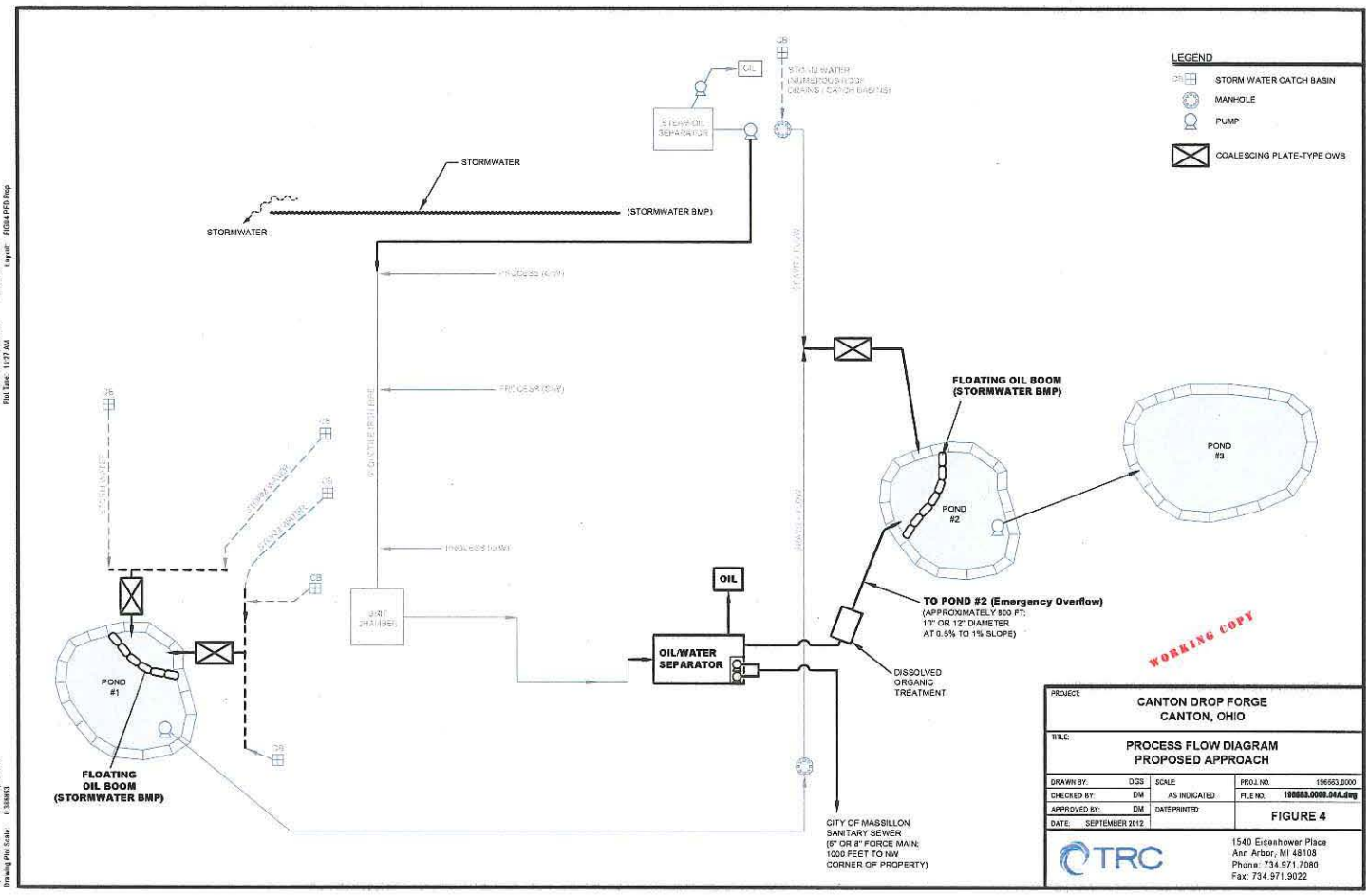
SHEET TITLE: PROPOSED FACILITY LAYOUT MAP

DRAWN BY: JTD/KZB | FILE: | PROJ NO: 114021.000
CHECKED BY: DM | AS NOTED | YEAR:
APPROVED BY: DM | DATE PRINTED:
DATE: SEPTEMBER 2012

FIGURE 3

TRC

1540 E Dublin and Granville Road
Columbus, OH 43229
Phone: 614 781 1700
Fax: 614 781 1702


LEGEND
STORM WATER CATCH BASIN
MANHOLE
PUMP
COALESCING PLATE-TYPE OWS
STORMWATER
STORMWATER
(STORMWATER BMP)
OIL
FLOATING OIL BOOM
(STORMWATER BMP)
POND #1
POND #2
POND #3
OIL
OIL/WATER SEPARATOR
TO POND #2 (Emergency Overflow)
(APPROXIMATELY 800 FT;
10" OR 12" DIAMETER
AT 0.5% TO 1% SLOPE)
DISSOLVED ORGANIC TREATMENT
CITY OF MASSILLON SANITARY SEWER (6" OR 8" FORCE MAIN; 1000 FEET TO NW CORNER OF PROPERTY)
FLOATING OIL BOOM
(STORMWATER BMP)
WORKING COPY
PROJECT:
CANTON DROP FORGE
CANTON, OHIO
TITLE:
PROCESS FLOW DIAGRAM
PROPOSED APPROACH
DRAWN BY: DGS
CHECKED BY: DM
APPROVED BY: DM
DATE: SEPTEMBER 2012
SCALE: AS INDICATED
DATE PRINTED:
PROJ. NO. 196663.0000
FILE NO. 196663.0000.04A.dwg
FIGURE 4
TRC
1540 Eisenhower Place
Ann Arbor, MI 48108
Phone: 734.971.7080
Fax: 734.971.9022

CDF007703

Appendix A
Existing OWS Flow Rates

CANTON DROP FORGE
OIL WATER SEPERATOR FLOW CALCULATIONS

DIRECTIONS:

	Influent Flow Rate (gpm)[1]	Pump No. 1 Flow (gpm)	Pump No. 2 Flow (gpm)
Average =	88	182	155
Max =	108	213	175
Min =	46	144	130

Date	Time (h:mm:ss)	On/Off	Pump No.	Comments: Current/Recent Weather	Comments: No. of Furnaces Operating	No. of Hammers Operating	Misc. Notes.	Elapsed Time (sec.)	Influent Flow Rate (gpm)[1]	Pump No. 1 Flow (gpm)	Pump No. 2 Flow (gpm)
5-Sep-12	8:38:23 AM	Off		Clear				113.00	46		
5-Sep-12	8:40:16 AM	On	1	Clear				47.00		156	
5-Sep-12	8:41:03 AM	Off		Clear				53.00	98		
5-Sep-12	8:41:56 AM	On	2	Clear				67.00			175
5-Sep-12	8:43:03 AM	Off		Clear				52.00	100		
5-Sep-12	8:43:55 AM	On	1	Clear				52.00		199	
5-Sep-12	8:44:47 AM	Off		Clear				57.00	91		
5-Sep-12	8:45:44 AM	On	2	Clear				72.00			163
5-Sep-12	8:46:56 AM	Off		Clear				48.00	108		
5-Sep-12	8:47:44 AM	On	1	Clear				51.00		210	
5-Sep-12	8:48:35 AM	Off		Clear				55.00	94		
5-Sep-12	8:49:30 AM	On	2	Clear							
5-Sep-12	1:03:40 PM	On	1	Clear				128.00			
5-Sep-12	1:05:48 PM	Off		Clear				52.00	100		
5-Sep-12	1:06:40 PM	On	2	Clear				77.00			167
5-Sep-12	1:07:57 PM	Off		Clear				53.00	98		
5-Sep-12	1:08:50 PM	On	1	Clear				86.00		158	
5-Sep-12	1:10:16 PM	Off		Clear				65.00	80		
5-Sep-12	1:11:21 PM	On	2	Clear				58.00			169
5-Sep-12	1:12:19 PM	Off		Clear				65.00	80		
5-Sep-12	1:13:24 PM	On	1	Clear				44.00		198	
5-Sep-12	1:14:08 PM	Off		Clear				67.00	77		
5-Sep-12	1:15:15 PM	On	2	Clear				57.00			168
5-Sep-12	1:16:12 PM	Off		Clear				65.00	80		
5-Sep-12	1:17:17 PM	On	1	Clear							
6-Sep-12	11:35:40 AM	On	2	Clear	3	5		80.00			
6-Sep-12	11:37:00 AM	Off						58.00	89		
6-Sep-12	11:37:58 AM	On	1					42.00		213	
6-Sep-12	11:38:40 AM	Off						60.00	86		
6-Sep-12	11:39:40 AM	On	2					70.00			160
6-Sep-12	11:40:50 AM	Off						60.00	86		
6-Sep-12	11:41:50 AM	On	1					45.00		202	
6-Sep-12	11:42:35 AM	Off						55.00	94		
6-Sep-12	11:43:30 AM	On	2					82.00			157
6-Sep-12	11:44:52 AM	Off									
17-Sep-12	1:51:55 PM	on	2		5	4		95.00			
17-Sep-12	1:53:30 PM	off						60.00	86		
17-Sep-12	1:54:30 PM	on	1					60.00		173	
17-Sep-12	1:55:30 PM	off						60.00	86		
17-Sep-12	1:56:30 PM	on	2					85.00			147
17-Sep-12	1:57:55 PM	off						57.00	91		
17-Sep-12	1:58:52 PM	on	1					58.00		180	
17-Sep-12	1:59:50 PM	off						67.00	77		

CANTON DROP FORGE
OIL WATER SEPERATOR FLOW CALCULATIONS

DIRECTIONS:

	Influent Flow Rate (gpm)[1]	Pump No. 1 Flow (gpm)	Pump No. 2 Flow (gpm)
Average =	88	182	155
Max =	108	213	175
Min =	46	144	130

Date	Time (h:mm:ss)	On/Off	Pump No.	Comments: Current/Recent Weather	Comments: No. of Furnaces Operating	No. of Hammers Operating	Misc. Notes.	Elapsed Time (sec.)	Influent Flow Rate (gpm)[1]	Pump No. 1 Flow (gpm)	Pump No. 2 Flow (gpm)
17-Sep-12	2:00:57 PM	on	2					85.00			138
17-Sep-12	2:02:22 PM	off						48.00	108		
17-Sep-12	2:03:10 PM	on	1					145.00		144	
17-Sep-12	2:05:35 PM	off						55.00	94		
17-Sep-12	2:06:30 PM	on	2					145.00			130
17-Sep-12	2:08:55 PM	off						50.00	104		
17-Sep-12	2:09:45 PM	on	1					60.00		190	
17-Sep-12	2:10:45 PM	off						67.00	77		
17-Sep-12	2:11:52 PM	on	2					98.00			130
17-Sep-12	2:13:30 PM	off						65.00	80		
17-Sep-12	2:14:35 PM	on	1					65.00		159	

Notes:

1. The following measurements were used to determine the volume of water entering the seperator sump pit during the "off" cycle between the high/low float levels.

H. Level (ft)	L. Level (ft)	Length (ft)	Width (ft)	Vol. (ft^3)	Vol. (gal)
9.2	10.9				
9.3	10.9				
9.25	10.9	2	3.5	11.55	86.4

Appendix B
Pipe Flow Calculations

CDF- Pipe Flow Calcs

GIVEN:

	English		Metric	
Pipe Size	6	in. =	0.152	m
Slope	0.1	ft/10 ft =	0.01	m/m

EQUATIONS:

$Q = (K'/n)\, D^{8/3} S^{1/2}$

$K' = nQ/(D^{8/3} S^{1/2})$

ASSUMPTIONS:

n = 0.015 PE Ref. Book, App. 19.A, cast iron = 0.012-0.015 for clean, 0.015-0.035 for dirty, tuberculated.

SOLUTION:

d (in.)	d/D	K'	Q (m^3/s)	Q (ft^3/s)	Q (gpm)	
0.6	0.1	0.00651	0.00	0.01	5	
1.2	0.2	0.0273	0.00	0.04	19	
1.8	0.3	0.061	0.00	0.10	43	
2.4	0.4	0.105	0.00	0.16	74	
3	0.5	0.156	0.01	0.24	109	
3.6	0.6	0.209	0.01	0.33	146	
4.2	0.7	0.261	0.01	0.41	183	
4.8	0.8	0.305	0.01	0.48	214	
5.4	0.9	0.332	0.01	0.52	232	
5.58	0.93	0.335	0.01	0.52	235	MAX
6	1	0.312	0.01	0.49	218	

Appendix C
Stormwater Flow Modeling

TRC
505 E. Huntland Drive
Suite 250
Austin, TX 78752

Main 512.329.6080

Technical Memorandum

To: Dave McKenzie, TRC

From: James L. Machin, P.E.

Subject: Canton Drop Forge Runoff, Oil-Water Separators
Date: September 28, 2012

Project No.: 196663

The Canton Drop Forge (CDF) facility in Canton, Ohio discharges storm water from industrial activity areas on site to two ponds (Pond #1 and Pond #2) located in the southwest and east central part of the site, respectively. The run-off is suspected to contain some oil & grease (O&G) and suspended solids. To reduce the O&G and suspended solids loading to the ponds, TRC evaluated the drainage areas of the ponds and assigned a "design rainstorm" to determine design flow rates for each area so that appropriately sized oil-water separators may be selected to process the storm water prior to its discharge to the ponds.

Drainage Areas

Drainage areas were estimated from the 1994 topographic map of the property provided by CDF, and surface conditions were estimated both from the map and from aerial images:

> Pond #1: The estimated storm sewer drainage area for Pond #1 comprises the western portion of the site north and northeast of the pond. This area is approximately 4.4 acres, of which 50% is estimated as bare ground/gravel, 33% is estimated as roof area, and 17% is estimated as vegetated.
>
> Pond #2: The estimated storm sewer drainage area for Pond #2 comprises the central portion of the site west and northwest of the pond, excluding the employee parking area. This area is approximately 7.5 acres, of which 44% is estimated as bare ground/gravel, 51% is estimated as roof area, and 5% is estimated as vegetated.

Water Quality Design Flows

Most pollutant runoff occurs with the "first flush" from relatively frequent storm events. The design flow for water quality treatment is often taken to be 60% of the 2-yr intensity rainstorm (King County, 2009), which is roughly equivalent to a 6-month storm event. An estimated 90% of the pollutant load occurs from storms with less than this intensity (Romano, 1990). The pollutant removal benefit from using less frequent storms is less, and they result in higher flows and oversized separators, with a correspondingly higher cost. Additionally, to avoid washout of captured oils, flow rates in excess of the design rate could be designed to bypass the unit.

With drainage areas of this size, the Rational Method (Q=CIA) is an appropriate tool to calculate peak flows. Runoff coefficients for a storm of this frequency and intensity were estimated at 0.5 for bare ground, 0.8 for roof, and 0.2 for vegetated. A weighted average coefficient was used for each drainage area. Time of concentration was estimated at 30 minutes, so the 2-year, 30-minute rainfall intensity for the Canton OH area of approximately 1.9 in/hr was used (Dept. of Commerce, 1961).

Design flows were calculated to be 1,250 gpm for Pond #1, and 2,500 gpm for Pond #2. The design flows could be reduced by diverting runoff from any uncontaminated roofs and vegetated areas out of the storm sewer system drainage area.

Oil-Water Separators

A coalescing plate-type separator is recommended for this application. This type of separator is equipped with numerous parallel corrugated plates at an angle of 45-60 degrees to enhance oil and solids removal. This greatly increases the oil flotation surface area and efficiency of the separator. An API separator is designed for industrial applications with a heavy oil load, such as refineries. Hydrodynamic separators are best with settleable solids but have an oil flotation surface area much less than with a coalescing plate separator. A coalescing plate separator can increase the effectiveness of oil separation and greatly reduce the size of the unit, particularly as compared to a standard API-type separator. It should be able to yield effluent concentrations of 10-15 mg/L O&G or better, depending on flow and influent concentration.

With any oil-water separator, maintenance is critical. For storm water applications, the high solids loading will likely mean that maintenance will be required approximately every six months. The schedule can be established more precisely after installation based on measurements of accumulated solids and oil over time.

Some suggested separators and rough estimated costs (not including installation):
PS International, PS-12000, 1500 gpm, ~$30K
Highland Tank, HT-12000, 1250 gpm, ~$45K
PS International, PS-20000, 2500 gpm, ~$42K
Highland Tank, HT-25000, 2500 gpm, ~$75K

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