

Cumberland Outfall Maintenance Program

April 25, 2013

Background

This document was prepared to assist the City of Cumberland with the documentation and assessment of storm sewer outfalls located within the city limits of Cumberland. EOR was contracted to assess 60 outfalls in and around Beaver Dam Lake to determine the quantity and extent of any sediment plumes identified within the project area (Figure 1). This information was used to develop a base map which will become an integral tool in the development of a management strategy for the maintenance of these outfalls.

Methods

For each outfall located in the field, the pipe size and type were documented and an invert elevation was surveyed. RTK GPS survey equipment was used as the primary device for measuring pipe invert elevations. A dense tree canopy occasionally blocked GPS satellites and as a result some invert elevations could not be measured in heavily forested areas. If a sediment plume occurred below an outfall, the perimeter and depth (height above the natural grade) was surveyed with RTK GPS and/or total station survey equipment. In addition to the sediment plume survey, outfalls that occurred along the shoreline of Beaver Dam Lake were assessed for wildlife habitat and aquatic vegetation that would be affected by the removal of the sediment deposit. Any aquatic macrophytes growing in and around the sediment plumes were identified and the relative densities of plants growing within or near the sediment plume were assessed.

Results

The City of Cumberland provided EOR with a storm sewer utility shapefile that was used as the basis for identifying outfalls in the field. This shapefile was imported into GIS software to create a field map of outfall locations. After reviewing the data in GIS, 60 potential outfall locations were identified. Of the 60 outfalls identified in GIS, 59 areas were assessed in the field, and 53 outfalls were located. Some outfalls identified in the stormwater utility shapefile did not exist in the field and some outfalls located in the field did not exist in the stormwater utility shapefile. Outfalls occurring the shapefile that were not located in the field were labeled with a yellow triangle and outfalls found in the field that didn't exist in the shapefile were labeled with a blue box (Figures 2-6). Most of the sites were assessed between July and August of 2012. Detailed descriptions of the sites follow each figure (Tables 1-5). The descriptions include notes on pipe size, type, condition, and quantity of sediment surveyed (if present). A total of 14 sediment plumes were identified at the following outfalls: 1, 2, 4, 5, 6, 11, 16, 31, 34, 42, 43, 45, 47, and 63.

Discussion

Prior to sediment plume removal, sediment testing will need to be conducted to determine if the sediment contains heavy metals, chemical compounds, hazardous waste, or other harmful substances. Sediments containing certain compounds will have to be disposed of at a hazardous waste site. The Wisconsin Department of Natural Resources must be consulted to determine the number of sediment cores and soils analysis for each project site. Based on sediment core data collected on November 15, 2011 at Library Lake outfalls 43, 45, and 63, the cost to perform the sediment analysis per sediment core was approximately \$950. Analytes required for testing at that time included: PCB's, PAH's, TVS, TKN, NH₃, TOC, Total Phosphorus, Organochlorine Pesticides, Non-Routine Testing, Metals Digestion, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Zinc, and Mercury. This list is by no means all inclusive and additional analyses may be required for future projects. A list of acronyms is included in Table 6.

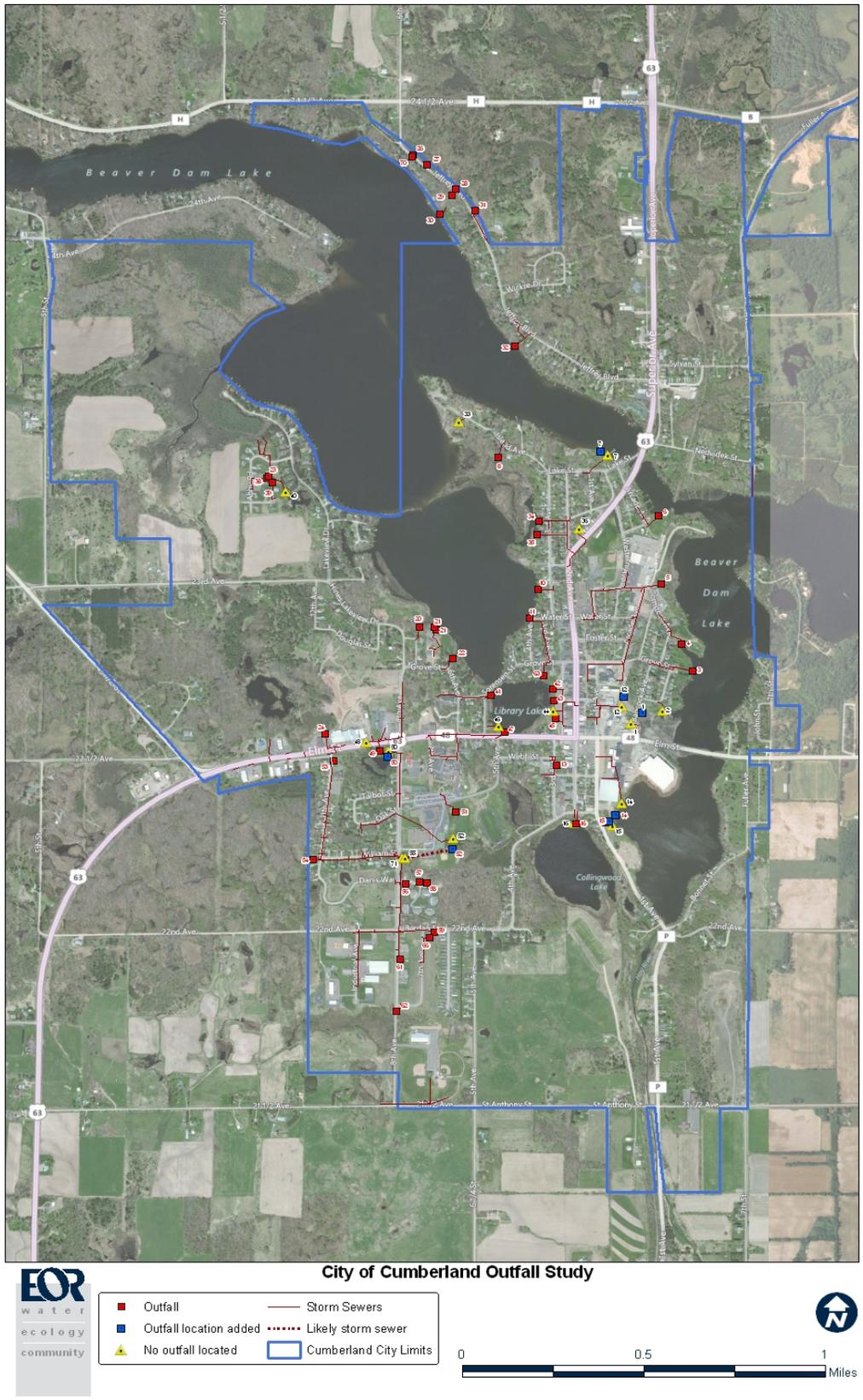


Figure 1. Outfall Survey Project Overview.



Figure 2. Outfall Locations, North.

Table 1. Outfall Site Descriptions, North.

Outfall #	Description
26	Two 18" RCP's, no discernible sediment plumes found below the outfalls but some sediment is present in the pipes.
27	15" RCP 100% plugged with sand and leaf debris. The grate needs to be removed to clean out the pipe, not able to survey with GPS, no discernible sediment plume.
28	18" RCP, no sediment plume, outlets to sandy gravel wooded swale, not able to survey with GPS.
29	18" RCP, no sediment plume, outlets to sandy gravel wooded swale, not able to survey with GPS.
30	18" RCP, no sediment plume, riprap occurs below the outfall, not able to survey with GPS.
31	24" RCP, a small sediment plume of approximately 2 cubic yards was found below outfall which is likely the product of the swale cutting through wooded area upstream of the plume. The sediment plume was mostly vegetated with sedges and reed canary grass, not able to survey with GPS.
70	18" RCP, not able to survey with GPS, no discernible sediment plume found.

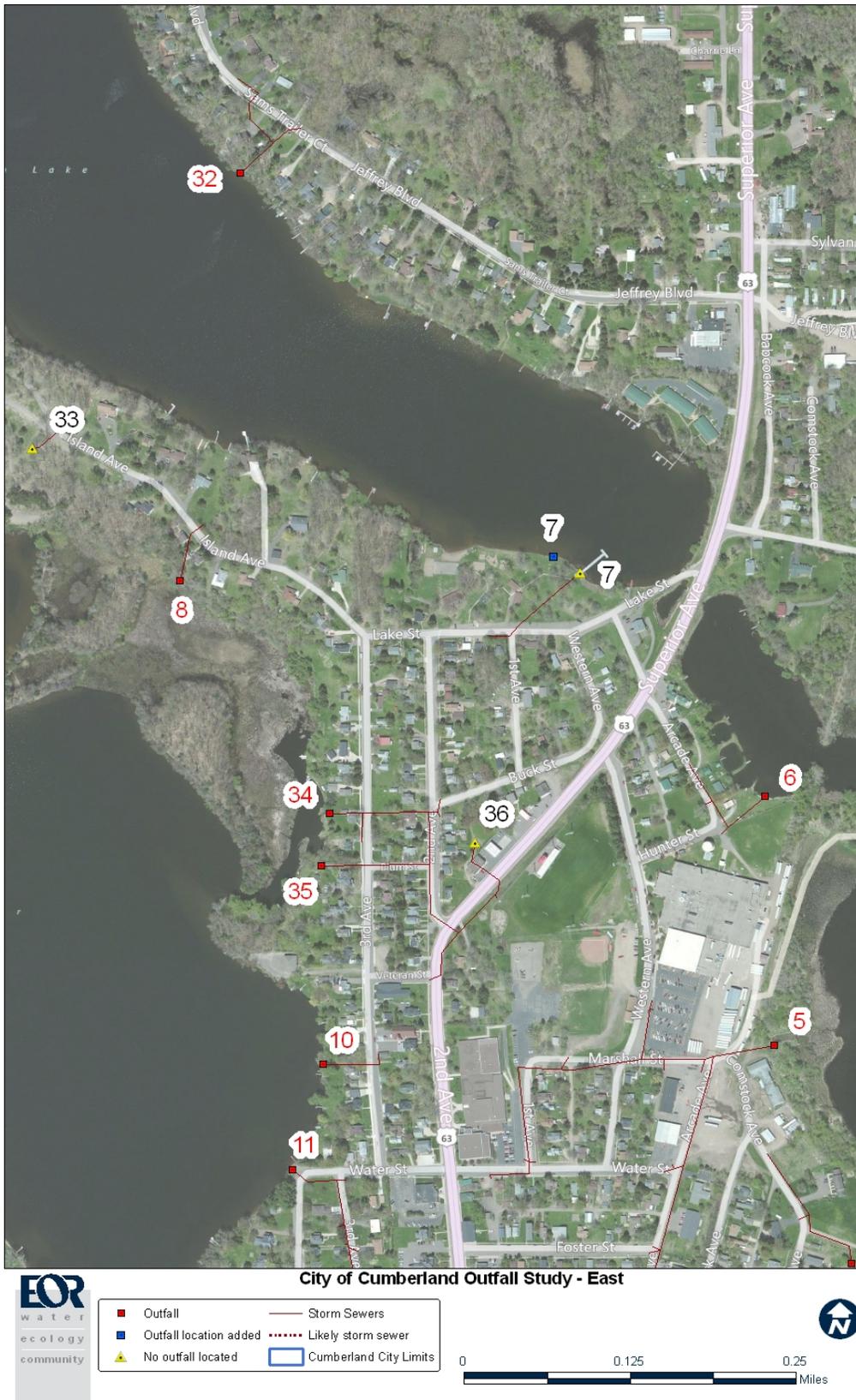


Figure 3. Outfall Locations, East.

Table 2. Outfall Site Descriptions, East.

Outfall #	Description
5	Two outfalls occur at this site: 21"x27" arch CMP, 14"x20" arch CMP. A sediment plume of approximately 15 cubic yards was surveyed beyond the outfall. Plant species present include cattail spp., reed canary grass, and arrowhead.
6	18" HDPE pipe, a small sediment plume of approximately 1.2 cubic yards was surveyed. Plant species present include coontail, Canada waterweed, and white water-lily.
7	No outfall found at the dock, but a 15" HDPE pipe was surveyed approximately 100 ft. northeast of the dock, no sediment plume found. The lakeshore is comprised of sandy gravel.
8	12" CMP, pipe slope close to 45 degrees near outlet resulting in some swale erosion below the pipe but no discernible sediment plume was found at the wetland edge. The pipe could use an energy dissipater to prevent further erosion, not able to survey outfall with GPS.
10	8" clay pipe 100% plugged with sediment, outlet is set low at the lakeshore and was likely plugged from ice heaving, no sediment plume found. The lakeshore is comprised of sandy gravel.
11	18" RCP in poor condition with the pipe joints separated near the outlet. A sediment plume of approximately 5 cubic yards was surveyed beyond the edge of the plunge pool. Plant species present include blue flag iris, reed canary grass, sandbar willow, and pickerelweed just beyond the sediment plume.
32	15" RCP, an approximate 3 ft. drop occurs below the outfall to the rocky lakeshore, no sediment plume found, the outfall could not be surveyed with GPS.
33	No outfall found, but overland flow likely occurs between the depressions in landscape.
34	15" RCP, a sediment plume of approximately 6.5 cubic yards was surveyed, plant species present include cattail spp. and white water-lily.
35	24" RCP, no discernible sediment plume, not able to survey with GPS.
36	No outfall found but a manhole near the BP gas station was located. The direction of stormwater flow at this site is unknown because the outfall could not be located.



Figure 4. Outfall Locations, West.

Table 3. Outfall Site Descriptions, West.

Outfall #	Description
20	Detailed assessment completed by Derek Lash of EOR. 12" CMP protruding from bank, gully erosion below, not able to survey with GPS.
21	Two outfalls at this location. Detailed assessment completed by Derek Lash of EOR. 15" HDPE pipe inlet to a pond with 6" PVC outlet, rock swale in good shape, not able to survey with GPS.
22	Detailed assessment completed by Derek Lash of EOR. 15" PVC protruding from bank, gully erosion below, not able to survey with GPS.
23	12" HDPE pipe, no sediment plume, pipe in good condition.
24	30" HDPE pipe, open cut channel below the outfall but no discernible sediment plume identified.
38	15" HDPE pipe, no discernible sediment plume.
39	12" HDPE pipe, no discernible sediment plume.
40	No outfall found, outfall possibly underwater or buried underground.
48	No outfall found.
49	42"W x 72"H box culvert with 1-2" of sediment at the invert. No sediment plume below outfall.
50	No outfall found, but a 24" CMP was located approximately 75 ft. to the south with a 3-4 ft. deep plunge pool below the outfall. A concrete slab overflow occurs at the edge of the plunge pool. The presence of a sediment plume could not be assessed due to water depth beyond the plunge pool.
53	18" HDPE pipe, pipe partially plugged with approximately 6" of sediment, no discernible sediment plume below outfall.



City of Cumberland Outfall Study - Southeast

- Outfall
- Outfall location added
- ▲ No outfall located
- Storm Sewers
- ⋯ Likely storm sewer
- ▭ Cumberland City Limits

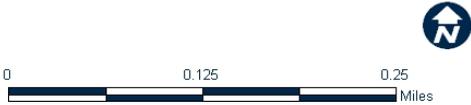


Figure 5. Outfall Locations, Southeast.

Table 4. Outfall Site Descriptions, Southeast.

Outfall #	Description
1	No outfall found, but a rusted out 18" CMP was located approximately 190 ft. to the north. The outlet pipe is in very poor condition. A sediment plume of approximately 4.3 cubic yards occurred beyond the plunge pool below the pipe outlet. Plant species present include reed canary grass, nightshade spp., and sandbar willow.
2	No outfall found; it is possibly buried in lake sediments. A small sediment plume of approximately 1.2 cubic yards was surveyed near the potential outfall location.
3	12" PVC, no sediment plume, aquatic macrophytes include pondweed spp. and Canada waterweed.
4	12" RCP in poor condition; the pipe joints have separated near the outlet. A sediment plume of approximately 9.5 cubic yards was surveyed, but the pipe elevation could not be surveyed with the GPS due to tree cover.
12	No outfall found, but a 4" clay pipe was located approximately 230 ft. to the northeast. Erosion was noted beneath the pipe and some overland erosion exists but no discernible sediment plume was found beyond the outfall. The outfall could not be surveyed with GPS.
13	12" RCP, no sediment plume, pipe outlets to parking lot grass swale.
14	No outfall found, but an 18" RCP was located approximately 190 ft. to the southwest. The outfall could not be surveyed with GPS due to tree cover. An approximate 12 ft. x 14 ft. x 3 ft. deep plunge pool with a sediment plume at outer edge likely formed beyond the plunge pool. The sediment plume could not be surveyed due to water depth. Plant species present include black willow and box elder. The pipe outlet occurs several feet above the water surface. Flows from the outlet from this elevation have likely scoured out the plunge pool below the outfall.
15	No outfall found, but an 18" RCP was located approximately 75 ft. to the northwest. The outfall could not be surveyed with GPS. The outlet is well above the lake, no discernible sediment plume found.
16	The west outfall was not found, but an 18" HDPE pipe was located to the east and a sediment plume of approximately 8 cubic yards was surveyed. Plant species present include smartweed and reed canary grass. A small swale with an eroding headcut was found below the pipe.
41	Recently modified site- new pipe installed in the summer of 2012 for the Neuer Pond BMP.
42	15" CMP, a sediment plume of approximately 2 cubic yards occurs beyond the outfall. Plant species present include sandbar willow, reed canary grass, and cattail spp.
43	15" RCP, a sediment plume of approximately 2 cubic yards occurs beyond the outfall. Sediment core analysis completed for this site, samples were collected on 11/15/11 (core #4). Plant species present include sandbar willow, and cattail spp.
44	No outfall found, no discernible sediment plume found.
45	15" CMP, a sediment plume of approximately 2 cubic yards occurs beyond the outfall. Sediment core analysis completed for this site, samples were collected on 11/15/11 (core #5). Plant species present include sandbar willow, reed canary grass, and cattail spp.
46	No outfall found.
47	30" RCP, a sediment plume of approximately 96 cubic yards was surveyed beyond the edge of the plunge pool.
63	15" RCP, a sediment plume of approximately 22.4 cubic yards was surveyed. Sediment core analysis completed for this site, samples were collected on 11/15/11 (core #3). Plant species present include reed canary grass, cattail spp., and white water-lily.



Figure 6. Outfall Locations, South.

Table 5. Outfall Site Descriptions, South.

Outfall #	Description
51	12" RCP, pipe joint separated on slope, survey elevation taken at the separated joint, no sediment plume found.
52	No outfall found, but a 42" RCP was located approximately 150 ft. to the south. A connection from site #71 occurs at the manhole located just southwest of the tennis court in the parking lot. This site has a riprap swale with no sediment plume.
54	This site is not an outfall. The 18" RCP slopes east toward 11 th Avenue and likely flows east toward outfall #52.
55	No outfall found.
56	12" RCP, no sediment plume found but there is sediment in the pipe with vegetation growing within the flared end section below the pipe grate.
57	8" steel pipe, no sediment plume found. A very small plunge pool occurs below the outfall, not able to survey with GPS.
58	12" RCP, no sediment plume found. An open cut channel occurs below the outfall and leads to the wetland below but no discernible sediment plume could be found.
59	18" RCP drop structure with weir in place, no sediment plume found below the outfall.
61	12" RCP, no sediment plume found below the outfall.
62	15" RCP, no discernible sediment plume found below the outfall.
66	21" RCP, no discernible sediment plume found below the outfall.
71	No outfall found, but a manhole located just east of 8 th Avenue allows access to the underground pipe that continues northeast and ties into the manhole just upstream of outfall #52.

Table 6. List of Acronyms.

BMP	Best Management Practice
CMP	Corrugated Metal Pipe
GPS	Global Positioning System
GIS	Geographic Information System
HDPE	High Density Polyethylene
NH3	Ammonia
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PVC	Polyvinyl Chloride
SPP	Species (not identified to taxonomic species level)
RCP	Reinforced Concrete Pipe
RTK	Real Time Kinematic
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TVS	Total Volatile Solids