Focused Feasibility Study – REVISION 3
Operable Unit 5 – West Area Soils

Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Prepared for
Joslyn Manufacturing Company

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1.0 Introduction

This revised Focused Feasibility Study (FFS) has been prepared for the portion of the Joslyn Manufacturing & Supply Co. Site (Joslyn Site or Site) generally known as the West Area and two adjacent residential lots owned by Joslyn. These areas, collectively, are designated as Operable Unit 5. The subject of this FFS is Operable Unit 5. The Joslyn Site is located north of the intersection of Azelia Avenue North and Lakebreeze Avenue North in Brooklyn Center, Hennepin County, Minnesota. It is bounded to the south by residential development, by Middle Twin Lake to the west, by an active Canadian Pacific Railway track to the north, and State Highway 100 to the east (Figure 1). The United States Environmental Protection Agency (U.S. EPA) Site Identification Number is MND044799856. The lead regulatory agency for this Site is the Minnesota Pollution Control Agency (MPCA). This FFS supersedes the FFS documents that were originally submitted in February 2011 (Barr, 2011), June 2012 (Barr, 2012b), and July 2013 (Barr, 2013).

1.1 Site History – Wood Treating

The Joslyn Site was used for wood-treating operations from the 1920s until its closure in 1980. The primary purpose of the wood-treating operations at the Site was the production of wooden utility poles that had been treated with preservatives. The Site also produced lesser quantities of treated wooden railroad ties, treated wooden pilings, and cross-arms for wooden utility poles. Three methods of wood treatment were used at the Site: butt-dip treatment (from facility origin to about 1965), thermal treatment (from 1940s until close), and pressure treatment (from 1965 to close). The wood preservatives used at this facility included creosote, pentachlorophenol (PCP), and copper-chromium arsenate. Creosote was the only fluid used in butt-dip treatment and PCP was the only treating fluid used in the thermal treatment process. Although all three preservatives were used at different times in the pressure treatment system, PCP was the primary treating chemical used in this process (Barr, 1996).

1.2 Site History – Investigation and ROD Remedial Actions

On May 30, 1985, the MPCA and Joslyn entered into a Response Order by Consent (Consent Order) to continue the investigation and cleanup of the Joslyn Site (MPCA, 1985). This investigation led to interim response actions that addressed areas of significant soil contamination through excavation and offsite disposal. On July 31, 1989, a Record of Decision (ROD) specified remedies for the four operable units defined at the Joslyn Site (MPCA, 1989).

- Installation, operation, and maintenance of a groundwater pump-out system (OU1 for shallow groundwater and OU2 for middle-sand groundwater);
- Installation, operation, and maintenance of a dense non-aqueous phase liquid (DNAPL) pumpout system (OU3);
- Onsite biological treatment of the contaminated soil that remained after the 1988 interim response action (OU4); and
- Regional groundwater and surface water monitoring (OU1, OU2, and OU3).

The OU4 remedy consisted of excavation of soil contaminated with the wood-treating fluids, followed by biological treatment of those soils in an onsite land treatment unit (LTU). The OU4 remedy was targeted at soils in the unsaturated zone, although excavation occurred below the water table where practicable as required by the ROD. The ROD also specified that following soil treatment, the LTU was to be closed.

1.3 Site History – Integration of Site Redevelopment and the ROD Remedies

In 1998 and as OU4 remedial actions were being completed, the MPCA requested that Joslyn conduct a soil sampling program to assess the presence of polynuclear aromatic hydrocarbons (PAHs), PCP, and dioxins/furans in accessible soils across the Site. The prospective site redeveloper conducted this investigation in 1998 and 1999 (Earth Tech, 1999a; Earth Tech 1999b). As a result of this release sampling investigation, the Site was divided into two areas – the redevelopable portion of the Site and the West Area. On the redevelopable portion of the Site, site redevelopment activities have since been completed. The West Area was identified as an area of the Site requiring additional investigation and possible remediation.

With the exception of the West Area, the Joslyn Site has been redeveloped as part of three separate phases. Redevelopment activities were undertaken by Real Estate Recycling, Inc. with the cooperation of Joslyn and under the oversight of the MPCA. Since 1999, three buildings for light industrial use have been constructed, along with their associated parking lots, stormwater ponds, and an extension of Azelia Avenue. The groundwater and DNAPL remedies (OU1, OU2, and OU3) continue to operate effectively following redevelopment (MPCA, 2004a). Site redevelopment features (buildings, driveways, and areas of clean-vegetated soil) provided the closure of the previously described LTU. With the closure of the LTU, the remedy for OU4 on the developed portion of the Joslyn Site was complete—resulting in a partial deletion of the Site from the Minnesota Environmental Response and Liability Act (MERLA) Permanent List of Priorities (PLP) and from the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) National Priorities List (NPL).

1.4 Site History – Middle Twin Lake

Due to its location adjacent to the Joslyn Site, numerous investigations have been conducted at Middle Twin Lake to determine whether releases to the lake from the Joslyn Site have occurred, and if so, whether or not there are unacceptable risks to human health and the environment. The 1998 and 1999 release sampling investigation discussed in Section 1.3 triggered additional studies due to the identification of soil contaminated with dioxin/furans within the West Area. This section briefly describes the studies related to Middle Twin Lake that have been conducted since 1999.

In 2003, the MPCA retained Bay West, Inc. to collect sediment samples from Middle Twin Lake to determine whether contaminants of concern (COCs) had been released from the Joslyn Site. The sampling results were presented in a June 2004 report which concluded that a release of COCs from the Joslyn Site into Middle Twin Lake sediments had occurred (Bay West, 2004). Joslyn questioned the conclusions cited in the report.

In 2004, a fish tissue study was completed on fish collected from Middle Twin Lake to help determine whether COCs had been released from the Joslyn Site, and if so, whether human health could be endangered by the consumption of fish obtained from Middle Twin Lake. The data were presented in 2005 (Barr, 2005b) and reviewed by the Minnesota Department of Health (MDH) in conjunction with the United States Department of Health and Human Services. A Health Consultation was prepared which showed that, of the COCs at the Joslyn Site, only dioxin/furans were present at elevated concentrations in the fish tissue (MDH, 2006).

The study noted that while concentrations of dioxin/furans in the fish tissue were five to forty times the respective concentrations measured in reference lakes selected for the study due to their similarity to Middle Twin Lake, the dioxin/furans concentrations did not differ significantly from concentrations found by the EPA in a study of 58 lakes in Minnesota. MDH considers dioxin/furans concentrations in fish in Middle Twin Lake to present no apparent public health hazard at this time if fish consumption advice is followed. MDH recommended that additional sediment samples be collected to determine if there is a human health risk from direct exposure to the sediments and to determine if there is a future risk to fish if sediments are disturbed. The fish tissue study is discussed in further detail in Section 3.2.1.1.

Joslyn completed an additional sediment sampling and analysis study in September 2007 and submitted results to the MPCA in a December 2007 report (Barr, 2007c). The MPCA concluded that the sampling results indicated that the concentration of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in sediments, both in the beach and non-beach study areas, were below the sediment screening value proposed by the MDH for the Joslyn Site project and that no further assessment was necessary. The 2007 study is discussed in further detail in Section 3.2.1.2.

1.5 Operable Unit 5 – The West Area and Two Residential Lots South of the West Area

As indicated in Section 1.3, the Joslyn Site is now divided into two discrete areas: the eastern portion of the Site that has been delisted and redeveloped for commercial use, and the undeveloped western portion known as the West Area (Figure 2). The West Area, which remains on the MPCA's PLP and the U.S. EPA's NPL, will be designated as a portion of Operable Unit 5 (OU5). Also included in OU5 are two Joslyn-owned residential lots located adjacent to and immediately south of the West Area (designated the Southern Lots). Figure 3 highlights the land parcels that are described in the remedial alternatives presented in this FFS. The term "OU5" shall mean the combined parcels of the West Area and the Southern Lots.

Sections 2 and 3 of this document present background information about OU5. Sections 4 and 5 describe and evaluate remedial alternatives considered as part of this FFS, and Section 6 identifies a recommended remedial alternative for OU5. This FFS follows the guidelines established in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (U.S. EPA, 1988) and is in fulfillment of requirements included in the Consent Order for the Site (MPCA, 1985). This FFS supports the preparation of a Record of Decision (ROD) that will document the selected remedy for OU5.

The process for selecting the remedy will be in accordance with CERCLA (U.S. EPA, 1980), as amended by Superfund Amendments and Reauthorization Act of 1986 (U.S. EPA, 1986), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, more commonly known as the National Contingency Plan (NCP) [U.S. EPA, 1994]. The selected remedy, once approved by all parties, will be implemented in conformance with the May 1985 Consent Order between Joslyn and the MPCA.

2.0 Operable Unit 5 Background

Operable Unit 5 consists of the West Area (the undeveloped 11.1-acre parcel of land located adjacent to the eastern shore of Middle Twin Lake) and the Southern Lots (two parcels immediately south of the West Area also owned by Joslyn). This section describes both areas and summarizes the environmental investigations that have been undertaken in OU5.

2.1 Description and Setting of West Area

The West Area is comprised of wetlands and wooded upland. Soils in the West Area consist of fill, as well as native lacustrine fine sands, silts and clays and peat in the wetland portions. Historic aerial photographs show that a pond was present in the southern portion of the West Area prior to 1950 (designated Pond C). A shallow constructed waterway, sometimes referred to as the "former ice chute", once existed across the northern portion the West Area. In the mid-1960s, an embankment for a railroad spur was placed from west to east across the central portion of the West Area. In 1999, it was recommended by the Minnesota Department of Natural Resources (MDNR) that the former spur be restored to an elevation that would more clearly define the MDNR regulatory jurisdiction on Twin Lake (MDNR, 1999). The "northern wetland" is under the jurisdiction of the MDNR since it is considered a public water of the state. The "southern" wetland is not considered a public water of the state, but is subject to Minnesota Wetland Conservation Act (WCA) jurisdiction as administered through the Shingle Creek Watershed Management Commission (SCWMC). In addition, the "northern" and "southern" wetlands are both under the jurisdiction of the United States Army Corps of Engineers (USACE) since the wetlands are part of, or adjacent to, Twin Lake which is considered a water of the United States.[1] Although the terms "northern wetland" and "southern wetland" will be used in subsequent sections of this FFS, it is acknowledged that both areas are hydrologically connected.

As part of the sampling conducted in 1999, a map was created organizing the West Area into a number of logical sub-areas (Figure 2). The delineation of each sub-area was based on topography, history of fill placement as observed in historic aerial photographs, and vegetation patterns. WA-1, WA-2, and WA-3 are generally upland areas on the eastern edge of the West Area adjacent to the former wood-treating areas on the Site. Historic fill placement was observed in these three sub-areas during review of Site aerial photographs. WA-4 and WA-5 are located on the western edge of the West Area adjacent to Middle Twin Lake and consist primarily of forested upland. WA-6 is located in the south-central portion of the West Area, and represents the approximate location of a former steam-boiler blowdown disposal pond at the facility (Pond C). Pond C was used for that purpose from sometime prior to 1944 until approximately 1950. WA-6 was further subdivided into WA-6S, WA-6MID and WA-6N based on historic site features, including the former railroad spur which had intersected Pond C. WA-7 is a shallow marsh located in the north-central portion of the West Area. WA-8 is defined as the east-west former rail spur located in the central portion of the West Area.

[1] The USACE will be asked to make an official jurisdictional determination prior to the implementation of the remedy.

Surface water runoff from most of the Joslyn Site has historically flowed through the West Area to Middle Twin Lake. However, the topography, porous soils, and vegetation likely resulted in minimal historical runoff except during extreme rainfall events. With redevelopment of the Site, runoff from approximately 48.6 acres, which includes the original 36-acre Site as well as a portion of the surrounding area, is now routed through the West Area. Runoff accumulates in the wetland located in the southern portion of the West Area and either evaporates or infiltrates into the groundwater except during very high runoff or lake flooding events when the low point along the old railway spur is overtopped (the approximate elevation of the low point along the railroad spur is 852.2 feet mean sea level [MSL]). A complete discussion of surface water runoff from the Site is presented in the Barr technical memorandum entitled "Joslyn Brooklyn Center Site – West Area Hydrologic Evaluation" (Barr, 2004b) submitted to the MPCA with Joslyn's response to the West Area Remedial Investigation Report comments and modifications (Barr, 2004a).

Most of the ground surface within the West Area falls below the elevation of the 100-year frequency flood level of Middle Twin Lake. During periods of high runoff and/or precipitation, the water level of Middle Twin Lake can remain elevated for long periods (sometimes weeks or months). The 100-year frequency flood level, the ordinary high water level (OHWL), and the normal water level (NWL) for Middle Twin Lake are 856.0, 853.1, and 851.5 feet MSL, respectively.

The 100-year flood elevation was obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) [FEMA, 2004] and checked for agreement with the unpublished FEMA Digital Flood Insurance Rate Map (DFIRM). The OWHL was obtained from the MDNR Lake Finder records. The OHWL is a reference elevation that defines the Minnesota Department of Natural Resources' regulatory authority over work that is proposed to alter the course, current or cross section of public waters and public water wetlands (Minnesota Statutes, 103G). For lakes and wetlands, the OHWL is the highest water level that has been maintained for a sufficient period of time to leave evidence on the landscape. The normal water elevation was obtained from SCWMC and represents the outlet elevation of the Upper, Middle, and Lower Twin Lakes system. The limits of the OHWL and the 100-year frequency flood level of Middle Twin Lake are shown on Figure 3.

Groundwater and lake level monitoring has been conducted at the Site for over 30 years, and data confirm that groundwater flows from Middle Twin Lake to the east-southeast. The Site groundwater remediation system effectively captures both the groundwater from near the water table and from an isolated sand unit located at an intermediate depth 60 to 100 feet below ground surface. The aquifer transmissivity is relatively high, so the effect of the pump-out system is rarely discernible in the water level monitoring. Water quality monitoring data, however, confirm that the pump-out system has been effective in preventing the migration of contaminants to either the groundwater downgradient of the Site or into the lower underlying aquifer. A groundwater model for the site is used to simulate the capture zone of the groundwater remediation system. The model was updated in 2015 to improve the model's accuracy at predicting the zone of groundwater capture by the pumpout system (Barr, 2015b). The zone of capture area simulated with the 2015-refined model covers the full extent of the West Area, the Southern Lots, and extends well beyond the estimated extent of the groundwater contamination plume, both north and south of the site.

The West Area wetland boundaries were initially delineated in 2007 (Barr, 2007b) and updated in 2012 (Barr, 2012c). The 2012 wetland delineation was approved in 2013 (SCWMC, 2013).

2.2 Description and Setting of the Southern Lots

The Joslyn-owned Southern Lots total approximately 0.6 acres. Currently zoned for residential use, roughly half of the areas of both parcels fall within the 100-year flood elevation of Middle Twin Lake (856.0 ft. MSL). Soils in the Southern Lots consist of fill, as well as native lacustrine fine sands, silts, clays, and peat. The majority of the area is forested with trees and shrubs including buckthorn, boxelder, green ash, willow, and elm.

A wetland delineation was conducted on the Southern Lots in 2012 (Barr, 2012c) and approved in 2013 (SCWMC, 2013).

2.3 Historical Investigations and Remedial Actions

Over the past 25 years, several environmental investigations have been conducted at the Joslyn Site to determine the magnitude and extent of PAH, PCP, and dioxin/furan (expressed as tetrachlorodibenzo-p-dioxin [TCDD] Toxicity Equivalency Quotient [TEQ], or TCDD-TEQ) soil contamination in OU5. The West Area, Southern Lots, and other related historical investigations are detailed in the following paragraphs.

2.3.1 West Area Investigations

Sampling and analysis activities were conducted in the West Area in 1981, 1986, 1997, 1998 and 1999 and the results are summarized in the *Sampling and Analysis Plan – Supplemental West Area Characterization* (Barr, 2000). MDH also summarized information for the Site in a *Public Health Assessment* (MDH, 2002). To more fully characterize the potential ecological and human health risks associated with exposure to environmental conditions in the West Area and to aid in identifying appropriate and cost-effective remedial options for the West Area, Joslyn conducted additional soil sampling in 2003 along east-west transects across the West Area. The results of this effort are summarized in *West Area Remedial Investigation Report* (Barr, 2003). Joslyn conducted two additional soil investigations in the West Area since publication of the 2013 FFS. A pre-design soil investigation was completed in January, 2014 (Barr, 2014) and an additional soil characterization investigation was completed in February, 2015 (Barr, 2015a). For ease of comparison, the historical soil sampling locations for each of the reports mentioned above are presented on Figure 4a and the results are presented in the tables in Appendix A of this FFS.

As shown on Figure 4a and in the tables in Appendix A, historical soil sampling results show significant differences in the concentrations of COCs within the sub-areas. Sub-areas WA-4 and WA-5 have not been significantly impacted by former operations at the Joslyn Site. Conversely, surface soils within sub-areas WA-6MID and WA-6S have been impacted. Concentrations of COCs in samples collected from sub-areas WA-1, WA-2, WA-3, WA-6N, WA-7 and WA-8 are generally less than those measured in samples collected from sub-areas WA6-MID and WA-6S. Taken together, TCDD-TEQ concentrations in individual West Area surface soil samples range from non-detectable to 176,621 ng/kg (parts per trillion, or ppt). PCP concentrations in West Area soils range from non-detectable to 120 mg/kg (parts per million, or ppm), and PAH concentrations, expressed as benzo(a)pyrene (BaP) equivalents range from non-detectable to

350 mg/kg. As described in Section 2.3.3, portions of WA-3 with higher PCP and PAH concentrations were subsequently excavated.

One north-south oriented cross section and two east-west oriented cross sections, each showing general site geology and dioxin concentrations, are shown on Figure 4b and Figure 4c, respectively. As shown on the cross sections, the dioxin concentrations generally show a decreasing trend both to the west and with depth.

2.3.2 Southern Lots and Roadway Investigations

Sampling activities conducted on and adjacent to the Southern Lots in 2003, 2004, 2005, and 2009 are summarized in a December 2, 2009 letter to Steve Schoff of MPCA (Barr, 2009). Historic sample locations are shown on Figure 4b and the results are presented in the tables in Appendix A. The 2003 data showed that PAHs and PCP were not present at concentrations of concern. The 2004 work demonstrated that concentrations of TCDD-TEQ previously observed on the Southern Lots did not extend to areas to the south of the Southern Lots. Based upon the 2005 data, it was concluded that although the surficial soils on the Southern Lots met MPCA residential SRVs for TCDD-TEQ, additional data were needed to evaluate the TCDD-TEQ concentrations present in the entire upper four feet of the Southern Lots. Data reported for four composite soil samples collected from the Southern Lots in 2009 support a conclusion that the south parcel of the Southern Lots will not require additional investigation or remediation. However, the upper four feet of that portion of the north parcel that is located within the 100-year floodplain of Middle Twin Lake will need to be remediated as part of OU5 (MPCA, 2005b). Taken together, the TCDD-TEQ concentrations reported for samples collected from the Southern Lots ranged from 0.465 ng/kg to 644 ng/kg.

2.3.3 Other Related Historical Investigations

Portions of the West Area have been investigated and/or remediated as part of the implementation of the OU4 remedy (excavation and onsite land treatment of contaminated soils). Investigations and/or response actions to address portions of the West Area during remedial actions associated with OU4 were conducted in 1981, 1986, 1997, 1998, and 1999 and are summarized in the following paragraphs. Historical excavation areas are shown on Figure 2.

Pond C Area

An investigation of the Joslyn Site disposal ponds, including Pond C which had been located at the West Area, was conducted in 1981 (Barr, 1981). Hazardous waste, as defined at the time of the investigation, was not observed at Pond C and subsequent investigations and response actions were focused on other areas of the Joslyn Site. The Pond C area was investigated again in 1997 as part of a larger West Area investigation (Barr, 1997). Visually contaminated soils observed during the 1997 investigation (approximately 650 cubic yards) were excavated and treated at the onsite LTU later that year (Barr, 1998). The excavation was backfilled with clean soil from an offsite source.

Ice Chute and Ditch from Pond C

An apparent former ice chute, a manmade ditch that was reportedly used to mine ice blocks from Twin Lake, is located at the northern portion of the West Area. During the use of Pond C, a drainage ditch was reportedly constructed from the northern dike of the pond to the ice chute. Two borings were placed in the former ice chute area and one boring in the drainage ditch during a 1997 investigation (Barr, 1997). Samples were collected from each boring for analysis for PAHs and PCP. Low-level PAHs were observed in one sample obtained from the former ice chute area. All other samples were non-detect for PAHs. PCP was not detected in any of the samples.

Area West of Pond A

An onsite wastewater disposal pond, Pond A, had been located immediately east of the West Area. The "Area West of Pond A" was specifically identified in the 1985 Consent Order as the area contained visually impacted soil and debris. Investigations conducted in 1986 in this area were used to delineate contaminated soil extents (Barr, 1986). Approximately 2,500 cubic yards of contaminated soil was removed from this area in 1989 and treated at the onsite LTU (Barr, 1990). Onsite material was used to backfill the excavation.

WA-3 Area Excavation

The release sampling investigation of the West Area in 1998 and 1999 indicated that a "hot spot" of visually contaminated soil was present at the southeastern portion of the West Area (Earth Tech, 1999a; Earth Tech 1999b). Approximately 1,000 cubic yards of visually contaminated soil was excavated to a depth of approximately three feet from the "hot spot" area and disposed off site at a Resource Conservation and Recovery Act (RCRA) Subtitle C disposal facility (Barr, 1999a). The excavation was backfilled with clean offsite soil.

Western LTU Dike Excavation

During the WA-3 area excavation described above, an area of visibly contaminated soil was identified beneath the western LTU dike. Approximately 50 cubic yards of this soil was excavated and treated at the onsite LTU (Barr, 1999b). Clean soil obtained from offsite sources was used to backfill the excavation.

2.4 Current and Potential Future Land Use

The land use surrounding OU5 is generally residential to the south, commercial/light industrial to the east, and open space to the north. The West Area itself consists of a combination of undeveloped wetland and forested open space. It is identified as open space on the City's Comprehensive Plan for 2020, but is currently zoned industrial (City of Brooklyn Center, 2000). Because much of the West Area falls below the 100-year flood level of Middle Twin Lake, it is not expected that it could ever reasonably be developed for industrial purposes.

Joslyn continues to own the West Area and maintains it as open space within a perimeter fence and posted signs to keep the majority of the West Area inaccessible to the general public. As of the date of

this document, adjacent Lot 1 has been owned by AX RER, L.P. since July 2012, and houses an industrial warehouse space.

Joslyn has stated that their intention is for the West Area to remain as open, undeveloped space with a perimeter fence to prevent access to the general public or trespassers for general liability purposes (Joslyn, 2004). The MPCA has determined that the reasonably anticipated land use for the West Area is industrial with the possibility that the West Area will remain as open space in the future (MPCA, 2004b). Institutional controls will be placed on the West Area to restrict future access to contaminated soils and/or to restrict future land uses, as needed, based on the selected West Area remedy.

The Southern Lots are currently zoned for residential use and are shown as residential on the City's Comprehensive Plan for 2020 (City of Brooklyn Center, 2000). Joslyn anticipates continued ownership of these two parcels with the use of institutional controls to restrict future land uses so that they will remain undeveloped (Barr, 2005a).

2.5 Preliminary Remediation Goals

The development of preliminary remediation goals (PRGs) has focused on COCs related to past industrial activity at the Joslyn Site. The COCs associated with historical wood treatment activity are PAHs, which are constituents of creosote; polychlorinated dibenzo-*p*-dioxins/furans (dioxins), which are contaminants of pentachlorophenol (PCP); and PCP. The 1989 ROD listed PAHs and PCP as the primary COCs for the Joslyn Site. Analyses for dioxins were added in 1999 to characterize the risk associated with exposure to residual soils in the context of future industrial/commercial land use.

In response to previous discussions of potential remediation options for the West Area, MPCA developed PRGs for human and ecological receptors (MPCA, 2005a). These PRGs (shown in Table 1) were derived using methods and assumptions drawn from established U.S. EPA and general risk assessment guidance. The development of the human health and ecological PRGs are discussed below.

2.5.1 Human Health PRGs

MPCA soil reference values (SRVs), which are chemical-specific soil concentrations above which an unacceptable risk to human health may exist, were identified as appropriate PRGs for all three COCs. The SRVs are generic guidelines which are derived using a mixture of central tendency and conservative assumptions about exposure to various types of receptors (MPCA, 1999). The objective of the SRV is the calculation of concentration below which a receptor with a reasonable maximum exposure (RME)—a high-end exposure that is reasonably expected to occur in a population—would not be above the non-cancer or cancer target risk.

It is assumed that the West Area will be subject to industrial land use in the future, consistent with the zoning of the Site. As a result, the industrial worker SRVs function as human health-based PRGs. Industrial SRVs assume the chronic working-life exposure of a worker to non-conforming soil through incidental soil ingestion, vapor inhalation, and direct dermal contact and absorption.

To account for current zoning of the Southern Lots, Joslyn also proposed a human health PRG for dioxins based upon a residential land use scenario. This is despite the low likelihood that any residential development would actually take place on these lots (Barr, 2005a). The MPCA residential SRV of 20 ng/kg was proposed to represent the residential PRG. Goals for PAHs and PCP were not developed for the Southern Lots because the concentration of these chemicals in the soil matrix was below the level of human health concern.

The PRGs did not address exposure pathways assumed to be incomplete, such as those related to direct contact with groundwater. The groundwater pump-out system in the eastern portion of the Joslyn Site effectively prevents this exposure pathway from being complete by collecting groundwater flowing from OU5. Therefore, PRGs covering the ingestion of, dermal absorption from, and vapor inhalation from direct exposure to groundwater were not developed.

PRGs addressing the present and future exposure pathway involving trespassers who gain illegal access to the Site were not considered for two reasons. The first is that there is adequate security fencing and signage indicating the existence of a human health risk. The second is that the exposure to such individuals is likely to be less than that of workers or recreational users; therefore, any remedy designed to minimize the risk to those receptors would be sufficient for the protection of trespassers to the Site.

A human health-based PRG for direct contact with surface water was not developed. Instead, this exposure pathway is represented by proxy. Sediment concentrations are indicators of contamination of site surface water as they preferentially accumulate hydrophobic compounds like the Site COCs. Therefore, exposure to sediment acts as a conservative proxy for the magnitude of COC transport into surface water and the resulting potential for exposure.

The MPCA has been working on revising SRVs and issued draft SRVs for public review and comment in the fall of 2016. Although they have not been finalized, Joslyn performed an evaluation of the effect of the draft SRVs on the site remedy. The evaluation, which is detailed in Appendix D, indicated that the draft SRVs would not have an effect on remedy decisions at the Site.

2.5.2 Ecological PRGs

The ecological PRGs for the West Area were developed from sediment quality criteria from multiple sources (CCME, 2002; Crane et al., 2000). Because a significant portion of the West Area falls below the OHWL, the MPCA determined that separate terrestrial PRGs were not needed (MPCA, 2005a). It is assumed that these criteria extend to the Southern Lots, of which a significant proportion of the surface area falls below the OHWL. Therefore, the ecological PRGs can be applied to soil and sediment across OU5.

Because the PRGs are representative of concentrations below which the risk to human and ecological receptors is not likely to exceed state target risks, soil quality data (both historical and new) will be compared to these values as part of the development and evaluation of potential remedial action alternatives in subsequent sections of this FFS. It should be noted that exposure to media-specific concentrations at or above the PRG does not necessarily indicate that the effective risk to receptors at this

particular Site is above the state guideline value of 1 in 100,000 excess lifetime cancer cases. However, it does indicate that in the absence of remedial action, a site-specific risk assessment would have to be conducted in order to verify a level of risk below this guideline.

3.0 Development of Remedial Action Objectives

This section of the FFS characterizes the risk that soil COCs in OU5 could pose to human health and the environment under a range of conservative exposure scenarios, and presents a proposed remedial action objective (RAO) for the remedial action alternatives being considered. As discussed in Section 2, the MPCA initiated this characterization in 2005 with its development of PRGs for the West Area. Joslyn proposes to adopt these PRGs for the West Area soils as the basis for actual remedial goals. In addition, Joslyn proposes to adopt as PRGs the MPCA residential dioxin SRV for the Southern Lots.

3.1 Basis for Remedial Action Objective

In general, an RAO provides the goals for protecting human health and the environment. The RAO should be media specific and it should address the COCs identified for each site, potential exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route (i.e., a PRG). As discussed in the U.S. EPA's "Rules of Thumb for Superfund Remedy Selection", the RAO should also permit a range of treatment and containment alternatives to be developed (U.S. EPA, 1997).

3.2 Exposure Pathways

Though explicit human and ecological exposure assessments have not been conducted for OU5, all of the PRGs proposed for the Site have been calculated using transparent exposure factors and equations. Media-specific COC concentrations that exceed PRGs at the Site indicate the potential for human or ecological risk beyond that deemed acceptable by the State of Minnesota. Soils in one or more sub-areas of OU5 show COC concentrations exceeding the human and/or ecological PRGs. The risks associated with this non-conforming soil are therefore linked to the potential completion of exposure pathways used in the derivation of the PRGs. These pathways include incidental ingestion of soil, inhalation of vapor from soil, or direct dermal contact with soil and consequent adsorption. The degree to which these pathways are applicable to the current status of OU5 is primarily a function of the following factors:

- The completion of exposure pathways involving site surface water, groundwater, or soil.
- The magnitude of soil contamination and toxicity when viewed in the context of the properties of the OU5 soil matrix.
- The accessibility of non-conforming OU5 soils to both human and ecological risk receptors.
- The existence of a bioactive zone (BAZ) for benthic organisms (applicable to ecological risk only).

The following sections briefly discuss these factors.

3.2.1 Surface Water

As indicated in Section 2, much of OU5 lies below the OHWL of Middle Twin Lake. The southern West Area wetland does not discharge directly to Middle Twin Lake, but can periodically discharge across the former rail spur to the northern wetland if hydrologic conditions are suitable. This northern wetland then has a direct connection to Middle Twin Lake via the former ice chute and through the emergent

vegetation located at the northwestern boundary of the West Area. Despite this hydrological connection, the COCs at the Site have a strong tendency to partition into organic material, causing surface water sampling to be of limited utility in assessing the magnitude of long-term chemical transport into Middle Twin Lake. Fish tissue and sediment function as useful proxies for transport via surface water due to their preferential accumulation of COCs. As indicated in Section 1.3 and discussed in further detail below, recent environmental investigations conducted by Joslyn in Middle Twin Lake assessed concentrations of site-related COCs in fish tissue and lake sediments. Both studies show that the surface water pathway from the West Area to Middle Twin Lake is not significant.

3.2.1.1 Middle Twin Lake Fish Tissue Study

The results of the fish tissue study were compiled in "Middle Twin Lake Fish Tissue Study Implementation Report" (Barr, 2006). The fish tissue dioxin concentrations found in Middle Twin Lake fall below the U.S. EPA fish tissue guideline concentration of 0.15 ng/kg in predator fish tissue—a standard developed using an exposure assumption of one 8-ounce fish meal per week over a 70-year lifetime. The median concentration of dioxin found in northern pike tissue from the lake is approximately an order of magnitude below this guideline value (Barr, 2006). The Minnesota Department of Health reviewed this report and subsequently published "Health Consultation, Middle Twin Lake Fish Tissue Study" for the Site in June 2006 (MDH, 2006). The summary of the MDH report included the following statement:

> "…dioxin and furan concentrations for fish from Middle Twin Lake do not differ significantly from concentrations found by EPA in samples from 58 lakes in Minnesota."

The MDH found in their Health Consultation for Middle Twin Lake that human health risk from fish ingestion was controlled by exposure to mercury and PCB—chemicals not associated with past site activity—and not dioxins (MDH, 2006). Current fish consumption guidance was released by the MDH for Middle Twin Lake in October 2011 (MDH, 2011a and 2011b). As in past guidance, the northern pike consumption advisories for Middle Twin Lake are based on tissue mercury concentrations, and not dioxin. These advisories recommend limiting intake to one 8-ounce meal per week for the general population, and one 8-ounce meal per week of less than 24-inch-long fish and one 8-ounce meal per month of greater than 24-inch-long fish for pregnant women. Given the relatively low levels of dioxin detected in northern pike tissue, these recommendations are protective for dioxin-specific excess lifetime cancer risk.

3.2.1.2 2007 Middle Twin Lake Sediment Study

Joslyn submitted the results of the Middle Twin Lake sediment sampling to the MPCA in December 2007 (Barr, 2007c). The sediment samples from the eastern shore of Middle Twin Lake had dioxin concentrations well below the PRG as represented by the site-specific sediment screening value (SSV). Accordingly, the risk to a future recreational user of Middle Twin Lake is below the state excess lifetime cancer risk target of 1 in 100,000. The dioxin SSV is a site-specific value advanced by the MDH for use at Middle Twin Lake (MPCA, 2006b). This value was calculated by incorporating five plausible exposure pathways: Direct ingestion of sediment, direct dermal contact with sediment, incidental ingestion of water containing suspended sediment, dermal contact with water containing suspended sediment, and inhalation of air containing chemicals that partition from sediments to water and volatize. The dominant

pathway was direct dermal contact with sediment, representing slightly over 50% of the total estimated dioxin exposure.

The MPCA's February 11, 2008 letter (MPCA, 2008) transmitted the results of its review of the sediment report and included the following statement of conclusions:

> "Sampling results indicate the concentration of polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans in sediments, in both the beach and non-beach study areas of Middle Twin Lake, are well below the sediment screening value proposed by MDH for this project and that no further assessment is necessary at this time."

3.2.1.3 Surface Water Pathway from the West Area to Middle Twin Lake

Based upon the fish tissue and sediment sampling work conducted by Joslyn, the data suggest that the surface water pathway from the West Area to Middle Twin Lake is not complete at the Site.

3.2.2 Groundwater

The long-term risk of COCs leaching from soil to groundwater is low based on the following two factors. First, groundwater in the vicinity of Middle Twin Lake flows from the lake to the east, so groundwater in the West Area does not discharge into the lake. Second, the existing groundwater pump-out system at the Joslyn Site effectively collects groundwater flowing from OU5 as described in Section 2.1 (Barr, 2015b), capturing it for treatment and discharge via the Metropolitan Council's regional wastewater treatment system.

3.2.3 Soil

Soils with elevated PAH, PCP, and/or dioxin concentrations have been documented onsite at the West Area and at the Southern Lots. Based on the concentrations reported for soil samples collected from both the West Area and the Southern Lots, it was concluded that dioxins (expressed as TCDD-TEQ) control the potential human health and ecological risk associated with exposure to soil in the West Area and on the Southern Lots. Soil concentrations are not homogeneous across OU5 but can be separated into three distinct groupings of sub-areas, representing different magnitudes of COC concentrations in soil.

- The sub-area grouping that includes WA-1 through WA-3 and WA-6 through WA-8, and borders the remediated Joslyn Site has the highest levels of impact from past wood treatment activities. For surface soils in this section of the West Area, all COCs have maximum concentrations exceeding the PRGs. Concentrations of site COCs are markedly higher in this group than elsewhere in OU5. This is thought to be the result of WA-6 having been the site of a disposal pond for boiler blowdown water. Additionally, the disposal of storm runoff from the eastern portion of the Joslyn Site may have contributed to high soil COC concentrations.
- The forested upland sub-areas (WA-4 and WA-5) bordering Middle Twin Lake to the east have substantially lower COC soil concentrations than the rest of the West Area.

- Two Joslyn-owned residential lots to the south of the West Area (Southern Lots) have low surficial soil dioxin concentrations, but higher underlying soil concentrations. The other COCs were not assessed on these lots as their concentrations on the southern border of the West Area were low and not of human health concern (Barr, 2009).

3.3 Nature of West Area Soil Matrix

One site-specific factor that influences the completion of potential exposure pathways from direct contact with non-conforming soils is the presence of a high proportion of natural organic soils (i.e., peat) in the wetland portions of OU5. By the nature of their molecular structure, dioxins strongly adsorb to organic materials like peat and other vegetative matter. This reduces the potential for dioxins to volatilize into the atmosphere or dissolve into water. The long-term risk from inhalation of volatilized dioxins associated with OU5 soils is extremely low. In addition, exposure from the incidental ingestion of soil is impacted by the organic content of the soil matrix. Absorption of dioxins from ingested soil is thought to range widely as a function of soil organic content, aging, and other factors (Van den Berg et al., 2005). Experimentally determined bioavailabilities range from 0.5% to 43% (U.S. EPA, 2003). Dioxins in soils with high organic content like the peat in OU5 typically show very low bioavailability in the human gut, resulting in lower absorbed doses. However, the MPCA's RME SRV assumes 30% bioavailability (MPCA, 1999).

3.4 Soil Accessibility

As indicated in Section 2.4, much of OU5 falls below the 100-year flood level of Middle Twin Lake, reasonably eliminating the potential that the West Area could be redeveloped for industrial purposes. Therefore, the evaluation of the direct contact pathway must focus on soils deemed accessible to humans or ecological risk receptors. The following paragraphs outline Joslyn's assumptions regarding soil accessibility at the Site.

3.4.1 Access to Human Receptors

For the Joslyn Site, "accessible" for human health purposes was previously defined as the upper three (3) feet of the final grade (MPCA, 1998a). Subsequent discussions with MPCA have indicated that an accessible zone of two (2) feet below surface with an underlying geotextile would also be acceptable as an "accessible" zone – this definition was used as the basis for the cap design of the onsite consolidate and cover remedies developed in this FFS (Alternatives 5 through 8). Because it is zoned as industrial open space, these definitions will apply to the West Area.

With respect to residential land use scenarios, the MPCA's Risk-Based Site Evaluation Manual defines accessible contamination as, "soil contamination generally located less than four (4) feet below the surface where the surface is not completely covered by an impervious (e.g., pavement) or permanent structure (MPCA, 1998b)." As a result, the human health risk-based PRGs apply to this depth across the Southern Lots.

Figure 4b presents a graphic of the definitions of accessible zones for human health protection at OU5.

3.4.2 Access to Ecological Receptors

In addition to the more passive notion of periodic accessibility of the soil by human receptors, there is evidence that the soil at the Site represents an ecological niche for certain organisms. Studies have shown that a bioactive zone (BAZ), a zone in which benthic organisms are present, exists in both upland and wetland soils. Non-conforming soils potentially place benthic organisms (and the organisms that may subsequently feed on them) at risk. During a June 2005 meeting convened between Joslyn representatives and the MPCA to identify a site remedy, the MPCA cited experience at other contaminated sites to state that the thickness of the BAZ in the West Area should be either 2 feet or 3 feet. MPCA indicated that a 2-foot thickness was acceptable in areas where the underlying contamination did not drastically exceed the PRG (about ten times the PRG).

The MPCA has also requested the use of an isolation zone (IZ) to further protect the remedy and the BAZ in wetland areas. The IZ will consist of 6 inches of clean soil backfilled prior to placement of a non-woven geotextile fabric that demarcates the boundary of the remedial excavations.

MPCA and Joslyn have agreed that geotextile fabric will also be placed at the base of remedial excavations in upland areas prior to placement of the BAZ cover soils.

3.5 Proposed Remedial Action Objective

Dioxins are the primary chemical of concern for OU5 and drive human health and ecological risk at the Site. OU5 soils do not pose a threat to act as a source for migration of contaminants within the soil or from the soil to other media. The human and ecological exposure pathways of most concern for OU5 are related to direct contact with non-conforming soil: incidental ingestion of soil, inhalation of vapors from soil, and dermal absorption upon direct contact with soil.

Accordingly, the RAO for OU5 is the elimination of direct soil contact exposure pathways for both human and ecological receptors.

3.6 Application of RAO to OU5

The remedial action alternative developed as a result of this FFS must satisfy the RAO. The RAO focuses on the elimination of direct contact by human and ecological receptors with contaminated soil, which is non-conforming soil defined as "accessible" by MPCA guidance.

3.6.1 Human Health Receptors

As discussed in Section 3.4, "accessible" was previously defined for the West Area as the upper three (3) feet of the final grade (MPCA, 1998a). The accessible soil depth for the Southern Lots is four (4) feet due to their residential zoning. For each area, the non-conforming soils within the respective depth will need to be removed or isolated, so that human exposure cannot take place.

3.6.2 Ecological Receptors

For elimination of the ecological risk pathway, the human health risk accessible zone remediation is sufficient to also create a clean BAZ and thus address ecological risk. The exception is within some West Area wetland areas where soil concentrations at a depth of three feet may exceed ten times the PRG. In such areas, the IZ must be in addition to the 3-foot accessible zone and thus excavation to a depth of 3.5 feet is required to address the ecological risk pathway.

3.6.3 RAO Summary

Taking both human health and ecological risk into consideration, excavation and/or isolation of surficial soils in the West Area can interrupt the direct contact exposure pathway and thereby reduce or eliminate the risk associated with soil contamination. Comparison of existing soil quality data to the human health and ecological screening values and consideration of BAZ requirements for each of the sub-areas within OU5 can result in remedial action alternatives that establish sufficient protection through covering, excavation, or some combination of the two. A summary of proposed combinations of BAZ and IZ depths that will be used to develop and evaluate remedial action alternatives is presented below. The names of the subareas are as shown on the figures.

Southern Lots

- Parcel 10-118-21-32-0059: No action required
- Parcel 10-118-21-32-0058: In areas below 100-year flood elevation, 4.0 feet excavation, no separate IZ, geotextile

Upland Areas

- WA-1B – 2.0 feet BAZ, no separate IZ, geotextile
- WA-2B – 2.0 feet BAZ, no separate IZ, geotextile
- WA-2D – 3.0 feet BAZ, no separate IZ, geotextile
- WA-3B – 3.0 feet BAZ, no separate IZ, geotextile
- WA-4B – 2.0 feet BAZ, no separate IZ, geotextile
- WA-5 – No action required

Wetland Areas

- WA-1A – 2.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-2A – 2.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-2C – 3.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-3A – 3.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-4A – 3.0 feet BAZ, geotextile, 0.5 foot IZ

- WA-5 (former ice chute) – 2.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-6S – 3.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-6 MID – 3.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-6N – 3.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-7 – 2.0 feet BAZ, geotextile, 0.5 foot IZ
- WA-8 (former rail spur) – 2.0 feet BAZ, geotextile, 0.5 foot IZ

The specific combinations of excavation and clean cover depth needed to achieve the desired BAZ/IZ thicknesses will be evaluated separately for each sub-area and each remedial action alternative.

For remedial alternatives involving onsite consolidation, contaminated soils will be covered with a minimum 2-foot clean soil cover, representing the RAO for upland areas, which provides 2.0 feet of BAZ, geotextile, and no separate IZ.

4.0 Development of Remedial Alternatives

The preliminary screening step of remedial alternatives and important factors considered in the development of remedial alternative selected for further evaluation are described in this section.

4.1 Preliminary Screening of Alternatives

A range of response action alternatives has been developed and screened to compare and select an appropriate remedial action concept for operable unit OU5 that will meet the proposed RAO and be protective of public health, cost-effective and acceptable to the public and regulatory agencies. Several alternatives were initially considered for inclusion in this FFS but were subsequently eliminated from further consideration for OU5 soils without extensive analysis due to their inability to adequately address human health and ecological risk. Response action alternatives eliminated include:

- Conventional thermal desorption
- Biological treatment
- In-situ chemical oxidation
- In-situ stabilization
- Solvent extraction/washing of the contaminated soils

Each of these technologies has significant limitations that led to its rejection. Conventional thermal desorption has not been shown to effectively treat dioxin/furan compounds in soils. The capability of microorganisms and bio-augmentation to reduce contaminant concentrations to below applicable SRVs within a reasonable timeframe is uncertain. In-situ chemical oxidation was eliminated from consideration based on mass transfer, thermodynamic and kinetic limitations of commercial oxidants with regard to dioxin/furan compounds. Solvent extraction/washing was also eliminated due to the uncertainty in the extent of dioxin/furan removal in soils with high organics and the high cost of phase-transfer, treatment and residual disposal (Bates, E.R., et al., 1989a and 1989b; Grosse, D.W., et al., 2000; and Sahle-Demessie, E., et al., 2000). In-situ stabilization was eliminated since it does not remove the risk of exposure and because the leaching of dioxins/furans to the groundwater is not an issue.

After the preliminary screening had been completed, remedial alternatives (beyond the "no action" alternative) focusing on stormwater management modifications, the creation of soil covers over contaminated soils, excavation of contaminated soils and offsite treatment, or consolidation of contaminated soils were further evaluated. The following sections describe important factors considered in the development of the remedial alternatives.

4.2 Regulatory Classification of OU5 Soils

The regulatory classification of OU5 soils is a critical element in evaluating and selecting an appropriate remedy. Communications between Joslyn, Barr, and the MPCA on this subject have been ongoing since at

least 2004. Specifically, the following five documents are important to review for their relevance to the FFS:

- Barr's August 26, 2004 memorandum titled "West Area Soil Characterization" (Barr, 2004c).
- MPCA's September 7, 2004 memorandum titled "Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste" (MPCA, 2004c).
- MPCA's November 2, 2004 letter regarding Joslyn Manufacturing and Supply Company Superfund Site (MPCA, 2004d).
- MPCA's August 29, 2006 office memorandum titled "Disposal of Dioxin Contaminated Soil in "Subtitle D" Landfills (MPCA, 2006a).
- Barr's memorandum titled "Regulatory Classification of OU5 Soils" (see Appendix B).

The following paragraphs summarize Joslyn's understanding of the regulatory classification of OU5 soils and discuss the implementability of, and the regulatory requirements for, OU5 soil remedial actions. Further details can be found in the memorandum included in Appendix B. The above-listed documents are included as attachments to Appendix B.

4.2.1 Onsite Consolidate and Cover

U.S. EPA's area of contamination (AOC) policy states that if contaminated environmental media is managed within an AOC, then the management of that soil would not constitute the generation of a hazardous waste. U.S. EPA generally defines an AOC as a discrete area of generally dispersed contamination. The entire Joslyn Site and the contiguous Southern Lots are considered an AOC due to its generally dispersed contamination at the close of the wood-treating operations in 1980 and below the cap created by the redeveloped portion of the site. Therefore, consolidation of the OU5 soils that require remediation under appropriate clean covers can be considered anywhere within the Joslyn Site and would not trigger the various rules and policies associated with the management and disposal of contaminated media. Consolidation locations considered during the development of this FFS included the West Area (Alternatives 4, 5, and 8) and portions of the Joslyn Site located east of the West Area where contaminated soil consolidation occurred previously (Alternatives 6 and 7). The design details and other considerations associated with the clean soil cover are discussed in Section 6.5

4.2.2 Offsite Treatment and/or Disposal

If soils that require remediation are excavated from OU5 are to be treated and/or disposed off of the Joslyn Site (outside of the AOC), the soils must be classified for proper management under federal and state regulations because the soil removal would be considered generation of a waste. Appendix B describes the regulatory evaluation that was conducted to determine whether OU5 soils would be managed as hazardous or non-hazardous waste under excavation and offsite treatment and/or disposal remedial actions. The results of the evaluation are summarized in the following paragraphs.

Under MPCA and EPA policies, it was determined that about 40% of the OU5 soils that require remediation would be managed as hazardous waste if they are to be disposed off site. Additionally, these

soils would require treatment prior to disposal in a Subtitle C landfill as hazardous waste. The only effective and commercially available treatment alternative for these soils is incineration prior to landfilling. There are no appropriate incinerators or Subtitle C landfills in Minnesota, therefore these soils would require transportation to an out of state location(s) for treatment and disposal. The regulatory evaluation determined that the remaining 60% of the OU5 soils that require remediation could be managed as non-hazardous waste if they were to be excavated and disposed off site. Under MPCA policies these soils could be disposed of in a Subtitle D landfill in Minnesota, pending landfill acceptance of the waste.

Offsite disposal of all contaminated OU5 soils was considered during development of this FFS (Alternative 3), as well as combination offsite disposal/onsite consolidation remedies where soils that could be managed as non-hazardous waste are disposed off site at a Subtitle D landfill, and the remaining soils that require remediation are consolidated on site (Alternatives 7 and 8).

4.3 Determination of Principal Threats

The NCP establishes an expectation that U.S. EPA will use treatment to address the principal threats posed by a site whenever practicable. In general, principal threat wastes are those source materials that contain hazardous substances that can act as a reservoir for migration of contaminants to groundwater, surface water, or air, and which cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

At the Joslyn Site, the remedies previously implemented for operable units OU1 through OU4 satisfied the criteria for treatment of principal threat wastes for the Site. Contaminated groundwater (OU1 and OU2) is not typically considered to be source material and therefore is not a principal threat waste. DNAPL (OU3) might be considered a principal threat waste. The OU3 remedy involves collection and treatment of DNAPL via incineration. Prior to biological treatment, the contaminated soils included in OU4 were deemed principal threat wastes due to their combination of toxicity and contaminant mobility. The remedy of OU4 involved a combination of treatment (which reduced both toxicity and mobility) and containment—biological treatment was achieved in the LTU and containment of the residual contamination was achieved through the buildings, parking lots, roads, and clean soil that cover the treated and remaining soil onsite.

The soils in OU5 are a combination of low-level and principal threat waste. As discussed in Section 3.3, the mobility of the contaminants associated with OU5 soils is extremely low. The toxicity of the soils in WA-6 could present a potentially significant risk to human health or the environment should exposure occur and, thus, this soil is considered a principal threat waste.

Remedial alternatives are evaluated in regards to how principal threats are addressed in Section 7.8.

4.4 Floodplain and Wetland Considerations

A majority of OU5 is located within the 100-year floodplain of Middle Twin Lake and a significant portion is delineated wetland as described in Section 2.1 and shown on Figure 2. The following potential

floodplain and wetland impacts were taken into consideration as soil cover, excavation, and consolidation alternatives were developed:

- Substantial permitting efforts with numerous regulatory agencies, including the SCWMC, USACE, City of Brooklyn Center, and MDNR, will likely be required to work in the wetland and floodplain.
- Wetland restoration will be required where wetlands are disturbed (e.g., remedial alternatives where soil will be excavated from OU5 and backfilled to existing conditions).
- Wetland replacement for permanent impacts to wetland areas (e.g., remedial alternatives where wetland will be filled due to creation of soil covers or consolidation).
- Floodplain mitigation, including the creation of floodplain at an offsite location, an onsite location, or a request for a variance will be required if the implementation of the selected remedial alternative results in a loss of floodplain (e.g., remedial alternatives where floodplain will be filled due to creation of soil covers or consolidation).

Remedial alternatives are evaluated in regards to potential wetland and floodplain impacts in Section 7.9.

4.5 Remedial Alternative Development Summary

Based on the considerations described in this section, the eight specific response action alternatives retained for further analysis include:

1. No Action
2. Stormwater Management Modifications
3. Excavation for Offsite Treatment and Disposal
4. In-Place Soil Cover
5. Onsite Consolidation with Soil Cover at West Area
6. Onsite Consolidation with Soil Cover at Azelia Avenue Pond
7. Limited Onsite Consolidation with Soil Cover at Building 1A Pond
8. Limited Onsite Consolidation with Soil Cover at West Area

The remainder of the FFS document focuses on these remedial alternatives.

5.0 Description of Remedial Alternatives

The following sections describe the components of each of the response action alternatives evaluated in detail for this FFS.

5.1 Alternative 1 – No Action

The NCP requires that a no action alternative be evaluated as part of the screening process, in order to provide a baseline for comparison to other alternatives. Under this alternative, no further actions would be taken to address the soils in operable unit OU5 of the Joslyn Site. Long-term maintenance needs for Alternative 1 are discussed in Section 6.3.9 and costs shown in Appendix C, Table C-1.

5.2 Alternative 2 – Stormwater Management Modifications

Modification of the current path of stormwater flow adjacent to and through OU5 can aid in meeting the RAO of removing the ongoing threat of COC transport to Middle Twin Lake. Section 6.3.1 describes the existing stormwater management system at the Site (Figure 5a) and Section 6.3.2 describes a conceptual plan for both interim and permanent stormwater management for OU5 (Figures 5b and 5c) that has been developed for use within Alternative 2 as a standalone stormwater-only remedial alternative or for use in conjunction with Alternatives 3, 4 and 5. Individual stormwater management plans for Alternatives 6, 7, and 8 were developed and are described in Sections 6.3.4 through 6.3.7. Long-term maintenance needs for Alternative 2 are discussed in Section 6.3.9.

5.3 Alternative 3 – Excavation for Offsite Treatment and Disposal

This alternative combines the stormwater management modifications of Alternative 2 with the excavation of contaminated soil from OU5. As shown on Figure 6, the depth of soil excavation will vary by sub-area. It was conservatively assumed that soils would not be segregated during excavation and that all excavated soils would require treatment by incineration at a permitted hazardous waste incinerator followed by disposal of incineration residuals at a Subtitle C landfill, even though approximately 60% of the excavated soils would be eligible for disposal at a Subtitle D landfill as described in Section 4.2.

This alternative includes the following assumed scope of work:

- Waste acceptance testing
- Permitting
- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Preparation of an excavated soil staging area
- Air monitoring during excavation

- Excavation and load-out of contaminated soil
- Processing/drying excavated soil
- Placement of a non-woven geotextile barrier
- Backfilling excavation areas with clean soil as required
- Transportation, treatment, and disposal of excavated soil
- Wetland mitigation (onsite or offsite as needed)
- Site restoration – planting and establishing vegetation, reestablish fencing
- Post-construction maintenance and monitoring

This alternative may require excavating soil below the water table in some locations. The excavated soil will be dewatered as necessary and then transported via trucks with covered beds to a staging facility for transfer into bulk transport vehicles (likely gondola rail cars) and transport to a permitted hazardous waste incinerator.

Since there will be minimal net change in existing grade, no significant floodplain mitigation will be required as part of this remedial alternative. Although the existing wetlands in OU5 will be restored following the excavation and backfill undertaken as part of this alternative, additional wetland mitigation may be required by the applicable regulatory agencies.

This alternative can be implemented only if the excavated soil can be accepted at an offsite location for treatment and/or disposal in accordance with the applicable rules for waste disposal as described in Section 4.2.2.

5.4 Alternative 4 – In-Place Soil Cover

This alternative involves combining the stormwater management modifications of Alternative 2 with the placement of 2.0 feet of clean cover over the entire West Area. The soils excavated from the Southern Lots as part of the stormwater management modifications will be consolidated into the West Area prior to capping. The West Area soil cover cap will be constructed as described in Section 6.5. Figures 7a and 7b provide details for this alternative.

The scope of work needed to cap contaminated soils with a vegetated soil cover is assumed to include the following tasks:

- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Placement of a non-woven geotextile barrier

- Placement of 1.5 feet of imported clean cover soil
- Placement of 0.5 feet of imported topsoil
- Floodplain and wetland permitting and mitigation (offsite as needed and/or available)
- Site restoration – planting and establishing vegetation
- Post-construction maintenance and monitoring

This alternative will require both floodplain and wetland mitigation for the Middle Twin Lake flood storage and wetlands that would be lost through the placement of the soil cover. If sufficient mitigation cannot be obtained to offset the net volume of floodplain filled as part of this alternative, a variance from SCWMC will be required.

5.5 Alternative 5 – Onsite Consolidation with Soil Cover at West Area

This alternative involves combining the OU5 stormwater management modifications as described in Section 6.3.2 with the excavation of contaminated soil from the north portion of the West Area and from the Southern Lots for onsite consolidation. The excavated soils would be consolidated into an onsite consolidation area constructed over the contaminated soil that remains in place in the southern part of the West Area. A small strip of land south of the consolidation area and north of the Southern Lots will also be excavated and consolidated. This consolidation area would be capped with a vegetative soil cover, as described in Section 6.5. Figures 8a and 8b shows details of this alternative.

The scope of work for this alternative is assumed to include the following tasks:

- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Excavation of contaminated soils and placement within the consolidation area
- Placement of non-woven geotextile
- Placement of 1.5 feet of imported clean cover soil at consolidation area
- Placement of 0.5 feet of imported topsoil at consolidation area
- Backfill of excavated areas with clean fill to original grade as required
- Floodplain and wetland mitigation
- Site restoration – planting and establishing vegetation
- Post-construction maintenance and monitoring

This alternative will require mitigation for both the Middle Twin Lake floodplain and wetlands that would be lost through the construction of the onsite consolidation area.

5.6 Alternative 6 – Onsite Consolidation with Soil Cover at Azelia Avenue Pond

This alternative consists of the excavation of contaminated soil from OU5 and the consolidation of the contaminated soils at a designated location east of Building 1 within the Joslyn Site. The proposed consolidation site is the current location of a stormwater pond (known as the Azelia Avenue Pond) and adjacent to a contaminated soil consolidation area created during development of the redeveloped portion of the Joslyn Site (Geomatrix, 2001 and 2002).

Excavation of contaminated soils at OU5 will proceed similarly to that proposed for Alternative 3. As shown on Figure 9a, the depth of soil excavation will vary by sub-area. The stormwater management modifications for Alternative 6 vary from Alternatives 2 through 5 because an existing stormwater pond would be filled as part of this alternative. Stormwater management modifications are discussed in Section 6.3.4 and 6.3.5.

The excavated soils would be consolidated at the location of the current Azelia Avenue Pond, filling in the pond and creating an aboveground consolidation area that abuts the existing contaminated soil consolidation area located north of the pond. This consolidation area would be capped with a vegetative soil cover, as described in Section 6.5. Figures 9a, 9b, 9c, and 9d show details of this alternative.

Several modifications to existing monitoring and pump-out wells located within or near the proposed consolidation area would need to be completed under this alternative. Two monitoring wells (W300SPN and W7) would require abandonment and replacement, and the well casings of one monitoring well (W254) and two pump-out wells (U4 and U5) would need to be extended.

The scope of work for this alternative is assumed to include the following tasks:

- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Excavation of contaminated soils and placement within the consolidation area
- Modifications to existing groundwater pump-out system
- Placement of non-woven geotextile
- Placement of 1.5 feet of clean cover soil at consolidation area
- Placement of 0.5 feet of topsoil at consolidation area
- Backfill of excavated areas with clean fill to original grade

- Wetland mitigation (onsite or offsite as needed)
- Site restoration – planting and establishing vegetation
- Post-construction maintenance and monitoring

Because there will be minimal net change in existing grade within OU5, it is anticipated that no significant floodplain mitigation will be required as part of this remedial alternative. The need for floodplain mitigation would be determined during final design. Although the existing wetlands in OU5 will be restored following the excavation and backfill undertaken as part of this alternative, additional wetland mitigation may be required by the applicable regulatory agencies.

5.7 Alternative 7 – Limited Onsite Consolidation with Soil Cover at Building 1A Pond

Alternative 7 consists of the excavation of contaminated soil from OU5 and the consolidation of a portion of the excavated soils at a designated location north of Building 1 within the Joslyn Site and disposal of a portion of the excavated soils off site in a Subtitle D landfill. The proposed consolidation site is the current location of the stormwater pond known as the Building 1A Pond, directly adjacent to the West Area.

Excavation of contaminated soil at OU5 will proceed similarly to that proposed for Alternative 3 of the FFS, with the depths of soil excavation varying by sub-area. Excavated soils will either transported off site to a Subtitle D landfill as described in Section 4.2 or they will be consolidated in the location of the current Building 1A Pond, filling in the pond and creating an aboveground consolidation area. Stormwater management modifications are discussed in Sections 6.3.4 and 6.3.6.

This consolidation area would be bounded by the Soo Line Railroad on the north and the existing fire access road for Building 1 on the south (Figure 1). The west side of the pile would abut OU5 and, therefore, could be expanded into OU5 as necessary. Due to potential floodplain and wetland impacts, however, the volume and extent of expansion into OU5 is a significant consideration. The proposed consolidation area at the Building 1A Pond would be capped as described in Section 6.5. Figures 10a, 10b, 10c, and 10d show details of this alternative.

An existing monitoring well (W2N) located in the vicinity of the Building 1A Pond will need to be abandoned under this alternative.

The scope of work for this alternative is assumed to include the following tasks:

- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Excavation of contaminated soils

- Placement of selected excavated soils within the consolidation area
- Transportation and disposal of selected excavated soil at a Subtitle D landfill
- Abandonment of an existing monitoring well
- Placement of non-woven geotextile fabric
- Placement of 1.5 feet of clean cover soil at consolidation area
- Placement of 0.5 feet of topsoil at consolidation area
- Backfill of excavated areas with clean fill to original grade
- Floodplain and wetland mitigation
- Site restoration – planting and establishing vegetation
- Post-construction maintenance and monitoring

Alternative 7 will require mitigation for floodplain and wetlands that will be lost through construction of the onsite consolidation area and for stormwater management modifications.

5.8 Alternative 8 – Limited Onsite Consolidation with Soil Cover at West Area

Alternative 8 consists of the excavation of contaminated soil from OU5 and the consolidation of a portion of the excavated soils within an onsite consolidation area (constructed over contaminated soil that remains in place in the southern part of the West Area) and disposal of a portion of the OU5 soils off site in a Subtitle D Landfill.

Excavation of contaminated soil at OU5 will proceed similarly to that proposed for Alternative 3 of the FFS, with the depths of excavation for contaminated soils located outside of the consolidation area footprint varying by sub-area. The excavated soils will either be transported off site to a Subtitle D landfill as described in Section 4.2 or they will be consolidated in the southern part of the West Area. The proposed consolidation area within the West Area would be capped as described in Section 6.5. Stormwater management modifications are discussed in Sections 6.3.4 and 6.3.7.

The scope of work for this alternative is assumed to include the following tasks:

- Temporary erosion protection
- Removal and disposal of vegetation including brush and trees
- Temporary and permanent stormwater management
- Access road construction
- Excavation of contaminated soils and placement of selected soils within the consolidation area
- Excavation of contaminated soils and transportation and disposal of selected excavated soil at an off-site Subtitle D landfill

- Placement of non-woven geotextile fabric
- Placement of 1.5 feet of clean cover soil at consolidation area
- Placement of 0.5 feet of topsoil at consolidation area
- Backfill of excavated areas with clean fill to original grade
- Floodplain and wetland mitigation
- Site restoration – planting and establishing vegetation
- Post-construction maintenance and monitoring

Alternative 8 will require mitigation for floodplain and wetlands that will be lost through construction of the onsite consolidation area and stormwater management modifications. The consolidation area was designed to reduce floodplain, wetland, and stormwater impacts by raising the height to accommodate consolidated soils rather than spreading the consolidation area further to the west and conforming to the lower, existing height of the adjacent Building 1 fire access road.

Two options for obtaining the floodplain mitigation necessary to implement Alternative 8 were evaluated. The first option was to create additional floodplain at an offsite location (Alternative 8A). Figures 11a, 11b, 11c, and 11d show details of this alternative. The second option was to create additional floodplain within the West Area, specifically at WA-4, and at the Southern Lots (Alternative 8B). Figures 12a, 12b, 12c, and 12d show details of this alternative. Figure 12e, which shows a post-remedy conceptual restoration plan, is an excerpt from a draft permit drawing set. The entire draft permit drawing set is included as Appendix E.

6.0 Other Remedial Alternative Considerations

In addition to the threshold and primary balancing criteria discussed in Section 7, other issues and factors considered as part of conceptual design included:

- Fencing
- Scheduling and Erosion Control
- Stormwater Management
- Backfilling of Excavations
- In-Place Capping and Consolidation Cover Design
- Geotechnical Stability
- Long-Term Maintenance and Institutional Controls

The following paragraphs briefly discuss each of these issues.

6.1 Fencing

A 6-foot-high perimeter fence has been in place around the West Area since 2000 to restrict unauthorized access to contaminated soils. For Alternatives 1 (no action) and 2 (stormwater management modifications only), no contaminated soil management is proposed, and the West Area would remain fenced as part of the remedy. For all other remedial alternatives (Alternatives 3 through 8), access to contaminated soils will be controlled via other mechanisms (consolidated under clean soil or removed from the Site); therefore, a fence would not be required at the West Area or at any consolidation areas as part of the remedy. Joslyn has indicated its intention to maintain a fence around the West Area (or any of the consolidation areas) for general liability purposes, and in keeping with their intention for the West Area to remain open, undeveloped space as described in Section 2.4. However, for Alternatives 3 through 8, the fence would not be an integral part of the remedy.

6.2 Scheduling and Erosion Control

Project scheduling and erosion control measures to be taken both prior to and during construction are critical to the success of the remedial alternatives requiring soil disturbance and/or movement (Alternatives 3 through 8). If possible, work would be scheduled to occur during late fall or winter months to reduce the potential for peak stormwater runoff events and the potential for fugitive dust and odor emissions. Rigorous erosion control measures would be employed to prevent erosion and migration of contaminated soil during excavation and/or consolidation (Alternatives 3 and 5 through 8) or the capping process (Alternative 4).

6.3 Stormwater Management

6.3.1 Existing Stormwater Management

Existing stormwater management at the Site includes the infrastructure servicing the current development: three buildings, associated parking lots, and Azelia Avenue between Lake Breeze Avenue and 50th Avenue North. The onsite buildings are known as Buildings 1, 2, and 3, with Building 1 located nearest Middle Twin Lake, Building 2 in the middle of the development just east of Azelia Avenue, and Building 3 furthest east and nearest Highway 100.

As shown on Figure 5a, three stormwater detention basins currently serve the Site: the Azelia Avenue Pond, Building 1A Pond, and Building 1B Pond. Azelia Avenue Pond, the largest of the three ponds, is located east of Building 1 and collects runoff from development east of Azelia Avenue. Building 1A Pond is located north of Building 1 and collects runoff from the Building 1 parking lots. Building 1B Pond is located west of Building 1 and collects the Building 1 roof drainage.

The existing stormwater detention basins provide three separate inflows to the West Area (see Figure 5a). Building 1A Pond discharges through a 12-inch pipe into the northern wetland directly west of its location, while Building 1B Pond discharges through a 24-inch pipe into the West Area immediately south of the former rail spur. The third inflow into the West Area is from the Azelia Avenue Pond, which was designed to discharge solely to Building 1A Pond until it reaches its overflow elevation. At this point, overflow from Azelia Avenue Pond is directed into an existing swale located south of Building 1 (the "south swale"), and then flows west via the south swale into the southern end of the West Area.

As indicated in Section 2.1, most surface water that enters the West Area either evaporates or infiltrates. Surface water not evaporated or infiltrated is routed via two existing pathways previously identified in Section 3.2.1 into Middle Twin Lake: (1) the former ice chute located in sub-area WA-5 or (2) the diffuse connection through the emergent vegetation that comprises much of sub-area WA-7. No direct pathway from the West Area's southern wetland to Middle Twin Lake currently exists; the southern wetland must overflow over the former rail spur (sub-area WA-8) into the northern wetland of WA-7 prior to discharging to the lake.

6.3.2 OU5 Stormwater Management Plan – Alternatives 2 through 5

While several options exist for interim and permanent stormwater management for the Site, it was determined that a stormwater management plan that could meet both interim and post-construction needs would be preferred. Such a plan could be evaluated within a standalone stormwater-only remedial alternative or as a means of minimizing the potential for runoff entering the West Area during implementation of other remedial alternatives. In either case, the conceptual plan would meet the RAO of removing the ongoing threat of contaminant transport to Middle Twin Lake.

The conceptual stormwater management plan seeks, therefore, to redirect runoff during construction, with the reintroduction of flow to the northern wetland following site restoration activities. This will be accomplished through construction of temporary sheet piling, new storm sewer piping, and stormwater treatment Best Management Practices (BMPs) [Figure 5b]. The stormwater management plan components

are described in the following paragraphs and detailed on Figure 5c. Costs for this OU5 stormwater management plan alone, which are incorporated into the overall capital costs for Alternatives 2 through 5, can be found in Appendix C, Table C-9.

6.3.2.1 Temporary Sheet Piling

Temporary sheet piling will be installed between the CP Rail corridor and the northern wetland (sub-area WA-7) to prevent surface flow from both the new storm sewer pipe described below (Pipe to North) and the Building 1A Pond outlet pipe from reaching WA-7 during construction. Additionally, temporary sheet piling will be placed around the northwest area of WA-7 to prevent runoff from the construction site from reaching Middle Twin Lake. Once construction is completed and the wetland area is stabilized, the temporary sheet piling can be removed or driven to the ground surface and the pipe discharges can be reintroduced into the newly constructed wetland.

6.3.2.2 Permanent Storm Sewer Piping

Two new storm sewer pipes will be installed to convey stormwater in the vicinity of the West Area, including a pipe flowing north from the south swale to the ditch along the south side of the CP Rail tracks and a pipe flowing west from the Southern Lots to Middle Twin Lake.

Pipe to North (South Swale to CP Rail Line Ditch)

A pipe to the north will be installed to convey flow from the south swale to the ditch that parallels the CP Rail track. This new storm sewer line will also intercept flow from the Building 1B Pond. This pipe will be installed at an elevation of 855 feet MSL or greater to the maximum extent practicable to ensure that it is located within the LTU berm that was constructed in the 1990s to provide biological treatment of soils (Barr, 1990). At elevations lower than 855 feet MSL, it is possible that contaminated or unstable soils would be encountered that would not be suitable for pipe installation. The outflow of the new storm sewer will flow above ground west through the CP Rail ditch and eventually discharge to Middle Twin Lake.

Pipe to West (Southern Lots to Lake)

A pipe to the west will be installed to convey overflow from the Southern Lots biofiltration basin to Middle Twin Lake. The outlet of this pipe will be placed above the normal water level of the lake, and a check valve will be installed to prevent backflow from the lake during periods of high water.

6.3.2.3 Permanent Stormwater Treatment BMPs

Several permanent stormwater treatment BMPs will be constructed to treat stormwater prior to discharge to Middle Twin Lake. These include the south swale infiltration basin, the Southern Lots biofiltration basin, and permanently raising the ground surface elevation in the area of the former ice chute.

South Swale Filtration Basin

The south swale will be retrofit to provide stormwater treatment by creating a filtration basin. This will be accomplished by adding fill to close off the downstream end of the swale, installing a perforated pipe

throughout the length of the swale, and amending the soils above the perforated pipe to encourage infiltration. The perforated pipe will be connected to a new manhole at the downstream end of the swale, the rim of which will be raised by 6 inches above grade to allow pooling of water within the swale prior to overflow for added water quality benefits.

Southern Lots Biofiltration Basin

A biofiltration basin will be constructed on the Southern Lots to treat the runoff that currently flows from the residential area south of the West Area into the West Area's southern wetland. Infiltration into the existing underlying soil will be prevented by the installation of an HDPE liner. Stormwater treatment will be accomplished through the chemical, biological, and physical processes associated with native plantings. The basin will be planted with water-tolerant vegetation that will filter sediment and nutrients from runoff in order to closely mimic the functions of the existing wetlands. Discharge from the biofiltration basin will be directed to a pipe (Pipe to West) and then to Middle Twin Lake.

Former Ice Chute Area

The elevation of the ground surface in the portion of sub-area WA-5 associated with the former ice chute will be increased to eliminate the direct connection between the West Area's northern wetland to Middle Twin Lake, both during and after construction. Raising the elevation of the area of the former ice chute will also increase the potential retention times within the West Area, providing increased potential for treatment of stormwater runoff in the northern wetland post-construction.

6.3.3 TMDL Implementation Plan Compliance – Alternatives 2 through 5

The chosen remedial alternative and stormwater management plan will need to comply with the November 2007 Twin and Ryan Lakes TMDL Implementation Plan (Wenck, 2007). The MPCA has listed North, Middle, and South Twin Lakes and Ryan Lake as impaired due to excess nutrients. Therefore, the focus of the TMDL implementation plan is to reduce annual total phosphorus loads to the lakes. The plan identifies the need for increased infiltration and retrofits to achieve the maximum possible total phosphorus load reduction.

The conceptual stormwater management plan developed for this FFS for Alternatives 2 through 5 will achieve the intent of the TMDL Implementation Plan, as all stormwater runoff will be treated prior to discharge to the Middle Twin Lake. In particular the following BMPs will provide nutrient removal:

- Building 1A Pond and Azelia Avenue Pond currently provide treatment as wet ponds and will continue to provide treatment after construction.
- Building 1B Pond currently serves as a vegetated filter and will continue to provide treatment after construction.
- The south swale will be retrofitted with amended soils and a perforated pipe to filter stormwater to encourage infiltration into the surrounding soils to the extent possible to retain phosphorus.
- The Southern Lots biofiltration basin will function much like a wetland by using plants to filter sediment and remove nutrients from runoff prior to discharge to the lake.

- Restoration of the wetland in WA-7 will serve to further filter runoff from the south swale and both Building 1A and Building 1B Ponds. While runoff from these areas will bypass the wetland during construction, natural wetland treatment will be restored upon completion of the Site remediation.
- The elimination of the direct connection between the West Area and Middle Twin Lake via the former ice chute area will prevent the northern wetland from discharging in this location, increasing the residence time for treatment of runoff within the wetland.

These BMPs will aim to protect Middle Twin Lake by providing improved physical and biological processes for total phosphorus removal, including sedimentation, filtration, infiltration, and uptake by wetland vegetation.

6.3.4 OU5 Stormwater Management Plan – Alternatives 6 through 8

The OU5 stormwater management plan for Alternatives 6 through 8 will be similar in objective to that of Alternative 2 through 5 (Section 6.3.2) in that it seeks to minimize the potential for runoff entering the West Area during implementation of the remedial alternatives. Many of the design components are replications of those used for Alternatives 2 through 5 with the major changes being the elimination of the Pipe to North and South Swale Filtration Basin. These design eliminations are due to greater control of flows to the West Area via the south swale (Alternatives 6 and 7) and inclusion of increased treatment and flow reduction in the southern West Area wetland (Alternatives 6, 7, and 8), which were not potential design components in Alternatives 2 through 5. Costs for this OU5 stormwater management plan alone, which are incorporated into the overall capital costs for Alternatives 6 through 8, can be found in Appendix C, Table C-10.

The OU5 stormwater management plan for Alternatives 6 through 8 are shown in the individual stormwater management plans (Figures 9c, 10c, 11c, and 12c) and details (Figures 9d, 10d, and 11d) for the respective alternatives along with other stormwater design components for that alternative, if applicable. The stormwater management plan components are described in the following paragraphs:

6.3.4.1 Temporary Stormwater Management

Temporary stormwater management will be removed upon completion of construction and will include:

- Diverting the west end of the south swale towards Middle Twin Lake into the Pipe to West (see Section 6.3.2.2 for Pipe to West details).
- Temporary sheet piling as described in Section 6.3.2.1.
- Temporarily blocking the Building 1B Pond outlet and pumping flows from the existing manhole as needed to an area not under construction at the time- either north of the rail spur, south of the rail spur, or to the diverted south swale.

6.3.4.2 Permanent Stormwater Management

Permanent stormwater management will remain in place after construction and will include the following features:

- Raising the ground surface elevation in the former ice chute area as described in Section 6.3.2.3.
- Raising the ground surface elevation of the former rail spur to above the Ordinary High Water Level (OHWL) to as recommended by the MDNR to clarify the landward extent of regulatory jurisdiction of Middle Twin Lake (MDNR, 1999).
- New storm sewer to replace the Building 1B Pond outlet that will be removed during construction.
- Pipe to West as described in Section 6.3.2.2 will be constructed as part of Alternatives 6, 7 and 8A; this pipe will not be included in Alternative 8B.
- Southern Lots Biofiltration Basin as described in Section 6.3.2.3 will be constructed as part of Alternatives 6, 7 and 8A; this feature will not be included in Alternative 8B.
- Construction of a curved berm north of the Southern Lots that allows flows from the biofiltration basin to be directed to the lake and flows from the south swale to be directed into the West Area. This berm will also prevent backup of stormwater onto non-Joslyn owned properties south of the West Area due to raising the rail spur grade. The western portion of the berm will be constructed pre-excavation in conjunction with the temporary south swale diversion to the lake. The eastern portion of this berm adjacent to the south swale diverting flow into the West Area will be constructed post-excavation in conjunction with removal of the temporary south swale diversion to the lake. This feature will not be included in Alternative 8B.

6.3.5 Alternative 6 Stormwater Management Plan

The stormwater modifications needed as part of Alternative 6 include incorporating the stormwater modifications described in Section 6.3.4 and construction of a new stormwater pond to replace the stormwater functions of the filled Azelia Avenue Pond. The stormwater modifications needed specifically for Alternative 6 are assumed to include the following permanent stormwater management features:

- New storm piping along the east and south of the existing Azelia Avenue Pond to convey stormwater from the eastern redevelopment to the new stormwater pond in the south swale.
- A new stormwater pond in the south swale. Retaining walls will be needed in the south swale to provide an equivalent water treatment and flood storage replacement for the filled Azelia Avenue Pond.

Alternative 6 currently assumes the use of reinforced concrete pipe (RCP) for new piping. However, watertight, fused HDPE may be required in some areas to prevent the potential of contaminated groundwater infiltrating stormwater flow.

6.3.6 Alternative 7 Stormwater Management Plan

The stormwater modifications needed as part of Alternative 7 include incorporating the stormwater modifications described in Section 6.3.4 and modifications to Azelia Avenue Pond to replace the stormwater functions of the filled Building 1A Pond. The stormwater modifications needed for Alternative 7 are assumed to include the following permanent stormwater management features:

- New storm piping to direct the Building 1 parking lot runoff east into the Azelia Avenue Pond.
- New storm piping and outlet structure to direct low flows from the Azelia Avenue Pond south of the pond and then east into the West Area. High flows will continue to use the existing Azelia Avenue Pond overflow pipes into the south swale.

Alternative 7 currently assumes the use of a combination of reinforced concrete pipe (RCP) and non-watertight HDPE for new piping. However, watertight, fused HDPE may be required in some areas to prevent the potential of contaminated groundwater infiltrating stormwater flow.

6.3.7 Alternative 8 Stormwater Management Plan

6.3.7.1 Alternative 8A

The stormwater modifications needed as part of Alternative 8A includes incorporating the stormwater modifications described in Section 6.3.4. No other additional stormwater management features are proposed for this alternative.

Alternative 8A currently assumes the use of reinforced concrete pipe (RCP) for new piping. However, watertight, fused HDPE may be required in some areas to prevent the potential of contaminated groundwater infiltrating stormwater flow.

6.3.7.2 Alternative 8B

The stormwater modifications needed as part of Alternative 8B include incorporating the stormwater modifications described in Section 6.3.4, except as noted in the following:

- Pipe to West as described in Section 6.3.2.2 will not be constructed as a permanent stormwater feature. This pipe will only function throughout the duration of construction and stabilization of vegetation within West Area and then be removed or abandoned in place.
- Southern Lots Biofiltration Basin and associated berm as described in Section 6.3.2.3 will not be constructed.

The above-referenced Pipe to West, Southern Lots Biofiltration Basin and associated berm will not be constructed as part of Alternative 8B as all stormwater runoff from the Southern Lots will be routed into the West Area. These features were not included within this alternative to reduce floodplain impacts, to maintain existing flow patterns within the wetland and to take advantage of the increased water quality benefits of the West Area due to the increased detention time resulting from the implementation of the floodplain mitigation area.

6.3.8 TMDL Implementation Plan Compliance – Alternatives 6 through 8

Similarly to Alternatives 2 through 5, stormwater modifications for Alternative 6 through 8 will comply with the TMDL Implementation Plan as all stormwater runoff will be treated prior to discharge to Middle Twin Lake. The following BMPs will provide nutrient removal for the specific alternatives listed:

- The new stormwater pond in the south swale will provide wet pond treatment similar to that provided previously by the Azelia Avenue Pond (Alternative 6).
- Discharge from the new stormwater pond (Alternative 6) and the altered Azelia Avenue Pond (Alternative 7) to the south swale will flow to the West Area where it will be further treated by both the restored southern and WA-7 (northern) wetlands.
- The Azelia Avenue Pond, now serving the entire redevelopment area, will provide extended detention treatment for a water quality rainfall depth of 1 inch or less (Alternative 7).
- Azelia Avenue Pond as described in Section 6.3.3 (Alternatives 8A and 8B).
- Building 1A Pond as described in Section 6.3.3 (Alternatives 6, 8A, and 8B).
- Restoration of the wetland in WA-7 will serve to further filter runoff from the south swale and Building 1B Pond (Alternatives 6, 7, 8A, and 8B) and the Building 1A Pond (Alternative 6, 8A and 8B) as described in Section 6.3.3.
- Building 1B Pond as described in Section 6.3.3 (Alternatives 6, 7, 8A and 8B).
- The elimination of the direct connection between the West Area and Middle Twin Lake via the former ice chute area as described in Section 6.3.3 (Alternatives 6, 7, 8A and 8B).
- Southern Lots Biofiltration Basin as described in Section 6.3.3 (Alternatives 6, 7, and 8A).

The raising of the rail spur will provide more storage volume prior to overflow in the West Area southern wetland for rate control and settling of nutrients (Alternatives 6, 7, 8A and 8B).

6.3.9 Preliminary Modeling Results

Preliminary stormwater modeling, including both hydrologic/hydraulic modeling and water quality modeling, was completed for the existing site conditions and Alternatives 5 through 8. The hydrologic/hydraulic modeling was used to determine peak runoff rates for the 2-,10-, and 100-year storm events while the water quality modeling was used to determine pollutant removal rates for total phosphorus (TP) and total suspended solids (TSS). Based on preliminary discussions with permitting agencies, the proposed stormwater management should equate or be an improvement over the existing conditions. Thus, stormwater management goals for the remedial alternative are that (1) proposed peak runoff rates do not exceed those of existing conditions and (2) proposed pollutant removal rates are greater than or equal to those of existing conditions.

Based on the modeling results, proposed peak runoff rates for Alternative 5 would exceed the existing rates for both the 2- and 10-year storm events. Additionally, the pollutant removal rates provided by the proposed water quality treatment for Alternative 5 would not meet the existing rates for TP and TSS.

Therefore, permitting agencies may determine the proposed stormwater management for Alternative 5 to be unacceptable for permit approval.

Conversely, proposed stormwater management for Alternatives 6, 7, 8A, and 8B will meet the peak runoff rate and water quality goals and would therefore be more likely to be gain permit approval.

6.4 Backfilling of Excavations

For alternatives that require excavation of contaminated soil (Alternatives 3 and 5 through 8), geotextile fabric will be placed prior to backfilling to final grade as described in Section 3.6.

6.5 In-Place Capping and Consolidation Cover Design

For alternatives requiring in-place capping or onsite consolidation (Alternatives 4 through 8), a 2-foot, vegetative soil cover will be constructed over the contaminated soils consisting of a non-woven geotextile fabric overlaid with 1.5 feet of clean cover soil and 0.5 feet of topsoil. The purpose of the geotextile is as follows: (1) to meet the requirement of a 2-foot accessible zone as described in Section 3.4.1, (2) to provide a demarcation between the cover soils and the underlying contaminated soils, (3) to reduce the potential for contaminant transport upward into the clean cover, and (4) to help reduce differential settlement.

The presence of a high proportion of natural organic materials (i.e., peat) in the OU5 soils that require remediation, and the molecular structure of dioxins, creates a matrix where the dioxin/furan will strongly adsorb to organic materials (peat and other vegetative matter). This reduces the potential for dioxins to volatilize into the atmosphere or dissolve into water. Thus the onsite consolidate and cover remedial actions considered as part of this FFS would not require an impermeable cap and a simple vegetated cap (geotextile overlain by two feet of clean soil) protects human health and the environment through elimination of exposure.

The proposed soil consolidation area in Alternative 8 is located in the southern part of the West Area, within the 100-year floodplain of Middle Twin Lake. To confirm that the proposed vegetated cover design described above would prevent washout of soils in the Alternative 8 consolidation area in the event of a 100-year flood, an evaluation of anticipated water flow velocities was conducted. The 100-year flood flow velocities expected adjacent to the consolidation area following implementation of Alternative 8 would be similar to the current velocities that were modeled in this area in 2004 (Barr, 2004b). The modeled peak flow velocities were 0.08 to 0.20 feet per second, less than the 1.0 foot per second velocity (critical velocity) design criteria for vegetated waterways on easily eroded soils (Barr, 2004b), indicating that a vegetated cover will protect against washout of soil from the consolidation area. Additionally, the proposed consolidation area would be set back from the lake and not subject to wave action due to the protective beach ridge to the west and the reconstructed railroad spur to the north.

6.6 Geotechnical Stability

Preliminary geotechnical analyses of the proposed consolidation area grading plans and designs for Alternatives 5 through 8 indicate that the various consolidation area configurations and vegetated soil covers will be stable. The need for a more detailed geotechnical evaluation will be considered as part of final design.

6.7 Long-Term Maintenance and Institutional Controls

Long-term maintenance needs for the remedial alternatives vary by the level of work and disturbance area. All alternatives will require at least routine site inspection and reporting. Additional needs for the alternatives include the following measures for the OU5 area and/or the consolidation area, as applicable:

- Alternatives 2 through 8 – Stormwater management system, surface soil erosion, and wetland vegetation monitoring and maintenance
- Alternatives 1 and 2 – Perimeter fence maintenance
- Alternative 4 through 8 – Vegetative soil cover maintenance
- Alternative 6 – Monitoring and pump-out well maintenance

For Alternatives 1 through 8, institutional controls would be put in place to restrict future land use and access to contaminated soils as necessary for OU5 and/or the consolidation area.

7.0 Comparative Analysis of Alternatives

This section of the FFS provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in Section 300.430 of the NCP. The remedial alternatives selected from the screening process were evaluated using the following nine criteria:

- Overall protection of human health and the environment
- Compliance with Applicable and/or Relevant and Appropriate Federal and State public health or environmental requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume of hazardous substances
- Short-term effectiveness
- Implementability
- Cost effectiveness
- Acceptance by EPA
- Acceptance by Community

The NCP categorizes the nine criteria into three groups:

1. Threshold Criteria – overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

2. Primary Balancing Criteria – long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and cost are primary balancing factors used to weigh major trade-offs among alternatives; and

3. Modifying Criteria – state and community acceptances are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated into the ROD.

Two additional criteria were also used to evaluate the remedial alternatives:

- Principal threat waste considerations

Floodplain and wetland mitigation

A narrative evaluation of the alternatives with respective to the criteria is provided in the following subsections. A comparative evaluation of the alternatives is included on Table 2.

7.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls. All of the alternatives except Alternative 1 (No Action) and Alternative 2 are protective of human health and the environment by reducing or eliminating exposure pathways.

Alternative 1 and Alternative 2 are therefore removed from further consideration.

7.2 Compliance with ARARs

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

7.2.1 Definition of ARARs and TBCs

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

"To be considered" materials (TBCs) are criteria, advisories, guidance, and proposed standards developed by government agencies that are not legally enforceable but contain information that would be helpful in carrying out, or in determining the level of protectiveness of, selected remedies. TBCs are meant to complement the use of ARARs, not replace or compete with them.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for a invoking a waiver of specific ARARs.

Tables 3-1 through 3-5 summarize the federal and state ARARs and TBCs compiled for this project and if/when they apply.

7.2.2 Comparison to ARARs and TBCs

It is generally understood that each of the alternatives included in this FFS can, with appropriate design and planning, meet ARARs and TBCs. The regulatory classification of OU5 soils as described in Appendix B and summarized in Section 4.2 presents important interpretation of ARARs and TBCs for contaminated soil management within and outside of the Joslyn Site, particularly for remedial actions that include offsite soil treatment and/or disposal.

Because Alternative 3 assumes incineration of all excavated OU5 soils prior to disposal in a landfill, the extreme expense associated with this alternative makes the selection of this alternative unlikely, and the regulatory classification of the portion of OU5 soils that would require management and offsite/treatment disposal as a hazardous waste a moot point.

Offsite disposal of soils that can be managed as a non-hazardous waste at a Subtitle D landfill will be required for Alternatives 7 and 8. As described in Section 4.2 (and in the memorandum included in Appendix B), the regulatory classification of the soils designated for disposal at a Subtitle D landfill in Alternatives 7 and 8 will result in compliance with ARARs and TBCs. Offsite disposal of these soils in a Subtitle D landfill will preserve sufficient consolidation area capacity to manage remaining soils on site.

7.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

Alternative 2 provides limited long-term effectiveness, as little or no contaminated soil will be removed or covered as part of this option; rather the potential for future erosion of contaminated soil is reduced. Alternative 3 provides the greatest long-term effectiveness by removing contaminated soils from the Joslyn Site and permanently eliminating the exposure pathways associated with the contaminated soil. Alternatives 4, 5, and 6 provide better long-term reduction of the exposure pathways associated with the contaminated soil than Alternative 2 by covering the contaminated soil. Alternatives 7 and 8 provide better long-term effectiveness and permanence than Alternatives 4, 5, and 6 by removing a portion of the contaminated soil from the Joslyn Site but not as great as Alternative 3.

Reviews at least every five years, as required, will be necessary to evaluate the effectiveness and permanence of any of these alternatives because hazardous substances will remain on site in concentrations above health-based screening levels.

7.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 2, 4, 5, and 6 do not include treatment as a component of the remedy. Therefore, these alternatives would not significantly alter the toxicity or volume of contamination at the Site. Alternative 2 would not reduce mobility. Alternatives 4, 5, 6, 7, and 8 would reduce mobility by capping contaminated soils. Alternatives 7 and 8 remove a portion of the contaminated soil from the Joslyn Site and would therefore lessen the toxicity and volume of contamination at the Site.

Alternative 3 reduces toxicity and volume through treatment.

7.5 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Significant stormwater events during periods of contaminated soil excavation could result in erosion and/or potential releases of contaminated soil or runoff to Middle Twin Lake. Under Alternatives 2, 3, 4, 5, 6, 7, and 8 scheduling the contaminated soil excavation for a late fall or winter period will reduce the potential for significant stormwater events that could affect remedial operations.

Alternatives 3, 6, 7, and 8 involve excavating the most highly contaminated soils in the West Area and staging these soils for loading for offsite transportation under Alternative 3 and for consolidation at the Joslyn Site under Alternatives 6, 7, and 8. This could result in longer potential exposure to higher concentrations of COCs for workers, residents of the local neighborhoods, and to surface water compared to Alternatives 2, 4, or 5.

7.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Each of the eight alternatives can be implemented using generally available construction methods, equipment, and materials. However, there are several implementability issues that pertain to the specific alternatives:

- Alternatives 2 through 8 require work in wetlands and the associated regulatory agency coordination and permitting (MDNR, SCWMC, etc.).
- The regulatory permitting potentially required to implement Alternative 3 increases the administrative and logistical complexity of this approach and makes it unlikely that it could be implemented.
- Alternative 5 would need significant floodplain mitigation. Alternatives 7 and 8 would require floodplain mitigation, but less than that required of Alternative 5.

- Alternative 8A would require coordination with offsite property owner(s) to obtain necessary floodplain mitigation. Alternative 8B would create floodplain in OU5 of the Joslyn Site.
- Alternatives 6 and 7 would require coordination with the lessee of the developed portion of the Joslyn Site and significant stormwater management changes due to the proposed filling of the Azelia Avenue Pond.

7.7 Cost

Cost estimates for each alternative estimating their present worth, including the No Action alternative, can be found in Appendix C and summarized in Table 4.

Capital costs include the estimated construction cost, the cost of engineering, design, permitting, and construction observation, and contingencies specific to each alternative. Operation and maintenance costs assume a post-implementation project duration of 30 years, but do not reflect a discount rate.

7.8 Principal Threat Waste

The NCP establishes an expectation that U.S. EPA will use treatment to address the principal threats posed by a site whenever practicable. Alternative 3 meets this expectation by the excavation and offsite treatment/disposal of contaminated OU5 soils. Alternatives 4, 5, 6, 7, and 8 do not meet the NCP's expectation of treating principal threat waste, but will utilize containment and will effectively eliminate the potential exposure pathway for human and ecological receptors. The NCP also states that treatment should be used to address principal threat wastes wherever *practicable*. As shown in the cost estimates in Appendix C, the implementation of Alternative 3 is significantly more expensive than Alternatives 4, 5, 6, 7, and 8 and is not practicable. Alternatives 5, 6, 7, and 8 provide the best balance of tradeoffs with respect to the other balancing criteria evaluated.

7.9 Floodplain and Wetland Mitigation

Alternatives 2 through 8 will require mitigation of both temporary and/or permanent wetland impacts created by the selected remedial alternative. For the purposes of this FFS, it is assumed that wetland regulatory agencies will deem the temporary wetland impacts (i.e., excavation of contaminated soils and in-place restoration of wetland to existing elevations) as "no loss," while permanent impacts will require offsite mitigation at a 2.5:1 ratio.

Alternatives 4, 5, and 8 will also require significant mitigation of the floodplain impacts to Middle Twin Lake. An evaluation of potential floodplain mitigation sites has been ongoing, and if floodplain mitigation is required as part of the selected alternative, Joslyn will continue to work with MPCA and the SCWMC to develop an acceptable floodplain mitigation plan.

A summary of the floodplain and wetland impacts are as follows:

- Alternative 2 – 7,500 sq. ft. of permanent impacts to the southern wetland; insignificant floodplain fill

- Alternative 3 – 182,800 sq. ft. of "no loss" impacts to the northern wetland and 7,500 sq. ft. of permanent impacts and 74,600 sq. ft. of "no loss" impacts to the southern wetland; insignificant floodplain fill
- Alternative 4 – 182,800 sq. ft. of permanent impacts to the northern wetland and 82,100 sq. ft. of permanent impacts to the southern wetland; 27,500 cubic yards of floodplain fill
- Alternative 5 – 182,800 sq. ft. of "no loss" impacts to the northern wetland and 82,100 sq. ft. of permanent impacts to the southern wetland; 12,500 cubic yards of floodplain fill
- Alternative 6 – 182,800 sq. ft. of "no loss" impacts to the northern wetland and 10,300 sq. ft. of permanent impacts and 71,800 sq. ft. of "no loss" impacts to the southern wetland; insignificant floodplain fill
- Alternative 7 – 15,400 sq. ft. of permanent and 167,400 sq. ft. of "no loss" impacts to the northern wetland and 10,300 sq. ft. of permanent impacts and 71,800 sq. ft. of "no loss" impacts to the southern wetland; insignificant floodplain fill
- Alternative 8A – 182,800 sq. ft. of "no loss" impacts to the northern wetland and 40,000 sq. ft. of permanent and 42,100 sq. ft. of "no loss" impacts to the southern wetland; 5,500 cubic yards of floodplain fill
- Alternative 8B – 182,200 sq. ft. of "no loss" impacts to the northern wetland and 40,000 sq. ft. of permanent impacts and 42,100 sq. ft. of "no loss" impacts and to the southern wetland; 5,200 cubic yards of floodplain fill

The floodplain and wetland impacts noted above for Alternatives 4 and 5, compared with the other alternatives, are considerable and expensive as shown in Appendix C, and could also require securing partnerships with outside parties for offsite replacement/mitigation.

For Alternatives 3 and 6, it is assumed that temporary impacts to wetlands will be "no loss" as wetland areas disturbed by excavation will be restored. It is assumed that no permanent wetland or significant floodplain impacts will result from Alternatives 3 and 6.

Two floodplain mitigation options were considered for Alternative 8 as noted in Section 5.8. Alternative 8A assumes floodplain mitigation will be obtained at an offsite location and Alternative 8B assumes that floodplain mitigation will be obtained onsite in the West Area and the Southern Lots.

8.0 Selected Remedy for OU5

8.1 Summary of the Rationale for the Selected Remedy

Based on CERCLA requirements, the NCP, and detailed analysis of the remedial alternatives, **Alternative 8B— Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)**, constitutes the best overall remedial action for operable unit OU5 at the Joslyn Site.

Alternative 8B provides protection of public health and the environment and is in compliance with ARARs. Alternative 8B represents the best balance of tradeoffs with respect to the five balancing criteria and is protective of human health and the environment by removing a portion of the contaminated soil and eliminating the pathways of exposure.

8.2 Detailed Description of the Selected Remedy

The selected remedy involves removal and offsite disposal of a portion of contaminated soil and the establishment of a consolidation area at the Joslyn Site featuring a multi-layer vegetated soil cover. The consolidation area would be located on the southern part of the West Area over contaminated soil (Figure 12a). The depth of excavation of contaminated soil will vary by sub-area as shown on Figure 12a. Figure 12b provides the same information as 12a, but enlarged and rotated. As described in Section 4.2 and the memorandum in Appendix B, excavated contaminated soils that can be managed off site as non-hazardous waste will be disposed offsite at a Subtitle D landfill, and the remaining contaminated soils will be consolidated into the onsite consolidation area. The excavated areas would be backfilled to original grades with soil types similar to native soils for each area. Geotextile fabric will be placed prior to backfilling. An engineered cover consisting of a geotextile fabric layer, a 1.5-foot soil layer, and a 0.5-foot topsoil layer would be constructed over the consolidated soils (Figure 12c).

Interim and permanent stormwater management modifications will also be designed to ensure that stormwater runoff will be appropriately routed and treated for existing and future needs (Figure 12d). Wetland and floodplain mitigation will be required for implementation of this alternative. Floodplain mitigation will be obtained onsite in the West Area and the Southern Lots. A post-remedy conceptual restoration plan is included as Figure 12e. The entire draft permit drawing set from which Figure 12e was excerpted is included as Appendix E.

The assumption for future land use for the Southern Lots is residential open space and industrial open space for the West Area. Institutional controls are therefore necessary to prevent the possibility of direct exposure to COCs through unplanned development or unscheduled intrusive activities. Long-term inspection would be required to ensure the soil cap and stormwater features maintain their integrity.

In summary, the selected remedy would include the following components:

- Engineering controls to control surface water runoff, groundwater, dust, air quality and ensure that Remedial Action Objectives are met during and after the remedy is in place.
- Clearing and shredding of trees from the work area.

- Excavation of contaminated soils for disposal at a Subtitle D Landfill or placement into the onsite consolidation area.
- Site restoration of each sub-area will include covering the contaminated excavated areas with a four-layer cover system including 0.5 feet of clean soil, geotextile fabric, additional clean soil, and a final top layer of surface soil. In particular,
    - The surface soil will either be topsoil or wetland-like soil, depending on the existing designation as upland or wetland; and
    - The total depth of clean soil and surface soil placed in the excavated areas will be equivalent to the excavated depth to bring the areas back up to existing grade.
- Construct the consolidation cover and permanent drainage features at the consolidation area.
- Restoring the site through planting of emergent wetland vegetation and a variety of tree species, as shown on Figure 12e.
- Institutional controls to restrict future land use and access to contaminated soils.
- Long-term maintenance including inspection and maintenance, as necessary, of consolidation area vegetated cap.

8.3 Opinion of Cost of Selected Remedy

A detailed cost breakdown for the selected remedy is presented in Appendix C (Tables C-8B, C-11, and C-13). The information in this cost table is based on the best available information, including consultation with a general contractor, regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial action. This is an order-of-magnitude opinion of cost that is expected to be within +30% to -15% of the actual project cost.

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Tables

Table 1

Preliminary Remediation Goals (PRGs)
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

PRG Classification	Applicable site sub-areas	Media	COCs	Units	Value	Sources
Industrial worker receptor SRV	West Area	Soil	Dioxins	ng TCDD-TEQ/kg (ppt)	35	MPCA, 1999; MPCA, 2005a
			cPAHs	mg B[a]P-equivalents/kg (ppm)	3	MPCA, 1999; MPCA, 2005a
			PCP	mg/kg (ppm)	120	MPCA, 1999; MPCA, 2005a
Resident receptor SRV	Southern Lots	Soil	Dioxins	ng TCDD-TEQ/kg (ppt)	20	MPCA, 1999
Recreational use receptor SSV	Middle Twin Lake	Sediment	Dioxins	ng TCDD-TEQ/kg (ppt)	50	MPCA, 2006b
Aquatic and terrestrial ecological receptor*	OU5, Middle Twin Lake	Soil, sediment	Dioxins	ng TCDD-TEQ/kg (ppt)	11.2	CCME, 2002; MPCA, 2005a
			cPAHs	mg B[a]P-equivalents/kg (ppm)	12.2	Crane et al., 2000; MPCA, 2005a
			PCP	mg/kg (ppm)	0.785	MPCA, 2005a

*Aquatic sediment quality values are assumed to be applicable as terrestrial values, given the paucity of OU5 surface area above the OHWL

TCDD-TEQ = tetrachlorodibenzo-p-dioxin [TCDD] Toxicity Equivalency Quotient [TEQ], or TCDD-TEQ

SRV = Soil Reference Value

SSV = Sediment Screening Value

B[a]P = Benzo(a)pyrene

Ppt = parts per trillion

Ppm = parts per million

Table 2
Comparative Analysis of Alternatives
Joslyn Manufacturing Supply Co.
Brooklyn Center, MN

Remedial Alternatives	Threshold Criteria[1]		Balancing Criteria[2]					Modifying Criteria[3]		Additional Considerations[4]
	Overall Protection of Human Health and the Environment[5]	Compliance with ARARs[6]	Long-Term Effectiveness and Permanence[7]	Reduction of Toxicity, Mobility, or Volume through Treatment[8]	Short Term Effectiveness[9]	Implementability[10]	Estimated Cost[11]	State Acceptance[12]	Local Acceptance[13]	Floodplain and Wetland Mitigation[14]
Alternative 1 - No Action (Fence monitoring only)	○	NA	Removed from further evaluation				$0.5M			NA
Alternative 2 - Stormwater Management Modifications	○	●	◔ *Limited* long-term effectiveness	◔ Does not significantly alter toxicity or volume of contamination, does not reduce mobility	● Least potential exposure	● No additional work required	$2.3M			7,500 sq. ft. of permanent wetland impacts; insignificant floodplain fill
Alternative 3 - Excavation for Offsite Treatment and Disposal	●	●	● *Greatest* long-term effectiveness by permanently eliminating exposure pathways	● Reduces toxicity and volume through treatment, may not reduce mobility	◔ Greatest potential exposure to COCs; consolidation *offsite*	◔ Complex regulatory permitting and logistical coordination required	$68M			257,400 sq. ft. of "no loss" wetland impacts; 7,500 sq. ft. of permanent wetland impacts; insignificant floodplain fill
Alternative 4 - In-Place Soil Cover	●	●	◑ *Better* long-term reduction of exposure pathways than Alt. 2	◑ Does not significantly alter toxicity or volume of contamination; would reduce mobility	◕ Limited potential exposure compared to Alts. 3, 6, 7, & 8	◔ Increased administrative challenges because of the significant amount of permanent wetland impacts	$15M			*offsite* consolidation - 264,900 sq. ft. of permanent wetland impacts; 27,500 cu. yd. of floodplain fill
Alternative 5 - Onsite Consolidation with Soil Cover at West Area	●	●	◑ *Better* long-term reduction of exposure pathways than Alt. 2	◑ Does not significantly alter toxicity or volume of contamination; would reduce mobility	◕ Limited potential exposure compared to Alts. 3, 6, 7, & 8	◔ Requires *significant* floodplain mitigation	$5.0M			*onsite consolidation* - 182,800 sq. ft. of "no loss" wetland impacts; 82,100 sq. ft. of permanent wetland impacts; 12,500 cu. yd. of floodplain fill
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond	●	●	◑ *Better* long-term reduction of exposure pathways than Alt. 2	◑ Does not significantly alter toxicity or volume of contamination; would reduce mobility	◑ Some additional potential exposure to COCs compared to Alts. 2, 4, & 5; consolidation onsite	◔ Requires coordination with lessee of developed *offsite* portion of Joslyn Site; and *significant* stormwater management changes	$5.9M			*onsite* consolidation - 254,600 sq. ft. of "no loss" wetland impacts; 10,300 sq. ft. of permanent wetland impacts; insignificant floodplain fill
Alternative 7 - Limited Onsite Consolidation with Soil Cover at Building 1A Pond	●	●	◕ *Better* long-term effectiveness and permanence than Alts. 4, 5, & 6 by removing a *portion* of contaminated soil	◕ Would reduce mobility; *lessens* toxicity and volume of contamination by removing a *portion* of the contaminated soil	◑ Some additional potential exposure to COCs compared to Alts. 2, 4, & 5; consolidation onsite	◔ Requires floodplain mitigation (less than Alt. 5), coordination with lessee of developed *offsite* portion of Joslyn Site and *significant* stormwater management changes	$5.4M			*offsite* consolidation - 239,200 sq. ft. of "no loss" wetland impacts; 25,700 sq. ft. of permanent impacts; insignificant floodplain fill;
Alternative 8A - Limited Onsite Consolidation with Soil Cover at West Area and Additional Floodplain Offsite	●	●	◕ *Better* long-term effectiveness and permanence than Alts. 4, 5, & 6 by removing a *portion* of contaminated soil	◕ Would reduce mobility; *lessens* toxicity and volume of contamination by removing a *portion* of the contaminated soil	◑ Some additional potential exposure to COCs compared to Alts. 2, 4, & 5; consolidation onsite	◑ Requires *offsite* floodplain mitigation, and coordination with *offsite* property owner(s)	$5.4M			224,900 sq. ft. of "no loss" wetland impacts; 40,000 sq. ft. of permanent wetland impacts; less than 6,000 cu. yds. of *offsite* floodplain fill
Alternative 8B - Limited Onsite Consolidation with Soil Cover at West Area and Additional Floodplain within West Area	●	●	◕ *Better* long-term effectiveness and permanence than Alts. 4, 5, & 6 by removing a *portion* of contaminated soil	◕ Would reduce mobility; *lessens* toxicity and volume of contamination by removing a *portion* of the contaminated soil	◑ Some additional potential exposure to COCs compared to Alts. 2, 4, & 5; consolidation onsite	◕ Requires floodplain mitigation and would create floodplain *onsite* in OU5 of the Joslyn Site.	$4.8M			224,900 sq. ft. of "no loss" wetland impacts, 40,000 sq. ft. of permanent wetland impacts; less than 6,000 cu. yds. of *onsite* floodplain fill

Threshold Criteria Scale

- ● **Meets criteria**
- ○ **Does not meet criteria**

Balancing Criteria Scale

- ● **High**
- ◕ **Medium-High**
- ◑ **Medium-Low**
- ◔ **Low**

Table 2
Comparative Analysis of Alternatives
Joslyn Manufacturing Supply Co.
Brooklyn Center, MN

Notes

1 Statutory requirements that each alternative must satisfy to be eligible for selection.
2 Technical criteria upon which the detailed analysis is primarily based.
3 Evaluation of state and community acceptance to implemented remedial actions.
4 Additional considerations provide further details on the impact of remedial actions on the community. Additional considerations could be balancing or modifying criteria.
5 The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.
6 The assessment against this criterion describes how the alternative complies with ARARs, or if a waiver is required and how it is justified. The assessment also addresses other information from advisories, criteria, and guidance that the lead and support agencies have agreed is "to be considered". It is generally understood that each of the alternatives included in this FFS can, with appropriate design and planning, meet ARARs and TBCs.
7 The assessment against this criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after response objectives have been met.
8 The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.
9 The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met.
10 This assessment evaluates the technical and administrative feasibility of alternatives and the availability of required goods and services. Alternatives 2-8 require work in wetlands and the associated regulatory agency coordination and permitting (MDNR, SCWMC).
11 This assessment evaluates the capital and operation and maintenance (O&M) costs of each alternative.
12 This assessment reflects the state's (or support agency's) apparent preferences among or concerns about alternatives. This assessment will be completed after the public comment period.
13 This assessment reflects the community's apparent preferences among or concerns about alternatives. This assessment will be completed after the public comment period.
14 This assessment quantifies the impact to the floodplain and wetland for each alternative. It is assumed that wetland regulatory agencies will deem the temporary wetland impacts (i.e., excavation of contaminated soils and in-place restoration of wetland to existing elevations) as "no loss", while permanent impacts will require offsite mitigation at a 2.5:1 ratio.

Table 3-1

Potential Federal Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Federal Environmental Laws (except RCRA)					
CERCLA	Addresses investigation and remediation of a release of a hazardous substance.	Release of a hazardous substance.	42 USC 9601 et seq.	Applicable	
NCP	Provides organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.	Release of a hazardous substance.	40 CFR 300	Applicable	
Safe Drinking Water Act	Protects the quality of public drinking water supplies from source to tap.		42 USC 300f et seq.	Does not apply to OU being evaluated in this FS report.	
Clean Water Act	Establishes structure for regulating discharges of pollutants and regulating surface water quality.	Activities that affect or may affect surface water.	33 USC 1251 et seq.	Applicable	Surface water management would be required during construction activities.
Clean Water Act	Surface water quality requirements for discharges of pollutants to federally-regulated waters.	Discharge of pollutants to federally-regulated waters.	33 USC 1342 40 CFR 129	Applicable	Surface water management would be required during construction activities.
Clean Air Act	Regulates air emissions from stationary and mobile sources.	Stationary or mobile source air emissions.	42 USC 7401 et seq.	Applicable	Only mobile sources will be excavation and trucking equipment. No stationary sources anticipated.
Section 10 (Rivers and Harbors Act of 1899)	Applies to activities that will obstruct or alter any navigable water of the United States.	Construction activities that will potentially obstruct or alter navigable waters.	33 USC 403	Not an ARAR	No activities are contemplated that would obstruct or alter any navigable waters of the United States.
Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq.					
Onsite waste generation	Waste generator shall determine if the waste is hazardous waste.	Generation of waste.	40 CFR 261 Subparts A through D	Applicable	Applicable for any operation where waste would be generated.
Generators of Hazardous Waste	Generation of contaminated soils that are characterized as hazardous wastes.	Management of hazardous waste	40 CFR 262	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be generated.
Transporters of Hazardous Waste	Transportation of hazardous waste to off-site facilities.	Transportation of hazardous waste to off-site facilities	40 CFR 263	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be transported off-site.

Table 3-1

Potential Federal Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	Management of hazardous waste.	Operations that include the management of hazardous waste.	40 CFR 264	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be treated, stored or disposed of. Only the substantive portions would be ARARs.
Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	Management of hazardous waste at interim status facilities.	Operations that include the management of hazardous waste at interim status facilities.	40 CFR 265	Applicable to contaminated soil that is a hazardous waste.	40 CFR 264 may supersede this regulation.
Management of Specific Hazardous Waste and Specific Types of Facilities	Management of specific hazardous wastes	Operations involving recyclable materials, reclamation of lead-acid batteries, hazardous waste burned in boilers and industrial furnaces, munitions, or low level mixed wastes.	40 CFR 266	Does not apply to OU being evaluated in this FS report.	These standards do not apply to contaminated soils at the site.
Land Disposal Restrictions	Restricts certain hazardous wastes from land disposal.	Placement or disposal of soil that is a hazardous waste.	40 CFR 268	Applicable to contaminated soil that is a hazardous waste.	Applicable to any operation where hazardous waste is land disposed.
Disposal of Solid Waste that is not a Hazardous Waste	Generator of RCRA Subtitle D regulated waste.	Placement of RCRA Subtitle D waste in a landfill.	40 CFR 257	ARAR for landfill disposal or generated RCRA Subtitle D waste	Applicable to onsite land disposal if RCRA Subtitle D waste is generated.
U.S. Department of Transportation					
General Information, Regulations and Definitions	Requirements for packaging, labeling, marking, placarding, and motor vehicles used for transportation of hazardous materials.	Offering of hazardous materials for transportation.	49 CFR 171	Applicable	The contaminated soil properties will determine which regulations are applicable.
Hazardous Materials Table, special provisions, communications, emergency response, training and security plans	Each person who offers hazardous material for transportation or each carrier that transports it shall mark each package, container, and vehicle in the manner required.	Offering of hazardous materials for transportation.	49 CFR 172	Applicable	The contaminated soil properties will determine which regulations are applicable.
Requirements for Shipments and Packagings	Definitions of hazardous materials for transportation purposes; requirements for preparing hazardous materials for shipment	Shipment of hazardous materials to off-site facilities	49 CFR 173	Applicable	The contaminated soil properties will determine which regulations are applicable.

Table 3-1

Potential Federal Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Occupational Safety and Health Administration (OSHA)					
Work on Contaminated Sites	Requirements for workers on uncontrolled hazardous waste sites such as training, personal protective equipment, recording and reporting work-related fatalities/injuries/illnesses.	Work on uncontrolled hazardous waste sites, RCRA CA sites, and emergency response sites.	29 CFR 1904 - Recording and Reporting Occupational Injuries and Illnesses 29 CFR 1910 - Occupational Safety and Health 29 CFR 1926 – Safety and Health Regulations for Construction	Applicable	The remedial action at the Site would involve work on a CERCLA NPL site; therefore, the requirements of these OSHA standards must be met.
Management Certain Toxic Substances					
Remediation of release of polychlorinated biphenols	Requirements governing the remediation, release, and disposal of PCBs must be met.	Remediation, release, and disposal of PCBs.	40 CFR 761	Does not apply to OU being evaluated in this FS report.	PCBs are not potential contaminants of concern for the OU currently under evaluation.
Dibenzo-para-Dioxins/Dibenzofurans	Requirements governing the testing and reporting of chemical substances containing dibenzo-para-dioxins / dibenzofurans	Manufacturing (and/or importing), or processing, a chemical substance identified under §766.25	40 CFR 766	Does not apply to OU being evaluated in this FS report.	Remediation of contaminated soil does not involve the manufacturing or processing of the regulated chemical substances.

Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the entire statutes or policies are considered as potential ARARs; only substantive requirements of the specific citations are considered potential ARARs. Specific potential ARARs are addressed in the table below each general heading.

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
State Environmental Laws					
Water Pollution Control Act	Administration and enforcement of laws relating to the pollution of any waters of the state.	Release of pollutants to Minnesota waters.	Minnesota Statute 115	Applicable	
Pollution Control Agency	Provides organizational structure and procedures for responding to problems relating to water, air, and land pollution.	Release of hazardous substance in Minnesota.	Minnesota Statute 116	Applicable	
Water Law	Provides regulations pertaining to any waters of the state, including surface water, wetlands and groundwater.	Release of pollutants to Minnesota waters or activities that affect bed, banks or cross section of Minnesota waters.	Minnesota Statute 103A, 103B, 103C, 103D, 103E; 103F, 103G, 103H	Applicable	
Permits and Certifications					
Permits and certification for regulated activities	General requirements for obtaining MPCA permit for regulated activities.	Work involving a regulated activity.	Minnesota Rules Ch. 7001.0010 through 7001.0210	Applicable to regulated activities	Substantive permit requirements would need to be met for regulated activities.
Hazardous waste facility permit	Requirements for hazardous waste facility permit.	Construction of a hazardous waste management facility in Minnesota.	Minnesota Rules Ch. 7001.0500 through 7001.0730	Applicable to regulated activities	Substantive permit requirements would need to be met for regulated activities.
NPDES Permits	Requirements for treatment and monitoring of discharges to waters of the state.	Discharge of a pollutant to waters of the state.	Minnesota Rules Ch. 7001.1000 through 7001.1150	Applicable to regulated activities	Substantive permit requirements would need to be met for regulated activities. Surface runoff would be managed with a Storm Water Pollution Prevention Plan (SWPPP).
Certifications	Requirements for certification for regulated activities.	Requirement to obtain certification by section 401 of the Clean Water Act.	Minnesota Rules Ch. 7001.1400 through 7001.1470	Does not apply to OU being evaluated in this FS report.	
Solid Waste Management Facility	Requirements for permitting a soil waste management facility.	Construction of a solid waste management facility in Minnesota	Minnesota Rules Ch. 7001.3000 through 7001.3550	Applicable to regulated activities	Substantive permit requirements would need to be met for regulated activities.

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Hazardous Waste Regulations					
Onsite waste generation	Waste generator shall determine if the waste is hazardous waste.	Generation of waste.	Minnesota Rules Ch. 7045.0102 through 7045.0155	Applicable	Applicable for any operation where waste would be generated.
Generators of Hazardous Waste	Generation of contaminated soils that are characterized as hazardous wastes.	Management of hazardous waste	Minnesota Rules Ch. 7045.0205 through 7045.0325	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be generated.
Transporters of Hazardous Waste	Transportation of hazardous waste to off-site facilities.	Transportation of hazardous waste to off-site facilities	Minnesota Rules Ch. 7045.0450 through 7045.0397	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be transported off-site.
Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	Management of hazardous waste.	Operations that include the management of hazardous waste.	Minnesota Rules Ch. 7045.0450 through 7045.0551	Applicable to contaminated soil that is a hazardous waste.	Applicable for any operation where hazardous waste would be treated, stored or disposed of. Only the substantive portions would be ARARs.
Owners and Operators of Interim Status Hazardous Waste Treatment, Storage and Disposal Facilities	Management of hazardous waste at interim status facilities.	Operations that include the management of hazardous waste at interim status facilities.	Minnesota Rules Ch. 7045.0552 through 7045.0686	Applicable to contaminated soil that is a hazardous waste.	Minnesota Rules 7045.0450 through 7045.0551 may supersede this regulation.
Management of Specific Hazardous Waste and Specific Types of Facilities	Management of specific hazardous wastes	Operations involving recyclable materials, reclamation of lead-acid batteries, hazardous waste burned in boilers and industrial furnaces, munitions, or spent or waste household batteries.	Minnesota Rules Ch. 7045.0652 through 7045.0686	Does not apply to OU being evaluated in this FS report.	These regulations do not apply to contaminated soils at the site.

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Management of Used Oil	Management of used oil	Operations involving management of used oil.	Minnesota Rules Ch. 7045.0692 through 7045.0990	Does not apply to OU being evaluated in this FS report.	These regulations do not apply to contaminated soils at the site.
County Regulation of Hazardous Waste Management	Procedures for the MPCA's overview of county hazardous waste programs	MPCA approved county ordinance describing their Hazardous Waste Programs	Minnesota Rules Ch. 7045.1000 through 7045.1030	Applicable to regulated activities.	Hennepin County has an MPCA approved county ordinance detailing their hazardous waste programs.
Land Disposal Restrictions	Restricts certain hazardous wastes from land disposal.	Placement or disposal of soil that is a hazardous waste.	Minnesota Rules Ch. 7045.1390 through 7045.1400	Applicable to contaminated soil that is a hazardous waste.	Applicable to any operation where hazardous waste is land disposed.
Solid Waste					
General requirements for management of solid waste.	Requirements and standards for solid waste	Generation of a solid waste	Minnesota Rules Ch. 7035.0300 through 7035.0605	Applicable to regulated activities	Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities.
Individual Properties	Responsibility for management of solid waste	Generation of solid waste	Minnesota Rules Ch. 7035.0700 through 7035.0805	Applicable to regulated activities	Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities.
Industrial Solid Waste Land Disposal Facilities	Requirements for industrial solid waste land disposal facilities	Generation and management of an industrial solid waste	Minnesota Rules Ch. 7035.1590 through 7035.2500	Applicable to regulated activities	Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities.
Solid Waste Management Facilities Financial Requirements	Requirements for cost estimates and financial assurances documentation	Construction of a industrial solid waste land disposal facility	Minnesota Rules Ch. 7035.2665 through 7035.2805	Applicable to regulated activities	Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities.

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Solid Waste Management Facility Specific Technical Requirements	Requirements for facilities that dispose of mixed municipal solid waste in or on the land.	Management of a mixed municipal waste landfill	Minnesota Rules Ch. 7035.2815 through 7035.2915	Does not apply to OU being evaluated in this FS report.	Soil remediation would not involve management of mixed municipal waste.
Abandonment of motor vehicles and scrap metal	Requirement for disposal and reuse of abandoned motor vehicles and other scrap metal	Disposal and reuse of abandoned motor vehicles and other scrap metal	Minnesota Rules Ch. 7035.3000 through 7035.3600	Does not apply to OU being evaluated in this FS report.	Soil remediation would not involve disposal or reuse of abandoned motor vehicles or scrap metal.
Solid Waste Programs and Projects	Requirements for application procedure for grants-in-aid, state requirements, approval of applications, and payments for programs or projects which will encourage both the reduction of the amount of material entering the solid waste stream and the reuse and recycling of solid waste.	Plan for facility meeting requirements	Minnesota Rules Ch. 7035.4000 through 7035.6000	Does not apply to OU being evaluated in this FS report.	Soil remediation project would likely meet requirements.
Infectious Waste	Requirements for owners and operators of facilities, commercial transporters and all infectious waste.	Generation and management of infectious waste	Minnesota Rules Ch. 7035.9100 through 7035.9150	Does not apply to OU being evaluated in this FS report.	Soil remediation would not involve infectious waste.
Disposal of Dioxin Contaminated Soil in Subtitle D Landfills	Provides conditions for disposal of dioxin contaminated soil in a Minnesota Subtitle D landfill. Dioxin-contaminated soil may be placed in a Minnesota "Subtitle D" facility if $TEQ_{DF} \leq$ 10 µg/kg.	Disposal of dioxin-contaminated soil in a MPCA-permitted Subtitle D landfill.	MPCA Office Memorandum to Remediation Division from Stephen Thompson and Elizabeth Gawrys. August 29, 2006	TBC	MPCA policy statement. Some of the soils considered in the FS exceed the 10 µg/kg TEQ_{DF} requirement. In addition, the MPCA concluded that: "If soils are not allowed to be disposed of in a Subtitle D Landfill, the only other viable option is to leave the contamination in place, which makes for more potential future human health exposure as compared to managing the soil in a landfill."

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Remediation of Residential and Commercial/Industrial Property under MPCA VIC Program	MPCA VIC guidance	Contaminated site – enrollment in MPCA VIC program	https://www.pca.state.mn.us/waste/cleanup-guidance#guidance-for-brownfield-redevelopment-projects	TBC	Applicable to remediation of brownfield sites under MPCA VIC program.
Water Supply Regulations					
Connection to public sewer	State Plumbing Code (MDH)	Use of public sewer and water systems and plumbing materials and methods	Minnesota Rules Ch. 4715	Does not apply to OU being evaluated in this FS report.	A plumbing connection would not be expected for the remedial activities.
Public Water Resource	Water appropriation permitting, standards and criteria for alterations to structure of public water (DNR).	Plans to appropriate water or alter structure of public water	Minnesota Rules Ch. 6115	Does not apply to OU being evaluated in this FS report.	No plans to appropriate water.
New well construction in contaminated area	Allows for designation of special Well Construction Area (MDH)	Conditions requiring Special Well Construction Area designation	Minnesota Rules Ch. 4725.3659	Does not apply to OU being evaluated in this FS report.	A special Well Construction Area will not be designated as part of a remedial action.
Monitoring well installation or abandonment	Well and boring construction, use, maintenance, and sealing information (MDH)	Water Well Code	Minnesota Rules Ch. 4725	Applicable	Wells may be installed or abandoned as part of remedial activities.
Certification of Environmental Laboratories	Laboratory accreditation requirements for the State of Minnesota (MDH).	Requirement that analyses be conducted by a certified lab.	Minnesota Statute 144.97 through 144.98 Minnesota Rules Ch. 4740 Minnesota Rules Ch. 4740.2010 through 4740.2040	Applicable	Laboratories that provide services for this project would be accredited for the appropriate testing methods.
Surface Water Quality					
Water Pollution Control Act	Regulates point source discharges to waters of the state.	Point source discharges to waters of the state	Minnesota Statute 115	Applicable	

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Water of the State	Classifies waters of the state and establishes standards	Standards for Surface Waters	Minnesota Rules Ch. 7050	Applicable	
Groundwater Quality					
Discharge to groundwater	Nondegradation goal, prohibition of discharge to saturated zone, limitation on discharge to unsaturated zone, remediation requirements.	Discharges to underground waters	Minnesota Rules Ch. 7060	Applicable	Best management practices would be applicable during remediation to prevent degradation of groundwater quality.
Groundwater use or contact	Establishes human health based groundwater standards (MDH)	Release of hazardous substances to drinking water aquifer	Minnesota Rules Ch. 4717.7500 and 4717.7801 to 4717.7900	Not an ARAR for pathways of concern	
Air Quality					
Air emissions	Duty to notify and abate excessive or abnormal unpermitted air emissions	Abnormal unpermitted air emissions	Minnesota Statute 116.061	Applicable	These regulations would be applicable in connection with activities that disturb soil and result in emissions during remedial activities.
Air emissions	Air quality rules	Air emissions	Minnesota Rules Chs. 7005, 7007, 7017	Applicable	These regulations would be applicable in connection with activities that disturb soil and result in emissions during remedial activities.
Air emissions	Standards of performance and emissions inventory	Stationary emission source	Minnesota Rules Chs. 7019	Does not apply to OU being evaluated in this FS report.	These regulations would be applicable to emissions from stationary sources and no stationary source is anticipated with remediation.
Air emissions	Air emissions and waste management permits	Requires permits for air emission sources	Minnesota Statute 116.081	Does not apply to OU being evaluated in this FS report.	The remedial actions would not involve the construction or modification of air or waste treatment facilities.

Table 3-2

Potential State and Local Action-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Noise Pollution Control					
Sound generation	Standards for noise generated during operations.	Generation of noise during site activities	Minnesota Rules Ch. 7030	Applicable	May need a waiver of this requirement if operation of construction equipment exceeds noise standards.
Health and Safety					
Worker protection	Standards for worker health, safety and training	Health and Safety	Minnesota Rules Ch. 5205	Applicable	Requirements would be met for health and safety of workers.
Property Use in Superfund Remedial Action Decisions					
Property use	Incorporating property use into cleanup decisions	Need for remedial action decision. Use of institutional controls as part of remedial actions.	MPCA Guidance on Incorporation of Planned Property Use into Site Decisions	TBC	Useful in setting PRGs and in defining the appropriate use of institutional controls.
Shingle Creek Watershed Management Organization Rules and Standards					
Stormwater Management	Manage subwatershed discharge rates and flood storage volumes to be consistent with the Commission's and local water resources management plans.	Plans for land or site development adjacent to or within a lake, wetland, or natural or altered watercourse as listed in the final inventory of Protected Waters and Wetlands, as prepared by the DNR.	Shingle Creek WMO, Rule D	Applicable	A stormwater management plan will be prepared and submitted for review and approval
Erosion and Sediment Control	Control runoff and erosion during land disturbing activities	Plans for projects covered by Rule D.	Shingle Creek WMO, Rule E	Applicable	An erosion and sediment control plan will be prepared and submitted for review and approval

Table 3-3

Potential Federal Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
National Archaeological and Historical Preservation Act					
Within area where action may cause irreparable harm, loss, significant artifacts.	Construction on previously undisturbed land would require an archaeological survey to the area.	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data.	Substantive requirements of 36 CFR 65, National Historic Landmarks Program.	Not an ARAR	There are no known archaeological or historical sites located within the OU boundaries.
Federal National Historic Preservation Act, Section 106					
Historic project owned or controlled by federal agency.	Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing or the National Register of Historic Places.	Property included or eligible for the National Register of Historic Places.	Substantive Requirements of 36 CFR 800, Protection of Historic Properties; 16 USC 470	Not an ARAR	There are no known archaeological or historical sites located within the OU boundaries.
Historical Sites, Buildings, and Antiquities Act					
Historic sites	Avoid undesirable impacts on landmarks.	Areas designated as historic sites.	16 USC 461-467; 40 CFR 6.3, Requirements for Environmental Information Documents and Third-Party Agreement for EPA Actions Subject to NEPA	Not an ARAR	There are no known archaeological or historical sites located within the OU boundaries.
Endangered Species Act of 1973					
Critical habitat upon which endangered species or threatened species depend.	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior. Reasonable mitigation and enhancement measures must be taken, including live propagation, transplantation and habitat acquisition and improvement.	Determination of effect upon endangered or threatened species or its habitat by conducting biological assessments.	16 USC 460 et seq. 16 USC 1531; 16 USC 1536(a) 50 CFR 81, Conservation of Endangered and Threatened Species of Fish, Wildlife, and Plant – Cooperation with the States 50 CFR 402, Interagency Cooperation – Endangered Species Action of 1973, as amended	Applicable	There are no records of endangered plant or animal species located on the portions of the Site where remedial actions would be conducted.

Table 3-3

Potential Federal Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Migratory Bird Treaty Act of 1972					
Migratory bird area	Protects almost all species of native birds in the U.S. from unregulated "take" which can include poisoning at contaminated sites.	Presence of migratory birds.	16 USC 703	Applicable if ground nesting birds present in remediation area.	Response activities would be scheduled such that it is unlikely that ground nesting birds would be affected. Survey of ground nesting birds will be completed prior to remediation.
Wilderness Act					
Wilderness Area	Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.	Federally-owned area designated as wilderness area.	16 USC 1131 et seq.; 50 CFR 35.1 et seq.	Not an ARAR	Remedial actions are not planned in areas located in or adjacent to an area designated as part of the National Wildlife Refuge System.
National Wildlife Refuge System					
Wildlife Refuge	Only actions allowed under the provisions of 16 USC Section 688 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System.	Areas designated as part of National Wildlife Refuge System.	16 USC 668; 50 CFR 27	Not an ARAR	Remedial actions are not planned in areas located in or adjacent to an area designated as part of the National Wildlife Refuge System.
Fish and Wildlife Coordination Act, Fish and Wildlife Improvement Act of 1978, Fish and Wildlife Conservation Act of 1980					
Area affecting stream or other water body	Provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife.	Diversion, channeling or other activity that modifies a stream or other water body and affects fish or wildlife.	16 USC 661; 16 USC 662 16 USC 742a; 16 USC 2901; 50 CFR 83	Applicable	Measures would be taken to protect water bodies that would be potentially affected.
Procedures for Implementing Requirements of the Council on Environmental Quality on the National Environmental Policy Act and Executive Order 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands. Wetlands of primary ecological significance must not be altered so that ecological systems in the wetlands are unreasonably disturbed.	Wetlands as defined by Executive Order 11990 Section 7.	40 CFR 6, Appendix A excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Applicable	There is wetland within OU5.

Table 3-3

Potential Federal Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Upper Mississippi River Management					
To ensure the coordinated development and enhancement of the Upper Mississippi River system.	Cooperative effort and mutual assistance on the comprehensive planning of the use, protection, growth, and development of the Upper Mississippi River System	Actions that may affect river reaches that have commercial navigation channels on the Mississippi River.	33 USC 652	Applicable	Water bodies adjacent to the Site are part of the Upper Mississippi River system.
Clean Water Act, Section 404					
Wetland	The degradation Section requires degradation or destruction of wetlands and other aquatic sites to be avoided to the extent possible. Dredged or fill material must not be discharged to navigable waters if the activity contributes to the violation of Maryland water quality standards CWA Sec. 307; jeopardizes endangered or threatened species; or violates requirements of the Title III of the Marine Protection, Research and Sanctuaries Act of 1972.	Wetland as defined by Executive Order 11990 Section 7.	40 CFR 230.10; 40 CFR 231 231.1, 231.2, 231.7, 231.8)	Applicable	There is wetland within OU5.
Wild and Scenic Rivers Act					
Within area affecting national wild, scenic, or recreational rivers.	Avoid taking or assisting in action that will have direct adverse effect on national, wild or scenic recreational rivers.	Activities that affect or may affect any of the rivers specified in Section 1276(a).	16 USC 1271 et seq. and Section 7(a); 36 CFR 297; 40 CFR 6.302(e)	Not an ARAR	There are no designated wild, scenic, or recreational areas within OU5.

Table 3-3

Potential Federal Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Coastal Zone Management					
Within coastal zone	Regulates activities affecting the coastal zone including lands thereunder and adjacent shoreline. Must conduct activities in a manner consistent with the approved State management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shoreland.	Section 307(c) of 16 USC 1456(c); 16 USC 1451 et. seq.; 15 CFR 930; 15 CFR 923.45	Not an ARAR	The Site is not located within a designated coastal zone.
Coastal Barrier Resources Act, Section 3504					
Within designated coastal barrier	Prohibits any new federal expenditure within the Coastal Barrier Resource System.	Activity within the Coastal Barrier Resource System	16 USC 3504	Not an ARAR	The Site is not located within a designated coastal zone.
Navigation and Navigable Waters					
Navigable waters	Establishes regulations pertaining to activities that affect the navigation of the waters of the United States.	Activities affecting navigable waters.	33 CFR 320-329 33 USC 1341	Not an ARAR	Response activities would not affect navigation of waters of the United States.
Magnuson Fishery Conservation and Management Act					
Managed Fisheries	Provides for conservation and management of specified fisheries within specified fishery conservation zones (in federal waters).	Presence of managed fisheries in federal waters.	16 USC 1801, et seq.	Not an ARAR	Response activities would not affect fisheries.
Hazardous Waste Control Act (HWCA)					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage or disposal of hazardous waste prohibited.	Resource Conservation and Recovery Act (RCRA) hazardous waste; treatment, storage or disposal of hazardous waste	40 CFR 264.18 (a)	Not an ARAR	The Site is not known to be within 61 meters of a fault displaced in the Holocene time.
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	40 CFR 264.18(b)	Not an ARAR	RCRA hazardous waste treatment, storage, or disposal facilities will not be constructed as part of response activities. The proposed Alternative 8 soil consolidation area is located within the floodplain and the vegetated soil cover is designed to avoid washout.

Table 3-3

Potential Federal Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR /TBC Evaluation	Comments
Within salt dome formation, underground mine, or cave	Placement of noncontainerized or bulk liquid hazardous waste prohibited.	RCRA hazardous waste placement.	40 CFR 264.18(c)	Not an ARAR	The Site is not located within a salt dome, underground mine, or cave.
Executive Order 11988, Protection of Floodplains					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Applicable	Portions of the OU included in this proposed action are within a designated floodplain. Measures would be taken to minimize, and mitigate and restore as necessary, floodplain impacts.
Rivers and Harbors Act of 1972					
Navigable waters	Permits are required for structures or work affecting navigable waters.	Activities affecting navigable waters.	33 USC 403	Not an ARAR	Response activities would not affect navigable waters.

Table 3-4

Potential State and Local Location-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Endangered Species					
Endangered Species	Protection of endangered species (DNR)	Endangered Species	Minnesota Rules Ch. 6134, Endangered, Threatened, Special Concern Species	Applicable	There are no records of endangered plant or animal species located on the portions of the OU that would be remediated.
Protected Waters/Water Appropriation					
Surface Water	Classifies lakes and wetlands, appropriation permitting (DNR)	Protected Waters/Water Appropriation	Minnesota Rules Ch. 6115, Public Water Resources	Applicable	Surface water bodies would be protected during remedial action.
Surface Water	Shoreland alterations or structures (DNR)	Shoreland Management	Minnesota Rules Ch. 6120, Shoreland and Floodplain Management	Applicable	Surface water bodies would be protected during remedial action.
Wetlands Conservation Act					
Wetlands	Protection of wetlands	Presence of wetlands	Minnesota Statute 103G.221-2373	Applicable	There is wetland within OU5.
Wetlands conservation	Protection of wetlands, wetland functions for determining public values.		Minnesota Rules 8420, Wetland Conservation	Applicable	There is wetland within OU5.
State Advisories					
Fish Consumption Advisories	Consumption guidelines for lakes and rivers where fish have been tested for contaminants.	Advisories established by Minnesota Department of Health	Fish Consumption Advice (MDH Website)	TBC	Fish consumption advisories have been established for Middle Twin Lake but are not applicable or relevant to remedial actions.
Shingle Creek Watershed Management Organization Rules and Standards					
Floodplain Alteration	Requires compensatory storage for floodplain fill.	Alteration or filling of land below the 100-year critical flood elevation of any public waters	Shingle Creek WMO, Rule F	Applicable	Portions of OU5 are within the 100-year floodplain.
Wetland Alteration	Requires replacement of affected wetlands where avoidance is not feasible and prudent.	Presence of wetlands	Shingle Creek WMO, Rule G	Applicable	There is wetland within OU5.
City of Brooklyn Center Ordinances					
Zoning Ordinance	Restricts use of property that is inconsistent with the City's designated uses.	Land development in Brooklyn Center	City of Brooklyn Center Code of Ordinances, Chapter 35	Applicable within City of Brooklyn Center	Designates land use classifications for the City of Brooklyn Center – would apply to future use of site.

Table 3-5

Potential Federal and State Chemical-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Soil					
Addressing dioxin in soil at CERCLA and RCRA sites.	Recommend preliminary PRGs of starting points for cleanup levels at CERCLA and RCRA sites.	CERCLA/RCRA site with dioxin contamination.	OSWER Directive 9200.4-26, April 13, 1998	Potential ARAR/TBC	Considered in development of risk-based soil PRGs.
Evaluating human health risk caused by exposure to contaminated soil.	Tier 1 and Tier 2 Soil Reference Values (SRVs)	Incidental soil ingestion, dermal contact with soil, and inhalation of outdoor vapors and particulates from soil.	Risk-Based Guidance for the Soil – Human Health Pathway, MPCA Risk-Based Site Evaluation Manual	TBC	Considered in development of risk-based soil PRGs.
Evaluating the risk to groundwater at sites form the soil-to-groundwater pathway	Tier 1 and Tier 2 Soil Leaching Values (SLVs)	Contaminants leaching to groundwater and potential exposure to groundwater.	Risk-Based Guidance for Evaluating the Soil Leaching Pathway, MPCA Risk-Based Site Evaluation Manual	TBC	Considered in development of risk-based soil PRGs.
Groundwater					
Groundwater, public water supplies	Meet National Primary Standards for maximum contaminant levels (MCLs)	Drinking water source at tap	Safe Drinking Water Act (SDWA); 40 CFR 141 40 CFR 142 40 CFR 143	Does not apply to OU being evaluated in this FS report.	Groundwater remediation underway under existing ROD.
Hazardous substances in groundwater	Establishes human health based groundwater standards (MDH) known as Health Risk Limits (HRLs)	Potential exposure to groundwater	Minnesota Rules Ch. 4717.7500 and 4717.7801 to 4717.7900	Does not apply to OU being evaluated in this FS report.	Groundwater remediation underway under existing ROD.

Table 3-5

Potential Federal and State Chemical-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Hazardous substances in groundwater	Framework for evaluating groundwater contamination and managing remediation decisions.	Use of groundwater for domestic purposes.	Groundwater Guidance Document, MPCA Risk-Based Site Evaluation Manual Drinking Water Criteria Spreadsheet (rev. 9/08)	Does not apply to OU being evaluated in this FS report.	Groundwater remediation underway under existing ROD.
Surface Water					
Surface Water	Ambient Water Quality Criteria established to protect aquatic life and human consumers of water or aquatic life.	Activities that affect or may affect surface water.	40 CFR 131, Water Quality Standards	Applicable	Remedial actions need to protect surface waters.
Surface Water Screening Criteria	Establishes human health-based and ecological surface water criteria	Activities that affect or may affect the surface water.	Surface Water Pathway Evaluation User's Guide, Tables 1 and 11, MPCA Risk-based Site Evaluation Manual	TBC	Considered in development of alternatives. Remedial actions need to protect surface water.
Air					
Ambient Air Quality Standards	Establishes acceptable air concentrations	Activity affects air quality.	Minnesota Rules Ch. 7009	Applicable	Applies to site activities.
Standards for Stationary Sources	Compliance with applicable state air pollution control rules for new and existing emission facilities	Emission from stationary sources.	Minnesota Rules Ch. 7011 (except 7011.0150 and 7011.8010)	Does not apply to OUs being evaluated in this FS report.	No emission facilities are planned at the Site.
Standards for Stationary Sources	Limits on visible emissions beyond the property boundary.	Activities that generate fugitive dust.	Minnesota Rules Ch. 7011.0150	Applicable	Implement reasonable measures as necessary to prevent particulate matter from becoming airborne.

Table 3-5

Potential Federal and State Chemical-Specific ARARs and TBCs
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

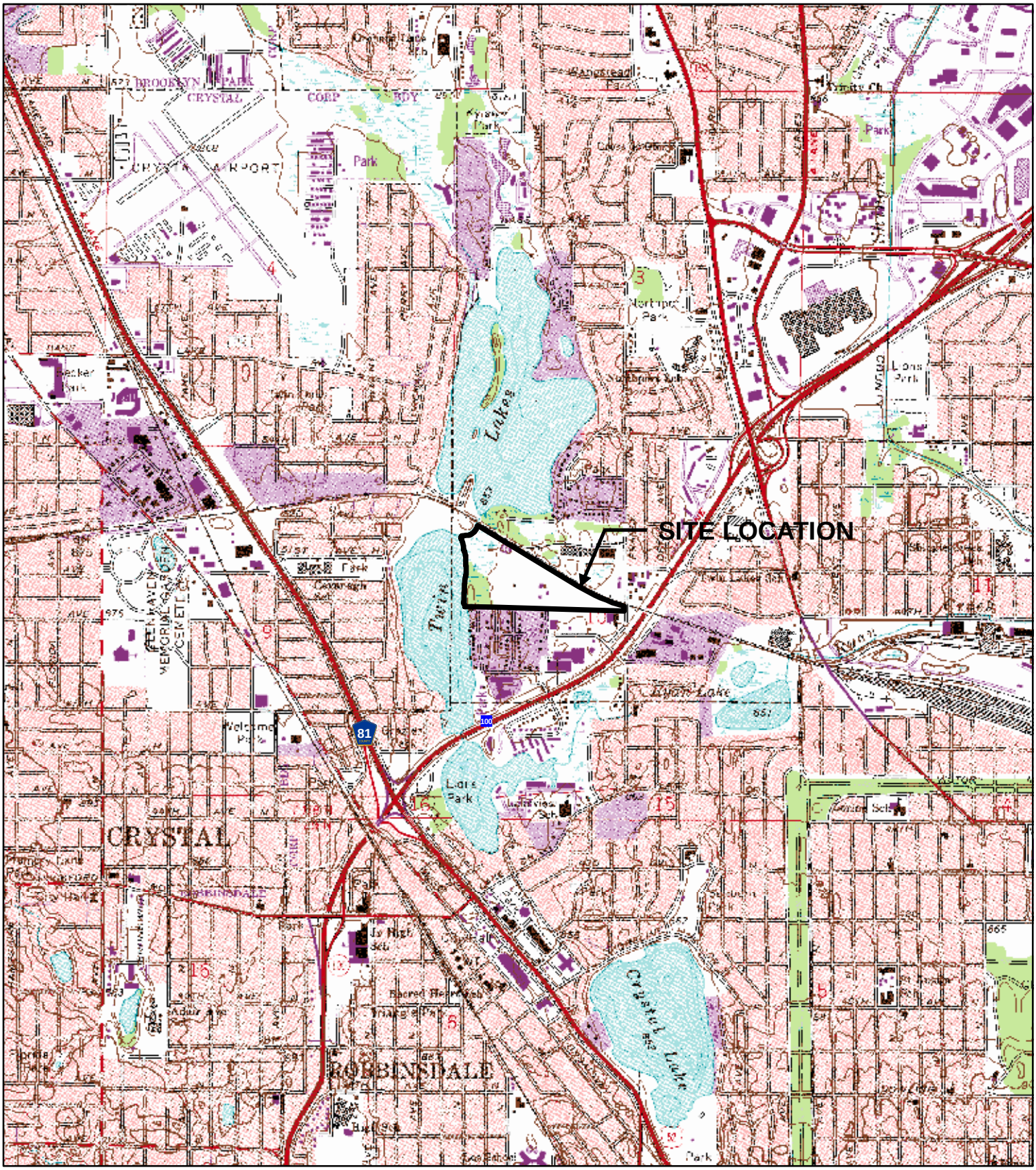
Standard	Requirement	Prerequisite	Citation	Potential ARAR/TBC Evaluation	Comments
Standards for Hazardous Air Pollutants: Site Remediation	Establishes emissions limitations and work practice standards for hazardous air pollutants emitted from site remediation activities.	Emission of hazardous air pollutant.	Minnesota Rules Ch. 7011.8010, adopts 40 CFR 63 Subpart GGGGG, by reference	Not an ARAR	Site remediation in not subject to this subpart since the site remediation will be performed under the authority of CERCLA (*See* 40 CFR 63.7881 (b) (2)).
Intrusion Screening Values (ISV) (September 24, 2008)	For evaluating the potential risks to human health caused by exposure to volatile compounds in buildings	Presence of volatile compounds in soil or shallow groundwater.	Risk-Based Guidance for the Vapor Intrusion Pathway, MPCA Risk-Based Site Evaluation Manual	Not an ARAR	No volatile compounds are present in soil or shallow groundwater.
All Media					
Carcinogenic PAHs in media	Estimating health risks from carcinogenic PAHs.	Potential PAH exposure to humans	MDH guidance Document, July 2, 2004.	TBC	Considered in development of risk-based soil PRGs.
Dioxin-like compounds in media	Estimating health risks from dioxin- like compounds.	Potential dioxin-like compound exposure to humans	MDH Guidance Document October 2006.	TBC	Considered in development of risk-based soil PRGs.
Hazardous substances in media	Guidelines and criteria for screening human health and ecological risks.	Potential hazardous substance exposure to humans and ecology	April 26, 1996 Working Site Screening Evaluation Guidelines. MPCA Risk-Based Site Evaluation Manual	TBC	Considered in development of risk-based soil PRGs.

Table 4

Summary of Remedial Alternative Costs
Joslyn Manufacturing & Supply Co.
Brooklyn Center, Minnesota

Alternative	Capital	O&M	Total Cost
Alternative 1 – No Action	$0	$530,000	$530,000
Alternative 2 – Stormwater Management Modifications	$1,700,000	$624,000	$2,320,000
Alternative 3 – Excavation for Offsite Treatment and Disposal	$67,350,000	$624,000	$67,970,000
Alternative 4 – In-Place Soil Cover	$14,590,000	$624,000	$15,210,000
Alternative 5 – Onsite Consolidation with Soil Cover at West Area	$4,330,000	$624,000	$4,950,000
Alternative 6 – Onsite Consolidation with Soil Cover at Azelia Avenue Pond	$4,740,000	$1,131,000	$5,870,000
Alternative 7 – Limited Onsite Consolidation with Soil Cover at Building 1A Pond	$4,600,000	$780,000	$5,380,000
Alternative 8A – Limited Onsite Consolidation with Soil Cover at West Area (Offsite Floodplain Mitigation)	$4,730,000	$624,000	$5,350,000
Alternative 8B – Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)	$4,160,000	$624,000	$4,780,000

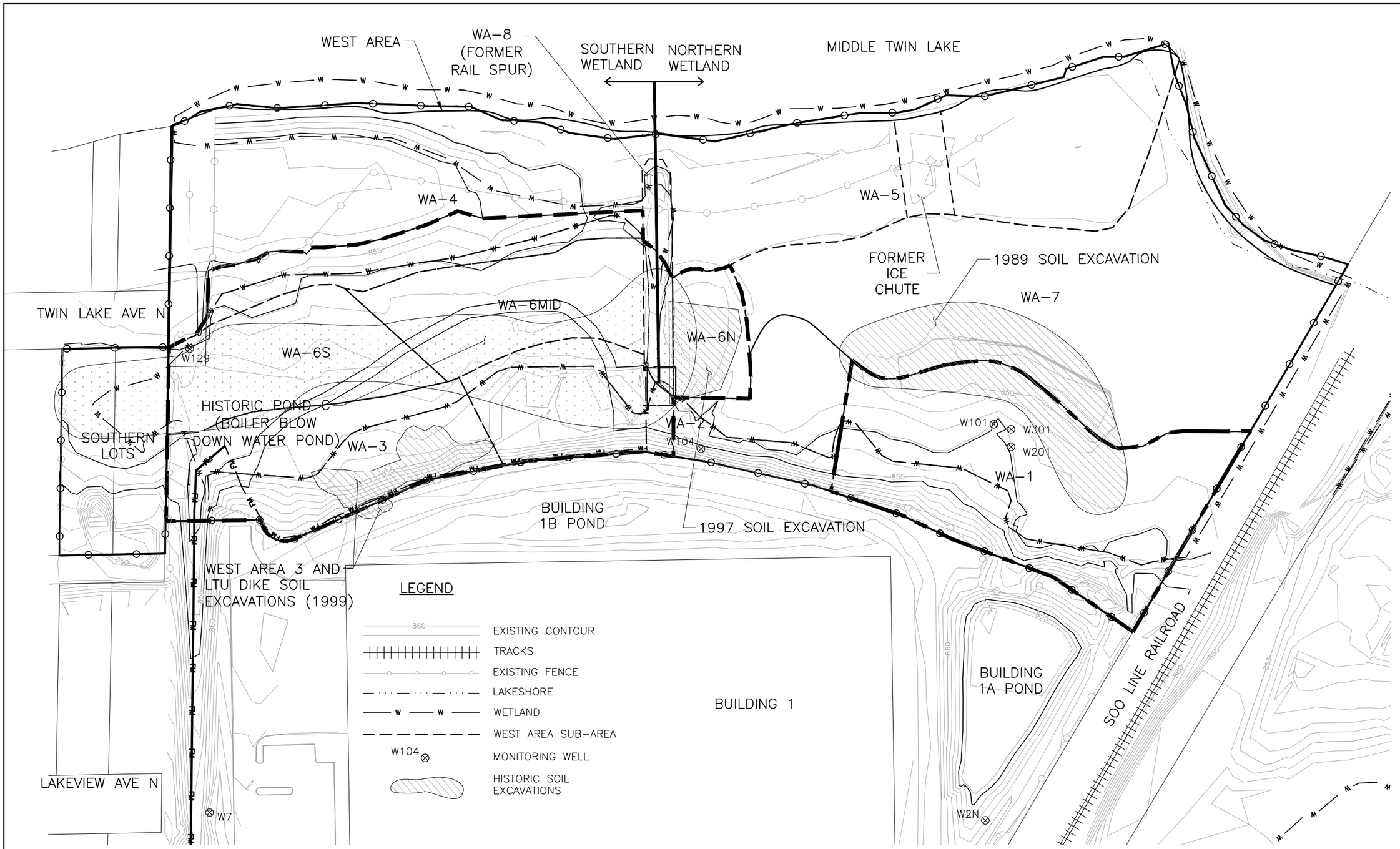
Figures



Feet
2,000 0 2,000

FIGURE 1
SITE LOCATION
JOSLYN MANUFACTURING & SUPPLY CO.
BROOKLYN CENTER, MINNESOTA

Barr Footer: Date: 6/29/2010 4:00:06 PM File: I:\Projects\23\27\110\GIS\Maps\Focused Feasibility Study\Figure 1_Site Location.mxd User: ss1



1 PLAN: SITE LAYOUT

N

0 100 200
SCALE IN FEET

CADD USER: Gareth W. Becker FILE: M:\DESIGN\23270110.00\23270110000_FFS_FIGURE 2.DWG PLOT SCALE: 1:2 PLOT DATE: 12/12/2016 2:02 PM

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Designed	
Approved	

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BROOKLYN CENTER, MINNESOTA

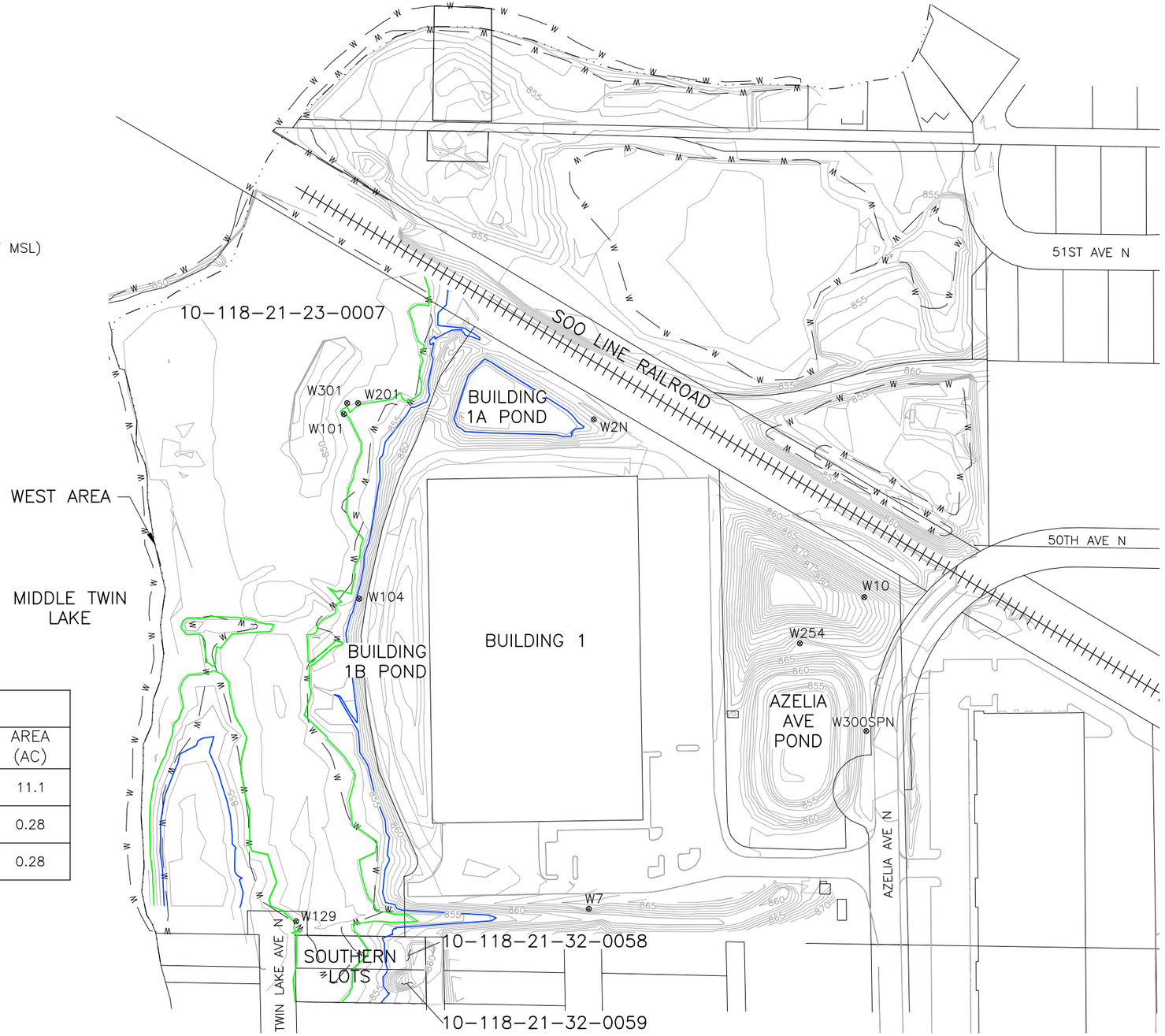
FOCUSED FEASIBILITY STUDY

SITE LAYOUT

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 2
REV. No.

LEGEND

- EXISTING CONTOUR (860)
- TRACKS
- LAKESHORE
- EXISTING MONITORING WELL
- 100–YR FLOODPLAIN (856.0 FEET MSL)
- ORDINARY HIGH WATER LEVEL (853.1 FEET MSL)



NOTE:
PARCEL BOUNDARIES
ARE APPROXIMATE

PARCEL DATA		
COUNTY PARCEL ID	OWNER	AREA (AC)
10–118–21–23–0007	JOSLYN MFG AND SUPPLY CO	11.1
10–118–21–32–0058	JOSLYN MANUFACTURING CO LLC	0.28
10–118–21–32–0059	JOSLYN MANUFACTURING CO LLC	0.28

1 — PLAN: SITE LAYOUT

N

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CONSTRUCTION							
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FOCUSED FEASILBILITY STUDY

LAND PARCELS AND FLOODPLAIN LIMITS

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 3
REV. No.

FLOODPLAIN MITIGATION EXTENTS

WEST AREA

MIDDLE TWIN LAKE

FORMER ICE CHUTE 5

TWIN LAKE AVE N

SOUTHERN LOTS

A–A' FIG.4C

B–B' FIG.4D

C–C' FIG.4D

BUILDING 1B POND

BUILDING 1

BUILDING 1A POND

LAKEVIEW AVE N

SOO LINE RR

WA–1

WA–2

WA–3

WA–4

WA–5

WA–6S

WA–6MID

WA–6N

WA–7

WA–8 (FORMER RAIL SPUR)

D–5 COMPOSITE

C–5R

WA–4–2013–1a
WA–4–2013–1b
WA–4–2013–2a
WA–4–2013–2b
WA–4–2013–3
WA–4–2013–4
WA–4–2013–5
WA–4–2013–6
WA–1–2013–1a
WA–1–2013–1b
WA–1–2013–1c
WA–1–2013–1d
WA–1–2013–2a
WA–1–2013–2b
WA–1–2013–2d
WA7–SW1
WA7–SW2
WA7–SW3
WA6–SW1
WA6–SW2
WA6–SW3

W101
W104
W129
W201
W301
W2N
W7
BKG–4

2–C–4
14–C–5
13–D–5
11–C–1
10–D–1

LEGEND

- LAKESHORE
- EXISTING CONTOUR
- TRACKS
- WEST AREA SUB–AREA
- CROSS SECTION LOCATION
- EXISTING MONITORING WELL
- SUBSURFACE SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLING LOCATION
- SEDIMENT SAMPLING LOCATION
- SURFACE WATER SUBSAMPLE COLLECTION LOCATION (7/1/02)
- SURFACE WATER SUBSAMPLE COLLECTION LOCATION (6/18/03)
- SURFACE WATER SUBSAMPLE COLLECTION LOCATION (7/17/03)
- SUBSAMPLE LOCATION (1998)
- SOIL SAMPLE LOCATION
- SOIL BORING (2015)

1 — PLAN: SITE LAYOUT

N

0 100 200

SCALE IN FEET

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FOCUSED FEASIBILITY STUDY

HISTORIC SOIL SAMPLING LOCATIONS
WEST AREA

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 4a
REV. No.

LEGEND

- ▷ SAMPLING LOCATION (2009)
- • SAMPLING LOCATION (2005)
- ● GEOPROBE COMPOSITE SUBSAMPLE LOCATION (2004)
- × 30' RADIUS COMPOSITE SUBSAMPLE LOCATION (2009)
- ◉ 45' RADIUS COMPOSITE SUBSAMPLE LOCATION (2009)
- ▫ NORTH/SOUTH PARCEL BOUNDARY SAMPLING LOCATION (2009)

1 — PLAN: SITE LAYOUT

N

0 60 120
SCALE IN FEET

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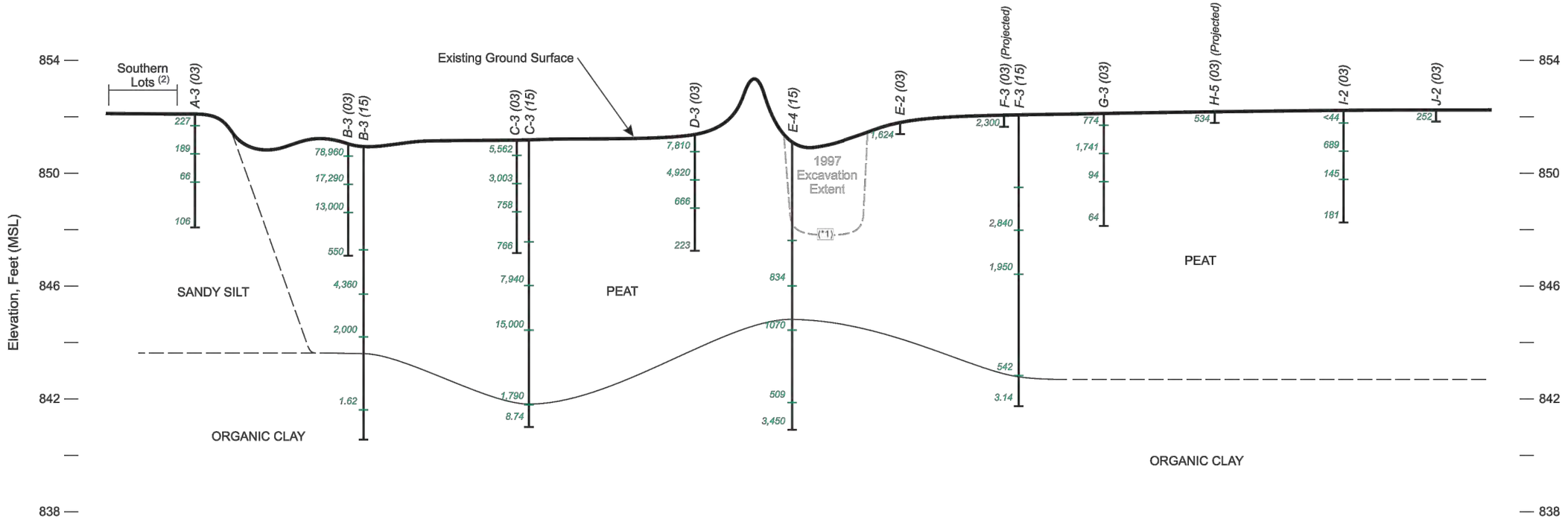
FOCUSED FEASIBILITY STUDY

HISTORIC SOIL SAMPLING LOCATIONS
SOUTHERN LOTS AND ROADWAY

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 4b
REV. No.

A SOUTH — **A'** NORTH



A–A' SECTION: GEOLOGIC CROSS SECTION
FIG.4c N.T.S.

0 — 100
Approximate Horizontal Scale in Feet
25X Vertical Exaggeration

(*1) 3 composite samples from bottom of 1997 excavation analyzed for PCP:

WA-NE = <510 mg/kg
WA-CEN = <380 mg/kg
WA-SW = <160 mg/kg

(*2) 4 composite samples from 0 - 4' below ground surface collected in 2009 and analyzed Dioxin Furan:

T1 - Comp = 636 mg/kg
T2 - Comp = 367 mg/kg
T3 - Comp = 107 mg/kg
T4 - 1 = 183 mg/kg

Dioxin Furan Method — *106*
4425 TCDD-Eq (ng/kg)

— Sample Interval Top
— Sample Interval Bottom

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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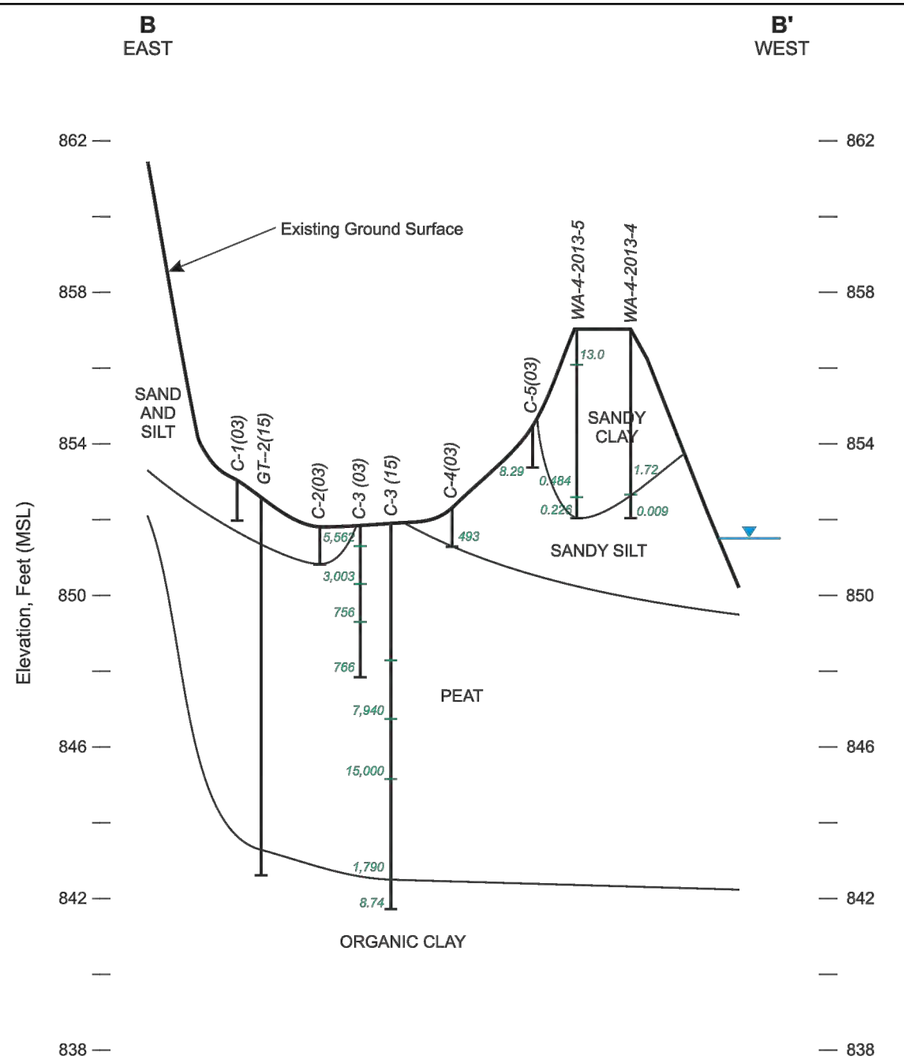
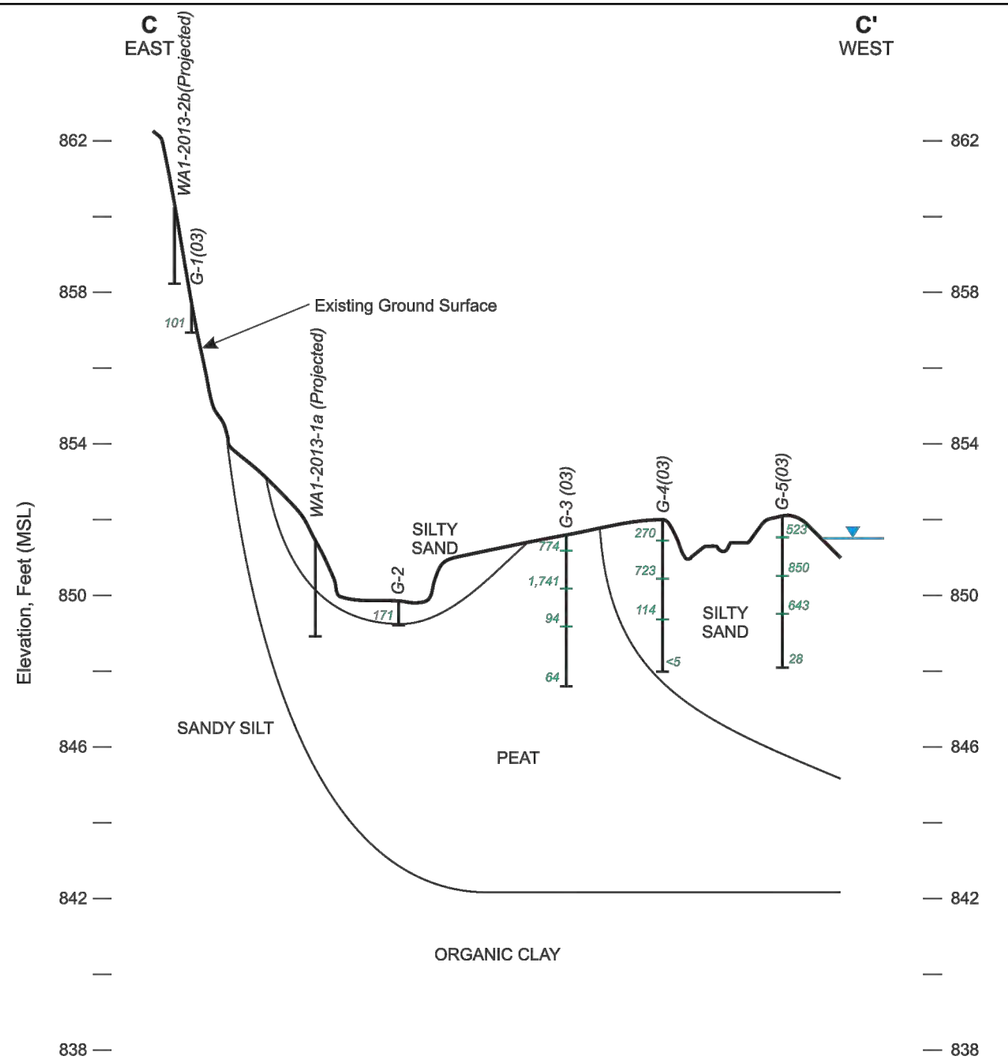
BROOKLYN CENTER, MINNESOTA

FOCUSED FEASIBILITY STUDY
GEOLOGIC CROSS SECTION A–A'

BARR PROJECT No. 23/27–0110
CLIENT PROJECT No.
DWG. No. FIGURE 4c
REV. No.



B–B' SECTION: GEOLOGIC CROSS SECTION
FIG.4d N.T.S.



C–C' SECTION: GEOLOGIC CROSS SECTION
FIG.4d N.T.S.

0 100
Approximate Horizontal Scale in Feet
25X Vertical Exaggeration

Dioxin Furan Method — 106
4425 TCDD-Eq (ng/kg)
Sample Interval Top
Sample Interval Bottom

Normal High Water (851.5)

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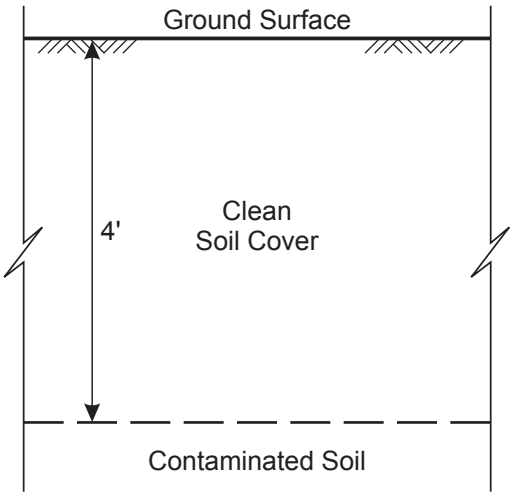
FOCUSED FEASIBILITY STUDY
GEOLOGIC CROSS SECTION B–B' AND C–C'

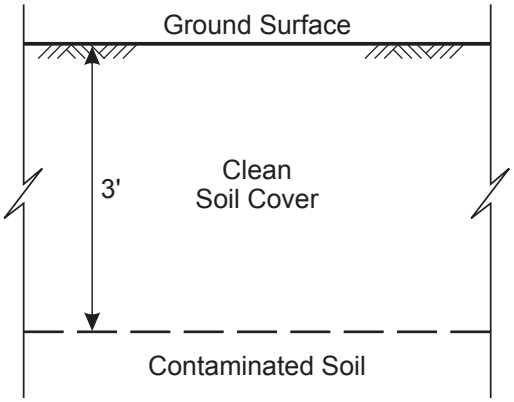
BARR PROJECT No. 23/27–0110
CLIENT PROJECT No.
DWG. No. FIGURE 4d
REV. No.

SOUTHERN LOTS ACCESSIBLE ZONE



- MPCA's Standard Definition of "Accessible Zone" (MPCA, 1998b)

WEST AREA ACCESSIBLE ZONE



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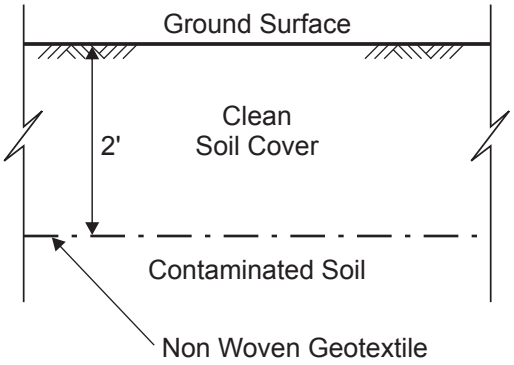


OPTION 1

- Site Specific Definition of "Accessible Zone" Applicable to the Joslyn Site (MPCA, 1998a)
- Definition was used on the Developed Portion of the Joslyn Site

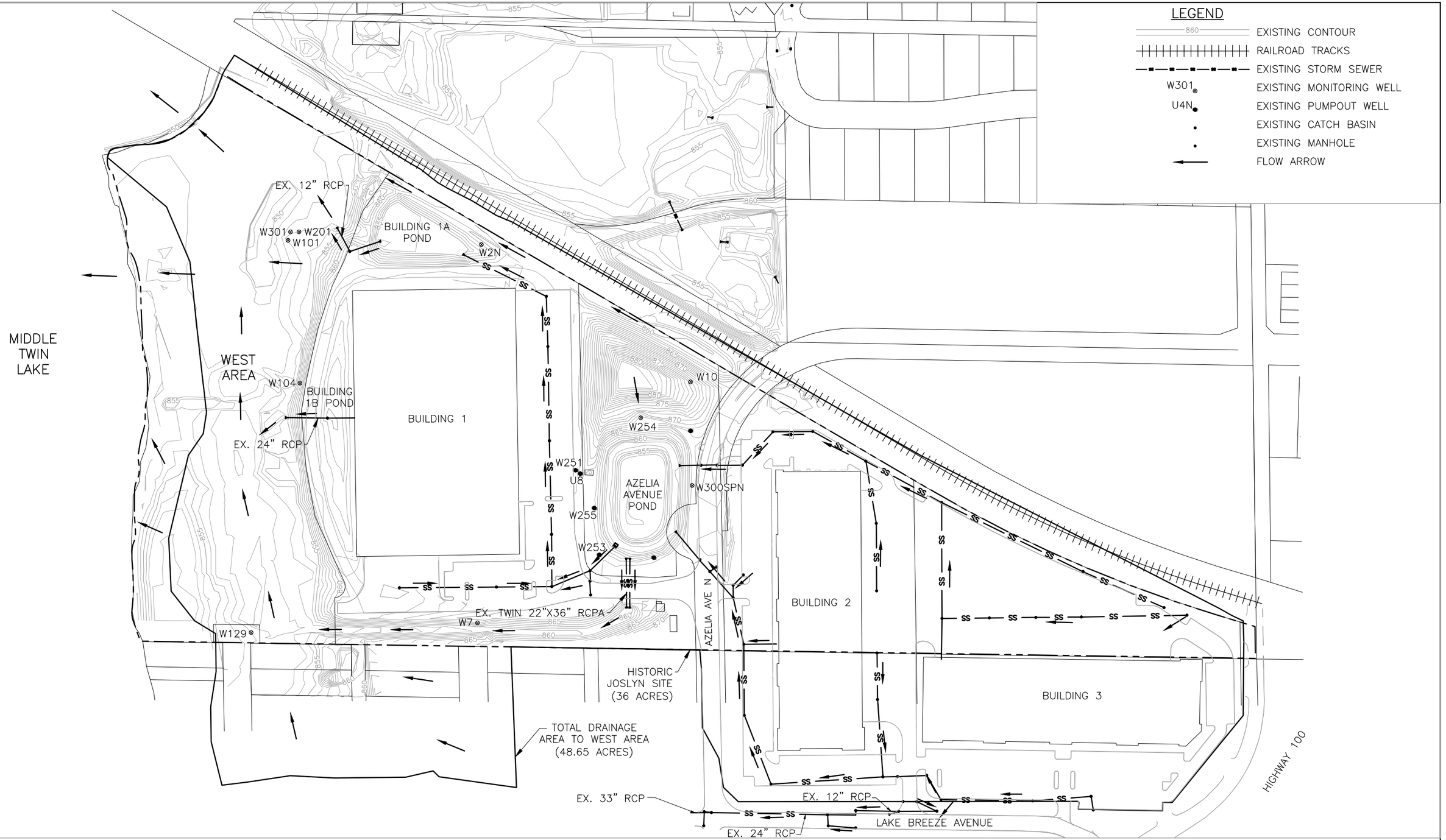
OPTION 2

- Site Specific Definition of "Accessible Zone" Applicable to the Joslyn Site's West Area
- Requires the use of Geotextile

Figure 4e

DEFINITIONS OF ACCESSIBLE ZONES
FOR HUMAN HEALTH PROTECTION
OU5 - Joslyn Site

P:\Mpls\23 MN\27\2327110\WorkFiles\Graphics\Definitions of Accessible Zones.CDR RLG 12-05-16



1 PLAN: SITE LAYOUT

N

0 100 200

SCALE IN FEET

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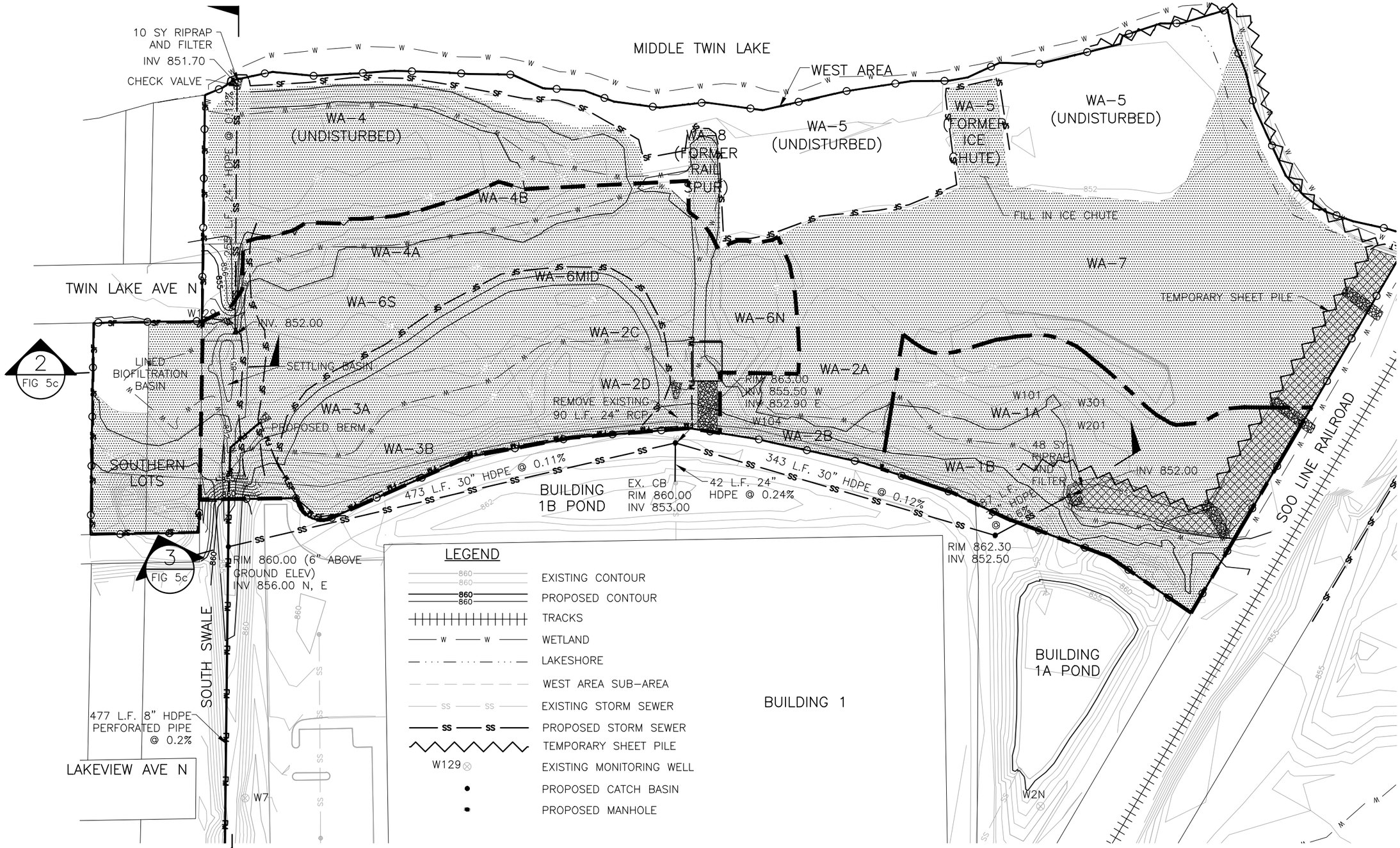
FOCUSED FEASIBILITY STUDY

EXISTING STORMWATER MANAGEMENT

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 5a
REV. No.



1 -- PLAN: SITE LAYOUT

0 100 200
SCALE IN FEET

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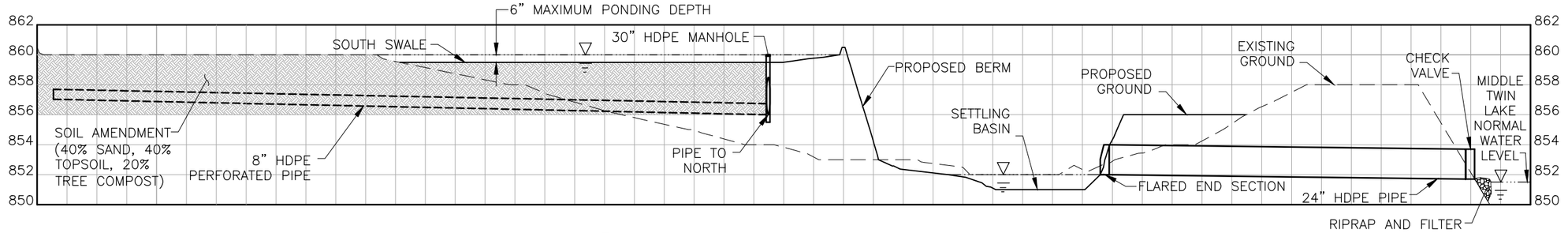
FOCUSED FEASIBILITY STUDY
OU5 STORMWATER MANAGEMENT PLAN ALTERNATIVES 2 THROUGH 5

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 5b
REV. No.

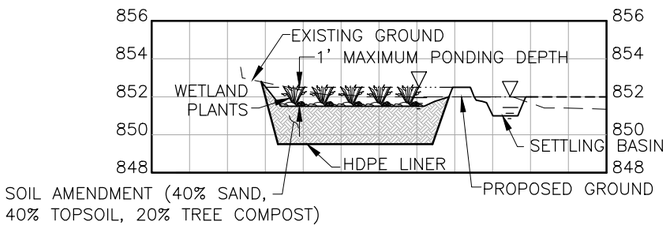
M:\Design\23270110.00\23270110000_FFS_Figure 5b.dwg Plot at 20 01/23/2012 17:07:27 ss1



1 FIG 5b **SECTION: SOUTH SWALE AND PIPE TO WEST**

0 4 8 12 16 — VERTICAL SCALE IN FEET

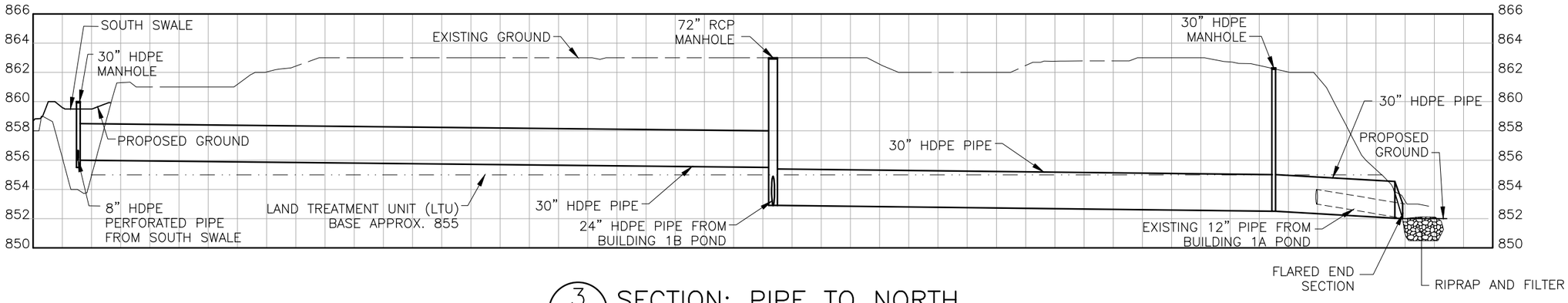
0 80 160 — HORIZ. SCALE IN FEET



2 FIG 5b **SECTION: BIOFILTRATION BASIN**

0 4 8 12 16 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



3 FIG 5b **SECTION: PIPE TO NORTH**

0 4 8 12 16 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

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OU5 STORMWATER MANAGEMENT DETAILS ALTERNATIVES 2 THROUGH 5

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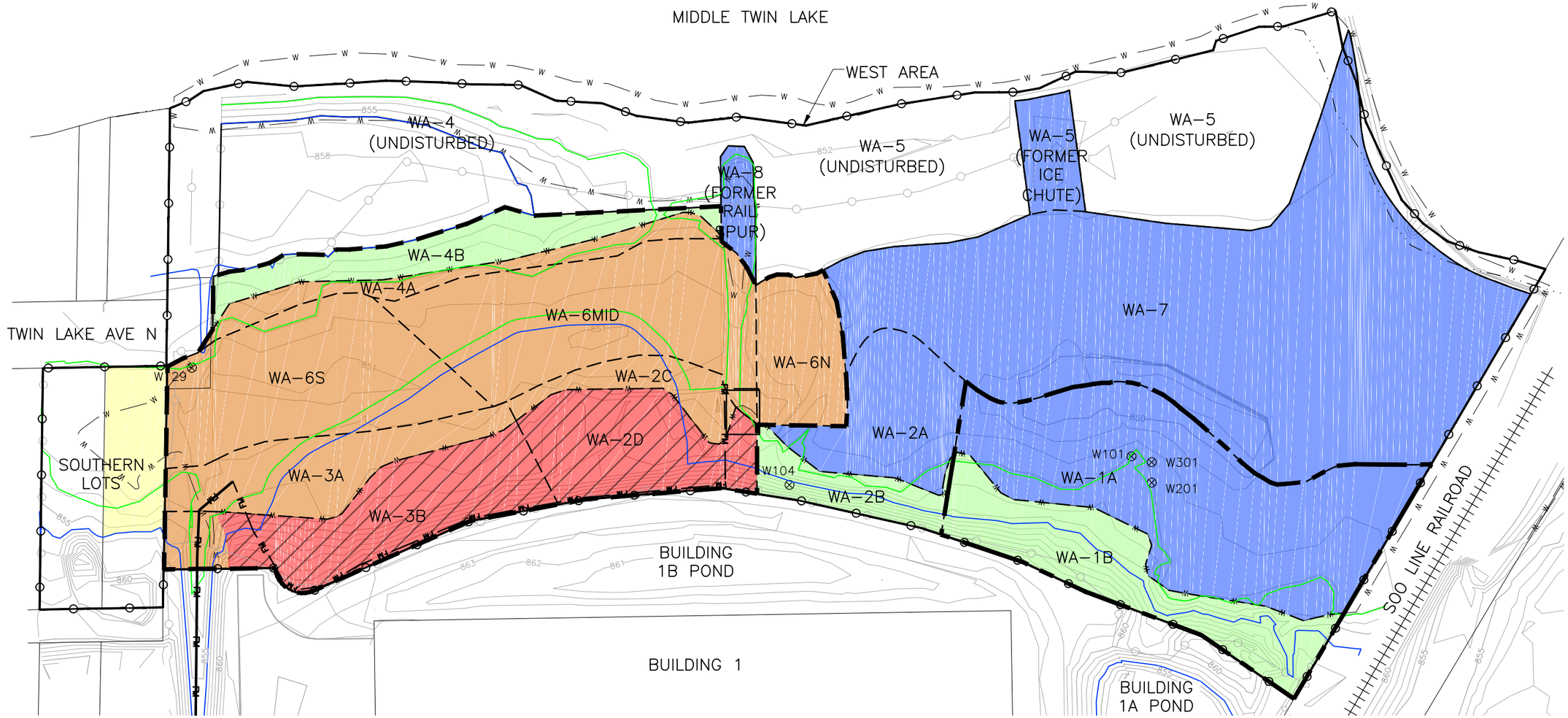
DWG. No. FIGURE 5c
REV. No.



NOTE: ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER EXCEPT AS NOTED

1 – PLAN: SITE LAYOUT

0 100 200

SCALE IN FEET

N

LEGEND

- EXISTING CONTOUR (860 / 852)
- TRACKS
- EXISTING FENCE
- WETLAND
- LAKESHORE
- W129 EXISTING MONITORING WELL
- WEST AREA SUB–AREA
- 3.5 FOOT EXCAVATION
- 4 FOOT EXCAVATION
- 2 FOOT EXCAVATION
- 2.5 FOOT EXCAVATION
- 1 FOOT EXCAVATION W/ 3 FOOT COVER

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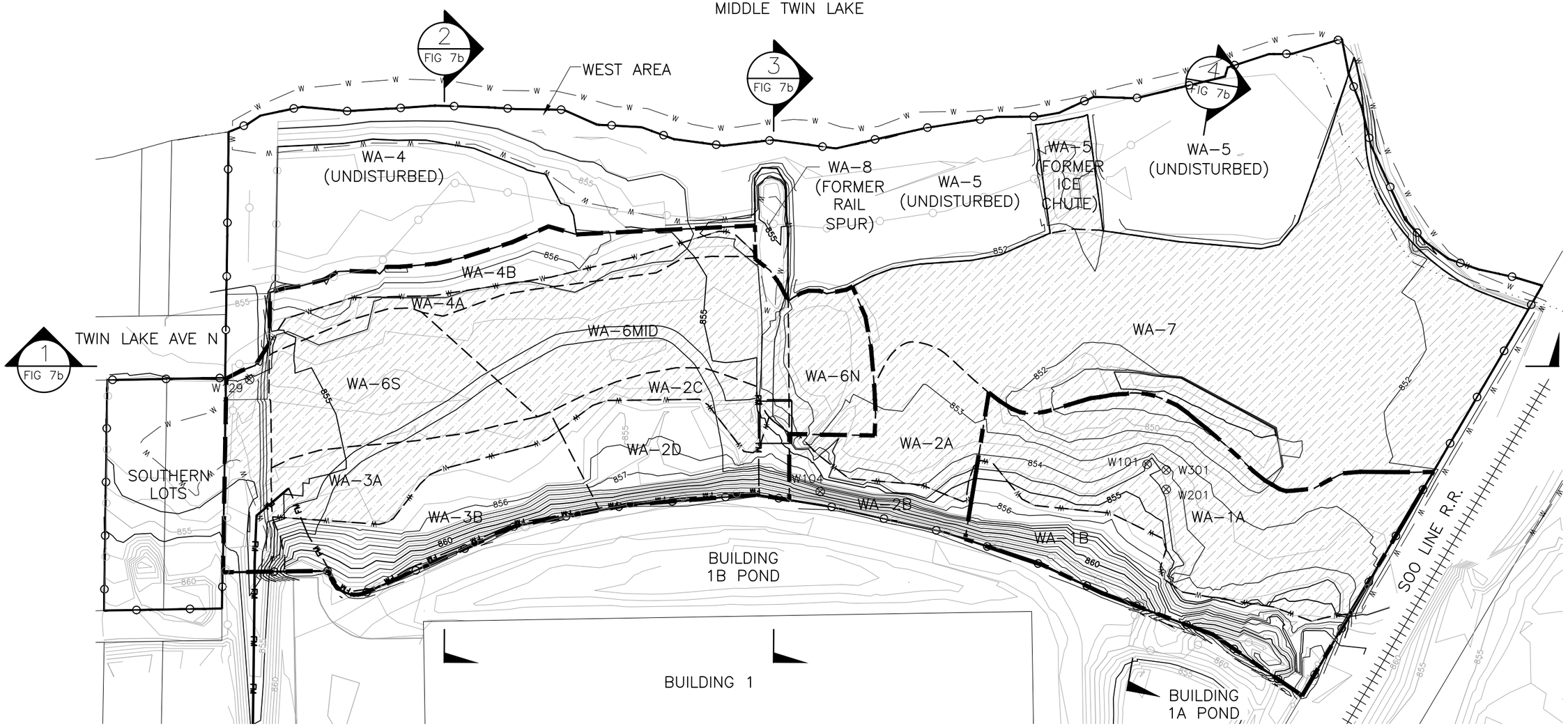
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 3
EXCAVATION FOR OFFSITE TREATMENT AND DISPOSAL PLAN

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 6
REV. No.



1 PLAN: SITE LAYOUT

0 100 200
SCALE IN FEET

LEGEND

- EXISTING CONTOUR (860 / 852)
- PROPOSED CONTOUR (860 / 852)
- EXISTING FENCE
- TRACKS
- WETLAND (W — W)
- LAKESHORE
- EXISTING MONITORING WELL
- WEST AREA SUB-AREA
- FILLED WETLAND (268,505 sq. ft.)

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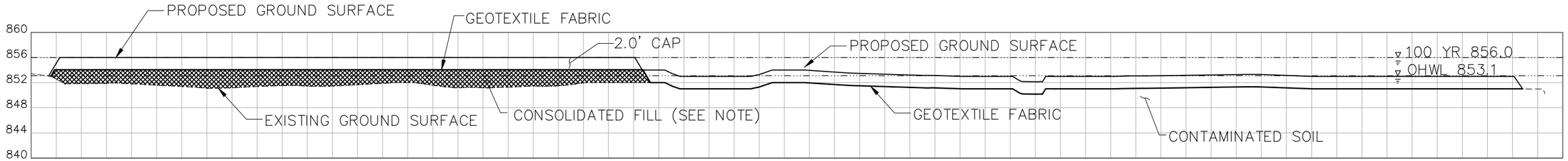
ALTERNATIVE 4
IN-PLACE SOIL COVER PLAN

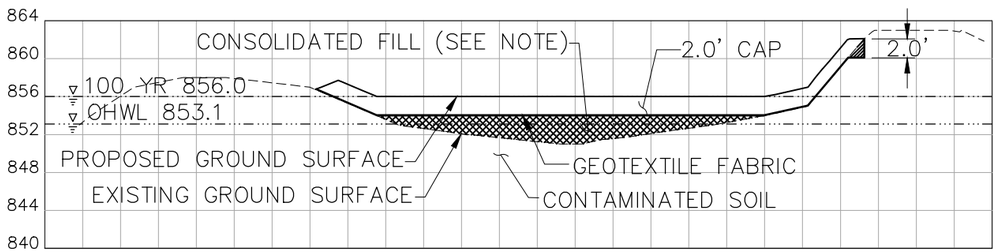
BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 7a
REV. No.

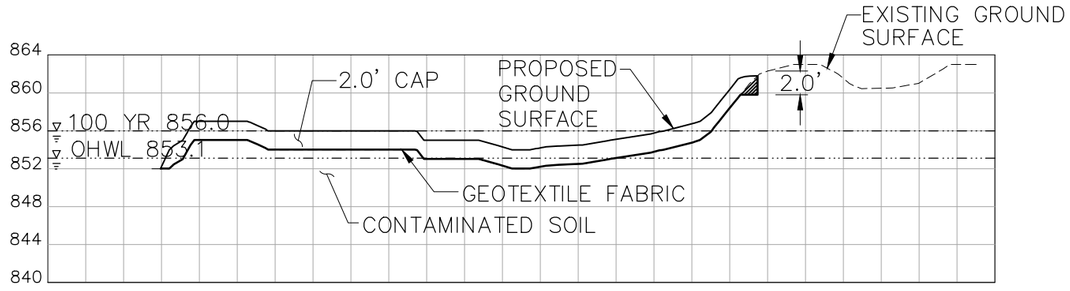


1 FIG 7a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL AND CONTAMINATED SOIL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET





2 FIG 7a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

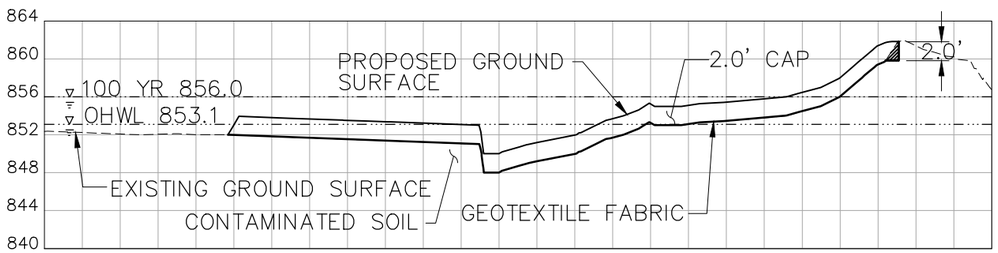
0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

3 FIG 7a SECTION: 2.0' SOIL COVER OVER CONTAMINATED SOIL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



4 FIG 7a SECTION: 2.0' SOIL COVER OVER CONTAMINATED SOIL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

NOTE: CONSOLIDATED FILL INCLUDES CONTAMINATED SOIL FROM SOUTHERN LOTS AND EXCAVATION REQUIRED FOR STORMWATER IMPROVEMENTS

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FOCUSED FEASIBILITY STUDY

ALTERNATIVE 4
IN-PLACE SOIL COVER CROSS SECTIONS

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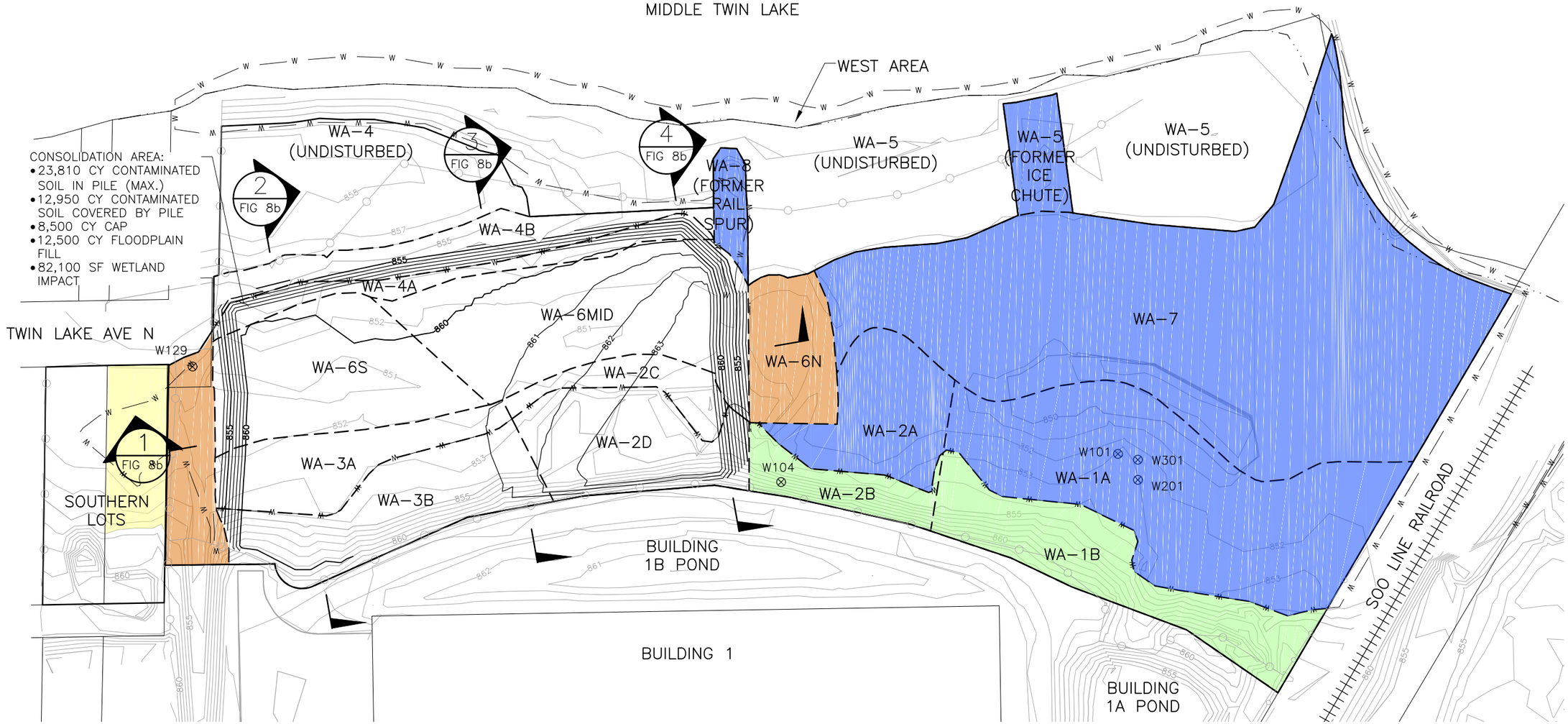
CLIENT PROJECT No.
DWG. No. FIGURE 7b
REV. No.



NOTE: ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER

1 PLAN: SITE LAYOUT

0 100 200

SCALE IN FEET

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING FENCE
- TRACKS
- WETLAND
- LAKESHORE
- WEST AREA SUB–AREA
- EXISTING MONITORING WELL
- 3.5 FOOT EXCAVATION
- 4 FOOT EXCAVATION
- 2 FOOT EXCAVATION
- 2.5 FOOT EXCAVATION

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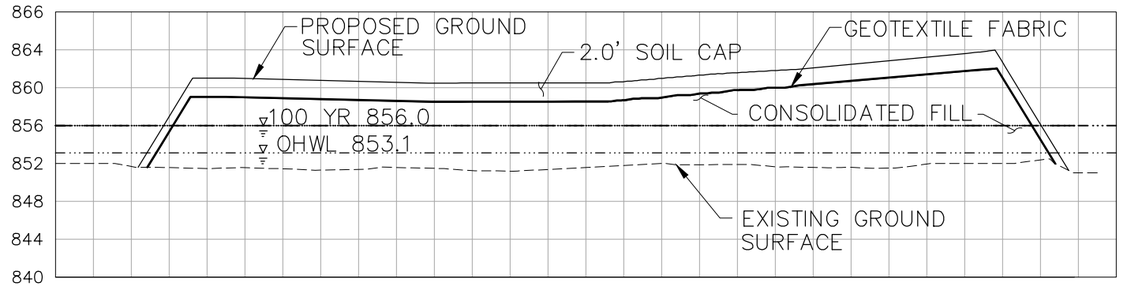
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 5
ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA PLAN

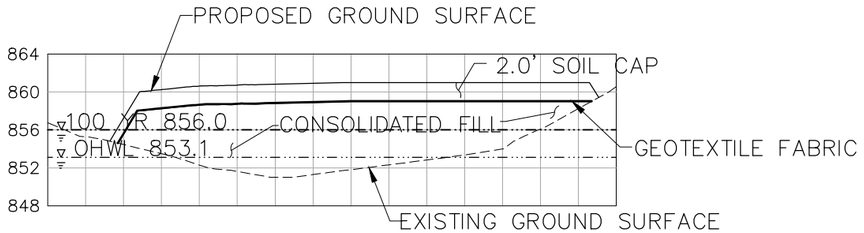
BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 8a
REV. No.



1 FIG 8a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

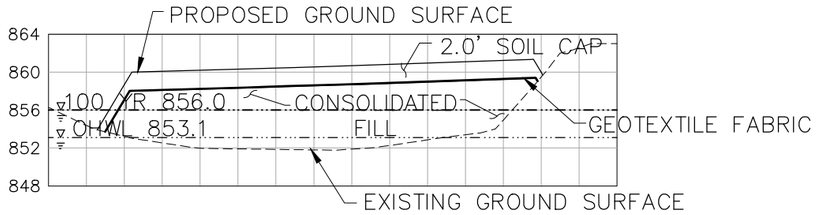
0 80 160 — HORIZ. SCALE IN FEET



2 FIG 8a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

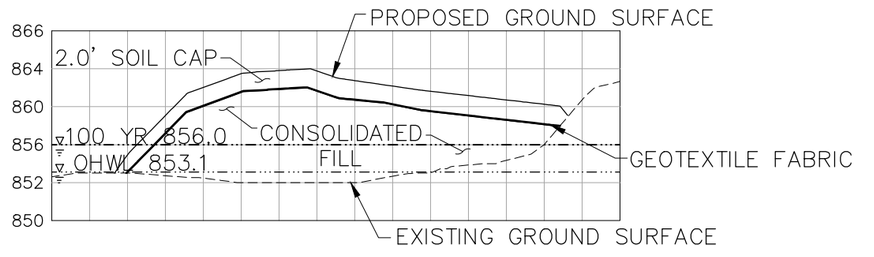
0 80 160 — HORIZ. SCALE IN FEET



3 FIG 8a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



4 FIG 8a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

NOTE: CONSOLIDATED FILL IS CONTAMINATED SOIL MATERIAL FROM SOUTHERN LOTS, WA-1A, WA-1B, WA-2A, WA-2B, WA-5 (ICE CHUTE), WA-6N, WA-7, WA-8 (RAIL SPUR), AND AREA IMMEDIATELY SOUTH OF REPOSITORY AS SHOWN ON FIGURE 8A.

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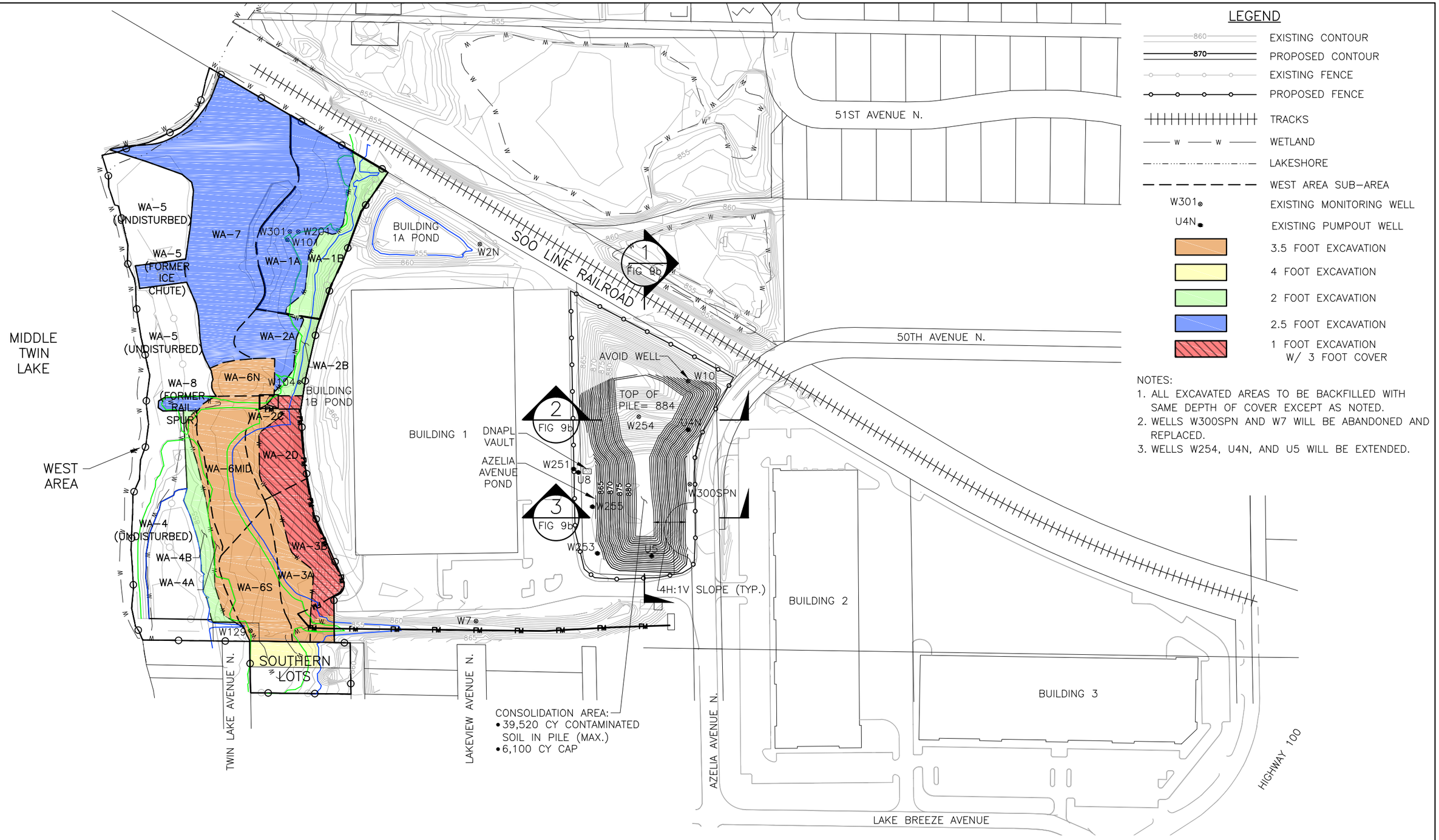
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 5
ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA
CROSS SECTIONS

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 8b
REV. No.



1 — PLAN: SITE LAYOUT

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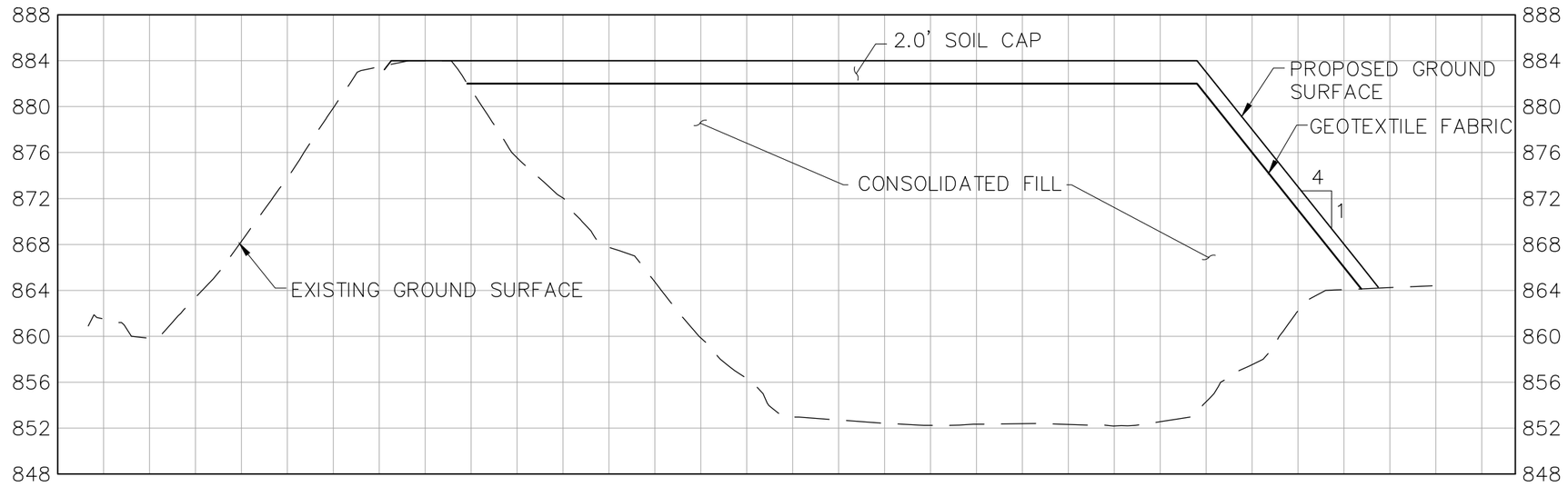
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 6
ONSITE CONSOLIDATION WITH SOIL COVER AT AZELIA AVENUE POND PLAN

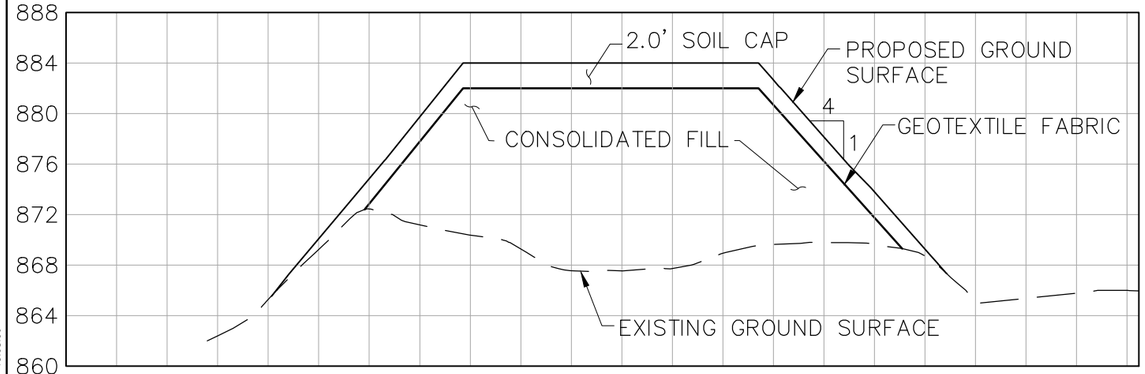
BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 9a
REV. No.



1 FIG 9a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 6 12 18 24 VERTICAL SCALE IN FEET

0 60 120 HORIZ. SCALE IN FEET



2 FIG 9a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

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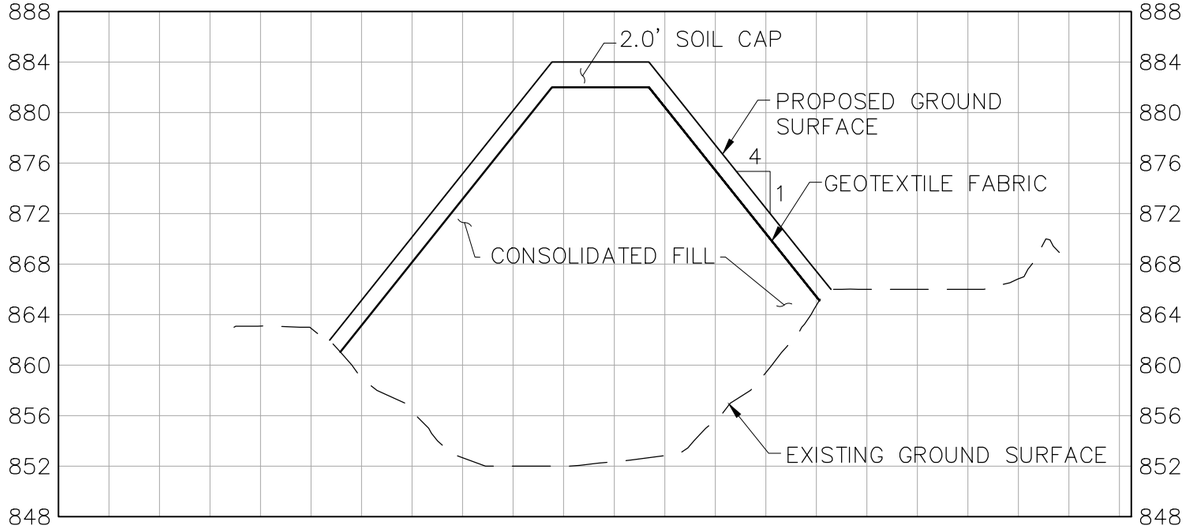
0 60 120 HORIZ. SCALE IN FEET



3 FIG 9a SECTION: 2.0' SOIL COVER OVER CONSOLIDATED FILL

0 6 12 18 24 VERTICAL SCALE IN FEET

0 60 120 HORIZ. SCALE IN FEET

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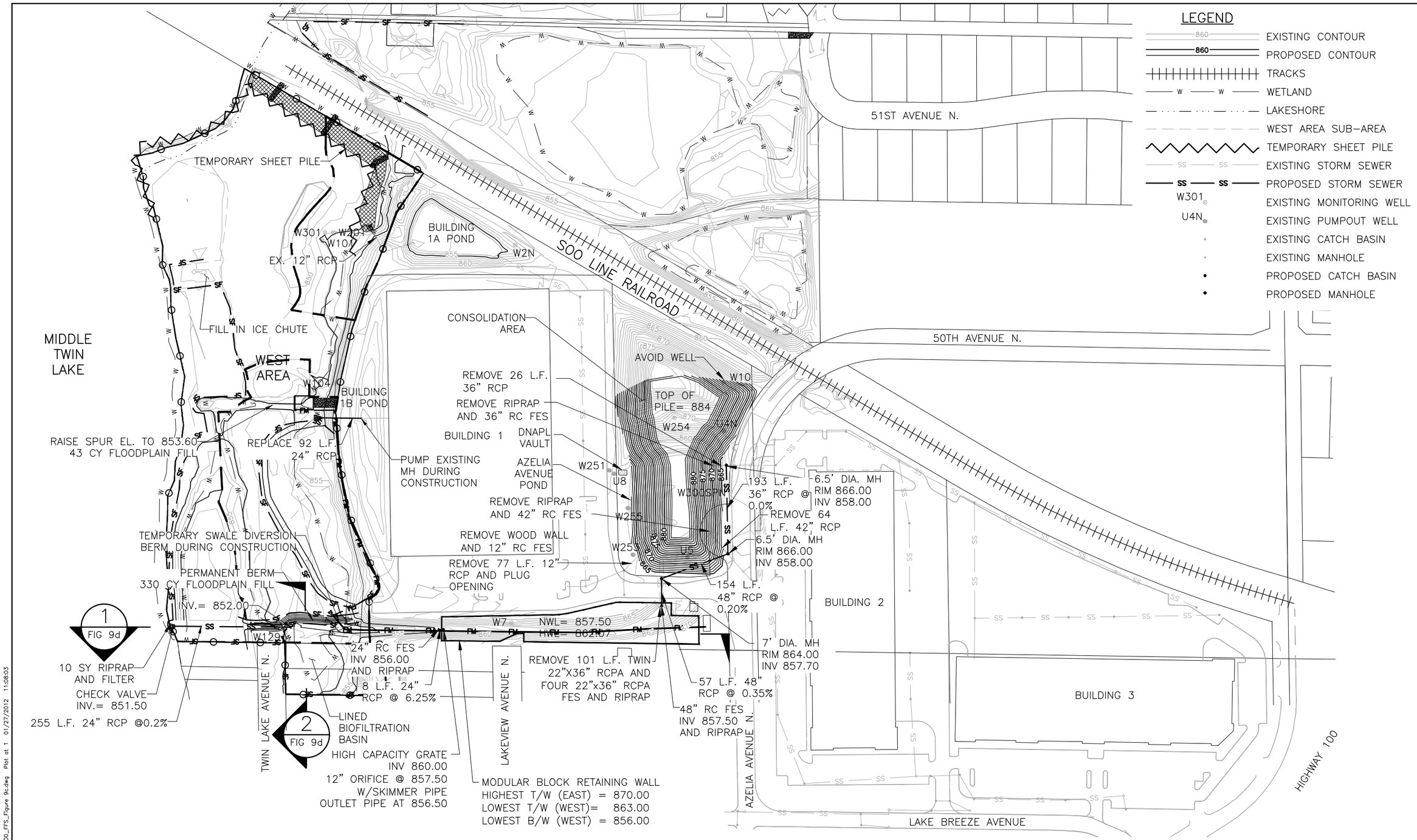
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 6
ONSITE CONSOLIDATION WITH SOIL COVER AT AZELIA AVENUE POND CROSS SECTIONS

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 9b
REV. No.

CADD USER: Gareth W. Becker FILE: M:\DESIGN\2327011.00\2327011000_FFS_FIGURE 9B.DWG PLOT SCALE: 1:2 PLOT DATE: 12/5/2016 1:58 PM
. . . ss1 M:\DESIGN\2327011.00\2327011000_FFS_Figure 9b (C3D).dwg Plot at 30 12/21/2010 13:08:06



1 PLAN: SITE LAYOUT

N

0 200 400

SCALE IN FEET

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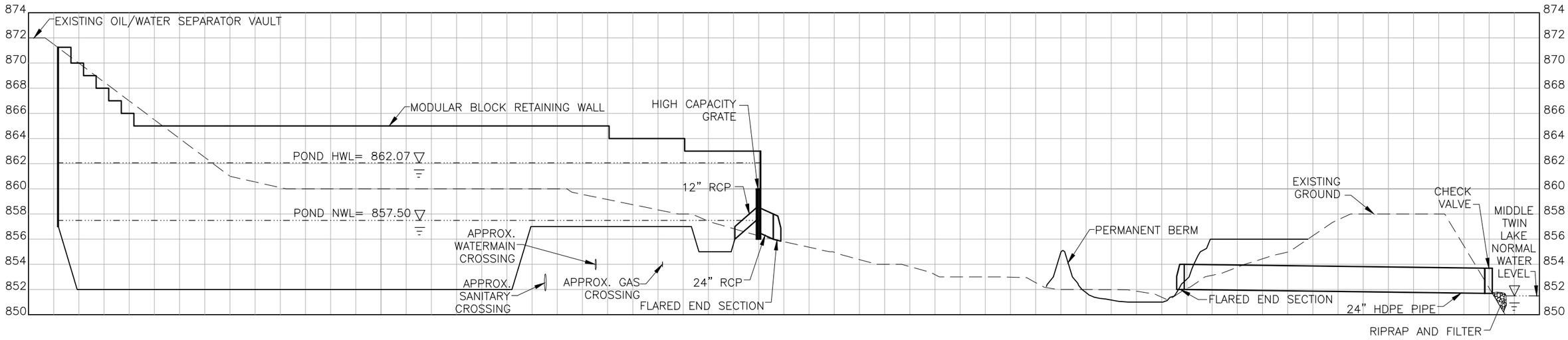
ALTERNATIVE 6
ONSITE CONSOLIDATION WITH SOIL COVER
AT AZELIA AVENUE POND STORMWATER MANAGEMENT PLAN

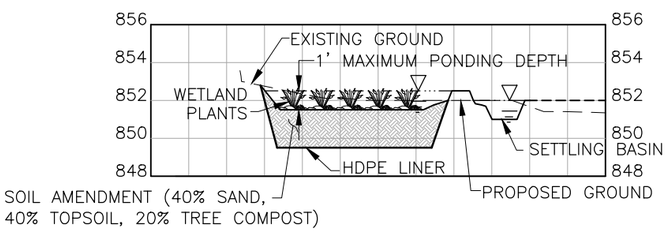
BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 9c
REV. No.



1 FIG 9c SECTION: SOUTH SWALE POND AND PIPE TO WEST

0 4 8 12 16 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



2 FIG 9c SECTION: BIOFILTRATION BASIN

0 4 8 12 16 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

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ALTERNATIVE 6
ONSITE CONSOLIDATION WITH SOIL COVER AT AZELIA AVENUE POND STORMWATER MANAGEMENT DETAILS

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 9d
REV. No.

CONSOLIDATION AREA:
- 19,400 CY CONTAMINATED SOIL IN PILE (MAX.)
- 2,700 CY CONTAMINATED SOIL COVERED BY PILE
- 4,800 CY CAP
- 2,400 CY FLOODPLAIN FILL
- 15,400 SF WETLAND IMPACT

FORMER BUILDING 1A POND

20' RR ROW SETBACK

51ST AVENUE N.

SOO LINE RAILROAD

50TH AVENUE N.

MIDDLE TWIN LAKE

WA-1A

WA-1B

WA-2A

WA-2B

WA-2C

WA-2D

WA-3A

WA-3B

WA-4 (UNDISTURBED)

WA-4A

WA-4B

WA-5 (UNDISTURBED)

WA-5 (FORMER ICE CHUTE)

WA-5 (UNDISTURBED)

WA-6MID

WA-6N

WA-6S

WA-7

WA-8 (FORMER RAIL SPUR)

WEST AREA

FIG 10b

BUILDING 1
FFE= 864.50

BUILDING 1B POND

AZELIA AVENUE POND

SOUTHERN LOTS

BUILDING 2

BUILDING 3

W10

W104

W129

W201

W253

W254

W255

W300SPN

W301

W7

U4N

U5

U8

W101

W251

TWIN LAKE AVENUE N.

LAKEVIEW AVENUE N.

AZELIA AVENUE N.

HIGHWAY 100

LAKE BREEZE AVENUE

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING FENCE
- PROPOSED FENCE
- TRACKS
- WETLAND
- LAKESHORE
- WEST AREA SUB-AREA
- EXISTING MONITORING WELL
- EXISTING PUMPOUT WELL
- 3.5 FOOT EXCAVATION
- 4 FOOT EXCAVATION
- 2 FOOT EXCAVATION
- 2.5 FOOT EXCAVATION
- 1 FOOT EXCAVATION W/ 3 FOOT COVER
- SUB-AREAS REQUIRING CONSOLIDATION

NOTES:
1. ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER EXCEPT AS NOTED.
2. SOIL EXCAVATED FROM OUTSIDE SUB-AREAS REQUIRING CONSOLIDATION WILL BE TRANSPORTED AND DISPOSED AT A SUBTITLE D LANDFILL.
3. WELL W2N WILL BE ABANDONED.

1/– PLAN: SITE

N

0 200 400
SCALE IN FEET

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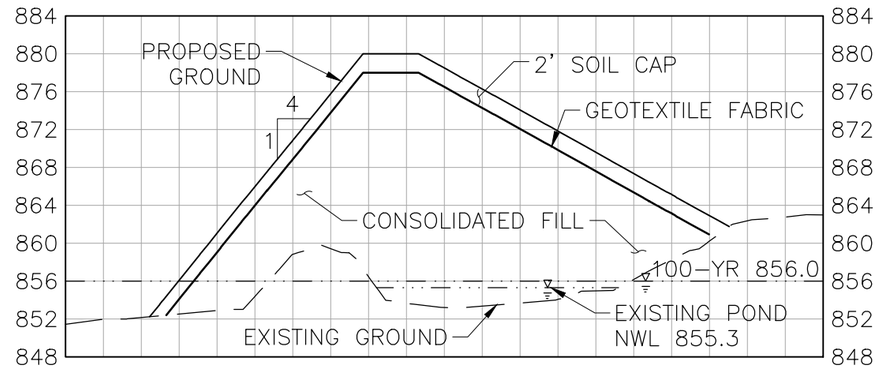
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 7
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT BUILDING 1A POND PLAN

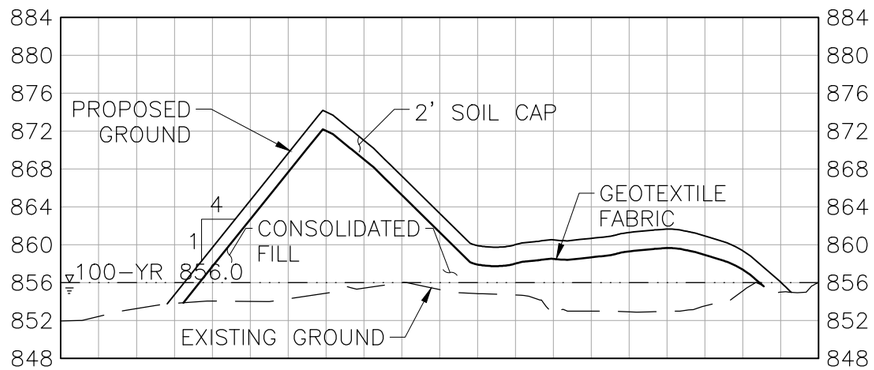
BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 10a
REV. No.



1 FIG 10a SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

0 8 16 24 32 VERTICAL SCALE IN FEET

0 80 160 HORIZ. SCALE IN FEET



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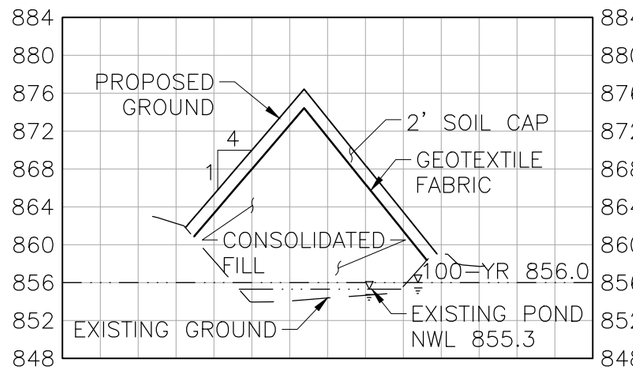

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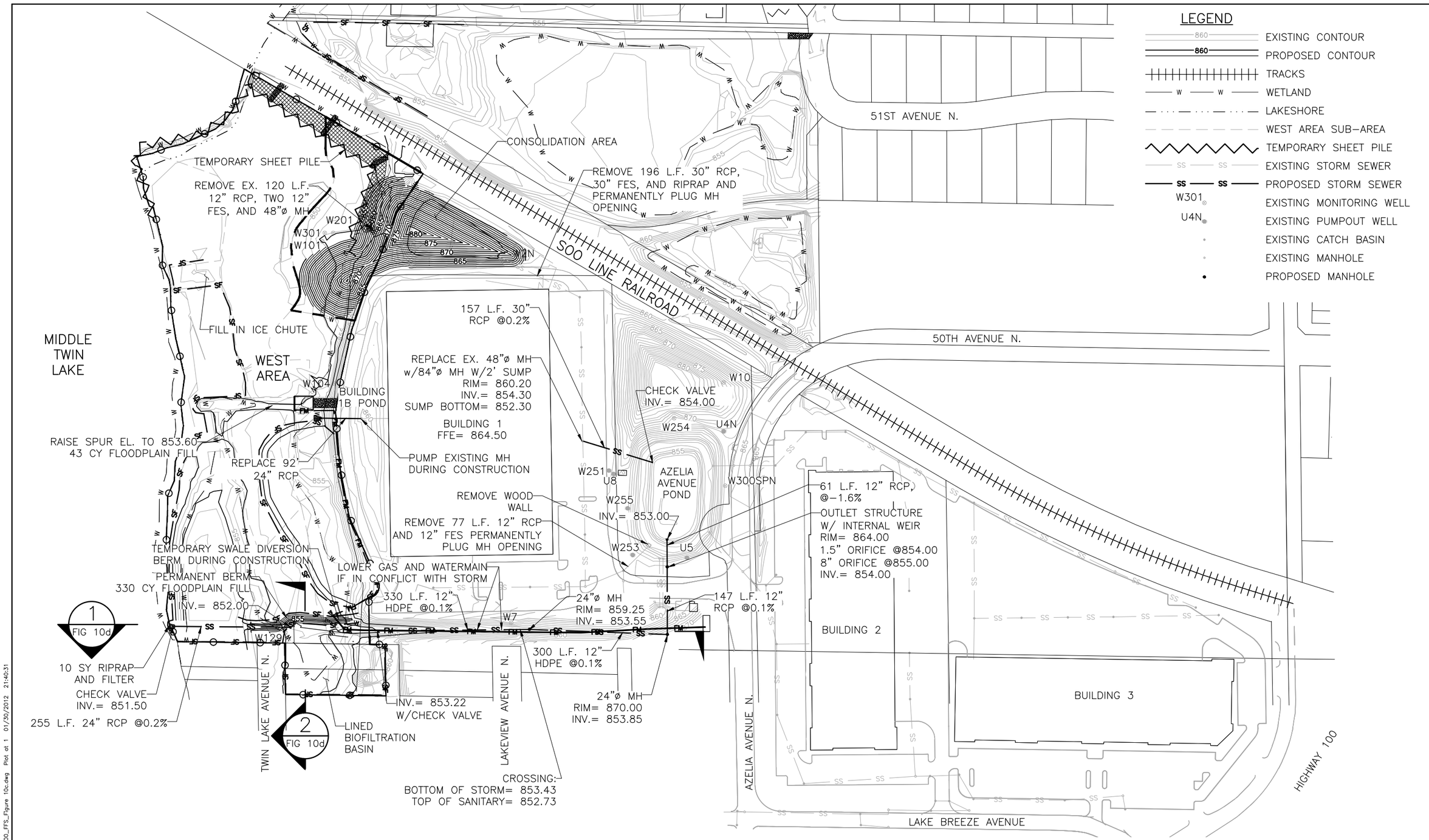
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 7
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT BUILDING 1A POND CROSS SECTIONS

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 10b
REV. No.



1 PLAN: SITE

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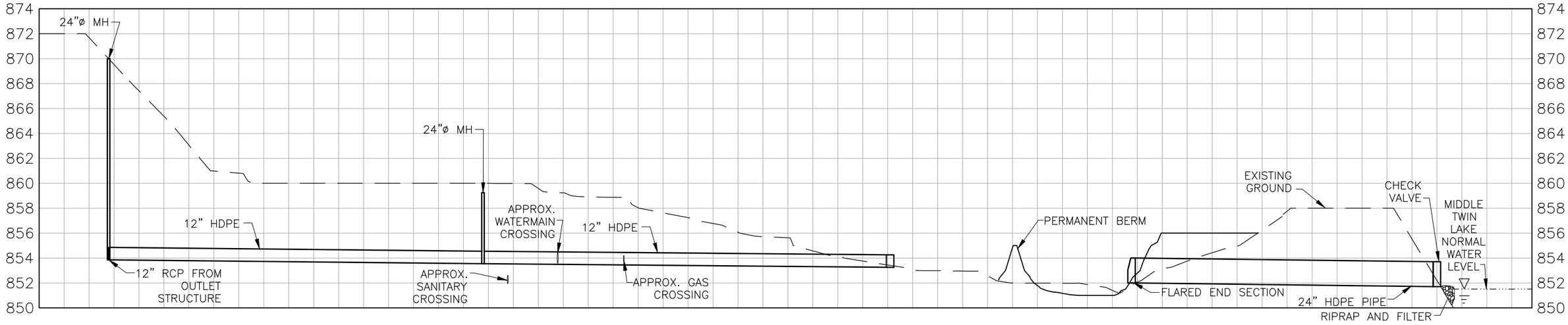
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 7
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT BUILDING 1A POND STORMWATER MANAGEMENT PLAN

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 10c
REV. No.



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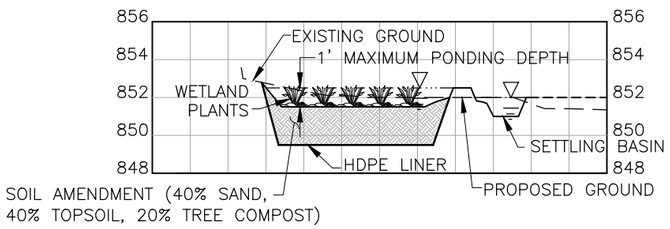

2 FIG 10c SECTION: BIOFILTRATION BASIN

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ALTERNATIVE 7
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER
AT BUILDING 1A POND STORMWATER MANAGEMENT DETAILS

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DWG. No. FIGURE 10d
REV. No.

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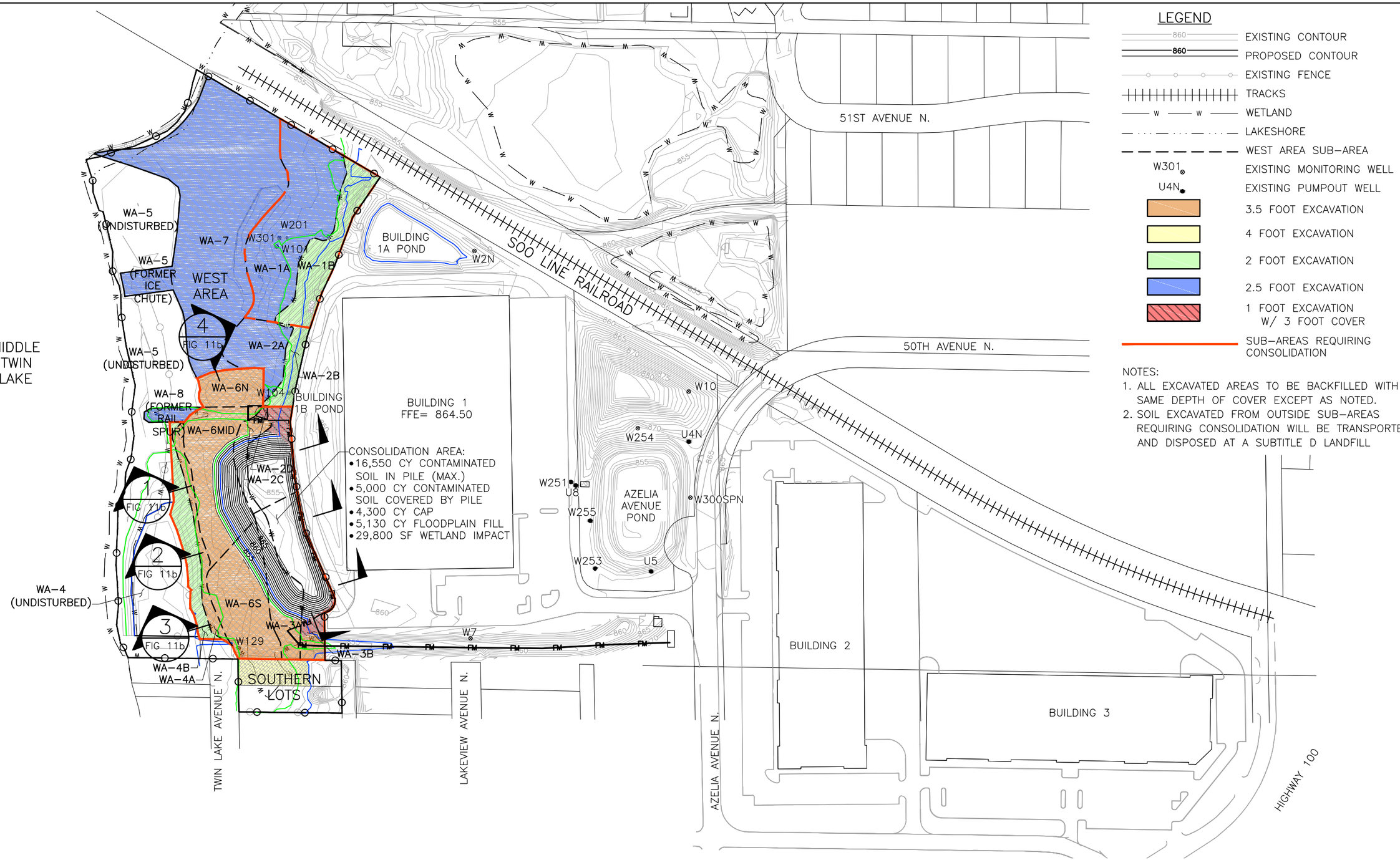

1 – PLAN: SITE

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ALTERNATIVE 8A – PLAN
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA (OFFSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 11a
REV. No.

CADD USER: Gareth W. Becker FILE: M:\DESIGN\23270110.00\23270110000_FFS_FIGURE 11A.DWG PLOT SCALE: 1:2 PLOT DATE: 12/5/2016 2:33 PM
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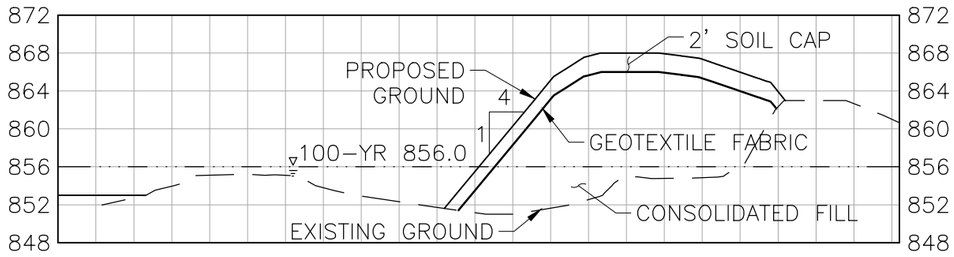
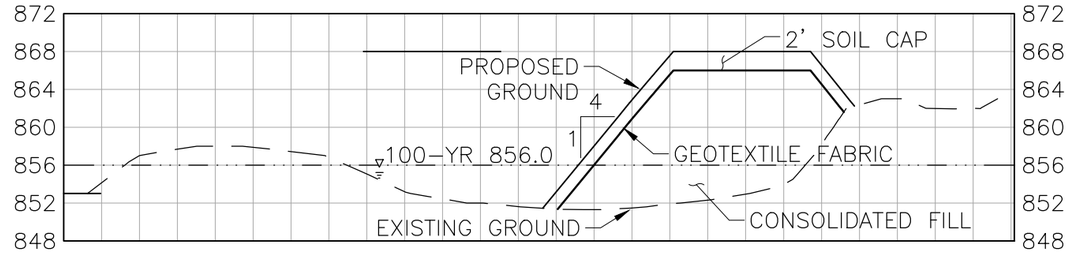


1 FIG 11a SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



2 FIG 11a SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

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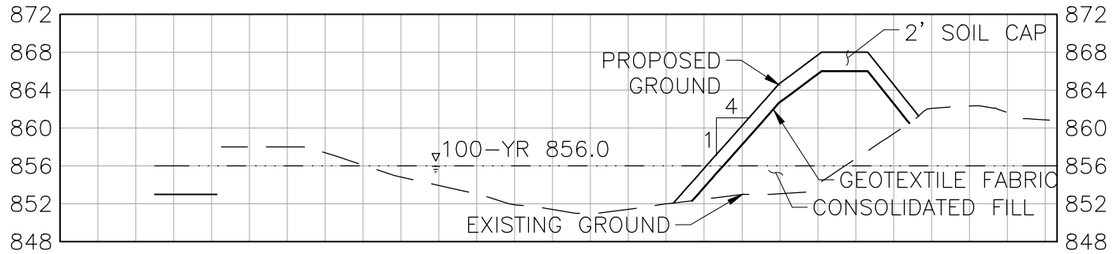
0 80 160 — HORIZ. SCALE IN FEET



3 FIG 11a SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

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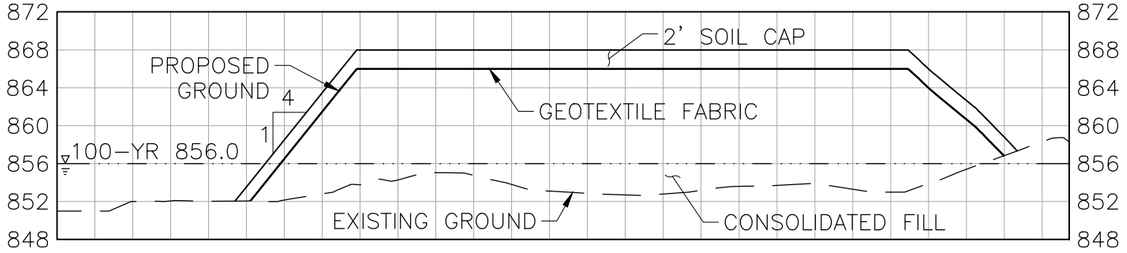
0 80 160 — HORIZ. SCALE IN FEET



4 FIG 11a SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

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ALTERNATIVE 8a – CROSS SECTIONS
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA (ONSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 11b
REV. No.

CADD USER: Gareth W. Becker FILE: M:\DESIGN\2327011000\2327011000_FFS_FIGURE 11B.DWG PLOT SCALE: 1:2 PLOT DATE: 12/5/2016 2:46 PM
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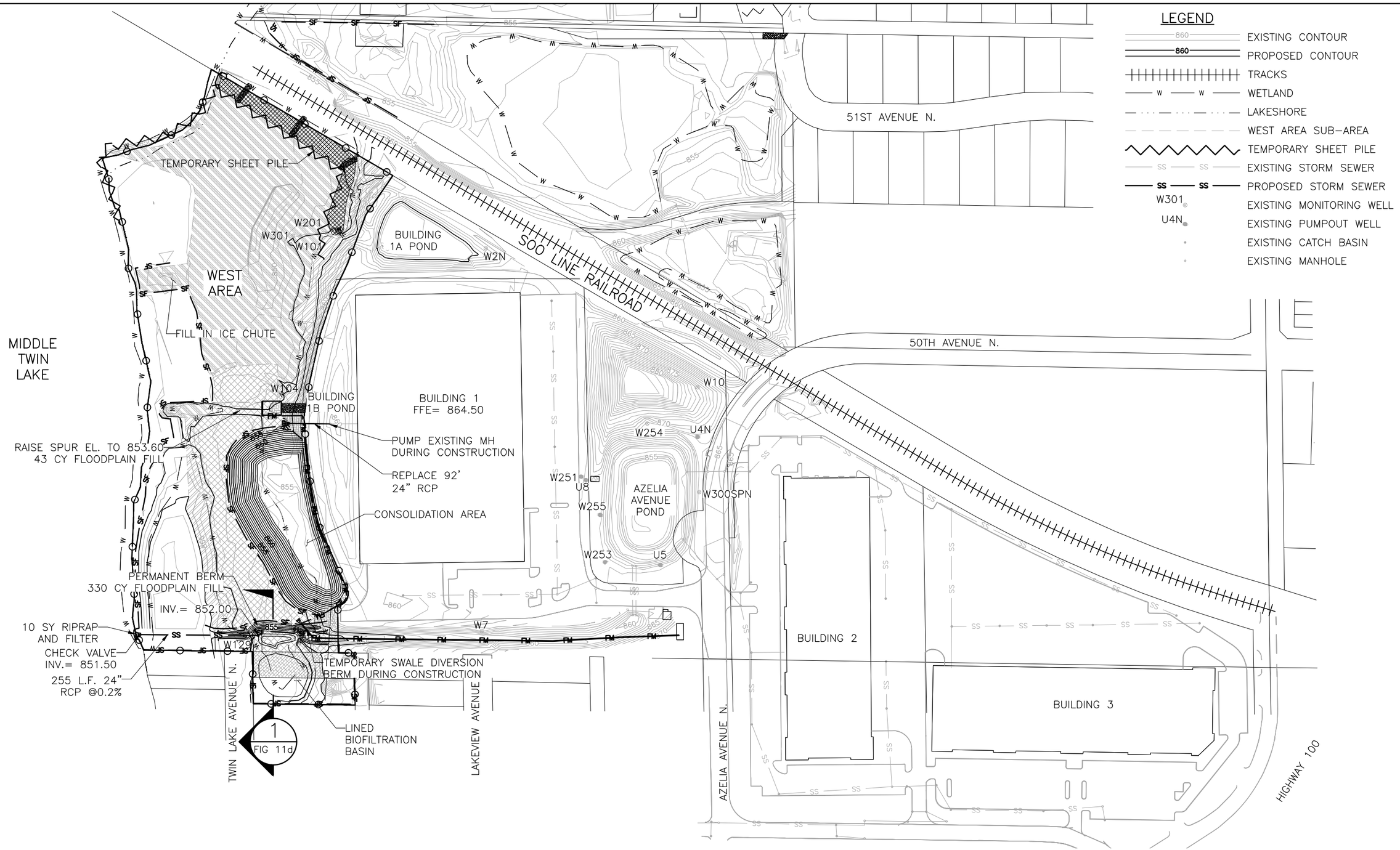

1 PLAN: SITE

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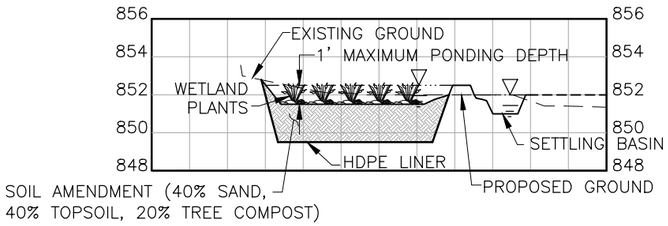
BROOKLYN CENTER, MINNESOTA

FOCUSED FEASIBILITY STUDY

ALTERNATIVE 8A – STORMWATER MANAGEMENT
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER
AT WEST AREA (OFFSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 11c
REV. No.



1 FIG 11c SECTION: BIOFILTRATION BASIN

0 4 8 12 16 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

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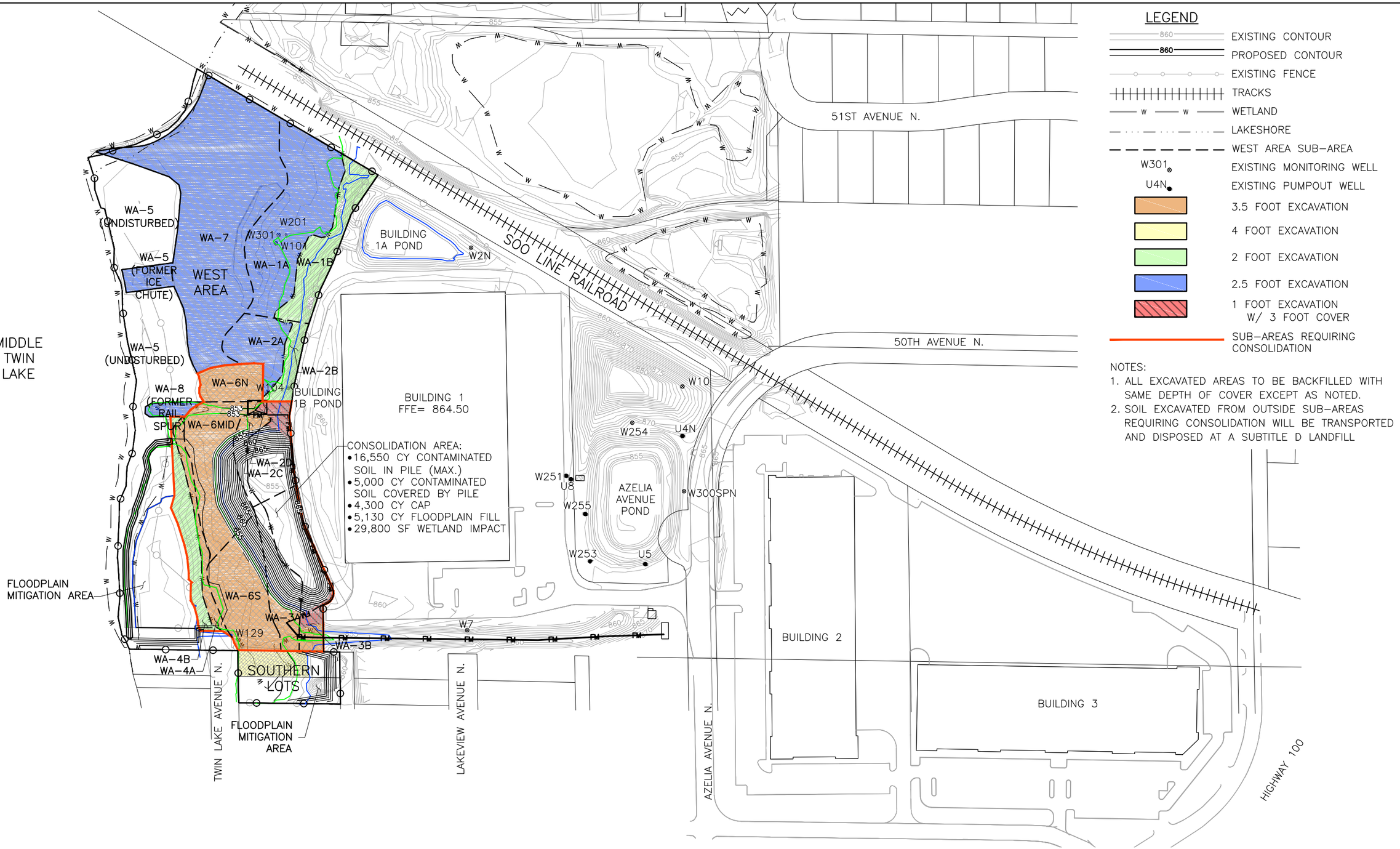
ALTERNATIVE 8A – MANAGEMENT DETAILS
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER
AT WEST AREA (OFFSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 11d
REV. No.



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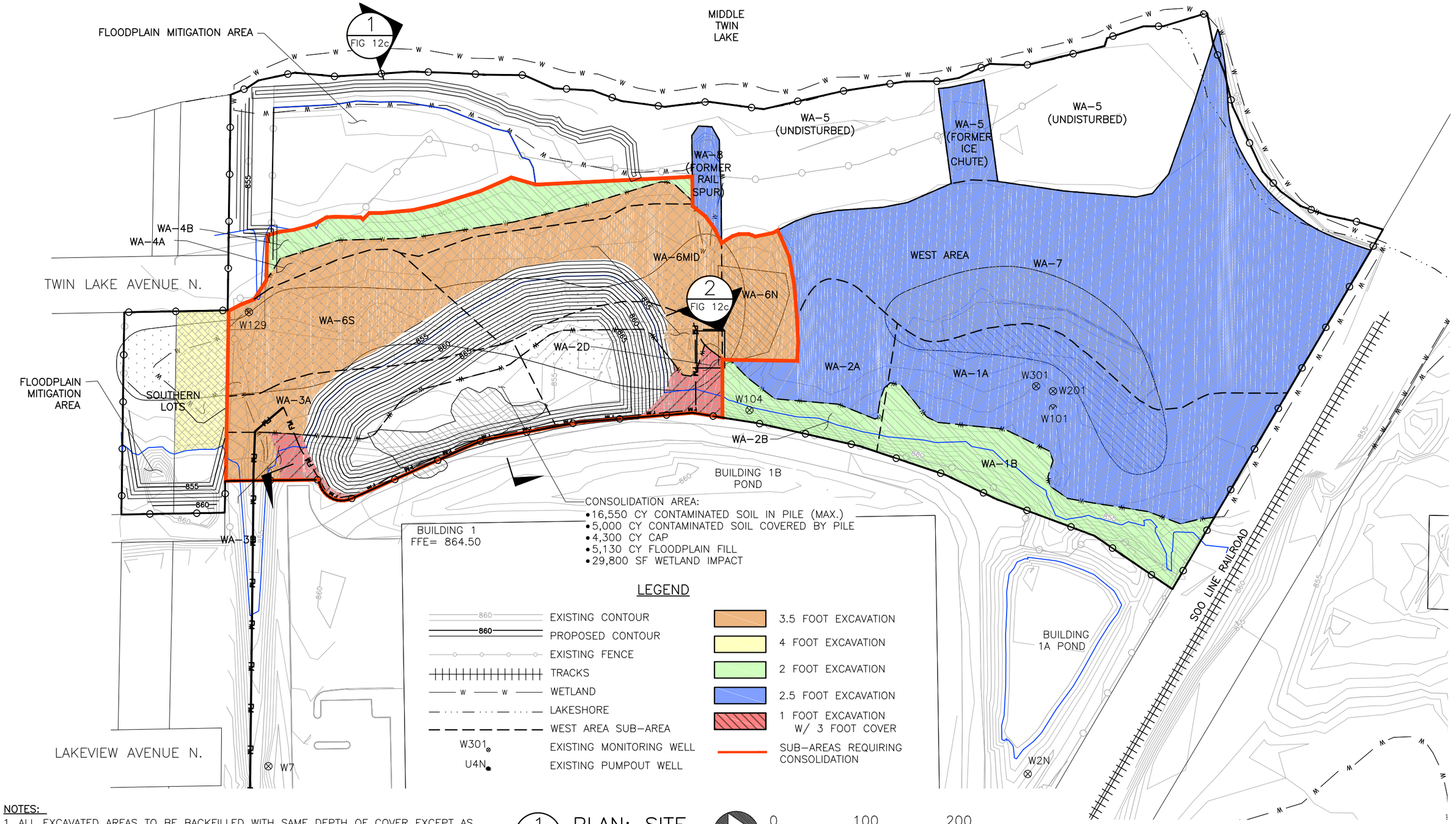
ALTERNATIVE 8B – PLAN
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA (ONSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 12a
REV. No.



NOTES:

1. ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER EXCEPT AS NOTED.
2. SOIL EXCAVATED FROM OUTSIDE SUB–AREAS REQUIRING CONSOLIDATION WILL BE TRANSPORTED AND DISPOSED AT A SUBTITLE D LANDFILL

1/– PLAN: SITE

0 100 200
SCALE IN FEET

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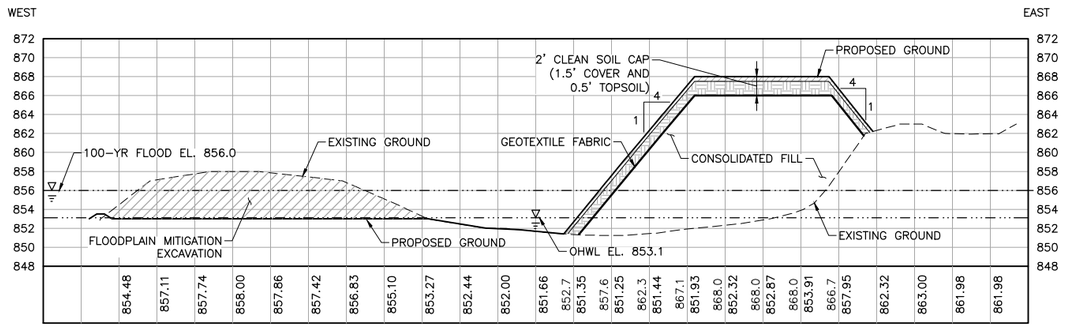
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 8B – PLAN (ENLARGED)
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA (ONSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27–110
CLIENT PROJECT No.
DWG. No. FIGURE 12b
REV. No.

CADD USER: Eric P. Fitzgerald FILE: M:\DESIGN\23270110.00\23270110000_FFS_FIGURE 12B_01.30.17.DWG PLOT SCALE: 1:2 PLOT DATE: 1/30/2017 4:01 PM
. ss1 M:\DESIGN\23270110.00\23270110000_FFS_Figure 11a.dwg Plot at 1 01/30/2012 15:45:22

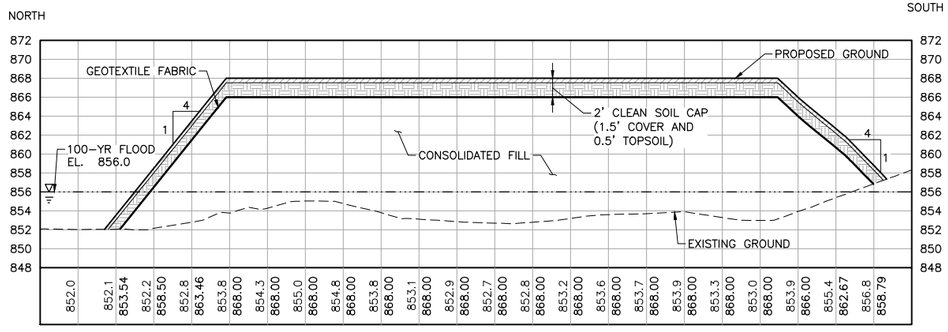


1 FIG 12b

SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET



2 FIG 12b

SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL

0 8 16 24 32 — VERTICAL SCALE IN FEET

0 80 160 — HORIZ. SCALE IN FEET

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FOCUSED FEASIBILITY STUDY

ALTERNATIVE 8B – CROSS SECTIONS
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER

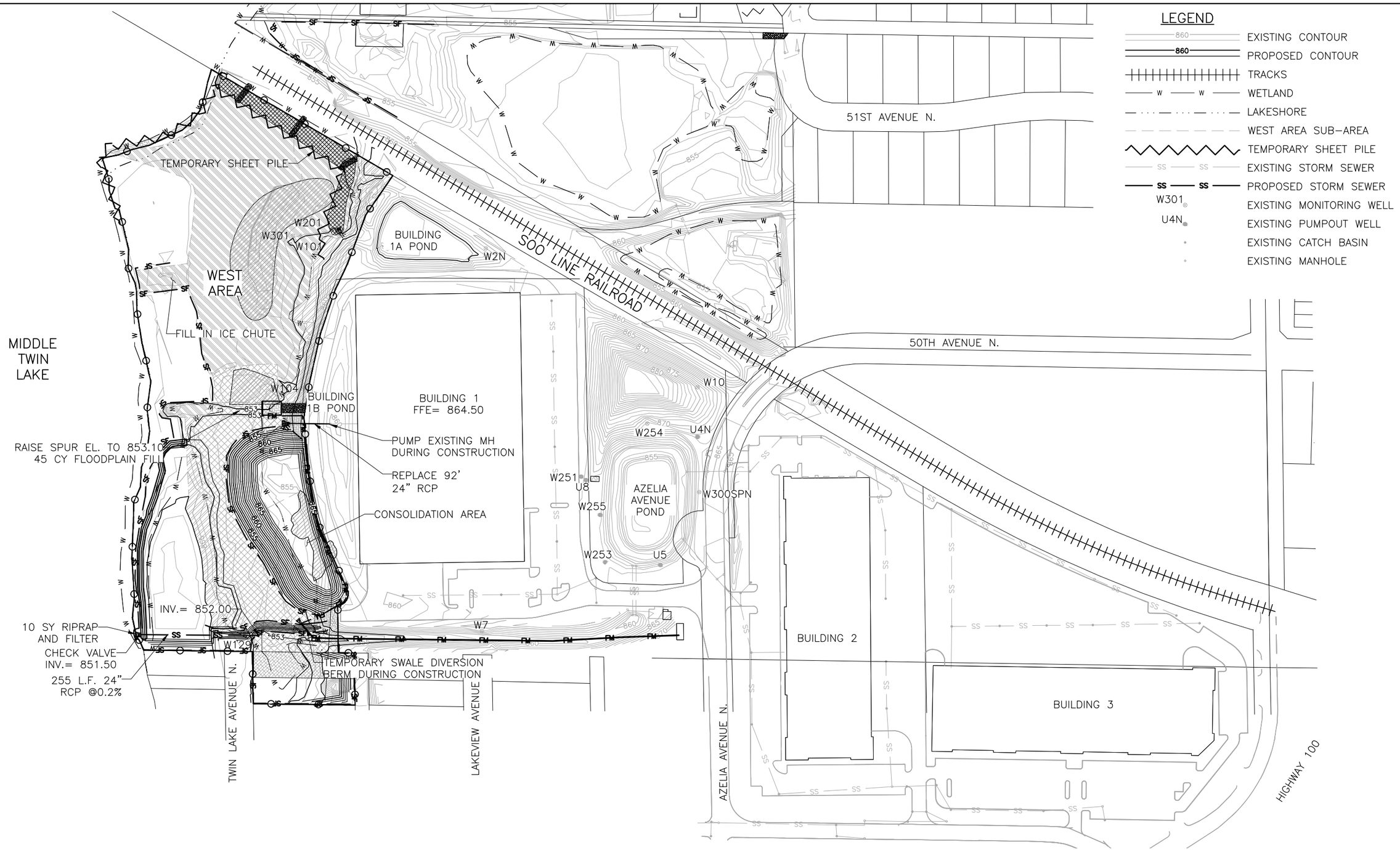
BARR PROJECT No. 23/27-110

CLIENT PROJECT No.

DWG. No. FIGURE 12c

REV. No.

ss1 M:\Design\23270110.00\23270110000_FFS_Figure 11b.dwg Plot at 1 01/30/2012 17:57:02



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ALTERNATIVE 8B – STORMWATER MANAGEMENT
LIMITED ONSITE CONSOLIDATION WITH SOIL COVER AT WEST AREA (ONSITE FLOODPLAIN MITIGATION)

BARR PROJECT No. 23/27-110
CLIENT PROJECT No.
DWG. No. FIGURE 12d
REV. No.

CADD USER: Gareth W. Becker FILE: M:\DESIGN\2327011\0.00\2327011000_FTS_FIGURE 12D.DWG PLOT SCALE: 1:2 PLOT DATE: 12/14/2016 2:54 PM
ss1 M:\Design\2327011\0.00\2327011000_FIG_Alternative 8 Plan.dwg Plot at 1 09/27/2011 00:30:49

1 PLAN: CONCEPTUAL RESTORATION PLAN

0 50 100

SCALE IN FEET

LEGEND

- EXISTING CONTOUR (860 / 851)
- PROPOSED CONTOUR (860 / 851)
- EXISTING STORM SEWER (SS)
- PROPOSED STORM SEWER
- PROPOSED FENCE
- RAILROAD TRACKS
- WETLAND (W)
- LAKESHORE
- EXISTING MONITORING WELL (W301)
- WETLAND (EMERGENT) SEEDING (34–181)
- RIPARIAN WETLAND/FLOODPLAIN (34–261)
- UPLAND SEEDING (36–211)
- CONSOLIDATION AREA SEEDING (35–221)
- PLANTINGS TO PROVIDE LIMITED SCREENING

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Checked	JEH
Designed	BARR
Approved	DWF

JOSLYN MANUFACTURING & SUPPLY CO. SITE
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FOCUSED FEASIBILITY STUDY

CONCEPTUAL RESTORATION PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. FIGURE 12e
REV. No.

Appendices

Appendix A

Historical Soil Quality Data

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	WA-1	WA-1	WA1-2014-1	WA1-2014-2	WA-2	WA-2	WA-3	WA-3	WA-4	WA-5	WA-6MID	WA-6N	WA-6S	WA-8		WA4-2014-1 (0-0.5)	WA4-2014-2 (0-2.5)	WA4-2014-3 (0-5.5)
		Date	12/04/1998	10/06/2000	1/16/2014	1/16/2014	12/04/1998	10/06/2000	12/04/1998	10/06/2000	12/04/1998	12/04/1998	10/06/2000	10/06/2000	10/06/2000	10/06/2000		1/16/2014	1/16/2014	1/16/2014
		Depth																0 - 0.5 ft	0 - 2.5 ft	0 - 5.5 ft
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	Analysis Location	Units																		
General Parameters																				
Carbon, total organic	Lab	%	--	**4.97**	--	--	--	**1.31**	--	**2.90**	--	--	**24.8** **26**	**2.51**	**21.4** **21.7**	**1.32**	**1.08**	--	--	--
pH	Field	pH units	--	**7.85**	--	--	--	**7.99**	--	**7.43**	--	--	**6.21**	**7.58**	**6.01**	**7.32**	**7.28**	--	--	--
Solids, percent	Lab	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total	Lab	%	**73**	--	**70.4**	**86.8**	**85**	--	**58**	**87.3**	**89**	**27**	**30.9**	**77.0**	**33.5**	**88.4**	**90.1**	**85.2**	**94.2**	**94.8**
SVOCs																				
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	**1.8**	--	**0.59**	< 0.29	< 0.33	--	**0.44**	**0.14**	< 0.33	< 0.33	**1.4**	**0.22**	**0.17**	**0.36**	**0.26**	< 0.29	< 0.27	< 0.26
Benzo(a)pyrene	Lab	mg/kg	**2.8**	--	**0.65**	< 0.29	**0.36**	--	< 0.33	**0.17**	**0.42**	< 0.33	**2.3**	**0.24**	**0.56**	**0.37**	**0.29**	< 0.29	< 0.27	< 0.26
Benzo(b)fluoranthene	Lab	mg/kg	**7.2**	--	**1.2**	**0.36**	**0.90**	--	**2.4**	**0.48**	**0.78**	< 0.33	**6.1**	**0.6**	**0.94**	**0.6**	**0.45**	< 0.29	< 0.27	< 0.26
Benzo(k)fluoranthene	Lab	mg/kg	**2.1**	--	**0.40**	< 0.29	**0.34**	--	**0.76**	**0.28**	< 0.33	< 0.33	**2.7**	**0.24**	**0.43**	**0.41**	**0.32**	< 0.29	< 0.27	< 0.26
Chrysene	Lab	mg/kg	**2.6**	--	**1.2**	< 0.29	**0.34**	--	**1.0**	**0.33**	**0.41**	< 0.33	**2.7**	**0.31**	**0.48**	**0.59**	**0.43**	< 0.29	< 0.27	< 0.26
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	**0.054**	< 0.33	< 0.33	**0.77**	**0.094**	**0.16**	**0.091**	**0.068**	< 0.29	< 0.27	< 0.26
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	**0.65**	--	**0.52**	< 0.29	< 0.33	--	< 0.33	**0.24**	< 0.33	< 0.33	**11**	**1.1**	**0.71**	**0.57**	**0.42**	< 0.29	< 0.27	< 0.26
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	**0.93**	**0.036**	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	**1.0**	**0.31**	--	--	--	--	--	--	--	--	--	--	--	**0.29**	**0.27**	**0.26**
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	**1.1**	**0.58**	--	--	--	--	--	--	--	--	--	--	--	**0.57**	**0.53**	**0.51**
2-Chloronaphthalene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	< 0.005	< 0.33	< 0.33	< 0.05	< 0.005	< 0.05	< 0.005	< 0.005	< 0.29	< 0.27	< 0.26
2-Methylnaphthalene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	**7.2**	**0.022**	< 0.33	< 0.33	**0.26**	< 0.005	**0.11**	**0.033**	**0.007**	< 0.29	< 0.27	< 0.26
Acenaphthene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	< 0.005	< 0.33	< 0.33	**0.063**	**0.048**	< 0.05	**0.01**	**0.007**	< 0.29	< 0.27	< 0.26
Acenaphthylene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	**0.023**	< 0.33	< 0.33	**0.54**	**0.053**	**0.13**	**0.032**	**0.021**	< 0.29	< 0.27	< 0.26

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	WA-1	WA-1	WA1-2014-1	WA1-2014-2	WA-2	WA-2	WA-3	WA-3	WA-4	WA-5	WA-6MID	WA-6N	WA-6S	WA-8		WA4-2014-1 (0-0.5)	WA4-2014-2 (0-2.5)	WA4-2014-3 (0-5.5)
		Date	12/04/1998	10/06/2000	1/16/2014	1/16/2014	12/04/1998	10/06/2000	12/04/1998	10/06/2000	12/04/1998	12/04/1998	10/06/2000	10/06/2000	10/06/2000	10/06/2000		1/16/2014	1/16/2014	1/16/2014
		Depth																0 - 0.5 ft	0 - 2.5 ft	0 - 5.5 ft
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	Analysis Location	Units																		
Anthracene	Lab	mg/kg	**0.56**	--	**0.53**	< 0.29	< 0.33	--	**1.3**	**0.11**	< 0.33	< 0.33	**3.1**	**0.44**	**0.38**	**0.89**	**0.11**	< 0.29	< 0.27	< 0.26
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	**3.8**	--	--	--	**0.45**	--	**0.29**	**0.31**	**0.50**	ND	**4.9**	**0.53**	**0.91**	**0.62**	**0.47**	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	mg/kg	**0.67**	--	**0.52**	< 0.29	< 0.33	--	< 0.33	**0.15**	< 0.33	< 0.33	**3.1**	**0.49**	**0.38**	**0.32**	**0.26**	< 0.29	< 0.27	< 0.26
Carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	mg/kg	**4.1**	--	**1.3**	< 0.29	< 0.33	--	< 0.33	**0.2 b**	< 0.33	< 0.33	**3.6**	**0.55**	**0.29**	**0.64**	**0.46**	< 0.29	< 0.27	< 0.26
Fluorene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	< 0.005	< 0.33	< 0.33	**0.065**	**0.055**	< 0.05	**0.068**	**0.007**	< 0.29	< 0.27	< 0.26
Naphthalene	Lab	mg/kg	< 0.33	--	< 0.35	< 0.29	< 0.33	--	< 0.33	**0.012**	< 0.33	< 0.33	**0.2**	< 0.005	**0.061**	**0.025**	**0.006**	< 0.29	< 0.27	< 0.26
Pentachlorophenol	Lab	mg/kg	**4.2**	--	< 2.2	**2.2**	**2.3**	--	**880**	**39**	< 0.33	< 0.33	**120 e**	**0.72**	**120**	**0.83**	**0.71**	< 1.8	< 1.6	< 1.6
Perylene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	mg/kg	**1.5**	--	**0.59**	< 0.29	< 0.33	--	**3.2**	**0.066**	< 0.33	< 0.33	**0.85**	**0.16**	**0.14**	**0.23**	**0.09**	< 0.29	< 0.27	< 0.26
Pyrene	Lab	mg/kg	**5.1**	--	**1.2**	< 0.29	**0.41**	--	**6.1**	**0.33**	< 0.33	< 0.33	**3.6**	**0.48**	**0.49**	**0.62**	**0.43**	< 0.29	< 0.27	< 0.26
Chlorinated Dioxins / Furans																				
2,3,7,8-Dioxin, tetra	Lab	ng/kg	**7.8**	--	**5.56**	**2.65 EMPC**	**6.5**	--	--	**9.61**	< 0.1	**0.56 jEMPC**	**2000**	**7.18**	**430**	**1.41**	**2.76**	**0.443 EMPC**	< 0.281	< 0.241
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	**63.4**	--	**52.3**	**24.8**	**51.7**	--	--	**256**	**0.44 jEMPC**	**4.2 j**	**29000**	**61.6**	**8000 e**	**15.3**	**22.1**	**1.64 j**	**0.337 j**	< 0.191
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	**177**	--	**231**	**94.2**	**218**	--	--	**561**	**1.6 j**	**12.1**	**180000**	**233**	**26000**	**381**	**72.1**	**4.79**	**0.738 j**	< 0.198
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	**1280**	--	**867**	**649**	**1000**	--	--	**10500**	**5.0**	**45.1**	**210000**	**627**	**110000**	**495**	**82.5**	**16.7**	**4.06 EMPC**	< 0.203
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	**502**	--	**628**	**247**	**478**	--	--	**1920**	**3.9 j**	**33.3**	**140000**	**328**	**28000**	**81.8**	**98.5**	**12.2**	**1.83 j**	< 0.201
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**32550 e**	--	**30200**	**28400**	**19920 e**	--	--	**251000**	**125**	**1310**	**4400000 ej**	**16400**	**2300000 e**	**10100**	**10400**	**541**	**124**	**4.15**
Dioxin, octa	Lab	ng/kg	**267630 e**	--	**301000**	**388000**	**237280 e**	--	--	**465000**	**968**	**11330 e**	**7000000 ej**	**117000**	**4900000 ej**	**120000**	**102000**	**5390 e**	**1400**	**40.5**
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	**42.5**	--	**27.0**	**12.1**	**28.3**	--	--	**8.31**	**0.92 j**	**1.7 jEMPC**	**1300 e**	**4.75**	**130**	**9.91**	**13.3**	< 0.660	< 0.155	< 0.148
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	**164**	--	**111**	**69.3**	**103**	--	--	**59.2**	**0.56 j**	**3.8 j**	**10000**	**28.8**	**1000**	**63.2**	**70.5**	**1.17 j**	< 0.142	< 0.152
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	**183**	--	**113**	**71.3**	**105**	--	--	**145**	**0.70 j**	**5.1**	**8600**	**60.8**	**1300**	**123**	**138**	**1.38 j**	**0.178 EMPC**	< 0.147
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	**1170**	--	**887**	**630**	**793**	--	--	**3050**	**3.7 j**	**33.0**	**79000**	**239**	**37000 e**	**458**	**554**	**10.7**	**0.935 EMPC**	< 0.148
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**341**	--	**202**	**121**	**214**	--	--	**1770**	**1.3 j**	**10.0**	**22000**	**101**	**8900 e**	**149**	**186 EMPC**	**3.92 EMPC**	< 0.587	< 0.123
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**514**	--	**344**	**204**	**307**	--	--	**1440**	**2.0 jEMPC**	**16.2**	**12000**	**123**	**5200**	**1410**	**206**	**7.19**	**0.742 EMPC**	< 0.139
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	**58.9**	--	< 10.7	< 7.44	**44.4 ***	--	--	**286**	< 0.06	**2.1 j***	**3600**	**110**	**500**	**302**	**197**	< 0.811	< 0.982	< 0.209
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**9640 e**	--	**8560**	**7050**	**8500 e**	--	--	**101000**	**40.1**	**357**	**1100000 ej**	**4230**	**1200000 ej**	**4250**	**4740**	**183**	**79.0**	**1.28 j**
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	**1110**	--	**504**	**421**	**686**	--	--	**7300**	**2.2 j**	**24.1**	**91000 j**	**286**	**88000 j**	**437**	**460**	**8.93**	**2.83 EMPC**	< 0.314
Dibenzofuran, octa	Lab	ng/kg	**41080 BQU**	--	**29400**	**35900**	**39420 e**	--	--	**618000**	**111**	**961**	**3400000 ej**	**17700**	**3200000 ej**	**12200**	**12800**	**749**	**413**	**5.07 j**
TEQ $_{DF}$ WHO05 · non-detects at zero for the detection limit	Calc	ng/kg	**1065.173**	--	--	--	**775.13**	--	--	**6182.317**	**4.5055**	**42.3523**	**157700**	**514.029**	**68733**	**571.707**	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	**1065.173**	--	--	--	**775.13**	--	--	**6182.317**	**4.5585**	**42.3523**	**157700**	**514.029**	**68733**	**571.707**	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**905**	**733 a**	--	--	--	--	--	--	--	--	--	--	--	**17.3 a**	**3.82 a**	**0.0680 a**
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	**905**	**731 a**	--	--	--	--	--	--	--	--	--	--	--	**16.8 a**	**3.50 a**	**0.068 a**
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**907**	**733 a**	--	--	--	--	--	--	--	--	--	--	--	**17.4 a**	**4.28 a**	**0.689 a**
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	**907**	**732 a**	--	--	--	--	--	--	--	--	--	--	--	**17.0 a**	**3.95 a**	**0.689 a**
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**906**	**733 a**	--	--	--	--	--	--	--	--	--	--	--	**17.3 a**	**4.05 a**	**0.378 a**
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	--	--	**906**	**732 a**	--	--	--	--	--	--	--	--	--	--	--	**16.9 a**	**3.72 a**	**0.378 a**

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

			Location	WA4-2014-3 (5.5-6)	WA4-2014-4 (0-4.5)	WA4-2014-4 (4.5-5)	WA4-2014-5 (0-0.5)	WA4-2014-5 (2-4.5)	WA4-2014-5 (4.5-5)	WA4-2014-6 (2-3.5)	WA4-2014-6 (3.5-4)	A-1	A-2	A-3 0-0.5'	A-3 0.5-1.5'	A-3 1.5-2.5'		A-3 2.5-4'	A-4	B
			Date	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003		2/04/2003	2/04/2003	2/04/
			Depth	5.5 - 6 ft	0 - 4.5 ft	4.5 - 5 ft	0 - 0.5 ft	2 - 4.5 ft	4.5 - 5 ft	2 - 3.5 ft	3.5 - 4 ft									
			Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	Analysis Location	Units																		
General Parameters																				
Carbon, total organic	Lab	%	--	--	--	--	--	--	--	--	**0.44**	**5.08**	**9.63**	**3.36**	**0.51**	**0.61**	**0.65**	**5.38**	**6.05**
pH	Field	pH units	--	--	--	--	--	--	--	--	**7.27**	**7.06**	**6.82**	**7.01**	**7.26**	**7.58**	**7.27**	**7.31**	**7.32**
Solids, percent	Lab	%	--	--	--	--	--	--	--	--	**92.0**	**69.3**	**45.4**	**71.4**	**84.3**	**86.2**	**85.5**	**66.9**	**63.2**
Solids, total	Lab	%	**91.4**	**94.2**	**97.5**	**80.7**	**93.1**	**91.5**	**95.1**	**76.3**	--	--	--	--	--	--	--	--	--
SVOCs																				
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Benzo(a)pyrene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
Benzo(b)fluoranthene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
Benzo(k)fluoranthene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
Chrysene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	**0.28**	**0.27**	**0.26**	**0.31**	**0.33**	**0.33**	**0.26**	**0.33**	**0.35**	**0.41**	**0.6**	**0.46**	**0.39**	**0.33**	**0.38**	**0.47**	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	**0.55**	**0.53**	**0.51**	**0.61**	**0.65**	**0.65**	**0.51**	**0.65**	**0.71**	**0.83**	**1.2**	**0.93**	**0.79**	**0.65**	**0.77**	**0.95**	--
2-Chloronaphthalene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
2-Methylnaphthalene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Acenaphthene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Acenaphthylene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	WA4-2014-3 (5.5-6)	WA4-2014-4 (0-4.5)	WA4-2014-4 (4.5-5)	WA4-2014-5 (0-0.5)	WA4-2014-5 (2-4.5)	WA4-2014-5 (4.5-5)	WA4-2014-6 (2-3.5)	WA4-2014-6 (3.5-4)	A-1	A-2	A-3 0-0.5'	A-3 0.5-1.5'	A-3 1.5-2.5'		A-3 2.5-4'	A-4	B
		Date	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	1/16/2014	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003		2/04/2003	2/04/2003	2/04/
		Depth	5.5 - 6 ft	0 - 4.5 ft	4.5 - 5 ft	0 - 0.5 ft	2 - 4.5 ft	4.5 - 5 ft	2 - 3.5 ft	3.5 - 4 ft									
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N
Parameter	Analysis Location	Units																	
Anthracene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--									--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--									--
Benzo(g,h,i)perylene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 2.3
Carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--									--
Fluoranthene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	**0.63**	< 0.45
Fluorene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Naphthalene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Pentachlorophenol	Lab	mg/kg	< 1.7	< 1.6	< 1.6	< 1.9	< 2.0	< 2.0	< 1.6	< 2.0	< 2.2	< 2.6	< 3.7	< 2.8	< 2.4	< 2.0	**18**	< 2.9	**69**
Perylene	Lab	mg/kg	--	--	--	--	--	--	--	--									--
Phenanthrene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	< 0.48	< 0.45
Pyrene	Lab	mg/kg	< 0.28	< 0.27	< 0.26	< 0.31	< 0.33	< 0.33	< 0.26	< 0.33	< 0.36	< 0.42	< 0.61	< 0.47	< 0.40	< 0.33	< 0.39	**0.57**	**0.54**
Chlorinated Dioxins / Furans																			
2,3,7,8-Dioxin, tetra	Lab	ng/kg	< 0.250	< 0.216	< 0.201	< 0.254	< 0.148	< 0.180	< 0.222	< 0.188	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	< 0.151	**0.191 EMPC**	< 0.163	**1.53 j**	< 0.140	< 0.141	< 0.134	**0.205 EMPC**	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	< 0.212	**0.431 EMPC**	< 0.156	**3.39**	< 0.303	< 0.198	< 0.153	**0.367 j**	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	< 0.208	**1.69 j**	< 0.153	**13.2**	**0.780 j**	**0.450 EMPC**	**0.398 EMPC**	**2.07 j**	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	< 0.211	**1.20 j**	< 0.155	**8.50**	**0.406 jb**	< 0.202	**0.377 EMPC**	**1.05 jb**	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**1.87 j**	**50.3**	**0.622 j**	**393**	**16.1**	**8.29**	**5.62**	**74.5**	--	--	--	--	--	--	--	--	--
Dioxin, octa	Lab	ng/kg	**19.8**	**498**	**4.50 jb**	**3920**	**154**	**84.0**	**31.4**	**1050**	--	--	--	--	--	--	--	--	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	< 0.154	< 0.123	< 0.107	< 0.750	< 0.0853	< 0.112	< 0.121	< 0.137	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	< 0.148	< 0.128	< 0.137	**1.09 EMPC**	< 0.132	< 0.115	< 0.121	< 0.169	--	--	--	--	--	--	--	--	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	< 0.144	**0.274 EMPC**	< 0.135	**1.22 EMPC**	< 0.141	< 0.121	< 0.121	< 0.172	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	< 0.112	**1.52 j**	< 0.144	**10.5**	**0.673 j**	**0.375 j**	< 0.145	**1.86 j**	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	< 0.0918	**0.387 j**	< 0.121	**2.42 EMPC**	**0.217 j**	< 0.145	< 0.119	**0.502 EMPC**	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	< 0.104	**0.703 EMPC**	< 0.136	**5.09**	**0.374 EMPC**	< 0.168	< 0.133	**0.762 EMPC**	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	< 0.153	< 0.368	< 0.205	< 0.991	< 0.250	< 0.252	< 0.199	< 0.370	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**0.759 EMPC**	**17.4**	**0.209 EMPC**	**141**	**6.74**	**3.29**	**1.40 j**	**28.0**	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	< 0.327	**1.26 j**	< 0.211	**9.23**	**0.753 bEMPC**	< 0.272	< 0.237	**1.77 j**	--	--	--	--	--	--	--	--	--
Dibenzofuran, octa	Lab	ng/kg	**2.31 j**	**61.3**	**0.956 j**	**580**	**17.2**	**8.91**	**3.85 j**	**118**	--	--	--	--	--	--	--	--	--
TEQ $_{DF}$ WHO05 ` non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	--	--	--	--	--	--	--	--	**40 b**	**194**	**227**	**189**	**56 ***	**15 b***	**106**	**229**	**13720 ***
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**0.0329 a**	**1.72 a**	**0.00860 a**	**13.0 a**	**0.484 a**	**0.226 a**	**0.158 a**	**2.15 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	**0.0291 a**	**1.53 a**	**0.00755 a**	**12.7 a**	**0.465 a**	**0.204 a**	**0.120 a**	**1.99 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**0.609 a**	**1.99 a**	**0.537 a**	**13.4 a**	**0.882 a**	**0.697 a**	**0.644 a**	**2.45 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	**0.606 a**	**1.80 a**	**0.536 a**	**13.1 a**	**0.864 a**	**0.675 a**	**0.605 a**	**2.28 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**0.321 a**	**1.86 a**	**0.273 a**	**13.2 a**	**0.683 a**	**0.462 a**	**0.401 a**	**2.30 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	**0.317 a**	**1.66 a**	**0.272 a**	**12.9 a**	**0.665 a**	**0.439 a**	**0.362 a**	**2.14 a**	--	--	--	--	--	--	--	--	--

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

Location			-1	B-1	B-1	B-1	B-1	B-2	B-3	B-3	B-3	B-3 0.5-1.5'	B-3 0-0.5'	B-3 1.5-2.5'	B-3 2.5-4'	B-4	B-5	C-1	C-2		C-3 0-0.5'	C-3 0.5-1.5'	C-3 1.5-2.5'	C-3 2.5-4'	C-3
Date			2003	2/02/2015	2/02/2015	2/02/2015	2/02/2015	2/04/2003	2/02/2015	2/02/2015	2/02/2015	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/03/2003		2/04/2003	2/04/2003	2/04/2003	2/04/2003	4/21/2003
Depth				0.5 - 2 ft	2 - 3.5 ft	6.5 - 9 ft	9 - 10 ft		3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft														
Sample Type			FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N
Parameter	Analysis Location	Units																							
General Parameters																									
Carbon, total organic	Lab	%	**5.52**	**3.81**	**2.47 h**	**0.553 h**	**0.124 h**	**3.03**	**43.7**	**42.2 h**	**11.3 h**	**21.2**	**22.8**	**31.3**	**42.3**	**13.9**	**5.34**	**10.5**	**2.79**	**2.87**	**25.8**	**24.3**	**38.2**	**40.4**	--
pH	Field	pH units	**7.47**	--	--	--	--	**6.69**	--	--	--	**6.34**	**6.65**	**6.24**	**6.22**	**5.93**	**7.37**	**6.87**	**5.95**	**6.09**	**6.07**	**6.24**	**6.03**	**6.13**	--
Solids, percent	Lab	%	**64.7**	--	--	--	--	**70.1**	--	--	--	**17.0**	**4.10**	**22.9**	**23.9**	**34.1**	**73.5**	**44.4**	**64.6**	**70.3**	**11.2**	**20.8**	**20.9**	**21.7**	--
Solids, total	Lab	%	--	**80.5**	**74.0**	**82.3**	**83.6**	--	**22.1**	**19.0**	**27.6**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																									
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50.0
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50.0
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
Benz(a)anthracene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	**1.7**	< 1.6	< 1.6	< 5.00
Benzo(a)pyrene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 7.0	< 0.51	< 0.36	**3.3**	**2.5**	< 1.6	< 1.6	**7.26**
Benzo(b)fluoranthene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	**2.6**	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 7.0	**0.65**	**0.58**	**14**	**11**	< 1.6	< 1.6	**8.10 c**
Benzo(k)fluoranthene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 7.0	< 0.51	< 0.36	**6.5**	**4.6**	< 1.6	< 1.6	**8.10 c**
Chrysene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	**1.0**	< 0.51	< 0.36	**5.6**	**4.4**	< 1.6	< 1.6	< 5.00
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
Dibenz(a,h)anthracene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 7.0	< 0.51	< 0.36	< 3.0	**1.8**	< 1.6	< 1.6	< 5.00
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 25.0
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	**2.2**	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 7.0	< 0.51	**0.39**	**9.2**	**8.5**	< 1.6	< 1.6	**2.5 pp**
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	--
2-Methylnaphthalene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00
Acenaphthene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00
Acenaphthylene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	B-1	B-1	B-1	B-1	B-2	B-3	B-3	B-3	B-3 0.5-1.5'	B-3 0-0.5'	B-3 1.5-2.5'	B-3 2.5-4'	B-4	B-5	C-1	C-2		C-3 0-0.5'	C-3 0.5-1.5'	C-3 1.5-2.5'	C-3 2.5-4'	C-3
		Date	2003	2/02/2015	2/02/2015	2/02/2015	2/04/2003	2/02/2015	2/02/2015	2/02/2015	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/03/2003		2/04/2003	2/04/2003	2/04/2003	2/04/2003	4/21/2003
		Depth		0.5 - 2 ft	2 - 3.5 ft	6.5 - 9 ft	9 - 10 ft		3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft														
		Sample Type	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N
Parameter	Analysis Location	Units																						
Anthracene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	**2.4**	< 1.6	< 1.6	**8.92**
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
Benzo(g,h,i)perylene	Lab	mg/kg	< 2.3	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	**2.0**	< 0.39	< 7.0	< 0.51	**0.38**	**8.4**	**7.8**	< 1.6	< 1.6	**5.06**
Carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**2.5 pp**
Fluoranthene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	**1.1**	< 0.51	< 0.36	**4.6**	**3.6**	< 1.6	< 1.6	< 5.00
Fluorene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00
Naphthalene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00
Pentachlorophenol	Lab	mg/kg	**69**	--	--	--	--	**8.1**	--	--	--	**51**	**71**	**59**	< 8.4	< 4.4	< 2.4	**76**	< 3.1	< 2.2	**55**	**62**	**13**	< 9.3	**450**
Perylene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00
Phenanthrene	Lab	mg/kg	< 0.45	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	< 0.70	< 0.51	< 0.36	< 3.0	< 1.6	< 1.6	< 1.6	< 5.00
Pyrene	Lab	mg/kg	**0.56**	--	--	--	--	< 0.46	--	--	--	< 2.0	< 8.1	< 1.4	< 1.4	< 0.73	< 0.39	**1.6**	< 0.51	< 0.36	**5.8**	**4.8**	< 1.6	< 1.6	< 5.00
Chlorinated Dioxins / Furans																									
2,3,7,8-Dioxin, tetra	Lab	ng/kg	--	**5.88**	**0.575 EMPC**	**0.247 EMPC**	< 0.307	--	< 0.572	**4.59**	< 0.592	--	< 1.0 h	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	--	**149**	**17.9**	**5.77**	< 0.773	--	**14.5**	**41.4**	< 0.755	--	**3266.494 jh**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	--	**522**	**96.4**	**74.2**	**6.51**	--	**160**	**194**	< 0.454	--	**13807.604 jh**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	--	**11900**	**4510 EMPC**	**4620**	**329**	--	**3430**	**1530**	**2.37 EMPC**	--	**34183.592 h**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	--	**1070**	**292**	**497**	**101**	--	**306**	**336**	< 0.435	--	**35156.664 h**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	--	**453000**	**122000 ***	**99200 ***	**27700 ***	--	**192000**	**94900 ***	**72.3**	--	**1106991.3 h**	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin, octa	Lab	ng/kg	--	**15000000 e**	**3050000 ***	**762000 ***	**289000 ***	--	**3730000**	**1430000 ***	**828**	--	**5282956.4 h**	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	--	**49.8**	**41.3**	**0.529 j**	< 0.280	--	< 0.622	< 0.910	< 1.64	--	< 1.0 h	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	--	**316**	**322**	**2.39 EMPC**	< 1.07	--	**3.22 j**	**6.09 EMPC**	< 0.379	--	< 2.5 h	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	--	**702**	**697**	**10.9**	< 1.07	--	**2.51 j**	**16.4 EMPC**	< 0.368	--	< 2.5 h	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	**4820**	**2230 EMPC**	**1040 ***	**16.8**	--	**443 ***	**299 ***	**1.09 EMPC**	--	**13247.806 jh**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	**724**	**643**	**96.8**	< 1.31	--	< 3.74	< 4.57	< 0.354	--	**3687.053 jh**	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	**1390**	**1210**	**383**	**9.31**	--	**197**	**133**	< 0.372	--	**8107.860 jh**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	--	**957**	**1080**	**98.4**	< 1.44	--	< 4.35	< 5.28	< 0.471	--	**3505.404 jh**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	--	**120000**	**39600**	**24100**	**1330**	--	**57800**	**23700**	**25.7 EMPC**	--	**394237.764 h**	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	--	**8990**	**3080**	**1260 EMPC**	**63.0**	--	**1800**	**911**	< 0.812	--	**17944.152 jh**	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran, octa	Lab	ng/kg	--	**3160000**	**479000 ***	**308000 ***	**9780 ***	--	**856000**	**264000 ***	**153**	--	**1609545.0 h**	--	--	--	--	--	--	--	--	--	--	--	--
TEQ $_{DF}$ WHO05 $^{'}$ non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	**808 ***	--	--	--	--	**4270**	--	--	--	**76960**	**17290**	**13000**	**552**	**355**	**38 b**	**1425**	**222**	**174**	**5562**	**3003**	**756**	**766**	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	**13800**	**3950 a**	**2260 a**	**427 a**	--	**4360 a**	**2000 a**	**1.62 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	**13800**	**3620 a**	**2250 a**	**427 a**	--	**4360 a**	**2000 a**	**1.32 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	**13800**	**3950 a**	**2260 a**	**429 a**	--	**4360 a**	**2000 a**	**3.47 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	**13800**	**3620 a**	**2250 a**	**429 a**	--	**4360 a**	**2000 a**	**3.17 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	**13800**	**3950 a**	**2260 a**	**428 a**	--	**4360 a**	**2000 a**	**2.55 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	--	**13800**	**3620 a**	**2250 a**	**428 a**	--	**4360 a**	**2000 a**	**2.24 a**	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	C-3	C-3	C-3	C-3	C-4	C-5	C-5	C-5R	D-1	D-1		D-1	D-1	D-1	D-2	D-3 0-0.5'	D-3 0.5-1.5'	D-3 1.5-2.5'	D-3 2.5-4'	D-4	D-5	E-1	E-2
		Date	2/02/2015	2/02/2015	2/02/2015	2/02/2015	2/03/2003	2/03/2003	4/21/2003	4/21/2003	2/03/2003	4/21/2003		2/02/2015	2/02/2015	2/02/2015	2/03/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/03/2003	1/20/2003	1/20/2003	1/20/2003
		Depth	3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft	9 - 10 ft								0.5 - 2 ft	2 - 3.5 ft	3.5 - 9 ft									
		Sample Type	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units																							
General Parameters																									
Carbon, total organic	Lab	%	**39.4**	**40.2 h**	**32.2 h**	**7.33 h**	**23.8**	**9.06**	--	**4.07**	**4.35**	--	--	**1.33**	**1.37 h**	**14.3 h**	**3.13**	**35.1**	**34.7**	**37.5**	**38.3**	**26.6**	**28.9**	**6.01**	**34.1**
pH	Field	pH units	--	--	--	--	**6.30**	**6.87**	--	**6.82**	**7.55**	--	--	--	--	--	**6.59**	**6.07**	**6.38**	**6.74**	**6.83**	**7.18**	**7.22**	**6.78**	**5.84**
Solids, percent	Lab	%	--	--	--	--	**31.8**	**78.6**	--	**81.5**	**83.8**	--	--	--	--	--	**75.0**	**18.6**	**26.5**	**25.3**	**23.7**	**29.4**	**14.9**	**47.6**	**7.19**
Solids, total	Lab	%	**22.1**	**17.5**	**18.7**	**35.5**	--	--	--	--	--	--	--	**87.8**	**84.2**	**39.9**	--	--	--	--	--	--	--	--	--
SVOCs																									
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	< 20.0	--	--	< 20.0	< 20.0 < 20.0	--	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	< 20.0	--	--	< 20.0	< 20.0 < 20.0	--	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	< 2.00	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	**41.9**	--	--	ND pp	ND pp ND pp	--	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	< 2.00	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	< 2.00	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	--	--	--	--	**1.6**	**160**	**41.7**	**43**	**2.7**	ND pp	ND pp ND pp	--	--	--	**1.1**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Benzo(a)pyrene	Lab	mg/kg	--	--	--	--	**3.4**	**240**	**57.5**	**80**	**1.7**	**2.09**	ND pp 2.24	--	--	--	**1.2**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Benzo(b)fluoranthene	Lab	mg/kg	--	--	--	--	**5.5**	**300**	**120 c**	**89**	**5.1**	**8.14 c**	**7.92 c** **8.36 c**	--	--	--	**2.8**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	**1.1**	< 4.6
Benzo(k)fluoranthene	Lab	mg/kg	--	--	--	--	**2.8**	**230**	**120 c**	**76**	**2.1**	**8.14 c**	**7.92 c** **8.36 c**	--	--	--	**1.5**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	**0.71**	< 4.6
Chrysene	Lab	mg/kg	--	--	--	--	**3.6**	**320**	**49.6**	**68**	**3.9**	**3.63**	**3.47** **3.79**	--	--	--	**2.4**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	**0.82**	< 4.6
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	**4.87**	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	--	--	--	--	< 0.95	**49**	**17.8**	**23**	**0.53**	< 2.00	< 2.00 < 2.00	--	--	--	< 0.38	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.71	< 4.7
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	**6.27**	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	**23.8**	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	< 10.0	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	**42.5**	--	--	< 10.0	< 10.0 < 10.0	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	--	--	--	--	**2.5**	**140**	**39.4**	**53**	**1.7**	ND pp	ND pp ND pp	--	--	--	**1.2**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.71	< 4.7
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	mg/kg	--	--	--	--	< 0.95	< 0.67	--	< 0.66	< 0.33	--	--	--	--	--	< 0.38	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
2-Methylnaphthalene	Lab	mg/kg	--	--	--	--	< 0.95	**8.4**	< 2.00	**0.83**	**0.48**	< 2.00	< 2.00 < 2.00	--	--	--	**0.43**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Acenaphthene	Lab	mg/kg	--	--	--	--	< 0.95	**22**	< 2.00	< 0.66	< 0.33	< 2.00	< 2.00 < 2.00	--	--	--	< 0.38	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Acenaphthylene	Lab	mg/kg	--	--	--	--	< 0.95	**2.2**	**7.02**	**1.1**	< 0.33	< 2.00	< 2.00 < 2.00	--	--	--	< 0.38	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6

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West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

Location			C-3	C-3	C-3	C-3	C-4	C-5	C-5	C-5R	D-1	D-1		D-1	D-1	D-1	D-2	D-3 0-0.5'	D-3 0.5-1.5'	D-3 1.5-2.5'	D-3 2.5-4'	D-4	D-5	E-1	E-2
Date			2/02/2015	2/02/2015	2/02/2015	2/02/2015	2/03/2003	2/03/2003	4/21/2003	4/21/2003	2/03/2003	4/21/2003		2/02/2015	2/02/2015	2/02/2015	2/03/2003	2/04/2003	2/04/2003	2/04/2003	2/04/2003	2/03/2003	1/20/2003	1/20/2003	1/20/2003
Depth			3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft	9 - 10 ft								0.5 - 2 ft	2 - 3.5 ft	3.5 - 9 ft									
Sample Type			N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units																							
Anthracene	Lab	mg/kg	--	--	--	--	< 0.95	**99**	**17.9**	**11**	**0.64**	**3.11**	**3.18** **3.04**	--	--	--	**11**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	**83.7**	--	--	**3.32**	**3.23** **3.41**	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	mg/kg	--	--	--	--	**2.2**	**120**	**42.6**	**53**	**1.6**	ND pp	ND pp 2.01	--	--	--	**1.0**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.71	< 4.7
Carbazole	Lab	mg/kg	--	--	--	--	--	--	**2.67**	--	--	ND pp	ND pp ND pp	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	mg/kg	--	--	--	--	**1.3**	**150**	**20.5**	**25**	**6.2**	**3.87**	**3.94** **3.79**	--	--	--	**1.6**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	**0.87**	< 4.6
Fluorene	Lab	mg/kg	--	--	--	--	< 0.95	**24**	**1.00 pp**	**0.89**	< 0.33	< 2.00	< 2.00 < 2.00	--	--	--	**0.71**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Naphthalene	Lab	mg/kg	--	--	--	--	< 0.95	**12**	**1.00 pp**	**2.0**	**0.53**	< 2.00	< 2.00 < 2.00	--	--	--	< 0.38	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Pentachlorophenol	Lab	mg/kg	--	--	--	--	< 5.8	< 4.1	< 10.0	< 4.0	**77**	**227**	**238** **215**	--	--	--	**23**	**9.2**	< 5.7	< 6.5	< 14	< 5.1	< 14	**7.5**	< 28
Perylene	Lab	mg/kg	--	--	--	--	--	--	**17.5**	--	--	< 2.00	< 2.00 < 2.00	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	mg/kg	--	--	--	--	< 0.95	**110**	**6.86**	**4.7**	**1.6**	**2.69**	**2.65** **2.73**	--	--	--	**1.9**	< 1.6	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	< 0.70	< 4.6
Pyrene	Lab	mg/kg	--	--	--	--	**1.8**	**180**	**51.0**	**48**	**9.1**	**5.09**	**5.16** **5.03**	--	--	--	**2.2**	**2.1**	< 0.94	< 1.1	< 2.2	< 0.84	< 2.3	**0.92**	< 4.6
Chlorinated Dioxins / Furans																									
2,3,7,8-Dioxin, tetra	Lab	ng/kg	< 0.156	**2.04 EMPC**	< 2.50	< 0.224	--	--	--	--	--	--	--	**24.1**	**1.88 EMPC**	< 0.824	--	--	--	--	--	--	< 1.0	--	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	**11.8**	**104**	**29.4**	**0.268 EMPC**	--	--	--	--	--	--	--	**521**	**32.0**	**1.72 EMPC**	--	--	--	--	--	--	**0.628 j**	--	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	**79.0**	**501**	**111**	**1.11 EMPC**	--	--	--	--	--	--	--	**1700**	**171**	**7.17**	--	--	--	--	--	--	**1.613 j**	--	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	**6270**	**18500**	**1280**	**8.76**	--	--	--	--	--	--	--	**21400**	**2180**	**52.3**	--	--	--	--	--	--	**29.186**	--	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	**385**	**1100**	**284**	**1.78 j**	--	--	--	--	--	--	--	**4160**	**359**	**13.5 EMPC**	--	--	--	--	--	--	**5.946**	--	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**290000**	**382000 ***	**73200**	**351**	--	--	--	--	--	--	--	**650000**	**52000 ***	**1860**	--	--	--	--	--	--	**1156.072**	--	--
Dioxin, octa	Lab	ng/kg	**5390000**	**4450000 ***	**725000**	**3750**	--	--	--	--	--	--	--	**5200000**	**684000 ***	**25300 e**	--	--	--	--	--	--	**8082.694 eb**	--	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	**61.3**	**327**	**17.3 EMPC**	< 0.291	--	--	--	--	--	--	--	**201**	**5.36**	< 0.863	--	--	--	--	--	--	**1.208 jc**	--	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	**411**	**2350**	**85.6**	**0.700 j**	--	--	--	--	--	--	--	**950**	**25.7**	**3.03 EMPC**	--	--	--	--	--	--	**1.623 j**	--	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	**3.39 j**	**4770**	**200**	**1.22 j**	--	--	--	--	--	--	--	**3090**	**138**	**5.14 j**	--	--	--	--	--	--	**6.145**	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	**3630**	**20500**	**890**	**4.90 j**	--	--	--	--	--	--	--	**16800**	**1000**	**41.6**	--	--	--	--	--	--	**32.754**	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**741**	**4370**	**205**	**1.45 j**	--	--	--	--	--	--	--	**3170**	**195**	**9.58 EMPC**	--	--	--	--	--	--	**4.254 jEMPC**	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**1230**	**6410**	**344**	**2.34 j**	--	--	--	--	--	--	--	**5320**	**328**	**13.5**	--	--	--	--	--	--	**7.749**	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	**1400**	**7660**	**288**	**1.71 j**	--	--	--	--	--	--	--	**4190**	**101**	**10.5**	--	--	--	--	--	--	**5.520**	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**141000**	**171000**	**35600**	**101**	--	--	--	--	--	--	--	**151000**	**22700**	**547**	--	--	--	--	--	--	**333.079**	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	**5500**	**16900**	**1060**	**5.89 j**	--	--	--	--	--	--	--	**15400**	**2020**	**38.0**	--	--	--	--	--	--	**13.245**	--	--
Dibenzofuran, octa	Lab	ng/kg	**1850000**	**1290000 ***	**147000**	**571**	--	--	--	--	--	--	--	**2800000**	**180000 ***	**2750**	--	--	--	--	--	--	**2018.758**	--	--
TEQ $_{DF}$ WHO05 · non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	--	--	--	--	**493**	**829**	--	**1126**	**9010**	--	--	--	--	--	**2850**	**7810**	**4920**	**666**	**223**	**448**	**25**	**5440**	**1624**
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**7940 a**	**15000 a**	**1790 a**	**8.74 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**51 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	**7940 a**	**15000 a**	**1790 a**	**8.55 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**49 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**7940 a**	**15000 a**	**1800 a**	**8.99 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**51.9 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	**7940 a**	**15000 a**	**1800 a**	**8.8 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**49.9 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	**7940 a**	**15000 a**	**1800 a**	**8.86 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**51.5 a**	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	**7940 a**	**15000 a**	**1790 a**	**8.67 a**	--	--	--	--	--	--	--	**17800**	**1540 a**	**49.4 a**	--	--	--	--	--	--	--	--	--

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	E-3	E-3	E-4	E-4	E-4	E-4	F-1	F-2	F-3	F-3	F-3	F-3	F-3	F-4		G-1	G-2	G-3 0-0.5'	G-3 0.5-1.5'	G-3 1.5-2.5'	G-3 2.5-4'	G-3 H-3	G-4 0-0.5'
		Date	1/20/2003	4/21/2003	2/02/2015	2/02/2015	2/02/2015	2/02/2015	1/20/2003	1/20/2003	1/20/2003	2/02/2015	2/02/2015	2/02/2015	2/02/2015	1/20/2003		1/20/2003	2/04/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	12/04/1998	1/21/2003
		Depth			3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft	9 - 10 ft				2.5 - 4 ft	4 - 5.5 ft	5.5 - 9 ft	9 - 10 ft										
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units																							
General Parameters																									
Carbon, total organic	Lab	%	**40.6**	--	**44.3**	**31.9 h**	**8.01 h**	**3.91 h**	**4.80**	**8.72**	**39.1**	**11.0**	**17.9 h**	**38.4 h**	**11.8 h**	**39.4**	**39.9**	**1.12**	**0.95**	**35.2**	**35.4**	**40.2**	**40.1**	--	**40.2**
pH	Field	pH units	**6.35**	--	--	--	--	--	**7.58**	**7.31**	**5.77**	--	--	--	--	**6.32**	**6.30**	**7.88**	**7.71**	**6.16**	**6.19**	**6.19**	**6.93**	--	**6.62**
Solids, percent	Lab	%	**16.4**	--	--	--	--	--	**79.1**	**55.5**	**8.67**	--	--	--	--	**9.64**	**10.3**	**83.5**	**85.2**	**7.43**	**7.72**	**11.8**	**13.2**	--	**8.05**
Solids, total	Lab	%	--	--	**22.0**	**16.5**	**32.9**	**40.8**	--	--	--	**31.3**	**25.8**	**13.4**	**30.6**	--	--	--	--	--	--	--	--	**84**	--
SVOCs																									
1,6-Dinitropyrene	Lab	mg/kg	--	< 10.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	< 10.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	< 41	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.49**	< 4.5	< 4.3	< 2.8	< 2.5	**0.64**	< 4.1
Benzo(a)pyrene	Lab	mg/kg	< 41	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.47**	< 4.5	< 4.3	< 2.8	< 2.5	**1.0**	< 4.1
Benzo(b)fluoranthene	Lab	mg/kg	**99**	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.70**	< 4.5	< 4.3	< 2.8	< 2.5	**1.8**	< 4.1
Benzo(k)fluoranthene	Lab	mg/kg	< 41	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.48**	< 4.5	< 4.3	< 2.8	< 2.5	**0.76**	< 4.1
Chrysene	Lab	mg/kg	< 41	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.64**	< 4.5	< 4.3	< 2.8	< 2.5	**0.78**	< 4.1
Dibenz(a,h)acridine	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	< 41	< 1.00	--	--	--	--	--	--	< 3.9	--	--	--	--	< 3.5	< 3.3	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.2
Dibenz(a,j)acridine	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	< 5.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	**97**	< 1.00	--	--	--	--	--	--	< 3.9	--	--	--	--	< 3.5	< 3.3	< 0.40	**0.37**	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.2
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	mg/kg	< 8.1	--	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
2-Methylnaphthalene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
Acenaphthene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
Acenaphthylene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1

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West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	E-3	E-3	E-4	E-4	E-4	E-4	F-1	F-2	F-3	F-3	F-3	F-3	F-3	F-4		G-1	G-2	G-3 0-0.5'	G-3 0.5-1.5'	G-3 1.5-2.5'	G-3 2.5-4'	G-3 H-3	G-4 0-0.5'
		Date	1/20/2003	4/21/2003	2/02/2015	2/02/2015	2/02/2015	2/02/2015	1/20/2003	1/20/2003	1/20/2003	2/02/2015	2/02/2015	2/02/2015	2/02/2015	1/20/2003		1/20/2003	2/04/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	12/04/1998	1/21/2003
		Depth			3.5 - 5 ft	5 - 6.5 ft	6.5 - 9 ft	9 - 10 ft				2.5 - 4 ft	4 - 5.5 ft	5.5 - 9 ft	9 - 10 ft										
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units																							
Anthracene	Lab	mg/kg	**14**	**0.50 pp**	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.69**	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	mg/kg	**100**	< 1.00	--	--	--	--	--	--	< 3.9	--	--	--	--	< 3.5	< 3.3	< 0.40	**0.34**	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.2
Carbazole	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	mg/kg	**35**	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.97**	< 4.5	< 4.3	< 2.8	< 2.5	**0.91**	< 4.1
Fluorene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
Naphthalene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	< 0.33	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
Pentachlorophenol	Lab	mg/kg	**77**	< 5.00	--	--	--	--	< 2.6	**4.6**	< 24	--	--	--	--	< 21	< 20	< 2.4	**3.3**	< 27	< 26	< 17	< 16	**1.0**	< 25
Perylene	Lab	mg/kg	--	< 1.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	mg/kg	< 8.1	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**0.94**	< 4.5	< 4.3	< 2.8	< 2.5	< 0.33	< 4.1
Pyrene	Lab	mg/kg	**74**	< 1.00	--	--	--	--	--	--	< 3.8	--	--	--	--	< 3.5	< 3.2	< 0.40	**1.0**	< 4.5	< 4.3	< 2.8	< 2.5	**1.1**	< 4.1
Chlorinated Dioxins / Furans																									
2,3,7,8-Dioxin, tetra	Lab	ng/kg	**140.802 j**	--	**6.54**	**3.80 EMPC**	**47.2**	< 1.47	--	--	--	**21.6**	**26.5**	**17.7**	< 0.298	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	**2003.655**	--	**66.4**	**55.3**	**124**	**35.9 EMPC**	--	--	--	**119**	**190**	**98.3**	**0.850 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	**10035.896**	--	**164**	**275**	**31.6**	**184**	--	--	--	**538**	**547**	**265**	**0.826 EMPC**	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	**69659.364**	--	**634**	**1050**	**279**	**2050**	--	--	--	**2560**	**2440**	**480**	**2.63 EMPC**	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	**33422.315 b**	--	**487**	**407**	**54.1**	**168**	--	--	--	**995**	**800**	**301**	**1.37 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**2442188.8 eb**	--	**40500**	**55100 ***	**22500 ***	**232000 ***	--	--	--	**122000**	**72000 ***	**11500**	**62.7**	--	--	--	--	--	--	--	--	--	--
Dioxin, octa	Lab	ng/kg	**5830616.8 e**	--	**366000**	**397000 ***	**134000 ***	**2220000 ***	--	--	--	**1450000**	**602000 ***	**145000**	**685**	--	--	--	--	--	--	--	--	--	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	**81.296 j**	--	**6.36**	< 2.91	**40.7**	< 1.17	--	--	--	**27.0**	**28.9 EMPC**	**18.6 EMPC**	< 0.312	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	**396.863 j**	--	**34.2**	**34.1**	**123**	**1.66 EMPC**	--	--	--	**75.4**	**88.3**	**61.2**	**1.01 EMPC**	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	**187.590 j**	--	**25.8**	**75.2**	**2.66 j**	< 3.02	--	--	--	**179**	**237**	**136**	**0.732 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	**10050.701 b**	--	**260**	**316**	**21.7**	**170 ***	--	--	--	**720 ***	**847**	**379**	**1.53 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**2324.595**	--	**72.5**	**81.5**	**72.7**	**30.3 ***	--	--	--	**330**	**290**	**106**	**0.844 EMPC**	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**5274.657**	--	**112**	**141**	**9.92**	**64.8**	--	--	--	**473**	**186 EMPC**	**162**	**1.08 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	< 2.5	--	**144**	**85.2 ***	< 4.22 *	< 31.5	--	--	--	**358**	**258 ***	**164**	**1.57 j**	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**642346.511 e**	--	**3730**	**7290**	**1350**	**12400 j***	--	--	--	**30700**	**17800**	**3150**	**16.7**	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	**23567.064**	--	**279**	**422**	**67.9**	**533 ***	--	--	--	**1220**	**1270**	**298**	**2.02 j**	--	--	--	--	--	--	--	--	--	--
Dibenzofuran, octa	Lab	ng/kg	**3021912.8 eb**	--	**29900**	**29300 EMPC***	**9360 ***	**91700 ***	--	--	--	**228000**	**91300 ***	**7960**	**106**	--	--	--	--	--	--	--	--	--	--
TEQ $_{DF}$ WHO05 · non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	**38110**	--	--	--	--	--	**64**	**440**	**2300**	--	--	--	--	**586**	**285**	**101**	**171**	**774**	**1791**	**94**	**64**	--	**270**
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3450 a**	--	--	--	**2840 a**	**1950 a**	**542 a**	**3.14 a**	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3430 a**	--	--	--	**2840 a**	**1940 a**	**541 a**	**2.91 a**	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3450 a**	--	--	--	**2840 a**	**1950 a**	**542 a**	**3.47 a**	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3430 a**	--	--	--	**2840 a**	**1940 a**	**541 a**	**3.24 a**	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3450 a**	--	--	--	**2840 a**	**1950 a**	**542 a**	**3.3 a**	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	--	--	**834**	**1070 a**	**509 a**	**3430 a**	--	--	--	**2840 a**	**1940 a**	**541 a**	**3.07 a**	--	--	--	--	--	--	--	--	--	--

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

			Location	G-4 0.5-1.5'	G-4 0.5-1.5'	G-4 1.5-2.5'	G-4 2.5-4'	G-5 0-0.5'	G-5 0.5-1.5'	G-5 1.5-2.5'	G-5 2.5-4'	H-1	H-2	H-3		H-4
			Date	1/20/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/20/2003	1/20/2003	2/04/2003		2/04/2003
			Depth													
			Sample Type	N	N	N	N	N	N	N	N	N	N	N	FD	N
Parameter	Analysis Location	Units														
General Parameters																
Carbon, total organic	Lab	%	--	**31.7**	**32.0**	**4.33**	**35.3**	**30.0**	**10.8**	**4.70**	**0.96**	**5.16**	**2.61**	**2.46**	**6.45**
pH	Field	pH units	--	**6.26**	**6.53**	**7.16**	**7.05**	**7.19**	**7.38**	**7.43**	**7.43**	**7.00**	**7.39**	**7.27**	**9.98**
Solids, percent	Lab	%	--	**19.8**	**21.4**	**43.3**	**7.49**	**11.4**	**33.6**	**52.8**	**81.1**	**66.1**	**76.7**	**77.9**	**74.8**
Solids, total	Lab	%	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	**1.7**	**0.58**	**0.40**	< 1.7
Benzo(a)pyrene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	**0.43**	< 5.0	< 1.7	< 1.7	< 1.7
Benzo(b)fluoranthene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 5.0	< 1.7	< 1.7	< 1.7
Benzo(k)fluoranthene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 5.0	< 1.7	< 1.7	< 1.7
Chrysene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	**0.44**	**1.8**	**0.77**	**0.55**	< 1.7
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 3.0	< 0.99	< 0.63	< 0.42	< 5.0	< 1.7	< 1.7	< 1.7
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 3.0	< 0.99	< 0.63	< 0.42	< 5.0	< 1.7	< 1.7	< 1.7
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33
2-Methylnaphthalene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33
Acenaphthene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33
Acenaphthylene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	G-4 0.5-1.5'	G-4 0.5-1.5'	G-4 1.5-2.5'	G-4 2.5-4'	G-5 0-0.5'	G-5 0.5-1.5'	G-5 1.5-2.5'	G-5 2.5-4'	H-1	H-2	H-3		H-4
		Date	1/20/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/21/2003	1/20/2003	1/20/2003	2/04/2003		2/04/2003
		Depth													
		Sample Type	N	N	N	N	N	N	N	N	N	N	N	FD	N
Parameter	Analysis Location	Units													
Anthracene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	**0.62**	**0.89**	**1.2**	< 0.33
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 3.0	< 0.99	< 0.63	< 0.42	< 5.0	< 1.7	< 1.7	< 1.7
Carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	**0.47**	**3.0**	**1.2**	**0.68**	< 0.33
Fluorene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33
Naphthalene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	< 0.50	< 0.33	< 0.33	< 0.33
Pentachlorophenol	Lab	mg/kg	--	< 11	< 9.4	< 4.7	< 27	< 18	< 6.0	< 3.8	< 2.5	< 3.1	< 2.0	< 2.0	< 2.0
Perylene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	< 0.41	**2.7**	**1.2**	**0.63**	< 0.33
Pyrene	Lab	mg/kg	--	< 1.7	< 1.6	< 0.77	< 4.5	< 2.9	< 0.99	< 0.63	**0.71**	**3.5**	**1.7**	**1.2**	< 1.7
Chlorinated Dioxins / Furans															
2,3,7,8-Dioxin, tetra	Lab	ng/kg	< 1.0	--	--	--	--	--	--	--	--	< 1.0	--	--	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	**14.206 j**	--	--	--	--	--	--	--	--	**11.183 j**	--	--	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	**48.588**	--	--	--	--	--	--	--	--	**25.260 j**	--	--	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	**246.881**	--	--	--	--	--	--	--	--	**295.504**	--	--	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	**104.928**	--	--	--	--	--	--	--	--	**77.656**	--	--	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**8658.012 b**	--	--	--	--	--	--	--	--	**7855.079**	--	--	--
Dioxin, octa	Lab	ng/kg	**61751.673 eb**	--	--	--	--	--	--	--	--	**61893.534 eb**	--	--	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	**12.805 jc**	--	--	--	--	--	--	--	--	**39.043 jc**	--	--	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	**36.098**	--	--	--	--	--	--	--	--	**51.525**	--	--	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	**21.062 j**	--	--	--	--	--	--	--	--	**42.979**	--	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	**225.651 b**	--	--	--	--	--	--	--	--	**310.538**	--	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**69.542**	--	--	--	--	--	--	--	--	**79.983**	--	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**105.359**	--	--	--	--	--	--	--	--	**133.655**	--	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	**75.530**	--	--	--	--	--	--	--	--	**96.315 EMPC**	--	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**2426.956**	--	--	--	--	--	--	--	--	**2551.074**	--	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	**169.898**	--	--	--	--	--	--	--	--	**229.146**	--	--	--
Dibenzofuran, octa	Lab	ng/kg	**6130.769 b**	--	--	--	--	--	--	--	--	**5278.028**	--	--	--
TEQ $_{DF}$ WHO05 : non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	--	**723**	**114**	<5	**523**	**850**	**643**	**28**	**102**	**306**	**62 ***	**42 b***	**59**
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--	--	--

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	H-5		I-1	I-2 0-0.5'	I-2 0.5-1.5'	I-2 1.5-2.5'	I-2 2.5-4'	I-3	J-1	J-2	J-3
		Date	1/20/2003		1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003
		Depth											
		Sample Type	N	FD	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units											
General Parameters													
Carbon, total organic	Lab	%	38.3	34.5	39.2	39.4	37.9	38.4	42.5	38.6	39.4	38.3	39.3
pH	Field	pH units	6.06	6.07	6.03	6.25	5.89	6.44	6.53	6.29	5.90	5.90	6.22
Solids, percent	Lab	%	11.8	12.6	5.68	4.90	7.30	10.6	9.09	10.5	7.49	6.22	15.8
Solids, total	Lab	%	--	--	--	--	--	--	--	--	--	--	--
SVOCs													
1,6-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
1,8-Dinitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
1-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
2-Nitrofluorene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
3-Methylcholanthrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
4-Nitropyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
5-Methylchrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
5-Nitroacenapthene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
6-Nitrochrysene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
7h-Dibenzo(c,g)carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Benzo(a)pyrene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Benzo(b)fluoranthene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Benzo(k)fluoranthene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Chrysene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Dibenz(a,h)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	Lab	mg/kg	< 2.9	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.4	< 2.2
Dibenz(a,j)acridine	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,i)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,l)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	mg/kg	< 2.9	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.4	< 2.2
B(a)P Equivalent, non-detects at 0, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1/2, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--
B(a)P Equivalent, non-detects at 1x, 2002 PEFs	Calc	mg/kg	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
2-Methylnaphthalene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Acenaphthene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Acenaphthylene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1

Table A-1
West Area Soil Quality Data
Joslyn Manufacturing Supply Co.
Brooklyn Center, Minnesota

		Location	H-5		I-1	I-2 0-0.5'	I-2 0.5-1.5'	I-2 1.5-2.5'	I-2 2.5-4'	I-3	J-1	J-2	J-3
		Date	1/20/2003		1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003	1/20/2003
		Depth											
		Sample Type	N	FD	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units											
Anthracene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
B(a)P Equivalent, 1999 PEFs	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	mg/kg	< 2.9	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.4	< 2.2
Carbazole	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Fluorene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Naphthalene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Pentachlorophenol	Lab	mg/kg	< 17	< 16	< 36	< 41	< 28	< 19	< 23	< 20	< 27	< 33	< 13
Perylene	Lab	mg/kg	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Pyrene	Lab	mg/kg	< 2.8	< 2.7	< 5.9	< 6.8	< 4.6	< 3.2	< 3.7	< 3.2	< 4.5	< 5.3	< 2.1
Chlorinated Dioxins / Furans													
2,3,7,8-Dioxin, tetra	Lab	ng/kg	--	--	< 1.0	--	--	--	--	--	--	**1.013 jEMPC**	--
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	--	--	< 2.5	--	--	--	--	--	--	**4.348 j**	--
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	--	--	**44.231 j**	--	--	--	--	--	--	**10.716 j**	--
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	--	--	**184.018 j**	--	--	--	--	--	--	**45.538**	--
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	--	--	**62.073 jEMPC**	--	--	--	--	--	--	**27.005**	--
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	--	--	**7180.028 eb**	--	--	--	--	--	--	**1272.648**	--
Dioxin, octa	Lab	ng/kg	--	--	**37177.779 b**	--	--	--	--	--	--	**7284.551 eb**	--
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	--	--	< 1.0	--	--	--	--	--	--	**5.352 jc**	--
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	--	--	< 2.5	--	--	--	--	--	--	**6.576 j**	--
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	--	--	< 2.5	--	--	--	--	--	--	**6.918 jEMPC**	--
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	--	**106.487 jb**	--	--	--	--	--	--	**39.183**	--
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	--	**31.46 j**	--	--	--	--	--	--	**11.419 j**	--
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	--	--	**42.957 jEMPC**	--	--	--	--	--	--	**18.091**	--
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	--	--	**11.995 j**	--	--	--	--	--	--	**8.059 j**	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	--	--	**1490.469**	--	--	--	--	--	--	**358.658**	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	--	--	**67.155 j**	--	--	--	--	--	--	**27.197 EMPC**	--
Dibenzofuran, octa	Lab	ng/kg	--	--	**6414.033 b**	--	--	--	--	--	--	**976.888**	--
TEQ $_{DF}$ WHO05 · non-detects at zero for the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TEQ DF WHO05, non-detects at half of the detection limit	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
Dioxin TEQ (by method 4425)	Lab	ng/kg	**534**	**465**	**1921**	<44	**689**	**145**	**181**	**35**	**17**	**252**	**123**
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 0, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1, TEF 2005 (EMPC @ 1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC @ 1)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--
TCDD Equivalent, reporting limit at 1/2, TEF 2005 (EMPC@1/2)	Calc	ng/kg	--	--	--	--	--	--	--	--	--	--	--

Table A-2
Historic Soil Quality Data - Southern Lots and Roadway
Joslyn Manufacturing and Supply Company
Brooklyn Center, Minnesota

		Location	RES1-SI1	RES1-SI2	RES1-SI3		RES2-SI1	RES2-SI3	RES2-SI4	SA1-Comp	SA2-Comp	SA3-COMP	SA4-COMP	SA5-Comp	SA6-Comp	SA7-Comp	T1-Comp	T2-Comp	T3-Comp	T4-1
		Date	3/04/2005	3/04/2005	3/04/2005		3/04/2005	3/04/2005	3/04/2005	9/02/2004	9/02/2004	9/02/2004	9/02/2004	9/02/2004	9/02/2004	9/02/2004	07/29/2009	07/29/2009	07/29/2009	07/29/2009
		Depth	0 - 0.5 ft				0 - 0.5 ft	0.5 - 1.5 ft	1.5 -4 ft								0-4 ft	0-4 ft	0-4 ft	0-4 ft
		Sample Type	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Analysis Location	Units																		
General Parameters																				
Carbon, total organic	Lab	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**19.3**	**7.15**	**5.75**	**28.8**
Solids, total	Lab	%	--	--	--	--	--	--	--	**82.5**	**80.6**	**75.2 h**	**68.1 h**	--	--	--	--	--	--	--
Herbicides																				
Pentachlorophenol	Lab	mg/kg	--	--	--	--	--	--	--	< 0.0061	< 0.0062	< 0.0067 h	< 0.0073 h	--	--	--	--	--	--	--
Chlorinated Dioxins / Furans																				
2,3,7,8-Dioxin, tetra	Lab	ng/kg	< 1.0	< 1.0	**2.725 EMPC**	< 1.0	< 1.0	< 1.0	< 0.992	< 1.0	< 1.0	< 0.019 h	< 0.057 h	< 1.0	< 1.0	**0.165 jEMPC**	**2.26**	**0.913 j**	**0.610 jEMPC**	< 0.167
1,2,3,7,8-Dioxin, penta	Lab	ng/kg	**0.642 j**	**1.956 j**	**4.333**	**5.957**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	**0.280 jh**	< 0.035 h	**0.214 j**	**0.179 jEMPC**	**0.317 j**	**10.8**	**8.07**	**4.47**	**3.57 j**
1,2,3,4,7,8-Dioxin, hexa	Lab	ng/kg	**1.944 j**	**7.1940**	**77.327**	**102.864**	**0.232 j**	**0.285 j**	< 2.481	< 2.5	< 2.5	**0.471 jhEMPC**	**0.078 jh**	**0.455 j**	**0.313 jEMPC**	**0.347 jEMPC**	**34.7**	**26.7**	**12.6**	**5.78**
1,2,3,6,7,8-Dioxin, hexa	Lab	ng/kg	**7.813**	**62.854**	**390.921**	**719.823**	**0.660 j**	**0.911 j**	**2.830 j**	< 2.5	< 2.5	**1.277 jh**	**0.306 jh**	**1.255 j**	**0.948 j**	**1.206 j**	**794 e**	**471**	**108**	**169**
1,2,3,7,8,9-Dioxin, hexa	Lab	ng/kg	**5.529**	**25.329**	**58.555**	**122.937**	**0.490 j**	**0.708 j**	< 2.481	< 2.5	< 2.5	**1.134 jh**	**0.224 jhEMPC**	**1.128 j**	**1.003 j**	**1.227 j**	**123**	**83.6**	**35.1**	**25.4**
1,2,3,4,6,7,8-Dioxin, hepta	Lab	ng/kg	**248.611**	**2656.809**	**16540.965**	**36059.420**	**21.136**	**29.226**	**145.291**	**132.713**	**46.878**	**39.439 bh**	**7.937 bh**	**35.232**	**27.327**	**29.941**	**32900**	**17300**	**5360**	**10100**
Dioxin, octa	Lab	ng/kg	**1843.382 eb**	**19942.814 eb**	**271822.016 eb**	**570865.629 eb**	**145.517 b**	**193.481 b**	**1002.516 eb**	**1073.116 e**	**341.913**	**280.959 bh**	**49.565 bh**	**294.493**	**244.150**	**228.059**	**234000 e**	**132000**	**44700**	**97400**
2,3,7,8-Dibenzofuran, tetra	Lab	ng/kg	< 1.0	**7.499 c**	**6.097 c**	**6.274 c**	< 1.0	< 1.0	< 0.992	< 1.0	< 1.0	**0.425 ch**	< 0.058 h	< 0.443	< 0.350	< 0.464	**1.49 EMPC**	**4.26**	**0.772 j**	< 0.558
1,2,3,7,8-Dibenzofuran, penta	Lab	ng/kg	< 2.5	**0.969 j**	**33.480**	**37.517**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	**0.149 jh**	< 0.047 h	**0.158 j**	< 2.5	< 2.5	**5.34 P**	**11.8 P**	**2.12 jEMPC**	**1.67 j EMPCP**
2,3,4,7,8-Dibenzofuran, penta	Lab	ng/kg	< 2.5	**1.930 j**	**27.610**	**31.845**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	**0.276 jh**	< 0.044 h	**0.284 j**	**0.342 j**	**0.420 j**	**6.18**	**10.6**	**1.52 j**	**0.471 j**
1,2,3,4,7,8-Dibenzofuran, hexa	Lab	ng/kg	**2.945 jEMPC**	**11.841**	**246.71**	**300.766**	**0.464 j**	**0.458 j**	**0.572 jEMPC**	< 2.5	< 2.5	**0.998 jbh**	**0.218 jbh**	**0.635 jEMPC**	**0.563 jEMPC**	**0.605 j**	**170**	**154 P**	**22.5**	**28**
1,2,3,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**0.923 jEMPC**	**3.356**	**47.883**	**60.483**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	**0.430 jh**	**0.120 jh**	**0.521 j**	**0.395 jEMPC**	**0.654 j**	**27.7**	**36.5**	**5.82**	**4.64 j**
1,2,3,7,8,9-Dibenzofuran, hexa	Lab	ng/kg	< 2.5	< 2.5	< 2.5	**15.142**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	< 0.120 h	< 0.022 h	< 2.5	< 2.5	< 2.5	**4.38 P**	**10.2 P**	**2.15 j**	< 1.37
2,3,4,6,7,8-Dibenzofuran, hexa	Lab	ng/kg	**2.278 j**	**2.871**	**64.604**	**48.965**	< 2.5	< 2.5	< 2.481	< 2.5	< 2.5	**0.490 jh**	**0.191 jh**	**1.093 j**	**1.000 j**	**1.611 j**	**70**	**66.3 P**	**14.1**	**13.7**
1,2,3,4,6,7,8-Dibenzofuran, hepta	Lab	ng/kg	**73.351**	**441.851**	**4050.639**	**6750.237**	**4.831**	**6.755**	**37.458**	**23.134**	**8.163**	**10.748 bh**	**1.736 jbh**	**14.027**	**9.191**	**10.379**	**7540**	**4310**	**1120**	**1880**
1,2,3,4,7,8,9-Dibenzofuran, hepta	Lab	ng/kg	**5.477**	**37.704**	**311.2**	**524.085**	**0.469 j**	**0.486 jEMPC**	< 2.481	< 2.5	< 2.5	**0.958 jh**	**0.159 jh**	**0.677 j**	**0.581 j**	**0.512 j**	**529**	**331**	**71.2**	**119**
Dibenzofuran, octa	Lab	ng/kg	**360.604**	**2142.915**	**20242.349 e**	**42579.379**	**15.455**	**22.554**	**250.824**	**98.848**	**32.620**	**35.586 h**	**5.404 h**	**49.653**	**31.620**	**41.648**	**63000**	**32400**	**7640**	**15400**
TCDD Equivalent, reporting limit at 0, TEF 2005	Calc	ng/kg	**6.53 a**	**52.6 a**	**401 a**	**772 a**	**0.497 a**	**0.663 a**	**2.52 a**	**1.91 a**	**0.663**	**1.43 a**	**0.196 a**	**1.38 a**	**1.00 a**	**1.56 a**	**639**	**367**	**107**	**183**
TCDD Equivalent, reporting limit at 1/2, TEF 2005	Calc	ng/kg	**7.61 a**	**53.3 a**	**401 a**	**772 a**	**3.08 a**	**3.25 a**	**5.34 a**	**5.01 a**	**3.76**	**2.07 a**	**2.53 a**	**2.03 a**	**1.68 a**	**1.75 a**	**639**	**367**	**107**	**183**

Barr Standard Footnotes and Qualifiers (Historical)

--	Not analyzed/Not available.
N	Sample Type: Normal
FD	Sample Type: Field Duplicate
a	Estimated value, calculated using some or all values that are estimates.
b	Potential false positive value based on blank data validation procedures.
c	Coeluting compound.
e	Estimated value, exceeded the instrument calibration range.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.
j	Reported value is less than the stated laboratory quantitation limit and is considered an estimated value.
p	Relative percent difference is >40% (25% CLP pesticides) between primary and confirmation GC columns.
EMPC	Estimated maximum possible concentration.

Minnesota Soil Reference Values

DI	Value represents a criteria for 2,3,7,8-TCDD or 2,3,7,8-TCDD equivalents.

Appendix B

Regulatory Classification of OU5 Soils Memorandum

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BARR

Memorandum

To: Steve Schoff (MPCA)
From: Dale W. Finnesgaard
Subject: Regulatory Classification of OU5 Soils
Date: January 31, 2017
Project: 23/27-0110

This technical memorandum summarizes Joslyn's understanding of the regulatory classification of Operable Unit 5 (OU5) soils (West Area soil and soil from Southern Lots) and discusses the implementability of, and the regulatory requirements for, OU5 soils remedial action. Barr, Joslyn, and the MPCA have exchanged both written and oral communications about this subject. This is an update of memorandums prepared previously.[1] This memorandum is included as an appendix to Joslyn's focused feasibility study (FFS), which will be used to support the remedy selection process. The regulatory determination of whether these soils must be managed as hazardous waste and the application of EPA and MPCA policies will affect the implementability and cost of remedial actions considered.

The FFS evaluates remedies designed to address polycyclic aromatic hydrocarbon (PAH), pentachlorophenol (PCP), and dioxin/furan soil contamination in OU5, including:

- Onsite consolidation and isolation of these soils from the human and ecological receptors by means of a clean soil cover.
- Excavation and offsite disposal of soils that exceed the MPCA cleanup criteria.

Figure 1 presents a flowchart which illustrates the organization of this memorandum and also illustrates the sequence of contaminated soil classification and management decisions that follow from the relevant policies and criteria as they are applied to the OU5 soils.

Section 1 of this memorandum evaluates issues associated with consolidate-and-cover remedial options. Soil remedies in Alternatives 4, 5, 6, 7, 8A, and 8B in the FFS include the consolidation of either a portion of or all OU5 soils that require remediation under a clean soil cover. Section 2 evaluates issues associated with excavate-and-offsite-disposal remedial actions. Soil remedies in Alternatives 3, 7, 8A, and 8B in the FFS include the excavation and offsite disposal of either a portion of or all OU5 soils that require remediation.

[1] Barr Engineering Co. Memorandum, Re: Regulatory Classification of West Area Soils; May 7, 2007, and Barr Engineering Co. Memorandum, Re: Regulatory Classification of OU5 Soils; March 14, 2012.

1.0 Consolidate-and-Cover Remedial Actions

EPA's area of contamination (AOC)[2] policy[3] states that if contaminated environmental media, such as the OU5 soils, is managed within an area of contamination, such as within the Joslyn Site, then the management of that soil would not create a new point of hazardous-waste generation. This allows soils to be consolidated or treated *in situ* without triggering land-disposal restrictions or minimum technology requirements. MPCA's "Flowchart for Managing Contaminated Environmental Media"[4] indicates that MPCA's and EPA's application of this policy are consistent. Therefore, alternatives based upon a consolidate-and-cover remedy would not trigger RCRA requirements and would be implementable when evaluated against MPCA and EPA policies.

The entire Joslyn Site (and the contiguous Southern Lots) is the AOC due to its "generally dispersed" contamination at the close of the wood-treating operations in 1980 and below the cap created by the redeveloped portion of the site. Therefore, consolidation can be considered anywhere within the Joslyn Site. However, the soil cannot be moved outside of the AOC at any time during the work.

2.0 Excavate-and-Offsite-Disposal Remedial Actions

Remedial actions that involve moving OU5 soils out of the AOC (out of the Joslyn Site) might trigger RCRA requirements, including RCRA's land-disposal restrictions and minimum technology requirements. The soil would need to be appropriately characterized for offsite disposal because the soil removal would be considered generation of a waste. The following subsections evaluate whether the OU5 soils that require remediation would be managed as hazardous or non-hazardous waste, if the soils were managed off site.

[2] Area of Contamination: …certain discrete areas of generally dispersed contamination… (EPA memorandum, March 13, 1996: "Use of the Area of Contamination Concept During RCRA Cleanups").

[3] AOC Policy: Because an AOC is equated to a RCRA land-based unit, consolidation and in situ treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA. This interpretation allows wastes to be consolidated or treated *in situ* within an AOC without triggering land disposal restrictions or minimum technology requirements. The AOC interpretation may be applied to any hazardous remediation waste (including non-media wastes) that is in or on the land. (EPA, October 14, 1998; "Management of Remediation Waste Under RCRA" and October 15, 1998 Summary Chart of October 14, 1998 Memorandum).

[4] MPCA memorandum – Management of Contaminated Environmental Media, Revisited—February 12, 1996.

2.1 Hazardous Waste Determination – the "Contained-In" Policy

EPA's "contained-in" policy[5] applies to environmental media after the soil leaves the AOC, at which point its removal would be considered the generation of a waste. The MPCA seems to have adopted EPA's "contained-in" policy and has developed its own "contaminated environmental media evaluation protocols" to supplement the "contained-in" policy[6]. EPA and MPCA, by adoption, consider contaminated environmental media to contain a hazardous waste when:

1. They exhibit a characteristic of hazardous waste.
2. They are contaminated with concentrations of hazardous constituents[7] from listed hazardous waste that are above health-based levels[8].

2.1.1 Hazardous Characteristics Criterion

Characteristic hazardous wastes are wastes that exhibit any one or more of the following properties: ignitability, corrosivity, reactivity, or toxicity. Joslyn has addressed whether the OU5 soils exhibit hazardous characteristics and concluded that they do not.[9] MPCA staff does not believe that concentrations below the SRV for PCP will be characteristically hazardous for Lethality (MN01) or for TCLP (D037) [10]. Because OU5 soils do not exceed the current SRV for PCP, the OU5 soils would not be considered to contain a hazardous waste under the hazardous characteristics test.

2.1.2 Hazardous Constituents Criterion

The second contained-in criterion has two separate components. The first is whether the hazardous constituents originated from a listed hazardous waste. The second is whether those hazardous

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[5] *Contained-in Policy: The contained-in principle is the basis for our longstanding policy that applies RCRA Subtitle C requirements to media contaminated with hazardous wastes. Under the contained-in policy, media (e.g., soil) must be managed as a hazardous waste as long as it contains listed hazardous waste or exhibits a hazardous waste characteristic. Under the contained-in policy, when hazardous constituents are present in media below site-specific risk-based levels, the media should no longer be regulated as a hazardous waste. The decision to no longer regulate media as a hazardous waste is made by an authorized state or EPA region on a case-by-case basis via a contained-in determination.* (Land Disposal Restrictions: Summary of Requirements, EPA 530-R-01-007, Revised August 2001).

[6] MPCA Memorandum: Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste. September 7, 2004.

[7] Hazardous Constituents listed in 40 CFR Part 261, Appendix VIII. Land Disposal Restrictions: Summary of Requirements, EPA 530-R-01-007, Revised August 2001. Also duplicated in MN Rule Ch. 7045.0141.

[8] Land Disposal Restrictions: Summary of Requirements, EPA 530-R-01-007, Revised August 2001.

[9] Barr Memorandum, "West Area Soil Characterization." August 26, 2004.

[10] MPCA letter (David Douglas), Re: Joslyn Manufacturing and Supply Company Superfund Site. November 2, 2004.

constituents, originating from a listed hazardous waste, are present above health-based levels. If both criteria are positive, then, per the MPCA policy, the soil "contains a hazardous waste" and must be managed as a hazardous waste. If either criterion is negative (and the media are not characteristically hazardous), then the soil can be managed as a non-hazardous waste.

2.1.2.1 Contamination from a Listed Hazardous Waste

This component requires a determination of whether the hazardous constituents found in OU5 soils originated from a listed hazardous waste. EPA and MPCA policy seem to differ on the determination of this criterion. Joslyn's review of available information regarding the source or sources of West Area contamination and application of EPA policy[11] lead to the conclusion that it is not possible to identify the source of the OU5 soil contamination and, therefore, it may be assumed that the source is not a listed waste[12]. However, MPCA's determination, based on MPCA's contaminated environmental media protocols[13] is that, because listed hazardous wastes with both waste and product listings are generated at wood-treating sites and because the Joslyn Site is a former wood-treating site, it may be presumed that a listed waste is the source of contamination in OU5 soils. For purposes of this memorandum and the FFS, the MPCA's determination on this issue was used (e.g., contamination found in OU5 soils originated from a listed hazardous waste).

2.1.2.2 Hazardous Constituent Levels

This component requires a determination of whether the hazardous constituents, originating from the listed hazardous waste, found in OU5 soils are present above health-based levels. In November 2004, MPCA indicated that the contained-in determination for the Joslyn Site would be based on PCP and PAHs (represented by B(a)P equivalents) and not dioxins/furans, in comparison to the MPCA's SRVs, which were used as the health-based levels[14].

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[11] EPA, October 14, 1998; "Management of Remediation Waste Under RCRA." and October 15, 1998 Summary Chart of October 14, 1998 Memorandum.

[12] Barr Engineering Co. Memorandum, Re: West Area Soil Characterization—Joslyn Manufacturing Co. Site—Brooklyn Center, Minnesota; August 26, 2004.

[13] MPCA Memorandum, Re: Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste. September 7, 2004.

[14] MPCA letter (David Douglas), Re: Joslyn Manufacturing and Supply Company Superfund Site. November 2, 2004.

MPCA's preliminary remediation goals (PRGs)[15] for the West Area of the Joslyn Site are based on MPCA's current SRVs for industrial land use. The current industrial SRVs for PCP and B(a)P, and thus the PRGs, are as follows:

- 120 ppm PCP.
- 3 ppm B(a)P-equivalents.

If the OU5 soils that require remediation were to be excavated and disposed offsite (i.e., outside of the AOC), about 40% of the soil meets the MPCA's criteria for "containing" a listed waste, which then requires management and disposal as a hazardous waste (see Section 2.2), and approximately 60% of the soil does not meet MPCA's "contained-in" criteria and can be managed and disposed as non-hazardous waste (see Section 2.3).

2.2 Offsite Disposal Requirements for OU5 Soils that "Contains" a Hazardous Waste

About 40% of the OU5 soils meets the MPCA's criteria for "containing" a listed waste, which would require management as a hazardous waste if the soil left the Joslyn Site. Figure 1 illustrates the portions of OU5 soils that would meet MPCA's criteria for "containing" a listed waste—generally WA-6, WA-3, and portions of WA-2 and WA-8.

This section describes the applicable requirements if this soil were to be managed offsite (i.e., outside of the AOC). In order to meet all applicable requirements, this portion of OU5 soils would require treatment via incineration prior to disposal off site.

2.2.1 RCRA Land Disposal Restrictions and Minimum Technical Requirements

In accordance with EPA's contained-in policy, which MPCA has adopted, if contaminated environmental media is determined by policy to contain hazardous waste, they are subject to land-disposal-restriction treatment standards specific for contaminated soils.[16] These treatment standards require that contaminated soils which will be land disposed, or landfilled, must first be treated to reduce concentrations by 90% or to meet hazardous-constituent concentrations that are ten times the universal treatment standards (UTSs), whichever is greater. (This is typically referred to as 90% capped by 10xUTS.) The soil treatment standards apply to all underlying hazardous constituents[17] reasonably expected to be

[15] MPCA Memorandum, Re: Preliminary Remediation Goals for the West Area of the Joslyn Manufacturing and Supply Company Superfund Site. June 1, 2005.

[16] Land Disposal Restrictions: Summary of Requirements, EPA 530-R-01-007, Revised August 2001.

[17] *Underlying Hazardous Constituent: Any constituent listed in 40 CFR 268.48, Table UTS—Universal Treatment Standards, except vanadium, fluoride, selenium, sulfides, and zinc, which can reasonably be expected to be present*

present in any given volume of contaminated soil when such constituents are found at initial concentrations greater than 10xUTS.[18] While it appears that MPCA has adopted EPA's contained-in policy, the UTSs (CFR 40 268.49) have not been incorporated into or referenced by Minnesota in its hazardous waste rules (MN Rule Ch. 7045). Thus, the EPA's UTSs are applicable in Minnesota. Also, since Minnesota does not have a hazardous waste landfill and thus soil disposal as a hazardous waste can only occur outside of Minnesota, the fact that Minnesota has not adopted EPA's UTSs has no impact on the evaluation of remedial actions for the Joslyn Site.

Table 1 presents the concentration of the underlying hazardous constituents in the samples collected from the portions of OU5 that are determined to "contain" a listed waste along with the UTS and 10xUTS for those underlying hazardous constituents. The table highlights samples in which at least one of the hazardous constituent concentrations in the soil exceeds 10xUTSs.

For the OU5 soils, two dioxin/furan analytical methods were used. One method (EPA 8290) provides concentration data for each dioxin and furan congener that is also an underlying hazardous constituent and, therefore, provides the data needed for a direct comparison to the corresponding UTS. The second method (EPA 4425—an immunoassay-based analysis) provides an estimate of the dioxin/furan (expressed as tetrachlorodibenzo-p-dioxin [TCDD] Toxicity Equivalency Quotient [TEQ], or TCDD-TEQ) concentration of the sample. This method does not provide congener-specific concentrations and direct comparison to the UTS is not possible. Based on review of the Method 8290 soil data and comparison of that data to the UTS, it appears that any sample that exceeds 252 parts per trillion (ppt) TCDD-TEQ will also exceed at least one of the UTSs. We compared this value (252 ppt TCDD-TEQ) to the OU5 soils data generated with Method 4425 in Table 1.

As Table 1 shows, most of the OU5 soils that meets MPCA criteria for containing a listed waste will not meet the 10xUTS requirement and, therefore, most of these soils cannot be placed in a Subtitle C (hazardous waste) landfill without treatment.

The treatment method must reduce the concentration of the underlying hazardous constituents by 90% capped by 10xUTS. The effective and available treatment methods for this portion of OU5 soils are limited to commercial incineration. Many hazardous-waste (Subtitle C) incinerators are subject to facility-specific waste acceptance plans that could prevent acceptance of the OU5 soils.

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at the point of generation of the hazardous waste, at a concentration about the constituent-specific UTS treatment standards. (EPA, October 14, 1998; "Management of Remediation Waste Under RCRA").

[18] EPA, October 14, 1998; "Management of Remediation Waste Under RCRA." and October 15, 1998 Summary Chart of October 14, 1998 Memorandum.

In summary, for about 40% of the OU5 soil that requires remediation, excavation and offsite disposal is fully implementable only through incineration and subsequent disposal in a Subtitle C landfill as hazardous waste.

2.3 Offsite Disposal Requirements of OU5 Soils that Do Not "Contain" a Hazardous Waste

About 60% of the OU5 soil that requires remediation does not meet MPCA's "contained-in" criteria and would be managed as non-hazardous waste if the soil left the Joslyn Site. Offsite disposal remedial actions would include a Subtitle D industrial landfill in Minnesota when dioxin concentrations in those soils are also below MPCA's 2006 dioxin policy criteria (10,000 ng/kg or 10 ppb TCCD-TEQ) [19] and a Subtitle C landfill for those soils above the dioxin policy criteria. The 60% of OU5 soils that do not meet MPCA's "contained-in" criteria also do not exceed MPCA dioxin policy criteria, are not characteristically hazardous, and can be disposed offsite in a Subtitle D landfill in Minnesota, subject further to site-specific consideration by the MPCA and the other conditions specified by the agency.

3.0 Conclusions

The consolidate-and-cover remedial actions do not "generate" wastes and would not trigger RCRA land-disposal restrictions and minimum technology requirements, provided the OU5 soils remain within the area of contamination (AOC). The Joslyn Site and the Southern Lots are all within the AOC—a discrete area of generally dispersed, but not necessarily homogenous, contamination. Therefore, consolidate-and-cover actions are implementable anywhere on the Joslyn Site.

For excavate-and-offsite-disposal remedial actions, the "contained-in" policy determines whether the soil meets EPA and/or MPCA criteria for "containing" a listed hazardous waste and, thus, whether RCRA land-disposal restrictions and minimum technology requirements would need to be followed. MPCA applying its contaminated environmental media protocols assumes that the OU5 soil contaminants were likely to have been caused by the release of a listed waste or unused product. Under MPCA's policy, those soils which exceed the soil reference value (SRV) for PCP and/or PAHs (represented by benzo(a)pyrene equivalents or B(a)P) are determined to "contain" a listed waste and RCRA requirements would apply. Approximately 40% of the soil requiring remediation in OU5 falls into this category. Such soil will require treatment prior to disposal and incineration is the only commercially available treatment method that will meet treatment criteria. Thus, incineration and disposal in a Subtitle C landfill could be required for substantially all of the OU5 soils that are determined under MPCA policy to contain listed waste.

[19] MPCA Memorandum (Stephen Thompson and Elizabeth Gawrys), Re: Disposal of Dioxin Contaminated Soil in "Subtitle D" Landfills. August 29, 2006.

For excavate-and-offsite-disposal remedial actions, soils that do not exceed the SRV for PCP and B(a)P are determined to not "contain" a listed waste and RCRA requirements would not apply; however, MPCA's dioxin-contaminated soil policy would apply. Under MPCA criteria, about 60% of the OU5 soils are not considered to "contain" a listed waste. For these soils to be disposed offsite (outside of the AOC), MPCA policy for disposal of dioxin-contaminated soil in a Subtitle D landfill applies. Since these soils meet MPCA criteria and contain less than 10,000 ng/kg TCDD-TEQ, they can be disposed of in a Subtitle D landfill.

Enclosures:

Table 1 – UTS Comparison for OU5 Soils That Meet MPCA "Contained In" Criteria

Figure 1 – Contaminated Soil Management Options for Evaluation of OU5 Remedial Actions

Attachment 1 – Copies of Selected References

MPCA Memorandum: Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste. September 7, 2004. (Included as an attachment to the November 2, 2004 letter.)

MPCA letter (David Douglas), Re: Joslyn Manufacturing and Supply Company Superfund Site. November 2, 2004.

MPCA Memorandum (Stephen Thompson and Elizabeth Gawrys), Re: Disposal of Dioxin Contaminated Soil in "Subtitle D" Landfills. August 29, 2006.

Table 1
UTS Comparison for OU5 Soils That Meet MPCA "Contained In" Criteria
Joslyn Manufacturing Co. Site
(concentrations in mg/kg, unless noted otherwise)

Location Date Lab Dup	1x UTS	10x UTS	A-1 2/4/2003 CAS	A-2 2/4/2003 CAS	A-3 0-0.5' 2/4/2003 CAS	A-3 0.5-1.5' 2/4/2003 CAS	A-3 1.5-2.5' 2/4/2003 CAS	A-3 2.5-4' 2/4/2003 CAS	A-4 2/4/2003 CAS	B-1 2/4/2003 CAS	B-1 0.5-2' 2/2/2015 ALS	B-2 2/4/2003 CAS	B-3 0-0.5' 2/4/2003 CAS	B-3 0.5-1.5' 2/4/2003 CAS	B-3 1.5-2.5' 2/4/2003 CAS	B-3 2.5-4' 2/4/2003 CAS	B-4 2/4/2003 CAS	B-5 2/4/2003 CAS	C-1 2/4/2003 CAS	C-2 2/3/2003 CAS	C-3 0-0.5' 2/4/2003 CAS	C-3 0.5-1.5' 2/4/2003 CAS	C-3 1.5-2.5' 2/4/2003 CAS	C-3 2.5-4' 2/4/2003 CAS	C-4 2/3/2003 CAS	C-5 2/3/2003 CAS	C-5R 4/21/2003 CAS	D-1 2/3/2003 CAS	D-1 0.5 -2' 2/2/2015 ALS	D-2 2/3/2003 CAS	D-3 0-0.5' 2/4/2003 CAS	D-3 0.5-1.5' 2/4/2003 CAS	D-3 1.5-2.5' 2/4/2003 CAS	D-3 2.5-4' 2/4/2003 CAS	D-4 2/3/2003 CAS	E-3 1/20/2003 CAS	F-2 1/20/2003 CAS	G-1 1/20/2003 CAS	H-1 1/20/2003 CAS
Dioxins/Furans, ng/kg																																								
2,3,7,8-TCDD	1000	10000	--	--	--	--	--	--	--	--	5.88	--	<1.0 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	24.1	--	--	--	--	--	--	140.802 j	--	--	--
1,2,3,7,8-Dioxin penta	1000	10000	--	--	--	--	--	--	--	--	149	--	3266.494 jh	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	521	--	--	--	--	--	--	2003.655	--	--	--
1,2,3,4,7,8-Dioxin, hexa	1000	10000	--	--	--	--	--	--	--	--	522	--	**13807.604 jh**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1700	--	--	--	--	--	--	**10035.896**	--	--	--
1,2,3,6,7,8-Dioxin, hexa	1000	10000	--	--	--	--	--	--	--	--	**11900**	--	**34183.592 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**21400**	--	--	--	--	--	--	**69659.364**	--	--	--
1,2,3,7,8,9-Dioxin, hexa	1000	10000	--	--	--	--	--	--	--	--	1070	--	**35156.664 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4160	--	--	--	--	--	--	**33422.315 b**	--	--	--
1,2,3,4,6,7,8-Dioxin, hepta	2500	25000	--	--	--	--	--	--	--	--	**453000**	--	**1106991.3 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**650000**	--	--	--	--	--	--	**2442188.8 eb**	--	--	--
Dioxin octa	5000	50000	--	--	--	--	--	--	--	--	**15000000 e**	--	**5282956.4 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**5200000**	--	--	--	--	--	--	**5830616.8 e**	--	--	--
2,3,7,8-TCDF	1000	10000	--	--	--	--	--	--	--	--	49.8	--	<1.0 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	201	--	--	--	--	--	--	81.296 j	--	--	--
1,2,3,7,8-Dibenzofuran, penta	1000	10000	--	--	--	--	--	--	--	--	316	--	<2.5 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	950	--	--	--	--	--	--	396.863 j	--	--	--
2,3,4,7,8-Dibenzofuran, penta	1000	10000	--	--	--	--	--	--	--	--	702	--	<2.5 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3090	--	--	--	--	--	--	187.590 j	--	--	--
1,2,3,4,7,8-Dibenzofuran, hexa	1000	10000	--	--	--	--	--	--	--	--	4820	--	**13247.806 jh**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**16800**	--	--	--	--	--	--	**10050.701 b**	--	--	--
1,2,3,6,7,8-Dibenzofuran, hexa	1000	10000	--	--	--	--	--	--	--	--	724	--	3687.053 jh	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3170	--	--	--	--	--	--	2324.595	--	--	--
1,2,3,7,8,9-Dibenzofuran, hexa	1000	10000	--	--	--	--	--	--	--	--	957	--	3505.404 jh	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4190	--	--	--	--	--	--	<25	--	--	--
2,3,4,6,7,8-Dibenzofuran, hexa	1000	10000	--	--	--	--	--	--	--	--	1390	--	8107.860 jh	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5320	--	--	--	--	--	--	5274.657	--	--	--
1,2,3,4,6,7,8-Dibenzofuran, hepta	2500	25000	--	--	--	--	--	--	--	--	**120000**	--	**394237.764 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**151000**	--	--	--	--	--	--	**642346.511 e**	--	--	--
1,2,3,4,7,8,9-Dibenzofuran, hepta	2500	25000	--	--	--	--	--	--	--	--	8990	--	17944.152 jh	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15400	--	--	--	--	--	--	23567.064	--	--	--
Dibenzofuran octa	5000	50000	--	--	--	--	--	--	--	--	**3160000**	--	**1609545.0 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**2800000**	--	--	--	--	--	--	**3021912.8 eb**	--	--	--
Dibenzofuran tetra, Total	1000	10000	--	--	--	--	--	--	--	--	86.0	--	<5.0 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	214	--	--	--	--	--	--	1118.086	--	--	--
Dibenzofuran penta, Total	1000	10000	--	--	--	--	--	--	--	--	573	--	**28167.971 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1500	--	--	--	--	--	--	**20655.227**	--	--	--
Dibenzofuran, hexa, Total	1000	10000	--	--	--	--	--	--	--	--	**22000**	--	**262999.264 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**47600**	--	--	--	--	--	--	**525238.854**	--	--	--
Dibenzofuran, hepta, Total			--	--	--	--	--	--	--	--	223000	--	2063008.2 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	162000	--	--	--	--	--	--	2359517.9	--	--	--
Dioxin tetra, Total	1000	10000	--	--	--	--	--	--	--	--	238	--	<5.0 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	826	--	--	--	--	--	--	2341.707	--	--	--
Dioxin penta, Total	1000	10000	--	--	--	--	--	--	--	--	4740	--	**23180.204 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**16600**	--	--	--	--	--	--	**23173.184**	--	--	--
Dioxin, hexa, Total	1000	10000	--	--	--	--	--	--	--	--	**53900**	--	**367397.546 h**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**61500**	--	--	--	--	--	--	**694700.772**	--	--	--
Dioxin, hepta, Total			--	--	--	--	--	--	--	--	141000	--	1813601.8 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	148000	--	--	--	--	--	--	5244224.0	--	--	--
Dioxin TEQ (by method 8290)[2]			--	--	--	--	--	--	--	--	13800	--	30317 h	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17800	--	--	--	--	--	--	47309	--	--	--
Dioxin TEQ (by method 4425)		252**	40 b	194	227	189	56 *	106	229	**13720 ***	--	**4270**	**76960**	**17290**	**13000**	**552**	**355**	38 b	**1425**	222	**5562**	**3003**	**756**	**766**	**493**	**829**	**1126**	**9010**	--	**2850**	**7810**	**4920**	**666**	223	**448**	**38110**	**440**	101	102
SVOCs																																								
2-Chloronaphthalene	5.6	56	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	<0.67	<0.66	<0.33	--	<0.38	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
2-Methylnaphthalene			<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	8.4	0.83	0.48	--	0.43	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Acenaphthene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	22	<0.66	<0.33	--	<0.38	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Acenaphthylene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	2.2	1.1	<0.33	--	<0.38	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Anthracene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	2.4	<1.6	<1.6	<0.95	**99**	11	0.64	--	11	<1.6	<0.94	<1.1	<2.2	<0.84	14	--	<0.40	<0.41
Benzo(g,h,i)perylene	1.8	18	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	<2.0	<1.4	<1.4	2.0	<0.39	<7.0	<0.51	8.4	7.8	<1.6	<1.6	2.2	**120**	53	1.6	--	1.0	<1.6	<0.94	<1.1	<2.2	<0.84	**100**	--	<0.40	<0.42
Fluoranthene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	0.63	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	1.1	<0.51	4.6	3.6	<1.6	<1.6	1.3	**150**	25	6.2	--	1.6	<1.6	<0.94	<1.1	<2.2	<0.84	**35**	--	<0.40	0.47
Fluorene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	24	0.89	<0.33	--	0.71	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Naphthalene	5.6	56	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	12	2.0	0.53	--	<0.38	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Pentachlorophenol	7.4	74	<2.2	<2.6	<3.7	<2.8	<2.4	18	<2.9	69	--	8.1	71	51	59	<8.4	<4.4	<2.4	**76**	<3.1	55	62	13	<9.3	<5.8	<4.1	<4.0	**77**	--	23	9.2	<5.7	<6.5	<14	<5.1	**77**	4.6	<2.4	<2.5
Phenanthrene	5.6	56	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	<1.6	<1.6	<1.6	<0.95	**110**	4.7	1.6	--	1.9	<1.6	<0.94	<1.1	<2.2	<0.84	<8.1	--	<0.40	<0.41
Pyrene	8.2	82	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	0.57	0.54	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	1.6	<0.51	5.8	4.8	<1.6	<1.6	1.8	**180**	48	9.1	--	2.2	2.1	<0.94	<1.1	<2.2	<0.84	74	--	<0.40	0.71
SVOCs BaP Equivalent List																																								
Benzo(a)anthracene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<0.70	<0.51	<3.0	1.7	<1.6	<1.6	1.6	160	43	2.7	--	1.1	<1.6	<0.94	<1.1	<2.2	<0.84	<41	--	<0.40	<0.41
Benzo(b)fluoranthene	6.8	68	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	2.6	<1.4	<1.4	<0.73	<0.39	<7.0	0.65	14	11	<1.6	<1.6	5.5	**300**	**89**	5.1	--	2.8	<1.6	<0.94	<1.1	<2.2	<0.84	**99**	--	<0.40	<0.41
Benzo(k)fluoranthene	6.8	68	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<7.0	<0.51	6.5	4.6	<1.6	<1.6	2.8	**230**	**76**	2.1	--	1.5	<1.6	<0.94	<1.1	<2.2	<0.84	<41	--	<0.40	<0.41
Benzo(a)pyrene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<7.0	<0.51	3.3	2.5	<1.6	<1.6	3.4	**240**	**80**	1.7	--	1.2	<1.6	<0.94	<1.1	<2.2	<0.84	<41	--	<0.40	0.43
Chrysene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<0.45	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	1.0	<0.51	5.6	4.4	<1.6	<1.6	3.6	**320**	**68**	3.9	--	2.4	<1.6	<0.94	<1.1	<2.2	<0.84	<41	--	<0.40	0.44
Dibenz(a,h)anthracene	8.2	82	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	<2.0	<1.4	<1.4	<0.73	<0.39	<7.0	<0.51	<3.0	1.8	<1.6	<1.6	<0.95	49	23	0.53	--	<0.38	<1.6	<0.94	<1.1	<2.2	<0.84	<41	--	<0.40	<0.42
Indeno(1,2,3-cd)pyrene	3.4	34	<0.36	<0.42	<0.61	<0.47	<0.40	<0.39	<0.48	<2.3	--	<0.46	<8.1	2.2	<1.4	<1.4	<0.73	<0.39	<7.0	<0.51	9.2	8.5	<1.6	<1.6	2.5	**140**	**53**	1.7	--	1.2	<1.6	<0.94	<1.1	<2.2	<0.84	**97**	--	<0.40	<0.42
BaP Equivalent[1]			ND	ND	ND	ND	ND	ND	ND	ND	--	350	ND	0.001	0.065	ND	ND	0.48	ND	ND	ND	6.5	0.12	ND	0.63	ND	ND	ND	--	120	5.7	4.4	20	ND	ND	ND	ND	ND	ND

All samples were collected from 0-0.5'
below ground surface except as noted above.

Reported values shown in **BOLD** print are greater than 10 times
the universal treatment standards (UTS's).

**Reported values of Dioxin TEQ (by method 4425) >252 ng/kg
are estimated to be >10 times the UTS's based on these data.

Sample locations where
reported values are or are estimated to be >10 times UTS's.

Table 1
UTS Comparison for OU5 Soils That Meet MPCA "Contained In" Criteria
Joslyn Manufacturing Co. Site
(concentrations in mg/kg, unless noted otherwise)

Location Date Lab Dup	1x UTS	10x UTS	H-2 1/20/2003 CAS	H-3 2/4/2003 CAS	WA-1 12/4/1998 Legend	WA-2 12/4/1998 Legend	WA-3 10/6/2000 CAS	WA-6MID 10/6/2000 STL	WA-6MID 10/6/2000 ALTA	WA-6MID 10/6/2000 CAS	WA-6N 10/6/2000 CAS	WA-6S 10/6/2000 STL	WA-6S 10/6/2000 ALTA	WA-6S 10/6/2000 CAS	WA-8 10/6/2000 CAS
Dioxins/Furans, ng/kg															
2,3,7,8-TCDD	1000	10000	<10	--	7.8	6.5	9.61	2000	1100	1330	7.18	430	262	466	1.41
1,2,3,7,8-Dioxin penta	1000	10000	11.183 j	--	63.4	51.7	256	**29000**	**20000**	**14100**	61.6	8000 e	5880	5760	15.3
1,2,3,4,7,8-Dioxin, hexa	1000	10000	25.260 j	--	177	218	561	**180000**	**144000**	**79600**	233	**26000**	22900	**29700**	381
1,2,3,6,7,8-Dioxin, hexa	1000	10000	295.504	--	1280	1000	**10500**	**210000**	**168000 e**	**105000**	627	**110000**	**95300**	**112000**	495
1,2,3,7,8,9-Dioxin, hexa	1000	10000	77.656	--	502	478	1920	**140000**	**96900**	**60400**	328	**28000**	**35900**	**31900**	81.8
1,2,3,4,6,7,8-Dioxin, hepta	2500	25000	7855.079	--	**32550 e**	19920 e	**251000**	**4400000 ej**	**6540000 e**	**430000**	**16400**	**2300000 e**	**2930000 e**	**1870000**	**10100**
Dioxin octa	5000	50000	**61893.534 be**	--	**267630 e**	**237280 e**	**465000**	**7000000 ej**	**52000000 e**	**2030000**	**117000**	**4900000 ej**	**23500000 e**	**1800000**	**120000**
2,3,7,8-TCDF	1000	10000	39.043 cj	--	42.5	28.3	8.31	1300 e	1340	1120	4.75	130	124	114	9.91
1,2,3,7,8-Dibenzofuran, penta	1000	10000	51.25	--	164	103	59.2	**10000**	8600	6600	28.8	1000	893	722	63.2
2,3,4,7,8-Dibenzofuran, penta	1000	10000	42.979	--	183	105	145	8600	**16800**	**12500**	60.8	1300	2290	1840	123
1,2,3,4,7,8-Dibenzofuran, hexa	1000	10000	310.538	--	1170	793	3050	**79000**	**62500**	**54300**	239	**37000 e**	**30900**	**30400**	458
1,2,3,6,7,8-Dibenzofuran, hexa	1000	10000	79.983	--	341	214	1770	**22000**	**17500**	**14200 (1)**	101	8900 e	8490	**12600 (1)**	149
1,2,3,7,8,9-Dibenzofuran, hexa	1000	10000	96.315 k	--	58.9	44.4 pr	286	3600	**23600**	**21000**	110	500	3270	3730	302
2,3,4,6,7,8-Dibenzofuran, hexa	1000	10000	133.655	--	514	307	1440	**12000**	**34900**	**17700**	123	5200	**13900**	**13500**	1410
1,2,3,4,6,7,8-Dibenzofuran, hepta	2500	25000	2551.074	--	9640 e	8500 e	**101000**	**1100000 ej**	**1210000 e**	**151000**	4230	**1200000 ej**	**1240000 e**	**958000**	4250
1,2,3,4,7,8,9-Dibenzofuran, hepta	2500	25000	229.146	--	1110	686	7300	**91000 j**	**79700**	12700	286	**88000 j**	**65500**	**63500**	437
Dibenzofuran octa	5000	50000	5278.028	--	41080 qe	39420 e	**618000**	**3400000 ej**	**4840000 e**	**504000**	17700	**3200000 ej**	**7900000 e**	**920000**	12200
Dibenzofuran tetra, Total	1000	10000	10.384	--	--	--	394 (1)	--	**18000 (1)**	**9880 (1)**	89.4 (1)	--	7450 (1)	6690 (1)	56.3
Dibenzofuran penta, Total	1000	10000	43.110	--	--	--	5730 (1)	--	**116000 (1)**	**92800 (1)**	672 (1)	--	**53400 (1)**	**61900 (1)**	790 (1)
Dibenzofuran, hexa, Total	1000	10000	1273.296	--	--	--	**131000**	--	**1360000 (1)**	**917000 (1)**	5550 (1)	--	**1060000 (1)**	**975000 (1)**	9000 (1)
Dibenzofuran, hepta, Total			14441.078	--	--	--	599000	--	79700	786000 (1)	19400 (1)	--	5940000	6000000 (1)	17700 (1)
Dioxin tetra, Total	1000	10000	114.879	--	--	--	92.7	--	**35700**	**35000**	210	--	7890	**11800**	36.1
Dioxin penta, Total	1000	10000	720.308	--	--	--	881	--	**295000**	**211000**	1010	--	**62000**	**63100**	177
Dioxin, hexa, Total	1000	10000	4887.065	--	--	--	**28200**	--	**2530000**	**1630000**	8490	--	**531000**	**569000**	2760
Dioxin, hepta, Total			11258.118	--	--	--	361000	--	ND	1160000	47100	--	5240000	3020000	26400
Dioxin TEQ (by method 8290)[2]			254.1	--	1043.31	742.85	5995.90	157540	168785	63532	499.83	67393	73905	59763	571.13
Dioxin TEQ (by method 4425)		252**	**306**	62 b*	--	--	--	--	--	--	--	--	--	--	--
SVOCs															
2-Chloronaphthalene	5.6	56	<0.50	<0.33	<0.33	<0.33	<0.005	--	--	<0.05	<0.005	--	--	<0.05	<0.005
2-Methylnaphthalene			<0.50	<0.33	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	3.4	34	<0.50	<0.33	<0.33	<0.33	<0.005	--	--	0.063	0.048	--	--	<0.05	0.01
Acenaphthylene	3.4	34	<0.50	<0.33	<0.33	<0.33	0.023	--	--	0.54	0.053	--	--	0.13	0.032
Anthracene	3.4	34	0.62	0.89	0.56	<0.33	0.11	--	--	3.1	0.44	--	--	0.38	0.89
Benzo(g,h,i)perylene	1.8	18	<5.0	<1.7	0.67	<0.33	0.15	--	--	3.1	0.49	--	--	0.38	0.32
Fluoranthene	3.4	34	3.0	1.2	4.1	<0.33	0.2 b	--	--	3.6	0.55	--	--	0.29	0.64
Fluorene	3.4	34	<0.50	<0.33	<0.33	<0.33	<0.005	--	--	0.065	0.055	--	--	<0.05	0.068
Naphthalene	5.6	56	<0.50	<0.33	<0.33	<0.33	0.012	--	--	0.2	<0.005	--	--	0.061	0.025
Pentachlorophenol	7.4	74	<3.1	<2.0	4.2	2.3	39	--	--	120 e	0.72	--	--	120	0.83
Phenanthrene	5.6	56	2.7	1.2	1.5	<0.33	0.066	--	--	0.85	0.16	--	--	0.14	0.23
Pyrene	8.2	82	3.5	1.7	5.1	0.41	0.33	--	--	3.6	0.48	--	--	0.49	0.62
SVOCs BaP Equivalent List															
Benzo(a)anthracene	3.4	34	1.7	0.58	1.8	<0.33	0.14	--	--	1.4	0.22	--	--	0.17	0.36
Benzo(b)fluoranthene	6.8	68	<5.0	<1.7	7.2	0.90	0.48	--	--	6.1	0.6	--	--	0.94	0.6
Benzo(k)fluoranthene	6.8	68	<5.0	<1.7	2.1	0.34	0.28	--	--	2.7	0.24	--	--	0.43	0.41
Benzo(a)pyrene	3.4	34	<5.0	<1.7	2.8	0.36	0.17	--	--	2.3	0.24	--	--	0.56	0.37
Chrysene	3.4	34	1.8	0.77	2.6	0.34	0.33	--	--	2.7	0.31	--	--	0.48	0.59
Dibenz(a,h)anthracene	8.2	82	<5.0	<1.7	<0.33	<0.33	0.054	--	--	0.77	0.094	--	--	0.16	0.091
Indeno(1,2,3-cd)pyrene	3.4	34	<5.0	<1.7	0.65	<0.33	0.24	--	--	11	1.1	--	--	0.71	0.57
BaP Equivalent[1]			ND	0.059	3.8	0.45	0.31	--	--	4.9	0.53	--	--	0.91	0.62

All samples were collected from 0-0.5'
below ground surface except as noted above.

Reported values shown in **BOLD** print are greater than 10 times the universal treatment standards (UTS's).

**Reported values of Dioxin TEQ (by method 4425) >252 ng/kg are estimated to be >10 times the UTS's based on these data.

Sample locations where reported values are or are estimated to be >10 times UTS's.

Table 1
UTS Comparison for OU5 Soils That Meet MPCA "Contained In" Criteria
Joslyn Manufacturing Co. Site
Footnotes

--	Not analyzed.
ND	Not detected.
b	Potential false positive based on blank data validation procedure.
j	Reported value is less than the stated laboratory quantitation limit and is considered an estimated value.
e	Estimated value, exceeded the instrument calibration range.
k	EMPC; estimated maximum possible concentration.
h	EPA sample extraction or analysis holding time was exceeded.
*	Estimated value, QA/QC criteria not met.

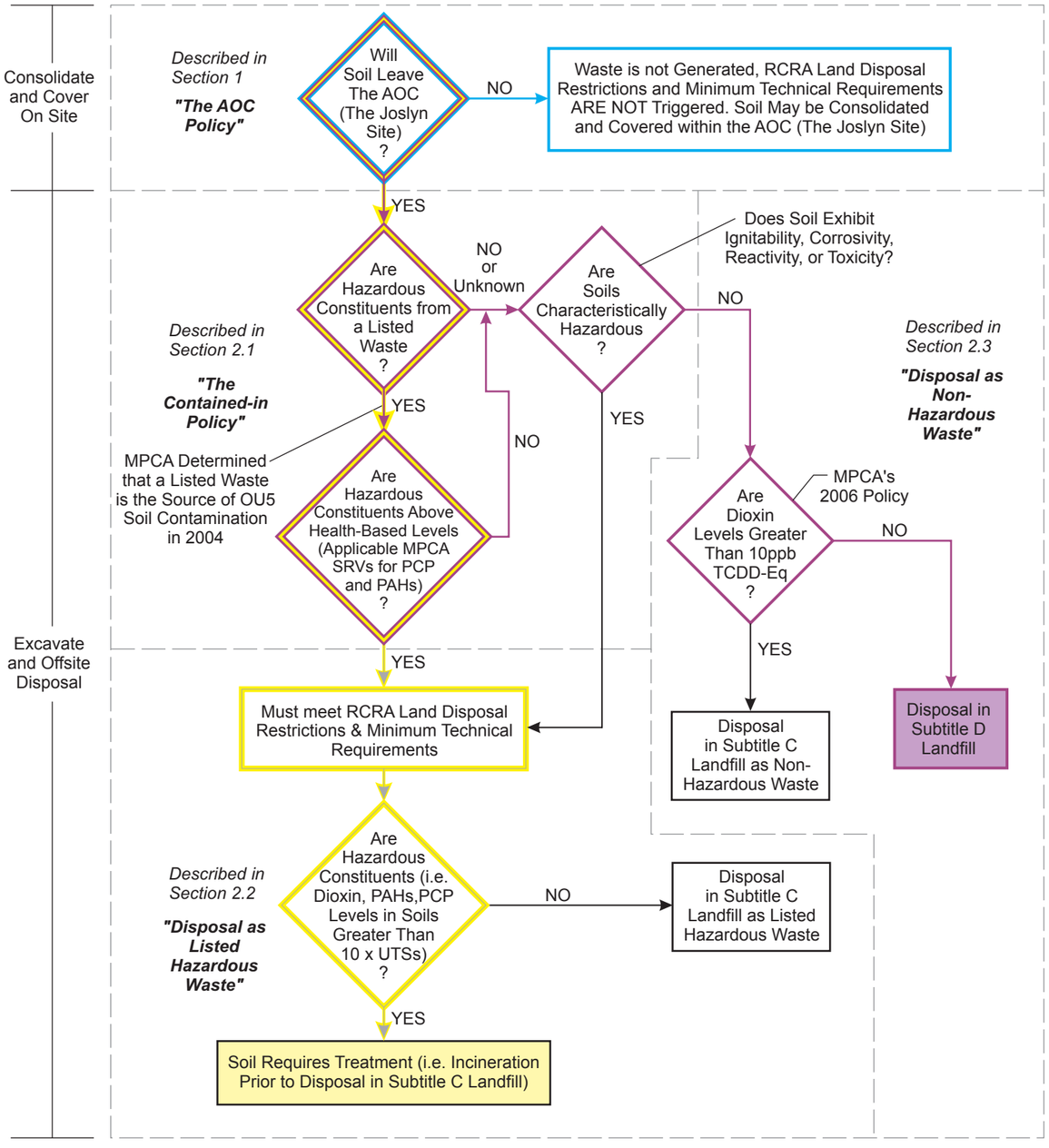
[1] Total BaP equivalents calculated using 0 for the detection limit on the non detected compounds.

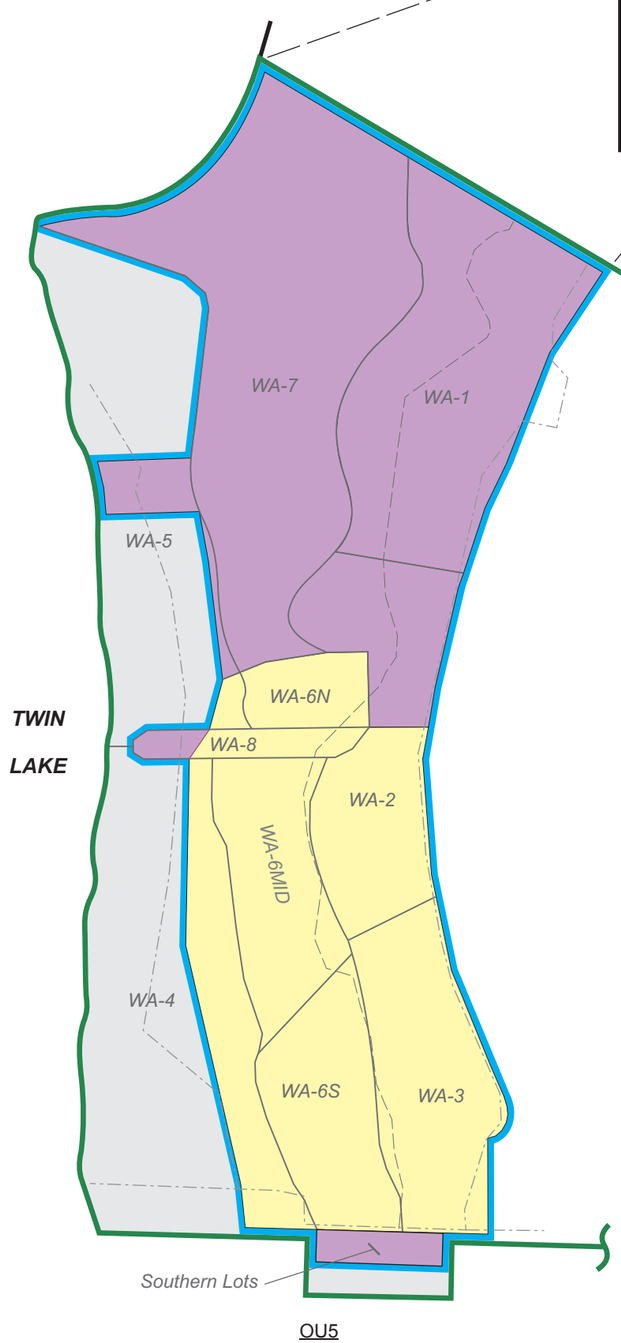
Benzo(a)pyrene (BaP) Equivalents -1999 ROD 5-year review: Summary Letter from MPCA (August 9, 1999; David Douglas to Carl Grabinski)

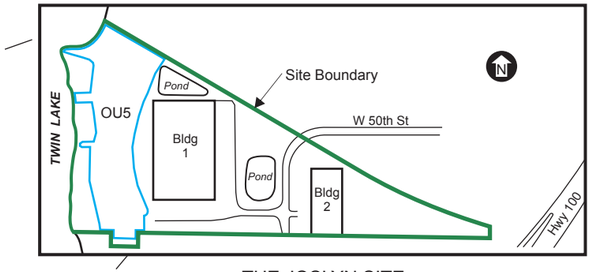
Chemical	CAS No.	Site Conc. (mg/kg) dry weight	Relative Potency Factor	BaP Equivalent (mg/kg)
Benzo(a)anthracene	56553	0.000	0.1	0.000
Benzo(b)fluoranthene	205992	0.000	0.1	0.000
Benzo(k)Fluoranthene	207089	0.000	0.01	0.000
Benzo(a)pyrene	50328	0.000	1	0.000
Chrysene	218019	0.000	0.001	0.000
Dibenz(a,h)anthracene	53703	0.000	1	0.000
Indeno(1,2,3-cd)pyrene	193395	0.000	0.1	0.000
		Total BaP equivalents = compare this value to the BaP SRV		0.000

[2] Dioxin TEQ calculated using 0 for the detection limit on the non detected compounds.

Chemical	Site Conc. (ng/kg) dry weight	Relative Potency Factor	Dioxin TEQ (ng/kg)
2,3,7,8-TCDD	0.001	1	0.001
1,2,3,7,8-Dioxin penta	0.001	1	0.001
1,2,3,4,7,8-Dioxin, hexa	0.001	0.1	0.000
1,2,3,6,7,8-Dioxin, hexa	0.001	0.1	0.000
1,2,3,7,8,9-Dioxin, hexa	0.001	0.1	0.000
1,2,3,4,6,7,8-Dioxin, hepta	0.001	0.01	0.000
Dioxin octa	0.001	0.0001	0.000
2,3,7,8-TCDF	0.001	0.1	0.000
1,2,3,7,8-Dibenzofuran, penta	0.001	0.05	0.000
2,3,4,7,8-Dibenzofuran, penta	0.001	0.5	0.001
1,2,3,4,7,8-Dibenzofuran, hexa	0.001	0.1	0.000
1,2,3,6,7,8-Dibenzofuran, hexa	0.001	0.1	0.000
2,3,4,6,7,8-Dibenzofuran, hexa	0.001	0.1	0.000
1,2,3,7,8,9-Dibenzofuran, hexa	0.001	0.1	0.000
1,2,3,4,6,7,8-Dibenzofuran, hepta	0.001	0.01	0.000
1,2,3,4,7,8,9-Dibenzofuran, hepta	0.001	0.01	0.000
Dibenzofuran octa	0.001	0.0001	0.000







THE JOSLYN SITE
(The AOC)

Area of Contamination ((AOC)

ALL REMEDIAL ACTIONS

Soil does not require remediation

CONSOLIDATE AND COVER REMEDIAL ACTIONS

Soil would not leave the area of contamination (AOC) and may be consolidated and covered within the AOC.

EXCAVATE AND OFFSITE REMEDIAL ACTIONS

Soil meets MPCA "Contained In" criteria and would require treatment (incineration) prior to off site disposal in a Subtitle C Landfill as hazardous waste. (Approximately 40% of OU5 soils requiring remediation)

Soil does not meet MPCA "Contained In" criteria and does not exceed criteria in MPCA's dioxin-contaminated soil policy. Soil may be disposed offsite in a Subtitle D Landfill as non-hazardous waste. (Approximately 60% of OU5 soils requiring remediation)

N

0 100

Approximate Scale in Feet

OU5

Figure 1

CONTAMINATED SOIL MANAGEMENT OPTIONS
FOR EVALUATION OF
OU5 REMEDIAL ACTIONS
Joslyn Manufacturing Co. Site
Brooklyn Center, MN

P:\Mpls\23 MN\27\23271110\Work Files\Graphics\Contaminated Soil Management Issues Associated with Evaluation of Remedial Alternatives for OU5.CDR RLG 01-24-17

Minnesota Pollution Control Agency

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 2, 2004

Mr. Carl Grabinski
Joslyn Manufacturing Company
9200 West Fullerton Avenue
Franklin Park, IL 60131

RE: Joslyn Manufacturing and Supply Company Superfund Site

Dear Mr. Grabinski:

The Minnesota Pollution Control Agency (MPCA) staff has reviewed the document entitled, "Barr Engineering Memorandum, West Area Soil Characterization," ("Memorandum") dated August 26, 2004. The Memorandum was submitted by Joslyn Manufacturing and Supply Company pursuant to Response Order by Consent (Consent Order) between Joslyn and the MPCA, dated May 30, 1985.

The MPCA staff's response to the Memorandum is to explain the MPCA Contained-In Policy as it relates to the Joslyn Site. As a state agency with a delegated RCRA program, the MPCA can make Contained-In Policy determinations on environmental media. The following three MPCA RCRA policy documents cited below (copies enclosed) shall be used to determine whether or not soils and sediments generated in the cleanup of West Area need to be handled as a hazardous waste.

1. "Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste," dated September 7, 2004;
2. "Management of Contaminated Environmental Media, Revised," dated February 12, 1996; and
3. "MPCA Site Remediation HW Determination Document," dated April 6, 1995.

In the case of PCP, based on the MPCA Contained-In Policy, soils and sediments contaminated with pentachlorophenol (PCP) at the Joslyn Site (a former wood treating facility) at levels below 135 parts per million (ppm) - the industrial Soil Reference Value for PCP - are not a listed hazardous waste if the management method is disposal in a permitted Municipal Solid Waste (MSW) or Industrial Landfill and the waste is acceptable according to the facilities waste acceptance criteria for all constituents.

The MPCA staff does not believe that concentrations below 135 ppm PCP will be characteristically hazardous for Lethality (MN01) or for TCLP (D037). However, the disposal facility accepting the soils may require further testing. Soils and sediments currently below 135 ppm at the Joslyn Site will not have to meet the Land Disposal Requirements (LDR) Universal Treatment Standard of 7.4 ppm PCP since the soil and sediment is not a hazardous waste. Soils above 135 ppm PCP at the Joslyn Site are contaminated by a listed waste (F027 and/or F032).

In the case of creosote-contaminated soil and sediment polyaromatic hydrocarbons (PAHs), the same MPCA Contained-In Policy as above applies to PAH concentrations below the Industrial Soil Reference Value of 4 parts per million (ppm) benzo(a)pyrene TEQs.

In addition, the current Record of Decision (ROD), dated July 31, 1989, does not include the U.S. Environmental Protection Agency (U.S. EPA) Contained-In Policy as a To Be Considered (TBC). The ROD calls for "removal of all waste residues and soil contaminated with a hazardous waste." Since the ROD was written, not only has the Contained-In Policy been described by the U.S. EPA, but new waste codes and hazardous waste rules have been promulgated. In the case of PCP, since PCP is now listed as a waste (F032) and as a discarded product (F027), PCP contaminated soils and sediments at the Joslyn Site are now considered contaminated with a listed hazardous waste. However, according to the MPCA Contained-In Policy, if concentrations are below levels that are harmful to human health and the environment for a given management method, the soils and sediments at the Joslyn Site do not have to be handled as a hazardous waste. For PCP and creosote, this means that Joslyn does not need to remove "all waste residues and soil contaminated with hazardous waste" as stated in the ROD to meet this new TBC.

Please call me at (651) 296-7818 if you have any questions regarding this letter.

Sincerely,

David N. Douglas
Project Manager
Superfund Unit 2
Remediation Division

DND:csa

Enclosures

cc: Dale Finnesgaard, Barr Engineering, Inc. (w/enclosures)

DEPARTMENT: POLLUTION CONTROL AGENCY

SF-00006-05(4/86)
STATE OF MINNESOTA

Office Memorandum

DATE: September 7, 2004

TO: Site Remediation Staff

FROM: Bruce Brott, Supervisor 9/7/04
Superfund Unit 2
Superfund Section
Majors and Remediation Division

Elizabeth Gawrys 9/7/04
Superfund Unit 2
Superfund Section
Majors and Remediation Division

PHONE: (651) 297-8380

SUBJECT: Hazardous Waste Determinations for Environmental Media Contaminated with Listed Waste

Contaminated environmental media (soils and ground water) generated during an environmental clean up may have to be managed as hazardous waste if contaminated by a listed hazardous waste (F, K, P or U). By Rule, a waste containing a listed waste is hazardous at any concentration unless a de minimus concentration has been set. However, U.S. Environmental Protection Agency (U.S. EPA), has stated that since environmental media are not inherently waste-like, contaminated environmental media with concentrations of contaminants that do not pose a risk to human health or the environment do not have to be managed as a hazardous waste. U.S. EPA, through it's Contained-In Policy, has set out some basic guidelines for States to use to determine if environmental media contaminated with a listed waste must be managed as hazardous waste or not. U.S. EPA has issued at least 15 regulations, policies and guidance documents that may be used to integrate RCRA at clean up sites. This is not a comprehensive list, but it does cover the main issues in Minnesota.

1. States must be authorized for the base RCRA program;
2. The determinations must be based on health risk calculations;
3. The determinations must use reasonable maximum exposures in the risk range of 10-4 to 10-6;
4. The determinations must be made before soils are removed from the area of contamination in order to evaluate the application of RCRA generator timelines, and LDRs;
5. Residuals from treatment of environmental media must be handled as a hazardous waste;
6. RCRA classification on generated media can go back in time prior to the listing.

As an authorized state, the Minnesota Pollution Control Agency (MPCA) has developed it's own contaminated environmental media evaluation protocols. In addition to the above, the MPCA environmental media evaluation protocol requires that:

1. Hazardous waste determinations be based on the management method proposed for the media along with the direct exposure calculations described above;
2. Media proposed to be managed at a subtitle D facility meet the 10-5 risk factor;

3. For the f-listed waste codes, only the listed waste constituents will be evaluated for the hazardous waste determination. However, LDR regulated hazardous constituents under the listing may be reviewed in site specific waste management circumstances (i.e. management other than landfilling);
4. For the few waste constituents that have both waste and product listings, it is not necessary to know if a waste or a product was released to determine that the media may contain a listed waste;
5. On site treatment of contaminated environmental media must have the approval of the MPCA to assure proper engineering controls and residual management.

Generators do not need the MPCA's assistance to make hazardous waste determinations on characteristic wastes. This memo further defines how the MPCA conducts hazardous waste determinations for contaminated environmental media. Memos dated 2/12/96 and 4/6/95 contain further detail on handling contaminated environmental media.

BB/EG:csa

DEPARTMENT: POLLUTION CONTROL AGENCY

SF-00006-05(4/86)
STATE OF MINNESOTA

Office Memorandum

DATE: February 12, 1996

TO: Distribution List

FROM: Bruce Brott and Beth Gawrys
Hazardous Waste Division

PHONE: 297-8380/297-8376

SUBJECT: Management of Contaminated Environmental Media, Revisited

Attached you will find two (2) documents, the Management of Contaminated Environmental Media memo and the accompanying Flow Chart for Managing Contaminated Environmental Media. Since the release of the April 6, 1995, memo entitled Minnesota Pollution Control Agency (MPCA) Site Remediation Hazardous Waste Determination Document, Hazardous Waste Division staff have received many MPCA and Minnesota Department of Agriculture staff questions on how to manage contaminated environmental media. This seems especially true in light of staff becoming aware of the RCRA Corrective Action Management Unit (CAMU) provisions that the MPCA promulgated in June 1995. The CAMU provisions can be used as Superfund ARARs. The MPCA Hazardous Waste staff are available to help other MPCA staff on the review of CAMU designs. For the time being, please complete the MPCA Site Remediation Hazardous Waste Determination Document attached to the April 6, 1995, memo when requesting CAMU review assistance.

If you have any questions on the attached documents, please call Bruce Brott or Beth Gawrys at the above phone numbers.

EG:mh

Attachments

2/29/96

Management of Contaminated Environmental Media

Contaminated environmental media (soil or ground water) is generated through clean-up activities and may contain a listed hazardous waste (F, P, K or U) or may be hazardous by characteristic. By Rule, a waste containing a listed waste is hazardous at any concentration unless a de minimus concentration has been set. Environmental Media (EMedia) is not a waste, but if it is hazardous by characteristic or contains a listed waste that poses an unacceptable risk to human health or the environment it must be handled **AS IF** it were a hazardous waste (hazardous EMedia). In many cases the health risk based number becomes the de minimus concentration of a listed waste in EMedia.

How the EMedia is handled on-site or off-site, along with the levels of contaminants in the media, may be considered in determining whether Resource Conservation and Recovery Act (RCRA) rules need to be followed.

1. Leave EMedia In Place

The cleanup program overseeing the site remediation and investigation has the option to choose a no removal alternative that meets its program cleanup goals (i.e. RCRA does not require specific cleanup goals at non-RCRA sites). In most cases, RCRA would oversee the cleanup of a release of hazardous waste.

2. Off-Site Shipment of EMedia

If the listed contaminant concentrations are below health risk based numbers and the unlisted contaminant concentrations are below the characteristically hazardous level, the EMedia may be managed as non hazardous in a solid waste landfill and transported without a hazardous waste (HW) manifest.

Listed contaminant concentrations above a health risk based number or unlisted contaminant concentrations that are hazardous by characteristic would require the EMedia to be transported under HW manifest to a permitted Treatment Storage or Disposal Facility (TSD) (i.e. managed as a hazardous waste).

3. On-Site Treatment of EMedia

In-situ treatment like airsparging or bioremediation of hazardous EMedia can occur without RCRA oversight as long as (1) the EMedia is kept in an area of similar contamination; (2) the actions have oversight from the MPCA; (3) only on-site EMedia is treated; and (4) further contamination at the site does not result from the treatment.

Ex-situ treatment that requires moving the EMedia to an uncontaminated location, or that requires noncontainer storage before treatment, can be accomplished under the Corrective Action Management Unit (CAMU) provisions if the waste can not be placed immediately into the treatment system. RCRA staff engineers can help MPCA staff in the review of CAMU designs to help determine what safeguards are required.

Contaminants removed from EMedia through treatment are hazardous if the EMedia was contaminated with a listed waste. If the EMedia was characteristically hazardous, the contaminants removed must be evaluated for proper management. Hazardous waste must be managed in accordance with RCRA requirements and be sent off-site to a TSD or recycling facility under HW manifest.

Common Questions

1. When do Land Disposal Restrictions (LDRs) apply?
   LDRs are not triggered when EMedia is stored in a designated CAMU.
   LDRs are not triggered if EMedia is placed in a contiguous area of similar contamination.

2. When does EMedia need to be evaluated to determine if it must be handled as a HW?
   When contaminated EMedia is excavated.
   When contaminated EMedia is shipped off-site.

3. When is a CAMU necessary?
   When a land disposal unit is created without meeting LDRs.
   When treatment, storage or consolidation is done in an uncontaminated area or outside the RCRA permitted unit.

4. How is a CAMU designated?
   U.S. Environmental Protection Agency Region VI has developed a policy on using CAMUs. There is a process flow chart for States that are authorized for Hazardous and Solid Waste Amendments (HWSA) and CAMUs. Steps include public notice, technical review and a permit modification for implementation of the CAMU. This policy can be used as guidance.
   The CAMU rule seems to imply that nonpermitted facilities that have been issued cleanup orders can use CAMUs.

5. How do nonRCRA programs take advantage of CAMUs?
   MPCA Superfund sites that have controlling documents and already have public notification requirements that can easily fulfill the CAMU provisions.

6. Could facilities without controlling documents use a CAMU?
   Some sort of controlling document or agreement is required in the CAMU rule.

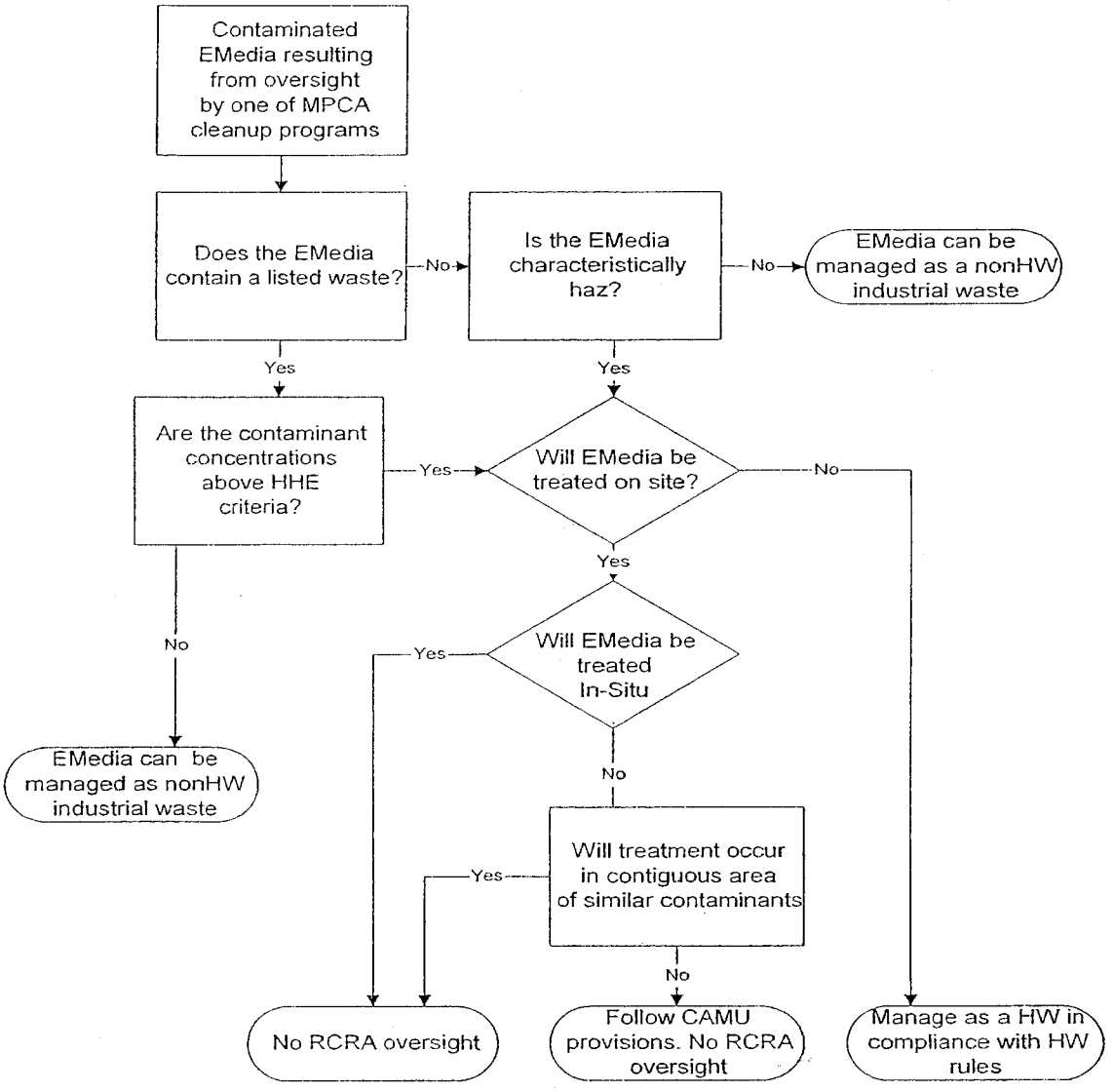
7. What about the public notice requirements in the CAMU rules?
   The CAMU rule requires public participation. Individual programs would need to evaluate the appropriate level of public participation for a given site.

8. What if the EMedia does not contain a listed waste but could potentially be above the Toxicity Characteristic Leaching Procedure (TCLP) regulated concentration?

For **OFF**-site management, the EMedia would need to be tested for TCLP for proper shipping and disposal.

For **On**-site management, if the cleanup program has set a clean up goal based on protecting human health and environment, the EMedia would not need to be evaluated using TCLP. TCLP data may be helpful in determining a cleanup goal by showing how leachable the contaminant is in the soil.

Flowchart for Managing Contaminated Environmental Media



SF-00006-05(4/86)

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE: January 12, 1996

TO:

FROM: Program Development Section
Hazardous Waste Division

PHONE: 297-8337

SUBJECT: Site Remediation HW Determination Document

The enclosed document titled" MPCA Site Remediation HW Determination Document" (tracking document) is to be used to track the management of any site remediation which requires interdivisional coordination and/or screening from the Hazardous Waste Division's Business Assistance Unit (BAU). If the environmental media is to be managed on-site within the area of contamination, there is no need for BAU screening to determine if the environmental media must be managed as a hazardous waste. If the Environmental media is to be sent off-site for management, the BAU unit should be contacted using the tracking document. When contacted, the BAU Unit will make a determination of whether or not the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste (as described below). This document is to be used as a tracking device to ensure that the "Decision Tree and Follow-up of Sites Threatening Soil and Ground Water Contamination" document, dated May 4, 1994, is followed. A description of when and how the tracking document should be used follows:

Project Oversight/Coordination:
The initial MPCA contact and/or site contractor has the responsibility of ensuring that the site information is submitted to the appropriate lead unit in the MPCA. The appropriate MPCA lead units for specific cleanup activities are defined in the "Follow-up of Contaminant Release Posing Soil or Ground Water Threats" Flow Chart (April 1994). Once the appropriate lead unit has been notified of the site, a MPCA site coordinator (lead unit representative) will be assigned.

Completion and Routing of Tracking Document:
The MPCA site coordinator has the responsibility of coordinating with the site contact/contractor to complete the site description data on the tracking document prior to submittal to the BAU Unit. The site description data should, at a minimum, include a history of activities conducted at the site, the likely sources of contamination, the time frame for the release(s) and a description of any wastes which have been released.

Hazardous Waste Determination Criteria Used by BAU Unit:
Environmental media will be deemed to contain a listed hazardous waste only in those cases where a known release of a listed hazardous waste has occurred. If any "F", "K", "P", or "U" listed wastes (Minn. R. 7045.0135, subp. 4) have been released at the site, the environmental media is deemed to contain a hazardous waste. Environmental media which is deemed to contain a hazardous waste must be managed as if it were a hazardous waste, unless a determination can be made that the concentration of the listed hazardous waste is low enough so as not to present an unacceptable risk to human health and/or the environment through oral, dermal or inhalation exposure.* If the environmental media exhibits a characteristic of hazardous waste or contains a listed hazardous waste at concentrations that pose an unacceptable risk to human health and the environment, the environmental media must be managed as a hazardous waste and a hazardous waste manifest must be used for tracking the waste if it is shipped off-site. Additionally, if the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste, on-site placement of the waste on the ground may only occur within the area of contamination until the media is deemed to no longer contain the hazardous waste or exhibit a characteristic of hazardous waste. (The area of contamination is defined as a contiguous area of similar contamination).

EPA's "Contained-in" Policy

MPCA Site Remediation HW Determination Document

Site Name:

Location:
(Street address, City, County)

Site Contractor:

Phone:

MPCA Coordinator:

Phone:

Cleanup Program:

Site Description: (Include history of industrial manufacturing activities conducted at the site and the likely source(s) of the contamination).

Contaminated Media Description: (Soil, GW, volume, contaminants, concentration, etc.)

This Section to be completed by the HW/BAU Unit.

Recommendation:

_____ Media does not contain a hazardous waste (Media does not have to be managed as a hazardous waste).

_____ Media contains an F,K,P or U listed hazardous waste. (Waste code_____)

_____ Media exhibits a characteristic of hazardous waste. (Waste code_____).

_____ Media has been deemed to no longer contain a hazardous waste after risk analysis review. (If media is initially found to contain a hazardous waste a risk analysis may be used to show that the media does not present any hazard to human health and the environment, and thus, no longer contains the hazardous waste).

BAU Unit Representative: Phone:

SF-00006-05(4/86)

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE: January 12, 1996

TO:

FROM: Program Development Section
Hazardous Waste Division

PHONE: 297-8337

SUBJECT: Site Remediation HW Determination Document

The enclosed document titled" MPCA Site Remediation HW Determination Document" (tracking document) is to be used to track the management of any site remediation which requires interdivisional coordination and/or screening from the Hazardous Waste Division's Business Assistance Unit (BAU). If the environmental media is to be managed on-site within the area of contamination, there is no need for BAU screening to determine if the environmental media must be managed as a hazardous waste. If the Environmental media is to be sent off-site for management, the BAU unit should be contacted using the tracking document. When contacted, the BAU Unit will make a determination of whether or not the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste (as described below). This document is to be used as a tracking device to ensure that the "Decision Tree and Follow-up of Sites Threatening Soil and Ground Water Contamination" document, dated May 4, 1994, is followed. A description of when and how the tracking document should be used follows:

Project Oversight/Coordination:
The initial MPCA contact and/or site contractor has the responsibility of ensuring that the site information is submitted to the appropriate lead unit in the MPCA. The appropriate MPCA lead units for specific cleanup activities are defined in the "Follow-up of Contaminant Release Posing Soil or Ground Water Threats" Flow Chart (April 1994). Once the appropriate lead unit has been notified of the site, a MPCA site coordinator (lead unit representative) will be assigned.

Completion and Routing of Tracking Document:
The MPCA site coordinator has the responsibility of coordinating with the site contact/contractor to complete the site description data on the tracking document prior to submittal to the BAU Unit. The site description data should, at a minimum, include a history of activities conducted at the site, the likely sources of contamination, the time frame for the release(s) and a description of any wastes which have been released.

Hazardous Waste Determination Criteria Used by BAU Unit:
Environmental media will be deemed to contain a listed hazardous waste only in those cases where a known release of a listed hazardous waste has occurred. If any "F", "K", "P", or "U" listed wastes (Minn. R. 7045.0135, subp. 4) have been released at the site, the environmental media is deemed to contain a hazardous waste. Environmental media which is deemed to contain a hazardous waste must be managed as if it were a hazardous waste, unless a determination can be made that the concentration of the listed hazardous waste is low enough so as not to present an unacceptable risk to human health and/or the environment through oral, dermal or inhalation exposure.* If the environmental media exhibits a characteristic of hazardous waste or contains a listed hazardous waste at concentrations that pose an unacceptable risk to human health and the environment, the environmental media must be managed as a hazardous waste and a hazardous waste manifest must be used for tracking the waste if it is shipped off-site. Additionally, if the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste, on-site placement of the waste on the ground may only occur within the area of contamination until the media is deemed to no longer contain the hazardous waste or exhibit a characteristic of hazardous waste. (The area of contamination is defined as a contiguous area of similar contamination).

EPA's "Contained-in" Policy

MPCA Site Remediation HW Determination Document

Site Name:

Location:
(Street address, City, County)

Site Contractor:

Phone:

MPCA Coordinator:

Phone:

Cleanup Program:

Site Description: (Include history of industrial manufacturing activities conducted at the site and the likely source(s) of the contamination).

Contaminated Media Description: (Soil, GW, volume, contaminants, concentration, etc.)

This Section to be completed by the HW/BAU Unit.

Recommendation:

_____ Media does not contain a hazardous waste (Media does not have to be managed as a hazardous waste).

_____ Media contains an F,K,P or U listed hazardous waste. (Waste code_____)

_____ Media exhibits a characteristic of hazardous waste. (Waste code_____).

_____ Media has been deemed to no longer contain a hazardous waste after risk analysis review. (If media is initially found to contain a hazardous waste a risk analysis may be used to show that the media does not present any hazard to human health and the environment, and thus, no longer contains the hazardous waste).

BAU Unit Representative: Phone:

Bruce Brott HWRCS

DEPARTMENT : POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE : April 6, 1995

TO : Distribution List

DRAFT

FROM : Bruce Brott & Pat Matuseski
Hazardous Waste Division

PHONE : 297-8380 and 297-8337

SUBJECT : MPCA Site Remediation HW Determination Document

Enclosed you will find two documents: MPCA Site remediation HW Determination Document and Decision Tree and Follow-up of Sites Threatening Soil and Ground Water Contamination. Please ensure that the appropriate staff in your units are familiar with the use of these documents (instructions included.)

The MPCA HW Division will require the use of the HW Determination Document whenever a request is made of our Division to determine whether a site remediation waste has to be managed as a hazardous waste.

If you, or your staff, have questions regarding the use of the form, please contact Pat Matuseski at 297-8337.

PM:jao

Enclosure

Interoffice Memorandum

See Distribution List

DRAFT

From: Hazardous Waste Division

Subject: Site Remediation HW Determination Document

The enclosed document titled "MPCA Site Remediation HW Determination Document" (tracking document) is to be used to track the management of any site remediation which requires interdivisional coordination and/or screening from the Hazardous Waste Division's Generator Technical Assistance (GTA) Unit. If the environmental media is to be managed on-site within the area of contamination, there is no need for GTA screening to determine if the environmental media must be managed as a hazardous waste. If the Environmental media is to be sent off-site for management, the GTA unit should be contacted using the tracking document. When contacted, the GTA Unit will make a determination of whether or not the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste (as described below.) This document is to be used as a tracking device to ensure that the "Decision Tree and Follow-up of Sites Threatening Soil and Ground Water Contamination" document, dated May 4, 1994, is followed. A description of when and how the tracking document should be used follows:

Project Oversight/Coordination:

The initial MPCA contact and/or site contractor has the responsibility of ensuring that the site information is submitted to the appropriate lead unit in the MPCA. The appropriate MPCA lead units for specific cleanup activities are defined in the "Followup of Contaminant Release Posing Soil or Ground Water Threats" Flow Chart (April 1994.) Once the appropriate lead unit has been notified of the site, a MPCA site coordinator (lead unit representative) will be assigned.

Completion and Routing of Tracking Document:

The MPCA site coordinator has the responsibility of coordinating with the site contact/contractor to complete the site description data on the tracking document prior to submittal to the GTA Unit. The site description data should, at a minimum, include a history of activities conducted at the site, the likely sources of contamination, the time frame for the release(s) and a description of any wastes which have been released.

Hazardous Waste Determination Criteria Used by GTA Unit:

Environmental media will be deemed to contain a listed hazardous waste only in those cases where a known release of a listed hazardous waste has occurred. If any "F", "K", "P" or "U" listed hazardous wastes (7045.0135 Subp. 4) have been released at the site, the environmental media is deemed to contain a hazardous waste. Environmental media which is deemed to contain a hazardous waste must be managed as if it were a hazardous waste, unless a determination can be made that the concentration of the listed hazardous waste is low enough so as not to present an unacceptable risk to human health and/or the environment through oral, dermal or inhalation exposure.* If the environmental media exhibits a characteristic of hazardous waste or contains a listed hazardous waste at concentrations that pose an unacceptable risk to human health and the environment, the environmental media must be managed as a hazardous waste and a hazardous waste manifest must be used for tracking the waste if it is shipped off-site. Additionally, if the environmental media contains a hazardous waste or exhibits a characteristic of hazardous waste, on-site placement of the waste on the ground may only occur within the area of contamination until the media is deemed to no longer contain the hazardous waste or exhibit a characteristic of hazardous waste. (The area of contamination is defined as a contiguous area of similar contamination.)

* EPA'S "Contained-in" Policy

MPCA Site Remediation HW Determination Document

Site Name:

Location:
(Street address, City, County)

Site Contractor:

Phone:

MPCA Coordinator:

Phone:

Cleanup Program:

Site Description: (Include history of industrial manufacturing activities conducted at the site and the likely source(s) of the contamination.)

Contaminated Media Description: (Soil, GW, volume, contaminants, concentration, etc.)

This Section to be completed by the HW GTA Unit.

Recommendation:

_____ Media does not contain a hazardous waste (Media does not have to be managed as a hazardous waste.)

_____ Media contains an F,K,P or U listed hazardous waste. (Waste code _____)

_____ Media exhibits a characteristic of hazardous waste. (Waste code _____)

_____ Media has been deemed to no longer contain a hazardous waste after risk analysis review.
(If media is initially found to contain a hazardous waste a risk analysis may be used to show that the media does not present any hazard to human health and the environment, and thus, no longer contians the hazardous waste.

GTA Unit Representative: Phone:

B. It is liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55 degrees Celsius (130 degrees Fahrenheit) as determined by the test method specified in National Association of Corrosion Engineers Standard TM-01-69 as standardized in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, issued by the United States Environmental Protection Agency, publication number SW 846 (First Edition, 1980 as updated by Revisions A (August 1980), B (July 1981), and C (February 1982) or Second Edition, 1982) or an equivalent test method approved by the commissioner under the procedures set forth in part 7045.0075, subpart 1.

A waste that exhibits the characteristic of corrosivity has the hazardous waste number of D002.

Subp. 5. **Reactivity.** A waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

A. it is normally unstable and readily undergoes violent change without detonating;

B. it reacts violently with water;

C. it forms potentially explosive mixtures with water;

D. when mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment;

E. it is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2.0 and 12.5 can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment;

F. it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement;

G. it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or

H. it is a forbidden explosive as defined in Code of Federal Regulations, title 49, section 173.51, as amended, a Class A explosive as defined in Code of Federal Regulations, title 49, section 173.53, as amended, or a Class B explosive as defined in Code of Federal Regulations, title 49, section 173.88, as amended.

A waste that exhibits the characteristic of reactivity has the hazardous waste number of D003.

Subp. 6. **Lethality.** Lethality is determined as follows:

A. A waste exhibits the characteristic of lethality as determined in item B, if a representative sample of the waste has any one of the following properties:

(1) an oral median lethal dose less than 500 milligrams of material per kilogram of body weight of test animal;

(2) a dermal median lethal dose less than 1,000 milligrams of material per kilogram of body weight of test animal;

(3) an inhalation median lethal concentration of less than 2,000 milligrams of material per cubic meter of air, if the material or a component is in a form that may be inhaled as a dust or mist; or

(4) an inhalation median lethal concentration of less than 1,000 parts per million of material in air, if the material or component may be inhaled as gas or vapor.

B. Lethality shall be determined by applying knowledge of materials and processes used, including reasonably available information on the lethality of the components of the waste. If available information and knowledge are insufficient to reasonably determine lethality, the generator must notify the commissioner. The commissioner may order additional evaluation as specified in part 7045.0217. Additional evaluation may include testing according to the specifications of item C.

C. Lethality shall be determined as described in subitems (1) to (3):

(1) Oral median lethal dose shall be determined by a test in which the specified time is 14 days, the group of test animals is at least ten white laboratory rats of 200 to 300 grams each, half of which are male and half of which are female, and the route of administration is a single oral dose.

(2) Dermal median lethal dose shall be determined by a test in which the specified time is 14 days and the group of test animals is ten or more white rabbits, half of which are male and half of which are female, and the route of administration is a 24–hour exposure with continuous contact on bare skin.

(3) Inhalation median lethal concentration shall be determined by a test in which the specified time is 14 days, the group of the test animals is at least ten white laboratory rats of 200 to 300 grams each, half of which are male and half of which are female, and the route of administration is continuous respiratory exposure for a period of one hour.

D. A waste that exhibits the characteristics of lethality has the hazardous waste number MN01.

Subp. 7. **Toxicity.** Toxicity is determined as follows:

A. A waste exhibits the characteristic of toxicity if, using the test methods described in Code of Federal Regulations, title 40, part 261, appendix II, as amended, or equivalent methods approved by the commissioner under the procedures in part 7045.0075, subpart 1, the extract from a representative sample of the waste contains any of the contaminants listed in subpart 8 at a concentration equal to or greater than the respective value given in that table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering, is considered to be the extract.

B. A waste that exhibits the characteristic of toxicity has the hazardous waste number specified in subpart 8 which corresponds to the toxic contaminant causing it to be hazardous.

C. If the concentration of a constituent in a waste is known and that constituent is listed in subpart 8, the maximum possible concentration in the extract can be calculated on the assumption that 100 percent of the constituent will be extracted. If the calculated maximum possible concentration in the extract is less than the limit listed in subpart 8, the waste is not a hazardous waste because of the subject constituent.

Subp. 8. **Maximum concentration of contaminants for the toxicity characteristic.**

Hazardous Waste Number	Contaminant	CAS No.	Maximum Concentration (milligrams per liter)
D004	Arsenic	7440–38–2	5.0
D005	Barium	7440–39–3	100.0
D018	Benzene	71–43–2	0.5
D006	Cadmium	7440–43–9	1.0
D019	Carbon tetrachloride	56–23–5	0.5
D020	Chlordane	57–74–9	0.03
D021	Chlorobenzene	108–90–7	100.0
D022	Chloroform	67–66–3	6.0
D007	Chromium	7440–47–3	5.0
D023	o–Cresol 2 methyl phenol	95–48–7	*200.0
D024	m–Cresol 3 methyl phenol	108–39–4	*200.0
D025	p–Cresol 4 methyl phenol	106–44–5	*200.0
D026	Cresol		*200.0
D016	2,4–D	94–75–7	10.0
D027	1,4–Dichlorobenzene	106–46–7	7.5
D028	1,2–Dichloroethane	107–06–2	0.5
D029	1,1–Dichloroethylene	75–35–4	0.7
D030	2,4–Dinitrotoluene SVOCs	121–14–2	0.13
D012	Endrin	72–20–8	0.02
D031	Heptachlor (and its epoxide)	76–44–8	0.008
D032	Hexachlorobenzene SVOC	118–74–1	0.13
D033	Hexachlorobutadiene VOC	87–68–3	0.5
D034	Hexachloroethane SVOC	67–72–1	3.0

SF-00006-05(4/86)

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE:	August 29, 2006	
TO:	Remediation Division	
FROM:	Stephen Thompson SCT Superfund and ER Section Remediation Division	Elizabeth Gawrys EG Superfund and ER Section Remediation Division
PHONE:	(651) 297-8604	(651) 297-8376
SUBJECT:	Disposal of Dioxin Contaminated Soil in "Subtitle D" Landfills	

Dioxin contaminated soils provide special remediation issues at remediation sites in Minnesota. Minnesota has several Superfund sites with hundreds to thousands of tons of dioxin (2,3,7,8 TCDD Equivalents) contaminated soils. Soil Reference Values (SRVs), which account for risk of human contact, for dioxins are very low. Options for disposal of dioxin contaminated soils are limited and extremely expensive. At times, the best alternative is to cap the contaminated soil on site. However, at other sites, on-site disposal is either not feasible or poses long-term risk situations. In those situations, the specific characteristics of dioxin make it appropriate to consider disposal of dioxin contaminated soil in a "Subtitle D" landfill. Some contaminated soils have multiple contaminants. If so, all other contaminants also need to be evaluated to determine if the dioxin contaminated soil can be managed at a Subtitle D landfill. MPCA RCRA staff will review all hazardous waste determinations, as allowed by EPA for authorized States, and make a case by case determination on soil management at cleanup sites which have MPCA oversight.

A. Factors that may make disposal of dioxin contaminated soils in Subtitle D landfills appropriate.

1. Characteristics of dioxin. Dioxins tend to adsorb to organic fraction in soil. Dioxin has high octanol water partition coefficients, suggesting that in the presence of sufficient amounts of organic matter, the dioxin would have a high propensity to remain adsorbed to the organic material rather than dissolve into and become mobilized by water.
2. Leachate analysis. Analysis of leachate/condensate from eleven different landfills, destined for disposal at MCES, shows all eleven analyses to be below detection limits for dioxins. This data lends support to the safety of allowing dioxin contaminated soil in certain instances described in this memo to be disposed of in "Subtitle D" landfills.

3. EPA precedence. In April 2004, the U.S. Environmental Protection Agency (EPA) gave approval to dispose of dioxin contaminated soil from an EPA lead Superfund site located in Cass Lake, Minnesota in a "Subtitle D" landfill located near Buffalo, Minnesota.
4. Cost and exposure risks. Hazardous waste disposal options are limited, or nonexistent in the United States for dioxin listed wastes. If soils are not allowed to be disposed of in a Subtitle D landfill, the only other viable option is to leave the contamination in place which makes for more potential future human exposure as compared to managing the soil in a landfill.

B. Standards and requirements

1. Soil with dioxin contamination levels of 10 parts per billion (ppb) or less of 2,3,7,8 TCDD equivalents may be considered for disposal in a Minnesota "Subtitle D" landfill. The 10 ppb value is based upon multiplying the Universal Treatment Standard for dioxin (1 ppb) by a factor of 10 as allowed for soils in EPA's Phase IV Land Disposal Restriction (LDRs).
2. Because of dioxin's specific characteristics discussed in paragraph A.1 above, dioxin contaminated soil which does not exceed 10 ppb, will be allowed to be disposed of in a Minnesota "Subtitle D" landfill under the conditions described below.
    a. The dioxin contaminated soil brought to the landfill must not be used as daily cover.
    b. The dioxin contaminated soil brought to the landfill must be placed together in a specific area and its location recorded. The soil should not be used as daily cover or placed in numerous locations.
    c. The landfill accepting the dioxin contaminated soil must have dioxin included in its waste acceptance plan.

This issue was brought before the Land Policy Forum on Tuesday, April 4, 2006. The Forum approved of this proposal.

Appendix C

Remedial Alternative Opinion of Cost

Table C-1
Alternative 1 - No Action (Fence Maintenance Only)
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 4,000	$ 4,000
Annual routine maintenance and repairs (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				**$ 13,500**
O&M Contingency 30%	1	LS	$ 4,050	$ 4,050
Annual Operation and Maintenance Total				**$ 17,600**
30-year O&M Total - No discount rate applied				**$ 528,000**
TOTAL O&M				**$ 530,000**

Table C-2
Alternative 2 - Stormwater Management Modifications
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
Capital Costs						
Mobilization (general conditions & safety plan)	1	LS	$	36,789	$	36,789
Temporary Erosion and Sediment Control						
Construction entrance into West Area	1	EACH	$	1,800	$	1,800
Establish silt fence	700	LF	$	3	$	2,100
Other erosion control items for NPDES requirements	1	LS	$	2,500	$	2,500
Site Preparation						
Remove portion of existing perimeter fence	519	LF	$	3	$	1,557
Clearing and grubbing, chip and spread onsite- Settling Basin Area	0.21	ACRE	$	10,000	$	2,065
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	ACRE	$	10,000	$	1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$	20	$	16,667
Decontamination pad/liner/drainage for south end	1	LS	$	15,000	$	15,000
Decon water management	1	LS	$	20,000	$	20,000
Contaminated Soil Excavation						
Excavate 3.5' and consolidate Settling Basin Area	1,166	CY	$	8	$	9,327
Excavate 4.0' and consolidate Southern Lots	1,244	CY	$	8	$	9,956
Total Excavation Volume	**2,410**	**CY**				
OU5 Stormwater Management Plan (see Table C-9 for details)	1	LS	$	640,000	$	640,000
Final Improvements						
Remove decon pad	1	LS	$	2,500	$	2,500
Reestablish portion of perimeter fence around West Area	519	LF	$	20	$	10,380
Purchases for Floodplain and Wetland Mitigation						
Potential Mitigation Area Parcels	1	LS	$	50,000	$	50,000
Permanent Wetland 1S Impacts (2.5:1 replacement)	3.5	ACRE	$	96,602	$	336,787
Direct Subtotal					**$**	**1,159,356**
Engineering (Design, Permitting, & Admin)	1	LS	$	32,000	$	32,000
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$	115,936	$	115,936
Direct and Indirect Subtotal					**$**	**1,307,291**
Contingency 30%	1	LS	$	392,187	$	392,187
Capital Total					**$**	**1,700,000**
Operation and Maintenance						
Perimeter fence replacement ($40,000/10 years)	1	LS	$	4,000	$	4,000.00
Annual routine maintenance and repairs (signs, tree cleanup, etc)	1	LS	$	4,500	$	4,500.00
Annual wetland vegetation monitoring and maintenance	1	LS	$	2,500	$	2,500.00
Quarterly Site Inspection and Annual Report	1	LS	$	5,000	$	5,000.00
Direct Subtotal					**$**	**16,000.00**
O&M Contingency 30%	1	LS	$	4,800	$	4,800.00
Annual Operation and Maintenance Total					**$**	**20,800.00**
30-year O&M Total - No discount rate applied					**$**	**624,000.00**
TOTAL CAPITAL AND O&M					**$**	**2,320,000.00**

Table C-3
Alternative 3 - Excavation for Offsite Treatment and Disposal
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing &Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Capital Costs				
Mobilization (general conditions & safety plan)	1	LS	$ 108,764	$ 108,764
Temporary Erosion and Sediment Control				
Construction entrance into West Area	1	EACH	$ 1,800	$ 1,800
Establish silt fence	1,200	LF	$ 3	$ 3,600
Other erosion control items for NPDES requirements	1	LS	$ 2,500	$ 2,500
Site Preparation				
Remove existing fence	2,562	LF	$ 3	$ 7,686
Dewatering (pump to onsite system)	1	LS	$ 25,000	$ 25,000
Remove misc demolition debris present on surface	1	LS	$ 1,000	$ 1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	ACRE	$ 10,000	$ 43,317
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	ACRE	$ 10,000	$ 1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$ 20	$ 16,667
Decontamination pad/liner/drainage for south end	1	LS	$ 15,000	$ 15,000
Decon water management	1	LS	$ 20,000	$ 20,000
Contaminated Soil Excavation, Staging, and Loading				
Excavate 2.5', stage and load WA-1A	6,061	TON	$ 8	$ 48,487
Excavate 2.0', stage and load WA-1B	2,134	TON	$ 8	$ 17,069
Excavate 2.5', stage and load WA-2A	1,876	TON	$ 8	$ 15,005
Excavate 2.0', stage and load WA-2B	716	TON	$ 8	$ 5,730
Excavate 3.5', stage and load WA-2C	1,107	TON	$ 8	$ 8,858
Excavate 1.0', stage and load WA-2D	866	TON	$ 8	$ 6,927
Excavate 3.5', stage and load WA-3A	2,639	TON	$ 8	$ 21,114
Excavate 1.0', stage and load WA-3B	1,529	TON	$ 8	$ 12,231
Excavate 3.5', stage and load WA-4A	1,382	TON	$ 8	$ 11,053
Excavate 2.0', stage and load WA-4B	1,306	TON	$ 8	$ 10,448
Excavate 2.5', stage and load WA-5 (former ice chute)	681	TON	$ 8	$ 5,448
Excavate 3.5', stage and load WA-6MID	5,890	TON	$ 8	$ 47,117
Excavate 3.5', stage and load WA-6N	1,894	TON	$ 8	$ 15,150
Excavate 3.5', stage and load WA-6S	5,052	TON	$ 8	$ 40,414
Excavate 2.5', stage and load WA-7	13,735	TON	$ 8	$ 109,879
Excavate 2.5', stage and load WA-8 (former rail spur)	387	TON	$ 8	$ 3,099
Excavate 4.0', stage and load Southern Lots	1,742	TON	$ 8	$ 13,938
Total Excavation Weight	**48,996**	**TON**		
Total Excavation Volume	**34,997**	**CY**		
Contaminated Soil Transportation and Disposal	48,996	TON	$ 1,000	$ 48,995,722
Site Restoration				
WA-1A				
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$ 3	$ 15,585
Import backfill - 1.5 ft	2,598	CY	$ -	$ -
Import 1.0' wetland-like soil	1,732	CY	$ 30	$ 51,950
Wetland planting/seeding	1.07	ACRE	$ 10,000	$ 10,733
WA-1B				
Import backfill - 1.5 ft	1,143	CY	$ -	$ -
Import 0.5' topsoil	381	CY	$ 15	$ 5,715
Upland planting/seeding	0.47	ACRE	$ 3,000	$ 1,417
WA-2A				
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$ 3	$ 4,823
Import backfill - 1.5 ft	804	CY	$ -	$ -
Import 1.0' wetland-like soil	536	CY	$ 30	$ 16,077
Wetland planting/seeding	0.33	ACRE	$ 10,000	$ 3,322
WA-2B				
Import backfill - 1.5 ft	384	CY	$ -	$ -
Import 0.5' topsoil	128	CY	$ 15	$ 1,919
Upland planting/seeding	0.16	ACRE	$ 3,000	$ 476

Table C-3
Alternative 3 - Excavation for Offsite Treatment and Disposal
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing &Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
WA-2C				
Geotextile (16 oz Nonwoven needle-punched)	678	SY	$ 3	$ 2,034
Import backfill - 2.5 ft	565	CY	$ -	$ -
Import 1.0' wetland-like soil	226	CY	$ 30	$ 6,779
Wetland planting/seeding	0.14	ACRE	$ 10,000	$ 1,401
WA-2D				
Import backfill - 2.5 ft	1,546	CY	$ -	$ -
Import 0.5' topsoil	309	CY	$ 15	$ 4,639
Upland planting/seeding	0.38	ACRE	$ 3,000	$ 1,150
WA-3A				
Geotextile (16 oz Nonwoven needle-punched)	1,408	SY	$ 3	$ 4,224
Import backfill - 2.5 ft	1,173	CY	$ -	$ -
Import 1.0' wetland-like soil	469	CY	$ 30	$ 14,080
Wetland planting/seeding	0.29	ACRE	$ 10,000	$ 2,909
WA-3B				
Import backfill - 2.5 ft	1,827	CY	$ -	$ -
Import 0.5' topsoil	365	CY	$ 15	$ 5,480
Upland planting/seeding	0.45	ACRE	$ 3,000	$ 1,359
WA-4A				
Geotextile (16 oz Nonwoven needle-punched)	838	SY	$ 3	$ 2,513
Import backfill - 2.5 ft	698	CY	$ -	$ -
Import 1.0' wetland-like soil	279	CY	$ 30	$ 8,377
Wetland planting/seeding	0.17	ACRE	$ 10,000	$ 1,731
WA-4B				
Import backfill - 1.5 ft	700	CY	$ -	$ -
Import 0.5' topsoil	233	CY	$ 15	$ 3,498
Upland planting/seeding	0.29	ACRE	$ 3,000	$ 867
WA-5 (former ice chute)				
Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
Import backfill - 2.0 ft	389	CY	$ -	$ -
Import 0.5' topsoil	97	CY	$ 15	$ 1,459
Poten Upland planting/seeding	0.12	ACRE	$ 3,000	$ 362
WA-6MID				
Geotextile (16 oz Nonwoven needle-punched)	3,606	SY	$ 3	$ 10,818
Import backfill - 2.5 ft	3,005	CY	$ -	$ -
Import 1.0' wetland-like soil	1,202	CY	$ 30	$ 36,059
Wetland planting/seeding	0.75	ACRE	$ 10,000	$ 7,450
WA-6N				
Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3	$ 3,478
Import backfill - 2.5 ft	966	CY	$ -	$ -
Import 1.0' wetland-like soil	386	CY	$ 30	$ 11,594
Wetland planting/seeding	0.24	ACRE	$ 10,000	$ 2,396
WA-6S				
Geotextile (16 oz Nonwoven needle-punched)	2,619	SY	$ 3	$ 7,858
Import backfill - 2.5 ft	2,183	CY	$ -	$ -
Import 1.0' wetland-like soil	873	CY	$ 30	$ 26,194
Wetland planting/seeding	0.54	ACRE	$ 10,000	$ 5,412
WA-7				
Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3	$ 35,318
Import backfill - 1.5 ft	5,886	CY	$ -	$ -
Import 1.0' wetland-like soil	3,924	CY	$ 30	$ 117,728
Wetland planting/seeding	2.43	ACRE	$ 10,000	$ 24,324

Table C-3
Alternative 3 - Excavation for Offsite Treatment and Disposal
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing &Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
WA-8 (former rail spur)				
Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3	$ 996
Import backfill - 2.0 ft	221	CY	$ -	$ -
Import 0.5' topsoil	55	CY	$ 15	$ 830
Upland planting/seeding	0.07	ACRE	$ 3,000	$ 206
Backfill Required Summary				
Poten Backfill Required for OU5	(24,088)	CY		
Total Backfill Required for OU5	**(24,088)**	**CY**		
Backfill Source Summary				
Total Backfill Required for OU5	(24,088)			
Backfill Imported	**(24,088)**	**CY**		
Imported Soil Costs				
Import Backfill	24,088	CY	$ 20	$ 481,752
Soil Quality Testing for Imported Backfill	1	LS	$ 36,000	$ 36,000
Soil Quality Testing for Imported Topsoil	1	LS	$ 2,880	$ 2,880
Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$ 14,400	$ 14,400
OU5 Stormwater Management Plan (see Table C-9 for details)	1	LS	$ 640,000	$ 640,000
Final Improvements				
Remove decon pad	1	LS	$ 2,500	$ 2,500
Reestablish fence around entire West Area	2,562	LF	$ 20	$ 51,240
Direct Subtotal				**$ 51,331,011**
Engineering (Design, Permitting, & Admin)	1	LS	$ 196,685	$ 196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 282,900	$ 282,900
Direct and Indirect Subtotal				**$ 51,810,596**
Contingency 30%	1	LS	$ 15,543,179	$ 15,543,179
Capital Total				**$ 67,350,000**
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 4,000	$ 4,000.00
Annual routine site maintenance (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500.00
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500.00
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000.00
Direct Subtotal				**$ 16,000.00**
O&M Contingency 30%	1	LS	$ 4,800	$ 4,800.00
Annual Operation and Maintenance Total				**$ 20,800.00**
Poten 30-year O&M Total - No discount rate applied				**$ 624,000.00**
TOTAL CAPITAL & O&M				**$ 67,970,000.00**

Table C-4
Alternative 4 - In-Place Soil Cover
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Capital Costs				
Mobilization (general conditions & safety plan)	1	LS	$ 103,675	$ 103,675
Temporary Erosion and Sediment Control				
Construction entrance into West Area	1	EACH	$ 1,800	$ 1,800
Establish silt fence	1,200	LF	$ 3	$ 3,600
Other erosion control items for NPDES requirements	1	LS	$ 2,500	$ 2,500
Site Preparation				
Remove existing perimeter fence	2,562	LF	$ 3	$ 7,686
Remove misc demolition debris present on surface	1	LS	$ 1,000	$ 1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	ACRE	$ 10,000	$ 43,317
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	ACRE	$ 10,000	$ 1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$ 20	$ 16,667
Decontamination pad/liner/drainage for south end	1	LS	$ 15,000	$ 15,000
Decon water management	1	LS	$ 20,000	$ 20,000
Contaminated Soil Excavation				
Excavate 2.0' and consolidate East Top of Slope	1,004	CY	$ 8	$ 8,032
Excavate 3.5' and consolidate Settling Basin Area	1,166	CY	$ 8	$ 9,327
Excavate 4.0' and consolidate Southern Lots	1,244	CY	$ 8	$ 9,956
Total Excavation Volume	**3,414**	**CY**		
Site Restoration				
WA-1A				
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$ 3	$ 15,585
Import cover - 1.5 ft	2,598	CY	$ -	$ -
Import 0.5' topsoil	866	CY	$ 15	$ 12,988
Upland planting/seeding	1.07	ACRE	$ 3,000	$ 3,220
WA-1B				
Geotextile (16 oz Nonwoven needle-punched)	2,286	SY	$ 3	$ 6,858
Import cover - 1.5 ft	1,143	CY	$ -	$ -
Import 0.5' topsoil	381	CY	$ 15	$ 5,715
Upland planting/seeding	0.47	ACRE	$ 3,000	$ 1,417
WA-2A				
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$ 3	$ 4,823
Import cover -1.5 ft	804	CY	$ -	$ -
Import 0.5' topsoil	268	CY	$ 15	$ 4,019
Upland planting/seeding	0.33	ACRE	$ 3,000	$ 996
WA-2B				
Geotextile (16 oz Nonwoven needle-punched)	767	SY	$ 3	$ 2,302
Import cover - 1.5 ft	384	CY	$ -	$ -
Import 0.5' topsoil	128	CY	$ 15	$ 1,919
Upland planting/seeding	0.16	ACRE	$ 3,000	$ 476
WA-2C				
Geotextile (16 oz Nonwoven needle-punched)	678	SY	$ 3	$ 2,034
Import cover - 1.5 ft	339	CY	$ -	$ -
Import 0.5' topsoil	113	CY	$ 15	$ 1,695
Upland planting/seeding	0.14	ACRE	$ 3,000	$ 420
WA-2D				
Geotextile (16 oz Nonwoven needle-punched)	1,855	SY	$ 3	$ 5,566
Import cover - 2.0 ft	1,237	CY	$ -	$ -
Import 0.5' topsoil	309	CY	$ 15	$ 4,639
Upland planting/seeding	0.38	ACRE	$ 3,000	$ 1,150
WA-3A				
Geotextile (16 oz Nonwoven needle-punched)	1,408	SY	$ 3	$ 4,224
Import cover -1.5 ft	704	CY	$ -	$ -
Import 0.5' topsoil	235	CY	$ 15	$ 3,520
Upland planting/seeding	0.29	ACRE	$ 3,000	$ 873

Table C-4
Alternative 4 - In-Place Soil Cover
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

	Item	Quantity	Unit	Unit Cost	Total Cost
	WA-3B				
	Geotextile (16 oz Nonwoven needle-punched)	2,192	SY	$ 3	$ 6,576
	Import cover - 1.5 ft	1,096	CY	$ -	$ -
	Import 0.5' topsoil	365	CY	$ 15	$ 5,480
	Upland planting/seeding	0.45	ACRE	$ 3,000	$ 1,359
	WA-4A				
	Geotextile (16 oz Nonwoven needle-punched)	838	SY	$ 3	$ 2,513
	Import cover - 1.5 ft	419	CY	$ -	$ -
	Import 0.5' topsoil	140	CY	$ 15	$ 2,094
	Upland planting/seeding	0.17	ACRE	$ 3,000	$ 519
	WA-4B				
	Geotextile (16 oz Nonwoven needle-punched)	1,399	SY	$ 3	$ 4,198
	Import cover - 1.5 ft	700	CY	$ -	$ -
	Import 0.5' topsoil	233	CY	$ 15	$ 3,498
	Upland planting/seeding	0.29	ACRE	$ 3,000	$ 867
	WA-5 (former ice chute)				
	Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
	Import cover - 1.5 ft	292	CY	$ -	$ -
	Import 0.5' topsoil	97	CY	$ 15	$ 1,459
	Upland planting/seeding	0.12	ACRE	$ 3,000	$ 362
	WA-6MID				
	Geotextile (16 oz Nonwoven needle-punched)	3,606	SY	$ 3	$ 10,818
	Import cover - 1.5 ft	1,803	CY	$ -	$ -
	Import 0.5' topsoil	601	CY	$ 15	$ 9,015
	Upland planting/seeding	0.75	ACRE	$ 3,000	$ 2,235
	WA-6N				
	Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3	$ 3,478
	Import cover - 1.5 ft	580	CY	$ -	$ -
	Import 0.5' topsoil	193	CY	$ 15	$ 2,899
	Upland planting/seeding	0.24	ACRE	$ 3,000	$ 719
	WA-6S				
Poten	Geotextile (16 oz Nonwoven needle-punched)	2,619	SY	$ 3	$ 7,858
	Import cover - 1.5 ft	1,310	CY	$ -	$ -
	Import 0.5' topsoil	437	CY	$ 15	$ 6,549
	Upland planting/seeding	0.54	ACRE	$ 3,000	$ 1,624
	WA-7				
	Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3	$ 35,318
	Import cover - 1.5 ft	5,886	CY	$ -	$ -
	Import 0.5' topsoil	1,962	CY	$ 15	$ 29,432
	Upland planting/seeding	2.43	ACRE	$ 3,000	$ 7,297
	WA-8 (former rail spur)				
	Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3	$ 996
	Import cover - 1.5 ft	166	CY	$ -	$ -
	Import 0.5' topsoil	55	CY	$ 15	$ 830
	Upland planting/seeding	0.07	ACRE	$ 3,000	$ 206
Cover Required Summary					
	Cover Required for OU5	(19,459)	CY		
	Total Cover Required for OU5	**(19,459)**	**CY**		
Cover Source Summary					
	Potential Mitigation Area Soil Exported to OU5	12,792	CY		
	Total Cover Required for OU5	(19,459)			
	Cover Imported	**(6,667)**	**CY**		

Table C-4
Alternative 4 - In-Place Soil Cover
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Imported Soil Costs				
Potential Mitigation Area Soil Exported to OU5	12,792	CY	$ 8	$ 102,336
Import Additional Cover from Offsite Source	6,667	CY	$ 20	$ 133,340
Soil Quality Testing for Imported Cover/Backfill	1	LS	$ 28,800	$ 28,800
Soil Quality Testing for Imported Topsoil	1	LS	$ 10,080	$ 10,080
OU5 Stormwater Management Plan (see Table C-9 for details)	1	LS	$ 640,000	$ 640,000
Potential Mitigation Area Costs (see Table C-12 for details)	1	LS	$ 730,000	$ 730,000
Final Improvements				
Remove decon pad	1	LS	$ 2,500	$ 2,500
Reestablish fence around entire West Area	2,562	LF	$ 20	$ 51,240
Purchases for Cover/Floodplain and Wetland Mitigation				
Potential Mitigation Area Parcels	1	LS	$ 50,000	$ 50,000
Floodplain Mitigation Site	1	LS	$ 7,820,700	$ 7,820,700
Permanent Wetland 1N & 1S Impacts minus credit	7.2	ACRE	$ 96,602	$ 694,459
Direct Subtotal				**$ 10,742,330**
Engineering (Design, Permitting, & Admin)	1	LS	$ 196,685	$ 196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 282,900	$ 282,900
Direct and Indirect Subtotal				**$ 11,221,915**
Contingency 30%	1	LS	$ 3,366,575	$ 3,366,575
Capital Total				**$ 14,590,000**
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 4,000	$ 4,000
Annual routine maintenance and repairs (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				**$ 16,000**
O&M Contingency 30%	1	LS	$ 4,800	$ 4,800
Annual Operation and Maintenance Total				**$ 20,800**
30-year O&M Total - No discount rate applied				**$ 624,000**
TOTAL CAPITAL AND O&M				**$ 15,210,000**

Table C-5
Alternative 5 - Onsite Consolidation with Soil Cover at West Area
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
Capital Costs						
Mobilization (general conditions & safety plan)	1	LS	$	119,677	$	119,677
Temporary Erosion and Sediment Control						
Construction entrance into West Area	1	EACH	$	1,800	$	1,800
Establish silt fence	1,200	LF	$	3	$	3,600
Other erosion control items for NPDES requirements	1	LS	$	2,500	$	2,500
Site Preparation						
Remove existing perimeter fence	2,562	LF	$	3	$	7,686
Dewatering (pump to onsite system)	1	LS	$	25,000	$	25,000
Remove misc demolition debris present on surface	1	LS	$	1,000	$	1,000
Clearing and grubbing, chip and spread onsite - West Area	4.33	ACRE	$	10,000	$	43,317
Clearing and grubbing, chip and spread onsite - Southern Lots	0.19	ACRE	$	10,000	$	1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$	20	$	16,667
Decontamination pad/liner/drainage for south end	1	LS	$	15,000	$	15,000
Decon water management	1	LS	$	20,000	$	20,000
Contaminated Soil Excavation						
Excavate 2.5' and consolidate WA-1A	4,329	CY	$	8	$	34,633
Excavate 2.0' and consolidate WA-1B	1,524	CY	$	8	$	12,192
Excavate 2.5' and consolidate WA-2A	1,340	CY	$	8	$	10,718
Excavate 2.0' and consolidate WA-2B	512	CY	$	8	$	4,093
Excavate 2.5' and consolidate WA-5 (former ice chute)	486	CY	$	8	$	3,891
Excavate 3.5' and consolidate WA-6N	1,353	CY	$	8	$	10,821
Excavate 2.5' and consolidate WA-7	9,811	CY	$	8	$	78,485
Excavate 2.5' and consolidate WA-8 (former rail spur)	277	CY	$	8	$	2,213
Excavate 3.5' and consolidate Area Immediately South of Repository	1,166	CY	$	8	$	9,327
Excavate 4.0' and consolidate Southern Lots	1,244	CY	$	8	$	9,956
Total Excavation Volume	**22,041**	**CY**				
Construction of Onsite Repository						
Geotextile (16 oz Nonwoven needle-punched)	13,110	SY	$	3	$	39,329
Import / grade 1.5 ft engineered cover soil	6,310	CY	$	-	$	-
Import / grade 0.5' topsoil	2,185	CY	$	15	$	32,774
Upland planting/seeding	2.71	ACRE	$	3,000	$	8,126
Site Restoration						
WA-1A						
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$	3	$	15,585
Import backfill - 1.5 ft	2,598	CY	$	-	$	-
Import 1.0' wetland-like soil	1,732	CY	$	30	$	51,950
Wetland planting/seeding	1.07	ACRE	$	10,000	$	10,733
WA-1B						
Import backfill - 1.5 ft	1,143	CY	$	-	$	-
Import 0.5' topsoil	381	CY	$	15	$	5,715
Upland planting/seeding	0.47	ACRE	$	3,000	$	1,417
WA-2A						
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$	3	$	4,823
Import backfill - 1.5 ft	804	CY	$	-	$	-
Import 1.0' wetland-like soil	536	CY	$	30	$	16,077
Wetland planting/seeding	0.33	ACRE	$	10,000	$	3,322
WA-2B						
Import cover soil from Potential Mitigation Area/other - 1.5 ft	384	CY	$	-	$	-
Import 0.5' topsoil	128	CY	$	15	$	1,919
Upland planting/seeding	0.16	ACRE	$	3,000	$	476
WA-5 (former ice chute)						
Geotextile (16 oz Nonwoven needle-punched)	584	SY	$	3	$	1,751
Import backfill - 2.0 ft	389	CY	$	-	$	-
Import 0.5' topsoil	97	CY	$	15	$	1,459
Upland planting/seeding	0.12	ACRE	$	3,000	$	362

Table C-5
Alternative 5 - Onsite Consolidation with Soil Cover at West Area
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
WA-6N						
Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$	3	$	3,478
Import backfill - 2.5 ft	966	CY	$	-	$	-
Import 1.0' wetland-like soil	386	CY	$	30	$	11,594
Wetland planting/seeding	0.24	ACRE	$	10,000	$	2,396
WA-7						
Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$	3	$	35,318
Import backfill - 1.5 ft	5,886	CY	$	-	$	-
Import 1.0' wetland-like soil	3,924	CY	$	30	$	117,728
Wetland planting/seeding	2.43	ACRE	$	10,000	$	24,324
WA-8 (former rail spur)						
Geotextile (16 oz Nonwoven needle-punched)	332	SY	$	3	$	996
Import backfill - 2.0 ft	221	CY	$	-	$	-
Import 0.5' topsoil	55	CY	$	15	$	830
Upland planting/seeding	0.07	ACRE	$	3,000	$	206
Cover/Backfill Required Summary						
Cover for OU5 Repository	(6,310)	CY				
Backfill for OU5	(12,391)	CY				
Total Cover/Backfill Required for OU5	**(18,701)**	**CY**				
Cover/Backfill Source Summary						
Potential Mitigation Area Soil Exported to OU5	12,792	CY				
Total Cover/Backfill Required for OU5	(18,701)					
Net Cover/Backfill Imported	**(5,909)**	**CY**				
Imported Soil Costs						
Potential Mitigation Area Soil Exported to OU5	12,792	CY	$	8	$	102,336
Import Additional Cover/Backfill from Offsite Source	5,909	CY	$	20	$	118,183
Soil Quality Testing for Imported Cover/Backfill	1	LS	$	27,360	$	27,360
Soil Quality Testing for Imported Topsoil	1	LS	$	4,320	$	4,320
Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$	10,080	$	10,080
OU5 Stormwater Management Plan (see Table C-9 for details)	1	LS	$	640,000	$	640,000
Potential Mitigation Area Costs (see Table C-12 for details)	1	LS	$	730,000	$	730,000
Final Improvements						
Remove decon pad	1	LS	$	2,500	$	2,500
Reestablish fence around entire West Area	2,562	LF	$	20	$	51,240
Purchases for Cover/Floodplain and Wetland Mitigation						
Potential Mitigation Area Parcels	1	LS	$	50,000	$	50,000
Permanent Wetland 1S Impacts (2.5:1 replacement) minus credit	3.0	ACRE	$	96,602	$	288,993
Direct Subtotal					**$**	**2,852,204**
Engineering (Design, Permitting, & Admin)	1	LS	$	196,685	$	196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$	282,900	$	282,900
Direct and Indirect Subtotal					**$**	**3,331,789**
Contingency 30%	1	LS	$	999,537	$	999,537
Capital Total					**$**	**4,330,000**

Table C-5
Alternative 5 - Onsite Consolidation with Soil Cover at West Area
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 4,000	$ 4,000
Annual routine maintenance and repairs (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				$ 16,000
O&M Contingency 30%	1	LS	$ 4,800	$ 4,800
Annual Operation and Maintenance Total				**$ 20,800**
30-year O&M Total - No discount rate applied				**$ 624,000**
Poter TOTAL CAPITAL AND O&M				**$ 4,950,000**

Table C-6
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Capital Costs				
Mobilization (general conditions & safety plan)	1	LS	$ 150,875	$ 150,875
OU5 Temporary Erosion and Sediment Control				
Construction entrance into West Area	1	EA	$ 1,800	$ 1,800
Establish silt fence	1,200	LF	$ 3	$ 3,600
Other erosion control items for NPDES requirements	1	LS	$ 2,500	$ 2,500
Azelia Avenue Pond Temporary Erosion and Sediment Control				
Construction entrance	1	EA	$ 1,800	$ 1,800
Establish silt fence	1,120	LF	$ 3	$ 3,360
Other erosion control items for NPDES requirements	1	LS	$ 1,000	$ 1,000
OU5 Stormwater Management Plan (see Table C-10 for details)	1	LS	$ 512,000	$ 512,000
OU5 Site Preparation				
Remove existing fence	2,562	LF	$ 3	$ 7,686
Dewatering (pump to onsite system)	1	LS	$ 25,000	$ 25,000
Remove misc demolition debris present on surface	1	LS	$ 1,000	$ 1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	AC	$ 10,000	$ 43,317
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	AC	$ 10,000	$ 1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$ 20	$ 16,667
Decontamination pad/liner/drainage for south end	1	LS	$ 15,000	$ 15,000
Decon water management	1	LS	$ 20,000	$ 20,000
Azelia Avenue Pond Site Preparation				
Remove entrance sign in southeast corner	1	LS	$ 2,000	$ 2,000
Remove fence around pond	885	LF	$ 3	$ 2,655
Dewatering	1	LS	$ 8,000	$ 8,000
Strip and stockpile topsoil	1,731	CY	$ 12	$ 20,766
Contaminated Soil Excavation, Staging, Loading, and Transportation to Azelia Avenue Pond				
Excavate 2.5', stage and load WA-1A	6,061	TON	$ 16	$ 96,973
Excavate 2.0', stage and load WA-1B	2,134	TON	$ 16	$ 34,138
Excavate 2.5', stage and load WA-2A	1,876	TON	$ 16	$ 30,010
Excavate 2.0', stage and load WA-2B	716	TON	$ 16	$ 11,461
Excavate 3.5', stage and load WA-2C	1,107	TON	$ 16	$ 17,715
Excavate 1.0', stage and load WA-2D	866	TON	$ 16	$ 13,854
Excavate 3.5', stage and load WA-3A	2,639	TON	$ 16	$ 42,229
Excavate 1.0', stage and load WA-3B	1,529	TON	$ 16	$ 24,462
Excavate 3.5', stage and load WA-4A	1,382	TON	$ 16	$ 22,106
Excavate 2.0', stage and load WA-4B	1,306	TON	$ 16	$ 20,897
Excavate 2.5', stage and load WA-5 (former ice chute)	681	TON	$ 16	$ 10,895
Excavate 3.5', stage and load WA-6MID	5,890	TON	$ 16	$ 94,234
Excavate 3.5', stage and load WA-6N	1,894	TON	$ 16	$ 30,300
Excavate 3.5', stage and load WA-6S	5,052	TON	$ 16	$ 80,827
Excavate 2.5', stage and load WA-7	13,735	TON	$ 16	$ 219,759
Excavate 2.5', stage and load WA-8 (former rail spur)	387	TON	$ 16	$ 6,197
Excavate 4.0', stage and load Southern Lots	1,742	TON	$ 16	$ 27,876
Total Excavation Weight	**48,996**	**TON**		
Total Excavation Volume	**34,997**	**CY**		
Azelia Avenue Pond Repository				
Geotextile (16 oz Nonwoven needle-punched)	10,383	SY	$ 3	$ 31,149
Import / grade 1.5 ft engineered cover soil	4,358	CY	$ -	$ -
Import / grade 0.5' topsoil	1,731	CY	$ -	$ -
Upland planting/seeding	2.15	ACRE	$ 3,000	$ 6,436

Table C-6
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
OU5 Site Restoration				
WA-1A				
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$ 3	$ 15,585
Import backfill - 1.5 ft	2,598	CY	$ -	$ -
Import 1.0' wetland-like soil	1,732	CY	$ 30	$ 51,950
Wetland planting/seeding	1.07	AC	$ 10,000	$ 10,733
WA-1B				
Import backfill - 1.5 ft	1,143	CY	$ -	$ -
Import 0.5' topsoil	381	CY	$ -	$ -
Upland planting/seeding	0.47	AC	$ 3,000	$ 1,417
WA-2A				
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$ 3	$ 4,823
Import backfill - 1.5 ft	804	CY	$ -	$ -
Import 1.0' wetland-like soil	536	CY	$ 30	$ 16,077
Wetland planting/seeding	0.33	AC	$ 10,000	$ 3,322
WA-2B				
Import backfill - 1.5 ft	384	CY	$ -	$ -
Import 0.5' topsoil	128	CY	$ -	$ -
Upland planting/seeding	0.16	AC	$ 3,000	$ 476
WA-2C				
Geotextile (16 oz Nonwoven needle-punched)	678	SY	$ 3	$ 2,034
Import backfill - 2.5 ft	565	CY	$ -	$ -
Import 1.0' wetland-like soil	226	CY	$ 30	$ 6,779
Wetland planting/seeding	0.14	AC	$ 10,000	$ 1,401
WA-2D				
Import backfill - 2.5 ft	1,546	CY	$ -	$ -
Import 0.5' topsoil	309	CY	$ -	$ -
Upland planting/seeding	0.38	AC	$ 3,000	$ 1,150
WA-3A				
Geotextile (16 oz Nonwoven needle-punched)	1,616	SY	$ 3	$ 4,848
Import backfill - 2.5 ft	1,347	CY	$ -	$ -
Import 1.0' wetland-like soil	539	CY	$ 30	$ 16,159
Wetland planting/seeding	0.33	AC	$ 10,000	$ 3,339
WA-3B				
Import backfill - 2.5 ft	2,085	CY	$ -	$ -
Import 0.5' topsoil	417	CY	$ -	$ -
Poten Upland planting/seeding	0.52	AC	$ 3,000	$ 1,551
WA-4A				
Geotextile (16 oz Nonwoven needle-punched)	846	SY	$ 3	$ 2,538
Import backfill - 2.5 ft	705	CY	$ -	$ -
Import 1.0' wetland-like soil	282	CY	$ 30	$ 8,459
Wetland planting/seeding	0.17	AC	$ 10,000	$ 1,748
WA-4B				
Import backfill - 1.5 ft	700	CY	$ -	$ -
Import 0.5' topsoil	233	CY	$ -	$ -
Upland planting/seeding	0.29	AC	$ 3,000	$ 867

Table C-6
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

	Item	Quantity	Unit	Unit Cost	Total Cost
	WA-5 (former ice chute)				
	Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
	Import backfill - 2.0 ft	389	CY	$ -	$ -
	Import 0.5' topsoil	97	CY	$ -	$ -
	Upland planting/seeding	0.12	AC	$ 3,000	$ 362
	WA-6MID				
	Geotextile (16 oz Nonwoven needle-punched)	3,606	SY	$ 3.00	$ 10,818
	Import backfill - 2.5 ft	3,005	CY	$ -	$ -
	Import 1.0' wetland-like soil	1,202	CY	$ 30.00	$ 36,059
	Wetland planting/seeding	0.75	AC	$ 10,000.00	$ 7,450
	WA-6N				
	Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3.00	$ 3,478
	Import backfill - 2.5 ft	966	CY	$ -	$ -
	Import 1.0' wetland-like soil	386	CY	$ 30.00	$ 11,594
	Wetland planting/seeding	0.24	AC	$ 10,000.00	$ 2,396
	WA-6S				
	Geotextile (16 oz Nonwoven needle-punched)	3,093	SY	$ 3.00	$ 9,279
Poten	Import backfill - 2.5 ft	2,577	CY	$ -	$ -
	Import 1.0' wetland-like soil	1,031	CY	$ 30.00	$ 30,929
	Wetland planting/seeding	0.64	AC	$ 10,000.00	$ 6,390
	WA-7				
	Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3.00	$ 35,318
	Import backfill - 1.5 ft	5,886	CY	$ -	$ -
	Import 1.0' wetland-like soil	3,924	CY	$ 30.00	$ 117,728
	Wetland planting/seeding	2.43	AC	$ 10,000.00	$ 24,324
	WA-8 (former rail spur)				
	Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3.00	$ 996
	Import backfill - 2.0 ft	221	CY	$ -	$ -
	Import 0.5' topsoil	55	CY	$ -	$ -
	Upland planting/seeding	0.07	AC	$ 3,000.00	$ 206
Cover/Backfill Required Summary					
	Cover for Repository	(4,358)	CY		
	Backfill Required for OU5	(24,920)	CY		
	Total Cover/Backfill Required	**(29,278)**	**CY**		
Cover/Backfill Source Summary					
	Backfill From Retaining Wall Pond	9,191	CY		
	Total Cover/Backfill Required	(29,278)	CY		
	Backfill Imported	**(20,087)**	**CY**		
Topsoil Required Summary					
	Topsoil for Repository	(1,731)	CY		
	Topsoil for OU5	(1,621)	CY		
	Total Topsoil Required	**(3,351)**	**CY**		
Topsoil Source Summary					
	Stripped from Azelia Avenue Pond Area	1,731	CY		
	Stripped from Retaining Wall Pond Area	685	CY		
	Total Topsoil Required	(3,351)	CY		
	Topsoil Imported	**(936)**	**CY**		
Imported Soil Costs					
	Import Backfill	20,087	CY	$ 20	$ 401,736
	Import Topsoil	936	CY	$ 15	$ 14,041
Poten	Soil Quality Testing for Imported and Onsite Backfill	1	LS	$ 43,200	$ 43,200
	Soil Quality Testing for Imported and Onsite Topsoil	1	LS	$ 5,280	$ 5,280
	Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$ 14,400	$ 14,400

Table C-6
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Azelia Avenue Pond Replacement Permanent Stormwater Management				
Removals				
Remove 36" RCP	26	LF	$ 10	$ 260
Remove 36" RC FES and Riprap	1	EA	$ 100	$ 100
Remove 42" RCP	64	LF	$ 10	$ 640
Remove 42" RC FES and Riprap	1	EA	$ 100	$ 100
Remove 22"x36" RCP	202	LF	$ 10	$ 2,020
Remove 22"x36" RC FES and Riprap	4	EA	$ 100	$ 400
Remove 12" RCP	77	LF	$ 10	$ 770
Remove Wood Wall	1	LS	$ 100	$ 100
Plug 12" Opening in Existing Manhole	1	LS	$ 200	$ 200
Remove Riprap in Swale	2	LS	$ 200	$ 400
Remove and Replace 4" Bituminous Road	480	SF	$ 13	$ 6,240
Remove and Replace Curb and Gutter	30	LF	$ 20	$ 600
Earthwork/Utilities				
Insulate Sanitary Sewer Service	40	LF	$ 30	$ 1,200
Insulate Water Service	65	LF	$ 30	$ 1,950
Strip and stockpile topsoil	685	CY	$ 12	$ 8,218
Common Excavation	9,191	CY	$ 5	$ 45,956
Riprap at FES outlets	26	CY	$ 50	$ 1,300
Granular Filter	13	CY	$ 40	$ 520
Storm Structures				
Connect Existing Pipe to New Manhole	2	EA	$ 800	$ 1,600
RC Manhole, 6.5' Dia., 8' Deep	2	EA	$ 8,000	$ 16,000
RC Manhole, 7' Dia., 6.5' Deep	1	EA	$ 7,000	$ 7,000
24" RCP, CL. III	8	LF	$ 40	$ 320
36" RCP, CL. III	193	LF	$ 70	$ 13,510
48" RCP, CL. III	211	LF	$ 120	$ 25,320
24" RC FES	1	EA	$ 700	$ 700
48" RC FES	1	EA	$ 1,800	$ 1,800
Outlet Structure w/ high capacity grate	1	EA	$ 5,000	$ 5,000
Retaining Wall, 8' average height	10,256	SF	$ 25	$ 256,400
Fence Around Retaining Wall Pond	1,300	LF	$ 20	$ 26,000

Table C-6
Alternative 6 - Onsite Consolidation with Soil Cover at Azelia Avenue Pond
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Well Modifications				
Abandon and Replace Monitoring Wells (W300SPN and W7)				
Per Diem (# days x # persons)	10	PERSON-DAY	$ 125	$ 1,250
Solid Waste Containerization - 55 Gallon Steel Drum	20	EA	$ 75	$ 1,500
Maintenance Cleaning (Boring Location)	2	EA	$ 250	$ 500
Set Up (Boring)	2	EA	$ 400	$ 800
6" Borehole Advancement (Overburden) (W7)	15	FT	$ 35	$ 525
6" Borehole Advancement (Rock) (W300SPN)	17	FT	$ 80	$ 1,360
10" Rotasonic Advancement (Overburden) (W300 SPN: 0-117')	117	FT	$ 130	$ 15,210
2" F & I SS Screen	15	FT	$ 30	$ 450
2" F & I SS Riser	135	FT	$ 30	$ 4,050
F & I Sand Pack (50 # bags)	10	EA	$ 10	$ 100
F & I Bentonite Seal (bag)	8	EA	$ 10	$ 80
F & I Cement Grout (bag)	40	EA	$ 20	$ 800
F & I Protective Casing (6")	120	FT	$ 16	$ 1,920
F & I Protective Casing (10")	35	FT	$ 25	$ 875
Well Development	4	HR	$ 175	$ 700
Well Sealing	158	FT	$ 15	$ 2,370
Extend Wells [W254 (Monitoring) , U4N (Pumpout) and U5 (Pumpout)]				
Inspect and Replace Pitless Fitting Connection	2	EA	$ 6,000	$ 12,000
4" F & I SS Riser	17	FT	$ 30	$ 510
F & I Protective Casing (8")	17	FT	$ 20	$ 340
8" F & I SS Riser	16	FT	$ 120	$ 1,920
F & I Protective Casing (14")	16	FT	$ 50	$ 800
Extend Electrical Line at Pumpout Well	2	EA	$ 1,000	$ 2,000
Test pumpout wells - Labor (manhours)	4	EA	$ 125	$ 500
Final Improvements				
Remove decon pad	1	LS	$ 2,500	$ 2,500
Replace entrance sign at southeast corner of Azelia Avenue Pond Are	1	LS	$ 10,000	$ 10,000
Reestablish fence around entire West Area	2,562	LF	$ 20	$ 51,240
Establish fence around Azelia Avenue Pond area	1,700	FT	$ 20	$ 34,000
Direct Subtotal				**$ 3,168,381**
Engineering (Design, Permitting, & Admin)	1	LS	$ 196,685	$ 196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 282,900	$ 282,900
Direct and Indirect Subtotal				**$ 3,647,966**
Contingency 30%	1	LS	$ 1,094,390	$ 1,094,390
Capital Total				**$ 4,740,000**
Operation and Maintenance				
Monitoring and Pumpout Well Maintenance	3	EA	$ 3,000	$ 9,000
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 8,000	$ 8,000
Annual routine site maintenance (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				**$ 29,000**
O&M Contingency 30%	1	LS	$ 8,700	$ 8,700
Annual Operation and Maintenance Total				**$ 37,700**
30-year O&M Total - No discount rate applied				**$ 1,131,000**
TOTAL CAPITAL & O&M				**$ 5,870,000**

Table C-7
Alternative 7 - Limited Onsite Consolidation with Soil Cover at Building 1A Pond
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Capital Costs				
Mobilization (general conditions & safety plan)	1	LS	$ 141,709	$ 141,709
OU5 Temporary Erosion and Sediment Control				
Construction entrance into West Area	1	EA	$ 1,800	$ 1,800
Establish silt fence	1,200	LF	$ 3	$ 3,600
Other erosion control items for NPDES requirements	1	LS	$ 2,500	$ 2,500
Building 1A Pond Temporary Erosion and Sediment Control				
Establish silt fence	900	LF	$ 3	$ 2,700
Other erosion control items for NPDES requirements	1	LS	$ 1,000	$ 1,000
Azelia Avenue Pond Temporary Erosion and Sediment Control				
Construction entrance	1	EA	$ 1,800	$ 1,800
Establish silt fence	900	LF	$ 3	$ 2,700
Other erosion control items for NPDES requirements	1	LS	$ 1,000	$ 1,000
OU5 Stormwater Management Plan (see Table C-10 for details)	1	LS	$ 512,000	$ 512,000
OU5 Site Preparation				
Remove existing fence	2,562	LF	$ 3	$ 7,686
Dewatering (pump to onsite system)	1	LS	$ 25,000	$ 25,000
Remove misc demolition debris present on surface	1	LS	$ 1,000	$ 1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	AC	$ 10,000	$ 43,317
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	AC	$ 10,000	$ 1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$ 20	$ 16,667
Decontamination pad/liner/drainage for south end	1	LS	$ 15,000	$ 15,000
Decon water management	1	LS	$ 20,000	$ 20,000
Building 1A Pond Site Preparation				
Strip and stockpile topsoil	1,284	CY	$ 12	$ 15,412
Azelia Avenue Pond Site Preparation				
Dewater to Elevation 854	1	LS	$ 5,000	$ 5,000
Contaminated Soil Excavation, Staging, Loading, and Transportation to Building 1A Pond Consolidation Required				
Excavate 3.5', stage and load WA-2C	1,107	TON	$ 6	$ 6,643
Excavate 1.0', stage and load WA-2D	866	TON	$ 6	$ 5,195
Excavate 3.5', stage and load WA-3A	2,639	TON	$ 6	$ 15,836
Excavate 1.0', stage and load WA-3B	1,529	TON	$ 6	$ 9,173
Excavate 3.5', stage and load WA-4A	1,382	TON	$ 6	$ 8,290
Excavate 2.0', stage and load WA-4B	1,306	TON	$ 6	$ 7,836
Excavate 3.5', stage and load WA-6MID	5,890	TON	$ 6	$ 35,338
Excavate 3.5', stage and load WA-6N	1,894	TON	$ 6	$ 11,363
Excavate 3.5', stage and load WA-6S	5,052	TON	$ 6	$ 30,310
Subtotal Excavation Weight	**21,664**	**TON**		
Subotal Excavation Volume	**15,474**	**CY**		
Transport and Disposal to Subtitle D Landfill				
Excavate 2.5', stage, load, and transport WA-1A	6,061	TON	$ 25	$ 151,521
Excavate 2.0', stage, load, and transport WA-1B	2,134	TON	$ 25	$ 53,340
Excavate 2.5', stage, load, and transport WA-2A	1,876	TON	$ 25	$ 46,890
Excavate 2.0', stage, load, and transport WA-2B	716	TON	$ 25	$ 17,907
Excavate 2.5', stage, load, and transport WA-5 (former ice chute)	681	TON	$ 25	$ 17,024
Excavate 2.5', stage, load, and transport WA-7	13,735	TON	$ 25	$ 343,373
Excavate 2.5', stage, load, and transport WA-8 (former rail spur)	387	TON	$ 25	$ 9,683
Excavate 4.0', stage, load, and transport Southern Lots	1,742	TON	$ 25	$ 43,556
Total Excavation Weight	**27,332**	**TON**		
Total Excavation Volume	**19,523**	**CY**		

Table C-7
Alternative 7 - Limited Onsite Consolidation with Soil Cover at Building 1A Pond
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Building 1A Pond Repository				
Geotextile (16 oz Nonwoven needle-punched)	7,706	SY	$ 3	$ 23,118
Import / grade 1.5 ft engineered cover soil	3,511	CY	$ -	$ -
Import / grade 0.5' topsoil	1,284	CY	$ -	$ -
Upland planting/seeding	1.59	ACRE	$ 3,000	$ 4,776
OU5 Site Restoration				
WA-1A				
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$ 3	$ 15,585
Import backfill - 1.5 ft	2,598	CY	$ -	$ -
Import 1.0' wetland-like soil	1,732	CY	$ 30	$ 51,950
Wetland planting/seeding	1.07	AC	$ 10,000	$ 10,733
WA-1B				
Import backfill - 1.5 ft	1,143	CY	$ -	$ -
Import 0.5' topsoil	381	CY	$ -	$ -
Upland planting/seeding	0.47	AC	$ 3,000	$ 1,417
WA-2A				
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$ 3	$ 4,823
Import backfill - 1.5 ft	804	CY	$ -	$ -
Import 1.0' wetland-like soil	536	CY	$ 30	$ 16,077
Wetland planting/seeding	0.33	AC	$ 10,000	$ 3,322
WA-2B				
Import backfill - 1.5 ft	384	CY	$ -	$ -
Import 0.5' topsoil	128	CY	$ -	$ -
Upland planting/seeding	0.16	AC	$ 3,000	$ 476
WA-2C				
Geotextile (16 oz Nonwoven needle-punched)	678	SY	$ 3	$ 2,034
Import backfill - 2.5 ft	565	CY	$ -	$ -
Import 1.0' wetland-like soil	226	CY	$ 30	$ 6,779
Wetland planting/seeding	0.14	AC	$ 10,000	$ 1,401
WA-2D				
Import backfill - 2.5 ft	1,546	CY	$ -	$ -
Import 0.5' topsoil	309	CY	$ -	$ -
Upland planting/seeding	0.38	AC	$ 3,000	$ 1,150
WA-3A				
Geotextile (16 oz Nonwoven needle-punched)	1,408	SY	$ 3	$ 4,224
Poten Import backfill - 2.5 ft	1,173	CY	$ -	$ -
Import 1.0' wetland-like soil	469	CY	$ 30	$ 14,080
Wetland planting/seeding	0.29	AC	$ 10,000	$ 2,909
WA-3B				
Import backfill - 2.5 ft	1,827	CY	$ -	$ -
Import 0.5' topsoil	365	CY	$ -	$ -
Upland planting/seeding	0.45	AC	$ 3,000	$ 1,359
WA-4A				
Geotextile (16 oz Nonwoven needle-punched)	838	SY	$ 3	$ 2,513
Import backfill - 2.5 ft	698	CY	$ -	$ -
Import 1.0' wetland-like soil	279	CY	$ 30	$ 8,377
Wetland planting/seeding	0.17	AC	$ 10,000	$ 1,731
WA-4B				
Import backfill - 1.5 ft	700	CY	$ -	$ -
Import 0.5' topsoil	233	CY	$ -	$ -
Upland planting/seeding	0.29	AC	$ 3,000	$ 867

Table C-7
Alternative 7 - Limited Onsite Consolidation with Soil Cover at Building 1A Pond
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

	Item	Quantity	Unit	Unit Cost	Total Cost
	WA-5 (former ice chute)				
	Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
	Import backfill - 2.0 ft	389	CY	$ -	$ -
	Import 0.5' topsoil	97	CY	$ -	$ -
	Upland planting/seeding	0.12	AC	$ 3,000	$ 362
	WA-6MID				
	Geotextile (16 oz Nonwoven needle-punched)	3,606	SY	$ 3.00	$ 10,818
	Import backfill - 2.5 ft	3,005	CY	$ -	$ -
	Import 1.0' wetland-like soil	1,202	CY	$ 30.00	$ 36,059
	Wetland planting/seeding	0.75	AC	$ 10,000.00	$ 7,450
	WA-6N				
Poten	Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3.00	$ 3,478
	Import backfill - 2.5 ft	966	CY	$ -	$ -
	Import 1.0' wetland-like soil	386	CY	$ 30.00	$ 11,594
	Wetland planting/seeding	0.24	AC	$ 10,000.00	$ 2,396
	WA-6S				
	Geotextile (16 oz Nonwoven needle-punched)	2,619	SY	$ 3.00	$ 7,858
	Import backfill - 2.5 ft	2,183	CY	$ -	$ -
	Import 1.0' wetland-like soil	873	CY	$ 30.00	$ 26,194
	Wetland planting/seeding	0.54	AC	$ 10,000.00	$ 5,412
	WA-7				
	Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3.00	$ 35,318
	Import backfill - 1.5 ft	5,886	CY	$ -	$ -
	Import 1.0' wetland-like soil	3,924	CY	$ 30.00	$ 117,728
	Wetland planting/seeding	2.43	AC	$ 10,000.00	$ 24,324
	WA-8 (former rail spur)				
	Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3.00	$ 996
	Import backfill - 2.0 ft	221	CY	$ -	$ -
	Import 0.5' topsoil	55	CY	$ -	$ -
	Upland planting/seeding	0.07	AC	$ 3,000.00	$ 206
Cover/Backfill Required Summary					
	Cover for Repository	(3,511)	CY		
	Backfill Required for OU5	(24,088)	CY		
	Total Cover/Backfill Required	**(27,598)**	**CY**		
Cover/Backfill Source Summary					
	Total Cover/Backfill Required	(27,598)	CY		
	Backfill Imported	**(27,598)**	**CY**		
Topsoil Required Summary					
	Topsoil for Repository	(1,284)	CY		
	Topsoil for OU5	(1,569)	CY		
	Total Topsoil Required	**(2,854)**	**CY**		
Topsoil Source Summary					
	Stripped from Building 1A Pond	1,284	CY		
	Total Topsoil Required	(2,854)	CY		
Poter	**Topsoil Imported**	**(1,569)**	**CY**		
Imported Soil Costs					
	Import Backfill	27,598	CY	$ 20	$ 551,966
	Import Topsoil	1,569	CY	$ 15	$ 23,539
	Soil Quality Testing for Imported Backfill	1	LS	$ 40,320	$ 40,320
	Soil Quality Testing for Imported and Onsite Topsoil	1	LS	$ 4,320	$ 4,320
	Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$ 14,400	$ 14,400

Table C-7
Alternative 7 - Limited Onsite Consolidation with Soil Cover at Building 1A Pond
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Building 1A Pond Replacement Permanent Stormwater Management				
Removals				
Remove 30" RCP	196	LF	$ 10	$ 1,960
Remove 30" RC FES and Riprap	1	EA	$ 100	$ 100
Plug 30" Opening in Existing Manhole	1	LS	$ 200	$ 200
Remove RC Manhole, 48" Dia.	1	EA	$ 500	$ 500
Remove 12" RCP	197	LF	$ 10	$ 1,970
Remove 12" RC FES	3	EA	$ 100	$ 300
Remove Wood Wall	1	LS	$ 100	$ 100
Plug 12" Opening in Existing Manhole	1	LS	$ 200	$ 200
Storm Structures				
RC Manhole 24" Dia., 6' Deep	1	EA	$ 1,500	$ 1,500
RC Manhole, 24" Dia., 16' Deep	1	EA	$ 2,500	$ 2,500
RC Manhole, 84" Dia., 8' Deep	1	EA	$ 7,000	$ 7,000
Outlet Structure	1	EA	$ 6,000	$ 6,000
12" RCP, CL. V	61	LF	$ 32	$ 1,952
12" RCP, CL. V, Directional Bore	147	LF	$ 200	$ 29,400
12" HDPE	330	LF	$ 30	$ 9,900
12" HDPE, Directional Bore	300	LF	$ 200	$ 60,000
12" RC FES	1	EA	$ 550	$ 550
30" RCP, CL. III	157	LF	$ 55	$ 8,635
12" Tideflex TF-1 Check Valve	1	EA	$ 4,000	$ 4,000
30" Tideflex TF-1 Check Valve	1	EA	$ 5,000	$ 5,000
Relocations				
Relocate 10" water main	80	LF	$ 60	$ 4,800
Relocate 2" gas main	80	LF	$ 80	$ 6,400
Well Modifications				
Abandon Monitoring Wells (W2N)				
Per Diem (# days x # persons)	1	PERSON-DAY	$ 125	$ 125
Well Sealing	12	FT	$ 15	$ 180
Final Improvements				
Remove decon pad	1	LS	$ 2,500	$ 2,500
Reestablish fence around entire West Area	2,562	LF	$ 20	$ 51,240
Establish fence around Building 1A Pond area	1,380	FT	$ 20	$ 27,600
Purchases for Floodplain and Wetland Mitigation				
Permanent Wetland 1N Impacts (1:1 replacement) minus credit	0.35	ACRE	$ 96,602	$ 34,095
Potential Mitigation Area Parcels	1	LS	$ 50,000	$ 50,000
Direct Subtotal				**$ 3,059,992**
Engineering (Design, Permitting, & Admin)	1	LS	$ 196,685	$ 196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 282,900	$ 282,900
Direct and Indirect Subtotal				**$ 3,539,577**
Contingency 30%	1	LS	$ 1,061,873	$ 1,061,873
Capital Total				**$ 4,600,000**
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 8,000	$ 8,000
Annual routine site maintenance (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				**$ 20,000**
O&M Contingency 30%	1	LS	$ 6,000	$ 6,000
Annual Operation and Maintenance Total				**$ 26,000**
30-year O&M Total - No discount rate applied				**$ 780,000**
TOTAL CAPITAL & O&M				**$ 5,380,000**

Table C-8A
Alternative 8A - Limited Onsite Consolidation with Soil Cover at West Area (Offsite Floodplain Mitigation
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
Capital Costs						
Mobilization (general conditions & safety plan)	1	LS	$	147,993	$	147,993
Temporary Erosion and Sediment Control						
Construction entrance into West Area	1	EA	$	1,800	$	1,800
Establish silt fence	1,200	LF	$	3	$	3,600
Other erosion control items for NPDES requirements	1	LS	$	2,500	$	2,500
Site Preparation						
Remove existing fence	2,562	LF	$	3	$	7,686
Dewatering (pump to onsite system)	1	LS	$	25,000	$	25,000
Remove misc demolition debris present on surface	1	LS	$	1,000	$	1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	AC	$	10,000	$	43,317
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	AC	$	10,000	$	1,928
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$	20	$	16,667
Decontamination pad/liner/drainage for south end	1	LS	$	15,000	$	15,000
Decon water management	1	LS	$	20,000	$	20,000
Contaminated Soil Excavation and Consolidation						
Consolidation Required						
Excavate 3.5', and consolidate WA-2C	273	CY	$	8	$	2,185
Excavate 1.0', and consolidate WA-2D	134	CY	$	8	$	1,070
Excavate 3.5', and consolidate WA-3A	626	CY	$	8	$	5,006
Excavate 1.0', and consolidate WA-3B	444	CY	$	8	$	3,548
Excavate 3.5', and consolidate WA-4A	987	CY	$	8	$	7,895
Excavate 2.0', and consolidate WA-4B	933	CY	$	8	$	7,463
Excavate 3.5', and consolidate WA-6MID	2,791	CY	$	8	$	22,328
Excavate 3.5', and consolidate WA-6N	1,353	CY	$	8	$	10,821
Excavate 3.5', and consolidate WA-6S	2,939	CY	$	8	$	23,516
Subtotal Excavation Volume	**10,479**	**CY**				
Transport and Disposal to Subtitle D Landfill						
Excavate 2.5', stage, load, and transport WA-1A	6,061	TON	$	25	$	151,521
Excavate 2.0', stage, load, and transport WA-1B	2,134	TON	$	25	$	53,340
Excavate 2.5', stage, load, and transport WA-2A	1,876	TON	$	25	$	46,890
Excavate 2.0', stage, load, and transport WA-2B	716	TON	$	25	$	17,907
Excavate 2.5', stage, load, and transport WA-5 (former ice chute)	681	TON	$	25	$	17,024
Excavate 2.5', stage, load, and transport WA-7	13,735	TON	$	25	$	343,373
Excavate 2.5', stage, load, and transport WA-8 (former rail spur)	387	TON	$	25	$	9,683
Excavate 4.0', stage, load, and transport Southern Lots	1,742	TON	$	25	$	43,556
Total Excavation Weight	**27,332**	**TON**				
Total Excavation Volume	**19,523**	**CY**				
Construction of Onsite Repository						
Geotextile (16 oz Nonwoven needle-punched)	6,837	SY	$	3	$	20,510
Import / grade 1.5 ft engineered cover soil	3,160	CY	$	-	$	-
Import / grade 0.5' topsoil	1,139	CY	$	-	$	-
Upland planting/seeding	1.41	ACRE	$	3,000	$	4,238

Table C-8A
Alternative 8A - Limited Onsite Consolidation with Soil Cover at West Area (Offsite Floodplain Mitigation
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

	Item	Quantity	Unit		Unit Cost		Total Cost
OU5 Site Restoration							
	WA-1A						
	Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$	3	$	15,585
	Import backfill - 1.5 ft	2,598	CY	$	-	$	-
	Import 1.0' wetland-like soil	1,732	CY	$	30	$	51,950
	Wetland planting/seeding	1.07	AC	$	10,000	$	10,733
	WA-1B						
	Import backfill - 1.5 ft	1,143	CY	$	-	$	-
	Import 0.5' topsoil	381	CY	$	-	$	-
	Upland planting/seeding	0.47	AC	$	3,000	$	1,417
	WA-2A						
	Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$	3	$	4,823
	Import backfill - 1.5 ft	804	CY	$	-	$	-
	Import 1.0' wetland-like soil	536	CY	$	30	$	16,077
	Wetland planting/seeding	0.33	AC	$	10,000	$	3,322
	WA-2B						
	Import backfill - 1.5 ft	384	CY	$	-	$	-
	Import 0.5' topsoil	128	CY	$	-	$	-
	Upland planting/seeding	0.16	AC	$	3,000	$	476
	WA-2C						
	Geotextile (16 oz Nonwoven needle-punched)	234	SY	$	3	$	702
	Import backfill - 2.5 ft	195	CY	$	-	$	-
	Import 1.0' wetland-like soil	78	CY	$	30	$	2,341
	Wetland planting/seeding	0.05	AC	$	10,000	$	484
	WA-2D						
	Import backfill - 2.5 ft	334	CY	$	-	$	-
	Import 0.5' topsoil	67	CY	$	-	$	-
	Upland planting/seeding	0.08	AC	$	3,000	$	249
	WA-3A						
	Geotextile (16 oz Nonwoven needle-punched)	328	SY	$	3	$	985
	Import backfill - 2.5 ft	274	CY	$	-	$	-
	Import 1.0' wetland-like soil	109	CY	$	30	$	3,284
	Wetland planting/seeding	0.07	AC	$	10,000	$	679
	WA-3B						
	Import backfill - 2.5 ft	205	CY	$	-	$	-
	Import 0.5' topsoil	41	CY	$	-	$	-
	Upland planting/seeding	0.05	AC	$	3,000	$	153
	WA-4A						
	Geotextile (16 oz Nonwoven needle-punched)	838	SY	$	3	$	2,513
	Import backfill - 2.5 ft	698	CY	$	-	$	-
	Import 1.0' wetland-like soil	279	CY	$	30	$	8,377
	Wetland planting/seeding	0.17	AC	$	10,000	$	1,731
	WA-4B						
Poten	Import backfill - 1.5 ft	700	CY	$	-	$	-
	Import 0.5' topsoil	233	CY	$	-	$	-
	Upland planting/seeding	0.29	AC	$	3,000	$	867

Table C-8A
Alternative 8A - Limited Onsite Consolidation with Soil Cover at West Area (Offsite Floodplain Mitigation
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
WA-5 (former ice chute)				
Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
Import backfill - 2.0 ft	389	CY	$ -	$ -
Import 0.5' topsoil	97	CY	$ -	$ -
Upland planting/seeding	0.12	AC	$ 3,000	$ 362
WA-6MID				
Geotextile (16 oz Nonwoven needle-punched)	2,392	SY	$ 3.00	$ 7,177
Import backfill - 2.5 ft	1,994	CY	$ -	$ -
Import 1.0' wetland-like soil	797	CY	$ 30.00	$ 23,923
Wetland planting/seeding	0.49	AC	$ 10,000.00	$ 4,943
WA-6N				
Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3.00	$ 3,478
Import backfill - 2.5 ft	966	CY	$ -	$ -
Import 1.0' wetland-like soil	386	CY	$ 30.00	$ 11,594
Wetland planting/seeding	0.24	AC	$ 10,000.00	$ 2,396
WA-6S				
Geotextile (16 oz Nonwoven needle-punched)	2,046	SY	$ 3.00	$ 6,138
Import backfill - 2.5 ft	1,705	CY	$ -	$ -
Import 1.0' wetland-like soil	682	CY	$ 30.00	$ 20,461
Wetland planting/seeding	0.42	AC	$ 10,000.00	$ 4,228
WA-7				
Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3.00	$ 35,318
Import backfill - 1.5 ft	5,886	CY	$ -	$ -
Import 1.0' wetland-like soil	3,924	CY	$ 30.00	$ 117,728
Poten Wetland planting/seeding	2.43	AC	$ 10,000.00	$ 24,324
WA-8 (former rail spur)				
Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3.00	$ 996
Import backfill - 2.0 ft	221	CY	$ -	$ -
Import 0.5' topsoil	55	CY	$ -	$ -
Upland planting/seeding	0.07	AC	$ 3,000.00	$ 206
Cover/Backfill Required Summary				
Cover for Repository	(3,160)	CY		
Backfill Required for OU5	(18,496)	CY		
Total Cover/Backfill Required	**(21,656)**	**CY**		
Cover/Backfill Source Summary				
Potential Mitigation Area Soil Exported to OU5	12,792	CY		
Total Cover/Backfill Required	(21,656)	CY		
Backfill Imported	**(8,864)**	**CY**		
Topsoil Required Summary				
Topsoil for Repository	(1,139)	CY		
Topsoil for OU5	(1,003)	CY		
Total Topsoil Required	**(2,142)**	**CY**		
Topsoil Source Summary				
Total Topsoil Required	(2,142)	CY		
Topsoil Imported	**(2,142)**	**CY**		
Wetland-Like Soils Source Summary				
Wetland-Like Soils Required	(8,525)	CY		
Wetland-Like Soils Imported	**(8,525)**	**CY**		

Table C-8A
Alternative 8A - Limited Onsite Consolidation with Soil Cover at West Area (Offsite Floodplain Mitigation
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Imported Soil Costs				
Potential Mitigation Area Soil Exported to OU5	12,792	CY	$ 8	$ 102,336
Import Backfill	8,864	CY	$ 20	$ 177,274
Import Topsoil	2,142	CY	$ 15	$ 32,132
Soil Quality Testing for Imported Backfill	1	LS	$ 12,960	$ 12,960
Soil Quality Testing for Imported and OnsiteTopsoil	1	LS	$ 4,320	$ 4,320
Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$ 12,960	$ 12,960
OU5 Stormwater Management Plan (see Table C-10 for details)	1	LS	$ 512,000	$ 512,000
Potential Mitigation Area Costs (see Table C-12 for details)	1	LS	$ 730,000	$ 730,000
Final Improvements				
Remove decon pad	1	LS	$ 2,500	$ 2,500
Reestablish fence around entire West Area	2,562	FT	$ 20	$ 51,240
Purchases for Floodplain and Wetland Mitigation				
Permanent Wetland 1S Impacts (2.5:1 replacement) minus credit	0.00	ACRE	$ 96,602	$ -
Potential Mitigation Area Parcels	1	LS	$ 50,000	$ 50,000
Direct Subtotal				**$ 3,157,857**
Engineering (Design, Permitting, & Admin)	1	LS	$ 196,685	$ 196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 282,900	$ 282,900
Direct and Indirect Subtotal				**$ 3,637,442**
Contingency 30%	1	LS	$ 1,091,233	$ 1,091,233
Capital Total				**$ 4,730,000**
Operation and Maintenance				
Perimeter fence replacement ($40,000/10 years)	1	LS	$ 4,000	$ 4,000
Annual routine site maintenance (signs, tree cleanup, etc)	1	LS	$ 4,500	$ 4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500
Quarterly Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000
Direct Subtotal				**$ 16,000**
O&M Contingency 30%	1	LS	$ 4,800	$ 4,800
Annual Operation and Maintenance Total				**$ 20,800**
30-year O&M Total - No discount rate applied				**$ 624,000**
TOTAL CAPITAL & O&M				**$ 5,350,000**

Table C-8B
Alternative 8B - Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
Capital Costs						
Mobilization (general conditions & safety plan)	1	LS	$	125,465	$	125,465
Temporary Erosion and Sediment Control						
Construction entrance into West Area	1	EA	$	1,800	$	1,800
Establish silt fence	3,110	LF	$	3	$	9,330
Other erosion control items for NPDES requirements	1	LS	$	2,500	$	2,500
Site Preparation						
Remove existing fence	2,562	LF	$	3	$	7,686
Dewatering (pump to onsite system)	1	LS	$	25,000	$	25,000
Remove misc demolition debris present on surface	1	LS	$	1,000	$	1,000
Clearing and grubbing, chip and spread onsite- West Area	4.33	AC	$	10,000	$	43,300
Clearing and grubbing, chip and spread onsite- Southern Lots	0.19	AC	$	10,000	$	1,900
Access road aggregate (1,500' x 15' x 1' avg)	833	CY	$	20	$	16,667
Decontamination pad/liner/drainage for south end	1	LS	$	15,000	$	15,000
Decon water management	1	LS	$	20,000	$	20,000
Contaminated Soil Excavation and Consolidation						
Consolidation Required						
Excavate 3.5', and consolidate WA-2C	273	CY	$	8	$	2,185
Excavate 1.0', and consolidate WA-2D	134	CY	$	8	$	1,070
Excavate 3.5', and consolidate WA-3A	626	CY	$	8	$	5,006
Excavate 1.0', and consolidate WA-3B	444	CY	$	8	$	3,548
Excavate 3.5', and consolidate WA-4A	987	CY	$	8	$	7,895
Excavate 2.0', and consolidate WA-4B	933	CY	$	8	$	7,463
Excavate 3.5', and consolidate WA-6MID	2,791	CY	$	8	$	22,328
Excavate 3.5', and consolidate WA-6N	1,353	CY	$	8	$	10,821
Excavate 3.5', and consolidate WA-6S	2,939	CY	$	8	$	23,516
Subtotal Excavation Volume	**10,479**	**CY**				
Transport and Disposal to Subtitle D Landfill						
Excavate 2.5', stage, load, and transport WA-1A	6,061	TON	$	25	$	151,521
Excavate 2.0', stage, load, and transport WA-1B	2,134	TON	$	25	$	53,340
Excavate 2.5', stage, load, and transport WA-2A	1,876	TON	$	25	$	46,890
Excavate 2.0', stage, load, and transport WA-2B	716	TON	$	25	$	17,907
Excavate 2.5', stage, load, and transport WA-5 (former ice chute)	681	TON	$	25	$	17,024
Excavate 2.5', stage, load, and transport WA-7	13,735	TON	$	25	$	343,373
Excavate 2.5', stage, load, and transport WA-8 (former rail spur)	387	TON	$	25	$	9,683
Excavate 4.0', stage, load, and transport Southern Lots	1,742	TON	$	25	$	43,556
Total Excavation Weight	**27,332**	**TON**				
Total Excavation Volume	**19,523**	**CY**				
Construction of Onsite Repository						
Geotextile (16 oz Nonwoven needle-punched)	6,837	SY	$	3	$	20,510
Import / grade 1.5 ft engineered cover soil	3,160	CY	$	-	$	-
Import / grade 0.5' topsoil	1,139	CY	$	-	$	-
Upland planting/seeding	1.41	ACRE	$	3,000	$	4,238

Table C-8B
Alternative 8B - Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
OU5 Site Restoration				
WA-1A				
Geotextile (16 oz Nonwoven needle-punched)	5,195	SY	$ 3	$ 15,585
Import backfill - 1.5 ft	2,598	CY	$ -	$ -
Import 1.0' wetland-like soil	1,732	CY	$ 30	$ 51,950
Wetland planting/seeding	1.07	AC	$ 10,000	$ 10,733
WA-1B				
Import backfill - 1.5 ft	1,143	CY	$ -	$ -
Import 0.5' topsoil	381	CY	$ -	$ -
Upland planting/seeding	0.47	AC	$ 3,000	$ 1,417
WA-2A				
Geotextile (16 oz Nonwoven needle-punched)	1,608	SY	$ 3	$ 4,823
Import backfill - 1.5 ft	804	CY	$ -	$ -
Import 1.0' wetland-like soil	536	CY	$ 30	$ 16,077
Wetland planting/seeding	0.33	AC	$ 10,000	$ 3,322
WA-2B				
Import backfill - 1.5 ft	384	CY	$ -	$ -
Import 0.5' topsoil	128	CY	$ -	$ -
Upland planting/seeding	0.16	AC	$ 3,000	$ 476
WA-2C				
Geotextile (16 oz Nonwoven needle-punched)	234	SY	$ 3	$ 702
Import backfill - 2.5 ft	195	CY	$ -	$ -
Import 1.0' wetland-like soil	78	CY	$ 30	$ 2,341
Wetland planting/seeding	0.05	AC	$ 10,000	$ 484
WA-2D				
Import backfill - 2.5 ft	334	CY	$ -	$ -
Import 0.5' topsoil	67	CY	$ -	$ -
Upland planting/seeding	0.08	AC	$ 3,000	$ 249
WA-3A				
Geotextile (16 oz Nonwoven needle-punched)	328	SY	$ 3	$ 985
Import backfill - 2.5 ft	274	CY	$ -	$ -
Import 1.0' wetland-like soil	109	CY	$ 30	$ 3,284
Wetland planting/seeding	0.07	AC	$ 10,000	$ 679
WA-3B				
Import backfill - 2.5 ft	205	CY	$ -	$ -
Import 0.5' topsoil	41	CY	$ -	$ -
Upland planting/seeding	0.05	AC	$ 3,000	$ 153
WA-4A				
Geotextile (16 oz Nonwoven needle-punched)	838	SY	$ 3	$ 2,513
Import backfill - 2.5 ft	698	CY	$ -	$ -
Import 1.0' wetland-like soil	279	CY	$ 30	$ 8,377
Wetland planting/seeding	0.17	AC	$ 10,000	$ 1,731
WA-4B				
Poten Import backfill - 1.5 ft	700	CY	$ -	$ -
Import 0.5' topsoil	233	CY	$ -	$ -
Upland planting/seeding	0.29	AC	$ 3,000	$ 867

Table C-8B
Alternative 8B - Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
WA-5 (former ice chute)				
Geotextile (16 oz Nonwoven needle-punched)	584	SY	$ 3	$ 1,751
Import backfill - 2.0 ft	389	CY	$ -	$ -
Import 0.5' topsoil	97	CY	$ -	$ -
Upland planting/seeding	0.12	AC	$ 3,000	$ 362
WA-6MID				
Geotextile (16 oz Nonwoven needle-punched)	2,392	SY	$ 3.00	$ 7,177
Import backfill - 2.5 ft	1,994	CY	$ -	$ -
Import 1.0' wetland-like soil	797	CY	$ 30.00	$ 23,923
Wetland planting/seeding	0.49	AC	$ 10,000.00	$ 4,943
WA-6N				
Geotextile (16 oz Nonwoven needle-punched)	1,159	SY	$ 3.00	$ 3,478
Import backfill - 2.5 ft	966	CY	$ -	$ -
Import 1.0' wetland-like soil	386	CY	$ 30.00	$ 11,594
Wetland planting/seeding	0.24	AC	$ 10,000.00	$ 2,396
WA-6S				
Geotextile (16 oz Nonwoven needle-punched)	2,046	SY	$ 3.00	$ 6,138
Import backfill - 2.5 ft	1,705	CY	$ -	$ -
Import 1.0' wetland-like soil	682	CY	$ 30.00	$ 20,461
Wetland planting/seeding	0.42	AC	$ 10,000.00	$ 4,228
WA-7				
Geotextile (16 oz Nonwoven needle-punched)	11,773	SY	$ 3.00	$ 35,318
Import backfill - 1.5 ft	5,886	CY	$ -	$ -
Import 1.0' wetland-like soil	3,924	CY	$ 30.00	$ 117,728
Poten Wetland planting/seeding	2.43	AC	$ 10,000.00	$ 24,324
WA-8 (former rail spur)				
Geotextile (16 oz Nonwoven needle-punched)	332	SY	$ 3.00	$ 996
Import backfill - 2.0 ft	221	CY	$ -	$ -
Import 0.5' topsoil	55	CY	$ -	$ -
Upland planting/seeding	0.07	AC	$ 3,000.00	$ 206
Cover/Backfill Required Summary				
Cover for Repository	(3,160)	CY		
Backfill Required for OU5	(18,496)	CY		
Total Cover/Backfill Required	**(21,656)**	**CY**		
Cover/Backfill Source Summary				
Onsite Mitigation Area Soil for use on OU5	7,200	CY		
Total Cover/Backfill Required	(21,656)	CY		
Backfill Imported	**(14,456)**	**CY**		
Topsoil Required Summary				
Topsoil for Repository	(1,139)	CY		
Topsoil for OU5	(1,003)	CY		
Total Topsoil Required	**(2,142)**	**CY**		
Topsoil Source Summary				
Total Topsoil Required	(2,142)	CY		
Topsoil Imported	**(2,142)**	**CY**		
Wetland-Like Soils Source Summary				
Wetland-Like Soils Required	(8,525)	CY		
Wetland-Like Soils Imported	**(8,525)**	**CY**		

Table C-8B
Alternative 8B - Limited Onsite Consolidation with Soil Cover at West Area (Onsite Floodplain Mitigation)
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit		Unit Cost		Total Cost
Imported Soil Costs						
Onsite Mitigation Area Soil for use on OU5	7,200	CY	$	8	$	57,600
Import Backfill	14,456	CY	$	20	$	289,114
Import Topsoil	2,142	CY	$	15	$	32,132
Soil Quality Testing for Imported Backfill	1	LS	$	21,600	$	21,600
Soil Quality Testing for Imported and OnsiteTopsoil	1	LS	$	4,320	$	4,320
Soil Quality Testing for Imported Wetland-Like Soil	1	LS	$	12,960	$	12,960
OU5 Stormwater Management Plan (see Table C-11 for details)	1	LS	$	440,000	$	440,000
Potential Mitigation Area Costs (see Table C-13 for details)	1	LS	$	270,000	$	270,000
Final Improvements						
Remove decon pad	1	LS	$	2,500	$	2,500
Reestablish fence around entire West Area	2,562	FT	$	20	$	51,240
Purchases for Floodplain and Wetland Mitigation						
Permanent Wetland 1S Impacts (2.5:1 replacement) minus credit	1.36	ACRE	$	63,650	$	86,564
Direct Subtotal					**$**	**2,721,322**
Engineering (Design, Permitting, & Admin)	1	LS	$	196,685	$	196,685
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$	282,900	$	282,900
Direct and Indirect Subtotal					**$**	**3,200,907**
Contingency 30%	1	LS	$	960,272	$	960,272
Capital Total					**$**	**4,160,000**
Operation and Maintenance						
Perimeter fence replacement ($40,000/10 years)	1	LS	$	4,000	$	4,000
Annual routine site maintenance (signs, tree cleanup, etc)	1	LS	$	4,500	$	4,500
Annual wetland vegetation monitoring and maintenance	1	LS	$	2,500	$	2,500
Quarterly Site Inspection and Annual Report	1	LS	$	5,000	$	5,000
Direct Subtotal					**$**	**16,000**
O&M Contingency 30%	1	LS	$	4,800	$	4,800
Annual Operation and Maintenance Total					**$**	**20,800**
30-year O&M Total - No discount rate applied					**$**	**624,000**
TOTAL CAPITAL & O&M					**$**	**4,780,000**

Table C-9
OU 5 Stormwater Management Plan- Alternatives 2 through 5
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Temporary Stormwater Management				
Sheet Pile 935' to direct flow around WA-7	14,025	SF	$ 25	$ 350,625
Permanent Stormwater Management				
WA-5 (Former Ice Chute)				
Build up area of former ice chute to prevent direct connection to lake	292	CY	$ 20	$ 5,838
Pipe to North				
Water supply and fire hydrant relocation	1	LS	$ 13,000	$ 13,000
Furnish and Install 30" dia. HDPE manhole, 9.8' deep	10	FT	$ 500	$ 4,900
Furnish and Install Precast 72" dia. RC manhole, 7.5' deep	8	FT	$ 900	$ 6,750
30" HDPE Pipe, solid wall fused	903	LF	$ 80	$ 72,240
30" HDPE Flared End Section	1	EA	$ 700	$ 700
Riprap and Granular Filter	25	CY	$ 50	$ 1,250
Common Excavation	149	CY	$ 5	$ 745
Building 1B Pond (Roof Drainage)				
Remove, decon and dispose/recycle existing 24" RCP	92	LF	$ 30	$ 2,760
Remove, decon and dispose/recycle existing 24" RC Flared End Section	1	EA	$ 100	$ 100
24" HDPE Pipe, solid wall fused	42	LF	$ 60	$ 2,520
South Swale				
Import Common Fill and berm swale end and around soil amendment	785	CY	$ 20	$ 15,704
Common Excavation	388	CY	$ 5	$ 1,938
Furnish and Install 30" dia. HDPE Manhole, 4' deep	4	FT	$ 300	$ 1,200
8" Perforated HDPE	477	LF	$ 25	$ 11,925
Soil Amendment (20% compost, 40% sand, 40% topsoil)	565	CY	$ 35	$ 19,787
Pipe to West				
Import Common Fill and cover Pipe to West	111	CY	$ 20	$ 2,220
24" HDPE Pipe, solid wall fused	255	LF	$ 60	$ 15,300
24" HDPE Flared End Section	1	EA	$ 600	$ 600
24" Tideflex TF-1 Check Valve	1	EA	$ 5,000	$ 5,000
Riprap and Granular Filter	10	CY	$ 50	$ 500
Biofiltration Basin				
Soil Amendment (20% compost, 40% sand, 40% topsoil)	740	CY	$ 35	$ 25,900
Seeding	0.23	AC	$ 10,000	$ 2,296
HDPE Liner	1,111	SY	$ 3	$ 3,333
Anchor Trenching for HDPE Liner	360	LF	$ 8	$ 2,880
Site Restoration				
Remove (or drive deeper) sheet piling around WA-7	14,025	SF	$ 2	$ 28,050
Pipe to North				
Import 0.5' topsoil	313	CY	$ 15	$ 4,696
Upland planting/seeding	0.39	ACRE	$ 3,000	$ 1,164
Building 1B Pond				
Import 0.5' topsoil	14	CY	$ 15	$ 216
Upland planting/seeding	0.02	ACRE	$ 3,000	$ 54
South Swale				
Import 0.5' topsoil	14	CY	$ 15	$ 216
Upland planting/seeding	0.02	ACRE	$ 3,000	$ 54
Settling Basin				
Geotextile (16 oz Nonwoven needle-punched)	690	SY	$ 3	$ 2,069
Import backfill	932	CY	$ 20	$ 18,647
Import 0.5' topsoil	167	CY	$ 15	$ 2,498
Upland planting/seeding	0.2	ACRE	$ 3,000	$ 619
Plant trees	1	LS	$ 1,500	$ 1,500
Biofiltration Basin				
Excavate and create basin	232	CY	$ 20	$ 4,640
Export excess soil to settling basin and berm construction	34	CY	$ 8	$ 269
Import 0.5' topsoil	74	CY	$ 15	$ 1,111
Upland planting/seeding	0.1	ACRE	$ 3,000	$ 275
Plant trees	1	LS	$ 1,500	$ 1,500

Table C-9
OU 5 Stormwater Management Plan- Alternatives 2 through 5
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Imported Backfill Soil Summary				
WA-5 Former Ice Chute Fill	(292)			
Backfill Over Pipe West to Lake	(111)			
Backfill for Southern Lots and Settling Basin	(232)			
TOTAL	**(635)**			
Imported Topsoil Summary				
Pipe to North	(313)			
Building 1B Pond	(14)			
South Swale	(14)			
Southern Lots and Settling Basin Area	(74)			
TOTAL	**(416)**			
Soil Testing				
Soil Quality Testing for Imported Backfill	1	LS	$ 1,440	$ 1,440
Soil Quality Testing for Imported Topsoil	1	LS	$ 1,440	$ 1,440
TOTAL				**$ 640,469**

$ 640,000

Table C-10
OU 5 Stormwater Management Plan- Alternatives 6, 7 & 8A
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	UnitCost	Total Cost
Temporary Stormwater Management				
South Swale				
Import fill and create swale diversion	30	CY	$ 20	$ 600
Stormwater Diversion				
Sheet Pile 935' to direct flow around WA-7	14,025	SF	$ 25	$ 350,625
Pump Building 1B Manhole	1	LS	$ 26,000	$ 26,000
Permanent Stormwater Management				
WA-5 (Former Ice Chute)				
Build up area of former ice chute to prevent direct connection to lake	292	CY	$ 20	$ 5,838
WA-8 (Former Rail Spur)				
Build up area of railroad spur to recreate DNR jurisdictional boundary	43	CY	$ 20	$ 860
Building 1B Pond (Roof Drainage)				
Remove, decon and dispose/recycle existing 24" RCP	92	LF	$ 30	$ 2,760
Remove, decon and dispose/recycle existing 24" RC Flared End Section	1	EA	$ 100	$ 100
24" RCP, CL. III	92	LF	$ 40	$ 3,680
24" RC Flared End Section	1	EA	$ 600	$ 600
Pipe to West				
24" RCP, CL. III	255	LF	$ 40	$ 10,200
24" RC Flared End Section	1	EA	$ 1,200	$ 1,200
24" Tideflex TF-1 Check Valve	1	EA	$ 5,000	$ 5,000
Riprap and Granular Filter	10	CY	$ 50	$ 500
Biofiltration Basin				
Soil Amendment (20% compost, 40% sand, 40% topsoil)	740	CY	$ 35	$ 25,900
Seeding	0.23	AC	$ 10,000	$ 2,296
HDPE Liner	1,111	SY	$ 3	$ 3,333
Anchor Trenching for HDPE Liner	360	LF	$ 8	$ 2,880
Site Restoration				
Remove swale diversion	1	LS	$ 200	$ 200
Remove (or drive deeper) sheet piling around WA-7	14,025	SF	$ 2	$ 28,050
Pipe to Lake				
Import 0.5' topsoil	30	CY	$ 15	$ 444
Upland planting/seeding	0.04	ACRE	$ 3,000	$ 110
Building 1B Pond				
Import 0.5' topsoil	17	CY	$ 15	$ 256
Upland planting/seeding	0.02	ACRE	$ 3,000	$ 63
Settling Basin and Berm				
Geotextile (16 oz Nonwoven needle-punched)	690	SY	$ 3	$ 2,069
Import backfill/create berm	1,245	CY	$ 20	$ 24,894
Import 0.5' Topsoil	167	CY	$ 15	$ 2,498
Upland planting/seeding	0.2	ACRE	$ 3,000	$ 619
Plant trees	1	LS	$ 1,500	$ 1,500
Biofiltration Basin				
Excavate and create basin	232	CY	$ 8	$ 1,856
Export excess soil to settling basin and berm construction	34	CY	$ 8	$ 269
Import 0.5' Topsoil	74	CY	$ 15	$ 1,111
Upland planting/seeding	0.1	ACRE	$ 3,000	$ 275
Plant trees	1	LS	$ 1,500	$ 1,500

Table C-10
OU 5 Stormwater Management Plan- Alternatives 6, 7 & 8A
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item		Quantity	Unit	UnitCost	Total Cost
Imported Backfill Soil Summary					
	South Swale	(30)			
	WA-5 (Former Ice Chute)	(292)			
	WA-8 (Former Rail Spur)	(43)			
	Settling Basin and Berm	(1,245)			
	TOTAL	**(1,610)**			
Imported Topsoil Summary					
	Pipe to Lake	(30)			
	Building 1B Pond	(17)			
	Settling Basin and Berm	(167)			
	Biofiltration Basin	(74)			
	TOTAL	**(287)**			
Soil Testing					
Soil Quality Testing for Imported Backfill		1	LS	$ 2,880	$ 2,880
Soil Quality Testing for Imported Topsoil		1	LS	$ 1,440	$ 1,440
TOTAL					**$ 512,000**

Table C-11
OU 5 Stormwater Management Plan- Alternative 8B
Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	UnitCost	Total Cost
Temporary Stormwater Management				
South Swale				
Import fill and create swale diversion	30	CY	$ 20	$ 600
Stormwater Diversion				
Sheet Pile 935' to direct flow around WA-7	14,025	SF	$ 25	$ 350,625
Pump Building 1B Manhole	1	LS	$ 26,000	$ 26,000
Permanent Stormwater Management				
WA-5 (Former Ice Chute)				
Build up area of former ice chute to prevent direct connection to lake	292	CY	$ 20	$ 5,838
WA-8 (Former Rail Spur)				
Build up area of railroad spur to recreate DNR jurisdictional boundary	43	CY	$ 20	$ 860
Building 1B Pond (Roof Drainage)				
Remove, decon and dispose/recycle existing 24" RCP	92	LF	$ 30	$ 2,760
Remove, decon and dispose/recycle existing 24" RC Flared End Section	1	EA	$ 100	$ 100
24" RCP, CL. III	92	LF	$ 40	$ 3,680
24" RC Flared End Section	1	EA	$ 600	$ 600
Pipe to West				
24" RCP, CL. III	255	LF	$ 40	$ 10,200
24" RC Flared End Section	1	EA	$ 1,200	$ 1,200
24" Tideflex TF-1 Check Valve	1	EA	$ 5,000	$ 5,000
Riprap and Granular Filter	10	CY	$ 50	$ 500
Site Restoration				
Remove swale diversion	1	LS	$ 200	$ 200
Remove (or drive deeper) sheet piling around WA-7	14,025	SF	$ 2	$ 28,050
Pipe to Lake				
Import 0.5' topsoil	30	CY	$ 15	$ 444
Upland planting/seeding	0.04	ACRE	$ 3,000	$ 110
Building 1B Pond				
Import 0.5' topsoil	17	CY	$ 15	$ 256
Upland planting/seeding	0.02	ACRE	$ 3,000	$ 63
Imported Backfill Soil Summary				
South Swale	(30)			
WA-5 (Former Ice Chute)	(292)			
WA-8 (Former Rail Spur)	(43)			
TOTAL	**(365)**			
Imported Topsoil Summary				
Pipe to Lake	(30)			
Building 1B Pond	(17)			
TOTAL	**(47)**			
Soil Testing				
Soil Quality Testing for Imported Backfill	1	LS	$ 1,440	$ 1,440
Soil Quality Testing for Imported Topsoil	1	LS	$ 1,440	$ 1,440
TOTAL				**$ 440,000**

Table C-12
Potential Mitigation Area Preparation and Restoration- Alternatives 4, 5, & 8A
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Temporary Erosion, Sediment, and Traffic Control				
Traffic control	1	LS	$ 5,000	$ 5,000
Construction entrance into Potential Mitigation Area	1	EACH	$ 1,800	$ 1,800
Establish silt fence	700	LF	$ 3	$ 2,100
Other erosion control items for NPDES requirements	1	LS	$ 1,000	$ 1,000
Site Preparation				
Remove 18" RCP	8	LF	$ 10	$ 80
Remove 18" RC Flared End Section	1	LS	$ 100	$ 100
Remove Pond Weir	1	LS	$ 500	$ 500
Dewatering	1	LS	$ 6,000	$ 6,000
Clearing and grubbing, chip and spread onsite	4.35	ACRE	$ 5,000	$ 21,743
Access road aggregate (1,200' x 15' x 1' avg)	667	CY	$ 20	$ 13,333
Decon water management	1	LS	$ 20,000	$ 20,000
Site Restoration				
Excavate 1', stage, and load peat	4,369	TON	$ 8	$ 34,953
Transport and dispose peat	4,369	TON	$ 25	$ 109,229
Geotextile (16 oz Nonwoven needle-punched)	14,895	SY	$ 3	$ 44,685
Export additional inorganic soil for remediation	12,792	CY	$ -	$ -
Regrade onsite organic soil	3,366	CY	$ 5	$ 16,830
Wetland planting/seeding	5.63	ACRE	$ 10,000	$ 56,294
Import 0.5' topsoil for new wetland buffer	874	CY	$ 15	$ 13,103
Buffer planting/seeding	1.08	ACRE	$ 10,000	$ 10,829
Wetland credit	1.72	ACRE	$ -	$ -
Plant trees	1	LS	$ 25,000	$ 25,000
Soil Testing				
Soil Quality Testing for Imported Topsoil	1	LS	$ 1,440	$ 1,440
Direct Subtotal				**$ 384,020**
Engineering (Design, Permitting, & Admin)	1	LS	$ 38,402	$ 38,402
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 76,804	$ 76,804
Direct and Indirect Subtotal				**$ 499,226**
Contingency 30%	1	LS	$ 149,768	$ 149,768
Capital Total				**$ 650,000**
Operation and Maintenance				
Annual routine maintenance and repairs (tree cleanup, etc)	1	LS	$ 4,500	$ 4,500.00
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500.00
Wetland Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000.00
Direct Subtotal				**$ 12,000.00**
O&M Contingency 30%	1	LS	$ 3,600	$ 3,600.00
Annual Operation and Maintenance Total				**$ 15,600.00**
5-year O&M Total - No discount rate applied				**$ 78,000.00**
TOTAL				**$ 730,000**

Table C-13
Onsite Mitigation Area Preparation and Restoration- Alternative 8B
Focused Feasibility Study - Operable Unit 5
Joslyn Manufacturing & Supply Co. Site
Brooklyn Center, Minnesota

Item	Quantity	Unit	Unit Cost	Total Cost
Temporary Erosion and Sediment Control				
Miscellaneous erosion control items for NPDES requirements	1	LS	$ 2,500	$ 2,500
Site Preparation				
Dewatering	1	LS	$ 6,000	$ 6,000
Clearing and grubbing, chip and spread onsite	1.2	ACRE	$ 5,000	$ 6,200
Site Restoration				
Excavate/regrade mitigation area	7,200	CY	$ 8	$ 57,600
Reuse soil onsite for clean cover/backfill	7,200	CY	$ -	$ -
Import 0.5' topsoil	1,000	CY	$ 15	$ 15,000
Upland planting/seeding	1.2	ACRE	$ 3,000	$ -
Plant trees	1	LS	$ 25,000	$ 25,000
Direct Subtotal				**$ 112,300**
Engineering (Design, Permitting, & Admin)	1	LS	$ 11,230	$ 11,230
Construction (Mgmt, Oversight, Survey, & Reporting)	1	LS	$ 22,460	$ 22,460
Direct and Indirect Subtotal				**$ 145,990**
Contingency 30%	1	LS	$ 43,797	$ 43,797
Capital Total				**$ 190,000**
Operation and Maintenance				
Annual routine maintenance and repairs (tree cleanup, etc)	1	LS	$ 4,500	$ 4,500.00
Annual wetland vegetation monitoring and maintenance	1	LS	$ 2,500	$ 2,500.00
Wetland Site Inspection and Annual Report	1	LS	$ 5,000	$ 5,000.00
Direct Subtotal				**$ 12,000.00**
O&M Contingency 30%	1	LS	$ 3,600	$ 3,600.00
Annual Operation and Maintenance Total				**$ 15,600.00**
5-year O&M Total - No discount rate applied				**$ 78,000.00**
TOTAL				**$ 270,000**

Appendix D

Evaluation of Effect of Proposed SRV Revisions on Selected Remedy Memorandum

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BARR

Technical Memorandum

To: Project File
From: Eric Lund, PE (Barr Engineering Co.)
Subject: Joslyn OU-5; Evaluation of Effect of Draft SRV Revisions on Selected Remedy
Date: January 4, 2017
Project: 23270110.03

This technical memorandum has been prepared for inclusion as an Appendix to the Focused Feasibility Study (FFS). The supporting analytical data is included or discussed in the FFS.

Background

The Minnesota Pollution Control Agency (MPCA) has been working on revising the Soil Reference Values (SRVs) and issued draft SRVs for public review and comment in the fall of 2016 (MPCA, 2016). The fall 2016 SRVs are the third draft SRVs issued since the MPCA began the SRV update process, and it is possible the draft SRVs may change again before the guidance is finalized. It is anticipated that the draft SRVs will be finalized sometime in early 2017. The FFS will be published prior to the MPCA finalizing the draft SRVs. It is also probable that the MPCA will have selected the OU5 remedy before these changes are finalized. Therefore, the current SRVs remain as the appropriate criteria upon which remedy decisions are based in the FFS. Nevertheless, Barr compared historical soil data collected from the West Area (including the Southern Lots) to the draft SRVs to determine if the draft SRVs, if applied to the site, would have an effect on the proposed remedy.

Table 1 provides a summary of the current and draft SRVs for the site contaminants of concerns (COCs), which are polycyclic aromatic hydrocarbons (PAHs), expressed as benzo(a)-pyrene equivalents [B(a)P-eq.]; pentachlorophenol [PCP]; and polychlorinated dibenzo-*p*-dioxins/furans [dioxins], expressed as tetrachlorodibenzo-p-dioxin equivalents [TCDD-eq].

Table 1 – Draft SRV Revisions for Site COCs

	B(a)P – eq	Pentachlorophenol	TCDD-eq
Current SRV – Residential	2 mg/kg	80 mg/kg	20 ng/kg
Draft SRV – Residential	1 mg/kg	8.6 mg/kg	5 ng/kg
Current SRV – Commercial / Industrial	3 mg/kg	120 mg/kg	35 ng/kg
Draft SRV – Commercial/ Industrial	14 mg/kg	46 mg/kg	27 ng/kg

West Area (Commercial / Industrial SRVs)

There are several historic sample results that exceed the draft SRVs but not the current SRVs. These sample results are all either PCP or pyrene, as summarized below:

- **PCP:** The PCP concentrations detected in several samples from the southern half of OU-5 exceeds the draft SRV but not the existing SRV. The exceedances are primarily surface soil samples, with the deepest of the samples being collected from a depth of 2.5 feet below ground. For each of these instances, an existing SRV was already exceeded, either in the same sample location or from a nearby location. Therefore, the remedy proposed in Alternative 8B already addresses these soils.
- **Pyrene:** Pyrene is not a site COC; however, because the draft SRV (44 mg/kg) is significantly less than the existing SRV (5,800 mg/kg), there would be several new exceedances of the draft SRVs. Those exceedances are from surficial soil samples C-5 and C-5R (WA-4) and E-3 (WA-7). Similar to the PCP exceedances detailed above, the new exceedances would already be addressed by excavation under the proposed remedy for Alternative 8B.

Southern Lots (Residential SRVs)

Samples collected from the southern lots, or immediately adjacent to the southern lots (i.e., the A-series), were compared to the draft residential SRVs. There were several instances in which the calculated B(a)P-eq or TCDD-eq concentration would exceed the draft SRVs only when using a non-zero value (either 0.5x or 1x the reporting limit) for results of individual constituents that were less than the reporting limit. With the exception of the two instances detailed below, the results would not exceed the draft SRVs when the equivalent concentrations were calculated using zero for results less than the reporting limit.

- **TCDD-eq:** The TCDD-eq concentration in sample RES1-SI1 exceeds the draft Residential SRV for this sample, which was collected from the upper foot from the southern lots. Although the draft SRV would be exceeded, the proposed remedy for Alternative 8B already includes excavation of these soils in Southern Lots.
- **PCP:** The PCP concentration in sample A-3 (2.5-4') exceeds the draft *Residential SRV* but not the draft *Commercial / Industrial SRV*. The sample location is immediately adjacent to the southern lots. Therefore, the Residential SRV was conservatively evaluated in this memo for consistency with previous reports (Barr, 2009). Although the Industrial criteria is likely the appropriate criteria for the specific sample location, further evaluation of the criteria is not necessary because the dioxin concentration exceeds both the current and draft SRVs in the same sample. Therefore, the remedy proposed in Alternative 8B in this area already addressed these soils.

Conclusion

As the current SRVs will be in effect when the FFS revision 3 is submitted and likely when the MPCA selects the remedy for OU5, Alternative 8B has appropriately relied upon or used the current SRVs. However, the draft SRVs could be in effect shortly thereafter and perhaps before the planned remedy (Alternative 8B) is complete. Therefore, Barr compared the draft SRVs to OU5 soil data. The comparison indicated that the OU5 soils that exceed the draft SRVs would already be addressed by the remedial actions proposed in Alternative 8B. Therefore, it is not necessary to modify Alternative 8B based on draft SRVs if they are finalized before remedy completion.

References

Barr, 2009. Letter from Dale Finnesgaard (Barr) to Steve Schoff (MPCA) regarding Southern Lot Soil Quality – Joslyn Manufacturing Site. December 2, 2009.

MPCA, 2016. Soil Reference Value Technical Support Document. September, 2016.

Appendix E

Draft Permit Drawing Set

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OU5 REMEDIATION PROJECT

BROOKLYN CENTER, MN

LOCATION MAP
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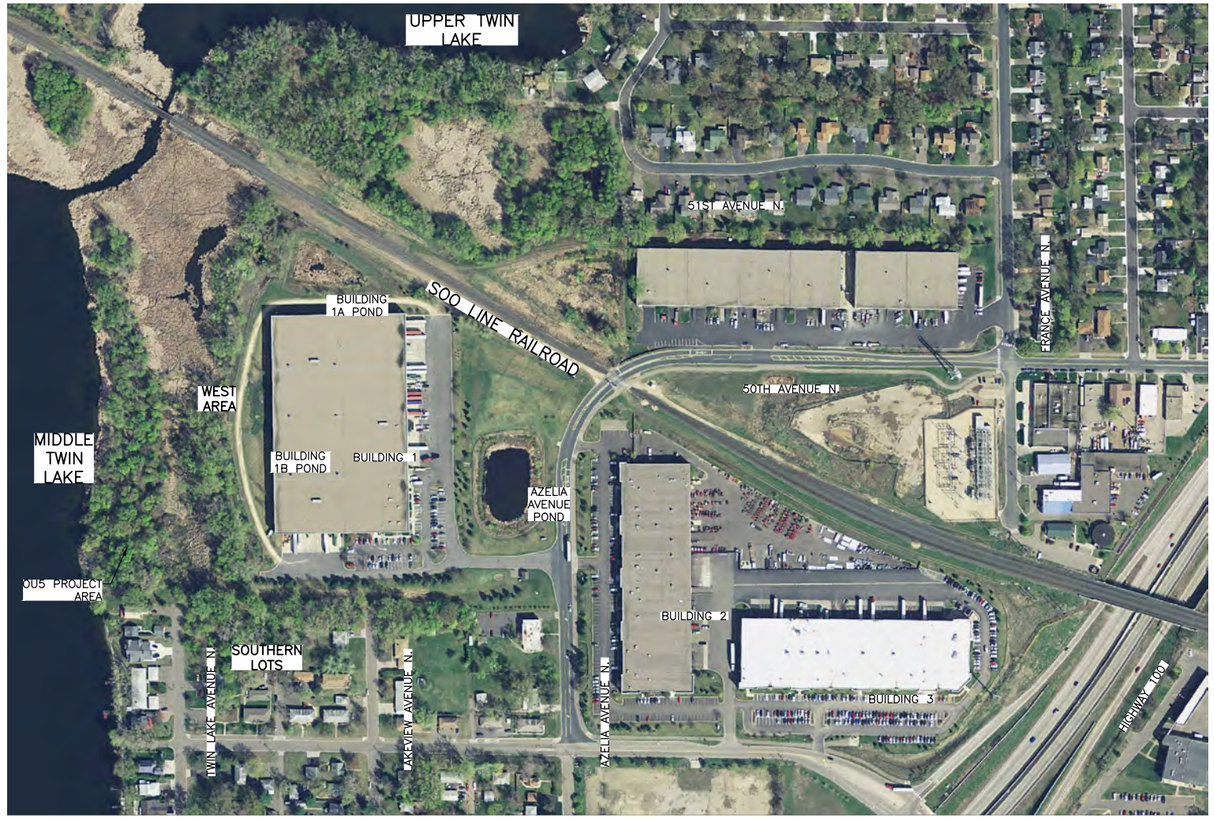

VICINITY MAP

0 200 400
SCALE IN FEET

SHEET INDEX	
SHEET NO.	SHEET NAME
G-1	SITE LOCATION AND SHEET INDEX
G-2	ESTIMATED QUANTITIES AND ANTICIPATED CONSTRUCTION SEQUENCING
C-1	CONSTRUCTION ACCESS, STAGING, AND WATER MANAGEMENT PLAN
C-2	EXISTING CONDITIONS AND REMOVAL PLAN
C-3	EROSION CONTROL PLAN
C-4	EXCAVATION PLAN
C-5	FINAL GRADING PLAN
C-6	STORMWATER MANAGEMENT PLAN
C-7	CONCEPTUAL RESTORATION PLAN
C-8	PLANTING DETAILS
C-9	EXCAVATION CROSS SECTIONS
C-10	CONSOLIDATION CROSS SECTIONS
C-11	SUB-AREA BACKFILL DETAILS
C-12	EROSION CONTROL DETAILS
C-13	STORMWATER MANAGEMENT DETAILS AND CROSS SECTIONS

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OU5 REMEDIATION PROJECT

SITE LOCATION AND SHEET INDEX

BARR PROJECT No.	
23270110.00	
CLIENT PROJECT No.	
DWG. No.	REV. No.
G-1	A

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SUMMARY OF ESTIMATED QUANTITIES				
ITEM NO.	SPEC. NO.	ITEM	QUANTITY	UNIT
CONSTRUCTION STAGING				
1	01 35 29	MOBILIZATION AND DEMOBILIZATION	1	LS
2	01 33 00	CONSTRUCTION WORK PLAN	1	LS
SITE PREPARATION				
3	02 24 90	WATER MANAGEMENT	8	WEEK
4	02 41 00	REMOVALS	1	LS
5	02 51 00	DECONTAMINATION	8	WEEK
6	31 10 00	CLEARING AND GRUBBING	1	LS
7	31 20 00	OU5 ACCESS/HAUL ROAD CONSTRUCTION MAINTENANCE	1	LS
8	31 20 00	OU5 ACCESS/HAUL ROAD AGGREGATE	1,100	TON
TEMPORARY EROSION AND SEDIMENT CONTROL				
9	31 25 00	TEMPORARY EROSION AND SEDIMENT CONTROL	1	LS
10	31 25 00	ROCK CONSTRUCTION ENTRANCE	1	EACH
11	31 25 00	SILT FENCE	1	LS
12	31 25 00	STREET SWEEPING	8	WEEK
13	31 37 00	INSTALLATION AND PLACEMENT OF RIPRAP	35	TON
14	31 37 00	INSTALLATION AND PLACEMENT OF GRANULAR FILTER	20	TON
EARTHWORK				
15	31 20 00	SOIL EXCAVATION AND STAGING	1	LS
16	31 20 00	TRANSPORT AND DISPOSAL AT SUBTITLE D LANDFILL	27,300	TON
17	31 20 00	TRANSPORT AND PLACEMENT AT OU5 REPOSITORY	10,500	CY
18	31 20 00	TRANSPORT AND PLACEMENT OF GENERAL BACKFILL FROM MITIGATION AREA	5,300	CY
STORMWATER MANAGEMENT				
19	31 62 16.13	SHEET PILES	1	LS
20	33 40 00	RCP STORM SEWERS	1	LS
21	33 40 00	TEMPORARY CMP AND CHECK VALVE	1	LS
CONSOLIDATION AREA CAP CREATION AND SITE RESTORATION				
22	31 05 19.13	GEOTEXTILE FABRIC	1	LS
23	31 20 00	IMPORT AND PLACMENT OF GENERAL BACKFILL	21,000	TON
24	31 20 00	IMPORT AND PLACEMENT OF TOPSOIL	3,000	TON
25	31 20 00	IMPORT AND PLACEMENT OF WETLAND SOIL	12,000	TON
26	32 90 00	WETLAND SEEDING AND PLANTING	5.5	AC
27	32 90 00	UPLAND SEEDING AND PLANTING	1.3	AC
28	32 90 00	CONSOLIDATION AREA SEEDING AND PLANTING	1.4	AC
29	32 90 00	RIPARIAN WETLAND/FLOODPLAIN SEEDING AND PLANING	1.7	AC
30	32 90 00	TREE PLANTING	24	EACH
31	32 90 00	INSTALL NEW CHAINLINK FENCE AROUND OU5	3,700	LF

ANTICIPATED CONSTRUCTION SEQUENCING:

1. INSTALL SEDIMENT CONTROL PRACTICES ON ALL DOWNGRADIENT PERIMETERS BEFORE ANY UPGRADIENT LAND DISTURBING ACTIVITIES BEGIN INCLUDING HIGH-VISIBILITY CONSTRUCTION FENCING FOR AREAS NOT TO BE DISTURBED, SILT FENCE, AND FLOTATION SILT CURTAIN.
2. INSTALL DECONTAMINATION PAD AND WATER MANAGEMENT STRUCTURES AND PIPING.
3. REMOVE, DECONTAMINATE AND DISPOSE OF EXISTING PERIMETER FENCE, BUILDING 1B POND OUTLET PIPE, AND MISCELLANEOUS DEBRIS.
4. INSTALL ROCK CONSTRUCTION ENTRANCE.
5. CLEAR AND GRUB CONSTRUCTION AREA. CHIP WOODY MATERIAL AND STAGE OR TRANSPORT AND DISPOSE OFFSITE AS INDICATED IN DRAWING AND SPECIFICATIONS.
6. DEWATER, EXCAVATE CONTAMINATED MATERIAL AND BACKFILL IN AREAS OF STORMWATER DIVERSION INFRASTRUCTURE INCLUDING NORTH OF TEMPORARY SHEET PILE AND SOUTH WEST AREA STRIP. EXCAVATED MATERIAL SHALL BE CONSOLIDATED IN THE CONSOLIDATION AREA OR DISPOSED OFFSITE AS REQUIRED BY THE DRAWINGS AND SPECIFICATIONS. BACKFILL EXCAVATED AREAS AS INDICATED IN THE DRAWINGS AND SPECIFICATIONS.
7. INSTALL STORMWATER DIVERSION INFRASTRUCTURE INCLUDING TEMPORARY SHEET PILE, TEMPORARY BERM AND PIPE TO LAKE.
8. INSTALL RIPRAP AND FILTER BLANKET FOR BUILDING 1A POND OUTLET AND TEMPORARY PIPE TO LAKE OUTLET.
9. INSTALL EROSION CONTROL BLANKET AND ROCK CHECK DAMS NORTH OF TEMPORARY SHEET PILE.
10. DEWATER AND EXCAVATE CONTAMINATED SOIL FROM WEST AREA SUB-AREAS TO BE TRANSPORTED OFFSITE AND DISPOSE OF AT A SUBTITLE D LANDFILL IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.
11. DEWATER AND EXCAVATE CONTAMINATED SOILS FROM WEST AREA SUB-AREAS TO BE CONSOLIDATED AND CONSOLIDATE ONSITE AS INDICATED BY DRAWINGS AND SPECIFICATIONS.
12. DEWATER AND EXCAVATE FLOODPLAIN MITIGATION AREA AS INDICATED IN THE DRAWINGS AND SPECIFICATION.
13. BACKFILL WEST AREA SUB-AREAS AS INDICATED IN DRAWINGS AND SPECIFICATIONS.
14. CONSTRUCT CONSOLIDATION AREA CAP AS INDICATED IN DRAWINGS AND SPECIFICATIONS.
15. INSTALL OUTLET PIPE FOR BUILDING 1B POND.
16. REMOVE TEMPORARY PIPE.
17. REMOVE TEMPORARY BERM.
18. SMOOTH AND FINISH GRADE SITE.
19. SEED WETLAND AND UPLAND AREAS AND PLANT TREES AS INDICATED IN DRAWINGS AND SPECIFICATIONS.
20. REMOVE DECONTAMINATION PAD AND WATER MANAGEMENT STRUCTURES AND PIPING.
21. INSTALL NEW FENCE AROUND OU5 AREA.
22. REMOVE TEMPORARY EROSION CONTROL AND SEDIMENT CONTROL MEASURES AFTER 70% VEGETATIVE COVER HAS BEEN ESTABLISHED.

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Designed	TRE
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OU5 REMEDIATION PROJECT

ESTIMATED QUANTITIES AND ANTICIPATED CONSTRUCTION SEQUENCING

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CLIENT PROJECT No.	
DWG. No.	REV. No.
G-2	A

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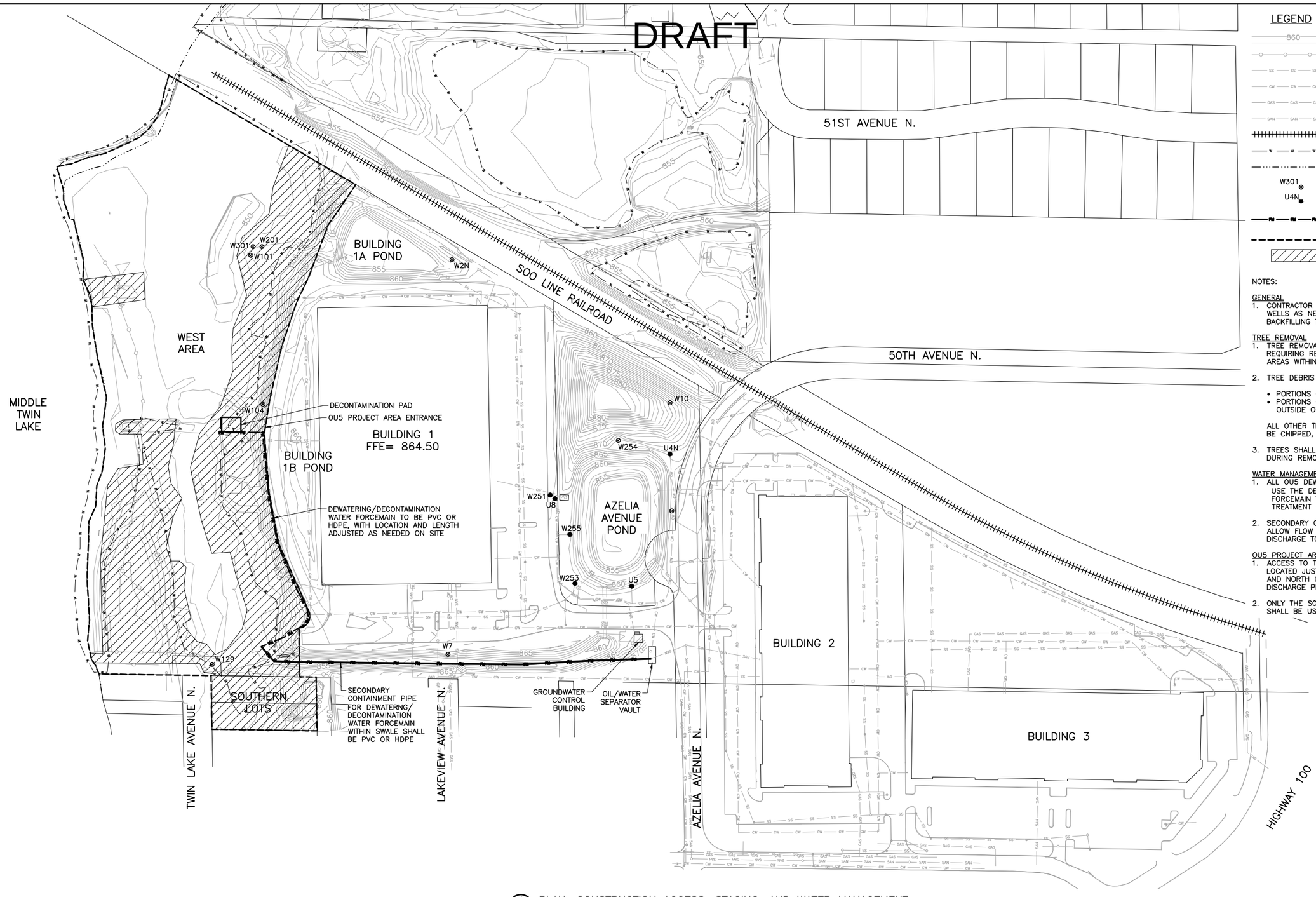

LEGEND

- EXISTING CONTOUR
- EXISTING FENCE
- EXISTING STORM SEWER
- EXISTING CITY WATER
- EXISTING GAS LINE
- EXISTING SANITARY SEWER
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- EXISTING MONITORING WELL
- EXISTING PUMPOUT WELL
- DEWATERING/DECONTAMINATION WATER FORCEMAIN
- OU5 PROJECT AREA
- TREE REMOVAL AREA

NOTES:

GENERAL
1. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS AS NECESSARY DURING EXCAVATION AND BACKFILLING TO AVOID DAMAGE.

TREE REMOVAL
1. TREE REMOVAL AREA IS APPROXIMATE. TREES REQUIRING REMOVAL MAY BE LOCATED IN ADDITIONAL AREAS WITHIN CONSTRUCTION LIMITS.
2. TREE DEBRIS TO BE TAKEN OFF SITE INCLUDES:
   - PORTIONS OF TREES LOCATED ABOVE GROUND
   - PORTIONS OF TREES LOCATED BELOW GROUND AND OUTSIDE OF THE WETLAND BOUNDARY

   ALL OTHER TREE DEBRIS MUST REMAIN ON SITE, BE CHIPPED, AND MANAGED FOR OFFSITE DISPOSAL.
3. TREES SHALL NOT BE DRAGGED THROUGH ONSITE SOIL DURING REMOVAL AND DISPOSAL.

WATER MANAGEMENT
1. ALL OU5 DEWATERING AND DECONTAMINATION SHALL USE THE DEWATERING/DECONTAMINATION WATER FORCEMAIN TO PUMP WATER TO THE ONSITE TREATMENT SYSTEM.
2. SECONDARY CONTAINMENT OF THE FORCEMAIN SHALL ALLOW FLOW TO DRAIN BACK TO OU5 WITHOUT DISCHARGE TO MIDDLE TWIN LAKE.

OU5 PROJECT AREA ENTRANCE
1. ACCESS TO THE OU5 PROJECT AREA SHALL BE LOCATED JUST WEST OF THE BUILDING 1 FIRE ROAD AND NORTH OF THE EXISTING BUILDING 1B POND DISCHARGE PIPE.
2. ONLY THE SOUTH HALF OF THE EXISTING FIRE ROAD SHALL BE USED FOR EQUIPMENT ACCESS AND HAULING.

1 PLAN: CONSTRUCTION ACCESS, STAGING, AND WATER MANAGEMENT

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OU5 REMEDIATION PROJECT

CONSTRUCTION ACCESS, STAGING, AND WATER MANAGEMENT PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-1
REV. No. A

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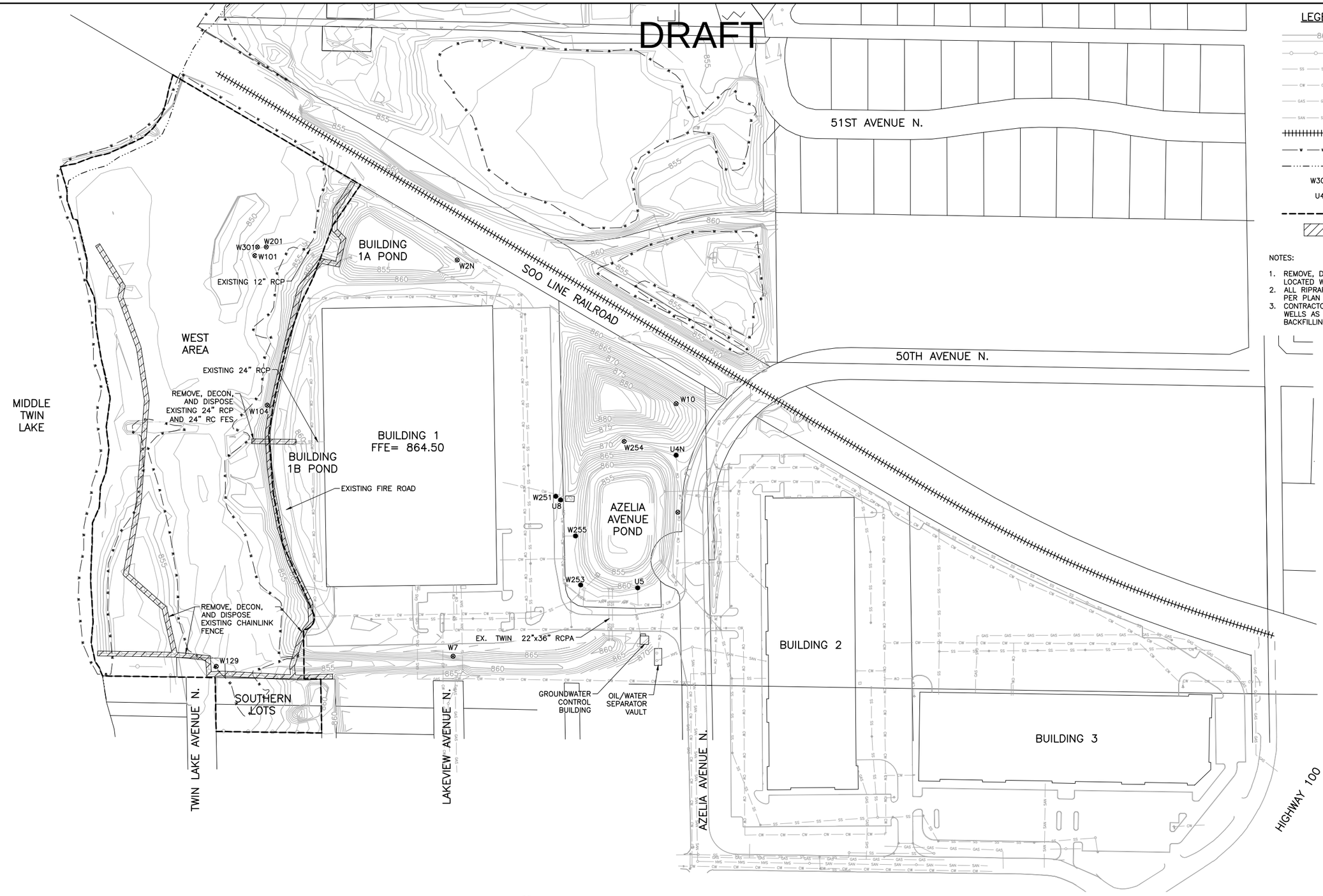

LEGEND

- 860 — EXISTING CONTOUR
- EXISTING FENCE
- SS — EXISTING STORM SEWER
- CW — EXISTING CITY WATER
- GAS — EXISTING GAS LINE
- SAN — EXISTING SANITARY SEWER
- RAILROAD TRACKS
- W — WETLAND
- LAKESHORE
- W301 — EXISTING MONITORING WELL
- U4N — EXISTING PUMPOUT WELL
- OU5 PROJECT AREA
- REMOVAL

NOTES:

1. REMOVE, DECON, AND DISPOSE OF EXISTING DEBRIS LOCATED WITHIN OU5 PROJECT AREA.
2. ALL RIPRAP SHALL BE SALVAGED AND REINSTALLED PER PLAN DETAILS.
3. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS AS NECESSARY DURING EXCAVATION AND BACKFILLING TO AVOID DAMAGE.

1 – PLAN: EXISTING CONDITIONS AND REMOVALS PLAN

0 100 200
SCALE IN FEET

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

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Checked	JEH
Designed	TRE
Approved	DWF

JOSLYN MANUFACTURING & SUPPLY CO. SITE
BROOKLYN CENTER, MN

OU5 REMEDIATION PROJECT

EXISTING CONDITIONS AND REMOVAL PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-2
REV. No. A

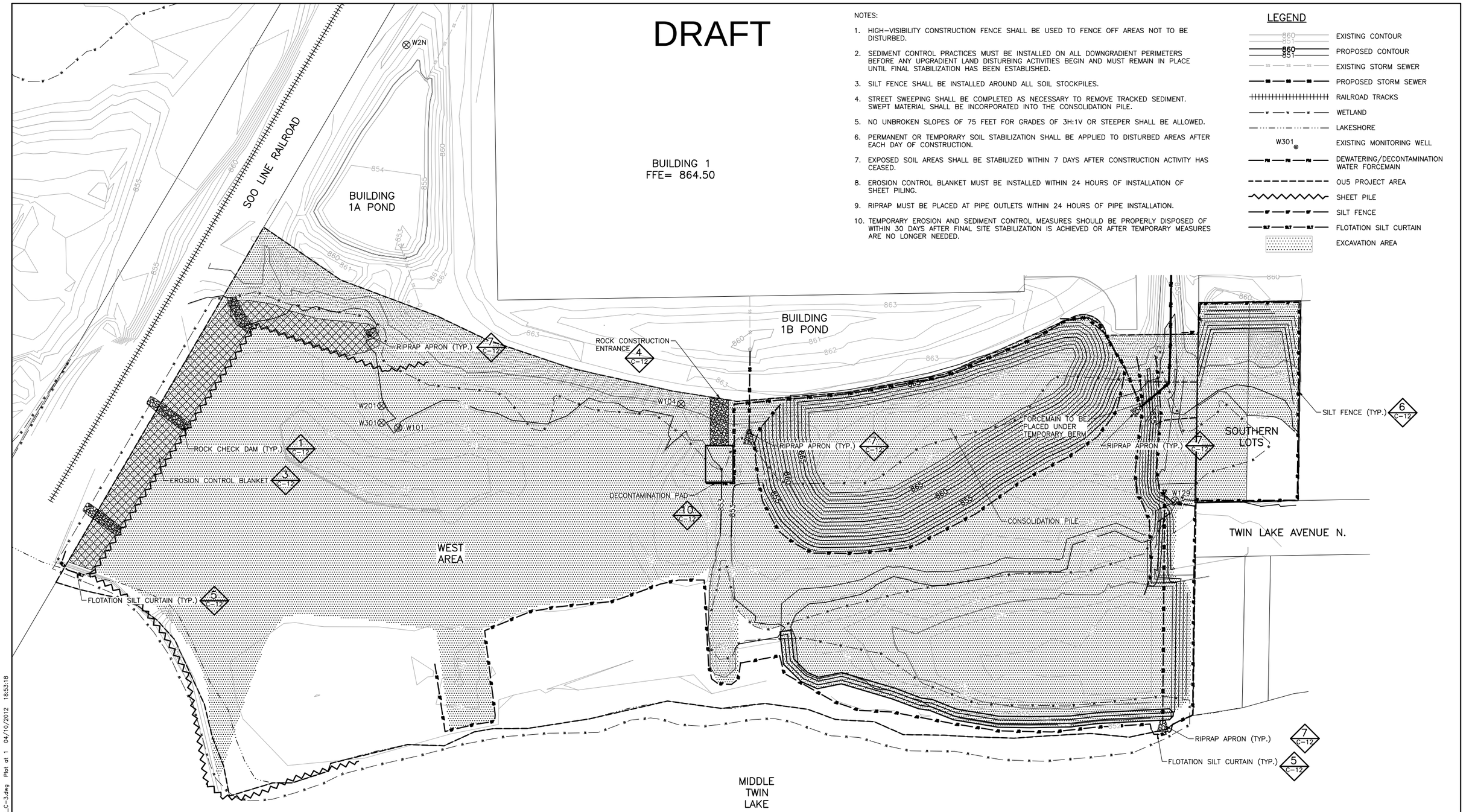
DRAFT

NOTES:

1. HIGH-VISIBILITY CONSTRUCTION FENCE SHALL BE USED TO FENCE OFF AREAS NOT TO BE DISTURBED.
2. SEDIMENT CONTROL PRACTICES MUST BE INSTALLED ON ALL DOWNGRADIENT PERIMETERS BEFORE ANY UPGRADIENT LAND DISTURBING ACTIVITIES BEGIN AND MUST REMAIN IN PLACE UNTIL FINAL STABILIZATION HAS BEEN ESTABLISHED.
3. SILT FENCE SHALL BE INSTALLED AROUND ALL SOIL STOCKPILES.
4. STREET SWEEPING SHALL BE COMPLETED AS NECESSARY TO REMOVE TRACKED SEDIMENT. SWEPT MATERIAL SHALL BE INCORPORATED INTO THE CONSOLIDATION PILE.
5. NO UNBROKEN SLOPES OF 75 FEET FOR GRADES OF 3H:1V OR STEEPER SHALL BE ALLOWED.
6. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DISTURBED AREAS AFTER EACH DAY OF CONSTRUCTION.
7. EXPOSED SOIL AREAS SHALL BE STABILIZED WITHIN 7 DAYS AFTER CONSTRUCTION ACTIVITY HAS CEASED.
8. EROSION CONTROL BLANKET MUST BE INSTALLED WITHIN 24 HOURS OF INSTALLATION OF SHEET PILING.
9. RIPRAP MUST BE PLACED AT PIPE OUTLETS WITHIN 24 HOURS OF PIPE INSTALLATION.
10. TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE PROPERLY DISPOSED OF WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER TEMPORARY MEASURES ARE NO LONGER NEEDED.

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- W301 EXISTING MONITORING WELL
- DEWATERING/DECONTAMINATION WATER FORCEMAIN
- OU5 PROJECT AREA
- SHEET PILE
- SILT FENCE
- FLOTATION SILT CURTAIN
- EXCAVATION AREA



1 PLAN: EROSION CONTROL PLAN

0 50 100

SCALE IN FEET

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OU5 REMEDIATION PROJECT

EROSION CONTROL PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-3
REV. No. A

DRAFT

NOTES:

1. SOIL EXCAVATED FROM OUTSIDE SUB–AREAS REQUIRING CONSOLIDATION WILL BE TRANSPORTED AND DISPOSED AT A SUBTITLE D LANDFILL.
2. SUB–AREAS TO BE TRANSPORTED OFFSITE SHALL BE EXCAVATED PRIOR TO SUB–AREAS REQUIRING CONSOLIDATION.
3. EXCAVATION WORK SHALL BE COMPLETED STARTING FROM OUTERMOST EXCAVATION LIMITS FROM EQUIPMENT ACCESS POINT WORKING INWARD TO AVOID THE SPREADING OF CONTAMINATED SOILS TO PREVIOUSLY EXCAVATED AREAS.
4. AREA NORTH OF SHEET PILE SHALL BE EXCAVATED FIRST TO FACILITATE INSTALLATION OF SHEET PILE.
5. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS AS NECESSARY DURING EXCAVATION AND BACKFILLING TO AVOID DAMAGE.
6. ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER, EXCEPT AS NOTED AND SHOWN IN DETAILS 1 THROUGH 6 ON SHEET C–11.
7. FLOODPLAIN MITIGATION AREA LOCATED OUTSIDE OF DEWATERIZED EXCAVATION AREAS SHALL NOT BE OVEREXCAVATED AND BACKFILLED.
8. SOILS EXCAVATED FROM THE FLOODPLAIN MITIGATION AREA SHALL BE UTILIZED AS COMMON BORROW AS INDICATED IN THE DRAWINGS AND SPECIFICATIONS.

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- EXISTING MONITORING WELL
- 4.0 FOOT EXCAVATION
- 3.5 FOOT EXCAVATION
- 2.5 FOOT EXCAVATION
- 2.0 FOOT EXCAVATION
- 1.0 FOOT EXCAVATION WITH 3.0 FOOT COVER
- FLOODPLAIN MITIGATION EXCAVATION
- OU5 SUB–AREAS
- SUB–AREAS REQUIRING CONSOLIDATION

BUILDING 1
FFE= 864.50

BUILDING 1A POND

BUILDING 1B POND

SOO LINE RAILROAD

CONSOLIDATION AREA

FLOODPLAIN MITIGATION AREA BOTTOM ELEVATION 853.1

FLOODPLAIN MITIGATION AREA BOTTOM ELEVATION 853.0

SOUTHERN LOTS

TWIN LAKE AVENUE N.

RAISED RAILROAD SPUR TOP OF SPUR 853.1

MIDDLE TWIN LAKE

WA–1A
WA–1B
WA–2A
WA–2B
WA–2C
WA–2D
WA–3A
WA–3B
WA–4
WA–4A
WA–4B
WA–5 (UNDISTURBED)
WA–5 (FORMER ICE CHUTE)
WA–5 (UNDISTURBED)
WA–6MID
WA–6N
WA–6S
WA–7
WA–8 (FORMER RAIL SPUR)

W2N W201 W301 W101 W104 W129

2/C–9 1/C–9 3/C–9 4/C–9

1 PLAN: EXCAVATION AND GRADING PLAN
SCALE IN FEET 0 50 100

PERMIT DRAWINGS NOT FOR CONSTRUCTION

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OU5 REMEDIATION PROJECT

EXCAVATION PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C–4
REV. No. A

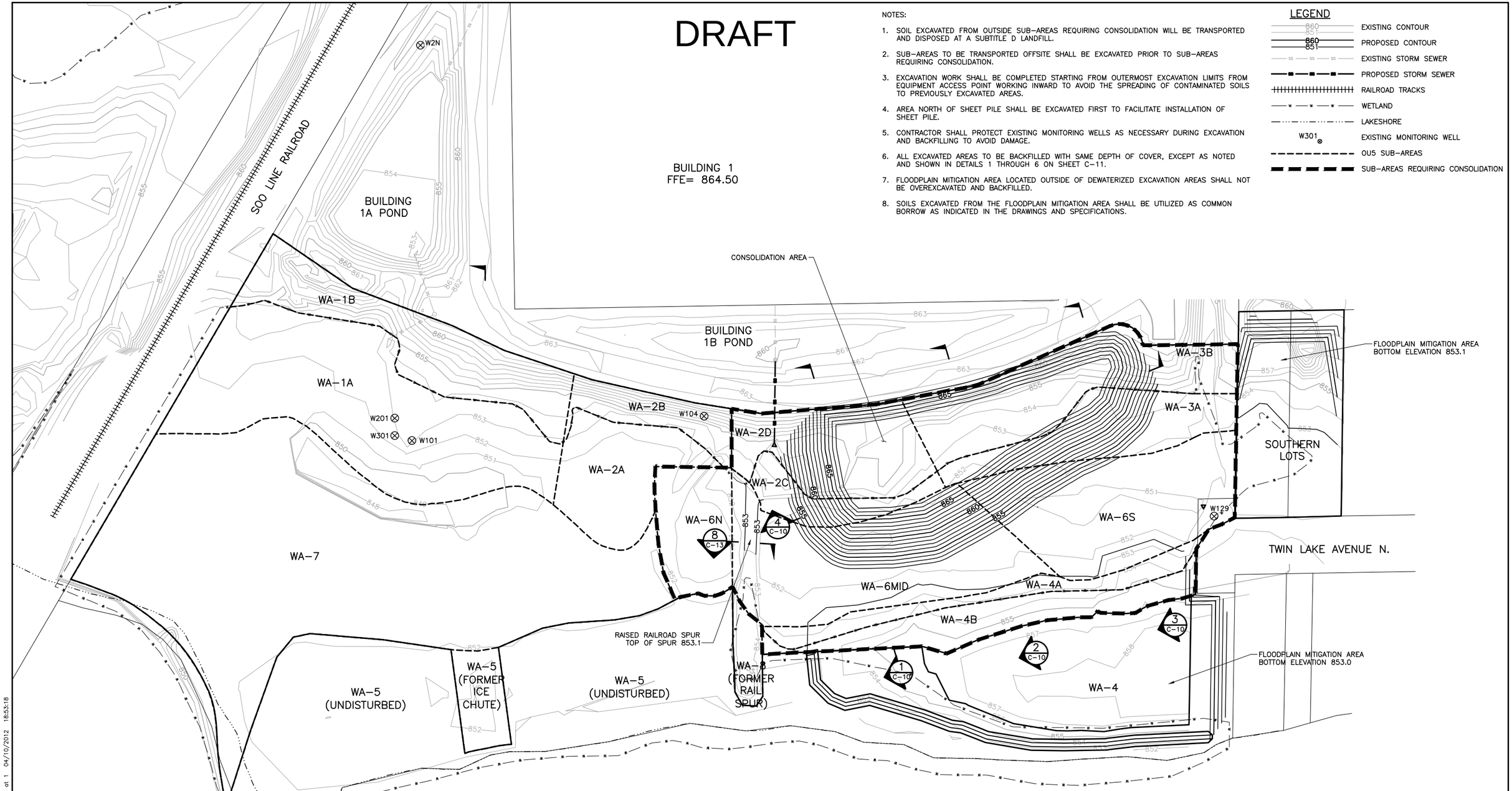
DRAFT

NOTES:

1. SOIL EXCAVATED FROM OUTSIDE SUB–AREAS REQUIRING CONSOLIDATION WILL BE TRANSPORTED AND DISPOSED AT A SUBTITLE D LANDFILL.
2. SUB–AREAS TO BE TRANSPORTED OFFSITE SHALL BE EXCAVATED PRIOR TO SUB–AREAS REQUIRING CONSOLIDATION.
3. EXCAVATION WORK SHALL BE COMPLETED STARTING FROM OUTERMOST EXCAVATION LIMITS FROM EQUIPMENT ACCESS POINT WORKING INWARD TO AVOID THE SPREADING OF CONTAMINATED SOILS TO PREVIOUSLY EXCAVATED AREAS.
4. AREA NORTH OF SHEET PILE SHALL BE EXCAVATED FIRST TO FACILITATE INSTALLATION OF SHEET PILE.
5. CONTRACTOR SHALL PROTECT EXISTING MONITORING WELLS AS NECESSARY DURING EXCAVATION AND BACKFILLING TO AVOID DAMAGE.
6. ALL EXCAVATED AREAS TO BE BACKFILLED WITH SAME DEPTH OF COVER, EXCEPT AS NOTED AND SHOWN IN DETAILS 1 THROUGH 6 ON SHEET C–11.
7. FLOODPLAIN MITIGATION AREA LOCATED OUTSIDE OF DEWATERIZED EXCAVATION AREAS SHALL NOT BE OVEREXCAVATED AND BACKFILLED.
8. SOILS EXCAVATED FROM THE FLOODPLAIN MITIGATION AREA SHALL BE UTILIZED AS COMMON BORROW AS INDICATED IN THE DRAWINGS AND SPECIFICATIONS.

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- EXISTING MONITORING WELL
- OU5 SUB–AREAS
- SUB–AREAS REQUIRING CONSOLIDATION



1 – PLAN: EXCAVATION AND GRADING PLAN

0 50 100

SCALE IN FEET

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OU5 REMEDIATION PROJECT

FINAL GRADING PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C–5
REV. No. A

CADD USER: Troy R. Erickson FILE: M:\ADEPTWORK\TRE\23270110000_OU5_C–5.DWG PLOT SCALE: 1:2 PLOT DATE: 5/8/2014 11:04 AM
ss1 M:\Design\23270110.00\23270110000_OU5_C–3.dwg Plot at 1 04/10/2012 18:53:18

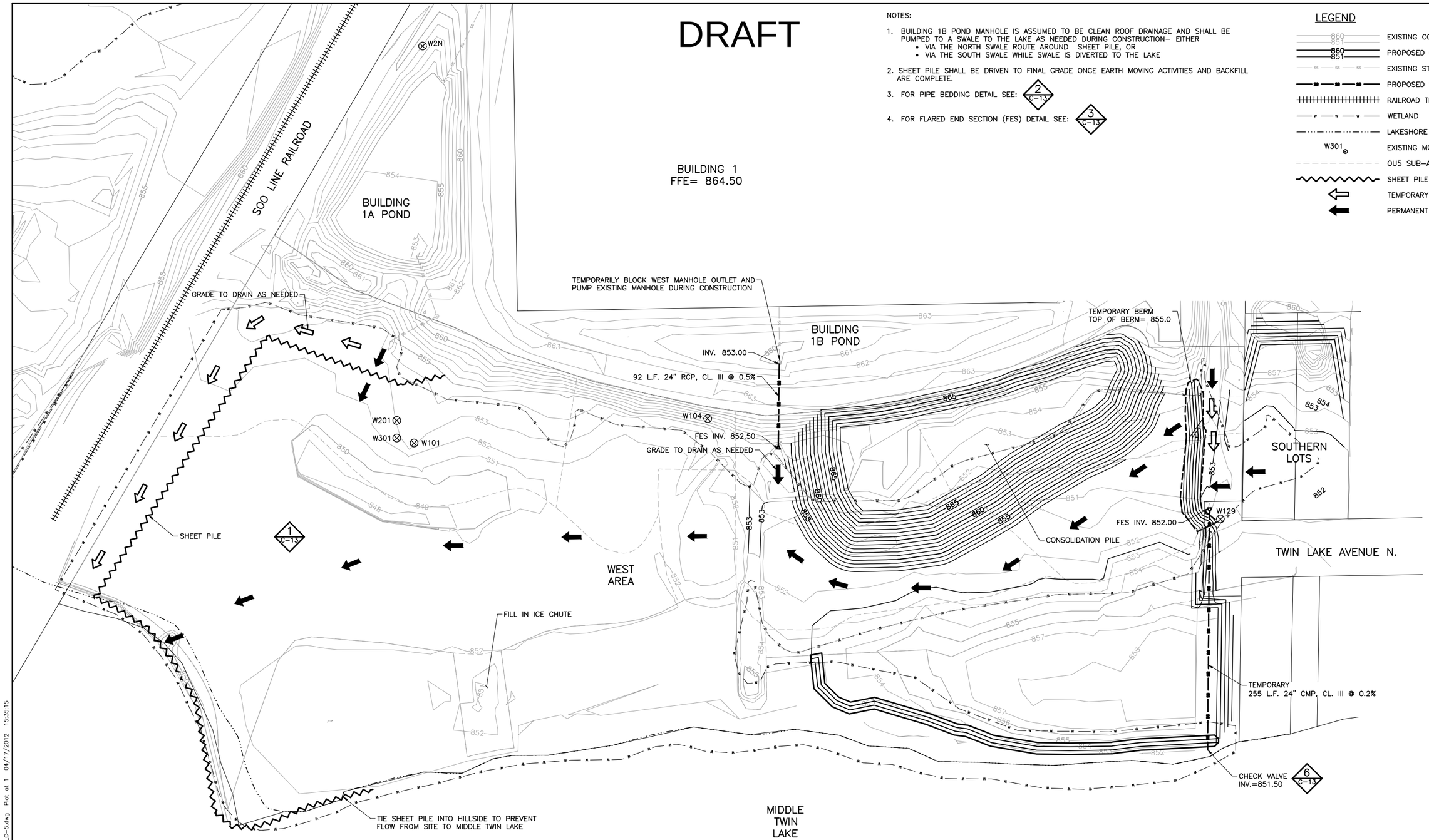
DRAFT

NOTES:

1. BUILDING 1B POND MANHOLE IS ASSUMED TO BE CLEAN ROOF DRAINAGE AND SHALL BE PUMPED TO A SWALE TO THE LAKE AS NEEDED DURING CONSTRUCTION– EITHER
   - VIA THE NORTH SWALE ROUTE AROUND SHEET PILE, OR
   - VIA THE SOUTH SWALE WHILE SWALE IS DIVERTED TO THE LAKE
2. SHEET PILE SHALL BE DRIVEN TO FINAL GRADE ONCE EARTH MOVING ACTIVITIES AND BACKFILL ARE COMPLETE.
3. FOR PIPE BEDDING DETAIL SEE: 2 / C-13
4. FOR FLARED END SECTION (FES) DETAIL SEE: 3 / C-13

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- W301 EXISTING MONITORING WELL
- OU5 SUB–AREAS
- SHEET PILE
- TEMPORARY FLOW PATH
- PERMANENT FLOW PATH



1 / – PLAN: STORMWATER MANAGEMENT PLAN

0 50 100

SCALE IN FEET

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NOT FOR CONSTRUCTION

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OU5 REMEDIATION PROJECT

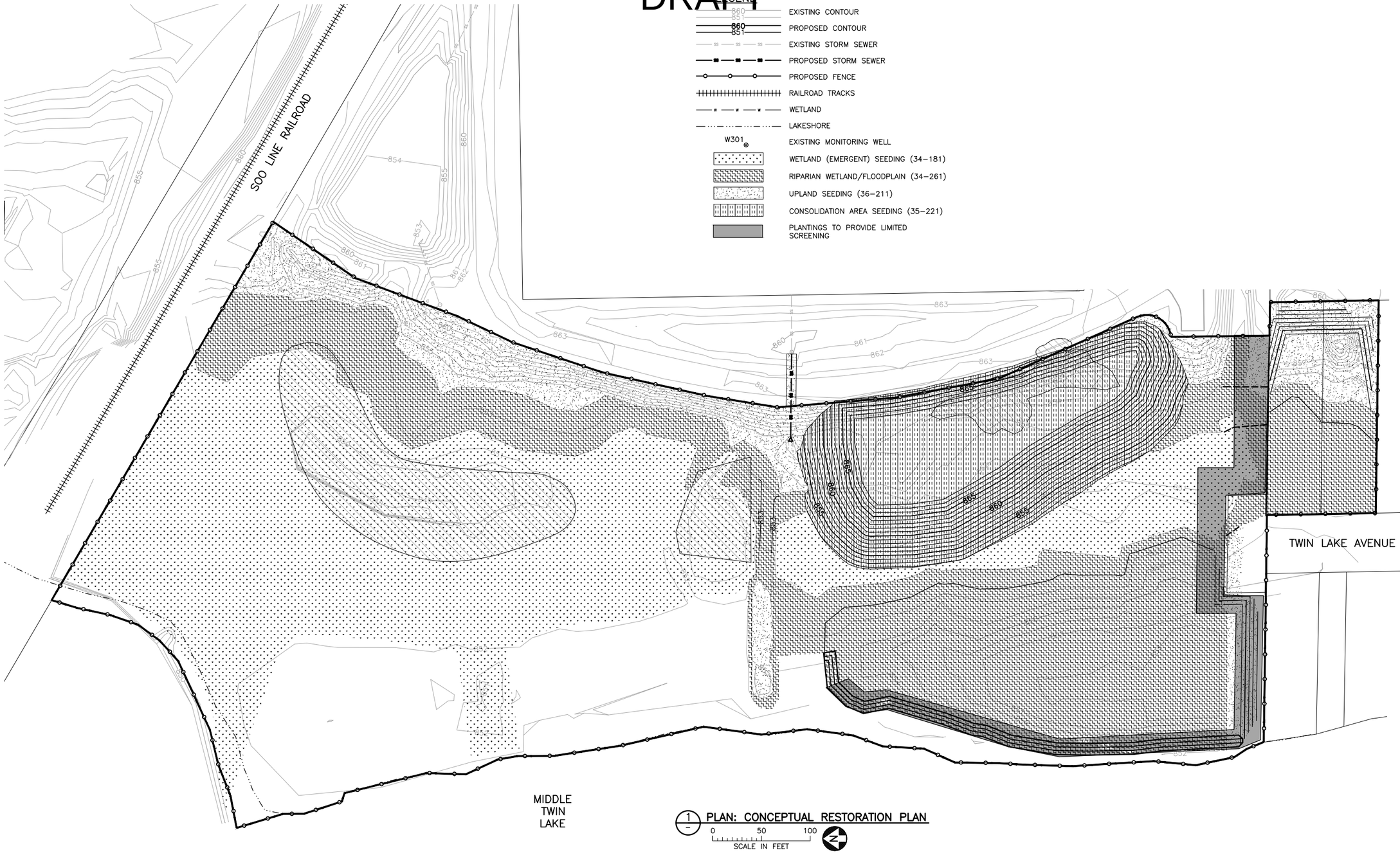
STORMWATER MANAGEMENT PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C–6
REV. No. A

DRAFT

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED FENCE
- RAILROAD TRACKS
- WETLAND
- LAKESHORE
- W301 EXISTING MONITORING WELL
- WETLAND (EMERGENT) SEEDING (34–181)
- RIPARIAN WETLAND/FLOODPLAIN (34–261)
- UPLAND SEEDING (36–211)
- CONSOLIDATION AREA SEEDING (35–221)
- PLANTINGS TO PROVIDE LIMITED SCREENING



1 PLAN: CONCEPTUAL RESTORATION PLAN

0 50 100

SCALE IN FEET

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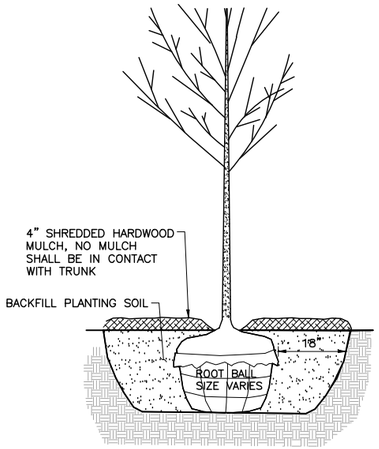
CONCEPTUAL RESTORATION PLAN

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-7
REV. No. A

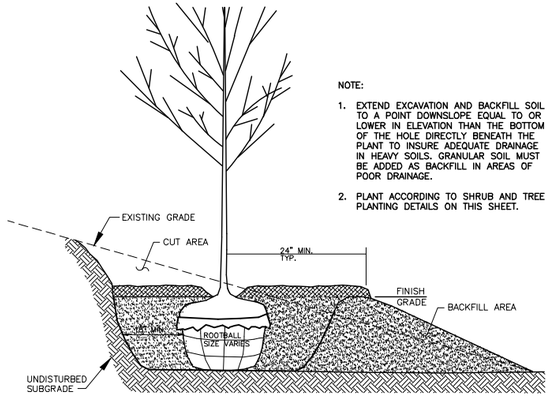
DRAFT



NOTES:

1. PROVIDE AND INSTALL PLANT MATERIAL THAT MEET SPECIFICATIONS.
2. REMOVE DEAD OR DAMAGED BRANCHES. RETAIN THE NATURAL FORM OF THE TREE. DO NOT CUT THE LEADER.
3. DIG PLANT HOLES 18" MIN. LARGER THAN BALL, ALL SIDES.
4. SET TREE ON LIGHTLY FIRMED BACKFILL SOIL AT THE SAME DEPTH GROWN IN THE NURSERY (AT THE CROWN).
5. CUT ROPES AT BASE OF TRUNK, PULL BURLAP DOWN EXPOSING 1/3 OF ROOTBALL AND THOROUGHLY BURY ROPES AND BURLAP BELOW GRADE.
6. BACKFILL WITH PLANTING SOIL FIRM SOIL AROUND ROOTBALL TO MAINTAIN PLUMB AND ENSURE NO AIR GAPS AROUND ROOTBALL.
7. CONSTRUCT 3" WATERING BASIN. THOROUGHLY WATER WITHIN 3 HOURS OF INSTALLATION.
8. PLACE 4" SHREDDED HARDWOOD MULCH. NO MULCH TO BE IN CONTACT W/ TRUNK.
9. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING TREES IN A PLUMB POSITION THROUGHOUT THE GUARANTEE PERIOD.
10. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. IN CASE OF ANY DISCREPANCIES BETWEEN THIS DETAIL, PLANS OR SPECIFICATIONS, THE SPECIFICATION SHALL GOVERN.

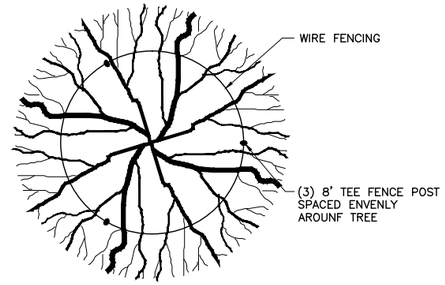
1 – DETAIL: B&B TREE PLANTING
NOT TO SCALE

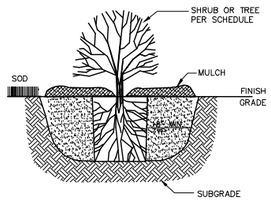


NOTE:

1. EXTEND EXCAVATION AND BACKFILL SOIL TO A POINT DOWNSLOPE EQUAL TO OR LOWER IN ELEVATION THAN THE BOTTOM OF THE HOLE DIRECTLY BENEATH THE PLANT TO INSURE ADEQUATE DRAINAGE IN HEAVY SOILS. GRANULAR SOIL MUST BE ADDED AS BACKFILL IN AREAS OF POOR DRAINAGE.
2. PLANT ACCORDING TO SHRUB AND TREE PLANTING DETAILS ON THIS SHEET.

3 – DETAIL: TREE PLANTING ON A SLOPE
NOT TO SCALE





NOTES:

PROVIDE AND INSTALL PLANT MATERIAL THAT MEET SPECIFICATIONS.

DIG PLANT HOLES 18" MIN. LARGER THAN CONTAINER SIZE, ALL SIDES.

SCARIFY BOTTOM AND SIDES OF HOLE

REMOVE DEAD OR DAMAGED BRANCHES. RETAIN THE NATURAL FORM OF THE SHRUB.

HAND LOOSEN ROOTS OF CONTAINERIZED MATERIAL. IF NECESSARY, SCORE OUTSIDE OF SOIL MASS TO REDIRECT CIRCLING FIBROUS ROOTS.

SET SHRUB ON UNDISTURBED NATIVE SOIL OR ON LIGHTLY FIRMED BACKFILL SOIL, AT THE SAME DEPTH AS IT WAS GROWN IN THE NURSERY.

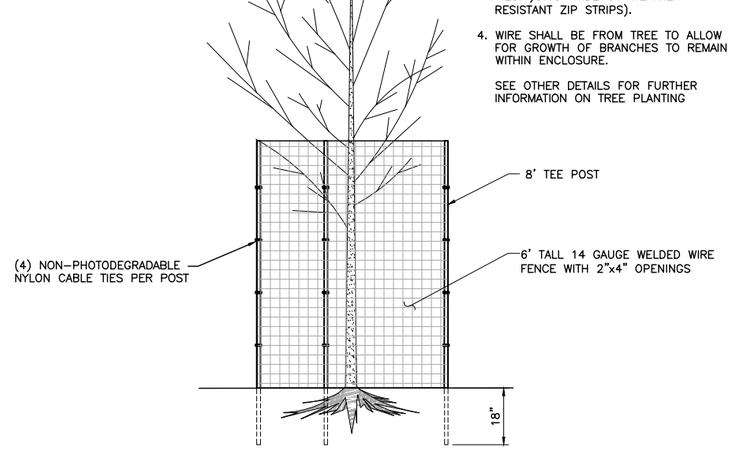
BACK FILL WITH PLANTING SOIL – SEE SPEC. LIGHTLY FIRM SOIL TO MAINTAIN PLUMB POSITION AND ENSURE NO AIR GAPS AROUND ROOTS.

DISH TOP OF BACKFILL BY 3" TO ACT AS WATERING BASIN. WATER THOROUGHLY WITHIN 3 HOURS OF INSTALLATION

PLACE 4" DEPTH SHREDDED HARDWOOD IN CONTACT W/TRUNK.

REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. IN CASE OF ANY DISCREPANCIES BETWEEN THIS DETAIL, PLANS OR SPECIFICATIONS, THE SPECIFICATION SHALL GOVERN.

2 – DETAIL: CONTAINER SHRUB/TREE
NOT TO SCALE



NOTES:

1. INSTALL 9' "T"-POST MINIMUM 18" INTO THE GROUND, (3) SPACED EVENLY AROUND TREE.
2. 6' TALL 14 GAGE WELDED WIRE FENCE WITH 2"x4" OPENINGS.
3. FENCING TIE TO POST WITH (4) NON-PHOTODEGRADABLE NYLON CABLE TIES.)0.15" WIDE UV-WEATHER RESISTANT ZIP STRIPS).
4. WIRE SHALL BE FROM TREE TO ALLOW FOR GROWTH OF BRANCHES TO REMAIN WITHIN ENCLOSURE.

SEE OTHER DETAILS FOR FURTHER INFORMATION ON TREE PLANTING

4 – DETAIL: DEER PROTECTION FENCING
xx
NOT TO SCALE

0 1 2 3 4
SCALE IN FEET

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

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CONSTRUCTION							
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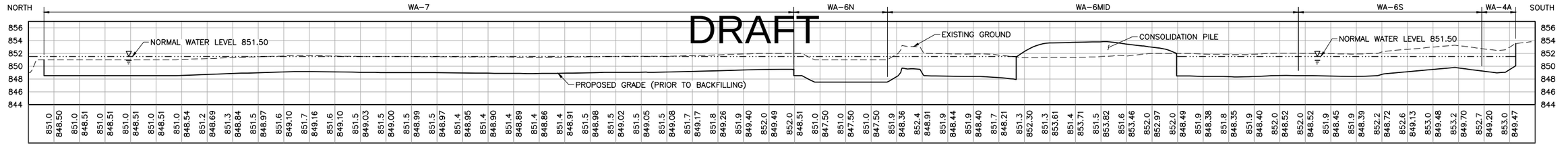
BROOKLYN CENTER, MN

OU5 REMEDIATION PROJECT

PLANTING DETAILS

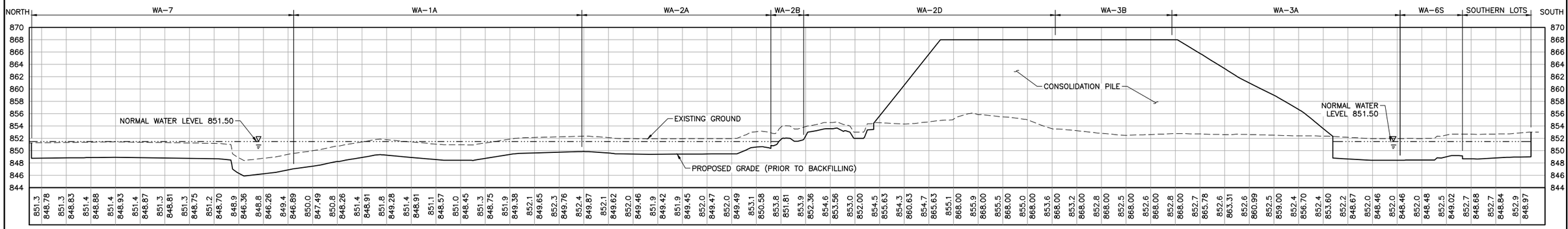
BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-8
REV. No. A



1 C–4 **SECTION: EXCAVATION SURFACE**

0 4 8 12 16 VERTICAL SCALE IN FEET

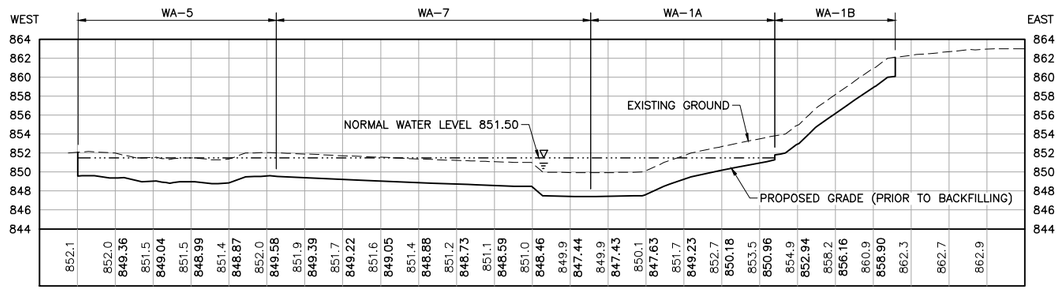
0 40 80 HORIZONTAL SCALE IN FEET



2 C–4 **SECTION: EXCAVATION SURFACE**

0 4 8 12 16 VERTICAL SCALE IN FEET

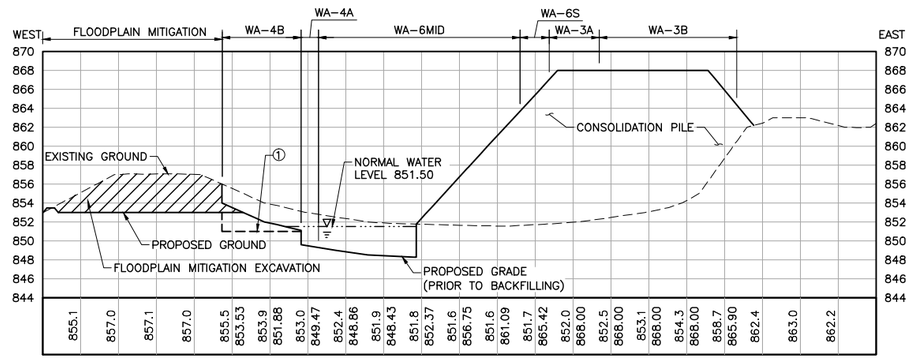
0 40 80 HORIZONTAL SCALE IN FEET



3 C–4 **SECTION: EXCAVATION SURFACE**

0 4 8 12 16 VERTICAL SCALE IN FEET

0 40 80 HORIZONTAL SCALE IN FEET



① OVEREXCAVATION TO MATCH FINAL GRADE AFTER BACKFILL.

4 C–4 **SECTION: EXCAVATION SURFACE**

0 4 8 12 16 VERTICAL SCALE IN FEET

0 40 80 HORIZONTAL SCALE IN FEET

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SIGNATURE

PRINTED NAME

DATE REG. NO.

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BID
CONSTRUCTION

RELEASED TO/FOR

A B C 0 1 2 3
DATE RELEASED

BARR
Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1–800–632–2277

Project Office:
BARR ENGINEERING CO.
4700 WEST 77TH STREET
MINNEAPOLIS, MN.
55435–4803
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www.barr.com

Scale	AS SHOWN
Date	2/21/2014
Drawn	TRE
Checked	JEH
Designed	TRE
Approved	DWF

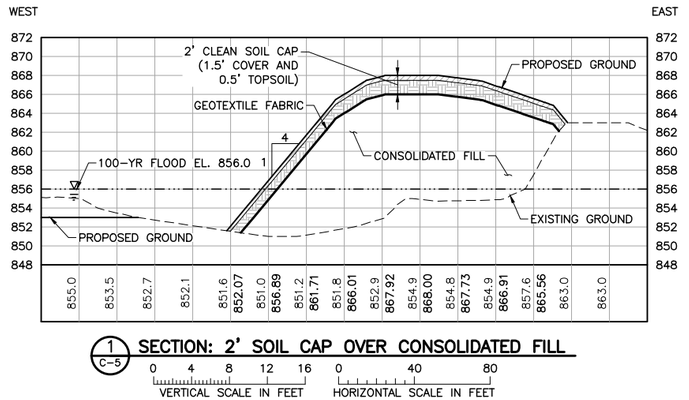
JOSLYN MANUFACTURING & SUPPLY CO. SITE
BROOKLYN CENTER, MN

OU5 REMEDIATION PROJECT

EXCAVATION CROSS SECTIONS

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C–9
REV. No. A

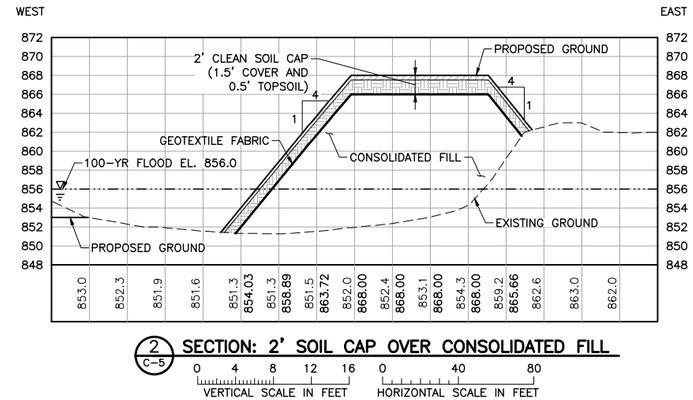
DRAFT



1 C-5 **SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL**

0 4 8 12 16 VERTICAL SCALE IN FEET

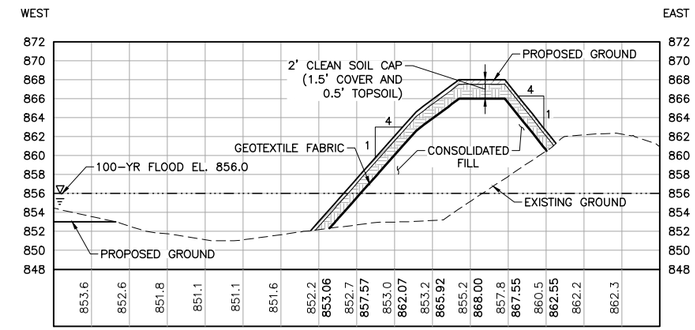
0 40 80 HORIZONTAL SCALE IN FEET



2 C-5 **SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL**

0 4 8 12 16 VERTICAL SCALE IN FEET

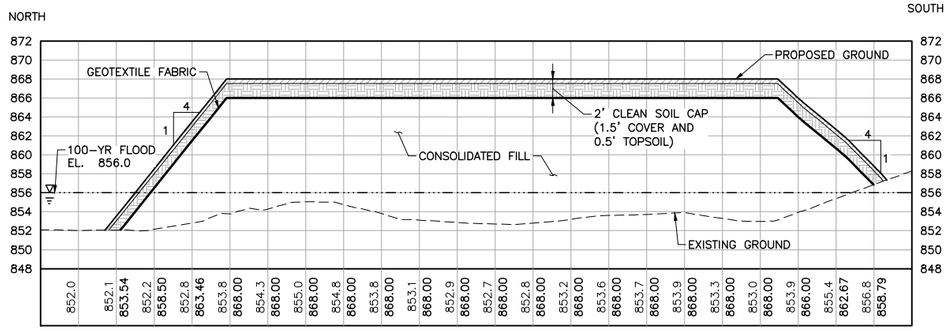
0 40 80 HORIZONTAL SCALE IN FEET



3 C-5 **SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL**

0 4 8 12 16 VERTICAL SCALE IN FEET

0 40 80 HORIZONTAL SCALE IN FEET



4 C-5 **SECTION: 2' SOIL CAP OVER CONSOLIDATED FILL**

0 4 8 12 16 VERTICAL SCALE IN FEET

0 40 80 HORIZONTAL SCALE IN FEET

PERMIT DRAWINGS
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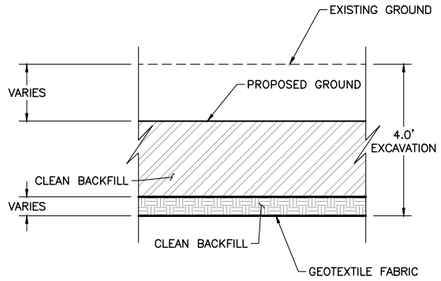
OU5 REMEDIATION PROJECT

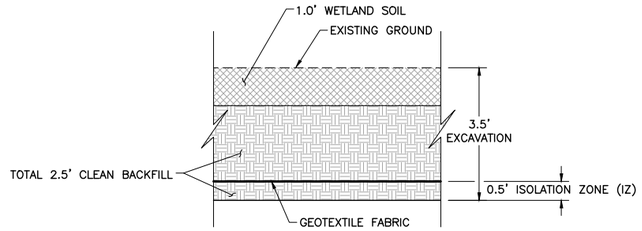
CONSOLIDATION CROSS SECTIONS

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-10
REV. No. A

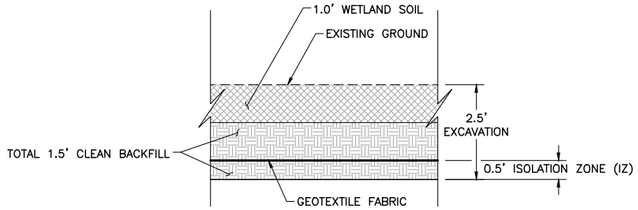
DRAFT



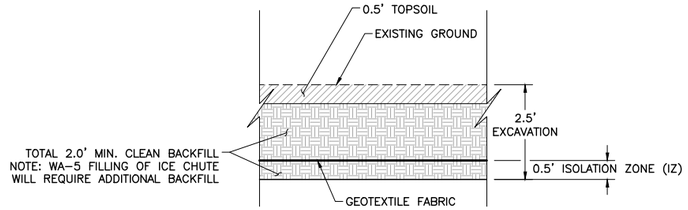
1 C-4 **DETAIL: 4.0' EXCAVATION, WETLAND RESTORATION– SOUTHERN LOTS NORTH PARCEL**
NOT TO SCALE



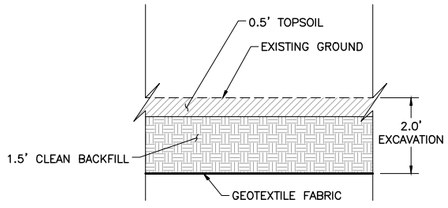
2 C-4 **DETAIL: 3.5' EXCAVATION, WETLAND RESTORATION– WA–2C, WA–6N; SOUTH WA–6MID; NORTH WA–3A, WA–4A, WA–6S**
NOT TO SCALE



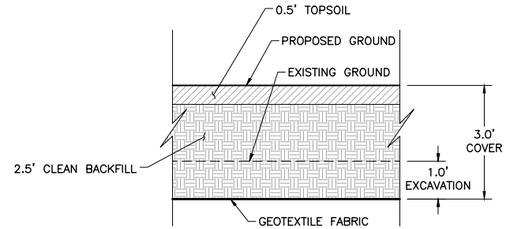
3 C-4 **DETAIL: 2.5' EXCAVATION, WETLAND RESTORATION– WA–1A, WA–2A, WA–7**
NOT TO SCALE



4 C-4 **DETAIL: 2.5' EXCAVATION, UPLAND RESTORATION– WA–5, WA–8**
NOT TO SCALE



5 C-4 **DETAIL: 2.0' EXCAVATION, UPLAND RESTORATION– WA–1B, WA–2B, WA–4B**
NOT TO SCALE



6 C-4 **DETAIL: 1.0' EXCAVATION, 3.0' FOOT COVER, UPLAND RESTORATION– WA–2D; NORTH WA–3B**
NOT TO SCALE

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

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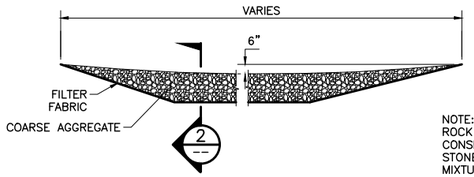
OU5 REMEDIATION PROJECT

SUB–AREA BACKFILL DETAILS

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C–11
REV. No. A

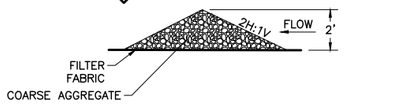
DRAFT



NOTE:
ROCK CHECK DAMS SHOULD CONSIST OF WELL-GRADED STONE CONSISTING OF A MIXTURE OF ROCK SIZES WITH THE FOLLOWING GRADATION:

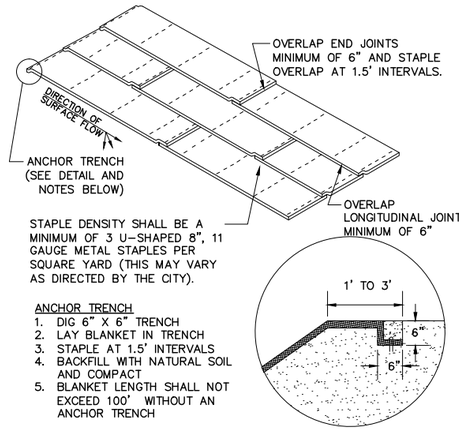
SIZE	% PASSING
24"	100
15"	75
12"	50
4"	10

1 C-3 **DETAIL: ROCK CHECK DAM**
NOT TO SCALE



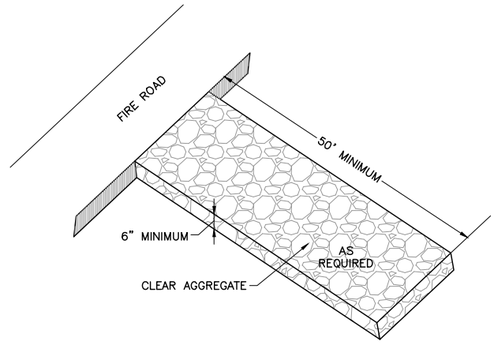
2 -- **SECTION: ROCK CHECK DAM**
NOT TO SCALE

NOTE:
1. EROSION CONTROL BLANKET SHALL BE MN/DOT SPECIFICATION 3885 CATEGORY 3 WOOD FIBER



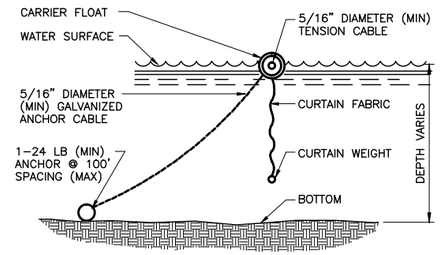
ANCHOR TRENCH
1. DIG 6" X 6" TRENCH
2. LAY BLANKET IN TRENCH
3. STAPLE AT 1.5' INTERVALS
4. BACKFILL WITH NATURAL SOIL AND COMPACT
5. BLANKET LENGTH SHALL NOT EXCEED 100' WITHOUT AN ANCHOR TRENCH

3 C-3 **DETAIL: TYPICAL EROSION CONTROL BLANKET**
NOT TO SCALE

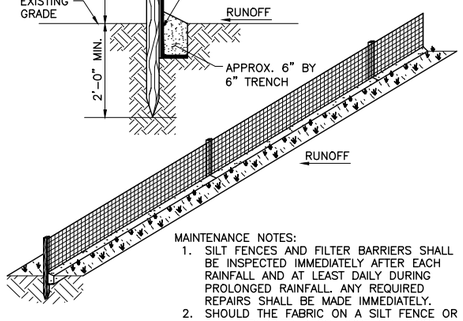


4 C-3 **DETAIL: CONSTRUCTION ENTRANCE**
NOT TO SCALE

NOTES:
1. 6" MAXIMUM FOR WATER DEPTHS UP TO 3'-0" DEEP AND 1'-0" MAXIMUM FOR DEPTHS OVER 3'-0" 2.
2. ELIMINATE ANCHOR AND CABLE FOR WATER DEPTHS LESS THAN 3'-0" OR DISTANCE BETWEEN SHORE ANCHORS FOR TENSION CABLE OF LESS THAN 100'
3. ANCHOR TENSION CABLE AT BOTH SIDES WITH STEEL POSTS OF DIAMETER AND LENGTH TO PREVENT BENDING AND PULL-OUT
4. WEIGHT HEAVY ENOUGH TO HOLD CURTAIN VERTICAL IN CURRENT AND WAVES TYPICAL FOR SITE.
5. MATERIALS:
   - CURTAIN – 22 OZ VINYL COATED NYLON FABRIC
   - FLOAT – 8" MINIMUM DIAMETER PLASTIC SEGMENTS
   - CURTAIN WEIGHT – CONTINUOUS GALVANIZED STEEL CHAIN $\frac{5}{16}$" MINIMUM DIAMETER, OR SEGMENTS OF $\frac{5}{16}$" DIAMETER STEEL CABLE, 24" LONG @ 12" BETWEEN PIECES



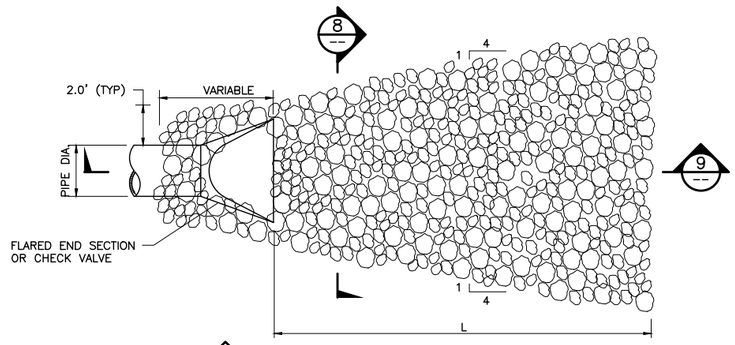
5 C-3 **DETAIL: FLOTATION SILT CURTAIN**
NOT TO SCALE



CONSTRUCTION NOTES:
1. THE HEIGHT OF A SILT FENCE SHALL NOT EXCEED 36 INCHES.
2. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM OF A 6 INCH OVERLAP, AND SECURELY SEALED.
3. POSTS SHALL BE SPACED A MAXIMUM OF 4 FEET APART AT THE BARRIER LOCATION AND DRIVEN SECURELY INTO THE GROUND (MINIMUM 24 INCHES).
4. A TRENCH SHALL BE EVACUATED APPROXIMATELY 6 INCHES WIDE AND 6 INCHES DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
5. WHEN STANDARD STRENGTH FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEASE 1 INCH LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 2 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
6. THE STANDARD STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 8 INCHES OF THE FABRIC SHALL BE EXTENDED INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE. FILTER FABRIC SHALL NOT BE STAPLED TO EXISTING TREES.
7. WHEN EXTRA STRENGTH FILTER FABRIC AND CLOSER POST SPACING ARE USED, THE WIRE MESH SUPPORT FENCE MAY BE ELIMINATED. IN SUCH CASE, THE FILTER FABRIC IS STAPLED OR WIRED DIRECTLY TO THE POSTS WITH ALL OTHER PROVISIONS OF ITEM NO. 6 APPLYING.
8. THE TRENCH SHALL BE BACKFILLED AND SOIL COMPACTED OVER THE FILTER FABRIC.
9. SILT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY STABILIZED.

MAINTENANCE NOTES:
1. SILT FENCES AND FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
2. SHOULD THE FABRIC ON A SILT FENCE OR FILTER BARRIER DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER IS STILL NECESSARY, THE FABRIC SHALL BE REPLACED PROMPTLY.
3. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. THEY MUST BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY ONE-HALF THE HEIGHT OF THE BARRIER.

6 C-3 **DETAIL: SILT FENCE**
NOT TO SCALE



7 C-3 **DETAIL: RIPRAP APRON**
NOT TO SCALE

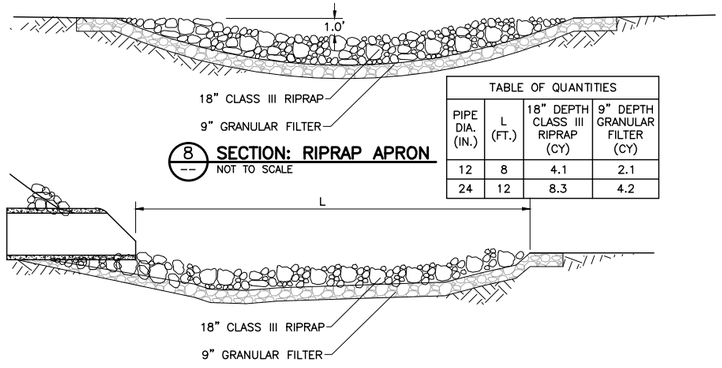
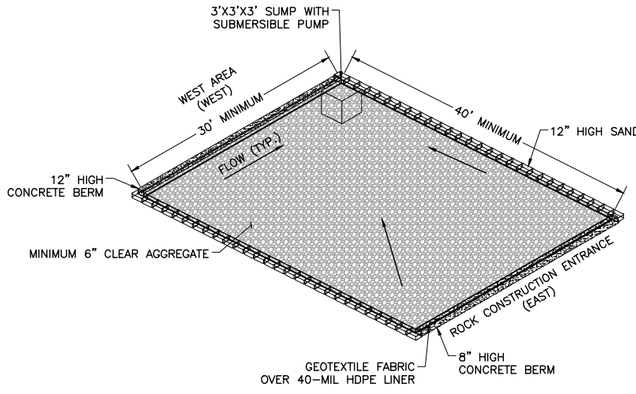


TABLE OF QUANTITIES			
PIPE DIA. (IN.)	L (FT.)	18" DEPTH CLASS III RIPRAP (CY)	9" DEPTH GRANULAR FILTER (CY)
12	8	4.1	2.1
24	12	8.3	4.2

8 -- **SECTION: RIPRAP APRON**
NOT TO SCALE

9 -- **SECTION: RIPRAP APRON**
NOT TO SCALE



10 C-3 **DETAIL: DECONTAMINATION PAD**
NOT TO SCALE

PERMIT DRAWINGS NOT FOR CONSTRUCTION

CADD USER: Troy R. Erickson FILE: M:\ADEPTWORK\TRE\2327011000_OU5_C-11.DWG PLOT SCALE: 1:2 PLOT DATE: 5/8/2014 11:23 AM
ss1 M:\DESIGN\2327011000\2327011000_OU5_C-10.dwg Plot at 1 04/23/2012 13:54:26

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OU5 REMEDIATION PROJECT

EROSION CONTROL DETAILS

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DWG. No. C-12
REV. No. A

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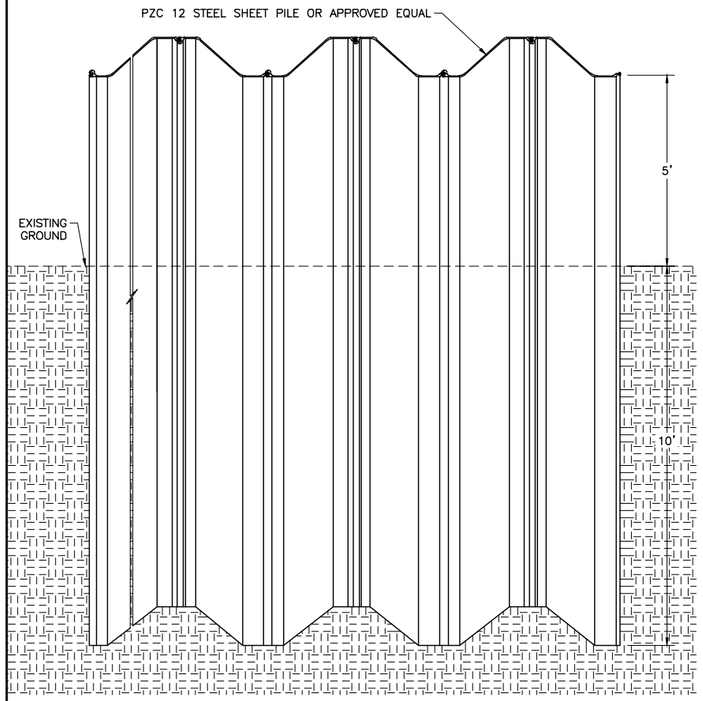
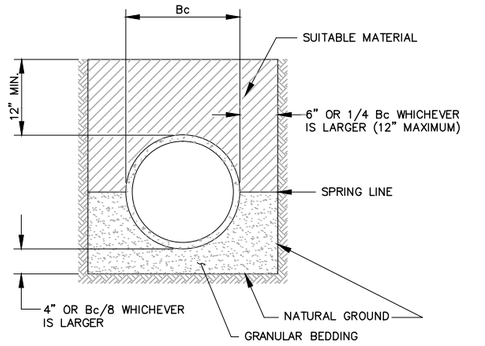
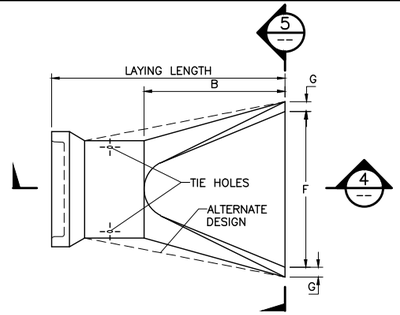


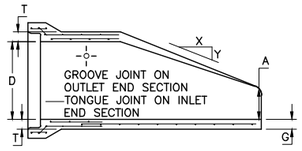
1 C-6 **DETAIL: SHEET PILE**
NOT TO SCALE



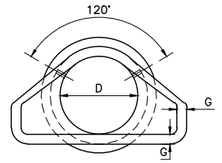
2 C-6 **DETAIL: PIPE BEDDING DETAIL FOR STORM SEWER**
NOT TO SCALE



3 C-6 **DETAIL: FLARED END SECTION**
NOT TO SCALE



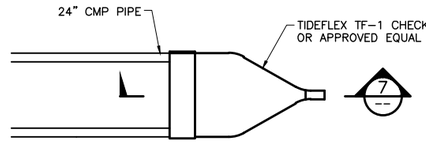
4 – **SECTION: FLARED END SECTION**
NOT TO SCALE



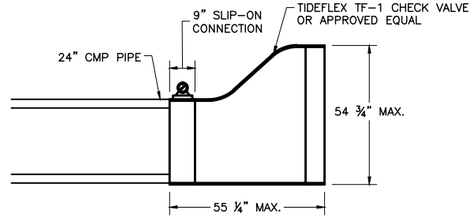
5 – **SECTION: FLARED END SECTION**
NOT TO SCALE

PIPE DIAMETER D	LAYING LENGTH		SLOPE	T	A	B	F	G	WEIGHT PER SECTION
INCHES	OUTLET	INLET	X TO Y	INCHES	INCHES	INCHES	INCHES	INCHES	LBS.
24	6'-0"	6'-0"	2.5 TO	3	9 1/2	43 1/2	48	3	1520

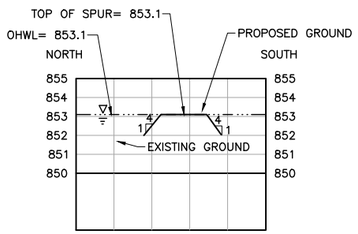
NOTES:
1. END SECTION IS MANUFACTURED IN ACCORDANCE WITH APPLICABLE PORTIONS OF ASTM SPECIFICATIONS C76.
2. TIE BOLT HOLES ARE PROVIDED FOR THE INSTALLATION OF TIE BOLTS BETWEEN THE FLARED END SECTION AND THE ADJACENT PIPE.



6 C-6 **DETAIL: CHECK VALVE**
NOT TO SCALE



7 – **SECTION: CHECK VALVE**
NOT TO SCALE



8 C-5 **SECTION: RAILROAD SPUR RAISE**
0 2 4 6 8 VERTICAL SCALE IN FEET
0 20 40 HORIZONTAL SCALE IN FEET

PERMIT DRAWINGS
NOT FOR CONSTRUCTION

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
SIGNATURE
PRINTED NAME
DATE REG. NO.

CLIENT
BID
CONSTRUCTION
RELEASED TO/FOR

A B C 0 1 2 3
DATE RELEASED

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Date	2/21/2014
Drawn	TRE
Checked	JEH
Designed	TRE
Approved	DWF

JOSLYN MANUFACTURING & SUPPLY CO. SITE
BROOKLYN CENTER, MN

OU5 REMEDIATION PROJECT

STORMWATER MANAGEMENT DETAILS AND CROSS SECTIONS

BARR PROJECT No. 23270110.00
CLIENT PROJECT No.
DWG. No. C-13
REV. No. A