Appendix C
Red Butte Creek Stormwater Culvert Inspection Plan

Red Butte Creek (RBC) Stormwater Culvert Inspection Plan DRAFT 7

Introduction

This stormwater culvert inspection plan for the Red Butte Creek Incident is based on doing source correction if needed. Inspections will be done on foot, with remote cameras, and by flushing as appropriate. The primary objective is to determine if any free oil remains in the stormwater culvert systems and the Liberty Park detention basin stormwater piping and then to remove the oil if found. The basic plan is to inspect likely locations where oil might be pooled in the culverts (and piping) and/or trapped in sediment. Remove the oil if found, and then do a water-flush of the culverts (and piping) to document that no free oil remains. The inspection is divided into five parts: road culverts along Red Butte Creek from the spill site to Liberty Park, North culvert system (800 South), Middle culvert system (900 South), South culvert system (1300 South) and Liberty Park detention basin stormwater piping. The focus of the North culvert system is on the water delivered to irrigate the cemetery lawn. Fire hydrant and/or Red Butte Creek water may be used as part of the inspection. The focus of the Middle and South culvert systems centers on the culverts leading into and out of the Liberty Park detention basin. Water from the proposed 30 cfs flush of the upper portions of the Red Butte Creek will be used as the source water to flush the Middle culvert system. The South culvert system will be flushed with Parley's Creek water.

Objectives

1. Determine if any free oil from the RBC Incident remains in the RBC stormwater culvert system and stormwater piping associated with the Liberty Park detention basin that may impact the Jordan River.
2. Remove free oil (if found).
3. Review existing data from the preliminary inspection of the stormwater culvert system.
4. Locate and inspect high and low elevations and dead-legs in the stormwater culvert system for free oil.
5. Work with Salt Lake City (SLC) Department of Public Utilities (DPU) and Unified Command (UC) to certify that the stormwater culvert system is ready for return to normal operations.

Scope

The RBC Stormwater Culvert Inspection Plan covers three culvert systems and Liberty Park detention basin stormwater piping. Storm water eventually enters the Jordan River (Figure 1). These culverts run underground from east to west. The North culvert system is approximately 22,200 ft in length. The Middle culvert system is approximately 21,600 ft. The South culvert line is approximately 12,000 ft. The Middle and South culvert systems join at the Liberty Park detention basin. The Middle culvert line has a permanently floating trash recovery system that functionally removes some of the hydrocarbons from municipal sources (leaks from vehicles and backyard oil changers who dump waste oil into the culverts). Red Butte Creek, Emigration Creek and Parley's Creek flow into the culverts as well as municipal stormwater that drain from lawns and streets into the culverts.

Figure 1. Red Butte Creek Stormwater Culvert System Aerial Photograph. Water flows from right to left (east to west) by gravity. Red Butte Creek, Emigration Creek and Parley's Creek and municipal stormwater drain into the Jordan River through the culvert systems.

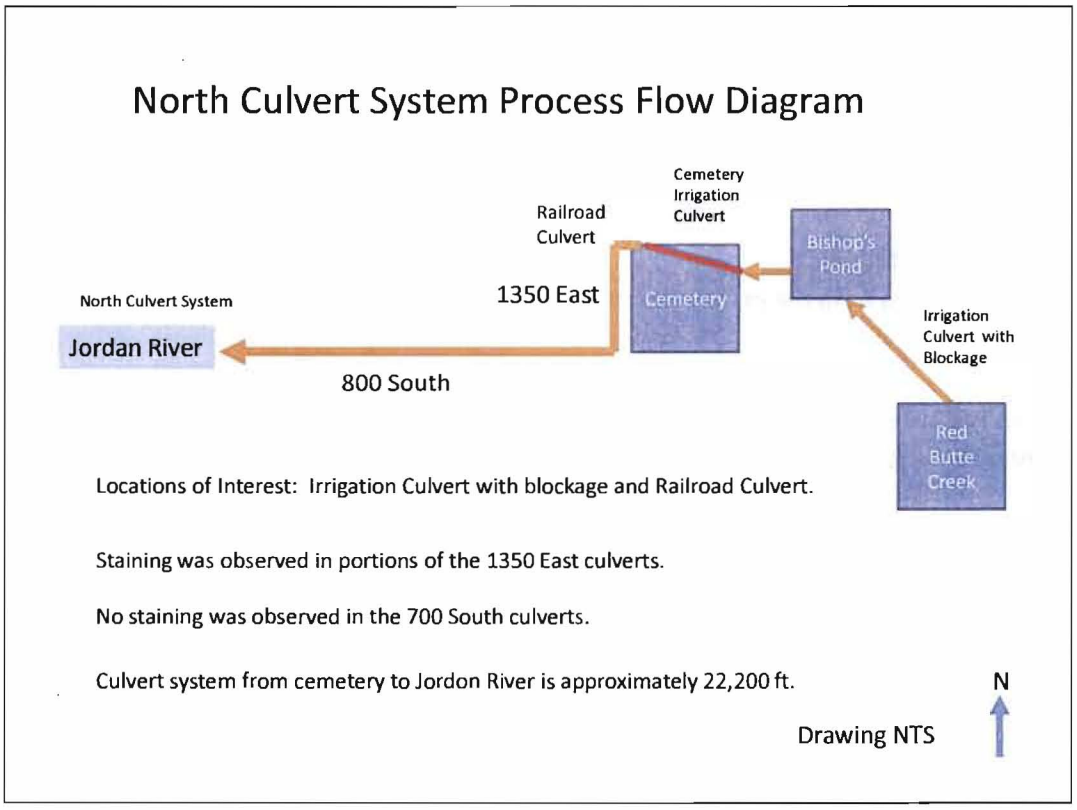


Figure 2. North Stormwater Culvert System Process Flow Diagram. Water from the Red Butte Creek can flow by gravity into the Bishop's Pond. The water irrigates the cemetery lawn. The irrigation culvert has a potential blockage of unknown origin. The railroad culvert is a potential low spot.

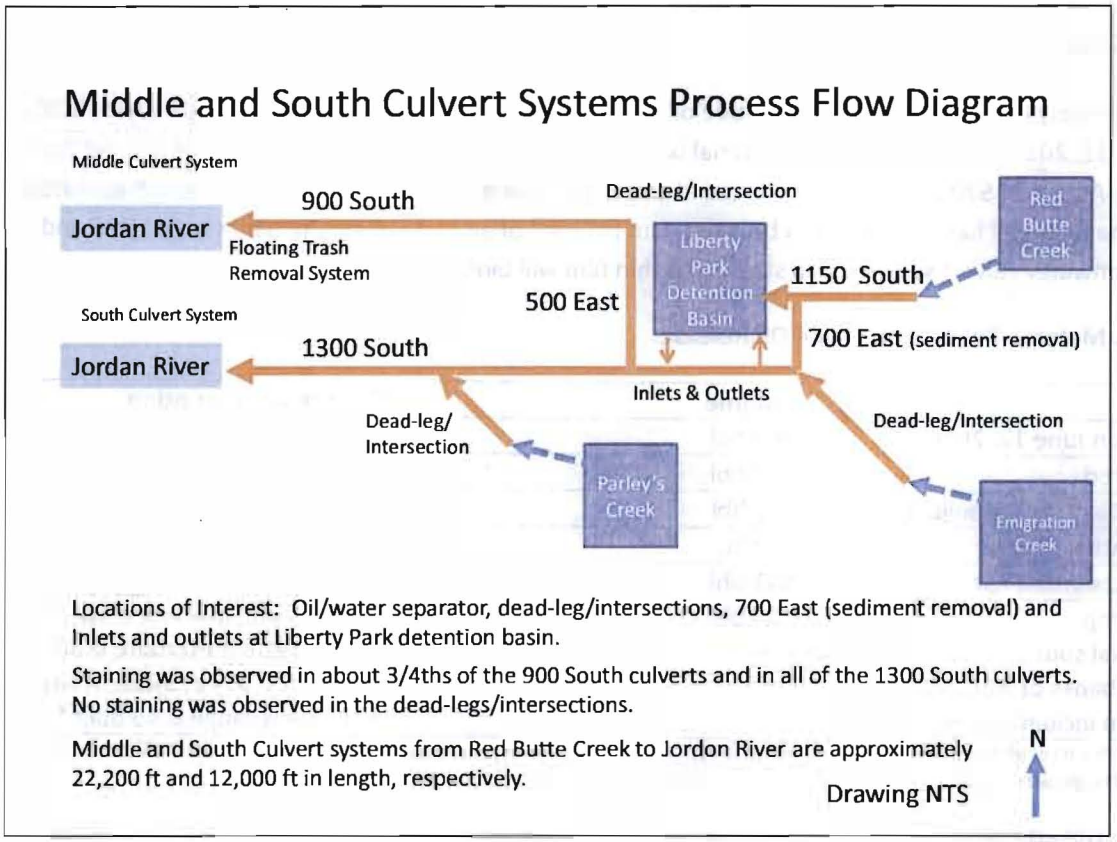


Figure 3. Middle and South Culvert Systems Process Flow Diagram. Water from Red Butte Creek, Emigration Creek and Parley's Creek as well as municipal stormwater drains into the Middle and South stormwater culvert systems. The Liberty Park detention basin was used to collect oil from the incident. Sediment was removed from the 700 East culverts. Locations of interest are inlets and outlets to Liberty Park. The 1300 South culvert has a permanently installed oil/water separator for interdiction of hydrocarbons from municipal stormwater runoff.

Table 1. Red Butte Creek Stormwater Culvert System Summary

Stormwater Culvert	Length (ft)	Description
North	22,200 ft	Includes 800 South, 1350 East and culverts to and from Bishop's Pond
Middle	21,600 ft	Includes 900 South, 500 East, 700 East, 1150 South and culvert from Emigration Creek
South	12,000 ft	Includes 1300 South and culvert from Parley's Creek
Total	55,800 ft	

Background

Approximately 800 barrels of a 33 API crude oil leaked from the pipeline into the Red Butte Creek (RBC) on June 12, 2010. The current draft material balance (Table 2) has accounted for about 641 of the 800 barrels. A total of 570 barrels was collected at the spill site and by skimming and 50 barrels evaporated. The remaining 159 barrels is likely to be a thin film (~1/64th of an inch) along the banks of the RBC and in the stormwater culvert systems as a stain. The thin film will biologically degrade.

Table 2. Material Balance on Crude Oil Release

Oil	Volume	Comment/Description
Spilled on June 12, 2010	800 bbl	33 API crude oil blend
Recovered	570 bbl	From spill site and skimming
Waste Disposal (oil solids)	21 bbl	Rolloff box inventory
Evaporated	50 bbl	Based crude distillation data
Total Accounted For	641 bbl	
Remaining (potential sources – culvert stain, film on banks of RBC, and oil in soil from incident site)	159 bbl	Banks of RBC and stormwater culvert system estimate is 38 bbl.* Oil in soil at incident site estimate is range is 49 bbl.**

*Assumes ~5.6 miles of stained culverts with a 2 ft band height with a 1/64th inch oil film thickness and ~2.1 miles of Red Butte Creek bank with a 2 ft band height with a 1/64th inch oil film thickness. Actual stain length, band height and thickness may vary.

**Assumes 1700 yd3 of soil with a soil density of 1800 lb/yd3, oil density of 315 lb/bbl and 0.5% TPH in soil. Actual volume of soil, soil density and TPH concentration may vary.

The culvert inspection plan is part of an effort to confirm that the remaining oil is a thin film and not pooled in the stormwater culvert system.

Inspection Plan for the RBC Stormwater Culvert Systems

The basic inspection sequence:

- Determine likely locations for oil to pool based on consultation with Department of Public Utilities (DPU) personnel and review of culvert system drawings.
- Inspect those locations with cameras and/or boroscopes to minimize confined space entries.
- If oil is found, remove it by appropriate means.
- Water-flush culverts and monitor for oil or sheen.
- If oil or sheen is found, trace it to the source and remove the source (if appropriate).
- Water-flush culverts again if needed.

Inspection of North Stormwater Culvert System

The North stormwater culvert system will be inspected (Table 3) at the suggested locations by a crew with representatives from Chevron Pipeline, Salt Lake City Department of Public Utilities and other agencies and trustees (if interested). The inspections will be done with cameras and/or boroscopes to minimize confined space entry into the culverts. Particular attention will be paid to the locations that

may hold pooled oil: 1) the irrigation culvert running from the Red Butte Creek to the Bishop's Pond and 2) the railroad culvert. If free or recoverable oil is found, it will be removed. The water-flush will then follow using fire hydrant water (city drinking water). The water will be collected into fract tanks and disposed of in the refinery wastewater treatment system. The culvert will be monitored at the Jordon River for sheen. If sheen is found, it will be traced back to the source and the source removed (if appropriate). Removal may entail vacuum, pads or swabbing.

Table 3. Inspection Plan for Stormwater Culvert Systems

Culvert System	Proposed Date for Inspection	Suggested Inspection Locations	Source of Water Test
North	Week of July 5th or 12th	-Irrigation culvert from RBC to Bishop's Pond (camera and flush) -Cemetery irrigation culverts (visual inspection) -Railroad culvert (camera) -Dead-leg joining main and lateral culverts (camera) -At Jordan River (visual inspection) -Other sites as needed?	Fire Hydrant* (or RBC)
Middle	Week of July 12th	-Culverts into and out of Liberty Park (visual inspection and camera) -700 East (camera) -Junctions of lateral and main culverts -Culvert from Emigration Creek -At Jordan River -Other sites as needed	30 cfs Flush with Red Butte Reservoir**
South	Week of July 12th or 19th	-1300 South from Liberty Park to Parley's Creek (camera) -1300 South from Parley's Creek to Jordan River (flush with Parley's Creek water) -At Jordan River (visual inspection) -Other sites as needed	Parley's Creek***

*If fire hydrant water is used, the water will be collected into fract tanks and disposed of in the refinery wastewater treatment system to avoid introduction of chlorinated water into the Jordan River.

**1300 South to be closed with a weir so that the 30 cfs flush goes through 500 East to 900 South and then out to the Jordan River.

***1300 South to be flushed with Parley's Creek water.

Inspection of Middle and South Stormwater Culvert Systems

The Middle and South stormwater culvert systems are slated to be inspected (Table 3) at the suggested locations by a crew with representatives from Chevron Pipeline, Salt Lake City Department of Public Utilities and other agencies and trustees (if interested). The inspections will be done with cameras and/or boroscopes to minimize confined space entry into the culverts. Particular attention will be paid to the locations that may hold pooled oil: 1) the culverts running into and out of the Liberty Park retention basin and 2) the dead-leg culvert on the East side of Liberty Park where sediment was removed. If free or recoverable oil is found, it will be removed. The water flush will then follow using 30 cfs flush of the Red Butte Creek that is scheduled for July 13th. The culvert outlets will be monitored at the Jordon River for sheen. If sheen is found, it will be traced back to the source and the source removed (if appropriate). Removal may entail vacuum, pads or swabbing.

Inspection of Culverts along Red Butte Creek

There are ten culverts and one weir associated with road crossings along the Red Butte Creek (Table 4). Inspection of these culverts is likely to find only staining and no pooling. These are potential locations where kids might play and come in contact with the oil film. The Sunnyside culvert was described by DPU personnel as potentially having a bend, cobbles and cracks.

Table 4. Culverts along the Red Butte Creek.

Culvert No.	Location	Dimensions
1	Spill Site Weir	50 cfs
2	Chipeta	44 RCP
3	Arapeen	42 RCP
4	Foothill	72 CMP
5	Sunnyside (bend, cobbles & cracks)	48 RCP
6	900 South	36 CMP
7	1500 East (Bonneview)	36 RCP
8	1300 East	36 x 48 RCP
9	1100 East	48 RCP
10	McClelland	36 x 48 RCP
11	Downstream from 900 East	36 x 48 RCP

Inspection of Liberty Park Detention Basin Stormwater Piping

There are three main inlets/outlets to the Liberty Park detention basin (see attachments on Liberty Park construction drawings). The inlet on northeast side typically carries Red Butte Creek water. The outlets on southeast and southwest over flow water into 1300 South culvert. There is a collection of stormwater/by-pass piping in and around the Liberty Park detention basin. 500 East and 700 East are the main culverts. Some of the piping is not on the as built diagrams. Inspections will be done with camera and by drawing down levels.

Table 5. Liberty Park Detention Basin Inspection Locations.

No.	Location	Comments
1	North(east) Inlet	
2	700 East	Sediments removed
3	500 East	
4	Subdrain Trenches	Under cobble and liner. Several branches. Drains through sump on west side of basin.
5	South(east) Outlet	Can connect to Emigration Creek and 1300 South.
6	South(west) Outlet	Can connect to 1300 South.

Stormwater Culvert Cleanup Criteria

The stormwater culverts are considered to be clean if the criteria are met in Table 5. Culverts are divided into two categories: underground with limited to no access and at road crossings with access. Free oil and sediment with oil are removed. Oil film producing sheen are flushed and monitored. Stains are left.

Table 5. Stormwater Culvert Cleanup Criteria

Cleanup Criteria	Culvert Underground with Limited to No Access	Culverts at Road Crossings with Access
Free Oil	Remove	Remove
Oil Film producing Sheen	Flush and Monitor	Flush and Monitor
Sediment with Oil	Remove	Remove
Stains	Leave	Leave

Stormwater Culvert Inspection Deliverables

- A verbal summary of the culvert inspections will be provided to Unified Command within 24 hours of the inspections.
- If oil is found, Operations will be notified immediately for rapid activation of a crew to remove the oil. Removal work will be done safely and with the cooperation of the Department of Public Utilities.
- A formal written culvert inspection report will be provided the Unified Command within 3 days after completion of the inspections. The report will document what is found by GPS coordinates and include photos and/or videos.
- Other?

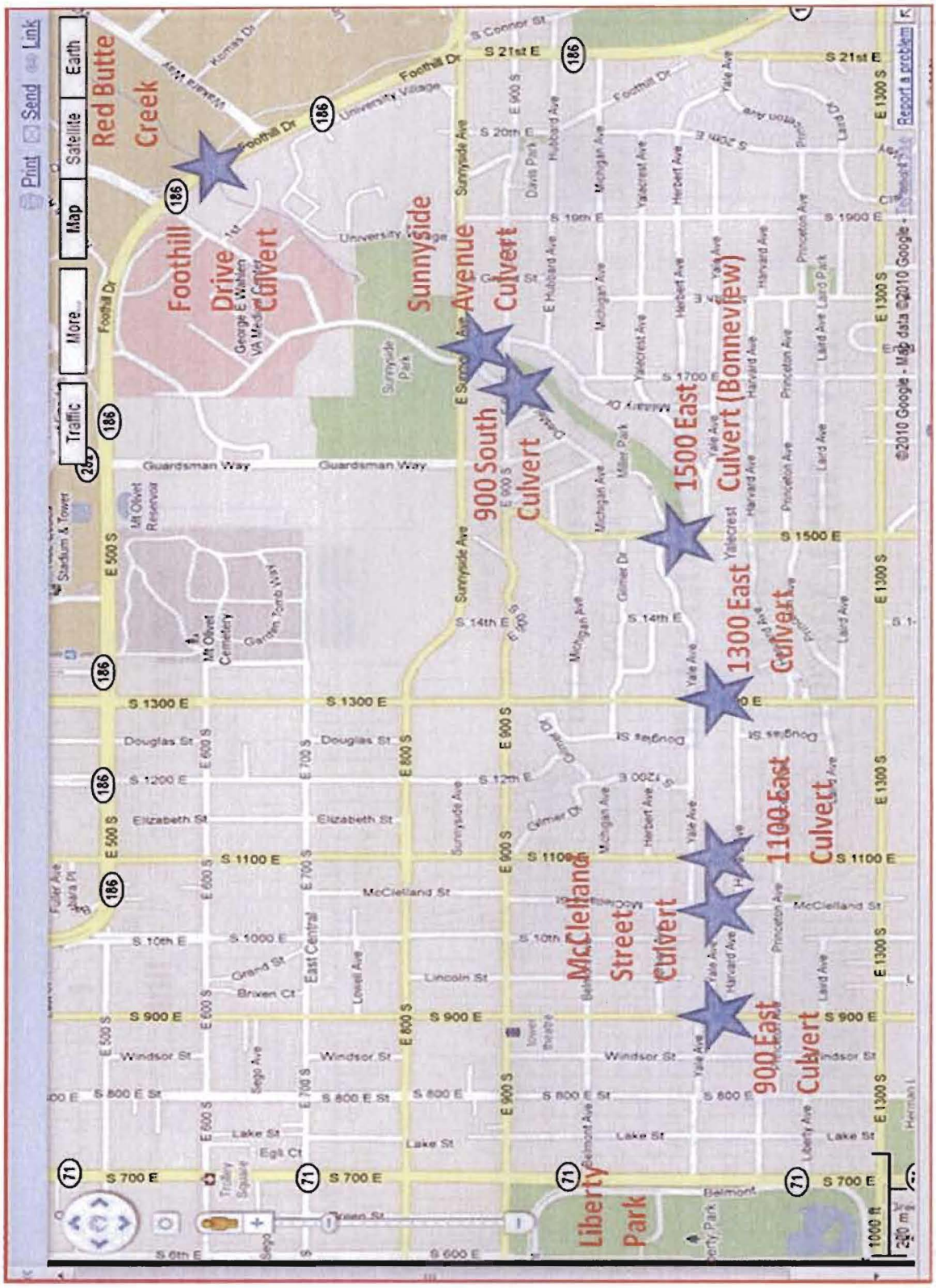
Attachments

- Culvert Maps
- Liberty Park Construction Drawings
- Spreadsheet of suggested locations of interest (modified SCAT form for culverts)
- Equipment List (camera, boroscope, flashlights, GPS, etc)
- Sign-off Sheet for Inspectors
- Suggested Cleanup Techniques
- Culvert Inspection JSA

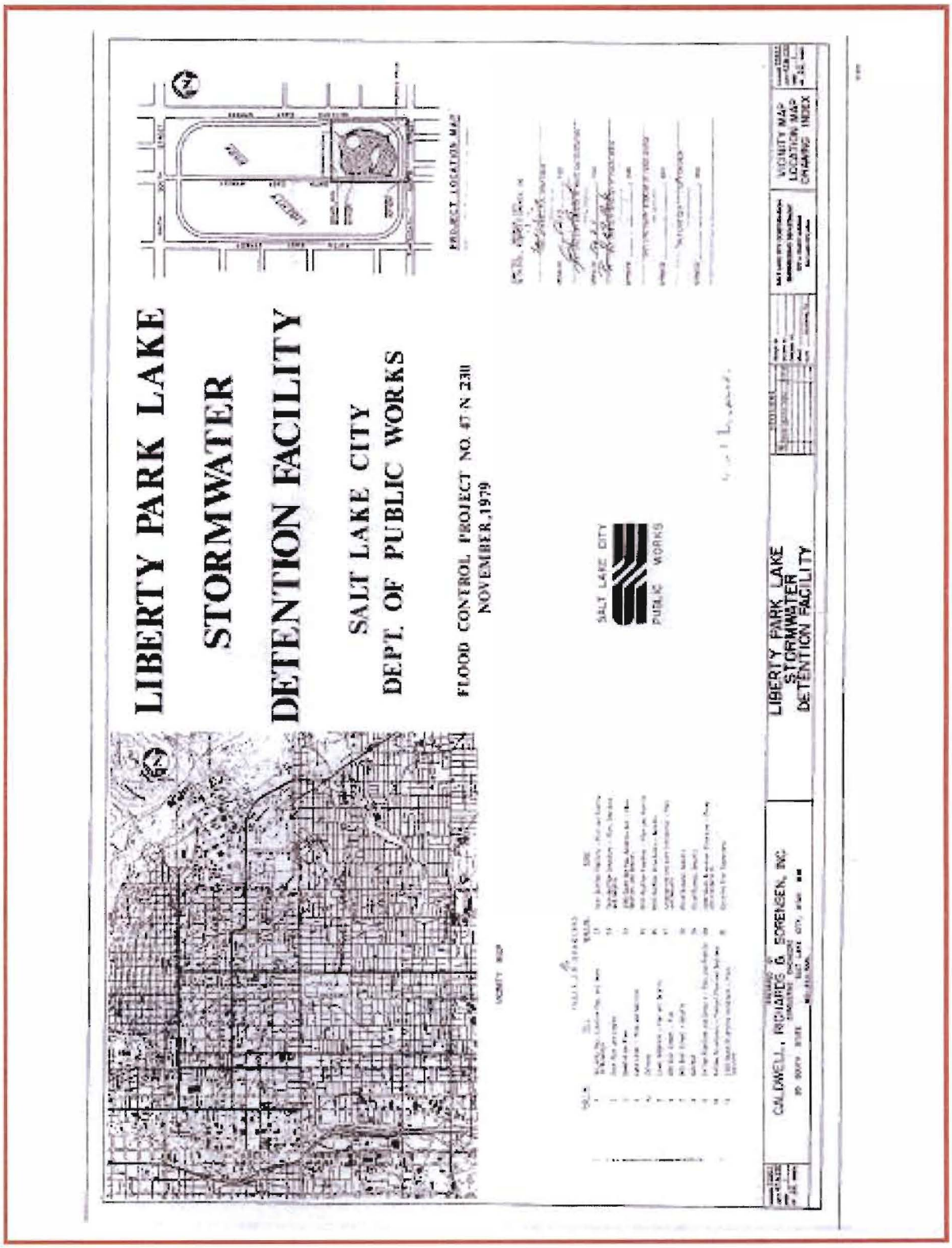
Culvert Map No. 1. The large edition printout is in the Command Center.

Culvert Map No. 2. Stars denote location of culverts. See Table 4 for culvert list.

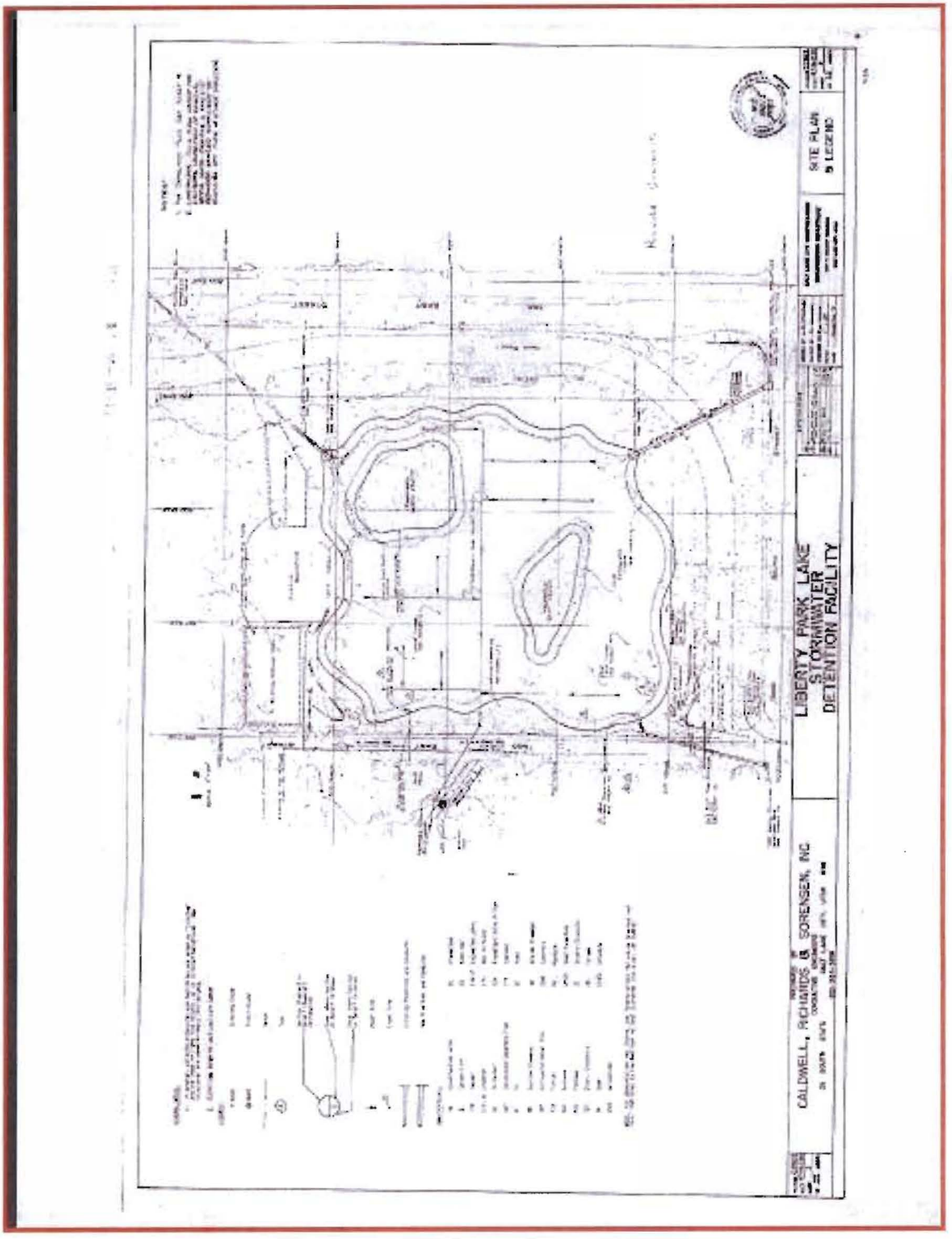
Culvert Map No. 3. Stars denote locations of culverts and weir. See Table 4 for list of culverts.



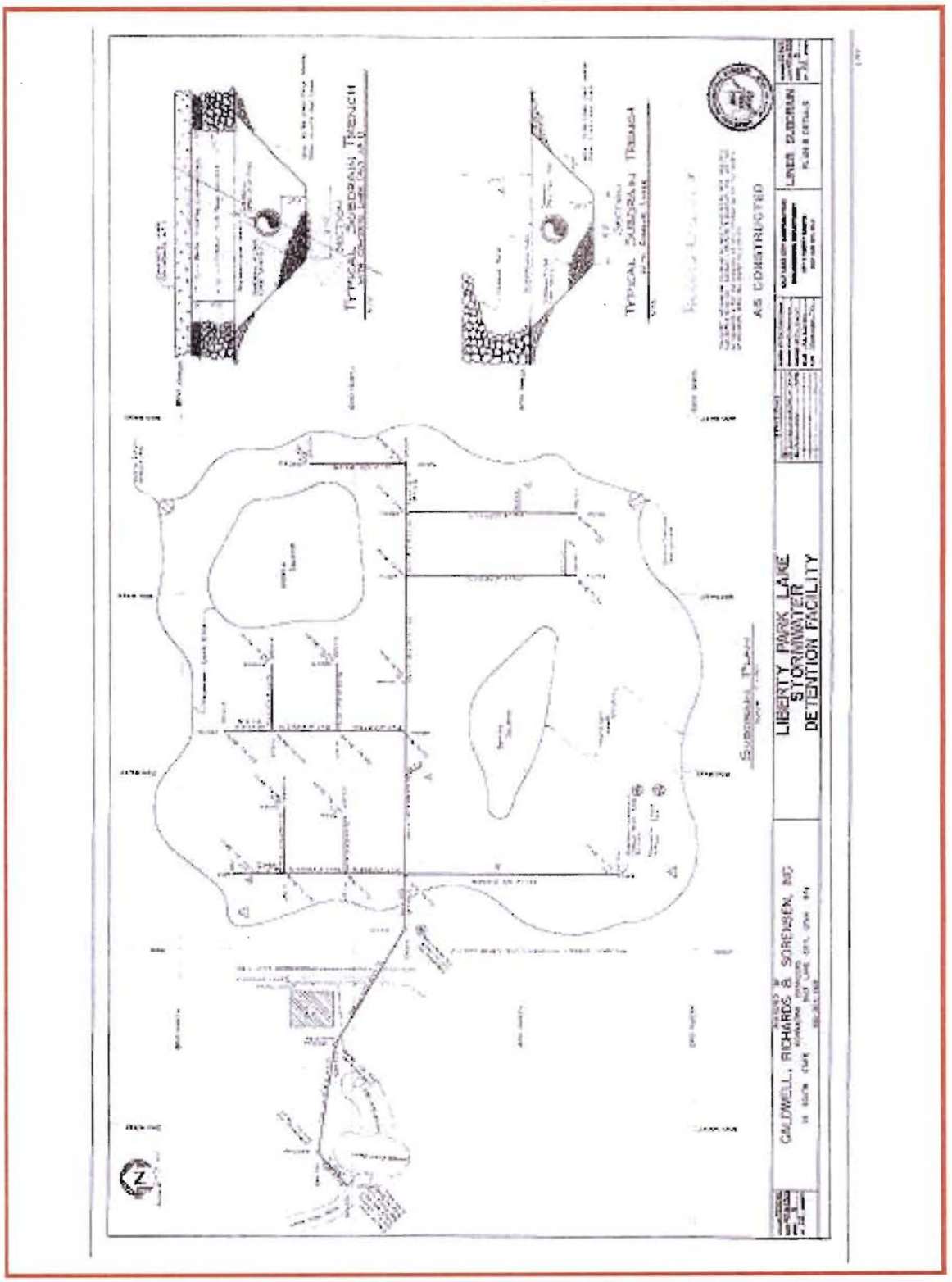
Liberty Park Construction Drawing Cover Page.



Liberty Park Construction Drawing of Inlet and Outlet Piping.



Liberty Park Construction Drawing of Subdrain Trenches



Spreadsheet Checklist for Culvert Inspections

Culvert (location, grid or segment)*	Inspection Date	Sign-off (Yes/No)	Additional Work	Re-inspection Date
RBC				
Spill Site Weir				
Chipeta				
Arapeen				
Foothill				
Sunnyside				
900 South				
1500 East (Bonneview)				
1300 East				
1100 East				
McClelland				
Downstream from 900 East				
North Culvert System				
RBC to Bishop's Pond culvert				
Cemetery Irrigation culvert				
Railroad culvert				
1350 East				
800 South				
Jordan River 800 South Outlet				
Middle and South Culvert System				
1150 South				
700 East				
Dead-leg/Intersection from Emigration Creek to 700 East				
1300 South from 700 East to 500 East				
1300 South from 500 East to Dead leg/Intersection from Parley's Creek				
Inlets and Outlets to Liberty Park Detention Basin				
500 East				
900 South				
1300 South				
Jordan River 900 South Outlet				
Jordan River 1300 South Outlet				

Culvert (location, grid or segment)*	Inspection Date	Sign-off (Yes/No)	Additional Work	Re-inspection Date
Liberty Park Detention Basin				
North(east) Inlet				
700 East				
500 East				
South(east) Outlet				
South(west) Outlet				
Subdrain Piping				

*Divide culverts into grids and segments as needed.

Equipment List for Culvert Inspections

This list of equipment for the culvert inspections is neither mandatory nor complete. It is merely a list of potential equipment might be used. The intent is to effectively use equipment to minimize confined space entries.

- Rubber boots (knee, hip-boot, chest-high waders)
- Camera
- Boroscope
- Flashlight
- Spare Batteries
- Gloves (rubber, leather, jersey)
- Wipes (sorbent pads)
- Decontamination kit
- Write-in-rain notebook
- Clip board
- Note pad
- Writing tool (pens, pencils)
- PDA recording device
- Drinking water
- Snacks
- Hand sanitizer
- Sun screen
- PPE (hard hats, safety glasses, Nomex, Tyvek, boots, etc)
- Rope
- Safety harness
- PFD
- Radios
- Cell phones
- VOC/H2S meters
- Tools to open manhole covers and grates

Sign-off Sheet for Culvert Inspections

Is this culvert ready for Sign-off? (Yes No)_____

Culvert _____

Segment_____

DPU Signature_____

RP Representative_____

SOSC Signature_____

FOSC Signature_____

Potential Cleanup Techniques for Culverts

Water Wash. This operation is done with a gentle or high-intensity power wash depending on the integrity of culvert. Water would collected by skimming and/or booming.

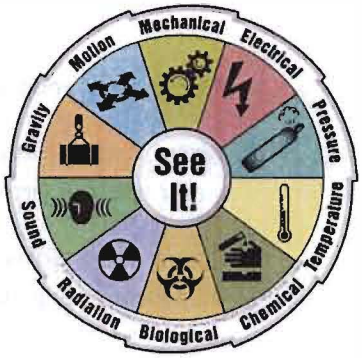
CytoSol. CytoSol is a chemical countermeasure that dissolves the hydrocarbons. CytoSol is a biodiesel made from soy bean oil. CytoSol does not dissolve into water very well, but does float well on the top of water. In testing it has worked well on hard surfaces (rocks, cements and tree roots). It is sprayed by hand with backpack or hand held sprayers. The soak time is 15 to 30 minutes. The CytoSol can be hosed off with water wash or scrubbed and then washed. The washed materials (hydrocarbons and CytoSol) can be collected by skimming and/or booming.

Swabbing. For small diameter culverts, a swab can pulled through to effectively remove the surface film of oil. The swab might be made from sorbent pads or oleophilic materials.

Wiping. Wiping with sorbent pads by hand works in large diameter culverts where standing is possible. This technique also works with long-reach poles with attached pads.

Collection by Skimming. Oil film dislodged from culverts by washing ends up in the water. Local collection of the hydrocarbons close to the culverts is advised. A variety of skimmers will work.

Collection from Booms. Oil film dislodged from culverts by washing ends up in the water. Local collection of the hydrocarbons close to the culverts is advised. Boom can contain the hydrocarbons. The hydrocarbons can sucked up with wet vacuum or collected with a skimmer.



Culvert Inspection Job Safety Analysis (JSA)

The preliminary Stormwater Culvert Inspection JSA should be updated as needed.