A Cost Efficient Asset Management Approach Using GIS

July 2012

Matt George
GIS Program Engineer
Pierce County Public Works – Road Operations - Maintenance Engineering
mgeorge@co.pierce.wa.us
Home of Mt Rainier in the Cascade Mountains

Home of Joint Base Lewis-McChord

Second most populous County in Washington State

800,000 people

1,700 Square miles

32 miles south of Seattle

650 miles of Public Storm Drainage Pipes

3,110 lane miles of County Maintained Right of Way

368 Fresh Lakes

Puget Sound

2015 U. S. Open Chambers Bay PGA Pro Golf
A Cost Efficient Asset Management Approach Using GIS

First, understanding why the effort was made!
Then how we did it!

- Federal and Local Laws are pushing us to adopt a planned approach method to Asset Management.
- Required Resources/Tools Needed
- Organized Planned Approach
- Building a scalable Asset Maintenance and Condition Rating System intended for our Storm Drainage system.
- Principle design will work for a small city or large county
- Pavement, Shoulders, Roadside vegetation, including Fences, Gates, Bollards, and Sidewalks
- Planned approach works with one crew or up to as many crews as budget, available staff constraints can handle
- Today’s discussion will focus on Storm Water Drainage Inventory
How we got started?
In making an Asset Management System?

✓ Things we know and can control
  - Know What are our assets
  - Know Where are our assets
  - Know what Criteria to use to rate assets
  - Know how to rate our assets Consistently
Asset Management – in 9

- Data Acquisition Methods
- Data Collection of Feature Assets
- Data Processing
- Data Quality Control
- Developing Standards for Asset Conditions
- Assessment Feature Rating Score System
- Managing File Geodatabases – ArcGIS
- CMMS – Solutions
- Work Order Generation
Asset Management Building Blocks

Data Collection
- Industry standards
- Database Schema
- Data Dictionary
- Data Processing
- Data Conversion
- Workflow for processing new features

Assessment
- Developing Arcpad Forms
- Developing criteria for rating assets
- Uniform standards scalable to all features
- Schedule for assessment ratings
- Managing Assessment ratings
- CMMS
- Understanding the data
- Feature level cost
- Improving business decisions from rating analysis
177,000 Drainage Features captured with GPS. This was just the beginning of what we know now in Asset Management.

Drainage inventory reduced to one crew to maintain new construction and modifications of existing drainage feature assets.
Drainage Collection Complete down to the Feature Level
Timeline in Review

1998

Web map Service for Generating Storm Drainage Requests

Trimble Data Collector goes into the field

2012

File Processing in Terrasync

Data Processing in ArcGIS
Drainage Inventory (What and Where)

- Road Operations, Surface Water Management and GIS have been collecting drainage data since April 1999
- Extraction of department level data by ownership for Assessment
- 20,000 number of CB/MH
- 50,000 segments of pipe for 550 miles
- 39,000 segments of channel for 1,150 miles
- Vaults
- Tanks
- Storm Filters
- Media Filter Drains
- Bio-swales
- Hydrodynamic Separators
- Channel Weirs
- CB’s with
  - Frop’s
  - Weirs
Pierce County Drainage Assessment Manual

March 2011

Presented By
Pierce County Public Works and Utilities
Road Operations

Bruce Wagner, Maintenance Manager
Road Operations Staff

Pierce County Road Operations
4912 196 St E – Spanaway, WA 98387
(253) 798-6000
e-mail: pwpwworks@co.pierce.wa.us

Pierce County Internet Site
http://www.co.pierce.wa.us/pc/a/stus/profile.htm

Drainage Manual

Criteria and Consistency
Asset Condition Rating Scale

- No Defect
  - (A) Defect Level; Isolated
  - (A) Defect Level; Several
  - (A) Defect Level; Predominant
  - (B) Defect Level; Isolated
  - (B) Defect Level; Several
  - (B) Defect Level; Predominant
  - (C) Defect Level; Isolated
  - (C) Defect Level; Several
  - (C) Defect Level; Predominant

“Work Should” Be Completed Before The Next Assessment As Resource Capacity Allows

“Work Should” Be Completed As Soon As Practicable

“No Work” Necessary At This Time

NOTE: “This asset condition scale is not intended to be utilized to address emergencies. If an asset is found to be in such condition as to pose an immediate threat to public safety, property or habitat, corrective action should be taken as soon as possible.”
# Table of Contents

- Data Collection Procedures and Guidelines
- Inspection Procedures and Guidelines
- General Guidelines for ROW Limits

**Linear Features**
- Bioswale / Channel / Rain Garden
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 6
- Pipe / Live Stream Culvert
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 12
- Tank
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 21

**Point Features**
- Catch Basin Type 1 and Type 2 / Manhole
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 28
- Channel Barrier
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 37
- Access Lids
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 43

**Polygon Features**
- Vault
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 46
- Sand Filter
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 54
- Filter Strip
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 60
- Media Filter Drain
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 66
- Ponds
  - Data Assessment
  - Tab 1 – Asset Information
  - Tab 2 – Condition
  - Page 72
Table of Contents

Appendix A
  Terminology 95

Appendix B
  Function Codes 97

Appendix C
  Drainage Maintenance Data Collection Procedures 98

Appendix D
  Condition Value Scores 100

Appendix E
  Data pulled from GIS 107

Appendix F
  Comments Codes 107

Appendix G
  How to log into Laptop 107
Condition Rating

Tab 2 – Condition

Catch Basin / manholes that are not maintained will not be able to filter the sediment and pollutants out of the storm water runoff as designed.

SEVERITY:  
- Minor: Bent rungs that are still attached and functional, minor cracks in structure with no sediment entering the structure, sediment or trash greater than 1 ft from IE.
- Moderate: Trash immediately upstream of grate, sediment entering the structure through holes or cracks in structure, grate is low, rungs not safe, grate stuck, broken or missing, sediment is less than 1 ft from IE.
- Severe: Vegetation, trash, or sediment blocking water from entering the structure, cracks that are allowing sediment into the structure, lid is not attached to the structure, broken or could not be opened, grate is raised and water is bypassing the structure sediment to the IE.

EXTENT: The extent of the catch basin / manhole defect is related to the entire defined feature. Catch basin / manholes will be measured by an extent range of (1,4,7) Minor, (2,5,8) Moderate, or (3,6,9) Severe. For example, a value of 3 equals minor severity, high extent.

ACTION: Based on the action required to repair/maintain a catch basin / manhole, a function code(s) of (40L, 40H) and work units will be assigned to represent the associated activity.

The feature being assessed will be rated based on severity of Minor (1-3), Moderate (4-6), and Severe (7-9) scales. The rating of 1, 4, and 7 are isolated distresses within a feature. The rating of 2, 5 and 8 are moderate distress areas within the feature. The rating of 3, 6 and 9 are distresses that exist throughout the majority of the feature. Condition values of 7, 8 and 9 are 4, 5 and 6 but with a secondary impact to another asset. The rating of Minor means that there are signs of a potential maintenance need in the future but still within the Pierce County Stormwater Manual (PCSWM) requirements. The rating of Moderate means that there are currently signs of a maintenance need per the PCSWM, but which are not affecting another asset at this time. The rating of Severe means that there are currently signs of a maintenance need per the PCSWM, and the condition is affecting another asset or has greatly affected the function of the feature. **See PCSWM for specific detailed requirements.**
Pierce County Asset Management Program

Drainage Collection Procedures and Asset Assessment Manual

Data Collection Procedures and Guidelines
This is for collection of drainage features as defined by this manual within the ROW and Public Works Facilities Maintained by Road Operations.

Items needed for data collection:
- Laptop
- ArcPad 8.0
  - County Base Map Layer
  - Road Layer
  - Drainage Layer
  - Our Feature Shapefiles and Geodatabase
- USB GPS Navigation Receiver

Supplemental items needed for data collection:
- Map of area to collect data
- Safety equipment (PPE)
- Flash Light (Million candle)
- Lid Puller
- Shovel
- Machete
- Rods (20"
- Tape Measure
- Persuader (pulling tight lids)
- T-handle locking lid key (3-4" tall)
- Mirrors
- Flat head screw driver Lg
- Dixon Yellow Chalk
- Rags
- Hand sanitizer
- Leather gloves
- Compass
- Wasp and Hornet spray
- Paper
- Pen
- Pencil
- Calculator
Non-Structural Inspection of Assets
The following inspection procedures offer a method of determining feature attribute and condition information by observing and recording the presence of severities of defects or distresses in the feature. The elements of Biowale / Channel / Rain Garden, Filter Strip, Media Filter Drain, and Pond feature information and condition rating can be assessed as follows:

- Visually identify the feature
- Identify the feature on the laptop in GIS by selecting the feature
- Verify the Asset Info Tab has the correct information in it (walk the length of the feature) and make changes to items that are incorrect or missing
- Select the Condition Tab and fill out the items for the feature.
- Select the Comments Tab and verify that Assessment Date is correct and that the initials of the collector are in the Assessed By.

Structural Inspection of Assets
The following inspection procedures offer a method of determining feature attribute and condition information by observing and recording the presence of specific severities of defects or distresses in the feature. The elements of Pipe / Live Stream Culvert, Tank, Catch Basin type 1 and Type 2 / Manhole, Channel Barrier, Access Lid, Vault, and Sand Filter feature information and condition rating can be assessed as follows:

- Visually identify the feature
- Identify the feature on the laptop in GIS by selecting the feature
- Verify the Asset Info Tab has the correct information in it (walk the length of the feature, pull lids as needed) and make changes to items that are incorrect or missing
- Select the Condition Tab and fill out the items for the feature.
- If feature has a Mechanical Filter in it select the MFTab and fill in the information (Optional)
- If feature has a Control Structure in it select the CSTab and fill in the information (Optional)
- Select the Comments Tab and verify that Assessment Date is correct and that the initials of the collector are in the Assessed By.
General Guidelines for ROW Limits

NOTES:
The purpose of this sketch is to provide the Pierce County Road Operations Personnel a reference to make a field determination of the location of the road right-of-way boundary. The prescribed road prism area is defined as the area from the back of the power pole arm, front edge of fence, back of pedestal or the apparent brush cutting/mowing limits maintained by Pierce County.

When cleaning a feature that goes off ROW, clean only to the apparent ROW / maintenance limits.
Catch Basin Type 1 and Type 2 / Manhole

A chamber or well, usually built at the curb line of a street, for the admission of surface water to a storm sewer or subdrain, having at its base a sediment sump designed to retain sediment and debris below the point of overflow. The difference between a Catch Basin Type 2 and a Manhole is that a Manhole does not have a sump.

Rating of Catch Basin / Manhole

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Defect</td>
<td></td>
</tr>
<tr>
<td>MINOR</td>
<td>Very minor defects (Minor trash, sediment greater than 1 ft from I/E)</td>
</tr>
<tr>
<td>MODERATE</td>
<td>Needs some work within 6 months (Sediment less than 1 ft from I/E, crack but no sediment coming in)</td>
</tr>
<tr>
<td>SEVERE</td>
<td>Need work now (Cracks allowing soil into structure, water missing structure, sediment in the pipe, major trash)</td>
</tr>
</tbody>
</table>

Catch Basin Type 1

Catch Basin Type 2 / Manhole

Catch Basin and Manhole
Data Assessment for CB/MH

Tab 1 – Asset Info
- Structure Type – Type of asset (BRICK/MORTER, CB1, CB2, CURB INLET, CBMF, MH, MHMF, OTHER, PIPE)
- Structure Material – Material the pipe is made out of (CONCRETE, OTHER, METAL)
- Sump Depth – How deep is the sump, from the bottom of the pipe to the sump
- Depth Inchet – How deep is the structure from the rim to the sump
- Locking Lid – Does the structure have a locking lid (YES, NO)
- Lid Type – Type of the lid (BEEHIVE, B1, GRATE, CMGRATE, GRATED_OTHER, HB, OTHER, ROLLED, S1, GRATE, SOLID, UTILITY, VANED)
- Lid Material – Material the lid is made of (CONCRETE, OTHER, METAL, WOOD)
- Lid Length – Length of the lid, in inches
- Lid Width – Width of the lid, in inches
- Lid Shape – Shape of the lid (RECTANGLE, ROUND, SQUARE, OTHER)
- Flow Direction – Direction of flow (E, N, NE, NW, S, SE, SW, W)
- Discharge Destination – What is the next feature in this system (DRAINAGE_STRUCTURE, CHANNEL, PIPE, CHANNEL_BARRIER, VAULT, FILTER, STRIP, ECOLOGY, EMBANKMENT, STORMWATER_POND, FRESH_WATER, SALT_WATER, UNKNOWN, OTHER, NONE)

Tab 2 – Condition
- REPAIR
  - Structure Damage – What damage does the structure have (N/A, NONE, MINOR, MODERATE, SEVERE)
  - Lid Damage – What kind of damage does the lid have (NONE, MINOR, SEVERE)
  - Lid Position – Where is the lid related to the surface around it (LEVEL, LOW, HIGH)
- MAINTENANCE
  - Sediment Level – Deepest recorded sediment level in the access openings (0=N0 visible sediment, 3=Greater than 1ft below I.E., 6=Less than 1ft below I.E., 9=Above the I.E.)

Tab 3 – MF Info
- See page #_ for Mechanical Filters
Tab 4 – CS Info
• See page #_ for Control Structures

Tab 5 – Comments
• Assessment Date – Date data was collected
• Assessed By – Who collected the information
• Description – Additional descriptions that came from GIS data coverage
• Comments – Additional comments needed

Required fields italicized

Data Assessment for CB/MH
# Mechanical Filter

A canister-type filter with zeolite/perlite/ granular activated carbon or some other combination of media that are found in vaults, catch basins, or manholes manufactured by a proprietary system. The target pollutants for removal are total suspended solids (TSS), total and soluble phosphorous, total nitrogen, soluble metals, oil & grease and other organics.

## Rating of Mechanical Filters

<table>
<thead>
<tr>
<th>Category</th>
<th>Defect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINOR</td>
<td>Very minor defects</td>
</tr>
<tr>
<td></td>
<td>(Spotty sediment on cartridge, scum line below)</td>
</tr>
<tr>
<td>MODERATE</td>
<td>Needs some work within 6 months</td>
</tr>
<tr>
<td></td>
<td>(Do before next assessment)</td>
</tr>
<tr>
<td>SEVERE</td>
<td>Need work now</td>
</tr>
<tr>
<td></td>
<td>(Top of cartridge covered with sediment, scum line above)</td>
</tr>
</tbody>
</table>

![Image of Mechanical Filters](image-url)
Data Assessment:
Polygon, Point Feature

Attributes in form to be filled out:

Tab 3 – Mechanical Filter

Information
- **Cap Color** – Color of the cap (BLUE, GRAY, GREEN, ORANGE, WHITE)
- **# of Cartridges** – How many cartridges are in the structure
- **Filter Height** – What is the height of the cartridges (12”, 18”, 27”)

Condition
- **Scum Line** – Where is the scum line located (ABOVE CARTRIDGE, BELOW CARTRIDGE, NONE)
- **Top of Cartridge** – Sediment level on top of the cartridge (COVERED SEDIMENT NONE, SPOTTY SEDIMENT, )
Data Assessment for CB/MH

Locking Lid:

Lid Shape:
- Rectangle
- Round
- Square
Condition Types

**Condition Type:** REPAIR

**Structural Damage**
Cracks in underground structures can allow sediment to enter the structure, or be a sign of collapse.

**Lid Damage**
Damage to lids could allow trash into the structure.

**Lid Position**
If the lid of a structure is low, it could cause pavement failure sooner, or cause damage to vehicles. If the lid is high, it could allow water to bypass the structure and remain on the roadway.

**Maintenance**

**Sediment Level**
Sediment level is measured from the sump to the top of the sediment.
Control Structure

Control structures are located in catch basins or manholes and are restrictor devices for controlling outflow from a facility to meet the desired performance. River type restrictor devices ("Riv", or "FROP-T") also provide some residential separation to temporarily detain oil or other floatable pollutants in runoff due to accidental spill or illegal dumping. Weirs and baffles are located within catch basins, manholes, tanks, or vaults. Weirs are designed to reduce flow and baffles are designed to slow down flow. The Hydrodynamic System (HDS) removes fine sediment, particles, tree oil, and debris from urban runoff. This system uses an effective combination of swivel-concentration and flow-control technologies to accomplish treatment. It is not allowed as a stand-alone system but only as a treatment train. An HDS can be located in a catch basin type 2 manhole or vault. Weirs can also be located in ditches but are called ditch weirs under channel barriers.

Rating of Control Structures

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Defect</td>
<td></td>
<td>Do Nothing</td>
</tr>
<tr>
<td>MINOR</td>
<td>Very minor defects</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>MODERATE</td>
<td>Needs some work within 6 months</td>
<td>Do before next Assessment</td>
</tr>
<tr>
<td>SEVERE</td>
<td>Need work now</td>
<td>Do within 2 months</td>
</tr>
</tbody>
</table>

Frop-T
Attributes in form to be filled out:

Tab 3/4 – Control Structure

Information
- Control/WQ Structure Type – Type of control structure located within the feature (BAFFLE, BAFLE/FROP-T, FROP-T, HDS, NONE, OTHER, WEIR, SAND_FILTER, COALESCING_PLATES, DOWN TURNED ELBOW, FROP-B, DROP STRUCTURE, GATE VALVE)
- Cleanout Gate – Is there a cleanout gate (YES, NO)

Condition
- Control/WQ Functioning – Is there flow restrictor functioning (N/A, YES, NO)
- Control/WQ Damage – Is there damage to the flow restrictor (YES, NO)
- Oil Presence – Is there an oil presence that completely covers the top of the water (N/A, YES, NO)

Required fields italicized
Initial Inspection Example
Every time an inspection of a CB/MH occurs the inspector goes to the next 3 structures upstream from that CB/MH until you come across either 3 CB/MH's in a row that do not require cleaning (a score of 3 or less) or there are no more CB/MH's in that system.
Completed Inspection Example
Hierarchy Structure
1.0 Watershed
1.1 Sub-Basin
1.1.1 Drainage Sub-System
1.1.1.1 Drainage Feature
Pierce County Asset Management Program

Drainage Maintenance Data Collection Procedures

This is for collection of maintenance information on drainage features within the ROW only.

Additional items needed for maintenance data collection not associated with a vactor truck:
- Laptop
- ArcPad 8.0
  - County Base Map Layer
  - Road Layer
  - Drainage Layer
  - Our Feature Shapes and Geodatabase
- USB GPS Navigation Receiver

Inspection Procedures and Guidelines

Guideline for Collection of Maintenance Information of Drainage Assets

The following inspection procedures offer a method of determining condition at time of maintenance by observing and recording the severities of defects or distresses in the feature:
- Visually identify the feature
- Identify the feature on the laptop in GIS by selecting the feature
- Note the items needed to fill out the form before cleaning the feature
- Fill out the form as much as you can, then clean the feature if needed
- If sediment level was scored a 5 or greater, move to the next feature upstream until you have either finished the system or have inspected 3 in a row that scored less than 5 which does not require cleaning. If the original feature had a sediment score less than 5 move on to the next assigned feature to be cleaned.

Notes:
The GIS form that is to be filled out is used for a condition assessment before maintenance is performed, but some information that is needed to be filled out might not be able to be collected before cleaning of the feature ex. Structure Condition, but should still reflect a before maintenance condition.

Rating of Catch Basin / Manhole

<table>
<thead>
<tr>
<th>NONE</th>
<th>0 – No Defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Do Nothing)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MINOR</th>
<th>3 – Very minor defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Do Nothing)</td>
<td>(Sediment greater than 1 foot from EB)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODERATE</th>
<th>5,6 – Needs some work within 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Do before next Assessment)</td>
<td>(Sediment less than 1 foot from EB, grate low, cracks no sediment)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEVERE</th>
<th>7,9 – Need work now, affecting another asset</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Do within 2 months)</td>
<td>(Grate high, cracks with sediment, grate or area around broken)</td>
</tr>
</tbody>
</table>
• CB/ MH inspected this year = 16,500 (1.1.11 Though 8.18.11 with over 15,000 from 3.7.11 to 5.24.11)
• CB/ MH cleaned this year = 7,200
  (1.1.11 Though 8.30.11 with over 6,100 from 3.21.11 to 8.30.11)
• Current percent of public CB/ MH within the Right-of-Way inspected ~ 85%
• Estimated amount of sediment/ pollutants removed this year from CB/ MH Cleaned = 1,250 cu yds
Dollars Spent in 2011

- 40 Series (Actual Labor, Equipment, and Material)
  - H (Mechanical Cleaning) $599,583 EA
  - J (Jet Rodding of Pipe) $140,854 LH
  - I (Inspection) $272,736 LH
  - W (Decanting) $16,423 TON

- Engineering (Estimated)
  - Inspections/Program $50,000

2011 $1,079,596
Function: Mechanically Clean Drainage Structure
Function Code: 40H

Purpose:
To prevent flooding, erosion and damage to road infrastructure and wildlife habitat. Drainage structure cleaning includes the inspection of the pipe body and/or adjacent ditch(s) to determine if further maintenance activities are required.

Procedure:
Establish traffic control as necessary. If work is being conducted in or near a wet area, an approved Work Order and/or WPA must be on site. Install BMPs as needed or dictated by permit or work order. Remove debris from the drainage structure with a camel/vactor truck. Any generated waste materials shall be hauled to the assigned decant station. Inspect adjacent drainage features, and note any additional maintenance needs.

Quality:
The drainage structure shall be clear of all materials to the bottom of the structure. All work shall be recorded on the appropriate Regional Road Maintenance Guideline checklist.

Inspection:
As soon as it is practicable upon completion of work, the site shall be reviewed by a Lead Worker or Supervisor. The inspection shall ensure that the scope of work completed meets service level expectations and environmental requirements.

Resource Requirements

<table>
<thead>
<tr>
<th>Labor</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Class Code</td>
<td>Description</td>
</tr>
<tr>
<td>91154</td>
<td>MT</td>
</tr>
<tr>
<td>9161</td>
<td>FB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hand Tools</th>
<th>Power Tools</th>
<th>Consumable</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round Point Shovel</td>
<td>Grate Hook</td>
<td>Gas Monitor</td>
<td>Hearing Protection</td>
</tr>
<tr>
<td>Grate Hook</td>
<td>Ld Wrench</td>
<td>Rubber Boots</td>
<td></td>
</tr>
<tr>
<td>Flash Light</td>
<td>Pipe</td>
<td>Rain Gear</td>
<td></td>
</tr>
<tr>
<td>Pll Pole</td>
<td>Pipe Tong</td>
<td>Safety Classes</td>
<td></td>
</tr>
<tr>
<td>Potato Hook</td>
<td>Pry Bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pry Bar</td>
<td>Bridge Hammer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Planning and Control Data

- Unit Cost (Operational)
- Average Daily Production
- Average Annual Production
- Average Production per Lane Mile
- % of Total Annual Budget

<table>
<thead>
<tr>
<th>Unit Cost</th>
<th>Average Daily Production</th>
<th>Average Annual Production</th>
<th>Average Production per Lane Mile</th>
<th>% of Total Annual Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>$87.56 per Each</td>
<td>42 Each (8 Hour Day)</td>
<td>$140,466.82</td>
<td>$0.0050 per Mile</td>
<td>0.0545%</td>
</tr>
</tbody>
</table>