

CMOM risk modeling
Tuesday, January 10, 2012

Similar to REHAB approach, but emphasis on cleaning and inspection.

Intended for modeling team to build

Deliverables – set of docs to DEQ at end of year (Dec 31st, 2012)

- CMOM Plan
- Grease management
- Spill response
- Pump station

- Cleaning/inspection plan (12/29/2012)

- Pipelines
 - Manholes

- Rehab plan

1st year of many year effort . This is the first phase.

Will not sacrifice long term goals for short term limitations

Purpose of workshop is to fill in the blanks, which are many.

Steps:

- 1) Model development – complete June 1, 2012
 - Expect model to be inconsistent with budget
- 2) Alternative eval – June – August
- 3) Final Plan prep

Risk model development:

- 1) Failure mechanism matrix - Identify failure modes
- 2) Develop assessment methods
- 3) How is the information used?

Models vs. model (cleaning and inspection are different enough to warrant that) – Gail

- Rehab model
- Cleaning model
- Inspection model

Model will need a **champion** – needing to “sell to BLT” to make sure the budget is behind the plan based on the model. Virgil/Gary need tight connection to model throughout its development.

What are the expectations already (will this short circuit the model results)

What is the model expected to deliver for answers (based on current thoughts of the system – i.e. feelings that deterioration at accelerating rate)

Force mains not in the clean/inspect plan on purpose – in another plan for now.

Inspection: (Sanitary and combined for now)

Mainlines

Small (< 30")

Large

Manholes

Laterals

Control facilities

Why inspect? Set into a risk based failure mechanism model

Small diameter mainlines

Item	Inventory	Data quality
PM	Hansen	Good
Grease	Hansen	Good, mappable as defect
Poor struct condition	Hansen	Good, mappable as defect, but not complete nor up to date.
Post repair QA	Hansen	Repair has an activity, the inspection does not. Looks just like every other inspection
Roots	Hansen	Mappable, tracked by root work order
Unknown items (pipes with missing information)	Hansen to find them	Gail has a method

PM – current service levels (Joe’s curve)

2 years of existing data

Inspection interval can reduce uncertainty risk

Large diameter mainlines

Item	Inventory	Data quality
PM	Hansen	Good
Capacity (sedimentation)	Hansen	Tied to work orders (pre/post inspection cleaning)
Poor struct condition	Hansen	

Caused by root, corrosion, I/I)		
Post repair QA	Hansen	
Unknown items	Hansen to find them	Gail has method

Tunnel inspections have not been entered into Hansen

Manholes (thousands of inspections currently)

Item	Inventory	Data quality
PM	Hansen	Some narrative type information, but not gradable.
Poor struct condition	Hansen	
Corrosion?		
Air quality? (health and safety)		

Manhole inspections are different from pipes. Still a work in progress. No condition grading possible with current method. Many components of a manhole prevent good grading just yet. Gas test meter readings are done, but not always recorded. Current grading very relative and arbitrary. Superficial inspection.

EPA seems fixated on manholes, so it will matter, but very little specification for model building now. Their focus is structural condition.

Could get some traction just using material types and date in construction to start, but formal method will need to be define, but not necessarily built by June, though document proposed method

Laterals

Currently very sparse

Inspection curretnly project and problem specific

Mainline inspection already includes lateral connection inspection w/ limited inspection up lateral. Can spot dropped laterals during ML inspections.

Bob Pyle lateral inspection proposal already exists. Gary says that program does not work. Find and fix does not appear to work as a program.

Lateral program will grow, but not yet under this part of the effort.

Collection system controls (active controls)

Item	Inventory	Data quality
PM	Should be both Hansen and Synergen	Not currently defined
Trouble shooting of known		

problems		
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Flap valves
Sluice gates
Bubblers/level control

May group by types of facilities

Some PUMA inspections
Specialized inspections

!!Model may not do much here for this phase, still developing fundamentals.
Currently no scheduled maintenance
These items should probably be mirrored between Hansen and Synergen
Inventory still needs to be done

Cleaning:

Mainline definitions

Small (<16) – just jet and catch with basket
Medium (16-30) – vactor (jet and vact)
Large (>30) – specialty cleaning methods (depends on what

Laterals – no way to clean, do not clean

Why clean?

Mainline – small diameter

Item	Inventory	Data quality
PM	Hansen	Not completely comprehensive
Grease management	Hansen	Not completely comprehensive
Roots	Hansen	Not completely comprehensive
Sewage releases? (some question if it should be included)	Hansen	Not completely comprehensive
Repair work	Hansen	Not completely comprehensive
Sediment (may not belong here). A lot of utility construction debris is an on-going problem (3 rd party). Gail says in small diameter,	Hansen	Not completely comprehensive

this is likely NOT a driver		
Decision – part of PM		

If planned/scheduled work, goes into Hansen. Both BOM and Gail do this. But not all the district engineers enter the cleaning work. Some of the superfund cleaning (outside contractors) do not get entered all that often into Hansen.

What you're cleaning in small diameter pipes for TV inspection is not effecting capacity, it is more visibility.

Mainline medium diameter

Item	Inventory	Data quality
PM	Hansen	Not completely comprehensive
Grease management	Hansen	Not completely comprehensive
Sewage releases? (some question if it should be included)	Hansen	Not completely comprehensive
Repair work	Hansen	Not completely comprehensive
Sediment (may not belong here). A lot of utility construction debris is an on-going problem (3 rd party). Gail says in small diameter, this is likely NOT a driver	Hansen	Not completely comprehensive
Decision – part of PM		

Similar to SMALL diameter for data quality. Roots less important
Are not seeing all that many sediment related backups in small and medium pipes – Gail.

Mainline large diameter and tunnels

Item	Inventory	Data quality
Support TV inspection program	Hansen	Not completely comprehensive
Capacity/sed accumulation		Not completely comprehensive

Large diameter is worse quality than small diameter as it is contracted MORE than small diameter.

Failure mode is blockages in pump stations from pipes (treated as a point source) – i.e. Swan Island

Already accelerated cleaning cycle for two pipes segments US of all pump stations

!!Sidebar – development vs. production. Getting MDAS to know about the project is important. Bring them in now, later, when. Virgil to talk to Debbie and invite members of her team to attend vetting for informational purposes.

Rehab:

All activity needs to accumulate to DEQ report.

What is the OVERALL, comprehensive REHAB activity of the Bureau (the jellybean map is not all of it). Jelly bean map is seen as all phase II. It is not.

Pipes:

Virgil's pie chart

- Spot repairs – spec coming

- geographic

- Urgent CIP large and small

 - Put these into report and NOT turn into a PRF at this time

 - Problem is small urgent is currently understaffed.

- Laterals – strike from chart (Gary)

- Manholes

- Unknown pipes – strike from chart (Gary)

 - Some mixing of definitions here

 - Remainder pipes

 - Orphans

 - Non-urgent

 - 911 emergency

- Phase II rehab

Gary's three tiers

- 911 – has to happen now

- Urgent – action needed

- Not so urgent, but lingering

Most maintenance work is within 30 day window.

Manholes:

Need driven focus for manholes (most manholes may get dealt with by pipe rehab work)

Two different pies (urgent and planned)

Do we need a plan for manhole repair, or just show how it is included in pipe rehab work? Currently do not have an inspection program for manholes

- For inspection, best we can analyze is material, surcharging, construction date.

- Current inspection done as part of mainline inspection will always be unsatisfactory as to outcome.

Laterals

Like manholes, many are dealt with as part of mainline rehab.
Most responses are emergency driven (needs based).

Do we need a plan for lateral repair, or just show how it is included in pipe rehab work?
Currently do not have an inspection program for laterals

Current inspection done as part of mainline inspection will always be unsatisfactory as to outcome.

What density of “bad” laterals become bad for the pipe? Laterals don’t make it to jelly beans already.

Do we need to do an analysis to see if we need to do lateral rehab on its own?

Laterals are half of the SSO’s already.

Gary’s categories (again)

Planned

Emergency

??

Decision: No separate program for laterals, just like manholes it will be piggybacked onto mainline rehab.

Also need to define inspection program (much less defined than even manholes, which at least has a preliminary concept using material type, etc.)

Sewer inspection and cleaning risk based service level model

Current risk vs. alternate risk vs. cost we are looking to invest

May need to simplify because the data may not support going to a full NBCR.

What do we do in place?

Likelihood and consequence of failure

Gary’s 6 steps

- 1) List variables - Based on failure mechanisms for each subsystem
- 2) Data inventory and assessment for each variable
- 3) Performance measures from available/useable data
- 4) Define risk based function
- 5) Composite risk model
- 6) Measures of model “goodness”

Cleaning vs. inspection v. rehab

Data/analysis

Inspection

Age

Material

Pipe slope/tractive forces

History (previous inspection history)

Roots – takes 6 years to get adequate data

Grease – currently 3 month inspection to spot patterns in problem pipes

Struct. Condition

Date of last inspection

571 spot repairs still need to be reinspected – of those, 5% are grade 4-5 already
(why just do a spot repair if it is already so bad?)

Most of 2010 repairs were reinspected.

Cleaning

Slope, velocity

Material (clay pipes have sags, older concrete spalls)

Tractive force

Dry weather flows

Frequency of peak flows

Diurnal pattern

Secondary field for removal quantities for sediment - map it!

Number of cleaning events as well

Roots

Extent of roots? Light, medium, heavy roots

Cumulative score rating – if high enough, it goes into

i.e. light roots at every joint

vs. heavy roots at few point

Pipe vs. laterals

Sawing off roots is like trimming bushes, encourages more growth

Interval between cleaning (calibration parameter?)

Previous inspection info?

Pipe sags

Rehab

For inspection and cleaning, need map that shows pipes needing regular inspection and cleaning (PM). How identify these? Risk is separate from implementation.

Don't need a model for post repair, unknown, third party

Do need a model for Grease, struct., roots

Consequence of failure

- Sinkholes (geographic)

- Sewer plug – back ups

Storm intensity can also factor into this in terms of how many residents are impacted before we respond. Most recent history shows mostly single residents are impacted.

- Pipe capacity may not really be pipe capacity, but could be plugs instead.

Is what we have sufficient to characterize this or not? (Is the two basement assumption good enough as well? – Virgil says yes)

Measure of “goodness” of model

The models need to recommend draft schedules on inspection, cleaning, and rehab, which then need to be compared against delta BRE and budget already allocated for each.

Start with likelihood of failure, and recommended schedule should be 50% of that (to start).

- Currently, schedule is basin by basin. Model may output pipe by pipe.

Lumping/grouping will need to happen, but will not be the task of the model (as with Rehab).

(Structural) Inspection interval by risk is already done (Issac has written)

- Not for roots, grease, or sediment

- Proposal is start with this for TV inspection

- Check against known areas (like mid-county)

Next steps

- Mark/Arnel schedule,

- Present to Virgil.

- Prioritize

- (Prime directive – keep it simple, use as much of what is already there)