



Architecture
Landscape
Interior Design

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December 22, 2015

Public Works and Government Services Canada
201-1800 11th Avenue, Broad Street Crossing
Regina, Saskatchewan

Attention: Mustak Sarwer, B.Arch, Intern OAA, PMP
Project Management, Western Region
Professional and Technical Services Branch. Real Property Services

Re: Food Services Building – Investigation of Saturated Crawlspace

Ft3 Architecture Landscape Interior Design were commissioned by Public Works and Government Services Canada to investigate saturation of an existing crawlspace found within the Food Services Building located at the RCMP Training Depot in Regina, Saskatchewan.

Our primary mandate was to determine the cause of the water saturation. On both occasions when attending the site on September 9th, 2014 and again on July 16th, 2015 it was ruled out water leakage from any source above the crawlspace floor as it appeared the water had percolated from below the crawlspace surface, leading us to concentrate our efforts with solely investigating the weeping tile installation.

There were three notable locations of sever water saturation and these are identified on the attached weeping tile drawing (A2.1) of the crawlspace. The following report will serve to identify possible rationale as to why the saturation is occurring based on our findings and go to provide recommendations in providing further in-depth investigation.

Area "A"

This area located between grids G-F / 6-7 had the Permalon removed exposing the saturated soil of the crawlspace. It was clear this area had been taking on moisture over a long period of time. The soil was comprised of a slight amount of sand and majority of clay, with the clay having maximized the amount of absorption it was capable of during this long period of time (see photos dated September 9th, 2014). We had revisited the site on July 16th 2015 and concluded considerable amount of drying had occurred (see photos) and most likely due to low levels of water infiltration having taken place thus allowing for this to occur. This area was still saturated approximately 10 months after our initial review.

PRINCIPALS:

*Jerald D. Peters Architect AAA AIBC MAA OAA SAA FRAIC
Joanne L. McFadden Interior Designer IDA PIDIM IDC*

Rock G. Jerome CET CCCA

*Marten W. Duhoux Architect AAA MAA NWTAA SAA MRAIC AIA
Chantal L. Alary Landscape Architect MALA SALA CSLA*

Area “B”

The writer, while en-route to the other notable exposed area of the crawlspace floor (Area “C”), found Area “B” to also be very saturated (see drawing A2.1 attached). The permalyn had not been removed in this area however the soil beneath the permalyn was found to be very soft. The permalyn was not removed and the writer took note of the extent of size of saturation evident and this is shown on the attached drawing.

Area “C”

The area known as “Area C” is located in front of the future knock out panel and new tunnel entry. This area had the largest amount of permalyn removed and was considered the most heavily saturated area in overall square footage. There was evidence of sever saturation similar to that found in Area “A”.

Sump Pit Investigation.

In reviewing the attached drawing A2.1 the writer identified the sump pit located west of grid 8 between grids E-D as the sump pit servicing weeping tile routed through or adjacent those saturated areas of crawlspace floor noted above.

A closer examination of the sump pit internally identified water at the very bottom of the pit due most likely to migration via the bottom seam of the pit walls atop the pit floor and not the weeping tile inverts. This can be considered the high point of the water level beneath the crawlspace floor and only in the immediate vicinity of the sump pit. The migration of water at this juncture is due most likely to a failure in the water tight seal between the sump pit walls and sump pit floor.

There was no clear staining on the corrugated pit walls below the weeping tile connections at the inside of the sump pit. The two weeping tile connections considered North and East seem to have been wet but not recently (*we have included time lapsed photos from 09/09/14 and 06/16/15*) and this is derived by a dark like appearance in relationship to the weeping tile connection on the west side of the pit wall. We note on the revisit the east connection inside the sump pit was completely dry and the north had minor amount of moisture.

There was a considerable amount of wash out noticed both inside the North and East connections along with material pushed through the gap surrounding the pit wall and the connections. We conclude there is a possible break in the weeping tile line upstream allowing for material to wash into the weeping tile as well allowing for trench material to be washed into the gap surrounding the connections and the sump pit wall.

The writer noted the North and East connections in the sump pit were found to be perforated type weeping tile leading to believe there was *no solid weeping tile (non-perforated) installed from below the grade beam to the sump pit*. It is good practise to install a solid line of weeping tile c/w with a minimal 1% slope directly from perforated weeping tile installed outside of the grade beams (see attached photo and design detail) to a sump pit within a crawlspace. This required *“non-perforated”* weeping tile to be installed in sloped trenches is then connected to perforated weeping tile all of which is installed beneath the crawlspace floor. Based on our findings *we conclude there was no non-perforated weeping tile* installed to carry water into the sump pit examined.

Reasons for Saturation of Crawlspace.

The writer will base the following commentary below on the level of investigation conducted. Without further in depth investigation, such as providing a scope of the weeping tile with a camera, the comments below are only considered possible reasons as to why the saturation has taken place.

Reason #1 – Crushed or disconnected Weeping Tile

One possibility is the weeping tile shown as entering the crawlspace below the grade beam on grid G could be crushed or disconnected. If indeed the line has been installed in this approximate area and is a non-perforated line as required, sloped to the sump pit correctly, then the only explanation is a portion of the line at the interior of the crawlspace has been crushed or a connection, either below the grade beam or along the weeping tile, has become disconnected. This would mean the water entering the weeping tile below the grade beam would migrate to the noted areas "A" and "B" as they are in close proximity of the entry point.

Reason #2 – Perforated Weeping Tile used in lieu of Non-Perforated

The use of Non-perforated weeping tile is a requirement for the "main connection runs". These main connection runs tie into the exterior perforated perimeter weeping tile at the grade beams and the interior crawlspace perforated weeping tile also connect to these main connection runs which are routed to the sump pits. Detail 3/A2.1 on attached drawing A2.1 (*Basement and Crawlspace Plan*) clearly identifies the perforated weeping tile required within the interior of the crawlspace and is to be connected to the Non-perforated weeping tile which is then routed into the sump pits. This is evident by the notation under detail 3/A2.1 "tie into sump pits with non-perforated PVC weeping pipe".

The above noted scenario and noted detail is the correct design intent for collection and distribution of water within any weeping tile system. Based on our findings we question if the *non-perforated* weeping tile was ever used as the main connection run routed through the crawlspace and into the sump pits. We refer you to the attached (enlarged) photo that clearly shows the weeping tile penetrating the sump pit as having perforations giving evidence to the use of incorrect weeping tile used as "main connection run".

This could explain why there appears to be little to no water entering the sump pit through these weeping tile inverts. It also goes to explain why the water that enters immediately into the crawlspace from the exterior (below the grade beams) may not be getting to the sump pit and is in fact migrating to the areas noted as being saturated. Furthermore, with there being a considerable amounts of soil material pushed through the gap between the sump pit wall and the outside edges of the weeping tile leads us to believe the trench material is being allowed to wash into the sump pit due likely to water pushing through the perforations of the "main connection runs".

The entry points of the exterior perimeter perforated weeping tile system are the locations where the greatest amount of water is flowing from external sources (ie rain events) and if this high concentration of water is not contained inside a *non-perforated* weeping tile system it will then have the result of water migrating through the perforations of the main connection run and then saturating the crawlspace floor material. The areas of heavy saturation lend its self to this theory and based on our findings of the main connection run which appears to be the incorrect type of weeping tile installed we conclude this likely is one of the main contributors toward the saturation but is not the only contributor as we refer you to Reasons #1 and #3.

Reason #3 – Poor slope of weeping tile and trenches

At time of install each type of weeping tile supplied is to be sloped. The perforated weeping tile is to be sloped 2% as per design noted on attached design drawing and the main connection runs (non-perforated) are to be sloped 1% also noted on attached design drawing. This is a very important requirement and how well the weeping tile system functions when called upon depends on the slopes being provided correctly.

With the trenches being sloped properly (effectively providing correct slope for the weeping tile) this still does not guarantee the final installation for slope remains correct. Depending on material used within the trench proving a base for the underside of the weeping tile it could lend to a loss of slope over time. The materials used at the bottom of the trench are not as critical as the time of year the trench is installed. Should there be frost still directly below the trench and regardless if you have the correct material and it is compacted, once the frost does finally thaw, the slope could be slightly lost or it could be dramatically lost to a point of slumping thus creating a collection point. We have not been made aware of the conditions at the time of installing the weeping tile and only indicate this as another contributing factor.

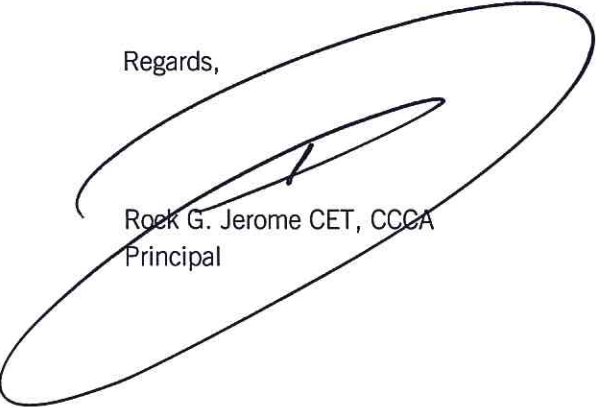
Conclusion:

We recommend a camera be used to scope the weeping tile from the sump pit up stream as far as possible. This further investigation could reinforce our findings as to the possibility of a crushed or disconnected weeping tile at point of entry into the crawlspace or other possible locations, the non use of perforated weeping tile as main connection runs and a poor slope of weeping tile trenches.

There is considerable evidence the installation did not follow the design intent in areas noted on the design drawings and warrants further aggressive review to ensure such evidence is supported.

We thank for this opportunity to provide you with our investigation of the weeping tile and look forward to working further with you.

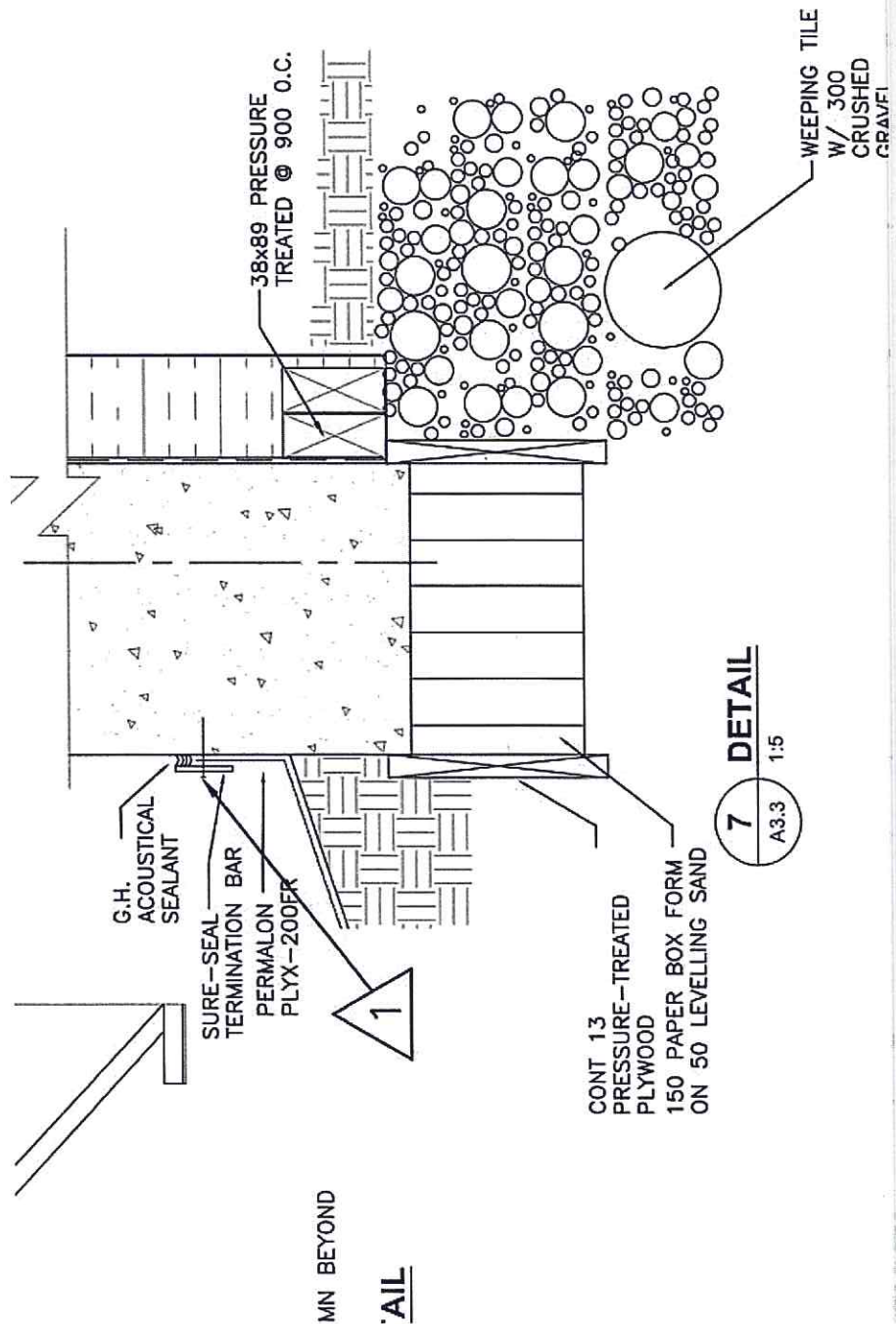
Regards,



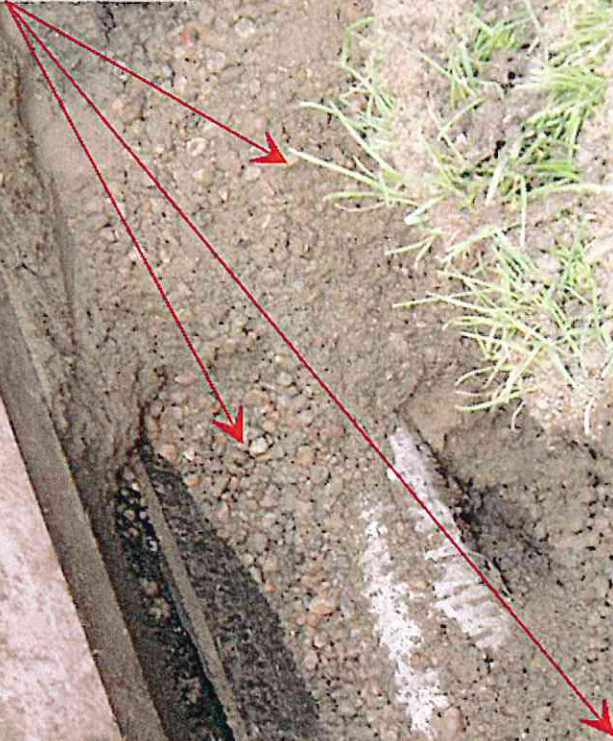
Rock G. Jerome CET, CCCA
Principal

FOOD SERV BUILDING

| |
|---|
| Approved by/Approuve par |
| Designed by/Concept par |
| Drawn by/Dessine par P.E./G.P. |
| PWGSC Project Manager/Administrateur BILL BARTON |
| PWGSC, Architectural and Engineering Resou Ressources Architectural et de Directeur d'in |
| Client/client RCMP DEPOT MAJOR CAPITAL PROJ |
| Drawing Title/Titre du dessin WALL DETAILS |



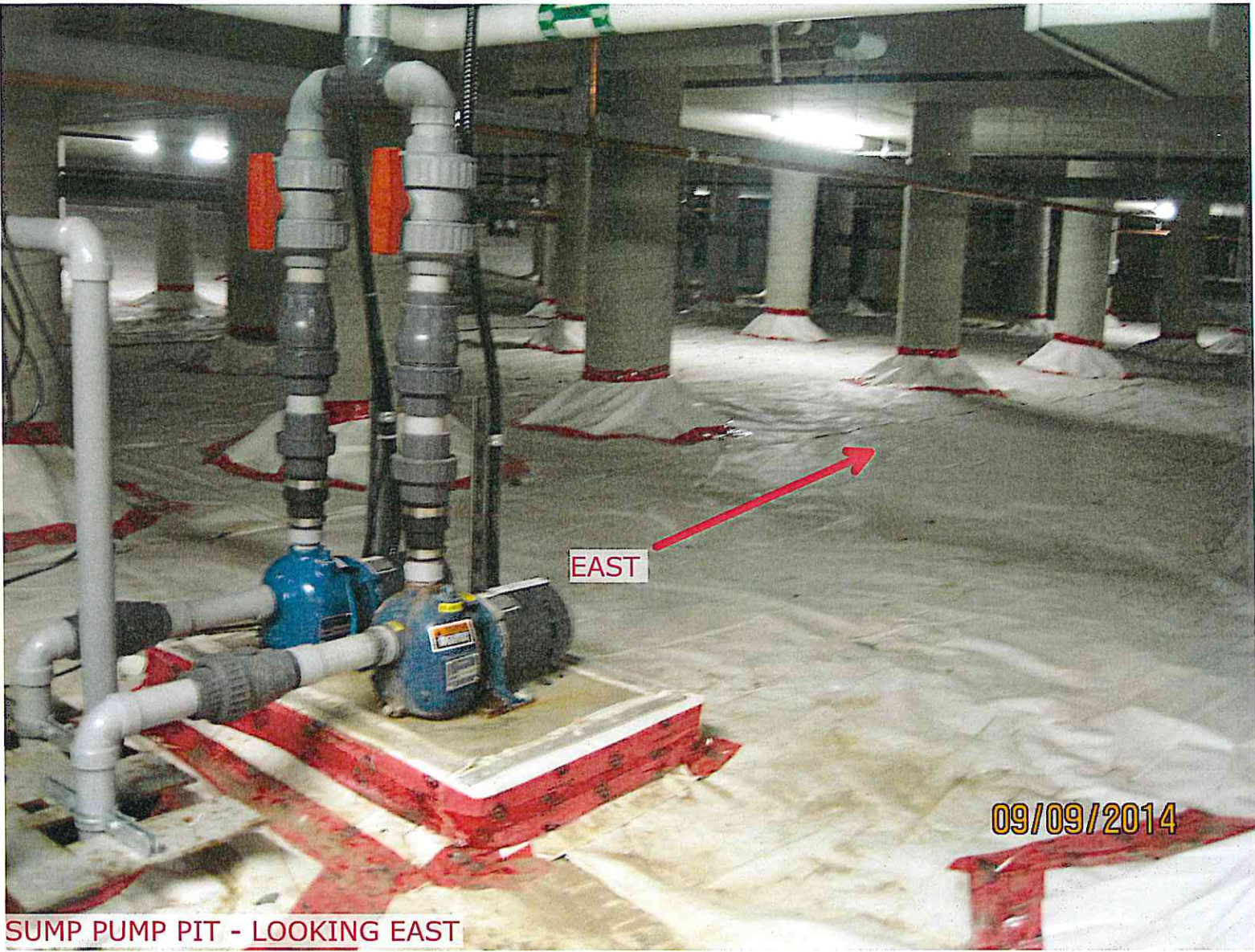
MIXTURE CONTAINS
TOO MUCH SMALL
SEDIMENT. LARGE
CRUSHED GRAVEL IS
REQUIRED AS PER
ORIGINAL DRAWINGS.



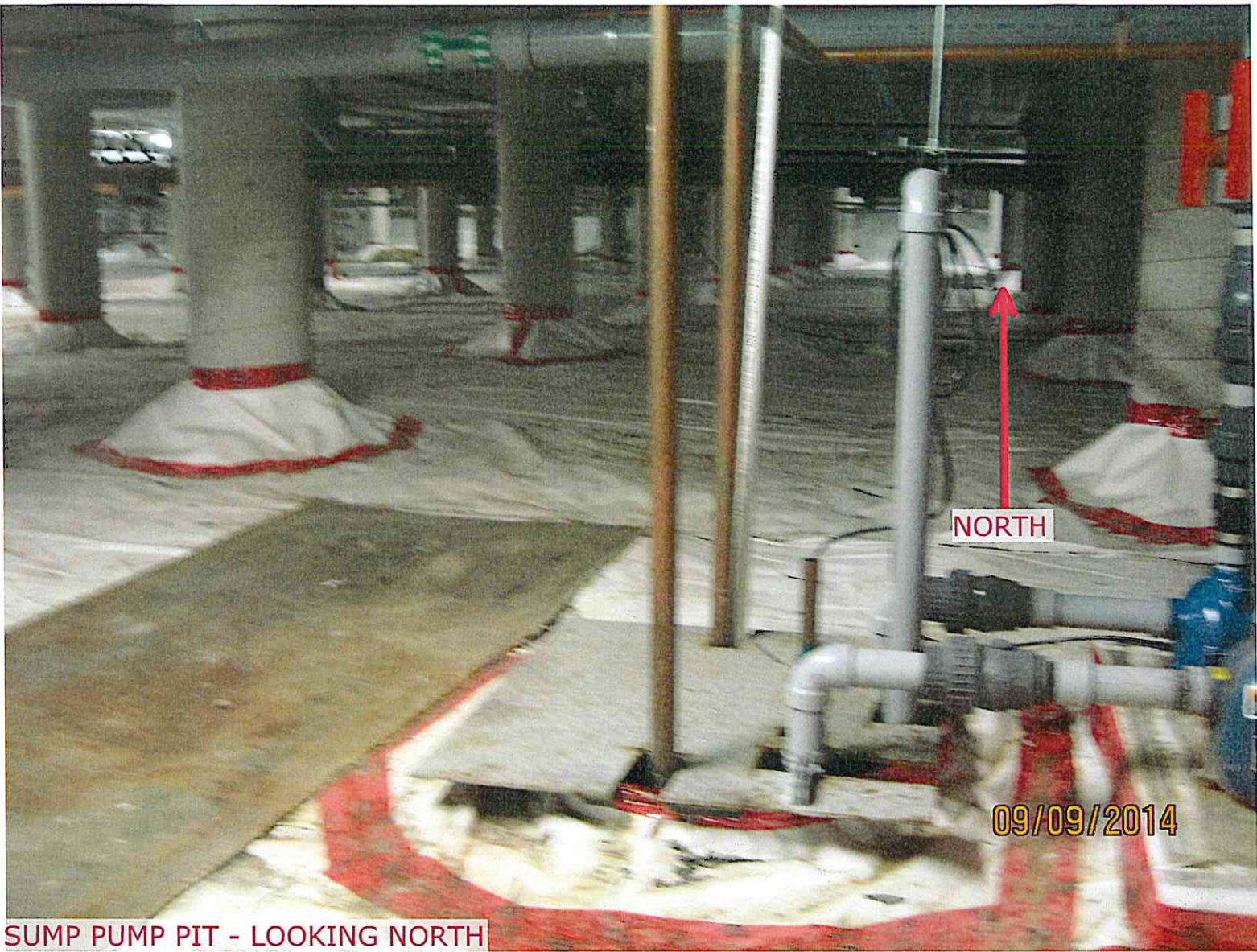
RAWLSPACE INVESTIGATION - EXTERIOR WEEPING TILE



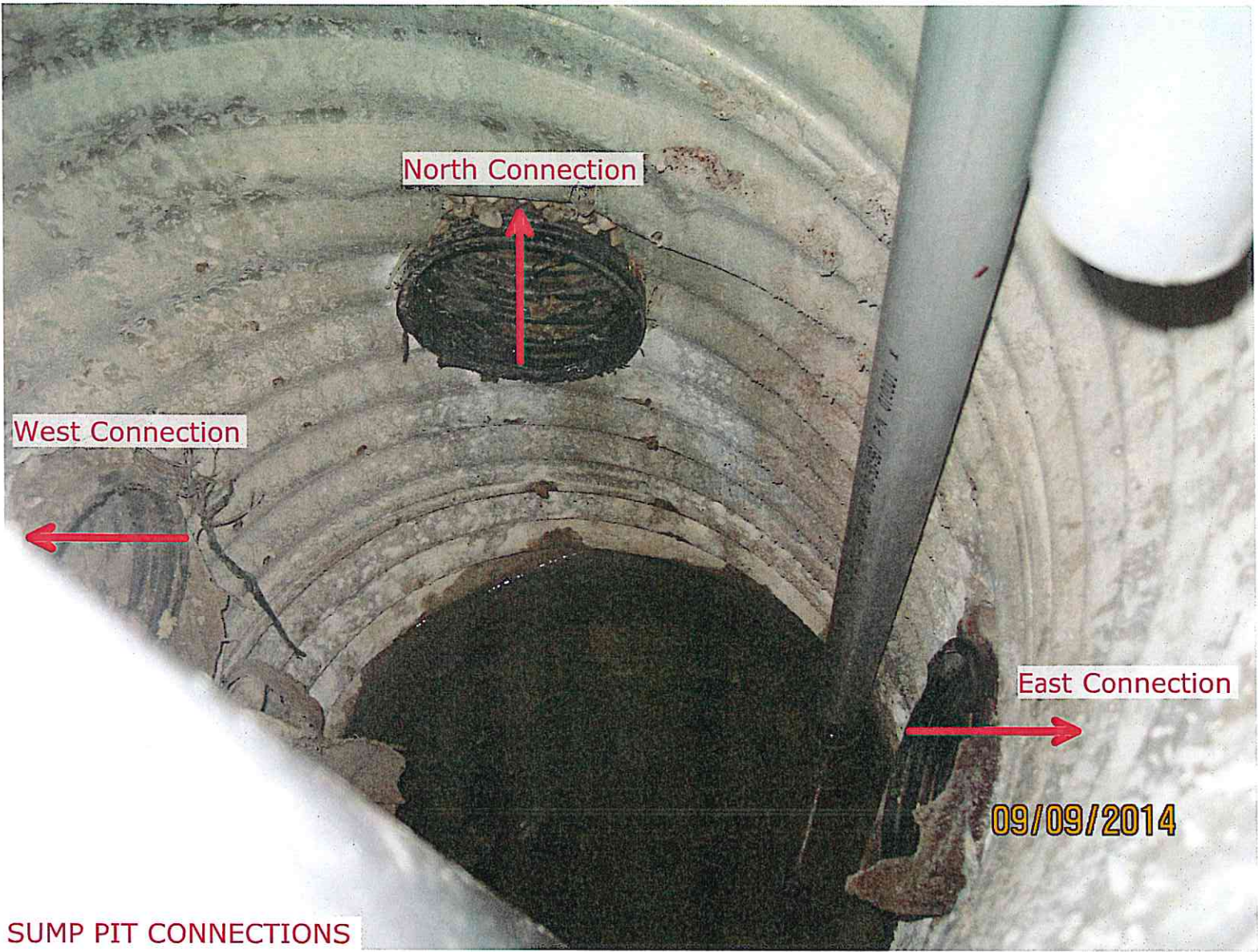
SUMP PUMP PIT COVER



SUMP PUMP PIT - LOOKING EAST



SUMP PUMP PIT - LOOKING NORTH



SUMP PIT CONNECTIONS



Material pushed through gaps surrounding pit wall and connections.

Wash out inside North and East connections. Possible break in weeping tile line upstream.

09/09/2014

NORTH AND EAST CONNECTION AT SUMP PIT

North and East connections have darker appearance in relation to West connection indicating they were wet at some point but not recently.

Water at the bottom of Sump Pit possibly due to migration via failure of bottom seam of pit connection.

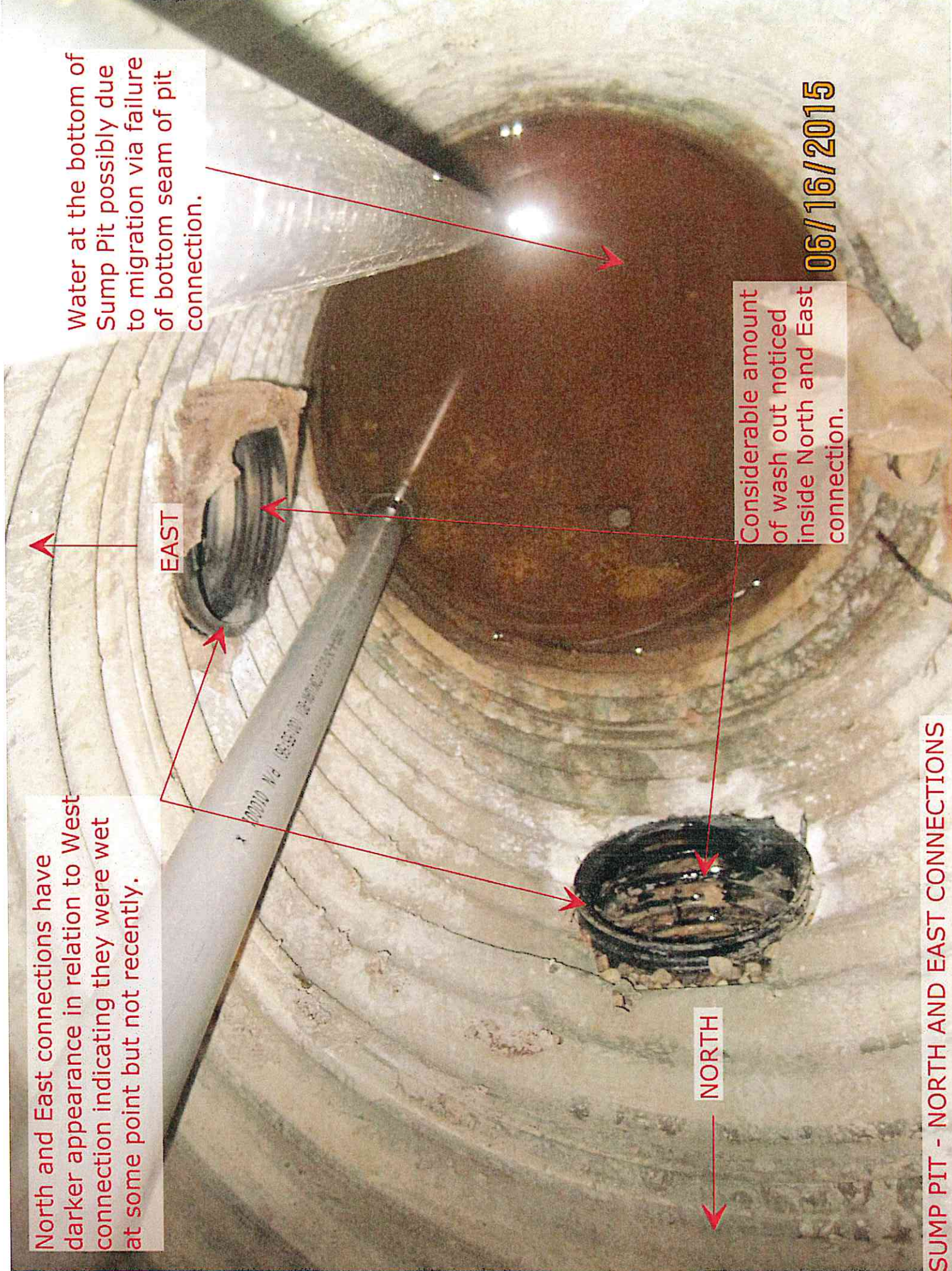
Considerable amount of wash out noticed inside North and East connection.

06/16/2015

EAST

NORTH

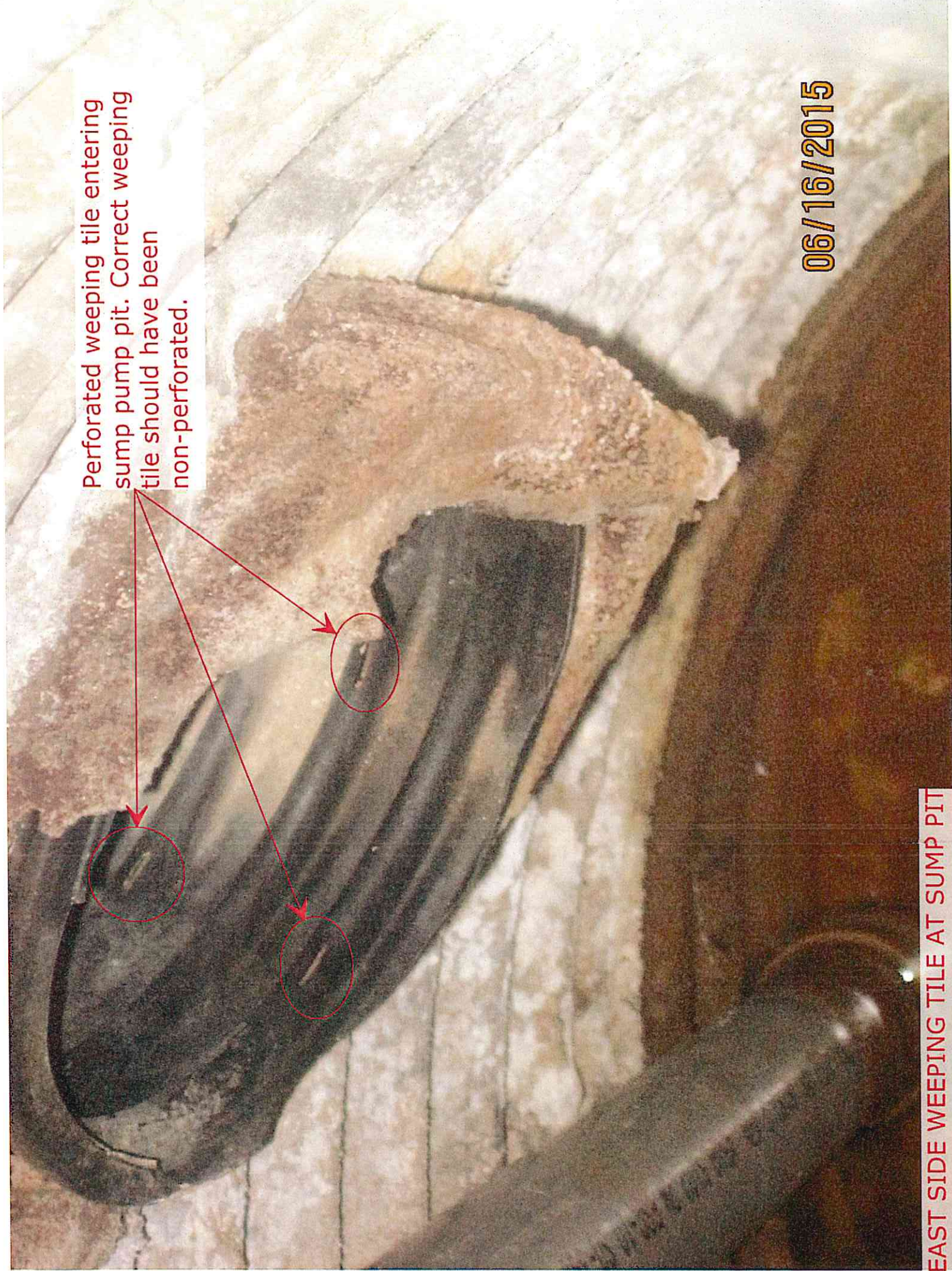
SUMP PIT - NORTH AND EAST CONNECTIONS



Perforated weeping tile entering sump pump pit. Correct weeping tile should have been non-perforated.

06/16/2015

EAST SIDE WEEPING TILE AT SUMP PIT





CRAWLSPACE INVESTIGATION - AREA A

Excessive water saturation in soil.



09/09/2014

SOIL CONDITION AT AREA A

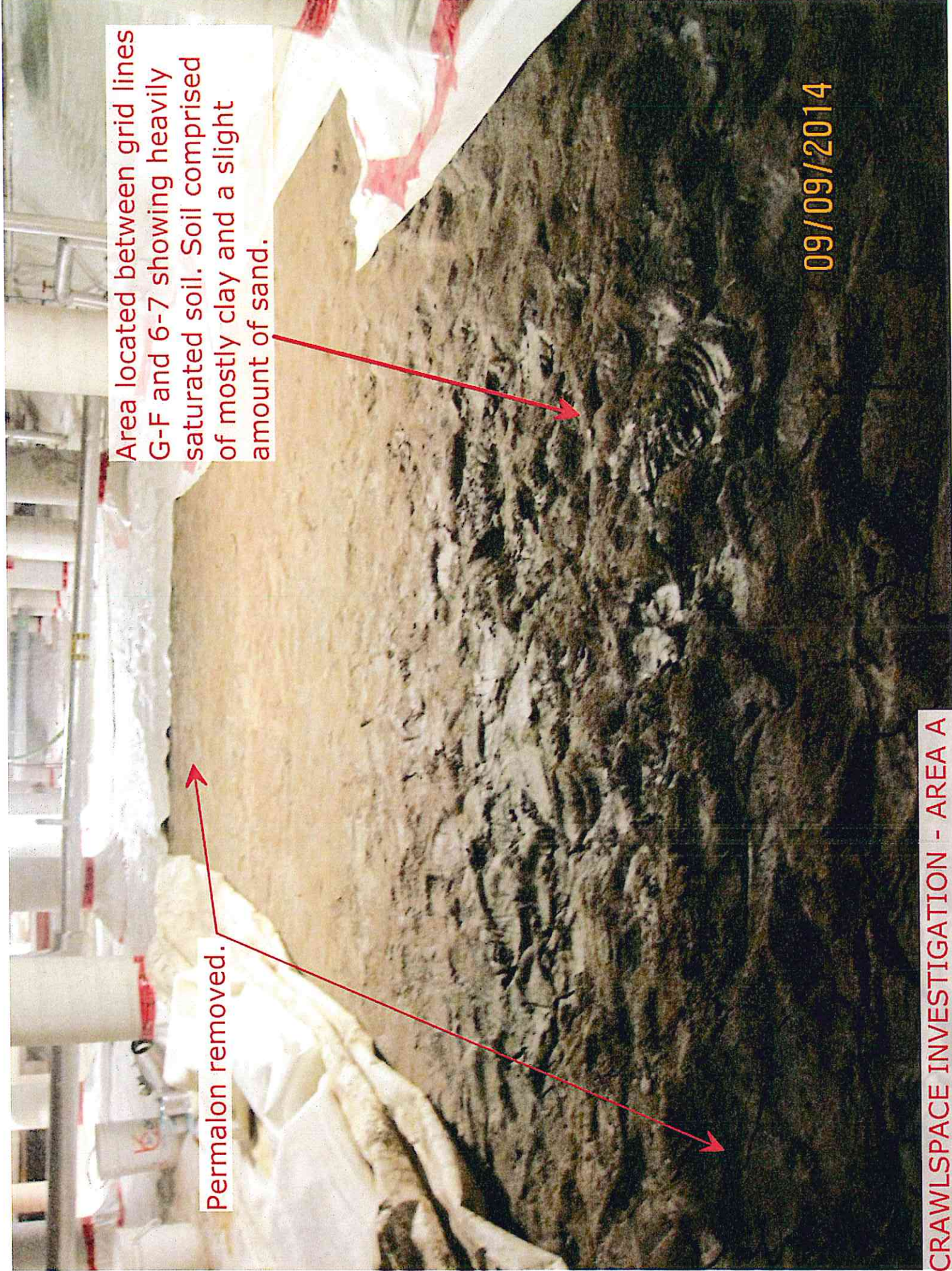


Area located between grid lines G-F and 6-7 showing heavily saturated soil. Soil comprised of mostly clay and a slight amount of sand.

Permalon removed.

09/09/2014

CRAWLSPACE INVESTIGATION - AREA A

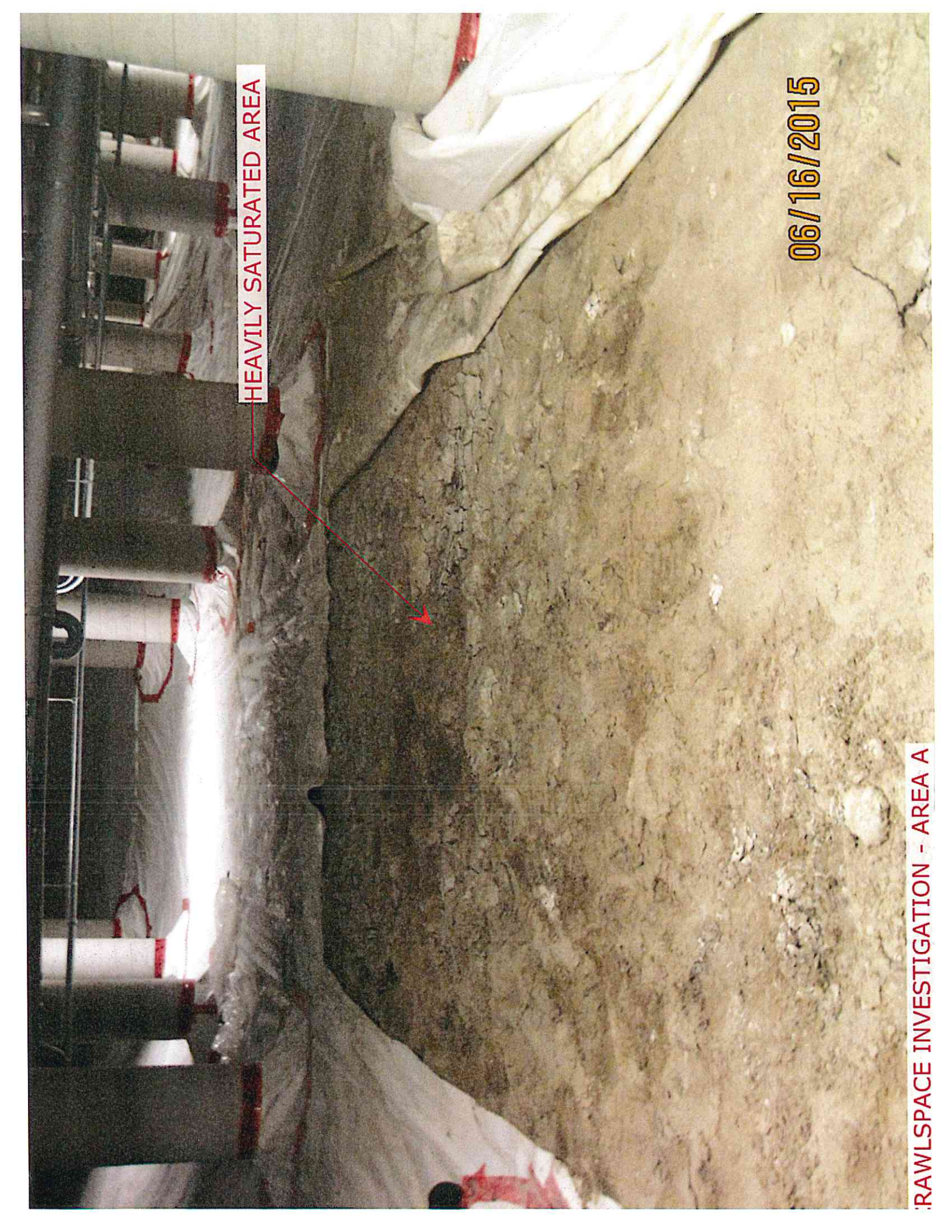


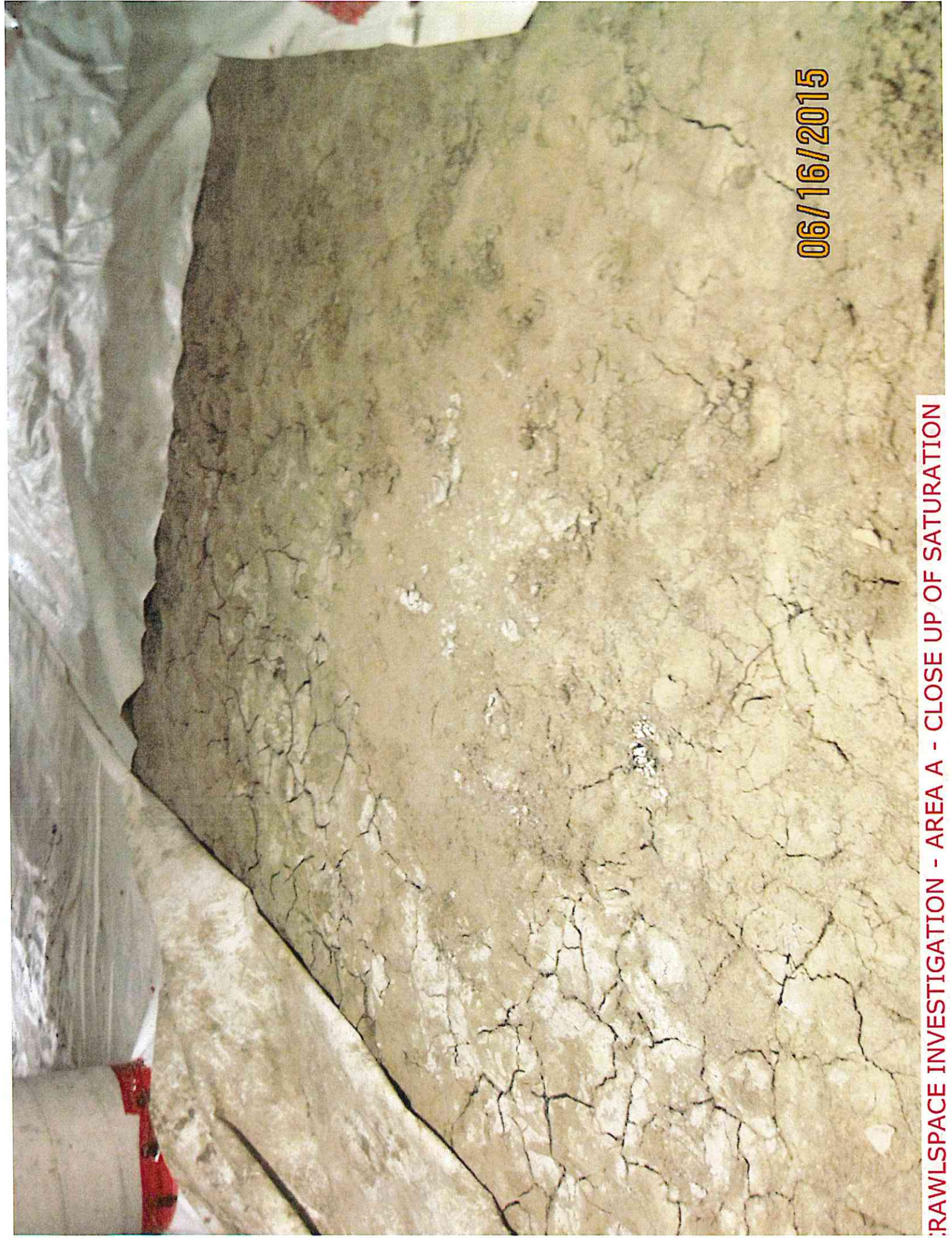
HEAVILY SATURATED AREA



06/16/2015

RAWLSPACE INVESTIGATION - AREA A





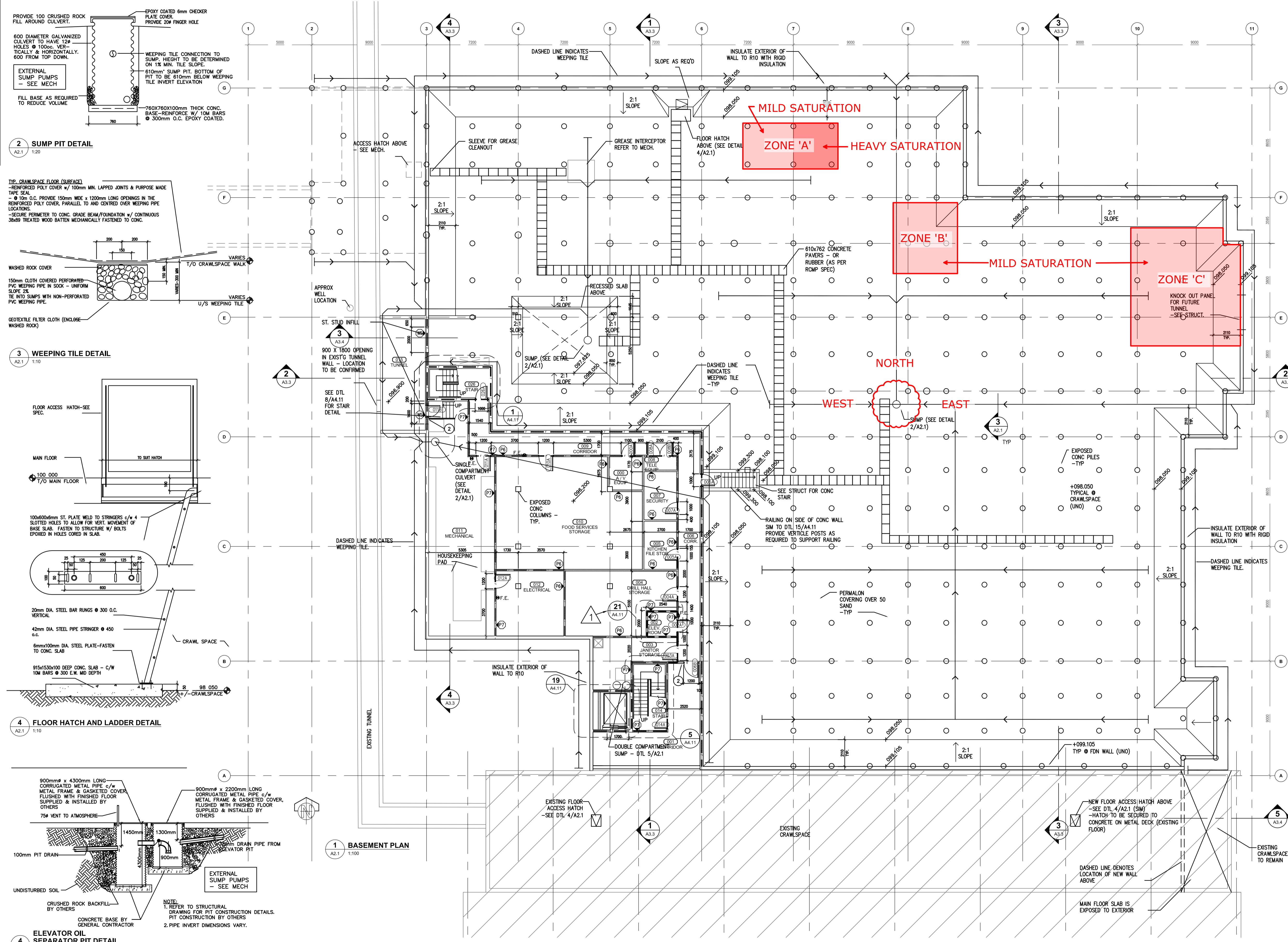
06/16/2015

RAWLSPACE INVESTIGATION - AREA A - CLOSE UP OF SATURATION



09/09/2014

AREA 'C' LOCATION



DO NOT SCALE DRAWINGS

| Revision/Revisions | Description/Description | Date/Date |
|--------------------|-------------------------|-----------|
| 3 | PWSSC RECORD DRAWINGS | 09/10/26 |
| 2 | UPDATED DRAWINGS | 08/05/20 |
| 1 | REVISION | 08/02/20 |
| 0 | ISSUED FOR TENDER | 07/11/29 |

Royal Canadian Mounted Police / **Gendarmerie royale du Canada**

Project title/Titre du projet
Shaw Street, RCMP Academy
 Regina, SK Canada

RCMP FOOD SERVICES BUILDING

Approved by/Approuvé par
 BFN 07/11/29
 Designed by/Conçu par
 BFN 07/11/29
 Drawn by/Dessiné par
 RRI/GP/RM/BFN 07/11/29
 PWSSC Project Manager/Administrateur de Projets TPSGC
BILL BARTON
 PWSSC Architectural and Engineering Resources Manager/
 Ressources Architecturales et de Directeur d'Ingénierie, TPSGC

Client/Client
 RCMP DEPOT MAJOR CAPITAL PROJECTS

Drawing title/Titre du dessin
BASEMENT & CRAWLSPACE PLAN

| Project No./No. du projet | Sheet/Feuille | Revision no./ La Révision no. |
|----------------------------------|----------------------|----------------------------------|
| 409674 STANTEC # 144400733 | A2.1 OF XX | 2 |