WILDERMUTH™
ENVIRONMENTAL INC.

October 11, 2011

Irvine Ranch Water District
Attention: Paul Weghorst
15600 Sand Canyon Avenue
Irvine, CA 92618

Subject: ***Strand Ranch South Basin Field Reconnaissance and Remediation Recommendations***

Dear Mr. Weghorst,

At the request of the Irvine Ranch Water District (IRWD), Wildermuth Environmental, Inc. (WEI) conducted a field reconnaissance of the Strand Ranch South Basins (Figure 1) to determine if the observed infiltration rate declines could be attributed to clogging of the basin and, if present, to determine the nature of the clogging material. This letter report provides a brief background on the development of the Strand Ranch recharge basins and describes reconnaissance methods employed, a summary of findings, and recommendations for the remediation of the South Basins.

Background

The Strand Ranch recharge basins were constructed between 2009 and 2010. Eleven basins were constructed on the north side of the Cross Valley Canal (CVC), and nine basins were constructed on the south side of the CVC. The basins were constructed using graders, dozers, scrapers, etc. to form approximately four-foot high berms from material removed from the basin bottoms. The South Basins were graded relatively flat with a slight hydraulic gradient to the west.

Water is delivered to the north basins via the north CVC turnout and supply channel and to the south basins via the south CVC turnout and supply channel. Metering of the volume of water delivered to the basins occurs via sonic velocity meters, one at each CVC turnout. Water enters the south basins through two transfer structures: one to Basin 4 and one to Basin 1. Each basin is then connected to the adjacent basin via transfer structures. All transfer structures are comprised of single or multiple corrugated steel pipe (CSP) culverts with flash boards for adjusting flow between adjacent basins.

Reconnaissance Methods

Prior to visiting the basins, maps were created with a 124-foot grid pattern over the South Basins to provide a method for spatial coverage and an alpha-numeric descriptor for samples, photographs, and observations. The grid consisted of alphabetized rows (A-R) and numerical columns (1-42). Observations, samples, and photographs were identified by the row letter and column number. On September 29, 2011, two professional

23692 Birtcher Drive, Lake Forest, CA 92630 Tel: 949.420.3030 Fax: 949.420.4040 www.wildermuthenvironmental.com

geologists from WEI performed a field reconnaissance of the South Basins. The reconnaissance consisted of walking each basin, making observations of the basin bottoms, and noting any potential clogging mechanisms (i.e. fine-grained sediment, deposition type and thickness, biologic materials, erosion, shallow sediment type, and relative density of the basin sediments).

Typically, in recharge basins, a clogging layer, consisting of fine-grained sediment and algae, will form on the basin bottom over time, which reduces the infiltration of water through the basin bottom. The fine-grained sediments that occur on basin bottoms are the primary clogging mechanism. Our observations focused on the material type, thickness, and spatial distribution of the mud/algae chips within each basin in order to determine the location and depth of the material to be removed.

In the course of our investigation, sediment samples were collected and photographs were taken documenting our observations. The photographs are included as an attachment to this report. Samples were collected from all of the basins, except Basin 18, and are available for inspection.

South Basin Observations

Desiccation cracks form as wet muddy sediment desiccates, causing contraction via a decrease in tensile strength. Individual cracks join up forming a polygonal, interconnected network. As the cracks dry, the edges of the cracks curl and separate from the underlying beds and form mud chips. In general, mud chips and combined mud/algae chips were observed within all of the basins, and the chips were underlain by relatively coarser-grained material. However, there were locations where the desiccation crack was thicker than the observed mud chip. For example, in Basin 4 (Photos 10-12), there were mud chips that extended deeper than the observed fine-grained mud layer. In this particular incident, the portion of the desiccation crack underlying the fine-grained mud chip was relatively loose, silty sand.

Berm erosion was observed in all basins where the standing water level intercepted the berm. The erosion has resulted in an approximately 1.5 to 2 foot vertical erosion face at the top of the berm. The coarser-grained materials eroded from the berm have been deposited over the lower part of the existing berm to form a relatively gently sloping apron from the bottom of the eroded face to the basin bottom. And, the finer-grained materials eroded from the berm have seemingly been deposited over the basin floor and contribute to the clogging layer.

All of the basins contained relatively small quantities of dead vegetation on the basin bottoms.

- **South Supply Channel (Photos 1-9)**

  The South Supply Channel was inspected for signs of erosion, sediment deposition, and any other indications that it may be a source of basin clogging material. The supply channel bottom was observed to be covered with fine-grained sediment that displayed uniform desiccation cracks, comprising polygonal chips. The desiccation chips on the channel bottom are approximately 2 inches thick and are composed of fine-grained sediment. As shown in Photo 6, the channel bottom sediment consisted of silts and clays with some very fine-grained sand and contained a significant volume of open pores within the soil. There was no significant erosion observed within the channel bottom or sides. These observations apply to the entire channel except for the far south end where observations could not be made due to ponding over the concrete-lined section of the channel.

- **Basin 1 (Photos 18-24 and 1b-12b)**

  The area of Basin 1 is approximately 24 acres (1,045,284 square feet [sf]). This basin has two transfer structures (TS). TS No. 1 consists of five 42-inch CSP culverts that convey water from the South Supply Channel to Basin 1 (Photo 18). TS No. 2 consists of five 42-inch CSP culverts that convey water from Basin 1 to Basin 2. At the time of our visit, the basin was dry, and all areas of the basin were accessible for inspection. The bottom of Basin 1 is covered with fine-grained sediments and minor dead vegetation. The fine-grained deposits range in thickness from less than 0.1 inch to approximately 1 inch. As shown in Figure 1, the thicknesses of the sediment deposits are mostly less than 0.2 inches. The fine-grained deposits were about 1-inch thick in the immediate vicinity of TS No. 1. As shown in Photo 19, the basin bottom shows signs of uneven grading, resulting in bottom elevation differences as large as 1.5 feet. (The clip board shown in the photo is about 12 inches long and was used to provide a visual reference.) Two bottom sediment samples were collected from Basin No. 1 at grid locations 40K and 42H.

- **Basin 2 (Photo 25 and 13b-21b)**

  The area of Basin 2 is approximately 29 acres (1,246,714 sf). This basin has three transfer structures. TS No. 2 consists of five 42-inch CSP culverts that convey water from Basin 1 to Basin 2. TS No. 3 consists of four 42-inch CSP culverts that convey water from Basin 2 to Basin 3. TS No. 8 consists of one 42-inch CSP culvert that delivers water from Basin 5 to Basin 2. At the time of our visit, the basin was free of standing water, had a moist surface, and all areas of the basin were accessible for inspection. As shown in Photo 19b, the bottom of Basin No. 2 is covered primarily in a combined fine-grained sediment and algal material that forms desiccation chips that are typically less than 2-inches across. As shown in Figure 1, the thicknesses of the sediment/algal deposits are mostly less than 0.2 inches. Three bottom sediment samples were collected from Basin 2 at grid locations 29L, 30F, and 34R.

- **Basin 3 (Photos 57-59 and 56b-59b)**

  The area of Basin 3 is approximately 30 acres (1,308,391 sf). This basin has three transfer structures. TS No. 3 consists of four 42-inch CSP culverts that convey water from Basin 2 to Basin 3. TS No. 4 consists of three 42-inch CSP culverts that convey water from Basin 3 to Basin 18. TS No. 9 consists of one 42-inch CSP culvert that delivers water from Basin 6 to Basin 3. At the time of our visit, the basin contained a small pond of water and wet soils in the very south end within rows Q and R; the rest of the basin was free of standing water and had a moist surface. With the exception of the area with standing water, all other areas of the basin were accessible for inspection. As shown in Photo 56b, the bottom of Basin 3 is covered primarily in a combined fine-grained sediment and algal material that forms desiccation chips that are typically less than 2-inches across. As shown in Figure 1, the thickness of the sediment/algal deposits is mostly less than 0.2 inches. One bottom sediment sample was collected from Basin 3 at grid location 22F. This sample is available for inspection.

- **Basin 4 (Photos 10-17)**

  The area of Basin 4 is approximately 9 acres (407,254 sf). This basin has two transfer structures. TS No. 5 consists of three 42-inch CSP culverts that convey water from the South Supply Channel to Basin 4. TS No. 6 consists of two 42-inch CSP culverts that convey water from Basin 4 to Basin 5. At the time of our visit, the basin was free of standing water, and all areas of the basin were accessible for inspection. As shown in Photo 13, the bottom of Basin 4 is covered primarily in fine-grained sediment that forms desiccation chips that are typically more than 4-inches across. As Figure 1 shows, the thickness of the sediment deposits is typically less than 0.2 inches on the south half of the basin within rows D, E, and F, and 0.2 to 0.3 inches thick on the north half of the basin within rows B and C. As shown in Photo 17, at the outlet of TS No. 5, the fine-grained sediment layer is approximately 2 inches thick with a large fraction of open voids. Four bottom sediment samples were collected from Basin 4 at grid locations 36B, 36C, 42B, and 42F. These samples are available for inspection.

- **Basin 5 (Photos 26-32 and 22b-27b)**

  The area of Basin 5 is approximately 10 acres (432,599 sf). This basin has three transfer structures. TS No. 6 consists of two 42-inch CSP culverts that convey water from Basin 4 to Basin 5. TS No. 7 consists of two 42-inch CSP culverts that convey water from Basin 5 to Basin 6. TS No. 8 consists of one 42-inch CSP culvert that delivers water from Basin 5 to Basin 2. At the time of our visit, the basin was free of standing water, and all areas of the basin were accessible for inspection. As shown in Photo 31, the bottom of Basin 5 is covered primarily in fine-grained sediment that forms desiccation chips that are typically more than 4-inches across. As shown in Figure 1, the sediment deposits are typically less than 0.2 inches thick. However, along the north and northwest parts of the basin, the sediment deposits are up to 0.4 inches thick. There is a pit eroded into the bottom of the basin in grid 35F that resulted from the discharge of SREX-7 development water (Photo 26). One bottom sediment sample was collected from Basin 5 at grid location 29B. This sample is available for inspection.

- **Basin 6 (Photos 61-63 and 60b-62b)**

  The area of Basin 6 is approximately 6 acres (278,957 sf). This basin has three transfer structures. TS No. 7 consists of two 42-inch CSP culverts that convey water from Basin 5 to Basin 6. TS No. 9 consists of one 42-inch CSP culvert that delivers water from Basin 6 to Basin 3. TS No. 10 consists of two 42-inch CSP culverts that convey water from Basin 6 to Basin 18. At the time of our visit, the basin was free of standing water, and all areas of the basin were accessible for inspection. Basin No. 6 contains a debris pile in grid 25D, consisting of broken irrigation pipe and other metallic and concrete debris. Additionally, there is a sediment pile across the southeast part of the basin in grids, 26E, 27E, and 28E. As shown in Photo 62, the rest of the bottom of Basin 6 is covered primarily in fine-grained sediment that forms desiccation chips that are typically more than 4-inches across. As shown in Figure 1, the sediment deposits are typically less than 0.2 inches thick. However, along the north and northwest parts of the basin, the sediment deposits are up to 1 inch thick. Two bottom sediment samples were collected from Basin 6 at grid locations 22C and 26B. These samples are available for inspection.

- **Basin 18 (Photos 53-56 and 46b-55b)**

  The area of Basin 18 is approximately 35 acres (1,538,383 sf). This basin has three transfer structures and one pipe riser. TS No. 4 consists of three 42-inch CSP culverts that convey water from Basin 3 to Basin 18. TS No. 10 consists of two 42-inch CSP culverts that convey water from Basin 6 to Basin 18. TS No. 11 consists of two 42-inch CSP culverts that convey water from Basin 18 to Basin 19. The pipe riser connects Basin 18 to a slough to the north of Basin 18. At the time of our visit, the basin contained small ponds of water at the transfer structures and large areas with moist surface soils. The rest of the basin was free of standing water and was accessible for inspection. As shown in Photo 47B, the bottom of Basin No. 18 is covered primarily in a combined fine-grained sediment and algal material that forms desiccation chips that are typically less than 2-inches across. As shown in Figure 1, the thickness of the sediment/algal deposits range from less than 0.1 inch to approximately 0.3 inch with the majority of the deposits less than 0.2 inch.

- **Basin 19 (Photos 45-52 and 38b-45b)**

  The area of Basin 19 is approximately 38 acres (1,664,718 sf). This basin has two transfer structures. TS No. 11 consists of two 42-inch CSP culverts that convey water from Basin 18 to Basin 19. TS No. 12 consists of one 42-inch CSP culvert that conveys water from Basin 19 to Basin 20. At the time of our visit, the basin contained small ponds of water at the transfer structures and along the west berm (some of which contain carp) and had large areas with a moist soil surface. The remainder of the basin was free of standing water and was accessible for inspection. As shown in Photo 19, the bottom of Basin No. 19 is covered primarily in a combined fine-grained sediment and algal material that forms desiccation chips that are typically less than 2-inches across. As shown in Figure 1, the thickness of the sediment/algal deposits is typically less than 0.1 inch. Concrete irrigation pipe was observed in the bottom of Basin 19 in grids 9F, 10F, and 11F, and is presumed to be a remnant from the existing irrigation system. One bottom sediment sample was collected from Basin 19 at grid location B9. This sample is available for inspection.

- **Basin 20 (Photos 33-44 and 28b-37b)**

  The area of Basin 20 is approximately 36 acres (1,583,895 sf). This basin has one transfer structure. TS No. 12 consists of one 42-inch CSP culvert that conveys water from Basin 19 to Basin 20. At the time of our visit, the basin contained large areas of standing water, making most of the west half and south quarter of the basin inaccessible for inspection. As shown in Photo 42, the areas that were accessible for inspection showed primarily algae deposits over silts and very fine-grained sands. As shown in Figure 1, the thickness of the algae deposits is typically less than 0.1 inch. As shown in Figure 1 and Photo 35, concrete irrigation pipe was observed in the bottom of Basin 20 in grids 5F and 6F and is presumed to be a remnant from the existing irrigation system. Three bottom sediment samples were collected from Basin 20 at grid locations A5, J5, and N5. These samples are available for inspection.

Recommended Basin Remediation

The following recommendations apply to each basin except for Basin 20. A fine-grained sediment and/or algae clogging layer is present on the bottom of each basin. A motor grader should be used to blade to a sufficient depth to move the fine-grained clogging layer overlying the basin bottoms into windrows. The average thickness of the clogging layer for each basin is summarized in Table 1 and is based upon the observed thickness within each grid cell in the basin, as shown in Figure 1. Because the basin bottoms are not flat, the blading depth will vary and will likely result in the removal of more than just the clogging material. The approximate minimum volume of material to be removed from each basin is listed in Table 1 and is based on the assumption that only the clogging layer will be removed. Once the clogging layer has been windrowed, the material should be removed by scraper and disposed of at a site suitable to the IRWD and the RRBWSD.

Compaction of the basin soils likely occurred when wheeled and tracked heavy equipment was used to construct the basins. Heavily compacted soils contain few large pores and have a reduced rate of both water infiltration and drainage from the compacted layer. Compaction caused by heavy axle loads (greater than 10 tons per axle) on wet soils can extend to depths of two feet or more.[1] To mitigate this compaction, the basins should then be ripped to a recommended depth of at least 36 inches.

[1] University of Minnesota Extension Service, Soil Compaction: Causes, Effects, and Control, (http://www.extension.umn.edu/distribution/cropsystems/components/3115s01.html)

During basin remediation, care should be exercised to avoid disturbing the toe of the basin berms.

During the field reconnaissance, much of Basin 20 was covered in standing water, and the entire basin bottom was wet. When Basin 20 is dry, we recommend that it be inspected for a clogging layer, and based upon our observations of the other basins, it will likely require the same method of remediation described above.

Sincerely,

Wildermuth Environmental, Inc.

William E. Leever, PG, CHg
Principal Hydrogeologist

Mark J. Wildermuth, PE
President

Enclosures:

Table 1 – South Basin Area and Clogging Layer Removal Volume
Photographs

Table 1 - South Basin Area and Clogging Layer Removal Volume

Basin No.	Bottom Area (acres)	Bottom Area (sq. ft.)	Average Removal Thickness (inches)	Minimum Volume of Material to be Removed (cu. yd.)
1	24	1,045,284	0.2	673
2	29	1,246,714	0.2	753
3	30	1,308,391	0.2	791
4	9	407,254	0.2	289
5	10	432,599	0.2	261
6	6	278,957	0.3	258
18	35	1,538,383	0.2	782
19	38	1,664,718	0.1	512
20	36	1,583,895	NA	NA
Total	218	9,506,194		4,318

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Author: WLeever
Date: 10/7/2011

N

0 500 Feet

0 100 200 Meters

Standing Water (approx.)

Buried Irrigation Pipe (approx.)

Photo

Sample

IRVINE RANCH WATER DISTRICT

Thickness (inches) of Clogging Layer at the Strand Ranch South Basins

Figure 1

Photo 1: South turnout structure

Photo 2: Looking south from south turnout structure

Photo 3: Looking north towards south turnout structure

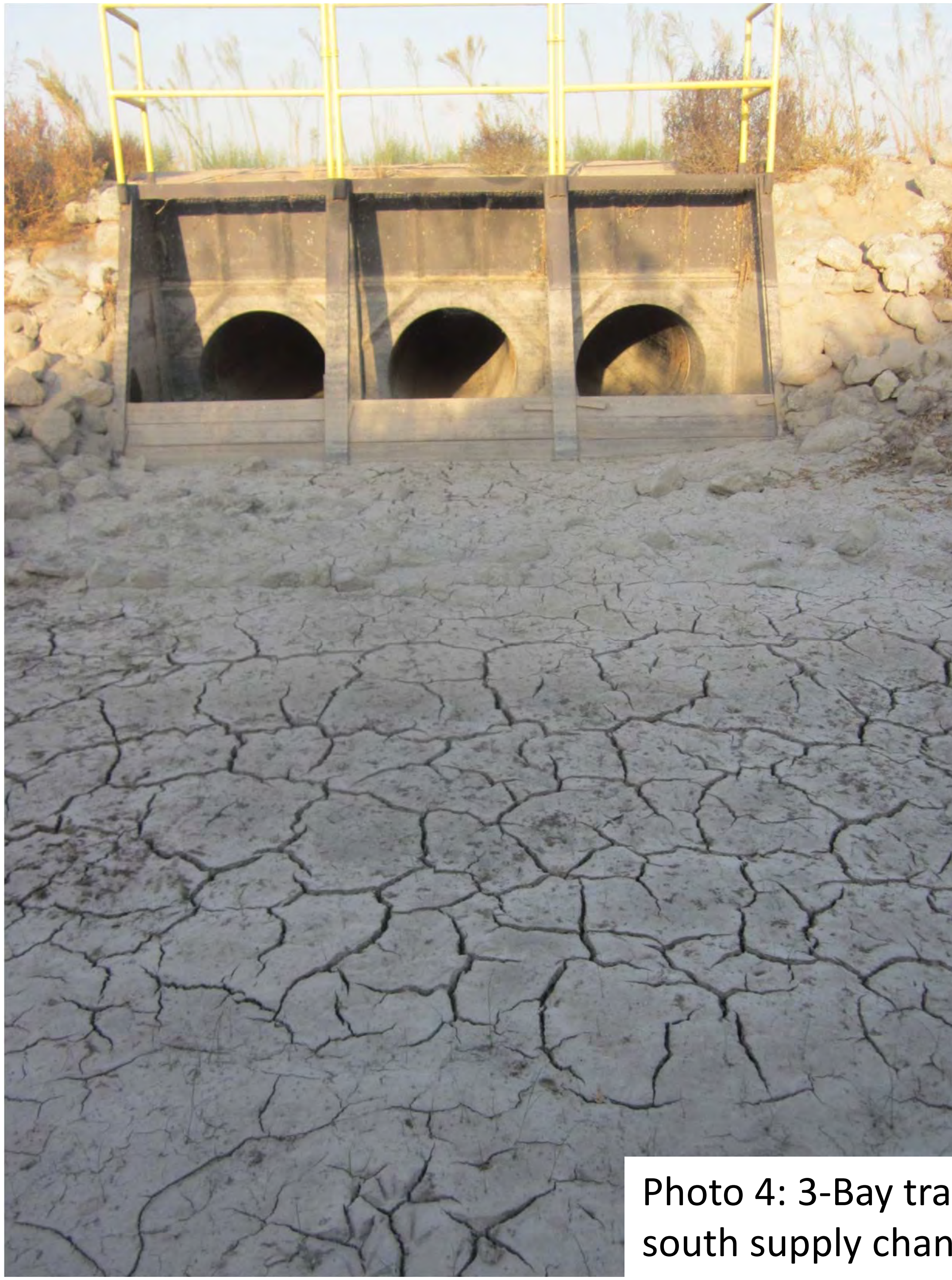

Photo 4: 3-Bay transfer structure from south supply channel to Basin No. 4

Photo 5: South supply channel sample showing thin mud-cake overlying silty sediment; mud-cracks are visible in the background

Photo 6: South supply channel sample showing thin mud-cake overlying silty sediment; mud-cracks are visible in the background

Photo 7: 5-Bay transfer structure from south supply channel to Basin No. 1; standing water with green algae

Photo 8: Green algae in stagnant water in south supply channel

Photo 9: Looking north at south supply channel

Photo 10 (36E): Basin No. 4 thin mud-cake (~0.1")
and underlying silty sediment (sample)

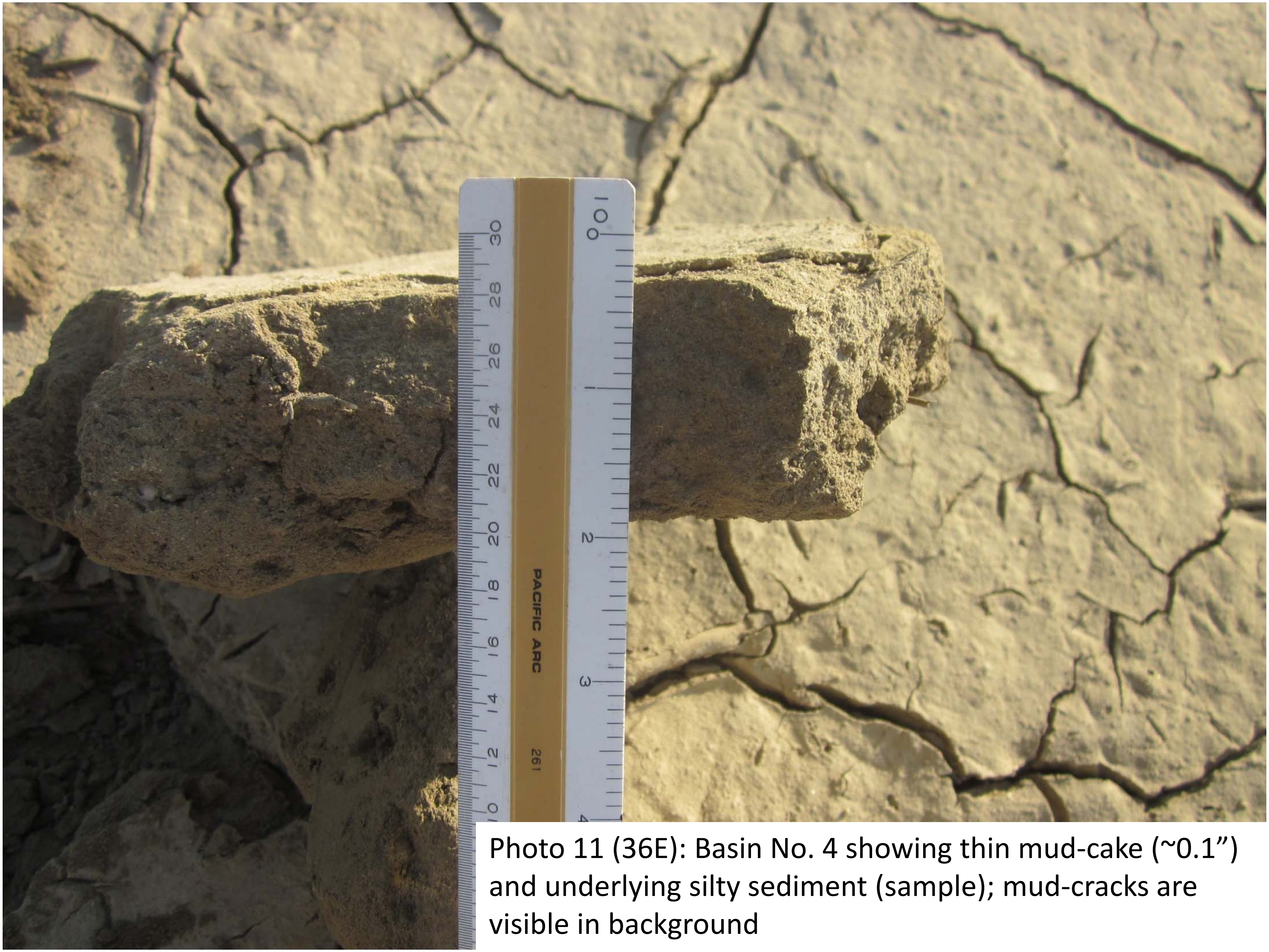

Photo 11 (36E): Basin No. 4 showing thin mud-cake (~0.1”) and underlying silty sediment (sample); mud-cracks are visible in background

Photo 12 (36E): Basin No. 4 showing thin mud-cake and underlying silty sediment (sample)

Photo 13 (36C): Basin No. 4 mud-cracks; thin ~0.1 -0.2” thick mud-cake caps silty sediment

Photo 14 (38B): Basin No. 4 north berm erosion (~2’)


Photo 15 (38B): Basin No. 4 north berm erosion (~2’)

Photo 16 (42B): 3-Bay transfer structure between south supply channel and Basin No. 4; heavy fines in outlet structures

Photo 17 (42B): Basin No. 4 mud-cracks ~2” thick with evidence for biological activity

Photo 18 (42I): 5-Bay transfer structure between south supply channel and Basin No. 1; little silt in outlet structures

Photo 19 (42I): Uneven grading in Basin No. 1 bottom; mud-cracks are visible in the depression

Photo 20 (41O): Basin No. 1 surface dimpling and mud-cracks

Photo 21 (41I): Basin No. 1 mud-cracks ~1” thick

Photo 22 (41I): Basin No. 1 mud-cracks ~1" thick; silt underlies mud-cracks

Photo 23 (39R): Basin No. 1 south berm erosion

Photo 24 (39R): Basin No. 1 south berm erosion

Photo 25 (36P): 5-Bay transfer structure between Basin No. 1 and No. 2

Photo 26 (35F): Basin 5 pit erosion from SREX-7 discharge

Photo 27 (30E): 1-Bay transfer structure
From Basin No. 5 to Basin No. 2

Photo 28 (29E): Basin No. 5 mud-cracks; thin ~0.1-0.2" thick mud-cake overlies silty sediment

Photo 29 (29E): Basin No. 5 desiccation

Photo 30 (29C) : 2-Bay transfer structure between Basin No. 5 and No. 6

Photo 31 (29B): Basin No. 5 mud-cracks and chips overlying silty sediment

Photo 32 (36E): 2-Bay transfer structure between Basin No. 4 and No. 5


Photo 33 (4A): Basin No. 20 looking southwest

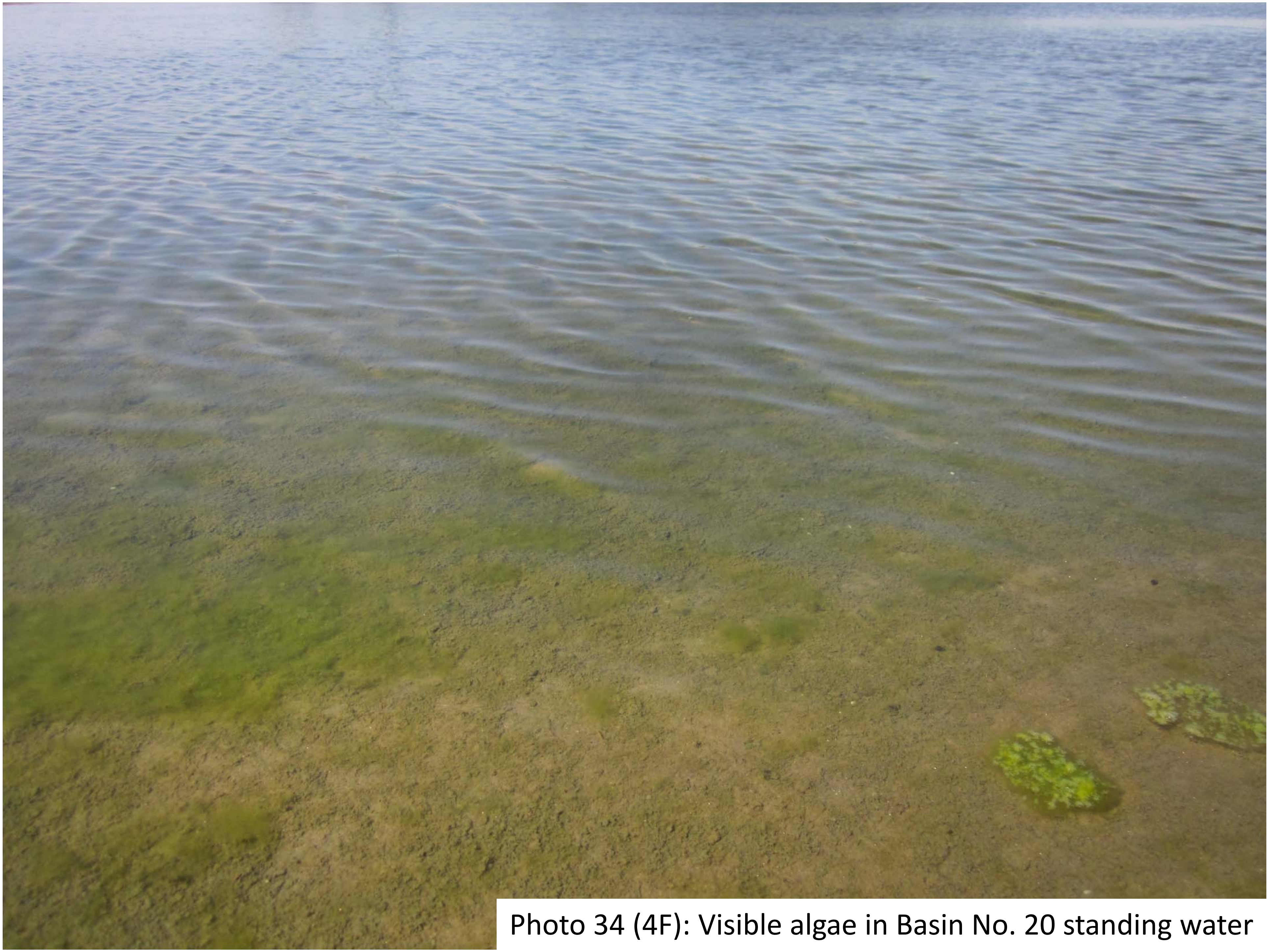

Photo 34 (4F): Visible algae in Basin No. 20 standing water

Photo 35 (5F): Old irrigated pipe filled with water in Basin No. 20; a second old pipe is barley visible to the right

Photo 36-41: Turkey vultures and cattle on KWB property

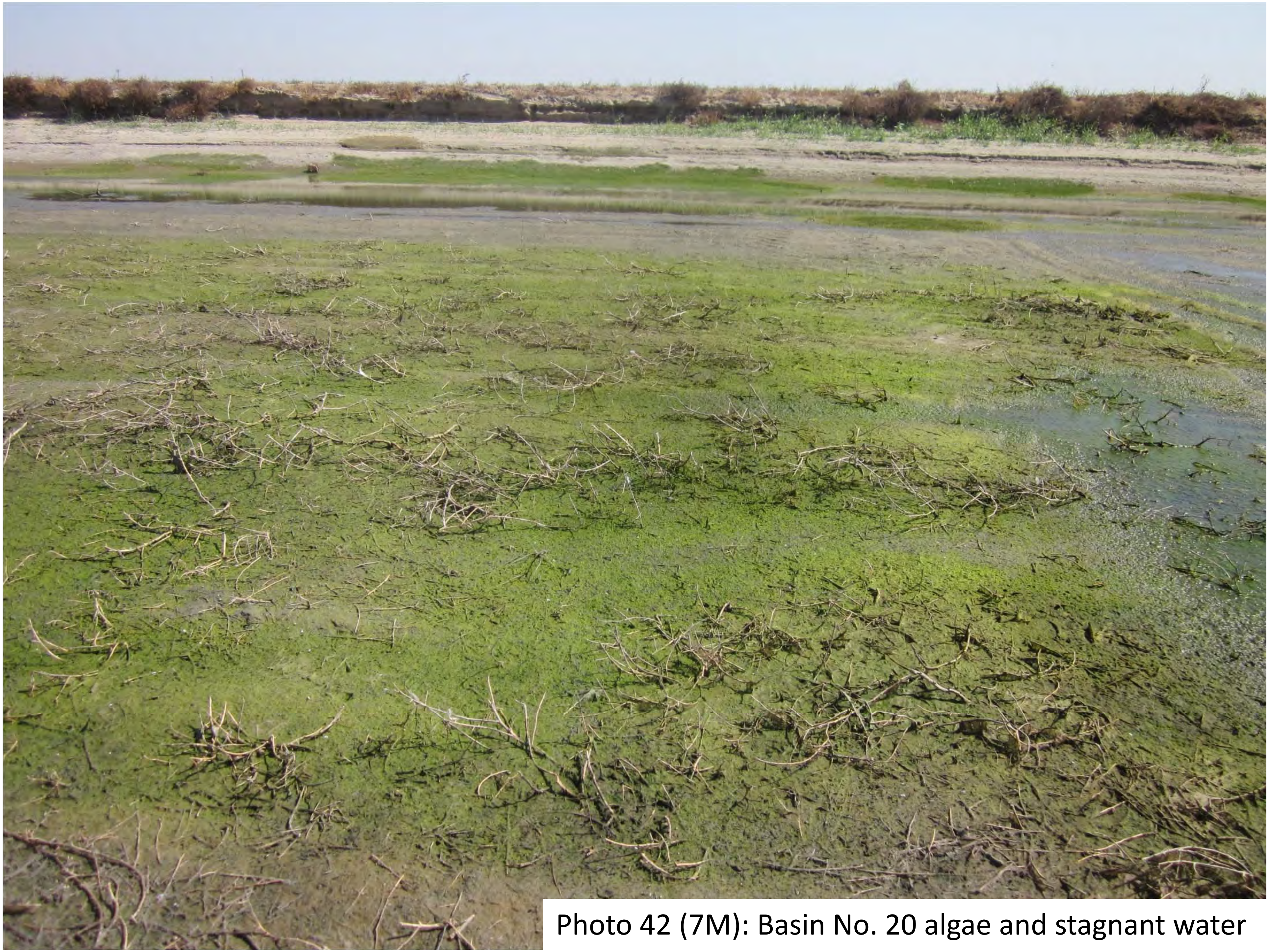

Photo 42 (7M): Basin No. 20 algae and stagnant water

Photo 43 (3O): Standing water in south-end of Basin No. 20

Photo 44 (7Q): Basin No. 20 looking northwest

Photo 45 (8Q): Basin No. 19 looking northeast

Photo 46 (8L): Basin No. 19 mud/bio-chips


Photo 47 (8L): Basin No. 19 mud/bio-chips; dragonfly for scale

Photo 48 (8G): Fish in stagnant water (heavy algae) adjacent to 1-Bay transfer structure in Basin No. 19

Photo 49 (8G): Fish in stagnant water (heavy algae) adjacent to 1-Bay transfer structure in Basin No. 19

Photo 50 (8G): 1-Bay transfer structure between Basin No. 19 and 20

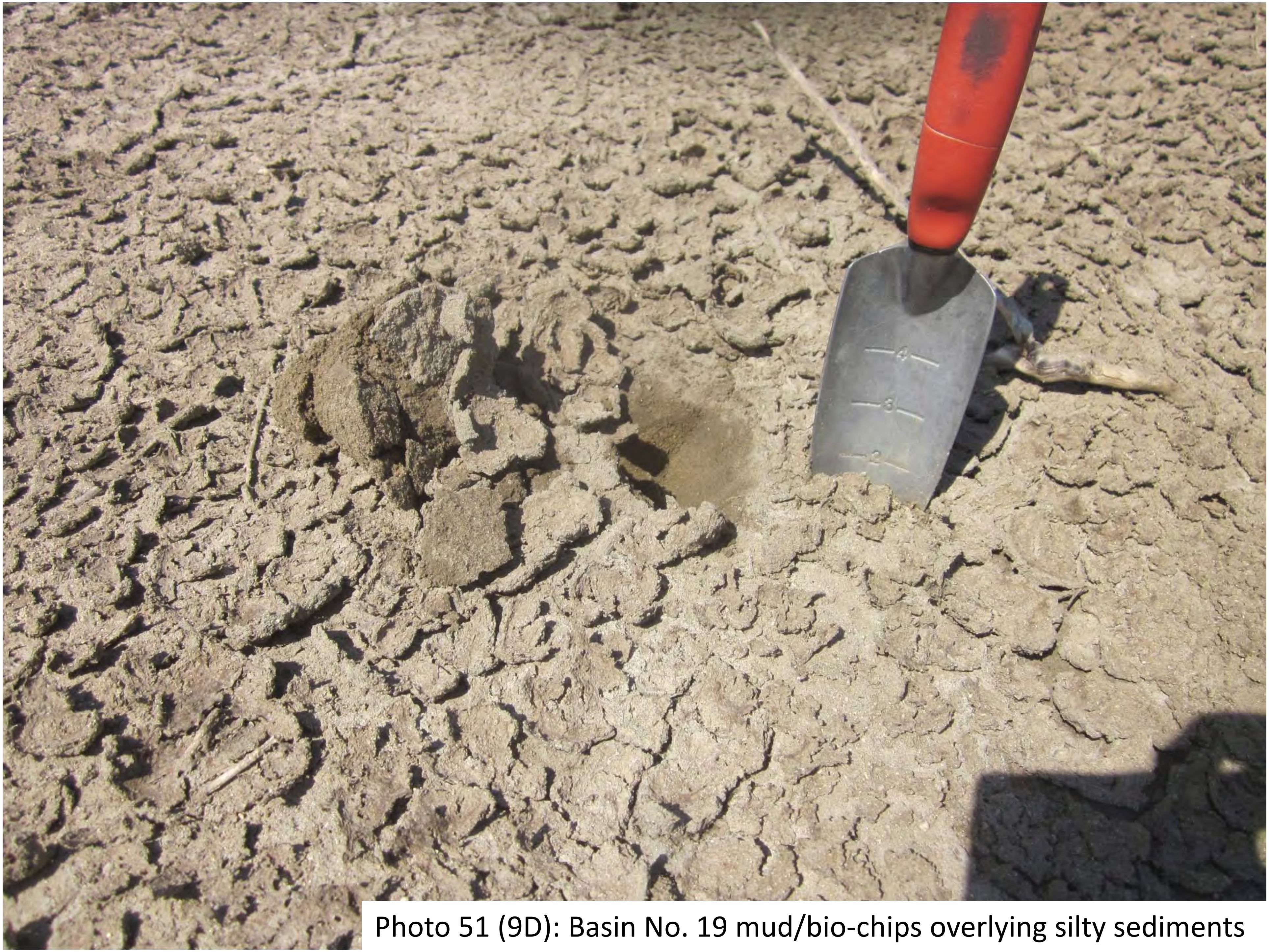

Photo 51 (9D): Basin No. 19 mud/bio-chips overlying silty sediments

Photo 52 (9B): Basin No. 19 mud/bio-chips overlying sandy-silt sediments (sample)

Photo 53 (21C): 2-Bay transfer structure between Basin No. 18 and No. 6

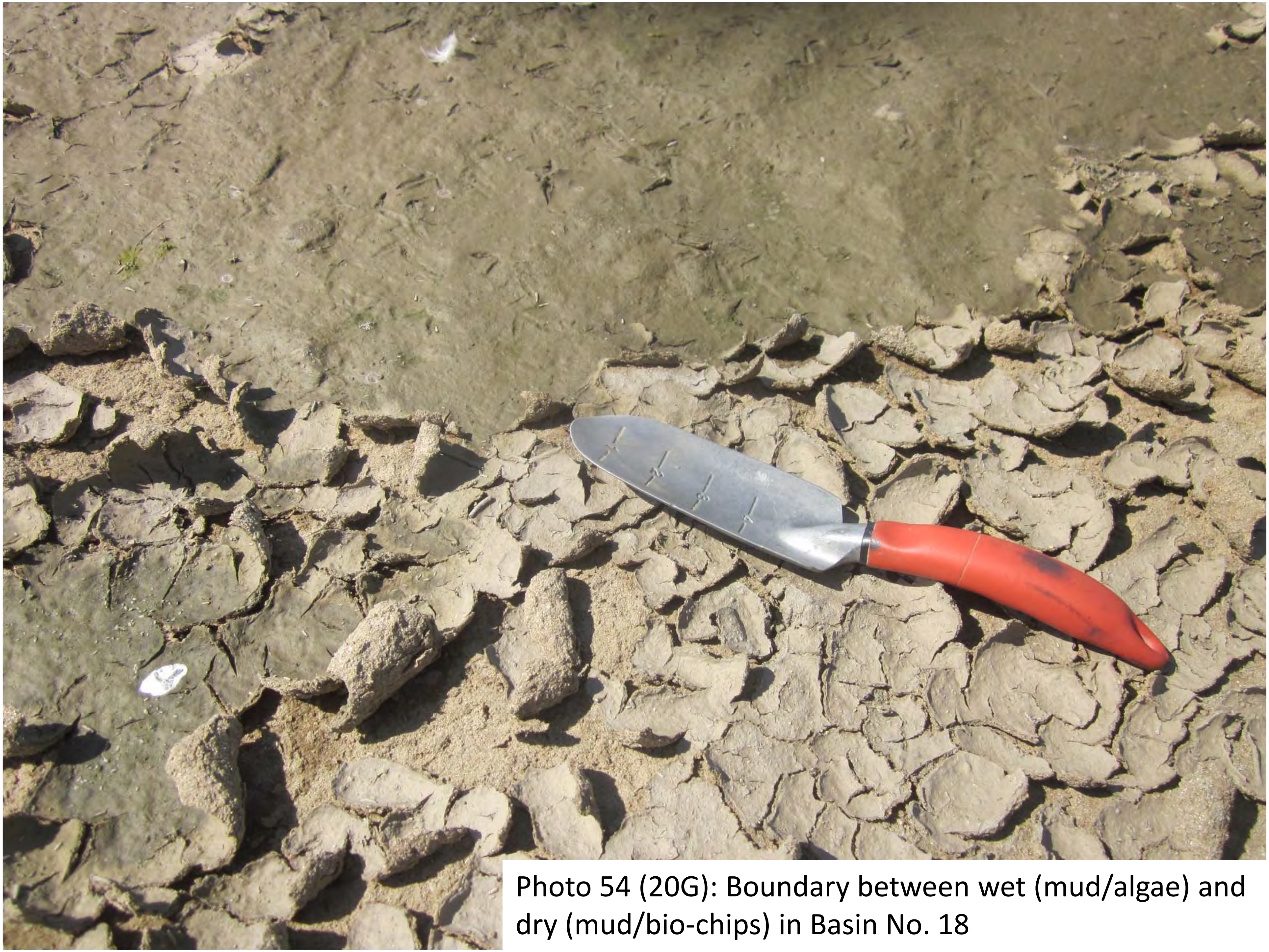

Photo 54 (20G): Boundary between wet (mud/algae) and dry (mud/bio-chips) in Basin No. 18

Photo 55 (21J): Basin No. 18 berm erosion

Photo 56 (21P): 3-Bay transfer structure from Basin 3 to 18

Photo 57 (23R): Stagnant water (heavy algae) in south end of Basin No. 3

Photo 58: Stagnant water (heavy algae) in south end of Basin No. 3

Photo 59 (22P): 3-Bay transfer structure between Basin No. 18 and No. 3; stagnant water in rip-rap with red algae and dead growth

Photo 60 (28C): 2-Bay transfer structure between Basin No. 5 and No. 6

Photo 61 (22C): 2-Bay transfer structure between Basin No. 6 and No. 18

Photo 62 (22C): Basin No. 6 mud-cracks (sample)

Photo 63 (22C): Basin No. 6 mud-cracks

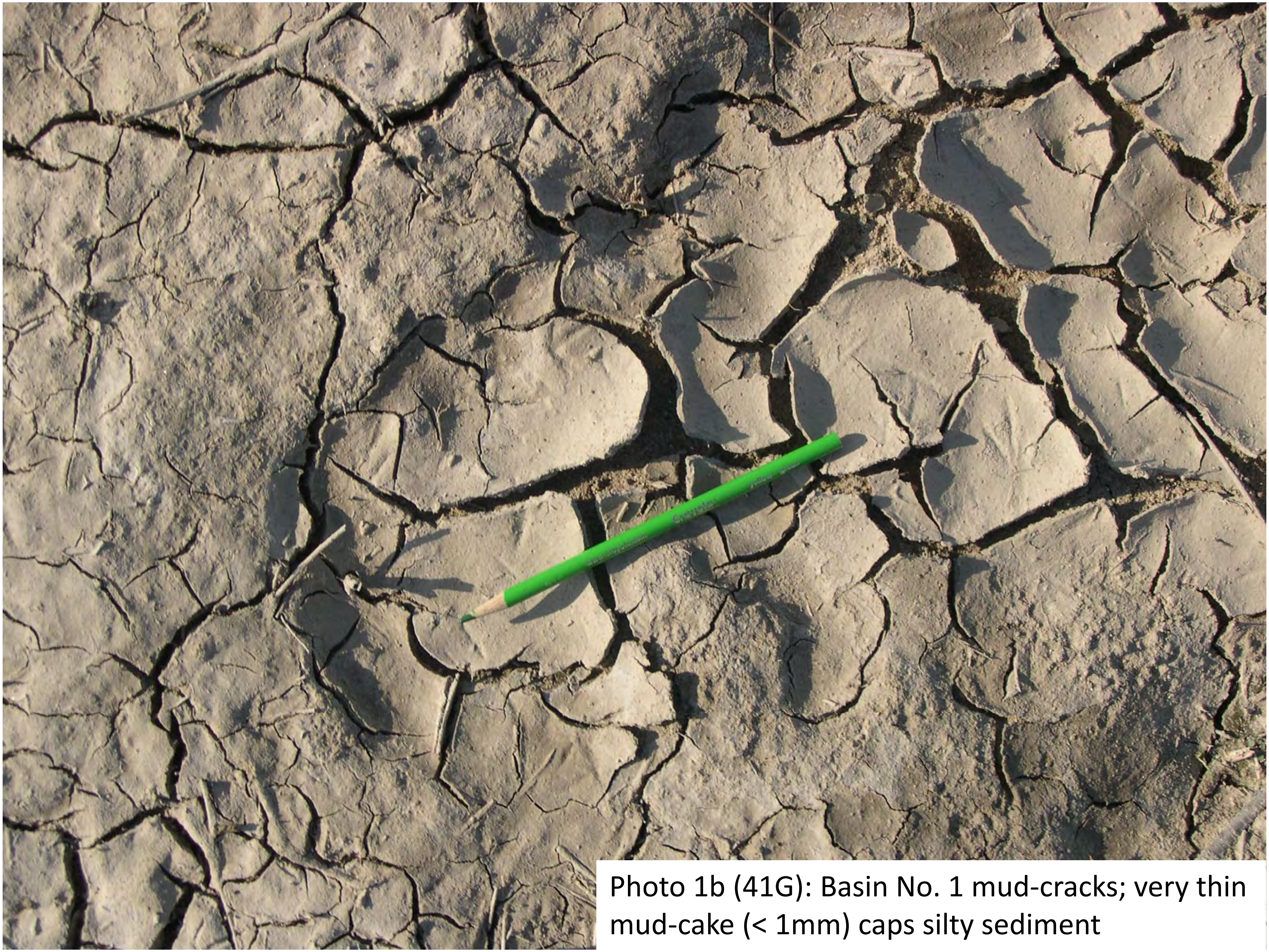

Photo 1b (41G): Basin No. 1 mud-cracks; very thin mud-cake (< 1mm) caps silty sediment

Photo 2b (39G): Basin No. 1 north berm erosion; soft silt slopes to basin bottom

Photo 3b (39G): Basin No. 1 north berm erosion looking east

Photo 4b (39G): Basin No. 1 north berm erosion looking west

Photo 5b (36G): Basin No. 1 mud-cracks and chips ~1 cm thick; mud-cake ~2 mm thick caps silty sediment (sample)

Photo 6b (36H): Basin No. 1 mud-cracks ~2-10 cm in length and ~2-5 cm thick; thin mud-cake ~1-2 mm thick caps sandy silt sediment

Photo 7b (36N): Basin No. 1 mud-cracks; thin mud-cake ~5 mm thick caps silty sediment; shallow soil shows evidence of biological activity

Photo 8b (36O): Basin No. 1 very thin mud-cake (<1 mm thick) caps silty sediment

Photo 9b (36O): Minor mud-cracking in southwest section of Basin No. 1

Photo 10b (36P): 5-Bay transfer structure between Basin No. 1 and No. 2; stagnant water with green algae in rip-rap

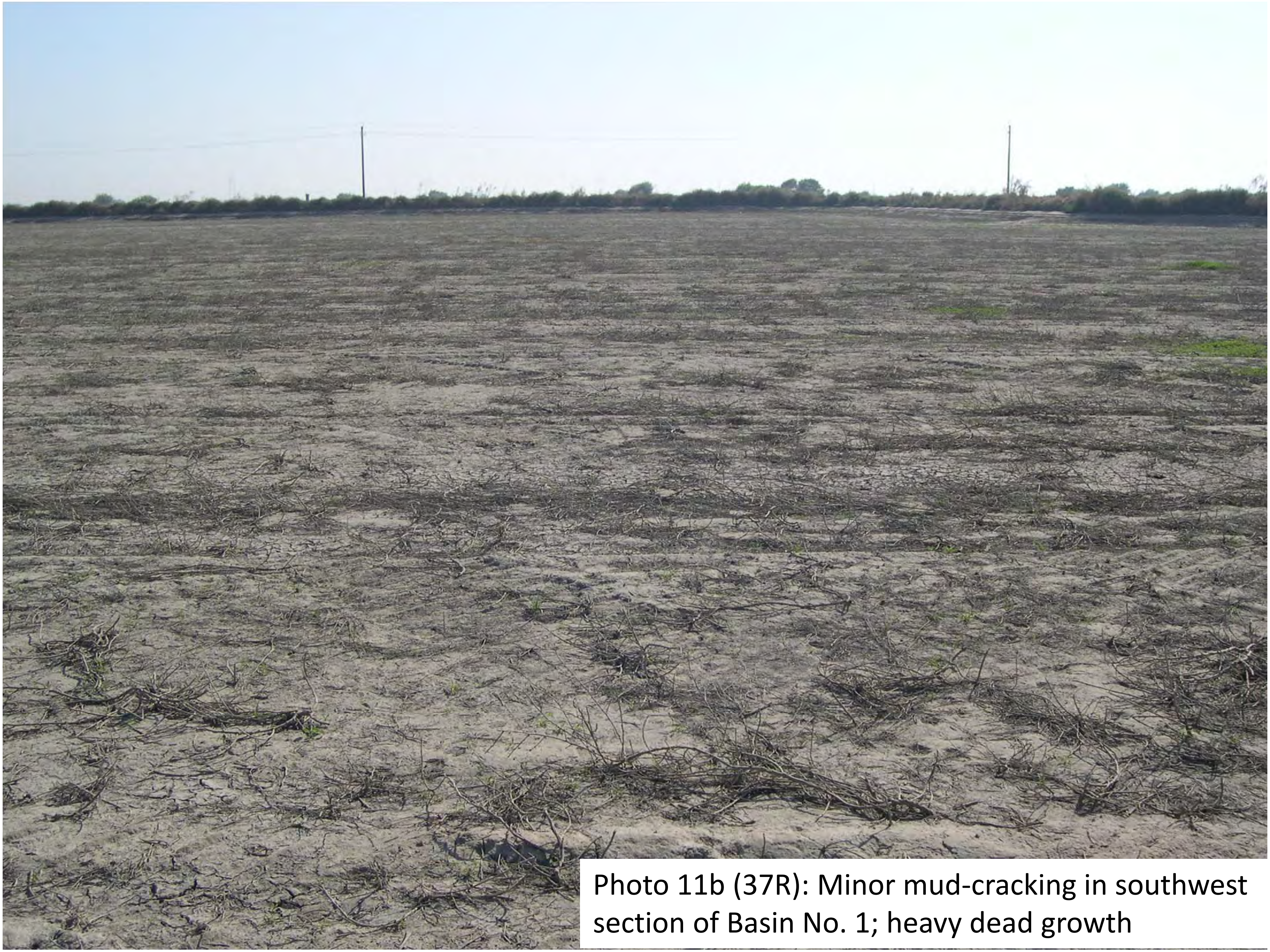

Photo 11b (37R): Minor mud-cracking in southwest section of Basin No. 1; heavy dead growth

Photo 12b (37R): Thin mud-cake ~0.5 mm thick caps silty sediment in Basin No. 1

Photo 13b (35F): Basin No. 2 mud-cracks ~10 cm in length and ~2-5 cm thick

Photo 14b (31G): Basin No. 2 boundary between dry silt and green algal (sample)

Photo 15b (31G): Basin No. 2 algal mat
with round algal features

Photo 16b (30G): 1-Bay transfer structure between Basin No. 2 and No. 5

Photo 17b (29G): 4-Bay transfer structure between Basin No. 2 and No. 1; stagnant water with green algae in rip-rap

Photo 18b (29G): 4-Bay transfer structure between Basin No. 2 and No. 1; stagnant water with green algae in rip-rap

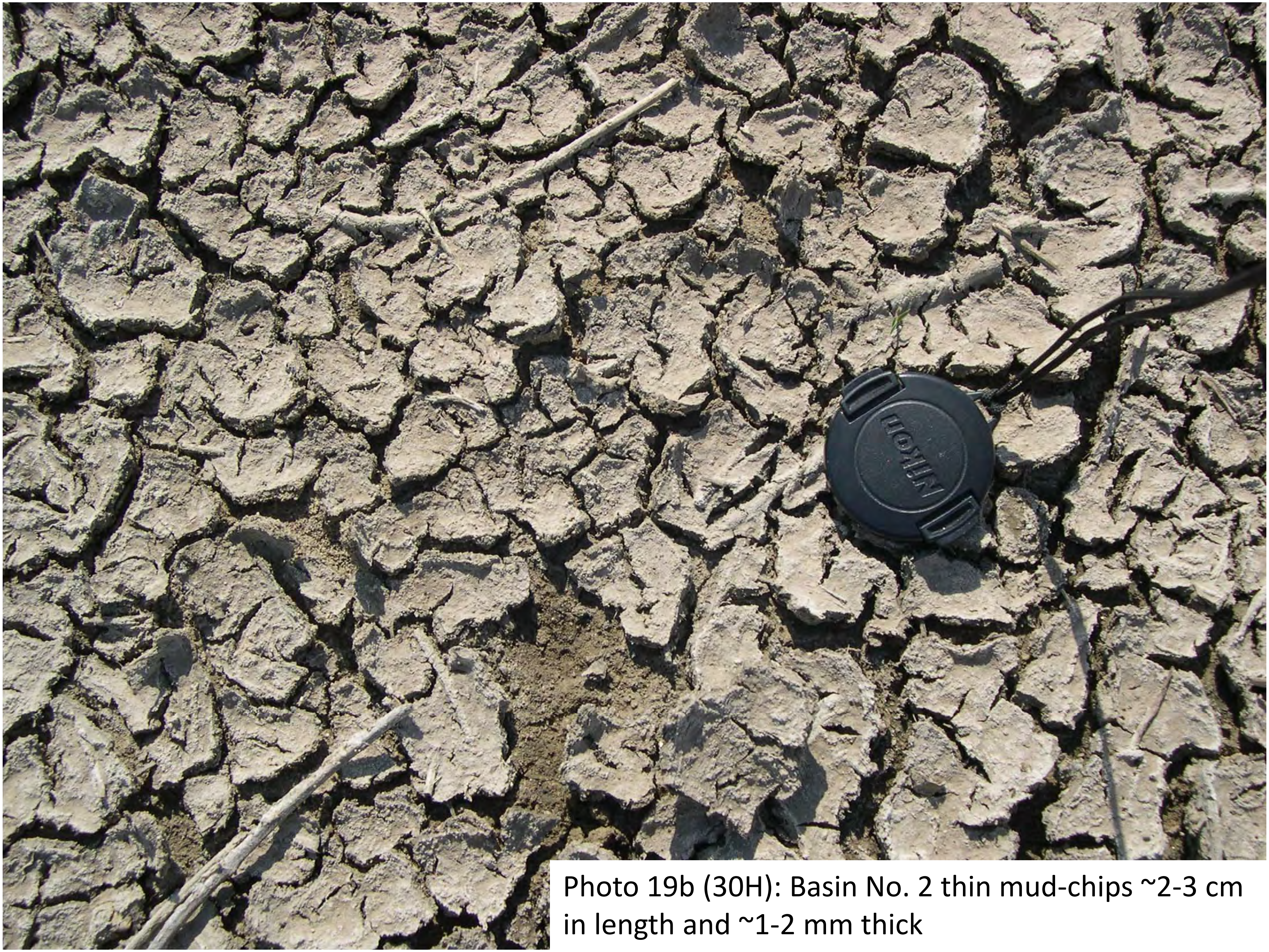

Photo 19b (30H): Basin No. 2 thin mud-chips ~2-3 cm in length and ~1-2 mm thick

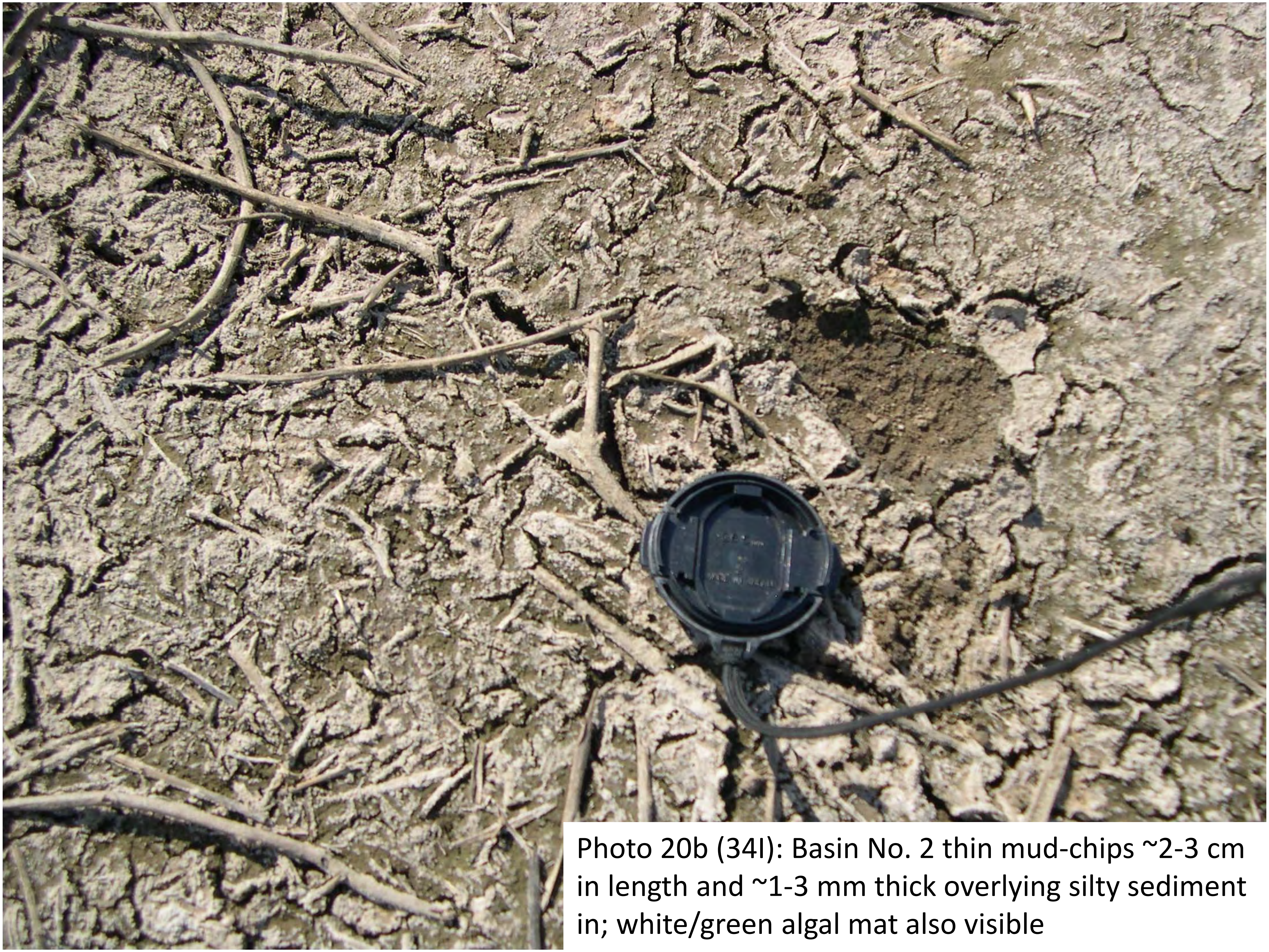

Photo 20b (34I): Basin No. 2 thin mud-chips ~2-3 cm in length and ~1-3 mm thick overlying silty sediment in; white/green algal mat also visible

Photo 21b (35K): Basin No. 2 heavy dead growth

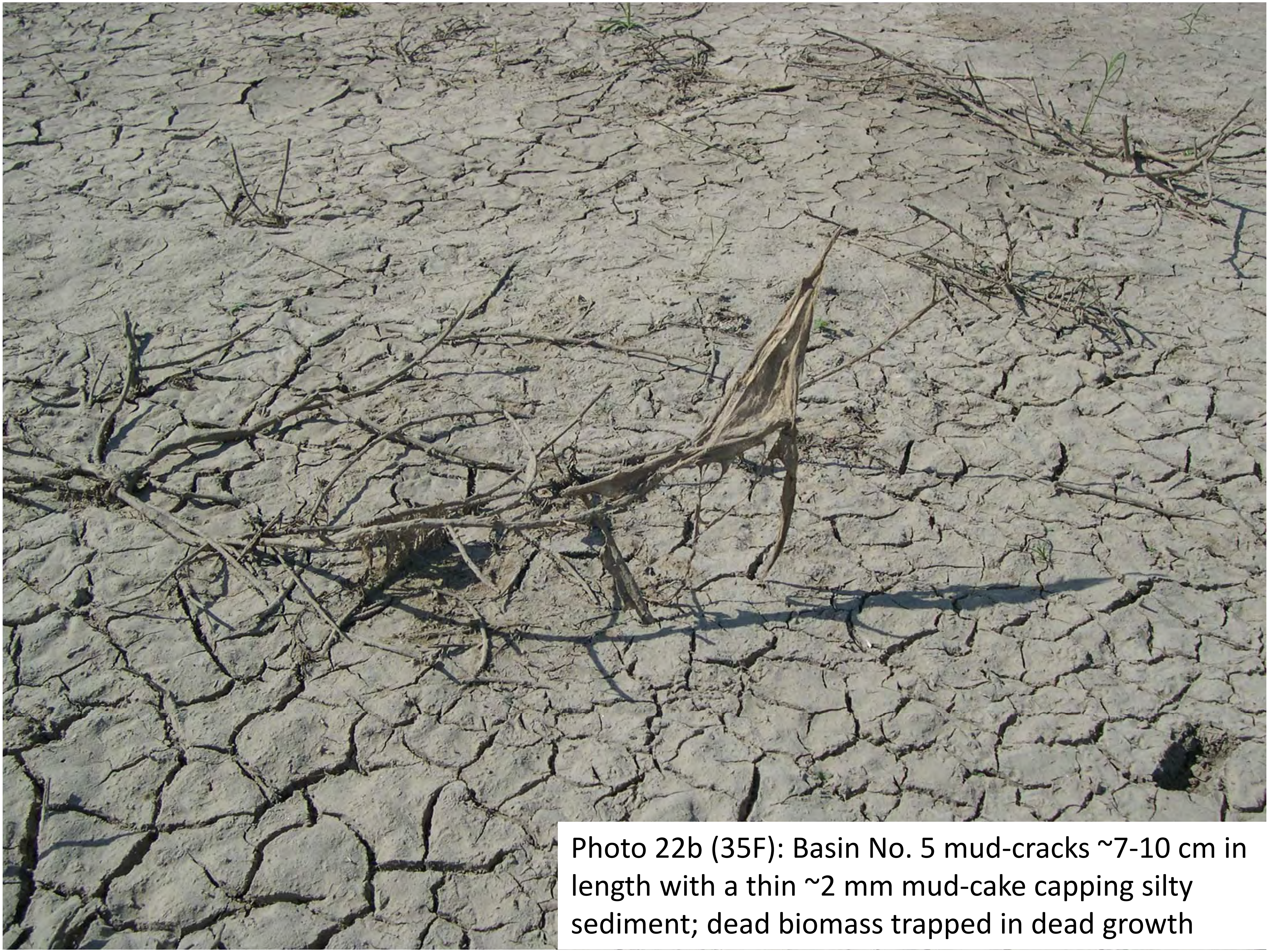

Photo 22b (35F): Basin No. 5 mud-cracks ~7-10 cm in length with a thin ~2 mm mud-cake capping silty sediment; dead biomass trapped in dead growth

Photo 23b (36E): 2-Bay transfer structure between Basin No. 5 and No. 4; wash-out adjacent to rip-rap

Photo 24b (36E): 2-Bay transfer structure between Basin No. 5 and No. 4; wash-out adjacent to rip-rap

Photo 25b (35E): 2-Bay transfer structure between Basin No. 5 and No. 4; wash-out adjacent to rip-rap

Photo 26b (36C): Basin No. 5 east berm erosion; soft silt slopes to basin bottom

Photo 27b (35B): Basin No. 5 minor mud-cracks in small depressions

Photo 28b (7A): Basin No. 20 dark brown mud/bio-chips ~2-5 cm in length and ~1 mm thick overlying sandy silt sediment; white-green algal mat also visible

Photo 29b (7D): Basin No. 20 dead biomass (algae) mat covering sandy silt sediments

Photo 30b (7G): 1-Bay transfer structure between Basin No. 20 and No. 19; stagnant water in rip-rap with algae growth

Photo 31b (7G): 1-Bay transfer structure between Basin No. 20 and No. 19; wash-outs adjacent to rip-rap; small patches of grass growth visible

Photo 32b (7H): Basin No. 20 east berm erosion

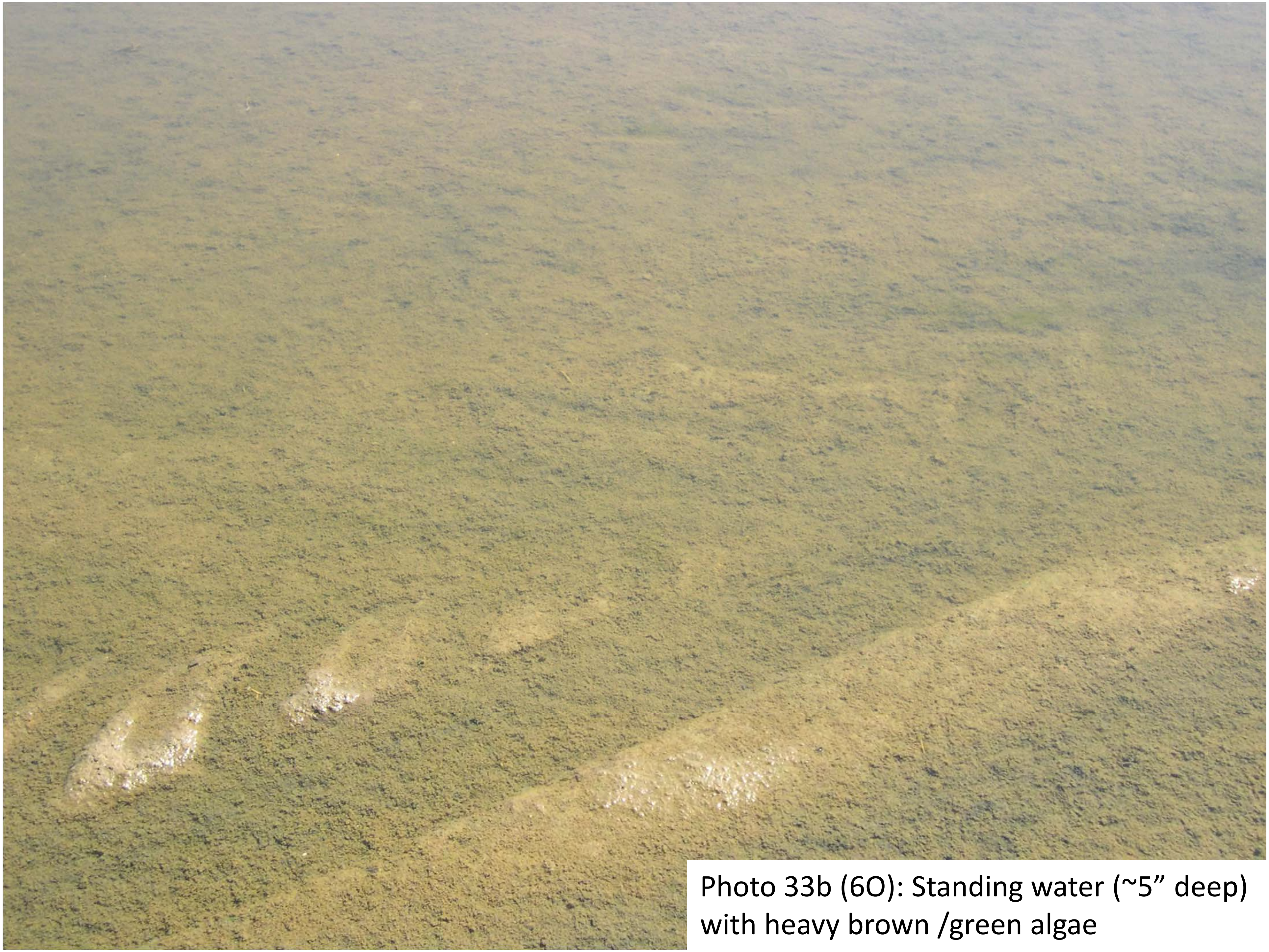

Photo 33b (6O): Standing water (~5” deep) with heavy brown /green algae

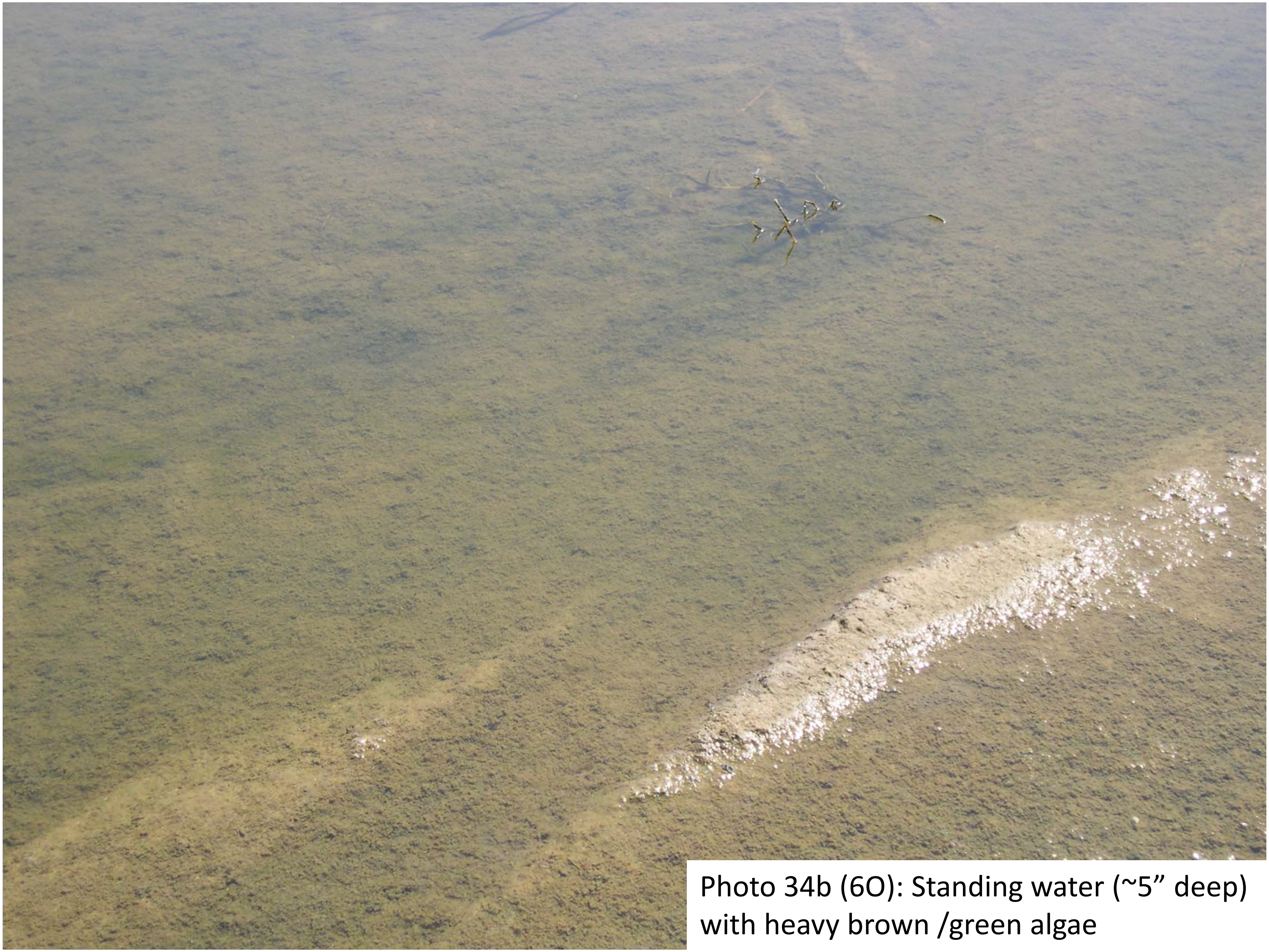

Photo 34b (6O): Standing water (~5” deep) with heavy brown /green algae

Photo 35b (5O): Very thin bright green algal mat and dead growth covering sandy silt sediment

Photo 36b (5P): Standing water and wildlife in southwest section of Basin No. 20

Photo 37b (5N): Brown/green algae covering dark brown-black anoxic material

Photo 38b (10A): Basin No. 19 mud/bio-chips ~2-5 cm in length and ~1-4 mm thick overlying sandy silt sediment

Photo 39b (14E): 2-Bay transfer structure between Basin No. 19 and No. 18; wash-out adjacent to rip-rap with stagnant water and algae

Photo 40b (14E): 2-Bay transfer structure between Basin No. 19 and No. 18; stagnant water and algae in rip-rap

Photo 41b (12E): Basin No. 19 mud/bio-chips ~2-5 cm in length and ~2-3 mm thick overlying sandy silt sediment

Photo 42b (13P): Basin No. 19 mud/bio-chips ~2-5 cm in length and ~2-3 mm thick overlying sandy sediment (sample)

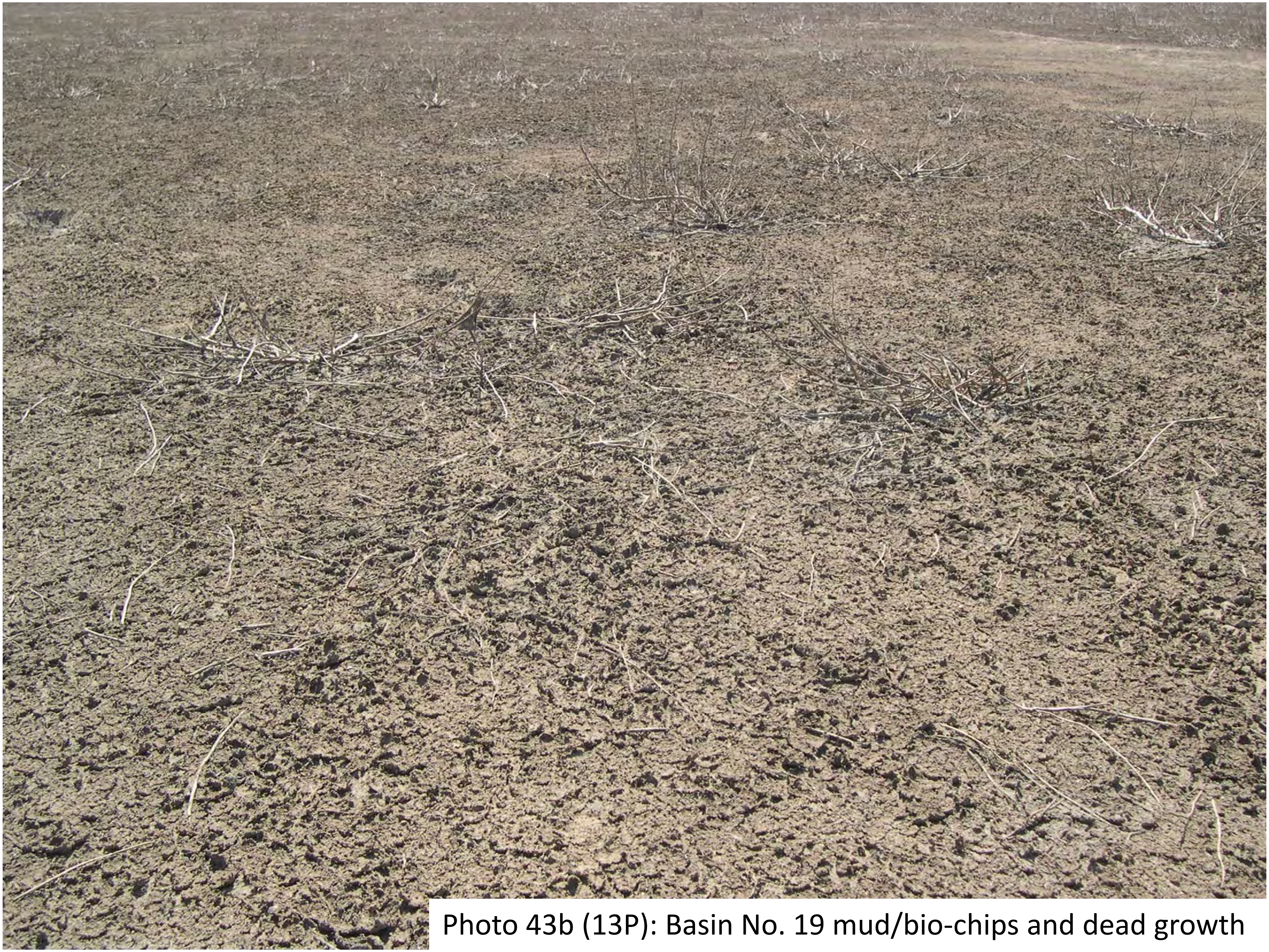

Photo 43b (13P): Basin No. 19 mud/bio-chips and dead growth

Photo 44b (14P): Basin No. 19 white-green biomass (algae) covers moist dark brown silt

Photo 45b (15H): Basin No. 1 mud/bio-chips ~2-3 cm in length and 1-2 mm thick overlying sandy silt sediment

Photo 46b (21B): Basin No. 18 round algal features

Photo 47b (19B): Basin No. 18 mud-chips ~5-7 cm in length and ~1 mm thick mud-cake caps silty sediment; entire chip is ~5 mm thick and overlies sandy silt sediment


Photo 48b (19B): 1-Bay transfer structure between Basin No. 18 and slough area; stagnant water with brown and green algae in rip-rap; green algae mat covers sediment adjacent to rip-rap


Photo 49b (15D): Turkey vulture

Photo 50b (15F): 2-Bay transfer structure between Basin No. 18 and No. 19; sediment covers part of rip-rap and outlet structure; green algae mat covers sediment adjacent to rip-rap; west berm erosion

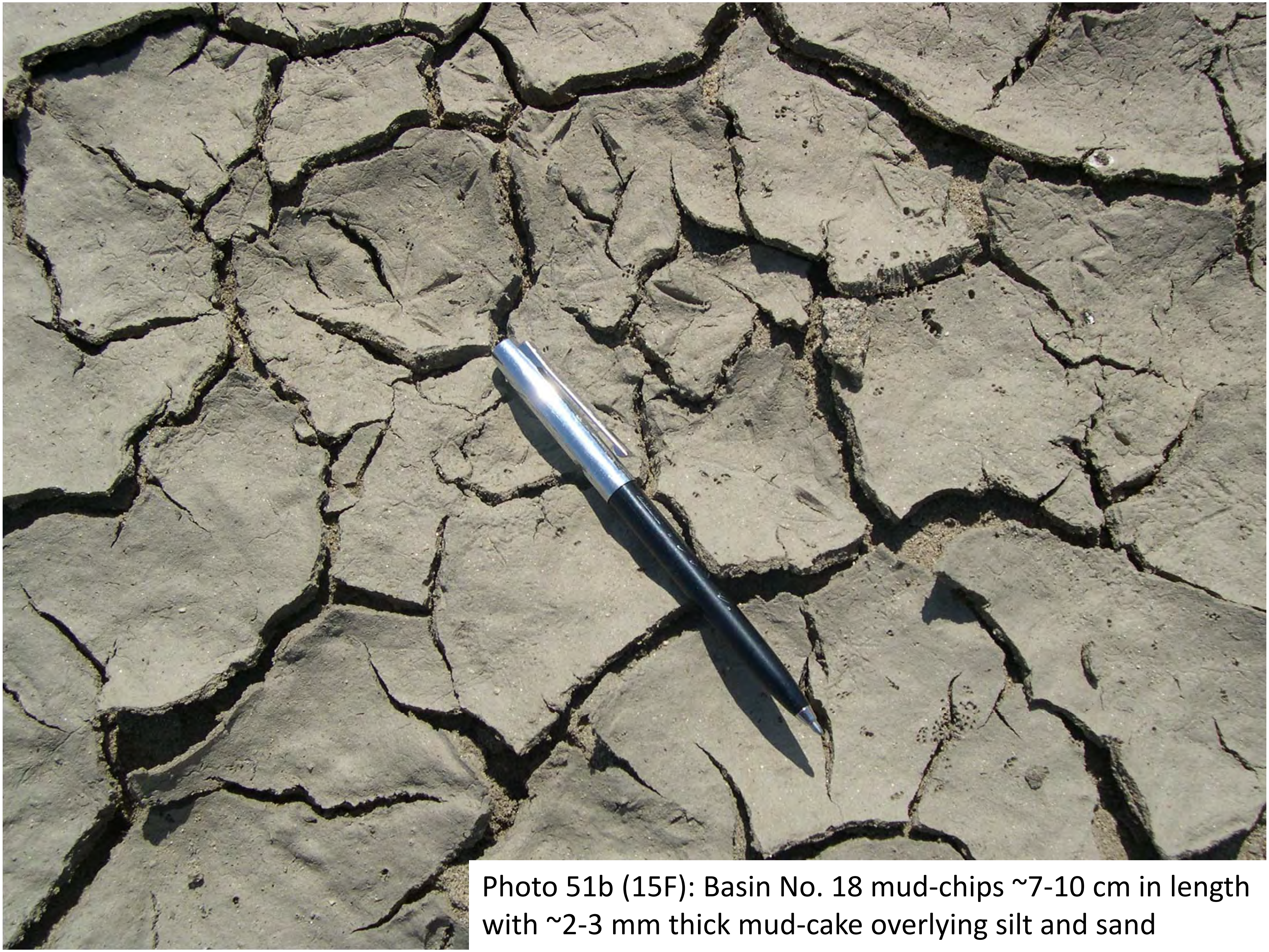

Photo 51b (15F): Basin No. 18 mud-chips ~7-10 cm in length with ~2-3 mm thick mud-cake overlying silt and sand

Photo 52b (17O): Basin No. 18 moist sandy silt capped with thin ~1-2 mm thick mud-cake; minor mud-chips

Photo 53b (17O): Basin No. 18 minor mud-chipping in depressions; dead growth

Photo 54b (17M): Basin No. 18 minor mud-chips; algae mats surrounding dead growth

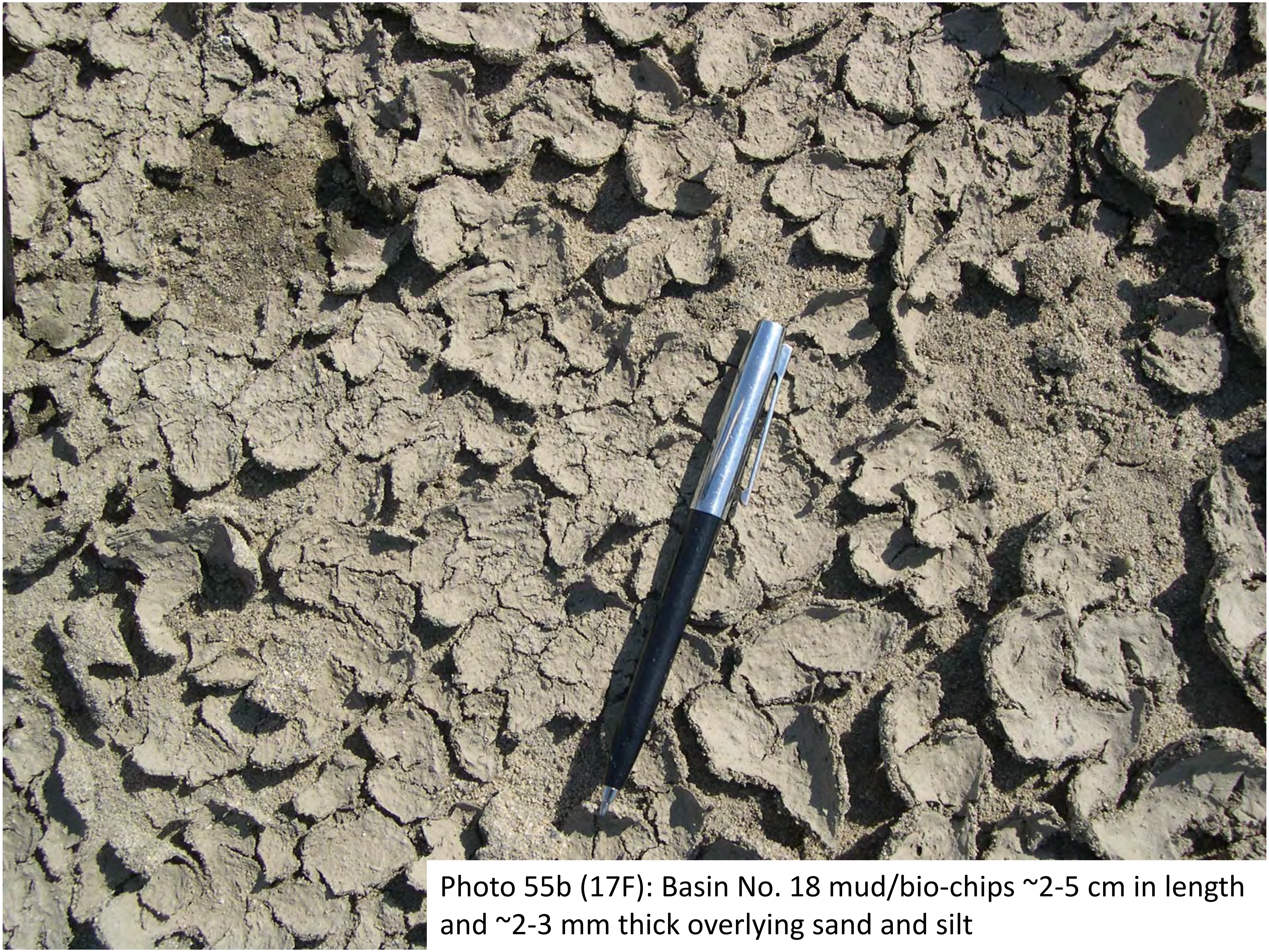

Photo 55b (17F): Basin No. 18 mud/bio-chips ~2-5 cm in length and ~2-3 mm thick overlying sand and silt

Photo 56b (22F): Basin No. 3 mud-cracks ~5 cm in length with ~1-2 mm thick mud-cake; entire mud-crack ~5 mm thick

Photo 57b (23E): 1-Bay transfer structure between Basin No. 6 and No. 3; stagnant water with algae in rip-rap; small wash-out adjacent to rip-rap

Photo 58b (28G): 4-Bay transfer structure between Basin No. 3 and No. 2; stagnant water with algae in rip-rap; small; some algal mats adjacent to rip-rap

Photo 59b (25J): Basin No. 3 very thin mud/bio-chips <1 mm thick

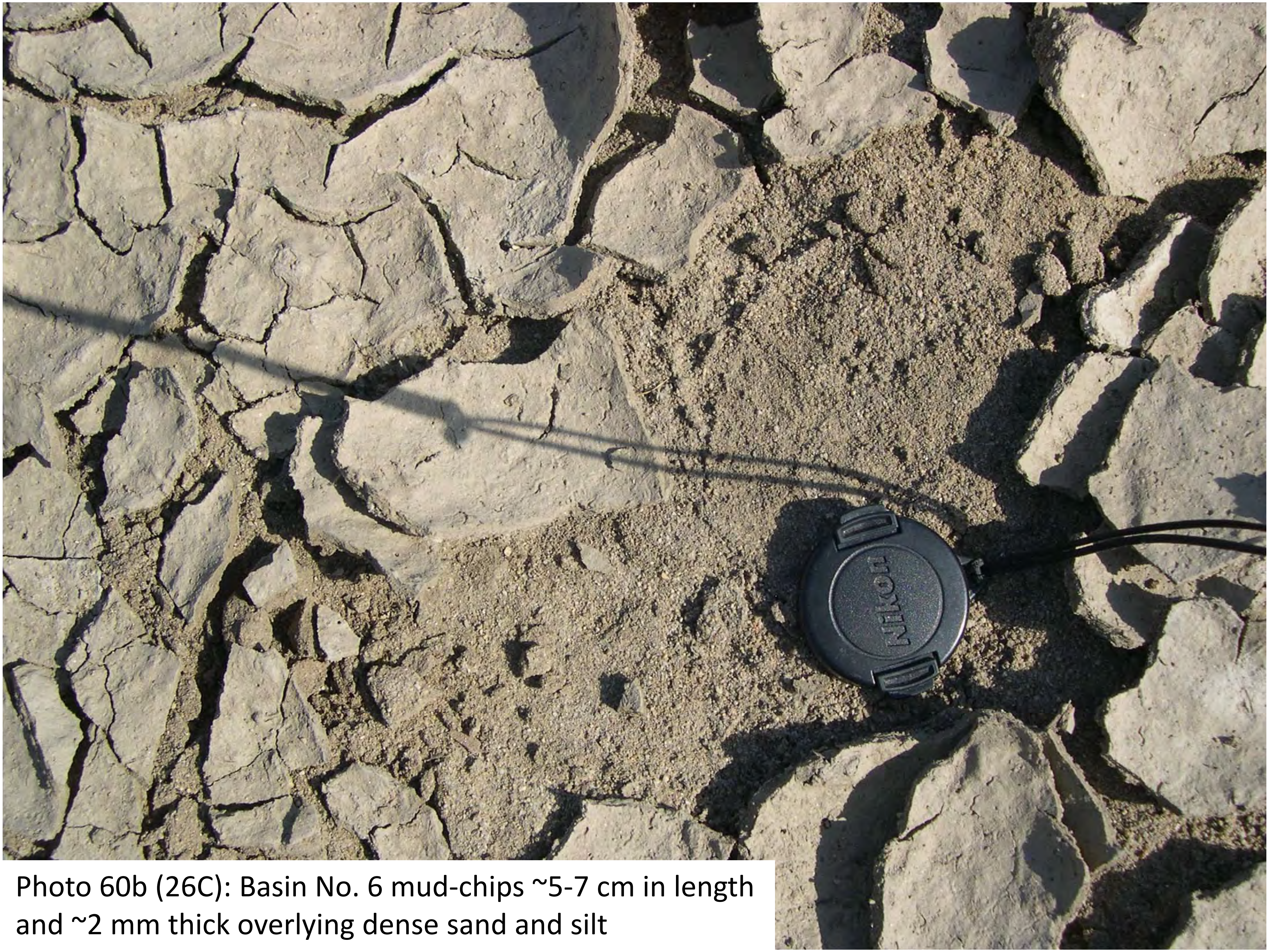

Photo 60b (26C): Basin No. 6 mud-chips ~5-7 cm in length and ~2 mm thick overlying dense sand and silt

Photo 61b (26B): Basin No. 6 mud-cracks ~12-17 cm in length with ~2-3 mm thick mud-cake capping silt; mud-cracks are underlain by hard sand and silt (sample)

Photo 62b (23E): 1-Bay transfer structure between Basin No. 6 and No. 3; stagnant water with green algae in rip-rap