Middle and Outer Reef Impact assessment notes

Each site visited has data sheets and photos that add information to the below.

**April 25, 2015**

Conducted site surveys at southern controls on outer reef. Also collected five quads of substrate at site.

R3SC3

Green turfs visible across site. Sediment trapped in turfs. Sediment was coarse with a small fraction o fines. Overall a coarse sediment matrix. Lyngbya present.

R3SC2

Green and brown turfs visible through sediment. Sediment was coarse. Juvenile octocorals noted. Lyngbya present.

R3SC1

This site has more sand overall than either 2 or 3, a function of habitat type. Also, fist size rubble (paleo Acropora) was present across site. Turfs were evident and binding sediment. Sediment was coarse, some fines were detected, but overall sediment is coarse.

R3S3

Turf algae apparent through sediment, turf shorter channel side, when compared to controls (<1 cm). Sediment coarse at site, with fines. Fine feel to sediment compared to controls.

R3S2

Turf apparent through sediment, turf shorter than control. Some fine finger feel to sediment.

**April 26, 2015**

R3S1

Turfs visible through sediment, sediment coarse. No fines noted. Coral recruits evident channel side. Channel right on the edge of this site. No impact.

R3S2 – 200 m line

200m line laid from channel side in a southward direction. Photos collected every 10m on either side of the line. Coral data collected along line within 1 m of the line (1/2 meter on each side). Visibility was 50-75 feet. Recruits and corals less than 5cm in size were abundant. 10m south of the channel octocoral density increases and many Xestos were present. No impact.

R3S1 – 200m line

200 m line laid from channel side in a south direction.Coral recruits, turf algae immediately evident. Went to 35 m distance. Lots of Halimeda. No impact.

R3NC1

Brown and green turf algae evident, Dictyota, lots of turf – looks like spring. Saw no coral recruits. Halimeda.

R3N1 White sediment on bottom, very few turfs coming through, although there is texture to the sediment – so turfs are underneath it. No macroalgae, cyanobacteria on bottom. No coral recruits evident. Some Lyngbya.

**April 27, 2015**

R3N2-500

Turf algae with sediment coming through. Very few corals. Pockets of silty material in low areas, on the lee of slopes, but mostly coarse sand.

Hypack 10:48:15 – north edge of anchorage

Turfs evident. No sign of impact. Sediment coarse, no partial mortality noted.

R3N2- 250

No sediment pockets with dredge material, sediment depth was greater than R3N2-500. Sediment texture was silty, but turfs coming through.

R3N2-150

Sand was coarse, but this is first location where M. cavernosas had signs of partial mortality consistent with sediment stress as documented at channel side sites. Sand was coarse with pockets of silty material. This site is lower in relief than 250 or 500.

R3N2-50

In low relief areas, partial mortality consistent with sediment impact. Found pockets of clay like material.

Storms blew through the area between April 27 and May 11.

**May 11, 2015**

R2NC2 – 24 feet.

Visibility was 15 feet (low). The site looked sandy – from storms? Crustose reds, Dictyota, coral recruits, and turfs visible. Sediment was mostly coarse. Less than ½ cm generally, except for pockets which were 2-3 cm.

R2NC2-2.5 miles

Low relief hardbottom with many octocorals in a range of sizes, small to very large (greater than 1m). Low hard coral cover. Sediment was coarse, cyanobacteria bloom – white fluffy cyano on macroalgae. Lots of macroalgae - reds, browns, greens, turf evident. Less than ½ cm of sediment in general. No signs of impact.

R2N1-1000

Sand. No hardbottom habitat.

R2N1-950 Sediment was coarse with some silty constituents. Sediment depth was ½ cm to 1 cm in depth. Habitat was low relief hardbottom – low hard coral cover, abundant octocorals, No macroalgae. Sediment bound by turfs. Octocoral recruits and sponges present. S. sid and M. cav present with disease (WP). No coral mortality consistent with sediment stress. Area of effect? Not area of impact?

R2NC2 – 3.5 miles -28 feet in depth.

Silty fine material bound by cushion of green turf algae. Octocorals in a range of sizes present. Lots of hard corals. No signs of marginal partial mortality. Sediment depth was ¼-1/2cm in depth. Sand pockets were coarse. 1-2 m relief overall. A cervicornis photographed, healthy.

R2N1-750

Silty sediment over everything. Some turfs, but no green turfs. Corals greater than 10cm were M. cav and S. sid. Some recruits in low areas, near sand. Octocorals of all sizes present. A. cervicornis present and healthy. One colony with partial mortality, but it was in a hole.

**May 12, 2015 – weather day. First day DEP was there.**

**May 13, 2015**

**R3S-50 29-33 feet**

29-33 feet depth water. Turf binding sediment. Mix of coarse and fine sand. Octocorals and sponges dominant. Hard corals more rare. Recruits evident – S. sid, S. rad, M. cav. Quantitative site surveys.

**R3S-150**

Similar to R3S-50. Turfs were more apparent. Macroalgae present. Visibility was low. Quantitative site surveys.

R3S2 – no notes. DEP dove with Alex and Martine.

**May 14, 2015**

**R3N-150** 9:30am. 37-42 feet.

Spur and groove, sand in grooves. Sediment fine and coarse mix. Sediment in grooves on lee side of spur was silty. Small silty pockets visible. Quantitative site surveys.

**R3N-250**

Turfs visible. Influence of micro-environment on corals –corals in pockets or holes, affected by something in the distant past so that partial mortality along bottom edge is encrusted with red calcareous algae. Longer dead than partial mortality associated with sedimentation stress.

**R2N1-650** bounce dive with DEP

Visibility was very low (7 feet). Silty clay like material visible at surface brown/gray in color. Turfs not apparent. Multiple pockets of sand. Sand that was coarse. Bottom was freshly buried. Lots of partial mortality attributed to disease.

May 15 – marine warning – high winds.

May 16 – high winds in forecast, no field work

May 17 – high winds in forecast no field work

May 18 – no field work.

**May 19, 2015**

**R2NC1 site surveys**

Low visibility 5-10 feet. Sand coarse. Some turfs, lots of buried margins (storms over weekend?). Sediment depth <1/2 cm.

**R2NC2 site surveys**

Sediment less than 0.25cm. Turfs were previously abundant at this site, but were not present on this visit. Many coral margins were covered. PBURs everywhere. Dictyota, some Halimeda. Mostly coarse sediment, some fines present.

**R2N1 site surveys**

Octocorals and sponges visible. Sand fine, but coarse, No silty feeling material. ½ cm to 1cm in depth across site. 50 foot visibility. Investigated known partial mortality on living corals. Partial mortality due to sediment stress were covered in turf algae, which had bound sediment on it. When rub away, the skeleton is still visible and texturally evident, not eroded, still white. No calcareous algae on mortality this age. NOAA divers shadowed the team.

**R2N2 site surveys**

More silty material present compared to R2N1. Sediment depth was ½ to 1cm in depth. Pockets of sediment were deeper. Octocorals and sponges looked good. Sediment on turfs obscuring turfs. Some texture coming through from turfs, but color was whitish. Excellent visibility 50 feet – NOAA divers shadowed us.

**R2SC1 site surveys**

Most corals are dead. Disease ravaged this site. Sediment generally less than ½ cm. Turfs evident, but covered in a dusting of sediment.

R2SC2 site surveys

Most corals dead at this site. Sediment dusting turfs. New Acropora recruit on T3. Turfs evident greens and browns. Halimeda as well.

**May 20, 2015**

**R2S1 site surveys**

sand on site 0-1 cm. Verified PMs on the site and took photos. Not much turf showing through, very sandy, with fine sand. Identified pockets of clay like material. Most turfs buried by 1/2cm of fine sand.

**R2S2 site surveys**

Finer sediment at R2S2 compared to R2S1. At least ¼ cm of sediment over everything. Sediment depth ranged from 0-1cm across site. Lots of disease.

**R2SC1- 1025 meters Hypack target 11:32:44**

Sediment was soft, similar to channel-side texturally. ½ cm of sediment bound by turfs. Saw active WP disease. Normal distribution of corals and octocorals, and sponges. Pockets of sand were coarse. No Sticky material. No partial mortality of corals. No impact, effect?

**R2SC1 12:10:17 target**

Similar to R2SC1 – 1025 meters. Turfs binding sediment. Sediment depth was ½ cm. Low relief hardbottom, no partial mortality on corals.

**R2S1-400m**

Pockets of clay like material. Habitat was patchy with sand pockets. Sediment overall was soft. Sediment bound by turfs on hardbottom high areas. Sediment depth was ½ cm over most of site. Octocoral predation by fireworm – so cool!! Sand pockets were ~3cm. No partial mortality of corals.

**R2S1 – 200m**

25 feet depth. Low relief – 0-6 inches. Consistent habitat with further south, not as many sand pockets. Sediment was soft and held by turfs. Pockets of clay like material. Dead *D. clivosa* margins with sticky clay like material adhering to edge. See photos.

**R2S1 300m**

Similar to 200m in terms of low relief habitat – 0-6 inches. No pockets of clay like material. ½ cm sediment depth, bound by turfs. 2 D. clivosa margins with marginal mortality. Couple clivosas with no mortality at margin. Transition area? Sand pockets present. Large Acropora palmata rubble present.

**May 21, 2015**

Quantitative surveys completed at R2S1-400 (outside impact) and R2S1 – 200m.

**R2N1-750**

Incredible visibility – 40 feet. More than 20 Acropora cervicornis colonies present. Depth ranged from 23-30 feet. Sand channel at bottom of site in east to west direction – spur and groove. Sediment in groove was coarse with fine layer on top. Sediment was ½ cm over everything. Turf trapped sediment.

**R2N1-650**

24-30 feet. Similar to 750. Sediment was softer, and siltier. Sign of recent deposition. ½ to 1cm depth. No A. cervicornis. Many M. cavs with disease. Some mortality at margins, more than 750. Habitat a little bit lower relief than 750.

**R2N1-550**

**Depth 23-29.**  Bowl surrounded by hills. One colony of A. cervicornis. Sediment was coarse in pockets. Fine sediment over everything. Sediment depth on hardbottom was 0.5-1cm Less disease than at 650.

**R2N1 – 450**

Depth 19-28.A lot of topo complexity here. Sediment fine on top of everything. Pockets were mostly coarse with some fine pockets. Sediment depth was ½ cm. No A. cervicornis.

**May 22, 2015**

**R2N1 -350**

Depth 25-28 feet. Fewer hard corals than previous sites. Mor octocorals. M. cavernosa most abundant coral. Disease – some WP still affecting colonies. Some partial mortality at colony margins, but not all. Not on low ones where you would expect sediment to accumulate. Sediment depth was ½ cm. No A. cervicornis. More like a hardbottom than reef environment.

**R2N1-250**

Depth 26-29 feet. Low relief, similar to R2N1-350. Mcavs most abundant. Large octos. Sediment depth was ½ cm. Turfs binding sediment. Some coarse pockets. More fine pockets. Many mixed. Everything covered in fines. No A. cervicornis. More like HB than reef – octos dominate.

**R2N1-150**

Similar to 250. More like hardbottom habitat. A lot of bare space. Sediment covers everything. Disease evident (WP) on Mcavs. Large octocorals. Some marginal mortality.

Quantitative surveys at R2N1-550 and 850 for impact and non-impact

**R2N1-550**

2/3 transects in low relief areas had mortality consistent with sedimentation mortality. These corals were in lower relief areas. Relief was higher on some parts of transects and there were no impacts in these higher areas. Visibility was low 10-15 feet. No A. cerv documented. Most common corals were Mcavs. Due to apparent impact in these low lying areas of transects, moved non-impact survey to 950.

**R2N1-950**

Not enough corals to survey. This habitat was hardbottom like – sand patches with occasional corals, large octocorals. Therefore moved to 850.

**R2N1-850**

Similar habitat type to R2N1-950 – hardbottom like. Hard corals were mostly Solenastreas. Many hard corals were in sand channels.

Summary

R3N – impact survey 150. Non-impact 250. Impact from 0-150m.

R3S – impact survey at 50. Non impact survey at 150. Really no impact on south side of reef 3.

R2S – impact survey at 200. Outside impact at 400. 0-300 is low relief – possible reason for sediment mortality here. Corals were large – suggesting at least 10 years old.

R2N – impact survey at 550 – impact in low relief areas, but in higher areas. 850 – non impacted survey. This is a different habitat type, one that would tolerate sedimentation and may never exhibit impacts to coral margins.

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| **Site** | **Date Surveyed** | **Purpose of Visit** | **Data Collected** | **Habitat Type** | **Depth** | **Visibility** | **Sediment Depth** | **Sediment Characteristics** | **Turf Algae** | **Hard Corals** | **Acropora** | **Octocorals** | **Sponges** | **Coral Disease** | **Partial Mortality** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| R3SC3 | April 25, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 36 | 50 |  | Coarse | Green | Yes | No | Yes | Yes | Yes | No |
| R3SC2 | April 25, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 25 | 50 |  | Coarse | Green | Yes | No | Yes | Yes | Yes | No |
| R3SC1 | April 25, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 35 | 50 |  | Coarse, some fines | Green | Yes | No | Yes | Yes | Yes | No |
| R3S3 | April 25, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 46 | 40 |  | Coarse some fines | Shorter compared to control | Yes | No | Yes | Yes | Yes | No |
| R3S2 | April 25, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 44 | 40 |  | Coarse some fines | Shorter compared to control | Yes | No | Yes | Yes | Yes | No |
| R3S1 | April 26, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 38 | 40 |  | Coarse | Shorter compared to control | Yes | No | Yes | Yes | Yes | No |
| R3S2-200 | April 26, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 42 | 50-75 |  |  |  | Yes | No | Yes | Yes |  |  |
| R3S1-200m line | April 26, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 42 | 40 |  |  | Yes | Yes | No | Yes | Yes |  |  |
| R3NC1 | April 26, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 46 | 20 |  | Coarse | Thick turfs | Yes | No | Yes | Yes | Yes | No |
| R3N1 | April 26, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 44 | 40 |  | Fine white sand | Texture but no color | Yes | No | Yes | Yes | Yes | Yes |
| R3N2-500 | April 27, 2015 | Impact Assessment | Qual | Low and high relief spur and groove | 47 | 60 |  | Coarse with few pockets of silty material | Yes | Yes | No | Yes | Yes | Yes | No |
| Hypack 10:48:15 | April 27, 2015 | Impact Assessment | Qual |  | 48 | 60 |  | Coarse | Yes | Yes | No | Yes | Yes | Yes | No |
| R3N2-250 | April 27, 2015 | Impact Assessment | Qual | Low and high relief spur and groove | 48 | 60 |  | Coarse and silty mix. No pockets | Yes | Yes | No | Yes | Yes | Yes | No |
| R3N2-150 | April 27, 2015 | Impact Assessment | Qual | Low relief spur and groove | 46 | 60 |  | Coarse, pockets of silty material | Yes | Yes | No | Yes | Yes | Yes | Yes |
| R3N2-50 | April 27, 2015 | Impact Assessment | Qual | Low relief spur and groove | 45 | 60 |  | Coarse and silty with pockets of silty | Yes | Yes | No | Yes | Yes | Yes | Yes |
| R2NC2 | May 11, 2015 | Impact Assessment | Quant and Qual | Low relief | 24 | 15 | ½ cm or less | Coarse with some fines | Yes | Yes | No | Yes | Yes | Yes | No |
| R2NC2-2.5 miles | May 11, 2015 | Impact Assessment | Qual | Low relief hardbottom | 25 | 15 | ½ cm or less | Coarse | Yes | Yes | No | Yes | Yes | Yes | No |
| R2N1-1000 | May 11, 2015 | Impact Assessment | Qual | Sand | 24 | 15 |  | Coarse | No | No | No | No | No | No | No |
| R2N1-950 | May 11, 2015 | Impact Assessment | Qual | Low relief hardbottom | 27 | 6 | ½-1cm | Coarse and silty | Yes | Yes | No | Yes | Yes | Yes | No |
| R2NC2-3.5 miles | May 11, 2015 | Impact Assessment | Qual |  | 28 | 6 | ½ cm or less | Fine sand and silty | Yes | Yes | Yes | Yes | Yes | Yes | No |
| R2N1-750 | May 11, 2015 | Impact Assessment | Qual |  | 25 | 6 |  | Coarse and silty | Yes | Yes | Yes | Yes | Yes | Yes | No |
| R3S-50 | May 13, 2015 | Impact Assessment | Quant and Qual | Low relief Spur and groove | 29-33 | 20 |  | Mix of coarse and fine | Yes | Yes | No | Yes | Yes | Yes | No |
| R3S-150 | May 13, 2015 | Impact Assessment | Quant and Qual | Low relief spur and groove | 30 | 33 |  |  | Yes | Yes | No | Yes | Yes |  |  |
| R3N-150 | May 14, 2015 | Impact Assessment | Quant and Qual | Spur and groove | 37-42 | 30 |  | Mix of coarse and fine, small silty pockets |  | Yes | No | Yes | Yes |  |  |
| R3N-250 | May 14, 2015 | Impact Assessment | Quant and Qual |  | 41 | 25 |  |  | Yes | Yes | No | Yes | Yes |  | No |
| R2N1-650 | May 14, 2015 | Impact Assessment | Qual |  | 28 | 7 |  | Coarse, silty clay visible | No |  | No | Yes | Yes | Yes | Yes (disease) |
| R2NC1 | May 19, 2015 | Impact Assessment | Quant and qual | Linear reef | 19 | 5-10 | <1/2  cm | Coarse | Yes | Yes | No | Yes | Yes |  |  |
| R2NC2 | May 19, 2015 | Impact Assessment | Quant and qual | Rocky reef | 25 | 15 | <0.25cm | Mostly coarse, some fine | No | Yes | No | Yes | Yes |  |  |
| R2N1 | May 19, 2015 | Impact Assessment | Quant and qual | Rocky reef | 28 | 50 | ½-1cm | Mix of coarse and fine | Yes | Yes | No | Yes | Yes |  | Yes |
| R2N2 | May 19, 2015 | Impact Assessment | Quant and qual | Linear reef | 38 | 50 | ½ to 1cm | Pockets of silty sed | Yes | Yes | No | Yes | Yes |  |  |
| R2SC1 | May 19, 2015 | Impact Assessment | Quant and qual | Rocky reef | 22 | 40 | <1/2 cm |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes (disease) |
| R2SC2 | May 19, 2015 | Impact Assessment | Quant and qual | Linear reef | 20 | 35 |  |  | Green and brown | Yes | Yes | Yes | Yes |  |  |
| R2S1 | May 20, 2015 | Impact Assessment | Quant and qual | Rocky reef | 26 | 40 | 0-1cm | Fine sand, pockets of clay material | Yes (not much) | Yes | No | Yes | Yes |  | Yes |
| R2S2 | May 20, 2015 | Impact Assessment | Quant and qual | Linear reef | 30 | 40 | 0-1cm |  |  | Yes | No | Yes | Yes | Yes |  |
| R2SC1-1025m | May 20, 2015 | Impact Assessment | Qual |  | 25 | 40 | ½ cm | Soft sed, coarse sand | Yes | Yes | No | Yes | Yes | Yes | No |
| R2SC1 12:10:17 Hypack | May 20, 2015 | Impact Assessment | Qual | Low relief hardbottom | 25 | 40 | ½ cm | Soft sed, coarse sand | Yes | Yes | No | Yes | Yes |  | No |
| R2S1-400 | May 20, 2015 | Impact Assessment | Quant and qual |  | 24 | 40 | ½ cm | Soft, pockets of silty material | Yes | Yes | No | Yes | Yes |  | No |
| R2S1-200 | May 20, 2015 | Impact Assessment | Quant and qual | Low relief | 25 | 40 |  | Soft, pockets of clay | Yes | Yes | No | Yes | Yes |  | Yes |
| R2S1-300 | May 20, 2015 | Impact Assessment | Qual | Low relief | 24 | 40 | ½ cm |  | Yes | Yes | Palmata rubble | Yes | Yes |  | Yes |
| R2N1-750 | May 21, 2015 | Impact Assessment | Qual | Spur and groove | 23-30 | 40 | ½ cm | Coarse in groove, layers of fine | Yes | Yes | Yes | Yes | Yes |  |  |
| R2N1-650 | May 21, 2015 | Impact Assessment | Qual | Spur and groove, low relief | 24-30 | 30 | ½ to 1cm | Soft, silty |  | Yes | No | Yes | Yes | Yes | Yes |
| R2N1-550 | May 21, 2015 | Impact Assessment | Qual | Bowl surrounded by hills | 23-29 | 30 | ½ to 1 cm | Fine, Coarse in pockets |  | Yes | Yes | Yes | Yes | Yes |  |
| R2N1-450 | May 21, 2015 | Impact Assessment | Qual |  | 19-28 | 25 | ½ cm | Fine, coarse in pockets |  | Yes | No | Yes | Yes |  |  |
| R2N1-350 | May 22, 2015 | Impact Assessment | Qual | Hard bottom, low relief | 25-28 | 10 | ½ cm |  |  | Yes | No | Yes | Yes | Yes | Yes |
| R2N1-250 | May 22, 2015 | Impact Assessment | Qual | Low relief | 26-29 | 10 | ½ cm | Mix of coarse and fine | Yes | Yes | No | Yes | Yes |  |  |
| R2N1-150 | May 22, 2015 | Impact Assessment | Qual | Hard bottom | 30 | 10 |  |  |  | Yes | No | Yes | Yes | Yes | Yes (marginal) |
| R2N1-550 | May 22, 2015 | Impact Assessment | Quant and qual | Low relief | 30 | 10-15 |  |  |  | Yes | No | Yes | Yes |  |  |
| R2N1-950 | May 22, 2015 | Impact Assessment | Qual | Hard bottom | 32 | 15 |  |  |  | Yes | No | Yes | Yes |  |  |
| R2N1-850 | May 22, 2015 | Impact Assessment | Quant and qual | Hard bottom | 30 | 15 |  |  |  | Yes | No | Yes | Yes |  |  |