

Flood Statement

Oxford Falls Grammar School

Prepared for Oxford Falls Grammar School / 17 March 2020 (Rev 2)

191571

Contents

1.0	Introduction	3
2.0	Guidance documents.....	4
3.0	Flood Risk	5
3.1	Flood Risk Precinct.....	5
3.2	Land Use Category	6
3.3	Prescriptive Controls.....	7
3.3.1	Flood Effects caused by Development - A.....	8
3.3.2	Floor Levels - F	8
3.3.3	Car Parking – G	9
3.3.4	Prescriptive Controls B, C, D, E, and H.....	9
3.3.5	Pedestrian Link Bridge	10
4.0	TTW site specific flood model	11
4.1	Model development	11
4.2	Model results	11
5.0	Flood Prone Land Design Standard	14
6.0	Riparian Zone.....	15
7.0	Conclusion	17
	Appendix A	18
	Appendix B	19
	Appendix C	20

1.0 Introduction

This report has been prepared by Taylor Thomson Whitting (TTW) to support the Review of Environmental Factors (REF) submission for the proposed Oxford Falls Grammar School development. It covers flood risk and the associated flood planning levels that have been adopted for the site. The ground level and level 1 of the proposed development is shown in Figure 1 and Figure 2 respectively. Habitable floor areas are limited to Level 1 with non-habitable areas located at ground level. Finished floor levels (FFL) are 74.75m and 78.35m for ground and level 1 respectively.

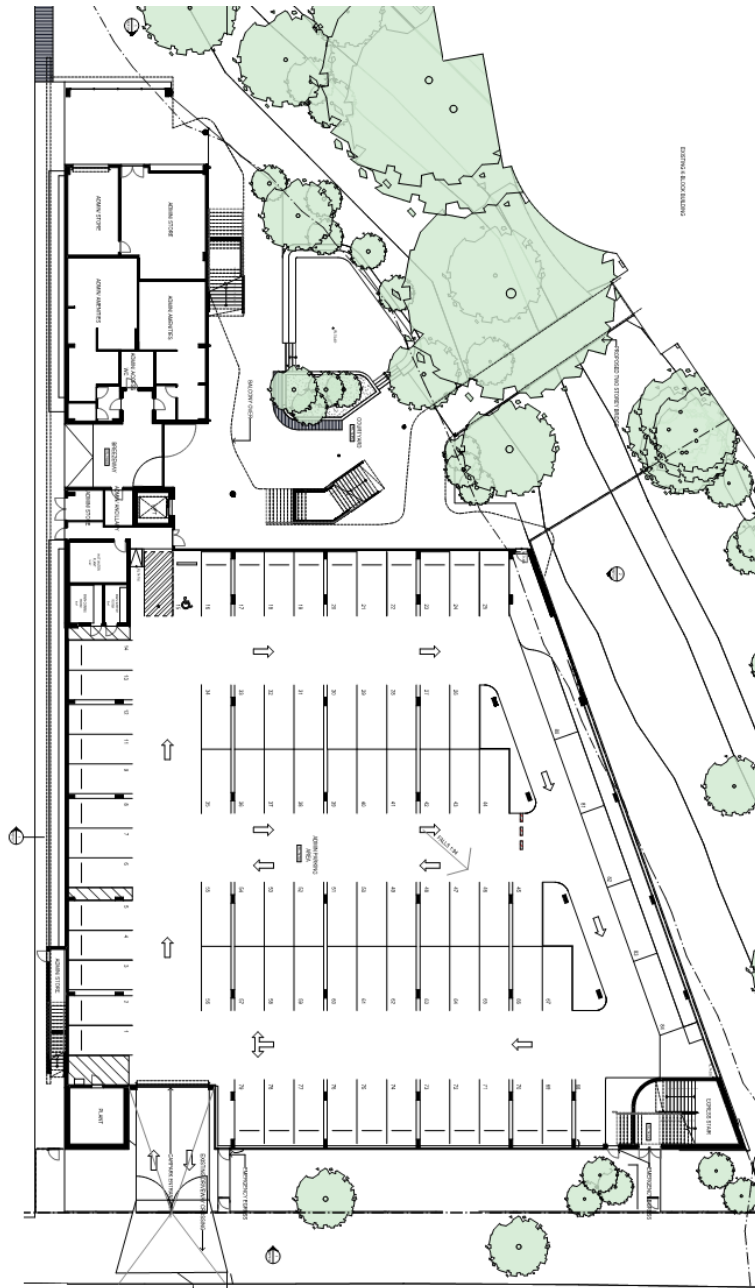


Figure 1 - Proposed development - Ground level plan

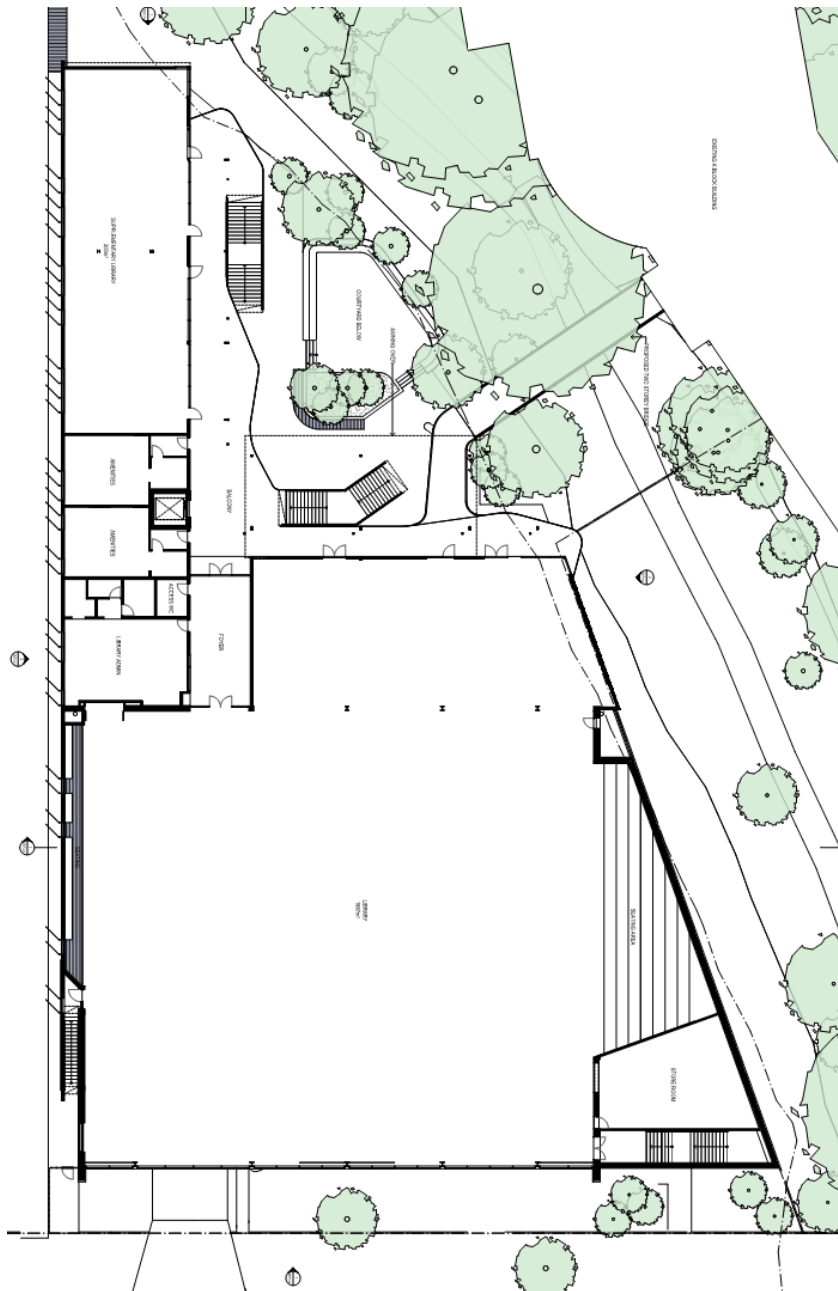


Figure 2 - Proposed development - Level 1 plan

2.0 Guidance documents

The following have informed the assessment of flood risk, and associated flood planning levels, in this report:

- State Environmental Planning Policy (Infrastructure) 2007;
- NSW Floodplain Development Manual (April 2005);
- Warringah Development Control Plan (2011);
- Northern Beaches Council - Flood Prone Land Design Standard; and
- Narrabeen Lagoon Floodplain Risk Management Plan – Revised Draft (September 2018).

3.0 Flood Risk

Flood affected land is considered environmentally sensitive and thus needs to be considered under the SEPP (Infrastructure) 2007. The flood risk has been assessed in line with the NSW Floodplain Development Manual. Prescriptive controls from the Warringah Development Control Plan are not a requirement of the SEPP, however they have been assessed as they represent good practice guidance.

Section 'E11 Flood Prone Land' of the Warringah Development Control Plan (DCP) provides the prescriptive controls that may be applied to development on flood prone land. It outlines the following steps to be followed:

- (a) Determine the Flood Risk Precinct;
- (b) Determine the Land Use Category;
- (c) Check if the proposal will satisfy the applicable prescriptive controls; and
- (d) Where prescriptive controls are not satisfied or require the preparation of a Flood Management Report, then such a report shall be prepared.

3.1 Flood Risk Precinct

The site falls within the Narrabeen Lagoon Flood Study (September 2013) produced by BMT WBM. A copy of the flood model was obtained from Council. Unfortunately, it was not possible to run the model due to use of a MORPH module, which is not commercially available, and numerous run errors. It was possible to interrogate the results file which highlighted an anomaly in water levels upstream of the Dreadnought Road culvert (refer Figure 3). This artificially raised water levels diverting flow over the school sports field. It should be noted that the online mapping tool for determining the Flood Risk Precinct, available on the Northern Beaches Council website Planning Controls page, is based on the Council flood model. Due to the water level error in the model a site-specific flood model has been developed for the site to determine flood planning levels.

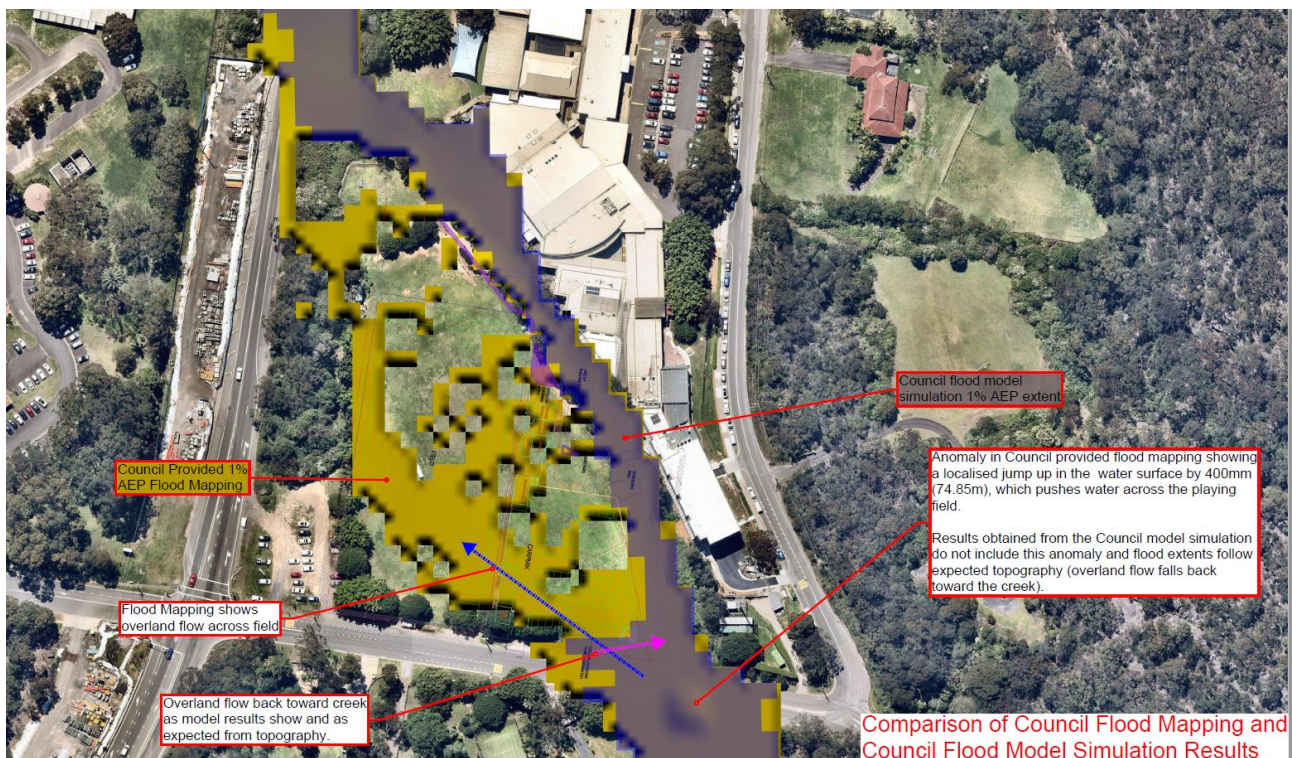


Figure 3 - Dreadnought Road culvert water level anomaly (Narrabeen Lagoon Flood Study)

The site specific flood study shows the development is within the Low Flood Risk Precinct, with the exception of a portion of the stairs in the south east corner which is within Medium Flood Risk Precinct. The Low Flood Risk Precinct is all flood prone land (i.e. below the PMF) that is above the 1% AEP. The western side of the stairs protrudes into the 1% AEP flood extents, but is not subject to a high hydraulic hazard, so is classified as a Medium Flood Risk Precinct (refer to Figure 4). As the development is in more than one precinct the controls for the Medium Flood Risk Precinct have been adopted.



Figure 4 - Existing 1% AEP flood depths (TTW site specific flood model)

3.2 Land Use Category

As an educational establishment the proposed Oxford Falls Grammar School development falls under the 'Vulnerable Uses' land use category as shown in Figure 5.

Table 1 Land Use Groups

Critical	Vulnerable Uses	Residential
Emergency services facility	Child care centre	Boarding house
Hospital	Educational establishment	Dual occupancy
Sewerage system	Home-based child care	Dwelling house
Telecommunications facility (SP2)	Community health service facility	Exhibition home
Public Utility Undertaking (SP2)	Information and education facility	Exhibition village
Electricity generating works	Respite day care centre	Hostel
	Seniors housing	Residential flat building
	Caravan park	Rural worker's dwelling
	Group home	Secondary dwelling
	Residential care facilities	Semi-detached dwelling
	Correctional centre	Multi dwelling housing
	Tourist and visitor accommodation	Shop top housing
		Attached dwelling

Figure 5 - Land Use Groups (Table 1, E11 Flood Prone Land, Warringah DCP)

3.3 Prescriptive Controls

The prescriptive controls for 'Medium Flood Risk Precincts' and 'Vulnerable Uses' in the Warringah DCP are shown in Figure 6.

		Vulnerable Uses
A	Flood effects caused by Development	A1 A3 A4
B	Drainage Infrastructure & Creek Works	B1 B2
C	Building Components & Structural	C1 C2 C3
D	Storage of Goods	D1 D2
E	Flood Emergency Response	E1 E2 E3
F	Floor Levels	F2 F3 F7
G	Car Parking	G1 G4 G6 G7 G9 G10
H	Fencing	H1
I	Pools	I1

Figure 6 - Prescriptive Controls for Medium Flood Risk Precincts (Matrix 1, E11 Flood Prone Land, Warringah DCP)

3.3.1 Flood Effects caused by Development - A

The applicable Flood Effects caused by Development prescriptive controls are shown in Figure 7.

A1	Jetty
Intensive plant agriculture	Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it complies with the Flood Prone Land Design Standard found on Council's webpage.
A3	The applicant shall include in their submission, calculations to illustrate that any fill or other structures that reduce the total flood storage are replaced by Compensatory Works.
A4	<p>Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it been designed and can be constructed so that in a Probable Maximum Flood event:</p> <p>(a) There are no adverse impacts on flood levels and velocities caused by alterations to the flood conveyance;</p> <p>(b) There are no adverse impacts on surrounding properties; and (c) It is sited to minimise exposure to flood hazard.</p> <p>Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Forms A and A1 of Northern Beaches</p>

Figure 7 - Flood Effects caused by Development prescriptive controls (E11 Flood Prone Land, Warringah DCP)

Prescriptive control A4 is particularly onerous and exceeds standard practice to comply with the NSW Floodplain Development Manual. The proposed development will ensure there are no adverse impacts on flood levels, velocities, or surrounding properties in the 1% AEP event. The PMF will be considered with respect to safe flood evacuation routes.

3.3.2 Floor Levels - F

The applicable Floor Level prescriptive controls are shown in Figure 8. These refer to the 1% AEP, Flood Planning Level, and Probable Maximum Flood (PMF). All habitable floor space is located on level 1 of the proposed building and above the PMF.

F2	All development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no loss of flood storage in a 1% AEP Event. Where the dwelling is located over a flow path it must be elevated on suspended pier/pile footings such that the level of the underside of all floors including balconies and decks within the flood affected area are at or above, or raised to the Flood Planning Level to allow clear passage of the floodwaters under the building. The development must comply with the Flood Prone Land Design Standard.
F3	Where the lowest floor has been elevated to allow the passage of flood waters, a restriction shall be imposed on the title of the land, pursuant to S88B of the Conveyancing Act confirming that the undercroft area is not to be enclosed.
F7	All floor levels within the development shall be at or above the Probable Maximum Flood level or Flood Planning Level whichever is higher.

Figure 8 - Floor Level prescriptive controls (E11 Flood Prone Land, Warringah DCP)

The floodway referenced in F2 is defined in the Warringah DCP as shown below:

Floodway

is the area of the floodplain where a significant discharge of water occurs during floods and is often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

Warringah Development Control Plan - Part A Introduction

Figure 9 - 'Floodway' definition (E11 Flood Prone Land, Warringah DCP)

The floodway could therefore be taken to be the top of bank level of the existing creek. The 1% AEP event is contained within the creek, and thus the floodway will be unaffected by the proposed works.

3.3.3 Car Parking – G

The applicable Car Parking prescriptive controls are shown in Figure 10. G6 is not relevant as carports are not proposed. There is no basement parking proposed so any enclosed or elevated parking structures, as described in G9 and G10, would also be bound by the floor level prescriptive controls F2 and F7.

G1	Open carpark areas and carports shall not be located within a floodway.
G4	Vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site where there is more than 300mm depth of flooding in a 1% AEP flood event. The minimum height of the vehicle barriers or restraints must be at or above the Flood planning Level. Vehicle barriers or restraints must comply with the Flood Prone Land Design Standard.
G6	Carports must comply with the Flood Prone Land Design Standard
G7	Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1% AEP flood event and no impact on flood conveyance through the site
G9	All enclosed car parks must be protected from inundation up to the Probable Maximum Flood level or Flood Planning Level whichever is higher. For example, basement carports must be provided with a crest at the entrance, the crest of which is at the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher.
G10	Enclosed Garages must be located at or above the Probable Maximum Flood Level or Flood Planning Level whichever is higher.

Figure 10 - Car Parking prescriptive controls (E11 Flood Prone Land, Warringah DCP)

3.3.4 Prescriptive Controls B, C, D, E, and H

The applicable prescriptive controls for the following are shown in Figure 11:

- B – Drainage Infrastructure and Creek Works;
- C – Building Components & Structural;
- D – Storage of Goods;
- E – Flood Emergency Response; and
- H – Fencing.

Whilst these must be complied with, they are generally addressed through a Flood Management Plan and elements of the detailed design. It should be noted E2 requires a 'shelter in place' to be provided above the PMF. This will be the first floor of the proposed building which will be accessible by multiple stairs.

B1	Flood mitigation works or stormwater devices that modify a major drainage system, stormwater system, natural water course, floodway or flood behaviour within or outside the development site may be permitted subject to demonstration through a Flood Management Report that they comply with the Flood Prone Land Design Standard found on Council's webpage.
B2	A Section 88B notation under the Conveyancing Act 1919 may be required to be placed on the title describing the location and type of flood mitigation works with a requirement for their retention and maintenance.
C1	All buildings shall be designed and constructed as flood compatible buildings in accordance with Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, Hawkesbury-Nepean Floodplain Management Steering Committee (2006).
C2	All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Structural certification shall be provided confirming the above. Where shelter-in-place refuge is to be provided the structural integrity is to be to the Probable Maximum Flood level.
C3	All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.
D1	Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.
D2	Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level.
E1	Development shall comply with Council's Flood Emergency Response Planning for Development in Pittwater Policy and the outcomes of any Flood Risk Emergency Assessment Report where it applies to the land.
E2	New development must provide an appropriately sized area to safely shelter in place above the Probable Maximum Flood level and appropriate access to this area should be available from all areas within the development.
E3	Adequate Warning Systems, Signage and Exits shall be installed to allow safe and orderly evacuation without reliance upon the SES or other authorised emergency services personnel.
E4	The application shall demonstrate that evacuation/shelter in place in accordance with the requirements of this DCP will be available for any potential development arising from a torrens title subdivision.
H1	Fencing, including pool fencing, shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. Appropriate fencing must comply with the Flood Prone Land Design Standard in addition to other regulatory requirements of pool fencing.

Figure 11 - Prescriptive controls B, C, D, E and H (E11 Flood Prone Land, Warringah DCP)

3.3.5 Pedestrian Link Bridge

The proposed pedestrian link bridge structure, joining the proposed development with existing Block K, would be bound by the floor level prescriptive control F2 described in section 3.3.1. That is the underside of structure should be above the flood planning level of the 1% AEP event + 500mm freeboard.

4.0 TTW site specific flood model

4.1 Model development

As discussed in Section 3.1 a site-specific flood model has been developed due to issues with the Narrabeen Lagoon Flood model received from Council. The baseline TUFLOW model included the following:

- Detailed topographical survey for existing ground levels;
- Extent of existing buildings modelled;
- Existing bridges modelled from topographical survey;
- Existing Dreadnought Road culvert modelled from topographical survey;
- Existing Wakehurst Parkway culvert consistent with Council model;
- Catchment areas consistent with Council model; and
- Inflow applied upstream of Dreadnought Road culvert to eliminate water level anomaly in Council model.

4.2 Model results

Figure 12, Figure 13 and Figure 14 show the existing flood depth, proposed flood depth and flood level for the 1% AEP event. Figure 15 shows the change in flood level between the existing and proposed scenarios. This confirms that the proposed development has a negligible effect on flood levels and thus will not adversely impact downstream or upstream properties. Figure 16 shows the proposed flood level in the PMF event. Habitable floor area is limited to Level 1 (FFL 78.35m) which is comfortably above the PMF level (about 75-75.5m).

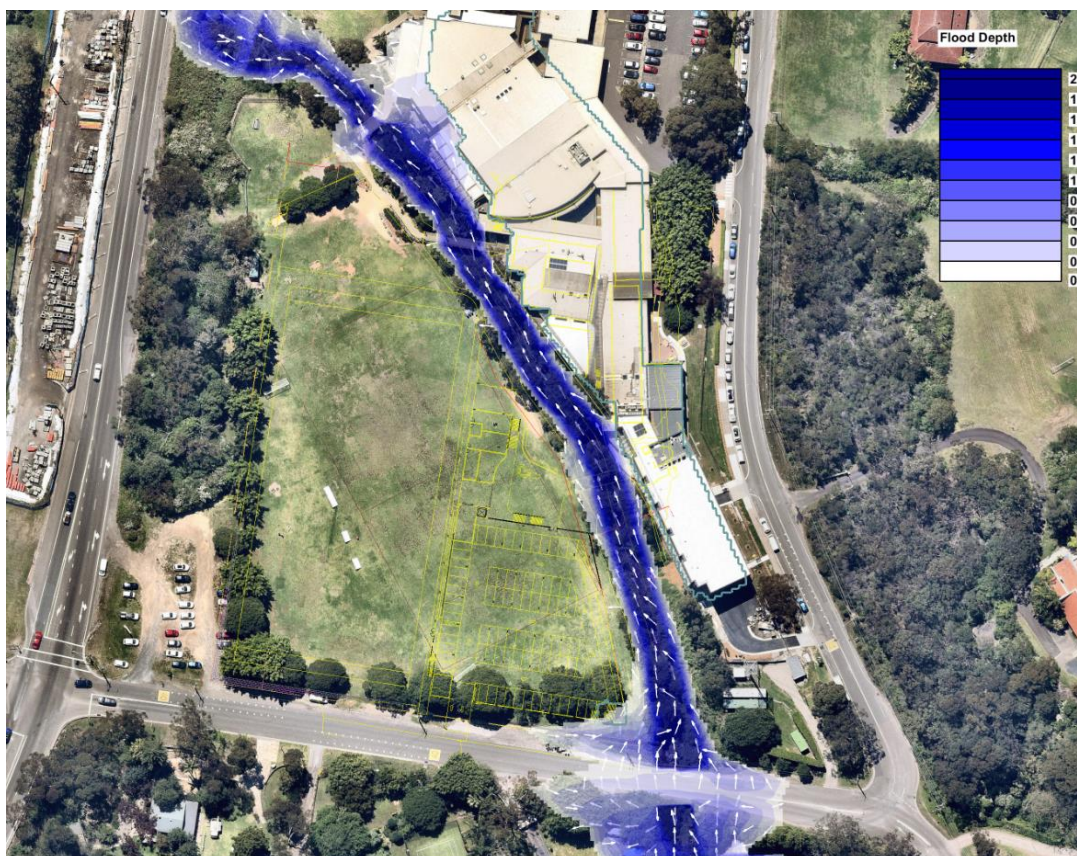


Figure 12 - 1% AEP Existing flood depth

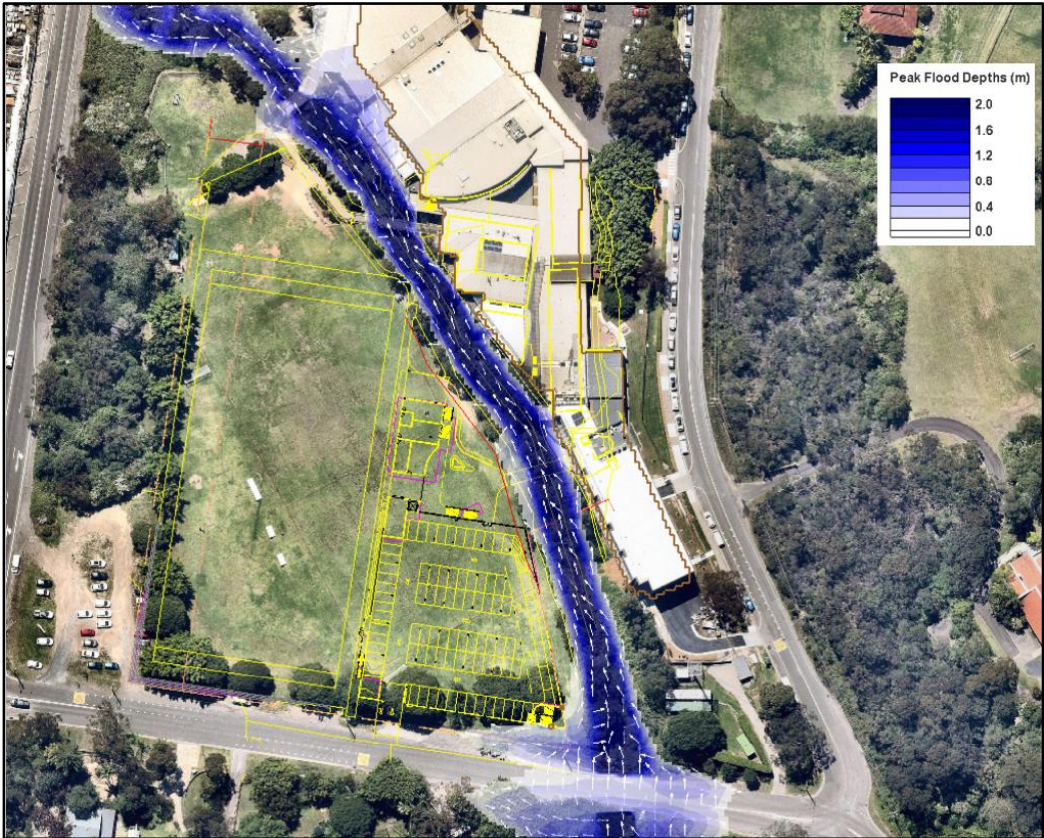


Figure 13 - 1% AEP Proposed flood depth

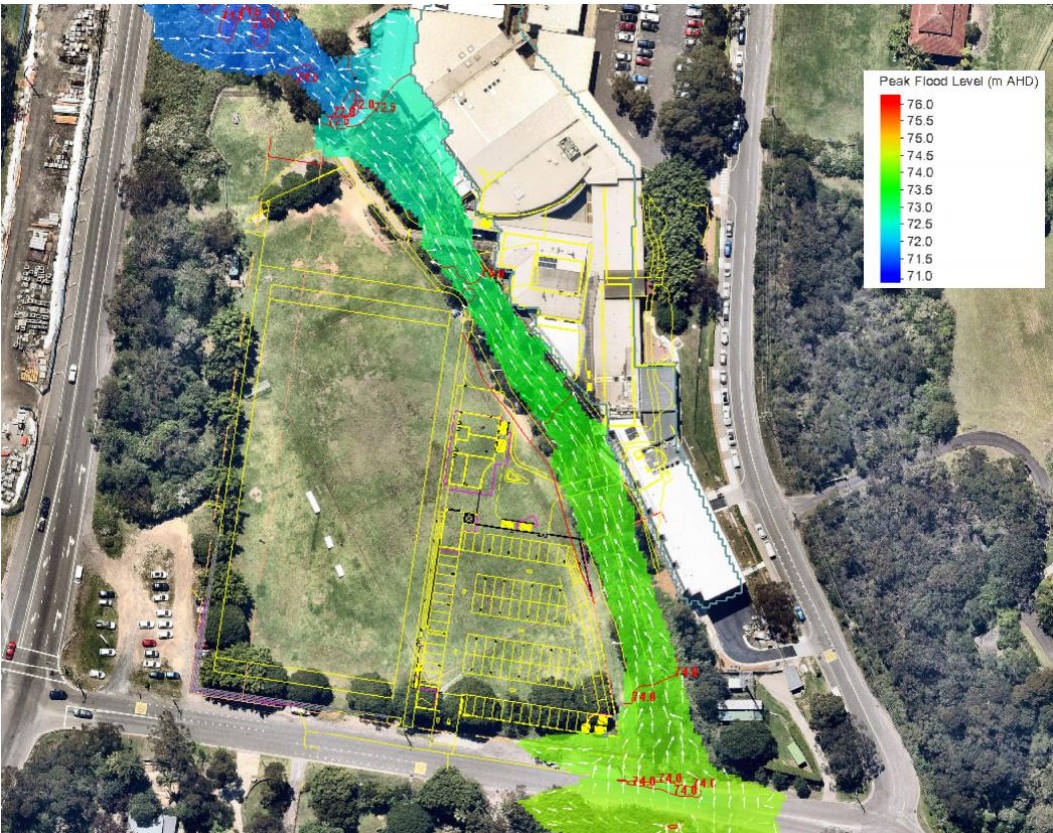


Figure 14 - 1% AEP Proposed flood level



Figure 15 - 1% AEP Change in flood level between existing and proposed

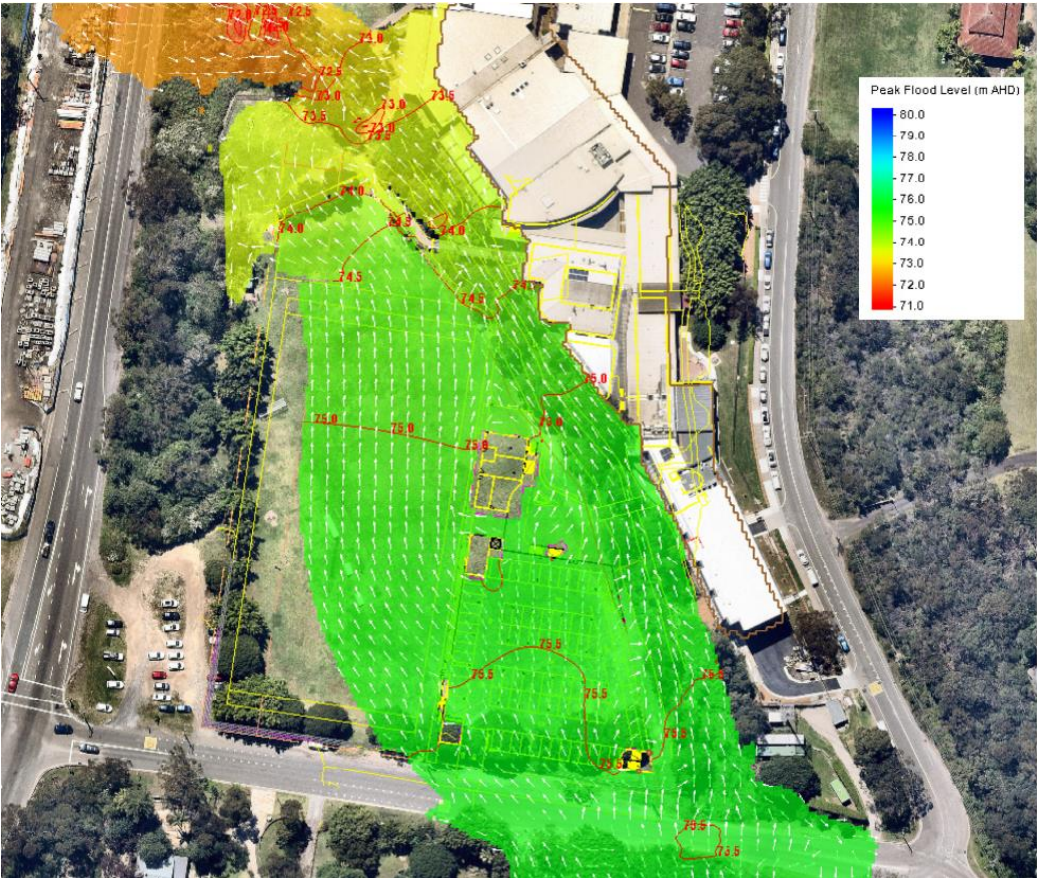


Figure 16 - PMF Proposed flood level

5.0 Flood Prone Land Design Standard

The Northern Beaches Council Flood Prone Land Design Standard provides detailed specifications for development on flood prone land in support of the prescriptive controls outlined in Section 3.3. The applicable specifications are shown in Figure 17.

A1	<p>The development has been designed and can be constructed so that in a 1%AEP flood event:</p> <ul style="list-style-type: none"> (a) There is no net loss of flood storage/ floodway; (b) There are no adverse changes in flood levels and velocities caused by alterations to the flood conveyance; (c) There are no adverse effects on surrounding properties; and (d) It is sited to minimise exposure to flood hazard. <p>Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.</p>
B1	<p>The development has been designed and can be constructed so that in a 1% AEP flood event:</p> <ul style="list-style-type: none"> (a) There is no loss of flood storage/floodway; (b) There are no adverse effects on surrounding properties; (c) The works do not have an adverse impact on the environment. (This includes but is not limited to the altering of natural flow regimes, the clearing of riparian vegetation, artificial modification of the natural stream, such as by relocation, piping etc, in accordance with Council's Protection of Waterways and Riparian Land Policy). <p>Certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.</p>
F2	<p>For suspended pier/pile footings, there must also be sufficient openings in perimeter walls located below the 1% AEP flood level to allow for the flood waters to flow through unimpeded:</p> <ul style="list-style-type: none"> a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, and (b) 50-75% of the perimeter of the underfloor area is of an open design between the natural ground level and the 1% AEP flood level. Only 25-50% of the perimeter would be permitted to be solid, and (c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway.
G4	<p>Vehicle barriers or restraints (such as mounding, bunding, louvers or similar) that redirect and/or exclude floodwaters will not be permitted. Perimeter walls/louvers installed as vehicle barriers or restraints are to be of an open design, where 50-75% of the perimeter walls/louvers are 'open' between natural ground level and the <i>Flood Planning Level</i>. Only 25-50% of the perimeter walls/louvers would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water</p>
H1	<p>Fencing (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be open for passage of flood waters - All new fencing on the property must be flood compatible with 50-75% of the fence being of an open design between the natural ground level and the Flood Planning Level. Only 25-50% of the perimeter fence would be permitted to be solid. Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.</p>

Figure 17 - Flood Prone Land Design Standard specifications (Northern Beaches Council)

There is a Riparian Zone located to the east of the proposed development as shown in Figure 19. Any works undertaken on waterfront land within 40m of the watercourse top of bank may require a Controlled Activity Approval. The creek is a 1st order stream as shown in Figure 18. This means the vegetated riparian zone (VRZ) may be reduced to 10m either side of the top of bank, subject to review by the Department of Primary Industries. There is ongoing dialogue with the Department of Primary Industries and the required documentation will be submitted at the appropriate time including detailed plans showing proposed works relative to the existing and proposed bed and bank profiles and water levels. Refer to Appendix C for the Department of Primary Industries Guidelines related to riparian corridors on waterfront land.

Topographic map showing the area around the Sports Centre. The map includes contour lines, roads, and buildings. Key features include:

- Contour Lines:** Elevation markers such as 1081, 1083, 1084, 1085, 1087, 1089, 1091, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 1178, 1179, 1180, 1181, 1182, 1183, 1184, 1185, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1459, 1460, 1461, 1462, 1463, 1464, 1465, 1466, 1467, 1468, 1469, 1470, 1471, 1472, 1473, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1493, 1494, 1495, 1496, 1497, 1498, 1499, 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1540, 1541, 1542, 1543, 1544, 1545, 1546, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1567, 1568, 1569, 1570, 1571, 1572, 1573, 1574, 1575, 1576, 1577, 1578, 1579, 1580, 1581, 1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746

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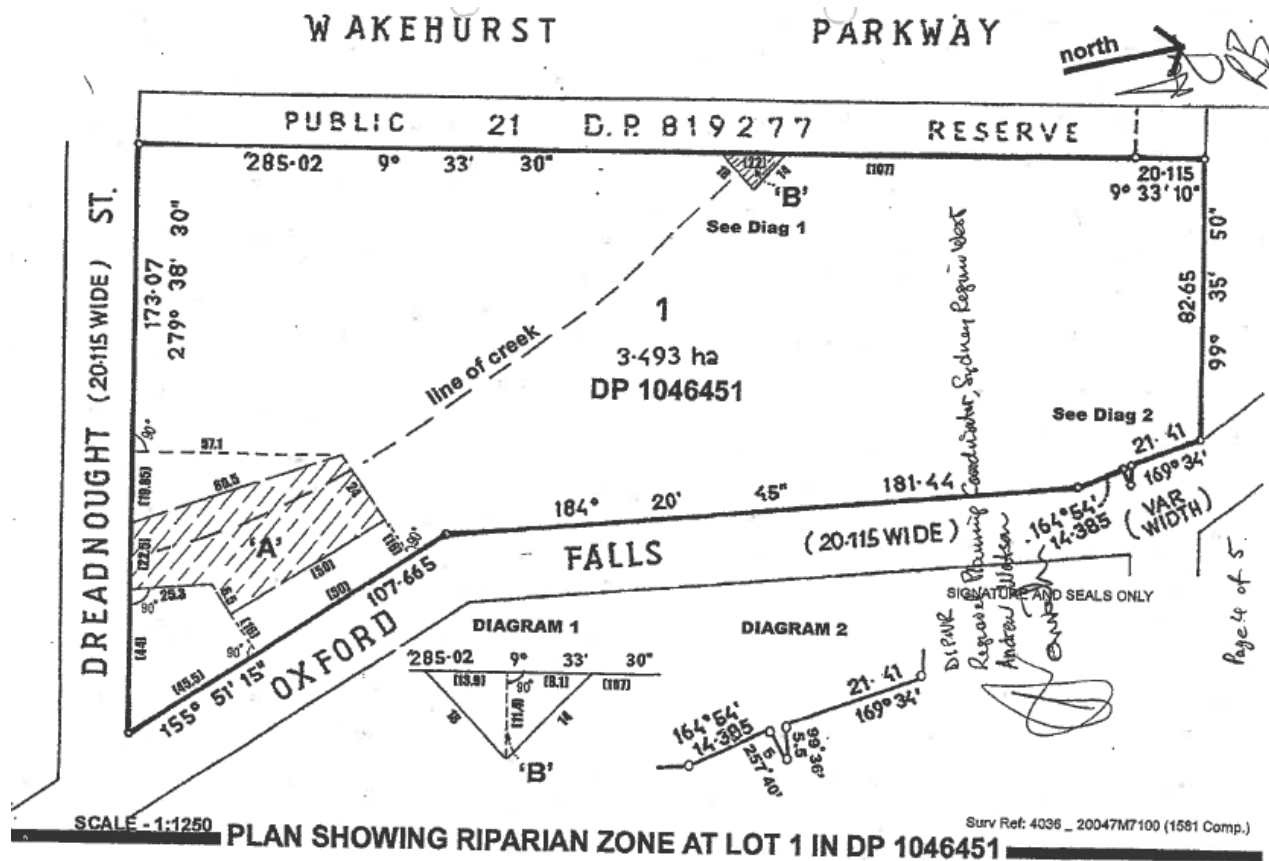


Figure 19 - Riparian Zone (Department of Planning and Environment)

7.0 Conclusion

The proposed development has been assessed through the development of a site-specific flood model. Below are the key recommendations that have been incorporated into the design to ensure the flood criteria has been met:

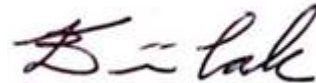
- Habitable floor areas have been located on Level 1 (FFL 78.35m) above the PMF in the proposed design;
- Non-habitable floor areas on ground level (74.75m) have been located above the Flood Planning Level in the proposed design;
- There no adverse impact on flood levels including downstream and upstream properties in the 1% AEP event; and
- 'Shelter in place' flood evacuation routes are provided to Level 1 above the PMF and access to the adjacent school buildings is available via the second level pedestrian bridge.

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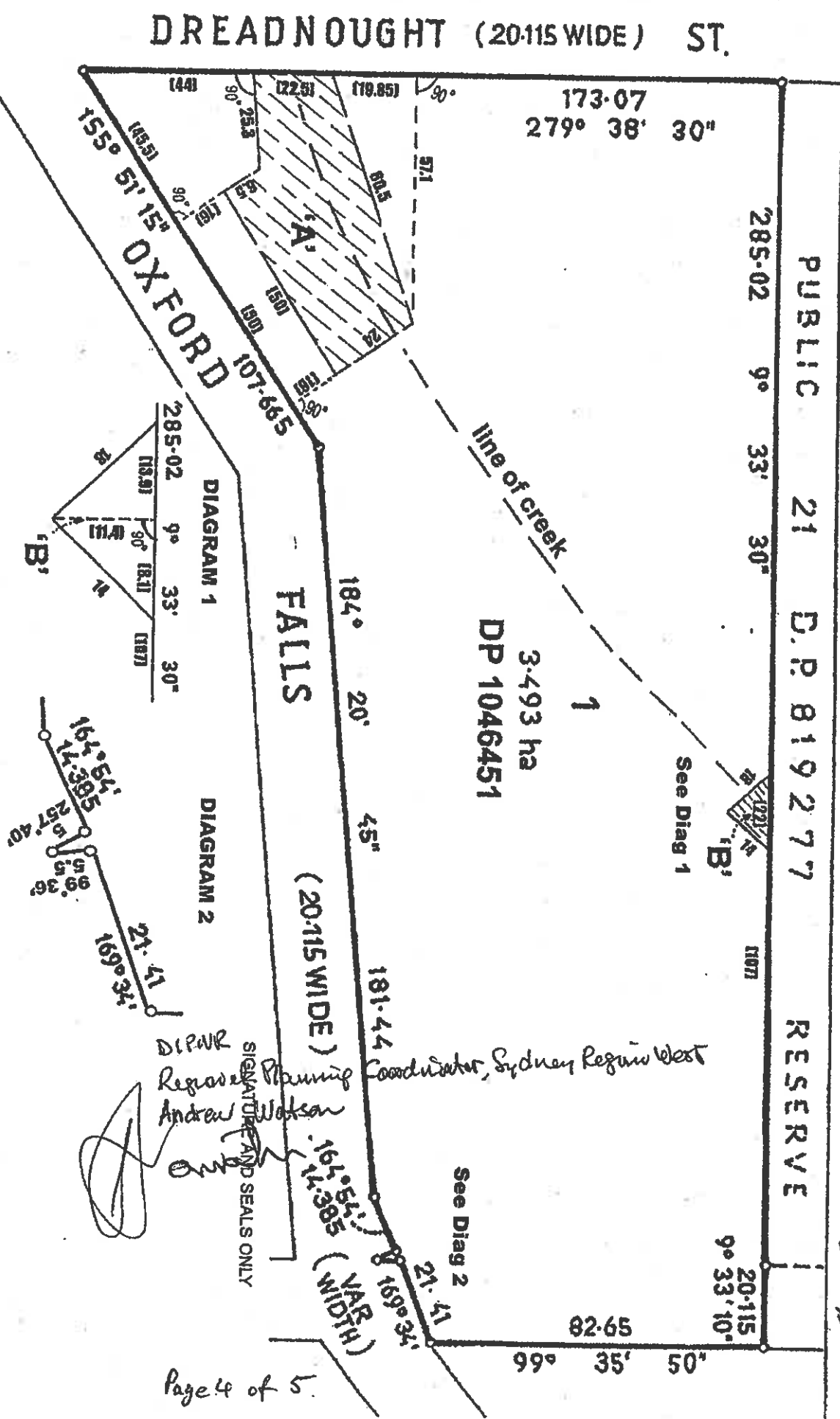
EIRIAN CRABBE
Associate Director

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Appendix A

Riparian Zone extent

SCALE - 1:1250
PLAN SHOWING RIPARIAN ZONE AT LOT 1 IN DP 1046451



WAKEHURST

PARKWAY

North

Annexure B to the Restriction on the Use of Land by a Prescribed Authority

Parties:

**OXFORD FALLS GRAMMAR SCHOOL LIMITED ACN 002 746 741 and
WARRINGAH COUNCIL and DEPARTMENT OF INFRASTRUCTURE, PLANNING
AND NATURAL RESOURCES**

Dated: 16 Decmber 2004

Restriction

1. No fence, fill, excavation or any other structure is to be erected or constructed on the Riparian Zone without the express approval of Warringah Council in consultation with the Department of Infrastructure, Planning and Natural Resources.
2. No vegetation is to be planted or permitted to remain on the Riparian Zone unless it is of an endemic species, local to the immediate area as approved by the Department of Infrastructure, Planning and Natural Resources and Warringah Council and no vegetation is to be harmed or destroyed or removed from the Riparian Zone at any time without the express approval of Warringah Council in consultation with the Department of Infrastructure, Planning and Natural Resources.
3. In this Restriction 'Riparian Zone' means the parts of the land comprised in Folio Identifier 1/1046451 indicated as 'A' and 'B' in the plan forming part of this Annexure B.

PART OF THE LAND BEING BOUND.


RB.
aw

Appendix B

Flood Prone Land Design Guide

FLOOD INFORMATION REQUEST – MULTI-PURPOSE

Property: Oxford Falls Grammar School

Lot DP:

Issue Date: 17/08/2018

Flood Study Reference: Narrabeen Lagoon Flood Study, 2013

Flood Information for lot:

1% AEP – See Flood Map B

1% AEP Maximum Water Level³: 74.75 mAHD

1% AEP Maximum Peak Depth from natural ground level³: 2.95 m

1% AEP Maximum Velocity: 2.93 m/s

1% AEP Provisional Flood Hazard: High See Flood Map E

1% AEP Hydraulic Categorisation: Floodway See Flood Map F

Flood Planning Area – See Flood Map C

Flood Planning Level (FPL)^{1,2, 3 &4}: 75.25 m AHD

Probable Maximum Flood (PMF) – See Flood Map D

PMF Maximum Water Level²: 75.34 m AHD

PMF Maximum Depth from natural ground level: 4.07 m

PMF Maximum Velocity: 4.74 m/s

PMF Flood Hazard: High See Flood Map G

PMF Hydraulic Categorisation: Floodway See Flood Map H

Flood Risk Precinct – See Map K

¹The flood information does not take into account any local overland flow issues nor private stormwater drainage systems.

²Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/flood planning levels across the site.

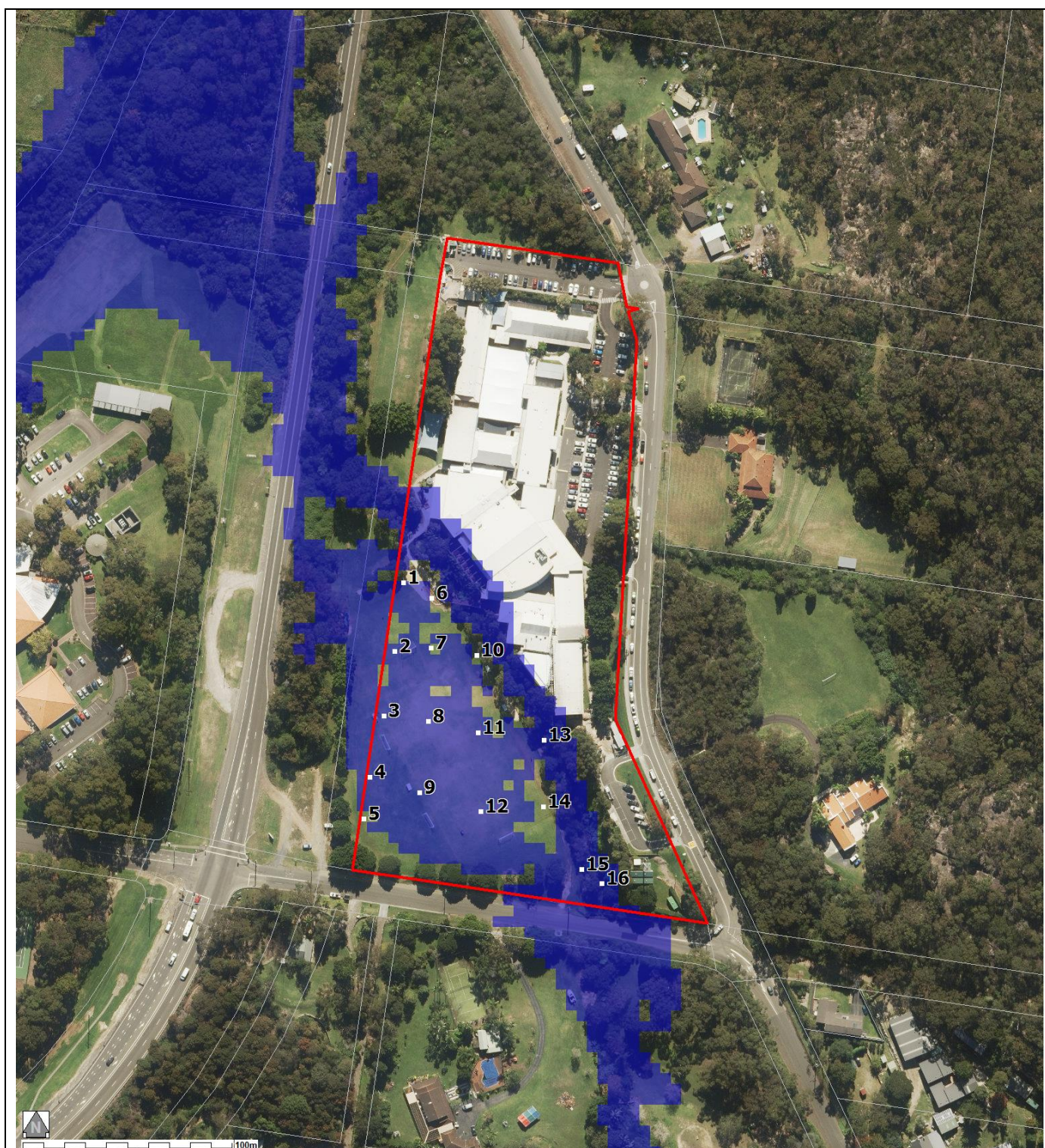
³Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels than those indicated on this flood advice.

⁴Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or Flood Planning Level

General Notes:

- All levels are based on Australian Height Datum (AHD) unless otherwise noted.
- This is currently the best available information on flooding; it may be subject to change in the future.
- Council recommends that you obtain a detailed survey of the above property and surrounds to AHD by a registered surveyor to determine any features that may influence the predicted extent or frequency of flooding. It is recommended you compare the flood level to the ground and floor levels to determine the level of risk the property may experience should flooding occur.
- Development approval is dependent on a range of issues, including compliance with all relevant provisions of Northern Beaches Council's Local Environmental Plans and Development Control Plans.
- Please note that the information contained within this letter is general advice only as a detail survey of the property as well as other information is not available. Council recommends that you engage a suitably experienced consultant to provide site specific flooding advice prior to making any decisions relating to the purchase or development of this property.
- The Flood Studies on which Council's flood information is based are available on Council's website.

FLOOD LEVEL POINTS



Note: Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only.

Flood Levels

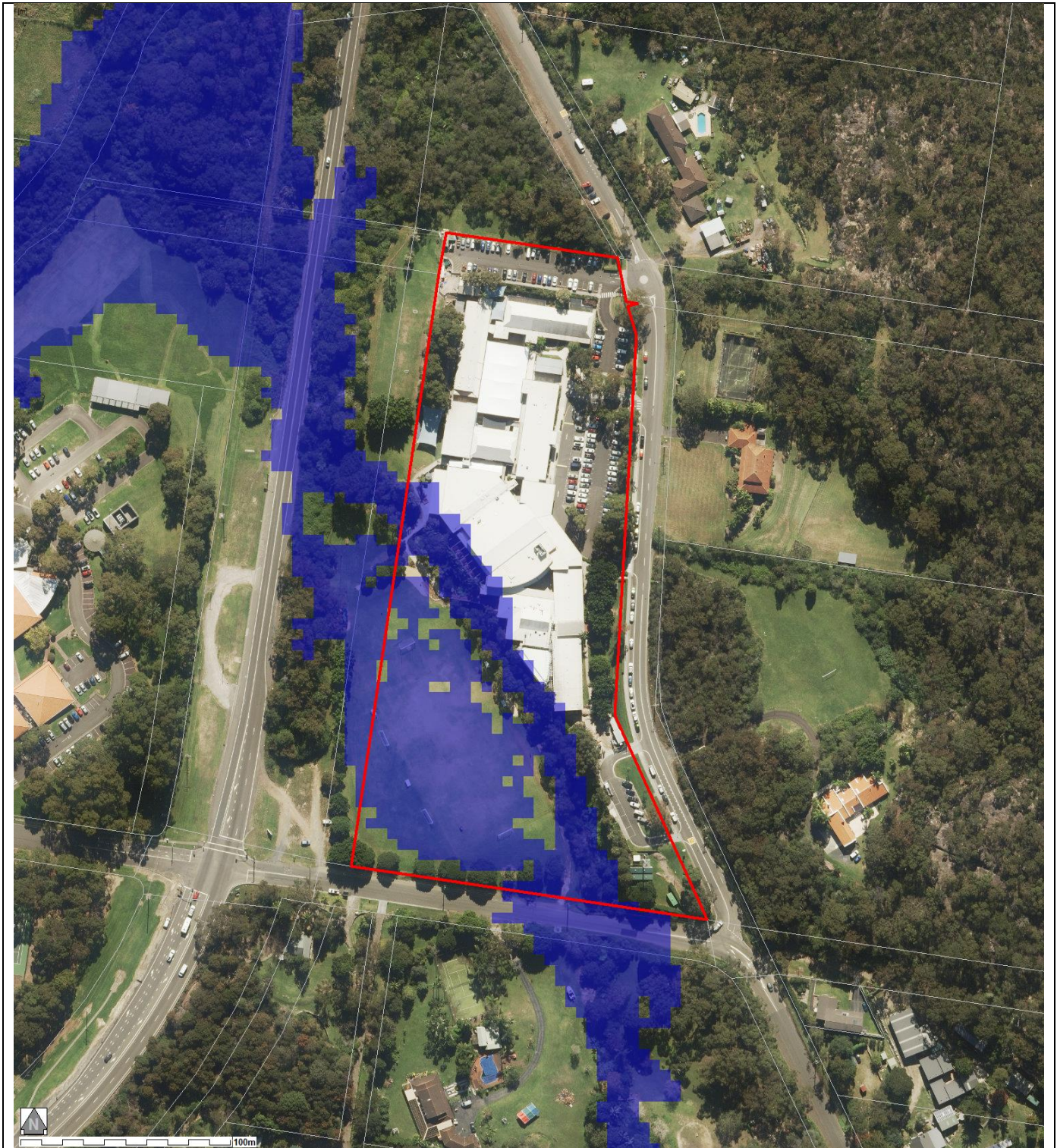
ID	5% AEP Max WL (m AHD)	5% AEP Max Depth (m)	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)	1% AEP Max Velocity (m/s)	Flood Planning Level (m)	PMF Max WL (m AHD)	PMF Max Depth (m)	PMF Max Velocity (m/s)
1	N/A	N/A	73.90	0.02	0.51	74.21	74.04	0.16	1.95
2	N/A	N/A	74.16	0.02	0.00	74.65	74.42	0.28	1.04
3	N/A	N/A	74.34	0.04	0.46	74.82	74.63	0.33	0.73
4	N/A	N/A	74.45	0.12	0.54	74.95	74.77	0.44	0.72
5	N/A	N/A	N/A	N/A	N/A	75.04	74.82	0.19	0.54
6	N/A	N/A	N/A	N/A	N/A	73.96	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A	74.58	74.44	0.35	1.48
8	N/A	N/A	74.43	0.06	0.63	74.92	74.72	0.35	0.97
9	N/A	N/A	74.62	0.09	0.62	75.11	74.87	0.34	0.86
10	N/A	N/A	N/A	N/A	N/A	74.44	74.53	0.55	1.93
11	N/A	N/A	74.38	0.07	0.49	74.88	74.80	0.49	0.98
12	N/A	N/A	74.67	0.06	0.67	75.19	74.98	0.37	1.32
13	N/A	N/A	73.81	0.06	0.66	74.36	74.90	1.15	1.30
14	N/A	N/A	N/A	N/A	N/A	74.76	75.00	0.67	1.76
15	74.00	0.46	74.27	0.73	1.04	74.82	75.20	1.66	1.31
16	74.03	1.99	74.32	2.29	0.80	74.88	75.23	3.19	1.01

WL – Water Level

PMF – Probable Maximum Flood

N/A = no peak water level/depth/velocity available in flood event

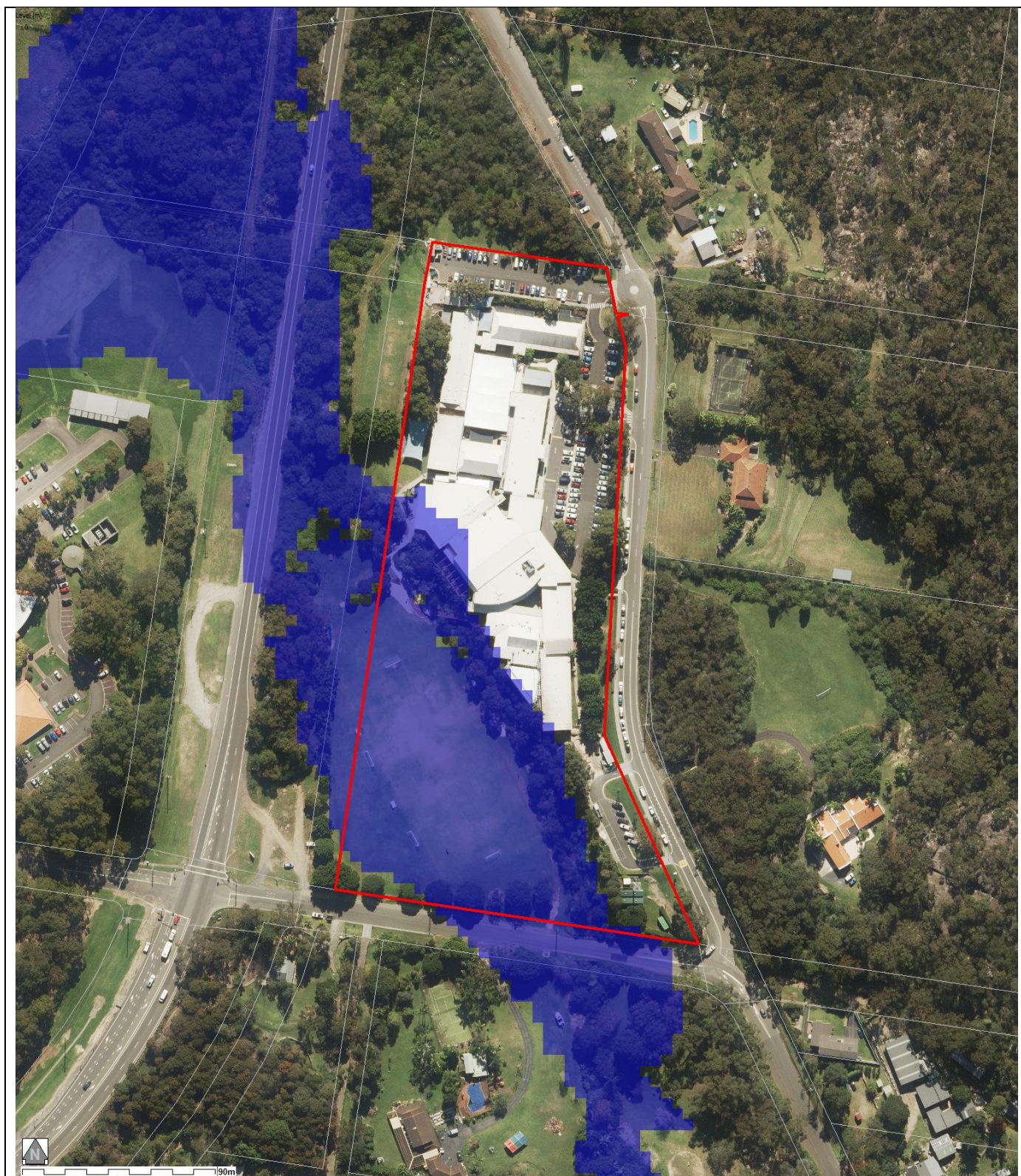
FLOOD MAP B: FLOODING - 1% AEP EXTENT



Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source Near Map 2014) are indicative only.

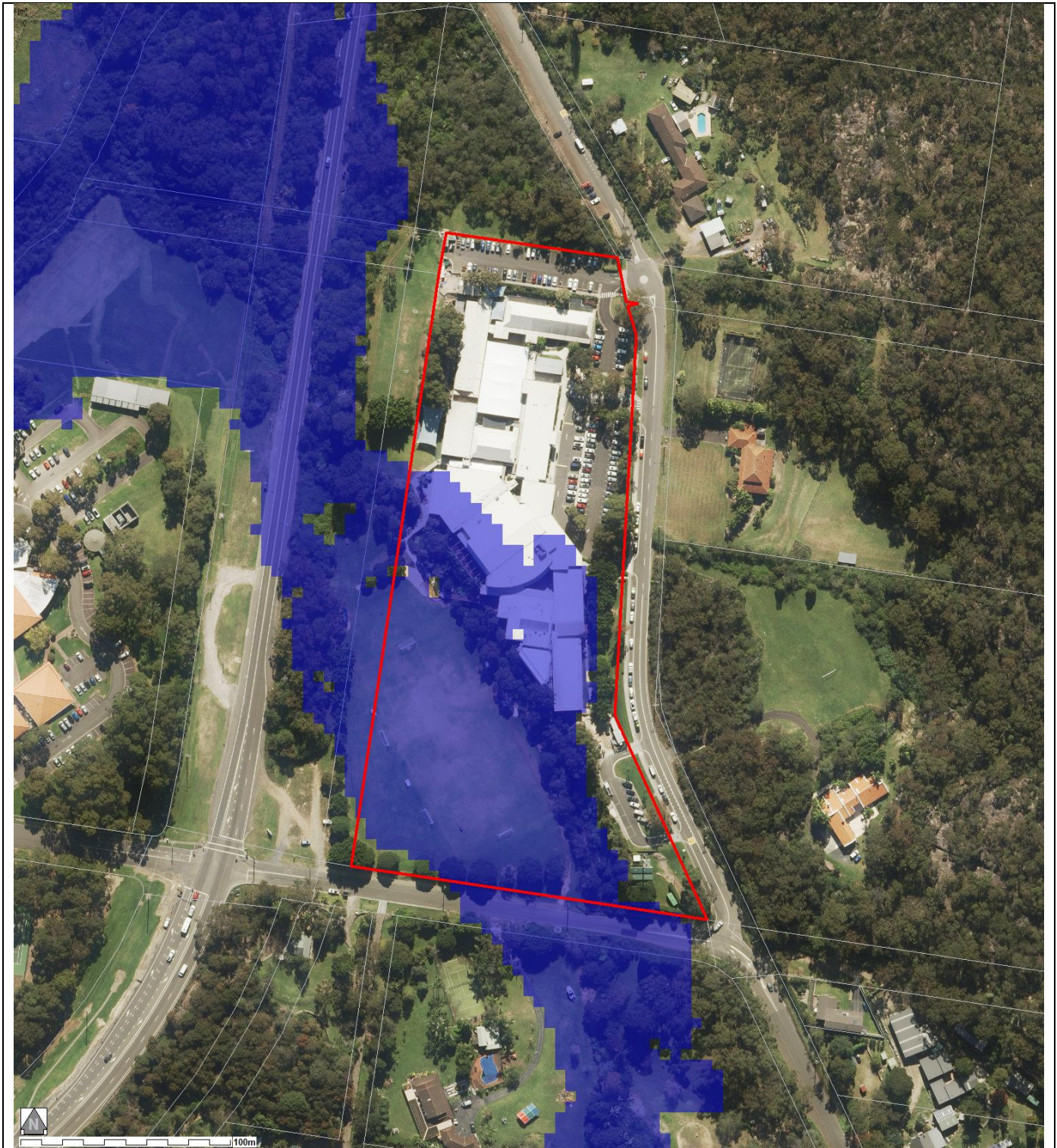
FLOOD MAP C: FLOOD PLANNING AREA EXTENT



Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source Near Map 2014) are indicative only.

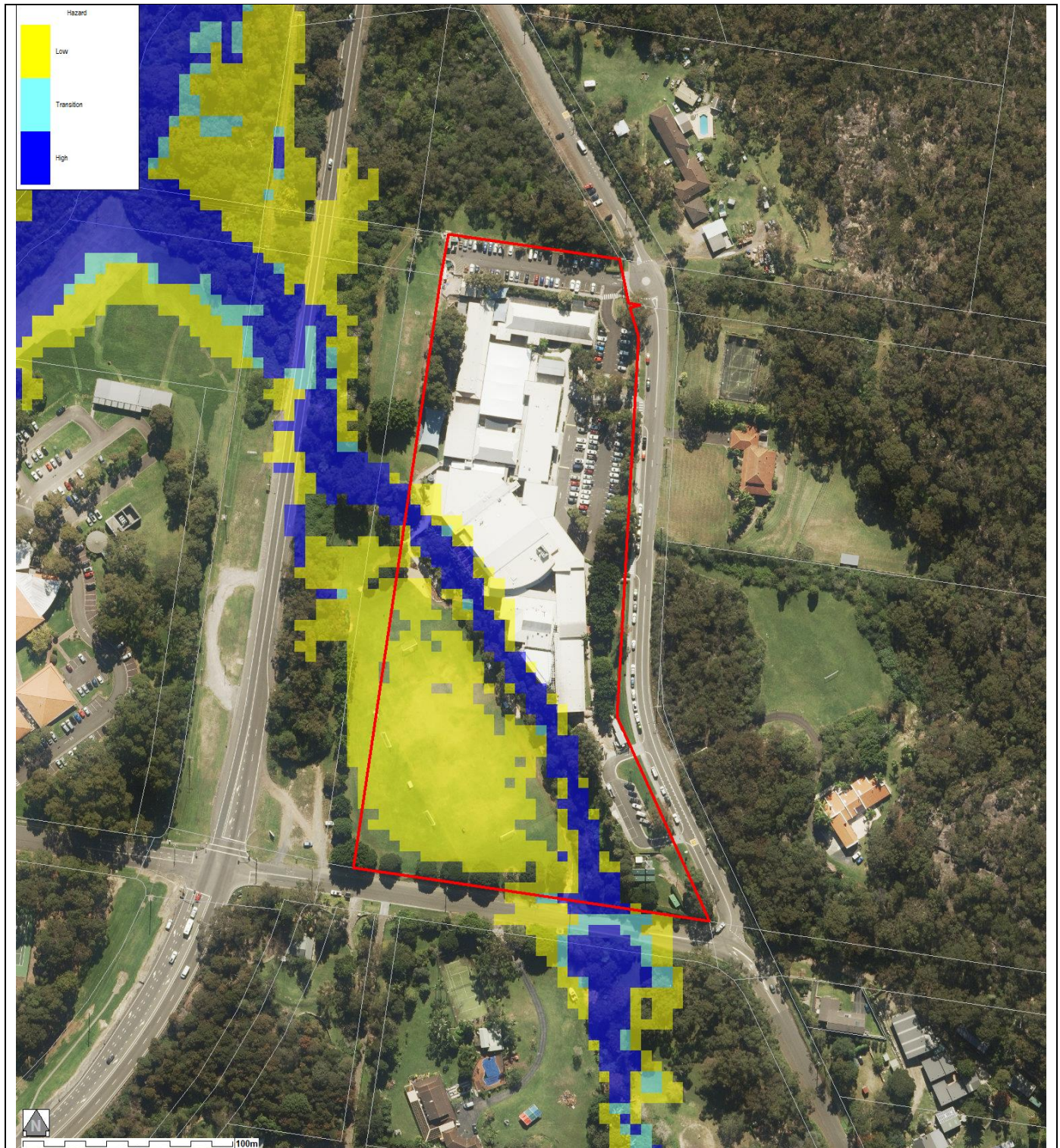
FLOOD MAP D - PMF EXTENT MAP



Notes:

- extent represents the Probable Maximum Flood (PMF) flood event
- extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only

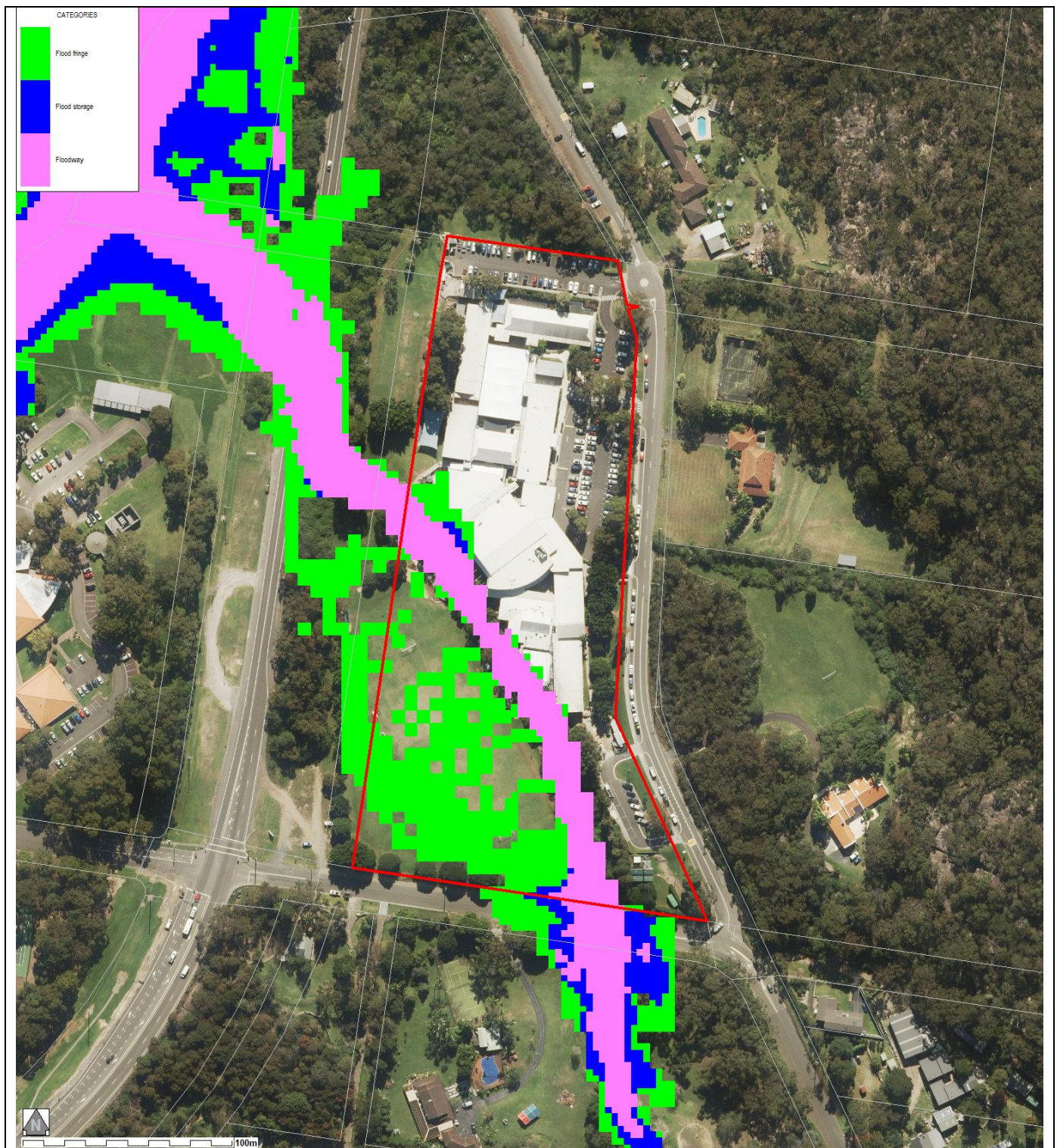
FLOOD MAP E – 1% AEP FLOOD HAZARD EXTENT MAP



Notes:

- extent represents the 1% annual Exceedance Probability (AEP) flood event
- extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only

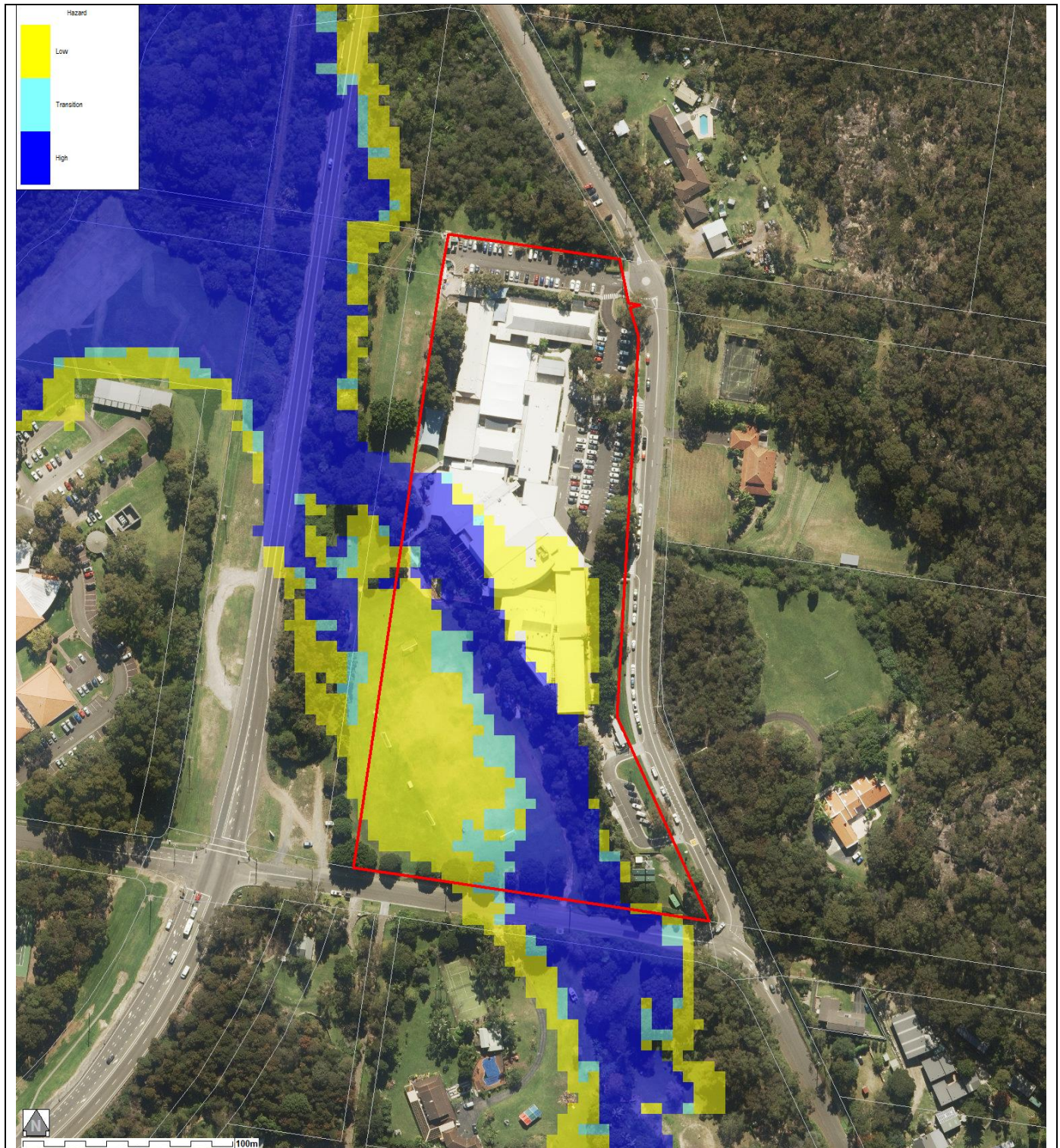
FLOOD MAP F – 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



Notes:

- extent represents the 1% annual Exceedance Probability (AEP) flood event
- extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only

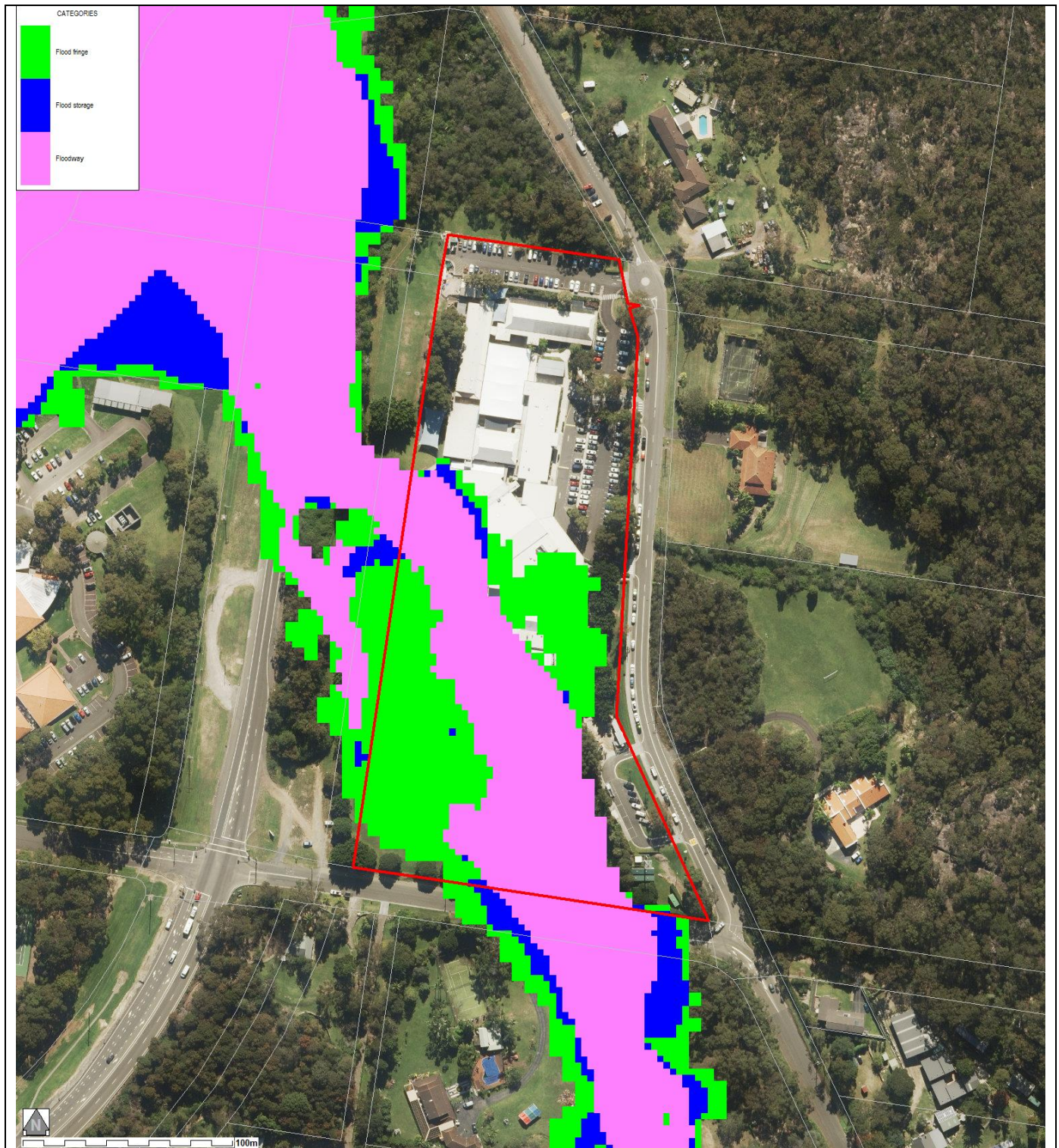
FLOOD MAP G – PMF FLOOD HAZARD EXTENT MAP



Notes:

- extent represents the 1% annual Exceedance Probability (AEP) flood event
- extent represents the Probable Maximum Flood (PMF) event
- extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only

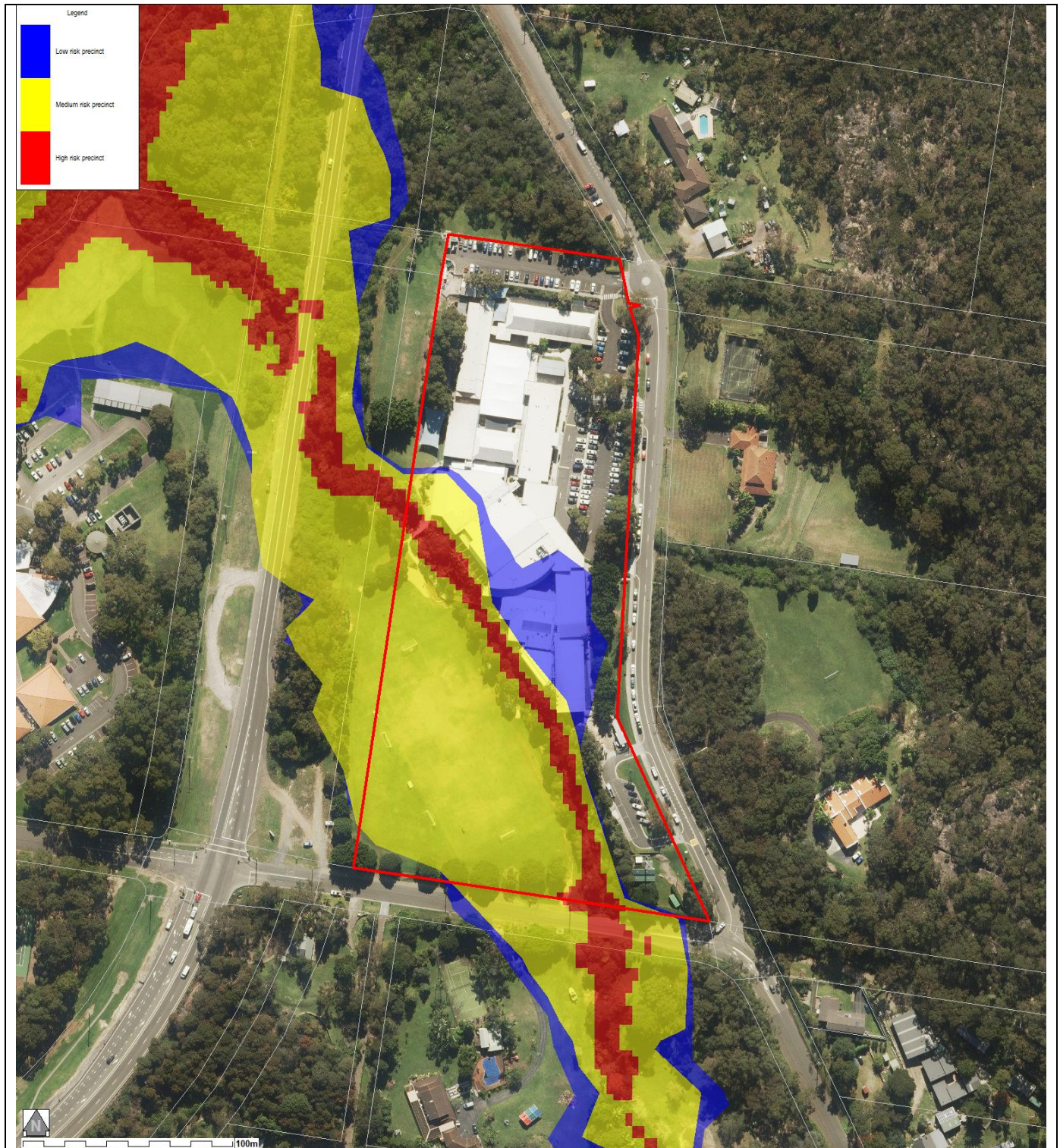
FLOOD MAP H – PMF FLOOD HYDRAULIC CATEGORY EXTENT MAP



Notes:

- extent represents the Probable Maximum Flood (PMF) event
- extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: N/A) and aerial photography (Source: NearMap 2014) are indicative only

FLOOD MAP K – FLOOD RISK PRECINCT MAP



Notes:

- **Low Flood Risk precinct** means all flood prone land not identified within the High or Medium flood risk precincts.
- **Medium Flood Risk precinct** means all flood prone land that is (a) within the 1% AEP Flood Planning Area; and (b) is not within the high flood risk precinct.
- **High Flood Risk precinct** means all flood prone land (a) within the 1% AEP Flood Planning Area; and (b) is either subject to a high hydraulic hazard, within the floodway or subject to significant evacuation difficulties (H5 and or H6 Life Hazard Classification).
- Does not include climate change

Appendix C

Guidelines for Riparian Corridors

Flood Prone Land Design Standard

This design standard provides detailed specifications for development on flood prone land in support of the Flood Prone Land clause in the:

- Manly Development Control Plan (2013)
- Warringah Development Control Plan (2011)
- Pittwater 21 Development Control Plan (2015)

A1	<p>The development has been designed and can be constructed so that in a 1%AEP flood event:</p> <p>(a) There is no net loss of flood storage/ floodway; (b) There are no adverse changes in flood levels and velocities caused by alterations to the flood conveyance; (c) There are no adverse effects on surrounding properties; and (d) It is sited to minimise exposure to flood hazard.</p> <p>Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.</p>
B1	<p>The development has been designed and can be constructed so that in a 1% AEP flood event:</p> <p>(a) There is no loss of flood storage/floodway; (b) There are no adverse effects on surrounding properties; (c) The works do not have an adverse impact on the environment. (This includes but is not limited to the altering of natural flow regimes, the clearing of riparian vegetation, artificial modification of the natural stream, such as by relocation, piping etc, in accordance with Council's Protection of Waterways and Riparian Land Policy).</p> <p>Certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.</p>
F2	<p>For suspended pier/pile footings, there must also be sufficient openings in perimeter walls located below the 1% AEP flood level to allow for the flood waters to flow through unimpeded:</p> <p>a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, and (b) 50-75% of the perimeter of the underfloor area is of an open design between the natural ground level and the 1% AEP flood level. Only 25-50% of the perimeter would be permitted to be solid, and (c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway.</p>
F9	<p>It must be demonstrated that:</p> <p>(a) The Flood Planning Level is more than 1 metre above the typical existing ground level, and (b) The maximum footprint of the foyer is limited to 15 square metres, and (c) The foyer is not used for habitable purposes, and (d) All structural elements, external finishes and internal finishes are constructed from flood compatible materials, and (e) All electrical services, power points, fittings and equipment are located above the Flood Planning Level.</p>
F10	<p>It must be demonstrated that:</p> <p>(a) The development is located within an existing Business Zone and; (b) The minimum floor level of the first internal 5 metres from one street front only, is no lower than the adjacent footpath level, and</p>

	<p>(c) The maximum internal distance from the front of the building is 5 metres, and</p> <p>(d) The maximum area for each individual premises below the <i>Flood Planning Level</i> is 30 square metres, and</p> <p>(e) There is direct internal access between areas above and below the <i>Flood Planning Level</i> for each individual premises, and</p> <p>(f) All new and existing structural elements, external finishes and internal finishes below the <i>Flood Planning Level</i> are constructed from flood compatible materials, and</p> <p>(g) All electrical services, power points, fittings and equipment are located above the <i>Flood Planning Level</i>, and</p> <p>(h) All internal areas below the <i>Flood Planning Level</i> are assumed to be enclosed and so will not be available to form an offset for floodplain storage volume.</p>
G4	<p>Vehicle barriers or restraints (such as mounding, bunding, louvers or similar) that redirect and/or exclude floodwaters will not be permitted. Perimeter walls/louvers installed as vehicle barriers or restraints are to be of an open design, where 50-75% of the perimeter walls/louvers are 'open' between natural ground level and the <i>Flood Planning Level</i>. Only 25-50% of the perimeter walls/louvers would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water</p>
G6	<p>Car ports must:</p> <p>(a) Be of an open design, where 50-75% of the perimeter walls are 'open' between natural ground level and the <i>Flood Planning Level</i>. Only 25-50% of the perimeter wall would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water; and</p> <p>(b) Constructed of flood compatible material.</p>
G8	<p>It must be demonstrated that:</p> <p>(a) The <i>Flood Planning Level</i> is more than 1.5m above the typical existing ground level, and</p> <p>(b) All structural elements, external finishes and internal finishes below the <i>Flood Planning Level</i> are constructed from flood compatible materials, and</p> <p>(c) All electrical services, power points, fittings and equipment are located above the <i>Flood Planning Level</i>, and</p> <p>(d) 50-75% of the perimeter walls are 'open' between natural ground level and the <i>Flood Planning Level</i>. Only 25-50% of the perimeter would be permitted to be 'solid', Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water, and</p> <p>(e) Internally there are no solid dividing walls within the carparking area, and</p> <p>(f) No 'storage cages' are permitted within the carparking area below the <i>Flood Planning Level</i>, and</p> <p>(g) Prominent signage is displayed that warns of the possibility of flooding and that personal goods other than vehicles must not be stored in the carparking area, and</p> <p>(h) Vehicle barriers or restraints will be provided to prevent floating vehicles leaving the carparking area.</p>
H1	<p>Fencing (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be open for passage of flood waters - All new fencing on the property must be flood compatible with 50-75% of the fence being of an open design between the natural ground level and the <i>Flood Planning Level</i>. Only 25-50% of the perimeter fence would be permitted to be solid. Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.</p>