

Introduction

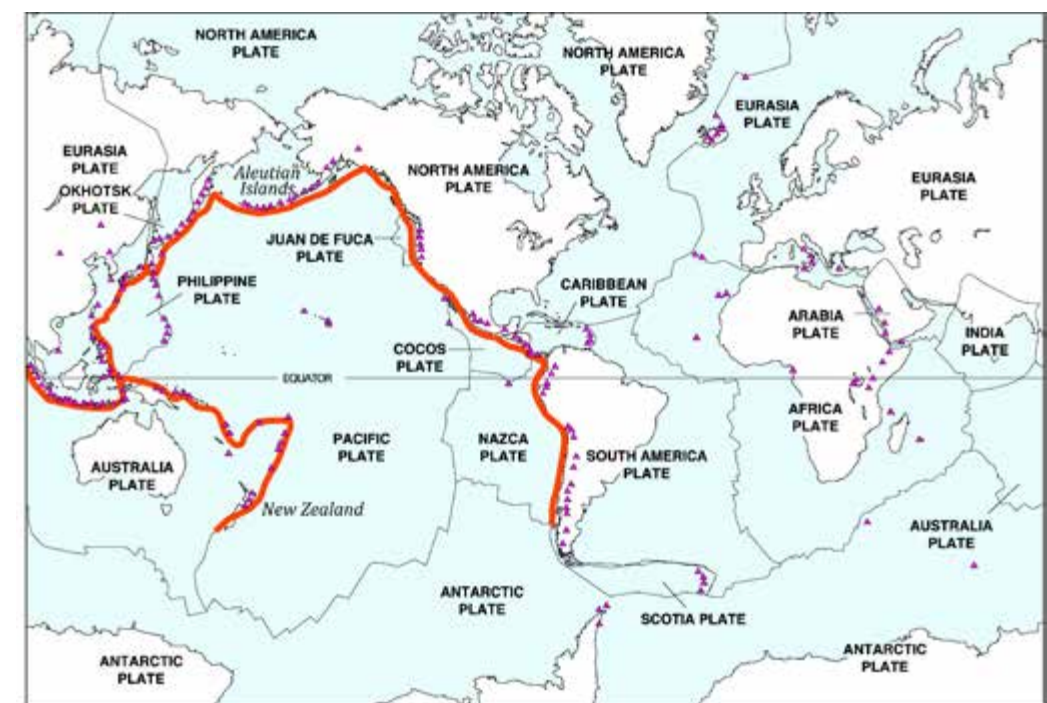
The Oregon Department of Geology and Mineral Industries (DOGAMI) has been identifying and mapping the tsunami inundation hazard along the Oregon coast since 1994. In Oregon, DOGAMI manages the National Tsunami Hazard Mitigation Program, which has been administered by the National Oceanic and Atmospheric Administration (NOAA) since 1995. DOGAMI's work is designed to help cities, counties, and other sites in coastal areas reduce the potential for disastrous, tsunami-related consequences by understanding and mitigating the geologic hazard. Using federal funding awarded by NOAA, DOGAMI has developed a new generation of tsunami inundation maps to help residents and visitors along the entire Oregon coast prepare for the next Cascadia Subduction Zone (CSZ) earthquake and tsunami, as well as for far-travelled, or "distant" tsunamis.

The "Ring of Fire", also called the Circum-Pacific belt, is the zone of earthquake activity surrounding the Pacific Ocean. It is an arc stretching from New Zealand along the eastern edge of Asia north across the Aleutian Islands of Alaska, and south along the coast of North and South America (Figure 1). The Ring of Fire is located at the borders of the Pacific Plate and other major tectonic plates. The Pacific Plate colliding with and sliding underneath other plates creating subduction zones that eventually release energy in the form of an earthquake rupture. This rupture causes a vertical displacement of water that creates a tsunami. When these events occur around the Ring of Fire but not directly off the Oregon coast, they take more time to travel the Pacific Ocean and arrive onshore in Oregon (Figure 2). Distant earthquake/tsunami events have affected the Oregon coast, for example, offshore Alaska in 1964 and offshore Japan in March 2011.

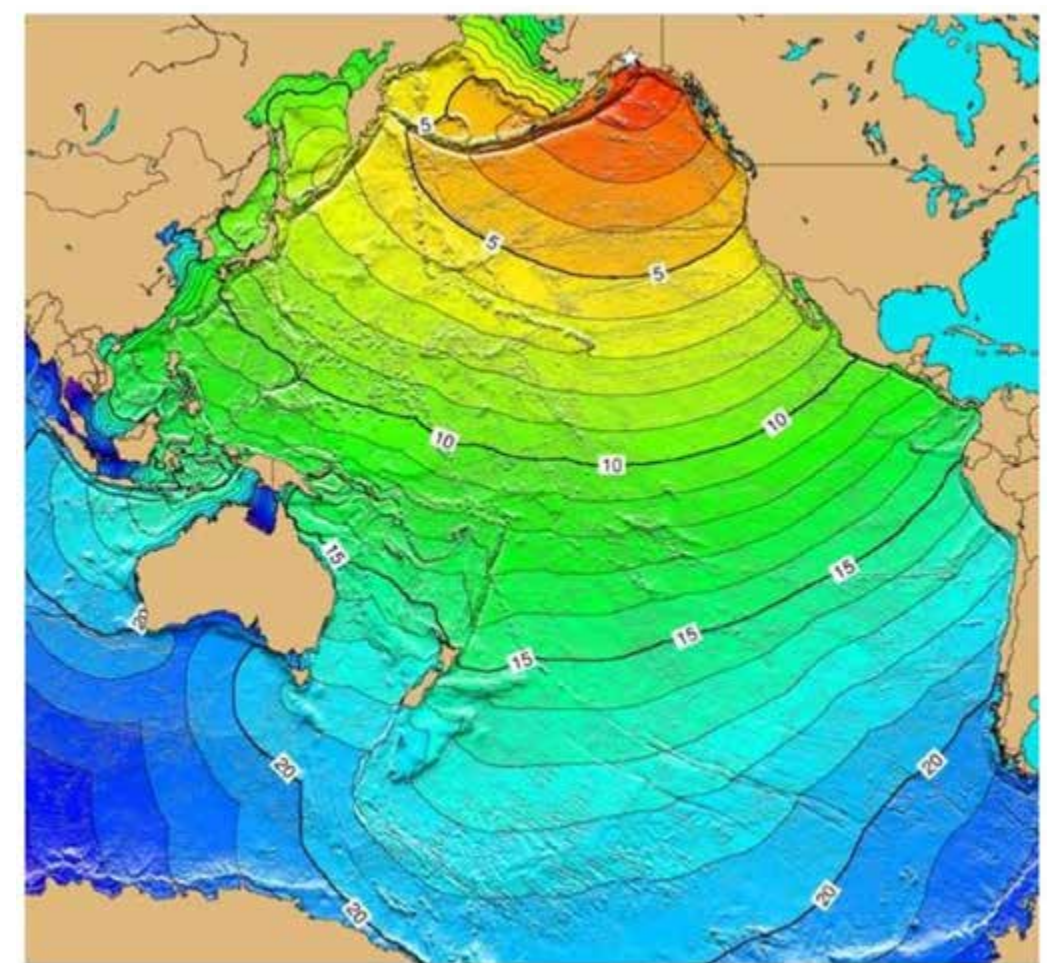
Historically, about 28 distant tsunamis have been documented by Oregon tide gauges since 1854. The most severe was generated by the 1964 M9.2 Prince William Sound earthquake in Alaska. Oregon was hit hard by the tsunami, which killed four people and caused an estimated \$20,000 to \$1 million dollars in damage to bridges, houses, cars, boats and sea walls. The greatest tsunami damage in Oregon did not occur along the ocean front as one might expect, but in the estuary channels located further inland. Of the communities affected, Seaside was inundated by a 10 foot tsunami wave and was the hardest hit. Tsunami wave heights reached 10 to 11.5 feet in the Nehalem River, 10 to 11.5 feet at Downey Bay, 11.5 feet at Newport, 10 to 11 feet at Tanners, 11 feet at Reedport, 11 feet at Brookings, and 14 feet at Coos Bay (Witter and others, 2011).

Alaska-Aleutian M9.2 Specifications: DOGAMI modeled two distant earthquake and tsunami scenarios involving M9.2 earthquakes originating near the Gulf of Alaska. The first scenario attempts to replicate the 1964 Prince William Sound event, and the second scenario represents a hypothetical maximum event. This maximum event is the same model used by the U.S. Geological Survey (USGS) in their 2006 tsunami hazard assessment of Seaside (TPSA 2006). This model uses extreme fault model parameters that result in maximum seafloor uplift nearly twice as large as in the 1964 earthquake. The selected source location on the Aleutian chain of islands also shows higher energy directed toward the Oregon coast than other Aleutian source locations. For these reasons the hypothetical "Alaska Maximum" scenario is selected as the worst case distant tsunami scenario for Oregon. Detailed information on fault geometries, subsidence, computer models, and the methodology used to create the tsunami scenarios presented on this map can be found in DOGAMI Special Paper 43 (Witter and others, 2011).

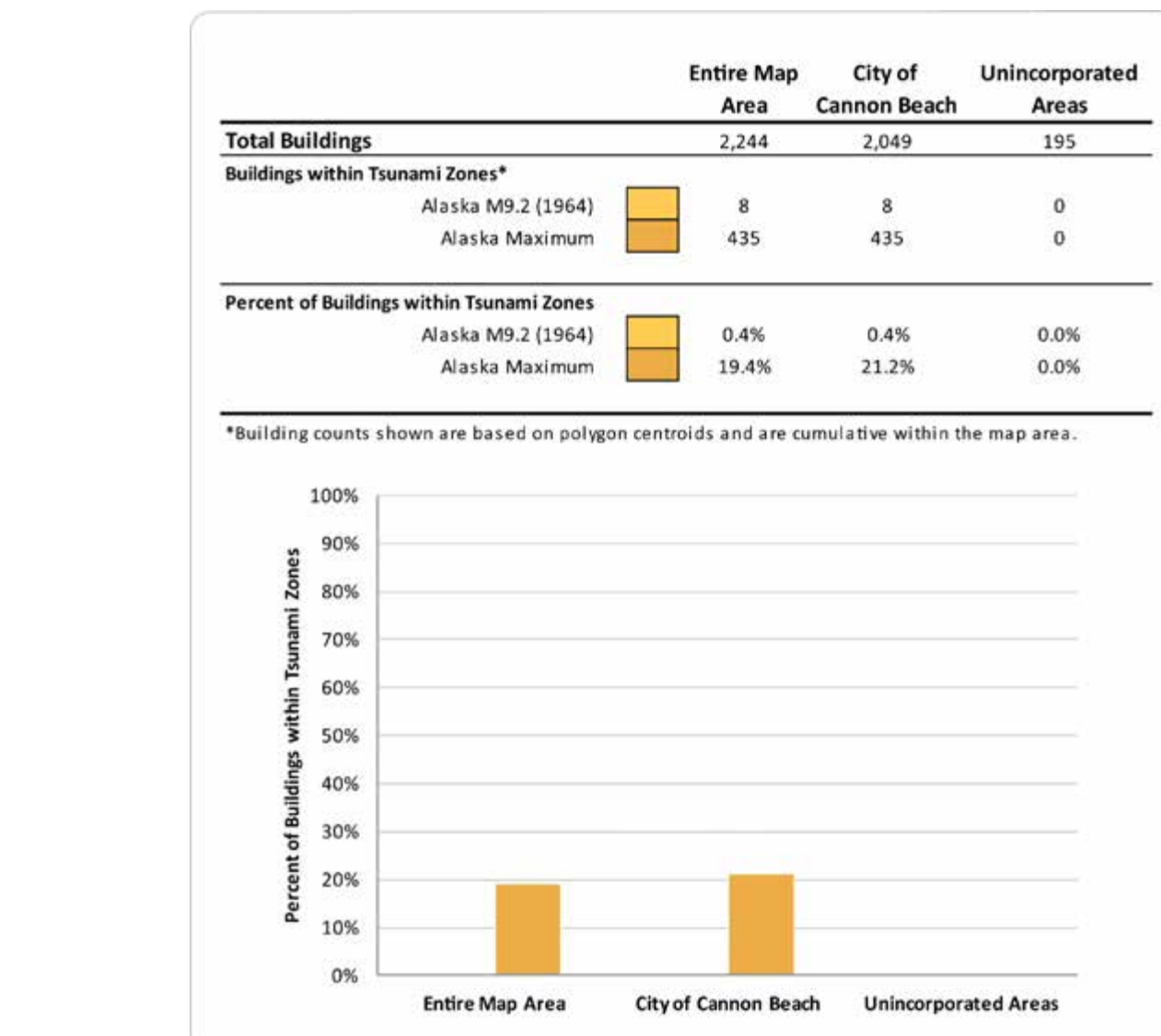
Ring of Fire



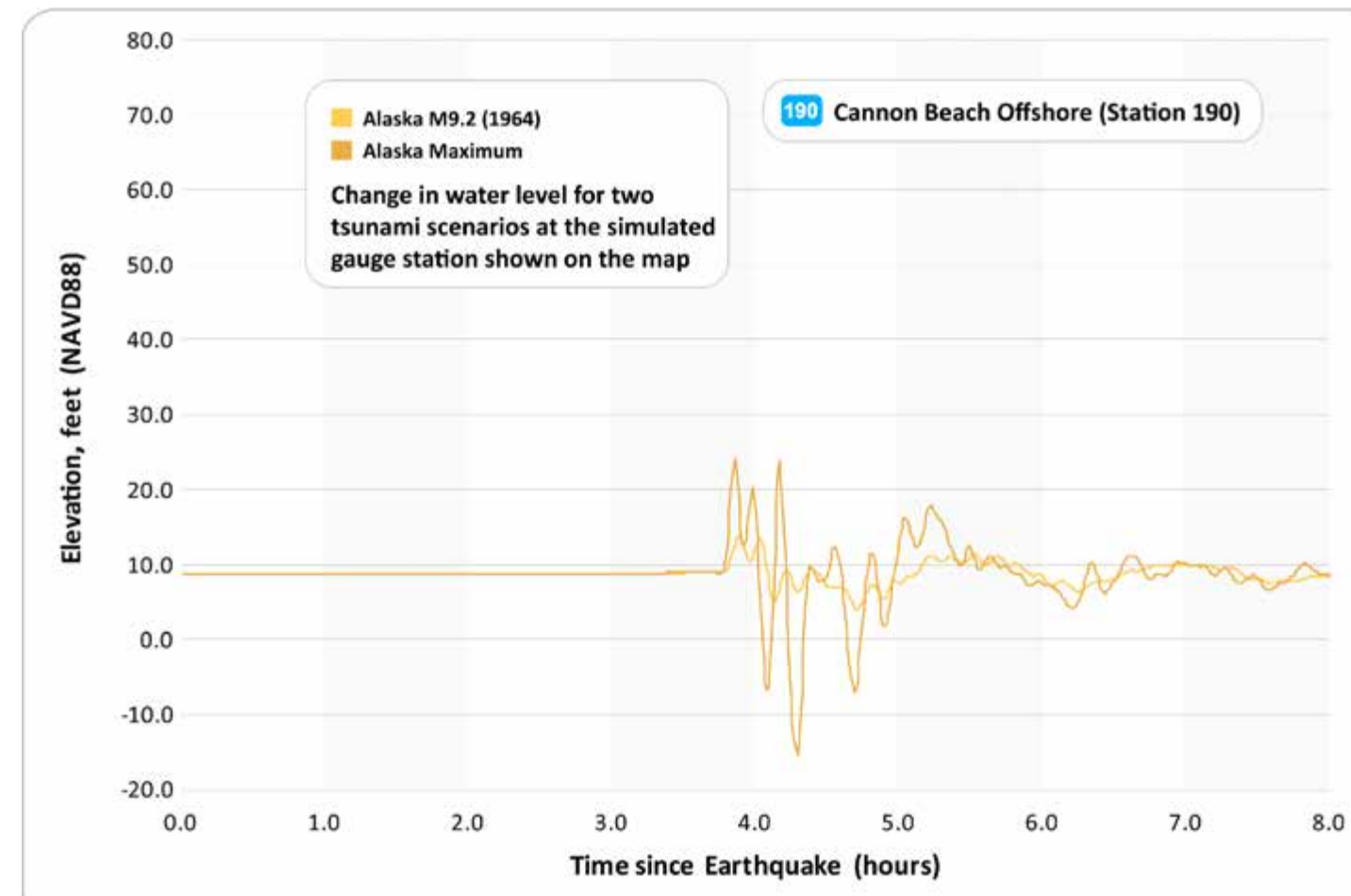
Prince William Sound 1964 M9.2 Earthquake and Tsunami Travel Time Map



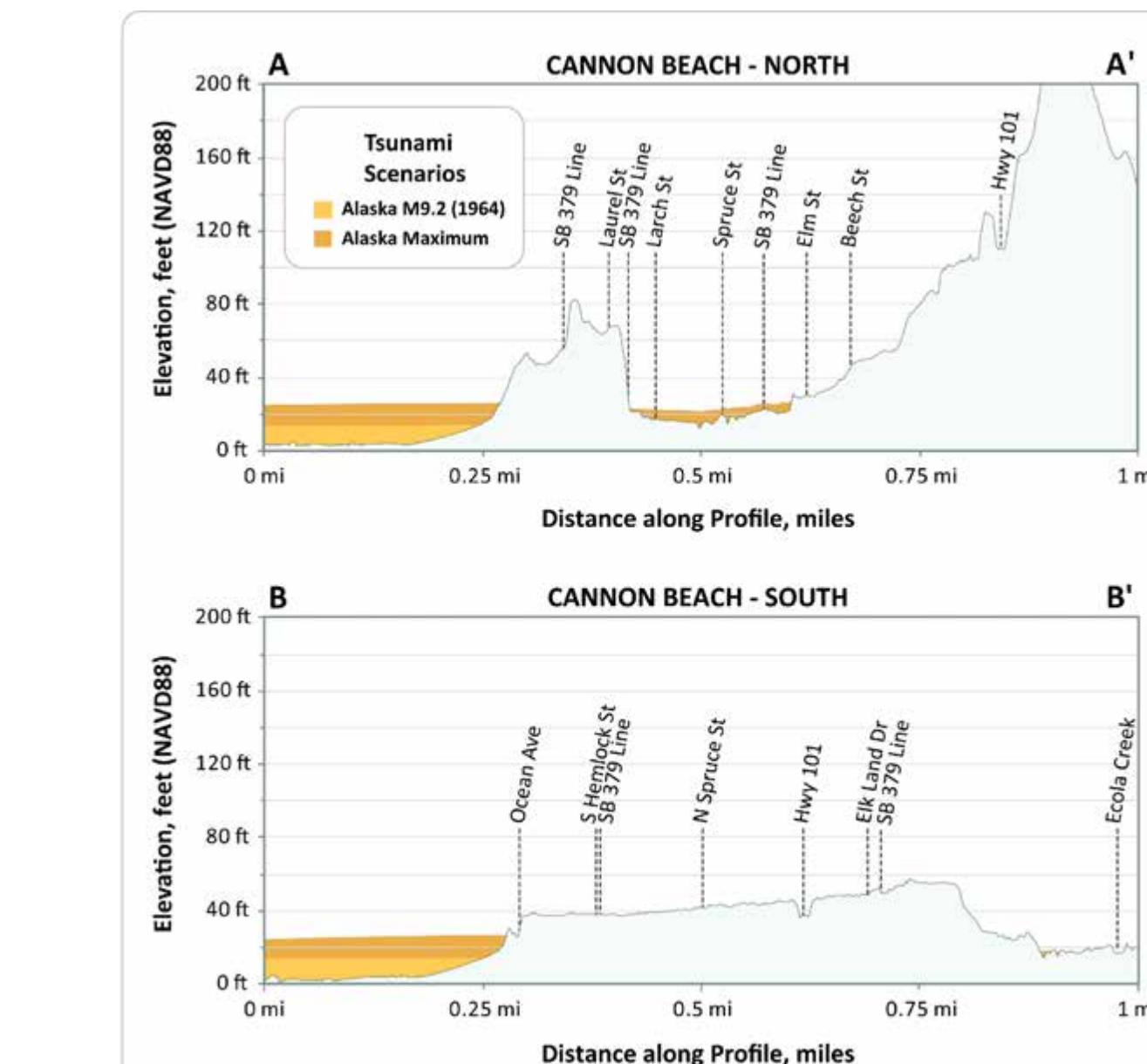
Buildings within Tsunami Inundation Zones



Estimated Tsunami Wave Height through Time for Simulated Gauge Station

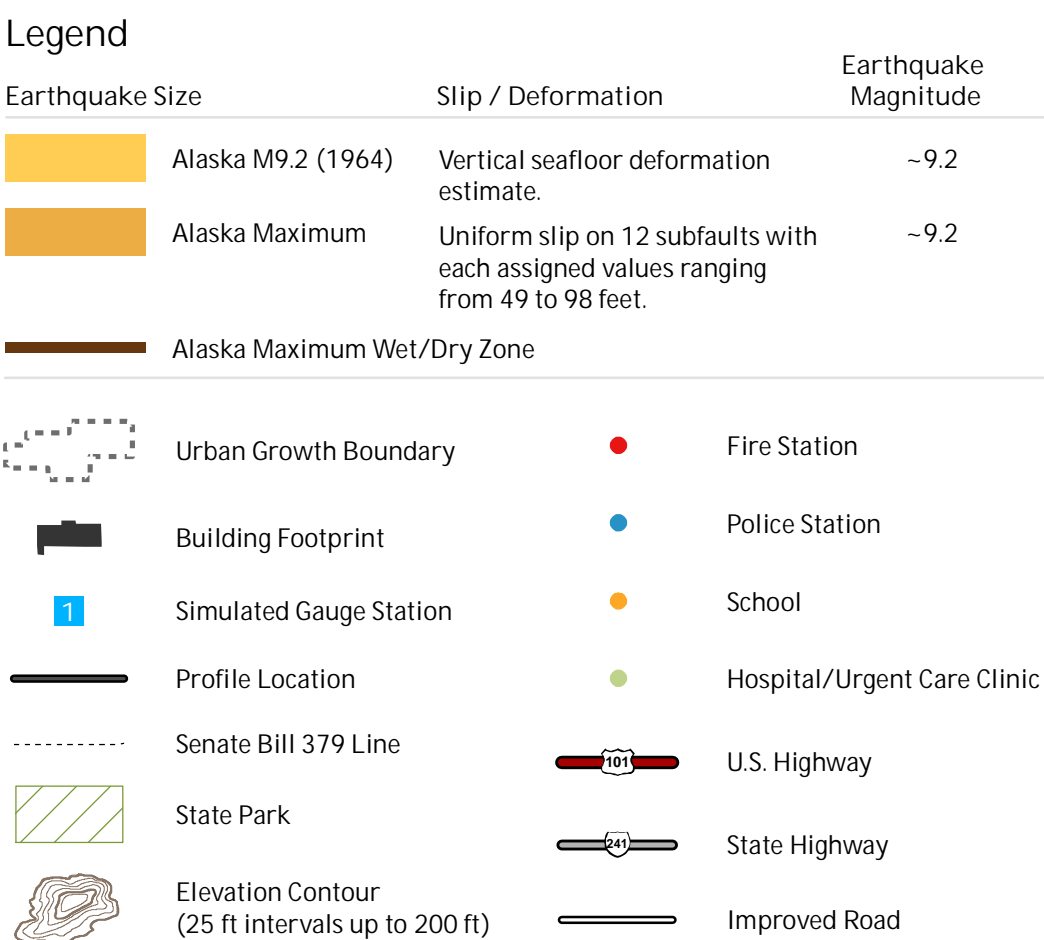
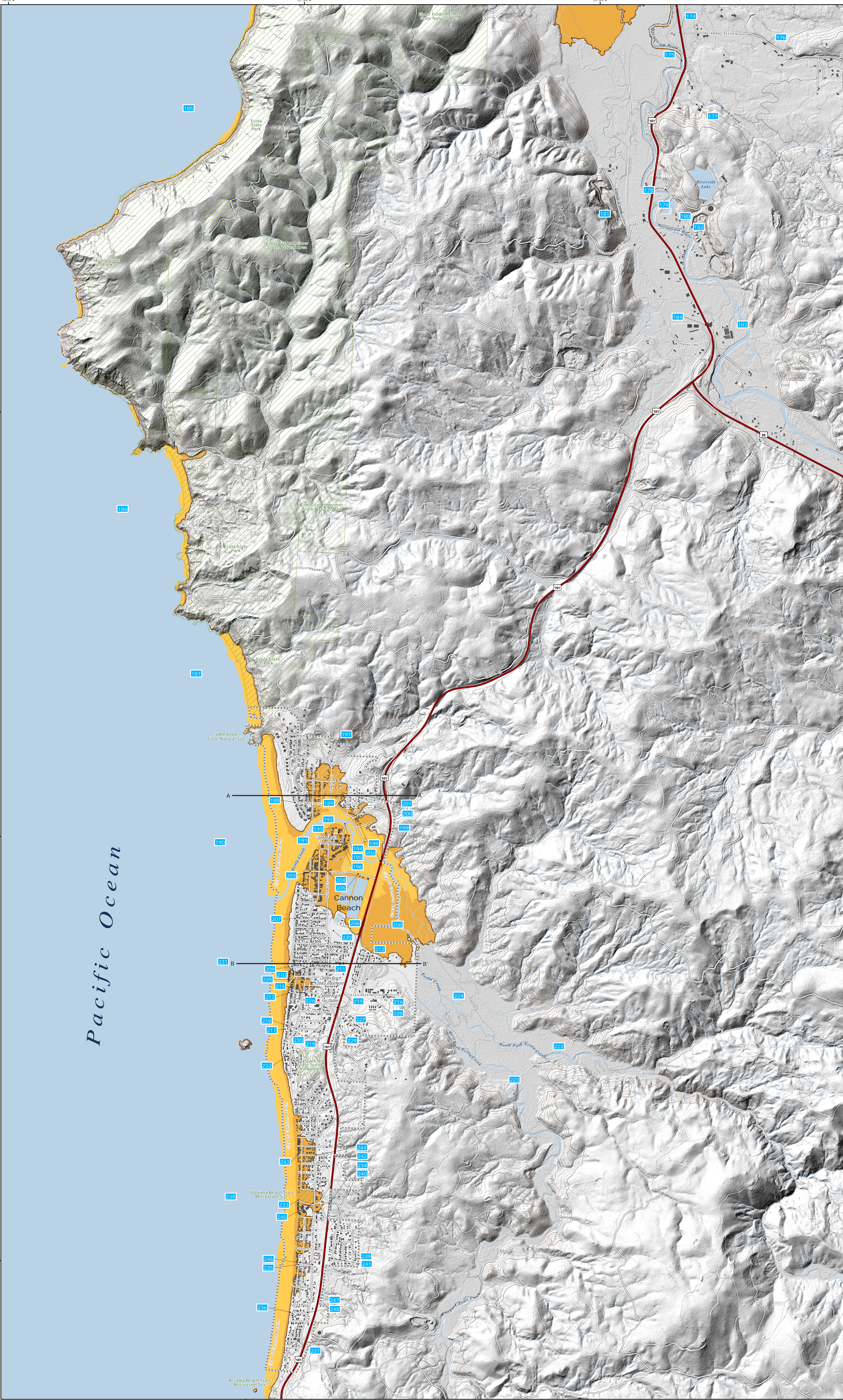


Maximum Wave Elevation Profiles

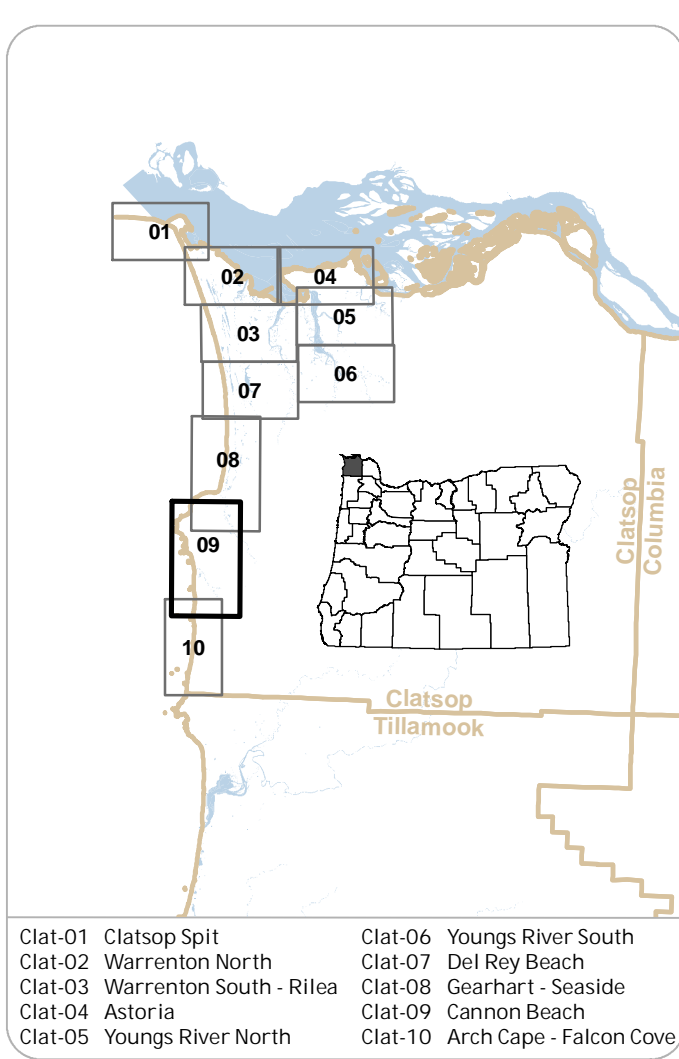


Distant Source (Alaska-Aleutian Subduction Zone) Tsunami Inundation Map Cannon Beach, Oregon

2013



Tsunami Inundation Map Index



Data References

Source Data:
This map is based on hydrodynamic tsunami modeling by Joseph Zhang, Oregon Health and Science University, Portland, Oregon. Model data used were generated by the U.S. Geological Survey, Pacific Northwest Division of Geology and Mineral Industries (DOGAMI), Portland, Oregon.
Hydrology data, contours, critical facilities, and building footprints were obtained by DOGAMI. Senate Bill 379 line data were redigitized from L. Smith and Sean G. Pickner, DOGAMI, in 2011 (GIS file set, in press).
Urban growth boundaries (2011) were provided by the Oregon Department of Land Conservation and Development (DLCD).
Transportation data (2011) provided by Clatsop County were redigitized by DOGAMI to improve the spatial accuracy of the features or to add newly constructed roadways present in their latest data files.
Lidar data are from DOGAMI Lidar Data Quadrange LIDAR 2011-45125-03, 45126-03, and LIDAR 2011-45125-04, 45126-04, 45127-04, 45128-04, 45129-04, 45130-04, 45131-04, 45132-04, 45133-04, 45134-04, 45135-04, 45136-04, 45137-04, 45138-04, 45139-04, 45140-04, 45141-04, 45142-04, 45143-04, 45144-04, 45145-04, 45146-04, 45147-04, 45148-04, 45149-04, 45150-04, 45151-04, 45152-04, 45153-04, 45154-04, 45155-04, 45156-04, 45157-04, 45158-04, 45159-04, 45160-04, 45161-04, 45162-04, 45163-04, 45164-04, 45165-04, 45166-04, 45167-04, 45168-04, 45169-04, 45170-04, 45171-04, 45172-04, 45173-04, 45174-04, 45175-04, 45176-04, 45177-04, 45178-04, 45179-04, 45180-04, 45181-04, 45182-04, 45183-04, 45184-04, 45185-04, 45186-04, 45187-04, 45188-04, 45189-04, 45190-04, 45191-04, 45192-04, 45193-04, 45194-04, 45195-04, 45196-04, 45197-04, 45198-04, 45199-04, 45200-04, 45201-04, 45202-04, 45203-04, 45204-04, 45205-04, 45206-04, 45207-04, 45208-04, 45209-04, 45210-04, 45211-04, 45212-04, 45213-04, 45214-04, 45215-04, 45216-04, 45217-04, 45218-04, 45219-04, 45220-04, 45221-04, 45222-04, 45223-04, 45224-04, 45225-04, 45226-04, 45227-04, 45228-04, 45229-04, 45230-04, 45231-04, 45232-04, 45233-04, 45234-04, 45235-04, 45236-04, 45237-04, 45238-04, 45239-04, 45240-04, 45241-04, 45242-04, 45243-04, 45244-04, 45245-04, 45246-04, 45247-04, 45248-04, 45249-04, 45250-04, 45251-04, 45252-04, 45253-04, 45254-04, 45255-04, 45256-04, 45257-04, 45258-04, 45259-04, 45260-04, 45261-04, 45262-04, 45263-04, 45264-04, 45265-04, 45266-04, 45267-04, 45268-04, 45269-04, 45270-04, 45271-04, 45272-04, 45273-04, 45274-04, 45275-04, 45276-04, 45277-04, 45278-04, 45279-04, 45280-04, 45281-04, 45282-04, 45283-04, 45284-04, 45285-04, 45286-04, 45287-04, 45288-04, 45289-04, 45290-04, 45291-04, 45292-04, 45293-04, 45294-04, 45295-04, 45296-04, 45297-04, 45298-04, 45299-04, 45300-04, 45301-04, 45302-04, 45303-04, 45304-04, 45305-04, 45306-04, 45307-04, 45308-04, 45309-04, 45310-04, 45311-04, 45312-04, 45313-04, 45314-04, 45315-04, 45316-04, 45317-04, 45318-04, 45319-04, 45320-04, 45321-04, 45322-04, 45323-04, 45324-04, 45325-04, 45326-04, 45327-04, 45328-04, 45329-04, 45330-04, 45331-04, 45332-04, 45333-04, 45334-04, 45335-04, 45336-04, 45337-04, 45338-04, 45339-04, 45340-04, 45341-04, 45342-04, 45343-04, 45344-04, 45345-04, 45346-04, 45347-04, 45348-04, 45349-04, 45350-04, 45351-04, 45352-04, 45353-04, 45354-04, 45355-04, 45356-04, 45357-04, 45358-04, 45359-04, 45360-04, 45361-04, 45362-04, 45363-04, 45364-04, 45365-04, 45366-04, 45367-04, 45368-04, 45369-04, 45370-04, 45371-04, 45372-04, 45373-04, 45374-04, 45375-04, 45376-04, 45377-04, 45378-04, 45379-04, 45380-04, 45381-04, 45382-04, 45383-04, 45384-04, 45385-04, 45386-04, 45387-04, 45388-04, 45389-04, 45390-04, 45391-04, 45392-04, 45393-04, 45394-04, 45395-04, 45396-04, 45397-04, 45398-04, 45399-04, 45400-04, 45401-04, 45402-04, 45403-04, 45404-04, 45405-04, 45406-04, 45407-04, 45408-04, 45409-04, 45410-04, 45411-04, 45412-04, 45413-04, 45414-04, 45415-04, 45416-04, 45417-04, 45418-04, 45419-04, 45420-04, 45421-04, 45422-04, 45423-04, 45424-04, 45425-04, 45426-04, 45427-04, 45428-04, 45429-04, 45430-04, 45431-04, 45432-04, 45433-04, 45434-04, 45435-04, 45436-04, 45437-04, 45438-04, 45439-04, 45440-04, 45441-04, 45442-04, 45443-04, 45444-04, 45445-04, 45446-04, 45447-04, 45448-04, 45449-04, 45450-04, 45451-04, 45452-04, 45453-04, 45454-04, 45455-04, 45456-04, 45457-04, 45458-04, 45459-04, 45460-04, 45461-04, 45462-04, 45463-04, 45464-04, 45465-04, 45466-04, 45467-04, 45468-04, 45469-04, 45470-04, 45471-04, 45472-04, 45473-04, 45474-04, 45475-04, 45476-04, 45477-04, 45478-04, 45479-04, 45480-04, 45481-04, 45482-04, 45483-04, 45484-04, 45485-04, 45486-04, 45487-04, 45488-04, 45489-04, 45490-04, 45491-04, 45492-04, 45493-04, 45494-04, 45495-04, 45496-04, 45497-04, 45498-04, 45499-04, 45500-04, 45501-04, 45502-04, 45503-04, 45504-04, 45505-04, 45506-04, 45507-04, 45508-04, 45509-04, 45510-04, 45511-04, 45512-04, 45513-04, 45514-04, 45515-04, 45516-04, 45517-04, 45518-04, 45519-04, 45520-04, 45521-04, 45522-04, 45523-04, 45524-04, 45525-04, 45526-04, 45527-04, 45528-04, 45529-04, 45530-04, 45531-04, 45532-04, 45533-04, 45534-04, 45535-04, 45536-04, 45537-04, 45538-04, 45539-04, 45540-04, 45541-04, 45542-04, 45543-04, 45544-04, 45545-04, 45546-04, 45547-04, 45548-04, 45549-04, 45550-04, 45551-04, 45552-04, 45553-04, 45554-04, 45555-04, 45556-04, 45557-04, 45558-04, 45559-04, 45560-04, 45561-04, 45562-04, 45563-04, 45564-04, 45565-04, 45566-04, 45567-04, 45568-04, 45569-04, 45570-04, 45571-04, 45572-04, 45573-04, 45574-04, 45575-04, 45576-04, 45577-04, 45578-04, 45579-04, 45580-04, 45581-04, 45582-04, 45583-04, 45584-04, 45585-04, 45586-04, 45587-04, 45588-04, 45589-04, 45590-04, 45591-04, 45592-04, 45593-04, 45594-04, 45595-04, 45596-04, 45597-04, 45598-04, 45599-04, 45600-04, 45601-04, 45602-04, 45603-04, 45604-04, 45605-04, 45606-04, 45607-04, 45608-04, 45609-04, 45610-04, 45611-04, 45612-04, 45613-04, 45614-04, 45615-04, 45616-04, 45617-04, 45618-04, 45619-04, 45620-04, 45621-04, 45622-04, 45623-04, 45624-04, 45625-04, 45626-04, 45627-04, 45628-04, 45629-04, 45630-04, 45631-04, 45632-04, 45633-04, 45634-04, 45635-04, 45636-04, 45637-04, 45638-04, 45639-04, 45640-04, 45641-04, 45642-04, 45643-04, 45644-04, 45645-04, 45646-04, 45647-04, 45648-04, 45649-04, 45650-04, 45651-04, 45652-04, 45653-04, 45654-04, 45655-04, 45656-04, 45657-04, 45658-04, 45659-04, 45660-04, 45661-04, 45662-04, 45663-04, 45664-04, 45665-04, 45666-04, 45667-04, 45668-04, 45669-04, 45670-04, 45671-04, 45672-04, 45673-04, 45674-04, 45675-04, 45676-04, 45677-04, 45678-04, 45679-04, 45680-04, 45681-04, 45682-04, 45683-04, 45684-04, 45685-04, 45686-04, 45687-04, 45688-04, 45689-04, 45690-04, 45691-04, 45692-04, 45693-04, 45694-04, 45695-04, 45696-04, 45697-04, 45698-04, 45699-04, 45700-04, 45701-04, 45702-04, 45703-04, 45704-04, 45705-04, 45706-04, 45707-04, 45708-04, 45709-04, 45710-04, 45711-04, 45712-04, 45713-04, 45714-04, 45715-04, 45716-04, 45717-04, 45718-04, 45719-04, 45720-04, 45721-04, 45722-04, 45723-04, 45724-04, 45725-04, 45726-04, 45727-04, 45728-04, 45729-04, 45730-04, 45731-04, 45732-04, 45733-04, 45734-04, 45735-04, 45736-04, 45737-04, 45738-04, 45739-04, 45740-04, 45741-04, 45742-04, 45743-04, 45744-04, 45745-04, 45746-04, 45747-04, 45748-04, 45749-04, 45750-04, 45751-04, 45752-04, 45753-04, 45754-04, 45755-04, 45756-04, 45757-04, 45758-04, 45759-04, 45760-04, 45761-04, 45762-04, 45763-04, 45764-04, 45765-04, 45766-04, 45767-04, 45768-04, 45769-04, 45770-04, 45771-04, 45772-04, 45773-04, 45774-04, 45775-04, 45776-04, 45777-04, 45778-04, 45779-04, 45780-04, 45781-04, 45782-04, 45783-04, 45784-04, 45785-04, 45786-04, 45787-04, 45788-04, 45789-04, 45790-04, 45791-04, 45792-04, 45793-04, 45794-04, 45795-04, 45796-04, 45797-04, 45798-04, 45799-04, 45800-04, 45801-04, 45802-04, 45803-04, 45804-04, 45805-04, 45806-04, 45807-04, 45808-04, 45809-04, 45810-04, 45811-04, 45812-04, 45813-04, 45814-04, 45815-04, 45816-04, 45817-04, 45818-04, 45819-04, 45820-04, 45821-04, 45822-04, 45823-04, 45824-04, 45825-04, 45826-04, 45827-04, 45828-04, 45829-04, 45830-04, 45831-04, 45832-04, 45833-04, 45834-04, 45835-04, 45836-04, 45837-04, 45838-04, 45839-04, 45840-04, 45841-04, 45842-04, 45843-04, 45844-04, 45845-04, 45846-04, 45847-04, 45848-04, 45849-04, 45850-04, 45851-04, 45852-04, 45853-04, 45854-04, 45855-04, 45856-04, 45857-04, 45858-04, 45859-04, 45860-04, 45861-04, 45862-04, 45863-04, 45864-04, 45865-04, 45866-04, 45867-04, 45868-04, 45869-04, 45870-04, 45871-04, 45872-04, 45873-04, 45874-04, 45875-04, 45876-04, 45877-04, 45878-04, 45879-04, 45880-04, 45881-04, 45882-04, 45883-04, 45884-04, 45885-04, 45886-04, 45887-04, 45888-04, 45889-04, 45890-04, 45891-04, 45892-04, 45893-04, 45894-04, 45895-04, 45896-04, 45897-04, 45898-04, 45899-04, 45900-04, 45901-04, 45902-04, 45903-04, 45904-04, 45905-04, 45906-04, 45907-04, 45908-04, 45909-04, 45910-04, 45911-04, 45912-04, 45913-04, 45914-04, 45915-04, 45916-04, 45917-04, 45918-04, 45919-04, 45920-04, 45921-04, 45922-04, 45923-04, 45924-04, 45925-04, 45926-04, 45927-04, 45928-04, 45929-04, 45930-04, 45931-04, 45932-04, 45933-04, 45934-04, 45935-04, 45936-04, 45937-04, 45938-04, 45939-04, 45940-04, 45941-04, 45942-04, 45943-04, 45944-04, 45945-04, 45946-04, 45947-04, 45948-04, 45949-04, 45950-04, 45951-04, 45952-04, 45953-04, 45954-04, 45955-04, 45956-04, 45957-04, 45958-04, 45959-04, 45960-04, 45961-04, 45962-04, 45963-04, 45964-04, 45965-04, 45966-04, 45967-04, 45968-04, 45969-04, 45970-04, 45971-04, 45972-04, 45973-04, 45974-04, 45975-04, 45976-04, 45977-04, 45978-04, 45979-04, 45980-04, 45981-04, 45982-04, 45983-04, 45984-04, 45985-04, 45986-04, 45987-04, 45988-04, 45989-04, 45990-04, 45991-04, 45992-04, 45993-04, 45994-04, 45995-04, 45996-04, 45997-04, 45998-04, 45999-04, 46000-04, 46001-04, 46002-04, 46003-04, 46004-04, 46005-04, 46006-04, 46007-04, 46008-04, 46009-04,